
**Refrigeration Suction Control
APP- 019**

This application note will detail the operation of our new suction pressure control. This control is primarily focused on screw compressors, but will also be applicable using a freq drive on a reciprocating compressor. One of the big problems with a screw compressor is what to do with the 0-20 or 4-20ma signal. The screw compressors have no feed back on the slide valve so it is very difficult to match up for a call of say 50% capacity. MCS controls use a current sensor and try to match it to the input signal. The problem with this is that the head pressure can vary greatly and will cause this to vary all over. The unique solution that we have developed is to use Suction pressure control. The 0-20ma or 0-100% input signal will determine the suction pressure setpoint. You can program a suction setpoint and a span. The 0-100% signal from the panel will cause the suction setpoint to float from the setpoint thru the span. Example - suction setpoint = 60 psi, span = 15 psi. The floating suction setpoint will float from 60 psi to 45 psi depending on the input signal. The CR-110 will pulse the screw compressor up and down to maintain the floating suction setpoint. Thus no feed back is required. This prevents any low suction conditions and allows very accurate temperature control. Tests have shown temperature control better than $\pm .1$ degree. The wiring and controls on the screw compressor are the same as the conventional controls. The shorter the span the more accurate temperature control you will have.

We are in the process of using some other parameters to determine the ideal suction pressure for any given conditions. This application will deal with the setup and operation of the current suction controls.

Control Parameters:

Suc SP (Suction Setpoint) - this is the highest value the suction pressure would run.

Suc Span (Suction Span) - this is the span that the suction setpoint will float. Typical setting would be from 10 to 20 psi. This is always applied on the low side of the suction setpoint. Example would be a Suc SP = 60 and a Suc Span 20 psi. The Suction Setpoint would then float between 60 and 40 psi depending on the upper and lower settings.

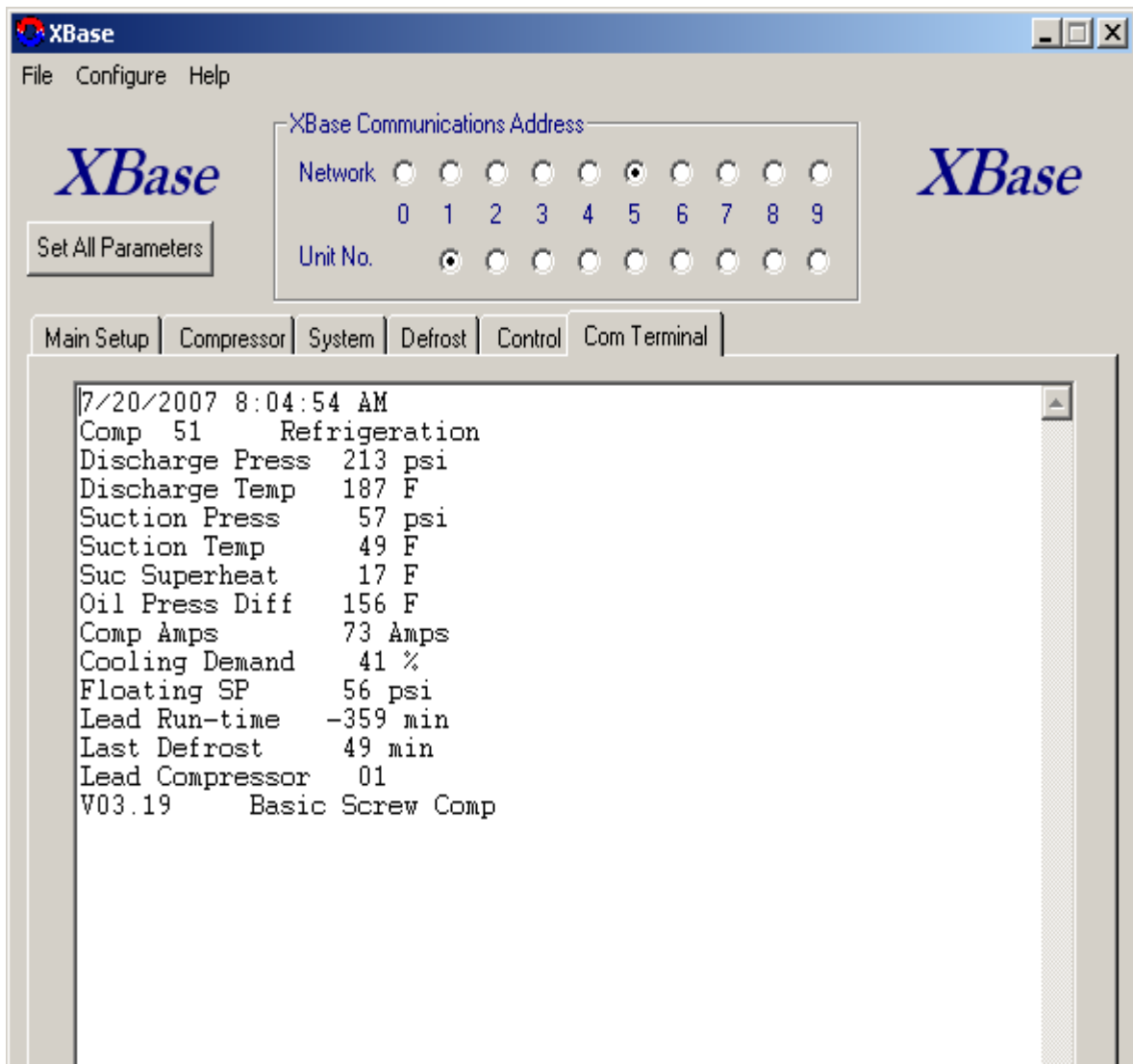
Span L (Span Low) - this is the value in percent that will define the lower operation point of the compressor.

Span H (Span High) - this is the value in percent that will define the high operation point of the compressor.

Example - Suc SP = 60, Suc Span = 20, Span L = 30, Span H = 100. When the output signal of the panel reached 30%, the Floating Suction Setpoint (FSP) would equal 60 psi. As the signal increased the FSP would linearly decrease until 100% would equal 40 psi.

Example 2 - (Multiple compressors) Suc SP = 60, Suc Span = 20, Span L = 30, Span H = 50. When the output signal of the panel reached 30%, the Floating Suction Setpoint (FSP) would equal 60 psi. As the signal increased the FSP would linearly decrease until 50% would equal 40 psi.

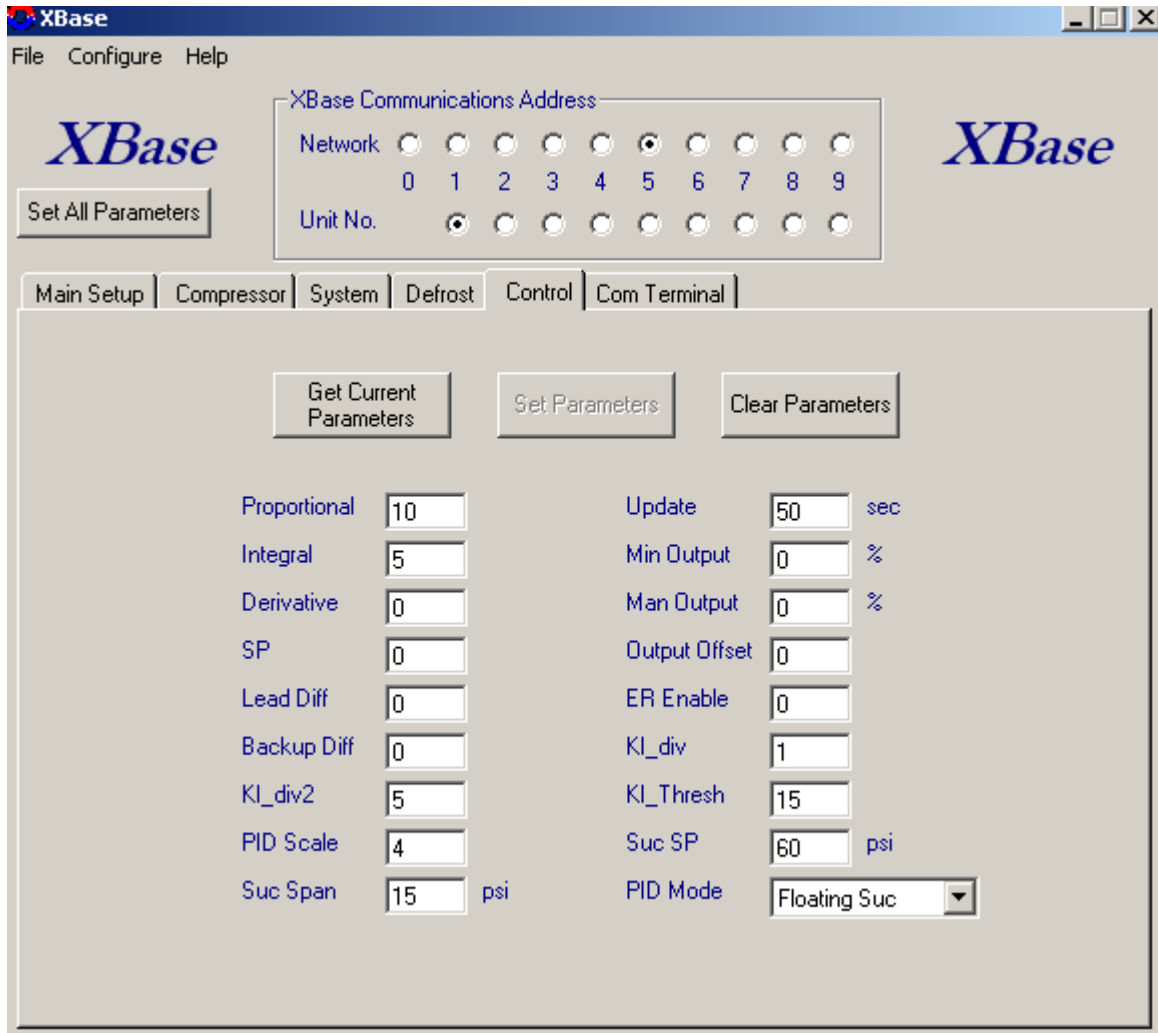
The CR-110 uses a PID loop to control the floating suction setpoint. This is very accurate and will maintain a very steady suction pressure. **See application note 5 for more detail information on the CR-110 operation on a screw compressor.**



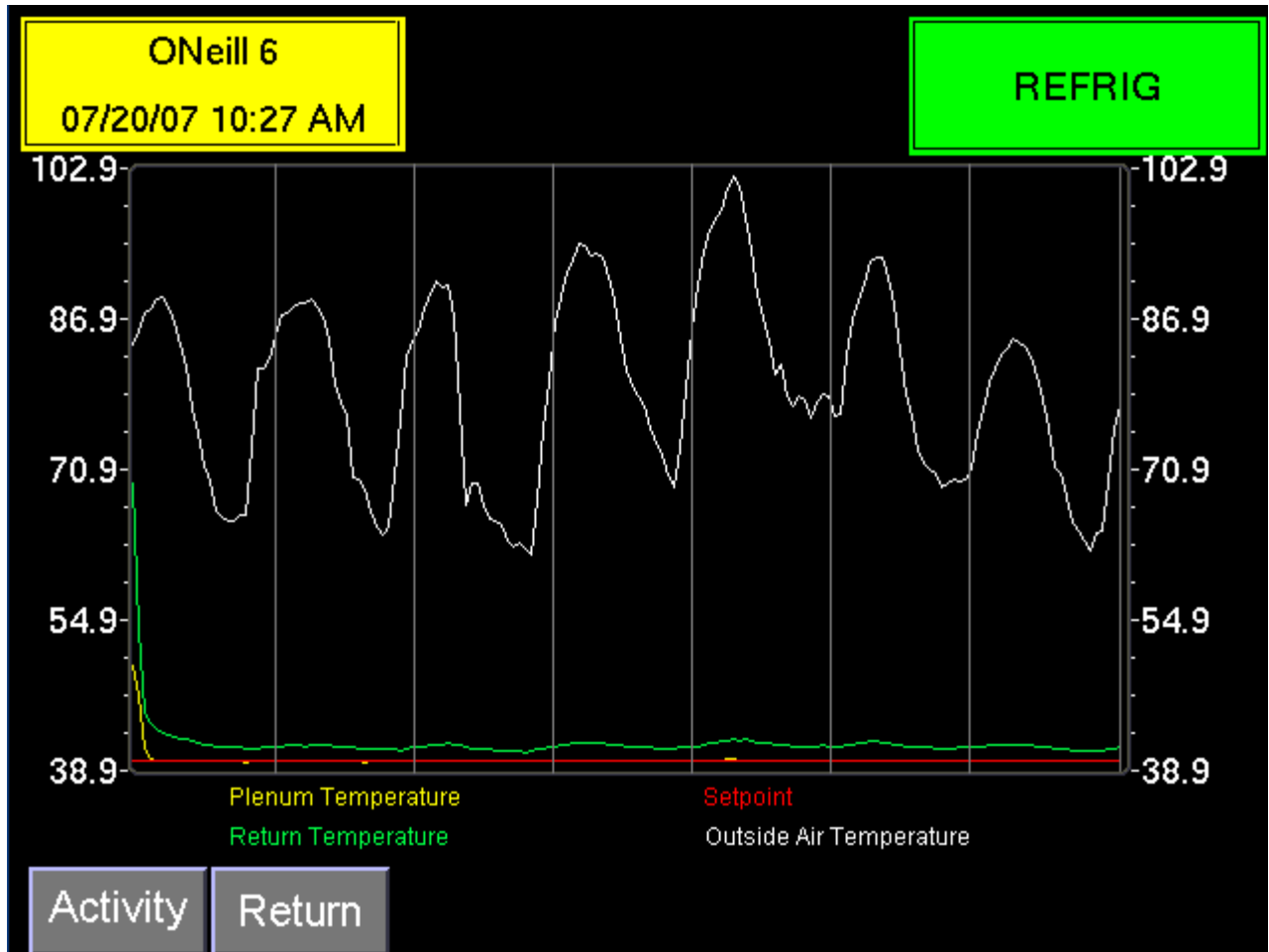
This is an example of a single screw compressor running suction pressure control. The panel output is 41% and this is producing a Floating Suction Setpoint of 56psi. The actual suction pressure is 57psi. The CR-110 will constantly pulse the screw compressor to try and maintain the FSP of 56 psi. Screw compressor slides have a tendency to drift and not hold a given position. This is a real problem for the MCS controller, but here we are simply trying to match up the suction pressure with the FSP, so it does not matter.



This is the screen where you set the Span L and Span U. This example is for a single compressor and spans to 100%. The liquid line solenoid will come on at 20% and the floating suction setpoint will span between 20 to 100 percent.



This is the setup up for the Suc SP and the Suc Span. You also need to select Floating Suc for the PID mode. This example has Suc SP at 60 and Suc span at 15. This will allow the suction pressure setpoint to span from 60 to 45 psi.



This is an example of what suction pressure control can do. This is a seven day graph, the plenum temperature is yellow and underneath the red setpoint line. You can see three times in seven days that we were .1 degrees off, the rest of the time we were exactly on setpoint. The last .1 bump was self inflicted as I was doing some tests. Note the return air raising in the heat of the day. This system was also doing CO2 purging during this time and we still remained on Setpoint.