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FKP-R/R2

User Guide for Pressure and Temperature controller with integrated pressure sensor

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FKP-R2

FKP-R

FUNCTION

FKP-R/R2 is a complete pressure and temperature control center for fan driven electronic motor drives.

FKP-R/R2 keeps a constant controlled pressure in ventilation systems. Typical area of use is ventilating bathrooms and kitchens.

The drive is equipped with an internally mounted pressure sensor, but it can also be connected to an external sensor. Several types of external temperature sensors can be connected in order to perform temperature compensated pressure control.

FKP-R/R2 can also be used as a temperature controller and as a hysteresis controller from an external sensor signal.

FKP-R/R2 can also be equipped with a Real Time Clock (option), which makes the drive capable of various forms of scheduling. These include lowering the pressure reference at night and weekly pressure schedules.

Monitoring is done with the onboard alarm relay and analog output; and via MODBUS.

The controller's enclosure is water-and dustproof to IP54.

Settings and parameters can be viewed and changed in plain English (or Swedish) on the FKP-R/R2's large, four line, display using an easy-to-use menu system controlled by a navigation wheel.

Cable connections are made on screw terminals and pressure hose on press-on hose connectors.

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USAGE INSTRUCTIONS

When the drive is powered, its status is shown on the display. If the start signal is not connected, "*Drive Stopped*" is shown. Upon connection of the start signal to terminal 4 or 6, the drive will start, and the status screen will be shown.

Press the wheel to activate the display backlight, and turn it to enter the menu system.

There is one top-level menu and several submenus. The basic menu system has two submenus: "*Press/Temp. settings*" and "*System settings*". Navigate between the menus by turning the wheel, and choose a menu by pressing it. To exit a menu level, select "*Back*".

In the sub-menus, there are settings (parameters) that can be changed. To change a parameter, press the wheel when it is selected. This will show the text "*Choose*" or "*Change*" together with the value to be changed. Turn the wheel to change the value, and press it to confirm the change and return to the sub-menu. Some menu items are only informational and cannot be changed. Press the wheel to exit these menus.

If a fault occurs, an error screen will be shown, explaining the nature of the fault. Press the wheel to reset it. For further details on error handling, see the chapter **Faults and Alarms**.

Appendix A and B contain a quick reference to all the settings in the FKP-R/R2 and its options.

CONNECTION

FKP-R/R2 is powered by 230VAC but can also be powered by 24VDC.

The card is galvanically isolated from the incoming phase. All signal and control cables are connected to screw clamps on this board.
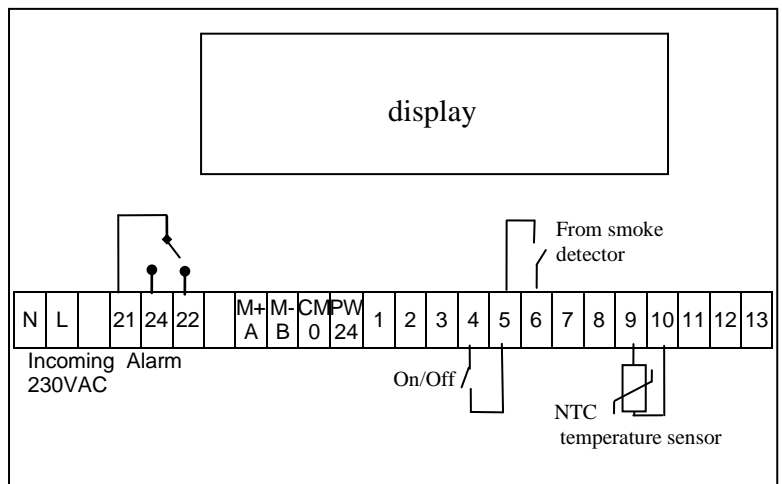

Figure 1. Connection for pressure control with fixed out signal activated by smoke detector. Outside temperature sensor connected on terminal 9, 10.

Table 1 shows terminal number and function.

Terminal Nr	Function
N	Supply phase och common
L	230VAC
21	Alarm Common
24	Alarm (OK)
22	Alarm (Fault)
A/M+	MODBUS+ (A eller D0)
B/M-	MODBUS- (B eller D1)
0/CM	MODBUS Common
PW24	Power supply for external units
1	10V Reference
2	0-10V IN 1 (external active temperature sensor)
3	Signal common
4	24V Digital In 1 (start)
5	24V Output
6	24V Digital In 2 (start/fixed outsig.)
7	0-10V IN 2 (external pressure sensor / hysteresis signal)
8	Signal common
9	Extern passiv NTC/PT1000
10	tvåtrådars temperatursensor
11	0-10V, 4-20mA or 0-20mA OUT
12	Signal common
13	24V Digital In 3 (extra)

Table 1. FKP-R/R2 signal connection.

Terminals 21 to 24 are connected to the alarm relay. They are fully isolated from all other voltages within the drive, and are capable of switching 8A at 250VAC. Terminal 24 is closed when the drive is free of faults.

Terminals M+, M- and 0 are the MODBUS terminals. M- corresponds to MODBUS D1 or B, while M+ is D0 or A. 0 is the MODBUS common ground potential.

A 10V reference voltage is available on terminal 1. Terminal 2 is the 0-10V to connect an external active temperature sensor when the drive is in Temperature control mode or Temperature compensating mode.

Signal common is available on terminals 3,8, 12 and 0/CM.

Terminals 4 and 6 are 24V digital inputs. Connecting 24V to terminal 4 or 6 makes the controller start, these signals are OR:ed connected, connecting 24V to both signals will stop the controller. Terminal 6 can also be used as fixed out signal or fixed pressure. This depends on the setting of *"System settings/Use fixed ref."* parameter 62. In this case the OR functions is disabled.

A 24V output is available on terminal 5.

Terminal 7 is a 0-10V analog input which can be used to connect an external pressure sensor or some other active sensor. This sensor should have a 0-10V output; if it has 4-20mA output then a (499ohm) resistor must be connected between signal and common. Choose this with parameter 75.

Terminal 9 and 10 is used to connect an external passive NTC thermistor or a PT1000 sensor.

Terminal 11 is a 4-20mA or 0-20mA output, which may be loaded with 0-560 ohms. Connect a (499ohm) resistor and set "current out range" to "0-20mA", to get 0-10V output.

The function of the output current range is chosen with parameter 63, found under "*System settings*".

CONNECTION OF PRESSURE HOSE

If FKP-R/R2 is used as a pressure controller then hoses to measure pressure must be connected to the ventilation channel.

The internal pressure sensor has two 5mm hose connections for positive and negative pressure.

Positive pressure (upper connection) is marked with (+).

If the fan is an exhaust fan then the measuring hose is connected to the negative connection and the opposite side of the hose is connected inside the ventilation channel.

For best measuring result the hose should be connected so that the hose opening is in the center of the channel and perpendicular to the flow. The controller controls the pressure where the hose is connected. For best result do not connect the hose in direct proximity of the fan, but some distance in to the channel.

The channel pressure is normally controlled relative to the atmospheric pressure. If FKP-R/R2 is mounted inside a fan or compartment where the surrounding pressure can be other than the atmospheric pressure, a second hose should be connected to the positive connection and the other side to a place with atmospheric pressure.

If the hose is subject to weather and wind then it should be mounted in such manner that water and dirt can not enter. Figure 2 displays a suggestion of connecting the hose so that water and dirt do not enter.

Figure 2. Mounting of pressure hose for measuring of atmospheric pressure.

The hose end should also be placed in such way it is not affected by wind as this changes the pressure.

NOTE. If water or dirt enters the internal pressure sensor it can damage the sensor.

CONNECTION OF TEMPERATURE SENSOR

There are multiple choices in temperature sensor to the FKP-R/R2. NTC 100Kohm (4FKP-T1), NTC 10Kohm (4FKP-T2) or PT1000 can be used but also an active sensor can be connected.

This active sensor can have either current or voltage output.

If no sensor is connected then "NO SENSOR" is displayed in the display.

FKP-R/R2 has separate inputs for NTC and PT1000 sensors on terminal 9 and 10.

Figure 3. Temperature sensor 4FKP-T2.

If an active sensor is used it is connected to terminal 2. Settings 21 *"Active temp min."* sets the temperature at 0V from the sensor and settings 22 *"Active temp max."* sets the temperature at 10V.

Settings 20 sets the sensor in use.

PRESS/TEMP. SETTINGS: (Temperature controller settings)		
Nr:	Parameter:	Value:
20	Temp. sensor type	NTC 100k, NTC 10k, PT1000, Active, MODBUS
21	Active temp. min	-50 - 0°C
22	Active temp. max	0 - 100°C

The temperature sensor should be mounted in such way that it does not get heated by hot air from the ventilation shaft. The sensor should therefore not be placed in the fan exhaust or on the fan itself as it could be warm from the air. Direct sun light can also give false measurements and should therefore be avoided.

CONTROLLER SETTING

The way the drive is controlled is selected with parameter 2. There are four ways the FKP-R/R2 can be controlled:

- Pressure control. The FKP-R/R2 will use an external or internal pressure sensor to control pressure with its output signal.
- Temperature compensated pressure control. This has the same function as pressure control, with the exception that a temperature sensor is used to compensate the reference pressure.
- Temperature control. Controls the output signal using a temperature signal. No pressure sensor is used in this mode.
- MODBUS 0-10V controls the controller as if it had an analog signal to control the output signal directly. This option is only available if the drive has the added MODBUS option.

CONTROLLER SETTING:		
Nr:	Parameter:	Value:
2	Control method	Pressurecont., Pressurecont./ Tempcomp., Temp control, MODBUS 0-10V

PRESSURE CONTROL

The FKP-R/R2 is equipped with a built in pressure controller, and a pressure sensor with a range of -1000 - 1000Pa. To use this controller, select "*Pressurecont.*" in parameter 2 "*Control method*" under *"Drive settings"*.

It is also possible to use an external pressure sensor with the FKP-R/R2. See connection table.

Setting up the FKP-R/R2 pressure controller is simple and fast. The pressure controller is of PI-type. Its gain is set with parameter 15, and its integration time with parameter 16. If an integration function is not desired, set the time to 0. Normally there is no need to change these settings.

The reference pressure of the controller is set with parameter 10. In this menu the actual compensated pressure reference value after it has been temperature compensated is also displayed. I.e. if it is warm outside the compensated pressure ref will be the same as pressure ref, but if it is cold outside then the compensated pressure ref will be lower the set pressure reference. This value is displayed to help setting correct reference value.

The output of the controller is limited by the maximum and minimum out signal limits (parameters 40 and 41). Note that parameter 40 and 41 are located in the "*System settings*" menu.

PRESS/TEMP. SETTINGS: (Pressure controller settings)		
Nr:	Parameter:	Value:
10	Pressure ref (external) (internal)	0 - 1500Pa 0 - 1000Pa
54	Fixed pressure	0 - 1000Pa
11	Press. input	internal, external, MODBUS
12	Ext. min press.	-1500 - 0Pa
13	Ext. max press.	0 - 1500Pa
14	Zero pressure	Yes, No
15	Controller gain Kp	0 - 999
16	Integ. time Ti	1 - 999

Parameter 10 is used to select the type of pressure sensor in use, internal or external.

The pressure sensor (internal or external) can be calibrated by setting the zero pressure point. This is done by selecting "*Yes*" on parameter 14 when there is no difference in pressure applied to the pressure inputs. The FKP-R/R2 will use the measured pressure as the new zero pressure point. The internal sensor is calibrated from the factory and usually does not require further calibration.

If an external sensor is to be used, the pressure corresponding to 0V should be set in parameter 12, and the pressure corresponding to 10V in parameter 13. This should always be followed by a zeroing of the pressure as described above.

A forced fixed pressure can be set by an external input signal, see *"System settings"*.

OUTSIDE TEMPERATURE COMPENSATION

The FKP-R/R2 is equipped to compensate for pressure changes in ventilation systems caused by the changing outside temperature. When the outside temperature drops, a chimney effect often occurs in ventilation channels, causing increased airflow. To compensate for this, the pressure reference is lowered as seen in figure 4.

At -15°C the chimney effect is around 1,7Pa/m build height up to the ventilation exhaust. At 0°C it is around 1Pa/m. Depending on the height of the building, the pressure reduction can be calculated.

E.g. a building of 10m height can have a reduction pressure of 10x1,7=17Pa at -15°C.

To activate temperature compensation, select "*Tempcomp. Pressure cont.*" in parameter 2 ("*Control method*").
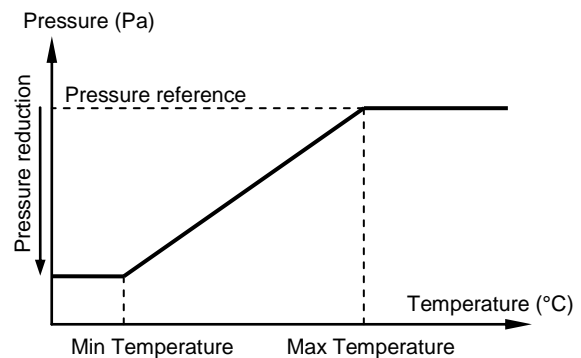

Figure 4. Outside temperature compensation.

The pressure reduction is applied to the reference pressure (parameter 10), and changes linearly with temperature. The maximum reduction is set with parameter 17 and can be set from 0Pa to current pressure reference.

Pressure reduction starts when the temperature drops below the value set in parameter 18, and continues until the temperature reaches the value set in parameter 19. Below that temperature, the pressure reference is held constant at maximum reduction.

Outside temperature compensation requires an external temperature sensor. Connection and mounting instructions see section Connection of temperature sensor.

PRESS/TEMP. SETTINGS: (Outside temperature compensation / Temperature control)		
Nr:	Parameter:	Value:
17	Press. reduction	0 – press.ref. Pa
18	Temperature max	-50 - 50°C
19	Temperature min	-50 - 50°C

PRESSURE CONTROLLER ALARMS

The FKP-R/R2 will always indicate a pressure alarm via the alarm relay. If parameter 23, "*Stop on alarm*", is selected (set to 'yes'), the drive will also stop on these alarms. Otherwise the drive will continue to run the motor during these alarms. Alarm limits for under- and over pressure are set with parameters 24 and 25 respectively.

PRESS/TEMP. SETTINGS: (Pressure controller alarms)		
Nr:	**Parameter:**	**Value:**
23	Stop on alarm	Yes/No
24	Alarm upper lim.	-1500 - 1500Pa
25	Alarm lower lim.	-1500 - 1500Pa
26	Alarm delay	0 - 1000sec

To prevent the pressure alarms from tripping during short pressure pulses (caused by wind etc), the alarms are delayed. In order to cause an alarm, the pressure must be outside the limits for longer than the time set in parameter 26.

TEMPERATURE CONTROL

It is also possible to control the FKP-R/R2 by temperature only. This mode is chosen by selecting "*Temp. contr*" in parameter 2.

Temperature control works by changing the out signal proportional to temperature, just like how temperature compensation changes the pressure reference. This is shown in figure 5.

Parameter 34 sets the temperature at which maximum out signal is used and parameter 33 sets the temperature for the minimum. The maximum and minimum out signal are set in the usual manner with parameters 40 and 41 in the "*System settings*" menu.

The temperature signal can be from an external active temperature sensor or from passive NTC/PT1000 sensor connected to terminal 9,10. Inverting the function is done by setting *"Min temperature"* higher than *"Max temperature"*.

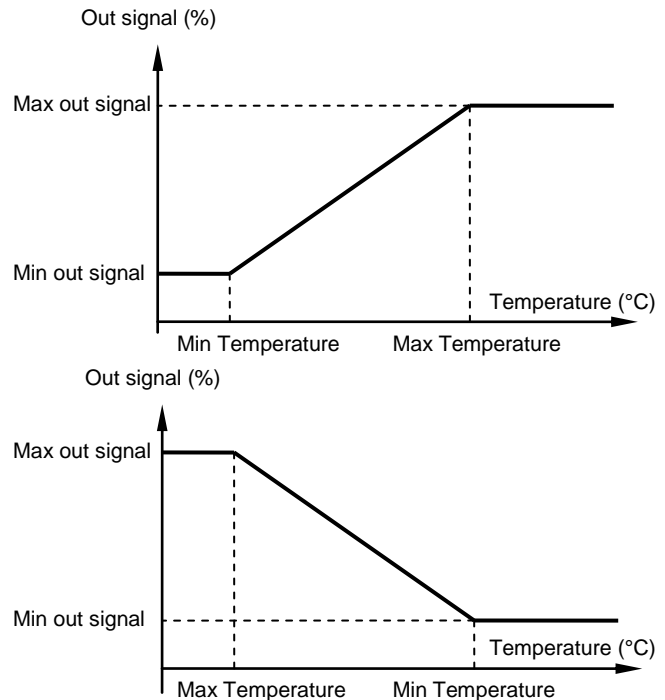Connection and mounting instructions see section Connection of temperature sensor.

Figure 5. Temperature control.

SYSTEM SETTINGS

The language used in the menu system can be changed with parameter 1, "*Language*". Two choices are available in the current version, English and Swedish.

Max and Min out, parameter 40 and 41, limits the controller out signal so that the signal never go beyond these limits.

A fixed reference can be chosen with parameter 62 which will be activated by terminal 6. NOTE, this will configure terminal 6 to trigger fixed reference and will not be trigger for start signal.

To use fixed reference signal, choose *"Use fixed ref."* or *"Hysteresis cont."*.

The fixed signal can either be a fixed out signal or fixed pressure ref. The fixed pressure is set by parameter 54 under *"Press/Temp. settings"*.

FKP-R/R2 has built in hysteresis control of an analog input signal. Use parameter 71 to activate this function. The choices are the same as for parameter 62. Both functions can be used simultaneously and do always have priority over pressure and temperature control and also the timer function.

Fixed out signal always has priority over fixed pressure.

E.g. if the FKP-R/R2 is in pressure control mode when terminal 6 is activated, then pressure control will be disabled and the controller will set a fixed out signal. If terminal 6 is deactivated then the controller will return to pressure control mode.

At fixed or forced out signal an (F) is displayed in the display.

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Start and stop levels for the hysteresis control are set by parameter 72 and 73. A stop delay can be accomplished by setting parameter 74.

Inverting the function is done by setting stop level higher then the start level.

Terminal 7 is the analog in signal for the hysteresis control and parameter 75 set the input range. If the in signal is a 4-20mA signal then a 499ohm resistor must be connected between terminal 7 and common.

SYSTEM SETTINGS:		
Nr:	Parameter:	Value:
61	Language	Swedish, English
40	Max out	0 – 100%
41	Min out	0 – 100%
44	Fixed outsignal	0 – 100%
62	Use fixed freq.	Never, Freq. on terminal 6, Pressure on terminal 6
71	Hysteresis control	off, start fixed freq., start fixed pressure
72	Hysteresis start	1 – 100%
73	Hysteresis stop	0 – 99%
74	Hysteresis stop-delay	0 – 15min
75	Insignal on term 7	0-10V, 4-20mA (499Ohm)
63	Current out	4-20mA, 0-20mA
65	System log	Days and Hours
66	System error log	See error screen
67	Drive information	Model, firmware
68	Reset logs	Yes, No
69	Restore default settings	Yes, No
70	System states	System data

The entire controller can be restored to default settings by changing parameter 69. Language and MODBUS parameters will also be reset.

"Reset logs" clear all error logs.

"System states" shows a good overview of many of the systems internal variables. Here can all input and outputs of the controller be viewed. This list is primarily used for troubleshooting.

"System log" displays the runtime of the controller and can not be reset.

The FKP-R/R2 model and firmware version can be found in "Drive information".

MODBUS/RTU

With the RS485 MODBUS option, the FKP-R/R2 can communicate with a MODBUS master using MODBUS/RTU. Essentially all the settings that can be changed via the menu system can also be changed via MODBUS and more important data can be read out. See the MODBUS Data Dictionary for more information (page 15).

MODBUS SETTINGS:		
Nr:	Parameter:	Value:
100	MODBUS address	1 - 247
101	MODBUS parity	None, Even, Odd
102	MODBUS baudrate	2400, 4800, 9600, 19200

MODBUS parameters are available under "System settings/MODBUS settings", and consist of address, parity and baudrate (bitrate).

FAULTS AND ALARMS

If a fault occurs, it is always shown on an error screen.

The controller will stop and restart automatically 60 seconds after any fault ceases. The countdown to restart is shown on the screen. If the fault persists, the controller will go into alarm mode after 60 seconds. This will be indicated by the text "Drive alarm!", and by the alarm relay changing to the fault state. Once the controller is in alarm mode, it can only be brought out of it by pressing the encoder wheel, or by interrupting the power supply.

- "EEPROM error" is displayed if the parameter memory is corrupt. The memory is reset to default controller settings. Please contact service.
- In pressure controlled mode, the controller will also be subject to "Over pressure" and "Under pressure" faults. These occur when the pressure is too high or too low compared to the settings (24 and 25) of the pressure controller. These faults can be set to not stop the controller even if the alarm relay is triggered. This is controlled by the "Stop on alarm".

To aid in troubleshooting, the FKP-R/R2 will record all faults for later viewing. This recording will not be reset by loss of power to the drive. The faults are shown in the "System settings/System error log" parameter. The first items shown are the total count of errors of each type that have occurred. Below the separating line, the last 8 faults are shown. The most recent fault is shown at the top. Each fault has a number to shown how many faults have occurred in total. (For example, the third fault to have occurred is numbered 3.)

It is possible to reset the error history of the controller using the "System settings/Reset logs"

parameter. This will have no other effect on the controller.

CONTROLLER STOPPED

If a start signal is not connected to either terminal 4 (forward) or 6 (reverse), the display will show the "controller stopped screen". The menus can as always be accessed by turning the encoder wheel.

The information screen will appear as soon as a start signal is connected.

INFORMATION SCREEN

The FKP-R/R2 shows many types of information while running, to aid in diagnostics and troubleshooting.

When the controller is active (a start signal is connected, and no faults have occurred), the display will show relevant status information. Output signal will always be shown. If pressure control is selected, the screen will also show the current pressure. If temperature compensation or temperature control is selected, the current outside temperature will also be shown. If the controller has the timer option, this will be display at the bottom of the display.

```
Pressure      1Pa
Temp.:     23.6°C
Out:100%
       (F)100% P1
```
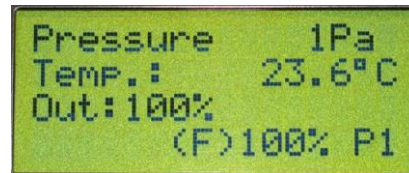
Figure 6. FKP-R/R2 Information screen in pressure controlled mode with temperature compensation. The built-in timer, program P1, is active and is forcing (F) the pressure reference to 100%.

MOUNTING

The FKP-R/R2 is water and dust protected up to IP54 classification. It is quickly and easily mounted thanks to holes in the corners. Lift the lid to access mounting holes.

To maintain water protection, the seal on the lid must be undamaged, and the screws tightened. NOTE! Do not over tighten the screw as this can cause damage to the threads.

The cable glands should always be proper fastened and all cable glands that are not used should be replaced with blind plugs to ensure IP54.

The reverse side of the lid contains a quick connection reference.

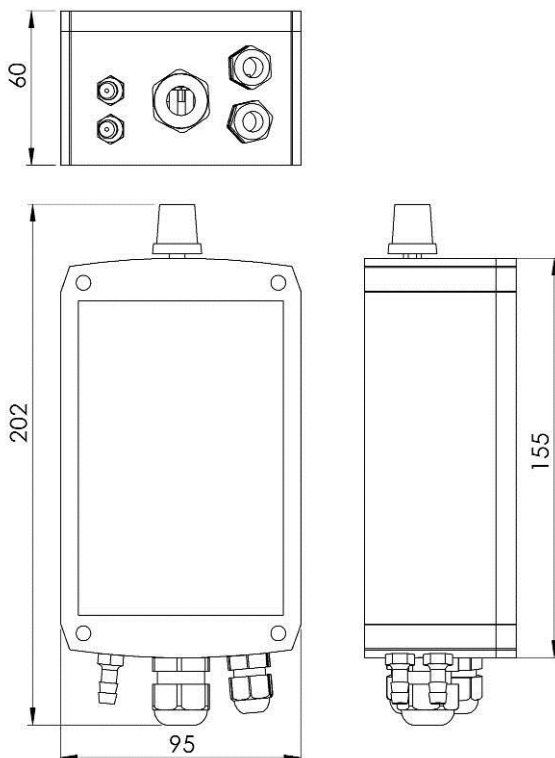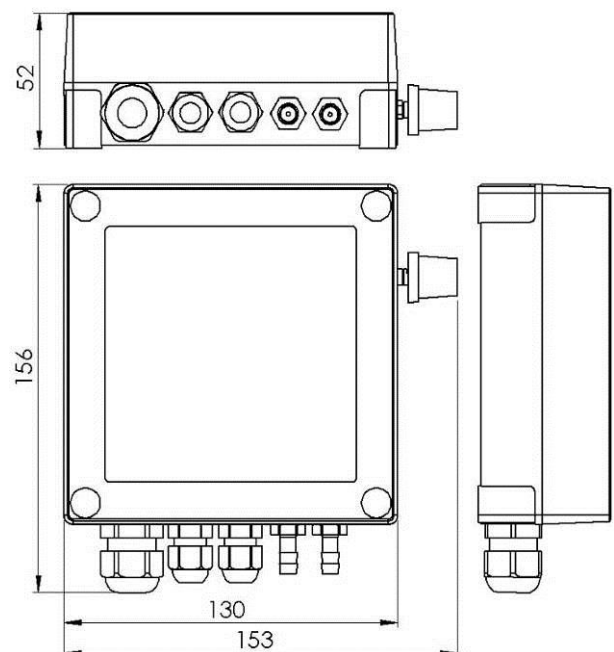The pressure connections are sized for 5mm PVC hose.

Figure 7. FKP-R2 dimensions.

FKP-R dimensions.

OPTIONS
The FKP-R/R2 can be equipped with a timer option in order to provide a complete ventilation control solution. The built-in timer allows control of the controller pressure and out signal based on time-of-day and weekday.

BUILT-IN TIMER SETTINGS
The optional built-in Real Time Clock (RTC) allows for lowering, rising or forcing the reference value of the controller (be it pressure, temperature or MODBUS reference) based on almost arbitrary schedules.
The RTC has a backup battery to allow it to keep track of the time even when the FKP-R/R2 has no external power applied. The current time and day is set with parameter 86 and 87 respectively under "*System settings*".

SYSTEM CLOCK:		
Nr:	Parameter:	Value:
86	System clock	Monday - Sunday
87	System clock	hh:mm:ss

The weekly schedule is set under "*Timer settings*" by first choosing one of seven available programs (parameter 80). This is followed by choosing the start and stop times, the day to run the program, and the reference value while running it. From the factory, all programs are deactivated by setting "*Run Px on*" (parameter 81) to "*No days*".
The starting time is set with parameter 82, and the stop time with parameter 83. If the stop time is set before or the same as the start time, the program will run from the start time on the chosen day, to the stop time on the next day. For example, if the chosen day is Monday, the starting time is 14:00, and the stopping time is 07:00, the program will run from 14:00 on Monday until 07:00 on Tuesday.

TIMER SETTINGS:		
Nr:	Parameter:	Value:
80	Chosen program	P1 - P7
81	Run Px on	No days, Mon - Sun, Weekdays, Weekends, All days
82	Start time for Px	00:00 - 23:59
83	Stop time for Px	00:00 - 23:59
84	Ref.value of Px	0 - 400%
85	Force ref. value	Yes, No

The reference value (parameter 84) is expressed as a percentage of the active reference value of the drive from 0 to 400%.
If 0% reference is set then the controller will stop the out signal when this program is active.

If temperature control is used, then the reference value change the *"Max out"* between 0-400%, but max 10V as this is the controller maximum out signal.
The set out signal ramp will be moved up or down according to figure 8.
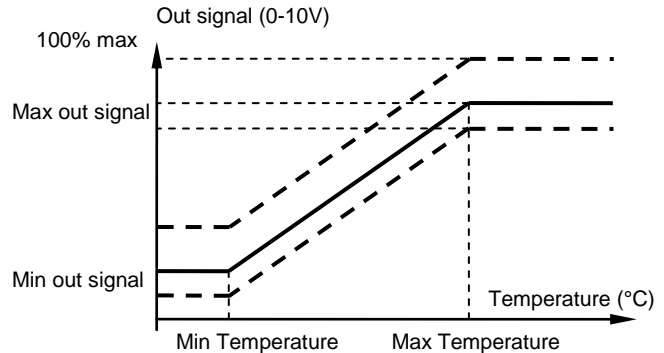
Figure 8. Change of out signal reference.

If *"Force ref. value"* parameter 85 is set to *"yes"* then the reference value will be constant and independent of the temperature.
I.e. the controller will force the out signal to be constant between 0-400% of *"Max out"*.

Temperature compensated pressure works in the same way as temperature control regarding offset of the pressure curve and the forcing function.
If the controller have a pressure reference set to 100Pa and reference value set to 70% and *"force ref. value"* to *"yes"*, then the controller will lower the actual pressure ref to 70Pa when the program is active even if it is cold outside.
With forcing off the pressure will drop even lower if the temperature is lower then *"Max Temperature"*.
The out signal can not go outside the *"Max out"* and *"Min out"* limits.
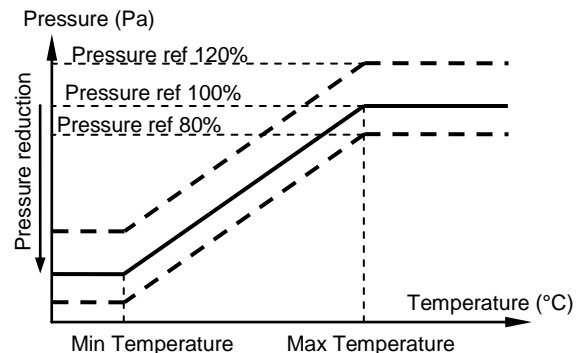
Figure 9. Change in pressure reference.

In the mode where only pressure control is used, the pressure reference is changed between 0-400% and the out signal is limited by *"Max out"* and *"Min out"*.
Forcing the reference value has no effect in this mode.

If the controller mode MODBUS 0-10V reference is used then the out signal can vary between 0V and 10V by setting the "Ref. value" to between 0-400% of the 0-10V reference signal.
Forcing the reference value has no effect in this mode.

If several programs are scheduled to run with overlapping times, the program with the highest number will take priority. For example, if P1 is set from 12:00 to 17:00 with reference 30%, and P2 is set from 15:00 to 16:00 with reference 10%, then the drive will run with 30% reference from 12:00 to 15:00, with 10% reference from 15:00 to 16:00, and with 30% reference from 16:00 to 17:00.

In case one or more programs are active but not performing any reference reduction (that is, not scheduled to run at this time), the information screen will show "*P**" in the lower right corner. When a program is running and reducing the reference, the screen will show the program number and the reference reduction (as seen in Figure 6).
If reference forcing is active then a (F) will be display in the display.

Appendix A. **Quick reference to FKP-R/R2 menu system.**

CONTROLLER SETTING:				
Nr:	Parameter:	Value:	Default:	Description:
2	Control method	Pressure cont., Press. cont./ Tempcomp. Temp cont. MODBUS 0-10V	Press. Cont./ Tempcomp.	Choose the way the controller is controlled. Choices are 0 - 10 V frequency reference; Pressure control with or without temperature compensation; Temperature control only. MODBUS 0-10V is used when the controller is controlled from a MODBUS ref. signal.

PRESSURE/TEMPERATURE SETTINGS:				
Nr:	Parameter:	Value:	Default:	Description:
10	Pressure ref (external) (internal)	0 - 1500Pa 0 - 1000Pa	100Pa	Pressure reference of the controller, also shows actual value and pressure reference value after temperature compensation.
17	Pressure reduction	0 - pressure ref.(Pa)	15Pa	Magnitude of the decrease of the pressure reference at the lower temperature compensation corner point.
54	Fixed pressure	0 - 1000Pa	100Pa	Sets fixed frequency ref if this setting is used from parameter 62 or 71.
18	Temperature max	-50 - 50°C	15°C	Upper corner point for temp. comp.
19	Temperature min	-50 - 50°C	-15°C	Lower corner point for temp. comp.
23	Stop on alarm	Yes, No	Yes	"Yes" will stop the out signal of the controller (and activate the alarm relay) on pressure alarms, "No" will only activate the alarm relay.
24	Alarm upper limit	-1500-1500Pa	400Pa	Alarm limit for overpressure.
25	Alarm lower limit	-1500-1500Pa	25Pa	Alarm limit for underpressure.
26	Alarm delay	0 - 1000sec	600sec	Time until a pressure alarm is generated.
20	Temp. sensor type	NTC 100k, NTC 10k, PT1000, active, MODBUS	NTC 10k	Type of temperature sensor (active sensors are connected to terminal 2 or from MODBUS).
21	Active temp min.	-50 - 0°C	-40°C	Temperature with 0V from active sensor.
22	Active temp max.	0 - 100°C	80°C	Temperature with 10V from active sensor.
11	Pressure input	internal, external, MODBUS	internal	Pressure sensor type, Choose MODBUS if pressure ref is controlled from MODBUS.
12	External min pressure	-1500 - 0Pa	0Pa	Pressure with 0V from external sensor.
13	External max pressure	0 - 1500Pa	999Pa	Pressure with 10V from external sensor.
14	Zero pressure	Yes, No	-	Calibrate actual pressure to zero now.
15	Controller gain Kp	0 - 999	0	Gain applied to the difference between the actual and reference pressures.
16	Integ. time Ti	1 - 999	400	Controller integration time.

The colors mark which parameters are active dependant on the choice of Control method

Appendix A. **Quick reference to FKP-R/R2 menu system.**

				SYSTEM SETTINGS:
Nr:	Parameter:	Value:	Default:	Description:
61	Language	Swedish, English	Swedish	Menu system language.
40	Max out	50 - 100%	100%	Upper limit for controller out signal.
41	Min out	0 - 50%	0%	Lower limit for controller out signal.
44	Fixed outsignal	0 - 100%	50%	Fixed out signal, used settings 62 is active and terminal 6 has a signal.
62	Use fixed ref.	never, Out signal on terminal 6, press. on terminal 6	Never	Fixed out signal, used when terminal 6 and 4 has a signal. Choose fixed out signal, parameter 44 or fixed pressure, parameter 54.
71	Hysteresis control	Off, start fixed out signal, start fixed pressure	Off	Choose what to activate when the hysteresis control has been activated by a signal on terminal 7. Fixed frequency is set by parameter 44 and fixed pressure by parameter 54. Off deactivates hysteresis control.
72	Hyst. start	1 - 100%	45%	Choose hysteresis start level on analog terminal 7.
73	Hyst. stop	0 - 99%	35%	Choose hysteresis stop level on analog terminal 7.
74	Hyst. Stop delay	0- 15min	0min	Sets off delay. At hysteresis stop the acual stop is delayed this time.
75	Insignal on term 7	0-10V, 4-20mA (499Ohm)	0-10V	Set signal scaling on termial 7. If 4-20mA is used then an external resistor (499ohm) is to be connected between the terminal and Signal Common.
63	Current out range	4-20mA, 0-20mA	0-20mA	Choose current out signal range.
65	System log	Days and hours	-	Shows the time the controller has been running with start signal connected.
66	System error log	See error screen	-	Shows the count of each type of fault, and the 8 most recent faults.
67	Drive Information	Model, firmware	-	The type, manufacturer, firmware revision date and options of the controller.
68	Reset logs	Yes, No	-	Resets the system error log.
69	Restore default settings	Yes, No	-	Restores all parameters to default.
70	System states	System data	-	Shown many of the internal variables of the system (for service use).
				MODBUS SETTINGS: (under System Settings)
Nr:	Parameter:	Value:	Default:	Description:
100	MODBUS address	1 - 247	1	Choose MODBUS-address of this controller.
101	MODBUS parity	None, Even, Odd	Even	Choose MODBUS parity.
102	MODBUS baudrate	2400, 4800, 9600, 19200	19200	Choose MODBUS communication bitrate.

STATUS SCREENS:		
Parameter:	**Value:**	**Description:**
Information screen	Pressure/temp/ref, Out signal, timer	Always shown in when the controller is running. Shows "P*" or "xx% Px" if the controller has an active timer function.
Code screen	Menu code	Gives access to the parameters of the controller, see the inside of the lid.
Error screen	EEPROM error, Over pressure, Under pressure	Shows controller faults and alarms. Alarms are reset by pressing the encoder wheel or power cycling.
Stopped screen	Controller stopped text	Shown when the controller is stopped due to missing start signal.

Appendix B. **Quick reference to FKP-R/R2 options menus.**

TIMER SETTINGS:				
Nr:	**Parameter:**	**Value:**	**Default.:**	**Description:**
80	Chosen program	P1 - P7	P1	Choose a program to change
81	Run Px on	No days, Mon. - Sun., Weekdays, Weekends, All days	No days	Choose which days the program should run on. Select "No days" to deactivate timer.
82	Start time for Px	00:00 - 23:59	00:00	Choose which time on the chosen day the program starts.
83	Stop time for Px	00:00 - 23:59	00:00	Choose which time the program stops. If the chosen time is before the start time, the program will run until the next day.
84	Ref value for Px	0 - 400%	100%	Percentage of pressure or output reference used when the program is active. 0% stops the output signal.
85	Force reference	Yes, No	No	Forces the reference value so it do not change over temperature.

CLOCK SETTINGS: (under System Settings)				
86	System clock	Monday-Sunday	-	Sets the current day
87	System clock	hh:mm:ss	-	Sets the current time of day

MODBUS-FUNCTION

FKP-R/R2 Modbus/RTU is compatible with SCADA-system and support all standard functions.
The units address is set under "system settings/MODBUS settings" in the menus, parity and baudrate are also set here.

Default settings are:
Address = 1
Parity = even
Baudrate = 19200

FKP-R support Modbus-functions:
1 = Read Coils (Logisk 1/0)
2 = Read Discrete Input
3 = Read Holding Register
4 = Read Input Register
6 = Write Single Register
16 = Write Multiple Registers

Modbus register addresses are numbered from 1 but the actual sent address is numbered from 0.
The register addresses that are referenced in this user guide are numbered from 1 and the address that is sent should be one less.

"Scaling:" in the table marks how many times the Modbus-value is up scaled compared to actual value. E.g. 10Volt corresponds to Modbus-value 100 as the scaling is 10.

LIMITATIONS

Only "MODBUS CONTROL SIGNALS" shall be used when FKP-R is remote controlled and the update Write-cycles are high.
These signals are not saved in the internal memory as all other Write-signals are.

All other Write-signals may not be continuous written to. Continuous write to these signals will destroy the internal EEPROM memory as it has limited number of write-cycles.

MODBUS-SIGNALS

Signal name:	Function type:	Address:	Value:	Scaling:	Default settings:	Description:
I/O-SIGNALS						
Digital in 1 (Start)	1, 2	1	-	-	-	Indicates signal on teminal 4
Digital in 2 (Start)	1, 2	2	-	-	-	Indicates signal on teminal 6
Digital in 3	1, 2	3				Indicates signal on teminal 13
Alarm relay	1, 2	4	1=on (Normal run), 0=off (Error)	-	-	Indicates the alarm relay state, terminal 21-24.
MEASURING SIGNALS						
0 - 10V IN 1	3, 4	51	**-**	10	-	Shows in signal on Terminal 2. (V)
0 - 10V IN 2	3, 4	52	**-**	10	-	Shows in signal on Terminal 7. (V)
Out side temperature	3, 4	53	-	100	-	Shows out side temperature from external temperature sensor. (°C)
Pressure act. value	3, 4	54	-	1	-	Shows the pressure from the internal pressure sensor or from external if it is used.(Pa)
Compensated pressure ref. value	3, 4	55	-	1	-	Actual pressure ref. value. Shows the pressure after temperature compensation and or timer ref. changes.
Out signal	3, 4	56	-	1	-	Shows out signal of the controller in %.

MODBUS-SIGNALS

CONTROL SETTINGS-SIGNALS						
Signal name:	**Function type:**	**Address:**	**Value:**	**Scaling:**	**Default settings:**	**Description:**
Control method	3, 6, 16	82	1 = Pressure control 2 = Temp.comp. Pressure cont. 3 = Temp. control 4 = MODBUS 0 - 10V	-	1	Set control method.
PRESSURE/TEMPERATURE SETTINGS-SIGNALS						
Pressure ref (external) (Internal)	3, 6, 16	83	0 - 1500Pa 0 - 1000Pa	1	100 (100Pa)	The controller pressure reference value. (Pa)
Pressure reduction	3, 6, 16	84	0 - pressure ref.	1	15 (15Pa)	Magnitude of the decrease of the pressure reference at the lower temperature compensation corner point.
Max temperature	3, 6, 16	85	-50 - 50°C	100	1500 (15°C)	Upper corner point for temp. comp.
Min temperature	3, 6, 16	86	-50 - 50°C	100	-1500 (-15°C)	Lower corner point for temp. comp.
Stop on alarm	3, 6, 16	87	0 = no 1 = yes	-	1	"Yes" will stop the controller (and activate the alarm relay) on pressure alarms, "No" will only activate the alarm relay.
Alarm upper limit	3, 6, 16	88	-1500-1500Pa	1	400 (400Pa)	Alarm limit for overpressure.
Alarm lower limit	3, 6, 16	89	-1500-1500Pa	1	25 (25Pa)	Alarm limit for underpressure.
Alarm delay	3, 6, 16	90	0 -1000sec	1	600 (600sec)	Time until a pressure alarm is generated.
Temperature sensor type	3, 6, 16	91	0 = NTC 100k 1 = NTC 10k 2 = PT1000 3 = Active 4 = MODBUS	-	1	Type of temperature sensor (active sensors are connected to terminal 2 or from MODBUS).
Aktive min temp.	3, 6, 16	92	-50 - 0°C	100	-4000 (-40°C)	Temperature with 0V from active sensor.
Aktive max temp.	3, 6, 16	93	0 - 100°C	100	8000 (80°C)	Temperature with 10V from active sensor.
Pressure input	3, 6, 16	94	0 = Internal 1 = External 2 = MODBUS	-	0	Pressure sensor type, Choose MODBUS if pressure ref is controlled from MODBUS.
External min pressure	3, 6, 16	95	-1500 - 0Pa	1	0 (0Pa)	Pressure with 0V from external sensor.
External max pressure	3, 6, 16	96	0 -1500Pa	1	999 (999Pa)	Pressure with 10V from external sensor.
Zero pressure	3, 6,16	97	0 = no 1 = yes	-	0	Calibrate actual pressure to zero now.
Controller gain Kp	3, 6, 16	98	0 - 999	1	0	Gain applied to the difference between the actual and reference pressures.
Integ. time Ti	3, 6, 16	99	1- 999	1	400	Controller integration time.
Fixed pressure	3, 6, 16	100	0 - 1000Pa	1	100 (100Pa)	Sets fixed frequency ref if this setting is used from parameter 62 or 71.

SYSTEM SETTINGS-SIGNALS						
Language	3, 6, 16	101	0 = Swedish 1 = English	-	0	Menu system language.
Max out signal	3, 6, 16	102	50 - 100%	1	100 (100%)	Upper limit for controller out signal.
Min out signal	3, 6, 16	103	0 - 50%	1	0 (0%)	Lower limit for controller out signal.
Fixed outsignal	3, 6, 16	104	0 - 100%	1	50 (50%)	Fixed out signal, used when setting 62 (signal 105) is used and terminal 6 is high.
Use fixed ref. signal	3, 6, 16	105	0 = Never 1 = Out signal on terminal 6, 2=Pressure on terminal 6	-	0	Fixed out signal, used when terminal 6 and 4 has a signal. Choose fixed ref signal, parameter 44 (signal 104) or fixed pressure, parameter 54 (signal 100).
Reset logs	3, 6, 16	106	0 = no, 1 = yes	-	0	Resets the system error log.
Reset alarm	3, 6, 16	107	0 = Not reset 1 = Reset	-	0	Reset the controller if it has tripped from a fault.
Current out range	3, 6, 16	108	0 = 4-20mA, 1 = 0-20mA	-	0	Choose current out signal range.
Restore default settings	3, 6, 16	109	0 = no, 1 = yes	-	-	Restores all parameters to default.
Insignal on term 7	3, 6, 16	110	0 = 0-10V, 1 = 4-20mA (499Ohm)	-	0	Set signal scaling on termial 7. If 4-20mA is used then an external resistor (499ohm) is to be connected between the terminal and Signal Common.
Hysteresis control	3, 6, 16	111	0 = Off, 1 = Start fixed out signal, 2 = Start fixed pressure	-	0	Choose what to activate when the hysteresis control has been activated by a signal on terminal 7. Fixed frequency is set by parameter 44 (signal 104) and fixed pressure by parameter 54 (signal 100). Off deactivates hysteresis control.
Hysteresis start	3, 6, 16	112	1 - 100%	1	45 (45%)	Choose hysteresis start level on analog terminal 7.
Hysteresis stop	3, 6, 16	113	0-99%	1	35 (35%)	Choose hysteresis stop level on analog terminal 7.
Hysteresis stop delay	3, 6, 16	114	0 - 15min	1	0 (0 min)	Sets off delay. At hysteresis stop the acual stop is delayed this time.

TMER SETTINGS-SIGNALS						
Chosen program	3, 6, 16	117	1 - 7 = P1 - P7	-	1	Choose a program to change.
Rin Px on	3, 6, 16	118	0 = No days 1-7 = Mon. - Sun. 8 = Weekdays 9 = Weekends 10 = All days	-	0	Choose which days the program should run on. Select "No days" to deactivate timer.
Star time Hours	3, 6, 16	119	00:XX - 23:XX	1	0	Choose which time on the chosen day the program starts.
Start time Minutes	3, 6, 16	120	XX:00 - XX:59	1	0	
Stop time Hours	3, 6, 16	121	00:XX - 23:XX	1	0	Choose which time the program stops. If the chosen time is before the start time, the program will run until the next day.
Stop time Minutes	3, 6, 16	122	XX:00 - XX:59	1	0	
Ref value for Px	3, 6, 16	123	0 - 400%	1	100 (100%)	Percentage of pressure or frequency reference used when the program is active. 0% stops the out signal.
Force reference	3, 6, 16	124	0 = no 1 = yes	-	0	Forces the reference value so it do not change over temperature.
Systemklocka dag	3, 6, 16	125	1 - 7 = Monday - Sunday	-	-	Sets the current day
System clock Hours	3, 6, 16	126	hh:xx:xx	1	-	Sets the current time of day
System clock Minutes	3, 6, 16	127	xx:mm:xx	1	-	
MODBUS CONTROL-SIGNALS (continuous updatable)						
MODBUS 0-10V	3, 6, 16	201	0 - 10V	10	0	Used as 0-10V signal when Control type 4 = MODBUS 0-10V.
MODBUS Pressure ref.	3, 6, 16	202	0 - 1500Pa	1	0	Used for continuous controlling of pressure reference.
MODBUS Pressure act.	3, 6, 16	203	0 -1500Pa	1	0	Used as pressure act. when Pressure Input = MODBUS.
MODBUS Temperature act.	3, 6, 16	204	-50 - 100°C	100	0	Used as temperature act. when Temperature sensor type 4 = MODBUS.

SYSTEM DATA-SIGNALS						
Signal name:	Function type:	Address:	Value:	Scaling:	Default settings:	Description:
System log Days	3, 4	57	Days	1	-	Shows the time the drive has been running with start signal connected.
System log Hours	3, 4	58	Hours (0-24h)	10	-	
Controller state	3, 4	59	0 = FAULTACTIVE 1 = FAULTHOLD 2 = ACWAIT 3 = IDLE 4 = RUN	-	-	Shows the state of the controller.
Active Timer program	3, 4	60	1 - 7 = P1 - P7 0 = No program active 8 = Programmed but not active	-	-	Shows the state of Timer. 0 equals no program is currently active. 8 indicates that the Timer has something programmed but the program is not currently active.
System error log	3, 4	61	EEPROM error	-	-	Shows the count of each type of fault for last "Reset logs".
	3, 4	62	Over pressure	-	-	
	3, 4	63	Under pressure	-	-	
ERROR SIGNALS						
Error message	3, 4	64	-1 = no error 14 = EEPROM error 15= Over pressure 16 = Under pressure	-	-	Shows current fault.The fault presesists until the controller resumes normal operations. If the controller has tripped, Reset alarm, parameter 107 has to be set to reset the controller.

TECHNICAL DATA

Type:	**FKP-R/R2**	**Cable connections:**	Cable glands (included): Plastic 1pcs M16×1,5, Plastic 2pcs M12×1,5
Power supply:	230VAC / 24VDC	**Pressure sensor (internal):**	±1000Pa (1Pa resolution)
Temperature range:	-30 - +40°C	**Pressure connection:**	two 5mmØ
When there are special demands for extreme temperature ranges, please contact manufacturer.		**Alarm relay:**	250VAC, 8A
		Communication:	MODBUS
Enclosure:	IP54		
Outputs:	4-20mA/0-20mA (0-10V with external resistor 499Ohm), 10V reference	**Dimensions:**	FKP-R: 156 x 153 x 52mm FKP-R2: 202 x 95 x 60mm
		Weight:	0.4kg
Inputs:	two 0-10V Alternatively 4-20mA with external resistor, two 24V digital, Analog NTC, PT1000		

Options:

Pressure sensor (internal):	2500/5000/30000Pa
Temperature sensor:	NTC10 (external)
Timer:	Built in real-time clock.

PASSIVE TEMPERATURE SENSOR

Type:	4FKP -T2
Sensor element:	NTC 10kohm
Temperature range:	-39 - +50°C
Enclosure:	Plastic
Enclosure class:	IP54, cable gland downwards
Cable connection:	2,1m PVC cable 2wire x 0,5mm2
Dimensions:	100 x 100 x 38mm