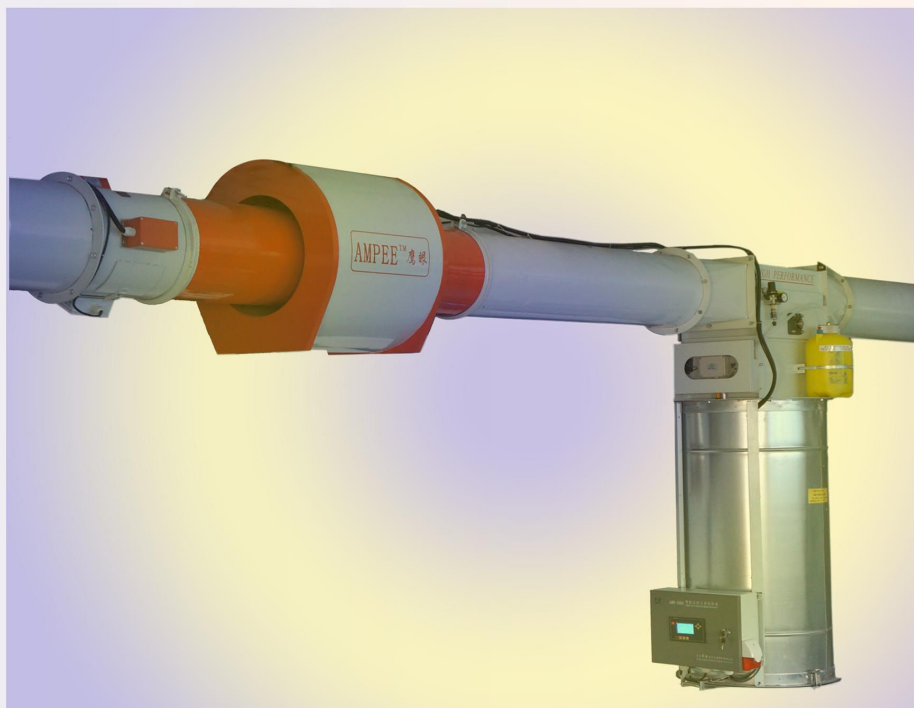# AMP-EE01
Eagle Eyes Metal & Spark Diverter
User Manual

Jiangsu Ampeon Electronic Engineering Co.,Ltd

P r e f a c e

Thanks for choosing AMPEON's high-performances metal and spark diverter AMP series. The AMP series is manufactured with high-quality components and materials and incorporates the latest microprocessor technology available. Jiangsu AMPEON continuously practices the design and innovation of the product and provides excellent products with professional attitude. Furthermore, it responds to the customers with professional service and benefits each other with the customers.

The manual is to be used for the installing, parameter setting, troubleshooting and daily maintenance of spark diverter. In order to assure the proper installing and usage of the product, please read this manual in detail before installing. Please keep this user manual at hand and distribute to all users for reference.

Welcome to visit the website www.ampeon.cn.

⚠ **ATTENTION!**

1. First please carry out the delivery inspection and check whether there is damage caused by transportation process.
2. After unpacking, please compare with the packing list and check the type, specification and components of the product. If it does not conform to your order documents or if you have any questions regarding the product,   please contact to the dealer or the service office of our company.
3. Jiangsu Ampeon Electronic Engineering Co., Ltd. provides services of the three guarantee period 18 months from the delivery date.
4. Troubles due to lightening strike, water invasion and obvious artificial miss or damage etc. are not in the range of repair guarantee.
5. Metal & spark diverter series products are important products of the fore-spinning procedure in cotton spinning mill. But the users in cotton spinning mill should also take integrated measures in fire protection equipments, selection of material, management regulations etc. to assure the safety production.

⚠ **CAUTION！**

1. The power supply must first be shut off before the electric wiring.
2. Wiring, repairing & maintenance of the machine should be carried out by electric professionals.
3. Do not carry out compression test toward the inner components because the semiconductor units are easy to be broken down by the high voltage and are easy to damage.
4. The circuit board CMOS integrated circuit is apt to static electricity damage. So you should take the static electricity prevention measure before touching the circuit board with hand.
5. As the machine is installed to the pipe in high place, installing personnel should take safety measures. Suspending or bracket should be solid to prevent the machine from dropping down.
6. Select safety area to install the equipment, prevent the high temperature & direct shinning and avoid humidity and splashing of the water drops.

C o n t e n t s

A. Overview

1、Use and structural features

AMP-EE01 type Eagle Eyes Metal and Spark Diverter is the latest product of Jiangsu Ampeon. It is manufactured whit high-quality components and materials and incorporates the high speed microprocessor technology. It is installed on the pipe of pneumatic transport systems for materials like fibers or tuft. It effectively detects metallic particles and sparks, mixed or generated in the production process. So that ensure the safety of blowing-carding production line in spinning mills or other fiber processing production lines.

Features

- Detects all kinds of metallic particles Ferrous and Non-Ferrous such as : Brass, Stainless Steel, Copper, Aluminum.
- Highly sensitive to infrared radiation emitted by fast moving small sparks in pneumatic transport systems for textile fibers.
- Intelligent identification of metals kinds, moving speed to ensure reliable elimination.
- Self-monitoring of actuator valve actuation time.
- Automatic recording the real time when the fire alarm happens.
- Automatic simulation and testing of spark detection system.
- Water spray system is available.
- Level sensor indicates when collection can is full.
- RS-485 Serial interface, communicate on Mod-bus networks.
- Easy installation.
- Metal is diverted into collecting box and production is not interrupted.
- Operates in both positive and negative pressure.

2、Technical parameter

1）Sensitivity　　Metal detection: Steel ball diameter more thanΦ3mm

　　　　　　　　　　　　　　　Aluminum ball diameter more than Φ5mm

　　　　　　　　Spark detection: Spark diameter more thanΦ0.5mm spark

2）Response time:　　　≤200ms

3）Power supply:　　AC220V±10%，50HZ

4）Compressed air pressure range:　　600～800KPa

5）Sound level of alarm: >60db

6）Power: <100VA

7）Requirement of the environment:

temperature -10℃—40℃, relative humidity（20-75）%RH

B. Electric wiring and installing

In order to reach the best performance of AMP-EE01 Eagle Eyes metal & spark diverter, proper electric wiring and installing is the most important approach. Please be sure to read this "User manual" carefully before installation. And the installation environment and conditions for further correct measurement and evaluation.

1、Installing

1.1 The installation of the connecting pipe of spark detectors

A） Spark detectors

B）-X95 junction box

C）Flange

D）Observation window
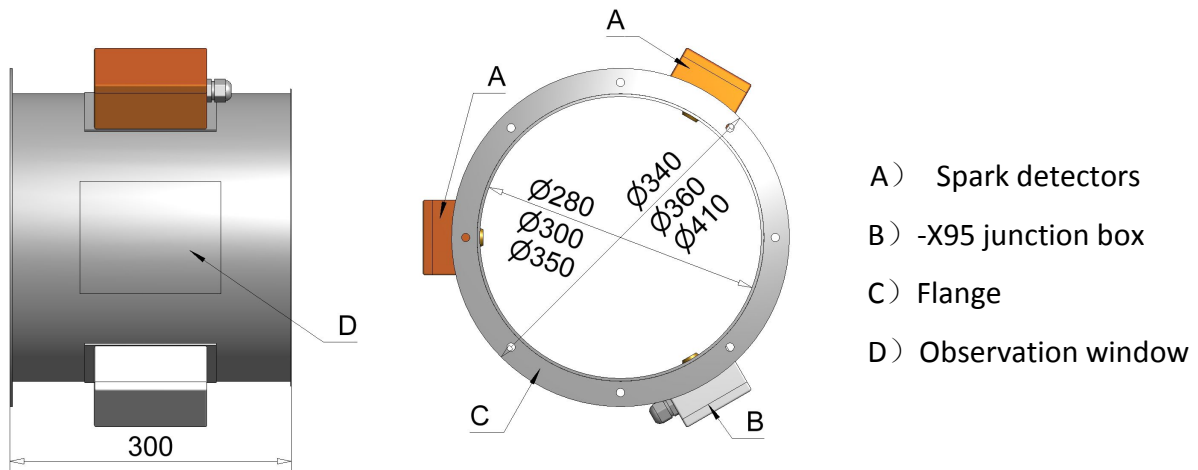
Figure 1：The connecting pipe of spark detectors

The connecting pipe of the spark detectors can be installed to the pipeline directly, a side connected with the existing pipeline by flange, the other side connected with the glass steel pipe by a clamp.

1.2 The installation of the metal detector

A）Metal detectors

B）-X90 junction box

C）Hoisting ring
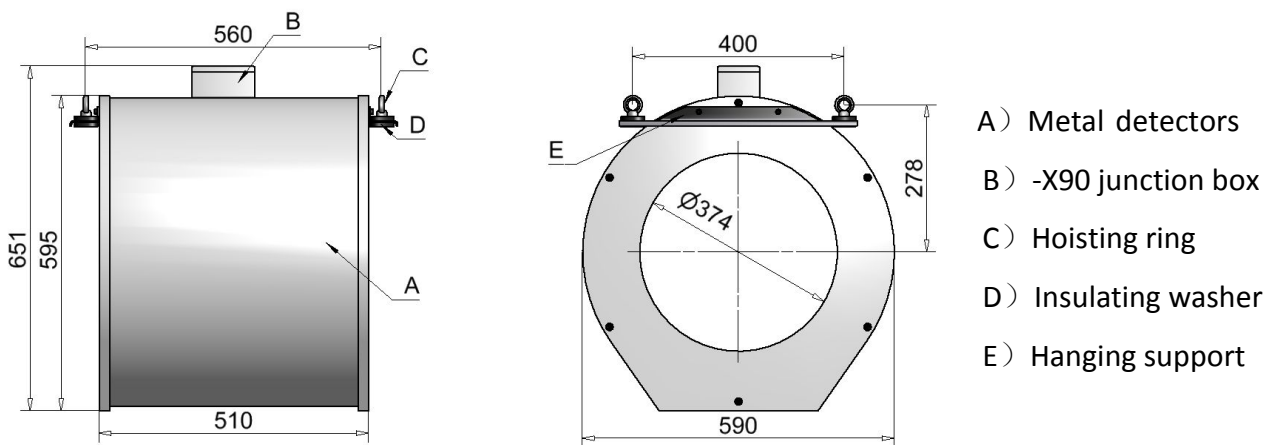
D）Insulating washer

E）Hanging support

Figure 2: Parts and dimension of the metal detector

1) Metal detector can be hung up at the four hoisting rings by metal rods. Metal detector should be installed firmly, to avoid incorrect detecting caused by the vibrating.

2) Make sure the shielded cables for signal receiving and transferring between the metal detector and control box is connected reliably ， then fix it without vibrating . Connector cables are part of the sensor and have to be protected against interferences.

3) Metal detector should keep a certain distance from the things that generate the electromagnetic radiation such as electric motor, transformer and fluorescent lamp etc. Furthermore, it should keep a certain distance from big moving metal object. The cables with big current should be also kept a distance from the detector.

1.3 The installing of control box

A） Control box

B） Control panel

C） Cable Gland
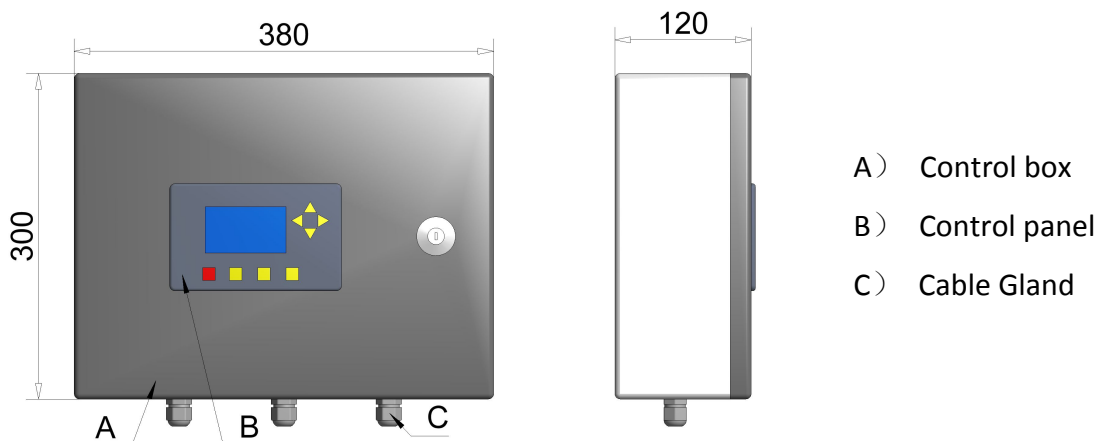
Figure 3：Parts and External dimension of control box

Usually the control box is installed on the Support of the collecting box (Figure 4.E). Of course you can also install control box on the nearby wall .

1.4 The installing of actuator unit

The actuator unit is composed of two parts: diverter and collecting box（refer to Figure 4）.The collecting box is installed under the diverter and be careful not to reversely installed and assure that the collect valve (Figure 4:D) can act flexibly.

Figure 4: Parts and external dimension of actuator unit

A) Diverter AE01
B) Collecting box
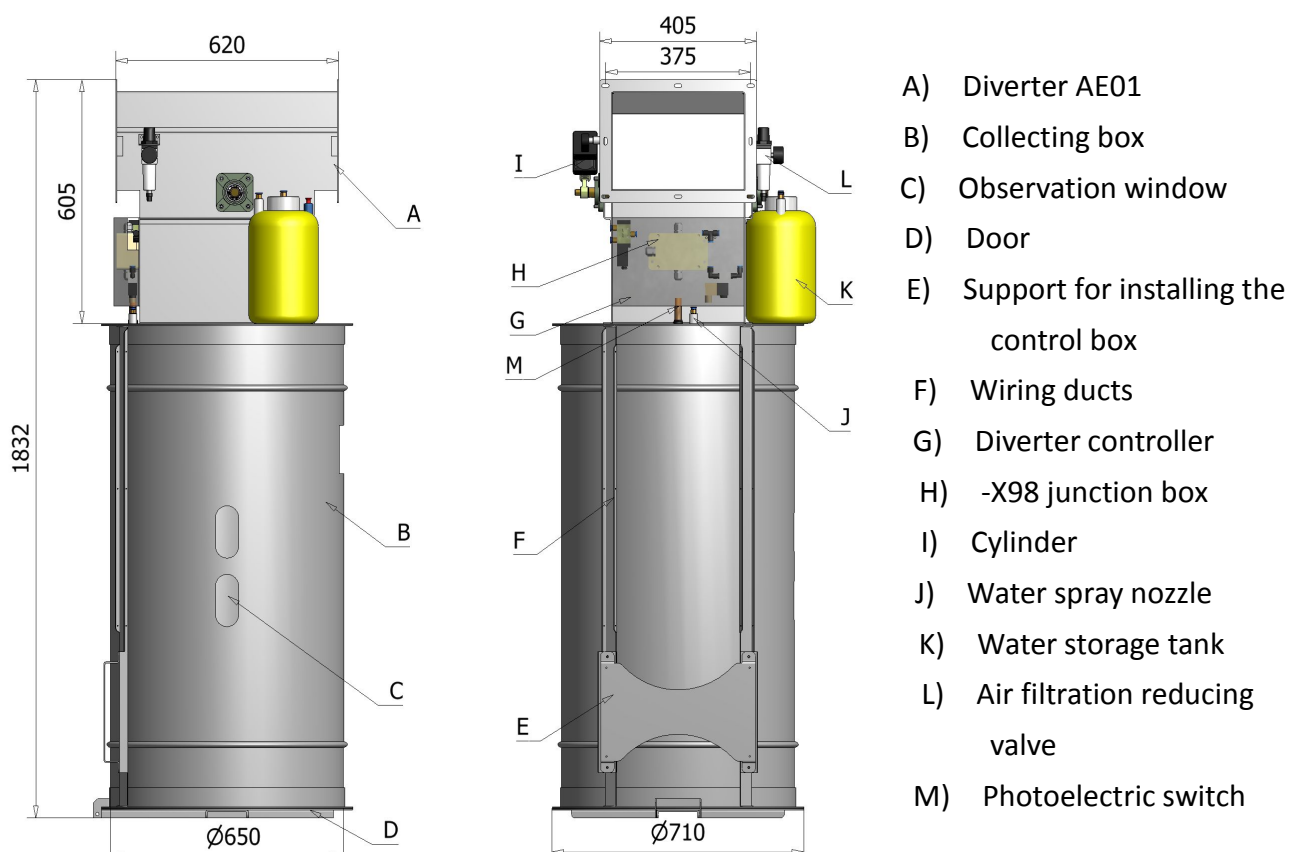C) Observation window
D) Door
E) Support for installing the control box
F) Wiring ducts
G) Diverter controller
H) -X98 junction box
I) Cylinder
J) Water spray nozzle
K) Water storage tank
L) Air filtration reducing valve
M) Photoelectric switch

The diverter is connected to the existing pipeline by square to round joint pipe and installed with metal rods, and when installing, pay attention to the direction of inlet and outlet. Because the diverter adopts the fast reaction pneumatic mechanism, 600～800kPa stable and clean compressed air must be provided.

The photoelectric switch is used to be a level sensor. It indicates when collection box is nearly full.

When the displayer is show "The collecting box is full", the collecting box must be emptied immediately.

⚠ **ATTENTION！**
The collecting box should be installed to a proper site to avoid the diverted material falling on the cotton bale or other machines, when the door of the collecting box is opened.

⚠ **ATTENTION！**
When emptying the collecting box, the bottom of the diverter (especially the movable flap) may not be touched! There is danger on injury due to sudden movement parts.

1.5 The standard installation

Before installing the AMPEE01, you need to calculate the right distance between the metal detector and the diverter. You can do this with the following formula.

Distance[m]= Transport velocity[m/s]*Reaction time[s]*Safety factor

The **Distance** is the metal detector to the diverter.

The **Transport velocity** is the material transport velocity in the pipeline.

The **Reaction time** is defined as the time taken by diverter to reach activated position after receiving a switching impulse.

The range of the **Safety factor** is 1.2~1.3.

The 'I' in the following figure 5 is a piece of connection pipe, it should be supplied by customer. The length of the pipe is normally from 2m to 4m, corresponding to transport velocity from 10m/s to 25m/s;
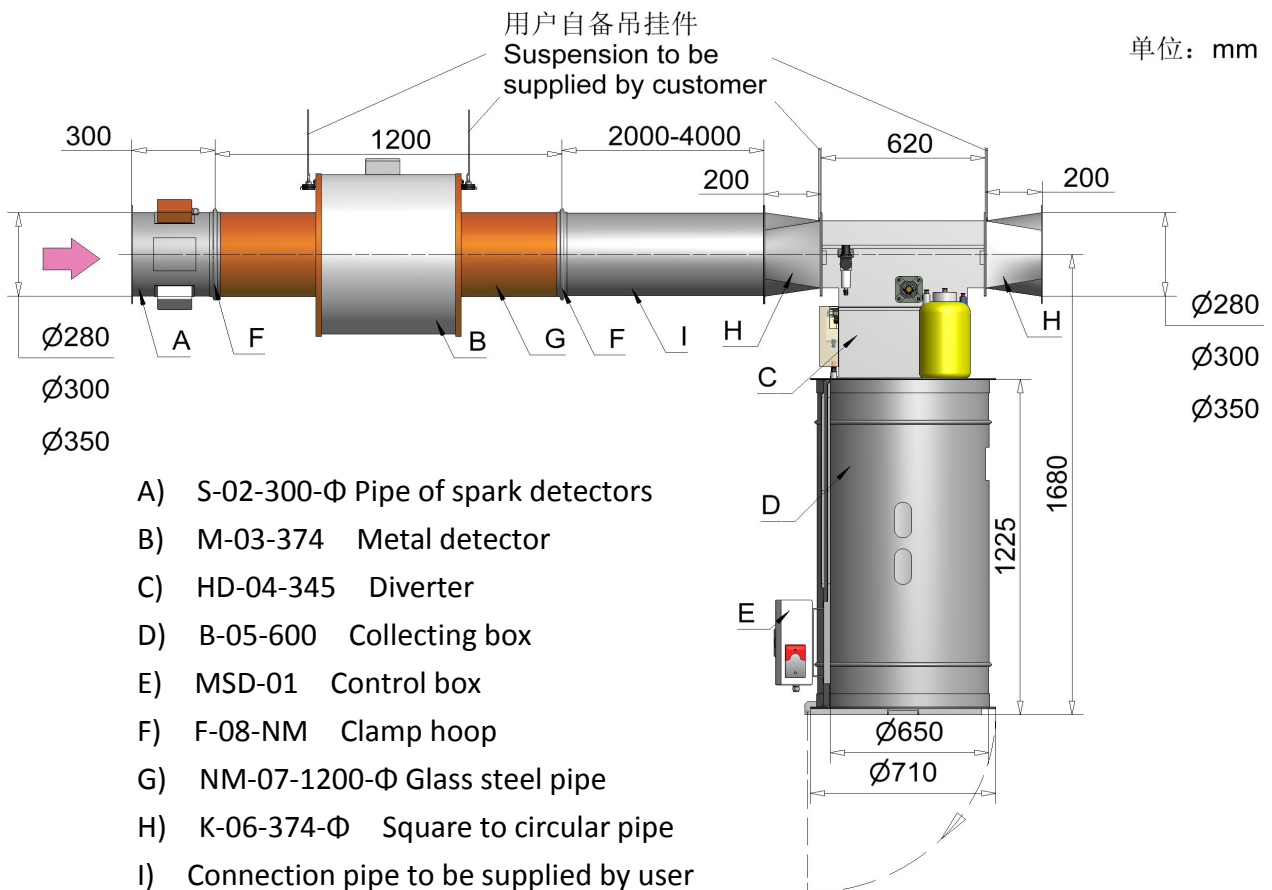

A) S-02-300-Φ Pipe of spark detectors
B) M-03-374 Metal detector
C) HD-04-345 Diverter
D) B-05-600 Collecting box
E) MSD-01 Control box
F) F-08-NM Clamp hoop
G) NM-07-1200-Φ Glass steel pipe
H) K-06-374-Φ Square to circular pipe
I) Connection pipe to be supplied by user

Figure 5：Standard Installation of the AMPEE01

2．Electric wiring

-X95)　Spark Detectors Junction Box

-X90)　Metal Detector Junction Box

-X98)　Diverter Junction Box
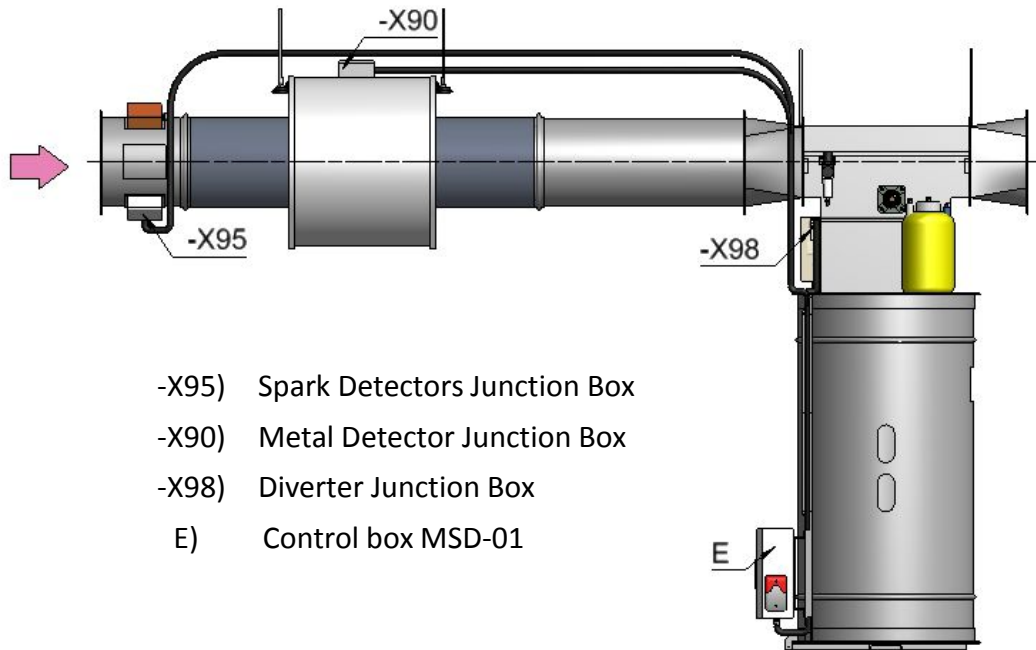
E)　　Control box MSD-01

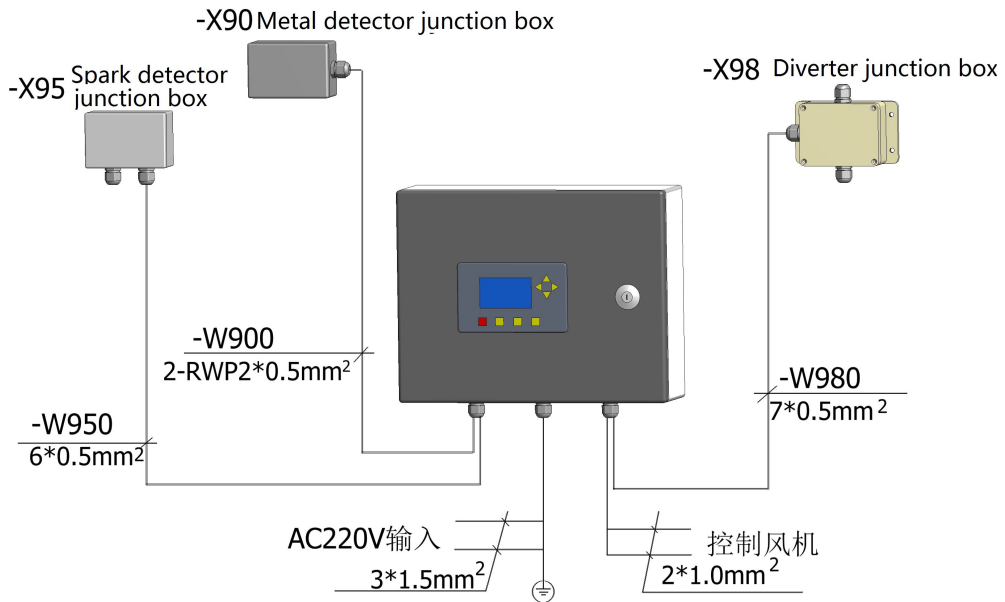Figure 6 a:　Electric wiring of the standard installation

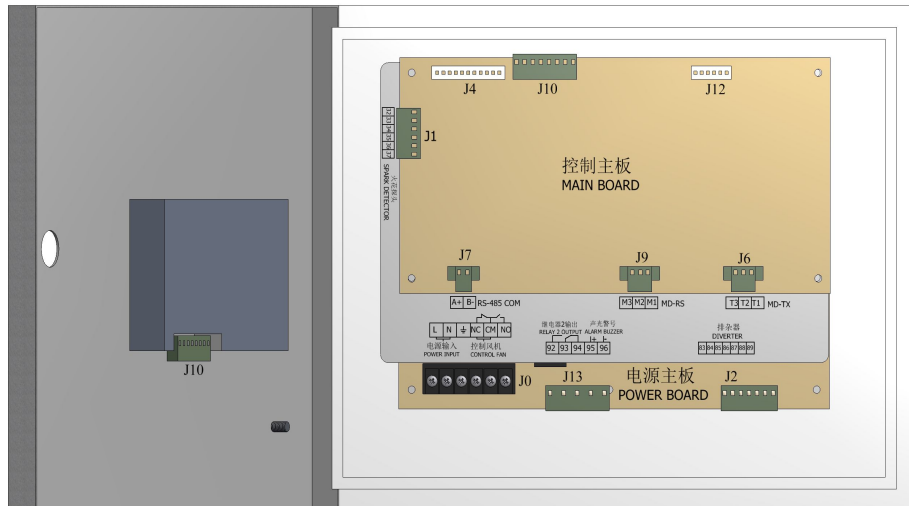Figure 6 b:　Electric wiring of the control box

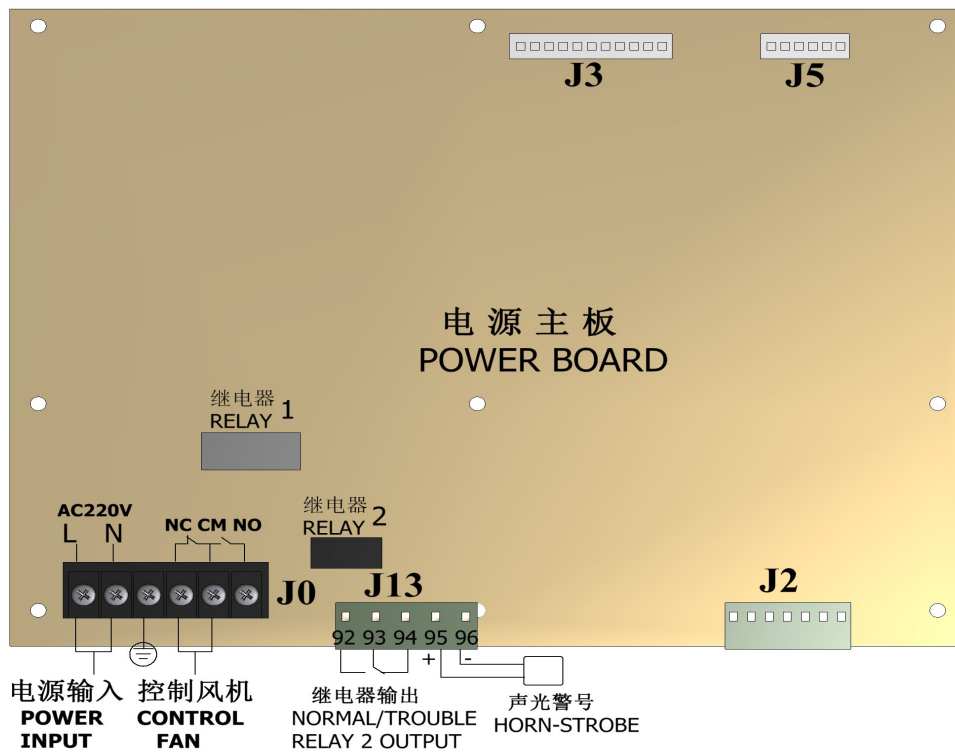Figure 7: Wiring terminals in the control box

Figure 8: Electric wiring of the power board

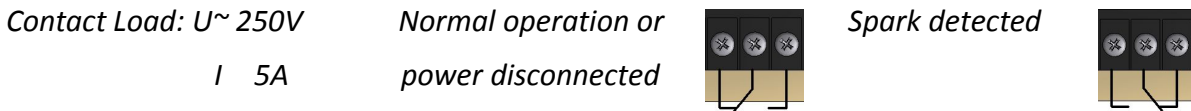## 2.1 Electric wring - J0 of the control box

a) Terminal 1 and terminal 2 are the power input AC220V, terminal 3 is earthing.

⚠️ **ATTENTION!**

We shall avoid the share of power supply with other equipments that may produce interference radiation. We shall pay special attention to avoiding the phenomenon that on the time of spark alarm stopping，the power supply of instrument itself can't be shut down for output of relay signal.

b) Terminal 4 'NC' and terminal 5'CM' provide a couple of voltage-free normally closed relay contacts，that can be used to control the fan and other production machinery. (Terminal 5 'CM ' and terminal 6 'NO' provide a couple of normally opened relay contacts.)

Relay 1: This relay is activated when the fire alarm is activated.

Contact Load: U~ 250V *Normal operation or* *Spark detected*
I 5A *power disconnected*

c)Terminal 7 and 8 drive the electromagnetic valve of the diverter

2.2 Electric wring – J13 of the control box

a) Terminal 92 、terminal 93 and terminal 94 ，a voltage-free contact is provided that can be use to monitor the function status of the machine. In the default configuration Relay 2 is configured as a Ready Relay.

Relay 2: Ready relay (Recommended warning output)

You can use this switching signal to activate a warning device or to stop the material flow through the conveying line.

Contact Load: U~ 125V *Normal operation:* *Error or power*
I 0.6A *disconnected:*
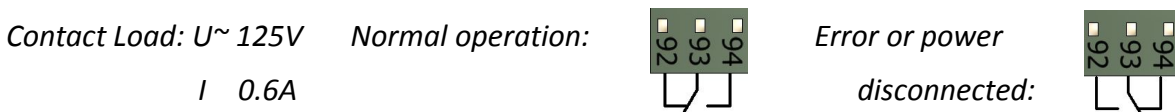
b) Terminal 95 and terminal 96 are connected to the Horn –strobe. Terminal 95 is anode ,terminal 96 is cathode.

2.3 Electric wiring of the main board to the metal detector

The -X90 wiring terminals in the metal detector junction box is connected to the control box main board through 2 shielded cables, in which the wiring terminals [1 2 3] is connected to the transmitter cable (TX - cable) ;
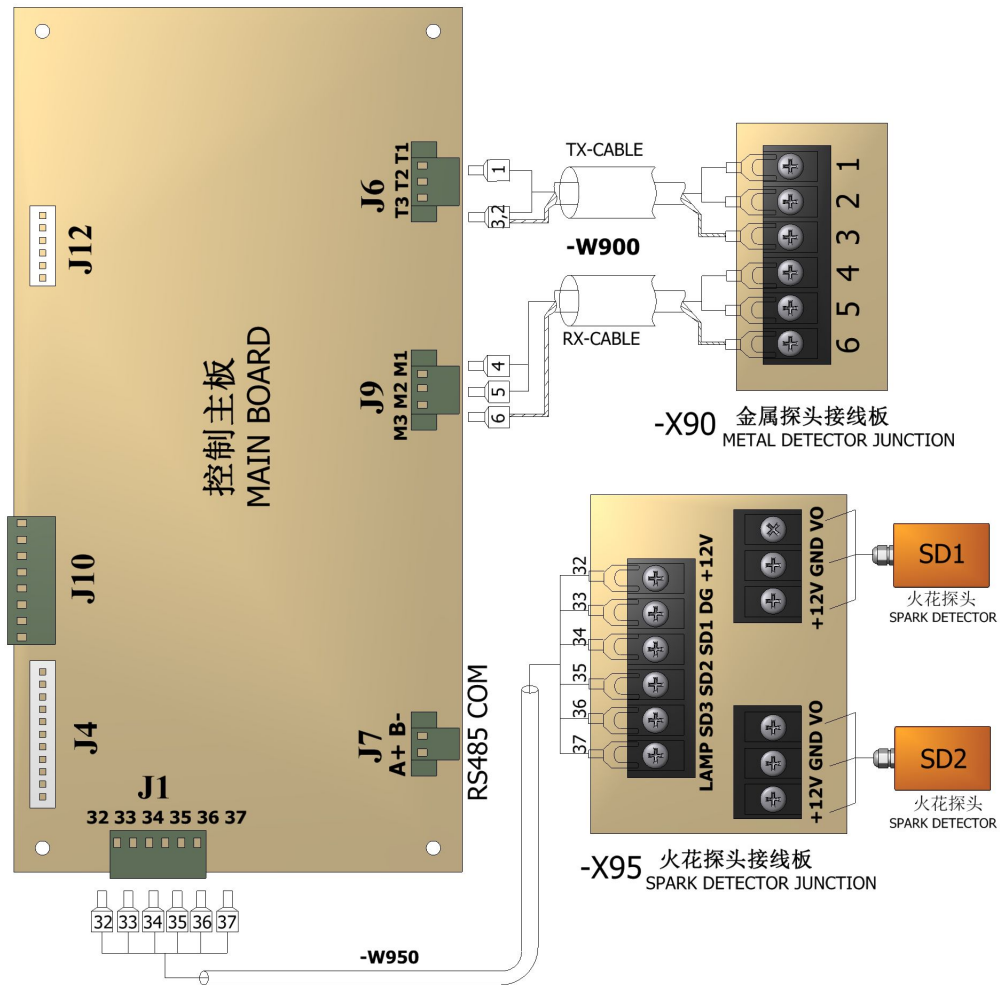The wiring terminals [4 5 6] is connected to the receiver cable (RX - cable).

Figure 9: Electric wiring of the main board

2.4Electric wiring of the main board to the spark detectors

There are two spark detectors SD1 and SD2 connected in the spark detector junction box - X95. The wiring terminals No.32 to No.37 on the main board in the control box are connected to the terminals of the spark detector junction box - X95.

2.5 Electric wiring of the control box to the diverter

The J10 on the power board of the control box can be connected to the junction box - X98 of the diverter. The No.83 and No.88 terminals on J10 is the DC voltage output to drive the magnetic valve of the diverter .
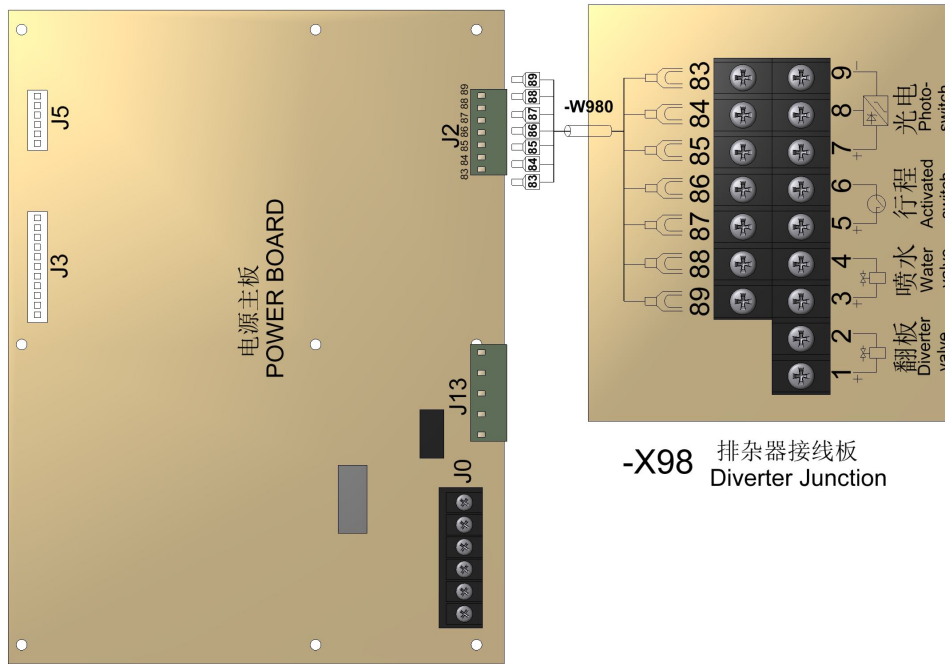
Figure 10: Electric wiring of the control box to diverter

2.6 Earthing and safety

a) You should earth properly according to the safety standard of local government. This equipment needs to be separately earthed. It is suggested that the earthing wire be as short as possible and it is prohibited to earth it together with other equipments.

b) While overhauling, please first shut down the power supply and interrupt the compressed air supply. The temperature of the radiator is very high. So don't touch it to avoid burn.

c) After the fire alarm is activated, you should shut down the general power supply of the procedure and then put out the fire.

d) The function test or maintenance work that needs climbing should be carried out by more than two people.

C. Using of the control panel

1、The instruction of LCD Displayer and function of the control panel

1.1 Explanation of the panel

1）The main working page in normal operation

Figure 11: Diagram of control panel and main display

Display		Explanation
08/22/2010 16:35		The time now is 16:35 on Aug.22,Year 2010
Spark	○ ○ ○	The spark detectors
	——	The flash will show '—' to'| ',while the diverter is activating
Metal	8	The count of metal detector is '8'
	【83%】	The sensitivity parameter of metal detecting is '83%'
♫ 2		There are 2 fire alarm messages.
FUN→MENU		①Indicates you press the key 'FUN' to shift the main menu page to parameter settings. ②'Locked' will be displayed after the keyboard locked.

Table 1：Instructions of the main page

The Operation LED should always light up during operation. It will not light up for a while, when the metal is detected. If it does not light up, an error in the system.

When the instrument detect metal, there will be a presentation at the forth line of the main page. e.g.: '←7.4m/s', it means 'the speed of the removing metal is 7.4m/s'.The speed here is just for reference and it is not the actual speed. Because the size and the kinds of metal are different, compared with the actual speed, there may be errors; The arrow symbols "←, →" show you which kind of the metal detected(ferrous or non ferrous) .

2）The fire alarm page

After resetting the alarm by pressing the key [RESET ALARM] , the fire alarm page will return to the main page.

Figure 12: The fire alarm display

Display	Explanation
08/22/2010 09：26	The spark detector alarmed at 9:26 on Aug.22, Year 2010.
spark ◯ ◯ ◯	It means No. spark detector detected the spark
♫ 2 Fire！	The record of fire alarm is twice.

Table 2: Explanation on the fire alarm display

3) Pressing the key 'FUN' (press 'FUN+▲' under the state of key locked) to enter into the Parameter setting menu , see Figure 13
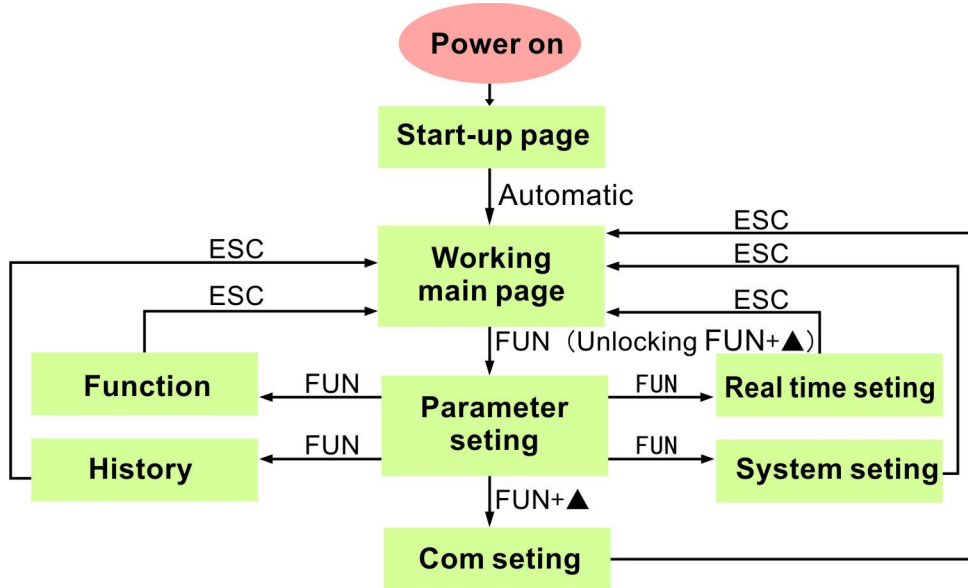

Figure 13： Flow chat of switching the menu page

1.2 Explanation of the keys

1) [RESET ALARM]   Reset fire alarm key. After pressing the key, the alarm status will be eliminated and the instrument returns to the normal working state.

2) [ZERO]   Counter clear key. The key is used to clear the counter of metal

[FUN]

detector's action.

3)   Function key. The key is used to switch the menu page (refer Figure13). If the keyboard is locked, you can enter the menu page by pressing the 'FUN' and '▲ ' keys simultaneously. .

4)   **ESC**   Home key. After pressing the key, you will return to the main page.

5)   **+**   Up key，   **−**   Down key，   **◄**   Left key，   **►**   Right key， These keys have the functions of switching parameter settings and changing the data，and we will call them '▲ , ▼ , ◄ , ►' for short as follows.

2、Parameter setting

After pressing the key 'FUN' on the main menu page , you will turn to the menu page of Parameter setting.

```
1.  Real time set
2.  System set
3.  Function set
4.  History
5.  Com set
```
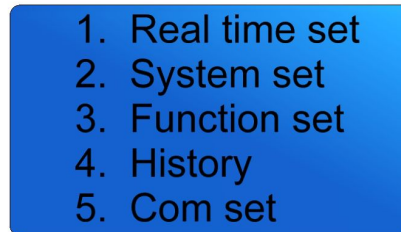
Figure 14: Parameter settings main menu

When the cursor is flashing in the '1.Real time set' item, press the key 'FUN' to enter into time settings, use the key '▲ , ▼' to switch positions of the cursor. Press the key 'FUN' entering into the page where the cursor stayed.

2.1 Real time setting

After you enter into the time setting menu page, press '◄, ►' turning to switch among the month, date, year, hour, minute. Through pressing the key '▲, ▼', we can change the value of the data. After finishing the setting of the time, press the 'ESC' key to return to the main page.

```
08/22/2010
16:35
        Time Set
     ESC→EXIT
```
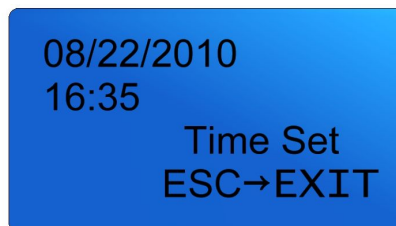
Figure 15: Time settings menu

2.2 System setting

After you enter into the system setting menu page , press the two keys '▲, ▼'can change for the up and down item shifting.

```
1. English    英文
2. Key lock   OFF
3. Auto Rst   OFF
```

Figure 16a: System settings menu

```
1. English    英文
2. Key lock   OFF
3. Auto Rst   OFF
   Rst Time  00:00
```

Figure 16b: System settings menu

1) The cursor is flashing in the ' 1. CHINESE 中文 'item, shows that we can choose according to the language, press '◄, ►',then we can select the system's language between Chinese and English.

2) The cursor is flashing in the '2.key lock' item, shows that we can lock the keyboard now, pressing the key '◄, ►' to select 'ON' or 'OFF'.

3）When the cursor is flashing in the '3.Auto RST' item, shows that we can press the key '◄, ►' to enable or disable the 'Auto RST'. When the 'Auto RST' shows 'ON' （refer to Figure 16b）, there will be an order as 'RST time 00:00' appeared at the bottom of the page .You can use the key '▲,▼' to shift the flashing items. Press "◄, ►" in a 24-hour time automatically reset time settings. If the automatic reset function is enable, the metal count value will be reset to zero automatically at the set time every day.

2.3 Function setting

After entering function setting menu, press '▲, ▼'can change for the up and down item shifting.

```
1. Sensitivity  83%
2. Activate   0.00S
3. Reset     2.00S
4. Spark test
```

Figure 17： Function setting menu

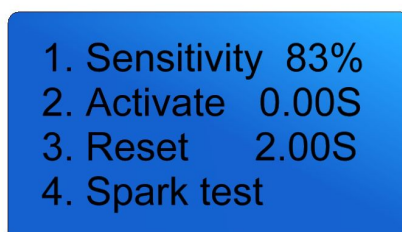| Parameter	Settings	Factory setting
1.Sensitivity	0-99 %	69%
2.Activate	0.00s-3.00s	0.00S
3.Reset	1.00s-3.00s	1.50S

Table 3: Function parameter value table

1）Sensitivity

①The metal detecting Sensitivity Parameter range is 0-99%,the lowest is 0 and the highest is 99%. The percentage is higher, the sensor is more sensitive.

②You can set the 'Sensitivity' parameter according to the actual requirement. The value in the range 40-65% can satisfy most of the users in spinning mills.

2）Activate

'Activate' parameter refers to the additional time by the software from detects the metal is detected to the diverter is actuated. Use the key '◄, ►' can set the parameter. The setting precision of the activate parameter is 0.01S and the setting range is 0.00S-3.00S. If press '◄, ►'for 3 seconds simultaneously, the data would change continuously.

⚠ **Warning:**

The parameter is closely related to the length of connection pipe and the Transport, so if it was set improperly, that might cause the diverter acts incorrectly.

3）Reset

'Reset' parameter refers to the additional time by the software from the activated position to the normal position of the movable flap. Use '◄, ►' to set the parameter of 'Reset', the range is 1.00S-3.00S and the setting precision is 0.01S.If press '◄, ►'simultaneously for 3 seconds, the data would change continuously.

⚠ **Warning:**

If the parameter is set too low, maybe that material including the metal can not be diverted, but if the parameter is set too high, more contaminated material

will be diverted.

4）Spark test

When the cursor flashes at ' 4. Spark test', press the key 'FUN' entering into the spark testing page, then you can take the simulation test with the fire alarm function of the machine.

```
1. Spark    SD1
2. Spark    SD2
      ▶ Start
```
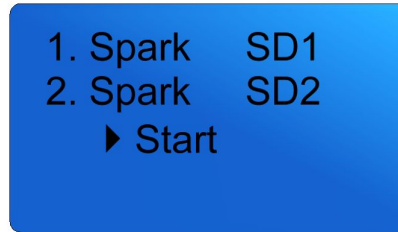
Figure 18: Spark testing page

① When the cursor flashes in the item of spark SD1,press the key '►',and then the test lamp in the spark detector junction box will light up. If the spark SD1 worked normally, the host machine should send out audible and visual alarm, at the same time the diverter actuated and the Relay 1 is activated .They would reset automatically 2-3seconds later.

②When the cursor flashes in the second item of Spark SD2,press '►' key, and the test lamp will be light up in the same way, then make spark test to Spark SD2.

③You can press the key '►'repeatedly to make sure that if SD1 &SD2 can be worked normally, if you find something wrong with the spark detector or the sensitivity is lower, you should mend it promptly.

2.4 History

In the menu setting, when the cursor flashes at '4. History ' item, you can press the key 'FUN', then enter into the History inquiring page.

Read the recent records of metal detected and spark alarming.

```
Metal Speed
 120ms  →6.4m/s
Fire Alarm：♬2
08/21/2010  09:26
```

Figure 19: History inquiry

1）120 ms, → 6.4 m/s ", this message tells you how long the diverter took to move from the normal to the activated position and the metal transport velocity just detected is 6.4 m/s . The arrow symbols "←, →" show you which kind of the metal detected(ferrous or non ferrous)

2）08 / 21 / 2010 09 : 26 records the time of the latest fire alarm ,press the key '►', you can turn to the previous fire alarm history.

3）Press 'ESC' return to the main page.

2.5 Communication setting

There is a built-in RS-485 serial interface, marked J7   is located on the main board (see figure 9).

When the cursor flashes in NO.5 ' 5. com set' item in parameter setting menu, you can enter into to the Communication setting page by press 'FUN','▲' simultaneously.

1. Address   1
2. Baud rate 19200
3. Modbus Network
   (7,N,2 ASCII)
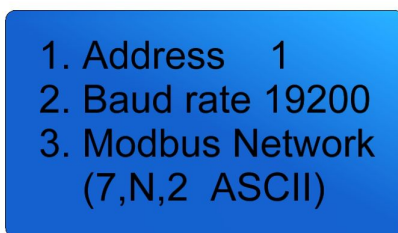
Figure 20 : Communication setting menu

1) Press '▲, ▼' can select the communication address which can be set from No1 to No.15 .

2）RS-485 can be set up to communicate on Modbus networks, baud rate is 19200bit/s,and the communication protocol uses Modbus ASCII mode ,protocol <7，N，2 >.

3、Communication protocol

3.1 10-bit character frame（for ASCII）

Start bit	0	1	2	3	4	5	6	Stop bit	Stop bit

3.2 Communication protocol ASCII mode:

STX	Start character =':'(3AH)
Address Hi	Communication address：
Address Lo	8-bit address consists of 2 ASCII codes
Function Hi	Command Code：

Function Lo	8-bit command consists of 2 ASCII codes
DATA（n-1）	Contents of data：
……	n×8-bit data consist of 2n ASCII codes
DATA 0	n<=20,maximum of 40 ASCII codes（20 data）
LRC CHK Hi	LRC check sum：
LRC CHK Lo	8-bit check sum consist of 2 ASCII codes
END Hi	End characters：
END Lo	END Hi=CR(0DH)， END Lo=LF(0AH)

3.3 Functions

03H: multi read, read data from registers

Command message：   Response message：

STX	':'
Address	'0'
	'1'
Function	'0'
	'3'
Starting address	'0'
	'0'
	'0'
	'0'
Number of data (count by word)	'0'
	'0'
	'0'
	'4'
LRC Check	'F'
	'8'
END	CR
	LF

STX	':'
Address	'0'
	'1'
Function	'0'
	'3'
Number of data (count by word)	'0'
	'8'
0000H	'8'
	'0'
	'8'
	'0'
0001H	'0'
	'0'
	'6'
	'9'
0002H	'1'
	'6'
	'1'
	'5'
0003H	'0'
	'0'
	'2'
	'3'
LCR Check	'3'
	'D'
END	CR

3.4 Address list

Status monitor Read only	0000H	bit0	1：metal is in action
		bit1	1：the hopper is full
		bit7	1：Chinese 0：English
		bit8	1：detected the spark
		bit15	1：the machine works normally
	0001H		The speed of detected meta
	0002H		Real-time clock of the machine

	0003H	The count of detected metal

D. Debugging and usage maintenance

1、Fire alarm simulation test

a. You can use the fire alarm testing function brought by the machine itself .See Chapter C Using of the control panel/2.3 Function setting/ 4Spark test.

b. There is an active window on the pipe beside the spark diverter. You can also shine the spark detector through the window by torch. If the controller can carry out normal action, the spark diverter function is good. （The tungsten filament of the torch is a hot body and includes infrared ray） When the fire alarm function is activated, it is necessary to reset manually.

c. During the normal use, if fire alarm happens, the fan and other machinery's operation can not be started until the cause is found out. Occasionally although the spark is small but it can be out by itself, we should also stop for not less than half an hour, and we can not start until it is inspected and the safety can be assured.

⚠ **Warning:**
① The spark alarm function should be checked regularly with simulation test to assure that they are in the good working status. It is suggested that the test be carried out at least once every two weeks.
② The dust and fibers on the surface of lens in spark detectors must be regularly checked and cleaned.

2、Metal diverting function test and adjustment

In the meantime of metal diverting function test, it is necessary to do the setting of parameters such as sensitivity, activate, reset and so on.

a. 'Sensitivity' setting on the control panel can control the sensitivity of detecting metal scraps. The higher the sensitivity is, the more sensitive the metal sensor has. You can set the sensitivity according to the actual needs.

b. 'Activate' parameter can adjust the delay time from the metal detector detects the metal to the diverter activated. Thus the parameter is adjusted to minimum 0.00S,and after many times of testing, it is proved to be able to discharge metal scraps correctly. This status indicates that the distance from the metal detector to the diverter is the shortest and it is the most ideal.

c. 'Reset' parameter refers to the delay time of resetting after the action of the

diverter. The parameter can directly affect the contaminated material volume. It is best to assure that the metal scraps can be properly discharged but the contaminated material volume is the minimum.

d. While you is carrying out the metal test, please be observant to avoid the metal from entering the blower in the next procedure. You can use spreader tinfoil not less than 1cm^2, otherwise 3mm or smaller screw washer with obvious identification. Then wrap it with cotton and let it be plucked by bale plucker or directly put it into the transport pipe. When the indicator of the control box lights and the diverter actuated, that indicates that the metal detection function of this machine is normal.

e. If the diverter actuated, but you can't find the test metal in the collecting box, you should carefully observe and repeatedly adjust Activate and reset parameter until you can reliably divert the test metal. In the meantime, you should assure the dropped volume is the minimum. After repeat test, if you still can't divert properly, it is necessary to reconsider the install distance from metal detector to diverter. Activate

3、Maintenance and inspections

a. The user should make regular check on the functions of the spark detectors and metal detector to assure they is in good working state.

b. The material diverted in the collecting box should be emptied timely, or it may damage the diverter.

c. The diverter should also be checked regularly to make sure in the good state.

⚠ **Warning:**
The power supply and the Compressed air supply should be shut off while overhauling the diverter. It can insure the user from unexpected hurt by the movable flap.