



# Flame Monitor D-UG 660 / D-LE 103

# DURAG

## Application

The flexibility of the DURAG Flame Monitoring System D-UG 660 / D-LE 603 makes it perfectly suitable for monitoring all kinds of furnaces, even under difficult conditions. Typical applications of DURAG flame monitors are e.g.:

- Power Stations
- Chemical Industries
- Refineries
- Cement Plants
- Waste Incinerators

The combination of D-UG 660 Control Unit and D-LE 603 Flame Sensors offers a lot of information and adjustment options. It is recommended for use in furnace plants with several burners, which make great demands on selectivity at high sensitivity levels. At fuel change or to compensate for strong movements of the flame, a secondary flame sensor connected in parallel can take over flame monitoring. This operating convenience makes the D-UG 660 universally suitable for use in plants of varying fuel types and/or load conditions.

## High Flexibility by Remote Gain Control

Various adjustable elements in the control unit and flame sensor enable easy adaptation to the specific combustion process to be made. Adjustments are available for the following parameters:

- Flame on threshold
- Gain
- High-Pass Filter Frequency

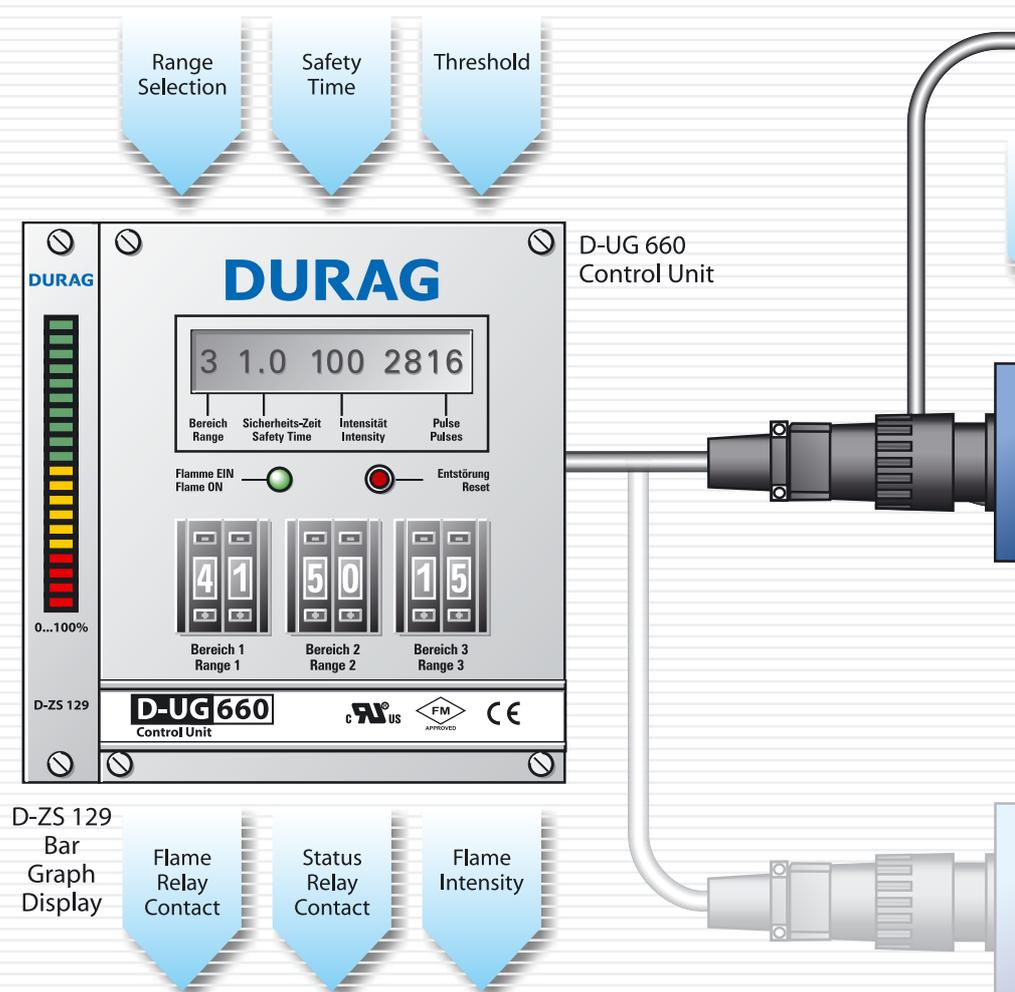
The flame-on threshold and gain are used to adapt the flame monitor to the most differing intensities of light emission from various fuels under different load conditions, whilst the adjustment of the cut-off frequency of the high pass filter is used for the selective monitoring of specific burners in multi burner system boilers. A remote switch-over of the gain and flame-on threshold is a useful aid for the different operations of the boiler plant. A pulse reduction process allows further adaptation to the selectivity to be made so that stray light signals from adjacent burners can be suppressed.

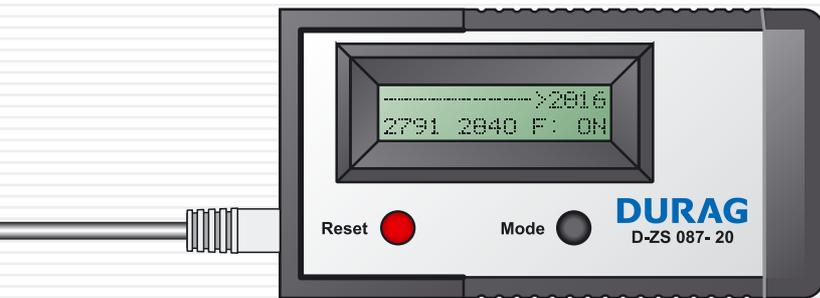
## Range Selection and Remote Gain Control

	Example 1: Adjustment on different fuels	Example 2: One fuel but different conditions	Control Unit D-UG 660			Flame Sensor D-LE 603 UA		
			Threshold	Safety Time	Analogue Output	Gain	Frequency Filter	Pulse Reduction
1	Gas	Cold Start	Threshold 1 (00...99)	Safety Time 1 (1...5,5 s)	0-20 mA or 4-20 mA	Gain A (1...4)	Filter A (30/70/120 Hz)	Pulse Reduction (0-2500 P/s)
2	Oil	Warm Operation	Threshold 2 (00...99)	Safety Time 2 (1...5,5 s)		Gain A (1...4)	Filter A (30/70/120 Hz)	
3	Coal	Exhaust Gas Recirculation	Threshold 3 (00...99)	Safety Time 3 (1...5,5 s)		Gain B (1...4)	Filter B (30/70/120 Hz)	

## Safety and Certification

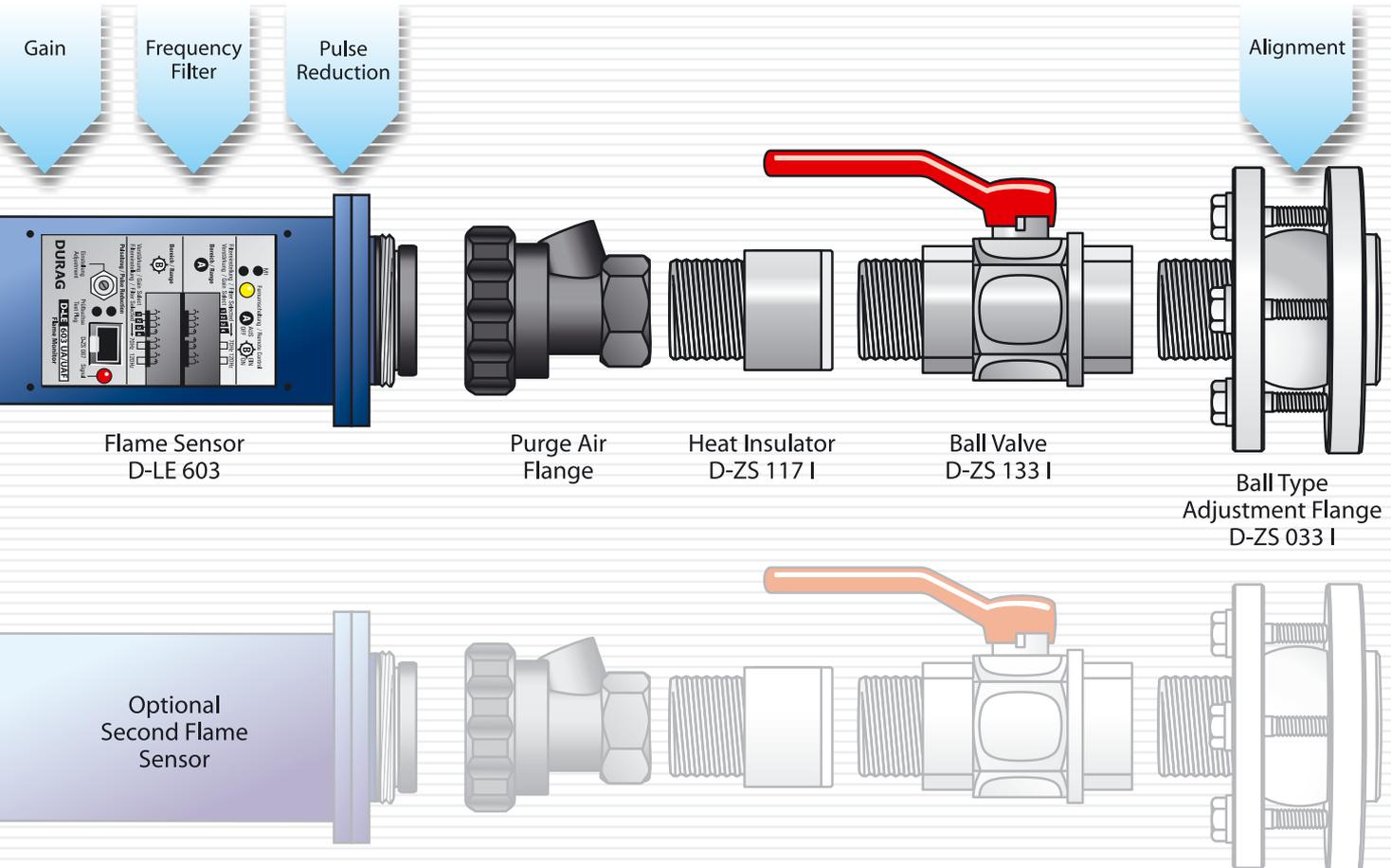
Due to the potentially high risk of combustion processes, every flame monitor should meet the highest standards for safety. Therefore, the design of the D-UG 660 / D-LE 603 Flame is fail-safe and performs periodically self-checks. A dual channel micro-processor system ensures a safe operation of the flame monitor all the time. The high level of safety of the DURAG Flame Monitoring System D-UG 660 / D-LE 603 has been approved and certified by numerous independent test institutes, for example:





### Setup Utility

Every D-LE 603 Flame Sensor has a test plug for the connection of a D-ZS 087-20 Digital Display. Using this utility, the installation and adjustment of the D-UG 660 / D-LE 603 Flame Monitor is greatly eased. By displaying the current flame intensity, the D-LE 603 Flame Sensor can be aligned optimally to the flame. Further information such as minimum and maximum flame intensity are displayed as well as a recommended setting for the response threshold.



Selected range

Safety time, adjustable from 1.0 s to 5.5 s in 0.5 s steps

Percental flame intensity

Flame signal pulse frequency (per second)

### Full Information

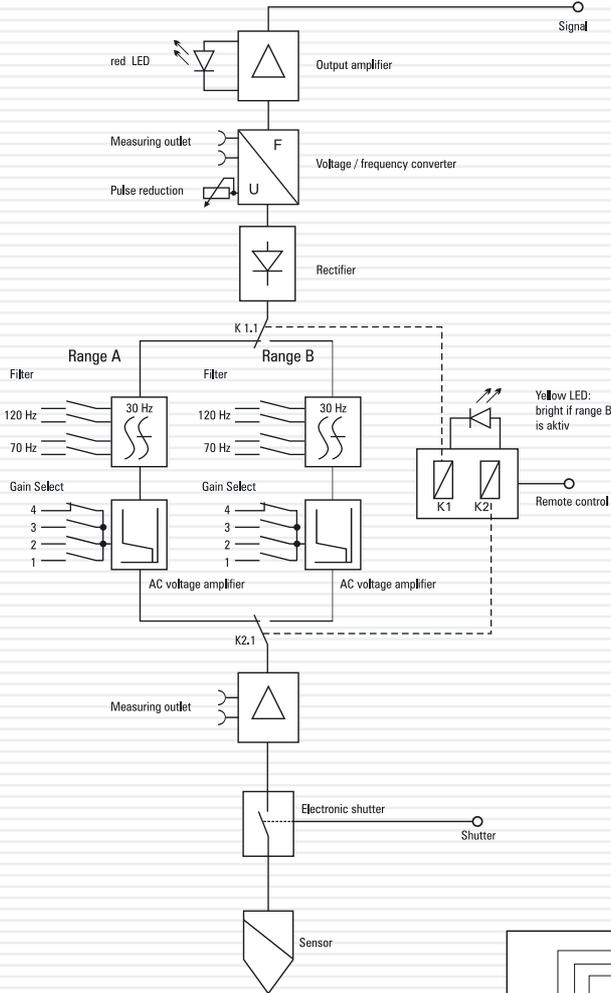
The built in alphanumeric LCD display provides the operator with a wide range of information. During normal operation the current safety time as well as absolute and relative flame intensities are displayed. In case of any error it offers detailed information about the error to improve maintenance.

## Functional Description

After start-up the D-UG 660 Control Unit performs a self test which is periodically repeated during operation. The threshold for the 'Flame ON' indication can be set in 100 steps. Stray light from adjacent flames will therefore not lead to flame messages. The D-UG 660 Control Unit offers selectable settings that can be previously optimised for three operational conditions. The safety time for the 'Flame OFF' message can be preset in the control unit and appears in the LCD display.

For interference-free transmission through extensive cable lengths, all D-LE 603 Flame Sensors convert the flame signal into strong pulses, which are transmitted to and counted by the D-UG 660 Control Unit. Two analogue outputs of 0/4...20 mA are indicating the absolute and the weighted flame intensity. The weighted flame intensity depends on the absolute flame intensity and the threshold setting.

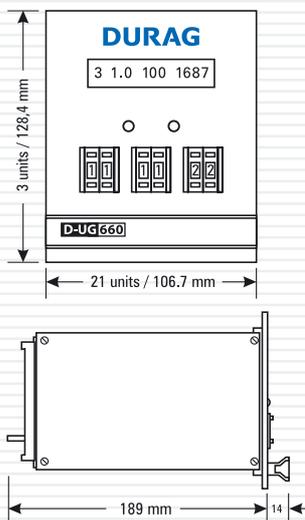
The pulse frequency indication (flame signal) informs the user on the stability of the burner flame. Changes of the flame structure lead to changes of the pulse frequency and are recognizable through the second analogue output of the flame detector device: this is important information for obtaining and preserving optimal operational conditions.



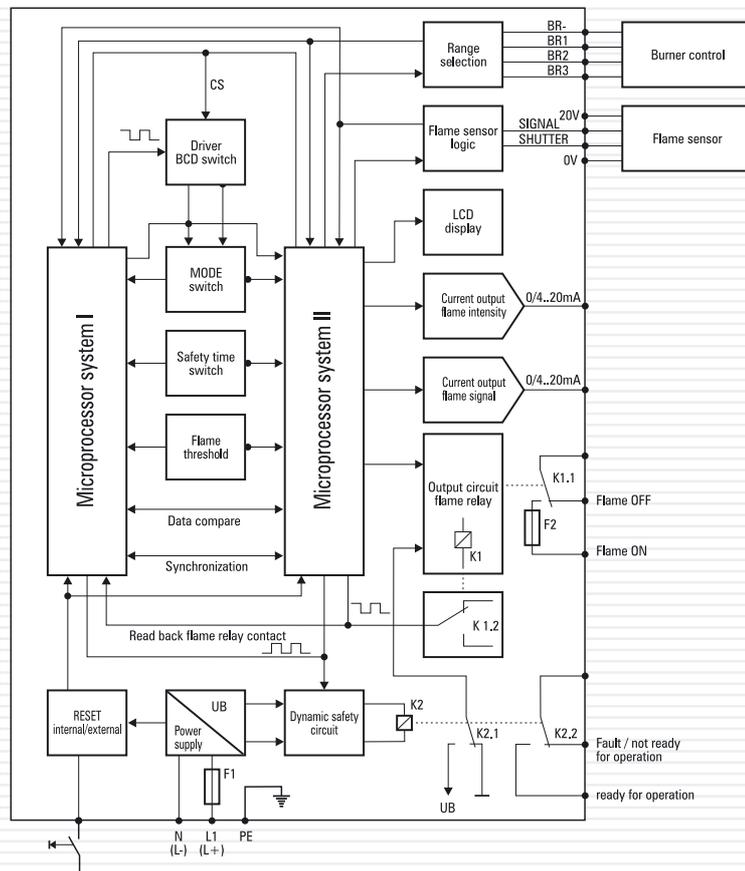
Left: Schematic Diagram of D-LE 603 UA

## Design

The D-UG 660 Control Unit is supplied as a plug-in slide module (21 TE and 3 HE) for 19" racks. As an option, numerous of racks (IP00) and housing (IP55) for cabinet or wall mounting enclosures are available.



Dimensional Drawing of the D-UG 660 Control Unit



Schematic Diagram of D-UG 660

■ Survey of D-LE 603 Flame Sensors							
Flame Sensor	Photo Element	Spectral Range (nm)	Suitable for Fuels				Remarks
			Gas	Oil	Coal	Wood	
D-LE 603 UH-xx	High voltage UV cell	190 - 270	++	O			Selective monitoring of single burners of gas and oil flames in multi burner installations.
D-LE 603 US-xx	Plate UV cell	190 - 280	++	+			Selective monitoring of single burners of oil and gas flames in multi burner installations with low UV radiation levels [due to fuel composition] e.g. tail gas and refinery gas flames.
D-LE 603 UAF-xx	GaP with UV-filter	280 - 410	O	++			Selective monitoring of single burners of oil and gas flames in multi burner installations with intensive flame radiation from neighbouring burners (flame simulation). Possibility of remote switching of the amplification setting (e.g. when changing fuels) - only in connection with D-UG 660 control unit.
D-LE 603 UA-xx	GaP without UV-filter	190 - 520	+	++	+	+	Selective monitoring of single burners of oil and gas flames in multi burner installations with low NOx combustion (e.g. recirculating gas operation) Possibility of remote switching of the amplification setting (e.g. when changing fuels) - only in connection with D-UG 660 control unit.
D-LE 603 UI-xx	High voltage UV cell + Ge	190 - 270 780 - 1800	++	++	+	+	Dual photo element flame sensor with UV and IR sensitivity, remote spectral range selection
D-LE 603 IS-xx	Si	300 - 1100	!	+	++	+	Selective monitoring of single burners of coal and oil flames in multi burner installations. Ideal for monitoring oil burners which have insufficient UV radiation caused by NOx reducing methods.
D-LE 603 IG-xx	Ge	780 - 1800	O	+	++	++	Selective monitoring of single burners of coal (also brown coal), oil and gas flames in multi burner installations. Monitoring of combustion of waste, as with yellow to orange colouring, which have no UV radiation or where the UV radiation is cut off by dust, steam or flue gases.
D-LE 603 ISE-xx	Si 4 quadrant	300 - 1100	!		++		Combination flame sensor with two different logarithmic input amplifiers for selective monitoring of single burners of coal flames in multi burner installations which have greatly fluctuating levels of brightness.
D-LE 603 ISO-xx	Si 4 quadrant	300 - 1100	!		++		Combination flame sensors with one linear and one logarithmic input amplifier for furnace body monitoring in coal boilers as well as selective monitoring of single burners with flames of differing conditions.

**xx = P:** Axial standard plug cable connection, IP 67 / NEMA 4X  
**xx = MP:** Axial metal plug cable connection IP 54 / NEMA 3S  
**xx = CG:** Cable connection with PG 13,5 cable gland, IP 65 / NEMA 4X  
**xx = 94 Ex:** Ex-proof enclosure EEx de IIC T6

**Explanation of symbols:**  
**++** The flame sensor is **ideally suitable** for this fuel considering its flame detection and flame selectivity.  
**+** The flame sensor is **well suited** to this fuel, although under certain conditions it may show an increased flame simulation signal. This is especially possible with combination operation (e.g. oil and gas).  
**O** The flame sensor is **conditionally suited** to this fuel. The monitoring characteristics depend mainly upon the combustion technique.  
**!** Due to local regulations the flame sensor might not be approved for monitoring of gas flames.

This information is based on years of experience in a great proportion of combustion systems. Variations due to differing flame behaviour, caused by special combustion techniques cannot be taken into account or excluded.

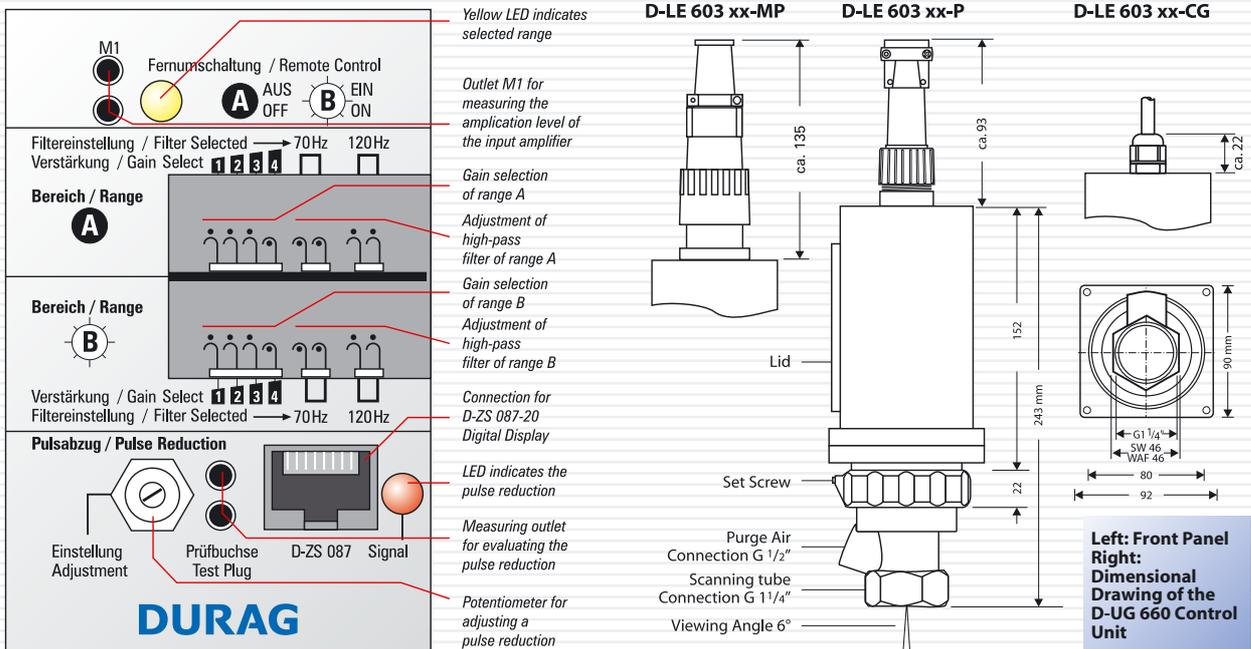
### ■ D-LE 603 UH / US / UA / UAF Ultraviolet Flame Sensors

These flame sensors have a spectral range of either 190 to 280 nm or 190 to 520 nm, depending on the model. All blue-burning flames, e.g. gas flames whose portion of visible light is low, may be monitored by these flame sensors.

### ■ D-LE 603 IS / IG / ISE / ISO Infrared Flame Sensors

These IR flame sensors have a spectral sensitivity of either 400 to 1100 nm or 780 to 1800 nm, depending on the model.

Only those signals are processed which correspond to flame flickering. Thus flame monitoring is not influenced by ambient light, as far as constant light is concerned. Flames whose UV radiation is absorbed by dust, water vapour or other materials may be monitored in the infrared range. A waste incinerator would be an example of such an application. IR flame sensors with a sensitivity of up to 1800 nm have proven themselves in monitoring gas and oil combustion systems employing NO<sub>x</sub> reduction techniques such as flue gas recirculation.



### ■ D-UG 660 Control Unit

Mains voltage	115/230 V AC, +10% -15%
Mains frequency	42-60 Hz
D.C. voltage	24/48 VDC ±20%
Power consumption	20 W
Permissible ambient temperature	-20°C to +60°C (0°F to 140°F)
Safety time	1 - 5.5 s, adjustable in 0.5 s steps
Flame Relay	SPDT (230 VAC, 2 A)
Status Relay	SPDT (230 VAC, 2 A)
Analogue Output	0/4...20 mA
Protection (EN 60529)	IP00
Weight:	approx. 1 kg (2.2 lb.)

### ■ D-LE 603 Flame Sensor

Supply voltage	20 VDC (from control unit)
Spectral sensitivity (depending on type of flame sensor)	190-1800 nm
Permissible ambient temperature	-20°C to +60°C (0°F to 140°F)
Viewing Pipe Connection	G 1¼"
Purge Air Connection	G ½"
Optical Viewing Angle	6°
Protection (EN 60529):	
- cable version (-CG)	IP65 / NEMA 4X
- standard plug version (-P)	IP67 / NEMA 4X
- metal plug version (-MP)	IP54 / NEMA 3S
Weight	approx. 1.8 kg (4.0 lb.)

### ■ Available Accessory Equipment

- **D-ZS 087 - 20**  
Digital indicating instrument for optimal alignment of flame sensors through pulse frequency measurement and for storing pulse peak values
- **D-ZS 118**  
Optical adjustment auxiliary unit for alignment of the ball-type adjustment flange on the scanner tubes
- **D-ZS 077-10**  
UV-C test light source 230 V / 50 Hz
- **D-ZS129-30**  
Bar graph display for flame intensity
- **D-ZS 093**  
UV-A, UV-B and IR test light source 230 V / 50 Hz
- **D-ZS 033 - I**  
Swivel mount for D-LE 603
- **D-ZS 117 - I**  
Heat insulator with electrical disconnection
- **D-ZS 133 - I**  
Ball-type valve for closing the viewing pipe

Extensive descriptions of these units with specifications, setting instructions, dimensions and connection plans are available upon request.