Thermal Mass Flow Meter
Quick Start Guide
Copyrights and Trademarks

Copyright © 2013 Kurz Instruments, Inc.

All rights reserved.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system without express written permission from Kurz Instruments, Inc. 2411 Garden Road, Monterey, California 93940; Phone: 831-646-5911, Fax: 831-646-8901, or www.kurz.instruments.com

The material in this manual is for information only and is subject to change without notice. Every reasonable effort has been made to ensure that the information in this manual is complete and accurate. Kurz Instruments, Inc. makes no representations or warranties of any kind concerning the contents of this publication, and therefore assumes no liability, loss, or damages resulting from use, errors, or omissions in this publication or from the use of the information contained herein. Kurz Instruments, Inc. is not responsible for printing or clerical errors.

Kurz Instruments, Inc., reserves the right to make engineering changes, product improvements, and product design changes without reservation and without notification to its users. Consult your Kurz Instruments, Inc. representative or a factory applications engineer for information regarding current specifications.

Kurz Instruments, Inc. assumes no liability for damages or injuries (consequential or otherwise) caused by the improper use and/or improper installation of this product or where this product is used in any application other than what it was designed for and intended. Kurz Instruments, Inc. expressly denies any responsibility if this product has been modified without Kurz Instruments, Inc. written approval or if this product has been subjected to unusual physical or electrical stress, or if the original identification marks have been removed or altered.

Equipment sold by Kurz Instruments, Inc. is not intended for use in connection with any nuclear facility or activity unless specifically sold for such applications and specific conditions for such usage are detailed. If the equipment is used in a nuclear facility or activity without supporting quotation, Kurz Instruments, Inc. disclaims all liability for any damage, injury, or contamination, and the buyer shall indemnify and hold Kurz Instruments, Inc., its officers, agents, employees, successors, assigns, and customers, whether direct or indirect, harmless from and against any and all losses, damages, or expenses of whatever form and nature (including attorneys fees and other costs of defending any action) which they, or any of them, may sustain or incur, whether as a result of breach of contract, warranty, tort (including negligence), strict liability or other theories of law, by reason of such use.

The Kurz logo is a trademark of Kurz Instrument, Inc., registered in the U.S. and other countries. Use of the Kurz logo for commercial purposes without the prior written consent of Kurz Instruments, Inc. may constitute trademark infringement in violation of federal and state laws. MetalClad, Series MFTB, Series 454FTB, Series 504FTB, Series 534FTB, and KBar-2000B are trademarks of Kurz Instruments, Inc.

Other company and product names mentioned herein are trademarks of their respective owners. Mention of third-party products is for informational purposes only and constitutes neither an endorsement nor a recommendation. Kurz Instruments, Inc., assumes no responsibility with regard to the performance or use of these products.
# Table of Contents

**Preface** ........................................................................................................ iii
Before You Begin ................................................................................................ iv
Using this Manual ............................................................................................ iv
Manual Conventions ....................................................................................... iv

## Chapter 1

**Installation** .................................................................................................. 1-1
  Overview ........................................................................................................ 1-1
  Unpacking ...................................................................................................... 1-2
  Hardware Description .................................................................................... 1-2
  Installation Requirements ............................................................................. 1-3
    Insertion Flow Meters .............................................................................. 1-3
    Insertion Flow Meter Guidelines ............................................................. 1-5
    In-Line Flow Meters .................................................................................. 1-6
    In-Line Flow Meter Guidelines ................................................................. 1-6
  Wiring Requirements .................................................................................... 1-7
  K-BAR Flow Meter System .......................................................................... 1-8
    Multipoint Flow System Guidelines ....................................................... 1-8
    K-BAR Configuration ................................................................................. 1-9
Preface
Before You Begin

Important  The device warranty is void if the device is not installed in accordance with the specified installation requirements. Read and thoroughly understand the installation requirements before attempting to install the device. If you have any questions, contact your Kurz customer service representative before attempting installation.

Using this Manual

Kurz Instruments, Inc., documentation includes manuals, product literature, Adobe Acrobat PDF files, and application online Help files. The Kurz Instruments CD contains all the available documentation files. To read PDF files, download the free Adobe Acrobat Reader from www.adobe.com.

The Kurz Instruments Web site provides additional information:

- **World Wide Web**: www.kurzinstruments.com
- **Email**: service@kurzinstruments.com
- Documentation links to the most current manuals and literature

You can access device support in the following ways:

- **Main**: 831-646-5911
- **Phone**: 800-424-7356
- **Fax**: 831-646-8901

Manual Conventions

The following table lists conventions used in the Kurz Instruments, Inc., documentation, and gives an example of how each convention is applied.

<table>
<thead>
<tr>
<th>Convention</th>
<th>For Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text type, click, or select (for example, field names, menus, and commands) are shown in bold.</td>
<td>Check the Configuration File checkbox.</td>
</tr>
<tr>
<td>Text appearing in a display or window is shown in courier.</td>
<td>PRESS ENTER TO SET METER DATA</td>
</tr>
<tr>
<td>An arrow (→) is used to separate a menu name from its menu command.</td>
<td>Select Start→All Programs→Kurz Instruments→KzComm.</td>
</tr>
<tr>
<td>Simplified directory structures and path names are used in examples. Your folder names may be different.</td>
<td>Programs Files\Kurz Instruments\KzComm.</td>
</tr>
</tbody>
</table>
Thank you for purchasing one of the finest thermal mass flow meters available in the industry. Kurz Instruments has a strong reputation for designing and manufacturing highly accurate and responsive thermal mass flow meters for industrial gas flow measurement. For more than 35 years our team has successfully provided solutions to our customers most demanding and difficult applications. Kurz products are used in a wide variety of industrial applications including combustion air, aeration air flow, digester gas, nuclear power plants, flare stack monitoring, and compressed air.

This guide is for the following B-Series devices using firmware v2.x:

- Series 454FTB (insertion)
- Series 454FTB-WGF (insertion)
- Series 504FTB (in-line)
- Series 504FTB-CL2 (in-line)
- Series 534FTB (in-line)
- Series K-BAR 2000B (multipoint)

This Quick Start Guide is an abbreviated version of the B-Series Hardware Guide. Once your flow meter is correctly installed, refer to the following guides:

- KzComm User Guide for accessing your flow meter configuration parameters using KzComm or a terminal emulator, and configuring the USB port.

All guides are available on the customer CD and online.
Unpacking

Your Kurz flow meter is shipped with the following items:

- Flow meter
- Calibration certificate
- Customer CD
- Quick lookup card (additional copies are available in the B-Series Operations Guide and the B-Series Hardware Installation Guide)

Hardware Description

The Kurz flow meter electronics head has front and back covers. The front cover allows access to the display/keypad (optional), and the back cover allows access to wiring connections.

The features for the B-Series flow meter shown in the figure include:

1. ¾-inch FNPT signal and power conduit ports
2. Backlit 2x16-character display and 20-character keypad interface (optional)
3. ¾-inch FNPT sensor support port (transmitter-attached version), conduit or cable port (transmitter-separate version)
4. Safety label and product ID tag
5. AC power input — 85 to 265 VAC 50/60 Hz 1 phase
6. Optional hardware, AI, DO, DI, Purge valve, I/O connector TB6
7. Power indicator — green LED, right side of TB1
8. Main I/O wiring terminal block for sensor, power, RS-485 and 4-20 mA outputs, TB1
9. External and internal ground lug locations and shielded wire pig-tail termination location
10. USB mini-B connector
Installation Requirements

The flow meter must be installed and used in accordance with safe design and standard industry practices, accounting for the process pressures, corrosion, temperature, and any potentially hazardous areas.

Important The device warranty is void if the device is not installed in accordance with the specified installation requirements. Read and thoroughly understand the installation requirements before attempting to install the device. If you have any questions, contact your Kurz customer service representative before attempting installation.

Each flow meter has a flow arrow below the sensor electronics head. The arrow indicates the direction of the process flow, as designated in your order specifications.

The electronics head on the sensor support must be accessible for wiring. Wiring requirements include electrical and communications (computer) connections.

- For transmitter-attached (TA) devices with the display/keypad option, the area must allow for viewing and accessing the display/keypad.
- For transmitter-separate (TS) devices, the area must provide a location for mounting the transmitter electronics and a connection from the transmitter to the sensor electronics.

Insertion Flow Meters

Insertion flow meters have a sensor support connected to an electronics head. Remove the protective shipping cover from the tip of the probe support before installing the device. The probe sensors must have direct contact with the process flow.

Important Do not bend the probe sensors. The probe sensors get extremely hot when the flow meter is powered ON. Do not touch the sensors unless the flow meter is powered OFF and there has been sufficient time for the sensors to cool down.

Insertion meters must be mounted to the pipe/duct with a compression fitting, flange mounted, or packing gland and all mountings must be checked to ensure there are no leaks. Considerable force can be exerted on the probe support and flange when the process gas is under pressure.

The insertion depth depends on the duct size and sensor size. The sensor should be center mounted into the pipe or duct so the sensing element is in the middle where there is the most stable flow profile. Due to the recommended placement, a 2.5-inch diameter pipe is the suggested minimum. However, installing a compression fitting, flange, or packing gland offer some flexibility in the sizing recommendation.

Important The probe support must not be altered or modified for any reason.
Dry gas and wet gas process flows have different probe angle requirements.

- For the Series 454FTB flow meter with dry gas flows, the probe can be inserted at any angle that meets the general installation requirements.
- For the Series 454FTB-WGF flow meter, the ideal location is at a 45-degrees up angle so that condensed water flows away from the sensor.

Additionally, the flow meter should be installed away from flow disruptions (such as elbows or branches) to ensure the flow meter provides the best repeatability and accuracy.

\[
A = \pi R^2 + SBCF = \frac{A}{(A + 12dL)} + \frac{V_{avg}}{V_s \cdot CF(v)}
\]

where:
- \( A \) = area in \( \text{ft}^2 \) or \( \text{m}^2 \)
- \( R \) = inside radius
- \( SBCF \) = SBCF
- \( d \) = probe diameter in feet or meters
- \( L \) = probe depth in feet or meters
- \( V_{avg} \) = average flow velocity
- \( V_s \) = sensor velocity
- \( CF(v) \) = velocity correction factor

![Diagram of flow meter installation](image_url)
Insertion Flow Meter Guidelines

Before installing and operating an insertion flow meter, confirm the following information:

Mount the probe support so the probe sensors are centered in the duct/pipe. This location has the most stable flow reading. Note the flow arrow points in the direction of the process flow.

The upstream-downstream distance from flow profile disruptions are 5x diameters downstream and x diameters upstream. This provides a 2% maximum error from the baseline straight pipe calibration for the distance criteria. Longer straight runs reduce this error level.

**Disruption Types:**
- Valves change the flow profile as they open and close.
- Branching joints change the flow profile as the percentage of flow between the branches.
- Elbows or direction changes disrupt long-run pipe profiles by creating a flow profile that wobbles or moves depending on the flow rate. The distance from elbows can be reduced by using field calibrations.
- Multiple elbows impart a swirl that requires increasing the upstream distance, typically up to 50% more distance.
- A line size change can introduce instability. The distance from a line size change can be reduced by using field calibrations.

The duct or pipe inside dimensions are used to determine the flow area of the meter. An area wizard in the meter setup menu walks you through entering the data and the meter will calculate the flow area.

The Sensor Blockage Correction Factor (SBCF) is a result of the probe support blocking some of the flow area and accelerating the velocity in the duct/pipe cross section. By measuring from the end of the sensor window to the duct inside wall and entering the insertion depth (L) in the Meter Setup menu, the flow meter will calculate the SBCF.

Insertion flow meters provide good repeatability, but the absolute flow number requires a reference flow measurement (field calibration data). The velocity-dependent (CFv) correction factor is the ratio of True Reading to Indicated Reading. Using a point velocity sensor, convert the volumetric flow rate or mass flow rate based on the area and the average velocity.

Contact Kurz or a field calibration company.
In-Line Flow Meters

In-line flow meters provide excellent accuracy and dependability for small line sizes.

In-Line Flow Meter Guidelines

Before installing and operating an in-line flow meter, confirm the following information:

Note the flow arrow points in the direction of the process flow.

The upstream-downstream distance from flow profile disruptions are 5x diameters downstream and x diameters upstream. This provides a 2% maximum error from the baseline straight pipe calibration for the distance criteria. Longer straight runs reduce this error level.

**Disruption Types:**
- Valves change the flow profile as they open and close.
- Branching joints change the flow profile as the percentage of flow between the branches.
- Elbows or direction changes disrupt long-run pipe profiles by creating a flow profile that wobbles or moves depending on the flow rate. The distance from elbows can be reduced by using field calibrations.
- Multiple elbows impart a swirl that requires increasing the upstream distance, typically up to 50% more distance.
- A line size change can introduce instability. The distance from a line size change can be reduced by using field calibrations.

**Confirm flow arrow:**
Yes ___  No___

**Disruption distance:**
Down _________  Up _________
Wiring Requirements

Kurz insertion and in-line thermal flow meters are 4-wire devices, with two wires for power and two wires for signal. There can be four wires for signal if the feature was ordered. The 4-20 mA analog output (AO) connections are for reading flow, temperature, or velocity. The power input is either 24VDC or 85-265VAC. Refer to the B-Series Hardware Guide for a complete set of wiring diagrams.

Transmitter Attached (TA) Wiring

Transmitter Separate (TS) Wiring
**K-BAR Flow Meter System**

The K-BAR is a multipoint sensor array used to measure the flow in applications that:
- Have changing flow profiles at the same flow rate (such as near valves, dampers, or branching duct work)
- Need higher system reliability due to redundant sensors
- Need lower flow noise from averaging a duct cross section

**Multipoint Flow System Guidelines**

Before installing and operating a multipoint flow system, confirm the following information:

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>How stable are the gas properties?</td>
<td></td>
</tr>
<tr>
<td>Is more than one gas state being supported?</td>
<td></td>
</tr>
<tr>
<td>What are the expected average velocities?</td>
<td></td>
</tr>
<tr>
<td>What is the minimum velocity?</td>
<td></td>
</tr>
<tr>
<td>What is the maximum velocity?</td>
<td></td>
</tr>
<tr>
<td>What are the accuracy expectations?</td>
<td></td>
</tr>
<tr>
<td>Is there a plan for field calibration?</td>
<td></td>
</tr>
<tr>
<td>What are the process temperatures?</td>
<td></td>
</tr>
<tr>
<td>How much dirt is present in the flow stream?</td>
<td></td>
</tr>
<tr>
<td>What kind of vibrations levels are present in the duct?</td>
<td></td>
</tr>
<tr>
<td>What kind of vibrations levels are present near the electronics location?</td>
<td></td>
</tr>
<tr>
<td>What kind of vibrations levels are present near the flow computer location?</td>
<td></td>
</tr>
<tr>
<td>What is the inner dimension of the duct?</td>
<td></td>
</tr>
<tr>
<td>What is the outer dimension of the duct?</td>
<td></td>
</tr>
<tr>
<td>Is there clearance next to the mounting location for inserting the K-BAR, including its J box or attached electronics?</td>
<td></td>
</tr>
<tr>
<td>What kind of wall reinforcement will be needed?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Not Stable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Very Stable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Accuracy</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>High Accuracy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Kurz Thermal Mass Flow Meter Quick Start Guide
K-BAR Configuration

The system is composed of two components.

- The sensor array
- The flow computer, which collects and processes the array data into flow and temperature outputs

Each K-BAR array is custom-sized to measure the process velocity in equal area zones. The average total duct flow is computed based on the duct area using and field calibration factors specified at startup.

The length of the K-BAR probe support determines the mounting requirements. The probe support must be held in place with sufficient rigidity to minimize the vibrations created by the process, and there must be enough clearance for installation and maintenance.

As shown in the diagram, a single-end support installation (categories A, B, E, and F) is cantilever mounted from the flange. The size and length of the flange mounting adapter is determined by the K-BAR specifications. For high vibration applications or when access is limited to one side, a double-end mounting installation (categories C, D, G, and H) is recommended. The double-end support uses a probe support cup on the side opposite the mounting flange.

Round Stacks / Ducts

- Category A: Half span, single-end support
- Category B: Full span, single-end support
- Category C: Full span, external-end support
- Category D: Full span, internal-end support

Rectangular Stacks / Ducts

- Category E: Half span, single-end support
- Category F: Full span, single-end support
- Category G: Full span, external-end support
- Category H: Full span, internal-end support
Most K-BAR installations are flange mounted. In environments where the stack/duct pressure does not match ambient, the clearance gap between the K-BAR probe and flange mounting adaptor can cause significant blow-by. The K-BAR should be installed during a planned outage to reduce safety risks and improve the ease of the installation.

The electronics and wiring locations are determined by several factors such as the application environment, weather, temperatures, vibration, and maintenance requirements. The two most common installation types are:

- **Transmitter attached**
  
  Transmitter-attached installations send a linearized 4-20 mA flow signal to the flow computer. Each sensor has its electronics on the end of the K-BAR, which minimizes wiring and EMC requirements.

- **Transmitter separate**
  
  Transmitter-separate installations typically use a short service loop between the transmitter electronics and the sensor wire junction box on the end of the probe. The wire gage and conduit shielding determine the length you can run the sensor wires. The wire from the K-BAR to the transmitter electronics must be shielded in solid conduit, EMT, or braided shielded cable using peripheral bonds at each end.

Refer to the *B-Series Hardware Guide* for a complete set of wiring diagrams.