

STATIC GROUNDING & OVERFILL PROTECTION SYSTEM

Model: FLE-T-IIC

User Manual



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Preface

This manual introduces the operating principle, technical parameters, installation and precautions of **FLE-T-IIC** Overfill Protection & Grounding System (Protector for short hereinafter).

This system has to be used jointly with **FLK-02** sensor and Sensing Static Grounding Clamp to form a complete set. The information of supported product is available in this manual.

Safety

This is Flameproof Intrinsically Safe equipment. Its explosion-protection marking is Exdia II BT4. The installer, operator and maintenance personnel must have basic knowledge of intrinsic grounding practices as well as mechanical skills and a general understanding of intrinsically safe electrical equipment when using this product. This equipment passed the test of NEPSI (National Supervision and Inspection Center for Explosion Protection and Safety of Instrumentation), and accord with relevant stipulations of General Requirements, Intrinsically Safe Circuit and Electrical Apparatus in GB3836.1-2000, GB3836.2-2000, GB3836.4-2000. The explosion protection certificate number is CNEx11.1832.

Others

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1.0 Application

FLE-T-IIC Overfill Protection & Grounding System can effectively prevent the overflow of liquid and guarantee that the static grounding resistance meets the prescription of relevant safety regulations thus making it especially suitable to be used when the highly inflammable and explosive petrochemicals are frequently transferred, such as:

- (1) The fuel oil entrucking system, including tank car for railway and buses.
- (2) The sealed entrucking of liquid benzenes and hydrocarbons.
- (3) The canning system of other chemical products.

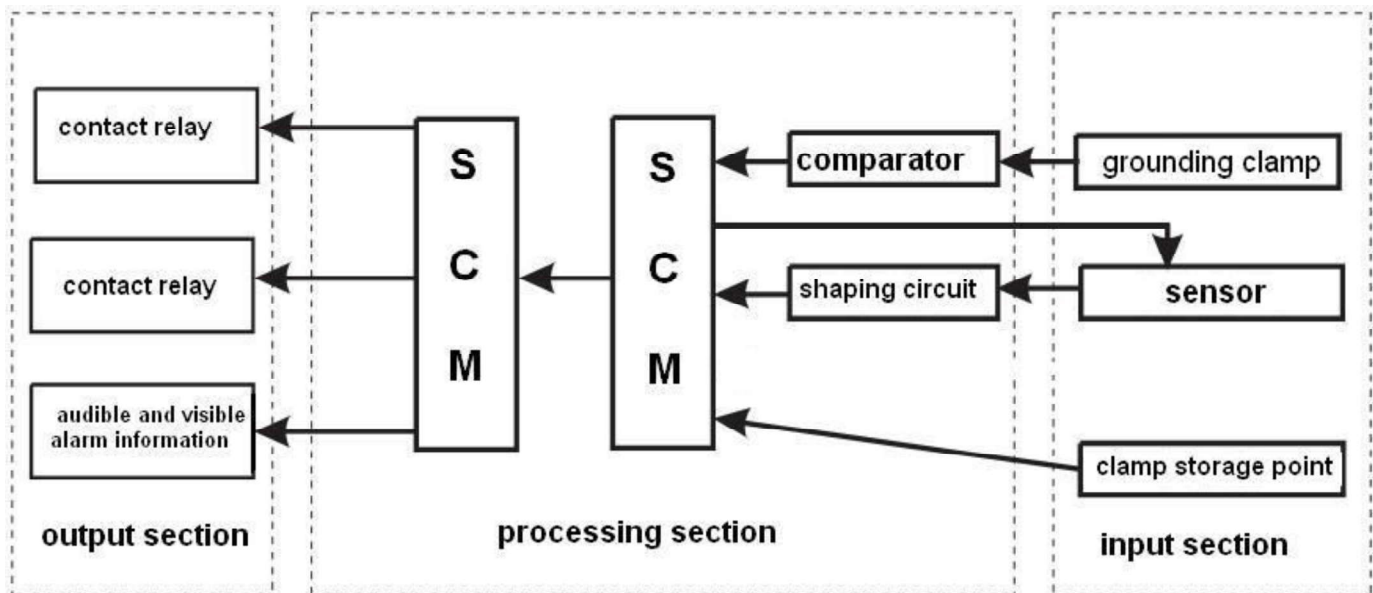
2.0 General

2.1 Operating Principle

The Protector comprises an automatic control system of intelligent overfill prevention and static grounding with SCM as its core. (See Figure2.1.1)

1. The Protector monitors the liquid level by FLK -02 sensor, and gives out audible and visible alarms when the liquid reaches the sensor.
2. The Protector automatically monitors the grounding state of static-prone tank cars through static grounding clamp. It gives out audible and visible alarms when the resistance value between the tank car and grounding stud exceeds a set value.
3. The Protector can also provide the signals of grounding state and liquid level for a third system, such as Automated Fueling System; so that the system can control pumps and valves as well as decide whether to start.
4. The Protector can also control pumps and valves directly according to grounding and liquid level (This function requires additional explanation upon ordering).

System working drawing:



2.2 System Composition and Function

The whole system comprises controller, Sensing Static Grounding Clamp, clamp storage point, ground cable, FLK-02 sensor, alarm indicator and a four-pin explosion-protection box.



Figure 2.2.1

1. **Controller** (see Figure 2.2.1): the controller is consisted of explosion-protection enclosure and control circuit which linked to peripheral system through connecting terminal. Explosion-protection grade: ExdiaIIBT4.

(1) Detects and processes the primary instrument signal (UZK-02 sensor, static grounding clamp and clamp storage point etc.).

- (2) Provides audible and visible signal for the alarm indicator.
- (3) Outputs on-off signal to the Automated Fueling System.
- (4) Outputs pump and valve controlling signal (This function requires additional explanation upon ordering).



Figure 2.2.2

- 2. **Sensor** (see Figure 2.2.2): detects the liquid and outputs signals to the controller in order to prevent overflow. The standard length of sensor is 6 meters.



Figure 2.2.3

- 3. **Clamp storage point** (see Figure 2.2.3): indicates whether the controller system is working. Please clip the static grounding clamp onto it while the system is not working.

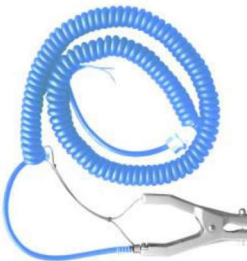


Figure 2.2.4

- 4. **Sensing static grounding clamp** (see Figure 2.2.4):
 - (1) Remove the oil paint and rust to assure that the car body is well grounded.

(2) The standard cable length is 8 meters which can be extended to about 5 meters.



Figure 2.2.5

5. **Ground cable** (see Figure 2.2.5): transmits the static electricity that has been drawn from the car body by the static grounding clamp to the ground. Standard cable length is 3 meters.



Figure 2.2.6

6. **Alarm indicator**: (see Figure 2.2.6): the three LED lights on its panel, digitron and buzzer give out audible and visible alarm signals and show the resistance value.

2.3 Features

1. The Protector has the interlock function, so that if the static grounding is not well connected, the third system can't work.

(Valves can't be lifted and pumps can't be started)

2. The Protector uses a single-chip-computer to assure a stable performance of the system.

3. The sensor has a continuous self-check and alert feature to insure the system is working properly, thus greatly facilitate the operation.

4. The resistance value and audible and visible alarm information can be provided.

5. The Protector provides the on-off signals of liquid level and static grounding state for the use of third system.
6. The relevant equipment of the explosion-resistant enclosure, output control circuit, primary instrument and its processing circuit adopt intrinsically safe circuits.
7. Automatic controlling valve and pump. (This function requires additional explanation upon ordering.)

2.4 Technical parameters

1. Working voltage: 220VAC $\pm$ 10%
2. Working current: <35mA
3. Response time: <2 Seconds
4. Explosion-protection grade: Exdia II BT4
5. Ingress protection: control unit: IP65
6. Grounding resistance: $\leq 10\Omega$
7. Alarming mode: audible and visible alarm
8. Operation temperature: -40°C to +60°C

3. 0 Connecting to Automated Fueling System

The signal interface of the automated fueling systems is different, so we have to debug the interface.

The protector offers 4 groups of signal pump controlling signal, valve controlling signal, static grounding signal and overfill prevention signal. Each group offers 3 output nodes, refer Figure 3.1 for the relationship. Pls. choose the connecting way according to the signal interface of third-party devices.

States Terminals		Power off	Normal	Alarm	Standby
Pump controlling signal	No.2 &3	Closed	Open	Closed	Closed
	No.2 &1	Open	Closed	Open	Open
Valve controlling signal,	No.5 &6	Closed	Open	Closed	Closed
	No.5 &4	Open	Closed	Open	Open
Overfill prevention signal	No.14 &15	Closed	Open	Closed	Closed
	No.14 &13	Open	Closed	Open	Open
Static grounding signal	No.17 &18	Closed	Open	Closed	Closed
	No.17 &16	Open	Closed	Open	Open
Homing Signal	No.11&12	Closed	Closed	Closed	Open
	No.11 &10	Open	Open	Open	Closed

4.0 Installation

4.1 Electrical Installation

4.1.1 Circuit Board Mark

See Appendix 1 for the circuit board terminal identification

1. Precautions during wire connection

- (1) Terminal No.1 to 18 is for signal output. The connection can be either positive or negative direction.
- (2) Terminal No.19 to 21 adopt 3-core 15mm² cable to connect with 200VAC $\pm$ 10%, Terminal 21 connects to the ground.
- (3) Terminal No.22 to 25 connect to alarm indicator.
- (4) Terminal No.28 to 30 connect to sensor.

- (5) Terminal No.31 connects to grounding clamp.
- (6) Terminal No.32 connects to ground cable.
- (7) Terminal No.33 connects to the clamp storage point.

2 .The parameters of relevant terminals on normal states:

- (1) 220VAC $\pm$ 10% between terminals No.19and No.20.
- (2) Normal close or normal open can be chosen from Terminal No1 to 18.
- (3) When the terminals are open, the resistance is infinite; when the terminals are closed, the resistance is zero.

4.1.2 Wire Connection

Refer to Appendix 2: Electrical Wiring Diagram.

The Protector adopts the independent power supply, which bifurcates according to the mode of automated fueling system:

- 1. If the automated fueling system is distributed style:

Power imports 220VAC directly from distribution system or automated fueling system. The system outputs signal through 2 $\times$ 1.0mm² signal wire connected to automated fueling system.

- 2. If the automated fueling system is centralized style:

Power imports 220VAC directly from distribution system or automated fueling system. 2 $\times$ 1.0mm² signal wire is laid from the computer room to the fuel distribution platforms to connect the controller and provide signals for the computer.

4.1.3 On-site Wiring

See Figure 4: The on-site Wiring Diagram.

4.2 Mechanical Installation

See Figure 3 and 5 for mechanical installation outline drawing.

5.0 Operation

5.1 Working State Display

The whole working state of this system is directly displayed by indicator, buzzer and digitron. All states are as follows:

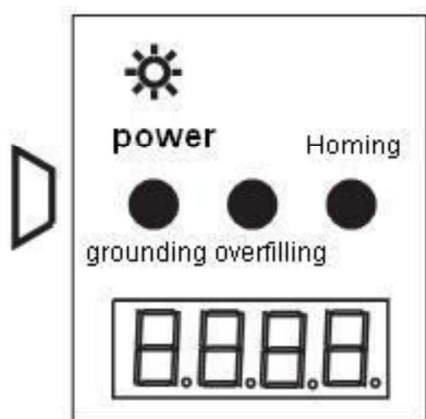
 = light on

 = light flashes

● = light off

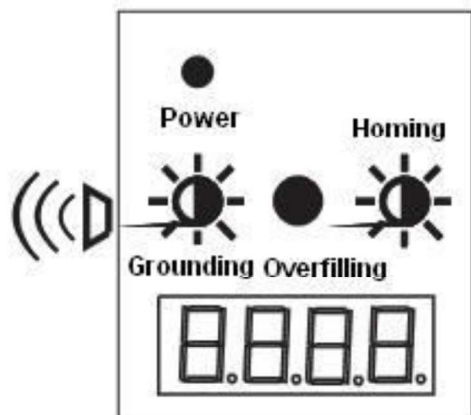
 = buzzer off

 = buzzer on



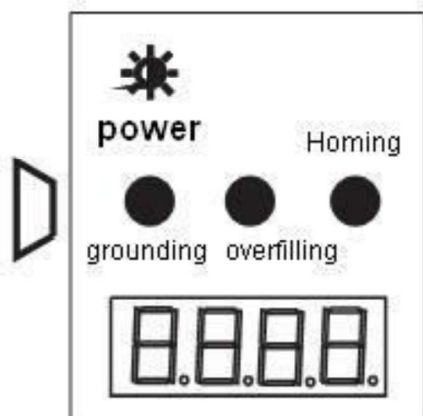
1) Standby state

When the static grounding clamp is clipped to the storage point, the power indicator light is on but doesn't flash. The whole system is in standby state



2) Grounding and homing alarm

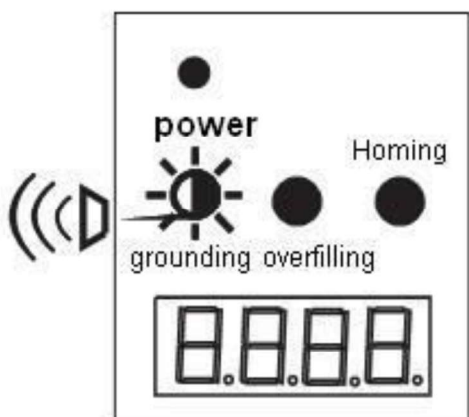
When the static grounding clamp left the storage point, the power indicator light is Off, the grounding indicator and the homing indicator flashes, the buzzer alarms. At this time, the alarm signals of grounding, overfilling and homing are sent out.



3) Normal working state

When the static grounding clamp leaves storage point, the whole system enters into working state. (Clip the static grounding clamp to the equipment that has to be connected to earth. Make sure the grounding state is good. The monitored liquid's level is below the UZK-02 sensor. All these combine to be "normal working state".)

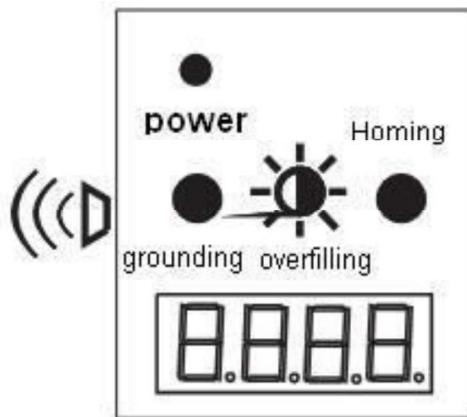
The power indicator light flashes rhythmically. Both the static grounding indicator light and liquid level indicator light are off, giving out signals for normal working.



4) G

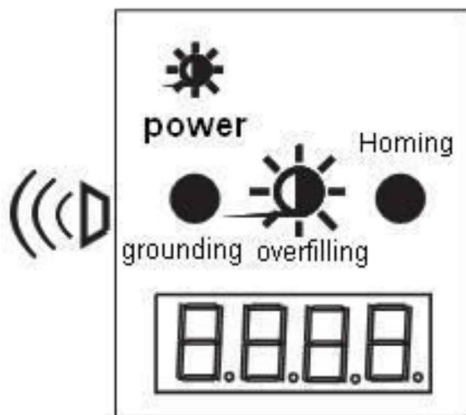
When the grounded loop resistance exceeds specified value or grounding is not good, the grounding indicator light flashes; the power indicator light and liquid

level indicator light are off; the buzzer gives out urgent alarms, danger signals of grounding are sent at the same time.



5) Overfilling alarm

When the sensor senses liquid, the power and static grounding indicator light are off, the liquid level indicator light flashes, buzzer urgently alarms, liquid level alarm signals are sent at the same time.



6) Sensor malfunction alarm

When there is malfunction on the sensor or its connecting wire, the indicator lights of power and liquid level flash at the same time, buzzer gives out alarm. Signals of overfill alarm are sent to the computer system.

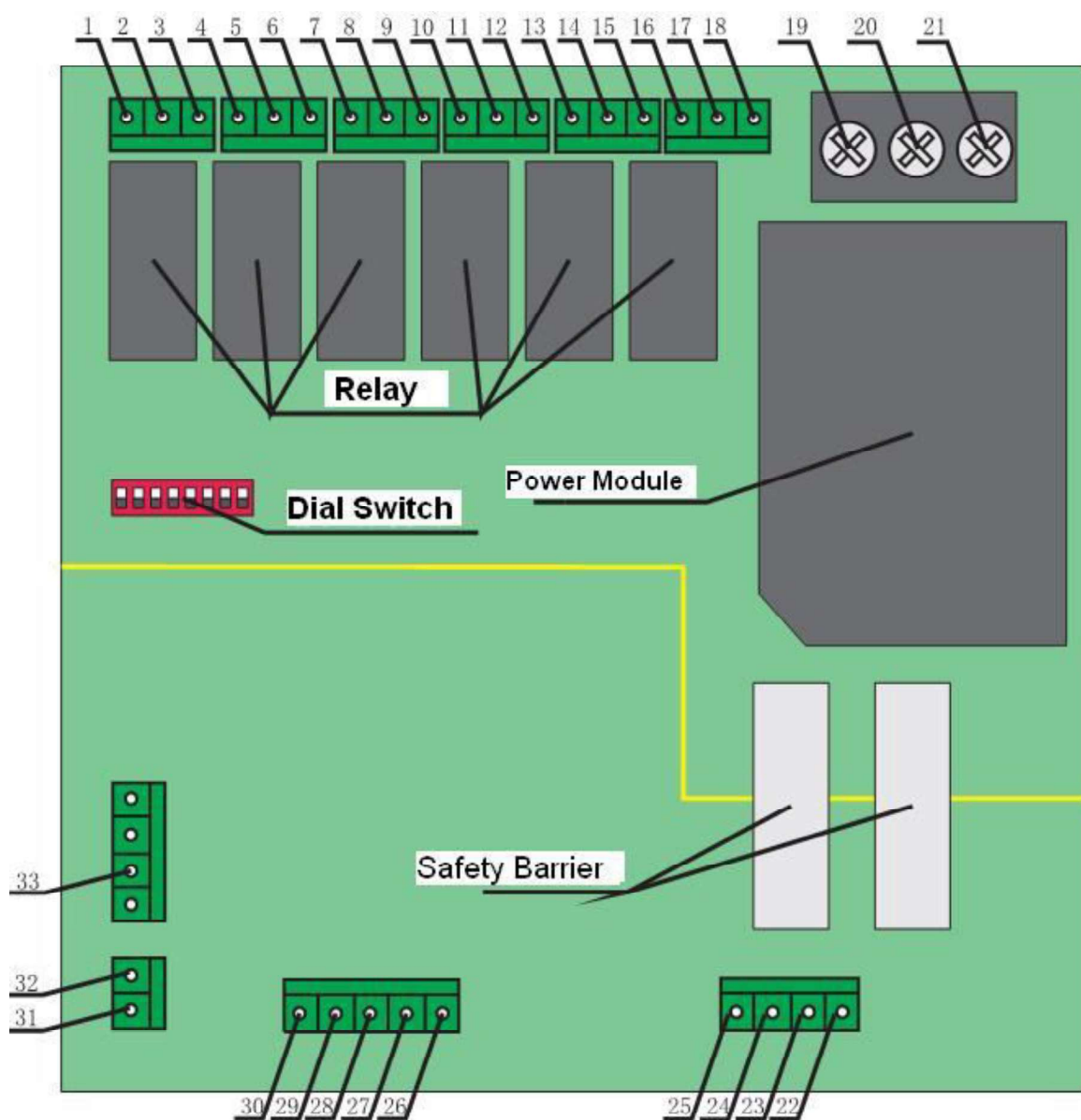
5.2 Operation procedures

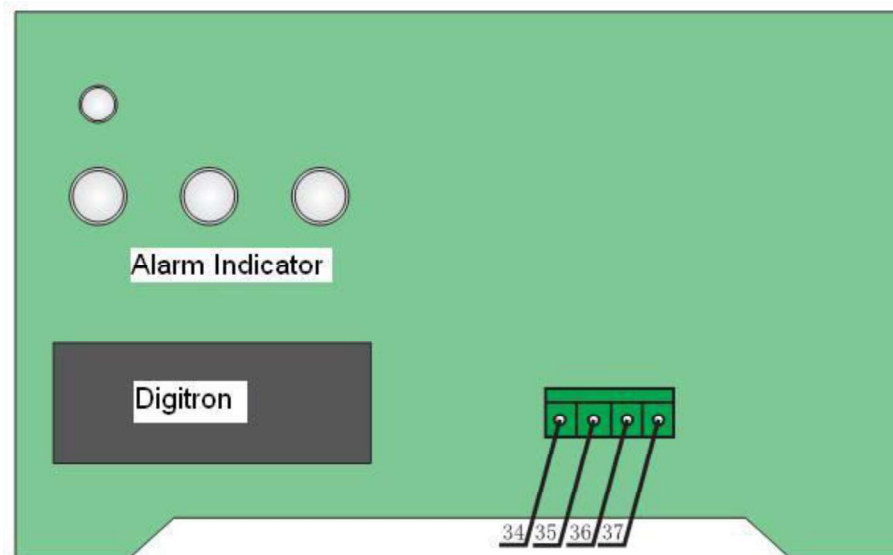
1. Remove the static grounding clamp from storage point when the system is in the standby state, the grounding alarms. Clip the static grounding clamp to the equipments in need of earth connection so that there is no alarm for static grounding. The indicator of the power flashes, the system enters into working state.
2. Adjust the distance between sensor and magnet according to the detected height of monitored liquid. Well set the height of UZK-02 sensor.
3. When the protector is in a normal working state, the monitored equipments can perform loading.
4. When the loading process is finished, the operator should withdraw UZK-02 sensor and remove the static grounding clamp to clip it to the storage point. The system enters standby state, get ready for next time use.

5.3 Key Points in Explosion Protection

1. The controller mainly comprises an enclosure, lid, introducing devices and inner circuit board, and the enclosure is die-cast from ZL102 which has high strength and remarkable endurance of punching.
2. The enclosure and lid of the controller employ plate explosive proof structure, the parameters are: $L \geq 25.5$, $I \geq 12.5$, $i_c \leq 0.08$.
3. The sensor, static grounding clamp and alarm indicator past intrinsically safe experiment.
4. Intrinsically safe wire and un-intrinsically safe wire should be arranged separately.
5. It is forbidden to change or adjust the components or structures that influence explosion protection if they have already passed relevant test.
6. The on-site installation must be under the guidance of GB3836.15 *Electrical apparatus for explosive gas atmosphere: part 15 electric installation in hazardous areas (except mines)*.

Appendix I Diagrammatic Sketch of Circuit Board

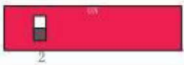




- 1- pump controlling signal output 1(NC)
- 2-pump controlling signal public end(C)
- 3- pump controlling signal output 2(NO)
- 4- valve controlling signal output 1(NC)
- 5- valve controlling signal public end(C)
- 6- valve controlling signal output 2(NO)
- 7- reserved
- 8- reserved
- 9- reserved
- 10-homing signal output 1(NC)
- 11- homing signal public end(C)
- 12- homing signal output 2 (NO)
- 13-overfilling signal output1(NC)
- 14- overfilling signal public end(C)
- 15- overfilling signal output2(NO)
- 16-grounding signal output1(NC)

- 17-grounding signal public end(C)
- 18- grounding signal output2(NO)
- 19-AC220V input L(220-L)
- 20- AC220V input L(N)
- 21-Grounding (GND)
- 22-alarm indicator box power anode (VCC)
- 23- alarm indicator box power grounding (GND)
- 24-485 communication signal B(B)
- 25-485 communication signal A(A)
- 28-sensor power (LVCC1)
- 29- sensor signal (FIN1)
- 30- sensor power grounding (GND)
- 31-grounding clamp signal (CLAMP1)
- 32-ground cable signal (CLAMP2)
- 33-clamp storage point signal (STATE)
- 34-485 communication signal A(A)
- 35-485 communication signal B(B)
- 36- alarm indicator box power grounding (GND)
- 37- alarm indicator box power anode (VCC)

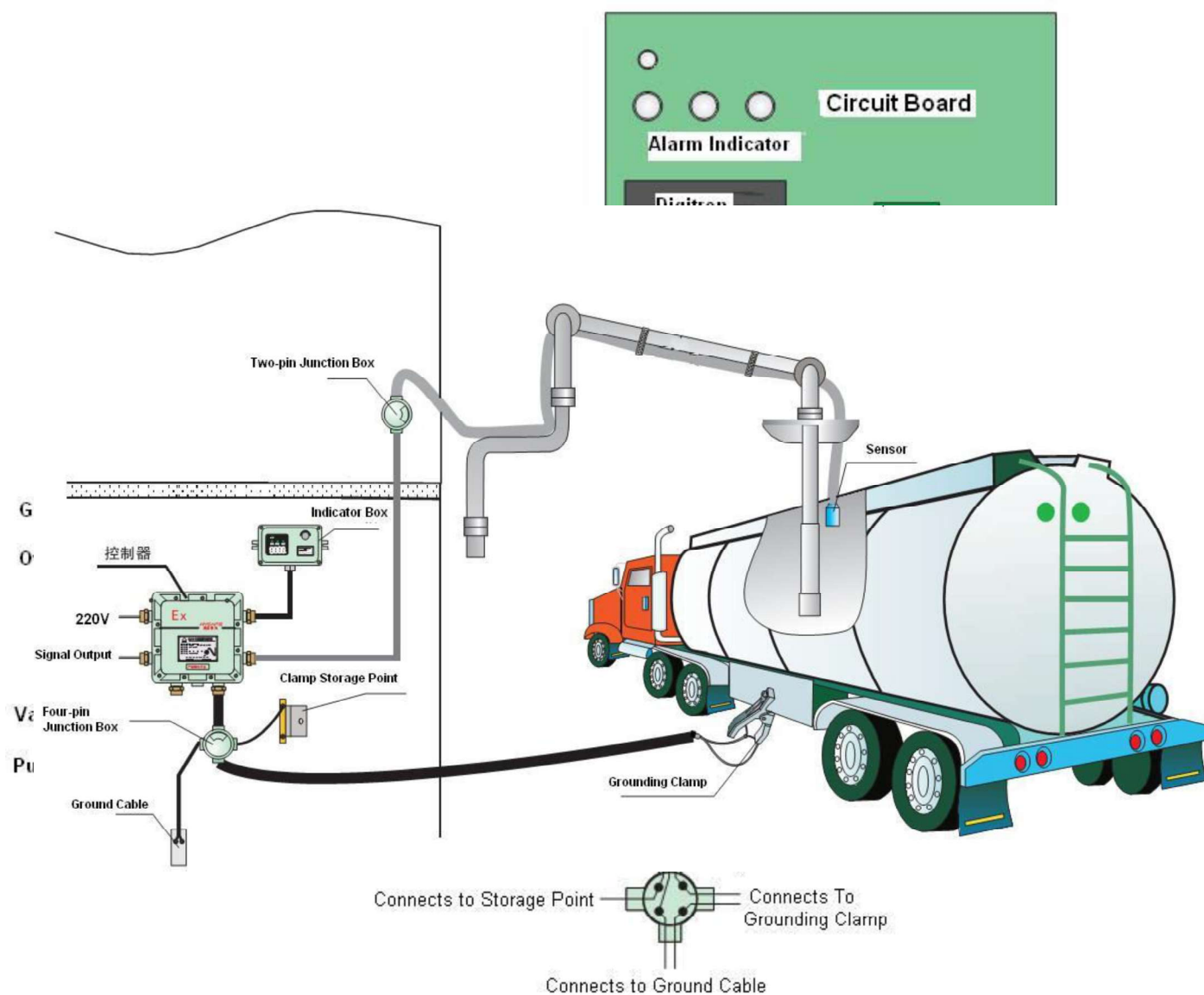
Dial Switch Function

Serial No.	Name	Working		Bypass	
1	OUT-C		Output Separately		Two-in-one Output
2	TS-BS		Grounding Working		Grounding Bypass
3	T01-BS		Overfilling Working		Overfilling Bypass

Appendix II Electrical Wiring Diagram

Technical requirements

1. Connect wires after power-cut in fuel distribution area (hazardous r area);
2. Make the wires in order and in good connection.
3. Avoid different connections from prescription.
4. Mark the corresponding identification number at both ends of every wire.



2. If the hose is just at the position of loading arm's movable joint during installation, please reserve enough length in order not to affect the rotation of the movable joint.
3. Install the clamp storage point at the tail of the car's parking place for the convenient use of static grounding clamp.
4. Install the four-pin junction box near the storage point for convenience.
5. Place the indicator box at the place where the operator can see the indicator lights and hear the alarm.;
6. Install the controller at a place where is convenient and waterproof.
7. The above recommended installation methods can be adjusted to some extent according to different installation sites.

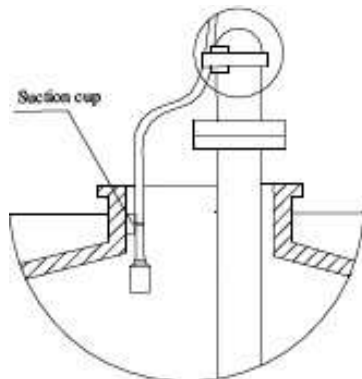


Figure A

While using the sensor, first insert the loading arm into the tank car, then take the sensor down and put the magnet at the proper height of the tank. After use, put the magnet at the loading arm's top part, get ready for next time use.

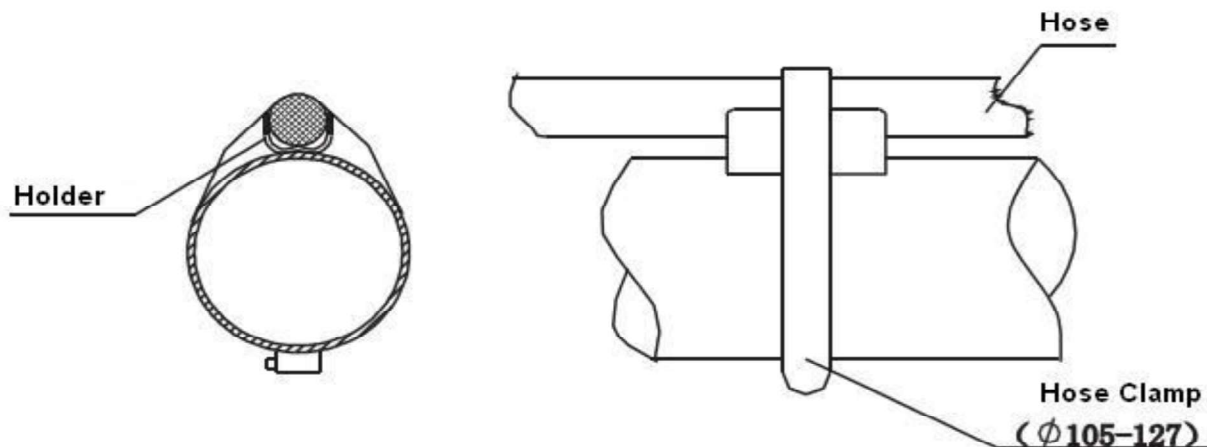
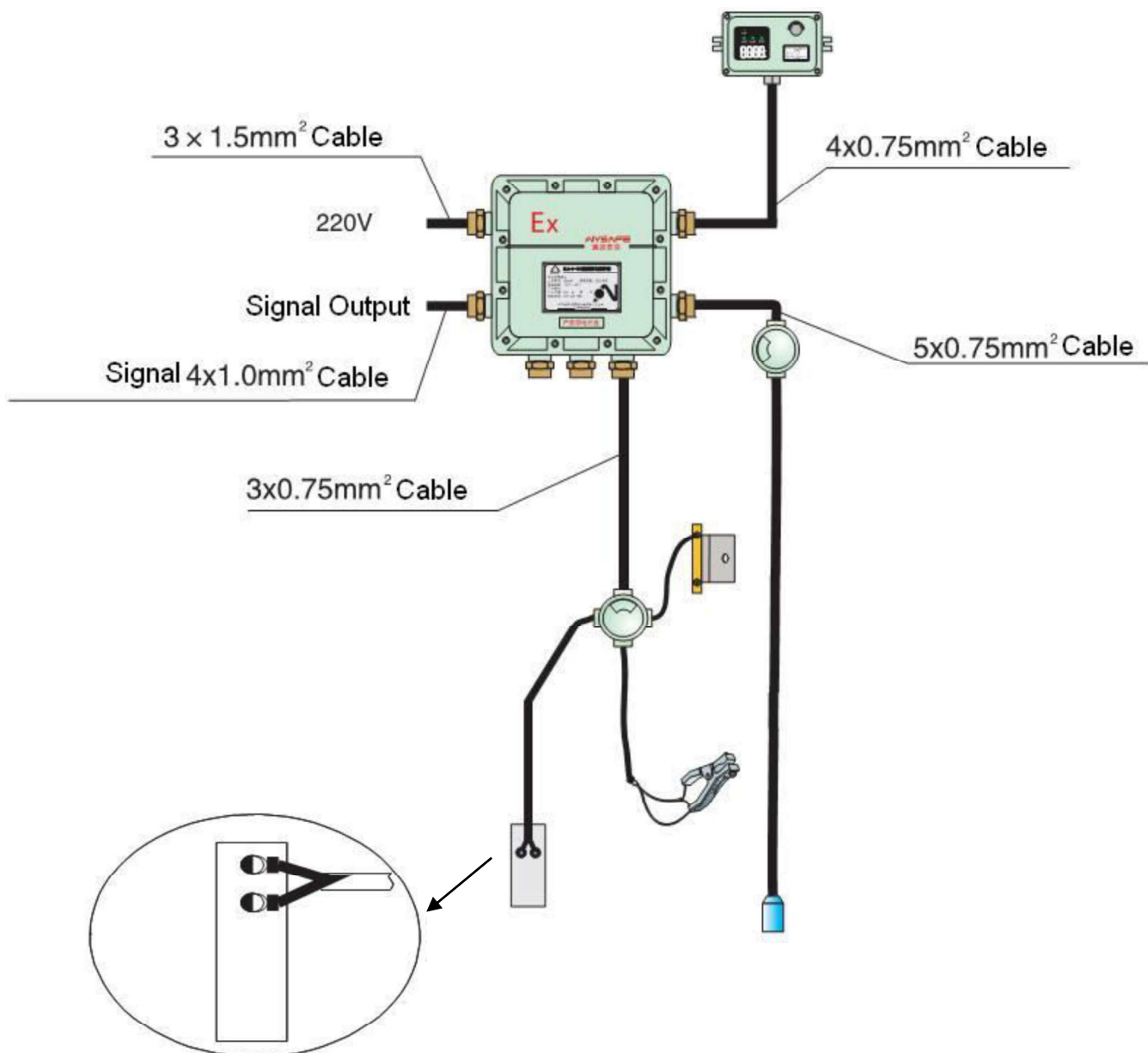


Figure B

Appendix IV The on-site Wiring Diagram

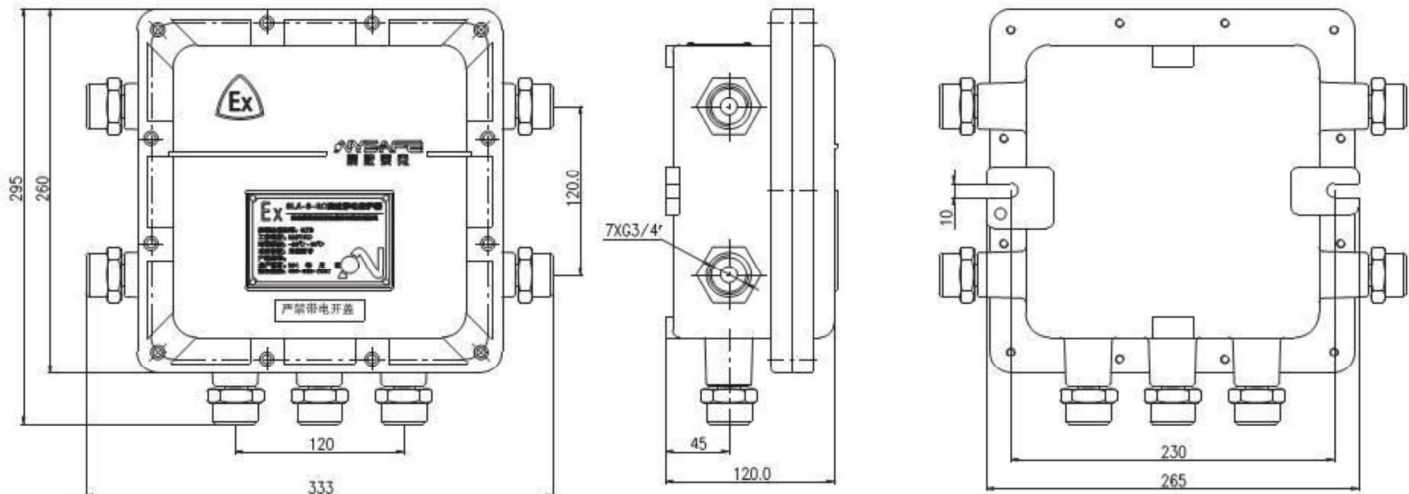
Technical requirement:

1. This system can be used jointly with both centralized and distributed automated fueling systems.
2. Other schemes can be adopted according to the actual on-site condition if they meet the explosive-proof requirement and can guarantee the failure-free operation.

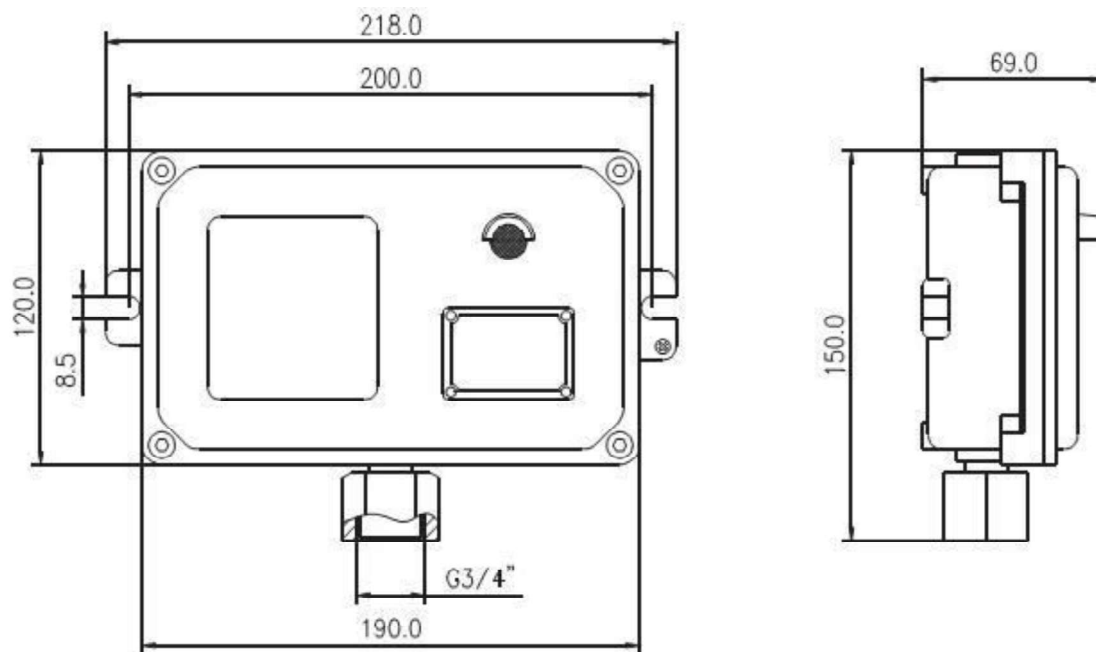


Note: each system requires a grounding stud and its grounding resistance should be less than 10 ohms.

Appendix V Mechanical Installation Dimensional Drawing



CONTROLLER



Digital Alarm Display Box



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