



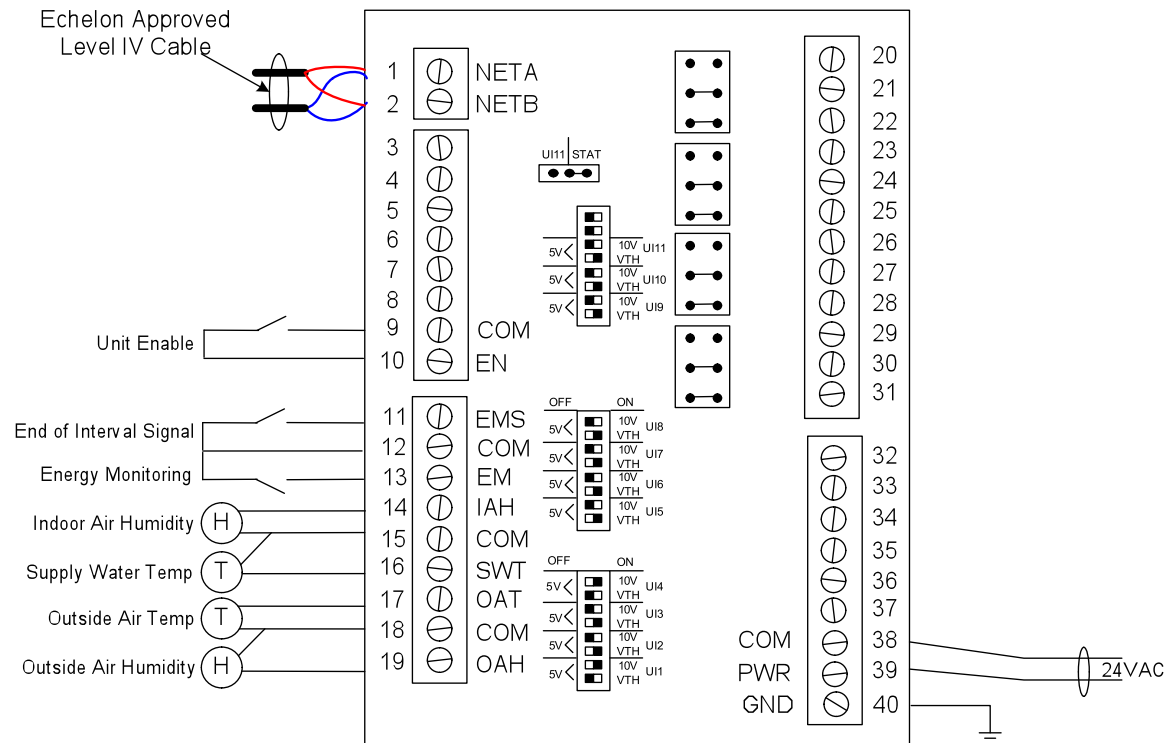
# Energy Monitoring and Optimum Start

## ASM2 Aux. Sensor Module – Demand Metering

### Features

- Outside air temperature measurement
- Outside air humidity measurement
- Supply water temperature measurement
- Indoor humidity measurement
- Unit enable digital input
- Energy monitoring via pulse counting

# ASM2 Aux. Sensor Module – Demand Metering



# ASM2 Setup

- Scaling Factor – This is the number of pulses per KWh of energy consumed
- Load Level 1 – This variable allows the first stage of load shedding threshold to be set
- Load Level 2 - This variable allows the second stage of load shedding threshold to be set
- Reading Interval – This variable allows the number of minutes per time interval to be set (i.e. sliding window)

# Configuring the LCI for load shedding

- From within a group
  - Members – select controllers that will have their load shed
  - Load Shed – Sets the priority level for this groups to be shed. If set to a Disabled no load shedding will take place for this group.
  - Set to Level 1 and this group will be the first to have their loads shed
  - Set to Level 2 and this group will be the second to have their loads shed

# Sequence of Operation

- As the ASM2 calculates the energy consumption it compares it to the preset levels set in Load Level 1 & 2, every 30 seconds.
- If the value is greater or equal to load level 1, the energy consumption alarm will be set to 1
- If set to a 1 the value will be compared to Load Level 2. If it is greater than or equal then the energy consumption alarm will be set to 2
- Energy consumption alarms are sent to LCI

# Sequence of Operation

- When alarm is received at the LCI it compares the value to the Load Level And sheds all loads accordingly.
- When a value of 1 is received all groups with Load Level of 1 will be shed
- When a value of 2 is received all groups with load level of 1 and 2 will be shed
- Loads are restored when the alarm is cleared

# Optimum Start

- Non-adaptive
- Optimum Start Only
- Utilizes
  - OAT
  - Space Temperature
  - Controllers Heating or Cooling factor
  - Current occupancy schedule
- Global enabling and disabling
- Disabling of individual controllers



# Configuring Optimum Start

- Enabled by default
- Utilities>LCI Setup>Optimum Start On/Off
- Controllers>HVACSetup>Optimum Start>Heating Factor and Cooling Factor
  - Value of zero disables heating and cooling factor
  - Value of 5 minutes per degree is the default
  - Range is 0 – 255 minutes per degree

# Optimum Start Sequence of Operation

- LCI continually calculates the OS time for scheduled controllers
- Each OS controller must be part of a group with a schedule
- OS heat factor is used when the space temp is less than the effective setpoint
- OS cool factor is used when the space temp is greater than the effective setpoint
- If a scheduled controller is in the unoccupied mode, the OS algorithm subtracts the calculated time offset from the starting time of the schedule and compares it to the current time to determine occupancy.
- If controller reaches SP before occupancy the controller is kept occupied

## Optimum Start Calculation No OAT Influence

If there is no influence from OAT

$$\Delta_t = \text{Space\_Temp} - \text{Effective\_SP}$$

$$\text{Schedule\_Offset} = \Delta_t * \text{heating}\{\text{cooling}\} \text{ factor}$$

Cooling Example:

Operating Schedule 7:00 – 17:30

Cooling Factor 5 minutes/Degrees F

Space Temp 79 Deg F

Effective SP 72 deg F

Using the above equations:

$$\text{Schedule\_Offset} = (79 - 72) * 5 = 35$$

OS Time 6:25 AM

## Optimum Start Calculation With OAT Influence

If there is influence from OAT

$$\Delta_t = \text{Space\_Temp} - \text{Effective\_SP}$$

$$\text{Schedule\_Offset} = \Delta_t * \text{heating}\{\text{cooling}\} \text{ factor}$$

$$\text{OAT\_Gain} = (\text{OAT} - \text{Space\_Temp}) / 10 \text{ clamped to a max of } 3$$

$$\text{OAT\_Offset} = (\text{Schedule\_Offset} * \text{OAT\_gain}) / 3$$

$$\text{Schedule\_Offset} = (\text{Schedule\_Offset} + \text{OAT\_Offset})$$

## Optimum Start Calculation With OAT Influence

### Heating Example:

Operating Schedule 7:00 – 17:30

Heating Factor 5 minutes/Degrees F

OAT 50 Deg F

Space Temp 70 Deg F

Effective SP 75 deg F

Using the above equations:

$$\text{Schedule\_Offset} = (70 - 75) * 5 = 25$$

$$\text{OAT\_Gain} = (50-70) / 10 = 2$$

$$\text{OAT\_Offset} = (25 * 2) / 3 = 16$$

$$\text{Schedule\_Offset} = 25 + 16 = 41 \text{ minutes}$$

OS Time 6:19 AM