TITAN Products Ltd

FCU-501 FAN COIL CONTROLLER
WITH RDU-4 INTERFACE

BACnet Enabled

Description

The FCU-501 is designed to provide complete control of fan coil units and/or underfloor heating circuits. The FCU-501 incorporates all the inputs and outputs to ensure that this advanced application specific controller meets all the demands for energy efficient and flexible temperature control. The controller can be used standalone, in a Master/Slave group or part of a BMS system via the standard inbuilt native BACnet MS/TP communications. The FCU-501 is fully compatible with the Titan Products RDU-4 user interface.

Features

- 24V AC supply
- Native BACnet communications
- Master/Slave grouping (shared information)
- 0-10V outputs up to 4 dependant on configuration
- Up to 4 x 24V AC triac outputs dependant on configuration
- TPC/PWM or on/off control on triac outputs
- 5 x 0-10V analogue inputs or use as digital inputs
- 3 x VF interlocked relays for fan control
- 1 x VF changeover relay
- On/off, eco, frost settings or high limit
- 2 x 10K3 temperature sensor inputs
- Extensive applications selection
- Remote setpoint display option
- System flush
- Hours run for filter maintenance
- Din Rail mounting

Specification

Supply	24V AC/DC
Power Consumption	3 VA (no RDU) plus outputs 8 VA with RDU display
Triac Outputs	350mA max
0-10V Outputs	5mA max
Temperature Sensors	10K3A1
Analogue Inputs	0-10V
Digital Inputs	Voltfree
Relay Outputs	240V 5 amp max
Communications	Native BACnet
Network	MS/TP - RS485
Indication	Tx/Rx comms
Enclosure	DIN mounting (IP20) L94-VO
Size	106mm wide 92mm high 62mm deep

Display Setting Option

The FCU-5 is fully compatible with Titan Products RDU4 user interface. The RDU4 allows user selection of temperature, control modes, fan speed, ON/OFF overrides and other bespoke functions.

The RDU4 also allows (through engineers pass-code) access to amend the controller default settings and networking addressing of the FCU-501 controllers. In addition all the settings can be viewed and modified over the BACnet communications interface.
A new feature for the FCU501 is Backup & Restore which allows the firmware to be updated through the MSTP communications.

The FCU-501 is also fully compatible with the Remote Access App download available from the Apple App Store or Google Play Store. See remote access section for more details.

The RDU4 is available is in a number of different finishes as standard. These include white plastic, brass, brushed stainless steel and polished chrome. Other finishes on request

Control Mode:

The FCU-501 offers 4 control modes as standard which can be manually selected via the RDU4 user interface or via the in-built BACnet communications if connected to a BMS:

Auto: The controller will automatically open / close the relevant heating / cooling valves and modulate the fan speed against the respective temperature set point for heat, cool and fan.

Heat: The controller will inhibit the cooling control loops and automatically adjust the heating valve output against the user temperature setpoint. The fan can be manually adjusted between Auto / Low / Medium / High and will continue to run at the selected speed until altered. If under floor heating is being used, the fan control will be automatically inhibited during the heat control mode.

Cool: The controller will inhibit the heating control loops and automatically adjust the cooling valve output against the user temperature setpoint. The fan can be manually adjusted between Auto / Low / Medium / High and will continue to run at the selected speed until altered.

Off: All the controller outputs are inhibited and the controller will operate to any fabric protection settings. See unoccupied condition settings.

Application Modes:

The FCU-501 can be set up to provide:
- Combined FCU heating / cooling control
- FCU Cooling / Under Floor Heating control
- FCU Cooling / Under Floor Heating / FCU Heating Boost control

Please see Application selection in control settings for more details.

Remote Access:
When used in conjunction with the Titan Products TP-NM-R/2000 NetMaster router, the FCU-501 controllers can be accessed and enabled remotely from mobile devices through the Titan Products Remote Access app. The app can be downloaded via the Apple App Store or the Android Play Store dependant on the platform required. For more information contact Titan Products.

Controller Settings
The settings listed describe a range of the standard settings, options and operational features that are available from the applications library. All settings can be accessed and modified through the RDU4 or over the BACnet communications interface.

Network & Application Settings	**Description**
Network:	Native MS/TP BACnet (1/4 load) or Stand-alone.
Unit address:	This setting is for the controller's unique unit MAC address on MS/TP bus and is set in the Unit Specific menu. **Range 1 to 127 for a master.**
Device Object ID:	This setting is for the controller's unique device object ID which is for the whole of the site installation and is set in the Unit Specific Menu. **Range 0 to 4194302**
Baud Rate:	Set communication baud rate **Range Options: 9600, 19200, 38400 or 76800**

Control Settings

Group Control:	Allows individual controllers to be set-up as a **Group Master** or **Group Slave**. This sets groups of controllers to take control information and instructions such as temperature, fan speed, ON/Off etc. from a common Master (126 Slaves max). Any number of Groups can be set within the limit of 127 controllers on the MS/TP network. Note: If more than 30 ADDRESS's are used on one MSTP line then repeaters may be required also if communications traffic is high then the number of Devices will be restricted. The objects to be available for Group Transfer will be defined by the type of controller.
Temp Units:	Set °C or °F. All temperature units that are used in the controller setup menus and displayed in the user display menus will be in the format selected. **Range = °C / °F Default = °C**
Temp/Setpoint Display:	When the Controller is used with a remote display setting unit (RDU4), this setting allows the actual measured temperature to be displayed or hidden. **Range = Yes / No Default = Yes (actual temperature is shown)**
Application Selection:	Allows selection of the following application requirements: **Fan Coil Heat/Cool:** Mode selections of Auto / Off / Low / Med / High. The user has the option to select Auto / Low / Medium / High fan speeds in both heating and cooling only modes. The 0-10V Fan control output is controlled by the FCU-501 when Auto is selected and the fan buttons are inhibited. **Fan Coil Cool / UF Heat:** Mode selections of Auto/ Heat / Cool / OFF. In this application the fan does not operate during the Heat control mode or when heating is called for during the Auto control mode. In the Cool Mode the fan defaults to Auto and the user can select fan speeds of Auto / Low / Med / High via the RDU4. If Low / Med / High is selected the fan will continue to run at this speed until the control mode is altered. **Fan Coil Cool/UF Heat/Fan Coil Heat Boost:** Mode selections of Auto/ Heat / Cool / OFF. This application runs exactly like Fan Coil Cool / UF heat as above however the application introduces a Fan Coil Heating boost output. See Heat Boost section.
Default Control Mode:	This defines the control mode that the controller enters on power up or Enable/Disable **Range = Auto / Heat / Cool / OFF Default: Auto**
Temperature Offset Value:	Allows a positive or negative temperature offset to be applied to the measured control temperature. **Range = –10 to +10°C in 0.1°C steps Default = 0°C**
Dead Band setting:	Provides a dead band between the heating and cooling control cycles. **Range = 0 to 10°C in 0.1°C steps Default = 1°C**
Proportional Band Heat:	Sets the proportional band for the heating cycle. **Range = 0.5 to 10°C in 0.1°C steps Default = 2°C**
Proportional Band Heat Boost:	Sets the proportional band for the heating boost cycle. **Range = 0.5 to 10°C in 0.1°C steps Default = 2°C**
Proportional Band Cool:	Sets the proportional band for the cooling cycle. **Range = 0.5 to 10°C in 0.1°C steps Default = 2°C**

Integral Time:	This setting defines the Integral action time for the P+I control function and is common to both heat/cool outputs. **Range = 0 to 20 minutes in 0.5 minute increments Default = 2 minutes**
Max Setpoint:	This setting defines the maximum set point value the system user can enter via the RDU. **Range = 0 to 50°C in 0.5°C steps Default = 30°C**
Min Setpoint:	This setting defines the minimum set point value the system user can enter via the RDU. **Range = 0 to 50°C in 0.5°C steps Default = 15°C**
Default Setpoint	This defines the value of the control set point on power up or switch on. **Range = 0 to 50°C in 0.5°C steps Default = 21°C**
Low Limit Set Point: (Supply Air Temperature)	This limit setting option is to prevent cold draughts from the FCU being discharged into the space when the unit is operating in a cooling mode. The control uses a supply air temperature sensor and the action is to reduce the cooling output in a proportional manner prior to the low limit set point value being reached. If this value is reached the cooling output will be reduced to zero. Two settings are provided for this function; a set point and a low limit proportional band. **Set point range = 10 to 21°C in 0.5°C steps Default = 13°C** **Proportional band = 1 to 5°C in 0.5°C steps Default = 2°C**
High Limit Setpoint:	This limit setting option is to prevent excessive temperatures in the supply air or underfloor heating that may cause overheating when the controller is operating in a heating mode. The control action is to reduce the heating output in a proportional manner prior to the high limit set point value being reached. If this value is reached the heating output will be reduced to zero. Two settings are provided for this function a set point and a high limit proportional band. **Set point range = 25 to 50°C in 0.5°C steps Default = 30°C** **Proportional band = 1 to 5°C in 0.5°C steps Default = 2°C** **Note:** - Limit Set points can be assigned to the temperature sensor S2, S3, the normal control sensor S1 or one of the 0-10V analogue inputs
System Flush:	The system flush is designed to prevent water stagnating in the heating / cooling coils. The FCU501 offers a system flush which can be programmed within the FCU-501 controller with an elapse run time or which can be initiated over BACnet communications from a BMS. If a heating or cooling valve has been exercised open through the normal control process within the set flush elapse period, then that valve will not be subjected to a system flush operation. If working on an internal elapse timer, if any valve has been exercised with normal control in this period that valve is not subjected to a flush process. If Elapse Time is selected the System Flush can be instructed to operate on the following valves: **Range = Both / Heat / Cool Default = Both**
System Flush Period:	The period between flushes from a power cycle. Not Used when BMS System Flush selected. **Range = 0-336hrs Default = 0 (No Auto Flush)**
System Flush Time:	The period each valve is opened for to enable flushing **Range = 0-500 seconds Default = 180 seconds**

System Flush BMS:

It is possible to initiate the system flush via a BMS by writing to the relevant BACnet point (see BACnet manual). If written to, the following procedure will commence:
1) Flush Timer is started
2) Fan control output is inhibited
3) Valves selected for Flush open to 100%
4) After the Flush Timer is complete the control returns to it programmed operation.
Note: The Fan does not run in any Flush period.

Supply Air Reset:

The FCU-501 offers an alternative control approach for fan coil applications whereby the control setpoint is on the supply air temperature and this setpoint is automatically adjusted dependant on the measured space temperature and its deviation away from the desired internal comfort level. Rather than the use of traditional heat / cool control function operating against a desire room temperature setpoint, the supply air temperature is varied by the prevailing room condition. This control action serves to provide a more stable control action to meet the room demands and effectively provides an improved comfort level and energy efficiency. The supply air temperature control also incorporates Min/Max temperature settings to maintain stability and prevent over heat and under cooling.

Supply Air Reset Control Settings:

Midpoint (SP):

This is the balanced temperature when the supply air and room temp are equal. It is also the desired room temperature for comfort condition.

SP adjustment:

Range = +/-5°C with increments of 0.5°C Default = +/- 3°C

Dead band (DB)

The room temp dead band where the room is balanced to the set point and any deviation beyond the DB instigates the start of output control heat or cool.
Range = 0 to 5°C Default = 1°C (0.5°C either side of the set point)

Note: As the Supply Air set point is automatically reset by the variable room condition the DB value is always exerted on wherever the variable set point control point is along the heat or cool slope.

Min Supply Air °C

Range 10 to 20°C

Max Supply Air °C

Range 20 to 40°C

Min Room Temp °C

Range 10 to 20°C

This setting will correspond with the MAX Supply Air °C and thereby set the Heat slope and temp reset ratio.

Max Room Temp °C

Range 20 to 30°C

This setting will correspond with the Supply Air Min and thereby set the Cool slope and temp reset ratio.

Fan Settings & Options:

Fan Control Type:

0-10V Fan Speed control is used for EC fans.

Fan Speeds:

This sets the number of manual fan speeds required across the 0-10V fan output.
The actual output value for each fan speed is subject to the Fan V min and Fan V Max settings:
Range = 1-3 Default = 3

Auto Fan Speed:

If set, the fan automatically increases/decreases the 0-10V fan control output (between the Fan Min/Max values) dependent on the temperature deviation from the controller set point during the manual selection of the heat / cool modes only. If the range is set to No, there will be no option for auto fan mode in manual heat / cool control modes.
Range = Yes / No Default = Yes

Auto Fan Off in DB:

Option to have the fan running through the control dead band or stop when the temperature condition is within the dead band. Note this only applies when the fan is running in an auto condition.
Auto Fan DB = Yes / No Default = No (Fan off in Db)

Default Fan Speed in Heat / Cool: This defines the default fan speed on entering manual Heat / Cool control modes.
Range = Auto / Low / Medium / High Default = Auto

MAX Fan Output:

The Maximum Voltage Output the controller will use to drive the EC Fan Motor in the heating and cooling cycles
Range = 0-10V Default = 10V

MIN Fan Output (Heat):

The Minimum Voltage Output the controller will use to drive the EC Fan Motor in the heating cycle.
Range = 0-10V Default = 0V

MIN Fan Output (Cool):

The Minimum Voltage Output the controller will use to drive the EC Fan Motor in the cooling cycle.
Range = 0-10V Default = 0V

Fan Offset (Heat):

This is the fan PB start point before (+) or after (-) the start point of the heat valve opening
Range = -5 to 5°C Default = 0°C

Fan Offset (Cool):

This is the fan PB start point before (+) or after (-) the start point of the cool vale opening
Range = -5 to 5°C Default = 0°C

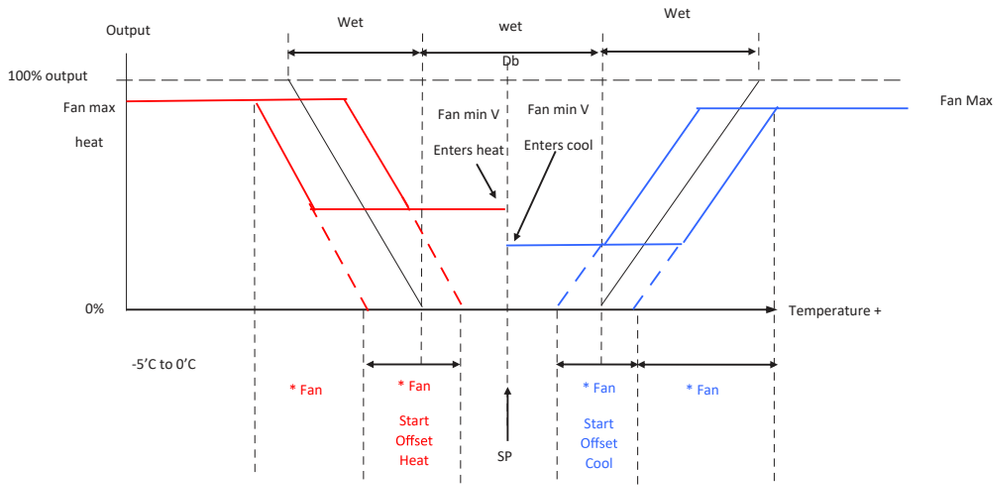
Fan PB (Heat):

This is the proportional band for the fan during the heat cycle. This is the number of °C away from the fan start point where the fan will be at its Max Output. This setting allows f or the fan output to follow the heat valve or lead/lag the heat valve output
Range = 0.1 to 10°C Default = 2°C

Fan PB (Cool):

This is the proportional band for the Fan during the cool cycle. This is the number of °C away from the fan start point where the fan will be at its Max Output. This setting allows for the fan output to follow the heat valve or lead/lag the heat valve output
Range = 0.1 to 10°C Default = 2°C

Fan PB and Offset Explained:
Example shows different Fan PB settings for the heat and cool cycle. By the altering the fan and wet (valve) PB settings with the fan start offset the fan auto modulation can be set to cross the wet modulation at a determined point.
The wet control DB is still used for the fan control hysteresis unless the fan offset is inside the wet DB. In this scenario the switch point will be the fan start point. If the fan start point equals the SP then a fixed 0.5°C value from the set point is used to prevent fan hunting if there are different min speed settings for the Auto fan in the heating and cooling cycles.



Fan Slew Range:
This is the time it takes for the Fan Output to increase from its MIN output to MAX output.
Range = 0-300 seconds Default = 20 seconds

Fan Enable:
This allows the use of one of the three on board relays to switch power to the fan when required. **Note:** Relay rated at 5amp Max @ 240V

Fan Start Up:
This provides an option to start up the fan at full speed whenever it is switched from an OFF to an ON condition. If selected the fan will receive full power for 10 seconds on start-up and after the initial 10 seconds has expired the fan speed will reduce to the selected default value or the temperature control value.
Range = 0 - 10 Default = 0 seconds

Fan Overrun:
When enabled this feature sets a fan overrun time after any switch-off. If selected, and when the controller is in the Fan Overrun period the Fan will default to low speed for the duration of the overrun period.
Range = 0 - 15 minutes in 1 minute steps Default = 0 minutes

Fan ON Delay setting:
This setting provides an option to delay the start of the fan when the controller is enabled or powered ON from an OFF condition. This is to prevent the possibility of cold draughts if thermal actuators are being used. The delay period allows the thermal actuator to warm up after a prolonged OFF period. The delay will only run in the heating cycle.
Operation of Fan Start Delay
The delay start time is dependent on the period of OFF time. If the OFF period is less than the set delay time (the valve run time) then no delay is given. If it is greater than the set delay time, the delay will run for 50% of the set time ensuring the heating valve is 50% open before the fan runs.
>If OFF for less than set delay time – No Delay
> If OFF for more set delay time – Delay Runs for 50% of the set time
Range = 0 to 180 seconds in 30 seconds steps Default = 0 minutes

Occupancy Timed Override:
This option provides a timed override ON to the system. If any value other than 0 is set then the override can be started using the RDU4, if programmed, or by using a digital input and a remote push button.
Range = 0 - 180 minutes in 30 minute steps Default = 0 minutes

Valve and Control Settings:

0-10V Valve Control Outputs:

The 0-10V outputs can be configured to control the heating and/or cooling valves.
Dual Output: 2 x 0-10V for individual control of heating and cooling.
Single Output: heating and cooling are single 0-10V signals with 5V acting as the balance set point. The heating has a span of 5 - 10V and the cooling has a span of 5 - 0V.
MIN/MAX V Settings: Both the Heat and Cool 0-10V outputs can be assigned individual MIN and MAX V settings. When applied, the Heat and Cool proportional bands will automatically re-scale to fit the V range between the V MIN and V MAX settings.

24VAC Valve Control Outputs:

The 4 x triac 24V AC outputs can be configured to control the heating and/or cooling valves. The options include PWM, TPC or ON/OFF 24VAC control:

PWM Pulse width modulation:
Use two triac outputs to provide heating and cooling control.

TPC Time proportional control:
Use four triac outputs to provide positional control of both heating and cooling valves.

On/Off control:
Use one or two triac outputs to switch the heating and/or cooling load. Alternatively, the 24V AC triac outputs can be configured to provide up to 4 stages of heating (via load relays) or DX cooling.

If not used for heating control then any Triac 24V AC switched output can be configured to switch auxiliary/associated plant such as Heat / Cool / Fan enable.

PWM Control (24VAC):

The PWM time operates on a mark/space ratio that is determined by the temperature deviation from the set point across the proportional band setting. PWM control is fully on when the temperature is outside the PB setting.

The temperature input resolution is 0.1°C therefore the incremental adjustment due to temperature change is stated as 10 increments per 1°C. The PWM time in seconds will be determined by the Proportional Band (Pb) setting.

For example:
- Pb set at 1.0°C gives a PWM time of 10 seconds
- Pb set at 1.5°C gives a PWM time of 15 seconds
- Pb set at 2.0°C gives a PWM time of 20 seconds

Range = 10 to 360 seconds Default = 30 seconds

If PWM control is selected, the controller provides an option to select an Intermittent Pre-Heat time for use with thermal actuators. The purpose of this is to keep inactive thermal actuators warm to achieve a close level of control.

TPC Control (24V AC):

Time Proportional Control (TPC) is for 24VAC Open and Close (Raise / Lower) actuators. The setting should match the full run time of the actuator from fully closed to fully open. When TPC is used, the controller has the option to automatically synchronise the position of the actuators on switch OFF and every 24 hours on a continuously running system.
Range = 10 to 360 seconds Default = 150 seconds

On/Off Control (24V AC):

If ON/OFF control of the heating and or cooling circuits is used then the proportional band setting equals the On/Off differential and the controller uses the assigned triac outputs for heat and cool control.
The value of the Dead band setting is also used in On/Off control and represents the temperature value between the OFF point (heat or cool) and the switch ON point (cool or heat).

HIU Enable

This allows the use of one of the 3 on board relays or any unallocated Triac to enable/ disable the HIU when required. The HIU enable is triggered when the measured temperature falls into a heat cycle. Some applications require a delay on enable whilst the heating valve opens to relieve back pressure on the circulating pump. HIU enable is setup in the configuration and allocated to the specific output.

The Delay Enable Settings: Delay = 0 to 30 secs
Note: Relay rated at 5amp Max @ 240V / Triacs 24V AC 350mA max

CIU Enable

This allows the use of one of the 3 on board relays or any of the unallocated triac outputs to enable/disable the Cooling Interface Unit when required.
The CIU enable is triggered when the measured temperature increases into a cool cycle. Some applications require a delay on enable whilst the cooling valve opens to relieve back pressure on the circulating pump. CIU enable is setup in the configuration and allocated to the specific output.

The Delay Enable Settings are: Delay = 0 to 30 secs
Note: Relay rated at 5amp Max @ 240V / Triacs 24V AC 350mA max

Condensate Pump Enable

This allows the use of one of the 3 on board relays or any of the unallocated triac outputs to activate a condensate pump if one of the FCU-5 digital inputs is allocated to condensate input and activated. Alternatively the output can be set to run on an intermittent time base whenever the FCU cooling valve is active.
Range = Yes / No
Note: Relay rated at 5amp Max @ 240V / Triacs 24V AC 350mA max

Unoccupied Settings & Options:
These setting define the action to be taken when the controller is switched OFF to an unoccupied mode via an allocated DI, the RDU4 or from the BMS.

Off:

Heat/Cool outputs off, Fan is switched off, or goes to overrun then off.

Low Temp Fabric Protection:

This selection allows for a minimum low temperature fabric and frost protection operation. Should the measured temperature fall to the low temperature set point then the controller is enabled, any associated plant is enabled and the fan will run at the default low fan speed with the heating valve opening to its min %. Should the temperature continue to fall then the Fan & Valve will modulate to 100% across the Low Temp Protection proportional band. As the temperature increases the Fan Speed and Valve will modulated down to Min % value and remain there until the measured temperature rises 1.5°C above the Low Temperature SP.

Low Temp (start) = 0 to 20°C
Low Temp Pb (100% ON) = 0 to 10°C
Low Temp Heat Valve Min % = 0 to 100%

High Temp Fabric Protection:

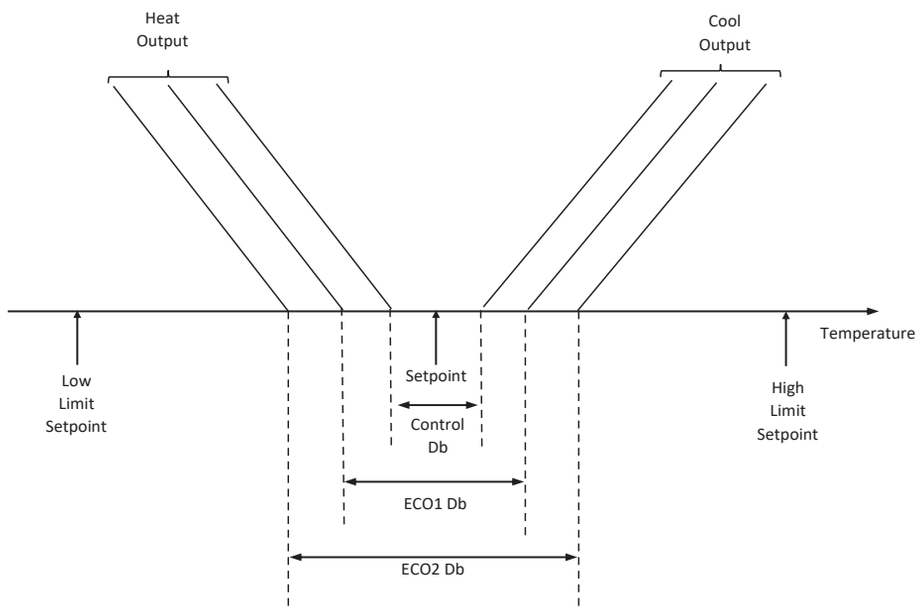
This selection allows for a high temperature fabric protection operation. Should the measured temperature increase to the high temperature set point then the controller is enabled, any associated plant is enabled and the fan will run at the default low fan speed with the cooling valve opening to its min %. Should the temperature continue to increase then the Fan & Valve will modulate to 100% across the High Temp Protection proportional band. As the temperature decreases the Fan Speed and Valve will modulated down to Min % value and remain there until the measured temperature decreases by 1.5°C below the High Limit Temperature SP.

High Temp (start) = 25 to 50°C
High Temp Pb (100% ON) = 0 to 10°C
High Temp Heat Valve Min % = 0 to 100%

ECO 1 Dead Band: The ECO 1 economy setting replaces the controller default dead band thereby decreasing the heating set point and increasing the cooling set point by the value selected.
Range 1 to 20°C.

ECO 2 Dead Band: This ECO setting acts in the same manner as ECO2 above but is specific to the hotel application to provide an "Occupied Standby" mode of operation.
Range 1 to 20°C.

The ECO DB settings are illustrated in the below diagram.



FCU-501 Physical I/O

Analogue or Digital Inputs: Each of the 4 x inputs, In1 to In4, can be used as either analogue (0-10V) inputs or used as digital volt- free switched inputs.

Analogue Inputs: When used as 0-10V analogue inputs each input can be configured for any of the following functions:

Temperature Reset input: If the RDU-4 is not used, a 0-10V input can used to provide a control Set Point adjustment with a variable range selectable in 1°C stages from +/-2°C to +/- 10°C with 5V = to 0°C of reset.

Monitoring: The 0-10V inputs can be scaled, ranged and monitored via BACnet communications
Temp °C / CO2 PPM / Humidity % RH / Pressure Pa / Bar / Power Amps/Volts/KW

Digital Inputs: When used as Digital Inputs the volt-free switched contacts can operate on open or closed contacts. Examples of the configuration options are as follows:-

ON/OFF – This is used to switch the controller ON (occupied) or OFF (unoccupied) from a remote switch. If an RDU-4 is used, "Off" will be displayed.

Window Interlock – For applications with a window contact to switch OFF the FCU-5. If used inconjunction with the RDU4, "WINDOW" will be displayed on the screen display.

Summer/Winter – Used when the system employs a common single valve for heating and cooling. When the allocated DI is activated, the heating control output is changed to a cooling control output. This action can be transmitted globally when used as in a Master/Slave configuration or by the BMS system using BACnet communications. If used on a single valve system the controller can be configured to provide an auxiliary heat control output from a spare analogue or triac output.

Fan Proving – Used with an Air Differential Pressure Switch to identify that the fan is running before the heating or cooling control outputs are activated.

Condensate Detection – Used to reset both heating and cooling or cooling only control actions to close if condensation is detected. The fan control can be programed to either stop or continue to run during the detection of condensation.

Occupancy Extension – Uses a Momentary Push Button to start/stop the controller for a set time period outside the normally occupancy run time.

System Flush – The system flush can be configured to be activated when a digital input, via a momentary push button, is detected.

High Temperature Cut Out – The controller will inhibit the heating output is a HTCO digital input is activated. The fan will continue to run to purge any residual heat.

Fire Detection Input – The controller close all control outputs if a fire digital input is detected.

Status Monitoring – All inputs can be monitored via a BMS using BACnet communications.

Temperature sensor Inputs

3 x 10K3A1 Temp sensor inputs (S1, S2 & S3) can be allocated to
- Control Sensor with option of averaging between the 3 + RDU sensor
- Limit Sensor (supply air)
- External Sensor
- Resistive Remote Set Point Adjuster

The RDU-4 can also be supplied with an in-built temperature control sensor if required.

Temperature SP Adjust

If the RDU-4 is not used, a 0-10V input or a 1k-11K resistive input can used to provide a control setpoint adjustment with a variable range selectable in 1°C stages from +/-2°C to +/- 10°C with 5V = to 0°C of reset

0-10V Analogue Outputs

The 3 x 0-10V outputs can be configured to provide the following control options:

- Heating Valve Control
- Cooling Valve Control
- Heating and Cooling (single output control from one 0-10V output)
- Cooling or Heating changeover (Summer/Winter control from 1 x 0-10V output)
- Fan Control (0-10V control 1 to 3 stages with min and max output settings)
- 0-10V On/Off condition

Note: 0-10V outputs rated at 5mA.

Triac 24V AC Outputs	The 4 x 24VAC digital outputs can be configured to provide the following control options: • Heating Valve Control (PWM, TPC or On/Off) • Cooling Valve Control (PWM, TPC or On/Off) • Cooling or Heating (Summer/Winter control) • HIU / CIU enable • Fan enable • System Fault indication (E.g. High Temp Cut Out, Fan Proving) *Note: 24VAC outputs rated at 350mA. Loading relay may be required.*
On-board Relays	2 x NO Contacts and 1 x Changeover contact independent volt-free relays can be configured to operate under the following options: **Auxiliary Plant** – Used to start up common circuits such as enabling under floor heating wiring centres, heating and cooling interface units on demand. This option includes a fixed switching hysteresis to prevent short cycling and an optional delay ON time with a range of 0-60 seconds to ensure the HIU / CIU secondary circulation pump is not pumping against a closed valve. **Fan Enable** – The operation of the relays can be used to switch power to the fan when required. *Note: on-board relays rated at 5amp MAX @ 240V.*

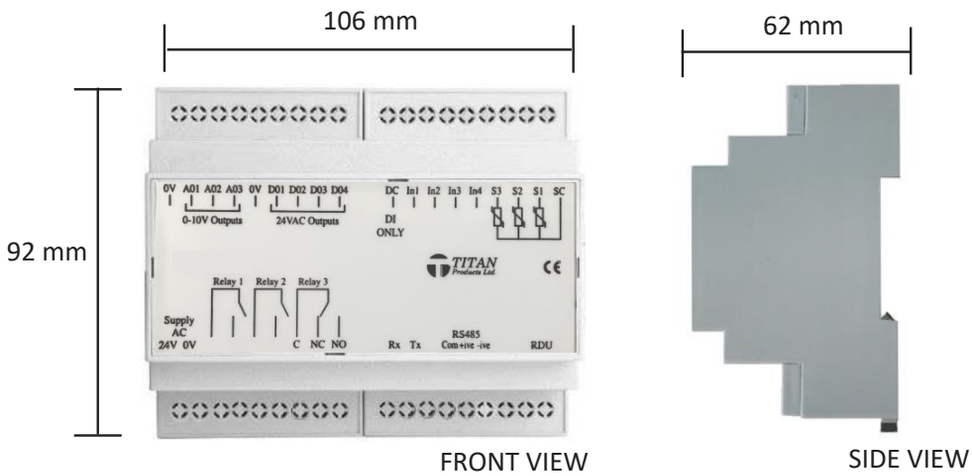
Remote Access

The FCU-5031 is fully compatible with the TP-NM-R/2000 which, when added to a BACnet network, allows the user to interact with the FCU-501 to alter any user settings such as Temperature Setpoint, Control Mode and Fan Speed settings via a remote access download app.

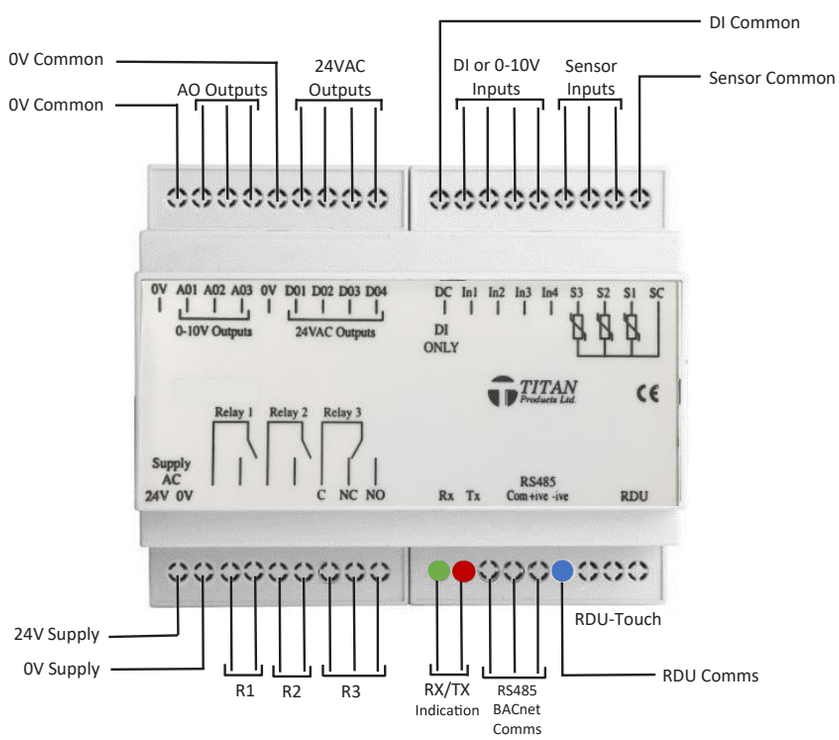
The Remote Access app also allows the user to set up a flexible time schedule for each controller on the network.

The App is downloaded via the Apple App store for IOS devices and the Google Play Store for Android devices. For more information contact Titan Products Ltd.

DIN Rail enclosure dimensions



Connections



Cable Recommendations

Item	Cable Spec & Reference	Requirements
BACnet Communications to BMS Router and between Master - Slave Controllers	Belden 9841 (0.2mm2) Twisted Pair with Drain wire and foil wrap or equivalent. **Note: Drain wire can be used to as a common connection.** **Note: Must be suitable for RS485 Standard**	Daisy chain network configuration only. The cable shield must be connected to Earth ground at the network router end only. **Note: Ensure a 120 ohms resistor is fitted to end of line controller.**
Plug In lead between FCU503 & RDU-Touch	RJ45 CAT5 cable (unbooted recommended) **Note: Titan Products can supply premade leads to length**	Max Cable length 100m Straight-Through cable type.
Resistive 2 Wire Temperature Sensors	2 Core twin twisted screened:- 0.75mm -1mm Belden 8760 (0.82mm2) or Equivalent	Screen Earthed at Controller end only
0-10V Sensors	2 Core twin twisted screened:- 0.75mm -1mm Belden 8760 (0.82mm2) or Equivalent	Screen Earthed at Controller end only
Valve and Damper Actuators	4 Core Screened:- 2 x Twisted Pair:- 0.75mm -1mm Belden (0.82mm2) or Equivalent **Note: This depends on the type and number of actuators being used. Check requirements with actuator manufacturer before installation**	Screen Earthed at Controller end only
Digital inputs :- PIR's / Condense Sensor / Fan prove/ On-Off Switch	2 Core twin twisted screened:- 0.75mm -1mm Belden 8760 (0.82mm2) or Equivalent	Screen Earthed at Controller end only

- All low voltage cables must be segregated from any mains carrying inductors and they should not be run in the same containment system
- All low voltage cables must not run in close proximately to any mains AC inductive loads such as florescent fittings and electric motors

BACnet Network Configuration

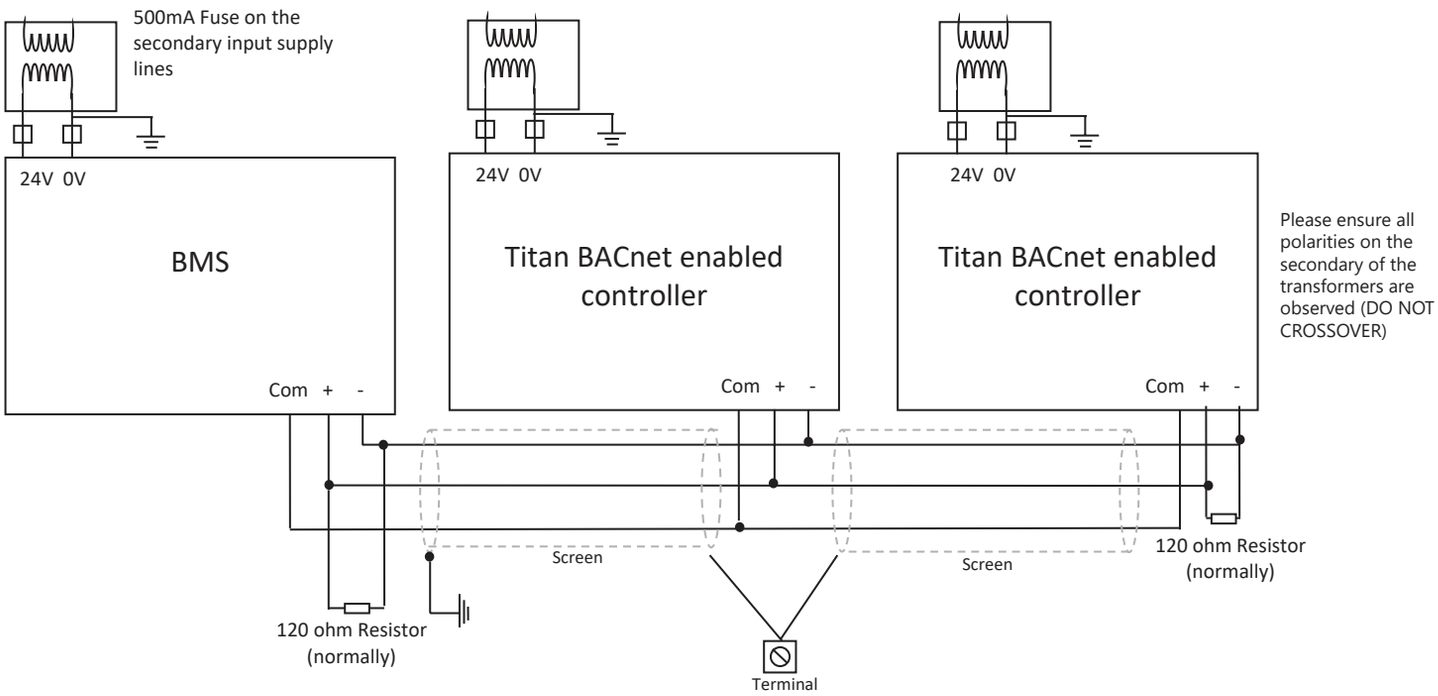
Based on the standards for RS485 networks a BACnet MS/TP network layer allows for only a daisy-chained network configuration, consisting of a single cable routed between controllers. Star and Ring network topologies are not supported.

The network electrically supports a maximum of 127 nodes, however BUS network size capability is determined by factors such as network traffic and BMS capabilities and we recommend maximum network size of 32 devices.

To comply with the EIA-485 standard, the maximum number of nodes per segment shall be 32 and any additional nodes will require the use of repeaters. If only Titan controllers are on the MS/TP network, the number of controllers may be increased but this will depend on the network traffic, the baud rate being used and the length/route of the cable.

A termination resistor of 120 ohms should be connected at each of the end devices, when a network is connected to a Router or BMS this becomes one of the end devices. Please check with the Router/BMS manufacturer if the 120 ohms end of line resistor is fitted internally.

BACnet Connections



The above diagram shows a typical 3-wire daisy chain configuration. For all BACnet standard wiring variants please consult ASHRAE wiring standards.