AMP-EE01.v21

Eagle Eyes Metal&Spark Diverter

User Manual

(Version 1.01)

AMPE TECHNOLOGY CO.,LTD

www.ampecn.com

P r e l u d e

Thanks for using new models AMP series of high performance metal & spark diverter produced by Ampe Technology Co., Ltd. AMP series products are manufactured with high quality units, materials and with the utilization of latest microcomputer technology. Ampe Technology Co., Ltd. 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 provides cautions about the installation, parameter setting, troubleshooting and daily maintenance of metal & spark diverter to the user. In order to assure the proper installation and usage of the product, please read this manual in detail before installation. Please keep the manual well and give it to the operator of the machine.

Welcome to visit the website of Ampe Technology Co., Ltd.：www.ampecn.com. The website provides the download of the operation instructions and technical BBS service.

The following are the cautions that need special attention:

⚠ 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. Ampe Technology 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 down 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, installation 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.

Contents

A. Overview

1. Use and structural features

AMP-EE01.v21 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;
- Having strong anti-interference ability and adapting to the complex electromagnetic environment of industrial production;
- The efficient and fast impurity remover ensures the minimum action response time, requiring only a short installation distance;
- Large capacity cotton storage box design with cotton level detection and spark extinguishing functions;
- Intelligent identification of the type and movement speed of metal objects, ensuring reliable removal of metals;
- Automatic simulated spark detection system with complete fault alarm and alarm record query system;
- Having three-level management passwords for administrators, engineers, and operation and maintenance personnel;
- RS485 communication interface, Modbus communication protocol; It can be connected to AMPE IoT to achieve remote control of apps and WeChat platforms.

2. Technical parameter

1）Sensitivity: Metal detection: Steel ball diameter more than Φ2mm
Aluminum ball diameter more than Φ3.5mm
Spark detection: Spark diameter more than Φ0.5mm spark

2）Response time: ≤100ms

3）Power supply: 100-240VAC

4）Compressed air pressure range: 600～800KPa

5）Sound level of alarm: >60db

6）Power: <100VA

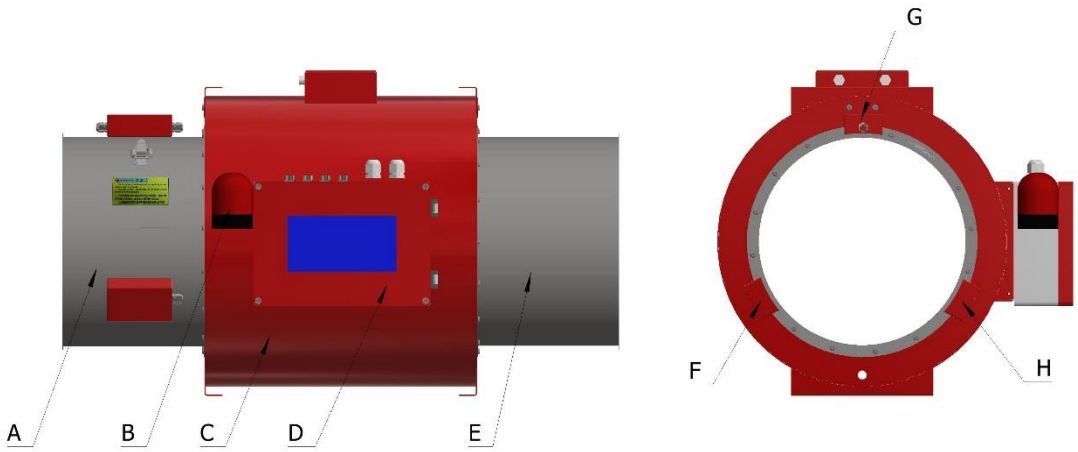
7）Requirement of the environment:
temperature -10℃—70℃, relative humidity（20-75）%RH

B. Electric wiring and installing

In order to reach the best performance of AMP-EE01.v21 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. Component Introduction

1.1 Integrated metal＆spark detectors



A Observation window B Alarm C Metal detector D Control box E Stainless steel pipe
F Spark detector SD3 G Spark detector SD1 H Spark detector SD2

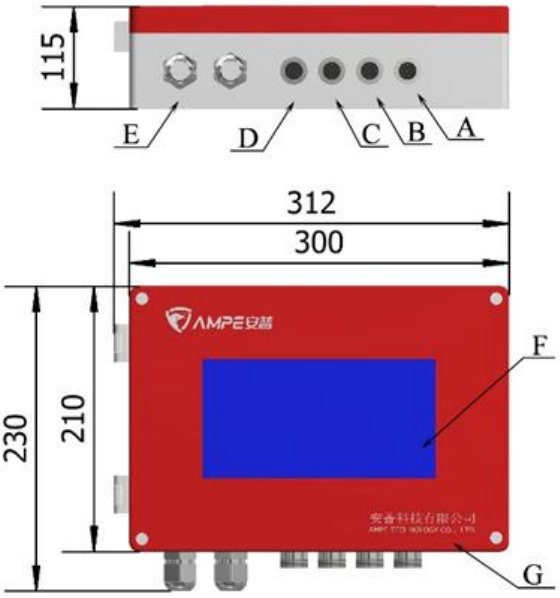
Figure 1：The connecting pipe of spark detectors

1) The connection between stainless steel pipe and metal detector is made of insulating material. In order not to affect the performance of metal detector, the main body of metal detector cannot be directly connected with hanger. 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 vibration. 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.

1.2 The installing of control box

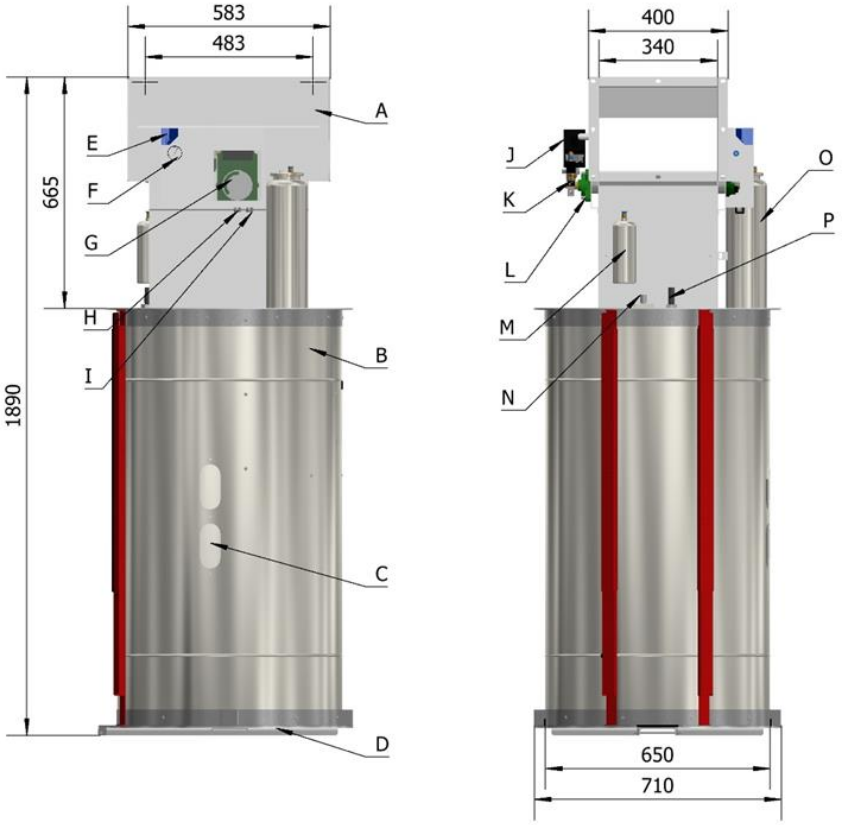


A. RX-Cable
B. TX-Cable
C. Spark Detection Aviation Plug
D. Diverter Cable
E. Cable Pipe Joint
F. Touch Screen
G. Control Box

Figure 2：Parts and External dimension of control box

1.3 The installing of actuator unit

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



A.Diverter
B.Collector box
C.Observation window
D.Door
E.Working station indicator
F.Pressure gage
G.Action time display
H.Plug1
I.Plug2
J.Cylinder
K.Solenoid valve
L.Bearing block
M.Gasholder
N.Water spray nozzle
O.Water storage tank
P.Photoelectric switch

Figure 4: Parts and external dimension of actuator unit

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 green light of the working status indicator on the diverter (Part E in Figure4) flashes, indicating that the kettle is short of water; Blue light flashing indicates insufficient air pressure; Red light flashing indicates spark probe alarm; Blue green is displayed when the equipment status is normal.

The photoelectric switch is used to be a level sensor. It indicates when collector box is nearly full.When the displayer is show “The collector box is full”, the collector box must be emptied immediately.

⚠ ATTENTION！

The collector 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 collector box is opened.

⚠ ATTENTION！

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

1.4 The standard installation

AMPEE01.v21 can be installed according to the Figure 5a. The required cotton conveying pipeline has been configured.Before installing the AMPEE01.v21, 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

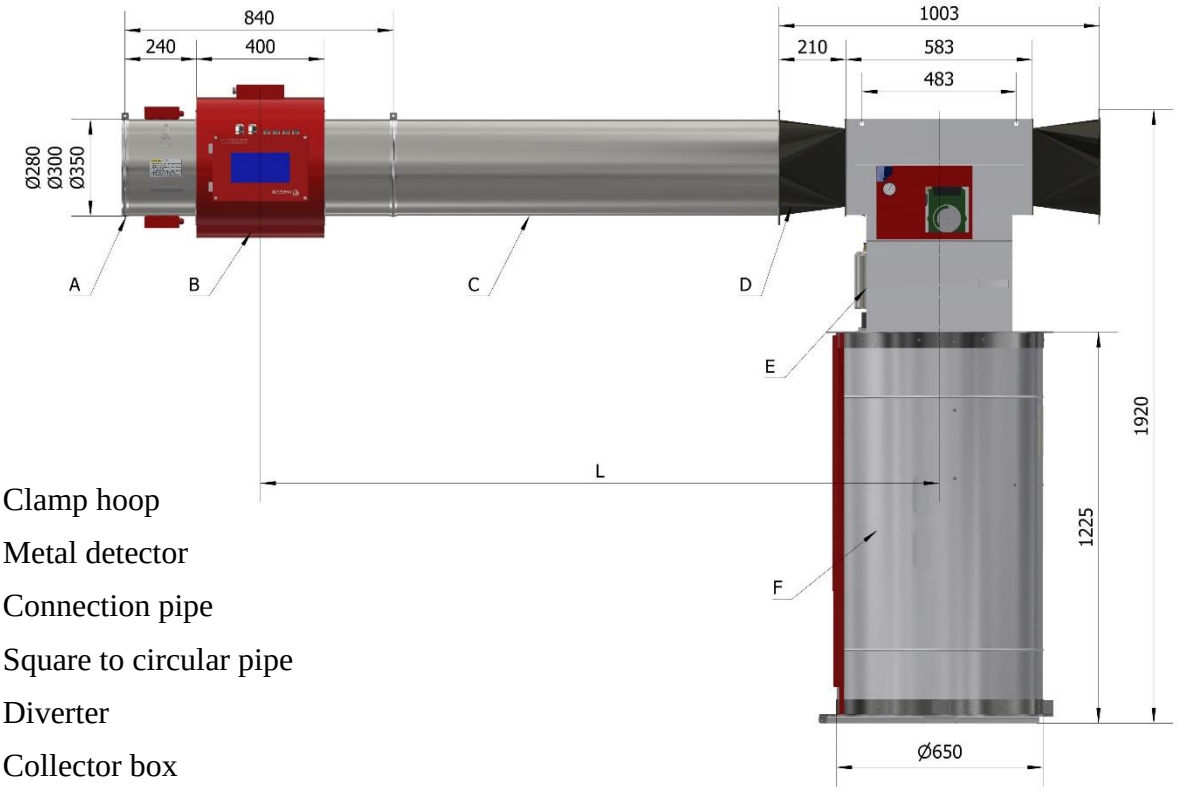
The **Distance** is the metal detector to the diverter.

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 ‘ C ’ in the following figure 5 is a piece of connection pipe, the length of the pipe is1.2m, corresponding to transport velocity from 10m/s to 25m/s;



A. Clamp hoop
B. Metal detector
C. Connection pipe
D. Square to circular pipe
E. Diverter
F. Collector box

Figure 5a：Standard Installation of the AMPEE01

Figure 5b: Schematic diagram of the installation position of the control box

The control box has been installed on the outside of the metal before delivery，as shown in figure 5b(I).According to the user's own situation,it can be installed on the support of the cotton drop bucket,as shown in fugure 5b(II).

2. Electrical wiring

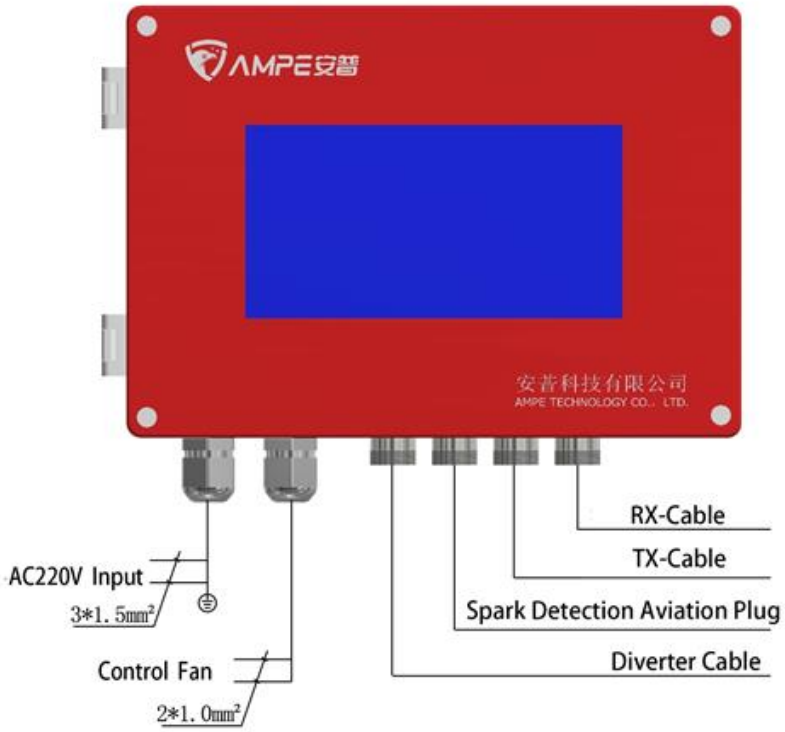


Figure 6: Electric wiring of the control box

2.1 Internal wiring of control box

1) Electrical wiring of terminal P7

a. Terminal 01 and 02 of P7 are power input, terminal 03 is ground electrode.

ATTENTION

1. The power supply should be avoided being cut off when spark alarm stopping happens;

2. The power supply wiring should come from power distribution cabinet in the workshop, do not use AC 220V from control transformer of the electrical control cabinet. We shall avoid the share of power supply with other equipment that may produce interference radiation, such as high-power inverter and motor’ s frequent start-stop. Please provide separate power supply if possible.

b. Terminal 04 “NO”, 05 “COM” and 06 “NC” are a group of passive relay contact output. The relevant equipment can be shut off when spark alarm happens.

c. Terminal 07, 08 and 09 are passive relay contact output. It detects the performance of this equipment, the relay contact works if there is a fault.

d. Terminal 10 and 11 are connected to solenoid valve coil of diverter. The specification of solenoid valve coil is DC20V-24V.

e. Terminal 12 and 13 are connected with external alarm elimination keys.

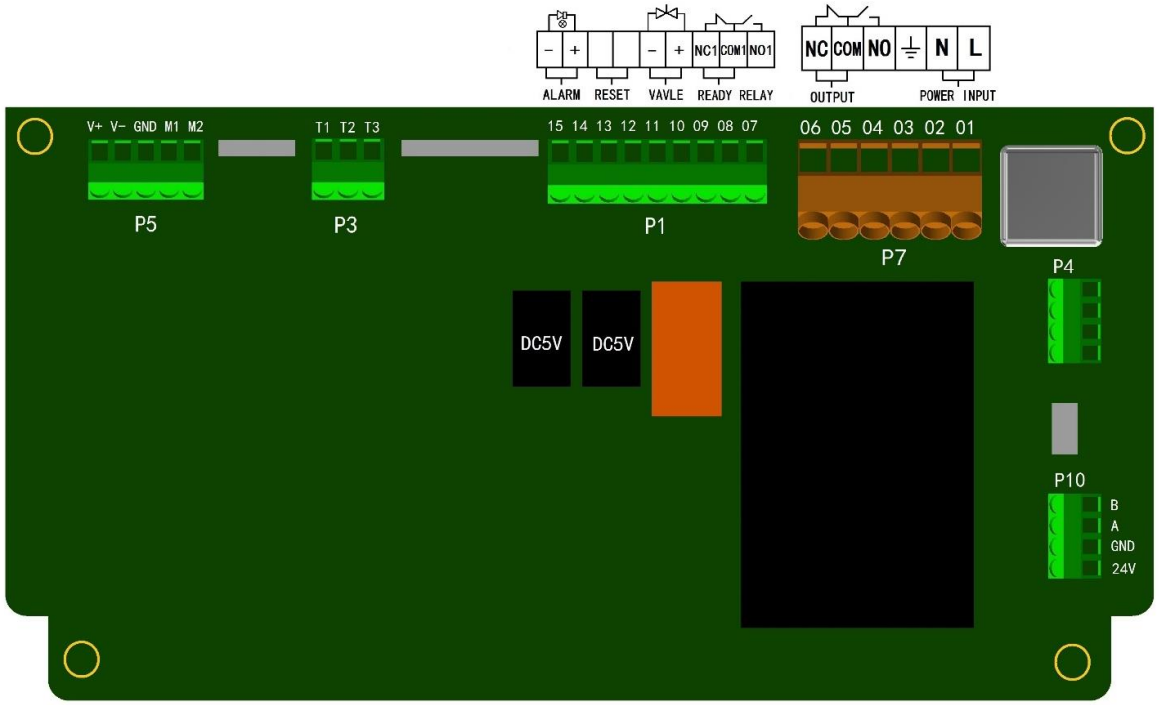


Figure 7: Wiring terminals in the control box

f. Terminal 14 and 15 are connected to sound and light alarm signal, terminal 14 is connected to positive pole, terminal 15 is connected to negative pole.

2) Electrical wiring of P3 terminal

P3 is a spare wiring terminal for the metal detector TX socket.

3) Electrical wiring of P5 terminal

P5 is a spare wiring terminal for the metal detector RX socket.

4) Electrical wiring of P4 terminal

P4 is connect the touch screen (DOP-107BV).

5) Electrical wiring of P10 terminal

P10 is the 485 communication interface

2.2 Grounding and safety

1) All the units must be grounded directly to a common ground terminal according to the safety standard of local government.

2) This equipment needs to be separately grounded and it is prohibited to be grounded together with others. It is suggested that the grounded wire be as short as possible.

3) While overhauling, please first shut down the power supply and interrupt the compressed air supply.

4) After the spark alarm, the power supply should be immediately turned off before extinguishing the fire.

5) Spark alarm tests or maintenance that require climbing must be carried out safely and with at least two people involved.

6) Ensure the safety of personnel when testing the turning action of the actuator.

C. Using of the control panel

1. Boot screen

Figure 8. Boot screen

"AMP-EE01"is product model, "ver1.01"is software version model.

2. Work picture (main page)

2.1 Main page

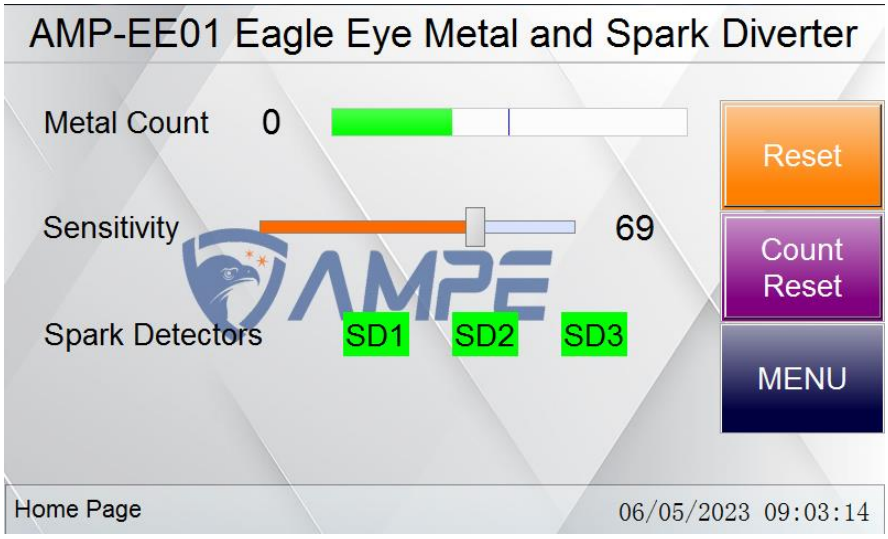


Figure 9. Work picture(main page)

Note: After start up, system enters work homepage automatically. System should return into work homepage after doing menu settings. System return into homepage automatically when under the condition of spark and metal alarm.

Panel displays	description
06/05/2023 09:03:14	Time display: 06/05/2023 09:03:14
metal count 0	Metal detection alarm number 0
Sensitivity 69%	Metal detection sensitivity(0%~99%), The current value is 69
Spark detectors SD1 SD2 SD3	Represents the working state of SD1, SD2 and SD3 sensors
Reset	Alarm reset key
Count reset	Zero metal count
Menu	Click it into menu

Table 1 :Description of touch screen content

Sensitivity can be modified in the main page, click the number or slide the progress bar button to change the sensitivity value. The value can be set from 0 to 99.

2.2 Metal alarm screen

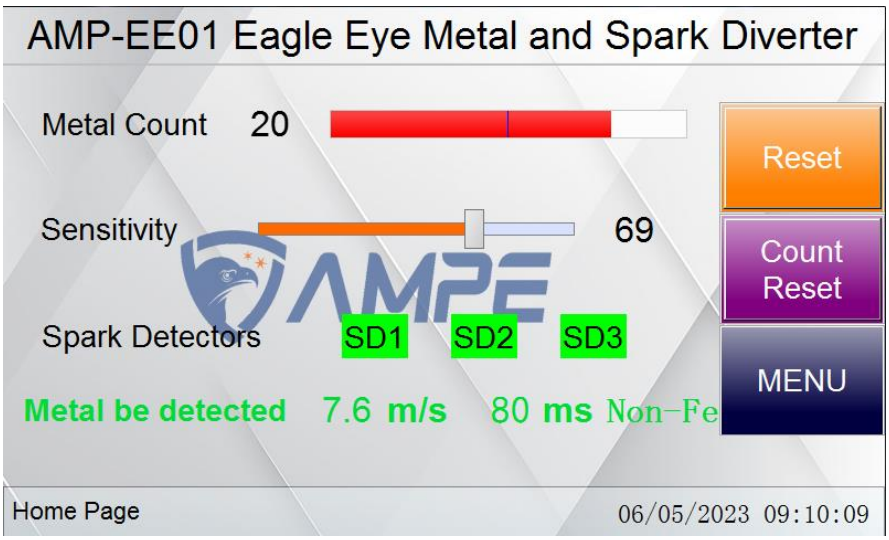


Figure 10. Detect metal material

When sensor detects metal material, screen displays the context “Metal be detected, speed 7.6 m/s 80ms”. It means that the speed of metal flow rate is 7.6m/s, the speed of the metal is for reference only. Due to the different size, shape and nature of the metal, there may be errors compared with the actual speed; "Non-fe" means non-ferromagnetic metal and "Fe" means ferromagnetic metal; “80ms” means the actual action time of the actuator; the bottom of the display screen displays the flow alarm message “metal be detected”.

2.3 Spark alarm screen

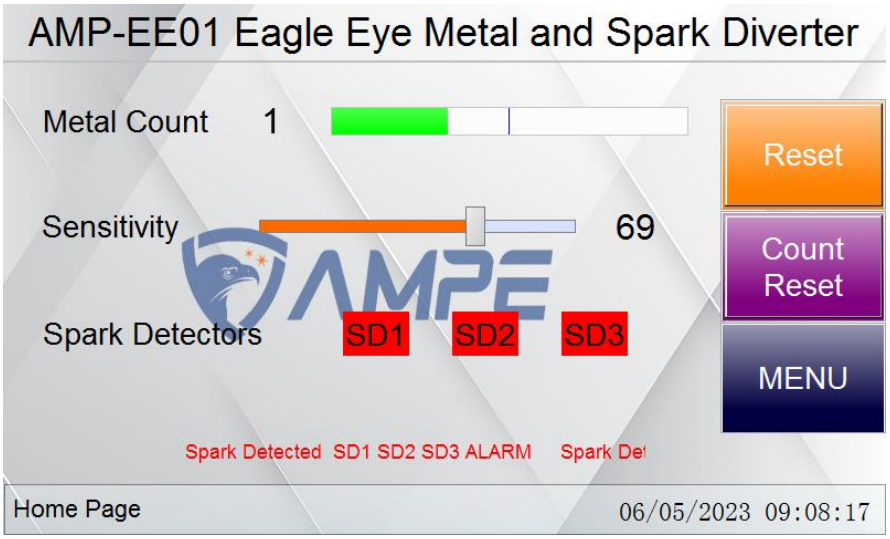


Figure 11. Touch screen display frame when detects spark

When sensor detects sparks, screen displays the context “Spark detected SD1 SD2 SD3 Alarm”, it means SD1 SD2 SD3 detect the spark.

3. Menu description

Click “menu” in the work home page to enter into the main menu page.

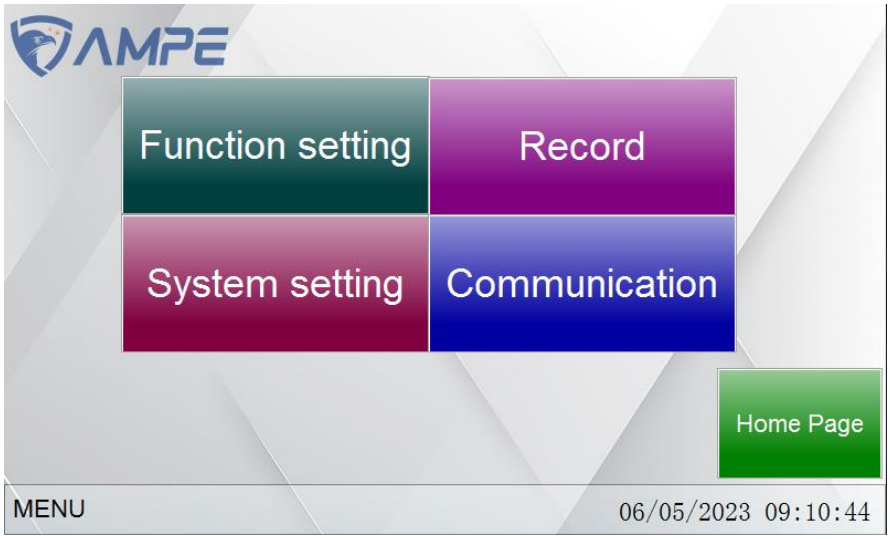


Figure 12. parameter setting main menu page

Main menu has four sub menus including function setting, record, system setting and communication.

Click the “home-page” button to return to the home page.

4. Parameter setting instructions

4.1 Function setting

Click “function setting” key to enter into parameter setting screen, the entry password is level 1 or above.

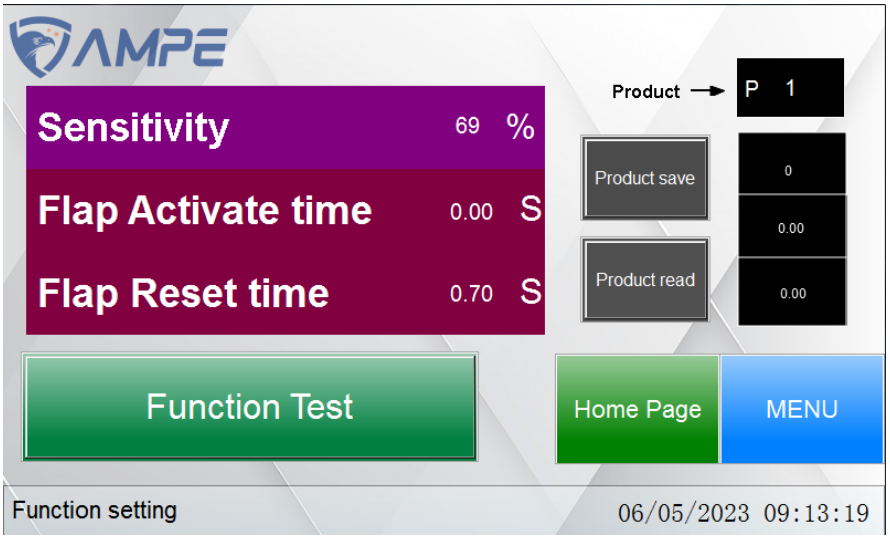


Figure 13. Function setting

Parameter	Setting range	Factory set value
Metal sensitivity	0-99%	69%
Flap Activate time	0.00s-3.00s	0.00s
Flap Reset time	0.50s-3.00s	0.70s

Table 2: function setting table

4.1.1 Metal detection “sensitivity” parameter description:

① The 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.

⚠ ATTENTION

When the sensitivity is set to 0%, the metal detection function will be turned off.

② The flap activate time setting range is 0.00s and 3.00s, which refers to the additional delay from detecting metal to the reaction of the diverter. Normally the time is set to 0s.

③ The flap reset time setting range is 0.00s and 3.00s,.The delayed reset time after the flipping action of the diverter.

4.1.2 Product Memory

Product: P1-P8, it means 8 kinds of product.

Product save: Product : P1, click “Product Save” button and the current setting parameter is saved in product P1 memory.

Product read: Product : P1, click “Product read” button and the P1 setting parameter is set in current product memory.

4.1.3 Click “Function Test” key and enter into function test page. (**Note: when “Spark Detectors Configuration” and “Diverter Standard Configuration” function are shut down, “Function Test” is shut down. It is configured before delivery.)**

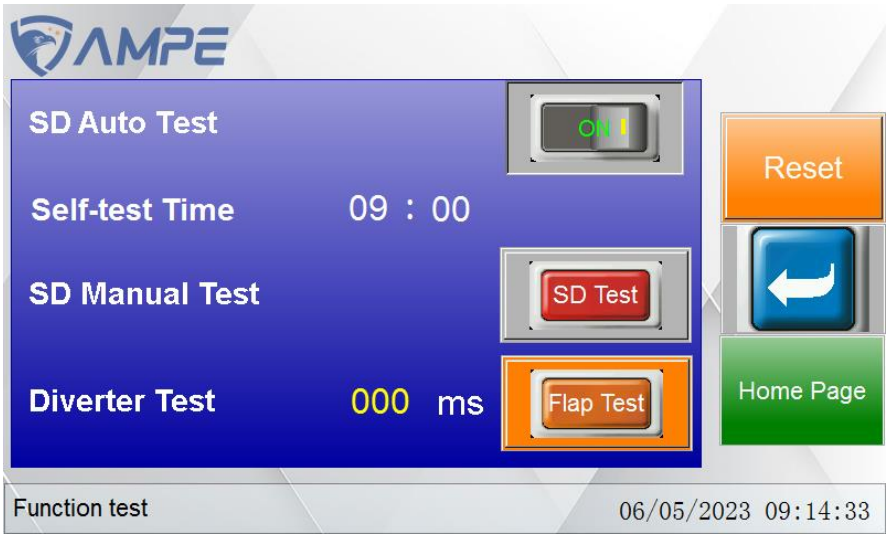


Figure 14a. Function test page

① “SD Auto Test”: Turn on this function, and the spark sensors will perform a self check every day. Click the button to turn off the self check function;

② “Self-test Time”: When “SD Auto Test” function is open, the self-test time can be set by clicking on the number to set the time.

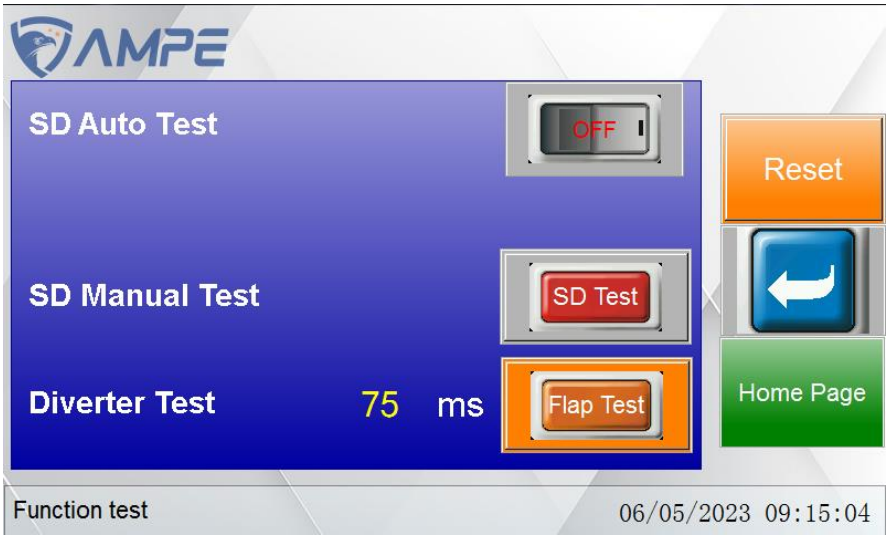


Figure 14b. Display of SD Auto test function turned off

③ "SD Manual Test": click "SD Test"key, test spark sensor function manually. When there is a fault in the spark sensor, the bottom of the page displays a fault such as "SD1 SD2 SD3 fault E10 E11 E12", it means fault code 10、11、12 : there is fault in SD1 SD2 SD3. As shown in Figure 14c.

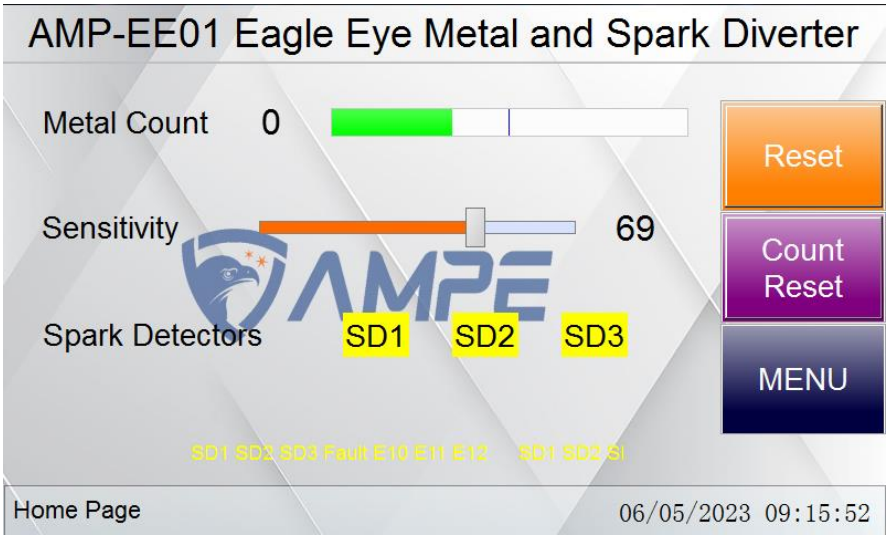


Figure 14c. display of spark sensor manual test fault

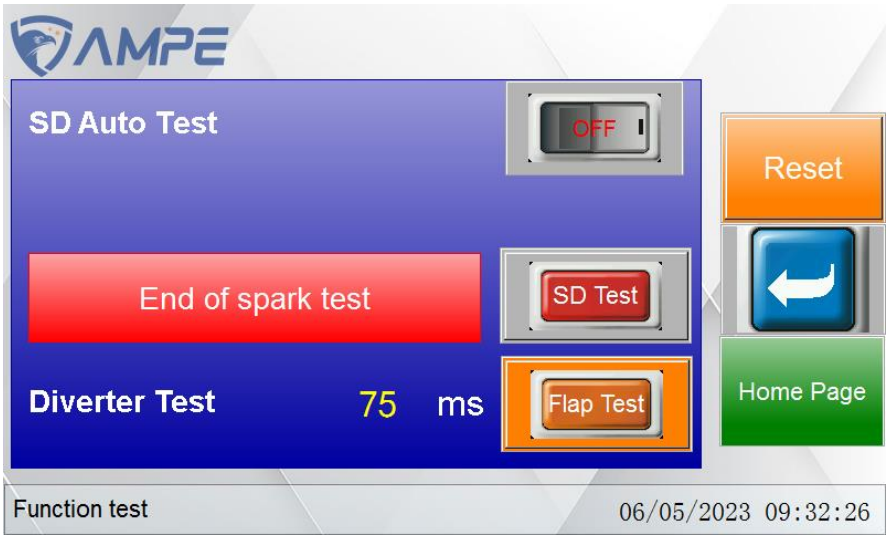


Figure 14d. display of spark sensor manual test done

④ "Diverter Test 75ms": click "Flap Test" key and test actuator. It displays the flap actuation time after action.

⚠ CAUTION

Flip action test function may lead to danger, please ensure that the actuator is not being maintained by the maintenance personnel and that this function can only be used under the premise of no personal injury.

4.2 System setting

Click " system setting" key and enter system setting page. The entry password is level 1 or above.

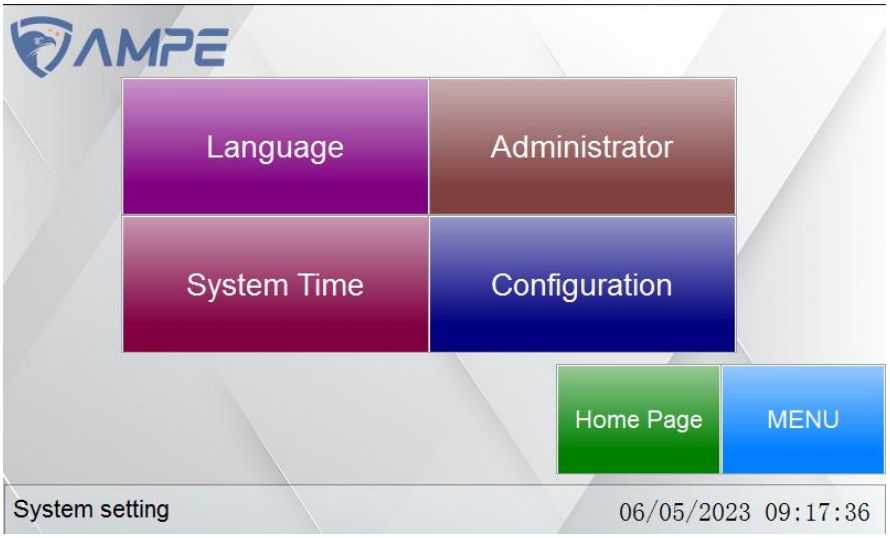


Figure 15. System setting

4.2.1 “Language”: it will switch the language of the system.

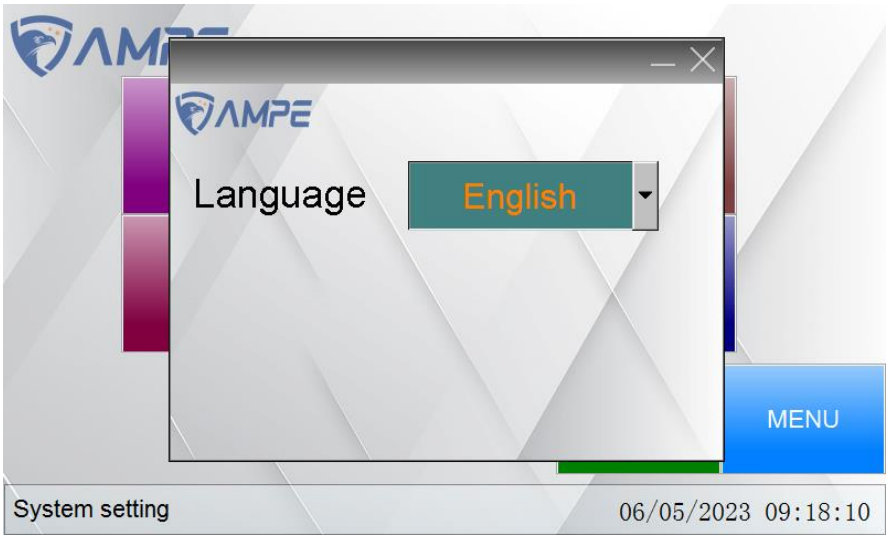


Figure 16. Language setting

4.2.2 “System Time”: click the key and change the system time.

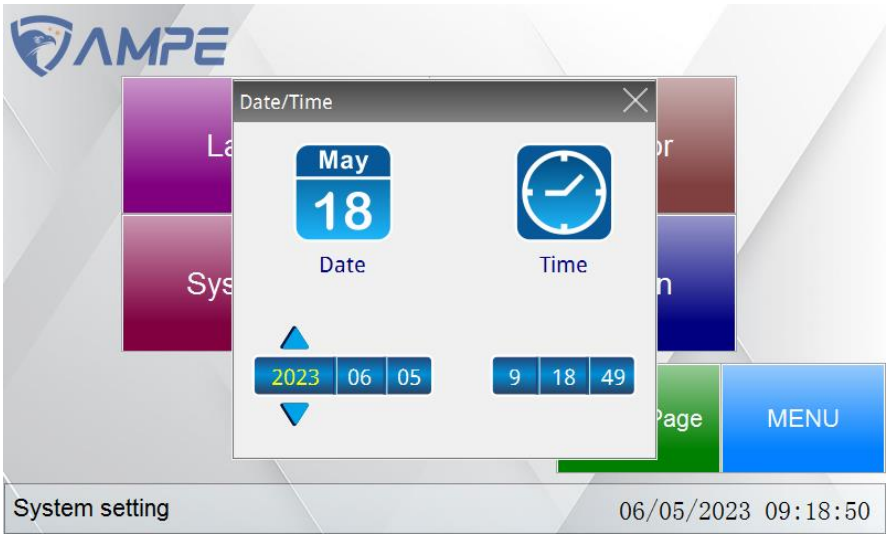


Figure 17. System setting

4.2.3 “Administrator”: The entry password is the administrator level 3.

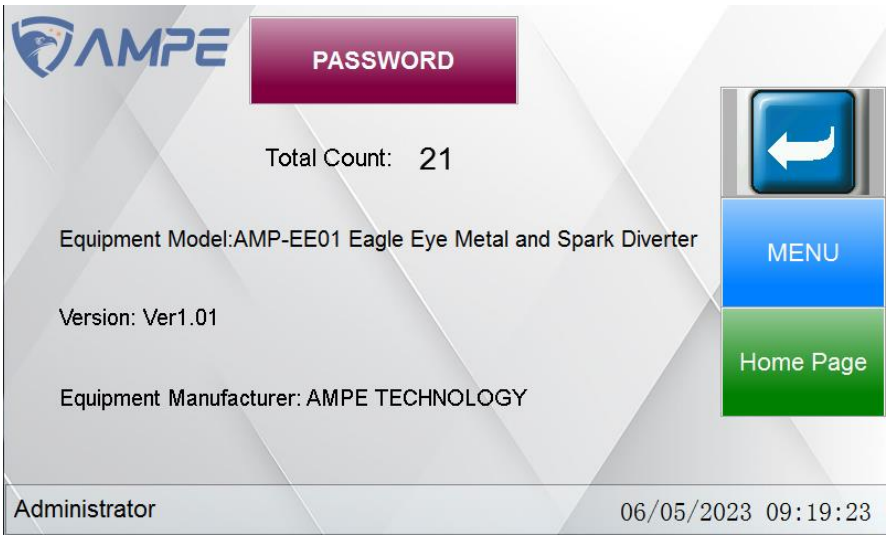


Figure 18a. Administrator screen

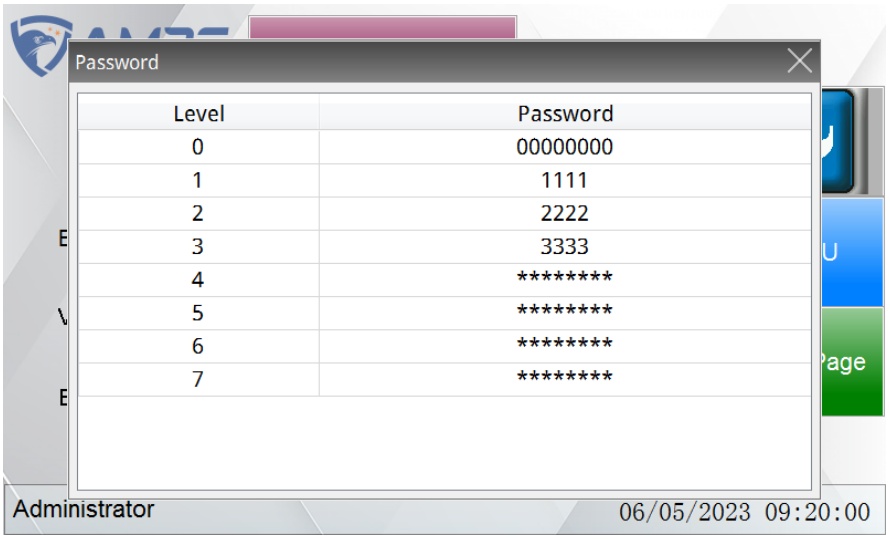


Figure 18b. display of password

There are three levels of passwords for user, including level 1, 2 and 3.

The level 3 password is the first priority level password, can set all of the parameters.

The level 2 password can set system parameters and communication parameters.

The level 1 password only can set sensitivity for metal detector.

The level 0 is the factory settings for display, no need to operate it.

4.2.4 “configuration”， Click “ configuration” key and enter configuration page. The entry password is level 3.

It includes the “spark detectors standard configuration”and the“diverter standard configuration”, which can be turned on or off according to user needs.If the“spark detectors standard configuration”is turned off, the spark detection function is turned off; If the “diverter

standard configuration"is turned off, the sensors and fault diagnosis functions of the standard actuator are blocked. Generally, non-standard actuators can be set to off.

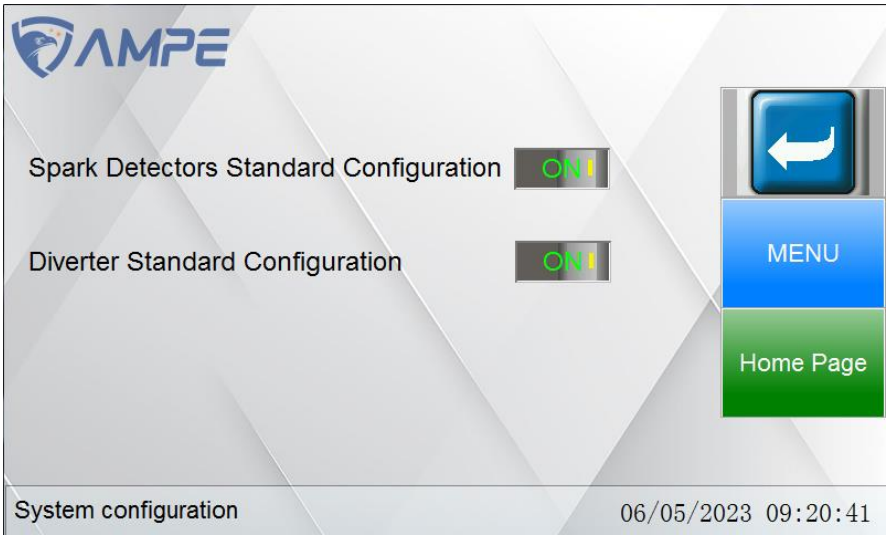


Figure 19. system configuration

⚠ ATTENTION

The entry password of "Configuration" is level 3 or above all. The system configuration has been set before delivery; system configuration is related to the hardware configuration of the system and users do not need to set. If users need to change system configuration or shield some function, please contact our company.

4.3 Record

Click "Record" key and enter into history page.

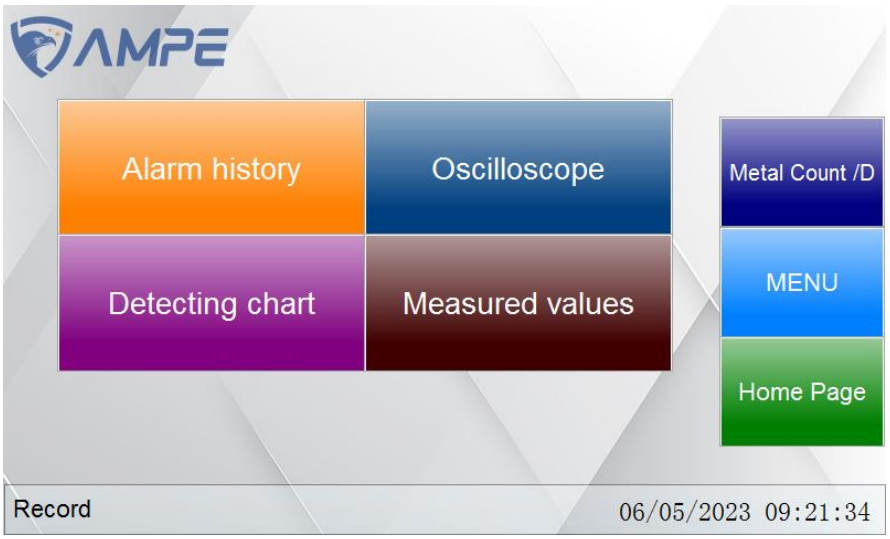


Figure 20. Record

1）“Alarm history”: users can check the specific time of each alarm;

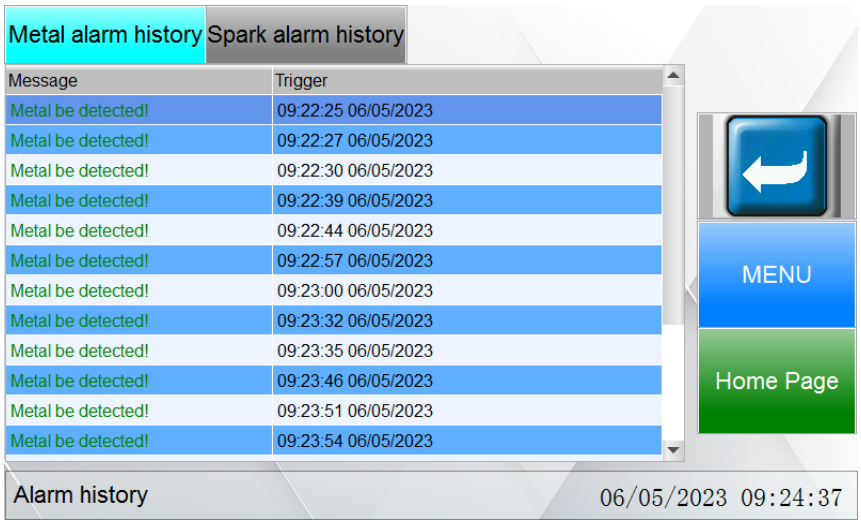


Figure 21a. Metal alarm history

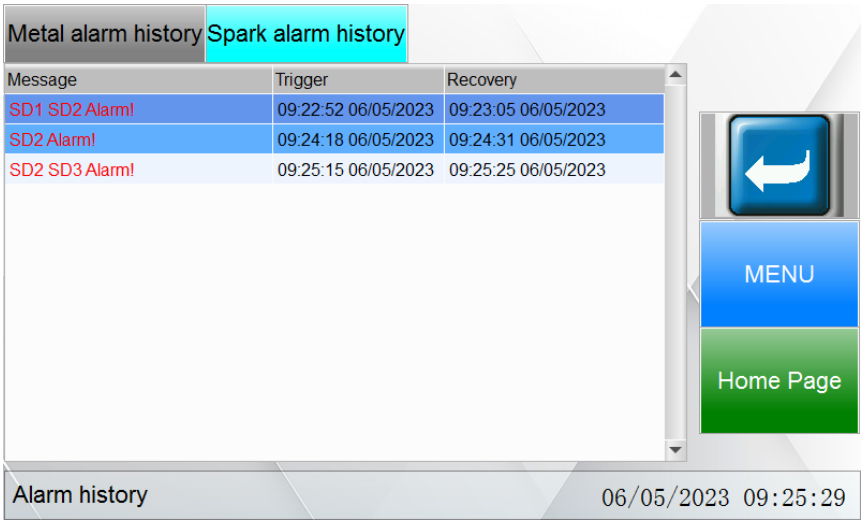


Figure 21b. Spark alarm history

2）Click “Detecting chart” key, user can see the metal detection trend chart.

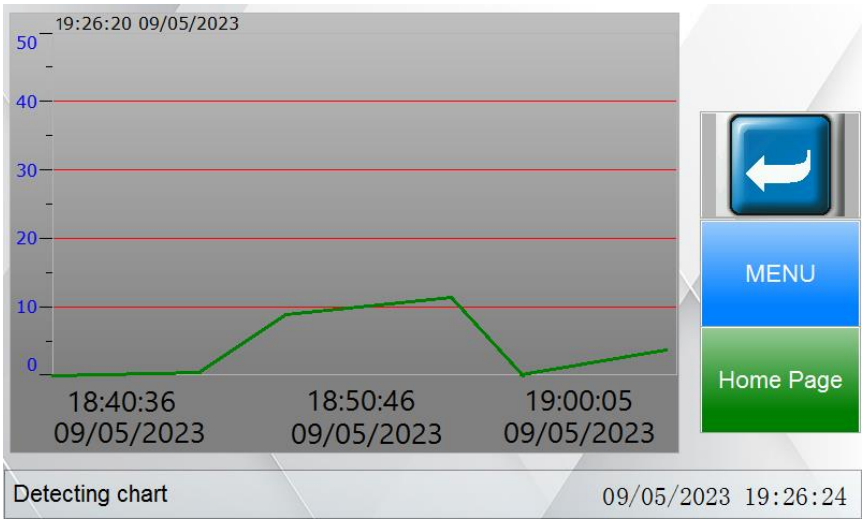


Figure 22. Detecting chart

3）Click “Oscilloscope” key and check metal detecting signal oscillogram.

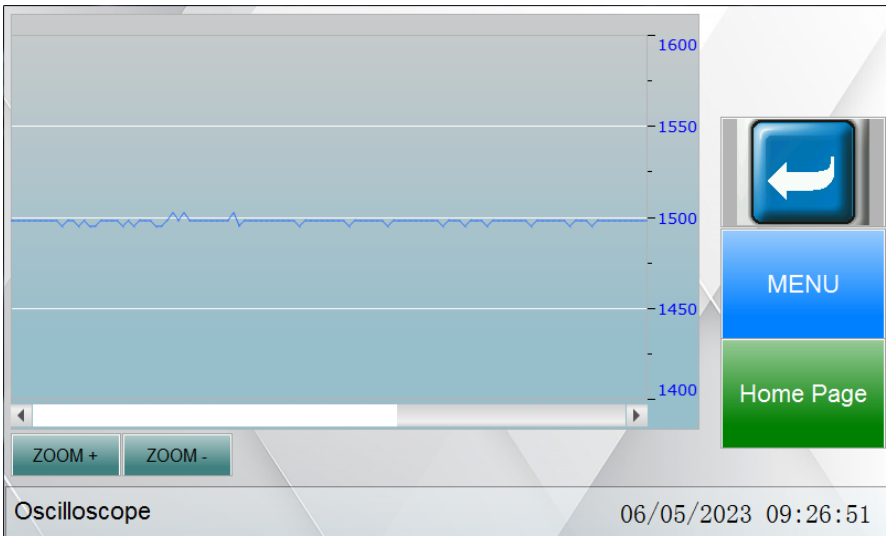


Figure 23. Oscilloscope

4）Click “Measured values” key and enter into the meaured value monitoring page

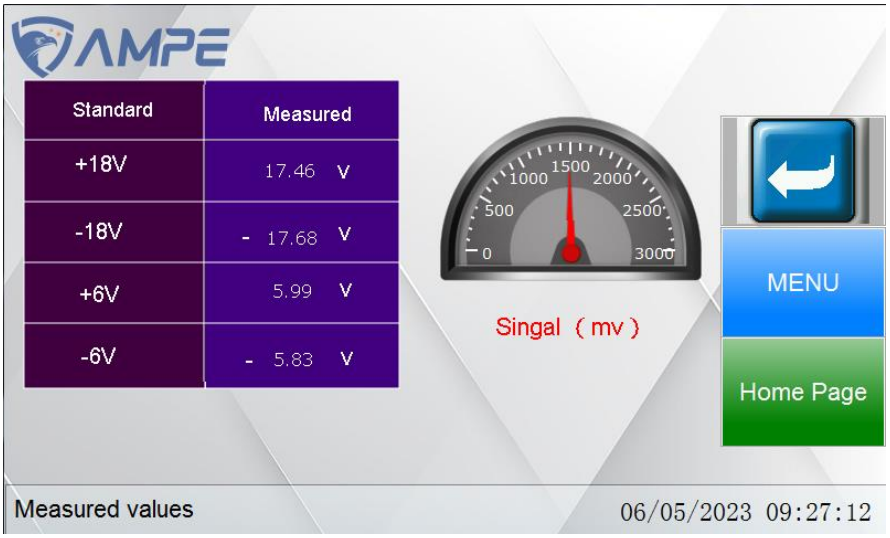


Figure 24. Measured values

It is the analog millivoltmeter of main board’s power detection and metal detection signal.

5）Click “Metal count/day” key to check metal detecting times every day.

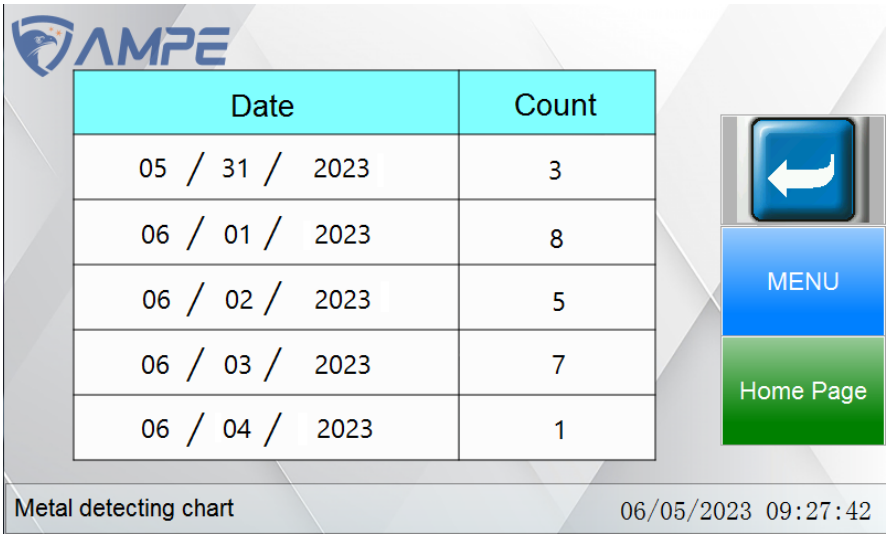


Figure 25. Metal Count/D

4.4 Communication parameter setting

Click “Communication” key, the entry password is level 2 or above all.

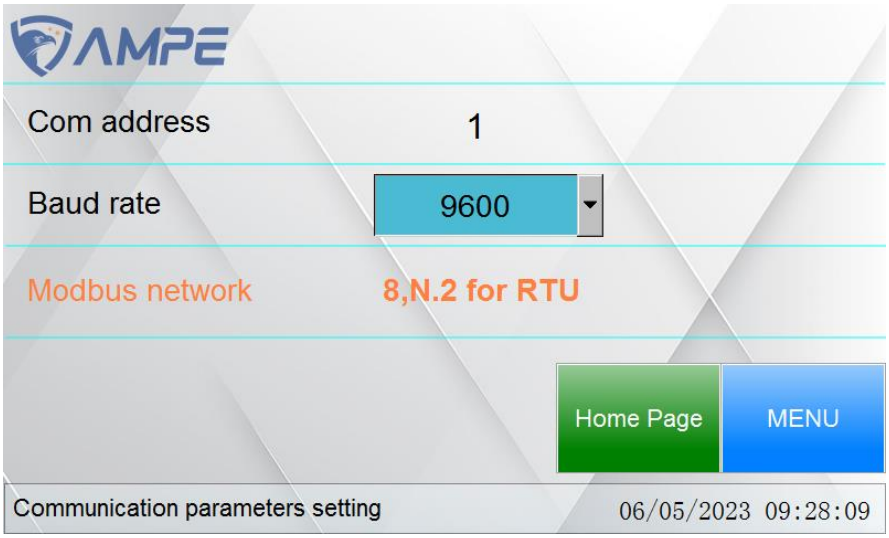


Figure 26. Communication

1. “Com address”: click numbers and modify communication address, range is 1 to 64.

2. “Baud rate”: click numbers and modify baud rate, range is 1 to 3. 1, 2 and 3 correspond to the baud rate 9600, 19200 and 38400 bit/s.

3. “Modbus network” is unmodifiable item, the factory setting is "8, N, 2 for RTU.

D. Communication protocol

1. Communication format

11-bit character frame（for RTU）

Start bit	0	1	2	3	4	5	6	7	Stop bit	Stop bit

2. Communication protocol RTU mode

START	Keep no input signal greater than or equal to 10ms
address	Communication address
Function	Function code
DATA（n-1）	Contents of data：
……	n×8-bit data
DATA 0	n≤40
CRC CHK Low	CRC check sum
CRC CHK High	16-bit CRC check code consists of two 8-bit combinations
END	Keep no input signal greater than or equal to 10ms

3. Local communication protocol parameters address definition

a) Function code 03,06

Register data read write (function code 03, 06)	0001H	Sensitivity parameter	R/W
	0002H	Metal counts	R
	0003H	Delay action time parameter	R/W
	0004H	Reset time parameter	R/W
	0005H	Action time parameter	R
	0006H	Communication address	R
	0007H	Baud rate	R
	0008H	Self-test time hour	R/W
	0009H	Self-test time minute	R/W
	000AH	Version number	R
	000BH	Number of alarm spark sensor	R
	000CH	Detection signal	R

b) Function code 01,05

	Bit1	Metal detection	R
	Bit2	Box full E2	R
	Bit3	act timeout E4	R
	Bit4	Diverter Flap E5	R
	Bit5	Pressure low E6	R

Coil data read (function code 01 05)	Bit6	Low water level alarm E7	R
	Bit7	Spark sensor auto test	R/W
	Bit8	Metal type	R
	Bit9	Fire alarm	R/W
	Bit10	SD1 is faulty E10	R
	Bit11	SD2 is faulty E11	R
	Bit12	SD3 is faulty E12	R
	Bit13	Function of diverter self-test	R/W
	Bit14	Spark test	W
	Bit1	Metal detection	R

Force coil bit 9 to OFF state

Function: Reset fire alarm/ Reset part of the fault alarm content

Force coil bit14 to ON state

Function: analog spark test function command

E. Debugging and usage maintenance

1. Fire alarm simulation test

a. You can use the fire alarm testing function brought by the machine itself . This product is equipped with automatic detection function and manual detection function. The automatic detection function is turned on, and the system will conduct an automatic spark function test according to the set time.

b. Click on the spark test button in the "Function Test" page (see section C 4.1.3 of this instruction for details) to manually test the spark sensor. When there is a fault with the spark sensor, the bottom of the page displays a fault code such as E10 SD1 fault.

c. 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.

d. During normal use, the spark alarm must be identified before it can operate. In the event of a small spark triggering the alarm, it must also be stopped for more than half an hour and checked to ensure safety before it can operate.

⚠ 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 fibres 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 are 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 collector 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.

3. Maintenance and inspections

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

b. The material diverted in the collector 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.

d. All wire connection and bolt fastener should be checked regularly.

e. Regularly inspect the detection window of the spark sensor through the observation window to maintain its cleanliness.

⚠ 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.

4. Debugging

The fault message list contains the following information:

◆ E2

Box full: the collector box is full

1) The collector box is full and needs to be emptied.

2) Check whether the photoelectric switch is working normally.

◆ E4

Act timeout: The flap did not arrive at the activated position in the set time

1) Check whether the components such as the electromagnetic valve, cylinder .etc are working normally; check whether the pressure of compressed air is in the demand range.

2) Check whether the flap had been jammed.

3) Check the wiring of the proximity switch and other wires.

◆ E5

Diverter Flap: The flap is not at proper position when it's working.

1) Check whether the flap had been jammed in the abnormal position.

2) Check whether the proximity switch is working or not.

◆ E6

Pressure low: the pressure of compressed air is too low.

1) Check whether the compressed air was supplied normally, or in the demand range.

2) Check whether the pressure switch is working and if necessary check the wiring of the pressure switch.

◆ E7

Water level monitoring

1) Check whether the water is shortage;

2) Check whether the water level sensor is broken

◆ E10

SD1 error

1) SD1 is not installed

2) The sensitivity of SD1 is too low.

◆ E11

SD2 error

1) SD2 is not installed

2) The sensitivity of SD2 is too low.

◆ E12

SD3 error

1) SD3 is not installed

2) The sensitivity of SD3 is too low.

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