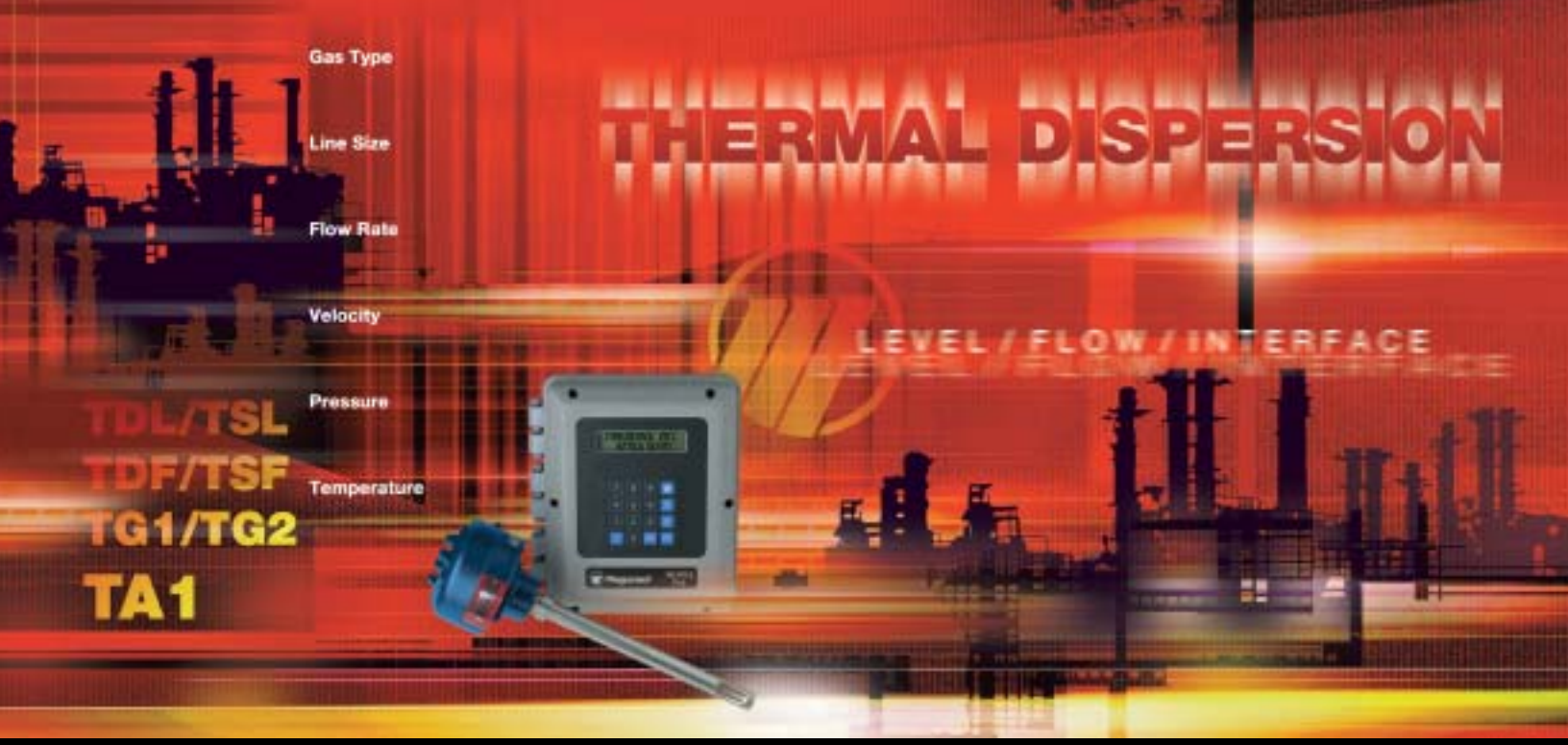


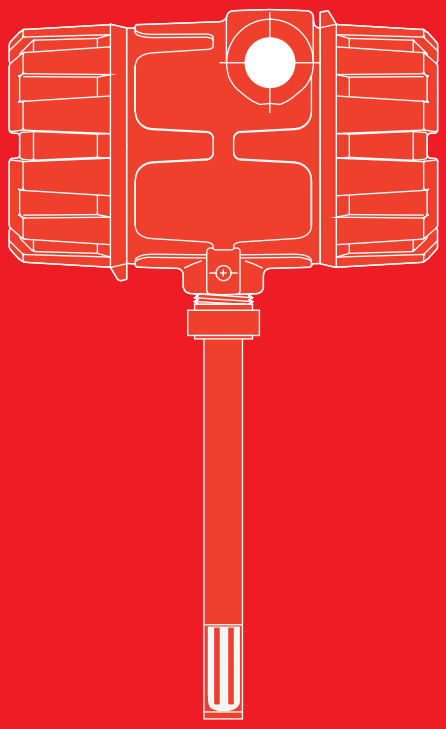
THERMATEL® THERMAL DISPERSION

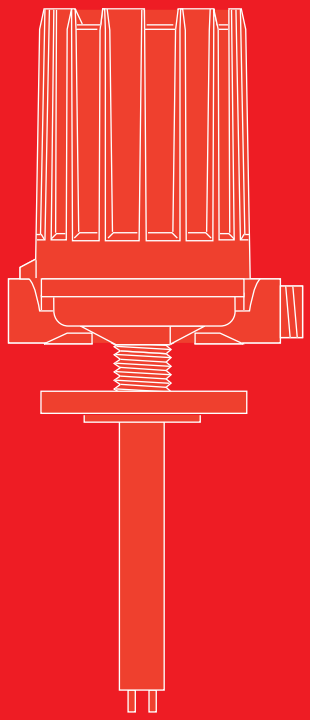
Magnetrol®

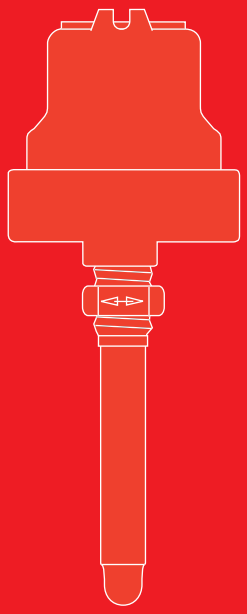
Worldwide Level and Flow Solutions℠

The Total Spectrum of Solutions ▶

Magnetrol's products employ many technologies to meet the challenges of level and flow control. Thermatel switches and transmitters utilize the principles of thermal dispersion for accurate and reliable level, flow, and interface control.







MAGNETROL

THERMAL DISPERSION PRODUCTS

Magnetrol International —a world leader in level and flow control technology— designs, manufactures, markets and services level and flow instrumentation worldwide.

Magnetrol's product groups are based upon these technologies:

- Air Sonar
- Buoyancy
- Contact Ultrasound
- Guided Wave Radar
- RF Capacitance
- Thermal Dispersion
- Vibration
- Visual Indicators

The industries we serve include:

- Petroleum Production
- Petroleum Refining
- Power
- Petrochemical
- Chemical
- Water & Wastewater
- Pulp & Paper
- Food & Beverage
- Pharmaceutical

THERMATEL
THERMAL DISPERSION

C O N T E N T S

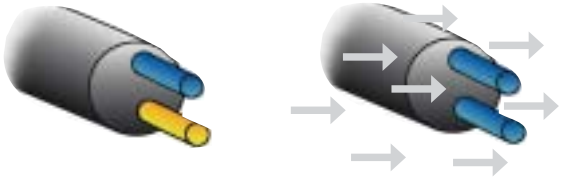
An Introduction To Thermatel Technology & Products

Thermatel products utilize thermal dispersion technology for unsurpassed accuracy and reliability in monitoring gas flow, liquid flow, and liquid level. A market-proven technology, thermal dispersion has been in use by process industries for measurement and control purposes since the early 1960s.

Product Scope

The Thermatel product line has been structured to provide customers with a complete range of options in thermal dispersion technology. Each Thermatel product is engineered and manufactured to provide the highest reliability in even the most demanding process environments.

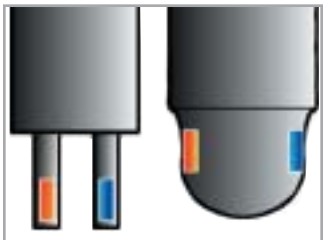
Thermatel products range from single-point switches to the powerful TA1/TA2 Thermal Mass Flow Transmitters. The TA1/TA2 powerful microprocessor-based electronics make these units the premier thermal dispersion transmitters in the industry. They are easy to set up, configure, and provide high levels of accuracy, repeatability, and diagnostics. Magnetrol's TA1 & TA2 flow transmitters represent today's state of the art in mass flow measurement technology.



High Temperature Differential | Low Temperature Differential

Thermatel products employ twin RTD sensors to sense process change in level and flow applications. One sensor measures surrounding process temperature to provide a temperature reference. The second sensor is self-heated to establish a temperature differential above the reference temperature. In level applications, the cooling effect of contacting media reduces the temperature difference between the RTDs, as does an increase in velocity in flow applications. In each instance, the decrease in temperature differential triggers a relay action.

Applications Range



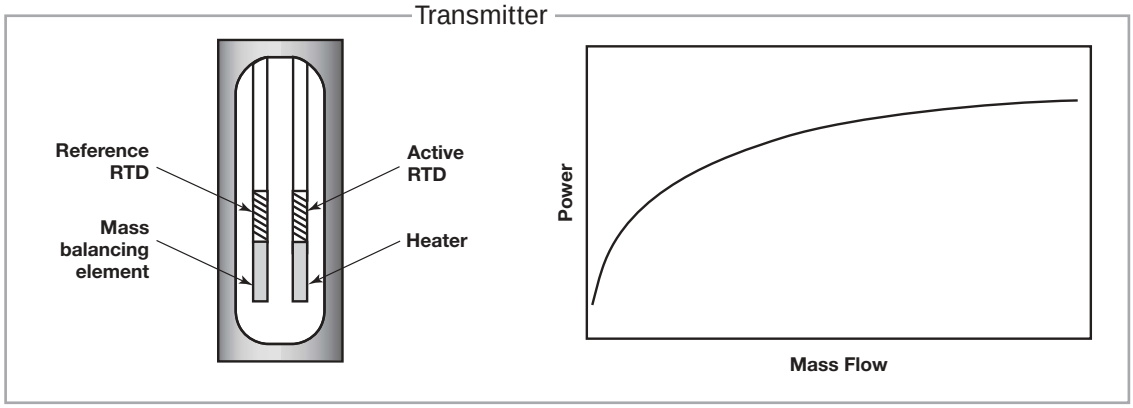
Insertion probe designs for Thermatel switches use two basic RTD configurations. The twin-tip design with exposed sensor tips is available in a broader range of materials and sustains higher pressures. The spherical tip design (only available in 316L stainless steel) offers greater sensor protection and a faster response to reduction flow or level.

Thermatel products are in service worldwide in many of the most demanding applications. Industries served include petroleum refining and production, power and energy, chemical, water and wastewater, pulp and paper, and food and pharmaceutical processing. Thermatel level switches provide outstanding performance with liquids and slurries even in environments where foam and turbulence are present. Unlike other technologies unable to detect low flow rate, Thermatel products provide outstanding low flow sensitivity.

For highly accurate mass flow measurement of air and gases, the Thermatel TA1 and TA2 Thermal Mass Flow Transmitters are without peer. Typical applications include combustion, compressed and aeration air lines, as well as natural and digester gas, flare lines, plus other gas flow applications.

Principle of Operation: Switches

Flow and level detection is accomplished when Thermatel's sensing elements detect changes in the heat transfer characteristics of the process media. As a flow switch, Thermatel switches will rapidly detect changes in liquid or gas flow rate by detecting heat transfer, which increases at higher flow rates. Level detection is accomplished by sensing changes in the thermal conductivity of media. Thermatel switches can also be calibrated to sense difference in heat transfer at an interface between two dissimilar media, such as oil/water, water/foam, or liquid/solids.



Thermatel switches rely on two miniature sensing elements to detect heat transfer. Resistance Temperature Detectors (RTDs) establish a thermal relationship that establishes the basis for flow and level detection. One RTD measures the temperature of the surrounding media which serves as the instrument's reference temperature. The second RTD is heated to establish a temperature differential above the reference temperature. In flow sensing applications, the first RTD cools in the presence of flow. In level sensing applications, the RTD cools in the presence of media. In each case, cooling the heated RTD decreases the differential temperature between the two RTDs. This decrease is then converted into a relay actuation which performs a control function.

Principle of Operation: Transmitter

Thermal dispersion technology provides a mass flow measurement of air or gas. This is accomplished by precisely measuring the cooling effect as the mass (molecular) flow passes the heated sensor. The sensor consists of two elements: the reference which measures the temperature of the gas and a second element which is heated at a variable power. This maintains the desired temperature difference between the two sensors.

The illustration on the top of this page shows the amount of power required to maintain a constant temperature difference between the two sensors. Under low mass flow conditions, there is minimal cooling and little power is required. As the mass flow increases, more power is required. This provides excellent low flow sensitivity and high turndown capabilities.

Each instrument is factory calibrated and configured for the specific application. If necessary, the TA1 or TA2 can be reconfigured in the field for different conditions.

Strengths ✚ and Cautions ▬

- ✚ Direct mass flow measurement—does not require pressure or temperature compensation which is required by other technologies.
- ✚ Thermatel offers excellent low flow sensitivity: gas velocities from 25 ft/min (0.13 m/s) to over 50,000 ft/min (250 m/s).
- ✚ Sensing and control functions are accomplished without moving parts—resulting in little or no maintenance and fewer on-line problems.
- ✚ Thermatel products are easy to install and provide rugged, accurate and reliable service.
- ▬ An alternative flow meter technology should be considered where condensed moisture is continuously present.
- ▬ Excessive build-up on the probe can reduce heat transfer rate and thus reduce accuracy and repeatability.

THERMATEL TA1/TA2 Mass Flow Transmitters

For Measurement of High and Low Flow Rates of Air and Gas

Model TA2
Mass Flow Transmitter

General Description: Magnetrol's TA1 and TA2 Thermal Dispersion Mass Flow Transmitters provide direct mass flow measurement of air and gases. The powerful microprocessor-based electronics provide an instrument that is easy to configure to the application, yet provides flexibility and ease of use. Advanced temperature compensation provides high accuracy over the entire operating range of the instrument. Installed cost of this instrument is very competitive with other gas flow measurement technologies.

Technology Features:

- Direct mass flow measurement
- Excellent low flow sensitivity
- High turndown ratios
- Ease of installation
- Low pressure drop

Product Features:

- Flow totalizer
- Keypad with 2 line × 16 character display
- Stainless steel and Hastelloy probe with wide selection of process connections
- NIST traceable calibration.
- Optional Hot Tap Retractable Probe assembly

Applications: Typical applications include combustion air-flow measurement, compressed air, natural gas flow, flare lines, digester gas, and other process gas flow measurement.

Model TA1
Mass Flow Transmitter

In **Magnetrol's Product Calibration Lab**, Thermatel products are calibrated and tested to meet customer specifications. Test variables include gas type, flow rates, velocities, and temperatures.

▲ THERMATEL TA1 For Gas Mass Flow Measurement

Unique Features:

- ▲ Remote electronics
- ▲ (2) 4-20 mA signals – one for mass flow and one for temperature
- ▲ Up to four 10 amp relays (optional)
- ▲ 16 button keypad integral to front cover
- ▲ RS-485/Modbus® communications
- ▲ NEMA 4X housing plus Class I, Division 2 Non-Incendive rating
- ▲ Explosion proof probe enclosure

▲ THERMATEL TA2 For Gas Mass Flow Measurement

Unique Features:

- ▲ Integral or remote electronics
- ▲ HART®, AMS communication
- ▲ All explosion proof housing with FM/CSA and ATEX approvals
- ▲ Ability to replace probe in field
- ▲ 4 button keypad for entry of instrument configuration

APPROVALS

FM APPROVED

SPECIFICATIONS

Supply Voltage: 120 VAC, 50-60 Hz
240 VAC, 50-60 Hz
24 VDC

Flow Range: 25-50,000 SFPM
(0.13-250 Nm/s)

Accuracy:
Flow ±1% of reading plus
0.5% of calibrated scale

Accuracy:
Temperature ±2° F (1° C)

Repeatability: ±0.5% of reading

Operating Temp:
Sensor -50° to +400° F
(-45° to +200° C)

Turn Down: 100:1 typical
depending upon application

THERMATEL Level and Flow Switches

Features:

- ▲ No moving parts
- ▲ Operating temperatures to +850° F (+450° C); pressures up to 6,000 psig (414 bar)
- ▲ Probes available in 316L stainless steel, Monel, and Hastelloy C
- ▲ Integral or remote electronics
- ▲ Sensor can be mounted in any position
- ▲ TSF and TSL offer optional self-test capabilities
- ▲ Agency approvals include FM/CSA Class I, Division 1; Class I, Division 2; and Class II, Division 1. CENELEC Explosion Proof approvals available
- ▲ Optional hermetically-sealed relay
- ▲ Sanitary probe design

APPROVALS

FM APPROVED · Ex · CSA · CE

SPECIFICATIONS

Supply Voltage: 120 VAC, 50-60 Hz; 240 VAC, 50-60 Hz; 24 VDC

TS Output Relay: DPDT, 10 Amp; Hermetically sealed DPDT, 5 Amp

TD Output Relay: SPDT, 10 Amp

Operating Temp: Sensor -100° to +850° F (-73° to +450° C)

▲ THERMATEL TDL / TSL For Liquid Level Measurement and Interface Detection

Level Switch Description: TDL and TSL switches offer highly reliable level and interface detection in the most demanding liquid process environments. The TDL Series features a standard SPDT relay. The TSL Series features an on-demand electronic self-test and DPDT relay.

Applications: High viscosity liquids, slurries, air/foam, foam/liquid, oil/water interface, aerated fluids, high temperature, high pressure, corrosive environments

▲ THERMATEL TDF / TSF For Liquid and Gas Flow Rate Measurement

Flow Switch Description: TDF and TSF switches offer highly reliable detection of high flow or low flow of liquid and gas flow rates. Detection of both liquid and gas flow rates is obtained with the same device utilizing different calibration. The TDF Series features a standard SPDT relay. The TSF Series features an on-demand electronic self-test and DPDT relay.

Applications: Pump protection, relief valve monitoring, low flow and no flow detection, cooling water, seal fluids, exhaust flow

THERMATEL TG1 / TG2 Switches

Two-wire, Intrinsically-Safe Flow / Level / Interface

General Description: Magnetrol's TG1/TG2 switch is the industry's only two-wire, intrinsically-safe thermal dispersion switch. The switch consists of a probe and preamplifier with remote DIN rail electronics. Barriers in the DIN rail enclosure provide a two-wire, intrinsically-safe circuit to the probe/preamplifier.

Product Operation: The preamplifier converts the temperature difference to a pulse signal which is super-imposed on the two wires providing power to the sensor. The DIN rail electronics provide operation control including set point adjustment, LED indication of flow/level, relay, fail-safe adjustment, and time delay. A non-linear mA output signal is available for diagnostics and repeatable flow/level indication.

Features:

- DIN rail mounted electronics with built-in barrier provide a two-wire intrinsically-safe circuit to the probe/preamplifier
- Versatile switch for flow and level
- Set point adjustment at remote electronics
- Up to 1,650 feet (500 meters) cable length
- LED indication provides monitoring of actual flow/level
- mA output signal will provide repeatable indication plus can be used for diagnostics
- Uses all Thermatel probes including low flow body and high-temperature sensor

Applications:

FLOW: Liquid or gas flow, pump protection, cooling air/water, relief valves, flow/no flow

LEVEL: Hi/Low level, high viscosity media, high solids content, aeration/foaming, sanitary applications, interface detection, high-temperature applications

APPROVALS

CE Ex

SPECIFICATIONS

Supply Voltage: 24 VDC

Relay: 2 Amp, SPDT relay

Signal: mA output, non-linear

Fail-safe: Switch selectable

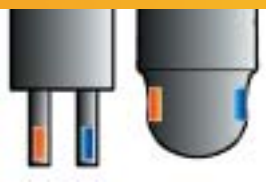
LED Indication:
4 Green: Flow/Level is safe
1 Yellow: Flow/Level is near set point
1 Red: (except TG2) Alarm condition

Set-Point: Adjustable via potentiometer

Operating Temperature:
Sensor -100° to +850° F (-70° to +450° C)

Flow Range:
Insertion Probes Water: 0 - 5 fps
Air: 0 - 250 fps
Low Flow Body Water: 0.08 - 30 gph
Gas: 0.2 - 30 SCFH

THERMATEL Switch Sensors



Twin-Tip Sensors are mounted at the end of each tip. **Spherical Sensors** are bonded directly to the wall of the tip for greater sensitivity and sensor protection.

Probe pressure and temperature ratings are dependent upon process connection; maximum pressure and temperature ratings are shown below.

Twin-Tip Sensor

General Use:	General purpose and corrosive resistant applications
Material Options:	316L stainless steel, Hastelloy C-276, or Monel
Process Connections:	NPT threads, G threads, ANSI flanges, DIN flanges
Max Temperature:	+390° F (+200° C)
Max Pressure:	3,000 psig (207 bar)
Insertion Lengths:	2 to 130 inches (50 to 3,300 mm)

Spherical-Tip Sensor

General Use:	General purpose service and high-viscosity applications
Material:	316L stainless steel
Process Connections:	NPT threads, G threads, ANSI flanges, DIN flanges
Max Temperature:	+390° F (+200° C)
Max Pressure:	600 psi (40 bar)
Insertion Lengths:	2 to 130 inches (50 to 3,300 mm)

High-Temperature Sensor

General Use:	For high-temperature process environments
Material:	316L stainless steel; Hastelloy C-276
Process Connections:	NPT threads, G threads, ANSI flanges, DIN flanges
Max Temperature:	+850° F (+454° C)
Max Pressure:	6,000 psi (413 bar)
Insertion Lengths:	2 to 36 inches (50 to 900 mm)

Low Flow Body Sensor

General Use:	Low flow detection; suitable for chemical feed pumps, additive flow, pump seals, process analyzers
Material:	316L stainless steel
Flow Rate:	0.08 gph (8 quarts/day) to 30 gph (0.3 to 113.5 liters/hr.)
Process Connections:	¼" and ½" NPT, and G threads
Max Temperature:	+390° F (+200° C)
Max Pressure:	5,800 psi (400 bar)

THERMATEL 052-7201 Switch

Flow Switch for Naval Applications

General Description:

The Thermatel “Navy Switch” is a special version of the TSF switch. It is approved by the United States Navy for use on board Naval ships for flow detection in sprinkler systems.

Features:

- Meets MIL-S-901D: Grade A shock requirements
- Meets MIL-STD-167-1: Vibration requirements
- Unit comes with Tee for use with MIL-T-16420 CUNI tubing (For tubing sizes: 1.25", 1.50", 2.00", 2.50", 3.00" or 4.00")
- 120 VAC power
- 10 amp DPDT relay
- Calibrated for sprinkler systems to detect flow of 10 GPM with 10-second delay time—other calibrations are available

THERMATEL RPA Hot Tap Assembly

Allows probe installation or removal without process shut-down

General Description:

When used with Thermatel insertion probes, the Retractable Probe Assembly (RPA) permits the probe to be installed or removed from the vessel or pipe while the process remains in operation. Once installed, it is not necessary to drain or depressurize a tank or shut down the operation in order to install or remove a Thermatel instrument.

Features:

- Standard 316 stainless steel gland construction
- Carbon steel or stainless steel process connections
- Flange and ball valve available as an option
- Suitable for use with standard Thermatel probes
- 1½" NPT or flange connection
- Teflon® compression rings standard

Capabilities:

- Temperatures to +400° F (+200° C)
- Standard pressure to 50 psi (3.4 bar)
- High-pressure design option to Class 300 pound service

Thermatel Hot Tap Assemblies:
Standard Design (Left) and High Pressure Design (Right).

Magnetrol®

Worldwide Level and Flow Solutions℠

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