Electronic Flow Monitor

for water-based liquids

KAL-K





- Range: approx. 4 ... 200 cm/s
- p_{max}: 100 bar
- Temperature of medium: -20 ... +80 °C
  Option: 0 ... +120 °C
- Process connection:
  G ¼, G ½, G ¾
  M12x1, ¼" NPT, ½" NPT, ¾" NPT
  Tri-Clamp®
- Material sensor:
  1.4305; 1.4301; 1.4404; 1.4571
- Intelligent temperature compensation
- No moving parts
- Minimal pressure loss

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Method of operation

The model KAL-... electronic flow monitor continuously monitors water-based liquids. 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 analogue 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 install and commission
- Minimal pressure loss
- Easy to use

Measuring /switching ranges

NW [mm]	approx. measuring range l/min water	NW [mm]	approx. measuring 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 nominal pipe 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 nominal pipe size, depth of engagement of the sensor, and flow profile, the deviations from the specified flow rates can be of considerable magnitude.

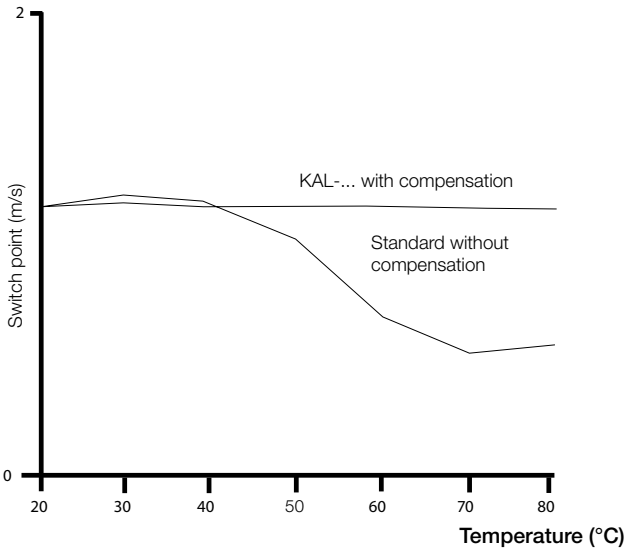
Temperature compensation

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 micro-controller and controls the alarm signal or the analogue output.

The sensor switch point is absolutely consistent, as the sensor has been adapted to suit the process data.

Drift of the switch point by temperature influence



Range of models

Compact devices

KAL-A...	Flowmeter with analogue output (4-20 mA)
KAL-AK	Flowmeter /-monitor with analogue output (4-20 mA) and alarm signal (PNP/NPN, N/O 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...	Electronics with relay contact and trend display for flow monitoring
KAL-E3...	Electronics with relay contact for flow and temperature monitoring trend display for flow monitoring

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Technical Details (electronics)

Case material:	glass-fibre-reinforced polyamide
Sensor material:	Stainless steel (see order details)
Power supply:	24 V_{DC} ±10 % 110 V_{DC} ±30 %, 110, 230 V_{AC} -20/+10 %,
Power input:	max. 4.5 W (typically 1,2 W) max. 3.6 W for 24 V_{DC}
Ambient temperature:	-20 °C ... +60 °C
Medium:	water-based (water content at least 90 %); not suitable for oils and fuels
Temperature of medium:	-20 °C ... +80 °C (standard version) 0 °C ... +120 °C (high temp. version)
CIP compatibility:	max. 140 °C non-operating
Max. pressure:	100 bar
Warm up time:	max. 12 s
Switching range:	approx. 4 cm/s to 200 cm/s
Temperature gradient:	unlimited
Response time:	5.6 ... 12 s typically on request: 2- 5.6 s (KAL-KS...)
Flow rate indication:	trend display with 8-digit LED chain
Switch point adjustm.:	with potentiometer, optical indication on LED chain with flashing LED
Output indicator:	LED, red = alarm, green = flow OK
Electr. connection:	cable gland M16x1.5; connector M12x1 (only 24 V_{DC} version) circular connector ⅞" with socket (230/115 V-versions) or connector M12x1 with socket and 2 m cable, 24 V_{DC} version
Switch output:	
24 V_{DC} version:	semiconductor, PNP/NPN switchable, max. 400 mA, short-circuit proof
110 V_{DC} version:	relay max. 0,2 A /110 V_{DC}
110 V_{AC}, 230 V_{AC} version:	relay max. 5 A
N/O function:	actual value ≥ setpoint value; (standard setting: green LED is energized) output switched
N/C function:	available as option
Protection:	IP65



Order Details (Example: **KAL-K1215 S PG 3**)

Version	Connection	Material stainless steel / version 1.4301 Standard Version	1.4301 Extended version	1.4305 Standard Version	1.4571 Standard Version	1.4571 Extended version	Type of contact	Electrical connection	Power supply
Standard Version (-20...+80°C)	G ¼	**KAL-K1308**	-	-	**KAL-K1408**[1]	-	**S** = N/O contact **Ö** = N/C contact	**PG** = cable gland M16x1.5 **ST** = connector M12x1[2] **SK** = circular connector with socket	**0**[4] = 230 V_{AC} **1** = 110 V_{AC} **3** = 24 V_{DC} **6** = 110 V_{DC}
	G ½	**KAL-K1315**	**KAL-K6315**	**KAL-K1215**	**KAL-K1415**	**KAL-K6415**			
	G ¾	**KAL-K1320**	**KAL-K6320**	-	**KAL-K1420**[1]	**KAL-K6420**[1]			
	M 12x1	**KAL-K0312**	-	-	-	-			
	¼" NPT	**KAL-K5308**	-	-	**KAL-K5408**[1]	-			
	½" NPT	**KAL-K5315**	**KAL-K8315**	-	**KAL-K5415**	**KAL-K8415**			
	¾" NPT	**KAL-K5320**	**KAL-K8320**	-	**KAL-K5420**[1]	**KAL-K8420**[1]			
Version for high temperature (0...+120°C)	G ¼	**KAL-KH1308**	-	-	**KAL-KH1408**[1]	-	**S** = N/O contact **Ö** = N/C contact	**PG** = cable gland M16x1.5 **ST** = connector M12x1[2] **SK** = circular connector with socket	**1** = 110 V_{AC} **3** = 24 V_{DC} **6** = 110 V_{DC}
	G ½	**KAL-KH1315**	**KAL-KH6315**	**KAL-KH1215**	**KAL-KH1415**	**KAL-KH6415**			
	G ¾	**KAL-KH1320**	**KAL-KH6320**	-	**KAL-KH1420**[1]	**KAL-KH6420**[1]			
	M 12x1	**KAL-KH0312**	-	-	-	-			
	¼" NPT	**KAL-KH5308**	-	-	**KAL-KH5408**[1]	-			
	½" NPT	**KAL-KH5315**	**KAL-KH8315**	-	**KAL-KH5415**	**KAL-KH8415**			
	¾" NPT	**KAL-KH5320**	**KAL-KH8320**	-	**KAL-KH5420**[1]	**KAL-KH8420**[1]			
	Tri-Clamp®, DIN 32676	-	-	-	**KAL-4340S**[3]	-	N/O contact	Cable gland ½" NPT	24 V_{DC}

[1] Stainless steel hexagon 1.4301 [2] For 24 V_{DC} only [3] Stainless steel 1.4404 [4] Only available for order items KAL-K1215SPG0/ KAL-K1315SPG0/ KAL-K1415SPG0

Extended version (special length) only with ½" and ¾" (see Dimensions page 6)

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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 ... 200 cm/s
Temperature of medium:	-20 °C ... +80 °C, option (KAL-...HT): 0 °C ... +120 °C
Ambient temperature:	-20 °C ... +80 °C, KAL-...HT: 0 °C ... +120 °C
Max. pressure:	100 bar (KAL-1132 and KAL-1140: 25 bar)
Protection:	IP 68
Approval:	ATEX: ⟨Ex⟩ II 1G Ex ia IIB T4 Ga IECEx: Ex ia IIB T4 Ga

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

Electronics Model KAL-E(H)..

Power input:	max. 3.6 W
Switch capacity:	max. 250 V, max. 3 A
Switch point adjustm.:	with Potentiometer
Switching function:	changeover, on rising flow (terminals 9 +10 closed)
Option (KAL-E3..):	changeover, on rising temperature below setpoint, LED is energized (terminals 12 + 13 closed)
Output:	changeover relay
Output indicator:	with LED
Warm up time:	max. 12 s
Temperature range:	-20 ... +80 °C
Accuracy:	temperature limit value ±2 %
Repeatability:	approx. 2%
Response time:	5 ... 12 s (typically)
DIN rail fitting:	DIN EN 50022 and DIN 46277
Protection:	case: IP 40, terminals: IP 20
Case:	polycarbonate, L75 x W 55 x H 110 mm
Sensor output:	short-circuit proof, cable break is detected as flow stoppage
Power failure:	calibration data are store without battery for 10 years
Approval:	ATEX: ⟨Ex⟩ II (1)G [Ex ia Ga] IIB IECEx: [Ex ia Ga] IIB

Order Details sensor (example: **KAL-1308 HT**)



Connection	Order numbers				Electrical connection/ version
	Sensor with insertion fitting		Sensor with inline fitting		
	1.4301	1.4571	Fitting brass/ Sensor 1.4301	Fitting 1.4301/ Sensor 1.4301	
G ¼	**KAL-1308**	**KAL-1408**	**KAL-1108**	**KAL-1208**	**00** = 2 m PVC cable **HT** = 2 m Silicone cable **YP** = PVC cable/ special length **YS** = Silicone cable/ special length **YY** = Special cable/ special length **Ex** = Ex sensor, PVC cable Ex ia IIB T4 Ga (specify cable length)
G ⅜	-	-	**KAL-1110**	**KAL-1210**	
G ½	**KAL-1315**	**KAL-1415**	**KAL-1115**	**KAL-1215**	
G ¾	**KAL-1320**	**KAL-1420**	**KAL-1120**	**KAL-1220**	
G 1	-	-	**KAL-1125**	**KAL-1225**	
G 1 ¼	-	-	**KAL-1132**	**KAL-1232**	
G 1 ½	-	-	**KAL-1140**	**KAL-1240**	
M 12 x 1	**KAL-0312**	-	-	-	
¼" NPT	**KAL-5308**	**KAL-5408**	**KAL-5108**	**KAL-5208**	
⅜" NPT	-	-	**KAL-5110**	**KAL-5210**	
½" NPT	**KAL-5315**	**KAL-5415**	**KAL-5115**	**KAL-5215**	
¾" NPT	**KAL-5320**	**KAL-5420**	**KAL-5120**	**KAL-5220**	

Order Details electronics (example: **KAL-E10** (standard) or **KAL-EH10** (version for high temperature)



Field of application	Flow trend display	Temperature monitoring	Supply voltage			
			24 V_{DC}	24 V_{AC}	110 V_{AC}	230 V_{AC}
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 ia Ga] IIB	**Flow/ Temperature**	8-LEDs	-20 ... +80 °C	-	**KAL-E32Ex**	-	**KAL-E30Ex**

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Technical Details

Case material:	glass-fibre-reinforced polyamide
Sensor material:	stainless steel (see order details)
Power supply:	24 V_{DC} ±20 %
Power input:	max. 3,6 W (typically 1,2 W)
Ambient temperature:	-20 °C ... +60 °C
Medium:	water-based (water content at least 90 %); not suitable for oils and fuels
Temperature of medium:	-20 °C ... +80 °C
Max. pressure:	100 bar
Warm up time:	max. 12 s
Measuring range:	approx. 4 cm/s to 200 cm/s
Temperature gradient:	unlimted
Response time:	5.6 ... 12 s
Accuracy:	±10 % of full scale
Repeatability:	±1 % of full scale
Signal output:	4 - 20 mA
Flow rate indication:	trend display with 8-digit LED chain
Protection:	IP65

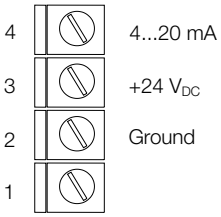
For KAL-AK... only

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

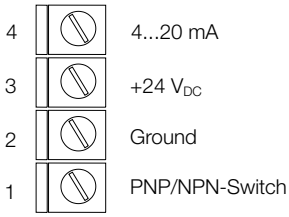


Electrical connection

KAL-A...



KAL-AK...



Order Details (example: KAL-A1308A4 PG)

Output/ contact	Connection	Order numbers for materials 1.4301	1.4305	1.4571	Electr. connection
4-20 mA/ without contact	G ¼	KAL-A1308A4	-	KAL-A1408A4[1]	PG = cable gland M16x1,5 ST = connector M12x1
	G ½	KAL-A1315A4	KAL-A1215A4	KAL-A1415A4	
	G ¾	KAL-A1320A4	-	KAL-A1420A4[1]	
	M 12 x 1	KAL-A0312A4	-	-	
	¼" NPT	KAL-A5308A4	-	KAL-A5408A4[1]	
	½" NPT	KAL-A5315A4	-	KAL-A5415A4	
	¾" NPT	KAL-A5320A4	-	KAL-A5420A4[1]	
	Tri-Clamp®, DIN 32676	-	-	KAL-7340S[2]	Cable gland ½" NPT
4-20 mA/ N/O contact NPN/PNP switchable	G ¼	KAL-AK1308AS	-	KAL-AK1408AS[1]	PG = cable gland M16x1,5 ST = connector M12x1
	G ½	KAL-AK1315AS	KAL-AK1215AS	KAL-AK1415AS	
	G ¾	KAL-AK1320AS	-	KAL-AK1420AS[1]	
	M 12 x 1	KAL-AK0312AS	-	-	
	¼" NPT	KAL-AK5308AS	-	KAL-AK5408AS[1]	
	½" NPT	KAL-AK5315AS	-	KAL-AK5415AS	
	¾" NPT	KAL-AK5320AS	-	KAL-AK5420AS[1]	
	Tri-Clamp®, DIN 32676	-	-	KAL-7340SP[2]	Cable gland ½" NPT

[1] Stainless steel hexagon 1.4301 [2] Stainless steel 1.4404

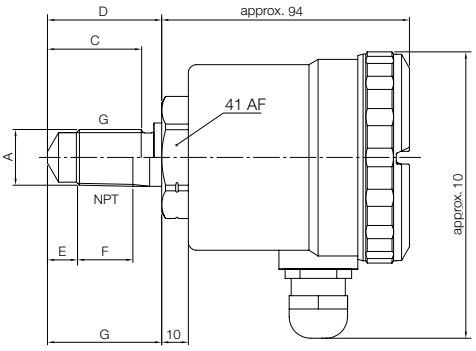
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Dimensions [mm]

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

A	C	D	E	F	G
G ¼	23	29	6	-	-
G ½	36	43	9	-	-
G ¾	40	46	12	-	-
M12 x 1	22	26	6	-	-
¼" NPT	-	-	6	12	29
½" NPT	-	-	18	15	43
¾" NPT	-	-	16	19	39

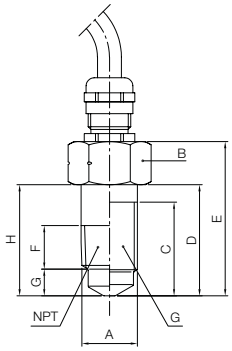
Special length "D" with G ½ and G ¾ from 71 mm
Special length "E" with ½" NPT and ¾" NPT from 57 mm



KAL-... Sensor

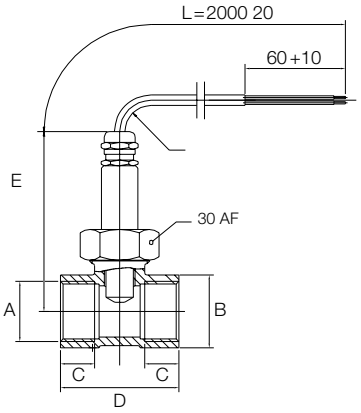
A	B	C	D	E	F	G	H
G ¼	19 AF	23	26	43	-	-	-
G ½	27 AF	36	43	58	-	-	-
G ¾	32 AF	39	43	58	-	-	-
M12 x 1	19 AF	23	23	43	-	-	-
¼" NPT	19 AF	-	-	43	12	5.5	26
½" NPT	27 AF	-	-	58	20	11	43
¾" NPT	32 AF	-	-	58	15	16	43

Special length "D" with G ½ and G ¾ from 71 mm
Special length "G" with ½" NPT and ¾" NPT from 57 mm



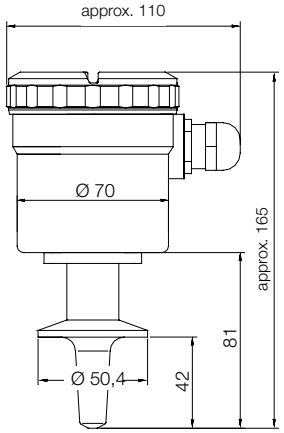
KAL-... with pipe fitting

A	B	C	D	E
G ¼	27 AF	10	50	81
G ⅜	27 AF	10	50	81
G ½	27 AF	10	50	81
G ¾	32 AF	15	52	82.5
G 1	39 AF	15	56	85
G 1 ¼	46 AF	15	50	90
G 1 ½	55 AF	15	50	92.5



KAL-..4340S with Tri-Clamp®
KAL-..7340S with Tri-Clamp®

Counterpart according to DIN 32676
for NW 32/NW40



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