APRIL 8, 2024

# MT-5-A-LORA-H USER MANUAL

V1.18

DIGITAL CONTROL TECHNOLOGY LTD

# History of Revisions

| Revision | Date | Summary of changes |
|---|---|---|
| V1.00 | April 15, 2023 | First release. |
| V1.01 | Sept 11, 2023 | Revised for RTU. |
| V1.02 | Oct 23, 2023 | Revised for HPU. |
| V1.03 | Nov 07, 2023 | Revised for Event Log and RTC time. |
| V1.04 | Nov 20, 2023 | Revised for FCU. |
| V1.05 | Nov 24, 2023 | Revised for FCU 2 Pipe, 4 Pipe systems. |
| V1.06 | Dec 06, 2023 | Revised for RTU, HPU Cut in Cut Out Algorithm. |
| V1.07 | Dec 20, 2023 | Revise LoRaWAN Packet and FUOTA |
| V1.08 | Dec 22, 2023 | Revise Terminal configurations |
| V1.09 | Jan 03, 2024 | Add Temperature Unit Selection |
| V1.10 | Jan 19, 2024 | Separate heating and cooling setpoint<br>Split SET_SETTING1 to two setting command<br>Change Event Log to auto transmit<br>Fix Scheduler bugs |
| V1.11 | Jan 21, 2024 | Add Cooling SP and Heating SP to Morning, Afternoon, Evening and Night Session |
| V1.12 | Jan 24, 2024 | Add Humidity Display |
| V1.13 | Jan 31, 2024 | Added New LoRaWAN Setting API |
| V1.14 | Mar 04, 2024 | Bug fix. |
| V1.15 | Mar 09, 2024 | Add BACnet Points |
| V1.16 | Mar 11, 2024 | Add restrictions on Application Mode and Operation Mode.<br>Add RS485 Specifications |
| V1.17 | Mar 25, 2024 | Fix Temperature display for > 100 and <32°F or <0°C as HI and Lo.<br>Add button cell warning statement |
| V1.18 | April 08, 2024 | Add user override function. |

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# 1. Overview

MT-5 is a series of advanced thermostat with LoRaWAN, RS485(BACnet MSTP and Modbus RTU), and WIFI supported. It measures the room temperature, and controls the fans and valves to adjust the room temperature to the pre-configured temperature. This device supports configuration like two-pipe/four-pipe, two-lines/three-lines valves, and three fan speeds controls, modulating valve and ECM fan. It supports relative humidity measurement and optional eCO2 measurement for comfort and Air Quality Control. It is developed as a LoRaWAN end node and can be communicated wirelessly with standard LoRaWAN system. Therefore, this is suitable be applied in office buildings, residential buildings, hotels, clubhouses, airports, railway stations, stadiums, and so on.

This particular user manual only covers MT-5-A, 5 Relay DO model.

# 2. Dimensions

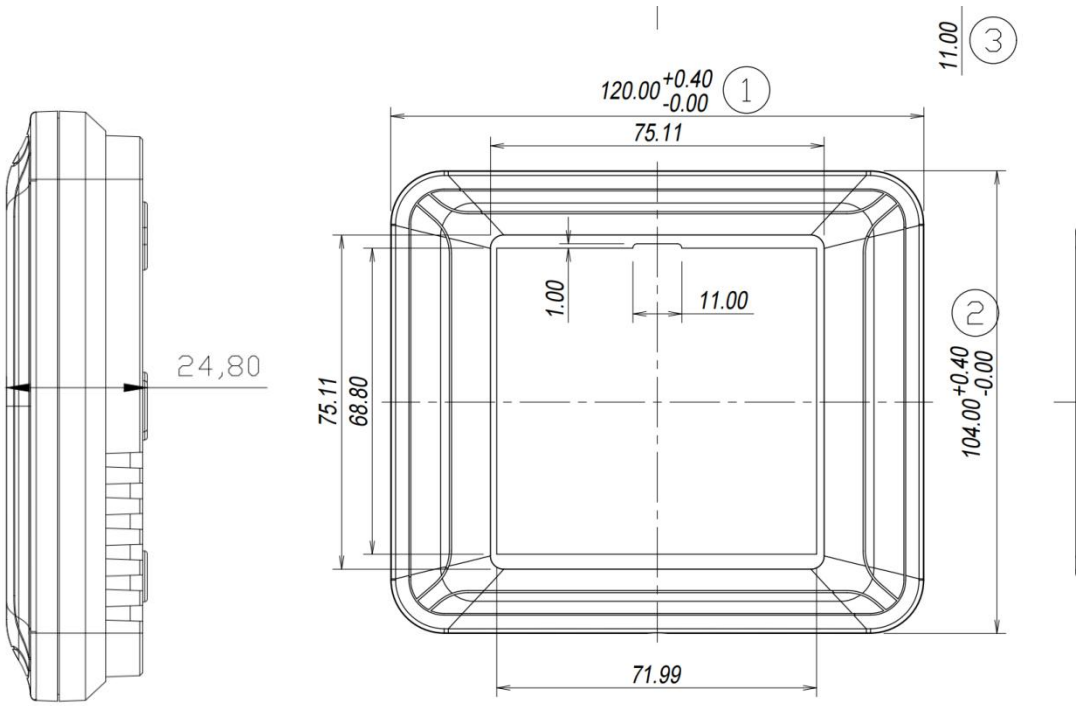



FIGURE 1: MT-5 FRONT AND SIDE DIMENSION(MM)

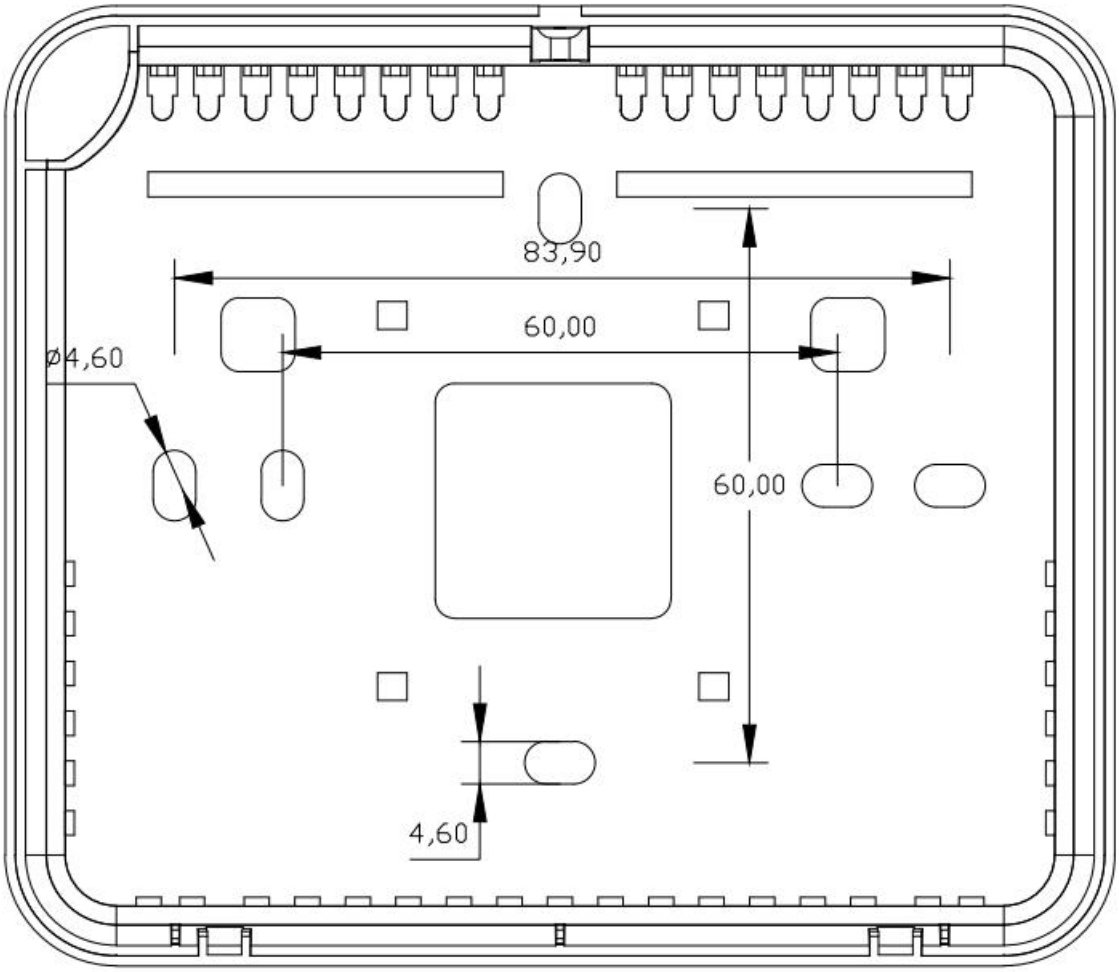



**FIGURE 2: MT-5 MOUNTING HOLES DISTANCES AND SIZES(MM).**

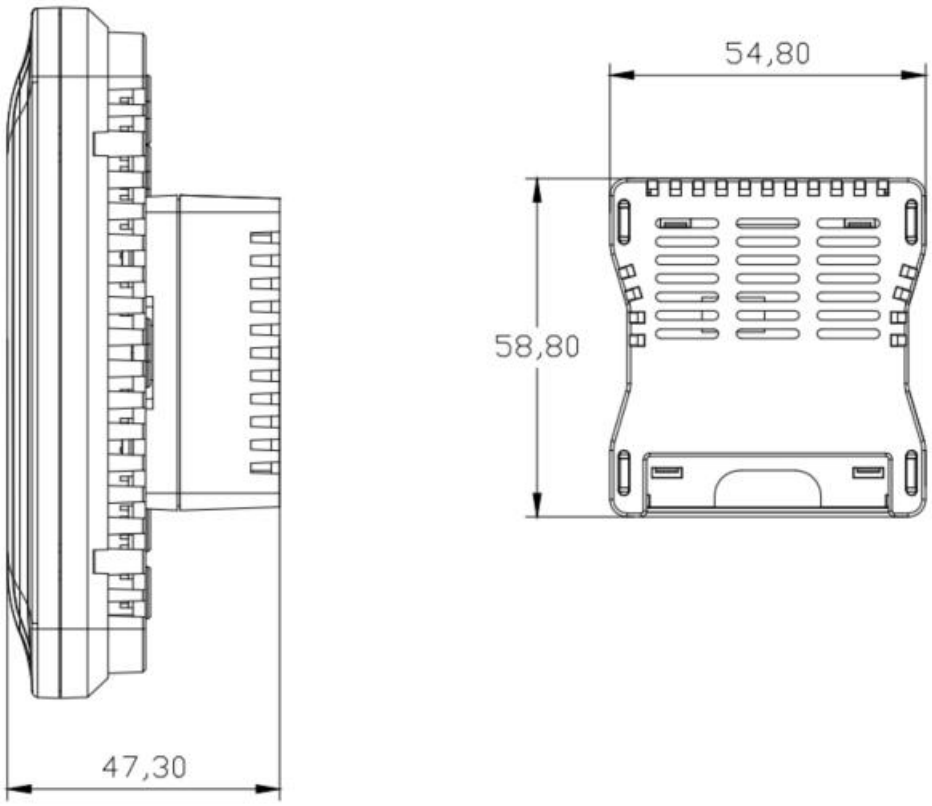
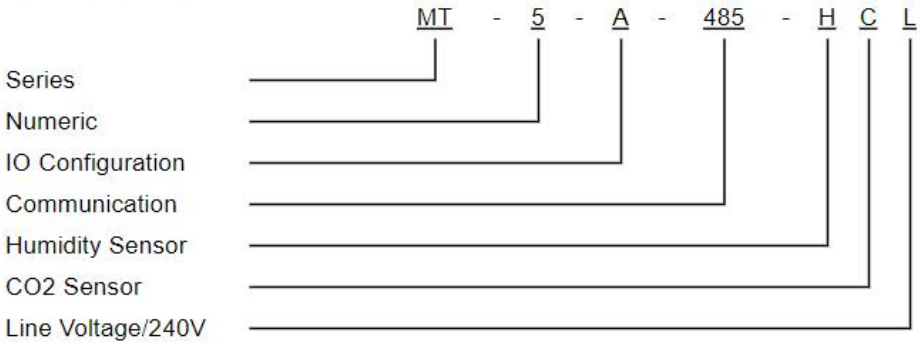



FIGURE 3: MT-5-X/L DIMENSION

# 3. MT-5 Series and Order Code

MT-5 Naming Convention and Order Code

**MT-5 Series Order Code**




**Communication Option**

| | |
|---|---|
| 485 | RS485 supported. This option will supports Modbus RTU and BACnet MSTP |
| LoRa | LoRaWan supported.<br>This option will supports Modbus RTU and BACnet MSTP also. |
| WIFI | WIFI supported. This option will supports Modbus TCP and BACnet IP via WIFI.<br>This option will supports Modbus RTU and BACnet MSTP also. |

Note : RS485 is the default feature. It is available for LoRA and WIFI version.

## 4. Specifications

| MT-5 | |
|---|---|
| Pwer Supply | 24VAC +20%/-15% 50/60Hz |
| Power Consumption | TBA |
| Temperature Sensor | 0°C to 70°C ± 0.25°C |
| Temperature Control Range | 1°C to 50°C (default is 16-30°C) |
| Humidity Sensor | 20% RH to 80% RH ±2.5% RH @ 20°C to 80°C |
| eCO2 Sensor | 400 ppm to 5000 ppm |
| Relay | 24VAC 0.3A, 24VDC 1A |
| Display | 64 x 64mm Black Mask LCD |
| Control | Touch Screen Button |
| Casing Material | Fireproof ABS+PC with scratch resistance acrylic |
| Operating Temperature | -10 to 60°C, 5% RH to 95% RH non-condensing |
| Storage Temperature | -20°C to 70°C |
| Dimension | Panel : TBA(L x W x H) |
| Installation Method | Standard 86-type box, NEMA WD-6 junction box |
| Installation Hole Distance | 60mm (standard 86-type box hole distance)<br>83.9mm (3.281”)( NEMA WD-6 junction box) |
| Cable Specification | 0.5-1.5mm$^2$ |

# 5. Hardware Descriptions

## 5.1 Front

There are 7 button on the front panel.

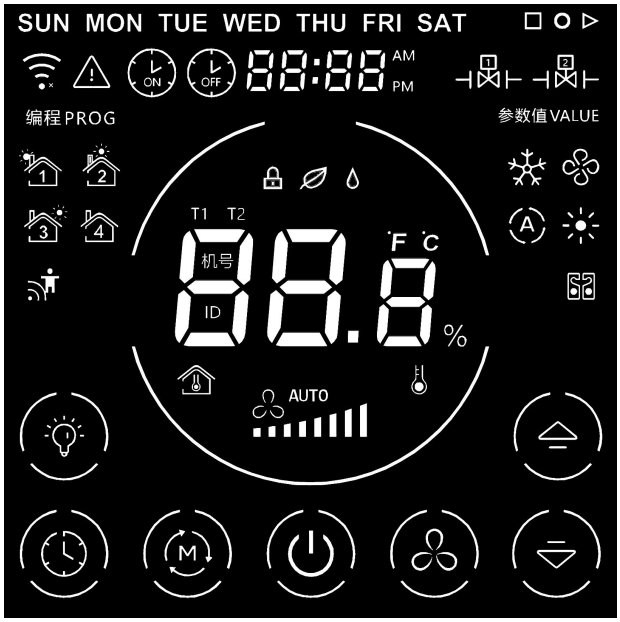



FIGURE 4: FRONT VIEW

## 5.2 Back

Main Port is used to connect with the supply power and valve control.

Temperature Sensor is used to measure the room temperature.

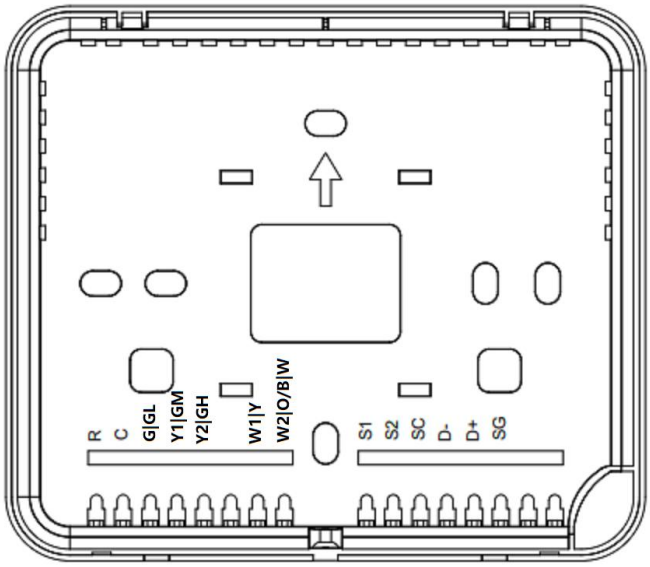



FIGURE 5: LOW VOLTAGE WIRING

## 5.3 Motherboard Battery

The only function of the battery is used for saving the device time, it does not need to be replaced in normal circumstances, since the configuration will not be lost even the battery is dead. To replace the battery in the MT-5, the back cover of the screen is required to be removed. Battery model is CR1216 lithium battery with nominal voltage of 3V, which can last for 5 years. The battery should be used carefully, as it can overheat, explode, catch fire. **The battery is not included. Please use a UL certified battery for safety**.

The followings are the precautions of using a battery:

- The battery type is CR1216, nominal voltage 3V, non-rechargeable lithium-ion button cell.
- Remove and immediately recycle or dispose of used batteries according to local regulations and keep away from children. Do NOT dispose of batteries in household trash or incinerate.
- Do not reuse recycled battery, used batteries may cause severe injury or death.
- Call a local poison control center for treatment information if the battery is accidentally swallowed.
- Non-rechargeable batteries are not to be recharged, doing this may cause the battery to catch fire.
- Do not force discharge, recharge, disassemble, heat above 50°C/122°F or incinerate. Doing so may result in injury due to venting, leakage or explosion resulting in chemical burns.
- Ensure the batteries are installed correctly according to polarity (+ and -).
- Do not mix old and new batteries, different brands or types of batteries, such as alkaline, carbon-zinc, or rechargeable batteries.
- Remove and immediately recycle or dispose of batteries from equipment not used for an extended period of time according to local regulations.
- Always completely secure the battery compartment. If the battery compartment does not close securely, stop using the product, remove the batteries, and keep them away from children.
- Do not short-circuit the battery, as it will leak, overheat, or explode.
- If the battery is overheating, stop using it.

# 6. Wiring Connections

## 6.1 Power Supply

MT-5 when used without offline adapter use 24VAC +20%/-15% or 24VDC +/- 5%

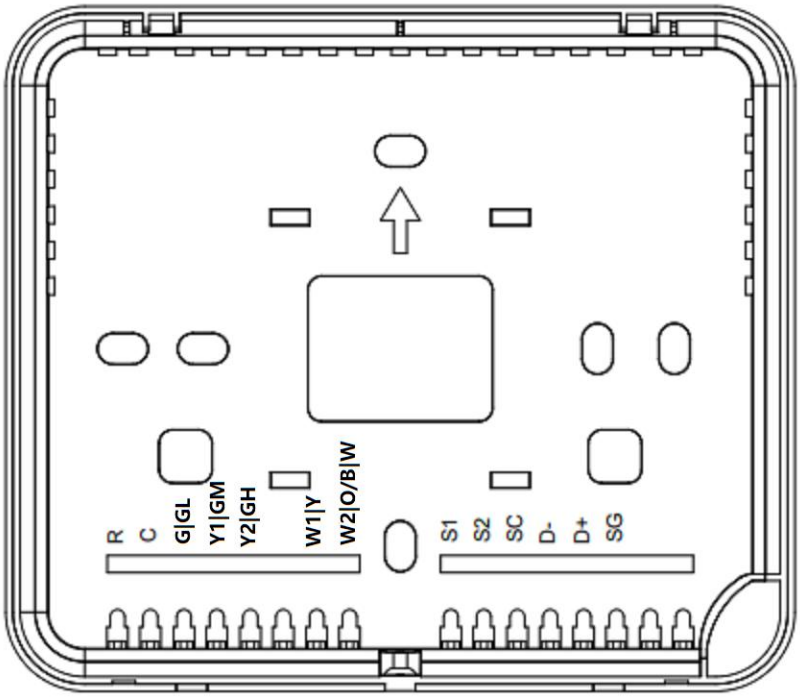



FIGURE 6: CONNECTION WITHOUT OFFLINE ADAPTER

## 6.2 RS485 Connection

RS485 port on MT-5 is used for Modbus RTU, and BACnet MSTP.

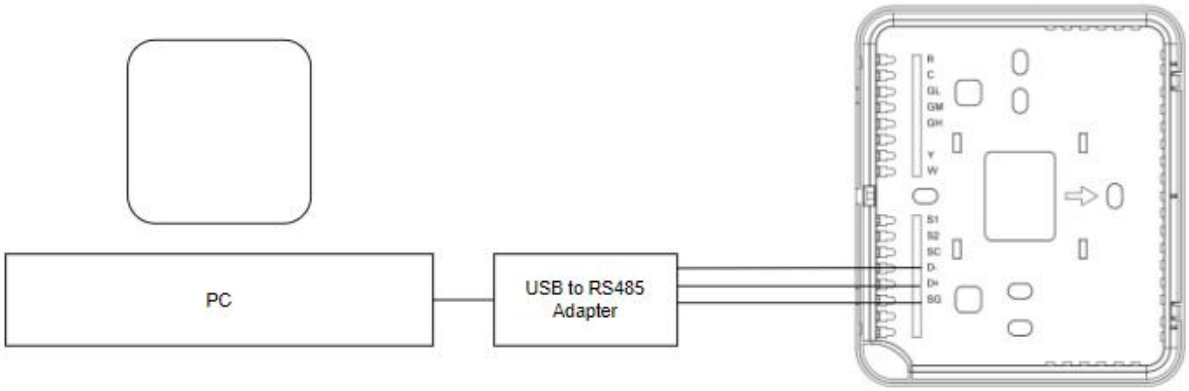



**FIGURE 7: RS485 CONNECTION**

# 7. Installation

Please make sure the device is not powered during installation. MT-5 should be installed at somewhere with good air circulation, far from the heat source and windows, to avoid direct sunlight. It also should be installed in a standard 86-type box (86 x 86 mm). Please do not punch any hole on the cover box, do not disassemble the power adapter, as it will damage the device and cause harm. Please consult manufacturer technician before performing any action that is dangerous. When the device is showing 'E01' on the screen and buzzing, it means that the device is in error.

Apply slotted screwdriver to pry the screen cover open at the holes as shown below to separate the LCD from the back cover or in case of Offline version from the back cover and the MTPS power adapter.

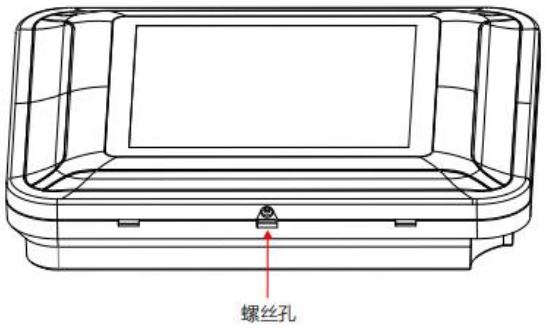



FIGURE 8: OPEN AND SEPARATE THE LCD FROM THE BACK COVER

Install the back cover to the wall plate box after wiring is done and screw the back casing to the box as shown below.

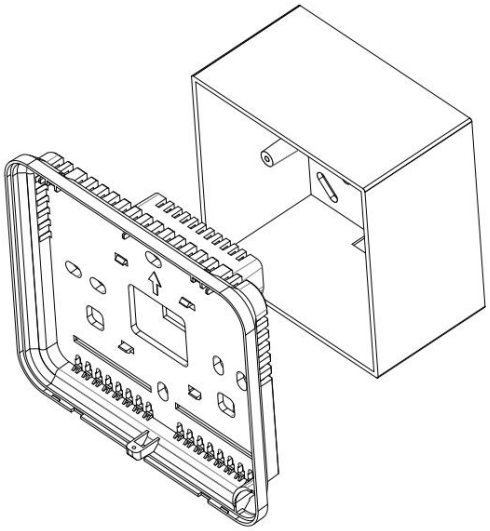


FIGURE 9: SLOTTED SCREWDRIVER AND SCREEN COVER

Snap the screen cover on to the bottom cover that is pried open previously. Do not apply force on the screen, as it will damage the screen sensor, apply force at the edge will do the work. Screw back the screw at the bottom to secure the screen.

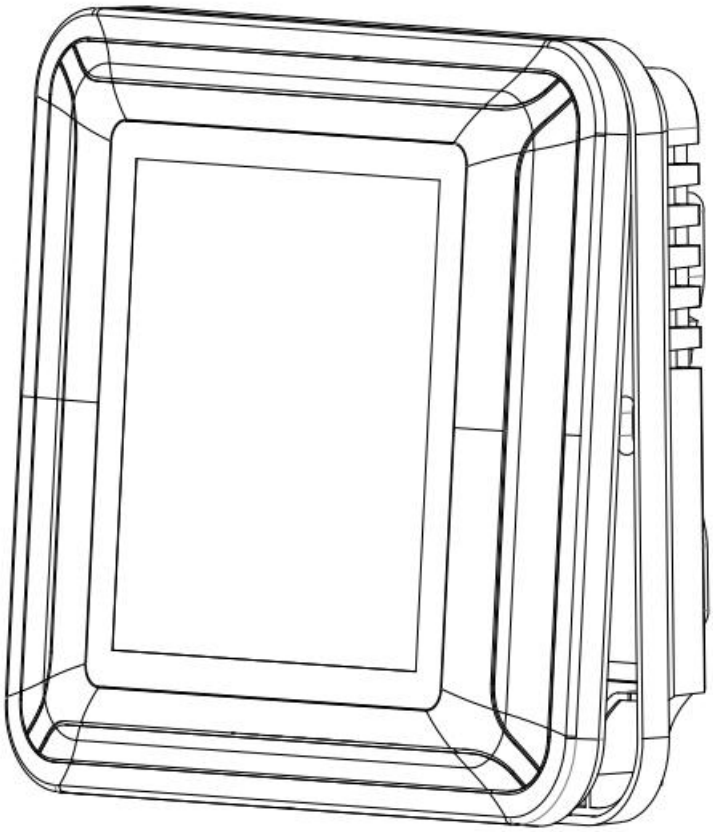


FIGURE 10: SCREEN COVER INSTALLATION

# 8. Application

## 8.1 Roof Top Unit Application

User can select the operating mode by touch screen mode button or remote access by network command. The available user selectable modes are: Off(by the power button), Fan, Dry, Cool, Heat and Auto.

Parameters used:

| | |
|---|---|
| Cooling Setpoint | User selected cooling setpoint temperature |
| Y(1) Offset | Offset from setpoint, Y1 Off. |
| Y(2) Offset | Offset from setpoint, Y1 On, and Y2 Off. |
| Y(3) Offset | Offset from setpoint, Y2 On. |
| Heating Setpoint | User selected heating setpoint temperature |
| W(1) Offset | Offset from setpoint, W1 Off |
| W(2) Offset | Offset from setpoint, W1 On, and W2 Off. |
| W(3) Offset | Offset from setpoint, W2 On. |
| Coff | Compressor minimum off time, in seconds, 0 = disable, max 65535s. |
| Con | Compressor minimum on time, in seconds, 0 = disable, max 65535s. |
| Boost Min Time | Activate higher Fan/stage when temperature stay in the zone for too long, in second, 0 = disable, max 65535s. |

Conditions:

Y(3) Offset > Y(2)Offset > Y(1) Offset

W3 Offset < W2 Offset < W1 Offset

Default values:

CoolSP = 25°C or 77°F

HeatSP = 20°C or 68°F

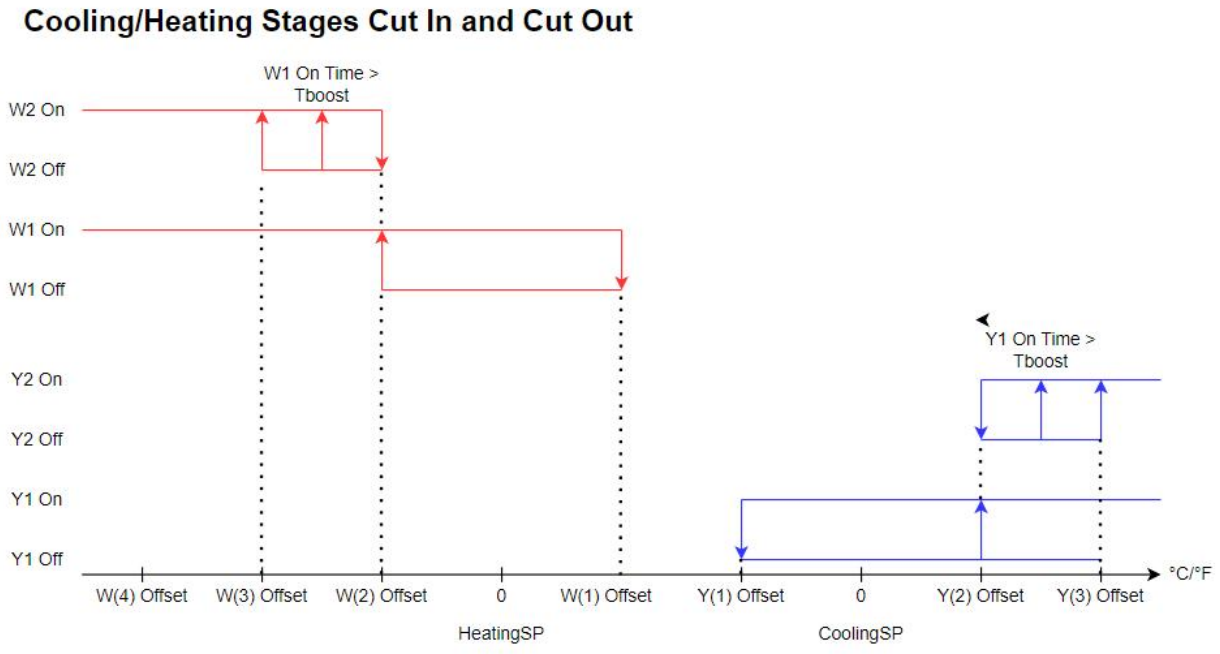
Y(1) Offset = -0.5, Y(2) Offset = 1.5, Y(3) Offset = 3.0,

W(1) Offset = -1.0, W(2) Offset = -3.5, W(3) Offset = -5.0

Coff = 180 s, Con = 120 s

Boost Stage Time = 180 s

Note : Only SP has unit, either °C or °F, Offsets are unit-less and will add directly from SP.




Default Value

| | | |
|---|---|---|
| HeatingSP = 20.0°C or 68°F | CoolingSP = 25.0°C or 77°F | Tboost = 180 s |
| W(1) Offset = 1.0 | Y(1) Offset = -0.5 | |
| W(2) Offset = -3.5 | Y(2) Offset = 1.5 | |
| W(3) Offset = -5.0 | Y(3) Offset = 3.0 | |

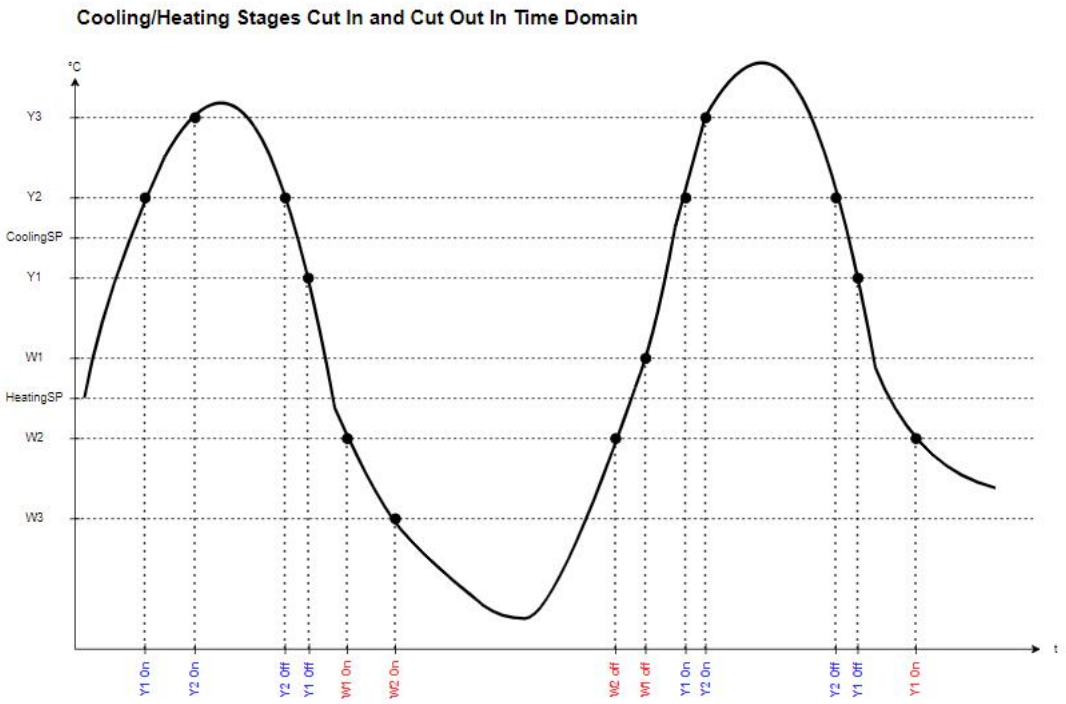



FIGURE 11: ROOF TOP UNIT SEQUENCES

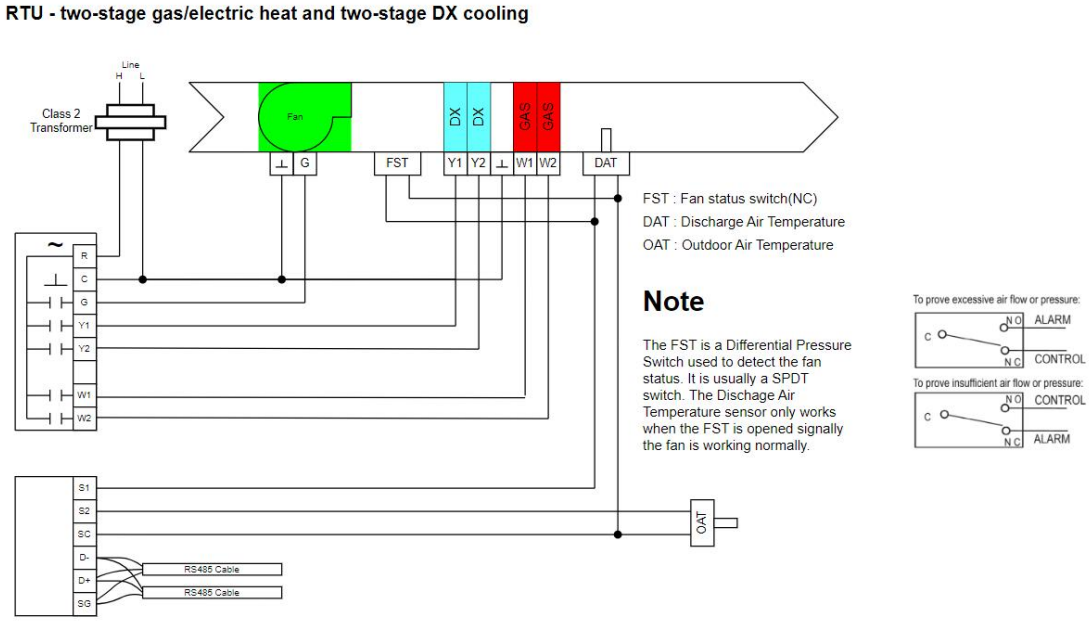
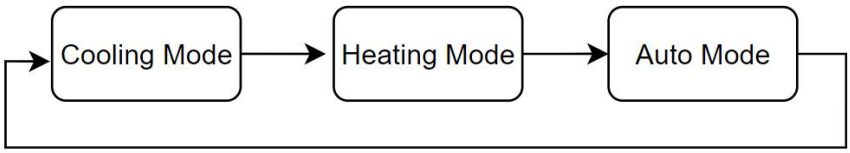



FIGURE 12: ROOF TOP UNIT CONNECTION

Note : FST, DAT and OAT are not implemented yet.

### 8.1.1 Operation Mode

User can change the operation mode from Cooling Mode, Heating Mode and Auto Mode.




For RTU application not all the operating mode is valid.

| Operating Mode | Validity/Implement | Command from BACnet or LoRaWAN |
|---|---|---|
| Cooling Mode | Supported | Accepted |
| Fan Mode | Not Supported | Default to Cooling Mode |
| Heating Mode | Supported | Accepted |
| Auto Mode | Supported | Accepted |
| Dry Mode | Not Implemented | Default to Cooling Mode |

### 8.1.2 Compressor On/Off Protection

The compressor must be idle for at least 3 minutes once it is deactivated. There will be no delay during power on reset for standard configuration. If the compressor has been turned off for more than 2 minutes before power off, then the compressor can be turned on immediately upon thermostat switch on, otherwise it will has to wait until the 3 minutes has passed.

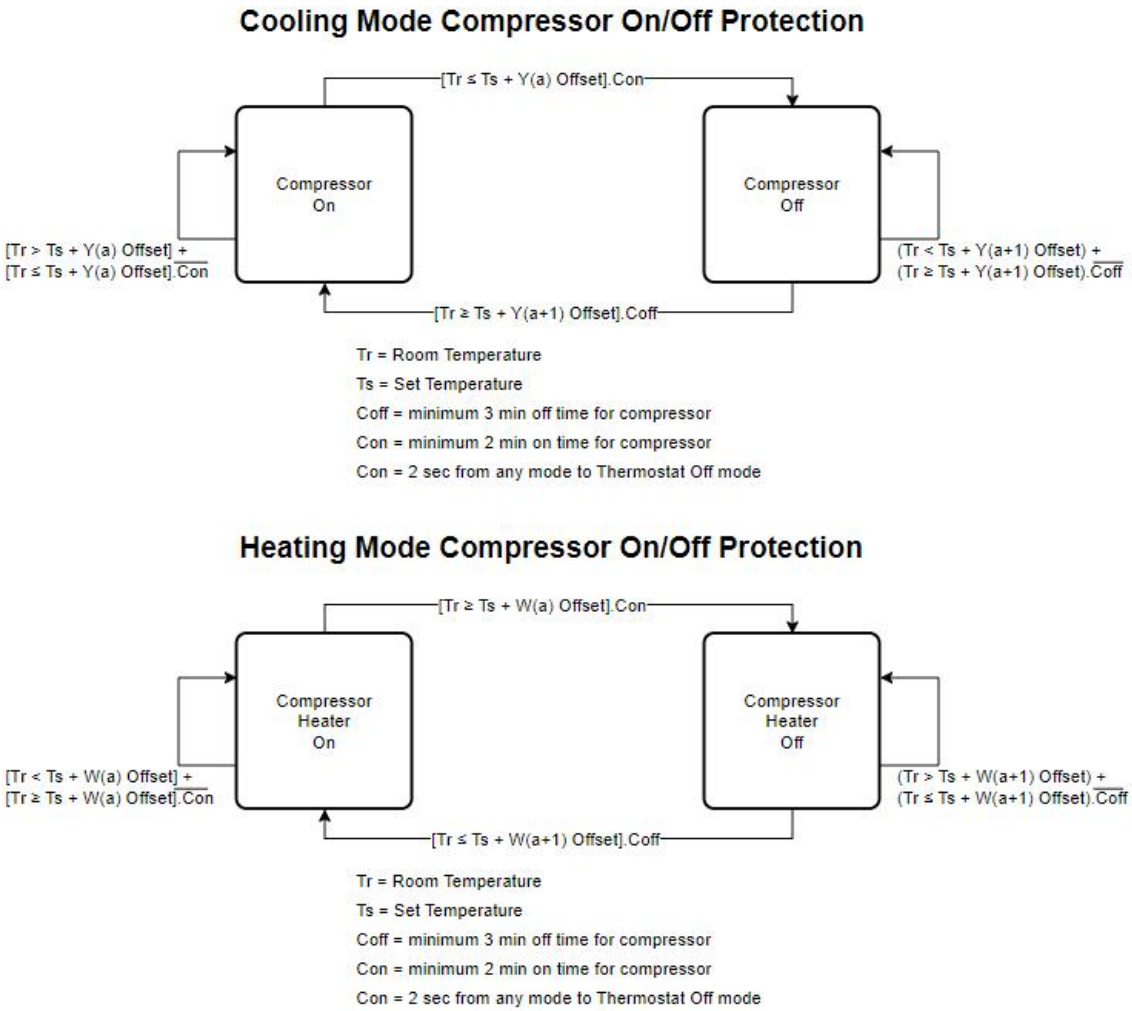



**FIGURE 13: COMPRESSOR ON/OFF PROTECTION SEQUENCES**

## 8.2 Heat Pump Application

User can select the operating mode by touch screen mode button or remote access by network command. The available user selectable modes are: Off(by the power button), Fan, Dry, Cool, Heat and Auto.

Parameters used:

| | |
|---|---|
| Cooling Setpoint | User selected cooling setpoint temperature |
| Y(1) Offset | Offset from setpoint, Y1 Off |
| Y(2) Offset | Offset from setpoint, Y1 On, Y2 Off, O Off, B On. |
| Y(3) Offset | Offset from setpoint, Y2 On. |
| Heating Setpoint | User selected heating setpoint temperature |
| W(1) Offset | Offset from setpoint, Y1 Off. |
| W(2) Offset | Offset from setpoint, Y1 On, Y2 Off, O On, B Off. |
| W(3) Offset | Offset from setpoint, Y2 On, W1 Off. |
| W(4) Offset | Offset from setpoint, W1 On. |
| Coff | Compressor minimum off time, in seconds, 0 = disable, max 65535s. |
| Con | Compressor minimum on time, in seconds, 0 = disable, max 65535s. |
| Boost Min Time | Activate higher Fan/stage when temperature stay in the zone for too long, in seconds , 0 = disable. |

Conditions:

Y(3) Offset > Y(2)Offset > Y(1) Offset

W(4) Offset < W3 Offset < W2 Offset < W1 Offset

Default values:

CoolSP = 25°C or 77°F

HeatSP = 20°C or 68°F

Y(1) Offset = -0.5, Y(2) Offset = 1.5, Y(3) Offset = 3.0,

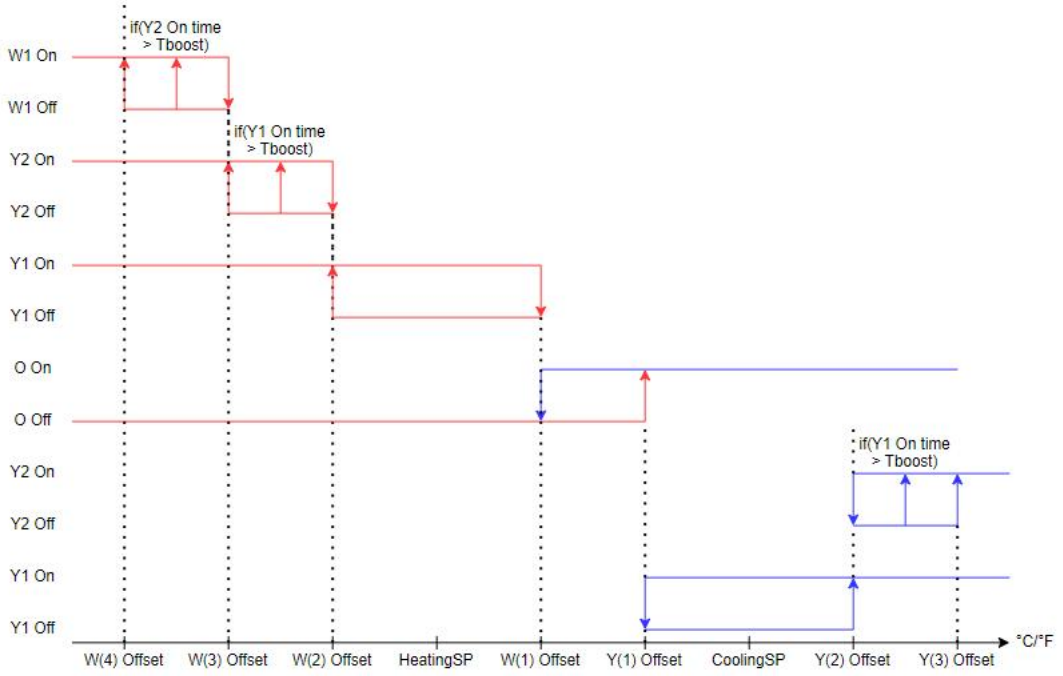
W(1) Offset = 1.0, W(2) Offset = -3, W(3) Offset = -5.0, W(4) Offset = -7.0

Coff = 180 s, Con = 120 s

Boost Stage Time = 180 s

Note : Only SP has unit, either °C or °F, Offsets are unit-less and will add directly from SP.

**Cooling/Heating Stages Cut In and Cut Out**




Default Value

| | | |
|---|---|---|
| HeatingSP = 20.0°C or 68°F | CoolingSP = 25.0°C or 77°F | |
| W(1) Offset = 1.0 | Y(1) Offset = -0.5 | Tboost = 180 sec |
| W(2) Offset = -3.5 | Y(2) Offset = 1.5 | |
| W(3) Offset = -5.0 | Y(3) Offset = 3.0 | |
| W(4) Offset = -7.0 | | |

**Cooling/Heating Stages Cut In and Cut Out In Time Domain**

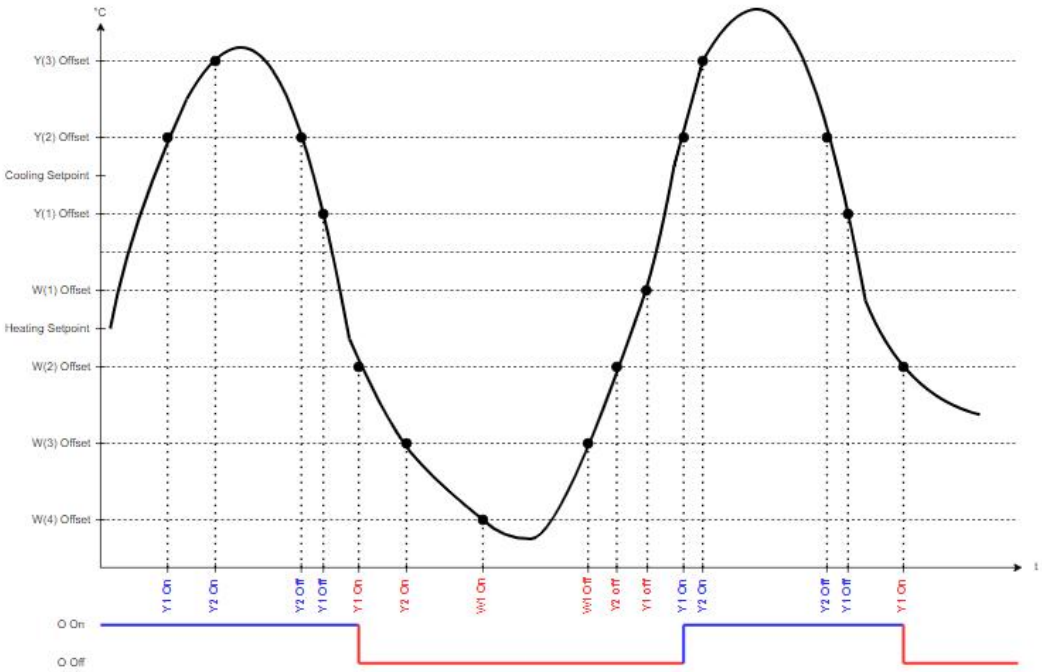


FIGURE 14: HEAT PUMP UNIT SEQUENCES

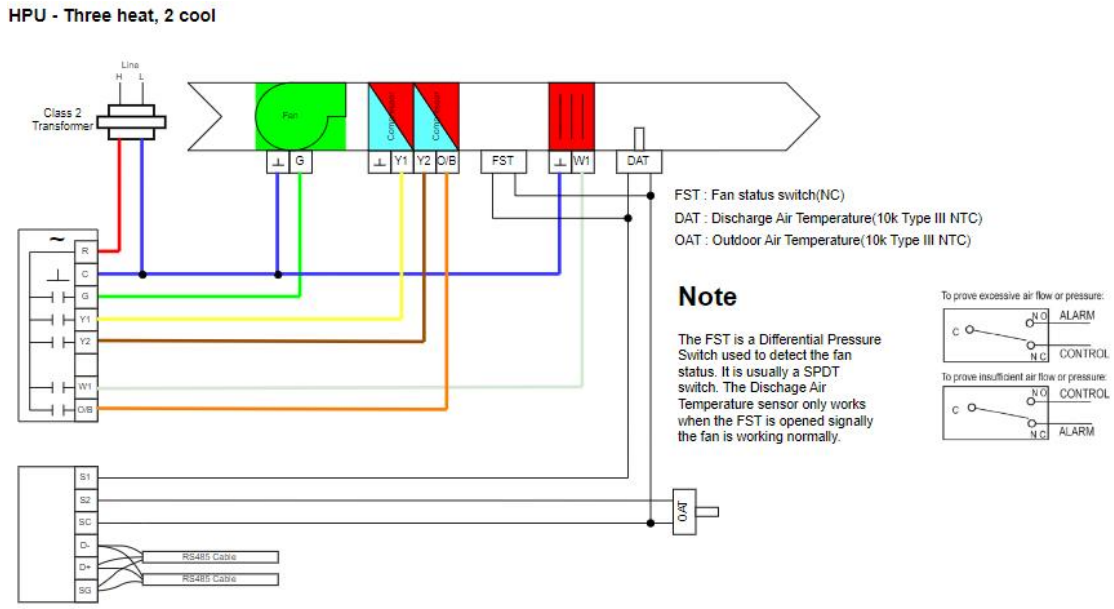
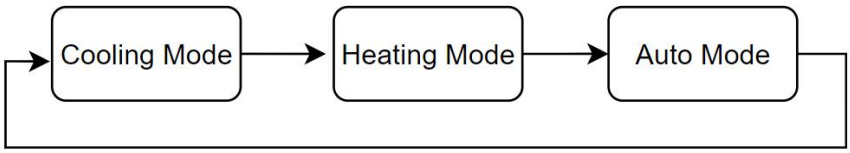



FIGURE 15: HEAT PUMP APPLICATION

Note : FST, DAT and OAT are not implemented yet.

### 8.2.1 Operation Mode

User can change the operation mode from Cooling Mode, Heating Mode and Auto Mode.




For HPU application not all the operating mode is valid.

| Operating Mode | Validity/Implement | Command from BACnet or LoRaWAN |
|---|---|---|
| Cooling Mode | Supported | Accepted |
| Fan Mode | Not Supported | Default to Cooling Mode |
| Heating Mode | Supported | Accepted |
| Auto Mode | Supported | Accepted |
| Dry Mode | Not Implemented | Default to Cooling Mode |

### 8.2.2 Compressor On/Off Protection

The compressor must be idle for at least 3 minutes once it is deactivated. There will be no delay during power on reset for standard configuration. If the compressor has been turned off for more than 2 minutes before power off, then the compressor can be turned on immediately upon thermostat switch on, otherwise it will has to wait until the 3 minutes has passed.

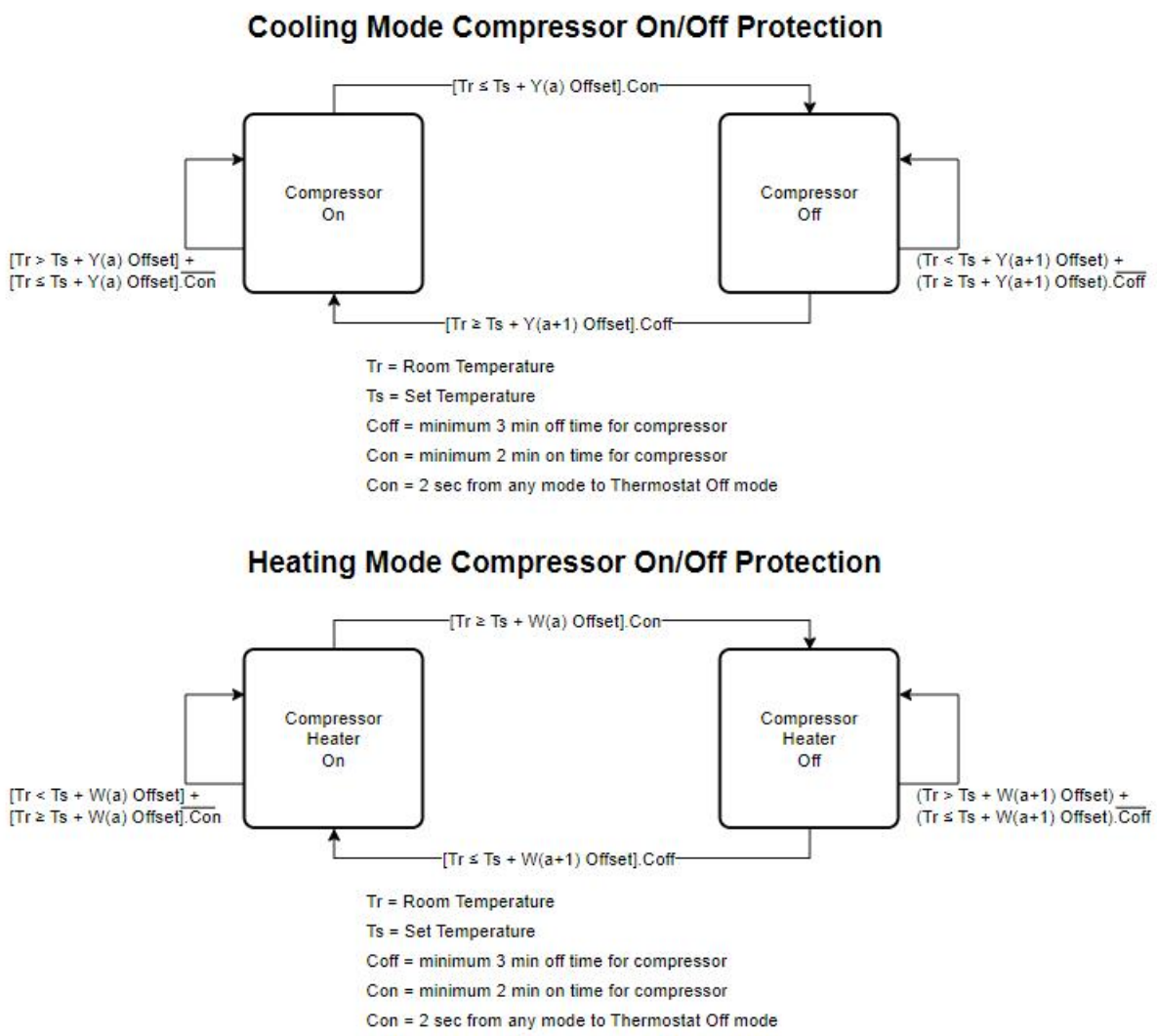



FIGURE 16: COMPRESSOR PROTECTION

### 8.2.3 4-Way Valve Changing

Before compressor cut in, if the 4-way valve is off, then the 4-way valve changing sequence must takes effect to change the cooling circuit to that of heat pump circuit. The 4-way valve can only turn on in heat mode. Upon return to non-heat mode, the 4-way must change to OFF position. The 4-way valve only can be changed 56 seconds after the compressor has been cut out; the compressor after that can be cut in 2 minutes and 4 seconds later. When the 4-way valve has been changed and the compressor has not been switched on, the 4-way valve may still be changed again immediately.

Cooling Mode(O)

| G | Y1 | Y2 | W1 | O | B |
|---|---|---|---|---|---|
| ON | ON | ON | OFF | ON | OFF |

Cooling Mode(B)

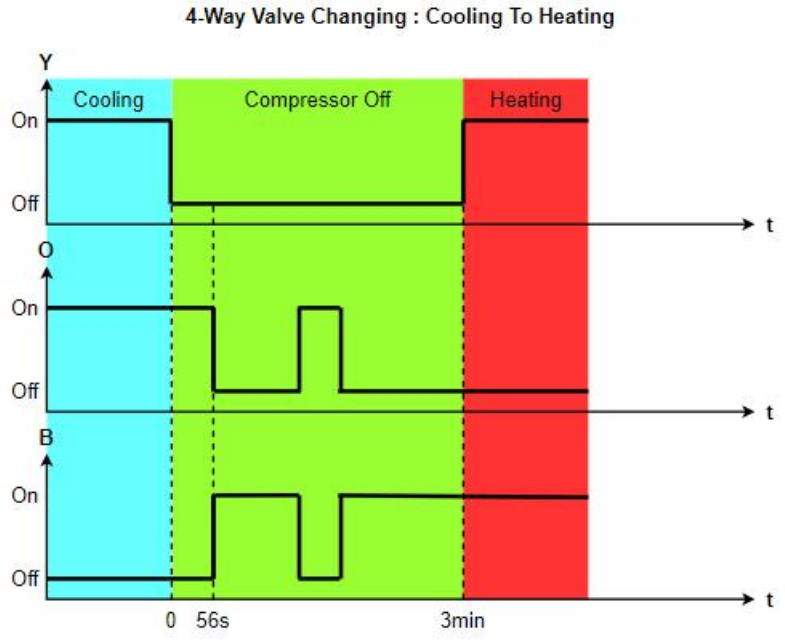
| G | Y1 | Y2 | W1 | O | B |
|---|---|---|---|---|---|
| ON | ON | ON | OFF | OFF | ON |

Heating Mode(O)

| G | Y1 | Y2 | W1 | O | B |
|---|---|---|---|---|---|
| ON | ON | ON | OFF | OFF | ON |

Heating Mode(B)

| G | Y1 | Y2 | W1 | O | B |
|---|---|---|---|---|---|
| ON | ON | ON | OFF | ON | OFF |



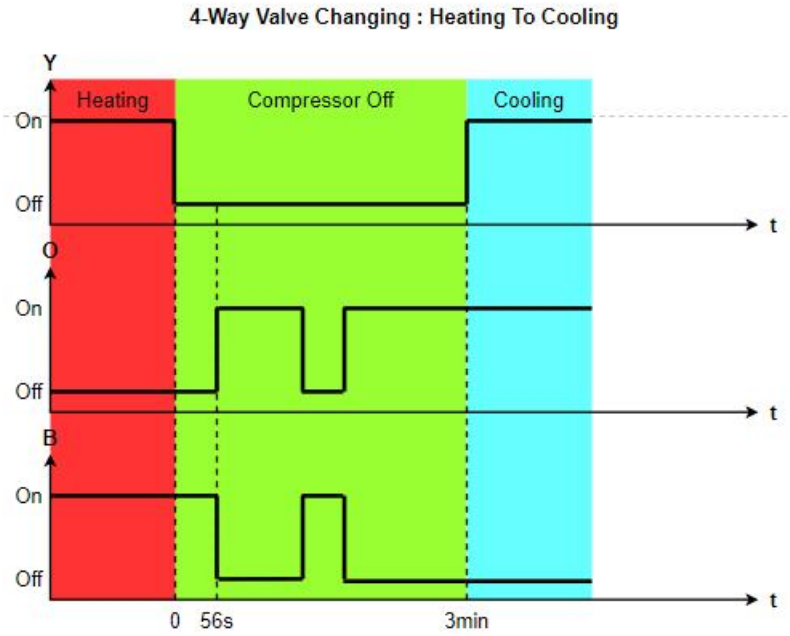




FIGURE 17: COMPRESSOR ON/OFF DELAY PROTECTION

## 8.3 Fan Coil Application

User can select the operating mode by touch screen mode button or remote access by network command. The available user selectable modes are: Off(by the power button), Fan, Dry, Cool, Heat and Auto.

Parameters used:

| | |
|---|---|
| Cooling Setpoint | User selected cooling setpoint temperature |
| Y(1) Offset | Offset from set point, Y valve off, fan speed change to Low |
| Y2 Offset | Offset from set point, Y valve on, fan speed change to medium |
| Y3 Offset | Offset from set point, Y valve on, fan speed change to high |
| Heating Setpoint | User selected heating setpoint temperature |
| W1 Offset | Offset from set point, W valve off, fan speed change to Low |
| W2 Offset | Offset from set point, W valve on, fan speed change to medium |
| W3 Offset | Offset from set point, W valve on, fan speed change to high |
| Traveling Time | Use in Floating Valve application, in seconds, 0 = disable, max 65535s. |
| Boost Min Time | Activate higher Fan/stage when temperature stay in the zone for too long, in seconds , 0 = disable, max 65535s. |

Default Value:

CoolSP = 25°C or 77°F

HeatSP = 20°C or 68°F

| | |
|---|---|
| W1 Offset = 1.0 | Y1 Offsset = -0.5 |
| W2 Offset = -3.5 | Y2 Offset = 1.5 |
| W3 Offset = -5.0 | Y3 Offset = 3.0 |
| Traveling Time = 0 s | Boost Stage Minimum Time = 180 s |

Note : Only SP has unit, either °C or °F, Offsets are unit-less and will add directly from SP.

### 8.3.1 Fan Operation

Four user selectable fan speed, Low, Medium, High and Auto. Whenever the system is on, the fan should be energized. When the user selected fan speed is not Auto, the fan shall operate at the user selected fan speed. In Dry Mode, the fan speed is always Low.

For Auto fan speed in Cool mode, its operation depends on room temperature and set point.

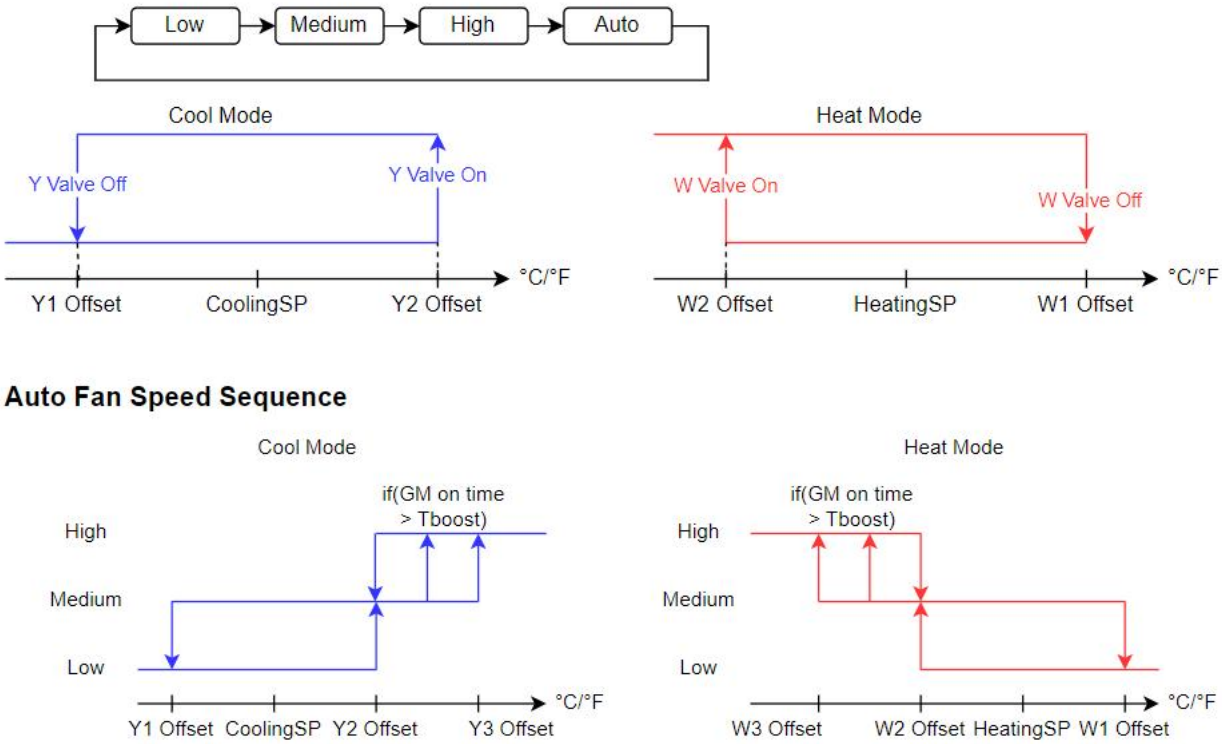



FIGURE 18: FAN SPEED SEQUENCE IN COOL, HEAT AND AUTO FAN MODE

## 8.3.2 Two Pipe Cooling Mode And Heating Mode

In this mode , fan is always running. User can select all fan speed.

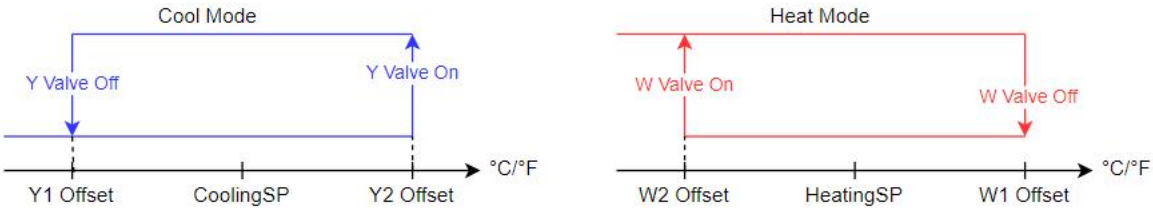
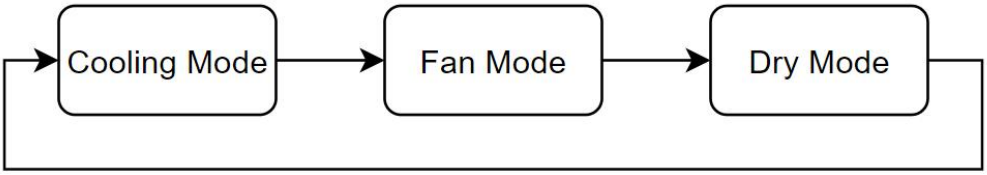


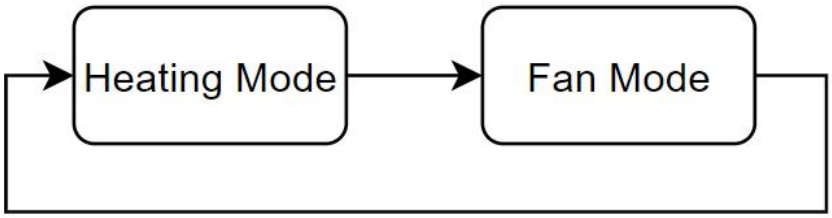

FIGURE 19: TWO PIPE COOLING AND HEATING MODE

### 8.3.3 Two Pipe Cooling Only Operation Mode




| Operating Mode | Validity/Implement | Command from BACnet or LoRaWAN |
|---|---|---|
| Cooling Mode | Supported | Accepted |
| Fan Mode | Supported | Accepted |
| Heating Mode | Not Supported | Default to Cooling Mode |
| Auto Mode | Not Supported | Default to Cooling Mode |
| Dry Mode | Supported | Accepted |

### 8.3.4 Two Pipe Heating Only Operation Mode




| Operating Mode | Validity/Implement | Command from BACnet or LoRaWAN |
|---|---|---|
| Cooling Mode | Not Supported | Default to Heating Mode |
| Fan Mode | Supported | Accepted |
| Heating Mode | Supported | Accepted |
| Auto Mode | Not Supported | Default to Heating Mode |
| Dry Mode | Not Supported | Default to Heating Mode |

## 8.3.5 Four Pipe Cooling , Heating And Auto Mode

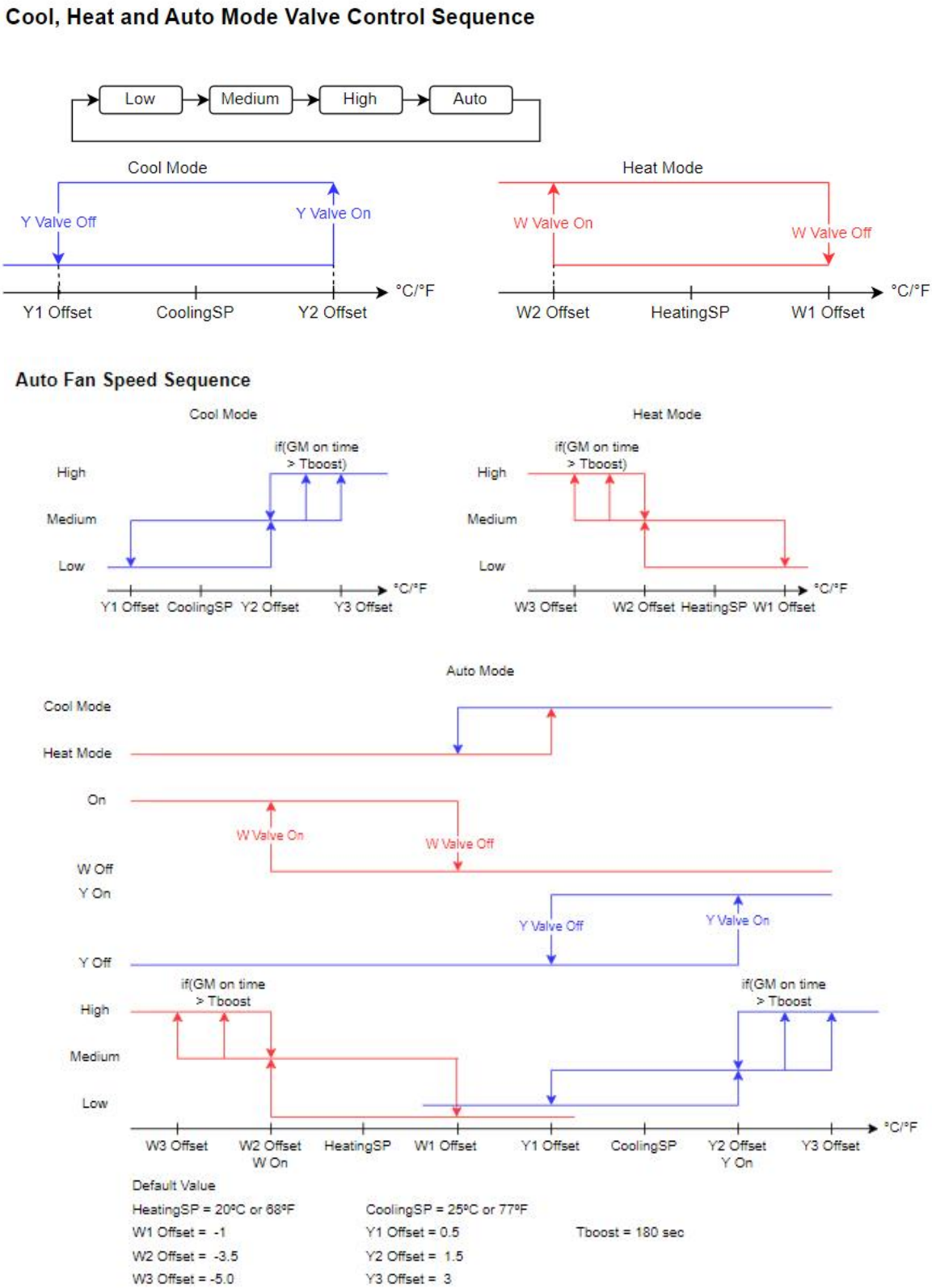
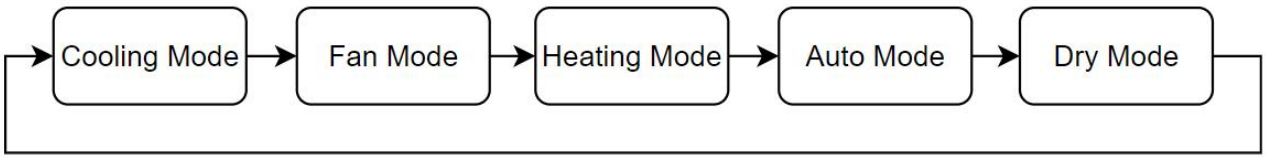



FIGURE 20: FOUR PIPE COOLING, HEATING AND AUTO MODE

### 8.3.6 Four Pipe Cooling, Heating and Auto Operation Mode




| Operating Mode | Validity/Implement | Command from BACnet or LoRaWAN |
|---|---|---|
| Cooling Mode | Supported | Accepted |
| Fan Mode | Supported | Accepted |
| Heating Mode | Supported | Accepted |
| Auto Mode | Supported | Accepted |
| Dry Mode | Supported | Accepted |

### 8.3.7 Fan Mode

User selectable speed are Low, Medium and High. No temperature setting is allowed. If the unit is running in Auto Fan speed, upon entering the Fan Mode, the unit will change the speed to Low. Vice-versa, if the unit is out from Fan Mode, then Auto Fan Speed will be restored.

### 8.3.8 Dry Mode

There are 4 operating Zone in Dry Mode. The operating Zone is determined by the difference between Room Temperature and Setpoint as shown below.

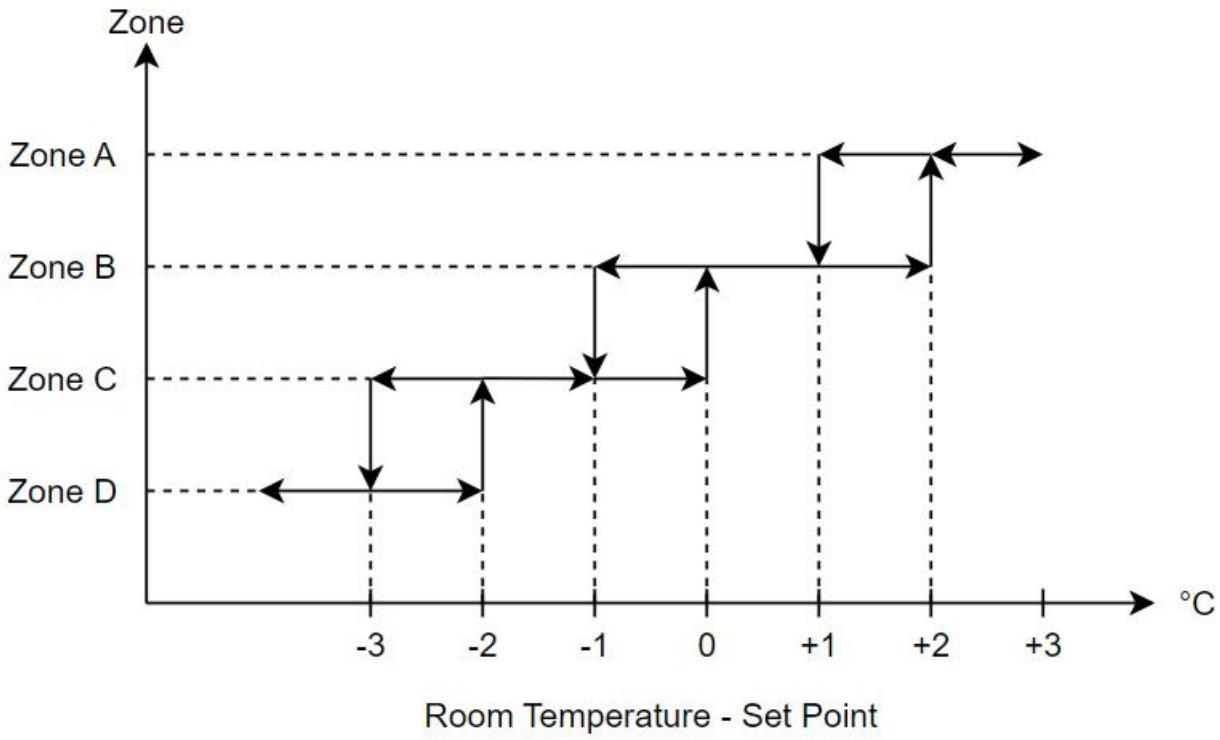



FIGURE 21: DRY MODE ZONES

The determination of Zone only will be done every 12 minutes(one cycle of Dry Mode cycle).

For the various operating zones, the cooling valve and the fan sequences are as shown below. Note that the low fan cuts in 30 seconds before the valve cuts in, and the low fan cuts out 30 seconds after the valve cuts out.

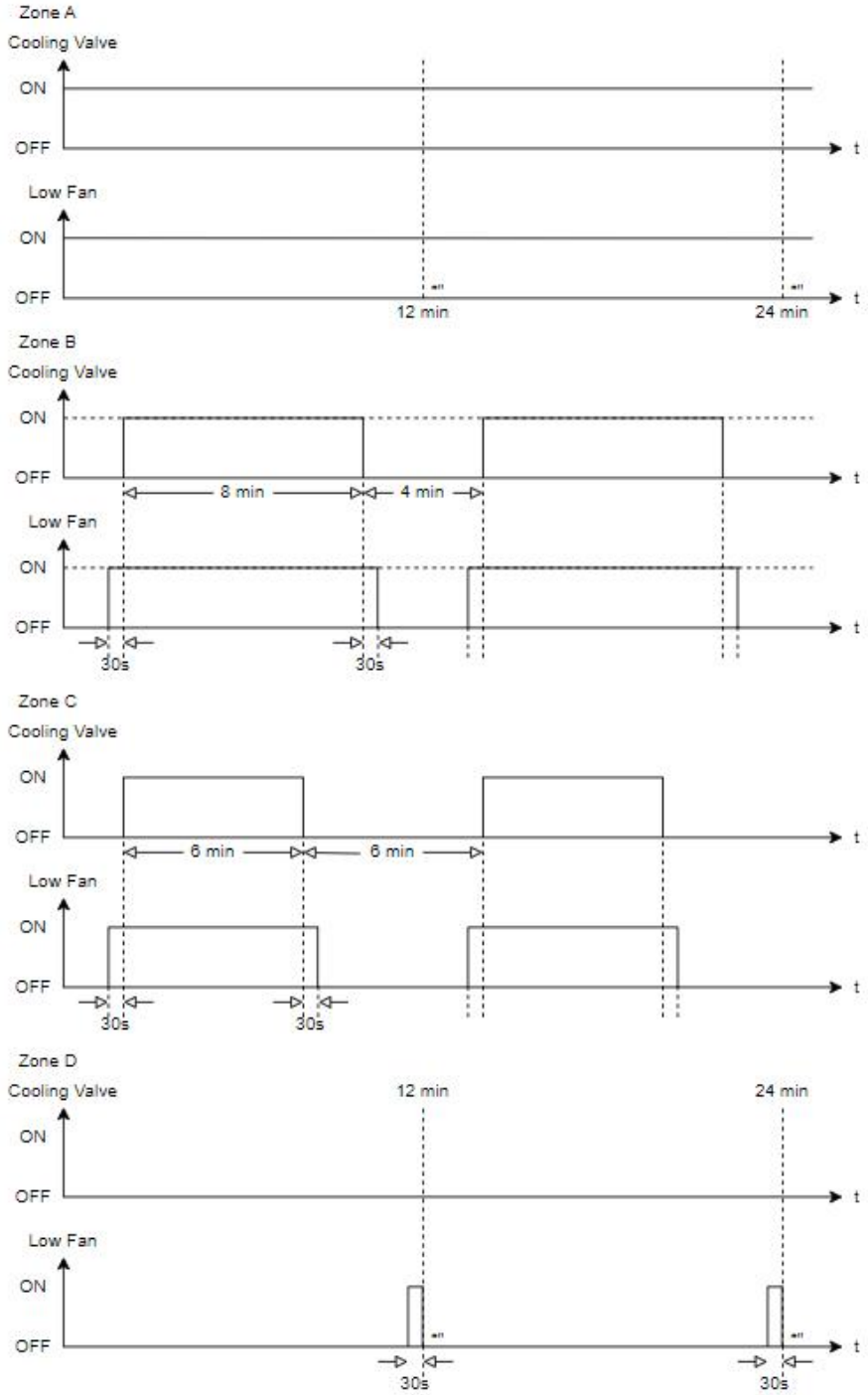
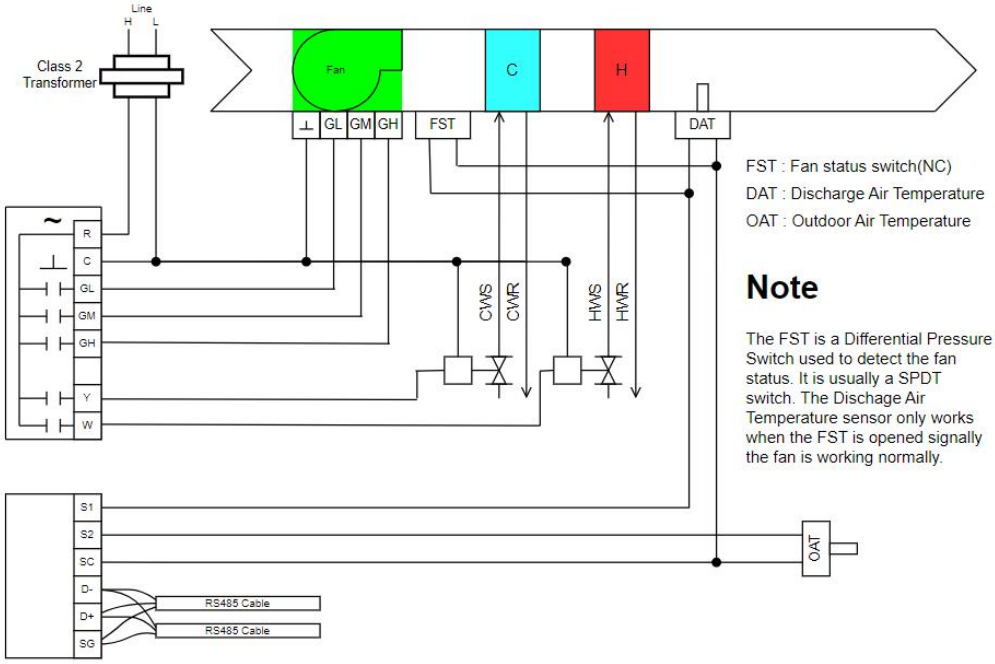


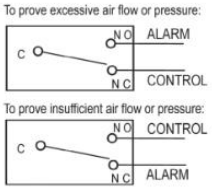

**FIGURE 22: DRY MODE SEQUENCE**

**FCU - Four Pipe, Three Speed Fan with Cooling and Heating**




## Note

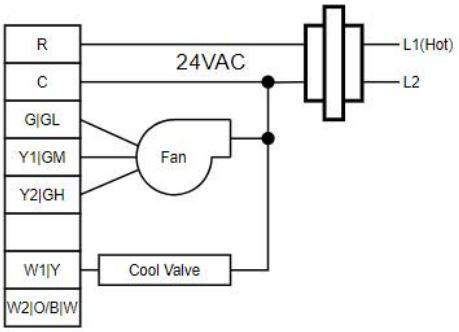
The FST is a Differential Pressure Switch used to detect the fan status. It is usually a SPDT switch. The Dischage Air Temperature sensor only works when the FST is opened signally the fan is working normally.

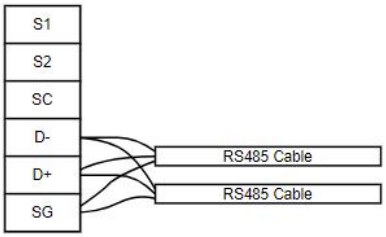



Note : FST, DAT and OAT are not implemented yet.

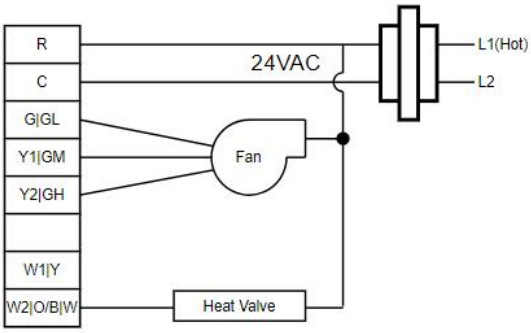
## 8.3.9 FCU Application Type And Wiring

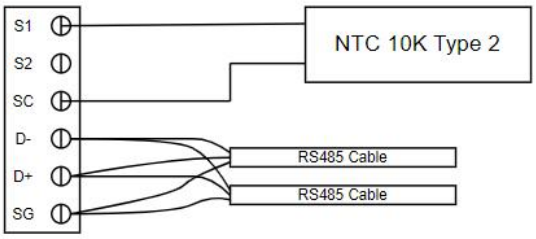
01. Two Pipe Cooling With On/Off Valve



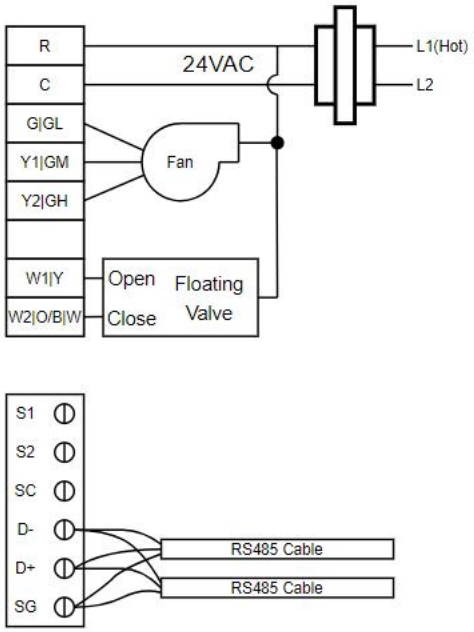




02. Two Pipe Heating With On/Off Valve

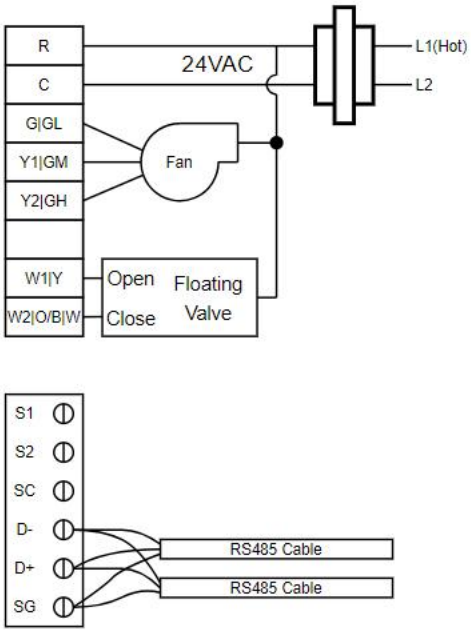


03. Two Pipe Cooling With Floating Valve




04. Two Pipe Heating With Floating Valve




05. Four Pipe Cooling and Heating With On/Off Valve

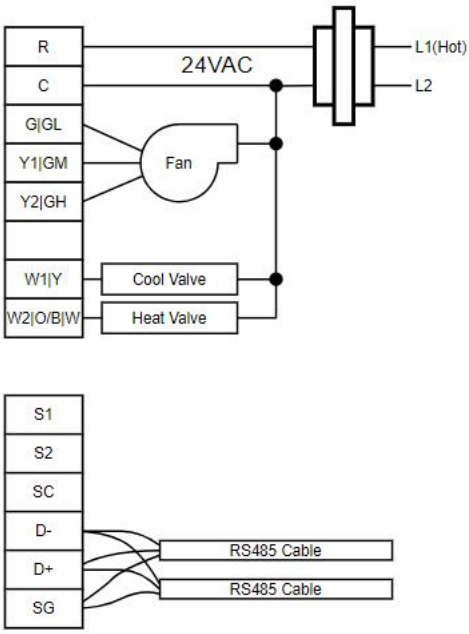



**FIGURE 23: FCU APPLICATION AN TYPE AND WIRING**

# 9. Operation Guides

## 9.1 Panel Operations

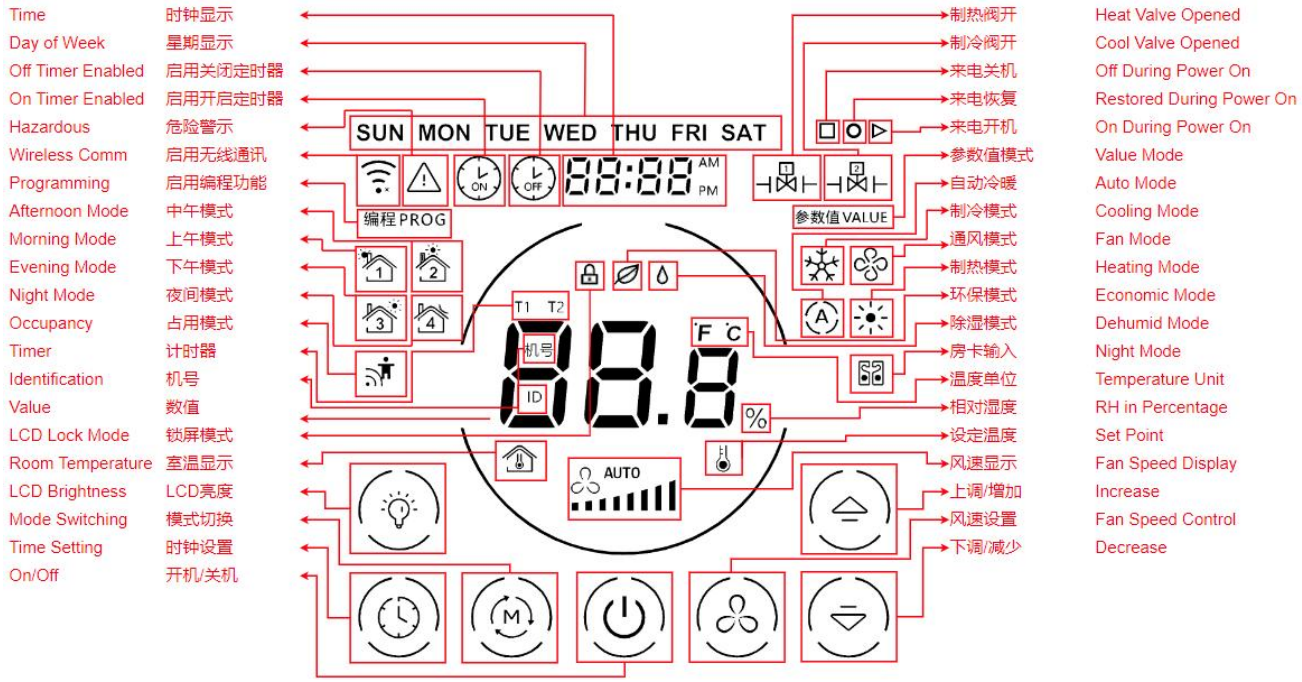



FIGURE 24: PANEL BUTTONS AND SYMBOLS

## 9.2 Mode

Press 'Mode' button to switch the device modes. In 4 pipe FCU, HPU and RTU with both Heating and Cooling capabilities application, there are 4 modes can be switched to, which are 'Cool' , 'Fan' , 'Heat' , and 'Auto' and 'Dry'.

## 9.3 Fan Speed

Press 'Fan Speed' button to switch the fan speed. In FCU mode, there are 4 modes of speed can be switched to, which are 'low' , 'medium' , 'high' , and 'auto' . 'Auto' mode can only be set when the device is in 'Cool' or 'Heat' mode.

In HPU and RTU application, there is only one speed fan and it is always on.

## 9.4 Temperature Setting

Press 'Increase Temperature' or 'Decrease Temperature' to control the set temperature in 1°C of step level. To set the Cooling or Heating setpoint via the LCD panel, select the cooling mode or heating mode, then press the up or down key to change the cooling or heating setpoint

respectively. Auto mode will use these cooling and heating setpoint and can not change setpoint setting in auto mode. In auto mode, pressing up key will show the cooling setpoint, while pressing the down key will show the heating setpoint.

## 9.5 Time Setting

Press 'Time Setting' button 1 time to enter to 'week' menu, the 'week' symbol will now be blinking, press 'Increase Temperature' or 'Decrease Temperature' button to configure the 'week' parameter.

Press 'Time Setting' button 2 times to enter to 'hour' menu, the 'hour' symbol will now be blinking, press 'Increase Temperature' or 'Decrease Temperature' button to configure the 'hour' parameter.

Press 'Time Setting' button 3 times to enter to 'minute' menu, the 'minute' symbol will now be blinking, press 'Increase Temperature' or 'Decrease Temperature' button to configure the 'minute' parameter.

Press 'Time Setting' button 4 times to enter the 'hour open timer' menu, the 'Timer' symbol and the 'hour' number will now be blinking (when the 'hour' is showing '—' instead of number, it means that the timer is not yet enabled), press 'Increase Temperature' or 'Decrease Temperature' button to configure the 'hour open timer' parameter.

Press 'Time Setting' button 5 times to enter the 'minute open timer' menu, the 'Timer' symbol and the 'minute' number will now be blinking (when the 'minute' is showing '—' instead of number, it means that the timer is not yet enabled), press 'Increase Temperature' or 'Decrease Temperature' button to configure the 'minute open timer' parameter.

Press 'Time Setting' button 6 times to enter the 'hour close timer' menu, the 'Timer' symbol and the 'hour' number will now be blinking (when the 'hour' is showing '—' instead of number, it means that the timer is not yet enabled), press 'Increase Temperature' or 'Decrease Temperature' button to configure the 'hour close timer' parameter.

Press 'Time Setting' button 7 times to enter the 'minute close timer' menu, the 'Timer' symbol and the 'minute' number will now be blinking (when the 'minute' is showing '—' instead of number, it means that the timer is not yet enabled), press 'Increase Temperature' or 'Decrease Temperature' button to configure the 'minute close timer' parameter.

Press 'Time Setting' button 8 times to exit the time setting menus. If modification is made at the previous procedures, press 'Fan Speed' button to instantly quick the time setting menus.

## 9.6 LCD Brightness

Press 'LCD Brightness' button to adjust the brightness of the LCD.

## 9.7 Weekly Scheduler

The weekly scheduler consist of the following parameters:

| | |
|---|---|
| Weekly Schedule Enable Sunday | : 0 = disable, 1 = enable |
| Weekly Schedule Enable Monday | : 0 = disable, 1 = enable |
| Weekly Schedule Enable Tuesday | : 0 = disable, 1 = enable |
| Weekly Schedule Enable Wednesday | : 0 = disable, 1 = enable |
| Weekly Schedule Enable Thursday | : 0 = disable, 1 = enable |
| Weekly Schedule Enable Friday | : 0 = disable, 1 = enable |
| Weekly Schedule Enable Saturday | : 0 = disable, 1 = enable |
| Scheduler On Time Hour | : 0-23, 24 = disable |
| Scheduler On Time Minute | : 0-59, 60 = disable |
| Scheduler Off Time Hour | : 0-23, 24 = disable |
| Scheduler Off Time Minute | : 0-59, 60 = disable |
| Morning Session Time Hour | : 0-23, 24 = disable |
| Morning Session Time Minute | : 0-59, 60 = disable |
| Afternoon Session Time Hour | : 0-23, 24 = disable |
| Afternoon Session Time Minute | : 0-59, 60 = disable |

Evening Session Time Hour : 0-23, 24 = disable

Evening Session Time Minute : 0-59, 60 = disable

Night Session Time Hour : 0-23, 24 = disable

Night Session Time Minute : 0-59, 60 = disable

Morning Session Set Point : Temperature Set Point for morning session

Afternoon Session Set Point : Temperature Set Point for afternoon session

Evening Session Set Point : Temperature Set Point for evening session

Night Session Set Point : Temperature Set Point for night session

When the thermostat on time is reached but the session time is not yet reach, user set point is used.

If user changed the set point during any session, user set point is saved and used until the next session timer check point.

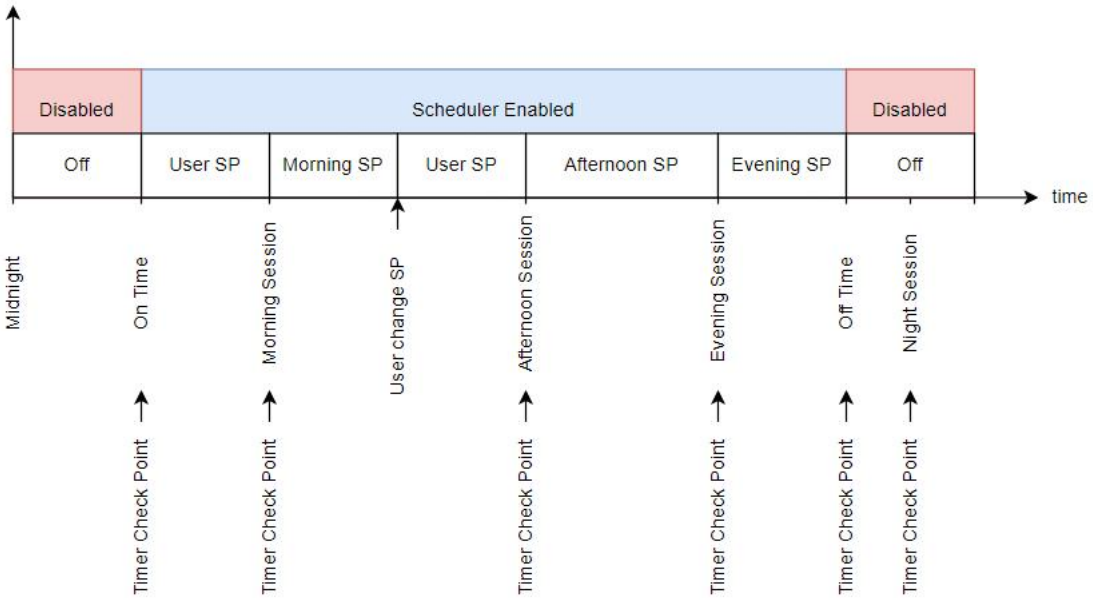



FIGURE 25: WEEKLY SCHEDULER

## 9.8 Temperature and Humidity Display

If the Model has humidity sensor, the humidity reader will be display with temperature alternatively with temperature display for 55s then humidity for 5s.

## 9.9 User Override

When scheduler is activated, user can override the scheduler using the following method.

Press and hold 'Mode' button for around 5s, either 'Cool' or 'Heat' will be blinking depends on the current Application. Use the 'Increase Temperature' or 'Decrease Temperature' button to switch between Cool and Heat mode. Note that in certain Application, such as 2 Pipe Cooling or Heating only FCU, the mode would not switch as there is only one mode.

After the user override operation mode is selected, press 'Mode' to enter user override set point setting, the "Set Point" will be blinking. Use the 'Increase Temperature' or 'Decrease Temperature' button to select the desired user override set point.

Press 'Mode' again to enter user override time in minutes. the 'Timer' will be blinking and the time display will display the current user override default time. Use the 'Increase Temperature' or 'Decrease Temperature' button to select the desired user override time in minutes. The user override time is between 1 to 255 minutes.

Press 'Mode' again to activates user override mode. In this mode, all off the Scheduler session symbol will be on, the 'Timer' will be on, and the time display will be displaying the remaining user override time in minutes.

If the user wish to cancel or exit the user override mode, Press and hold 'Mode' button for around 5s, this will cancel the user override mode and return to normal mode, whether if the scheduler is still active or not.

# 10. Communication

The Device ID and Modbus Address defaults to the third less significant byte of the serial number or DevEUI for LoRaWAN application unless user changed it in the terminal. For example:

SN/DevEUI = 0x18A7880200**12**0000

The BACnet ID or Modbus Address = 0x12 or 18 decimal.

If that byte is 0x00, the BACnet ID or Modbus Address default to 1.

## 10.1 Modbus RTU Settings

Modbus RTU supports the following:

| | |
|---|---|
| Baud Rate | 9600, 19200(Default), 38400, 57600, 115200 |

| | |
|---|---|
| Parity | None, Odd, Even |
| Stop Bit | 1, 2 |

## 10.2 BACnet MSTP Settings

For BACnet MSTP, user need to select the baud rate only as the parity and stop bit are fixed.

The selection of the parity and stop bit have no effect in BACnet MSTP.

| | |
|---|---|
| Baud Rate | 9600, 19200(Default), 38400, 76800 |
| Parity | None(fixed) |
| Stop Bit | 1(fixed) |

# 11. USB Virtual COM Terminal Program

The Terminal Program provides a simple way to configure the controller with minimum hardware and software. It uses the controller's USB type C interface as virtual communication port, *MEK-i IO-Module Configuration Tools* or any dump terminal software and a PC.

After the LCD panel has been taken out from the back cover, connect the LCD panel to a computer via a USB type C data cable. The LCD panel will be powered by the USB type C cable. The computer will recognize the LCD panel as a virtual com port. Check the port number in the device manager.

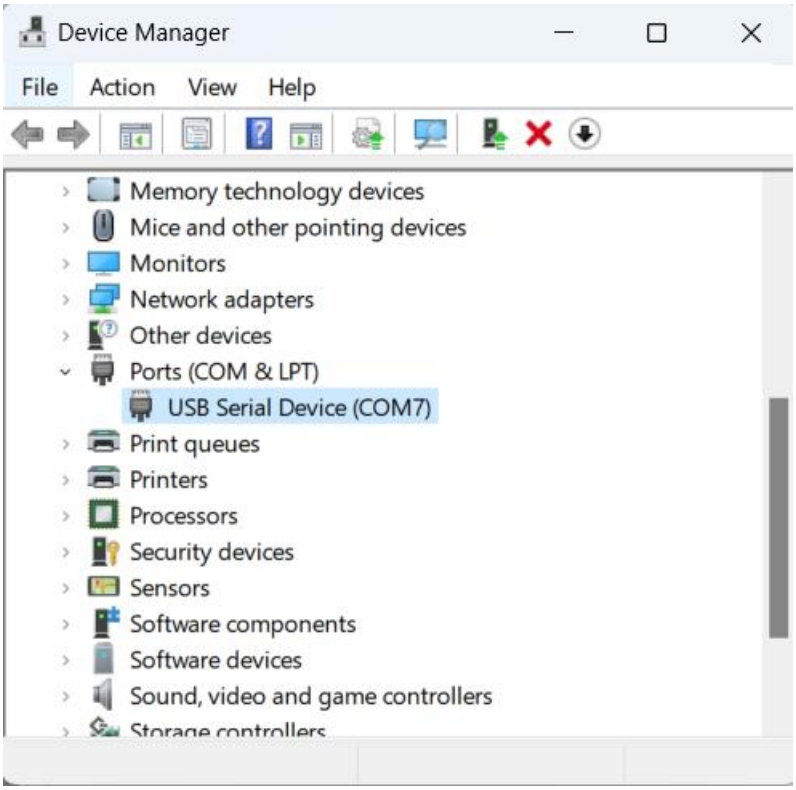


FIGURE 26 CHECK THE COMMUNICATION PORT NUMBER

To activate Terminal program, simply click the Connect on Terminal tab in *MEK-i IO-Module Configuration Tools* after select the correct PC serial communication port to establish the connection. If any dump terminal software (e.g. Hyper Terminal) is used, create a connection with following settings:

| | |
|---|---|
| Baudrate | 19200 bps |
| Data Bit | 8 bits |
| Stop Bit | 1 bit |
| Parity | Even |
| Flow Control | None |

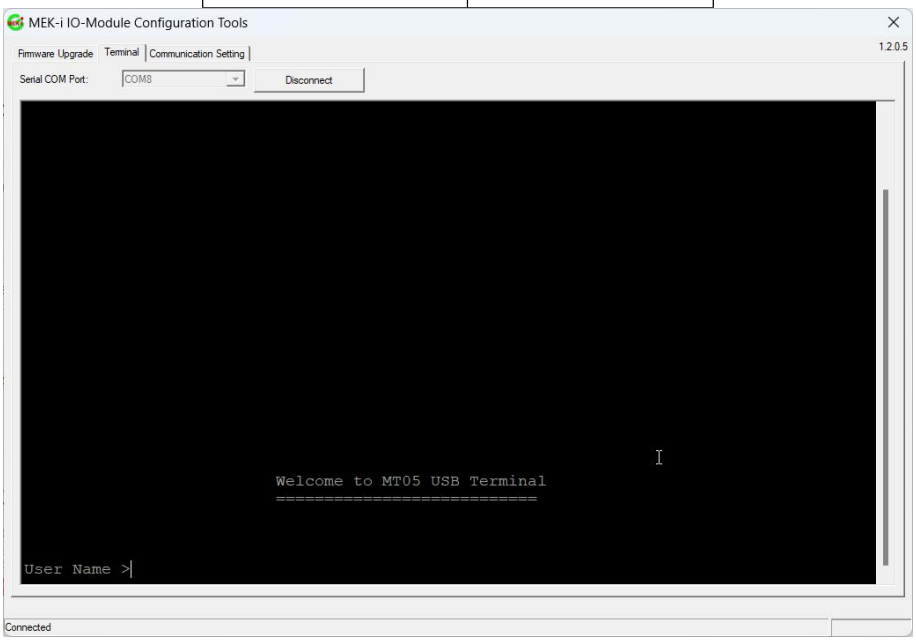



FIGURE 27 TERMINAL - LOGIN SCREEN

The default user name and password are ***admin*** and ***1234*** respectively. Follow the screen instructions for various settings. Press Esc key to return to previous menu or to refresh the display.

FIGURE 28 TERMINAL : MAIN MENU

## 11.1 User Name Menu

The User Name is used for Terminal Program login. The default value is 'admin'.

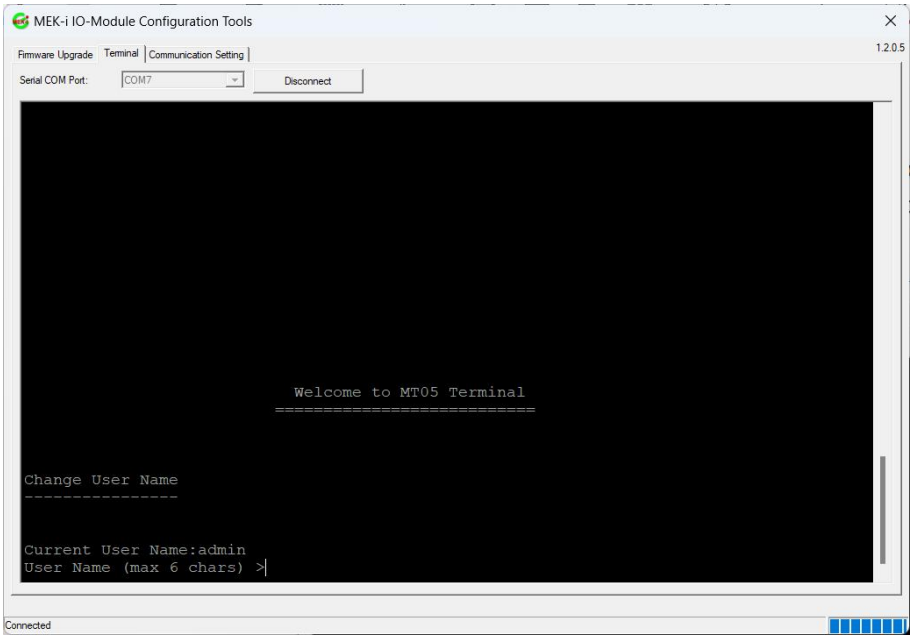



FIGURE 29 TERMINAL - USER NAME MENU

## 11.2 Password Menu

The Password is used for Terminal Program login. The default value is '1234'.

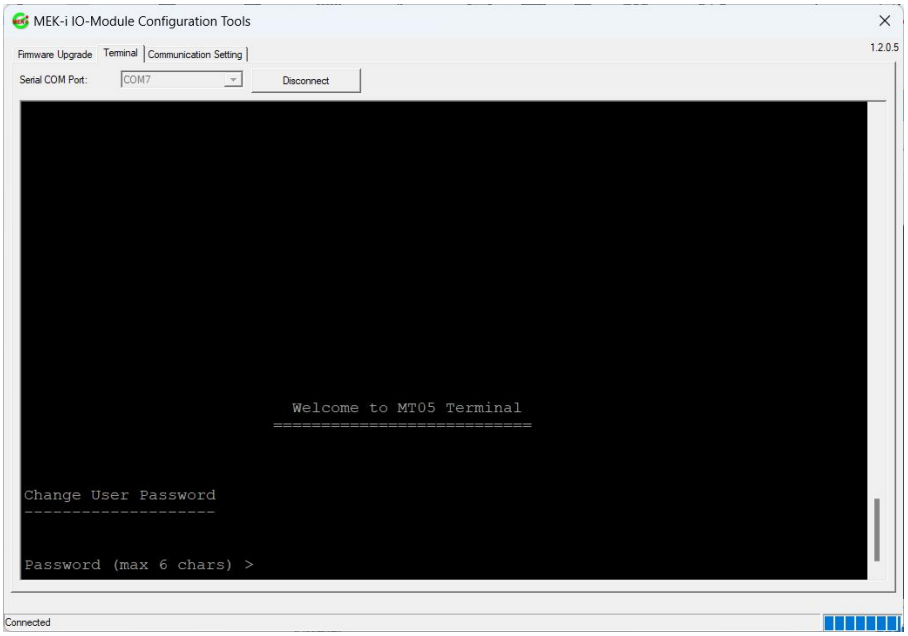



FIGURE 30: TERMINAL - PASSWORD MENU

## 11.3 Main Menu

The main menu consist of several setting menu as shown.

```
COM13 - PuTTY

                        Welcome to MT05 USB Terminal
                        ============================

Main Menu
---------
1 - Thermostat Advanced Configuration
2 - Thermostat Offset Configuration
3 - Thermostat Time Limit Configuration
4 - Thermostat Schedule Configuration
5 - LoRaWAN Configuration
6 - Real Time Clock Set Up
7 - Serial Port Configuration
8 - Device Information
9 - Enter Bootloader
A - Restore factory settings
B - Reboot

Enter your selection:
>
```

## 11.4 Thermostat Advanced Configuration

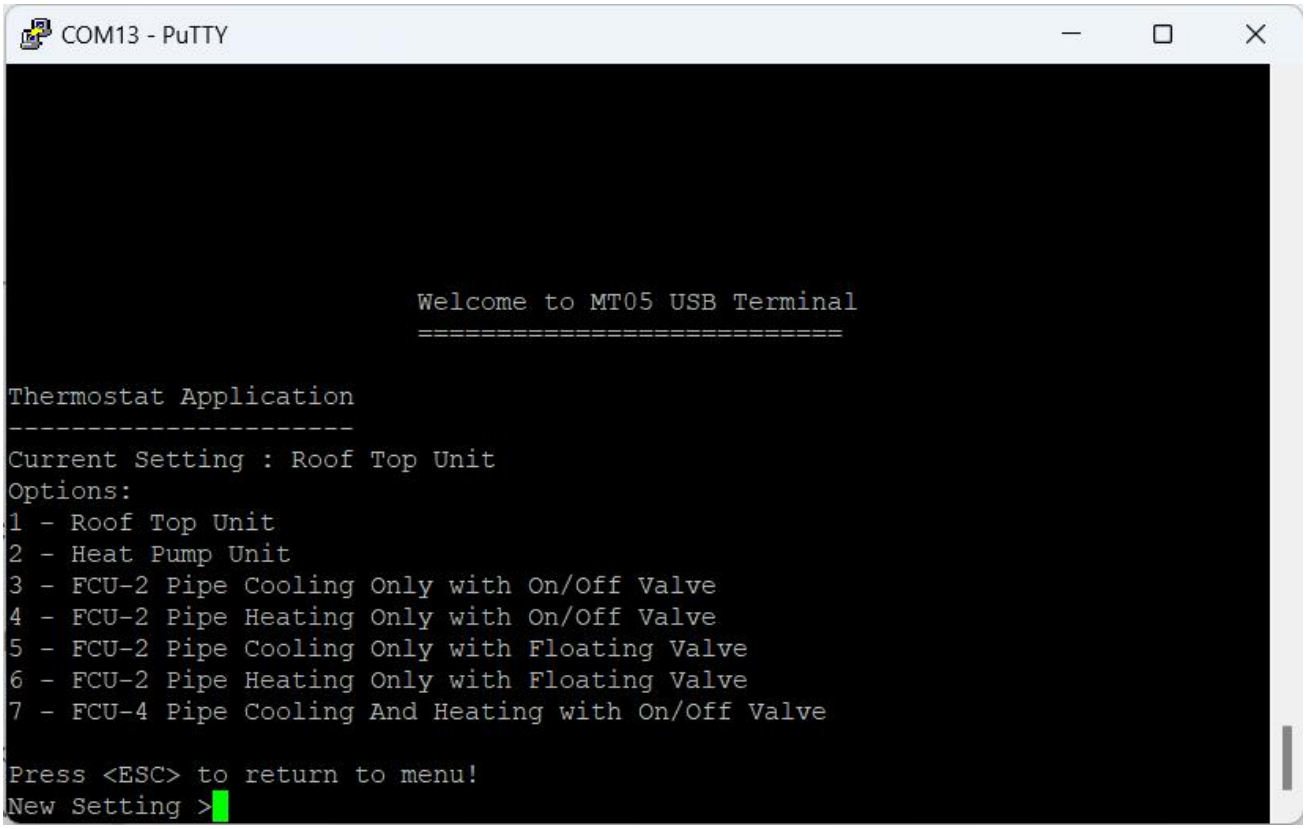
```
COM13 - PuTTY

                        Welcome to MT05 USB Terminal
                        ============================

Thermostat Setting Menu
-----------------------
1 - Thermostat Application (Roof Top Unit)
2 - O/B Mode (B Mode)
3 - Operation Mode (Cool Mode)
4 - Keylock (Unlock All Button)
5 - Clock Mode (12 Hour Clock)
6 - Power on off (Off)
7 - Power on off default state (On boot Restore previous state)
8 - Thermistor Selection (Internal Thermistor)
9 - Cooling Setpoint (77.0 degree)
A - Heating Setpoint (68.0 degree)
B - Temperature Compensation (-3.0 degree)
C - Temperature Offset (0.0 degree)
D - Temperature Unit (Fahrenheit)

Press <ESC> to return to previous menu!
Enter your selection:
>
```

### 11.4.1 Thermostat Application




There are twelve application:

1. Roof Top Unit

2. Heat Pump Unit

3. Fan Coil Unit Two Pipe Cooling Only With On/Off Valve

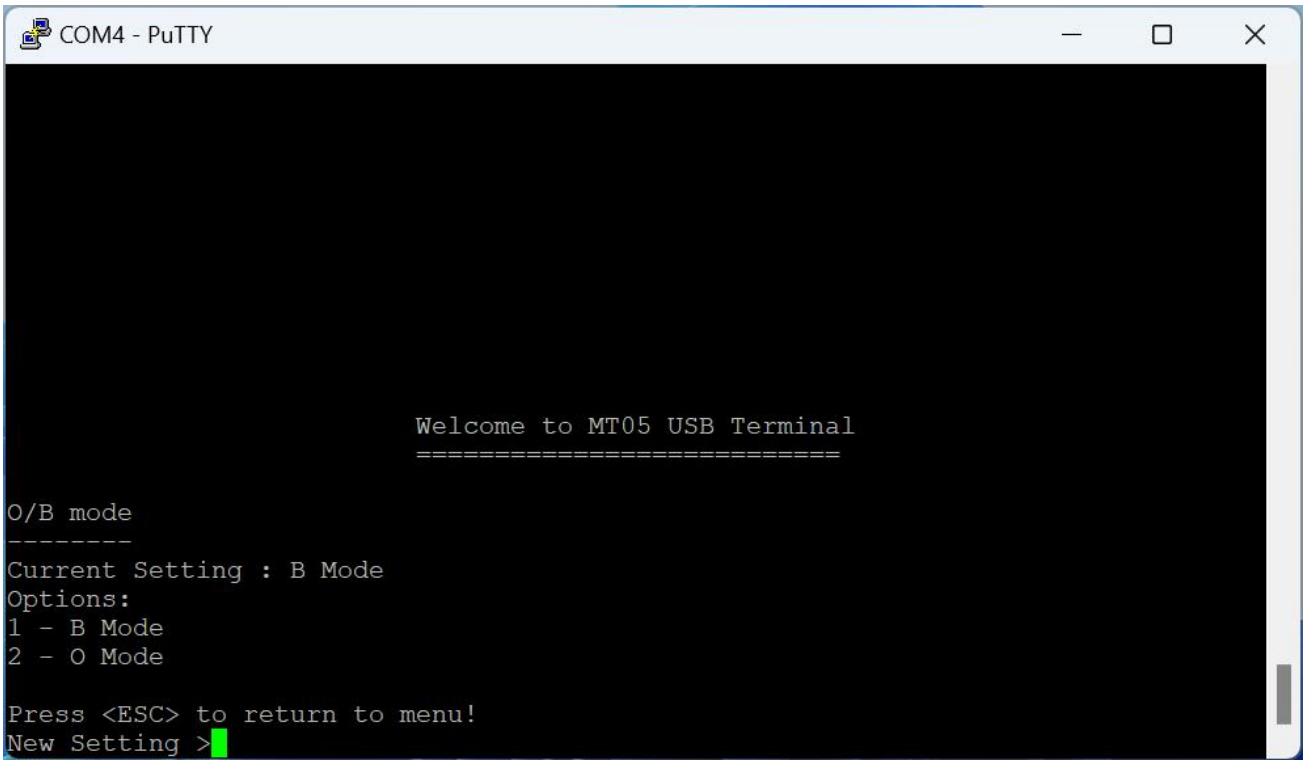
4. Fan Coil Unit Two Pipe Heating Only With On/Off Valve

5. Fan Coil Unit Two Pipe Cooling Only With Floating Valve

6. Fan Coil Unit Two Pipe Cooling Only With Floating Valve

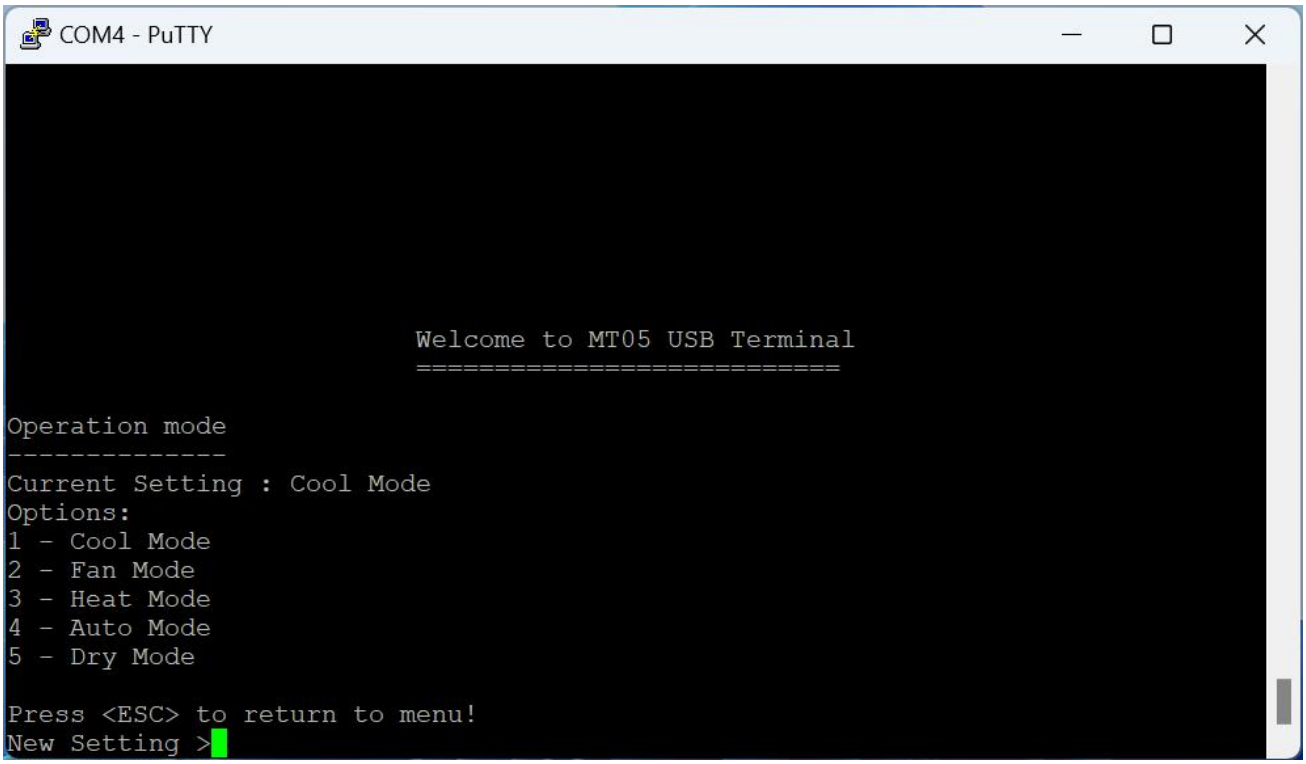
7. Fan Coil Unit Four Pipe Cooling and Heating With On/Off Valve

### 11.4.2 O/B Mode




This defines the Four Way Valve Switch in O or B mode.

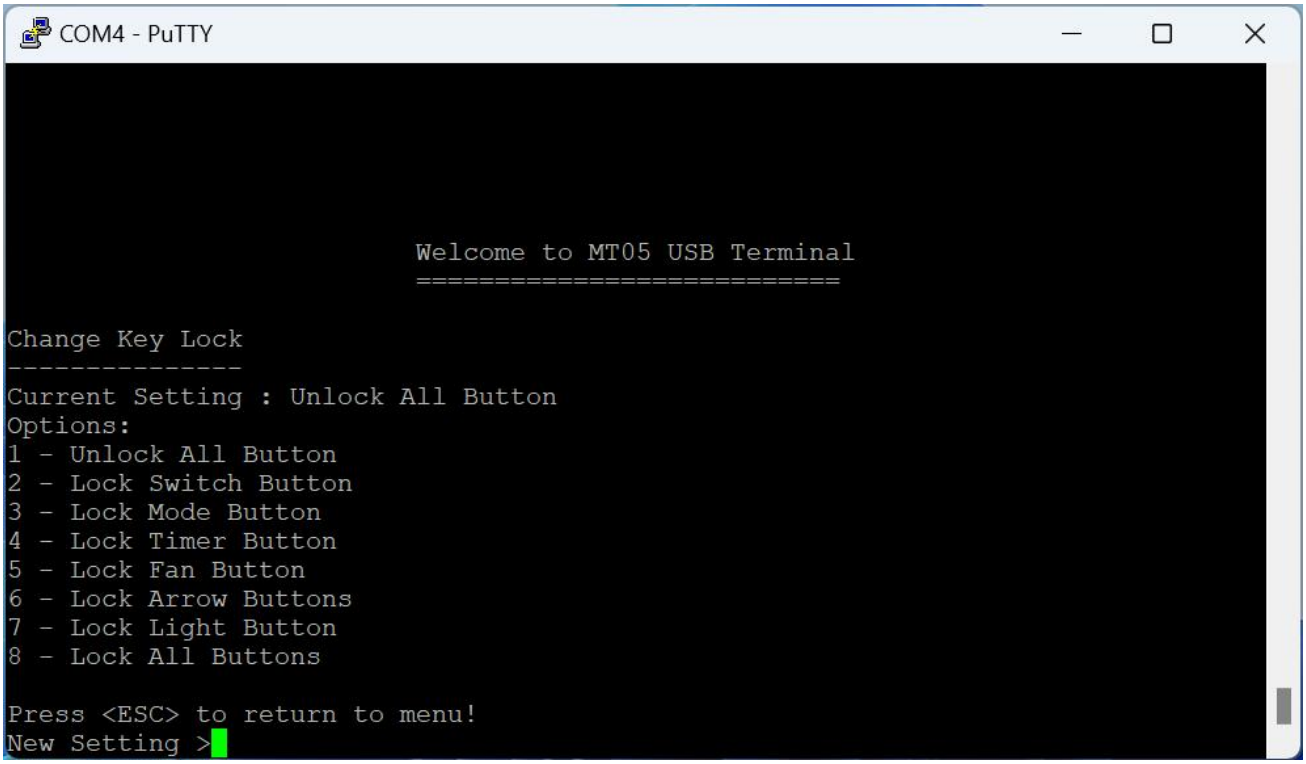
### 11.4.3 Operation Mode




Retrieve and control the current operation mode.

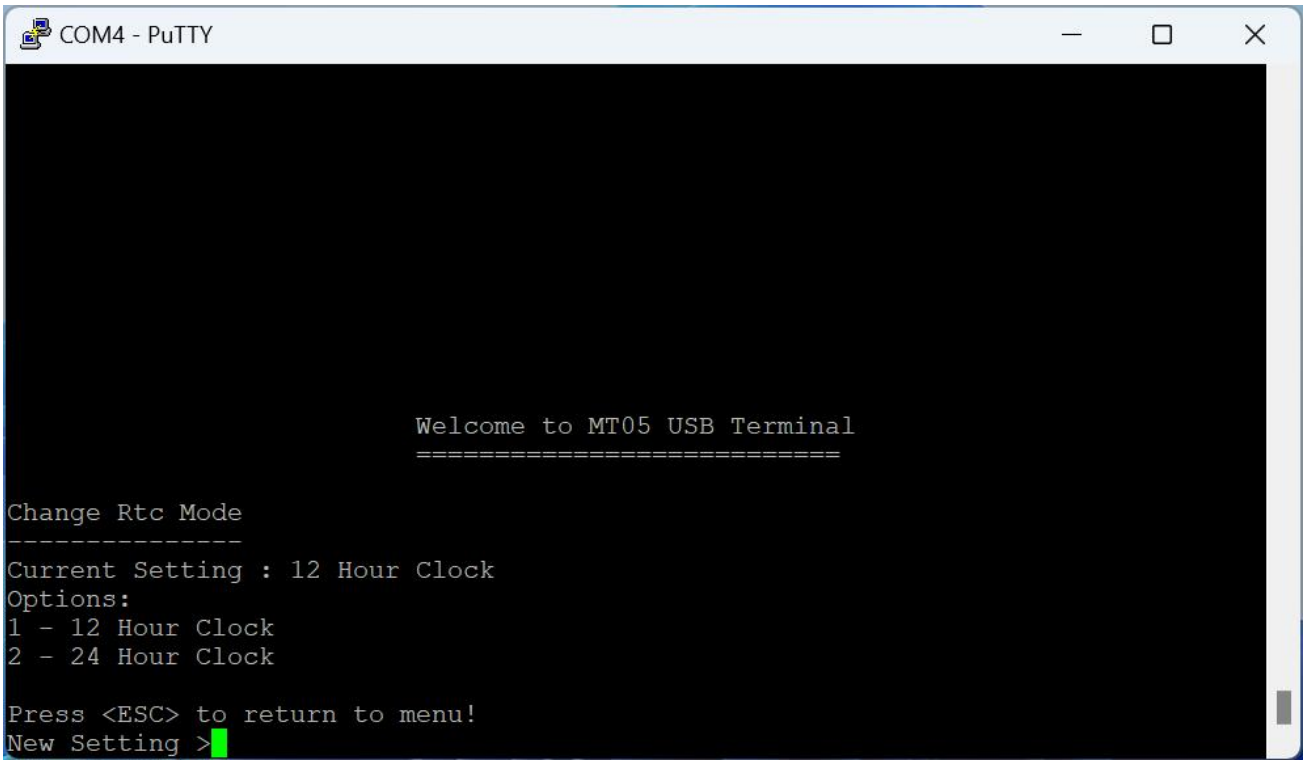
Depends on the selected application, some of the application does not support certain operation mode. Refer to section 8 for further details.

### 11.4.4 Keylock



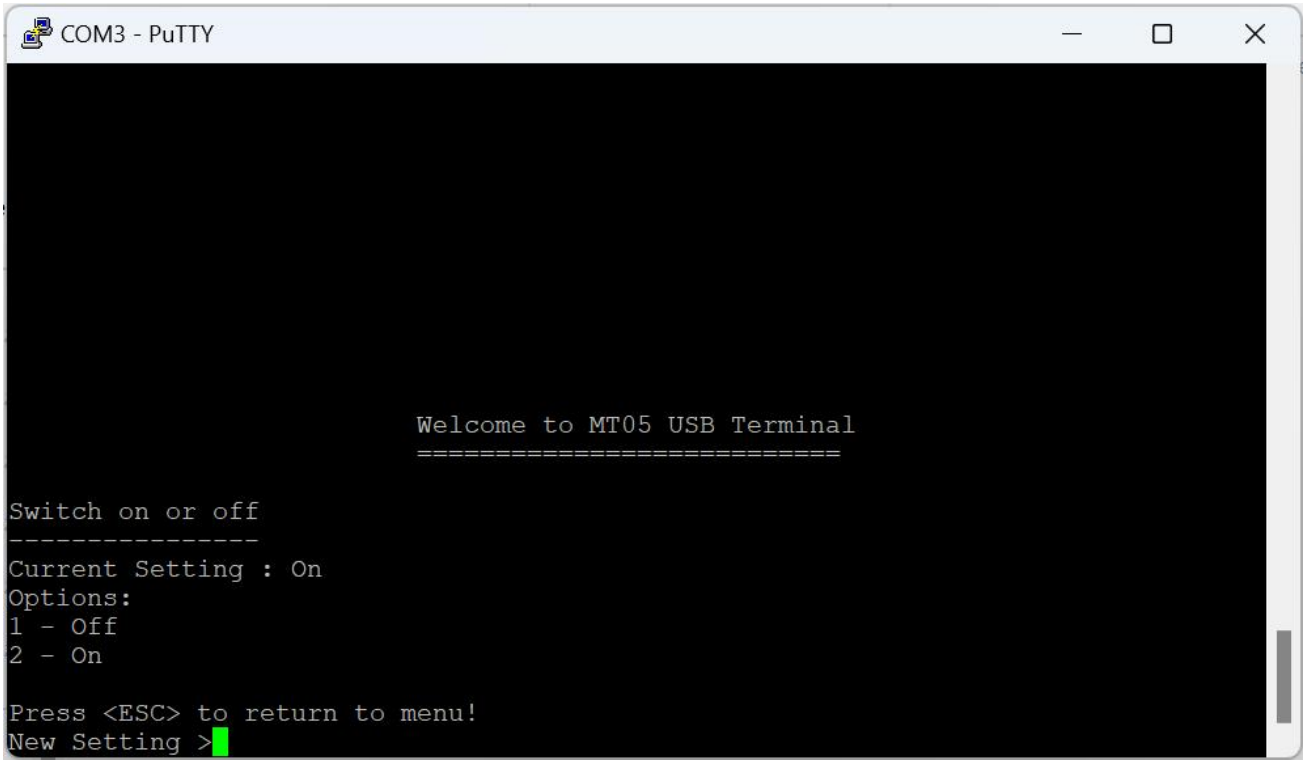

Touch screen button can be locked to prevent user changing the settings.

### 11.4.5 Clock Mode



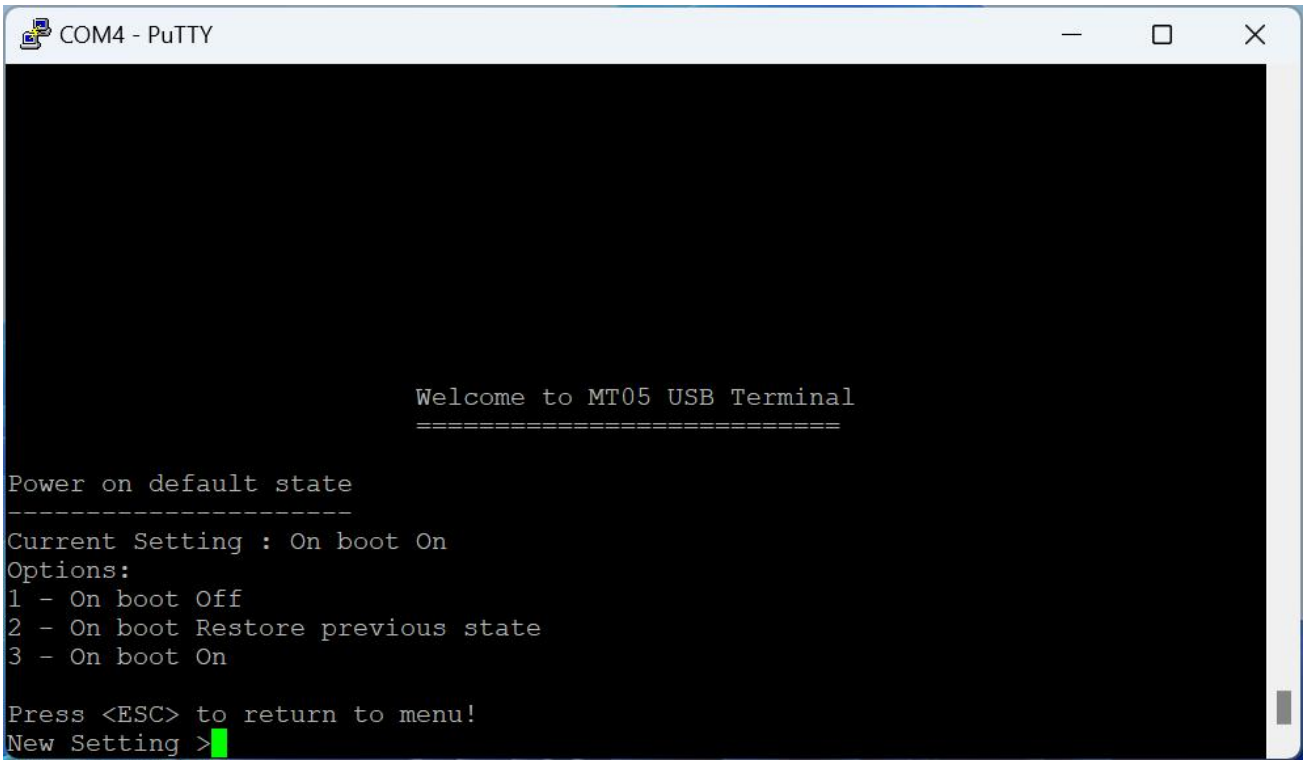

Clock display can be set to 24 hour format or 12 hour format.

### 11.4.6 Power On Off



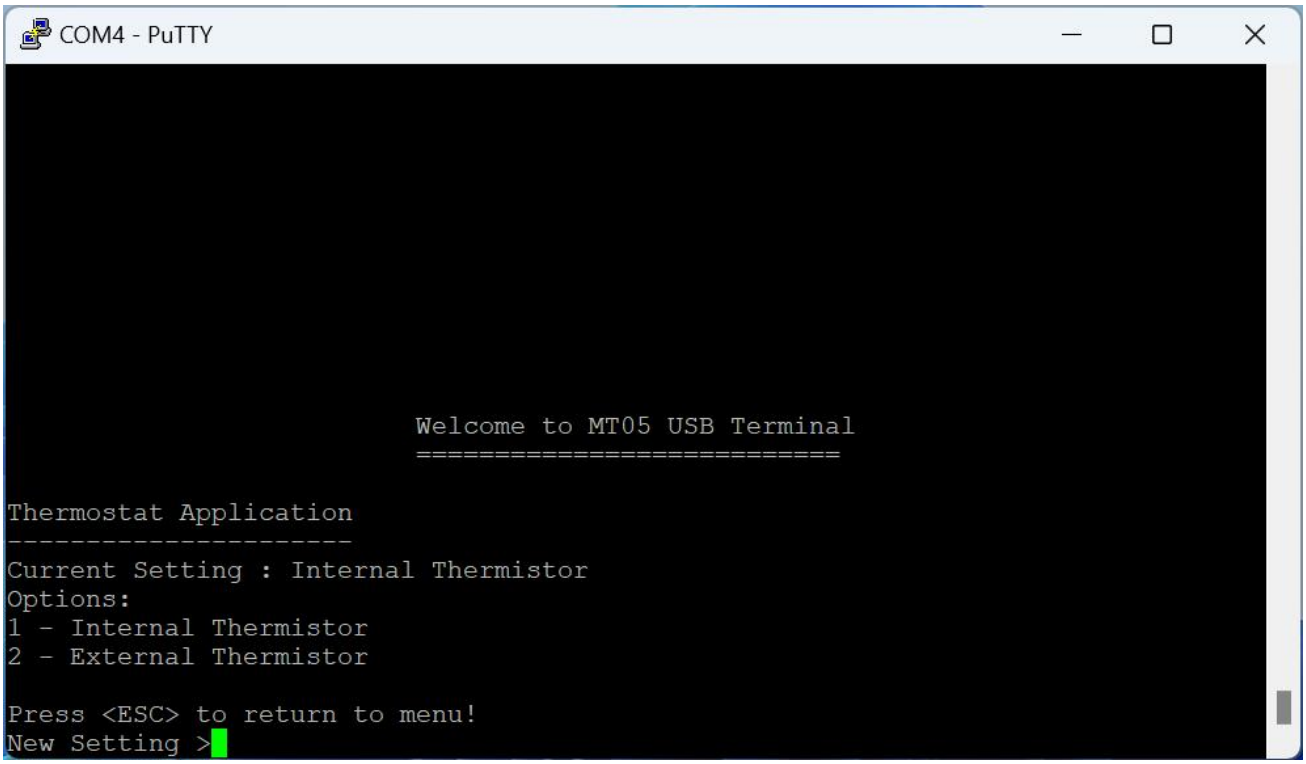

Set the device on or off.

### 11.4.7 Power On Default State



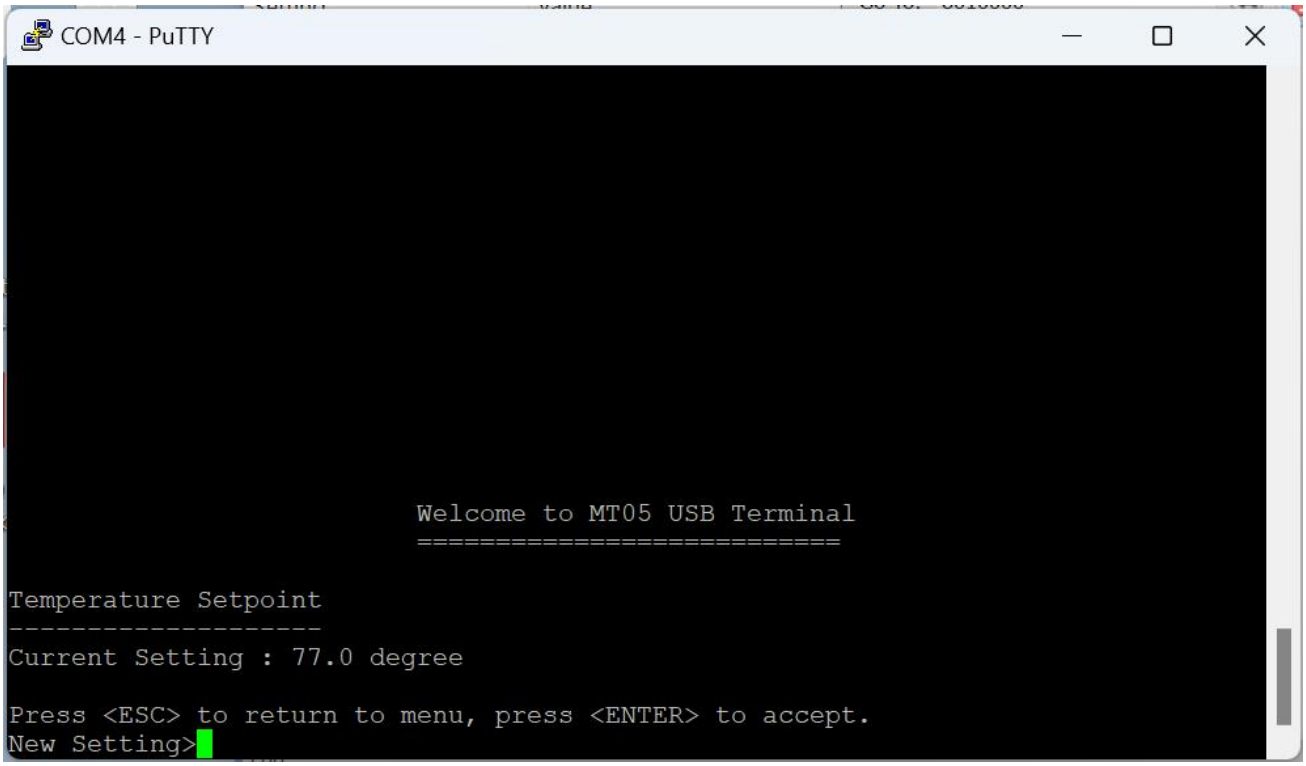

Configure the power on default state.

### 11.4.8 Thermistor Selection

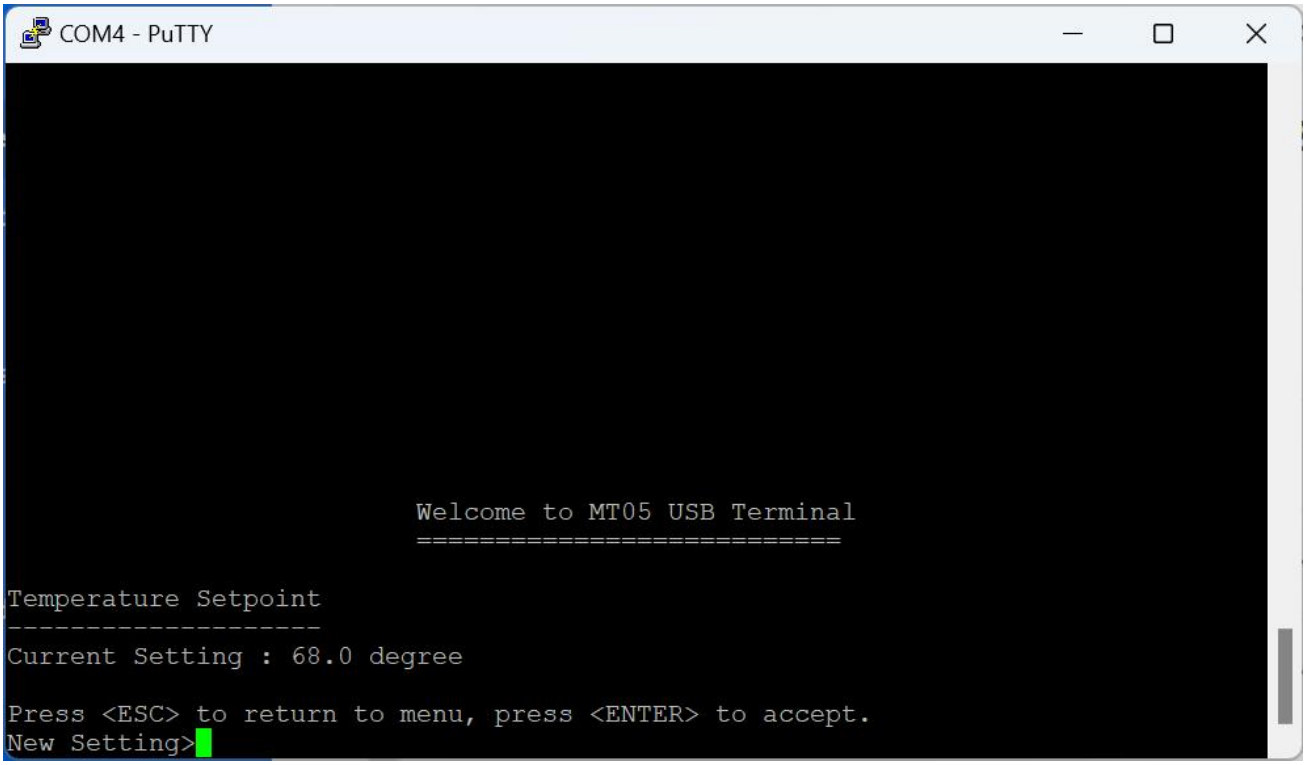



Select internal or external thermistor sensor.

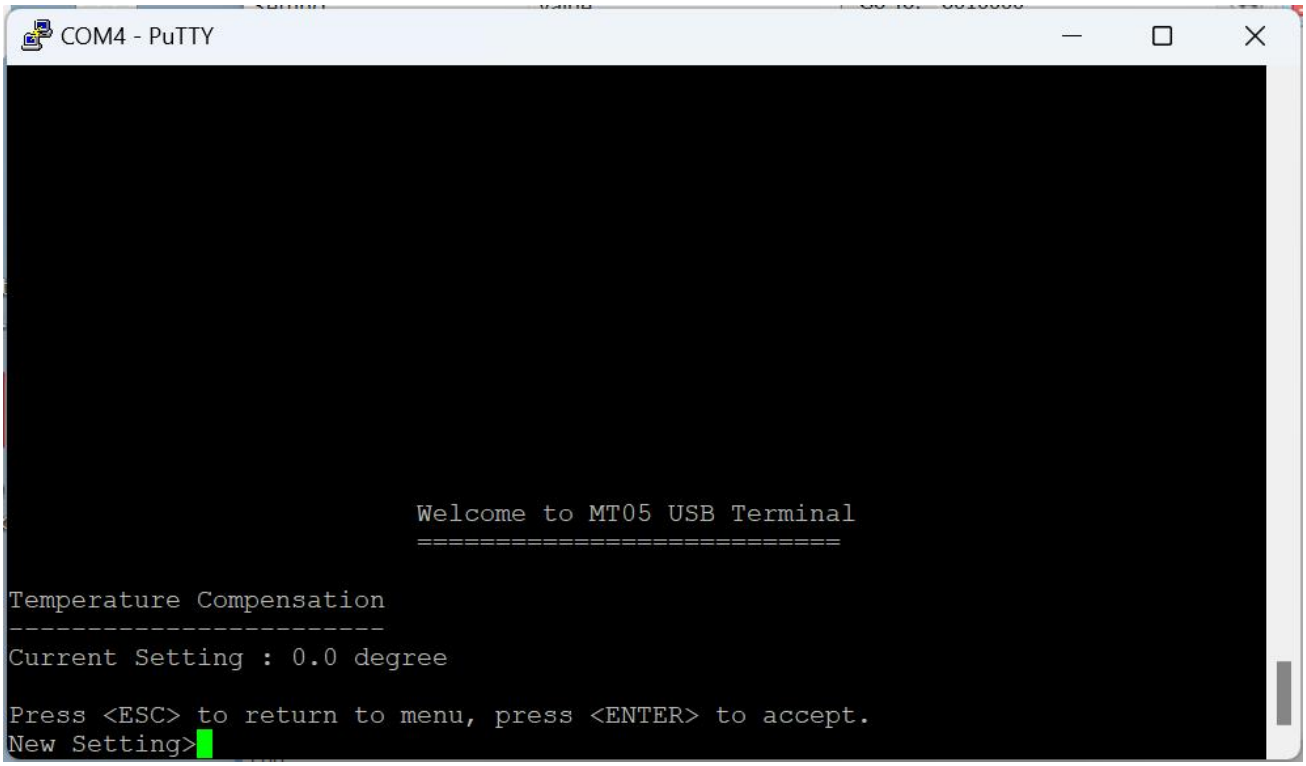
### 11.4.9 Cooling Set Point



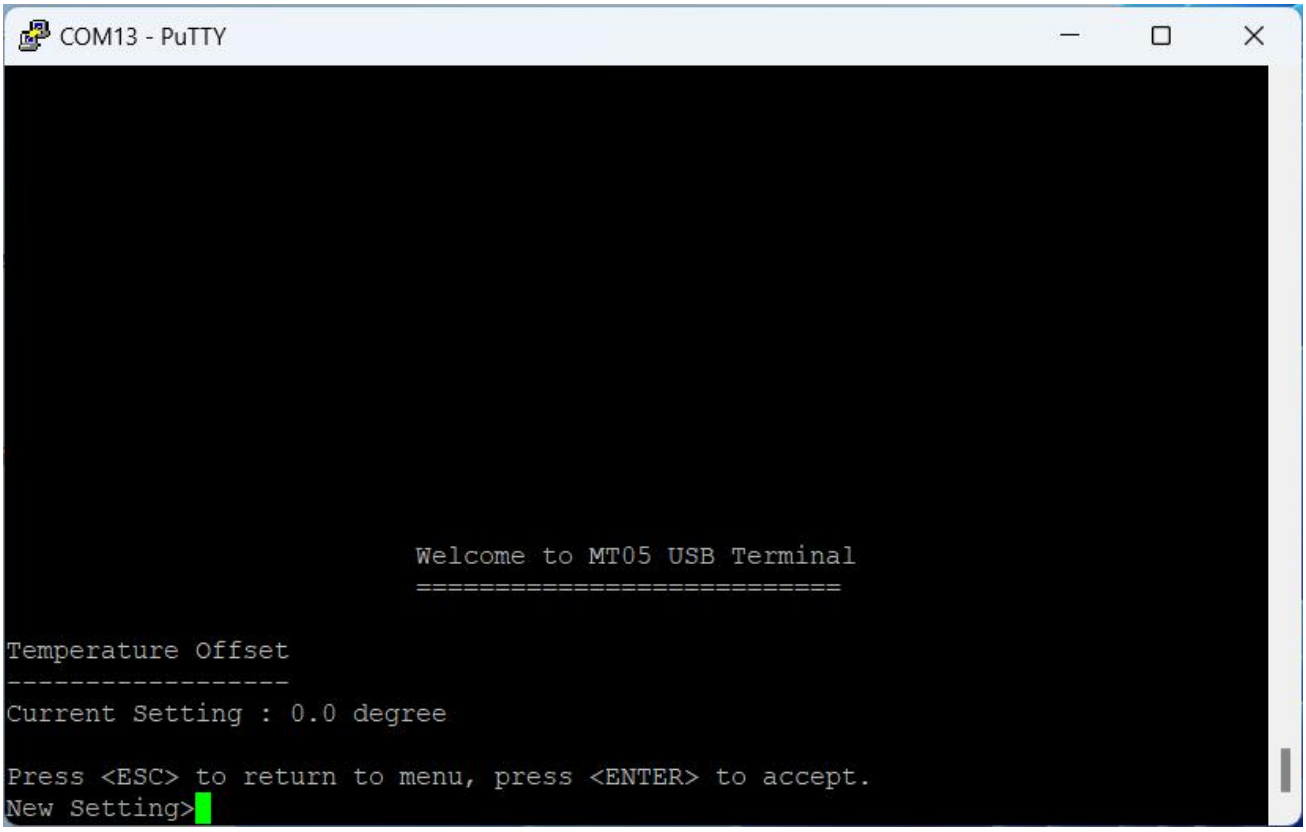

### 11.4.10 Heating Set Point



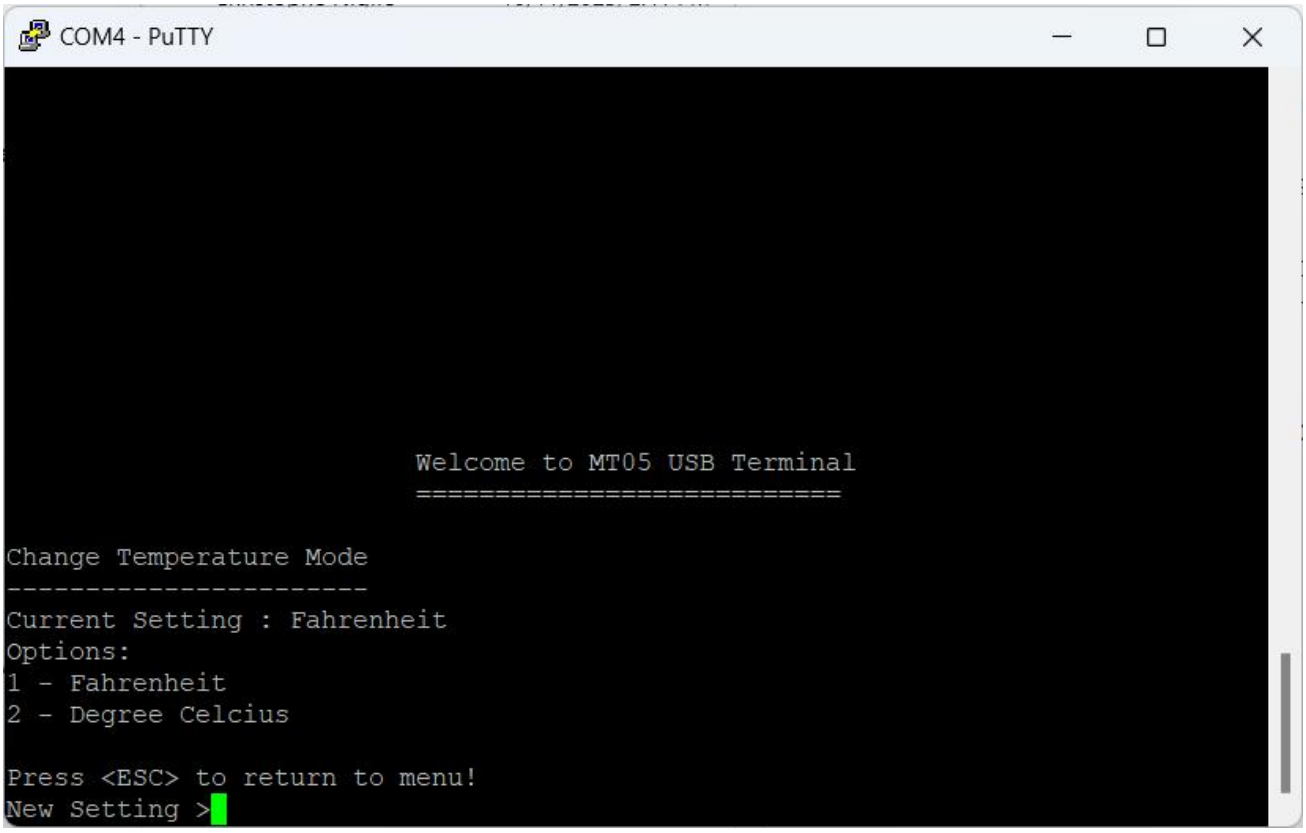
### 11.4.11 Temperature Compensation




### 11.4.12 Temperature Offset

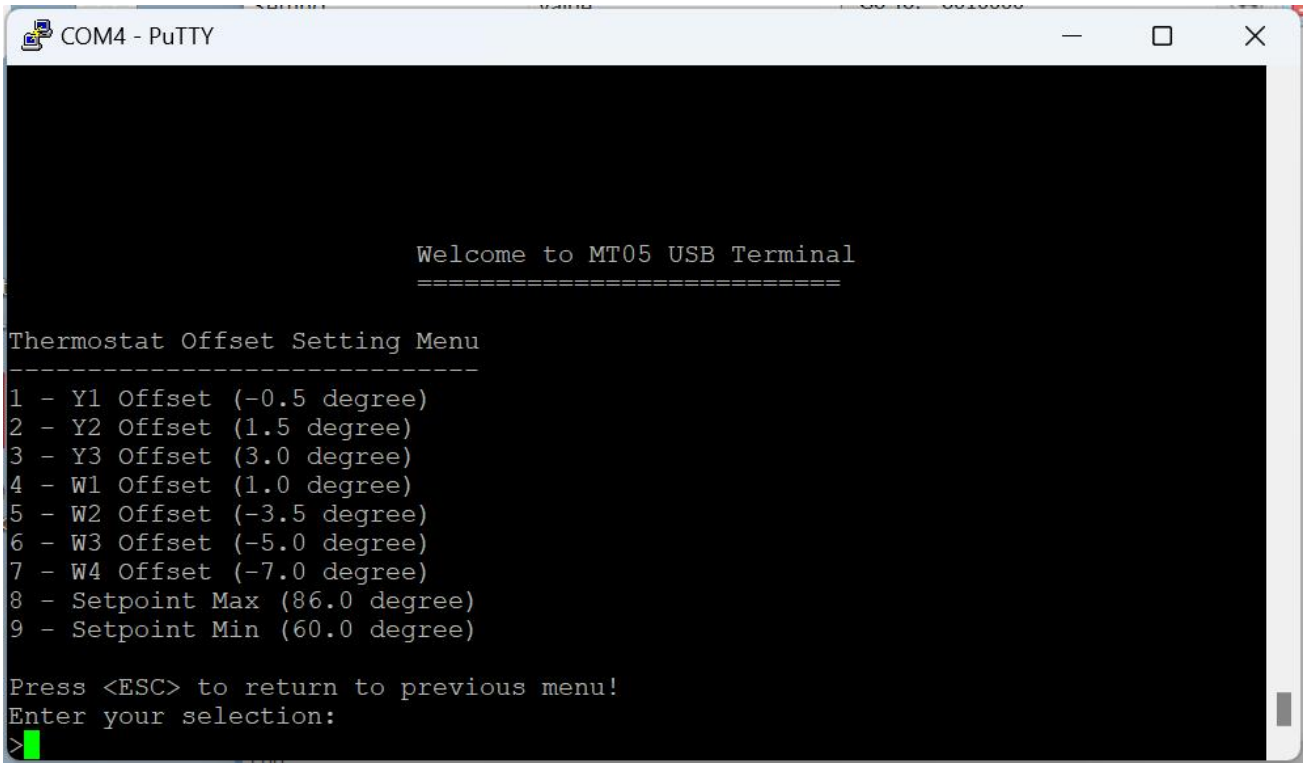


### 11.4.13 Temperature Unit



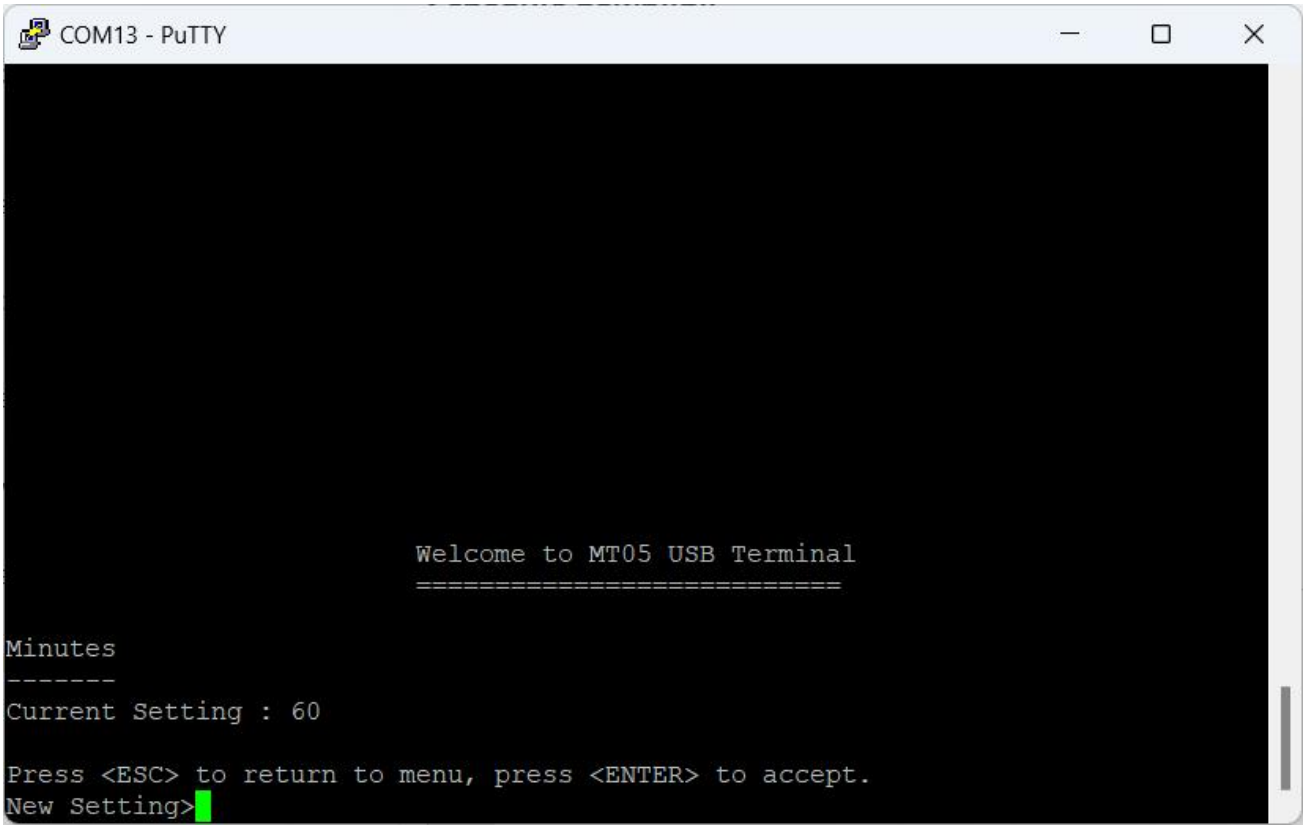

Select temperature unit.

## 11.5 Thermostat Offset Configuration

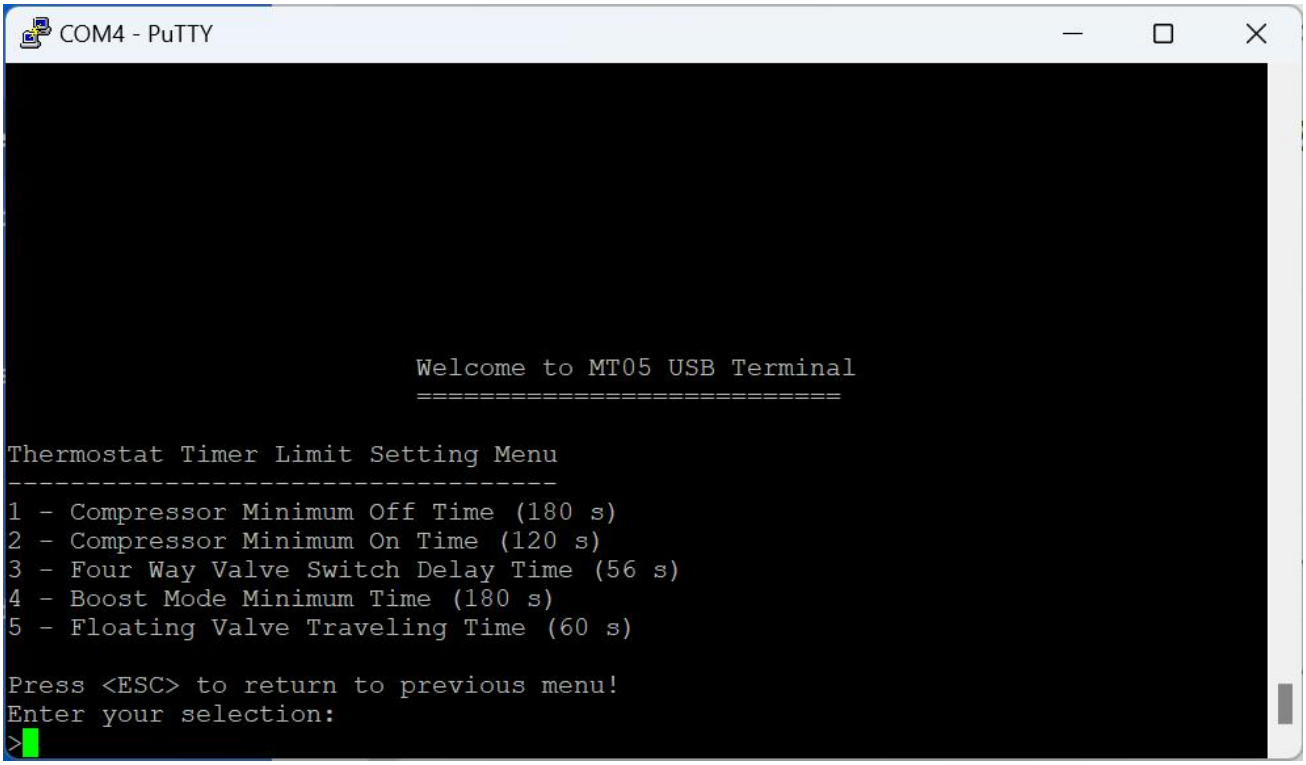


Various Offset and Setpoint Maximum and minimum settings

## 11.6 Thermostat User Override Default Time

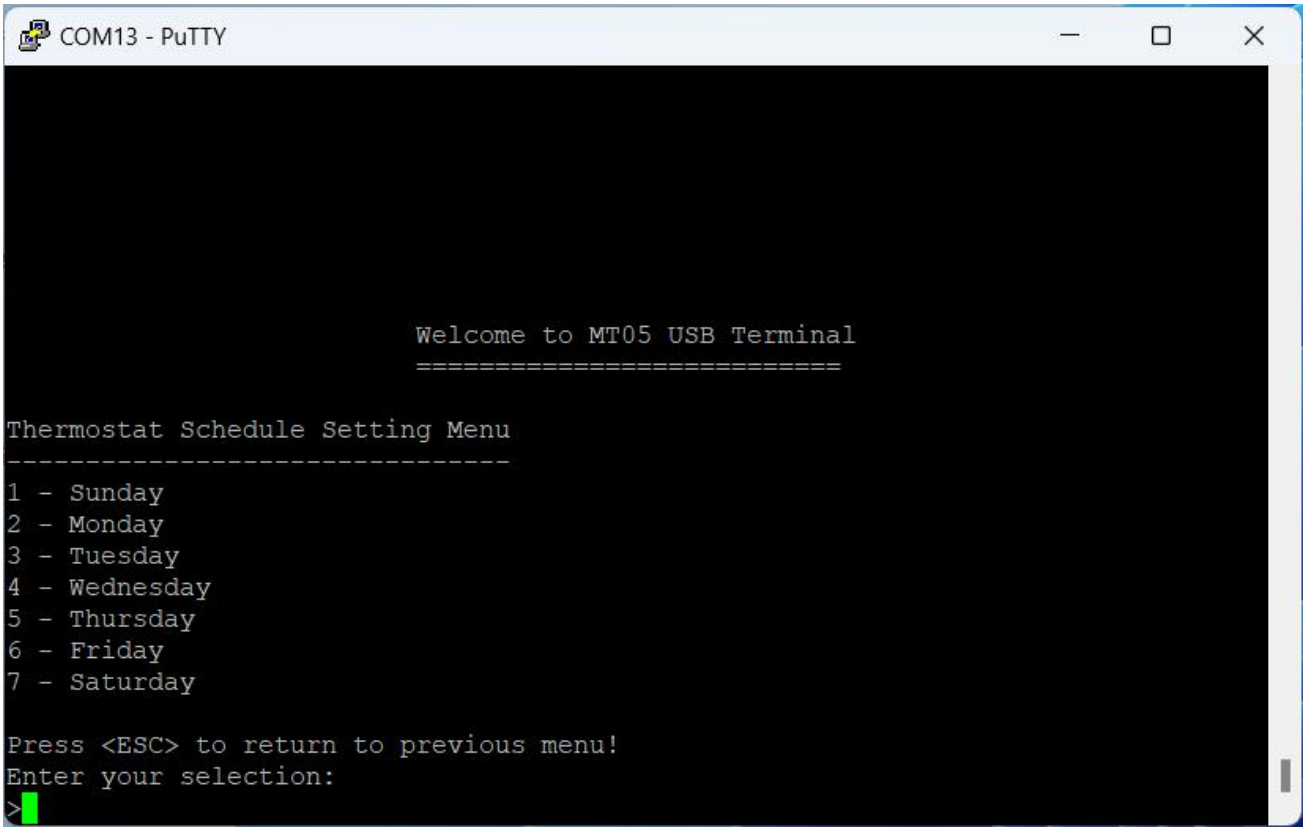



## 11.7 Thermostat Time Limit Configuration

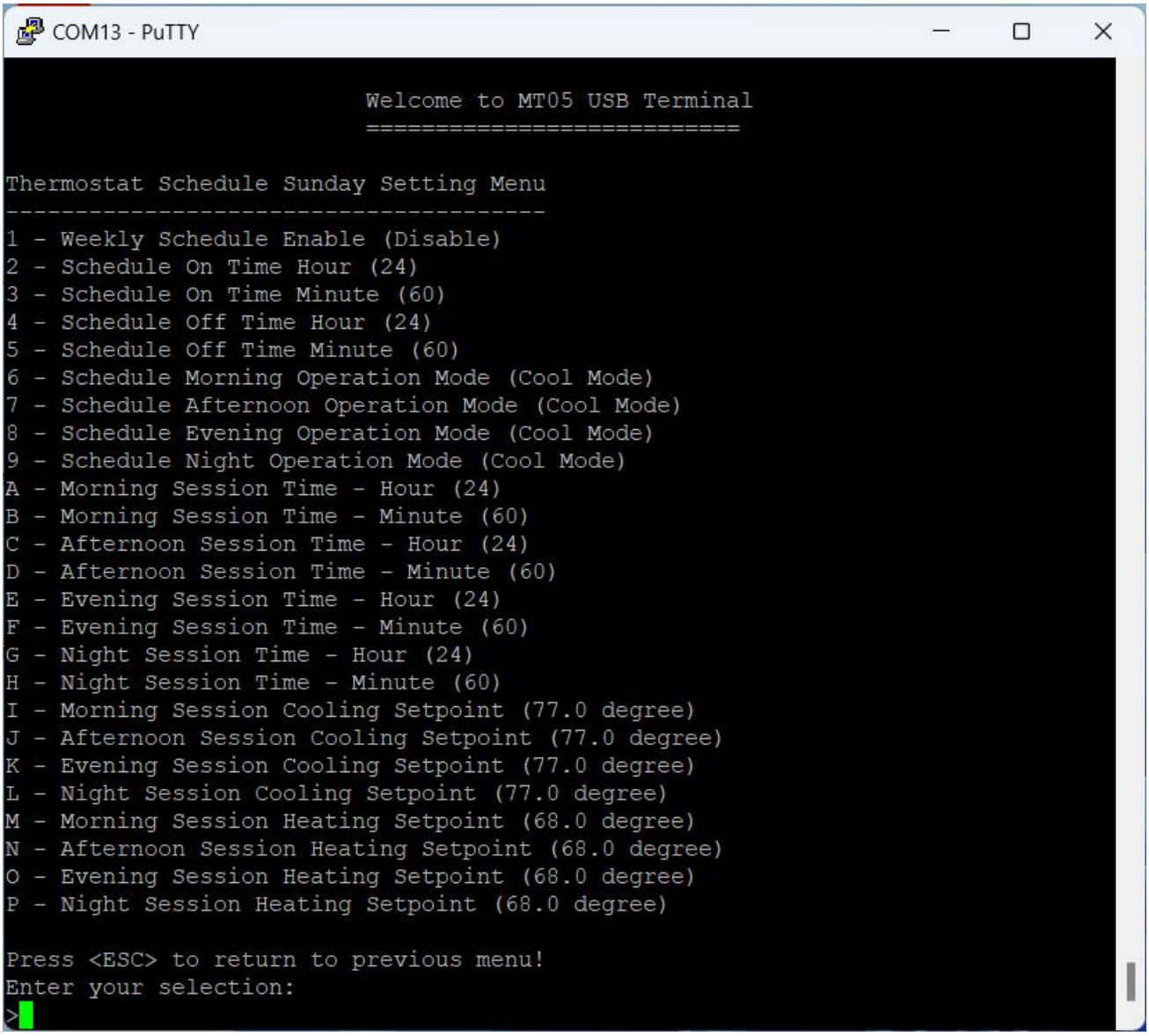


Various minimum timing settings

## 11.8 Thermostat Schedule Configuration




The scheduler consist of a weekly schedule with each day four sessions. Refer to section 9.7.




## 11.9 LoRaWAN Setting

All parameters for the operation of the thermostat LoRaWAN can be set/read through LoRaWAN Setting menu.

User can obtain all the information for the DevEUI, App/JoinEUI, AppKey, etc or apply your own parameters.

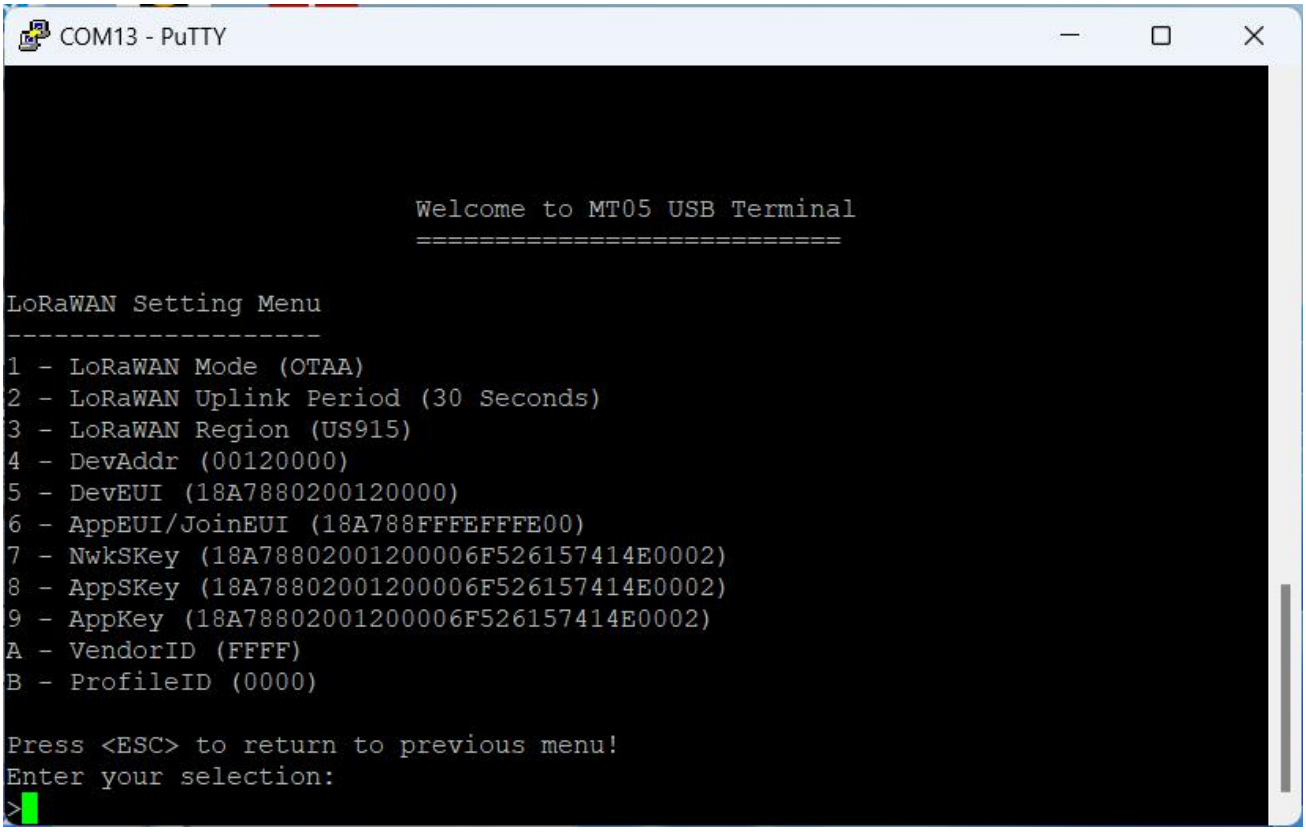



FIGURE 31: TERMINAL - LORAWAN SETTING

## 11.10 Real Time Clock Setup

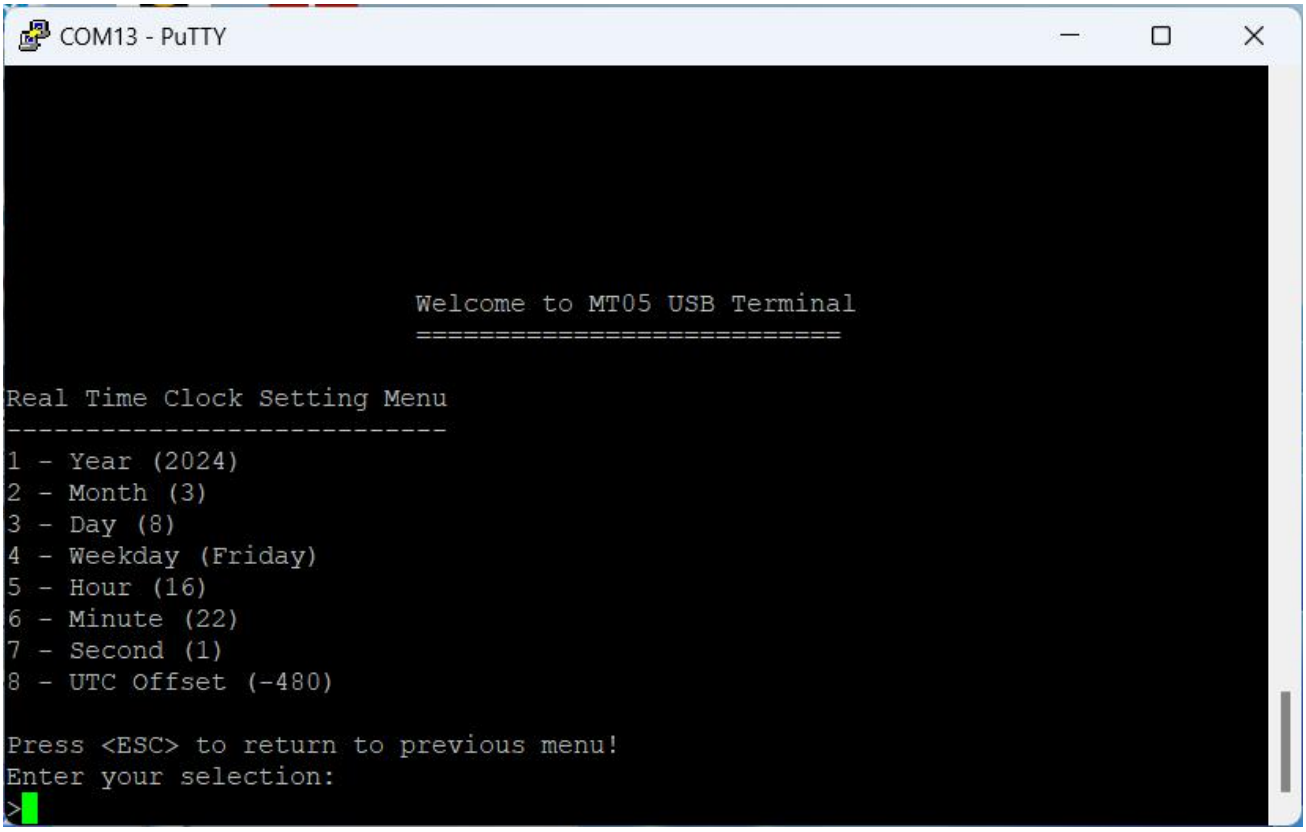


FIGURE 32: TERMINAL - REAL TIME CLOCK SETTING

Set up Real time clock. The Real Time Clock stores the local time. UTC time will be obtained by substrating RTC time with UTC offset.

## 11.11 Device Information

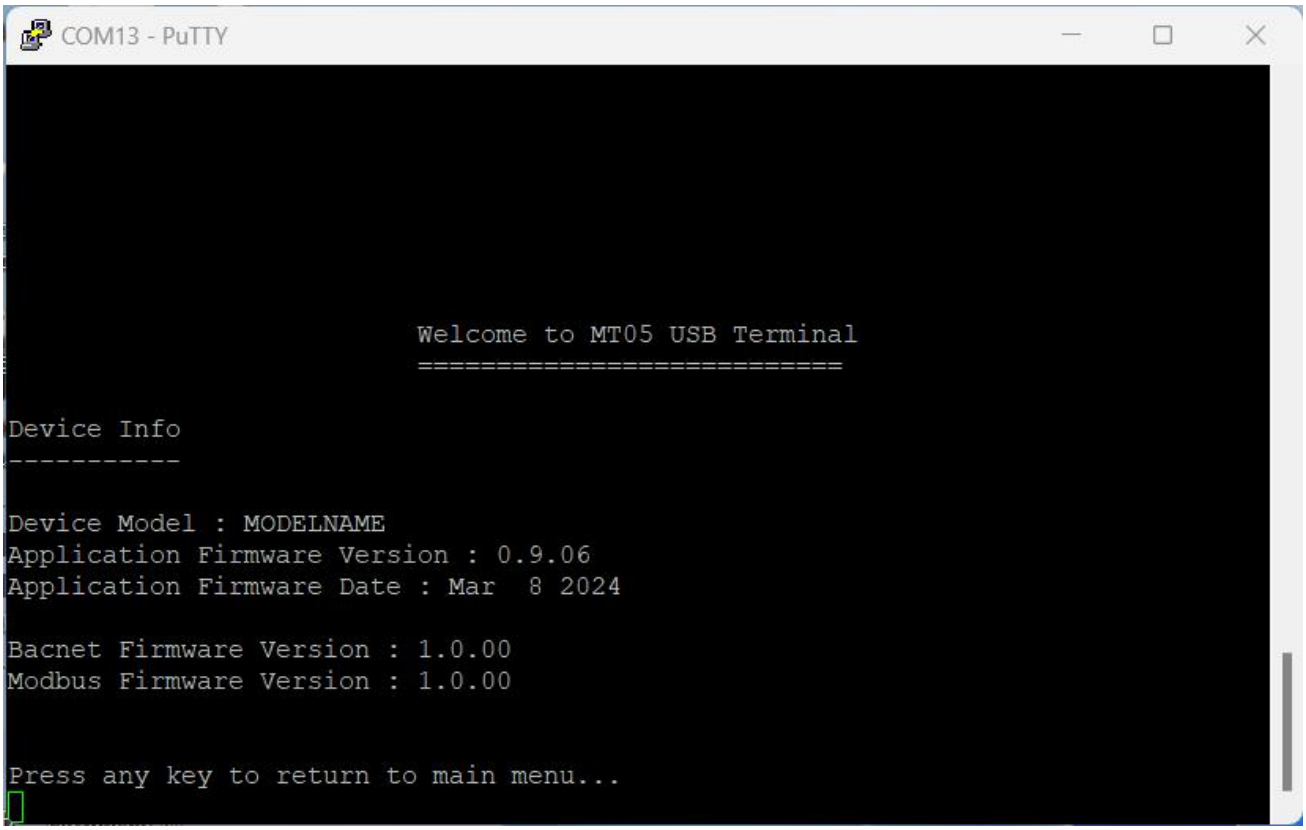



FIGURE 33: TERMINAL - DEVICE INFORMATION

Device Information contains the Device Model, Firmware Version and Date.

## 11.12 Bootloader Mode

Bootloader mode is used to update firmware.

Enter “Y” to go into bootloader mode.

MT-5 will turn into a Mass Storage Device.

The firmware can be updated just by drap and drop the firmware binary file into the MSD drive.

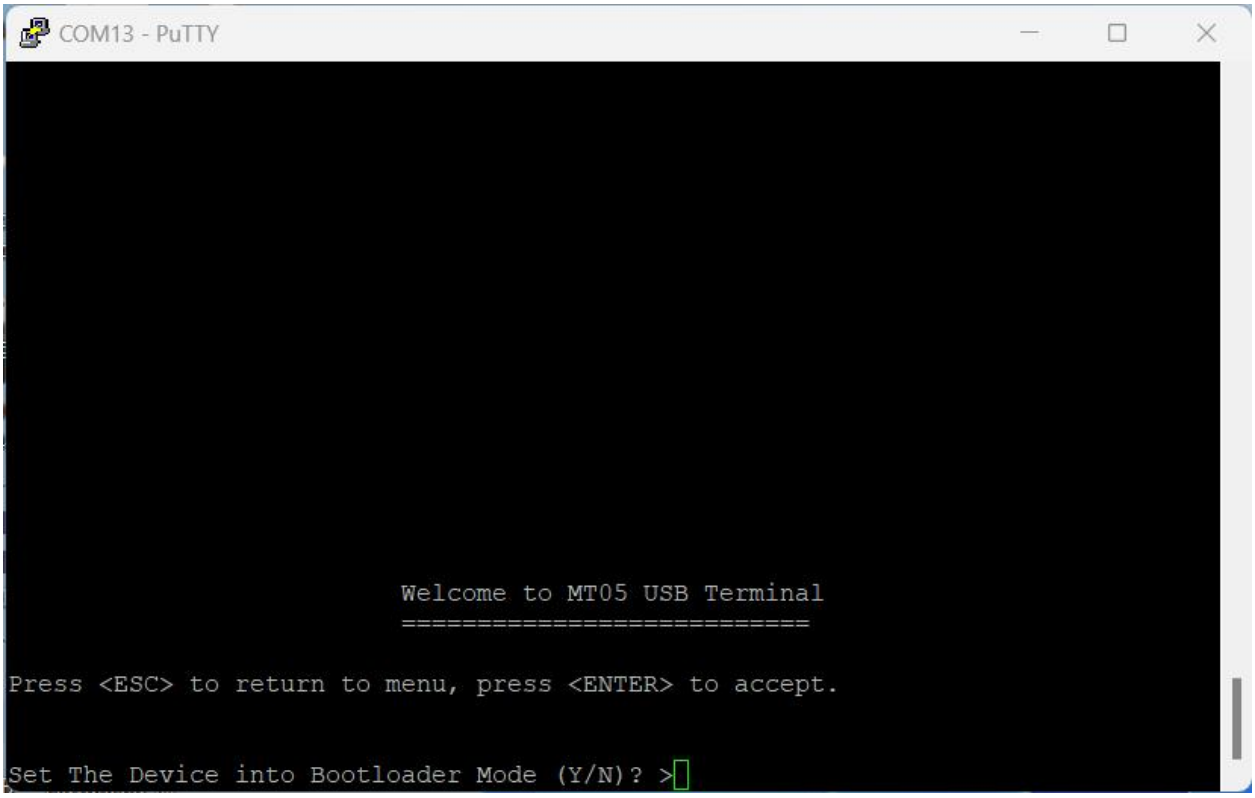



FIGURE 34: TERMINAL - BOOTLOADER

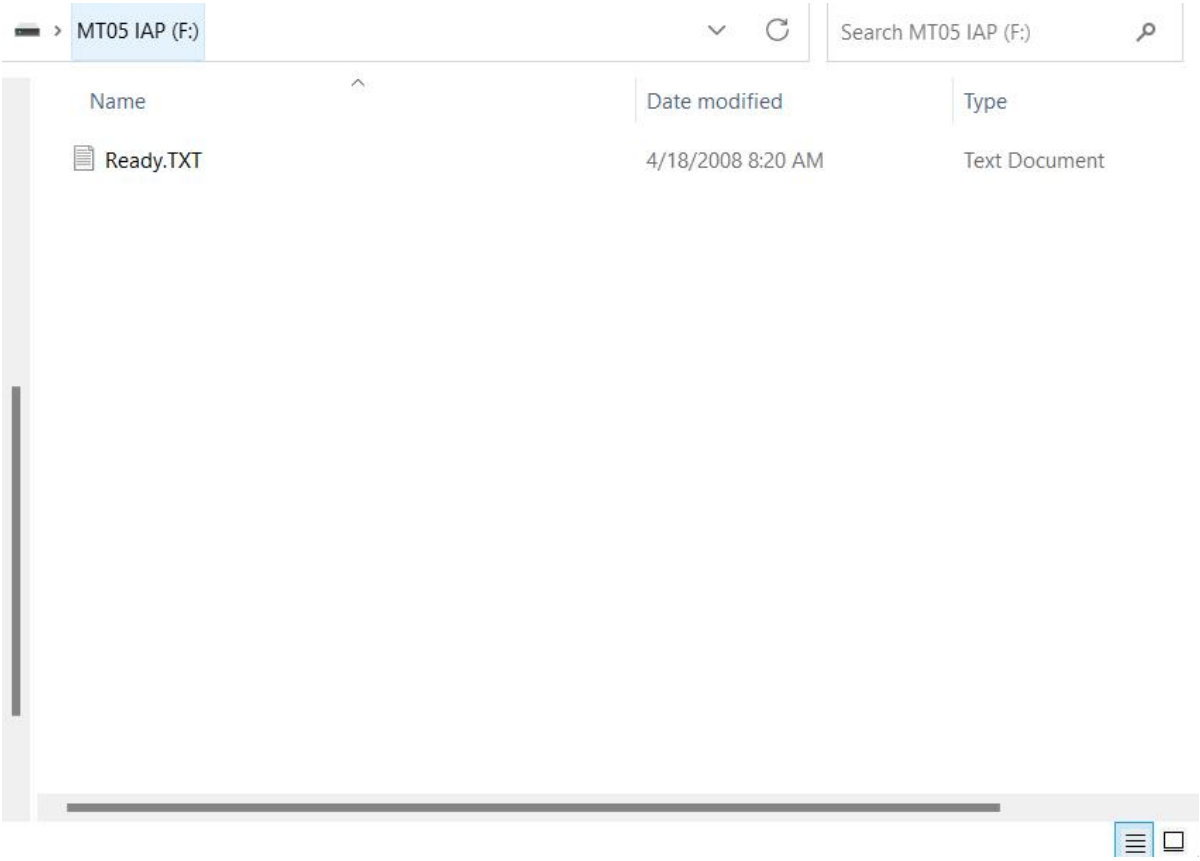



FIGURE 35: TERMINAL - MASS STORAGE DEVICE

## 11.13 Restore Factory Default Setting

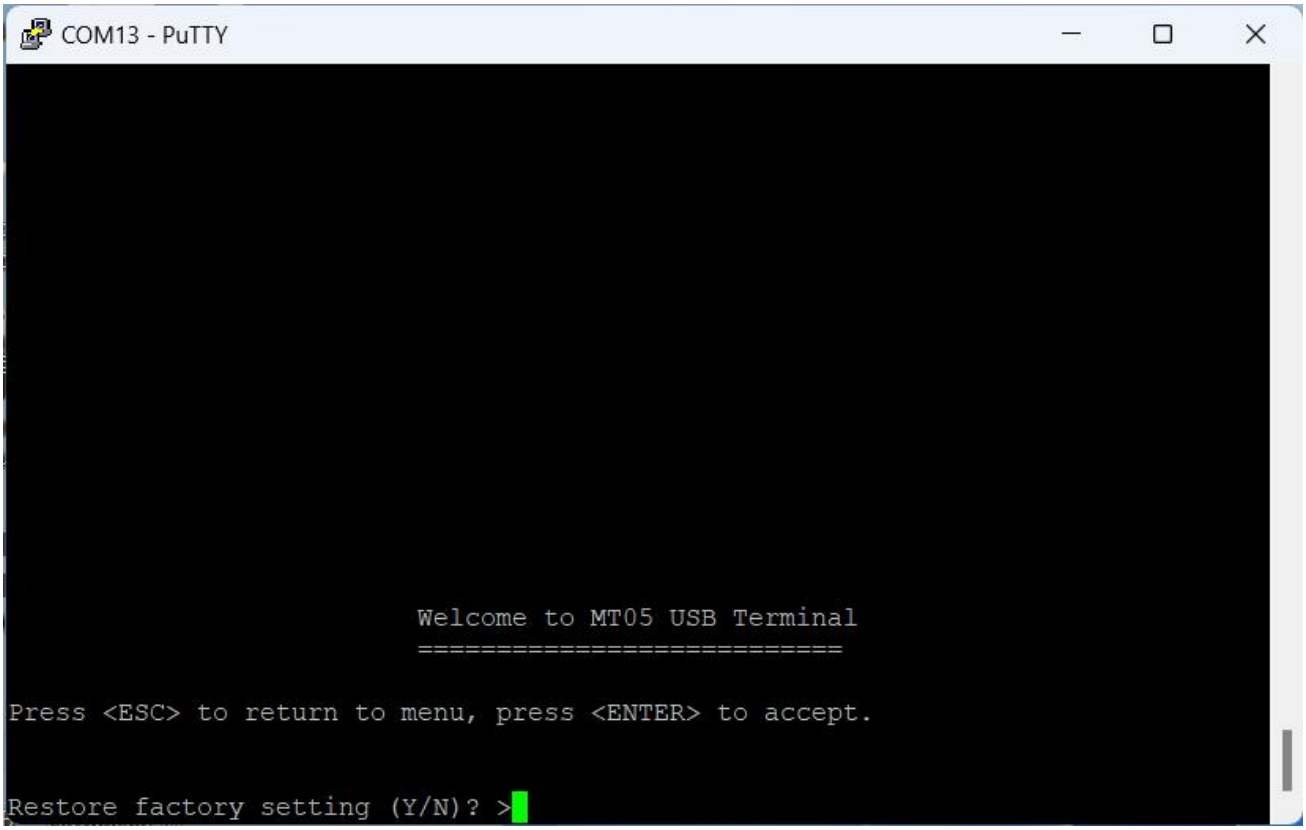



FIGURE 36: TERMINAL - RESTORE FACTORY DEFAULT SETTING

This option will reset all the settings back to the factory default, including the LoRaWAN DevEUI etc.

## 11.14 Reboot

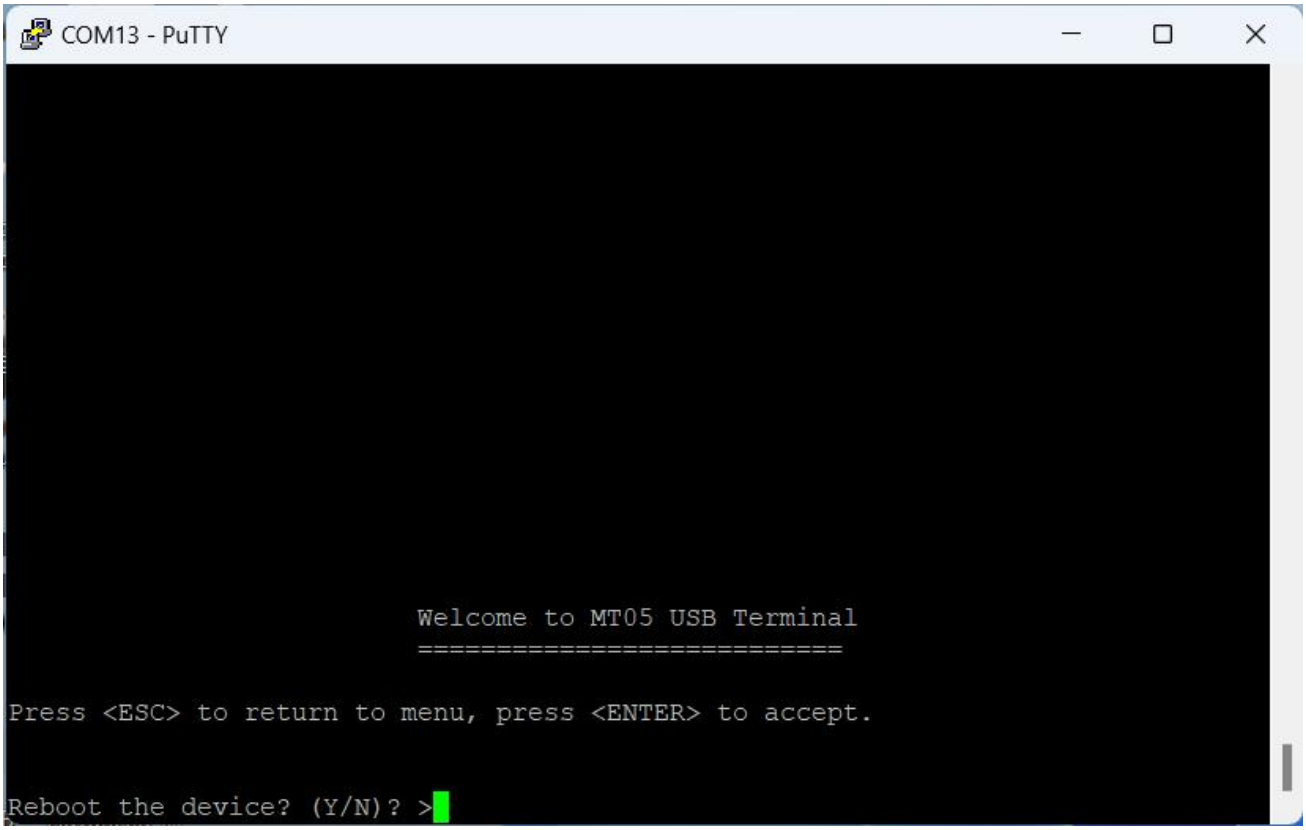



FIGURE 37: TERMINAL - REBOOT

The reboot function is used when settings like Serial Port Configuration changes. The device need to be reboot for the new Serial Port Setting to take effect.

# 12. LoRaWAN（Only Model with LoRa）

## 12.1 Regional Parameters

MT-5 implements Regional Parameters RP002-1.0.3 Final.

## 12.2 Activation

There are 2 methods for the MT-5 to be applied in LoRaWAN system, which are OTAA and ABP.

All the parameters are available in the USB Terminal and can be overwrite with user preferred values.

The DevEUI, App/JoinEUI, VendorID and VendorProfileID can be scanned from the minimum required QR code as required in “LoRaWAN Device Identification QR Code” at the back of th top LCD Display panel.

The format is :

LW:D0:AppEUI/JoinEUI:DevEUI:VendorIDVendorProfileID

Example : LW:D0:18A788FFFEFFFE00:18A7880200000000:FFFF0000

Note : The VenderID and VenderProfileID will be provided after MT-5 has join LoRa Alliance.

User can provide his own VenderID and VenderProfileID in the USB terminal.

## 12.3 OTAA

There are three essential parameters to be used in LoRaWAN OTAA, which are 'DevEUI', 'JoinEUI' and 'JoinKey'.

## 12.4 DevEUI

Unique ID of each LoRaWAN device. This 'DevEUI' of MT-5 is provided by the manufacturer. User can use their own DevEUI.

## 12.5 JoinEUI

Unique ID of each type of LoRaWAN device. This 'JoinEUI' of MT-5 is provided by the manufacturer. User can provide their own JoinEUI.

## 12.6 AppKey/JoinKey

Unique ID of each LoRaWAN device to be used by the LoRaWAN system to decode the one-time 'NwkSKey' and 'AppSKey'. Due to 'NwkSKey' and 'AppSKey' are generated differently every time, therefore OTAA is better in term of privacy. 32-bits 'DevAddr' is also generated differently every time, so 'DevEUI' is required to identify an LoRaWAN OTAA device. This 'JoinKey' is also provided by the manufacturer. User can provide their own JoinKey.

The default JoinKey is generated using the following formula:

DevEUI cascade with 6F:52:61:57:41:4E:00:02

Example:

| | |
|---|---|
| DevEUI | 18:A7:88:00:02:00:00:00 |
| AppKey/JoinKey | 18:A7:88:00:02:00:00:00:6F:52:61:57:41:4E:00:02 |

## 12.7 ABP

Comparing to OTAA, ABP is relatively easier to be configured. Insert the correct 'DevAddr', 'NwkSKey', 'AppSKey' into the LoRaWAN system, and the ABP device is ready to run. All the parameters are provided by the manufacturer. User can provide their own parameters.

## 12.8 Payload

It is necessary for the application to encode the application data structure into raw data before sending it down stream to a node and decode the raw data received from the node to application data structure that the application could understand.

## 12.9 FUOTA

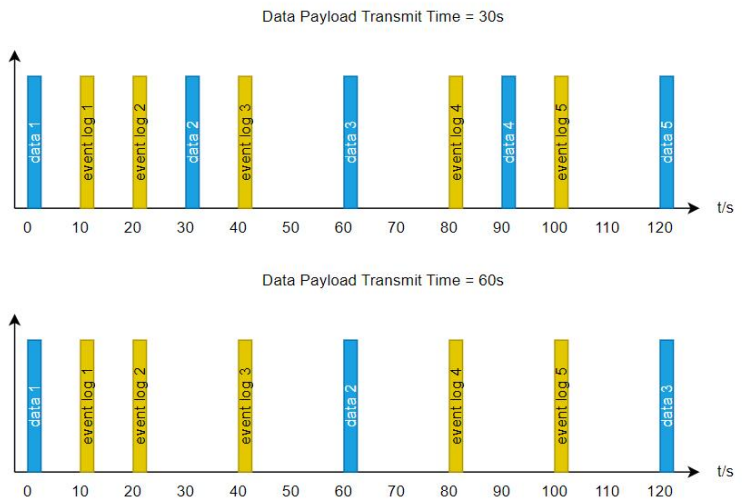
MT-5-A supports FUOTA. It has been tested on AWS. It supports both Class C(single device) or multicast group.

Fragment size = 48 bytes, Maximum redundancy = 10%

## 12.10 Event Log

The Event Log will transmit in between the normal data transmission. For example, the default transmit time for the data payload is 30s, after the data payload has transmitted, this is time zero. At time 10s, if there is an event log, it will be transmitted, at time 20s, if there is still another event log, it will be transmitted. If the remaining time to data payload transmit is less than 10s, there will be no event log transmission. After the data payload is transmitted, the cycle repeats.

If the data payload transmit time is set to a longer period, then there will be more 10s interval for the event log to be transmit, if there is any.




## 12.11 Command

| Enum | Uplink Command Type | Downlink Command Type |
|---|---|---|
| 1 | GET_DATA* | |
| 2 | GET_SETTING0_REPLY | GET_SETTING0 |
| 3 | GET_SETTING1_REPLY | GET_SETTING1 |
| 4 | GET_SETTING2_REPLY | GET_SETTING2 |
| 5 | GET_SETTING3_REPLY | GET_SETTING3 |

| | | |
|---|---|---|
| 6 | GET_SETTING4_REPLY | GET_SETTING4 |
| 7 | GET_SETTING5_REPLY | GET_SETTING5 |
| 8 | GET_SETTING6_REPLY | GET_SETTING6 |
| 9 | GET_SETTING7_REPLY | GET_SETTING7 |
| 10 | GET_SETTING8_REPLY | GET_SETTING8 |
| 11 | GET_SETTING9_REPLY | GET_SETTING9 |
| 12 | GET_EVENT_LOG_REPLY | GET_EVENT_LOG |
| 13 | SET_SETTING0_REPLY | SET_SETTING0 |
| 14 | SET_SETTING1_REPLY | SET_SETTING1 |
| 15 | SET_SETTING2_REPLY | SET_SETTING2 |
| 16 | SET_SETTING3_REPLY | SET_SETTING3 |
| 17 | SET_SETTING4_REPLY | SET_SETTING4 |
| 18 | SET_SETTING5_REPLY | SET_SETTING5 |
| 19 | SET_SETTING6_REPLY | SET_SETTING6 |
| 20 | SET_SETTING7_REPLY | SET_SETTING7 |
| 21 | SET_SETTING8_REPLY | SET_SETTING8 |
| 22 | SET_SETTING9_REPLY | SET_SETTING9 |
| 23 | SET_RTC_REPLY | SET_RTC |
| 24 | GET_FIRMWARE_VERSION_REPLY | GET_FIRMWARE_VERSION |

*Uplink periodically send GET_DATA if no downlink command received.

*All data sent in Little Endian byte order.

## 12.12 UpLink Payload

All uplink payloads are unconfirmed.

### 12.12.1 GET_DATA Command

Operating Data : 11 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

Byte 1-2: Room Temperature*100

Byte 3-4: CO2 ppm

Byte 5-6: Humidity*100 (% RH)

Byte 7-10: 32 bit Unix Timestamps(Little Endian, 4 byte aligned)

e.g.: 0x11223344, Byte 1 = 0x44, Byte 2 = 0x33, Byte 3 = 0x22, Byte 4 = 0x11

### 12.12.2 GET_SETTING0_REPLY

Operating Setting : 7 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

Byte 1: Application

0 = RTU

1 = HPU

2 = FCU Two Pipe Cooling Only with On/Off Valve

3 = FCU Two Pipe Heating Only with On/Off Valve

4 = FCU Two Pipe Cooling Only with Floating Valve

5 = FCU Two Pipe Heating Only with Floating Valve

6 = FCU Four Pipe Cooling And Heating with On/Off Valve

Byte 2: O/B | Power On Default State | Thermistor Selection

Bit 4-7: Reserved

Bit 3: O/B configuration (0 : B mode, 1 = O mode)

Bit 1-2: Power on default state

0 = Default off

1 = Restore previous state

2 = Default on

Bit 0: Thermistor sensor selection, 0 = internal, 1 = external on UI1.

Byte 3-4: Temperature Compensation*100, -9.9 to 9.9.

Byte 5-6: Temperature Offset*100 ,-9.9 to 9.9.

Byte 7-8: Auto Uplink Period, Minimum 30s, 30s~ 65535s.

Byte 9-10: Event Log Count, Event Log that is not read or auto sent yet.

### 12.12.3 GET_SETTING1_REPLY

Operating Setting : 8 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

Byte 1: Operation Mode

0 = Cool Mode, 1 = Fan Mode, 2 = Heat Mode, 3 = Auto Mode, 4 = Dry Mode.

Byte 2: Temperature Unit | Key Lock | Clock Mode | On/Off

Bit 6-7: Reserved

Bit 5: Temperature Unit, 0 = Fahrenheit, 1 = Celsius.

Bit 2-4: Key Lock

0 = Unlocked

1 = Lock On/Off button

2 = Lock Mode button

3 = Lock Timer button

4 = Lock Fan button

5 = Lock Up/Down button

6 = Lock Light button

7 = Unlock All button

Bit 1: Clock Mode(0 = 12 hour format, 1 = 24 hour format)

Bit 0: On/Off (0 = OFF, 1 = ON)

Byte 3-4: Cooling Set Point*100, Set Point Min to Set Point Max.

Byte 5-6: Heating Set Point*100, Set Point Min to Set Point Max.

Byte 7: Operating State

0 = Normal, 1 = Scheduler, 2 = User Override.

### 12.12.4 GET_SETTING2_REPLY

operating setting Cont.. : 11 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

Byte 1-2: Y(1) Offset*100, -9.9 to 9.9.

Byte 3-4: Y(2) Offset*100, -9.9 to 9.9.

Byte 5-6: Y(3) Offset*100, -9.9 to 9.9.

Byte 7-8: Set Point Max*100, 16.0 to 86.0.

Byte 9-10: Set Point Min*100, 16.0 to 86.0.

### 12.12.5 GET_SETTING3_REPLY

operating setting Cont.. : 9 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

Byte 1-2: W(1) Offset*100, -9.9 to 9.9.

Byte 3-4: W(2) Offset*100, -9.9 to 9.9.

Byte 5-6: W(3) Offset*100, -9.9 to 9.9.

Byte 7-8: W(4) Offset*100, -9.9 to 9.9.

### 12.12.6 GET_SETTING4_REPLY

operating setting Cont.. : 11 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

Byte 1-2: Compressor Minimum Off Time, sec, 0 to 65535, 0 = disable.

Byte 3-4: Compressor Minimum On Time, sec, 0 to 65535, 0 = disable.

Byte 5-6: Four Way Valve Switch Delay from Compressor Off, sec, 0 to 65535, 0 = disable.

Byte 7-8: Boost Mode Minimum Time, sec, 0 to 65535, 0 = disable.

Byte 9-10: Floating Valve Traveling Time, sec, 0 to 65535.

### 12.12.7 GET_SETTING5_REPLY

Operating setting : 11 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

Byte 1: Weekday(0-6, Sunday to Saturday)

Byte 2: 0 = Disable, 1 = Enable

Byte 3: Scheduled On Timer Hour, 0 to 23, 24 = disable.

Byte 4: Scheduled On Timer Minute, 0 to 59, 60 = disable.

Byte 5: Scheduled Off Timer Hour, 0 to 23, 24 = disable.

Byte 6: Scheduled Off Timer Minute, 0 to 59, 60 = disable.

Byte 7: Scheduler Morning Operation Mode.

0 = Cool Mode, 1 = Fan Mode, 2 = Heat Mode, 3 = Auto Mode, 4 = Dry Mode.

Byte 8: Scheduler Afternoon Operation Mode.

0 = Cool Mode, 1 = Fan Mode, 2 = Heat Mode, 3 = Auto Mode, 4 = Dry Mode.

Byte 9: Scheduler Evening Operation Mode.

0 = Cool Mode, 1 = Fan Mode, 2 = Heat Mode, 3 = Auto Mode, 4 = Dry Mode.

Byte 10: Scheduler Night Operation Mode.

0 = Cool Mode, 1 = Fan Mode, 2 = Heat Mode, 3 = Auto Mode, 4 = Dry Mode.

### 12.12.8 GET_SETTING6_REPLY

Operating setting : 11 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

Byte 1: Weekday(0-6, Sunday to Saturday)

Byte 2: 0 = Disable, 1 = Enable

Byte 3: Morning Session Temperature Timer Hour, 0 to 23, 24 = disable..

Byte 4: Morning Session Temperature Timer Minute, 0 to 59, 60 = disable,

Byte 5: Afternoon Session Temperature Timer Hour, 0 to 23, 24 = disable..

Byte 6: Afternoon Session Temperature Timer Minute, 0 to 59, 60 = disable,

Byte 7: Evening Session Temperature Timer Hour, 0 to 23, 24 = disable..

Byte 8: Evening Session Temperature Timer Minute, 0 to 59, 60 = disable,

Byte 9: Night Session Temperature Timer Hour, 0 to 23, 24 = disable..

Byte 10: Night Session Temperature Timer Minute, 0 to 59, 60 = disable,

### 12.12.9 GET_SETTING7_REPLY

Operating setting : 11 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

Byte 1: Weekday(0-6, Sunday to Saturday)

Byte 2: 0 = Disable, 1 = Enable

Byte 3-4: Morning Session Cooling Set Point * 100, 16.0 to 86.0.

Byte 5-6: Afternoon Session Cooling Set Point * 100, 16.0 to 86.0.

Byte 7-8: Evening Session Cooling Set Point * 100, 16.0 to 86.0.

Byte 9-10: Night Session Cooling Set Point * 100, 16.0 to 86.0.

### 12.12.10 GET_SETTING8_REPLY

Operating setting : 11 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

Byte 1: Weekday(0-6, Sunday to Saturday)

Byte 2: 0 = Disable, 1 = Enable

Byte 3-4: Morning Session Heating Set Point * 100, 16.0 to 86.0.

Byte 5-6: Afternoon Session Heating Set Point * 100, 16.0 to 86.0.

Byte 7-8: Evening Session Heating Set Point * 100, 16.0 to 86.0.

Byte 9-10: Night Session Heating Set Point * 100, 16.0 to 86.0.

### 12.12.11 GET_SETTING9_REPLY

Operating setting : 6 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

Byte 1: Operation State

0 = Normal, 1 = Scheduler, 2 = User Override

Byte 2: User selected overrided operation mode

Byte 3-4: User selected overrided Set Point * 100, 16.0 to 86.0.

Byte 5: User selected override time in minutes

### 12.12.12 GET_EVENT_LOG_REPLY

Reply after received Downlink GET_EVENT_LOG command : 10 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

Byte 1-4: 32 bit Unix Timestamps(Little Endian, 4 byte aligned)

e.g.: 0x11223344, Byte 1 = 0x44, Byte 2 = 0x33, Byte 3 = 0x22, Byte 4 = 0x11

Byte 5: Event Log Type

0 = Relay state change event

1 = USB Login event

Byte 6: Log Data

Depends on Byte 5, Event Log Type

Log Type = 0, Log Data = Relay state changed.

Log Type = 1, Log Data = 0, User Login Failed, Log Data = 1, User Login Success.

### 12.12.13 SET_SETTING0_REPLY

Reply after received Downlink configuration command : 1 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

### 12.12.14 SET_SETTING1_REPLY

Reply after received Downlink configuration command : 1 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

### 12.12.15 SET_SETTING2_REPLY

Reply after received Downlink configuration command : 1 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

### 12.12.16 SET_SETTING3_REPLY

Reply after received Downlink configuration command : 1 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

### 12.12.17 SET_SETTING4_REPLY

Reply after received Downlink configuration command : 1 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

### 12.12.18 SET_SETTING5_REPLY

Reply after received Downlink configuration command : 1 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

### 12.12.19 SET_SETTING6_REPLY

Reply after received Downlink configuration command : 1 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

### 12.12.20 SET_SETTING7_REPLY

Reply after received Downlink configuration command : 1 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

### 12.12.21 SET_SETTING8_REPLY

Reply after received Downlink configuration command : 1 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

### 12.12.22 SET_SETTING9_REPLY

Reply after received Downlink configuration command : 1 BYTES

Byte 0 : Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

### 12.12.23 SET_RTC_REPLY

Reply after received Downlink SET_RTC command : 1 BYTE

Byte 0: Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

### 12.12.24 GET_FIRMWARE_VERSION_REPLY

Reply after received Downlink GET_FIRMWARE_VERSION command : 5 BYTE

Byte 0: Header (D7: Toggle when receive a downlink, D6-D1:Data type Command, D0: 0x01)

Byte 3-0: Firmware version in decimal.

Version = received decimal / 100;

905 = Version 9.05

## 12.13 Downlink Payload

All downlink payloads are confirmed.

### 12.13.1 GET_SETTING0

Operating Setting : 1 BYTES

Byte 0: Data type Command

### 12.13.2 GET_SETTING1

Operating Setting : 1 BYTES

Byte 0: Data type Command

### 12.13.3 GET_SETTING2

Operating Setting : 1 BYTES

Byte 0: Data type Command

### 12.13.4 GET_SETTING3

Operating Setting : 1 BYTES

Byte 0: Data type Command

### 12.13.5 GET_SETTING4

Operating Setting : 1 BYTES

Byte 0: Data type Command

### 12.13.6 GET_SETTING5

Operating Setting : 1 BYTES

Byte 0: Data type Command

Byte 1: Weekday(0-6, Sunday to Saturday)

### 12.13.7 GET_SETTING6

Operating Setting : 1 BYTES

Byte 0: Data type Command

Byte 1: Weekday(0-6, Sunday to Saturday)

### 12.13.8 GET_SETTING7

Operating Setting : 1 BYTES

Byte 0: Data type Command

Byte 1: Weekday(0-6, Sunday to Saturday)

### 12.13.9 GET_SETTING8

Operating Setting : 1 BYTES

Byte 0: Data type Command

Byte 1: Weekday(0-6, Sunday to Saturday)

### 12.13.10 GET_SETTING9

Operating Setting : 1 BYTES

Byte 0: Data type Command

### 12.13.11 GET_EVENT_LOG

Operating Setting : 1 BYTES

Byte 0: Data type Command

### 12.13.12 SET_SETTING0

Operating Setting : 7 BYTES

Byte 1: Application

0 = RTU

1 = HPU

2 = FCU Two Pipe Cooling Only with On/Off Valve

3 = FCU Two Pipe Heating Only with On/Off Valve

4 = FCU Two Pipe Cooling Only with Floating Valve

5 = FCU Two Pipe Heating Only with Floating Valve

6 = FCU Four Pipe Cooling And Heating with On/Off Valve

Byte 2: O/B | Power On Default State | Thermistor Selection

Bit 4-7: Reserved

Bit 3: O/B configuration (0 : B mode, 1 = O mode)

Bit 1-2: Power on default state

0 = Default off

1 = Restore previous state

2 = Default on

Bit 0: Thermistor sensor selection, 0 = internal, 1 = external on UI1.

Byte 3-4: Temperature Compensation*100, -9.9 to 9.9.

Byte 5-6: Temperature Offset*100 ,-9.9 to 9.9.

### 12.13.13 SET_SETTING1

Operating Setting : 7 BYTES

Byte 0: Data type Command

Byte 1: Operation Mode

0 = Cool Mode, 1 = Fan Mode, 2 = Heat Mode, 3 = Auto Mode, 4 = Dry Mode.

Byte 2: Temperature Unit | Key Lock | Clock Mode | On/Off

Bit 6-7: Reserved

Bit 5: Temperature Unit, 0 = Farenheit, 1 = Celsius.

Bit 2-4: Key Lock

0 = Unlocked

1 = Lock On/Off button

2 = Lock Mode button

3 = Lock Timer button

4 = Lock Fan button

5 = Lock Up/Down button

6 = Lock Light button

7 = Unlock All button

Bit 1: Clock Mode(0 = 12 hour format, 1 = 24 hour format)

Bit 0: On/Off (0 = OFF, 1 = ON)

Byte 3-4: Cooling Set Point*100, Set Point Min to Set Point Max.

Byte 5-6: Heating Set Point*100, Set Point Min to Set Point Max.

### 12.13.14 SET_SETTING2

Operating Setting: 11 BYTES

Byte 0: Data type Command

Byte 1-2: Y(1) Offset*100, -9.9 to 9.9.

Byte 3-4: Y(2) Offset*100, -9.9 to 9.9.

Byte 6-5: Y(3) Offset*100, -9.9 to 9.9.

Byte 7-8: Setpoint Max*100, -16.0 to 86.0.

Byte 9-10: Setpoint Min*100, -16.0 to 86.0.

### 12.13.15 SET_SETTING3

Operating Setting : 9 BYTES

Byte 0: Data type Command

Byte 1-2: W(1) Offset*100, -9.9 to 9.9.

Byte 3-4: W(2) Offset*100, -9.9 to 9.9.

Byte 5-6: W(3) Offset*100, -9.9 to 9.9.

Byte 7-8: W(4) Offset*100, -9.9 to 9.9.

### 12.13.16 SET_SETTING4

Operating Setting : 11 BYTES

Byte 0: Data type Command

Byte 1-2: Compressor Minimum Off Time, sec, 0 to 65,535.

Byte 3-4: Compressor Minimum On Time, sec, 0 to 65,535.

Byte 5-6: Four Way Valve Switch Delay from Compressor Off, sec, 0 to 65,535.

Byte 7-8: Boost Mode Minimum Time, sec, 0 to 65,535.

Byte 9-10: Floating Valve Traveling Time, sec, 0 to 65535.

### 12.13.17 SET_SETTING5

Operating Setting : 11 BYTES

Byte 0: Data type Command

Byte 1: Weekday(0-6, Sunday to Saturday)

Byte 2: 0 = Disable, 1 = Enable

Byte 3: Scheduled On Timer Hour, 0 to 23, 24 = disable..

Byte 4: Scheduled On Timer Minute, 0 to 59, 60 = disable,

Byte 5: Scheduled Off Timer Hour , 0 to 23, 24 = disable..

Byte 6: Scheduled Off Timer Minute, 0 to 59, 60 = disable,

Byte 7: Scheduler Morning Operation Mode.

0 = Cool Mode, 1 = Fan Mode, 2 = Heat Mode, 3 = Auto Mode, 4 = Dry Mode.

Byte 8: Scheduler Afternoon Operation Mode.

0 = Cool Mode, 1 = Fan Mode, 2 = Heat Mode, 3 = Auto Mode, 4 = Dry Mode.

Byte 9: Scheduler Evening Operation Mode.

0 = Cool Mode, 1 = Fan Mode, 2 = Heat Mode, 3 = Auto Mode, 4 = Dry Mode.

Byte 10: Scheduler Night Operation Mode.

0 = Cool Mode, 1 = Fan Mode, 2 = Heat Mode, 3 = Auto Mode, 4 = Dry Mode.

### 12.13.18 SET_SETTING6

Operating Setting : 11 BYTES

Byte 0: Data type Command

Byte 1: Weekday(0-6, Sunday to Saturday)

Byte 2: 0 = Disable, 1 = Enable

Byte3: Morning Session Temperature Set Point Timer Hour, 0 to 23, 24 = disable..

Byte 4: Morning Session Temperature Set Point Timer Minute, 0 to 59, 60 = disable,

Byte 5: Afternoon Session Temperature Set Point Timer Hour, 0 to 23, 24 = disable..

Byte 6: Afternoon Session Temperature Set Point Timer Minute, 0 to 59, 60 = disable,

Byte 7: Evening Session Temperature Set Point Timer Hour, 0 to 23, 24 = disable..

Byte 8: Evening Session Temperature Set Point Timer Minute, 0 to 59, 60 = disable,

Byte 9: Night Session Temperature Set Point Timer Hour, 0 to 23, 24 = disable..

Byte10: Night Session Temperature Set Point Timer Minute, 0 to 59, 60 = disable,

### 12.13.19 SET_SETTING7

Operating Setting : 11 BYTES

Byte 0: Data type Command

Byte 1: Weekday(0-6, Sunday to Saturday)

Byte 2: 0 = Disable, 1 = Enable

Byte 3-4: Morning Session Cooling Set Point * 100, 16.0 to 86.0..

Byte 5-6: Afternoon Session Cooling Set Point * 100, 16.0 to 86.0..

Byte 7-8: Evening Session Cooling Set Point * 100, 16.0 to 86.0..

Byte 9-10: Night Session Cooling Set Point * 100, 16.0 to 86.0..

### 12.13.20 SET_SETTING8

Operating setting : 11 BYTES

Byte 0: Data type Command

Byte 1: Weekday(0-6, Sunday to Saturday)

Byte 2: 0 = Disable, 1 = Enable

Byte 3-4: Morning Session Heating Set Point * 100, 16.0 to 86.0.

Byte 5-6: Afternoon Session Heating Set Point * 100, 16.0 to 86.0.

Byte 7-8: Evening Session Heating Set Point * 100, 16.0 to 86.0.

Byte 9-10: Night Session Heating Set Point * 100, 16.0 to 86.0.

### 12.13.21 SET_SETTING9

Operating setting : 11 BYTES

Byte 0: Data type Command

Byte 1: Operation State

0, 1 = Not used, 2 = User Override Enable, 3 = User Override Cancel

User Override Enable will be ignored if MT-5 currently not in Scheduler state.

Byte 2: Operation Mode

User selected override operation mode

Byte 3-4: User selected override Set Point * 100, 16.0 to 86.0.

Byte 5: User selected override time in minutes.

1 to 255 minutes.

### 12.13.22 SET_RTC

Operating Setting : 10 BYTES

Byte 0: Data type Command

Byte 1-2: RTC Year, (0 to 65,535).

Byte 3: Month(1-12)

Byte 4: Day(1-31)

Byte 5: Hour(0-23)

Byte 6: Minute(0-59)

Byte 7: Second(0-59)

Byte 8: Weekday(0-6, Sunday to Saturday)

Byte 9-10: Offset in minutes.

This offset is needed to convert the local time stored in RTC to UTC timestamp.

Please refer to Section 10 for detail.

## 12.14 Data Type Structure And Byte Order Decoding

All the data values such as AI, AO and remote point values are encoded in little endian byte order 4 byte memory slots and send in less significant byte first.

For example, AI temperature is represented using IEEE-754 single precision floating point format and has an hexadecimal value of 0x41CDEB85. 0x41 is the most significant byte and 0x85 is the less significant byte.

This hexadecimal value is stored in memory in little endian byte order as 0x85 0xEB 0xCD 0x41 in increasing memory address order and is sent less significant byte first.

Byte x : 0x85

Byte x+1 : 0xEB

Byte x+2 : 0xCD

Byte x+3 : 0x41

# 13. BACnet Object Table

| Object Name | Type & Instance | Readable/Writable | Description | Range and Definition |
|---|---|---|---|---|
| On Off Status | BV 1 | R | Current On Off Status | 0 = Off, 1 = On |
| W2\|O/B\|W Status | BV2 | R | DO Status | 0 = Off, 1 = On |
| W1\|Y Status | BV3 | R | DO Status | 0 = Off, 1 = On |
| Y2\|GH Status | BV4 | R | DO Status | 0 = Off, 1 = On |
| Y1\|GM Status | BV5 | R | DO Status | 0 = Off, 1 = On |
| G\|GL Status | BV6 | R | DO Status | 0 = Off, 1 = On |
| Set On Off | BV7 | R/W | Set On Off Status | 0 = Off, 1 = On |
| Clock Mode | BV8 | R/W | 12 Hour or 24 hour format | 0 = 12 hour , 1 = 24 hour |
| Temperature Unit | BV9 | R/W | Fahrenheit or Celsius | 0 = Fahrenheit, 1 = Celsius |
| Thermistor Selection | BV10 | R/W | Internal or External | 0 = Internal, 1 = External |
| O/B Configuration | BV11 | R/W | O/B Configuration | 0 = B Mode, 1 = O Mode |
| Weekly Schedule Enable Sunday | BV12 | R/W | Enable/Disable | 0 = Disable, 1 = Enable |
| Weekly Schedule Enable Mondayday | BV13 | R/W | Enable/Disable | 0 = Disable, 1 = Enable |
| Weekly Schedule Enable Tuesday | BV14 | R/W | Enable/Disable | 0 = Disable, 1 = Enable |
| Weekly Schedule Enable Wednesday | BV15 | R/W | Enable/Disable | 0 = Disable, 1 = Enable |
| Weekly Schedule Enable Thursday | BV16 | R/W | Enable/Disable | 0 = Disable, 1 = Enable |
| Weekly Schedule Enable Friday | BV17 | R/W | Enable/Disable | 0 = Disable, 1 = Enable |
| Weekly Schedule Enable Saturday | BV18 | R/W | Enable/Disable | 0 = Disable, 1 = Enable |
| Room Temperature | AV1 | R | Room Temperature | 0.0 ~ 999 |
| Humidity | AV2 | R | Relative Humidity | 0% ~ 100 % |
| Cooling Set Point | AV3 | R/W | Cooling Set Point | Set Point Min to Set Point Max (Configured in Terminal) |
| Heating Set Point | AV4 | R/W | Heating Set Point | Set Point Min to Set Point Max (Configured in Terminal) |
| Set Point Minimum | AV5 | R/W | Set Point Minimum | 16 ~ 86 |
| Set Point Maximum | AV6 | R/W | Set Point Maximum | 16 ~ 86 |

| | | | | |
|---|---|---|---|---|
| Temperature Compensation | AV7 | R/W | Temperature Compensation | -9.9 ~ 9.9 |
| Temperature Offset | AV8 | R/W | Temperature Offset | -9.9 ~ 9.9 |
| Y1 Offset | AV9 | R/W | Y1 Offset | -9.9 ~ 9.9 |
| Y2 Offset | AV10 | R/W | Y2 Offset | -9.9 ~ 9.9 |
| Y3 Offset | AV11 | R/W | Y3 Offset | -9.9 ~ 9.9 |
| W1 Offset | AV12 | R/W | W1 Offset | -9.9 ~ 9.9 |
| W2 Offset | AV13 | R/W | W2 Offset | -9.9 ~ 9.9 |
| W3 Offset | AV14 | R/W | W3 Offset | -9.9 ~ 9.9 |
| W4 Offset | AV15 | R/W | W4 Offset | -9.9 ~ 9.9 |
| Compressor Minimum On Time | AV16 | R/W | Compressor Minimum On Time | 0 ~ 65,535 |
| Compressor Minimum Off Time | AV17 | R/W | Compressor Minimum Off Time | 0 ~ 65,535 |
| Four Way Valve Switch Delay | AV18 | R/W | Four Way Valve Switch Delay | 0 ~ 65,535 |
| Boost Mode Minimum Time | AV19 | R/W | Boost Mode Minimum Time | 0 ~ 65,535 |
| Floating Valve Traveling Time | AV20 | R/W | Floating Valve Traveling Time | 0 ~ 65,535 |
| Sunday Scheduled On Time Hour | AV21 | R/W | Sunday Scheduled On Time Hour | 0 ~ 23,<br>24 = Disable |
| Sunday Scheduled On Time Minute | AV22 | R/W | Sunday Scheduled On Time Minute | 0~ 59,<br>60 = Disable |
| Sunday Scheduled Off Time Hour | AV23 | R/W | Sunday Scheduled Off Time Hour | 0 ~ 23,<br>24 = Disable |
| Sunday Scheduled Off Time Minute | AV24 | R/W | Sunday Scheduled Off Time Minute | 0~ 59,<br>60 = Disable |
| Sunday Morning Session Hour | AV25 | R/W | Sunday Morning Session Hour | 0 ~ 23,<br>24 = Disable |
| Sunday Morning Session Minute | AV26 | R/W | Sunday Morning Session Minute | 0~ 59,<br>60 = Disable |
| Sunday Afternoon Session Hour | AV27 | R/W | Sunday Afternoon Session Hour | 0 ~ 23,<br>24 = Disable |

| | | | | |
|---|---|---|---|---|
| Sunday Afternoon Session Minute | AV28 | R/W | Sunday Afternoon Session Minute | 0~ 59,<br><br>60 = Disable |
| Sunday Evening Session Hour | AV29 | R/W | Sunday Evening Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Sunday Evening Session Minute | AV30 | R/W | Sunday Evening Session Minute | 0~ 59,<br><br>60 = Disable |
| Sunday Night Session Hour | AV31 | R/W | Sunday Night Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Sunday Night Session Minute | AV32 | R/W | Sunday Night Session Minute | 0~ 59,<br><br>60 = Disable |
| Sunday Morning Session Cooling Set Point | AV33 | R/W | Sunday Morning Session Cooling Set Point | 16 ~ 86 |
| Sunday Afternoon Session Cooling Set Point | AV34 | R/W | Sunday Afternoon Session Cooling Set Point | 16 ~ 86 |
| Sunday Evening Session Cooling Set Point | AV35 | R/W | Sunday Evening Session Cooling Set Point | 16 ~ 86 |
| Sunday Night Session Cooling Set Point | AV36 | R/W | Sunday Night Session Cooling Set Point | 16 ~ 86 |
| Sunday Morning Session Heating Set Point | AV37 | R/W | Sunday Morning Session Heating Set Point | 16 ~ 86 |
| Sunday Afternoon Session Heating Set Point | AV38 | R/W | Sunday Afternoon Session Heating Set Point | 16 ~ 86 |
| Sunday Evening Session Heating Set Point | AV39 | R/W | Sunday Evening Session Heating Set Point | 16 ~ 86 |
| Sunday Night Session Heating Set Point | AV40 | R/W | Sunday Night Session Heating Set Point | 16 ~ 86 |
| Monday Scheduled On Time Hour | AV41 | R/W | Monday Scheduled On Time Hour | 0 ~ 23,<br><br>24 = Disable |
| Monday Scheduled On Time Minute | AV42 | R/W | Monday Scheduled On Time Minute | 0~ 59,<br><br>60 = Disable |
| Monday Scheduled Off Time Hour | AV43 | R/W | Monday Scheduled Off Time Hour | 0 ~ 23,<br><br>24 = Disable |
| Monday Scheduled Off Time Minute | AV44 | R/W | Monday Scheduled Off Time Minute | 0~ 59,<br><br>60 = Disable |
| Monday Morning Session Hour | AV45 | R/W | Monday Morning Session Hour | 0 ~ 23, |

| | | | | |
|---|---|---|---|---|
| | | | | 24 = Disable |
| Monday Morning Session Minute | AV46 | R/W | Monday Morning Session Minute | 0~ 59,<br><br>60 = Disable |
| Monday Afternoon Session Hour | AV47 | R/W | Monday Afternoon Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Monday Afternoon Session Minute | AV48 | R/W | Monday Afternoon Session Minute | 0~ 59,<br><br>60 = Disable |
| Monday Evening Session Hour | AV49 | R/W | Monday Evening Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Monday Evening Session Minute | AV50 | R/W | Monday Evening Session Minute | 0~ 59,<br><br>60 = Disable |
| Monday Night Session Hour | AV51 | R/W | Monday Night Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Monday Night Session Minute | AV52 | R/W | Monday Night Session Minute | 0~ 59,<br><br>60 = Disable |
| Monday Morning Session Cooling Set Point | AV53 | R/W | Monday Morning Session Cooling Set Point | 16 ~ 86 |
| Monday Afternoon Session Cooling Set Point | AV54 | R/W | Monday Afternoon Session Cooling Set Point | 16 ~ 86 |
| Monday Evening Session Cooling Set Point | AV55 | R/W | Monday Evening Session Cooling Set Point | 16 ~ 86 |
| Monday Night Session Cooling Set Point | AV56 | R/W | Monday Night Session Cooling Set Point | 16 ~ 86 |
| Monday Morning Session Heating Set Point | AV57 | R/W | Monday Morning Session Heating Set Point | 16 ~ 86 |
| Monday Afternoon Session Heating Set Point | AV58 | R/W | Monday Afternoon Session Heating Set Point | 16 ~ 86 |
| Monday Evening Session Heating Set Point | AV59 | R/W | Monday Evening Session Heating Set Point | 16 ~ 86 |
| Monday Night Session Heating Set Point | AV60 | R/W | Monday Night Session Heating Set Point | 16 ~ 86 |
| Tuesday Scheduled On Time Hour | AV61 | R/W | Tuesday Scheduled On Time Hour | 0 ~ 23,<br><br>24 = Disable |
| Tuesday Scheduled On Time Minute | AV62 | R/W | Tuesday Scheduled On Time Minute | 0~ 59,660 = Disable |
| Tuesday Scheduled Off | AV63 | R/W | Tuesday Scheduled Off | 0 ~ 23, |

| | | | | |
|---|---|---|---|---|
| Time Hour | | | Time Hour | 24 = Disable |
| Tuesday Scheduled Off Time Minute | AV64 | R/W | Tuesday Scheduled Off Time Minute | 0~ 59,<br><br>60 = Disable |
| Tuesday Morning Session Hour | AV65 | R/W | Tuesday Morning Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Tuesday Morning Session Minute | AV66 | R/W | Tuesday Morning Session Minute | 0~ 59,<br><br>60 = Disable |
| Tuesday Afternoon Session Hour | AV67 | R/W | Tuesday Afternoon Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Tuesday Afternoon Session Minute | AV68 | R/W | Tuesday Afternoon Session Minute | 0~ 59,<br><br>60 = Disable |
| Tuesday Evening Session Hour | AV69 | R/W | Tuesday Evening Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Tuesday Evening Session Minute | AV70 | R/W | Tuesday Evening Session Minute | 0~ 59,<br><br>60 = Disable |
| Tuesday Night Session Hour | AV71 | R/W | Tuesday Night Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Tuesday Night Session Minute | AV72 | R/W | Tuesday Night Session Minute | 0~ 59,<br><br>60 = Disable |
| Tuesday Morning Session Cooling Set Point | AV73 | R/W | Tuesday Morning Session Cooling Set Point | 16 ~ 86 |
| Tuesday Afternoon Session Cooling Set Point | AV74 | R/W | Tuesday Afternoon Session Cooling Set Point | 16 ~ 86 |
| Tuesday Evening Session Cooling Set Point | AV75 | R/W | Tuesday Evening Session Cooling Set Point | 16 ~ 86 |
| Tuesday Night Session Cooling Set Point | AV76 | R/W | Tuesday Night Session Cooling Set Point | 16 ~ 86 |
| Tuesday Morning Session Heating Set Point | AV77 | R/W | Tuesday Morning Session Heating Set Point | 16 ~ 86 |
| Tuesday Afternoon Session Heating Set Point | AV78 | R/W | Tuesday Afternoon Session Heating Set Point | 16 ~ 86 |
| Tuesday Evening Session Heating Set Point | AV79 | R/W | Tuesday Evening Session Heating Set Point | 16 ~ 86 |
| Tuesday Night Session Heating Set Point | AV80 | R/W | Tuesday Night Session Heating Set Point | 16 ~ 86 |

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|---|---|---|---|---|
| Wednesday Scheduled On Time Hour | AV81 | R/W | Wednesday Scheduled On Time Hour | 0 ~ 23,<br><br>24 = Disable |
| Wednesday Scheduled On Time Minute | AV82 | R/W | Wednesday Scheduled On Time Minute | 0~ 59,<br><br>60 = Disable |
| Wednesday Scheduled Off Time Hour | AV83 | R/W | Wednesday Scheduled Off Time Hour | 0 ~ 23,<br><br>24 = Disable |
| Wednesday Scheduled Off Time Minute | AV84 | R/W | Wednesday Scheduled Off Time Minute | 0~ 59,<br><br>60 = Disable |
| Wednesday Morning Session Hour | AV85 | R/W | Wednesday Morning Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Wednesday Morning Session Minute | AV86 | R/W | Wednesday Morning Session Minute | 0~ 59,<br><br>60 = Disable |
| Wednesday Afternoon Session Hour | AV87 | R/W | Wednesday Afternoon Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Wednesday Afternoon Session Minute | AV88 | R/W | Wednesday Afternoon Session Minute | 0~ 59,<br><br>60 = Disable |
| Wednesday Evening Session Hour | AV89 | R/W | Wednesday Evening Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Wednesday Evening Session Minute | AV90 | R/W | Wednesday Evening Session Minute | 0~ 59,<br><br>60 = Disable |
| Wednesday Night Session Hour | AV91 | R/W | Wednesday Night Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Wednesday Night Session Minute | AV92 | R/W | Wednesday Night Session Minute | 0~ 59,<br><br>60 = Disable |
| Wednesday Morning Session Cooling Set Point | AV93 | R/W | Wednesday Morning Session Cooling Set Point | 16 ~ 86 |
| Wednesday Afternoon Session Cooling Set Point | AV94 | R/W | Wednesday Afternoon Session Cooling Set Point | 16 ~ 86 |
| Wednesday Evening Session Cooling Set Point | AV95 | R/W | Wednesday Evening Session Cooling Set Point | 16 ~ 86 |
| Wednesday Night Session Cooling Set Point | AV96 | R/W | Wednesday Night Session Cooling Set Point | 16 ~ 86 |
| Wednesday Morning Session Heating Set Point | AV97 | R/W | Wednesday Morning Session Heating Set Point | 16 ~ 86 |

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|---|---|---|---|---|
| Wednesday Afternoon Session Heating Set Point | AV98 | R/W | Wednesday Afternoon Session Heating Set Point | 16 ~ 86 |
| Wednesday Evening Session Heating Set Point | AV99 | R/W | Wednesday Evening Session Heating Set Point | 16 ~ 86 |
| Wednesday Night Session Heating Set Point | AV100 | R/W | Wednesday Night Session Heating Set Point | 16 ~ 86 |
| Thursday Scheduled On Time Hour | AV101 | R/W | Thursday Scheduled On Time Hour | 0 ~ 23,<br>24 = Disable |
| Thursday Scheduled On Time Minute | AV102 | R/W | Thursday Scheduled On Time Minute | 0~ 59,<br>60 = Disable |
| Thursday Scheduled Off Time Hour | AV103 | R/W | Thursday Scheduled Off Time Hour | 0 ~ 23,<br>24 = Disable |
| Thursday Scheduled Off Time Minute | AV104 | R/W | Thursday Scheduled Off Time Minute | 0~ 59,<br>60 = Disable |
| Thursday Morning Session Hour | AV105 | R/W | Thursday Morning Session Hour | 0 ~ 23,<br>24 = Disable |
| Thursday Morning Session Minute | AV106 | R/W | Thursday Morning Session Minute | 0~ 59,<br>60 = Disable |
| Thursday Afternoon Session Hour | AV107 | R/W | Thursday Afternoon Session Hour | 0 ~ 23,<br>24 = Disable |
| Thursday Afternoon Session Minute | AV108 | R/W | Thursday Afternoon Session Minute | 0~ 59,<br>60 = Disable |
| Thursday Evening Session Hour | AV109 | R/W | Thursday Evening Session Hour | 0 ~ 23,<br>24 = Disable |
| Thursday Evening Session Minute | AV110 | R/W | Thursday Evening Session Minute | 0~ 59,<br>60 = Disable |
| Thursday Night Session Hour | AV111 | R/W | Thursday Night Session Hour | 0 ~ 23,<br>24 = Disable |
| Thursday Night Session Minute | AV112 | R/W | Thursday Night Session Minute | 0~ 59,<br>60 = Disable |
| Thursday Morning Session Cooling Set Point | AV113 | R/W | Thursday Morning Session Cooling Set Point | 16 ~ 86 |
| Thursday Afternoon Session Cooling Set Point | AV114 | R/W | Thursday Afternoon Session Cooling Set Point | 16 ~ 86 |

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|---|---|---|---|---|
| Thursday Evening Session Cooling Set Point | AV115 | R/W | Thursday Evening Session Cooling Set Point | 16 ~ 86 |
| Thursday Night Session Cooling Set Point | AV116 | R/W | Thursday Night Session Cooling Set Point | 16 ~ 86 |
| Thursday Morning Session Heating Set Point | AV117 | R/W | Thursday Morning Session Heating Set Point | 16 ~ 86 |
| Thursday Afternoon Session Heating Set Point | AV118 | R/W | Thursday Afternoon Session Heating Set Point | 16 ~ 86 |
| Thursday Evening Session Heating Set Point | AV119 | R/W | Thursday Evening Session Heating Set Point | 16 ~ 86 |
| Thursday Night Session Heating Set Point | AV120 | R/W | Thursday Night Session Heating Set Point | 16 ~ 86 |
| Friday Scheduled On Time Hour | AV121 | R/W | Friday Scheduled On Time Hour | 0 ~ 23,<br>24 = Disable |
| Friday Scheduled On Time Minute | AV122 | R/W | Friday Scheduled On Time Minute | 0~ 59,<br>60 = Disable |
| Friday Scheduled Off Time Hour | AV123 | R/W | Friday Scheduled Off Time Hour | 0 ~ 23,<br>24 = Disable |
| Friday Scheduled Off Time Minute | AV124 | R/W | Friday Scheduled Off Time Minute | 0~ 59,<br>60 = Disable |
| Friday Morning Session Hour | AV125 | R/W | Friday Morning Session Hour | 0 ~ 23,<br>24 = Disable |
| Friday Morning Session Minute | AV126 | R/W | Friday Morning Session Minute | 0~ 59,<br>60 = Disable |
| Friday Afternoon Session Hour | AV127 | R/W | Friday Afternoon Session Hour | 0 ~ 23,<br>24 = Disable |
| Friday Afternoon Session Minute | AV128 | R/W | Friday Afternoon Session Minute | 0~ 59,<br>60 = Disable |
| Friday Evening Session Hour | AV129 | R/W | Friday Evening Session Hour | 0 ~ 23,<br>24 = Disable |
| Friday Evening Session Minute | AV130 | R/W | Friday Evening Session Minute | 0~ 59,<br>60 = Disable |
| Friday Night Session Hour | AV131 | R/W | Friday Night Session Hour | 0 ~ 23,<br>24 = Disable |

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|---|---|---|---|---|
| Friday Night Session Minute | AV132 | R/W | Friday Night Session Minute | 0~ 59,<br><br>60 = Disable |
| Friday Morning Session Cooling Set Point | AV133 | R/W | Friday Morning Session Cooling Set Point | 16 ~ 86 |
| Friday Afternoon Session Cooling Set Point | AV134 | R/W | Friday Afternoon Session Cooling Set Point | 16 ~ 86 |
| Friday Evening Session Cooling Set Point | AV135 | R/W | Friday Evening Session Cooling Set Point | 16 ~ 86 |
| Friday Night Session Cooling Set Point | AV136 | R/W | Friday Night Session Cooling Set Point | 16 ~ 86 |
| Friday Morning Session Heating Set Point | AV137 | R/W | Friday Morning Session Heating Set Point | 16 ~ 86 |
| Friday Afternoon Session Heating Set Point | AV138 | R/W | Friday Afternoon Session Heating Set Point | 16 ~ 86 |
| Friday Evening Session Heating Set Point | AV139 | R/W | Friday Evening Session Heating Set Point | 16 ~ 86 |
| Friday Night Session Heating Set Point | AV140 | R/W | Friday Night Session Heating Set Point | 16 ~ 86 |
| Saturday Scheduled On Time Hour | AV141 | R/W | Saturday Scheduled On Time Hour | 0 ~ 23,<br><br>24 = Disable |
| Saturday Scheduled On Time Minute | AV142 | R/W | Saturday Scheduled On Time Minute | 0~ 59,<br><br>60 = Disable |
| Saturday Scheduled Off Time Hour | AV143 | R/W | Saturday Scheduled Off Time Hour | 0 ~ 23,<br><br>24 = Disable |
| Saturday Scheduled Off Time Minute | AV144 | R/W | Saturday Scheduled Off Time Minute | 0~ 59,<br><br>60 = Disable |
| Saturday Morning Session Hour | AV145 | R/W | Saturday Morning Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Saturday Morning Session Minute | AV146 | R/W | Saturday Morning Session Minute | 0~ 59,<br><br>60 = Disable |
| Saturday Afternoon Session Hour | AV147 | R/W | Saturday Afternoon Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Saturday Afternoon Session Minute | AV148 | R/W | Saturday Afternoon Session Minute | 0~ 59,<br><br>60 = Disable |
| Saturday Evening Session Hour | AV149 | R/W | Saturday Evening Session Hour | 0 ~ 23, |

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|---|---|---|---|---|
| | | | | 24 = Disable |
| Saturday Evening Session Minute | AV150 | R/W | Saturday Evening Session Minute | 0~ 59,<br><br>60 = Disable |
| Saturday Night Session Hour | AV151 | R/W | Saturday Night Session Hour | 0 ~ 23,<br><br>24 = Disable |
| Saturday Night Session Minute | AV152 | R/W | Saturday Night Session Minute | 0~ 59,<br><br>60 = Disable |
| Saturday Morning Session Cooling Set Point | AV153 | R/W | Saturday Morning Session Cooling Set Point | 16 ~ 86 |
| Saturday Afternoon Session Cooling Set Point | AV154 | R/W | Saturday Afternoon Session Cooling Set Point | 16 ~ 86 |
| Saturday Evening Session Cooling Set Point | AV155 | R/W | Saturday Evening Session Cooling Set Point | 16 ~ 86 |
| Saturday Night Session Cooling Set Point | AV156 | R/W | Saturday Night Session Cooling Set Point | 16 ~ 86 |
| Saturday Morning Session Heating Set Point | AV157 | R/W | Saturday Morning Session Heating Set Point | 16 ~ 86 |
| Saturday Afternoon Session Heating Set Point | AV158 | R/W | Saturday Afternoon Session Heating Set Point | 16 ~ 86 |
| Saturday Evening Session Heating Set Point | AV159 | R/W | Saturday Evening Session Heating Set Point | 16 ~ 86 |
| Saturday Night Session Heating Set Point | AV160 | R/W | Saturday Night Session Heating Set Point | 16 ~ 86 |
| Fan Speed | MV1 | R | Fan Speed | 0 = Low, 1 = Medium, 2 = High, 3 = Auto |
| Operation Mode Feedback | MV2 | R | Current operation Mode | 0 = Cooling Mode, 1 = Fan Mode,<br>2 = Heating Mode, 3 = Auto Mode,<br>4 = Dry Mode |
| Thermostat Application | MV3 | R/W | Thermostat Application | 0 = Roof Top Unit,<br>1 = Heat Pump Unit,<br>2 = FCU-2 Pipe Cooling Only with On/Off Valve,<br>3 = FCU-2 Pipe Heating Only with On/Off Valve,<br>4 = FCU-2 Pipe Cooling Only with Floating Valve,<br>5 = FCU-2 Pipe Heating Only with floating Valve,<br>6 = FCU-4 Pipe Cooling and Heating with On/Off Valve, |
| Key Lock | MV4 | R/W | Key Lock | 0 = Unlock All Buttons 1 = Lock Switch Button<br>2 = Lock Mode Button 3 = Lock Timer Button<br>4 = Lock Fan Button, 5 = Lock Arrow Button<br>6 = Lock Light Button 7 = Lock All Buttons |
| Set Operation Mode | MV5 | R/W | Set Operation Mode | 0 = Cooling Mode, 1 = Fan Mode,<br>2 = Heating Mode, 3 = Auto Mode,<br>4 = Dry Mode |

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|---|---|---|---|---|
| Power On Off Default State | MV6 | R/W | Determine the thermostat should be on or off when power up. | 0 = On Boot Off Previous State<br>1 = On Boot Restore<br>2 = On Boot Off |
| Sunday Morning Session Operation Mode | MV7 | R/W | Sunday Morning Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Sunday Afternoon Session Operation Mode | MV8 | R/W | Sunday Afternoon Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Sunday Evening Session Operation Mode | MV9 | R/W | Sunday Evening Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Sunday Night Session Operation Mode | MV10 | R/W | Sunday Night Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Monday Morning Session Operation Mode | MV11 | R/W | Monday Morning Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Monday Afternoon Session Operation Mode | MV12 | R/W | Monday Afternoon Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Monday Evening Session Operation Mode | MV13 | R/W | Monday Evening Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Monday Night Session Operation Mode | MV14 | R/W | Monday Night Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Tuesday Morning Session Operation Mode | MV15 | R/W | Tuesday Morning Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Tuesday Afternoon Session Operation Mode | MV16 | R/W | Tuesday Afternoon Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Tuesday Evening Session Operation Mode | MV17 | R/W | Tuesday Evening Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Tuesday Night Session Operation Mode | MV18 | R/W | Tuesday Night Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Wednesday Morning Session Operation Mode | MV19 | R/W | Wednesday Morning Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Wednesday Afternoon Session Operation Mode | MV20 | R/W | Wednesday Afternoon Session Operation Mode | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode,<br>4 = Dry Mode |
| Wednesday Evening | MV21 | R/W | Wednesday Evening | 0 = Cooling Mode,<br>1 = Fan Mode,<br>2 = Heating Mode,<br>3 = Auto Mode, |

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|---|---|---|---|---|
| Session Operation Mode | | | Session Operation Mode | 4 = Dry Mode |
| Wednesday Night Session Operation Mode | MV22 | R/W | Wednesday Night Session Operation Mode | 0 = Cooling Mode, 1 = Fan Mode, 2 = Heating Mode, 3 = Auto Mode, 4 = Dry Mode |
| Thursday Morning Session Operation Mode | MV23 | R/W | Thursday Morning Session Operation Mode | 0 = Cooling Mode, 1 = Fan Mode, 2 = Heating Mode, 3 = Auto Mode, 4 = Dry Mode |
| Thursday Afternoon Session Operation Mode | MV24 | R/W | Thursday Afternoon Session Operation Mode | 0 = Cooling Mode, 1 = Fan Mode, 2 = Heating Mode, 3 = Auto Mode, 4 = Dry Mode |
| Thursday Evening Session Operation Mode | MV25 | R/W | Thursday Evening Session Operation Mode | 0 = Cooling Mode, 1 = Fan Mode, 2 = Heating Mode, 3 = Auto Mode, 4 = Dry Mode |
| Thursday Night Session Operation Mode | MV26 | R/W | Thursday Night Session Operation Mode | 0 = Cooling Mode, 1 = Fan Mode, 2 = Heating Mode, 3 = Auto Mode, 4 = Dry Mode |
| Friday Morning Session Operation Mode | MV27 | R/W | Friday Morning Session Operation Mode | 0 = Cooling Mode, 1 = Fan Mode, 2 = Heating Mode, 3 = Auto Mode, 4 = Dry Mode |
| Friday Afternoon Session Operation Mode | MV28 | R/W | Friday Afternoon Session Operation Mode | 0 = Cooling Mode, 1 = Fan Mode, 2 = Heating Mode, 3 = Auto Mode, 4 = Dry Mode |
| Friday Evening Session Operation Mode | MV29 | R/W | Friday Evening Session Operation Mode | 0 = Cooling Mode, 1 = Fan Mode, 2 = Heating Mode, 3 = Auto Mode, 4 = Dry Mode |
| Friday Night Session Operation Mode | MV30 | R/W | Friday Night Session Operation Mode | 0 = Cooling Mode, 1 = Fan Mode, 2 = Heating Mode, 3 = Auto Mode, 4 = Dry Mode |
| Saturday Morning Session Operation Mode | MV31 | R/W | Saturday Morning Session Operation Mode | 0 = Cooling Mode, 1 = Fan Mode, 2 = Heating Mode, 3 = Auto Mode, 4 = Dry Mode |
| Saturday Afternoon Session Operation Mode | MV32 | R/W | Saturday Afternoon Session Operation Mode | 0 = Cooling Mode, 1 = Fan Mode, 2 = Heating Mode, 3 = Auto Mode, 4 = Dry Mode |
| Saturday Evening Session Operation Mode | MV33 | R/W | Saturday Evening Session Operation Mode | 0 = Cooling Mode, 1 = Fan Mode, 2 = Heating Mode, 3 = Auto Mode, 4 = Dry Mode |
| Saturday Night Session Operation Mode | MV34 | R/W | Saturday Night Session Operation Mode | 0 = Cooling Mode, 1 = Fan Mode, 2 = Heating Mode, 3 = Auto Mode, 4 = Dry Mode |

# FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## RF Exposure Information

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.