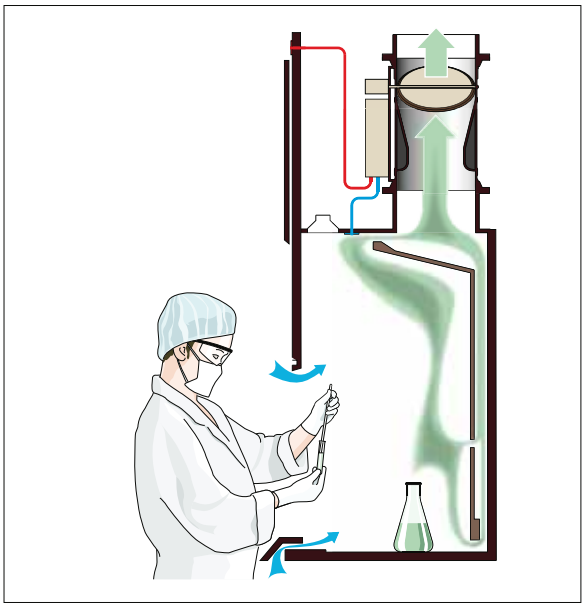
PFR-C FUME HOOD CONTROL SYSTEM

- Ultra low actual face velocity measurement
- Millisecond response time of the control
- Excellent measurement sensor repeatability
- Total air tight shut off Valve made of PPs
- Pressure independent damper control
- Long term velocity measurement stability
- Ultra low hysteresis of the control action
- Extract Volume limiting and supply tracking
- Operator Panel with alarms and exhaust
- Modbus rtu Communication to BMS and PLC's
- After Sales Service is provided by CMR
- 24 month warranty
- 30 Years field application experience

PFR-C Complete Fume Hood Control System

The PFR-C is a PFR-A Valve and a DPC-320 Controller and has been especially designed for Fume Hood control operation to fit any fume cupboard manufacturers equipment and is ready for installation as a complete factory commissioned system.
The most important advantage is that it can control any type of fume hood without the need to connect to moving sash parts such as drive mechanisms, sliding window sensors or the fitting of sash height measurement potentiometers.

The DPC-320 FC-Controller measures the differential pressure between the fume hood inner body and the Laboratory which is a very low pressure of 0.15 Pa. This measurement is converted into a velocity, which represents 0.50 m/s face velocity. The measurement tubes are connected to the DPC without any wiring of an independent sensor. The DPC-320 maintains 0.50 m/s linear face velocity at all times regardless of the sash type, vertical or horizontal, with or without sliding windows. This means the sash can be closed down to 10mm or opened to 500mm or higher and the face velocity will remain at 0.50 m/s. The set point is user adjustable from 0.35 to 1.00 m/s.



PFR-C Fume Hood Face Velocity Control

The velocity measurement is factory calibrated and only a check has to be carried out to issue a site certificate. All the face velocity calibration can be done via the operator keyboard panel without a lap top or climbing to the top section where the controller is located.

The DPC-320 is mounted on a PFR-A PPs Valve which has also a fast acting actuator. The unit is normally powered by 230Vac and pre-wired. 24Vac and 110Vac is also available. A modbus rtu communication is standard, so that the complete system can be monitored and commanded via the local BMS or PLC control system. The PPs Valve has a built in Venturi total air volume measurement device. The valves are supplied in sizes of 160,200,250 and 315mm Ø with flanges.

The DPC-320 has an additional sensor which measures the volume on the venturi and limits the extract volume so that the design of the laboratory is respected at all times and the central extract fan cannot run out of its design capacity. If there are 100 Fume Hoods and each is designed to extract 0.3m3/s then this is the limit and sufficient extract air will be available to all other fume hoods throughout the building.

PFR-C Fume Hood Controllers in operation

Night set back set points are programmable i.e. 0.35m/s and normal set points can be adjusted up to 1m/s. Emergency exhaust set points can go up to 1m/s or more.

The operator control panel is fitted to the side upright or at any position and the actual face velocity, alarm, actual extract volume, and position of damper, is displayed. An emergency exhaust button can instantly increase the exhaust in case of spillage.

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Issue PFR-C-GB04-1

PFR-C FUME HOOD CONTROL SYSTEM

With built in ultra low face velocity and extract volume sensor

The DPC-320 Fume Hood controller maintains 0.50 m/s linear face velocity at all times regardless of the sash type, vertical or horizontal with sliding windows. This means the sash can be closed down opened to 500mm and the face velocity will remain at 0.50 m/s. The set point is user adjustable from 0.35 to 1.00 m/s. All alarm levels can be adjusted and remote mute, total shut off, hand position can be connected to the BMS via Modbus rtu. An emergency exhaust panic button is standard in case of chemical spillage to provide user safety. The DPC has a second sensor which measures the extract volume and a min and max extract volume can be adjusted. When the sash is fully open only the design volume will be extracted. If the sash is closed a minimum volume will always be extracted. The DPC-320 is factory tested and pre-commissioned and works on any make of Lab Hoods.

DPC-320 Fume Hood Controller

Typical Fume Cupboard

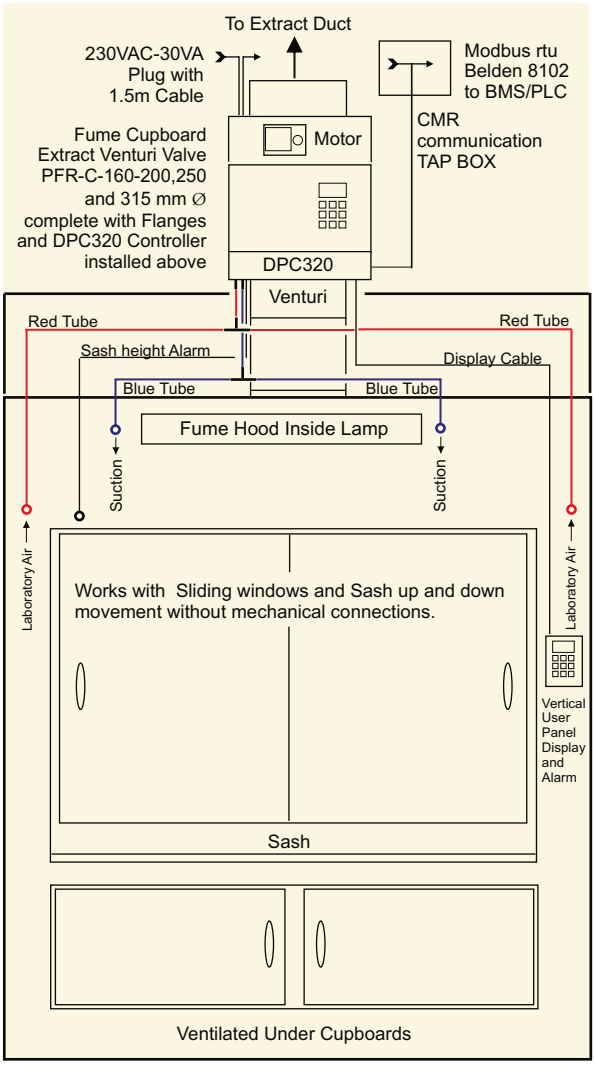
A typical fume cupboard extract control system in a Laboratory. When the sash is lifted, the DPC senses the incoming velocity and controls the PFR extract valve instantly to provide 0.5m/s at all times. The operator display panel is a horizontal type in this case and is mounted below the sash. Face Velocity and extract volume alarms are standard.

PFR-C PPs Valve

The PFR air valve is air tight and a venturi volume measurement is built in. The response time is milliseconds. The valve can be shut off air tight. The DPC controller is mounted on top and is fully wired, factory tested and ready commissioned.

Horizontal Display

The remote operator panel displays face velocity, extract volume, position of valve, low velocity or extract volume alarm as well as sash high alarm. An emergency exhaust button is fitted. Calibration is carried out through this remote keyboard.



Fume hood face velocity or sash height control with volume limiting

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PFR-C FUME HOOD CONTROL SYSTEM

A compact laboratory control system with BMS interface

The Laboratory below has seven Fume hoods with PFR-C VAV controls. They have a min extract rate of 200m3/h therefore a total minimum extract of 1400m3/h. The General Extract DPC measures the general extract volume of the extract venturi valve and the total Fume Hood Extract volume with a PPs Veloprobe in the duct and adjusts the general Extract proportionally. The minimum Supply Air into the Laboratory must be 1800m3/h and as the Laboratory must always be negative, the general extract will adjust itself to 600m3/h, therefore the total extract is now 2000m3/h and the supply air DPC adjusts the supply VAV to 1800m3/h to keep the Laboratory slightly negative.

When the sashes are lifted up, the total Fume Hood Extract shall increase, the General Extract DPC shall measure this change on the fume hood extract duct and shall decrease the general extract volume. The Supply shall track the extract always keeping the Lab negative.

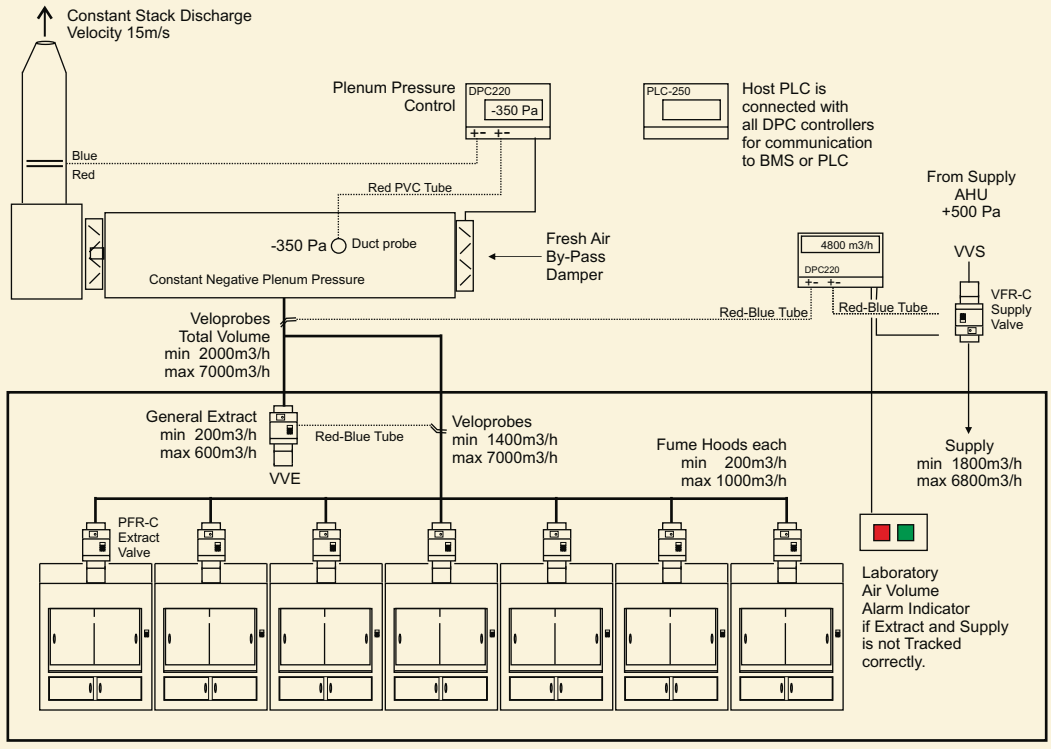
The Plenum pressure is controlled by a DPC adjusting the fresh air by pass damper to guarantee the stack velocity of 15m/s at all times. As the Fume Hoods close, the suction pressure increases and therefore the fresh air damper opens to maintain the stack velocity and duct pressure.

Each Fume Hood, Supply and general extract DPC controller has modbus communication and all volumes are transmitted to the Host which performs all calculations to balance the air flow. BMS interface is standard.

DPC-220Controller

VFR-C Supply-Extract Valve

Typical Laboratory Fume Hood Extract - General Extract - Supply Air and Plenum Pressure Control



Controlling a complete laboratory and monitoring the extract and supply volumes

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PFR-C FUME HOOD PPs VENTURI VALVE

PPs PLASTIC VALVES
The PFR Fume Extract Valve is made of PPs and is circular. It has a Venturi Flow Measurement device built in. The actuator VMS-408 and DPC-320 controller is factory fitted to the valve and fully tested and ready for installation. The most popular sizes are 250 and 315. mm Ø and all the mounting brackets are moulded and welded to the valve body. Other sizes are available in the PVR range of valves from 400 up to 630mm Ø on request..

VENTURI VOLUME MEASUREMENT
The valves have a venturi extract volume measurement which is used to control the make up supply air. The extract volume is measured and volume limiting is achieved. Regardless how high the sash is lifted, the volume shall be controlled to the maximum design volume. In addition, the total volume shall be added of all fume hoods in a laboratory in order to match the supply air volume.

All CMR valves are airtight to DIN 1946 T4. The CMR actuator is able to drive the valve to a total shut off position, which is of great advantage in case of maintenance or isolation work to be carried out. All CMR Valves work up to 1000 Pa duct pressure. The Valve is totally pressure independent and has a response time of milli seconds to provide a constant face velocity. The Valve sizes should be selected to provide a minimum velocity preferably above 2 m/s in the extract duct at minimum sash height to be able to read the extract volume accurately if this volume is to be used to control the make up air.

Valve Body Construction
The PFR Venturi Valve is manufactured to the highest engineering precision with CNC machines. The valve is manufactured from a pipe extrusion with all cut outs for the damper blade axle and the tube fittings. The Venturi is formed and welded into the body. All tube connections are welded. The damper blade consists of discs with an EDPM seal. A sturdy drive shaft is fitted onto the valve blade and is then embedded into air tight bearings on both sides of the valve to provide smooth action with very low torque. All components which are in the air stream are PPs or PPs coated. The blade and drive shaft are designed for very fast motor rotation i.e. 1 second from open to closed position.

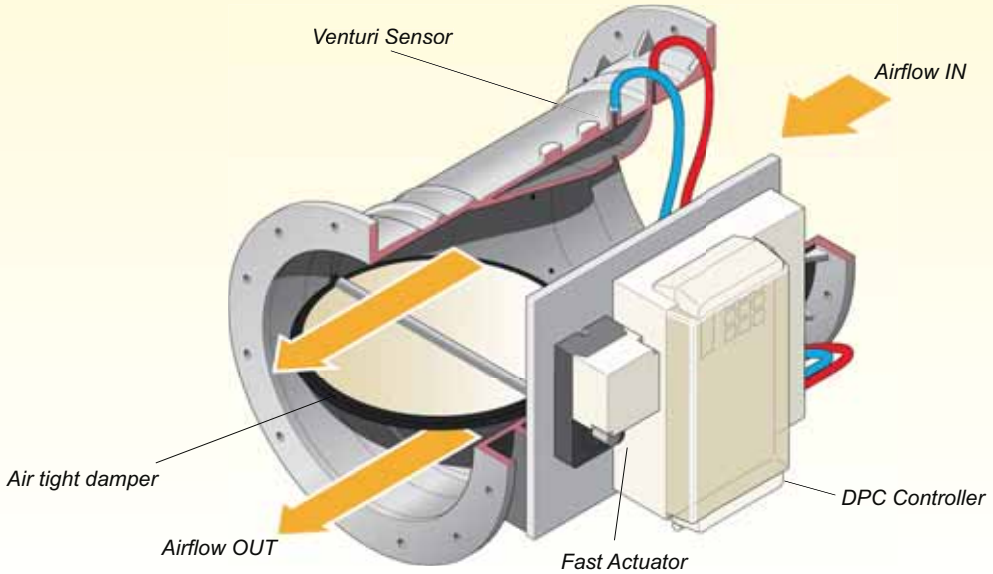
PFR Venturi Valve with fast Actuator and DPC-320 Controller

Venturi Construction
The Venturi is designed for each Size and formed to the same precision with CNC machines. It consists of total averaging pressure measurement holes on the inlet of the venturi. The venturi is welded into the inside of the valve which has a reduced open area. The air is forced through the nozzle at higher speed and static averaging pressure holes pick up the increased static pressure.

Venturi Measurement
The total and the static pressure is then converted by the CMR Volume Sensor into a scaled and linear air volume providing either l/s, m3/s or m3/h. The venturi in combination with the CMR Sensors and DPC's are factory calibrated and provide an accurate and repeatable measurement.

Due to the very unique shape of the venturi, the pressure is regained and a low total overall pressure drop is achieved in oder to save energy.

PFR-C Venturi PPs Valve with DPC-320 Controller and fast Actuator 0-90° and Modbus rtu communication



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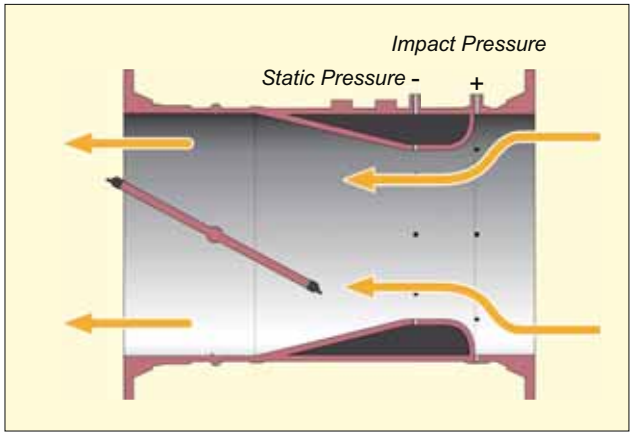
PFR-C VENTURI VELOCITY PRESSURES



PFR Venturi tube connections

The velocity pressure is measured by the Venturi built into the PFR Valve and the total impact pressure is measured on the positive (+red) and the static pressure is measured on the negative (- blue) tube connections. The CMR Volume Sensor shall be connected to the corresponding nipples using CMR PVC red and blue tube.
When the CMR Sensor is supplied with the PFR Venturi then it is pre-adjusted at the factory - i.e. duct diameter, density and PFR Venturi Magnification Factor (mf) and the range is in m^3/s ,m^3/h, l/s or ACR (air change rate). It is ready for connection to the control or monitoring system.

If the CMR Volume Sensor such as P-Sensor, V-Sensor, DPM-Sensor or DPC-Controller was supplied separately and it was not factory adjusted then it is quite simple to adjust the parameters on site. All Sensor have a keyboard and display. The duct diameter and the magnification factor of the PFR Venturi Valve must be entered which is stated on each valve size on page 12 .

If the volume indicated on the CMR Sensor display is deviating from the actual measurements, then the magnification factor can be adjusted to suit the installation abnormalities via the Sensor's keyboard. To find the best possible accuracy for your application, adjust the fan to a constant volume – start with 50% of the minimum and maximum operating volume and take a pitot travers reading with a CAL150 instrument. Once the average volume has been established and it is not the same as displayed on the CMR Sensor, then adjust the Magnification Factor (mf) until the same display is achieved. Check at 25%, 75% and 100% volume set point The CMR Sensors have also parameters to linearize each point of the measurement for more critical applications.

Useful PFR Venturi scaling formula:

$$\text{velocity m/s} = \sqrt{\frac{2 \times (\Delta P \text{ in Pa} / (mf) \text{ factor})}{1.2 \quad \text{Density}}}$$

Example:

2 x (100Pa across PFR-C-315 / 5.784 mf) = 17.289 / 1.2 = 14.907
$\sqrt{14.907}$ = 3.861 m/s
3.861 m/s x (duct area 0.07744) = 0.298m^3/s * 3600 = 1076 m^3/h

Conversion Table - Velocity in m/s at standard density to Velocity Pressure in Pa

m/s	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.01	0.02	0.05	0.10	0.15	0.22	0.29	0.38	0.49
1	0.60	0.73	0.86	1.01	1.18	1.35	1.54	1.73	1.94	2.17
2	2.40	2.65	2.90	3.17	3.46	3.75	4.06	4.37	4.70	5.05
3	5.40	5.77	6.14	6.53	6.94	7.35	7.78	8.21	8.66	9.13
4	9.60	10.09	10.58	11.09	11.62	12.15	12.70	13.25	13.82	14.41
5	15.00	15.61	16.22	16.85	17.50	18.15	18.82	19.49	20.18	20.89
6	21.60	22.33	23.06	23.81	24.58	25.35	26.14	26.93	27.74	28.57
7	29.40	30.25	31.10	31.97	32.86	33.75	34.66	35.57	36.50	37.45
8	38.40	39.37	40.34	41.33	42.34	43.35	44.38	45.41	46.46	47.53
9	48.60	49.69	50.78	51.89	53.02	54.15	55.30	56.45	57.62	58.81
10	60.00	61.21	62.43	63.65	64.90	66.15	67.42	68.69	69.98	71.29
11	72.60	73.93	75.26	76.61	77.98	79.35	80.74	82.13	83.54	84.97
12	86.40	87.85	89.30	90.77	92.26	93.75	95.26	96.77	98.30	99.85
13	101.40	102.97	104.54	106.23	107.74	109.35	110.98	112.61	114.26	115.93
14	117.60	119.29	120.98	122.69	124.42	126.15	127.90	129.65	131.42	133.21
15	135.00	136.81	138.62	140.45	142.30	144.15	146.02	147.89	149.78	151.69
16	153.60	155.53	157.46	157.46	159.41	161.38	163.35	165.34	167.33	169.34
17	173.40	175.45	177.50	179.57	181.66	183.75	185.86	187.97	190.10	192.25
18	194.40	196.57	198.74	200.93	203.14	205.35	207.58	209.81	212.06	214.33
19	216.60	218.89	221.18	223.49	225.82	228.15	230.50	232.85	235.22	237.61
20	240.00	242.41	244.82	247.25	249.70	252.15	254.62	257.09	259.58	262.09
21	264.60	267.13	269.66	272.21	274.78	277.35	279.94	282.53	285.14	287.77
22	290.40	293.05	295.70	298.37	301.06	303.75	306.46	309.17	311.90	314.65
23	317.40	320.17	322.94	325.73	328.54	331.35	334.18	337.01	339.86	342.73
24	345.60	348.49	351.38	354.29	357.22	360.15	363.10	366.05	369.02	372.01
25	375.00	378.01	381.02	384.05	387.10	390.15	393.22	396.29	399.38	402.49

To get the range of the CMR Sensor use the keyboard and display the range . This is the sensor range in m^3/s or m^3/h at 10V / 20mA. Enter this range into your control system. No further calculations are necessary. If you want to use the table above, use the range of the transmitter in Pa and divide it by the (mf) of the PFR. Look up the velocity above. i.e. 100Pa / 5.784 (315 Valve) = 17.289 Pa.
Look up above ~ 17.50 Pa and read on side and top ~ 5.4 m/s then multiply with duct area 0.07744(315 Valve) m^2 to get m^3/s then multiply by 3600 to get m^3/h.

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Issue PFR-C-GB04-1

PFR-C ACTUATOR AND CONTROLLER

CMR HI Speed Actuator VMS-408
The CMR fast running actuators have a response time of milli seconds and a total ruinning time of only 1s for 0-20° with 8Nm and are supplied for valves up to 315mm Ø. Larger Valves are fitted with an actuator having 16Nm from 400mmØ. up to 630mmØ. They are the most popular actuators to work in conjunction with the DPC-320 Controllers. The actuators are 24Vac with an input signal of 2..10V and a position feed back of 2..10V. The angle of rotation can be mechanically as well as electrically limited on either side. The actuator drive has the latest technology and is equipped with a hi-tech brushless electric motor which can withstand the extreme movements of opening and closing the damper.

DPC-320 CONTROLLER
The Power Supply can be 24, 110 or 230Vac 50/60Hz and shall be fitted with a plug and cable to suit any Country. The power can also be connected to terminals inside the controller. All fuses and power supplies to operate the controller, motor and display plate are incorporated within the controller. The controllers front control panel is protected by a clear IP 65 window lid. The LCD display indicates the actual face velocity in m/s, position of damper, extract volume and the control set point.
A keyboard is on the front plate with HAND/AUTO and when selecting the Hand position the valve can be opened or closed via the up and down keys. This is ideal for maintenance or other shut down purposes. A low and high alarm threshold set point can be adjusted. A built in timer times out the low or high alarm and switches on a red LED on the keyboard. A mute key is fitted to mute the alarm either momentary or permanently. All parameters can be adjusted via the keyboard, which is operator password protected.

REMOTE DISPLAY OPERATOR PANEL
The buzzer and all functions are built into the remote alarm display plate and can be fitted on the fume cupboard front. Custom made designs to suit the clients fume cupboards are available from CMR.
The remote keyboard is connected via a single multi core cable from the DPC-320 and is easily fitted on site. The Operator Display panel has an emergency exhaust key and a mute alarm key. All measurements are indicated on the LCD display such as actual face velocity i.e. 0.50 m/s, set point, position of damper, software version and node address. All other parameters can be displayed and adjusted via password access.

The panels are availlable in Horizontal, Vertical or in a DIN case 96x96 for local or remote installation.

SASH HIGH SENSOR
The sash high sensor is easily connected and the Fume Hood manufacturer normally has sash high built in digital switch which can be connected into the DPC-320

AUTOMATIC SASH OPENING - CLOSING
If the Fume hood is equipped with an automatic sash drive open or close system via a proximity sensor then the DPC-320 has a digital input in order to re-set the face velocity set point from 0.50m/s to 0.30m/s to reduce the air extract volume for energy saving.

MODBUS COMMUNICATION
The DPC-320 is equipped with modbus rtu and CMR provides a standard interface host panel which shall communicate with all major BMS and PLC's to monitor and interrogate the CMR Fume Hood Controllers. The CMR Service Department can connect directly to the Interface panel via a VPN connection to provide fast after sales service.

Dedicated interface panels with Profinet, Profibus, Modbus IP, Bacnet IP etc. are manufactured by CMR.

CMR HI-Speed Actuator VMS-408

DPC-320 Compact Fume Hood Controller

Horizontal or VericalOperator Display Panel

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Issue PFR-C-GB04-1

PFR-C DPC-320 OPERATOR PANELS

CONTROL VALUE LCD
This LCD display indicates the actual Face Velocity across the sash of the fume cupboard.

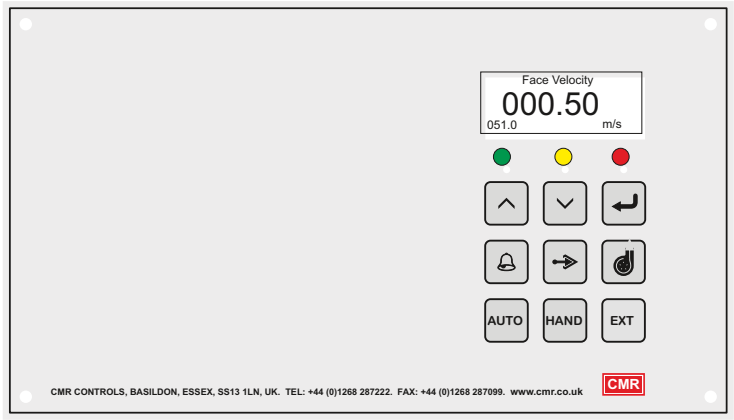
CONTROL SET POINT
The control set point of the face velocity is set to 0.50 m/s. The set point is displayed in the lower left corner.

LOW FACE VELOCITY ALARM
The low alarm set point can be set to 0.40 m/s. If the velocity is lower than 0.40 m/s than it shall alarm after a time out. The internal timer is adjustable from 1 - 300s which means the alarm buzzer and light switches on after i.e. 20 seconds of the air flow being lower than 0.40m/s.

LOW EXTRACT VOLUME ALARM
The extract volume is monitored and shall control the extract damper to limit the volume in case the sash is totally open.
If the extract volume is too low and alarm can be raised which works identically to the low velocity alarm above.

MUTE ALARM
The BELL button is the mute button and by pressing it the buzzer shall switch off.
The alarm can be permanently muted via the parameter set up which is password protected.

CAL ON REMOTE DISPLAY PLATE
If the CAL is switched to ON the valve motor stops operating and the damper position is locked in the last position.
The tubes can now be removed from the velocity sensor and calibration work can be carried out safely.



DPC-320 Controller Front Panel

AUTO OPERATION
The auto switch shall switch the fume cupboard controller in automatic control if it was switched to HAND. which means the valve motor works on face velocity control.

HAND OPERATION
If the switch is set to HAND position, the valve motor can be positioned with the UP and DOWN arrow keys which program the manual set point to any position from fully closed at 0% to fully open at 100%.

FAN BUTTON
This is an optional switch to power up a ventilator

PROGRAM BUTTON
This is used to enter the parameters into the controller and is password protected.

REMOTE FUME CUPBOARD DISPLAY AND ALARM CONTROLS

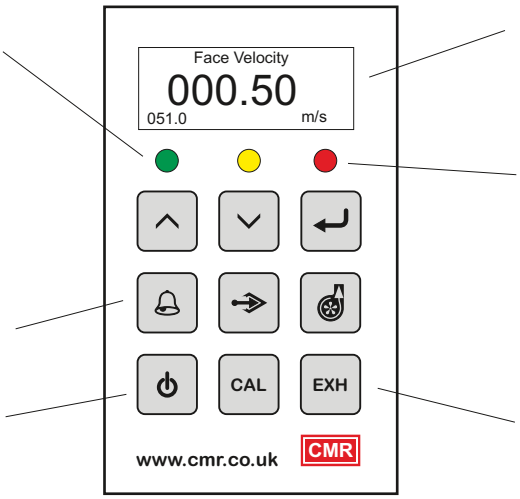
ALL HEALTHY
The green light is normally on if there are no alarms present. I.e. the face velocity is normal, the extract volume is normal and there is no sash high alarm then the green light is switched on.

SASH HIGH
If the sash high proximity switch is fitted then the yellow light would be used for the sash high alarm and the low velocity and low extract volume alarms would work in parallel.

MUTE ALARM
By pressing the BELL button the alarm can be muted.

TOGGLE SWITCH = VALVE SHUT
When this button is pressed it shall set the valve to shut position and by pressing the switch again it shall open the valve. The lower bottom left corner of the LCD shall show 'SHUT' if valve is closed.

NOTE:
This switch can also be used for custom applications



GRAPHIC LCD DISPLAY
The LCD display indicates the actual face velocity on the sash. The indicator is duplicated from the DPC controller Actual Velocity indicator and is scaled in m/s. The display is slower to indicate than the control action as dampening is programmed into the LCD.

ALARM
The red Alarm Light shall come on in case the face velocity or the extract volume is lower than the alarm set points. The buzzer shall come on as well if not permanently muted. When pressing the BELL button the buzzer can be muted and also reset if the alarm has been set to latching
.

EXH = EMERGENCY EXHAUST
When pressing the EXH panic button, the yellow light comes on and the airflow shall increase to a pre-adjusted set point up to 1.00m/s to provide an emergency extract in case of chemical spillages in the fume cupboard. The set point can be adjusted via the keyboard When pressing the EXH button again the yellow light will switch off and the air flow reverts back to its original set point .

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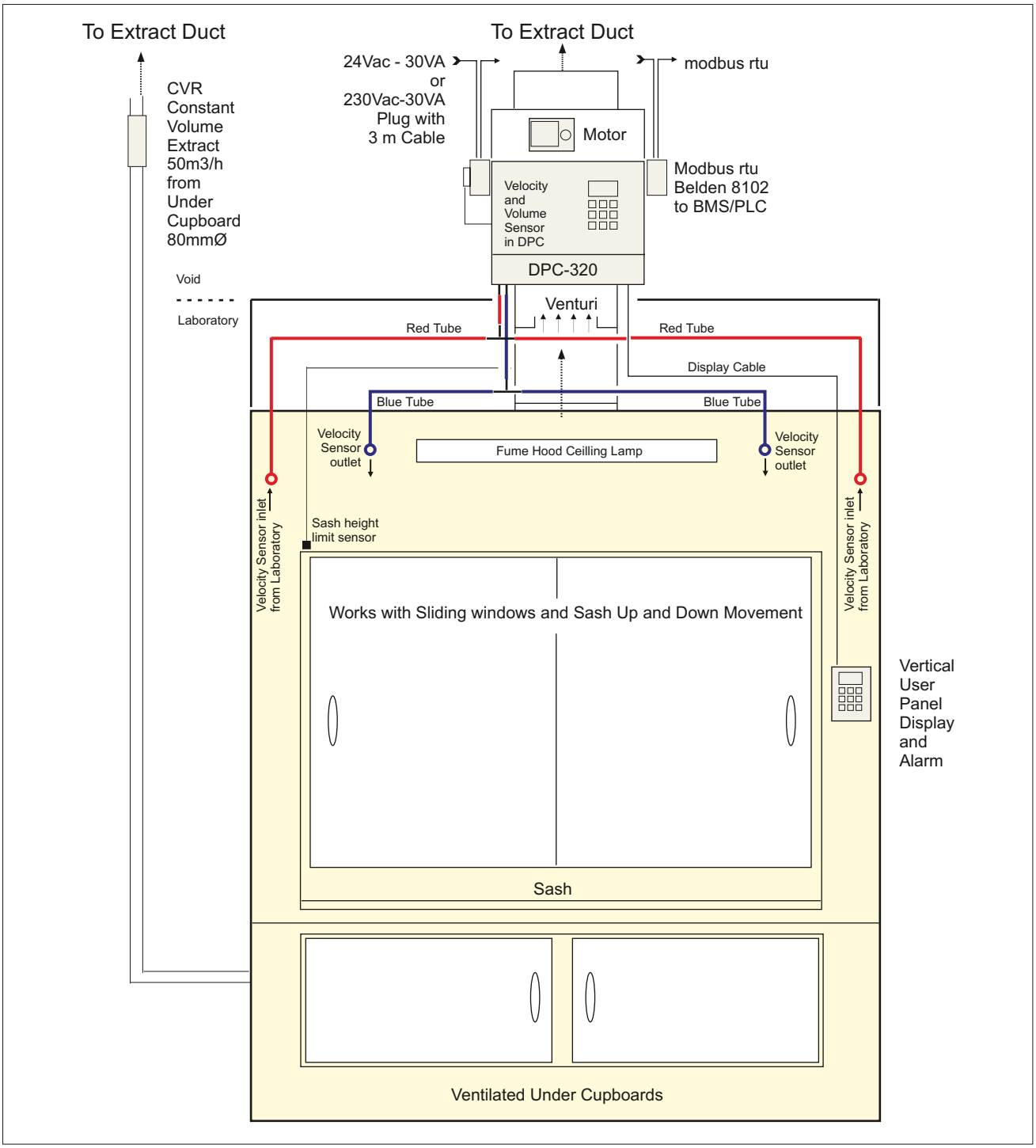
PFR-C FUME HOOD CONTROL SYSTEM

The CMR Face Velocity Sensor is a unique measuring device which works on the principle of differential pressure measurement between the inside of the Fume Hood and the laboratory. It is built into the DPC-320 Controller. The inlet of the sensor is red PVC Tube and is fitted above the sash on either side of the upright posts and is then connected to the red inlet of the DPC. The blue PVC tube is the outlet into the Fume Hood and is fitted next to either side of the Lamp and then connected to the blue outlet of the DPC.

The air is being sucked by the Fume Hood from the clean side of the Laboratory through the CMR Sensor to the inside of the Fume Hood, which means the sensor is never exposed to the chemicals used in the Fume Hood.

The sensing element heats the sampled air to 160°C on a ceramic base and by means of differential temperature measurement the face velocity is determined and scaled. Micron dust particles will pass through the sensor and is rejected by the heat of the sensor. The CMR Velocity Sensor is in use since 25 years without faillure or drift.

The sensor provides a linear output signal which represents the front face velocity of the sash. The sensor is linear over a range of 0.35 to 1.00 m/s over any sash height up to 500mm or higher or sliding windows of any type . The installation is easy and can be done on site on any Fume Hood Make. The Operator Panel is used to fine tune the face velocity and extract volume measurements.



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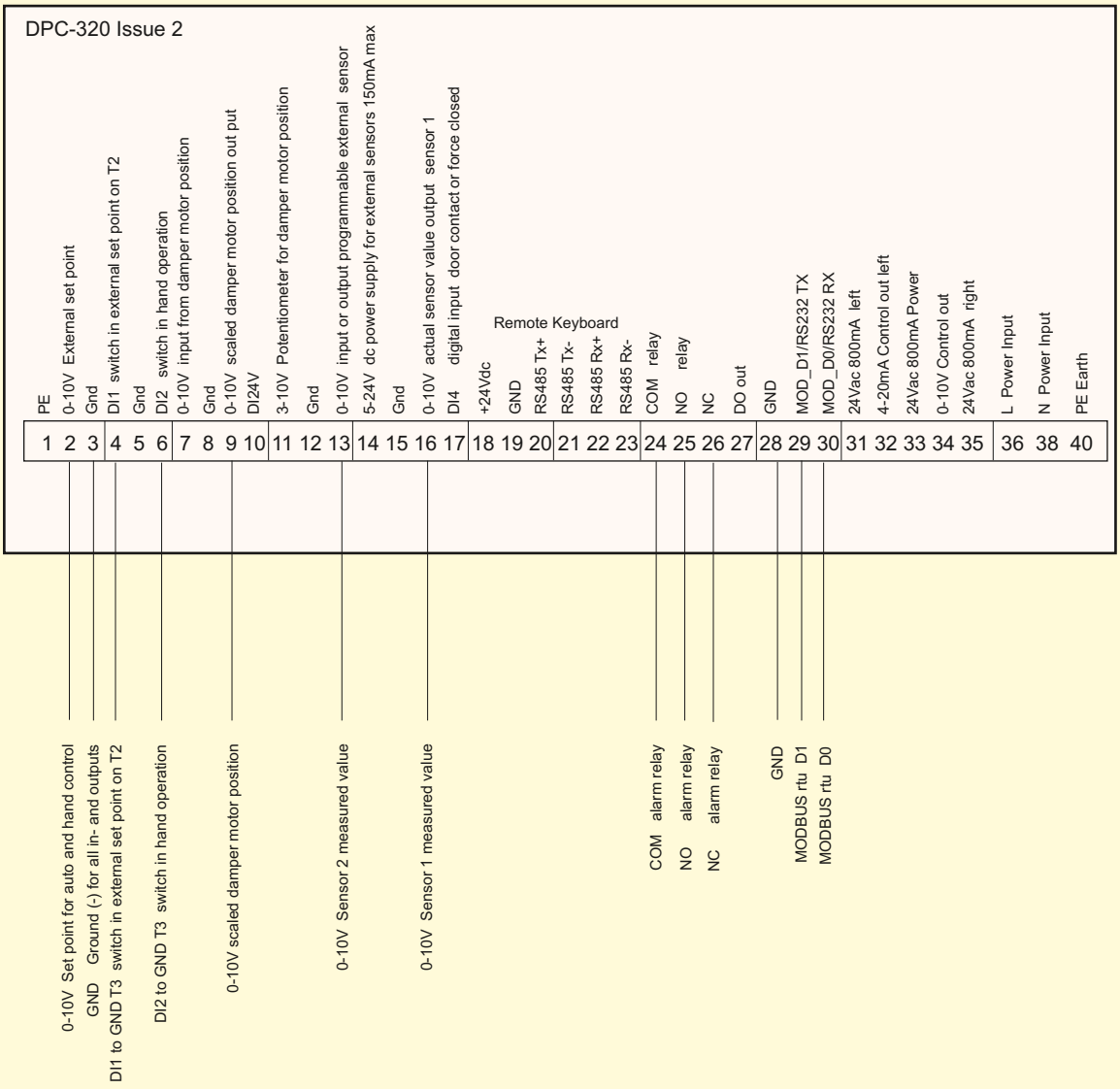
Issue PFR-C-GB04-1

PFR-C FUME HOOD BMS WIRING



BMS wiring from DPC to BMS (12 core shielded cable 0.5mm2)

T2 + Input 0-10V set point from BMS - T3 is GND
T4 to switch to GND T3 BMS to provide Volt Free Contact to switch in BMS set point on T2
T6 to switch to GND T3 BMS to provide Volt Free Contact to switch the DPC in Hand Mode.
When in hand mode - the set point from the BMS on T2 becomes the set point for the motor position

T9 + Output 0-10V scaled damper position feedback to BMS - T3 is GND
T13 + Output 0-10V sensor 2 scaled measured value - T3 is GND
T16 + Output 0-10V sensor 1 scaled measured value - T3 is GND

T24 common relay connection for digital input to BMS
T25 NO relay connection for GND of digital input channel of BMS

MODBUS rtu Wiring Belden 8102

T29 GND MODBUS rtu
T30 D1 MODBUS rtu
T31 D0 MODBUS rtu

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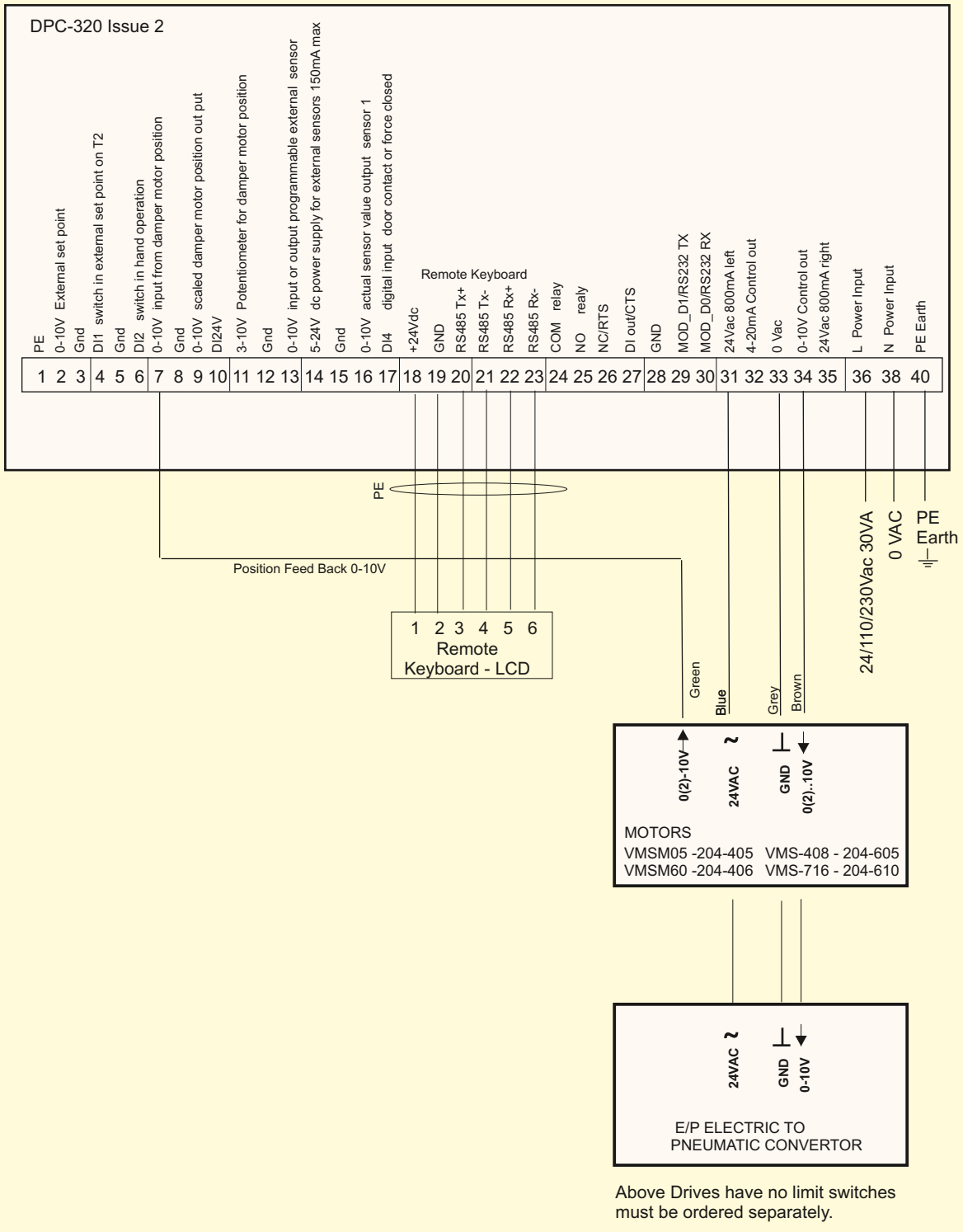
DPC-320 (0) 2..10V ACTUATOR CONTROL



Above Drives have no limit switches must be ordered separately.

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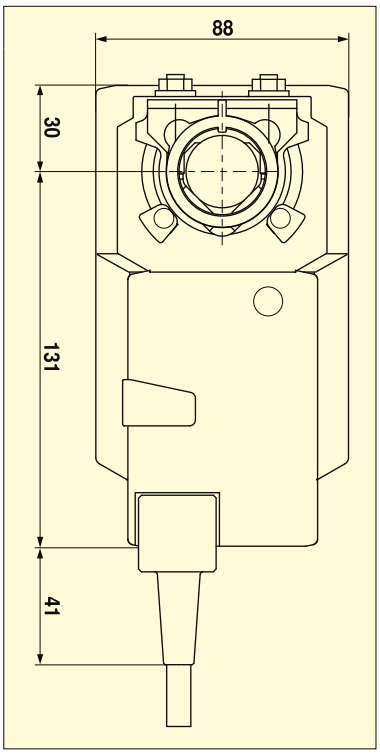
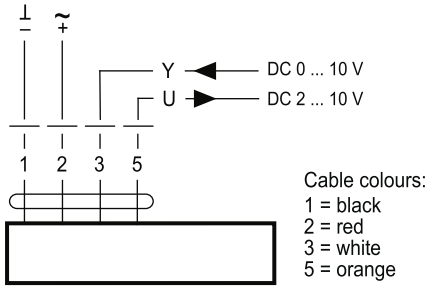
PFR-C FUME HOOD ACTUATOR DATA

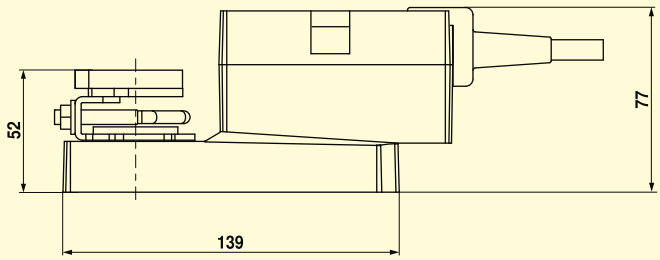
VMS-408 Part No. 204-605



CMR Technical Data Electric Actuator Type VMS-408 Part No. 204-605	
Characteristic	**Specifactions**
Nominal voltage	24 V ac 50/60 Hz 19.2...28.8 V 24 V dc 21.6...28.8 V
Protection class	IP54 in any position - NEMA 2, UL Enclosure Type 2
Power Consumption	13.0 W at rest 2W (For wire sizing 20VA (I max.20A @5ms)
Transformer Sizing	20.0 VA
Max output torque	8 Nm at nominal voltage
Rotation direction	Reversible with switch 0/1 - motion at Y = 0V CW or CCW
Angle of rotation	Max.95° can be limited at both ends with mechanical stops
Manual adjustment	With Hand push button disengaging of gears,can be locked
Drive shaft Clamp	◇ 8..26.7mm square or○ 8..26.7mm round damper shaft
Running time	4 seconds for 90° during normal operation
Feedback	2..10V dc standard - position accuracy 5%
Control signal Y	0..10V - operating range 2..10V
Ambient temperature	-30 to +40°C no restrictions (+50°C contact CMR)
Storage temperature	-40 to +80°C
Mode of Operation	Type 1 - Control Pollution degree 3
Certification	Certified to IEC/EN 60730-1 and IEC/EN 60730-2-14
EMC	CE according to 2004/108/EC rated impulse voltage 0.8kV
Connection Cable	1m length , 4 x 0,75 mm²
Weight	approx. 0.8 kg
Maintenance	Maintenance free
Wiring schematics VMS-408 Actuator Part No: 204-605 Speed 4s at 8Nm Y = 0..10V Operating from 2..10V Modulating U = 2..10V Position Feed Back	

Square or Round Shaft Adaptor

Damper spindle	Length	○	□	◇
	≥42	8 ... 26.7	≥8	≤26.7
*	≥20	8 ... 20	≥8	≤20



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PFR-C VENTURI VALVE SPECIFICATIONS

Selection of Volume Control Damper

It is essential to determine the air volume during the design stage. Normally there is a minimum and a maximum volume which has to be controlled.

The duct area should be calculated so that the velocity is approximately 2.5m/s at the minimum volume and preferably 5m/s at the operating point if possible. If the velocity is more than 5m/s at the maximum volume then the noise level criteria needs to be considered. The maximum velocity should not exceed 9m/s as the duct resistance shall increase and the overall energy consumption shall go up. Use selection Table 1 on page X.

The PFR Venturi Valves is equipped with a bracket to fit the actuator and Controller. It has a damper blade with an embedded seal. The venturi reduces the diameter for a very short length and it is formed for pressure regain. The reduced internal area of the valve shall increase the velocity pressure momentarily but will have a regain of pressure after passing through the venturi, which means that the overall pressure drop can be kept at a minimum.

The drive shaft which is heat welded to the valve blade is designed to withstand the very high momentary torque developed by the fast actuator. The shaft is guided by sealed bearings on either side of the valve body.

Installation

The PFR Venturi Valve works in any position provided it is used in non condensing conditions. It can be installed vertically or horizontally with the actuator being on the side rather then having the actuator hanging down. This way, the weight is reduced on the seals and provides a long term efficient operation. It is also easier for the maintenance engineers to replace an actuator. When the damper is installed, Care must be taken to leave sufficient space for the engineers to inspect the DPC and the motor - a 600mm space would be perfect.

Hysteresis

The PFR Venturi Valves have a very low hysteresis due to the sturdy single blade construction and therefore the damper can be moved very accurately to a control position.

Maintenance

The PFR Venturi Valve is maintenance free.

Materials

PFR valve Body	- PPsl
Blade/Seal	- PPs / EPDM
Drive Shaft	- PPs
Drive Shaft Seal	- 'O'Ringsl
Bearing	- PPs
Outer Duct Seals	- Formed
Actuator Brackets	- PPs

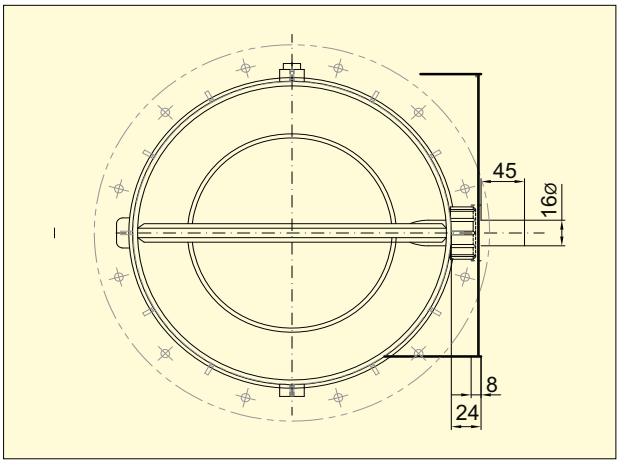
Valve sizes see table on right.
Valve diameters are sized to fit standard round PPs duct.
Alternative Brackets on request.

Specifications

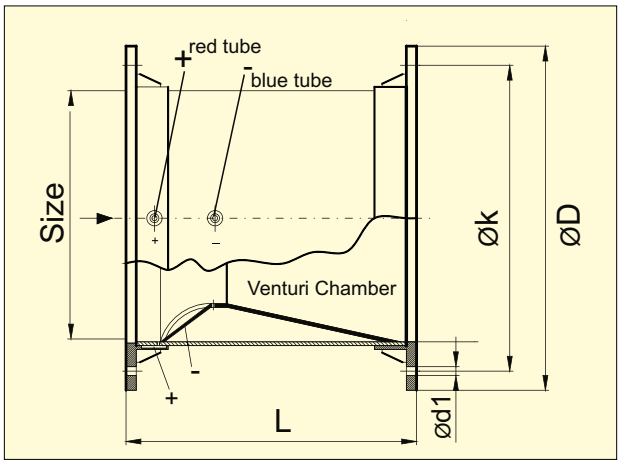
Recommended minimum air velocity is	2.5 m/s
Recommended operating air velocity is	5 m/s
Maximum recommended air velocity is	9 m/s

Humidity 10% to 90% non condensing.
Operating Temperature (dry condition) -20 to 70°C

PFR Venturi PPs Valve with DPC Bracket



PFR Venturi PPs Valve with DPC Bracket



PFR Venturi PPs Valve Dimensions

PFR Venturi Valve dimensions and magnification factor (mf)							
Size Ø	Stock Code	L	ØD	Øk	Ød1	Qty	mf
160 mm	PFR-C-160	310	230	200	7	8	5.169
200 mm	PFR-C-200	350	270	240	7	8	5.077
250 mm	PFR-C-250	400	320	290	7	12	5.072
315 mm	PFR-C-315	490	395	350	9	12	5.080

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PFR-C SELECTIONS AND PERFORMANCE

Part Number Selection Table 1

Part Number	Description	Size DN mm	Length L3 mm	Area m2	Volume at 3m/s m3/s	Volume at 5m/s m3/s	Volume at 9 m/s m3/s	Volume at 3m/s m3/h	Volume at 5m/s m3/h	Volume at 9 m/s m3/h
PFR-C-160	160mm FC Venturi Valve with DPC 320	160	310	0.02011	0.060	0.101	0.181	217	362	652
PFR-C-200	200mm FC Venturi Valve with DPC 320	200	350	0.03142	0.094	0.157	0.283	339	566	1018
PFR-C-250	250mm FC Venturi Valve with DPC 320	250	400	0.04909	0.147	0.245	0.442	530	884	1591
PFR-C-315	315mm FC Venturi Valve with DPC 320	315	490	0.07794	0.234	0.390	0.701	842	1403	2525

Performance and Noise Levels

			Static Pressure at Venturi in Pa 100 Pa									Static Pressure at Venturi in Pa 250 Pa									Static Pressure at Venturi in Pa 500 Pa								
Valve	Velocity	Volume	LW (dB/Octave) Power level								Sum	LW (dB/Octave) Power level								Sum	LW (dB/Octave) Power level								Sum
Size Ø	m/s	m3/h	63	125	250	500	1k	2k	4k	8k	dB(A)	63	125	250	500	1k	2k	4k	8k	dB(A)	63	125	250	500	1k	2k	4k	8k	dB(A)
160	2	145	62	56	50	44	38	32	25	20	46	67	61	56	50	44	38	30	25	52	71	66	60	54	48	42	34	29	56
	5	362	71	65	59	53	48	42	36	29	56	77	71	65	59	53	47	41	35	61	81	75	69	63	57	51	46	39	65
	7.5	543	75	69	63	58	52	46	40	33	60	81	75	69	63	57	51	46	39	65	85	79	73	67	62	56	50	43	70
	10	724	78	72	66	61	55	49	43	36	63	84	78	72	66	60	54	49	42	68	88	82	76	70	64	59	53	46	73
200	2	226	63	57	51	46	40	34	26	21	48	69	63	57	51	45	39	32	27	53	73	67	61	55	49	44	36	31	58
	5	565	73	67	61	55	49	43	37	30	57	78	72	66	61	55	49	43	36	63	82	76	71	65	59	53	47	40	67
	7.5	848	77	71	65	59	53	47	42	35	61	82	76	71	65	59	53	47	40	67	87	81	75	69	63	57	51	44	71
	10	1131	80	74	68	62	58	50	44	38	64	85	79	74	68	62	56	50	43	70	89	84	78	72	66	60	54	47	74
250	2	353	65	59	53	47	41	35	27	23	49	70	64	59	53	47	41	33	28	55	74	69	63	57	51	45	37	32	59
	5	884	74	68	62	56	51	45	39	32	59	80	74	68	62	56	50	44	38	64	84	78	72	66	60	54	49	42	68
	7.5	1325	78	72	68	61	58	49	43	36	63	84	78	72	66	60	54	49	42	68	88	82	76	70	65	59	53	46	73
	10	1767	81	75	69	64	58	52	46	39	66	87	81	75	69	63	57	52	45	71	81	85	79	73	67	62	56	49	76
315	2	561	66	60	55	49	43	37	29	24	51	72	66	60	54	48	42	35	30	56	76	70	64	58	53	47	39	34	61
	5	1403	76	70	64	58	52	46	40	34	60	81	75	69	64	58	52	46	39	66	85	80	74	68	62	56	50	43	70
	7.5	2104	80	74	68	62	56	50	45	38	64	85	79	74	68	62	56	50	43	70	90	84	78	72	66	60	54	47	74
	10	2806	83	77	71	65	59	53	47	41	67	88	82	77	71	65	59	53	46	73	93	87	81	75	69	63	57	50	77

Differential Pressure on Venturi

Selection Table

Example:

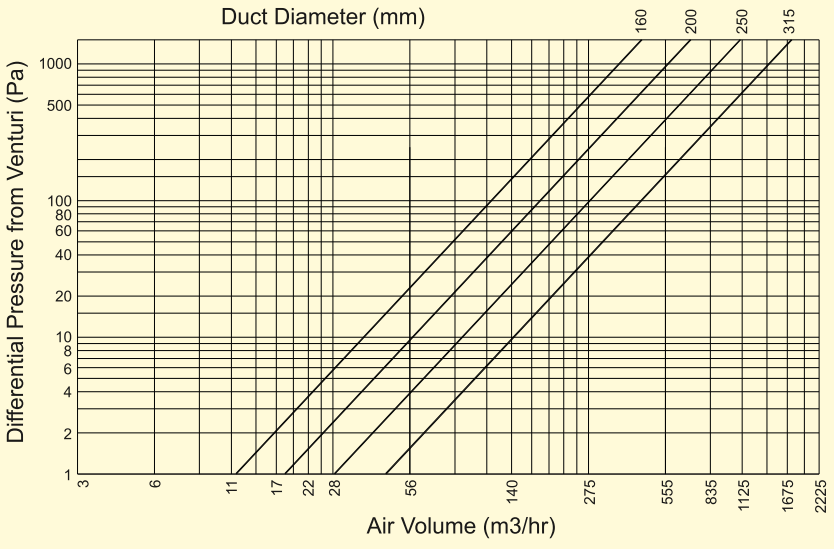
Duct Diameter: 250mm

Air Volume: 275 l/s

Differential Pressure: 100 Pa

Equivalent Velocity: 5.61 m/s

Note:
The minimum recommended velocity is 1.5 m/s, with a suggested maximum of 10m/s



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PFR-C ORDER DESCRIPTION

GENERAL
CMR manufactures and assmbles PFR-C Fume Hood Control System tohether with the DPC-320 and fast actuator. Because of the variety of sizes and power supplies a selection table on page 15 is available to make ordering easier. In order to select the correct part number we have made up a sample selection below:

START PART NUMBER
The part number starts with the selection of the Valve type 'PFR'.
The Part Number starts 'PFR'

CONTROL TYPE
The control type depends on the controller which is mounted on the valve. The fume hood controller is always a DPC-320 which has the code 'C'.
The Part Number extends to 'PFR-C'

VALVE SIZE
There are 4 sizes 160, 200, 250 and 315mm Ø.
We have selected Size 315 which has the Code '315'.
The Part Number extends to 'PFR-C-315'.

REMOTE OPERATOR DISPLAY PANEL
There are three Operator Panels availlable:
Vertical most used Type which has the Code 'V'
Horizontal which is normally below the sash table which has the Code 'H'
The DIN 96x96 case which is a panel mount instrument case and has the Code 'D'
We have selected in the example Code 'V'.
The Part Number starts 'PFR-C-315-V

POWER SUPPLY
The PFR-C can be ordered in
24VAC with Code '3'
110VAC with Code '4'
230VAC no power cable fitted with Code '5'
230V UK complete with cable and UK plug with Code '6'
230V EU complete with cable and European plug with Code '7'

All cables are 3m long .
We have chosen 230V with cable and UK plug which has Code '6'.
The Part Number extends to 'PFR-C-315-V-6.

FINAL PART NUMBER
The Part Number to order is 'PFR-C-315-V-6'

Now try and select your own PFR-C using the PFR-C Order Selection Table.

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PFR-C ORDER SELECTION

THE SELECTION TABLE IS FOR A DPC-320 FUME CUPBOARD CONTROLLER

The selection Table has been prepared to make ordering easy. Each Column contains a number of different options which are available and a Part Number can be established depending on a specific requirement.
The Example Part Number PFR-C-315-6 which is printed above the Selection Table and can be identified as being a PFR Valve for Fume Hood Control.

The Control Type is 'C' which is a DPC-320 controller fitted on top.
The valve size is a 315mm Ø Venturi Valve, which has the code 315.
The operator display panel is Vertical and has the code 'V'
The power supply is 230VAC with cable and UK plug which has the code'6'.

EXAMPLE PART NUMBER SELECTION (The code after the (=) sign is used i.e. Part-No. = PFR)

CFR	C	315	V	6
Valve	**Control**	**Valve**	**Operator**	**Power**
Part No.	**Type**	**Size**	**Panel**	**Supply**
Base = PFR	Type = C	160mm = 160	Vertical = V	24 Vac = 3
		200mm = 200	Horizonrtal = H	110 Vac = 4
		250mm = 250	DIN 96x96 = D	230 Vac = 5
		315mm = 315		230UK = 6
				230EU = 7

HOW TO ORDER

Make up your own PFR Fume Hood Control System using the empty cells

EXAMPLE
A Fume Hood Control System is required of the type PFR
The Control Type is 'C' with a DPC-320 controller.
The Valve Size required is 250mm Ø
The Remote Operator Panel is Horizontal
The power supply must be 230VAC and has a cable with a European plug
|
The part Number for this System is PFR-C-250-H-7

Call CMR for assistance at any time

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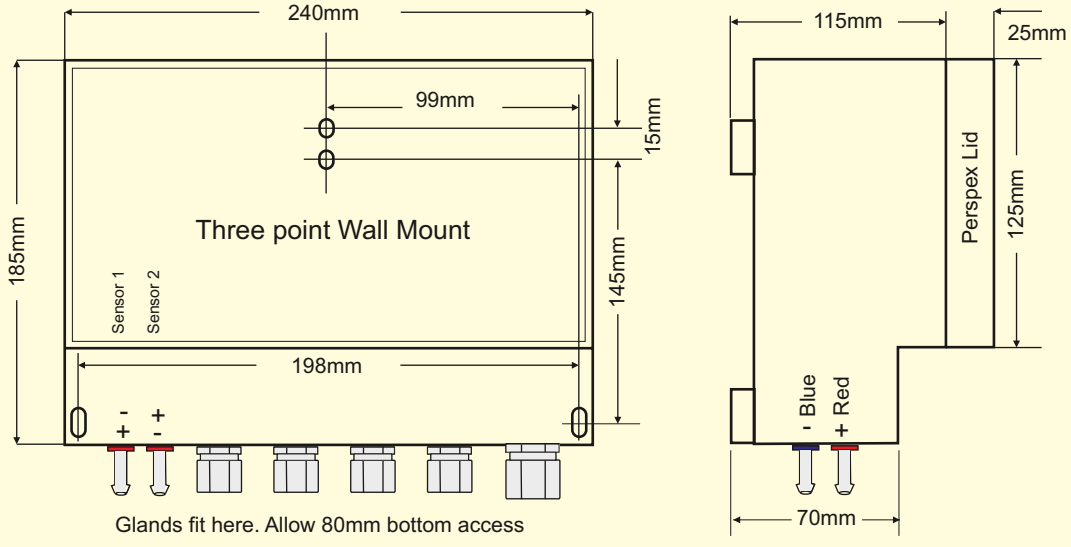
PFR-C FUME HOOD SPECIFICATION

Measurement Range	Sensor 1 = 0...2 m/s face velocity sensor and Sensor 2 = 0.. 250 Pa for extract volume sensor
Adustable Range	Sensor 1: Any Range from 0.35m/s to 2.00m/s Sensor 2: Any range from 0 to 500 Pa
Overload Capacity	To 340mBar (34000 Pa)
Media	Non Corrosive Gases such as Air,N2,O2,CO2,N2 O, inert Gases
Sensor 1/ 2 Type	1. Air Velocity Mass flow / 2. Differential Pressure (diaphragme type)
AC Power Supplies	24 VAC 50/60Hz - 30VA - Fuse 1.0 A Wickmann
	110VAC 50/60Hz - 30VA - Fuse 315 mA Wickmann
	230VAC 50/60Hz - 30VA - Fuse 315 mA Wickmann
AC Control Output	24 VAC (internal power from isolation transformer) 20VA max 830mA (Fused 1A Wickmann)
	Triac output
DC Control Output	0(2)..10Vdc and 4..20mA
Sensor Output Voltage	0-10V (0...100% of Range)
RL = 5kOhm min	.
Hysteresis/Repeatability	0.3% Typical of Full Scale
Linearity (Accuracy)	Sensor 1 = 1% FS 2.00 m/s - Sensor 2 0.25% of Full Scale > 100 Pa - 0.25Pa of Full Scale < 100 Pa
Zero Drift	0.02%K (+10°C to +50°C) - 0.0% with Auto Zero
Hand - Auto Key	On keyboard or Digital input on T4 external set point switch T6 change over from auto to hand
External Set Point	0...10V on T2
Position Input	0...10V on T7
Alarm Threshold	On keyboard Programmable
Control Function	Off-Set - Sensitivity - Proportional Band - Timing / Integral - Ramp Speed - output Freeze
Alarm Relays	1A 24VDC / AC Low/High Alarm single pole - Buzzer and repeater single pole on-off.
Operating Temperature	+10°C to +40°C (Storage -40°C to +70°C
Mounting Position	Vertical or Horizontal
Weight	1.5 kg
Electrical Connections	1 x 20mm 4 x 16mm Gland Internal screw Connections.
Air Tube Connections	2 x Positive and Negative Nipple 6.5mm O/D x 15mm long standard for CMR PVC tube
Communication	2 x Modbus rtu Plus Remote Keyboard Modbus rtu
Enclosure	ABS Grey with clear front Lid - Protection Class IP65.
Conformity	EN61326-1 EMC EN61010-1 SAFETY CE according to 2004/108/EC and IEC/EN 60730-2-14
Calibration Certificate	Calibration Certificate traceable to International Standards is supplied for the DPC320 pressure sensor

DPC-320 Issue 1 ENCLOSURE DIMENSIONS



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