Product Specifications

The Thermo Scientific GMS is an in-line multi-constituent analyzer that monitors a process flowing through a pipeline. By providing crucial product content and consistency information, the GMS will improve your efficiency and product quality, resulting in significant cost savings.

Thermo Scientific GMS

Guided Microwave Spectrometer for In-line Constituent Analysis

Applications

- Liquids
- Pastes
- Granular solids
- Dough
- Ground meat
- Highly viscous materials

The Thermo Scientific GMS is a fast, non-contact method for monitoring multiple components in liquid, solid or multiphase materials that pass through a pipe. The system is used to analyze products such as dough and ground meat where other technologies such as NIR may not provide a suitable solution. The chamber and control module are easily integrated into your process. Unlike other analyzers, its simple design contains no moving parts or optical components that require routine maintenance, resulting in extremely low long-term cost of ownership.

All hardware can be configured to meet or exceed BISSC (Baking Industry Sanitation Standards Committee) and USDA recommendations ensuring compliance with industry standards and regulations. The chamber is easily installed with a variety of end connections and sizes to accommodate most process lines. Multiple outputs, alarm status indicator light and an optional digital display communicate real-time results. The GMS provides you with crucial product information resulting in improved quality and process efficiency.

Advantages

- Analyzes multiphase products such as slurries, dough, liquids and larger particle size products
- Analyzes multiple components
- Measurement is truly representative of the bulk product even for heterogeneous materials. GMS is not a surface measurement
- Integrates seamlessly into your process with no flow obstruction
- Results are not affected by the sample color
- Excellent repeatability, accuracy, precision and stability

Applications

Applications
The GMS is used to analyze samples flowing through a pipe. Typical materials include liquids, pastes, granular solids, dough, ground meat, and highly viscous materials.

The GMS can be used to measure:

- Moisture in:
  - Raw ingredients such as corn, rice, soybeans
  - Processed materials such as tomato paste, corn masa, ground meats
  - Chemicals and plastics
- Brix, pH, viscosity and acid in:
  - Orange juice
  - Soft drinks
  - Mayonnaise
  - Tomato products
- Fat in:
  - Ground meats
  - Peanut butter
  - Milk and other dairy products
- Salt in:
  - Mashed potatoes
  - Most vegetable products
- Solvents in a mixture or chemical
- Alcohol in beverages
- Reaction progress

What is GMS?
GMS stands for Guided Microwave Spectrometer. The system uses very low powered microwave energy (only 0.005 W compared to 750 W for a typical microwave oven) at hundreds of specific frequencies to analyze the physical and chemical properties of a sample *(See figure 1).* GMS is best at determining multiple constituent concentrations of a process with varying particle sizes.

Microwave energy is sensitive to the concentration of polar, semi-polar and non-polar molecules such as water, protein, fat, oil and ion/salt concentration in a process or sample. The GMS applies a sinusoidal (AC) microwave signal to the material that passes through the sample in the chamber providing a representative measurement of the bulk product. In the presence of microwave energy, the polar molecules in the sample such as water rotate and align with the electromagnetic field, similar to aligning the poles on a magnet. The movement of the molecules causes the microwave signal to be attenuated and the velocity of the wave decreases as it passes through the sample. The resulting GMS spectrum has two characteristic features, the cut-off frequency and the passband region. *(See figure 2.)*

The cut-off region is the characteristic high slope "rise" in the spectrum, shown by the vertical line in figure 2. It is determined by the dielectric constant of the sample. This cut-off region is the result of the sample attenuating and reducing the velocity of the energy, which changes its wavelength. The pass band region is generally fairly horizontal. It shifts primarily in the vertical direction with small changes in the slope. The amplitude (intensity) of the pass band region is determined by the conductivity of the sample and how much energy is lost in the transmission from the transmitter to the receiver antennae of the chamber. *(See figure 3.)* The cutoff region is generally sensitive to moisture and the passband region to other constituents. Using a well-defined calibration, the changes in the passband and cutoff regions are correlated to the amount of change in the concentration of the component of interest in the mixture.

Figure 1 – Electromagnetic spectrum

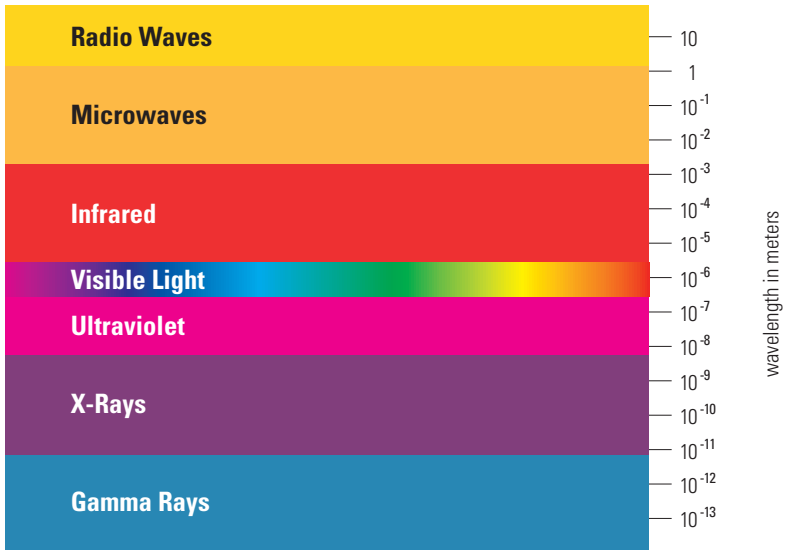


Figure 2 – GMS spectrum features

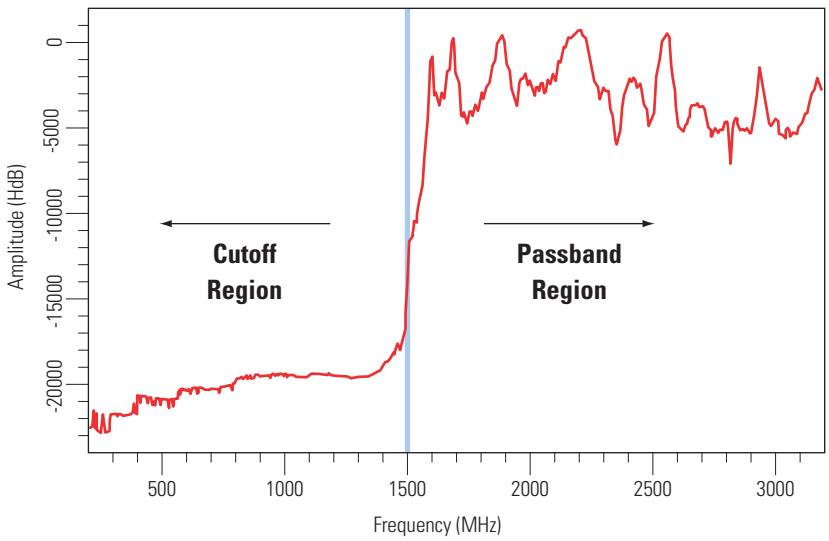
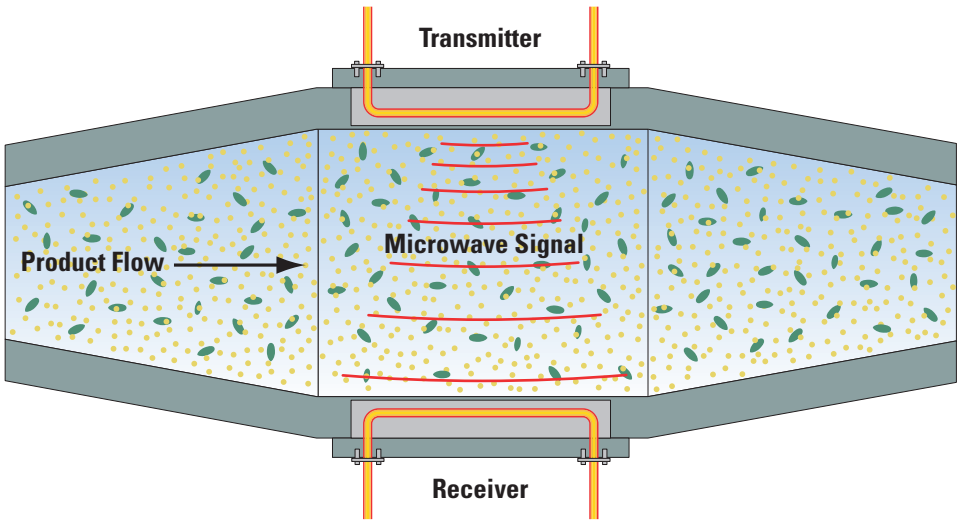


Figure 3 – GMS waveguide chamber



The system includes the chamber, electronics control module and PC-based software for developing calibrations and configuring the analyzer. It is available in both online process and at-line laboratory configurations.

Thermo Scientific GMS

Technical Specifications	
Sample Types	Liquids Granular solids Pastes Multiphase (solids, liquids and slurries)
Microwave Power	1 mW standard
Microwave Bandwidth	High band configuration: 200 to 3,200 MHz Low band configuration: 200 to 1,600 MHz
Temperature Compensation	Resistor Temperature Device (RTD) Signal output for temperature via 4-20 mA output
Calibration	Software for calibration development, diagnostics and uploading variables
Alarm Indicators	Red/Green diagnostic light
Process Connections	ANSI Flange 150# ANSI Flange 300# Tri-Clamp™ Threaded Sanitary I-line (Interlock)
Communications	Up to (4), 4-20 mA analog outputs RS232
Modem Support	On-board, 2400 baud
Physical Specifications	
Chamber Dimensions	5.08 cm (2 in) 7.62 cm (3 in) 10.16 cm (4 in) Special sizes, determined by application, available by special order
Chamber Material	316 SST
Process Temperature Limits	0°C to +150°C (+32°F to +302°F); up to 2000 kpa pressure
Control Module Dimensions	39.4 cm (15.51 in) x 33 cm (12.99 in) x 17 cm (6.69 in)
Control Module Enclosure	NEMA4X (separate from chamber) Optional junction box for one 4-20 mA output, modem phone jack and RS232 port
Electronics Module Connection	3.66 m (12 ft) flex conduit interconnect Longer lengths available by special order
Operating Temperature Range	Control module: +10°C to +40°C (+50°F to +104°F)
Operating Relative Humidity	Control module: 0-95% non-condensing
Vibration Limits	Control module: Up to 1 m/s^2 from 5-200 Hz Stable, non-vibrating stand or surface
Weight	39 kg (85.8 lb) average
Power Requirements	90-260 VAC (47-63 Hz)
Computer Requirements	386 MHz (minimum), Windows® 98, 2000, ME or XP operating system, 3 MB hard drive space available, RS232 serial port, DB9 (male) communication port

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