

Level measurement

Continuous level measurement

Radar level transmitters

Introduction

Overview

Radar measurement technology is non-contacting and low maintenance. Because microwaves require no carrier medium, they are virtually unaffected by the process atmosphere (vapor, pressure, dust, or temperature extremes). Siemens offers a variety of models to meet the specific needs of your application.

SITRANS Probe LR is a 2-wire, 6 GHz pulse radar level transmitter for continuous monitoring of liquids and slurries in storage vessels with nominal pressure and temperature, to a range of 20 m (66 ft).

SITRANS LR100 is a 2 wire loop powered radar transmitter for continuous level measurement of liquids and slurries to a range of 8 m (26 ft).

SITRANS LR110 is a compact radar transmitter for continuous level measurement of liquids, slurries, and solids to a range of 15 m (49.2 ft).

SITRANS LR120 is a compact radar transmitter for continuous level measurement of liquids and solids to a range of 30 m (98.4 ft).

SITRANS LR140 is a 2 wire loop powered radar transmitter for continuous level measurement of liquids and slurries to a range of 8 m (26 ft).

SITRANS LR150 is a compact radar transmitter for continuous level measurement of liquids, slurries, and solids to a range of 15 m (49.2 ft), with optional HMI.

SITRANS LR200 is a 2-wire, 6 GHz pulse radar level transmitter for continuous monitoring of liquids and slurries in process vessels including high temperature, pressure, agitation, and turbulence, to a range of 20 m (65 ft).

SITRANS LR250 is a 2-wire, 25 GHz pulse radar level transmitter for continuous monitoring of liquids and slurries in storage and process vessels including high temperature and pressure, corrosive or aggressive materials, to a range of 20 m (66 ft). Ideal for small vessels and low dielectric media.

SITRANS LR460 is a 4-wire, 24 GHz FMCW radar level transmitter with extremely high signal to noise ratio and advanced signal processing for continuous monitoring of solids, up to 100 m (328 ft). It is ideal for measurement in extreme dust and high temperature applications.

SITRANS LR560 2-wire, 78 GHz FMCW radar level transmitter for continuous monitoring of solids and liquids, to a range of 100 m (328 ft). It is easy to install, plug and play, and there is virtually no maintenance.

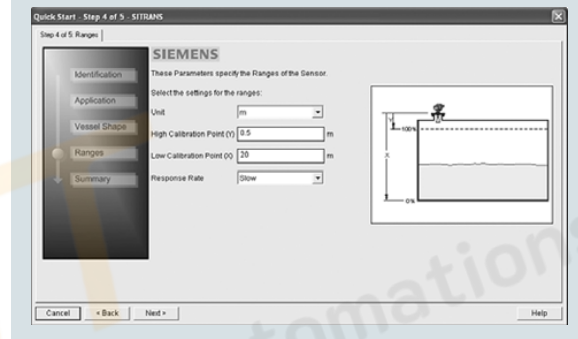
Auto False-Echo Suppression

SITRANS LR instruments offer the unique advantage of Process Intelligence signal processing technology. This in-depth knowledge and experience is built into the software's advanced algorithms to provide intelligent processing of echo profiles. The result is repeatable, fast and reliable measurement.

A special feature of SITRANS radar devices is Auto False-Echo Suppression, an echo processing technique that automatically detects and suppresses false echoes from vessel obstructions. You can implement this feature using two parameters on the local interface or SIMATIC PDM communicating over HART or PROFIBUS PA.



Local display interface – graphically displays echo profiles and diagnostic information (available with LR200, LR250, and LR560)
Quick to configure – Quick Start Wizard via SIMATIC PDM guides you during setup



Mode of operation

Principle of Operation

Radar measurement technology measures the time of flight from the transmitted signal to the return signal. From this time, distance measurement and level are determined.

Unlike ultrasonic measurement, radar technology does not require a carrier medium and travels at the speed of light (300 000 000 m/s). Most industrial radar devices operate from 6 to 78 GHz.

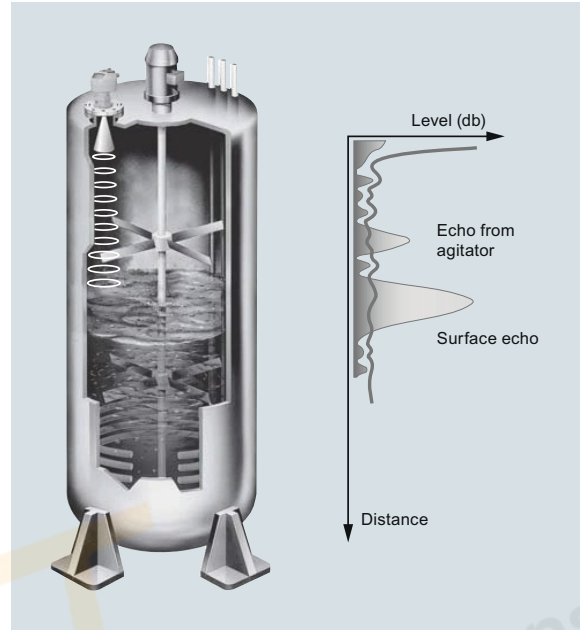
Siemens offers pulse radar transmitters (SITRANS Probe LR, SITRANS LR200, SITRANS LR250) and FMCW (Frequency Modulated Continuous Wave) radar transmitters (SITRANS LR100, SITRANS LR110, SITRANS LR120, SITRANS LR140, SITRANS LR150, SITRANS LR460, SITRANS LR560).

Pulse radar emits a microwave pulse from the antenna at a fixed repetition rate that reflects off the interface between the two materials with different dielectric constants (the atmosphere and the material being monitored).

The echo is detected by a receiver and the transmit time is used to calculate level.

Reflected echoes are digitally converted to an echo profile. The profile is analyzed to determine the distance from the material surface to the reference point on the instrument.

FMCW (Frequency Modulated Continuous Wave) radar devices send microwaves to the surface of the material. The wave frequency is modulated continuously. At the same time, the receiver is also receiving continuously and the difference in frequency between the transmitter and the receiver is directly proportional to the distance to the material.



Radar operation in a reactor vessel

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Technical specifications

Radar Selection Guide

| Criteria | SITRANS Probe LR | SITRANS LR200 | SITRANS LR100 | SITRANS LR110 | SITRANS LR120 |
|---|---|--|--|--|--|
| Typical industries | Chemicals, petrochemicals, water/waste-water, drilling mud | Chemicals, petrochemicals, aluminum, wastewater | Chemicals, petrochemicals, mining, food and beverage | Chemicals, petrochemicals, mining, food and beverage | Chemicals, petrochemicals, mining, food and beverage |
| Typical applications | Liquids, storage vessels, wet wells, drilling mud tanks | Liquids, process vessels with agitators, buildup, high temperatures | Liquid storage vessels, non-intrusively through plastic tanks, chemicals, aggregates | Liquid storage vessels, non-intrusively through plastic tanks, chemicals, aggregates | Liquid storage vessels, non-intrusively through plastic tanks, chemicals, aggregates |
| Range | 0.3 ... 20 m (1 ... 65 ft) | 0.4 ... 20 m (1.3 ... 65 ft) | 0 ... 8 m (0 ... 26 ft) | 0 ... 15 m (0 ... 49.2 ft) | 0 ... 30 m (0 ... 98.4 ft) |
| Frequency | 6.3 GHz | 6.3 GHz | 80 GHz nominal | 80 GHz nominal | 80 GHz nominal |
| Performance accuracy | 0.1 % of range or 10 mm (0.4 inch) | 0.1 % of range or 10 mm (0.4 inch) | ± 5 mm | ± 2 mm | ± 2 mm |
| Temperature | Ambient: -40 ... +80 °C (-40 ... +176 °F) Process: -40 ... +80 °C (-40 ... +176 °F) | Ambient: -40 ... +80 °C (-40 ... +176 °F) Process: -40 ... +200 °C (-40 ... +392 °F), dependent on antenna type | Ambient: -40 ... +60 °C (-40 ... +140 °F) Process: -40 ... +60 °C (-40 ... +140 °F) | Ambient: -40 ... +80 °C (-40 ... +176 °F) Process: -40 ... +80 °C (-40 ... +176 °F) | Ambient: -40 ... +80 °C (-40 ... +176 °F) Process: -40 ... +80 °C (-40 ... +176 °F) |
| Output/ communications/ remote configuration and diagnostics | <ul style="list-style-type: none"> • 4 ... 20 mA/HART • SIMATIC PDM | <ul style="list-style-type: none"> • 4 ... 20 mA/HART • PROFIBUS PA • SIMATIC PDM • AMS • SITRANS DTM/FDT for PACTware, Fieldcare, etc. | <ul style="list-style-type: none"> • 4 ... 20 mA • SITRANS mobile IQ | <ul style="list-style-type: none"> • 4 ... 20 mA/HART • Modbus RTU • SITRANS mobile IQ • SIMATIC PDM • AMS • SITRANS DTM/FDT for PACTware, Fieldcare | <ul style="list-style-type: none"> • 4 ... 20 mA/HART • Modbus RTU • SITRANS mobile IQ • SIMATIC PDM • AMS • SITRANS DTM/FDT for PACTware, Fieldcare |
| Power | <ul style="list-style-type: none"> • 24 V DC nominal • Loop powered | <ul style="list-style-type: none"> • 24 V DC nominal • Loop powered | <ul style="list-style-type: none"> • 12 ... 35 V DC • Loop powered | HART: <ul style="list-style-type: none"> • 12 ... 35 V DC • Loop powered Modbus: <ul style="list-style-type: none"> • 8 ... 30 V DC • Loop powered | HART: <ul style="list-style-type: none"> • 12 ... 35 V DC • Loop powered Modbus: <ul style="list-style-type: none"> • 12 ... 35 V DC • Loop powered |
| Approvals | CE, RCM, Lloyds Register of Shipping, ABS, FCC, Industry Canada, RED ATEX, CSA, FM, INMETRO, EAC, IECEX, ANZEx, TIIS | CE, RCM, Lloyds Register of Shipping, ABS, FCC, Industry Canada, RED ATEX, CSA, FM, INMETRO, EAC, IECEX, ANZEx, TIIS, NEPSI | General Purpose CE, CSA, FM, RCM | Hazardous ATEX, IECEX, CE, CSA, FM, RCM | Hazardous ATEX, IECEX, CE, CSA, FM, RCM |

Technical specifications (continued)

| Criteria | SITRANS LR140 | SITRANS LR150 | SITRANS LR250 | SITRANS LR460 | SITRANS LR560 |
|---|--|--|---|--|--|
| Typical industries | Chemicals, petrochemicals, mining, food and beverage | Chemicals, petrochemicals, mining, food and beverage | Chemicals, petrochemicals, oil and gas, mining, marine, food and beverage, pharmaceutical | Cement, power generation, food processing, mineral processing, mining | Cement, chemical, power generation, grain, food processing, mineral processing, mining |
| Typical applications | Liquid storage vessels, non-intrusively through plastic tanks, chemicals, aggregates | Liquid storage vessels, non-intrusively through plastic tanks, chemicals, aggregates | Liquids, storage and process vessels with agitators, vaporous liquids, high temperatures, low dielectric media, crude oil produced water | Cement, fly ash, grain, coal, flour, plastics | Cement, fly ash, chemical fertilizer, grain, coal, flour, plastics, environmental water level monitoring |
| Range | 8 m (26.2 ft) | 15 m (49.2 ft) | 50 mm (2 inch) from end of horn to 20 m (65 ft), horn dependent | 100 m (328 ft) | 40 m (131 ft) 100 m (328 ft) |
| Frequency | 80 GHz nominal | 80 GHz nominal | K-band (25.0 GHz) | 24 ... 25 GHz FMCW | 78 ... 79 GHz |
| Performance accuracy | 5 mm | 2 mm | ≤ 3 mm (0.118 inch) | 0.25 % | 5 mm (0.2 inch) |
| Temperature | Ambient: -40 ... +60 °C (-40 ... +140 °F) Process: -40 ... +60 °C (-40 ... +140 °F) | Ambient: -40 ... +70 °C (-40 ... +158 °F) Process: -40 ... +80 °C (-40 ... +176 °F) | Ambient: -40 ... +80 °C (-40 ... +176 °F) Process: -40 ... +200 °C (-40 ... +392 °F), dependent on antenna type | Ambient: 65 °C (149 °F) Process: 200 °C (392 °F) | Ambient: -40 ... +80 °C (-40 ... +176 °F) Process: -40 ... +100 °C (-40 ... 212 °F) Optional: 200 °C (392 °F) |
| Output/communications/remote configuration and diagnostics | <ul style="list-style-type: none"> 4 ... 20 mA SITRANS mobile IQ | <ul style="list-style-type: none"> 4 ... 20 mA/HART SITRANS mobile IQ SIMATIC PDM AMS SITRANS DTM/FDT for PACTware, Fieldcare | <ul style="list-style-type: none"> 4 ... 20 mA/HART PROFIBUS PA FOUNDATION Fieldbus SIMATIC PDM AMS SITRANS DTM/FDT for PACTware, Fieldcare, etc. | <ul style="list-style-type: none"> 4 ... 20 mA/HART PROFIBUS PA SIMATIC PDM | <ul style="list-style-type: none"> 4 ... 20 mA/HART PROFIBUS PA SIMATIC PDM AMS SITRANS DTM/FDT for PACTware, Fieldcare, etc. |
| Power | <ul style="list-style-type: none"> 12 ... 35 V DC Loop powered | HART: <ul style="list-style-type: none"> 12 ... 35 V DC Loop powered | <ul style="list-style-type: none"> 24 V DC nominal Loop powered | <ul style="list-style-type: none"> 100 ... 230 V AC, ± 15 %, 50/60 Hz, 6 W 24 V DC, +25/-20 %, 6 W | <ul style="list-style-type: none"> 24 V DC nominal Loop powered |
| Approvals | General purpose CE, CSA, FM, RCM | Hazardous ATEX, IECEx, CE, CSA, FM, RCM | CE, RCM, Lloyds Register of Shipping, ABS, BV, FCC, Industry Canada, RED ATEX, CSA, FM, INMETRO, EAC, IECEx, TIIS, NEPSI Functional safety SIL-2, EHEDG, 3-A, USP Class VI | CE, RCM, FCC, Industry Canada, RED ATEX, CSA, FM, INMETRO, IECEx, EAC | CE, RCM, FCC, Industry Canada, RED ATEX, CSA, FM, INMETRO, IECEx, NEPSI, EAC |

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