

# TDFi-RT

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



## APPLICATION

The TDFi-RT is an advanced, state-of-the-art electronic thermal dispersion type fan inlet air measurement device for reporting airflow and air temperature. The TDFi-RT host reads from one or two sensors and up to 16 additional clients to collect a maximum of 32 airflow and temperature readings from one or more fans. 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 clients with two sensors per client 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-RT 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-RT to fit your application!



## STANDARD CONSTRUCTION

<b>Standoff Mounted Sensors</b>	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.
<b>Sensor Distribution</b>	Up to two sensor assemblies can be mounted per fan. When utilizing two sensor assemblies per fan, position the sensors opposite each other at the fan inlet. NOTE: on dual inlet fans, only two sensor assemblies are required to sample the flow from the entering airstream.
<b>Sensor Accuracy</b>	Airflow: $\pm 3\%$ . Temperature: $\pm 0.10^\circ\text{F}$ ( $0.056^\circ\text{C}$ ).
<b>Sensor Ranges</b>	Airflow Rate: 0-10,000 FPM. Temperature: $-25^\circ\text{F}$ to $140^\circ\text{F}$ ( $-32^\circ\text{C}$ to $60^\circ\text{C}$ ). Humidity: 0-99% RH, non-condensing.
<b>Host or Client (one per two sensors or fan location)</b>	Daisy-Chain Client Monitor Box(es) to Host Monitor Box. - One Host required per BACnet, Modbus, or Analog automation interface.
<b>Communication Cable</b>	For ease of installation, use Connect-Air part number W24182P-2306BL providing communications and power in one cable. This wire has a twisted shielded pair 24 AWG low capacitance communications cable and an 18 AWG power cable in one wire.
<b>Host Automation Interface</b>	Host 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. <i>Analog Outputs are protected from short circuits with a resettable solid state fuse.</i> - Volume Output : 4-20mA or 2-10 VDC with 500 ohm resistor. - Temperature Output : 4-20mA or 2-10 VDC with 500 ohm resistor.
<b>Monitor Box</b>	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)
<b>Operating Range</b>	$-20^\circ\text{F}$ to $120^\circ\text{F}$ ( $-29^\circ\text{C}$ to $49^\circ\text{C}$ )
<b>Power Requirement</b>	Power supplied by others, less than 15VA @ 24 VAC or DC.



## STANDARD FEATURES

- ▶ Self-diagnostics utilizing artificial intelligence
- ▶ 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 is to be mounted out of the airstream
- ▶ One interface (Host) supports up to 16 fans (same or different fan sizes/types)
- ▶ 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-RT 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-RT 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 **local 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 local Host and one or more Client monitor boxes will include one 25' length of data/power cable to connect the local Host to the nearest Client monitor box
- ▶ Remote Host - Can be installed up to 500 feet away from the Client

box when 25 foot sensor cables will not reach the 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

- ▶ 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 Remote Host Enclosure

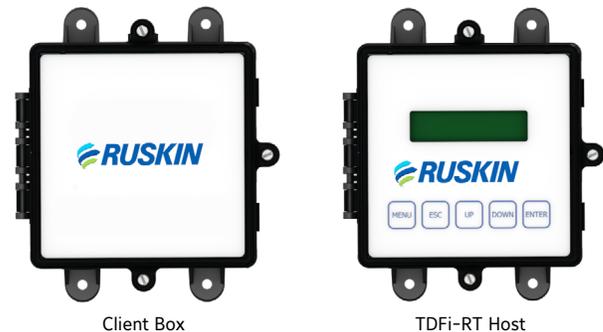
## CONTENTS AND INSTALLATION DETAILS

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

Ruskin model TDFi-RT is a solution that measures the inlet velocity and temperature of air entering at a fan's inlet. TDFi-RT comes with a HOST and two 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. Use only the non-pulley side for dual inlet fans. 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 pair of sensors are 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 3/8 diameter 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 be parallel to 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-RT has the lowest energy penalty of any aftermarket add-on fan inlet airflow measurement station.

The sensor's cables must be secured and routed to either a Host or Client box and connected to EJ-1 or EJ-2. Power and communications cables are connected to the Host. All Clients are daisy chained with the cables provided. Recommended wire is Connect-Air part number W24182P-2306BL with communications and power in one cable. 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:** Airflows shown will not be accurate until 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

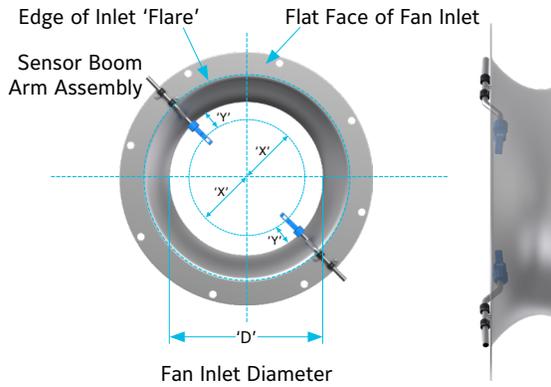


Daisy chain box-to-box power & data cable is included when more than one box is provided.

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

Placement of the sensor is 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



X = distance between centerline of fan and recommended sensor placement =  $\frac{1}{3}$  of Fan Inlet Diameter 'D'

Y = distance from edge of Fan Inlet Diameter to the recommended sensor placement =  $\frac{1}{6}$  of Fan Inlet Diameter 'D'

## WIRING DETAILS

### FIELD WIRING CONNECTIONS:

1. Plug sensors to numbered sockets on the bottom of the Host or corresponding Client box. Match sensor to port (EJ1, EJ2).
2. For single airflow measurement station applications when network interface is NOT used, connect 4–20mA A01 volume and A02 temperature output signal from Host to Building Automation System (BAS) observe polarity indicated on the wiring schematic, using shielded, twisted pair of at least 22 AWG or larger for longer runs.
3. Connect BACnet MS/TP or Modbus RTU to read average flow and average temperature for a single fan or fans from different systems (OA, RA, SA, EA).
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

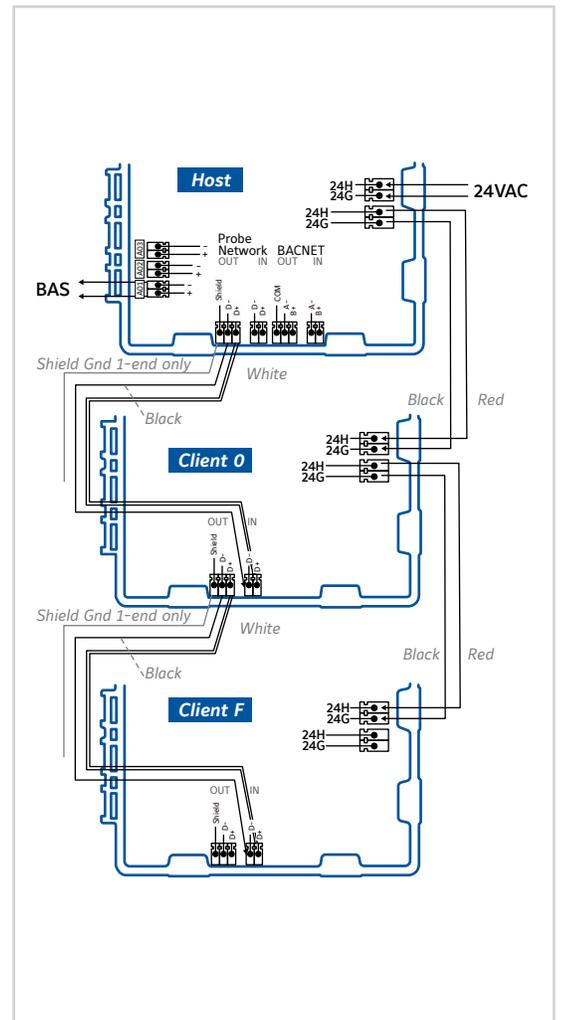
**OPERATIONS:** The Supervisor menu allows access to customize factory settings. The Operator menu is used to configure the air measurement station. When the fan count is set to 0, i.e. no fans configured, the Host will prompt the user to configure the system during boot, immediately before warm-up. This process will step the user through assignment of sensors to 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-RT Host front panel display will continuously show average flow or volume and average temperature in Imperial and SI units from the fan summary (FS) or for the selected fan.

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

**CONNECTIONS:** Use Connect-Air part number W24182P-2306BL with communications and power in one cable for longer Host-to-Client or Client-to-Client cable runs up to 500FT total cable length. Alternatively, use a twisted shielded pair 24 AWG low capacitance wire communications cable suitable for RS-485 type communications.

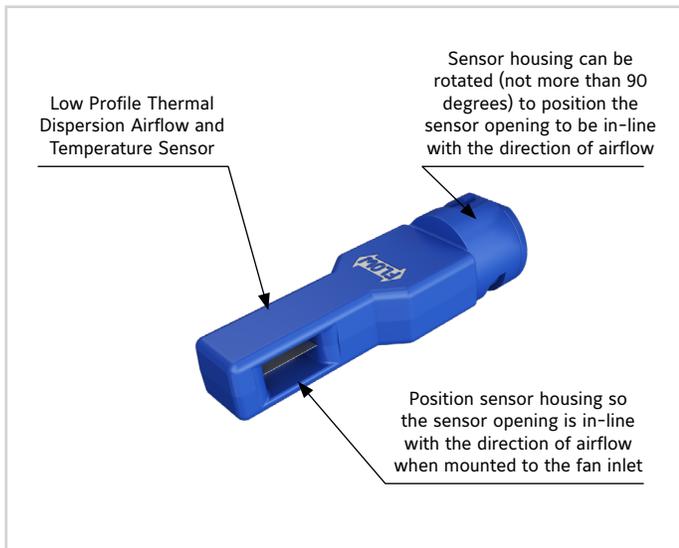
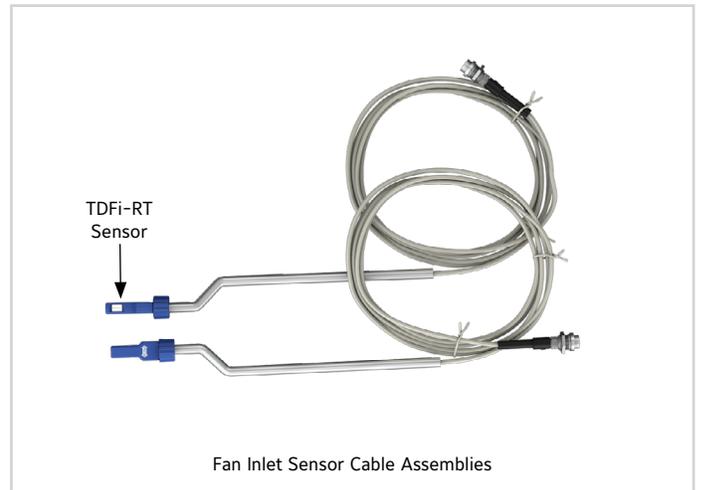
Important: Mount the HOST external from the fan plenum area so its interface can be accessed while the fans are running. Run control wiring away from variable frequency drives (VFD's) and broadcast antennas. Avoid running this device's wiring in the same conduit as AC power wiring or with wiring used to supply highly inductive loads, such as motors, contactors, and relays.



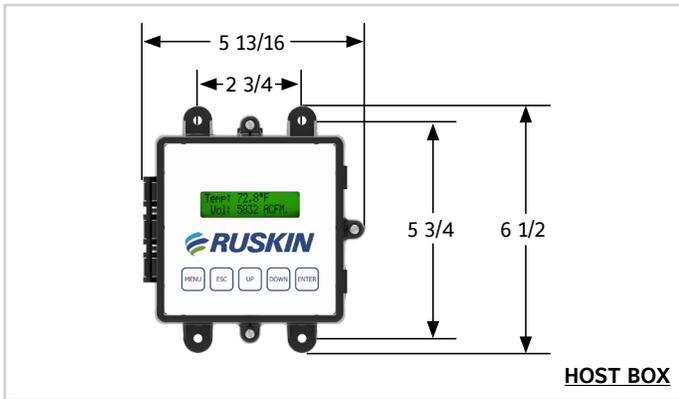
## TECHNOLOGY

Ruskin's TDFi-RT Fan Inlet Airflow Measurement Station utilizes advanced thermal dispersion technology and greatly reduces static pressure losses using either one or two sensors per fan. By tracking an airflow that changes with changing airflow through the fan, the TDFi-RT uses fewer and smaller sensors to minimize pressure drop and reduce the corresponding energy penalty associated with add-on fan inlet air measurement devices. With the TDFi-RT on a dual inlet fan, the airflow is only tracked on the non-pulley side of the fan where other technologies would have equipment positioned in both inlets. Only one Host is required for up to 16 fans with either one or two sensors per Host or Client. One Host and up to Sixteen Client boxes can be interfaced through a single BACnet or Modbus RTU address.

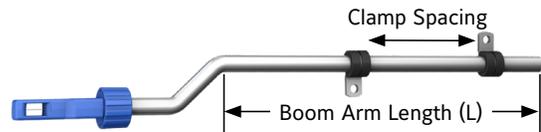
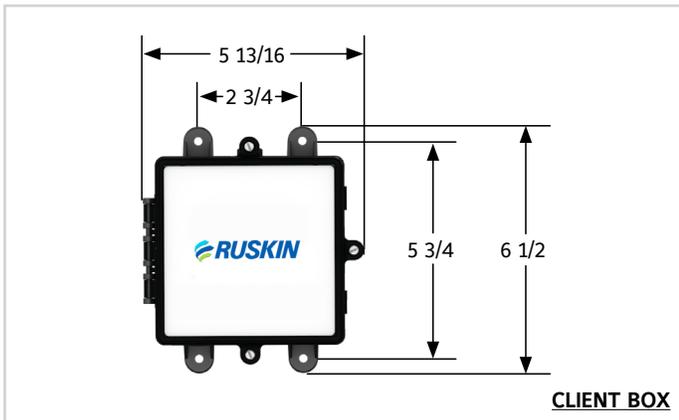
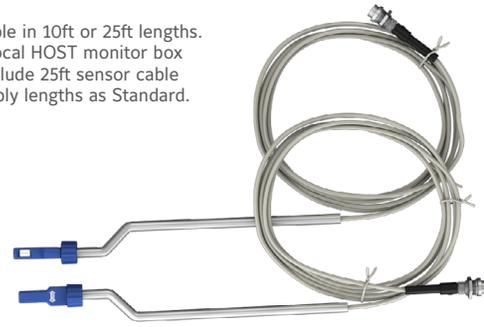
The TDFi-RT can be used on a single fan or multiple fans installed in different systems (AHU/RTU). Multiple fan inlet air measurement stations on up to 16 rooftop units can be read from a single Host interface. Each sensor can be configured as an independent fan or as a single fan in a multiple fan system.



## DIMENSIONAL DETAILS



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



Fan Inlet Diameter (D)	10" up to 22"	Above 22" thru 28"	Above 28" thru 34"	Above 34" thru 40"	Above 40" thru 46"	Above 46"
Minimum/Default Boom Arm Length (L)	6"	8"	10"	12"	14"	16"
Minimum Clamp Spacing	3"	3"	4"	4"	5"	6"

NOTE: Boom arm lengths longer than the Minimum/Default are available up to 16" in Length

**TDFi-RT Boom Arm**

## SUGGESTED SPECIFICATION

Furnish and install, at locations shown on plans or as in accordance with schedules calling for advanced thermal dispersion electronic fan inlet airflow and temperature measuring station. Thermal dispersion (TD) sensor (s) shall be cantilever mounted type. Unit shall be capable of monitoring and reporting the airflow and temperature at each fan inlet location through one or two sensors connected to a HOST or CLIENT that communicates with the building automation system (BAS). Sensor circuit casings shall be constructed of U.L. 94 flame rated, high impact ABS and include a stainless steel boom arm that positions the TD sensor in the fan inlet at the specified measurement points. Each sensor shall consist of a pair of thermistors, one passive, one heated, for measuring ambient temperature and air volume. Sensor shall be designed for operation in a wide range of environments, including high humidity and rapid thermal cycling. Sensor cables 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 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 cable shall be a non-proprietary twisted, shielded cable similar to 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. Complete assembly shall be constructed and assembled in an ISO 9001 certified facility. Sensor cables shall be a minimum of 10ft (3.05m) in length and shall be available up to 25ft (7.62m), when specified. Host or Client shall be capable of processing up to 2 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 or Modbus RTU interface shall be configurable for up to 16 fans operating independently on different air handlers or as multiple fans as part of one air measurement station on a single air handler. The TDFi-RT shall operate on 24 VAC. 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. All electronic components of the assembly shall be U.L. rated and RoHS compliant. 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 shall be in all respects equivalent to Ruskin model TDFi-RT.

### [LINKS TO IMPORTANT DOCUMENTS](#)

Document Title
I&M Manual
Technical Bulletin
Limited Warranty Document



3900 Dr. Greaves Road  
Kansas City, MO 64030  
Phone: (816) 761-7476  
Fax : (816) 765-8955  
Website: www.ruskin.com