TDFi-FA

Fan Array Airflow and Temperature Measurement Station
Electronic Thermal Dispersion Sensing Technology

RUSKIN
AUTHORITY IN AIR CONTROL

APPLICATION

The TDFi-FA is an advanced, state-of-the-art electronic thermal dispersion type fan inlet air measurement device for reporting airflow and air temperature in fan array applications. The TDFi-FA host reads data collected from up to 16 monitor boxes with each monitor box gathering information from up to 4 sensors (1 or 2 sensors per fan); thereby offering the ability to collect a maximum of 32 airflow and temperature values from the fan array installation. Each fan has one or two sensors located in the fan's inlet. The sensor's design ensures minimal pressure drop by using less hardware across the fan inlet. Each sensor has a heated and passive thermistor. Up to 16 Client monitor boxes with max four sensors each can be connected to one host. The airflow and temperature information from each sensor is configured to correspond to the fan on which it is installed. This feature makes it possible to use only one Host as the interface point for processing air measurement from multiple fans on one or more AHU or RTU. The host will average up to 32 sensors on 16 fans when installed and configured as one airflow measurement station. The total interconnect wire distance between the host and the sum of all clients can be up to 500 feet. The TDFi-FA Host has a two-line, 16 character, display for setup and configuration and will show both airflow and temperature.

Contact Ruskin for assistance selecting options and features for the TDFi-FA to fit your application!

STANDARD CONSTRUCTION

Standoff Mounted Sensors	One or two sensor assemblies per fan are cantilever-mounted to the face of the fan for proper positioning of the sensor into the airstream.
Sensor Distribution	One or two sensors will be mounted to each individual fan in the fan array. When utilizing two sensor assemblies per fan, position the sensors opposite each other at the fan inlet.
Installed Accuracy	Airflow: ±3% (Upon completion of the required Field Calibration process). Temperature: ±0.10° F (0.056° C).
Product Performance Range	Airflow Rate: 0-10,000 FPM. Temperature: –20° F to 120° F (–29° C to 49° C). Humidity: 0-99% RH, non-condensing.
Power Requirement	24 VAC/VDC (+/- 15%) @ 15VA
Host or Client (one per two sensors or fan location)	Daisy-Chain Client Monitor Box(es) to Host Monitor Box. - One Host required per BACnet, Modbus, or Analog automation interface.
Communication Cable	Factory supplied combination cables (24/1 pr Comm + 18/2 Power), Shielded, Blue Jacket. Cables include cord grips and Phoenix connectors attached for terminating in monitor boxes (Host, Client, Remote Host) in a daisy chain configuration. Quantity and length of factory supplied cables are based on total sensor count.
Host Automation Interface	One Host monitor box is required per BACnet or Modbus and/or Analog Automation Interface. - Airflow and temperature, advanced configuration and troubleshooting. Two analog individually configurable outputs for Volume or Temperature. Analog Outputs are protected from short circuits with a resettable solid state fuse. - Volume Output : 4-20mA or 2-10 VDC with 500 ohm resistor. - Temperature Output : 4-20mA or 2-10 VDC with 500 ohm resistor.
Monitor Box	UL Type 1 rated enclosures. HOST monitor box includes a 16 x 2 character LCD display. - 5 3/4"W x 6 1/2"H x 4"D (146mm x 165mm x 102mm)
Operating Range	–20° F to 120° F (–29° C to 49° C)

STANDARD FEATURES

▶ BACnet MS/TP, Modbus RTU, and analog outputs are standard

▶ Cantilever sensor design; standoff mounted fan inlet

▶ Tool-free, one touch setup through Host surface membrane

▶ Host Monitor Box: The Host is the User & Network interface and must be mounted external to the airstream

▶ One interface (Host) supports up to 16 fans of the same diameter

▶ Standard cabling (no proprietary cables)

▶ Built-in 1, 2, or 3 point field calibration using actual airflows. Field calibration after installation is required to achieve specified accuracy

▶ UL Type 1 rated Monitor Box Enclosures

▶ Sensor Housing Assembly certified to IP-54 rating criteria per IEC 60529, Ed. 2.2 08/29/2013

Ruskin TDFi-FA helps satisfy the requirements for minimum outside air as required by the following.

▶ LEED (USGBC)

▶ ASHRAE 62.1, ASHRAE 90.1 and ASHRAE 189.1

▶ California Title 24

▶ International Mechanical Code (IMC)

▶ International Energy Conservation Code (IECC)

NOTE: Dimensions in inches, parentheses ( ) indicate SI units.

LISTINGS AND COMPLIANCES

▶ UL Listed: UL 60730-1; UL 60730-2-9; UL 60730-2-15
▶ UL Compliant: UL 60335-1 and CAN/CSA-C22.2 No. 60335-1
▶ UL 60335-2-40 and CSA C22.2 No. 60335-2-40
▶ FCC: Meets part 15 Subpart B, Class A device requirements.
▶ CE: European shipments only
▶ BACnet (BTL): Certified to BACnet standard ISO 16484-5 rev. 1.14

VARIATIONS

Ruskin model TDFi-FA is available with the following variations at additional cost.

▶ Sensor Cable Lengths: For **CLIENT** monitor boxes, 25' (7.625m) is available as an option. 10' is Standard. For **HOST** monitor boxes, 25' (7.625m) is Standard. **Remote HOST** monitor boxes do NOT include sensor cable assemblies

▶ Client data/power cables are available in lengths of 18", 32", 44", 50", 10ft, and 25ft...and include factory terminated phoenix connectors. **Note:** Installations that include a Host and one or more Client monitor boxes will include one 25' length of data/power cable to connect the Host to the nearest Client monitor box

▶ REMOTE HOST Required when Host install location is greater than 25ft from nearest fan inlet. Can be installed up to 500ft from the nearest Client monitor box. The Host monitor box, unlike the Client monitor box, must be located external to the air stream and readily accessible during the field calibration process. There are NO sensor assemblies connected to the REMOTE HOST. The Host, which unlike the Client box, must be located external to the air stream and easily accessible during the calibration process. Utilizing a Remote Host adds one Client box to the airflow measuring station. There are no sensor assemblies connected to a Remote Host

▶ The REMOTE HOST feature includes data/power cable length options of 10ft, 25ft, and 50ft. The REMOTE HOST data/power cable connects the REMOTE HOST to the nearest Client box

▶ 120VAC to 24VAC, 40VA power transformer shipped loose

▶ 120VAC to 24VAC, 100VA power transformer shipped loose.

▶ 500' roll Connect-Air W24182P-2306BL power & comm cable

▶ UL Type 4 rated enclosure for REMOTE HOST monitor box

CONTENTS AND INSTALLATION DETAILS

Please see Ruskin TDFi-FA installation and maintenance manual for product application on approved fan types.

Ruskin model TDFi-FA is a solution that measures the inlet velocity and temperature of air entering at a fan's inlet. TDFi-FA comes with a Host and up to four (4) thermal dispersion air measurement sensors that are used to sample the airflow and air temperature. One or two sensors per fan inlet are located on the face of the fan inlet bell. Up to 32 fan inlet sensors can be installed on a max of 16 fans with one or two sensors per fan inlet bell using one Host as the network interface.

Each sensor is connected to either the Host or an additional Client enclosure. The thermal dispersion sensors are housed in an aerodynamic, high impact, ABS plastic, casing on the end of a stainless steel boom arm with a fixed length cable and connector that plugs into its corresponding Host or Client box. The sensor is cantilevered into the fan's inlet with the boom arm mechanically fastened to the fan housing using the two loop clamps provided (self drilling fasteners not included). After installation the sensor's opening is rotated to align with the air entering airflow and locked into position with a one half turn locking collar. The sensor's design allows the sensor to be parallel with the air entering stream independent of the boom arm's mounting location and rotation. This unique patented sensor design facilitates face mount or offset inlet independent of the shape of the inlet bell. The TDFi-FA has the lowest energy penalty of any aftermarket add-on fan inlet airflow measurement station.

Each sensor assembly cable must be secured and routed to either a Host or Client box and connected to the EJ-1, EJ-2, EJ-3, or EJ-4 port. The combination power/data cables supplied with the TDFi-FA should be used to connect one monitor box to another in a daisy chain configuration (applicable when more than one monitor box is utilized). The sensor readings are used during the field calibration process to assign airflows at low, medium and high to actual airflows as established by test and balance or read from the fan curve. See the installation manual automatic calibration procedure. **IMPORTANT:** Displayed airflow will not be accurate until device configuration and field calibration process has been completed. Client boxes can be located in the fan plenum however the Host must be externally located such that the menu and display can be safely accessed during the calibration process without having an effect on the actual airflows. Avoid box mounting locations that will be subject to excessive vibration or electromagnetic interference. For example a location next to a variable speed drive or 480V power line would not be acceptable and may lead to product failure or erratic readings. Client or Host should be installed on an adjacent structural wall with the greatest

Host Monitor Box
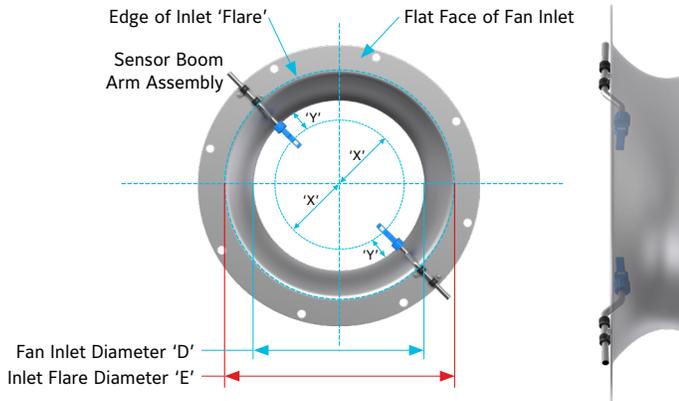

Client Monitor Box

Daisy chain box-to-box power & data cable is included when more than one box is provided.

separation possible from high voltage connections or any power or lighting wiring within the sensor cable lengths supplied.

Placement of the sensor should be located at or near the highest restriction point of the fan inlet. Sensors should be positioned with the sensor's opening at a point equal to 1/6 of the fan inlet diameter from the edge, in the opening near the 12:00 o'clock and 6:00 o'clock positions, or directly opposite the other sensor at any tangent point of an imaginary circle equal to 2/3 of the opening's diameter. Rotate the boom to position the sensor as deep into the fan's inlet as possible without interfering with the fan wheel's rotation. The sensor housing can be rotated on the end of the boom to position the opening for max flow through the sensors.

CONTENTS AND INSTALLATION DETAILS

Edge of Inlet 'Flare'
Flat Face of Fan Inlet
Sensor Boom Arm Assembly

'Y'
'X'
'X'
'Y'

Fan Inlet Diameter 'D'
Inlet Flare Diameter 'E'

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)

WIRING DETAILS

FIELD WIRING CONNECTIONS:

1. Plug sensors into the connections designated EJ-1, EJ-2, EJ-3, and EJ-4 located on the Host or Client monitor box (Sensor will not be connected to a REMOTE Host, if applicable). Utilize the tag adhered to the sensor cable to identify the fan associated with each cable.

2. Analog Outputs (AO1 & AO2): Fan SUM airflow measurement station applications connect to AO1 Volume and to AO2 Temperature output signals from the Host to the Building Automation System (BAS). Observe polarity as indicated on the wiring schematic using shielded, twisted pair of at least 22 AWG or larger for longer runs.

3. Digital Outputs (RS-485): Fan SUM and/or individual fan airflow and temperature measurements are achieved by connection from the BACnet MS/TP or Modbus RTU I/O signals in the Host monitor box to the Building Automation System (BAS).

4. IMPORTANT: Apply power only after all connections have been completed per above. Once all connections have been completed, connect 24VAC power to the HOST interface.
   a. Connect 24VAC hot to +24H terminal
   b. Connect 24VAC common to -24C terminal
   c. Shield is floating unless -24C terminal is connected to earth ground one end only

OPERATIONS: The Supervisor menu allows access to customized factory settings. The Operator menu is used to configure the air measurement station. When the fan count is set to 0 (i.e., no fans are configured due to user fan data reset or factory reset), the HOST will prompt the user to configure the system during boot; immediately before warm-up. The menu will guide the user through the process of assigning individual sensors to specific fans. Pressing MENU at any point in the setup will skip the setup process. The UP and DOWN buttons on the control panel are used to scroll through the menu options and to adjust values.

NORMAL OPERATION: Under normal operation, the TDFi-FA Host front panel display will continuously show average flow or volume and average temperature in Imperial and SI units from the fan summary (FSUM) or for the selected fan (e.g., F01 for Fan 1, F02 for Fan 2, etc.)

Important: The TDFi-FA will display a changing airflow and accurate temperature when the sensors are installed and have been configured for at least one fan. The one, two, or three point automatic calibration steps must be completed before the air measurements displayed will meet the published accuracy rating. See the installation manual for additional information.

CABLE CONNECTIONS: Utilize the lengths of factory supplied communication and power cable to connect monitor boxes. For installations that require longer lengths of cabling than provided, use a twisted shielded pair 24 AWG low-capacitance communications cable suitable for RS-485 type network connectivity.
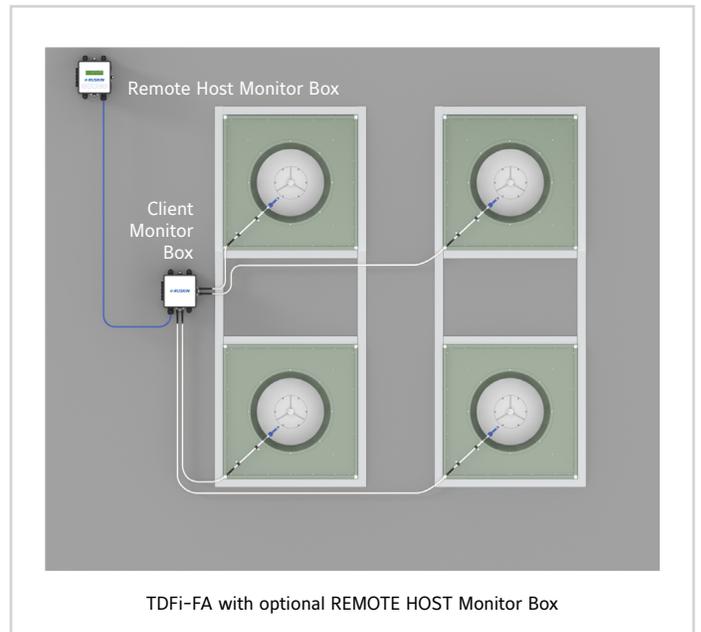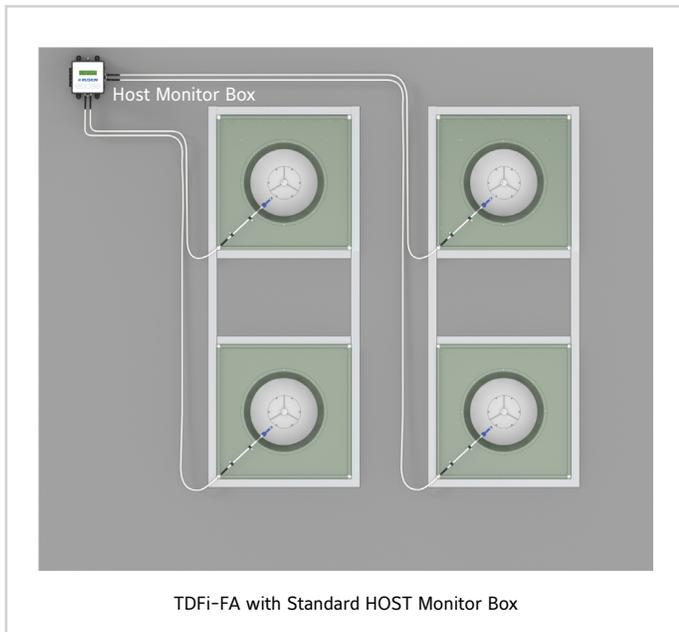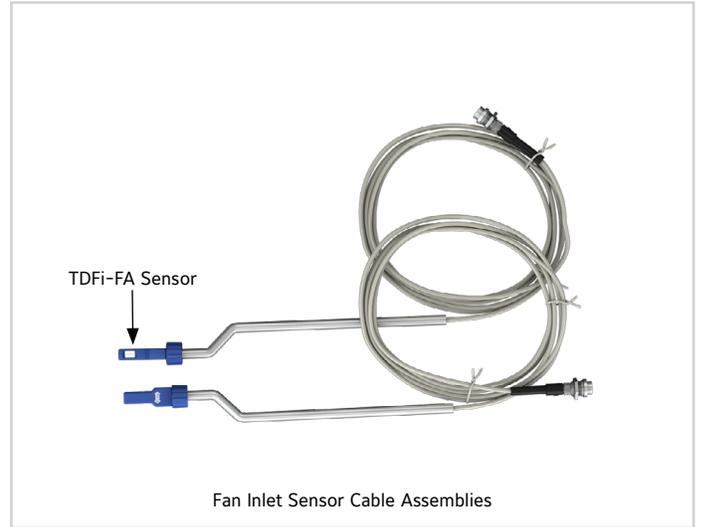
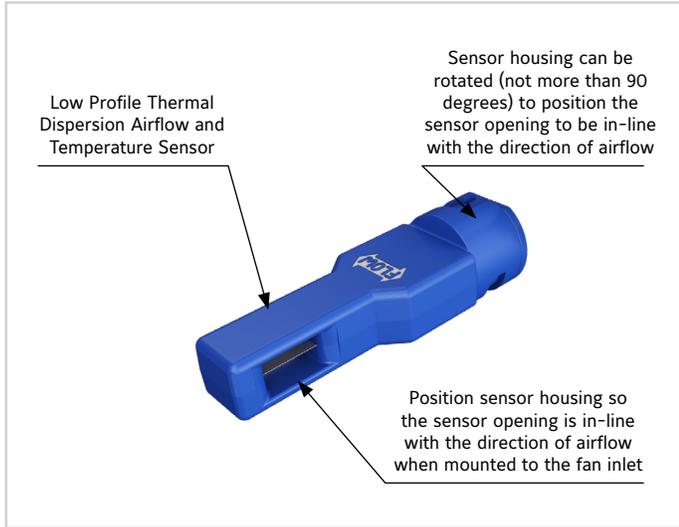Important: Mount the HOST or REMOTE HOST external from the fan plenum area so its interface can be accessed while the fans are running. Run control wiring away from variable frequency drives (VFD's) and broadcast antennas. Avoid running this device's wiring in the same conduit as AC power wiring or with wiring used to supply highly inductive loads, such as motors, contactors, and relays.
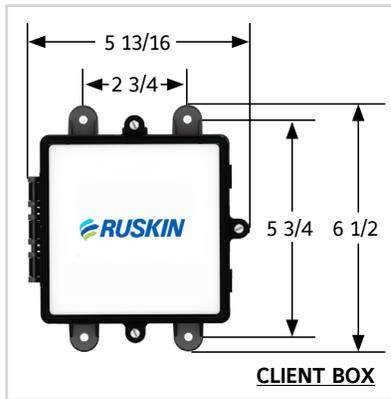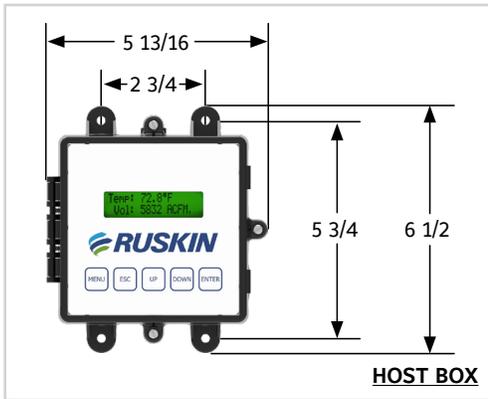

Host

Client 0

Client F
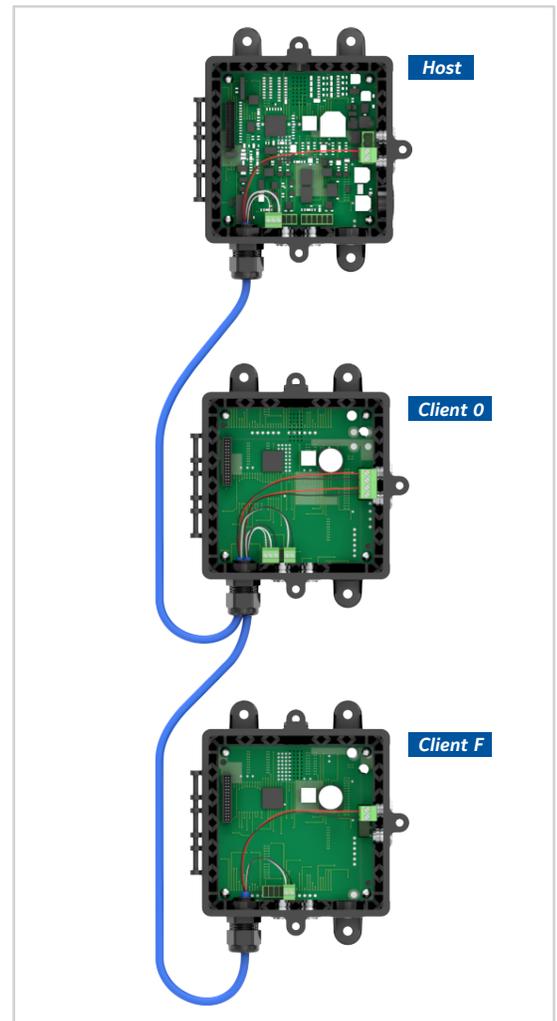
TECHNOLOGY

Ruskin's TDFi-FA Airflow Measurement Station for fan array applications utilizes thermal dispersion technology with low profile sensors to minimize the energy penalty and reduce fan horsepower requirements.

One Host monitor box is capable of transmitting fan data from up to 16 fans to the BAS, with either 1 or 2 sensors per fan. One Host, and up to 16 Client monitor boxes, can be interfaced through a single BACnet or Modbus RTU address.

Low Profile Thermal Dispersion Airflow and Temperature Sensor

Sensor housing can be rotated (not more than 90 degrees) to position the sensor opening to be in-line with the direction of airflow

Position sensor housing so the sensor opening is in-line with the direction of airflow when mounted to the fan inlet

TDFi-FA Sensor

Fan Inlet Sensor Cable Assemblies

Host Monitor Box

TDFi-FA with Standard HOST Monitor Box

Remote Host Monitor Box

Client Monitor Box

TDFi-FA with optional REMOTE HOST Monitor Box

DIMENSIONAL DETAILS
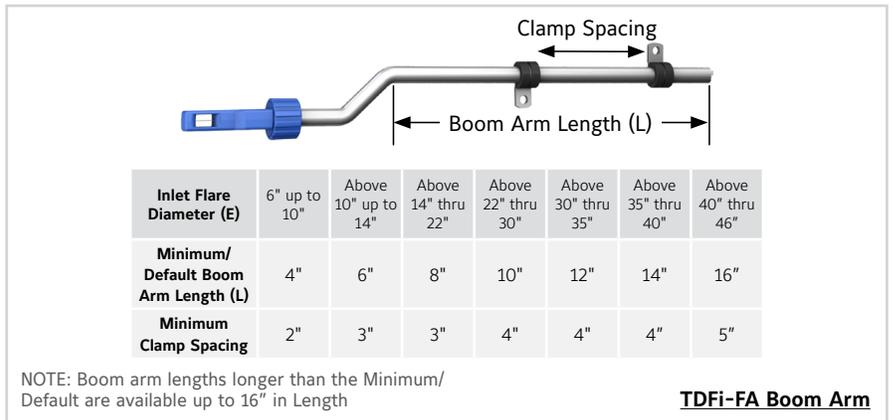

HOST BOX

5 13/16
2 3/4
5 3/4 6 1/2

CLIENT BOX

5 13/16
2 3/4
5 3/4 6 1/2

NOTE:
Available in 10ft or 25ft lengths. Each local HOST monitor box will include 25ft sensor cable assembly lengths as Standard.

TDFi-FA Sensor Cable Assembly

HOST BOX SIDE VIEW

3.80

Clamp Spacing

Boom Arm Length (L)

Inlet Flare Diameter (E)	6" up to 10"	Above 10" up to 14"	Above 14" thru 22"	Above 22" thru 30"	Above 30" thru 35"	Above 35" thru 40"	Above 40" thru 46"
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 are available up to 16" in Length

TDFi-FA Boom Arm

SUGGESTED SPECIFICATION

Furnish and install, at locations shown on plans or as in accordance with schedules calling for thermal dispersion electronic airflow and temperature measuring devices for fan array applications. Sensors shall be heated and passive thermistors cantilever-mounted into the face of the fan inlet. The airflow measurement station shall be capable of monitoring and reporting the airflow and temperature at each fan inlet location through one or two sensors per fan that communicates with the building automation system (BAS). The sensor circuit housing shall be constructed of U.L. 94 flame rated, high impact ABS and supported on a stainless steel boom arm that positions the sensor into the fan inlet at the specified measurement points. Each sensor location shall consist of a set of thermistors; one passive and one heated, for measuring ambient temperature and airflow velocity. The sensors shall be designed for operation in a wide range of environments, including high humidity and rapid thermal cycling. The sensor cable assemblies shall be connected directly to the Host or Client monitor boxes using gold plated contacts to ensure absolute connectivity and long term accuracy. One Host monitor box and up to 16 Client monitor boxes shall collect data from each sensor and digitally communicate the airflow and temperature of each sensing point to the Host monitor box.

Utilizing the menu through the keypad on the Host monitor box, each sensor shall be configured to represent the airflow through the fan on which it is installed. Monitor boxes (both Host and Clients) shall be wired in daisy chain fashion to each other terminating at a Host. The daisy chain communications cabling shall be provided with the airflow measurement station and shall be a non-proprietary twisted, shielded cable similar to Connect-Air part number W24182P-2306BL with communications and power in one cable. Alternatively, a twisted shielded pair 24 AWG low capacitance wire communications cable and an 18 AWG power cable in separate conduits may be used. Complete assembly shall be constructed and assembled in an ISO 9001 certified facility. Sensor cable assemblies shall be a minimum of 10ft (3.05m) in length and shall be available up to 25ft (7.62m), when specified. Each Host and Client monitor box shall be capable of processing up to 4 independent sensing points. The Airflow Temperature Measurement System (AFTMS) shall include a Host that interfaces with the building automation system (BAS) using BACnet or Modbus and/or 4-20mA analog outputs reporting volume and temperature measurements. The BACnet MS/TP or Modbus RTU interface shall be configurable for use with fan arrays incorporating up to 16 fans of the same diameter. The fan inlet airflow measuring station shall operate on either 24VAC or 24VDC power. The Host user interface shall feature a 16x2 character alphanumeric LCD display and shall be field adjustable to display either I.P. or S.I. units. The airflow measuring station shall be UL-rated as an assembly. Calibrated performance shall be based on test and balance field measurement following three point calibration procedures performed after the sensors have been mounted on the fan inlet(s) in accordance with setup instructions. The fan inlet airflow measuring station for fan array applications shall be, in all aspects, equivalent to Ruskin model TDFi-FA.

LINKS TO IMPORTANT DOCUMENTS

Document Title
I&M Manual
Technical Bulletin
Limited Warranty Document

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