AP-9

Analog Voltage and Current Output Scaling

1 Introduction

PLATINUM series controllers offer Analog Voltage and Current Output with an accuracy of 0.1%. Voltage output requires no calibration, but current output is influenced by the load resistance and requires an offset adjustment to reach stated accuracy when the output is operating in re-transmission mode.

This application note describes two methods to adjust current scaling factors. Scaling can be easily calculated if the load resistance is known. If the load resistance is unknown it can be determined in a running system using a Volt Meter.

2 Initial Setup

First set the desired output scaling range. In this example the Analog Output 1 is set to 4-20mA mode and the desired scaling is set to 0C = 4mA and 100C = 20mA. Under the programing menu the ANG1 output is set to the following configuration:

ANG1					
	ModE				
		RtRN	Rd1	0	Process value for **oUt1**
			oUt1	4.00	Output value for **Rd1**
			Rd2	100	Process value for **oUt2**
			oUt2	20.00	Output value for **Rd2**
	RNGE	4–20			4–20 mA

2.1 Calculating the Offset

If the load resistance is known the offset can be calculated by the following equations:

$I_A = I_d * (R_L+70000)/70000$

Where:

I_A = Adjusted Current

I_D = Desired Current

R_L = Load Resistance

In the example if the load resistance is 400 Ohms:

$I_{A(low)} = 0.004 * (400+70000)/70000=0.00402 = 4.02mA$

$I_{A(high)} = 0.020 * (400+70000)/70000=0.02011 = 20.11mA$

The Platinum can support up to 500 Ohms of load resistance in current loop mode.

The Platinum Unit configuration is then updated with the adjusted currents:

ANG1					
	ModE				
		RtRN	Rd1	0	Process value for **oUt1**
			oUt1	4.02	Output value for **Rd1**
			Rd2	100	Process value for **oUt2**
			oUt2	20.11	Output value for **Rd2**
	RNGE	4–20			4–20 mA

2.2 Determining the Resistance

In many systems the load resistance may not be precisely known. In this case the required adjustments may be determined by using the measuring the output voltage at a set current to calculated the load resistance using the following equation.

$R_L = (V * 700000) / (70000 * I_D - V)$

Where:

V = Measured Voltage (In Volts*)

I_D = Expected Current (In Amps*)

R_L = Load Resistance

*Note that since the voltage measurement is taken in Volts, I_D must be expressed in Amps for this equation.

It is best to measure the system at the highest possible current to increase accuracy. An easy way to generate a fixed output current is to use Manual Output Mode:

1. While running Press the ▶ arrow button until the display says MANL.
2. Press the ↵ button. The display reads M.CNT.
3. Press the ▶ arrow button. The display reads M.INP.
4. Press the ↵ button. The display now shows a simulated current process input.

The ▶and ◀ buttons may be used to raise or lower the simulated process input. Raise the process input to 100C and then take a Voltage Measurement which in this example should represent a 20mA output.

For example, if the measured voltage across the output is 8V:

$R_L = (8 * 700000)/(70000 * 0.020 - 8) = 402.3$ Ohms

This resistance may be used in the equation in Section 3 to determine the Adjusted Currents.

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