UV cells

UV cells contain a vacuum tube as the flame sensor.

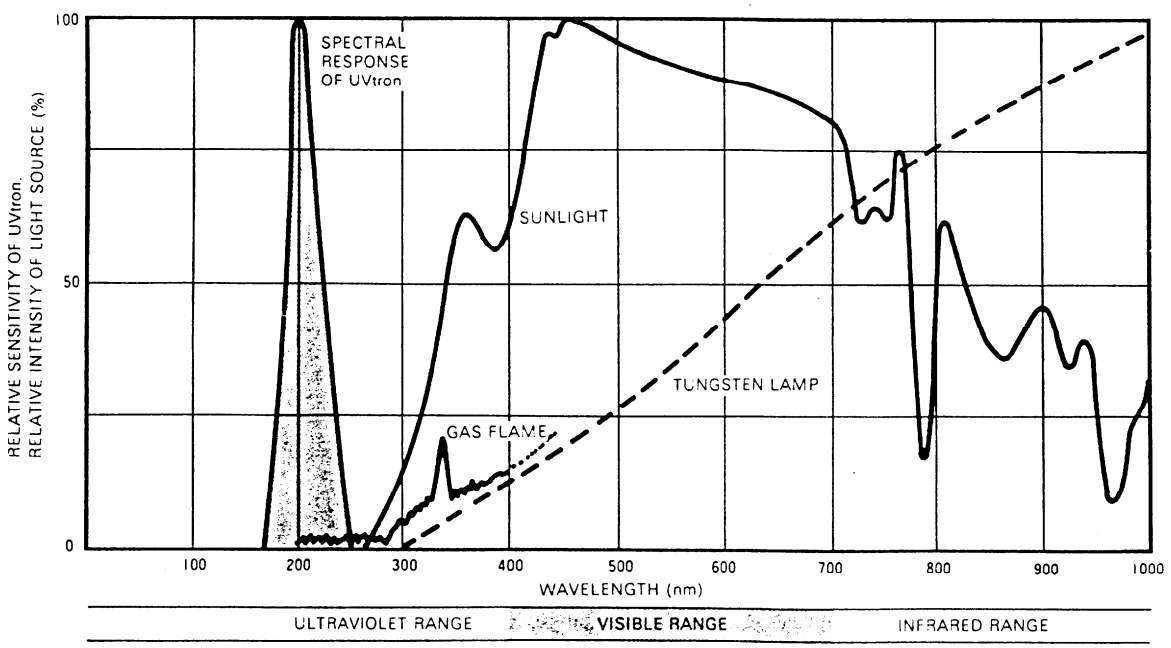
Types

UVZ 780 (for intermittend operation) and UVZE 780 (for continous operation).

The UVZ 780 is used together with either a MMG 8xx, TMG 740-3 or SGU 930(i) control box to detect flames of gas or dual fuel burners. It contains mainly the UV tube itself (make: Sylvania) and is available in 3 different sensitivities:

UVZ 780 white	standard sensitivity	TMG, SGU
UVZ 780 blue	low sensitivity	TMG, SGU
UVZ 780 red	high sensitivity	MMG, TMG, SGU

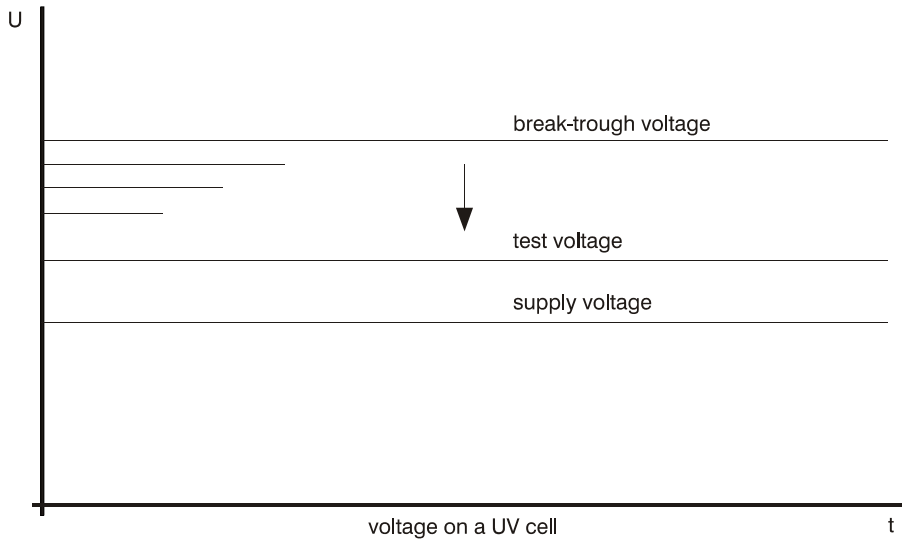
Due to its spectral sensitivity, the UV cell does not react visible or IR light, therefore it does not react to stray light (exception: ignition spark):



Although UV cells are widely used on both domestic and industrial applications, they all feature a huge disadvantage: ageing, which can lead to an unsafe operation of the burner. Therefore, special precaution has to be taken to overcome this subject.

Notes

As all vacuum tubes, a UV cell needs an operation voltage of several houndred volts. The UV cell itself contains two electrodes (electrically insulated from each other), sealed in a glass tube which is filled with a special gas. If the tube is supplied by its operation voltage, still no current runs between the two electrodes. But as soon UV radiation is provided, the gas dropps in resistance, the tube «ignites» and an electrical current can flow from one to the other electrode (several micro amps).
If the supply voltage would be too high, the UV tube would also ignite without any UV radiation provided (known as «break-through» voltage).
Usually, there is a difference of the operating voltage and break-through voltage which allow the safe operation of the UV tube.
The ageing process is that during the lifetime of the UV tube, the break-through voltage dropps and comes close to the operation voltage. If it is too close, the UV tube would ignite even without UV radiation. This would be detected during the pre-purge resp. stray light check at the beginning of each operating cycle. But if the break-through voltage would come to the level of the operation voltage during one operating cycle, the UV tube would not detect if the flame would extinguish and the fuel valve would stay open! This most dangerous situation must be avoided.
This can be achieved with the following procedure: during pre-purge resp. stray light check, the UV tube would be supplied with a higher-than-normal supply voltage (test voltage). If the break-through voltage is already close to the normal supply voltage, the UV tube would ignite and the burner would not start due to stray-light. This feature is standard on all Satronic controls suitable for UV flame detection. The typical life time of a UV cell is approx. 5–10‘000 hours.



voltage on a UV cell

Notes

UVZE 780

As this mentioned UV test feature is performed only once during the start of a burner, it is not suitable for burners in continous operation mode. A more sophisticated test is performed there.

UVZE 780 standard sensitivity TME 780

The UVZE 780 is available in standard sensitivity only!

The UVZE 780 consists of a quite bulky housing, which contains the UV tube itself plus a shutter mechanism. During operation, every four minutes, the TME 780 sends out a «check-signal», which activates the shutter.
The shutter covers the viewing areas of the UVZE 780 (end-on and side-on) for approx. one sec. The TME 780 checks during this time if the flame signal disapears; if not, it would mean the UV tube is in self-igniting state due to ageing. Of course, the flame relay inside the TME 780 amplifier is bridged for this period, otherwise the TME 780 would go to a safety shutdown.

Due to this additional feature, both the UVZE and the TME 780 are remarkable more sophisticated and therefore more expensive than the normal UVZ and TMG combination.

Infrared flicker detector

Types available

IRD 810	seperate sensor and amplifier, potential-free output
IRD 810 Industrial	same, sensor in heavy-duty housing, for industrial applications
IRD 820	seperate sensor and amplifier, ionisation signal output
IRD 820 Industrial	same, sensor in heavy-duty housing, for industrial applications

The IRD 8xx can be used on all Satronic control boxes

IRD 1010	for blue burning oil burners (domestic) available in may different variations and viewing attitudes
IRD 1020	for gas power burners available in may different variations and viewing attitudes needs magnetic mounting flange M93

As the appropriate standard EN298 asks for a switch-off facility if the IRD 1020 would be removed from the burner, a built-in reed relay plus the magnetic mounting flange M93 are used. By removing the IRD 1020 from its flange, the reed relay would open and interrupt the flame signal!

Notes

IR flame sensors (solid state sensors, similar to those used in remote control receivers, like TV's) detect all kind of IR radiation (heat sources). If used without a special circuit, the flame sensor would be far too slow to detect a loss-of-flame within the safety time of 1 sec, because glowing parts inside the burning chamber would emit enough IR radiation to fool the sensor.
A built-in electronic filter lets only pass the «flickering» part of the IR signal, which can be compared to an electric AC signal. As all flames flicker within a certain frequency, it is easy to seperaty between the continous IR light signal from glowing burner parts and the alternating signal provided by the flame itself.

Satronic type	**MZ 770 S**	**FZ 711 S**	**FZE 780**	**Flame rod**	**UVZ 780**	**UVZE 780**	**IRD 1010**	**UVD 970**	**IRD 1020**	**UVD 971**
principle	photo resistor	photo resistor	photo cell	flame	UV-cell	UV-cell	IR flickering detection	UV solid state	IR flickering detection	UV solid state
fuel	oil	oil	oil	gas	gas / dual fuel	gas / dual fuel	oil	oil	gas	gas
operation mode	intermitten d	intermittend	continous	intermittend	intermitten d	continous	intermittend	intermittend	intermittend	intermittend
flame colour	yellow / orange	yellow / orange	yellow / orange	blue / transp.	blue / transp.	blue / transp.	blue / yellow	blue / yellow	blue / transp.	blue / transp.
reliabitly	good	good	good	good	bad / ageing)	bad / ageing)	good	good	good	good
safety	good	good	good	excellent	(good)	(good)	good	good	good	good
size	small	smal	avarage	Very small	avarage	bulky	good	good	good	good
costs	cheap	cheap	expensive	cheap	expensive	Verry expensive	reasonable	reasonable	reasonable	reasonable
viewing angle	end /side on	end /side on	end /side on	-	end /side on	end /side on	end or side on	end (or side) on	end or side on	end (or side) on
runs on control..	TF83x, Dx97x	TF80x, TMO	TME	TFI, MMI, MMG, TMG, SGU, Dx97x	MMG, TMG, SGU	TME780	TF8xx, TMO, DxO97x	TF8xx, DxO97x	TFI. MMI. MMG, TMG, SGU, DxG97x	TFI. MMI. MMG, TMG, SGU, DxG97x
application	oil burner for domestic heating	oil burner for domestic heating	industrial oil burner (continous)	atmospheric gas boilers / power gas burners	power gas burners	power gas burners (continous)	low emmision oil burners	low emmision oil burners	power gas burners	power gas burners
extra				not available from satronic		self-checking	var. sensitivity		verry sensitivity magn. flange	

With the built-in potentiometer, the gain of the internal flame signal amplifier can be adjusted and easily adapted to the specific burner.
As the output signal is in digital form (high resistance = no flame, low resistance = flame), measuring the output current to as a reference of the strenght of the IR flame signal does not help, therefore the two built-in LED's are used to indicate the status of the IRD.

Notes