

## Thermal Flow Switch for Water-Based Liquids



measuring  
•  
monitoring  
•  
analyzing

### KAL-K



- Flow Velocities from 0.04...2 m/s
- $T_{max} : 250\text{ }^{\circ}\text{F}$ ,  $P_{max} : 1450\text{ PSIG}$
- NPT and 3-A Compliant Sanitary Fittings
- No Moving Parts
- Intelligent Temperature Compensation
- Extremely Low Pressure Loss
- Easy to Operate
- Insensitive to Dirt



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**Description**

The KAL-K thermal flow switch utilizes KOBOLD's temperature compensating electronics. This compact, one-piece unit provides reliable readings unaffected by temperature or physical characteristics of a wide variety of process liquids. This is made possible through the use of state-of-the-art microprocessor technology. The microprocessor can be field calibrated to both the liquid properties and operating range in a simple, five minute set-up procedure. This intelligence, coupled with a "no moving parts" design, make the KAL a superior performer in virtually all applications. The KAL-K is also offered in a 3-A compliant version.

The KAL-K incorporates an 8 segment bar-graph LED flow trend indicator and one flow alarm setpoint. The setpoint is fully configurable as NPN, PNP, normallyopen or normally-closed.

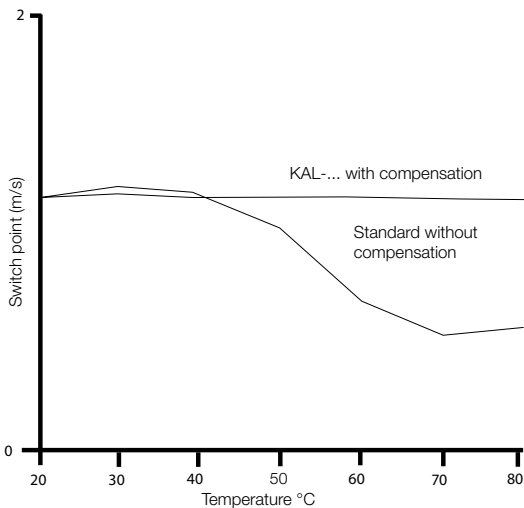


**Operation**

The KAL design is based on the time proven calorimetric principle. The sensor is internally heated to a few degrees above the temperature of the medium. Flow of the medium causes removal of heat from the sensor, resulting in a cooling effect. The rate of cooling is a measure of the flow velocity. The microprocessor based design of the KAL distinguishes it from the competition. Full temperature compensation of the flow rate is readily obtained through a simple, one-time, calibration procedure. This assures elimination of flow rate reading drift caused by temperature variations in the process liquid.

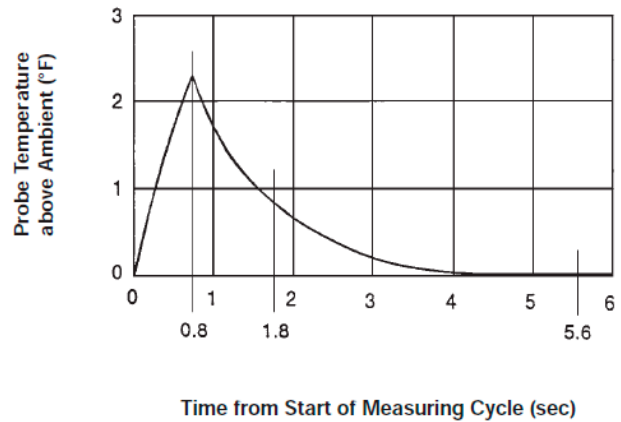
**Temperature Compensation**

The KOBOLD KAL flow products use a microprocessor to compensate for temperature changes through use of an internal look-up table. End-users can easily adapt the equipment to the requirements of their unique installations. Unlike conventional calorimetric flow switches, the technically advanced design of the KAL provides a flow reading which is unaffected by temperature.



**KAL Timing - Heating and Measuring Cycle**

Typical Flow Measuring Cycle



**Operating Behavior**

1. At t=0, the probe temperature is recorded. This reading represents the ambient liquid temperature.
2. Still at t=0, the KAL begins heating the probe.
3. At t=0.8 seconds, the heating cycle ends and the KAL begins monitoring the probe temperature.
4. At t=1.8 seconds, a temperature reading is taken and compared to the t=0.8 second temperature. The rate of cooling is calculated and compared to a Cooling Rate vs Flow Rate table specific to the ambient temperature recorded at t=0.
5. The probe is allowed to cool until t=5.6 seconds. A temperature reading is taken and compared to the initial t=0 reading. If the temperatures are equal (or nearly so), the flow reading is determined valid and passes through to the KAL output. If the temperatures are not equal, the KAL waits another 5.6 sec, and Step 5 repeats.



**Specifications**

<b>Switching Range:</b>	0.04...2 m/s
<b>Media:</b>	Water-based Liquids
<b>Response Time</b>	
<b>Typical:</b>	5.6 seconds
<b>Optional w/"F":</b>	1.2 seconds
<b>Fittings</b>	
<b>Standard:</b>	1/2" or 3/4" NPT
<b>Sanitary:</b>	1-1/2" Tri-Clamp®
<b>Flow Trend Indicator:</b>	8 Red LEDs
<b>Temperature Rating</b>	
<b>Operating:</b>	32...250 °F
<b>CIP:</b>	280 °F (non-operating)
<b>Maximum Pressure:</b>	1450 PSIG
<b>Wetted Parts</b>	
<b>Standard NPT:</b>	304 SS
<b>Optional NPT:</b>	316-Ti SS
<b>Sanitary:</b>	316L SS
<b>Housing</b>	
<b>Standard:</b>	IP 65
<b>Sanitary:</b>	IP 65
<b>Power Requirements</b>	
<b>Supply Voltage:</b>	24 V <sub>DC</sub> ± 10%
<b>Optional:</b>	110 V <sub>AC</sub>
<b>Current Draw:</b>	300 mA Max.
<b>Switch Characteristics</b>	
<b>Adjustment:</b>	By Potentiometer
<b>Status Indicator:</b>	Bi-colored LED
<b>24 V<sub>DC</sub> Units</b>	
<b>Type:</b>	PNP or NPN, Open Collector
<b>Switch Rating</b>	
<b>DC Only:</b>	400 mA at 24V
<b>110 VAC Units:</b>	
<b>Type:</b>	N/O Dry Contact
<b>Switch Rating</b>	
<b>AC Only:</b>	5A at 240 V
<b>DC Only:</b>	0.2 A at 110V



**Approximate Switch Points at Various Pipe Diameters**

Nominal ID (inch)	Range Water (GPM)	Nominal ID (inch)	Range Water (GPM)
1/2	0.08...4.0	4	6.0...250
3/4	0.2...9.0	6	12...575
1	0.4...16	8	20...1025
1 1/4	0.5...25	10	35...1600
1 1/2	0.8...36	12	50...2300
2	1.3...64	16	85...4100
2 1/2	2.0...100	20	130...6400
3	3.0...140		

**Note:**

The approximate flow ranges specified in the table above have been calculated for each pipe diameter from the known flow velocity range of the KAL. It must be noted that flow in pipes is non-uniform across the pipe cross-section and approaches zero at the pipe wall. This means that, in practice, the depth of installation of the probe, the internal pipe diameter, and the flow profile of the liquid in the pipe can interact to produce very significant deviations from the flow ranges in this data sheet.

For correct operation of the KAL-K thermal flow switch, the tip of the flow sensor must be located sufficiently into the flow stream of the process to sense the liquid flow. Therefore it is very important to consider the sensor's insertion depth and how it is installed in the process pipe. If the sensor tip is not adequately immersed into the flow stream, the sensor will not measure flow rate correctly, or worst case will not detect any flow at all. Ideally for correct detection, we recommend the sensor tip be located at a distance from the pipe wall equal to 20% of the internal cross-section diameter of the pipe. Note that NPT fittings are tapered, and consideration should be given to the fact that when installed together, NPT mating fittings will not fully thread down to the bottom of the female connection.

**KAL-K Order Details (Example: KAL-4315C)**

Fitting	Model (304 SS)	Model (316-Ti SS)	Model (316 L SS)	Options
1/2" NPT	<b>KAL-4215</b>	<b>KAL-4315</b>	-	..C = 1/2" NPT Conduit Electrical Connection ..EP = Extended Probe* ..F = Fast Response Time (24 V <sub>DC</sub> Units Only) ..K = N/C Switch Logic ..M12 = Plug Connector w/6 ft Cable for 24 V <sub>DC</sub> Units ..P03R = 110 V <sub>AC</sub> Version with Dry Contact
3/4" NPT	-	<b>KAL-4320</b>	-	
1-1/2" Tri-Clamp®	-	-	<b>KAL-4340S</b>	

\*specify probe length on your order (NPT models only)

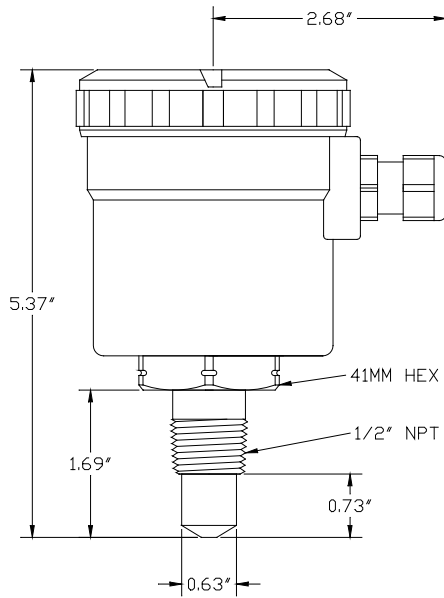


# Thermal Flow Switch Model KAL-K

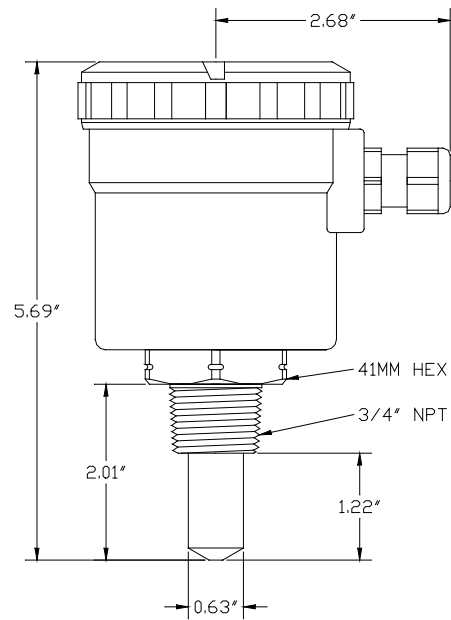
## Dimensions

### Standard Version

1/2" Model



3/4" Model



### Sanitary Version

