



## KAL-K & KAL-A COMPACT THERMAL FLOW SENSOR



- Revolutionary Microprocessor-Based Drift Stabilization
- NPT and 3-A Compliant Sanitary Fittings
- Non-Corrosive Housing
- No Moving Parts
- Extremely Low Pressure Loss
- Easy to Operate
- Insensitive to Dirt
- 4-20 mA Flow Rate Signal with KAL-A

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The KAL-K thermal flow switch and KAL-A thermal flow sensor utilize KOBOLD's revolutionary, temperature compensating electronics. These compact, one-piece units provide reliable readings unaffected by temperature or physical characteristics of a wide variety of process liquids. This breakthrough is made possible through the use of state-of-the-art microprocessor technology. The microprocessor can be field calibrated to the users' 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.

To further enhance the versatility of the KAL-K and KAL-A, both are 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, normally-open or normally-closed.

The KAL-A applies the KAL's advanced microprocessor based technology to the problem of rate detection. It incorporates a 4-20 mA, flow rate proportional output, the same 8-segment LED display found in the KAL-K, and an optional PNP setpoint alarm relay.

## 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.

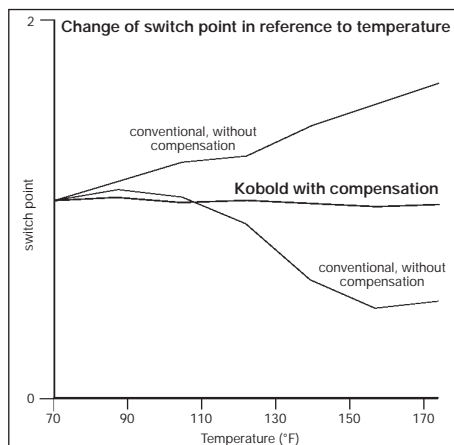
The microprocessor based design of the KAL distinguishes it from the competition. Full temperature compensation of the flow rate is readily obtained through a simple, one-time, calibration procedure. This assures elimination of flow rate reading drift caused by temperature variations in the process liquid.

### Note:

The flow ranges specified in the table on the right are extrapolated from values measured with water in a 1" pipe. Since flow characteristics vary with pipe dimensions, observed flow ranges may differ significantly from the values provided in the table.



## KOBOLD KAL-K and KAL-A Flow Sensors



## 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.

## Approximate Sensing Range at Various Pipe Diameters

| Nominal ID inches | Range GPM Water |
|-------------------|-----------------|
| 1/2               | 0.3 - 5.0       |
| 3/4               | 0.5 - 8.9       |
| 1                 | 0.8 - 14        |
| 1 1/4             | 1.1 - 20        |
| 1 1/2             | 2.0 - 35        |
| 2                 | 3.1 - 55        |
| 2 1/2             | 4.4 - 80        |
| 3                 | 7.9 - 140       |

| Nominal ID inches | Range GPM Water |
|-------------------|-----------------|
| 4                 | 12 - 220        |
| 6                 | 28 - 500        |
| 8                 | 50 - 900        |
| 10                | 78 - 1400       |
| 12                | 110 - 2000      |
| 16                | 200 - 3600      |
| 20                | 310 - 5600      |





- Revolutionary Microprocessor-Based Switch-Point Stabilization
- NPT and 3-A Compliant Sanitary Fittings
- Compact Design
- No Moving Parts
- Extremely Low Pressure Loss
- Easy to Operate
- Insensitive to Dirt

The KAL-K thermal flow switch utilizes KOBOLD's advanced microprocessor-based technology to provide a stable setpoint regardless of changes in temperature. The KAL-K's solid-state switches can be configured as NPN or PNP and normally-open or normally closed.

Based on the calorimetric principle, the KAL-K can continuously monitor the flow of both viscous and non-viscous media. Unlike other designs, the KAL is unique in its use of a single element to both heat the probe tip and measure its temperature. This integrated heating-measuring approach allows the probe to be machined into a single, continuous, protrusion-free surface. The absence of protrusions prevents contaminant from building up on the probe tip. This improves the KAL's performance in two ways:

1. The KAL's sensing stability is increased because contaminant cannot thermally isolate the probe from the liquid.
2. System down-time associated with probe cleaning is dramatically decreased.

Stability and Reliability ... a KOBOLD KAL trademark!

### KAL-K Ordering Information

| Model  | Wetted Parts | 1/2" Model     | 3/4" Model |
|--|--------------|----------------|------------|
| Standard NPT                                       | 304 SS       | KAL-4215       | -          |
| NPT w/316-Ti SS                                    | 316-Ti SS    | KAL-4315       | KAL-4320   |
| Sanitary   | 316-Ti SS    | KAL-4340-S     |            |
| Plug Connector with 6 ft cable (24 VDC units only) |              | Suffix: "M12"  |            |
| N/C Switch Logic                                   |              | Suffix: "K"    |            |
| 110 VAC version with dry contact                   |              | Suffix: "P03R" |            |
| Fast Response Time (24 VDC units only)             |              | Suffix: "F"    |            |



### KOBOLD KAL-K in Standard Housing

#### Specifications

**Switching Range:** 0.05 - 2 m/s  
**Media:** water-based liquids  
60 cSt Max.

**Response Time**  
**Typical:** 5.6 seconds  
**Optional w/"F":** 1.2 seconds

**Fittings**  
**Standard:** 1/2" or 3/4" NPT  
**Sanitary:** 1 1/2" Tri-Clamp®

**Flow Trend Indicator:** 8 Red LEDs  
**Temperature Rating**  
**Operating:** 32°F to 250°F  
**CIP:** 280°F Max.  
**Maximum Pressure:** 1450 PSIG

**Wetted Parts**  
**Standard NPT:** 304 SS  
**Optional NPT:** 316-Ti SS  
**Sanitary:** 316-Ti SS

**Housing**  
**Standard:** NEMA 4 (Nylon®)  
**Sanitary:** NEMA 4 (Nylon®)

**Power Requirements**  
**Supply Voltage:** 24 VDC ± 10%  
**Optional:** 110 VAC  
**Current Draw:** 300 mA max.

**Switch Characteristics**  
**Adjustment:** by Potentiometer  
**Status Indicator:** Bi-colored LED  
**24 VDC Units:**  
**Type:** N/O PNP or NPN open collector  
**Switch Rating DC only:** 400 mA @ 24V  
**110 VAC Units:**  
**Type:** N/O dry contact  
**Switch Rating AC only:** 5A @ 240 V  
**DC only:** 0.2 A @ 110V

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## Features

- Temperature independent 4-20 mA output
- Optional setpoint switch
- NPT and 3-A compliant sanitary fittings
- Compact Design
- Operate over a wide viscosity range
- No moving parts
- Extremely low pressure loss
- Easy to operate
- Insensitive to dirt

The KAL-A uses the calorimetric principle to continuously monitor the flow of low viscosity water-based media. Flow rate is transmitted via a 4-20 mA output while an optional PNP switch provides an alarm function. The transmission capability of the KAL-A is made possible by the high degree of temperature stability provided by its "intelligent" microprocessor based design. This digital approach also enables the use of a single RTD element to both heat the probe tip and measure it's temperature. Integrating the heating-measuring functions allows the probe to be machined into a single, continuous, protrusion-free surface. The absence of protrusions prevents contaminant from building up on the probe tip. These design enhancements improve the KAL's performance in two ways:

1. The KAL's sensing stability is increased because contaminant cannot thermally isolate the probe from the liquid.
2. System down-time associated with probe cleaning is dramatically decreased.

Stability and Reliability ... a KOBOLD KAL trademark!

## KAL-A Ordering Information

| Model                                  | Wetted Parts | 1/2" Model    | 3/4" Model |
|--|--------------|---------------|------------|
| Standard                               | 304 SS       | KAL-7215      | -          |
| Standard 316-Ti SS                     | 316-Ti SS    | KAL-7315      | KAL-7320   |
| .                                      |              |               |            |
| Sanitary                               | 316-Ti SS    | KAL-7340-S    |            |
| Options                                |              |               |            |
| PNP Switch                             |              | Suffix: "P"   |            |
| Micro DC Connector with 6 ft. of cable |              | Suffix: "M12" |            |



## KOBOLD KAL-A Specifications

### Specifications

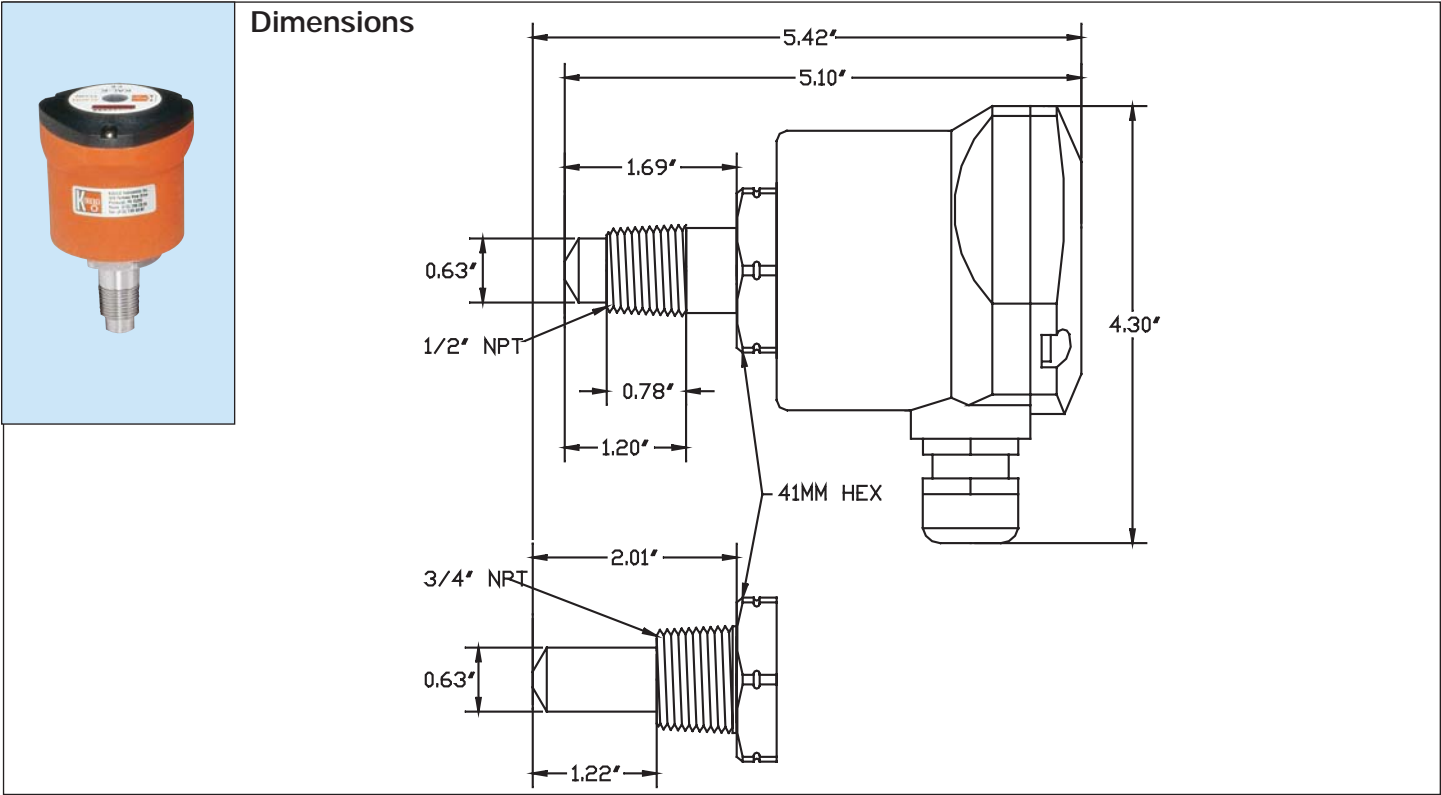
|                              |                                    |
|------------------------------|------------------------------------|
| <b>Sensing Range</b>         | 0.05 - 2 m/s                       |
| <b>Media:</b>                | Water-based liquids<br>60 cSt max. |
| <b>Response Time</b>         | 5.6 seconds                        |
| <b>Typical:</b>              |                                    |
| <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>Maximum Pressure:</b>     | 1450 PSIG                          |
| <b>Sanitary:</b>             | 600 PSIG                           |
| <b>Temperature</b>           |                                    |
| <b>Operating:</b>            | 0°F to 176°F                       |
| <b>CIP:</b>                  | 280°F                              |

|                     |                        |
|---------------------|------------------------|
| <b>Wetted Parts</b> |                        |
| <b>Standard:</b>    | 304 SS or<br>316-Ti SS |
| <b>Sanitary:</b>    | 316-Ti SS              |
| <b>Housing</b>      |                        |
| <b>Standard:</b>    | NEMA 4 (Nylon®)        |
| <b>Sanitary:</b>    | NEMA 4 (Nylon®)        |

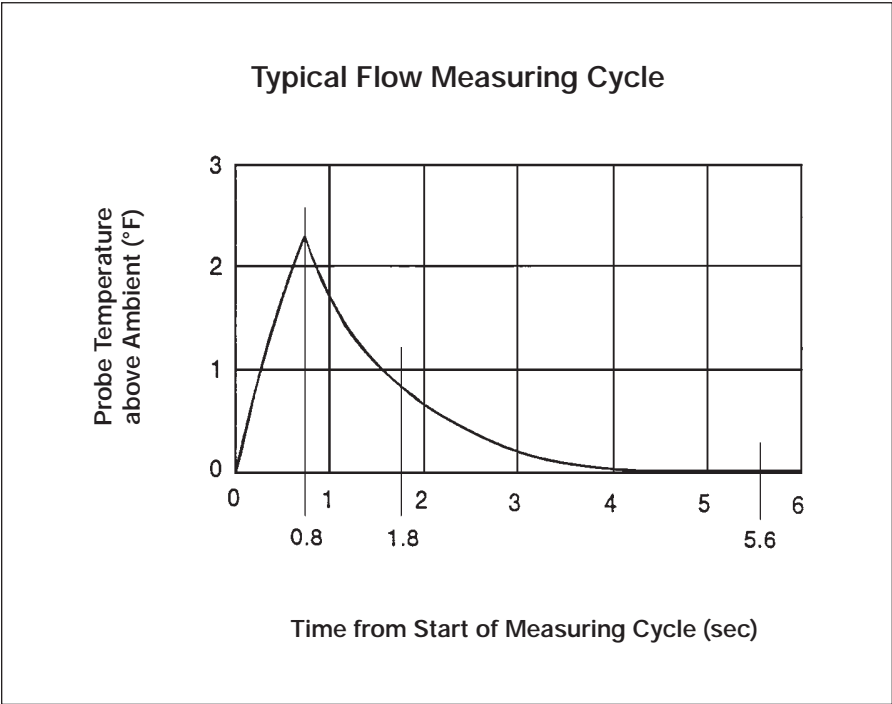
|  |                                    |
|--|------------------------------------|
| <b>Analog Output</b>                   |                                    |
| <b>Signal Type:</b>                    | 4-20 mA, 3-wire<br>into 500 Ω max. |
| <b>Linearity:</b>                      | ±10% of full scale                 |
| <b>Repeatability:</b>                  | ±1% of full scale                  |
| <b>Zero Adjustment:</b>                | 0-75% of range                     |
| <b>Span Adjustment:</b>                | 25-100% of range                   |
| <b>Optional Switch Characteristics</b> |                                    |
| <b>Adjustment:</b>                     | by Potentiometer                   |
| <b>Output:</b>                         | PNP open collector                 |
| <b>Max. Current:</b>                   | 400 mA                             |
| <b>Max. Voltage:</b>                   | 24 VDC                             |
| <b>Status Indicator:</b>               | Bi-colored LED                     |
| <b>Power Requirements</b>              |                                    |
| <b>Supply Voltage:</b>                 | 24 ± 2 VDC                         |
| <b>Current Draw:</b>                   | 300 mA max.                        |



Standard Version



KAL Timing - Heating and Measuring Cycle



Operating Behavior

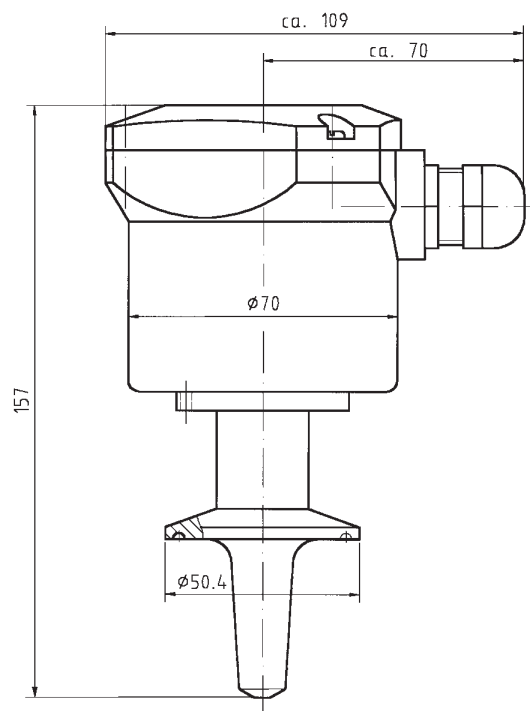
- At  $t=0$ , the probe temperature is recorded. This reading represents the ambient liquid temperature.
- Still at  $t=0$ , the KAL begins heating the probe.
- At  $t=0.8$  seconds, the heating cycle ends and the KAL begins monitoring the probe temperature.
- At  $t=1.8$  seconds, a temperature reading 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  $t=0$ .
- 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.

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## Sanitary Version



all dimensions in mm

**NOTE: Housing version shown below is no longer offered!**

