Electronic Flow Monitor

for liquids

Flow
Pressure
Level
Temperature
measurement
monitoring
control

- Intelligent temperature compensation with measuring range adjustment
- Easy to fit
- No moving parts
- No mechanical wear
- Negligible pressure loss

Model:
KAL-...
KAL-K...
KAL-A (K)...

Method of operation

The model KAL-... electronic flow monitor continuously monitors liquid media. It is suited for securely monitoring flows with minimum pressure loss. Sensitivity to soiling is significantly reduced by means of a single-part sensor.

Theory of operation

The operation of the model KAL-... electronic flow monitor is based on the calorimetric principle. The end face of the sensor is heated to a few degrees above the temperature of the flow medium. When the medium flows, the heat generated in the sensor is transferred to the medium, ie, the sensor is cooled. The cooling procedure is an accurate measure of the flow velocity.
The sensor signal is compared with the reference data stored in a microcontroller. An alarm signal and/or an analog signal (4-20 mA) that is proportional to the flow velocity is output if the actual flow velocity deviates from the desired flow velocity. The microcontroller allows the flow indicator to be easily calibrated and the temperature to be compensated.

Features

- Optimal temperature compensation
- Intelligent switching
- Measuring range adjustment
- No moving parts
- Easy to fit and put into service
- Minimum pressure loss
- Easy to use

Measuring and switching ranges

Nominal size (mm)	Appr. meas. range l/min. water	Nominal size (mm)	Appr. meas. range l/min. water
8	0,12 - 6,0	40	3,0 - 150
10	0,19 - 9,4	50	4,7 - 235
15	0,42 - 21,8	60	6,8 - 340
20	0,75 - 37,7	80	12,0 - 603
25	1,18 - 59,0	100	18,8 - 942
30	1,7 - 84,8	150	42,4 - 2120

Important: The flow velocity has been converted for the pipe nominal size for the specified measuring ranges. Please note that the flow velocity approaches zero in the pipeline in the direction of the wall. Depending on the pipe nominal size, depth of engagement of the sensor, and flow profile, the deviations from the specified flow rates can be of considerable magnitude.

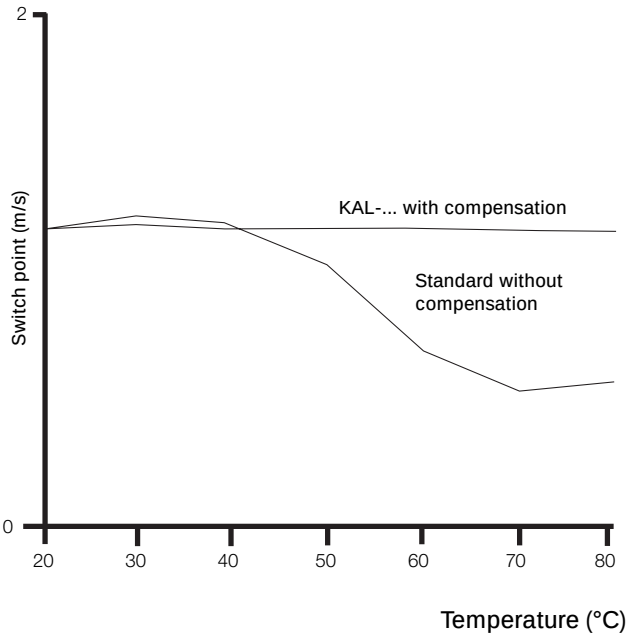
Temperature compensation

The temperature of the KOBOLD flow monitor is compensated with a microcontroller. All data required for temperature compensation are stored in EEPROMS, and are maintained for at least 10 years after power failure. The instruments may be easily adjusted by the customer to suit process conditions.

The measured flow rate is compared with the zero-point adjustment values stored in the EEPROM and the stored characteristic curves. The data is processed by the microcontroller and controls the alarm signal or the analog output.

The sensor switching point is absolutely consistent, as the sensors have been adapted to suit the process data.

Drift of operating point with respect to temperature



Range of models

Compact devices

KAL-A... Flow meter with analog output (4-20 mA)
KAL-AK Flow meter /-monitor
with analog output (4-20 mA)
and alarm signal (PNP/NPN, make contact)
KAL-K... Flow indicator
alarm signal (PNP/NPN, N/O contact)

Separate version

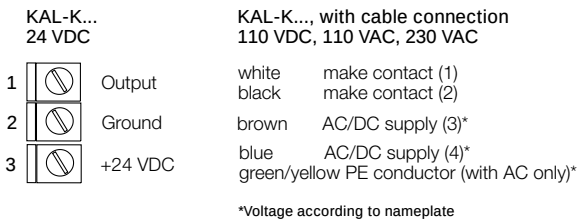
KAL-.. Sensor
KAL-E1.. Electronics with relay contact
for flow monitoring
KAL-E2.. Electonics with relay contact and trend indication
for flow monitoring
KAL-E3.. Electronics with relay contact
for flow and temperature monitoring
Trend indication for flow monitoring

Technical details:

Electronics:

Power supply:	24 VDC ± 10 % 110 VDC ± 30 %, 110, 230 VAC -20/+10 %
Power input:	max. 4,5 (typically 1,2 W) max. 3,6 W for 24 VDC
Ambient temperature:	-20° C ... +60° C
Temperature of medium:	-20° C ... +80° C
CIP compatibility:	max. 140° C non-operating
Max. pressure:	100 bar
Time delay before availability:	max. 12 s
Switching range:	approx. 4 cm/s to 200 cm/s
Temperature gradient:	unlimited
Response time:	typically 5,6...12 s upon request: 2- 5,6 s (KAL-KS...)
Flow rate indication:	trend indication with 8-LED's
Switch point adjustment:	with potentiometer, optical indication on LED chain with flashing LED
Output indicator:	LED, red= alarm, green= flow OK
Switching output:	24 VDC version: semiconductor PNP/NPN switchable, max. 400 mA, short-circuit proof 110 VDC version: relay max. 0,2 A /110 VDC 110 VAC, 230 VAC version: relay max. 5 A
N/O function:	actual value ≥ setpoint value; (standard setting: green LED is energized) output switched through
N/C function:	available as option
Protection type:	IP 65
Case material:	polyamide

Electrical connection



Order details

Connection	Order numbers for materials 1.4301	1.4305	1.4571	Type of contact	Electrical connection	Supply
G ¼	KAL K1308	-	KAL K1408*			
G ½	KAL K1315	KAL K1215	KAL K1415			0=230 VAC
G ¾	KAL K1320	-	KAL K1420*	S=N/O contact	PG=PG 13,5	1=110 VAC
M 12x1	KAL K0312	-	-	(NPN/PNP		3 = 24 VAC
¼" NPT	KAL K5308	-	KAL K5408*	switchable)	ST=connector	6=110 VDC
½" NPT	KAL K5315	-	KAL K5415		M12x1	
¾" NPT	KAL K5320	-	KAL K5420*	O=N/C contact		
Tri clamp, DIN 32676	-	-	KAL K4440	(optional)		

Example of order: KAL-K 5320 S PG 1

*Stainless steel hexagon 1.4301

Technical details

Sensor:

Material: case: see order details
cable: PVC, option (KAL-...HT): silicone
cable gland: Brass nickel-plated; PG 7

Cable: 2 x 0,56 mm², length = 2 m
max. line length 100 m

Switching range: 4 cm/s to 200 cm/s

Temperature of medium: -20° C to +80° C,
(KAL-...HT) option: 0° C to +120° C

Ambient temperature: -20° C to +80° C,
KAL-...HT: -20 to +120 °C

Max. pressure: 100 bar (KAL-1132 and KAL-1140: 25 bar)

Protection type (DIN 40050): IP 68

Approval: Ex II 1G EEx ia IIB T4

Important!
For cable lengths >10m, the client can lucrease the absolute switching accuracy manually by adjustment (cable resistance must be considered). (See Compensation – Temperature).

Model KAL-E(H)..electronics

Power input: max. 3,6 W
Switching capacity: max. 250 V, max. 3 A
Switch point adjustment: with potentiometer
Switching function: relay picks up with flow
(terminals 9 & 10 closed)
(KAL-E3..) option: relay picks up if temperature falls below setpoint, LED is energized
(terminals 12 & 13 closed)
Output: relay with 1 changeover contact
Output indicator: with LED
Time delay before availability: max. 12 s
Temperature range: -20...+80° C
Accuracy: temperature limit value ± 2 %
Reproducibility: approx. 2 %
Response time: typically 5 ... 12 sec
DIN rail fitting: DIN EN 50022 und DIN 46277
Protection type: case: IP 40, terminals: IP 20
Case: polycarbonate, L 75 x W 55 x H 110 mm
Sensor output: short-circuit proof, cable break is detected as flow stoppage
Power failure: calibration data are stored for at least 10 years without battery power.
Approval: Ex II (1)G [EEx ia] IIB

Sensor order details

Connection	Order numbers: Sensor for coupling fitting 1.4301	Sensor for coupling fitting 1.4571	Sensor with pipe fitting: Brass fitting/ Sensor 1.4301	Sensor with pipe fitting: Fitting 1.4301/ Sensor 1.4301	Electrical Connection
G ¼	KAL 1308	KAL 1408	KAL 1108	KAL 1208	00= 2 m PVC-cable
G ½	KAL 1315	KAL 1415	KAL 1115	KAL 1215	
G ¾	KAL 1320	KAL 1420	KAL 1120	KAL 1220	HT= 2 m silicone cable
G 1	-	-	KAL 1125	KAL 1225	
G 1¼	-	-	KAL 1132	KAL 1232	YY= special cable/ special length
G 1½	-	-	KAL 1140	KAL 1240	
M 12x1	KAL 0312	-	-	-	Ex= Ex-sensor, PVC-cable Ex II 1G EEx ia IIB T4 (specify cable length)
¼" NPT	KAL 5308	KAL 5408	-	-	
½" NPT	KAL 5315	KAL 5415	-	-	
¾" NPT	KAL 5320	KAL 5420	-	-	

Order details electronics (KAL-E..standard, KAL-EH..high temperature version)

	Range of application	Trend indication flow	Temperature monitoring	Supply voltage: 24 VDC	24 VAC	110 VAC	230 VAC
	Flow	-	-	KAL-E13	KAL-E12	KAL-E11	KAL-E10
				KAL-EH13	KAL-EH12	KAL-EH11	KAL-EH10
	Flow	8-LEDs	-	KAL-E23	KAL-E22	KAL-E21	KAL-E20
				KAL-EH23	KAL-EH22	KAL-EH21	KAL-EH20
	Flow/ Temperature	8-LEDs	-20...+80 °C	KAL-E33	KAL-E32	KAL-E31	KAL-E30
			0...+120 °C	KAL-EH33	KAL-EH32	KAL-EH31	KAL-EH30
Ex II (1)G [EEx ia] IIB	Flow/ Temperature	8-LEDs	-20...+80 °C	-	KAL-E32Ex	-	KAL-E30Ex

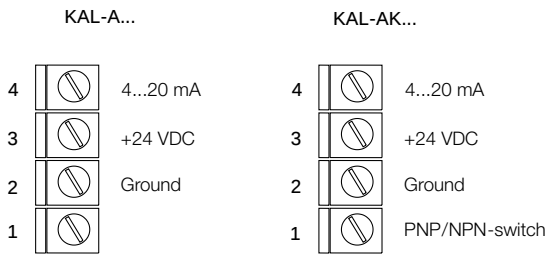
Technical details

Power supply:	24 VDC ± 20 %
Power input:	max. 3,6 W (typically 1,2 W)
Ambient temperature:	-20° C to +60° C
Temperature of medium:	-20° C ... +80° C
Max. pressure:	100 bar
Time delay before availibility:	max. 12 s
Measuring range:	approx. 4 cm/s to 200 cm/s
Temperature gradient:	unlimited
Response time:	5,6...12 s
Accuracy:	± 10 % of measured value
Reproducibility:	± 1 % of measured value
Signal output:	4-20 mA
Flow rate indication:	Trend indication with 8-LED's
Protection type:	IP 65
Case material:	glass-fibre-reinforced polyamide

For KAL-AK...only

Switching function:	N/O contact
Switch point adjustment:	with potentiometer, optical indication on LED chain with flashing LED
Output indicator:	LED, red= alarm, green= flow OK
Switching output:	semiconductor, PNP/NPN switchable, max. 400 mA, short-circuit proof

Electrical connection



Order details

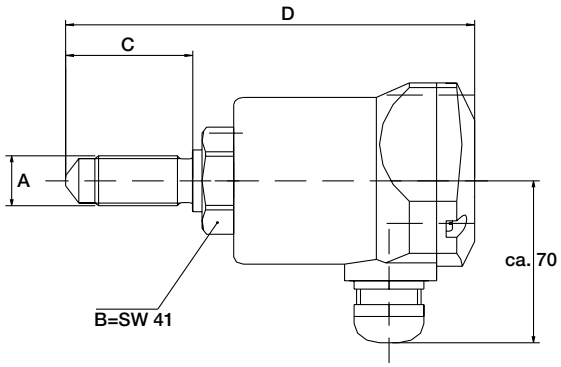
Output/contact	Connection	Order numbers for materials 1.4301	1.4305	1.4571	Electrical connection
4-20 mA/ without contact	G ¼	KAL A1308A4	-	KAL A1408A4*	PG=PG 13,5 ST=plug M12x1
	G ½	KAL A1315A4	KAL A1215A4	KAL A1415A4	
	G ¾	KAL A1320A4	-	KAL A1420A4*	
	M 12x1	KAL A0312A4	-	-	
	¼" NPT	KAL A5308A4	-	KAL A5408A4*	
	½" NPT	KAL A5315A4	-	KAL A5415A4	
	¾" NPT	KAL A5320A4	-	KAL A5420A4*	
	1½" Tri clamp, DIN 32676	-	-	KAL A4440A4	
4-20 mA/ N/O contact NPN/PNP switchable	G ¼	KAL AK1308AS	-	KAL AK1408AS*	PG=PG 13,5 ST=plug M12x1
	G ½	KAL AK1315AS	KAL AK1215AS	KAL AK1415AS	
	G ¾	KAL AK1320AS	-	KAL A1420AS*	
	M 12x1	KAL AK0312AS	-	-	
	¼" NPT	KAL AK5308AS	-	KAL AK5408AS*	
	½" NPT	KAL AK5315AS	-	KAL AK5415AS	
	¾" NPT	KAL AK5320AS	-	KAL AK5420AS*	
	1½" Tri clamp, DIN 32676	-	-	KAL AK4440AS	

Example of order: KAL-A1308A4PG

*Stainless steel hexagon 1.4301

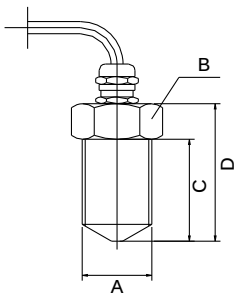
Dimensions
KAL-K..., KAL-A(K)...

A (mm)	C (mm)	D (mm)
G ¼	26	123
G ½	40	137
G ¾	43	140
M 12x1	23	120
¼“ NPT	16	123
½“ NPT	27	137
¾“ NPT	33	133



KAL-...sensor

A (mm)	B	C (mm)	D (mm)
M 12x1	HEX 19	23	43
G ¼	HEX 19	26	43
G ½	HEX 27	43	58
G ¾	HEX 32	43	58



KAL-...with pipe fitting

A	B	C (mm)	D (mm)	E (mm)
G ¼	HEX 27	10	50	81
G ½	HEX 27	10	50	81
G ¾	HEX 32	15	52	82,5
G 1	HEX 39	15	56	85
G 1¼	HEX 46	15	50	90
G 1½	HEX 55	15	50	92,5