



# Series TDFS2 Thermal Dispersion Flow Switch

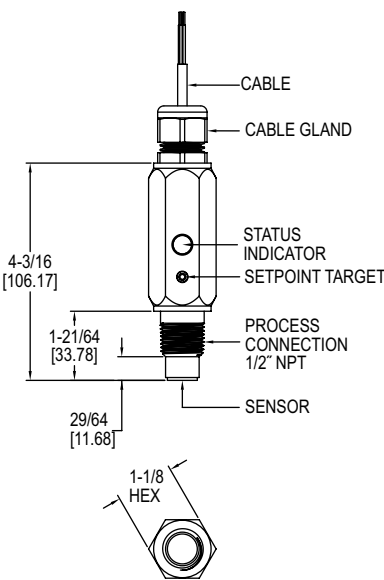
## Specifications - Installation and Operating Instructions



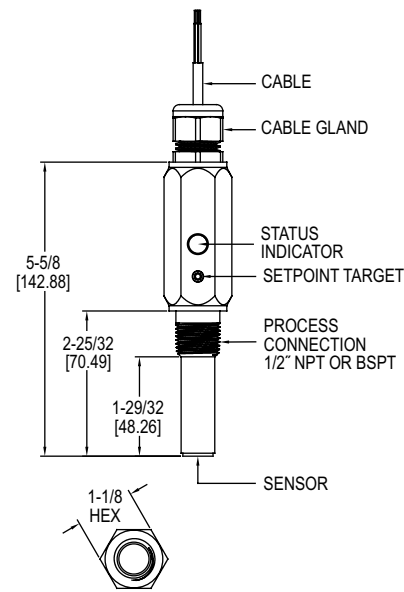
TDFS2-1-P-06



TDFS2-2-P-06



TDFS2-1-P-06



TDFS2-2-P-06

The **Series TDFS2 Thermal Dispersion Flow Switch** is a thermal flow switch that indicates whether the flow rate is above or below a user set flow rate. The unit incorporates two LED status indicators providing visual switch indication. The set flow rate (setpoint) is field adjustable and the unit has both NO and NC NPN outputs. See Figure 1 for output and LED actions on change of flow.

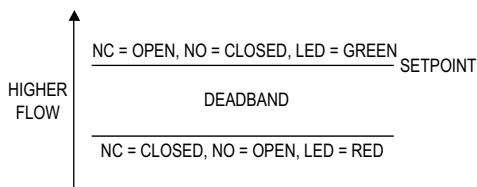


Figure 1: Switch setpoint and deadband

### OPERATING PRINCIPLE

The TDFS2 uses an impulse thermal dispersion measurement technique to measure the flow rate. The probe is heated above the process temperature and then is allowed to cool. The flow rate is determined from the rate at which the probe cools. The measurement cycle time is approximately 8 seconds.

### INSTALLATION

**NOTICE** Ensure that the process fluid is compatible with the wetted materials, and do not exceed the maximum device ratings.

**WARNING** Severe injury may occur. Ensure that the system is not pressurized before installing or removing this device or other objects from the system. The device and/or object may become a projectile.

**NOTICE** Do not use with abrasive fluid mixtures.

**NOTICE** Use caution if fluid temperature changes or fluid composition changes are present in the end application. Verify that the device operates properly if either is present. The setpoint will shift if the specific heat, density or viscosity of the fluid changes.

SPECIFICATIONS	
<b>Service:</b>	Compatible water-based fluids.
<b>Wetted Materials:</b>	316 SS.
<b>Pipe Range:</b>	1/2 to 1-1/2" (15 to 40 mm) or 2 to 10" (50 to 250 mm) (model selectable).
<b>Setpoint Range:</b>	0.5 to 10 ft/s (0.15 to 3.0 m/s).
<b>Repeatability:</b>	0.07 ft/s (0.02 m/s) +3% of setpoint.
<b>Typical Deadband:</b>	0.1 ft/s (0.03 m/s) +15% of setpoint.
<b>Temperature Limits:</b>	Ambient: 5 to 140°F (-15 to 60°C); Process: 5 to 140°F (-15 to 60°C), Storage: -40 to 185°F (-40 to 85°C).
<b>Pressure Limits:</b>	300 psig (20.67 bar).
<b>Response Time:</b>	Approximately 8 s.
<b>Power Requirement:</b>	9-24 VDC.
<b>Switching Current:</b>	400 mA, derate 5 mA/°C above 23°C.
<b>Current Consumption:</b>	Average: 93 mA; Peak: 300 mA.
<b>Electrical Connection:</b>	1/2" NPT female or cable gland with 4 conductor 22 AWG 6' (1.83 m) long (model selectable).
<b>Process Connection:</b>	1/2" NPT or BSPT male (model selectable).
<b>Enclosure Rating:</b>	NEMA 4X (IP65).
<b>Housing Materials:</b>	316 SS, 416 SS, polycarbonate, neoprene, and acrylated urethane.
<b>Switch Type:</b>	1 NO NPN, 1 NC NPN.
<b>Input Power and Protection:</b>	0.5A fuse (resettable) reverse polarity protected.
<b>Switched Output Protection:</b>	0.5A fuse (resettable) reverse polarity protected.
<b>Agency Approvals:</b>	CE.

MODEL CHART						
<b>Example</b>	TDFS2	-1	-C	-06	-BSPT	TDFS2-1-C-06-BSPT
<b>Series</b>	TDFS2					Thermal dispersion flow switch
<b>Pipe Size</b>		1				1/2 to 1-1/2" (15 to 40 mm) pipe sizes
		2				2 to 10" (50 to 250 mm) pipe sizes
<b>Electrical Connection*</b>			C B P			1/2" female NPT with PVC cable for conduit connection Cable gland with burial rated cable Cable gland with PVC jacketed cable
<b>Cable Length</b>				X		Cable length (ft.)
<b>Options</b>					BSPT	1/2" BSPT process connection
*Per ft cable length adder.						

APPROXIMATE FLOW RATES FOR COLD WATER IN SS TEE AND CARBON STEEL SCHEDULE 40 PIPE: TDFS2-1-X-X					
Pipe Size	1/2" (15 mm)	3/4" (20 mm)	1" (25 mm)	1-1/4" (32 mm)	1-1/2" (40 mm)
GPM (LPM)	0.47-9.42 (1.78-35.66)	0.82-16.47 (3.10-62.35)	1.35-27.01 (5.11-102.24)	2.33-46.66 (8.82-176.63)	3.18-63.51 (12.04-240.41)

APPROXIMATE FLOW RATES FOR COLD WATER IN SS TEE AND CARBON STEEL SCHEDULE 40 PIPE: TDFS2-2-X-X							
Pipe Size	2" (50 mm)	3" (80 mm)	4" (100 mm)	5" (125 mm)	6" (150 mm)	8" (200 mm)	10" (250 mm)
GPM (LPM)	5.25-104.98 (19.87-397.39)	11.55-230.91 (43.72-874.09)	19.9-397.9 (75.33-1506.21)	31.24-624.81 (118.26-2365.16)	45.14-902.7 (170.87-3417.08)	78.01-1560.17 (295.30-5905.87)	122.99-2459.81 (465.57-9311.36)

Mount the TDFS2 so that the sensor extends into the flow by 10-25% of the pipe ID. Use PTFE tape on the process connection to reduce the risk of leaks. For proper flow measurement, the sensor must be fully submerged in the fluid. Bubbles, turbulence, and sediments will cause improper operation. For best operation, mount 30° to 150° off vertical on horizontal runs (see Figure 2). Allow a straight run of at least 12 pipe diameters upstream and 5 pipe diameters downstream to ensure optimal flow measurement. For optimal repeatability, ensure the flow switch is not operating in the transition region (laminar to turbulent flow).

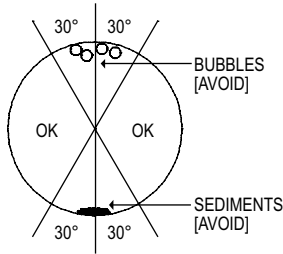


Figure 2: Mounting orientation

**ELECTRICAL CONNECTION**

The power input and switched outputs are individually fused at 0.5A and are reverse polarity protected. A shielded 4 conductor cable provides the electrical connection to the TDFS2. The cable drain wire must be connected to earth ground in CE applications or when strong RF fields are present.

Two open collector switched outputs are provided. One is normally open (NO), and the other output is normally closed (NC). The output logic is shown in Table 1.

Condition	NO	NC
Flow Above Setpoint	Closed	Open
Flow Below Setpoint	Open	Closed
Off/Internal Fault	Open	Open

Table 1: Open collector operation

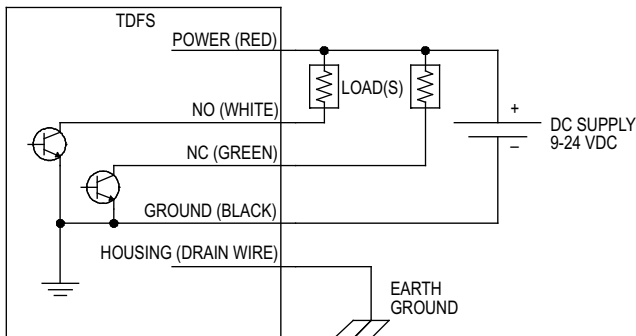


Figure 3: Wiring diagram

Ensure that units with conduit opening are properly sealed with appropriate conduit.

**SETPOINT ADJUSTMENT**

The setpoint may be adjusted with the supplied magnet. There are two setpoint targets on the unit located under the LED status indicator on opposite sides of the unit (see Figure 4). Either setpoint target may be used, and either end of the magnet may be used. If the setpoint does not set easily, try reversing the magnet.

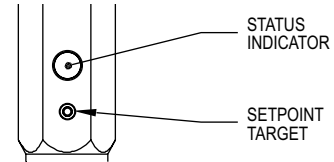


Figure 4: Set point target

Steps:

- 1) Ensure that the unit is properly installed and powered.
- 2) Set the system flow to the desired setpoint flow rate.
- 3) Tap the setpoint target three times with the supplied magnet. Move the magnet approximately 2 inches away from the target between each tap. The taps should be approximately 1 second apart. The LED status indicator will blink slowly when the setpoint request is recognized. The slow blink will stop when the setpoint has been stored.

**STATUS INDICATOR**

The status indicator (See Figure 4) provides visual indication of the TDFS2 status. Two status indicators are located on opposite sides of the unit. Each status indicator has one red LED and one green LED. Table 2 describes the status indicator states.

If an error condition is present, the unit will continue measurement attempts until the problem has cleared. The status indicator will cycle on and off during this time.

Description	Color	State
Off	N/A	Waiting for first measurement or unit is off
Dimmed Pulses	Any	Start of a measurement cycle (normal operation)
Steady	Red	Flow is below the setpoint
	Green	Flow is above the setpoint
Intermittent	Red and Green	Error condition: (1) Process temperature is out of range (2) Internal fault
Slow Blink	Any	A setpoint adjustment was requested
	Green	Flow is in the nominal range
	Red and Green	Flow is below the nominal range
	Alternating	Setpoint will be limited to the maximum allowable flow

**Table 2: Status indicator states**

**NOTICE**

Design a fail-safe system that takes into consideration the possibility of switch failure, power failure and operator error.

**MAINTENANCE/REPAIR**

Upon final installation of the Series TDFS2, no routine maintenance is required. The Series TDFS2 is not field serviceable and should be returned if repair is needed. Field repair should not be attempted and may void warranty.



This symbol indicates waste electrical products should not be disposed of with household waste. Please recycle where facilities exist. Check with your Local Authority or retailer for recycling advice.

**WARRANTY/RETURN**

Refer to "Terms and Conditions of Sale" in our catalog and on our website. Contact customer service to receive a Return Materials Authorization (RMA) number before shipping the product back for repair. Be sure to include a brief description of the problem plus any additional application notes.

**PARTS**

Replacement magnets (part number 100571-00) may be ordered from Dwyer Instruments, Inc.

**PRESSURE DROP**

TDFS2-1-X-X		TDFS2-2-X-X					
Velocity ft/s (m/s)	1/2" (15 mm) in w.c. (kPa)	3/4" (20 mm) in w.c. (kPa)	2-1/2" (65 mm) in w.c. (kPa)	4" (100 mm) in w.c. (kPa)	6" (150 mm) in w.c. (kPa)	8" (200 mm) in w.c. (kPa)	10" (250 mm) in w.c. (kPa)
0.5 (0.15)	0	0	0	0	0	0	0
1.0 (0.31)	0	0	0.1 (0.013)	0	0	0	0
2.0 (0.61)	0	0.2 (0.045)	0.1 (0.045)	0	0	0	0
3.0 (0.91)	0.2 (0.045)	0.4 (0.099)	0.4 (0.095)	0.1 (0.018)	0	0	0
4.0 (1.22)	0.5 (0.125)	0.7 (0.174)	0.7 (0.164)	0.1 (0.033)	0.1 (0.017)	0	0
5.0 (1.52)	0.7 (0.174)	1.2 (0.299)	1.0 (0.252)	0.2 (0.053)	0.1 (0.025)	0.1 (0.014)	0
6.0 (1.83)	2.6 (0.648)	1.7 (0.423)	1.4 (0.358)	0.3 (0.078)	0.1 (0.035)	0.1 (0.020)	0.0 (0.010)
7.0 (2.13)	3.3 (0.822)	2.1 (0.523)	1.9 (0.482)	0.4 (0.107)	0.2 (0.047)	0.1 (0.028)	0.0 (0.012)
8.0 (2.44)	4.3 (1.071)	2.7 (0.673)	2.5 (0.625)	0.6 (0.141)	0.2 (0.060)	0.1 (0.037)	0.1 (0.014)
9.0 (2.74)	3.5 (0.872)	3.4 (0.847)	3.1 (0.787)	0.7 (0.180)	0.3 (0.075)	0.2 (0.047)	0.1 (0.017)
10.0 (3.05)	4.5 (1.121)	4.2 (1.046)	3.9 (0.967)	0.9 (0.224)	0.4 (0.091)	0.2 (0.058)	0.1 (0.019)

**Table 3: Pressure drop (water)**

