



## MFC | multifunctional speed controller

The MFC series automatically control the speed of single phase voltage controllable electric motors (230 Vac - 50 Hz) according the values of multifunctional inputs (Ai1 or Ai2). These inputs can be temperature sensors (PT500) or other sensors with output 0-10 V or 0-20 mA (pressure, CO<sub>2</sub>, humidity, light). There is a possibility to connect this device to a BMS (building management system) interface or to use analog voltage (0-10 V) for remote enabling or disabling.

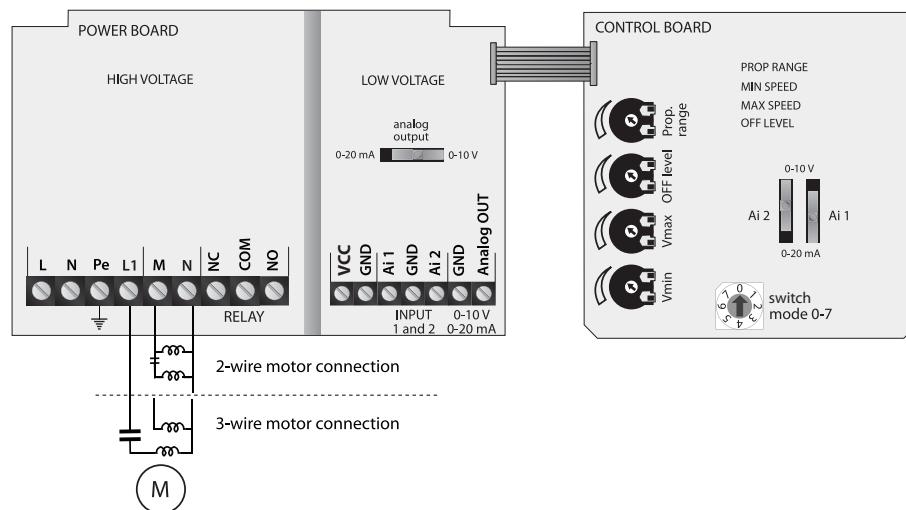
The working principle of this controller is based on the so-called 'zero crossing detection'. An optotriac combined with a microprocessor ensures flawless and accurate control where motor noises are considerably lower. There is a rotary switch to choose the working mode. When the mode is chosen, the controller will program the inputs automatically, such as temperature or analog inputs.

### Features

- < 230 Vac - 50 Hz - from 1,5 up to 10 A
- < Infinitely variable control
- < Minimum and maximum speed setting
- < Several preset programs (modes) selectable by switch
- < Enclosure: plastic (R-ABS, UL94-V0, RAL 7035), IP54
- < Ready mounted cable glands
- < Maximal ambient temperature: 35 °C
- < According to the low voltage directive: 2006/95/EC / the EMC directive: 2004/108/EC
- < Sensors not included

	<b>I<sub>max</sub></b>	<b>Fuse</b>
<b>MFC-0-15- AT</b>	1.5 A	3.15 A (5*20 mm)
<b>MFC-0-30- AT</b>	3.0 A	5.0 A (5*20 mm)
<b>MFC-0-60- AT</b>	6.0 A	10.0 A (5*20 mm)
<b>MFC-0100- AT</b>	10.0 A	16.0 A (16*32 mm)

### Wiring diagram & general overview



#### INPUTS

High voltage: power supply

L Line  
N Neutral  
Pe Power earth

Low voltage: control signals

Ai1 Multi-functional input 1 (temp. sensor PT500 or 0-10 V/0-20 mA)  
Ai2 Multi-functional input 2 (temp. sensor PT500 or 0-10 V/0-20 mA, the device detects the PT500 automatically)

GND Ground

#### OUTPUTS

High voltage:

L1 Output 230 Vac, unregulated  
M Output for motor  
REL Relay output with NO and NC contacts (230 V/16 A resistive)

Low voltage:

VCC Power supply 24 Vdc/100 mA  
OUT Analog output (0-10 V/100 mA or 0-20 mA - selected by switch)

#### Position:

0. HE-heating mode with/without OFF
1. VE-ventilation mode with/without OFF
2. DT mode (differential temperature)
3. Analog VE mode (analog signal) with/without OFF
4. HE-heating mode with/without OFF and remote control
5. VE-ventilation mode with/without OFF and remote control
6. Analog VE mode (analog signal) with/without OFF and remote control
7. Analog mode (EVS) without OFF and inverse control

## Programs

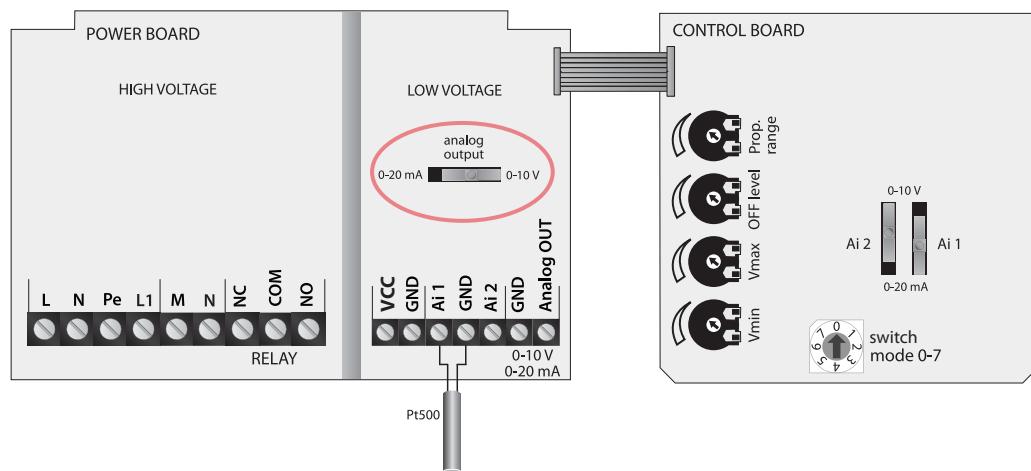


### Pos. 0 - HE-heating mode with/without OFF

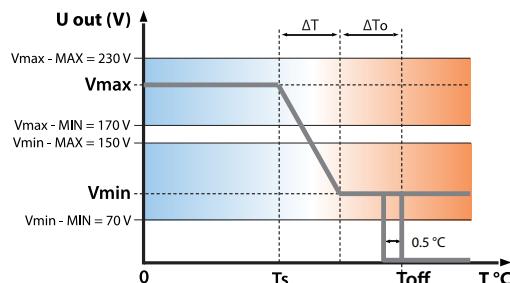
Ai1 input – temperature sensor (PT500)

Ai2 input – free, not used

## Wiring scheme



## Control curve



Ts – Set temperature by external potentiometer "SET POINT".  
Ts = 5 ÷ 35 °C

ΔT – set proportional range by inner trimmer "PROP RANGE"  
ΔT = 10 ÷ 25 % from Ts

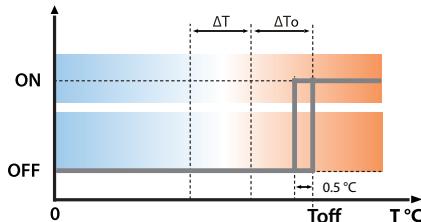
ΔTo – set off-temperature by inner trimmer "OFF LEVEL"  
ΔTo = 10 ÷ 40 % from Ts

Toff - off-temperature  
Toff = Ts + ΔT + ΔTo

Vmin – minimum output voltage  
Vmin = 70 ÷ 150 V

Vmax – maximum output voltage  
Vmax = 170 ÷ 230 V

## Relay position



## Examples

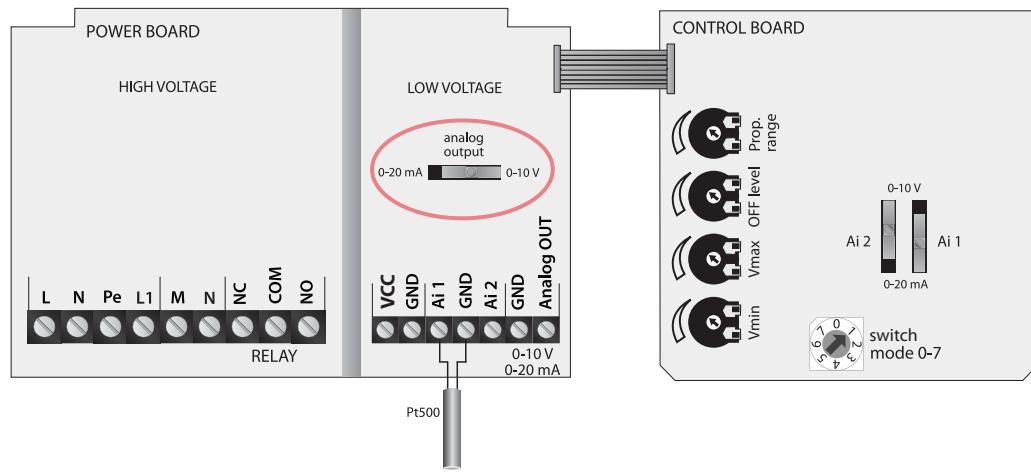
Ts = 15°C	Ts = 20°C	Ts = 25°C	Ts = 30°C
ΔT = 1.5 ÷ 4 °C	ΔT = 2 ÷ 5 °C	ΔT = 2.5 ÷ 6.5 °C	ΔT = 3 ÷ 7.5 °C
ΔTo = 1.5 ÷ 6 °C	ΔTo = 2 ÷ 8 °C	ΔTo = 2.5 ÷ 10 °C	ΔTo = 3 ÷ 12 °C
To = 18 ÷ 25 °C	To = 24 ÷ 33 °C	To = 30 ÷ 41.5 °C	To = 36 ÷ 49.5 °C



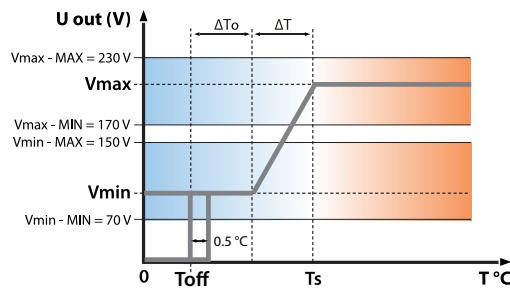
### Pos. 1 - VE-ventilation mode with/without OFF

Ai1 input – temperature sensor (PT500)  
 Ai2 input – free, not used

### Wiring scheme



### Control curve



$T_s$  – Set temperature by external potentiometer "SET POINT".  
 $T_s = 5 \div 35 ^{\circ}\text{C}$

$\Delta T$  – set proportional range by inner trimmer "PROP RANGE"  
 $\Delta T = 10 \div 25\%$  from  $T_s$

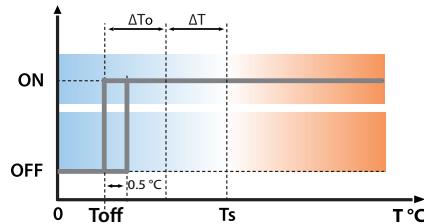
$\Delta T_{off}$  – set off-temperature by inner trimmer "OFF LEVEL"  
 $\Delta T_{off} = 10 \div 40\%$  from  $T_s$

$T_{off}$  - off-temperature  
 $T_{off} = T_s - \Delta T - \Delta T_{off}$

$V_{min}$  – minimum output voltage  
 $V_{min} = 70 \div 150\text{ V}$

$V_{max}$  – maximum output voltage  
 $V_{max} = 170 \div 230\text{ V}$

### Relay position



### Examples

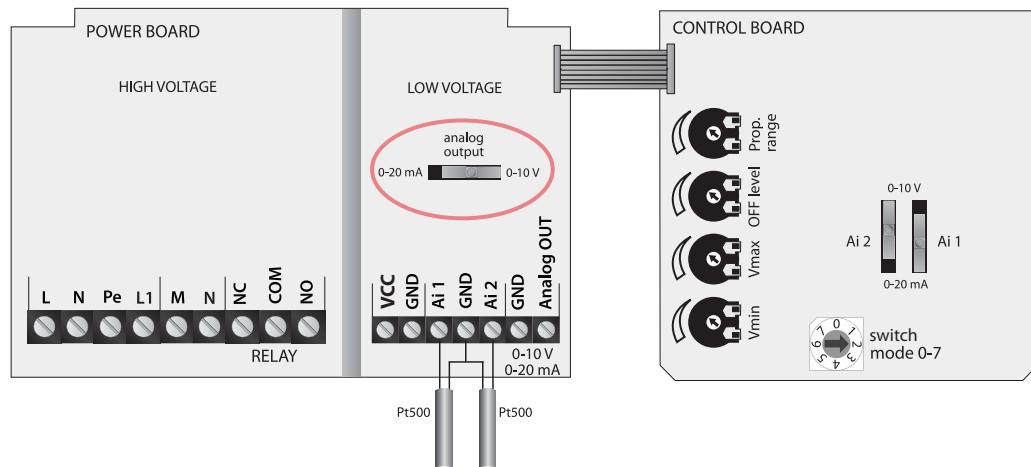
$T_s = 15^{\circ}\text{C}$	$T_s = 20^{\circ}\text{C}$	$T_s = 25^{\circ}\text{C}$	$T_s = 30^{\circ}\text{C}$
$\Delta T = 1.5 \div 4^{\circ}\text{C}$	$\Delta T = 2 \div 5^{\circ}\text{C}$	$\Delta T = 2.5 \div 6.5^{\circ}\text{C}$	$\Delta T = 3 \div 7.5^{\circ}\text{C}$
$\Delta T_{off} = 1.5 \div 6^{\circ}\text{C}$	$\Delta T_{off} = 2 \div 8^{\circ}\text{C}$	$\Delta T_{off} = 2.5 \div 10^{\circ}\text{C}$	$\Delta T_{off} = 3 \div 12^{\circ}\text{C}$
$T_{off} = 5 \div 12^{\circ}\text{C}$	$T_{off} = 7 \div 16^{\circ}\text{C}$	$T_{off} = 8.5 \div 20^{\circ}\text{C}$	$T_{off} = 11.5 \div 24^{\circ}\text{C}$



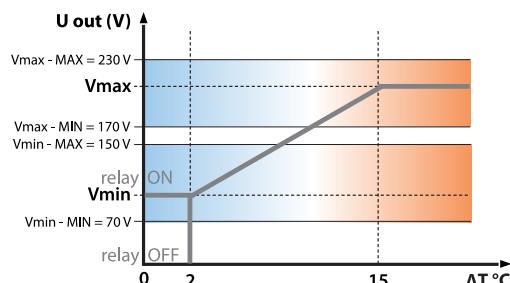
### Pos. 2 -DT mode (differential temperature)

Ai1 input – temperature sensor (T1) (PT500)  
 Ai2 input – temperature sensor (T2) (PT500)

### Wiring scheme



### Control curve



T<sub>s</sub> – Set temperature by external potentiometer "SET POINT".  
 T<sub>s</sub> = 5 ÷ 35 °C

T<sub>2</sub> – high temperature (ceiling temperature)

T<sub>1</sub> – low temperature (floor temperature)

ΔT = T<sub>2</sub> - T<sub>1</sub>

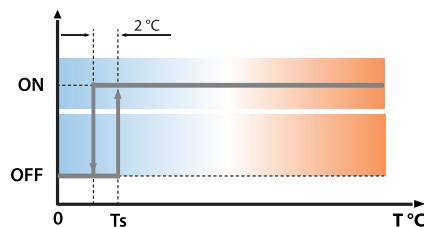
OFF level → ΔT < 2 °C when RELAY switched OFF

V<sub>min</sub> – minimum output voltage  
 V<sub>min</sub> = 70 ÷ 150 V

V<sub>max</sub> – maximum output voltage  
 V<sub>max</sub> = 170 ÷ 230 V

If: T<sub>1</sub> < T<sub>s</sub> and T<sub>2</sub> < T<sub>s</sub> + 2 °C → RELAY switch ON;  
 Else: RELAY switch OFF

### Relay position



### Examples

T <sub>s</sub> , °C	20	20	20	20	20	24
T <sub>1</sub> , °C	10	10	15	19	22	22
T <sub>2</sub> , °C	25	15	16	21	23	26
ΔT, °C	15	5	1	2	1	2
RELAY	OFF	ON	ON	ON	OFF	OFF

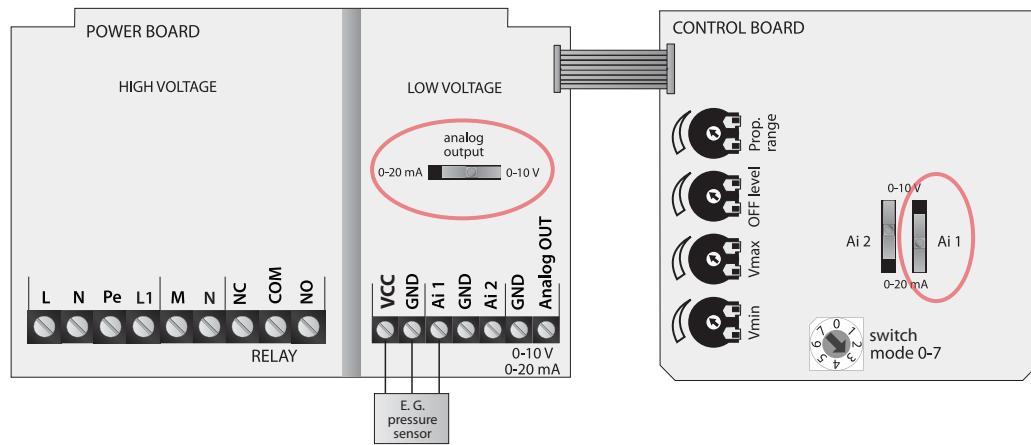


### Pos.3 - Analog VE mode (analog signal) with/without OFF

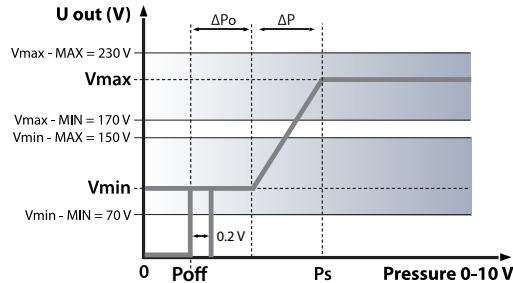
Ai1 input – analog input (0-10 Vdc or 0-20 mA)

Ai2 input – free, not used

### Wiring scheme



### Control curve



$P_s$  – Set Pressure by external potentiometer "SET POINT".  
 $P_s = 0 \div xxxx \text{ Pa}$

$\Delta P$  – set proportional range by inner trimmer "PROP RANGE"  
 $\Delta P = 20 \div 80 \% \text{ from } (10\text{V} - P_s)$

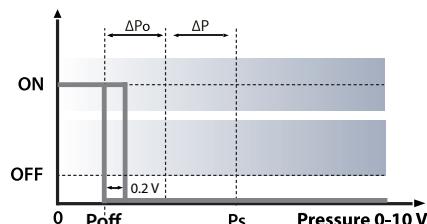
$\Delta P_o$  – set off-level by inner trimmer "OFF LEVEL"  
 $\Delta P_o = 10 \div 40 \% \text{ from } (10\text{V} - P_s)$

Poff – off-point  
 $P_{off} = P_s - \Delta P - \Delta P_o$

Vmin – minimum output voltage  
 $V_{min} = 70 \div 150 \text{ V}$

Vmax – maximum output voltage  
 $V_{max} = 170 \div 230 \text{ V}$

### Relay position



### Examples

#### Pressure sensor 0 ÷ 100 Pa

$P_s = 15 \text{ Pa}$	$P_s = 20 \text{ Pa}$	$P_s = 50 \text{ Pa}$	$P_s = 80 \text{ Pa}$
$\Delta P = 3 \div 12 \text{ Pa}$	$\Delta P = 4 \div 16 \text{ Pa}$	$\Delta P = 10 \div 40 \text{ Pa}$	$\Delta P = 16 \div 64 \text{ Pa}$
$\Delta P_o = 1.5 \div 6 \text{ Pa}$	$\Delta P_o = 2 \div 8 \text{ Pa}$	$\Delta P_o = 5 \div 20 \text{ Pa}$	$\Delta P_o = 8 \div 32 \text{ Pa}$
$P_o = 19.5 \div 33 \text{ Pa}$	$P_o = 26 \div 44 \text{ Pa}$	$P_o = 65 \div 100 \text{ Pa}$	No OFF level

#### Pressure sensor 0 ÷ 500 Pa

$P_s = 75 \text{ Pa}$	$P_s = 100 \text{ Pa}$	$P_s = 250 \text{ Pa}$	$P_s = 400 \text{ Pa}$
$\Delta P = 15 \div 60 \text{ Pa}$	$\Delta P = 20 \div 80 \text{ Pa}$	$\Delta P = 50 \div 200 \text{ Pa}$	$\Delta P = 80 \div 320 \text{ Pa}$
$\Delta P_o = 7.5 \div 30 \text{ Pa}$	$\Delta P_o = 10 \div 40 \text{ Pa}$	$\Delta P_o = 25 \div 100 \text{ Pa}$	$\Delta P_o = 40 \div 160 \text{ Pa}$
$P_o = 97.5 \div 165 \text{ Pa}$	$P_o = 130 \div 220 \text{ Pa}$	$P_o = 325 \div 500 \text{ Pa}$	No OFF level

#### Pressure sensor 0 ÷ 2000 Pa

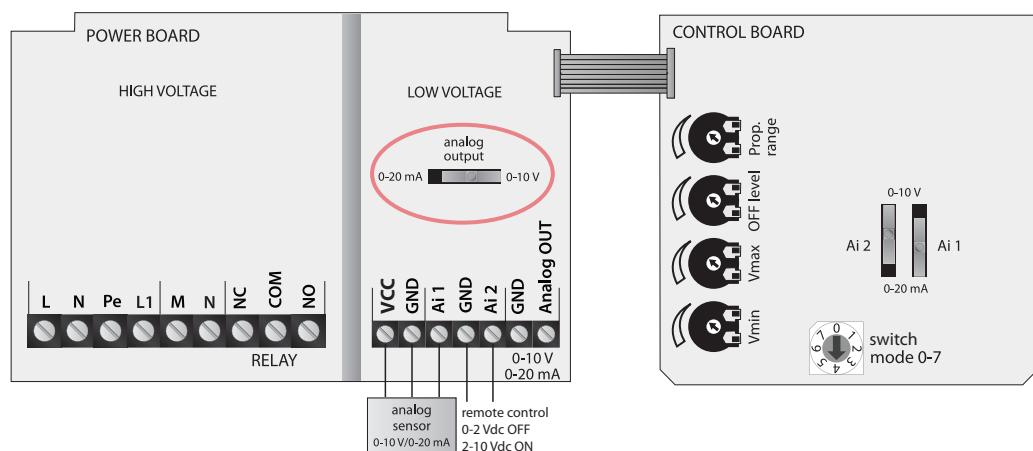
$P_s = 300 \text{ Pa}$	$P_s = 400 \text{ Pa}$	$P_s = 1000 \text{ Pa}$	$P_s = 1600 \text{ Pa}$
$\Delta P = 60 \div 240 \text{ Pa}$	$\Delta P = 80 \div 320 \text{ Pa}$	$\Delta P = 200 \div 800 \text{ Pa}$	$\Delta P = 320 \div 1280 \text{ Pa}$
$\Delta P_o = 30 \div 120 \text{ Pa}$	$\Delta P_o = 40 \div 160 \text{ Pa}$	$\Delta P_o = 100 \div 400 \text{ Pa}$	$\Delta P_o = 160 \div 640 \text{ Pa}$
$P_o = 390 \div 660 \text{ Pa}$	$P_o = 520 \div 880 \text{ Pa}$	$P_o = 1300 \div 2000 \text{ Pa}$	No OFF level



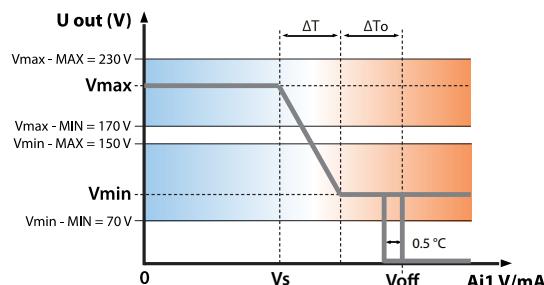
#### Pos. 4 - HE-heating mode with/without OFF and remote control

Ai1 input – analog (0-10 V/0-20 mA for temperature, pressure, CO<sub>2</sub> or other)  
 Ai2 input – remote control 0-10 V: >2 V = enabled < 2 V = disabled  
 0-20 mA: > 4 mA = enabled < 4 mA = disabled

#### Wiring scheme



#### Control curve



$T_s$  – Set temperature by external potentiometer "SET POINT"  
 $T_s = 5 \div 35^{\circ}C$

$\Delta T$  – set proportional range by inner trimmer "PROP RANGE"  
 $\Delta T = 10 \div 25\%$  from  $T_s$

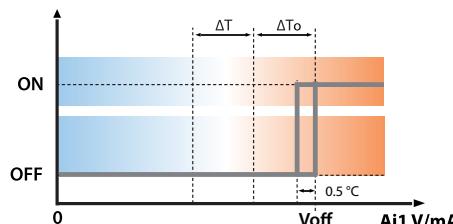
$\Delta T_{off}$  – set off-temperature by inner trimmer "OFF LEVEL"  
 $\Delta T_{off} = 10 \div 40\%$  from  $T_s$

Toff - off-temperature  
 $Toff = T_s + \Delta T + \Delta T_{off}$

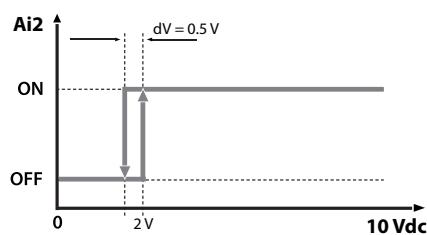
$V_{min}$  – minimum output voltage  
 $V_{min} = 70 \div 150 V$

$V_{max}$  – maximum output voltage  
 $V_{max} = 170 \div 230 V$

#### Relay position



#### Remote control



#### Examples

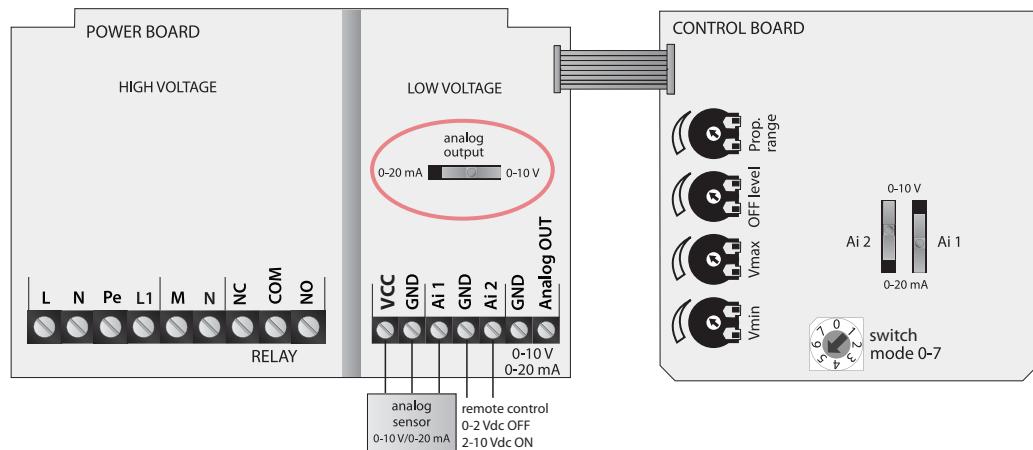
$T_s = 15^{\circ}C$	$T_s = 20^{\circ}C$	$T_s = 25^{\circ}C$	$T_s = 30^{\circ}C$
$\Delta T = 1.5 \div 4^{\circ}C$	$\Delta T = 2 \div 5^{\circ}C$	$\Delta T = 2.5 \div 6.5^{\circ}C$	$\Delta T = 3 \div 7.5^{\circ}C$
$\Delta T_{off} = 1.5 \div 6^{\circ}C$	$\Delta T_{off} = 2 \div 8^{\circ}C$	$\Delta T_{off} = 2.5 \div 10^{\circ}C$	$\Delta T_{off} = 3 \div 12^{\circ}C$
$Toff = 18 \div 25^{\circ}C$	$Toff = 24 \div 33^{\circ}C$	$Toff = 30 \div 41.5^{\circ}C$	$Toff = 36 \div 49.5^{\circ}C$



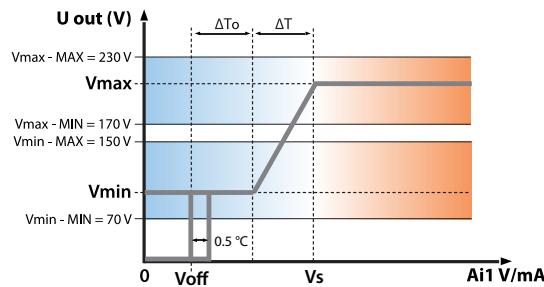
## Pos. 5 - VE-ventilation mode with/without OFF and remote control

Ai1 input – analog (0-10 V/0-20 mA for temperature, pressure, CO<sub>2</sub> or other)  
 Ai2 input – remote control 0-10 V: >2 V = enabled < 2 V = disabled  
 0-20 mA: > 4 mA = enabled < 4 mA = disabled

### Wiring scheme



### Control curve



$T_s$  – Set temperature by external potentiometer "SET POINT".  
 $T_s = 5 \div 35 ^\circ C$

$\Delta T$  – set proportional range by inner trimmer "PROP RANGE"  
 $\Delta T = 10 \div 25 \%$  from  $T_s$

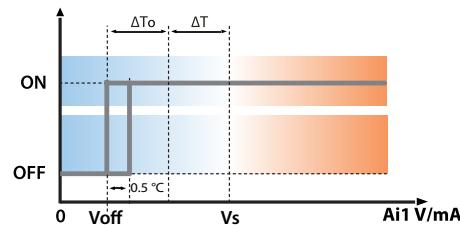
$\Delta T_{off}$  – set off-temperature by inner trimmer "OFF LEVEL"  
 $\Delta T_{off} = 10 \div 40 \%$  from  $T_s$

Off-temperature  
 $Toff = T_s - \Delta T - \Delta T_{off}$

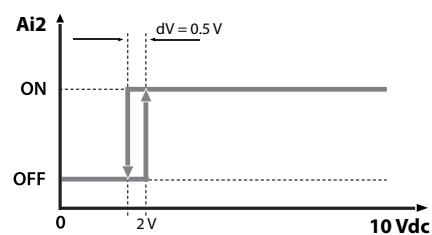
Minimum output voltage  
 $V_{min} = 70 \div 150 V$

Maximum output voltage  
 $V_{max} = 170 \div 230 V$

### Relay position



### Remote control



### Examples

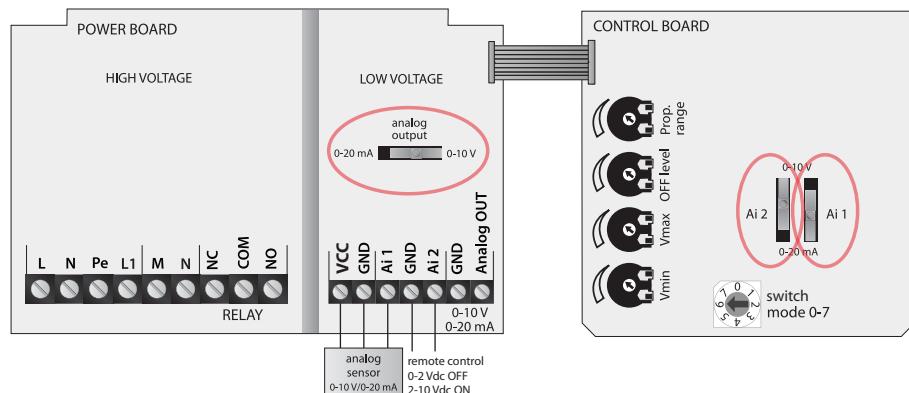
$T_s = 15^\circ C$	$T_s = 20^\circ C$	$T_s = 25^\circ C$	$T_s = 30^\circ C$
$\Delta T = 1.5 \div 4^\circ C$	$\Delta T = 2 \div 5^\circ C$	$\Delta T = 2.5 \div 6.5^\circ C$	$\Delta T = 3 \div 7.5^\circ C$
$\Delta T_{off} = 1.5 \div 6^\circ C$	$\Delta T_{off} = 2 \div 8^\circ C$	$\Delta T_{off} = 2.5 \div 10^\circ C$	$\Delta T_{off} = 3 \div 12^\circ C$
$Toff = 5 \div 12^\circ C$	$Toff = 7 \div 16^\circ C$	$Toff = 8.5 \div 20^\circ C$	$Toff = 11.5 \div 24^\circ C$



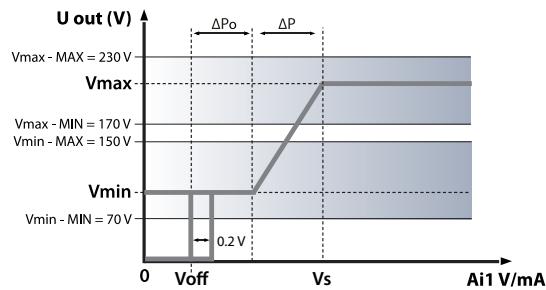
### Pos. 6 - Analog VE mode (analog signal) with/without OFF and remote control

Ai1 input – analog (0-10 V/0-20 mA for temperature, pressure, CO<sub>2</sub> or other)  
 Ai2 input – remote control 0-10 V: >2 V = enabled < 2 V = disabled  
 0-20 mA: > 4 mA = enabled < 4 mA = disabled

### Wiring scheme



### Control curve



Tp – Set pressure by external potentiometer "SET POINT"

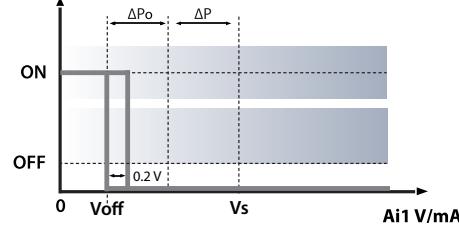
ΔP – Set proportional range by inner trimmer "PROP RANGE"  
 $\Delta P = 20 \div 80\% \text{ from } Ps$

$\Delta Po$  – set off-level by inner trimmer "OFF LEVEL"  
 $\Delta Po = 10 \div 40\% \text{ from } Ps$

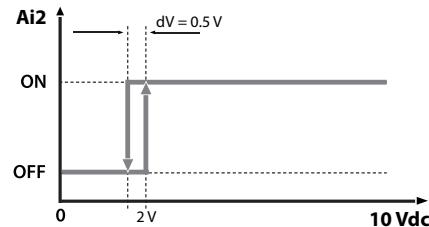
Poff – off-point  
 $Poff = Ps - \Delta P - \Delta Po$

Vmin – minimum output voltage  
 Vmax – maximum output voltage

### Relay position



### Remote control



### Examples

#### Pressure sensor 0 ÷ 100 Pa

Ps = 15 Pa	Ps = 20 Pa	Ps = 50 Pa	Ps = 80 Pa
$\Delta P = 3 \div 12 \text{ Pa}$	$\Delta P = 4 \div 16 \text{ Pa}$	$\Delta P = 10 \div 40 \text{ Pa}$	$\Delta P = 16 \div 64 \text{ Pa}$
$\Delta Po = 1.5 \div 6 \text{ Pa}$	$\Delta Po = 2 \div 8 \text{ Pa}$	$\Delta Po = 5 \div 20 \text{ Pa}$	$\Delta Po = 8 \div 32 \text{ Pa}$
$Po = 19.5 \div 33 \text{ Pa}$	$Po = 26 \div 44 \text{ Pa}$	$Po = 65 \div 100 \text{ Pa}$	No OFF level

#### Pressure sensor 0 ÷ 500 Pa

Ps = 75 Pa	Ps = 100 Pa	Ps = 250 Pa	Ps = 400 Pa
$\Delta P = 15 \div 60 \text{ Pa}$	$\Delta P = 20 \div 80 \text{ Pa}$	$\Delta P = 50 \div 200 \text{ Pa}$	$\Delta P = 80 \div 320 \text{ Pa}$
$\Delta Po = 7.5 \div 30 \text{ Pa}$	$\Delta Po = 10 \div 40 \text{ Pa}$	$\Delta Po = 25 \div 100 \text{ Pa}$	$\Delta Po = 40 \div 160 \text{ Pa}$
$Po = 97.5 \div 165 \text{ Pa}$	$Po = 130 \div 220 \text{ Pa}$	$Po = 325 \div 500 \text{ Pa}$	No OFF level

#### Pressure sensor 0 ÷ 2000 Pa

Ps = 300 Pa	Ps = 400 Pa	Ps = 1000 Pa	Ps = 1600 Pa
$\Delta P = 60 \div 240 \text{ Pa}$	$\Delta P = 80 \div 320 \text{ Pa}$	$\Delta P = 200 \div 800 \text{ Pa}$	$\Delta P = 320 \div 1280 \text{ Pa}$
$\Delta Po = 30 \div 120 \text{ Pa}$	$\Delta Po = 40 \div 160 \text{ Pa}$	$\Delta Po = 100 \div 400 \text{ Pa}$	$\Delta Po = 160 \div 640 \text{ Pa}$
$Po = 390 \div 660 \text{ Pa}$	$Po = 520 \div 880 \text{ Pa}$	$Po = 1300 \div 2000 \text{ Pa}$	No OFF level

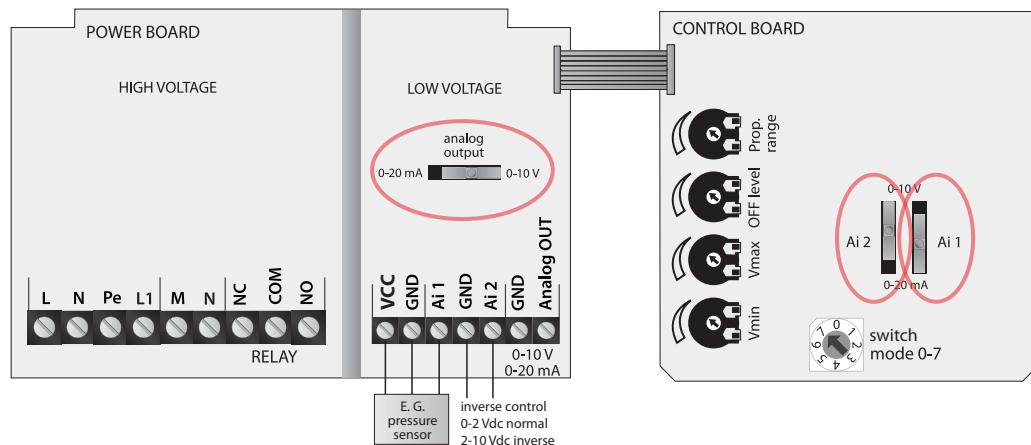


### Pos.7: Analog mode (EVS) without OFF and inverse control

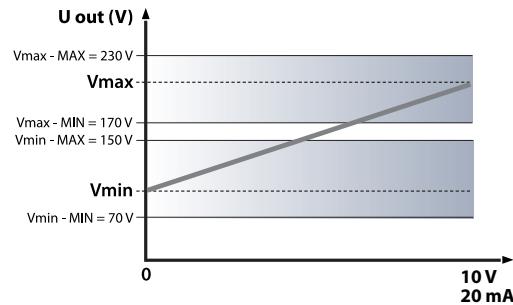
Ai1 input – analog input (EVS functionality) without OFF

Ai2 input – inverse control 0-10 V: >2 V = normal < 2 V = inverse  
0-20 mA: > 4 mA = normal < 4 mA = inverse

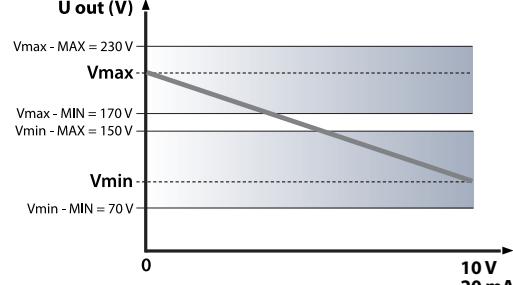
### Wiring scheme



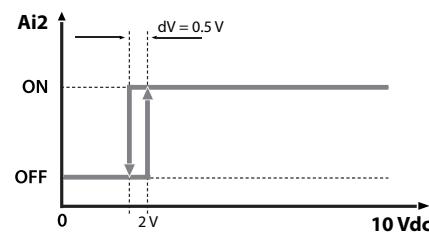
### Control curve



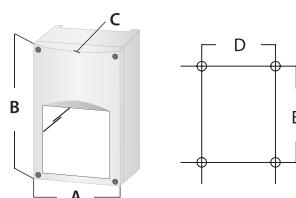
### Inverse control curve



### Remote control



### Dimensions & fixing



	A	B	C	D	E	net weight	gross weight
MFC-0-15- AT	115	180	85	98	140	710 g	800 g
MFC-0-30- AT	115	180	85	98	140	760 g	850 g
MFC-0-60- AT	115	180	85	98	140	920 g	1010 g
MFC-0100- AT	115	180	85	98	140	920 g	1010 g