Air Quality Solutions

Installation and Maintenance Manual

Model: TDFi-RT

Fan Inlet Airflow and Temperature Measurement Station

Electronic Thermal Dispersion Sensing Technology

Contents

TDFi-RT Advanced Thermal Dispersion Fan Inlet Airflow & Temperature Measuring Station

Installation Instructions

Refer to the Ruskin.com website for the most up-to-date version of this document.

APPLICATIONS

The Ruskin model TDFi-RT (Thermal Dispersion Fan inlet – Real Time) fan inlet airflow measuring system uses thermal dispersion technology to measure and average the airflow velocity and temperature from fan inlet sensors mounted on the fan inlet bell, providing accurate and repeatable airflow measurement from 0 to 10,000 fpm (0 to 50.8 mps) within ±3% accuracy. The TDFi-RT sensing probes can be installed in retrofit applications or specified on new construction projects.

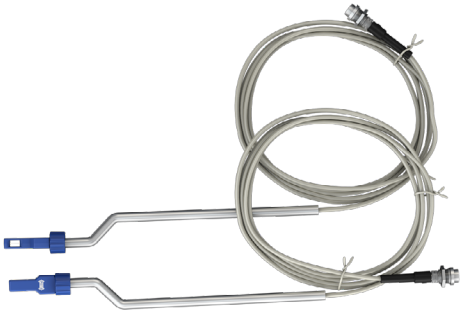
The factory-assembled TDFi-RT system includes the HOST monitor box, CLIENT monitor box(es) as applicable based on the system configuration, sensor Boom Arm assemblies, and communication cable(s) which are connected to each CLIENT box.

HOST Monitor Box

CLIENT Monitor Box

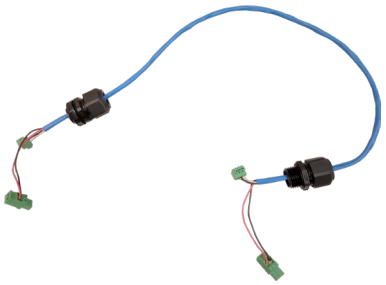
M8 Connection for Sensor Cable Assemblies on each Monitor Box.

NOTE: As the Remote Host boxes will not have Sensor Cable Assemblies connected, M8 connectors will come with a protective cap to cover the openings.



Sensor Cable Assemblies

NOTE: Quantity shipped is based on Customer's selection of 1 or 2 sensors per fan.



Communication Cable (Power/Data)

NOTE: Quantity shipped is based on number of Client Monitor Boxes required per system.

Each fan inlet sensor measures flow and temperature, sending this information to a Host or Client monitor box which provides airflow and air temperature information on an LCD screen. The HOST sends the average flow and average temperature of all sensors and fans to the BAS through two analog outputs (4-20mA or 2-10VDC) or for each fan through BACnet MS/TP or Modbus RTU protocol.

The TDFi-RT provides effective airflow measuring on individual fans, fans of differing diameters, and fan arrays when installed in accordance with the information contained in this manual. Acceptable fan types include Centrifugal, Plenum, and Axial.

The unique design of the TDFi-RT ensures minimal pressure drop by using less hardware across the fan inlet. The TDFi-RT's principle of operation is to monitor the airflow using either one or two thermal dispersion sensors at a location in the fan's inlet where the air entering velocity through the fan changes as the fan speed increases or decreases. While the TDFi-RT will display an airflow when initially installed, it is critical that the calibration process be completed using actual system airflows which will then automatically compensate for slight differences in installation locations, different fan types, and installed system effects.

IMPORTANT: It is critical that the calibration process be completed using actual system airflows

Upon completion of the calibration process, the TDFi-RT will accurately display and track airflow throughout the fan's complete range of operating airflows.

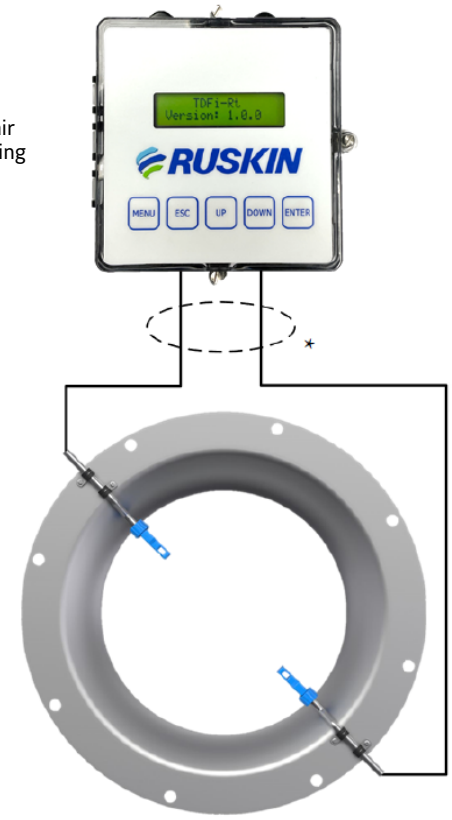
CONFIGURATIONS

Shown below are a few examples of typical installations with the various components of the system called out. Each TDFi-RT can be configured for installation on up to 16 fans, utilizing 1 or 2 sensors per fan. Each configuration example below displays 2 sensors per fan.

* (2) Sensor Cable Assemblies per Fan
(25' lengths is Standard)

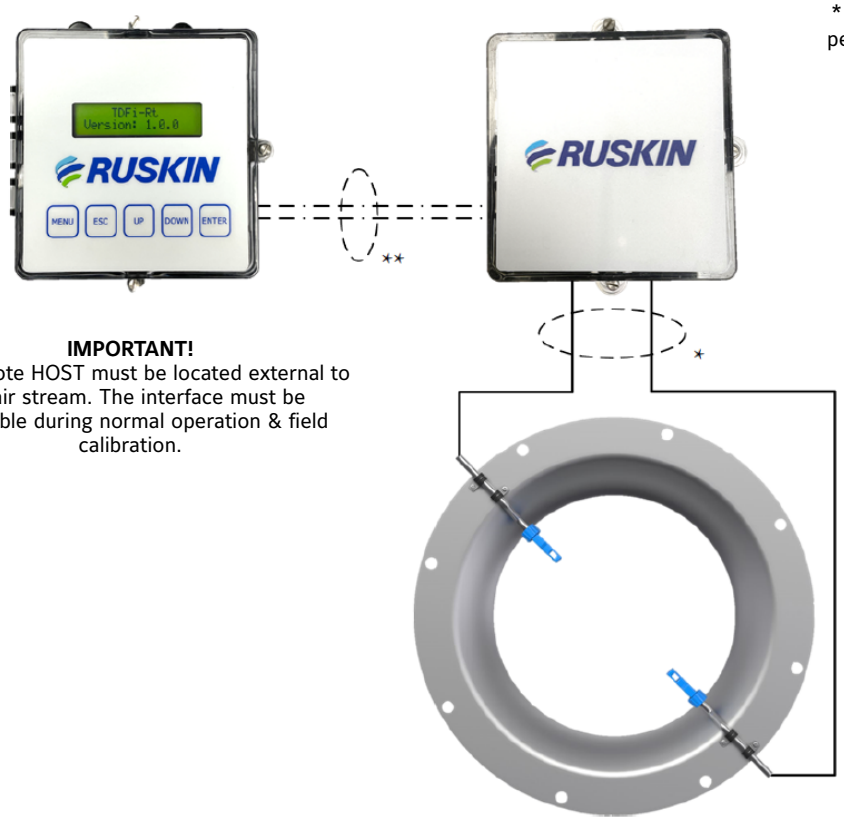
IMPORTANT!

The HOST must be located external to the air stream. The interface must be accessible during normal operation & field calibration.



CONFIGURATION:
1 FAN / 2 SENSORS PER FAN

I&M: Figure 1



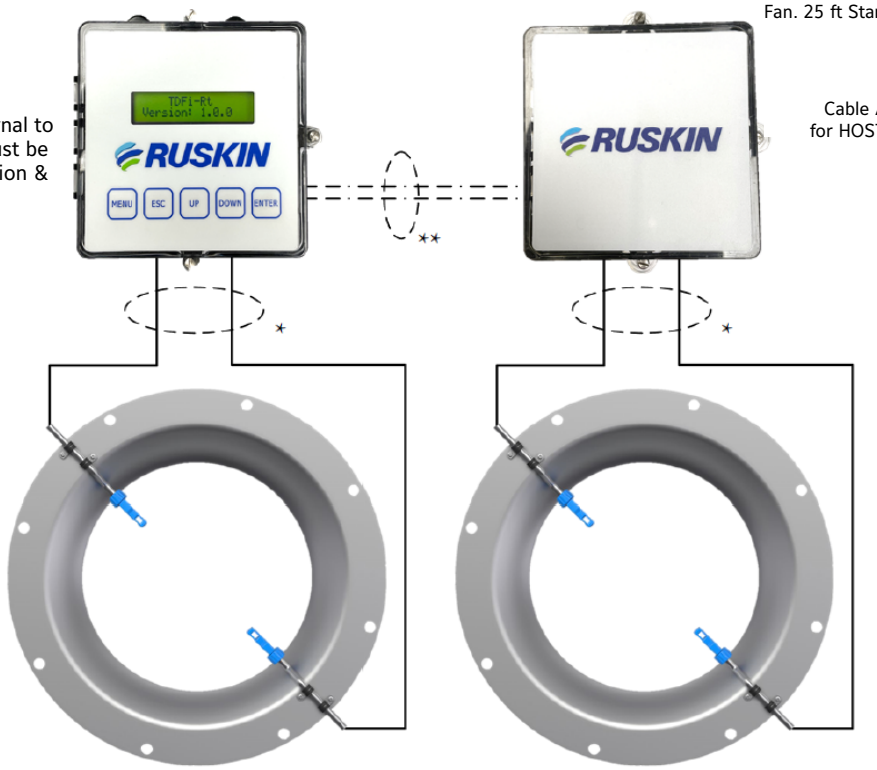
* (2) Sensor Cable Assemblies per Fan (10 ft or 25 ft options) 10 ft Standard

** Remote Host Power/Data Cable Assemblies (10', 25' & 50' options)

IMPORTANT!
The Remote HOST must be located external to the air stream. The interface must be accessible during normal operation & field calibration.

CONFIGURATION:
1 FAN / 2 SENSORS PER FAN
With Remote Host

I&M: Figure 2



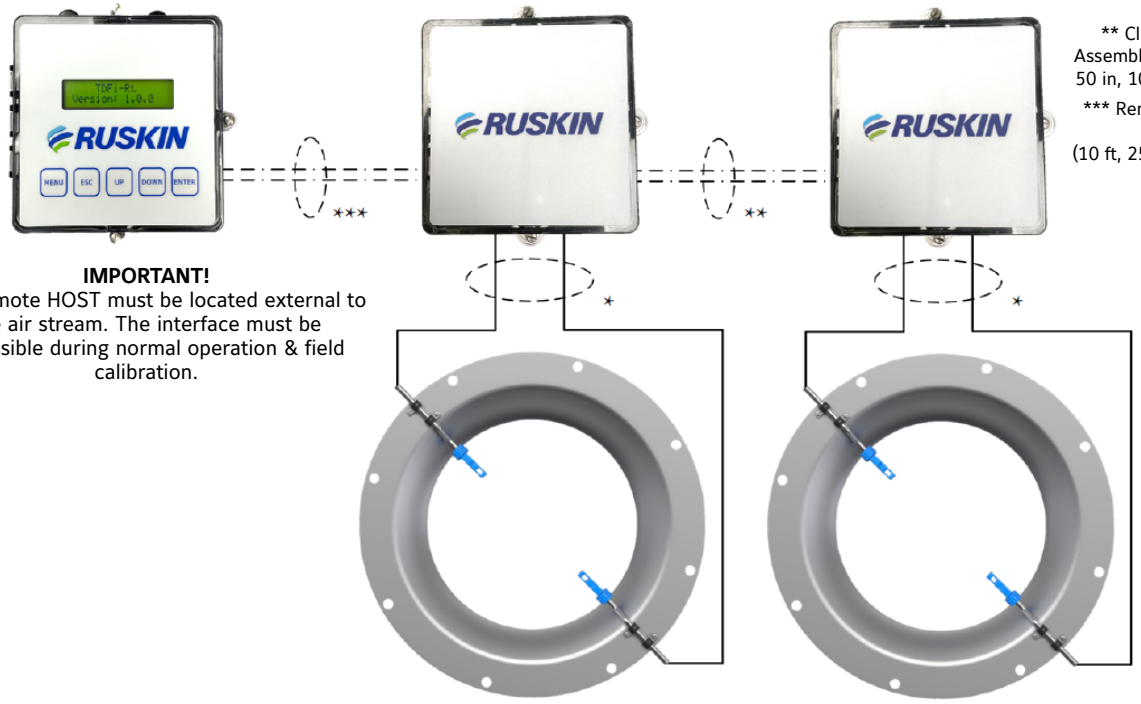
* (2) Sensor Cable Assemblies per Fan. 25 ft Standard for HOST; 10 ft or 25 ft options for CLIENT (10 ft is Standard)

** Client Power/Data Cable Assembly. 25' Standard for HOST-to-CLIENT connection

IMPORTANT!
The HOST must be located external to the air stream. The interface must be accessible during normal operation & field calibration.

CONFIGURATION:
2 FAN / 2 SENSORS PER FAN

I&M: Figure 3



* (2) Sensor Cable Assemblies per Fan (10 ft or 25 ft options) 10 ft Standard

** Client Power/Data Cable Assembly. (18 in, 32 in, 44 in, 50 in, 10 ft, and 25 ft options)

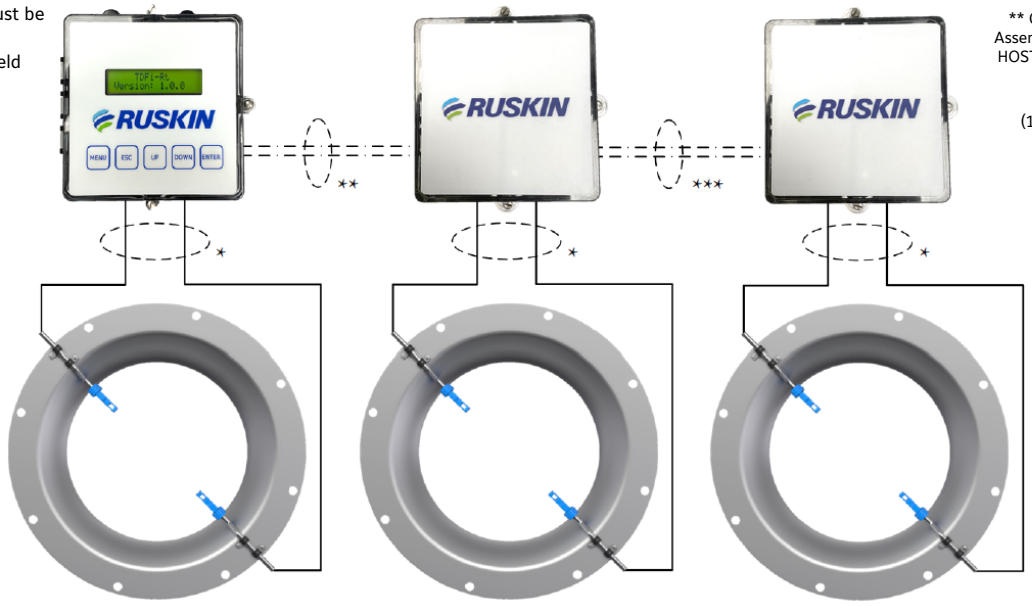
*** Remote Host Power/Data Cable Assemblies (10 ft, 25 ft, and 50 ft options)

IMPORTANT!
The Remote HOST must be located external to the air stream. The interface must be accessible during normal operation & field calibration.

CONFIGURATION:
2 FAN / 2 SENSORS PER FAN
With Remote Host

I&M: Figure 4

IMPORTANT!
The HOST must be located external to the air stream. The interface must be accessible during normal operation & field calibration.



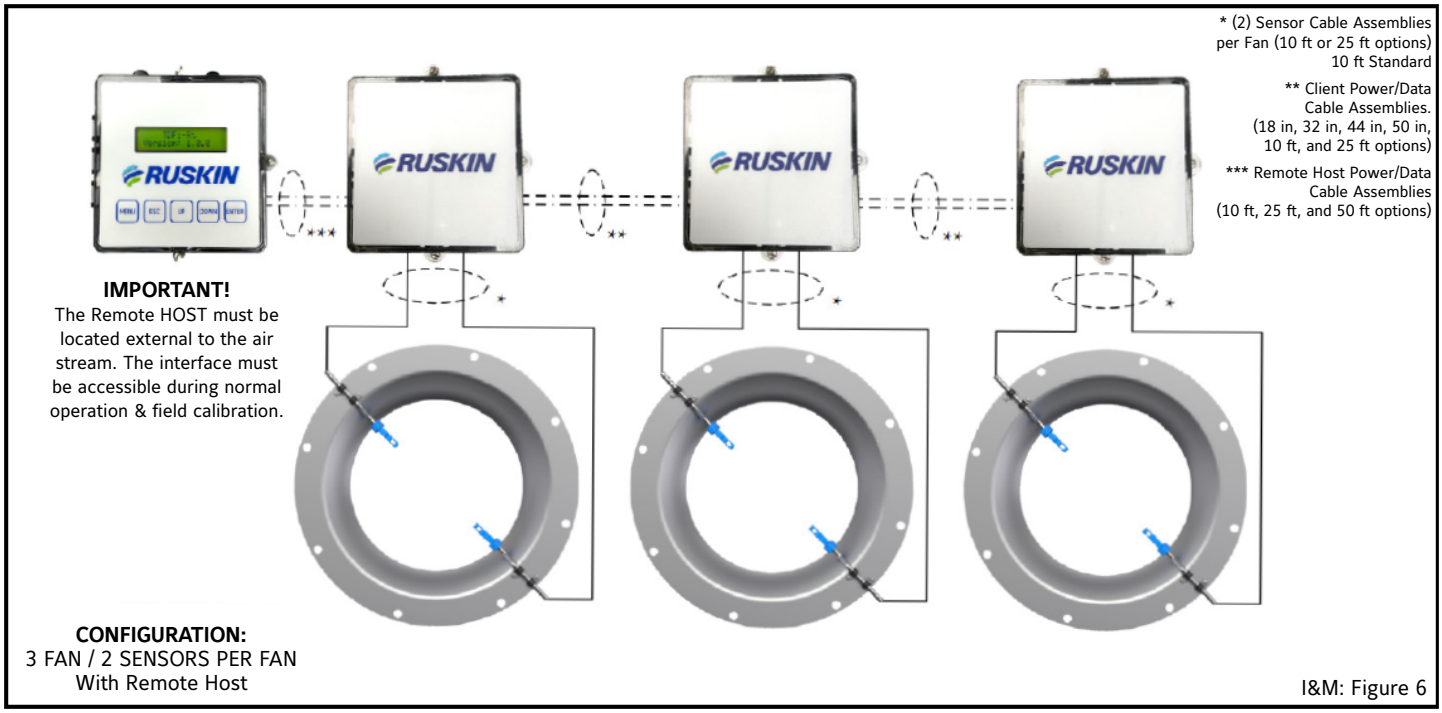
* (2) Sensor Cable Assemblies per Fan. 25 ft Standard for HOST; 10 ft or 25 ft options for CLIENT (10 ft is Standard)

** Client Power/Data Cable Assembly. 25 ft Standard for HOST-to-CLIENT connection

*** Client Power/Data Cable Assembly. (18 in, 32 in, 44 in, 50 in, 10 ft, and 25 ft options)

CONFIGURATION:
3 FAN / 2 SENSORS PER FAN

I&M: Figure 5



I&M: Figure 6

INSTALLATION

Warning: Risk of Electric Shock Disconnect power supply before making electrical connections. Contact with components carrying hazardous voltage can cause electrical shock and may result in severe personal injury or death.

Only a qualified service technician should install this system. To avoid unsatisfactory operation or damage to the product, strictly follow the instructions provided and do not substitute parts. Damage to the product resulting from not following the instructions or using unauthorized parts may be excluded from the manufacturer's warranty coverage.

IMPORTANT: In addition to these instructions, the installation contractor shall comply with all local and International codes and standards to ensure proper and safe installation.

Software Configuration Information for Commissioning:

After the installation described in this document is complete, please refer to the TDFi-RT Technical Bulletin for information regarding configuration options.

The Technical Bulletin document can be viewed or downloaded at this location: http://www.ruskin.com/model/tdfi-rt

The Technical Bulletin document can also be viewed via the QR code shown below:

Unpacking the Advanced Thermal Dispersion Fan Inlet Airflow Measuring System

Remove the thermal dispersion sensor cable assemblies, monitor boxes, power/data cabling, and any accessories from the shipping containers and inspect for damage prior to installation. The contents of each shipping box will satisfy the requirements for each air measurement station on your order. If the components necessary for one air measurement station of your order can not safely be placed into a single shipping box, an additional box(es) will be included with all boxes for a single air measurement station banded together at the factory to simplify the process of receipt inspection.

Note: care should be taken to keep all Host monitors, Client monitors, and sensor cable assemblies for each system together, especially if there are multiple air measurement stations.

The Ruskin TDFi-RT system includes the following standard or optional components/configurations:

HOST Monitor Box or REMOTE HOST Monitor Box

REMOTE HOST COMMUNICATIONS CABLE (if REMOTE HOST option is selected and if configuration includes a Client monitor box.)

1. Available in 10 ft, 25 ft, and 50 ft lengths; 10 ft is Standard.
2. REMOTE HOST communication cable connects the remote host with the nearest Client box; if applicable.
3. REMOTE HOST Monitor box does not include sensor Boom Arm Assemblies. All sensors will be connected to Client monitor boxes.

CLIENT COMMUNICATION CABLE

1. Available in 18", 30", 44", 50", 10ft, and 25ft lengths; 50" is Standard
2. CLIENT communication cables connect one Client monitor box to another Client monitor box and also from the local HOST monitor box to the nearest Client monitor box.
3. For applications which include a local HOST monitor box and one or more Client monitor boxes, one 25ft length of power/data (communication) cable will be provided as Standard to connect the local HOST monitor box to the nearest Client monitor box.

SENSOR CABLE ASSEMBLY (For local HOST or CLIENT Monitor Boxes)

1. Available with 1 or 2 per HOST/CLIENT Monitor Box
2. Available in 10ft or 25ft lengths.
   NOTE: Sensor Cable Assemblies for local HOST monitor boxes are provided in 25ft lengths, as Standard.
3. Each sensor cable assembly includes two (2) mounting clamps (Standard)

SENSOR HOUSING ASSEMBLY

1. 1 sensor housing assembly per sensor cable assembly.
2. The sensor housing assembly is shipped with the sensor opening positioned properly on the boom arm. However, the sensor housing can be rotated on the boom arm in the field ± 90° from the factory-set position to ensure the airflow passes directly through the sensor opening in its final install position.
3. Airflow can pass through either side of the sensor opening.

MONITOR BOX ENCLOSURE

1. Available with NEMA 1 (Standard) or NEMA 4 (Optional)
2. Applies to all REMOTE HOST, HOST, and CLIENT Monitor Boxes

ACCESSORIES

1. Optional - Cord Grips (2)

TRANSFORMER

1. Optional: ZG-X40 (24VAC, 40VA)
2. Optional: IAQ080 (24VAC, 100VA)

IDENTIFYING LOCATION TO MOUNT HOST MONITOR BOX (REMOTE OR LOCAL HOST)

Once it is determined that all components are accounted for, the first step is to select the location where the HOST Monitor box (User Interface) will be mounted. This location must be external to the fan plenum area so that the user interface is easily accessible and viewed while the fan(s) are in operation. Access doors that would affect airflow through the fan(s) must be closed and all fan guards and safety guards must be in place during the calibration process while the fan(s) are in operation.

The menu buttons on the HOST Monitor box (User Interface) must be accessible during the setup and calibration process while the fan(s) are run through their full range of airflows. If the airflow measurement station was supplied with a local HOST monitor box with either one (1) or two (2) sensor cable assemblies, select a location for the HOST monitor box that is within the length of sensor cable(s) supplied with the sensor cable assembly. The local HOST will come with sensor cable assembly lengths of 25ft, as Standard.

Unlike a HOST monitor box, a CLIENT monitor box can be installed inside the fan plenum area (in closer proximity to the fans). Depending on the number of fans and the equipment supplied, the TDFi-RT can be installed with one or two sensors per fan for any number of fans that make up an array. Use two sensors on a single inlet fan (SWSI) or a dual inlet fan (DWDI). On dual inlet fans (DWDI), only two sensors are required and are to be mounted on the "non-pulley" side of the fan.

NOTICE: Locate the local HOST within reach of the sensor cable assembly that is mounted to the fan inlet. Sensor cable assembly lengths of 25 ft are provided as Standard for the local HOST monitor box.

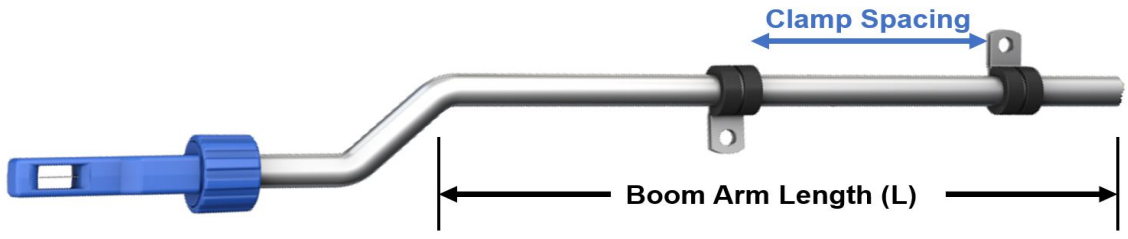
A REMOTE HOST, when supplied with CLIENT box(es) can be installed remotely up to 500ft away and connected to the CLIENT using a twisted shielded pair network wire suitable for Modbus type networks or use Connect-Air part number W24182P-2306BL with communications and power in one cable.

LOCATING THE BOOM ARM AND SENSOR ON THE FAN INLET

Inspect the fan inlet opening to ensure no obstructions or irregularities interfere with installation of the sensors. When the TDFi-RT configuration includes a HOST and CLIENT monitor box(es), the CLIENT monitor box(es) are intended to be installed in the fan plenum areas and wired to a local or remote HOST monitor box. All monitor boxes (HOST and CLIENT) must be mounted away from VFD drives and as far as possible from high voltage wiring. Boxes must be mounted on on a solid, secure surface that is free from vibrations.

WARNING
Do NOT install HOST or CLIENT monitor boxes near VFD drives or near high voltage wiring.

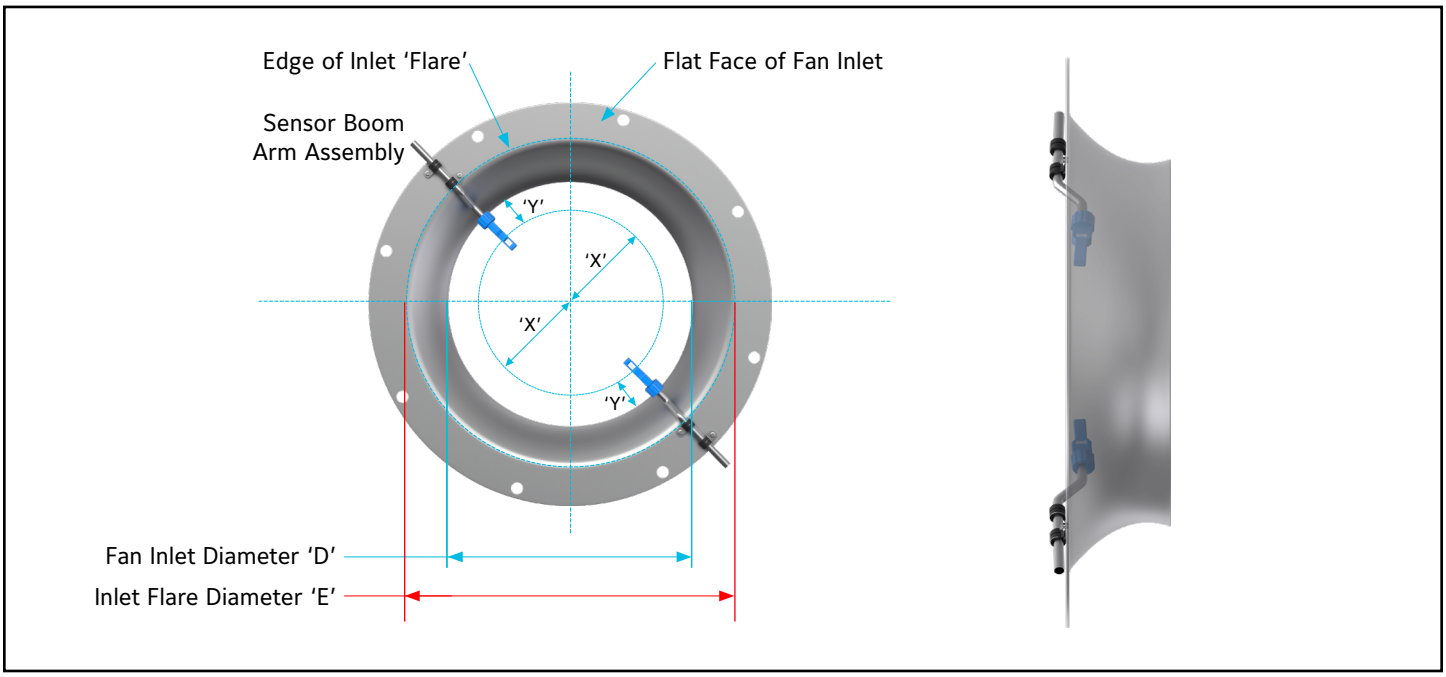
Mount the boom arm onto the face of the fan (inlet bell/flare) using the vibration dampening loop clamps supplied (two clamps included per sensor cable assembly). Space the clamps on boom arm according to the table below to minimize to minimize effects of vibration on the sensor housing assembly.



Inlet Flare Diameter (E)	6″ up to 10″	Above 10″ thru 14″	Above 14" thru 22"	Above 22" thru 30"	Above 30" thru 35"	Above 35" thru 40"	Above 40″
Minimum / Default Boom Arm Length (L)	4″	6"	8"	10"	12"	14"	16"
Minimum Clamp Spacing	2″	3"	3"	4"	4"	4"	5"

Note: Boom arm lengths longer than the Minimum/Default based on the Inlet Flare Diameter are available up to 16″.

The sensor should be cantilevered into the airstream such that the sensor opening is positioned on the circumference of an imaginary circle that measures two-thirds of the fan's inlet diameter (D). Adjust the boom arm assembly so that the sensor is as deep into the throat of the fan inlet as possible without interfering with the operation of the fan. When properly installed, the sensor should be positioned a distance of one-sixth of the fan inlet diameter (D) from the edge of the fan inlet. (Y = 1/6 x D)



X = distance between centerline of fan and recommended sensor placement = 1/3 of Fan Inlet Diameter 'D'

Y = distance from edge of Fan Inlet Diameter to the recommended sensor placement = 1/6 of Fan Inlet Diameter 'D'

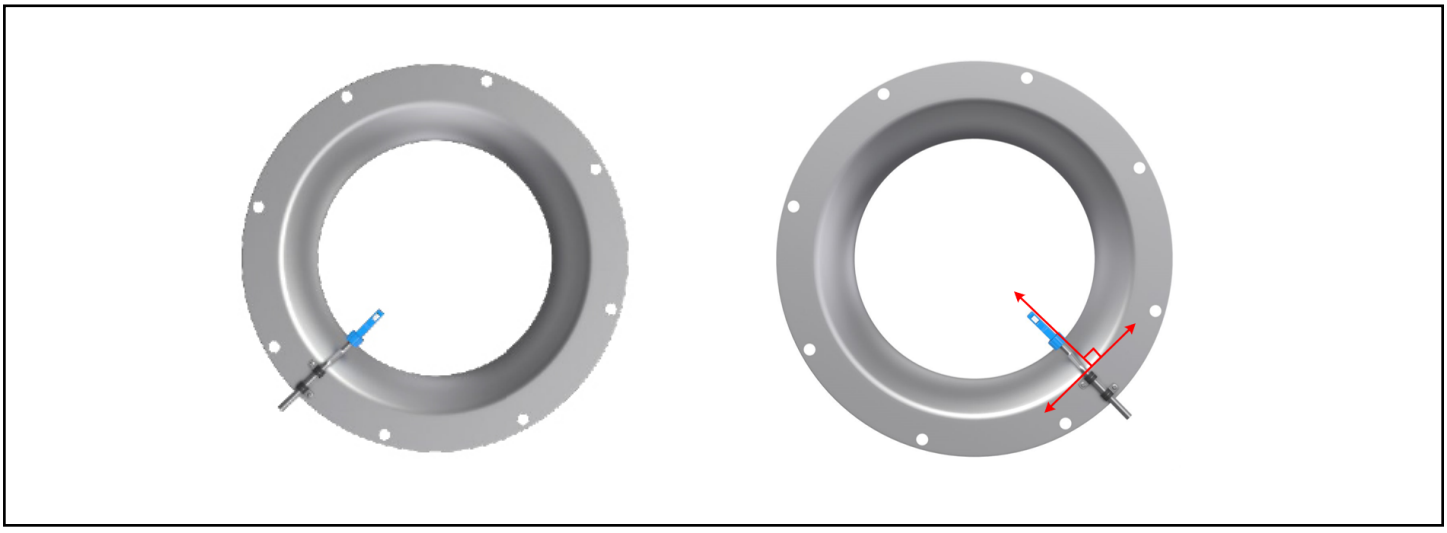
E = Inlet Flare Diameter

D = Fan Inlet Diameter (dimension of narrowest opening at inlet to the fan)

For example, when mounting a boom arm assembly onto a fan with an 18 inch diameter inlet (D), the sensor should be located 3 inches (18 ÷ 6 = 3) from the internal edge of the fan inlet.

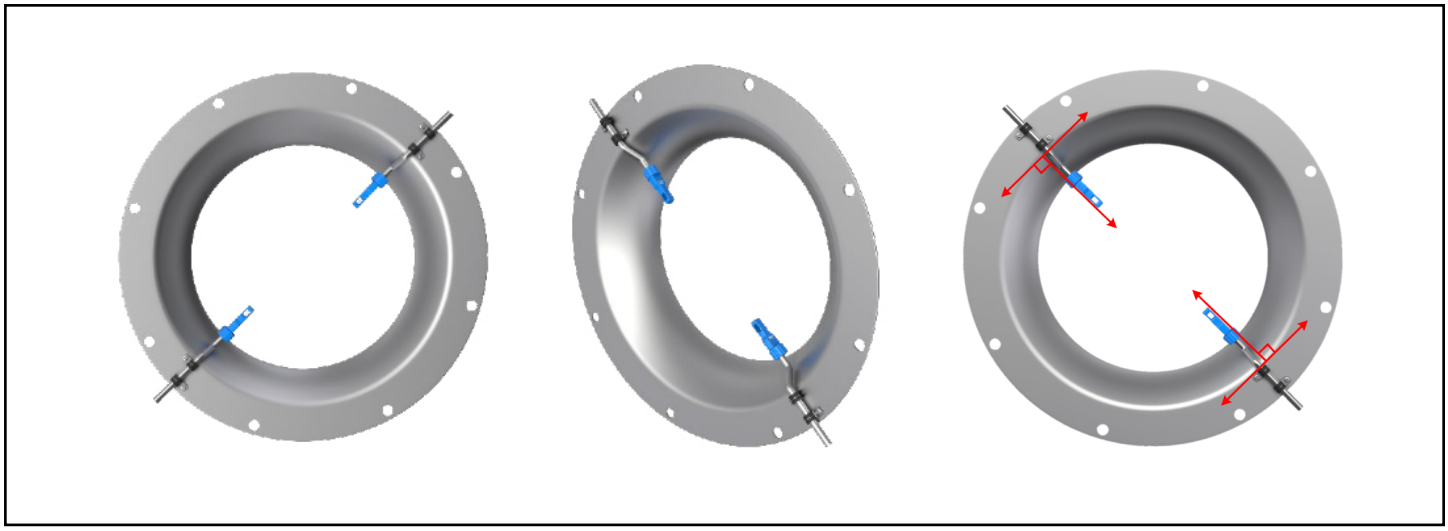
NOTE: Locating the sensor within ±1 inch of the ideal 'Y' position is acceptable for achieving proper airflow measuring performance.

For installations that will include one sensor per fan, the boom arm assembly can be mounted at any location around the circumference of the fan. Position the sensor at a 90° angle (perpendicular) to the tangent of the fan's circumference.



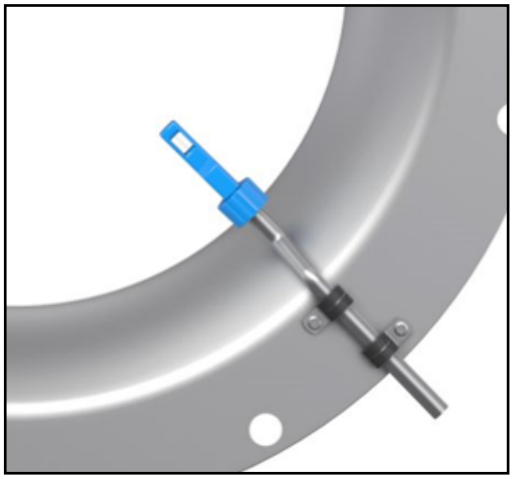
When installing one sensor per fan of a fan array, mount the boom arm assemblies at alternating positions from one fan to another. For example, one boom arm assembly should be mounted on the left side of the fan #1 (from 6 o'clock position to the 12 o'clock position) and the boom arm assembly on an adjacent fan #2 should be mounted on the right side of the fan (from 12 o'clock position to the 6 o'clock position).

For installations that include two sensors per fan, the sensors should be located 180° apart from each other...when possible. For fans with top or bottom airflow discharge locations, the ideal sensor location would be at the 3 o'clock and 9 o'clock positions; and for fans with left or right airflow discharge locations, the 12 o'clock and 6 o'clock locations would be ideal. However, any point on the circumference of the fan will be acceptable if the ideal position is not possible due to interference.



Avoid placement of the sensors downstream from objects that are present in the airstream at the fan inlet. Airstream disturbance should be avoided to achieve a stable and repeatable airflow measurement by positioning the sensors as far as possible from existing obstructions (turbulence) in the air entering flow pattern.

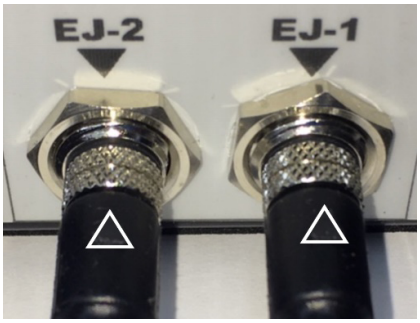
The design of the TDFi-RT will fully compensate during the calibration process for normal variance in sensor placement. However, it is critical that the sensor opening is positioned correctly after the boom arm assembly has been secured so that you can see directly through the sensor into the fan.



CONNECTING THE SENSOR CABLE ASSEMBLY TO THE HOST OR CLIENT MONITOR BOX

With power OFF, connect the fan inlet sensor to the ports on the HOST or CLIENT monitor box marked EJ-1 and EJ-2. To plug in the sensor cable, match up the black arrow on the monitor box label with the arrow on the cable over-mold.

After the connector pins of the cable are aligned with the socket, insert the cable pins into the socket. The knurled ring can then be rotated clockwise to tighten and secure the cable to the socket connection. Finger-tighten only to avoid damage to the components. When connected properly using only finger-tight torque, the connection will prevent moisture from entering the connector and the sensors from becoming accidentally disconnected from the monitor box.



Failure to install the sensor cable assembly completely and fully into the EJ-1/EJ-2 socket will result in failed calibrations and system configuration.

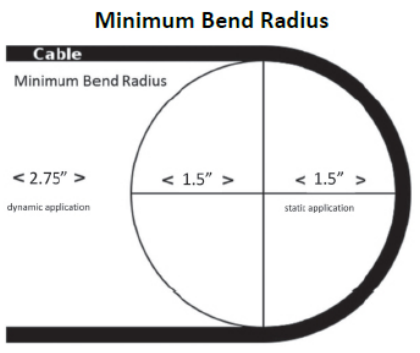
IMPORTANT: Improper sensor installations will result in FAILED calibrations!

WIRING

Comm Cable Specifications

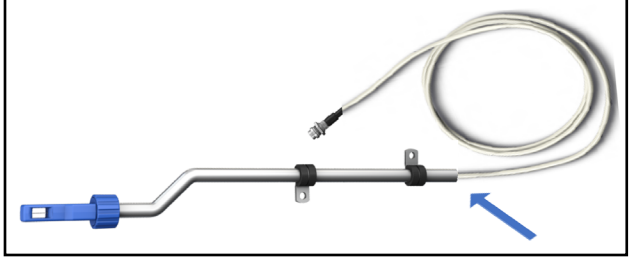
For ease of installation, Connect-Air part number W24182P-2306BL with communications and power in one cable is recommended. Alternatively, use a twisted shielded pair 24 AWG low capacitance wire communications cable and an 18 AWG power cable.

Note: Do not kink the supplied blue interconnection wires. In an exposed or conduit installation, the wiring minimum bend radius is 1.5 inches (38 mm).



Sensor Cable Assemblies

Note: Do not kink or pinch the supplied white sensor cabling as this will affect performance. Do not apply tensile stress to the cabling as this could lead to damage of the cable-sensor connection and ultimately lead to sensor failure. Care should be taken to ensure the cabling does not exceed the minimum bend radius (especially at the point where the cable enters the boom arm (see below) as this could result in damage to the wire insulator and sensor failure. In an exposed or conduit installation, the wiring minimum bend radius is 1.5 inches (38 mm).



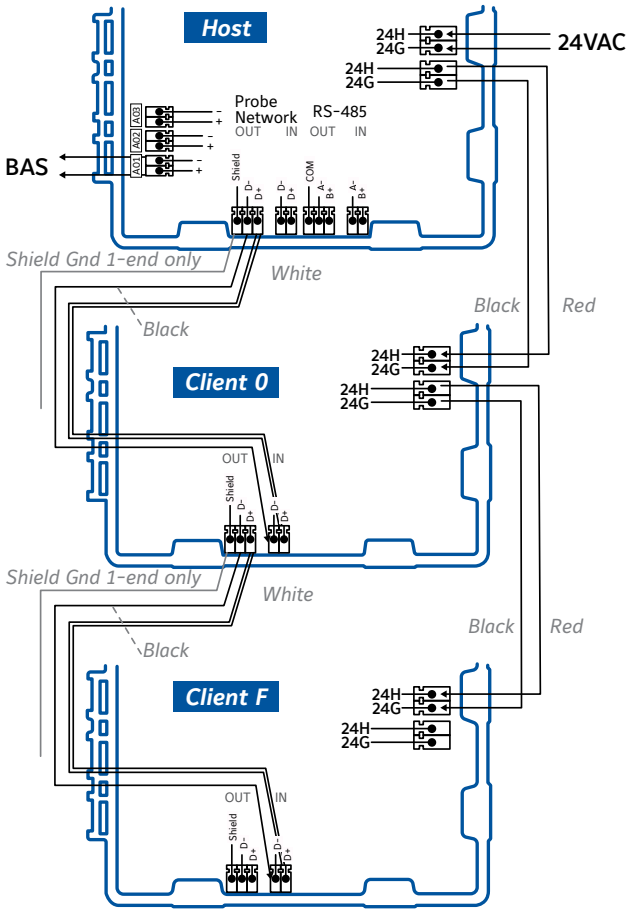
WIRING CONNECTIONS

IMPORTANT: Do not run the probe wiring in the same conduit as other AC power wiring or with wiring used to supply highly inductive loads, such as motors, contactors, and relays. Fluctuating, erratic, and inaccurate signal levels are possible when AC power wiring is present in the same conduit as the signal lines. Run the wiring away from variable frequency drives or broadcast antennas.

HOST Monitor Box

CLIENT Monitor Box

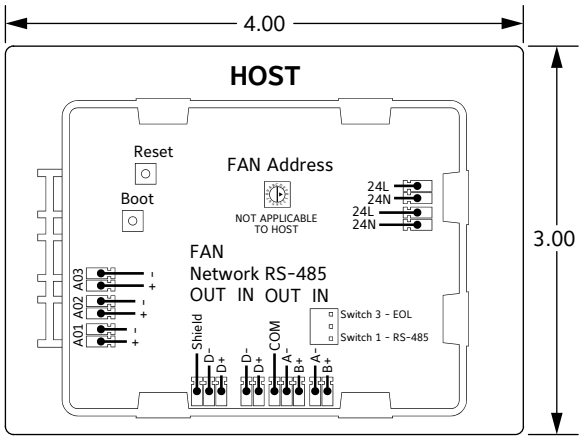
CLIENT Monitor Box



Typical Wiring Configuration

HOST AND REMOTE HOST MONITOR BOX

IMPORTANT: The HOST provides two 4-20mA signals to building automation systems. Do not apply loop power to the HOST or REMOTE HOST monitor boxes. The system requires a two-wire power connection and separate two-wire connections for each analog output. Analog outputs are isolated from power; therefore, 3 wire connections will NOT work correctly.



Not Shown: Two (2) 499 Ohm resistors in plastic bag secured to the inside of the HOST monitor box.

HOST AND REMOTE HOST MONITOR BOX FEATURES

Callout	Feature	Description
1	Reset	Cycle power to the device without unplugging it. A power cycle is required to reset overload protection and output short circuit.
2	499 Ohm Resistor(s)	To convert the output from 4-20mA to a 2-10VDC output, install a 499 ohm resistor across the + and - terminals of the A01 or A02 output. Two 499 ohm resistors are taped to the inside of each Host enclosure.

Analog Output

1. Carefully remove the top of the Phoenix Contact screw terminal connector and insert the wires. Tighten the terminals and reconnect them to the monitor board.
2. Connect the 4-20mA analog flow output (A01: Pos and Com) and the 4-20mA analog output factory default temperature (A02: temperature output) from the HOST to the building automation system.

Note: The factory default flow output is A01. Either output A01 or A02 can be configured for temperature or flow, or both can be configured for temperature and/or flow.

Probe Network

Connect the Shield, D-, and D+ from the HOST monitor to the CLIENT monitor using the approved communications wire. A03 is not used at this time.

RS-485 Network Output (BACnet MS/TP or Modbus RTU)

1. Carefully remove the top of the Phoenix Contact screw terminal connector and insert the wires. Tighten the terminals and reconnect them to the control board.
2. Connect the RS-485 output (A- and B+) from the HOST to an RS-485 network (BACnet MS/TP or Modbus RTU), if required, using a 3- conductor network cable meeting the corresponding BACnet or Modbus standards. Ensure that all three connections (N+, N-, and NC) are connected.

Note: If a 2-conductor network cable or other non-conforming cable is used, network speed, length, and reliability may be compromised or network failure may occur.

Note: The two A- connections and the two B+ connections are electrically identical.

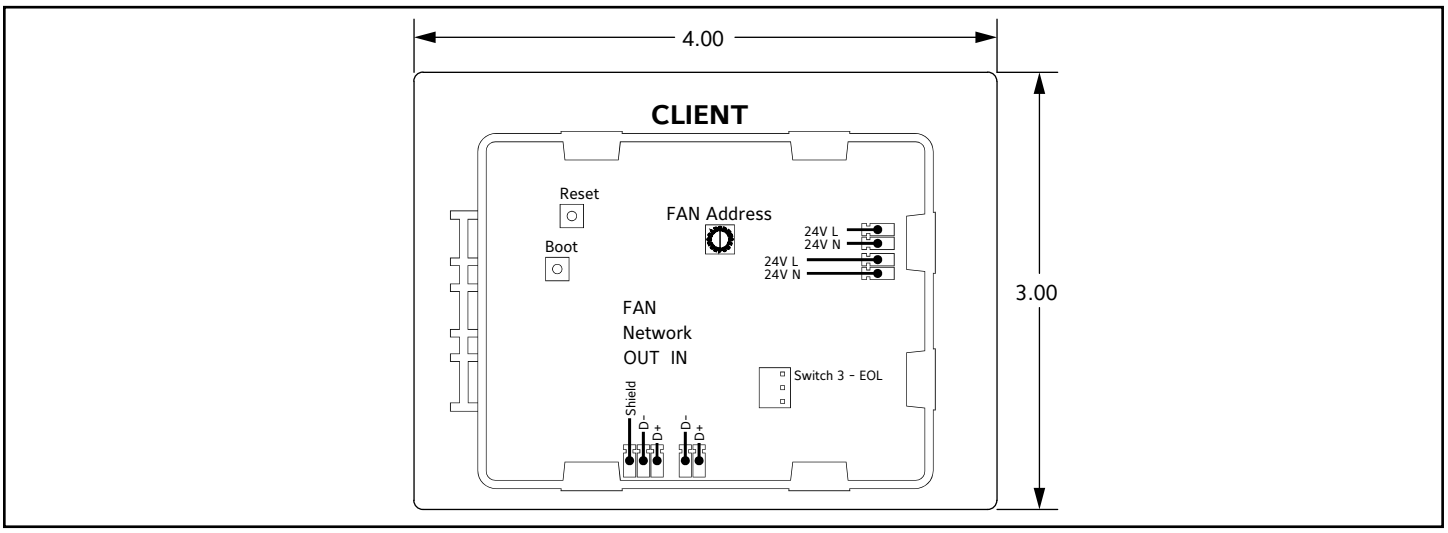
3. Connect the shield wire from the HOST to the Shield terminal.

Note: The Shield is always connected on one end only of each wire run and should never be connected on both ends of one wire.

Power

1. Carefully remove the top of the Phoenix Contact screw terminal connector and insert the wires. Tighten the terminals and reconnect them to the controller board.
2. Connect the 24VAC from power source to the HOST; and daisy chain the power from monitor box to monitor box.
3. Connect the 24VAC hot wire to the HOST monitor box terminal labeled 24H.
4. Connect the 24VAC common wire to the HOST monitor box terminal labeled 24G.

Note: The two 24H connections are electrically identical; and the two 24G connections are also electrically identical.



CLIENT MONITOR BOX FEATURES

Callout	Feature	Description
1	Reset	Cycle power to the device without unplugging it.
2	Monitor Box Address Rotary Switch	Sets the address for each Client monitor box on the network. The rotary switch is set at the factory for each system. Note: Duplicate addresses are not allowed on the network. HOST monitor box does not require or have an address.

Network

1. Carefully remove the top of the Phoenix Contact screw terminal connector and insert the wires. Tighten the screw terminals and reconnect them to the circuit board.
2. Connect the probe network terminal from the HOST to the network terminals in the CLIENT monitor box.
   a. The shield only connects on one end.
   b. Connect the 24 AWG black wire from the HOST monitor box terminal labeled Network D- to the CLIENT monitor box terminal labeled Network D-.
   c. Connect the 24 AWG white wire from the HOST monitor box terminal labeled D+ to the CLIENT monitor box terminal labeled Network D+.
3. Connect additional CLIENT monitor boxes in a daisy-chain series.

Note: The last client in each airflow measuring station can have the end of line (EOL) switch set for the network (switch 3; see HOST Figure on page 15). If the HOST is connected to a RS-485 Building Automation System (BAS) network interface and the Advanced Thermal Dispersion Airflow Measuring System is at the end of line on the RS-485 network, set the RS-485 EOL switch to 1 ON (shown in the OFF position on the HOST Figure; located on page 15).

Power

Note: Each CLIENT monitor box requires power and can be powered from the same source as the HOST monitor box. Observe polarity to prevent a direct short. Two power connections are provided and are electrically the same. These connections can be used interchangeably to connect additional CLIENT monitor boxes.

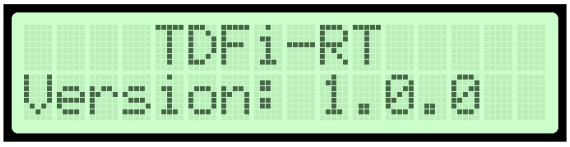
1. Carefully remove the top of the Phoenix screw terminal connector and insert the wires. Tighten the screw terminals and plug into to the circuit board.
2. Connect the 18 AWG copper red wire from the HOST monitor box terminal labeled 24H to the CLIENT monitor box terminal labeled 24H.
3. Connect the 18 AWG copper black wire from the HOST monitor box terminal labeled 24G to the CLIENT monitor box terminal labeled 24G.

Completing the Wiring

When the HOST and CLIENT monitor box wiring is complete, apply power to the system.

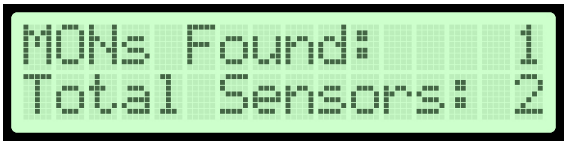
When power is applied, the firmware version number will be displayed along with the number of Monitor boxes (MON) and the total number of sensors.

Example:



The next screen will then populate with the number of Monitors and Total Sensors that the system has identified.

Example:



Confirm this information is correct for the airflow measurement system installed. If it is incorrect, check all network wiring and CLIENT address dial settings. Confirm that no two CLIENT monitors are set for the same address. Each CLIENT address setting must be unique on the network to work correctly. The HOST monitor box address is hard-coded and does not need to be changed or addressed. Confirm the connections are made to the network and are not to the RS-485 or analog output connections on the HOST. After the device warms up, the temperature and flow readings will be displayed.

IMPORTANT: Confirm the connections are made to the network and are not to the RS-485 or analog connections on the HOST. After the device warms up, the temperature and flow readings will be displayed.

Refer to the TDFi-RT Advanced Thermal Dispersion Fan Inlet Airflow Measuring System TECHNICAL BULLETIN for detailed configuration instructions. http://www.ruskin.com/model/tdif-rt

FACTORY CONFIGURATION NOTE: Each airflow measuring station is factory configured for the equipment included. If necessary, the display will prompt user to enter the number of fans and the number of sensors per fan. If the airflow measuring station is NOT configured or a 'Factory Defaults' has been performed, a manual configuration will be required.

Configure Settings At Power-Up (if not already configured or Factory Default was performed)

Example:

Config System?

- » Select YES

Number of Fans?

- » Select the Number of Fans

Number of Sensors per Fan?

- » Select the Number of Sensors per Fan

Enter to Configure (Fan 1, Fan 2, etc.)

- » Assign the appropriate Monitor Box with the associated Fan Number

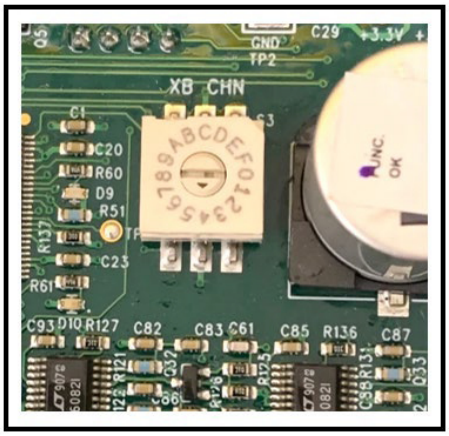
Resetting Factory Default Fan Configurations - Supervisor Menu

Example: **Enter the Supervisor Menu**

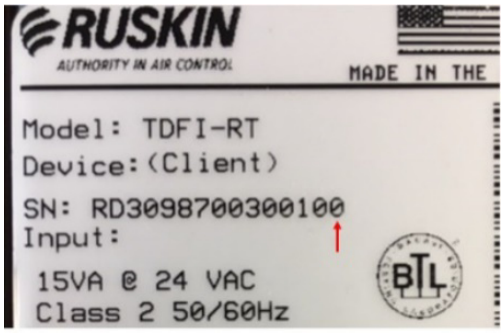
- » Select 'Fan Array Config'
  - Number of Fans
    - › If necessary, using the UP or DOWN buttons to match the correct number of fans in the system.
  - Number of Sensors per Fan
    - › If necessary, using the UP or DOWN buttons to correct number of sensors per fan.
  - Set Fan Sensors
    - › If necessary, using the UP or DOWN buttons to correct the associated fan number with its respective Monitor box.

CONFIGURATION NOTE: Select Monitor #. This can be MON H for the HOST box or hex address MON 0 through MON F for CLIENT box(es).

NOTE: The HOST monitor box is a hard-coded address in firmware. Changing the rotary switch address selector in the HOST enclosure is **NOT REQUIRED**.



The serial number on the outside of the CLIENT box ends with the factory preset rotary's address. Addresses can be changed if necessary, using the Rotary switch in the CLIENT enclosures only.



With boom arms mounted, sensors properly located within fan inlet, and the configuration process noted above completed, the TDFi-RT will display an increasing airflow when the fan speed is increased.

The airflow displayed is only an indication of changing airflow and is not an accurate airflow measurement until the calibration steps have been successfully completed at known airflows.

IMPORTANT: It is critical that the calibration process be completed using actual system airflows. Individual site Calibration is REQUIRED.

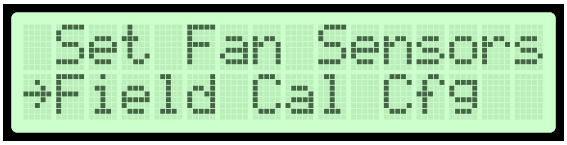
FAN CALIBRATION PROCEDURES

When power is initially applied for the first time, the air measurement station is NOT calibrated. Each TDFi-RT fan inlet airflow measurement station must be field calibrated by running the fan at one, two, or three known airflow values or using airflow measurements provided by Test & Balance (T&B) contractor. It is recommended to record damper positions (if applicable) and drive speeds while T&B is on site to facilitate recalibration anytime measurement equipment must be moved or replaced.

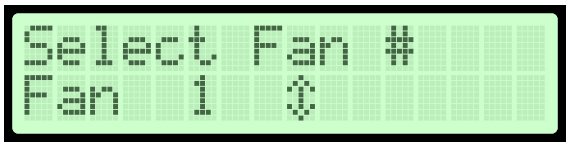
It is necessary to manually go through the following steps to enter calibration mode.

For Single Fan or Fans of Various Diameters

1. Enter the SUPERVISOR Menu
   a. Select 'Field Cal Config'

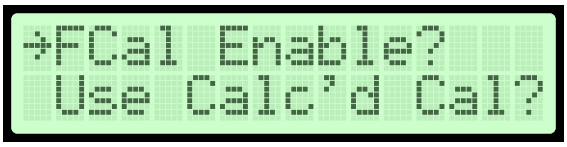


      i. Select Fan #
         1. Using the UP or DOWN buttons, select the associated Fan.



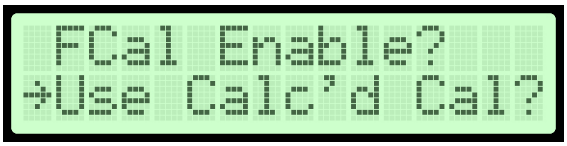
Note: Only the number of selectable Fans on the system can be calibrated. If an expected Fan association is not present, you will need to configure the Fan using the 'Fan Array Config' feature located under SUPERVISOR Settings.

   b. Select FCal Enable?



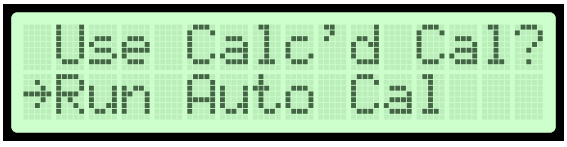
      i. Using the UP or DOWN buttons, select Field Cal 'On'

   c. Select Use Calc'd Cal?



      i. Using the UP or DOWN buttons, select 'Yes'

   d. Select Run Auto Cal



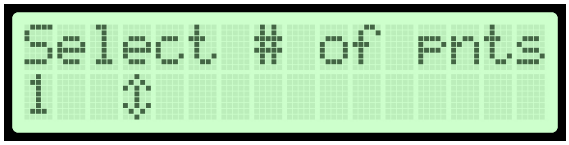
i. ‘Press Enter to Calibrate’ will be displayed. Press ENTER.

ii. Site ‘Fan Diameter’ will be displayed. Using the UP or DOWN buttons, enter the associated Fan Diameter as measured where the sensors are installed. Press ENTER.

iii. ‘Calc’d Area’ will be displayed. Press ENTER.

Note: The SqFt value displayed is calculated from the Fan Diameter entered above. Enter a custom SqFt value if different from the calculated value from the Fan Diameter entry. The HOST will reverse calculate the NEW Fan Diameter if the SqFt is changed by the user. Changing the SqFt setting will also change the Design Range High value as well for the Flow Analog Output.

e. ‘Select # of Pnts’ is displayed



i. Using the UP or DOWN buttons, select the number of the desired ‘Calibration Points’. Press ENTER.

Note: 3, 2, or 1 Calibration Points are available for selection.

1-Point is used for fixed speed fans.

2-Point is used with a min airflow (not Zero) and a max airflow.

3-point is used with a min airflow (not Zero), a medium airflow that is half-way between the min airflow and the max airflow, and a max airflow. Max airflow is all that the fan can possibly generate if the VFD is being driven past 60Hz.

IMPORTANT: The minimum calibration value is NOT Zero and must be a point to the right of the fan’s performance curve.

f. Measured Point 1 is displayed

i. Run the fan at the Minimum Airflow.

1. After the fan has reached the minimum airflow, use the UP or DOWN buttons to select the airflow value of the desired ‘Calibration Points’. Press ‘ENTER’

g. (If applicable) Measured Point 2 is displayed.

i. Run the fan at the Medium Airflow.

1. After the fan has reached the medium airflow measured, use the UP or DOWN buttons to select the airflow value of the desired ‘Calibration Points’. Press ‘ENTER’

h. (if applicable) Measured Point 3 is displayed.

i. Run the fan at the Maximum Airflow possible.

1. After the fan has reached the highest airflow, use the UP or DOWN buttons to select the airflow value of the desired ‘Calibration Points’. Press ‘ENTER’

CALIBRATION NOTE: If the HOST is the automation interface for more than one airflow measurement station on different AHUs or the same AHU’s supply and return fans, repeat the steps above for each airflow measurement station.

For Fan Arrays of Same Diameter

1. Enter the SUPERVISOR Menu

a. Select ‘Fan Array Config’

b. Select ‘Fan Array Cal’

i. Site ‘Fan Diameter’ will be displayed. Using the UP or DOWN buttons, enter the array’s fan inlet diameters for one fan as measured where the sensors are installed. Press ‘ENTER’.

ii. ‘Calc’d Area’ will be displayed. Press ‘ENTER’

Note: The SqFt value displayed is calculated from the fan diameter entered above.

c. ‘Press Enter to Calibrate’ will be displayed. Press ‘ENTER’

d. ‘Select # of Pnts’ is displayed.

i. Using the UP or DOWN buttons, select the number of desired ‘Calibration Points’. Press ‘ENTER’.

Note: 3, 2, or 1 Calibration Points are available for selection.

1-Point is used for fixed speed fans.

2-Point is used with a min airflow (not Zero) and a max airflow.

3-point is used with a min airflow (not Zero), a medium airflow that is half-way between the min airflow and the max airflow, and a max airflow. Max airflow is all that the fan can possibly generate if the VFD is being driven past 60Hz.

IMPORTANT: The minimum calibration value is NOT Zero and must be a point to the right of the fan's performance curve.

e. Measured Point 1 is displayed

ii. Run the fan at the Minimum Airflow.

1. After the fan has reached the minimum airflow, use the UP or DOWN buttons to select the airflow value of the desired 'Calibration Points'. Press 'ENTER'

f. (If applicable) Measured Point 2 is displayed.

iii. Run the fan at the Medium Airflow.

1. After the fan has reached the medium airflow measured, use the UP or DOWN buttons to select the airflow value of the desired 'Calibration Points'. Press 'ENTER'

g. (If applicable) Measured Point 3 is displayed.

iv. Run the fan at the Maximum Airflow possible.

1. After the fan has reached the highest airflow, use the UP or DOWN buttons to select the airflow value of the desired 'Calibration Points'. Press 'ENTER'

Note: when calibration is complete, to view the calibration data continue to follow the display prompts until 'View Cal' is displayed.

When the calibration steps are completed correctly, the measured airflow will accurately track the actual airflow.

Calibrated results may be unacceptable for installations where the airflow was obstructed through the fan's intake. When this is the case, it may be necessary to reposition the sensors free from interference/obstructions and repeat the calibration process above to have the airflow measurement track well through the full range of operation.

Table A: BACnet Device Instance Numbers

Name	Description	Type	Inst	Units
TDFi-RT[1]	The Device Object	DEV	XXXX[1]	See Appendix 'B'
Notification Class	Handles where to send events and notifications	NC	1	See Appendix 'B'
Fan Summary Temperature	Fan Summary Average Temperature	AV	1	See Appendix 'B'
Fan Summary ACT Airflow Velocity[3]	Fan Summary airflow velocity or volume	AV	2	See Appendix 'B'
Fan 1 Temperature	Individual Fan 1 Temperature	AV	3	See Appendix 'B'
Fan 1 Actual Airflow Velocity[3]	Individual Fan 1 airflow velocity or volume	AV	4	See Appendix 'B'
Fan 2 Temperature	Individual Fan 2 Temperature	AV	5	See Appendix 'B'
Fan 2 Actual Airflow Velocity[3]	Individual Fan 2 airflow velocity or volume	AV	6	See Appendix 'B'
Fan 3 Temerature	Individual Fan 3 Temperature	AV	7	See Appendix 'B'
Fan 3 Actual Airflow Velocity[3]	Individual Fan 3 airflow velocity or volume	AV	8	See Appendix 'B'
Fan 4 Temperature	Individual Fan 4 Temperature	AV	9	See Appendix 'B'
Fan 4 Actual Airflow Velocity[3]	Individual Fan 4 airflow velocity or volume	AV	10	See Appendix 'B'
Fan 5 Temperature	Individual Fan 5 Temperature	AV	11	See Appendix 'B'
Fan 5 Actual Airflow Velocity[3]	Individual Fan 5 airflow velocity or volume	AV	12	See Appendix 'B'
Fan 6 Temperature	Individual 6 Temperature	AV	13	See Appendix 'B'

Table A: BACnet Device Instance Numbers

Name	Description	Type	Inst	Units
Fan 6 Actual Airflow Velocity[3]	Individual Fan 6 airflow velocity or volume	AV	14	See Appendix 'B'
Fan 7 Temperature	Individual Fan 7 Temperature	AV	15	See Appendix 'B'
Fan 7 Actual Airflow Velocity[3]	Individual Fan 7 airflow velocity or volume	AV	16	See Appendix 'B'
Fan 8 Temperature	Individual Fan 8 Temperature	AV	17	See Appendix 'B'
Fan 8 Actual Airflow Velocity[3]	Individual Fan 8 airflow velocity or volume	AV	18	See Appendix 'B'
Fan 9 Temperature	Individual Fan 9 Temperature	AV	19	See Appendix 'B'
Fan 9 Actual Airflow Velocity[3]	Individual Fan 9 airflow velocity or volume	AV	20	See Appendix 'B'
Fan 10 Temperature	Individual Fan 10 Temperature	AV	21	See Appendix 'B'
Fan 10 Actual Airflow Velocity[3]	Individual Fan 10 airflow velocity or volume	AV	22	See Appendix 'B'
Fan 11 Temperature	Individual Fan 11 Temperature	AV	23	See Appendix 'B'
Fan 11 Actual Airflow Velocity[3]	Individual Fan 11 airflow velocity or volume	AV	24	See Appendix 'B'
Fan 12 Temperature	Individual Fan 12 Temperature	AV	25	See Appendix 'B'
Fan 12 Actual Airflow Velocity[3]	Individual Fan 12 airflow velocity or volume	AV	26	See Appendix 'B'
Fan 13 Temperature	Individual Fan 13 Temperature	AV	27	See Appendix 'B'
Fan 13 Actual Airflow Velocity[3]	Individual Fan 13 airflow velocity or volume	AV	28	See Appendix 'B'
Fan 14 Temperature	Individual Fan 14 Temperature	AV	29	See Appendix 'B'
Fan 14 Actual Airflow Velocity[3]	Individual Fan 14 airflow velocity or volume	AV	30	See Appendix 'B'
Fan 15 Temperature	Individual Fan 15 Temperature	AV	31	See Appendix 'B'
Fan 15 Actual Airflow Velocity[3]	Individual Fan 15 airflow velocity or volume	AV	32	See Appendix 'B'
Fan 16 Temperature	Individual Fan 16 Temperature	AV	33	See Appendix 'B'
Fan 16 Actual Airflow Velocity[3]	Individual Fan 16 airflow velocity or volume	AV	34	See Appendix 'B'

Table B: Modbus RTU Register Map

NOTE: Ruskin's Modbus RTU is designed for product and customer security. Write Configuration changes to the Coil (00002 – 00008) and Holding Registers (40001 – 40074) require a Map Access Key.

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Holding Registers							
40001	3	3, 16	string	Map Access Key	ALL	Write Parameter Access Key	Key = Unique Primary/Host Device Access Key
40004	9	3, 16	string	Device Name	ALL	Custom Line 2 Text	16 Character Maximum, null padded and terminated; 17-byte max; User Custom Name;
40013	1	3, 6, 16	uint16	Unit Standard	ALL	Systems of Measurements	0 = SI, 1 = Imperial (Default)
40014	1	3, 6, 16	uint16	Volumetric Flow Type	ALL	Unit of Measurement - Airflow	0 = Actual Flow Per Second (LPS / CFS) 1 = Actual Flow Per Minute (LPM / CFM) (Default) 2 = Actual Flow Per Hour (CMH / CFH) 3 = Standard Flow Per Second (LPS / CFS) 4 = Standard Flow Per Minute (LPM / CFM) 5 = Standard Flow Per Hour (CMH / CFH)
40015	1	3, 6, 16	uint16	Airflow Type	ALL	Airflow Measurement Type	0 = Velocity, 1 = Volume (Default)
40020	2	3, 16	float	Elevation	ALL	Site Elevation above Sea Level in Ft	0 to 15,000 ft (0 ft; Default)

Table B: Modbus RTU Register Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Holding Registers							
40022	1	3, 6, 16	uint16	Relative Humidity	**ALL**	RH Percentage in %	0 to 100% (50%; Default)
40023	2	3, 16	float	Low Flow Alarm	ALL	Low Flow Alarm - Setpoint - Fan Summary	0 to 10,000 FPM (0 ft/min; Default)
40025	2	3, 16	float	High Flow Alarm	ALL	High Flow Alarm - Setpoint - Fan Summary	0 to 10,000 FPM (10,000 ft/min; Default)
40027	2	3, 16	float	Alarm Deadband - Flow	ALL	Alarm Deadband - Flow - Fan Summary	0 to 500 FPM (0 ft/min; Default)
40029	2	3, 16	float	Alarm Delay - Flow	ALL	Alarm Delay - Flow - Fan Summary	0 to 10 Minutes (0 min; Default)
40031	2	3, 16	float	Low Temp Alarm	ALL	Low Temperature Alarm - Setpoint - Fan Summary	-29.2°F to 129.2°F (-20.2°F; Default)
40033	2	3, 16	float	High Temp Alarm	ALL	High Temperature Alarm - Setpoint - Fan Summary	-29.2°F to 129.2°F (120.2°F; Default)
40035	2	3, 16	float	Alarm Deadband - Temp	ALL	Alarm Deadband - Temp - Fan Summary	0 to 18°F (0°F; Default)
40037	2	3, 16	float	Alarm Delay - Temp	ALL	Alarm Delay - Temp - Fan Summary	0 to 5 Minutes (0 ft/min; Default)
40041	2	3, 16	float	Fan 'ARRAY' Area - SqFt	Fans	Fan area size in ft² - Fan Summary	0.20 to 39.41 ft² (3.12 ft²; Default) - Sets all fans to the same area - Reading this value is identical to reading register 40043
40043	2	3, 16	float	Fan 1 Area - SqFt	Fans	Fan area size in ft² | Fan 1	0.20 to 39.41 ft² (3.12 ft²; Default)
...	2	3, 16	float	...			
40073	2	3, 16	float	Fan 16 Area - SqFt	Fans	Fan area size in ft² | Fan 16	0.20 to 39.41 ft² (3.12 ft²; Default)
40079	2	3, 16	float	Fan 1 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 1	0 to 10,000 FPM (0 ft/min; Default)
40081	2	3, 16	float	Fan 1 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 1	0 to 10,000 FPM (10,000 ft/min; Default)
40083	2	3, 16	float	Fan 1 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 1	0 to 500 FPM (0 ft/min; Default)
40085	2	3, 16	float	Fan 1 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 1	0 to 5 Minutes (0 min; Default)
40087	2	3, 16	float	Fan 1 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 1	-29.2°F to 129.2°F (-20.2°F; Default)
40089	2	3, 16	float	Fan 1 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 1	-29.2°F to 129.2°F (120.2°F; Default)
40091	2	3, 16	float	Fan 1 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 1	0 to 18°F (0°F; Default)
40093	2	3, 16	float	Fan 1 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 1	0 to 5 Minutes (0 ft/min; Default)
...	2	3, 16	float	...			
40319	2	3, 16	float	Fan 16 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 16	0 to 10,000 FPM (0 ft/min; Default)
40321	2	3, 16	float	Fan 16 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 16	0 to 10,000 FPM (10,000 ft/min; Default)
40323	2	3, 16	float	Fan 16 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 16	0 to 500 FPM (0 ft/min; Default)

Table B: Modbus RTU Register Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Holding Registers							
40325	2	3, 16	float	Fan 16 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 16	0 to 5 Minutes (0 min; Default)
40327	2	3, 16	float	Fan 16 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 16	-29.2°F to 129.2°F (-20.2°F; Default)
40329	2	3, 16	float	Fan 16 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 16	-29.2°F to 129.2°F (120.2°F; Default)
40331	2	3, 16	float	Fan 16 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 16	0 to 18°F (0°F; Default)
40333	2	3, 16	float	Fan 16 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 16	0 to 5 Minutes (0 ft/min; Default)
Coils							
00001	1	1, 5, 15	bool	System Reset	ALL	Device Reset	1 = RESET
00003	1	1, 5, 15	bool	Low Flow Alarm - On/ Off	ALL	Low Flow Alarm - Enable - Fan Summary	1 = ON, 0 = OFF (Default)
00004	1	1, 5, 15	bool	High Flow Alarm - On/ Off	ALL	High Flow Alarm - Enable - Fan Summary	1 = ON, 0 = OFF (Default)
00005	1	1, 5, 15	bool	Low Temp Alarm - On/ Off	ALL	Low Temperature Alarm - Enable - Fan Summary	1 = ON, 0 = OFF (Default)
00006	1	1, 5, 15	bool	High Temp Alarm - On/ Off	ALL	High Temperature Alarm - Enable - Fan Summary	1 = ON, 0 = OFF (Default)
00007	1	1, 5, 15	bool	Float Word Order	ALL	Swap Between Big- and Little-Endian Word Order for Floats	1 = Big Endian, 0 = Little Endian (Default)
00008	1	1, 5, 15	bool	String Order	ALL	Sets the string byte ordering used in read and write processing	1 = Swapped, 0 = Normal (Default)
00009	1	1, 5, 15	bool	Fan 1 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 1	1 = ON, 0 = OFF (Default)
00010	1	1, 5, 15	bool	Fan 1 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 1	1 = ON, 0 = OFF (Default)
00011	1	1, 5, 15	bool	Fan 1 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 1	1 = ON, 0 = OFF (Default)
00012	1	1, 5, 15	bool	Fan 1 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 1	1 = ON, 0 = OFF (Default)
...	1	1, 5, 15	bool	...			
00069	1	1, 5, 15	bool	Fan 16 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 16	1 = ON, 0 = OFF (Default)
00070	1	1, 5, 15	bool	Fan 16 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable | Fan 16	1 = ON, 0 = OFF (Default)
00071	1	1, 5, 15	bool	Fan 16 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 16	1 = ON, 0 = OFF (Default)
00072	1	1, 5, 15	bool	Fan 16 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 16	1 = ON, 0 = OFF (Default)

Table B: Modbus RTU Register Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
System Status							
30001	1	4	uint16	Device Type	ALL	Device Model Number	3 = TDFi-RT, 4 = RA-1270, 5 =Other
30002	1	4	uint16	Airflow Type	ALL	Airflow Type	0 = Actual, 1 = Standard
30003	1	4	uint16	Airflow Unit	ALL	Airflow Unit	0 = FPM, 1 = MPS, 2 = CFS, 3 = CFM, 4 = CFH, 5 = LPS, 6 = LPM, 7 = CMH
30004	1	4	uint16	Temperature Unit	ALL	Temperature Unit	0 = °F, 1 = °C
30005	1	4	uint16	System Node Count	ALL	Total node count on the Ruskin network	1 - 17 Devices Connected (Host)| Monitors (TDFi-RT)
30006	1	4	uint16	System Fan Count	Fans	Total fan count on the Ruskin network	1 - 16 Fans
30007	1	4	uint16	Device Version	ALL	Host - PCB Firmware	MSB = Major, LSB = Minor
30008	1	4	uint16	Device Version-2	ALL	Host - PCB Build	MSB = Patch, LSB = Build number
30009	1	4	uint16	Protocol Version	ALL	Host - Modbus RTU Firmware	MSB = Major, LSB = Minor
30010	1	4	uint16	Protocol Version-2	ALL	Host - Modbus RTU Build	MSB = Patch, LSB = Build number
30028	1	4	uint16	Bad Data HR Address	ALL	Set to the last holding register address that had out of range data written to it	Any Valid Holding Address or 0 if no bad write has taken place since last boot
30029	1	4	uint16	Status	ALL	Current System Status	0 = NORMAL, 1 = ALARM, 2 = FAULT, 3 = ALARM & FAULT
30030	1	4	uint16	Flow Alarm	ALL	Flow is Less or Greater than the Flow Limits	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30031	1	4	uint16	Temp Alarm	ALL	Temperature is Less or Greater than the Temperature Limits	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30032	2	4	float	Airflow	ALL	Average Airflow Velocity or Volume in SI or Imperial Units	0 to 10,000 FPM (TDFi-RT)
30034	2	4	float	Temperature	ALL	Average Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30044	1	4	uint16	Fan 1 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 1	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
...	1	4	uint16	...			
30059	1	4	uint16	Fan 16 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 16	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30060	1	4	uint16	Fan 1 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 1	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
...	1	4	uint16	...			
30075	1	4	uint16	Fan 16 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 16	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM

Table B: Modbus RTU Register Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
RUSKIN NETWORK DEVICE							
Device - Serial Numbers							
30101	16	4	string	Host Serial Number	All	Primary / Host Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30117	16	4	string	Device 1 Serial Number	All	OEM Device Serial Number | Fan 1	0 to 31 Characters, null padded, null terminated; 32 byte
...	16	4	string	...			
30357	16	4	string	Device 16 Serial Number	All	OEM Device Serial Number | Fan 16	0 to 31 Characters, null padded, null terminated; 32 byte
Device - Airflows							
30373	2	4	float	Airflow Summary	All	Device Network - Airflow Velocity or Volume in SI or Imperial Units	Fans - 0 to 10,000 FPM
30375	2	4	float	Device 1 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 1	Fans - 0 to 10,000 FPM
...	2	4	float	...			
30405	2	4	float	Device 16 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 16	Fans - 0 to 10,000 FPM
Device - Temperatures							
30407	2	4	float	Temperature Summary	All	Device Network - Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30409	2	4	float	Device 1 Temperature	All	Average Temperature in SI or Imperial Units | Fan 1	-20°F to 120°F (-29°C to 49°C)
...	2	4	float	...			
30439	2	4	float	Device 16 Temperature	All	Average Temperature in SI or Imperial Units | Fan 16	-20°F to 120°F (-29°C to 49°C)

Table C: Float Register Packing

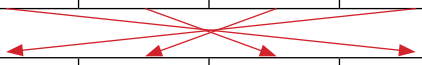
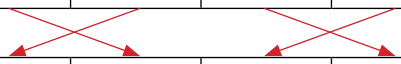
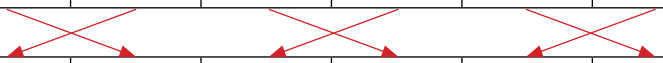
Big Endian Setting -Coil 00007				
Example = 0 x 12345678				
Application	0 x 78	0 x 56	0 x 34	0 x 12
				
Registers	0 x 12	0 x 34	0 x 56	0 x 78
	Register 1		Register 2	
Little Endian Setting - Coiling 00007				
Example = 0 x 12345678				
Application	0 x 78	0 x 56	0 x 34	0 x 12
				
Registers	0 x 56	0 x 78	0 x 12	0 x 34
	Register 1		Register 2	

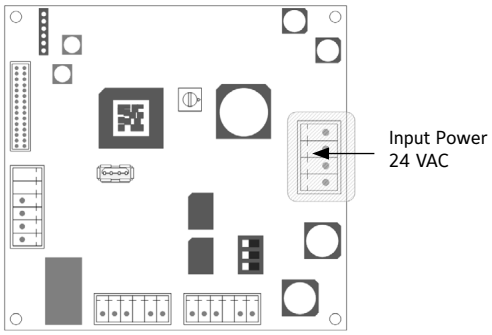
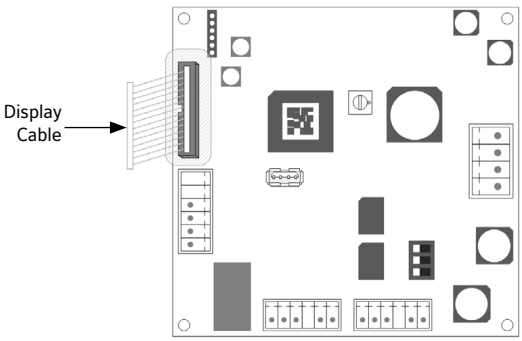
Table D: uint16 Register Packing

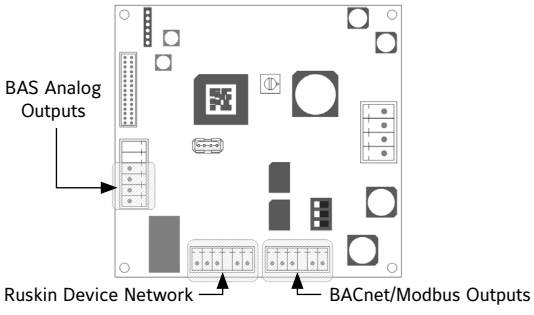
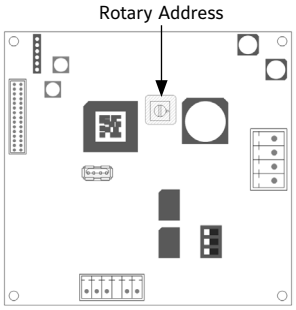
All Setting		
Example = 0 x 1234		
Application	0 x 34	0 x 12
		
Registers	0 x 12	0 x 34
	Register 1	

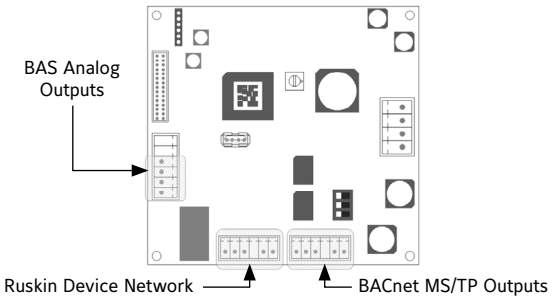
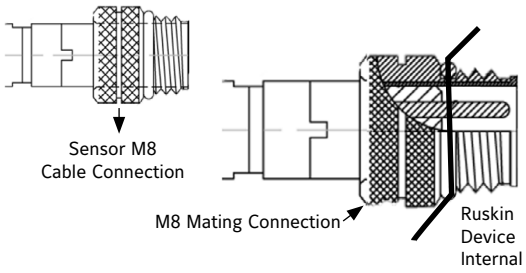
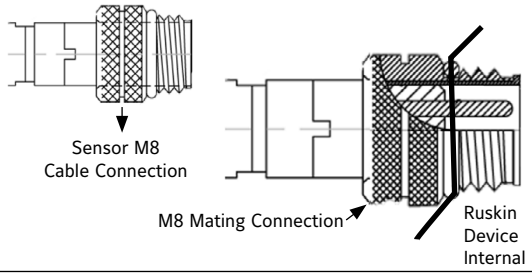
Table E: String Register Packing

String Order Normal - Coil 00008						
Example = “Hello”						
Application	H'	e'	l'	l'	o'	\0'
						
Registers	H'	e'	l'	l'	o'	\0'
	Register 1		Register 2		Register 3	
String Order Swapped - Coil 00008						
Example = “Hello”						
Application	H'	e'	l'	l'	o'	\0'
						
Registers	e'	H'	l'	l'	\0'	o'
	Register 1		Register 2		Register 3	

TROUBLESHOOTING.

<table>
<tr><th>Problem</th><th>Possible Cause</th><th>Corrective Action</th><th colspan="2">UI Location & Steps</th></tr>
<tr><td rowspan="2">Airflow reading does not match what T&B is reporting</td><td rowspan="2">Calibration Steps have not been completed.</td><td>If Fan Array:
Use Automatic Calibration Feature and use 1 point for a fixed speed fan, 2 or 3 point calibration for variable airflows.</td><td colspan="2">Menu > Supervisor Menu > Fan Array Config > Fan Array Cal
Note: Follow Setup Steps</td></tr>
<tr><td>If Individual Fan(s):
Use Automatic Calibration Feature and use 1 point for a fixed speed fan, 2 or 3 point calibration for variable airflows.</td><td>Run Auto Cal
Menu > Supervisor Menu > Fan Array Config > Field Cal Cfg
1. Select Fan # = Select Desired Fan
2. Fcal Enable? = Select ON
3. Use Calc’d Cal? = Select YES
4. Run Auto Cal = Follow Setup Steps</td><td>Enter Gain & Offset
Menu > Supervisor Menu > Fan Array Config > Field Cal Cfg
1. Select Fan # = Select Desired Fan
2. Fcal Enable? = Select ON
3. Use Calc’d Cal? = Select NO
4. Manual Gain = Enter user desired value
5. Manual Offset = Enter user desired value</td></tr>
<tr><td rowspan="2">Analog Output flow does not match what T&B is reporting.
NOTE: The analog output is the Fan Sum value and cannot be configured for, or used as, an output for individual fans when installed as more than one air measurement station.</td><td>Design Range High is not set correctly</td><td rowspan="2">Verify the appropriate device settings.</td><td colspan="2" rowspan="2">Menu > Operator Menu > Output Cal Menu > Design Range Hi
1. Use the ‘UP’ or ‘DOWN’ button to make changes
Note: If a change was made to the Fan Diameter post Calibration. A new calibration is REQUIRED!</td></tr>
<tr><td>User made a change to the Fan Diameter, post Calibration or post setting the Design Range high</td></tr>
<tr><td rowspan="3">No Display</td><td rowspan="3">No Power</td><td>Verify the appropriate input power supply voltage selection to the 24 VAC transformer.</td><td colspan="2"></td></tr>
<tr><td>With a multi-meter verify that 24VAC is applied to the correct terminals.</td><td colspan="2"> 
</td></tr>
<tr><td>If LED’s near the processor chip are flashing, ensure that the ribbon cable is fully seated in the boards socket.</td><td colspan="2"> 
</td></tr>
</table>

Problem	Possible Cause	Corrective Action	UI Location & Steps
Number of Monitor Boxes shown when power is applied is incorrect	Host to Client network are not wired correctly or terminated on wrong port.	Left to Right pinout on board is shield, minus, plus, shield , minus, plus. Confirm polarity is correct. **Note:** Analog Out (AO), Probe Network, and BACnet/Modbus ports on the Host use interchangeable connectors.	
	Two client boxes may have the same addresses. Look at rotary dial on ancillary probes. **Note:** Host is hard coded and rotary setting has no effect.	Assign the correct Address per Fan Client	
	Fan Assignment Error	Verify that the user fan assignment is correct	Menu > Supervisor Menu > Fan Array Config 1. Number of Fans = Select Desired Fan Quantity 2. Sensor Per Fan = Select Number of sensors install per fan 3. Set Fan Sensors = Select Fan # **Note:** Under the menu the user MUST assign the Fan # to the corresponding Monitor Box
	Monitor does not have power	Verify that all Monitor Boxes have 24 VAC and that they are ONLINE.	Menu > Supervisor Menu > Sensor Mgmt > Disp MON Status 1. Use the 'UP' button to view Active Monitors **Note:** If a monitor should be present and online. Verify that the monitor is assigned to the appropriate fan and communicating.
No BACnet or Modbus communications with BAS	No RS-485 Communication with the BAS Network	Network wires terminated to incorrect point or wrong connector	Pin OUT is shield, minus, plus, shield, minus, plus Lock at drawings and make sure left and right are not swapped. Verify configuration parameters match what is required to communicate with the BAS
	Modbus RTU messages are not getting a response	Modbus RTU disabled and/or port settings are mis-matched	Enable Modbus RTU in the Network Configuration Menu and ensure the port settings (buad, rate, parity, address) match for the intended network
	Modbus RTU float data doesn't match display	The Float Word Order on the device reading the float data does not match the settings on our device	Ensure the float Word Order setting matches the expected formatting. Refer to table 6 for how floats are packed and how the setting adjusts the formatting
	Modbus RTU string data doesn't match the expected value	The string order on the device reading the string does not match the settings on our device	Ensure the string order setting matches the expected formatting Refer to Table 6 for how strings are packed and how the setting adjusts the formatting
	Reading or writing a float or string register on the register map returns an exception code 2 with writing enabled	Not all of the float or string registers associated with that value was read in the same request	To ensure data integrity of values that are read and written, all registers of float or string registers must be read in the same request message
	Writing a value to a valid register returns an exception code 2	Writing to our device was not enabled	Refer to the installation & Maintenance Manual for instructions to enable writing mode

Problem	Possible Cause	Corrective Action	UI Location & Steps
No BACnet or Modbus communications with BAS	Writing a value to a valid register does not appear to be accepted despite returning a valid response	The value written to our device was a valid Modbus RTU value but out of our acceptable range on our device -OR- The write enable period timed out resetting the configuration to its previous state	Refer to the Modbus RTU Register map (Table 11 in the installation & Maintenance Manual) for the acceptable writable registers ranges. Registers 30028 can be read to determine what Holding Register address was last written to with an out of range value
	Network wires are not wired correctly or terminated on wrong port.	Left to Right pinout on board is shield, minus, plus, shield , minus, plus. Confirm polarity is correct. **Note:** Analog Out (AO), Fan Network, and BACnet or Modbus ports on the Host use interchangeable connectors.	
	Not Configured Correctly	Verify configuration parameters match what is required to communicate with the BAS.	BACnet or Modbus Support Document
Device Serial Number is not viewable	Client devices are internally mounted to the fan wall	Serial numbers are available through the Host's GUI for all devices connected.	Menu > Supervisor Menu > About Device > Enter 1. Use the 'UP' button to view Active Monitor Firmware Versions. 2. Pressing 'Enter' on the Host when the desired Monitor is displayed will show the Monitor's Serial Number. **Note:** If a monitor should be present and online. Verify that the monitor is assigned to the appropriate fan and communicating.
Detected Number of Sensors do not match the installed number	Cable Assembly 'M8' connector is not fully installed.	Ensure all sensor 'M8' connectors are properly installed and making a good electrical connection.	
Normal Operation Display Mode indicates an * in the upper left corner	Sensor(s) assigned to a fan is not connected or responding.	Verify that all Monitor Boxes have 24 VAC and that they are ONLINE.	Menu > Supervisor Menu > Sensor Mgmt > Disp MON Status 1. Use the 'UP' button to view Active Monitors **Note:** If a monitor should be present and online. Verify that the monitor is assigned to the appropriate fan and communicating.
		Ensure all sensor 'M8' connectors are properly installed and making a good electrical connection.	

Problem	Possible Cause	Corrective Action	UI Location & Steps
Normal Operation Display Mode indicates an * in the upper left corner	Monitor(s) assigned to a fan is not connected or responding.	Verify that the user fan assignment is correct	Menu > Supervisor Menu > Fan Array Config 1. Number of Fans = Select Desired Fan Quantity 2. Sensor Per Fan = Select Number of sensors install per fan 3. Set Fan Sensors = Select Fan # **Note:** Under the menu the user MUST assign the Fan # to the respected Monitor Box
Normal Operation Display Mode indicates an ! in the upper left corner	Indicates that there are duplicate sensors assigned to the same fan number	Verify that the user fan and sensor assignments are correct	Menu > Supervisor Menu > Fan Array Config 1. Number of Fans = Select Desired Fan Quantity 2. Sensor Per Fan = Select Number of sensors install per fan 3. Set Fan Sensors = Select Fan # **Note:** Under the menu the user MUST assign the Sensor # to the respected Monitor Box. A sensor can only be assigned to one location.
Normal Operation Display Mode indicates an # in the upper left corner	Indicates that the number of sensors or monitors has changed since the last sensor scan.	Verify that the user fan and sensor assignments are the same as originally installed.	Menu > Supervisor Menu > Fan Array Config 1. Number of Fans = Select Desired Fan Quantity 2. Sensor Per Fan = Select Number of sensors install per fan 3. Set Fan Sensors = Select Fan # **Note:** Under the menu the user MUST assign the Fan # to the respected Monitor Box
Received an 'INPUT NOT SAVED Out of Range' message during calibration.	User entered a calibration point value greater than the Fan Diameter/SqFt setting. **Note:** Operating range is 0 – 10,000 FPM	Verify that the user setting for the diameter allows for a design ranger higher than the calibration values	From the Calibration Menu Menu > Supervisor Menu > Fan Array Config > Fan Array Cal or Field Cal Cfg 1. Fan Diameter = Enter Fan Diameter for the application or 2. Area Confirm = Enter in custom user SqFt value if different from the calculated value from the Fan Diameter entry. **Note:** The device will reverse calculate the new 'Fan Diameter' if SqFt is changed by the user. This will also change the Design Range High value as well for the Analog Output.
			From the Operator Menu Menu > Operator Menu > Flow Config 1. Fan Diameter = Enter Fan Diameter for the application or 2. Area Confirm = Enter in custom user SqFt value if different from the calculated value from the Fan Diameter entry. **Note:** The device will reverse calculate the new 'Fan Diameter' if SqFt is changed by the user. This will also change the Design Range High value as well for the Analog Output.

APPENDIX 'A'

Modbus RTU - Network Registers and Object Lists

Supported Modbus RTU Application:

Modbus Application Protocol V1 1b3

Reference Guide: PI-MBUS-300 Rev. J

Supported Modbus RTU Function Codes:

Modbus Standard				
Functions	**Object type**	**Access**	**Size**	**Address Space**
1, 5, 15	Coil	Read-write	1 bit	00001 - 09999
4	Input register	Read-only	16 bits	30001 - 39999
3, 6, 16	Holding register	Read-write	16 bits	40001 - 49999

NOTE: Ruskin's Modbus RTU is designed for product and customer security. Write Configuration changes to the Coil (00002-00008) and Holding Registers (40001-40074) require a Map Access Key.

Supported Modbus RTU Format:

Baud Rate: 9600, 19200, 38400 (default), 57600, 76800, 115200

Parity: ODD, EVEN (default), NONE1 (one stop bit), NONE2 (two stop bits)

Address Range: 1-247 (99; default)

NOTE: If site settings differ from Ruskin's default values. Modbus RTU Format configuration changes are required at the device level and cannot be made through Modbus RTU.

Map Access Key:

The map access key is a six-digit alpha numeric character combination. Within the device serial number, the map access key is the customers unique sales order or factory order number. The map access key starts with the second digit through the seventh digit of the Primary or Host device's serial number.

Serial Number Example: JC4194900300400

Map Access Key: C41949

Write Configuration Steps:

The Ruskin device requires the below EXACT sequence of operation from the Server prior to applying Server write configurations to memory.

Server Required Steps:

1. Send a Device 'Reset Command' to Register 00001

IMPORTANT: To access the 'Write' functionality a valid 'Map Access Key' is required to be sent within 2 minutes of sending the 'Reset Command'

2. Send the Device 'Map Access Key' to Register 40001-40003

IMPORTANT: If an invalid 'Map Access Key' is entered the device will NOT allow write access to the 'Coil' or 'Holding Registers'.

3. Send the desired 'Device Configurations' to Register 00002-00008 and 40004-40075
4. Send a second Device 'Reset Command' to Register 00001

IMPORTANT: If 30 minutes has elapsed or a second Device 'Reset Command' has not been received within 30 minutes from a Valid 'Map Access Key'. The device settings will Revert to the previously saved device settings in memory.

Write Unit Requirements:

The Ruskin device requires the below EXACT write format units from the Server when configuration setting changes are made through the Holding Registers.

1. Flow units must be written in FPM

IMPORTANT: If the current device setting for flow is not in FPM units. The server must convert the device setting value to FPM units when applying a flow configuration change.

2. Temperature units must be written in °F

IMPORTANT: If the current device setting for temperature is not in °F units. The server must convert the Ruskin device setting value to °F units when applying a temperature configuration change.

3. Area units must be written in SqFt

IMPORTANT: If the current device setting for area is not in SqFt units. The server must convert the Ruskin device setting value to SqFt units when applying an area configuration change.

Ruskin's Modbus RTU – Data Map

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Holding Registers							
40001	3	3, 16	string	Map Access Key	ALL	Write Parameter Access Key	Key = Unique Primary/Host Device Access Key
40004	9	3, 16	string	Device Name	ALL	Custom Line 2 Text	16 Character Maximum, null padded and terminated; 17 byte max; User Custom Name
40013	1	3, 6, 16	uint16	Unit Standard	ALL	Systems of Measurements	0 = SI, 1 = Imperial (Default)
40014	1	3, 6, 16	uint16	Volumetric Flow Type	ALL	Unit of Measurement - Airflow	0 = Actual Flow Per Second (LPS / CFS) 1 = Actual Flow Per Minute (LPM / CFM) (Default) 2 = Actual Flow Per Hour (CMH / CFH) 3 = Standard Flow Per Second (LPS / CFS) 4 = Standard Flow Per Minute (LPM / CFM) 5 = Standard Flow Per Hour (CMH / CFH)
40015	1	3, 6, 16	uint16	Airflow Type	ALL	Airflow Measurement Type	0 = Velocity, 1 = Volume (Default)
40020	2	3, 16	float	Elevation	ALL	Site Elevation above Sea Level in Ft	0 to 15,000 ft (0 ft; Default)
40022	1	3, 6, 16	uint16	Relative Humidity	ALL	RH Percentage in %	0 to 100% (50%; Default)
40023	2	3, 16	float	Low Flow Alarm	ALL	Low Flow Alarm - Setpoint - Fan Summary	0 to 10,000 FPM (0 ft/min; Default)
40025	2	3, 16	float	High Flow Alarm	ALL	High Flow Alarm - Setpoint - Fan Summary	0 to 10,000 FPM (10,000 ft/min; Default)
40027	2	3, 16	float	Alarm Deadband - Flow	ALL	Alarm Deadband - Flow - Fan Summary	0 to 500 FPM (0 ft/min; Default)
40029	2	3, 16	float	Alarm Delay - Flow	ALL	Alarm Delay - Flow - Fan Summary	0 to 10 Minutes (0 min; Default)
40031	2	3, 16	float	Low Temp Alarm	ALL	Low Temperature Alarm - Setpoint - Fan Summary	-29.2°F to 129.2°F (-20.2°F; Default)
40033	2	3, 16	float	High Temp Alarm	ALL	High Temperature Alarm - Setpoint - Fan Summary	-29.2°F to 129.2°F (120.2°F; Default)
40035	2	3, 16	float	Alarm Deadband - Temp	ALL	Alarm Deadband - Temp - Fan Summary	0 to 18°F (0°F; Default)
40037	2	3, 16	float	Alarm Delay - Temp	ALL	Alarm Delay - Temp - Fan Summary	0 to 5 Minutes (0 ft/min; Default)

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Holding Registers							
40041	2	3, 16	float	Fan 'ARRAY' Area - SqFt	Fans	Fan area size in ft² - Fan Summary	0.20 to 39.41 ft² (3.12 ft²; Default) - Sets all fans to the same area - Reading this value is identical to reading register 40043
40043	2	3, 16	float	Fan 1 Area - SqFt	Fans	Fan area size in ft² | Fan 1	0.20 to 39.41 ft² (3.12 ft²; Default)
40045	2	3, 16	float	Fan 2 Area - SqFt	Fans	Fan area size in ft² | Fan 2	0.20 to 39.41 ft² (3.12 ft²; Default)
40047	2	3, 16	float	Fan 3 Area - SqFt	Fans	Fan area size in ft² | Fan 3	0.20 to 39.41 ft² (3.12 ft²; Default)
40049	2	3, 16	float	Fan 4 Area - SqFt	Fans	Fan area size in ft² | Fan 4	0.20 to 39.41 ft² (3.12 ft²; Default)
40051	2	3, 16	float	Fan 5 Area - SqFt	Fans	Fan area size in ft² | Fan 5	0.20 to 39.41 ft² (3.12 ft²; Default)
40053	2	3, 16	float	Fan 6 Area - SqFt	Fans	Fan area size in ft² | Fan 6	0.20 to 39.41 ft² (3.12 ft²; Default)
40055	2	3, 16	float	Fan 7 Area - SqFt	Fans	Fan area size in ft² | Fan 7	0.20 to 39.41 ft² (3.12 ft²; Default)
40057	2	3, 16	float	Fan 8 Area - SqFt	Fans	Fan area size in ft² | Fan 8	0.20 to 39.41 ft² (3.12 ft²; Default)
40059	2	3, 16	float	Fan 9 Area - SqFt	Fans	Fan area size in ft² | Fan 9	0.20 to 39.41 ft² (3.12 ft²; Default)
40061	2	3, 16	float	Fan 10 Area - SqFt	Fans	Fan area size in ft² | Fan 10	0.20 to 39.41 ft² (3.12 ft²; Default)
40063	2	3, 16	float	Fan 11 Area - SqFt	Fans	Fan area size in ft² | Fan 11	0.20 to 39.41 ft² (3.12 ft²; Default)
40065	2	3, 16	float	Fan 12 Area - SqFt	Fans	Fan area size in ft² | Fan 12	0.20 to 39.41 ft² (3.12 ft²; Default)
40067	2	3, 16	float	Fan 13 Area - SqFt	Fans	Fan area size in ft² | Fan 13	0.20 to 39.41 ft² (3.12 ft²; Default)
40069	2	3, 16	float	Fan 14 Area - SqFt	Fans	Fan area size in ft² | Fan 14	0.20 to 39.41 ft² (3.12 ft²; Default)
40071	2	3, 16	float	Fan 15 Area - SqFt	Fans	Fan area size in ft² | Fan 15	0.20 to 39.41 ft² (3.12 ft²; Default)
40073	2	3, 16	float	Fan 16 Area - SqFt	Fans	Fan area size in ft² | Fan 16	0.20 to 39.41 ft² (3.12 ft²; Default)
40079	2	3, 16	float	Fan 1 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 1	0 to 10,000 FPM (0 ft/min; Default)
40081	2	3, 16	float	Fan 1 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 1	0 to 10,000 FPM (10,000 ft/min; Default)
40083	2	3, 16	float	Fan 1 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 1	0 to 500 FPM (0 ft/min; Default)
40085	2	3, 16	float	Fan 1 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 1	0 to 5 Minutes (0 min; Default)
40087	2	3, 16	float	Fan 1 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 1	-29.2°F to 129.2°F (-20.2°F; Default)
40089	2	3, 16	float	Fan 1 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 1	-29.2°F to 129.2°F (120.2°F; Default)
40091	2	3, 16	float	Fan 1 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 1	0 to 18°F (0°F; Default)
40093	2	3, 16	float	Fan 1 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 1	0 to 5 Minutes (0 ft/min; Default)
40095	2	3, 16	float	Fan 2 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 2	0 to 10,000 FPM (0 ft/min; Default)
40097	2	3, 16	float	Fan 2 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 2	0 to 10,000 FPM (10,000 ft/min; Default)
40099	2	3, 16	float	Fan 2 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 2	0 to 500 FPM (0 ft/min; Default)

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Holding Registers							
40101	2	3, 16	float	Fan 2 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 2	0 to 5 Minutes (0 min; Default)
40103	2	3, 16	float	Fan 2 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 2	-29.2°F to 129.2°F (-20.2°F; Default)
40105	2	3, 16	float	Fan 2 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 2	-29.2°F to 129.2°F (120.2°F; Default)
40107	2	3, 16	float	Fan 2 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 2	0 to 18°F (0°F; Default)
40109	2	3, 16	float	Fan 2 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 2	0 to 5 Minutes (0 ft/min; Default)
40111	2	3, 16	float	Fan 3 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 3	0 to 10,000 FPM (0 ft/min; Default)
40113	2	3, 16	float	Fan 3 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 3	0 to 10,000 FPM (10,000 ft/min; Default)
40115	2	3, 16	float	Fan 3 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 3	0 to 500 FPM (0 ft/min; Default)
40117	2	3, 16	float	Fan 3 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 3	0 to 5 Minutes (0 min; Default)
40119	2	3, 16	float	Fan 3 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 3	-29.2°F to 129.2°F (-20.2°F; Default)
40121	2	3, 16	float	Fan 3 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 3	-29.2°F to 129.2°F (120.2°F; Default)
40123	2	3, 16	float	Fan 3 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 3	0 to 18°F (0°F; Default)
40125	2	3, 16	float	Fan 3 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 3	0 to 5 Minutes (0 ft/min; Default)
40127	2	3, 16	float	Fan 4 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 4	0 to 10,000 FPM (0 ft/min; Default)
40129	2	3, 16	float	Fan 4 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 4	0 to 10,000 FPM (10,000 ft/min; Default)
40131	2	3, 16	float	Fan 4 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 4	0 to 500 FPM (0 ft/min; Default)
40133	2	3, 16	float	Fan 4 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 4	0 to 5 Minutes (0 min; Default)
40135	2	3, 16	float	Fan 4 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 4	-29.2°F to 129.2°F (-20.2°F; Default)
40137	2	3, 16	float	Fan 4 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 4	-29.2°F to 129.2°F (120.2°F; Default)
40139	2	3, 16	float	Fan 4 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 4	0 to 18°F (0°F; Default)
40141	2	3, 16	float	Fan 4 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 4	0 to 5 Minutes (0 ft/min; Default)
40143	2	3, 16	float	Fan 5 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 5	0 to 10,000 FPM (0 ft/min; Default)
40145	2	3, 16	float	Fan 5 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 5	0 to 10,000 FPM (10,000 ft/min; Default)
40147	2	3, 16	float	Fan 5 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 5	0 to 500 FPM (0 ft/min; Default)
40149	2	3, 16	float	Fan 5 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 5	0 to 5 Minutes (0 min; Default)
40151	2	3, 16	float	Fan 5 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 5	-29.2°F to 129.2°F (-20.2°F; Default)
40153	2	3, 16	float	Fan 5 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 5	-29.2°F to 129.2°F (120.2°F; Default)

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Holding Registers							
40155	2	3, 16	float	Fan 5 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 5	0 to 18°F (0°F; Default)
40157	2	3, 16	float	Fan 5 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 5	0 to 5 Minutes (0 ft/min; Default)
40159	2	3, 16	float	Fan 6 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 6	0 to 10,000 FPM (0 ft/min; Default)
40161	2	3, 16	float	Fan 6 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 6	0 to 10,000 FPM (10,000 ft/min; Default)
40163	2	3, 16	float	Fan 6 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 6	0 to 500 FPM (0 ft/min; Default)
40165	2	3, 16	float	Fan 6 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 6	0 to 5 Minutes (0 min; Default)
40167	2	3, 16	float	Fan 6 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 6	-29.2°F to 129.2°F (-20.2°F; Default)
40169	2	3, 16	float	Fan 6 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 6	-29.2°F to 129.2°F (120.2°F; Default)
40171	2	3, 16	float	Fan 6 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 6	0 to 18°F (0°F; Default)
40173	2	3, 16	float	Fan 6 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 6	0 to 5 Minutes (0 ft/min; Default)
40175	2	3, 16	float	Fan 7 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 7	0 to 10,000 FPM (0 ft/min; Default)
40177	2	3, 16	float	Fan 7 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 7	0 to 10,000 FPM (10,000 ft/min; Default)
40179	2	3, 16	float	Fan 7 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 7	0 to 500 FPM (0 ft/min; Default)
40181	2	3, 16	float	Fan 7 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 7	0 to 5 Minutes (0 min; Default)
40183	2	3, 16	float	Fan 7 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 7	-29.2°F to 129.2°F (-20.2°F; Default)
40185	2	3, 16	float	Fan 7 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 7	-29.2°F to 129.2°F (120.2°F; Default)
40187	2	3, 16	float	Fan 7 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 7	0 to 18°F (0°F; Default)
40189	2	3, 16	float	Fan 7 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 7	0 to 5 Minutes (0 ft/min; Default)
40191	2	3, 16	float	Fan 8 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 8	0 to 10,000 FPM (0 ft/min; Default)
40193	2	3, 16	float	Fan 8 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 8	0 to 10,000 FPM (10,000 ft/min; Default)
40195	2	3, 16	float	Fan 8 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 8	0 to 500 FPM (0 ft/min; Default)
40197	2	3, 16	float	Fan 8 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 8	0 to 5 Minutes (0 min; Default)
40199	2	3, 16	float	Fan 8 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 8	-29.2°F to 129.2°F (-20.2°F; Default)
40201	2	3, 16	float	Fan 8 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 8	-29.2°F to 129.2°F (120.2°F; Default)
40203	2	3, 16	float	Fan 8 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 8	0 to 18°F (0°F; Default)
40205	2	3, 16	float	Fan 8 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 8	0 to 5 Minutes (0 ft/min; Default)
40207	2	3, 16	float	Fan 9 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 9	0 to 10,000 FPM (0 ft/min; Default)

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Holding Registers							
40209	2	3, 16	float	Fan 9 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 9	0 to 10,000 FPM (10,000 ft/min; Default)
40211	2	3, 16	float	Fan 9 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 9	0 to 500 FPM (0 ft/min; Default)
40213	2	3, 16	float	Fan 9 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 9	0 to 5 Minutes (0 min; Default)
40215	2	3, 16	float	Fan 9 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 9	-29.2°F to 129.2°F (-20.2°F; Default)
40217	2	3, 16	float	Fan 9 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 9	-29.2°F to 129.2°F (120.2°F; Default)
40219	2	3, 16	float	Fan 9 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 9	0 to 18°F (0°F; Default)
40221	2	3, 16	float	Fan 9 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 9	0 to 5 Minutes (0 ft/min; Default)
40223	2	3, 16	float	Fan 10 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 10	0 to 10,000 FPM (0 ft/min; Default)
40225	2	3, 16	float	Fan 10 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 10	0 to 10,000 FPM (10,000 ft/min; Default)
40227	2	3, 16	float	Fan 10 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 10	0 to 500 FPM (0 ft/min; Default)
40229	2	3, 16	float	Fan 10 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 10	0 to 5 Minutes (0 min; Default)
40231	2	3, 16	float	Fan 10 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 10	-29.2°F to 129.2°F (-20.2°F; Default)
40233	2	3, 16	float	Fan 10 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 10	-29.2°F to 129.2°F (120.2°F; Default)
40235	2	3, 16	float	Fan 10 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 10	0 to 18°F (0°F; Default)
40237	2	3, 16	float	Fan 10 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 10	0 to 5 Minutes (0 ft/min; Default)
40239	2	3, 16	float	Fan 11 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 11	0 to 10,000 FPM (0 ft/min; Default)
40241	2	3, 16	float	Fan 11 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 11	0 to 10,000 FPM (10,000 ft/min; Default)
40243	2	3, 16	float	Fan 11 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 11	0 to 500 FPM (0 ft/min; Default)
40245	2	3, 16	float	Fan 11 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 11	0 to 5 Minutes (0 min; Default)
40247	2	3, 16	float	Fan 11 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 11	-29.2°F to 129.2°F (-20.2°F; Default)
40249	2	3, 16	float	Fan 11 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 11	-29.2°F to 129.2°F (120.2°F; Default)
40251	2	3, 16	float	Fan 11 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 11	0 to 18°F (0°F; Default)
40253	2	3, 16	float	Fan 11 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 11	0 to 5 Minutes (0 ft/min; Default)
40255	2	3, 16	float	Fan 12 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 12	0 to 10,000 FPM (0 ft/min; Default)
40257	2	3, 16	float	Fan 12 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 12	0 to 10,000 FPM (10,000 ft/min; Default)
40259	2	3, 16	float	Fan 12 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 12	0 to 500 FPM (0 ft/min; Default)
40261	2	3, 16	float	Fan 12 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 12	0 to 5 Minutes (0 min; Default)

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Holding Registers							
40263	2	3, 16	float	Fan 12 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 12	-29.2°F to 129.2°F (-20.2°F; Default)
40265	2	3, 16	float	Fan 12 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 12	-29.2°F to 129.2°F (120.2°F; Default)
40267	2	3, 16	float	Fan 12 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 12	0 to 18°F (0°F; Default)
40269	2	3, 16	float	Fan 12 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 12	0 to 5 Minutes (0 ft/min; Default)
40271	2	3, 16	float	Fan 13 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 13	0 to 10,000 FPM (0 ft/min; Default)
40273	2	3, 16	float	Fan 13 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 13	0 to 10,000 FPM (10,000 ft/min; Default)
40275	2	3, 16	float	Fan 13 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 13	0 to 500 FPM (0 ft/min; Default)
40277	2	3, 16	float	Fan 13 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 13	0 to 5 Minutes (0 min; Default)
40279	2	3, 16	float	Fan 13 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 13	-29.2°F to 129.2°F (-20.2°F; Default)
40281	2	3, 16	float	Fan 13 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 13	-29.2°F to 129.2°F (120.2°F; Default)
40283	2	3, 16	float	Fan 13 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 13	0 to 18°F (0°F; Default)
40285	2	3, 16	float	Fan 13 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 13	0 to 5 Minutes (0 ft/min; Default)
40287	2	3, 16	float	Fan 14 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 14	0 to 10,000 FPM (0 ft/min; Default)
40289	2	3, 16	float	Fan 14 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 14	0 to 10,000 FPM (10,000 ft/min; Default)
40291	2	3, 16	float	Fan 14 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 14	0 to 500 FPM (0 ft/min; Default)
40293	2	3, 16	float	Fan 14 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 14	0 to 5 Minutes (0 min; Default)
40295	2	3, 16	float	Fan 14 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 14	-29.2°F to 129.2°F (-20.2°F; Default)
40297	2	3, 16	float	Fan 14 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 14	-29.2°F to 129.2°F (120.2°F; Default)
40299	2	3, 16	float	Fan 14 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 14	0 to 18°F (0°F; Default)
40301	2	3, 16	float	Fan 14 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 14	0 to 5 Minutes (0 ft/min; Default)
40303	2	3, 16	float	Fan 15 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 15	0 to 10,000 FPM (0 ft/min; Default)
40305	2	3, 16	float	Fan 15 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 15	0 to 10,000 FPM (10,000 ft/min; Default)
40307	2	3, 16	float	Fan 15 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 15	0 to 500 FPM (0 ft/min; Default)
40309	2	3, 16	float	Fan 15 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 15	0 to 5 Minutes (0 min; Default)
40311	2	3, 16	float	Fan 15 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 15	-29.2°F to 129.2°F (-20.2°F; Default)
40313	2	3, 16	float	Fan 15 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 15	-29.2°F to 129.2°F (120.2°F; Default)
40315	2	3, 16	float	Fan 15 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 15	0 to 18°F (0°F; Default)

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Holding Registers							
40317	2	3, 16	float	Fan 15 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 15	0 to 5 Minutes (0 ft/min; Default)
40319	2	3, 16	float	Fan 16 | Low Flow Alarm	Fans	Low Flow Alarm - Setpoint | Fan 16	0 to 10,000 FPM (0 ft/min; Default)
40321	2	3, 16	float	Fan 16 | High Flow Alarm	Fans	High Flow Alarm - Setpoint | Fan 16	0 to 10,000 FPM (10,000 ft/min; Default)
40323	2	3, 16	float	Fan 16 | Alarm Deadband - Flow	Fans	Alarm Deadband - Flow | Fan 16	0 to 500 FPM (0 ft/min; Default)
40325	2	3, 16	float	Fan 16 | Alarm Delay - Flow	Fans	Alarm Delay - Flow | Fan 16	0 to 5 Minutes (0 min; Default)
40327	2	3, 16	float	Fan 16 | Low Temp Alarm	Fans	Low Temperature Alarm - Setpoint | Fan 16	-29.2°F to 129.2°F (-20.2°F; Default)
40329	2	3, 16	float	Fan 16 | High Temp Alarm	Fans	High Temperature Alarm - Setpoint | Fan 16	-29.2°F to 129.2°F (120.2°F; Default)
40331	2	3, 16	float	Fan 16 | Alarm Deadband - Temp	Fans	Alarm Deadband - Temp | Fan 16	0 to 18°F (0°F; Default)
40333	2	3, 16	float	Fan 16 | Alarm Delay - Temp	Fans	Alarm Delay - Temp | Fan 16	0 to 5 Minutes (0 ft/min; Default)
Coils							
00001	1	1, 5, 15	bool	System Reset	ALL	Device Reset	1 = RESET
00003	1	1, 5, 15	bool	Low Flow Alarm - On/Off	ALL	Low Flow Alarm - Enable - Fan Summary	1 = ON, 0 = OFF (Default)
00004	1	1, 5, 15	bool	High Flow Alarm - On/Off	ALL	High Flow Alarm - Enable - Fan Summary	1 = ON, 0 = OFF (Default)
00005	1	1, 5, 15	bool	Low Temp Alarm - On/Off	ALL	Low Temperature Alarm - Fan Summary	1 = ON, 0 = OFF (Default)
00006	1	1, 5, 15	bool	High Temp Alarm - On/Off	ALL	High Temperature Alarm - Fan Summary	1 = ON, 0 = OFF (Default)
00007	1	1, 5, 15	bool	Float Word Order	ALL	Swap Between Big- and Little-Endian Word Order for Floats	1 = Big Endian, 0 = Little Endian (Default)
00008	1	1, 5, 15	bool	String Order	ALL	Sets the string byte ordering used in read and write processing	1 = Swapped, 0 = Normal (Default)
00009	1	1, 5, 15	bool	Fan 1 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 1	1 = ON, 0 = OFF (Default)
00010	1	1, 5, 15	bool	Fan 1 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 1	1 = ON, 0 = OFF (Default)
00011	1	1, 5, 15	bool	Fan 1 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 1	1 = ON, 0 = OFF (Default)
00012	1	1, 5, 15	bool	Fan 1 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 1	1 = ON, 0 = OFF (Default)
00013	1	1, 5, 15	bool	Fan 2 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 2	1 = ON, 0 = OFF (Default)
00014	1	1, 5, 15	bool	Fan 2 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 2	1 = ON, 0 = OFF (Default)
00015	1	1, 5, 15	bool	Fan 2 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 2	1 = ON, 0 = OFF (Default)

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Coils							
00016	1	1, 5, 15	bool	Fan 2 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 2	1 = ON, 0 = OFF (Default)
00017	1	1, 5, 15	bool	Fan 3 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 3	1 = ON, 0 = OFF (Default)
00018	1	1, 5, 15	bool	Fan 3 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 3	1 = ON, 0 = OFF (Default)
00019	1	1, 5, 15	bool	Fan 3 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 3	1 = ON, 0 = OFF (Default)
00020	1	1, 5, 15	bool	Fan 3 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 3	1 = ON, 0 = OFF (Default)
00021	1	1, 5, 15	bool	Fan 4 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 4	1 = ON, 0 = OFF (Default)
00022	1	1, 5, 15	bool	Fan 4 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 4	1 = ON, 0 = OFF (Default)
00023	1	1, 5, 15	bool	Fan 4 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 4	1 = ON, 0 = OFF (Default)
00024	1	1, 5, 15	bool	Fan 4 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 4	1 = ON, 0 = OFF (Default)
00025	1	1, 5, 15	bool	Fan 5 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 5	1 = ON, 0 = OFF (Default)
00026	1	1, 5, 15	bool	Fan 5 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 5	1 = ON, 0 = OFF (Default)
00027	1	1, 5, 15	bool	Fan 5 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 5	1 = ON, 0 = OFF (Default)
00028	1	1, 5, 15	bool	Fan 5 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 5	1 = ON, 0 = OFF (Default)
00029	1	1, 5, 15	bool	Fan 6 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 6	1 = ON, 0 = OFF (Default)
00030	1	1, 5, 15	bool	Fan 6 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 6	1 = ON, 0 = OFF (Default)
00031	1	1, 5, 15	bool	Fan 6 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 6	1 = ON, 0 = OFF (Default)
00032	1	1, 5, 15	bool	Fan 6 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 6	1 = ON, 0 = OFF (Default)
00033	1	1, 5, 15	bool	Fan 7 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 7	1 = ON, 0 = OFF (Default)
00034	1	1, 5, 15	bool	Fan 7 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 7	1 = ON, 0 = OFF (Default)
00035	1	1, 5, 15	bool	Fan 7 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 7	1 = ON, 0 = OFF (Default)
00036	1	1, 5, 15	bool	Fan 7 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 7	1 = ON, 0 = OFF (Default)

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Coils							
00037	1	1, 5, 15	bool	Fan 8 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 8	1 = ON, 0 = OFF (Default)
00038	1	1, 5, 15	bool	Fan 8 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 8	1 = ON, 0 = OFF (Default)
00039	1	1, 5, 15	bool	Fan 8 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 8	1 = ON, 0 = OFF (Default)
00040	1	1, 5, 15	bool	Fan 8 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 8	1 = ON, 0 = OFF (Default)
00041	1	1, 5, 15	bool	Fan 9 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 9	1 = ON, 0 = OFF (Default)
00042	1	1, 5, 15	bool	Fan 9 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 9	1 = ON, 0 = OFF (Default)
00043	1	1, 5, 15	bool	Fan 9 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 9	1 = ON, 0 = OFF (Default)
00044	1	1, 5, 15	bool	Fan 9 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 9	1 = ON, 0 = OFF (Default)
00045	1	1, 5, 15	bool	Fan 10 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 10	1 = ON, 0 = OFF (Default)
00046	1	1, 5, 15	bool	Fan 10 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 10	1 = ON, 0 = OFF (Default)
00047	1	1, 5, 15	bool	Fan 10 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 10	1 = ON, 0 = OFF (Default)
00048	1	1, 5, 15	bool	Fan 10 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 10	1 = ON, 0 = OFF (Default)
00049	1	1, 5, 15	bool	Fan 11 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 11	1 = ON, 0 = OFF (Default)
00050	1	1, 5, 15	bool	Fan 11 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 11	1 = ON, 0 = OFF (Default)
00051	1	1, 5, 15	bool	Fan 11 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 11	1 = ON, 0 = OFF (Default)
00052	1	1, 5, 15	bool	Fan 11 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 11	1 = ON, 0 = OFF (Default)
00053	1	1, 5, 15	bool	Fan 12 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 12	1 = ON, 0 = OFF (Default)
00054	1	1, 5, 15	bool	Fan 12 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 12	1 = ON, 0 = OFF (Default)
00055	1	1, 5, 15	bool	Fan 12 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 12	1 = ON, 0 = OFF (Default)
00056	1	1, 5, 15	bool	Fan 12 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 12	1 = ON, 0 = OFF (Default)
00057	1	1, 5, 15	bool	Fan 13 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 13	1 = ON, 0 = OFF (Default)

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Coils							
00058	1	1, 5, 15	bool	Fan 13 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 13	1 = ON, 0 = OFF (Default)
00059	1	1, 5, 15	bool	Fan 13 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 13	1 = ON, 0 = OFF (Default)
00060	1	1, 5, 15	bool	Fan 13 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 13	1 = ON, 0 = OFF (Default)
00061	1	1, 5, 15	bool	Fan 14 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 14	1 = ON, 0 = OFF (Default)
00062	1	1, 5, 15	bool	Fan 14 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 14	1 = ON, 0 = OFF (Default)
00063	1	1, 5, 15	bool	Fan 14 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 14	1 = ON, 0 = OFF (Default)
00064	1	1, 5, 15	bool	Fan 14 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 14	1 = ON, 0 = OFF (Default)
00065	1	1, 5, 15	bool	Fan 15 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 15	1 = ON, 0 = OFF (Default)
00066	1	1, 5, 15	bool	Fan 15 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable |Fan 15	1 = ON, 0 = OFF (Default)
00067	1	1, 5, 15	bool	Fan 15 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 15	1 = ON, 0 = OFF (Default)
00068	1	1, 5, 15	bool	Fan 15 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 15	1 = ON, 0 = OFF (Default)
00069	1	1, 5, 15	bool	Fan 16 | Low Flow Alarm - On/Off	Fans	Low Flow Alarm - Enable | Fan 16	1 = ON, 0 = OFF (Default)
00070	1	1, 5, 15	bool	Fan 16 | High Flow Alarm - On/Off	Fans	High Flow Alarm - Enable | Fan 16	1 = ON, 0 = OFF (Default)
00071	1	1, 5, 15	bool	Fan 16 | Low Temp Alarm - On/Off	Fans	Low Temperature Alarm - Enable | Fan 16	1 = ON, 0 = OFF (Default)
00072	1	1, 5, 15	bool	Fan 16 | High Temp Alarm - On/Off	Fans	High Temperature Alarm - Enable | Fan 16	1 = ON, 0 = OFF (Default)
SYSTEM CONFIGURATION							
SYSTEM STATUS							
30001	1	4	uint16	Device Type	ALL	Device Model Number	3 = TDFi-RT, 4 = RA-1270, 5 =Other
30002	1	4	uint16	Airflow Type	ALL	Airflow Type	0 = Actual, 1 = Standard
30003	1	4	uint16	Airflow Unit	ALL	Airflow Unit	0 = FPM, 1 = MPS, 2 = CFS, 3 = CFM, 4 = CFH, 5 = LPS, 6 = LPM, 7 = CMH
30004	1	4	uint16	Temperature Unit	ALL	Temperature Unit	0 = °F, 1 = °C
30005	1	4	uint16	System Node Count	ALL	Total node count on the Ruskin network	1 - 17 Devices Connected (Host)| Monitors (TDFi-RT)
30006	1	4	uint16	System Fan Count	Fans	Total fan count on the Ruskin network	1 - 16 Fans
30007	1	4	uint16	Device Version	ALL	Host - PCB Firmware	MSB = Major, LSB = Minor

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
SYSTEM STATUS							
30008	1	4	uint16	Device Version-2	ALL	Host - PCB Build	MSB = Patch, LSB = Build number
30009	1	4	uint16	Protocol Version	ALL	Host - Modbus RTU Firmware	MSB = Major, LSB = Minor
30010	1	4	uint16	Protocol Version-2	ALL	Host - Modbus RTU Build	MSB = Patch, LSB = Build number
30028	1	4	uint16	Bad Data HR Address	ALL	Set to the last holding register address that had out of range data written to it	Any Valid Holding Address or 0 if no bad write has taken place since last boot
30029	1	4	uint16	Status	ALL	Current System Status	0 = NORMAL, 1 = ALARM, 2 = FAULT, 3 = ALARM & FAULT
30030	1	4	uint16	Flow Alarm	ALL	Flow is Less or Greater than the Flow Limits	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30031	1	4	uint16	Temp Alarm	ALL	Temperature is Less or Greater than the Temperature Limits	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30032	2	4	float	Airflow	ALL	Average Airflow Velocity or Volume in SI or Imperial Units	0 to 10,000 FPM (TDFi-RT)
30034	2	4	float	Temperature	ALL	Average Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30044	1	4	uint16	Fan 1 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 1	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30045	1	4	uint16	Fan 2 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 2	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30046	1	4	uint16	Fan 3 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 3	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30047	1	4	uint16	Fan 4 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 4	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30048	1	4	uint16	Fan 5 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 5	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30049	1	4	uint16	Fan 6 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 6	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30050	1	4	uint16	Fan 7 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 7	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30051	1	4	uint16	Fan 8 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 8	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30052	1	4	uint16	Fan 9 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 9	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30053	1	4	uint16	Fan 10 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 10	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30054	1	4	uint16	Fan 11 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 11	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30055	1	4	uint16	Fan 12 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 12	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30056	1	4	uint16	Fan 13 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 13	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30057	1	4	uint16	Fan 14 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 14	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30058	1	4	uint16	Fan 15 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 15	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30059	1	4	uint16	Fan 16 Flow Alarm	Fans	Flow is Less or Greater than the Flow Limit | Fan 16	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30060	1	4	uint16	Fan 1 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 1	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30061	1	4	uint16	Fan 2 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 2	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
SYSTEM STATUS							
30062	1	4	uint16	Fan 3 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 3	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30063	1	4	uint16	Fan 4 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 4	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30064	1	4	uint16	Fan 5 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 5	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30065	1	4	uint16	Fan 6 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 6	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30066	1	4	uint16	Fan 7 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 7	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30067	1	4	uint16	Fan 8 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 8	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30068	1	4	uint16	Fan 9 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 9	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30069	1	4	uint16	Fan 10 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 10	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30070	1	4	uint16	Fan 11 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 11	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30071	1	4	uint16	Fan 12 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 12	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30072	1	4	uint16	Fan 13 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 13	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30073	1	4	uint16	Fan 14 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 14	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30074	1	4	uint16	Fan 15 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 15	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM
30075	1	4	uint16	Fan 16 Temp Alarm	Fans	Temperature is Less or Greater than the Temperature Limit | Fan 16	0 = NORMAL, 1 = LOW ALARM, 2 = HIGH ALARM

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
RUSKIN NETWORK DEVICES							
Device - Serial Numbers							
30101	16	4	string	Host Serial Number	All	Primary / Host Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30117	16	4	string	Device 1 Serial Number	All	OEM Device Serial Number | Fan 1	0 to 31 Characters, null padded, null terminated; 32 byte
30133	16	4	string	Device 2 Serial Number	All	OEM Device Serial Number | Fan 2	0 to 31 Characters, null padded, null terminated; 32 byte
30149	16	4	string	Device 3 Serial Number	All	OEM Device Serial Number | Fan 3	0 to 31 Characters, null padded, null terminated; 32 byte
30165	16	4	string	Device 4 Serial Number	All	OEM Device Serial Number | Fan 4	0 to 31 Characters, null padded, null terminated; 32 byte
30181	16	4	string	Device 5 Serial Number	All	OEM Device Serial Number | Fan 5	0 to 31 Characters, null padded, null terminated; 32 byte
30197	16	4	string	Device 6 Serial Number	All	OEM Device Serial Number | Fan 6	0 to 31 Characters, null padded, null terminated; 32 byte
30213	16	4	string	Device 7 Serial Number	All	OEM Device Serial Number | Fan 7	0 to 31 Characters, null padded, null terminated; 32 byte
30229	16	4	string	Device 8 Serial Number	All	OEM Device Serial Number | Fan 8	0 to 31 Characters, null padded, null terminated; 32 byte
30245	16	4	string	Device 9 Serial Number	All	OEM Device Serial Number | Fan 9	0 to 31 Characters, null padded, null terminated; 32 byte
30261	16	4	string	Device 10 Serial Number	All	OEM Device Serial Number | Fan 10	0 to 31 Characters, null padded, null terminated; 32 byte
30277	16	4	string	Device 11 Serial Number	All	OEM Device Serial Number | Fan 11	0 to 31 Characters, null padded, null terminated; 32 byte
30293	16	4	string	Device 12 Serial Number	All	OEM Device Serial Number | Fan 12	0 to 31 Characters, null padded, null terminated; 32 byte
30309	16	4	string	Device 13 Serial Number	All	OEM Device Serial Number | Fan 13	0 to 31 Characters, null padded, null terminated; 32 byte
30325	16	4	string	Device 14 Serial Number	All	OEM Device Serial Number | Fan 14	0 to 31 Characters, null padded, null terminated; 32 byte
30341	16	4	string	Device 15 Serial Number	All	OEM Device Serial Number | Fan 15	0 to 31 Characters, null padded, null terminated; 32 byte
30357	16	4	string	Device 16 Serial Number	All	OEM Device Serial Number | Fan 16	0 to 31 Characters, null padded, null terminated; 32 byte

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
RUSKIN NETWORK DEVICES							
Device - Airflows							
30373	2	4	float	Airflow Summary	All	Device Network - Airflow Velocity or Volume in SI or Imperial Units	Fans - 0 to 10,000 FPM
30375	2	4	float	Device 1 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 1	Fans - 0 to 10,000 FPM
30377	2	4	float	Device 2 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 2	Fans - 0 to 10,000 FPM
30379	2	4	float	Device 3 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 3	Fans - 0 to 10,000 FPM
30381	2	4	float	Device 4 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 4	Fans - 0 to 10,000 FPM
30383	2	4	float	Device 5 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 5	Fans - 0 to 10,000 FPM
30385	2	4	float	Device 6 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 6	Fans - 0 to 10,000 FPM
30387	2	4	float	Device 7 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 7	Fans - 0 to 10,000 FPM
30389	2	4	float	Device 8 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 8	Fans - 0 to 10,000 FPM
30391	2	4	float	Device 9 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 9	Fans - 0 to 10,000 FPM
30393	2	4	float	Device 10 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 10	Fans - 0 to 10,000 FPM
30395	2	4	float	Device 11 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 11	Fans - 0 to 10,000 FPM
30397	2	4	float	Device 12 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 12	Fans - 0 to 10,000 FPM
30399	2	4	float	Device 13 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 13	Fans - 0 to 10,000 FPM
30401	2	4	float	Device 14 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 14	Fans - 0 to 10,000 FPM
30403	2	4	float	Device 15 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 15	Fans - 0 to 10,000 FPM
30405	2	4	float	Device 16 Airflow	All	Average Airflow Velocity or Volume in SI or Imperial Units | Fan 16	Fans - 0 to 10,000 FPM

Ruskin's Modbus RTU – Data Map (Continued)

Register	Register Count	Function	Type	Name	Product Line	Description	Range
RUSKIN NETWORK DEVICES							
Device - Temperatures							
30407	2	4	float	Temperature Summary	All	Device Network – Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30409	2	4	float	Device 1 Temperature	All	Average Temperature in SI or Imperial Units | Fan 1	-20°F to 120°F (-29°C to 49°C)
30411	2	4	float	Device 2 Temperature	All	Average Temperature in SI or Imperial Units | Fan 2	-20°F to 120°F (-29°C to 49°C)
30413	2	4	float	Device 3 Temperature	All	Average Temperature in SI or Imperial Units | Fan 3	-20°F to 120°F (-29°C to 49°C)
30415	2	4	float	Device 4 Temperature	All	Average Temperature in SI or Imperial Units | Fan 4	-20°F to 120°F (-29°C to 49°C)
30417	2	4	float	Device 5 Temperature	All	Average Temperature in SI or Imperial Units | Fan 5	-20°F to 120°F (-29°C to 49°C)
30419	2	4	float	Device 6 Temperature	All	Average Temperature in SI or Imperial Units | Fan 6	-20°F to 120°F (-29°C to 49°C)
30421	2	4	float	Device 7 Temperature	All	Average Temperature in SI or Imperial Units | Fan 7	-20°F to 120°F (-29°C to 49°C)
30423	2	4	float	Device 8 Temperature	All	Average Temperature in SI or Imperial Units | Fan 8	-20°F to 120°F (-29°C to 49°C)
30425	2	4	float	Device 9 Temperature	All	Average Temperature in SI or Imperial Units | Fan 9	-20°F to 120°F (-29°C to 49°C)
30427	2	4	float	Device 10 Temperature	All	Average Temperature in SI or Imperial Units | Fan 10	-20°F to 120°F (-29°C to 49°C)
30429	2	4	float	Device 11 Temperature	All	Average Temperature in SI or Imperial Units | Fan 11	-20°F to 120°F (-29°C to 49°C)
30431	2	4	float	Device 12 Temperature	All	Average Temperature in SI or Imperial Units | Fan 12	-20°F to 120°F (-29°C to 49°C)
30433	2	4	float	Device 13 Temperature	All	Average Temperature in SI or Imperial Units | Fan 13	-20°F to 120°F (-29°C to 49°C)
30435	2	4	float	Device 14 Temperature	All	Average Temperature in SI or Imperial Units | Fan 14	-20°F to 120°F (-29°C to 49°C)
30437	2	4	float	Device 15 Temperature	All	Average Temperature in SI or Imperial Units | Fan 15	-20°F to 120°F (-29°C to 49°C)
30439	2	4	float	Device 16 Temperature	All	Average Temperature in SI or Imperial Units | Fan 16	-20°F to 120°F (-29°C to 49°C)

Ruskin's Modbus RTU – Ordering Definition

Big Endian Setting -Coil 00007				
Example = 0 x 12345678				
Application	0 x 78	0 x 56	0 x 34	0 x 12
Registers	0 x 12	0 x 34	0 x 56	0 x 78
	Register 1		Register 2	

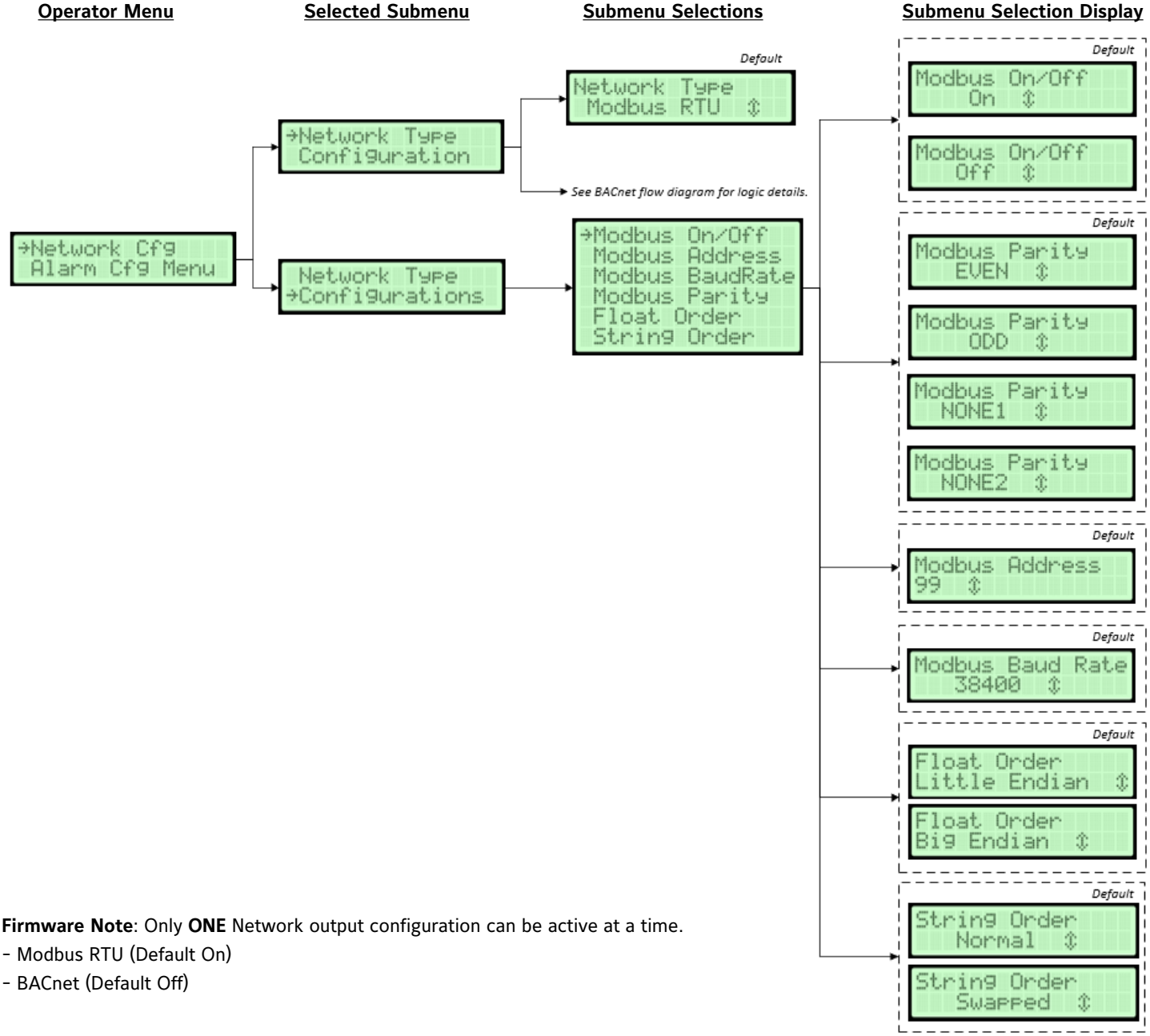
All Setting		
Example = 0 x 1234		
Application	0 x 34	0 x 12
Registers	0 x 12	0 x 34
	Register 1	

Little Endian Setting - Coiling 00007				
Example = 0 x 12345678				
Application	0 x 78	0 x 56	0 x 34	0 x 12
Registers	0 x 56	0 x 78	0 x 12	0 x 34
	Register 1		Register 2	

String Order Normal - Coil 00008						
Example = "Hello"						
Application	H'	e'	l'	l'	o'	\0'
Registers	H'	e'	l'	l'	o'	\0'
	Register 1		Register 2		Register 3	

String Order Swapped - Coil 00008						
Example = "Hello"						
Application	H'	e'	l'	l'	o'	\0'
Registers	e'	H'	l'	l'	\0'	o'
	Register 1		Register 2		Register 3	

Ruskin's Modbus RTU – Device UI Flow



Firmware Note: Only **ONE** Network output configuration can be active at a time.
- Modbus RTU (Default On)
- BACnet (Default Off)

Modbus RTU Network Settings

The Modbus RTU submenu contains the following parameters:

- Modbus RTU On/Off
- Modbus RTU Network Address
- Modbus RTU Baud Rate
- Modbus RTU Parity
- Modbus RTU Float Order
- Modbus RTU String Order

RS-485 Network Selection

Network protocol of the RS-485 connection.

[Menu path: Operator Menu > Network Cfg > Network Type]

Default: Modbus RTU

Optional Settings: BACnet MSTP

Modbus RTU On/Off

[Menu path: Operator Menu > Network Cfg > Configuration > Modbus On/Off]

Default: On

Optional Settings: Off

Modbus RTU Network Address

Network address of the Primary

[Menu path: Operator Menu > Network Cfg > Configuration > Modbus Address]

Default: 99

Optional Settings: 1 to 247

Modbus RTU Baud Rates

The baud rate of the network

[Menu path: Operator Menu > Network Cfg > Configuration > Modbus Baud Rate]

Default: 38400

Optional Settings: 9600, 19200, 57600, 76800, 115200

Modbus RTU Parity

Sets the Parity bit for network data checking

[Menu path: Operator Menu > Network Cfg > Configuration > Modbus Parity]

Default: EVEN

Optional Settings: ODD, NONE1, NONE2

Modbus RTU Float Order

Swap between Big-Endian (most significant value in sequence is stored first) and Little-Endian (least significant value in sequence is stored first) word order for Floats

[Menu path: Operator Menu > Network Cfg > Configuration > Float Order]

Default: Little Endian

Optional Settings: Big Endian

Modbus RTU String Order

Sets the string byte ordering used in read and write processing

[Menu path: Operator Menu > Network Cfg > Configuration > String Order]

Default: Normal

Optional Settings: Swapped

APPENDIX 'B'

BACnet MS/TP – PIC Statement & Objects List

Protocol Implementation Conformance Statement – PICS

General Information	**Date:**	12 August 2019
	Vendor Name:	Ruskin
	Vendor ID:	692
	Product Name:	TDFi-RT Electronic Fan Inlet Airflow Monitoring System
	Product Model Number:	TDFi-RT
	Firmware Revision:	0.4.0
	Application Software Version:	1.1.1
	BACnet Protocol Revision:	14
	Product Description:	Electronic Fan Inlet Monitor System
	BACnet Standard Device Profile:	BACnet Application Specific Controller (B-ASC)
	BACnet Interoperability Building Blocks Supported: Data Sharing - ReadProperty-B (DS-RP-B) Data Sharing - WriteProperty-B (DS-WP-B) Device Management - DynamicDeviceBinding-A (DM-DDB-A) Device Management - DynamicDeviceBinding-B (DM-DDB-B) Device Management - DynamicObjectBinding-B (DM-DOB-B) Device Management - DeviceCommunicationControl-B (DM-DCC-B) Alarm and Event Management - Notification - Internal-B (AE-N-I-B) Alarm and Event Management - Information-B (AE-INFO-B) Alarm and Event Management - Alarm Summary-A (AE-ASUM-B)	
	Segmentation Capability:	No
	Data Link Layer Options:	MS/TP master baud rates: 9600, 19200, 38400, 76800
	Device Address Binding:	No static device binding supported
	Networking Options:	None
	Character Sets Supported:	ISO 10646 (UTF 8)

Standard Objects

The device supports the following standard object types:

- Device
- Analog Value
- Notification Class

Advanced Thermal Dispersion Air Measuring Station – BACnet MS/TP Objects

Object Name	Description	Type	Inst	Units
TDFi-RT[1]	The Device Object	DEV	XXXX[1]	See Property Table 1
Notification Class	Handles where to send events and notifications	NC	1	See Property Table 2
Fan Summery Temperature	Fan Summery Average Temperature	AV	1	See Property Table 3
Fan Summery ACT Airflow Velocity[3]	Fan Summery airflow velocity or volume	AV	2	See Property Table 3
Fan 1 Temperature	Individual Fan 1 Temerature	AV	3	See Property Table 3
Fan 1 Actual Airflow Velocity[3]	Individual Fan 1 airflow velocity or volume	AV	4	See Property Table 3
Fan 2 Temperature	Individual Fan 2 Temperature	AV	5	See Property Table 3
Fan 2 Actual Airflow Velocity[3]	Individual Fan 2 airflow velocity or volume	AV	6	See Property Table 3
Fan 3 Temerature	Individual Fan 3 Temperature	AV	7	See Property Table 3
Fan 3 Actual Airflow Velocity[3]	Individual Fan 3 airflow velocity or volume	AV	8	See Property Table 3

Advanced Thermal Dispersion Air Measuring Station – BACnet MS/TP Objects

Name	Description	Type	Inst	Units
Fan 4 Temperature	Individual Fan 4 Temperature	AV	9	See Property Table 3
Fan 4 Actual Airflow Velocity[3]	Individual Fan 4 airflow velocity or volume	AV	10	See Property Table 3
Fan 5 Temperature	Individual Fan 5 Temperature	AV	11	See Property Table 3
Fan 5 Actual Airflow Velocity[3]	Individual Fan 5 airflow velocity or volume	AV	12	See Property Table 3
Fan 6 Temperature	Individual 6 Temperature	AV	13	See Property Table 3
Fan 6 Actual Airflow Velocity[3]	Individual Fan 6 airflow velocity or volume	AV	14	See Property Table 3
Fan 7 Temperature	Individual Fan 7 Temperature	AV	15	See Property Table 3
Fan 7 Actual Airflow Velocity[3]	Individual Fan 7 airflow velocity or volume	AV	16	See Property Table 3
Fan 8 Temperature	Individual Fan 8 Temperature	AV	17	See Property Table 3
Fan 8 Actual Airflow Velocity[3]	Individual Fan 8 airflow velocity or volume	AV	18	See Property Table 3
Fan 9 Temperature	Individual Fan 9 Temperature	AV	19	See Property Table 3
Fan 9 Actual Airflow Velocity[3]	Individual Fan 9 airflow velocity or volume	AV	20	See Property Table 3
Fan 10 Temperature	Individual Fan 10 Temperature	AV	21	See Property Table 3
Fan 10 Actual Airflow Velocity[3]	Individual Fan 10 airflow velocity or volume	AV	22	See Property Table 3
Fan 11 Temperature	Individual Fan 11 Temperature	AV	23	See Property Table 3
Fan 11 Actual Airflow Velocity[3]	Individual Fan 11 airflow velocity or volume	AV	24	See Property Table 3
Fan 12 Temperature	Individual Fan 12 Temperature	AV	25	See Property Table 3
Fan 12 Actual Airflow Velocity[3]	Individual Fan 12 airflow velocity or volume	AV	26	See Property Table 3
Fan 13 Temperature	Individual Fan 13 Temperature	AV	27	See Property Table 3
Fan 13 Actual Airflow Velocity[3]	Individual Fan 13 airflow velocity or volume	AV	28	See Property Table 3
Fan 14 Temperature	Individual Fan 14 Temperature	AV	29	See Property Table 3
Fan 14 Actual Airflow Velocity[3]	Individual Fan 14 airflow velocity or volume	AV	30	See Property Table 3
Fan 15 Temperature	Individual Fan 15 Temperature	AV	31	See Property Table 3
Fan 15 Actual Airflow Velocity[3]	Individual Fan 15 airflow velocity or volume	AV	32	See Property Table 3
Fan 16 Temperature	Individual Fan 16 Temperature	AV	33	See Property Table 3
Fan 16 Actual Airflow Velocity[3]	Individual Fan 16 airflow velocity or volume	AV	34	See Property Table 3

Note: AV objects 3 – 34 are only available depending on the number of fans configured. For example, if 5 fans are configured, only fans 1 thru 5 will have AV objects 3 – 14 available.

AV – Analog Value

NC – Notification Class

1. Name is dependent on line 2 display settings configured on the device. With line 2 parameter set to custom, the device name appends the line 2 text to the BACnet device name.
2. Configured in the device settings menu.
3. Name is dependent on display settings configured on the device. Prefixed by “Actual” (ACT) or “Standard” (STD) and suffixed by “Velocity” or “Volume” based on settings in the display menu.

Electronic Fan Inlet Monitor station BACnet property types

Property Table 1: Device Object			
Property	**Type**	**Access**	**Description**
Object Identifier[1]	BACnet Object Identifier	R	The object number (instance) for the DEV object
Object Type	BACnet Object Type	R	The DEV object type - DEVICE
Object Name	Character String	R	The DEV object name
System Status	BACnet Device Status	R	Reflects the current status of the device
Vendor Name	Character String	R	Manufacturer of the device
Vendor Identifier	Unsigned16	R	The unique vendor identification code
Model Name	Character String	R	Model of the device
Firmware Revision	Character String	R	Level of firmware installed on the device
Application Software Version	Character String	R	Version of application software installed on the device
Protocol Version	Unsigned	R	Indicates the BACnet protocol version
Protocol Revision	Unsigned	R	Indicates the BACnet protocol revision
Max APDU Length Accepted	Unsigned	R	Maximum number of octets that may be contained in a single APDU
Segmentation Supported	BACnet Segmentation	R	Indicates if the device supports segmentation
APDU Timeout	Unsigned	R	The time in milliseconds between retransmission of an APDU requiring acknowledgment
Number of APDU Retries	Unsigned	R	Maximum number of times an APDU shall be transmitted
Protocol Services Supported	BACnet Service Supported	R	Indicates which standardized protocol services are executed by the device
Protocol Object Types Supported	BACnet Object Types Supported	R	Indicates which standardized object types can be present in the device
Object list	BACnet ARRAY(N) of BACnet Object Identifier	R	Indicates the list of objects accessible on the device
Max Master[1]	Unsigned(0.127)	R	The Max Master of the device
Max Info Frames	Unsigned	R	The Max info Frames of the device
Device Address Binding	BACnet LIST of BACnet Address Binding	R	List of Address Bindings
Database Revision	Unsigned	R	Revision number for the device's database
Property List	BACnet ARRAY(N) of BACnet Property Identifier	R	Array of the supported object properties

Property Table 2: Notification Class Object			
Property	**Type**	**Access**	**Description**
Object Identifier	BACnet Object Identifier	R	The object number (instance) for the NC object
Object Type	BACnet Object Type	R	The NC object type - NOTIFICATION CLASS
Object Name	Character String	R	The NC object name
Notification Class	Unsigned	R	Indicates the Instance of the Notification Class
Priority	BACnet ARRAY(3) of Unsigned	R	Conveys the priority to be used for event notifications for TO OFF NORMAL TO FAULT and TO NORMAL
Ack Required	BACnet Event Transition Bits	R	Conveys whether acknowledgment shall be required for notification generated for TO OFF NORMAL TO FAULTS and TO NORMAL event transitions.
Recipient List	BACnet LIST of BACnet Destination	R/W	Conveys a list of up to 1 recipient destinations to which destinations shall be sent. * Limited to 1 recipient with valid days set to all days, from time as 00:00:00:00, to time as 23:59:59:59 and transitions as (TRUE, TRUE, TRUE)
Property List	BACnet ARRAY(N) of BACnet Property Identifier	R	Array of the supported object properties

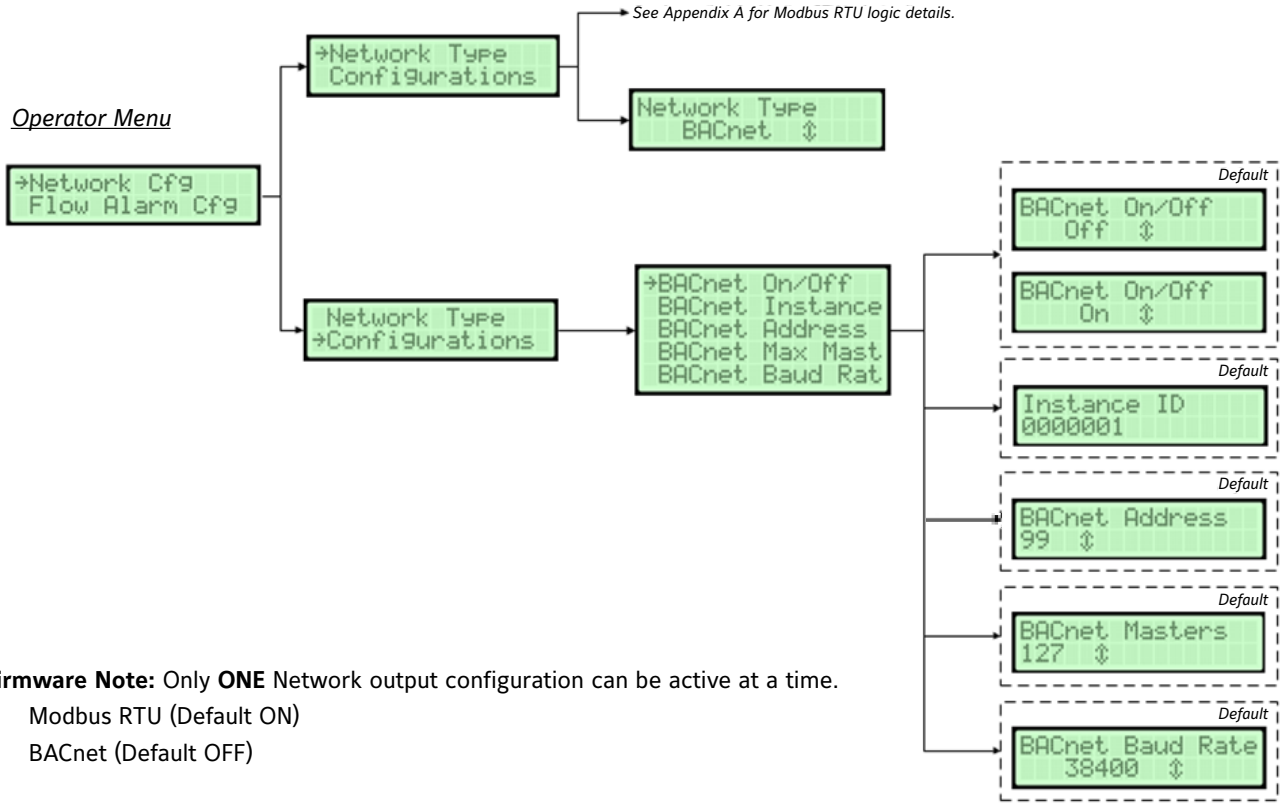
Electronic Fan Inlet Monitor station BACnet property types

Property Table 3: Analog Value Object			
Property	**Type**	**Access**	**Description**
Object Identifier	BACnet Object Identifier	R	The object number (instance) for the AV object
Object Type	BACnet Object Type	R	The AV object type - ANALOG VALUE
Object Name	Character String	R	The AV object name
Present Value	Real	R	The present float value of the AV object, Temperature or Flow, in the set displayed units
Units[1]	BACnet Engineering Units	R	The units of the present value, limits, and deadbands: 62 - Celsius 64 - Fahrenheit 74 - Meters / Second 77 - Feet / Minute 84 - Feet^3 / Minute 87 - Liters / Second 88 - Liters / Minute 135 - Meter^3 / Hour 142 - Feet^3 / Second 191 - Feet^3 / Hour
Out of Service	Boolean	R	Boolean that represents if the reported value is not valid, such as during warm up
Status Flags	BACnet Status Flags	R	4 bits representing if the object is: IN ALARM, FAULT, OVERRIDDEN, OUT OF SERVICE
Event State	BACnet State	R	Indicates the event state of this object
High Limit[1]	Real	R	The device's set high limit that triggers the alarm flags for this object
Low Limit[1]	Real	R	The device's set low limit that triggers the alarm flags for this object
Deadband[1]	Real	R	The device's set deadband for the object's alarm flag triggering
Time Delay[1]	Unsigned	R	The time delay in seconds for the object's alarm flag triggering
Time Delay Normal	Unsigned	R	The time delay in seconds for the object's alarm flag to return to normal
Limit Enable	BACnet Limit Enable	R	The limit enable bits that represent if the object's alarms have the high and/or low limits enabled: Low Limit Enable High Limit Enable
Event Enable	BACnet Event Transition Bits	R	Indicates what events are enabled: TO OFF NORMAL TO FAULT TO NORMAL * All are enabled if High or/and Low limits are enabled
Acked Transitions	BACnet Transition Bits	R	Indicates the acknowledgment state for events
Event Detection Enable	Boolean	R	Indicates whether or not intrinsic reporting is enabled
Notification Class	Unsigned	R	Indicates the instance of the Notification Class to use for events
Notify Type	BACnet Notify Type	R	Indicates the notification type - Alarm
Event Time Stamps	BACnet ARRAY (3) of BACnet Time Stamp	R	Conveys the times of the last TO OFF NORMAL TO FAULT and TO NORMAL events as sequence numbers
Event Message Texts	BACnet ARRAY (3) of Character String	R	Conveys the message text for the last TO OFF NORMAL TO FAULT and TO NORMAL events
Event Message Texts Config	BACnet ARRAY (3) of Character String	R	The base text that defines the message text of Event Message Texts
Event Algorithm Inhibit	Boolean	R/W	Indicates whether or not the event algorithm is disabled for the object
Event Algorithm Inhibit Ref	Bacnet Object Property Reference	R	Indicates the property that controls Events Algorithm Inhibit Uninitialized
Reliability	BACnet Reliability	R	Indicates if the Present Value is reliable
Reliability Evaluation Inhibit	Boolean	R	Indicates whether or not reliability evaluation is disabled for the object
Property List	BACnet ARRAY (N) of BACnet Property Identifier	R	Array of the supported object properties
Proprietory(1110)[2]	BACnet Engineering Units	R	Units for proprietary properties 1112 and 1114. Shares the same enumerations as the Units property
Proprietory(1111)[2]	Character String	R	Fan Sensor 1 status
Proprietory(1112)[2]	Real	R	Fan Sensor Raw Value
Proprietory(1113)[2]	Character String	R	Fan Sensor 2 Status (Status only available depending on device settings)
Proprietory(1114)[2]	Real	R	Fan Sensor 2 Raw Value (Value only valid depending on device settings)

R - Read Access W - Write Access

1. These properties are configured through the configuration menu on the device
2. The proprietary properties are only available on AV objects 3-34.

Ruskin's BACnet MS/TP – Device UI Flow:



Firmware Note: Only **ONE** Network output configuration can be active at a time.

- Modbus RTU (Default ON)
- BACnet (Default OFF)

BACnet MS/TP Network Settings

The BACnet MS/TP submenu contains the following parameters:

- BACnet On/Off
- BACnet Instance
- BACnet Address
- BACnet Max Masters
- BACnet Baud Rate

RS-485 Network Selection

Network protocol of the RS-485 connection.

[Menu path: Operator Menu > Network Cfg > Network Type]

Default: Modbus RTU

Optional Settings: BACnet MS/TP

BACnet On/Off

[Menu path: Operator Menu > Network Cfg > Configuration > BACnet On/Off]

Default: Off

Optional Settings: On

BACnet Instance

Update the currently selected value. The instance number must be unique from all BACnet devices on the entire system. The range of values is 1 to 4,194,302.

[Menu path: Operator Menu > Network Cfg > Configuration > BACnet Instance]

Default: 0000001

Optional Settings: Value from 1 through 4,194,302

BACnet Address

Select a value between 4 and 127. Holding down the button increases the rate the value updates.

[Menu path: Operator Menu > Network Cfg > Configuration > BACnet Address]

Default: 99

Optional Settings: Value from 4 through 127

BACnet Max Masters

Select a value between 1 and 127. Holding down the button increases the rate the value updates.

[Menu path: Operator Menu > Network Cfg > Configuration > BACnet Max Mast]

Default: 127

Optional Settings: Value from 1 through 127

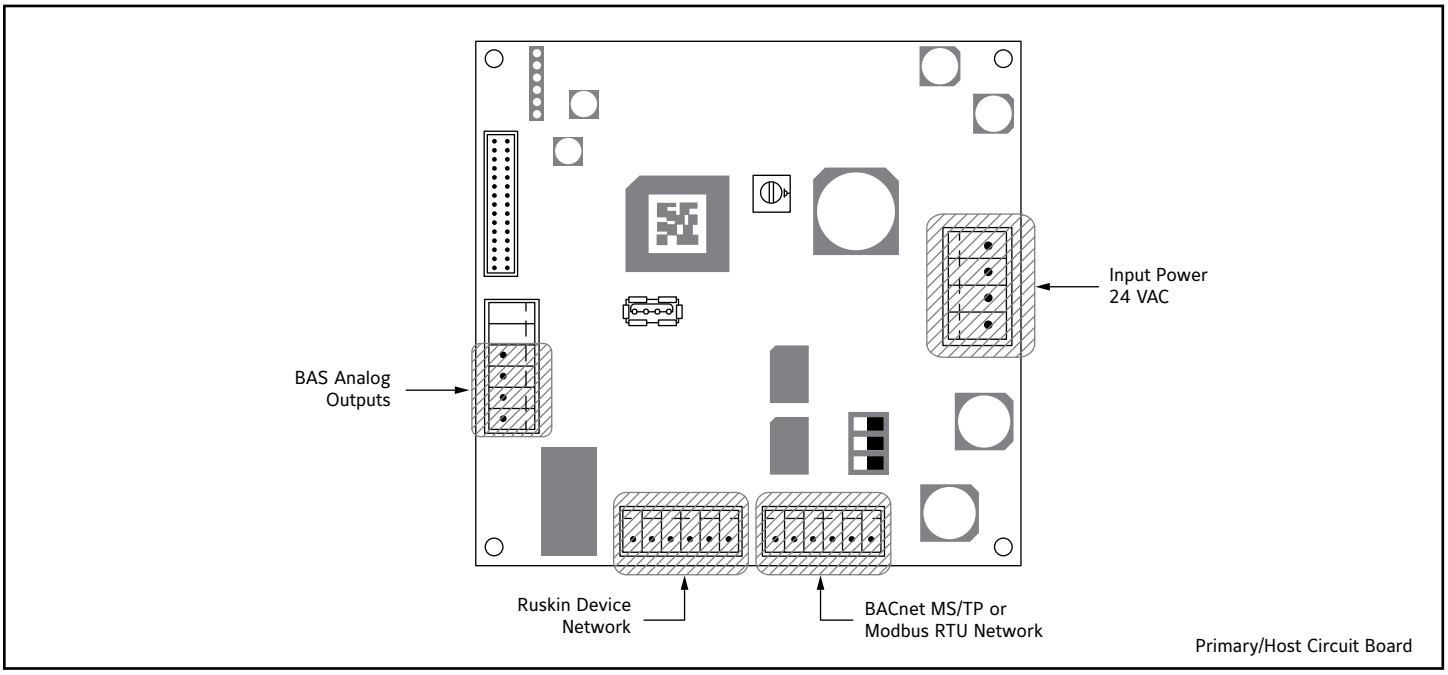
BACnet Baud Rate

[Menu path: Operator Menu > Network Cfg > Configuration > BACnet Baud Rate]

Default: 38400

Optional Settings: 9600, 19200, 76800

Ruskin Circuit Board I/O:



MAINTENANCE

At a minimum frequency of twice each year, scroll through the volume and temperature values displayed on the HOST or through the BAS. Inspect and clean the sensor nodes if the readings indicate a trend that varies from normal, expected readings.

At a minimum frequency of once per year, inspect the thermal dispersion sensors installed in unfiltered outside air, return air, or exhaust air applications to ensure that the sensors are free of excessive buildup of lint, dust, or other airborne particulates.

IMPORTANT: When installed in unfiltered air application. it is the site owner's responsibility to implement a preventive maintenance schedule that aligns with their minimum annual cleaning requirements.

Failure to implement a site cleaning schedule and/or adhere to the manufacturers cleaning guidelines could result in equipment failure which would not be covered under the manufacture's limited warranty.

Steps to follow if direct visual inspection is not possible and the sensors must be removed from the system:

1. Before cleaning the sensors, make sure the power to the thermal dispersion airflow measuring device is turned OFF or disconnected

   IMPORTANT: Prior to removing the sensor cable assembly (if required), document location and positioning of the sensor. It is critical that the opening in the sensor housing be positioned in the same location as prior to removal. Failure to install the sensor cable assembly in the same position/location can result in variance of airflow measurements (variations greater than those measured during the onsite calibration process).
2. Remove the two (2) boom arm mounting clamps, freeing the sensor cable assembly from the fan inlet.
3. Wipe down the sensor cable assembly with a clean, damp cloth. Ensure that the sensor cable assembly and sensor opening is horizontal during cleaning so any moisture encountered in the cleaning process will free fall from the boom arm and sensor housing.
4. Using Micro-Tip Cotton Swabs to clean the sensors within the sensor housing.
   a. Soak or spray a cotton swab in 70% or higher Isopropyl Alcohol (IPA).
   b. Insert the cotton swab into the opening of the flow hood assembly; ensuring there is no vigorous contact with the sensors (keeping caution of the sensor locations).
5. Gently press the cotton swab over the sensor surface area to remove debris or contaminates.

   IMPORTANT: Twisting or applying excessive force could result in damage to the sensors protective coating.
6. Using another new, clean micro-tip cotton swab, soak or spray in 70% or higher Isopropyl Alcohol (IPA).
   a. Gently clean away any debris on the sides and top surface area of the sensors.
7. Re-mount the sensor cable assembly onto the fan inlet; ensuring the boom arm and sensor housing is positioned in the same location as was before removal for cleaning.
8. Let the Isopropyl Alcohol (IPA) fully evaporate before applying power.

CLEANING REGIMENT: https://www.ruskin.com/doc/Id/9827

REPAIR INFORMATION

If the TDFi-RT thermal dispersion fan inlet airflow measuring system fails to operate within its specifications, please contact the nearest Ruskin representative for technical support.

Measuring stations are tested at an AMCA Registered Laboratory using instrumentation and procedures in accordance with AMCA Standard No. 610-93, Airflow Station Performance.

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Ruskin office. Ruskin shall not be liable for damages resulting from misapplication or misuse of its products.

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