

Low-Cost, Non-Invasive, Microwave-Based Bulk Solids Flow Detector

Thermo Ramsey

Granuflow GTR 130



Principle Sensor Features

The Granuflow GTR 130, a non-contact flow sensor, is ideal for monitoring solids flow in pipelines, ducts, air-slides, and at transfer points of vibrating chutes, conveyor belts and bucket elevators. Some successful applications include the monitoring of roofing granules being applied to shingles, the flow of ingredients into extruders and mixers, and the flow of additives into the production of wallboard. Thermo Ramsey has extensive experience in applying microwave technology in all kinds of applications and various types of industries.

Real-time flow information is needed to closely monitor processes, which leads to:

- Increased reliability
- Reduced downtime
- Fewer hazards for equipment and operators
- Less waste of raw materials
- Reduction in unusable end product

Process Proven and Reliable

Used for automation purposes, the GTR 130 optimizes the efficient use of machinery and energy by switching process equipment on or off as required. This results in:

- Less wear on machinery
- Decreased maintenance and equipment failure
- Conservation of energy

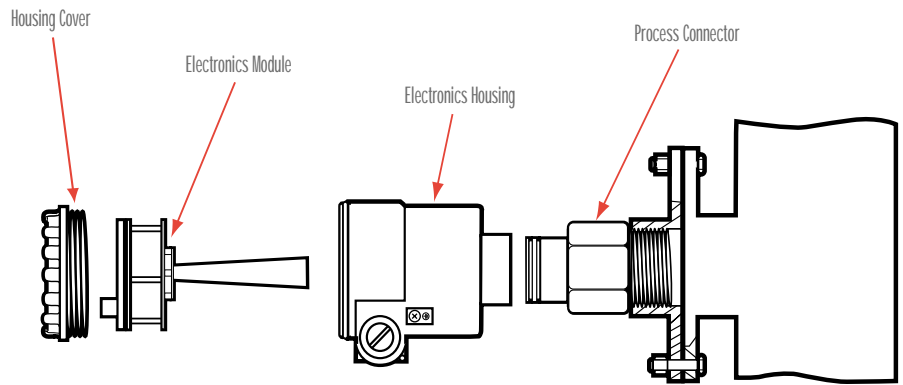
The GTR 130 sensor has no moving mechanical parts. This eliminates wear of the sensor and makes the instrument maintenance and trouble-free.

- The microwave principle allows non-invasive installation with no direct contact with the process.
- Ideal replacement for reed or flapper switches. Eliminates opening the process to clean or replace switches.
- Removal of the electronics without removing the process connection with a snap-out/snap-in electronics module.

Modular Design

The GTR 130 provides a simple solution to electronics servicing. Snap-out the complete electronics, snap-in an off-the-shelf module. Your process remains closed and flow control is continued in a matter of minutes instead of several hours.

In extremely corrosive environments, the housing can be replaced without opening the process. The process connection maintains an outside seal of the flowing material. Modular design also allows the changing of the process connector without purchasing a new sensor.



Snap-out/Snap-in Electronics Module

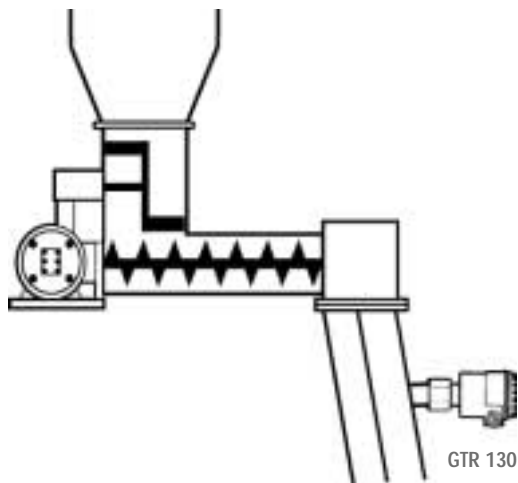
Typical Applications

Monitoring of Volumetric Dosing

- Detects major operational malfunctions of volumetric blending systems such as blockages, empty hoppers, flushing, etc.

This avoids unexplainable output variations due to improper or missing batching components.

The GTR 130 verifies that a volumetric dosing system is operating as expected. Blockages and empty hoppers can be detected early enough to prevent major damage to the process.

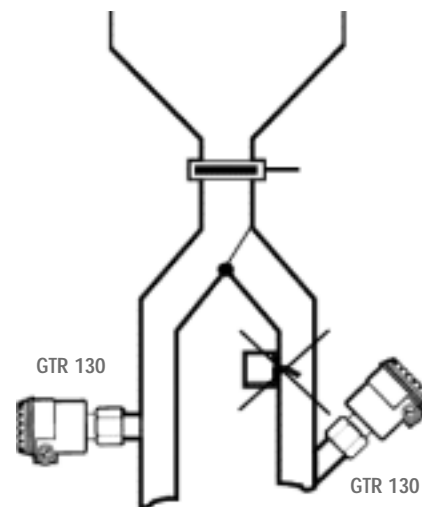


GTR's Monitoring Volumetric Dosing Operation

Monitoring of Silo Discharge

- Detects operational malfunctions at the silo discharge such as bridging, rat-holing, or loose gates. Subsequent diverter valves can be easily monitored as well.

The GTR 130 detects bridging or no-flow in the silo due to extreme rat-holing. It can supply a signal to the bin activators or operators. Monitoring the correct operation of gates and valves is an additional benefit for this application. This avoids loss of material, accidental discharge or materials going through wrong paths.

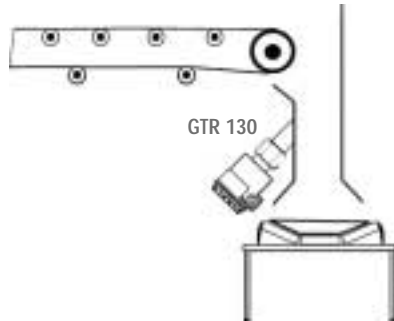


Two GTR's Monitoring Silo Discharge

Monitoring of Mechanical Conveying

- Detects mechanical damage in conveyors, as well as conveyors running empty. This ensures early indication of problems in the conveying system, avoiding accumulative damage. Allows activation of mechanical conveyors only when needed, which reduces maintenance, energy costs and equipment wear.

A GTR 130 before or after mechanical conveyors provides valuable information about the mechanical function of upstream and downstream equipment.

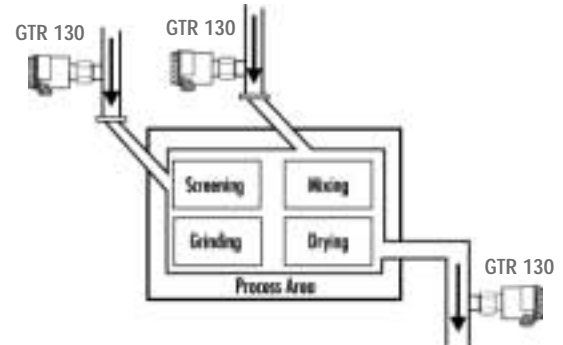


GTR's Monitoring Transfer Point on Conveyor System

Dryer, Screener, Classifier, Mills, etc.

- Detects the proper material flow to and from the process. Failure of material supply to the process will be detected early enough to avoid inefficient operation of the equipment. Blockage or damage in the screens, mills, etc., are detected when they occur. Preventive actions can be taken before production or quality losses occur.

A GTR 130 installed with high performance process equipment will indicate various kinds of malfunctions. Besides the positive effects on efficiency, reliability and product quality, the GTR functions as a safety measure to avoid in-plant hazards.



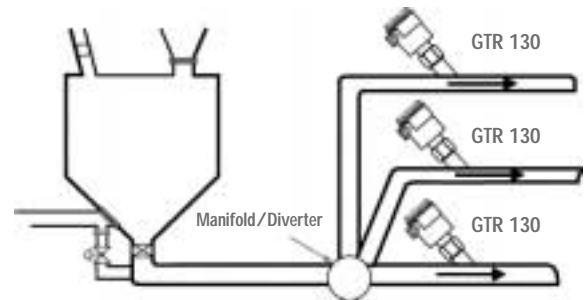
GTR's Monitoring Various Phases of a Process

Pneumatic Conveying and Injection

- Detects any major malfunction in the operation of pneumatic conveying systems that could result in changing of material characteristics, wear of gates or feeders, and moisture accumulation in the pipes, etc.

High pressure fluctuations in the transport line will not affect the operation of a GTR 130. In hundreds of installations, the sensor has been successfully applied to pipe diameters of 3/4" and larger.

Injection of solids via multiple injection points sometimes requires the control of each transport line, where the process cannot function with even a partial blockage in the material intake (e.g., coal injection in a blast furnace).

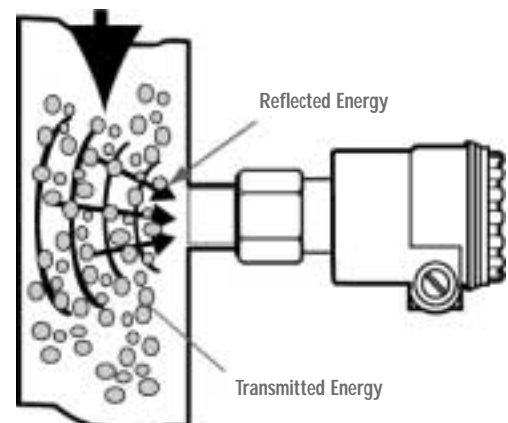


GTR's Monitoring Pneumatic Injection System

Operating Principle

Operating Principle

The GTR 130 is a microwave-based motion detector that detects the Doppler shift of the flowing material. The Gunn-diode emits a low power, continuous signal that is reflected from moving material in the process. The GTR 130 measures the difference between emitted and reflected microwave frequencies. If the return signal has a Doppler frequency shift, then motion is detected. Attenuation of the received microwave energy caused by nominal material build-up does not affect flow detection.



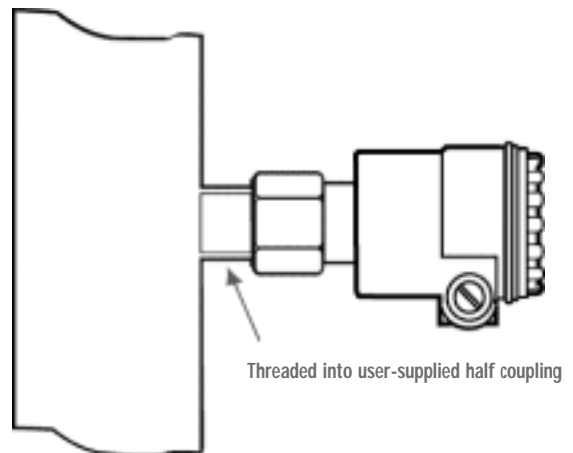
Keep the Process Closed

Detection Through Walls

Microwaves can penetrate non-conductive materials like plastic, glass and wood with negligible attenuation. The GTR 130 is, therefore, capable of looking through thick walls into the process. Non-conductive build-up on the wall of the container does not affect the signal, which makes the installation of a GTR 130 easy. External mounting allows the process to remain closed, and allows detection from the safe area outside a hazardous process, or a high pressure/temperature system.

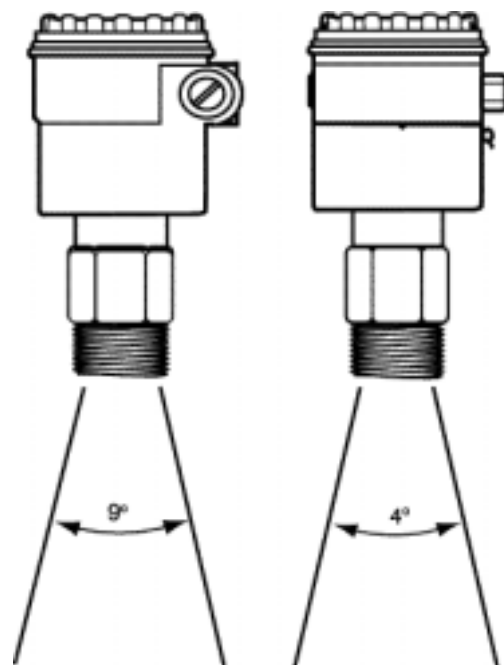
Table 1 gives the values of wall thicknesses for various materials, which attenuate the intensity of the microwaves by half. The GTR 130 can detect flowing conditions even when a small percent of the emitted microwave energy is available.

Wall Material	Wall Thickness
Glass (window, sight)	1-2 inches
Wood (dry chip board)	1/2-1 inch
Plastics (PVC, PE, PTFE)	<4 inches negligible attenuation



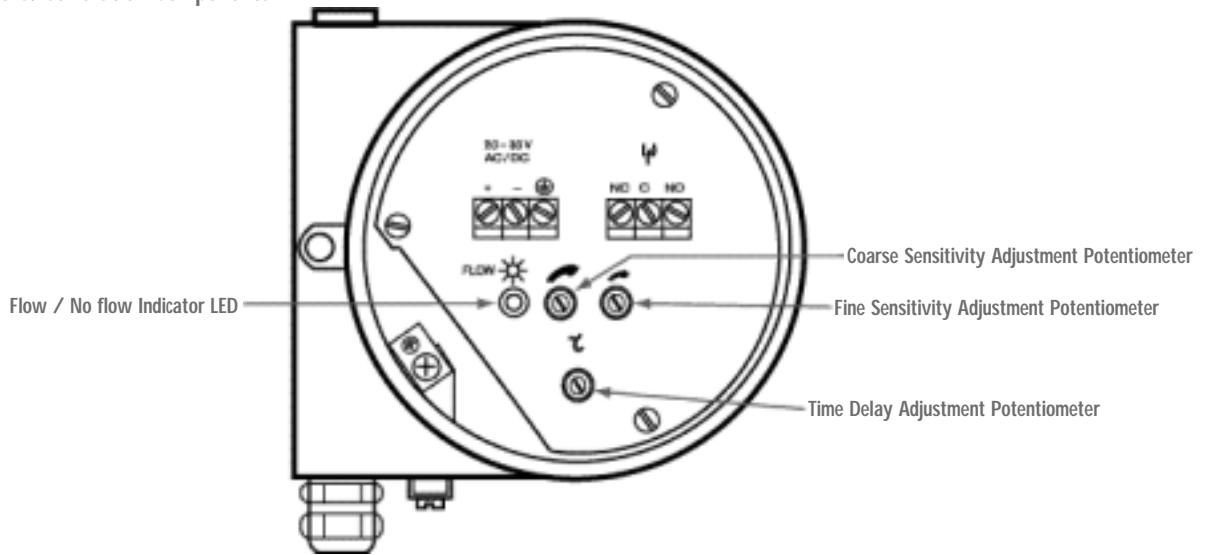
The Sensing Beam

The GTR 130 microwave antenna emits and receives continuously. The narrow shape of the beam allows precise placement of the sensor, protecting the system against false readings caused by movement outside the actual process. A Doppler frequency of 1.6 Hz up to 1.6 kHz can be detected. This corresponds to a solids velocity of 0.5 in/sec to 32 ft/sec when the material flow is perpendicular to the sensor (higher velocities require special mounting). The minimum detectable concentration is approximately 0.125 lb/ft depending on process conditions.



Wiring/Calibration Components

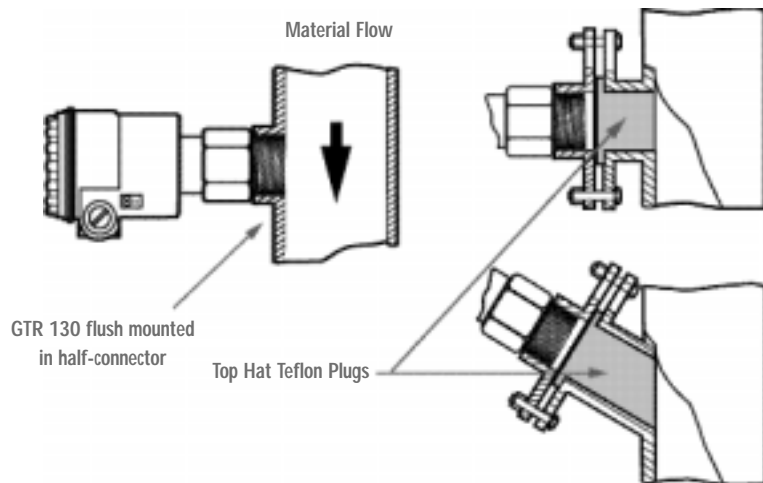
Wiring Connectors/Calibration Components



Mounting

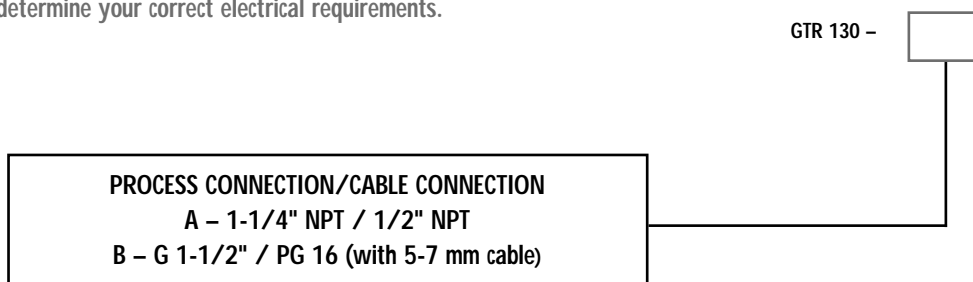
Mounting the GTR 130 depends on the particular features of the actual application. The sensor is normally threaded into a compatible internal half-connector.

The sensor can be flange-mounted as shown. If the process material is conductive and tends to build up, impairing the microwaves, a plug of PVC or PTFE should be placed into the standoff portion to prevent material from entering the standoff. Top hat teflon plugs are available as an option.



Ordering Information

Use this chart to determine your correct electrical requirements.



GTR 130 Technical Data

Housing: Single compartment.
Aluminum with epoxy coating.

Protection: NEMA 4

Ambient Temperature (housing):
-5°F to +140°F

**Max. Temperature on
Sensor Horn Surface:** 175°F

Weight: Approximately 2.2 lb

**Maximum Operating Pressure
at Sensor Horn:** 15 PSI

Power Supply: 20-30V DC; +15%, -10%

Power Consumption: Approximately 12VA

Operating Frequency (microwaves):
24.125 GHz

Detection Range: 0 to 60 inches
(depending on application)

Relay Output Contact Rating:
Max. 250V, Max. 4A, Max. 500 VA

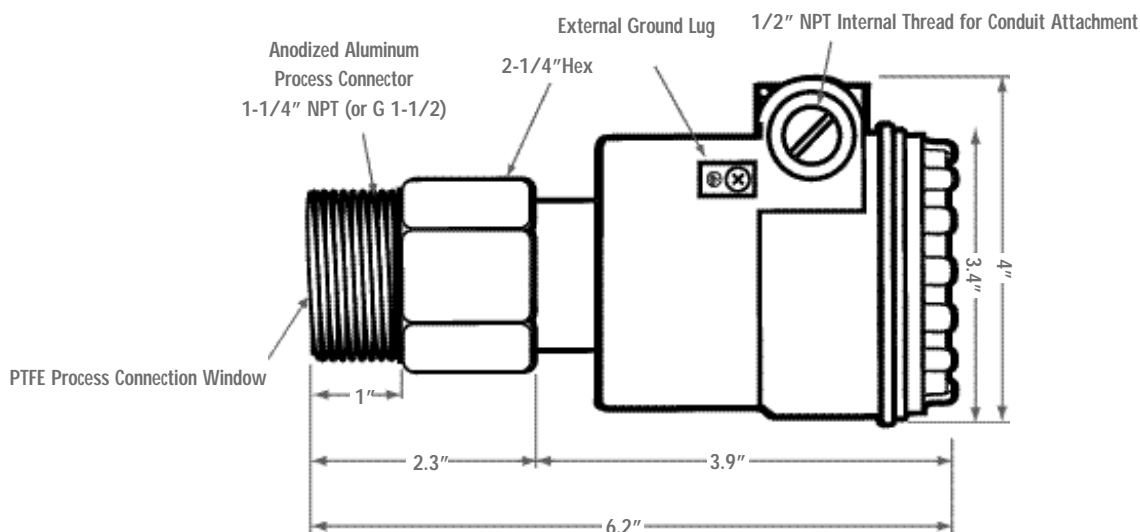
Time Delay: Adjustable between
0 and 10 seconds

Mounting Connection: 1-1/4" NPT or G 1-1/2"
Anodized Aluminum

Process Connection Window: PTFE

Conduit Connection: 1/2" NPT internal
(optional PG 16, G 1/2, or M 20 x 1.5
cable gland)

GTR 130 Dimensions



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