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## Measuring electronic differential pressure with a SITRANS LT500

Application Manual

## Legal information

### Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

#### **DANGER**

indicates that death or severe personal injury **will** result if proper precautions are not taken.

#### **WARNING**

indicates that death or severe personal injury **may** result if proper precautions are not taken.

#### **CAUTION**

indicates that minor personal injury can result if proper precautions are not taken.

#### **NOTICE**

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

### Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

### Proper use of Siemens products

Note the following:

#### **WARNING**

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

### Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

### Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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# Introduction

## 1.1 Objective

The objective of this application guide is to measure electronic differential pressure in a vessel to determine the level of the material inside.

## 1.2 Equipment

Equipment Description	MLFB/A5E Number
SITRANS LT500 (dual point)	7ML60...
SITRANS P320/420 (mA/HART absolute or gauge) x2	7MF03.../7MF04...
IS barriers (if required) x2	A5E50113513

## 1.3 Disclaimer

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### Note

While every effort is made to verify the following information, no warranty of accuracy or usability is expressed or implied.

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## Overview

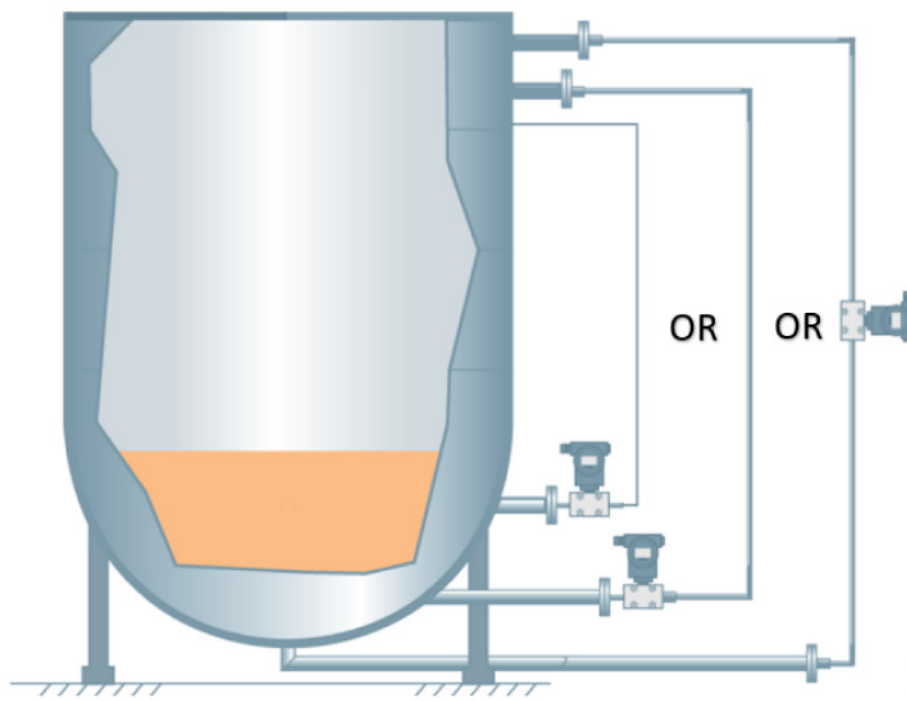
A standard differential pressure application uses one sensor with two process mounting locations, one at the top and one at the bottom of the tank. The disadvantages of this typical solution are:

- Increased cost due to capillary lines connecting the two process entries
- Reduced accuracy (4-5x) and reliability caused by temperature effects on remote seal and capillary line fill fluids
- Reduced resolution as the pressure sensor must be sized for the application needs with regards to the highest pressure rating, while the input from the top of the tank could be significantly lower than that value

The advantages are:

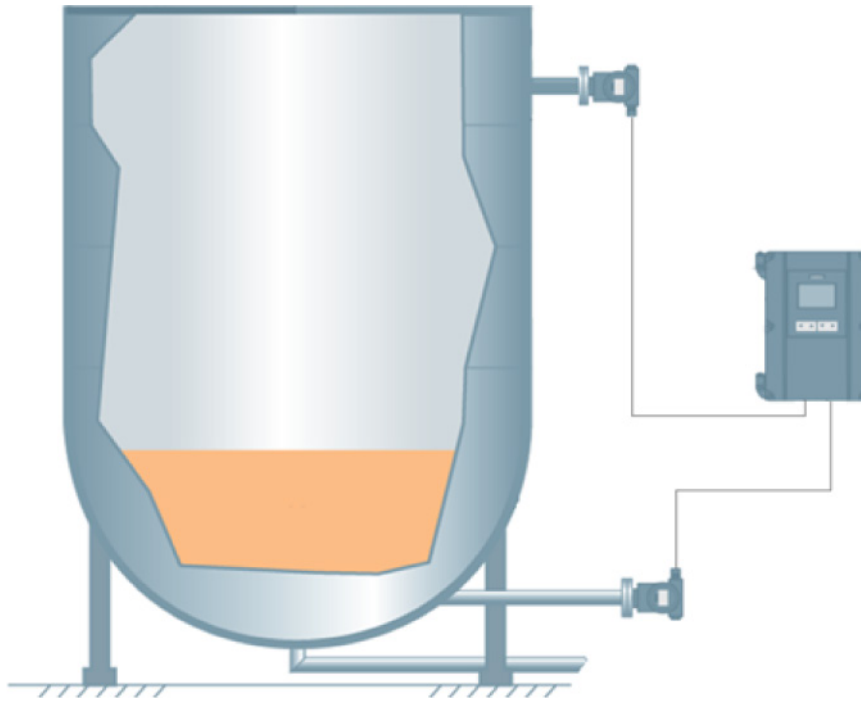
- Costly and complex installations are eliminated
- Imbalanced systems caused by differing lengths of high and low-pressure side capillaries can be avoided

### Typical application styles (3) measuring level with differential pressure



Electronic differential pressure uses two independent sensors mounted to the tank with a third consolidator to provide the final process value, in this case a level reading.

### Typical application measuring level with electronic differential pressure



### Application Considerations

Ensure that the pressure sensor selected is suited for the application pressure ratings, chemical compatibility as well as local governing codes for use in hazardous areas.

To achieve an output of level measurement from two independent pressure sensors, the signals will be input into the LT500 controller and the output from this device will provide the process values and potential control for the process if required.

The sensor mounted to the top of the tank must remain “dry” to ensure reliable and accurate measurement.

As the LT500 is a general purpose only device, if the application is in an EX area, the LT500 must be located in a “safe” environment. The LT500 provides the loop power for the pressure sensors and if required, an intrinsically safe barrier can also be supplied.

## Pressure sensor settings

The settings of the P320 or P420 are both the same.

The following parameters need to be set as a minimum:

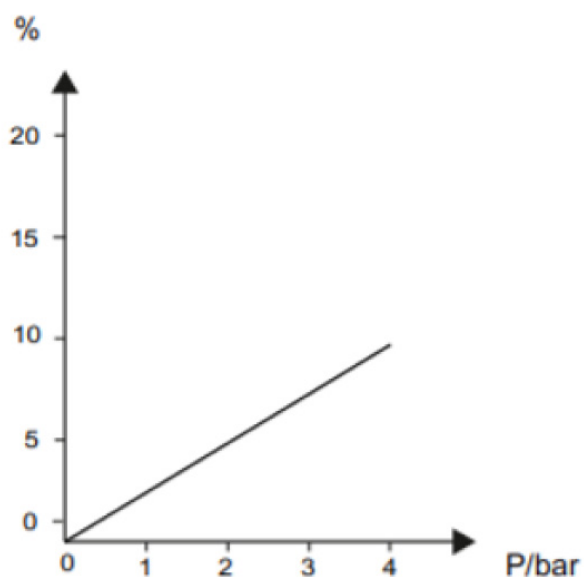
Parameter ID	Parameter name on the display	Meaning
01	PRESS UNITS	Pressure units
02	LOWER RANGE	Set lower range value (without pressure applied)
03	UPPER RANGE	Set upper range value (without pressure applied)
05	APPLICATION	Application <sup>1)</sup>
07	ZERO POINT	Zero point adjustment
08	APPLY LRV	Apply lower range value (with pressure applied)
09	APPLY URV	Apply upper range value (with pressure applied)
16	LEVEL UNITS	Level unit

### Level measurement

To set the application of the device for the level measurement, select the "level" characteristic curve using the "Application" parameter (LEVEL).

For a level measurement, the device calculates the level height and the hydrostatic pressure. The geometry of the vessel is not included in the calculation.

The device uses a linear characteristic curve:



### Example

For the level measurement, you set the following values, for example:

Damping value	2.0 s
Lower range value	0.0 bar
Upper range value	5.0 bar
Application	Level (LEVEL)
Unit	m
Lower scaling point	0.0 m
Upper scaling point	49 m

### Application formula

$$h = (p_2 - p_1) / (\rho * g)$$

$p_2$  = hydrostatic pressure [bar]

$p_1$  = pressure of the enclosed gas in the vessel [bar]

$\rho$  = specific gravity of the fluid [kg/m<sup>3</sup>]

$g$  = gravitational force or gravitational acceleration [m/s<sup>2</sup>]

$h$  = height of the liquid column [m] = level

## Controller settings

The settings of the LT500 are key to ensuring the proper process integration.

The following parameters need to be set as a minimum:

1. Run the QSW for level on PT. 1 with the pressure unit mounted on the bottom of the tank and PT. 2 with the pressure unit mounted on the top of the tank using a generic (4..20mA) sensor type for both.
2. Set the display views (2.8.5.1) so that the main PV displayed is level difference.
3. Set the mA output (2.4.2.4) to correspond to level difference.