

ebm-papst

DC fans – specials



ebmpapst

engineering a better life

DC fans

Specials

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Cooling capacity and efficiency

Greater power density, increasing miniaturization and extreme electronic component density are placing increased demands on the cooling capacity and efficiency of fans. Therefore, intelligent and space-saving integration of the fan in the device configuration is very important:

- Tailor-made cooling adapted to the situation as and when required.
- Programmable cooling by defining speed profiles.
- Transparency of function thanks to complete, interactive monitoring in all operating conditions.

Standard fans in electronics cooling have proven themselves a million times over.

With a constant speed and an appropriate sound level, they continuously provide the air flow required for extreme cases. But these extreme situations occur seldom – if at all – during operation. What is needed is an intelligent fan that adapts automatically to the level of cooling required at the time.

ebm-papst provides intelligent cooling concepts that are optimally adapted to practical requirements. For example:

Speed adjustment via temperature sensor

ebm-papst answers with a complete range of DC fans with temperaturecontrolled speed adjustment via a temperature sensor, available in a variety of standard dimensions.

Installation is very simple. Either an external temperature sensor in the form of an exposed wire that can be placed anywhere, or an internal sensor located directly in the fan hub in the air flow provides continuous and undissipated thermal information to the control electronics for speed adjustment. A range of temperature sensors can be found on page 262.

DC fans with separate control input

Open or closed-loop speed control is also possible with DC fans that have a separate control input. So a control voltage or a pulse-width modulated signal can be used to vary the speed. These options are used primarily in devices that have the appropriate standard interfaces and require varied fans depending on the load.

Speed signal

DC fans with speed signal.

The integrated "electronic tachometer" continuously provides an actual speed signal for external evaluation. A very simple signal evaluation on the customer side informs the user of the current fan speed at all times. The speed signal is provided by a separate wire.

Alarm signal

For applications that require monitored fan operation with an alarm signal, ebm-papst offers a number of alarm signals variants. Depending on the type of fan in question, the signal will either be static, already evaluated, or a continuous, interface-compatible, high or low signal. The alarm signal is provided by a separate wire.

Powerful GreenTech motor

Fans with three-phase EC drives and microprocessor-controlled motor electronics. The torque of these three-phase motors, which is virtually independent of the rotor position, allows the fan to run very smoothly. The speed of these fans can be controlled over a very wide speed range by means of PWM, analog voltage, or temperature. Optionally, the fans can be supplied with reversible direction of rotation and active brake operation.

Robust over the long term

Our fan solutions offer maximum operational reliability even in harsh ambient conditions and are extremely durable. They withstand temperature changes, high humidity levels and UV light. We can say this with confidence because we subject each of our solutions to the following voluntary, extremely demanding tests:

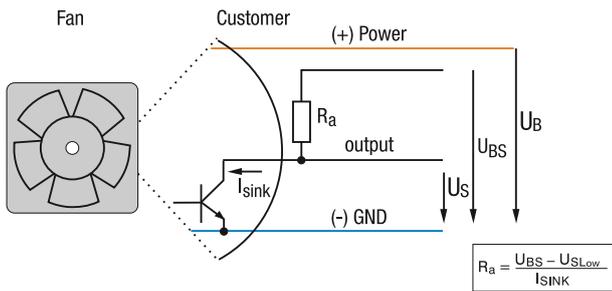
- Shock and vibration test
- Corrosion test
- Highly accelerated life test (HALT)
- Temperature change rain test
- EMC test

Speed signals

Speed signal /2

- Speed-proportional, square-wave signal for external monitoring of the fan motor speed
- 2, 3, or 6 pulses per revolution
- Open-collector signal output
- Extremely wide operating voltage range
- Easy adaptation to user interface
- Connection via separate cable
- The sensor signal also serves as a major comparison variable for setting and maintaining the setpoint speed for interactive or controlled cooling with one or more interconnected fans.

Electrical hookup



All voltages measured to ground. External load resistor $R_a / U_s / U_{BS}$ required.

Available on request

- Electrically isolated speed signal circuit
- Varying voltage potentials for power and logic circuit

Signal data

	Speed signal $U_{S,Low}$	Condition I_{sink}	Speed signal $U_{S,High}$	Tach operating voltage $U_{BS,max.}$	Admissible sink current $I_{sink,max.}$	Pulses per revolution*
Type	VDC	mA	VDC	VDC	mA	
12 / 24 V	≤ 0,4	2	≤ 30	30	4	2
48 V	≤ 0,4	2	≤ 60	60	4	2

Subject to changes.

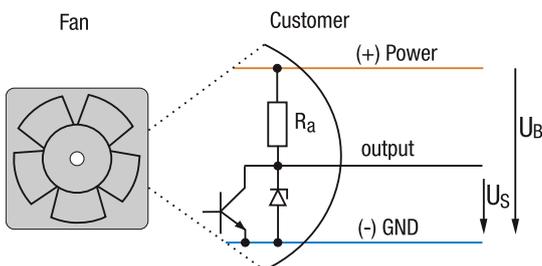
Standard value, can vary depending on fan series.

* Depending on the fan electronics other values are feasible e. g. 3 or 6.

Speed signal /12

- Speed-proportional, square-wave signal for external monitoring of the fan motor speed
- 2, 3, or 6 pulses per revolution
- TTL-compatible
- Integrated pull-up resistor
- Connection via separate cable
- The sensor signal also serves as a major comparison variable for setting and maintaining the setpoint speed for interactive or controlled cooling with one or more interconnected fans.

Electrical hookup



All voltages measured to ground.

Available on request

- Electrically isolated speed signal circuit
- Varying voltage potentials for power and logic circuit

Signal data

	Speed signal $U_{S,Low}$	Condition I_{sink}	Speed signal $U_{S,High}$	Condition I_{source}	Admissible sink current $I_{sink,max.}$	Pulses per revolution*
Type	VDC	mA	VDC	mA	mA	
12 / 24 / 48 V	≤ 0,4	1	2,5–5,5	1	1	2

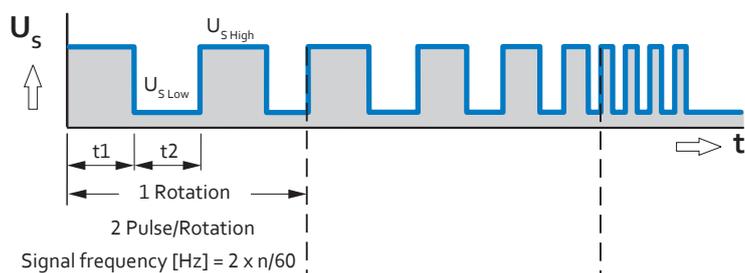
Subject to changes.

Standard value, can vary depending on fan series.

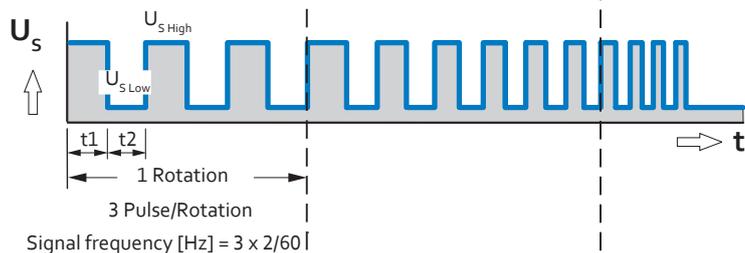
* Depending on the fan electronics other values are feasible e. g. 3 or 6.

Signal output voltage

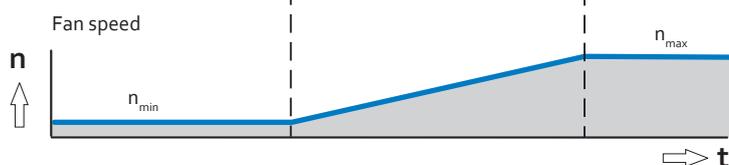
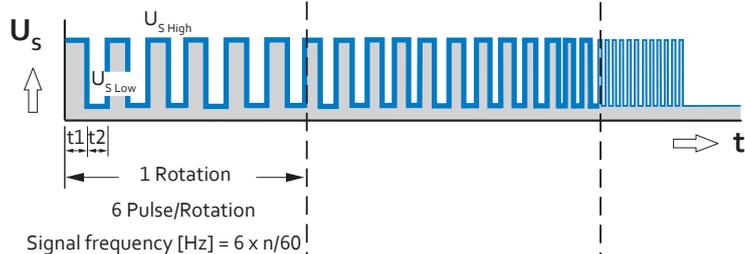
Standard signal for all types (exceptions see below)



For multi option control input and 4100 NH7, NH8 and 3250 J



All TD fans e.g. 6300 TD



Note

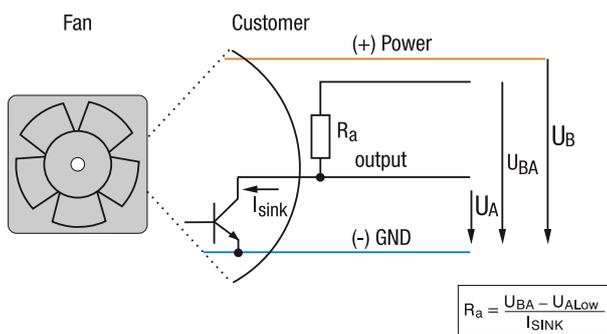
Fans that come with these fan specials could have variations with respect to the temperature range, voltage range, and power consumption compared to standard fans without specials.

Alarm signals

Alarm signal /17 speed limit

- Alarm signal for speed monitoring
- Signal output via open collector
- The fan emits a continuous high signal during trouble-free operation within the permissible voltage range.
- Low signal when speed limit is not reached
- After elimination of the fault, the fan returns to its setpoint speed; the alarm signal reverts to high.

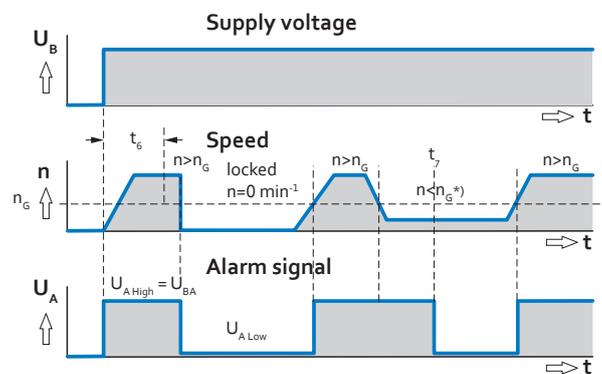
Electrical hookup



All voltages measured to ground. External load resistor R_a from U_A to U_{BA} required.

Available on request

- Integrated signal storage for subsequent recognition of short-term faults (latch).
- Alarm circuit open collector or TTL.
- Electrically isolated for maximum device safety; Defects in the power circuit do not affect the alarm circuit.

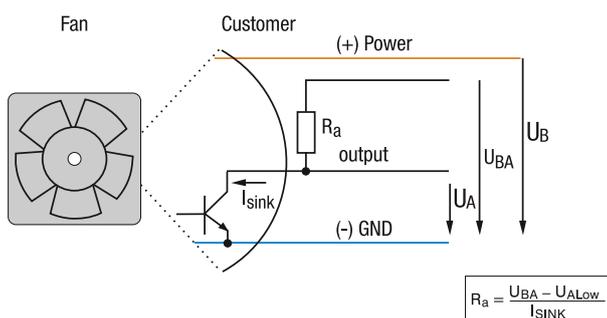


t_6 = Alarm signal suppression during startup; t_7 = Alarm delay time during run-up
* $n <$ speed limit n_G by braking or locking

Alarm signal /19 speed limit

- Alarm signal for speed monitoring
- Signal output via open collector
- The fan emits a continuous low signal during trouble-free operation within the permissible voltage range.
- High signal when speed limit is not reached
- After elimination of the fault, the fan returns to its setpoint speed; the alarm signal reverts to low.

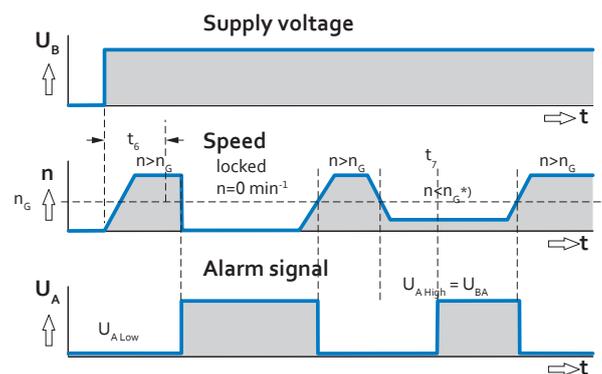
Electrical hookup



All voltages measured to ground. External load resistor R_a from U_A to U_{BA} required.

Available on request

- Integrated signal storage for subsequent recognition of short-term faults (latch).
- Alarm circuit open collector or TTL.
- Electrically isolated for maximum device safety; Defects in the power circuit do not affect the alarm circuit.



t_6 = Alarm signal suppression during startup; t_7 = Alarm delay time during run-up
* $n <$ speed limit n_G by braking or locking

Alarm signal data

Type	Alarm output voltage $U_{A,Low}$	Condition	Condition I_{sink}	Alarm output voltage $U_{A,High}$	Condition	Condition I_{source}	Alarm operating voltage $U_{BA,max}$	Max. permissible sink current
	VDC		mA	VDC		mA	VDC	mA
12 / 24 V	≤ 0.4	$n > n_G$	2	≤ 30	$n > n_G$	0	30	10
48 V	≤ 0.4	$n > n_G$	2	≤ 60	$n > n_G$	0	60	10

Subject to changes.

Standard value, can vary depending on fan series.

Selectable parameters:

- Speed limit
- t6 Alarm signal suppression during start-up
- t7 Alarm delay time during run-up

For existing products, information about alarm signals is included in the product data sheet.

Note

Fans that come with these fan specials could have variations with respect to the temperature range, voltage range, and power consumption compared to standard fans without specials.

Alarm signal data

Type	Alarm output voltage	Condition	Condition	Alarm output voltage	Condition	Condition	Alarm operating voltage	Max. permissible
	$U_{A,Low}$		I_{sink}	$U_{A,High}$		I_{source}	$U_{BA,max}$	sink current
	VDC		mA	VDC		mA	VDC	mA
12 / 24 V	≤ 0.4	$n > n_G$	2	≤ 30	$n > n_G$	0	30	10
48 V	≤ 0.4	$n > n_G$	2	≤ 60	$n > n_G$	0	60	10

Subject to changes.

Standard value, can vary depending on fan series.

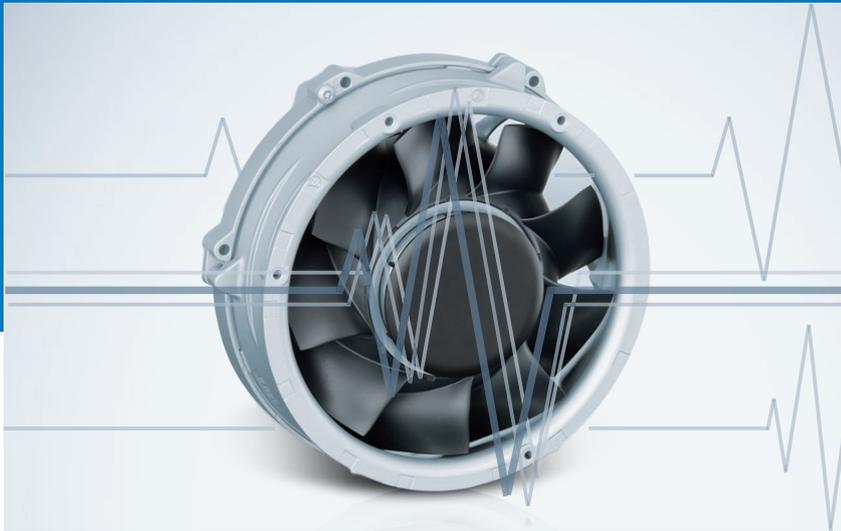
For existing products, information about alarm signals is included in the product data sheet.

Note

Fans that come with these fan specials could have variations with respect to the temperature range, voltage range, and power consumption compared to standard fans without specials.

Speed setting

via temperature sensor



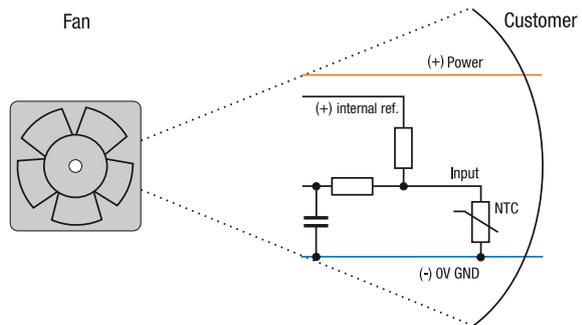
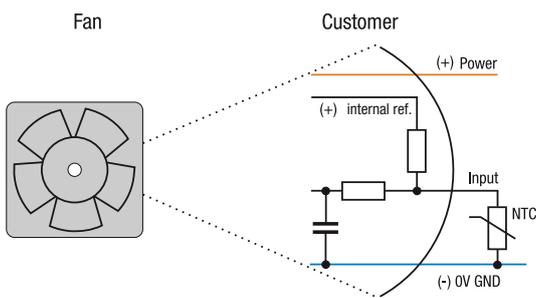
The control variable is a temperature sensor that is either integrated in the fan or connected to an additional control cable.

External temperature sensor type T

Ext. NTC resistor type LZ370 (p. 366) is required (not included in the standard scope of delivery)

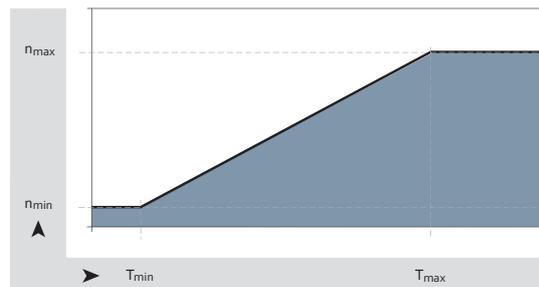
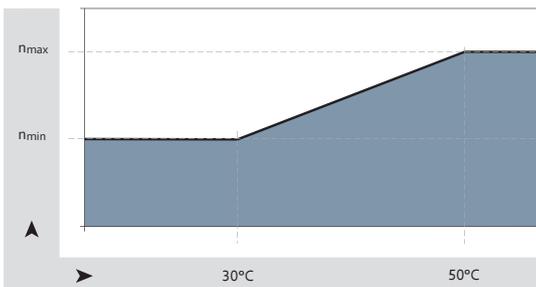
Internal temperature sensor type I

NTC integrated in the fan hub



Standard speed/temperature curve for type T and type I

Optionally available with selectable temperature/speed curve



$$n_{\min} \approx \frac{1}{2} n_{\max}$$

$$T_{\min} \approx 30\text{ }^{\circ}\text{C}; T_{\max} = 50\text{ }^{\circ}\text{C}$$

$$n_{\min} \approx 800\text{ 1/min}$$

$$n_{\max} \text{ based on model}$$

$$T_{\min} \approx 5\text{ }^{\circ}\text{C}$$

$$T_{\max} \leq 85\text{ }^{\circ}\text{C, based on model}$$

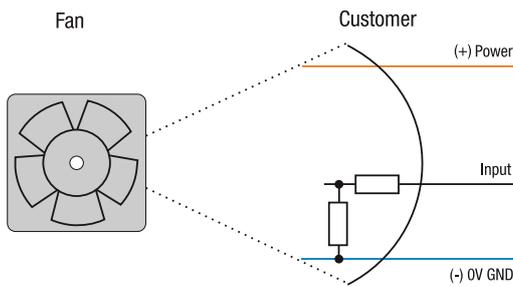
Speed setting

via control voltage
or PWM signal

The control variable is a PWM signal
or analog control voltage.

Speed setting via analog control voltage type A

Standard control range 0...10 V

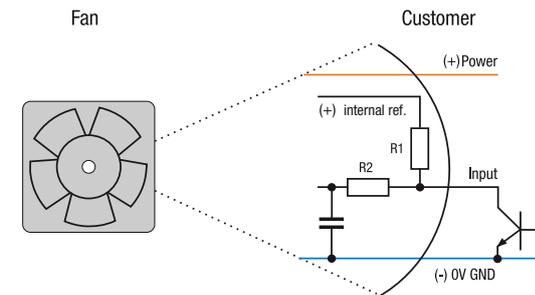


Typical input resistance > 10 kΩ

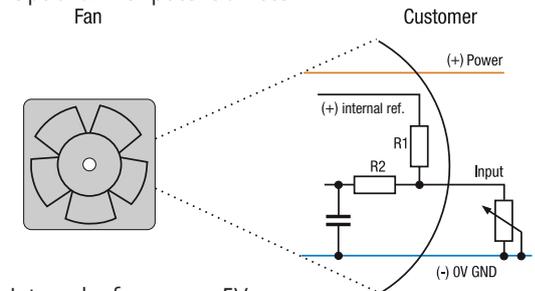
Speed setting via PWM type P

Standard PWM signal in two versions

- a) PWM frequency, mainly 1...10 kHz (0-100%), Open-collector input
- b) Four-wire interface according to Intel specifications for 12 VDC fans, PWM frequency 25 kHz, incl. speed signal /2



Optional with potentiometer

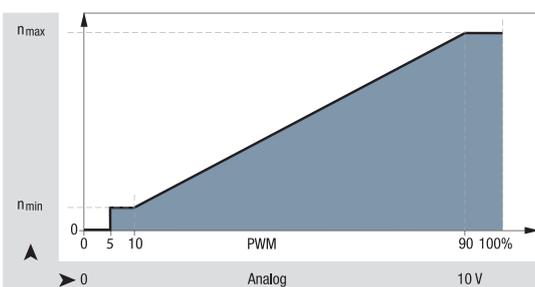


Internal reference = +5V

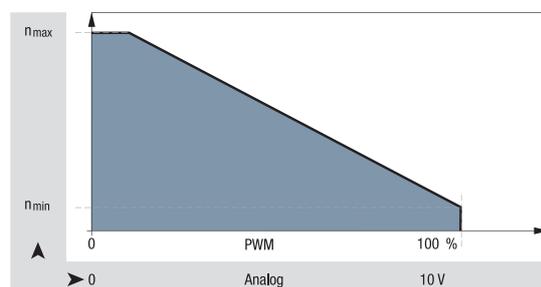
R1 typical 4.7...10 kΩ

R2 typical 100 kΩ

Standard P / A curve

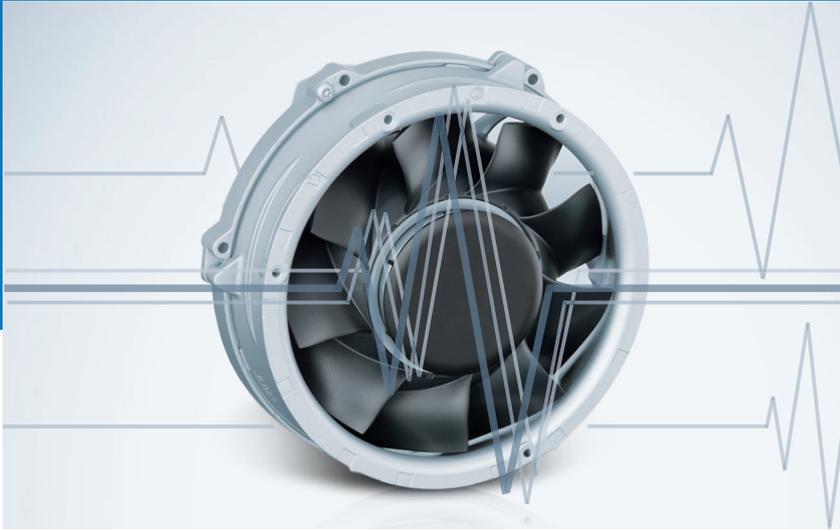


Optionally available with selectable P / A speed curve



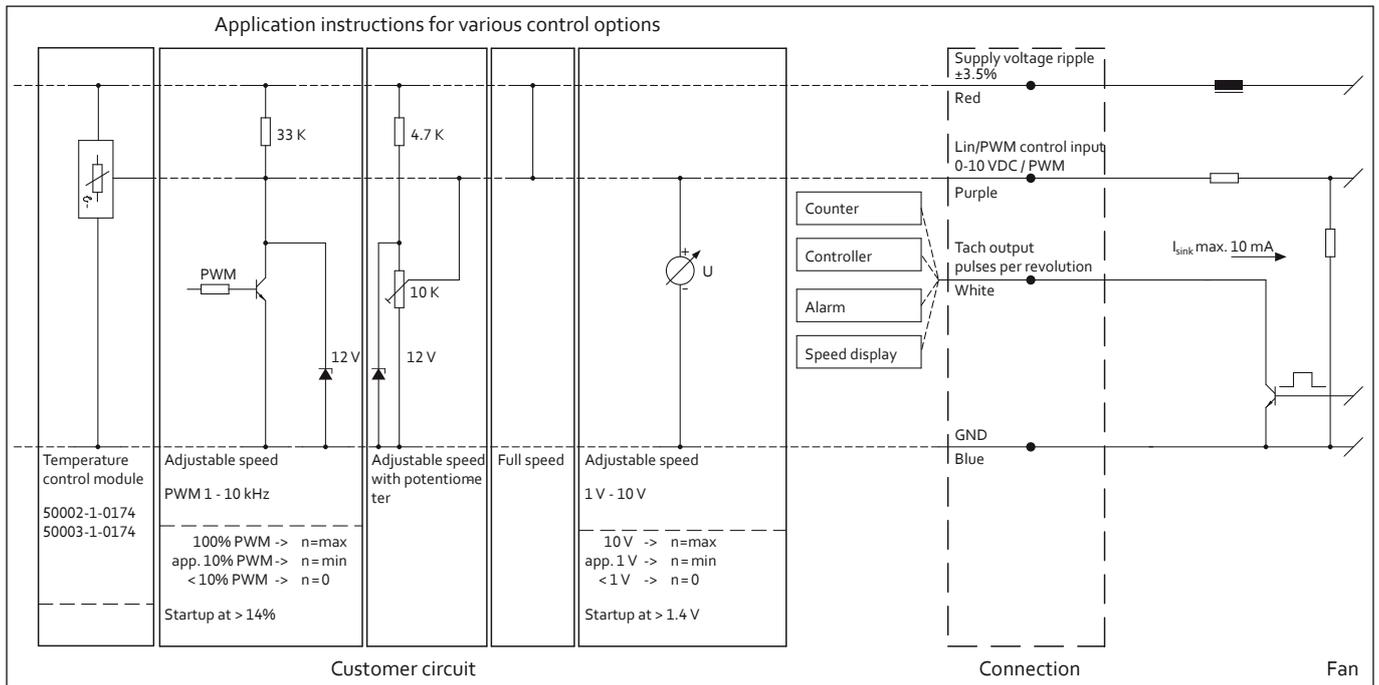
Speed setting

via multi-option control input

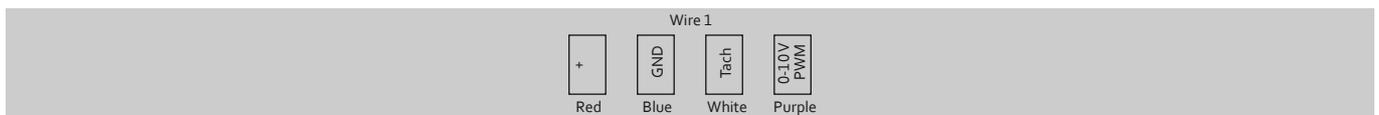


- Customer can operate input either with PWM signal, analog voltage, external temperature control module, or resistor.
- The control signal speed characteristics of the fan differ from the standard curve of the A and P inputs (see p. 263).
- To reach the maximum speed, the control cable must be connected to the U_B .
- The control input is usually combined with an open collector tachometer (type /2, see page 256)

Speed setting via multi-option control input type O



DC fans - specials



Wire	Connection	Color	Assignment/function
1	+	red	Supply voltage ripple $\pm 3,5\%$
	GND	blue	GND

Wire	Connection	Color	Assignment/function
1	Tach	white	Tach output: 3 Impulse / revolution
	0-10V / PWM	purple	Control input (Impedance 100 k Ω)

FanCheck

R4R *Ready for Restart*

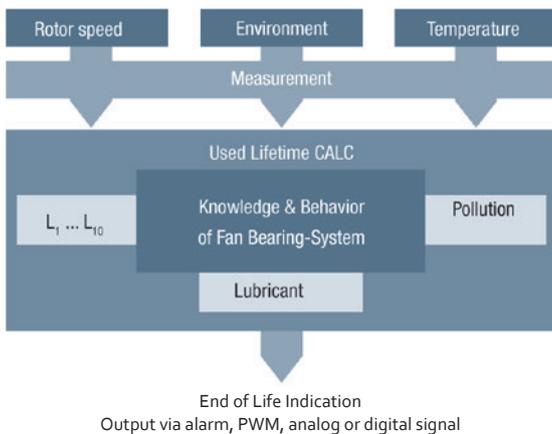
FanCheck is a diagnostic tool integrated into the fan electronics for determining the remaining service life of the fan, dependant, upon temperature, speed, and preset environmental parameters.

The FanCheck system emits a pulse width modulated signal, which reflects the remaining service life of the fan. The pulse width is proportional to the remaining service life of the fan. The FanCheck signal has a pulse width of 10 % at the end of the service life and a pulse width of 90 % with full service life.

Basic data, such as the ball bearing system, bearing lubrication or lubricant used, are programmed in advance as parameters into the software.

The customer defines the environmental conditions, such as the use of fans in moist, dusty, or dirty environments; other parameters such as ambient temperature and speed are determined continuously. Based on all the influencing parameters, the software can, by means of a complex algorithm, calculate the remaining service life for each individual fan.

Functionality



IT equipment such as servers, routers, and in-row cooling applications must be 100% operational. For this reason, maintenance work is often carried out during operation.

If a single fan or a plug-in unit with several fans is taken out of service for this purpose, this can create a tricky situation: The remaining fans must provide adequate air flow. As a result of this and the back pressure of applications, air flows through the fan taken out of service and it is driven by an external source, as with a wind turbine.

The problem is that when driven by an external source, these speeds can amount to several thousand revolutions per minute and in the opposite direction of rotation.

R4R manages a feat of strength: Thanks to high-torque motors and state-of-the-art electronics, it still guarantees a proper start-up process, enabling efficient and fast system maintenance, including the replacement of fans while the system is running.

Climate- and moisture protection



- Capable of satisfying special requirements for a broad range of applications
- Resistance of fans to environmental conditions such as dust, splashing water, humidity, spray water, and salt spray.
- Competent solutions to adapt fans to environmental conditions.

Moisture protection

A coat of paint over the motor and circuit board protect the fans against spray water and condensation.

Degree of protection IP 54 / IP 68*

In the degree of protection IP 54, the motor and circuit boards are coated and therefore protected against spray water and moisture. The degree of protection IP 68 is important for ebm-papst products, as it ensures a high degree of protection for the encapsulated motor and electronics against foreign bodies and water, while protecting the user against potential hazards upon contact. Degrees of protection higher than IP 68 are possible on request.

In addition, the IP68 protection enables ATEX certification according to DIN EN 60 079-7 (Group 2A, T4) for use in explosive atmospheres according to the certified protection class and resistance to salt spray.

Salt spray protection

Salt spray represents one of the most difficult requirements for product durability. ebm-papst has the technology to protect fans and blowers from salt spray reliably and for the long term.

Stainless steel bearings

Special bearings made of stainless steel provide additional protection.

Solutions that are available and are used may differ depending on the fan size. We would be glad to develop solutions tailored to the demands of your application.

Degree of protection – IP code*

Protection against foreign bodies and accidental contact (first digit)		Water protection (second digit)	
X	No protection	X	No protection
1	Protection against foreign objects > 50 mm (back of the hand)	1	Protection against dripping water or condensation
2	Protection against foreign objects > 12 mm (finger)	2	Protection against dripping water, fans tilted 15° from vertical
3	Protection against foreign objects > 2.5 mm (tool)	3	Protection against sprayed water up to 60° from vertical
4	Protection against foreign objects > 1 mm (wire)	4	Protection against sprayed water from all sides
5	Protection against dust in harmful quantities	5	Protection against low-pressure water jets
6	Dust-proof	6	Protection against high-pressure water jets
		7	Protection against temporary submersion (15 cm - 1 m)
		8	Protection against continuous submersion

* IP = International degree of protection marking
For AC- and EC-fans max. IP 65 available.