Power Interactive Regulation (PIR) Feature Description

PIR is essentially bi-directional line drop compensation. The LV regulator changes its setpoint based on the direction (sign) of the power flowing thru the regulator and the amplitude (amperage).

In other words, as normal load power consumption increases the regulator can be programed to increase its set point to compensate for the voltage drop between the regulator and the load. Conversely when DER on the load side of the regulator is causing the power flow to reverse, the regulator set point decreases to compensate for the voltage rise between the DER and the regulator.

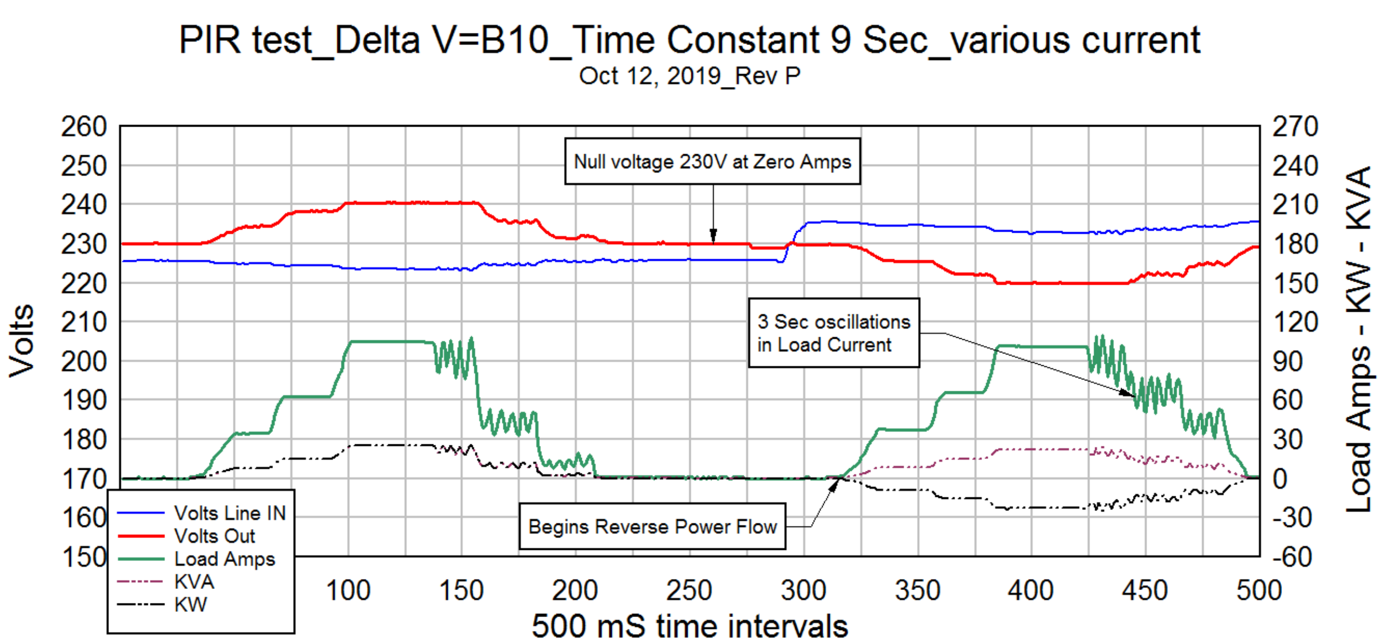
PIR can be Enabled/Disabled and there are 3 parameters which define the PIR operation.

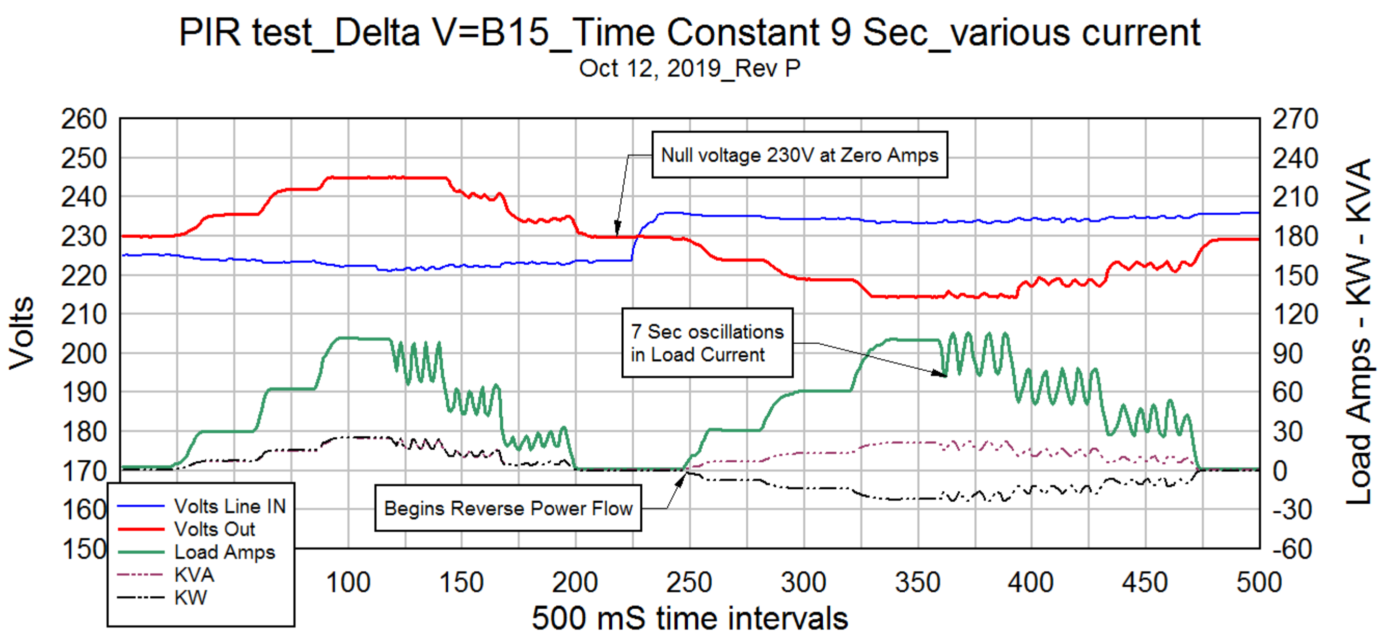
Null Voltage – this defines the output voltage of the regular when the power flow is zero. This setpoint value may be different than the set point the regulator uses when PIR is disabled.

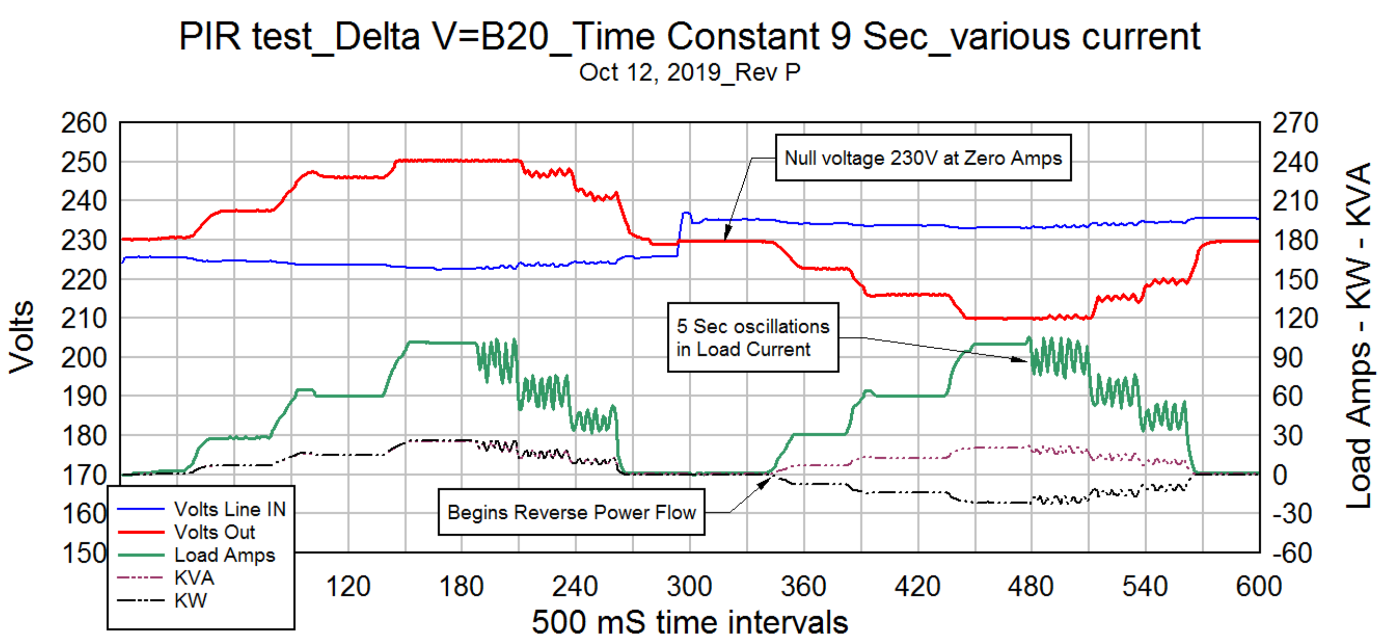
Max Voltage Delta – this is expressed as the maximum voltage change when the load current is ≥ the maximum current rating of the regulator. It defines the slope of the voltage change per amp of load current. This can be symmetrically positive or negative depending on the direction of power flow, or limited to only function in one direction. Since this is not a transmission line application, we consider Z to be insignificant and simplify the voltage drop/rise model to I^2R.

Time Constant – this defines how quickly the regulator reacts to changes in amperage in seconds, which has an effect on the dampening or stability of the circuit. Typically, 6 to 30 Seconds.

Three graphs of PIR performance at different Delta Voltage (10,15 & 20) parameter values are provide below for reference.




PIR test_Delta V=B15_Time Constant 9 Sec_various current
Oct 12, 2019_Rev P
Null voltage 230V at Zero Amps
7 Sec oscillations in Load Current
Begins Reverse Power Flow
Volts Line IN
Volts Out
Load Amps
KVA
KW
Volts
Load Amps - KW - KVA
500 mS time intervals


PIR test_Delta V=B20_Time Constant 9 Sec_various current
Oct 12, 2019_Rev P
Null voltage 230V at Zero Amps
5 Sec oscillations in Load Current
Begins Reverse Power Flow
Volts Line IN
Volts Out
Load Amps
KVA
KW
Volts
Load Amps - KW - KVA
500 mS time intervals

The graph below illustrates how a LVR with PIR can be used to mitigate voltage compliance issues created by a typical duck tail load curve on a LV network.