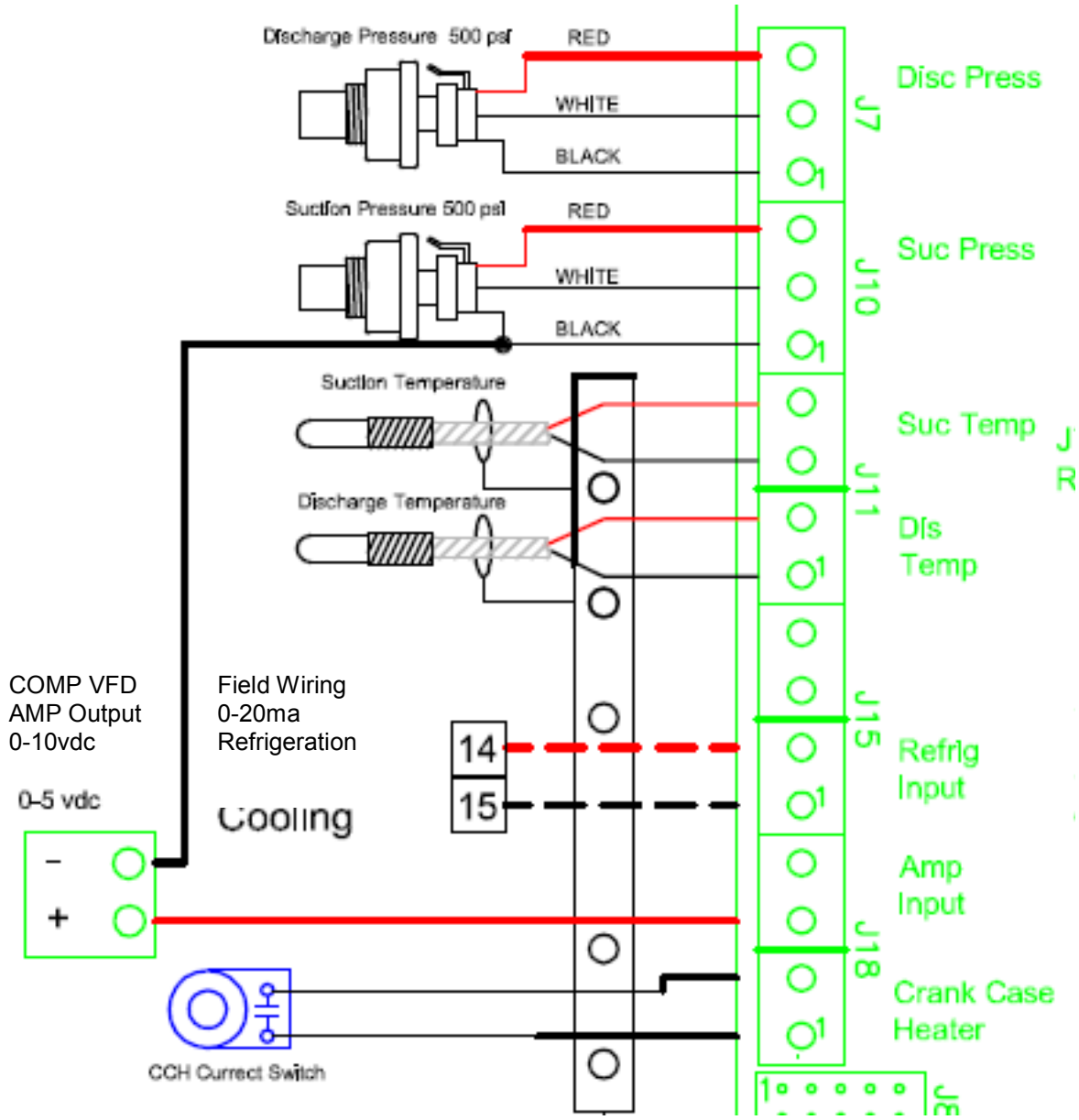
Lamb Two VFD Compressor with Heat Mode
APP– 044

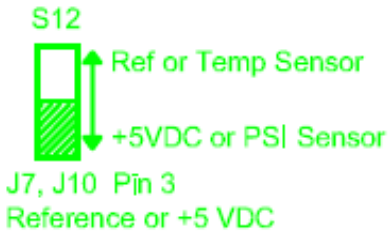
Application:

This application note will cover the refrigeration setup and installation for a Lamb Sweet Potato storage. It will use two compressors a 25hp and a 40hp. Both will run with VFD's and the 25 hp will have a reverse heat mode. The XT panel must have a panel config set to 4. A relay on the Heat output will switch the 0-20ma signal from refrig to heat.

Analog Inputs:



The discharge and suction pressure sensors must both be 500 psi for this application.

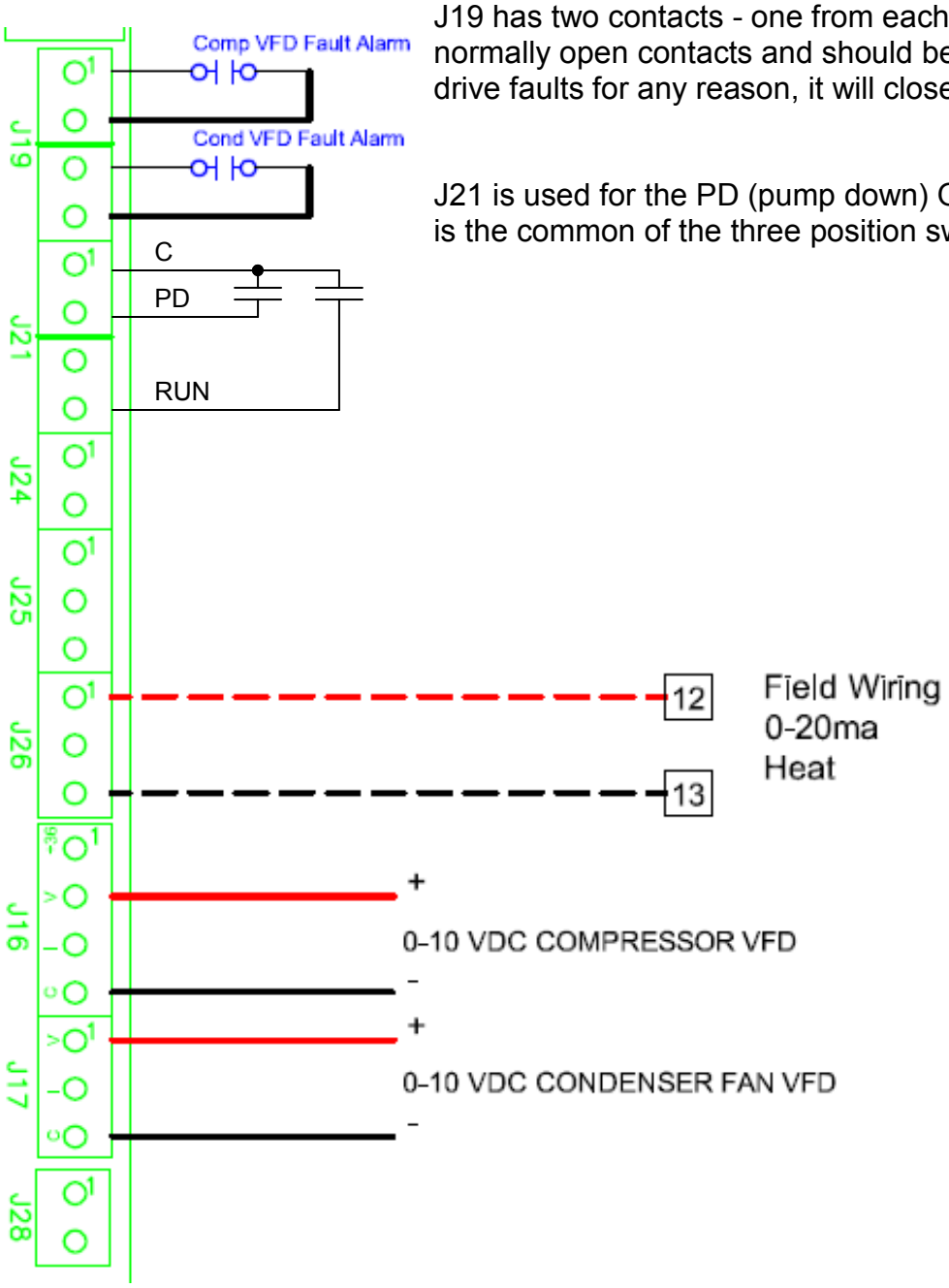


The switch must be in the down position to supply the 5vdc to the transducers.

The 0-20ma Refrig signal from the XT panel goes to pins 1&2 of the terminal J15. The Heat signal from the XT panel goes to pins 1&3 on J26.

J19 has two contacts - one from each drive. These are normally open contacts and should be set up so that if the drive faults for any reason, it will close the contract.

J21 is used for the PD (pump down) OFF, RUN switch. C is the common of the three position switch.



In the Refrigeration mode, the two compressor overlap and prevent short cycling of either compressor.
The smaller 25hp compressor will be used for both refrigeration and heat. The larger 40hp will be used for refrigeration only. In the heat mode, a reversing valve will switch the evaporator into the condenser and the condenser into the evaporator. In the heat mode, the condenser fans are used to control the suction pressure. The speed of the compressor is used to regulate the amount of heat being produced and the head pressure. There is a max and min on the head pressure and the heat signal from the XT will ramp the compressor between the max and min settings.

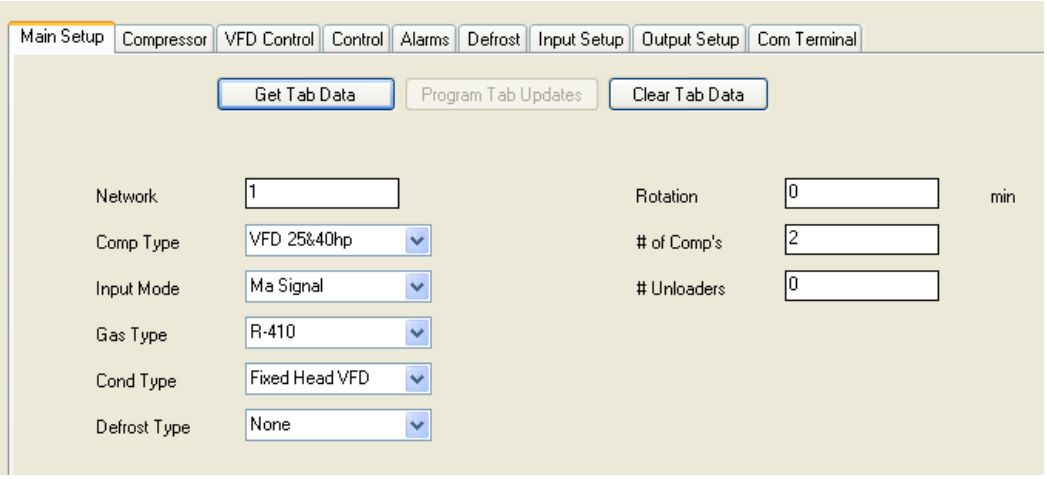
Rdemand %	HP	C1	C2	C1	C2
5	12.5	50			
6	13.1	52			
7	13.6	55			
8	14.2	57			
9	14.7	59			
10	15.3	61			
11	15.8	64			
12	16.4	66			
13	16.9	68			
14	17.5	70			
15	18.0	73			
16	18.6	75			
17	19.1	77			
18	19.7	80			
19	20.2	82	50		
20	20.8	84	51		
21	21.3	86	53		
22	21.9	89	54		
23	22.4	91	56		
24	23.0	93	57		
25	23.6	95	59		
26	24.1	98	60		
27	24.7	100	61		

This table shows the staging of the two compressors from 5 to 27%. Compressor C1 will start at 50% and then ramp up to 100 %. If the demand stays below 27%, C1 will ramp up and down to match the demand. If the demand goes above 27%, compressor C2 will start at 61% and C1 will shut off. C1 would stay off until the demand drops below 19%.

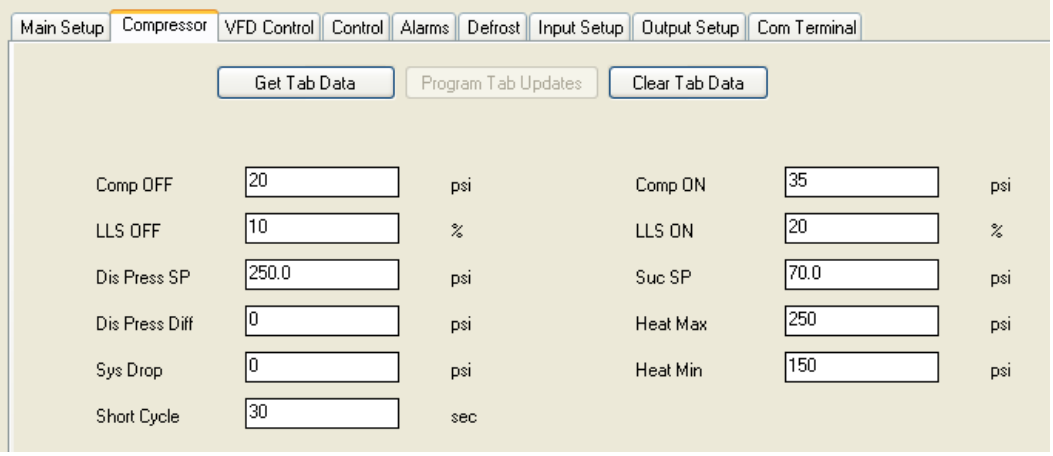
Rdemand %	HP	C1	C2	C1	C2
28	25.2		63		
29	25.8		64		
30	26.3		66		
31	26.9		67		
32	27.4		69		
33	28.0		70		
34	28.5		71		
35	29.1		73		
36	29.6		74		
37	30.2		76		
38	30.7		77		
39	31.3		79		
40	31.8		80		
41	32.4		81		
42	32.9		83	52	50
43	33.5		84	53	51
44	34.1		86	53	52
45	34.6		87	54	53
46	35.2		89	55	53
47	35.7		90	56	54
48	36.3		91	57	55
49	36.8		93	58	56
50	37.4		94	58	57
51	37.9		96	59	58
52	38.5		97	60	59
53	39.0		99	61	59
54	39.6		100	62	60
55	40.1			63	61
56	40.7			63	62
57	41.2			64	63
58	41.8			65	64
59	42.3			66	65
60	42.9			67	66
61	43.4			68	66
62	44.0			68	67
63	44.6			69	68
64	45.1			70	69
65	45.7			71	70
66	46.2			72	71
67	46.8			73	72
68	47.3			73	72
69	47.9			74	73
70	48.4			75	74
71	49.0			76	75
72	49.5			77	76
73	50.1			78	77
74	50.6			78	78
75	51.2			79	78

Compressor C2 will operate by itself up to 54% demand. As long as the demand stays below 54%, C2 will ramp up and down. Once the demand goes above 54% C1 would turn on at 62% and C2 would ramp down to 60%. Once both compressor are on, they will both ramp up and down between 100% and 42 %. Once the demand drops below 42%, C1 would shut down and C2 would take over at 83%.

Rdemand %	HP	C1	C2	C1	C2
76	51.7			80	79
77	52.3			81	80
78	52.8			82	81
79	53.4			83	82
80	53.9			83	83
81	54.5			84	84
82	55.1			85	84
83	55.6			86	85
84	56.2			87	86
85	56.7			88	87
86	57.3			88	88
87	57.8			89	89
88	58.4			90	90
89	58.9			91	91
90	59.5			92	91
91	60.0			93	92
92	60.6			93	93
93	61.1			94	94
94	61.7			95	95
95	62.2			96	96
96	62.8			97	97
97	63.3			98	97
98	63.9			98	98
99	64.4			99	99
100	65.0			100	100



The compressor type is VFD 25&40hp. Later, additional profiles will be programmed for compressors of different horsepower. If a VFD is used on the condenser fans, the type should be Fixed Head VFD.



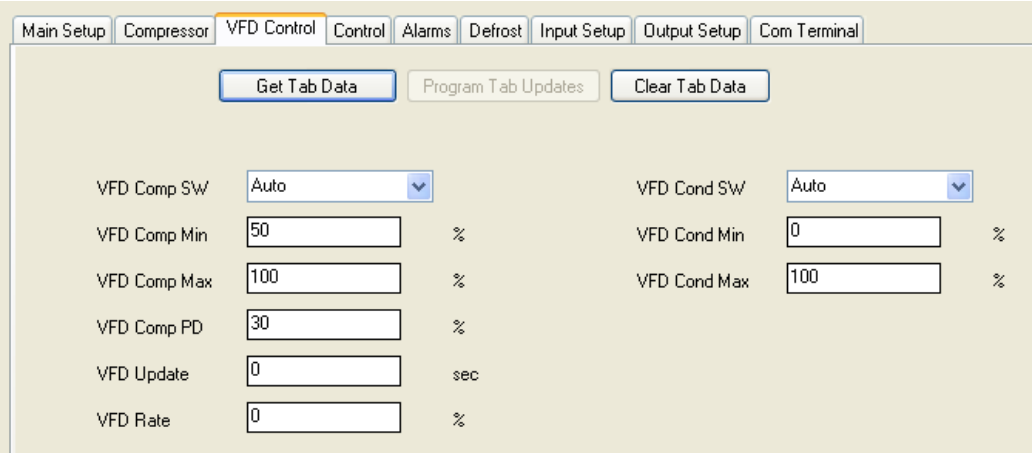
The Comp OFF and Comp ON are the pressure values for starting and stopping the compressor. There is no pump down mode in the CRX controller. The mode will stay Refrig until the pressure drops below the Comp OFF setting. The Dis Press SP is the setpoint for the discharge pressure the VFD will control to. With a VFD the Dis Press Diff and Sys Drop settings are not used.

The Suc SP is used in the Heat mode. This setpoint is used to control the suction pressure using the condenser fans. In the Heat mode, the condenser is now the evaporator. Increasing the fan speed will cause the suction pressure to increase. Decreasing the fan speed will cause the suction pressure to decrease.

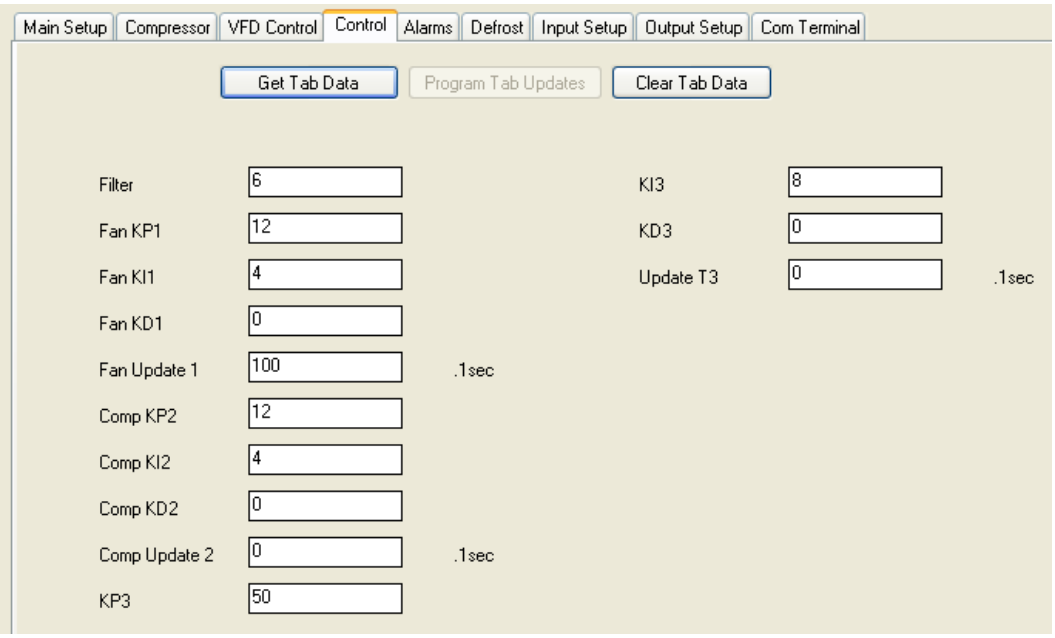
Heat Max and Heat Min are used in the Heat mode. The Heat 0-20ma signal from the XT panel will cause a floating Discharge Setpoint to move between the Heat Min and Heat Max settings. The compressor VFD will run the compressor from 50% to 100% to vary the heat. Increasing the speed of the compressor will produce more heat and decreasing the speed will decrease the heat.

The LLS OFF and LLS ON are used in both the Cooling and Heat modes. In the Refrigeration mode, the setting will control when the liquid line solenoid will open and close. In the Heat mode, the reversing valve will operate on these setting using the Heat demand signal. In the Heat mode the liquid line solenoid remains off.

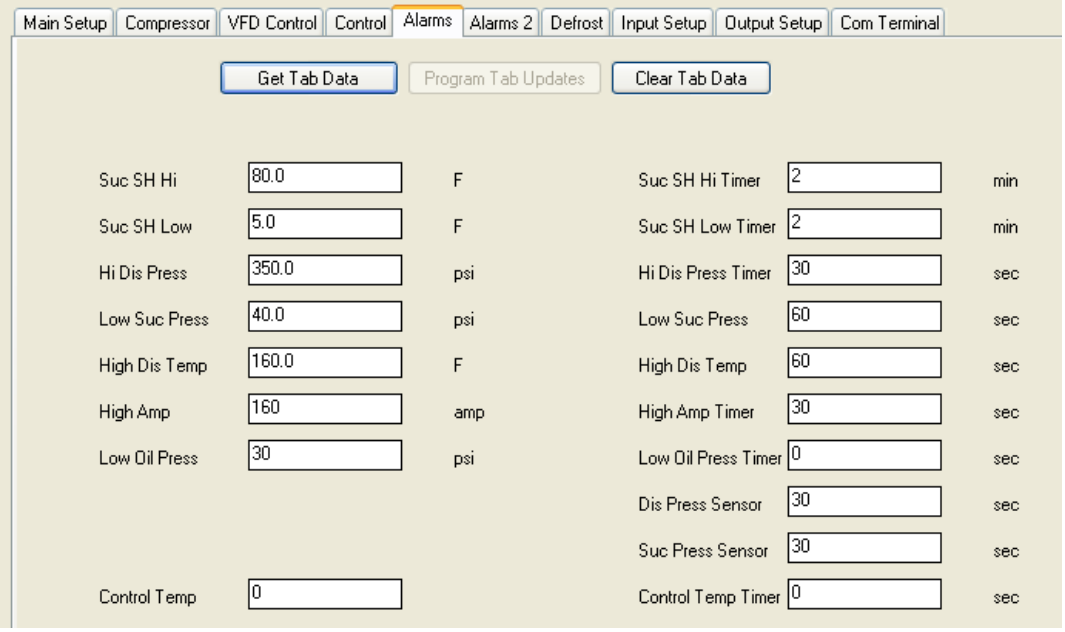
The Suc SP, Heat Max and Heat Min should be set according to the compressor manufactures specifications.



The VFD Comp SW and the VFD Cond SW should both be in Auto. Each has a Min and a Max setting. The VFD Cond Min should be set at 0. The VFD Comp PD is the speed at which the compressor will run when the suction pressure is above the Comp Off setting and the LLS is off. The VFD update and VFD Rate are not used in this application.



The PID loop for the Fan and Comp are primarily used in the Heat cycle. The PID loop setting are the same as the XT as far as action. PID loop three is not used at this time.



Suc SH Hi: suction superheat high - high alarm point for suction superheat. If the suction superheat exceeds this value for the Suc SH Hi Timer, the system will shutdown and alarm. The alarm can be disabled by setting the timer to zero. A neg number in the timer will make it a soft alarm.

Suc SH Lo: suction superheat low - low alarm point for suction superheat. If the suction superheat exceeds this value for the Suc SH Low Timer, the system will shutdown and alarm. The alarm can be disabled by setting the timer to zero. A neg number in the timer will make it a soft alarm.

Hi Dis Press: high discharge pressure - high discharge pressure alarm point. If the discharge pressure exceeds this value for the Hi Dis Press Timer, the system will shutdown and alarm. The alarm can be disabled by setting the timer to zero. A neg number in the timer will make it a soft alarm.

Low Suc Press: low suction pressure - low suction pressure alarm point. If the suction pressure is less than this value for the Low Suc Press timer, the system will shutdown and alarm. The alarm can be disabled by setting the timer to zero. A neg number in the timer will make it a soft alarm.

High Dis Temp: high discharge temperature - high discharge temperature alarm point. If the discharge temperature exceeds this value for the High Dis Temp timer, the system will shutdown and alarm. The alarm can be disabled by setting the timer to zero. A neg number in the timer will make it a soft alarm.

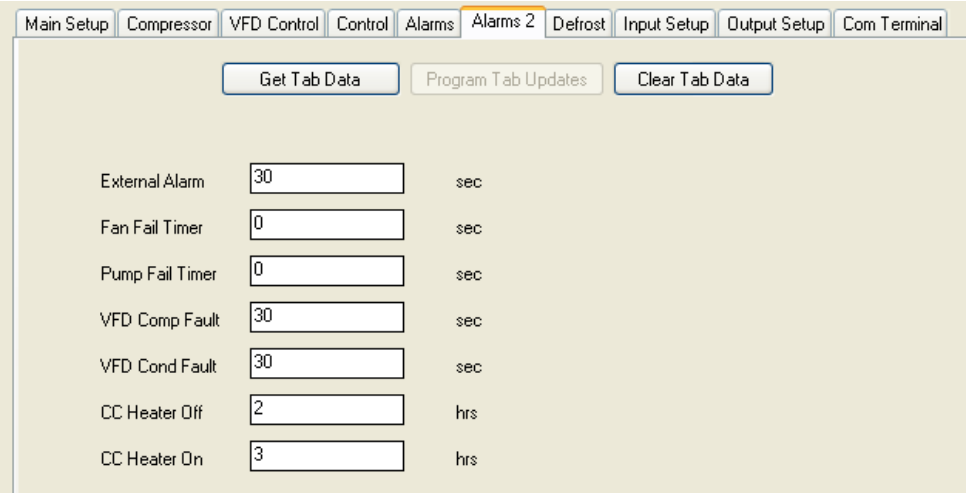
High Amp: high alarm point for compressor amps. If the compressor amp reading exceeds this value for the High Amp Timer, the system will shutdown and alarm. The alarm can be disabled by setting the timer to zero. A neg number in the timer will make it a soft alarm.

Low Oil Pressure - this parameter applies only to screw compressors. Set the Low Oil Press Timer to zero to disable.

Dis Press Sensor: this is the timer for a discharge pressure sensor failure. If the sensor goes out of limit for this amount of time, the system will shutdown and alarm. The alarm can be disabled by setting the timer to zero. A neg number in the timer will make it a soft alarm.

Suc Press Sensor: this is the timer for a suction pressure sensor failure. If the sensor goes out of limit for this amount of time, the system will shutdown and alarm. The alarm can be disabled by setting the timer to zero. A neg number in the timer will make it a soft alarm.

Control Temp: this alarm is not used and the timer should be set to zero.



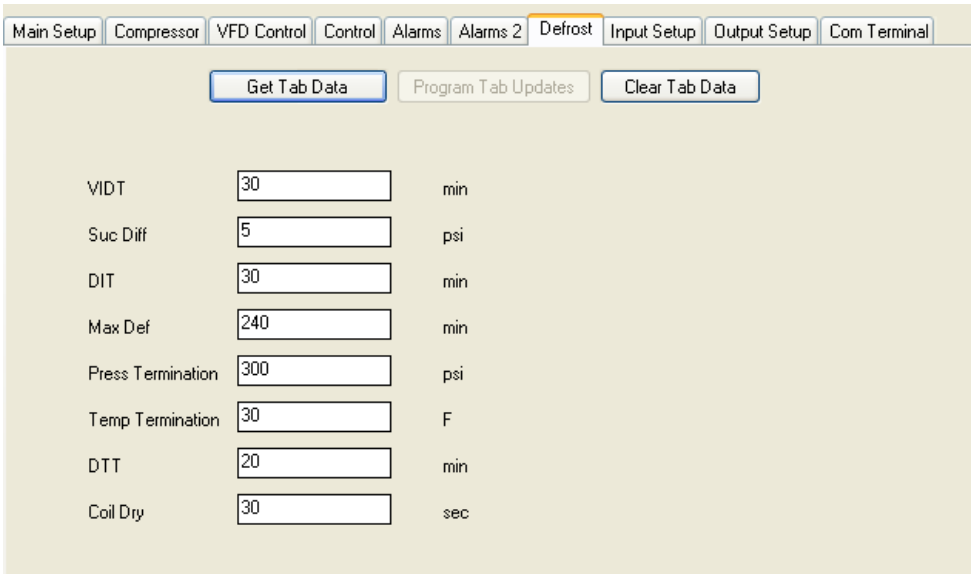
External Alarm: this is a series of contacts consisting of high pressure switch, oil switch and phase monitor. This alarm is normally proved and drops out during an alarm. The time in seconds is the delay until the alarm is tripped and shuts the system down. This alarm is only active when the compressor is running. The alarm can be disabled by setting the timer to zero. This is a self resetting alarm.

Fan Fail Timer: this alarm is not used in this application and should be set to zero.

Pump Fail Timer: this alarm is not used in this application and should be set to zero.

VFD Comp Fault: variable frequency drive compressor fault - if the compressor VFD faults a contact will close and after the elapsed time the system will shutdown. The alarm can be disabled by setting the timer to zero. A neg number in the timer will make it a soft alarm. This is a self resetting alarm.

VFD Cond Fault: variable frequency drive condenser fault - this alarm is trigger when the VFD on the Condenser fans faults. If the fault continues for the duration of the VFD cond Fault timer it will shut the system down. This is a self resetting alarm. The alarm can be disabled by setting the timer to zero. A neg number in the timer will make it a soft alarm.



VIDT: variable initiated defrost timer - this time establishes the amount of time the suction pressure is trended. This is much like a average.

Suc diff: suction differential - as ice forms on the coils, the suction pressure will gradually drop. The suction differential is the amount of drop to initiate a defrost cycle.

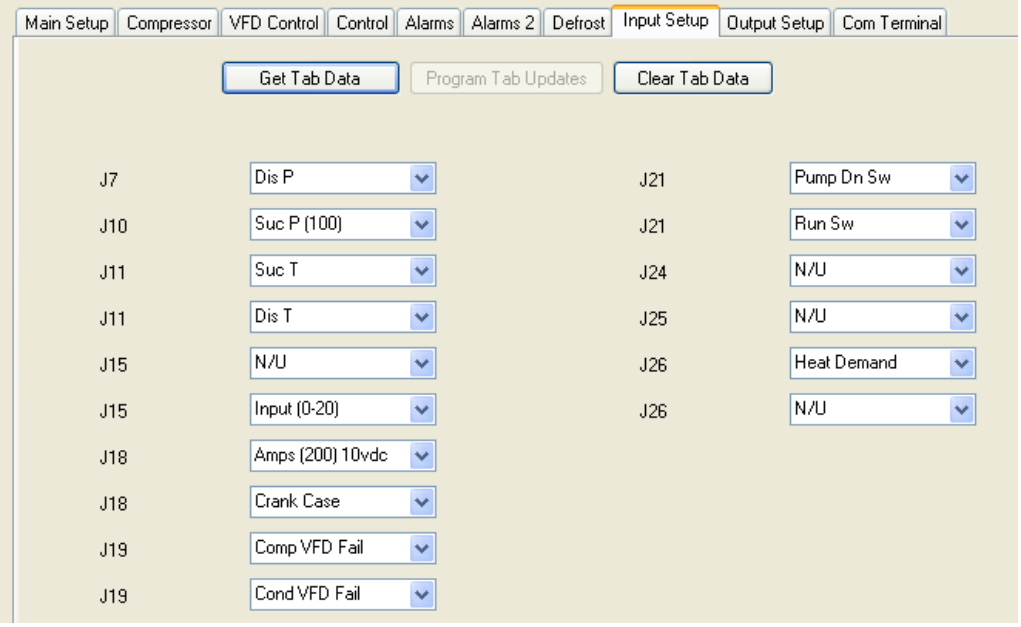
DIT: defrost initiate timer - once the suction pressure drops below the suction differential the timer must time out to initiate a defrost.

Max Def: maximum defrost - this timer will override the VIDT and will initiate a defrost cycle.

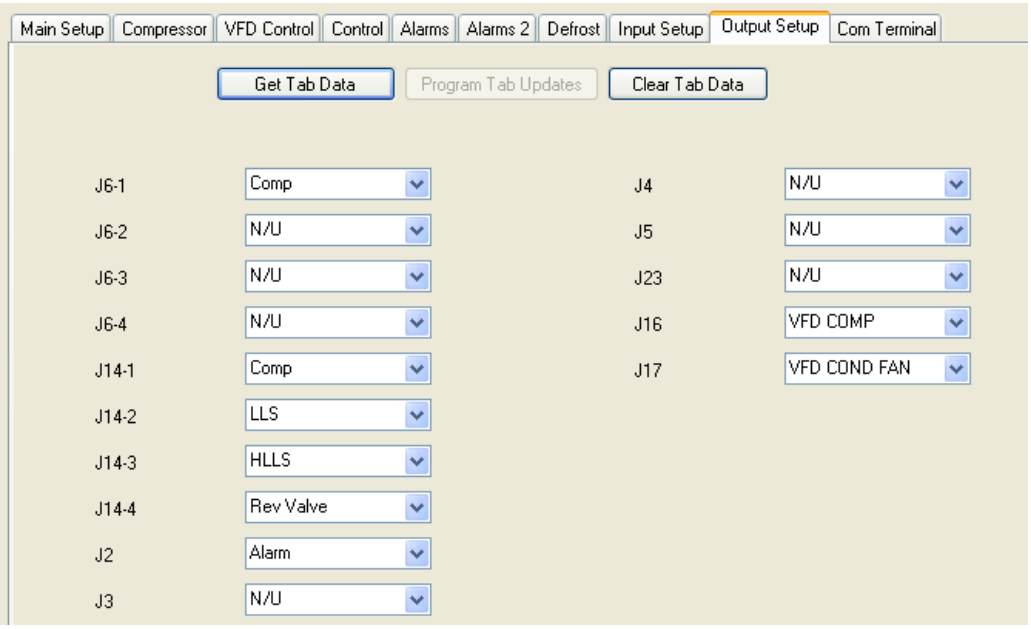
Press Termination: pressure termination - this is used with a hot gas defrost cycle. If in a hot gas defrost cycle and the discharge pressure exceeds this parameter the defrost cycle will be terminated.

Temp Termination: temperature termination - when the coil surface exceeds this parameter the defrost cycle will be terminated.

Coil Dry: after the defrost cycle is terminated the refrigeration cycle will be ran for this amount time without the evaporator fans. This will freeze any free condensate to the coil surface.



Each of the inputs can be select for the desired parameters. This is the suggested list. Note that the upper input on J26 is the 0-20ma heat signal from the XT panel. J19 is the fault signal from each of the drives.



Note - J6-1 and J14-1 are both selected as Compressor. J14-1 is the actual compressor start contact. J6-1 is wired to start the VFD for the condenser fans. Since we only want the condenser fans to run when the compressor is running, J6-1 is selected as Compressor. If Cond Fan 1 was selected, then the contact would open and close with the Discharge setpoint and differential.