What is Thermal Dispersion?

Winter Storm Fern Practical Experience

Same Air Temperature, but who feels colder?

That's Thermal Dispersion! - Flow

Thermal Dispersion

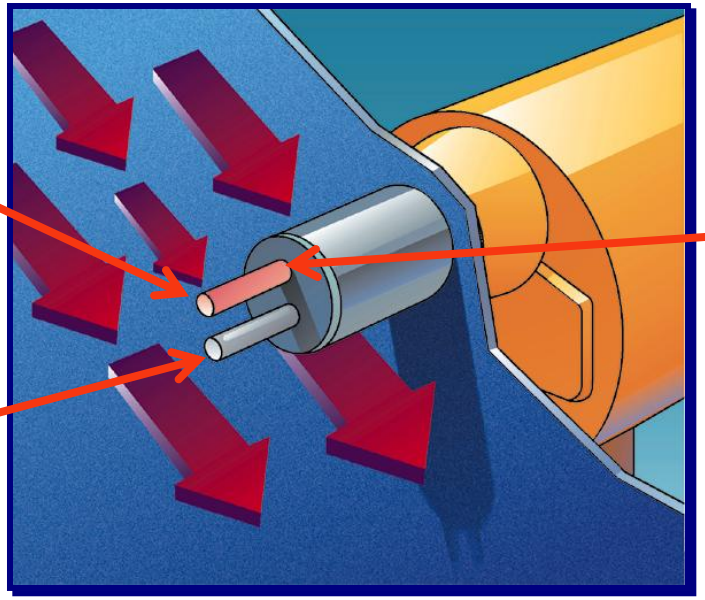
Practical Experience

Same air temperature, who feels colder?

That's Thermal Dispersion! – Liquid Level

Thermal Dispersion Technology
Principle of Operation

RTD plus Heater Element as Active or Heated Sensor



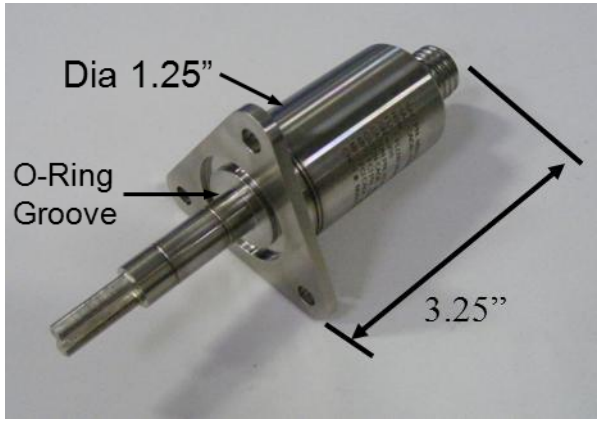
Constant Power Supply from Electronics to Heater Element (Switch)

Or

Varying Power Supply from Electronics to Heater Element (Transmitter)

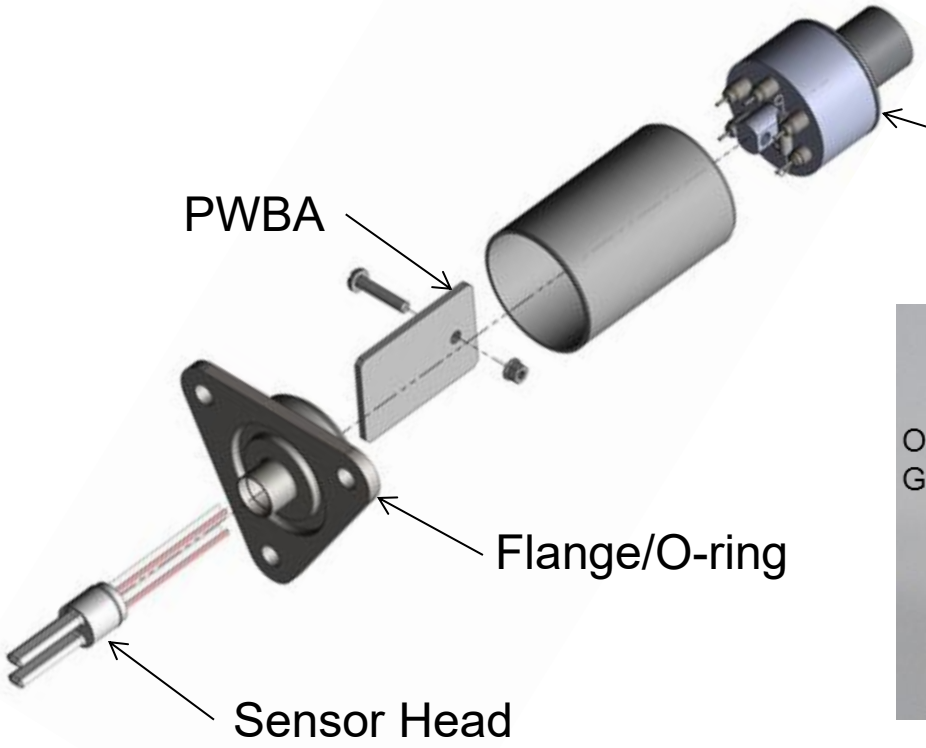
RTD as Reference or Unheated Sensor

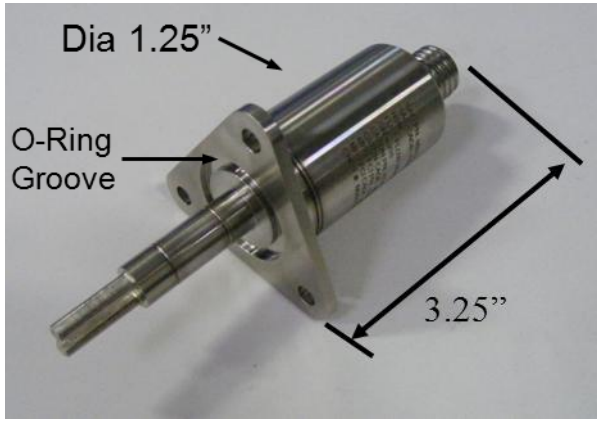
COTS Flow & Level Switch – Single Output



- Stainless Steel welded construction
- Hermetic design
- Compact, robust Line Replaceable Unit (LRU)
- Weight 0.45 lbs Max
- Flange mount W/face O-ring seal
- No Moving Parts, MTBF 200,000+ hrs
- Analog circuit, no software – No DO-178B required
- Electronics capable up to 250 °F (125 °C) continuous operation
- Process Temp capability -40 to +350 °F (-40 to 175 °C)
- Switch point can be adjusted through electrical connector
- Can be used in different media types: Oil, Fuel, Air, Coolant
- Calibrations in customer process fluid and piping sections available
- Qualified to high level of Commercial and Military Requirements

COTS Flow & Wet/Dry Switch – Single Output

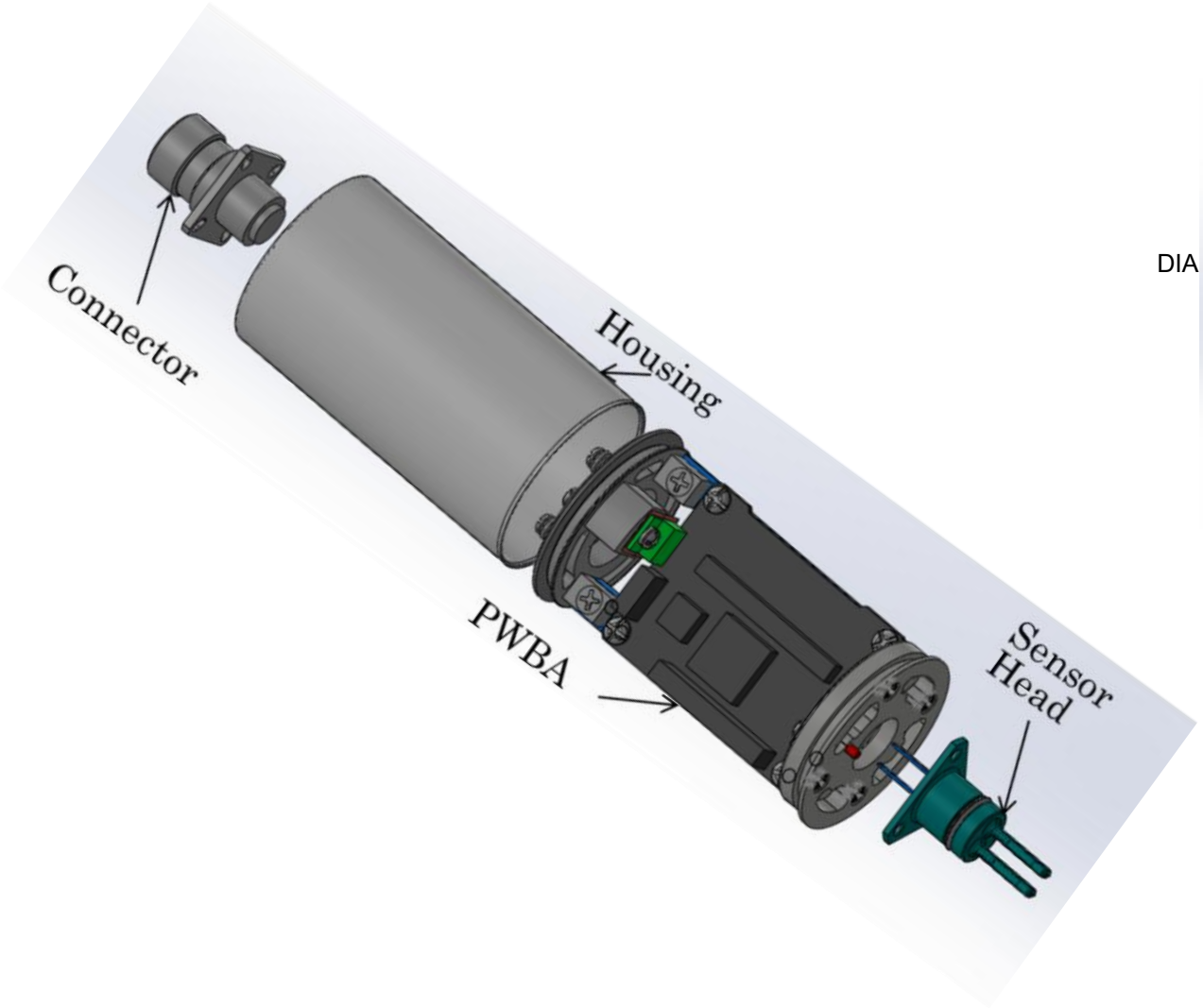


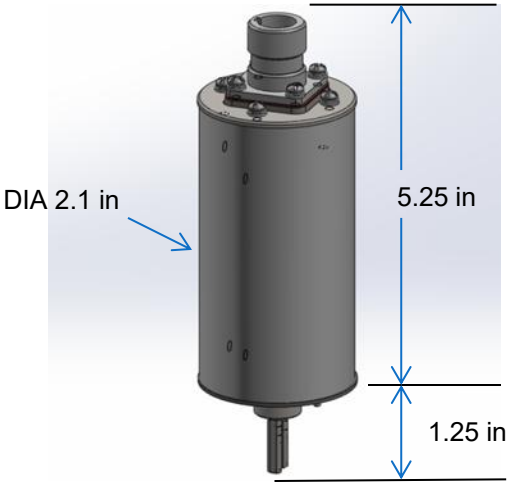


Mass Flow/Temp Transmitter

- **Description**
  - Sensor body is made from 300 Series Stainless Steel
  - O-Ring sealed repairable assembly
  - 4 bolt mounting flange
  - D38999- Connector
  - *Weight 1.2 lbs max*
- **Features**
  - 28 VDC input
  - Power consumption 10 watts Max
  - Two outputs: Temp and Flow Linear 0.5 – 4.5 VDC
  - Media Temp: -40 F to + 350F, Ambient -40 F to +185F
  - Flow range: Liquid up to 10 ft/sec, Gas up to 180 actual ft/sec
  - Accuracy: Flow ±2% FS, Temp ±2F
  - Reliable, used on multiple applications
  - Commercial and Military High Level Qualification pedigree
  - Calibration in customer's media and piping configuration available

Mass Flow/Temp Transmitter





Flow/Temp, Transmitter and/or switch

FLOW SENSOR TRANSMITTER ASSEMBLY FCI PN

CONNECTOR PIN-OUT

J1

1	POWER IN (+22V TO +29V)
2	POWER RETURN
3	CHASSIS GROUND
4	TEMP -
5	FLOW +
6	FLOW -
7	TEMP +
8	FACTORY USE ONLY
9	FACTORY USE ONLY
10	FACTORY USE ONLY
11	FACTORY USE ONLY
12	FACTORY USE ONLY
13	FACTORY USE ONLY

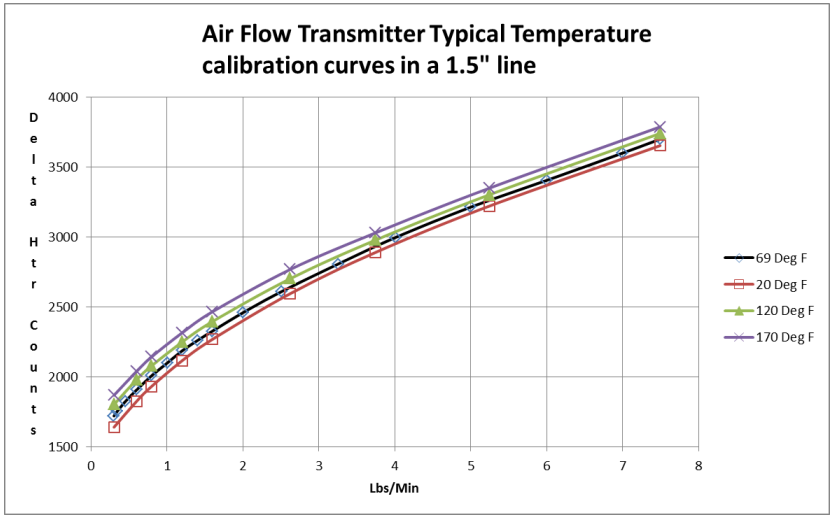
Output Capability

Two Linear 0 – 5 VDC outputs

Six sinking switch outputs

Flow Transmitter

Temperature Compensation and Calibration

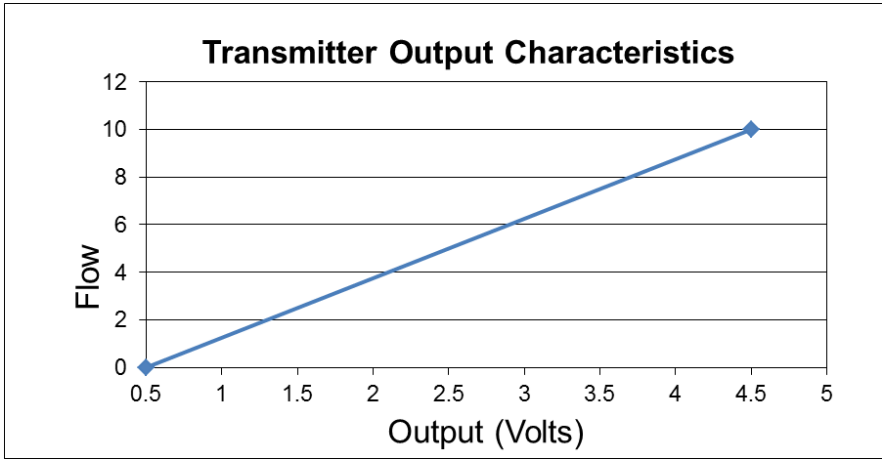


Temp Compensation

- Flow vs output at various temperatures
- Apply a slope and an offset to bring the curves together

Calibration- Linearize the output

- In Situ
- FCI Ducting – Matching Diameter
- FCI Ducting – Matching velocities



Thermal Dispersion
Liquid Level Sensor Operation

Liquid Level Switches - Constant Heater Power, Varying Delta Temperature

- Poor heat transfer, highest delta temperature – air or gas
- Moderate heat transfer, higher delta temperature – oil or fuel
- Good heat transfer, lower delta temperature – water or heat transfer fluids

Remote Oil Level Sensors (ROLS) – Simple Single RTD Design

- Single RTD is reference temperature sensor at beginning of current pulse
- Single RTD self heat to perform heater function during current pulse
- Single RTD is active temperature sensor at end of current pulse
- Difference in delta temperature between beginning and end of current pulse indicates wet or dry sensor condition

Single Point Liquid Level Switches

Single Point Liquid Level Switch Features

- ❑ Single Point Sensor Elements
- ❑ Requires only 28 VDC Power Input
- ❑ Customer “Sink” or “Source” Output
- ❑ Any Mounting Orientation – Vertical, Horizontal or Angled
- ❑ 100,000+ Hour Proven MTBF No Moving Part Reliability
- ❑ External Flange Mounting Configurations For Reservoirs, Sumps and Pipes
- ❑ Wet/Dry or Immiscible Liquid Interface
- ❑ FCI Proprietary Operating Principle – Thermal Dispersion Technology (TDT)

Liquid Level Elements and Remote Oil Level Sensor (ROLS)

ROLS Features

- ❑ Single or Multipoint Sensor Elements
- ❑ Internal or External Mounting Configurations
- ❑ Interfaces with Customer Electronics (FADEC)
- ❑ “Electronic Dipstick” Function – Active only when pulsed while gearbox is at rest
- ❑ RTD Temperature Sensor Output Available During Normal Gearbox Operation
- ❑ 200,000+ Hour Proven MTBF Reliability
- ❑ FCI Proprietary Operating Principle

Advantages of Thermal Dispersion Technology

- No moving parts
- Rugged and highly reliable (100,000+ hours MTBF)
- Unaffected by contaminants
- Insignificant pressure drop in flow stream
- Available Independent Temperature Output with Flow or Level Sensor
- Proven RTD type sensors
- Low flow sensitivity, turn down up to 100/1
- Direct mass flow measurement
- Low weight and small size
- Flight qualified to highest Commercial and Military Requirements