

Eclipse Trilogy Flame Safeguards

T600 Series
Version 2



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Introduction

1

Features

- Programmable parameters
- Continuous or intermittent operation
- Communication options
- Modulating output control (0-10V, 4-20 mA or PWM)
- Two programmable flame sensor inputs
- Programmable "operation" output terminal
- Advanced diagnostics
- Runtime, lifetime and cycle counters
- History shows last 10 errors
- Software for status, settings and logging
- CE, FM, UL, CSA, GOST-R, AGA and SIL 3 approvals



Type 1



Type 2



Type 2
Integral Display



Type 2
Modulating

Description

The T600 microprocessor-controlled automatic flame safeguard control is for intermittent and continuous operation of gas, oil or combination gas / oil burners.

The flame is monitored by either an ionization (flame rod) input, dual contacts (NO and NC), a single contact (NO) or a combination of the ionization and contact inputs. This dual monitoring capability combined with configurable sequences enables supervision of burners with two flame sensor positions, long line burners, redundancy for burners with a moving flame, and two burners from a single valve train (one-down-all-out).

The program sequence and timings can be configured to match the application.

The settings are protected by passwords against unauthorized access.

All settings for the T600 can be made by means of a laptop / PC via the VisionBox or through the integral display (certain models only).

For operation in burner networks, Profibus or Modbus communication is available as an option.

T600 Types

- Type 1 without display

This version may be used if accessing information via the display is not required or limited state/fault information is acceptable.

- Type 2 with integral display
This version gives local display of detailed information.
- Type 2 with modulating capabilities
This version allows for modulating control of process components.
- Type 3 with metal housing and integral display
This version provides an extra level of environmental protection for particularly demanding installations.

Application

For industrial burners, with or without pilot (start gas), for ovens and furnaces meeting the requirements of NFPA 86 and for industrial thermoprocessing equipment meeting the requirements of EN 746-2 or ISO 13577 series.

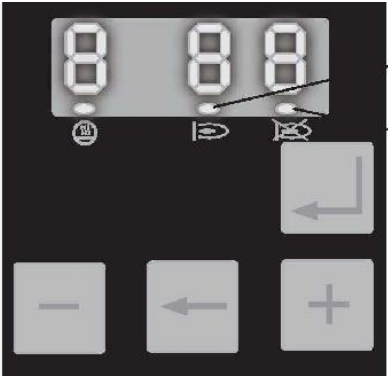
Approvals

CE, FM, UL, CSA, GOST, AGA
(See page 18 for details)

T600 Options

Type 1	
Purge / No Purge	No Display
	Communications Special Order
Type 2	
Purge / No Purge	Display Standard
	Communications Option
Modulating	Display Standard
	Communications Included
Type 3	
Purge / No Purge	Display Standard
	Communications Option
Modulating	Display Standard
	Communications Included

Integral Display



The integral display provides information through various modes:

Operation Display

- Current operating state
- Program state
- Bus address

Info Display

- Flame quality value
 - Resettable counters for start-up, operating hours and operating cycles

Error Display

- Automatic activation of error messages
- Additional information about faults
- Query of the last ten faults

Parameter Display

- Password-protected access for qualified personnel to make parameter adjustments
- Includes important parameters such as:
 - Pre-purge
 - Safety time for startup phase
 - Post-purge time
 - Behavior after flame lift-off
 - Operating modes of V1 and V2
 - Continuous or intermittent operation

Status Information

Designation	Description	Visible via VisionBox	visible via Display
General Information			
Lockout	System is locked, error code	•	LED
State Number	Current state of the system, key combination + and -	•	7-segment
Current Access Level	For parameter changes via password entry	•	
Flame	Flame detected	•	LED
Manual Mode	System in manual mode	•	7-segment
Flame Quality	Value > 49 good flame (ionization)	•	Info
Bus Connection Present	Communication via Profibus, Modbus	•	7-segment
Burner Start Request	Signal combination from bus setpoint input and hardware input	•	LED
Inputs			
Air Pressure Switch	Signal to terminal 18	•	
Flame 1	Signal from flame 1 input, terminal 5	•	
Flame 2 NO	Signal from flame 2 NO input, terminal 16	•	
Flame 2 NC / Gas Pressure Switch / POC	Signal from flame 2 NC input, gas pressure switch or POC, terminal 17	•	
Hardware Input for Burner Start	On / off signal for burner start, terminal 19	•	
Outputs			
Gas valve V1	Pilot valve, terminal 13	•	
Gas valve V2	Main valve, terminal 14	•	
Ignition	Igniter or ignition transformer, terminal 15	•	
Fan	Combustion air blower starter, terminal 8	•	
Counters			
Time Counter / Lifetime Counter	Time since switching on the power	•	
Runtime Meter	Fixed operating time	•	
Resettable Runtime Meter	Resettable via VisionBox and display	•	Info
Start Counter	Fixed counter of startups	•	
Resettable Start Counter	Resettable via VisionBox and display	•	Info
Switching Cycles Counter V2	Count of main valve cycles	•	Info
Internal Information			
State Timer in Minutes	Displayed state timer runs in minutes, otherwise in 1/16s.	•	
Initialization Phase	The flame safeguard is being initialized	•	
Multi-function Switch	"ON" when reset button is pressed	•	
Access Level Change	CCC or value flashes on display, 0 key expected	•	7-segment
Safety Switch-off Flag	System is locked	•	
Error Index	Internal error counter	•	
Remaining State Time	65535 if unlimited remaining time	•	
Cycl. State Counter	Counts in 1/128s cycle	•	
Processor Load	Represents percentage of processor capacity	•	

LED: Indicated by one of the 3 LEDs on the display
7-segment: Indicated by one or several characters of the 7-segment display
Info: Displayed in informative display mode

Accessories

UV 41HE / UV 42
UV flame detectors. Suitable for intermittent operation.

UV 41HE - Ionization output
UV 42 - Contact output

Suitable for continuous operation in conjunction with shutter module UV 4x EM 1/1 and T600 with self-check control option.



FLW 411
Flame detector module used when a second ionization flame detector is required. The FLW 411 is connected to the second flame sensor input of the T600.



Configured Part Number

T600rr [rr
= revision number

NOTE: Not all functions or capabilities are shown here. Contact Eclipse for additional options.

1 2 3 4 5 6 7 8 9 10 11 12 13 14

1 - Customer	
	Standard Product Options

2 - Model	
1	No-Purge
2	Purge
3	Analog Modulating Control

3 - Type	
1	No Display
2	Integral Display
3	Metallic with Display

4 - Voltage	
1	115VAC
2	230VAC

5 - Ignition Configuration	
A	Interrupted Pilot
B	Direct Spark / Intermittent Pilot
C	High-Low

6 - Application	
A	Single Burner, Aux (NC) Input for POVC
B	Single Burner, Aux (NC) Input for Gas Switch (No POVC)
C	Dual Burners, Aux (NC) Input for POVC
D	Dual Burners, Aux (NC) Input for Gas Switch (No POVC)
E	Line Burner and 2 Flame Sensors, Aux (NC) Input for POVC
F	Line Burner and 2 Flame Sensors, Aux (NC) Input for Gas Switch (No POVC)
G	Redundant: Pilot 1 or 2, Main 1 or 2, Aux (NC) Input for POVC
H	Redundant: Pilot 1 or 2, Main 1 or 2, Aux (NC) Input for Gas Switch (No POVC)
J	High-Low Burner, Aux (NC) Input for POVC
K	High-Low Burner, Aux (NC) Input for Gas Switch (No POVC)

7 - Pre-Purge Time	
3	3 seconds
A	10 seconds
C	20 seconds
D	30 seconds
F	60 seconds
K	120 seconds
M	240 seconds
P	360 seconds
R	600 seconds
T	900 seconds
U	1200 seconds
X	No Purge

Configured Part Number (Continued)

T600rr [rr
= revision number

1 2 3 4 5 6 7 8 9 10 11 12 13 14

8 - First Safety Time (Pilot TFI)	
3	3 seconds
5	5 seconds
A	10 seconds
B	15 seconds

9 - Second Safety Time (Main TFI)	
3	3 seconds
5	5 seconds
A	10 seconds
B	15 seconds
X	None (Direct Spark / Intermittent Pilot)

10 - FFRT - Pilot and Main	
1	1 seconds
3	3 seconds

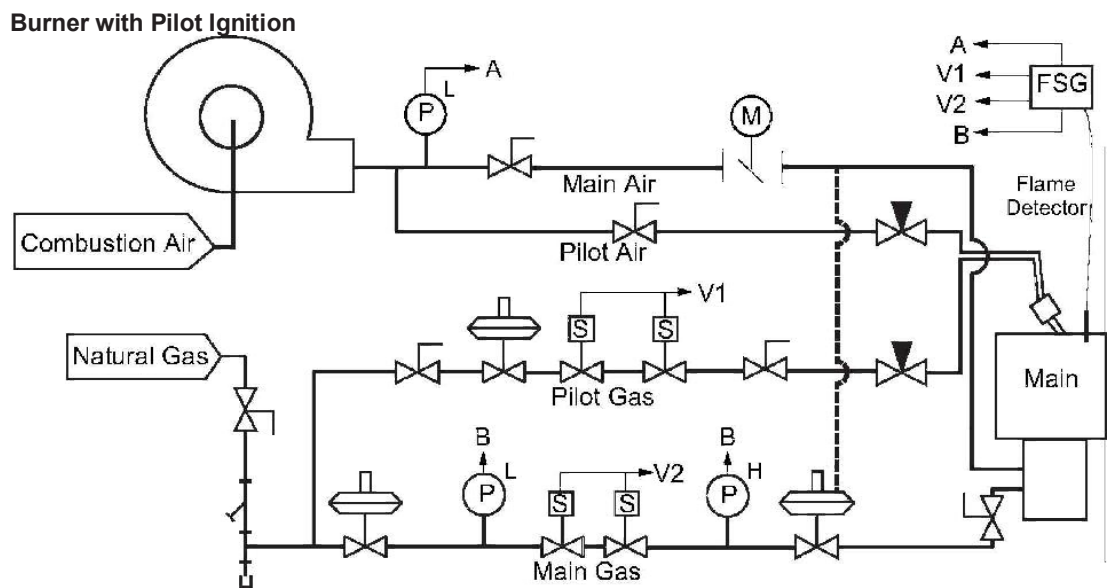
11 - Post Purge Time	
3	3 seconds
A	10 seconds
D	30 seconds
F	60 seconds
X	None

12 - Extended Capabilities	
A	Self-Check Scanner Control Only
B	Modbus Communications Only
C	Profibus Communications Only
D	Modbus Communications and Self-Check Scanner Control
E	Profibus Communications and Self-Check Scanner Control
J	Modulating with Self-Check Scanner Control Only
K	Modulating with Modbus Communications Only
L	Modulating with Profibus Communications Only
M	Modulating with Modbus Communications and Self-Check Scanner Control
N	Modulating with Profibus Communications and Self-Check Scanner Control
X	None

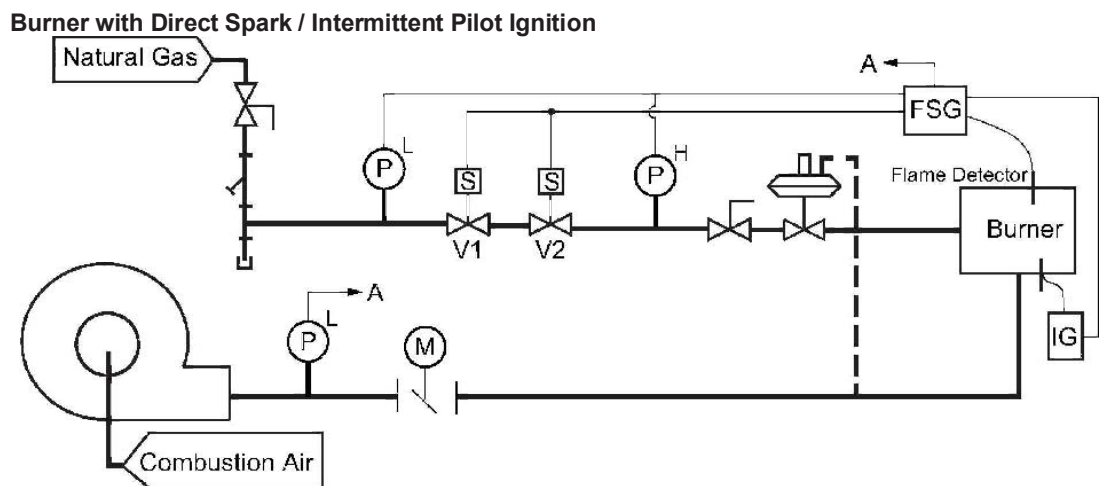
13 - Modulating Control Signal	
A	PWM
B	0-10 VDC
C	4-20 mA
X	None

14 - Actuator Stroke Time	
C	12.5 seconds
D	15 seconds
F	25 seconds
G	30 seconds
J	45 seconds
M	60 seconds
X	None

Typical System Diagram

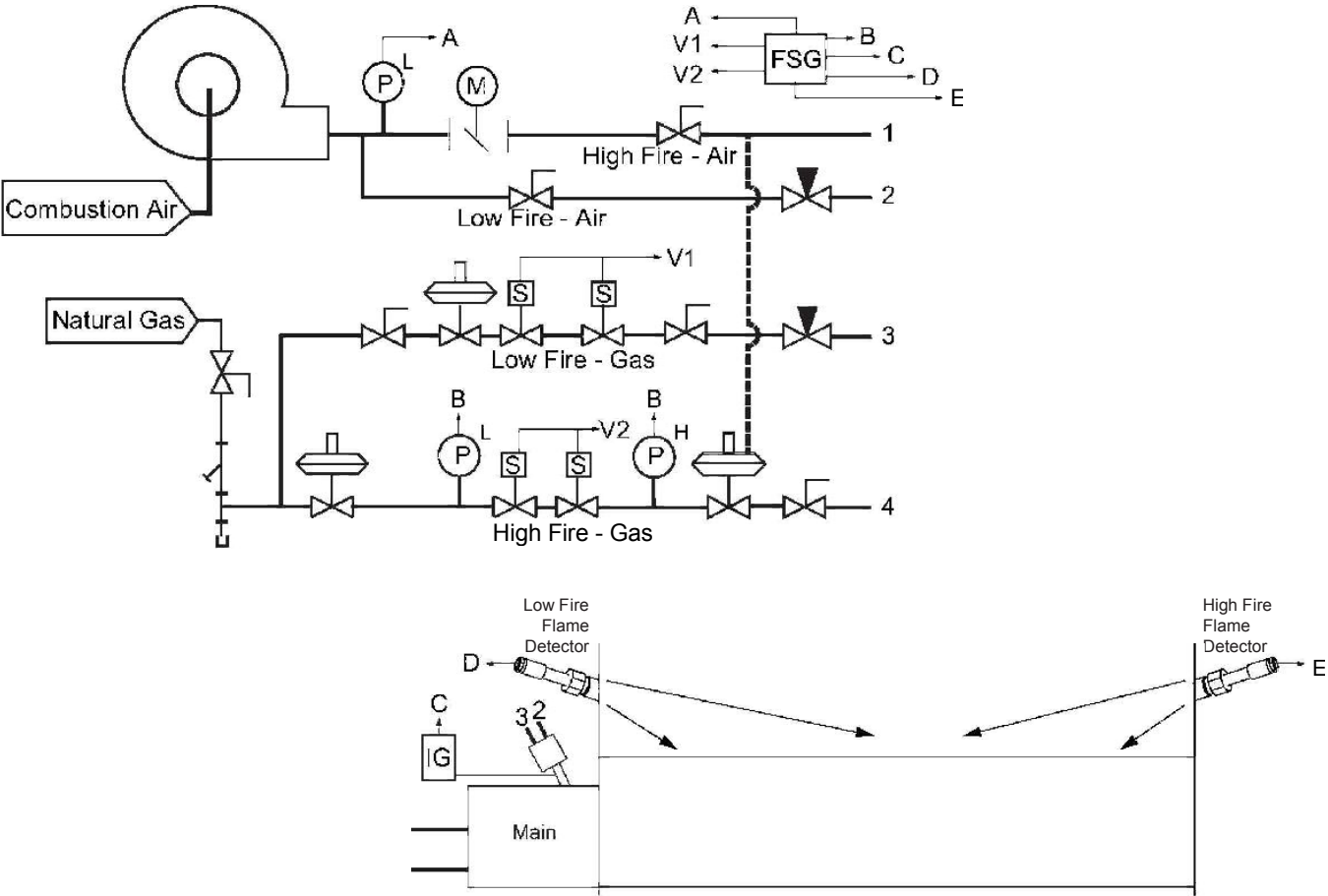


After the burner start signal, the fan is switched on and the air pressure is checked by the pressure switch. After the pre-purge time has lapsed, the ignition is switched on and the pilot valve(s), V1, is opened for the trial for ignition. After proof of pilot flame, the main valve(s), V2, is opened. See section 5, "Operational State Overview" for details on the complete sequence.



After the burner start signal, the fan is switched on and the air pressure is checked by the pressure switch. After the pre-purge time has lapsed, the ignition is switched on and the two valves V1 and V2 are opened together. See section 5, "Operational State Overview" for details on the complete sequence.

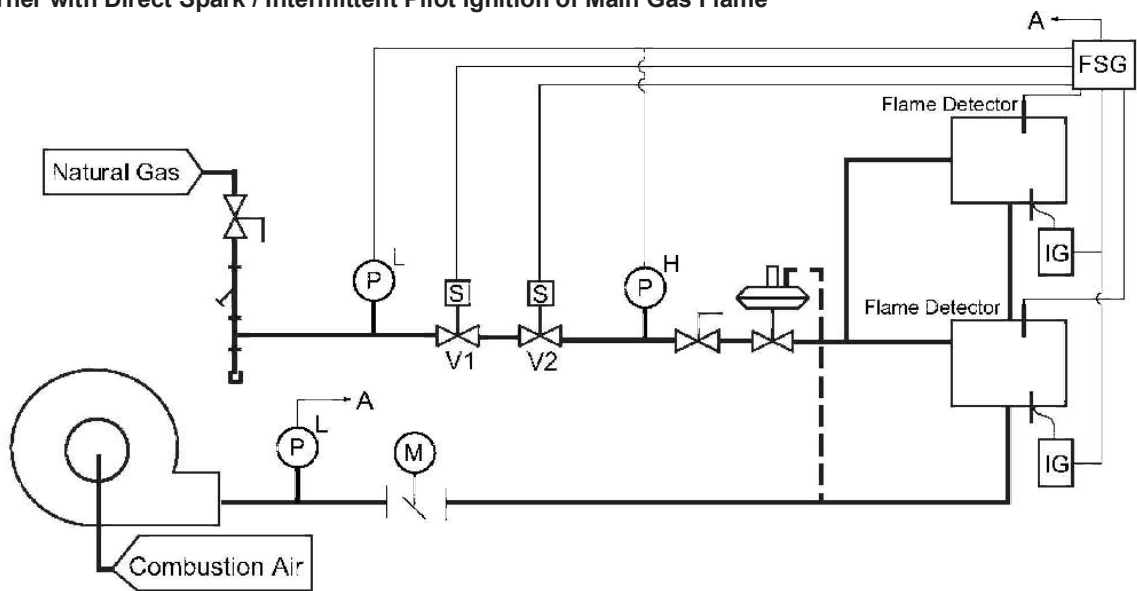
High-Low or Line Burner



1 4

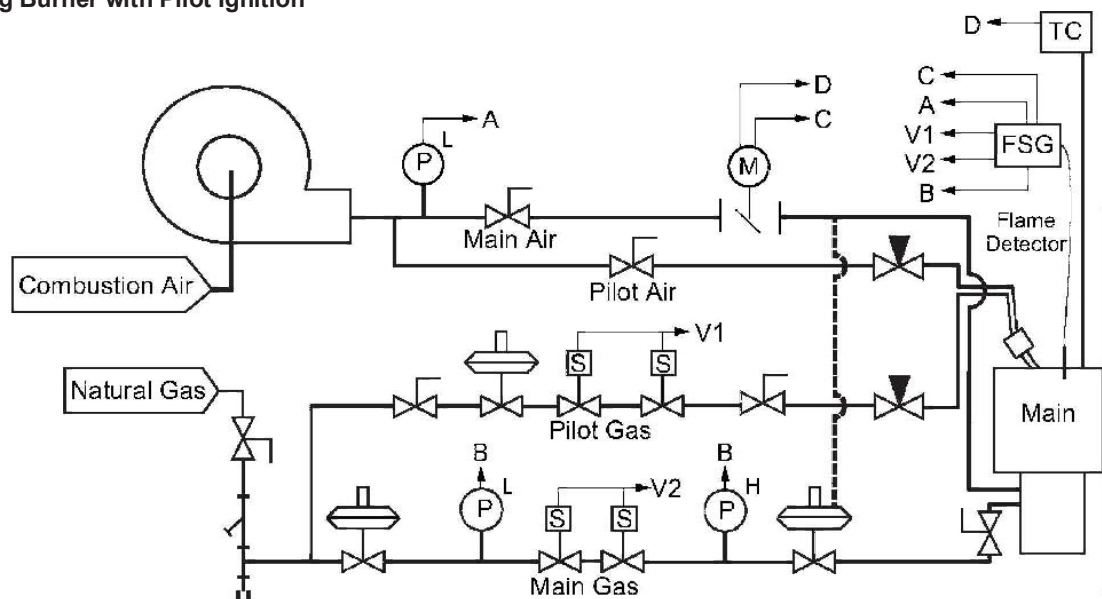
After the burner start signal, the fan is switched on and the air pressure is checked by the pressure switch. After the pre-purge time has lapsed, the ignition is switched on and the low fire valve, V1, is opened for the trial ignition. V1 stays open and V2 will open and close depending on the communication bus command. If two flame detectors are used, a valid signal from either detector will allow operation. A loss of signal from both detectors causes a shutdown. See section 5, "Operational State Overview" for details on the complete sequence

Dual burner with Direct Spark / Intermittent Pilot Ignition of Main Gas Flame



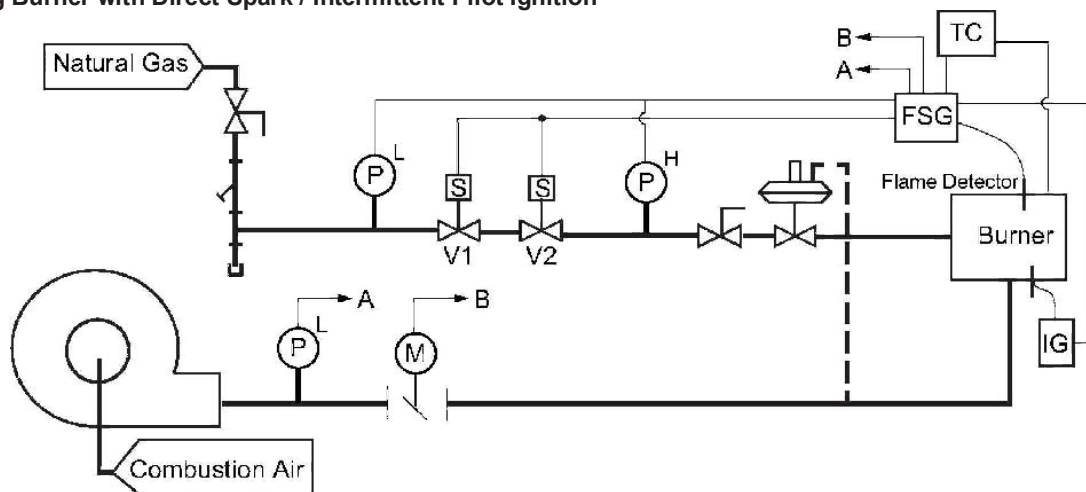
After the burner start signal, the fan is switched on and the air pressure is checked by the pressure switch. After the pre-purge time has lapsed, the ignition is switched on and the two valves V1 and V2 are opened together. On failure of either flame detector, both V1 and V2 are closed and both burners are shut-off. NOTE: Dual burner pilot ignition is also possible. See section 5, "Operational State Overview" for details on the complete sequence

Modulating Burner with Pilot Ignition



After the burner start signal, the fan is switched on and the air pressure is checked by the pressure switch. The actuator drives to the high fire position and remains here until the pre- purge time has elapsed. The actuator drives to the low fire position, the ignition is switched on and the pilot valve(s),V1, is opened for the trial for ignition. After proof of pilot flame, the main valve(s), V2, is opened and the burner will begin modulation based on feedback from the temperature controller. See section 5, "Operational State Overview" for details on the complete sequence

Modulating Burner with Direct Spark / Intermittent Pilot Ignition



After the burner start signal, the fan is switched on and the air pressure is checked by the pressure switch. The actuator drives to the high fire position and remains here until the pre- purge time has elapsed. The actuator then drives to the low fire position, the ignition is switched on and valves V1 and V2 are opened together for the trial for ignition. After proof of pilot flame, valves V1 and V2 will remain open and the burner will begin modulation based on feedback from the temperature controller. See section 5, "Operational State Overview" for details on the complete sequencez

Technical Data

2

General Mechanical	
Protection Rating of the Plastic Housing	Type 1: IP 42 (approximately equivalent to NEMA 12) Not UV (sunlight) protected Type 2: IP 54 (approximately equivalent to NEMA 3) Not UV (sunlight) protected
Protection Rating of the Metal Housing	Type 3: IP 65 (approximately equivalent to NEMA 4) Not UV (sunlight) protected ATTENTION: use suitable cable screw connectors only
Ambient Temperature	-20°C ... +60°C (-4°F ... +140°F) (UL Approval) -40°C ... +70°C (-40°F ... +158°F)
Storage and Transport	-40°C ... +80°C (-40°F ... +176°F)
Humidity	< 95%, no condensation permitted (tested to DIN 60730-1)
Useful Life of Switching Outputs	Minimum 250,000 switching operations
Mounting Position	as desired
Approximate Dimensions in mm (inches) (excluding cable screw connector)	Type 1 (L x H x T): 152.5 x 148.5 x 77 (6.0 x 5.9 x 3.0) Type 2 Purge / No Purge (L x H x T): 152.5 x 151.5 x 77 (6.0 x 6.0 x 3.0) Type 2 Modulating (L x H x T): 190 x 151.5 x 170 (7.5 x 6.0 x 6.7) Type 3 (L x H x T): 160 x 240 x 80 (6.3 x 9.5 x 3.2)
Weight in kg (lbs)	Type 1: 0.82 (1.8) Type 2 Purge / No Purge: 0.82 (1.8) Type 2 Modulating: 1.42 (3.13) Type 3: 2.2 (4.85)
Display	Type 1: 2 LEDs - 1 red, 1 yellow Type 2: 3-digit 7-segment display plus 3 LEDs Type 3: 3-digit 7-segment display plus 3 LEDs

General Electrical		
Rated Voltage	230 VAC -15% ... + 10% or 115 VAC -15% ... + 10%, depending on the version	
Frequency	50 Hz ... 60 Hz	
Fuse	6.3A slow-blow fuse or 10A fast-blow fuse, integrated, exchangeable	
Isolation	No galvanic isolation between mains and 24 VDC or 5 VDC	
Electrical Connection	ATTENTION: <ul style="list-style-type: none"> Assure correct line voltage and protective earth conductor connection according to the wiring diagram. The contact protection for the UV sensor must be guaranteed by mounting it in the operating equipment. Assure protection for the wiring and connector of the UV sensor through proper mechanical mounting and support. All connecting wires must be suitable for maximum expected temperatures and must not be rated less than 167°F (75°C). 	
Power Consumption (own consumption)	Maximum 10W Typically 115V 230V Standby 1.5W ... 1.8W Operation 3.4W ... 4.8W With communications or self-check option: Standby 3.3W ... 3.5W Operation 5.4W ... 6.3W	
Designation	Type of Input	Electrical Data
L1 Connection Over Replaceable Fuse Type 1 / Type 2	Power supply	L1 protected by integrated fuse, 6.3A slow-blow or 10A fast-blow
TWI Interface Type 1 /Type 2	TWI	Connection only for VisionBox and parameterization box NOT galvanically isolated!
Switch for Parameter Mode Type 1 /Type 2	2 - position switch	ON / OFF switch on flame safeguards (may only be switched after having removed the flame safeguard from the base)
User Interface Type 1 (without display)	One momentary switch	Confirm or reset
User Interface Types 2 and 3 (with display)	Four buttons	Reset, back, plus and minus

Spark generator connection

The T600 does not include an ignition transformer.
For suitable ignition transformers, see Datasheet 841 at www.eclipsenet.com/products/ignition_transformers. **ATTENTION:**
A special ignition transformer is required depending on the electrode arrangement (i.e. for single- electrode operation).

Outputs				
Designation	Safety-Related	Type of Output	Line Length	Electrical Data
V1 Main Gas Valve	•	Relay contact	Maximum 100 m (328 ft)	115/230 VAC / 2A cos ϕ = 1 (resistive) Minimum load 0.5W
V2 Safety Gas Valve	•	Relay contact	Maximum 100 m (328 ft)	115/230 VAC / 2A cos ϕ = 1 (resistive) Minimum load 0.5W
Ignition	•	Relay contact	Maximum 100 m (328 ft)	115/230 VAC / 1A cos ϕ = 0.4 corresponds to 115/230 VAC / 2.5A cos ϕ = 1 (resistive)
Fan	-	Relay contact	Maximum 100 m (328 ft)	115/230 VAC / 1A cos ϕ = 0.4 corresponds to 115/230 VAC / 2.5A cos ϕ = 1 (resistive)
Operation	-	Relay contact	Maximum 100 m (328 ft)	115/230 VAC / 1A cos ϕ = 1 (resistive)
Fault	-	Relay contact	Maximum 100 m (328 ft)	115/230 VAC / 1A cos ϕ = 1 (resistive)
Flame Detector Supply	-	For UV 41HE or UV 42	Maximum 100 m (328 ft)	230 VAC / 10 mA*
Modulating Outputs				
Fan Activation	-	PWM 4 kHz, without detection of speed feedback	Maximum 10 m (32.8 ft)	24 VDC (3 lines: GND, +24 VDC, PWM control signal)
Frequency Converter Activation	-	0...10 V	Maximum 10 m (32.8 ft)	10 VDC
Activation of Shutter	-	Switching contact	Maximum 100 m (328 ft)	24 VDC

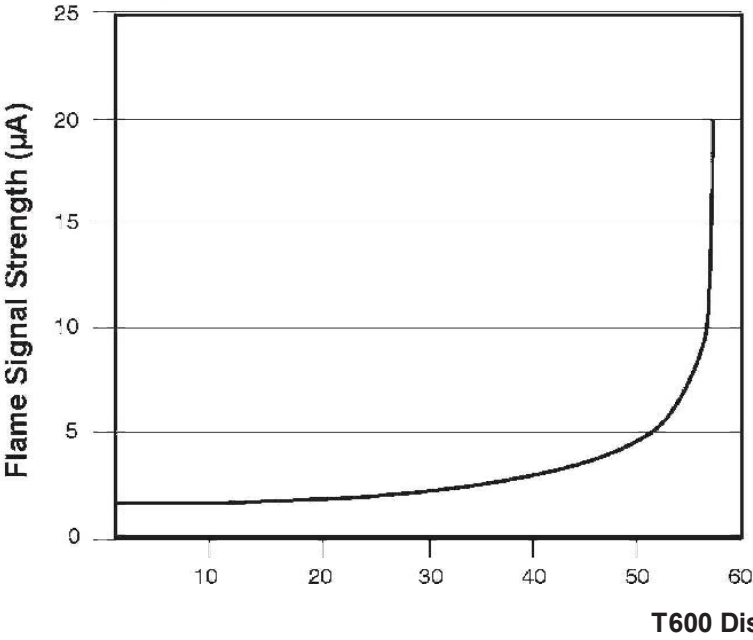
*The flame detector is always supplied with 230 VAC (even the 115 VAC version) via the T600 flame detector power supply, pin 7

The sum of the currents of all safety-related loads must not exceed 5 A! The sum of the currents of all loads must not exceed the installed fuse value

Inputs			
Designation	Type of Input	Line Length	Electrical Data
Safety Chain	Voltage-free (dry-contact)	Maximum 100 m (328 ft)	115 / 230 VAC / max. 10 A
Flame Detector 1 (Ionization)	Ionization for one- or two- probe operation	Maximum 10 m (32.8 ft)*	Threshold: ~ 1.2 gA Short-circuit current to N: 280 gA
Flame Detector 2 NO		Maximum 100 m (328 ft)	115 / 230 VAC "normally open"
Flame Detector 2 NC	Switching contact	Maximum 100 m (328 ft)	115 / 230 VAC "normally closed"
Burner Start	Switching contact	Maximum 100 m (328 ft)	115 / 230 VAC
Air Pressure Switch	Switching contact	Maximum 100 m (328 ft)	115 / 230 VAC
Remote Unlocking	Switching contact	Maximum 100 m (328 ft)	115 / 230 VAC
Modulating Inputs			
"High Fire" Feedback	Switching contact	Maximum 100 m (328 ft)	115/230 VAC
"Low Fire" Feedback	Switching contact	Maximum 100 m (328 ft)	115/230 VAC
Power +	Switching contact	Maximum 100 m (328 ft)	115/230 VAC
Power -	Switching contact	Maximum 100 m (328 ft)	115/230 VAC

*If the line length must be greater than 10 m (32.8 ft), an additional flame detector should be used.

Flame Signal Strength (current) vs. T600 Display



The quality of the flame signal is displayed for flame detector 1 as a number between 0 and 58. Evaluation of the flame signal is only possible with ionization flame monitoring. When using the UV 42, the maximum value is always displayed.

Approval Overview

Approval Overview	Order No.	CE	FM	UL Recognized	CAN/CSA- C22.2	GOST	AGA
T600 Type 1 / AC 115V	Configured	x	x	x	x	x	x
T600 Type 1 / AC 230V	Configured	x	x		x	x	x
T600 Type 2 / AC 115V	Configured	x	x	x	x	x	x
T600 Type 2 / AC 230V	Configured	x	x		x	x	x
T600 Type 3 / AC 115V	Configured	x	x	x	x	x	x
T600 Type 3 / AC 230V	Configured	x	x		x	x	x
Flame detector							
FLW 41I	101013621	x			x	x	x
UV 41HE	See page 104	x	x	x	x	x	x
UV 42	See page 106	x	x	x	x	x	x
UV 4x EM 1/1	101015404	x	x	x	x	x	x

Approvals

EC type-examination certificate according to the EC Gas Appliances Directive:

T600 Series CE-0085 BU 0487

EC type-examination certificate according to the EC Pressure Equipment Directive:

Directive:

T600 Series CE0036

FM Approved to FM 7610

UL Recognized Component per UL 372, UL 1998 and CAN/CSA-C22.2.

GOST/Rostekhnadzor

Suitable for applications up to SIL3

Meets the requirement according to IEC 61508 (2nd ed. 2011)

Certified by TUV Sud

AGA Certified to AS 4625-2005 and EN 298 - 2003

SIL (Safety Integrity Level)

600 Series from V1.1	UV 4x	UV 4x-EM1/1 (Shutter)	Components	SIL	SFF	PFH
x			Ionization input	3	99.48%	1.80E-09
x			Input Flame Sensor 2 NO, Flame Sensor 2 NC, Air pressure switch and remote unlocking	3	99.38%	1.80E-09
x	x		UV 41HE + ionization input	2	96.91%	1.50E-07
x	x		UV 42 + input Flame Sensor 2 NO	2	96.87%	1.51E-07
x	x	x	UV 4x-EM1/1 (shutter) + UV 41HE + ionization input	3	99.35%	3.15E-08
x	x	x	UV 4x-EM1/1 (Shutter) + UV 42 + input Flame Sensor 2 NO	3	99.34%	3.15E-08