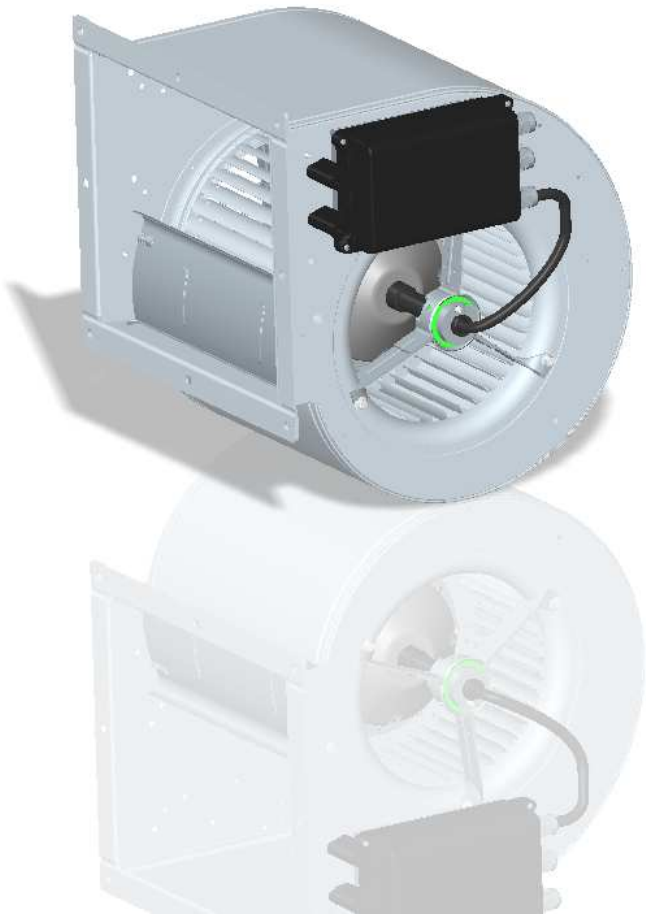
NICOTRA Gebhardt

# DDMP FAN

# Operating Manual



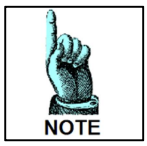


**Rev. 1 – 22nd June 2015 – Applicable from DDMP driver version 3 (see Modbus Input Register 0)**

## Definitions and Warnings


***Warning For the purpose of this documentation and the product warning labels, "Warning" indicates that death, severe personal injury or substantial damage to property can result if proper precautions are not taken.***


***Caution For the purpose of this documentation and the product warning labels, "Caution" indicates that minor personal injury or material damage can result if proper precautions are not taken.***




***Note For the purpose of this documentation, "Note" indicates important information relating to the product or highlights part of the documentation for special attention.***

**Qualified personnel**

For the purpose of this Instruction Manual and product labels, a "Qualified person" is someone who is familiar with the installation, mounting, start-up and operation of the equipment and the hazards involved. He or she must have the following qualifications:

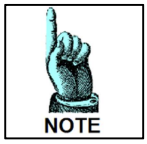
- ➔ Trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety procedures.
- ➔ Trained in the proper care and use of protective equipment in accordance with established safety procedures.
- ➔ Trained in rendering first aid.

**Use for intended purpose only**

The equipment may be used only for the application stated in the manual and only in conjunction with devices and components recommended and authorized by Nicotra Gebhardt.

## Read carefully


***Before installing and commissioning the DDMP fan, you must read all safety instructions and warnings carefully including all the warning labels attached to the equipment. Make sure that the warning labels are kept in a legible condition and replace missing or damaged labels.***




***NICOTRA Gebhardt reserves the right to change without notice.***

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## Safety Instructions

The following warnings, cautions and notes are provided for your safety and as a means of preventing damage to the product or components at the connected machines. This section lists warnings, cautions and notes, which apply generally when handling the Nicotra Gebhardt Driver, classified as **General, Transport & Storage, Commissioning, Operation and Repair.**

**Specific warnings, cautions and notes** that apply to particular activities are listed at the beginning of the relevant chapters and are repeated or supplemented at critical points throughout these sections.

**Please read the information carefully, since it is provided for your personal safety and will also help prolong the service life of your DDMP fan.**

## General

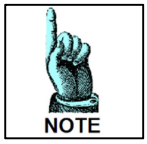

***This equipment contains dangerous voltages and controls potentially dangerous rotating mechanical parts. Non-compliance with these warnings or failure to follow the instructions contained in this manual can result in loss of life, severe personal injury or serious damage to property.***

***Only suitable qualified personnel should work on this equipment, and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon its proper handling, installation, operation and maintenance.***

***Children and the general public must be prevented from accessing or approaching the equipment!***

***Risk of electric shock! The DC–BUS capacitors remain charged after mains supply has been switched off. It is not permissible to open the equipment until 10 minutes after the mains supply has been removed***.


***This equipment may only be used for the purpose specified by the manufacturer. Unauthorized modifications and the use of spare parts and accessories that are not sold or recommended by the manufacturer of the equipment can cause fires, electric shocks and injuries.***




***Keep these operating instructions within easy reach of the equipment and make them available to all users. Whenever measuring or testing has to be performed on live equipment suitable electronic tools should be used.***

***Before installing and commissioning, please read these safety instructions and warnings carefully and all the warning labels attached to the equipment.***

***Make sure that the warning labels are kept in a legible condition and replace missing or damaged labels.***

## Transport & Storage


*Correct transport, storage, erection and mounting, as well as careful operation and maintenance are essential for proper and safe operation of the equipment.*


*Protect the DDMP fan against physical shocks and vibration during transport and storage. Also be sure to protect it against water (rainfall) and excessive temperatures.*

## Commissioning


*Work on the device/system by unqualified personnel or failure to comply with warnings can result in severe personal injury or serious damage to material.*

*Only suitably qualified personnel trained in the setup, installation, commissioning and operation of the product should carry out work on the device/system.*
*This equipment must be grounded.*
*The following terminals can carry dangerous voltages even if the Driver is inoperative:*

- *the power supply terminals L, N*
- *the motor terminals U, V, W*

## Operation


*The Driver must NOT be removed from the related DDMP fan type and size.*
*The Driver can't be used separate from the related fan.*


*Ensure correct grounding connections. The ground cable must be sufficient to carry the maximum supply fault current which normally will be limited by the fuses or MCB. Suitably rated fuses or MCB should be fitted in the mains supply to the inverter, according to any local legislation or codes.*


*The Driver operates at high voltages.*
*Certain parameter settings may cause the inverter to restart automatically after an input power failure.*

## Repair


*Repairs on equipment may only be carried out by Nicotra Gebhardt.*
*Before opening the equipment for access, disconnect the power supply and wait for at least 10 minutes until the DC-BUS capacitor is completely discharged!*

## Declaration of conformity

The DDMP Driver product is conform to the relevant safety provisions of the Low Voltage Directive 2006/95/EC and the EMC Directive 2004/108/EC and has been designed and manufactured in accordance with the following harmonized European standards:

- **EN 61000-3-2 "Electromagnetic compatibility (EMC) - Part 3-2**: Limits - Limits for harmonic current emissions (equipment input current <= 16 A per phase)".
- **EN 61000-6-3 "Electromagnetic compatibility (EMC) - Part 6-3**: Generic standards - Emission standard for residential, commercial and light-industrial environments".
- **EN 61000-6-4 "Electromagnetic compatibility (EMC) - Part 6-4:** Generic standards - Emission standard for industrial environments".
- **EN 61800-3 EMC Product Standard for Power Drive Systems.**

**Electromagnetic Compatibility**

The DDMP product is designed with high standards of EMC in mind. The Driver, suitable for use within the European Union, is fitted with an internal EMC filter. This EMC filter is designed to reduce the conducted emissions back into the supply through the power cables for compliance with harmonised European standards.
It is the responsibility of the installer to ensure that the equipment or system into which the product is incorporated complies with the EMC legislation of the country of use. Within the European Union, equipment into which this product is incorporated must comply with the EMC Directive 2004/108/EC.

## Product overview

**General Information**

The DDMP is a forward curved blade fan equipped by an external permanent magnet rotor motor. The rotor magnets are made by rare earths (NdFeB) that strongly reduce the motor dimension and therefore the fan obstruction. The motor shape itself has been chosen for increasing the airflow inside the fan scroll.
The Driver is compact and it's directly installed on board of the fan. It is equipped with an active PFC and it drives the motor through a sensorless algorithm.

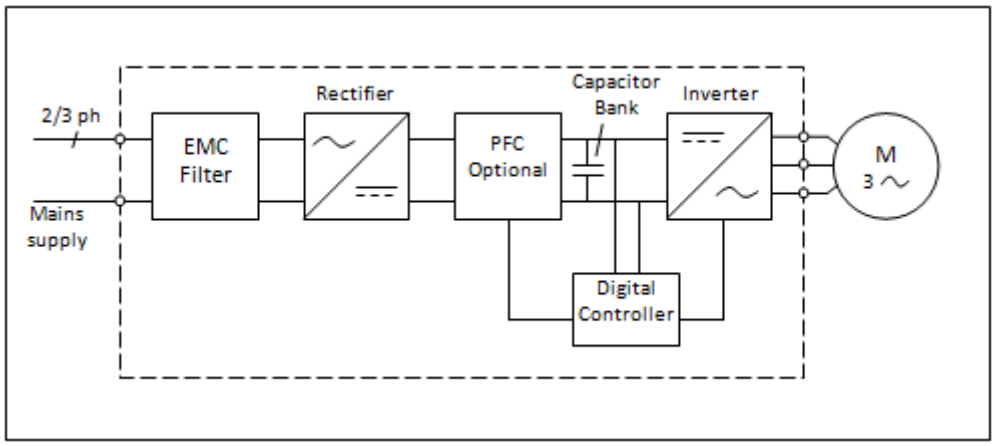



**Fig. 1 – Driver functioning principle**

**The Driver**

In the following figures is shown the Driver and its parts.

**Fig. 2 – DDMP Driver front and side view**

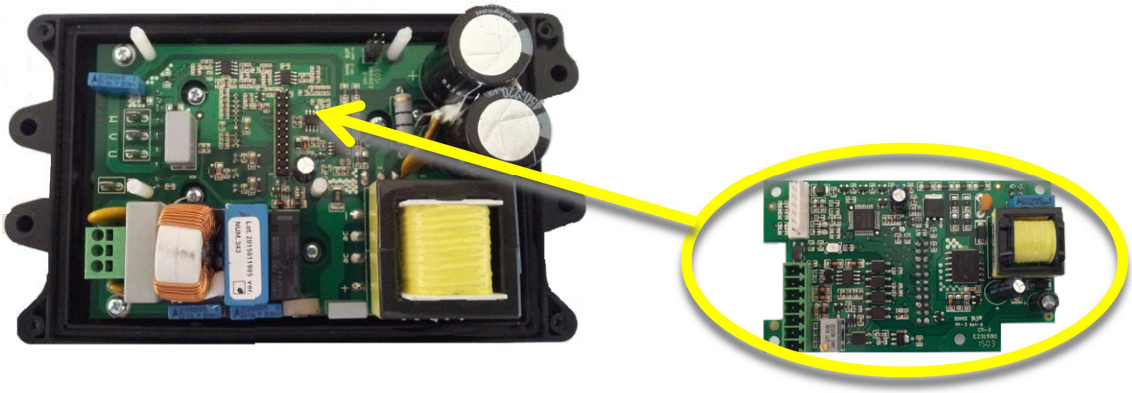


**Fig. 3 – DDMP Driver – POWER BOARD and CONTROL BOARD**

**Fig. 4 – DDMP Driver – Complete view**

**Features**

- Sinusoidal Sensorless control
- Supply voltage 230Vac
- Integrated active Power Factor Controller
- Simple cable connection with cage clamps
- Integrated Modbus RTU interface
- Integrated analogue interface 0-10V
- Tachometric output available

**Performance**

- Closed-loop speed control function
- Soft start
- Adjustable limits and operating mode
- Self-protecting strategies implemented
- High efficiency
- NTC bypassed during operation
- PFC disabled at stop
- 1.1 kW maximum input power
- Power Factor >95%

**Protection**

- Brownout protection
- Missing phase protection
- Short circuit protection
- Overload protection
- Overheat protection
- Impeller blocking protection
- Safe Operating Area (speed, power and current limitation)

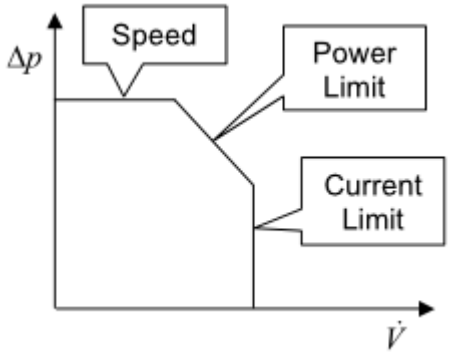



**Fig. 5 – Safe Operating Area**

**Ambient Operating Conditions**

- Protection Class: IP 44
- Humidity Range: 90% non-condensing
- Altitude: if the fan is to be installed at an altitude > 1000m, derating is required.
- Shocks: do not drop the Driver or expose it to sudden shock.
- Vibration: do not install the Driver in an area where it is likely to be exposed to constant vibrations.

## Connection

***Work on the device/system by unqualified personnel or failure to comply with warnings can result in severe personal injury or serious damage to material.***
***Only suitably qualified personnel trained in the set-up, installation, commissioning and operation of the product should carry out work on the device/system. This equipment must be grounded.***
***The following terminals can carry dangerous voltages even if the Driver is inoperative:***

- ***the power supply terminals L, N***
- ***the motor terminals U, V, W***

The DDMP driver connections are shown in figure 6.

- The motor is already connected to the Driver by the operators Nicotra||Gebhardt
- The end user have to connect the power supply cable
- The end user have to connect the command signal to the control board

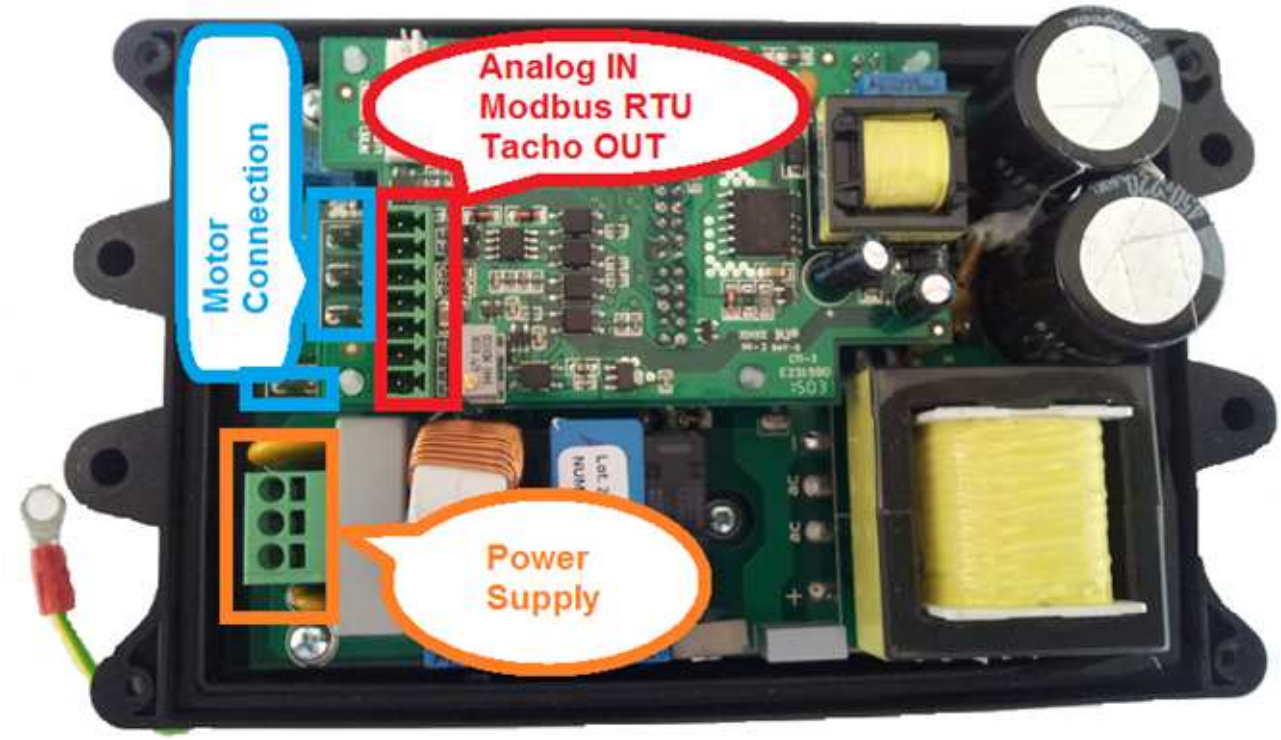



**Fig. 6 – Driver connection terminals**

***The grounding cable/metal strip connecting the Driver to the side plate of the driver must not be disconnected.***

**Power supply connection:**

Single Phase 230V (tolerance ± 10%) frequency 50/60Hz (Fig. 7)

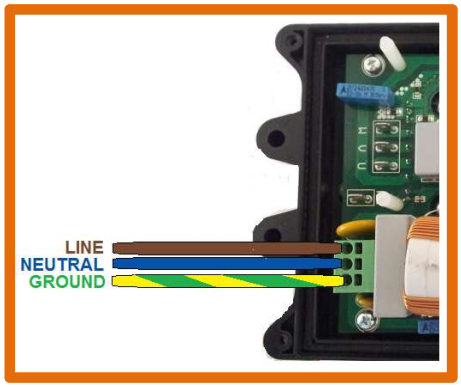



**Fig. 7 – Driver – POWER SUPPLY connection**

**Control Board connection:**

As default the Driver is programmed for an analog input command of 0-10V (Fig. 8).
The analog input can accept also a PWM signal with f>1kHz.

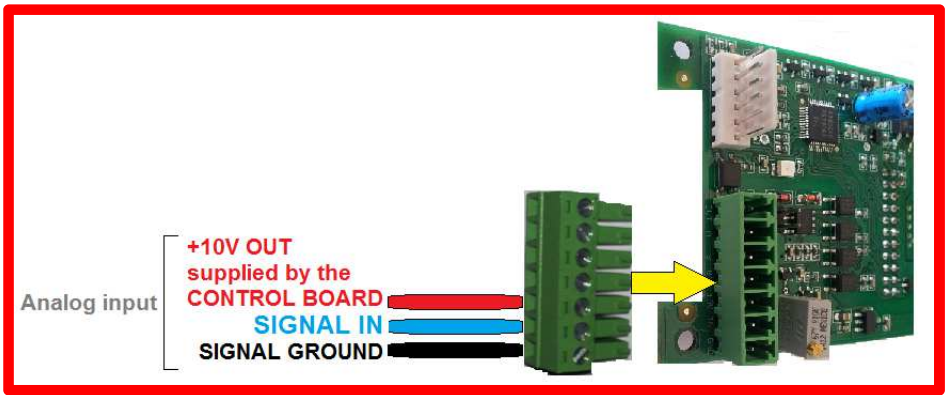



**Fig. 8 – Driver – CONTROL BOARD analog connection**

In figure 9 is shown the Modbus connection diagram.

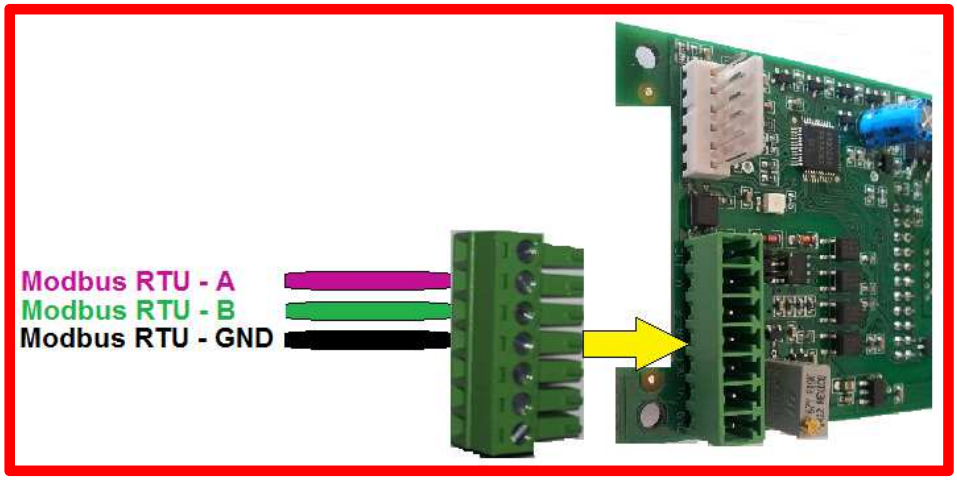
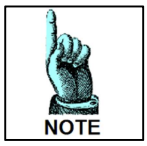



**Fig.9 – Driver – CONTROL BOARD modbus connection**


***Don't use devices having the signal GND connected to the NEUTRAL cable of the power supply. The driver may be damaged or not functioning properly.***




***To set the speed through the Modbus protocol is necessary to set a dedicated register (Input Type – HOLDING REGISTER 34 see " Modbus communication" paragraph )***

In figure 10 is shown how to connect the tachometric output.

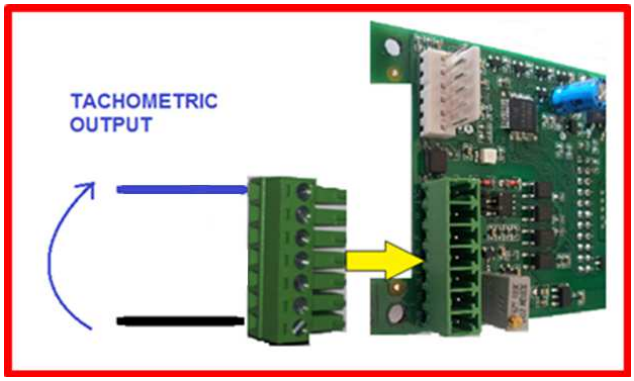
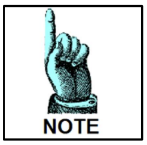



**Fig.10 – Driver – CONTROL BOARD tachometric output connection**

The tachometric output is a 0 to 5V PWM waveform at 1KHz with the following duty cycle:

$$Duty\ Cycle\ (Speed) = \begin{cases} 0\%, & 0 \le Speed < Speed_{min} \\ 10\% + \dfrac{90\% \cdot (Speed_{Real} - Speed_{min})}{Speed_{MAX} - Speed_{min}}, & Speed \ge Speed_{min} \end{cases}$$




***Remember that the $Speed_{Real}$ = 0 below $Speed_{min}$***


***The +10V power supply available of the Driver is intended to be used with a potentiometer of minimum 2KOhm.***
***Any different devices connected to it could bring to an undesired functioning of the Driver or the connected device. The absorbed current must be <5mA.***


***Don't reverse the input signal or connect the +10V to signal ground.***
***The Driver could be damaged.***

***Don't apply signals with voltage higher than 10V***
***The Driver could be damaged.***

## Analog Signal Command

The fan speed is proportional to the analog input voltage and the relationship is shown in figure 11.

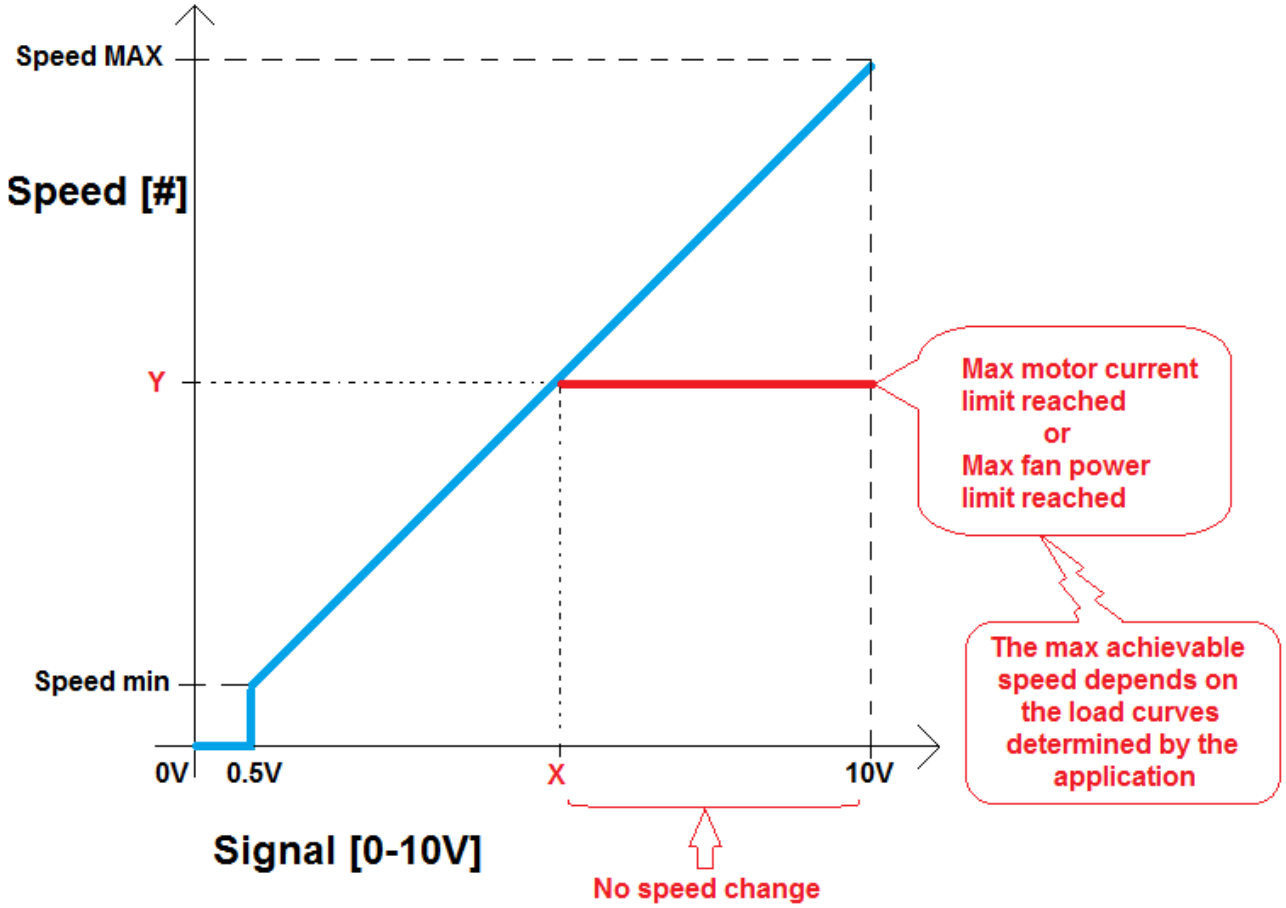



**Fig.11 – Analog signal-Speed relationship**

The MAX and min speed default values changes in function of the fan sizes .
In the table 1 there are all the default values of actual DDMP series.

WARNING

***The MAX and min speed values are changeable via Modbus, setting the HOLDING REGISTER 1 and 2 that are MIN RPM and MAX RPM.***
***Don't set values outside the minimum and maximum RPM default value indicated in the table 2 or possible fan wheel explosion or motor failures may occur (see " Modbus communication" paragraph).***

NOTE

***A typical problem related to the fan speed is the resistances selection.***
***Here in the following a simple procedure for calculating them.***

1) Find the **Voltage$_{(Required)}$ = $V_{Req}$** for achieving the **Speed$_{(Desired)}$** using the diagram Signal/Speed of figure 11.

$$V_{Req} = \frac{Speed_{Desired} - Speed_{min}}{Speed_{MAX} - Speed_{min}} \cdot 9.5V + 0.5V$$

2) Reminding that $Potentiometer\ value = Pot_{Val} = R_1 + R_2 \geq 2KOhm$
And that the analog **Input Impedance = $Z_{in}$ =** 20kOhm

$$V_{Req} = \frac{200K \cdot R_2}{Pot_{Val} \cdot (20K + R_2) - R_2^2}$$

$$R_2 = \frac{Pot_{Val} \cdot V_{Req} - 200K + \sqrt{(200K - V_{Req} \cdot Pot_{Val})^2 + 80K \cdot V_{req}^2 \cdot Pot_{Val}}}{2 \cdot V_{Req}}$$

In figure 12 is shown the behavior of the analog voltage signal increasing the potentiometer value.

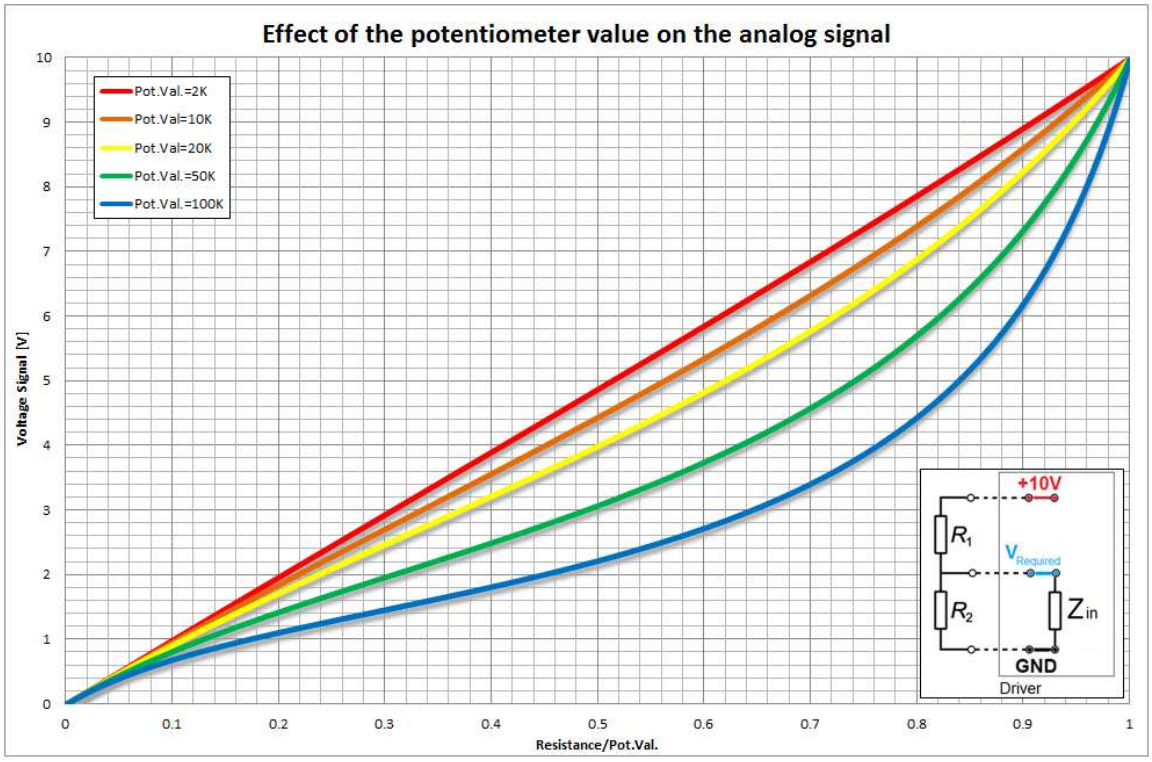



**Fig.12 – Effect of the potentiometer value on the analog signal**

3) With more fans regulated through the same potentiometer the previous formula becomes:

$$V_{Req} = \frac{200K \cdot R_2}{Pot_{Val} \cdot (20K + NR_2) - NR_2^2}$$

In figure 13 is shown the behavior of N fans installed din parallel.

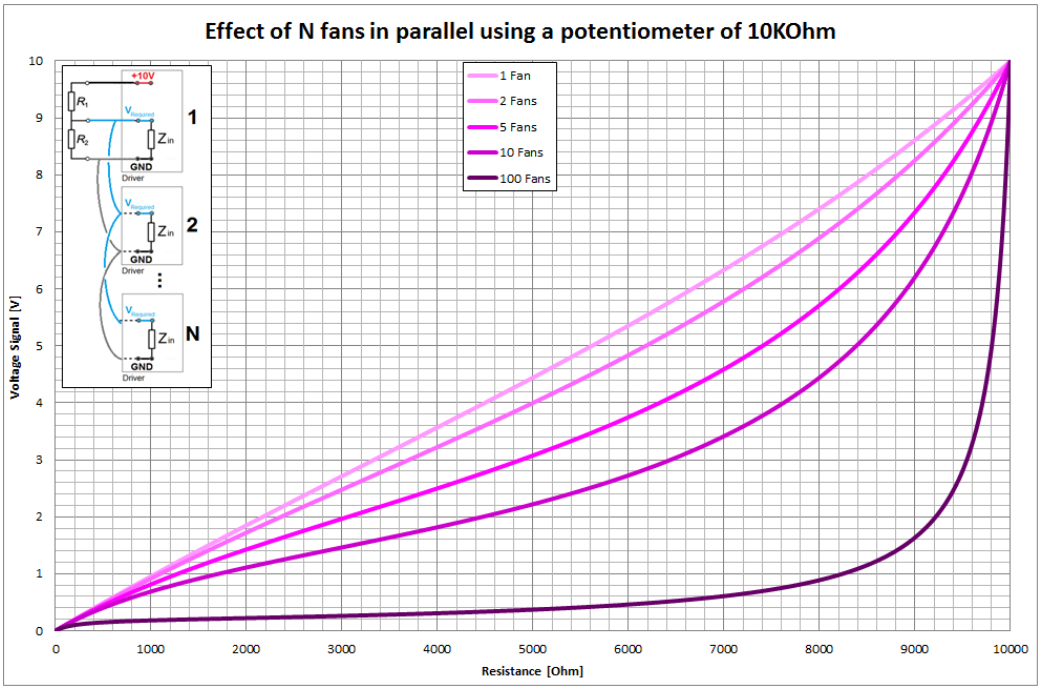



**Fig.13 – Effect of N fans in parallel**

## Fan performance curve description

The DDMP fans are tested with an installation type "B": FREE INLET – DUCTED OUTLET.
In Fig. 14 is shown how the performances are affected by changing the fan speed and the fan load.

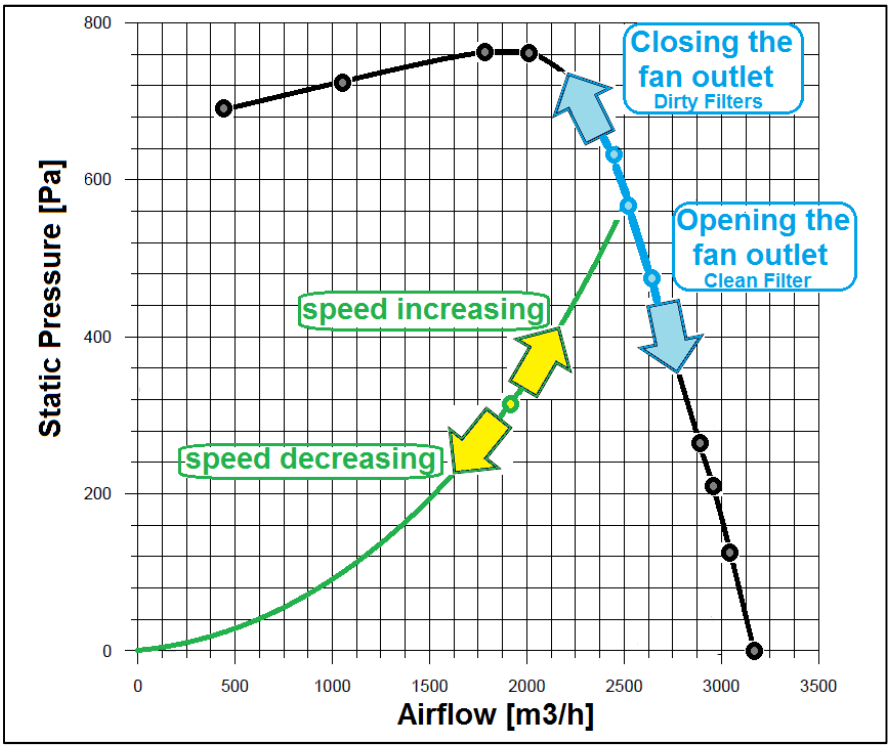



**Fig.14 – Fan behavior by changing speed or load**

In figure 15 is shown an example of DDMP performance curve using the Driver with default setting (without changing the MAX and min speed values into the modbus register number 1 and 2).
In the indicated working point the correct analog voltage signal is 7V, because the Driver automatically limits the performance in order to make the fan work in a safe operating area (see. Fig.5 at page 7).
Therefore even applying a voltage signal of 10V the speed of the fan doesn't change until the analog signal goes below 7V.

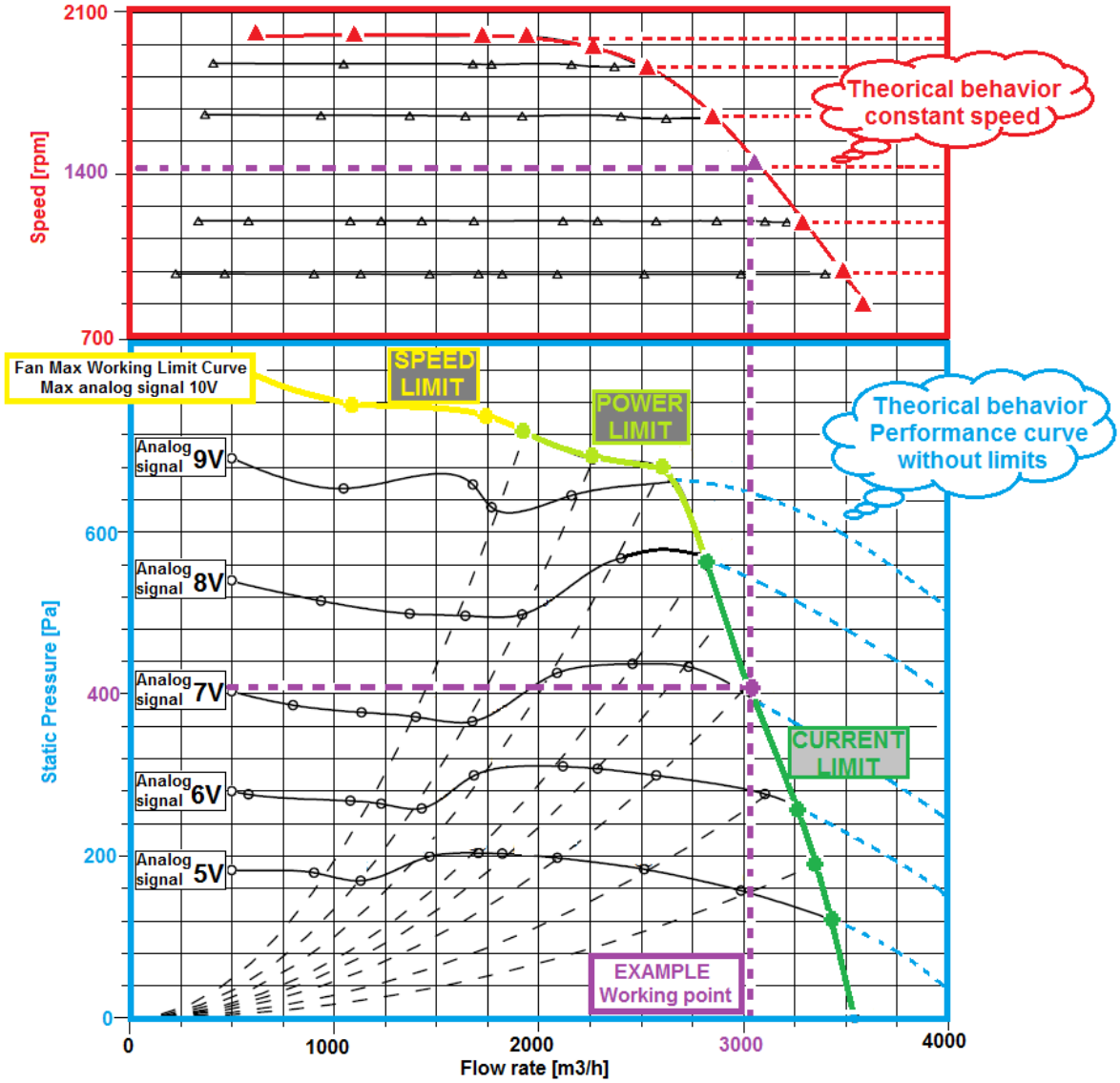



**Fig.15 – Performance curve explanation – Example DDMP 9/9**

## Analog signal PARALLEL

It is possible to have two fans running at the same speed by applying the same analog signal.
In figure 16 is shown how to make the connection by using a potentiometer.

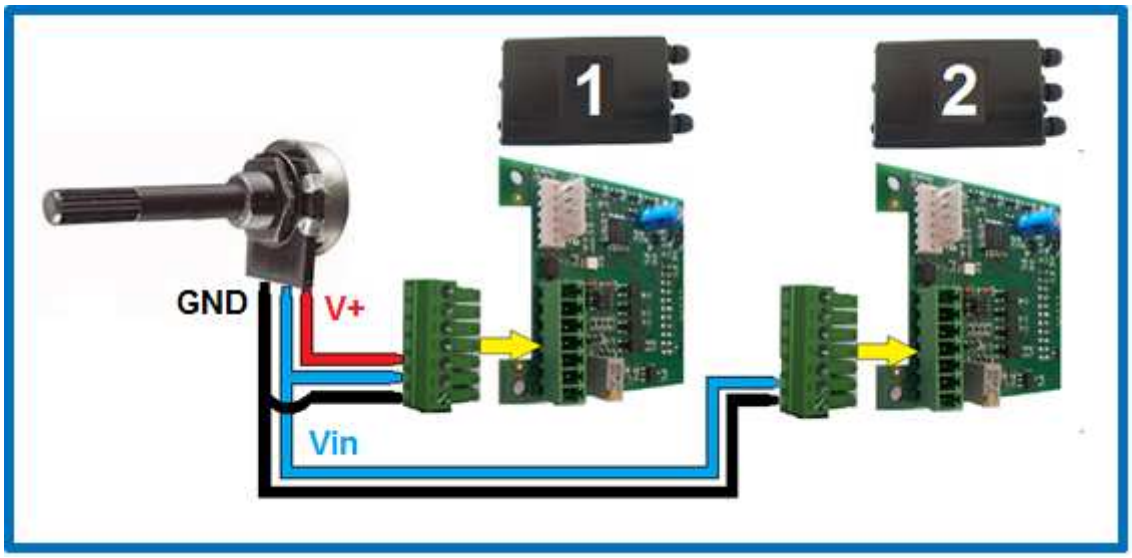



**Fig.16 – SPEED CONTROL - PARALLEL Connection**

CAUTION

***If two or more fans are put in the same compartment it is important that they start at the same time, otherwise the first fan running forces the other to run in backward rotation.***
***The DDMP fans are able to start with a low backward rotation (speed < 200rpm), but they stops if the backward rotation is higher.***
***With the signal parallel this problem can be avoided.***

## Nicotra||Gebhardt Potentiometer

Nicotra||Gebhardt can supply a dedicated potentiometer: REGPOT code 143138 In figure 17 is shown the connection diagrams (with stop function o without).

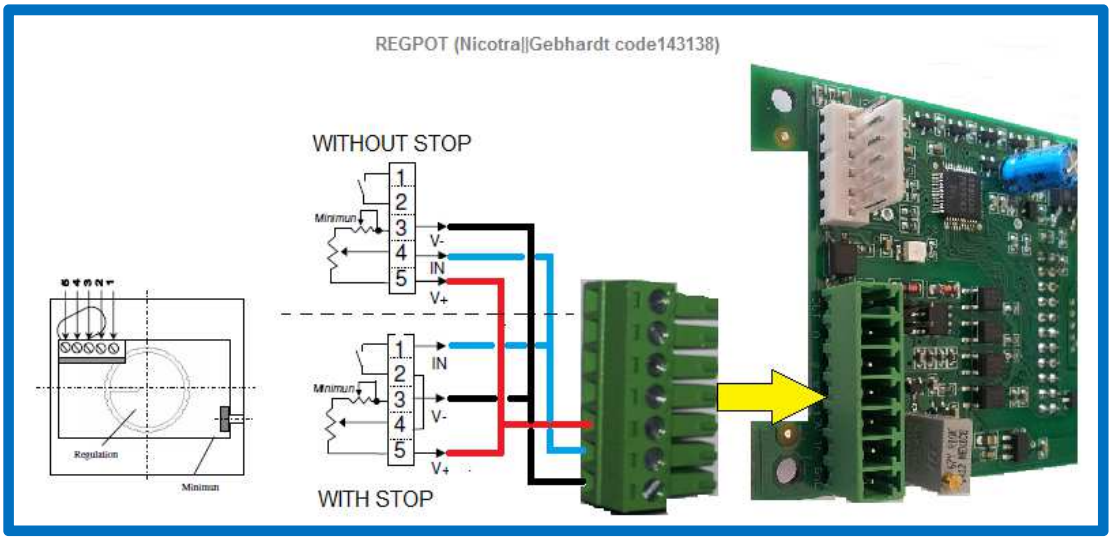



**Fig.17 – Nicotra||Gebhardt potentiometer -REGPOT**

## Constant Airflow

The constant airflow mode is available by setting the Modbus Holding register parameter number 39 "CONSTANT AIRFLOW" at the desired value comprised between min and max defined by Nicotra||Gebhardt (see table 2 and 3).
It is also possible to set the Constant Airflow through an analog signal by setting the Modbus Holding register parameter number 34 "INPUT TYPE" at value 4.

In figure 18 it is shown the relationship between the signal and the constant airflows.

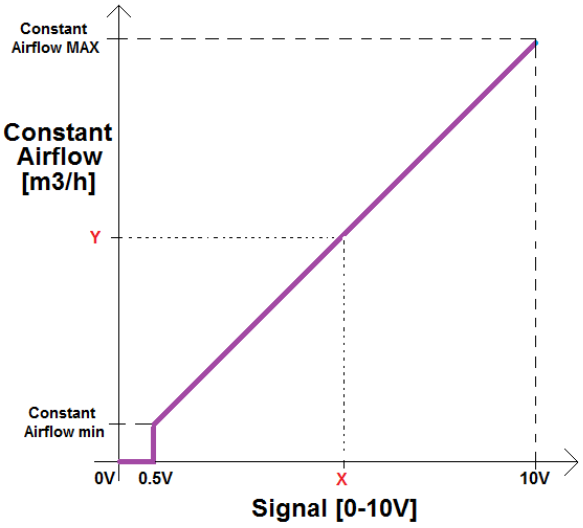



**Fig. 18 – Analog Signal-Constant Airflow relationship**

NOTE

***The max resolution from on constant airflow to another is +/-50m3/h.***
***The max precision guaranteed is SET AIRFLOW +/- 100 m3/h***
***In the instability areas typical of some fan sizes the constant airflow precision can't be guaranteed. It's anyway suggested to work outside these areas.***

## MASTER/SLAVE functioning

A master and slave configuration is possible by setting the MASTER both in Constant Airflow mode or Speed Control and the SLAVE in Speed Control mode only.
The SLAVE Modbus Holding Register number 34 "INPUT TYPE" must be set at value= 3 (see Modbus communication paragraph) and in figure 19 is shown the connection diagram.

<u>The Holding Register 46 = configuration of the OUTPUT as Tachometric or Alarm must be set at 0.</u>

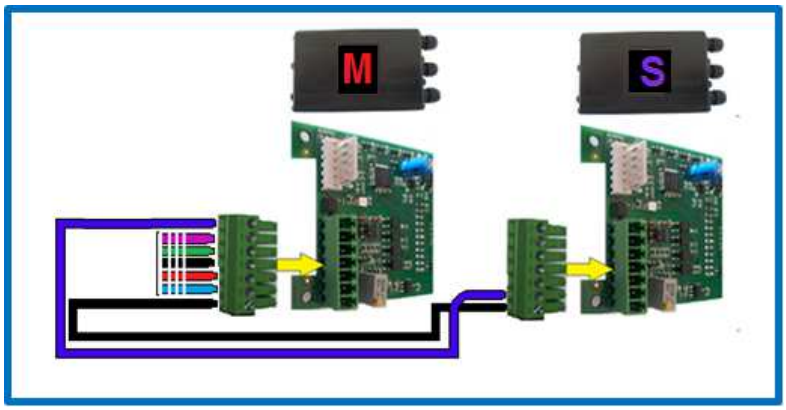



**Fig. 19 – MASTER/SLAVE connection**

## Analog Input scaled for a signal of 0-5V

Using the Slave configuration ("Input Type" register = 3) it is possible to drive a fan at its max speed using a signal 0-5V, without changing the max speed register configuration.

## Constant Airflow curve example

In figure 20 are shown 4 constant airflow curves randomly chosen.

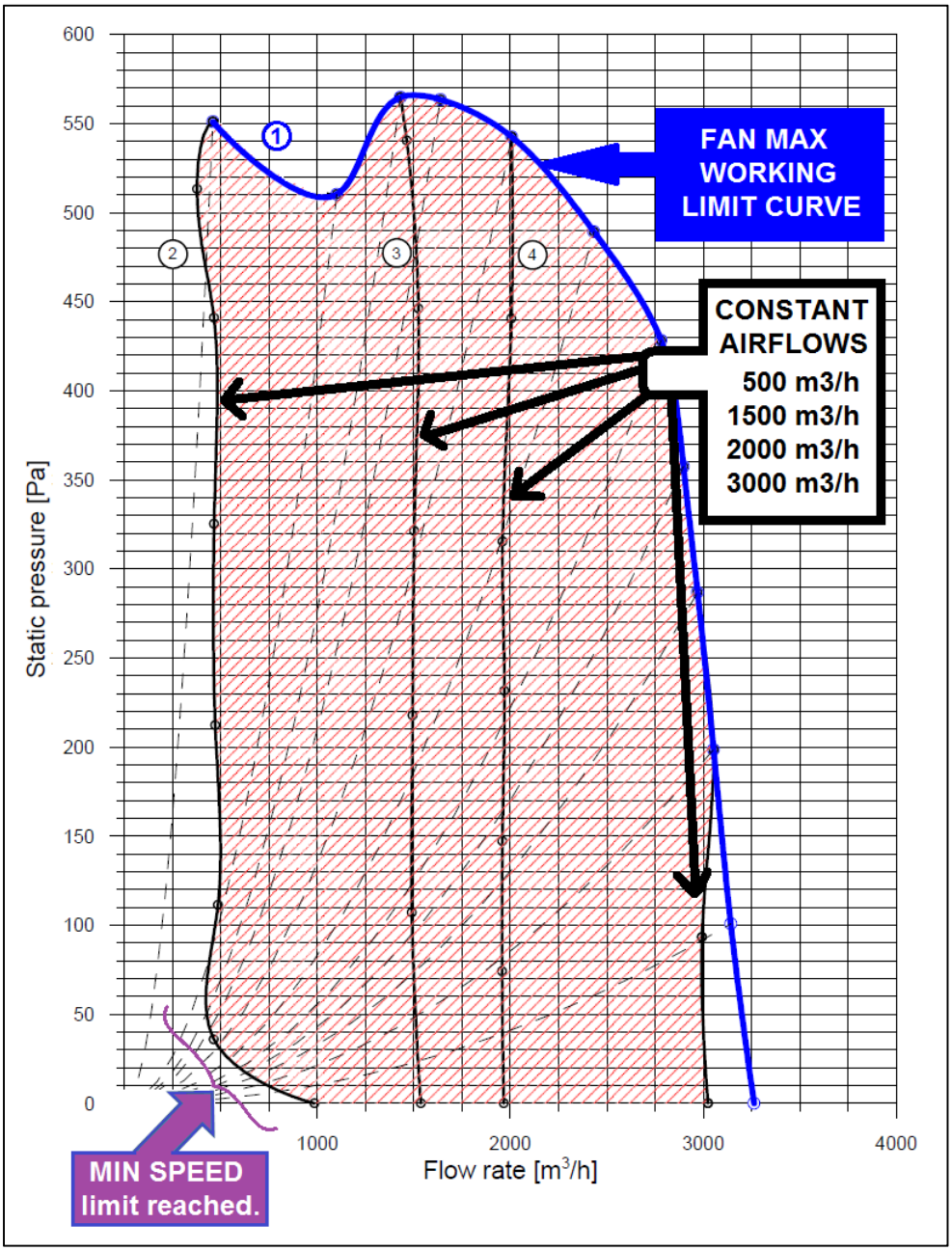



**Fig. 20 – Constant Airflow Example**

CAUTION

***It is possible to modify the max and min constant airflow values by modifying the Modbus parameters in the holding register 42 and 43. .***
***Setting the Constant Airflow max value above and the min value below the default values, the constant airflow is no more guaranteed.***

## Choosing the right fan size

Other important aspects than the fan performance when there are the fan noise and the fan efficiency.

### Fan Noise

NOTE

***In figure 21 is shown the indicative distribution of the Sound Pressure Level of a DDMP model .***
***The DDMP fans can reach high speed compared to the std. AC fans, therefore it's important to evaluate the speed at the required performance to avoid noise problems***

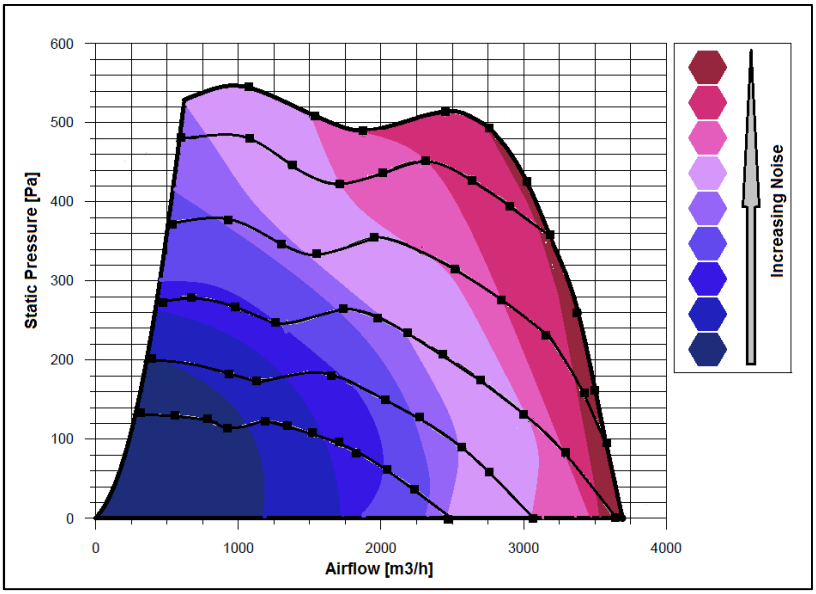



**Fig.21 – DDMP Noise distribution – Sound Pressure Level – Example DDMP 7/9**

### Fan Efficiency

In figure 22 is shown the behavior of the Total Efficiency of a DDMP fan changing the speed (in the example the size 7/7).

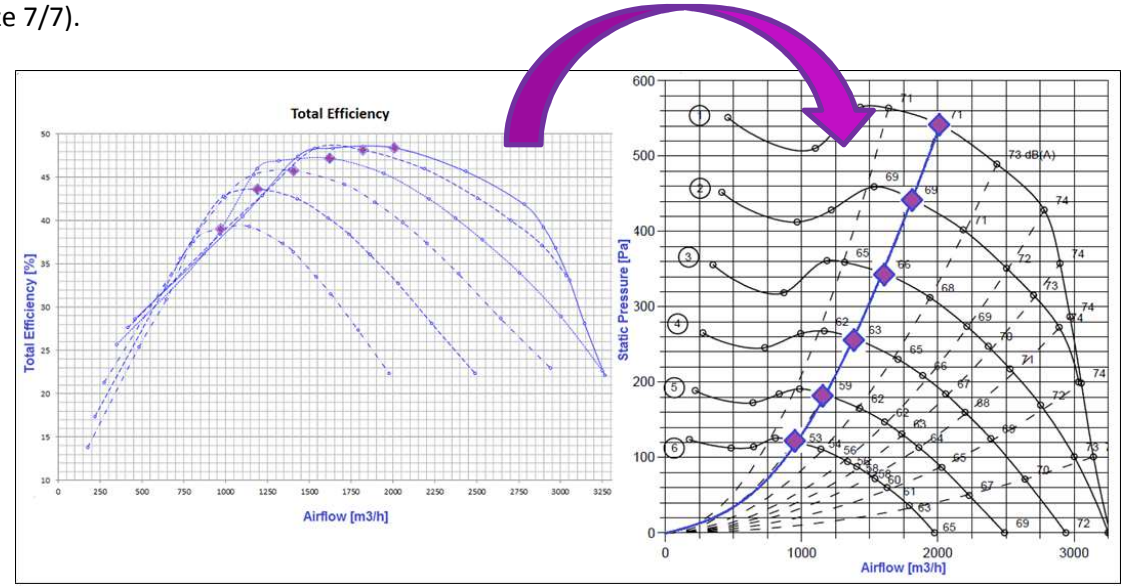


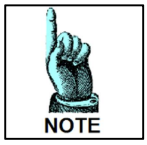

**Fig.22 – DDMP Efficiency behavior – Example DDMP 7/7**

## Driver Overheating: DERATING

When the temperature of the Driver components overtake a fixed threshold of 75°C the Driver automatically reduces the performance in order to decrease the heating.
If it is not possible to reach a steady thermal equilibrium, the Driver shuts down.
The protection acts limiting the current to the motor .

## Motor Overheating: THERMAL PROTECTOR

The motor is protected through a Thermal Protector.
If the motor temperature is too high the thermal protector open one phase and the Driver recognize the error and it stops the fan (see the Alarm Handling chapter).




***The Motor Winding temperature and the Driver derating are dependent on the fan size and on the fan working point.***
***Therefore it is possible that the fan could work at 50°C without a performance limitation***

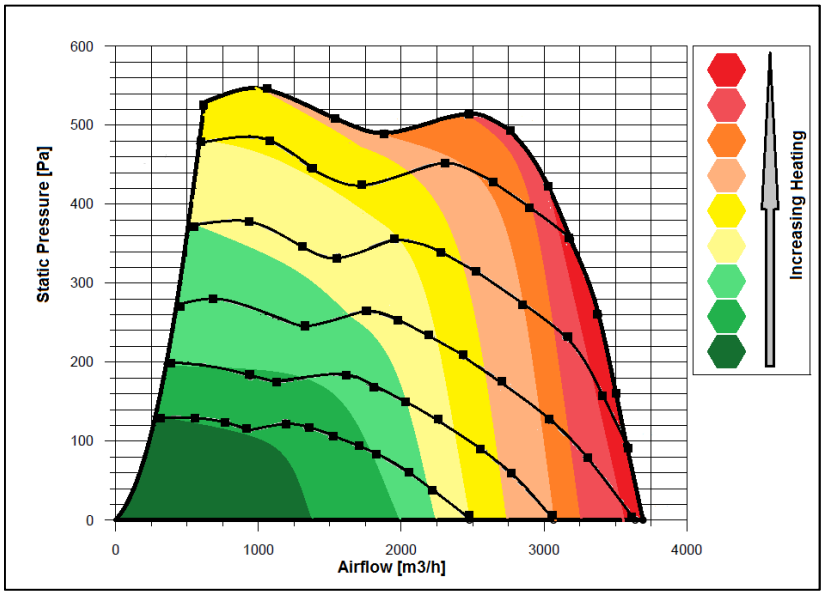



**Fig.23 – DDMP thermal behavior – Example DDMP 7/9**


***The Driver and motor areas rated for operating in a temperature range between -20°C and +40°C.***
***The derating is tested and guaranteed from +40°C to +50°C .***
***Higher temperatures could damage the motor winding or the performance could be strongly reduced.***

## Modbus Communication

**Protocol interface:** MODBUS RTU with RS485
**Baud rate:** 9600 baud
**Parity:** None
**Supported Function:**

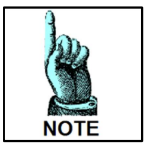
- *03 – Read Output Register*
- *04 – Read Input Register*
- *06 – Write Single Holding Register*
- *16 – Write Multiple Holding Register*

**Holding Register**

In the table 1 are indicated the default Modbus parameters.

| Holding Registers | | | |
|---|---|---|---|
| **Address** | **Name** | **units** | **Description** |
| **1** | **MIN SPEED** | **rpm** | Defines the fan min speed. |
| **2** | **MAX. SPEED** | **rpm** | Defines the fan max speed. |
| **7** | **MAX CURRENT** | **mA** | Defines the motor max peak current. |
| **21** | **FIXED SPEED** | **rpm** | Defines a fixed speed and allows the fan running without setting the register 66 or requiring an analog signal |
| **34** | **INPUT TYPE** | **Adim** | This parameter identifies the input command for driving the fan:<br>Value = 0 → the speed is set through Modbus by setting the register 66 (Change speed)<br>***(The speed reference is lost once the fan is powered off)***<br>Value = 1 → the speed is set through the analog inputs<br>Value = 2 → the speed is set through Modbus by setting the register 21 (FIXED SPEED)<br>***(The fan start always at the fix speed defined even if powered off)***<br>Value = 3 → the fan works in slave mode driven by analog input signal.<br>***(see MASTER/SLAVE mode in Constant Airflow Paragraph)***<br>Value = 4 → the fan works in constant airflow mode driven by analog input signal.<br>***(between min and max constant airflow values)*** |
| **36** | **MAX POWER** | **Watts** | Defines the Driver max power out. |
| **39** | **CONSTANT AIRFLOW** | **m3/h** | Defines a fixed airflow and allows the fan running without an analog input signal. |
| **42** | **MIN AIRFLOW** | **m3/h** | Defines the fan min settable Constant Airflow. |
| **43** | **MAX AIFLOW** | **m3/h** | Defines the fan max settable Constant Airflow. |
| **44** | **FAN MODEL** | **Adim** | Defines the fan sizes for the Constant Airflow application. |
| **45** | **MODBUS ADDRESS** | **Adim** | Configurable Modbus Address (default value = 1) |
| **46** | **ALARM/TACHO MODE** | **Adim** | Value 0 → Tachometric<br>Value 1 → Alarm |
| **66** | **SET SPEED** | **Adim.** | Defines the actual speed |

**Table 1 – Holding Register description**



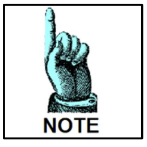

***Possible modes by setting the INPUT TYPE mode at value 0.***

- ***CONSTANT AIRFLOW:***

***insert the desired value into the holding register 39 CONSTANT AIRFLOW. The value into the holding register 66 will be ignored.***

- ***SPEED CONTROL:***

***The value of the holding register 39 CONSTANT AIRFLOW must be put at 0 m3/h***
***The fan doesn't stop and keeps the last calculated speed even the register 66 has stored a different value. To change the fan speed is necessary to set another speed value.***




***Restore the default values and put the register 66 SET SPEED=0 before changing the INPUT TYPE register***

***Do NOT Change the register 66 = SET SPEED when the fan is not set for MODBUS and for SPEED CONTROL application .***

## Default Values

In table 2 are indicated all the available Modbus parameters, the purpose is to guarantee a restoring

**RED REGISTERS** are not modifiable.

**ORANGE REGISTER** are modifiable but only by Nicotra||Gebhardt technicians

**YELLOW REGISTER** are modifiable by the end user, BUT respecting the limits indicated in the manual.

**GREEN REGISTER** are modifiable by the end user.

| Holding Registers | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Addr. | Name | Units | 7/7T | 7/7 | 7/9 | 8/7T | 9/7 | 8/9T | 225/240 | 9/9 | 10/8 | 10/10 | Access |
| 0 | Special | Adim. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Warning |
| 1 | Min. RPM | rpm | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 400 | Yes |
| 2 | Max. RPM | rpm | 3000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | Yes |
| 3 | Acceleration | rpm/s | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | No |
| 4 | Deceleration | rpm/s | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | No |
| 5 | Pole couples | Couples | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | No |
| 6 | Startup Current | m A | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | Warning |
| 7 | Max. Current | m A | 4500 | 4500 | 4500 | 4500 | 4500 | 4500 | 4500 | 4500 | 5500 | 5500 | Yes |
| 8 | Startor Resistance | Ohm/100 | 109 | 450 | 450 | 450 | 450 | 450 | 450 | 450 | 135 | 135 | No |
| 9 | Synch. Inductance | H/10000 | 24 | 133 | 133 | 133 | 133 | 133 | 133 | 133 | 100 | 100 | No |
| 10 | P.M. Flux | Wb/10000 | 1654 | 2515 | 2515 | 2515 | 2515 | 2515 | 2515 | 2515 | 2883 | 2883 | No |
| 11 | Current Kp | Adim. | 627 | 1080 | 1080 | 1080 | 1080 | 1080 | 1080 | 1080 | 605 | 605 | No |
| 12 | Current Ki | Adim. | 703 | 1270 | 1270 | 1270 | 1270 | 1270 | 1270 | 1270 | 444 | 444 | No |
| 13 | Speed Kp | Adim. | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | Warning |
| 14 | Speed Ki | Adim. | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 100 | 100 | Warning |
| 15 | Flux fb. Gain | Adim. | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | No |
| 16 | Phase offset | Degrees | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | No |
| 17 | Startup time | s / 100 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | 800 | Warning |
| 18 | Flux ext. Filter tau | s / 100 | 10.00 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | No |
| 19 | Sampling Freq. | Hz | 13600 | 13600 | 13600 | 13600 | 13600 | 13600 | 13600 | 13600 | 13600 | 13600 | No |
| 20 | Freq. Ratio | Hz / Hz | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | No |
| 21 | Fixed speed setting | rpm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Yes |
| 22 | Max. Blocking curr. | mA | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | Warning |
| 23 | Min. Blocking curr. | mA | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 250 | 250 | Warning |
| 24 | Blocking time | s / 100 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | Warning |
| 25 | Alignment current | mA | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 2000 | 2000 | Warning |
| 26 | Alignment time | s / 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 200 | 200 | Warning |
| 27 | Id Fall time | s / 100 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | No |
| 28 | Id ref | mA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | No |
| 29 | Max temp 1 | C° / 10 | 75 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | No |
| 30 | Max temp 2 | C° / 10 | 75 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | 750 | No |
| 31 | Temp Hist. | C° / 10 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | No |
| 32 | Avoid range start | rpm | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | Warning |
| 33 | Avoid range end | rpm | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | Warning |
| 34 | Input type | Adim. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Yes |
| 35 | Stop speed | rpm | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | 20000 | Warning |
| 36 | Maximum Power | W | 1050 | 1050 | 1050 | 1050 | 1050 | 1050 | 1050 | 1050 | 1050 | 1050 | Yes |
| 37 | Power Kp | Adim. | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | No |
| 38 | Power Ki | Adim. | 14000 | 14000 | 14000 | 14000 | 14000 | 14000 | 14000 | 14000 | 14000 | 14000 | No |
| 39 | Constant Airflow | m^3/h | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Yes |
| 40 | Kp Flow | Adim. | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | Warning |
| 41 | Ki Flow | Adim. | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | 4000 | Warning |
| 42 | Min Airflow | m^3/h | 1000 | 500 | 1000 | 750 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | Yes |
| 43 | Max Airflow | m^3/h | 1950 | 3000 | 3500 | 2750 | 3000 | 3250 | 3250 | 3250 | 3750 | 4000 | Yes |
| 44 | Fan Model | Adim. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Yes |
| 45 | Modbus Address | Adim. | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | Yes |
| 46 | Alarm/Tacho mode | Adim. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Yes |

**Table 2 – Default settings**

## Configurable Modbus Address

The driver has 1 as default address for Modbus communication.
Modifying the Holding Register 45 is possible to have a daisy chain communication between several fans.
The max number of devices that can be differently addressed is 255.

All devices will reply also to the address 1 in addition to other set values.
This presents two main advantages:

- If the address of a driver is unknown it is possible to determine it by powering only one driver each time though the address 1.
- If several inverters are connected to the same bus, all can be stopped or set at the same speed by sending one command to the address 1.

## Fan Limits

In the table 3 are indicated the fan limits: fan min and max speed, motor max current and Driver max absorbed power.

| FAN LIMITS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SIZE | Value in REG 44 | Driver code | Motor Code | Min speed [rpm] | Max Speed [rpm] | Min Const. Airflow [m3/h] | Max Const. Airflow [m3/h] | Max Current [mA] | Max power [W] |
| NONE | 0 | - | - | - | - | - | - | - | - |
| DDMP 7/7 Tight | 1 | 1431A5 | 1416A3 | 400 | 3000 | 1000 | 1950 | 4500 | 1050 |
| DDMP 7/7 | 2 | 1431A5 | 1416A0 | 400 | 2000 | 500 | 3000 | 4500 | 1050 |
| DDMP 7/9 | 3 | 1431A5 | 1416A1 | 400 | 2000 | 1000 | 3500 | 4500 | 1050 |
| DDMP 8/7 Tight | 4 | 1431A5 | 1416A0 | 400 | 2000 | 750 | 2750 | 4500 | 1050 |
| DDMP 9/7 | 5 | 1431A5 | 1416A0 | 400 | 2000 | 1000 | 3000 | 4500 | 1050 |
| DDMP 8/9 Tight | 6 | 1431A5 | 1416A1 | 400 | 2000 | 1000 | 3250 | 4500 | 1050 |
| DDMP 9/9 | 7 | 1431A5 | 1416A1 | 400 | 2000 | 1000 | 3250 | 4500 | 1050 |
| DDMP 225/240 | 8 | 1431A5 | 1416A1 | 400 | 2000 | 1000 | 3250 | 4500 | 1050 |
| DDMP 10/8 | 9 | 1431A5 | 1416A2 | 400 | 2000 | 1000 | 3750 | 5500 | 1050 |
| DDMP 10/10 | 10 | 1431A5 | 1416A2 | 400 | 2000 | 1000 | 4000 | 5500 | 1050 |

**Table 3 – DDMP speed limits**

**Changing the speed, current and power limits:**


***DON'T SET VALUES OUTSIDE THE LIMITS INDICATED IN TABLE 2.***
***The fan components could be damaged and dangerous condition for the user may occur.***
***(example: wheel explosion if the max speed register is set for a too high speed)***

### *REDUCING THE MAX SPEED*

In figure 24 is shown the behavior of the fan by reducing the MAX SPEED through the modification of the register number 2 into the Modbus Holding Register

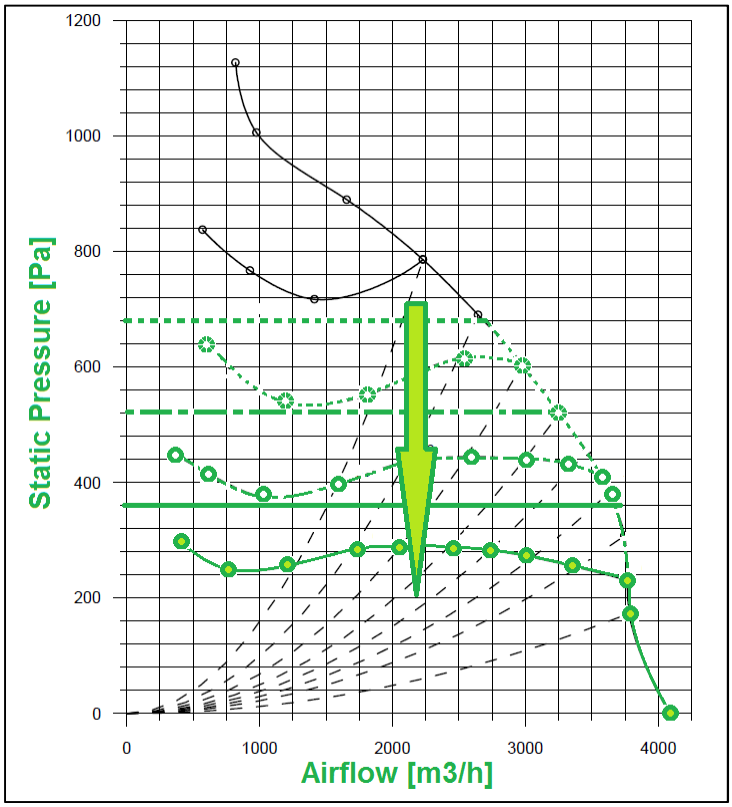



**Fig.24 – DDMP Reducing the MAX SPEED limits – Example DDMP 10/8 (see also fig. 13)**

### *REDUCING THE MAX POWER*

In figure 25 is shown the behavior of the fan by reducing the MAX POWER through the modification of the register number 36 into the Modbus Holding Register

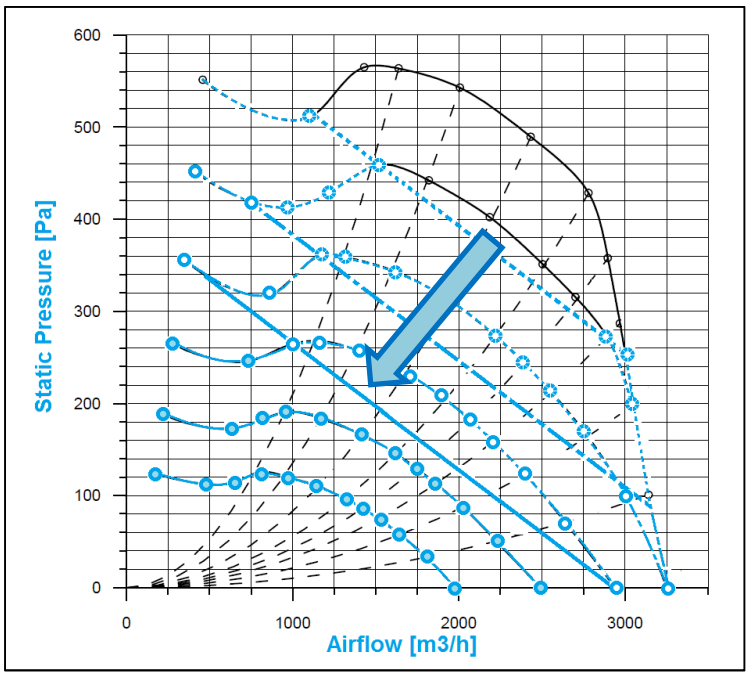



**Fig.25 – DDMP Reducing the MAX POWER limits – Example DDMP 7/7**

***REDUCING THE MAX CURRENT***

In figure 26 is shown the behavior of the fan by reducing the MAX CURRENT through the modification of the register number 7 into the Modbus Holding Register

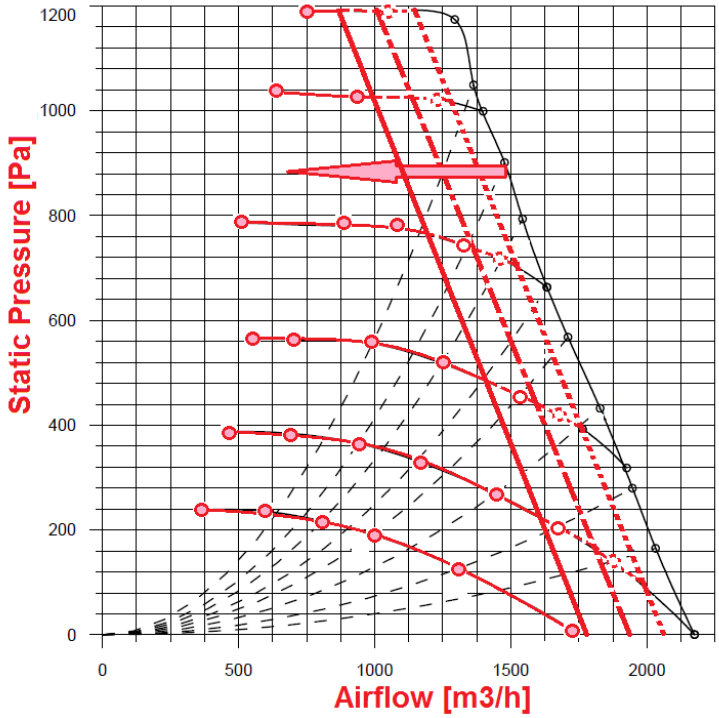



**Fig.26 – DDMP Reducing the MAX CURRENT limits – Example DDMP 7/7 Tight**

**Input Register**

In the table 4 are indicated the most significant Modbus input registers.

| Input Registers | | | |
|---|---|---|---|
| **Address** | **Name** | **units** | **Description** |
| **0** | **Driver Version** | **Adim** | Indicates the version of the driver. |
| **2** | **SPEED REFERENCE** | **rpm** | Indicates the target speed set through the potentiometer or Modbus. |
| **3** | **MEASURED SPEED** | **rpm** | Indicates the real speed of the fan. |
| **10** | **ALARM - 1** | **See table 4** | Indicates the functioning status of the Driver. |
| **12** | **MOTOR CURRENT** | **mA** | Indicates the absorbed current by the motor |
| **14** | **POTENTIOMETER INPUT** | **Volts/10** | Indicates the potentiometer voltage value |
| **15** | **TEMPERATURE** | **Celsius** | Indicates the Driver power module temperature |
| **17** | **ALARM - 2** | **See table 4** | Indicates the functioning status of the Driver. |
| **31** | **ABSORBED POWER** | **W** | Indicates the Driver absorbed Power. |
| **36** | **AIRFLOW REFERENCE** | **m3/h** | Indicates the target Constant Airflow set through the potentiometer or Modbus. |

**Table 4 – Holding Register**

## Modbus USB-RS485 converter

As accessory it's possible to use a Nicotra||Gebhardt USB-RS485 converter code 1431A7(see fig. 27)


**Fig.27 – USB-RS485**

## OFFLINE Programming

It is possible to program the DDMP Driver in an offline mode by using a dedicated cable (Nicotra||Gebhardt code 1431A6).
The connection must be made following the figure 28

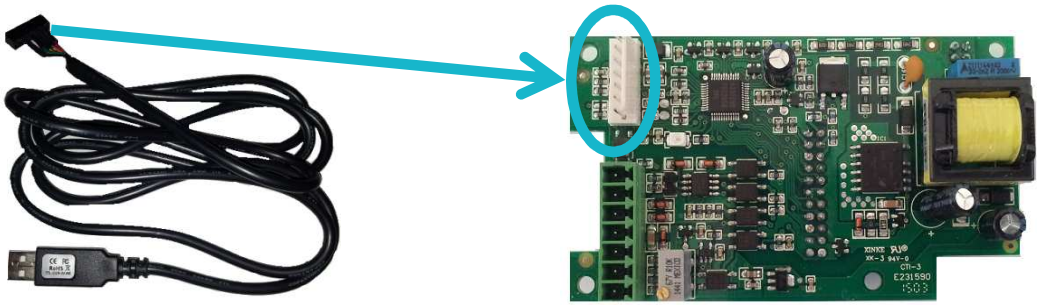


**Fig. 28 – OFFLINE connection**


***During the OFFLINE operation the driver MUST BE DISCONNECTED FROM POWER SUPPLY or could be damaged or destroyed.***

## Alarm Handling

**Monitoring:**

The alarms can be monitored by:

a) Modbus Registers
b) LED blinking (see blinking legend)
c) ON/OFF output (alternative to TACHOMETRIC output. To be configured through parameter 46 in Holding Register). The output is in ON state if an alarm occurs and in OFF state during normal operations.

**Driver actions:**

When an alarm occurs the Driver can have these two possible actions:

1) **AUTO-RESTART =** the Driver tries to restart for 10 times. If the error is still present the Driver stops. To restart the fan, once the problem is corrected, it is necessary to power the Driver OFF for 5 minutes and then power the Driver ON
2) **BLOCKING=** the Driver stops immediately. To restart the fan, once the problem is corrected, it is necessary to power the Driver OFF for 5 minutes and then power the Driver ON

**Modbus Registers and alarm description:**

In table 5 are indicated the possible alarms and the values stored in the related Modbus register 10 and 17.

| Alarm REG 10 | Alarm REG 17 | Description | Actions |
|---|---|---|---|
| 0 | 0 | Normal operation, no errors | NO ACTIONS |
| 1 | 0 | Memory error | BLOCKING |
| 2 | 0 | Short-circuit | BLOCKING |
| 3 | 0 | Loss of synchronism with the motor | AUTO-RESTART |
| 4 | 1 | Input voltage outside range (only with motor stopped) | AUTO-RESTART |
| 4 | 32 | Bus voltage over 430V during operation (instantaneous measurement) | AUTO-RESTART |
| 4 | 33 | Bus voltage below 350V during operation (instantaneous measurement) | AUTO-RESTART |
| 4 | 34 | Input relay not closed | AUTO-RESTART |
| 4 | 49 | Motor cable U disconnected | BLOCKING |
| 4 | 50 | Motor cable V disconnected | BLOCKING |
| 4 | 51 | Motor cable W disconnected | BLOCKING |
| 4 | 113 | Overtemperature | AUTO-RESTART |

**Table 5 – Alarm description and related Modbus addresses**


***An occurring alarm with NO ACTIONS could imply a dangerous functioning anyway.***
***The Driver is NOT protected against a very high power supply voltage.***
***A very low power supply voltage during the motor running could damage Driver***

**LED blinking legend**

In the table 6 is indicated the legend for reading the alarm through the LED present on the Control Board.

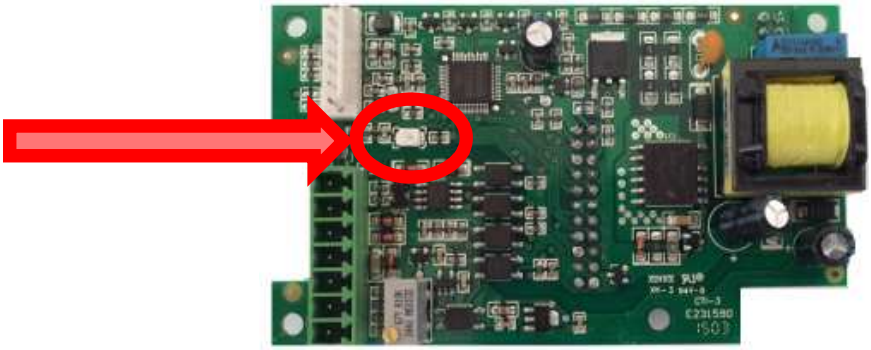


**Fig. 29 – Blinking LED**

| Description | Blinking |
|---|---|
| Normal operation, no errors | 1 Blink/s |
| Memory error | 2 Blink/s |
| Short-circuit | 3 Blink/s |
| Loss of synchronism with the motor | 4 Blink/s |
| Input voltage outside range (only with motor stopped) | 4 Blink/s |
| Bus voltage over 430V during operation (instantaneous measurement) | 4 Blink/s |
| Bus voltage below 350V during operation (instantaneous measurement) | 4 Blink/s |
| Input relay not closed | 4 Blink/s |
| Motor cable U disconnected | 4 Blink/s |
| Motor cable V disconnected | 4 Blink/s |
| Motor cable W disconnected | 4 Blink/s |
| Overtemperature | 4 Blink/s |

**Table 6 – Alarm description – LED Blinking**

In figure 30 is indicated the LED blinking description

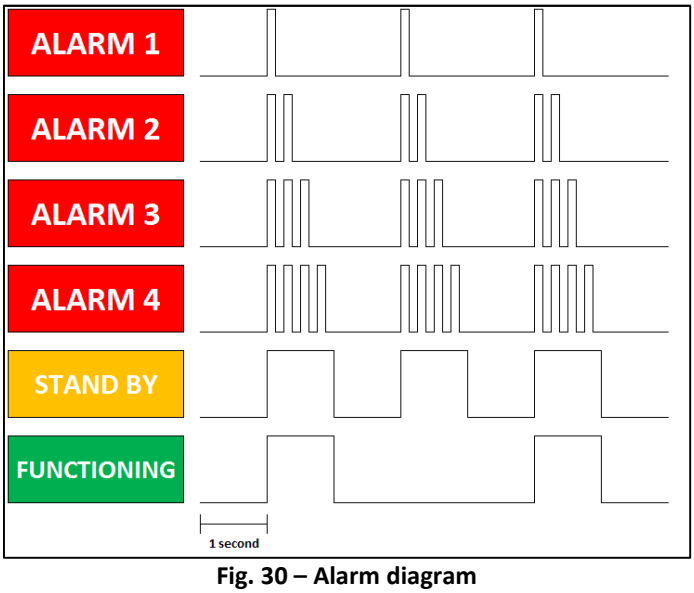



**Fig. 30 – Alarm diagram**

# NOTES