



DTM-RUM

0..10Vdc / MODBUS ROOM THERMOSTATS

- Room thermostat with or without display
- Supports 0..10Vdc, 3-point and thermic actuators
- With external T° sensor input
- With external CO₂ sensor input
- Modbus RTU compatible

Room



0..10Vdc

DESCRIPTION

The DTM-RUM room thermostat is specifically designed for individual room temperature and zone control applications. These thermostats have built-in RS-485 channel for Modbus communication, but can operate stand-alone as well. The thermostats can be connected to any supervisory software/system that supports Modbus RTU.

The DTM-RUM has built-in display and unique touch sensitive buttons for adjusting the user parameters and to configure the controller.

The DTM-RUM thermostat supports 0..10Vdc actuators, 3-point controlled actuators and thermic actuators. One of the thermostat 0..10Vdc outputs can be configured for fan speed control via relay module (D-FCRY3).

Temperature is detected by the internal sensor of the DTM-RUM. If an external temperature sensor such as return air sensor or remote room sensor is required, this can be connected to the wiring terminals provided on the thermostat. The external sensor type is NTC10.

The thermostat has DAY and NIGHT operating modes. When in the NIGHT mode the controller can be overridden to the DAY mode via a hardware input, by touching day extension button or over the MODBUS network. The thermostat has also a CO₂ measurement input for boosting the ventilation (fan speed) in case of high CO₂ level in the room space.

TECHNICAL DATA

TYPE

DTM-RUM

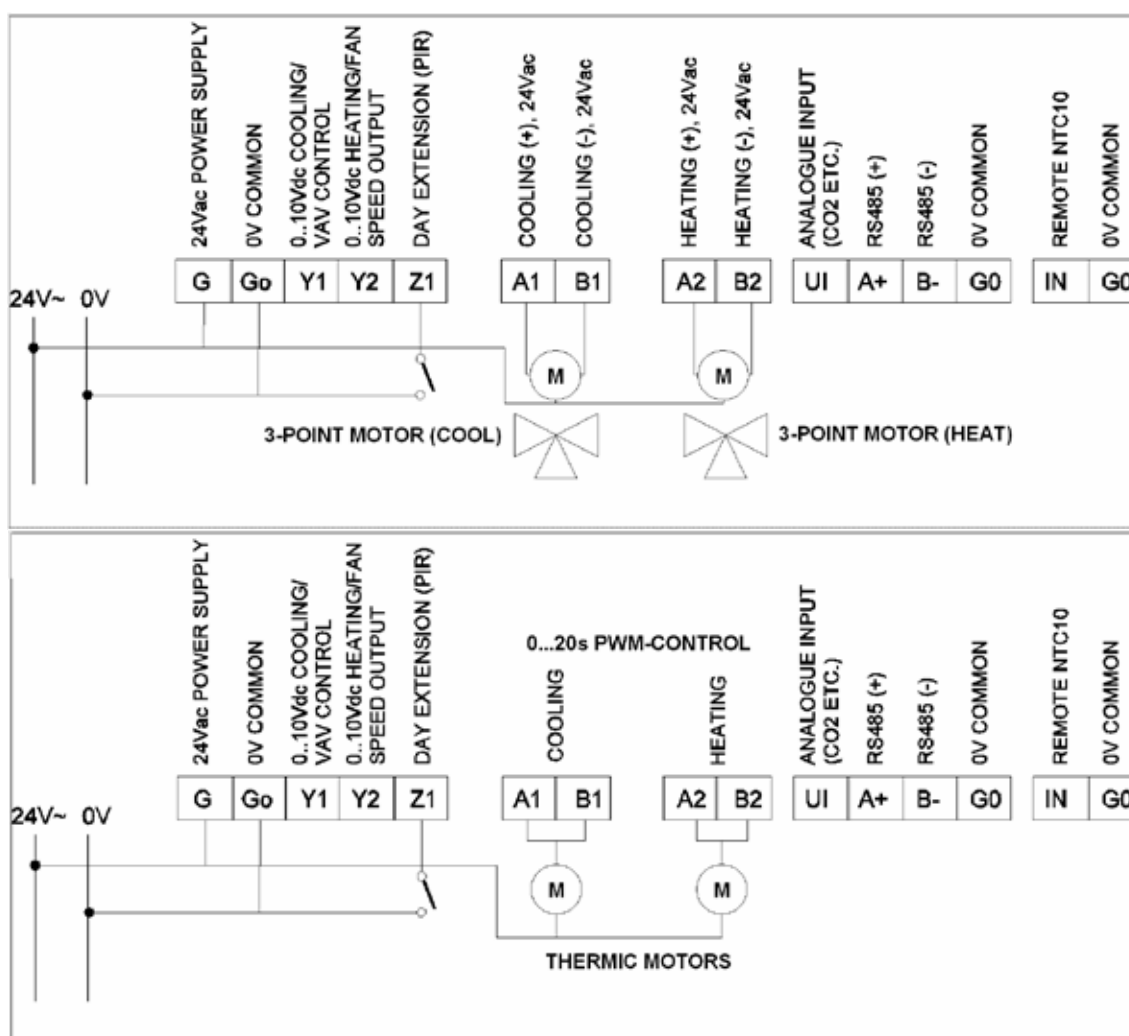
DTM-RUM(-LCD)	Room Temperature Controller with Modbus Networking Capability
Power Supply	24Vac/dc (20...26V), <1VA NOTE! If using DC-voltage only 0..10V outputs are operational
Inputs	Built-in temperature sensor 1 x NTC10 e.g. TEHY-NTC10 (for control or measurement only) 1 x Volt-Free (PIR – normally closed) 1 x Analogue (CO ₂ measurement)
Outputs	2 x 0..10Vdc (Heating/Cooling Actuators, VAV or Fan Speed Control) 4 x 24Vac Triacs, 1A maximum (3-Point Actuators / Thermic Actuators)
Communications	RS-485 Modbus RTU 9600/19200/38400 bps 8 data bits, Parity : none, 1 Stop bit (up to 128 devices per segment)
Set Point Adjustment	DAY SETPOINT 21°C ±3°C (factory default); setpoint adjustable pressing "+" and "-" buttons within programmable ± range; network setpoint available via Modbus or in the configuration mode NIGHT SETPOINT 5-20°C (factory default 18°C); adjustment available via Modbus or in configuration mode

TECHNICAL DATA		TYPE
		DTM-RUM
Accuracy	$\pm 0.5^{\circ}\text{C}$	
Dead Zone	$Dz = 0..3^{\circ}\text{C}$ (factory default = 0.3°C)	
Proportional Band	$Xp = 1..8^{\circ}\text{C}$ (factory default = 4°C)	
Integral Action Time	$Tn = 50..500\text{s}$ (factory default = 300 sec)	
3-Point Control Actuator Speed	$Mt = 30..300\text{s}$ (factory default = 180 sec)	
Protection Class	IP20	
Operating Humidity	0..95% rH non-condensing	
Wiring Terminals	1.5 mm ²	
Housing	ABS Plastics	
Dimensions	87W x 86H x 32D mm	

WIRING



The electrical installation, device connection and commissioning can only be carried out by qualified professionals and according to the local wiring regulations!



Operation Modes

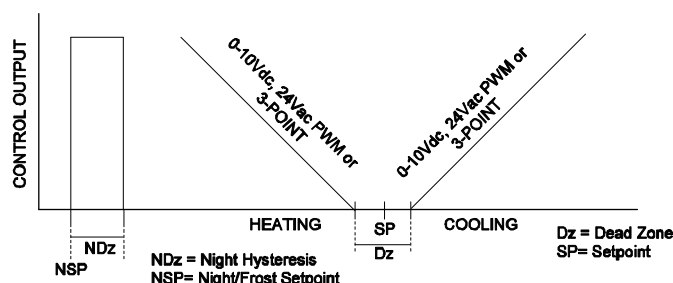
DTM-RUM has two operation modes: DAY and NIGHT. The unit can be switched between day and night modes either via Modbus network or via the DAY EXTENSION typically connected to PIR. The user can also change NIGHT mode to DAY mode by pressing "MAN IN THE HOUSE" (occupancy) button on the unit. After 2-hours (adjustable) DAY mode returns automatically back to the NIGHT mode. When in DAY mode the DTM-RUM thermostat operates the valve outputs according to the below diagram.

In the DAY mode the temperature is controlled to the setpoint using PI-control. The DTM-RUM thermostat has adjustable deadzone between heating and cooling modes.

The DTM-RUM thermostat DAY setpoint (SP) is calculated as follows:-

$SP = SP_{network} \pm SP_{local}$, where $SP_{network}$ is setpoint set via Modbus network and SP_{local} is the setpoint set by the user by pressing "+" and "-" buttons. SP_{local} range is limited at the commissioning stage (default $\pm 3^{\circ}C$)

In the NIGHT mode the DTM-RUM thermostat controls to the NIGHT/FROST setpoint. If the temperature falls below the NIGHT setpoint ($5..20^{\circ}C$), the heating output is opened and the fan is overridden on (if fan speed control has been enabled). The NIGHT setpoint is adjustable via Modbus network or in the configuration mode.



When the DTM-RUM thermostat returns to the DAY MODE from NIGHT, the DTM-RUM thermostat DAY setpoint can return to the DAY setpoint programmed previous day, or the DAY SP can be reset to the $SP_{network}$ Modbus Network Setpoint. This is a configurable option (configuration parameter SP_ND). If no network setpoint is available $21^{\circ}C$ is used as default.

Fan Speed Control

Fan speed control can be enabled during the commissioning (configuration parameter FAN). When fan speed control is enabled the Heating Analogue output is converted operate as the control signal to the FCY3 fan speed control relay module.

In automatic control the fan speed output operates as follows:-

- Valves closed → Fan speed output 0%
- Heating/Cooling Valve Opens → Fan speed output is set to 3.3V (Speed 1)
- Heating/Cooling Valve Opens more than 25% → speed output is set to 6.6V (Speed 2)
- Heating/Cooling Valve Opens more than 50% → speed output is set to 10V (Speed 3)

Automatic Speed 3 control is disabled as default. However, the user can manually override speed 3 on through the keypad. Typically speed 3 causes a higher level fan noise and therefore it is recommended that this is manual override option operated by the user. Automatic Speed 3 control can be enabled during the commissioning via basic settings.

When the DTM-RUM thermostat switches to NIGHT mode or the temperature is within the deadzone, the fan is automatically switched OFF after 5 minutes timeout.

Ventilation Boost (CO2 Control)

If HDK or HDH CO2 transmitter is connected to the DTM-RUM thermostat analogue input U1, the DTM-RUM thermostat can be enabled to boost the fan speed / switch the fan On in case of high CO2 content in the occupancy space. This is a very useful feature to provide demand based ventilation. High CO2 level overrides the fan speed set by the temperature based fan speed control.

Hardware Day Extension

The DTM-RUM thermostat has hardware digital input that can be connected to a momentary push button contact (e.g. PJP1) or to a PIR sensor (e.g. LA24) to override the DTM-RUM thermostat to DAY operation. These are typically used out of hours to provide comfort control. Alternatively PIR input can be used as the primary means of switching between DAY and NIGHT modes. The digital input is normally closed.

NOTE: The digital input is activated when it is first time closed. The DTM-RUM thermostat is supplied with the digital input as open contact.

Local Day Extension

The DTM-RUM thermostat can be overridden to DAY operation by pressing the "MAN IN THE HOUSE" occupancy button. When pressed the DTM-RUM thermostat is overridden to DAY mode for the period of two hours. The extension time is adjustable between 1..480 minutes via Modbus network.

VAV Control with Fresh Air Demand Boost

The DTM-RUM thermostat can also be used as Variable Air Volume DTM-RUM thermostat by connecting the VAV Box damper to the output Y1. The output Y1 is then modulated according to temperature demand in the room space.

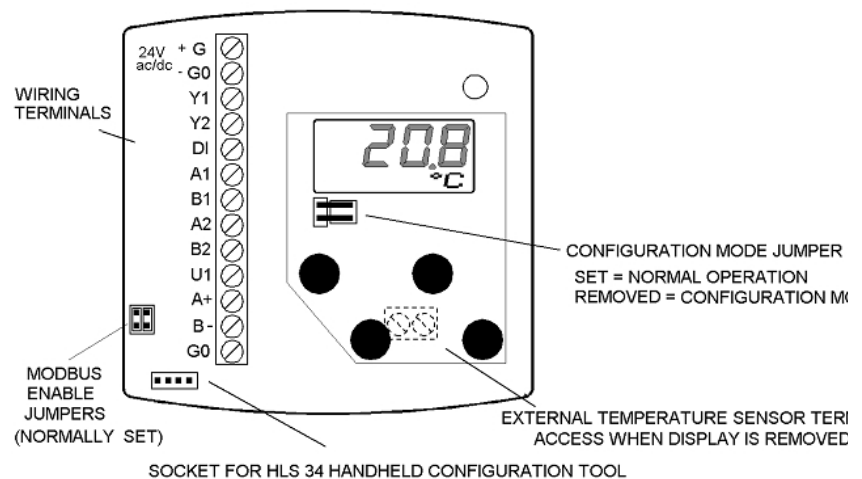
If HDK or HDH CO2 transmitter is connected to the DTM-RUM thermostat analogue input U1, the DTM-RUM thermostat can increase the fresh air demand i.e. overdrive the analogue output Y1 when the CO2 content in the room space exceeds the acceptable limit. The CO2 influence is set via configuration parameters CO2 LO (e.g. 750 ppm) and CO2 HI (e.g. 1250 ppm). Between the CO2 limits the influence is calculated using linear relationship i.e. when CO2 measurement is at CO2 HI setpoint, the CO2 influence is 100% (Y1=10V).

DTM-RUM thermostat Configuration

The DTM-RUM thermostat is parameterised locally via a configuration mode, or using DTM-RUM Handheld Configuration Tool. The DTM-RUM handheld tool allows quick configuration of large number of DTM-RUM thermostats.

To configure the DTM-RUM thermostat locally, first remove the top cover. A CONFIGURATION MODE JUMPER is located below the LCD display. When the jumper is set the DTM-RUM thermostat is in normal operation. By removing the jumper the DTM-RUM thermostat enters to the configuration mode.

Once the configuration has been completed, by setting the jumper the DTM-RUM thermostat returns to the normal operation.



Configuration parameters



To change settings, remove CONFIGURATION MODE JUMPER (under the cover) and press "MAN IN THE HOUSE" symbol to select appropriate parameter. Press "+" or "-" to change the settings. Once completed set the jumper and configuration is automatically saved.

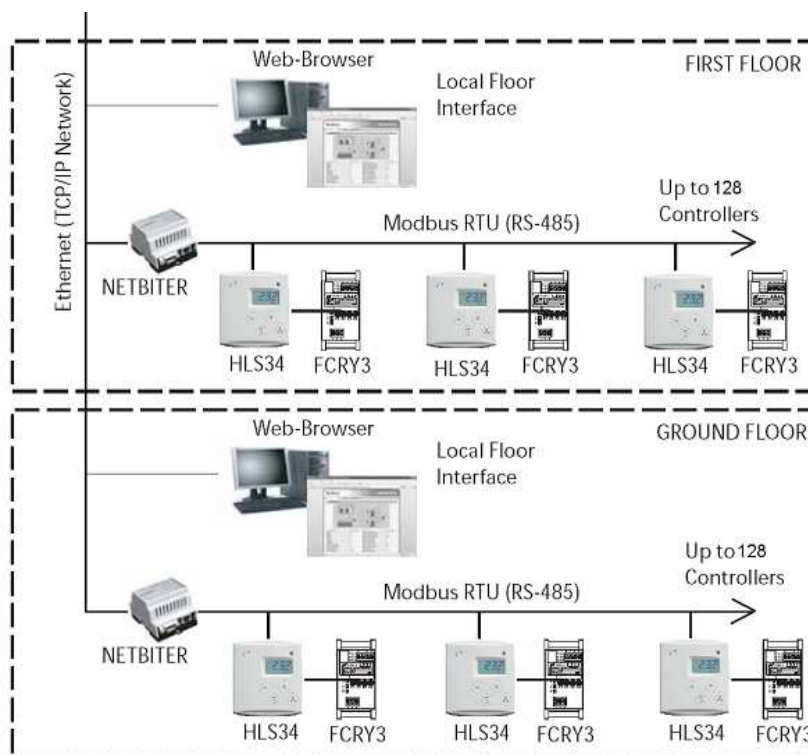
OFF EXT. S	EXTERNAL TEMPERATURE SENSOR OFF = Uses built-in sensor ON = Uses external sensor
20.8 TE °C	TEMPERATURE SENSOR ADJUST Adjust accordingly if necessary
30 ±SP °C	USER SETPOINT LIMIT (SPlocal) Maximum setpoint range for the local user
16.0 C SP °C	NIGHT SETPOINT SETTING
OFF SP ND	NIGHT TO DAY SP TRANSITION OFF = Uses last set user setpoint ON = Resets to network setpoint
0.3 DZ °C	DEADZONE Adjustable deadzone around the day setpoint
20 XP °C	PROPORTIONAL BAND Proportional band for the control loop
300 Tint S	INTEGRATION TIME Integral action time in second for the control loop

180 Tmot S	ACTUATOR RUNNING TIME Actuator running time for 3-point and thermic actuators
J1=0 C= DIR	COOLING OUTPUT (Y1) MODE DIR = Direct Operation REV = Reverse Operation
J2=0 W= DIR	HEATING OUTPUT (Y2) MODE DIR = Direct Operation REV = Reverse Operation
J3=0 = PI	CONTROL MODE PI = Proportional + Integral Control P = Proportional Only Control
J4=0 TERMO	ACTUATOR TYPE SELECTION TERMO = Thermic Actuator 3-P = 3-Point Actuator
J5=1 2-st	NUMBER OF COOLING STAGES 2-st = 2 Cooling Stages 1-st = 1 Cooling Stage
J6=1 M-1st	SEQUENCE OF COOLING STAGES M-1st = 3-Point/PWM Stage First V-1st = 0...10V Stage First
0 FAN	FANSPEED ENABLE 0 = Fan speed control disable 1 = Automatic 0-1-2 fan speed 2 = Automatic 0-1-2-3 fan speed
750 CO2 LO	CO2 LOW LIMIT Low limit setpoint for the CO2 control (Y1/Y2 influence = 0V)
1250 CO2 HI	CO2 HIGH LIMIT High limit setpoint for the CO2 control (Y1/Y2 influence = 10V)
19.2 kBaud	MODBUS NETWORK BAUD RATE 9.6k, 19.2k or 38.4k
2 ID =	MODBUS SLAVE ADDRESS 1 TO 247

Network Diagram

Up to 128 DTM-RUM thermostats can be connected to a single network segment.

The diagram below illustrated the typical installation where the room thermostats are connected on the floor level to the Netbiter embedded web-server. Each Netbiter holds a time schedule for the floor to switch the thermostat between day and night operation modes.



Modbus Registers

The controller supports the following Modbus registers and function codes.
The default communication speed is 9600 bps, 8 data bits, Parity None and 1 Stop Bit.

Register	Parameter Description	Data Type	Range
FUNCTION CODE 01 - READ COILS			
1	Overdrive mode	Bit0	On - Off
2	NIGHT-mode	Bit1	On - Off
3	SERVICE ALARM	Bit2	On - Off
5	Fan Speed 1 asked	Bit4	On - Off
6	Fan Speed 2 asked	Bit5	On - Off
7	Fan Speed 3 asked	Bit6	On - Off
8	Fan Speed 4 (Auto) asked	Bit7	On - Off
FUNCTION CODE 02 - READ DISCRETE INPUTS			
1	Occupied by PIR (NIGHT mode to DAY-mode)	Bit0	On - Off
2	Manually Occupied (NIGHT mode to DAY-mode)	Bit1	On - Off
3	DAY EXTENSION (NIGHT mode to DAY-mode)	Bit2	On - Off
4	EXT.S (External Sensor)	Bit3	On - Off
5	Fan Speed 1 run	Bit4	On - Off
6	Fan Speed 2 run	Bit5	On - Off
7	Fan Speed 3 run	Bit6	On - Off
FUNCTION CODE 03 - READ HOLDING REGISTERS			
2	Coils 16 - 01	16 bit	
3	Fan Speed (Set by Network)	Signed 16	0 - 1 - 2 - 3 - 4
4	Cooling Output (Set by Network)	Signed 16	0,0 ... 100,0 (%)
5	Heating Output (Set by Network)	Signed 16	0,0 ... 100,0 (%)
6	Set Point (Set by Network)	Signed 16	5,0 ... 37,0 (C)
13	DAY EXTENSION period	Signed 16	1 ... 480 (min)
FUNCTION CODE 04 - READ INPUT REGISTERS			
1	Discrete Inputs 16 - 01	16 bit	
2	Coils 16 - 01	16 bit	
3	Fan Speed (Set by Network)	Signed 16	0 - 1 - 2 - 3 - 4
4	Cooling Output (Set by Network)	Signed 16	0,0 ... 100,0 (%)
5	Heating Output (Set by Network)	Signed 16	0,0 ... 100,0 (%)
6	Set Point (Set by Network)	Signed 16	5,0 ... 37,0 (C)
7	Temperature	Signed 16	-60,0 ... 60,0 (C)
8	CO2	Signed 16	0 ... 2000 (ppm)
9	Current Cooling Output	Signed 16	0,0 ... 100,0 (%)
10	Current Heating Output	Signed 16	0,0 ... 100,0 (%)
11	Current Fan Speed	Signed 16	0 - 1 - 2 - 3

Register	Parameter Description	Data Type	Range
12	Current Setpoint	Signed 16	5,0 ... 37,0 (C)
13	DAY EXTENSION period	Signed 16	1 ... 480 (min)
FUNCTION CODE 05 - WRITE SINGLE COIL			
1	Overdrive mode (Cooling and Heating outputs)	Bit0	On - Off
2	NIGHT-mode	Bit1	On - Off
3	SERVICE ALARM	Bit2	On - Off
5	Fan Speed 1 asked	Bit4	On - Off
6	Fan Speed 2 asked	Bit5	On - Off
7	Fan Speed 3 asked	Bit6	On - Off
8	Fan Speed 4 (Auto) asked	Bit7	On - Off
FUNCTION CODE 06 - WRITE SINGLE REGISTER			
2	Coils 16-01	16 bit	
3	Set Fan Speed	Signed 16	0 - 1 - 2 - 3 - 4
4	Cooling Output (Overdrive mode = "on")	Signed 16	0,0 ... 100,0 (%)
5	Heating Output (Overdrive mode = "on")	Signed 16	0,0 ... 100,0 (%)
6	Set Point by Network (DAY value only)	Signed 16	5,0 ... 37,0 (C)
13	DAY EXTENSION period	Signed 16	1 ... 480 (min)
FUNCTION CODE 16 - WRITE MULTIPLE REGISTERS			
2	Coils 16-01	16 bit	
3	Set Fan Speed	Signed 16	0 - 1 - 2 - 3 - 4
4	Cooling Output (Overdrive mode = "on")	Signed 16	0,0 ... 100,0 (%)
5	Heating Output (Overdrive mode = "on")	Signed 16	0,0 ... 100,0 (%)
6	Set Point by Network (DAY value only)	Signed 16	5,0 ... 37,0 (C)
FUNCTION CODE 22 - MASK WRITE REGISTER			
2	Coils 16 - 01	16 bit	AND 0 ... 0xFFFF OR 0 ... 0xFFFF