ENGINEERING
TOMORROW

User Guide

Testing and startup guide
Type **AK-PC 782B**



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This guide is intended to assist factory quality control departments and site startup technicians.

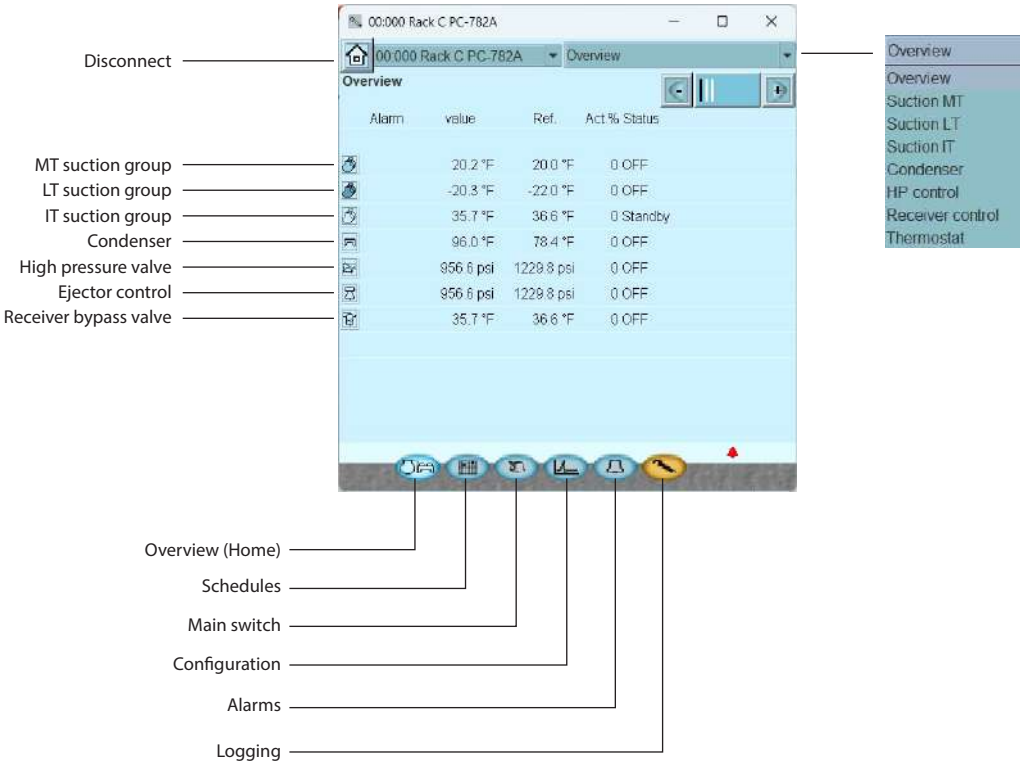
It contains the pre-checks that danfoss personnel would typically conduct on site prior to the refrigeration system being charged and started.

This is only a guide and is not intended to replace original equipment manufacturer recommendations

If further assistance is needed please contact Danfoss technical support at 888-danfoss.

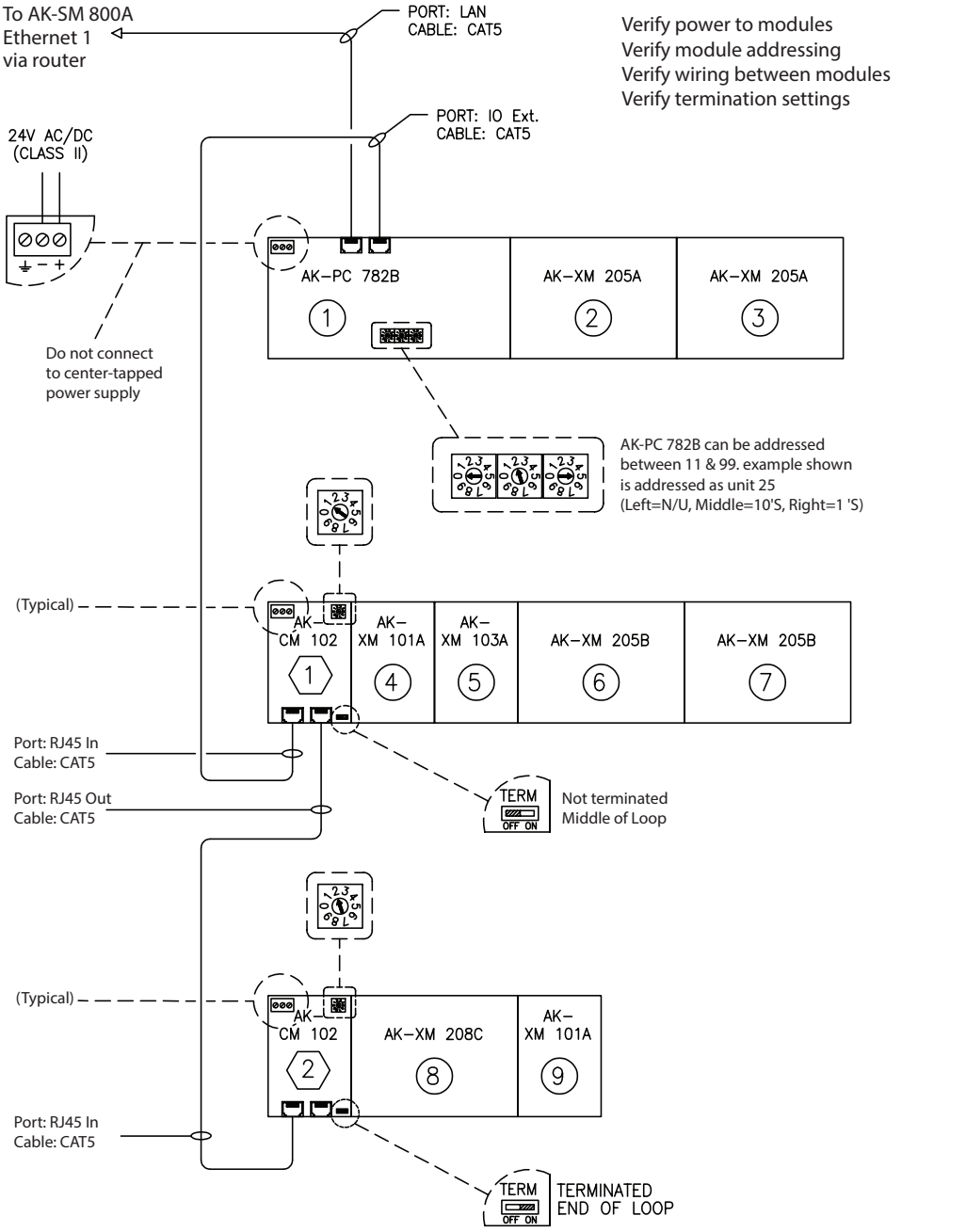
1. AK-PC 782B ST500 overview layout

Alarm = Red alarm bell when alarm is present
Value = Controlling sensor actual value
Ref. = Target set point
Act.% = Percent active capaclly or valve open %
Status = Condition of control sequence



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2. AK-PC 782B wiring & addressing overview

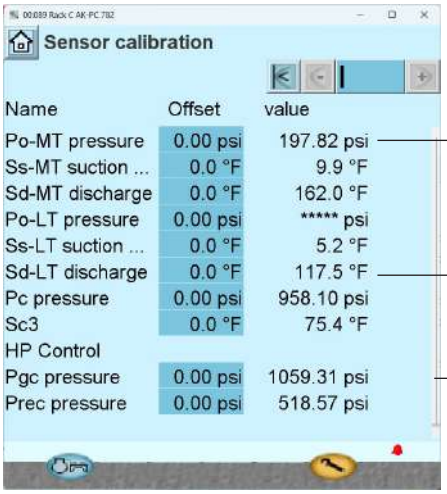


(1) Represents board number assigned in pack controller using ST500

(1) Represents communications module address to identify order of CM102's In the I/O extension loop. Has no relation to AK-PC 782B dial addresses.

3. AK-PC 782B analog input verification

Open ST500, press , then select "sensor calibration"



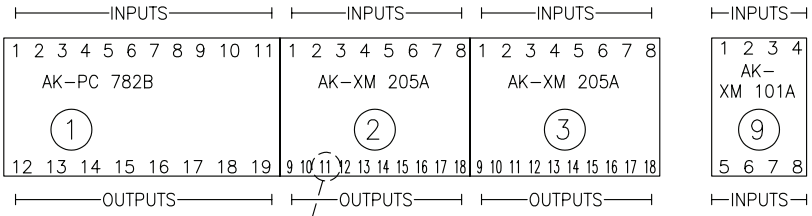
Verify transducer assignments by unplugging its connector at the transducer. The psi reading will change to "****" once unplugged.

Verify sensor assignments by spraying the physical probe with cold shot to see its temperature decrease

Be sure to scroll down the page to verify all transducers & sensors.

If there are issues with readings, first verify MOD/PT assignments.

AK-PC 782B point numbering layout.
The AK-PC 782B, as well as all modules connected to the pack controller, follow point numbering from top-left to bottom-right as shown below.

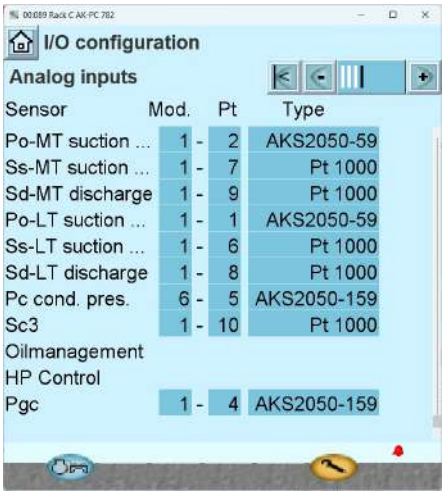


Example, a compressor contactor coil wired. To the third output point on module #2
would be defined as module #2, point 11.

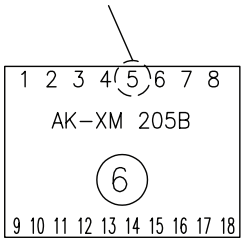
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4. AK-PC 782B analog input configuration

Open ST500, press , then select "I/O configuration"

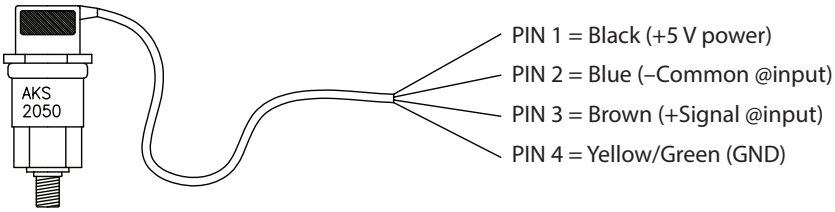


Example: "Pc cond. pres." assigned module #6, point #5 using the layout from page 2.
We should find the transducer landed at this location on the middle row of modules



If MOD/PT assignments are accurate, verify sensor wiring

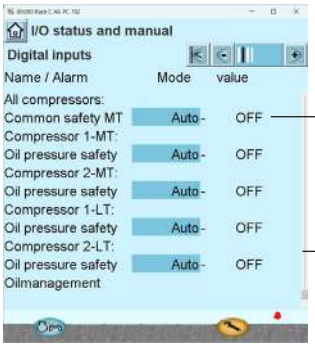
Transducers should be AKS2050-59 or AKS2050-159 only



Danfoss temperature sensors are not polarity sensitive
one wire to input (–), the other wire to input (+)

5. AK-PC 782B digital input verification

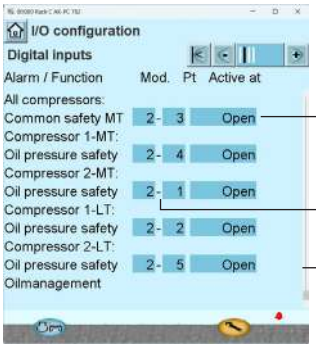
Open ST500, press , then select "I/O status and manual". Press the "+" icon to move to "Digital Inputs" page.



The status of each digital input is shown in the value column. Toggle each input to verify its operation.

Be sure to scroll down the page to verify all digital inputs

If issues are present, verify MOD/PT assignments and "Active at" selection.



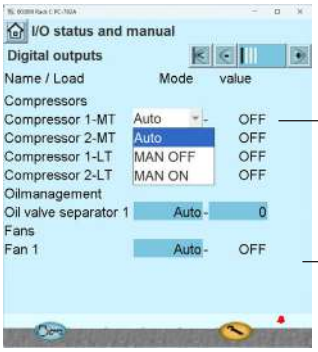
If "Active at" is set to open, it means the compressor safety is active with the input
In the open position. Compressor safeties are commonly setup to be active at closed (refer to manufacturer's drawings)

Verify MOD/PT assignments in the same fashion as described on pages 3 & 4.

Be sure to scroll down the page to verify all "Active at" selections.

6. AK-PC 782B digital output verification

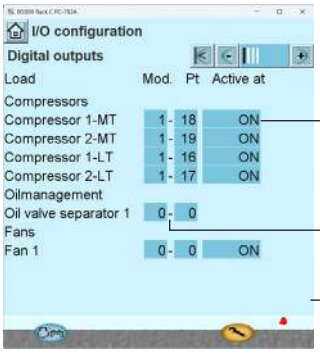
Open ST500, press , then select "I/O status and manual"



The status of each digital output is shown in the value column. Toggle each output to Verify its operation.

Be sure to scroll down the page to verify all digital outputs.

If issues are present, verify MOD/PT assignments and "Active at" selection



If "Active at" is set to ON, it means the relay is wired normally closed. The AK-PC782B will energize the relay to activate the compressor. If the device is wired normally open, select off.

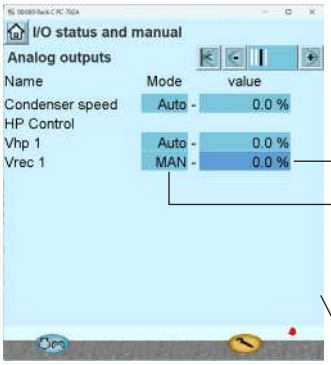
Verify MOD/PT assignments in the same fashion as described on pages 3 & 4.

Be sure to scroll down the page to verify all "Active at" selections.

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7. AK-PC 782B output input verification

Open ST500, press , then select "I/O status and manual". Press the "+" icon to move to "analog outputs" page

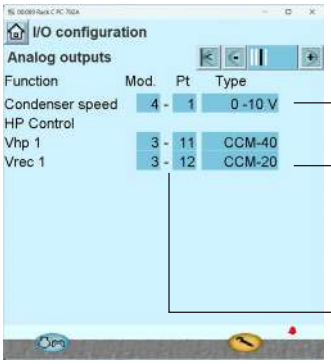


The status of each analog output is shown in the value column.

Toggle mode from Auto to MAN and set a manual valve percentage to verify operation.
Note: change mode back to auto for normal operation (Manual overrides stay forever).

Be sure to scroll down the page to verify all "Active at" selections.

If issues are present, verify MOD/PT assignments and "Type" selection.



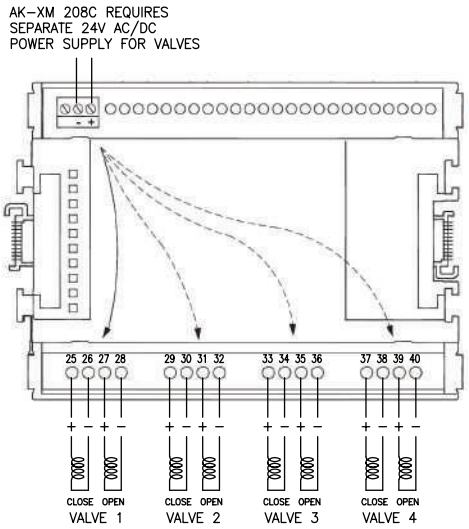
Analog voltage outputs can be defined as either
0 – 5 V
1 – 5 V
0 – 10 V
10 – 0 V
5 – 0 V

Select valve model listed on the valve name plate

Verify MOD/PT assignments in the same fashion as described on pages 3 & 4.

8. AK-PC 782B stepper valve wiring

Valves with integrated actuators example: CCM-40



		TERMINAL ON XM 208C			
VALVE #	1	25	26	27	28
	2	29	30	31	32
	3	33	34	35	36
	4	37	38	39	40
ETS		WHITE	BLACK	RED	GREEN
CCM/CCMT					
CTR					
KVS 15					
KVS 42–54					

Valves with external ICAD actuators example: ICMTS-20



7–WIRE CABLE (BLACK)	A	BLACK	COMMON ALARM
	B	BROWN	ICM FULLY OPEN
	C	RED	ICM FULLY CLOSED
	D	ORANGE	GROUND
	E	YELLOW	0/4–20mA INPUT
	F	GREEN	0/2–10V INPUT
	G	BLUE	0/4–20mA OUTPUT
3–WIRE CABLE (RED)	I	BLACK	BATTERY (19VDC)
	II	WHITE	24VDC (+) SUPPLY
	III	BROWN	24VDC (–) SUPPLY

"GND" TERMINAL ON ANALOG OUTPUT POINT

"SIG" TERMINAL ON ANALOG OUTPUT POINT

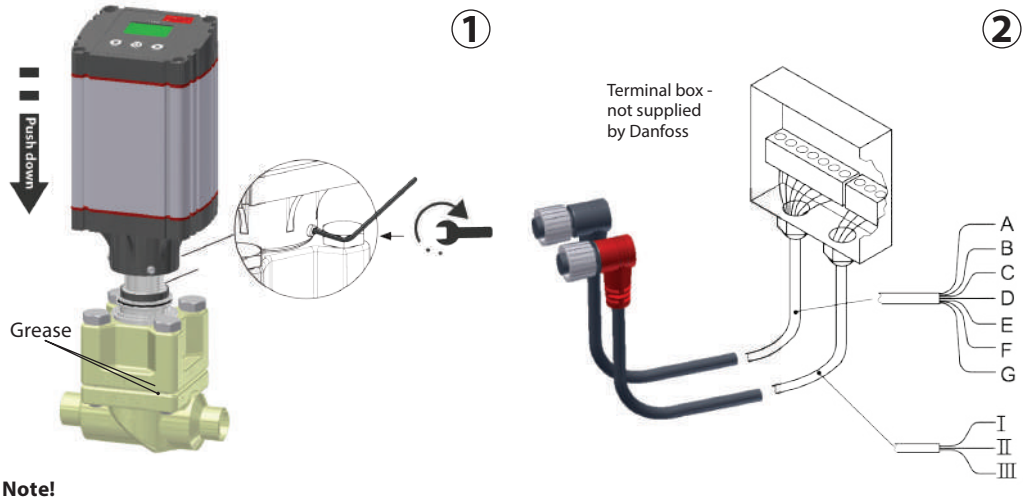
250 OHM RESISTOR

POWER SUPPLY (+)

POWER SUPPLY (–)

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9. ICAD 600A/1200A quick start



Note!
Cross tighten all 3 screws to ensure equal tightening.
Max 3 Nm torque.



24 Volt DC ONLY

Please observe cable voltage drop
Distance between the applied DC transformer and the ICAD terminal box may cause
a voltage drop. Cross section of cables and size of DC transformer must be calculated so that the voltage at all time at the ICAD terminal box*, both during standstill and during operation of ICAD, is within this range:

Ref.	Colour		Description
A	Black	–	Common Alarm
B	Brown	–	ICM fully open
C	Red	–	ICM fully closed
D	Orange	–	GND ground
E	Yellow	+	0/4 – 20 mA Input
F	Green	+	0/2 – 10 V input or digital input for on/off control
G	Blue	+	0/4 – 20 mA Output

I	Black	+	Fail safe supply Battery / UPS* 19 V DC
II	White	+	Supply voltage 24 V DC
III	Brown	–	

* Uninterruptable Power Supply

Prefabricated ICAD cable length Code number		1.5 m 027H0426	3 m 027H0438	10 m 027H0427	15 m 027H0435
Voltage ICAD terminal (600A/1200A) [V DC]	Min.	21	22	23	24
	Max.	26.4			

* Do not measure inside the ICAD itself

Programming the ICAD

Note:
If the keypad is not operated within 20 seconds; time out will automatically exit programming mode.

Decrease value | Edit / Enter | Increase value

Valve size setup (mandatory)

When powering up the ICAD, A1 will flash in the display

④



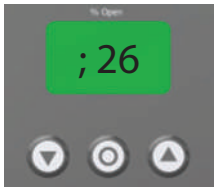
Hold down for 2 seconds to enter programming mode



Press and go to parameter 10.
Press



Press until you reach 11 (password).
Press

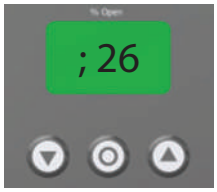


Press until you reach parameter 26
Press



Press or to select ICM size or CVE.
Press

1: ICM 20 with ICAD 600A
2: ICM 25 with ICAD 600A
3: ICM 32 with ICAD 600A
4: ICM 40 with ICAD 1200A
5: ICM 50 with ICAD 1200A
6: ICM 65 with ICAD 1200A
7: ICM 100 with ICAD 1200A
8: ICM 125 with ICAD 1200A
9: ICM 150 with ICAD 1200A
10: CVE pilot with ICAD 1200A



ICM/CVE & ICAD is now calibrating



Hold down for 2 seconds to exit programming mode

Valve label ID:

ICM 20	ICM 25-65	ICM 100-150
		

NOTE!
If media temperature is lower than -30 °C (-22 °F) it is mandatory to set parameter i30 an i31.
See separate document attached in ICAD box: document number **AN285243155312**

Changing analogue input signal (optional)

⑤



Hold down for 2 seconds to enter programming mode



Press until you reach parameter 03.
Press



Press or to select analogue input signal

1: 0 – 20 mA
2: 4 – 20 mA*
3: 0 – 10 V
4: 2 – 10 V

* default factory setting



Press



Hold down for 2 seconds to exit programming mode



If A3 alarm occurs the analogue input signal is out of range

24 Volt DC ONLY

For further functions, programming possibilities and factory settings; please see ICAD instruction.

Factory reset of ICAD

Disconnect power ❶

Press down and ❷ simultaneously while reconnecting power ❶
Release and ❷

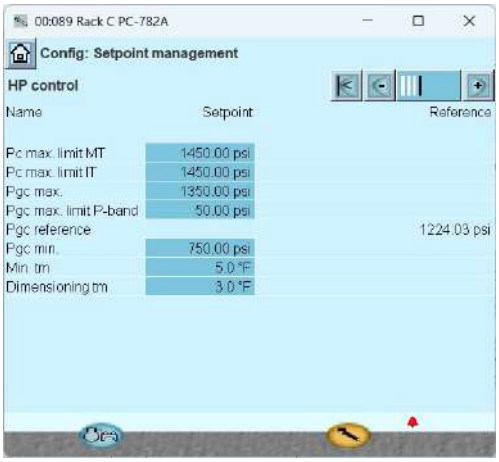
Note:
If factory reset has been performed the ICAD will start flashing A1 in the display.



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10. AK-PC 782B high pressure valve settings

Open ST500, press , then select "Setpoint management". Press the "+" icon to move to "HP control" page.



Pc max. limit MT = maximum allowable gas cooler psi. If pressure reaches pc max. limit MT minus Pgc max. limit P-band, fans ramp to 100% and entire compressor capacity cuts off.

Example: 1450 psi - 50 psi = 1400 psi. If GC psi reaches 1400 psi, fans go to 100% and compressors are staged down until GC psi gets below pgc max. setting of 1350 psi.

Pc max. Limit IT = same functionality as Pc max. limit MT

Pgc max. = maximum allowable gas cooler psi. Fan speed is used to maintain this setting. If fans alone do not reduce psi, the above setting is reached and compressors cut off

Pgc max. limit P-band = this value is subtracted from Pc max. limit setting to allow compressors to de-activiate prior to reaching Pc max. limit setting

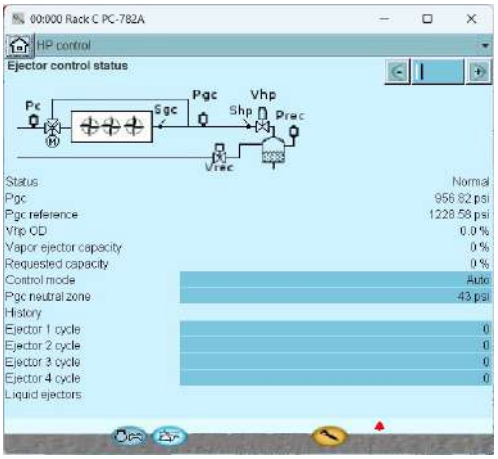
Pgc min. = Minimum allowable gas cooler psi. (Low ambient setting)

Min. Tm = condenser fan speed setting for differential between Sc3 air probe and Sgc gas cooler outlet probe. (This is the temperature delta setting for floating).

Dimensioning TM = similar to min. Tm setting. When all compressors are active the pack uses this setting in lieu of min. TM.

11. AK-PC 782B high ejector control settings

Open ST500, press , then select "Setpoint management". Press the "+" icon to move to "HP control" page.



Control mode = auto means the pack controller is staging the ejectors. Man is mainly used for testing purposes and allows the user to define a percentage from 0 – 100 (remember to change this setting back to auto! The man settings remain forever).

Pgc neutral zone = this setting straddles Pgc max. Setting to determine when to activate and de-activate ejector stages. This prevents excessive cycling of ejector solenoids.

Example: Pgc max. = 1350 psi, Pgc neutral zone = 43 psi, ejectors staging will increase at 1371 psi and descrease at 1329 psi

Ejector 1 cycle = total number of time that ejector 1 has been activated since the last time the pack controller was power cycled.

Cycle rate: an ejector valve should not disconnect more than once/minute over.
An average of 24 hours. The setting Pgc neutral zone described above can be used to slow down ejector cycling. Increasing Pgc neutral zone reduces number of cycles

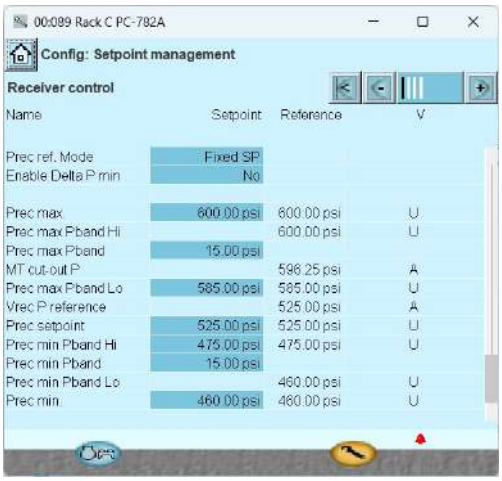
Wiring note: ejectors solenoids wire to solid state relay outputs.

General operation: ejectors operate in a similar fashion as condenser fans. As the gas cooler psi increases, additional ejectors will activate. When the gas cooler psi decreases, ejectors will de-activate. The pack controller will stage ejectors in random order when needed to keep the cycle counts relatively close to each other.

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12. AK-PC 782B receiver bypass valve settings

Open ST500, press , then select "Setpoint management". Press the "+" icon to move to "receiver control" page



Prec ref. Mode = leave this as fixed SP

Enable Delta P min = leave this as No

Prec max. = maximum allowable receiver pressure. Also Prec max Pband Hi setting

Prec max Pband = this value is subtracted from Prec max. Setting to arrive at Prec max Pband Lo setting. once value is reached valve to drive to 100% open

Prec max Pband Lo = safety value if reached will cause valve to open 100%

Prec setpoint = this setting defines the target receiver pressure

Prec min Pband Hi = this value equals Prec min. Setting plus Prec min Pband. Once this value is reached the valve will drive to the 100% closed position

Prec min Pband = this value is added to Prec min. To close the receiver valve Prior to reaching Prec min. setting

Prec min. = going below this value will generate a low receiver pressure alarm

13. AK-PC 782B low temp suction group settings

Open ST500, press , then select "Setpoint management". Press the "+" icon to move to "LT control" page



Neutral zone band = this setting straddles to setpoint setting to determine when to activate and de-active compressor stages. Inverter is used to stay within neutral zone.

Example: to setpoint = -13.0 °F, neutral zone band = 5.0 °F, compressor staging will increase at 15.5 °F and decrease at 10.5 °F

Night offset = a digital input can be used to increase to setpoint during non-trading hours to reduce system energy usage

To setpoint = this setting defines the target suction temperature

To max. alarm = going above this setting will generate a high temperature alarm

Max. reference = maximum value of the pressure transducer

Min. reference = minimum value of the pressure transducer

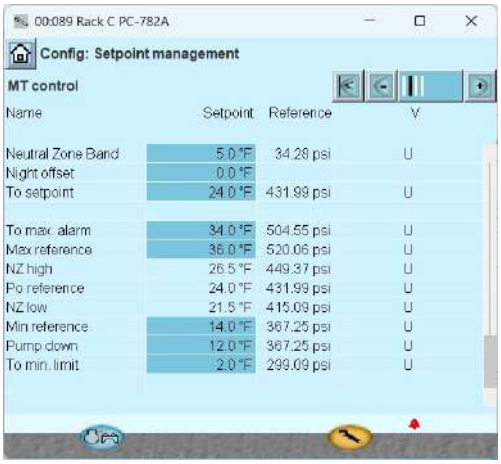
Pump down = if this value is reached the compressors will be cut off

To min. Limit = if this setting is reached all compressor activity is lock off. This differs from pump down setting in that to min. Limit also disables the receiver valve

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14. AK-PC 782B medium temp suction group settings

Open ST500, press , then select "Setpoint management". Press the "+" icon to move to "MT control" page.



Neutral zone band = this setting straddles to setpoint setting to determine when to activate and de-active compressor stages. Inverter is used to stay within neutral zone.

Example: to setpoint = -13.0 °F, neutral zone band = 5.0 °F, compressor staging will increase at 15.5 °F and decrease at 10.5 °F

Night offset = a digital input can be used to increase to setpoint during non-trading hours to reduce system energy usage

To setpoint = this setting defines the target suction temperature

To max. Alarm = going above this setting will generate a high temperature alarm

Max reference = maximum value of the pressure transducer

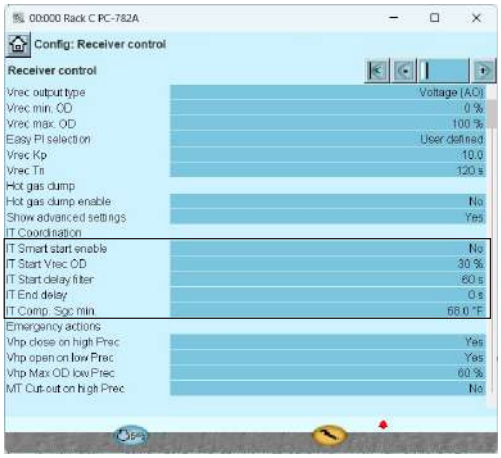
Min reference = minimum value of the pressure transducer

Pump down = if this value is reached the compressors will be cut off

To min. Limit = if this setting is reached all compressor activity is lock off. This differs from pump down setting in that to min. Limit also disables the receiver valve.

15. AK-PC 782B IT (parallel compression) suction group settings

Open ST500, press , then select "Setpoint management". Press the "+" icon to move to "MT control" page.



Operation note: initial settings for when the it suction group is activated are located In the receiver control section of ST500. It is here that you define at what Vrec % the IT suction group is activated.

IT smart start enable = the pack control can automatically calculate ideal IT start Vrec OD if this option is set to Yes. Otherwise the user defines IT start Vrec OD.

IT start Vrec OD = this is the % that Vrec has to be open before the receiver gas load is shifted to the IT compressor group.

IT start delay filter = once Vrec reaches it start vrec od, the number of seconds defined must expire before the IT suction group activates. Basically an ON delay for IT group.

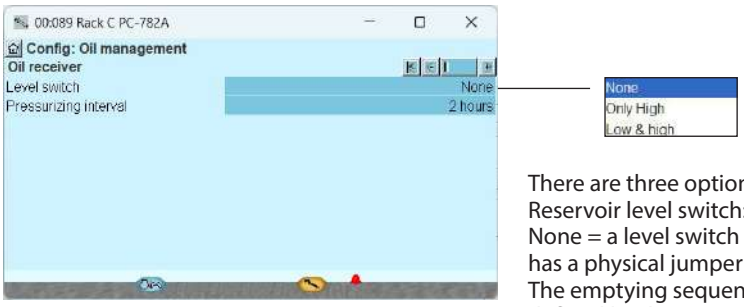
IT end delay = OFF delay for IT group before switching control back to Vrec

IT Comp. Sgc min. = the gas cooler outlet temp must be above this value for the IT suction group to activate. This ensures enough load to the group to keep it running.

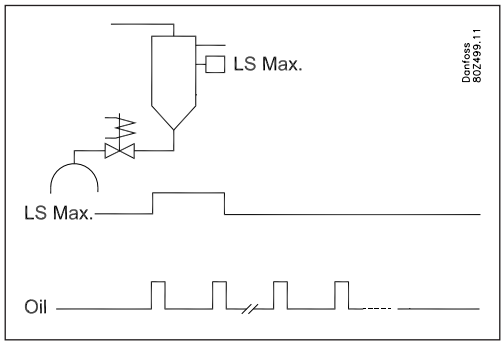
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16. AK-PC 782B oil reservoir setup

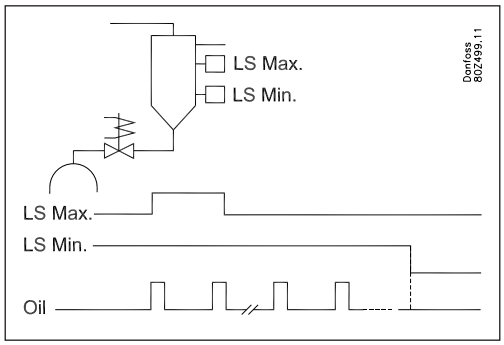
Open ST500, press , then select "Oil management"



There are three options for the oil Reservoir level switch:
None = a level switch is defined and the input has a physical jumper that remains in place. The emptying sequence repeats indefinitely as defined by the settings shown on the next page.

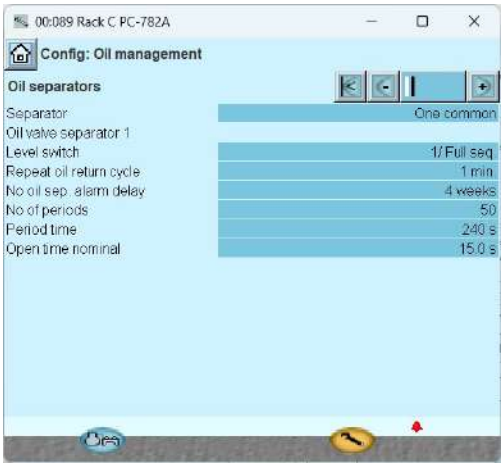


Only high = the level switch indicates the Reservoir is full and starts the emptying sequence. Once the level drops below the switch the sequence stops until the high level switch is activated again.



Low & High = the emptying sequence starts when the high level switch activates and continues until the low level switch is activated

Open ST500, press , then select "Oil management". Press the "+" icon to move to next page



Separator = select the number of oil reservoirs

Level switch = 1 /Full seq. is used for both none and only High. Low & high is selected on systems with both a high and low level switch on the oil reservoir.

Repeat oil return cycle = time between emptying sequences

No oil sep. alarm delay = alarm delay if high-level never activates

No of periods = times oil pulse valve should open during emptying sequence

Period time = time between valve openings

Open time nominal = time valve is open during the period

Example: based on the settings above, when the emptying sequence starts it will pulse the oil reservoir dump valve for 15 seconds every four minutes.

Danfoss A/S
Climate Solutions • danfoss.com • +45 7488 2222

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