SCC Inc.

LFS1… Flame Switch

Product Description

The LFS1… flame switch is used to send a signal to a PLC or other device when the connected flame detector senses a flame. It has a pair of contacts (one normally closed, one normally open) that change state when a flame is detected.

Features

- UL approved and SIL 3 rated for continuous operation with a flame rod
- UL approved and SIL 2 rated for intermittent operation with a UV scanner
- 0-10 VDC output for flame signal strength
- Multi-color LED provides operational status

Product Part Numbers

The following LFS1… flame switches are available:

Part Number	Flame Detector	Operating Voltage
LFS1.21A1	UV scanner or flame rod	120 VAC
LFS1.21A2		230 VAC

Accessories

AGK11.7   Plug-in base required with each LFS1… flame switch.

AGK65.1   Conduit holder with five M16 x 1.5mm threaded holes. This is
                              required to connect conduit to plug-in base AGK11.7.

ADP-M16XE500(5)   5-pack of M16 x 1.5mm to 1/2" NPSM metal conduit adapters
                              compatible with liquid-tight or EMT fittings.

QRA4.U   Ultraviolet flame scanner, forward viewing, normal sensitivity,
                              with 3/4" NPSM connection. For more information, see
                              Document No. n7711.

THERMAL-75X75   Thermal barrier for use with the QRA4.U flame scanner. Adapts
                              a 3/4" NPSM thread to a female 3/4" NPT connection. Rated
                              for scanner tube temperatures up to 280°F. For more
                              information, see Document No. QRA-1300.

AGG02   Heat insulating lens with spring washer and O-ring, for
                              applications where the temperature at the scanner will exceed
                              176°F, to be mounted inside thermal barrier THERMAL-75X75.
                              For more information, see Document No. QRA-1300.

Accessories (continued)

AZL23.00A9

Backlit programming display unit for any LFS1… flame switch. The AZL23.00A9 is required to adjust parameter settings.

TDCCOMBO

Pre-made 7-foot cable and adapter for connecting the AZL23.00A9 display to the LFS1… flame switch.

ARC466890660

RC unit required when using a flame rod on a system with an ungrounded neutral connection. Connects to terminal 2 (neutral) and the ground terminal on the AGK11.7 plug-in base.

KF8896

Adapter for replacing obsolete LFE10… burner controls with an LFS1… flame switch.

LFS1-DIN

Mounting kit used to connect LFS1… plug-in base AGK11.7 onto a DIN rail with a 15mm or greater depth. For more information, see Document No. LFS-1500.

Approvals

The LFS1… flame switch has the following approvals:

		with LEC1		DVGW	TÜV SÜD				FM Approvals
LFS1.21Ax	●	●	●	●	●	●	●	●	●	●

CE **Applied directives:**

- Low Voltage Directive   2014/35/EU
- Pressure Equipment Directive   2014/68/EC
- Gas Appliances Regulation (EU)   (EU) 2016/426
- Electromagnetic Compatibility EMC (immunity) *)   2014/30/EU

*) The compliance with EMC emission requirements must be checked after the flame safeguard is installed in equipment

EAC Conformity (Eurasian Conformity)

ISO 9001:2015
ISO 14001:2015
OHSAS 18001:2007

China RoHS
Hazardous substances table:
http://www.siemens.com/download?A6V10883536

The LFS1… flame switch has the following SIL ratings and parameters:

Table 2: LFS1… SIL Ratings and Parameters

Part Number	Flame Detector	SIL Rating	PFHD [1/h]	MTTFD [y]	SFF
LFS1.21Ax	Flame rod	SIL3	1.80E-08	6500	≥99%
	QRA4.U or QRA4.U and flame rod	SIL2	2.30E-07	510	≥99%

Wiring

Table 3: LFS1… Terminal Designations and Ratings

Terminal	Function	Rating	Parameter
1	Incoming power - line	LFS1.21A1 - 120V, 6.3A LFS1.21A2 - 230V, 6.3A	N/A
2	Incoming power - neutral	N/A	N/A
3	Flame rod signal	270 VAC 20 µA maximum	182
4	QRA ground (-)	N/A	N/A
5	QRA signal (+)	Extraneous light test - 290 VAC Normal operation - 250 VAC 700 µA maximum ≥ 20 µA required to register a flame signal ≤ 5 µA required to lose flame signal	N/A
6	Extraneous light test input	1 mA maximum	N/A
7	0-10 VDC output for flame signal strength	0.1 mA maximum Increments of 40 mVDC	699.00 699.01
9, 10	Normally closed (NC) relay output	1 A maximum 250 VAC, 125 VDC maximum	217.00 217.01
11, 12	Normally open (NO) relay output	1 A maximum 250 VAC, 125 VDC maximum	217.00 217.01
⏚	Incoming power – ground	N/A	N/A

Wiring (continued)
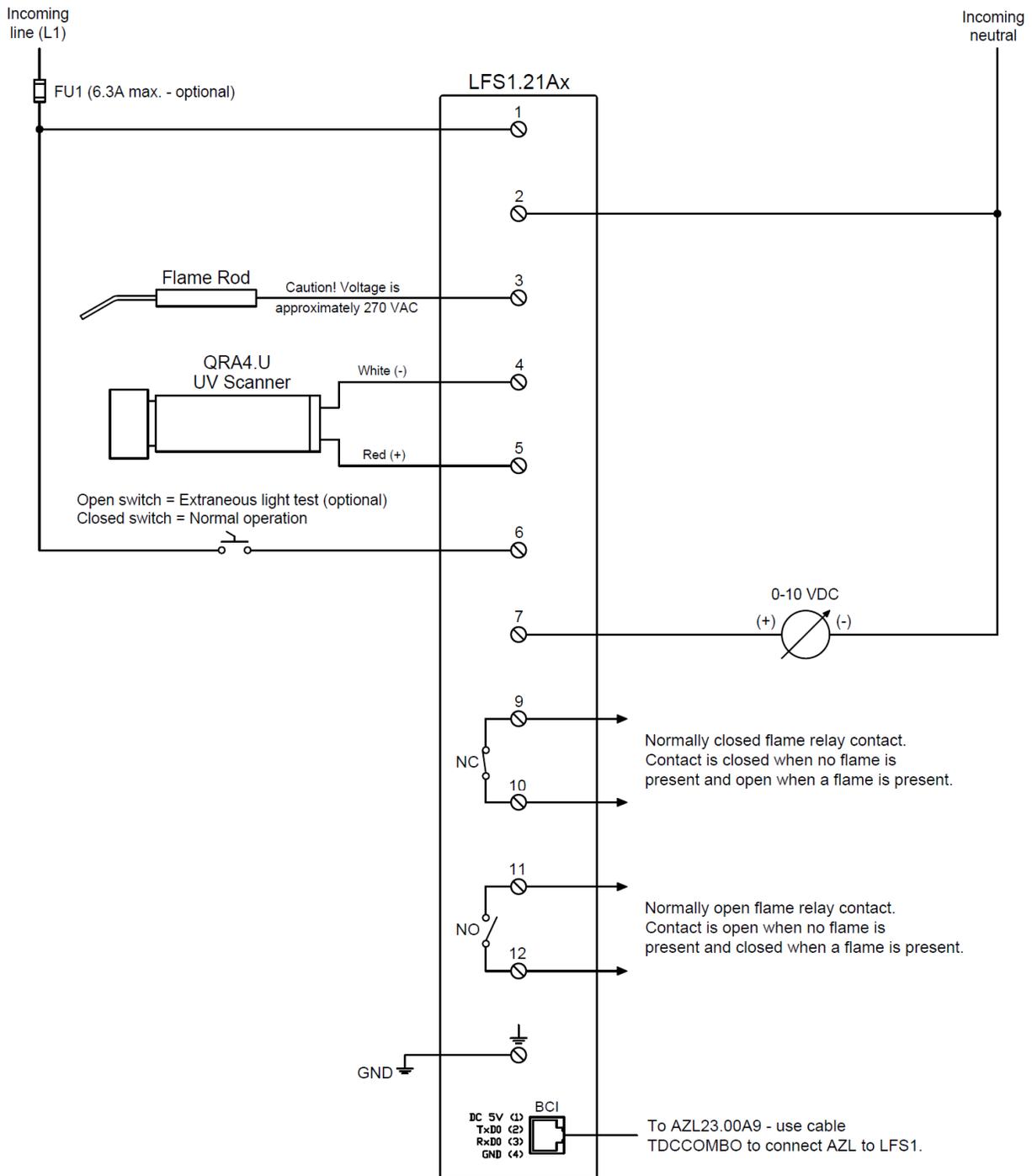
Notes:
1. There are three spare neutral terminals on the AGK11.7 wiring base directly connected to terminal 2.
2. There are four ground terminals on the AGK11.7 wiring base.
3. Terminal 31 on the AGK11.7 wiring base is not used.

Parameters

The LFS1… has several parameters that can be adjusted or viewed with the AZL23.00A9 display unit.

These parameters are broken up into three main groups by password access:

Info / Ser Level access does not require a password and encompasses all the parameters that an end user might have to view or adjust.

Service Level access does require a password and encompasses all the parameters that a service technician might need to access.

OEM Level access requires a different password than the service level, and enables the OEM to access all available parameters, including safety-related parameters.

The parameters on the LFS1… are organized into groups of 100. Each group of 100 is described below:

> 000: Changing passwords
> 100: General information / configuration
> 200: Flame response times
> 600: Analog output configuration
> 700: Fault history
> 900: Operational data

Some parameters have multiple indexes. For example, parameter 699 will initially display as 699:00 (index 0) but can be changed to 699:01 (index 1). To move between indexes, use the following procedure:

When first accessing parameter 699, 699:00 will display. The "699" will be flashing. Press the ENTER key once, and the "00" will begin flashing. Press the + or – key to move between the various indexes. To change the value stored in an index, press ENTER again and use the + or – key to change the value. Once the correct value is displayed, press ENTER to store it.


Figure 3: LFS1… Parameter Example with Indexes

Every LFS1… parameter is described thoroughly in the following LFS1… parameter list.

Sequence Diagram

The following sequence diagram illustrates when input and output terminals are expected to be energized or de-energized.

	Terminal	Description	NORMAL OPERATION			EXTRANEOUS LIGHT TEST	
			No Flame Signal Present	Flame Signal Present	Alarm	No Flame Signal Present	Flame Signal Present
		AZL Display	oP : P1	oP : P2	Loc...	oP : P1	oP : P2
INPUTS	1	Main Voltage	(Energized)	(Energized)	(Energized)	(Energized)	(Energized)
INPUTS	3 / 5	Flame Signal	X	(Energized)	X	X	(Energized)
INPUTS	6	Extraneous Light Test	(Energized)	(Energized)	(Energized)	X	X
OUTPUTS	7	0-10 VDC	0 VDC	Varies	0 VDC	0 VDC	Varies
OUTPUTS	9 / 10	NC Contact	(Energized)	X	(Energized)	(Energized)	X
OUTPUTS	11 / 12	NO Contact	X	(Energized)	X	X	X

Legend :   [Energized]   Energized
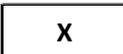
[X]   De-energized

Extraneous Light Test

Terminal 6 on the LFS1… can be used to activate or de-activate an extraneous light test when using a QRA4.U UV scanner. The purpose of the test is to check for a defective UV scanner that is sensing a flame when a flame is not present.

Terminal 6 is a line voltage input. Removing voltage from the terminal puts the LFS1… into extraneous light test mode. Applying voltage to terminal 6 puts the LFS1… into normal operation. When using a flame rod, line voltage should always be connected to terminal 6.

When the LFS1… is in extraneous light test mode, the voltage to the QRA4.U UV scanner is amplified to 290 VAC. During normal operation, the voltage on the QRA4.U is 250 VAC. The increased voltage on the scanner makes for a more stringent test and will find a scanner that is close to failing.

Table 5 below shows what happens during the extraneous light test depending on whether the QRA4.U UV scanner is sensing a flame.

Table 5: Extraneous Light Test

	Status LED	Position of NC Contact (9/10)	Position of NO Contact (11/12)	Display on AZL
No Flame Signal Present	Flashing yellow	Closed	Open	oP : P1
Flame Signal Present	Alternating yellow / green	Open	Open	oP : P2

The primary indicator that a flame signal has been detected during the extraneous light test is that the NC flame relay contact opens. When this happens, the flame scanner should be replaced.

Below is the sequence of operation for the extraneous light test:

1. The test should be conducted with the burner off.
2. Power is removed from terminal 6.
3. The normally open (NO) contact (terminals 11/12) opens, even if it was closed prior to removing power from terminal 6.
4. If the QRA4.U scanner is working properly, the normally closed (NC) contact (terminals 9/10) remains closed. If the QRA4.U scanner has failed, the normally closed (NC) contact opens.
5. Replace the QRA4.U scanner if it has failed.
6. Apply power to terminal 6 to end the extraneous light test.

Troubleshooting

The LFS1… has two possible fault codes that can occur.

Table 5: LFS1… Complete Fault Code List

Fault Code	No. of LED Blinks	Description	Corrective Action
10	10	This fault is a catchall and can be caused by a variety of issues, including wiring errors and internal LFS1… errors. It can also be caused by a short-circuited QRA4.U UV scanner.	Double-check all wiring. If using a UV scanner, unplug scanner and reset the fault. If the fault persists, replace the LFS1… flame switch.
167	15	A manual lockout was caused by pressing the Info button and any other button at the same time on the AZL23.	Reset the fault

When a fault occurs, the LED on the LFS1… will turn solid red. To determine what the fault code is, press and hold the button on the LFS1… for more than three seconds and then let go. The red LED will blink a certain number of times according to the table above. If an AZL23 is connected, the AZL23 will display "Loc" followed by the fault code. To reset the fault, press the button on the LFS1… for two seconds and then release.

The fault history is stored in the 700 set of parameters. These are only accessible with an AZL23 remote display. To access the 700 set of parameters on the AZL23, press and hold the Info button until "SEr" is displayed, then let go. The LFS1… stores the last two fault codes:

Parameter 701 displays information about the current status of the LFS1…
Parameter 702 displays information about the most recent fault.

Each fault code listed has indexes that provide additional information about the fault:

Index 00 = Fault code
Index 01 = Start number
Index 02 = Phase
Index 03 = Load

Index 01 will display a value of "._._". This means that the AZL23 display ran out of room to display the start number. When this happens, hold down the info button to display the value.

An example of how the AZL23 displays a fault code in the fault history is shown below:

Status LED

There is an LED on the front of the LFS1… that displays the current status of the flame switch. Table 4 below describes what each LED color code represents.

Table 4: Color Codes of the LFS1… Status LED

Color	Status
None	No operating voltage
Solid yellow	No valid flame signal
Solid green	Valid flame signal
Flashing green	Weak flame signal[1]
Flashing yellow	Extraneous light test active – no flame signal present
Alternating yellow/green	Extraneous light test active – flame signal present
Alternating yellow/red	Undervoltage (AZL displays Ph01)
Solid red	Alarm
Flickering red	Interface diagnostics mode[2]

1. A weak flame signal is less than 24 µA DC when using a UV scanner and less than 2 µA DC when using a flame rod.
2. Interface diagnostics mode is accessed by pressing and holding the reset button for more than three seconds. To exit interface diagnostics mode, press and hold the reset button again for more than three seconds.

Specifications

Electrical characteristics   Mains voltage
                                     - LFS1.21A1   85-132 VAC
                                     - LFS1.21A2   170-253 VAC
   Mains frequency   50-60 Hz
                                     Power consumption   5 VA
                                     External fuse (optional)   6.3 A max., 250 VAC
                                     Internal fuse between terminals 1.6 A, 250 VAC
                                        11 and 12 (non-replaceable)

Operating environment   Ambient temperature   -4 to 140°F [-20 to 60°C]
   Mounting position   Optional
                                     Degree of protection   IP40
                                     Weight   0.32 lb [145 g]

0-10 VDC Output Scaling

Terminal 7 on the LFS1… flame switch is a 0-10 VDC output based on the micro-amp signal being measured by the flame detector. The scaling of the 0-10 VDC output can be set via parameter 699.00 (when using a flame rod) or 699.01 (when using a QRA4.U). The scaling of the 0-10 VDC output has no effect on the flame signal strength safety thresholds. The two charts below should be used as a guide.
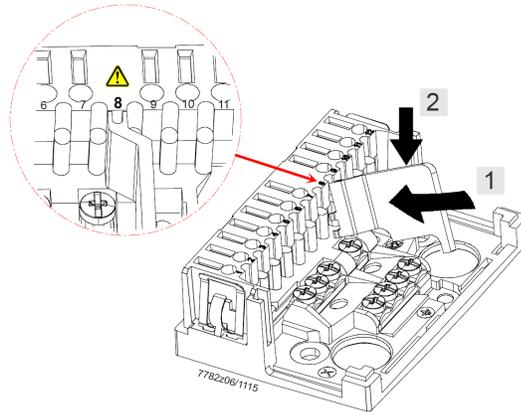

*) Factory setting
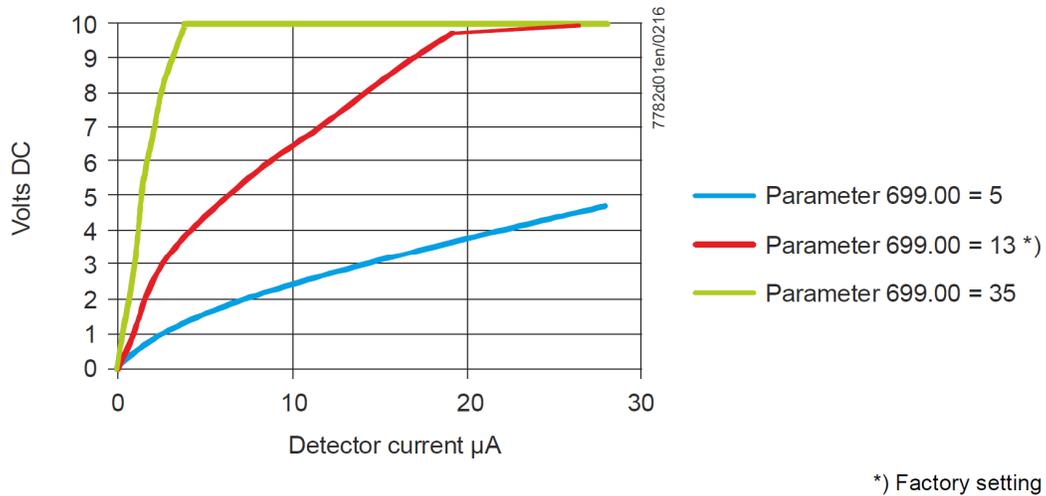
Figure 1: 0-10 VDC Output Scaling When Using a Flame Rod
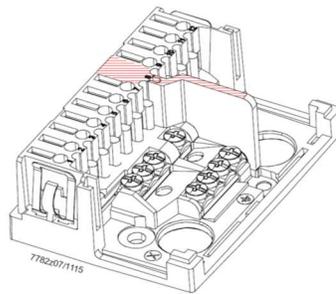

*) Factory setting
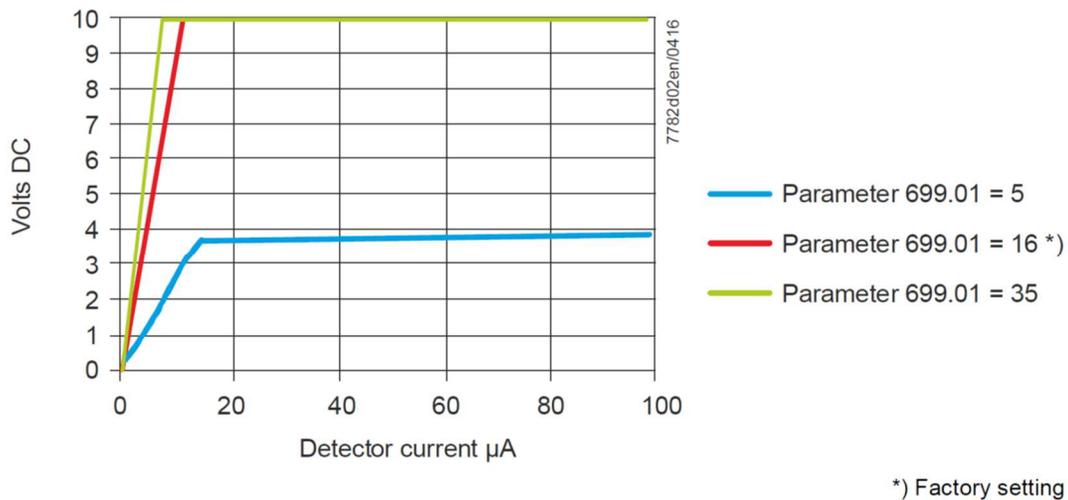
Figure 2: 0-10 VDC Output Scaling When Using a QRA4.U UV Scanner

Installation Notes

- The separating plate supplied with plug-in base AGK11.7 should be installed into terminal 8 as shown below.

The separating plate should be connected so that the top of the plate is level with the top of the plug-in base as indicated by the red hatched region shown below.

- When using the LFS1… flame switch in a system with a non-grounded neutral connection and a flame rod as the flame detector, RC unit ARC466890660 must be connected between terminal 2 and the ground terminal on plug-in base AGK11.7.

- Single electrode operation (using a common electrode for ignition and flame sensing) is not allowed.

- It is possible to connect both a flame rod and UV scanner to the LFS1… flame switch. If one or both flame detectors sense a flame, the LFS1… considers the burner to have a valid flame.

- When measuring the 0-10 VDC output on terminal 7, the measuring equipment should have at least a CAT III safety rating.

- If replacing an LFE10…, the ground connection on terminal 10 of the LFE10… wiring base must be removed.

Dimensions

LFS1.21Ax with Plug-in Base AGK11.7 and Conduit Holder AGK65.1

RESET BUTTON AND
STATUS LED

1.86
[47]

2.47
[63]

0.20
[5]

2.12
[54]

2.33
[59]

1.63
[42]

M16 x 1.5mm
CONDUIT CONNECTION
TYP.(5)

Ø0.87
[Ø22]

2.49
[63]

0.37
[9]

3.46
[88]

3.58
[91]

AGK11.7

Ø0.213 THRU
[Ø5.4]
TWO MOUNTING HOLES

Ø0.638 THRU
[Ø16.2]

0.413
[10.5]

0.945
[24.0]

0.945
[24.0]

1.181
[30.0]

1.181
[30.0]

3.46
[88.0]

Ø0.177 THRU
[Ø4.5]
FOR GROUND SCREW

0.157
[4.0]

0.669
[17.0]

0.925
[23.5]

2.46
[62.5]

1.12
[28.5]

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