Konduit

User Guide

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Abbreviations

A	absorbance
A	ampere
AU	Absorbance Unit
C	Celsius
CE	Conformité Européenne
cm	centimeter
Cond	conductivity
DV	diafiltration volume
EMC	Electromagnetic Compatibility
EU	European Union
H	height
Hz	hertz
kg	kilogram
L	length
mA	milliampere
mS	millisiemens
nm	nanometers
PPE	personal protective equipment
psi	pounds per square inch
Temp	temperature
TFF	tangential flow filtration
UF/DF	ultrafiltration/diafiltration
UV	ultraviolet
VAC	Volts Alternating Current
VDC	Volts Direct Current
W	width

1. Introduction

Konduit is an add-on module that monitors and evaluates conductivity, UV, and temperature for automated process controls with the KrosFlo® KR2*i* and KMP*i* TFF Systems.

Table 1. Konduit Capabilities

Function	Application
Endpoint conductivity control	UF/DF
Endpoint UV control	UV[1]
Concentration	Certain molecules
UV alarm	Breakthrough
A_{260} and A_{280}	UV[1]

[1]UV photometer is optional.

For the latest version of the document, please visit repligen.com. It is highly recommended that the installation process be executed by a trained Repligen engineer. For further support with troubleshooting or process optimization, please contact your local Repligen Field Application Scientist.

2. About This Document

This manual uses several different phrases. Each phrase should draw the following level of attention:

Table 2. Explanation of User Attention Phrases

Phrase	Description
Note:	Points out useful information.
IMPORTANT	Indicates information necessary for proper instrument operation.
PRECAUTION	Cautions users of potential physical injury or equipment damage if the information is not heeded.
WARNING!	Warns users that serious physical injury can result if warning precautions are not heeded.

Table 3. Safety Precautions

Symbol	Description
WARNING 	Wear standard laboratory personal protective equipment (PPE), including lab coat, protective eye wear, and gloves.
WARNING 	This product is for laboratory and manufacturing production use only. Not for administration to humans.
CAUTION 	Risk of danger. Consult Operating Instructions for nature of hazard and corrective actions. Potentially hazardous situation which, if not avoided, may result in property/equipment damage
CAUTION 	Risk of crushing. Keep fingers away from rotor while pump is in operation. Stop pump before loading or unloading tubing
CAUTION 	Hot surface. Do not touch
CAUTION 	Risk of electric shock, consult Operating Instructions for nature of hazard and corrective actions
WARNING 	Imminently hazardous situation which, if not avoided, will result in death or serious injury
WARNING 	Pay attention to the magnetic forces when handling the magnetic levitating centrifugal pump-head. Avoid other magnets or metal parts as contamination from physical damage or cracks may arise from the magnetic attraction. Specifically pay attention to the magnetic forces when handling two pump-heads at the same time.

Table 4. Instrument Safety Labels

Symbol	Description
Danger 	High voltage exists and is accessible. Use extreme caution when servicing internal components. Remove power from the pump before any cleaning operation is started
Caution 	Power must be turned off before connecting the external remote-control cable to prevent damage to the drive
Caution 	To avoid electrical shock, the power cord protective grounding conductor must be connected to the ground. Not for operation in wet locations as defined in BS EN 61010-1:2010+A1:2019 *Safety requirements for electrical equipment for measurement, control, and laboratory use General requirements*

3. Product Description

The base unit of Konduit integrates conductivity, temperature, UV monitoring, and automation functionalities into the KrosFlo KR2*i* and KMP*i* Tangential flow filtration (TFF) Systems. Included are two combination conductivity/temperature inputs, two UV inputs, and a power supply. The conductivity/temperature inline flowpath sensor is made of polysulfone and is available in assorted hose barb sizes.

An optional UV photometer is available in either 260 or 280 nm and consists of two fiber optic cables and two optical couplers for connecting to the flow cell and a power supply. Single-use UV flowpath components, made of polysulfone, are available in assorted hose barb sizes.

Table 5. Monitoring Ranges

Parameter	Range
UV1/UV2	0 – 3 AU
Conductivity	0.1 – 100 mS/cm
Temperature	2°C – 50°C

Table 6. Part Numbers

Part Number	Component
ACCD-BR	KONDUiT Base Unit - rebranded
ACCD-U280	UV Photometer 280nm
ACCD-U260	UV Photometer 260nm
ACCS-18HB	CONDUCTIVITY SENSOR PACKAGING 1/8" HB
ACCS-14HB	Conductivity Sensor, Single-use, non-sterile, PS, 1/4" HB
ACCS-12HB	Conductivity Sensor, Single-use, non-sterile, PS, 1/2" HB
ACUF-14HB	UV Flow Cell, Single-use, 0.5cm PL, non-sterile, PS 1/4" HB
ACUF-12HB	UV Flow Cell, Single-use, 0.5cm PL, non-sterile, PS 1/2" HB

Table 7. Specifications

Parameter	Specification		
Dimensions (L x W x H)	7¾" x 4¾" x 4½"		
Weight	1.6 kg		
Power Supply Range	Input Power Input Frequency Input Current		100 – 240 VAC 47 – 63 Hz ~0.4 A
Power Requirements	Voltage Current		24 VDC 0.625 A
Environment	Temperature, Operating Temperature, Storage Chemical Resistance Pressure Range		2°C to 50°C -25°C to 65°C Powder-coated aluminum, urethane ≤75 psi (≤5 bar)
Readability	Conductivity	Range Accuracy	0.1 – 100 mS/cm ± 0.1 mS/cm for 0.1 – 2 mS/cm ±5% for 2 – 50 mS/cm ±5% for 50 – 100 mS/cm
	Temperature	Range Accuracy	0 to 70°C Better than ±0.2°C (typically better than 0.1°C)
	UV (Optional)	Output signal	4 – 20 mA sourcing with 500 ohms at 24 VDC; scaled to 0 – 3 AU with accuracy of 0 – 2 AU ±1% FS (±0.03 AU) ; 2 – 3AU ±2% FS (±0.06 AU)
		Typical Response Time Maximum Zero Shift Long Term Output Drift:	1 second <2% of full scale (<0.040 AU) <5% per month of full scale (<0.100 AU)
Compliance	Conforms to ANSI/UL Std 61010-1; Certified to CAN/CSA Std C22.2 No. 61010-1; This product has been tested to the requirements of CAN/CSA-C22.2 No. 61010-1 second edition, including Amendment 1, or 12 400-12355-000 Rev. 03, KR2*i* / KMP*i* TFF Systems System Configuration and Major Components		
For CE Mark	EN61010-1: (EU Low Voltage Directive) EN61326: (EU EMC Directive)		

4. Setup Instructions

Note: *Prior to assembling Konduit, ensure that TFF System has been properly installed.*

1. With TFF System powered on, connect Konduit communication cable either to the KR2*i* auxiliary octopus cable or to a null modem cable that is then connected to Valve 2 on the KMP*i* octopus cable.
2. Connect the power cable to the power port. A green light on the On/Off button indicates that Konduit is receiving power (Figure 1).

Figure 1. Back of Konduit

3. Assemble the TFF flowpath, placing the conductivity/temperature and, if available, UV inline sensors at the correct placement in the flowpath (Table 8).
    a. Conductivity/temperature sensor The sensor can be placed either in the permeate line or the recirculation line for diafiltration endpoint control (Table 8).
    b. UV sensor: For UV alarms, place sensor in the permeate line to detect sample breakthrough. For UV concentration, place in the recirculation loop. For UV diafiltration, place in the permeate line (Table 8).

Table 8. Placement of Inline Sensors

Sensor	Use	Placement	Notes
Conductivity/Temperature	concentration	permeate	fill with starting buffer
	diafiltration	recirculation	fill with DF buffer
UV[1,2]	alarm	permeate	detects breakthrough
	concentration	recirculation	endpoint > starting point
	diafiltration[3]	permeate	endpoint < starting point

[1]Fill sensor with buffer and press "tare" on UV box prior to starting automated sequence
[2]Fiber optic cables are very fragile do not place weight on top of them or fold them.
[3]Molecule-of-interest should be detected prior to starting automated sequence

4. The conductivity setpoint can be higher or lower than the starting conductivity. The system will track in the linear range either positive or negative from the starting conductivity until the setpoint is reached.
5. Install tubing in Automated Back Pressure Valve (ABV, Figure 2).

Figure 2. Installation of Tubing in ABV

6. Connect all sensors to corresponding ports (Figure 3).

Figure 3. Front of Konduit; UV, Cond/Temp Ports

7. After making all connections, wait at least one minute for Konduit to establish connection with TFF System.

Note: *UV photometer cannot be remotely tared. Press TARE on photometer body.*

8. Launch KF Comm 2 Data Collection workbook for TFF System.

Note: *Konduit can be placed behind the KR2i or KMPi System. No physical buttons or interfaces are on the base unit. The UV photometer has a tare button that needs to be accessible. Cables can be placed in the cable boxes provided with the KR2i or KMPi Systems.*

Note: *Conductivity sensors must be filled with the initial starting buffer prior to starting the automated sequence. When sensor is placed on permeate line this buffer should be the same buffer that sample is in. This will eliminate any potential early shutdown of the auto mode.*

5. Konduit Software Configuration

The TFF System can be configured for use with Konduit through the KF Comm 2 software. For complete instructions on how to configure non-Konduit-specific TFF system functions, refer to the KrosFlo KR2*i*/KMP*i* TFF Systems User Guide at repligen.com.

5.1 Software Operation (KF Comm 2)

1. For Konduit operation with KF Com 2 or 2C software, please refer to Repligen document UG-3116: KFComm2 Software, User Guide.
2. Power on the TFF System, then connect Konduit to the TFF System and power port. Wait at least one minute for Konduit to establish connection with the TFF System.
3. Launch the KF Comm 2 Data Collection workbook for the TFF System. A COMM port selection error may appear due to a common default COMM port error. To connect KF Comm 2 to COMM port:
    a. Click on KF Comm 2 Config gear icon.
    b. Click on Find Comm to have KF Comm 2 consecutively test all available COMM connections to automatically find and connect to COMM port.

Note: *If COMM port is not found, the Find Comm module will circle through all available COMM ports indefinitely. Refer to the KrosFlo KR2i/KMPi TFF Systems User Guide at repligen.com.*

4. In the Pump Control window, click on Konduit gear icon to bring up Konduit Settings.
    c. Input Cond/Temp sensor K-Factor(s) found on the sensor label.
5. In Pump Control, click on the hardware setup gear icon to bring up Hardware Setup.
    d. Input which Konduit Channel (Cond/Temp 1 or UV 1) is used as the setpoint to end diafiltration in Diafiltration Setpoint. If user does not want to use Konduit to end diafiltration, set Diafiltration Setpoint option to DV (diafiltration volume).

Note: *KF Comm 2 will still collect data from channels that were not selected to be used to end diafiltration; these data points will be for reference only and will still trigger alarms.*

6. In Pump Control, click on the alarms gear icon to bring up Alarms.
    e. Set applicable Konduit UV alarms when applicable.
    f. If no alarm desired, set alarm value to 0 to turn alarm off
    g. The Overview screen will display alarms with color-coded indicators:
        i. Correct reading: wide, gray
        ii. High Stop: wide, orange
        iii. High Alarm: narrow, red
        iv. Low Stop: wide blue
        v. Low Alarm: narrow blue

The position of the current reading line (wide gray) relative to the rest of the alarms indicates how close a value is to triggering an alarm.

Note: *If an alarm is triggered, a notification will appear on the screen. The alarm will continue to sound until the notification is acknowledged.*

7. In Pump Control, in any pump mode that has at least one diafiltration step, a Konduit setpoint can be used to end diafiltration under the Modify Setpoints view. Refer to the KrosFlo KR2*i*/KMP*i* TFF Systems User Guide.
8. Starting the application
    h. Start: Starts the application
    i. Stop: Stops the application
    j. Pause: Pauses the application
    k. Resume: Resumes the application after a pause
    l. An automated run will automatically stop when all setpoints are reached.

Note: *In Overview, a progress bar shows the current live reading and its relative position to the next setpoint. This view is not available in manual or control modes.*

9. OPTIONAL: If using a UV photometer, a note should be placed, for reference only, in the header section of the Data Collection workbook indicating a wavelength of 260 or 280 nm.

Note*: To create a recipe with flow totalizer the user must set the Konduit Channel 1 to auxiliary and the type to flowmeter.*

5.2 Software Operation (KF Comm 1)

1. KF Comm, or KF Comm 1, is legacy software discontinued in 2020.

6. Maintenance

Periodically clean Konduit base with damp cloth and/or mild detergent. Do not immerse or use excessive fluid. Inspect connectors to ensure they are not damaged and are securely fastened.

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