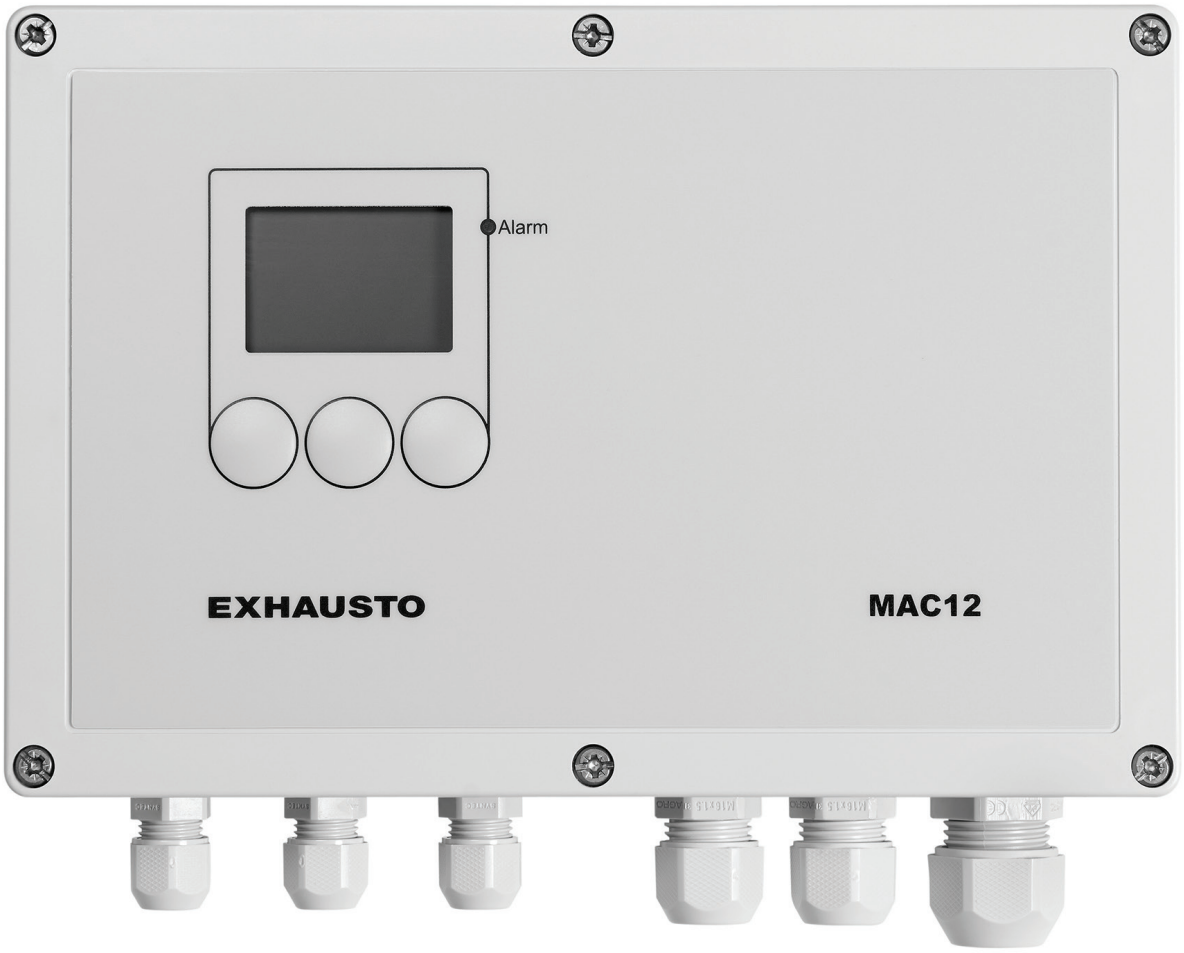
EXHAUSTO

GB

MAC12
-XTP
-MXTP

Constant pressure regulator



Original instructions

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EXHAUSTO

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1. Product information MAC12

Description

MAC12 is an electronic constant pressure regulator that is used for controlling pressure in ventilation systems with ducts and fans. MAC12 can be used with fan motors that are equipped with voltage regulation (MPR),frequency converters (MGE or FC) or up to five EC controllers. MAC12 is used together with MPR for single-phase motors.

Main functions

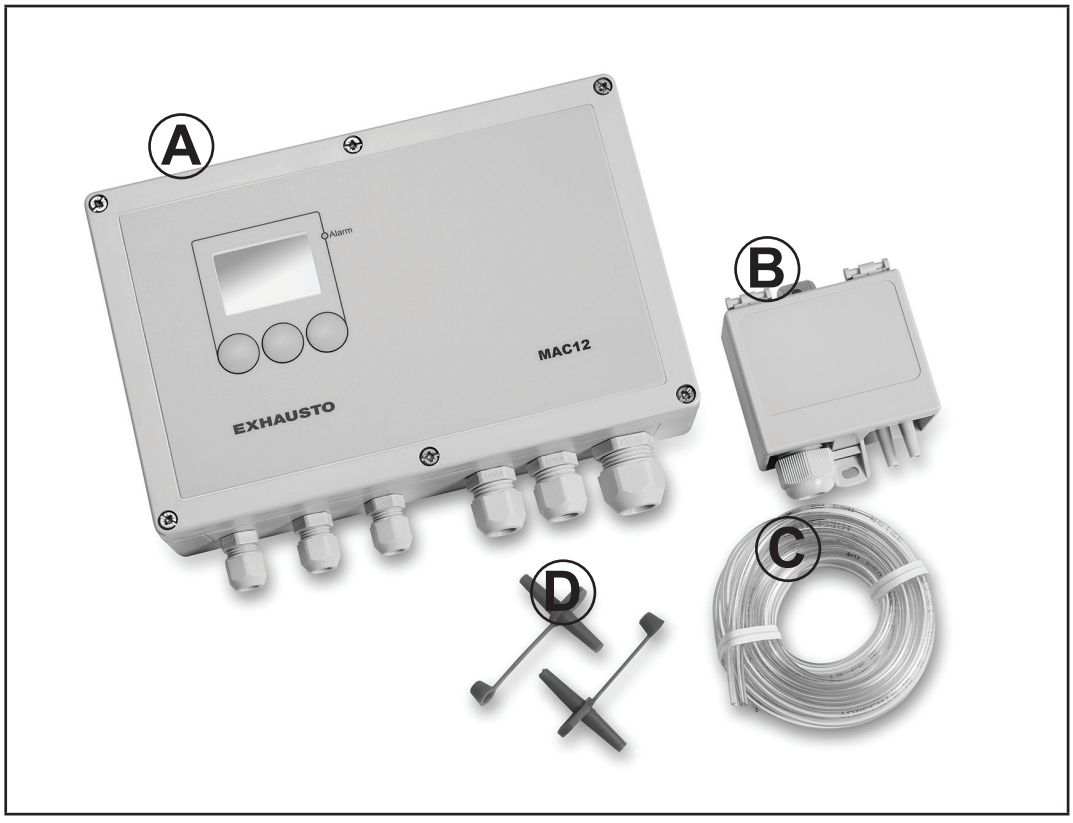
MAC12 has the following main functions:

- 0-10 VDC output and motor relay, which can control a frequency converter or a triac regulator.
- Potential-free alarm output for connecting to BMS or other type of alarm system.
- Three different operating modes with corresponding High, Low and Override Mode
- Start/stop can be controlled by an external signal
- Override Mode can be controlled by an external signal.
- Using a temperature sensor, MAC12 can execute outdoor temp. compensation.
- External modbus interface to BMS and other distributed control systems.
- Internal modbus interface for connecting with EXHAUSTO EC motor control and establishing several duct systems.

1.1 Delivery

The MAC12 delivery consists of the following parts:

	Pos.	Part	Product number
The delivery consist of:	A	Constant pressure regulator	MAC12
	B	Pressure transducer XTP	MAC12XTP / MXTP
	C	2 m hose for pressure transducer	
	D	Sealing plug for pressure transducer	
	E	Product instructions	
Accessories	F	Outdoor air temperature sensor, XTT	XTT



2. Installation

2.1 Fitting

The work must be performed by an authorised electrician, in accordance with locally applicable regulations and legislation.

MAC12 and XTP/MXTP must be fitted on a level and stable surface.

Fitting the MAC12

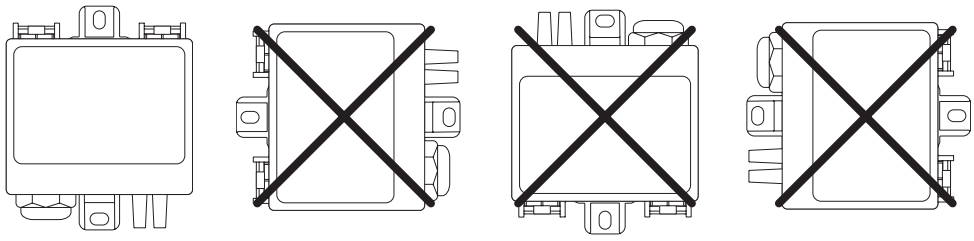
Step	Action
1	Unscrew the front plate and securely screw the MAC12 in the four corner holes, ensuring the MAC12 is facing the correct way with the adapters for the cables facing downwards.
2	Remove sealing plugs where cables will be fed through the cable adapters.
3	Feed the cables through the cable adapters and connect in accordance with the terminal overview in section 2.2 and secure.
4	Refit the front plate.

Fitting XTP

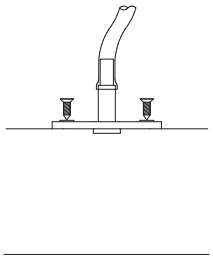
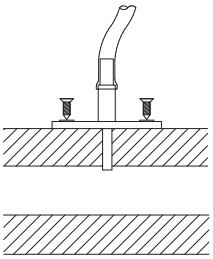
Step	Action
1	Screw XTP securely in the two screw flanges
2	Feed the cables through the cable adapters and connect and secure
3	Fit the air spigot in the ventilation duct in the desired measuring point
4	Connect the air spigot to the minus-spigot on the XTP with the hose piece.
5	If the XTP is fitted in a pressure neutral area, it is necessary to connect the second measuring spigot on the XTP. Otherwise a piece of hose must be connected that goes to a neutral pressure area.

XTP orientation must be correct

The correct orientation of XTP is with the cable adapters facing downwards – to prevent moisture getting inside.



Static pressure measurement in duct

Uninsulated duct	Insulated duct
	
Pressure gauge nipple is fitted directly onto duct. The plastic tube is removed from nipple.	Pressure gauge nipple is placed outside of insulation. Plastic tube insulation thickness is shortened.

Max distance between MAC12 and pressure transducer

MAC12 - XTP: ≤ 80m 3x0.5□
MAC12 - MXTP: ≤ 200m 4x0.5□

Connecting supply voltage

The supply cable and fuses must be dimensioned in accordance with applicable regulations and legislation.

Isolation switch

EXHAUSTO A/S would like you to note that in accordance with The Machinery Directive*, an isolation switch must be permanently installed in the unit.
The isolation switch must

- be lockable or positioned in plain sight in the immediate vicinity of the unit.
- disconnect all poles from the supply voltage - contact distance min. 3 mm in each pole.

The isolation switch is not supplied by EXHAUSTO.

*Please refer to Machinery Directive (98/37/EC) - Appendix 1 - paragraph 1.6.3. "Isolation of energy sources".

2.2 Adjusting the pressure sensors

When MAC12 is set up to regulate one or more ducts, the individual pressure sensors must be adjusted so that the control system can read them.

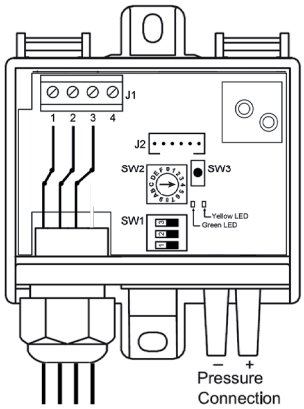
1 duct

For controlling 1 duct, the analog 0-10V pressure sensor XTP is used.
The pressure sensor must be indicated as a 0-10V sensor type in setup, under menu function 64, "Pressure sensor type".

Adjust the pressure sensor with rotary selector SW2 to the pressure range constituting the ventilation unit's normal working range. The pressure range must be the same as in setup under menu function 65 "Pressure sensor range".

Please note!

If the green diode flashes, the current pressure is above or below the selected measurement range. The pressure range must be altered in both XTP and MAC12.



XTP	*SW2 position*
Pressur e range	- SW2
-50..+50 Pa	0=On
0..+100 Pa	1=On
0..+150 Pa	2=On
0..+300 Pa	3=On
0..+500 Pa	4=On
0..+1000 Pa	5=On
0..+1600 Pa	6=On
0..+2500 Pa	7=On

Example: If selector SW2 is set to Pos 4 (0-500 Pa), the 0-500 range must also be selected in setup.

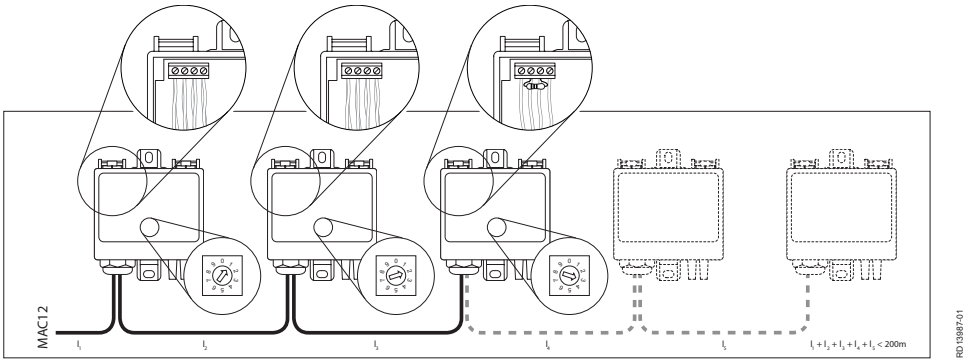
2-5 ducts

For regulating several ducts, Modbus sensor type MXTP is used.

MXTP is connected in series ("daisy-chain"). The first MXTP is connected directly to MAC12. The next MXTP is connected to the previous MXTP, etc.

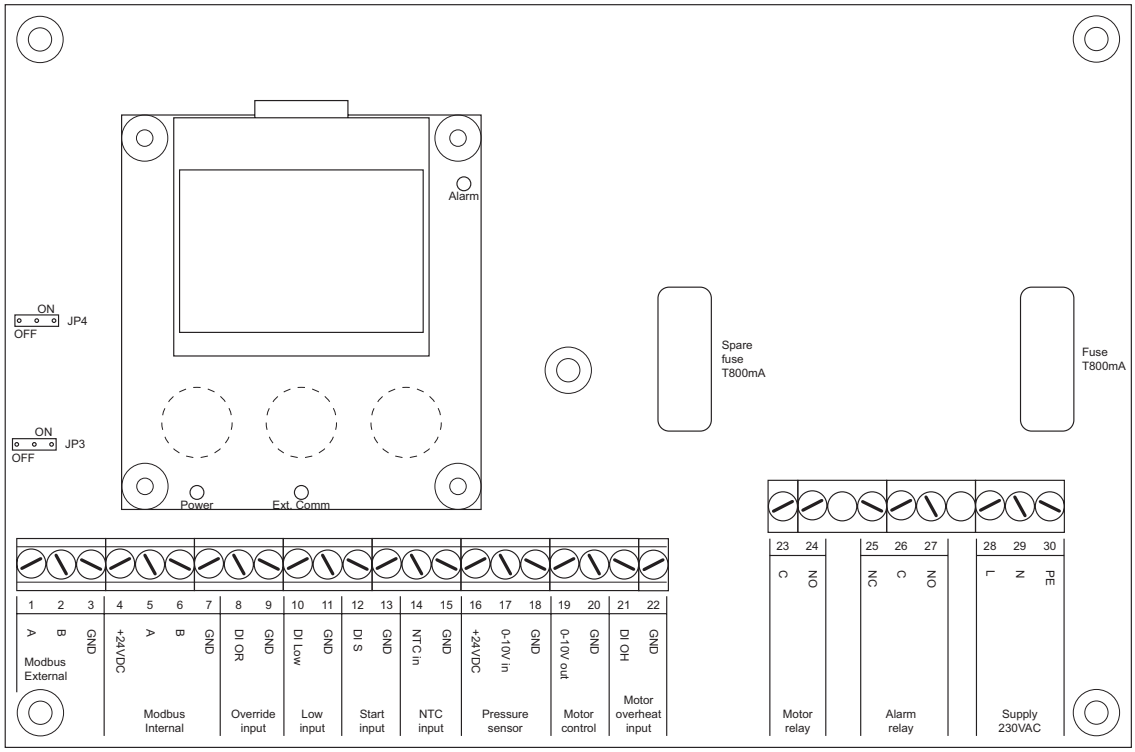
Please note!

ONLY the final MXTP **MUST** have a terminating resistor (120 O) mounted over pins 2 and 3 on the connection terminals; see following example with three connected MXTPs.



The selector is set initially with no. 1 on the first one, no. 2 on the next one, etc.

2.3 Overview drawing



Terminal block

Connection	Description	Terminal no.
Modbus External	External modbus for BMS	1, 2, 3
Modbus Internal	Internal Modbus for MXTP, EC controller	4, 5, 6, 7
Override input	Digital - Override	8, 9
Low input	Digital - Low pressure	10, 11
Start input	Digital - Start	12, 13
NTC input	Temperature sensor	14, 15
Pressure sensor	0-10 VDC input for pressure sensor	16, 17, 18
Motor control	0-10 VDC output for motor control	19, 20
Motor overheat input	Digital - Motor overheating	21, 22
Motor relay	Relay - motor	23, 24
Alarm relay	Relay - alarm	25, 26, 27
Supply 230 VAC	Supply voltage 230 VAC ±10 %, 50 Hz	28, 29, 30

LED

Power (Green) Lit if supply voltage connected.
Not lit if the 24 VDC is short-circuited or overloaded.

Ext. Comms. (Green) Flashes when there is communication on the external modbus.

Alarm (Red) - Lit constantly with an alarm.

Jumpers

JP3 Termination on external modbus (standard value OFF)

JP4 Termination on internal modbus (standard value ON)

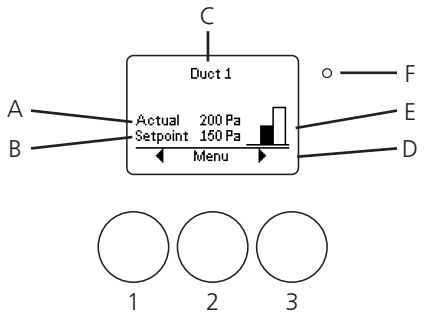
Fuse 1 x T 800 mA Extra fuse supplied. Fuse must comply with IEC60127-1.

3. Menu functions

3.1 User interface

User interface

The user interface consist of a graphical display and three navigation buttons. The display shows the current operating situation. Using an access code, the settings menu can be accessed and the MAC12 parameters can be changed.



Display, operating situation

In operating situation, the operating mode can be changed and settings read - see table:

Position	Explanation
A	Current measured pressure for the selected duct
B	Setpoint for the pressure of the selected duct
C	States the selected duct
D	Function of buttons 1, 2 or 3
E	Current operating mode
F	Alarm LED, lit red in case of alarm Active alarms will be shown on the screen

Buttons

Position	Explanation
1	Left button Used mainly to navigate up through the menu or down in setting value.
2	Centre button Used mainly to select function
3	Right button Used mainly to navigate down through the menu or up in setting value.

3.2 Menu functions

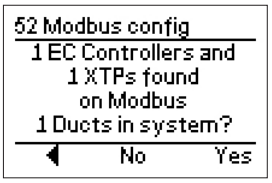
3.2.1 Configuration

Starting up MAC12 for the first time

When starting MAC12 for the first time, you will be guided through a short configuration process. This also applies if the system has been reset to the factory settings.

Use the ▲ and ▼ buttons to select language. Confirm with the *OK* button.

MAC12 now executes an automatic search of Modbus units. When this is finished, the total number of detected EC controllers, XTPs and ducts is shown. If what the system reports agrees with the actual set-up, confirm using the*Yes* button.

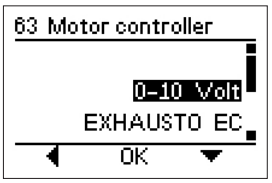


If what the system reports differs from the actual set-up, a manual set-up may be executed by using the *No* button.

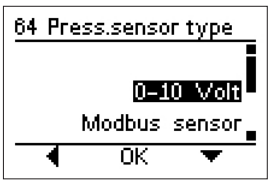
Press ◻ to navigate to the previous menu item.

Single duct.

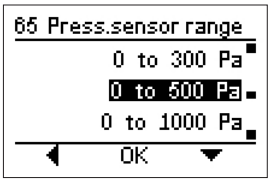
If the system only has a single duct, continue to configure the units that will control the duct. As the first step, select the type of motor controller. If there is no motor controller the EXHAUSTO EC controller should be selected with 0-10 VDC. Use the◻ button to change between options. Press the *OK* button to select the desired motor controller.



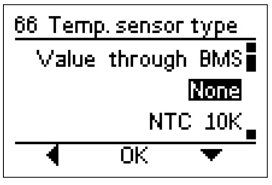
Next, select the type of pressure sensor. Select modbus-based pressure sensor or pressure sensor based on 0-10 VDC. Use the◻ button to change between options. Press the *OK* button to select the desired pressure sensor type.



If the selected pressure sensor is based on 0-10 VDC, the desired pressure range is stated. If a modbus-based pressure sensor is used, this happens automatically. Use the◻ button to change between options. Press the *OK* button to select the desired pressure range.



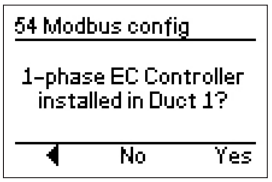
Lastly, state the temperature sensor used.
Two types of NTC sensors can be used. A 10 kΩ or a 22 kΩ NTC. Alternatively, the temperature can be measured via a BMS system. Use the◻ button to change between options. Press the *OK* button to select the desired temperature sensor type.



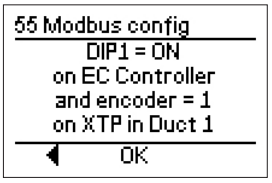
Several ducts

If there are several ducts, it will be necessary to further configure communication with the individual units. The following configuration will be executed once for each duct that is connected.

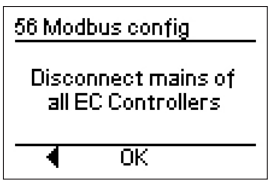
As the first step, select the EC controller. Press the *Yes* button if the EC controller used is single-phase, otherwise press the *No* button.



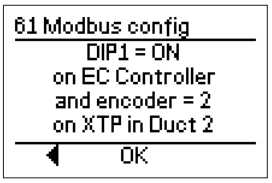
If the EC controller used for the duct is NOT single-phase, the display will show what the settings on the EC controller and the XTP must be for the individual duct. This must be correctly configured before continuing. Press the *OK* button to continue to the next duct.



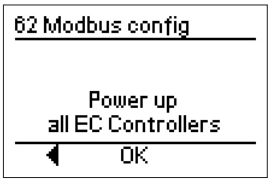
If the EC controller used is single-phase, power MUST be removed from all of the EC controllers before continuing. Press the *OK* button to continue.



The display will now show what the settings on the EC controller and the XTP must be for the individual duct. This must be correctly configured before continuing. Press the *OK* button to continue.



Reconnect power to all of the EC controllers. Press the *OK* button to continue to automatic control of modbus connection on the duct.



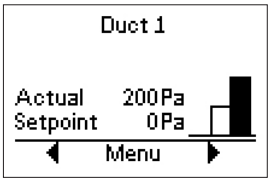
This configuration must be repeated until all of the ducts are configured correctly. When this is done, the temperature sensors can then be configured, in the same way as with a single duct.

3.2.2 Ducts

MAC12 can control up to five ducts using EXHAUSTO EC controllers.
The menu system for MAC12 is designed so that changes are made to the configuration of the individual ducts, by first selecting the duct where the changes are desired. However, there will be individual menu items that are common to all ducts and some individual menu items can be changed in different ways.

Selecting duct

Use the ◄ and► buttons to select the duct. You can only change between connected ducts. Next, press the **Menu** button to go to the menu associated with the selected duct.



3.2.3 Setting pressure

MAC12 can control the pressure drop in up to five ducts by reading the pressure from up to five sensors and setting the speed in up to five EC controllers via modbus. The conditions for each duct are configured manually.

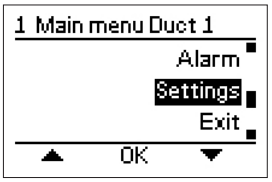
Selecting duct

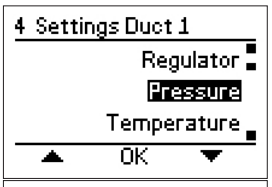
With 0-10V control, all of the settings will be carried out on duct 1.

Use the ◄ and ► buttons to select the duct. Next, press the **Menu** button to go to the menu associated with the selected duct.

Use the ▲ and ▼ buttons to navigate through the menu to **Settings** and press the **OK** button. Enter access code **1234**.

Use the ▲ and ▼ buttons to navigate through the menu to **Pressure** and press the **OK** button.



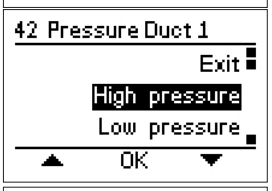


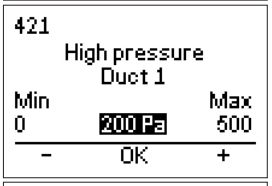
Pressure with High Pressure

In High Pressure operating mode, each motor is controlled individually to achieve a given pressure across the individual ducts.

Use the ▲ and ▼ buttons to navigate through the menu to **High Pressure** and press the **OK** button.

The pressure with High Pressure operating mode can now be set within the pressure sensor's operating range. If the pressure sensor range for example is set to **0–500 Pa**, it will be possible to set High Pressure in this range



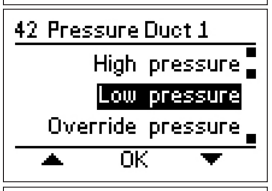


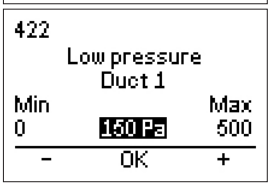
Pressure with Low Pressure

When the MAC12 input LOW is active, this pressure value will apply to all of the connected ducts.

Use the ▲ and ▼ buttons to navigate through the menu to **Low Pressure** and press the **OK** button.

The pressure with Low Pressure operating mode can now be set within the pressure sensor's operating range. If the pressure sensor range for example is set to **0–500 Pa**, it will be possible to set Low Pressure in this range.



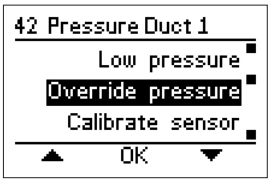


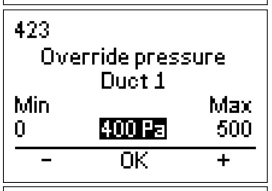
Pressure with Override Pressure

When the MAC12 input Override is active, this pressure will apply to all of the connected ducts.

Use the ▲ and ▼ buttons to navigate through the menu to **Override Pressure** and press the **OK** button.

The pressure with Override Pressure operating mode can now be set within the pressure sensor's operating range. If the pressure sensor range for example is set to **0–500 Pa**, it will be possible to set Override Pressure in this range.





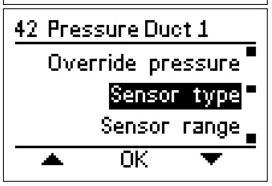
Selecting pressure sensor type

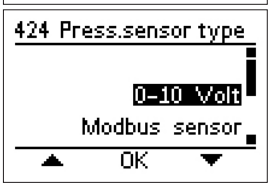
If the pressure sensor is replaced by another type, the sensor type can be selected under the menu item **Pressure Sensor Type**, using the same method as used with installation.

Use the ▲ and ▼ buttons to navigate through the menu to **Sensor Type** and press the **OK** button.

Use the ▲ and ▼ buttons to select the pressure sensor type and then press the **OK** button.

NB: Modbus sensor (MXTP) must always be used with systems with several ducts.



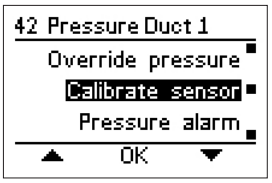


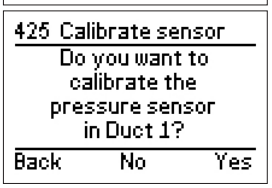
Calibrating pressure sensor

The pressure sensor for each duct can be calibrated individually. This can only be executed if the MAC12 system has stopped. The menu item will appear only if the selected pressure sensor is modbus-based.

Use the ▲ and ▼ buttons to navigate through the menu to **Calibrate sensor** and press the **OK** button.

After the pressure sensor has been made pressure neutral, press the **Yes** button to calibrate the pressure sensor.



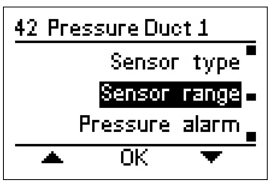


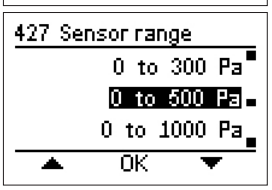
Selecting pressure sensor range

If the selected pressure sensor is based on 0-10 VDC, the control system can select the pressure range. This is done automatically with modbus-based pressure sensors.

Use the ▲ and ▼ buttons to navigate through the menu to **Sensor range** and press the **OK** button.

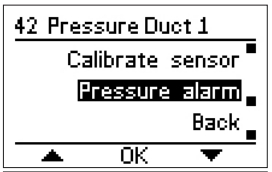
Use the ▲ and ▼ buttons to select the pressure range and then press the **OK** button.



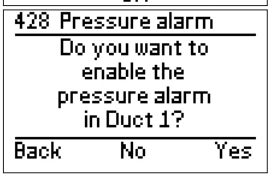


Pressure alarm

MAC12 can be configured to trigger an alarm if the measured pressure falls outside the desired range. A red Alarm LED will be lit and the Alarm relay will be activated. Alarms must be configured individually for each duct.

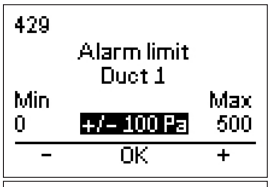


Use the ▲ and ▼ buttons to navigate through the menu to **Pressure Alarm** and press the **OK** button.



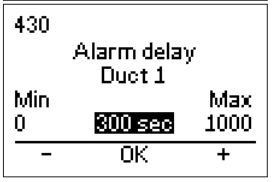
Press the **Yes** button to activate the pressure alarm for a given duct.

The pressure tolerance can then be set in the range 0 - ±500 Pascals pressure with a factory setting of ±100 Pascal.

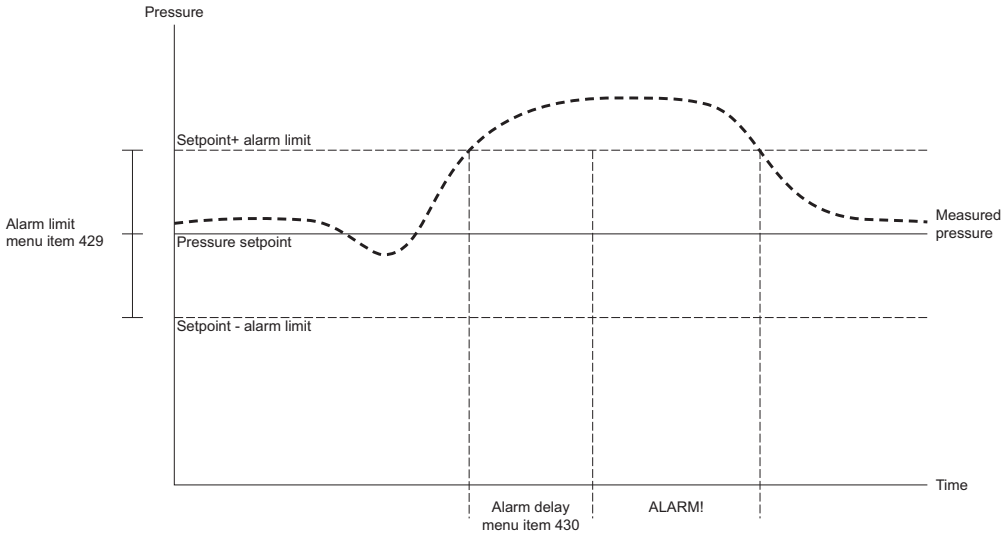


Use the **-** and **+** buttons to set the desired tolerance. Next press the **OK** button.

An alarm can be configured with a time delay. A time delay allows the pressure to be outside of the desired range for a given time before the alarm is triggered.



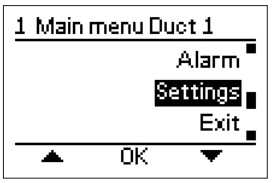
Use the **-** and **+** buttons to set the desired time delay. Next press the **OK** button.



3.2.4 Setting regulator

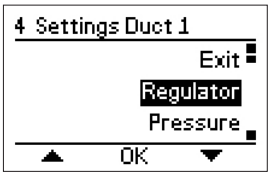
The pressure regulation function must calculate the deviation of the input signal for the necessary output signal (speed of the motor) to minimise the deviation. This is solved using a PI regulator, where the P share is calculated on the basis of the statistical deviation and a K_p factor, and the I share is calculated on the basis of the deviation over time and the T_i factor. Both of these factors can be set individually for each duct.

Use the ◄ and ► buttons to select the duct. Next, press the **Menu** button to go to the menu associated with the selected the duct.



Use the ▲ and ▼ buttons to navigate through the menu to **Settings** and press the **OK** button. Enter access code **1234**.

Use the ▲ and ▼ buttons to navigate through the menu to **Regulator** and press the **OK** button.

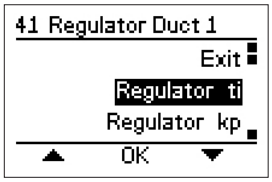


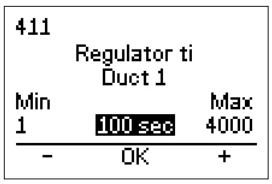
Regulator T_i

The integral share in the PI regulator is set in the menu item **Regulator ti**.

Use the ▲ and ▼ buttons to navigate to the menu item and press the **OK** button.

The T_i factor can then be set in the range 1–4000 seconds with a factory setting of 100 seconds.



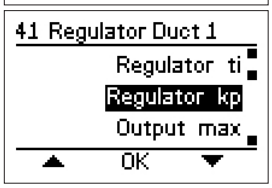


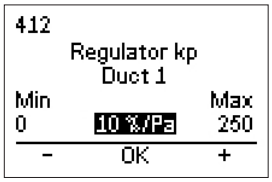
Regulator K_p

The integral share in the PI regulator is set in the menu item **Regulator kp**.

Use the ▲ and ▼ buttons to navigate to the menu item and press the **OK** button.

The K_p factor can then be set in the range 0-250%/Pa with a factory setting of 10 %/Pa.



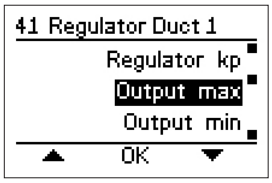


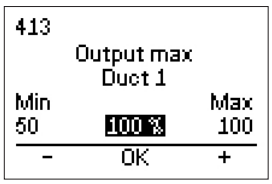
Maximum output of motor

The maximum output of the motor can be limited under the menu item **Output max.**.

Use the ▲ and ▼ buttons to navigate to the menu item and press the **OK** button.

The maximum output can then be set in the range 50–100 % with a factory setting of 100%.



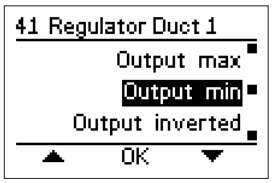


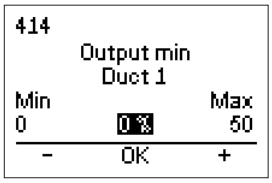
Minimum output of motor

The minimum output of the motor can be limited under the menu item **Output min.**. This can be used, for example should you want the motor always to be running.

Use the ▲ and ▼ buttons to navigate to the menu item and press the **OK** button.

The minimum output can then be set in the range 0–50 % with a factory setting of 0 %.



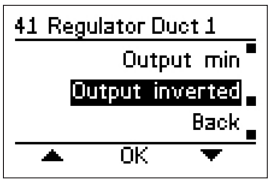


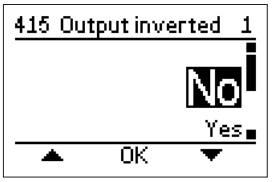
Inverted output

It is possible to invert the motor's output. That is, rather than the motor operating at maximum at 100%, the same signal will cause the motor to go to the minimum output and vice versa with 0%.

Use the □ and □ buttons to navigate to the menu item **Output inverted** and press the **OK** button.

The factory setting is set to **No**.





3.2.5 Temperature

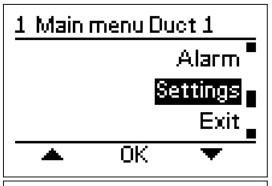
MAC12 has the option for outdoor temperature compensation, where the pressure is adjusted in relation to the outdoor temperature. MAC12 will maintain the pressure until the *High* temperature is achieved. From temperature *High* to temperature *Low*, the pressure will be reduced linearly with the given pressure fall. The compensation is carried out individually for each duct.

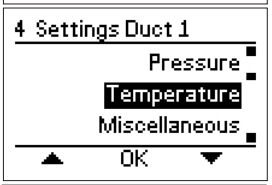
Selecting duct

Use the□ and □ buttons to select the duct. You can only change between connected ducts. Next, press the **Menu** button to go to the menu associated with the selected duct.

Use the □ and □ buttons to navigate through the menu to **Settings** and press the **OK** button. Enter access code **1234**.

Use the □ and □ buttons to navigate through the menu to **Temperature** and press the **OK** button.



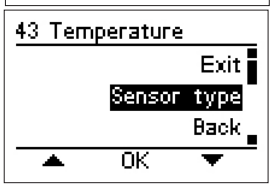


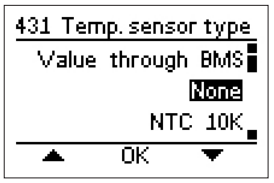
Temperature sensor type

To execute temperature compensation, a temperature sensor must be fitted. Two types of NTC sensors can be used. A 10 kΩ or a 22 kΩ. Alternatively, the temperature can be measured via a BMS system.

Use the □ and □ buttons to navigate through the menu to **Sensor Type** and press the **OK** button.

Use the□ button to change between options. Press the **OK** button to select the desired temperature sensor type.

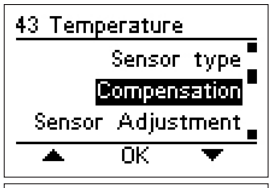


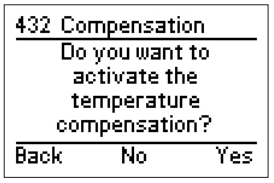


Temperature compensation

Use the □ and □ buttons to navigate through the menu to **Compensation** and press the **OK** button.

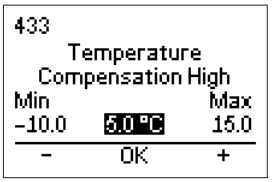
Press the **Yes** button to activate temperature compensation.





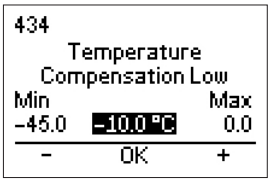
The **High** temperature can be set in the range -10.0 °C - +15.0 °C with a factory setting of +5.0 °C.

Use the **-** and **+** buttons to set the desired **High** temperature. Next press the **OK** button.



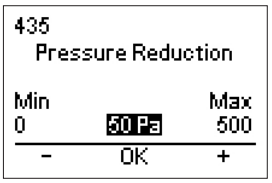
The **Low** temperature can be set in the range -45.0 °C - 0.0 °C with a factory setting of -10.0 °C.

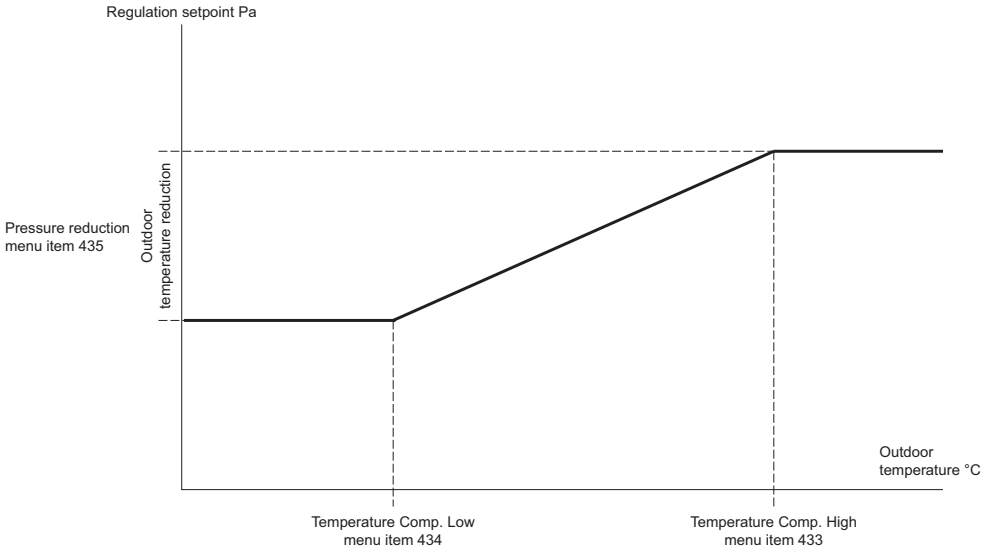
Use the **-** and **+** buttons to set the desired **Low** temperature. Next press the **OK** button.



The desired pressure reduction can be set in the range 0–500 Pascal with a factory setting of 50 Pascal.

Use the **-** and **+** buttons to set the desired pressure reduction. Next press the **OK** button.

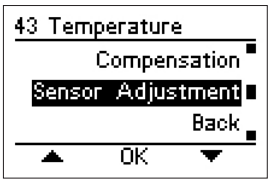




Adjusting temperature sensor

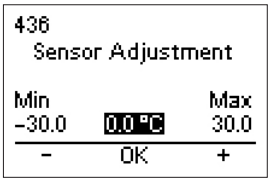
Deviation of the measured temperature in relation to the actual temperature can be offset with a sensor adjustment.

Use the ▲ and ▼ buttons to navigate through the menu to **Sensor adjustment** and press the **OK** button.



The desired temperature adjustment can be set in the range -30.0 °C - +30.0 °C with a factory setting of 0.0 °C.

Use the **-** and **+** buttons to set the desired temperature adjustment. Next press the **OK** button.



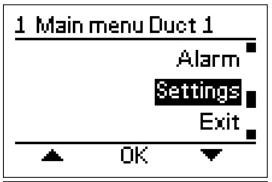
3.2.6 Communication on external modbus

If you want the MAC12 to communicate with external systems such as a PC, BMS or distributed control system, the communication parameters must be adjusted to suit the external system. NB: This does not change the internal modbus configuration, which is used to communicate with MXTP, etc.

Press the **Menu** button to go to the menu.

Use the ▲ and ▼ buttons to navigate through the menu to **Settings** and press the **OK** button. Enter access code **1234**.

Use the ▲ and ▼ buttons to navigate through the menu to **Communication** and press the **OK** button.

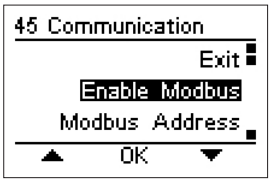


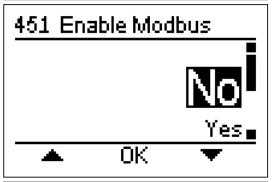
External Modbus

As standard, the external modbus is active. It can be deactivated. e.g. to avoid unnecessary data traffic in connection with various tests.

Use the ▲ and ▼ buttons to navigate through the menu to **Activate Modbus** and press the **OK** button.

Use the ▼ button to change between options. Press the **OK** button.



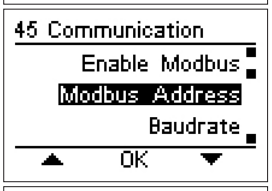


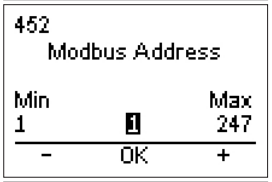
Modbus address

First select MAC12 modbus address. This can be set in the range **1 - 247** with a factory setting of **1**.

Use the ▲ and ▼ buttons to navigate through the menu to **Modbus Address** and press the **OK** button.

Use the **-** and **+** buttons to set the desired modbus address. Next press the **OK** button.



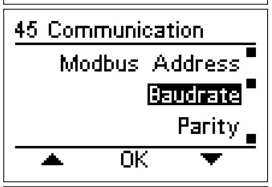


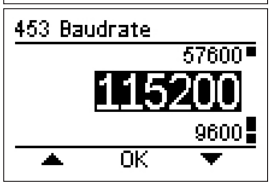
Baud rate

Next, set the communication rate. As standard, this is set to 115200 baud.

Use the ▲ and ▼ buttons to navigate through the menu to **Baud Rate** and press the **OK** button.

Press the **OK** button to confirm the baud rate.





Parity bit

Next, set the parity bit. The parity bit is set as **None**, **Even** or **Uneven** parity with a factory setting of **Even** parity.

Use the ▲ and ▼ buttons to navigate through the menu to **Parity** and press the **OK** button.

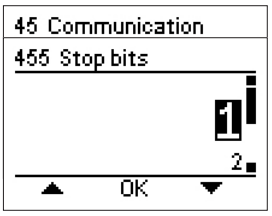
Use the ▲ and ▼ buttons to set the desired parity. Next press the **OK** button.

Stop bits

Lastly, set the total number of stop bits.
The total number of stop bits can be *one* or *two* stop bits. As standard, the total number of stop bits is set to *one*.

Use the ▲ and ▼ buttons to navigate through the menu to **Stop Bits** and press the **OK** button.

Use the ▲ and ▼ buttons to set the desired total number of stop bits. Next press the **OK** button.



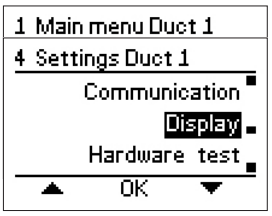
3.2.7 Display

MAC12 has a display with built-in backlighting. The display has an operating temperature range of +40 °C to -20 °C. The display response time may become slower at temperatures below 0 °C.

Press the **Menu** button to go to the menu.

Use the ▲ and ▼ buttons to navigate through the menu to **Settings** and press the **OK** button. Enter access code **1234**.

Use the ▲ and ▼ buttons to navigate through the menu to **Display** and press the **OK** button.



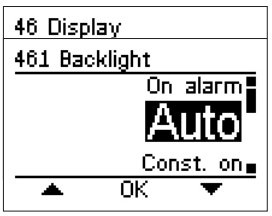
Backlight

The backlight can be set to switch on in three different ways.

Automatic (**Auto**)
Backlight comes on whenever a button is pushed. Backlight will switch off again if a button has not been pushed in the last three minutes.

Backlight always on (**Const. lit**)
The backlight always stays on, as long as there is power to the MAC12 system.

Alarm triggered (**Alarm lit**)
Like the automatic function, the backlight will switch on if an alarm is triggered.

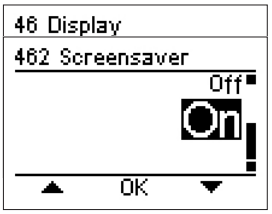


Use the □ and □ buttons to navigate through the menu to **Backlight** and press the **OK** button.

Use the □ and □ buttons to select the mode for backlight and press the **OK** button.

Screensaver

The display screensaver can be switched on/off. The screensaver factory setting is *On*.



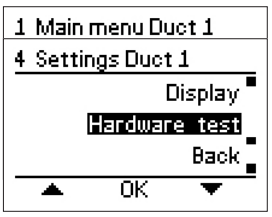
Use the □ and □ buttons to navigate through the menu to **Screensaver** and press the **OK** button.

Use the □ and □ buttons to choose the on/off status for the screensaver and press the **OK** button.

3.2.8 Hardware test

MAC12 functions can test various hardware in the system. MAC12 has two fitted relays fitted: a motor relay and an alarm relay. These relays can be opened and closed manually to test a function. So too can the 0-10 VDC output be controlled manually as past of a function test.

Press the **Menu** button to go to the menu.



Use the □ and □ buttons to navigate through the menu to **Settings** and press the **OK** button. Enter access code **1234**.

Use the □ and □ buttons to navigate through the menu to **Hardware Test** and press the **OK** button.

Alarm Relay

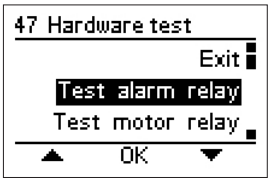
Opens/closes the alarm relay manually. During test, an alarm signal is overridden to the relay if required.

Use the □ and □ buttons to navigate through the menu to **Test Alarm Relay** and press the **OK** button.

Use the □ and □ buttons to choose the status for the alarm relay. Press the**OK** button to exit the test.

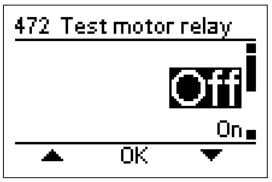
Motor relay

Opens/closes the motor relay manually. During test, an motor signal is override to the motor relay if required.



Use the □ and □ buttons to navigate through the menu to **Test Motor Relay** and press the **OK** button.

Use the and buttons to choose the status for the motor relay. Press the**OK** button to exit the test.

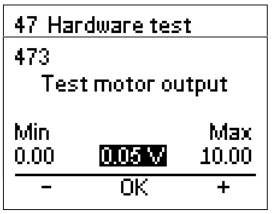


Motor output

Override manually the output voltage to the motor control.

Use the and buttons to navigate through the menu to **Test Motor Output** and press the **OK** button.

Use the **-** and **+** buttons to set the desired output voltage. Next, press the**OK** button to exit the test.



3.2.9 Miscellaneous settings

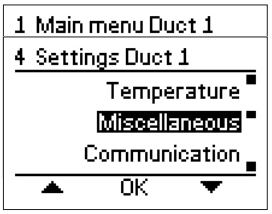
Motor controller

The motor type can be changed at all times, if required in connection with the addition of a duct or when replacing a faulty unit.

Use the and buttons to select the duct. Next, press the **Menu** button to go to the menu associated with the selected duct.

Use the and buttons to navigate through the menu to **Settings** and press the **OK** button. Enter access code **1234**.

Use the and buttons to navigate through the menu to **Miscellaneous** and press the **OK** button.



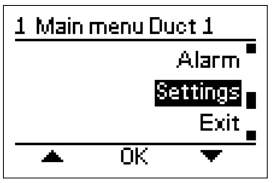
Use the and buttons to navigate through the menu to **Motor controller** and press the **OK** button.

Use the and buttons to select the type of motor controller and press the **OK** button.

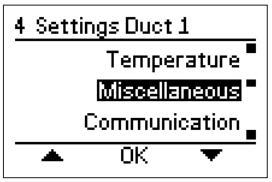
Replace EC Controller

An EC controller can be changed at all times, e.g. if a unit is faulty.

Use the and buttons to select the duct. Next, press the **Menu** button to go to the menu associated with the selected duct.



An EC controller can be changed at all times, e.g. if a unit is faulty.

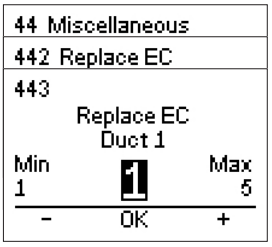


Use the □ and □buttons to select the duct. Next, press the **Menu** button to go to the menu associated with the selected duct.

Use the □ and □ buttons to navigate through the menu to **Settings** and press the **OK** button. Enter access code **1234**.

Use the □ and □ buttons to navigate through the menu to **Miscellaneous** and press the **OK** button.

Use the □ and □ buttons to navigate through the menu to **Replace EC** and press the **OK** button.

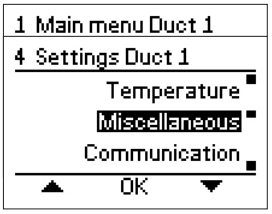


Press the **OK** button to confirm that you want to replace the EC controller.

Next, select the duct where the EC controller is to be replaced. Next, follow the same configuration as in the installation configuration; see section *3.2.1 Configuring*

Add duct

At all times, extra ducts can be added to the existing system – limited to a total number of five ducts.



Press the **Menu** button to go to the menu.

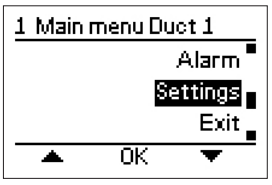
Use the □ and □ buttons to navigate through the menu to **Settings** and press the **OK** button. Enter access code **1234**.

Use the □ and □ buttons to navigate through the menu to **Miscellaneous** and press the **OK** button.

Use the □ and □ buttons to navigate through the menu to **Add Duct** and press the **OK** button. Confirm you want to add a new duct to the system. Next, configure the added duct; see section*3.2.1 Configuring*.

Change language

To change the language, go to the **Language** menu.



Press the **Menu** button to go to the menu.

Use the □ and □ buttons to navigate through the menu to **Settings** and press the **OK** button. Enter access code **1234**.

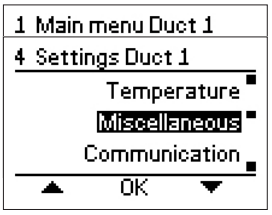
Use the □ and □ buttons to navigate through the menu to **Miscellaneous** and press the **OK** button.

Use the □ and □ buttons to navigate through the menu to **Language** and press the **OK** button.

Use the □ and □ buttons to select the desired language and press the **OK** button.

Restore factory settings

To reset the MAC12 system, you can select the menu item **Factory Setting**.



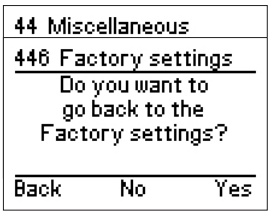
WARNING: this will delete all settings and the old configuration cannot automatically be restored.

Press the **Menu** button to go to the menu.

Use the □ and □ buttons to navigate through the menu to **Settings** and press the **OK** button. Enter access code **1234**.

Use the □ and □ buttons to navigate through the menu to **Diverse** and press the **OK** button.

Use the □ and □ buttons to navigate through the menu to **Factory Setting** and press the **OK** button.



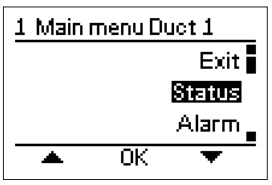
Press the **Yes** button to restore factory settings.

The MAC12 system will then restart automatically and you will be asked to execute a new *First start-up of MAC12*.

3.2.10 Status read-out

MAC12 contains functions that can read all of the parameters associated with controlling the system. The parameters for each duct are read. However, some parameters are common to all ducts.

Use the □ and □buttons to select the duct. Next, press the **Menu** button to go to the menu associated with the selected duct.



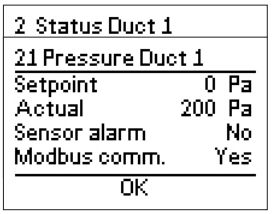
Use the □ and □ buttons to navigate through the menu to **Status** and press the **OK** button.

Pressure

Show the relevant parameters for pressure in the selected duct.

Use the □ and □ buttons to navigate through the menu to **Pressure** and press the **OK** button.

The relevant parameters are shown on the screen. Press the **OK** button to exit the status screen.

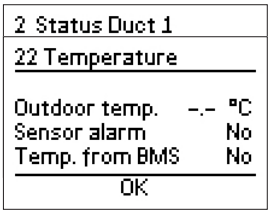


Temperature

Shows the relevant parameters for temperature.

Use the □ and □ buttons to navigate through the menu to **Temperature** and press the **OK** button.

The relevant parameters are shown on the screen. Press the **OK** button to exit the status screen.

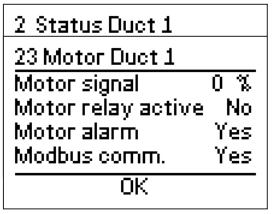


Motor

Shows the relevant parameters for the motor.

Use the □ and □ buttons to navigate through the menu to **Motor** and press the **OK** button.

The relevant parameters are shown on the screen. Press the **OK** button to exit the status screen.

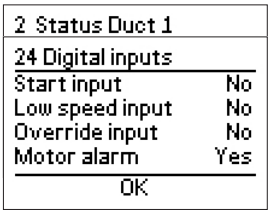


Digital inputs

Shows the relevant parameters for the digital inputs.

Use the □ and □ buttons to navigate through the menu to **Digital Inputs** and press **OK**.

The relevant parameters are shown on the screen. Press the **OK** button to exit the status screen.

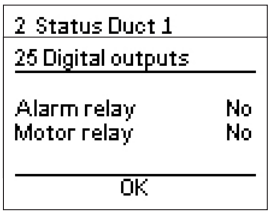


Digital outputs

Shows the relevant parameters for the digital outputs.

Use the □ and □ buttons to navigate through the menu to **Digital Outputs** and press **OK**.

The relevant parameters are shown on the screen. Press the **OK** button to exit the status screen.

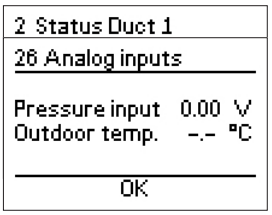


Analogue inputs

Shows the relevant parameters for the analogue inputs.

Use the □ and □ buttons to navigate through the menu to **Analogue Input** and press **OK**.

The relevant parameters are shown on the screen. Press the **OK** button to exit the status screen.

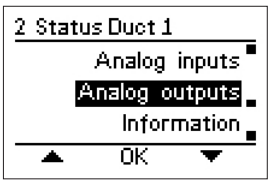


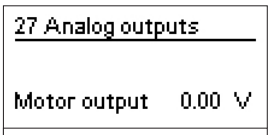
Analogue Output

Shows the relevant parameters for the analogue outputs.

Use the □ and □ buttons to navigate through the menu to **Analogue Output**and press **OK**.

The relevant parameters are shown on the screen. Press the **OK** button to exit the status screen.

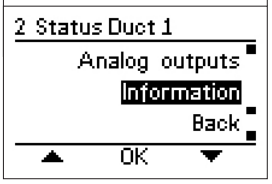




Information

Further information about the system can be read in this menu item.

Use the □ and □ buttons to navigate through the menu to **Information** and press the **OK** button.



Contact

Displays the manufacturer's logo and contact information.

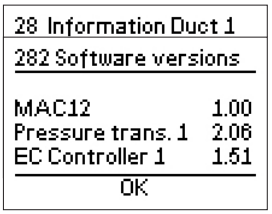
Use the □ and □ buttons to navigate through the menu to **Contact** and press the **OK** button.

Press the **OK** button to exit the information screen.

Software versions
Displays the software versions of the units found in the system.

Use the □ and □ buttons to navigate through the menu to **Software Versions** and press the **OK** button.

Press the **OK** button to exit the information screen.

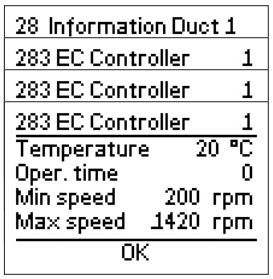


EC controller
Displays information about the type of EC controller in the system.

Use the □ and □ buttons to navigate through the menu to **EC Controller** and press the **OK** button.

Use the □ and □ buttons to navigate between the information screens for the EC controller.

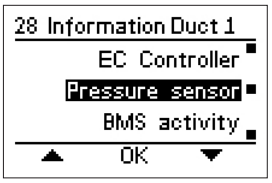
Press the **OK** button to exit the information screen.

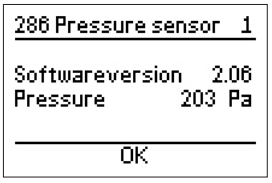


Pressure sensor
Displays the pressure sensor types that are in the system.

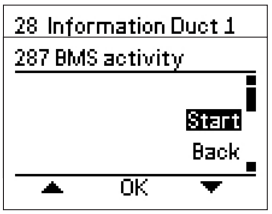
Use the □ and □ buttons to navigate through the menu to **Pressure Sensor** and press the **OK** button.

Press the **OK** button to exit the information screen.





BMS activity
Displays the BMS activities that are taking place on the external modbus.



Use the □ and □ buttons to navigate through the menu to **BMS Activity** and press the **OK** button.

Use the □ and □ buttons to navigate through the menu to **Start** and press the **OK** button to start to display the BMS activity.

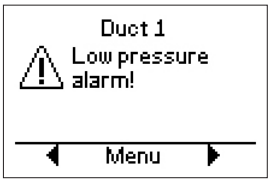
Press the**OK** button to exit the information screen.

3.2.11 Alarms

MAC12 has a number of alarms to indicate if the system has detected an error. All of the alarms, except for the power supply alarm, will close the built-in alarm relay and light the alarm LED, which is positioned on the right of the screen.

Alarm LED

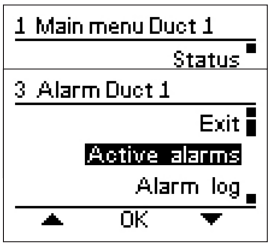
When the alarm LED is lit, the cause is shown on the screen. When there are alarms generated on several ducts, you can navigate between the alarms using the □ and □ buttons.



Displaying active alarms

The list of active alarms can also be manually displayed. First, select the duct with the specific list of alarms
Selecting duct. Use the □ or □ button to navigate to the menu item *Alarm*. Next press the *OK* button.

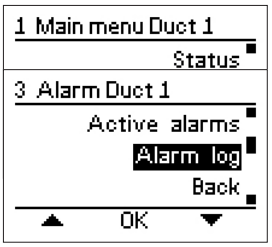
Use the □ or □ button to navigate to the menu item *Active Alarms*. Next press the *OK* button.



Displaying alarm log

MAC12 automatically saves the 10 most-recent alarms for each duct in an alarm log. Any alarm older than that is automatically deleted.

Use the □ or □ button to navigate to the menu item*Alarm Log*. Next press the *OK* button. MAC12 will now show the alarm log with the most recent alarm at the top of the list. Use the □ or □ button to navigate between the alarms.



Appendix A : Alarm explanation

Alarm message	Explanation	Comments
High Pressure alarm!	Measured pressure too high in relation to range.	
Low Pressure alarm!	Measured pressure too low in relation to range.	
Motor Overheating alarm!	Motor is overheating.	Stops all motors.
Temperature sensor Short-circuit alarm!	Temperature sensor's resistance measured as being almost 0 Ω. The sensor is probably faulty.	Switch off temperature compensation.
Temperature sensor Disconnected alarm!	The resistance of the temperature sensor is measured as being infinite. The sensor is not correctly fitted or is faulty.	Switch off temperature compensation.
Temperature sensor BMS Value alarm!	The measured values of the temperature sensor are outside of the acceptable range.	Switch off temperature compensation.
Pressure sensor Communication alarm!	MXTP is not Communicating correctly with the MAC12 system. Check the connection and configuration.	Stop motor in the duct where the MXTP is fitted.
EC controller Low voltage alarm!	Voltage below 240 VDC on the EC controller from the DC link.	
EC controller Overvoltage alarm!	Voltage above 370 VDC on the EC controller from the DC link.	
EC controller Overload alarm!	The overload limit for the EC controller has been reached.	Reduce speed of motor.
EC controller Overheating - Reduction alarm!	EC controller overheating. NTC on IGBT module measuring 90 °C or greater.	
EC controller Overheating - Stop alarm!	EC controller overheating. NTC on IGBT module measuring 120 °C or greater.	
EC controller MCE Error alarm!	MCE error. General fault on IRF chip.	
EC controller Rotor blocked alarm!	Rotor blocked. Motor cannot drive the rotor around because something physical is stopping it. Remove whatever is blocking the rotor.	
EC controller Phase Lost alarm!	Missing phase on motor. Check connections to motor.	
EC controller Communication alarm!	No communication with the EC controller. Check connections.	

Appendix B : Modbus ID list

Input registers (16 bit integer register, read only)

General status på MAC12

Adress	Name	Min	Max	Unit	Scale	Information
3x0000	Pressure sensor input voltage	0	10000	mV	1	
3x0001	Outdoor temperature	-450	700	°C	0.1	
3x0002	DI “Start” active	0	1	-	-	
3x0003	DI “Motor alarm” active	0	1	-	-	
3x0004	DI “Low speed” active	0	1	-	-	
3x0005	DI “Override” active	0	1			
3x0006	Motor output voltage	0	10000	mV	1	
3x0007	DO “Alarm relay” active	0	1	-	-	
3x0008	DO “Motor start” active	0	1	-	-	
3x0009	MAC12 software ver.	100	10000	-	0.01	100 = 1.00
3x000A	Fault contents 0	0	65535	-	-	bit 0 = High pressure alarm (in any Duct) bit 1 = Low pressure alarm (in any Duct) bit 2 = DI Motor alarm bit 3 = AI Temperature sensor short bit 4 = AI Temperature sensor open bit 5 = Not used bit 6 = Modbus temperature sensor out of range bit 7 = XTP communication error (in any Duct) bit 8 = Supply voltage error
3x000B	Actual operation mode	0	3	-	-	0 = OFF / Stopped 1 = ON / High speed 2 = ON / Low speed 3 = ON / Override
3x000C	Number of Ducts	1	5	-	-	
3x000D	Not used	0	0			
3x000E	Not used	0	0			
3x000F	Not used	0	0			
3x0010	FIFO alarm log 0 *- newest alarm*	0	9	-	-	0 = No alarm 1 = High pressure alarm (in any Duct) 2 = Low pressure alarm (in any Duct) 3 = DI Motor alarm 4 = AI Temperature sensor short 5 = AI Temperature sensor open 6 = Not used 7 = Modbus temperature sensor out of range 8 = XTP communication error (in any Duct) 9 = Supply voltage error
3x0011	FIFO alarm log 1	0	9	-	-	As register 3x0010
3x0012	FIFO alarm log 2	0	9	-	-	As register 3x0010
3x0013	FIFO alarm log 3	0	9	-	-	As register 3x0010
3x0014	FIFO alarm log 4	0	9	-	-	As register 3x0010
3x0015	FIFO alarm log 5	0	9	-	-	As register 3x0010
3x0016	FIFO alarm log 6	0	9	-	-	As register 3x0010
3x0017	FIFO alarm log 7	0	9	-	-	As register 3x0010
3x0018	FIFO alarm log 8	0	9	-	-	As register 3x0010
3x0019	FIFO alarm log 9 *- oldest alarm*	0	9	-	-	As register 3x0010

Input registers (16 bit integer register, read only)

Status of duct *N* (1 ≤ *N* ≤ 5)

Adress	Name	Min	Max	Unit	Scale	Information
3x0N00	Actual pressure	-500	5000	Pa	1	Pressure measured in duct *N*
3x0N01	Pressure setpoint	-500	5000	Pa	1	Current pressure setpoint for duct *N*
3x0N02	Fault contents 1A	0	65535	-	-	bit 0 = High pressure alarm in duct *N* bit 1 = Low pressure alarm in duct *N* bit 2 = DI Motor alarm on MAC12 bit 3 = AI Temperature sensor short on MAC12 bit 4 = AI Temperature sensor open on MAC12 bit 5 = Not used bit 6 = Modbus temperature sensor out of range on MAC12 bit 7 = XTP communication error in duct *N* bit 8 = Supply voltage error on MAC12
3x0N03	Fault contests 1B	0	65535	-	-	bit 0 = Not used bit 1 = Under voltage from EC controller in duct *N* bit 2 = Over voltage from EC controller in duct *N* bit 3 = Over current limit reached from EC controller in duct *N* bit 4 = Not used bit 5 = Over heat reduce from EC controller in duct *N* bit 6 = Over heat stop from EC controller in duct *N* bit 7 = Hardware fault from EC controller in duct *N* bit 8 = MCE fault from EC controller in duct *N* bit 9 = Rotor blocked from EC controller in duct *N* bit 10 = Motor phase lost from EC controller in duct *N* bit 11-14 = Not used bit 15 = Communication error with EC controller in duct *N*
3x0N04	XTP software version	100	10000	-	0.01	100 = 1.00 in duct *N*
3x0N05	EC software version	100	10000	-	0.01	100 = 1.00 in duct *N*
3x0N06	Actual operation mode	0	3	-	-	0 = OFF / Stopped 1 = ON / High speed 2 = ON / Low speed 3 = ON / Override
3x0N07	Not used	0	0			
-						
3x0N0F	Not used	0	0			
3x0N10	FIFO alarm log 0 *- newest alarm*	0	32	-	-	0 = No alarm 1 = High pressure alarm in duct *N* 2 = Low pressure alarm in duct *N* 3 = DI Motor Alarm on MAC12 4 = AI Temperature sensor short on MAC12 5 = AI Temperature sensor open on MAC12 6 = Not used 7 = Modbus temperature sensor out of range on MAC12 8 = XTP communication error in duct *N* 9 = Supply voltage error on MAC12 10-17 = Not used 18 = Under voltage from EC controller in duct *N* 19 = Over voltage from EC controller in duct *N* 20 = Over current limit reached from EC controller in duct *N* *21 = Not used* 22 = Over heat reduce from EC controller in duct *N* 23 = Over heat stop from EC controller in duct *N* 24 = Hardware fault from EC controller in duct *N* 25 = MCE fault from EC controller in duct *N* 26 = Rotor locked from EC controller in duct *N* 27 = Motor phase lost from EC controller in duct *N* 28-31 = Not used 32 = Communication error EC controller in duct *N*
3x0N11	FIFO alarm log 1	0	32	-	-	As register 3x0N10
3x0N12	FIFO alarm log 2	0	32	-	-	As register 3x0N10
3x0N13	FIFO alarm log 3	0	32	-	-	As register 3x0N10
3x0N14	FIFO alarm log 4	0	32	-	-	As register 3x0N10
3x0N15	FIFO alarm log 5	0	32	-	-	As register 3x0N10
3x0N16	FIFO alarm log 6	0	32	-	-	As register 3x0N10
3x0N17	FIFO alarm log 7	0	32	-	-	As register 3x0N10
3x0N18	FIFO alarm log 8	0	32	-	-	As register 3x0N10
3x0N19	FIFO alarm log 9 *- oldest alarm*	0	32	-	-	As register 3x0N10

Holding registers (16 bit integer register, read / write)

General settings for MAC12

Adress	Name	Min	Max	Default	Unit	Scale	Information
4x0000	Operation mode MAC12 *only if value is higher than the one selected by digital inputs on hardware*	0	3	0	-	-	0 = OFF / Stopped 1 = ON / High speed 2 = ON / Low speed 3 = ON / Override
4x0001	Not used	-	-	-	-	-	
4x0002	Pressure sensor type	0	1	0	-	-	0 = 0-10 VDC 1 = Modbus
4x0003	Pressure sensor range	0	9	5	-	-	0 = -50 to +50 Pa 1 = -500 to +500 Pa 2 = 0 to 100 Pa 3 = 0 to 150 Pa 4 = 0 to 300 Pa 5 = 0 to 500 Pa 6 = 0 to 1000 Pa 7 = 0 to 1600 Pa 8 = 0 to 2500 Pa 9 = 0 to 5000 Pa
4x0004	Temperature sensor type	0	3	0	-	-	0 = None 1 = NTC 10 kOhm 2 = NTC 22 kOhm 3 = External Modbus value (Reg. 4x0005)
4x0005	Modbus temperature	-450	700	250	°C	0.1	
4x0006	Temperature compensation enable	0	1	0	-	-	0 = OFF 1 = ON
4x0007	Temperature compensation High	-100	150	50	°C	0.1	
4x0008	Temperature compensation Low	-450	0	-100	°C	0.1	
4x0009	Temperature compensation Reduce	0	500	50	Pa	1	
4x000A	Temperature sensor adjustment	-300	300	0	°C	0.1	
4x000B	Motor controller type	0	1	0	-	-	0 = 0-10 VDC 1 = MOdbus
4x000C	Hardware test enable	0	1	0	-	-	0 = OFF 1 = ON
4x000D	Test alarm relay	0	1	0	-	-	0 = OFF 1 = ON *only if 4x000C = 1*
4x000E	Test motor start	0	1	0	-	-	0 = OFF 1 = ON *only if 4x000C = 1*
4x000F	Test output voltage	0	1000	0	mV	10	*only if 4x000C = 1*
4x0010	Alarm reset	0	1	0	-	-	0 = OFF 1 = RESET *applies to ALL ducts!*
4x0011	Clear alarm log	0	1	0	-	-	0 = OFF 1 = CLEAR *applies to ALL ducts!*
4x0012	Factory reset	0	1	0	-	-	0 = OFF 1 = RESET *only if 4x1000 = 1234*

Holding registers (16 bit integer register, read / write)

Settings for duct *N* (1 ≤ *N* ≤ 5)

Adress	Name	Min	Max	Default	Unit	Scale	Information
4x0N00	Pressure setpoint High	0	5000	200	Pa	1	For duct *N*
4x0N01	Pressure setpoint Low	0	5000	150	Pa	1	For duct *N*
4x0N02	Pressure setpoint Override	0	5000	400	Pa	1	For duct *N*
4x0N03	Regulator tI	10	4000	100	Sec	1	For duct *N*
4x0N04	Regulator kP	10	250	10	%/Pa	1	For duct *N*
4x0N05	Output % max	50	100	100	%	1	For duct *N*
4x0N06	Output % min	0	50	0	%	1	For duct *N*
4x0N07	Output inverted	0	1	0	-	-	0 = OFF 1 = ON *for duct N*
4x0N08	Pressure alarm enable	0	1	1	-	-	0 = OFF 1 = ON *for duct N*
4x0N09	Pressure alarm limit	0	5000	100	Pa	1	Delta value *for duct N*
4x0N0A	Pressure alarm delay	0	1000	300	Sec	1	For duct *N*
4x0N0B	Calibrate pressure sensor	1	1	0	-	-	0 = OFF 1 = Calibrate *only if 4x1000 = 1234*
4x0N0C	Operation mode for duct *N* *only if value is higher than selected by hard-ware or reg. 4x0000*	0	3	0	-	-	0 = OFF / Stopped 1 = ON / High speed 2 = ON / Low speed 3 = ON / Override
4x0N0D	*Not used*	0	0	0	-	-	
4x0N0E	*Not used*	0	0	0	-	-	
4x0N0F	*Not used*	0	0	0	-	-	
4x0N0D	Alarm reset	0	1	0	-	-	0 = OFF 1 = RESET *for duct N*
4x0N0E	Clear alarm log	0	1	0	-	-	0 = OFF 1 = CLEAR *for duct N*

Appendix C : Technical data

MAC12

Parameter	Value
Size (H x W x D):	175 x 223 x 55
Weight:	800 g
Power supply:	230 VAC ±10 % @50/60 Hz
Inherent power consumption	0.5W @ 230 VAC
Fuses:	max. 13 A
Enclosure:	IP 54
Ambient operating temperature:	-20°C to +40°C /for brief periods -30°C to +50°C
Connections:	
Modbus external	Screw terminal 3 x ≤ 1.5 mm²
Modbus internal	Screw terminal 4 x ≤ 1.5 mm²
Override input	Screw terminal 2 x ≤ 1.5 mm²
Low input	Screw terminal 2 x ≤ 1.5 mm²
Start input	Screw terminal 2 x ≤ 1.5 mm²
NTC input	Screw terminal 2 x ≤ 1.5 mm²
Pressure sensor	Screw terminal 3 x ≤ 1.5 mm²
Motor control	Screw terminal 2 x ≤ 1.5 mm²
Modbus protocol internal:	115200 baud, 8 data bits, 1 stop bit, even parity
Modbus protocol external:	Configure in menu
Setpoint range:	0–5000 Pa
Classification:	Class II

MXTP / MAC12XTP

Parameter	Value
Size (H x W x D):	90 x 75 x 36
Weight (MXTP):	75 g
Weight (MAC12XTP)	80 g
Power consumption:	0.5 W
Enclosure:	IP 54
Ambient operating temperature:	-30 °C to +50 °C
Connections (MXTP):	Screw terminal 4 □ ≤ 1.5 mm²
Connections (MAC12XTP):	Screw terminal 3 x ≤ 1.5 mm²
Modbus protocol (MXTP):	115200 baud, 8 data bits, 1 stop bit, even parity
Transducer output (MAC12XTP)	0-10 VDC, 2-10 VDC, 0-20 mA, 4-20 mA
Measurement range:	0-2500 Pa
Precision (MXTP):	0.5% □ MV + 2.5 Pa *
Precision (MAC12XTP):	1.5% □ MV + 0.3% □ SR + 2.5 Pa *

MAC12XTT

Parameter	Value
Type:	NTC 10 kΩ
Measurement range:	-45 °C - +70 °C
Precision:	At 0 °C - 25 °C ±0.5 °C; all other ±1 °C
Max. cable length:	40 m @ 0.5 mm²
Enclosure:	IP54

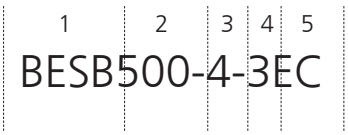
* MV = Measured Value (measured pressure value)
SR = Set Measuring Range
Precision applies to the temperature range -20 °C - +40 °C

Appendix D : Connection diagram overview

Which connection diagram must be used

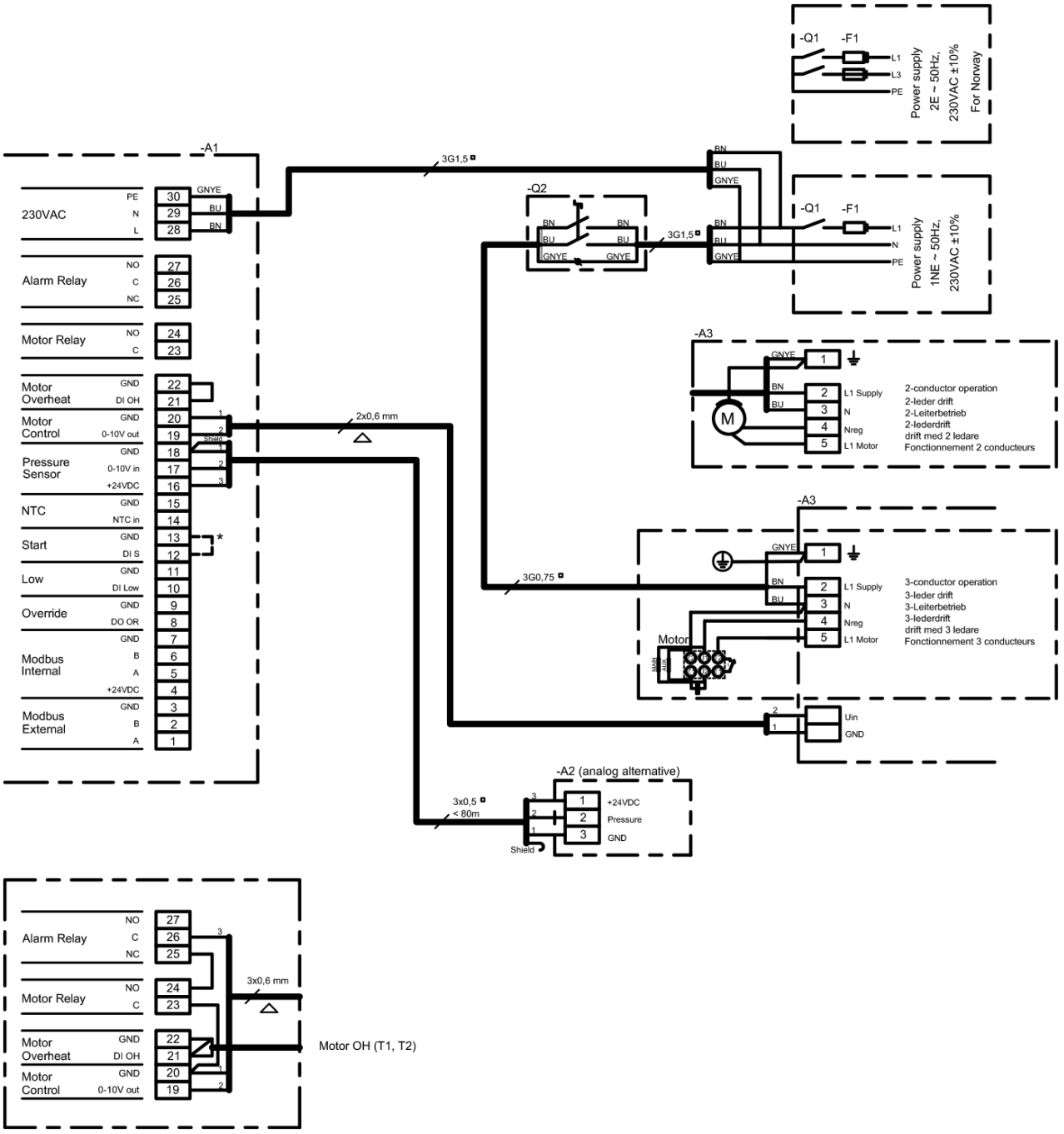
Type		Connection diagram
DTV/DTH/VVR (model size 160, 200, 250, 315, 400, 450)	DTVxxx-4-1	D.1
	DTVxxx-4-1EC	D.2
	DTHxxx-4-1	D.1
	DTHxxx-4-1EC	D.2
	VVRxxx-4-1	D.1
	VVRxxx-4-1EC	D.2
BESF (model size 146, 160, 180, 200, 225, 250, 280)	BESFxxx-4-1	D.1
	BESFxxx-4-1EC	D.2
	BESFxxx-4-3EC	D.3
BESB (model size 250, 315, 400, 500)	BESBxxx-4-1	D.1
	BESBxxx-4-1EC	D.2
	BESBxxx-4-3EC	D.3
Modbus	Single-phase	D.4
	Triple-phase	D.5
FC MGE	Single-phase FC	D.6
	Single-phase MGE	D.7

Explanation of product names



No.	Abbreviation, e.g.	Explanation	Example
1	BESB	Ventilator type	DTV, DTH, VVR, BESF, BESB
2	500	Size	For DTV, DTH, VVR and BESB, the number corresponds to the duct dimension
3	4	Number of poles, i.e. rpm	2 = 2800 4 = 1400
4	3	Total number phases/ voltage	1 = single-phase and 230 VAC 3 = triple-phase and 400 VAC
5	EC	Motor control	Empty = No motor control FC = Frequency converter EC = EC Controller

Appendix D : Connection diagram D.1

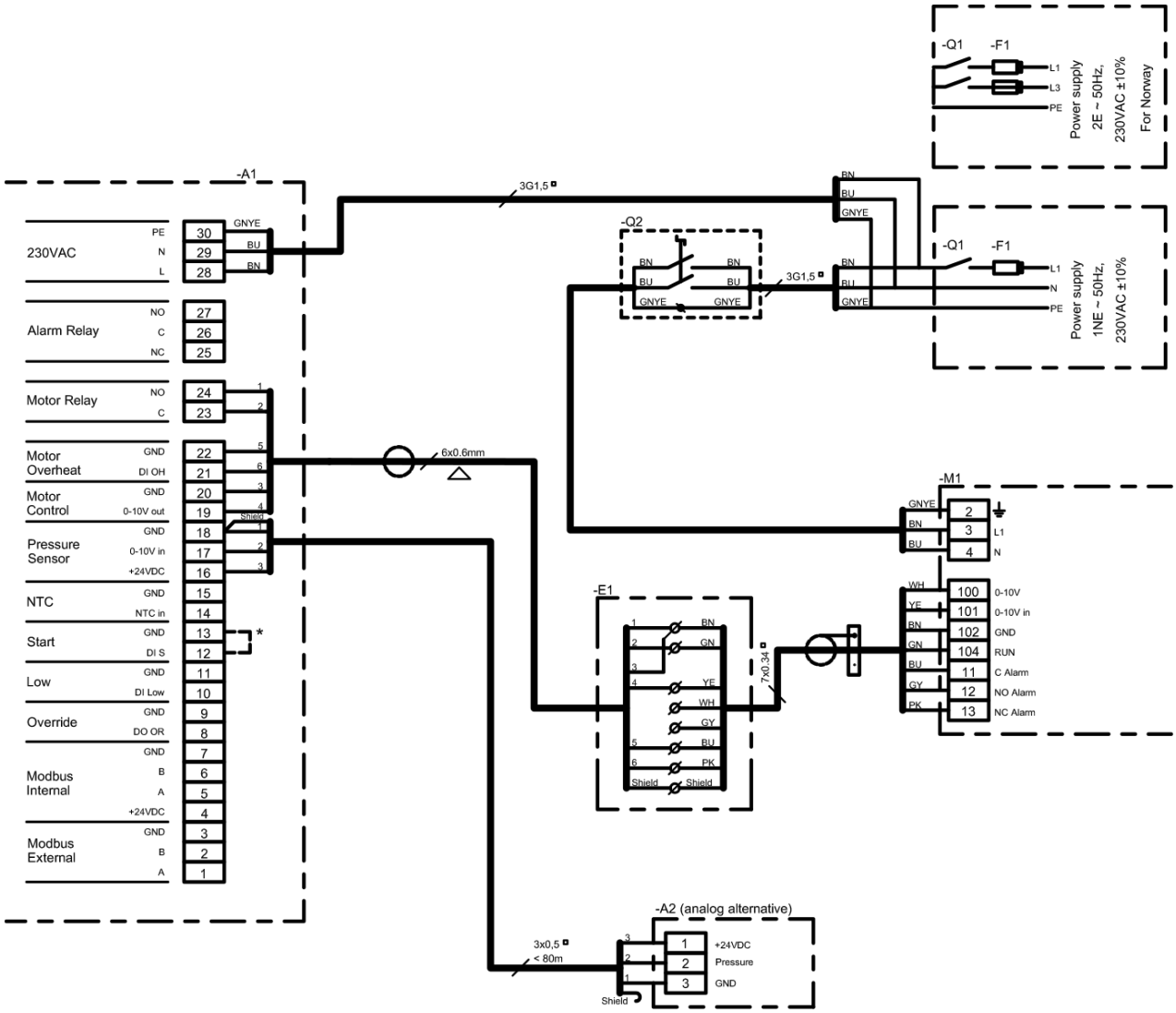


*** Please note! A connection must be established if an external modbus is not used.**

Letter code (IEC 757)	BK	BN	RD	YE	GN	BU	VT	GY	WH	PK	GNYE	Shield
Conductor colour	black	brown	red	yellow	green	blue pale blue	violet	grey	white	pink	green yellow	shield

Component explanation		
-A1 -A2 -A3		MAC12 XTP sensor (0-10V) MPR-4/MPR-8
-F1	*	Fuse in supply panel
-Q1 -Q2	* *	Supply switch in supply panel Isolation switch
*** Not supplied by EXHAUSTO**		

Appendix D : Connection diagram D.2

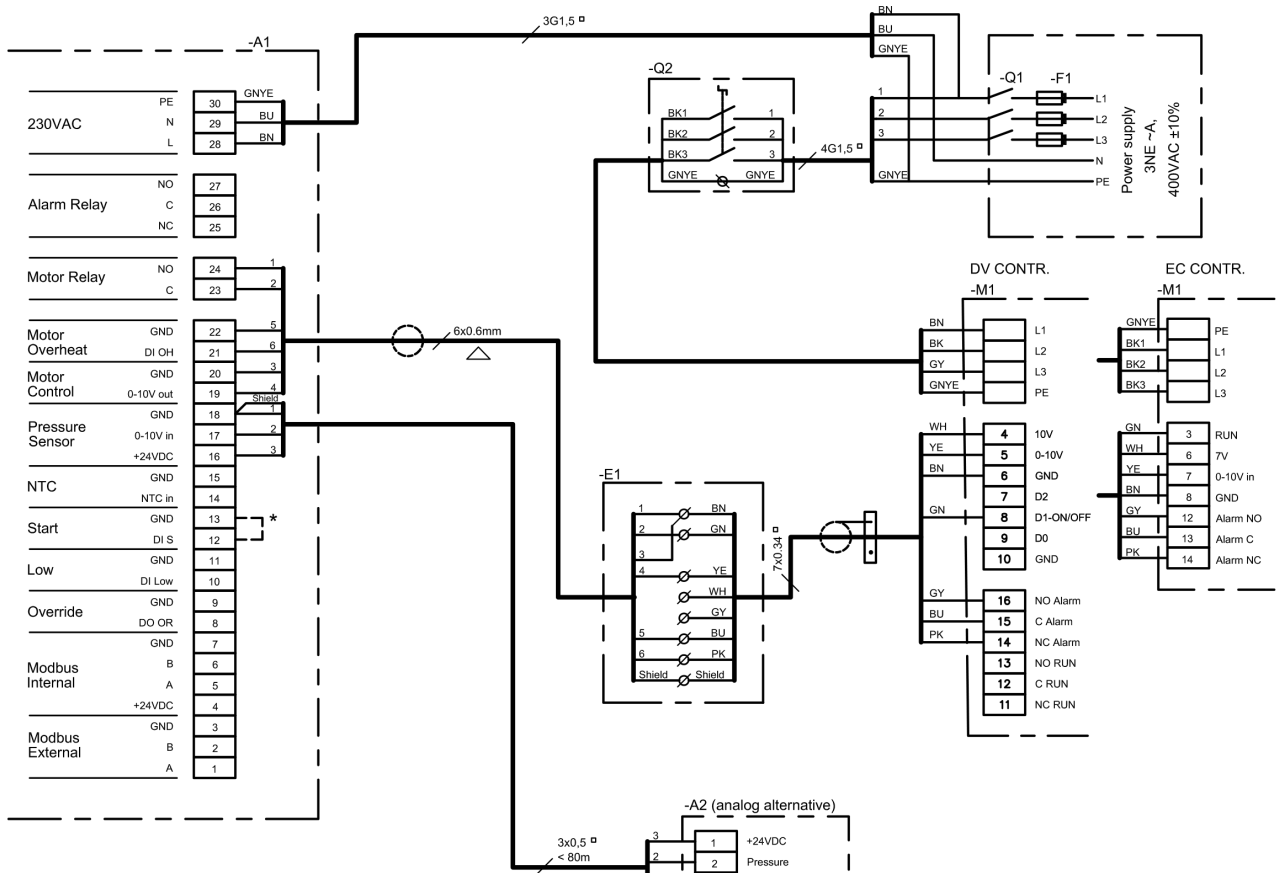


*** Please note! A connection must be established if an external modbus is not used.**

Letter code (IEC 757)	BK	BN	RD	YE	GN	BU	VT	GY	WH	PK	GNYE	Shield
Conductor colour	black	brown	red	yellow	green	blue pale blue	violet	grey	white	pink	green yellow	shield

Component explanation		
-A1 -A2		MAC12 XTP sensor (0-10V)
-E1	*	Terminal box
-M1		Fan and motor control
-F1	*	Fuse in supply panel
-Q1 -Q2	* *	Supply switch in supply panel Isolation switch
*** Not supplied by EXHAUSTO**		

Appendix D : Connection diagram D.3

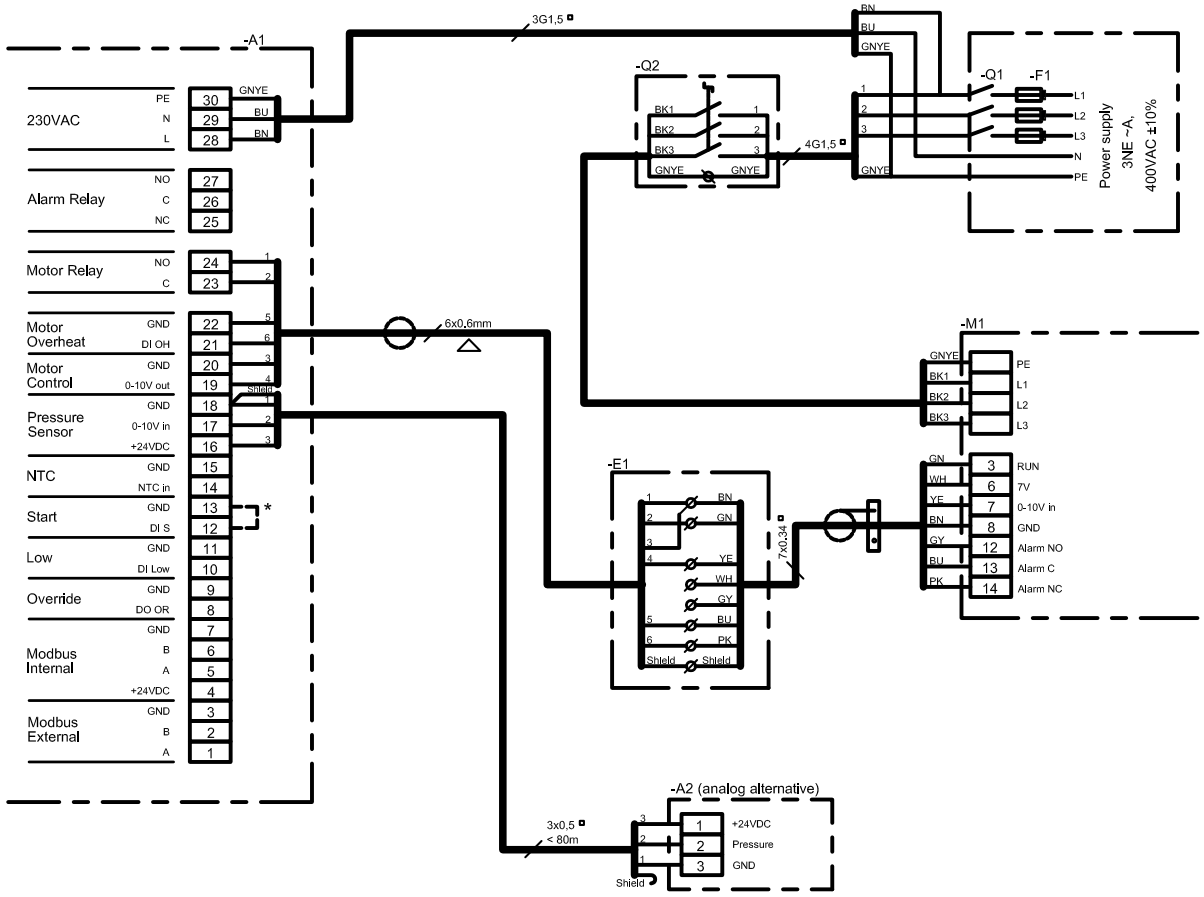


*** Please note! A connection must be established if an external modbus is not used.**

Letter code (IEC 757)	BK	BN	RD	YE	GN	BU	VT	GY	WH	PK	GNYE	Shield
Conductor colour	black	brown	red	yellow	green	blue pale blue	violet	grey	white	pink	green yellow	shield

Component explanation		
-A1 -A2		MAC12 XTP sensor (0-10V)
-E1	*	Terminal box
-M1		Fan and motor control
-F1	*	Fuse in supply panel
-Q1 -Q2	* *	Supply switch in supply panel Isolation switch
*** Not supplied by EXHAUSTO**		

Appendix D : Connection diagram D.4



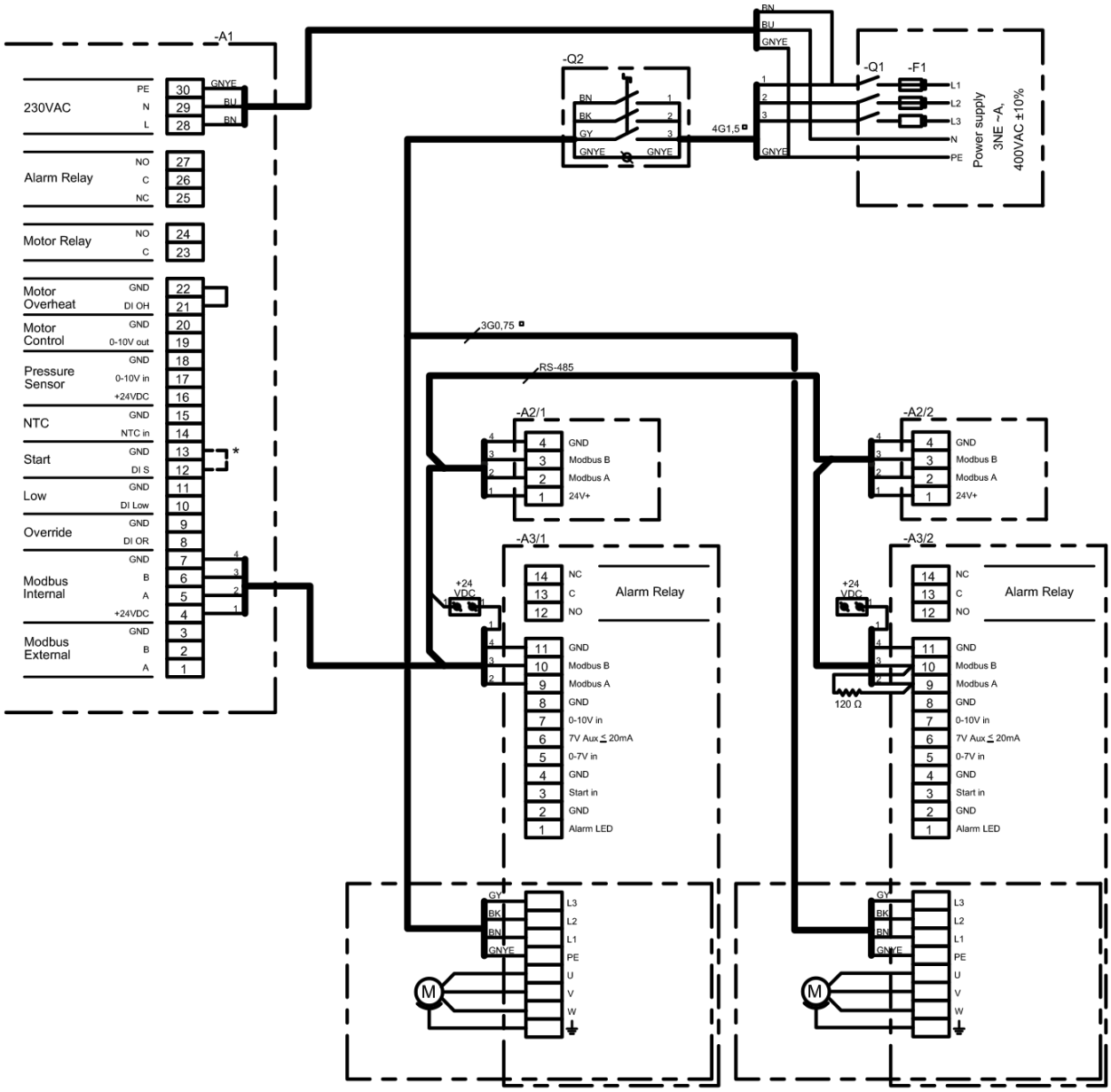
*** Please note! A connection must be established if an external modbus is not used.**

NB A modbus cable must always be terminated with a 120Ω termination resistor cross the terminals *Modbus A* and *Modbus B* on the last device in the bus. In the above-named connection diagram, the last device is EC controller *-A3/2*.

Letter code (IEC 757)	BK	BN	RD	YE	GN	BU	VT	GY	WH	PK	GNYE	Shield
Conductor colour	black	brown	red	yellow	green	blue pale blue	violet	grey	white	pink	green yellow	shield

Component explanation		
-A1 -A2/x -A3/x		MAC12 MXTP sensor (duct 1 ≤ x ≤ 5) EC controller (duct 1 ≤ x ≤ 5)
-F1	*	Fuse in supply panel
-Q1 -Q2	* *	Supply switch in supply panel Isolation switch
*** Not supplied by EXHAUSTO**		

Appendix D : Connection diagram D.5



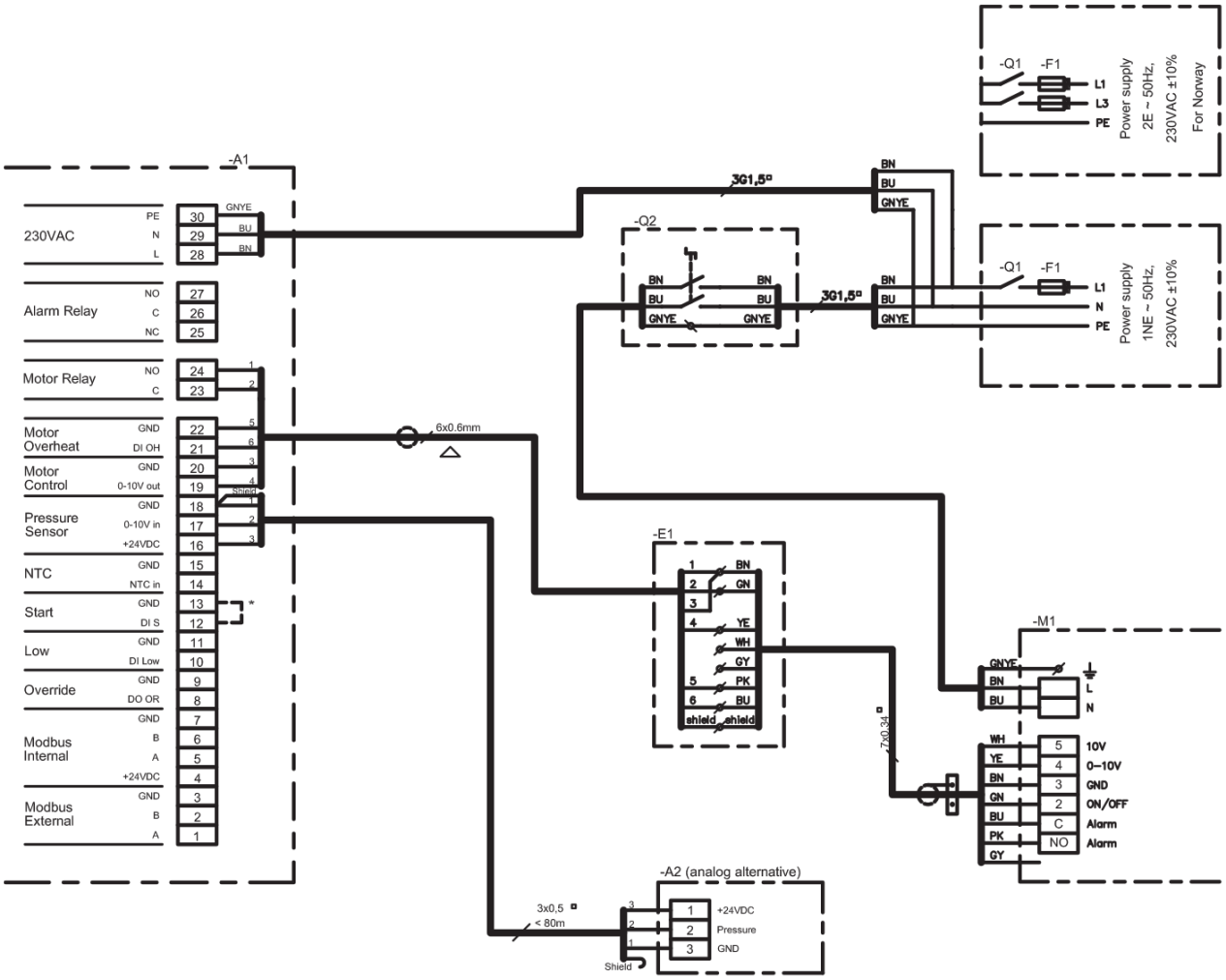
*** Please note! A connection must be established if an external modbus is not used.**

NB A modbus cable must always be terminated with a 120Ω termination resistor cross the terminals *Modbus A* and *Modbus B* on the last device in the bus. In the above-named connection diagram, the last device is EC controller *-A3/2*.

Bogstav-kode (IEC 757)	BK	BN	RD	YE	GN	BU	VT	GY	WH	PK	GNYE	Shield
Lederfarve	sort	brun	rød	gul	grøn	blå lyseblå	violet	grå	hvid	pink	grøn gul	skærm

Component explanation		
-A1 -A2/x -A3/x		MAC12 MXTP sensor (duct 1 ≤ x ≤ 5) EC controller (duct 1 ≤ x ≤ 5)
-F1	*	Fuse in supply panel
-Q1 -Q2	* *	Supply switch in supply panel Isolation switch
*** Not supplied by EXHAUSTO**		

Appendix D : Connection diagram D.6

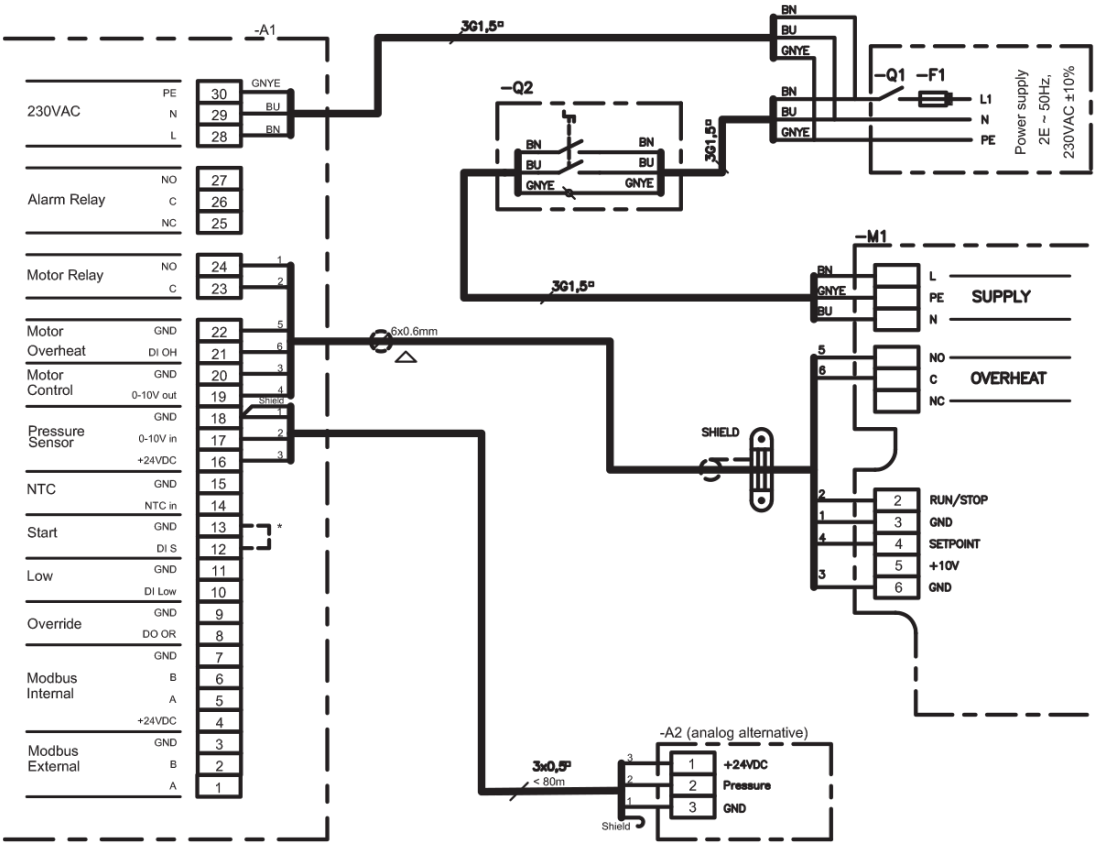


*** Please note! A connection must be established if an external modbus is not used.**

Bogstav-kode (IEC 757)	BK	BN	RD	YE	GN	BU	VT	GY	WH	PK	GNYE	Shield
Lederfarve	sort	brun	rød	gul	grøn	blå lyseblå	violet	grå	hvid	pink	grøn gul	skærm

Component explanation		
-A1 -A2 -M1		MAC12 XTP sensor (duct 1) Fan and motor control
-F1	*	Fuse in supply panel
-Q1 -Q2	* *	Supply switch in supply panel Isolation switch
*** Not supplied by EXHAUSTO**		

Appendix D : Connection diagram D.7



*** Please note! A connection must be established if an external modbus is not used.**

Bogstav-kode (IEC 757)	BK	BN	RD	YE	GN	BU	VT	GY	WH	PK	GNYE	Shield
Lederfarve	sort	brun	rød	gul	grøn	blå lyseblå	violet	grå	hvid	pink	grøn gul	skærm

Component explanation		
-A1 -A2 -M1		MAC12 MXTP sensor (duct 1) Fan and motor control
-F1	*	Fuse in supply panel
-Q1 -Q2	* *	Supply switch in supply panel Isolation switch
*** Not supplied by EXHAUSTO**		

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