KURZ™ INSTRUMENTS, INC.

IK-EVA™ 4200
Multi-Point Isokinetic Sampling System
User's Guide

Customer Name: ______________________

P.O. Number: ______________________

Date of Order: ______________________

Complete Model Number: ______________________

Kurz™ Order Number: ______________________

Serial Number: ______________________

Document Number: 360118, Rev. A

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Unit Description Sheet

Complete Model Number: ______________________

Kurz Order Number: ______________________

Customer P. O. Number: ______________________

Purchasing Specification:

Flow Rate/Velocity: ______________________

Stack/Duct Size: ______________________

Wall Thickness: ______________________

Nominal Pressure: ______________________

Nominal Temperature: ______________________

Series 193 System Enclosure: ______________________

Input Power To System Enclosure:

☐ 115 VAC - 60 Hz

☐ 230 VAC - 50 Hz

ADAM Configuration:

______ Input Channels (22 maximum)

______ Meters (12 maximum)

______ Analog Outputs (8 maximum)

______ Alarms (16 maximum)

______ Channel Kickout is Enabled

______ % (or more) of Full Scale Enables High Kickout

______ % (or less) of Full Scale Enables Low Kickout

______ Printer is ON

______ RS-232 is ON

IK-BAR Size:	☐ IK-BAR 12; Length: ____________	
	☐ IK-BAR 24; Length: ____________	
IK-BAR Construction:	☐ 316 Stainless Steel	
	☐ Aluminum	
	☐ Hastelloy	
	☐ PVC	
	☐ Other: ____________________	
Sensor:	☐ Mini Dual-Sting MetalClad Sensor	
	☐ Dual-Sting MetalClad Sensor	
	☐ Other: ____________________	
	☐ Tefzel Sensor Cable	
Current-Transmitters:	465R____	
Series 195 Enclosure:	____________________________	
Mounting Configuration:	☐ TASE (Transmitter Attached, Single-Ended)	
	☐ TADE (Transmitter Attached, Double-Ended)	
	☐ TSSE (Transmitter Separate, Single-Ended)	
	☐ TSDE (Transmitter Separate, Double-Ended)	
Mounting Hardware:	☐ Carbon Steel FMA (Flange Mounting Adapter) for duct	
	☐ DESC; Material: ______________________	
	☐ IK-FMA; Material: ____________________	
Sampling Meter:	☐ 505- ______________________	
	Inlet Fitting Size: ____________	
	Outlet Fitting Size: ___________	
	☐ 450- ______________________	

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Document Title: *IK-EVA 4200 Multi-Point Isokinetic Sampling System User's Guide (With ADAM)*

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Because the IK-EVA systems are modular, each system and installation is unique. Kurz attempts to provide reasonable documentation generic in nature and covering typical systems and installations. No guarantee is made that an IK-EVA system was built accoding to standard procedures. Extensive typical drawings are available for use in field installations. Customers who desire as-built drawings should contact the factory for price quotations.

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The Kurz IK-EVA 4200 Multi-Point Isokinetic Sampling System is warranted to be free from defects in material or workmanship for one year from the date of shipment from the factory. Kurz's obligation is limited to repairing, or at its option, replacing products and components that, on verification, prove to be defective. Warranty work will be performed at the factory in Monterey, California. Kurz shall not be liable for installation charges, for expenses of buyer for repairs or replacement, for damages from delay or loss of use, or other indirect or consequential damages of any kind. Kurz extends this warranty only upon proper use and/or installation of the product in the application for which it is intended and does not cover products that have been serviced or modified by any person or entity other than Kurz Instruments Incorporated and its authorized service technicians. This warranty does not cover damaged sensors, units that have been subjected to unusual physical or electrical stress, or upon which the original identifications marks have been removed or altered.

Transportation charges for material shipped to the factory for warranty repair are to be paid for by the shipper. Kurz will return items repaired or replaced under warranty prepaid. No items shall be returned for warranty repair without prior authorization from Kurz. Call Kurz Instruments service department at (408) 646-5911 to obtain a return authorization number.

This warranty contains the entire obligation of Kurz Instruments Incorporated. No other warranties, expressed, implied, or statutory are given.

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About This Book

This book contains five sections and five appendixes, each of which is briefly described below. The book is not designed to be read cover to cover; rather, it is designed to present information to the IK-EVA 4200 user in as accessible a manner as possible.

Organization

Section 1: Product Overview

This section introduces you to the purpose, components, and specifications of the IK-EVA 4200 system.

Section 2: Installation

Section 2 explains how to install your IK-EVA system.

Section 3: Operation

This section describes the operator controls and explains how to use the IK-EVA system.

Section 4: Programming the ADAM

This section describes ADAM's programming mode that allows the system to be customized for the application.

Section 5: Routine Maintenance and Testing

This section describes how to perform routine maintenance such as cleaning the sensors and the 730 valve. It also provides test procedures for verifying the operation of the electronics of the system.

Appendix A: Engineering Drawings

Appendix A contains drawings that are helpful during installation because they illustrate the interconnections between components of the IK-EVA system.

Appendix B: Sensor Placement Examples

The EPA and ANSI both provide standards for monitoring gas velocities in ducts and stacks. In common use are EPA methods 1 and 2 and ANSI method N13.1-1969. Each is described briefly in this appendix.

Appendix C: Kurz Equipment Storage Requirements

The Kurz specification for equipment storage requirements provides general storage criteria and specifies the minimum storage and maintenance requirements for the supplied equipment for periods up to five years at the manufacturer's facilities, the plant sites, or other storage facilities.

Appendix D: Calculations and ADAM Setup Data

Appendix E contains reference data that is important to understanding the system configuration. A copy of the calibration sheets are included in this section as are tables summarizing the ADAM programming.

About the Art in This Book

The computer-generated art in the main sections of this book is intended to illustrate particular points under discussion. It includes only as much detail as is relevant to the discussion at hand. No attempt has been made to accurately scale these drawings or to include details not under discussion in the text that precedes and follows each drawing. If you need more detailed and precise visual information, refer to the appropriate engineering drawings included in Appendix A.

Section 1: Product Overview

1.1 Introduction to Isokinetic Sampling

The purpose of isokinetic sampling is to withdraw a representative sample of particles in an air or gas stream at the same rate (velocity) at which the air or gas flows through the stack. Isokinetic sampling means that the sample flow rate is proportional to the flow rate in the duct or stack. Under such conditions, minimal interference is imparted on the air or gas, such that particles in the air or gas do not cross streamlines either to enter or to bypass the sampling nozzles.

Isokinetic sampling is required for all extractive, particulate, source-measurement methods (EPA Methods 5 and 17 for example) and in sampling airborne, radioactive materials (ANSI N13.1-1969). EPA Method five is a manual test method which uses a Pitot tube for measuring velocity and a calibrated orifice for measuring sample flow rate at each specified sample point in the duct or stack being tested. A complex series of calculations are required to set the proper sample flow rate at each sample point. Equal sample times are used at each point where each sample point represents the center of an equal area of flow within the duct or stack, thereby obtaining an accurate isokinetic sample of the entire area of the duct or stack.

Continuous isokinetic sampling systems have generally used several fixed sampling nozzles and velocity sensors mounted within the duct, each of which are located at the center of equal flow areas, thereby performing an "instantaneous" velocity traverse. Many systems use an averaging, multi-point Pitot tube to measure the average velocity and a sampling "rake" (with several nozzles) to withdraw the sample. Generally, an orifice-type flow meter is used to measure the total sample flow rate, with the flow rate held proportional to the average velocity. Pneumatic isokinetic systems as described may be manually or automatically operated.

1.2 System Overview

The Kurz Series 4200 Isokinetic Sampling System is a continuous, automatic, isokinetic stack sampling system. Operation of the 4200 is fairly simple and straightforward. The 4200 system calculates the average flow in a duct or stack and draws an isokinetic sample based on that flow rate. The sample flow is controlled by comparing the 0-5 Vdc linear output signal representing the average flow in the duct or stack with the 0-5 Vdc linear output signal representing the flow rate through the sampling nozzles.

The sample is withdrawn by a vacuum system (typically a pump), with the flow rate regulated through the 730 Series Flow Control Valve. If the sample drawn through the nozzles is not proportional to the flow in the vent stack, the 710 Isokinetic Controller sends a signal to open or close the valve, until the velocity sample flow is proportional to the stack flow velocity. An isokinetic alarm can be activated when the sample is not drawn isokinetically.

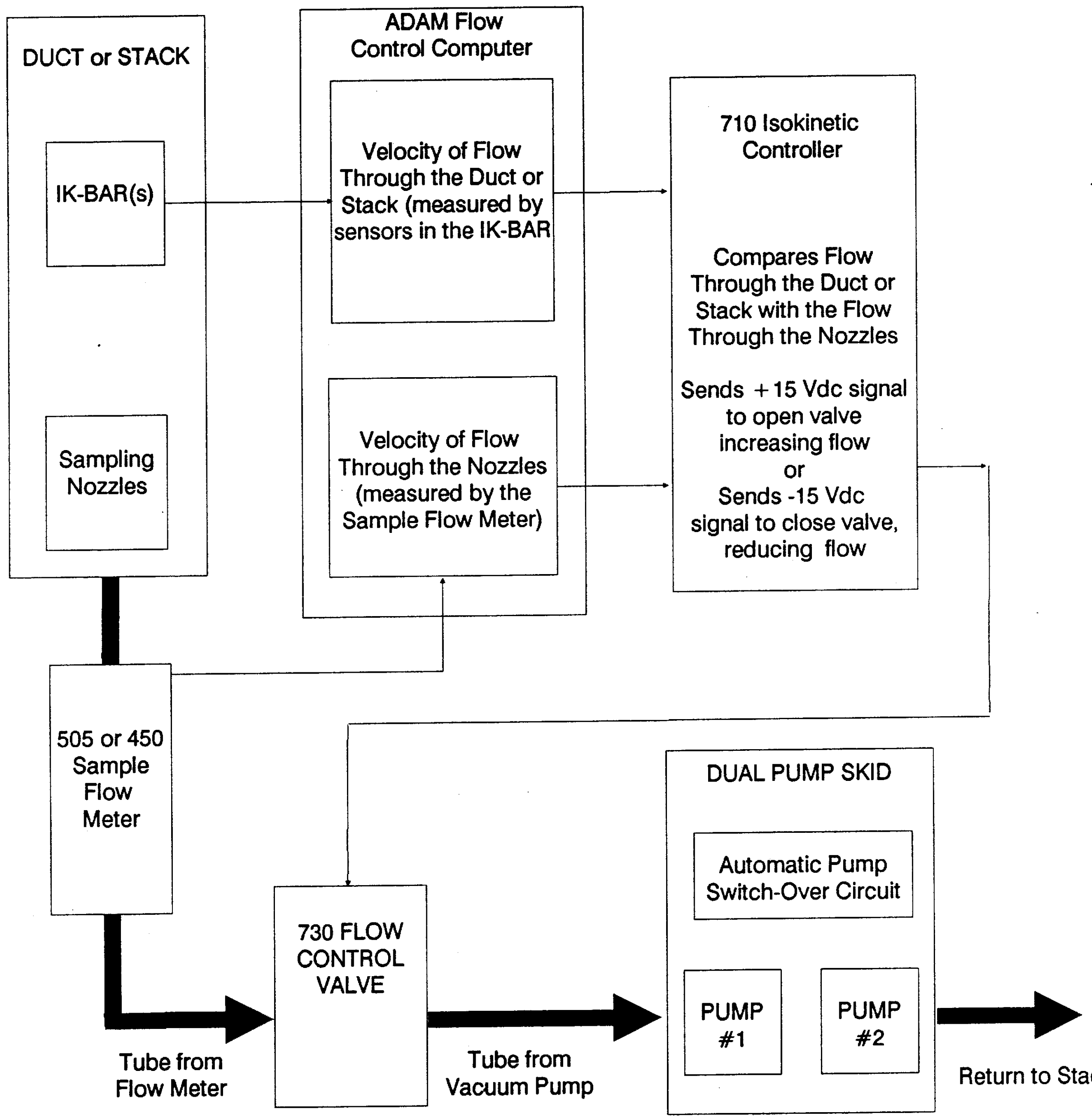
A simplified block diagram of the system's operations is provided on the next page in Figure 1-1.

1.3 System Components

Typical IK-EVA 4200 Systems include the following components:

- One or more IK-BAR(s) with attached sampling rakes
- Series 195 Current-Transmitter Enclosure
- 450 Insertion Sample Flow Meter or 505 In-Line Sample Flow Meter (may be integrated into a flow splitter)
- 730 Series Flow Control Valve
- Vacuum Pump (or dual-pump skid with 2 pumps and automatic switch-over circuitry)
- ADAM Series 155 Mass Flow Computer with Thermal Printer
- 710 Isokinetic Controller
- 111-8 Alarm Module
- One or more 132 Isolated 4-20mA Output Modules
- Model 40 Field Calibrator
- Series 193 System Enclosure with Series 191 Power Supply

Figure 1-1. *Simplified Block Diagram of Isokinetic Operation*



1.3.1 The IK-BAR Sensors and Sampling Nozzles

The 4200 uses one or more IK-BAR probe assemblies to measure the air or gas flow in the duct or stack and to withdraw a representative sample through sampling nozzles attached to the sample rake(s) on the IK-BAR. In most cases the low-particle loss screw-on nozzle tips are placed across from the sensors in the IK-BAR so that the sample rate is withdrawn proportionately to the velocity as measured by the corresponding sensors. The probe assembly drawing for the IK-BAR(s) in your system is included in Appendix A.

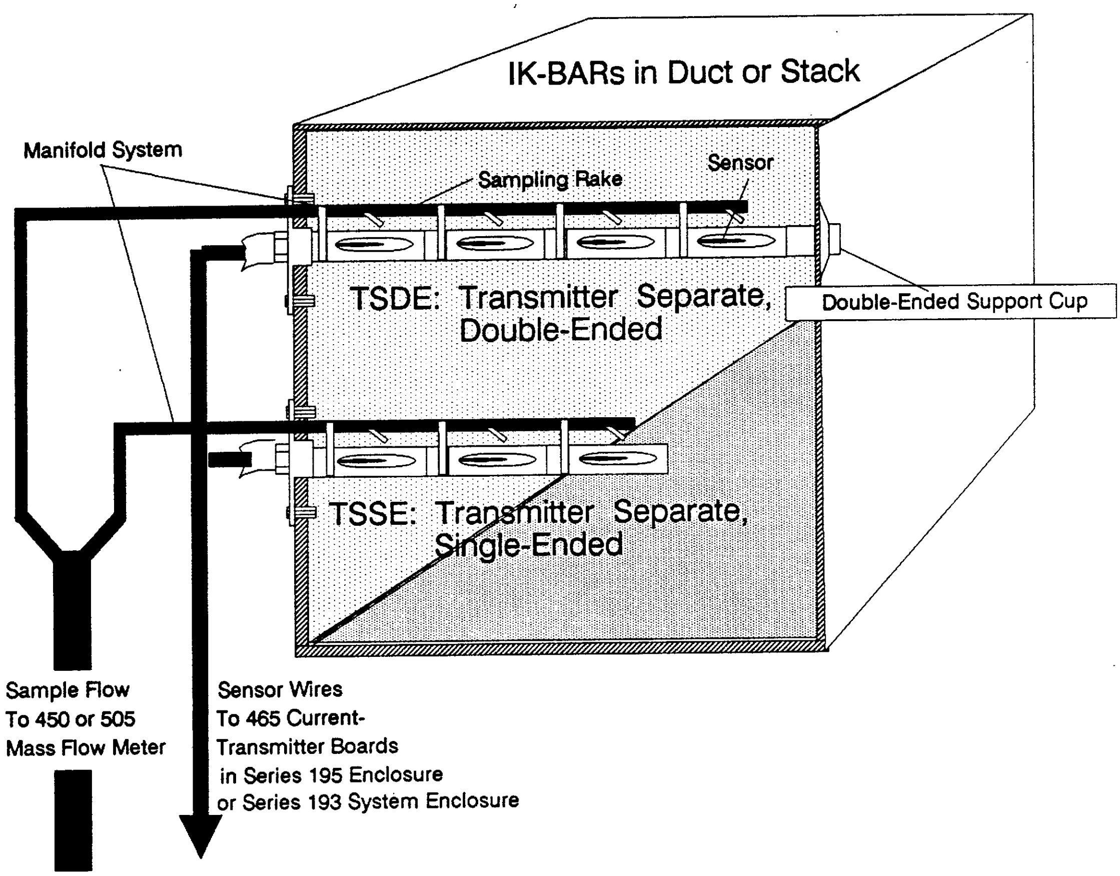
The sensors in the IK-BAR(s) measure the mass flow in the duct(s) or stack(s). The MetalClad velocity sensors on the IK-BAR(s) are housed within protective windows and joined by pipe-nipple sections. Each sensor in the IK-BAR(s) is connected to a matching 465 Current-Transmitter Board. The current-transmitter board provides the power to the sensor and contains the Whetstone bridge circuit that is the key to the operation of the thermal sensor. The signal from the current-transmitter boards is directed to the input channels of the ADAM Mass Flow Computer through field wiring terminals in the Series 193 System Enclosure.

Each IK-BAR probe can accomodate one or two individual sampling rakes per probe. Multiple sample rakes can be channeled into a common sample line using dual-junction, triple-junction, and quadruple-junction manifolds. The standard sample flow rate for each sample rake is 1-5 SCFM. Each sample line should be fitted with a full port stainless steel ball valve for shutoff.

A filter or sample box is optional. Most customers supply their own or route the sample into an analytical train. Kurz can optionally supply a fiberglass NEMA-type enclosure to house a stainless steel 4-inch filter assembly. A shut-off valve is included to allow for filter removal and replacement.

The IK-BAR probe flange bolts to the FMA Flange Mounting Adaptor welded to the duct or stack. If the IK-BAR is double-ended (it is to be secured at both ends of the duct), the DESC Double-Ended Support Cup is welded onto the opposite wall to support the end of the IK-BAR probe. Appendix A contains drawings of the IK-FMA and DESC mounting hardware. Figure 1-2 illustrates the physical installation of the IK-BARs in a duct.

Figure 1-2. *Installation of IK-BARs in a Duct or Stack*



1.3.2 450 or 505 Sample Flow Meter

The flow drawn through the nozzles is directed into the sample rake(s) on the IK-BAR. Sample lines are attached to the sample rakes through a compression union on the IK-BAR probe flange. The 450 or 505 Sample Flow Meter is installed in this sample line to measure the sample flow pulled by the vacuum pump. The sensor in the 450 or 505 is connected through a Killark junction box to it's associated 465 Current- Transmitter board. The sensor signal from the Sample Flow Meter is transmitted through the current-transmitter board to one of the input channels of the Series 155 ADAM Mass Flow Computer.

The 450 Insetion Mass Flow Meter can be integrated into a flow splitter to provide secondary samples to radiation or other types of secondary monitoring equipment in the plant. Typically one to two sampling nozzles installed inside the flow splitter body provide additional sample flows for the secondary monitoring equipment.

The assembly drawing for the 450 or 505 is provided in Appendix A.

1.3.3 730 Series Flow Control Valve

The 730 Series Flow Control Valve is an electrical metering valve that combines the electric drive motor, the valve body, and limit switches into a well designed integrated package. The 730 Flow Control Valve controls the sample flow rate. The valve opens or closes in response to a +15V or -15 Vdc correction signal from the 710RM-D Series Isokinetic Controller. If the sample flow rate is too low (when compared with the average velocity in the stack or duct), the valve opens to increase the sample flow rate. If the sample flow rate is too high (when compared with the average velocity in the stack or duct), the valve closes to decrease the sample flow rate.

The standard valve incorporates a high torque DC gear motor designed to be operated by "error signals" (+15 or -15 Vdc signals) from the Series 710 Controller. The flow coefficient (C_V) of the 730 is linear over a wide range due to its nearly 300 degree rotation between a complete flow shutoff and full open. The standard full open to full close time is 30 seconds, unless an optional valve speed has been specified. In addition, the orifice size is unaffected by changes in system pressure and the valve remains in its last position during constant flow or during power shutoff.

Because the motor is used only when the valve must move to a new position during flow control, the motor operates only for brief periods and is usually idle. In this type of application the motor should enjoy an extremely long life and should not require replacement of the brushes.

1.3.4 The Pumps and Automatic Switch-Over Circuit

The sample is drawn by a vacuum pump into a sample line through the sampling nozzles on the sample rake attached to the IK-BAR assembly. The optional Dual Pump Skid provides two vacuum pumps and an automatic pump switch-over circuit to ensure that an isokinetic sample will continue to be extracted in the event one pump fails.

If a pump fails, the switch-over circuit will activate the other pump. Both pumps will continue to operate to draw the sample and a relay contact will toggle so that you can connect an external device to provide an audible or visible indication that a pump has failed. Ladder logic and schematic diagram drawings of the switch-over circuit are provided in Appendix A if you have purchased the IK-EVA 4200 system with a dual-pump skid.

1.3.5 The Series 155 ADAM Module

The Series 155 ADAM Mass Flow Computer is a microcomputer housed in the Series 193 System Enclosure. The ADAM has a 20-key keypad and 2-line by 16 character LCD display that can be used to program the ADAM to perform specific functions and display system status. The ADAM can also be operated through an ASCII terminal or through a personal computer used as a terminal (by running one of many terminal emulation software programs available).

The ADAM performs the following functions:

- Conditions and linearizes up to 22 sensor input signals received from the current-transmitter boards associated with the sensors in the IK-BARs and the 450 or 505 Sample Flow Meter. These inputs are represented by Channels A through P in the ADAM.
- Configures up to eight meters, each meter can represent the measurements of a single channel or the measurements for a combination of selected channels or meters.
- Displays flow rates, totalized flow and elapsed time, average velocity, calibration factor, flow area, and channels or meters included in the meter measurements.
- Outputs up to eight 0-5 Vdc analog signals indicating the flow measurements for selected meters.
- Sets and displays system time and date.
- Sets the digital filter size.
- Sets and activates alarms used to monitor flow conditions.
- Kicks out sensor readings outside of a specified range.
- Reads and displays input voltages from each sensor channel.
- Logs meter data to printer.
- Controls access to critical system parameters through the setting and checking of user access codes .