

EcoSmart Connect Control
Operation Manual

1.0 CONTROLS

The system incorporates a preconfigured BACnet MS/TP enabled controller.

1 Connect Controller



1.1 Controllable Items

- Supply Fan
- Extract Fan
- Heat Recovery Bypass Damper (if applicable).
- Thermal Wheel (if applicable).
- Heating Coil (if fitted).
- Cooling Coil (if fitted).
- DX coil (If fitted).
- Inlet Damper (If fitted).
- Exhaust Damper (If fitted).
- Recirculation damper (If fitted).

1.2 Enable Signal

The unit can be enabled via the following methods:

- Software switch (ENABLE) via local display or network.
- Volt free input contacts.
- Night Cooling / Summer free-cooling strategy.
- Scheduled via weekly calendar (Schedules are accessed and adjusted via the ESCO-LCD or the MAP gateway device).
- Fan speed override.
- Room module PIR sensor.
- Room module 3-fan speed button (While in low, med or high state).

When the enable signal is removed, the unit will run on for a time defined by the run-on setpoint.

If auto run-on is enabled, the unit will measure each enable period and set a dynamic run-on time proportionally to this value. Auto Run-on Scale Factor" and limited by the input "Auto Run-on Max Time.

1.3 Occupancy Control

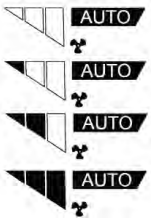
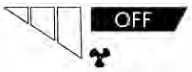
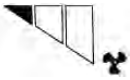
Ecosmart Connect control allows the connection of multiple Room Modules which are automatically detected and connect to the controller via a SA (Sensor Actuator) MS/TP bus. See Network Accessory section for more connection details.

1.3.1 PIR Room Sensor

When a Room Module PIR sensor is connected via the SA bus, the control will automatically use this as an enable signal by default. There is a non-adjustable minimum run-on time of 15mins for Room Module PIR's. This is in addition to any software run-on times.

1.3.2 RM 3-Speed Fan Override (ESCO-TDFS Only)

When a RM fan speed override is available it will override fan speed functions. This function overrides any run-on time (except for electric heater heat dissipation). While in override mode, the unit will ignore return air temperature and set the supply air to the setpoint. Multiple fan override sensors are supported with the highest demand taking priority. Whenever a fan-speed override Room Module is connected, the display will automatically show the fan speed status at all times. A timeout can be set for the fan mode to revert back to auto after a predetermined time period. The setting Fan Override Operation and Fan Override Timeout can be adjusted to achieve this.

Mode	Operation	Display
"Auto"	The Controller will ignore the fan speed override. Current Fan speed will still be displayed.	
"Off"	The controller will override all functions and stop the fans.	
"Low"	The fans run at low speed.	
"Medium"	The fans run at medium speed.	
"High"	The fans run at high speed.	

1.3.3 RM Occupancy Display

If an RM sensor with occupancy display is connected, it will automatically display the occupancy state as follows.

State	Description	RM Display
Occupied	An enable signal is present i.e. Fans are running.	
Unoccupied	No enable & no trickle i.e. Fans are stopped.	
Standby	No enable signal but fans are trickling.	

1.4 Multiple Sensors

Where multiple sensors are connected the following options are available.

State	Description
Temp Sensor Operation	Room module average (Default) Return Air only Room Module & Return Air Average
Setpoint Operation	Last Value Changed (Default) Software Setpoint Only Last Value Changed With Timeout
Humidity Sensor Operation	Average (Default) Max Ignore
CO2 Sensor Operation	Average (Default) Max Ignore
Pressure Sensor Operation	Average (Default) Max Ignore

1.5 Auxiliary Inputs 16 & 17 (0-10V Inputs)

The function of IN16 & IN17 can be set by the network inputs IN16 Function & IN17 Function. The available options are as follows.

Function	Description	Available Ranges
None	The signal is ignored	N/A
Fan Speed Control	A 0-10V input is used as a fan speed demand. 0V = Min Speed 10V = Max Speed	N/A
EGG (Ecosmart Gateway Gadget)	0-10V from the EGG PCB is controls used as a fan speed demand. The optional EGG PCB can be used for backwards compatibility with some Ecosmart Classic sensors.	N/A
0-10V CO2 Sensor	0-10V is scaled as defined by the network input "CO2 0-10V Output Range"	0-2,000ppm 0-4,000ppm 0-5,000ppm 0-10,000ppm 0-20,000ppm
0-10V Temperature Sensor	0-10V is scaled as defined by the network input "Temperature Sensor 0-10V Output Range"	0 - 40°C 0 - 50°C 0 - 80°C 0 - 90°C 0 - 100°C
0-10V Pressure Sensor	0-10V is scaled as defined by the network input "Pressure Sensor"	0 - 25 Pa 0 - 50 Pa 0 - 100 Pa 0 - 300 Pa 0 - 500 Pa 0 - 1000 Pa 0 - 1600 Pa 0 - 2500 Pa 0 - 3000 Pa
0-10V Humidity Sensor	0-10V is scaled to 0-100% humidity	0 - 100% only

1.6 Fan Speed Control Input

Once assigned to either input 16 or 17, the 0-10V input is scaled to 0-100% fan speed demand.

1.7 CO2 Control

When a CO2 sensor is assigned to the system and an enable signal is received, ventilation will increase fans speeds to reduce CO2 concentration. The target CO2 sensor setpoint can be changed as one of the commissioning setpoints. Room Module CO2 sensors are detected automatically. 0-10V CO2 sensors need to be assigned to input 16 or 17.

1.8 Humidity Control

When a humidity sensor is assigned to the system and an enable signals received, ventilation will increase fans speed to reduce humidity. The target humidity setpoint can be changed as one of the commissioning setpoints. Room Module humidity sensors are detected automatically. 0-10V humidity sensors need to be assigned to input 16 or 17.

1.9 Constant Pressure Control

An extract air pressure sensor is fitted to IN16 standard. IN16 is disabled by default but constant pressure control can be enabled by setting IN16 function to 0-10v pressure sensor.

When enabled, the unit will increase the fans speeds as required until the pressure differential between the extract air and atmosphere reaches the constant pressure setpoint.

The target pressure setpoint can be changed as one of the commissioning setpoints. Room Module pressure sensors are not available.

1.10 Dirty Filter Switch

Filter differential pressure switches are fitted as standard. These monitor the Extract filter, Supply filters. These are connected into input IN9 & IN10 and will be open circuit on overpressure. The adjustable range is 0.5 to 4mbar and is set by the default to 2mbar.

1.11 Configurable Mode (Via Switched Live 2)

The switched live 2 input is a configurable input that can be set to perform a number of functions. The function is set via the network input Configurable Mode SL2.

These functions will include the following:

- **Fan Boost (Default Setting)** - This enables Fan Boost Mode
- **Heat Boost** - The heater function will be enabled. Fan speeds will be increased where necessary to keep supply temp at the heater boost setpoint (Default 35°C).
- **Extract Setback** - When this mode is selected and SL2 is active, the unit will force the extract fan to run at Extract Setback Speed (Commissionable setpoint), regardless of all other demands. Supply fan will operate at the normal speed. If increased demand is required (e.g. via CO2 or 0-10v IN16/17 some other input) the supply fan speed will increase but the extract fan speed will not. This mode can be used when the unit is used in conjunction with a separate air system.

1.11.1 Fan Boost

When the control receives a boost signal, from either the network input "Boost" or "Configurable SL2" configured to boost, the fans will run at their individual boost speeds. Once the signal is removed the fans will run on for a time defined by the boost run-on setpoint. Any demand in excess of the boost speed will be ignored (apart from 3 speed override and purge schedule).

1.11.2 Heat Boost

When the control receives a heat boost signal, from either the network input "Heat Boost" or "Configurable SL2" configured to "heat boost", the heater output will increase to 100%. The fan speed will be increased as required to reach the heat boost setpoint.

1.12 Temperature Control

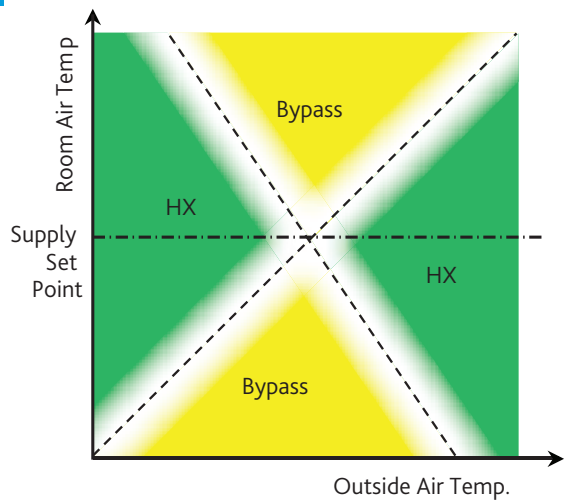
1.12.1 Supply Temperature Control (Default)

While an enable signal is present, this mode modulates heating, cooling & heat exchanger bypass dampers with the aim of the supply air reaching the temperature setpoint. Heating and cooling outputs will only function if the "Heating Type" or "Cooling Type" network inputs are set to heating or cooling options.

The heat exchange bypass damper operates by calculating the supply air temperature based on the return air temperature, the outside air temperature and the heat exchanger efficiency (e.g. A 13°C outside air temperature with a 23°C return air temperature will give a supply air temperature of 20.5°C).

The control then chooses the damper position which requires the minimal heat/cool tempering in order to achieve the setpoint.

2 Supply Temperature Control - HX Bypass



White areas indicate regions where either heat exchanging or bypassing will achieve the same supply temperature.

1.12.2 Room Temperature Control

While an enable signal is present, this mode modulates heating, cooling & heat exchanger bypass dampers with the aim of the room air reaching the temperature setpoint. Please note that heating and cooling outputs will only function if the "Heating Type" or "Cooling Type" network inputs are set to heating or cooling options.

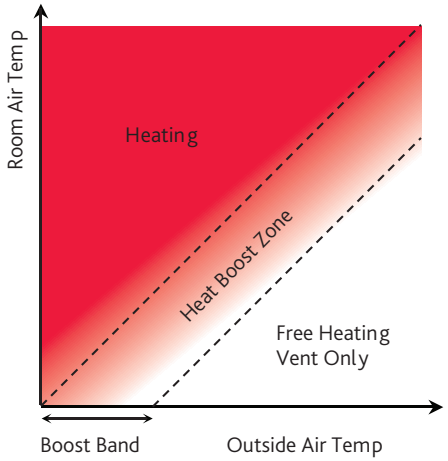
When heating or cooling is required achieve the room setpoint, the output of the heat/cool loops are split between ventilation demand or heat/cool demand according to the following graphs. The intermediate "boost" zone is the area in which a small amount of free heating/ cooling is available. In this zone, heating/cooling is used to boost the free heating/cooling.

In room temperature control mode, the bypass damper is controlled according to the following chart. A minimum supply air temperature limit is included to stop the heat exchanger being bypassed when the air temp is uncomfortably cold, even though cooling is required. In this case the heat exchanger will temper the air for comfort. The reverse applies for the maximum supply air temperature limit.

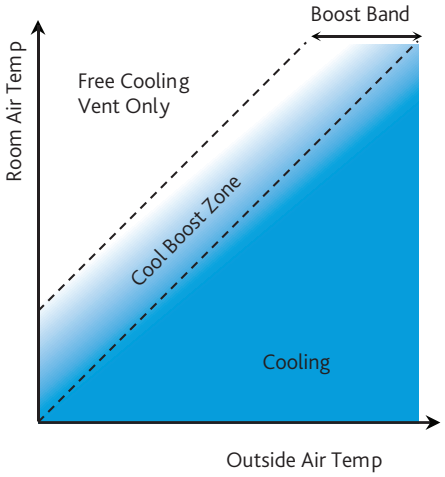
If the supply air temperature exits the minimum - maximum supply temperature range, the unit will adjust ventilation, heating or cooling to compensate.

Room temperature control will only be effective if the heater unit is sized correctly for the space. If the unit is undersized, heating from an external source may be required.

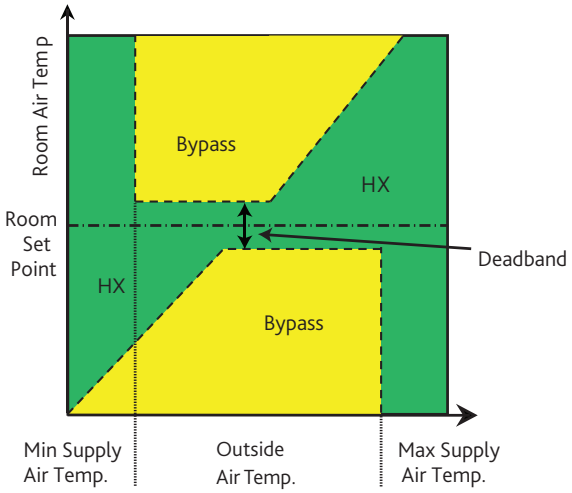
3 Room Temperature Control - Heating



4 Room Temperature Control - Cooling



5 Room Temperature Control - HX Bypass



1.12.3 Overrides

When the following conditions occur, the system will temporarily exit "Room Temperature Mode" and enter "Supply Temperature Mode".

- Trickle Mode with no enable signal (Trickle deadband applies).
- Heat Boost Active
- Fan Boost Active
- Purge Mode Active
- 3-Speed override by Room Module

1.13 Trickle Mode

When trickle mode is active, the fans will run at their minimum speed even when there is no enable signal. Heating and cooling will also function in this mode if available. While in trickle mode, the unit will function in "Supply Temperature Control Mode" but with a different, wider deadband, set by the network input Trickle Deadband.

1.14 Frost Protection

Should the internal temperature of the unit fall below a value defined in the commissioning variables, the control will override all heating/cooling logic to open the LPHW or CW control valves, if fitted. This is to allow any protective flow through the heating/cooling coils. The supply fan will stop and the appropriate frost protection software module will enter an alarm state. This period will last for a minimum of 5 minutes by default. The fault relay will also open. Heat and cool demand relays will operate and the software frost alarm will enter an alarm state.

Frost protection will only function if the Heating Type or Cooling Type setpoints are set to LPHW or CW.

1.15 Reverse Cycle DX (Optional For BPS Variants)

For units for use with Mitsubishi reverse cycle condenser units, one or more PACIF012B-E Interface boards are fitted inside the control panel. The controller interacts with this board in the following ways:

- Digital Output Heat/Cool selection from FAC relay 8. Another relay is used to split output over multiple boards.
- 0-10°c Heat/Cool demand from FAC OUT4 .
- Faults are monitored via iQ4 input 8 (Alarm circuit 2).

When Mitsubishi Reverse Cycle DX is fitted, this is selected in software by setting the cooling type "Reverse Cycle". A heating type is not required unless another heating type is fitted (e.g. LPHW).

Once this is selected cooling and heating demand will share FAC OUT4 and heat/cool is decided on the state of FAC Relay 8 (Energised = Cool Demand).

For the cases where Reverse Cycle DX and another heating type are both fitted, the schedule object "Reverse Cycle backup Heating" can be set to revert to the other heating option at certain times of the day.

Although the controller outputs a variable 0-10v heating/cooling voltage, the Mitsubishi condenser can only run at 7 discrete levels and so cannot supply an accurate supply air temperature. For this reason, it is recommended that the control is set to operate in room temperature control mode. This will regulate the room air temperature rather than supply air temperature.

The PAC boards are powered from the BPS control, the only connections required to the Outdoor condenser are S2 & S3. For the same reason, SW8-3 must be set to "ON" on the outdoor unit.

The enable run-on time must be set to 3 minutes for reverse cycle units. This is required to keep the compressor running for at least 3 minutes for each period.

1.16 Night Cooling / Summer Free Cooling

Once enabled in software, this routine can be set to a network time schedule to cool the fabric of the building at night using only the external air. This mode only functions if the daytime temperature is above the setpoint, cooling is possible and if the cooling air is not too cold.

1.17 Purge Mode

Once enabled in software, this routine can be set to a network time schedule to provide a period of increased air change throughout a space. This mode only functions if the inlet air is above a minimum temperature of 12°C. While purge is in progress, the unit will function in "Supply Temperature Control Mode" but with a different, wider deadband, set by the network input "Trickle Deadband".

1.18 Hibernate Mode

This mode is available for LPHW and CW units where the valves are required to be driven open in anticipation of a period where the unit is electrically isolated and inactive. When enabled via the network input "Hibernate Mode" this will stop the fans and open all LPHW & CW valves fully. The unit can then be powered down. This mode activation is reset upon power cycle so when restarted the unit will function as normal.

This mode is for periods when to building is left dormant and will stop the coils trapping water and causing a freeze risk. It will be the buildings responsibility to provide freeze-preventative heating during this time. This can also be used for a cleaning or flushing cycle.

1.19 Inlet / Outlet Dampers (Optional)

Inlet and outlet dampers are 24vac and controlled by the fan run relay. When energised it gives a 24vac signal to both I/O dampers to open. A fan start delay can be imposed to allow the damper time to open. This is adjustable via display screens or commissioning tools.

When installed, there is the option of connecting the internal damper close switch to the fault circuit alarm circuit 2 (orange wires).

When IO dampers are fitted the software object "IO Damper Fitted" must be set to "Yes". This will cause the software to delay the fans starting for the IO Damper delay period. It will also ignore faults on Alarm Circuit 2 if the fans are stopped and the dampers are closed intentionally. See Internal connection section for physical damper connections.

1.20 Partial Recirculation Damper (Optional)

If a partial recirculation module is fitted, the recirculation damper will open / close via OUT8 according to the following strategy.

If the room temperature is more than 5°C (adjustable via recirc-offset variable) from the setpoint and free-cooling or free-heating is not available then partially recirculate the air. This aids heating and cooling elements and avoids thermal loss from the room.

1.21 Alarms

The alarms can be either one of two categories.

1.21.1 Critical Alarm (Latching)

Once in critical alarm state the unit will drive all heating and cooling outputs to 0V. In the event of fan fail other functions continue as normal. The critical alarm is latched and requires power cycle or reset via the "Reset Alarms" variable.

Causes of critical alarm:

- Supply Fan Fail IN1.
- Extract Fan Fail IN2.
- Electric Heater Alarm IN7 (If Fitted).
- Fan Tacho Fail IN8 (If Fitted, this will replace the alarms on IN1 & IN2).

1.21.2 Maintenance Alarm (Non-Latching)

Once in maintenance alarm state the only action taken is de-energising of the fault relay. Once the trigger is removed, the alarm will reset automatically.

Causes of maintenance alarm:

- Sensor Failure.
- Low supply temperature, default 8°C. This can be set to stop fans if required.
- Frost protection routine active, default 4°C (This only runs if water valves are selected as fitted.
- Excessively high supply temperature reading (This will stop heating).
- Supply Filter dP fault IN9 (if fitted).
- Extract Filter dP fault IN10 (if fitted).
- Condensate Pump - Alarm IN4 (if fitted).
- IO Damper Alarm - Alarm IN3 (if fitted).
- Thermal Wheel Alarm - Alarm IN11 (if fitted).

All alarms have a hold off period set by the setpoint "Alarm delay".

1.21.3 Thermal Trip

In case of software failure, as a final resort, the electric heater is protected by a fail-safe thermal overload switch. This switch disables the heater controller via a contactor once the temperature reaches 80°C. When this occurs, the critical alarm will latch in software and the supply contactor will latch in the off position.

Once the unit cools, the contactor will remain latched off until power cycle.

1.22 Configurable Analogue Output 4 (OUT4)

Relay 8 is a configurable relay output which can be set to the following functions. It can be set by the multi-state object "RL8 Mode".

- **Cooling Demand (Default Setting)**
  This option will run the Relay as a cooling command relay. This output will only function if a cooling type is selected.
- **Window Actuator**
  This option will run a Window Indication routine with a dual CO2 setpoint strategy. Relay 8 will be used to indicate to the end user whether it is appropriate to open the windows or not. This relay can be wired to an end user's signal lamp or other signal. This relay is SPST so an additional relay is required if a light is required for each state. A multistate object, 'Window Mode Status', exists with two states, 'Open' and 'Close'.

At external temperatures less than the 'Window Open Threshold' (14°C default) the indicator will signal close windows. The 'CO2 Winter Target' will be used as the setpoint (1000ppm default).

At external temperatures greater than the 'Window Open Threshold' (14°C default) and CO2 level higher than the 'CO2 Winter Target', the indicator will signal open windows. The 'CO2 Summer Target' will be used as the setpoint (1500ppm default).

If the HX bypass damper is driven to bypass while fans are enabled, the indicator will signal open windows (HX Bypass due to Condensate pump failure will not affect windows status).

The 'Window Mode Status' will indicate close windows when the unit is not enabled and at all other times.

1.23 Configurable Analogue Output 4 (OUT4)

OUT4 is a configurable analogue output which can be set to the following functions via the multi-state object "OUT4 Mode".

- **Cooling Demand (Default Setting)**
  This will provide a standard 0-10V cooling output. This output will only function if a cooling type is selected.
- **ES Classic BMS**
  This option will provide a 0-10v ESClassic BMS output based on ventilation demand. This can then be used in conjunction with the fan run relay to run multiple slave Classic units from a master Connect control.

The type of BMS output can be selected by the muti-state object 'ECS BMS Thermic Output'.

Auto - The BMS output will switch between heating and cooling depending on outdoor air temperature.

None - The unit will only supply 'Vent Only' voltages.

Heating - The unit will only supply 'Heating' voltages.

Cooling - The unit will only supply 'Cooling' voltages.

1.23.1 ES Classic BMS Output Table

Function	Ventilation Only	Cooling	Heating
Off / Trickle	0.25V	-	-
Speed 1	0.5V	0.75V	1V
Speed 2	1.5V	1.75V	2V
Speed 3	2.5V	2.75V	3V
Speed 4	3.5V	3.75V	4V
Speed 5	4.5V	4.75V	5V
Speed 6	5.5V	5.75V	6V
Speed 7	6.5V	6.75V	7V
Speed 8	7.5V	7.75V	8V
Speed 9	8.5V	8.75V	9V
Speed 10	9.5V	9.75V	10V

1.24 Fire Alarm

Once the Fire Alarm object is switched to the Alarm State, all fans, heating and cooling elements will stop instantly. The fault relay will de-energise and a fault message will be sent to the ESCO-LCD. Once the fire alarm status is released, the units will continue running automatically.

1.25 BACnet Overview

BACnet is a data communication protocol for Building Automation and Control Networks. It allows compatibility between devices of different manufacturers. In BACnet, any device on the network can browse the network and discover devices.

1.26 Writing Values

It is best practice to only write to AV, BV & MSV (Analogue Variables, Binary Variables, and Multistate Variables). When writing to these, it is best to write at priority level 16.

1.27 Typical Basic Commissioning

- Set the analogue variables “Extract Fan Min Speed”, “Supply Fan Min Speed”, “Extract Fan Max Speed” and “Supply Fan Max Speed” during commissioning.
- If flow measurements are required enable the unit using the “Enable” MSV and boost the unit using the “Fan Boost” MSV.

1.28 Typical Basic Operation

- Enable the unit using the MSV “Enable” object. The fan runs at min speed.
- Increase the fan speeds using the AV “Fan Speed Demand” 0-100% (0% = Min Commissioned Speed, 100%= Max Commissioned Speed).
- Adjust setpoint using the AV “Software Setpoint”.

1.29 Writing Directly To Outputs

- It is not recommended to write directly to outputs since the internal logic of the control will be bypassed and some features will not function. The unit may also start without an enable signal.
- However, if this is required for test purposes (or otherwise), priority level 8 must be used.
- The internal control logic writes at priority level 16 so any data written to the outputs at this level is at risk of being overwritten.
- These values must be relinquished or nulled once used, otherwise the outputs will be locked at that value, even if the value is “0”.

1.30 Priority Array Storage

- Priority levels 8 & 16 are stored in the controller following a power cycle. All other levels are reset to null.
- Level 16 is not to be used for controller outputs since it will be overridden by the internal logic during operation.

1.31 Devices

A BACnet network can consist of several "device objects". Each device is given a unique "Device Instance Number". A typical example of a device is a controller or BACnet compatible LCD. EcoSmart Connect controllers are assigned a random device instance number at the factory and do not need to be changed. The instance number range is 1 - 4,194,303 (2^{22}). EcoSmart Connect controllers use a MSTP network for communication and are assigned a default MSTP address of 4.

The MSTP address must not be confused with the Device Instance Number. Most network browsers can identify a device by the Device Instance Number or the MSTP address.

1.32 Objects

In BACnet, information is stored within devices as several ‘virtual’ objects. Some examples of these are Fresh Air Temperature, Extract Fan Speed, CO2 Target, etc. Each object has several properties but the most important are shown in the table below. The maximum number of objects in a device is 4,194,303 (2^{22}) of each type.

Object Name	The name of the object. E.g. Setpoint
Object Instance Number	A unique number which represents the object within the device. E.g. 12544
Object Type	The type of object. E.g. Analogue Variable (AV)
Description	A short description of the object. E.g. The room setpoint
Present Value	The current value of the object. E.g. 20
Units	The units of the present value. E.g. °C

1.33 Object Types

A list of some typical object types is shown below.

AI	Analogue Input	An analogue object which is a physical input to a device.
AO	Analogue Output	An analogue object which is a physical output from a device.
AV	Analogue Variable	An analogue object which exists within a device.
BI	Binary Input	A true/false object which is a physical input to a device.
BO	Binary Ouput	A true/false object which is a physical output from a device.
BV	Binary Variable	A true/false object which exists within a device.
MSV	Multi-State Variable	This is an enumerated object which can have a number of states, each represented by a number. This is similar to a dropdown menu in windows forms. The State_Text property is an array containing the text for each value. Some browsers may not be able to read the text values so both are provided in this manual. E.g. 1=Off, 2=Low, 3=High, 4=Auto
SCH	Schedule Object	This is a special object with the ability to have a changing value depending on the time of date or day of the week.

1.34 Writing Of Values (Priority Array)

Any device on the BACnet network can write values to other device objects. To resolve conflicts, BACnet uses a 16-position priority array to work out who gets priority. Any request it change the present value is stored in the priority array at the priority level of the received request. The object then chooses the highest priority value to become the present value. Examples of priority array decision making are shown below.

Case 1	
Priority 1	null
Priority 2	null
Priority 3	null
Priority 4	null
Priority 5	null
Priority 6	null
Priority 7	null
Priority 8	null
Priority 9	null
Priority 10	null
Priority 11	null
Priority 12	null
Priority 13	null
Priority 14	null
Priority 15	null
Priority 16	null
Relinquish Default	0
Present Value	**0**

Case 2	
Priority 1	null
Priority 2	null
Priority 3	null
Priority 4	null
Priority 5	null
Priority 6	null
Priority 7	null
Priority 8	null
Priority 9	null
Priority 10	null
Priority 11	null
Priority 12	null
Priority 13	null
Priority 14	null
Priority 15	null
Priority 16	5
Relinquish Default	0
Present Value	**5**

Case 3	
Priority 1	null
Priority 2	null
Priority 3	null
Priority 4	null
Priority 5	null
Priority 6	null
Priority 7	null
Priority 8	null
Priority 9	7
Priority 10	null
Priority 11	null
Priority 12	null
Priority 13	null
Priority 14	null
Priority 15	null
Priority 16	5
Relinquish Default	0
Present Value	**7**

Case 4	
Priority 1	null
Priority 2	null
Priority 3	null
Priority 4	null
Priority 5	null
Priority 6	null
Priority 7	null
Priority 8	null
Priority 9	7
Priority 10	null
Priority 11	null
Priority 12	null
Priority 13	null
Priority 14	null
Priority 15	null
Priority 16	0
Relinquish Default	0
Present Value	**7**

Case 4	
Priority 1	null
Priority 2	null
Priority 3	null
Priority 4	null
Priority 5	null
Priority 6	null
Priority 7	null
Priority 8	null
Priority 9	null
Priority 10	null
Priority 11	null
Priority 12	null
Priority 13	null
Priority 14	null
Priority 15	null
Priority 16	0
Relinquish Default	0
Present Value	**0**

- **Case 1** - The object looks down the list until it gets to the first non-null value. In this case, all priority levels are empty so the (relinquish) default value of 0 is used as the present value.
- **Case 2** - Priority 16 is now 5 so the present value becomes 5.
- **Case 3** - Priority 9 is now 7. Priority 9 overrules priority 16 so the present value becomes 7. Note that priority 16 is still calling for 5 but it is being ignored.
- **Case 4** - Priority 16 is changed to 0 but this has no effect on the present value. It is still at 7 because of priority 9.
- **Case 5** - Priority 9 is relinquished back to null. This allows priority 16 to take priority again and the present value becomes 0.

The priority array is stored inside the device itself. This means that an external device can write to a priority position and the value will stay there even if the device is disconnected.

AI and BI object types are read only and therefore do not have a priority array.

AO & BO values are typically changed by the strategy at priority level 16. Any override must occur above this level and is not recommend. Be sure to relinquish all overrides once finished to minimise confusion and undesirable operation.

AV, BV & MSV values are generally not changed by the strategy so an external command at priority level 16 is sufficient to change the value permanently.

The following table shows the standard use of the priority array.

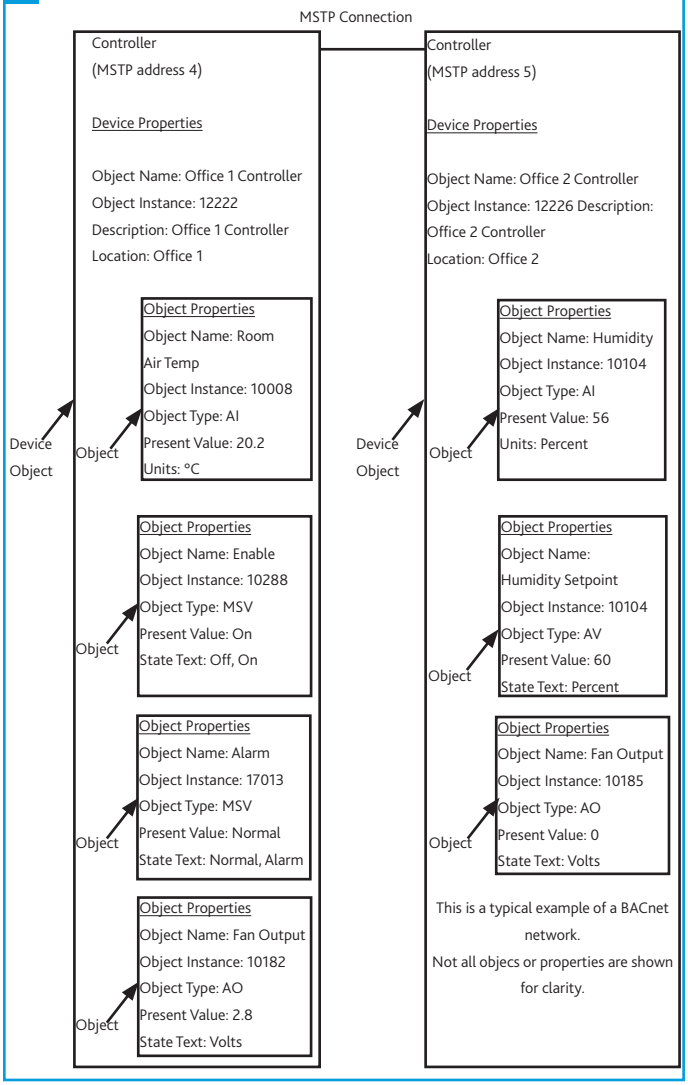
Priority	Application
1	Manual Life Safety
2	Automatic Life Safety
3	Available
4	Available
5	Criticial Equipment Control
6	Minimum On/Off
7	Available
8	Manual Operator
9	Available
10	Available
11	Available
12	Available
13	Available
14	Available
15	Available
16	Available

1.35 Inter-Networking

Inter-networking is used to connect two BACnet networks operating on different physical mediums (e.g. MSTP & IP). This is possible because no matter the physical medium, BACnet messages are always the same. A router can be fitted to the network to translate BACnet between different physical media.

1.35.1 Example BACnet Network

6 Example BACnet Network



1.36 BACnet Object List (By Category)

LCD Page Number	Object Name	Description	Point Type	Instance Number	Default Value	Range
1	Baud Rate	Baud rate	MSV	28508	Auto	Auto / 1200 / 9600 / 19200 / 38400 / 76800
1	Unit Selection	Unit Type - State 0 (XBC) / State 1 (BPS) / State 2 (BOXER)	MSV	28509	State 0	State 0 / State 1 / State 2
1	Heating Type	Selection of Heating Type - State 0 (None) / State 1 (LPHW) / State 2 (Electric Heater) / State 3 (3rd Party)	MSV	28510	State 0	State 0 / State 1 / State 2 / State 3
2	Cooling Type	Selection of Cooling Type - State 0 (None) / State 1 (Chilled Water) / State 2 (3rd Party) / State 3 (Reverse Cycle DX)	MSV	28511	State 0	State 0 / State 1 / State 2 / State 3
2	Unit Enable	Enable the Unit	MSV	28512	Off	Off / On
2	Unit Fault Status	Fault Relay (Output OUT9)	MSV	28539	Normal	Alarm / Normal / Hold
2	RM199 Status	Status of Network Sensor 1	MSV	28540	FALSE	False / True / Hold
3	Alarm Circuit 1	Alarm Circuit 1	MSV	28523	Normal	Alarm / Normal / Hold
3	Alarm Circuit 2	Alarm Circuit 2	MSV	28524	Normal	Alarm / Normal / Hold
3	SL Input	SL Enable (Input IN5)	MSV	28525	Off	Off / On / Hold
3	Cooling Demand	Cooling Demand Status	MSV	28538	Off	Off / On / Hold
4	SL2 Input	SL2 Enable (Input IN6)	MSV	28526	Off	Off / On / Hold
4	Bypass Damper	Bypass damper Status (Output OUT6)	MSV	28535	Inactive	Inactive / Active / Hold
4	Heat Demand	Heat / Recirc Demand (Output OUT8)	MSV	28536	Off	Off / On / Hold
4	Fan Command	Fan Enable Command (Output OUT10)	MSV	28537	On	Off / On / Hold
5	RM200 Status	Status of Network Sensor 2	MSV	28547	FALSE	False / True / Hold
5	RM201 Status	Status of Network Sensor 3	MSV	28554	FALSE	False / True / Hold
5	RM202 Status	Status of Network Sensor 4	MSV	28561	FALSE	False / True / Hold
5	RM203 Status	Status of Network Sensor 5	MSV	28568	FALSE	False / True / Hold
6	RM204 Status	Status of Network Sensor 6	MSV	28575	FALSE	False / True / Hold
6	RM205 Status	Status of Network Sensor 7	MSV	28582	FALSE	False / True / Hold
6	0-10v Press Range for IN16 & IN17	0-10v Pressure Range Select for IN16 & IN17 - State 0 (0-25) / State 1 (0-50) / State 2 (0-100) / State 3 (0-300) / State 4 (0-500) / State 5 (0-1000) / State 6 (0-1600) / State 7 (0-2500) / State 8 (0-3000)	MSV	28599	State 0	State 0 / State 1 / State 2 / State 3 / State 4 / State 5 / State 6 / State 7 / State 8
6	0-10v CO2 Range for IN16 & IN17	0-10v CO2 Range Select for IN16 & IN17 - State 0 (0-2000) / State 1 (0-4000) / State 2 (0-5000) / State 3 (0-10000) / State 4 (0-20000)	MSV	28600	State 0	State 0 / State 1 / State 2 / State 3 / State 4
6	IN16 is Temperature	Is IN16 setup as =	MSV	28601	FALSE	False / True / Hold
6	IN16 is Humidity	Is IN16 setup as =	MSV	28602	FALSE	False / True / Hold
6	IN16 is CO2	Is IN16 setup as =	MSV	28603	FALSE	False / True / Hold
6	IN16 is Pressure	Is IN16 setup as =	MSV	28604	FALSE	False / True / Hold
6	IN17 is Temperature	Is IN17 setup as =	MSV	28605	FALSE	False / True / Hold
6	IN17 is Humidity	Is IN17 setup as =	MSV	28606	FALSE	False / True / Hold
6	IN17 is CO2	Is IN17 setup as =	MSV	28607	FALSE	False / True / Hold
6	IN17 is Pressure	Is IN17 setup as =	MSV	28608	FALSE	False / True / Hold
6	RM199 Fan Speed Request	RM199 Fan Speed	AV	28545	Current	0, Auto / 1, Off / 2, Low / 3, Medium / 4, High

LCD Page Number	Object Name	Description	Point Type	Instance Number	Default Value	Range
6	RM199 Occupancy	RM199 Occupancy	AV	28546	Current	0, Occupied / 1, Unoccupied / 2, Bypass / 3, Standby
6	RM200 Fan Speed Request	RM200 Fan Speed	AV	28552	Current	0, Auto / 1, Off / 2, Low / 3, Medium / 4, High
6	RM202 CO2 AI	RM202 CO2 Sensor Analogue Input	AV	28564	Current	0 - 2000
6	RM202 Sensor Setpoint	RM202 Setpoint	AV	28565	Current	0-100
6	RM203 CO2 AI	RM203 CO2 Sensor Analogue Input	AV	28571	Current	0 - 2000
6	RM205 Temp AI	RM205 Temperature Sensor Analogue Input	AV	28583	Current	0-40
6	RM205 Humidity AI	RM205 Humidity Sensor Analogue Input	AV	28584	Current	0 -100
6	RM206 Temp AI	RM206 Temperature Sensor Analogue Input	AV	28590	Current	0-40
7	RM206 Status	Status of Network Sensor 8	MSV	28589	FALSE	False / True / Hold
7	IN16 Function	IN16 Function Input - State 0 (None) / State 1 (N/A) / State 2 (N/A) / State 3 (0-10v CO2 Sensor) / State 4 (0-10v Temp Sensor) / State 5 (0-10v Hum Sensor) / State 6 (0-10v Press Sensor)	MSV	28596	State 0	State 0 / State 1 / State 2 / State 3 / State 4 / State 5 / State 6
7	IN17 Function	IN17 Function Input - State 0 (None) / State 1 (FS Control) / State 2 (0-10v BMS) / State 3 (0-10v CO2 Sensor) / State 4 (0-10v Temp Sensor) / State 5 (0-10v Hum Sensor) / State 6 (0-10v Press Sensor)	MSV	28597	State 0	State 0 / State 1 / State 2 / State 3 / State 4 / State 5 / State 6
7	0-10v Temp Range for IN16 & IN17	0-10v Temp Range Select for IN16 & IN17	MSV	28598	State 0	State 0 / State 1 / State 2 / State 3 / State 4
7	RM200 Occupancy	RM200 Occupancy	AV	28553		0, Occupied / 1, Unoccupied / 2, Bypass / 3, Standby
7	RM203 Sensor Setpoint	RM203 Setpoint	AV	28572		0-100
7	RM206 Humidity AI	RM206 Humidity Sensor Analogue Input	AV	28591		0 -100
8	Temp Sensor Operation	Temperature Sensor Operation - State 0 (RM Average) / State 1 (Return Air Only) / State 2 (RM & Return Air Average)	MSV	28609	State 0	State 0 / State 1 / State 2
8	Humidity Sensor Operation	Humidity Sensor Operation - State 0 (Average) / State 1 (Minimum) / State 2 (Ignore)	MSV	28610	State 0	State 0 / State 1 / State 2
8	CO2 Sensor Operation	CO2 Sensor Operation - State 0 (Average) / State 1 (Minimum) / State 2 (Ignore)	MSV	28611	State 0	State 0 / State 1 / State 2
8	Pressure Sensor Operation	Pressure Sensor Operation - State 0 (Average) / State 1 (Minimum) / State 2 (Ignore)	MSV	28612	State 0	State 0 / State 1 / State 2
9	Setpoint Operation	Setpoint Input Operation - State 0 (Last Changed) / State 1 (Software Only) / State 2 (Last Changed with timeout)	MSV	28613	State 0	State 0 / State 1 / State 2
9	Supp Heat Output	BMS Configuration Input - State 0 (Auto) / State 1 (None) / State 2 (Heating) / State 3 (Cooling)	MSV	28614	State 0	State 0 / State 1 / State 2 / State 3
9	Fan Speed Override Control	Fan Speed Override Operation - State 0 (Override has Priority) / State 1 (Revert to Auto after Timeout)	MSV	28615	State 0	State 0 / State 1
9	Occ Sensor Enable	Occupancy Sensor Enabled	MSV	28616	No	No / Yes
10	OA Damper Interlock	IO Damper Fitted	MSV	28617	No	No / Yes

LCD Page Number	Object Name	Description	Point Type	Instance Number	Default Value	Range
10	Tacho Board Fitted	Tacho Board Fitted	MSV	28618	No	No / Yes
10	Control Type	Temperature Control Selection - State 0 (Supply Temp Control / State 1 (Return Temp Control)	MSV	28619	State 0	State 0 / State 1
10	Fan Config	Fan Configuration for Boxer Units - State 0 (Supply Only) / State 1 (Extract Only) / State 2 (Both)	MSV	28620	State 2	State 0 / State 1 / State 2
11	Fan Off Delay	Auto Run-On	MSV	28624	Off	Off / On
11	Damper Override LV	Manual Damper override - State 0 (Auto) / State 1 (HX) / State 2 (Bypass)	MSV	28626	State 0	State 0 / State 1 / State 2
11	Fan Boost	Enable Fan Boost	MSV	28635	Off	Off / On
11	Fire Alarm	Fire Alarm Network Input	MSV	28638	Normal	Normal / Alarm
12	Hibernate Mode	Hibernate Mode	MSV	28643	Off	Off / On
12	Low Temp Alarm Action	Low Supply Temp Action - State 0 (Alarm Only) / State 1 (Alarm & Stop Fans)	MSV	28647	State 0	State 0 / State 1
12	NFC Sch	Night Cooling Sampling Schedule	MSV	28651	Off	Off / On
12	NFC Sch Enable	Night Cooling Schedule Enable	MSV	28652	Off	Off / On
13	Cooling Output Type	OUT4 Mode Selection - State 0 (Cooling Demand) / State 1 (ESClassic BMS)	MSV	28653	State 0	State 0 / State 1
13	Purge	Purge Enable	MSV	28655	Off	Off / On
13	Purge Command	Purge Schedule	MSV	28656	Off	Off / On
13	SL2 Mode	Switch Live 2 Mode - State 0 (None) / State 1 (Fan Boost) / State 2 (Heating Boost) / State 3 (Extract Setback)	MSV	28668	State 0	State 0 / State 1 / State 2 / State 3
13	EF Setback from SF	Setback Speed of Extract from Supply for Positive Pressure	MSV	28633	Off	Off / On
14	PID Tuning Mode	Tuning Reset for PID Loops	MSV	28674	FALSE	False / True / Hold
14	Trickle Mode	Trickle Mode Enabled	MSV	28675	Off	Off / On
14	Local Schedule	Unit Enable (Via Schedule)	MSV	28680	On	Off / On
14	Alarm Reset	Reset the Alarms	MSV	28681	FALSE	False / True / Hold
14	Heat Boost	Enable heater Function	MSV	28641	Off	Off / On
15	Fan Active	Fan Run-on Active	MSV	28682	FALSE	False / True / Hold
15	Occupancy Status	Occupancy mode wo Runon	MSV	28683	0	0, Occupied / 1, Unoccupied / 2, Bypass / 3, Standby
15	Fan to Damper Delay	IO Damper Delay Active	MSV	28684	FALSE	False / True / Hold
15	Active Critical Alarms	Critical Alarm	MSV	28685	Normal	Normal / Alarm
15	Re-circ Override	Re-circulation Override - State 0 (Auto) / State 1 (Open) / State 2 (Close)	MSV	28677	State 0	State 0 / State 1 / State 2
16	Maintenance Alarm	Maintenance Alarm	MSV	28686	Normal	Normal / Alarm
16	Condensate Alarm	Condensate Alarm	MSV	28688	Normal	Normal / Alarm
16	Dirty Pre-filter alarm	Dirty Pre-filter alarm	MSV	28689	Normal	Normal / Alarm
16	Supply Fan Alarm	Supply Fan Alarm	MSV	28692	Normal	Normal / Alarm
17	Return Air dirty filter alarm	Extract Filter dirty alarm	MSV	28690	Normal	Normal / Alarm
17	Return Fan Alarm	Return Fan Alarm	MSV	28693	Normal	Normal / Alarm
18	Thermal Wheel Alarm	Thermal Wheel Alarm	MSV	28687	Normal	Normal / Alarm
18	Tacho Alarm	Tacho Alarm	MSV	28691	Normal	Normal / Alarm

LCD Page Number	Object Name	Description	Point Type	Instance Number	Default Value	Range
19	MVServiceInactive		-	-		
19	MVServiceActive		-	-		
19	MVServicePriority		-	-		
20	8-1/ Boot		-	-		
20	MVServicePriority		-	-		
20	MVCrticialInactive		-	-		
20	MVCriticalActive		-	-		
21	8-1/ Main		-	-		
21	8-1/ Archive		-	-		
21	8-1/ Static		-	-		
21	8-1/ Dynamic		-	-		
22	8-1/ Flash Memory		-	-		
22	8-1/ Data Model View Def		-	-		
22	8-1/ Data Model Templates		-	-		
22	8-1/ Backup Parameters		-	-		
22	8-1/ Restore Parameters		-	-		
23	ServiceInactiveEventNTF		-	-		
23	Enable Schedule		SCH	-		
23	Alarm Reset		SCH	-		
24	Critical Inactive Event NTF		-	-		
24	Service Priority Inactive Event NTF		-	-		
24	Service Priority Inactive Event NTF		-	-		
24	Service Active Event NTF		-	-		
25	Fresh Air intake	Fresh air Temperature	AV	28501	Current	0-100
25	Supply Air Temperature	Supply Air temperature	AV	28502	Current	0-100
25	Return Air Temperature	Return Air Temperature	AV	28503	Current	0-100
25	Room Temperature	Room Temperature	AV	28504	Current	0-100
25	Notification		-	-		
25	Critical Active Event NTF		-	-		
25	Room Temperature Trend	Used for Trending the Room Temperature	TND1	-		
25	Room CO2 Trend	Used for Trending the Room CO2	TND2	-		
26	Address	Device MS/TP Address	AV	28505	4	4-127
26	Device OID	Device Instance Number	AV	28506	5	
26	Effective Setpoint	Current Effective Setpoint	AV	28527		0-100
26	Cooling Output	Cooling Output	AV	28534		0-100
26	Room Humidity Trend	Used for Trending the Room Humidity	TND3			
26	Supply Air Temperature Trend	Used for Trending the Supply Air Temperature	TND5			
26	Return Air temperature Trend	Used for Trending the Extract Air Temperature	TND6			

LCD Page Number	Object Name	Description	Point Type	Instance Number	Default Value	Range
26	Setpoint Trend	Used for Trending the Temperature Setpoint	TND4			
27	Effective CO2	Current Effective Room CO2	AV	28528		0-100
27	Effective Humidity	Current Effective Room Humidity	AV	28529		0-100
27	Effective Pressure	Current Effective Room Pressure	AV	28530		0-100
27	Supply Fan Speed AO	Supply Fan Speed Analogue Output	AV	28531		0-10
27	Fresh Air Temperature Trend	Used for Trending the Fresh Air Temperature	TND7			
28	Exhaust Fan Speed AO	Extract Fan Speed Analogue Output	AV	28532		0-10
28	Heating Output	Heating Output	AV	28533		0-100
28	Frost Protection Temperature	Minimum Temperature for Frost protection to start	AV	28640		
28	Duct Static Pressure Setpoint	Pressure Target	AV	28654	400	0-1500
28	IN15 CO2 Sensor	IN15 CO2 Sensor	AV	28513		0-100
28	IN15 Temperature Sensor	IN15 Temperature Sensor	AV	28514		0-100
28	IN15 Humidity Sensor	IN15 Humidity Sensor	AV	28515		0-100
28	IN15 Pressure Sensor	IN15 Pressure Sensor	AV	28516		0-100
28	IN16 CO2 Sensor	IN16 CO2 Sensor	AV	28517		0-100
28	IN16 Temperature Sensor	IN16 Temperature Sensor	AV	28518		0-100
28	IN16 Humidity Sensor	IN16 Humidity Sensor	AV	28519		0-100
28	IN16 Pressure Sensor	IN16 Pressure Sensor	AV	28520		0-100
28	IN16 Fan Speed Control	IN16 Fan Speed Control	AV	28521		0-100
28	IN16 BMS 0-10v	IN16 BMS 0-10v	AV	28522		0-100
29	CO2 Setpoint	In-Room CO2 Setpoint	AV	28625		0-200
29	Deadband	Temperature Deadband for Supply temperature control	AV	28627		0-10
29	Fan Override Timeout	Time period for Fan Override	AV	28636		0-7200
29	Frost Protection Fan off Delay	Delay Timer for Fan during frost protection	AV	28639		0-600
29	Extract Fan Max Demand	Extract Fan Maximum Demand	AV	28631	100	0-100
29	Extract Fan Min Demand	Extract Fan Minimum Demand	AV	28632	20	0-100
29	Extract Fan Setback Speed	Set the speed for the Setback	AV	28634	30	0-100
29	RM199 Temp AI	RM199 Temperature Sensor Analogue Input	AV	28541		0-40
29	RM199 Humidity AI	RM199 Humidity Sensor Analogue Input	AV	28542		0 -100
29	RM201 Temp AI	RM201 Temperature Sensor Analogue Input	AV	28555		0-40
29	RM201 Humidity AI	RM201 Humidity Sensor Analogue Input	AV	28556		0 -100
29	RM201 Fan Speed Request	RM201 Fan Speed	AV	28559		0, Auto / 1, Off / 2, Low / 3, Medium / 4, High
29	RM201 Occupancy	RM201 Occupancy	AV	28560		0, Occupied / 1, Unoccupied / 2, Bypass / 3, Standby
29	RM203 Fan Speed Request	RM203 Fan Speed	AV	28573		0, Auto / 1, Off / 2, Low / 3, Medium / 4, High

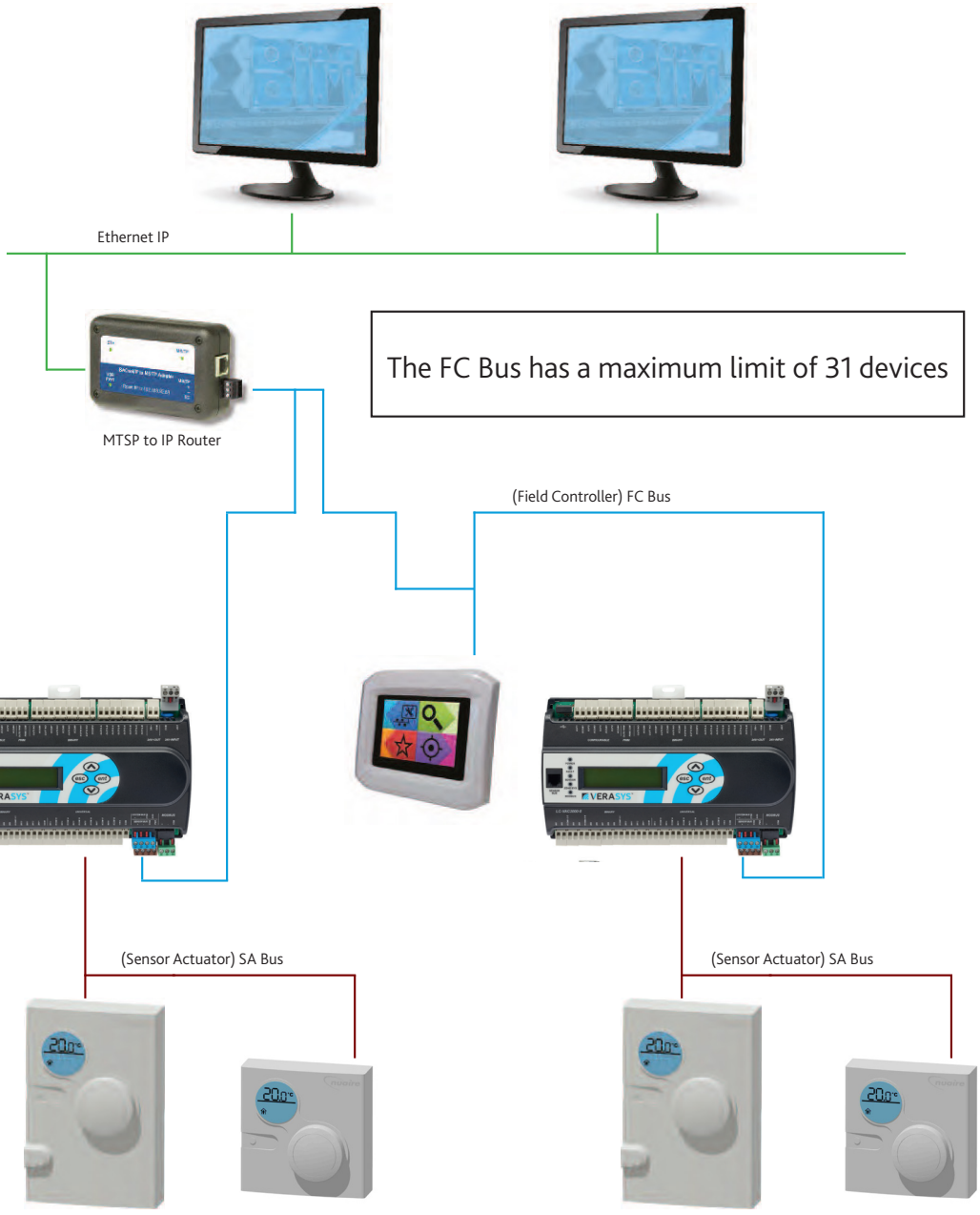
LCD Page Number	Object Name	Description	Point Type	Instance Number	Default Value	Range
29	RM203 Occupancy	RM203 Occupancy	AV	28574		0, Occupied / 1, Unoccupied / 2, Bypass / 3, Standby
29	RM204 CO2 AI	RM204 CO2 Sensor Analogue Input	AV	28578		0 - 2000
29	RM204 Sensor Setpoint	RM204 Setpoint	AV	28579		0-100
29	RM206 CO2 AI	RM206 CO2 Sensor Analogue Input	AV	28592		0 - 2000
29	RM206 Sensor Setpoint	RM206 Setpoint	AV	28593		0-100
30	Alarm Delay	A time delay for the alarm signal	AV	28621		0-120
30	Auto Run-on Scale Factor	a multiplier for the run-on timer.	AV	28622		0-10
30	BMS 0-10V Input	0-10V Network Fan speed demand, along with OUT4 output in "ESClassic BMS" mode	AV	28623		0-10
30	Fan Speed Command	0-10V Network Fan Speed Demand	AV	28637		0-100
30	Extract Fan Max Voltage	Extract Fan Maximum Voltage	AV	28628	10	0-10
30	Extract Fan Start Volt	Extract Fan Minimum Voltage	AV	28629	1	0-10
30	Extract Fan Boost Speed	Extract Fan Boost Speed	AV	28630	100	0-100
30	RM199 CO2 AI	RM199 CO2 Sensor Analogue Input	AV	28543		0 - 2000
30	RM199 Sensor Setpoint	RM199 Setpoint	AV	28544		0-100
30	RM200 Temp AI	RM200 Temperature Sensor Analogue Input	AV	28548		0-40
30	RM200 Humidity AI	RM200 Humidity Sensor Analogue Input	AV	28549		0 -100
30	RM201 CO2 AI	RM201 CO2 Sensor Analogue Input	AV	28557		0 - 2000
30	RM201 Sensor Setpoint	RM201 Setpoint	AV	28558		0-100
30	RM202 Temp AI	RM202 Temperature Sensor Analogue Input	AV	28562		0-40
30	RM202 Humidity AI	RM202 Humidity Sensor Analogue Input	AV	28563		0 -100
30	RM202 Fan Speed Request	RM202 Fan Speed	AV	28566		0, Auto / 1, Off / 2, Low / 3, Medium / 4, High
30	RM202 Occupancy	RM202 Occupancy	AV	28567		0, Occupied / 1, Unoccupied / 2, Bypass / 3, Standby
30	RM204 Temp AI	RM204 Temperature Sensor Analogue Input	AV	28576		0-40
30	RM204 Humidity AI	RM204 Humidity Sensor Analogue Input	AV	28577		0 -100
30	RM204 Fan Speed Request	RM204 Fan Speed	AV	28580		0, Auto / 1, Off / 2, Low / 3, Medium / 4, High
30	RM204 Occupancy	RM204 Occupancy	AV	28581		0, Occupied / 1, Unoccupied / 2, Bypass / 3, Standby
30	RM205 CO2 AI	RM205 CO2 Sensor Analogue Input	AV	28585		0 - 2000
30	RM205 Sensor Setpoint	RM205 Setpoint	AV	28586		0-100
30	RM206 Fan Speed Request	RM206 Fan Speed	AV	28594		0, Auto / 1, Off / 2, Low / 3, Medium / 4, High
30	RM206 Occupancy	RM206 Occupancy	AV	28595		0, Occupied / 1, Unoccupied / 2, Bypass / 3, Standby
31	SA-T High Limit	Supply High Temperature High Limit	AV	28644	50	40-60
31	Humidity Setpoint	In-room humidity Setpoint	AV	28645	50	40-60
31	SA-T Low Limit	Supply Low Temperature Low Limit	AV	28648	8	5-15

LCD Page Number	Object Name	Description	Point Type	Instance Number	Default Value	Range
31	Max Auto Run-on	Run on Time	AV	28649	600	0-1200
31	RM200 CO2 AI	RM200 CO2 Sensor Analogue Input	AV	28550		0 - 2000
31	RM200 Sensor Setpoint	RM200 Setpoint	AV	28551		0-100
31	RM203 Temp AI	RM203 Temperature Sensor Analogue Input	AV	28569		0-40
31	RM203 Humidity AI	RM203 Humidity Sensor Analogue Input	AV	28570		0 -100
31	RM205 Fan Speed Request	RM205 Fan Speed	AV	28587		0, Auto / 1, Off / 2, Low / 3, Medium / 4, High
31	RM205 Occupancy	RM205 Occupancy	AV	28588		0, Occupied / 1, Unoccupied / 2, Bypass / 3, Standby
32	Damper Delay	Damper Delay	AV	28646	0	0-120
32	NFC Fan Speed	Night Free Cooling Fan Speed	AV	28650	60	0-100
32	Purge Fan Speed	Purge Fan Speed	AV	28657	60	0-100
32	Purge Low SA-T Setpoint	Purge Maximum Temperature	AV	28658	5	30-21
32	Purge Min Temp	Purge Minimum Temperature	AV	28659	15	0-30
32	Heat Boost Setpoint	Heat Boost Temperature Setpoint	AV	28642	35	30-40
33	RTC Max Supply Temp	Return Temp Control Maximum Supply Temp	AV	28660	35	30-40
33	RTC Min Supply Temp	Return Temp Control Minimum Supply Temp	AV	28661	12	10-20
33	Run-on (Boost)	Run-On (Boost) speed	AV	28662	0	0-120
33	Run-on (Enable)	Run-On (Enable) speed	AV	28663	0	0-120
34	Setpoint Schedule	Setpoint Schedule	AV	28664	0	12-28
34	Setpoint Timeout	Setpoint Timeout	AV	28665	0	0-7200
34	Supply Fan Max Volt	Supply Temperature Max Voltage	AV	28666	10	0-10
34	Supply Fan Start Volt	Supply Temperature Start Voltage	AV	28667	1	0-100
35	Network Setpoint	Network Temperature Setpoint	AV	28669	22	12-28
35	Supply Fan Boost Speed	Supply Temperature Boost Speed	AV	28670	100	0-100
35	Supply Fan Max Demand	Supply Temperature Max Demand	AV	28671	100	0-100
35	Supply Fan Min Demand	Supply Temperature Min Demand	AV	28672	20	0-100
36	Trickle Deadband	Trickle Temperature Deadband	AV	28673	5	0-10
40	Re-circ Offset	Re-circulation offset temperature	AV	28678		0-100
41	Fan Start Delay (BPS Only)	For R32 Delay	AV	28676	300	0-300
42	Reverse Cycle Backup Heating	Reverse Cycle Backup Heating	MSV	28679	Off	Off / On

2.0 FC BUS DEVICES

2.1 Networking Connection Example

7 Networking Connection Example

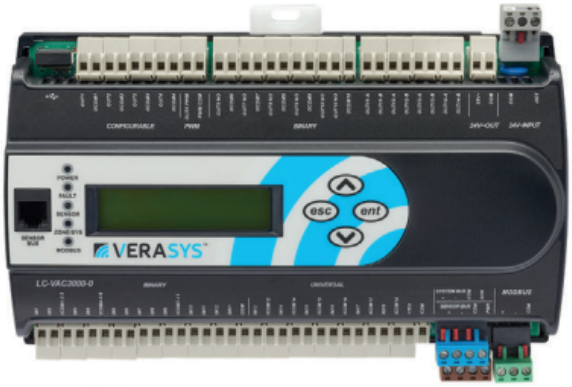


For best results, use a linear network and switch on the EOL resistors at each end of the FC bus.

2.2 FAC Controller

An FAC controller is used to control the unit. The controller can connect to the FC bus via the 4 pin FC connection.

8 FAC Controller



2.2.1 MAC Address

The physical MAC address of the FAC adjustable between 4-127 and is set via the DIP switch on the front of the unit. When multiple controllers are connected on the same FC bus, each controller 's MAC address must be unique.

2.2.2 BACnet Instance Number

The BACnet instance number of the FAC is factory-set to a random unique value from 0-4,194,304. This ensures that every controller will have a unique BACnet instance number on any possible network.

2.2.3 End Of Line (EOL) Resistor

When an FAC controller is used as a terminator at the end of a FC bus line, the EOL resistor dip switch can be switched on for best performance.

2.2.4 Fault Light Status

- **Blink 5Hz -** Not all possible room modules are connected. This is normal.
- **Blink 2Hz -** Startup in progress
- **Off Steady -** No Faults
- **On Steady -** No Software

2.2.5 Current Loop DIP Switches

These should all be set to disabled. Enabling these switches will cause incorrect sensor values.

2.3 BACnet IP To MS/TP Router (ESCO-IPN)

The BACnet IP to MS/TP Router exchanges information between networks and allows the controller to communicate on an IP network. One router is required for each MS/TP network.

9 ESCO-IPN



The BACnet router has a USB 2.0, Type B receptacle which is only used to obtain power from a computer or USB adapter. A mains adapter and cable is supplied. The router connects to the FC bus via screwed terminals.

Address Type	Default Address
IP Address	192.168.92.68
Subnet Mask	255.255.255.0 (/24)

A reset switch is available inside a small hole located on the side of the case. If you press the reset switch with a paper clip (or similar device) for at least 1 second, the switch resets to the default values of the IP address, gateway address, and netmask. After you use the reset switch, you need to reboot the router. The BACnet/IP to MS/TP Router contains a Web server. You can access the Web server from any Internet-compatible computer on the local network. To configure the router, you need a computer with an Ethernet connection, router, and standard Web browser.

2.4 Interconnection

The FC bus connects via the following MSTP cabling:

ESCO-MSTPC30M - Ecosmart Connect MSTP cable reel 30m
ESCO-MSTPC150M - Ecosmart Connect MSTP cable reel 150m

Suggested Wiring Colouring:

White	+
Green	-
Black	COM
Red	Unused

On the SA Bus, the + and - wire are one twisted pair, and the COM and SA PWR are the second twisted pair of wires. These cannot be used with RJ12 connections and must be stripped and connected using screwed terminals. The shield must be earthed at the control panel end only and be made continuous along the bus length. Room Modules must not be fitted more than 150metres (cable length) from the controller.

2.5 Touch Screen (ESCO-LCD) Field Advanced Display (FAD)

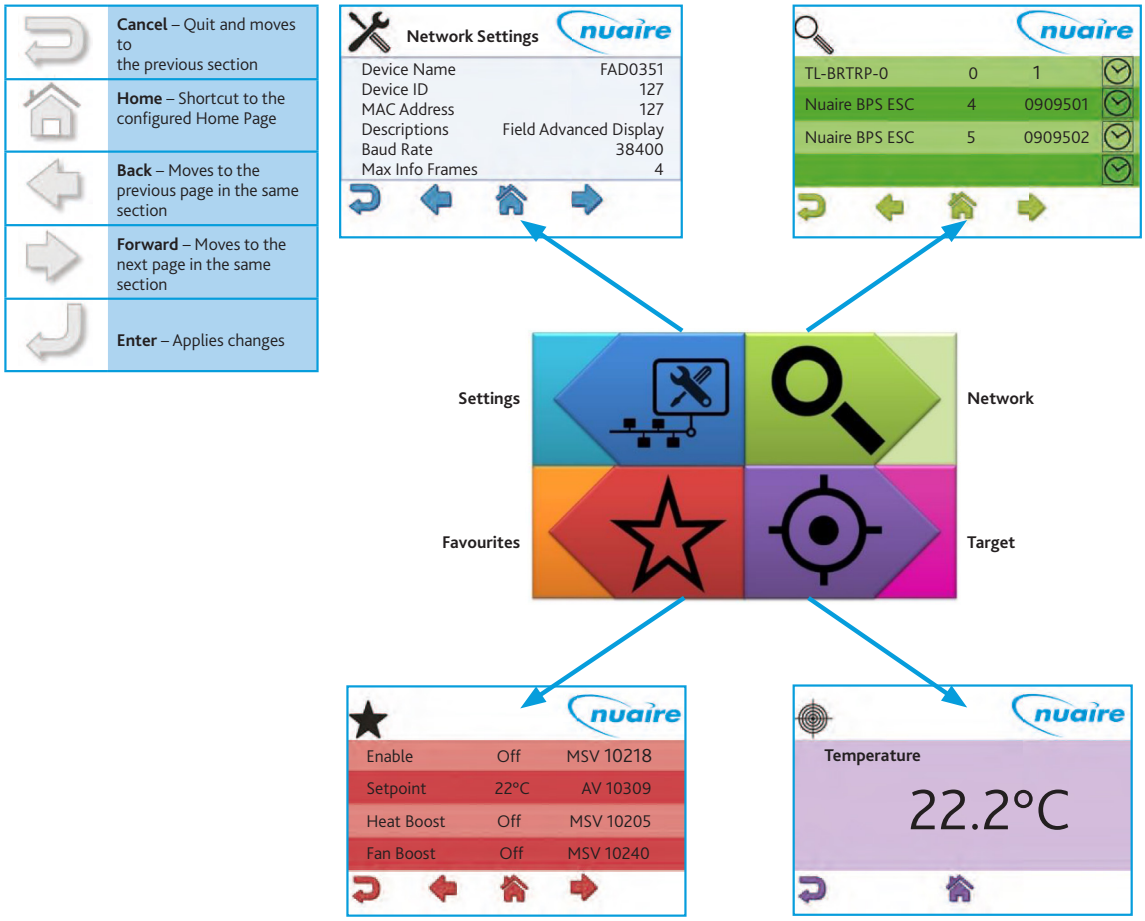
The ESCO-LCD is a user friendly operator interface featuring BACnet® communication and a colourful, graphic display with touch-screen interface. It is powered by 12-24VAC / VDC and connected via the FC bus.

10 ESCO-LCD



2.5.1 ESCO-LCD Navigation

11 ESCO-LCD Navigation



2.5.2 Writing of Values

The ESCO-LCD can browse all devices and objects on the network. By default, it writes variables (BV, AV, MSV) at level 16 and outputs (BO, AO) at level 8. No BACnet device can write inputs (BI, AI). It is highly recommended that the write levels are left at the default settings of 16 for Adjust Priority and 8 for Override Priority.

The ESCO-LCD will only display the present value of the object. If required, the complete priority arrays can be viewed by connecting to the network with a computer via a router and using any BACnet browser software to browse the network.

Object Types:

AI and BI object types are read only. An error will be displayed if an attempt is made to change these object types.

AO & BO values are changed by the strategy at priority level 16. By default, the ESCO-LCD will override these values at priority level 8. Overriding these values is not recommended and may cause undesirable operation. Be sure to relinquish all overrides once finished to minimise confusion.

AV, BV & MSV values are generally not altered by the strategy. By default, the ESCO-LCD will change this value at priority level 16. This is sufficient to change the value permanently.

Relinquishing:

The ESCO-LCD allows the relinquishing of values by selected an empty value for analogue values or the '---' value for discrete values. Setting an analogue value to "0" does not relinquish the command. The relinquish command will only apply to the priority level set in the settings.

2.6 Quick Setup

The following section explains how to quickly set-up the FAD with a target object and some favourites.

2.6.1 Selecting Target Object

Target objects allow the user to view a "target" device and object within the entire network.

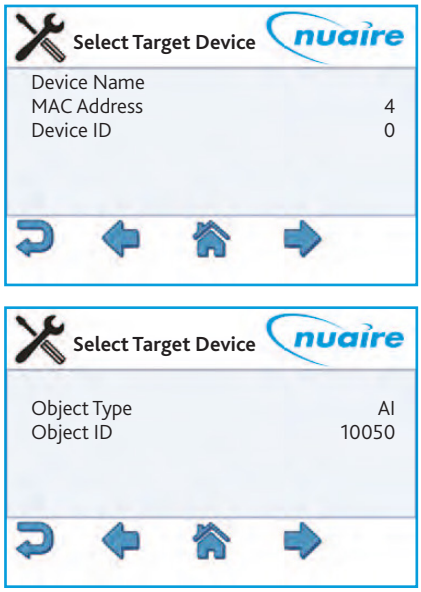
Selecting A Target Object:

- Navigate to the settings page.
- Select the right arrow four times to reach the Select Target Device screen.
- Enter the physical MAC address* of the controller (Device names or BACnetIDs can also be used but MAC addresses are shorter).
- Select the right arrow once.
- Enter the object type of the required object (e.g. AI, AO, MSV)**.
- Enter the BACnet ID** of the object (0-4194304).
- Select the home icon.

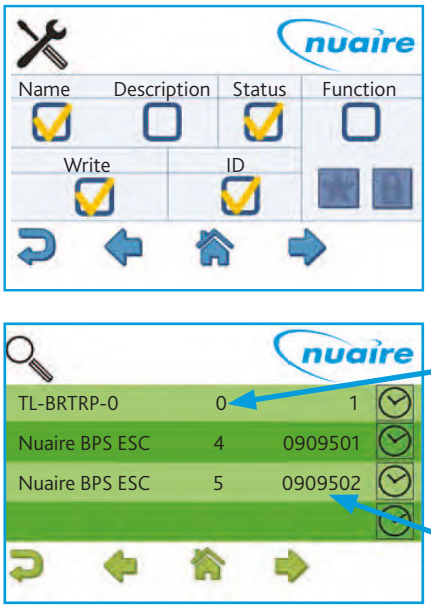
* This is the setting of the DIP switch on the front of the FAC controller. This can also be discovered by browsing to the network screen while ID is selected in the View Config settings screen.

** Popular object details are listed below, or use the network browser or see "Exposed BACnet Object List" for a full list.

12 Selecting Target Object



13 Entering Object Information



Network Page	Description	Object Type	Object ID
25	Room Temperature	AV	28504
27	Effective CO2	AV	28528
27	Effective Humidity	AV	28529
26	Effective Setpoint	AV	28527
2	Unit Enable	MSV	28512
23	Enable Schedule	SCH	
11	Fan Boost	MSV	28635
14	Heat Boost	MSV	28641
25	Fresh Air intake	AV	28501
35	Network Setpoint	AV	28669

2.6.2 Setting Default Home Page

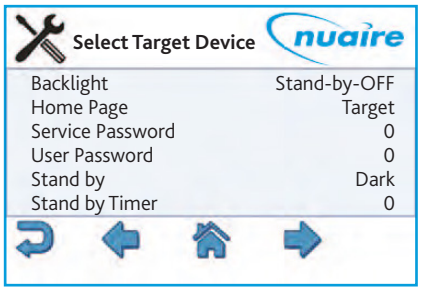
Setting Target Object Page As Default Home Page:

- Navigate to the settings page.
- Select the right arrow twice to reach the display settings screen.
- Select Home Page.
- Select Target.
- Select the enter icon.
- Select the home icon.

The BACnet type & ID will be displayed on the target page if 'ID' is selected on the 'View Config' settings screen.

If the target page is selected as the home page and a security password is set the home page will be locked. The only way to exit the target screen in this case is to press the Nuaire logo to the top right of the screen for 5 seconds.

14 Setting Default Homepage



2.6.3 Setting Favourites

The "Favourite" screen displays a list of favourite objects.

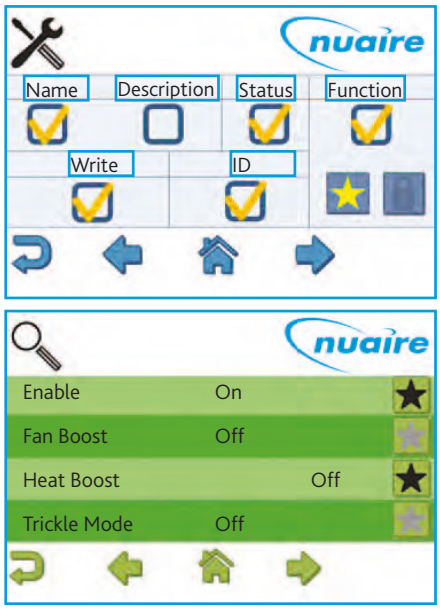
To add or remove favourites:

- Navigate to the settings page.
- Select the right arrow six times to reach the View Config screen.
- Select the function tickbox and favourite star.
- Select the home icon.
- Navigate to the network page.
- Select the appropriate controller.
- Navigate to the required object. See "Exposed BACnet Object List" for a full list (Pressing for 3 seconds on an object will display the full name).
- Select the star to turn it black.
- Navigate and select any other required favourites.
- When finished, navigate back to the View Config screen in the settings section and remove the function tick.

Favourites can be removed by browsing the favourites page, selecting an object and then selecting the trash can.

Favourites can be re-ordered by uploading the favourite settings to a usb memory stick and changing the order of the items in the favourites.csv file. This file can then be downloaded back to the LCD.

15 Setting Favourites



2.7 Security

If the target page or favourite page is selected as the home page and a security password is set, the home page will be locked. The only way to exit the target screen in this case is to press the Nuaire logo to the top right of the screen for 5 seconds. A security password will then be requested to access the main menu. The security password timeout is the same as the standby timer and set via the display settings.

2.7.1 Setting User Password

- Navigate to the settings page.
- Select the right arrow twice to reach the display settings screen.
- Change the user password a 4 digit number.
- The user password will now be requested each time a locked object is written.
- The user password is also needed to exit the target page (when the homepage is set to target).

2.7.2 Setting Service Password

- Navigate to the settings page.
- Select the right arrow twice to reach the display settings screen.
- Change the service password a 4 digit number.
- The service password will now be requested each time the settings page is accessed.

2.7.3 Disable Writing Values

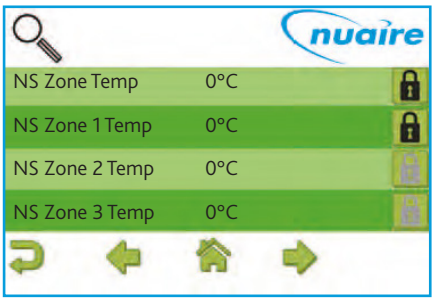
- Navigate to the settings page.
- Select the right arrow six times to reach the View Config screen.
- De-select the write tickbox, all controller points are now read only.
- A service password will need to be set to stop users re-enabling the write function.

2.7.4 Allow Writing Of Basic User Values

- Navigate to the settings page.
- Select the right arrow six times to reach the View Config screen.
- Select the function tick box and lock.
- Select the home icon.
- Navigate to the network page.
- Select the appropriate controller.
- Navigate to the required object, see "Exposed BACnet Object List" for a full list.
- Select any values that need password protection. A black lock indicates a locked value.

When finished, navigate back to the View Config screen in the settings section. Remove the Function tick and enable writing of values.

16 Allowing Writing of Values



A user password will need to be set to stop writing of locked values. It is recommended that all values are locked except the following:

- Enable
- Time Schedule
- Fan Boost
- Heat Boost
- Software Setpoint

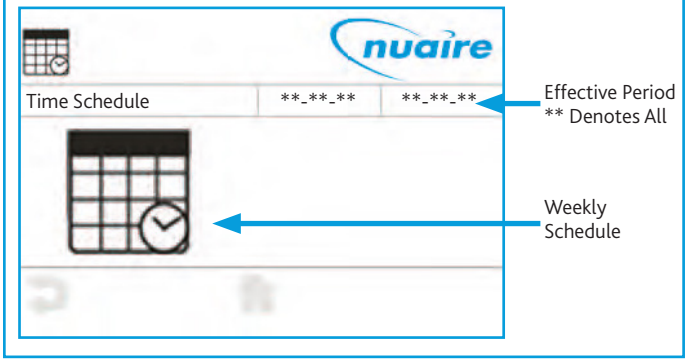
2.7.5 Setting Schedule

Standard BACnet schedule objects can be adjusted in the same way as any other BACnet object.

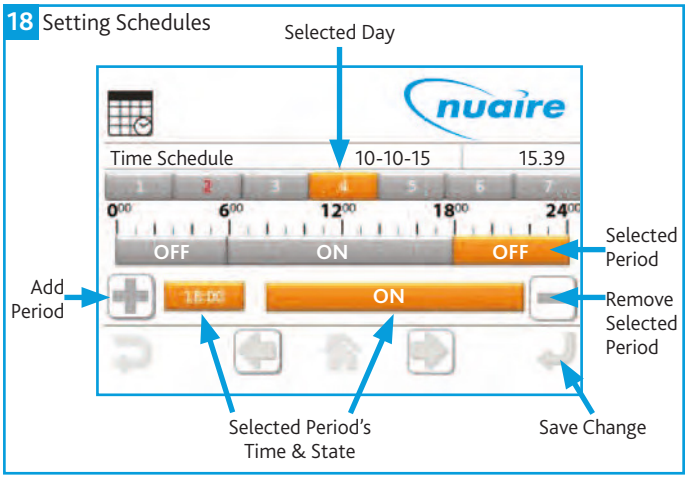
The BACnet schedule function consists of an array of singular time values with a corresponding ON/OFF state. In order to end an 'ON' period, a new value must be created with a value of 'OFF'. This new value's time can be adjusted to the desired end time.

Select a schedule object via object browser or the favourites menu to access the following screens.

17 Scheduling Page



18 Setting Schedules



2.7.6 Alarm Log

When an XBC alarm changes state, a signal is sent to the LCD display and logged on the alarm page. If there are items on the alarm page the standard top left page icons change to one of the following, depending on the current page. The alarm page can be accessed by selecting the alarm icon.

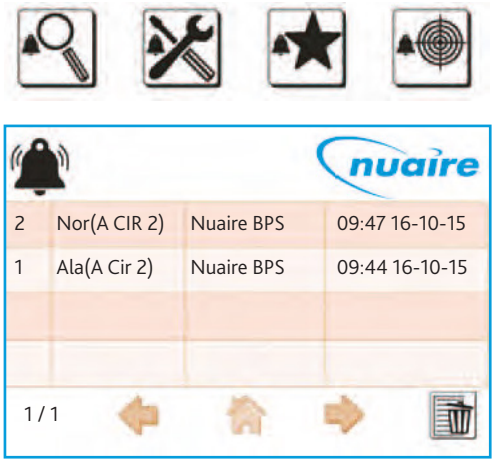
Alarm events are logged with a date and time:

- **'Nor'** represents a change to a normal state.
- **'Ala'** represents a change to an alarm state.
- The text in parentheses denotes the alarm the event applies to. The log can hold up to 40 events.

Logged alarm events can be deleted by using the delete icon. If all events are deleted, alarm states can still be checked by navigating to the BACnet alarm objects via the network browser page. See the BACnet alarm list for alarm objects.

The LCD can be set to sound a continuous beep when a new item is added to the alarm log. This beep is silenced by any user interaction, but the alarm event is still logged. This option can be changed via the settings page.

19 Alarm Log



2.7.7 Backup

The LCD settings, favourites and locked items can be backed up to a USB drive by plugging a USB into the rear of the LCD. The screen will automatically change to a download screen. Select the item required and choose upload.

To download data to the LCD select the data type and choose download.

If a user or service password is forgotten, they can be reset by re-downloading a backup file to the LCD that has no set password. It is recommended that a backup is made of a LCD with no password set.

2.8 Multiple Controllers

When accessing the Network View the FAD launches a Network Discovery function. The purpose of this function is to find other BACnet devices residing on the same MS/TP trunk. The maximum number of devices supported by the FAD discovery function is 32.

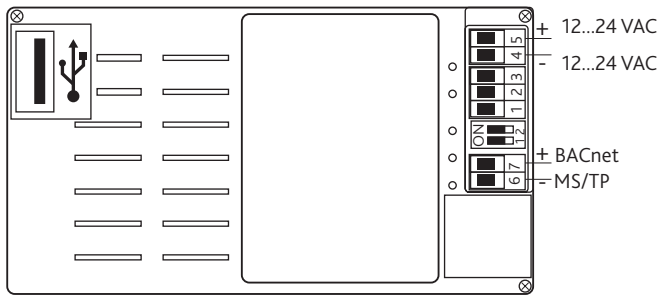
2.9 Controller Wiring

There are 2 ways of connecting the LCD controller:

- Connected to the FC bus using screwed terminals. A separate power supply is required.
- If the controller is standalone, the LCD display can be connected to the RJ12 FC bus port on the front of the FAC controller. This FC port will also power the LCD, so in this case, a separate power supply is not required. One of the following cables is required to achieve this:

ESCO-LCD-3M	Ecosmart-Connect LCD RJ12 Connection Cable 3m
ESCO-LCD-5M	Ecosmart-Connect LCD RJ12 Connection Cable 5m
ESCO-LCD-10M	Ecosmart-Connect LCD RJ12 Connection Cable 10m
ESCO-LCD-20M	Ecosmart-Connect LCD RJ12 Connection Cable 20m
ESCO-LCD-30M	Ecosmart-Connect LCD RJ12 Connection Cable 30m

20 Controller Wiring



Terminals	Description
1-3	Unused
4	Power Supply (-) 12...24 VAC / VDC
5	Power Supply (+) 12...24 VAC / VDC
6	BACnet MS/TP Port (RT-)
7	BACnet MS/TP Port (RT+)
	Programming USB Port

DIP Switch 1 BACnet MS/TP Line Terminator (End of Network 120Ω resistor switch)

DIP Switch 2 Unused

2.10 Setting Pages

These set of pages allow the user to configure the technical functions of the LCD both from the BACnet and user interface perspectives.

The settings page requires a service password for access.

2.10.1 Network Settings Page

Allow the user to discover all devices connected on the MS/TP network and browse all objects exposed within these devices.

Parameter Name	Description	Default Setting
Device Name	It defines the BACnet Device Object Name	FAD0351
Device ID	It defines the BACnet Device Object Identifier	127
MAC Address	MSTP Address of FAD	127
Descriptions	BACnet Description of FAD	Field Advanced Display
Baud Rate	It defines the FAD communication speed over the BACnet local network.	38400
Max Info Frames	It defines the BACnet Device Object Max_Info_Frames	3
Adjust Priority	The Adjust priority parameter defines with which priority the display will command AV / BV / MV values.	16
Override Priority	The Override priority parameter defines with which priority the display will command AO / BO / MO values	8
Page Refresh Time	It defines the polling speed at which the FAD will refresh the values shown on the screen	30 sec
Max Master	This parameter represents the value of the Max_Master property of the node's Device object	127
APDU Time	The APDU Timeout property defines the amount of time, in seconds, the FAD waits for responses from other devices.	3

2.10.2 Display Settings Page

Parameter Name	Description	Default Setting
Backlight	It defines whether the back light remains ON or turns OFF during Standby	Stand-By ON
Homepage	It defines which page to show at power up or pressing the "Home" shortcut button	Main Menu
Service Password	Password required to enter settings page	0
User Password	Password Required to change locked values (All values are locked by default)	0
Stand By	It defines the behaviour of the display once the "Stand By Timer" has expired without interactions from the user	-
Stand By Timer	It defines the inactivity period, in minutes, required to force the display in Stand By mode and for both Service and User passwords expiration. Defining this parameter to Zero, the passwords request (if any) is prompted at any access to pages requiring them	0 min
Feedback Sound	It defines whether the device shall provide a sound feedback during user interaction	OFF
Alarm	It defines whether the device shall provide a sound feedback when receiving a new Alarm. The notification sound can be continuous (ON) or intermittent (BEEP)	OFF
Date	It adjusts settings related to the Day, Month and Year of the FAD integrated clock	
Time	It adjusts settings related to the Hour and Minute of the FAD integrated clock	
Day Of Week	It adjusts settings related to the Day of Week (1-7) of the FAD integrated clock	

2.10.3 Selecting Target Device Page

Parameter Name	Description	Default Setting
Device Name	Name of the device where the object resides	
MAC Address	The MSTP address of the device where the object resides	
Device ID	The BACnet ID of the device where the object resides	
Object Type	The object type	
Object ID	The object BACnet ID	

2.10.4 View Configuration Page

Parameter Name	Description	Default Setting
Name / Description	Chooses whether objects are described by their name or description	Name
Write	Allows editing of objects	Yes
ID	This will display the BACnet ID next to all BACnet objects on the network, favourites and target pages	Yes
Function (Favourite / Lock)	This option allows objects to be added to the favourite or locked list. Once it is selected, navigate to the network page and choose which objects are required. A user password is required to change any locked object, if set. All values are unlocked by default.	None

3.0 SA BUS DEVICES

3.1 Room Module

Room Modules are electronic, wall-mountable sensors designed to work directly with the Nuaire control panel.

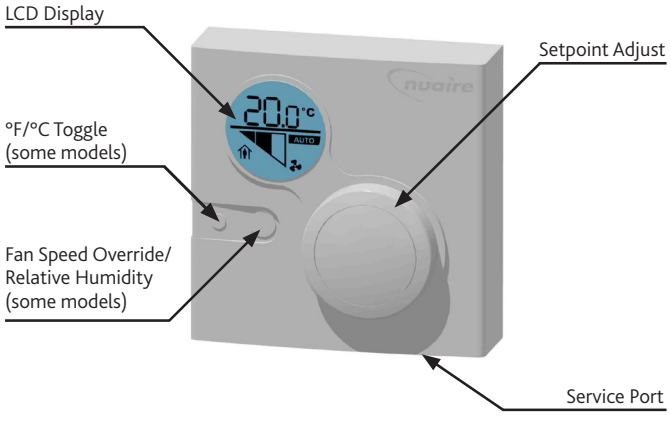
Room modules are automatically detected and require no set-up. The majority of RM modules monitor room temperature; however, options are available to also monitor zone humidity, carbon dioxide (CO2), local temperature setpoint adjustments, PIR, and other variables. This data is transmitted to a controller on the Sensor Actuator (SA) Bus.

21 Room Modules

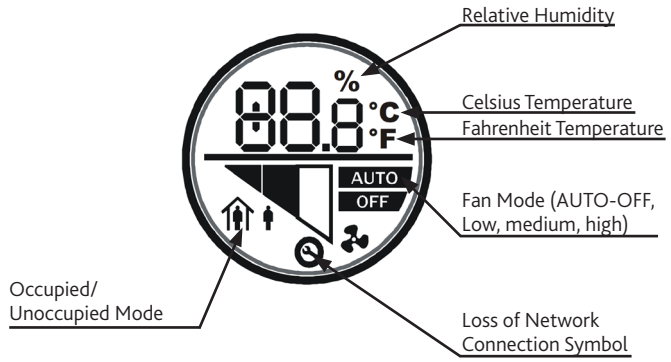


3.2 Features

22 Room Module Overview



23 Room Module Display



3.2.1 Backlit LCD Display

All LCD display versions of Room Modules include a dial to adjust room setpoint. While the setpoint is being adjusted the backlight will switch on and the display will update to show the setpoint. While inactive the display will revert to display the current room temperature. The occupancy status is also displayed on the LCD. On fan speed override models the fan speed and override status is also displayed. A maintenance icon will display if there is a sensor network error.

3.2.2 Service Port

A RJ12 service port is provided at the base of each Room Module. This allows the temporary connection of an extra module to the sensor network.

3.2.3 Fan Speed Override

This button cycles through fan speed override settings.

3.2.4 Room Humidity

The ESC-RM-2-TDH-120 model includes a push button on the face of the network sensor to allow occupants to view the temperature and relative humidity of the zone. Pressing the push button toggles between temperature and RH on the LCD. The LCD defaults to temperature 5 seconds after the push button is released. Following this procedure to permanently change the default display:

- If the display backlight is off, press and release the push button to illuminate the backlight. If the display backlight is already on, proceed to Step 2.
- Press and hold the push button for 5 seconds to switch to the desired default display (either temperature or RH). Note: The desired default display will flash for 5 seconds. After the display stops flashing, the new default display is in effect.
- Release the push button; the desired display is now the new default display.

The humidity setpoint cannot change via RM sensors. This must be changed through a commissioning tool.

3.3 Installation

3.3.1 Removing Rear Cover

- Use a pozi screwdriver to loosen the screw on the top of the unit.
- Insert a coin into the slot next to the security screw location, pressing the tab that keeps the unit closed. Then carefully pry the top edge of the sensor assembly away from its mounting base and remove.

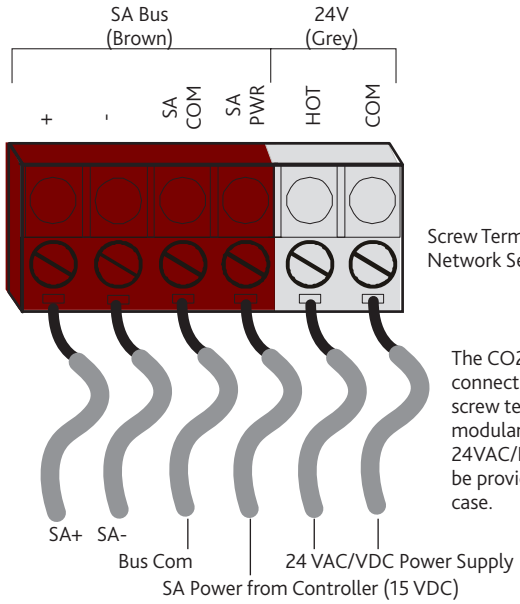
3.3.2 Modular Jack

For the modular jack, simply snap the wiring plug into the jack. A modular jack requires a straight-through, one-to-one connection (not a crossover). See interconnection section for details.

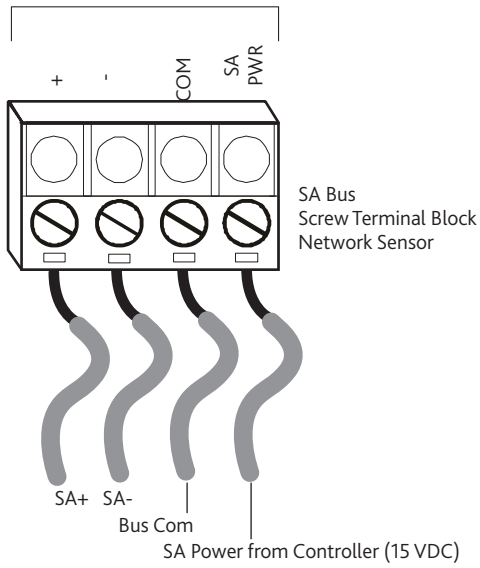
3.3.3 Room Module Wiring

If RJ12 cables are not used, the screw terminal connections on the Room Modules can be used.

24 CO2 Sensor Wiring

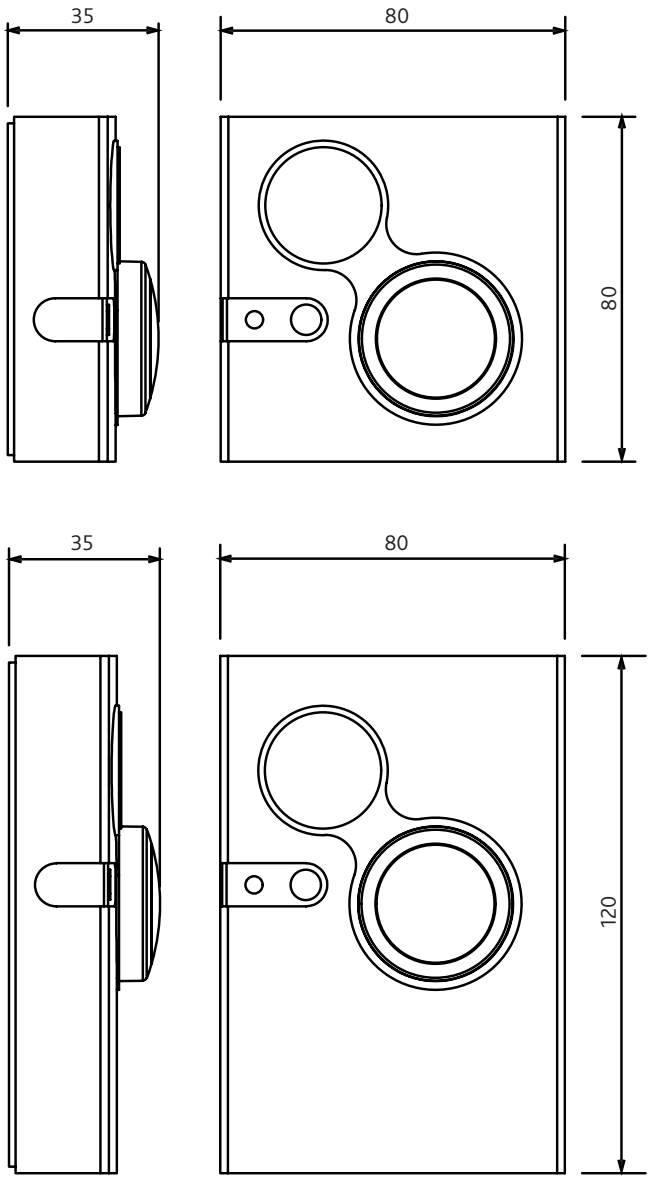


25 Standard Sensor Wiring



3.3.4 Room Module Dimensions

26 Sensor Dimensions (mm)



3.4 Available Room Modules

The following room modules are available:

Group	Nuaire Part	Size (mm)	Temperature Sensor	Humidity Sensor	LCD, Setpoint Adjust & Occupancy Display	PIR	Fan Speed Override	Fan Status Display	CO2 Sensor	Network Address Range	Notes
Group 1 - Max of 1 per Controller	ESCO-TDFS	80x80	Yes	No	Yes	No	Yes	Yes		199 (fixed)	
Group 2 - Max of 4 per Controller	ESCO-TS	80x80	Yes	No	No	No	No	No	No	200-203	
	ESCO-THS	80x80	Yes	Yes	No	No	No	No	No	200-203	
	ESCO-TDS	80x80	Yes	No	Yes	No	No	No	No	200-203	
	ESCO-TDHS	80x80	Yes	Yes	Yes	No	No	No	No	200-203	Relative Humidity is not displayed
	ESCO-TPL	80x120	Yes	No	No	Yes	No	No	No	200-203	
	ESCO-THPL	80x120	Yes	Yes	No	Yes	No	No	No	200-203	
	ESCO-TDPL	80x120	Yes	No	Yes	Yes	No	No	No	200-203	
	ESCO-TDHPL	80x120	Yes	Yes	Yes	Yes	No	No	No	200-203	Relative Humidity is not displayed
	ESCO-TDHL	80x120	Yes	Yes	Yes	No	No	No	No	200-203	Relative Humidity is not displayed
	ESCO-PL	80x120	No	No	No	Yes	No	No	No	200-203	
Group 3 - Max of 4 per	ESCO-CL	80x120	No	No	No	No	No	No	Yes	212-219	Powered via separate 24Vac/DC supply

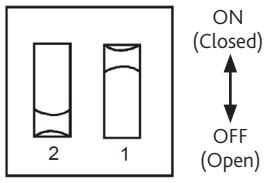
3.5 Sensor Addressing

ESCO-TDFS has a fixed device address of 199 on the SA Bus. The address can be changed on other models via DIP switches on the PCB rear. The designation of each address is shown in the following table.

Network Page	Description	Module Type
199	Fixed	Multi-function (with Fan Speed Override)
200-203	Adjustable	Multi-function
212-219	Adjustable	Room CO2 Sensor Module

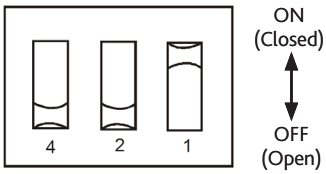
Each sensor on the SA bus must have a unique address. The default controller strategy is preconfigured to automatically detect all Room Modules on the network and react accordingly.

27 200-203 Address Switch Settings



Address		Switch Settings	
		Switch 2	Switch 1
200		OFF	OFF
201		OFF	ON
202		ON	OFF
203		ON	ON

28 212-215 Address Switch Settings



Address		Switch Settings		
		Switch 4	Switch 2	Switch 1
212		OFF	OFF	OFF
213		OFF	OFF	ON
214		OFF	ON	OFF
215		OFF	ON	ON
Not Supported		ON	ANY	ANY

3.6 Room Module Technical Specifications

Supply Voltage	15VDC (Powered from SA bus)
Temperature Measurement Range	0 to 40°C
Humidity Measruement Range	0 to 100% (Full) 10 to 90% (Calibrated)
Temperature Sensor Type	Local 1k ohm Platinum Resistance Temerature Detector (RTD); Class A per IEC 60751
Humidity Sensor Type	Thin Film Capacitive Sensor
Temperature Resolution (Models with LCD)	±0.5°C
Default Temperature Setpoint Adjustment Range	10 to 30°C
PIR Occupancy Sensor Motion Detection	Minimum 94 Angular Degrees up to a distance of 15 ft (4.6m); Based on a clear line of sight.
Ambient Operating Conditions	10 to 30°C, 10 to 90% RH (Temp Probe -10 to 60°C)
Ambient Storage Conditions	-20 to 60°C, t to 95% RH
CO2 Sensor Warmup Time	Less than 1 Minute; less than 10 minutes for full accuracy.

3.7 Interconnection

The sensors or other devices on the SA bus network connect either by modular RJ12 connections or by screwed terminals using plain ended cable. All sensors are fitted with both.

3.7.1 Modular Cable (Up To 30m)

The Room Modules can connect using a 24AWG twisted 3-pair cable with RJ12 connections over the Sensor Actuator (SA) bus. the following items are available.

ESCO-C3M	3m Prefabricated sensor cable with modular jacks
ESCO-C5M	5m Prefabricated sensor cable with modular jacks
ESCO-C10M	10m Prefabricated sensor cable with modular jacks
ESCO-C20M	20m Prefabricated sensor cable with modular jacks
ESCO-C30M	30m Prefabricated sensor cable with modular jacks
ESCO-2WA	2-port extension adapter
ESCO-3WA	3-port extension adapter

Room Modules must not be fitted more than 30metres (cable length) from the controller when using this connection method.

3.7.2 Plain Cable (30 - 150m)

If a Room Module is to be fitted more than 30metres (cable length) from a controller, the following cable is recommended.

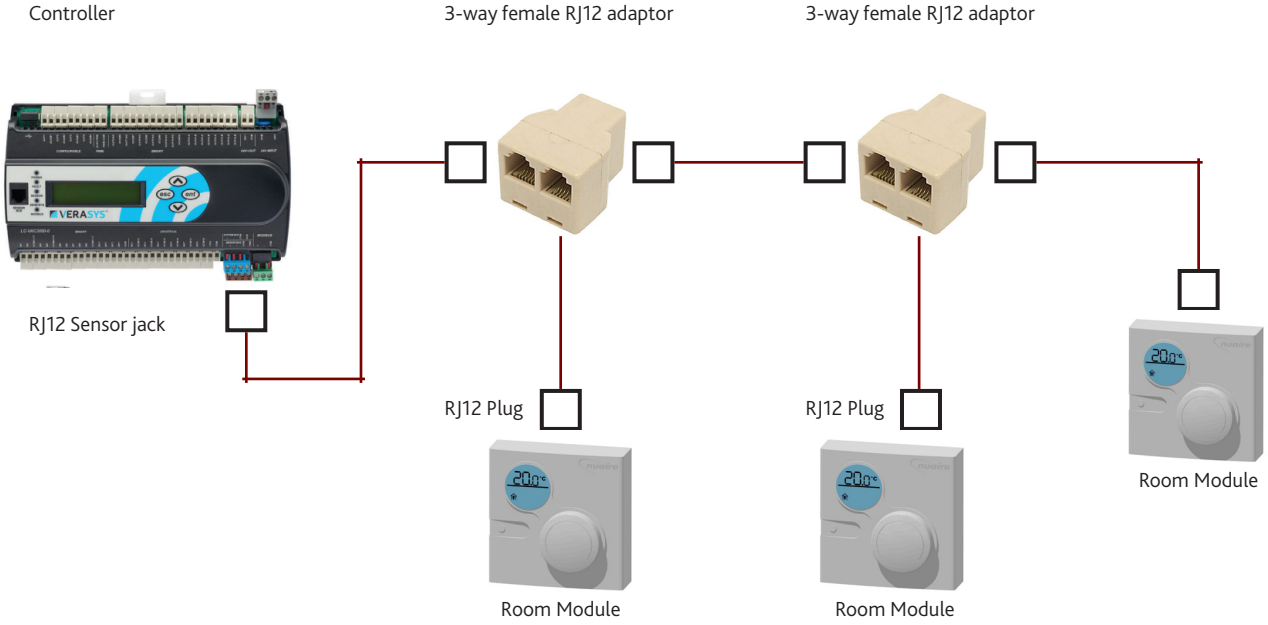
ESCO-MSTPC30M	Ecosmart Connect MSTP cable reel 30m
ESCO-MSTPC150M	Ecosmart Connect MSTP cable reel 150M

On the SA Bus, the + and - wire are one twisted pair, and the COM and SA PWR are the second twisted pair of wires.

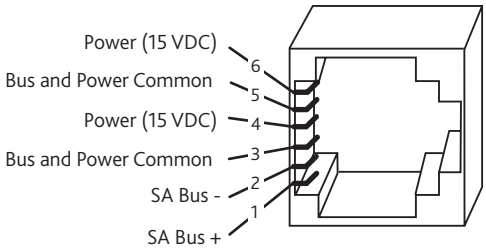
These cannot be used with RJ12 connections and must be stripped and connected using screwed terminals. The shield must be earthed at the control panel end only and be made continuous along the bus length.

Room Modules must not be fitted more than 150metres (cable length) from the controller.

29 Modular Network

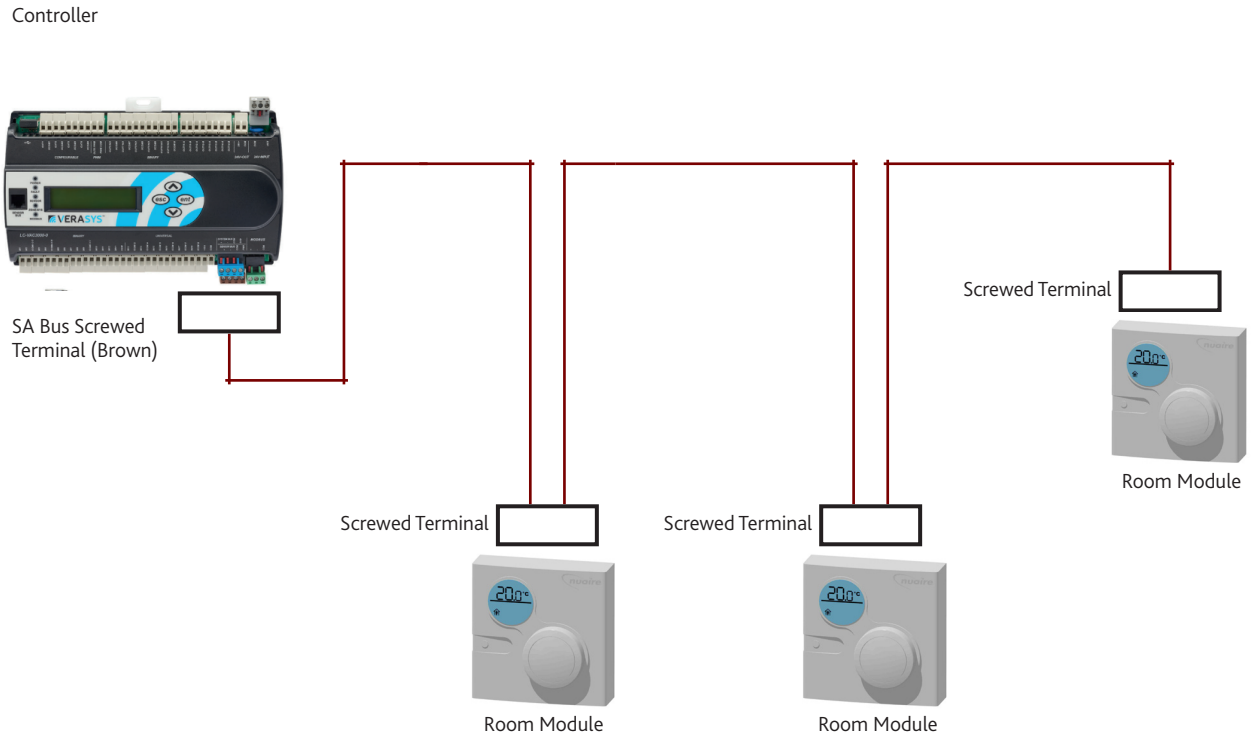


Sensor, SA Bus (RJ-12 Modular Jack)



Cable Type: Pre-fabricated 3 twisted pair with RJ12 Plugs, 26AWG

30 Plain Cable Network



Cable Type: Plain-ended shielded 2 twisted pair 22AWG

NOTES

NOTES