CR6300 Series Power Factor Transducer

Introduction

This guide will explain the two types of power factor measurement and their corresponding output values when using the CR6300 series power factor transducer.

Power Factor Types

The CR63xx can measure either displacement power factor or actual power factor. Displacement power factor is defined as the cosine of the *fundamental* phase angle between the voltage and current waveforms. In other words, it is the power factor due to "displacement" or phase shift, but not distortion, of the current with respect to the voltage.

Actual power factor comes from the definition of power factor: $\frac{|P_{Active}|}{V_{RMS} \times I_{RMS}}$. It takes both phase shift and waveform distortion into account.

Selecting Power Factor Type

The CR63xx is normally shipped set to measure displacement power factor. To measure actual power factor, slide the mode switch to the **ACT** position. This switch can be reached by removing the narrow access cover, as shown below. Move the switch actuator, using a small screwdriver, a toothpick, or a similar object.

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Displacement Power Factor Output

In displacement power factor mode, the CR63xx provides two pieces for information: the power factor, and whether the fundamental current component "leads" or "lags" the fundamental voltage. When the power factor is unity (1), the analog output is at half-scale. As the power factor is reduced in the lagging direction, analog output increases. Leading power factor decreases the analog output (see table below).

Phase Angle, θ	Cos θ	PF	Analog Output		
			CR6310	CR6311	CR6320
+90°	0	0 Leading	0 V	0 V	4 mA
+60°	0.5	0.5 Leading	1.25 V	2.5 V	8 mA
+45°	0.71	0.71 Leading	1.77 V	3.54 V	9.68 mA
0°	1	1 (Unity)	2.5 V	5 V	12 mA
-45°	0.71	0.71 Lagging	3.23 V	6.46 V	14.32 mA
-60°	0.5	0.5 Lagging	3.75 V	7.5 V	16 mA
-90°	0	0 Lagging	5 V	10 V	20 mA

The formulas for analog output are shown in the table below.

θ	Analog Output		
	CR6310	CR6311	CR6320
≥0° (Current Leading)	V_{Out} = 2.5 x PF	V_{Out} = 5 x PF	I_{Out} = 4 + (8 x PF) (mA)
<0° (Current Lagging)	V_{Out} = 5 – (2.5 x PF)	V_{Out} = 10 – (5 x PF)	I_{Out} = 20 - (8 x PF) (mA)

To get power factor from analog output value, use this table:

CR6310		CR6311		CR6320	
V_{Out} Range	PF	V_{Out} Range	PF	I_{Out} Range	PF
V_{Out} ≤ 2.5	PF = V_{Out} / 2.5	V_{Out} ≤ 5	PF = V_{Out} / 5	I_{Out} ≤ 12	PF = (I_{Out} – 4) / 8
V_{Out} > 2.5	PF = 5 – (V_{Out} / 2.5)	V_{Out} > 5	PF = 10 – (V_{Out} / 5)	I_{Out} > 12	PF = (20 – I_{Out}) / 8

Actual Power Factor Output

In actual power mode, the analog output is proportional to the power factor.

CR6310: V_{Out} = PF x 5

CR6311: V_{Out} = PF x 10

CR6320: I_{Out} = (PF x 12) + 4