AUTOFLAME®

Combustion Management Systems



FLAME SCANNERS GUIDE

01.06.2023

Autoflame Engineering Ltd.
Unit 1-2 Concorde Business Centre
Airport Industrial Estate
Wireless Road, Biggin Hill
Kent TN16 3YN
United Kingdom

Tel: +44 (0)1959 578 820
Email: technicalsupport@autoflame.com
Web: www.autoflame.com

AUTOFLAME
FLAME SCANNERS GUIDE

01.06.2023

This manual and all the information contained herein is copyright of Autoflame Engineering Ltd. It may not be copied in whole or part without the consent of the Managing Director.

Autoflame Engineering Ltd.'s policy is one of continuous improvement in both design and manufacture. We therefore reserve the right to amend specifications and/or data without prior notice. All details contained in this manual are correct at the time of going to print.

Important Notes

A knowledge of combustion related procedures and commissioning is essential before embarking in work on any of the MM/EGA systems including Flame Scanners. This is for safety reasons and effective use of the MM/EGA system. Hands on training is required. For details on schedules and fees relating to group training courses and individual instruction, please contact the Autoflame Engineering Ltd. offices at the address listed herein.

Short Form - General Terms and Conditions

A full statement of our business terms and conditions are printed on the reverse of all invoices. A copy of these can be issued upon application, if requested in writing.

The System equipment and control concepts referred to in this Manual MUST be installed, commissioned and applied by personnel skilled in the various technical disciplines that are inherent to the Autoflame product range, i.e. combustion, electrical and control.

The sale of Autoflame's systems and equipment referred to in this Manual assume that the dealer, purchaser and installer has the necessary skills at their disposal. i.e. A high degree of combustion engineering experience, and a thorough understanding of the local electrical codes of practice concerning boilers, burners and their ancillary systems and equipment.

Autoflame's warranty from point of sale

- Two years on all electronic and electro-mechanical equipment, assemblies and components.
- One year on all EGA systems and UV & IR scanners, including parts, components, cells and sensors.

The warranty assumes that all equipment supplied will be used for the purpose that it was intended and in strict compliance with our technical recommendations.

Autoflame's warranty and guarantee is limited strictly to product build quality, and design. Excluded absolutely are any claims arising from misapplication, incorrect installation and/or incorrect commissioning.

Contents

1. UV Flame Scanners 6

1.1. MM60003/HS - Self-Check, High Sensitivity, End View UV Scanner 7

1.2. MM80004/HS - High Sensitivity, End/Side View UV Scanner 9

1.3. MM60003/HS/SV - Self-Check, High Sensitivity, Side View UV Scanner 11

1.4. MM80004 - Standard, Side View UV Scanner (Mk8 Series) 13

1.5. MM60004 - Standard, Side View UV Scanner 15

1.6. MM60004/U - Standard, End View UV Scanner 17

1.7. MM60004/HSU - Standard, High Sensitivity, End View UV Scanner 19

1.8. MM60004/U/EXP - Standard, End View UV Scanner, ATEX Approved 21

1.9. MM60003/HS/EXP - Self-Check, High Sensitivity, End View UV Scanner, ATEX Approved 23

2. IR Flame Scanners 25

2.1. MM80017 – Self-Check, End View IR Scanner 26

2.3. MM80017/SV – Self-Check, Side View IR Scanner 28

3. Swivel Mount for Flame Scanners 30

4. Flame Scanners Installation & Operation 31

4.1. UV Flame Scanner Installation 31

4.2. UV Flame Scanner Operation 32

4.3. IR Flame Scanner Installation 33

4.4. IR Flame Scanner Operation 34

4.5. Cable Specifications 35

5. Mk8 MM Flame Detection Using Flame Switch 36

6. Mini Mk8 MM Flame Detection Using Ionisation 37

7. Flame Detection Options / Dual Scanners Operation 38

7.1. IR and UV, IR and Ionisation 38

7.2. IR or UV, IR or Ionisation 38

7.3. Ionisation to UV Switchover (Mini Mk8 MM only) 39

8. Troubleshooting 40

8.1. UV Shutter Faults 40

8.2. UV Problems 40

IMPORTANT SAFETY NOTES



An Autoflame flame scanner must be used with the Mk8 MM and Mini Mk8 MM systems. A third party flame sensor must never be used with the MM systems. If a third party flame detector is used then all the CE and UL approvals are void. This can also be very dangerous and can result in serious or even fatal injury, and may cause permanent equipment failure and substantial property damage.

Flame scanners must be installed, wired, commissioned and adjusted by an Autoflame trained and certified technician.

Any person installing, wiring, commissioning or adjusting the flame scanners without undergoing proper Autoflame training and without full understanding of the Micro Modulation (MM) system, may put themselves and others in a seriously dangerous situation that can result in serious injury or even death, and may cause permanent equipment failure and substantial property damage.

Some of the wiring connections are live, make sure to totally and safely isolate the mains power before undergoing any work related to the flame scanners. Failure to do so can result in fatal injury.

This guide must be read in conjunction with the relevant MM system manual.

1. UV Flame Scanners

Ultraviolet (UV) flame scanners work by detecting the UV radiation emitted from the flame. UV scanners have a very quick response and can detect a flame in as little as 3 to 4 milliseconds.

UV scanners can be used for most gaseous fuels including Natural Gas, LPG, Methane, Biogas, Hydrogen and many others. They can also be used on most liquid fuels including Diesel, Kerosene, Heavy Fuel Oil, Light Fuel Oil, Biodiesel, Methanol and many others. However on some fuels IR scanners are recommended as they can achieve better flame detection results.

The following UV scanners are available:

Part #	Sensitivity Level	View	Self-Check function
MM60003/HS	High	End View	Yes
MM60003/HS/SV	High	Side View	Yes
MM80004/HS	High	End/Side View	No
MM80004	Standard	Side View	No
MM60004	Standard	Side View	No
MM60004/U	Standard	End View	No
MM60004/HSU	High	End View	No

ATEX approved UV scanners are also available for use in Hazardous Environment where Explosion Proof, ATEX approved Equipment required:

Part #	Sensitivity Level	View	Self-Check function
MM60003/HS/EXP	High	End View	Yes
MM60004/U/EXP	Standard	End View	-

Note: Excessive vibration and heat can considerably reduce the lifespan of the flame scanner

Standard Approvals: BS EN 298 2012, UL372, CAN/CSA-C22.2 No.199

1.1. MM60003/HS - Self-Check, High Sensitivity, End View UV Scanner





Specifications

Part Number	MM60003/HS
Flame Detection Technology	UV
Lens Angle	0° - End view
Sensitivity Level	High
Self-Check	Mechanical Shutter
Max. Flame Detection Distance	1,500mm (60”)
Max. Operating Temperature	60°C (140°F)
Min. Operating Temperature	0°C (32°F)
IP Rating	54
NEMA Rating	3
Housing Material	Aluminium
Lead Included	-
Cable Gland	PG11 to ½” conduit adaptor
Power Consumption	0.5W – Powered by MM
Mounting	Any orientation. Lens must be in direct view of flame
Compatible With	Mk8 MM, Mini Mk8 MM, Mk7 MM, Mk6 MM.
Dimensions (Length x Diameter)	140 x 70 mm (5.51” x 2.76”)
Mounting	1” BSPT socket
Max. Cable Length	25m (82ft)
Warranty	1 year limited warranty
Max. allowed vibration level	1.8 m/s^2
Approval Standards	EN 13611: 2007 7.10.2.2 EN 60068-2-6:2008 UL 372 CAN/CSA-C22.2 No.199

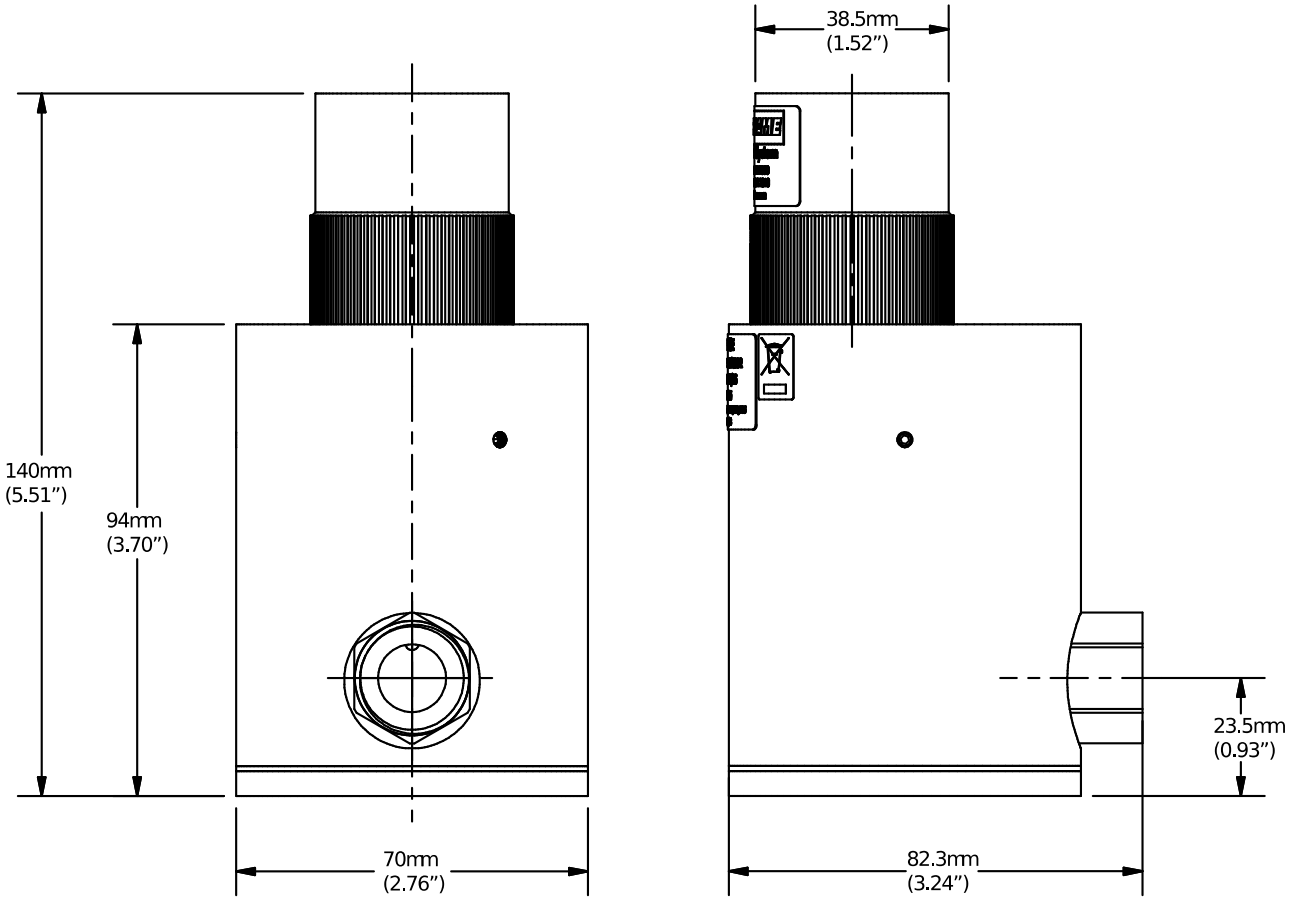
Wiring

Scanner Terminal		Wire Colour		MM Terminal
50	0V	Blue		50
51	300VDC pulse	Red		51
21	Shutter drive	Yellow		21
22	Shutter drive	Green		22
-	-	Screen		S

LED Colour		Flashing Checks
Red		UV Detection
Yellow		Shutter Operation



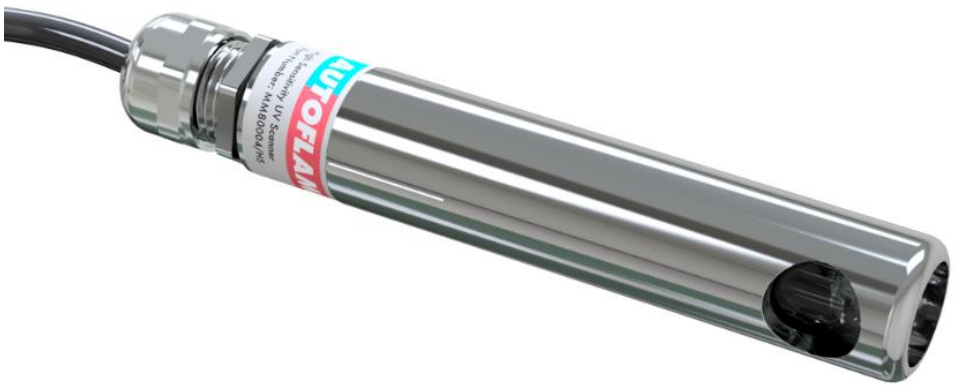
Dimensions



1.2. MM80004/HS - High Sensitivity, End/Side View UV Scanner

This is a Universal view UV scanner, high sensitivity, featuring a compact design, higher ingress protection level and built-in flying lead. This UV scanner features:

- Compact tube design to allow for easier installation. The housing is CNC machined from a single piece of Aluminium and houses all the internal components including the PCB and the UV sensor.
- 1.5 metre fixed flying lead, pre-wired from high-quality 2 core screened cable connected to the UV scanner body through a PG11 gland, offering superior water, moisture and dust protection.

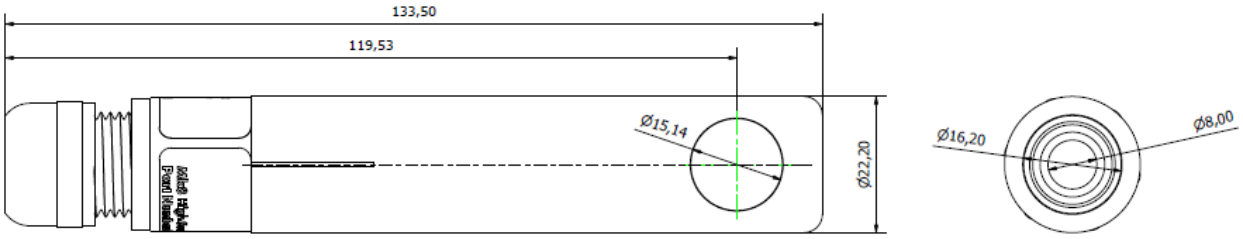


Part Number	MM80004/HS
Flame Detection Technology	UV
Lens Angle	0° - End view / 90° - Side view
Sensitivity Level	High
Self-Check	-
Max. Flame Detection Distance	1,500mm (60”) End / Side View
Max. Operating Temperature*	60°C (140°F)
Min. Operating Temperature	0°C (32°F)
IP Rating	65
NEMA Rating	4
Housing Material	Aluminium
Lead Included	1.5 m (5 ft)
Cable Gland	PG11
Power Consumption	0.5W – Powered by MM
Mounting	Any orientation. Lens must be in direct view of flame
Compatible With	Mk8 MM, Mini Mk8 MM, Mk7 MM, Mk6 MM.
Dimensions (Length x Diameter)	133.5 x 22 mm (5.26” x 0.87”)
Mounting	Mounting clip included
Max. Cable Length	25m (82ft)
Warranty	1 year limited warranty
Max. allowed vibration level	1.8 m/s^2
Approval Standards	BS EN 298
	UL 372 CAN/CSA-C22.2 No.199

Wiring

Wire Colour			MM Terminal
0V	Blue		50
300V DC Pulse	Red		51
-	Screen		S

Dimensions



1.3. MM60003/HS/SV - Self-Check, High Sensitivity, Side View UV Scanner





Specifications

Part Number	MM60003/HS/SV
Flame Detection Technology	UV
Lens Angle	90° - Side view
Sensitivity Level	High
Self-Check	Mechanical Shutter
Max. Flame Detection Distance	1,500mm (60”)
Max. Operating Temperature*	60°C (140°F)
Min. Operating Temperature	0°C (32°F)
IP Rating	54
NEMA Rating	3
Housing Material	Aluminium
Lead Included	-
Cable Gland	PG11 to ½” conduit adaptor
Power Consumption	0.5W – Powered by MM
Mounting	Any orientation. Lens must be in direct view of flame
Compatible With	Mk8 MM, Mini Mk8 MM, Mk7 MM, Mk6 MM.
Dimensions (Length x Diameter)	223.6 x 70 mm (8.8” x 2.76”)
Mounting	1” BSPT female socket
Max. Cable Length	25m (82ft)
Warranty	1 year limited warranty
Max. allowed vibration level	1.8 m/s^2
Approval Standards	EN 13611: 2007 7.10.2.2 EN 60068-2-6:2008 UL 372 CAN/CSA-C22.2 No.199

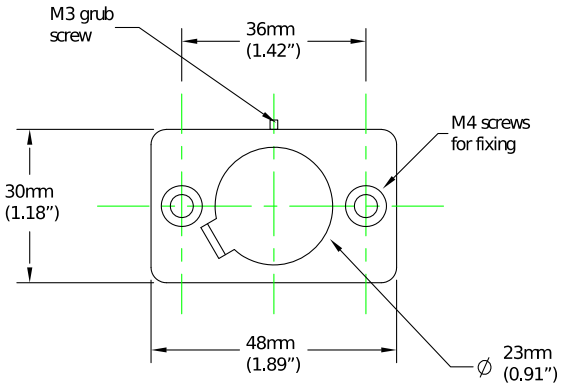
Wiring

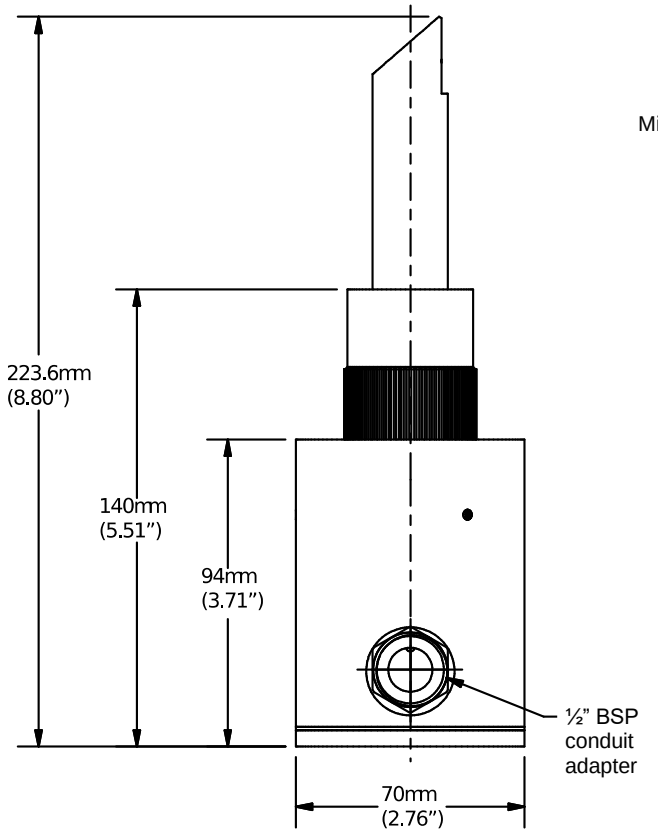
Scanner Terminal		Wire Colour		MM Terminal
50	0V	Blue		50
51	300VDC pulse	Red		51
21	Shutter drive	Yellow		21
22	Shutter drive	Green		22
-	-	Screen		S

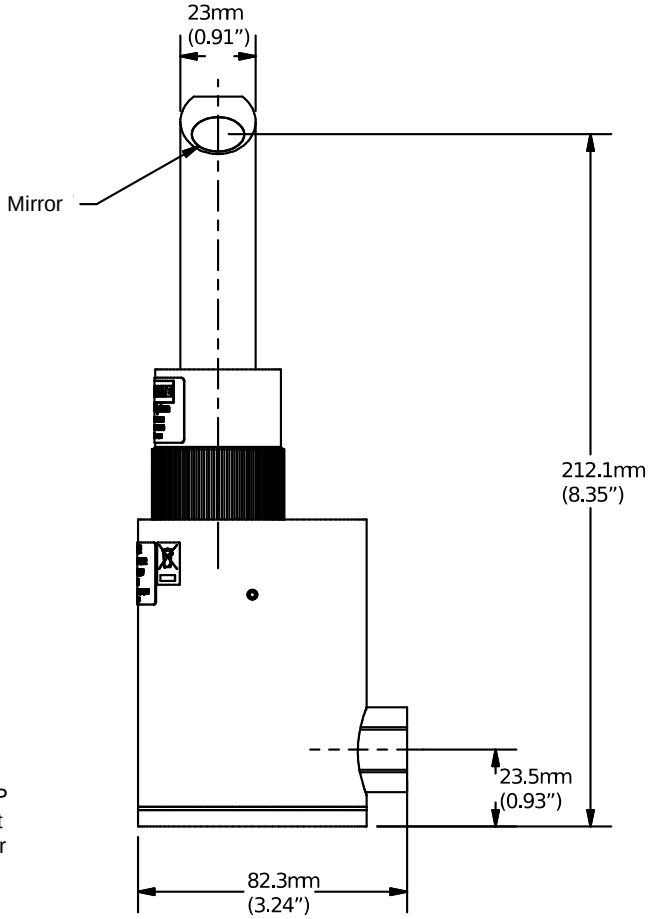
LED Colour		Flashing Checks
Red		UV Detection
Yellow		Shutter Operation



Dimensions







1.4. MM80004 - Standard, Side View UV Scanner (Mk8 Series)

Side view UV scanner, standard sensitivity, featuring compact design, higher ingress protection level and built-in flying lead. This UV scanner features:

- Compact tube design to allow for easier installation. The housing is CNC machined from a single piece of Aluminium and houses all the internal components including PCB and UV sensor.
- 1.5 metre fixed flying lead, pre-wired from high-quality 2 core screened cable connected to the UV scanner body through a PG11 gland, offering superior water, moisture and dust protection.





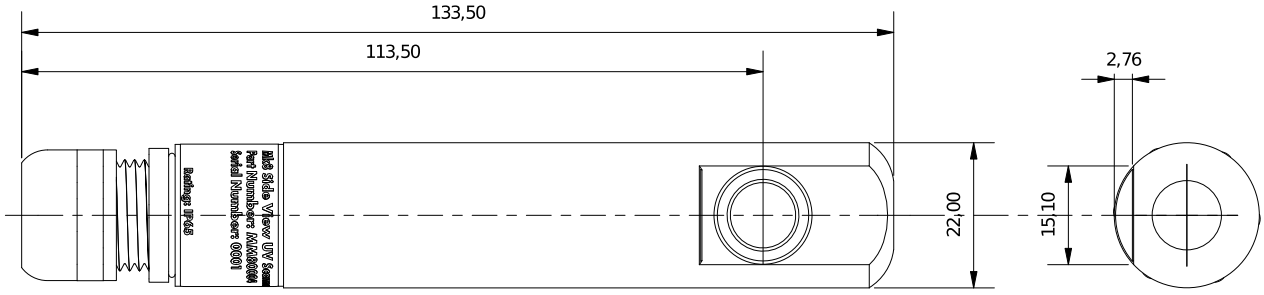
Specifications

Part Number	MM80004
Flame Detection Technology	UV
Lens Angle	90° - Side view
Sensitivity Level	Standard
Self-Check	-
Max. Flame Detection Distance	500mm (20”)
Max. Operating Temperature*	60°C (140°F)
Min. Operating Temperature	0°C (32°F)
IP Rating	65
NEMA Rating	4
Housing Material	Aluminium
Lead Included	1.5 m (5 ft)
Cable Gland	PG11
Power Consumption	0.5W – Powered by MM
Mounting	Any orientation. Lens must be in direct view of flame
Compatible With	Mk8 MM, Mini Mk8 MM, Mk7 MM, Mk6 MM.
Dimensions (Length x Diameter)	133.5 x 22 mm (5.26” x 0.87”)
Mounting	Mounting clip included
Max. Cable Length	25m (82ft)
Warranty	1 year limited warranty
Max. allowed vibration level	1.8 m/s^2
Approval Standards	BS EN 298
	UL 372 CAN/CSA-C22.2 No.199

Wiring

Wire Colour			MM Terminal
0V	Blue		50
300V DC Pulse	Red		51
-	Screen		S

Dimensions





1.5. MM60004 - Standard, Side View UV Scanner





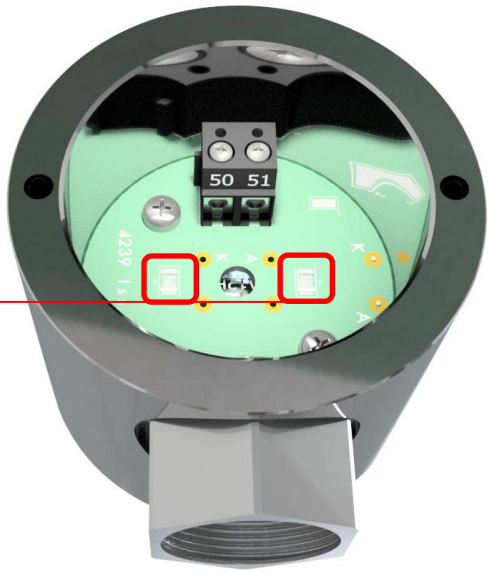
Specifications

Part Number	MM60004
Flame Detection Technology	UV
Lens Angle	90° - Side view
Sensitivity Level	Standard
Self-Check	-
Max. Flame Detection Distance	500mm (20”)
Max. Operating Temperature*	60°C (140°F)
Min. Operating Temperature	0°C (32°F)
IP Rating	54
NEMA Rating	3
Housing Material	Aluminium
Lead Included	-
Cable Gland	PG11 to ½” conduit adaptor
Power Consumption	0.5W – Powered by MM
Mounting	Any orientation. Lens must be in direct view of flame
Compatible With	Mk8 MM, Mini Mk8 MM, Mk7 MM, Mk6 MM.
Dimensions (Length x Diameter)	165.7 x 57 mm (6.52” x 2.24”)
Mounting	Bracket included
Max. Cable Length	25m (82ft)
Warranty	1 year limited warranty
Max. allowed vibration level	1.8 m/s^2
Approval Standards	EN 13611: 2007 7.10.2.2 EN 60068-2-6:2008 UL 372 CAN/CSA-C22.2 No.199

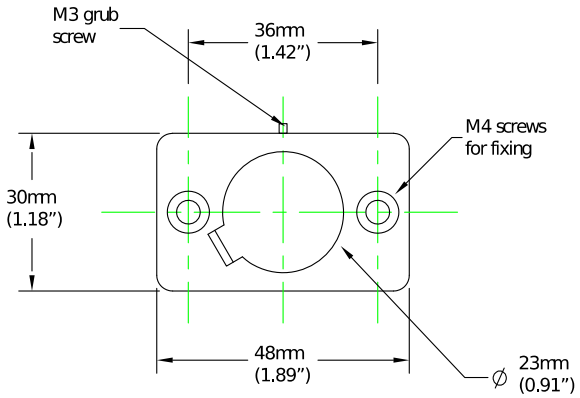
Wiring

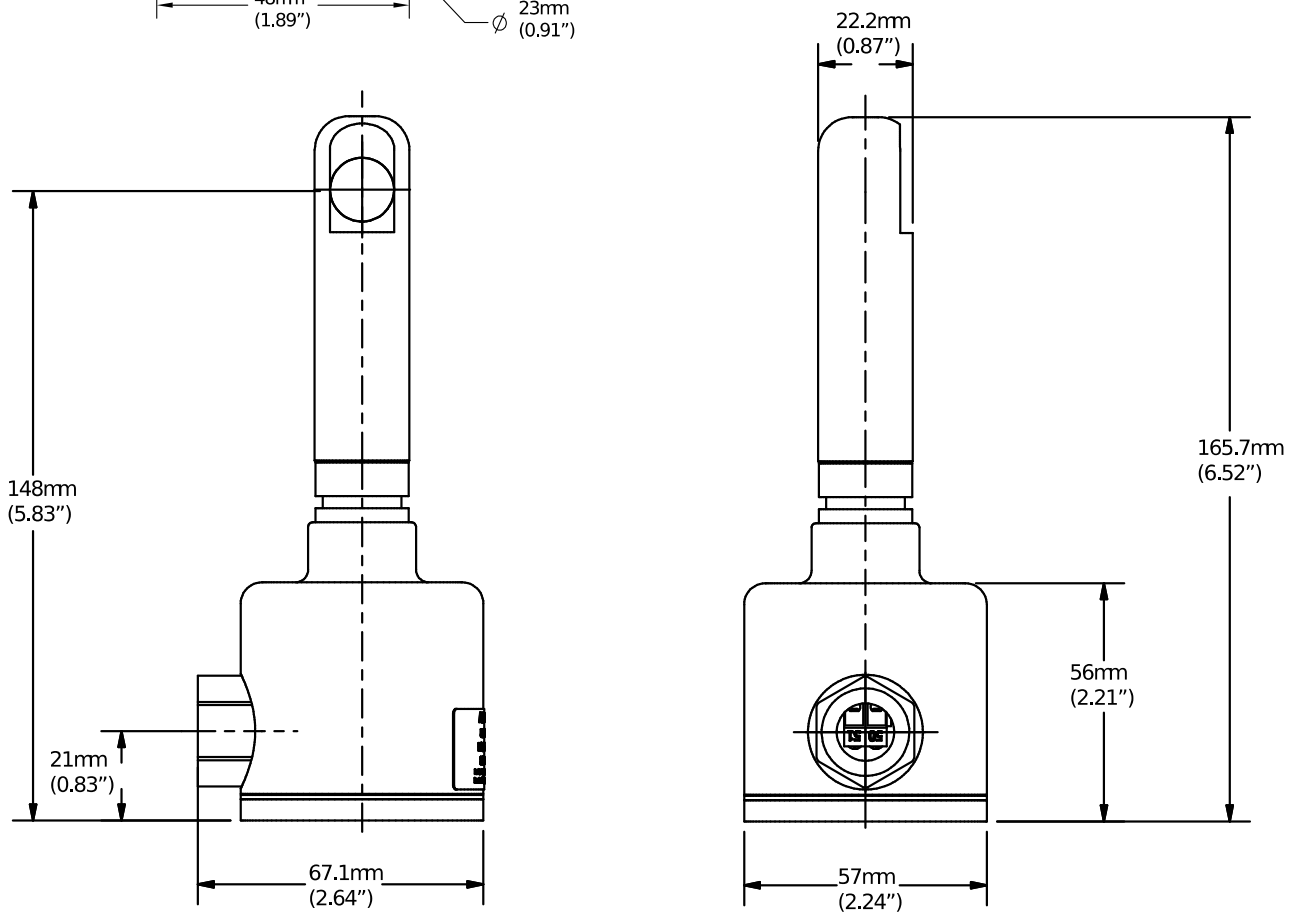
Scanner Terminal		Wire Colour	MM Terminal
50	0V	Blue	50
51	300VDC Pulse	Red	51
-	-	Screen	S

LED Colour	Flashing Checks
Red	UV Detection



Dimensions





1.6. MM60004/U - Standard, End View UV Scanner





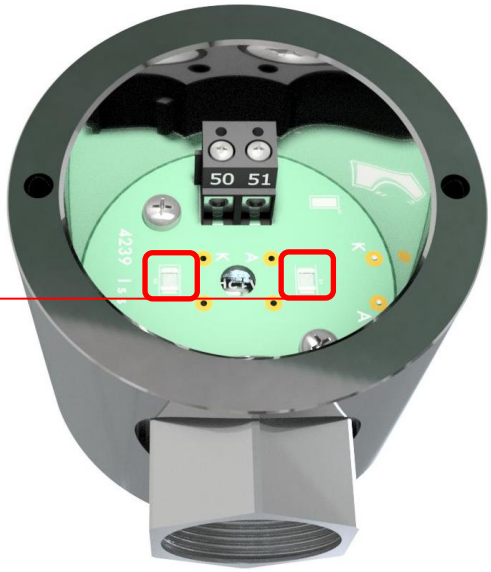
Specifications

Part Number	MM60004/U
Flame Detection Technology	UV
Lens Angle	00° - End view
Sensitivity Level	Standard
Self-Check	Yes
Max. Flame Detection Distance	500mm (20”)
Max. Operating Temperature*	60°C (140°F)
Min. Operating Temperature	0°C (32°F)
IP Rating	54
NEMA Rating	3
Housing Material	Aluminium
Lead Included	-
Cable Gland	PG11 to ½” conduit adaptor
Power Consumption	0.5W – Powered by MM
Mounting	Any orientation. Lens must be in direct view of flame
Compatible With	Mk8 MM, Mini Mk8 MM, Mk7 MM, Mk6 MM.
Dimensions (Length x Diameter)	108 x 57 mm (4.26” x 2.24”)
Mounting	1/2” NPT socket
Max. Cable Length	25m (82ft)
Warranty	1 year limited warranty
Max. allowed vibration level	1.8 m/s^2
Approval Standards	EN 13611: 2007 7.10.2.2
	EN 60068-2-6:2008 UL 372 CAN/CSA-C22.2 No.199

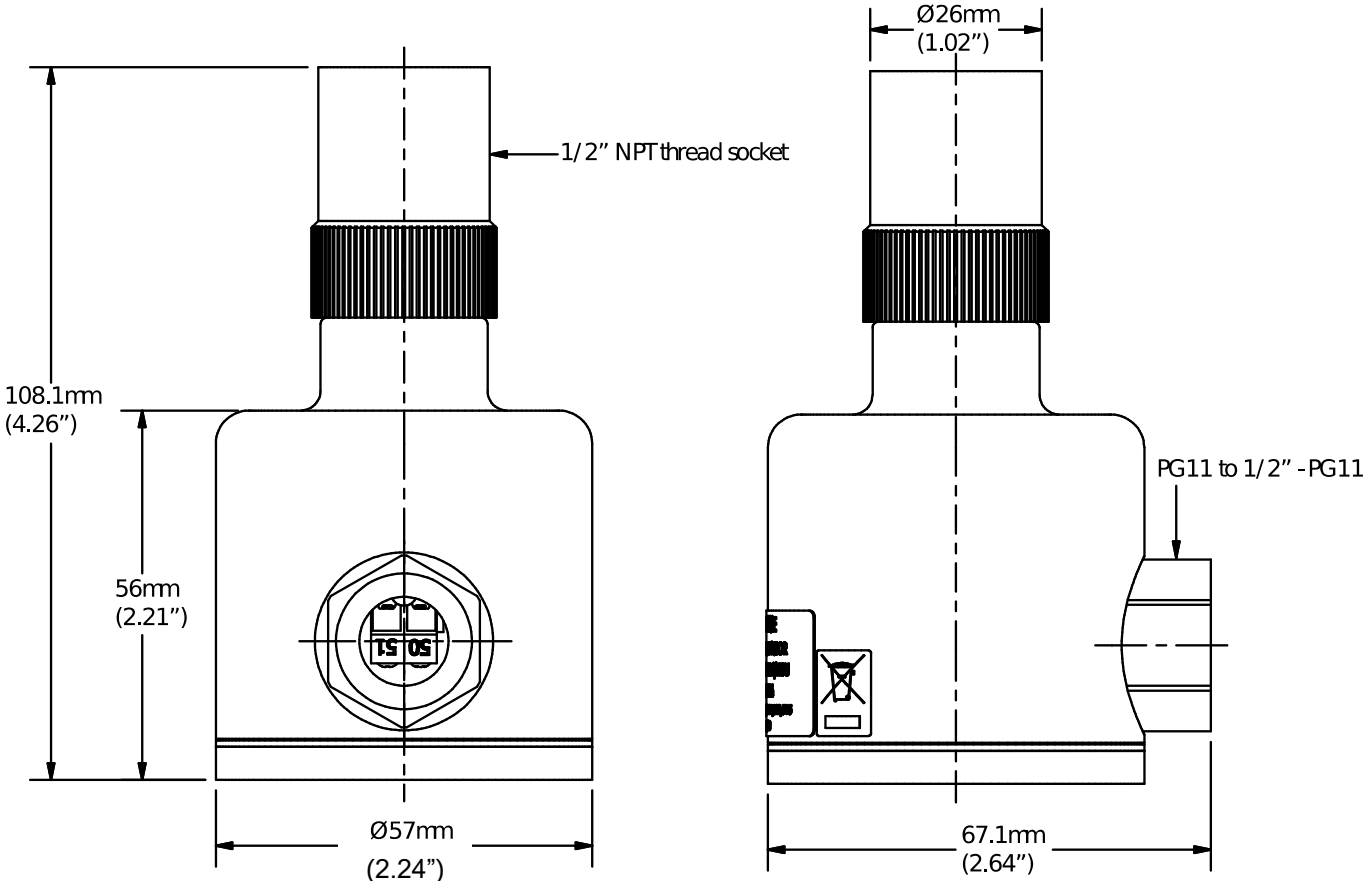
Wiring

Scanner Terminal		Wire Colour	MM Terminal
50	0V	Blue	50
51	300VDC Pulse	Red	51
-	-	Screen	S

LED Colour	Flashing Checks
Red	UV Detection



Dimensions



1.7. MM60004/HSU - Standard, High Sensitivity, End View UV Scanner





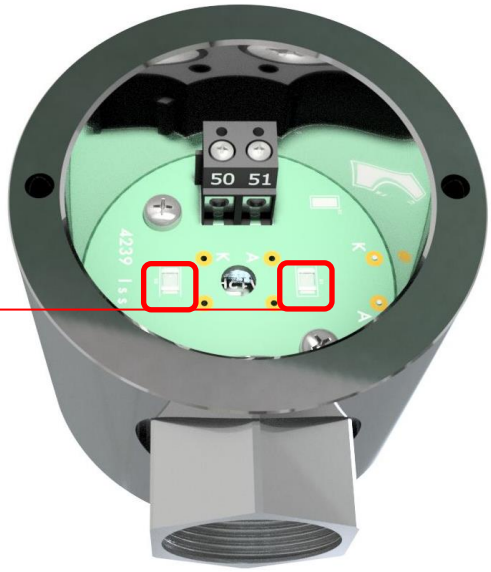
Specifications

Part Number	MM60004/HSU
Flame Detection Technology	UV
Lens Angle	00° - End view
Sensitivity Level	High Sensitivity
Self-Check	-
Max. Flame Detection Distance	1,500mm (60”)
Max. Operating Temperature*	60°C (140°F)
Min. Operating Temperature	0°C (32°F)
IP Rating	54
NEMA Rating	3
Housing Material	Aluminium
Lead Included	-
Cable Gland	PG11 to ½” conduit adaptor
Power Consumption	0.5W – Powered by MM
Mounting	Any orientation. Lens must be in direct view of flame
Compatible With	Mk8 MM, Mini Mk8 MM, Mk7 MM, Mk6 MM.
Dimensions (Length x Diameter)	108 x 57 mm (4.26” x 2.24”)
Mounting	1/2” NPT socket
Max. Cable Length	25m (82ft)
Warranty	1 year limited warranty
Max. allowed vibration level	1.8 m/s^2
Approval Standards	EN 13611: 2007 7.10.2.2 EN 60068-2-6:2008 UL 372 CAN/CSA-C22.2 No.199

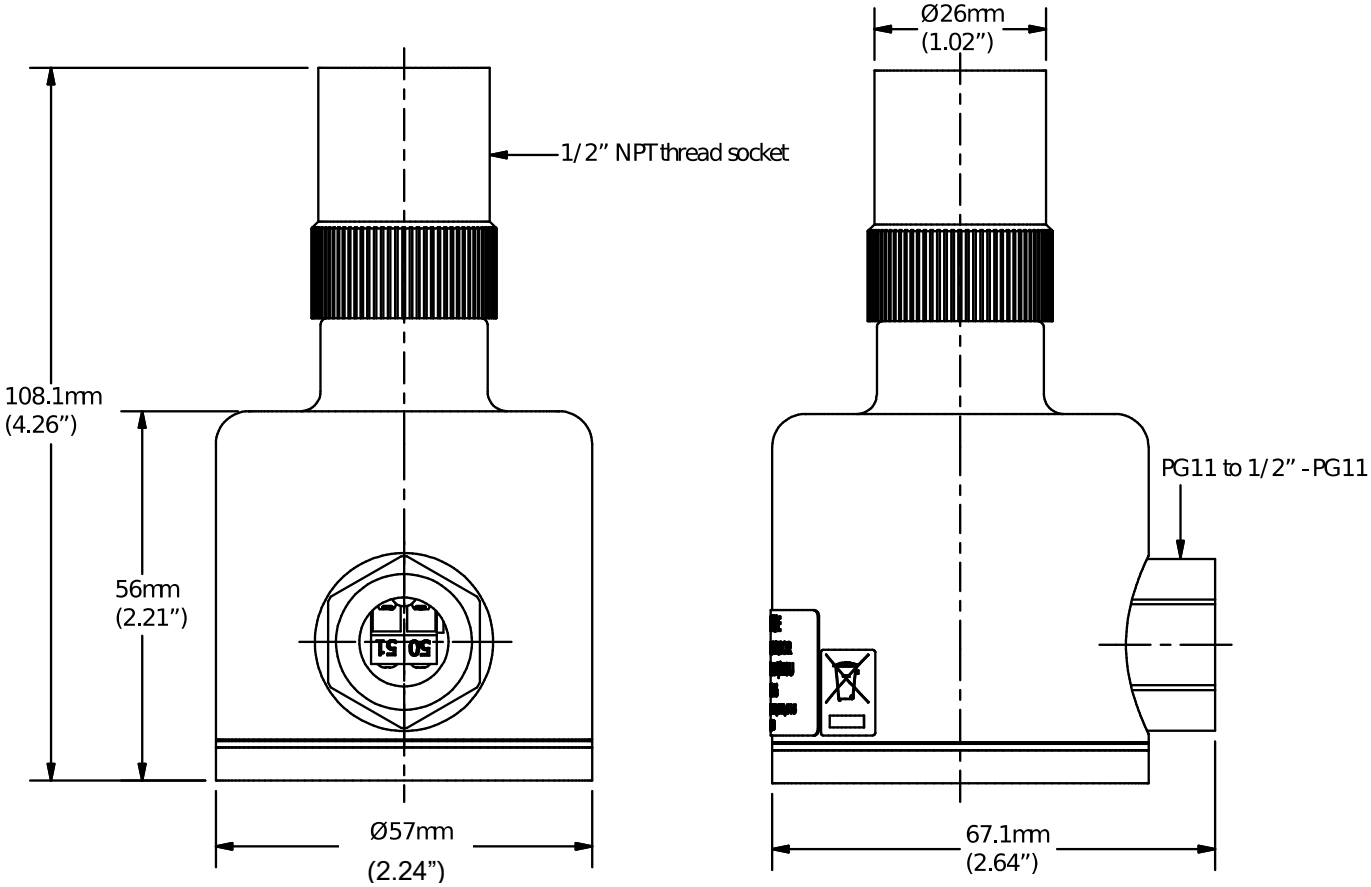
Wiring

Scanner Terminal		Wire Colour	MM Terminal
50	0V	Blue	50
51	300VDC Pulse	Red	51
-	-	Screen	S

LED Colour	Flashing Checks
Red	UV Detection



Dimensions



1.8. MM60004/U/EXP - Standard, End View UV Scanner, ATEX Approved

For use in Hazardous Environment where Explosion Proof, ATEX approved equipment is required.





Specifications

Part Number	MM60004/U/EXP
Flame Detection Technology	UV
Lens Angle	00° - End view
Sensitivity Level	Standard
Self-Check	-
Max. Flame Detection Distance	500mm (20”)
Max. Operating Temperature*	60°C (140°F)
Min. Operating Temperature	0°C (32°F)
IP Rating	54
NEMA Rating	3
Housing Material	Aluminium
Lead Included	-
Cable Gland	ATEX M20 cable gland
Power Consumption	0.5W – Powered by MM
Mounting	Any orientation. Lens must be in direct view of flame
Compatible With	Mk8 MM, Mini Mk8 MM, Mk7 MM, Mk6 MM.
Dimensions (Length x Diameter)	108 x 57 mm (4.26” x 2.24”)
Mounting	1/2” NPT socket
Max. Cable Length	25m (82ft)
Warranty	1 year limited warranty
Max. allowed vibration level*	1.8 m/s^2
Standards	EN 60079-0:2012, EN 60079-15:2010
Classification	II 3 G Ex nAc IIC Gc T4

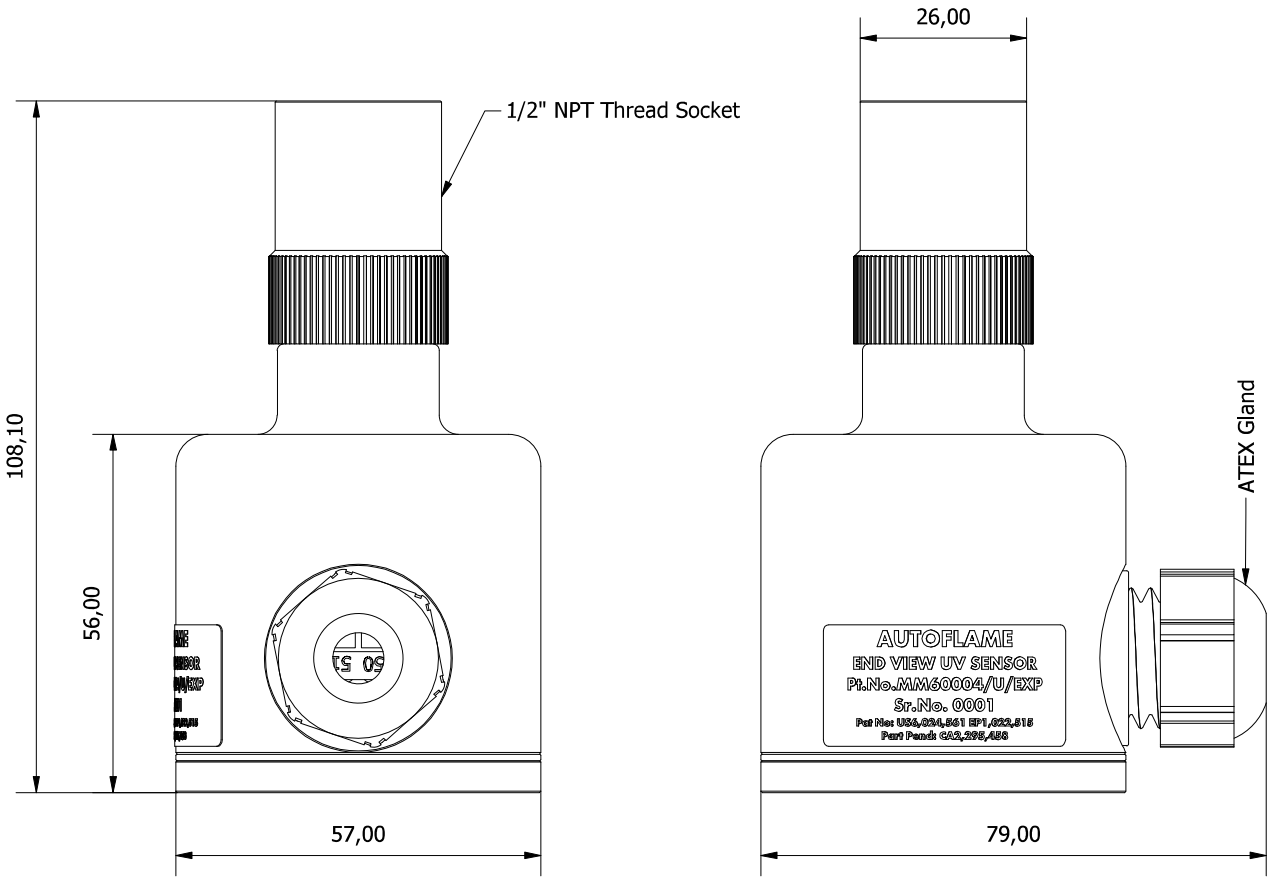
Wiring

Scanner Terminal		Wire Colour	MM Terminal
50	0V	Blue	50
51	300VDC Pulse	Red	51
-	-	Screen	S

LED Colour	Flashing Checks
Red	UV Detection



Dimensions



1.9. MM60003/HS/EXP - Self-Check, High Sensitivity, End View UV Scanner, ATEX Approved

For use in Hazardous Environment where Explosion Proof, ATEX approved equipment required.



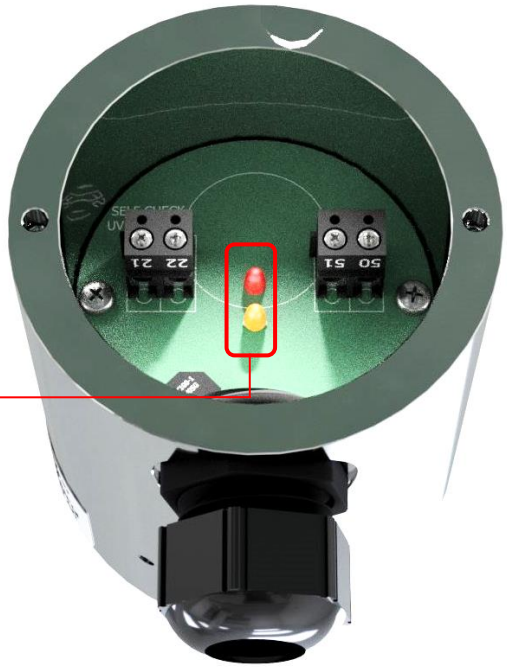
Specifications

Part Number	MM60003/HS/EXP
Flame Detection Technology	UV
Lens Angle	0° - End view
Sensitivity Level	High
Self-Check	Mechanical Shutter
Max. Flame Detection Distance	1,500mm (60”)
Max. Operating Temperature*	60°C (140°F)
Min. Operating Temperature	0°C (32°F)
IP Rating	54
NEMA Rating	3
Housing Material	Aluminium
Lead Included	-
Cable Gland	ATEX M20 cable gland
Power Consumption	0.5W – Powered by MM
Mounting	Any orientation. Lens must be in direct view of flame
Compatible With	Mk8 MM, Mini Mk8 MM, Mk7 MM, Mk6 MM.
Dimensions (Length x Diameter)	140 x 70 mm (5.51” x 2.76”)
Mounting	1” BSPT female socket
Max. Cable Length	25m (82ft)
Warranty	1 year limited warranty
Max. allowed vibration level	1.8 m/s^2
Standards	EN 60079-0:2012, EN 60079-15:2010
Classification	II 3 G Ex nAc IIC Gc T4

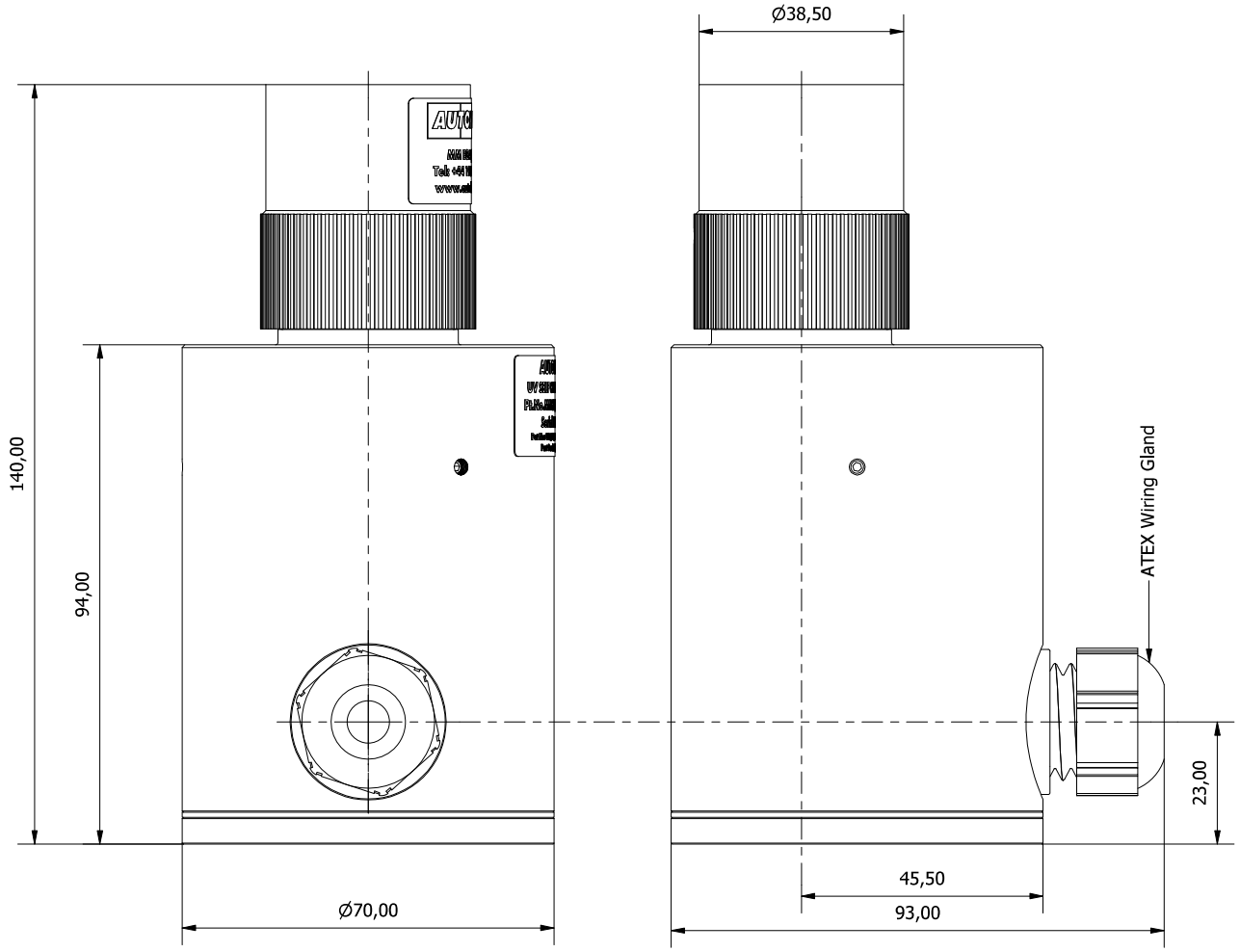
Wiring

Scanner Terminal		Wire Colour		MM Terminal
50	0V	Blue		50
51	300VDC pulse	Red		51
21	Shutter drive	Yellow		21
22	Shutter drive	Green		22
-	-	Screen		S

LED Colour		Flashing Checks
Red		UV Detection
Yellow		Shutter Operation



Dimensions



2. IR Flame Scanners

Infrared (IR) flame scanners monitor the infrared spectral band for flame flicker given off by hot combustion gases.

IR scanners are most suitable for liquid fuels including Diesel, Kerosene, Heavy Fuel Oil, Light Fuel Oil, Biodiesel, Methanol and many others. However they can also be used for most gaseous fuels.

The IR sensors feature an electronic self-check function that allows for continuous operation. The self-check function assesses the correct operation of the scanner every ½ hour

The following IR scanners are available:

Part #	View
MM80017	End View
MM80017/SV	Side View

Note: Excessive vibration and heat can considerably reduce the lifespan of the flame scanner

Standards: BS EN 298 2012, UL372, CAN/CSA-C22.2 No.199

2.1. MM80017 – Self-Check, End View IR Scanner





Specifications

Part Number	MM80017
Flame Detection Technology	IR – InfraRed
Lens Angle	0° - End view
Sensitivity Level	Standard
Self-Check	Electronic Self-Check
Max. Flame Detection Distance	1000mm (40”)
Minimum Sensed Flame (flicker rate)	12/second
Maximum Sensed Flame (flicker rate)	100/second
Flame Failure Detection Time (max)	500ms
Max. Operating Temperature*	60°C (140°F)
Min. Operating Temperature	0°C (32°F)
IP Rating	65
NEMA Rating	4
Housing Material	Aluminium
Lead Length	1.5m (5ft)
Cable Gland	PG11 built-in.
Mounting	Any orientation. Lens must be in direct view of flame
Compatible With	Mk8 MM, Mini Mk8 MM, Mk7 MM
Dimensions (Length x Diameter)	133.5 x 22mm
Mounting	Must be mounted using the included bracket with magnetic activator
Max. Cable Length	25m (82ft)
Warranty	1 year limited warranty
Max. allowed vibration level	1.8 m/s^2
Standards	BS EN 298 2012 UL 372 CAN/CSA-C22.2 No.199

Mounting

The IR flame scanner can be mounted in any orientation within the burner housing, the only requirement being that it has an unobstructed view of the flame.

The IR flame scanner features a magnetic reed switch to cut power to the scanner if it is removed from the burner as required by BS EN 298 2012. The supplied mounting fixture contains the magnets necessary to activate the reed switch allowing power to the scanner.

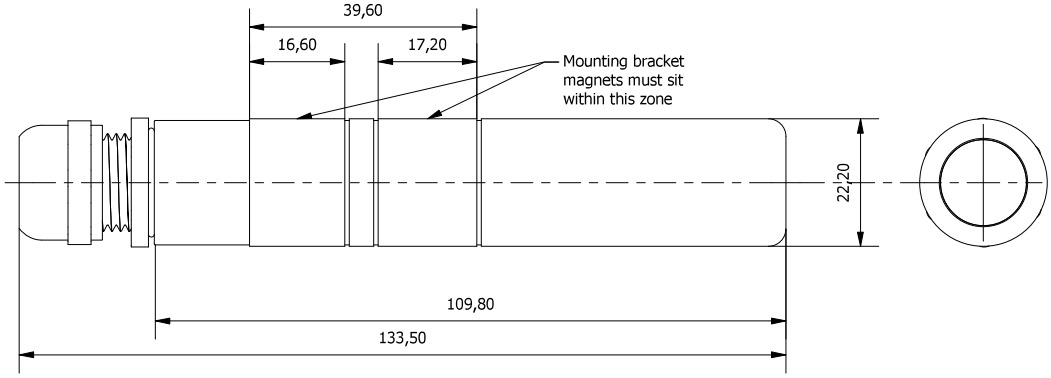
Grooves in the housing indicate the two zones (see drawings) within which the visible edge of the mounting bracket must sit in for the magnets to be activated.

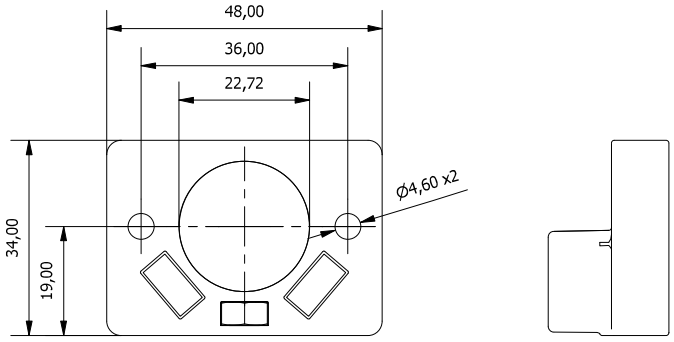
Wiring

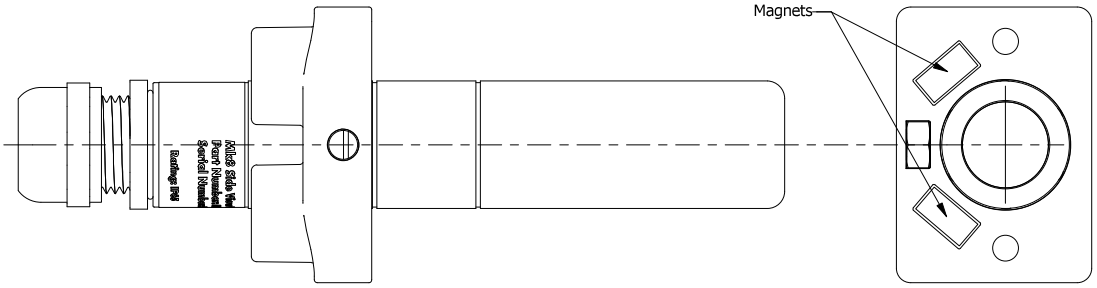
Scanner Wire Colour			MM Terminal
Serial -	Yellow		29
Serial +	Green		30
0V	Blue		48
15VDC supply	Red		49
Screen	Black		S

Technical Drawings









2.3. MM80017/SV – Self-Check, Side View IR Scanner





Specifications

Part Number	MM80017/SV
Flame Detection Technology	IR – InfraRed
Lens Angle	90° - Side view
Sensitivity Level	Standard
Self-Check	Electronic Self-Check
Max. Flame Detection Distance	1000mm (40”)
Minimum Sensed Flame (flicker rate)	12/second
Maximum Sensed Flame (flicker rate)	100/second
Flame Failure Detection Time (max)	500ms
Max. Operating Temperature*	60°C (140°F)
Min. Operating Temperature	0°C (32°F)
IP Rating	65
NEMA Rating	4
Housing Material	Aluminium
Lead length	1.5m (5ft)
Cable Gland	PG11 built-in.
Mounting	Any orientation. Lens must be in direct view of flame
Compatible With	Mk8 MM, Mini Mk8 MM, Mk7 MM
Dimensions (Length x Diameter)	133.5 x 22mm
Mounting	Must be mounted using the included bracket with magnetic activator
Max. Cable Length	25m (82ft)
Warranty	1 years limited warranty
Max. allowed vibration level	1.8 m/s^2
Standards	BS EN 298 2012 UL 372 CAN/CSA-C22.2 No.199

Mounting

The IR flame scanner can be mounted in any orientation within the burner housing, the only requirement being that it has an unobstructed view of the flame.

The IR flame scanner features a magnetic reed switch to cut power to the scanner if it is removed from the burner as required by BS EN 298 2012. The supplied mounting fixture contains the magnets necessary to activate the reed switch allowing power to the scanner.

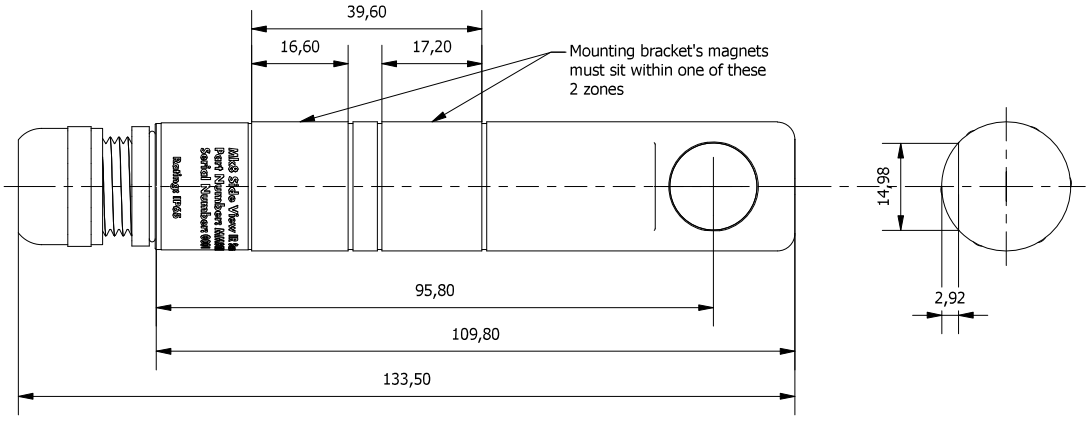
Grooves in the housing indicate the two zones (see drawings) within which the visible edge of the mounting bracket must sit in for the magnets to be activated.

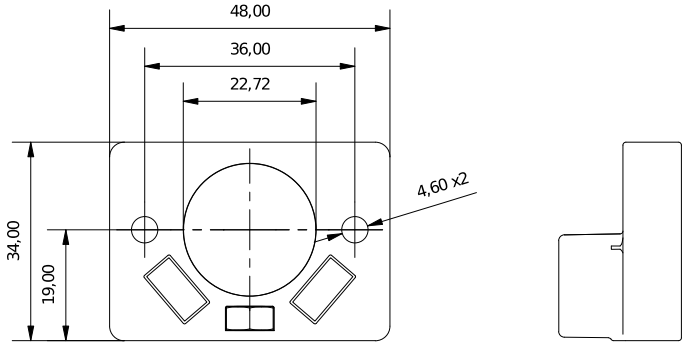
Wiring

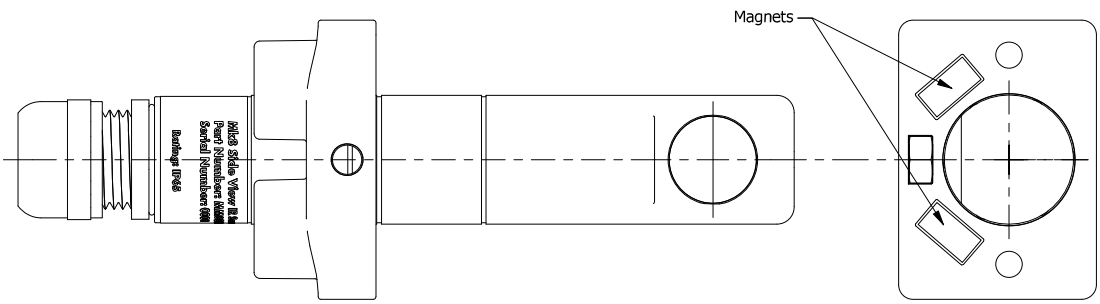
Scanner Wire Colour			MM Terminal
Serial -	Yellow		29
Serial +	Green		30
0V	Blue		48
15VDC supply	Red		49
Screen	Black		S

Dimensions





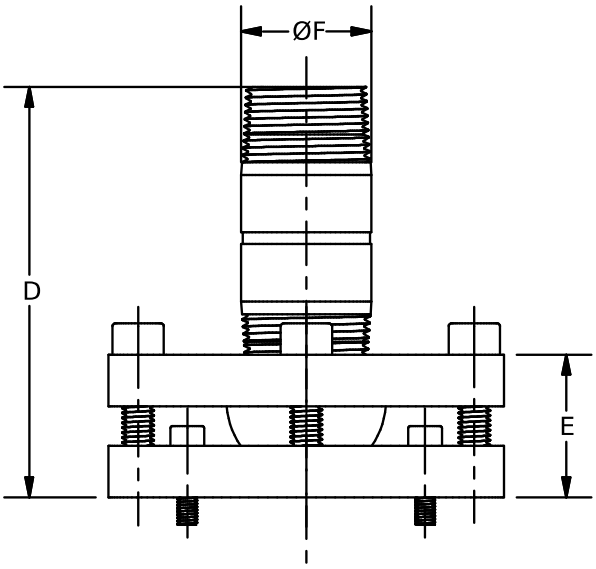


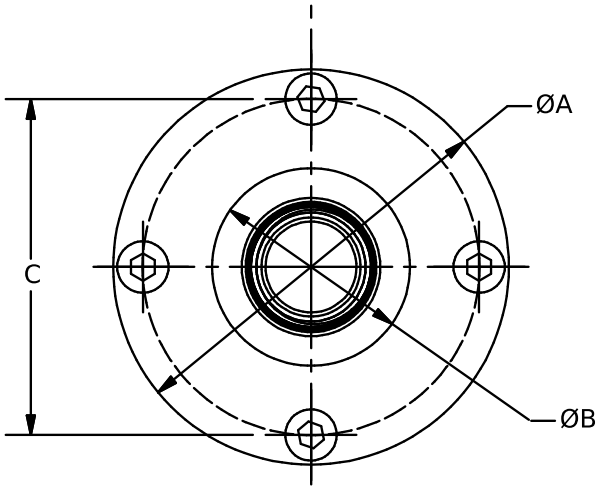


3. Swivel Mount for Flame Scanners

The swivel mount assembly can be used to optimise the positioning of the end view flame scanners. It can help to position the scanner in direct view of the flame and therefore can improve flame detection. The ball joint design allows the scanner to be positioned in any direction up to +/- 60° and enables 360° rotational positioning of the scanner.





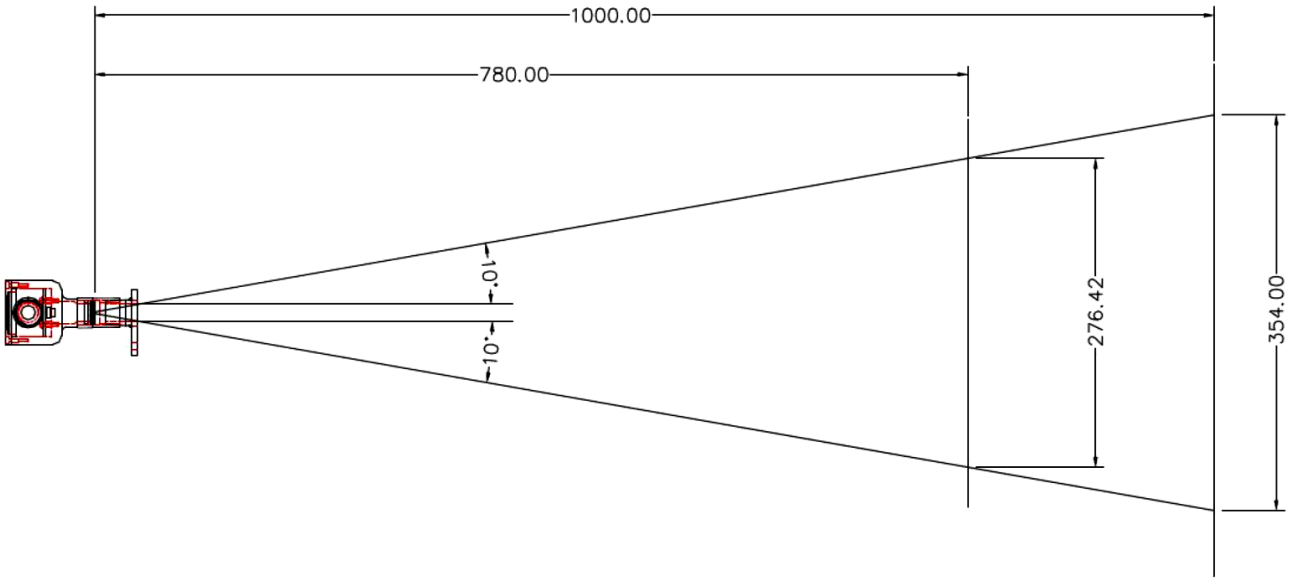


		Swivel mount 1” UVM60003	Swivel mount 0.5” UVM60004
Used with		MM60003/HS	MM60004/U MM60004/HSU MM80004/HS MM80017
Dimensions: mm (inch)	A	100 (3.94)	100 (3.94)
	B	50 (1.97)	50 (1.97)
	C	85 (3.35)	85 (3.35)
	D	104 (4.09)	86 (3.37)
	E	36 (1.42)	36 (1.42)
	F	33 (1.30)	26 (0.99)

4. Flame Scanners Installation & Operation

4.1. UV Flame Scanner Installation

The distance between the UV scanner and the flame depends on the shape (width) of the flame. The figure below shows the variation of the maximum allowed distance with the shape of the flame for a standard UV scanner.



Standard Sensitivity UV scanners can be used if the distance from the UV scanner to the flame is no greater than 500mm (20”). High sensitivity UV scanner is recommended if the distance from the UV scanner to the flame exceeds 500mm (20”).

The following considerations must be taken into consideration when selecting a UV scanner for a specific system setup:

- Flame size.
- Flame shape (dependent on the burner used).
- Flame intensity (a function of flame size and shape and fuel used).
- Flame obstructions – the scanner must have direct view of the flame.

The maximum safe distance a UV scanner can be from a flame is dependent on:

- The intensity of UV radiation emitted from the main flame and pilot flame
- The geometry of the combustion chamber and available space

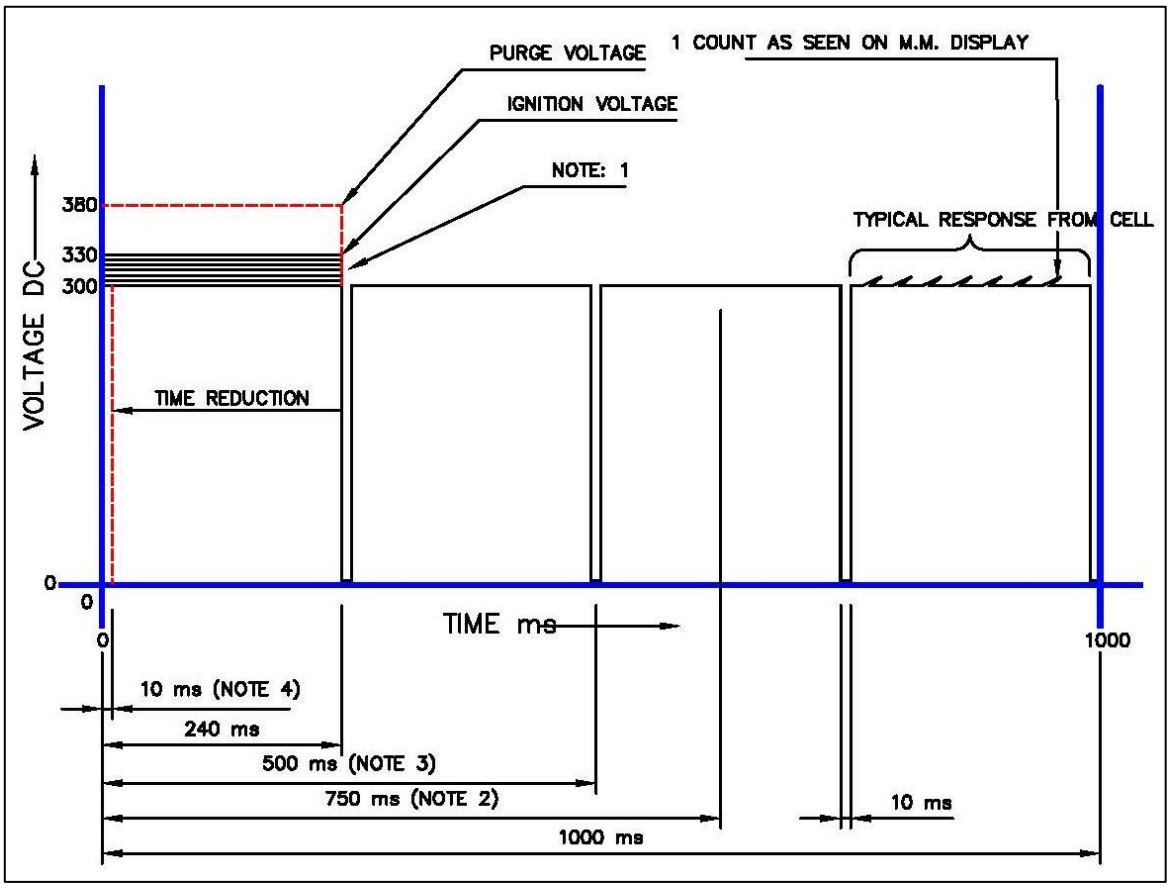
This will vary between applications but the maximum distance possible between a high sensitivity scanner and the flame should not exceed 1500mm (5ft), and between a standard sensitivity UV scanner and the flame should not exceed 500 mm (20”)

The above information is based on the results of tests conducted using a laboratory pilot flame supplied from a Bunsen burner of flame size 100x20mm.

The length of the cable connecting the UV scanner to the MM should not be longer than 25m (82ft).

If the UV scanner is wired incorrectly, a limited UV signal will be detected but the LED will not illuminate.

4.2. UV Flame Scanner Operation



UV Scanner Signal Timing Diagram

After the first safety time, voltage is reduced by 5 volts every 500ms. Providing the flame signal is above the UV setpoint. If below the UV threshold, voltage will remain at 330 volts. The voltage will not increase during main flame operation.

If 5 counts or less have been detected over any 730ms period, the system will invoke a lockout. A short circuit between the two wires connected to the UV would produce 3 counts or less. This is the reason for nominating 5 counts as the lockout level.

During normal operation, 300 volts would be applied for a 240ms period after the second safety time. This is providing the UV signal is above the UV setpoint which is set at 25 counts. The setpoint cannot be adjusted.

If the UV count is above 25 counts then the time voltage is applied to the UV sensor is decreased by 1ms every 500ms. This time is reduced until a maximum of 10ms has been reached. This helps preserve the life of the UV scanner as the time that voltage is applied to the scanner is reduced dramatically.

Every 500ms the recorded counts are averaged and displayed on the MM screen.

When using a self-check scanner the timing reduction resets when the paddle operates.

As the flame is increasing, the UV counts will stabilise at 5 times the UV threshold set in option/parameter 120. As the flame is decreasing, the UV counts will stabilise at 3 times the UV threshold set in option/parameter 120.

4.3. IR Flame Scanner Installation

The IR flame scanners incorporate a magnetic reed switch to prohibit their operation if they are removed from the burner. This must be mounted using the supplied bracket which incorporate the required magnet.

The distance the IR scanner can be positioned from the flame is dependent on:

- The intensity of the IR radiation emitted from the pilot flame and main flame.
- The geometry of the combustion chamber and available space.

The IR flame scanners are designed to measure the flicker response of the flame and should therefore be aimed towards the outer portion of the flame envelope where the flicker is more prominent.

Every 500ms the flame scanner outputs the flicker count for the preceding 500ms and the count should be above a threshold of 12 counts/second to indicate flame presence.

If the count is below that it may be necessary to:

- Move the scanner close to the flame or point it more towards the centre if the flame intensity is thought to be low.
- Move the scanner away from the flame if the IR intensity is thought to be too high causing the sensor to be in saturation

4.4. IR Flame Scanner Operation

When operating with an MM, the IR flame scanner receives power and outputs a flame pulse count on the data lines. The flame count is the flicker rate of the flame in pulses/second and is output every 500ms. The MM requires to see at least a pulse count of 12 to be certain that there is a flame present.

There are a number of errors which the MM may report as follows:

Error	Action
IR Comms Lost	Check the connection of the 4 wires back to the MM to ensure they are made correctly. In addition, this may mean that the magnetic reed switch is not activated so the unit has no power. Check the position of the mounting grooves in relation to the mounting bracket and adjust the unit position as required.
No flame count	The scanner cannot detect a flame when one is present. This may be that the view of the flame is obscured from the unit or that the unit is too close, or too far from the flame and signal is therefore saturated or in the noise floor. Alter the position of the scanner relative to the flame and retry.
High Ambient IR	The scanner is seeing a varying IR signal when no flame should be present. Check that there are no IR sources within the burner and retry.

4.5. Cable Specifications

The cable used for the UV and IR scanners must conform to the following specification:

- 16/0.2mm PVC insulated overall braid
- Screened
- PVC sheathed
- Sixteen wires per core
- Diameter of wires in each core: 0.2mm
- Rated at 440V AC rms at 1600Hz
- DEF 61-12 current rating per core 2.5A
- Maximum operating temperature: 70°C (158°F)
- Nominal conductor area: 0.5sq mm per core
- Nominal insulation radial thickness on core: 0.45mm
- Nominal conductor diameter per core: 0.93mm
- Nominal core resistance at 20°C: 40.1Ω/1000m
- Nominal overall diameter per core: 1.83mm
- Fill factor of braid screen: 0.7
- Equivalent imperial conductor sizes: 14/0.0076

The cable can be ordered directly from Autoflame using:

- UV cable - part # CAB50002 - 16-2-2C 2 core.
- IR cable - part # CAB50004 – 16-2-4C 4 core.

UV and IR scanners cable length should not exceed 25m (82ft).

For the self-check scanners, use 2 sets of 2 core cables.

5. Mk8 MM Flame Detection Using Flame Switch

The Mk8 MM allows an external flame switch for flame detection. Live input terminals 85 and 86 are used to wire the flame switch to the MM. To configure operation with a flame switch on the Mk8 MM, Option / Parameter 122 must be set to 1.

The operation of Terminals 85 and 86 must be as follows:

- When the flame switch indicates no flame, the voltage on Terminal 85 must be 0VAC, and the voltage on Terminal 86 must be mains voltage (110/230VAC).

- When the flame switch indicates the presence of a flame, the voltage on Terminal 85 must be mains voltage (110/230Vac), and the voltage on Terminal 86 must be 0VAC.

Terminal 85 is the functional input for detecting the flame while Terminal 86 is solely for the purpose of checking that Terminal 85 is operating correctly.

Terminal 86 must be seen to be the inverse of Terminal 85, i.e. if Terminal 85 is at 0VAC, Terminal 86 must be at mains voltage and if Terminal 85 is at mains voltage, Terminal 86 must be at 0VAC.

If Terminal 86 does not follow the inverse of Terminal 85 ‘Terminal 86 inverse’ lockout will occur.

Within the MM there is a latency of 250 milliseconds on the monitoring of Terminal 85. To ensure a 1 second overall flame failure response time, it is essential that the response time of the flame switch is set to no more than 750 milliseconds.

Flame switches often provide a volt free changeover contact to indicate the flame status. Alternatively, they may provide a pair of `inverse’ outputs. If the flame switch only provides a single output terminal, a relay will have to be installed between the flame switch and the MM to provide a set of volt free changeover contacts.

6. Mini Mk8 MM Flame Detection Using Ionisation

As well as using UV or IR, the Mini Mk8 MM supports Ionisation signal / Flame Rod. This can be wired into Terminal 64 and the cable must be screened at the MM side only.

When ionisation is optioned on the Mini Mk8 MM, the flame will be signalled when the rectification voltage is above 30V DC, the maximum sensed rectification voltage is 540V DC, above which a Lockout will be generated.

7. Flame Detection Options / Dual Scanners Operation

The table below shows the flame detection options for the Mk8 MM and Mini Mk8 MM systems.
Option / Parameter 122 sets the flame sensor selection options.

Flame Detection Option	Mk8 MM	Mini Mk8 MM
UV		
Ionisation		
IR		
IR and UV		
IR and Ionisation		
Ionisation to UV switchover		
IR or UV		
IR or Ionisation		
Flame Switch		

It is not possible to use dual UV scanners or dual IR scanners with the Mk8 MM or Mini Mk8 MM.

When using IR and/or UV scanners, both scanners work independently in detecting a flame signal so it is not required that the two scanners have to read the same flame signal strength.

7.1. IR and UV, IR and Ionisation

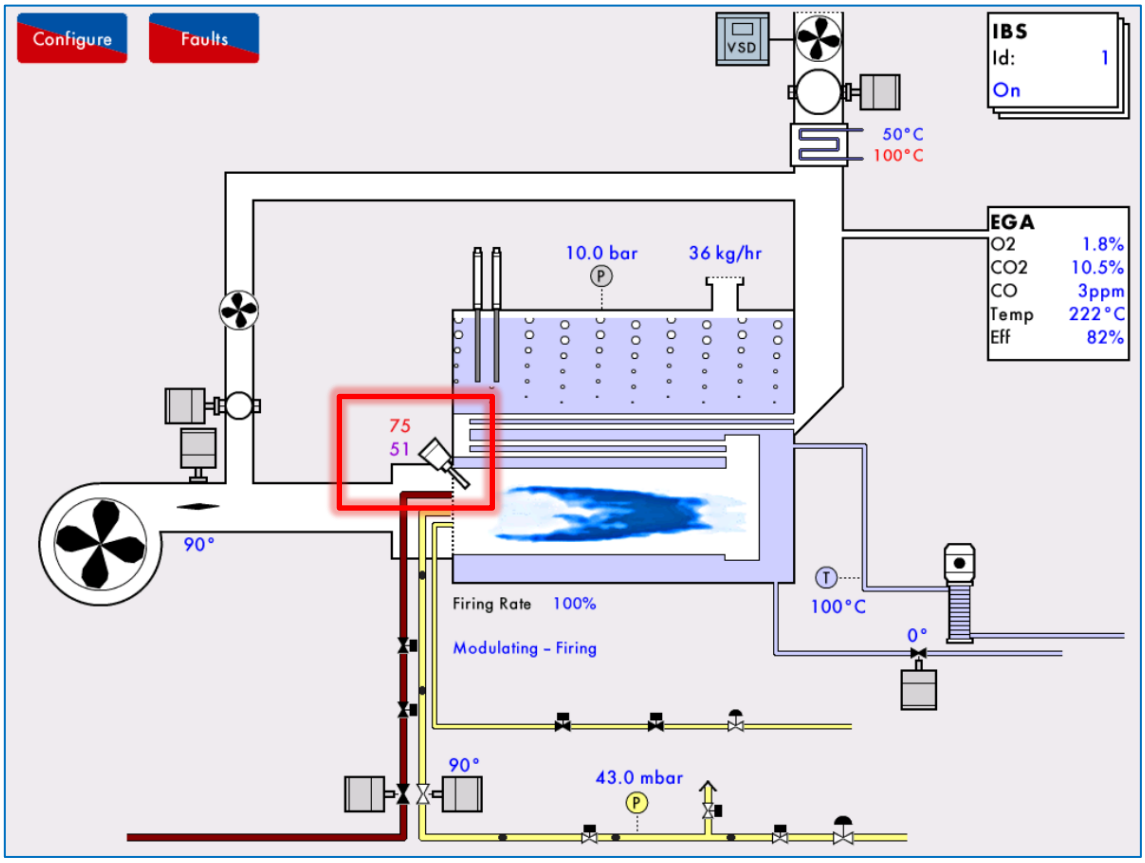
Both flame scanners must detect a flame when there should be and vice versa. If either flame scanner fails to see a flame when there should be a flame, the MM will lockout on no flame signal, even if the other scanner detects the flame. This is the same for simulated flame; only one scanner must see a flame when there should not be for the MM to lockout.

This mode can give extra safety to the flame detection system by adding a second scanner to verify that the other scanner is detecting the flame correctly in addition to the self-diagnostics built into the MM.

7.2. IR or UV, IR or Ionisation

Either flame scanner must detect a flame when there should be and vice versa. If one flame scanner fails to see a flame when there should be but the other scanner does detect a flame, then the MM will continue to fire without a lockout. Only if both flame scanners fail to detect the flame when there should be and vice versa, will the MM lockout. For a simulated flame, either or both scanners must see a flame when there should not be, for the MM to lockout.

This mode can be useful if the system requires 2 flame scanners, for example one for the pilot flame and another one for the main flame.



Main MM screen displays the UV and IR signal strength if both are optioned

7.3. Ionisation to UV Switchover (Mini Mk8 MM only)

Some burner applications require different flame detection methods for the pilot flame and the main flame. On the Mini Mk8 MM, Ionisation to UV Switchover function can be used and is selected by setting option 122 to 7.

An Ionisation / Flame Rod is used to detect the pilot flame and then a UV scanner is used to detect the main flame.

The pilot type (set in option 111) must be set to interrupted pilot when using Ionisation to UV Switchover.

8. Troubleshooting

8.1. UV Shutter Faults

UV shutter fault may be indicated by the two LED's on the back of the self-check UV scanner. The red LED indicates the presence of a flame; the yellow LED indicates shutter operation. The red LED will flicker in the presence of UV light. Every 60 seconds the yellow LED will come on, indicating that the shutter is closing. The red LED should then extinguish briefly. If this is not happening check the wiring to the self-check UV sensor:

Green wire	=	Terminal 22
Yellow wire	=	Terminal 21
Blue wire	=	Terminal 50
Red wire	=	Terminal 51

8.2. UV Problems

If the red LED's fail to illuminate but the burner operates, it is likely that the 2 wires are crossed. This must be corrected. Once corrected a full flame signal strength will be displayed/registered.

The Autoflame UV software utilises early spark termination within the internal flame safeguard control. Therefore, detection of the ignition spark is allowed. During start-up the ignition is de-energised and the pilot flame must be proven without the spark before the main fuel valves are open (safety shut off). Due to the above statement it is not necessary to have a sight tube on the UV for pick-up. This, in fact, will drastically reduce the flame pick-up.

If insufficient UV is detected, it is advised to use a swivel mount assembly (UVM60003/UVM60004) in order to obtain maximum pick-up. This will allow the commissioning engineer to reliably sight the UV for optimum performance and trouble free operation.

AUTOFLAME
FLAME SCANNERS GUIDE
01.06.2023

Autoflame Engineering Ltd.
Unit 1-2, Concorde Business Centre
Airport Industrial Estate, Wireless Road
Biggin Hill, Kent TN16 3YN
United Kingdom

Tel: +44 (0)1959 578 820
Email: technicalsupport@autoflame.com
Website: www.autoflame.com

AUTOFLAME®
Combustion Management Systems