NTM 200 SERIES
MODBUS RTU THERMOSTAT

NENUTEC®

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NTM 200 Series RS485 Modbus RTU networking LCD Fan Coil applies communication technology of Modbus RTU master/slave protocol to monitor and supervise year around air conditioning units in commercial, industrial and residential Installation.

Typical application includes the control of fan coil units, packaged terminal air conditioners and combination heating and cooling equipment, as part of the system that consists of two-way or three-way valve and a multispeed line voltage fan. The maximum number of NTM 200 slaves in a Modbus RTU network is 32.

PRODUCT FEATURE

- Modern Appearance
- Stylish rotary dial and buttons
- Large LCD with backlight
- Support Modbus RTU protocol
- Support standalone operation on RS485 communication failure
- Retention of temperature set-point and fanspeed upon power failure
- Unoccupied mode contact for energy-saving
- 2-wire on-off, 0-10 VDC and 3-wire floating models
- Dual-output model provides auto cooling/ heating changeover with adjustable deadband or/and manual override
- PI Algorithm (modulating models)
- Parameter setup manual
- Remote temperature sensor capability
- Seasonal changeover sensor availability
- Optional remote controller
- Additional Binary Input
- Extendibility to BACnet network with BACnet MS/TP Gateway module

SELECTABLE FUNCTION

- Selectable °C or °F temperature display
- Field selectable program to retain last operating event upon power failure
- Measured temperature off-set
- Selectable P-band and I-time
- Selectable Actuator stoke time (3-wire floating model)
- Field selectable 1 to 5 K deadband for dual output models
- Field adjustable high and low set point limit
- Field adjustable cooling and heating energy saving mode set points
- Selectable fan action in unoccupied mode
- Selectable Auto Fan sequence in heating mode
- Selectable operating mode sequence for dual output models
- Selectable manual/auto operating sequence for single output models
- Selectable constant display of temperature between sensing or set-point
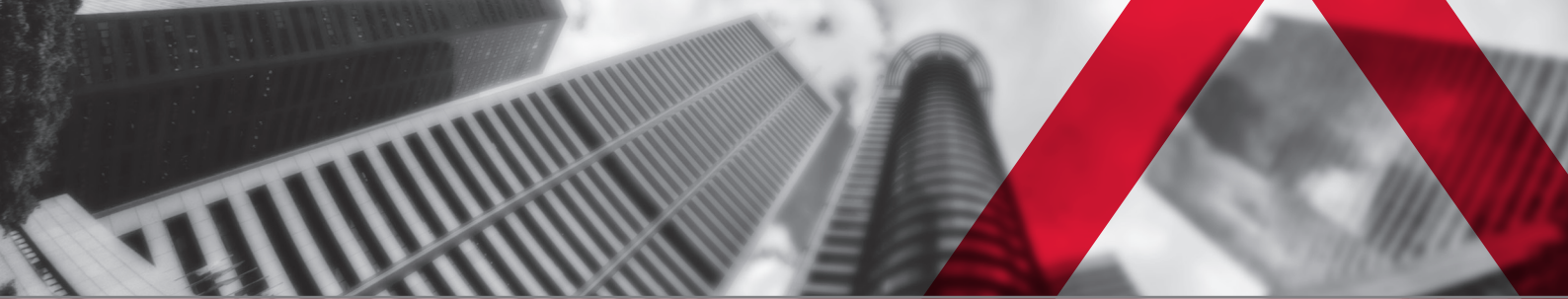
PRODUCT OVERVIEW

The NTM 200 are line voltage RS485 Modbus RTU networking LCD thermostat with 3 basic models that cover most of the types of FCU applications. There are models for cooling only, heating only and heating/cooling fan coil system integrate with 2-wire, 0-10 VDC or 3-wire input valve control. On-board high accuracy NTC sensor allows precision comfort control over occupied space area. The display temperature offset for the built-in temperature sensor will be compensated after being energized for approximately 15 minutes.

MODEL NTM 231

The Model NTM 231 is a line voltage RS485 Modbus RTU networking LCD thermostat that is designed for cooling only/ heating only fan coil unit with 2-wire onoff valve actuator application. Integral with system of Cooling/Heating-Fan-Off button that allows users to cutoff power for fan and the output for valve actuator. It allows to select the fan speed simply by pressing the fan button. All fan outputs by relay that can withstand max. of 3 Amp (resistive) 1 Amp (Inductive operating current.

MODEL NTM 241

The Model NTM 241 is a line voltage RS485 Modbus RTU networking LCD thermostat that is designed for cooling only/ heating only fan coil unit with 3-wire floating valve actuator application. Integral with system of Cooling/Heating-Fan-Off button that allows users to cutoff power for fan and the output for valve actuator. It allows to select the fan speed simply by pressing the fan button. All fan outputs by relay that can withstand max. of 3 Amp (resistive) 1 Amp(Inductive) operating current.

MODEL NTM 243

The Model NTM 243 is a line voltage RS485 Modbus RTU networking LCD thermostat that is designed for cooling only/ heating only fan coil unit with 0-10VDC input valve actuator application. Integral with system of Cooling/Heating-Fan Off button that allows users to cutoff power for fan and the output for valve actuator. It allows to select the fan speed simply by pressing the fan button. All fan outputs by relay that can withstand max. of 5 Amp (resistive) 2 Amp (Inductive) operating current.

FIGURE 1: NTM 200 SERIES APPLICATION GUIDE

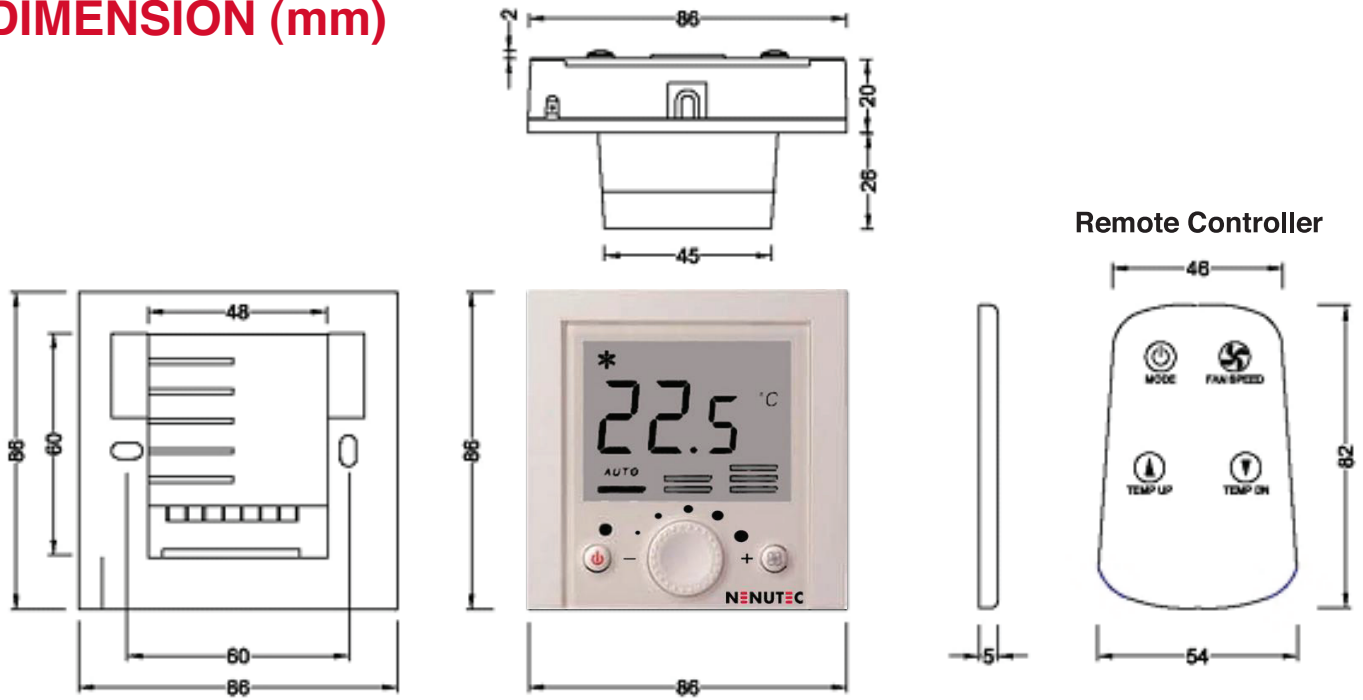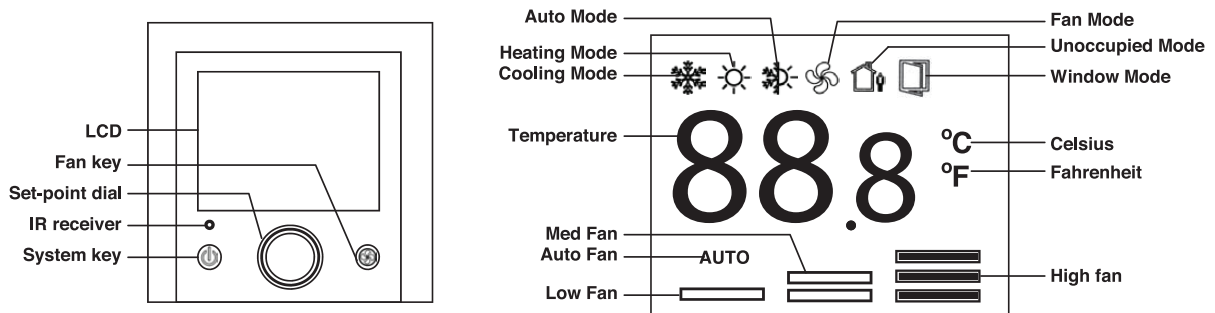| POWER	100 - 250 V, 50/60 Hz
VALVE CONTROL OUTPUT	31 = 2-wire on-off (Heating only or Cooling only 2-pipe)
	41 = 3-wire line floating (Heating only or Cooling only 2-pipe)
	43 = 0-10 VDC (Heating only or Cooling only 2-pipe)
	R = IR Receiver for Remote Controller
OPTION & COLOR COMPLIANCE	NIL = White Faceplate (Standard Color)
	G = Grey Faceplate (MOQ: 500pcs)
	B = Black Faceplate (MOQ: 500pcs)

SPECIFICATION

PRODUCT MODEL	See NTM 200 Series Model Number Selection Guide
POWER REQUIREMENT	100...250 V, 50/60 Hz
OPERATING TEMPERATURE DIFFERENTIAL (FOR 2-WIRE ON-OFF MODEL)	Fixed at 1 K for both cooling and heating modes
TEMPERATURE DISPLAY RANGE	5-35°C in 0.5 K increments: accuracy ±1 K (41-95°F in 0.5 R increments, accuracy ±1 R)
TEMPERATURE SET POINT RANGE	5-35°C in 0.5 K increments, initial factory setting at 22°C (41-95°F in 0.5 R increments)
DEADBAND OF DUAL-OUTPUT MODEL	3 K (Adjustable 1 to 5 K in setup menu)
AUTO FAN TEMPERATURE DIFFERENTIAL	At 2 K (2 R) increments. At > 0 K, fan is on low speed in cooling mode and fan status in heating mode depends on auto fan action selection setting.
SENSING ELEMENT	NTC thermistor, 10 k Ω @25°C; accuracy ± 0.5 K@25°C
UNOCCUPIED MODE ADDITIONAL BINARY INPUT	Input signal from external voltage-free contact
RS-485 COMMUNICATION SPEED	Baud rate fixed at 19200 bps
DEVICE MAC ADDRESSING	01-32 via parameter setup menu, factory set address "01"
MODBUS RTU NETWORK GUIDELINE	Maximum 32 devices and maximum 1,000 m cable length
BODY MATERIAL	Self-extinguishing, molded ABS
FINISH	Off white body / white face plate

ELECTRICAL RATING	2-wire and 3-wire models	Valve output relays	100-250 V, 3 A resistive, 1 A inductive, 50/60 Hz
		Fan output relays	100-250 V, 3 A resistive, 1 A inductive, 50/60 Hz
		Total rating	100-250 V, 5 A maximum, 50/60 Hz
	0-10 VDC models	Valve output impedance	Minimum 10,000 Ω
		Fan output relays	100-250 V, 5 A resistive, 2 A inductive, 50/60 Hz
		Total rating	100-250 V, 5 A maximum, 50/60 Hz

AMBIENT/STORAGE TEMPERATURE	0 to 50ºC / -30 to 50ºC, 10 to 90% RH non-condensing
CONNECTION	Non-removable terminal blocks
POWER WIRE	Wire size 1 mm² or 18 AWG solid copper recommended
SENSOR WIRE	22 AWG twisted shielded pair double-insulated cable
AGENCY APPROVAL	CE Mark compliant to EMC and low voltage directives
SHIPPING WEIGHT	350 g
DIMENSION	See Dimensions drawing in mm

DIMENSION (mm)

Remote Controller

LCD SEGMENT AND BUTTON

LCD
Fan key
Set-point dial
IR receiver
System key

Auto Mode
Heating Mode
Cooling Mode
Temperature
Med Fan
Auto Fan
Low Fan

Fan Mode
Unoccupied Mode
Window Mode
^{o}C Celsius
^{o}F Fahrenheit
High fan

AUTO

OPERATION NOTE

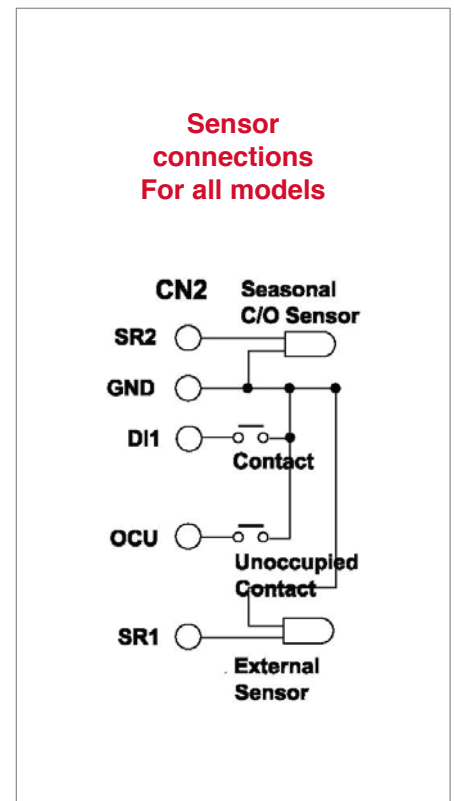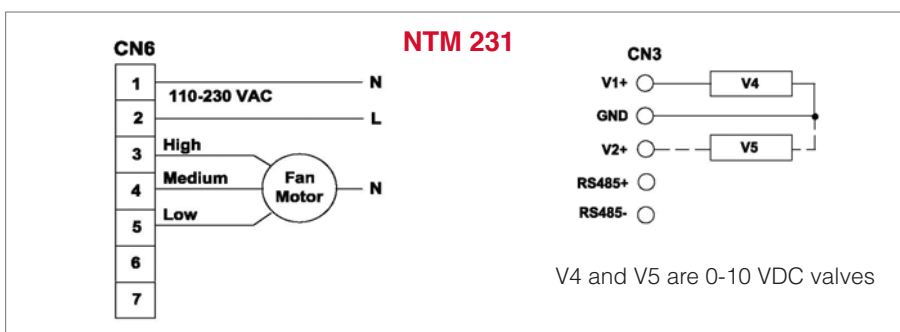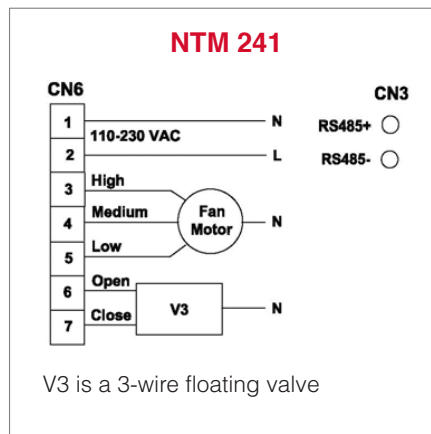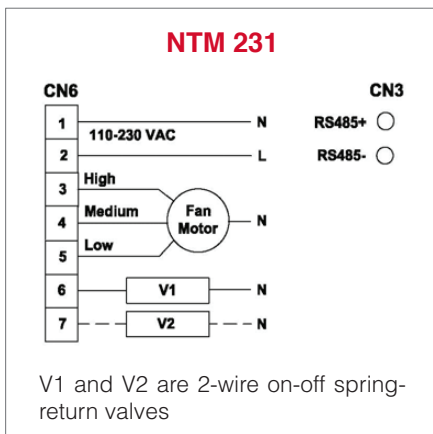| TEMPERATURE DISPLAY	LCD shows sensing temperature constantly except when temperature set point adjustment is being made
BACKLIGHT	The backlight will light up for 5 seconds when any button is pressed
MODE OF OPERATION	Press the system control key ⏻ to enter into the desired operating mode: Cool-Heat-Auto-Fan Only-Off
FAN SPEED	Press the fan control key ❄ to change the fan speed mode: High-Med-Low-Auto
TEMPERATURE SET-POINT	Increase or decrease temperature set point by rotating the adjustment dial clockwise or counter-clockwise.
UNOCCUPIED MODE (ENERGY-SAVING)	The energy saving mode is activated while "OCU" contact is in closure. In unoccupied mode, all buttons are locked and preset temperature set points are 26°C and 16°C for cooling and heating respectively. Fan speed is always set at "low".
WINDOW CONTACT	Window contact closure turns off the thermostat and locks all buttons
PARAMETER SETUP MENU	The thermostat allows authorized service agent to change the certain number of operating parameters, please refer to parameter setup manual for details.

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APPLICATION NOTE

- Cut jumper JP1 open if an external sensor is wired to SR1 and GND. Run the wiring away from any electrical motors or power wiring. Failure to do so may result in poor thermostat performance due to electrical noise.
- 22 or 24 AWG twisted shielded pair double-insulated cable is recommended as remote sensor wiring and its length must not exceed 25 m.
- Do not bundle and run power wiring and remote sensor wiring in the same conduit.
- The seasonal changeover sensor should be wrapped around the supply water pipe when associated with a water system. When the changeover sensor temperature exceeds 30 ºC, the thermostat enters into heating mode.
- External seasonal changeover sensor or switch is applicable to heating only or cooling only 2-pipe models only.
- OCU contact closure activates unoccupied mode.
- The thermostat 2-wire and 3-wire valve control outputs are designed for controlling zone valves. If used for controlling electric heaters, external contactors must be used.
- Hidden-line wiring for Terminal 7 of CN6 are applicable to dual-output model and 3-wire model only.
- On a single-output unit, V1 can be either a 2-wire spring-return cooling or heating valve.
- On a dual-output unit, V1 must be a 2-wire spring-return cooling valve and V2 a 2-wire spring-return heating valve.
- For a 3-wire floating output model set in cooling mode, Terminal 6 of CN6 is wired to open valve on temperature rise and Terminal 7 of CN6 to close valve on temperature drop. The action in heating mode is reversed.
- On a single-output unit, V4 can be either a 0-10 VDC cooling or heating valve.
- On a dual-output unit, V4 must be a 0-10 VDC cooling valve and V5 a 0-10 VDC heating valve.
- JP4 is available for 0-10 VDC models. Cut it if 2-10 VDC control signal is required.

WIRING DIAGRAM

CN2, CN3, CN6 socket and setup jumpers are located at the back of the PCB of the LCD unit

NTM 231

V1 and V2 are 2-wire on-off spring-return valves

NTM 241

V3 is a 3-wire floating valve

Sensor connections For all models

NTM 231

V4 and V5 are 0-10 VDC valves

WARNING: Incorrect wiring connection may cause permanent equipment damages to the thermostat

NETWORK & CABLING REQUIREMENT

To ensure network stability and reliable communications, particularly at high speeds on a BACnet MS/TP or Modbus RTU network for a number of devices, it is imperative that the following network and cabling requirements are adhered to:

ITEM	DESCRIPTION
CABLING	For BACnet MS/TP and Modbus RTU networks, it is recommended to use networking cabling that matches the following specifications: ● Balanced 100 to 120 ohms nominal impedance, 22 or 24 AWG Twisted Shielded Pair (TSP) Cable ● Nominal capacitance of 52 pF/m or lower ● Nominal velocity of propagation of 66% or higher
TOPOLOGY	Ensure the MS/TP or Modbus RTU network cable is installed as a daisy chain from one device to the next.
MAXIMUM NODE	The maximum number of devices per MS/TP or Modbus RTU network without any repeaters is 32.
TERMINATOR	A terminator of 120-ohm impedance must be installed at each end of each MS/TP or Modbud RTU network segment, or two per MS/TP or Modbus RTU network. Ensure that this requirement is not overlooked in laying out the network architecture and ordering product.
REPEATER	A repeater is not necessary unless the MS/TP or Modbus RTU network is extended beyond 1,000 m.

NETWORK CONFIGURATION
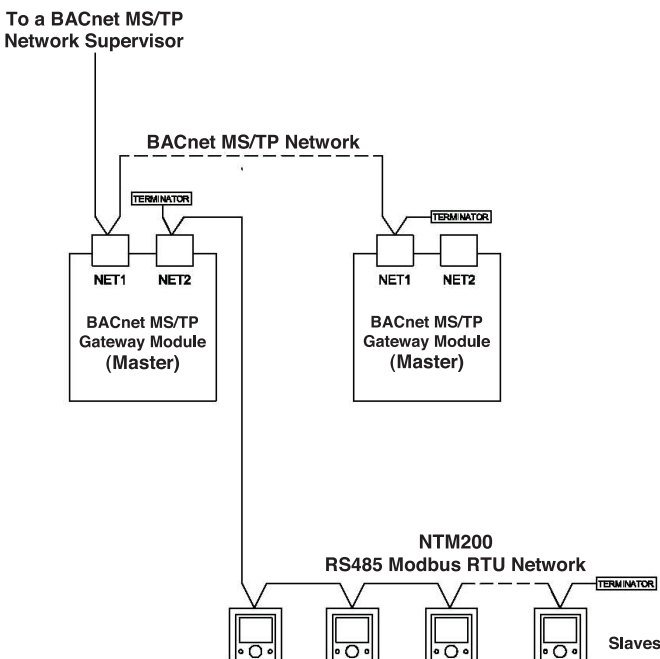
BACnet MS/TP Network Note:

● Ensure the recommended balanced cable is used.

● Ensure the cable is installed as a daisy chain from one device to the next (1,000 m maximum) and the shield is grounded at one single point of the network only.

● Ensure a MS/TP terminator is installed on each end of each MS/TP network.

● The maximum nodes per MS/TP network is 32 without a repeater.

Modbus RTU Network Note:

● Ensure the recommended balanced cable is used.

● Ensure the cable is installed as a daisy chain from one device to the next (1,000 m maximum) and the shield is grounded at one single point of the network only.

● Ensure a terminator is installed on each end of each or Modbus RTU network.

● The maximum nodes per Modbus RTU network is 32.

The performance specifications are nominal and conform to acceptable industry standards. NENUTEC shall not be liable for damages resulting from misapplication or misuse of its products.