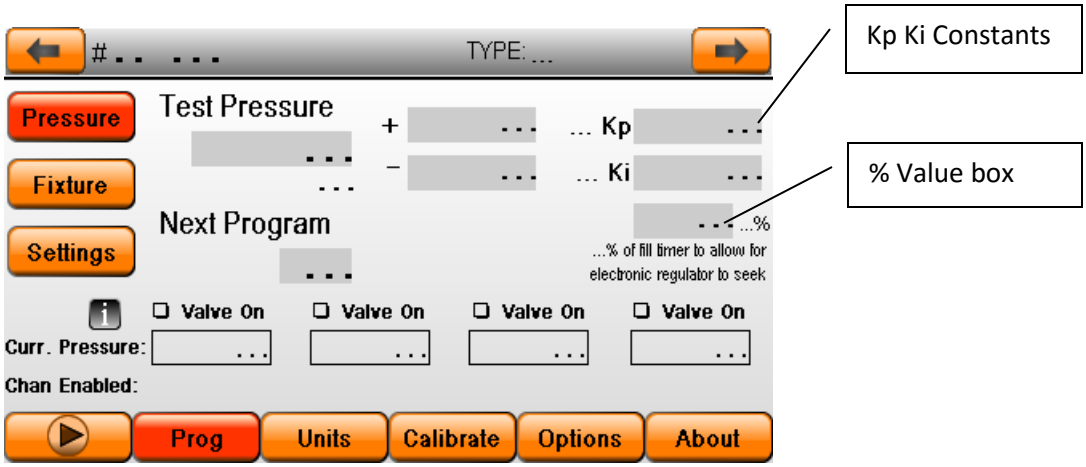
Tech Note – Electronic Regulator Feedback Control

There are three methods of regulator feedback/control on the Isaac HD with the electronic regulator option.

1. Open loop control with the initial calibrated DAC values
2. Closed loop control with feedback coefficients (Kp Ki) and feedback duration percentage.
3. Continuous closed loop control with user specified feedback coefficients (Kp Ki)

All three methods are enabled by using the % value on the 'Pressure' screen.



Open loop control using the initial DAC values.

During the calibration procedure the pressure sensor used for test decisions is calibrated and the data is stored on the processor board. During the same time the pressure sensor is calibrated the electronic regulator values are also calibrated. This is done by a chip on the boards called a DAC (Digital to analog Convertor) this converts a digital number to a voltage to drive the regulator. The digital number required to drive the regulator to the pressure the sensor is calibrated to is stored in memory. To use this mode, set the % value box to '0'. This mode offers no feedback or correction to the test pressure. Any variation in the incoming pressure can alter this output. Once the test pressure is entered into the value box, the regulator needs to be set by dead ending the test port and selecting the 'valve on'. When the live reading is steady at the test pressure uncheck the valve on box.

Closed loop control with feedback coefficients and feedback duration percentage. (Default)

This mode allows for feedback based on the pre-set 'Kp Ki' settings while specifying an amount of time to run the algorithm. To activate this mode enter a value from 1-99 in the % value box. This action enables the feature and specifies the amount of fill time to allow for feedback. For example, a value of 20% is set, the regulator will output to reach the test pressure based on the last time the test was successfully ran, then the feedback will take place the last 20% of the fill time fine tuning the test pressure closer to the set value . Setting the percentage time to high will cause unstable and/or oscillation. The typical value is 10-30%. The Kp Ki values can also be modified for feedback tuning.

Closed loop control with user specified feedback coefficients (Kp Ki)

The third mode is a continuous feedback with control constants (similar to a PID control). Setting the % value box 100 will enable the Kp and Ki control constants. The Kp and Ki functions will allow the fill curve to be shaped according to the application needs (Speeding up the fill or no overshoot on the test pressure). If the application pressure or the part volume changes the Kp Ki will need to be adjusted for these new parameters.

The Kp is used as the drive, the larger the number the more the regulator is driven to the set test pressure. If the constant is too large it will cause an oscillation.

The Ki is the correction factor, as the Kp drives the pressure towards the set point the Ki will correct the feedback to reach the target. To large of a value will cause wild corrections and oscillations.

Finding the Kp Ki values:

Start by setting a small Kp and zero in the Ki. Run a test with these parameters and observe the fill curve. The regulator may not reach the specified test pressure. Adjust the Kp in small increments until the fill curve becomes unstable after the initial fill. Add small amounts of Ki to correct the pressure to the desired value and fill curve.