KURZ PORTABLE AIR VELOCITY METERS · WE OUTRUN THE COMPETITION ·

M O D E L
2444
PORTABLE AIR VELOCITY METER

KURZ

SERIES 2440 THERMAL ANEMOMETER

KURZ INSTRUMENTS
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C E

ISO 9001 CERTIFIED QUALITY SYSTEM

KURZ
INSTRUMENTS INC.™

MODEL 2444 PORTABLE AIR VELOCITY METER

DESCRIPTION

The Model 2444 is a rugged, versatile industrial quality portable air velocity meter for a wide variety of velocity measurement applications in pipes and ducts. It uses the well-respected Kurz FD Fast-Dual Metalclad™ sensor and can be used at temperatures to 200°C. It is extraordinarily flexible as it can be extended in the field to accommodate both large and small ducts. The Model 2444 sensor support consists of the sensor section which has the FD all-welded Alloy C-276 sensor, and one or more 16" long, 3/4" diameter tube sections that can be screwed together to obtain a total length of 64.5" using three sensor support extension sections. The temperature rating is –40°C to +200°C. The Display Module has a powerful microprocessor with traverse data recording capability as well as other output options. It also has a rugged carrying case. It includes a 115/230 VAC 50/60 HZ charger, an optional vehicle 12 VDC charger, and an optional I/O Adapter Module which allows digital communication, 4-20 mA outputs, and data recording (1500 points). The Model 2444 represents the state-of-the-art in industrial quality Portable Air Velocity Meters. Kurz outruns the competition!

KEY FEATURES

- Easy-to-use menu for display and set-up with HELP screens.
- Two-line 16 character, back-lit LCD with twenty button keypad.
- User selected scrolling display.
- Twenty-four hour clock/calendar, Year 2000 compliance (four digit year).
- Two optically isolated loop-powered 4-20 mA outputs. User selected for velocity, flow rate or temperature (optional).
- 1500 Point Data Memory for recording traverses and other measurements.
- User selected English or Metric units (SFPM, SCFM, SCFH, PPM, PPH, °F; SMPS, SLPM, SCMH, KGM, KGH, °C).
- Multi-Point calibration correction factors for Flow and Temperature.
- User-entered METER ID Numbers.
- User-entered flow area.
- User selected low velocity cut-off.
- User selected Reference Conditions (STP).
- User selected digital time constants for each METER.
- Built-in flow totalizers and elapsed time.
- User Access Code.
- User selected RS-232C or RS-485 Serial port for terminal operation (optional).
- CE Compliance meeting the European Community requirements for EMI emissions and immunity.
- Configuration upload/download using a PC.
- Velocity/Temperature/Mapping (VTM) for wide ranging, process velocity and temperature.
- Nickel-Metal-Hydride 4.5 AH High Performance battery.
- Battery Charger, 100–240 VAC, 50/60 Hz.
- Exceptional Temperature Compensation.
- Flash EEPROM program for user firmware upgrades.
- Velocity range to 12,000 SFPM.
- Temperature rating of 200°C.
- Pressure rating of 300 PSIG.
- Rugged carrying case.
- Dirt Insensitive.
- Convenient threaded sensor support extensions.

- Fastest response to temperature and velocity changes available.
- Attitude insensitive.
- Sensor lead length independent.
- All components pass an extensive burn-in test for high reliability.
- Optional Modbus local area network with a read-only control set (Trademark of Square D Company).
- Electronics operating temperature range of -25°C to +65°C, non-condensing.
- Excellent low velocity sensitivity.
- .25% Repeatability.
- High accuracy over wide velocity and temperature range.
- Rugged, strong, dependable.
- Internal and External Data Logging.

APPLICATIONS

- Combustion Air Velocity and Flow Calibrations.
- Duct, Stack and Pipe Velocity Traverses.
- General Purpose Air Flow Measurements.
- Research and Development.
- HVAC Testing.

OUR MISSION

To manufacture and market the best thermal mass flow meters available and to support our customers in their efforts to improve their business.

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MODEL 2444 PORTABLE AIR VELOCITY METER

PRINCIPLE OF OPERATION

The Series 2440 uses the well-recognized Kurz thermal convection mass flow measurement method by detecting the heat transfer from the heated RTD sensor (Rp) referenced to the temperature of the ambient gas stream RTD sensor (Rt). A constant temperature difference between the heated sensor and the temperature sensor is maintained by a modified Wheatstone Bridge circuit in which the heated sensor is the controlled element. This provides unexcelled speed of response and the many other advantages of constant temperature thermal anemometry. The microprocessor-based electronics measures the heat transfer, computes the standard velocity and air temperature, and allows the user to configure and set-up the Series 2440 Display Module. Display screens are easy-to-use and provide all the flow, temperature and diagnostic information. For a more detailed description of Kurz technology, please see Document Number 364003.
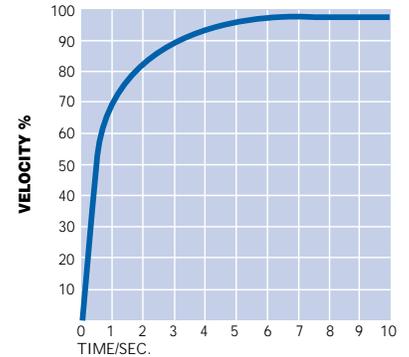

Series 2440 Accessories.

FD-MT Sensors

Model 2444 with Carrying Case.

TIME RESPONSE TO FLOW AND TEMPERATURE CHANGES

This graph shows the response of a Kurz Fast Dual (FD) MetalClad™ sensor to a step change in velocity. Kurz manufactures the fastest industrial quality sensors available.


This graph shows a typical response to a step change in temperature for a Kurz Fast Dual (FD) MetalClad™ sensor. It is exceptional and allows use of the sensor for combustion air flow measurements in boilers that mix hot and cold air for temperature control in coal pulverizers, for example.
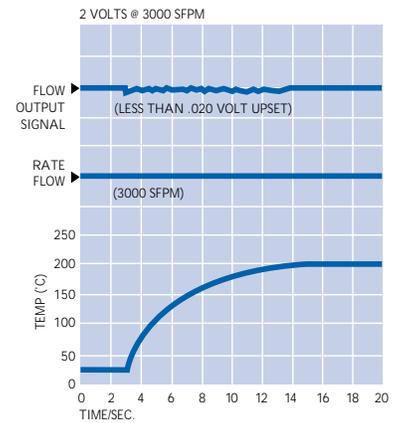

ORIENTATION EFFECTS

The graph shows a typical output response to changes in the incoming velocity direction. Data is shown for rotation and yaw, as defined by the diagram below. Note that the effect is small for angles up to ±20 degrees. This is extremely important for flow applications having severe turbulence and a non-axial velocity direction.
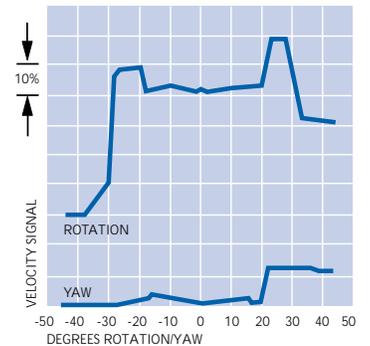
Sensor Measurement Error Versus Rotation/Yaw Angles.
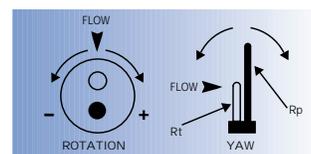
Sensor Rotation and Yaw Description.

MODEL 2444 PORTABLE AIR VELOCITY METER

SPECIFICATIONS

Velocity Range:
Standard: 0-12,000 SFPM

Process Temperature Rating:
-40˚C to 200˚C
(-40˚F to 392˚F)

Process Pressure Rating:
300 PSIG

Sensor Material:
Alloy C-276 Stings with Carpenter 20 Cb-3 sensor base; optional Titanium Nitride Coating

Sensor Support Material:
316L Stainless Steel

Repeatability: 0.25%

Velocity Time Constant:
1 S for velocity changes at 6000 SFPM at a constant temperature and 1 S for temperature changes at a constant velocity of 6000 SFPM.

Process Temperature Time Constant: 8 second at a velocity of 6000 SFPM.

Velocity Accuracy:
See Feature 6 for overall accuracy including the effects of process temperature.

Temperature Accuracy:
±(1/2% of Reading + 1˚C) for velocities above 100 SPFM.

Batteries: Nickel-Metal-Hydride 4.6 AH, 6 cells.

Charger:
100–240 VAC, 50/60 Hz.

Display Module:
Aluminum, Stainless Steel handle with 3 positions.

Display Module Temperature Rating:
-25˚C to +65˚C, non-condensing.

Carrying Case: Foam-lined plastic with handle.

Net Weight: 15 pounds.

Shipping Weight: 18 pounds.

TECHNICAL DESCRIPTION

SENSOR DESIGN
The Model 2444 uses the exceptional FD-MT MetalClad™ all-welded Alloy C276 sensor. In this design, the temperature sensor and velocity sensor are mounted in separate tubes (or "stings"), providing exceptional thermal isolation from the sensor support structure and fast response to process temperature changes.

SENSOR MATERIALS AND CONSTRUCTION
The standard sensor material for all Kurz metal sensors is Alloy C-276. This material is far superior to 316 Stainless Steel in high temperatures and corrosive applications. Kurz offers Titanium Nitride coating for abrasive, dirty applications, such as in boiler coal pulverizers.

PROCESS TEMPERATURE RATING
The FD-MT sensor temperature rating is 200˚C.

PROCESS TEMPERATURE COMPENSATION
The influence of temperature on the thermal properties of gases requires temperature compensation for repeatable and accurate measurements. Since the Model 2444 is used for a wide range of velocity and temperatures, Velocity/Temperature/Mapping (VTM) is used. VTM includes taking velocity calibrations at two or more process temperatures and using the microprocessor to calculate the velocity based on the built-in process temperature measurement. See Feature 6.

AIR VELOCITY CALIBRATION
Air calibrations are performed in the Kurz Model 400D NIST traceable wind tunnel.

SENSOR PROTECTION
Series 2440 electronics includes circuitry to prevent an over-temperature condition caused by a sensor, wiring or component failure. Our sensors will not overheat at zero flow, unlike most competitive devices because of our constant temperature sensor control method and the power limiting design.

VARIABLE PROBE LENGTH
The user may easily make the sensor support longer by adding one or more threaded sections to the Sensor Section. This is done by sliding the extensions over the cable connector and threading them together.

MICROPROCESSOR
Z180, 18 MHz.

SENSOR ELECTRONICS
The Series 2440 has several innovations which improve performance, reduce cost and provide extraordinary flexibility. A new constant temperature bridge circuit includes an efficient switching power supply and allows the microprocessor to calculate the process gas temperature directly using the temperature compensation sensor. The bridge PCB has an EEPROM loaded with the PCB serial number, calibration coefficients, and component values which insure the safety of the data. The sensor electronics includes a sensor lead resistance compensation circuit which is extremely important for long sensor wires, rapid gas temperature changes and large temperature gradients between the sensor and the ambient air.

ANALOG-T0-DIGITAL CONVERTER
A serial 16-bit ADC provides excellent resolution and noise rejection. To minimize noise the user can select the ADC sample rate for 50 Hz or 60 Hz to provide the best noise rejection.

MENUS
The Display, Executive and Programming menus are very easy-to-use and are largely self-explanatory. The flow and temperature data may be scrolled so it can be seen through the window in the cover. The user may press "D" and see the flow and temperature data, as well as the raw flow data. Pressing "H" holds the display screen (but not the readings). A user access code is required for programming, seeing data and entering configuration and other user data.

INTERNAL DATA RECORDING
Series 2440 includes memory to record 1500 data points. This allows the user to record velocity and temperature traverses, for example, and view the data by using the Display/Keypad.

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MODEL 2444 PORTABLE AIR VELOCITY METER

Meter Filter Time Constant:
User Selected 0 to 600 seconds.

EMI Approvals:
CE Compliance light industrial (EN50081-1) for emissions, heavy industrial (EN 50082-2) for Immunity and (EN 61000-4-5) for surges.

Serial Port Baud Rate:
1200, 2400, 4800, 9600, 14000, 19200, 38400.

Analog Outputs (4-20 mA):
Optically isolated, user loop-powered, 12 bit resolution and accuracy, maximum loop-resistance is 500 at 18 VDC, 800 at 24 VDC, 1400 at 36 VDC; meets NAMUR NE43 recommendations.

Digital Outputs:
RS-232 Port for Upload, Download, Record, Echo using user's PC; RS-485 communication port, with Modbus ASCII or RTU Mode. Requires I/O plug-in adapter module.

LCD: Back-lit two-line alphanumeric with 16 characters per line.

LCD Update:
Every two seconds.

Keypad:
20-button membrane.

Memory:
EEPROM for all important data, with automatic sensor identification; Flash EEPROM for Program Memory.

Reference Conditions:
Air at 77˚F, 14.69 PSIA, user selected.

Units: User selected English or Metric.

Data Recording:
1500 sets with time and date.

Microprocessor:
18 MHZ, Z180

Analog-to-Digital Conversion:
16 bit, user selected 50 or 60 Hz sample rate.

Environment:
Industrial quality air, relative humidity to 99%.

HELP SCREENS
By pressing "HH" the user can obtain important information on the use of the Series 2440 including the firmware version, Kurz telephone and fax numbers and the web site address, etc.

FLASH EEPROM PROGRAM MEMORY
The program may be updated in the field by the user using the RS-232 port. This new feature will allow our customers to upgrade to the latest firmware.

SELF DIAGNOSTICS
The Series 2440 performs an extensive check-out upon power-up, and continuously monitors the sensor inputs/outputs and verifies the integrity of the sensor wiring and the measurements. The Sensor Kick-Out feature is used to set the fault limits.

METER FILTER TIME CONSTANT
A digital filter time constant may be set for each METER which affects the display readings and the 4-20 mA outputs. The time constant may set from 0 to 600 seconds.

METER SET-UP
The Series 2440 has three "METERS". METER 01 is Velocity, METER 02 is Flow Rate, METER 03 is Temperature. If the area of a duct or pipe is programmed then the measured velocity will be multiplied by the area to give the flow rate, flow totalization and elapsed time. If In-Situ Flow Calibration Data is taken, the user can enter this "reference" data and the test data points, and the microprocessor will calculate the multipoint correction factors and present the corrected flow rate. A sensor blockage correction can also be entered.

STP CONDITIONS
The mass flow calibration data is referenced to the Kurz laboratory standard of 77˚F/14.69 PSIA (25˚C/760 mmHg). The user may change the STP conditions to suit his requirement in either English or Metric Units.

BAUD RATE SELECTIONS
The user may set the RS 232/RS 485 baud rate to 1200, 2400, 4800, 9600, 14400, 19200, or 38400.

4-20 mA OUTPUTS
These loop-powered outputs are optically isolated, and include the NAMUR NE43 recommendation regarding fault detection. The fault conditions are set at the Kurz Factory, but may be set by the user. The user may easily calibrate the 4-20 mA outputs by entering the Output Calibration menu, measuring the output and adjusting it using the LCD/Keypad. See Feature 7.

LOW VELOCITY CUT-OFF
The user may select a low velocity cut-off value such as 20 SFPM to eliminate nuisance readings.

BACK-LIT LCD SWITCH
This momentary switch is on the display module.

BATTERY VOLTAGE DISPLAY
The user can touch "D" on the keypad and scroll through the METER data and also see the battery level. A fully charged battery will operate for about 2-1/2 hours at 4000 SFPM.

FIRMWARE
The Series 2440 firmware supports:
► Remote Terminal Operation of the Display Module via RS-232 or RS 485.
► Data Transfer of the internal logged data to a PC in a spreadsheet compatible format.
► METER Summary Command (L) for external data logging from any computer. See the PC Data Logging Program, PN 451029.
► External/Remote data logging via Modbus RTU or ASCII protocol. See Feature 7 for details.

ORDERING INFORMATION

The Selection Table below lists the Model Number, Parent Number and Technical Data.

MODEL 2444 SELECTION TABLE

Model Number	Parent Number	Sensor Support Diameter	Process Temperature Rating	Process Pressure Rating	Sensor Type
2444	754040	3/4"	200˚C	300 PSIG*	FD-MT

* The sensor section and the screw-together extensions can easily withstand this pressure but the joints will leak a small amount

PROCESS TEMPERATURE RATING

Identifier	Description	Range
MT	Medium Temperature	-40˚F to 392˚F
		-40˚C to 200˚C

SENSOR TYPE

Identifier	Description	Time Response[1]	Applications
FD-MT	Fast Dual-MetalClad Velocity Sensor, all-welded Alloy C-276 construction.	Velocity: 1 Sec. Temperature: 1Sec.	Pipe/Ducts, Velocity Traverses, Dirty Air, Fast Changing Gas Velocity and Temperature, Pipe I.D. 2.5" and larger.

Note 1: Time response is the time required to attain 63% (1 time constant) of the original reading after a step change in process temperature in constant velocity, or a step change in velocity at constant process temperature at an initial mass velocity of 6000 SFPM.

PART NUMBER GENERATION PROCEDURE

Specify the entire Part Number using the Parent Number followed by an Option for each Feature as shown in the Part Number example below. Feature Options printed in bold type indicate the standard product, other options usually require a longer delivery time.

| 754040 | 13 | 24 | 13 | 18 | 01 | 24 | 10 |

Parent Number - F1 - F2 - F3 - F4 - F5 - F6 - F7

SUMMARY OF FEATURES

Feature	Feature Description
1	**Sensor Type/Sensor Material**
2	**Sensor Support Material/Length**
3	**Sensor Cable Material/Length**
4	**Gas Velocity Calibration Data Range**
5	**Speciality Gas Velocity Calibration**
6	**Process Temperature Compensation**
7	**I/O Adapter, Digital Outputs/4-20 mA Outputs**

FIRST DIGIT OF FEATURE 1: SENSOR TYPE

Option	Description
1	FD-MT

SECOND DIGIT OF FEATURE 1: SENSOR MATERIAL

Option	Description
3	Alloy C-276 Sensor Stings
7	Titanium Nitride Sensor Coating on Option 3 material

FIRST DIGIT OF FEATURE 2: SENSOR SUPPORT MATERIAL

Option	Description
2	316L Stainless Steel

SECOND DIGIT OF FEATURE 2: SENSOR SUPPORT LENGTH (NOTE 1)

Option	Description	Total Length
1	Sensor Section	16.5"
2	Sensor Section + 1 Extension	32.5"
3	Sensor Section + 2 Extensions	48.5"
4	Sensor Section + 3 Extensions	64.5"

Note 1: See the Series 2440 Accessories for additional or replacement extensions.

FIRST DIGIT OF FEATURE 3: SENSOR CABLE MATERIAL

Option	Description
1	Teflon Insulated Cable

SECOND DIGIT OF FEATURE 3: SENSOR CABLE LENGTH (NOTE 1)

Option	Description
3	16 Feet

Note 1: For a longer cable purchase an extension cable (8', 16', 24') which gives a great deal of flexibility and convenience. See the Series 2440 Accessories.

FEATURE 4: GAS VELOCITY CALIBRATION RANGE

The velocity data ia taken in English Units and Standard Reference Conditions (STP) of 77˚F and 14.69 PSIA. If Metric Velocity units or a different STP is required, the user can easily change the STP Reference, and select English or Metric Units using the Display/Keypad. A sufficient number of calibration data points are taken to ensure accuracy over the entire range.

FEATURE 4: GAS VELOCITY CALIBRATION DATA RANGE

Option	Description
18	12,000

FEATURE 5: SPECIALTY GAS VELOCITY CALIBRATION

Option	Gas Type
01	Air

FEATURE 6: PROCESS TEMPERATURE COMPENSATION

The influence of temperature on the thermal properties of gases and the operating temperature of a thermal mass flow sensor requires temperature compensation for repeatable and accurate measurements. Since the process temperature and gas velocity may vary widely, Velocity/Temperature/ Mapping (VTM) is used. VTM includes the standard temperature compensation procedure and velocity calibrations in air at two or more process temperatures. These multiple velocity calibrations are entered into the Microprocessor which performs a double interpolation between the velocity calibration curves using the built-in process gas temperature measurement.

FEATURE 6: PROCESS TEMPERATURE COMPENSATION

Option	Description
24	Velocity/Temperature/Mapping (VTM) with three calibration data sets over the process temperature range of -40˚C to 200˚C. Accuracy: ±[3% of Reading + (20 SFPM + 0.25 SFPM/˚C)], above or below 25˚C.

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FIRST DIGIT OF FEATURE 7: I/O ADAPTER, DIGITAL OUTPUTS

Option	Description
0	No I/O Adapter Module; no Digital or Analog Outputs.
I	I/O adapter module which plugs into the multi-pin module with a 2 ft cable. Includes a 6 ft RS-232 cable with the DB9F connectors for connecting between the I/O Adapter and a PC and a third connector used for field upgrades of the firmware. I/O Adapter supports RS-485 or RS-232 and two isolated loop-powered 4-20 mA outputs. Upload/download configuration transfer software is provided for a Windows PC. The Series 2440 firmware supports: ▶ Remote terminal operation of the Series 2440 Display Module via RS-232 or RS-485. ▶ Data transfer of the internal logged data to a PC in a spreadsheet compatible format. ▶ METER summary command (L) for external data logging from any computer. (For example, see the Kurz PC data logging program PN 451029) ▶ External/Remote data logging via Modbus, RTU or ASCII protocol.

SECOND DIGIT OF FEATURE 7: 4-20MA OUTPUTS (NOTE 1)

| Option	Number	Description
0	0	No 4-20 mA Outputs.
2	2	Two 4-20 mA Outputs loop-powered, AC/DC optically isolated.

Note 1: Option 1 of the First Digit of Feature 7 must be specified if the 4-20 mA option is ordered.

SERIES 2440 ACCESSORIES

| P/N	Description
150525	Model 2444/2445 Sensor Support Extensions.
260111-01	Series 2440 Sensor Extension Cable, Teflon, 8' long.
260111-01	Series 2440 Sensor Extension Cable, Teflon, 16' long.
260111-03	Series 2440 Sensor Extension Cable, Teflon, 24' long.
320029	Series 2440 Battery, 4.5 Ah, six cell, NiMH.
260108	Series 2440 AC Power Cord for Charger.
330046	Series 2440 AC Charger, 100–240 VAC, 50/60 Hz.
260110	Series 2440 Vehicle Charger Adapter, 12 VDC.
420334	Series 2440 I/O Adapter Module.
451029	PC Data Logging Program, CD-Rom, Manual.
260102	RS232 Cable, for upload/download, data transfer to PC and Firmware updates.
260106	Series 2440 I/O Adapter Cable.
150540	Model 2444/2445 3/4" MNPS by 5/8"-UNEF Sensor Support Adapter.

ORDERING INFORMATION

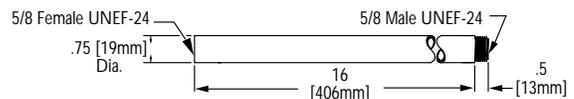Contact the Kurz Representative or the Kurz Factory to place the order or to obtain additional information.
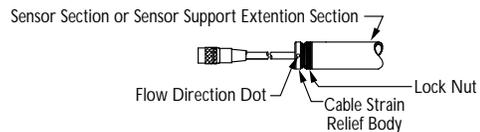
MODEL 2444 OUTLINE DRAWINGS
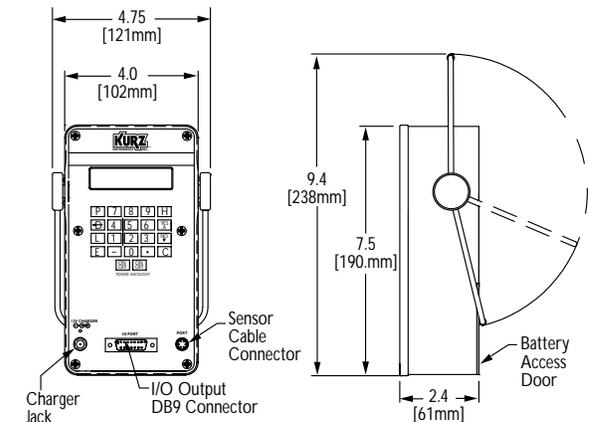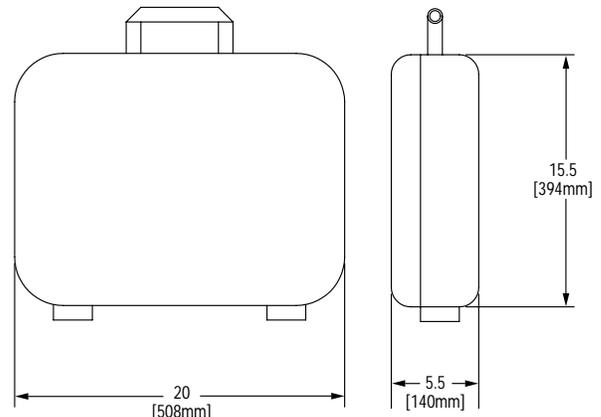

Series 2440 Display Module
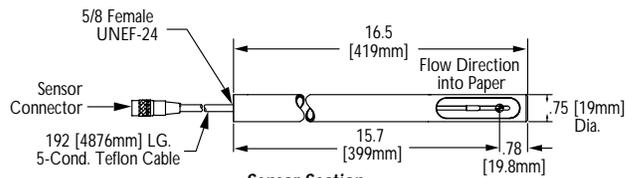
Sensor Section

Sensor Support Extention Section

Cable Strain Relief Fitting with Lock Nut

Model 2444 Sensor

Model 2444 Carrying Case

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