

Vapor Influence

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This instruction is a supplement to the Rosemount 3300 Series Reference Manual, see manual manual 00809-0100-4811.

⚠ WARNING

Explosions could result in death or serious injury:

Before connecting a HART-based communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.

⚠ WARNING

Failure to follow safe installation and servicing guidelines could result in death or serious injury:

Use the equipment only as specified in the Rosemount 3300 Series Reference Manual (Reference number 00809-0100-4811) and in this manual supplement. Failure to do so may impair the protection provided by the equipment.

Rosemount 3300 Series

INTRODUCTION

The Rosemount 3300 Series Radar Transmitter is a smart, two-wire continuous level transmitter that is based on Time Domain Reflectometry (TDR) principles. Low power nano-second-pulses are guided along a probe immersed in the process media. When a pulse reaches the surface of the material it is measuring, part of the energy is reflected back to the transmitter head, and the time difference between the generated and reflected pulse is converted into a distance from which the total level or interface level is calculated (see below).

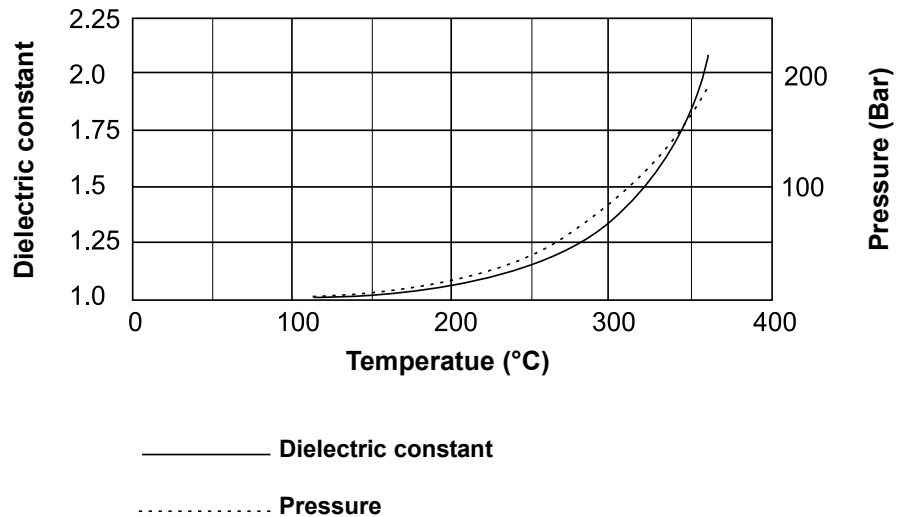
For radar level gauging the actual measured quantity is the propagation time through the empty space between the radar level transmitter and the liquid surface. Important for the typical accuracy of a radar level transmitter is that the propagation speed of the radar signal in most cases is very close to the perfectly constant velocity of light in vacuum. However in some important cases the deviation is not negligible and must be taken into account to get high accuracy. High tank pressure in combination with certain gases are examples.

INFLUENCE OF WATER VAPOR

Water vapour at high pressure can have a big influence on radar level transmitter measurements. This is due to the high pressure as well as the polar structure of water molecules. In such cases the 3300 transmitter can be configured to compensate for this effect by entering the dielectric constant of the vapor.

Water has an unusual high critical temperature and pressure (374 °C and 221 bar respectively, above which level measurement may be impossible), and in power plants the use of water in the vicinity of those limits may occur. In a closed vessel containing water liquid and water vapour existing data bases (traditionally referred to as a Mollier diagram) have been used to calculate pressure and vapour density and from this deduce the dielectric constant of the vapour. The dielectric constant will change as given in the diagram below covering the temperature range 0-360 °C.

Figure 1-1. Dielectric constant versus temperature for saturated water vapor

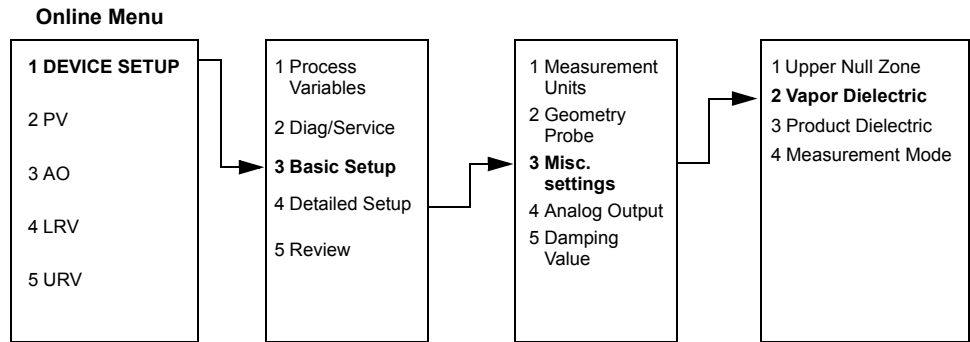


CONFIGURATION OF THE 3300 TRANSMITTER

The Rosemount 3300 transmitter is factory configured with a default value of the dielectric constant of vapor above the product surface equal to 1. This corresponds to the dielectricity of vacuum. For most vapors this value does not need to be changed since the effect on measurement performance is very small. For water vapor at high pressure the dielectric constant may be significantly higher. The dielectric constant of vapor stored in the 3300 transmitter database can be changed by using a 375 Field Communicator, or by using the Rosemount Configuration Tool (RCT).

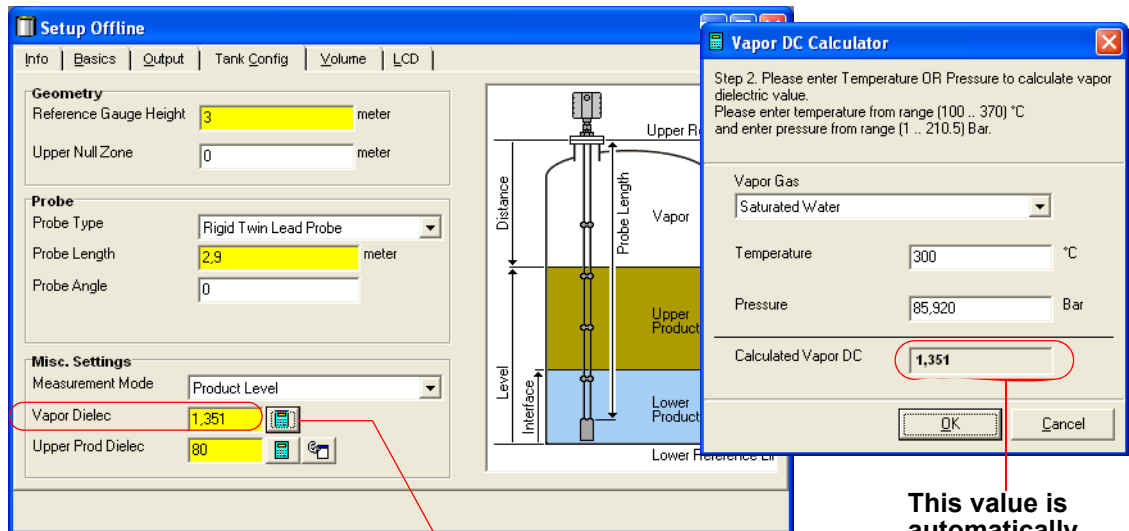
When using the **375 Field Communicator** the is available with HART command [1,3,3,2]:

Figure 1-2. HART command for configuration of Vapor Dielectric Constant



In the **RCT** program the Vapor Dielectric Constant is found in the Setup window / Tank Config tab:

Figure 1-3. Configuration of Vapor Dielectric Constant in RCT program



Click to open the Vapor Dielectric Calculator

This value is automatically transferred when pressing OK

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