
**CR-110 Application Note
APP-001****COMPRESSOR FREQ DRIVE APPLICATION**

This application Note will describe how to use the CR-110 to control a freq drive compressor for load control. This example will use a 4 compressor skid. Each compressor will have a CR-110 on it and they will be numbered 01,02,03, and 04. Compressor 01 will have a freq drive connected to it, with a minimum setting of 30%. This example is also using two sets of parallel compressors. C1 & C2 are parallel, and C3 & C4 are parallel. I will address the parallel aspect of it at the end of the application note.

Theory

Compressor C1 can be modulated between 30% and 100%. Depending on the number of compressors in the system, C1 will span different input signals. With 4 compressors C1 will run from 30 to 100% with an input span of 25%, for 2 compressors, C1 would span 50%. C1 will float its span, over the entire 0-100% input signal. The term float means that if the input signal was at 40% and C1 at 100%, C1 would stay at 100% as long as the input signal was increasing. Once the input signal start to decrease, C1 would immediately start to back off, regardless of where the input signal was. Example, C1 is at 100% with a 30% input signal and the input signal continued to climb to 50% where another compressor kicked in. The additional capacity satisfied the cooling load, and the input signal started to drop. The additional compressor would continue to run, but C1 would immediately start to back off. The additional compressor staging would match the span of C1. In this case additional compressors would be staged every 25%.

Logic

For compressor 01, we will use a relay on out 5 instead of a mag starter. This relay will give the freq drive a dry contract to start. Compressors 02,03, & 04 will be wired as basic refrigeration and operate as normal. There will be no compressor rotation, and the staging values will be fixed from 0 to 100 percent. The suggested settings would be: C1 on at 10%, off at 5%. C2 on at 50%, off at 25%. C3 on at 75%, off at 50%. C4 on at 100%, off at 75%.

The freq drive should be set for 0-20ma, and have a minimum setting of 30%. The minimum setting on the CR-110 should be set for 30% also. This will output 6ma's minimum. The CR-110 will use a 0-20ma signal for a 0-100% span.

Compressor 01 uses a unique PID setting to drive the compressor. The CR-110 would have a PID setting of comp freq in the PID drop down menu on the control tab. Also on the control tab is a manual output setting. This application uses this value to set the span for the 0-100 output to all the cards. For 4 compressors this value should be set to 25%. Thus the freq

drive will go from 30% to 100% for a 25% increase in the input signal from the control panel.

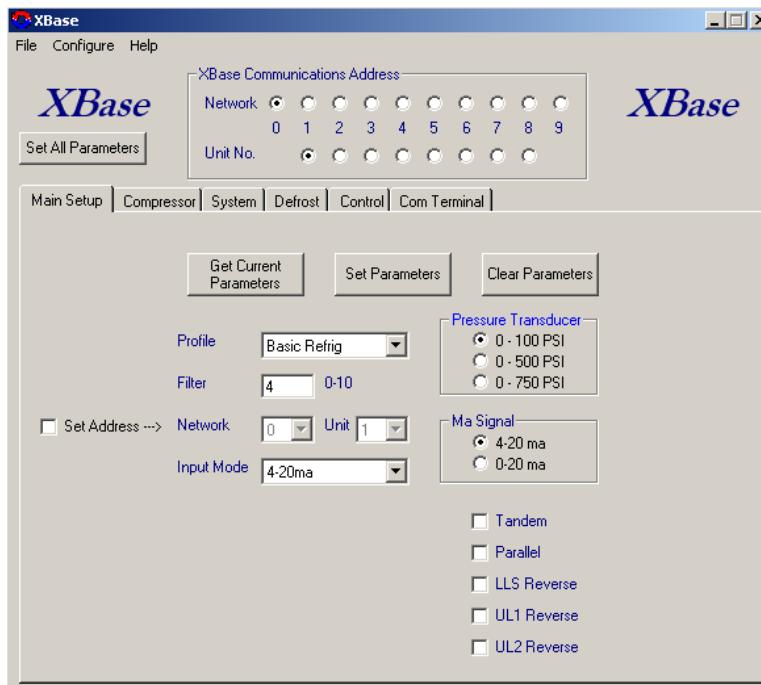
The unique operation allows compressor 01 to float its 0-25% operation anywhere in the 0-100% input signal.

Compressor 01 would start when the liquid line solenoid opens at 10%. At this point the compressor would be running at 30 of speed or minimum setting. As the input signal from the control panel increases by 25%, the compressor would ramp up to 100%. As the control signal continues to increase up to 50 %, the second compressor would start. Compressor 01 would remain at 100% as long as the input signal was not decreasing. As soon as the input signal started to decrease, Compressor 01 would then start to ramp down.

Compressor 01 will go from 30% to 100% of speed, and it floats anywhere in the 0-100 input signal. Thus it is the first to ramp up or down, when it is not at its limits.

Another example would be, if the panel was calling for 90% output. Compressor 01 would ramp up to 100%, Compressors 02,03 and 04 would all come on. Compressor 01 would then start to decrease to match the need output.

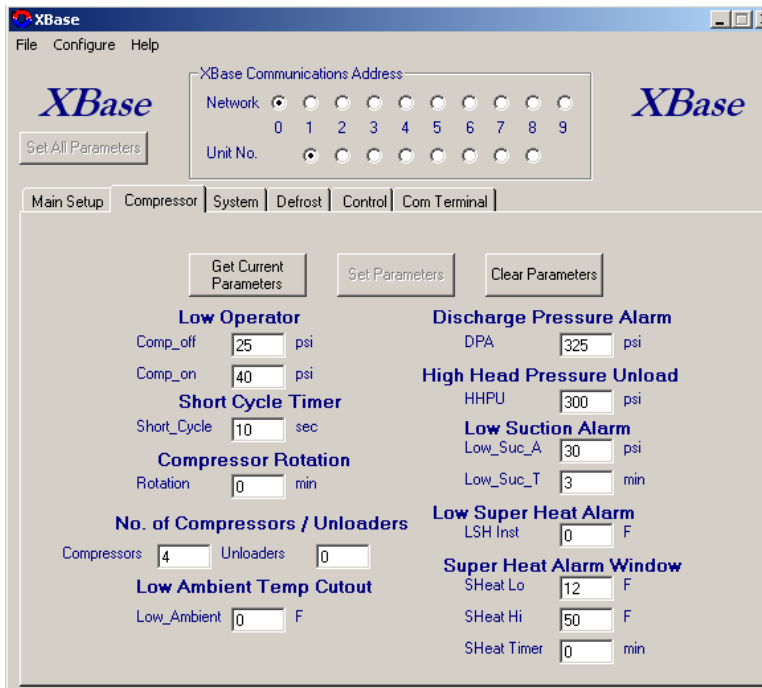
This application has two unique features. One is the freq drive on Compressor 01, the other is the parallel compressor. In a parallel compressor, only one compressor can pump down. In this situation, there are two sets of parallel compressor, so one compressor in each set must be designated to pump down. With this situation, we can not rotate compressor. I will first describe the setup of compressor C1 and then list the setup for C2,C3 & C4.



C1 is setup for Basic Refrig and a 4-20ma Input mode.

Since C1 and C2 are operating in parallel, C1 is designated to pump down. This is done by not checking the Tandem or Parallel boxes. On C2 we will check the Parallel box.

The Parallel box will keep the compressor from pumping down, unless it is the lead compressor. In this application the rotation is turned off so that C1 is always the lead compressor.



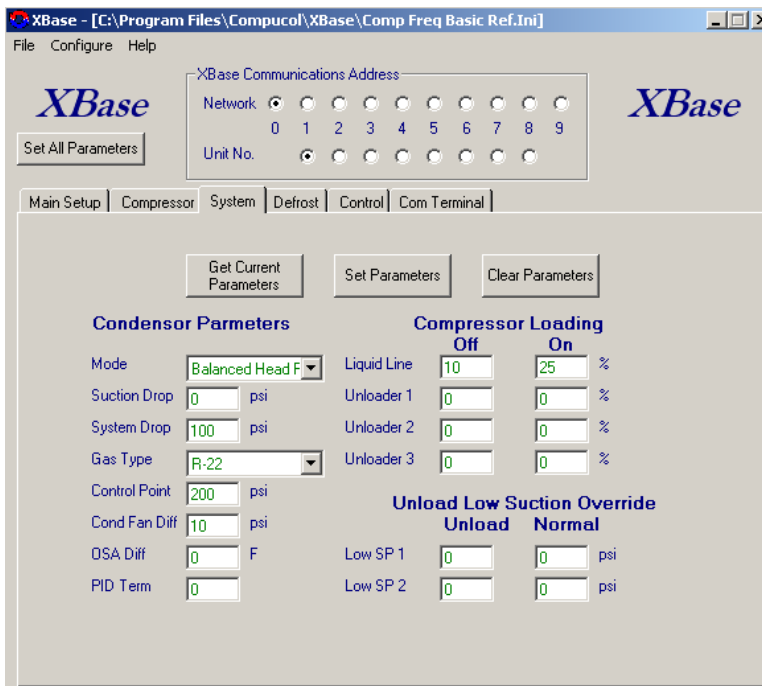
The Low Operator setting should be adjusted for the application.

Short Cycle Timer can be set to desired time. A short time of 10 s is handy for testing.

The Rotation is shut off by setting it to 0.

The number of Compressors must be set the total number of compressors. This will activate the passing of the input signal to each of the cards via the comp RS-485 port.

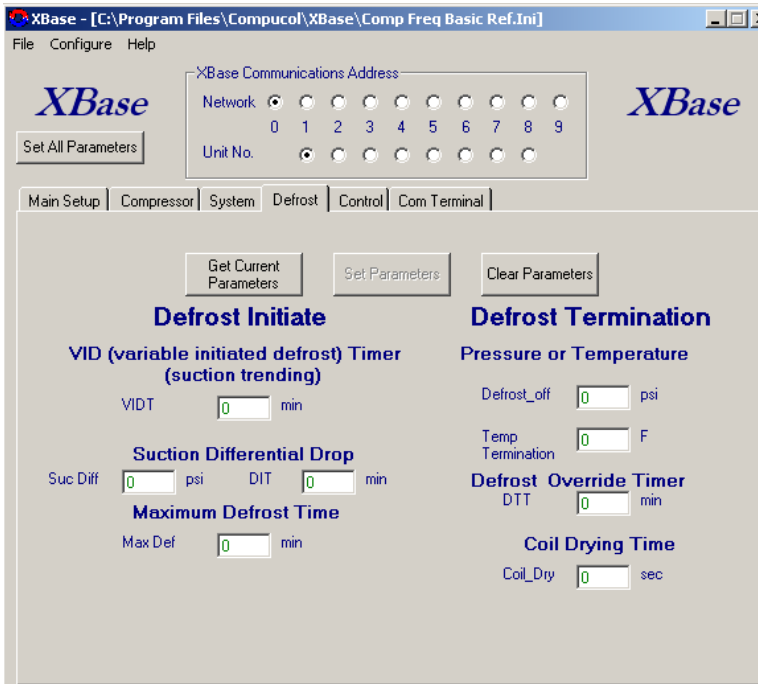
The alarms can be set to the desired setting, a 0 in the timers will disable the alarm.



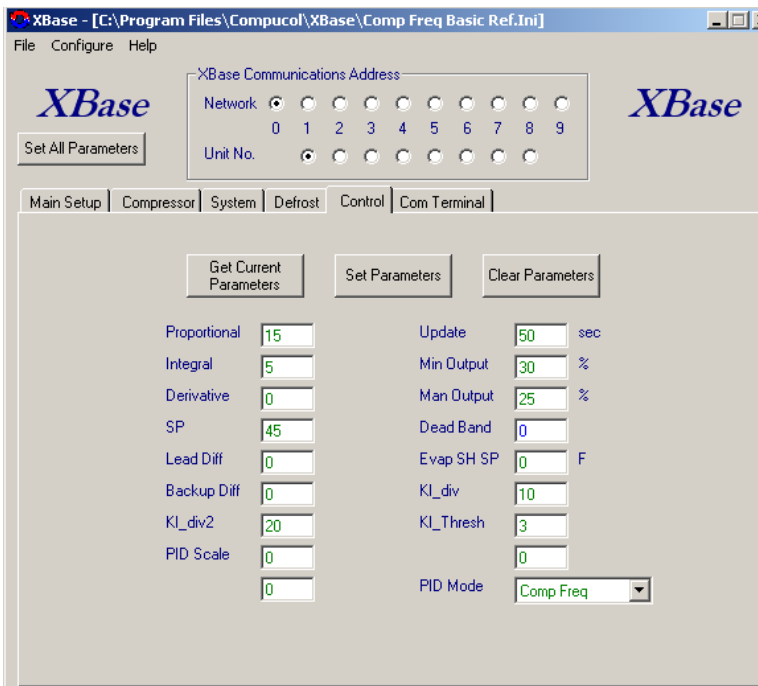
On C1 there are no unloaders, so we set the LLS only.

If the condenser fans seem to cycle, you may want to increase the Cond Fan Diff setting.

System Drop setting can be adjust for the minimum discharge pressure that the head will float to. Minimum head pressure setting is equal to System Drop + Suction pressure.



None of the Defrost Parameters are being used.

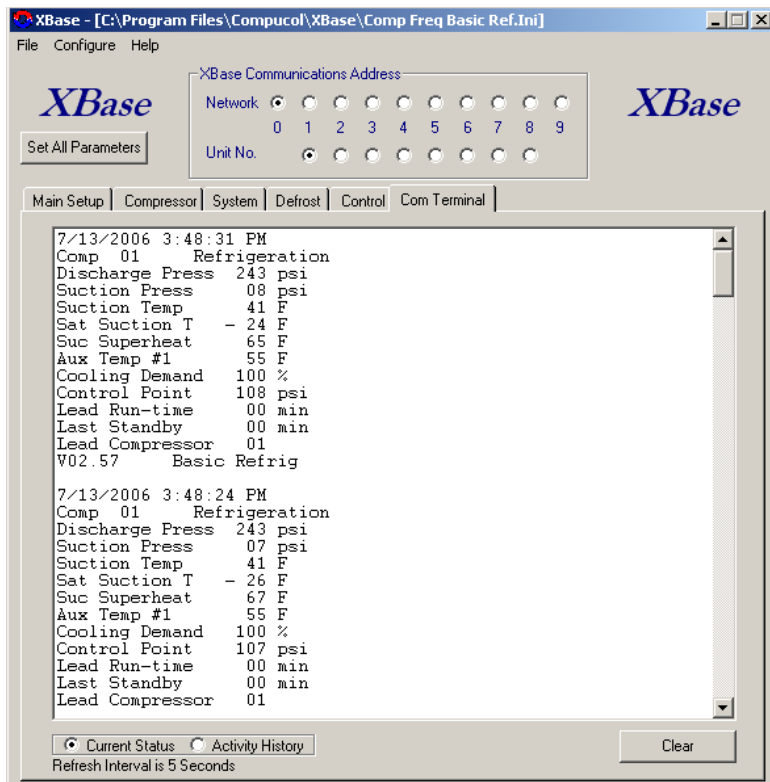


The PID Mode only for C1, is selected as Comp Freq.

Min Output is the lowest percentage of the 0-20ma signal from the CR-110 to the freq drive.

Man Output sets the span for the 0-20ma signal to the freq drive. A setting of 25 % will allow the drive to go from 30% or minimum setting to 100% for a 25% change of the control panel input signal.

The rest of the values are not used in this application.



The Com Terminal can be used to verify sensors and operation.

CR-110 Settings for each Compressor

7/14/2006 Comp 01 Comp 02 Comp 03 Comp 04

Data Name	Value	Value	Value	Value	
Lead Diff	0	0	0	0	
Filter	4	4	4	4	
Backup Diff	0	0	0	0	
DPA	325	325	325	325	
Comp_off	25	25	25	25	
Comp_on	40	40	40	40	
Short_Cycle	10	10	10	10	
Low_Suc_A	30	30	30	30	
Low_Suc_T	3	3	3	3	
Suction Drop	0	0	0	0	
System Drop	100	100	100	100	
Temp Termination	0	0	0	0	
Control Point	200	200	200	200	
Cond Fan Diff	10	10	10	10	
OSA Diff	0	0	0	0	
Liquid Line OFF	10	25	50	75	Individual settings
Liquid Line ON	25	50	75	95	No Rotation

Unloader 1	0	0	0	0
Unloader 1	0	0	0	0
Unloader 2	0	0	0	0
Unloader 2	0	0	0	0
Low SP 1	0	0	0	0
Low SP 1	0	0	0	0
Low SP 2	0	0	0	0
Low SP 2	0	0	0	0
Defrost_off	0	0	0	0
Suc Diff	0	0	0	0
DIT	0	0	0	0
DTT	0	0	0	0
SP	45	45	45	45
Proportional	15	15	15	15
Integral	5	5	5	5
Derivative	0	0	0	0
Update	50	50	50	50
Min Output	30	30	30	30
Man Output	25	25	25	25
Dead Band	0	0	0	0
Max Def	0	0	0	0
HHPU	300	300	300	300
VIDT	0	0	0	0
Rotation	0	0	0	0
Evap SH SP	0	0	0	0
Compressors	4	4	4	4
Unloaders	0	0	0	0
LSH Inst	0	0	0	0
SHeat Lo	12	12	12	12
SHeat Hi	50	50	50	50
SHeat Timer	0	0	0	0
Low_Ambient	0	0	0	0
Coil_Dry	0	0	0	0
Unloader 3	0	0	0	0
Unloader 3	0	0	0	0
PID Term	0	0	0	0
KI_div	10	10	10	10
KI_div2	20	20	20	20
KI_Thresh	3	3	3	3
PID Scale	0	0	0	0

Profile	Basic Ref	Basic Ref	Basic Ref	Basic Ref	
Mode	Balanced	Balanced	Balanced	Balanced	
Gas Type	R-22	R-22	R-22	R-22	
Input Mode	4-20ma	4-20ma	4-20ma	4-20ma	
PID Mode	Comp Freq	None	None	None	Only Comp 1 set for Freq
Network	5	5	5	5	Use Network 5 for XT panel
Unit	1	2	3	4	
Tandem	no	no	no	no	
Parallel	no	yes	no	yes	C1 & C3 will pump down
LLS Reverse	no	no	no	no	
UL1 Reverse	no	no	no	no	
UL2 Revers	no	no	no	no	

Note - Individual differences for compressors have been highlighted.

Dead Band setting: The Dead Band setting of 0 will allow the individual cards to all see the control panel full input signal. When using compressor rotation, the Dead Band is set to the number of compressors, divided into 100. If you have 4 compressors normally the Dead Band would be set for 25%. This would split up the percentage each compressor sees, and the LLS and Unloaders would all be set the same on each compressor to span 0 to 25%. In this case, we can not rotate compressors since we are Parallel and some other issues. Thus we set the Dead Band to 0, and then set the LLS for each compressor to stage from 0 to 100%

LLS settings: Each of the four cards have to have the LLS set individual for the 0 to 100% input signal.

PID Mode: The PID mode for C1 needs to be set to Comp Freq, and None for all others.

Parallel: The Parallel check box when checked will allow only the lead compressor to pump down. Since we have no rotation in this application, the lead compressor will always be C1. C2 is in parallel with C1, thus we check the Parallel box for C2 to prevent it from trying to pump down. C2 will turn on and off with the LLS settings. C3 and C4 are in parallel, and C3 is designated as the pump down compressor. Thus C4 needs to be checked as Parallel to keep it from trying to pump down.

Since this application is connecting to a XT panel the network should be designated as 5.