SENSORI™ CONTROL MANUAL - OLPP

VERSION 1.0

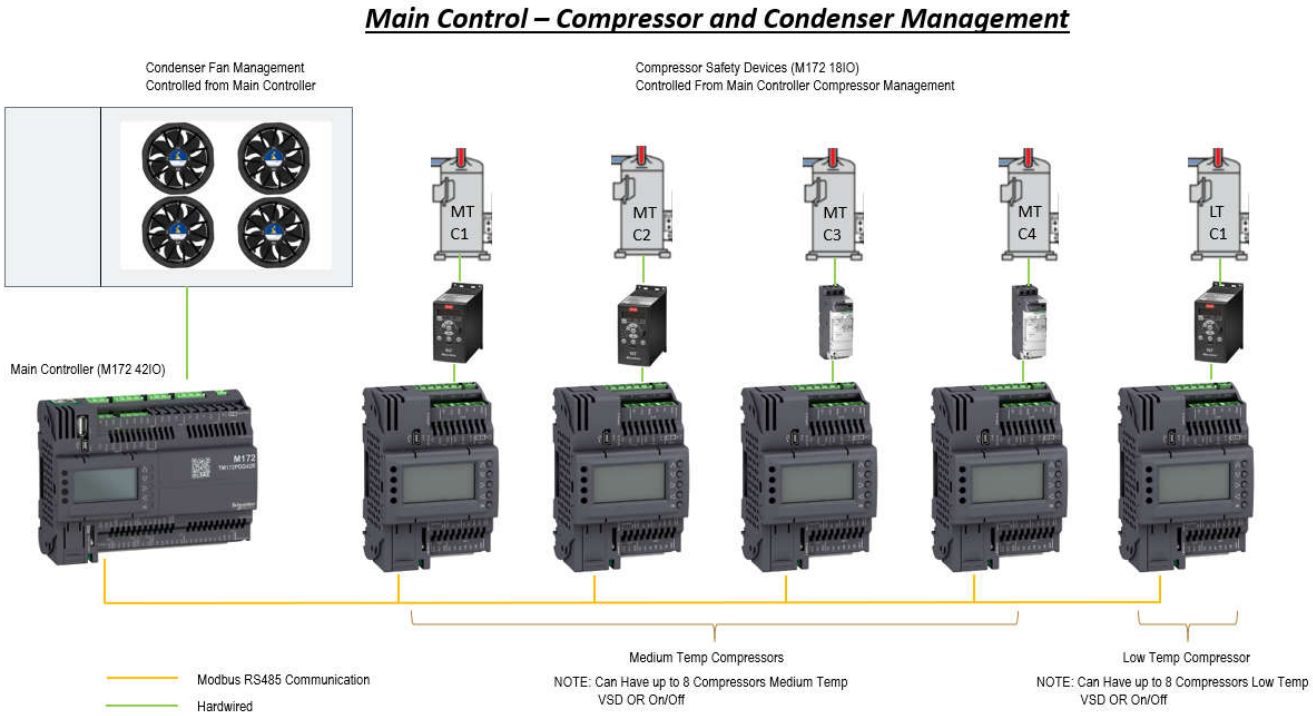
03/2021

OXFORD ENERGY SOLUTIONS

Contents

1. SENSORI™ MAIN MANAGEMENT

SYSTEM OVERVIEW

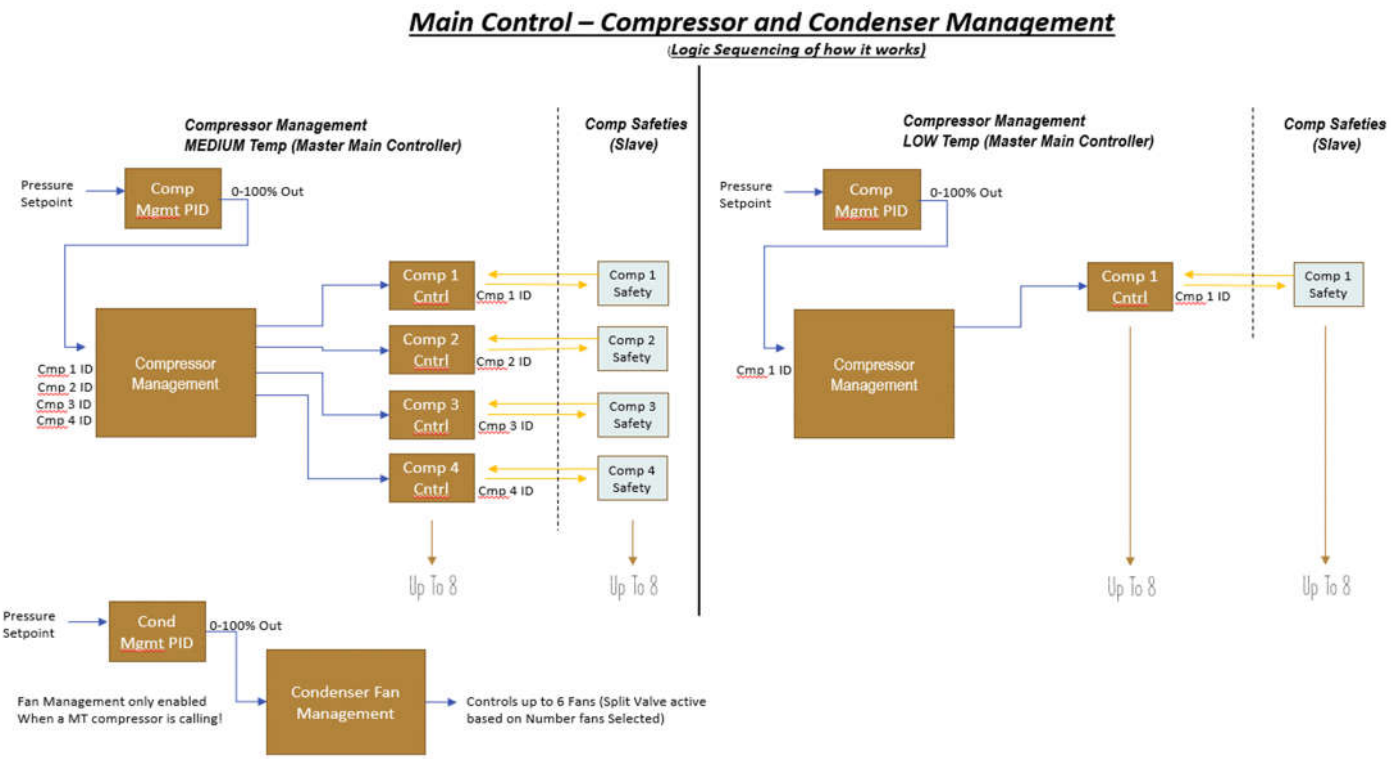


The **above** illustration shows an example of an **Oxford LPP system** using both Variable Speed Drives and generic on/off for compressor control through the Compressor Sensori Safety Controls.

The Examples given throughout this manual will be based on 4 Medium Temperature Compressors, 1 Low temperature “Booster” compressor, and 4 Condenser Fans.

Sensori Management can control up to 8 Medium temperature compressors, 8 Low-temperature compressors, and 6 Fans.

Compressor Management is done through Modbus RS485 communication for ease of wiring and polling of information for more accurate decisions for compressor switching, modulating, and alarm trending.



The **above** illustration shows the breakdown of how the compressor and condenser management work inside the Sensori PLC device.

Compressor Management is used to control several compressor types (Variable Speed or on/off). The Compressor Management block calculates the number of compressors, and the speed required to control the refrigerant pressure.

The Sensori Platform manages compressors in a way to help prolong their proper operation, balance machine lifetime and provides features for compressor breakdown management and to optimize operation.

The Compressor Management is used together with the Compressor Control block, which controls the operation of a single compressor. The Compressor Control block gathers all information from the Compressor Sensori Safety Device (PLC it communicates to over Modbus) that will be read for status ID operation of the Management.

When an alarm is received from the Compressor Safety, the information travels to all blocks letting the Compressor management know that an alarm is present. This allows the switching of other compressors while the compressor is down to maintain proper operating pressure.

COMPRESSOR MANAGEMENT

Compressor Sequence Control

Compressor Sequence control helps to ensure equal usage of the compressors and optimize power consumption.
Compressors are controlled based on the following sequences:

Sequence as per `usiCompMode`	Description
FIFO = First In First Out	o The compressor with the least operating hours is switched on first. o The first compressor which is switched on is also the first to be switched off. o Advantage: operation time is limited.
Runtime	o The compressor with the least operating hours is the first compressor to be switched on. o The compressor with the most operating hours is the first compressor to be switched off. o Advantage: balanced operation hours.
LIFO = Last In First Out + Runtime	o The parameter pointer `usiLifoSeq` determines this sequence. o The first compressor to be switched on is the first one in the sequence. o The first compressor to be switched off is the last one that has been switched on. o Advantage: priority of compressor usage can be set. **NOTE:** If several compressors have the same priority, the compressor with the least operating hours is the first compressor to be switched on.

NOTE:

- **<u>It is recommended to keep the system at LIFO mode</u>** as this mode is fully tested based on optimum performance.
- If a variable speed drive is available, the variable speed drive is switched on before the on/off compressors switch on, and the variable speed drive is stopped last.
- If a compressor is not available (Off timer or cycle timer are active, or the compressor is in alarm state), another compressor is started based on the sequence defined by Comp Mode above.
- If a compressor cannot be stopped (On-timer is active), another compressor is stopped based on the sequence defined by Comp Mode.

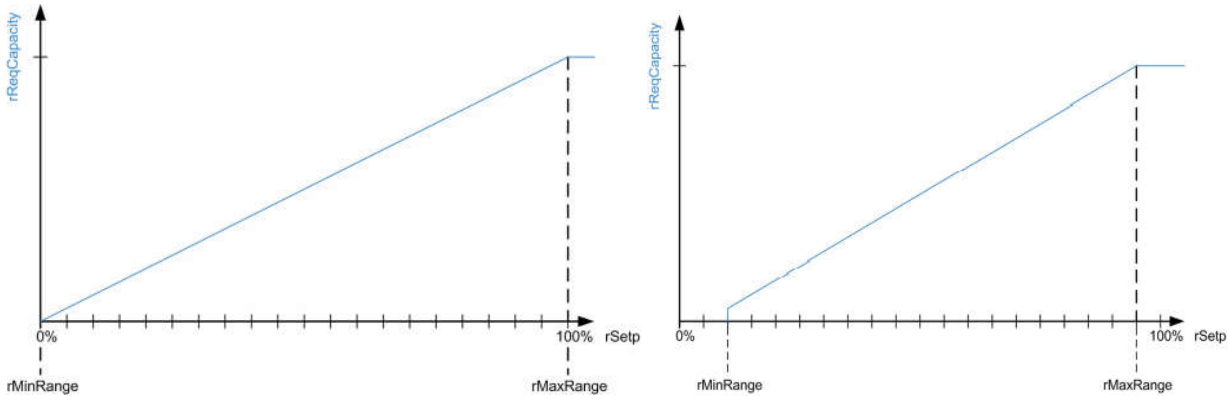
Compressor Breakdown Management

The compressor, which is detected as non-operating, is switched off. The next available compressor in the start sequence is switched on. The non-operating compressor cannot be started until the compressor is returned to an operational state.

Regulation with rMinRange and rMaxRange

To increase the stability of the system when the input of the Compressor Management (Setpoint 0-100% called by the PID control) is close to 0% or 100%, the regulation range for the compressor is adapted to the range rMinRange to rMaxRange. xCtrlMode is set to FALSE (uiDelayOn and uiDelayOff is active. See parameter list).

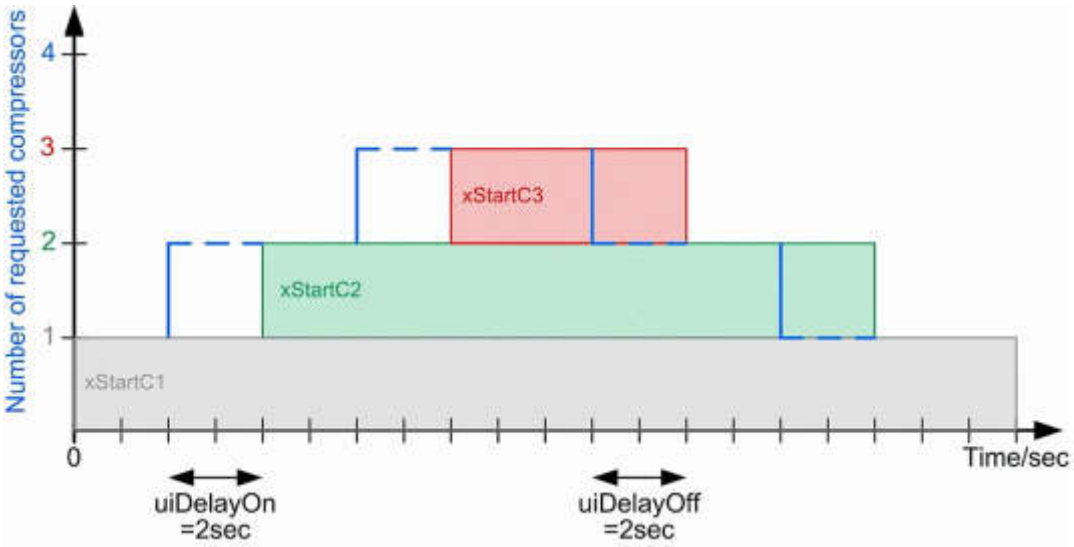
The graphics show an example for **rMinRange**, **rMaxRange** (1VS):



Regulation With Delay

The input **xCtrlMode** is set to FALSE. To increase the stability of the system, the input **uiDelayOn** can be set to delay the increment, or **uiDelayOff** to decrement the number of requested compressors.

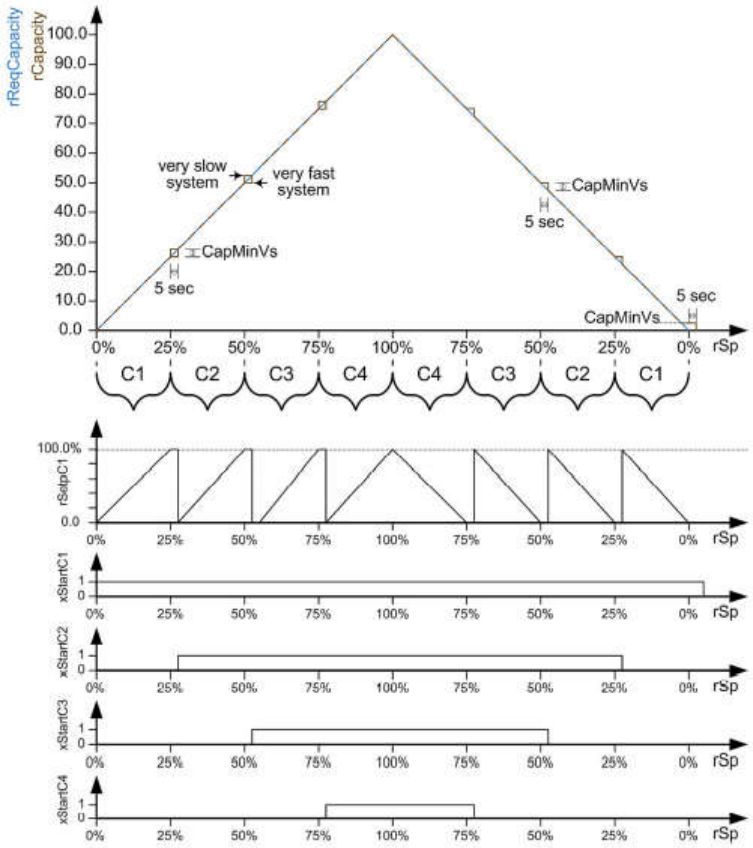
NOTE: When the first variable speed compressor has to be switched on, the delay is not active. When the first On/Off compressor has to be switched on, the delay is active. Example **uiDelay** overview:



The following example applies for one variable speed compressor and three on/off compressors with control mode (FIFO, Runtime, LIFO+ Runtime). The following values were set to show the diagram:

Parameter	Value/Unit
rMaxRange	100.0%
rMinRange	0.01%(∿ 0.0%)
usiNbVs	1
usiNbOnOff	3
rMaxFreq	50.0 Hz
rMinFreq	5.0 Hz
CapMaxVs	25.0 (for 1 variable speed compressor, internally calculated)
CapMinVs	2.5 (for 1 variable speed compressor, internally calculated)
rReqCapacity	0.0...100.0
rCapacity	2.5...100.0
uiDelayOn	5 s
uiDelayOff	5 s
rNomFreq	50 Hz
xCtrlMode	FALSE
uiCapVs	25
uiCapOnOff	25

The graphic shows an example for **rMinRange**, **rMaxRange** (1Vs+ 3 on/off)



Regulation with Minimum Frequency, Maximum Frequency, and Nominal Frequency

If...	Then...
If a variable speed compressor is available and ready,	A variable speed compressor is started first and a variable speed compressor is stopped last.
If more than one variable speed compressor is set by usiNbVs,	The variable speed compressors run until the maximum frequency (rMaxFreq) is reached before a new compressor is started. This is also valid if several variable speed drives are used.
If xStartC1 is set to TRUE and rSetpC1 is equal to 100.0%,	The variable speed compressor C1 is running at the maximum frequency rMaxFreq.
If more than one variable speed compressor is required,	The analog outputs rSetpC* has the same calculated values (analog for the value iSetpC*).

The following examples **A** and **B** are with a control mode (FIFO, LIFO, Runtime).
In both examples, **uiDelayOn** and **uiDelayOff** are set to 0.

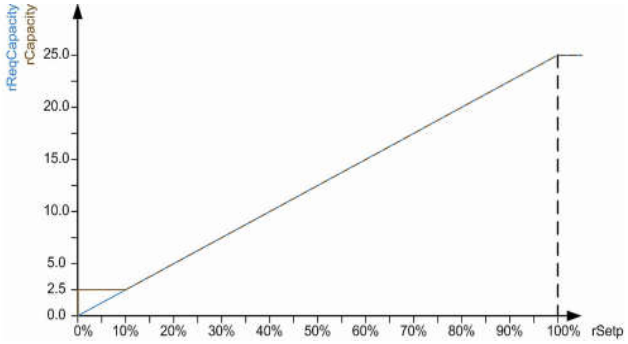
Example A

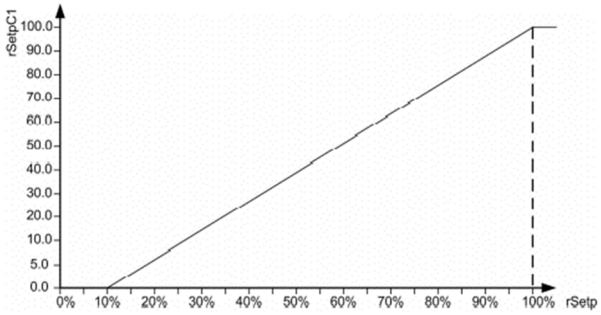
Parameter	Value / Unit
usiNbVs	1
usiNbOnOff	0
rMaxFreq	50 Hz
rMinFreq	5 Hz
rMinRange	0.01% (~ 0.0%)
rMaxRange	100%
rNomFreq	50 Hz
xCtrlMode	FALSE
uiCapVs	25
uiCapOnOff	25

Result: Maximum and minimum capacity (**CapMaxVs**, **CapMinVs**) of a variable speed drive, required capacity **rReqCapacity** (output)

Parameter	Value / Unit
CapMaxVs	25.0 (for 1 variable speed compressor, internally calculated)
CapMinVs	2.5 (for 1 variable speed compressor, internally calculated)
rReqCapacity	0.0...25.0
rCapacity	2.5...25.0

Example **rMinFreq**, **rMaxFreq**, **rNomFreq** (1 Vs):





Example B

Parameter	Scale / Unit
usiNbVs	4
usiNbOnOff	0
rMaxFreq	50 Hz
rMinFreq	30 Hz
rMinRange	0.01% (∿ 0.0%)
rMaxRange	100%
rNomFreq	50 Hz
xCtrlMode	FALSE
uiCapVs	25
uiCapOnOff	25

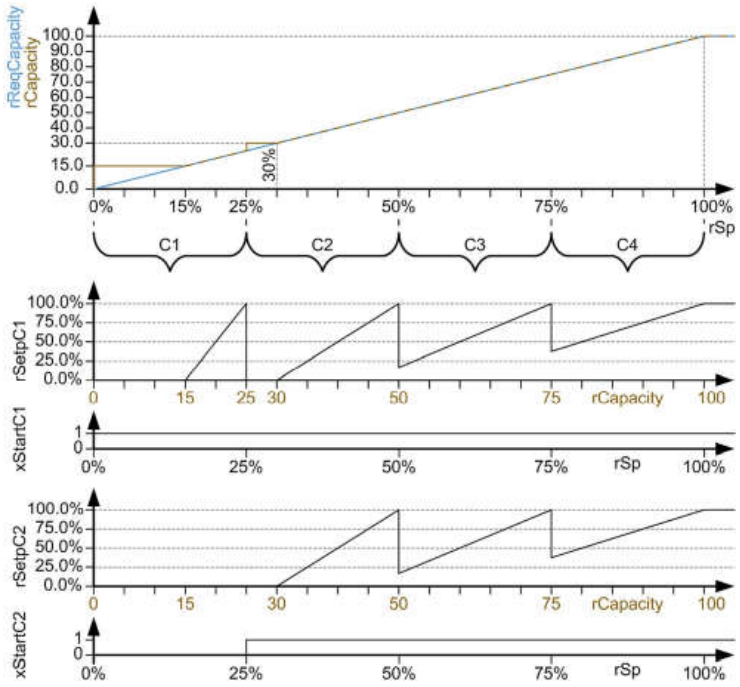
Result: Maximum and minimum capacity (**CapMaxVs**, **CapMinVs**) of a variable speed drive, required capacity **rReqCapacity** (output).

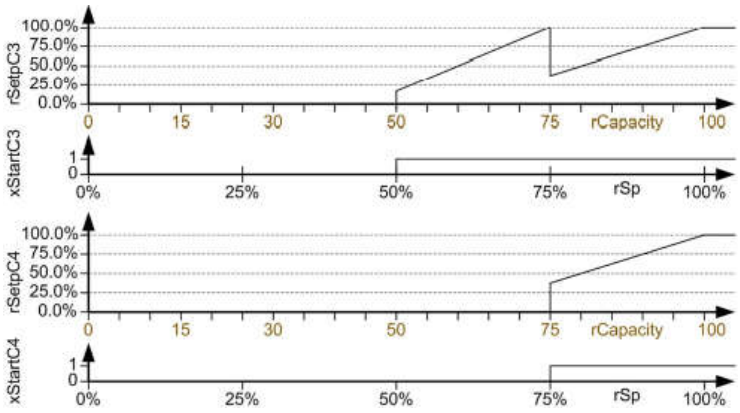
Parameter	Scale / Unit
CapMaxVs	25.0 (for 1 variable speed compressor, internally calculated)
CapMinVs	15 (for 1 variable speed compressor, internally calculated)
rReqCapacity	0.0...100.0
rCapacity	15...100.0

The outputs **rSetpC1** and **rSetpC2** are not started at **rCapacity** = 0 and **rCapacity** = 25. **rMinFreq** is set to 30.0 Hz and **CapMinVs** = 15.

If...	Then...
If `rSp` is greater than `rMinRange`,	The output `xStartC1` is set to TRUE. **Result**: A value of 15.0 is set at the output `rCapacity`, but the calculated required capacity `rReqCapacity` is less than the set `rCapacity`. In this case, the calculation of the output `rSetpC1` starts by `rReqCapacity` > `rCapacity`.
If `rReqCapacity` > `CapMaxVs`,	The system requires two variable speed drives. **Result:** o `rReqCapacity` is for example 25.1 (> `CapMaxVs`) and the outputs `xStartC1` and `xStartC2` are set to TRUE. o `rCapacity` is 30; also `rCapacity` > `rReqCapacity` and no further capacity is needed. o Both outputs `rSetpC1` and `rSetpC2` are 0. In this case, the calculation of the outputs `rSetpC1` and `rSetpC2` start by `rReqCapacity` > `rCapacity` (here 30).
If `rReqCapacity` > 2 x `CapMaxVs`,	The system requires three variable speed drives. **Result:** o `rReqCapacity` is for example 50.1 (> 2 x `CapMaxVs`) and the outputs `xStartC1` and `xStartC2` are set to TRUE. o `rCapacity` is 45, also `rCapacity` < `rReqCapacity`. o The required outputs `rSetpC1` and `rSetpC2` and `rSetpC3` are set to 17.0%.

Example rMinFreq, rMaxFreq, rNomFreq (4 Vs):

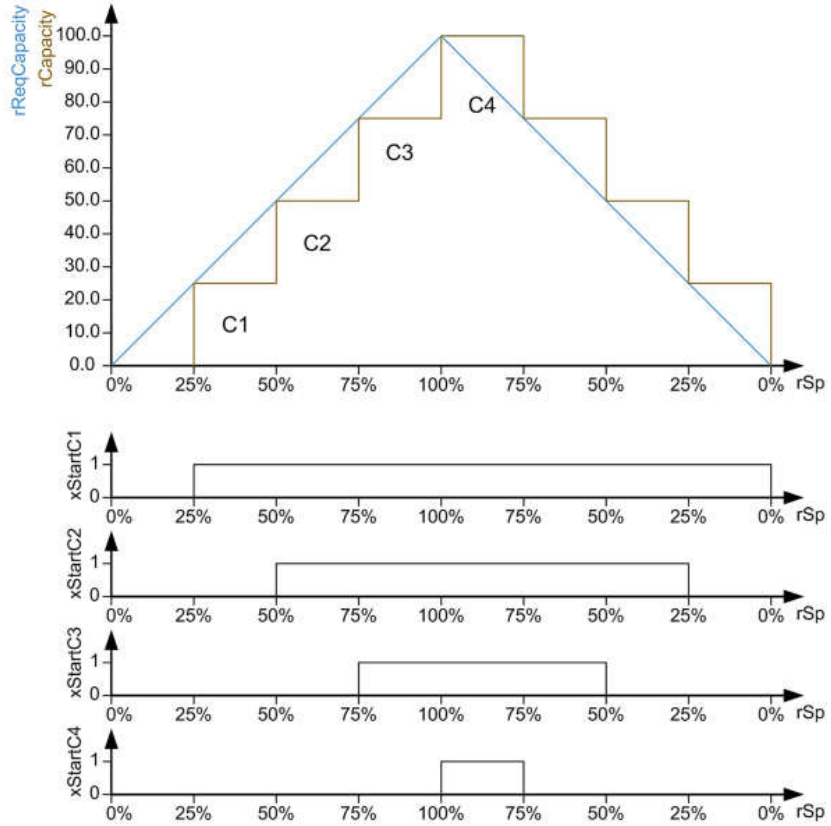




Regulation with 4 On/Off Compressors

This regulation is possible but not as precise as variable speed compressors. The following example is with control mode (FIFO, LIFO, Runtime). The following values were set to show the diagram:

Parameter	Scale / Unit
rMaxRange	100
rMinRange	0.01% (~ 0.0%)
uiDelayOn	0
uiDelayOff	0
xCtrlMode	FALSE

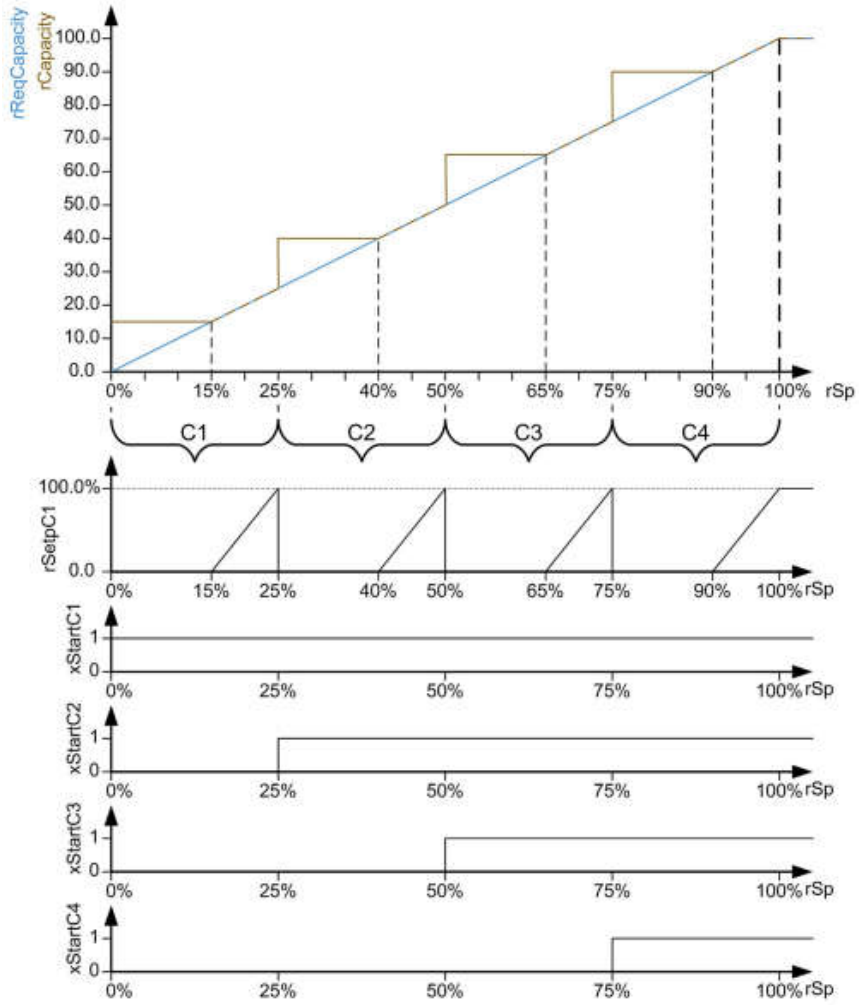


Regulation with One Variable Speed Compressor and 3 On/Off Compressors

The following example is with a control mode (FIFO, LIFO, Runtime).

The following values were set to show a hypothetical diagram:

Parameter	Value / Unit
rMaxRange	100%
rMinRange	0.01% (~ 0.0%)
usiNbVs	1
usiNbOnOff	3
rMaxFreq	50 Hz
rMinFreq	30 Hz
CapMaxVs	25.0 (for 1 variable speed compressor, internally calculated)
CapMinVs	15.0 (for 1 variable speed compressor, internally calculated)
rReqCapacity	0.0...100.0
rCapacity	15.0...100.0
uiDelayOn	0
uiDelayOff	0
xCtrlMode	FALSE
rNomFreq	50 Hz
uiCapVs	25
uiCapOnOff	25



Regulation With Hysteresis (rHys, rMinRange, rMaxRange)

The regulation with hysteresis is more adaptive than the regulation with delay because the time before starting or stopping a compressor depends on the variation speed of the value PID rSp

If...	Then...
If the setpoint of the PIDAdvanced rAnalog varies fast, for example when the machine is started or when the load reduces significantly,	The time to start or stop a compressor is reduced which improves the response time of the system.
If the setpoint of the PIDAdvanced rAnalog varies slowly, for example when the load is constant,	The time to start or stop a compressor is longer which increases the stability of the system.

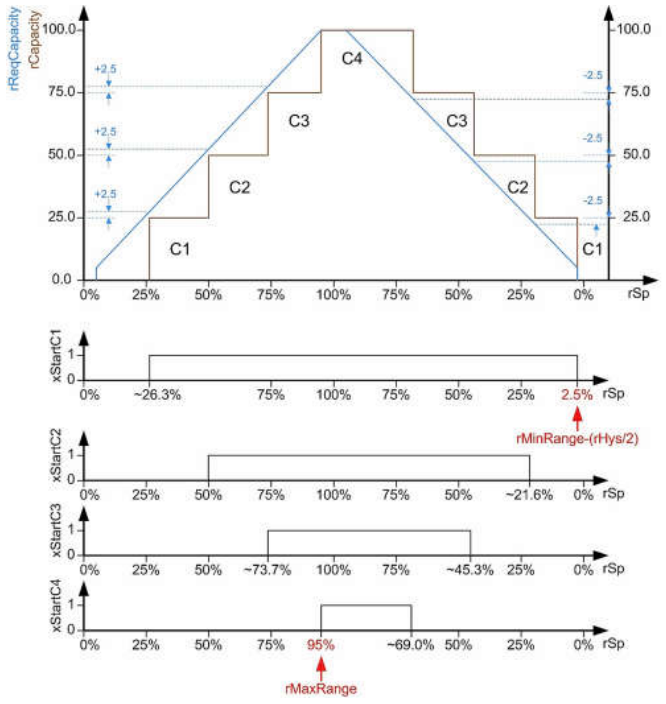
The value of `rHys` has more priority than `rMinRange` and `rMaxRange`.

If...	Then...
$\left(\frac{rHys}{2.0}\right) \leq rMinRange$	The last compressor stops by the value of $rMinRange - \left(\frac{rHys}{2.0}\right)$
$\left(\frac{rHys}{2.0}\right) > rMinRange$	The last compressor will stop by the setpoint=0.0 (rSp).

Example A:

Parameter	Value / Unit
rMaxRange	95%
rMinRange	5%
usiNbVs	0
usiNbOnOff	4
xCtrlMode	TRUE
rHys	5.0%

Example regulation with hysteresis (4 On/Off):



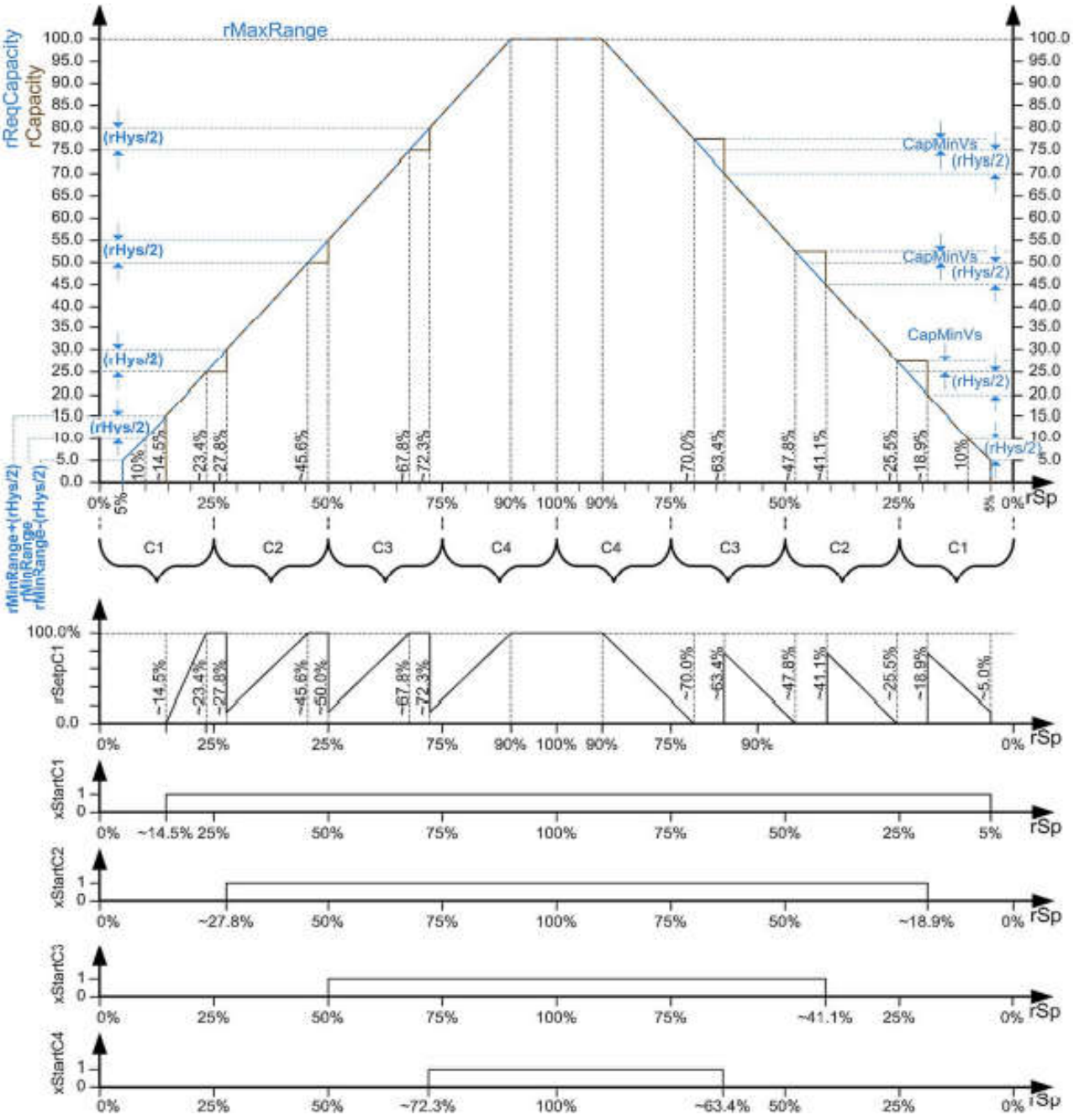
Example B:

Parameter	Value / Unit
rMaxRange	90%
rMinRange	10%
usiNbVs	1
usiNbOnOff	3
xCtrlMode	TRUE
rHys	10.0%
rMaxFreq	50 Hz
rMinFreq	5 Hz
rNomFreq	50 Hz
uiCapVs	25 (user unit)
uiCapOnOff	25 (user unit)

Result: Maximum and minimum capacity (CapMaxVs, CapMinVs) of a variable speed drive, required capacity rReqCapacity (output).

Parameter	Scale / Unit
CapMaxVs	25.0 (for 1 variable speed compressor, internally calculated)
CapMinVs	2.5 (for 1 variable speed compressor, internally calculated)
rReqCapacity	5.0…100.0 $\left(5.0 = rMinRange - \left(\frac{rHys}{2}\right)\right)$
rCapacity	15…100.0 $\left(5.0 = rMinRange - \left(\frac{rHys}{2}\right)\right)$

Example regulation with hysteresis (1 VS, 3 On/Off):



Compressor Control

The *Compressor Control* provides the following purposes:

- The compressor can be operated in automatic, manual or in maintenance mode.
- The integrated timers help to prevent the compressor from frequent switching.
- The *Compressor Control* function block suppresses resonance frequencies to reduce noise and increase compressor lifetime.
- 3 different operating modes: **automatic, manual, maintenance**
- Quick stop of the compressor
- Start/stop procedure enabled by the Compressor Management
- Timers: **uiMinOnTime**, **uiMinOffTime**, **uiMinCycleTime**
- Counts compressor operating hours for Compressor Management to decide Compressor Starts
- Display remaining time: minimum on timer, minimum off timer, and cycle timer
- Gathers all Alarm information by compressor to notify Compressor Management group

CONDENSER FAN MANAGEMENT

Condenser Fan Management works with a PID block (similar to the compressors) to control up to 6 Fan Stages based on a 0-100% Setpoint. The primary fan is recommended using a VFD for optimum system performance and steady head pressure. This enables the system for more stability and less compressor cycling, tighter EXV bandwidth, and overall system performance.

The following methods for fan management are provided:

- Fan Stages Sequence Control
- Fan Stages Status Management
- Fan Stages Operation Hours Control
- Fan Frequency Calculation
- Fan Stages Increment / Decrement Timer

Fan Stages are controlled based on the following sequences:

Sequence	Description
FIFO = First In First Out	o The fan with the least operating hours is switched on first. o The first fan which is switched on is also the first to be switched off. o Advantage: operation time is limited.
Runtime	o The fan with the least operating hours is the first fan to be switched on. o The fan with the greatest operating hours is the first fan to be switched off. o Advantage: balanced operation hours.
LIFO = Last In First Out	o The parameter `usiPriorityStage1...usiPriorityStage4` determines this sequence. o The first fan stage to be switched on is the first one in the sequence. o The first fan stage to be switched off is the last one that has been switched on. o Advantage: priority of fan stage usage can be set. o If fan stages have the same priority, the starting sequence is based on the operating hours.

NOTE: LIFO **MUST** BE USED WHEN USING WITH THE OXFORD LPP SYSTEM FOR FANS TO WORK PROPERLY WHEN A SPLIT VALVE IS PRESENT. Also, If the number of fans per stage are not equal, LIFO mode is only available.

Fan Status Management

If an input Alarm is set to TRUE, a fan stage has at least a non-operating fan, the function block assumes that only 1 fan per stage is not operating. The function block re-calculates the capacity and adapts the frequency setpoint and the number of running fans to compensate for the fan loss.

Fan Frequency Calculation

The fan frequency calculation is controlled by 2 modes specified in the **xMode** parameter.

- Manual mode: **xMode** = TRUE
- Automatic mode: **xMode** = FALSE

The following table provides an overview of the different modes:

Mode	Description
Manual	The fan speed signal is set to the frequency `uiManualFreq` and the fan stages are controlled with the inputs `xManualStage1`, `xManualStage2`, `xManualStage3` and `xManualStage4`. **NOTE:** Take care that the frequency `uiManualFreq` is set within the specified ranges of the drive and that the input signals `xManualStage1`, `xManualStage2`, `xManualStage3` and `xManualStage4` are set to TRUE only if the fan stages are present.
Auto	o The fan frequency and the number of operating fan stages are automatically calculated. o When all fans are in operation, `FanControlSignal` is set as fan speed signal after limiting between `FanFreqMin` and `FanFreqMax` values. o If `xLowNoiseOper` = TRUE, the maximum frequency `uiFanFreqMax` is reduced by a value specified in the parameter `uiLowNoiseMaxFreq`.

Fan Increment / Decrement Timer

The FanMgmt function block controls the fan increment sequence by the delay time set in the input parameters:

- **uiFanDelayIncr**
- **uiFanDelayDecr**

The **FanMgmt** function block differs the increment and the decrement sequence:

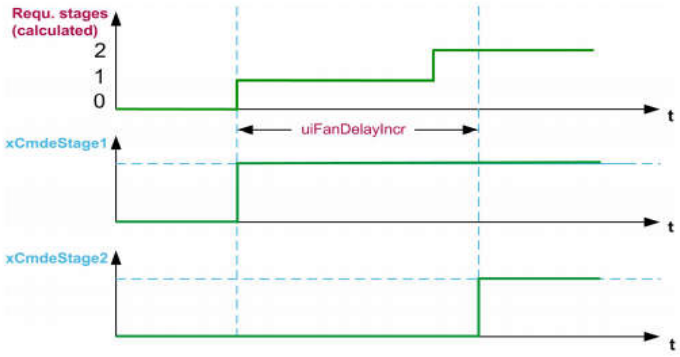
Sequence	Description
Increment Sequence	When the number of fans is incremented, if the timer `uiDelayFanIncr` is active, the operating fan stages run at the frequency `uiFanFreqMax`.
Decrement Sequence	When the number of fans is decremented, if the timer `uiDelayFanDecr` is active, the operating fan stages run at the frequency `uiFanFreqMin`.

Fan Stage Minimum OFF Time

The function block controls the minimum Off time of the fan stages. When a fan stage is switched off, the timer uiMinOffTime is started. The fan stages are not available until the timer uiMinOffTime has elapsed. If all the fan stages are not available, the function block starts anyway according to the priority defined by the fan mode usiFanMode.

Fan Increment Sequence

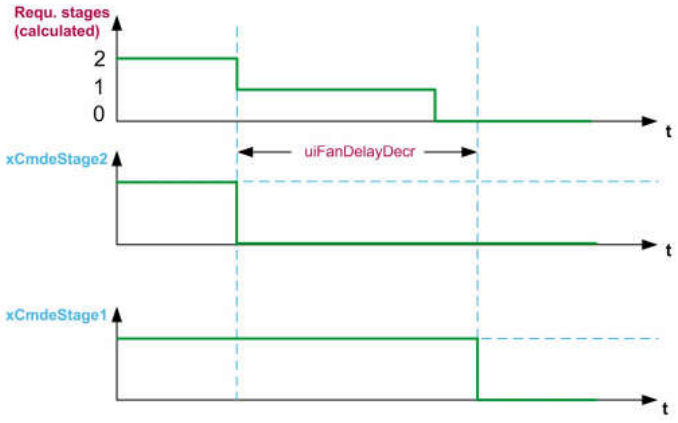
The timing diagram below describes the incrementing sequence of the Fan Management:



If...	Then...
the number of required fans is set from 0 to 1	o `xCmdeStage1` is switched on `FanDelayCmd` o The next fan stage can be switched on only after the `uiFanDelayIncr` timer is complete
the number of required fans is set from 1 to 2	`xCmdeStage2` is switched on after the time delay `uiFanDelayIncr` is complete.

Fan Decrement Sequence

This timing diagram presents the decrement sequence of the FanMgmt function block:



If...	Then...
the number of required fans is set from 2 to 1	o `xCmdeStage2` is switched Off after the `uiFanDelayIncr` is complete. o The next fan can be switched Off only after the `uiFanDelayIncr` timer is complete
the number of required fans is set from 1 to 0	`xCmdeStage1` is switched Off after the `uiFanDelayIncr` is complete.

SENSORI MANAGEMENT DEVICE

Status

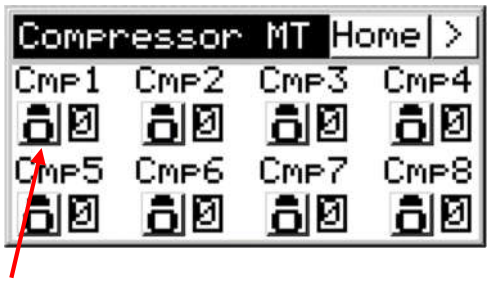
Home Page Screen – *consists of two status options*.

Status 1 – Displays information regarding individual compressors for both Low Temp, Medium Temp, and Condenser Fan information.

Status 2 – Displays information regarding The LPP system pressures and temperatures.

Status 1

"Page 1"- Medium Temp Compressors

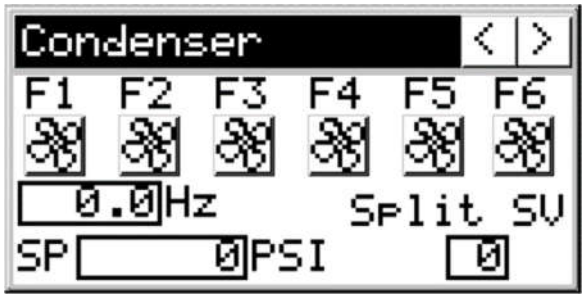


"Page 2"- Low Temp Booster Compressors

Compressor (**Cmp**) display symbol represents an active compressor called by the "*Compressor Control*". This is only told to run by the management group. When this symbol is visible, the signal to run that compressor through serial communication is sent to the Sensori Safety Device of that compressor. The Value Beside it displays the proof back.
Value 1 = proof active.

NOTE: IF NO SYMBOL IS VISIBLE, REMEMBER TO CHECK ELAPSE TIMES AND DELAYS. *See compressor control further below*.

"PAGE 3"-CONDENSER



F1-6 Display symbol represents an active fan when called by the "Condenser Management".

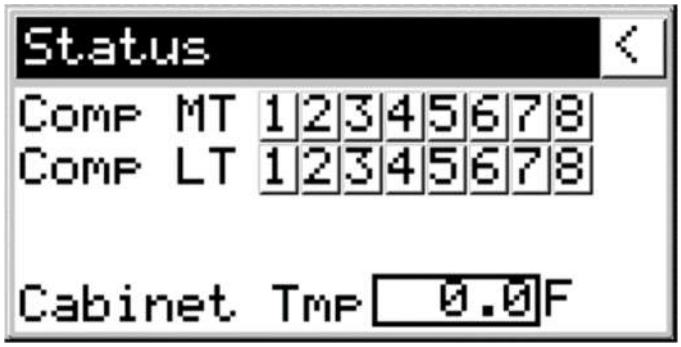
Fan 1 will always be active (*Variable Speed*) before any other fan is active. This is explained above in the Condenser Management section.

Below Fan 1 indicates the frequency (**Hz**) that is called for by the group. When the "max frequency" is shown and the setpoint is still below the active Liquid line pressure, a second fan will be enabled when called by the PID control, based on the priority fan.

Depending on the Number of Fans selected in the Management group, the **Split SV** (**Condenser Split Solenoid Valve**) will be energized until the second half of the condenser is called by the PID. The **Split SV** will never read "0" when there are no fans active on the second half of the condenser!

The **SP (Setpoint)** is the active setpoint of the PID control controlling the Condenser Management group of Fans. Depending on the ambient conditions, this setpoint will change in a linear matter. See Condenser Setpoints below for further information.

"PAGE 4"- MAIN STATUS

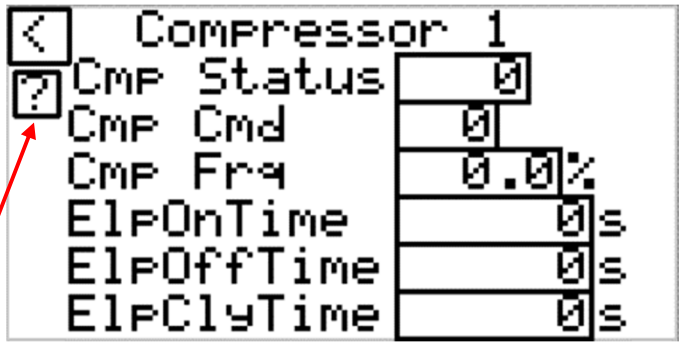


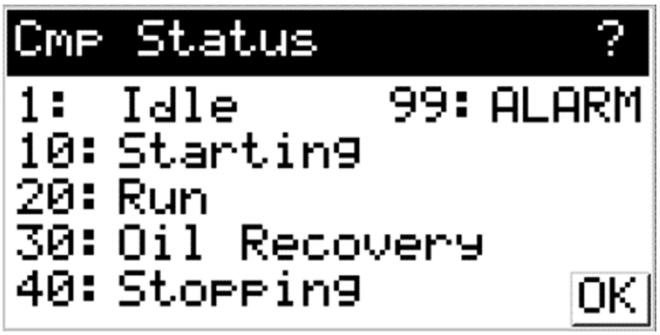
Main Status screen displays the compressor Control status. This is where the Compressor elapse times, and delays are displayed. *See Screen "**Compressor 1**".*

Cabinet Tmp (Temperature)- Displays the control value of the electrical cabinet temperature to control the cabinet fan. When the cabinet exceeds 75F, the cabinet fan will be enabled (*see wiring schematic of fan*).

NOTE: DAMAGE CAN OCCUR TO ELECTRICAL DEVICES IF THE FAN IS NOT OPERATING CORRECTLY!
***NEVER* PLUG ANY HOLES IN CABINET TO ENSURE PROPER AIRFLOW.**

Cmp Cmd (Compressor Command) displays the value (*1 being active*) that is being sent to the Sensori Compressor Safety Device, along with the **frequency** that is called to run. This is over Serial Communication.





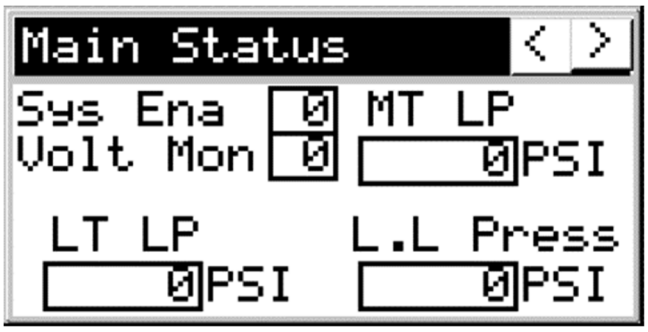
NOTE: OIL RECOVERY IS NOT USED ON OXFORD LPP! The system has been designed and tested that oil recovery is not an issue.

When **99** is displayed as **Cmp Status**, the compressor is being told by the external "Sensori Safety Device" that there is an alarm.

See the external device to find out what is alarming. This will also trigger the compressor management alarm/alert to let the group know that the compressor is not available.

Status 2

MAIN STATUS



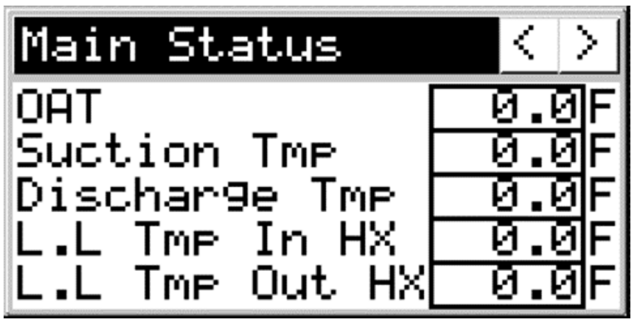
Sys Ena (**System Enable**)- This is associated to physical digital input 1 (*see wiring schematic).* When this input is not seen, the value displayed will read **0**, and the entire system will be off.

Volt Mon (**Voltage Monitor**)- When this function (*see "Setpoints"*) is enabled, the value will read **1**, if the physical digital input 2 (*see wiring schematic*) is true. If the function is not used, the value will remain **1**, even when the input is not seen.

MT LP (**Medium Temperature Suction Pressure**)- Value that is used to control the MT Compressor Management through PID.

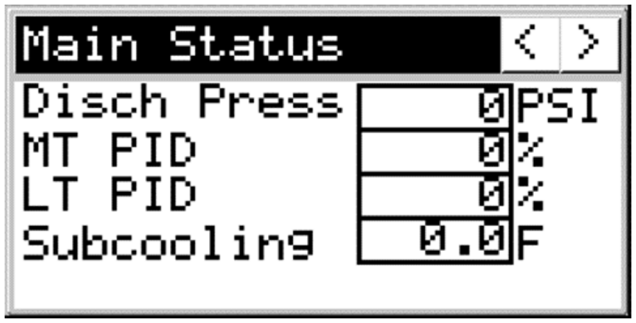
LT LP (**Low Temperature Suction Pressure**)- Value that is used to control the LT Compressor Management through PID.

L.L Press (Main Liquid Line Pressure)- Value that is used to control the Condenser Fan Management through PID.



OAT (**Outdoor Air Temperature**)- Used for Low pressure bypass, Condenser Management Setpoint, AND Cold Weather MT System Check!

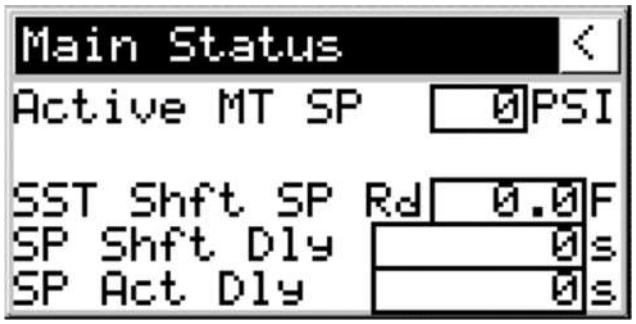
Suction Temperature, **Discharge Temperature**, **Liquid Line Temperature in and out of Heat Exchange Accumulator**, are all display values for system information. Liquid temperature out is used to calculate total subcooling as part of the system alarm when enabled. Values will display **0** when disabled.



Disch Press – **Discharge Pressure** is used strictly for a display value for information and will display **0** when disabled.

MT/LT PID – This is the PID value output (or input to the Compressor management setpoint) for both medium and low Temperature Compressor Management. A slow PID with small change is best to optimize system performance and avoid unnecessary compressor cycling.

Subcooling- **Total Subcooling of system**. Liquid Temp Out HX MUST be enabled to read a value here.



Cold Weather System Check

Active MT SP (**Active Medium Temperature Setpoint**) – Value that is displayed as the Control PID Setpoint for Compressor Management MT to be used. This value will change if cold weather system check is enabled! *See setpoints for further information*.

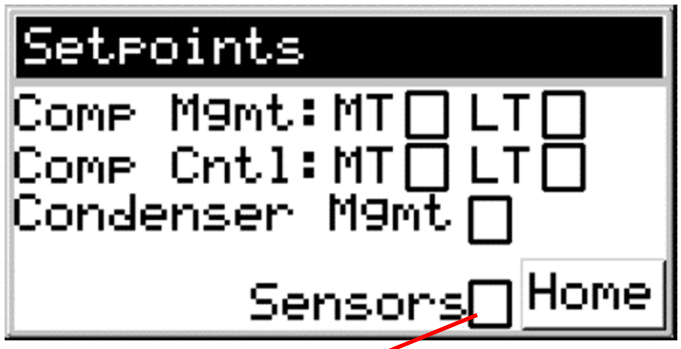
SST Shft SP (**Saturation Suction Temperature Shift Setpoint Readout**)- SST Setpoint based on the desired Suction Pressure Setpoint for the Cold Weather System Check Function.

SP Shft Dly (**Setpoint Shift Delay**)- Delay count in seconds, before the Setpoint shift is active.

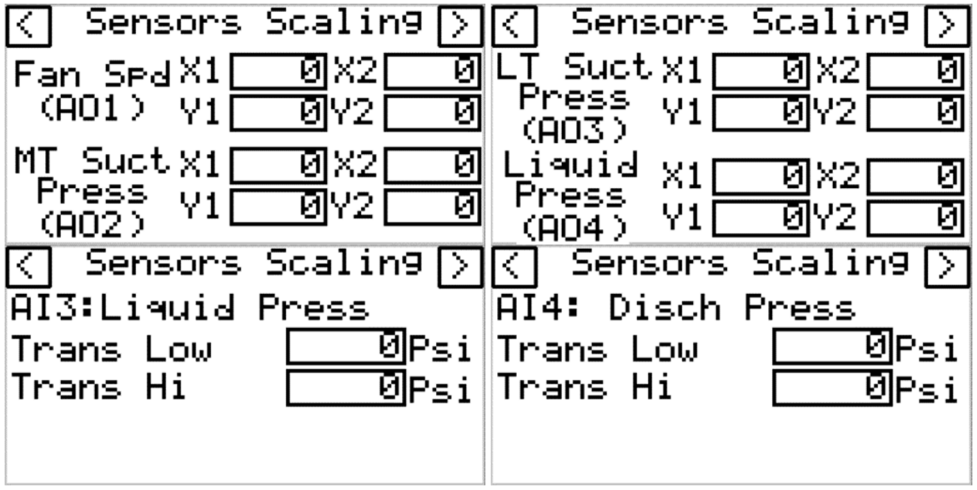
SP Act Dly (**Setpoint Active Delay**)- Shift Compressor Management Setpoint for x time or until Termination SP from capacity.

SETPOINTS

Setpoints are broken down in segments. **Compressor Management**, **Compressor Control**, **Condenser Management**. Although the PID is separate from the Management groups, the values are found in the Management setpoints. Sensor's scaling is also found here.



SENSOR SETPOINTS

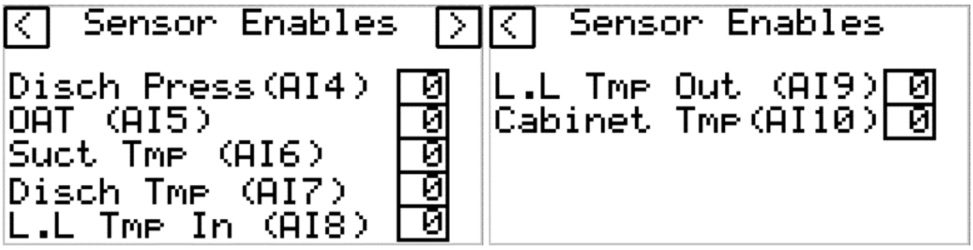


AO SCALING

Fan Speed for condenser primary fan scaling is set here. This is the scaling of the physical analog output value as an INTEGER type.
For example. The default x values are set at 0 (X1) – 1000(X2) and y values are set at 0(Y1) – 600(Y2). This wide range value gives more system accuracy for controlling fan speed.

MT/LT Suct and **Liquid Press– Medium/Low Temperature Suction Pressure** and **Liquid Pressure** are paralleled out as a 0-5vdc analog output.

AI SCALING – Liquid and Discharge Pressure Transducer scaling set in PSI. Scaling is only for a 4-20mA sensor!



Sensor Enables – ***AI1,2, and 3 are imperative for the system to run normal operation.*** The above analog inputs can be disabled if not used.

OAT will need to be enabled if using "System Check". If no **OAT** is present, the Condenser Management Setpoint will NOT 'float' and the system will see the temperature at a value of **0**. Be sure to set the min and max values correctly for the desired Condenser Fan Management setpoint. The system will use the "Fan Sp min" as your new setpoint.

L.L Tmp Out will need to be enabled when using "Subcooling Alarm."

Cabinet Tmp will need to be enabled when a cabinet fan is being controlled (*see wiring schematic*).

***NOTE*:** All Sensors will alarm if enabled only, however will not affect the operation of the system except for the sensors described above.

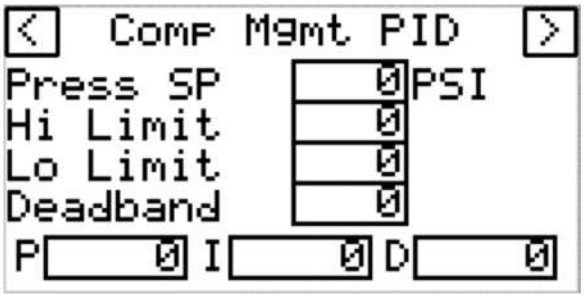
Compressor Management Setpoints

***NOTE*: Compressor Management** Medium Temperature Setpoints are only shown below since the Low Temperature Setpoints are controlled the exact same. For more Detailed information on how this works, refer to "*System Overview*".

**The Low Temperature Group can be disabled if only Medium Temperature is used. **

Set **LT Ena** to **0** if no Low temperature application is used.

Compressor Management MT Setpoints- 1

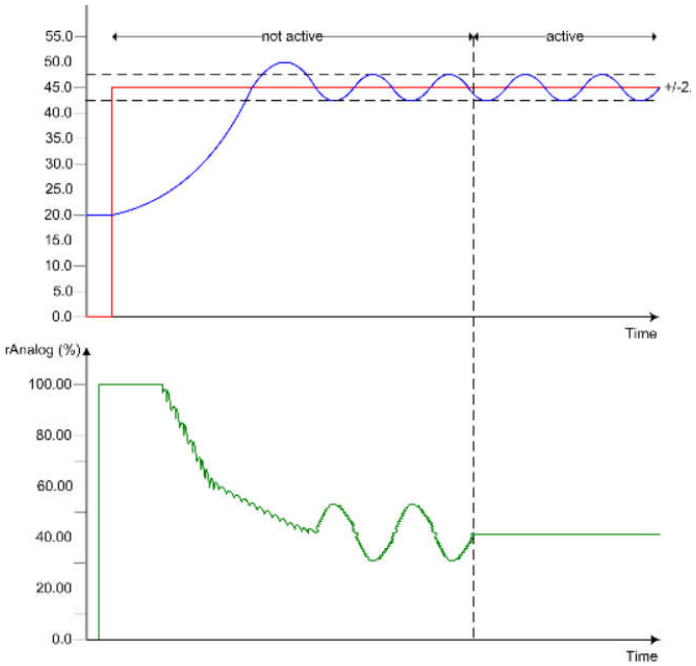


Press SP – This is the desired **Suction Pressure setpoint** that the PID group will read to control compressor staging. Note that this value set will always be the default value when Cold weather system check is enabled. *Default Value:* ***18***

Hi Limit – **High Limit percentage of the PID**. This is the maximum value The Compressor Management will see. Be sure to set this value high enough that all compressors will be called for in the management group. Refer to System Overview for further information. *Default Value***: 100**

Lo Limit – **Low limit that the PID will "ramp" down to**. If a value greater that 0 is set, be sure the proper minimum range and low limit values are set up in the management group. *Default Value:* **0**

Deadband – Used to smooth out control behaviour. Value is set in PSI.
Example: Value set at 2PSI **deadband** meaning that the PID output percentage (*Compressor Management Setpoint*), will not change when pressure is withing 2 PSI above and below PID Setpoint. See graph below. *Default Value:* **0**



Proportional Gain rKp

Example:

rKp > 0	Direct mode, for example, control for heating.
rKp = 0	The outputs rAnalog and iAnalog are set to 0.
rKp < 0	Reverse mode, for example, control for cooling (inverse control).

Integral Time uiTi

Example:

uiTi = 1	Fast integration time, causes a fast influence on the outputs rAnalog and iAnalog.
uiTi = 10	10 times slower than the fast integration time (a) and causes a slower influence on the outputs rAnalog and iAnalog.
uiTi = 0	uiTi is deactivated.

Derivate Time uiTd

Example:

uiTd = 1	The smallest damping, causes a high influence to the outputs rAnalog and iAnalog.
uiTd = 10	1/10 of the smallest damping, causes a lower influence on the outputs rAnalog and iAnalog.
uiTd = 0	uiTd is deactivated.

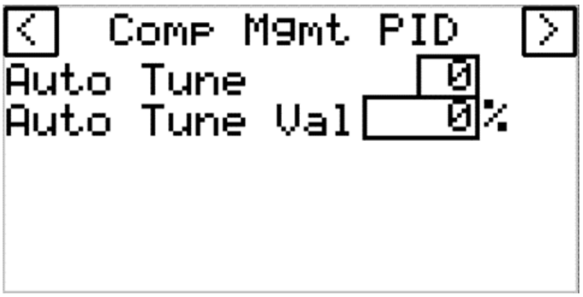
NOTE: In systems with dead time, uiTd should be set to 0. The value of uiTd must be greater than the cycle time. If it is less than the cycle time, then the uiTd value is overwritten with the value of the cycle time.

P I D – **Proportional, Integral, Derivative**.

It is not recommended changing these values on an Oxford LPP system unless discussed with a qualified and trained technician. The default values have been fully tested on multiple applications and damage can occur to compressors due to rapid cycling if set incorrectly! *Default Value:* **P= -5, I=500, D=0**

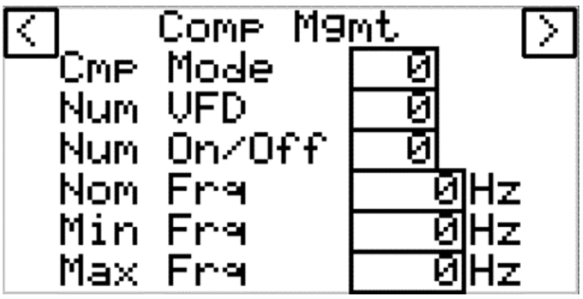
NOTE: ***FOR PROPORTIONAL TO WORK IN COOLING MODE, THE P MUST BE A NEGATIVE INTEGER*****!** The **PID** is a separate "Block" From the Compressor Management and runs as an individual PID for a 0-100% setpoint to the Compressor Management "Block", based on suction pressure.

Compressor Management MT Setpoints- 2



***AUTO TUNE NOT AVAILABLE. RELEASE WILL BE IN FUTURE FIRMWARE.*

Compressor Management MT Setpoints- 3



Cmp Mode - Compressor control sequence mode.
Default Value: **2**
o0: FIFO
o1: Runtime
o2: LIFO

NOTE: *IT IS RECOMMENDED USING "LIFO" COMPRESSOR MODE WITH OXFORD LPP SYSTEMS. This mode has been tested fully for optimum energy analysis and at maximum operating conditions.*

Num VFD – **Number of variable speed compressors**. *Default Value:* **2**
Num on/off + Num VFD ≤ 8 (*TOTAL COMBINED NOT TO EXCEED 8 COMPRESSORS*!)

Num On/Off – **Number of on/off compressors**. *Default Value:* **2**
Num on/off + Num VFD ≤ 8 (*TOTAL COMBINED NOT TO EXCEED 8 COMPRESSORS*!)
NOTE: PLC MUST BE POWER CYCLED AFTER SELECTING NUMBER OF COMPRESSORS VFD AND ON/OFF, FOR SYSTEM TO TAKE EFFECT.

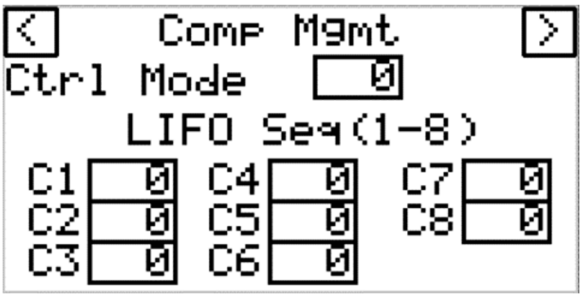
Nom Frq – **Nominal Frequency Speed of the compressors** (Hz) *Default Value:* **60**

Min Frq – **Minimum speed of the variable speed compressors** (Hz) *Default Value:* **30**

Max Frq – **Maximum Speed of the variable speed compressors** (Hz) *Default Value*: **60**

NOTE: MINIMUM AND MAXIMUM FREQUENCIES ALSO SET IN "*COMPRESSOR CONTROL*". ANALOG SCALING WILL DIFFER WHEN CHANGED!

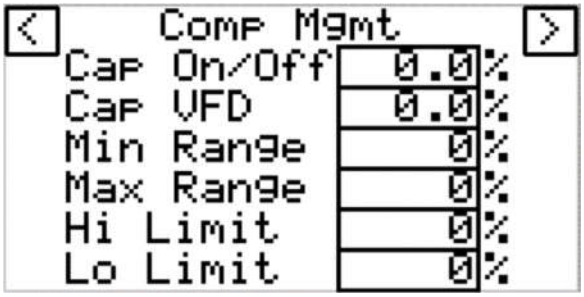
Compressor Management MT Setpoints- 4



Ctrl Mode - Control mode (switch on/off the compressors). *Default Value:* **0**
0: Delay
1: Hysteresis

LIFO Seq - Compressor start sequence (priority in sequencing mode LIFO).
NOTE: VARIABLE SPEED DRIVES HAVE THE HIGHEST PRIORITY.

Compressor Management MT Setpoints- 5



Cap On/Off - **Capacity of the on/off compressors**. This Capacity is of each compressor. It is recommended to size all on/off compressors the same capacity for optimum performance and for the Management to enable compressors based on true capacity. This value is a number set from 0 – 100%. *Default Value*: **32**

Cap VFD – **Capacity of the variable speed compressors** at 60 Hz. See "*Cap On/Off*". *Default Value:* **18**
NOTE: Notice the default values for the total number of compressors and capacities. Two on/off compressors at 32% each (64% of the system capacity) and two VFD compressors at 18% each (36% of the system capacity). This totals the full 100% system capacity.

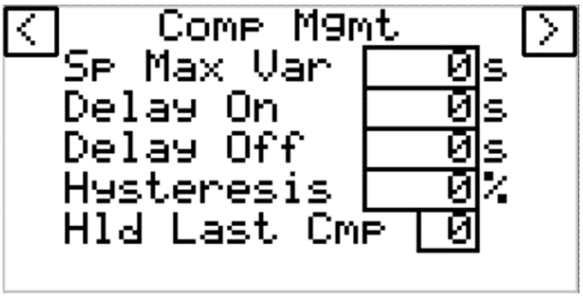
Min Range – **Low limit of the range**. Refer to System Overview (Regulation with rMinRange and rMaxRange) *Default Value:* **3**

Max Range – **High limit of the range**. Refer to System Overview (Regulation with rMinRange and rMaxRange) *Default Value:* **100**

Hi Limit – **High limit of the "PID" Output** (This is the Setpoint of the Compressor Management 0-100%) *Default Value:* **100**

Lo Limit – **Low limit of the "PID" Output** (This is the Setpoint of the Compressor Management 0-100%) *Default Value:* **0**

Compressor Management MT Setpoints- 6

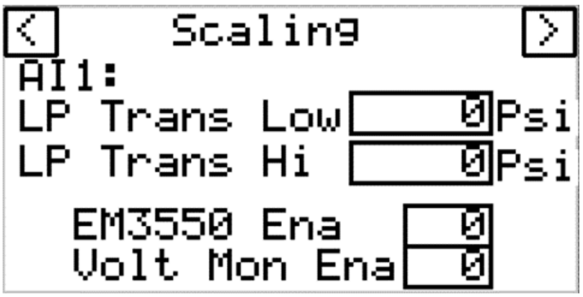


Sp Max Var - **Maximum setpoint variation** Time to increase/decrease the setpoint of 10%. 0 leaves the setpoint unchanged. It is possible to limit the slope of setpoint signal coming from PID to prevent too quick variation and consequently too fast switching on or off the compressors (for example during first power on). The input **Sp Max Var** indicates the time necessary to increase or decrease the setpoint of 10% value. *Default Value:* **5**

Delay On – **Delay to increment the number of requested compressors** ("Ctrl Mode" Set to 0). *Default Value:* **15**
Delay Off – **Delay to decrement the number of requested compressors** ("Ctrl Mode" Set to 0). *Default Value:* **1**
Hysteresis – **Hysteresis to increment and decrement the number of requested compressors** ("Ctrl Mode" Set to 1). *Default Value:* **10**

Hld Last Cmp – Hold Last Compressor On, even if shut off is requested. Used for Pump Down procedure. Not recommended using on Oxford LPP systems, as this will generate an alarm on the Sensori Compressor Safety Device. *Default Value:* **0**

Compressor Management MT Setpoints- 7



AI1 Scaling (MT Suction Pressure Read)
- **LP Trans Low.** *Default Value:* **-14.5**
- **LP Trans Hi.** *Default Value:* **300**

EM3550 Ena – **Schneider EM3550 Energy Meter Enable**. Set to 1 when using Oxford LPP System. This will enable Modbus communication. **The address of the Energy Meter MUST be set to address 17** and be the last device (*see wiring schematic*).

Set the Energy Meter to the following Communication settings…
- Address 17
- Baud Rate 38400 b/s
- Even Parity
- 8 Data Bits
- 1 Stop Bit

No Data will be able to read on the display screen of the Main Management PLC. This is strictly for Oxford LPP Main HMI/IPC for reading and trending energy data. *Default Value:* **1**

Volt Mon Ena – **System Voltage Monitor Enable**. When set to 1, Voltage Monitor physical digital input (*see wiring schematic*) must be true, or alarm will be triggered. When set to 0, the voltage input will be bypassed internally, and display a true status variable. *Default Value:* **1**

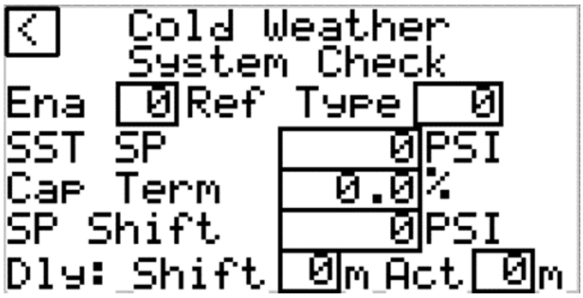
Compressor Management MT Setpoints- 8

Cold Weather System Check Overview

This feature is used for Low Pressure Refrigerants during Off cycle time. Use when ambient temperatures are below System SST, preventing Compressor Management to request a compressor. When the system is off and no compressors are running, refrigerant pressure will drop below the Compressor Management PID setpoint and no call for “PID” will be sent to the Management Group of compressors.
When enabled, this is prevented by the system comparing the “SST SP” selected and the ambient temperature. When the ambient drops below the SST setpoint AND no requested compressors are calling on the Management AND the Suction Pressure is below the active PSI setpoint set, the system will start to count.
When the **Shift Dly** set expires, the system will shift the Suction pressure setpoint to the Compressor Management Group for **Act Dly** time. This will drop the setpoint to the PID to force compressors to be requested on and build system heat and run-in normal condition.

NOTE: Make sure to Enable "Low Pressure Bypass" on Compressor Safety devices for this application to work properly. *OUTDOOR AIR TEMPERATURE is shared over Modbus communication for Sensori Safety Devices!* ***OAT AND "Ena" MUST Be enabled (set to 1) to use this feature.***

Compressor Management MT Setpoints- 8



Ena – **Enables Cold Weather System Check** *Default Value*: **0** (BE SURE TO ALSO ENABLE OAT!)

Ref Type – **Select Refrigerant** that is being used. *Default Value:* **16(R513a)**

0 = R22
1 = R134a
2 = R404A
3 = R407C
4 = R410A
5 = R407A
6 = R407F
7 = R290
8 = R507A
9 = R717
10 = R723
11 = R1234ze
12 = R744
13 = R448A
14 = R427A
15 = R450(N13)
16 = R513A
17 = R449A
18 = R1234yf
19 = R454B
20 = R454C
21 = R455A
22 = R434A
23 = R442A
24 = R32
255 = R515B

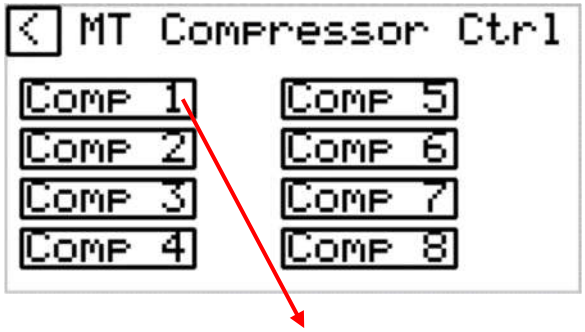
SST Setpoint – **Saturation temperature setpoint** in PSI. Set this pressure for cold ambient conditions to compare. When the ambient is less than this Saturation Temperature (converted internally from Pressure setpoint), the system will go to its first mode of system check. *Default Value*: **10** (**Min -10, Max 50**)

Cap Term – Set a value at which the required capacity from the Compressor Management will terminate the "**SP shift**". When the required capacity of the Compressor Management has reached the "**Cap Term**" setpoint, the system will return to its original suction setpoint for the PID to regulate. Setting this value higher than what the Compressor Management will call for will result in a termination strictly on time/ "**Act Dly**" time expires. Set value to 101 if terminated only on time. *Default Value:* **25 (Min 0, Max 101)**

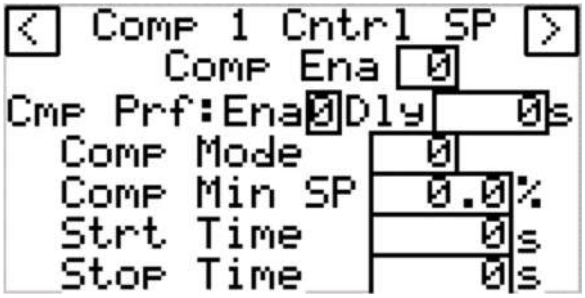
SP Shift – Set the Suction pressure that will be necessary to shift at for "**Act Dly**" time. Be sure to set this value low enough that the Compressor Management PID will call for a percentage of compressors. If the value is not set lower than what the actual suction pressure stands, the system will stay off. *Default Value:* **0** (**Min -15, Max 50**)
Shift Dly - Time delay count before the setpoint active Shift process is enabled. After "**Shift Dly"** time has expired, the setpoint will go into setpoint shift mode. *Default Value:* **45** (**Min 10, Max 120**)
Act Dly – Time Delay count that the system stays in shift mode for unless terminated elsewhere. Default Value: **45** (**Min 0, Max 10**)

Compressor Control Setpoints

NOTE: *Compressor Control Medium Temperature Setpoints are shown below and the Low Temperature Setpoints are controlled the same way. For more Detailed information on how this works, refer to "System Overview". See Table "Modbus Addressing"*



MT Compressor 1 Control Setpoints- 1



Cmp Prf Ena – **Enables Compressor Proof Alarm**. When Proof alarm occurs, a manual reset is required at the PLC device. Set to **0** if no proof alarm is being used and **1** if present (*See wiring schematic for proper Digital input configuration*). *Default Value*: **0**

Cmp Prf Dly - **Time Delay set before Compressor Proof Alarm will occur**. *Default Value:* **120s**

Comp Mode – **Compressor Mode** control of the compressor: *Default Value:* **1**

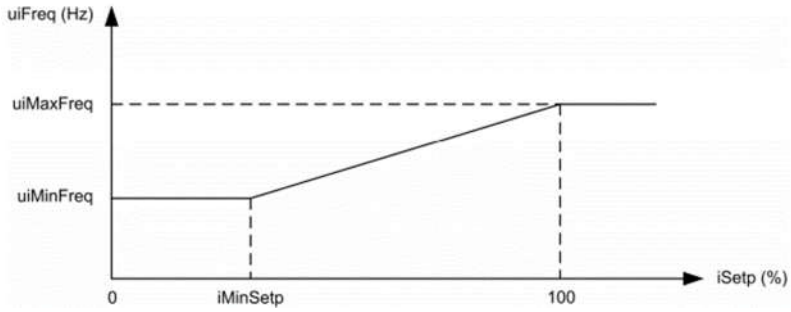
o1: automatic - Runs the Compressor based on setpoints and command from the Compressor Management. Timers and alarms are enabled.

o2: manual – The Compressor is controlled with Manual Setpoint and Manual Command. Timers and alarms are enabled.

o3: maintenance - The Compressor is controlled with Manual Setpoint and Manual Command. Timers are disabled and alarms are enabled.

Comp Min SP – Minimum set-point that corresponds to the "Min Frequency". *Default Value:* **0**
NOTE: COMP MIN SP MUST BE LOWER THAN 100.0%.

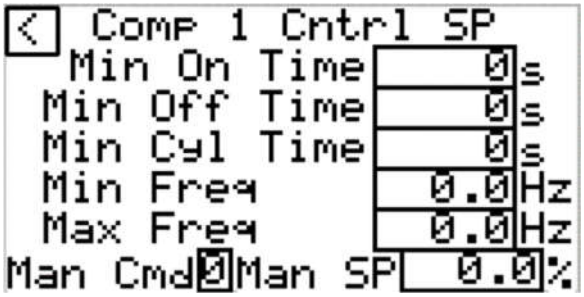
*Graphic below represents "**Comp Min SP**"*



Strt Time – When The **compressor receives a command** from the management to run, the Compressor will go to "**Max Freq**" for x "**Strt Time**" set. Set this value to **0** if comp speed is based on setpoint when initial command is set. *Default Value:* **0**

Stop Time – When the **compressor has no command** from the management, the Compressor will go to "**Max Freq**" for x "**Stop Time**" set. Set this value to **0** if compressor speed is based on setpoint when command is stopped, therefore, no command equals no compressor. *Default Value:* **0**

MT Compressor 1 Control Setpoints- 2



Min On Time – **Minimum time the compressor will stay running**. *Default Value:* **25** *(value is different on all compressors)*

Min Off Time – **Minimum time the compressor is stopped**. *Default Value:* **30** *(value is different on all compressors)*

Min Cyl Time – **Minimum time between 2 consecutive starts of the compressor**. *Default Value:* **30** *(value is different on all compressors)*

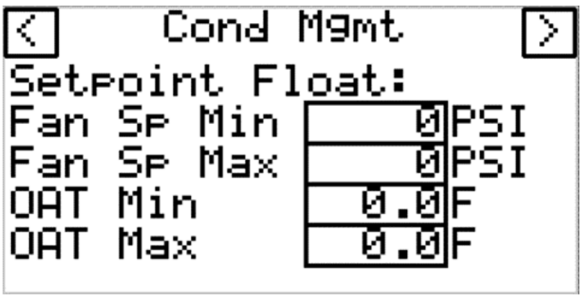
Min Freq – **Minimum frequency of the compressor that corresponds to the minimum set-point**.
Default Value: **30**
NOTE: MIN FREQ MUST BE LOWER THAN MAX FREQ.

Max Freq – **Maximum Frequency of the Compressor**. *Default Value:* **60**

Man Cmd and Man Sp – **Manually command the compressor** (Set to 1) to the manual Setpoint set in percentage.

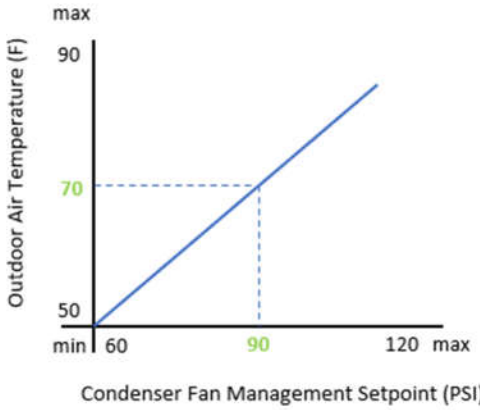
Condenser Management Setpoints

Condenser Management only enabled when a MT Compressor is calling to run. The first Fan will be active when the PID starts to react at start up. After the Condenser Fan Management has been enabled and the PID is at 0, the primary fan will not shut off (*Physical Digital Output*) and run minimum speed set on the VFD/Fan Management minimum frequency.
A Voltage Monitor (*Physical Digital Input*) or System Enable (*Physical Digital Input*) will also disable the function.



Condenser Fan Management Setpoint Float

Condenser Fan **Setpoint Float** is always enabled and is used to float the setpoint of the Condenser Management based on ambient temperature in a linear way. When ambient falls below the "**OAT Min**" value, the Condenser Fan Management setpoint will be the "**Fan Sp Min**." When ambient is above the "**OAT Max**" value, the Condenser Fan Management setpoint will be the "**Fan Sp Max**."



At an ambient temperature of 70F, the Condenser fan Management Setpoint is now 90 PSI.

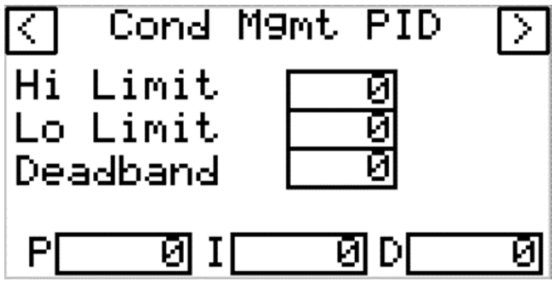
Fan Sp Min – **Minimum Condenser Fan Setpoint** to float. *Default Value:* **60**

Fan Sp Max – **Maximum Value the Condenser fan Setpoint** will reach to float. *Default Value:* **120**

OAT Min – **Minimum Outdoor ambient temperature**. *Default Value:* **50**

OAT Max – **Maximum Outdoor ambient temperature**. *Default Value:* **90**

Condenser Management Setpoints-1



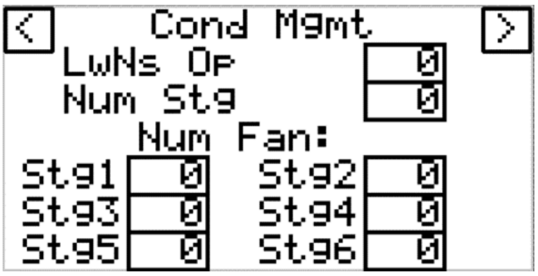
Hi Limit – **High Limit percentage of the PID**. This is the maximum value the Condenser Management will see. Be sure to set this value high enough that all fans will be called for in the Management group. Refer to System Overview for further information. *Default Value:* **100**

Lo Limit – **Low limit that the PID will "ramp" down to**. If a value greater than **0** is set, be sure the proper minimum range and low limit values are set up in the management group. *Default Value:* **0**

Deadband – **Used to smooth out control behaviour**. Value is set in PSI. Example: Value set at 2PSI deadband meaning that the PID output percentage (Condenser Management Setpoint), will not change when pressure is withing 2 PSI above and below PID Setpoint. *Default Value:* **2**

P I D – **Proportional, Integral, Derivative**. It is not recommended changing these values on the Oxford LPP system unless discussed with a qualified and trained technician. The default values have been fully tested on multiple applications and damage can occur to fans due to rapid cycling if set incorrectly!
Default Value: **P= -1, I=300, D=0**
NOTE: For Proportional to work in cooling mode, the P must be a negative integer!

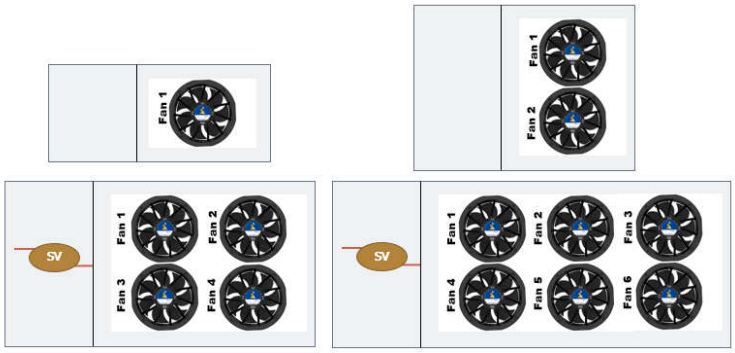
Condenser Management Setpoints-2



LwNs Op – **Low Noise Operation**. If **xLwNs Op** = 1, the maximum frequency "Freq Max" is reduced by a value specified in the parameter "**Lw Noise Max Freq**". *Default Value:* **0**

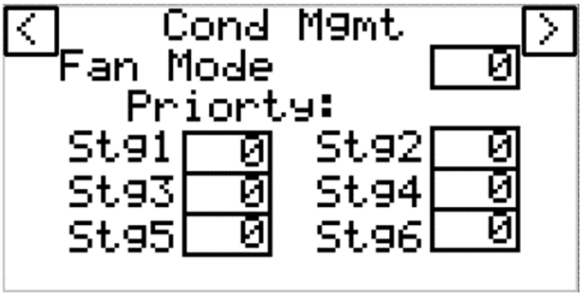
Num Stg – select the **number of fan stages** that will be used. Select only 1, 2, 4, or 6 stages. *Default Value:* **4**

NOTE: If 4 Fans are selected, the condenser split solenoid valve will be energized when stage 3 or 4 is requested to run. When 6 Fans are selected, the condenser split solenoid valve will be energized when stages 4, 5, or 6 is requested to run. See wiring schematic for Digital output wiring.



See diagram of condenser configurations.
Num Fan Stg 1-6 – **Number of Fans per stage**. For simplicity, keep 1 fan per stage active. See System Overview for further information. *Default Value***: 1 for each stage (min 1, max 12)**

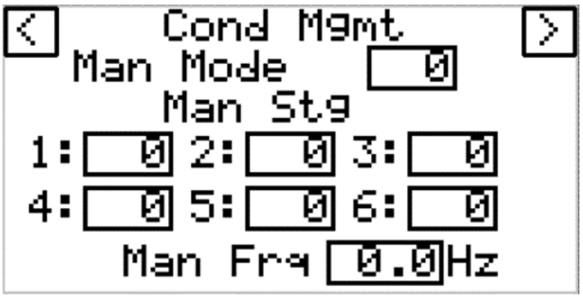
Condenser Management Setpoints-3



Fan Mode - **Fan On/Off sequence** mode. See System Overview for more information. *Default Value:* **2**
0 FIFO
1 Runtime
2 LIFO

Priority Stg 1-6 – Choose **priority of Fan stage**. Only available in LIFO mode. See System Overview for more information.
Default Value **Stg 1: 1,** *Default Value* **Stg 2: 10,** *Default Value* **Stg 3: 40,** *Default Value* **Stg 4: 50,** *Default Value* **Stg 5: 80,** *Default Value* **Stg 6: 100. (min 0, max 255)**

Condenser Management Setpoints-4



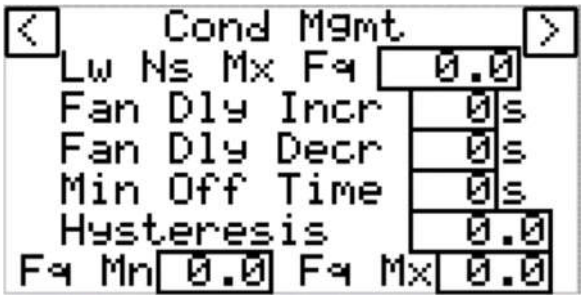
Man Mode - **Manual Mode** if value is set to 1. Set to 0 for Automatic Mode. **Default Value: 0**

Man Stg 1-6 - Select 1 where fan stage is necessary for manual mode. **Default Value: All 0**

Man Frq - Select the manual frequency that is necessary to run VFD speed. **Default Value: 0**

Condenser Management Setpoints-5

See System Overview for further information on all Parameters.



Lw Ns Mx Frq – **Low Noise Max Frequency** Setting. Only Used when "Lw Ns Op" is enabled. *Default Value:* **5**

Fan Dly Incr – **Delay to increment** the number of fan stages. *Default Value:* **10**

Fan Dly Decr – **Delay to decrement** the number of fan stages. *Default Value:* **10**

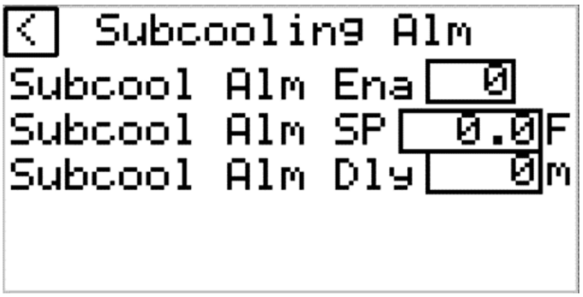
Min Off Time – **Minimum off time** of the stages. *Default Value:* **10**

Hysteresis – **Hysteresis** of the fan stages. *Default Value:* **100**

Fq Mn – **Minimum Frequency**. *Default Value:* **5**

Fq Mx – **Maximum Frequency**. *Default Value:* **60**

Condenser Management Setpoints-6



Subcooling Alarm

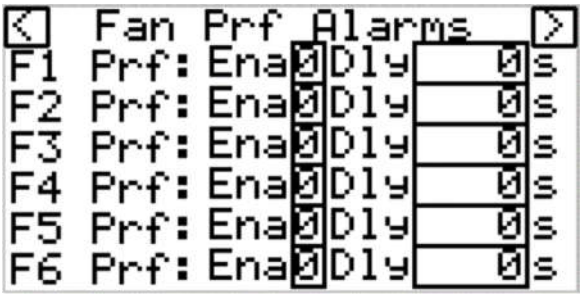
Subcooling alarm's main purpose is to detect a low refrigerant situation. When "**Subcool Alm Ena**" AND **Liquid line Temp Out of HX** accumulator (AI9) is set to 1, the Function looks first for a running Medium Temp Compressor. When any compressor is requested on, the "**Subcool Alm Dly**" starts to count if the total subcooling is below "**Subcool Alm SP**". The System uses the Main liquid line Temperature out of the HX Accumulator and the Main Liquid line pressure to Calculate total subcooling.

Subcool Alm Ena – Set to 1 if using subcooling alarm, 0 is disabled. *Default Value:* **0**

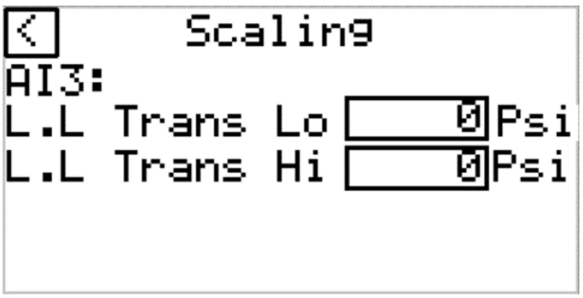
Subcool Alm SP – Subcooling setpoint at which the system will alarm if below this value for "Subcool Alm Dly" time. *Default Value:* **4 (Min 0, Max 20)**

Subcool Alm Dly – Alarm delay set before system alarm is triggered. Set in minutes. *Default Value:* **60 (Min 5, Max 120)**

Condenser Management Setpoints-7

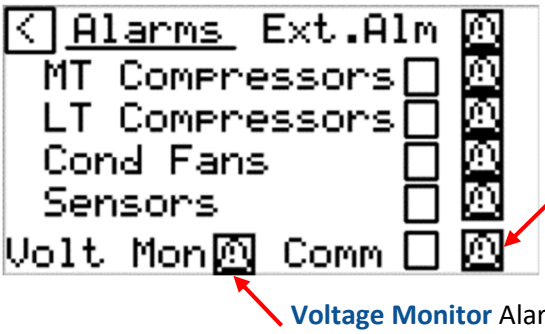


Select all desired Fan Proof alarm enables with a value of 1.
Dly – **Delay** in seconds before the system alarms when no proof is present.



AI3 Scaling (Liquid Pressure Read) –
Pressure **Trans Low**. *Default Value:* **-14.5**
Pressure **Trans Hi**. *Default Value:* **300**

ALARMS



Flashing Red LED Light on the Sensori Management Display Represents an alarm is active. Yellow/Amber light represents an Alert is active. When the alarm symbol is present, this indicates where the alarm/alert is situated.

Voltage Monitor Alarm Indication

Ext.Alm (**External Alarm**)- Used for an external alarm from and other device to display on Management. **This variable is used as AI12 as a dry contact digital input ONLY!** (*See wiring schematic*). Alarm is linked through Oxford LPP HMI for Email Notification of any external device not part of the Sensori Platform.

MT Compressor Alarms

LT COMPRESSOR ALARMS ARE SAME ID AND VALUES AS EXPLAINED IN MT

Mgmt Id - The output Mgmt Alarm ID represents a value from 0 to 15, whereby each bit represents an alarm.

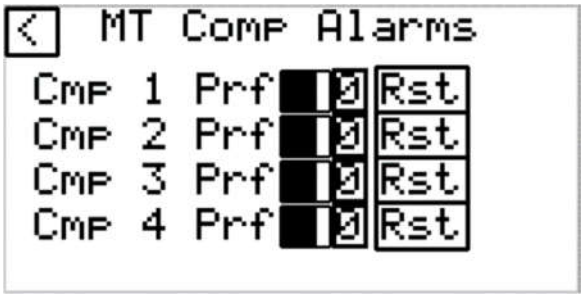
The bits and their description are described in the following table:

Alarm Bit	Alarm Cause	Effect
0	The parameter `rSp` is not set within the specified range.	The compressors are not operating.
1	The parameter `usiCompMode` is not set within the specified range.	
2	The parameters `usiLifoSeqC1`, `usiLifoSeqC2`, `usiLifoSeqC3`, `usiLifoSeqC4` are not set within the specified range.	
3	The parameters `usiNbOnOff` and `usiNbVs` are not set within the specified range or `(usiNbOnOff + usiNbVs) > 4 or usiNbOnOff + usiNbVs) = 0.`	
4	`usiNbOnOff > 0 or usiNbVs>0 and rNomFreq <= 0.0 or rNomFreq > 500.0.`	
5	`usiNbVs > 0 and rMinFreq <= 0.0 or rMinFreq > 500.0 or rMaxFreq <= 0.0 or rMaxFreq > 500.0 or rMaxFreq < rMinFreq.`	
6	`usiNbOnOff >0 and uiCapOnOff <= 0 or uiCapOnOff>1000`	
7	`usiNbVs > 0 and uiCapVs <= 0 or uiCapVs > 1000`	
8	`rMinRange > 99.90 or rMinRange <= 0.0 or rMaxRange > 100.0 or rMaxRange <= 0.0 or rMinRange > rMaxRange`	
9	The parameters `uiDelayOn` and `uiDelayOff` are not set within the specified range.	
10	The parameter `rHys` is not set within the specified range.	
11	All the compressors are in alarm state.	
12	System Clock Alarm, the value of the controller clock is not valid, for example 0:0:0:0:0:0. The internal calculation requires a valid value.	
13...15	Reserved	–

PID ID – PID alarm ID. The output Alarm ID represents a value from **0** to **15** whereby each bit represents a detected alarm. The table contains the bits and their description:

Alarm Bit	Alarm Cause	Effect
0	Application cycle time is greater than 2000 ms	The outputs `rAnalog` and `iAnalog` are set to 0.
1	Invalid value for the parameters (`rHighLimit`, `rLowLimit`)	
2	Invalid value of the parameter `rDeadband`	
3	Invalid values of the parameters `rKp`, `uiTi` or `uiTd`	
4-15	Reserved	–

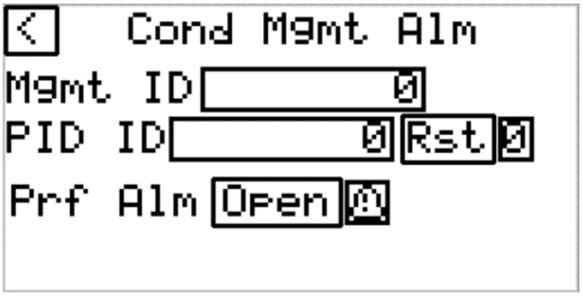
Prf Alm – Open page for Condenser Fan proof alarms and resets



Value of **1** indicating an alarm is present.

Rst = **Manual Reset**

Condenser Fan Alarms

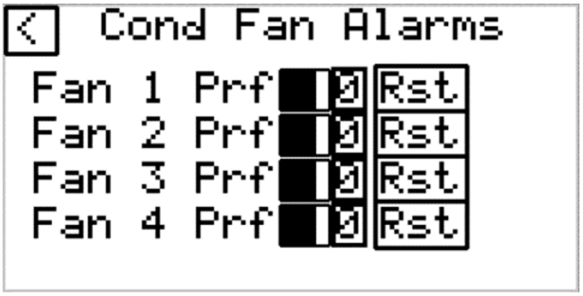


Mgmt ID - The Alarm ID output represents a value between **0** and **7**, whereby each bit represents a detected alarm. The bits and their description are described in the following table:

Alarm Bit	Alarm Description	Result
0	The value of the parameter usiNbStage is not set within the specified range.	Function block is disabled.
1	The minimum frequency is greater than the maximum frequency (uiFanFreqMin > uiFanFreqMax)	Function block is disabled.
2	The value of the parameters usiNbFanStage1...usiNbFanStage4 are not set within the specified range.	Function block is disabled.
3	The value of the parameter usiFanMode is not set within the specified range.	Function block is disabled.
4	The value of the parameter uiHysteresis is not set within the specified range.	Function block is disabled.
5	The value of the parameter uiFanFreqMin is not set within the specified range.	Function block is disabled.
6	The value of the parameter uiFanFreqMax is not set within the specified range.	Function block is disabled.
7	The number of fans per stage usiNbFanStage, is different and the fan mode usiFanMode is not equal to 2 (LIFO mode).	Function block is disabled.

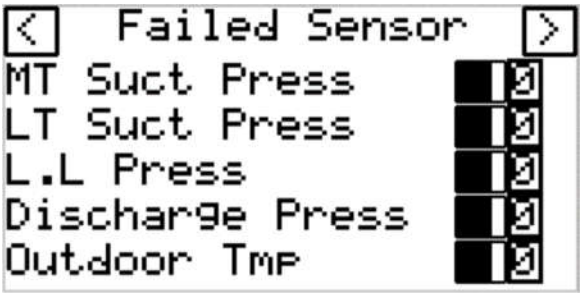
PID ID - See “PID ID” previous in “MT Compressor Alarms”

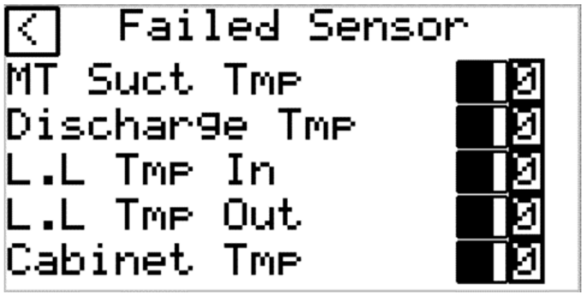
Prf Alm - Open page for Condenser Fan proof alarms and resets
Value of **1** indicating an alarm is present. **Rst** = **Manual Reset**



Sensor Alarms

Failed Sensors indicate a value of “**1**”.

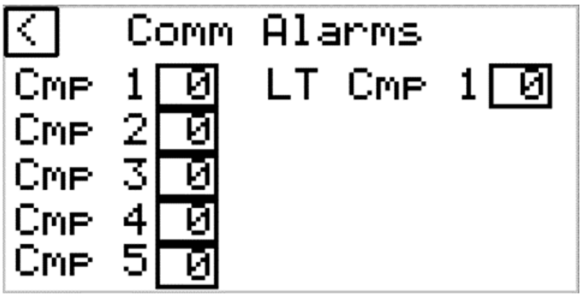




****NOTE:** Only AI1(**MT Suction Pressure**) and AI3 (**Liquid line Pressure**) will disable the MT Compressor Management and Fan Management when failed. AI2 (LT Suction Pressure) will disable the LT Compressor Management when failed.

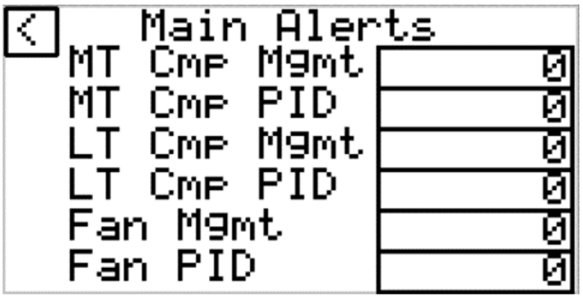
No other sensors will disable these groups when failed. **Liquid Temp Out** will impact the subcooling alarm if enabled. **Outdoor Air Temperature** will be important for Low pressure Bypass if enabled (Modbus integer to Sensori Safety devices) and will also be used for “Cold Weather System Check” and “Fan SP Float”. All other Sensors are strictly a read value, more importantly used with Oxford LPP system and HMI for trending information.

Comm (Communication) Alarms



Communication Alarm is indicated with a value of “**1**”. This is over Modbus serial (*see wiring schematic*). When Communication is lost to a device, the system is scanning and looking for a present value. This will slow the system read and writes down if a device is configured and not present.
If the Main Sensori Management Does not see any present value from a Modbus device within 30 seconds an alarm will trigger.

ALERTS



All Values display an ID to depict the alert active

MT/LT Cmp Mgmt Alert – In the event of an alert, the still available compressors are running and the output Alert ID gives some indications about the alert. The Alert ID output represents a value from 0 to 15, whereby each bit represents an alert.

The bits and their description are described in the following table:

Alert Bit	Alert Cause	Effect
0	Operating hours of compressor 1 > 16,700,100.	At 16,700,100 operating hours, the value is frozen and the AFB cannot calculate with the real operating hours of compressor 1.
1	Operating hours of compressor 2 > 16,700,100.	At 16,700,100 operating hours, the value is frozen and the AFB cannot calculate with the real operating hours of compressor 2.
2	Operating hours of compressor 3 > 16,700,100.	At 16,700,100 operating hours, the value is frozen and the AFB cannot calculate with the real operating hours of compressor 3.
3	Operating hours of compressor 4 > 16,700,100.	At 16,700,100 operating hours, the value is frozen and the AFB cannot calculate with the real operating hours of compressor 4.
4	Compressor 1 is in alarm state or not in auto mode	Compressor 1 is switched off and another available compressor is started.
5	Compressor 2 is in alarm state or not in auto mode	Compressor 2 is switched off and another available compressor is started.
6	Compressor 3 is in alarm state or not in auto mode	Compressor 3 is switched off and another available compressor is started.
7	Compressor 4 is in alarm state or not in auto mode	Compressor 4 is switched off and another available compressor is started.
8	`usiCompMode`: This controlled parameter has been modified, which requires a machine restart. The new configuration parameter is effective only after restart of the function block.	Present modifications are not active. The function block uses the previously set values.
9	`xCtrlMode`: These controlled parameters have been modified, which requires a machine restart. The new configuration parameter is effective only after restart of the function block.	
10	`usiNbOnOff` or `usiNbVs`: These controlled parameters have been modified, which requires a machine restart. The new configuration parameter is effective only after restart of the function block.	
11...15	Reserved	–

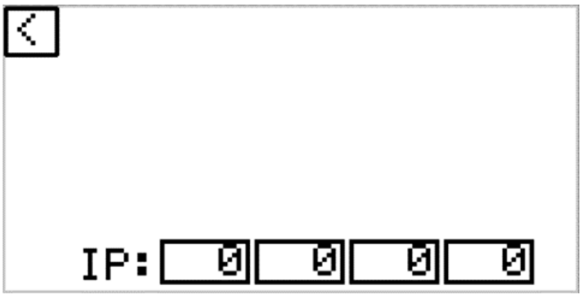
PID Alerts – All PID alerts are similar. The output **uiAlertID** represents a value from 0 to 15 whereby each bit represents a detected alert. The table contains the bits and their description:

Alert Bit	Alert Cause	Effect
0	Invalid value of the input rManualValue	rAnalog and iAnalog outputs are set to rHighLimit or rLowLimit
1	rLowlimit is equal to rHighLimit	rAnalog and iAnalog outputs are set to rLowLimit
2	Autotuning is active, the input xAutoTune is set to TRUE.	rAnalog and iAnalog outputs are set to rAutoTuneValue
3	rKp is set to 0.0	rAnalog and iAnalog outputs are set to 0.
4-15	Reserved	–

Fan Mgmt Alert – The **uiAlertID** output represents a value between 0 and 65535, whereby each bit represents an alert. The bits and their description are described in the following table:

Alert Bit	Alert Description	Result
0	A controlled parameter has been modified. The new configuration parameter is effective only after a restart of the function block. List of the latched parameters: o usiFanMode o uiFanFreqMax o uiFanFreqMin o uiHysteresis o usiNbStage o usiNbFanStage1 o usiNbFanStage2 o usiNbFanStage3 o usiNbFanStage4 o usiPriorityStage1 o usiPriorityStage2 o usiPriorityStage3 o usiPriorityStage4	Present modifications are not active. Function block uses the previously set values.
1	The value of the input uiFanCntrlSignal is not set within the specified range.	The value is limited.
2	The value of the parameter uiLowNoiseMaxFreq is not set within the specified range.	The value is limited.
3	The value of the parameter uiFanDelayIncr is not set within the specified range.	Function is in operation with limited performance.
4	The value of the parameter uiFanDelayDecr is not set within the specified range.	Function is in operation with limited performance.
5	xStage1Alarm input is active	An fan of the stage1 is in alarm state, the fan loss is compensated.
6	xStage2Alarm input is active	An fan of the stage2 is in alarm state, the fan loss is compensated.
7	xStage3Alarm input is active	An fan of the stage3 is in alarm state, the fan loss is compensated.
8	xStage4Alarm input is active	An fan of the stage4 is in alarm state, the fan loss is compensated.

EXT INFO



Set IP Address.
Oxford LPP System must use address **192.168.2.172** for connectivity to HMI.

Parameter USB Backup and Restore- Insert USB and select "**To**" to backup all Eeprom parameters/Setpoints in Sensori PLC. Recommended to leave copy on site with PLC in case of future problems. To Restore Setpoints into a new PLC, simply insert USB with backup file and select "**Frm**" Usb to input USB eeprom files.

Modbus Addressing

The table shows the Modbus Serial Addressing for the compressors to connect to the Sensori compressor safety devices. These address values are fixed and cannot be changed. When enabling the compressor in "compressor control setpoints", the Sensori Management will look for the address once the system is power cycled.

All Device Baud Rate = 38400 and Parity = Even.

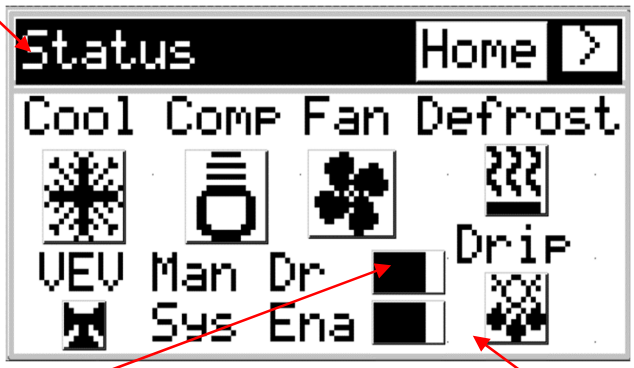
Modbus Addressing Table

Device Name	Modbus Address
Sensori MT Compressor 1 Safety	1
Sensori MT Compressor 2 Safety	2
Sensori MT Compressor 3 Safety	3
Sensori MT Compressor 4 Safety	4
Sensori MT Compressor 5 Safety	5
Sensori MT Compressor 6 Safety	6
Sensori MT Compressor 7 Safety	7
Sensori MT Compressor 8 Safety	8
Sensori LT Compressor 1 Safety	9
Sensori LT Compressor 2 Safety	10
Sensori LT Compressor 3 Safety	11
Sensori LT Compressor 4 Safety	12
Sensori LT Compressor 5 Safety	13
Sensori LT Compressor 6 Safety	14
Sensori LT Compressor 7 Safety	15
Sensori LT Compressor 8 Safety	16
EM3550 Energy Meter	17

2. SENSORI™ CASE MANAGEMENT With VEV (M172-18 I/O)

STATUS

Status Indication Screen SYMBOLS VISIBLE MEANS THAT STATE IS ACTIVE

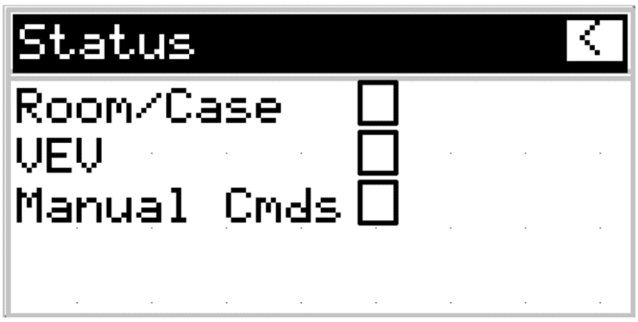


Man Dr – Manual Door Open Indication (*Refer to Manual Commands for Operation*)

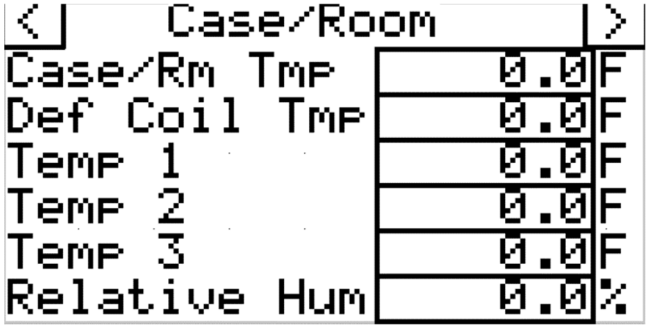
Sys Ena – System Enabled Indication: System enabled by Digital Input (*refer to wiring schematic*)

VEV Command active = Digital Output 5 active. This is used for a wired refrigeration command.

STATUS MENU SCREEN

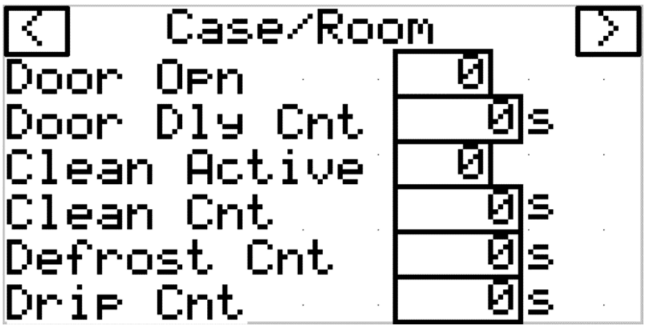


Case/Room Status Screen



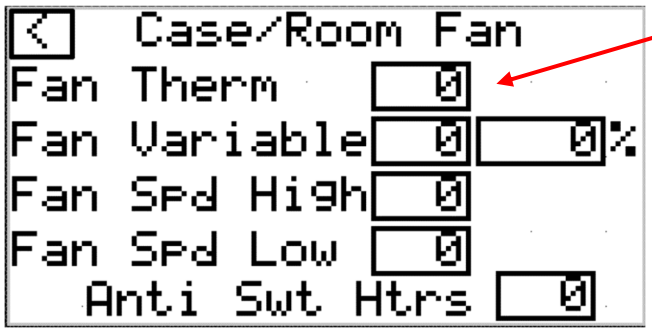
Relative Humidity only if present, 0 if not. Count Delays until **Defrost/Drip** expires based on time set in Setpoints menu.

Case/Rm Tmp – depending on number sensors and "Temp Rd Md" selected in Setpoints. This will show the combined method of case/product temps. If only one temp active, **Temp 1** will display the same, and all other temps will display 0.



Door Open: displays when physical Digital input (*Door Switch*) is active. **Door Delay** is based on time set in setpoints for open and close for counting.

Clean Active: displays when system in clean mode. **Clean Count** until clean has expired.



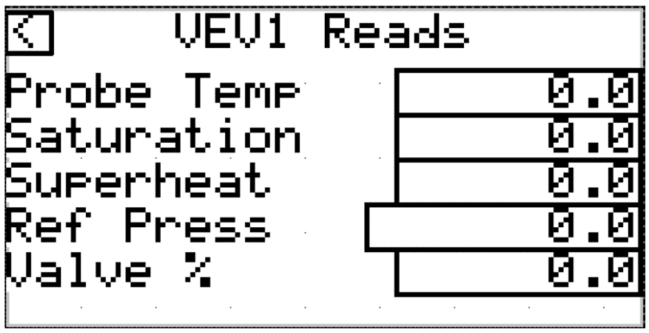
Evaporator **Fan Thermal** (*If Present*) – 1 = okay, 0 = Trip or not present (*Physical DI*)

Fan Variable Speed indicates if it is enabled and the percent active(*0-10vdc = 0-100%*)

Fan Speed High/Low Indication (*Further info in "Setpoints"*)

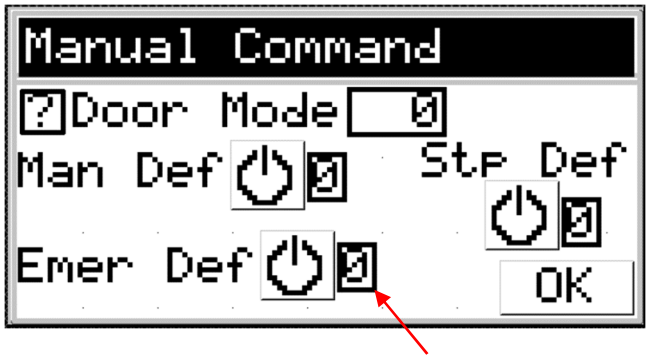
Anti Swt Htrs (Anti Sweat Heaters) – displays if heater is active (*Physical DO, see wiring schematic*). This is generally only used for door anti sweat heaters on a display case and is *currently not an option for the M172-42IO version.*

Vev Status



Refer to manual with EEV driver for more info on screen. (*Page 76*)

Manual Commands

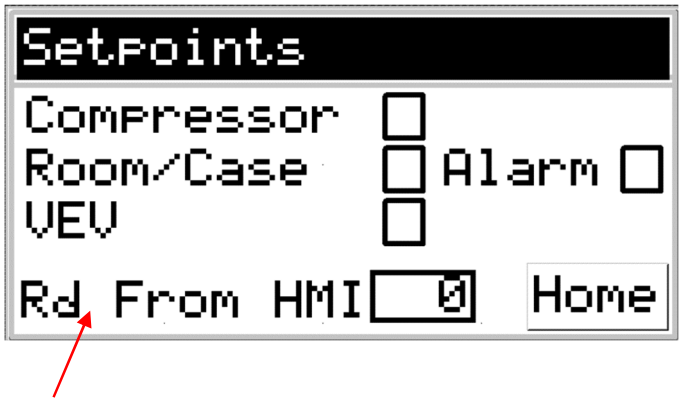


Push Button and indication for being active

Door Mode – 0 = Auto mode. This mode is waiting for the physical Door switch (DI), to be active before the count will start. When a count has expired, based on setpoints set for Door open/Close delays, the system will shut off.
1 = Manual Door open mode. Set this to 1 if system is to manually be shut down.

Manual Defrost – Listens to both time and defrost coil temperature, whichever comes first. Minimum defrost will be active.
Emergency Defrost – Only listens to the maximum time set in Setpoints menu. This will not look at defrost coil temp.
Stop Defrost – Can be used anytime the system automatically or manually is put into defrost. Drip time will occur after this is pressed.

SETPOINTS



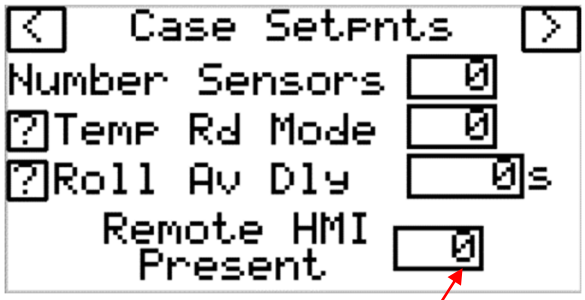
****NOTE: This value must be set to "0" if setpoint changes (that also have access from the remote HMI (DCL)) are being made. If Value is set to "0", certain setpoints will not allow you to change!!!****

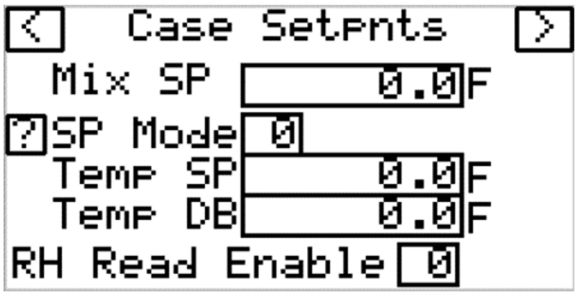
Refer to **Sensori Compressor Safety Manual** for Information on **Compressor** Setpoints.

Refer to **Sensori Safety and VEV Manual** for Information on **VEV** Setpoints.

Case/Room Setpoints

Setpoints on both the M172-42IO and M172-18IO are the same, however, the screen configuration is different. The M172-18IO has added functions for **Number of Sensors** and **Anti Sweat Heaters**.





If using the M172DCL display HMI select 1. If no remote display is used, select 0 and reboot PLC! **THIS IS SET IN AN INITIALIZE TASK AND SYSTEM MUST HAVE POWER RESET IF SET TO 0.**

Number Sensors used for Selected Temp Rd Mode. ****4 Sensors Max for Case Control M172-42IO. 3 Sensors below Setpoint**

Temp Rd Mode

0 = Actual Average Value (No Roll Average)
1 = Average (Roll)
2 = Max (Roll)
3 = Min (Roll)
4 = Mix (Roll) *MUST ONLY SELECT 2 SENSORS*
*Mix Temperature used primarily with a Product Temperature probe. Set Mix Setpoint to the % of Probe Read 2 (*Product*) for which the combined temperature will use to read for Control Temp.
Example:

Temp Rd 1 (Room Temp) = 40F
Temp Rd 2 (Product) = 50F
Mix SP = 25%
Value Out Combined = 42.5F

Roll Average Delay used for smoothing out quick temperature variations. Set delay for a smooth "Roll" into temperature change.

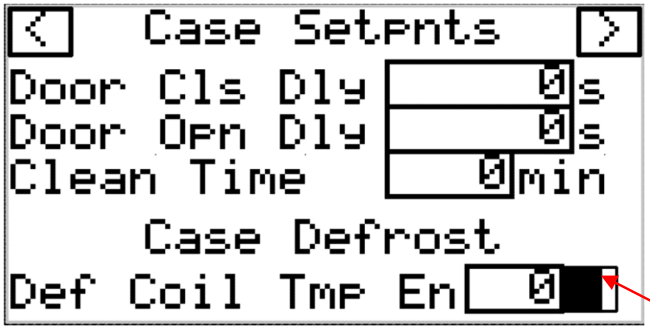
Mix SP When "Temp Rd Mode" = 4

Setpoint Mode

0 = Deadband is Centered of Setpoint
1 = Deadband is equally above and **Max for Case Control 18IO****
2 = Setpoint plus Deadband
3 = Setpoint minus Deadband

Relative Humidity only if using. This is read out only and has no effect on system operation.

This will indicate a failed sensor alarm and flash the red LED if open.

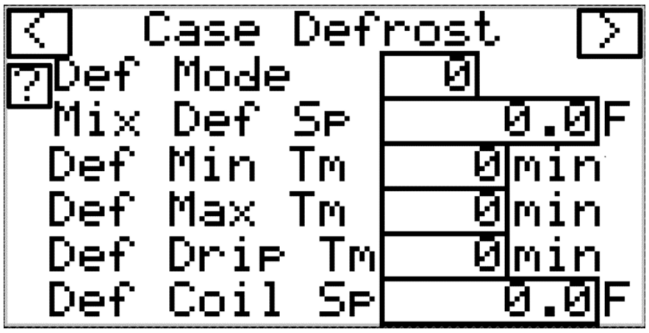


Set to 1 if a Defrost Coil Temperature is being used.

Door Delays – Set delays in seconds. When Door open Delay has expired its set time, the system will turn off the compressor and fans, and a door open will appear on both the status screen and home screen of the remote HMI (*if used*).

Door Open = Digital Input is TRUE/active state. When the door is closed (*DI open*) and **Door Cls Dly** has expired its time delay set, the system returns to normal operation. At any point during the count, the door changes state, we resume our normal running state. Defrost is still active when the door is open. This is to insure we do not miss a defrost cycle.

Clean Time – amount of time the system will be in clean mode, when either the Digital Input is True/active, or the manual pushbutton on the DCL remote HMI is pressed.

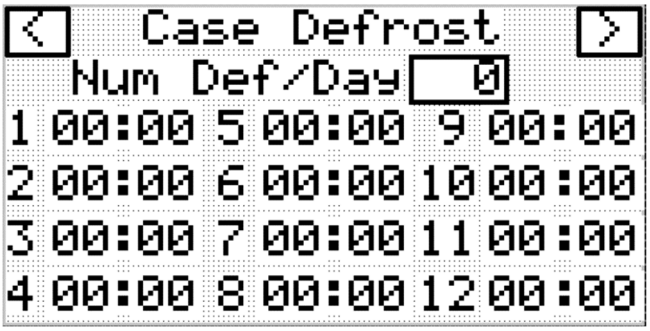


Defrost Mode

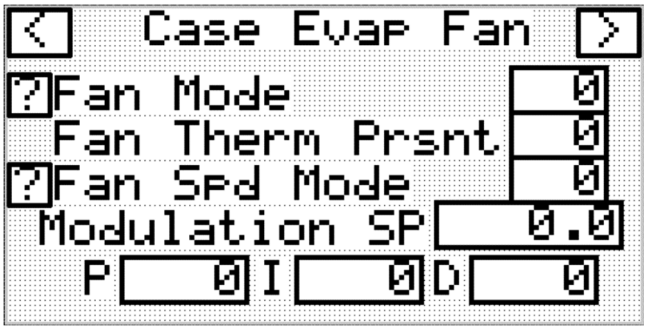
0 = Positive Defrost (Electric, Hot Gas, Etc)
1 = Air Defrost
2 = Mixed Defrost

Mixed Defrost – Used for increase energy savings.
Set **Mix Def SP** to desired setpoint at which the system will use this value to enable air/electric defrost. If the Case temperature (*combined value if applicable*) is above or equal to the **Mix Def SP**, the system will activate air defrost. If below, the system will activate electric defrost. **** USE ONLY IN MEDIUM/HIGH TEMP APPLICATIONS! ****

Defrost Minimum Time – Minimum time the system will be in defrost when either manually activated or automatically through scheduled times. (Set in minutes)
Defrost Maximum Time – Maximum time the system will be in defrost when either manually activated or automatically through scheduled times. (Set in minutes)
Defrost Drip Time – Time that the system is in "Drip" mode, no Cooling active. Evaporator Fans will be off in this mode unless air defrost is active.
Defrost Coil Termination Setpoint – Setpoint at which system will terminate defrost when value is reached. Minimum Defrost time must be reached before this is true.

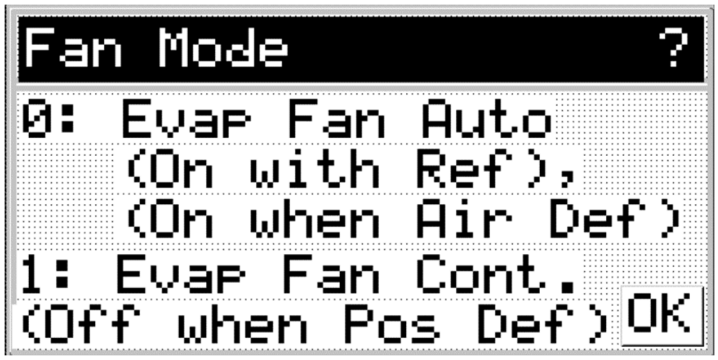


Number Defrosts per Day - Select how many defrosts will be active per day (maximum 12). If "4" is selected, then system will only listen to times 1-4. If "8" is selected, then system will only listen to times 1-8.

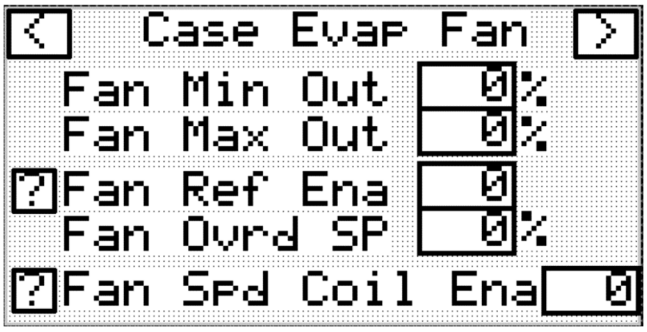


Fan Mode

0: Evaporator Fan Auto
1: Evaporator Fan Continuous



Fan Thermal Present – Set to 1 if Evaporator Thermals are present. (*See wiring schematic for DI, On= system ok*) If no thermals are used, set value to 0. Alarm will be activated if set to 1 and the Evaporator fan thermal switch is not closed.



Fan Speed Mode (*see wiring schematic*)
0: Modulating Fan
1: Two Speed Fan

0 : MODULATION

If Modulation is selected, Then the evaporator Fan will be controlled from a 0-10vdc signal out from the Sensori. This will be based on either Room Temperature or Coil Temperature.

Values that Correspond to Modulation

Fan Speed Setpoint: Used For "PID" to modulate to maintain.
Proportional Band(P)
Integral Time (I)
Derivative Time (D)

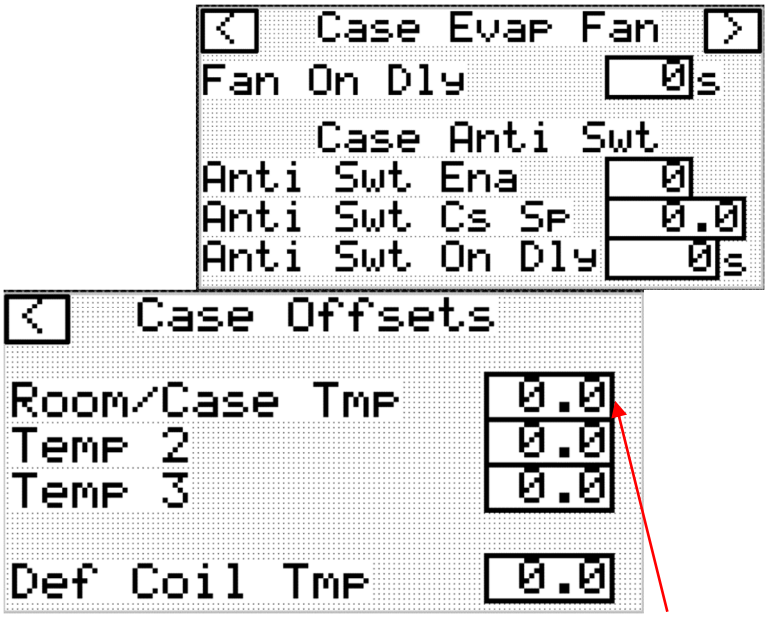
Fan Minimum Percent Out – Minimum percentage that the fan will run.
Fan Maximum Percent Out – Maximum percentage that the fan will run.
Fan Refrigeration Enable – If set to 1, Fan will override PID and run at "Fan Override Setpoint" value, when Cooling is active. If set to 0, the value will be based on PID only.
**** IF "Fan Refrigeration Enable" IS SET TO 0, PRECAUTION MUST BE TAKEN WHEN MINIMUM PERCENTAGE IS SELECTED, THAT THE COIL WILL NOT FREEZE WHEN COOLING IS ACTIVATED!!****
Fan Override Setpoint: Set this value if "Fan Refrigeration Enable" is set to 1. When Cool is active, this will be the override value the fan will run.
Fan Speed Coil Enable –

0: Case/Room Temperature to control fan speed (Combined value is applicable).

1: Evaporator Coil Temperature (same probe as defrost termination temperature) Only set to 1 if "**Def Coil Tmp En**" is enabled.

1 : TWO SPEED

If "Fan Speed Mode" is set to 1, Fan speed high will be active when Cool is active. Fan Speed Low will be active when there is no call for cooling. (*See wiring schematic for normally open and closed contacts*)



Temperature 1(AI1), NOT combined.

Fan On Delay – When Evaporator Fan is initially activated, it will delay for set time. Set this value low when using EXV to avoid valve from closing fully. If set to long on the M172-**42IO**, system could trip on low pressure. (0-45 SECONDS MAX)

Case Antisweat Heaters – (*Only an option on the M172-18IO model)*

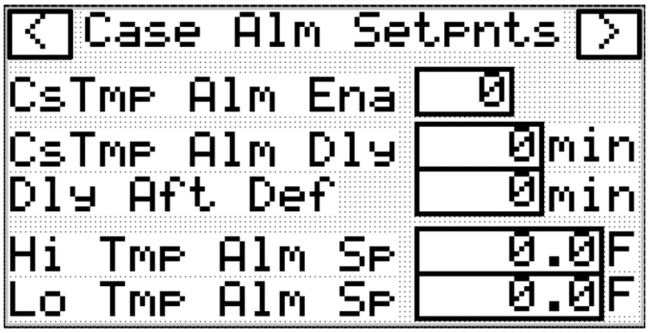
NOTE: This function only listens to Case/Room Temp AI1. NOT combined if more than 1 sensor present!

Antisweat Enable – Set to 1 is Antisweat Heaters are used.

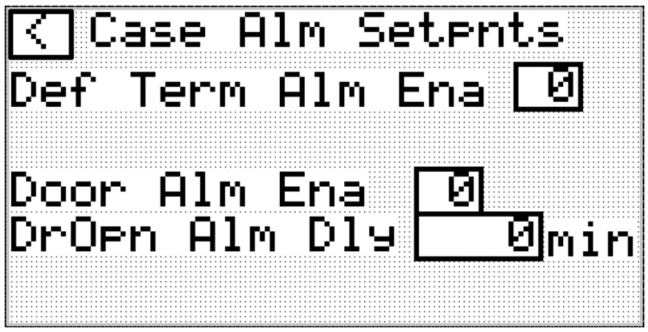
Antisweat case setpoint – Select setpoint value at which the heaters turn on. (Less than or equal to Setpoint = Heaters activated. Greater than Setpoint = Heaters deactivated)

Antisweat On Delay – Heaters will be delayed becoming active until value reached (seconds)

Alarm setpoints



Case Temp Alarm Enable – Set to 1 if monitoring temperature for alarm state using the **High and Low Temp alarm setpoints**.
When system initially terminates defrost mode, the **Cs Tmp Alm Dly** does not start to count until the **Dly Aft Def** time has been reached.



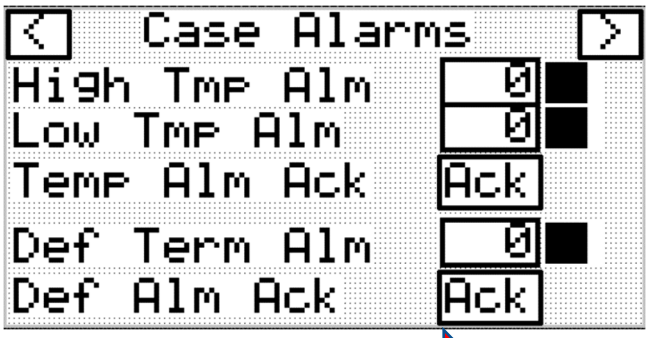
Defrost Termination Alarm Ena – Set to 1 if alarm is being used. If a coil temperature is present and maximum time is reached/do not terminate based on Coil temperature setpoint, in defrost, this alarm will be active.
Door Alarm Enable – Set to 1 if alarm is being used. If the "Door open" is true and the "**Dr Opn Alm Dly**" time has expired, this alarm will be active.

****NOTE:** When a door alarm becomes active, the system will override the case management thinking that the door is closed! This is to avoid a prolonged period for the system to be off when the door is left open and saves product from going bad! If "**Door Alm Ena**" is set to 0, the system will be off when the door is open.**

ALARMS

*** M172-**18IO** SCREEN DOES NOT INCLUDE "COMPRESSOR" ***

Indicates what alarms are present.

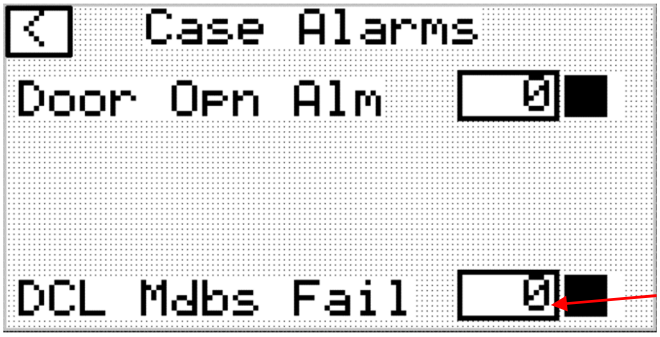


High Temperature Alarm
Low Temperature Alarm

Temperature Alarm Acknowledge Button: Eliminates alarm and starts count again if temperature above or below setpoint.

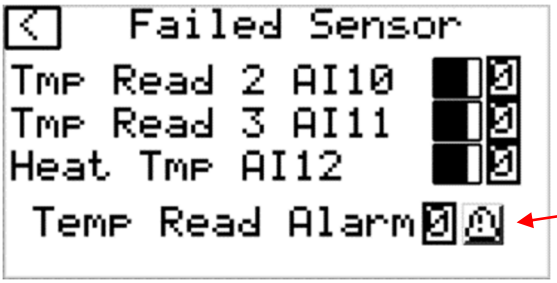
Defrost Termination Alarm – *see above*, "**Alarm Setpoints**". **Defrost Alarm Acknowledge**

****NOTE: No Alarm Acknowledges can be made from the Local Case management Sensori screen if the Remote HMI/DCL has access. Control must be taken from Remote. See above "Setpoints".**



Door Open Alarm: See above, "***Alarm Setpoints***".

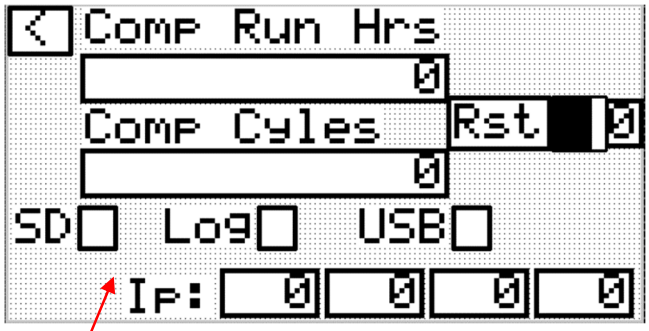
Remote **HMI/DCL Modbus com error**



Temp Read Alarm Indicates failed sensor for "Tmp Reads" when selecting "Number of Sensors". Also, can indicate if "Temp Rd Mode" 4 is selected and number of sensors DOES NOT equal 2!

EXTENDED INFORMATION

*** M172-**18IO** SCREEN DOES NOT INCLUDE "COMPRESSOR" ***



Refer to **Sensori Compressor Safety Manual**" for more information.

Data Logging Inputs 18IO

1. Temperature 1(Room/Case)
2. Temperature 2
3. Temperature 3
4. Combined Temperature
5. Relative Humidity
6. Coil Temperature
7. Refrigeration active
8. Defrost Active
9. Evaporator Fan Active
10. Door Switch
11. Vev Command
12. Vev Error

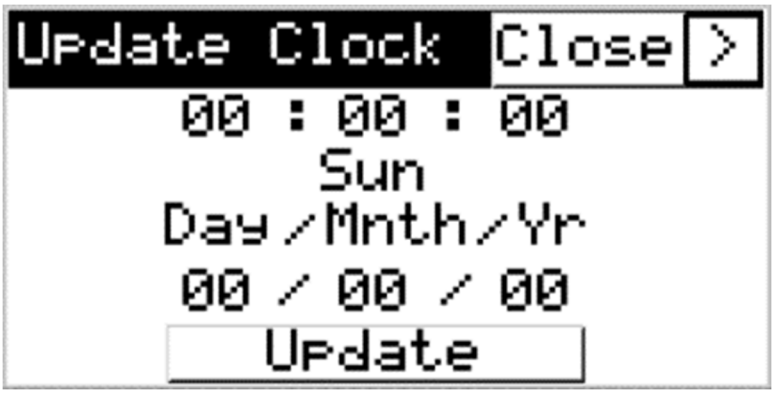
Example of Excel Data Sheet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Date Time	State	AI 1	AI 2	AI 3	AI 4	AI 5	AI 6	AI 7	AI 8	AI 9	AI 10	AI 11	AI 12
2	2018-06-14 12:59	1	71.1	0	0	0	71.1	71.4	0.1	0	0.1	0	0.1	25.6
3	2018-06-14 13:00	1	71.4	0	0	0	71.4	71.6	0.1	0	0.1	0	0.1	25.6
4	2018-06-14 13:01	1	71.3	0	0	0	71.3	71.6	0.1	0	0.1	0	0.1	25.6
5	2018-06-14 13:02	1	71.2	0	0	0	71.2	71.5	0.1	0	0.1	0	0.1	25.6
6	2018-06-14 13:03	1	71.1	0	0	0	71.1	71.4	0.1	0	0.1	0	0.1	25.6
7	2018-06-14 13:04	1	71.1	0	0	0	71.1	71.4	0.1	0	0.1	0	0.1	25.6
8	2018-06-14 13:05	1	71	0	0	0	71	71.3	0.1	0	0.1	0	0.1	25.6
9	2018-06-14 13:06	1	71	0	0	0	71	71.3	0.1	0	0.1	0	0.1	25.6
10	2018-06-14 13:07	1	71	0	0	0	71	71.3	0.1	0	0.1	0	0.1	25.6
11	2018-06-14 13:08	1	70.9	0	0	0	70.9	71.3	0.1	0	0.1	0	0.1	25.6
12	2018-06-14 13:09	1	70.9	0	0	0	70.9	71.3	0.1	0	0.1	0	0.1	25.6
13	2018-06-14 13:10	1	70.9	0	0	0	70.9	71.2	0.1	0	0.1	0	0.1	25.6
14	2018-06-14 13:11	1	70.9	0	0	0	70.9	71.2	0.1	0	0.1	0	0.1	25.6
15	2018-06-14 13:12	1	70.9	0	0	0	70.9	71.2	0.1	0	0.1	0	0.1	25.6

Commands are indicated as a “0.1” since written as an integer in program to extract. AI12 indicates a code error when any number is present based on the bit value that is indicating. All Logging deletes previous yearly.

Parameter USB Backup and Restore- Insert USB and select “**To**” to backup all Eeprom parameters/Setpoints in Sensori PLC. Recommended to leave copy on site with PLC in case of future problems. To Restore Setpoints into a new PLC, simply insert USB with backup file and select “**Frm**” Usb to input USB eeprom files.

RTC – Real Time Clock



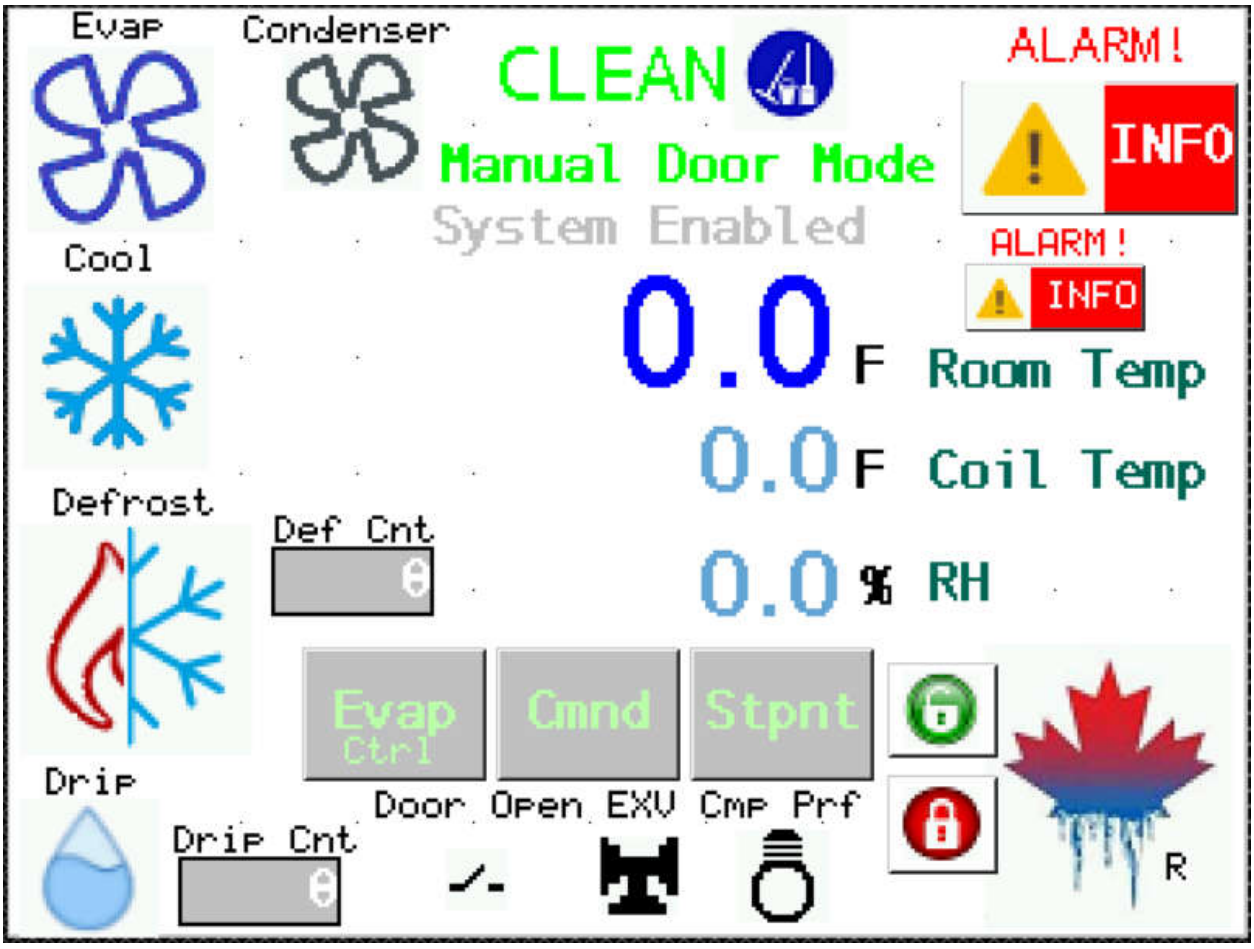
DAY/MONTH/YEAR

Set Real Time Clock for defrost to be accurate time settings!

0	No Time Zone specified	Daylight saving functionality is disabled.
1	Europe	Daylight saving functionality will start on last Sunday of March at 1:00 a.m. DST and end on last Sunday of October at 2:00 a.m.
2	US/Canada	Daylight saving functionality will start on second Sunday of March at 2:00 a.m. local time and end on first Sunday of November at 3:00 a.m.

M172DCL/HMI Remote Display

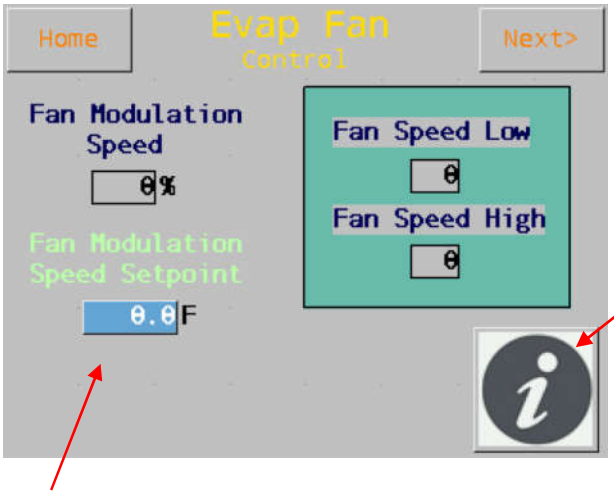
Home Screen: ONLY DISPLAYS WHAT IS ACTIVE



Green unlock button will open access to the following buttons.
Password is "**19**" and cannot be changed.
Pressing the Red lock will hide access to these buttons.

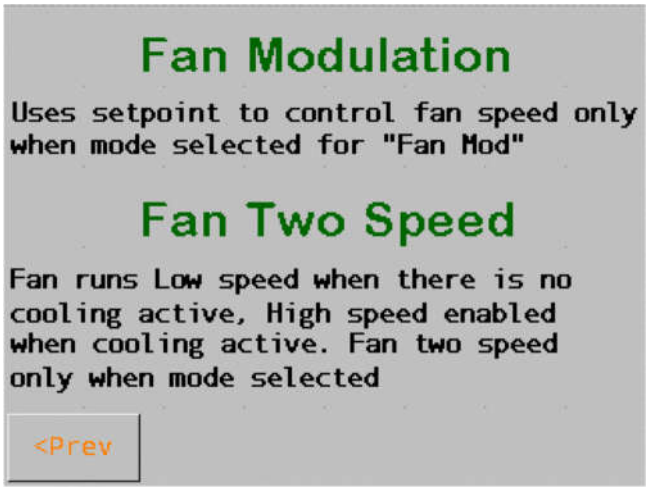
****NOTE: NO SETPOINTS, COMMANDS, OR CHANGES CAN BE MADE WHEN YOU ARE NOT READING FROM HMI, SELECTED IN SETPOINTS!!!** IF "Remote HMI Enabled" is reading "NO", only changes can be made from the Sensori Case Management PLC. If Set to "Yes" these changes can only be set from the HMI.**

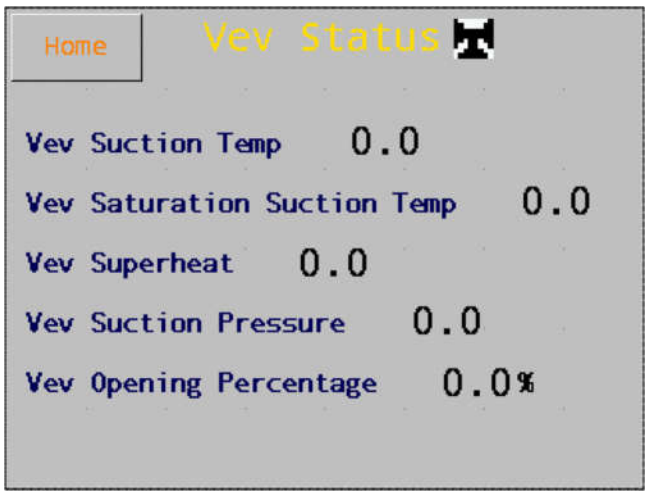
Evaporator Control



Information Button about Page (*See Picture Below*)

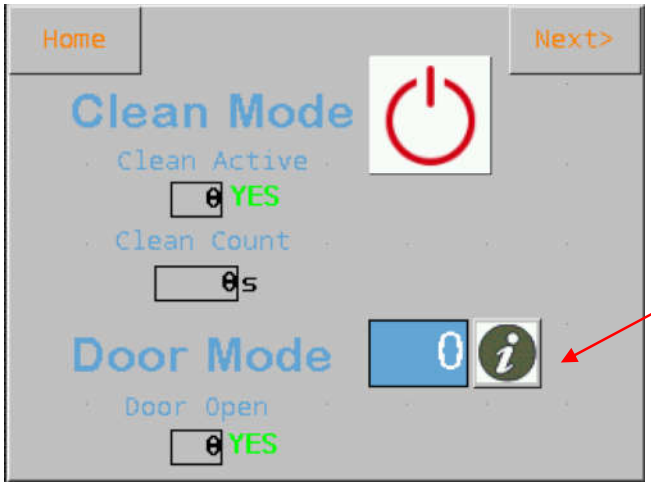
Fan Modulation Speed Setpoint can only be set/selected, when "Remote HMI Enabled" (*YES*)





Vev Status Screen will not change from Celsius or Fahrenheit based on using the HMI degree change. This will always show the same status as what the Sensori Case Management PLC is Showing from the VEV parameter, dL08.

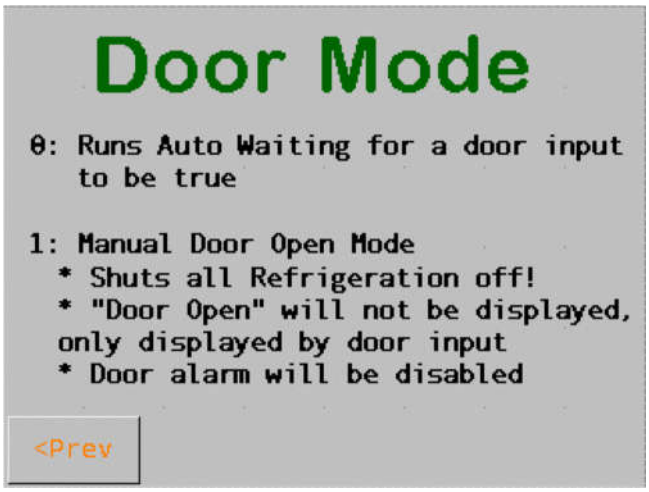
Commands



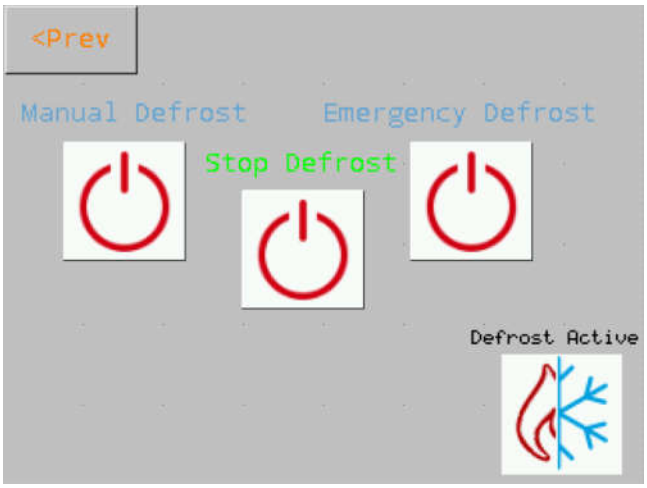
Information Button (*See Picture Below*)

Clean Mode Push Button will illuminate green when pressed and red after 4 seconds of being released. This will force the system into **Clean Mode** and count to time set from PLC.

****NOTE: IF READING FROM HMI, THIS BUTTON CAN BE ACTIVE, HOWEVER THE PHYSICAL DI CLEAN BUTTON WIRED IN WILL NOT WORK! AGAIN, ONLY ONE COMMAND CAN BE SENT! "REMOTE HMI ENABLED" MUST BE SET TO "NO" IF USING A REMOTE BUTTON INPUT.**

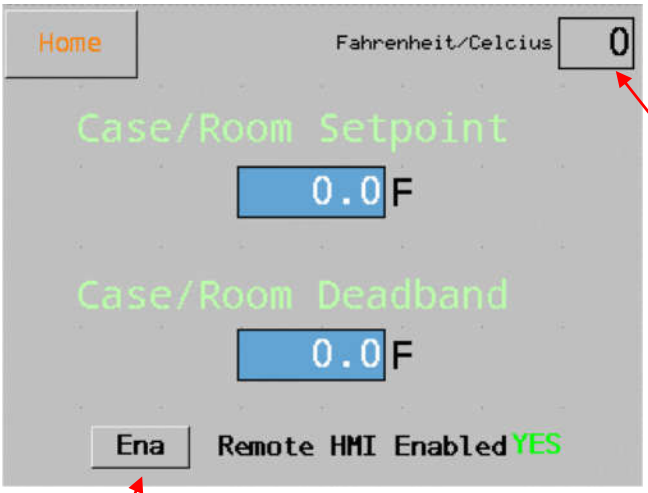


Door Mode – "**Door Open**" only displays from the physical DI door switch that is wired to PLC. This will not say that it is open if manual Door Mode is selected.



*See explanation of manual commands in **Sensori Case Management** (Section 2).*

****NOTE: NO COMMANDS CAN BE MADE WHEN YOU ARE NOT READING FROM HMI SELECTED IN SETPOINTS!!**



1 = Fahrenheit, 0 = Celsius (*see important note below*)

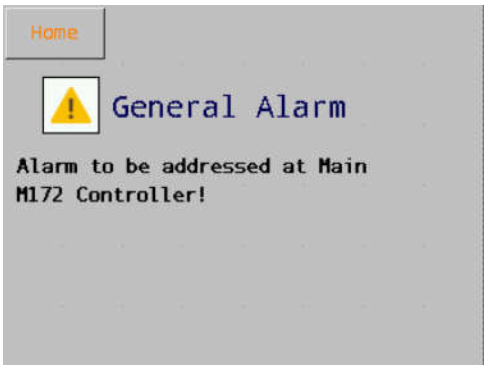
Once Enabled, this may only be removed by cycling power or taking control by the PLC!
If Remote HMI and Sensori Case Management have two different power sources and power is cycled on either unit, The **Remote HMI Enabled** always defaults to the Sensori Case Management PLC.

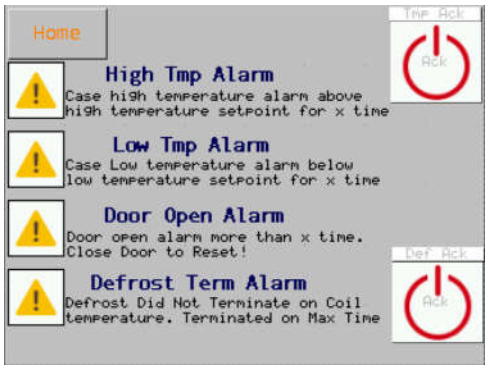
****IMPORTANT!!!**** When control is taken by the "DCL Display" (**Remote HMI Enabled = YES**), always make sure to set the **Case/Room Setpoint** AND **Case/Room Deadband** to CORRECT setpoint values when converting the Fahrenheit to Celsius and inverse! Taking control of the device and converting the values DOES NOT automatically convert setpoint changes, due to the control being at the display!

ALARMS

Large Alarm Button – Address at Sensori PLC (See Picture below)

Small Alarm Button – Can Acknowledge Alarms from Remote (See Picture below)





****NOTE: NO ALARM ACKNOWLEDGE CAN BE MADE WHEN YOU ARE NOT READING FROM HMI SELECTED IN SETPOINTS!!**

3. SENSORI™ COMPRESSOR SAFETY MANUAL

HOME PAGE

Using up and down arrows on Sensori, select one of the four menus and select "**ok.**"

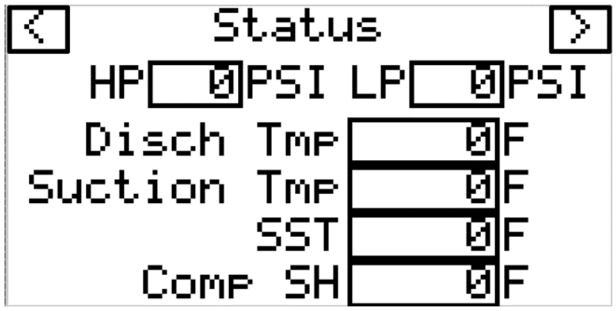
Simply select the next or previous arrow (**>**)/ (**<**) on the screen, to scroll through pages. At any given point that this is not an option, press and hold the left arrow on the Sensori to return to previous page.

1. Status
2. Setpoints
3. Alarms
4. Extended Information
5. RTC and Data logging

STATUS

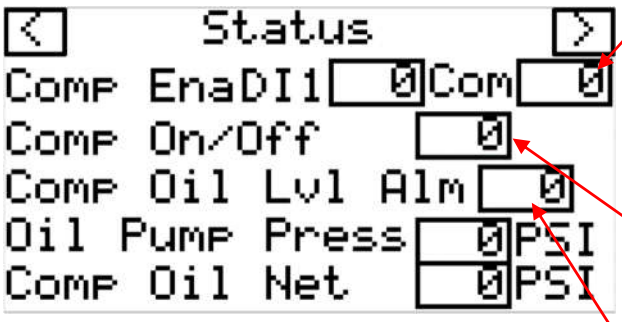
Page 1

High Pressure (Discharge Pressure), **Low Pressure** (Suction Pressure), **Discharge Temperature**, **Suction Temperature**, **SST** (Saturated Suction Temperature), **Compressor Superheat**



Page 2

Compressor Enable status (Digital Input or Communication Enable over Modbus), **Compressor On/Off** state, **Compressor Oil level Alarm** state, Compressor **Oil Pump Pressure** (status to read 0 if Oil Pump Bypass is set to 1), **Compressor Oil Net Pressure**.



Communication Enable, used over Modbus protocol RS-485. This is only used when a Compressor Management Device is present. *See "**Sensori Compressor Management**" for further details*.

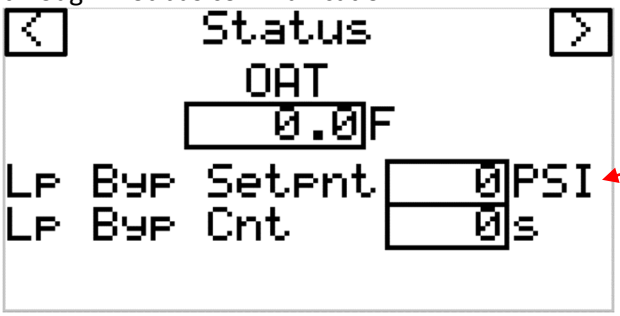
Compressor Physical Digital Output 1 (DO1) – *See wiring schematic*.

Compressor Oil Level Alarm Shows value of Physical Digital Input 2. (DI2)- *See wiring schematic*.

Page 3

Outdoor Air Temperature (*Only shows value when Low Pressure Bypass is enabled or through communication of Sensori Management, see below "Setpoints"*), **Low Pressure Bypass Current Setpoint** (*This value changes depending on ambient temperature*)**, Low Pressure Bypass Count**.

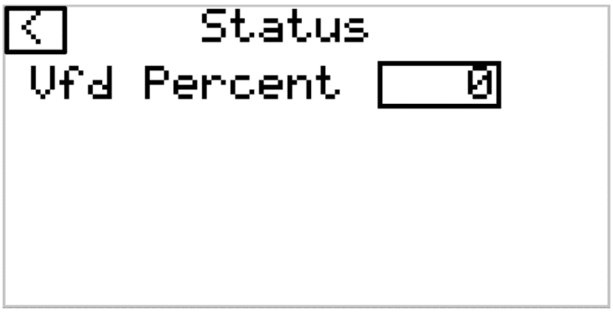
NOTE: When connected to Sensori Management (Oxford LPP System), Outdoor Air Temperature is through Modbus communication.



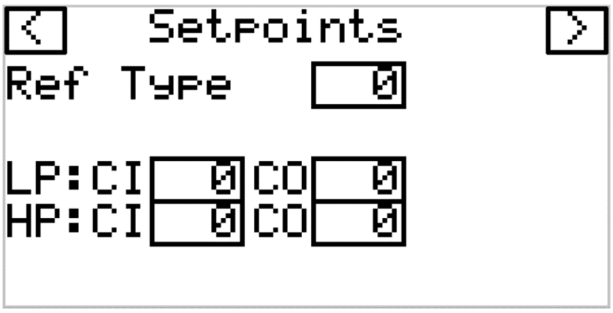
See Below "Setpoints" For Description of how LP Bypass works.

Page 4

Variable Frequency Drive Percentage. This is only used when a Compressor Management Device is present. *See "**Sensori Compressor Management**" for further details*.



SETPOINTS

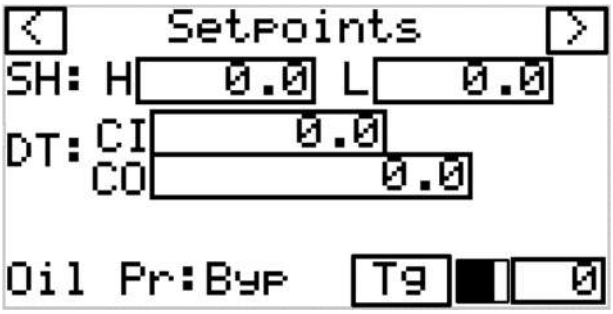


LP: Cut In, Cut out – Set low pressure cut out setting at which the compressor must shut off for a low side safety. Select the cut in for what the pressure must build to, before the compressor switches back on after the set delays) **DEFAULT: CUT IN=20PSI, CUT OUT=5PSI**

HP: Cut in, Cut out – Set the **High Pressure cut out** setting at which the compressor must shut off for a high side safety. The **cut in** value must be set at which the compressor will be able to be reset at. Set this value where the compressor can be reset by a technician. If in a state of "Trip", the high side pressure must be below the cut in value in order to be manually reset in "Alarms". **DEFAULT: CUT IN=250PSI, CUT OUT=375PSI**

Refrigerant Type – **Select which refrigerant** is being used 1-24. 255 is Custom(R515B). **Default=2(R404a)**

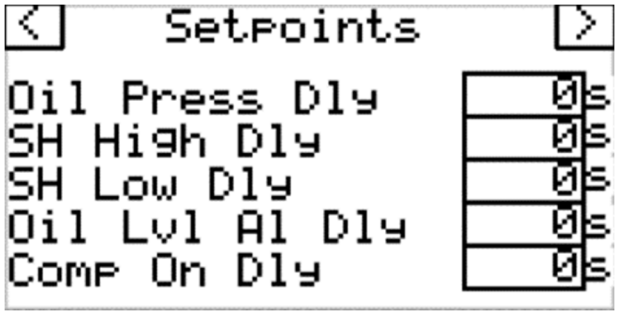
0 = R22
1 = R134a
2 = R404A
3 = R407C
4 = R410A
5 = R407A
6 = R407F
7 = R290
8 = R507A
9 = R717
10 = R723
11 = R1234ze
12 = R744
13 = R448A
14 = R427A
15 = R450(N13)
16 = R513A
17 = R449A
18 = R1234yf
19 = R454B
20 = R454C
21 = R455A
22 = R434A
23 = R442A
24 = R32
255 = R515B



Suction SH: High, Low – Range 0-50F. **Superheat High** is the value at which you want to protect the compressor from overheating. Overheating the compressor occurs above 20F and RE and efficiency is lost. **Superheat Low** must be set to protect the compressor from flood back. ***An initial delay If High Superheat or Low Superheat, is 60 seconds before it listens to the settable High and low Superheat Delays.*** **DEFAULT: HIGH=30F, LOW=0F**

DT: Cut in, Cut out – **Discharge Temperature cut out** must be set at which the compressor will shut down if too hot. Exceeding 225F discharge temperature can result in carbonation and oil breakdown. Set the **Cut in** value at which the compressor must be cooled down to before the compressor will be able to start, after the manual reset. **DEFAULT: CUT IN=150F, CUT OUT=200F**

Oil Pressure Bypass – Set this value to **0** using "toggle" if an oil pump is present. **Default=1 (No Oil Pump present)**



Oil Pressure Delay – Set this value only if "Oil Pressure Bypass" is set to **0**. This will be an oil net pressure delay. When the compressor is initially on, this will be set to a time at which it will count before the compressor alarms, if the net pressure does not exceed 10psi. On initial compressor start (*DI1=TRUE*), The value will count regardless of the net pressure. After the time has expired at any given point, if the net pressure is <10PSI, the compressor will trip an alarm immediately. This must be manually reset. Value set in seconds. **DEFAULT=90 seconds**

Superheat High and Low Delay – Delay that must expire after the "Superheat high" or "Superheat Low" has been reached, before an alarm is triggered, and compressor will switch to off. **An initial delay If High Superheat or Low superheat, is 60 seconds before it listens to the settable High and low Superheat Delays.** Value set in seconds. **DEFAULT=600 seconds HIGH, 300 seconds LOW**

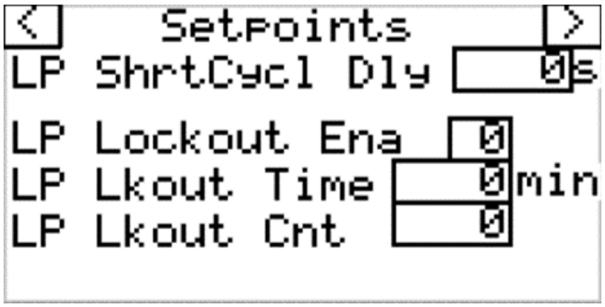
Oil Level Alarm Delay – Delay that must expire after the oil level alarm input is true, before an alarm if triggered, and compressor will switch to off. When using Emerson's OMB Electronic Oil Level Managing System, be sure to set this delay long enough to allow the OMB to reset and not lockout Sensori. See below for Emerson's LED Codes and Alarm Delays on OMB. Value set in seconds. **DEFAULT=300 seconds**

LED Codes When Lit:

Green – 24 VAC power is supplied to OMB.
Yellow – Float sensor determined that the oil level has been below ½ sight glass for over 10 seconds. Fill solenoid has been activated.
Red (continually lit) – Oil level has remained below ½ sight glass for over two minutes after fill solenoid has been activated. Alarm has been activated and compressor is prevented from operating until oil level reaches ½ sight glass when alarm automatically resets.
Red (flashing) – There have been five auto reset alarms registered within a 30 minute period. Alarm circuit is now locked on and compressor locked off. Fill solenoid is de-energized. Alarm remains locked in until 24 VAC power lead is manually unplugged and again plugged back into device.

Compressor on Delay – **Delay set to stage compressors** (if more than one) in an event of a power cycle, or simply to add a compressor delay when called to be enabled. Value set in seconds.

NOTE: When the compressor on delay is set, the oil level alarm, and delay and oil pressure alarm delay Must be compensated for(Ex. If a 90 second delay for oil pressure is needed, and a 5 second compressor on delay is set, the oil pressure must be set to 95 seconds.) It Is Recommended to only use this delay when multiple compressors are used to prevent big inrush on a power cycle. (*Example. Rack systems, Tandom Chillers, Etc.*) **DEFAULT=0 seconds**

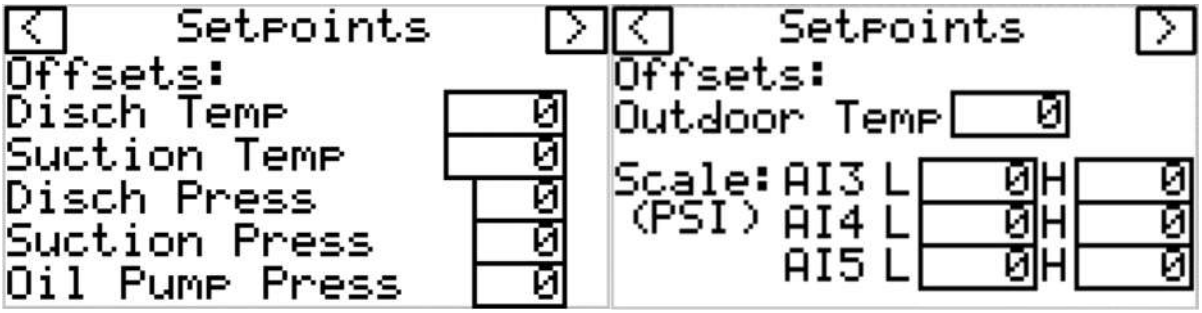


LP Short Cycle Delay- Delay at which the compressor will be off for, after the "cut in" value was reached. Set this value to avoid compressor start/stops on a low-pressure alarm. Value set in seconds. **DEFAULT=180 seconds**

LP Lockout Ena – Set value of "**1**" if enabling this function. Low Pressure Lockout requires a manual reset to happen when this function is enabled when a compressor trips the "LP Lockout Count" times within the "LP Lockout Time" value set.
LP Lockout Time – Set The time allotted for a low-pressure Lockout instance based on the count.
LP Lockout Count – Amount of times allowed for a trip instance before a full lockout exists.
Example: "LP Lockout Ena" = **1**
"LP Lkout Time" = **60min**
"LP Lkout Cnt" = **3**

Compressor Trips on low pressure (1 count). After 5 min the pressure builds in system to make the cut in setpoint and starts to time LP ShrtCycl Dly. The 3 min expires, and it tries to run, however trips again (2 count). Pressure builds after 5 min to make the cut in setpoint. System attempts to run for a third time (3 counts), and it trips low pressure again. It has now tripped 3 counts within 60 minutes and the system is off waiting for a manual reset to happen.

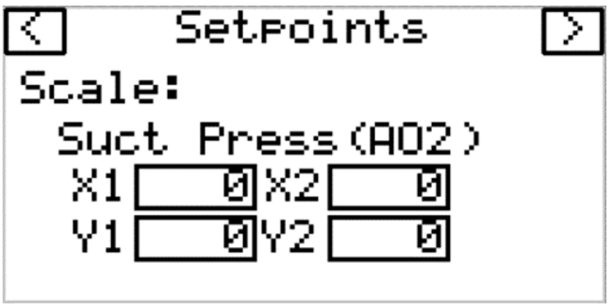
NOTE: When using OLPP system and connected to the HMI using SCADA, enabling this function will NOT email a low-pressure alarm unless it is in lockout state.



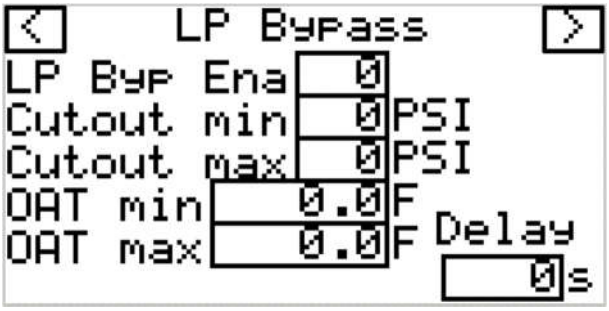
Offsets - Discharge Temperature, Suction Temperature, Discharge Pressure, Suction Pressure, Oil Pump Pressure, Outdoor Temperature.

Temperature offsets are to the decimal. Ex. For every 10, we change our temperature to 1F. Pressure offsets are 1 to 1.

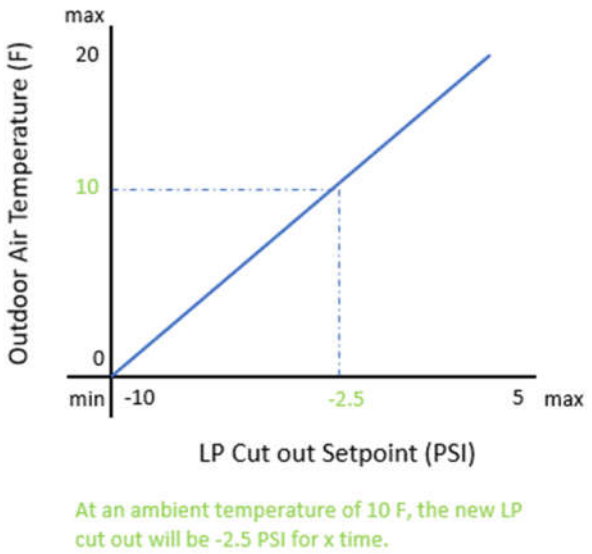
Scale - Scaling for pressure transducers analog input 3,4,5. *Must be a 4-20mA Pressure sensor*. Set scaling in PSI.

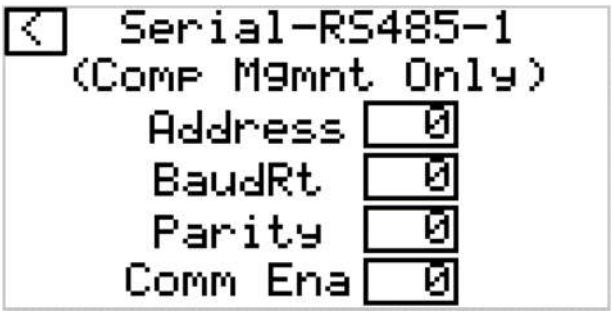


Scale - Scaling for Analog Output 1 and 2 for Discharge / Suction Pressure Out. 0-5vdc output only. Set "**X**" as Pressure scaling in REAL value. Set "**Y**" as voltage scaling in integer format (*ex. 500 = 5vdc*)
*AO1 is preconfigured for a 0-10vdc output when using Compressor Safety for Modbus to Oxford LPP Sensori Management to control Compressor Speed 0-100%. This AO1 Scaling cannot be changed on Sensori Compressor Safety, **ONLY** for Compressor Safety with VEV!



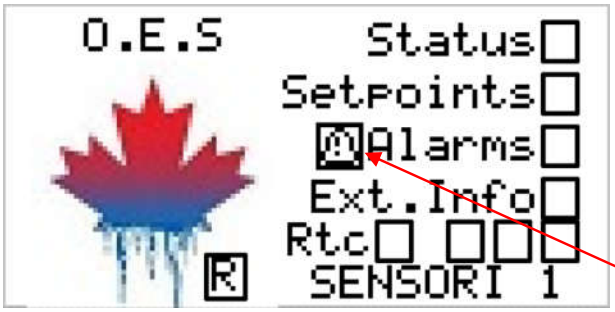
LP Bypass - Use this function if problems occur in winter for initial starts. Set "**LP Byp Ena**" to value of **1** if using this function, and a value of **0** if using only the low pressure cut out setpoint that was set previous. This function is used mostly with low pressure refrigerants such as R513a, to offset the low pressure cut out. This function uses a linear graph to offset the cut out value depending on the outdoor air temperature min and max set. Set your "**Cut out min**" and "**Cut out max**" as a linear scaling reference setpoint. Set the "**Delay**" in seconds for how long the cut out value will be present for during initial start up. See below graph for example. **Default Values: LP Byp Ena=0, Cutout min=-10PSI, cutout max= 5PSI, OAT min=0F, OAT max=20F, Delay=60 seconds**





Serial Communication- RS485 – Set "**Comm Ena**" to value of **1** when using this device with the Sensori Compressor Management, otherwise keep value to **0** or an alarm will occur. Set **Address** to the number the compressor will be. *Example, Compressor 1= address 1, compressor 2= address 2, etc.* Do Not Change **Baudrate** and **Parity** settings! **Keep Both Values at 2**. **Baudrate=38400, Parity = Even.**

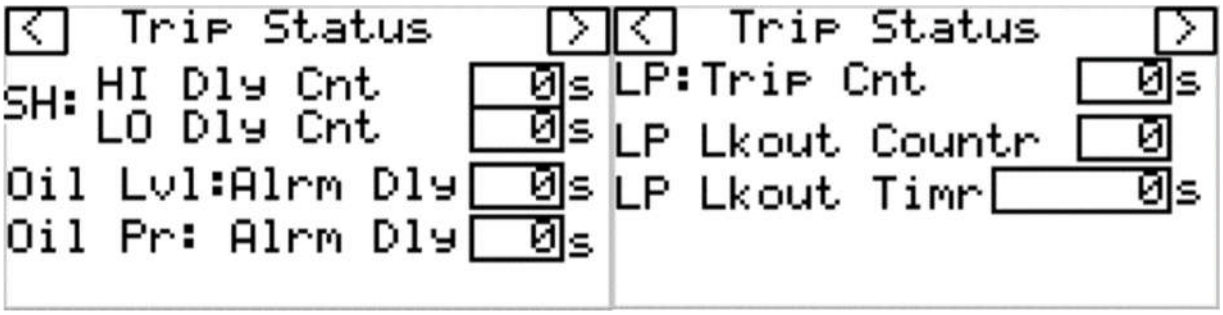
ALARMS



Indication of an alarm present!

All **Manual Resets** located on first screen. **High Pressure**, **Discharge Temperature**, **Oil Pressure**, **Superheat High** and **Low**. These resets indicate beside "*toggle*" an indication of a trip status using the true value of **1**. **0** indicates no alarm present. The "*toggle*" will also be highlighted black in a state of alarm.

Low pressure, and **oil level alarm** status is shown the same as mentioned above, however no "*toggle*" manual reset is required. Low pressure is always auto reset with settable individual time delay. See next screen to see state of delay for reset count. The oil level alarm input must be false to restart the compressor when a lockout has occurred. When using Emerson's OMB Electronic Oil Level Managing System, simply unplug the power connector to the device and plug it back.



SH(Superheat) High and Low delay Count- Delay Count, that was set in Setpoints, before we trip an alarm. If SH High or Low value is reached, this time must expire before we alarm and wait for manual reset.

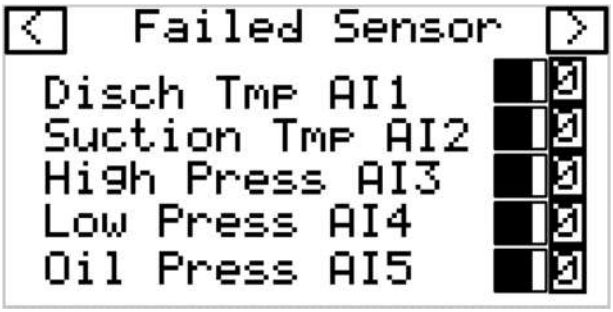
Oil Level Alarm Delay- Delay Count, that was set in Setpoints, before we trip an alarm. When this input is true, the count must expire before we lockout and alarm. This is reset only by resetting the alarm at the oil level device.

Oil Pressure Alarm Delay - Delay Count before we trip an alarm, if the oil net pressure is not greater than 10psig for the settable time limit that was set in Setpoints.

LP Trip Count- Counting of the low pressure short cycle delay, that was set in Setpoints, before the compressor will restart after the expired time.

LP Lockout Counter – Number of Counts recorded within the LP Lockout time set, when a low pressure trip occurs. Only Displayed if "Low Pressure Lockout Ena" = 1.

LP Lockout Timer – Time count in seconds. If Low Pressure Lockout is enabled and a trip occurs, this variable will begin to count until the setpoint time expires OR reaches total number of trip counts allowed.



Displays/Indicates a failed sensor and which analog input it is. If oil pressure is not present and no sensor is installed, the value will remain to **0**, and no alarm will be present. If Low Pressure Bypass function is not used, this value will also remain **0** with no sensor installed.

If a **Comm Error** occurs, check wiring of both the Sensori Safety and Management controls. It is important to install the **120-ohm resistors** where properly indicated. *See wiring schematics*.

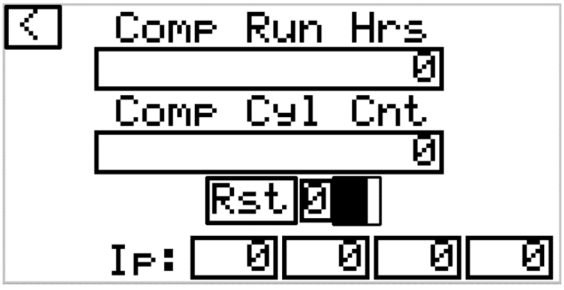
EXTENDED INFORMATION

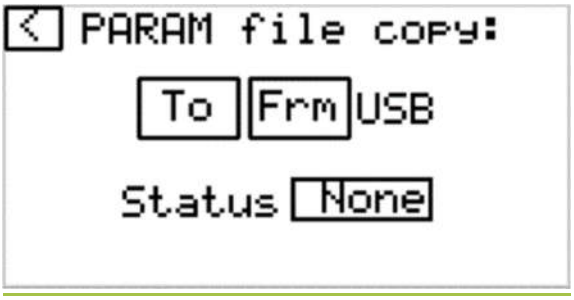
IP Address can be changed. **This address is default by 192.168.2.173**

Compressor Running Hours Clock

Compressor Cycle Rate Counter Note: Clock and Counter are based on Comp Output with no alarm

Reset- Resets both Compressor Running Hours Clock and Compressor Cycle Rate Counter





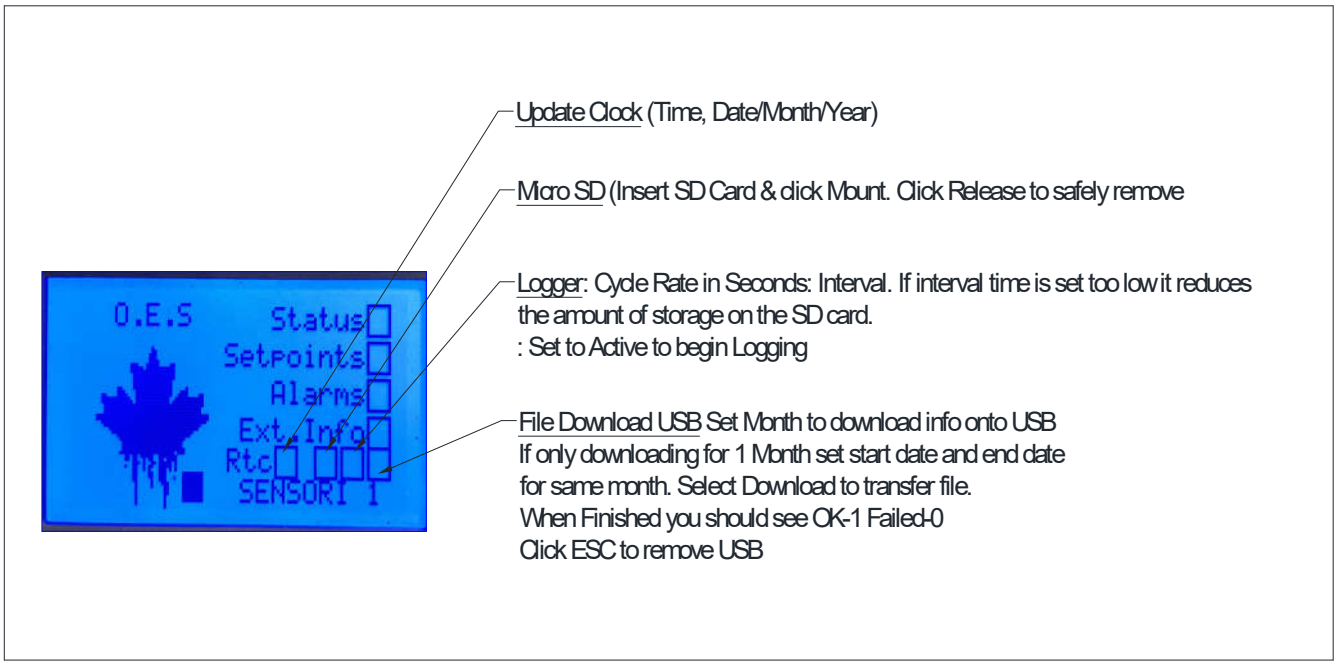
Parameter USB Backup and Restore. Insert USB and select “To” to backup all Eeprom parameters/Setpoints in Sensori PLC. Recommended to leave copy on site with PLC in case of future problems. To Restore Setpoints into a new PLC, simply insert USB with backup file and select “Frm” Usb to input USB eeprom files.

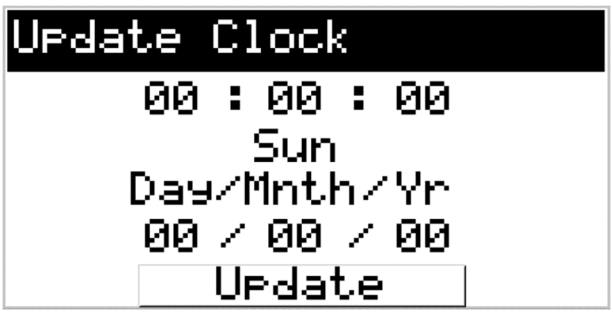
Data Log

To start Data logging a micro-USB must be inserted, and "**Mount**" must be selected on the "**Micro SD**" page indicated below. Use USB to pull select info by the month.

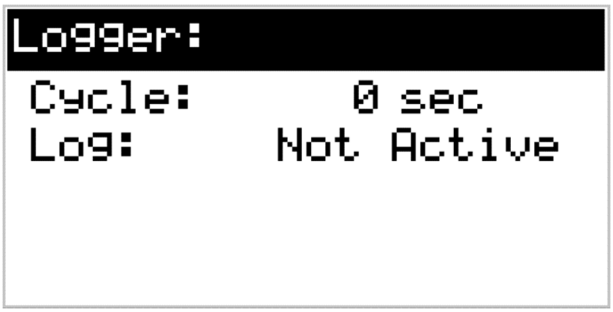
Safely Remove SD to Pull All Data. (**CAN LOSE ALL DATA if SD Card not removed safely**)

When LED blinks Yellow, it pulls info for logging from interval set, open info in Excel file, Data can be converted into graph.





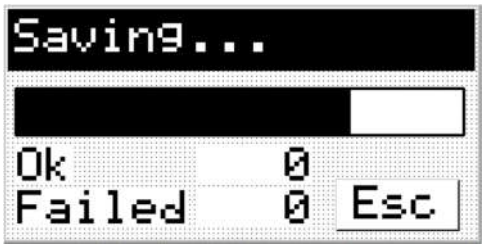
Updating the RTC is important when pulling data from the device. This will make it easy to trace a specific time and date at which an error has occurred in the system.



Set "**Log**" to active to start trending the below data every **x** seconds set in the "**Cycle**". The Data will automatically be overwritten every 365 days!

When viewing data in Excel, below are the column references.

AI1 - Disch Temp	AI7 - Oil Net Press
AI2 - Disch Press	AI8 - Low Press Alarm
AI3 - Suction Press	AI9 - Comp Run Hrs
AI4 - Oil Press	A10 - Comp Cycle Rate
AI5 - Oil Level Alarm	A11 - Comp Enable
AI6 - Comp Suct SH	A12 - Suction Temp



Select the **start** and **end date** at which you want to pull the above data to a USB. Set the same start and end date to pull data for that month. **OK = 1** means the data was successfully transferred to the USB.

For Website

Website > IP Address> Password

User is **administrator**

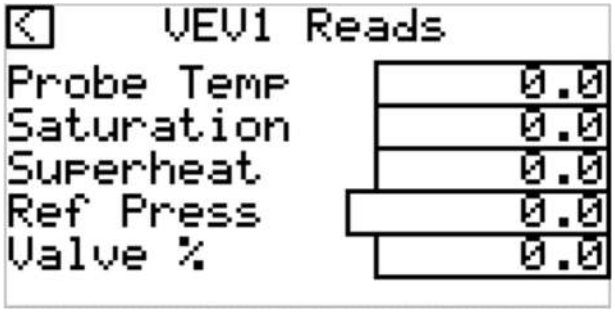
Login **password**

Password for Pages **19**

TO ACCESS FROM PHONE- use Schneider Wi-Fi Dongle, *Password is on back beside battery*.

Note: If you encounter problems you may need to clear Browser History.

4. VEV Driver



Probe temp – Temperature probe located on suction line at outlet of evaporator as installed by contractor.

Saturation – The SST of the selected refrigerant based on its current pressure.

Superheat – The calculated superheat in real time

Ref Press – The pressure of the suction line where the suction line transducer was installed by contractor.

Valve % – EXV valve operating % in real time.

SETPOINTS

***NOT ALL SETPOINTS ARE ACCESSIBLE FROM THE M172 SENSORI CONTROL.**
Setpoints that need to be changed that are not listed below MUST be changed using the TM171DLED Terminal.

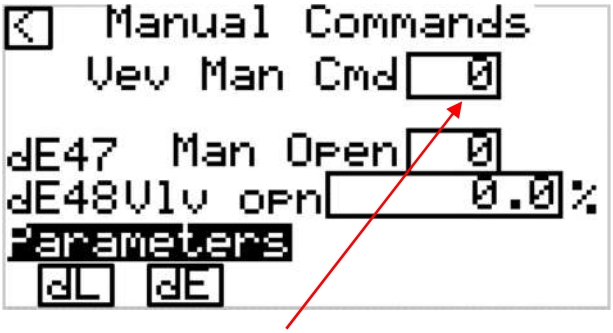
See **Schneider's Manual (Modicon M171 EEV)** for more information and selection of setpoints.
It is not recommended changing the PID settings, as this has been tested on multiple applications. The preconfigured PID settings (dE21) may be changed for desired applications and easier to work with as there are plenty options for speed and response times.

***NOTE:** Certain Parameters require a power cycle/Reset to the device for the change to take effect and save. Refer to Schneider's Manual to see list of parameters that need to be reset.

CIRCUIT MANAGEMENT AND VEV

To manually open the valve using parameters **dE47** and **dE48**, DI1 MUST BE ON/TRUE.

If no command is sent to this device from external source, the simulation mode will give you ability to control the valve manually.



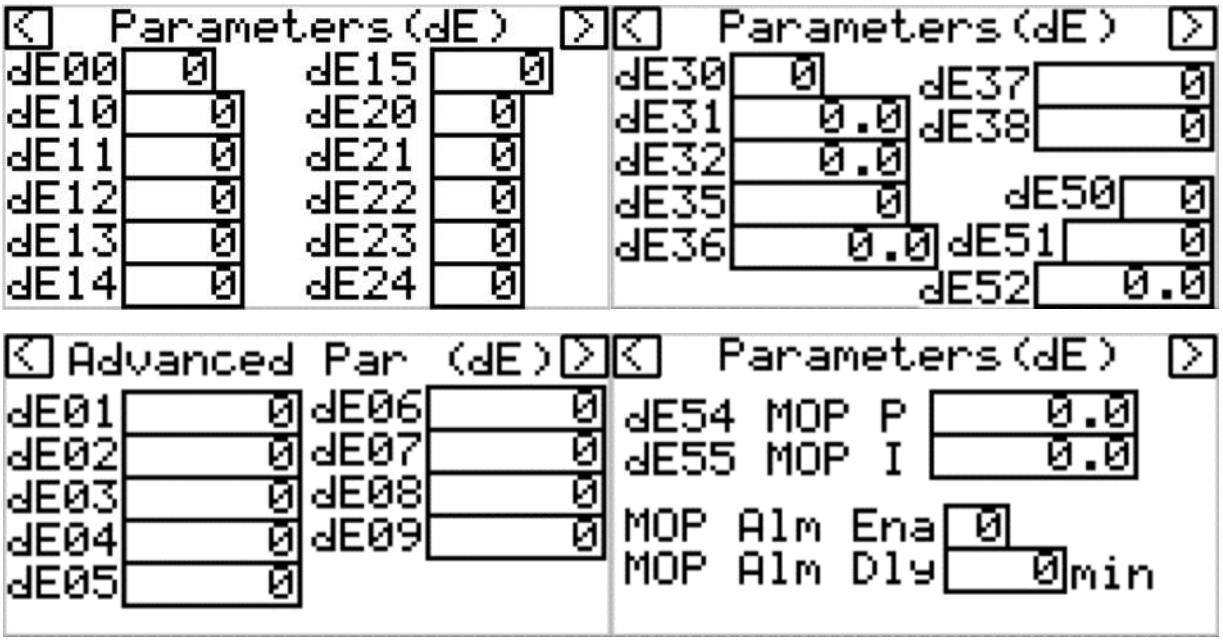
Like the previous screen – however, this is the internal command sent from the device to tell the valve to go into manual mode. Parameters **dE47** and **dE48** can only be used when there is a call for cooling/ the valve is active. When the valve is not active (*case is satisfied on temp, in defrost, or not enabled*), "Vev Man Cmd" may be used to force the valve using those selected parameters.

dE47 Man Open – Set to 0 for automatic/normal operation. Set to 1 for manual control.

dE48 Vlv Opn – This is the Valve Open % that you set. This will immediately set the valve to the % you selected. This does not have automatic superheat control – it is a manual override of the valve.

***Note:** IT IS RECOMMENDED TO USE THIS FEATURE ONLY WHEN SERVICING EQUIPMENT. *VALUE MUST BE SET BACK TO 0 FOR NORMAL OPERATION.*

PARAMETERS DE



MOP Function

When **dE50** = 1 (*enabled*), This function works as a Superheat Setpoint "Shift", changing the dynamic superheat setpoint on a PID control.

MOP is used mostly on a OLPP system when having an evaporator case SST above the normal operating OLPP system SST. This is used to prevent spiking of suction pressure and causing unnecessary compressor cycling.

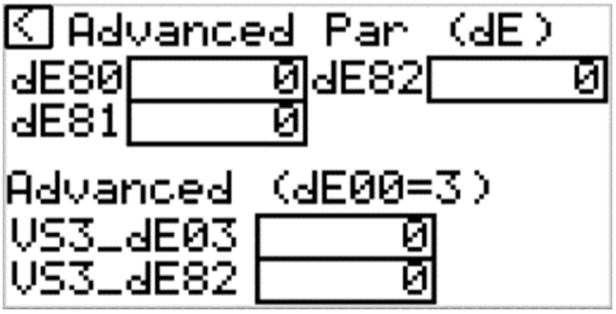
To prevent too high of a superheat, **dE31** (*overheating upper threshold*) must be set where a max superheat setpoint will be seen by the PID control algorithm (**dE54**, **dE55**). Superheat will float between **dE31** and **dE32** if the SST is above the Setpoint **dE52** and **dE51** set time has expired. Set **dE51** (*MOP disable time at start up*), to prevent MOP cycling from fast temperature/pressure fluctuations.

VALVE TYPE SETTINGS (ALCO / DANFOSS COLIBRI ETS)

Danfoss Colibri Expansion Valve ETS12C – ETS100C

When **dE00** = 3, **dE01-dE09** settings are as follows. These settings will not change.

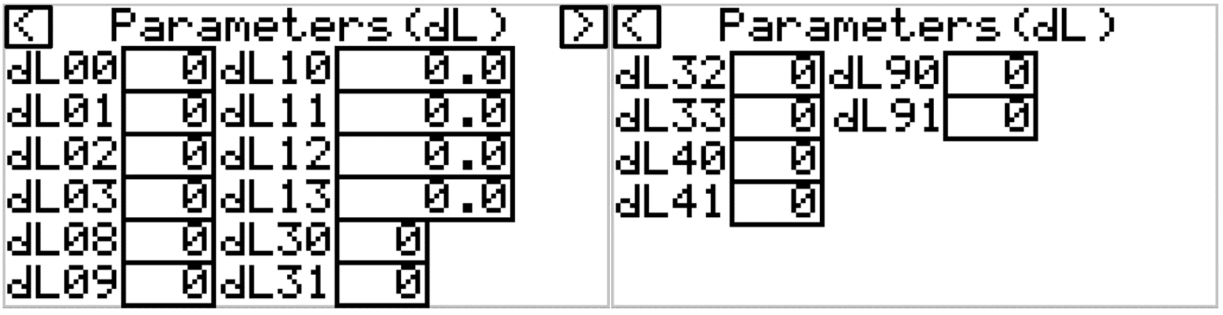
DANFOSS	ALCO
dE00 = 0 (CUSTOMIZABLE)	dE00 = 3 (EX4-6)
dE01 = 240 STEPS / SEC	dE01 = 500 STEPS / SEC
dE02 = 600	dE02 = 750
dE03 = 6 STEPS	dE03 = 100
dE04 = 600 mA RMS (800 mA PEAK)	dE04 = 500 mA
dE05 = 10 Ω	dE05 = 13 Ω
dE06 = 100 mA	dE06 = 100 mA
dE07 = MICROSTEP - (RECOMMENDED) (2) - FULL STEP CAN BE USED	dE07 = 0 (FULL STEP)
dE08 = 100%	dE08 = 100%
dE09 = 50 ms x 10 / STEP	dE09 = 50 ms x 10 / STEP



dE80-**dE82** PARAMETERS MUST BE SET TO MANUFACTURER SPECIFICATIONS AND MAX VALUES. **DAMAGE TO VALVE CAN OCCUR IF SETTINGS ARE NOT CORRECT!** These changes can only be made when **dE00** = 0 (customizable)

VS3_dE03 (*stepper motor extra steps in total closure*) and **VS3_dE82** (*extra steps in total closing every 24hrs of valve running*) only take effect when **dE00** = 3 (*Alco EX4-6*).

PARAMETERS DL



dE20 – Refrigerant Selection: 0 = R404A, 1 = R448A, 2 = R410A, 3 = R134a, 4 = R744, 5 = R407C, 6 = 427A, 7= R513a, 8 = R515B.

NOTE: *selection 7 and 8 are both "Customizable Refrigerants" selected in VEV.*

ALARMS!

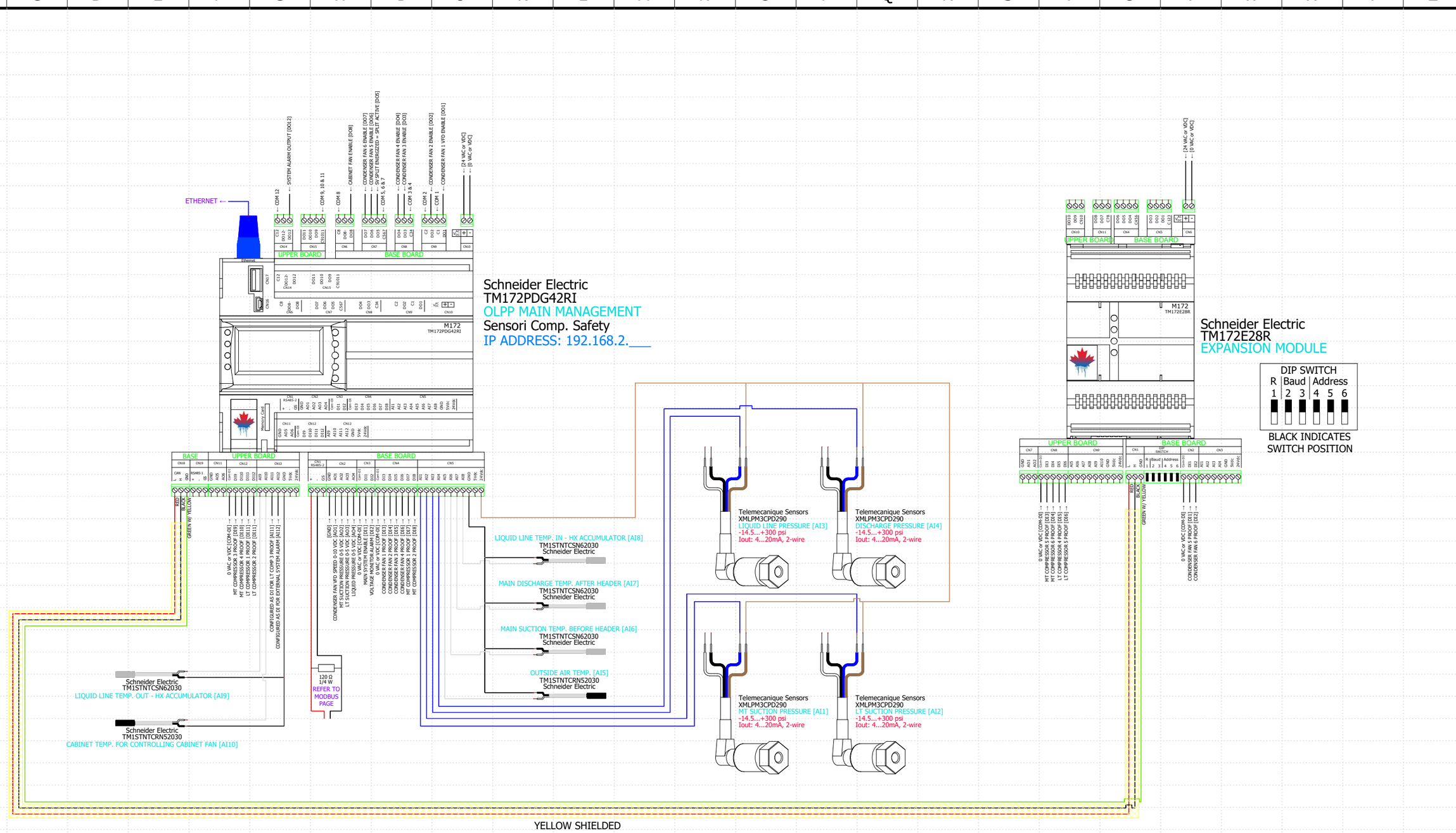
Indication that an alarm is present. Follow the Image to find which alarm is present.

This Screen lists all the VEV alarm codes that could be present.

A value of **0 = no alarm**. A value of **1 indicates an alarm for that feature is present**.

See Schneider's Manual (*Modicon M171 EEV*) for more information and probable causes for alarms indicated. If a Modbus error occurs, check wiring (**see schematic**) and ensure that resistors are installed in appropriate spots. (Start and End of line) Interferences may also be an issue with high voltages and improper grounding of devices.

***A MODBUS ERROR WILL OCCUR WHEN UNPLUGGING OR UNWIRING THE VALVE WHEN POWER IS ON TO DEVICE. Make sure to disconnect power to device when valve is being changed or wired. If an error occurs. A power reset is required to clear this alarm.**



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Oxford Energy Solutions Inc.
505082 Old Stage Road
Woodstock, ON, N4S 7V8, Canada
226-242-5674

OLPP MAIN MANAGEMENT

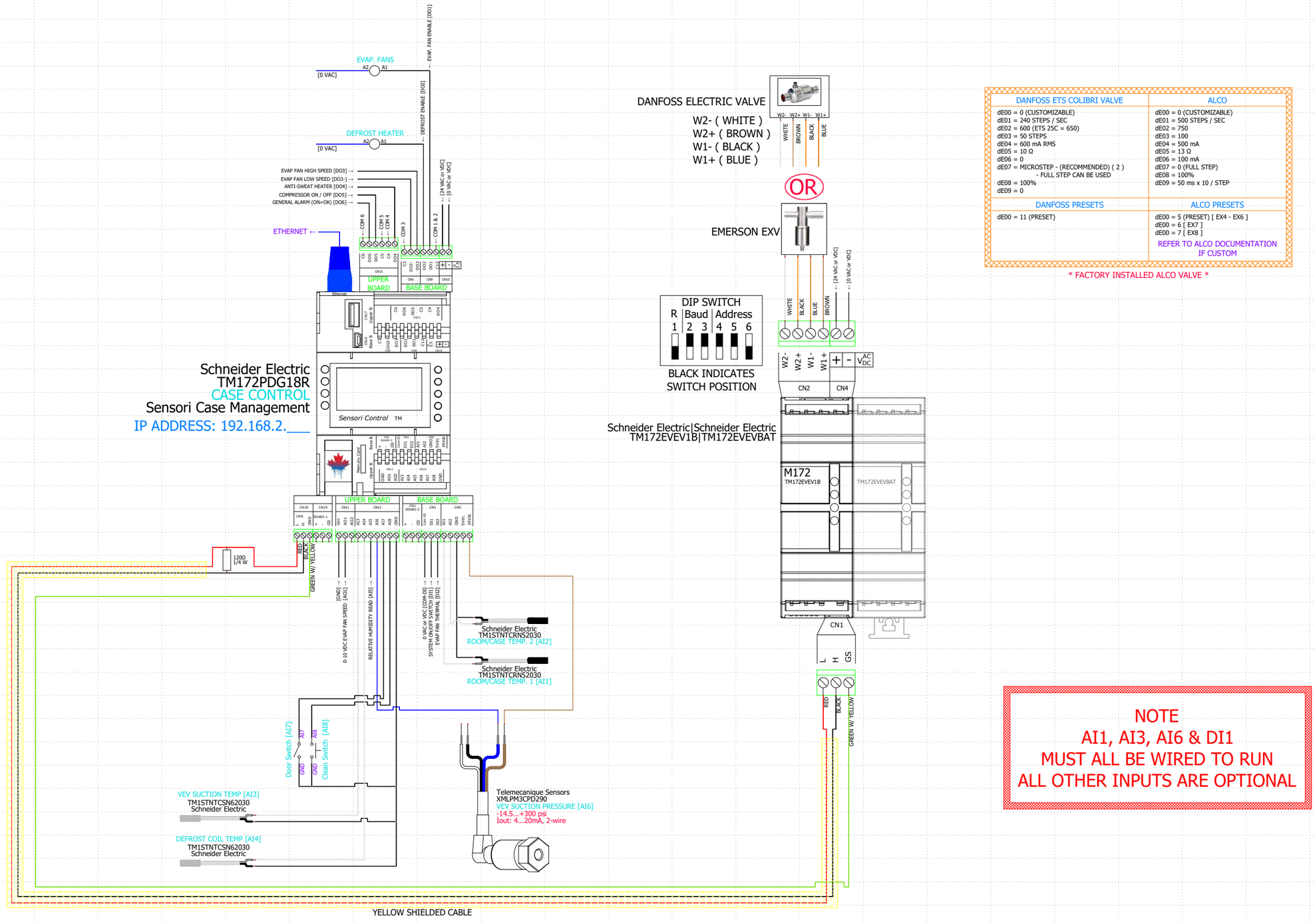
CONTRACT:

LOCATION: OES SENSORI DRAWINGS

REV.	DATE	NAME	CHANGES
0	2025-06-05	Michael D	INITIAL RELEASE

Drawn By: Michael D
Date: 2025-04-16

REVISION 0
SCHEME 06



DANFOSS ETS COLIBRI VALVE	ALCO
dE00 = 0 (CUSTOMIZABLE) dE01 = 240 STEPS / SEC dE02 = 600 (ETS 25C = 650) dE03 = 50 STEPS dE04 = 600 mA RMS dE05 = 10 Ω dE06 = 0 dE07 = MICROSTEP - (RECOMMENDED) (2) - FULL STEP CAN BE USED dE08 = 100% dE09 = 0	dE00 = 0 (CUSTOMIZABLE) dE01 = 500 STEPS / SEC dE02 = 750 dE03 = 100 dE04 = 500 mA dE05 = 13 Ω dE06 = 100 mA dE07 = 0 (FULL STEP) dE08 = 100% dE09 = 50 ms x 10 / STEP
DANFOSS PRESETS	**ALCO PRESETS**
dE00 = 11 (PRESET)	dE00 = 5 (PRESET) [EX4 - EX6] dE00 = 6 [EX7] dE00 = 7 [EX8] REFER TO ALCO DOCUMENTATION IF CUSTOM

* FACTORY INSTALLED ALCO VALVE *

NOTE
AI1, AI3, AI6 & DI1
MUST ALL BE WIRED TO RUN
ALL OTHER INPUTS ARE OPTIONAL

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226-242-5674

CASE CONTROL

CONTRACT:

LOCATION: OES SENSORI DRAWINGS

REV.	DATE	NAME	CHANGES
0	2025-06-05	Michael D	INITIAL RELEASE

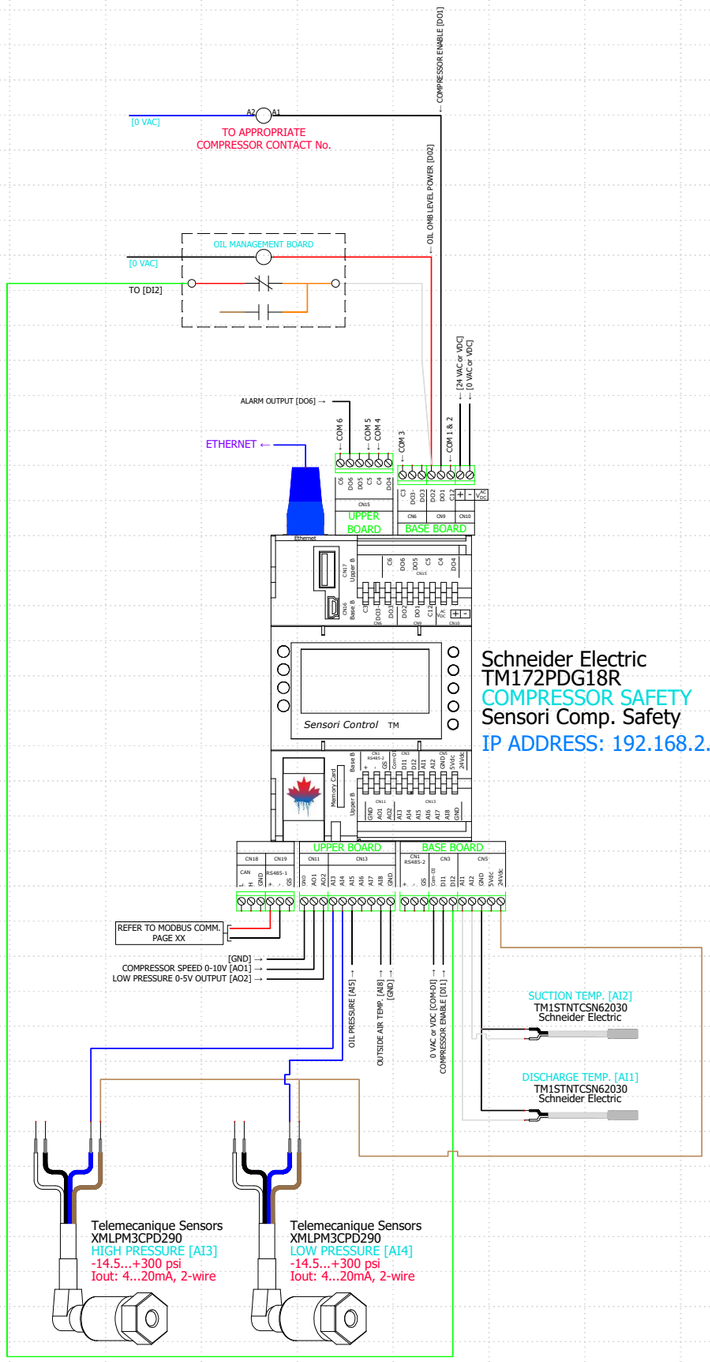
Drawn By: Michael D

Date: 2025-04-16

REVISION 0

SCHEME 04

SOLIDWORKS Electrical



Schneider Electric
TM172PDG18R
COMPRESSOR SAFETY
Sensori Comp. Safety
IP ADDRESS: 192.168.2.___

SOLIDWORKS Electrical

Oxford Energy Solutions Inc.
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COMPRESSOR SAFETY

CONTRACT:

LOCATION: OES SENSORI DRAWINGS

REV.	DATE	NAME	CHANGES
0	2025-06-05	Michael D	INITIAL RELEASE

Drawn By: Michael D

Date: 2025-04-16

REVISION 0

SCHEME 05