

**Screw Compressor CR-110 Parameters
APP- 028**

This application note will explain the parameters associated with the set up of a CR-110 card for a Screw Compressor. This document uses the Screw.inf (11-13-08) file. Other app notes will cover the VFD units. The CR-110 software is the VSC (variable speed compressor).

The screenshot shows a configuration window with the following elements:

- Profile:** A dropdown menu set to "Basic Screw".
- Filter:** A text input field containing "4" and a label "0-10".
- Set Address --->:** A checkbox that is currently unchecked.
- Network:** A dropdown menu set to "5".
- Unit:** A dropdown menu set to "1".
- Input Mode:** A dropdown menu set to "Ma Signal".
- Pressure Transducer:** Three radio buttons: "0 - 100 PSI" (selected), "0 - 500 PSI", and "0 - 750 PSI".
- Ma Signal:** Two radio buttons: "4-20 ma" and "0-20 ma" (selected).
- Checkboxes:** "Tandem", "Parallel", "LLS Reverse", "UL1 Reverse", and "UL2 Reverse", all of which are currently unchecked.

Profile:

The Profile is used to select the desired operation of the CR-110. Valid profiles for this application are Basic Screw, VFD Screw and VFD Comp.

Filter:

This is a digital filter for all the analog inputs. It can be set from 1 to 10. One would be the least filtering and ten would be the max filtering. The recommended filter setting is four.

Network:

This is the first number assigned to a condenser unit. Example - CR card address 01 would be network 0, compressor 1. CR card address 12 would be network 1 and compressor 2. A network is defined as a group of compressor that will stage together. Example - You could have two separate systems with multiple compressors on the same communications bus, one group would be network 0 and the other network 1. For system running on non XT-70 control panels the network is typically 0-4. For XT panels the network must be 5 or 7.

Unit:

The unit number is assigned starting with 1 and can go up to 8. Example - a two compressor system would have units 1 and 2. For staging and rotation, you must always start at 1 and go consecutive.

Set Address:

The Set Address is used to change the address of the CR card. When checked, you can change the address of the card. Note - the CR card must be in the test mode before it will accept a new address. To change the CR card to the test mode, turn the S2 switch to the center off position. Then turn the S2 switch first to the RUN position and then, within three seconds switch to the PD position. All the LED indicators should be lit when in the test position.

Input Mode:

The input mode allows you to select the type of input you are using for the staging of the sys-

tem. Ma Signal, Setpoint, Pulse and Setpoint C are valid inputs. Ma Signal is selected if you are using a 4-20ma or 0-20ma signal from a control panel. Pulsed is selected if you are using an IVI or panel that produces open and close dry contacts for control. Setpoint and Setpoint C are used when a thermistor on the CR card is used for temperature control. Setpoint C is used for controlling in degrees Celsius. Setpoint is also used for a rack system when you have a suction Setpoint.

Pressure Transducer:

This refers to the range of the suction transducer that you are using. The discharge transducer is always a 0-500 psi transducer. The suction transducer could be a 0-100 or 0-500 psi transducer.

Tandem:

Not used

Parallel:

If you check this box, the compressor will not pump down when the LLS closes. This should be check on compressor in a parallel system that you do not want to pump down.

LLS Reverse:

If you check this box, the LLS output will be normally closed.

UL1 Reverse:

If you check this box, the UL1 output 7 will be normally closed. Note - currently the output is on when unloaded.

UL2 Reverse:

If you check this box, the UL1 output 7 will be normally closed. Note - currently the output is on when unloaded.

Comp_off	<input type="text" value="25"/>	psi	High Dis A	<input type="text" value="325"/>	psi
Comp_on	<input type="text" value="55"/>	psi	High Dis U	<input type="text" value="300"/>	psi
Short_Cycle	<input type="text" value="60"/>	sec	Low_Suc_A	<input type="text" value="30"/>	psi
Rotation	<input type="text" value="0"/>	min	Low_Suc_T	<input type="text" value="5"/>	min
Compressors	<input type="text" value="2"/>		AMP Xducer	<input type="text" value="2"/>	
RLA_Alarm	<input type="text" value="180"/>		SHeat Lo	<input type="text" value="4"/>	F
RLA_Time	<input type="text" value="0"/>	sec	SHeat Hi	<input type="text" value="50"/>	F
			SHeat Timer	<input type="text" value="20"/>	min

Comp_off:

Suction pressure at which compressor will shut off during pump down.

Comp_on:

Suction pressure at which compressor will come on in Refrigeration.

Short_Cycle:

The short cycle timer will prevent the compressor from short cycling. Set the SCT

value, in seconds, for the desired off time before the compressor can restart.

Rotation:

This timer is in minutes and is used to switch the lead compressor. Once compressor # 1 has run the rotation setting, it will rotate the lead to the number two compressor. The staging for compressor # 1 will shift to compressor # 2 and the last compressor will send its staging to compressor # 1. The number of compressors must be set above 1 for this feature to be active.

Compressors:

Set this for the number of compressors in the network that will be staged.

RLA_Alarm:

This deals with a screw compressor where the amps need to be limited on start up and run. See app note 016 for more detail. Set to zero to disable.

RLA_Time:

This deals with a screw compressor where the amps need to be limited on start up and run. See app note 016 for more detail. Set to zero to disable.

High Dis A: (High Discharge Pressure Alarm)

This is a soft high head pressure alarm. It should be set about 30 psi less than the mechanical high pressure switch.

High Dis U: (High Discharge Pressure Unload)

When the ambient air temperature exceeds the rating of the condenser, the condenser no longer has the ability to reject the full load heat. This can produce a nuisance high head pressure alarm. The High Dis U feature will automatically unload the compressor, and prevent this alarm. The High Dis U setting should be set below the soft high head alarm. Example - if set for 300 psi, it pulses the screw to unload or lowers the VFD by 5% every update time until the pressure drops 15 psi. It will then resume normal operation.

Low_Suc_A: (Low Suction Alarm)

This alarm has two components; first is the low suction pressure point and the second is the

timer. The alarm is active only in the refrigeration, defrost, and pump down modes. If the suction pressure drops below this setting and remains there for the duration of the timer, the system will shut down and go into an Alarm mode. A value of zero in the timer will disable the alarm.

Low_Suc_T: (Low Suction Timer)

This is the timer for the Low Suction Alarm. The UOM is minutes and a typical value would be 5. A setting of zero will disable the alarm.

AMP Xducer: (Compressor amp draw)

If an amp transducer is being used this parameter will select the range of the transducer. 0 = 0-50 amps, 1 = 0-100 amps, 2 = 0-200 amps.

SHeat Lo: (Superheat Lo Alarm)

This is the low side of the compressor suction superheat alarm window. If the suction superheat drops below this value and the associated timer expires, the compressor will be shut down. A typical setting would be 8 degrees.

SHeat Hi: (Superheat Hi Alarm)

This is the high side of the compressor suction superheat alarm window. If the suction superheat raises above this value and the associated timer expires, the compressor will be shut down. A typical setting would be 30 degrees.

SHeat Timer: (Superheat Timer)

This is the timer for the Low and High superheat window. A typical setting would be 10 minutes. A setting of zero will disable this alarm.

Mode	Fixed Head Pres: ▾	LLS OFF	5 %	LLS ON	10 %
	0	Span L	30 %	Span U	60 %
System Drop	100 psi	Oil P	70 psi	Oil Time	60 sec
Gas Type	R-22 ▾	Pulse W	5 .1s	Off Time	5 sec
Control Point	170 psi	Low Suc U	45 psi	Low Suc D	5 psi
Cond Fan Diff	10 psi	Dis Temp U	220 F	Dis H Temp	250 F
RLA_Limit	150 amp				
PID Term	0				

MODE: (Condenser Fan Mode of Operation)

The mode refers to the type of air cooled condenser fan control that is desired.

Fixed Head Pressure uses the Control Point setting and Cond Fan Diff to cycle the condenser fans off and on.

Balanced Head Pressure control will float the head pressure depending on the ambient air conditions. The lowest pressure that the system will float to is the System Drop plus the suction pressure. The Cond Fan Diff is used to stage the condenser fans.

Balanced PID Pressure control will produce a 4-20ma signal for a variable freq drive condenser fan.

System Drop:

This is the total system pressure drop. A typical value would be 70 psi. The Balanced Head pressure Mode uses this value for controlling the head pressure. The controlling pressure is determined by the suction pressure plus the System Drop.

Gas Type:

Select the type of gas being used. This is a critical selection that allows the proper super heat to be calculated.

Control Point:

This is the desired head pressure in psi. This value is only used in the fixed head pressure control, or if one of the parameters used in the Balanced Head pressure control is missing.

Control Fan Diff:

Rather than have to enter all the values for each stage of the condenser fans to cut in and out, a differential value is used. The recommended value is 5 psi.

	Stage 1	Stage 2	Stage 3	Stage 4
OFF	CP	CP + D	CP + 2D	CP + 3D
ON	CP + 2D	CP + 3D	CP + 4D	CP + 5D
Example	Control point = CP = 200		Differential = D = 10	
OFF	200	210	220	230
ON	220	230	240	250

RLA Limit:

This deals with a screw compressor where the amps need to be limited on start up and run. See app note 016 for more detail. Set to zero to disable.

PID Term:

This is a value that is used for engineering only. It should be set to zero.

The following values are based on a 0-100% output.

Liquid Line Off - On:

The first value is the Liquid Line off value and the second is the on value. These values are in percent and will determine when the LL solenoid will open and when it will close. A typical value would be 5% off and 10% on.

Span L: (Span Low end)

The span adjustment allows you to set different compressors to span parts of the 0-100% cooling demand signal. The Span L is the output percentage when the compressor will be fully unloaded.

Span U: (Span Upper end)

The span adjustment allows you to set different compressors to span parts of the 0-100% cooling demand signal. The Span U is the output percentage when the compressor will be fully loaded.

Oil P & Oil Time:

The oil pressure is the Discharge Pressure - Suction Pressure. Any time the compressor is running, the pressure differential needs to be greater than the Oil Pressure setting. If the pressure has not built during the Oil Time, the system will shutdown and lockout.

Low Suc U & Low Suc D: (Low Suction unload and Low Suction Differential)

If during the refrigeration cycle the suction pressure is less than the Low Suc U for 1 minute, the unload solenoid will be pulsed on each update until the suction pressure rises to Low Suc

U + Low Suc D. On a VFD the speed will be decreased by 5% each update cycle. A zero in the Low Suc U will disable this function.

Dis Temp U: (Discharge Temperature Unload)

If during the refrigeration cycle the Dis Temp is greater than the Dis Temp U for 1 minute, the unload solenoid will be pulsed on each update until the Discharge temperature drops by 10 degrees. On a VFD the speed will be lowered by 5% on each update cycle. Once the temperature drops by 10 degrees, normal operation will be resumed. A zero in the Dis Temp U will disable this function.

Dis H Temp: (Discharge High Temperature)

If during the refrigeration cycle the Dis Temp is greater than the Dis H Temp for three minutes, the system will shutdown and lock out.

VIDT	<input type="text" value="0"/>	min	Defrost_off	<input type="text" value="0"/>	psi
Suc Diff	<input type="text" value="0"/>	psi	Temp Termination	<input type="text" value="0"/>	F
DIT	<input type="text" value="0"/>	min	DTT	<input type="text" value="0"/>	min
Max Def	<input type="text" value="0"/>	min	Coil_Dry	<input type="text" value="0"/>	sec

VIDT: (Variable Initiated Defrost)

This is a unique way in which a trend is established for determining the suction pressure operating point. This timer sets the length of time that the trend is taken. This allows the CR-110 to determine a defrost initiation based on a drop in suction pressure rather than just time. A normal setting would be between 30 and 60 minutes. Set to zero to disable.

Suc Diff: (Suction Differential)

Once a trend is established for the suction pressure, this value would be subtracted from the trend suction pressure and would be used to initiate a defrost cycle when the suction pressure was below this calculated value for a given time. A normal setting would be 3-5 psi. Set to zero if this operation is not desired.

DIT: (Defrost Initiated Timer)

This is the amount of time the suction pressure would be below the Suc Diff point before initiating a defrost. A setting of zero will disable this feature.

Max Def: (Max Defrost Time)

This is the time in minutes for the next defrost. If a defrost is not initiated using the VIDT, this time will initiate a defrost. Set to zero to disable all defrost cycles.

Defrost_Off: (Defrost Termination Pressure)

This is used for hot gas defrost termination. As soon as the discharge pressure rises above this value, the defrost will be terminated.

Temp Termination:

This value is not used and should be set to zero.

DTT: (Defrost Termination Timer)

This is the time in minutes that the defrost cycle will run before being terminated. A setting of zero will disable this feature. For hot gas defrost, this time will override the discharge pressure termination.

Coil_Dry: (Coil Freeze)

This is the time in seconds that the coil will be dried after the defrost termination. The system will run with the compressor and the LLS open but the evaporator fans will be off.

Proportional	<input type="text" value="15"/>	Update	<input type="text" value="50"/>	sec	
Integral	<input type="text" value="5"/>	Min Output	<input type="text" value="0"/>	%	
Derivative	<input type="text" value="0"/>	Man Output	<input type="text" value="0"/>	%	
SP	<input type="text" value="0"/>	Output Offset	<input type="text" value="0"/>		
COMP SH H	<input type="text" value="20"/>	F	EVAP SP	<input type="text" value="7"/>	F
COMP SH L	<input type="text" value="17"/>	F	EV HI LIMIT	<input type="text" value="18"/>	F
EV_UPATE	<input type="text" value="10"/>	min	EV LO LIMIT	<input type="text" value="7"/>	F
SH SAFETY	<input type="text" value="0"/>	F	Suc SP	<input type="text" value="75"/>	psi
Suc Span	<input type="text" value="25"/>	psi	PID Mode	Screw F Suc	

Proportional:

This value is only used when the PID Mode setting is other than None. The Proportional constant is simply a multiplier that can be used to fine tune the size of the Proportional Mode adjustment. Raising the value of P results in a greater reaction to input value changes. A typical setting would be 5-20. P only produces a output when there is change. Example - on suction control, if the suction pressure was not changing then P would not affect the output. Too much P and it will override the integral.

Integral:

This value is only used when the PID mode setting is other than None. The I value is what will cause the output to change when the input is not changing and is steady state. Increasing this value too much will cause the system to become unstable. A typical value would be 5. Example - on suction control, if the suction pressure was not at Setpoint and the screw or VFD was not changing, then increase the value of I.

Derivative:

This value is only used when the PID mode setting is other than None. The Derivative is constantly analyzing the rate of change of the error, makes a prediction about what the future error will be and makes adjustment to the output in an attempt to reduce the rate of change in

the error. For most cases the derivative is disabled by setting it to zero.

SP: (Setpoint)

This value is only used when the input mode is Setpoint or Setpoint C. This would be used as a stand alone controller and would use a thermistor for a controlling sensor. If you are not using an input of Setpoint or Setpoint C the value does not matter. This is not used when running suction pressure control.

COMP SH H (Compressor Superheat High)

This value is for the automatic compressor superheat control. It should be set to zero if not using this feature. This is the high value for the desired window for the compressor operation. Typical compressor suction superheat operation should be maintained between 18 to 20 degrees. In this case you would set the Comp SH H to 20 and the Comp SH L to 18. This feature is only available when using the ER-110 controller.

COMP SH L (Compressor Superheat Low)

This value is for the automatic compressor superheat control. It should be set to zero if not using this feature. This is the low value for the desired window for the compressor operation. Typical compressor suction superheat operation should be maintained between 18 to 20 degrees. In this case you would set the Comp SH L to 18 and the Comp SH H to 20. This feature is only available when using the ER-110 controller.

EV_UPDATE: (Evaporator Update time)

This is the time in minutes that the CR-110 broadcasts to the ER-110 cards for an update on the Superheat Setpoint. A typical setting would be 10 minutes.

SH SAFETY: (Superheat Safety)

This is a safety setting for the compressor suction superheat. A typical setting would 10 degrees. If the compressor suction superheat dropped below this setting the CR-110 would broadcast to all ER-110 to default to a superheat Setpoint of 12 degrees. As soon as the compressor super heat warmed back up, then auto control would resume. A setting of zero will disable this function.

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. See App note 019 for more detail. For a Rack system you do not want the Suction Setpoint to change so a setting of zero would disable the floating suction setpoint.

Update:

This is the update time for the PID loop and is active only when the PID is being used. This is in 10ths of a second. A typical setting would be 50, which would be 5 seconds. The PID loop is active only when running an input mode of Setpoint or Setpoint C. It is also active if using a

freq drive on the compressor or running suction control.

Min Output:

This is only used when the PID Mode is Comp Freq or VFD F Suc. Min output is the lowest percentage of the 0-20ma signal from the CR-110 to the freq drive.

Man Output:

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.

Output Offset:

The Output Offset setting is used for compressor rotation. If you only have one compressor, this setting is not used. If you have two compressors, this setting would be 50 %. If you have three compressors set it for 33% and for four compressors set it for 25 %. The liquid line solenoid and unloaders should be staged less than this setting. Example if you have two compressors, all staging on both compressors should be from 0-50%. In this example the lag compressor will subtract 50% from the output of the lead compressors. This will cause the lag to stage from 50-100% but have the same settings as the lead compressor.

Evap SH SP: (Evaporator Superheat Setpoint)

This parameter is only used when the CR-110 card is used in conjunction with a ER-110 card. This is the actual value that is being broadcast to the ER-110 cards for their Superheat Setpoint. This value will automatically change if the auto superheat control is active. If you are running in auto superheat, the CR-110 constantly monitors and averages the compressor suction superheat. If the suction superheat is outside of the super heat window, then it will change the Evap SH SP and broadcast this value to all the associated ER-110 cards.

EV HI Limit: (Evaporator High Limit)

When running in auto superheat mode, this is the High Limit that the superheat setpoint can be incremented to.

EV LO Limit: (Evaporator Low Limit)

When running in auto superheat mode, this is the Low Limit that the superheat setpoint can be decremented to.

Suc SP: (Suction Setpoint)

For a Rack System, this would be set to the lowest suction pressure any of the evaporators would need to maintain temperature. For a non Rack system being controller by a XT panel, this would be the highest value of suction pressure that would be required for the temperature.

PID Mode:

There are three valid modes of operation, Comp Freq, VFD F Suc and Screw F Suc. The Comp Freq is used when you do not want the floating suction setpoint operation. Typical use

would be for a rack system running on a fixed suction setpoint or an application where a control panel is being used to supply a ma input or pulse input signal and the VFD compressor will adjust its speed to control temperature. The VFD F Suc (VFD Floating Suction) and the Screw F Suc (Screw Floating Suction) are used when you want a floating suction setpoint. See app note 019 for more information.