Instruction Manual

Model Ultra FL800

Multi-spectrum Infrared Flame Detector

GASENSOR TECHNOLOGY

REV：MAN-Ultra FL800-A180404
P/N：GT-TD-MAN.04E

Warranty

GASENSOR TECHNOLOGY PTE. LTD.(hereinafter referred to as GASENSOR) will assume overall responsibilities for use, commissioning, service, maintenance and installation guidance of Ultra FL800 multi-spectrum infrared flame detector and offer two years warranty from the date of delivery under conditions of normal use and maintenance. All warranties are exclusive of unauthorized product replacement and repair without approval or consent of GASENSOR, product damage as a result of carelessness and improper installation and use of products with original trade mark being torn or replaced.

Important Notes

1. Before using this detector, please read the instruction manual carefully.
2. The detector operation and maintenance must be performed by trained qualified personnel. GASENSOR may provide such training.
3. Install the detector in strict accordance with the user's guide, and comply with the relevant laws, regulations and standards of respective country and enterprise so as to fully protect the safety of employees.
4. To ensure the best operating performance of detector, we suggest our customer to sign a long-term maintenance service contract with GASENSOR or their trained service personnel.

Contents

About This Manual

This manual describes in detail about the installation, operation and maintenance of GASENSOR's Ultra FL800 flame detector. The targeted audiences include installation personnel, field service personnel, MODBUS programmers and technical personnel involved in installation and usage of the flame detector.

Worthy Notes

Note: This manual provides additional information for example, solutions for exceptional circumstances, time saving tips and relevant information for reference.

Caution: This sign highlight that precautions shall be taken to prevent hazardous condition that may damage the equipment.

Warning: This sign highlight that precautions shall be taken to prevent hazardous conditions that may cause injury to personnel working on the equipment.

Format of MODBUS Register

MODBUS registers adopts hexadecimal system, expressed by 0x before a number or "h" after the number (e.g.: 0x000E or 000Eh).

Other Helpful Information

GASENSOR provides technical documents related to the company's full range of safety products which can be used in conjunction with Ultra FL800 instruction manual.

1. Preparing for installation

1.1 System Integrity Test

GASENSOR Technology strives to provide excellent quality products, services and solutions continuously to protect the lives and assets, benefiting the society from the dangers of hazardous fires, gases and vapors.

The safety products of GASENSOR should be handled with care. Their installation, calibration and maintenance shall be conducted according to the respective instruction manual. To ensure the optimum efficiency of instrument operations, GASENSOR recommends that the instruments be maintained in accordance with the given procedure.

1.2 Commissioning the Safety System

Before powering up, the wire connections, terminal connections and stability of the installations should be checked.

After the safety system has been started and gone through the factory specified "warm-up" phase, the signal output transmitted to or received from the equipment shall be within the manufacturer's specified range. The first calibration, verification and testing should be based on factory recommendations and guidance. The system shall be verified by a comprehensive, functional test of all supporting equipment of the safety system. This verification will ensure the system can alert when an alarm condition occurs and fault can be detected when the circuit fails.

1.3 Special Warnings

Warning: extreme caution should be taken when in the presence of toxic, combustible and flammable gas and vapors.

The flame detector manufactured by GASENSOR provides the best protection through experienced engineering design, testing, manufacturing process and rigorous quality control. The user shall be responsible for maintaining good operating condition of the flame detector system.

Some components and parts of Ultra FL800 can be damaged by static electricity.

To avoid electrostatic damage, take special care for system connection and ensure to make contact with the wiring terminal only. Ultra FL800 is an explosion proof rated (XP) detector, which can be applied in hazardous locations. Conduit seals or cable gland with gasket joint that is explosion proof rated must be used to ensure that the explosion-proof properties of Ultra FL800 is maintained and to prevent water from entering the system from the conduit or joints at cable glands.

Room temperature vulcanization (RTV) silicon rubber is not moisture proof and when used, it can cause damage to the housing and the internal component of the instrument. A damaged Ultra FL800 cannot be used in a hazardous environment. Such damage includes fractures of the enclosure, cracks in the internal components and protective seals.

1.4 Glossary of Terms

Table 1: Glossary

Term/ abbreviation	Definition
A	Ampere
AC	Alternating current
ANN	Artificial neural network
AWG	American Wire Gauge
Baud rate	The number of signal level changes per second in a line, no matter what the information contents of these signals are.
bps	Bits per second
Armored cable	Cables with intersecting or corrugated armor layer which provide the positive ground of cable armor.
Shielded cable	There is a mesh layer outside the cable
COM	DC ground
COPS	Continuous optical path scanning
CR	Control room
CRC	Cyclic redundancy check
DC	Direct current
DCS	Distributed control system
De-Energized	Disconnected from the power supply
DSP	Digital signal processor
EEPROM	Electrically erasable programmable read only memory
EMI	Electromagnetic interference
Energized	Apply voltage or power
FOV	Field of View
FS	Full scale
GASENSOR	GASENSOR TECHNOLOGY PTE. LTD.
HART	Communication protocol of remote high speed addressable transmitter
Hex	Hexadecimal number
I/O	Input/output
Instrumentation grounding	Grounding with earth wire
Latching	The normally open contact of the relay is still in the closed position, even if the alarm condition no longer exists.
LED	Light-emitting diode

LSB	least significant bit
mA	Milliampere,1/1000 ampere
Host	Controls one or more equipment or processes
MODBUS	Master-slave computer communication protocol
N/A	Not available
NC	Normally closed
NO	Normal open
Non-latching	The relay is reset to the initial state after the alarm condition is removed.
NPT	National Pipe Thread
OV return	Overvoltage return
0VDC	Common ground of power supply
Oxidation	Chemical reaction with oxygen
PCB	Printed circuit board
PLC	Programmable Logic controller
ppm	Parts per million
RFI	Radio frequency interference
RMS	Root-mean-square
ROM	Read-only memory
RTV	Room temperature vulcanization
Safety ground	Grounding to Earth
Slave	One or more equipment or processes controlled by the host
SMT	Surface mounting technology
SPDT	Single pole, double throw
SPST	Single pole, single-throw
TB	Terminal Board
V	Volt
VAC	Voltage Alternating current
VDC	Voltage Direct current
XP	Explosion proof

2. Product Overview

2.1 General

Ultra FL800 manufactured by GASENSOR is a multispectral infrared (MSIR) flame detector. The Ultra FL800 adopts advanced infrared detection technology with artificial neural network (ANN) to process the signals, which is highly immune to false alarms caused by the lightning, sunlight reflection, hot objects, arc welding and other radiation sources. In addition, the Ultra FL800 can penetrate or punch through the smoky fires caused by the burning of diesel oil, rubber and etc.

Ultra FL800 is certified explosion proof for use in both hazardous and safe areas (refer to section 6.2).

2.2 Performance and Advantages

Anti-false alarm capability: The product adopts the technique of intelligence artificial neural network with carefully selected Infrared sensor filters, which provides the most reliable ability of flame detection and minimized the probability of false alarms. See section 6.3 for the anti-false alarm capability.

Wide field of vision: Large area of coverage, no blind spot.

Modular design: Reduces the overall cost of installation and maintenance.

Continuous Optical Path Scanning (COPS): Regular optical path checking to ensure unobstructed view.

0-20mA analog output: Transmit alarm and fault signals to the remote display, computer or other host device such as an alarm station or main controller.

Dual redundant MODBUS RS-485 user interface: monitor the Ultra FL800 with 2 redundant channels. Users can use this interface for remote operation, change the setting of alarm and warning relay, eliminate selective fault, erase the error counters, change baud rates, change data formats for serial communication lines.

HART protocol (optional HART configuration): The Ultra FL800 instrument equipped with HART configuration supports the HART communication protocol (version 7). User can transmit the diagnostic message, equipment state information with this protocol and improve the efficiency of remote communication.

2.3 Principle of Operation

Ultra FL800 is a multispectral infrared flame detector with the function of intelligent recognition algorithms. And it makes use of infrared sensors that are able to detect infrared rays with different wavelengths. The integrated analysis of these features makes the detector highly resistant to false alarms. The ANN system can distinguish the signal sent by the sensor as the fire alarm signal or the non-fire alarm signal. The detector will output the result as follows:

- 0-20mA signal (3.5 to 20mA when with HART)
- Trigger real time Warning relay contact
- Trigger delayed alarm relay contact
- Trigger fault relay contact

- MODBUS output
- Redundant MODBUS output

(Refer to chapter 3 for more information of detector output).

2.4 LED Indicators

Three LEDs can be seen from the front window of the detector. These LEDs indicate the current operating mode of the detector. The following table shows the flashing sequence of LEDs under different operation modes.

Table 2: Flashing Sequence of the LEDs under Different Operation Conditions.

Serial number	Status	Green	Yellow	Red	Remarks
1	Power up	3 LEDs flashing once per second, continue for 15s			
2	Ready state	On	Off	Off	
3	Fault of optical path	Off	Flashing once per second	Off	
4	Other fault	Off	On	Off	
5	Test Mode Activated	On	On	Off	
6	Test Mode Warning	On	On	Flashing once per second	
7	Test Mode Alarm	On	On	On	
8	Warning	On	Off	Flashing once per second	
9	Alarm	On	Off	On	

2.5 Continuous Optical Path Scanning

Ultra FL800 flame detector has the function of continuous optical path scan, which self-checks the optical path, sensors and relevant electronic circuit every 2 minutes. If there is object on the front window surface of detector leading to retardation of the optical path, the detector will send signal representing optical path fault after 4 minutes. The output current from the detector will be 2.0mA (HART is 3.5 mA). When optical path fault occurs, fault relay is energized, in the meantime this status is transmitted by MODBUS (RS-485). The optical path self-check interval is raised to 20 seconds from 2 minutes after the occurrence of an optical path fault. Only after the obstacle is eliminated, the self-check interval will be restored to 2 minutes.

Caution: Blocked or dirty window may greatly reduce the visual angle and detection range of the detector.

Note: The optical path is checked once every 2 minutes and only after 2 consecutive check failures would trigger a fault signal output. Therefore it takes at least 4 minutes to detect a fault of optical path.

2.6 Test Mode Activation

Note: Actual flame cannot be detected when Ultra FL800 is in the test mode.

Ultra FL800 can initiate a special test mode where user can check the response of the instrument in the absence of ignition source. Once the test mode is activated, the detector can only respond to the test lamp as a simulated flame source.

The following four methods can be used to activate the Ultra FL800 test mode:

1. Flame test lamp flashing.
2. Momentary grounding of the test wire.
3. MODBUS command.
4. HART command (it can be used only if equipped with HART option).

2.7 Test Mode Activation with Test Lamp

Table 3: Test Mode Activation through Test Lamp

Phase	Operation	Duration (s)	LED Status (Refer to Table 2)	Current (mA)	Relay
0	Test lamp continuously flashing.	5-8	Ready state	4.5	\
1		6	Test Mode Activated	8	\
2		User setting delay	Test Mode Warning	16	Warning Relay Action
3		120	Test Mode Alarm	20	Alarm Relay Action
4	The test time out or test lamp is interrupted.	\	Ready state	4.5	Warning/ Alarm Reset or Latched

When the Ultra FL800 flame detector is in monitoring mode, user can use GASENSOR flame test lamp to activate test mode of the detector. After the test lamp is turned on and kept shining on the flame detector for a period of 5-8 seconds, the flame detector status will go from Phase 0 to Phase 1 as stated in Table 3.

After Ultra FL800 has entered test mode, continue to shine flame test lamp towards the front window of the detector, it will response as following:

- 6 seconds later, flame detector goes into Phase 2, LED indicates “Test Mode Warning” state, warning relay takes action.
- After the user selected delay (0-15s Refer to Table 17 for more details), device goes into

Phase 3, LED indicates “Test Mode Alarm” state, and alarm relay takes action.

- Test Mode Alarm state will last for 120 seconds, the Ultra FL800 will then enter Phase 4 and returns to the flame detection Ready state.

Note: The detector does not detect the flame when in test mode. If the test lamp is interrupted for more than 3 seconds, the test procedure will be discontinued, and the instrument will return to the Ready state. If the relay is latched, it can only be reset through the reset relay wire (refer to 3.6.3) or MODBUS command (refer to 3.6.9).

The detector Test Mode can only be re-activated by the flame test lamp after a 10 seconds delay once the alarm condition has returned to the Ready state.

2.8 Test Mode Activation through Grounding of Test Wire or MODBUS Command

Table 4: Test Mode Activation through Manual Command

Phase	Operation	Duration (s)	LED Status (Refer to Table 2)	Current (mA)	Relay
0	\	\	Ready state	4.5	\
1	Test wire grounded or MODBUS command start.	5-8	Test Mode Activated	8	\
2	Test wire kept grounded. Test lamp continuously flashing.	User setting delay	Test Mode Warning	8	\
3		120	Test Mode Alarm	8	\
4	The test time out or test terminated. Test wire ungrounded.	\	Ready state	4.5	\

Test wire shorted to ground (see 3.6.4) or apply MODBUS (see 3.6.9) test activation command to control Ultra FL800 flame detector to go from Phase 0 to Phase 1 as stated in Table 4. However, if the test lamp is not applied to the Ultra FL800 flame detector during test mode, the test mode will be exited after 3 minutes.

Once Ultra FL800 is led into the test mode by Grounding of test wire momentarily or MODBUS test activation command, continue to shine the test lamp towards the front window of the detector, it will response as following:

- After the test lamp has been shining for 5-8 seconds flame detector goes into Phase 2, LED indicates “Test Mode Warning” state, warning relay does not take action.
- After the user selected delay (0-15s Refer to Table 17 for more details), device goes into Phase3, LED indicates “Test Mode Alarm” state, and alarm relay does not take action.
- Test Mode Alarm state will last for 120 seconds, the Ultra FL800 will then enter Phase 4 and returns to the flame detection Ready state.

Note:

The detector does not detect the flame when in test mode. If the test lamp is interrupted for more than 3 seconds, or the test procedure is terminated through test wire or MODBUS command, then the instrument will return to the Ready state.
The detector Test Mode can only be re-activated by the flame test lamp after a 10 seconds delay once the alarm condition has returned to the Ready state.

3. Installation

Caution: some components in the Ultra FL800 can be damaged by static electricity, electrostatic protection should be used when handling and installing this instrument.

Note:

1. Only trained and qualified personnel for HART communication protocol may install and use HART configuration of the Ultra FL800 detector.
2. Only trained and authorized users may configure the Ultra FL800 detector.

The basic procedure of installation is listed in the following sections. The installation procedures may vary according to the different configurations of the site.

3.1 Unpacking the Instrument

All equipment supplied by GASENSOR is packed in the shockproof boxes to prevent from physical damage. Handle with care when unpacking and check according to enclosed packing list. Please contact GASENSOR if the instrument is damaged or differs from the purchase order.

Note: Each Ultra FL800 flame detector has been fully tested in the factory, but the entire system should be inspected to ensure the integrity of the system when activating initially.

3.2 Installation Requirements

The following guidelines must be followed when installing the instrument:

1. It is strictly prohibited to remove the housing cover when the detector is powered up “live” while in a hazardous location installation.
2. The detector has a strong ability to resist radio interference, but it shall be installed as far as possible to the radio transmitter or similar equipment.
3. The detector shall be installed away from the heat or light source.
4. Detectors installed outdoors and under the direct heat from the sun should be covered with a sun shade.
5. The detector should be installed in a convenient location for visual inspection, testing and cleaning to be carried out.
6. Before installation, make sure the field space size meets the requirement of the detector.

7. Detectors should be installed tilting down, to prevent dirt, water and moisture from accumulating on the windows.
8. The detector should be installed in the proper place to prevent the personnel or other objects from blocking its field of view.
9. The casing of detector must be reliably grounded.
10. Detector interface thread is 3/4 "NPT, unused cable interface shall be sealed with certified explosion-proof plug.
11. It is recommended that the RVVP3×1.5mm^{2}cables should be used for the connection of the instrument and system.
12. If the Ultra FL800 cable interface is *hard-wired*, the conduits must be sealed or contain a drain circuit.
13. If Ultra FL800 cable interface is connected by a hose, it must be introduced with a cable gland. The hose connections threads of cable gland fittings can be G1 / 2 ", G3 / 4", 1/2 "NPT, 3/4" NPT, etc. and should be confirmed when placing order.

3.3 Guidelines for Installation Location

A great variety of factors should be considered when choosing installation location for the detector. There are no fix rules to determine the optimum position for installing the detector to ensure the correct detection of the flame. However, the following general recommendations should be considered in case the detector needs to be installed in special location.

3.3.1 Field of View

Maximum detection range of Ultra FL800 is up to 65 meters. The vertex of the view is in the center of the detector. Horizontal viewing angle is measured through the horizontal plane of the central axis of the detector, while the vertical viewing angle is measured through the vertical plane of the same central axis. Both horizontal and vertical viewing angles of Ultra FL800 are classified into high-sensitivity area, medium sensitivity area and low sensitivity area. (As shown in Fig1 to Fig6)

Table 5: The Maximum Viewing Angle Covered by the High Sensitivity Area

Horizontal viewing angle		**Vertical viewing angle**	
Maximum detection range	Maximum detection visual angle	Maximum detection range	Maximum detection visual angle
65m (213ft)	90°	65m (213ft)	90°
35m (115ft)	100°	35m (115ft)	100°
15m (49ft)	90°	15m (49ft)	90°

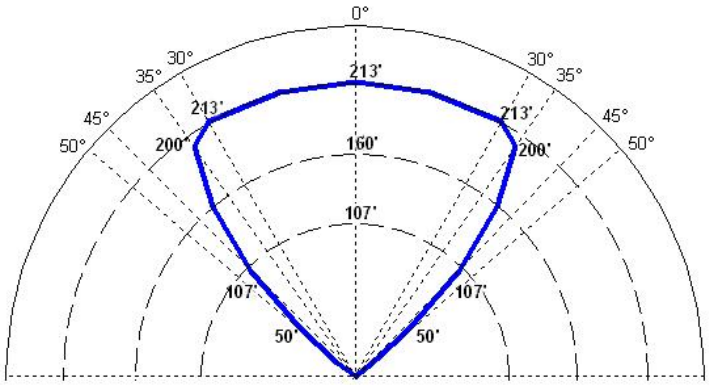

Figure 1: Horizontal Viewing Angle - n-heptane - high sensitivity

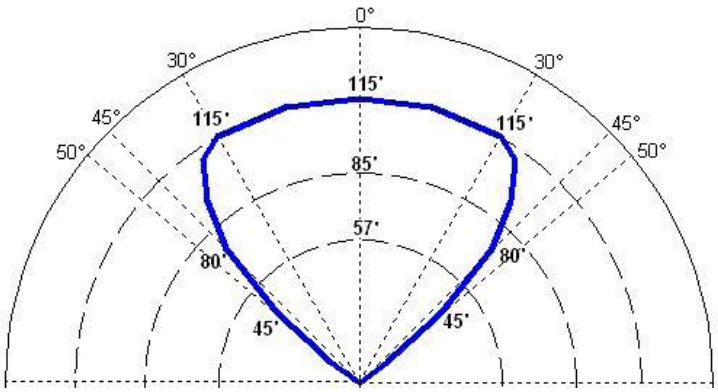

Figure 2: Horizontal Viewing Angle - n-heptane - middle sensitivity

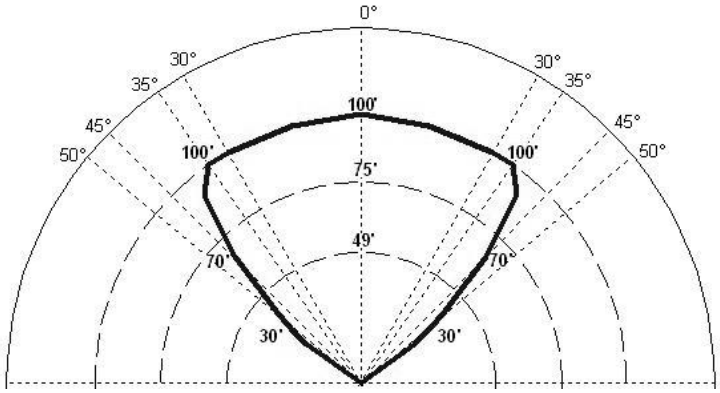

Figure 3: Horizontal Viewing Angle - n-heptane - low sensitivity

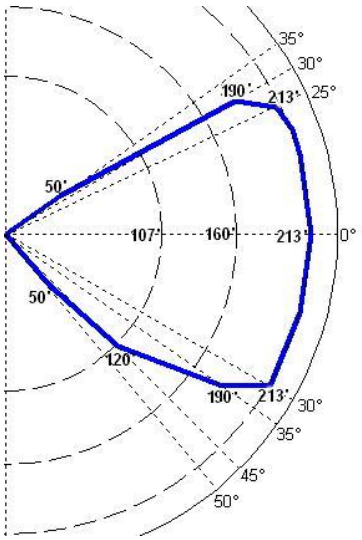

Figure 4: Vertical Viewing Angle - n-heptane - high sensitivity

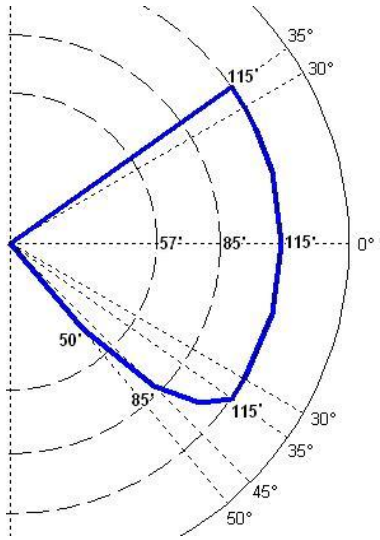

Figure 5: Vertical Viewing Angle -n-heptane -middle sensitivity

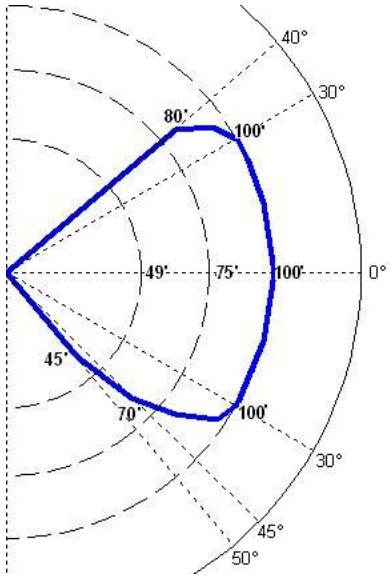

Figure 6: Vertical Viewing Angle -n-heptane -low sensitivity

Caution: The maximum viewing angle is at which the Ultra FL800 can detect a flame at 50% of its maximum distance.

3.3.2 Sensitivity Range

Range of the detector is affected by flame strength. The detector can detect up to the maximum range of 65 meters when the flame is caused by combustion of n-heptane with a surface area of 1 square foot. The detection range at various sensitivity setting is shown in the table below:

Table 6: The Detection Range for Different Sensitivity setting of n-heptane

Sensitivity setting	Detection range (m)
Low	15
Medium	35
High	65

3.3.3 Environmental Factors

- When installing the detector the user need to pay attention to environment temperature (Refer to Section 6.1.5, Environmental Requirements). The temperature of detector can increase beyond the specified temperature range if it is installed outdoor or other place that is directly under the sunshine. In such case, the sun shade should be installed, to make sure the temperature of detector within the stipulated temperature range limit, and also to ensure that any obstacles around the detector will not affect its viewing angle.
- Prevent icing over the window of detector, icing over the window of the detector may lead to fault situations.
- Sunlight shining on the window of the Ultra FL800 detector will reduce the detection range.

3.4 Field Wiring Procedures

Figure 7: Detector Base

Operate in accordance with the following procedures:

1. Loosen the set screw and remove the rear cover of housing.
2. Connect the wires as shown in Table 7.
3. Reassemble the instrument.

3.5 Detector Installation

The circuit board of the Ultra FL800 is installed in an explosion proof casing; see Section 6.2 for the explosive-proof grade.

Note: If the detector is installed in a very dirty environment, the window should be regularly checked, cleaned and its sensitivity shall be verified.

Warning: GASENSOR requests that the conduits used for Ultra FL800 must be sealed according to the explosion proof requirements. The plug or cable gland with gasket joint with explosion-proof shall be used to prevent the water from entering the enclosure and damage the electronic circuitries.

Ultra FL800 should be installed as shown in figure 8; the external dimensions of the product are shown in figure 9.

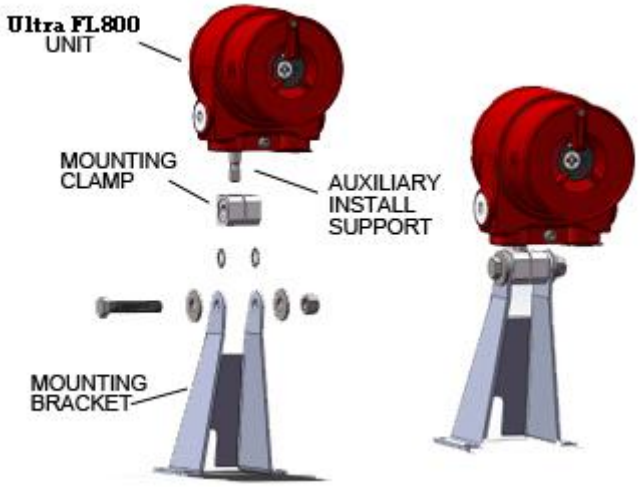

Figure 8: The Installation of the Detector

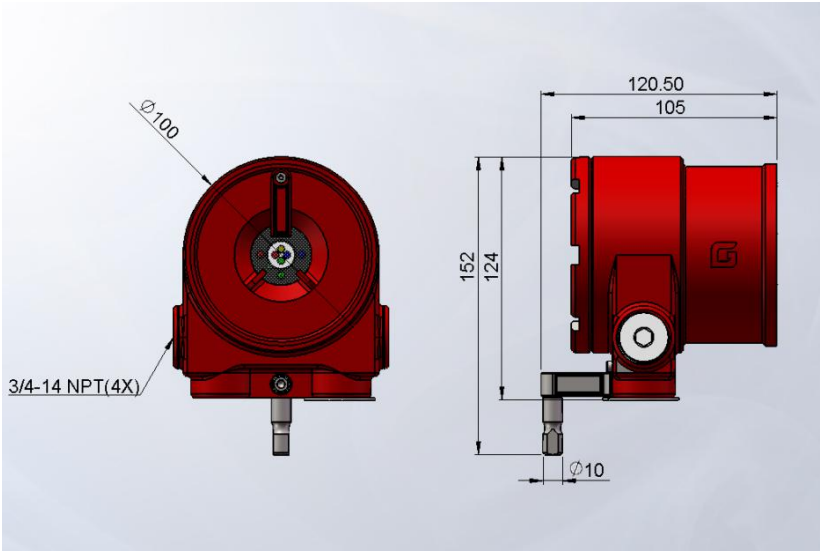

Figure 9: Dimensions (mm)

Note: When reinstalling the threaded plug, a non-hardened thread sealant shall be used to maintain the degree of protection.

3.6 Terminal Connections

All wires are connected to the field panel through a 3/4 "NPT explosion-proof compartment located at the base of the enclosure.

The multi-strand or single-strand wire with cross-sectional area of 14AWG (2.08mm^2) to 22AWG (0.33 mm^2) can be used.

Each wire should be stripped in accordance with Figure 10. Insert the metal part of the stripped wire into the corresponding terminal and tighten the screw to fix the wire.

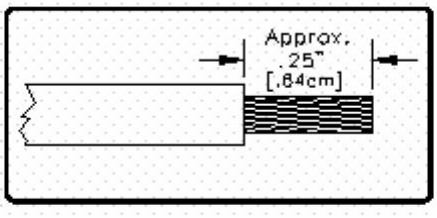

Figure 10: The Length of Stripped Wire

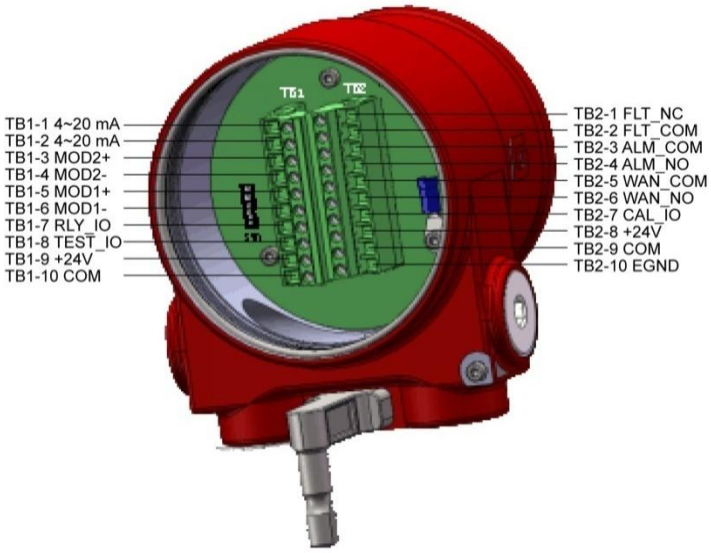

Figure 11: Wiring Instruction

Name of the terminals are shown in Table 7.
The serial numbers of terminals in Figure 11 are in order of 1 to 10 from top to bottom.

Table 7: Field Wiring Board Connection

Terminal - TB1			Terminal - TB2		
No.	**Terminal Name**	**Terminal Function**	**No.**	**Terminal Name**	**Terminal Function**
1	4-20mA	Current Output	**1**	FLT_NC	Fault Relay
2	4-20mA	Current Output	**2**	FLT_COM	Fault Relay COM

3	MOD2+	MODBUS Communication	**3**	ALM_COM	Alarm Relay COM
4	MOD2-		**4**	ALM_NO	Alarm Relay
5	MOD1+		**5**	WAN_COM	Warning Relay COM
6	MOD1-		**6**	WAN_NO	Warning Relay
7	RLY_IO	Relay Reset	**7**	CAL_IO	Communication Reset
8	TEST_IO	Test Mode Activate	**8**	+24V	Positive Power Supply
9	+24V	Positive Power Supply	**9**	COM	Negative Power Supply
10	COM	Negative power supply	**10**	EGND	Chassis Ground

3.6.1 Relay

The alarm output can be delayed for 0, 5, 10 or 15 seconds. Time delay can be set through MODBUS (RS-485) or Dip Switch (Table 17).

Detector gets into the warning state once a fire is detected. Detector will go into the alarm state if the flame exists for more than the time delay interval setting by the user.

3.6.2 Relay Protection

The inductive load connected to the alarm, warning and fault relay (electric bell, buzzer, relay, compressor, solenoid valve, etc.) must be equipped with overvoltage protection as shown in figure 12. The voltage peak produced by the inductive load can be more than 1000 volts. Such high voltage without over voltage protection can lead to false alarms and could possibly damage the relays.

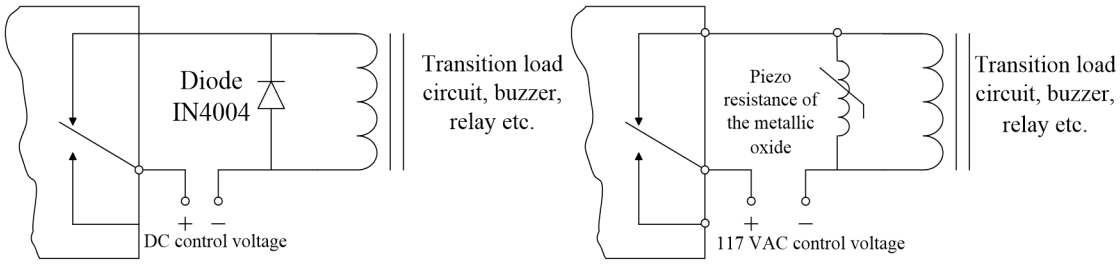

Figure 12: Protective Circuit of the Relay Contact

3.6.3 Relay Reset

Table 8: Relay Reset Terminal

Terminal Board	Connection Point	Name of Terminal	Functional Setting
TB1	7	RLY_IO	Reset the relay

Connect one end of a wire to the TB1 connection point 7 and the other end to the TB1 connection point 10. The reset function will be activated; the latching warning and alarm relay will be reset once the wire is connected.

3.6.4 Test Mode Activation

Table 9: Terminal of Test Mode

Terminal Board	Connection Point	Name of Terminal	Functional Setting
TB1	8	TEST_IO	Test mode activated

Connect one end of normally open switch to terminal 8 of TB1, the other end to terminal 10 of TB1, when switch is closed the test mode will be activated, output current of Ultra FL800 is 8mA. Then align the test lamp with UltraFL800 flame detector and then continue to expose the light onto the detector, when the detector detects the test light, the current output will be maintained at 8mA, alarm and warning relay will not be activated. The detector will return to normal operation mode if the switch is turned off.

3.6.5 Communication Reset

Table 10: Communication Reset Terminal

Terminal board	Connection point	Name of Terminal	Functional Setting
TB2	7	CAL_IO	Communication Reset

During operation, connect one end of a normally open switch to terminal 7 of TB2 and the other end to terminal 9 (ground) of TB2. Press this switch for about 1 second and release it so that the MODBUS parameters of two channels are reset to the default:

Baud rate 9600, format 8-N-1, MODBUS1 ID = 1, MODBUS2 ID = 2.

3.6.6 Analog Output

Table 11: Analog Output Terminal

Terminal Board	Connection Point	Name of Terminal	Functional Setting
TB1	1,2	4-20mA	Analog output

Table 12 shows signal corresponding to 0 ~ 20 mA current output:

Table 12: Analog Output Current

Analog Output	Duo MODBUS	HART	HART(compatible)
Activate	1.5 ±0.2 mA	3.5 ± 0.2 mA	1.5 ±0.2 mA
Fault signal	0 - 0.2 mA	3.5 ± 0.2 mA	1.25 ± 0.2 mA
Test mode	8 ± 0.2 mA	8 ± 0.2 mA	8 ± 0.2mA
COPS fault signal	2.0 ± 0.2 mA	3.5 ± 0.2 mA	2.0 ± 0.2 mA
Ready signal	4.5 ± 0.2 mA	4.5± 0.2 mA	4.5± 0.2 mA
Warning signal	16.0 ± 0.2 mA	16.0 ± 0.2 mA	16.0 ± 0.2 mA
Alarm signal	20.0 ± 0.2 mA	20.0 ± 0.2 mA	20.0 ± 0.2 mA

The maximum load of analog output is 500Ω.

Note: COPS fault signal can be set at 0mA in the factory (only for those detectors without HART function).

3.6.7 Cable Requirements

The following are the maximum cable length corresponding to different cable specifications (maximum loop resistance of 50 Ω) when a device with 250Ω input impedance is connected to the flame detector.

Table 13: Maximum Cable Length with Input Impedance of 250 Ω

AWG	Length (Feet)	Length(Meter)
14	9000	2750
16	5800	1770
18	3800	1160
20	2400	730
22	1700	520

3.6.8 Power Supply

Table 14 Terminals for Power Supplies

Terminal name	Connection point	Description
+24V	TB1-9, TB2-8	+24VDC input
COM	TB1-10, TB2-9	Ground (common)

The voltage supply range of the detector is 20 to 36 VDC (the detector gets into the under-voltage state when the voltage drops to 18.5V). The following table shows the maximum length of the cable conductor suitable for the 24 VDC power supply (maximum loop resistance of 20 Ω).

Table 15: The Maximum Cable Length Suitable for + 24 VDC Power Supply

AWG	Length(Feet)	Length(Meter)
14	4500	1370
16	2340	715
18	1540	470
20	970	300
22	670	205

3.6.9 MODBUS (RS - 485) Output

Table 16: MODBUS Terminal

Terminal Board	Connection Point	Functional Settings
TB1	3	MODBUS Communication 2+
TB1	4	MODBUS Communication 2 -

TB1	5	MODBUS Communication 1+
TB1	6	MODBUS Communication 1 -

The output terminals of MODBUS are shown in Table 16. MODBUS can be used to check the detector status or set detector configuration. Please refer to the MODBUS communication manual for more details.

3.7 Dip Switch Settings

Ultra FL800 can be configured through the DIP Switch or MODBUS (higher priority than DIP Switch on the bottom of the PCB. The rear cover of the detector must be opened when carrying out the configuration through the Dip Switch.

Dip Switch status and corresponding configurations are shown in Table 17.

Table 17: Dip Switch

Serial Number	Option	ON/CLOSED	OFF/OPEN
1	High sensitivity		1,2
2	Medium sensitivity	1	2
3	Low sensitivity	1,2	
4	0-second alarm delay		3,4
5	5-second alarm delay	3	4
6	10-second alarm delay	4	3
7	15-second alarm delay	3,4	
8	Alarm non-latching		6
9	Alarm latching	6	
10	Warning non- latching		5
11	Warning latching	5	
12	Alarm energized state		8
13	Alarm de-energized state	8	
14	Warning energized state		7
15	Warning de-energized state	7	

3.8 Power Up Instrument

Once the detector is powered up by 24VDC supply, the red, yellow, and green LEDs on the display board flicker continuously for 15 seconds, the analogue current output 1.5 mA (with HART is 3.5 mA) is generated, the fault relay is in the energized state. If the alarm and warning relay of the detector are configured in the energized state, the relays will be de-energized for approximately 0.5 seconds. When the power-up process is completed, the detector gets into the ready state, the green LED is always on, the status of each LED are show in Table 2.

4. Maintenance

4.1 Periodical Maintenance

Once the Ultra FL800 is correctly installed, minimal maintenance is required except for the regular sensitivity inspection and window cleaning.

GASENSOR recommends that a set of maintenance program be established and implemented.

Note: Periodically remove the accumulated particle and thin film deposit build up on both the sapphire lens and COPS reflector to ensure optimum system sensitivity. Window and reflector should be cleaned at least once every 30 days if the detector is installed in a particularly dirty environment.

4.2 Sapphire Window Cleaning

Clean the window with a clean, soft, lint-free cotton cloth or cotton ball dipped with a small amount of cleaning solution. The window is not made of glass but sapphire, the cleaning solution shall be supplied by GASENSOR (order P / N: W802002). Do not touch the window or COPS reflector with fingers when cleaning the window. The cleaning process is as follows:

1. Moist the window with the solution.
2. Wipe the window with a dry and clean lens cloth.
3. Let the window dry completely.
4. Clean the reflector with the same method.

⚠ **Caution:** the viewing angle and detection range of the detector will be greatly affected if the window is dirty or partially blocked. Industrial grade ammonia–containing cleaning solvent shall be used.

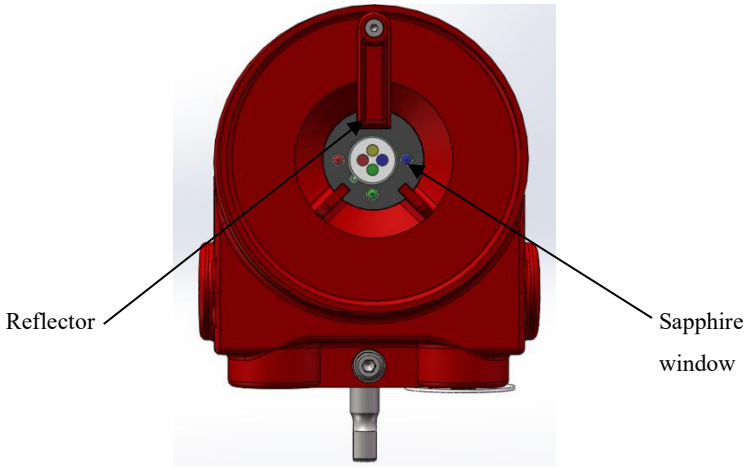

Figure 13: Cleaning the Optical Device

4.3 Sensitivity Check

To ensure the proper operation of each detector, user shall carry out an alarm test using GASENSOR's flame test lamp or test mode activation function (see section 3.6.4).

4.4 Storage

Ultra FL800 should be stored in a clean, dry place with the storage temperature and humidity parameters meet the environment requirements stipulated in Section 6.1.5.

5. Troubleshooting

5.1 Fault Analysis Table

This section is intended to guide user to troubleshoot possible faults on-site. Contact GASENSOR for assistance if the following method used does not eliminate the problem. A complete written report on fault symptoms should be attached if the instrument is returned to GASENSOR for repair.

Note: Warrantee will be void if repair work is carried out by non-GASENSOR personnel even within the warranty period. Please read the Warranty section carefully.

⚠ **Caution**: It should be ensured that the external alarm wiring is inhibited or de-energized before work is carried out to avoid the detector from leading to a false alarm.

Table 18: Failure Analysis Table

Failure	Probable causes	Corrective action
Analog output signal = 0 mA, Green LED on the display Not On.	No DC power supplied to the instrument	Ensure that + 24 VDC power supply is connected to the correct terminal
Analog output signal = 0 mA, Green LED on the display always On.	Low voltage (power supply of the instrument is about 18.5V)	Ensure that on-load voltage of the instrument is + 24VDC
Analog output signal = 0 mA, Yellow LED on the display always On, +24VDC power supply has been verified as normal.	FLASH checksum abnormal	Re start the instrument
Analog output signal = 0 mA, Yellow LED on the display always On, +24VDC supply is normal, and the instrument has been restarted.	FLASH checksum abnormal	Contact GASENSOR for support
Analog output signal = 2mA, Yellow LED on the display blinks in an interval of 1s	COPS fault, the optical path dirty or blocked (detection window)	Clean the window and reflector
The DIP switch setting does not match with the operating mode of the detector	The setting of the instrument may be changed by HART or MODBUS, does not match with the setting of the DIP switch	Reconfigure the instrument to be able to be set by DIP switch via MODBUS or HATR, as described in section 3.7 (DIP Switch Setting).

5.2 Assembly

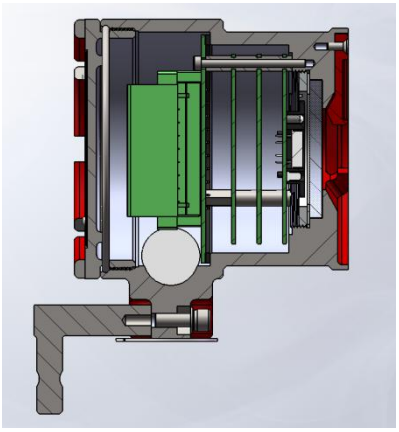

Figure 14: Sectional View of Ultra FL800

6. Appendix

6.1 Technical Parameters

6.1.1 System Technical Parameters

Typical response time: ≤ 5 seconds (when the detector and heptane flame are on the same central axis with 0s alarm delay time);

≤ 30 seconds (when the detector is at a 45° angle to the heptane flame).

Viewing angle: 90°@ 65 meters, 100°@ 35 meters;

Sensitivity: For n-heptane flame of one square foot, the maximum range for reliable detection is 15 meters (low sensitivity), 35 meters (medium sensitivity) and 65 meters (high sensitivity). Refer to Section 3.7 Dip Switch Setting for the setting of the sensitivity.

Note: Data of response time and viewing angle are obtained from measuring N-heptane flame of 1 square foot. The above is a typical value, and the results various with different fuel flames.

6.1.2 Mechanical Parameters

Casing material: 316 Stainless steel;

Color: Red;

Surface treatment: Spray paint with red epoxy powder.

6.1.3 Dimensions and Weight

Overall height: 120.50 mm;

Overall length: 124 mm;

Overall width: 110 mm;

Weight: 2.51 Kg.

6.1.4 Electrical Parameters

Rated Voltage: 24 VDC;

Voltage range: 20-36 VDC;

Maximum current draw: 150 mA;

Spectral range: 2-5 microns (IR);

Maximum output load: 500 Ω @ 24 VDC.

	Duo MODBUS	HART	HART（compatible）
Activation mode:	1.5 ±0.2 mA	3.5 ± 0.2 mA	1.5 ± 0.2 mA
Test mode:	8.0 ±0.2 mA	8.0 ±0.2 mA	8.0 ±0.2 mA
Monitor mode:	4.5 ±0.2 mA	4.5 ±0.2 mA	4.5 ±0.2 mA
Optical fault:	2.0 ± 0.2 mA	3.5 ± 0.2 mA	2.0 ± 0.2 mA
Warning signals:	16.0 ± 0.2 mA	16.0 ± 0.2 mA	16.0 ± 0.2 mA
Alarm signal:	20.0 ± 0.2 mA	20.0 ± 0.2 mA	20.0 ± 0.2 mA
Instrument reset:	1.5 ±0.2 mA	3.5 ± 0.2mA	1.5 ±0.2 mA
Other faults:	0- 0.2mA	3.5 ± 0.2 mA	1.25 ± 0.2 mA

Contact capacity of the relay: 5A@250VAC; 5A@30VDC.

RS-485 output: MODBUS protocol;

Baud rate: 4800, 9600, 19200, 38400bps;

Status indication: Three LEDs indicating instrument status and fault.

6.1.5 Environmental Technical Parameters

Operating temperature range: - 40℃~85℃ (T5), -40℃~70℃ (T6);

Storage temperature range: - 40℃~85℃;

Humidity range: 0 ~ 95% RH, non condensation.

6.2 Explosion-proof Rating and Protection Method

The explosion proof authentication for Ultra FL800 is as follows:

- Explosive-proof: II 2G Ex db IIC T5 Gb (Ta= -40℃-+85℃);
  II 2G Ex db IIC T6 Gb (Ta= -40℃-+70℃);
  II 2D Ex tb IIIC T100℃ Db IP67.
- Protection Level: IP67

6.3 Response to the False Alarms

Ultra FL800 detector has very high immunity towards a variety of false alarm sources, the following are the typical response examples:

Table 19: Anti-false Alarm Ability at High Sensitivity Setting

False Alarm Source	Distance (m)	Response after Adjustment	Distance (m)	Over-response after Adjustment
Heater (1.5kW)	1.8	No alarm	0.3	No alarm
Incandescent lamp of 100W	0.3	No alarm	0.3	No alarm
Fluorescent lamp (bulb of 240W)	< 0.3	No alarm	< 0.3	No alarm
Halogen lamp of 500W	0.6	No alarm	< 0.3	No alarm
Sunshine, reflected	1.8	No alarm	1.8	No alarm
Sunshine, straight	-	No alarm	-	No alarm
Heating steel plate (200℃)	0.9	No alarm	0.3	No alarm
Welding arc (#6012, 1/8 in,180 – 200 A, DC)	1.5	No alarm	3.4	No alarm
Welding arc (# 6012, 1/8, in 190 A, AC)	1.5	No alarm	2.7	No alarm
Welding arc (# 7014, 1/8 in, 180 – 200 A, DC)	4.6	No alarm	3.7	No alarm
Welding arc (# 7014, 1/8, in 190 A, AC)	4.6	No alarm	4.6	No alarm
Welding arc (# 7018, 1/8 in, 180 – 200 A, DC)	4.6	No alarm	4.0	No alarm
Welding arc (# 7018, 1/8, in 190 A, AC)	3.7	No alarm	3.1	No alarm

Table 20 lists the Ultra FL800's response to fires in the presence of false alarm sources in the background where the detector is set at high sensitivity.

Table 20: The Detector's Response to the Flame in the Presence of False Alarm Source (high sensitivity setting)

False Alarm Source	Maximum range	Flame	Minimum Distance
Reflected sunlight, none adjusted	1.8	Heptane fire of 1 square foot	10.7
Reflected sunlight, adjusted	9.1	Heptane fire of 1 square foot	9.1

Heater, none adjusted	0.3	Heptane fire of 1 square foot	10.7
Heater, adjusted	3.7	Heptane fire of 1 square foot	10.7
Incandescent lamp, none adjusted	0.8	Heptane fire of 1 square foot	10.7
Incandescent lamp, adjusted	0.8	Heptane fire of 1 square foot	10.7
Fluorescent lamp, none adjusted	0.8	Heptane fire of 1 square foot	10.7
Fluorescent lamp, adjusted	0.8	Heptane fire of 1 square foot	24.4
Halogen lamp, none adjusted	0.6	Heptane fire of 1 square foot	21.3
Halogen lamp, adjusted	1.2	Heptane fire of 1 square foot	10.7
Welding arc (# 7014, 3/16, in 190 A),none adjusted	3.7	Heptane fire of 1 square foot	24.4
Welding arc (# 7014, 3/16, in 190 A), adjusted	4.6	Heptane fire of 1 square foot	24.4

In general, the operator should keep the detector clear of the false alarm sources. Many false alarm sources such as welding or heater emits infrared radiation, which will reduce the detection distance of the detector.

6.4 Spare Parts and accessories

6.4.1 Spare Parts

Contact the nearest GASENSOR agent or GASENSOR Company directly, and provide the following information to order spare parts or accessories:

- Part number
- Name
- Number

Table 21: Table of Spare Parts

Serial number	Part name	Part number
1	Special Cleaning Solvent	W802002
2	TL8 Flame test lamp	103000

Version Record

Serial number	Version number	Abstract of modification	Remarks
1	A160608	First issuance.	
2	A170227	Modify the definition of terminal.	
3	A180404	Content check, parameters update. Update the explosion mark. Update the illustrations.	GT-ECR00051

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