Speed controller for AC fans

General description

The REFTECO electronic voltage regulator is normally used to regulate the speed of fans to control the fluid temperature in liquid coolers or condensing pressure in air cooled condensers.

The controller VRTMT is designed to control all inputs and outputs:

- View in real time the temperature/pressure measured by the sensor.
- Defines the voltage supplied to the motor.
- Defines the digital inputs state: Start, Emergency, lim. speed, Direct / Reverse.

The VRTMT operates on the basis of the inputs received through the measurements, the parameters settings values, the controlling I/O and the control panel. The control panel is used to set the parameters values and read the information about the I/O status, by a simple and guided software, through the following languages: Italian, English, Spanish, French, German, Russian. VRTMT has some pre-loaded settings that make it easy and rapid to use. VRTMT can function as Master mode (Heat/Cool) or Slave. While functioning as Master it supplies the fans with a directly (inversely in heating cases) regulation proportional to the detected pressure/temperature variation according to the parameters established in the programming. While function-ing as slave the regulator works as a simple voltage regulator whose command signal comes from a remote controller. VRTMT is provided with Modbus connection to dialog with a supervising remote device.

Speed controller for AC fans with 230V/1ph/50-60Hz feeding

VRM is a controller for the speed of AC fans with adjustable voltage. The controller characteristic is affected by the load and supply voltage. VRM operates based on the inputs received through the measurements, the parameters settings values and the controlling I/O. VRM has IP55 grade protection, pollution grade 3, anyway protect it from corrosive liquids, gas, heat sources and position it preferably sheltered from the sun's rays. Make sure that it does not undergo vibrations.

Coding

Position 1 2 3 4 5 6 7

VRM 12 A PT MT 55 XX (coding example)

Pos. 1 : Controller model

Pos. 2 : Nominal current 8 = 8A, 12 = 12A, 20 = 20A...

Pos. 3 : Power supply A = 230/400V ~ 50/60Hz

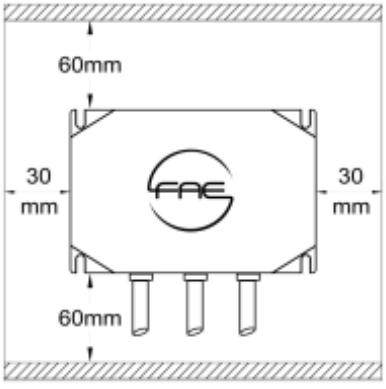
Pos. 4 : inputs for pressure sensors and temperature sensors or 0-10V command

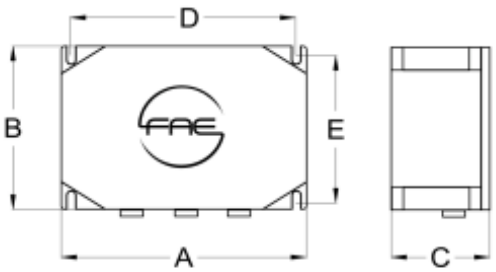
Pos. 5 : Container MT=metallic cover

Pos. 6 : Protection grade 55 = IP55

Pos. 7 : XX= specific variant (SM=small, max operating temp. 35°C)

Size	Weight (kG)	Dimensions (mm)			Fixed screw (mm)			Cable glands IP67 (diameter min. - max cable) (diameter hole mm)		
		A	B	C	D	E	Ø	5-7 Ø 17	7-10 Ø20	10-14 Ø 25
VRM 6	0,65	135	115	60	120	105	M4	-	3	-
VRM 8	0,65	135	115	60	120	105	M4	-	3	-
VRM 12...SM	0,65	135	115	60	120	105	M4	-	3	-
VRM 12	1,5	195	170	80	168	152	M4	2	1	2



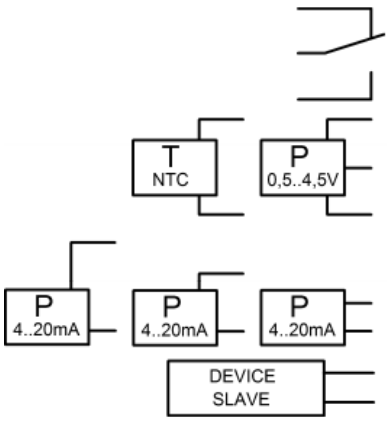


CONTROLS TERMINAL BOARD

	Descriptin	Application
I2	Mode Chiller : max speed input	Closed for max power load. Used for defrosting or heat pomp
	Mode Dry cooler : Set T1/ T2 input	Open active Set T1, Closed active Set T2
I1	Start-Stop input	Closed for power outputs active
TE	Ambient sensor input NTC (10 kΩ @25°C, β3435)	Activation of variable bandwidth and load partialization functions
+10	10V power supply output = (max 20mA)	External potentiometer power supply for manual Slave mode
+5V	5V power supply output = (max 20mA)	Ratiometric pressure sensor and NTC power supply
0V	Ground I/O	Ground I/O, (-) Slave inverter/device controlling signal
OUT	Analogical output, type 0...10V= (max 15mA)	(+) Slave inverter/device controlling signal
IN2	Analogue input 2, type 0,5...4,5V/ NTC (10 kΩ @25°C, β3435), (Ri = 10 kΩ)	Ratiometric pressure transducers / NTC sensor
IN1	Analogue input 1, type 0,5...4,5V / NTC (10 kΩ @25°C, β3435) (Ri = 10 kΩ) / 0.10V (Ri = 7kΩ)	Ratiometric pressure transducers / NTC sensor / 0..10V command for Slave Mode

S1 expansion card

The S1 card is an addition card employed to add new I/O to the basic controller.

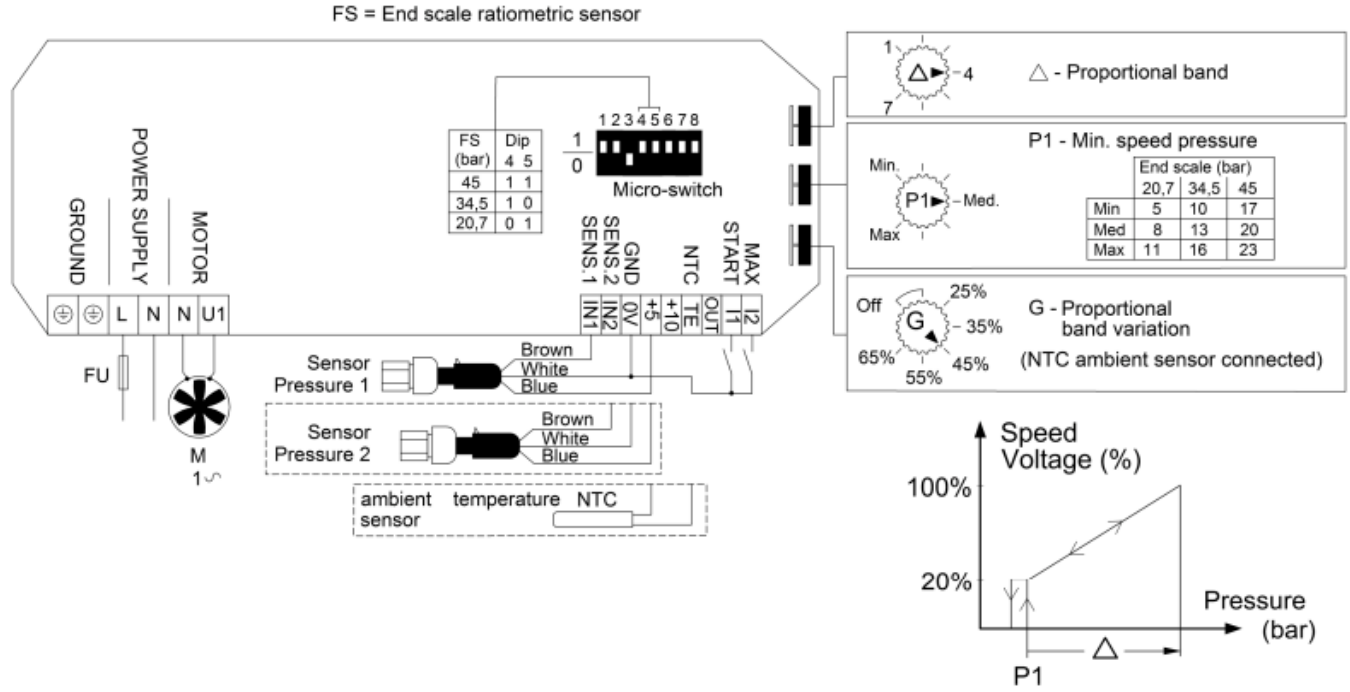


Term.	Description	Application	Page
OC1*	"Relays 3" outputs, type open collector. Max voltage 24V= / 24V~. Max power 200mA	Settable output. In the default setting OC1-OC2 are in conduct.	
OC2*			
NC	Relay 2 closed norm. contact output	Settable output. In the default setting the relay is enabled (NO-COM closed eachother) and is disabled by moving to the position represented in the picture in emergency case.	
COM	Relay 2 common contact output (1A-250V~/3A-30V=)		
NO	Relay 2 open norm. contact output		
+5V	Power supply output 5V=(max 15mA)	Ratiometric pressure transducer power supply and NTC	
0V	Mass I/O	Mass for analogical input	
IN 2	Analogical input 2, type 0,5...4,5V / ntc (10 kΩ @25°C, β3435), (Ri = 10 kΩ)	Ratiometric pressure transducers input and NTC	
4.20	Analogical input 2, type 4...20mA (Ri = 100 Ω)	Pressure transducers 4..20mA inputs. The higher signal is interpreted as analogical input 2.	
4.20*	Analogical input 3, type 4...20mA (Ri = 100 Ω)		
4.20*	Analogical input 4, type 4...20mA (Ri = 100 Ω)		
+V	Power supply output 12V= (max 100mA)	Pressure transducers 4..20mA power supply	
0V	Mass I/O	(-) Mass for inverter/Slave device	
OUT2	Analogical output 2, tipo 0...10V= (max 15mA)	(+) Control signal for inverter/Slave device	

***Not provided in the version S1-R. PAY ATTENTION: Ensure that the circuit power supply connected to OC1,OC2 must be insulated from +5V, +V, 0V.**

CHILLER OPERATION

For wiring and calibration, follow the pattern shown in the picture (the parts identified with the hatching are optional). After positioning the micro-switches Dip 1-2-6-7-8 on 1 and Dip 3 on 0, position the micro-switches Dip 4-5 according to the full scale of the sensor. Adjust with the proper knobs the set of pressure (P1) and the proportional band (Δ). With pressure P1, the control will adjust the load at the minimum speed and with pressure P1+Δ at the maximum speed. If the second sensor is connected, the control will adjust the load according to the largest signal. The contact I1 must be closed to enable the Start. In case you need to bypass the sensors reading and adjust the load to the maximum power, close the contact Max. In case of snow/ice, the minimum speed may be kept below P1 by placing the micro-switch Dip 6 on 0. With ambient probe connected and Dip 6 on 0, the minimum speed is enabled only with ambient temperature below 3°C.



Advanced settings of VARIABLE BAND

This function adapts the adjustment of the load to the temperature of the external air so that it is kept stable even with very low external temperatures. Similarly, it allows remaining around the pressure of maximum performance of the compressor at high temperatures. It may be used in support of the function of load shedding, or as a self-device. Connect the ambient probe after protecting it against heat sources, air currents and direct sunlight.

With reference to the ambient temperature of 15°C, adjust the minimum speed pressure (P1) and the proportional band (Δ) with the knobs provided. Use the knob (G) to establish the variation of the proportional bands every 5°C of difference from the temperature of reference of 15°C. The variation will be increasing for lower temperatures and decreasing for higher temperatures (with a minimum limit set at 2bar).

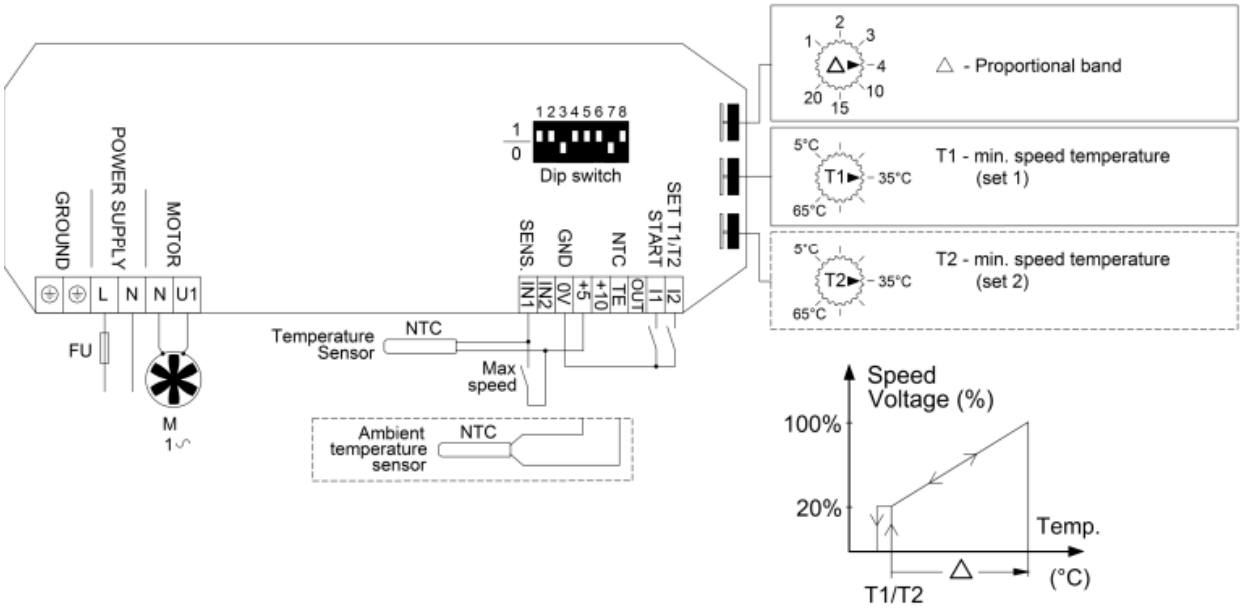
Ex. With reference to the calibrations of the picture (Δ=4, G=45%) and supposing we are working at an ambient temperature of 10°C, the band will increase by 0.45x4=1.8bar. Therefore, at the ambient temperature of 10°C, the control will set the load at the maximum speed with a pressure of P1+Δ +1.8bar. If the ambient temperature

falls below 5°C, the band increases by 2x0,45x4=3.6bar, so, at the ambient temperature of 5°C, the control will set the load at the maximum speed with a pressure of P1+Δ +3.6bar.

DRY COOLER OPERATION

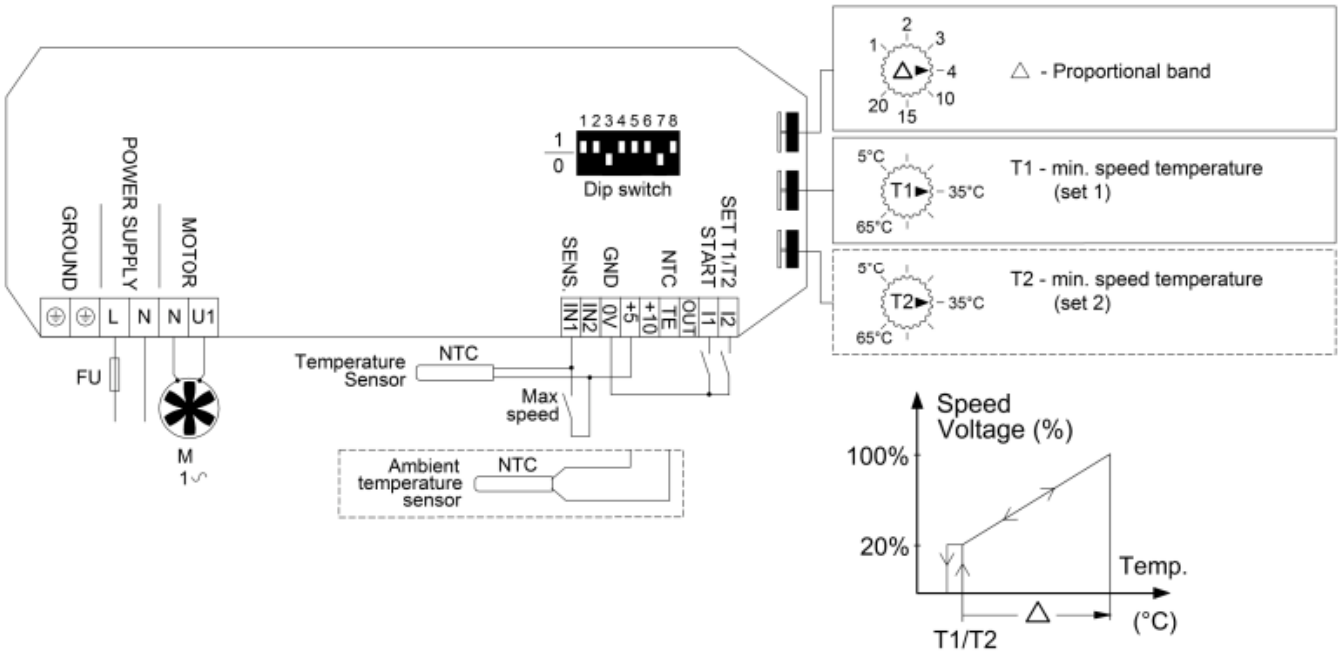
For wiring and calibration, follow the pattern shown in the picture (the parts identified with the hatching are optional).

After positioning the micro-switches Dip 1-2-4-5-6-8 on 1 and 3-7 on 0, adjust the set of temperature (T1) and the proportional band (Δ) with the provided knobs. With Temperature T1, the control will set the load at the minimum speed and with Temperature T1+Δ at the maximum speed. To set another set of temperature (T2), adjust the set of temperature (T2) by using the provided knob and close the contact I2. The contact I1 must be closed to enable the Start. In case of snow/ice, the minimum speed may be kept below the active temperature set by positioning the micro-switch Dip 6 on 0. With ambient probe connected and Dip 6 on 0, the minimum speed is enabled only with ambient temperature below 3°C.



SLAVE OPERATION

For wiring and calibration, follow the pattern shown in the picture. After positioning the micro-switches Dip 1-2-3-6 on 1 and Dip 4-5-7-8 on 0, with reference to the calibrations on the picture, the control will set the load at the minimum speed (V1) of the 30% with signal of minimum control (R) of 1V and will set the load at the maximum speed of 100% with control 10V. If you want to keep the minimum speed when the control is off, place the micro-switch Dip 6 on 0. With ambient probe connected and Dip 6 on 0, the minimum speed is enabled only with ambient temperature below 3°C.


GROUND
POWER SUPPLY
MOTOR
L
N
N
U1
FU
M
1~
1 2 3 4 5 6 7 8
1
0
Dip switch
SENS.
GND
NTC
SET T1/T2
START
IN1
IN2
0V
+5
+10
TE
OUT
I1
I2
Temperature Sensor
NTC
Max speed
Ambient temperature sensor
NTC
2
1
3
4
10
20
15
△ - Proportional band
5°C
T1
35°C
65°C
T1 - min. speed temperature (set 1)
5°C
T2
35°C
65°C
T2 - min. speed temperature (set 2)
Speed
Voltage (%)
100%
20%
Temp.
(°C)
T1/T2

Speed controller for AC fans with 400V/3ph/50-60Hz feeding

The VRTMT electronic controller is normally used to control the speed of AC fans, pumps and centrifugal pumps. It is based on the principle of symmetrical phase partialisation and it is suitable for adjustable voltage motors. VRTMT operates on the basis of the inputs received through the measurements, the parameters settings values, the controlling I/O and the control panel. The control panel is used to set the parameters values and read the information about the unit status. VRTMT is provided with Modbus connection to dialog with a supervising remote device.

Coding

Position 1 2 3 4 5 6 7

VRMT 12 C PT PL 55 XX (coding example)

Pos. 1 : Controller model

Pos. 2 : Nominal current 8 = 8A, 12 = 12A, 20 = 20A...

Pos. 3 : Power supply C= 230/400V ~ 50/60Hz D= 440/460V ~ 50/60Hz (not for VRTMT8)

Pos. 4 : Type of probe/s PT = pressure and temperature

Pos. 5 : Container PL = plastic

Pos. 6 : Protection grade 55 = IP55

Pos. 7 : Variants/additions O = weekly clock, C = operable door , D = Oled display

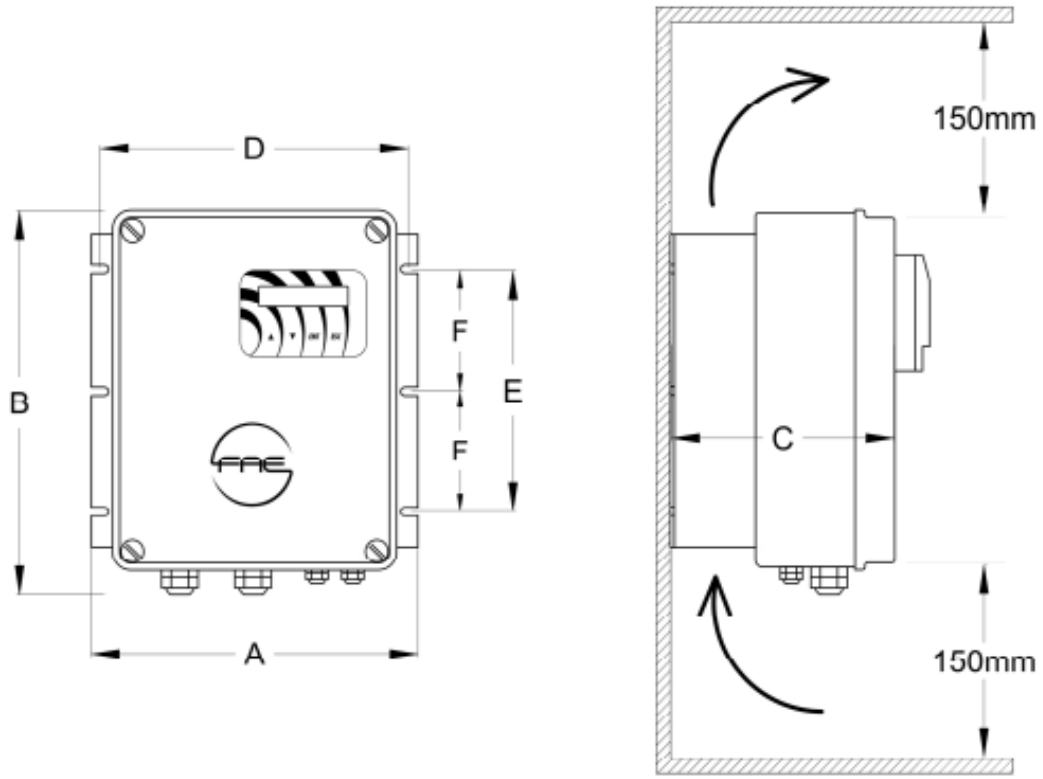
	Power max (kVA)	Current nominal (A)	Current max* (A)	Power dissipation (W)
VRTMT 8	5,5	8	12	30
VRTMT12	8	12	23	60
VRTMT20	13	20	30	80
VRTMT28	19	28	50	120
VRTMT40	26	40	70	155
VRTMT50	32	50	70	180
VRTMT60	41	60	80	250

The data are related to operate at 400V~ 50Hz. For 230V voltage supply or VRTMTXXD models at 440-460V all current are the same.

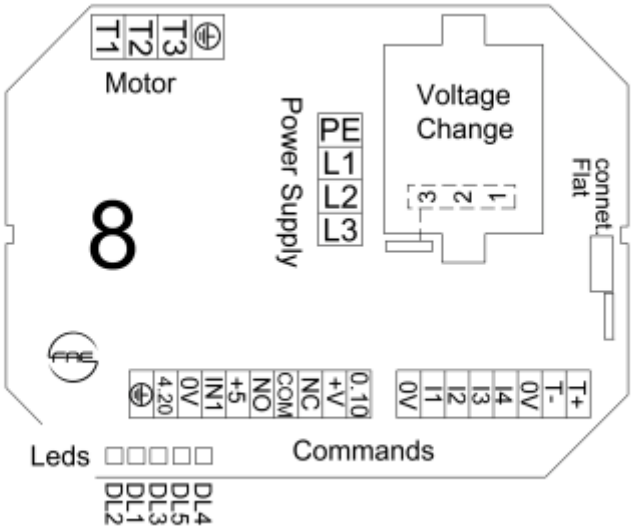
*Max current refers to an environment temperature of 50°C for a maximum time of 10 seconds every 5 minutes.

Model	Weight (kG)	Dimensions (mm)			Fixed screw (mm)				Cable glands IP68 (Metric)				
		A	B	C*	D	E	F	Ø	M16	M20	M25	M32	M40
VRTMT 8	2,5	230	165	150	215	80	/	M4	1+(1)	-	2	-	-
VRTMT12	4	230	265	165	215	170	/	M4	1+(1)	1	2	-	-
VRTMT20	4,8	230	265	230	215	170	/	M4	1+(1)	1	2	-	-
VRTMT28	7	340	270	235	322	165	/	M5	1+(1)	1	-	2	-
VRTMT40	9	340	270	235	322	165	/	M5	1+(1)	1	-	-	2
VRTMT50	17	340	440	235	322	340	170	M5	1+(1)	1	-	-	2
VRTMT60	18	340	440	235	322	340	170	M5	1+(1)	1	-	-	2

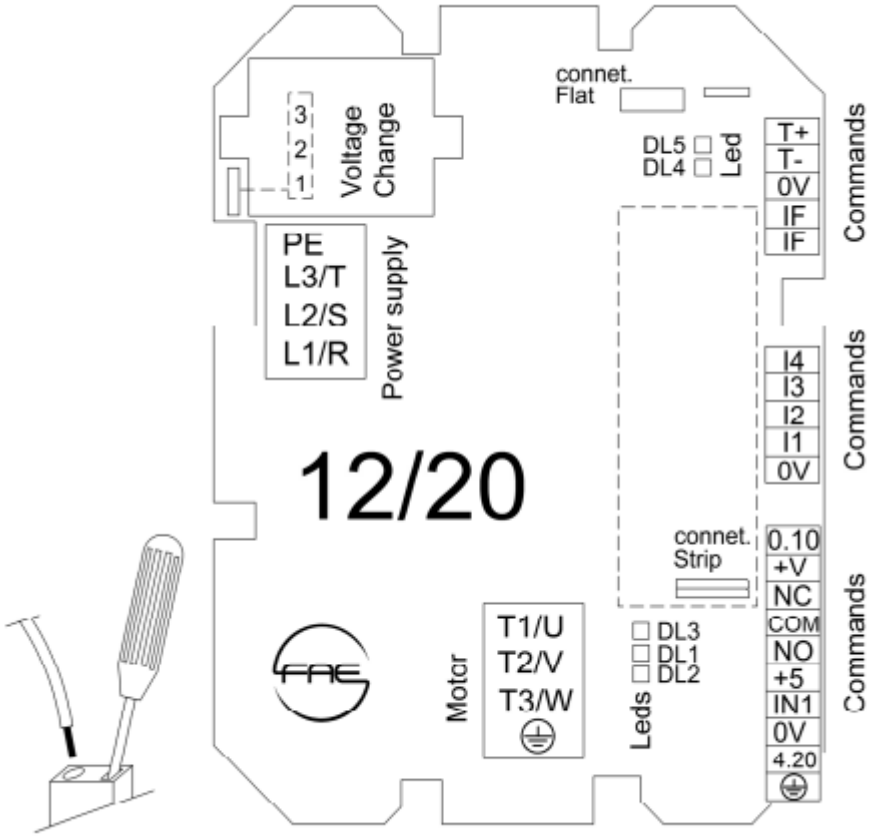
C* = increase C value of 29mm with polycarbonate operable door.
(1) = hole closed with watertight plug.



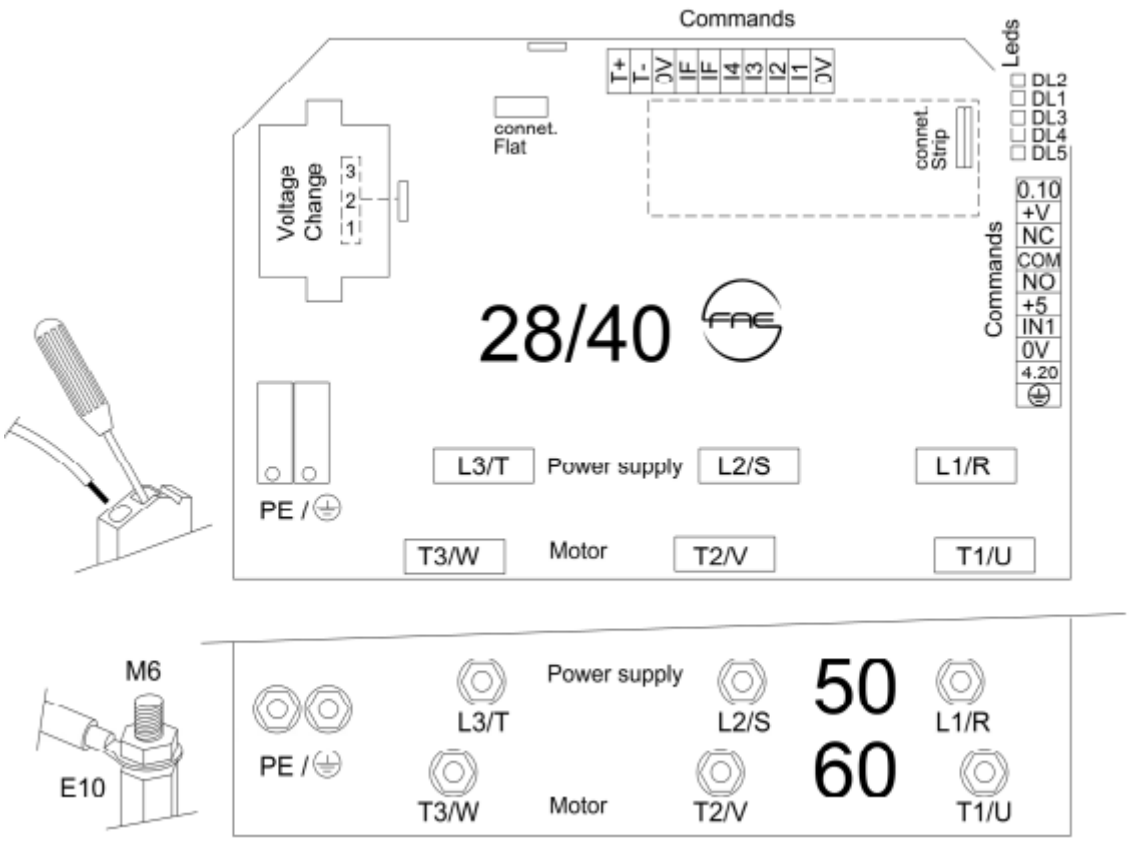
VRTMT 8



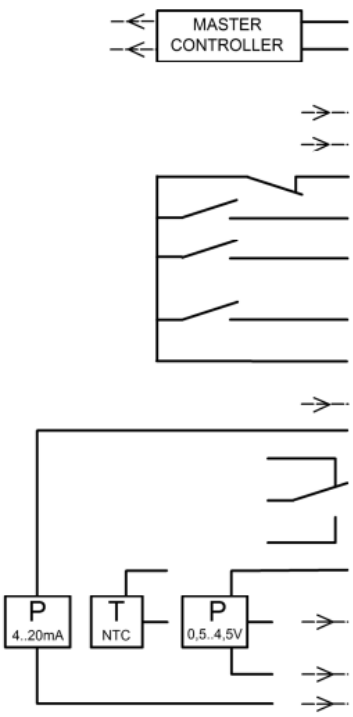
VRTMT 12-20



VRTMT 28-40 and 50-60



Control terminal board



Term.	Description	Application	Page
T1+	Serial RS485, Modbus RTU - Slave	Serial connection line to a Master controlled device	25
T1 -	Serial RS485, Modbus RTU - Slave		
0V	Ground I/O	Mass I/O	
IF	Pwm FV, 2..20kHz input (Ri =500Ω, 5..24V))	Variable frequency command for mode slave running	22
IF			
I 4	External emergency input	Open immediately blocks the control. It can be connected to the load temp. protecting device/s	
I 3	Start/Stop input	Programmable Start/Stop input	23
I 2	Limit Speed function input	Closed modifies the adjusting modes. It is often used for the night silenced operating	20
I 1	Direct/Reverse function input	Open enables the Cool1 cooling mode. Closed enables the Heat or Cool2 heating mode (to be set on basic sett. menu)	22
0V	Ground I/O	Mass for the digital inputs	
0.10	Analog input , type 0.10V (Ri = 40k Ω)	0..10V command for mode slave running	22
+V	12V power supply output = (max 30mA)	4..20mA pressure transducer power supply	
NC	Relay 1 closed norm. contact output	Programmable output. With standard setting for Defect, the relay is enabled (NO-COM eachother closed) and is disabled by turning to the position represented in the picture in emergency case.	24
COM	Relay 1 common contact output (1A-250V~/3A-30V=)		
NO	Relay 1 open norm. contact output		
+5V	5V power supply output = (max 15mA)	Ratiometric press. transd. and NTC power supply	
IN 1	Analogical input 1, type 0,5...4,5V / ntc (10 kΩ @25°C, β3435), (Ri = 10 kΩ) / pwm 5..15V	Ratiometric pressure transducers / NTC sensor / Pwm 100Hz type with variable average value	21-22
0V	Ground I/O	Mass for analogical input	
4.20	Analogical input 1, type 4...20mA (Ri = 100 Ω)	4..20mA pressure transducers input,command for mode slave running	21-21

CHILLER

Cooling cycle parameters

CHILLER		
P1	[IC]	
20.0	bar	

Pressure of the voltage/speed V1 point.
Min. 0 bar Max. **P2** Def. 20 bar

CHILLER		
P2	[IC]	
24.0	bar	

Pressure of the voltage/speed V2 point.
Min. **P1** Max. **P_MAX** Def. 24 bar

CHILLER		
P_MAX	[IC]	
25.0	bar	

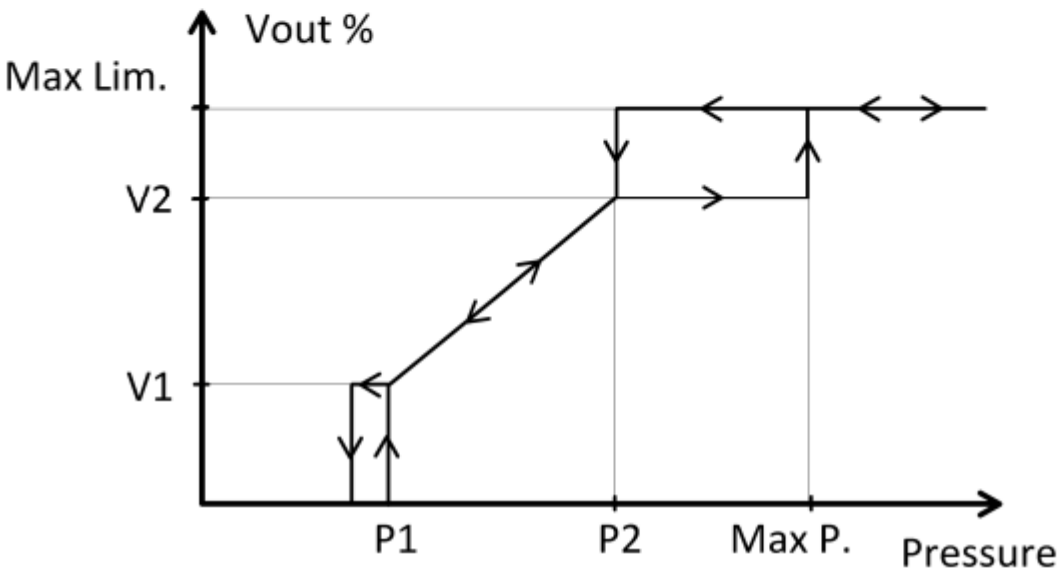
Maximum production pressure, above this the output is at the voltage **MotorMaxLim**.
Min. **P2** Max. **Full Scale** Def. 25 bar

CHILLER		
V1	[IC]	
20	%	

Voltage/speed of the pressure point P1.
Min. **MotorMinLim** Max. **V2** Def. 20%

CHILLER		
V2	[IC]	
90	%	

Voltage/speed of the pressure point P2.
Min. **V1** Max. **MotorMaxLim** Def. 90%



Heating cycle parameters

CHILLER		
P1	7.0	[IH] bar

Pressure of the voltage/speed V2 point.
Min. **P_MAX** Max. **P2** Def. 7 bar

CHILLER		
P2	11.0	[IH] bar

Pressure of the voltage/speed V1 point.
Min. **P1** Max. **Full Scale** Def. 11 bar

CHILLER		
P_MAX	5.0	[IH] bar

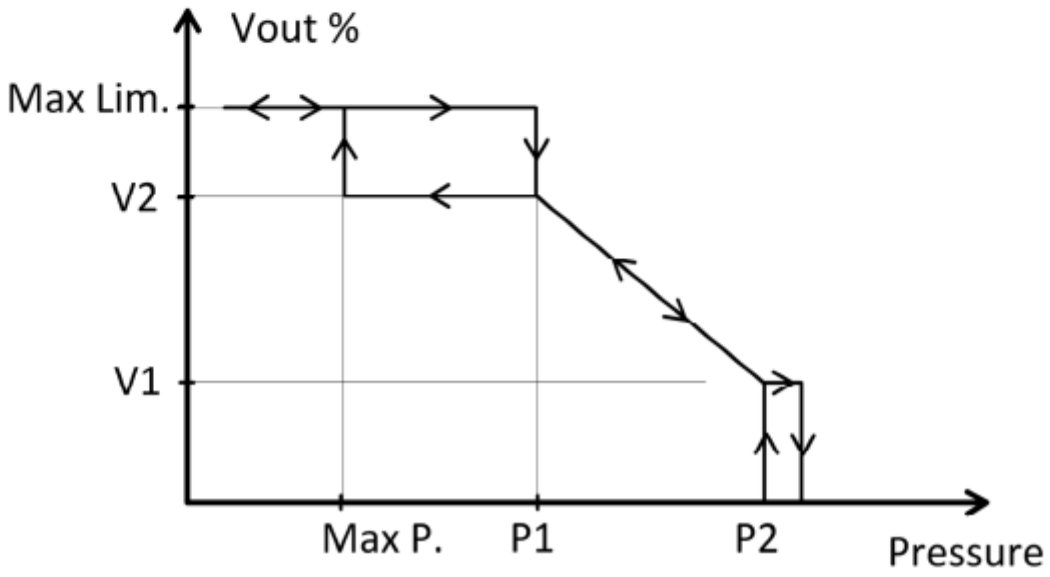
Maximum production pressure, below this the output is at the volt **MotorMaxLim**.
Min. 0 bar Max. **P1** Def. 5 bar

CHILLER		
V1	20	[IH] %

Voltage/speed of the pressure point P2.
Min. **MotorMinLim** Max. **V2** Def. 20%

CHILLER		
V2	90	[IH] %

Voltage/speed of the pressure point P1.
Min. **V1** Max. **MotorMaxLim** Def. 90%



DRY COOLER

Cooling cycle parameters

DRY COOLER		
T1	[IC]	°C
22.0		

Temperature of the voltage/V1 speed point.
Min. 0 °C Max. **T2** Def. 22,0 °C

DRY COOLER		
T2	[IC]	°C
28.0		

Temperature of the voltage/V2 speed point.
Min. **T1** Max. **T_MAX** Def. 28,0 °C

DRY COOLER		
T_MAX	[IC]	°C
29.0		

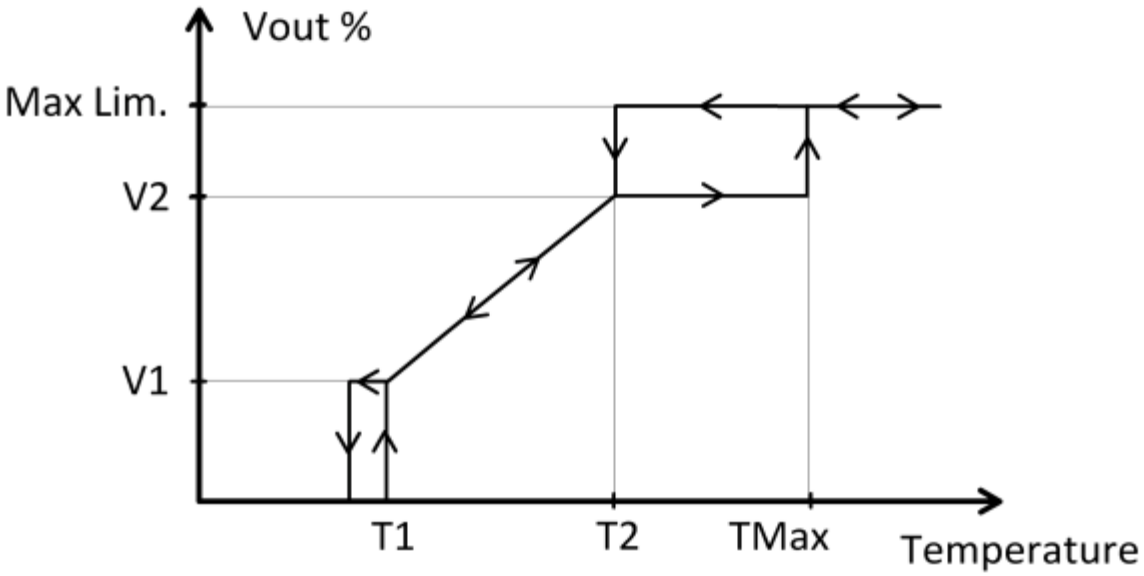
Maximum production temperature, above this the output is at the voltage **MotorMaxLim**.
Min. **T2** Max. 95 °C Def. 29,0 °C

DRY COOLER		
V1	[IC]	%
20		

Voltage/speed of the temperature point T1.
Min. **MotorMinLim** Max. **V2** Def. 20%

DRY COOLER		
V2	[IC]	%
90		

Voltage/speed of the temperature point T2.
Min. **V1** Max. **MotorMaxLim** Def. 90%



Heating cycle parameters

DRY COOLER		
T1	[IH]	
22.0	°C	

Temperature of the voltage/V2 speed point.
Min. **T_MAX** Max. **T2** Def. 22,0 °C

DRY COOLER		
T2	[IH]	
24.0	°C	

Temperature of the voltage/V1 speed point.
Min. **T1** Max. 95 °C Def. 24,0 °C

DRY COOLER		
T_MAX	[IH]	
21.0	°C	

Maximum production temperature, over this the output is at the voltage **MotorMaxLim**.
Min. 0 °C Max. **T1** Def. 21,0 °C

DRY COOLER		
V1	[IH]	
20	%	

Voltage/speed of the temperature point T2.
Min. **MotorMinLim** Max. **V2** Def. 20%

DRY COOLER		
V2	[IH]	
90	%	

Voltage/speed of the temperature point T1.
Min. **V1** Max. **MotorMaxLim** Def. 90%