SIG CON Signal Conditioners

Building & Factory Automation Systems

Acromag THE LEADER IN INDUSTRIAL I/O

Application Note:

Math Modules: Level/Volume: Converting Linear Level to Tank Volume

Defining the Problem:

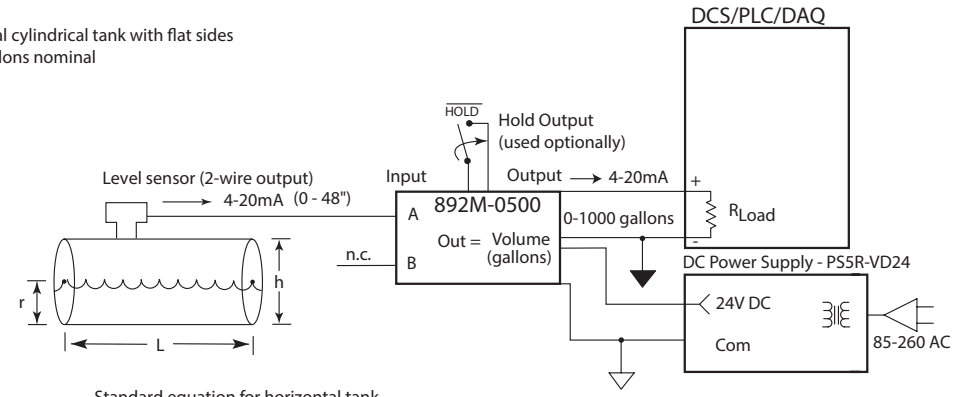
Convert a 4-20mA level signal (proportional to height) to a 4-20mA signal proportional to volume.

Solution:

Model 892M-0500 dual-input math module
Model 800C-SIP software interface package
Optional: Model PS5R-VD24 power supply

System Diagram:

Tank Style: Horizontal cylindrical tank with flat sides
Tank Volume: 1000 gallons nominal
Tank height (h) = 4'
Tank radius (r) = 2'
Tank length (L)= 10'9"



Standard equation for horizontal tank

Volume (gallons) $= (((x-r)\ 2\sqrt{h-h^2} + r\sin^{-1}(\frac{h-r}{r}) + \frac{r^2\pi}{2})* L)/231$

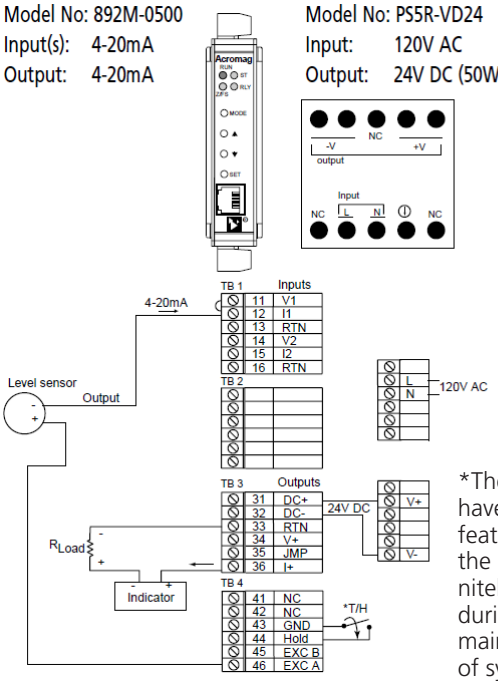
Where: r = radius (inches)
L = length (inches)
h = variable height (inches)
Conversion: 231 inches^3 = 1 gallon

$\pi = 3.141593$

Wiring Diagram:

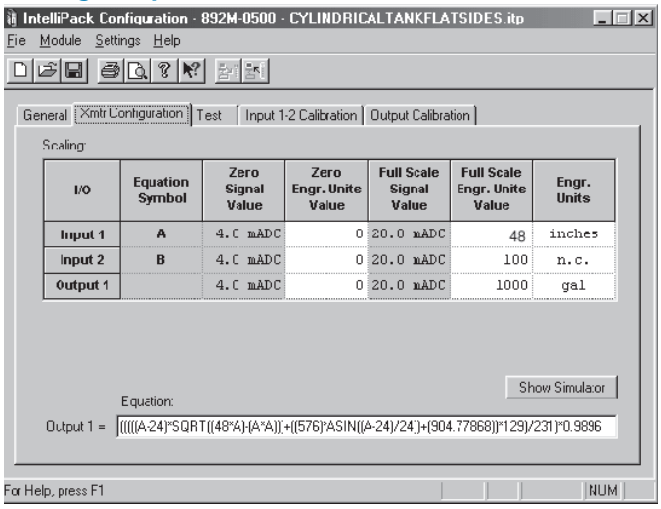
Model No: 892M-0500
Input(s): 4-20mA
Output: 4-20mA

Model No: PS5R-VD24
Input: 120V AC
Output: 24V DC (50W)



*The 892M modules have a track & hold feature that will hold the output indefinitely. This is useful during service & maintenance of systems.

Scaling & Equation:



Output Equation: (((((A-24)*SQRT((48*A)-(A*A)))+ ((576)*ASIN((A-24)/24)+(904.77868))*129)/231)* 0.9896

The volume equation above uses a final "multiplier" of 0.9896. This is used for full-scale "trimming" purposes. Without the multiplier, the calculated/theoretical output at full-scale is 1010 gallons. Also, a level tank is assumed for this example.

Tel 877.214.6267 ■ sales@acromag.com ■ www.acromag.com ■ 30765 Wixom Rd, Wixom, MI 48393 USA