NRT 300: Electronic air-conditioning controller, heating/cooling, equiflex

How energy efficiency is improved
Key directly on device for individual changeover between presence and absence

Areas of use
Individual unitary control and zone control (heating, cooling, heating/cooling) e.g. in air conditioning systems (2- or 4-pipe systems) in hotels and residential and business spaces.

Features
• Air-conditioning controller for 2- and 4-pipe systems (heating, cooling, heating/cooling)
• Measurement of room temperature by either integrated or external temperature sensor
• Saves energy costs by means of presence/absence key and rotary knob on front
• Inputs for C/O signal, changeover between presence and absence, dew-point monitoring and set-point shift
• Choice of P or PI control with 2-point, pulse-pause, 3-point or outputs (0...10 V)
• LED indicator
• Servicing level with adjustable control parameters
• Frost-protection facility
• Electrical connection in baseplate
• Electronics in attachable housing

Technical data

Power supply
- Power supply: 24 V~, ±20%, 50...60 Hz
- Power consumption: Approx. 2.5 VA

Parameters
- Setting range $X_s$: 10...30 °C
- Proportional band: 2...20 K
- Integral action time: 2...20 minutes or OFF (as P-controller)
- Period or running time of actuator: 0.5...20 minutes
- Control parameters: Non-volatile
- Dead zone $X_t$:
  - Normal: 0.4...5 K
  - Extended: 8 K
- Sensor time constant for air:
  - In room (0.1 m/s): 8 minutes
  - In duct (0.5 m/s): 3 minutes
  - In duct (3 m/s): 1 minutes

Ambient conditions
- Admissible ambient temperature: 0...50 °C
- Admissible ambient humidity: 5...95% rh, no condensation

Inputs/outputs
- Command variable $w$: 0...10 V, $R_i = 90$ kΩ
- Influence of $w$: 1.6 K/V

Function
- Operating mode: Sequence (heating/cooling)
- Change-over functions:$^{11}$ $X_s$, C/O, TP

Construction
- Weight: 0.1 kg
- Housing: Pure white (RAL 9010)
- Housing material: Fire-retardant thermoplastic
- Fitting: Wall fitting/recessed junction box
- Cable feed: At rear

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$^{11}$ $X_t$ = dead zone ON/OFF; C/O = summer/winter, (changeover); TP = dew point monitoring
Screw terminals
For wire of up to 1 mm²

Standards and directives
<table>
<thead>
<tr>
<th>Type of protection</th>
<th>IP30 (EN 60529)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection class</td>
<td>III (IEC 60730)</td>
</tr>
<tr>
<td>Energy class</td>
<td>I = 1 % as per EU 811/2013, 2010/30/EU, 2009/125/EC</td>
</tr>
</tbody>
</table>

CE conformity according to
EMC Directive 2014/30/EU EN 60730-1, EN 60730-2-9

Overview of types
<table>
<thead>
<tr>
<th>Type</th>
<th>Output signal</th>
<th>Load on outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRT300F041</td>
<td>Switched</td>
<td>0.5 A (0.9 A when external sensor fitted)</td>
</tr>
<tr>
<td>NRT300F061</td>
<td>Continuous</td>
<td>0...10 V, load &gt; 5 kΩ; with overflow &gt; 11 V (load-dependent)</td>
</tr>
</tbody>
</table>

Accessories
<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVF***</td>
<td>Motorised valve actuator (see product data sheet)</td>
</tr>
<tr>
<td>AVM***</td>
<td>Motorised valve actuator (see product data sheet)</td>
</tr>
<tr>
<td>AXM***</td>
<td>Motorised valve actuator (see product data sheet)</td>
</tr>
<tr>
<td>AXT2**</td>
<td>Thermal actuators for unit valves (see product data sheet)</td>
</tr>
<tr>
<td>EGH102F001</td>
<td>Dew-point monitor with sensor in housing</td>
</tr>
<tr>
<td>EGH102F101</td>
<td>Dew-point monitor with sensor on cable</td>
</tr>
<tr>
<td>0296724000</td>
<td>Sensor holder for wall mounting</td>
</tr>
<tr>
<td>0368139000</td>
<td>Rubber bung as sensor holder in ventilation duct</td>
</tr>
<tr>
<td>0303124000</td>
<td>Recessed junction box</td>
</tr>
<tr>
<td>0313347001</td>
<td>Cover plate, pure white, for 76 × 76 mm</td>
</tr>
<tr>
<td>EGT353F101</td>
<td>Cable temperature sensor; NTC 10k; -35...100 °C; L = 1.5 m</td>
</tr>
<tr>
<td>EGT353F103</td>
<td>Cable temperature sensor; NTC 10k; -35...100 °C; L = 3 m</td>
</tr>
<tr>
<td>EGT353F110</td>
<td>Cable temperature sensor; NTC 10k; -35...100 °C; L = 10m</td>
</tr>
<tr>
<td>EGT353F120</td>
<td>Cable temperature sensor; NTC 10k; -35...100 °C; L = 20m</td>
</tr>
<tr>
<td>0313414001</td>
<td>Bracket for wall mounting</td>
</tr>
<tr>
<td>0386273001</td>
<td>Plug-in power unit, input 230 V~, output 21 V~ (0.34 A), length of cable 1.8 m, IP30</td>
</tr>
<tr>
<td>0313409001</td>
<td>Holder for sensor cartridge in ventilation duct</td>
</tr>
<tr>
<td>0313501001</td>
<td>Housing with scale 10...30 °C</td>
</tr>
</tbody>
</table>

Description of operation
The temperature is measured with a temperature sensor. In the room controller, the sensor is integrated into the housing. For channel controllers, an external sensor is connected. The resistance of the sensor is converted into an actual-value signal (x) by a measuring bridge, and is then compared with the setpoint \( X_S \). The controller amplifies the control offset and, depending on its type, creates the corresponding output signals:

**F041, S1/2 = OFF:**
OPEN/STOP/CLOSED signals (3-point control) for the PI control with a motorised drive without a positioner. For heating with changeover to cooling via external signal (C/O) for 2-pipe system.

**F041, S1/2 = ON:**
Pulse-pause signals (2-point control) for P control for heating and cooling, for a thermal or continuous actuator for 4-pipe systems, or heating with changeover via external signal (C/O) to cooling for thermal actuator of a 2-pipe system.

**F061:**
Continuous signal for PI control for heating and cooling, for a continuous actuator for 4-pipe systems, or heating with changeover via external signal (C/O) to cooling for continuous actuator of a 2-pipe system.

* NRT300F061: Suitable as a master controller for max. 10 × NRT 300: (slope \( S = P-band X_S \); shift starting point FF = setpoint \( X_S \); operating mode = sequence)
Open-Stop-Close signals (Proportional-integral control F041)
In the case of an abrupt control offset, first a longer P pulse and then continuous smaller I pulses are output, until the control offset is smaller than half the switching range $X_{Sh}$. 

Pulse-Pause signals (proportional control F041)
Control factor $E$ (pulse duration/period duration) changes in proportion to the control offset. As a result, the average heating output also changes, as well as the stroke of a proportional thermal actuator such as a P-controller.

Dead zone changeover ($X_d$):
Thus, for the heating/cooling sequence, the dead zone is increased to $4 \times X_p$. As a result, the temperature is decreased in heating mode and increased in cooling mode (Eco mode).

Setpoint shift (command variable $w$):
The setpoint is increased with respect to the defined value $X_s$ with an influence of $+ 1.6 \, K/V$. This can be used, for example, to adjust the room temperature to the increasing outside temperature (summer shift), or to avoid condensation due to rising humidity.

Dew point (TP):
Frost-protection function:
When the contact of the dew-point monitor is closed, the cooling output becomes inactive or the cooling valve is closed. Independently of the defined setpoint and dead zone, at temperatures $< 6 \, ^\circ C$, the heating valve is opened. If the temperature rises above $7 \, ^\circ C$, the frost-protection function becomes inactive. If necessary, the temperature must be compensated in order to adhere precisely to the switching points.

Summer-/wintertime changeover (C/O):
When the contact is closed, the output for heating is switched to cooling.

Factory settings:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportional band</td>
<td>$X_p = 2 , K$</td>
</tr>
<tr>
<td>Dead zone for normal</td>
<td>$X_{tn} = 0.4 , K$</td>
</tr>
<tr>
<td>Integral action time</td>
<td>$t_n = inactive$</td>
</tr>
<tr>
<td>Temperature compensation</td>
<td>$ZERO = inactive$</td>
</tr>
</tbody>
</table>

Additionally for F041:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period or running time</td>
<td>$t_p = 4 , min$</td>
</tr>
<tr>
<td>Control time</td>
<td>$t_y = 4 , min$</td>
</tr>
</tbody>
</table>

Control characteristics

Contact $X_d$ open; presence:
sequence operating mode (heating and cooling).
When actual value $x_i = setpoint X_s$: both control units closed

Contact $X_d$ closed; absence:
sequence operating mode (reduced mode).
The dead zone is increased and causes a decrease in the heating mode and an increase in the cooling mode.
### Fixed-value + schedule function

**With NRT 300 as the master controller**

- Master controller
- Output 10V
- Command variable °C

Output $y_2$ or $y_1$ of the master controller can influence multiple controllers. With setpoint adjustment knob $X_S$, shift starting point FF can be selected, and with P-band $X_P$ the slope can be selected.

**With NRT 300 as the slave controller**

- Room temperature °C
- Command variable °C

In the fixed-value range, all the connected controllers regulate to the defined value $X_S$. In the follow-on range, the temperature is increased with slope $S$. The result of the influence of 1.6 K/V for the slave controller and the P-band of the master controller of $10 \text{ V}/X_P$ is: $S = \frac{16}{X_P}$.

With $X_P = 2\ldots20 \text{ K}$ for the master controller, the following slope results in K/K: $S = 8\ldots0.8$.

### Intended use

This product is only suitable for the purpose intended by the manufacturer, as described in the “Description of operation” section.

All related product regulations must also be adhered to. Changing or converting the product is not admissible.

### Disposal

When disposing of the product, observe the currently applicable local laws.

More information on materials can be found in the Declaration on materials and the environment for this product.

### Connection diagrams

#### NRT 300 F041: 4-pipe system/2-pipe system/2-pipe system

- **NRT 300 F041**: 4-pipe system/2-pipe system/2-pipe system

#### NRT 300 F061: 4-pipe system/2-pipe system

- **NRT 300 F061**: 4-pipe system/2-pipe system
Fixed-value control for heating/cooling

F041: Maximum of 4 actuators per output
F061: Outputs y₁ and y₂ (total load > 5 kΩ) for actuators with positioner, e.g. max. 6 per Rᵢ = 30 kΩ (AVR...S, B1W...S, V1W...S, AR...S, AK...S)

Fixed-value + schedule control with NRT 300 F061 as master controller

Outputs w₁ (y₁) and w₂ (y₂) (total load > 5 kΩ) of the master controller to shift max. 10 × NRT 300

Key

| H | Heating |
| K | Cooling |
| T | Temperature |
| w | Command signal |