KOBOLD DFT Flow Sensor

User Instructions

KOBOLD Instruments Inc.
1801 Parkway View Drive
Pittsburgh, PA 15205
(412) 788-2830 • Fax (412)-788-4890
www.koboldusa.com

KOBOLD Instruments Canada Inc.
9A Aviation
Pointe-Claire, QC H9R 4Z2
(514) 428-8090 • Fax (514) 428-8899

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CAUTION: For safety reasons, please read the cautionary information located at the end of the manual, before attempting installation.

1.0 General

The KOBOLD DFT is intended for use in applications where flow measurement is desired and the pulse output signal is to be transmitted to a remote location. The optional electronic controller allows the flow rate data to be indicated locally, has the capability to operate two internal, flow rate setpoint relays and transmit an analog output signal proportional to the flow rate.

The DFT with the optional electronic controller is equipped with a 3-digit, 7 segment, red LED display for flow rate indication. The controller also can transmit a 0-20mA, 4-20 mA, 0-5 VDC or 0-10VDC (according to customer specifications) analog signal, proportional to the flow measured by the instrument. The two internal SPDT relays are easily adjusted by the user via the front panel controls, to the desired flow rate setpoint.

The DFT uses a paddle wheel to meter flow. The principle of operation is quite simple; the paddle wheel rotation is calibrated for flow rate. This rotation-flow relationship is linear in theory. In practice, theory is nearly borne out, leading to a very precise measuring device. Any non-linearity is within the stated measurement error of the device.

The paddle wheel approach to flow measurement has the advantage that the instrument may be installed in any orientation; only the flow direction is specified. Further, this measurement technique is relatively insensitive to dirt in the medium (ferritic contaminants, however, must be avoided).

2.0 Specifications

Table 2.1: Mechanical Data

Flow Range:	0.02-0.14 GPM to 0.5-12 GPM
Accuracy:	+/- 2.5% of Full Scale
Media:	Water and other low-viscosity liquids
Maximum Pressure:	Brass Body:230 PSIG Teflon Body:85 PSIG
Temperature Range:	-10 to 180°F
Wetted Materials:	
Brass Body:	Ni-Plated Brass, 316 SS, Delrin, Buna-N
Teflon body:	Teflon. Ceramic

Table 2.2: Electrical Data

with Pulse Flow Transmitter

Power Supply:	5-24 VDC, 10 mA Maximum
Output Type:	NPN, Open Collector, 0-100 Hz Nominal
Electrical Connection:	DIN 43650 Plug
Environmental Protection:	IP65 (equivalent to NEMA 4)

with Electronic Controller (Option: K5, K10, K20)

Power Supply:	24 VDC (+/ -10%), 5 W Max.
Analog Output (as specified):	0-20mA, 4-20mA, 0-5 VDC, 0-10 VDC
Maximum Load (current output):	500 Ohms
Relays:	Maximum Voltage/Current:240 VAC/2A
Wiring Connection:	5 Ft. PVC Cable
Environmental Protection:	IP65 (equivalent to NEMA 4)

3.0 Installation Instructions

CAUTION: For safety reasons, please read the cautionary information located at the end of the manual, before attempting installation.

3.1 Electrical Installation

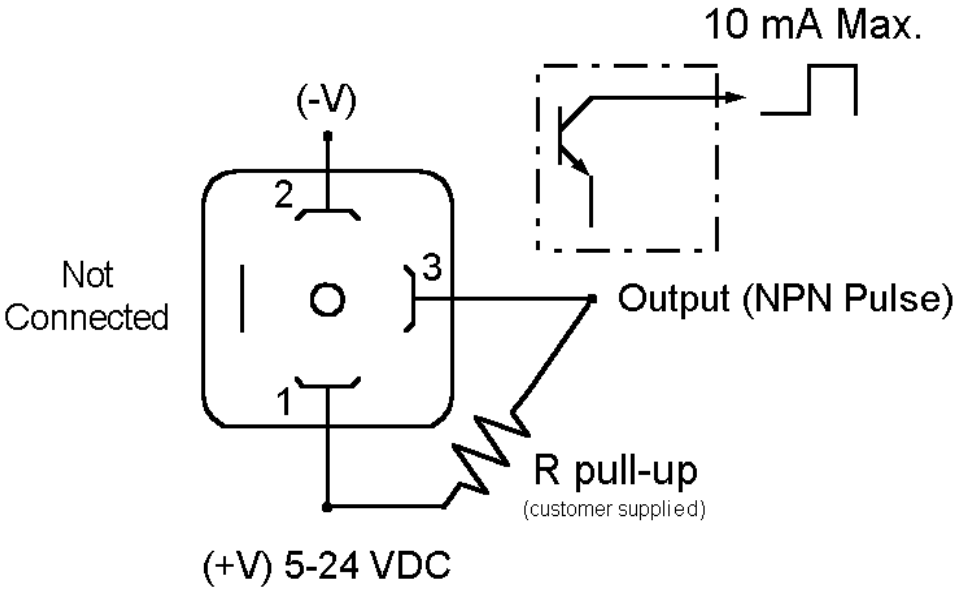
3.1.1 Make sure that the actual flow rate in your system lies within the flow range of the instrument. Flow rates in excess of 120% of the unit's maximum range will, in continuous use, lead to bearing and/or paddle wheel damage.

3.1.2 Ensure that the power supply voltage is in accordance with that specified on the identification tag.

3.1.3 **DFT w/Pulse Output:** If the sensor is to be used to provide a voltage pulse output, a sourcing output pull-up resistor **MUST** be connected between the supply voltage terminal and the open collector output terminal (terminals 1 and 3). This resistor should be sized such that the collector to emitter current is nominally 8 mA during the transistor "On" state. Under no circumstances should the collector to emitter current be allowed to exceed 10 mA. Electrical connections are made using the standard DIN 43650 plug as specified by the following wiring diagram:

Diagram 3.1; Pulse Output Wiring

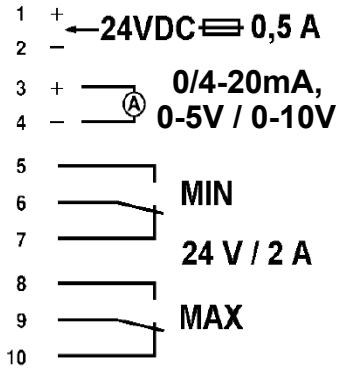
$$R_{\text{pull-up}} = \frac{V_{\text{supply}}}{.008} \text{ ohms}$$



3.1.4 **DFT w/Controller:** Electrical connections are made using the 10-wire cable as specified by the following wiring diagram:

Diagram 3.2: Wiring for Optional Electronic Controller

Wire 1: DC Power: **(+)**
Wire 2: DC Power: **(-)**
Wire 3: Analog Output: **(+)**
Wire 4: Analog Output: **(-)**
Wire 5: Min. Relay: N/O
Wire 6: Min. Relay: Common
Wire 7: Min. Relay: N/C
Wire 8: Max. Relay: N/O
Wire 9: Max. Relay: Common
Wire 10: Max. Relay: N/C



3.2 Mechanical Installation

3.2.1 The flow direction is indicated by an arrow on the housing. Install the instrument with the arrows aligned with the flow direction in your pipes. The flow sensor may be mounted in any orientation, as long as the axle remains in a horizontal plane.

3.2.2 Connect the unit with appropriately sized fittings. Take care not to place stresses on the housing. Use a wrench to hold the instrument static while you tighten the fittings on your pipe.

3.2.3 Should there be small amounts of ferrite contaminants in the medium, we recommend the installation of our magnetic filter (type MFR- or equivalent).

3.2.4 Medium should be introduced to the system slowly to avoid pressure surges which could damage the instrument.

4.0 Operation

4.1 DFT w/Pulse Output:

The device is delivered with a calibration diagram describing its frequency versus flow rate behavior. You must use this to calculate rate of flow in your system. Modification of the sensor (by physically modifying or replacing sensor components) requires recalibration of the unit.

4.1.1 Turning the Unit On

The sensor is operational as soon as it is wired into a power supply.

4.1.2 Flow Measurement

A frequency counting device must be used to read the sensor output and convert that measurement to rate of flow (frequency is directly proportional to flow). The exact nature of this relationship is graphically represented in the calibration diagram accompanying your unit. The calibration diagram also provides the sensor “k-factor” which is the number of pulses the sensor generates per gallon of water flow through the sensor.

4.2 DFT w/Electronic Controller:

The device is delivered fully calibrated and ready for use. The calibration screws (found inside the electronics housing), **MUST NOT** be adjusted by the user. Customer adjustment of these screws necessitates a recalibration of the unit. The precision of the instrument is guaranteed only if the calibration screws have not been adjusted. Modification of the sensor (by physically modifying or replacing sensor components) requires recalibration of the unit if the specified accuracy is to be maintained.

4.2.1 Turning the Unit On

The device is operational as soon as it is wired into a power supply. The red LED flow rate display will light indicating that power is present at the unit.

4.2.2 Using the Setpoint Relays

The DFT has two setpoint relays which may be used to control external equipment. If connecting equipment to the relays directly, ensure that the maximum current and voltage ratings of the relays are not exceeded. Note that the maximum values given in the specifications are PEAK values. Remember that certain types of loads can produce surges in voltage or current that may greatly exceed the operating values (e.g., turn-on current of electric motors.) If in doubt, we recommend that isolation relays be used to switch high current/voltage loads.

The status of the relays are displayed by two red LED's. The “maximum” LED lights when the flow rate exceeds the maximum setpoint value. The “minimum” LED lights when the flow rate is below the selected minimum setpoint value.

The relays are energized when in operating mode. Activation of the setpoints causes the relays to de-energize. Since any equipment connected through the relays is automatically shut down during a loss of power, this configuration provides for “Fail-Safe” operation in the event of power failure.

4.2.3 Adjusting the Setpoint Relays

The setpoints are adjusted with the aid of the flow rate display and the front touch pad of the DFT. Adjust as follows:

4.2.3.1 Select the limit switch you wish to adjust (either “MAX” or “MIN”) by pressing the appropriately labeled button on the front touch pad of the DFT. The value of the programmed flow rate setpoint is now displayed on the LED display. Hold this button down during the adjustment procedure.

4.2.3.2 Using the green up and down arrows on the device face, adjust the display to the desired setpoint value. The “up” arrow increases the setpoint value, while the “down” arrow decreases it. Touching the arrows momentarily will adjust the displayed value by the smallest amount which can be displayed. Holding the arrows down for longer times will cause the display to change value continuously, and more rapidly.

4.2.3.3 Release the “MIN” or “MAX” button. The setpoint value will remain displayed for about 3 seconds.

4.2.3.4 **WHILE THE SETPOINT VALUE IS STILL DISPLAYED ON THE READOUT,** press both “up” and “down” arrows simultaneously to lock the new setpoints into memory.

4.2.3.5 The setpoints are now recorded in the DFT’s non-volatile memory, and will remain in place even if power to the unit is disconnected.

PLEASE NOTE: The MIN/MAX setpoint values are completely independent of each other, thus, it is possible to set the minimum limit at a higher flow value than the maximum. Under certain conditions, this could disable your circuit until the limits are readjusted!

4.3 Flow Measurement

The DFT allows flow rate to be read two ways: Locally, via the built-in LED display or remotely, via the analog output. The DFT output signal, depending on customer specification, is either a 0-20mA, 4-20mA, 0-5VDC or 0-10VDC signal. The amount of current or voltage flowing is directly proportional to the measured flow. That is, with no flow, 0/4 mA or 0 V is transmitted, and at 100% of full scale, 20 mA, 5 VDC or 10 VDC is transmitted. This analog current or voltage is then interpreted by the end user with either a Kobold display, or some other electronic current or voltage sensitive instrument.

PLEASE NOTE: If the LED rate display is flashing, the design flow rate of the unit is being exceeded!

5.0 Arrival of Damaged Equipment

Your instrument was inspected prior to shipment and found to be defect-free. If damage is visible on the unit, we advise that you carefully inspect the packing in which it was delivered. If damage is visible, notify your local carrier at once, since the carrier is liable for a replacement under these circumstances. If your claim is refused, please contact Kobold Instruments for further advisement.

6.0 Maintenance

The KOBOLD DFT requires little maintenance provided the measured medium is kept free of contaminants. In particular, ferritic pollutants can cause problems for this device due to the incorporation of magnets into the paddle wheel. To avoid this, we recommend the installation of a magnetic filter, such as Kobold's model MFR or equivalent.

Do NOT tamper with the electronics as this voids your warranty.

7.0 Need help with your DFT Flowmeter?

Call one of our friendly engineers at 412-788-2830.

Caution

PLEASE READ THE FOLLOWING GENERAL FLOW METER / MONITOR WARNINGS BEFORE ATTEMPTING INSTALLATION OF YOUR NEW DEVICE. FAILURE TO HEED THE INFORMATION HEREIN MAY RESULT IN EQUIPMENT FAILURE AND POSSIBLE SUBSEQUENT PERSONAL INJURY.

- **User's Responsibility for Safety:** KOBOLD manufactures a wide range of process sensors and technologies. While each of these technologies are designed to operate in a wide variety of applications, it is the user's responsibility to select a technology that is appropriate for the application, to install it properly, to perform tests of the installed system, and to maintain all components. The failure to do so could result in property damage or serious injury.
- **Inspect instrument for damage upon arrival:** Cracked, fractured, bent or otherwise damaged instruments must not be put into use, since the device is weakened to an unknown extent. Refer to Section 5.0, Arrival of Damaged Equipment, for additional information.
- **Media and Chemical Compatibility:** The maximum tolerances of the device have been determined using water. If using other media, especially corrosive media, it is critically important that the user determine chemical compatibility with our instruments. KOBOLD Instruments Inc. cannot accept responsibility for failure and consequences resulting from use of media other than water.
- **Material Compatibility:** Make sure that the model which you have selected is chemically compatible with the application liquids. While the meter is liquid and spray resistant when installed properly, it is not designed to be immersed.
- **Proper Installation in Flow System:** Install the device in a fully supported position within your flow system. This avoids excessive stresses which may damage the instrument. In particular:

  a.) Ensure that the plumbing leading to and from the instrument is fully supported and that the instrument does not perform the physical function of a joint.

  b.) When calculating stress on the device caused by plumbing, the weight of the medium in the pipes must be considered as well.

  c.) Misaligned runs of rigid piping can cause large stresses when connected to the instrument. Do not connect in such a fashion.

  d.) When connecting fittings, hold the instrument fittings rigid with a correctly sized wrench. Do not install by twisting the instrument into the pipe fittings.

  e.) Do NOT install by holding the device housing to provide counter-torque to the pipe fitting.

  f.) Use an appropriate amount of TEFLON tape on male threads of fitting. This reduces the twisting stresses produced by tightening the fittings into each other.

  g.) Do not use pliers or wrenches on the housing, as this may damage it.

  h.) Do not overtighten, as this may fracture the fittings.

- **While Operating the Flow System:** During operation, there are a number of situations to avoid:

  a.) The sudden cessation of fluid flow causes what is typically referred to as "water hammer". Most people are familiar with this phenomenon from their home experience - it is the cause behind the loud clank of water pipes which occurs when faucets are turned off too suddenly. The cause behind this "water hammer" is quite easy to visualize. Water is fairly massive. The amount of water in long runs of pipe is quite substantial. When the faucets are turned off suddenly, especially from a full on condition, the water has considerable momentum and does not want to stop flowing. The situation is similar to stopping a car by running into a wall, rather than by applying brakes. Both are sudden rather than gradual. The damage to the wall can be substantial (not to mention the car).

  b.) The "water hammer" causes surges in fluid pressure which could cause the measurement instrument's pressure limit to be exceeded, resulting in failure and possible personal injury.

  c.) Fluid surges, as well as the water hammer, can be particularly damaging to empty flowmeters since there is no back pressure in the device. The damage is caused, once again, by momentary excess pressure. To avoid these surges, fluid lines should remain full (if possible) and water flow should be introduced to the device slowly.

  d.) If the instrument is isolated with inlet and outlet valves, the flowmeter must be completely drained when said valves are both closed. Failure to do so could result in damage to the device caused by thermal expansion of fluid.

  e.) Freezing of water in the instrument must be avoided since the resultant expansion will damage the flowmeter and make it unsafe for use.

- **Wiring and Electrical:** Section 2.0, Specifications and Section 3.0, Installation Instructions, provide the voltage and current limitations and the wiring for the various sensor types. The sensor electrical ratings should never be exceeded. Electrical wiring of the sensor should be performed in accordance with all applicable national, state and local codes.
- **Temperature and Pressure:** Section 2.0, Specifications, provides the temperature and pressure limits for each model. Operation outside these limitations will cause damage to the unit and can potentially cause personal injury. Fluid should never be allowed to freeze inside the sensor.
- **Make a Fail-safe System:** Design a fail-safe system that accommodates the possibility of switch or power failure. In critical applications, KOBOLD recommends the use of redundant backup systems and alarms in addition to the primary system.