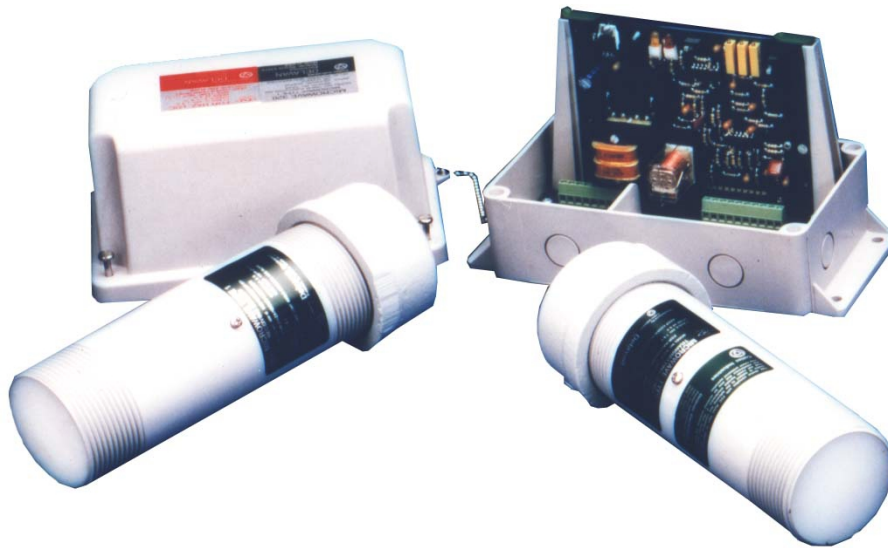




DATA SHEET

MICROWAVE/320

Position & Level Control



FM Approved with MT 851/MR 851 Sensors

Function

Single Point Switch for On-Off Control of Bulk Solids and liquids.

On-Off Switch for presence/absence indication of objects.

Typical Uses

High Level Alarm or Control.

Plugged Chute Detection.

Truck and RR Car Position.

Flow/No Flow Sensing of Bulk Materials in Chutes, on Conveyors.

Primary Areas of Application

Severe environments

Where the environment is too hostile to permit reliable operation of photo-electric controls. Microwave/320 is unaffected by dust, smoke, fog or vibration.

High temperature environments

Model MT 861 and MR 861 Transmitters and Receivers are designed for high temperature service. Please note: These sensors are water cooled to maintain an operating temperature of +140°F (+60°C) or less at the pre-amplifier.

Abrasive materials

Eg; Crushed coal, sand, ore. Rugged construction. No moving parts. Sensors do not protrude into flow stream.

Corrosive - Liquid Products

Eg; Water, acids, diluted acids (within the limits of transmitter and receiver housing and insulation materials), water with impurities.

Liquids - Interface

Eg; Petroleum products and water

Liquids - With Solids

Municipal Waste (sewage)

Features

Approved

All Microwave Type I Controls comply with FCC rules Part 15 and are approved by the FCC as being suitable for industrial applications. These controls have an average power density of 0.1 mw/cm² at the antenna, well below OSHA guidelines. No licenses or approvals required to use the controls.

Non-Contact

Sensor does not contact subject when used as a position indicator control.

No Vessel Openings

Sensors can see through most non-metallic vessels.

Non-Intrusive

When the Microwave/320 is used for level control, transmitter or receiver sensors do not protrude into vessel so bridging cannot occur.

Independent time delays

Standard, for smooth, chatterfree performance. Field adjustable.

Corrosion resistant, watertight remote enclosure

Glass-reinforced polyester enclosure features captive hardware and stainless steel trim to endure the most corrosive environments.

Versatile power supply

The standard unit accepts 120 VAC, 240 VAC or low voltage 24 DC input.

Long Cables

Pre-amplifiers are located at transmitter and receiver permit use of long cable lengths up to 1000 feet (340.8 m).

Failsafe

A simple field selectable slide Switch determines the High or Low FAILSAFE mode.

Principles of Operation

These controls are non-contact sensing microwave based controls. The transmitter (source) consists basically of a power supply, pulse modulator, Gunn oscillator, and directional antenna. The receiver consists of a directional antenna, a microwave mixer cavity with a Schottky barrier diode detector, a high gain, low noise amplifier, a pulse coding network, a voltage comparator circuit, and a relay driver circuit.

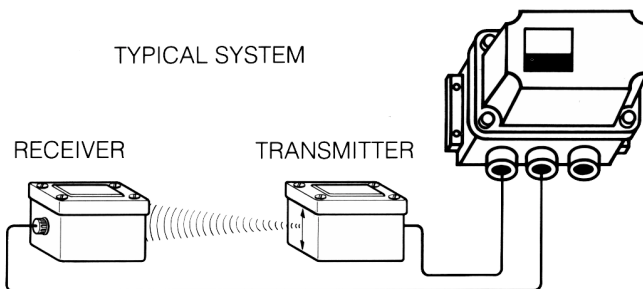
In the transmitter, power is converted to a well regulated and filtered 12V DC supply. It is then pulsed at about 1 KHz by the pulse modulator circuit. This circuit is included to permit pulse discrimination circuitry to be used. In addition, pulsing at a 10% duty cycle safely permits peak transmitted power levels 10 times greater than permitted under continuous wave operation. The pulsed DC is fed to a Gunn oscillator in the antenna assembly, where the 12V DC 1 KHz square wave is converted to a pulsed X band (10.525 GHz) microwave signal. The signal is radiated by the directional antenna, which is typically a 10 dB gain horn with a beam spread of approximately 40°.

In the receiver, the signal is received by a directional antenna and coupled to a mixer cavity containing a Schottky detector diode. This diode converts the low level microwave signal to a low level pulsed DC, which is then amplified by an adjustable gain — low noise IC amplifier to a 0-10V DC control signal. This system is interconnected and uses pulse discrimination coding. In these systems the receiver is on only when the transmitter is on, thus the system is virtually immune to false triggering from stray microwave interference. The level of the amplified received signal (0-10V DC) is compared with a preset value in a voltage comparator circuit. When the signal received exceeds the comparator setpoint, an output signal is initiated which is processed through time delay circuits to drive the output relay.

A microwave system has been described in the above, based on a fixed power transmitter and a receiver/detector with adjustable gain to discriminate between various signal power levels received at its antenna. Materials in the industrial environment have various effects on microwave signals. For example, low level microwaves cannot penetrate metals, but are reflected by them. They are absorbed almost entirely by water, and to varying degrees by water based solutions or products that have a significant moisture content such as grain, wood products, etc.

Transmission losses **increase** with **increasing** dielectric constants and increase with increasing conductivity. For example, air (dielectric constant of 1 and conductivity of zero) transmits microwave with no loss while sea water (dielectric constant of 55 at X-band and conductivity of 4 mhos/meter) provides extreme attenuation of the microwave energy. It is the material's dielectric constant and conductivity that determine whether or not the material is a good candidate for microwave control.

MICROWAVE/320



Typical Applications Level Control

Level Control

Level control of liquids or solids in tanks, bins, hoppers or chutes are some typical applications. Non-conductive fiberglass tanks represent minimal losses to X-band microwaves. Sensors are mounted on the outside, opposite one another on the tank. Losses through the tank walls and air or vapors above the product are low. When the product level reaches the control position, the signal is attenuated significantly, causing the output relay to change state. Metal tanks or hoppers must have a "window" transparent to microwave signals. Sightglasses (3"-4" dia.) can be used on liquid storage tanks, compatible with the pressures, temperatures and chemical properties of the materials stored in the tank. For metal vessels storing solid materials, "windows" can be constructed of materials such as high density polyethylene or other similar substances compatible with the product contained therein. A partial list of materials low in loss are below. These are potential candidates for windows.

Typical Window Materials

Magnesium Firebrick	Nylon
Fiberglass	Paraffin
Polyethylene	Plexiglass
Polystyrene	Glass (no lead)
PVC	Teflon
Lucite®	Styrofoam
Lexan®	Quartz
Mica	

Specifications

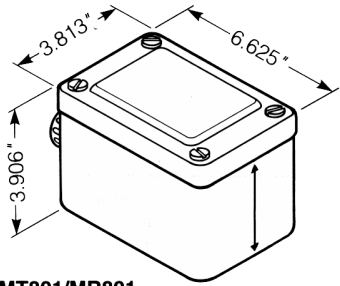
Input Voltage	NOMINAL	ABSOLUTE LIMITS
	115 VAC	95-135 VAC
	230 VAC	190-270 VAC
	24 VDC	±4v
Power	5 VA	
Frequency	50-60 Hz	
Time Delay	Independent with Auto Reset	on make, on break
Delay Time Range	50 m Sec.-10 Sec. Nominal	30 Sec. Max
Failsafe	Switch selectable - High Level	or Low Level.
	High Level Failsafe Position:	Relay is de-energized when material is present.
	Low Level Failsafe Position:	Relay is de-energized when no material is present.
Indicators	Two, light emitting diodes (LED)	
	RED - Illuminated when material is not present at sensor, Path is complete.	
	YELLOW - Illuminated when relay is energized.	
Operating Temperature (Amplifier)	-40°F to +160°F	(-40°C to +70°C)
Output	Relay, DPDT Form C	
Ratings	5 A at 120 VAC Resistive	
	3 A at 240 VAC Resistive	
	3A at 24 VDC Resistive	
Operating Temperature (Transmitter/Receivers)	See Page 3 for details	

Sensors (Transmitters & Receivers)

Sensor & Model No.

Description

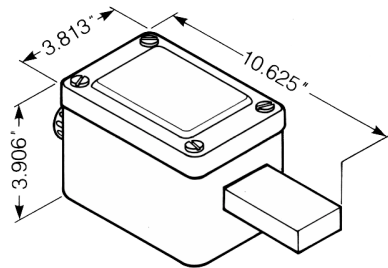
Typical Application



MT801/MR801

Long range transmitting/receiving sensors with 10db gain horn antennas. Maximum range 100' in air. NEMA 4 x enclosures. MT801/MR801 temperature range: -20°F to +140°F (-30°C to +60°C).

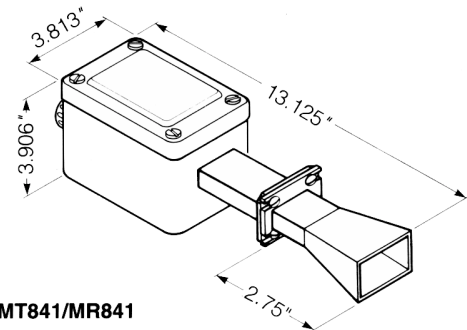
Standard Service
Vehicle detection, railroad car detection & positioning. Liquid level control, bin level control (sand, rock, asphalt, coal, cement, fly ash, etc.) Use with Part #41121 window.



MT811/MR811

Short range accurate high/low level detection. Range up to 10' in air. Used primarily for accurate position and level sensing of bottles, small boxes, etc. NEMA 12 enclosures. Temperature range: -20°F to +140°F (-30°C to +60°C).

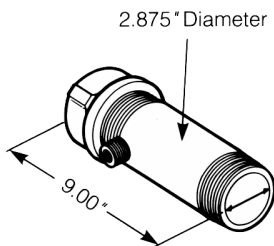
High/low level detection, empty bottle detection, battery filling level control, empty box detection counting, short range plugged chute.



MT841/MR841

Similar to MT811/MR811 except 10 db gain horn antennas are used. Designed to be used with P/N 41105-X, waveguide extension kit. Maximum range 100' in air, Enclosures is NEMA 12. When used with 41105-X, maximum temperature at antenna is 600°F (313°C). Amplifier maximum temperature is 140°F (60°C).

Waveguide with 10 db gain horn antenna. Level control when vessel or environment is extremely hot. Furnaces, kilns, cupolas, fly ash, furnace fluidized beds, etc. Use with Part #41121, #41213 and with castable refractory materials.

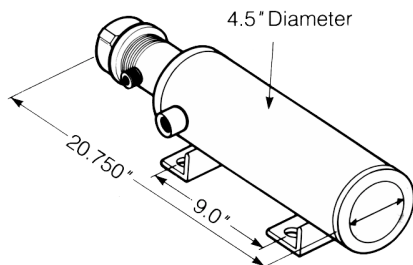


MT851/MR851



Identical to MT801/MR801 except sensors are constructed in 2 1/2\" steel pipe. Designed to be screwed directly into steel vessels using 2 1/2\" weldment. (P/N41249-order separately). Window material is FDA approved UHMW polyethylene 1\" thick. Contact factory for other available material. Temperature range: -20°F to +140°F (-30°C to +60°C).

Severe service.
Bin level control of sand, rock, asphalt, coal, etc. in areas where physical abuse of sensor is possible. Rugged.

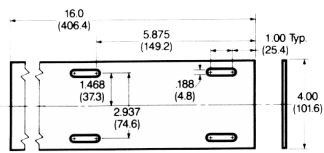


MT861/MR861

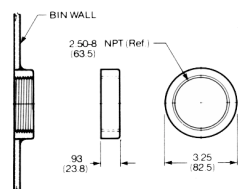
Similar to MT851 and MR851 except waveguide 10db horn and electronics is located inside water cooled jacket.

Hot product, water cooled Level control of limestone, ores and other products contained in fire-brick enclosures.

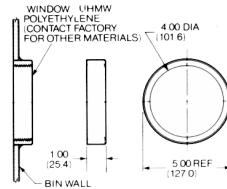
Accessories (mounting)



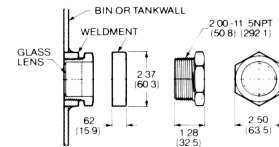
Part No. 41347 mounting support plate for MT/MR801, MT/MR811, MT/MR841 systems



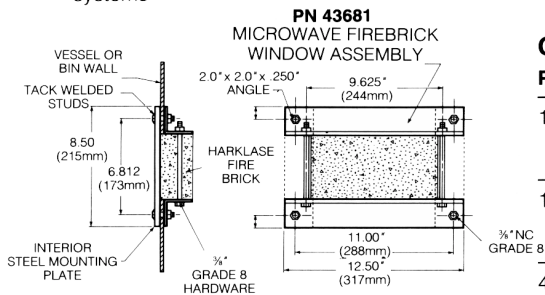
Part No. 41249-2 weldment for MT/MR851



Part No. 41121 Microwave UHMW Polyethylene, Lexan® or Teflon® window use with MT/MR801, MT/MR811, and MT/MR841 systems.



Part No. 41213 high temperature glass window for use and weldment with MT/MR841 and MT/MR811
Maximum Ratings: 860°F
500°F(260°C) @ 0 PSI
70°F(21°C) @ 450 PSI

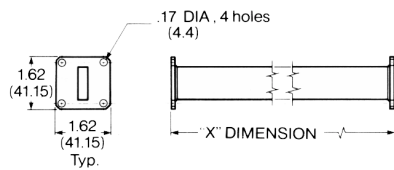


Cable Assemblies

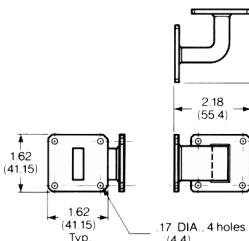
Part No.	Type	Description
16000	General Purpose	15ft. (5 meters). 2 Conductor Shielded PVC Jacketed Cable — Temp. Range -40°F to +160°F (-40°C to +70°C)
17102	General Purpose	50ft. (16 meters). 2 Conductor Shielded PVC Jacketed Cable — Temp. Range -40°F to +160°F (-40°C to +70°C)
42564	General Purpose	100ft. (33 meters). 2 Conductor Shielded PVC Jacketed Cable — Temp. Range -40°F to +160°F (-40°C to +70°C)
17198	High Temperature	2 Conductor Shielded Teflon Jacketed Cable Temperature Range -40°F to +400°F (-40°C to +204°C)

Accessory Items

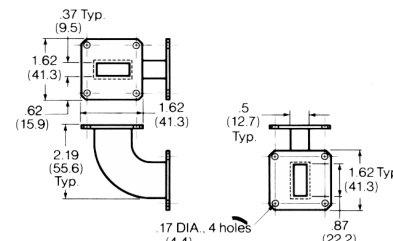
In certain cases it may be necessary to "pipe" waveguide around existing obstructions, extensions and elbows are available.



Part No. 41105-X waveguide extension kit (includes mounting hardware)



Part No. 41361 90° right angle waveguide "E BEND" (includes mounting hardware)



Part No. 41524 90° right angle waveguide "H BEND" (includes mounting hardware)

Time Delay Settings

Bin Level Control

Normally requires both time delays to insure that a turbulence upper level will not cause a false trip. Clockwise rotation of Beam Make and Beam Break increases time delay.

Plugged Chute Control

Applications will normally have delay on Beam Break so that falling material will not trip the control relay prematurely.

Starvation Control

Applications require a delay on Beam Make so that when product ceases to flow (starvation) the relay will not operate until some reasonable time period has elapsed. This prevents false signals due to temporary reduction in flow.

Object Detection Control

Such as vehicle washing equipment require about 1/2 second delay on Beam Make and Beam Break to prevent false signals.

General Comments

Always use as much time delay as the application will permit. These time delay adjustments permit custom application of the Microwave/320 System to your specific process needs.

TWO-YEAR PRODUCT WARRANTY

Delavan Electronics control products will be replaced, put in good operating condition, or the purchase price refunded, at the option of Delavan Electronics, free of charges except transportation, if defective in their manufacture, labeling, packaging, or shipping, and if notice of said defect is received by Delavan Electronics within two years from the date of shipment. The cost of such replacement, repair or refund of purchase price shall be the exclusive remedy for any breach of any warranty, and Delavan Electronics shall not be liable to any person for consequential damages for injury or commercial loss resulting from any breach on any warranty. Delavan Electronics makes no warranty of fitness for a particular purpose, and makes no other warranty, express or implied, including implied warranty arising from course of dealing or usage of trade.



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