Air Quality Solutions

Installation and Maintenance Manual

Remote Display

Ancillary

Primary

Model: TDP05K

Advanced Thermal Dispersion Airflow & Temperature Measuring Probe

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TDP05K Advanced Thermal Dispersion Airflow & Temperature Measuring System

Installation Instructions

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

APPLICATIONS

The TDP05K Thermal Dispersion Probe Airflow Measuring System is an air-measurement device that uses thermal dispersion technology to measure the airflow velocity and temperature in duct and plenum applications. Insertion probes can be installed in retrofit applications or specified on new construction projects.

The TDP05K may be used in rectangular, oval, or round applications when installed in accordance with this installation manual. The TDP05K is designed to be installed in almost any location that airflow needs to be measured. Measurements may be improved by following the placement guidelines in this document. When adequate space is not available, more probes and/or sensors are recommended.

To obtain the best air measurement results, avoid installing the Airflow Measuring System directly downstream of heating coils, cooling coils, or humidifiers.

This Installation Manual also applies to the model HTDP-S. Model HTDP-S offers the advanced technology available with the TDP05K and makes it available for Same-Day or Next-Day shipping. Contact Ruskin for availability of model HTDP-S as it is stocked in limited sizes and quantities.

NORTH AMERICAN EMISSIONS COMPLIANCE

United States

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his/her own expense

Canada

This Class (A) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numerique de la Classe (A) respecte toutes les exigences du Reglement sur le materiel brouilleur du Canada.

INSTALLATION

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

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.

Unpacking the Advanced Thermal Dispersion Probe Airflow Measuring System

Remove the thermal dispersion probes from the shipping containers and inspect the devices for damage before installation. The shipping box may contain more than one probe. The optional remote display may also be in same box if it is ordered with air measurement station.

NOTE: Care should be taken to keep the primary and ancillary probes for each system together if there are multiple systems of the same size. Communication issues may occur if ancillary probes are switched between systems resulting in duplicate probes with the same address on the same probe network.

Installing the Thermal Dispersion Probes

The sensor density is based on extensive lab testing to optimize the accuracy of the TDP05K Airflow Measuring System. When installing the thermal dispersion probes, use the Rectangular Duct Mounting, Round Duct Mounting, and Oval Duct Mounting sections to determine the proper spacing between each probe within the opening. Contact your local Ruskin® representative if you have questions regarding a particular application.

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.

AVERTISSEMENT: Risque de décharge électrique.
Debrancher l'alimentation avant de realiser tout branchement electrique. Tout contact avec des composants conducteurs de tensions dangereuses risque d'entraTner une decharge electrique et de provoquer des blessures graves, voire mortelles.

IMPORTANT: 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.

Software Configuration Information for Commissioning:

After the installation described in this document is complete, please refer to the TDP05K Technical Bulletin for information regarding configuration options.

The Technical Bulletin document can be viewed or downloaded at this location: http://www.ruskin.com/catalog/serve file/id/6767.

The Technical Bulletin document can also be accessed via this QR Code:

Mounting

Rectangular Duct Mounting

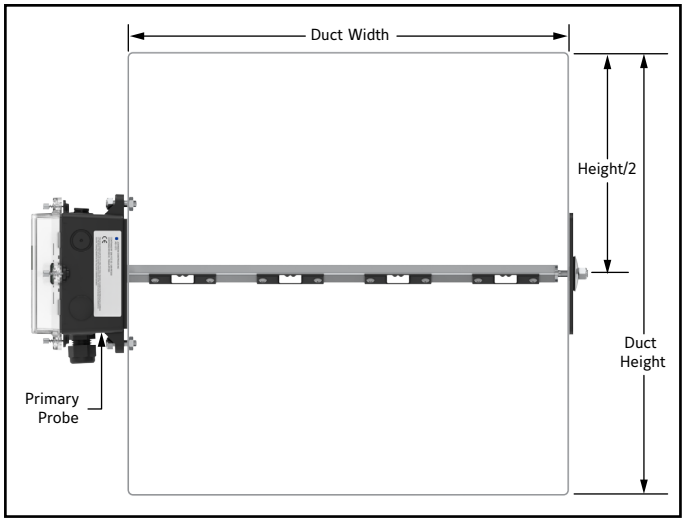


Figure 1: Rectangular Duct Mounting–One Probe Configuration

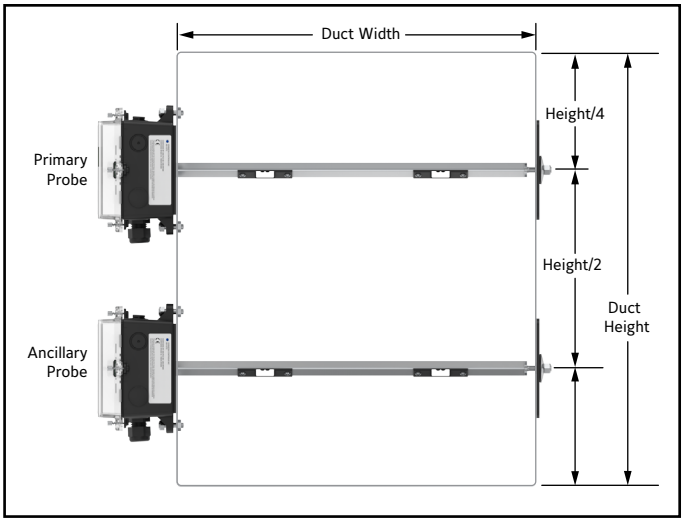


Figure 2: Rectangular Duct Mounting–Two Probe Configuration

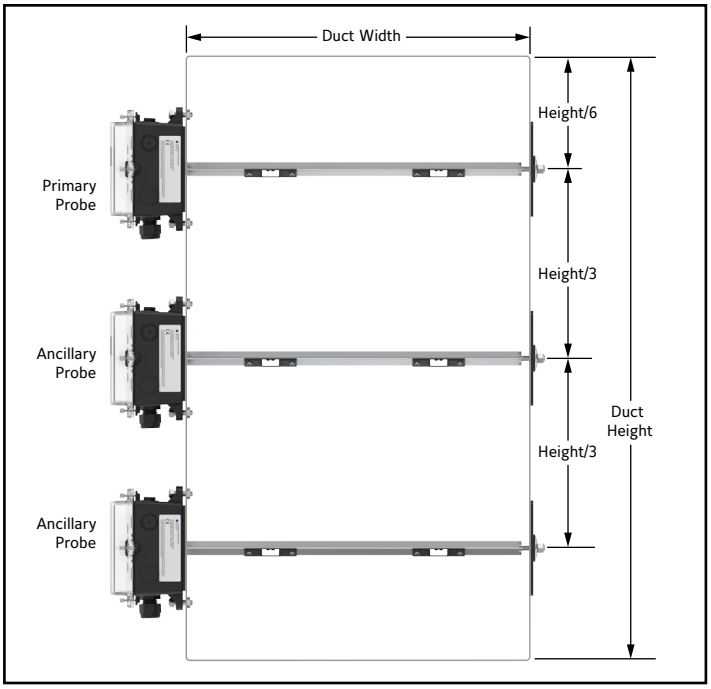


Figure 3: Rectangular Duct Mounting–Three Probe Configuration

NOTE: The primary probe should be installed in the most accessible location for the application.

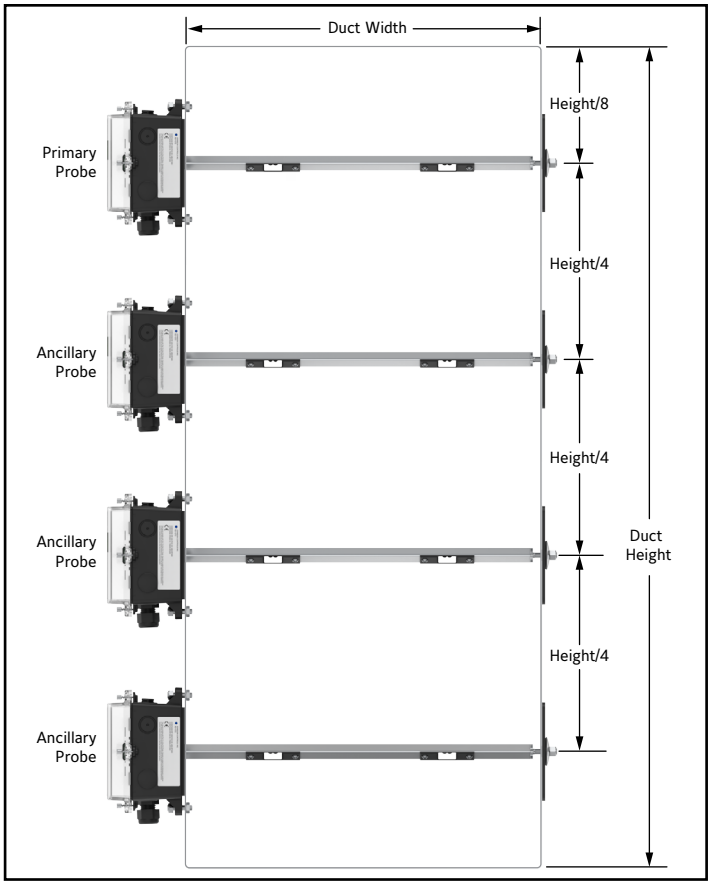


Figure 4: Rectangular Duct Mounting–Four Probe Configuration

Remote Wired Primary

The TDP05K Airflow Measuring Station can be ordered with a Remote Wired Primary (included with the HTDP-S) as the display option. All the probes installed in the duct are Ancillary probes and must be field wired to the Remote Wired Primary, which can be installed up to 500 feet 152 meters) from the air measurement probes. All terminations of the power and probe network are the same as shown in this document.

Remote Display

If the TDP05K Airflow Measuring Station is ordered with a Remote Display, this display duplicates the menu and display functions of the primary. The Primary is always the interface point with the building automation system. The Remote Display can be installed up to 500 feet (152 meters) when wired, and up to 200 feet (61 meters) when configured for wireless operation. The Remote Display is wired as another Ancillary on the probe network. The address for the Remote Display and Primary are hard coded with no field adjustments or setting of their addresses required.

Table 1: Number of Probes/Sensors per Probe for Rectangular Duct Applications

Duct Height "B"	Rectangular Duct Width "A" = Probe Length																			
	8" (203)	12" (305)"	14" (356)	16" (406)	18" (457)	20" (508)	22" (559)	24" (610)	30" (762)	36" (914)	42" (1067)	48" (1219)	54" (1372)	60" (1524)	66" (1676)	72" (1829)	84" (2134)	96" (2438)	108" (2743)	120" (3048)
8" (203)	1/2	1/2	1/3	1/3	1/4	1/4	1/4	1/4	1/6	1/6	1/6	1/6	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
12" (305)	1/2	1/2	1/3	1/3	1/4	1/4	1/4	1/4	1/6	1/6	1/6	1/6	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
14" (356)	1/2	1/3	1/3	1/3	1/4	1/4	1/6	1/6	1/6	1/6	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
16" (406)	2/2	2/2	2/2	2/2	2/2	2/3	2/3	2/3	1/6	1/6	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
18" (457)	2/2	2/2	2/2	2/2	2/3	2/3	2/3	2/3	1/6	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8
20" (508)	2/2	2/2	2/2	2/3	2/3	2/3	2/3	2/3	2/4	1/8	1/8	1/8	1/8	2/6	2/6	2/6	2/6	2/7	2/8	2/8
22" (559)	2/2	2/2	2/3	2/3	2/3	2/3	2/3	2/3	2/4	1/8	1/8	1/8	2/6	2/6	2/6	2/6	2/7	2/8	2/8	2/8
24" (610)	2/2	2/2	2/3	2/3	2/3	2/3	2/3	2/3	2/4	2/4	1/8	1/8	2/6	2/6	2/6	2/6	2/7	2/8	2/8	2/8
30" (762)	3/2	3/2	3/2	3/2	3/2	2/4	2/4	2/4	2/4	2/4	2/6	2/6	2/6	2/7	2/7	2/8	2/8	2/8	2/8	2/8
36" (914)	3/2	3/2	3/2	3/2	3/3	3/3	3/3	2/4	2/4	2/6	2/6	2/6	2/7	2/8	2/8	2/8	2/8	2/8	2/8	2/8
42" (1067)	3/2	3/2	3/3	3/3	3/3	3/3	3/3	3/3	2/6	2/6	2/7	2/7	2/8	2/8	2/8	2/8	2/8	2/8	2/8	2/8
48" (1219)	3/2	3/2	4/2	4/2	4/2	4/2	4/2	4/2	3/4	2/6	2/7	2/8	2/8	2/8	2/8	2/8	2/8	2/8	2/8	2/8
54" (1372)	4/2	4/2	4/2	4/2	4/2	4/2	3/4	3/4	3/4	2/7	2/8	2/8	2/8	2/8	2/8	4/4	2/8	2/8	2/8	2/8
60" (1524)	4/2	4/2	4/2	4/2	4/2	3/4	3/4	3/4	4/4	4/4	2/8	2/8	2/8	4/4	4/4	4/4	4/4	2/8	2/8	2/8
66" (1676)	4/2	4/2	4/2	4/2	4/3	3/4	3/4	3/4	4/4	4/4	4/4	2/8	2/8	4/4	4/4	4/4	4/4	4/4	2/8	2/8
72" (1829)	4/2	4/2	4/2	4/2	4/3	3/4	3/4	3/4	4/4	4/4	4/4	2/8	4/4	4/4	4/4	4/4	4/4	4/4	4/4	2/8
84" (2134)	4/2	4/2	4/2	4/2	4/3	3/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4
96" (2438)	4/2	4/2	4/2	4/2	4/3	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4
108" (2743)	4/2	4/2	4/2	4/2	4/3	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4
120" (3048)	4/2	4/2	4/2	4/2	4/3	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4

DETAIL A

TDP05K probe/sensor placement for rectangular applications.

Duct Height; Inches (mm)	Duct Width (Probe Length) Inches (mm)				
	14 (356)	18 (457)	24 (610)	30 (762)	36 (914)
8 (203)	1/4	1/4	1/4	1/6	1/8
12 (305)	1/4	1/4	1/4	1/6	1/8
14 (356)	1/4	1/4	1/4	1/6	1/8
16 (406)	2/4	2/4	2/4	1/6	1/8
18 (457)	2/4	2/4	2/4	1/6	1/8
20 (508)	2/4	2/4	2/4	2/6	1/8
22 (559)	2/4	2/4	2/4	2/6	1/8
24 (610)	2/4	2/4	2/4	2/6	2/8
30 (762)	3/4	3/4	2/4	2/6	2/8
36 (914)	3/4	3/4	2/4	2/6	2/8
42 (1067)	3/4	3/4	3/4	2/6	2/8
48 (1219)	4/4	4/4	3/4	3/6	2/8
54 (1372)	4/4	4/4	3/4	3/6	2/8
60 (1524)	4/4	4/4	3/4	4/6	4/8
66 (1676)	4/4	4/4	3/4	4/6	4/8
72 (1829)	4/4	4/4	3/4	4/6	4/8
84 (2134)	4/4	4/4	4/4	4/6	4/8
96 (2438)	4/4	4/4	4/4	4/6	4/8
108 (2743)	4/4	4/4	4/4	4/6	4/8
120 (3048)	4/4	4/4	4/4	4/6	4/8

HTDP-S Probe/Sensor Count per Duct Size

#Probes / #Sensors per Probe

Model HTDP-S

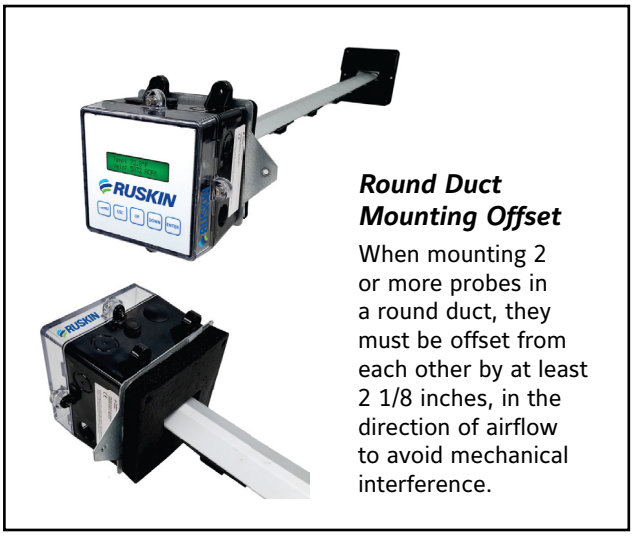
AVAILABLE FOR NEXT-DAY OR SAME-DAY SHIPPING!.

Ruskin model HTDP-S offers the advanced technology available with the model TDP05K and makes it available in these probe lengths for Same-Day or Next-Day shipping to meet critical project scheduling!

Rectangular Duct Internal Mounting

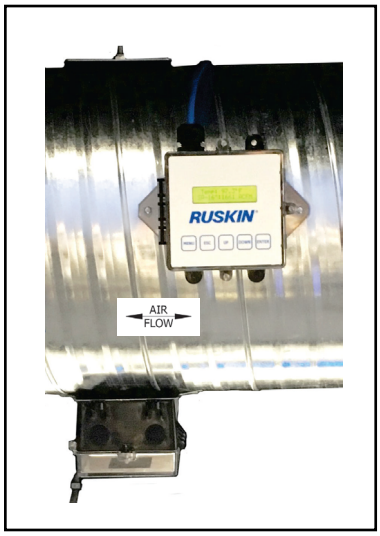
Each Internal Mount Air Measurement System consists of one or more ancillary probes to be mounted inside existing ductwork or opening to be wired to an externally located REMOTE WIRED PRIMARY or junction box. The REMOTE WIRED PRIMARY receives air and temperature measurement data via the probe network's twisted shielded pair. The REMOTE WIRED PRIMARY is the user interface as well as the interface point for power and connection to the Building Automation System. Spacing of Internal mount probes is the same as Insertion mount probes.

Round Duct Mounting



Round Duct Mounting Offset

When mounting 2 or more probes in a round duct, they must be offset from each other by at least 2 1/8 inches, in the direction of airflow to avoid mechanical interference.



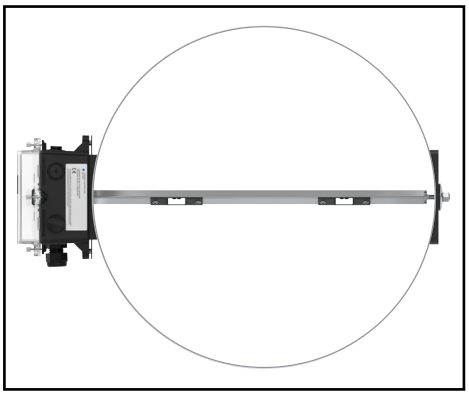


Figure 5: Round Duct Mounting One Probe Configuration

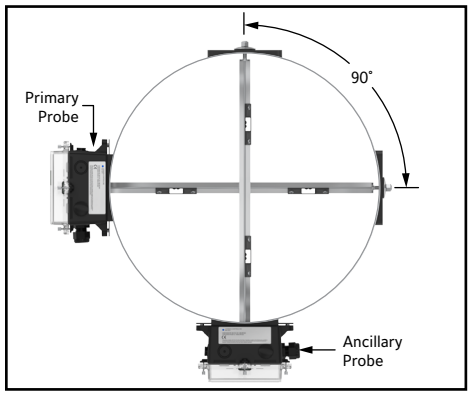


Figure 6: Round Duct Mounting Two Probe Configuration

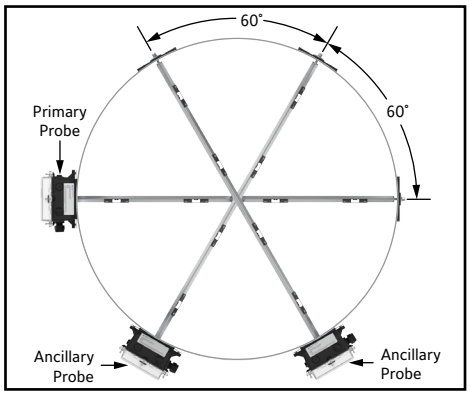


Figure 7: Round Duct Mounting Three Probe Configuration

NOTE: : The primary probe should be installed in the most accessible location for the application.

Table 2: Number of Probes / Sensors per Probe for Round Duct Applications

Duct Diameter, in. (mm)	# Probes / # Sensors per Probe	Figure Reference
Above 8" thru 14" (203 thru 356)	1 / 2	Figure 5
Above 14" thru 20" (356 thru 508)	2 / 4	Figure 6
Above 20" thru 42" (508 thru 1067)	2 / 6	Figure 6
Above 42" thru 60" (1067 thru 1524)	2 / 8	Figure 6
Above 60" thru 120" (1524 thru 3048)	3 / 8	Figure 7

Oval Duct Mounting

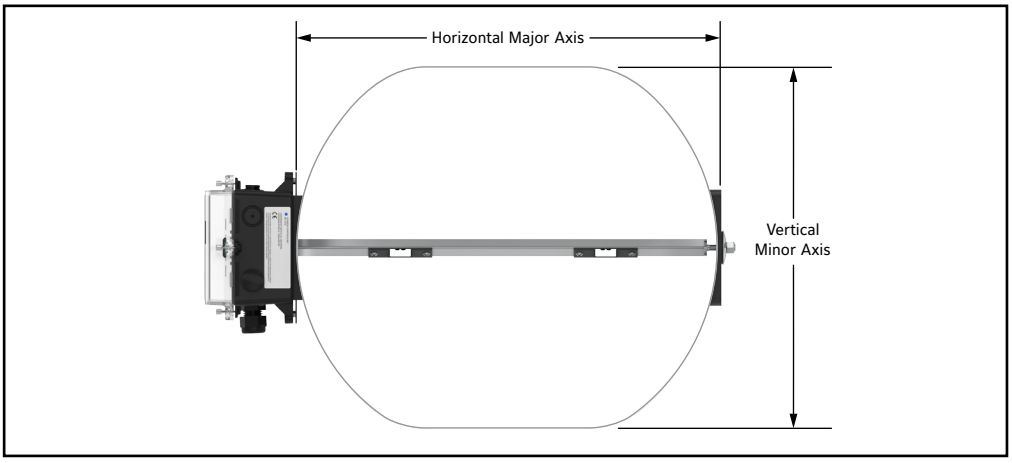


Figure 8: Oval Duct Mounting - One Probe Configuration

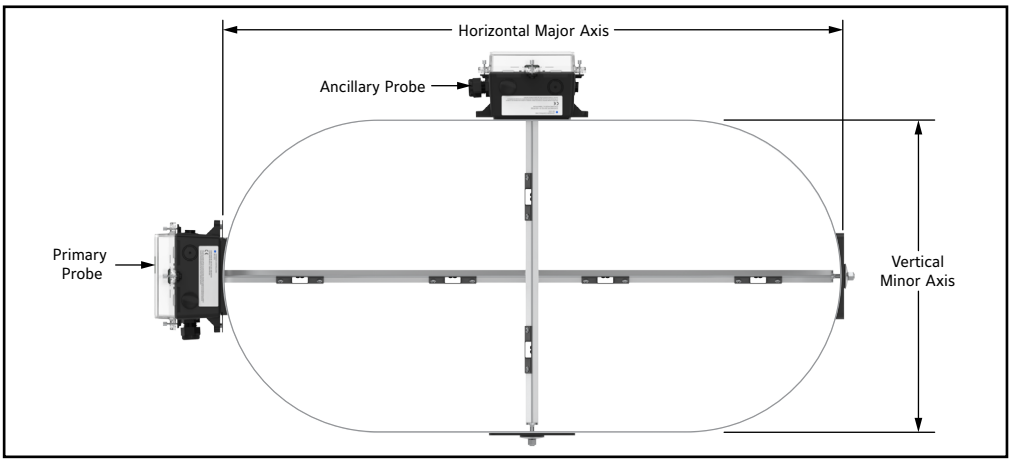


Figure 9: Oval Duct Mounting - Two Probe Configuration

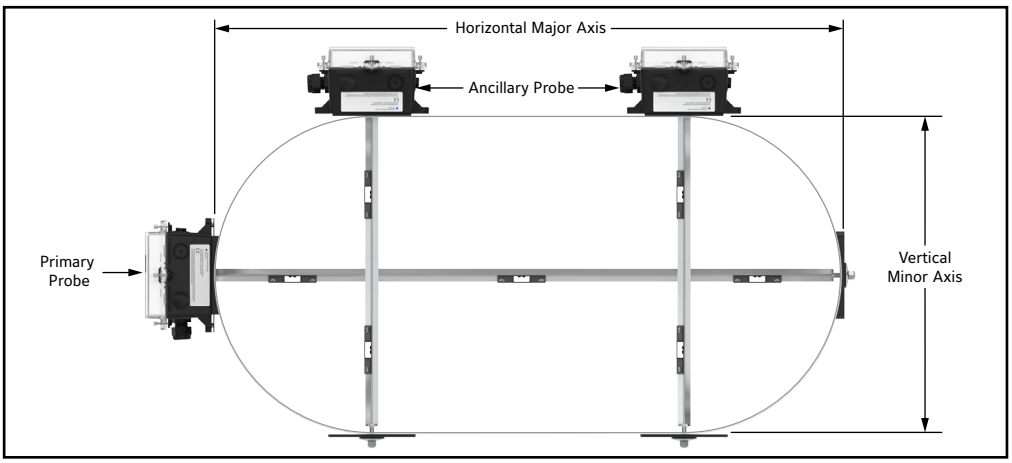


Figure 10: Oval Duct Mounting - Three Probe Configuration

NOTE: : The primary probe is the longest probe for oval mounting. It should be installed in the most accessible location for the application.

Table 3: Number of Probes/Sensors per Probe for Oval Duct Applications–12 to 22 in. (305 to 559 mm)

	First select duct height: Vertical Minor Axis, in. (mm)																	
Then select Horizontal Major Axis, in. (mm)	12 (305)			14 (356)			16 (406)			18 (457)			20 (508)			22 (559)		
	14[1] (356)	H	1/1	16[1] (406)	H	1/2	18[1] (457)	H	1/2	21[1] (533)	H	1/3	25[2] (635)	H	1/2	28[2] (711)	H	1/2
		V			V			V			V			V	1/2		V	1/2
	15[1] (381)	H	1/2	25[1] (635)	H	1/3	22[1] (559)	H	1/3	29[1] (737)	H	1/4	34[2] (864)	H	1/4	31[2] (787)	H	1/4
		V			V			V			V			V	1/2		V	1/2
	28[1] (356)	H	1/3	34[1] (864)	H	1/4	32[1] (813)	H	1/4	37[1] (940)	H	1/5	42[3] (1,067)	H	1/3	44[3] (1,118)	H	1/3
		V			V			V			V			V	2/2		V	2/2
	40[1] (356)	H	1/4	45[1] (1,143)	H	1/5	41[1] (1,041)	H	1/5	46[1] (1,168)	H	1/6	51[3] (1,295)	H	1/4	53[3] (1,346)	H	1/4
		V			V			V			V			V	2/2		V	2/2
	53[1] (1,346)	H	1/5	55[1] (1,397)	H	1/6	51[1] (1,295)	H	1/6	53[1] (1,346)	H	1/7	64[3] (1,626)	H	1/5	60[3] (1,524)	H	1/5
		V			V			V			V			V	2/2		V	2/2
	65[1] (1,651)	H	1/6	67[1] (1,702)	H	1/7	60[1] (1,524)	H	1/7	62[1] (1,575)	H	1/8	70[3] (1,778)	H	1/6	66[3] (1,676)	H	1/6
		V			V			V			V			V	2/2		V	2/2
	75[1] (1,905)	H	1/6	74[1] (1,880)	H	1/7	69[1] (1,753)	H	1/8	71[3] (1,803)	H	1/5	80[3] (2,032)	H	1/6	72[3] (1,829)	H	1/7
		V			V			V			V	2/2		V	2/2		V	2/2
	1. See Figure 8 for details. 2. See Figure 9 for details. 3. See Figure 10 for details.						79[1] (2,007)	H	1/8	78[3] (1,981)	H	1/6				79[3] (2,007)	H	1/8
								V			V	2/2					V	2/2
										81[3] (2,057)	H	1/6				85[3] (2,159)	H	1/5
											V	2/2					V	2/4

Table 4: Number of Probes/Sensors per Probe for Oval Duct Applications–24 to 36 in. (610 to 914 mm)

	First select duct height: Vertical Minor Axis, in. (mm)																				
Then select Horizontal Major Axis, in. (mm)	24 (610)			26 (660)			28 (711)			30 (762)			32 (813)			34 (864)			36 (914)		
	31[2] (787)	H	1/4	32[1] (813)	H	1/4	34[1] (864)	H	1/4	36[1] (914)	H	1/6	39[1] (991)	H	1/6	41[1] (1,041)	H	1/6	42[1] (1,067)	H	1/6
		V	1/2		V	1/2		V	1/2		V	1/2		V	1/2		V	1/2		V	1/4
	43[2] (1,092)	H	1/6	42[1] (1,067)	H	1/6	44[1] (1,118)	H	1/6	46[1] (1,168)	H	1/6	45[1] (1,143)	H	1/6	43[1] (1,092)	H	1/6	49[1] (1,245)	H	1/8
		V	1/2		V	1/2		V	1/2		V	1/4		V	1/4		V	1/4		V	1/4
	49[3] (1,245)	H	1/4	51[2] (1,295)	H	1/5	50[1] (1,270)	H	1/6	55[1] (1,397)	H	1/8	54[1] (1,372)	H	1/8	53[1] (1,346)	H	1/8	58[1] (1,473)	H	1/8
		V	2/2		V	2/2		V	1/4		V	1/4		V	1/4		V	1/4		V	1/6
	55[3] (1,397)	H	1/5	57[2] (1,448)	H	1/6	56[2] (1,422)	H	1/7	61[2] (1,549)	H	1/8	63[2] (1,600)	H	1/5	59[1] (1,499)	H	1/8	64[1] (1,626)	H	1/8
		V	2/2		V	2/2		V	2/2		V	2/2		V	2/4		V	1/6		V	1/8
	62[3] (1,575)	H	1/6	64[2] (1,626)	H	1/4	59[2] (1,499)	H	1/8	65[2] (1,651)	H	1/5	67[2] (1,702)	H	1/7	69[2] (1,753)	H	1/7	71[2] (1,803)	H	1/8
		V	2/2		V	2/4		V	2/2		V	2/4		V	2/4		V	2/4		V	2/4
	68[3] (1,727)	H	1/7	67[2] (1,702)	H	1/5	69[2] (1,753)	H	1/5	71[2] (1,803)	H	1/6	70[2] (1,778)	H	1/8	72[2] (1,829)	H	1/8	74[2] (1,880)	H	1/5
		V	2/2		V	2/4		V	2/4		V	2/4		V	2/4		V	2/4		V	2/6
	74[3] (1,880)	H	1/8	79[2] (2,007)	H	1/6	75[2] (1,905)	H	1/6	77[2] (1,956)	H	1/7	79[2] (2,007)	H	1/4	78[2] (1,981)	H	1/5	77[2] (1,956)	H	1/7
		V	2/2		V	2/4		V	2/4		V	2/4		V	2/6		V	2/6		V	2/6
	81[3] (2,057)	H	1/5	83[2] (2,108)	H	1/6	78[2] (1,981)	H	1/7	80[2] (2,032)	H	1/4	1. See Figure 9 for details. 2. See Figure 10 for details.								
		V	2/4		V	2/4		V	2/4		V	2/6									
	84[3] (2,134)	H	1/5				81[2] (2,057)	H	1/7												
		V	2/4					V	2/4												

Location Considerations

IMPORTANT: The thermal dispersion probes may be installed in the vertical or horizontal plane of the duct. In vertical mount applications, mount the control box on the top or the bottom of the opening. In horizontal mount applications, mount the probes so that the plastic sensor shrouds are on the bottom of the probe to minimize moisture accumulation in the extrusion. Intended applications are up to 99% non-condensing environments.

The minimum spacing between probes and filter banks or dampers is 6 inches (152 mm) in the direction of airflow. Probes should be upstream of any obstruction in the airstream. It is important that the probes or filters be positioned so the seams of the filters do not block or obstruct airflow through any sensors.

IMPORTANT: The probe enclosure cover is secured with three captive thumb screws. Take care when mounting the probes to ensure there is adequate clearance to open the cover and make electrical connections.

Minimum Mounting Distances

Figures 11a and 11b represent applications for which the Advanced Thermal Dispersion Airflow Measuring System is most suitable. If your particular application is not shown or if you do not have the space to observe the minimum distance, more probes and/or sensing points are recommended; contact your local Ruskin representative for the best solution. The locations shown on these details represent the minimum clearance from most obstruction that create an airflow disturbance.

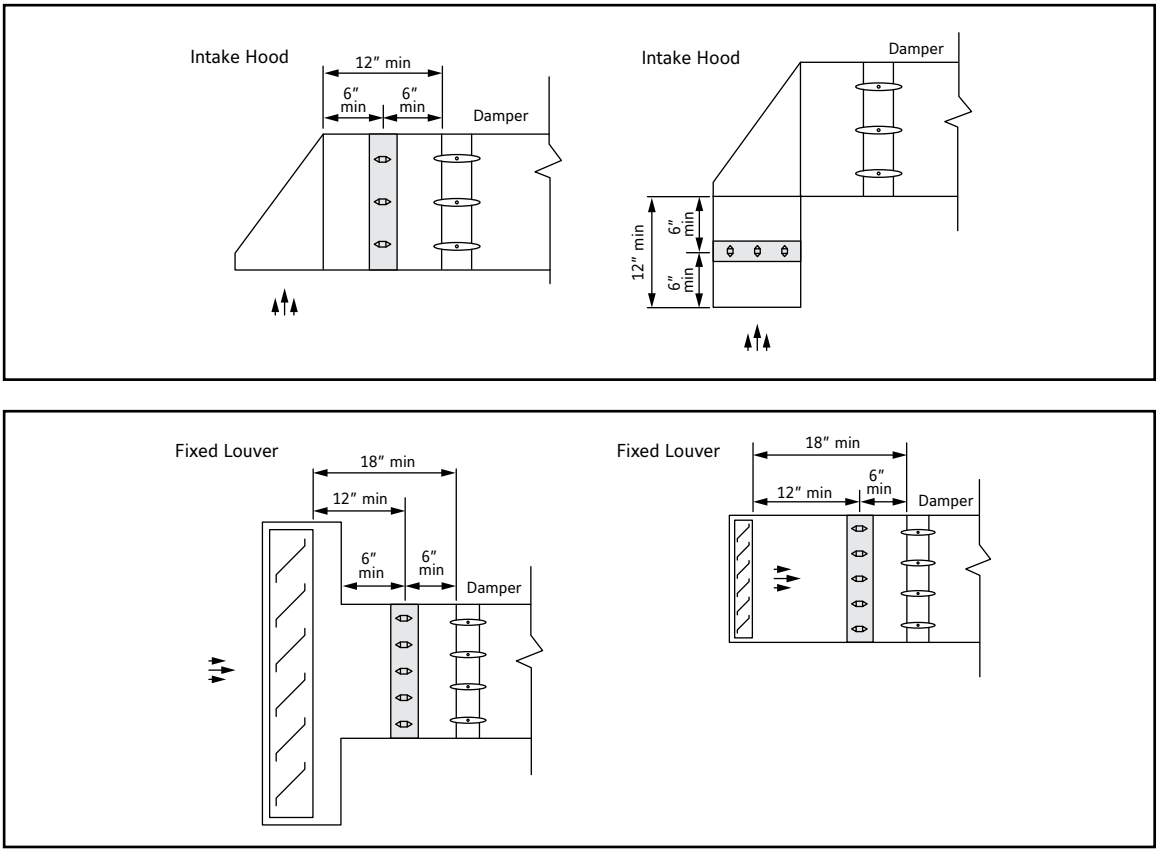


Figure 11a: Minimum Mounting Distances

Minimum Mounting Distances

Figure 11b represents applications for which the Advanced Thermal Dispersion Airflow Measuring System is most suitable. If your particular application is not shown or if you do not have the space to observe the minimum distance, more probes and/or sensing points are recommended; contact your local Ruskin representative for the best solution. The locations shown on these details represent the minimum clearance from most obstruction that create an airflow disturbance.

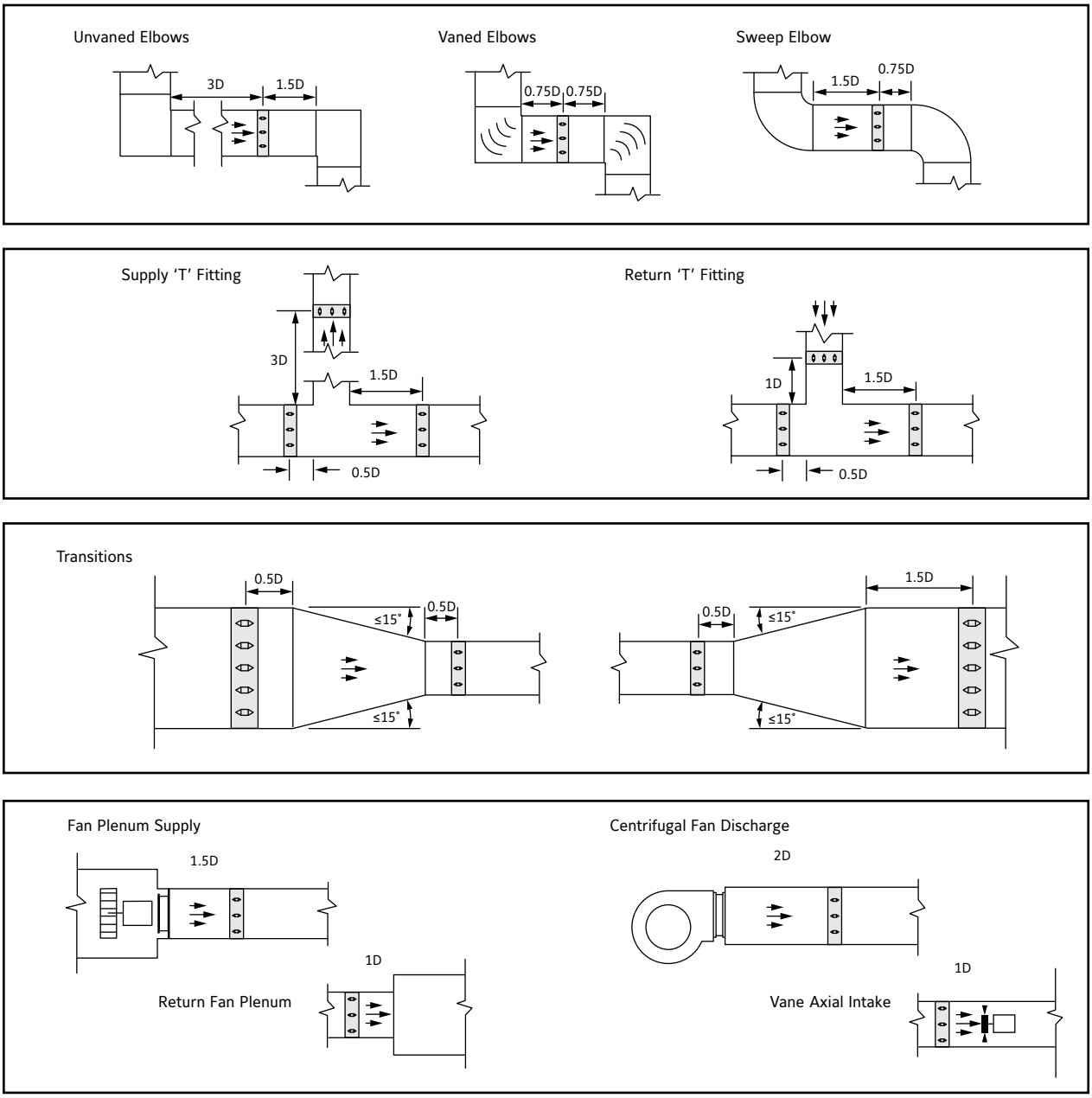


Figure 11b: Minimum Mounting Distances

Installing the Thermal Dispersion Probes with Insertion Mounting

1. Inspect the duct work, opening, or both to ensure no obstructions or irregularities interfere with installation of the probes. See Figure 12, Figure 13, and Figure 14 for the appropriate probe mounting location, showing insertion and standoff mounting options.

NOTE: Ensure that adequate clearance exists at the installation site to permit installation and removal of the probes.

2. Determine where to mount the probes and mark the hole locations on the outside of the duct or the plenum.
   a. Mark a 2 1/4 in. (57 mm) hole (round or square) for each probe insertion.
   b. Mark a 2-2 1/4 in. (50-57 mm) hole on the opposite side of the duct or plenum from the insertion hole.
   c. Double-check the hole locations before proceeding to the next step.
3. On the side of the duct where the box will be located, drill 2 1/4 in. (57 mm) holes at the correct heights to equally distribute the probes in the duct. Drill a 2-2 1/4 in. (50-57 mm) hole directly across from the 2 1/4 in. (57 mm) hole on the opposite side of the duct.
4. Remove the mounting plates on the mounting stud end of the probe. Keep the nuts and washers for next step.
5. Holding the box end of the probe, insert the mounting stud end of each probe into the 2 1/4 in. (57 mm) holes until the probe mounting stud extends through the 2-2 1/4 in. (50-57 mm) holes in the opposite side of the duct.
6. With the probes in place, go to the other side of the duct or plenum and install the mounting plates onto the studs. With the stud centered in the 2-2 1/4 in. (50-57 mm) hole, place the mounting plate over the stud, followed by the nut and washer. Tighten the nut and washer against the mounting plate. Do not over tighten.

NOTE: Do not place screws in the four corner holes of the mounting plates in this step.

7. Verify the stud is located in the center of the 2-2 1/4 in. (50-57 mm) hole and secure the mounting plate with four self-drilling screws. Repeat this step for each probe in the duct or plenum.

IMPORTANT: When the probes are exposed to the outdoor environment, you must use the National Electrical Manufacturers' Association (NEMA) Type 4 option. Use appropriate moisture resistant conduit and connections. Secure the NEMA 4 cover closed with the three screws provided, torqued to 8 in lb (*/- 1 in lb).

8. Moving back to the opposite side of the duct or plenum, measure from the top or bottom as in the previous step to center the probe on the correct dimension. The center of the probe should be the same distance from the top of the duct or plenum as the center of the mounting stud on the opposite side (within 1/2 in. [12 mm]). Once the probe has been positioned, secure the electrical box enclosure with four self-drilling screws.

IMPORTANT: Install the probes with the mounting plates square and without twisting or bending.

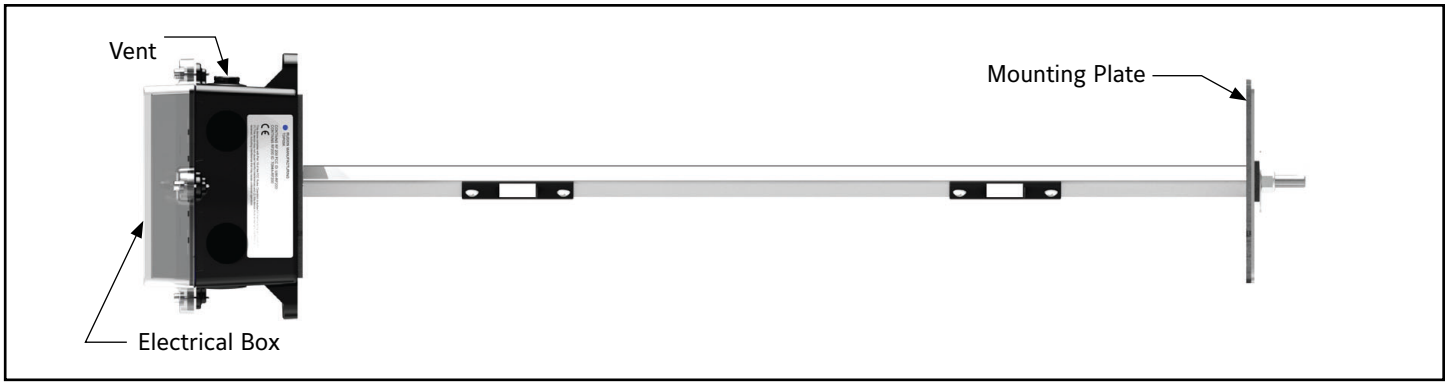


Figure 12: Advanced Thermal Dispersion Probe (Insertion Mount, Side View)

Installing the Thermal Dispersion Probes with Internal Mounting

1. Inspect the duct work, opening, or both to ensure no obstructions or irregularities interfere with installation of the probes. See Figure 12, Figure 13a, and Figure 13b for the appropriate probe mounting location, showing insertion, internal and standoff mounting options.

NOTE: Ensure that adequate clearance exists at the installation site to permit installation and removal of the probes.

2. Determine where to mount the probes and mark the locations on the inside of the duct or the plenum.
   a. Mark 2 holes for each probe control box standoff mounting bracket.
   b. Mark 2 holes for the internal mount rear bracket on the opposite side of the duct.
   c. Ensure probes will be level by double-checking the hole locations before proceeding to the next step.
3. Mount the probes on the inside of the duct with sheet metal screws or other suitable fasteners.
4. Drill a hole for the cable(s) to pass from the inside to the outside of the duct, and install a rubber grommet in the hole to protect the cable.
5. Route the shielded combination cable from each probe through the grommet to the Remote Wired Primary. If more than one probe is installed, a junction box may be used to connect the cable wires (with wire nuts) in parallel, then a single cable can be used to connect to the wired primary. Primary can be mounted up to 500 feet away. (Wire provided by installing contractor)
6. Terminate 4 wires from each probe in Junction box with wire nuts and extend probe network communication with twisted shielded pair, extend power with 18AWG or larger. Terminate in Remote Mounted Primary enclosure per installation instructions.
7. Recommended wire is Connect Air part number W24182P2306BL.

IMPORTANT: Install the probes with the mounting plates square and without twisting or bending.

See the primary probe wiring section to complete wiring.

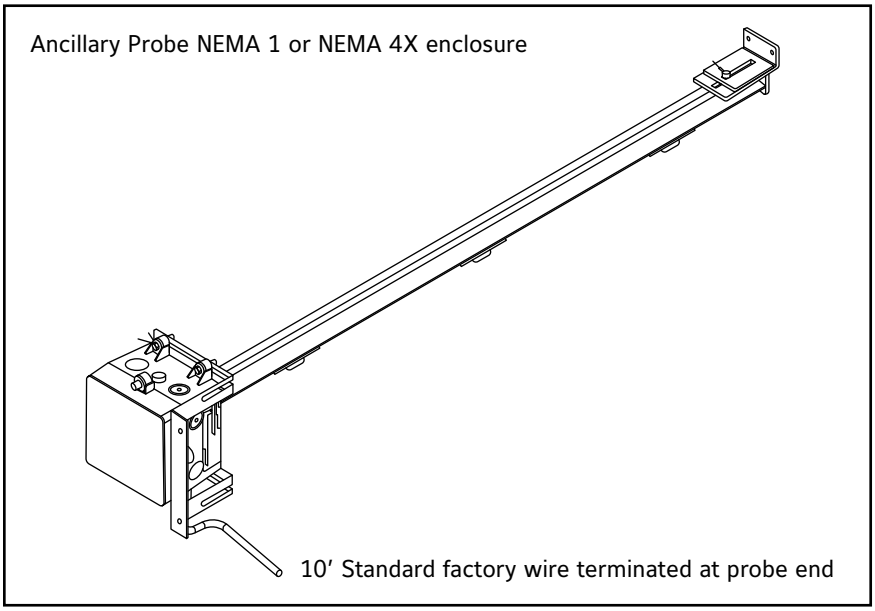


Figure 13a: Internal Mount

For NEMA4 rating, ensure Lid Screws (3) are torqued to 8 in-lbs (+/- 1 in-lb).

Figure 13b: Probe with Damper Stand-off Mounting Bracket

Wiring

Cable Specifications

For ease of installation, use 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 provided blue interconnection wires. In an exposed or conduit installation, the wiring minimum bend radius is 1.5 in. (38 mm).

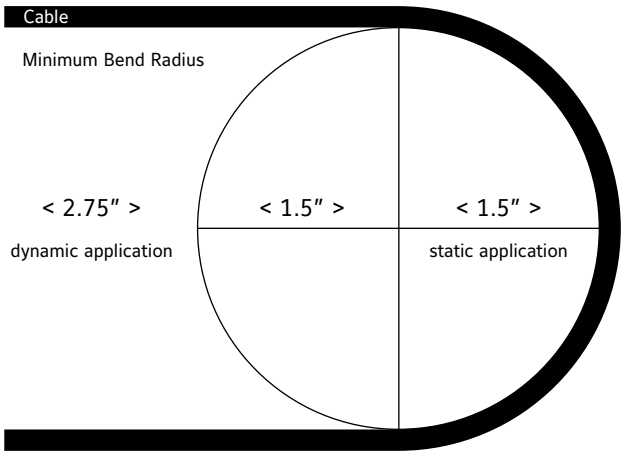


Figure 14a: Minimum Ben Radius

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, contractors, 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 and broadcast antennas.

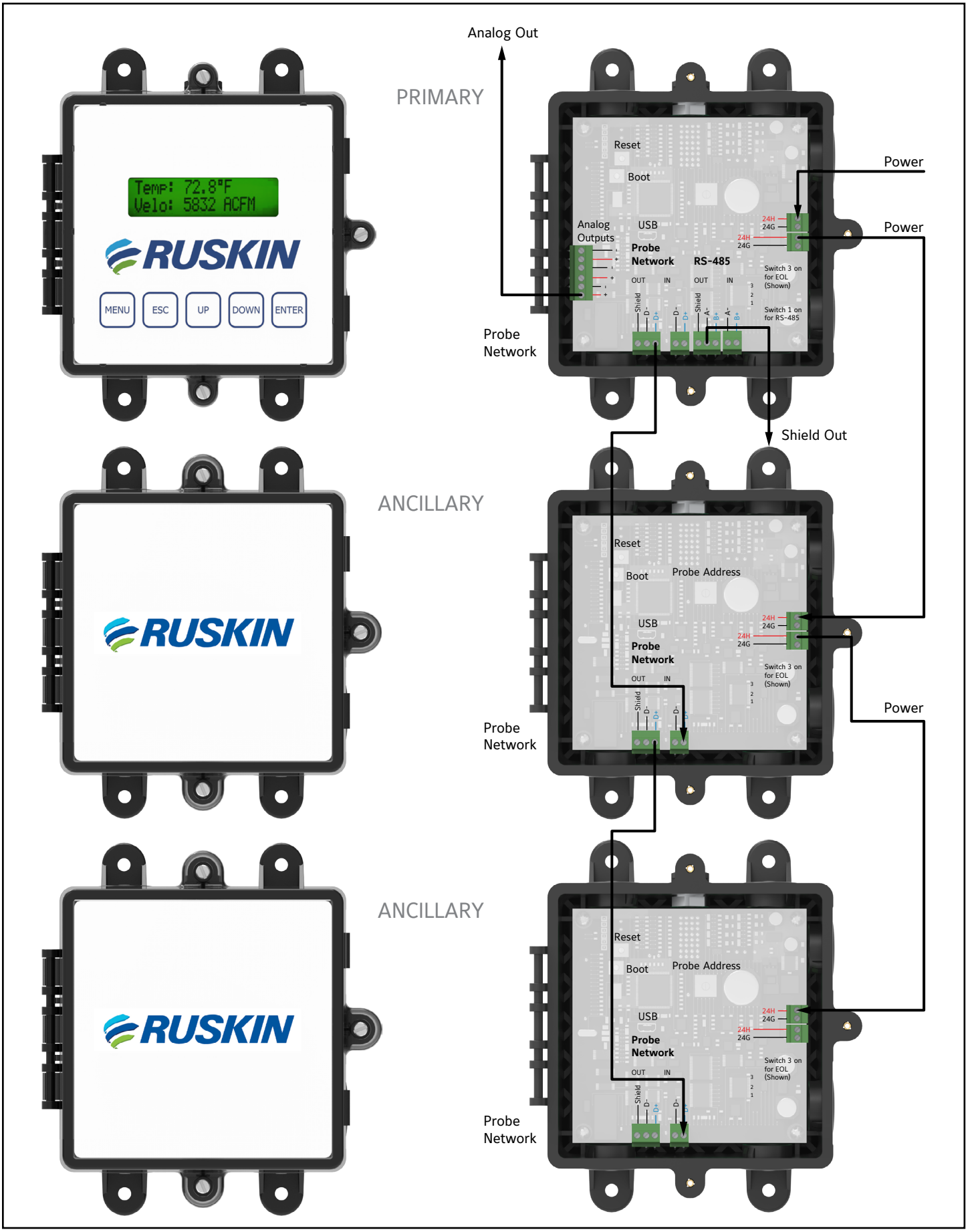
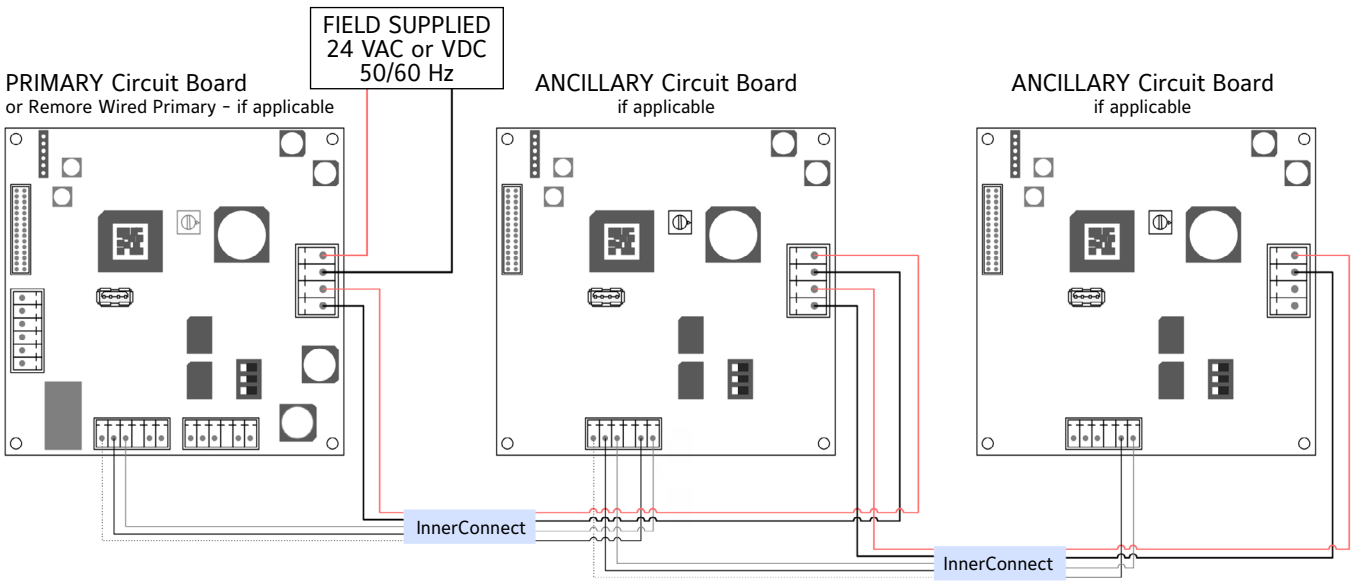


Figure 14b Sample Wiring Configuration



InnerConnect Cabling (Connect-Air part number W24182P-2306BL), provided by Ruskin when Client Monitor(s) are present.
NOTE:Cabling provides both communications (24 AWG) and power (18 AWG) in one cable.

Figure 14c

Primary Probe and Remote Wired Primary

IMPORTANT: The primary provides two 4 to 20 mA signals to building automation systems. Do not apply loop power to this probe. 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.

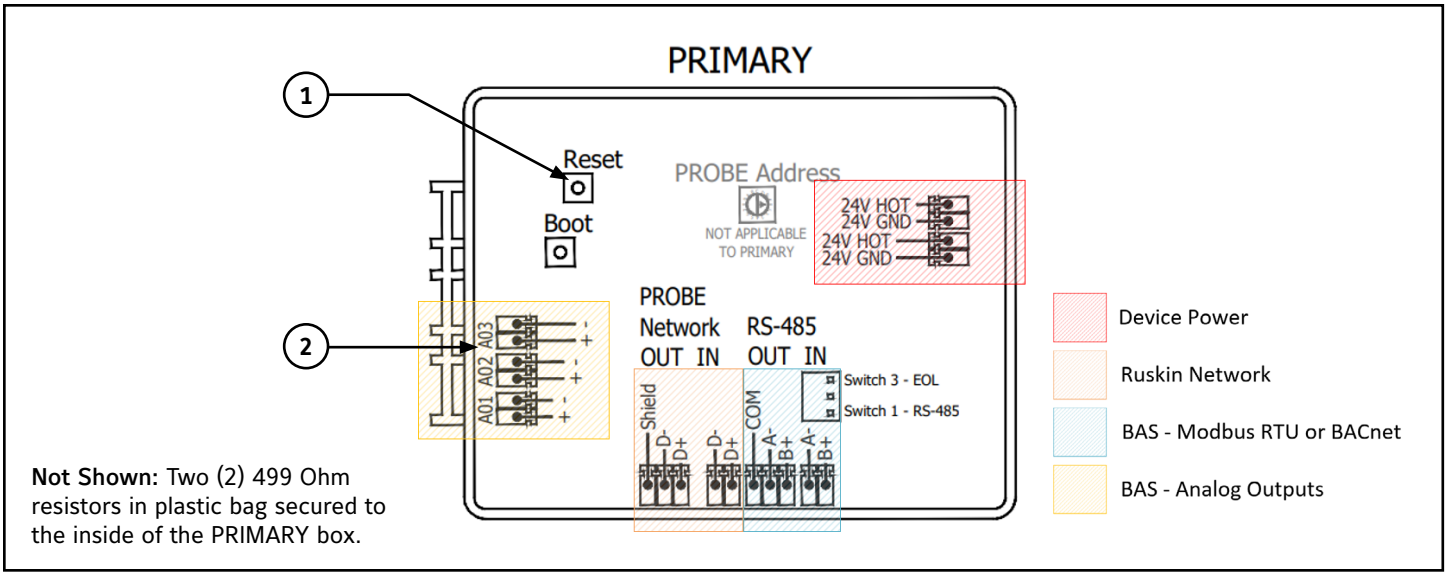


Figure 15: Primary Probe Wiring

Table 5: Primary Probe Features

Call-out	Feature	Description
1	Reset	Cycles 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.

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 controller board.
2. Connect the 4 to 20 mA analog flow output (A01: Pos and Com) and the 4 to 20 mA analog output factory default temperature (A02: temperature output) from the primary to a 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 primary to the ancillary probe or remote display 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 controller board.
2. Connect the RS-485 output (A- and B+) from the primary 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.

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

3. Connect the shield wire from the primary 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 24 VAC from power source to the Primary, and daisy chain the power, from probe to probe.
3. Connect the 24 VAC hot wire to the primary probe terminal labeled 24H.
4. Connect the 24 VAC common wire to the primary probe terminal labeled 24G.

NOTE: The two 24H connections are electrically identical, and the two 24G connections are also electrically identical.

Ancillary Probe Wiring

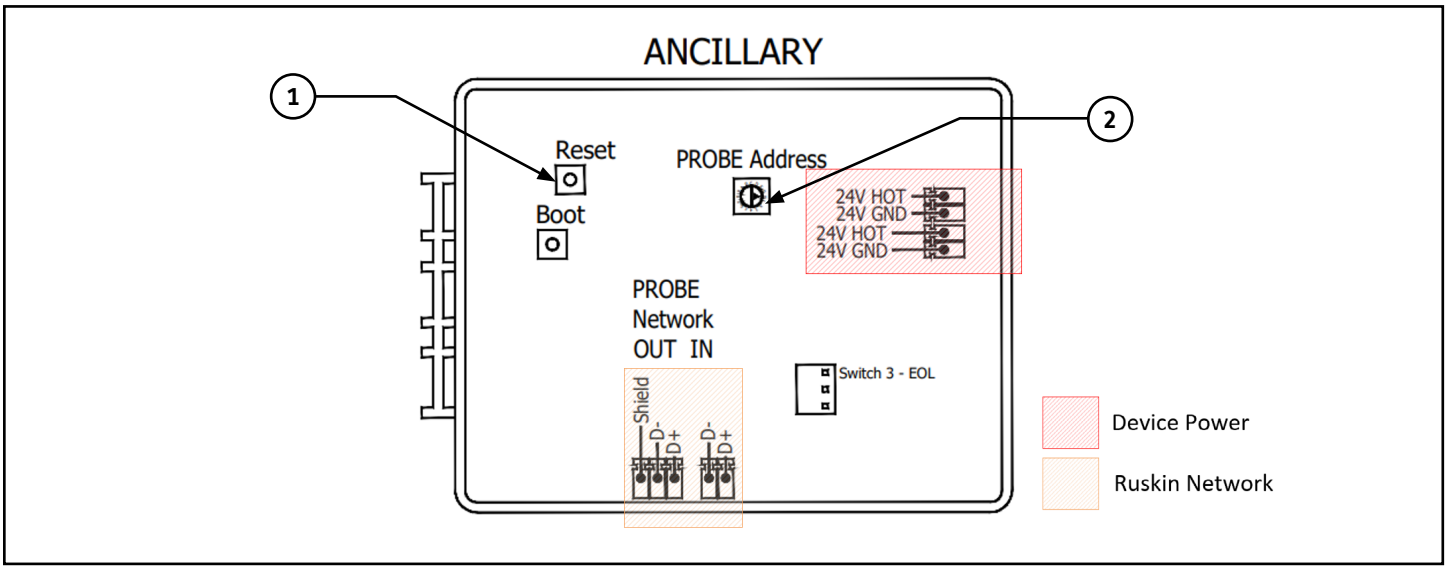


Figure 16: Ancillary Probe Wiring

Table 6: Ancillary Probe Features

Call-out	Feature	Description
1	Reset	Cycles power to the device without unplugging it.
2	Probe Address Rotary Switch	Sets the address for each probe on probe network. The rotary switch is set at factory for each system. Note: Duplicate addresses are not allowed on probe network. Primary and Remote Display do 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 primary to the probe network terminals on the ancillary probe(s).
   a. The shield only connects on one end.
   b. Connect the 24 AWG black wire from the primary probe terminal labeled Network D- to the ancillary probe terminal labeled Probe Network D-.
   c. Connect the 24 AWG white wire from the primary probe terminal labeled Network D+ to the ancillary probe terminal labeled Probe Network D+.
3. Connect additional probes in a daisy-chain series.

NOTE: The last probe in each air measurement station can have the end of line (EOL) switch set for the probe network (switch 3 [see Figure 15]). If primary is connected to an RS-485 network interface and the Advanced Thermal Dispersion Airflow Measuring System is the end of line in the RS-485 network, set the EOL switch to 1 ON (shown in the off position in Figure 16).

Power

NOTE: Each ancillary probe requires power and can be powered from the same source as the primary probe. 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 ancillary probes or the remote display.

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 18 AWG copper red wire from the primary probe terminal labeled 24H to the ancillary probe terminal labeled 24H. Observe the polarity to avoid a direct short.
3. Connect the 18 AWG copper black wire from the primary probe terminal labeled 24G to the ancillary probe terminal labeled 24G.

Remote Display Wiring

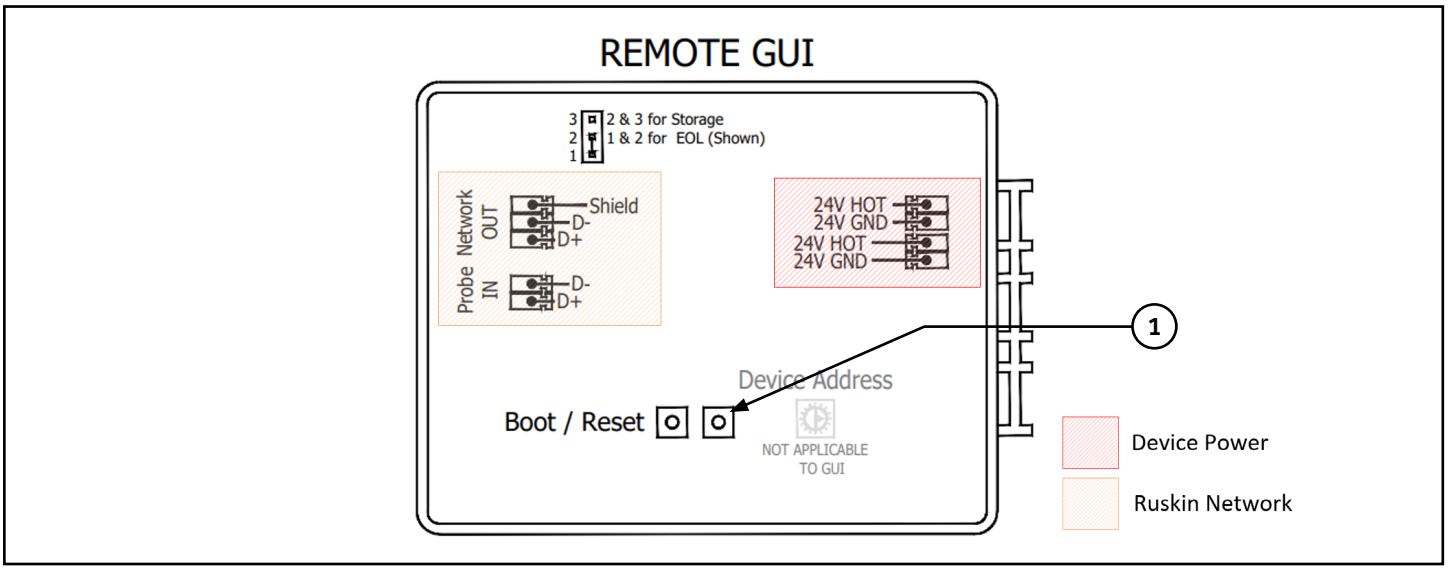


Figure 17: Remote Display Wiring

Table 7: Remote Display Features

Call-out	Feature	Description
1	Reset	Cycles power to the device without unplugging it

Network

NOTE: When the wireless option is used for communication between the primary probe and the remote display, no network connection is required.

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 out terminal from the primary probe to the probe network in terminal on the remote display.
   a. The shield only connects on one end.
   b. Connect the 24 AWG black wire from the primary probe terminal labeled Probe Network D- to the remote display terminal labeled Probe Network D-.
   c. Connect the 24 AWG white wire from the primary probe terminal labeled Network D+ to the remote display terminal labeled Probe Network D+.
   d. If the remote display in each TDP05K Airflow Measuring System is the end of line on the probe network, install a jumper across EOL pins 1 and 2. If the remote display is not the end of the line in the probe network, retain the jumper on pins 2 and 3 for storage.

Power

NOTE: The remote display can be powered from any 24 VAC source and does not need to be physically wired to the primary if the wireless option is selected. However, when wired to the probe network, it is typically more convenient to use the recommended wire and to power from the last ancillary probe or the primary, depending on the available connections.

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 18 AWG copper red wire from the primary or ancillary probe terminal labeled 24H to the remote display terminal labeled 24H. Observe the polarity when providing power to multiple probes connected to the same source to avoid a direct short. The remote display can be connected to any 24 VAC source when using the wireless options and no physical connection to the primary or probe network is required.
3. When power is supplied from the primary or an ancillary probe on the probe network, connect the 18 AWG copper black wire from the primary terminal labeled 24G to the remote display terminal labeled 24G.

NOTE: The two 24H connections are electrically identical, and the two 24G connections are also electrically identical.

Completing the Wiring

When the primary and ancillary probes, remote display and network wiring are complete, apply power to the system. The version number is displayed followed by the number of probes found and total sensors. Confirm this information is correct for the air measurement system installed. If it is incorrect, check all probe network wiring and ancillary probe address dial settings.

Confirm that no two ancillary probes are set for the same address. Each probe address must be unique on the probe network to work correctly. The primary probe and remote display are hard-coded addresses and do not need to be changed or addressed. Confirm the connections are made to the probe network and are not to the BACnet or analog output connections on the primary. After the device warms up, the temperature and flow readings display.

Refer to the TDP05K Advanced Thermal Dispersion Probe Air Flow Measuring System Technical Bulletin http://www.ruskin.com/catalog/serve file/id/6767 for detailed configuration instructions.

Menu Structure

Refer to the TDP05K Advanced Thermal Dispersion Probe Airflow Measuring System Technical Bulletin (LIT-12012477) for detailed configuration instructions.

Main Display (Normal Operation)

Line 1 displays the average temperature and line 2 displays the average velocity or volume.

Menu Button Selections

- Operator Menu
- Supervisor Menu

Operator Menu

The Operator Menu allows the user to view and change system parameters and variables.

Table 8: Operator Menu Options (Continued)

Operator Menu Submenus (Actual Display Name)	Submenu Function	Submenu Selections
Enable Operator PIN (Enable Oper PIN)	Enables PIN protection for the Operator Menu	N/A
Change Operator PIN (Change Oper PIN)	Allows the user to update the PIN	N/A
Flow Configuration (Flow Config)	Allows system variable configuration	Duct Shape Duct Width Duct Height Duct Diameter Duct Area Site Elevation Relative Humidity Flow Units Output Lockout
Display Configuration (Display Config)	Select parameters for displayed data	Display Filter Display Units Display Flow Type Line 2 Parameters Line 2 Custom
Analog Output 1 Parameters (Output 1 Param)	Select Analog Output 1 parameters (flow, temperature, or none)	Analog Output 1 Parameters
Analog Output 2 Parameters (Output 2 Param)	Select Analog Output 2 parameters (flow, temperature, or none)	Analog Output 2 Parameters
Temperature Low Pass Filter (Temp LPF)	Selects amount of filtering applied to the analog output for temperature	Temperature Low Pass Filter
Flow Low Pass Filter (Flow LPF)	Selects amount of filtering applied to the analog output for flow	Flow Low Pass Filter
Analog Output Calibration (Output Cal Menu)	Spans the analog outputs for temperature and flow. Use the positive or negative offset if 4 mA output is not as expected.	Output 1 mA Offset Output 1 mA Low Span Output 1 mA High Span Output 2 mA Offset Output 2 mA Low Span Output 2 mA High Span Design Range Low Design Range High Temperature Range Low Temperature Range High
	Firmware Version 1.3.4 and later	Test Output Channel 1 Test Output Channel 2
Temperature Balance Menu (Temp Bal Config)	Selects an offset for the reported average temperature	Temperature Balance Enable Temperature Offset

Table 8: Operator Menu Options

Operator Menu Submenus (Actual Display Name)	Submenu Function	Submenu Selections
K-Factor Configuration (K Factor Config)	Turns K-Factor on and off and allows configuration	K-Factor Enable? Calculate K-Factor? K-Factor Gain[1] K-Factor Offset[1] Number of Data Points[2] System at Point 1[2] Point 1 Velocity[2] System at Point 2[2] Point 2 Velocity[2] System at Point 3[2] Point 3 Velocity[2] Calculate K-Factor
Menu Inactivity Timeout (Menu Timeout)	Selects a time the device returns to normal operation and front panel backlight when no menu activity is detected	Menu Timeout
Network Configuration	Selects RS-485 network type (BACnet or Modbus) and allows configuration	BACnet: BACnet On/Off BACnet Instance BACnet Address BACnet Max Master BACnet Baud Rate Modbus: Modbus On/Off Modbus Address Modbus Baud Rate Modbus Parity Float Order String Order
Alarm Configuration Menu (Flow Alarm Configuration)	Turns high and low flow alarms on and off, allows alarm configuration	Alarm Low On/Off Alarm High On/Off Alarm Low Setpoint Alarm High Setpoint Alarm Deadband Alarm Delay
Alarm Configuration Menu (Temperature Alarm Configuration)	Turns high and low temperature alarms on and off, allows alarm configuration	Alarm Low On/Off Alarm High On/Off Alarm Low Setpoint Alarm High Setpoint Alarm Deadband Alarm Delay

1. This submenu selection only appears when Calculate K-Factor is set to No.
2. This submenu selection only appears when Calculate K-Factor is set to Yes.

Supervisor Menu

The Supervisor Menu allows the user to enable or disable probes and/or individual sensors, scans all sensors for status updates, and performs diagnostics on alert conditions.

Table 9: Supervisor Menu Options

Supervisor Menu Submenus (Actual Display Name)	Submenu Function	Submenu Selections
Enable Supervisor PIN (Enable Supv PIN)	Enables PIN protection for the Supervisor Menu	N/A
Change Supervisor PIN (Change Supv PIN)	Allows the user to update the PIN	N/A
Sensor Management (Sensor Mgmt)	Allows the user to scan the probe network to detect the installed probes and sensors. Allows for enabling and disabling the diagnostic status condition of the sensors	Display Active Sensor Scan for Sensor Display Sensor Status Scan for Sensor Enable Sensors Disable Sensors Display Probe Status Display Probe Data
Reset Sensors (Reset Sensors)	Select parameters for displayed data	Reset Sensors
Factory Default (Factory Default)	Restores the device to the factory default settings	Factory Default

Table 10: BACnet Device Instance Numbers

Name	Description	Type	Inst	Access	Units	Def	Details
Airflow	Current Airflow Rate	AV	2	R	CFM		Units CFM can be Configured velocity, IP or Metric
Temperature	Average Temperature	AV	1	R	F		Units degrees F or Degrees C
Low Flow Alarm	Alarm Lo						Device intrinsic alarming via AV2 'property' tag updates.
High Flow Alarm	Alarm Hi						Device intrinsic alarming via AV2 'property' tag updates.
Low Temperature Alarm	Alarm Lo						Device intrinsic alarming via AV1 'property' tag updates.
High Temperature Alarm	Alarm Hi						Device intrinsic alarming via AV1 'property' tag updates.

Table 11: 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	Description	Range
SYSTEM CONFIGURATION						
Holding Registers						
40001	3	3, 6, 16	string	Map Access Key	Write Parameter Access Key	Key = Unique Primary Device Access Key
40004	9	3, 6, 16	string	Device Name	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	Systems of Measurements	0 = SI, 1 = Imperial (Default)
40014	1	3, 6, 16	uint16	Volumetric Flow Type	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	Airflow Measurement Type	0 = Velocity (TDP05K Default), 1 = Volume
40016	2	3, 6, 16	float	K-Factor - Gain	Flow Multiplier	0.25 to 2.0 (1; Default)

Table 11: Modbus RTU Register Map (Continued)

Register	Register Count	Function	Type	Name	Description	Range
SYSTEM CONFIGURATION						
Holding Registers						
40018	2	3, 6, 16	float	K-Factor - Offset	Flow Offset	-750 to 750 FPM (0 FPM; Default);
40020	2	3, 6, 16	float	Elevation	Site Elevation above Sea Level in Ft.	0 to 15,000 ft (0 ft; Default)
40022	1	3, 6, 16	uint16	Relative Humidity	RH Percentage in %	0 to 100% (50% ; Default)
40023	2	3, 6, 16	float	Low Flow Alarm	Low Flow Alarm - Setpoint	0 to 5,000 FPM (5,000 ft/min; Default); TDP05K
40025	2	3, 6, 16	float	High Flow Alarm	High Flow Alarm - Setpoint	0 to 5,000 FPM (5,000 ft/min; Default); TDP05K
40027	2	3, 6, 16	float	Alarm Deadband - Flow	Alarm Deadband - Flow	0 to 984 FPM (0 ft/min; Default)
40029	2	3, 6, 16	float	Alarm Delay - Flow	Alarm Delay - Flow	0 to 10 Minutes (0 min; Default)
40031	2	3, 6, 16	float	Low Temp Alarm	Low Temperature Alarm - Setpoint	-29.2°F to 129.2°F (-20.2°F; Default)
40033	2	3, 6, 16	float	High Temp Alarm	High Temperature Alarm - Setpoint	-29.2°F to 129.2°F (120.2°F; Default)
40035	2	3, 6, 16	float	Alarm Deadband - Temp	Alarm Deadband - Temp	0 to 9°F (0°F; Default)
40037	2	3, 6, 16	float	Alarm Delay - Temp	Alarm Delay - Temp	0 to 10 Minutes (0 ft/min; Default)
40039	2	3, 6, 16	float	Duct Area - Sqft	Duct area size in ft^2 or m^2	0 to 100 ft^2 (0.44 ft^2; Default) or 0 to 9.3 m^2 - Writing will set duct type to 'Other' - Reading will read current calculated value if not set to 'Other'
Coil						
00001	1	1, 5	bool	System Reset	Device Reset	1 = RESET
00002	1	1, 5	bool	K-Factor	K-Factor Enable	1 = ON, 0 = OFF (Default)
00003	1	1, 5	bool	Low Flow Alarm - On/ Off	Low Flow Alarm - Enable	1 = ON, 0 = OFF (Default)
00004	1	1, 5	bool	High Flow Alarm - On/ Off	High Flow Alarm - Enable	1 = ON, 0 = OFF (Default)
00005	1	1, 5	bool	Low Temp Alarm - On/ Off	Low Temp Alarm - Enable	1 = ON, 0 = OFF (Default)
00006	1	1, 5	bool	High Temp Alarm - On/ Off	High Temp Alarm - Enable	1 = ON, 0 = OFF (Default)
00007	1	1, 5	bool	Float Word Order	Swap Between Big and Little Endian Word Order for Floats	1 = Big Endian, 0 = Little Endian (Default)
00008	1	1, 5	bool	String Order	Sets the string byte ordering used in read and write processing	1 = Swapped, 0 = Normal (Default)
System Status						
30001	1	4	uint16	Device Type	Device Model Number	0 = TDP05K, 1 = AD-1272, 2 = KAMP5K, 5 =Other
30002	1	4	uint16	Airflow Type	Airflow Type	0 = Actual, 1 = Standard
30004	1	4	uint16	Temperature Unit	Temperature Unit	0 = °F, 1 = °C
30005	1	4	uint16	System Node Count	Total node count on the Ruskin network	1 - 17 Devices Connected (Primary) | Probes (TDP05K)
30007	1	4	uint16	Device Version	Primary - PCB Firmware (TDP05K)	MSB = Major, LSB = Minor
30008	1	4	uint16	Device Version-2	Primary - PCB Build (TDP05K)	MSB = Patch, LSB = Build number

Table 11: Modbus RTU Register Map (Continued)

Register	Register Count	Function	Type	Name	Description	Range
SYSTEM CONFIGURATION						
System Status						
30009	1	4	uint16	Protocol Version	Primary - Modbus RTU Firmware (TDP05K)	MSB = Major, LSB = Minor
30010	1	4	uint16	Protocol Version-2	Primary - Modbus RTU Build (TDP05K)	MSB = Patch, LSB = Build number
30028	1	4	uint16	Bad Data HR Address	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	Current System Status	0 = NORMAL, 1 = ALARM, 2 = FAULT, 3 = ALARM & FAULT
30030	1	4	uint16	Flow Alarm	Flow is Less or Greater than the Flow Limits	0 = NORMAL, 1 = HIGH ALARM, 2 = LOW ALARM
30031	1	4	uint16	Temp Alarm	Temperature is Less or Greater than the Temperature Limits	0 = NORMAL, 1 = HIGH ALARM, 2 = LOW ALARM
30032	2	4	float	Airflow	Average Airflow Velocity or Volume in SI or Imperial Units	0 to 5,000 FPM (TDP05K)
30034	2	4	float	Temperature	Average Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
RUSKIN NETWORK DEVICE						
Devices - Serial Numbers						
30101	16	4	string	Primary Serial #	Primary Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30117	16	4	string	Device 1 Serial Number	Device 1 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30133	16	4	string	Device 2 Serial Number	Device 2 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30149	16	4	string	Device 3 Serial Number	Device 3 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30165	16	4	string	Device 4 Serial Number	Device 4 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30181	16	4	string	Device 5 Serial Number	Device 5 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30197	16	4	string	Device 6 Serial Number	Device 6 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30213	16	4	string	Device 7 Serial Number	Device 7 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30229	16	4	string	Device 8 Serial Number	Device 8 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30245	16	4	string	Device 9 Serial Number	Device 9 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30261	16	4	string	Device 10 Serial Number	Device 10 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30277	16	4	string	Device 11 Serial Number	Device 11 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30293	16	4	string	Device 12 Serial Number	Device 12 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30309	16	4	string	Device 13 Serial Number	Device 13 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30325	16	4	string	Device 14 Serial Number	Device 14 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30341	16	4	string	Device 15 Serial Number	Device 15 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
30357	16	4	string	Device 16 Serial Number	Device 16 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte

Table 11: Modbus RTU Register Map (Continued)

Register	Register Count	Function	Type	Name	Description	Range
RUSKIN NETWORK DEVICE						
Devices - Airflow						
30373	2	4	float	Primary Airflow	Primary Device Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30375	2	4	float	Device 1 Airflow	Device 1 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30377	2	4	float	Device 2 Airflow	Device 2 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30379	2	4	float	Device 3 Airflow	Device 3 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30381	2	4	float	Device 4 Airflow	Device 4 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30383	2	4	float	Device 5 Airflow	Device 5 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30385	2	4	float	Device 6 Airflow	Device 6 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30387	2	4	float	Device 7 Airflow	Device 7 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30389	2	4	float	Device 8 Airflow	Device 8 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30391	2	4	float	Device 9 Airflow	Device 9 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30393	2	4	float	Device 10 Airflow	Device 10 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30395	2	4	float	Device 11 Airflow	Device 11 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30397	2	4	float	Device 12 Airflow	Device 12 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30399	2	4	float	Device 13 Airflow	Device 13 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30401	2	4	float	Device 14 Airflow	Device 14 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30403	2	4	float	Device 15 Airflow	Device 15 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
30405	2	4	float	Device 16 Airflow	Device 16 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM
Devices - Temperature						
30407	2	4	float	Primary Temperature	Primary Device Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30409	2	4	float	Device 1 Temperature	Device 1 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30411	2	4	float	Device 2 Temperature	Device 2 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30413	2	4	float	Device 3 Temperature	Device 3 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30415	2	4	float	Device 4 Temperature	Device 4 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30417	2	4	float	Device 5 Temperature	Device 5 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30419	2	4	float	Device 6 Temperature	Device 6 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30421	2	4	float	Device 7 Temperature	Device 7 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30423	2	4	float	Device 8 Temperature	Device 8 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30425	2	4	float	Device 9 Temperature	Device 9 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30427	2	4	float	Device 10 Temperature	Device 10 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30429	2	4	float	Device 11 Temperature	Device 11 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)

Table 11: Modbus RTU Register Map (Continued)

Register	Register Count	Function	Type	Name	Description	Range
RUSKIN NETWORK DEVICE						
Devices - Temperature						
30431	2	4	float	Device 12 Temperature	Device 12 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30433	2	4	float	Device 13 Temperature	Device 13 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30435	2	4	float	Device 14 Temperature	Device 14 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30437	2	4	float	Device 15 Temperature	Device 15 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30439	2	4	float	Device 16 Temperature	Device 16 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)

Table 12: 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 13: 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 14: 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 15: TDP05K System Troubleshooting

Problem	Possible Cause	Corrective Action
Airflow readings to not match what T&B is reporting	Turbulent air or air flowing in two directions through the plane of the air measurement station	Use Automatic k-factor configuration and use 1-point calibration if only gain is required. If flow is non-linear, use two or three-point calibration feature. Install additional probes to provide more sensing points.
No Display	No Power	Verify 24VAC power at power terminal. Make sure the ribbon cable is fully seated in the board's socket. Visually check to make sure membrane is plugged in to display board in lid.
Number of PROBES shown when power is applied is incorrect.	Probe network NOT wired correctly or plug is plugged into the wrong port. Two Ancillary Probes may have the same addresses; look at rotary dial on ancillary probes.	Pin OUT is shield, minus, plus, shield, minus, plus. Look at drawings and make sure left and right are not swapped. AO, Probe Network, and BACnet ports on the primary will all fit each other's plugs. Make sure connections are made to the correct point on the board.
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. Look 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 12 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 14 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 {modbus supplement manual?} for instructions to enable writing mode
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 12) for the acceptable writable registers ranges. Register 30028 can be read to determine what Holding Register address was last written to with an out of range value. - OR - Refer to {modbus supplement manual?} for instructions regarding write mode and how to initiate a save

Repair Information

If the Advanced Thermal Dispersion Probe Airflow Measuring System fails to operate within product specifications, contact the nearest Ruskin representative

Maintenance

Twice a year, scroll through the velocity and temperature values. Inspect the thermal dispersion probes and clean the sensor nodes if the readings vary from normal readings.

Annually inspect the thermal dispersion sensors installed in unfiltered outside air, return air, or exhaust air applications to ensure that the thermal dispersion sensors are free of excessive buildup of lint, dust, or other airborne particulates.

IMPORTANT: When installed in unfiltered air applications, 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 manufacturer's cleaning guidelines could result in equipment failure, not covered under the manufacturer's warranty.

Only remove the probes if inspection is not possible any other way. It may be possible to clean the sensors as installed through other access.

Follow these steps if direct inspection via other means is not possible and the probes must be removed:

1. Before cleaning the sensors, make sure the power to the Advanced Thermal Dispersion Airflow Measuring System is turned off or disconnected.
2. Remove the mounting screws from the mounting plates on both sides of the thermal dispersion probe.
3. Remove the lock nut and the washer from the mounting stud.
4. Slide the probe out of the duct from the side with the box.
5. Wipe down the probe with a damp cloth. Ensure that the sensor is on the bottom side of the probe during cleaning so any moisture encountered in the cleaning process will drain out of the probe and sensor.
6. Using a Cotton Swabs to clean the sensors within the flow hood.
   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. Remain aware and show caution to avoid damage when working near the sensor locations.
7. Gently press the cotton swab over the sensor surface area when removing debris or contaminates.
   IM**PORTANT**: Twisting or applying excessive force could result in damage to the sensors protective coating.
8. Using a new cotton swab (not the same swab from step #6), 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.
9. Replace the probe assembly in the duct by reversing Steps 1 through 4.
10. Let the Isopropyl Alcohol (IPA) fully evaporate before applying power.

DETAILED CLEANING INSTRUCTIONS: https://www.ruskin.com/doc/Id/10195

Replacement Parts

See Table 16 for TDP05K Advanced Thermal Dispersion Probe Airflow Measuring System replacement part information.

Table 16: Advanced Thermal Dispersion Replacement Parts

Description
Remote Display (Graphic User Interface)
Wireless cards for the remote display and primary
One set of Type 4 plugs for knockouts (6 per set)
Cord grip and locking nut
One set of Type 4 nylon dust plugs for knockouts (6 per set)
Replacement captive screw assembly
Replacement flat ribbon cable for Primary (connects main board to display)

Technical Specifications

TDP05K Thermal Dispersion Probe Airflow Measuring System

Probe Material	2 x 3 4 in. (51 x 19 mm) 0 3 high-yield extruded aluminum with acid-etch clear anodized finish
Thermistor	Thermistor pair in polyimide flex membrane sensor
Size Range	8 x 8 in. to 120 x 120 in. (20 x 20 cm to 305 x 305 cm)
Mounting Brackets	16 Ga. stainless steel
Sensor Accuracy	Airflow: ±2% of reading and ±0.25% repeatability
Repeatability	±0.25%
Measurement Units	Inch-Pound (I.P.) or International System (S.I.)
Sensor Distribution	Equal area, Log-Tchebycheff or EK Log for round duct applications
Calibrated Range	0 to 5,000 FPM (0 to 1,523 MPM)
Temperature Sensor Accuracy	±0.10°F (0.0 °C)
Sensor Temperature Range	-20 to 120°F (-29 to 49°C)
Transmitter Temperature Range	-20 to 120°F (-29 to 49°C)
Humidity Range	0 to 99% RH, non condensing
Maximum Number Sensors	128
Power Requirement	24 VAC (+/- 15%); 15 VA Minimum
Power Consumption	<10 VA for 2 probes with 8 sensors per probe and LCD display on primary probe.
Output Signals	4 to 20 mA standard, 2 to 10 VDC requires 499 ohm resistor across output terminals.
Output Signal Adjustments	Field adjustable offset and span
Primary Display	1 x2 character LCD (airflow, temperature, setup, and diagnostics)
Velocity Requirements	Minimum: 0 FPM (0 MPM) Maximum: 5,000 FPM (1,523 MPM)
Pressure Drop	Four 48 in. (122 cm) long probes in 48 x 48 in. duct: < 0.1 w.g. @ 1000 FPM
Approximate Shipping Weight	12 lb (5.4 kg) for TDP05K Airflow Measuring System with two probes

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	Coil	Read-write	1 bit	00001 – 09999
2	Discrete input	Read-only	1 bit	10001 – 19999
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	Reg. Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Holding Registers							
40001	3	3, 6, 16	string	Map Access Key	ALL	Write Parameter Access Key	Key = Unique Primary/Host Device Access Key
40004	9	3, 6, 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 (TDP05K Default), 1 = Volume (TDFi-Rt Default)
40016	2	3, 6, 16	float	K-Factor - Gain	Probes	Flow Multiplier	0.25 to 2.0 (1; Default)
40018	2	3, 6, 16	float	K-Factor - Offset	Probes	Flow Offset	-750 to 750 FPM (0 FPM; Default);
40020	2	3, 6, 16	float	Elevation	ALL	Site Elevation above Sea Level in Ft	0 to 15,000 ft (0 ft; Default)
40022	2	3, 6, 16	uint16	Relative Humidity	ALL	RH Percentage in %	0 to 100% (50%; Default)
40024	2	3, 6, 16	float	Low Flow Alarm	ALL	Low Flow Alarm - Setpoint	0 to 5,000 FPM (5,000 ft/min; Default); TDP05K 0 to 10,000 FPM (10,000 ft/min; Default); TDFi-RT
40026	2	3, 6, 16	float	High Flow Alarm	ALL	High Flow Alarm - Setpoint	0 to 5,000 FPM (5,000 ft/min; Default); TDP05K 0 to 10,000 FPM (10,000 ft/min; Default); TDFi-RT
40028	2	3, 6, 16	float	Alarm Deadband - Flow	ALL	Alarm Deadband - Flow	0 to 984 FPM (0 ft/min; Default)
40030	2	3, 6, 16	float	Alarm Delay - Flow	ALL	Alarm Delay - Flow	0 to 10 Minutes (0 min; Default)
40032	2	3, 6, 16	float	Low Temp Alarm	ALL	Low Temperature Alarm - Setpoint	-29.2°F to 129.2°F (-20.2°F; Default)
40034	2	3, 6, 16	float	High Temp Alarm	ALL	High Temperature Alarm - Setpoint	-29.2°F to 129.2°F (120.2°F; Default)
40036	2	3, 6, 16	float	Alarm Deadband - Temp	ALL	Alarm Deadband - Temp	0 to 9°F (0°F; Default)
40038	2	3, 6, 16	float	Alarm Delay - Temp	ALL	Alarm Delay - Temp	0 to 10 Minutes (0 ft/min; Default)
40040	2	3, 6, 16	float	Duct Area - SqFt	Probes	Duct area size in ft^2 or m^2	0 to 100 ft^2 (0.44 ft^2; Default) or 0 to 9.3 m^2 - Writing will set duct type to 'Other' - Reading will read current calculated value if not set to 'Other'

Ruskin's Modbus RTU – Data Map:

Register	Reg. Count	Function	Type	Name	Product Line	Description	Range
SYSTEM CONFIGURATION							
Holding Registers							
Coils							
00001	1	1, 5	bool	System Reset	ALL	Device Reset	1 = RESET
00002	1	1, 5	bool	K-Factor	ALL	K-Factor Enable	1 = ON, 0 = OFF (Default)
00003	1	1, 5	bool	Low Flow Alarm - On/ Off	ALL	Low Flow Alarm - Enable	1 = ON, 0 = OFF (Default)
00004	1	1, 5	bool	High Flow Alarm - On/ Off	ALL	High Flow Alarm - Enable	1 = ON, 0 = OFF (Default)
00005	1	1, 5	bool	Low Temp Alarm - On/ Off	ALL	Low Temp Alarm - Enable	1 = ON, 0 = OFF (Default)
00006	1	1, 5	bool	High Temp Alarm - On/ Off	ALL	High Temperature Alarm - Enable	1 = ON, 0 = OFF (Default)
00007	1	1, 5	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	bool	String Order	ALL	Sets the string byte ordering used in read and write processing	1 = Swapped, 0 = Normal (Default)
SYSTEM STATUS							
30001	1	4	uint16	Device Type	ALL	Device Model Number	0 = TDP05K, 1 = AD-1272, 2 = Kele, 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 (includes Primary / Host) | Probes (TDP05K) | Monitors (TDFi-RT)
30007	1	4	uint16	Device Version	ALL	Primary - PCB Firmware (TDP05K) Host - PCB Firmware (TDFi-RT)	MSB = Major, LSB = Minor
30008	1	4	uint16	Device Version-2	ALL	Primary - PCB Build (TDP05K) Host - PCB Build (TDFi-RT)	MSB = Patch, LSB = Build number
30009	1	4	uint16	Protocol Version	ALL	Primary - Modbus RTU Firmware (TDP05K) Host - Modbus RTU Firmware (TDFi-RT)	MSB = Major, LSB = Minor
30010	1	4	uint16	Protocol Version-2	ALL	Primary - Modbus RTU Build (TDP05K) Host - Modbus RTU Build (TDFi-RT)	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	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

Ruskin's Modbus RTU – Data Map:

Register	Reg. Count	Function	Type	Name	Product Line	Description	Range
SYSTEM STATUS							
30032	2	4	float	Airflow	ALL	Average Airflow Velocity or Volume in SI or Imperial Units	0 to 5,000 FPM (TDP05K) 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)
RUSKIN NETWORK DEVICE							
Devices - Serial Numbers							
30101	16	4	string	Primary / Host Serial #	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	Device 1 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
...				...		...	...
30357	16	4	string	Device 16 Serial Number	All	Device 16 OEM Device Serial Number	0 to 31 Characters, null padded, null terminated; 32 byte
Devices - Airflow							
30373	2	4	float	Primary / Host Airflow	Probes	Primary Device Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM | Fans - 0 to 10,000 FPM
30375	2	4	float	Device 1 Airflow	All	Device 1 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM | Fans - 0 to 10,000 FPM
...				...		...	...
30405	2	4	float	Device 16 Airflow	All	Device 16 Average Airflow Velocity or Volume in SI or Imperial Units	Probes - 0 to 5,000 FPM | Fans - 0 to 10,000 FPM
Devices - Temperature							
30407	2	4	float	Primary / Host Temperature	Probes	Primary Device Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
30409	2	4	float	Device 1 Temperature	All	Device 1 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)
...				...		...	...
30439	2	4	float	Device 16 Temperature	All	Device 16 Temperature in SI or Imperial Units	-20°F to 120°F (-29°C to 49°C)

Ruskin's Modbus RTU – Ordering Definition:

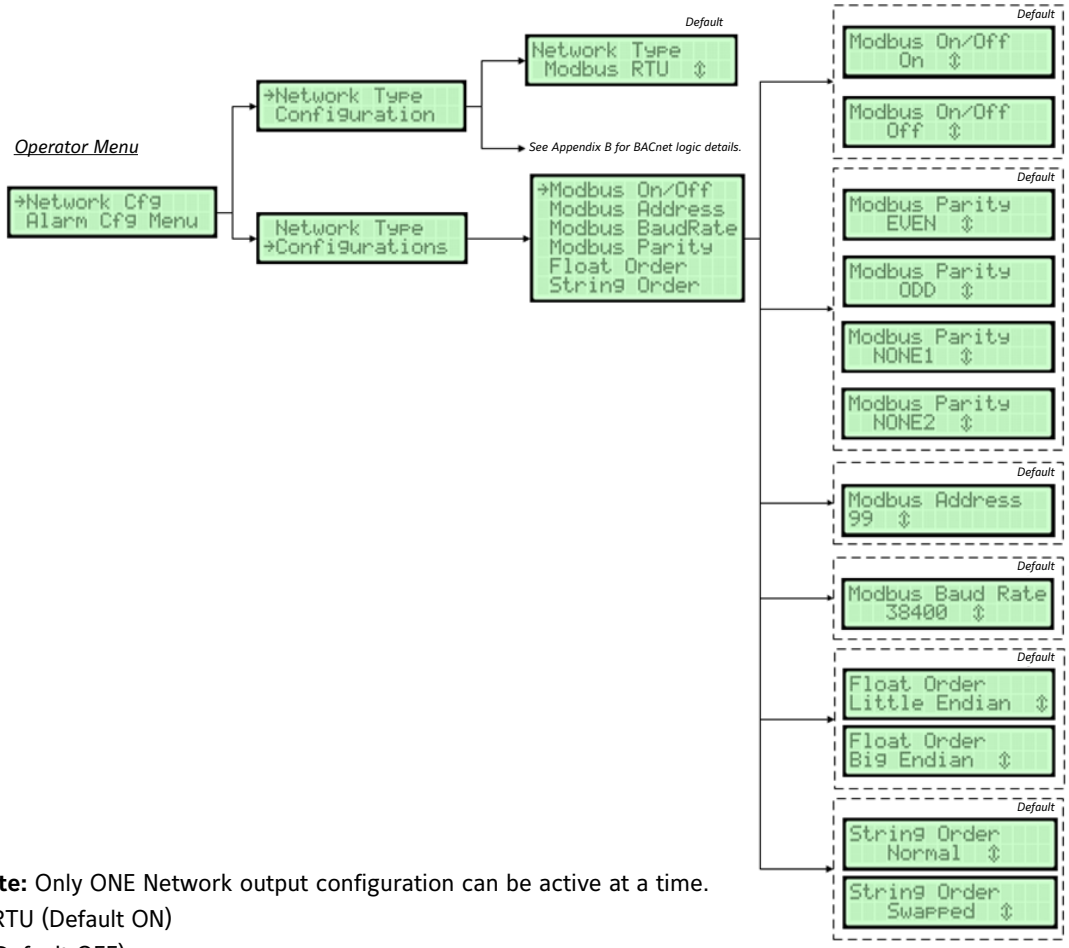
Big Endian Setting -Coil 00007				
Example = 0 x 12345678				
Application	0 x 78	0 x 56	0 x 34	0 x 12
Registers	0 x 12	0 x 34	0 x 56	0 x 78
	Register 1		Register 2	
Little Endian Setting - Coiling 00007				
Example = 0 x 12345678				
Application	0 x 78	0 x 56	0 x 34	0 x 12
Registers	0 x 56	0 x 78	0 x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

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

Ruskin's Modbus RTU – Ordering Definition:

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:**	21 December 2021
	Vendor Name:	Ruskin
	Vendor ID:	692
	Product Name:	TDP05K Thermal Dispersion Probe Airflow Measuring System
	Product Model Number:	TDP05K
	Firmware Revision:	1.5.3
	Application Software Version:	1.1.0
	BACnet Protocol Revision:	14
	Product Description:	Thermal Dispersion Electronic Airflow Measuring System
	BACnet Standard Device Profile:	BACnet Application Specific Controller (B-ASC)
	BACnet Interoperability Building Blocks Supported: Data Sharing - Read Property-B (DS-RP-B) Data Sharing - Write Property-B (DS-WP-B) Device Management - Dynamic Device Binding-A (DM-DDB-A) Device Management - Dynamic Device Binding-B (DM-DDB-B) Device Management - Dynamic Object Binding-B (DM-DOB-B) Device Management - Device Communication Control-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 Summery-A (AE-ASUM-B)	
	Segmentation Capability:	No
	Data Link Layer Options:	MS/TP master baud rates: 9600, 19200, 28400, 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
TDP05K[1]	The Device object	DEV	XXXX[2]	See Property Table 1
Notification Class	Handles where to send events and notifications	NC	1	See Property Table 2
Airflow Temperature	Average Temperature in SI or Imperial Units	AV	1	See Property Table 3
Actual Airflow Velocity[3]	Average station airflow velocity or volume in SI or Imperial Units	All	2	See Property Table 3

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 test 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” or “Standard” and suffixed by “Velocity” or “Volume” based on settings in the display menu.

Advanced Thermal Dispersion Air Measuring Station BACnet MS/TP – Property Types

Property Table 1: Device Object			
Property	**Type**	**Access**	**Description**
Object Identifier[4]	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	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[1]	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

Advanced Thermal Dispersion Air Measuring Station BACnet MS/TP – Property Types

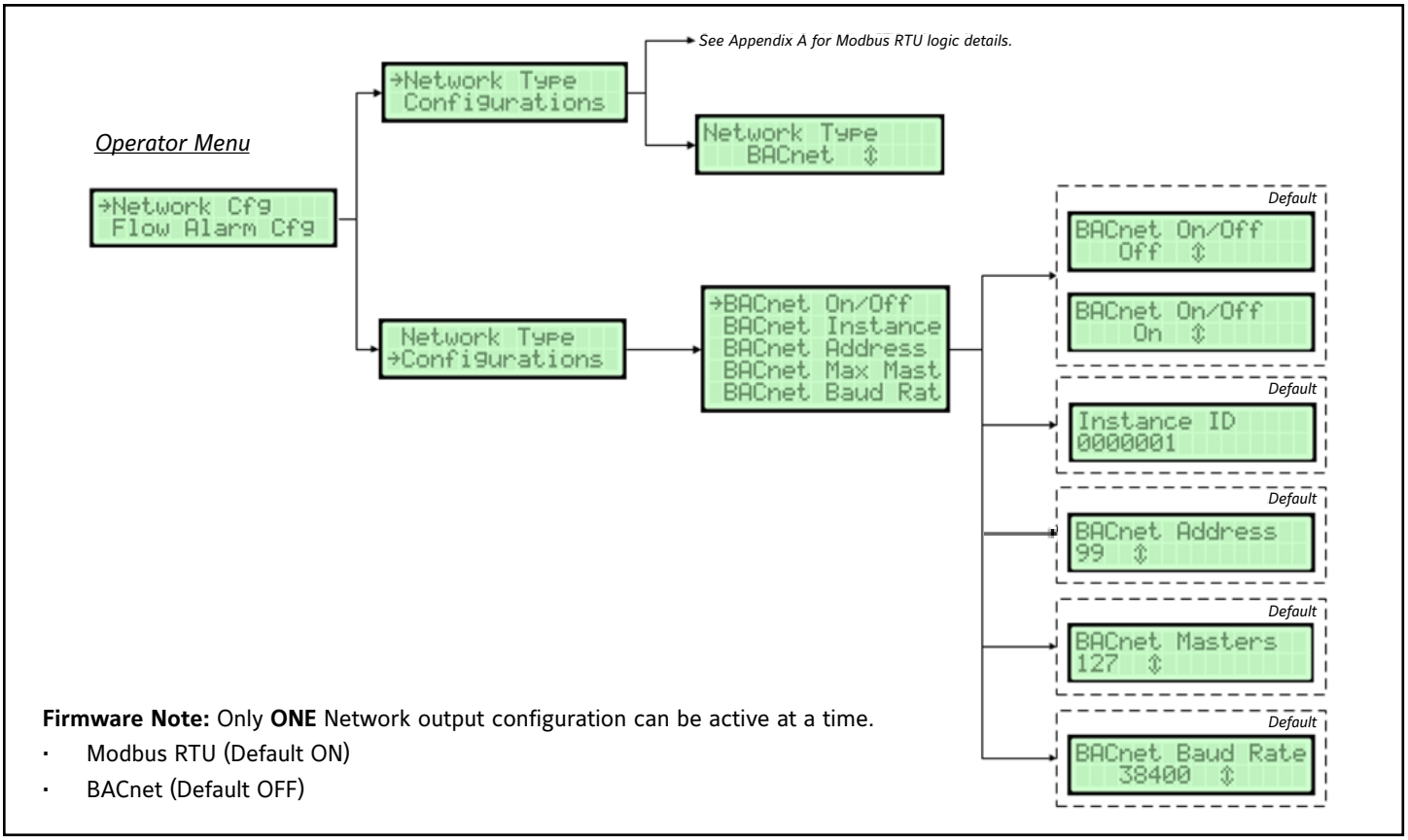
Property Table 3: Analog Value Object			
Property	**Type**	**Access**	**Description**
Object Identifier[1]	BACnet Object Identifier	R	The object number (instance) for the AV object
Object Type	BACnet Object Type	R	The AV object type – ANALOG VALUE
Object Name	Character String	R	The AV object name
Present 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 – Meter^3 / Hour 88 – Liters / Minute 135 – Liters / Second 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

R – Read Access

W – Write Access

1. These properties are configured through the configuration menu on the device

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

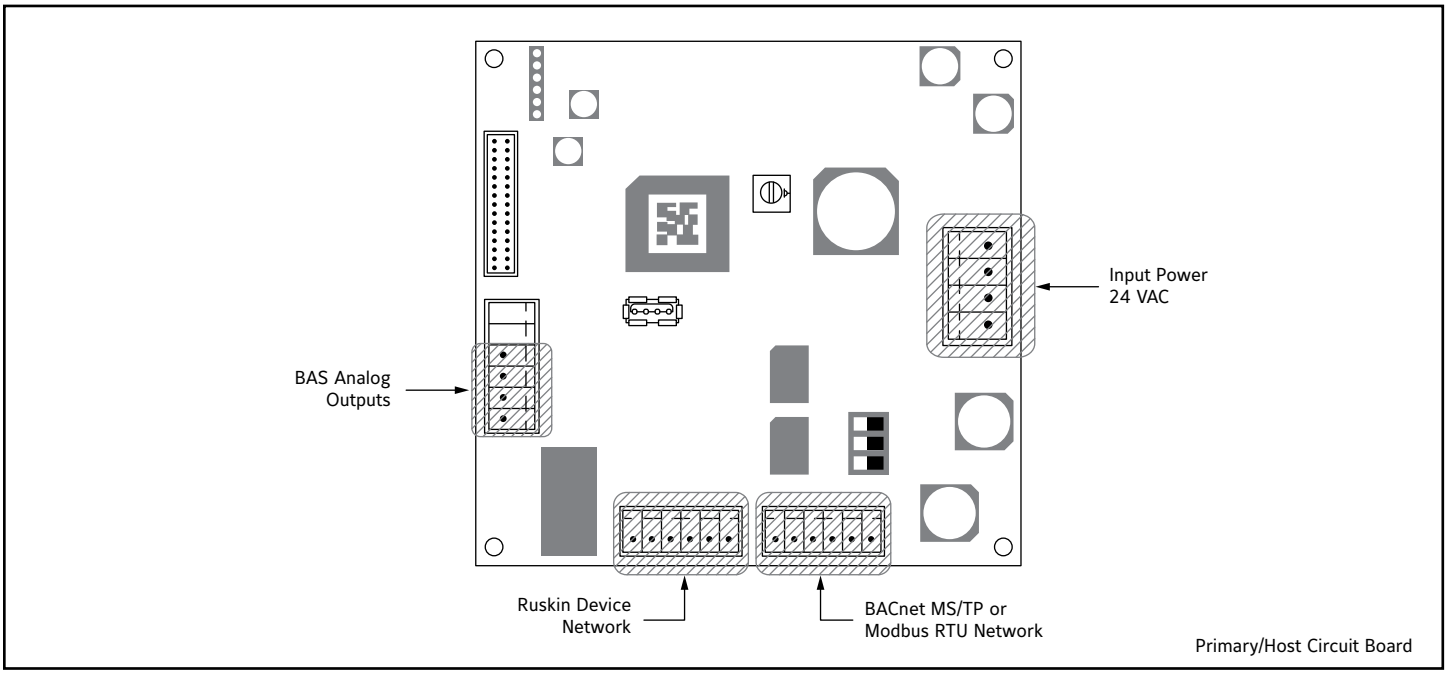
BACnet Baud Rate

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

Default: 38400

Optional Settings: 9600, 19200, 76800

Ruskin Circuit Board I/O:



Measuring stations are tested at an AMCA Certified 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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