

# **Industrial Automation**



# **Technical Note**

# Tank Level Control with VFD

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## 1 Introduction

Tank level control is a very common requirement in pump applications. This technical note shows how to control tank level with two digital sensor signals or with an analog level sensor through a variable frequency drive.

Be aware that this document addresses qualified persons, and it cannot replace profound technical education and training.

# 2 Two Point Level Control with Digital Level Signals

Two digital 24 V signals define the upper and lower tank level. If the pump function is to fill the tank, the lower level signal starts the pump and the upper level signal stops the pump. In tank emptying applications, the upper level signal starts the pump and the lower level signal stops it. To pump over from one tank to another, connect the starting sensors in parallel and the stopping sensors in series. The sensor states in the schematics show the empty position.

	Parameter Number		
	C200, C2000 series, M300	VFD-E, VFD-EL, VFD-EL-W	
Functional Description	series		
Operation Command Source	00-21 = 1	02.01 = 1 or 2	
Operation Control	02-00 = 3	04.04 = 2	
Enable Drive	02-04 = 49	04.06 = 16	
		04-09 = 8	

Table 2.0.1 Two Point Level Control Parameters by Drive Model

#### 2.1 Filling





#### 2.2 Emptying



Figure 2.2 Sensor Configuration for Tank Emptying

### 2.3 Pumping Over





# 3 Two Point Level Control with Analogue Level Sensor

Only applicable to C200, C2000 series and M300 series drives. This sensor configuration does not work in pump over applications.

The pump operates between two definable levels. The settings assume that the sensor signal rises with the tank level, e.g. with a capacitive or pressure-based sensor. If the sensor signal rises contrary to the tank level, like with an ultrasonic sensor, reverse the direction of parameter 02-18.

For tank filling, the lower level signal starts the pump and the upper level signal stops the pump. For tank emptying, the upper level signal starts the pump and the lower level signal stops it.

	Parameter Number	
Functional Description	C200, C2000 series, M300 series	
Operation Command Source	00-21 = 1	
Output Signal 'Analog Level	02-16 = 67	
Reached'		
Control Direction	02-18 = 0 for filling	
	02-18 = 8 for emptying	
Analog Level Source	03-44 = 0 for AVI or AVI1	
	03-44 = 1 for ACI	
	03-44 = 2 for AVI2 or AUI <sup>*1</sup>	
Upper Level	03-45 = Desired Maximum Level in %	
Lower Level	03-46 = Desired Minimum Level in %	

Table 3.0.1 Two Point Level Control Parameters by Drive Model

\*1: AVI2 or AUI only available on C200 and C2000 series drives

#### 3.1 Filling



Figure 3.1 Sensor Configuration for Tank Filling

#### 3.2 Emptying





# 4 Continuous Level Control with Analogue Level Sensor

The pump maintains tank level constant at the percentage that the speed set point is of the maximum speed defined in parameter 01-00.

E.g. 01-00 = 50 Hz, set point = 25 Hz  $\rightarrow$  the tank level control aims for 50% tank level.

The settings and schematics assume that the sensor signal rises with the tank level, e.g. with a capacitive or pressure-based sensor. If the sensor signal rises contrary to the tank level, e.g. with an ultrasonic sensor, reverse the function of parameter 08-00 for C200, C2000 series and M300 series or of parameter 10.01 for VFD-E, VFD-EL and VFD-EL-W drives.

	Parameter Number	
	C200, C2000 series, M300	VFD-E, VFD-EL, VFD-EL-W
Functional Description	series	
Feedback Source	03-00 = 5 for AVI	10.01 = 0 or 1 for AVI
	03-01 = 5 for ACI	10.01 = 2 or 3 for ACI
	03-02 = 5 for AUI <sup>*1</sup>	
PID Level Control	08-00 = 1 for emptying	10.01 = 0 or 2 for emptying
	08-00 = 4 for filling	10.01 = 1 or 3 for filling

Table 4.0.1 Continuous Level Control Parameters by Drive Model

\*1: AVI2 or AUI only available on C200 and C2000 series drives

#### 4.1 Filling



Figure 4.1 Sensor Configuration for Tank Filling

#### 4.2 Emptying



