AUTOFLAME®
Combustion Management Systems

www.fiammac.com
فیاماک، نماینده انحصاری
شرکت اتوفلیم
در ایران

AUTOFLAME SENSORS GUIDE

Fiammac

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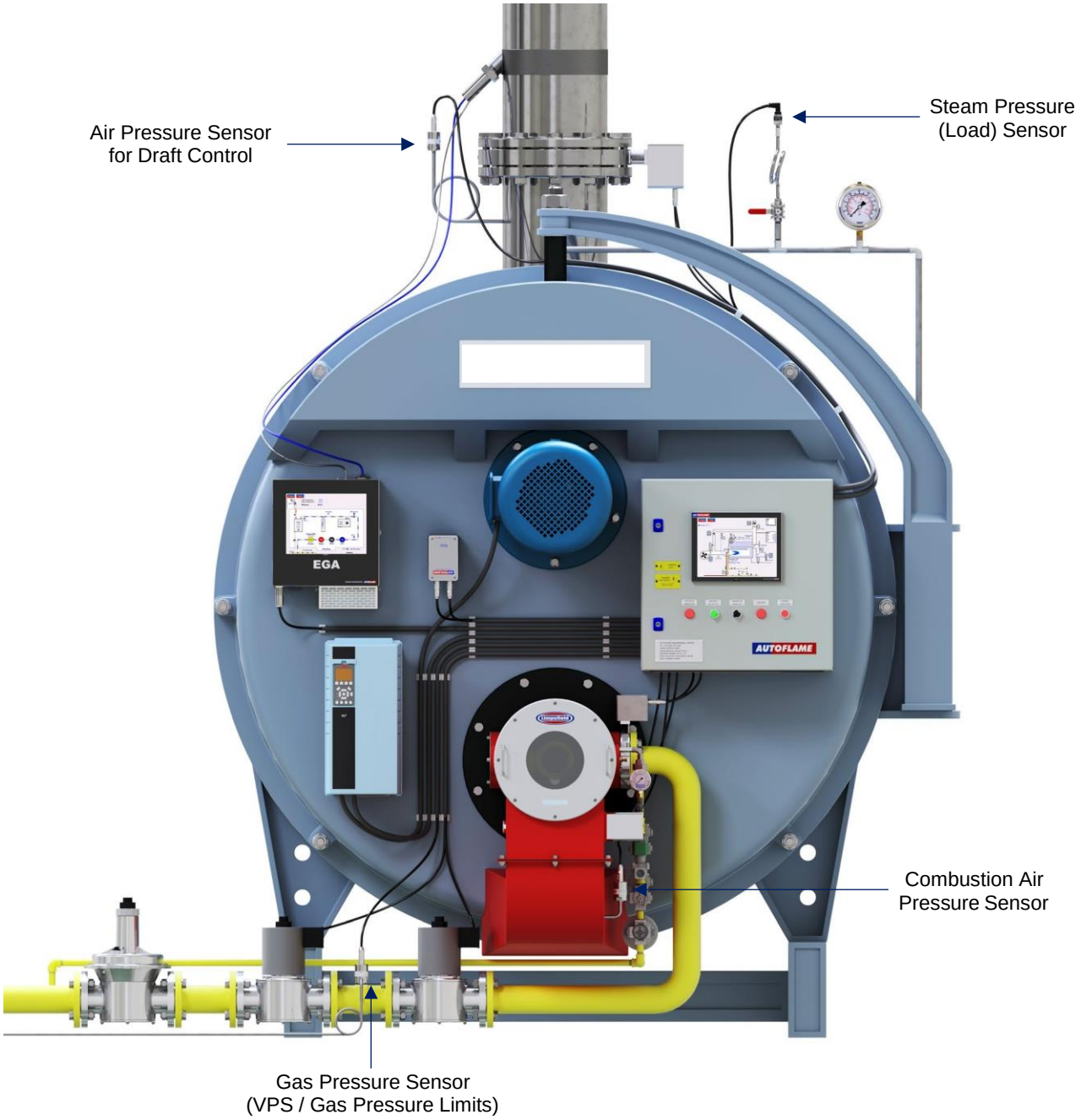
1. AUTOFLAME SENSORS

Autoflame offers the following range of sensors for use with the Mk8 and Mini Mk8 MM systems:

- Air pressure sensors.
- Gas pressure sensors.
- Oil pressure sensors.
- Temperature sensors.
- Steam pressure (load) sensors.
- Outside temperature sensors.

The picture below illustrates some of the applications of these sensors on a steam boiler.



2. GAS & AIR PRESSURE SENSORS (MK8 SERIES)

Gas pressure sensors can be used for the following purposes:

- Gas Valves Proving System (VPS) and/or gas pressure limits when used with an MM system.
- Gas pressure limits only when used with an MM system.

Air pressure sensors can be used for the following purposes:

- Combustion air pressure proving when used with an MM system.
- Draft pressure control when used with the Mk8 MM.

The gas and air pressure sensors can also be used for gas / air pressure monitoring application when used with the Mk8 DTI.

Specifications	
IP Rating	65
NEMA Rating	4
Check type	Self-check
Channels	Dual channel
Communication	Digital (RS485) and analogue
Max. Operating Temperature	85°C (185°F)
Min. Operating Temperature	-25°C (-13°F)
Housing	Aluminium
Wiring connection	2m (6.5ft) flying lead, pre-wired, screened
Installation	90° vertical (+/-10°)
Pressure measuring port	¼” parallel NPT / BSP female
Differential pressure port	1/8” parallel NPT / BSP female
Supplied with	¼” tapered NPT / BSP male nipple
Flying lead connector torque	1 to 3Nm max. tighten by hand only, do not over-tighten
Warranty	2 years limited warranty

Gas and Air Pressure Sensors Range

Gas Pressure Sensors Range

Part #	Pressure Range			Zero Range		
	mbar	"wg	PSI	mbar	"wg	PSI
MM80006	±68	±27	±1	±1.36	±0.54	±0.02
MM80008	±344	±138	±5	±6.88	±2.76	±0.1
MM80011	±1034	±415	±15	±20.68	±8.3	±0.3
MM80012	±2068	±831	±30	±41.36	±16.62	±0.6
MM80014	±6894	±2770	±100	±137.88	±55.4	±2

Air Pressure Sensors Range

Part #	Pressure Range			Zero Range		
	mbar	"wg	PSI	mbar	"wg	PSI
MM80005	±68	±27	±1	±1.36	±0.54	±0.02
MM80013	±137	±55	±2	±2.74	±1.1	±0.04

ATEX Certified Gas and Air Pressure Sensors

An ATEX approved range of the gas and air pressure sensors is also available for use in Hazardous Environments application where Explosion Proof equipment is required.

Classification: Ex Na IIC Gc

ATEX Certified Gas Pressure Sensors Range

Part #	Pressure Range			Zero Range		
	mbar	"wg	PSI	mbar	"wg	PSI
MM80006/EXP	±68	±27	±1	±1.36	±0.54	±0.02
MM80008/EXP	±344	±138	±5	±6.88	±2.76	±0.1
MM80011/EXP	±1034	±415	±15	±20.68	±8.3	±0.3
MM80012/EXP	±2068	±831	±30	±41.36	±16.62	±0.6
MM80014/EXP	±6894	±2770	±100	±137.88	±55.4	±2

ATEX Certified Air Pressure Sensors Range

Part #	Pressure Range			Zero Range		
	mbar	"wg	PSI	mbar	"wg	PSI
MM80005/EXP	±68	±27	±1	±1.36	±0.54	±0.02
MM80013/EXP	±137	±55	±2	±2.74	±1.1	±0.04

Gas / Air Pressure Sensor's Ports

The sensor has 2 pressure ports:

- Gas/ air pressure measuring port: used to measure the gas / air pressure.
- Differential pressure port: used as a reference to measure the atmospheric pressure, therefore it should always be exposed to atmospheric pressure.

Gas / Air Pressure Sensor's Selection

When selecting a gas pressure sensor for a specific application, it is necessary that the sensor's measuring range should be the closest to the gas pressure range of the application.

For example; a gas pressure sensor is required for the purpose of valve proving and gas pressure limits for a boiler with maximum gas pressure supply of 170mbar, therefore MM80008 should be selected. MM80011, MM80012, MM80014 or MM80006 should not be used.

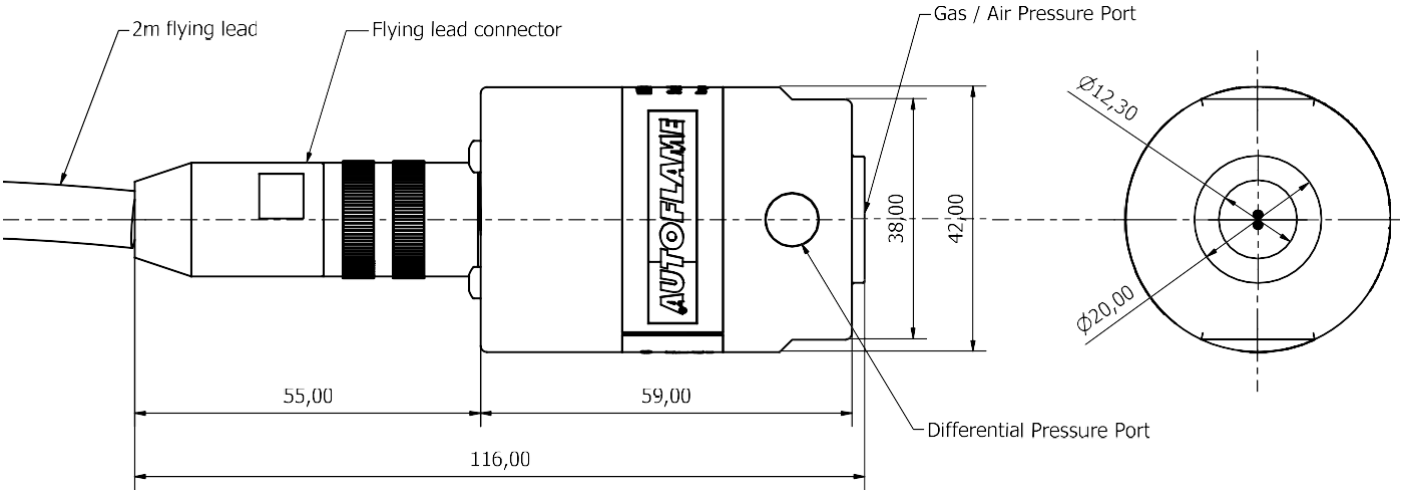
Wiring Gas / Air Pressure Sensor to an MM

For the purpose of VPS, gas pressure limits and air pressure proving, the sensors can be wired as follows:

Wire Colour			Mk8 MM Terminal	Mini Mk8 MM Terminal
Brown	RS485 -		31	29
Purple	RS485 +		32	30
Blue	0V DC		33	48
Red	15V DC		34	49
Screen			Do not connect at MM side	

The screen wire on the flying lead is only used when connecting the sensor's lead to the MM / DTI through a terminal block, it must not be connected on the MM / DTI side.

Drawing and Dimensions



All dimensions in mm, 1 inch = 25.4mm.

2.1. Installation

The pressure sensor must be installed at a vertical angle, perpendicular to the gas/air flow direction.

When the gas pressure sensor is used for gas pressure limits or valve proving, the sensor should measure regulated gas pressure, therefore it should be installed after the gas pressure regulator (governor).

It is recommended to connect the differential pressure port to atmospheric pressure outside the boiler house, as the pressure inside the boiler house could differ from atmospheric pressure. this can be done by piping the port to a vent inside the boiler house that is exposed to atmospheric pressure or using a pipe to connect the port to the atmosphere outside the boiler house.

It is recommended to connect the gas sensor using a pigtail pipe to prevent moisture traveling to the sensor.

IP Rating of the Gas & Air Pressure Sensors

The gas / air pressure sensor is rated IP65 / NEMA 4, and can be safe for external use providing that the following conditions are met;

- The flying lead is tightened according to specifications, over tightening the flying lead connector can cause damage to the seal and therefore the IP65 rating will not apply.
- The sensor's pressure measuring port should be connected to the gas pipe/air duct using tapered thread NPT connector, PTFE tape should be used to seal the thread connection and the connection must be tightened according to the specifications.
- The sensor's differential pressure port should be piped using tapered thread NPT connector, PTFE tape should be used to seal the thread and the connection must be tightened according to the specifications, make sure this pipe is always dry / free from water, moisture and dust.

The gas pressure sensor is rated IP52 / NEMA 3 if the atmospheric pressure port is not piped, the supplied plastic plug must be secured in place. Please check the Annex at the end of this manual for the explanation of different IP ratings.

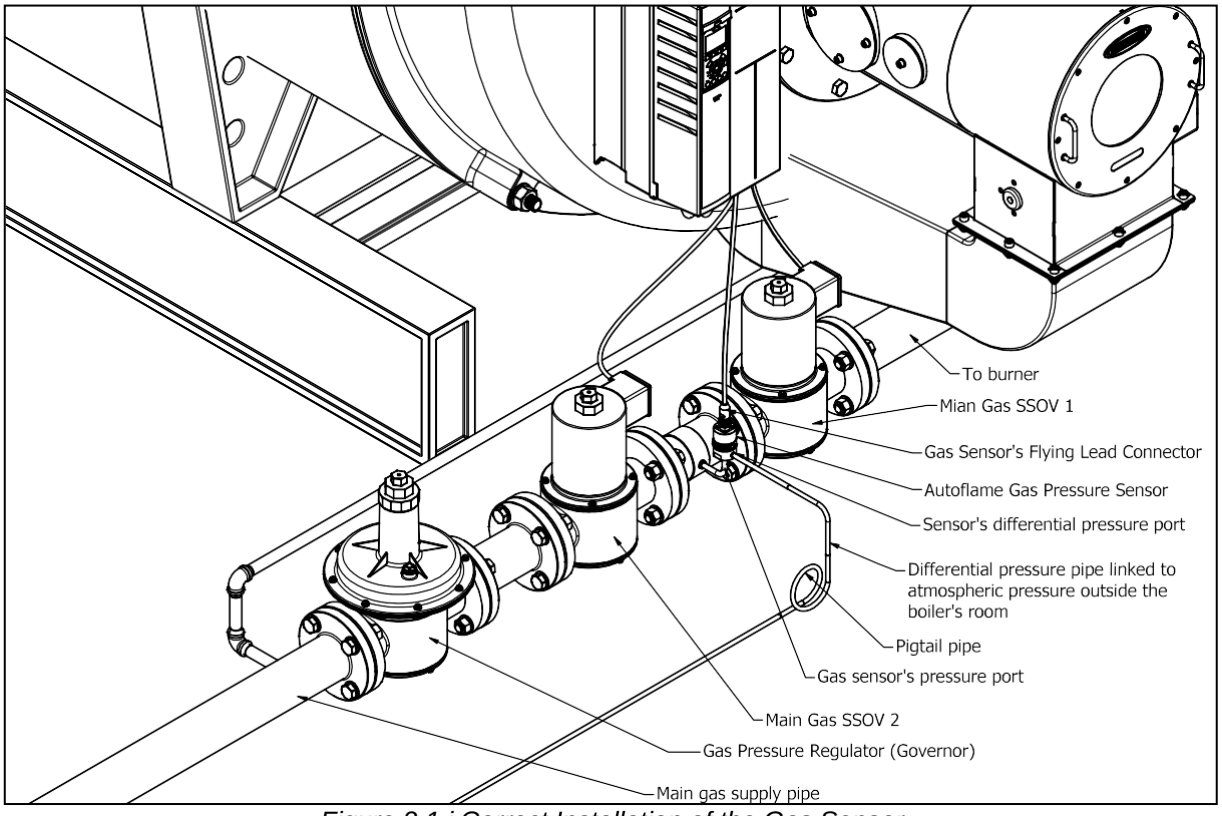


Figure 2.1.i Correct Installation of the Gas Sensor

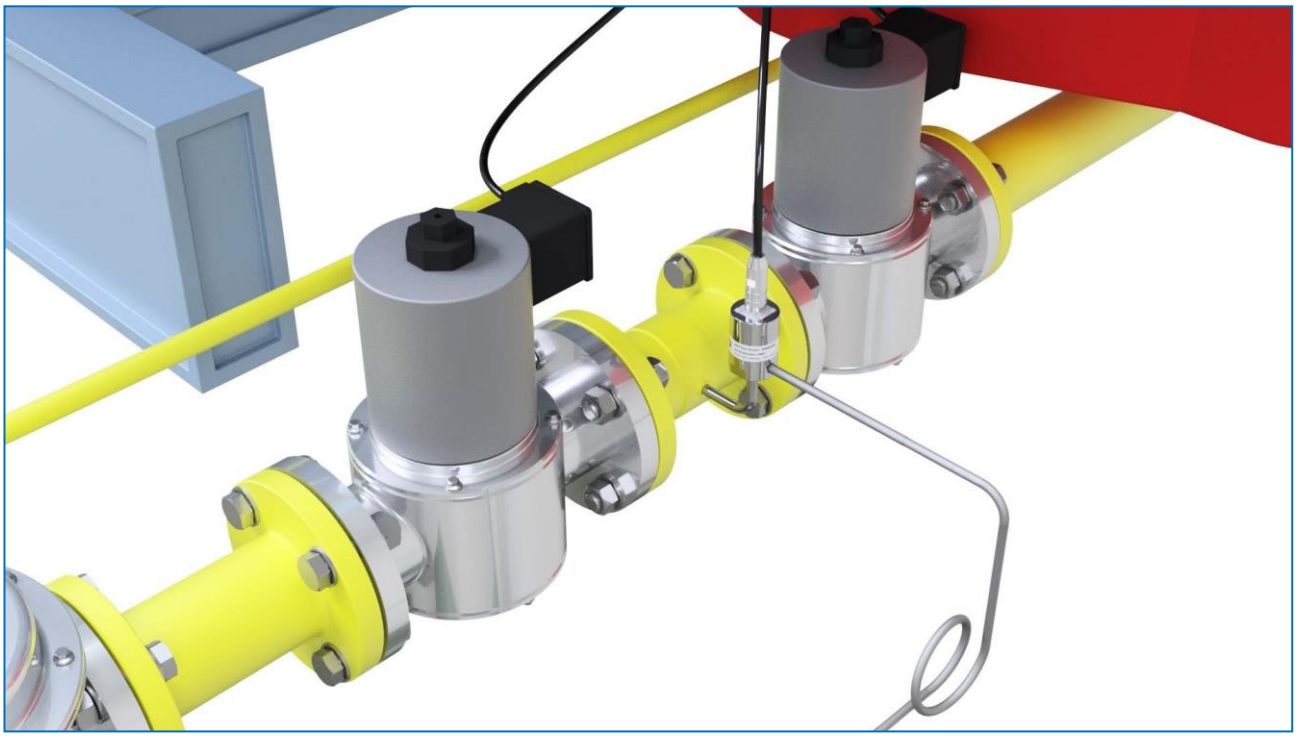


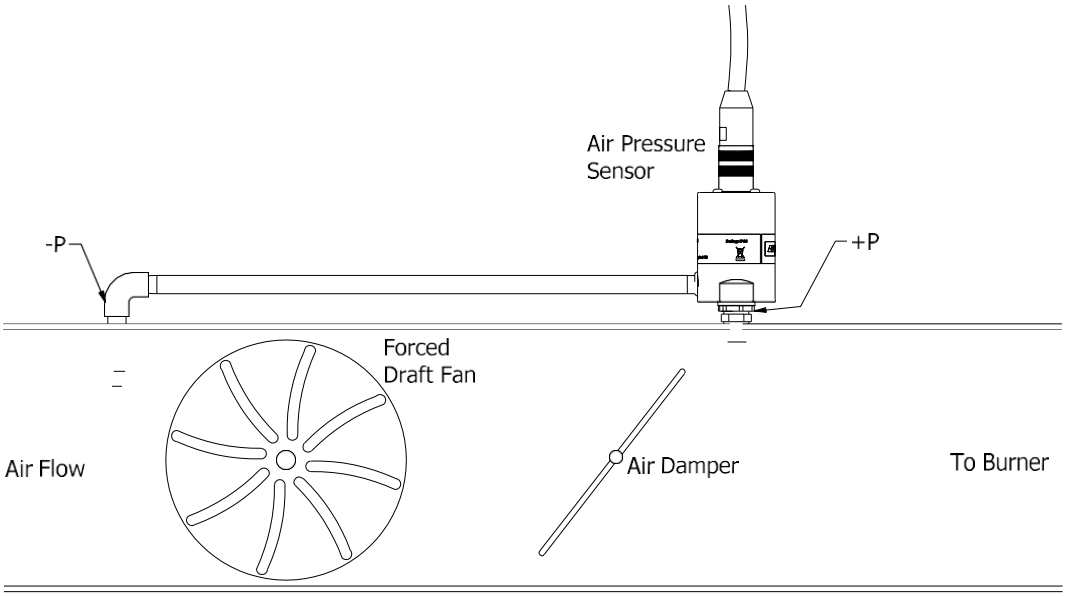
Figure 2.1.ii Correct Installation of the Gas Pressure Sensor for IP65 / NEMA4 rating

IP52 installation – Differential Pressure port is not piped (plastic cap must be placed)

IP65 installation – Differential pressure port is piped

Air Pressure Sensor Differential Pressure

The Autoflame Air Pressure Sensor has a differential pressure port, this can be installed as shown below to measure a differential pressure. This is necessary where the air pressure at low fire is below 1 mbar (0.4 "wg) or when it is a local code requirement. It is also necessary if IP65 protection rating for the sensor is required when using the sensor for outdoor applications for example.



2.2. Mk8 MM Gas Pressure Sensor Applications

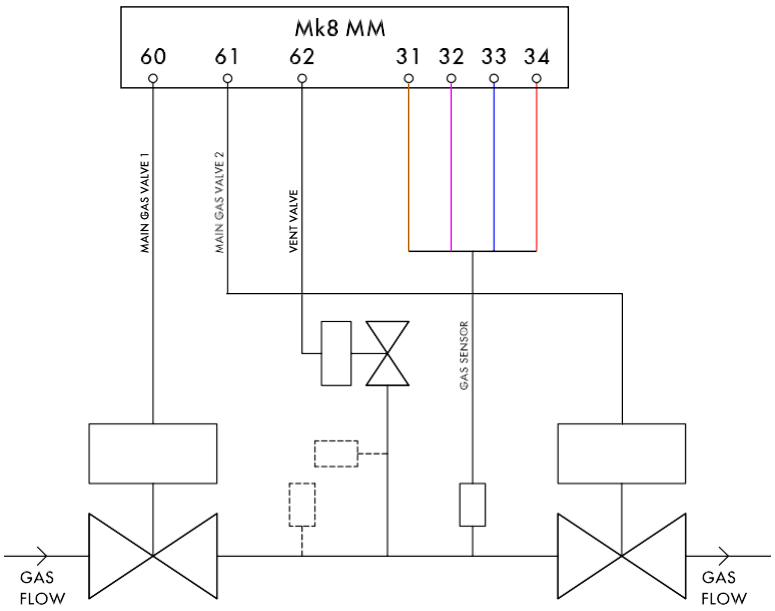
Autoflame Gas Pressure Senor can be used with the Mk8 MM for the purpose of Valve Proving System (VPS) or Gas Pressure Limits or both at the same time.

The following options/parameters are related to the operation of the gas pressure sensor:

Option / Parameter	Mk8 MM
125	Fuel pressure sensor mode – fuel 1
126	Fuel pressure sensor mode – fuel 2
127	Fuel pressure sensor mode – fuel 3
128	Fuel pressure sensor mode – fuel 4
129	VPS operation
130	Gas valve configuration
132	Gas valve proving time
133	Maximum pressure change allowed during VPS
134	VPS valve opening time
136	Gas pressure switch – offset lower limit
137	Gas pressure switch – offset upper limit
Parameter 41	Gas pressure units

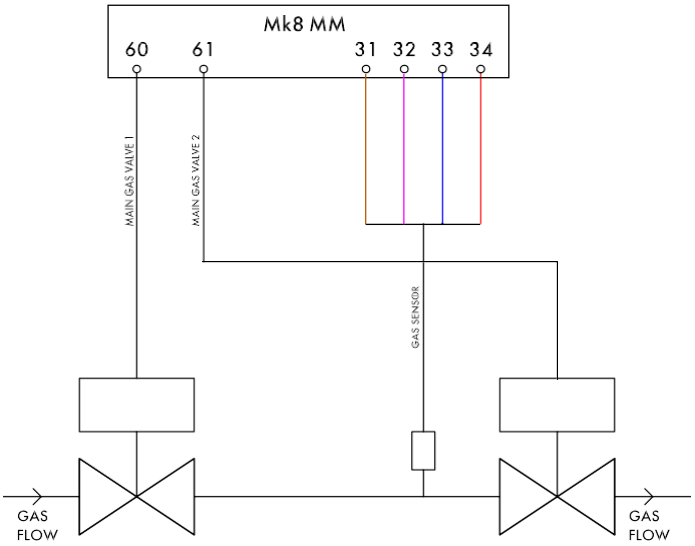
2.2.1. VPS / Pressure Limits with Vent Valve

Option /Parameter	Option #	Setting for	
		VPS / Pressure Limits	Gas Pressure Limits
Fuel Pressure Sensor Mode	125 (Fuel 1) 126 (Fuel 2) 127 (Fuel 3) 128 (Fuel 4)	1 - pressure Limits, Valve Proving	2 - Pressure Limits
Gas Valve Configuration	130	1 - Vent Normally Closed2 - Vent Normally Open	



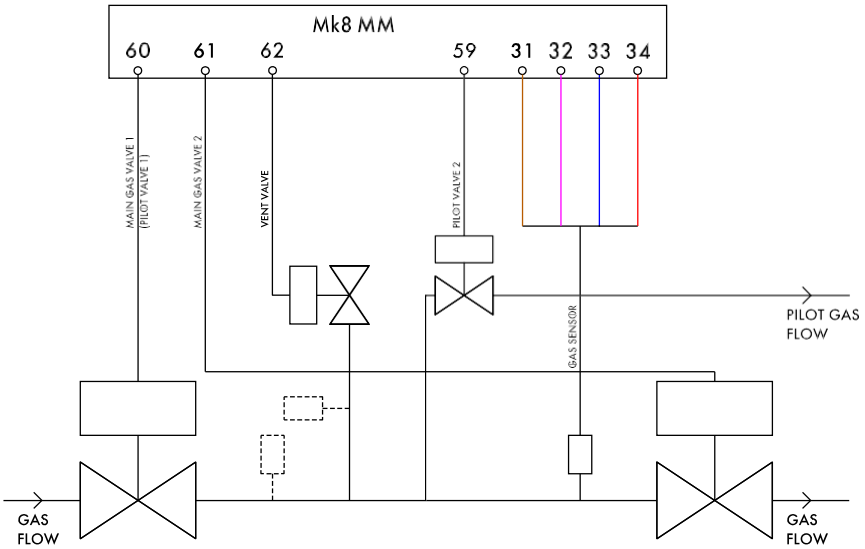
2.2.2. VPS / Pressure Limits, No Vent Valve

Option /Parameter	Option #	Setting for	
		VPS / Gas Pressure Limits	Gas Pressure Limits
Fuel Pressure Sensor Mode	125 (Fuel 1) 126 (Fuel 2) 127 (Fuel 3) 128 (Fuel 4)	1 - pressure Limits, Valve Proving	2 - Pressure Limits
Gas Valve Configuration	130	0 – No vent valve	



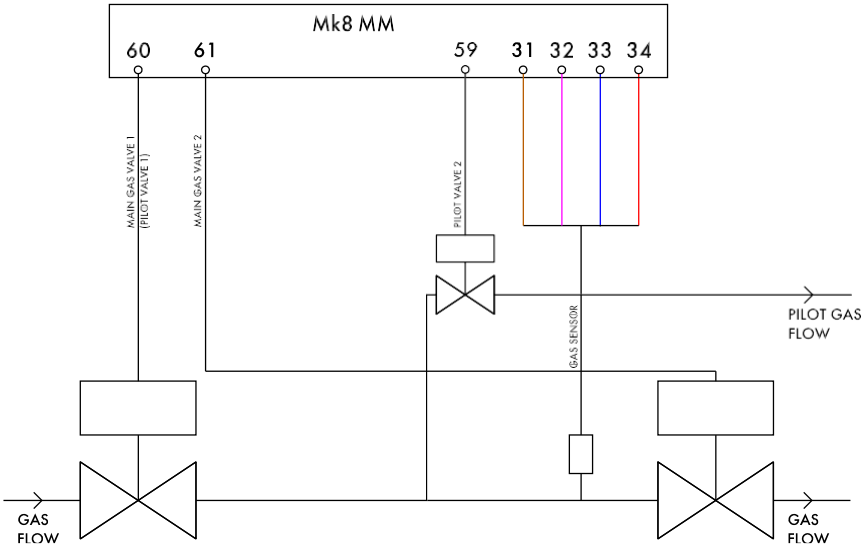
2.2.3. VPS / Pressure Limits with Vent Valve, Single Valve Pilot

Option / Parameter	Option #	Setting for	
		VPS / Gas Pressure Limits	Gas Pressure Limits
Fuel Pressure Sensor Mode	125 (Fuel 1) 126 (Fuel 2) 127 (Fuel 3) 128 (Fuel 4)	1. pressure Limits, Valve Proving	2. Pressure Limits
Gas Valve Configuration	130	4. Vent Normally Closed, Single Valve Pilot. 5. Vent Normally Open, Single Valve Pilot .	



2.2.4. VPS / Pressure Limits, No Vent Valve, Single Valve Pilot

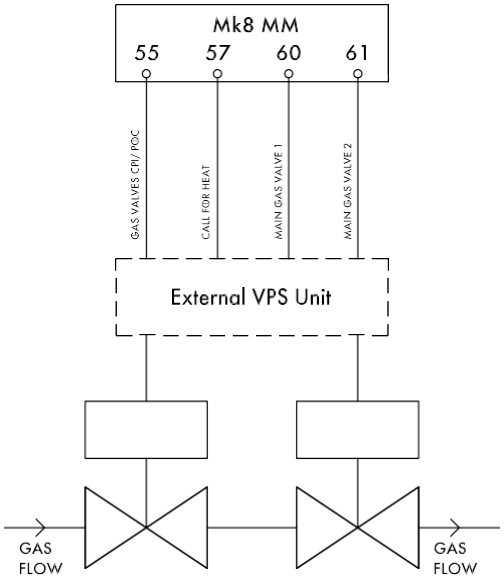
Option / Parameter	Option #	Setting for	
		VPS / Gas Pressure Limits	Gas Pressure Limits
Fuel Pressure Sensor Mode	125 (Fuel 1) 126 (Fuel 2) 127 (Fuel 3) 128 (Fuel 4)	1. pressure Limits, Valve Proving	2. Pressure Limits
Gas Valve Configuration	130	3. No Vent Valve, Single Valve Pilot.	



2.2.5. External VPS

Autoflame gas pressure sensor is not used.

Option / Parameter	Option #	Setting for VPS
Fuel Pressure Sensor Mode	125 (Fuel 1) 126 (Fuel 2) 127 (Fuel 3) 128 (Fuel 4)	3. External VPS



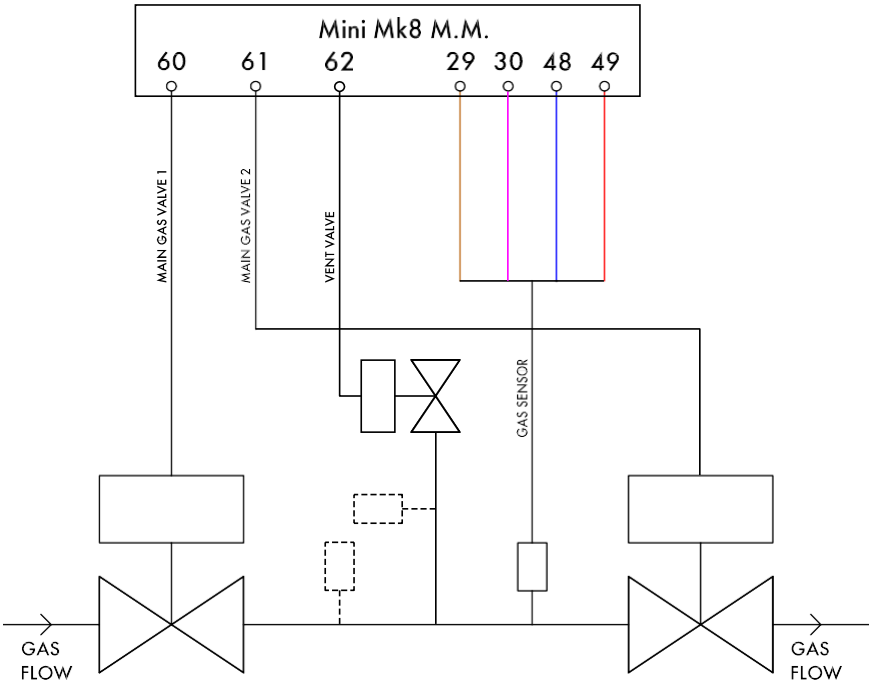
2.3. Mini Mk8 MM Gas Pressure Sensor Applications

If the Valve Proving System (VPS) facility is to be used then specific options/parameters must be set.

Option / Parameter	Mini Mk8 MM
125	Fuel pressure sensor mode – fuel 1
126	Fuel pressure sensor mode – fuel 2
128	VPS sensor type
129	VPS operation
130	Gas valve configuration
131	Gas pressure units
132	Gas valve proving time
133	Maximum change allowed during proving time
134	VPS valve opening time
136	Gas pressure switch – offset lower limit
137	Gas pressure switch – offset upper limit
138	Gas static line pressure lower limit offset
156	Terminal T82 function

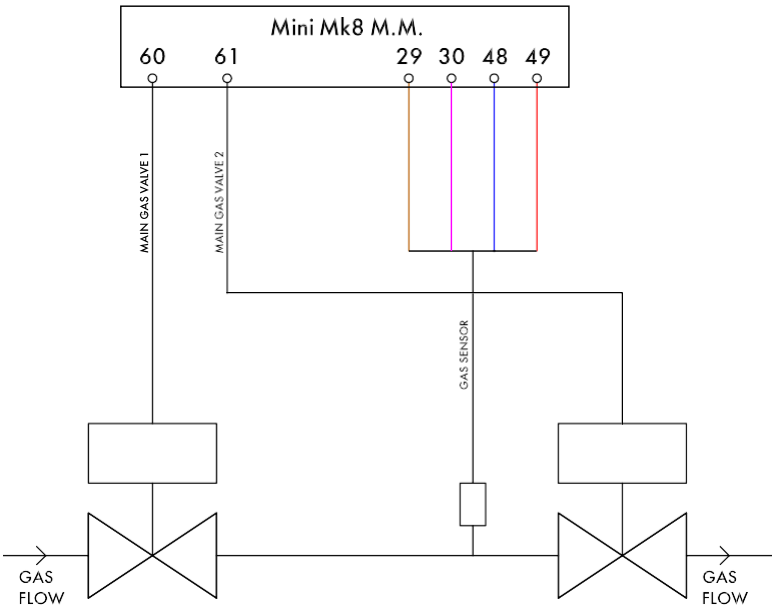
2.3.1. VPS / Pressure Limits with Vent Valve

Option /Parameter	Option #	Setting for	
		VPS / Pressure Limits	Gas Pressure Limits
Fuel Pressure Sensor Mode	125 (Fuel 1) 126 (Fuel 2)	1. pressure Limits, Valve Proving	2. Pressure Limits
VPS Sensor Type	128	1. Pressure Sensor	
Gas Valve Configuration	130	1. Vent Normally Closed 2. Vent Normally Open	



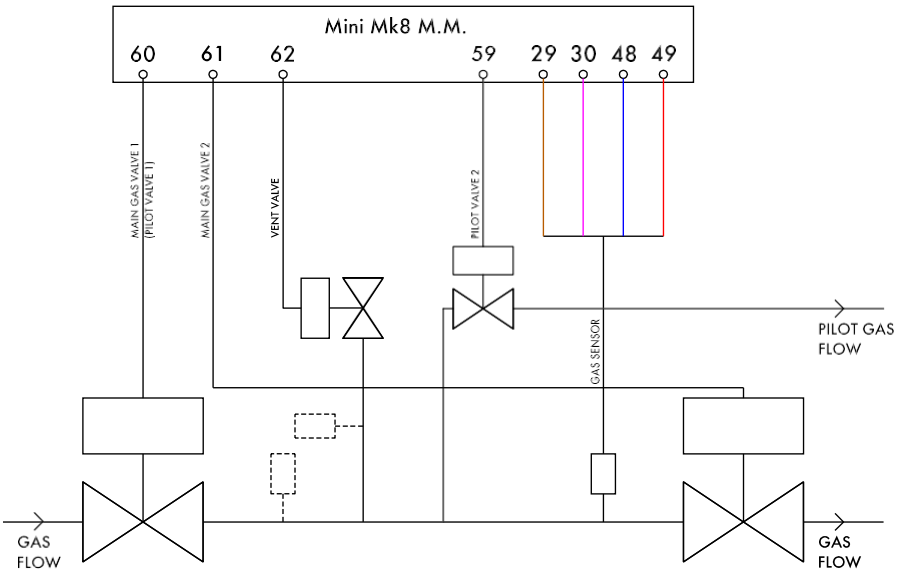
2.3.2. VPS/ Pressure Limits, No Vent Valve

Option /Parameter	Option #	Setting for	
		VPS / Gas Pressure Limits	Gas Pressure Limits
Fuel Pressure Sensor Mode	125 (Fuel 1) 126 (Fuel 2)	1 - pressure Limits, Valve Proving	2 - Pressure Limits
VPS Sensor Type	128	1. Pressure Sensor	
Gas Valve Configuration	130	0. No vent valve	



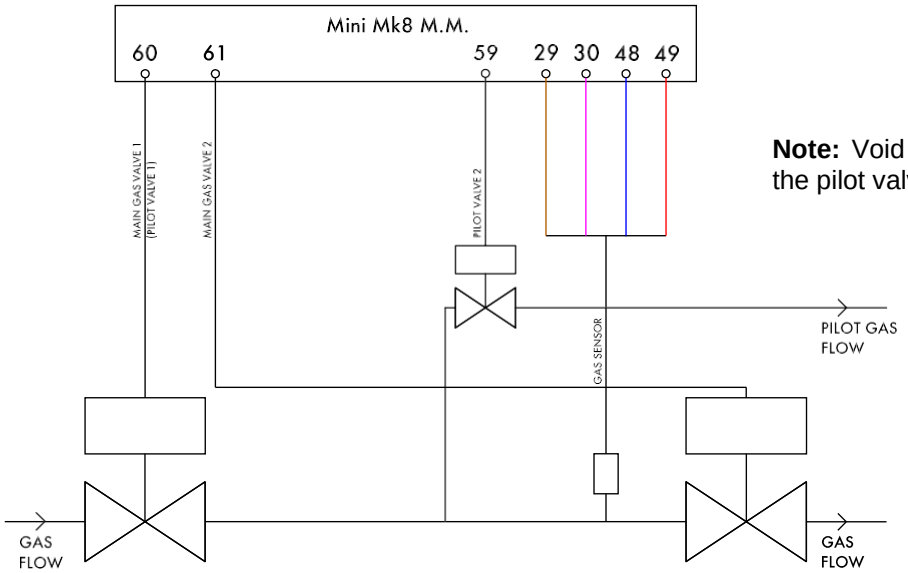
2.3.3. VPS / Pressure Limits with Vent Valve, Single Valve Pilot

Option / Parameter	Option #	Setting for	
		VPS / Gas Pressure Limits	Gas Pressure Limits
Fuel Pressure Sensor Mode	125 (Fuel 1) 126 (Fuel 2)	1. pressure Limits, Valve Proving	2. Pressure Limits
VPS Sensor Type	128	1. Pressure Sensor	
Gas Valve Configuration	130	4. Vent Normally Closed, Single Valve Pilot. 5. Vent Normally Open, Single Valve Pilot .	



2.3.4. VPS / Pressure Limits, No Vent Valve, Single Valve Pilot

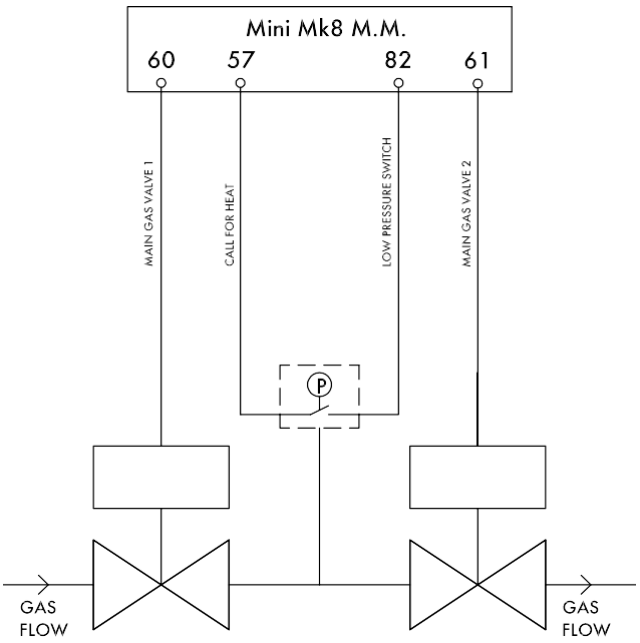
Option / Parameter	Option #	Setting for	
		VPS / Gas Pressure Limits	Gas Pressure Limits
Fuel Pressure Sensor Mode	125 (Fuel 1) 126 (Fuel 2)	1. pressure Limits, Valve Proving	2. Pressure Limits
VPS Sensor Type	128	1. Pressure Sensor	
Gas Valve Configuration	130	3. No Vent Valve, Single Valve Pilot.	



Note: Void to boiler phase is done via the pilot valve.

2.3.5. VPS Using Low Pressure Switch

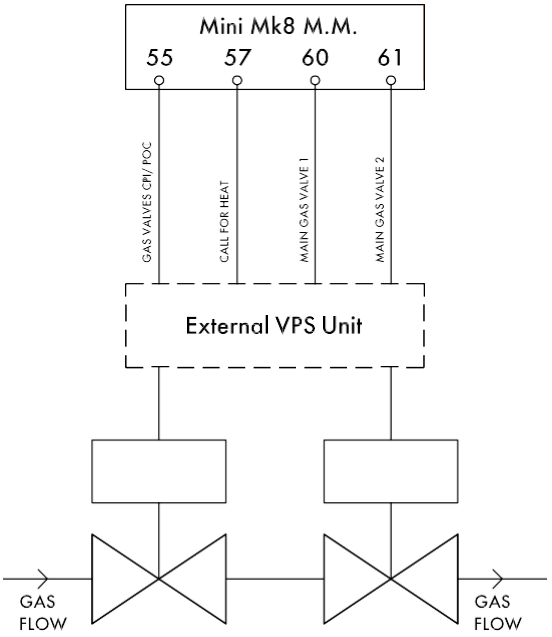
Option / Parameter	Option #	Setting for VPS
Fuel Pressure Sensor Mode	125 (Fuel 1) 126 (Fuel 2)	1. Valve Proving, Pressure Limits
VPS Sensor Type	128	0. Mains Input
Terminal 82 Function	156	1. Valve Proving Mains Input



Note: During VPS, the input on terminal 82 should be on during the VPS air proving and gas proving phases, and at all other VPS phases, the input to terminal 82 should be off. The pressure detected is the static line pressure, so the pressure switch should be set at a value just below this line pressure. When the burner is firing, terminal 82 is not checked.

2.3.6. External VPS

Option / Parameter	Option #	Setting for VPS
Fuel Pressure Sensor Mode	125 (Fuel 1) 126 (Fuel 2)	1. Valve Proving, Pressure Limits
VPS Sensor Type	128	0. Mains Input



2.4. Valve Proving Time and Pressure Change

The following formulae may be used for calculating the proving time and pressure change allowed. They are based on DVGW requirements of a leakage rate of 0.1% of the maximum volume flow.

Valve Proving Time:

$$Vpt = 4 \times \left(\left(\frac{lp \times Pv}{Mtp \div 1000} \right) + 1 \right)$$

Vpt	Valve proving time in seconds.
Ip	Inlet pressure in millibars.
Pv	Pipe volume in litres (volume = πr^2 x length, total volume of any interconnecting pipe between valve seals)
Mtp	Maximum gas throughput in litres per hour.

Pressure change:

$$Pressure\ change = 0.25 \times Nominal\ inlet\ pressure\ (mbar)$$

Example

Valve proving time:

Inlet pressure = 50 mbar
Pipe volume = 5 litres
Max gas flow = 100,000 litres per hour

$$Vpt = 4 \times \left(\left(\frac{50 \times 5}{100{,}000 \div 1000} \right) + 1 \right)$$

$$Vpt = 14secs$$

Set option and parameter 132 = 15 seconds

Note: option 132 is set in increments of 5 seconds, values must be rounded up.

Pressure change:

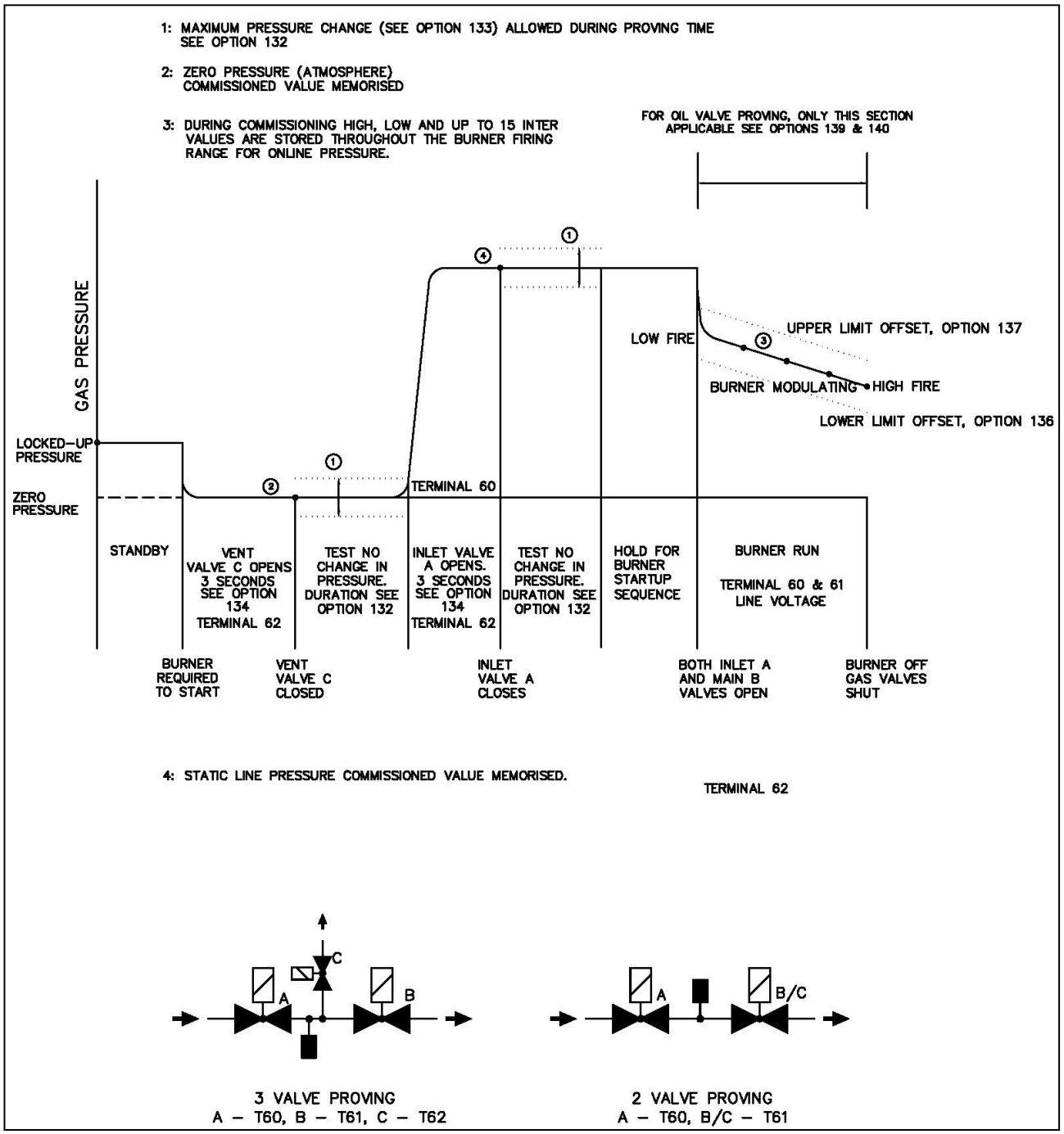
Inlet pressure = 50 mbar

$$Pressure\ change = 0.25 \times 50\ mbar$$

Set option and parameter 133 = 12.5 mbar

Note: This is a metric formula, therefore imperial units must be converted before applying this calculation.

Conversion	PSI to mbar	Ft^3 to Litres	Ft^3/hr to Litres
Multiplier	68.94.	28.31	28.31



Mk8 MM Gas Valve Proving / Oil High-Low Pressure Limits Diagram

The figure above shows the sequence for the Mk8 MM gas valve proving and high/low pressure limits using an Autoflame gas sensor.

2.5. Combustion Air Pressure Proving

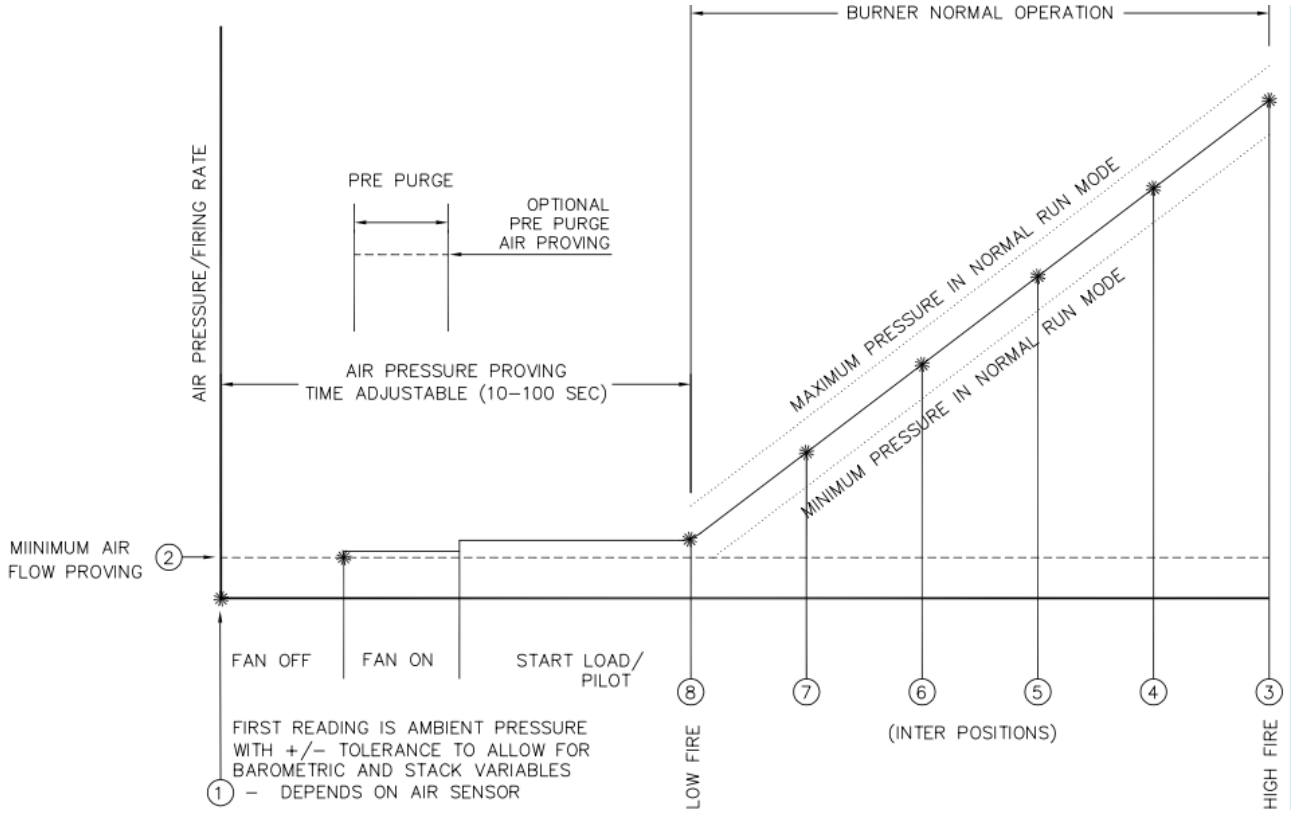
For the purpose of air pressure proving, the air pressure sensor can be wired as follows:

Wire Colour			Mk8 MM Terminal	Mini Mk8 MM Terminal
Brown	RS485 -		31	29
Purple	RS485 +		32	30
Blue	0V DC		33	48
Red	15V DC		34	49
Screen			Do not connect at MM side	

The screen wire on the flying lead is only used when connecting the sensor's lead to the MM / DTI through terminal block, it must not be connected on the MM / DTI side.

To use the air pressure sensor for combustion air pressure proving on an MM system, the following options / parameters must be set:

	Mk8 MM	Mini Mk8 MM
Air proving pressure threshold for purge	141	141
Air pressure error window	147	147
Air pressure sensor type	148	148
Air proving pressure threshold	149	149
Air pressure sensor units	Parameter 43	146



Note:

1. Position 2 must be 0.25"wg (0.62 mbar) higher than position 1.
2. Minimum pressure in normal run mode must be higher than position 2.
3. Position 8 must be set equal to position 2 or higher.
4. Default settings for minimum and maximum is 15% above and below entered value.

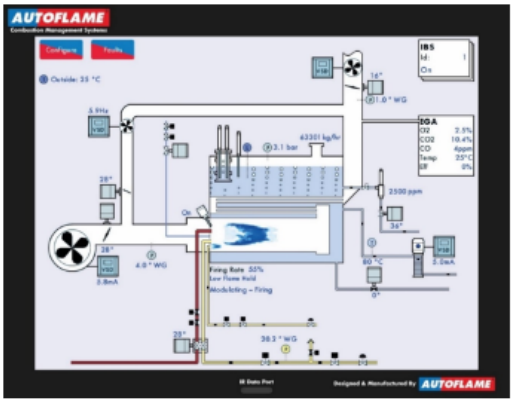
2.6. Draft Pressure Control – Mk8 MM

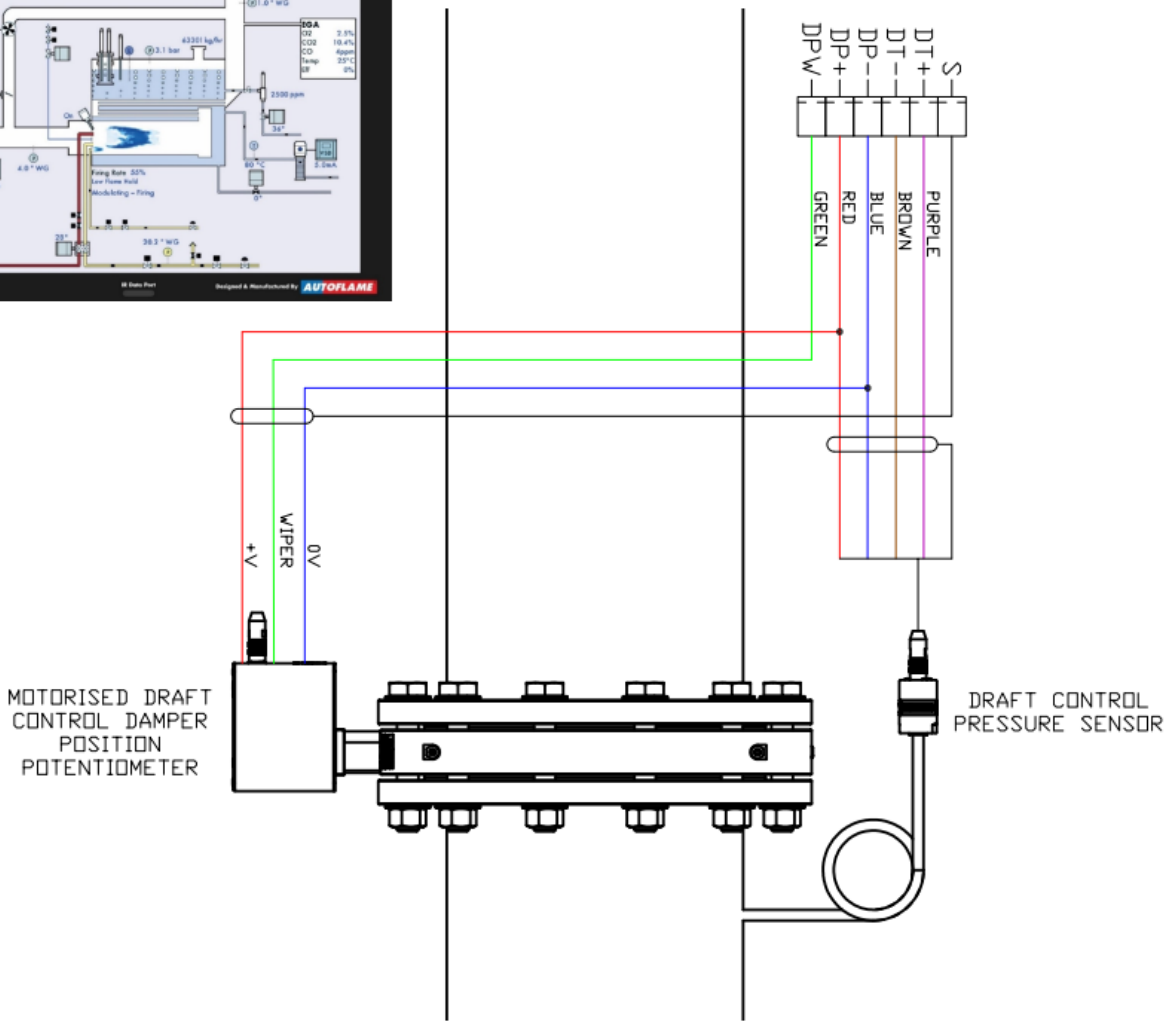
The air pressure sensor can be used with the Mk8 MM for the purpose of controlling the boiler's draft pressure. Please see the Mk8 MM manual for full details.

Draft Control is used to manage the excess draft from stacks, so heat transfer from the hot gases to the boiler tubes can be optimised. The MM draft control stores the pressure conditions at the commissioning stage and modulates with the firing curve to maintain this, irrespective of changing firing rate and stack conditions.

Wiring

Wire Colour			Mk8 MM Terminal
Brown	RS485 -		DT-
Purple	RS485 +		DT+
Blue	0V DC		DP-
Red	15V DC		DP+
Screen			Do not connect at MM side





2.7. Gas / Air Pressure Monitoring with Mk8 DTI

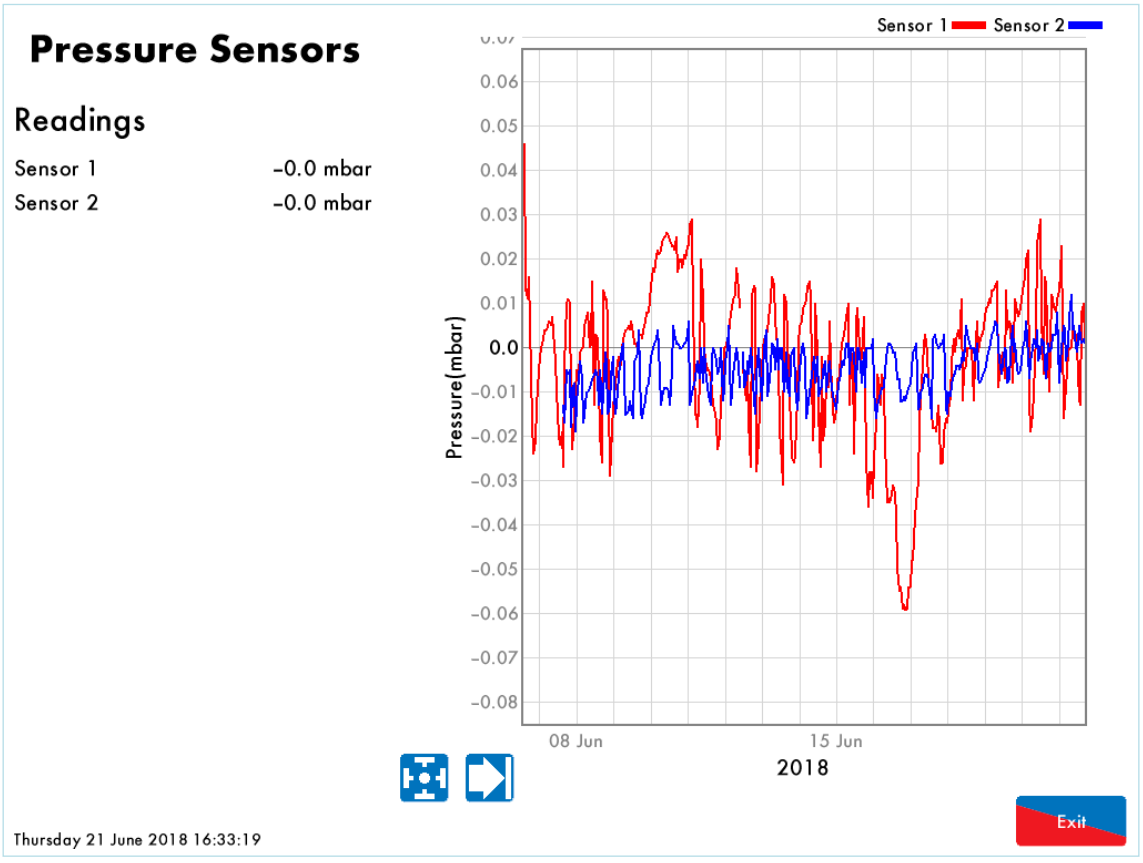
The Mk8 DTI allows monitoring gas and air pressure throughout the boiler house. Up to ten Mk8 gas pressure sensors, Mk8 air pressure sensors or any combination of both can be connected to the DTI. The DTI stores 3 years of pressure readings data. Live readings can be seen via the DTI's display as well as the logged history data.

Please see the Mk8 DTI manual for further information.

Wiring

Wire Colour	Mk8 DTI Terminal
Brown	RS485 -
Purple	RS485 +
Blue	15V DC +
Red	15V DC -
Black	S

The Pressure Sensor screen on the DTI displays the status of all the sensors connected directly to the DTI. This screen also provides history graphs for the logged data.



Pressure Sensor Screen on the DTI

3. OIL PRESSURE SENSOR

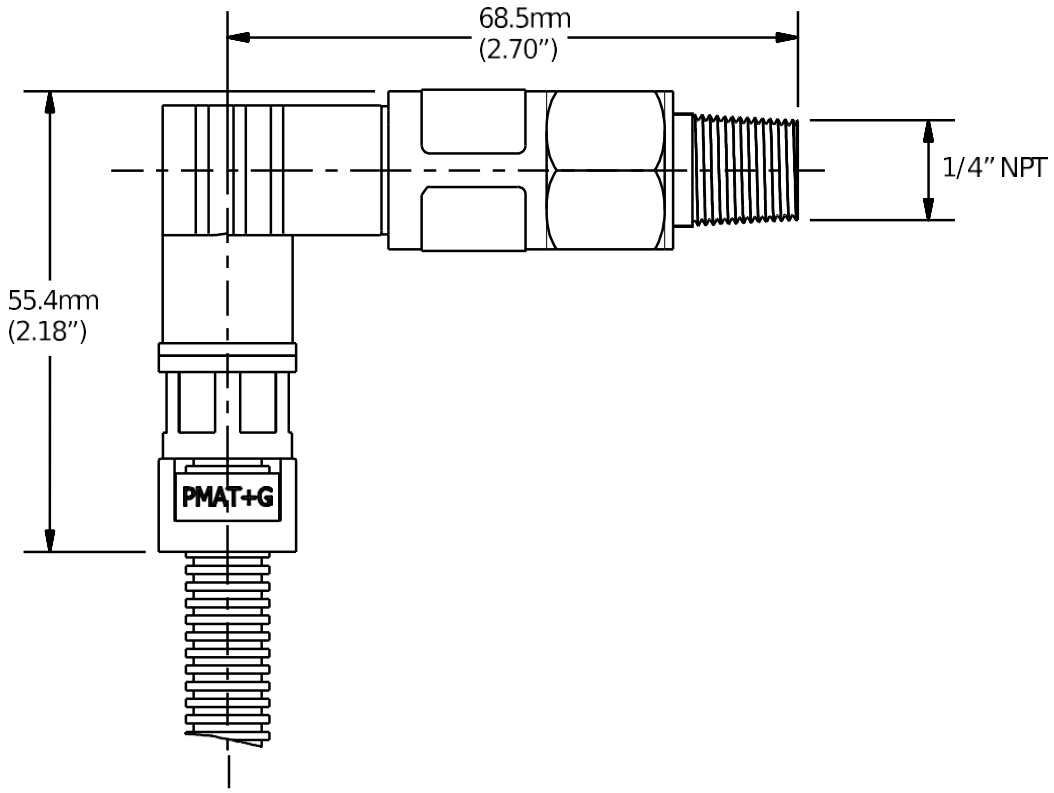
Autoflame oil pressure sensor can be used with the Mk8 MM for the purpose of checking the running oil pressure and setting up pressure limits when firing on liquid fuels.

Specifications	
Part #	MM60009
Compatibility	Mk8 MM only
Output Signal	1-6V
IP rating	65
NEMA rating	4X
Valve material	Stainless Steel
O-Ring material	Viton
Operating Temperature	-25 to 85˚C (-13 to 185˚F)
Media Temperature	-25 to 125˚C (-13 to 257˚F)
Operating Range	0 to 40 Bar (0 to 600 PSI)
Over Pressure Rating	80 Bar (1160 PSI)
Burst Pressure Rating	290 Bar (4350 PSI)
Connection	¼” NPT Parallel female
Fitting Size	M19
Fitting torque	25Nm
Lead	1.5m (5ft) prewired with waterproof protective conduit
Warranty	2 year limited warranty

Wiring

Wire Colour			Mk8 MM Terminal
White	2		35
Blue	3		48
Brown	1		49
Screen			Do not connect on the MM side

3.1. Dimensions



5.2. Installation

To use the oil pressure sensor with a Mk8 MM, the following options/parameters must be set:

Option/Parameter	Mk8 MM
125	Fuel pressure sensor mode – fuel 1
126	Fuel pressure sensor mode – fuel 2
127	Fuel pressure sensor mode – fuel 3
128	Fuel pressure sensor mode – fuel 4
139	Oil pressure switch – offset lower limit
140	Oil pressure switch – offset upper limit
Parameter 42	Oil pressure units

- Plug fits correctly in one position only, do not force.
- Do not use case to tighten pressure connection.

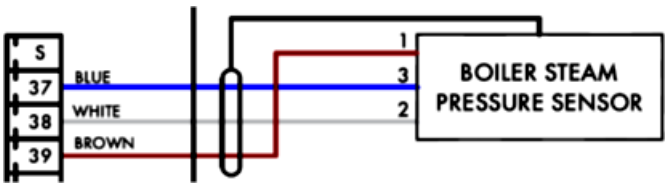
4. STEAM PRESSURE SENSOR

Autoflame Steam Pressure Sensor can be used with the MM system for the purpose of measuring the steam (load) pressure.

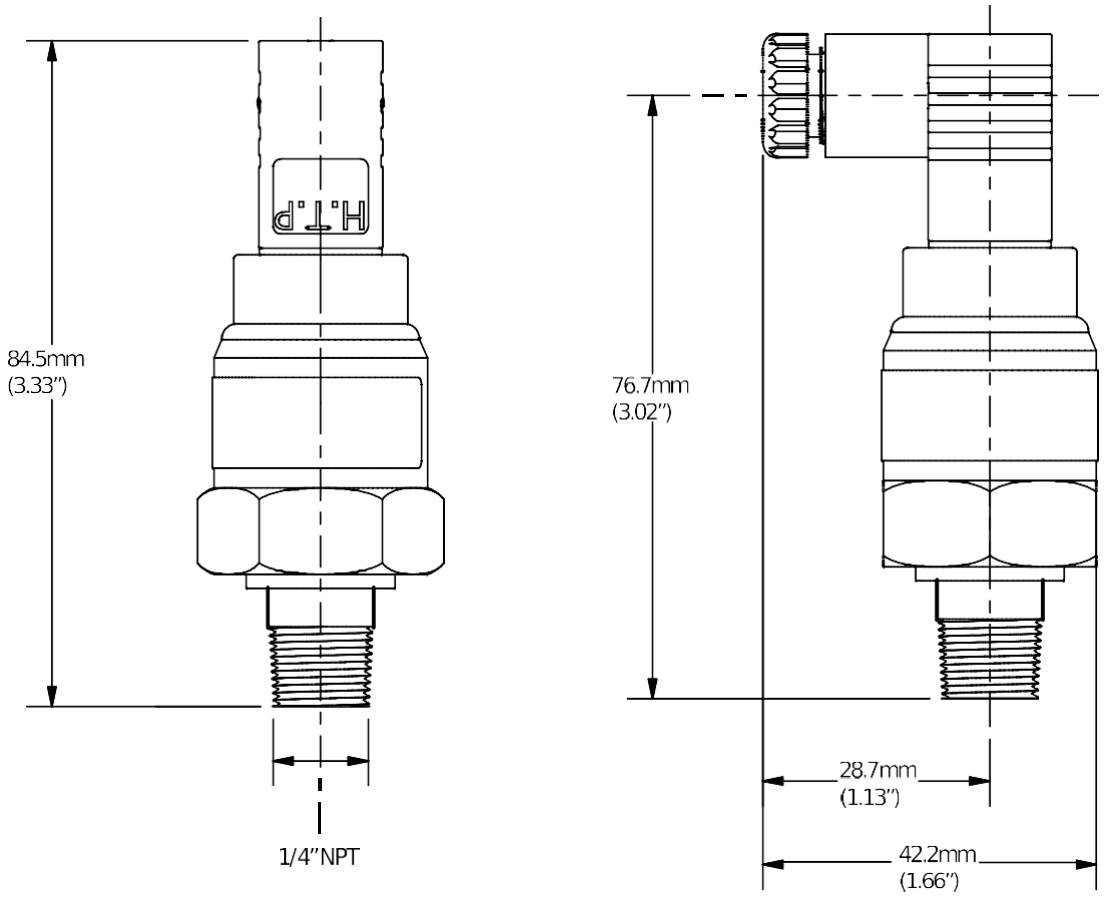
Specifications	
Output Signal	1-6V
IP rating	65
NEMA rating	4
Torque setting	Max 25Nm
Valve material	Stainless Steel
O-Ring material	Viton
Operating Outside Temperature	-25 to 85˚C (-13 to 185˚F)
Media Temperature	-25 to 125˚C (-13 to 257˚F)
Operating Range	0 to 40 Bar (0 to 600 PSI)
Over Pressure Rating	80 Bar (1160 PSI)
Burst Pressure Rating	290 Bar (4350 PSI)
Fitting Size	M27
Fitting torque	15 to 20Nm (11 to 14.8 ft lb)
Lead	1.5m (5ft) prewired with inside waterproof protective conduit
Warranty	2 year limited warranty

Wiring

Wire Colour	MM Terminal
White (2)	38
Blue (3)	37
Brown (1)	39
Screen	Do not connect on MM side



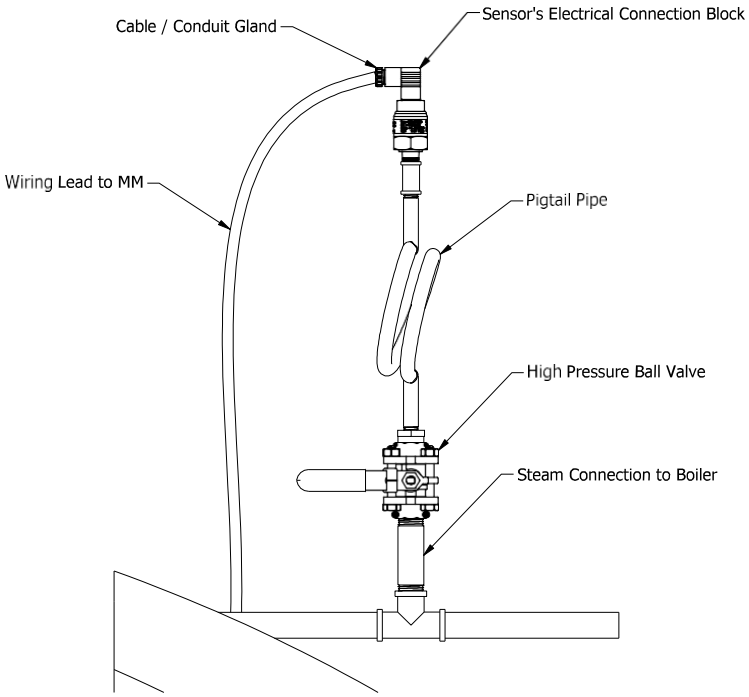
4.1. Dimensions



Part #	Connection	Sensor's Range	Over Pressure	Burst Pressure
MM10010	¼" BSP tapered	0 – 3.4 bar (0 – 50 PSI)	8 bar (116 PSI)	12 bar (174 PSI)
MM10010/U	¼" NPT tapered			
MM10008	¼" BSP tapered	0 – 20 bar (0 – 300 PSI)	50 bar (725 PSI)	75 bar (1087 PSI)
MM10008/U	¼" NPT tapered			
MM10009	¼" BSP tapered	0 – 34 bar (0 – 500 PSI)	80 bar (1160 PSI)	100 bar (1450 PSI)
MM10009/U	¼" NPT tapered			
MM10017	¼" BSP tapered	0 – 100 bar (0 – 1450 PSI)	200 bar (2900 PSI)	300 bar (4351 PSI)
MM10017/U	¼" NPT tapered			

4.2. Installation

- For correct operation, the detector must be installed with a pressure siphon loop.
- Plug fits correctly in one position only, do not force.
- Do not use case to tighten connection.
- An isolation vale can be installed between the sensor and the pressure vessel.



To calibrate the actual value, parameter 29 can be used to adjust the pressure sensor reading between a range of 80.0% and 120.0%.

The load sensor can be calibrated via Commissioning Mode or through Online Changes.

The percentage change may not be linear to the current temperature, i.e. 80% of 10 bar may not translate to 8 bar.

5. TEMPERATURE SENSOR

Autoflame Temperature Sensor is a resistance type temperature detector for use with the MM system for the purpose of:

- Measuring load temperature.
- Monitoring the exhaust temperature or the coil/tube temperature of the boiler on the Mk8 MM.
- Heat Flow metering applications on the Mk8 MM.
- Fully Metered Combustion applications on the Mk8 MM.
- Exhaust Temperature Shutdown Threshold on the Mk8 MM.

Autoflame temperature detector is available with various probe lengths ranging from 100mm to 400mm, other lengths are available upon request, please contact Autoflame with your requirements.

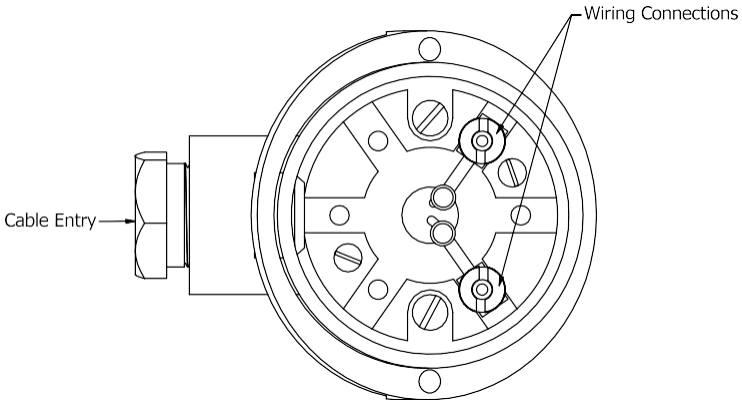
Specifications	
Range	0 to 400°C (0 to 752°F)
Sensor Type	RTD PT1000, 2 wire.
IP Rating	65
NEMA Rating	4
Max. Operating Temperature	85°C (185°F)
Min. Operating Temperature	-25°C (-13°F)
Max. Pressure Rating	40 bar (580 PSI)
Housing	Stainless Steel
Probe	Stainless Steel
Cable Gland	PG11
Wiring connection	Not included, 2 core screened cable (16-2-2C 2 Core) recommended
Installation	Any orientation, probe must be in in full contact with the medium being measured
Installation torque	25Nm (18ft lb)
Thermal Response	0.1s
Stability	+/- 0.05%
Warranty	2 years limited warranty

The table below provides the temperature vs. resistance data for the Autoflame temperature sensor:

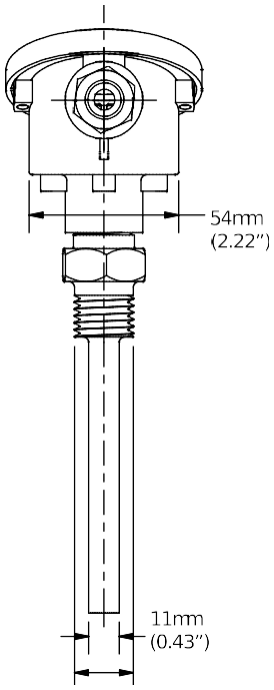
Temp. °C	Temp. °F	Ω	Ω/°C	Ω/°F
0	32	1000.0	3.90	2.17
10	50	1039.0	3.89	2.16
20	68	1077.9	3.88	2.16
30	86	1116.7	3.87	2.15
40	104	1155.4	3.86	2.14
50	122	1194.0	3.84	2.13
60	140	1232.4	3.83	2.13
70	158	1270.7	3.82	2.12
80	176	1308.9	3.81	2.12
90	194	1347.0	3.80	2.11
100	212	1385.0	3.79	2.11
110	230	1422.9	3.77	2.09
120	248	1460.6	3.77	2.09
130	266	1498.3	3.75	2.08
140	284	1535.8	3.73	2.07
150	302	1573.1	3.73	2.07
160	320	1610.4	3.72	2.07
170	338	1647.6	3.70	2.06
180	356	1684.6	3.70	2.06
190	374	1721.6	3.68	2.04
200	392	1758.4	3.67	2.04
210	410	1795.1	3.66	2.03
220	428	1831.7	3.15	1.75
230	446	1863.2	4.13	2.29
240	464	1904.5	3.62	2.01
250	482	1940.7	3.62	2.01
260	500	1976.9	3.60	2.00
270	518	2012.9	3.59	1.99
280	536	2048.8	3.57	1.98
290	554	2084.5	3.57	1.98
300	572	2120.2	3.55	1.97
310	590	2155.7	3.55	1.97
320	608	2191.2	3.53	1.96
330	626	2226.5	3.52	1.96
340	644	2261.7	3.50	1.94
350	662	2296.7	3.50	1.94
360	680	2331.7	3.48	1.93
370	698	2366.5	3.48	1.93
380	716	2401.3	3.46	1.92
390	734	2435.9	3.45	1.92
400	752	2470.4	3.44	1.91

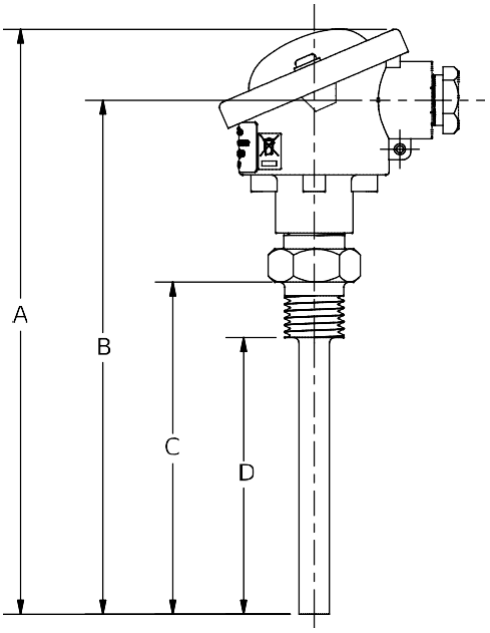
Wiring

Wire Colour	Mk8 MM / Mini Mk8 MM As load sensor	Mk8 MM Heat Flow / Fully Metered / Spare Temp. Sensor
Blue	37	-
Red	38	T1, T2, T3
Screen	S	S



5.1. Dimensions





Part #	Connection	Gland	mm (inch)			
			A	B	C	D
MM10006/100	½" BSP / NPT	PG11	211.42	185.75	120	100
MM10006/100U		½" NPSM	(8.32)	(7.31)	(4.72)	(4)
MM10006/150		PG11	261.42	235.75	170	150
MM10006/150U		½" NPSM	(10.29)	(9.28	(6.69)	(6)
MM10006/200		PG11	311.42	285.75	220	200
MM10006/200U		½" NPSM	(12.26)	(11.25)	(8.86)	(8)
MM10006/250		PG11	361.42	335.75	270	250
MM10006/250U		½" NPSM	(14.23)	(13.22)	(10.63)	(10)
MM10006/400		PG11	511.42	485.75	420	400
MM10006/400U		½" NPSM	(20.13)	(19.12)	(16.54)	(12)

5.2. Temperature Sensor's Applications

Th temperature sensor can be used for several applications with the MM systems, please see the relevant MM manual for full details.

Load Sensor

Autoflame temperature sensor can be used as a load sensor with the Mk8 MM or Mini Mk8 MM, for this the following options must be set:

#	Description	Setting
Option 1	Boiler temperature / pressure sensor type	0. temperature (MM10006, 0 – 400°C / 752°F)
Parameter 29	Load sensor adjustment	As required – the temperature reading can be adjusted to calibrate the actual value
Parameter 30	Load sensor filter time (the time it takes to update the sensor reading on the MM)	As required, 10 sec. default

To calibrate the actual load value, parameter 29 can be used to adjust the temperature sensor reading between a range of 80.0% and 120.0%.

The load sensor can be calibrated via Commissioning Mode or through Online Changes on the MM.

The percentage change may not be linear to the current temperature, i.e. 80% of 100°C may not show 80°C.

For example, if the actual temperature was showing as 91°C on the MM, but the true temperature was 79°C, change the value in parameter 29 until the correct temperature adjustment has been made. Figure 3.9.1.i shows the load sensor adjusted by 96.0% to display 79°C.

Heat Flow Applications

To use the temperature sensor for Heat Flow applications on the Mk8 MM, the following expansion options must be set:

#	Description	Temperature Sensor Used
120	2 Steam Flow	T1 input temp.
	3 Steam Flow with Economiser	T1 Input temp, T2 Feedwater temp.
	4 Steam Flow with Deaerator	T1 Makeup temp, T3 condensate temp.
	6 Steam Flow with Deaerator and Feed Sensor	T1 makeup temp, T2 feedwater temp, T3 condensate temp.
	7 Hot Water Flow	T1 input temp.
	9 Hot Water flow with Economiser	T1 input temp, T2 feedwater temp.
	11 Steam Flow from Feed Water Meter and Feed Sensor	T1 input temp.

Please see the Mk8 MM manual for full details about heat flow.

Spare Temperature Sensor

The Spare Temperature Sensor feature on the Mk8 MM allows an addition temperature sensor to be used for monitoring either the exhaust temperature or the coil / tubes temperature on a boiler. This also allows the configuration of a temperature shutdown threshold.

#	Default	Range	Description
130	0		Temp: Spare Temperature Sensor Function
		0	Disabled
		1	Coil Temperature
		2	Exhaust Gas Temperature
131	0		Temp: Spare Temperature Shutdown Threshold
		0	Disabled
		1 – 2000	Degree °C

This feature is available with the Heat Flow function, the sensor used for this depends on the setting for the Heat Flow function, the table below explains the sensor used for each setting.

#	Setting	Spare Temperature Sensor Used
1	Steam Flow with default values	T3
2	Steam Flow	T3
3	Steam Flow with Economiser	T3
4	Steam flow with Deaerator	T2
10	Steam Flow from Feed Water Meter	T3
11	Steam Flow from Feed Water Meter and Feed Sensor	T3
12	Spare Temperature Sensor Only	T3

Exhaust Temperature Shutdown Threshold

Expansion option 131 allows a spare temperature shutdown threshold to be set. The burner will shutdown and an alarm will be triggered when this threshold temperature is reached. This alarm can only be reset when the spare temperature sensor reading drops below this threshold.

The Exhaust Temperature Threshold is not an ultimate safety feature and it does not replace the need for high limit stat.

6. OUTSIDE TEMERATE COMPENSATION

Outside Temperature Compensation (OTC) is a function which allows the boiler's required setpoint to be automatically adjusted according to the outside air temperature. As the ambient air temperature increases the required setpoint will be decreased, and vice versa.

The way OTC is configured depends on whether the MM is operating as stand-alone or in a sequencing loop, the table below describes different possible setups:

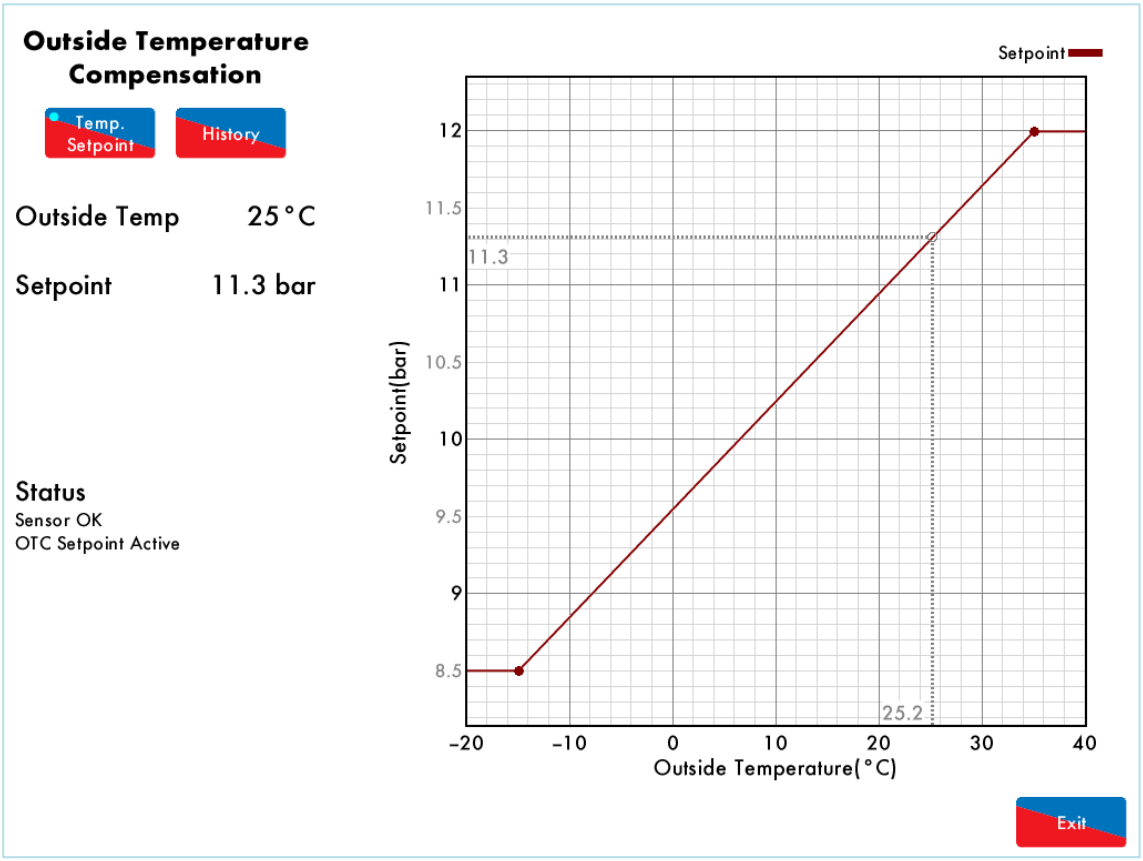
Mk8 MM (not in sequencing or DTI loop)	Outside Temperature Sensor is required (part # MM60007), and can be wired directly to the Mk8 MM.
Mini Mk8 MM (not in sequencing or DTI loop)	OTC Module (part # MM70015) and OTC Temperature Sensors (part # MM60007) are required, the OTC module is wired to the Mini Mk8 MM and the sensor is connected to the OTC module.
MMs in a sequencing loop (no DTI) with fixed ID lead boiler	OTC hardware is wired for the lead boiler only and the lag MMs take their OTC temperature reading from the lead MM.
MMs in a sequencing loop (no DTI) with rotating lead boiler	An OTC module and sensor is connected to the sequencing loop, and all the MMs in the sequencing loop can take their OTC temperature reading from the same OTC module.
MMs in a sequencing loop with Mk8 DTI	Mk8 DTI can act as an OTC unit if it is connected to the internet and configured to get local weather data online. No need for an OTC module or temperature sensor hardware. All the MMs in the DTI loop will get their OTC temperature readings from that DTI

The following options and parameters are related to Outside Temperature Compensation:

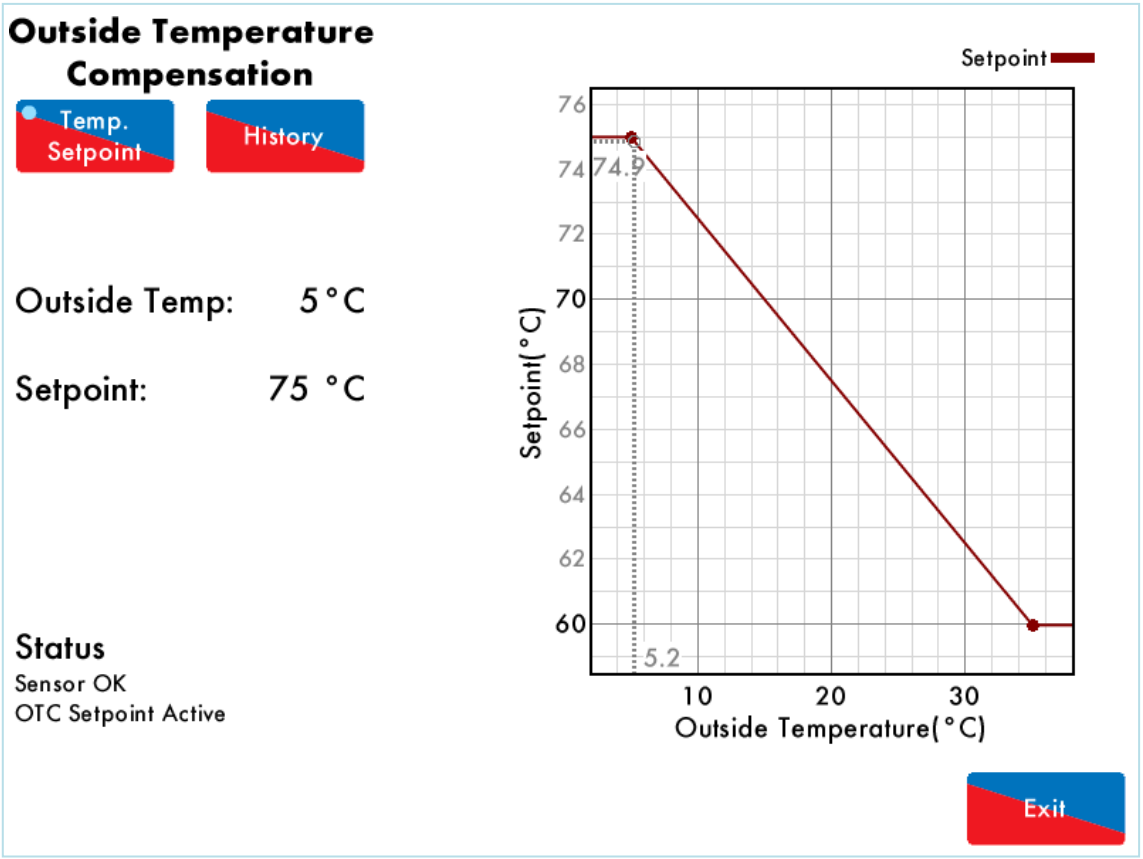
Option	Mk8 MM and Mini Mk8 MM
80	Outside temperature compensation
81	Setpoint at minimum outside temperature
82	Minimum outside temperature
83	Setpoint at maximum outside temperature
84	Maximum outside temperature
Parameter 88	Outside temperature sensor adjustment

If the actual outside temperature exceeds the boundaries set in options 82 and 84, the boiler setpoint will remain at the maximum or minimum setpoints specified by options 81 and 83.

Please check the Mk8 MM and Mini Mk8 MM manuals for further details on Outside Temperature Compensation function.



Outside Temperature Compensation Screen – Mk8 MM



Outside Temperature Compensation Screen – Mini Mk8 MM

6.1. Outside Temperature Sensor

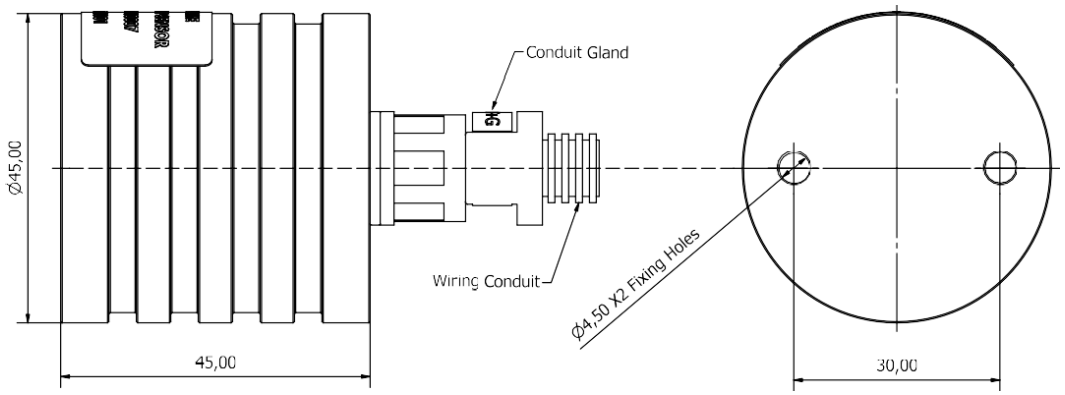
Autoflame Outside Temperature Sensor can be wired directly to the Mk8 MM or connected to the Outside Temperature Compensation Module for use with the Mini Mk8 MM. The sensor's body is made from aluminium and has 2 fixing holes to mount the sensor to a surface. The sensor comes with 2 metre screened cable, pre-wired to the sensor and shielded with protective, waterproof conduit.

Specifications	
Sensor Type	RTD PT1000, 2-wire
IP Rating	65
NEMA Rating	4
Max. Operating Temperature	85°C (185°F)
Min. Operating Temperature	-25°C (-13°F)
Housing	Aluminium
Cable Gland	Conduit gland
Wiring lead	2m (6.5ft) prewired inside a plastic conduit
Installation	Any direction
Mounting	2x M4 Screws
Thermal Response	0.1s
Stability	+/- 0.05%
Warranty	2 years limited warranty

Wiring

Wire Colour	Mk8 MM Terminal	OTC Module Terminal
Blue	19	-
Red	20	+
Screen	S	S

Drawing



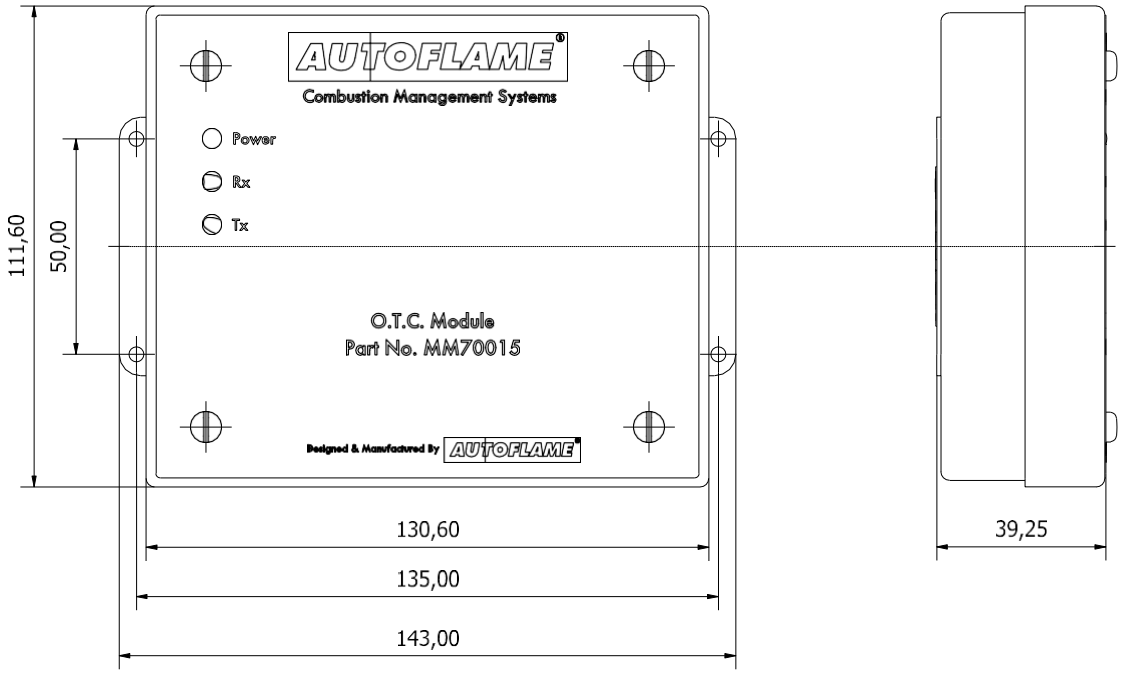
6.2. Outside Temperature Compensation Module

The outside temperature module can be used to:

- Interface an OTC temperature sensor to a Mini Mk8 MM
- Connect a temperature sensor to MMs in a squencing loop so that all MMs in the loop can get their OTC temperature readings from that sensor.

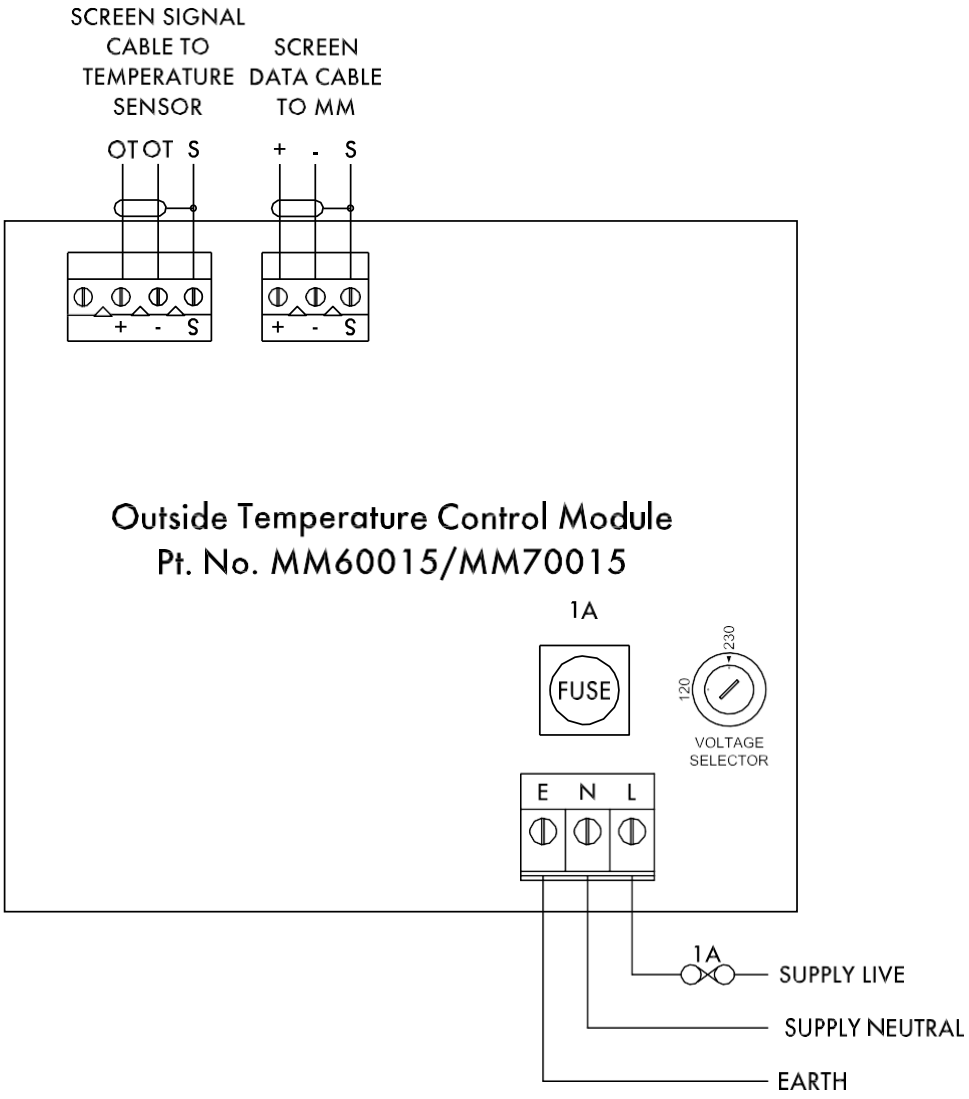
Specifications	
Supply voltage	110V or 230V AC – switch must be set before use
Communication	RS485
IP Rating	IP20
NEMA Rating	1
Max. Operating Temperature	60°C (140°F)
Min. Operating Temperature	0°C (23°F)
Warranty	2 years limited warranty

Drawing



Wiring

Wire Colour			Mini Mk8 MM Terminal
Black	RS485 -		27
Red	RS485 +		28
Screen			S



Annex: IP Ratings

The IP (International Protection) rating given to a piece of electrical apparatus is a two digit code indicating the degree of protection its enclosure affords it. The first digit represents protection against penetration by solid objects accessing hazardous parts, the second describing the enclosures, protection against the ingress of water. An X in place of either digit means that either the enclosure has not been tested or that the test is not applicable.

First digit	Mechanical protection		Second digit	Water ingress protection	
0		No protection	0		No protection
1		Protected against solid objects over 50mm, e.g. accidental touch by hands	1		Protected against vertically falling drops of water e.g. condensation
2		Protected against solid objects over 12mm, e.g. fingers	2		Protected against direct sprays of water up to 15 ° from the vertical
3		Protected against solid objects over 2.5mm, e.g. tools & wires	3		Protected against direct sprays of water up to 60 ° from the vertical
4		Protected against solid objects over 1mm, e.g. wires, nails etc.	4		Protected against water splashed from all directions, limited ingress permitted
5		Protected against dust limited ingress, not harmful deposits	5		Protected against low pressure jets of water from all directions, limited ingress permitted
6		Totally protected against dust	6		Protected against strong jets of water e.g. on ships deck, limited ingress permitted
n/a	n/a	n/a	7		Protected against the effects of temporary immersion between 15cm and 1m. Duration of test 30 minutes
n/a	n/a	n/a	8		Protected against long periods of immersion under pressure

Note: In the event of additional holes being drilled, pierced or knockouts removed, suitable measures should be taken to restore the product to its original rating IEC 529, BS EN 60529 does not apply to protection against the risk of explosion or conditions such as humidity, corrosive gases, fungi or vermin. In certain cases equipment designed to be mounted in an enclosure will contribute towards the stated IP rating, (e.g. pushbuttons mounted in an enclosure). Different parts of enclosures can have different degrees of protection and still conform to the standard.

AUTOFLAME
SENSORS GUIDE
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