Online Near Infrared Moisture Analyzer
Users Manual

In order to use the online near infrared moisture analyzer safely and correctly, please make sure to read this manual first.

The manual provides detailed instructions for installation, use, and maintenance. Please retain it for future references.

CONTENTS

TECHNICAL SPECIFICATIONS

Measurement range: 0-50% (the maximum measurement range is when the material is saturated with water)
Static accuracy: ±0.1%
Measurement accuracy: ±0.2% (change in material composition will cause measurement error)
Measurement channels: 50
Height range: 250mm±100mm
Operating temperature: 0-50℃
Operating humidity: 5-90%
Repeatability: 0.1%
Response time: 0-60 seconds
Filter range: 0-2.5%
Power supply: AC 110-240V 50Hz/60Hz
Power consumption: 150W
Light interference: not affected by changes in external light and no need for a hood over the probe
Temperature influence: With automatic temperature offset function, it is basically not affected by changes in external temperature

Chapter 1 Preface

1.1 Guarantee

Every product of (hereafter as the manufacturer) comes with a 12-month quality guarantee period starting the date of delivery. During the quality guarantee period, parts and components can be repaired and replaced free of charge. The manufacturer is not to be held accountable for any damage or loss not caused by the machine itself. The manufacturer also provides after service for customers, which allows buyers to directly contact the designated maintenance service office should any matters related to maintenance and replacement of parts occur.

1.2 Unpacking

Keep all packaging materials after unpacking in case of needs for long-distance transportation due to repair or relocation where extra protection and safety through them is preferred.

When unpacking, please carefully take out the internal items and place them in a clean area for inspection. Check against the packing slip if the quantity and model supplied thereof are consistent with the contract order, if the appearance of the machine is damaged, and if the outer insulation layer of the cable is intact.

Notice:

Prior to unpacking, be sure to check if the packing slip is consistent with your order.

1.3 Safe Use of the Moisture Meter

In order to use this machine safely, be sure to observe the following safety precautions during operation, maintenance and repair.

- Power supply: Make sure that the machine is connected to a power supply which is consistent with its requirement;
- Power supply requirements: The power supply of this machine should be equipped with an AC voltage stabilizer;
- Protective grounding: To prevent electric shock, be sure to apply protective grounding before the machine is put into use;
- Necessity of grounding: Please don't cut or dismantle the internal and external protective grounding wires of this instrument, as doing so will bring great danger to human body.
- External wiring: Connect the cables between the components of the machine only after the protective grounding is properly connected;
- Maintenance of the instrument: Never put your hand into the instrument or wipe it with wet cloth when it is powered on.;
- Replacing parts: make sure the machine is completely turned off by disconnecting the power supply of the power module before replacing any parts and components;
- Power Source: The power module utilizes a high-voltage line which is not to be disassembled any time when the machine is powered on.

Note:

The machine described in this manual is a precision electronic optical instrument. Its main power supply must be cut off when connecting cables or serviced. Failure to install and operate the machine in accordance with the instructions of this manual may compromise its safety in use. In order to ensure the electrical safety of the machine, the user is not allowed to make any changes to the cable interfaces and the supporting cables themselves.

1.4 Technical Parameters

1.4.1 Probe

- ✧ Dimensions: 350mm(L)×190mm(W)×270mm(H)；
- ✧ Weight: 7kg；
- ✧ Case standard: 6063-T5 aluminum alloy sealed box with blackened surface anode；
- ✧ IP protection rating: IP67；
- ✧ Operating Ambient temperature: working temperature 0～50℃, 0～80℃ (with cooling)；
- ✧ Cable length: maximum 50m；
- ✧ Measuring height: 250mm±100mm；
- ✧ Measuring range: Φ50mm at rated height；
- ✧ Power supply: DC 24V 100W；
- ✧ Ambient light influence: The performance of the instrument is not affected by changes in ambient light, but strong light directly shining into the window may interfere with its normal measurement. The following types of ambient light exert no influence on the measurement accuracy；
- ✧ Stable light source (color temperature 2500°K, luminous flux 250W/m2, generated measurement noise <0.02%)；

  Halogen lamp (AC power 80W, distance 2.5m, generated measurement noise <0.1%)；

  Filament lamp (AC power supply 100W, distance 2.5m, measurement noise generated <0.1%)；

  Mercury lamp (AC power 250W, distance 2.5m, generated measurement noise <0.1%)；
- ✧ I/O interface: the rear of the probe case:

  (1) 5-pin aviation socket: output for the probe signal and output for the DC24V power supply.

  (2) 3-pin aviation socket: input for the DC24V power supply.

1.4.2 Instrument Panel

- ✧ Dimensions: 200mm (length) × 180 mm (width) × 75 mm (thickness)；
- ✧ Weight: 3Kg；
- ✧ Case sealing standard: 6063-T5 aluminum alloy sealed box with dark spots on anode surface；
- ✧ IP protection rating: IP67；
- ✧ Ambient temperature: 0～50℃；
- ✧ Relative humidity: 5%～95% (non-condensing, 0～50℃)；
- ✧ Power: DC 24V 20W (supplied by the probe)；
- ✧ Display: 5-digit digital display；
- ✧ I/O interfaces: from left to right on the lower part of the meter:

  8-pin aviation plug: two-way RS485 interface;

  9-pin aviation socket: two-way IO, one DC4-20MA output;

  5-pin aviation plug: probe signal input, DC24V input.

1.5 System

1.5.1 System

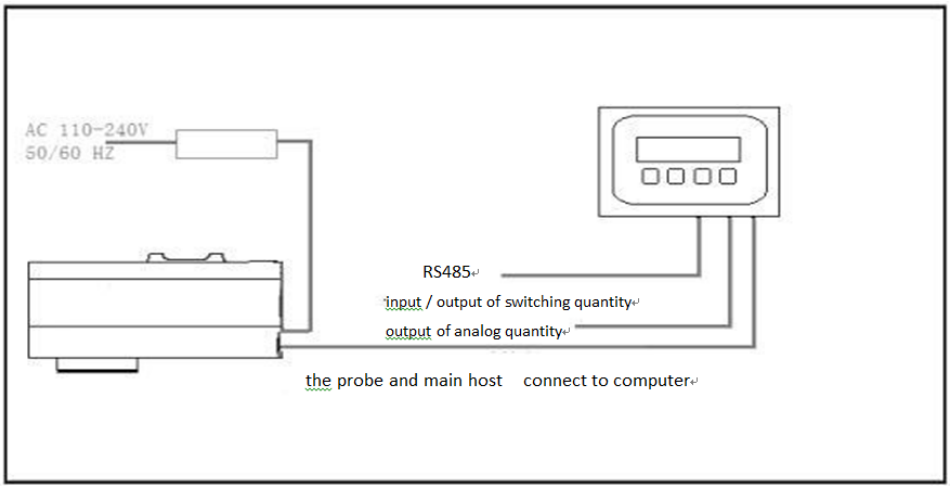


Figure 1.1 diagram of system

Figure 1.2 Outlook of System Display

1.5.2 Overview of the Probe

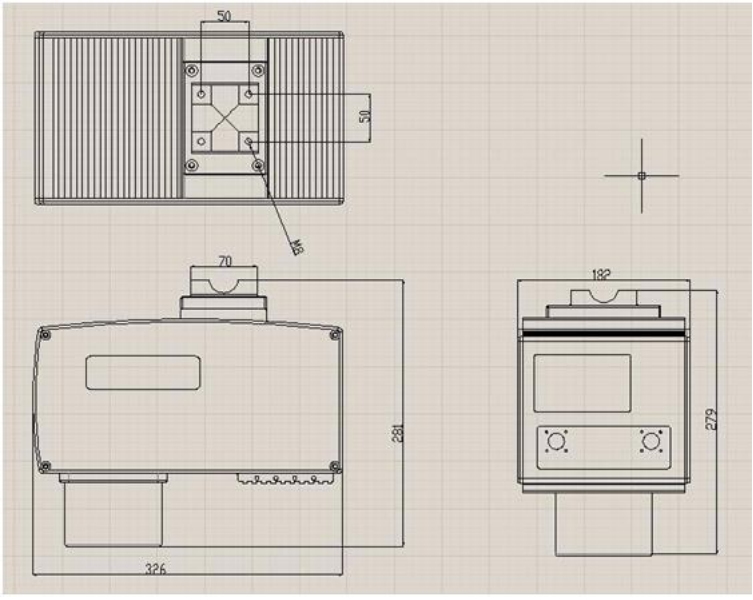


Figure 1.3 Layout of the probe

Figure 1.4 Outlook of the probe

1.5.3 The Layout of The Instrument Panel

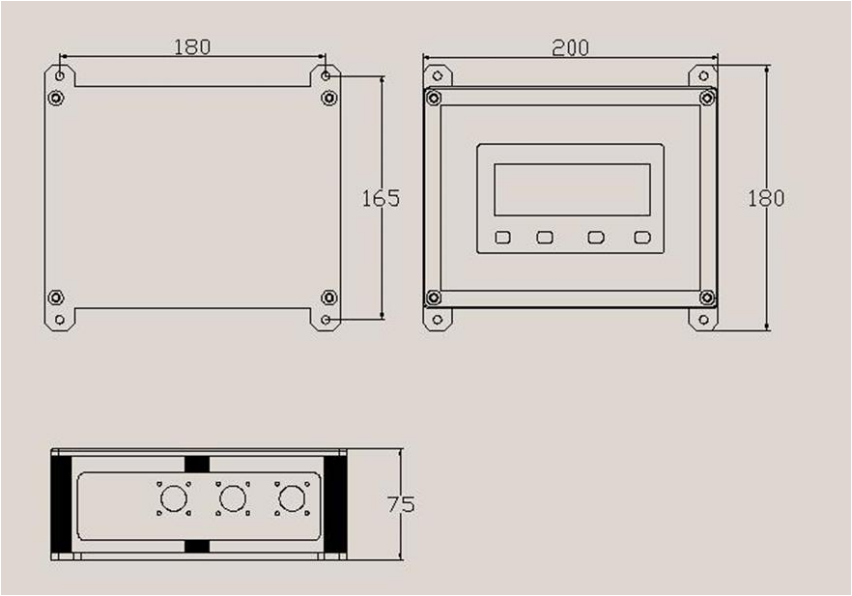


Figure 1.5 The Layout of the instrument panel

Chapter 2 Installation

2.1 Precautions for Installation

- Power supply

The power supply module relies on wide voltage for supplying power, which meets the current global power supply standard. Voltage range: AC 110-240V, frequency: 50Hz/60HZ, power: 150W.

- Cable routing

The signal cable of M-700 is routed in the weak signal tray, and the power cable is routed in the low-capacity power tray. The user must not change the special cable provided with the machine.

- To avoid electromagnetic interference

Never install any part of the M-700 system near sources of strong electromagnetic interference (EMI) such as high-power motors, electric welding equipment, equipment with strong electrostatic discharges, high-power transformers, frequency converters, etc.

- Avoid mechanical vibration

The M-700 system is a precision optoelectronic instrument to which excessive mechanical vibration can cause potential damage.

- Operating ambient temperature

Probe: 0～50℃, 0～80℃ (with cooling cycle);

Meter: 0～50℃.

- Operating ambient light

The performance of the machine is not affected by changes in ambient light, and there is no need to attach a hood onto the probe when using it. However, strong light directly shining into the window may interfere with its normal measurement. The following types of ambient light exert no influence on the measurement accuracy:

Stable light source (color temperature 2500 ℃, luminous flux 250W/m2, generated measurement noise <0.02%)

Halogen lamp (AC power 80W, distance 2.5m, generated measurement noise <0.1%)

Incandescent lamp (AC power supply 100W, distance 2.5m, measurement noise generated <0.1%)

Mercury lamp (AC power 250W, distance 2.5m, generated measurement noise <0.1%)

- Measurement through window

It may be necessary to measure the contents of the product underneath through a window formed by a piece of glass. The window material can be clear glass, but never plexiglass, polyester material or any plastic, because the latter ones can absorb and retain water molecules, compromising the test result as such. At the same time, in order to ensure accurate measurement, the product to be measured should be in continuous contact with the window glass (see Figure 2.6).

- Effects of ambient temperature

The probe automatically compensates for the influence of temperature, although the change of ambient temperature basically does not affect the measurement accuracy.

- Condensed steam

Do not allow vapor to condense into droplets because they can affect the measurement, a problem which can be prevented by devising an air-cleaning window.

Notice:

If physical interference is expected on the part of the production line, please do not fix the moisture meter probe and the meter unit on the production line. Please have them mounted onto additional fixtures instead. Make sure they are connected to the production line in the sense of being mounted independently and separately. (To determine if independent mounting is necessary, simply see if the reading of the moisture value measured jumps greater with the probe and the main unit fixed on the production line than with them dissembled from the production line. If greater, apply independent and separate mounting.)

2.2 Installation of Moisture Analyzer

2.2.1 probe installation requirements

The probe should be installed in an easily accessible place. First, it should be easy to sample under the probe and easy to maintain (such as wiping windows, cleaning surfaces, etc.);

(1) The machine should be installed in a safe position for measuring where the material to gauge will not have direct contact with the probe;

(2) Probe installation height and direction: (see Figure 2.1) The probe is to be installed over a certain material that is not fragmented as on a conveyor belt or a vibrating conveyor. Note that the material must at least demonstrate a thickness of 10mm (recommended 15mm above) in order to completely ignore the conveyor belt as a source of possible confusing effect in the background.

(3) In order to allow for a longer period of time for the material to reach a state of balance before taking measurements, the probe of the dryer or other equipment for adjustment is preferably installed as far as it can be from the steam outlet;

(4) It is a basic requirement for the production line to ensure that the material to measure embraces a certain degree of consistency and continuity in the production process;

(5) The consistency of the material has a great influence on the measurement accuracy compared with the oven drying method, especially on the latter's double-sampling deviation.

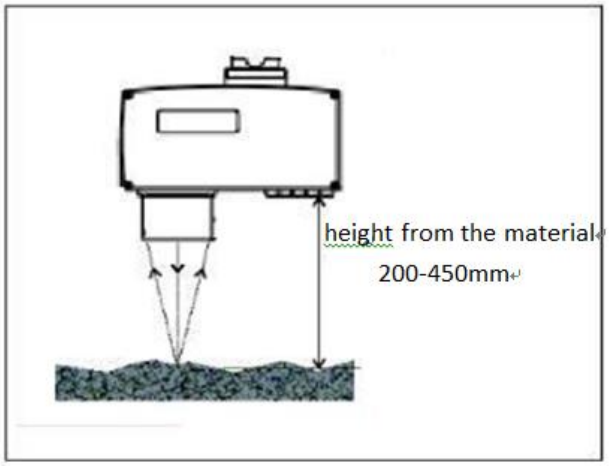


Figure 2.1 Installation height of Probe

2.2.2 Installation of Probe

① Fix the probe by using a round rod or a round stick: as shown in the figure below

② Remove the probe fixing accessories and fix them with four M6 screws on the probe casing, which are generally used for fixing aluminum alloy brackets such as moving guide rails. The sizes and positions of the fixed hole are as shown in the figure below.

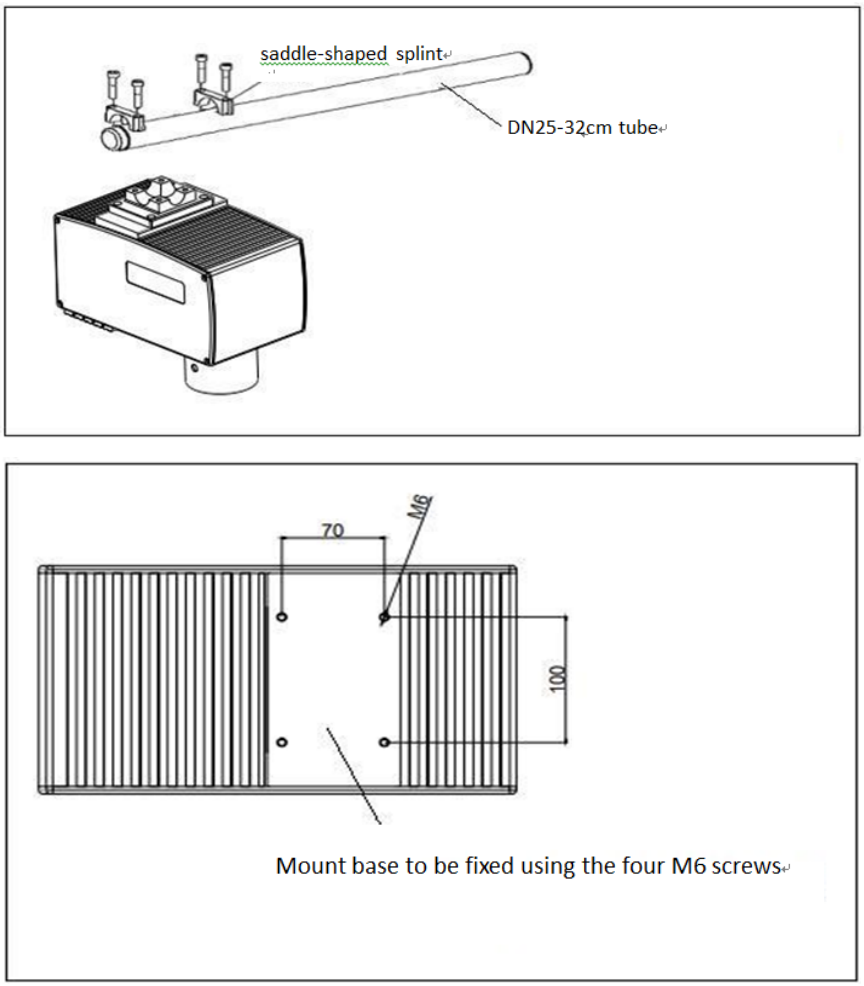


Figure 2.2 Probe Mounting Bracket

2.2.3 Installation of The Instrument Panel

The instrument panel can be installed on the wall or on the production host unit of the production line. It can, for example, be mounted onto the channel steel bracket of the production line.

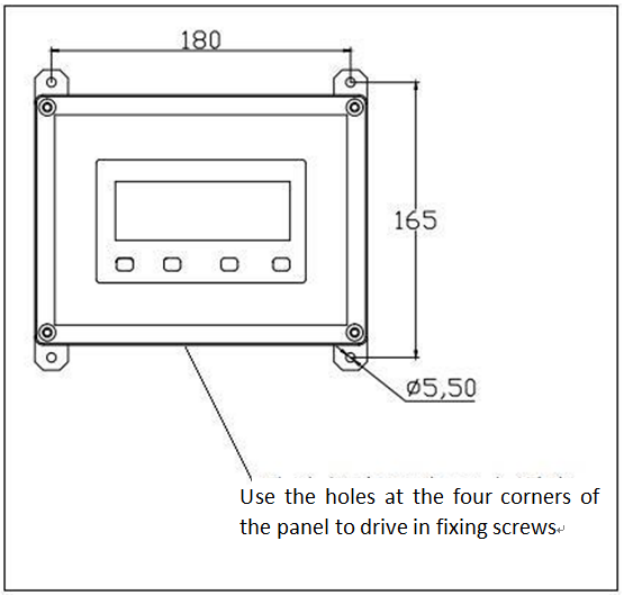


Figure 2.3 shows the basic idea of its installation

2.2.4 Measuring Probe Installation Through Window

Measurement through window:

It may be necessary to measure the contents of the product underneath through a window formed by a piece of glass. The window material can be clear glass, but never plexiglass, polyester material or any plastic, because the latter ones can absorb and retain water molecules, compromising the test result as such. Make sure to keep the probe at a certain distance and angle from the material to be measured (see Figure 2.4), and tilt the probe 17-23 ºto avoid reflection on the window glass. At the same time, in order to ensure precise measurement, the material to be measured should be in continuous contact with the window glass (see Figure 2.4).

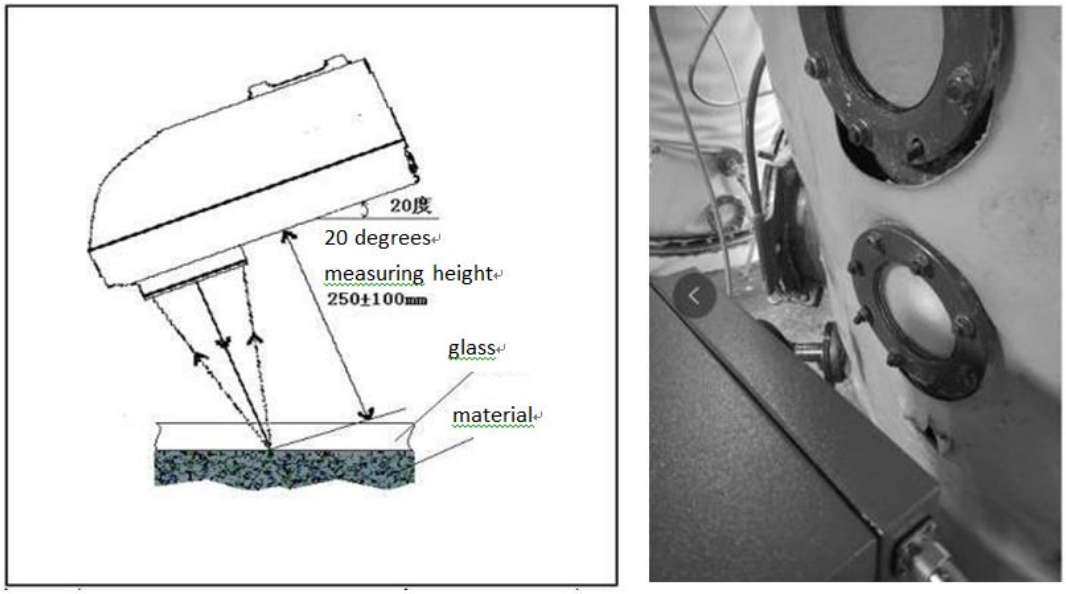


Figure 2.4 Installation of measuring probe through window

Chapter 3 Electrical Connections for the System

3.1 Components of the system

The system includes the following components:

1. One probe
2. One Display meter
3. One 5-core shielded cable (double-ended 5-pin aviation plug)
4. Power supply module (with power plug and 3-pin aviation plug)
5. One 8-pin aviation plug and one 9-pin aviation plug

3.2 Single Probe System

A single-probe system includes a meter and a probe.

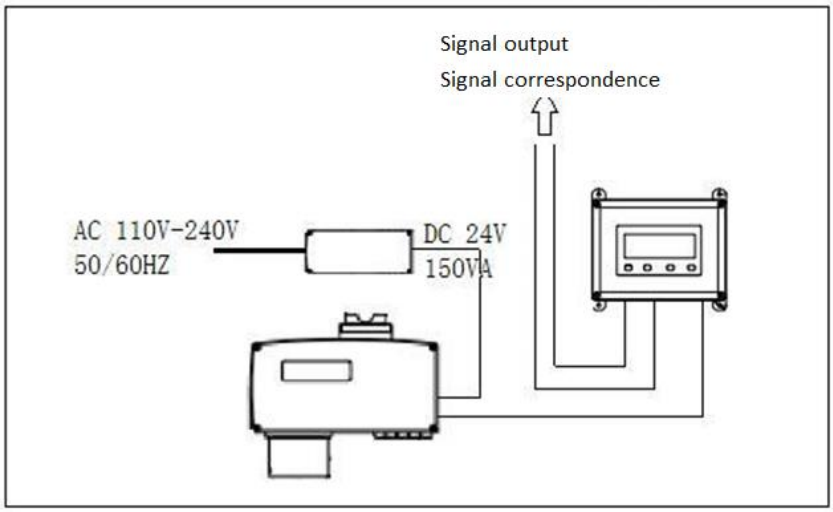


Figure 3.1 Overall connection for a single probe system

3.3 Multi-probe System

To form a multi-probe system, just connect more than one single probe system as shown in Figure 3.2.

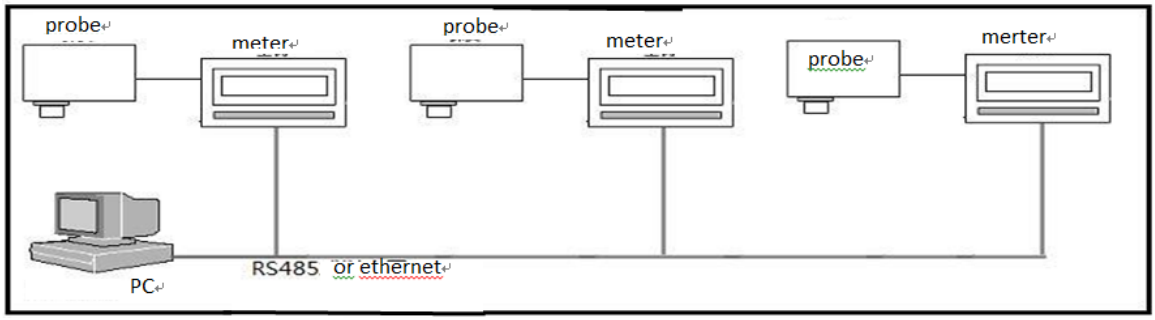
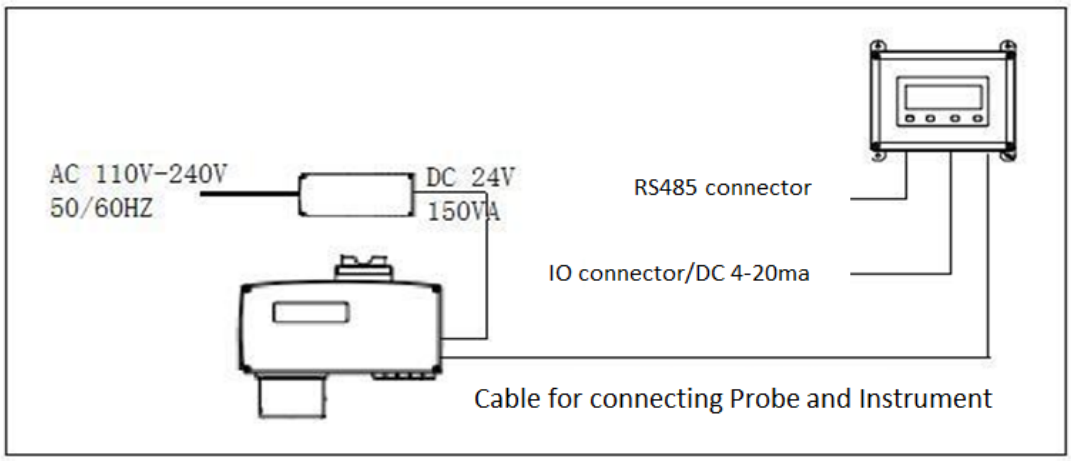


Figure 3.2 system with multiple probes

3.4 Electrical connection

3.4.1 Basic ideas of Electrical connection

Moisture analyzer adopts IP68 waterproof aviation plug for connection, which should be used as follows.



3.4.2 Connection Socket

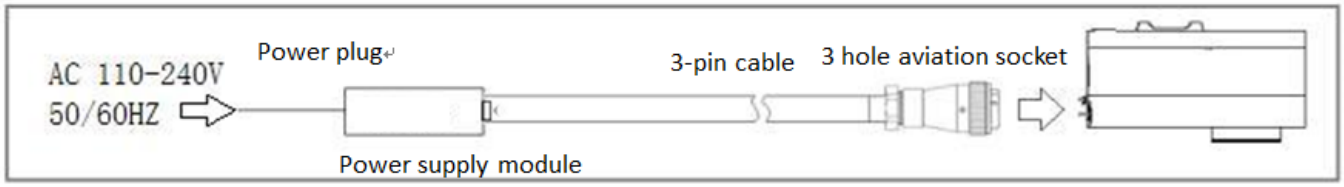
When connecting, please make sure the plug and socket are matched, press the snap button on the plug to align with the notch of the socket, and confirm that the plug and socket are fastened after insertion.

Aviation socket

Aviation plug

Power supply module defined:

Requires a power supply of A.C 220V, which comes with a power socket to be connected to an air switch or socket. In addition, in order to ensure stable power supply to the machine, the power supply should be equipped with an AC voltage stabilizer. The power supply features a waterproof DC24v switch, which can be used outdoors.



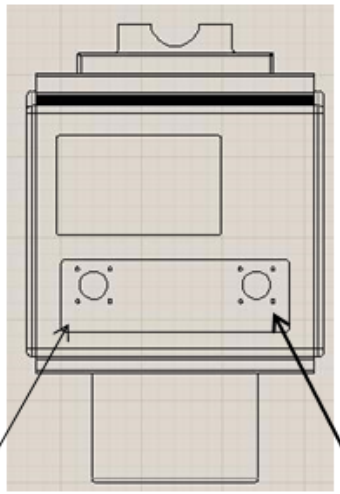
Three-pin aviation socket defined:

No.	Signal
1	24V+
2	24V ground
3	Ground wire

Probe interface:

5-pin aviation socket at the rear of the probe---connecting port to the display.

3-pin aviation socket at the rear of the probe---power supply module input interface.



5-pin aviation socket defined

No.	Signal
1	24V+
2	24Vground
3	Ground wire
4	RS485A
5	RS485B

5-pin

To connect to the display panel

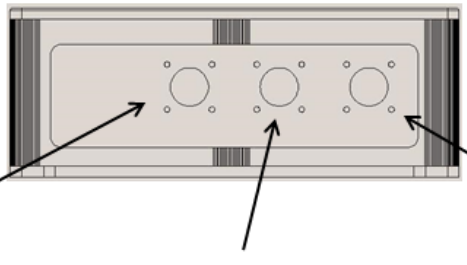
3-pin aviation socket defined

No.	Signal
1	24V+
2	24V ground
3	Ground wire

3-pin

To connect to the power supply module

Interfaces:



9-pin aviation socket defined

No.	Signal
1	Z
2	Y
3	RS485 B2
4	RS485 A2
5	RS485 B3
6	RS485 A3
7	RS485 B4
8	RS485 A4

8-pin

8-pin DA/IO I/O interface

8-pin aviation socket defined

No.	Signal
1	IN2
2	IN1
3	GND1
4	GND1
5	OUT2
6	OUT1
7	GND1
8	24MA-
9	24MA+

9-pin

9-pin RS485

5-pin aviation socket defined

No.	Signal
1	24V+
2	24V ground
3	Ground wire
4	RS485A
5	RS485B

5-pin

5-pin connector to the probe

Probe and meter to connect both ends of the power cable defined:

5P aviation socket defined

5-pin

No.	Signal
1	24V+
2	24Vground
3	Ground wire
4	RS485A
5	RS485B

5P aviation socket defined

No.	Signal
1	24V+
2	24Vground
3	Ground wire
4	RS485A
5	RS485B

5-pin

Chapter 4 Debugging

The instrument has been linearized and standardized in the full range before shipping. To debug the machine, only the geometric amount of translation needs to be fine-tuned, so that its measured value is

consistent with that of the user's regular method (such as the oven drying method). The sensitivity has been adjusted before shipping (default: 2.5), leaving no need for further adjustment.

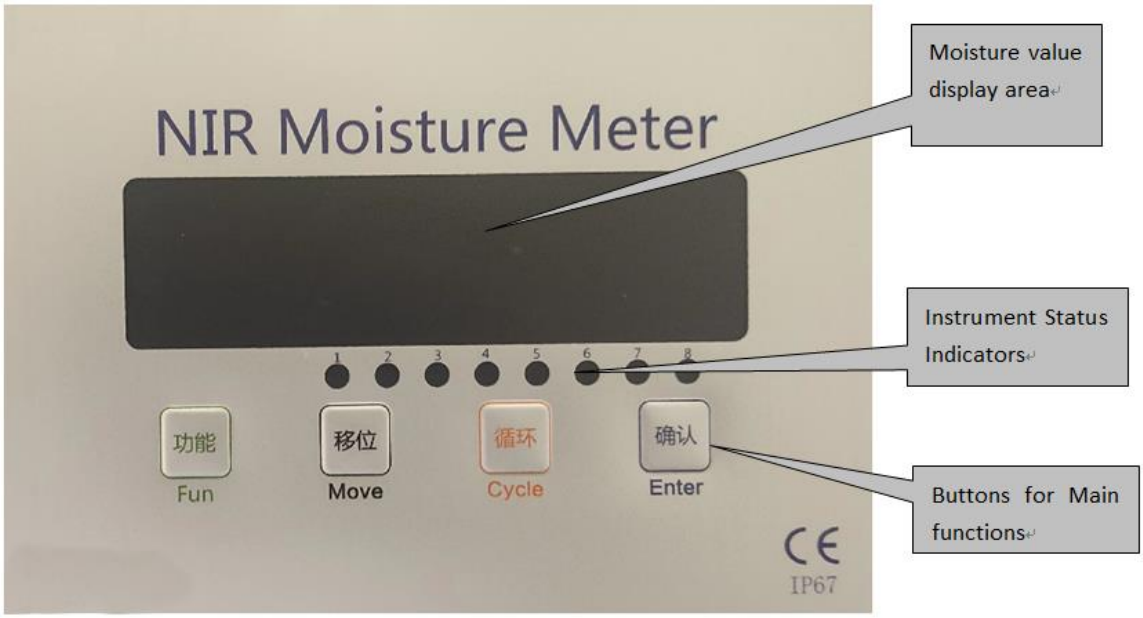
This chapter covers two parts of debugging:

(1) Setting: in order to adapt the machine to the actual requirements of its user, a series of parameter settings, such as translation amount, sensitivity, filter points, and filter range, etc., are performed;

(2) Calibration: Through on-line sampling and comparison measurement, the translation amount of the moisture meter is finely adjusted, so that the measurement value of the machine is consistent with the user's standard method (such as the oven method) within a certain accuracy range.

4.1 Setting

4.1.1 Introduction to the Display Panel



Instrument status indicators represent the following functionalities when lit:

① The communication between the meter and the probe is normal;
② RS485-2 communication is normal;
③ RS485-3 communication is normal;
④ RS485-4 communication is normal;
⑤ IN1 and GND1 are shorted;
⑥ IN2 and GND1 are shorted;
⑦ OUT1 output high alarm;
⑧ OUT2 output low alarm;

Operation Buttons:

Fun button: The function key is pressed once, and the instrument cyclic displays;
FUN1→SET1→Moisture value.

Move button: Each time it is pressed, the flashing digit moves to the right, and the digits take turns to flash in a left-right-left cycle.

Cycle button: Each time it is pressed, the flashing value increases by 1, and the value cycles from 0 to 9.

Enter button: SET parameters can be stored with the confirm button after being modified by the move and Cycle buttons.

4.1.2 FUN Function - Probe Signal Detection

(1) When the moisture meter is turned on and there is material under the probe, executing this function works to detect the 7-channel signal of the probe to determine whether the probe is working normally.
(2) FUN 1: Reference signal 1 ---the smaller the moisture, the larger the value;
(3) FUN 2: Reference signal 2 ---the smaller the moisture, the larger the value;
(4) FUN 3: Measurement signal 1 --- the smaller the moisture, the larger the value;
(5) FUN 4: Measurement signal 2 --- the smaller the moisture, the larger the value;
(6) FUN 5: Reference signal---basically 0;
(7) FUN 6: Multiple signal---as the color changes, the darker the color (the smaller the reflected signal), the larger the value;
(8) FUN 7: Motor speed---about 4000

Access method:

Press the Fun button and the instrument display FUN 1, Press the Enter button and the instrument will display "* * * *" , which is the signal representing FUN1(reference signal 1). Press the Enter button again, and the meter will display FUN 2. For other parameters, repeat the same process as above.

Note:

When the instrument displays a certain signal value, such as "* * * *", press the FUN button to exit. Press the FUN button continuously, and the instrument displays: FUN1→SET1→ moisture value, cyclic display .

4.1.3 SET Function---Parameter Definition and Initial Value

(1) SET1: Defined as the class number (channel), and the numerical range is 00-49, with a total of 50 class numbers. When measuring, the moisture meter measures different kinds of materials with large difference in color and texture, it will show that the moisture value will cause deviation, and it is very troublesome to readjust the parameters such as translation. You can set several different class numbers, and set the corresponding parameters (translation, sensitivity and filter points) in each class number to measure different kinds of materials.

(2) SET2: Defined as ground zero (translation), the value range is -99.99 to +99.99. When the displayed value of the moisture meter is quite different from the value detected by the laboratory oven, the user can readjust the translation amount of the moisture meter to make the measured value consistent with the user's standard method (e.g., oven method) within a certain accuracy range.

Note:

When entering SET2 to modify the parameters and when using the Move button to move between the digits, note that the value always sets out to be positive. Take 20.00. for example. When flashing it first (i.e., the leftmost) digit, the figure is automatically displayed as ⊣ 20,00, meaning +20.00.To change it to negative, simply press the Cycle button and display -20.00. That is

to say, when the first digit is on flash, the Cycle button has the function of switching between the positive and negative signs. In the SET2 and other settings that require negative parameters,users need to pay attention to the use of positive and negative functions to avoid parameter setting errors!!!

(3) SET3: Defined as slope (sensitivity), it represents that the fluctuation range of the moisture meter display is quite different from the fluctuation range of the material moisture change. When the sensitivity is set to be too high, the display of the moisture meter fluctuates greatly and tend to overrepresent the actual value of high moisture material and underrepresent that of low moisture measurement is low. When the sensitivity setting is too low, on the other hand, the begotten reading appears to be stable, failing to truly reflect the actual moisture change of the material, meaning the displayed value can be lower than what it should have been on the part of high moisture material, and vice versa.

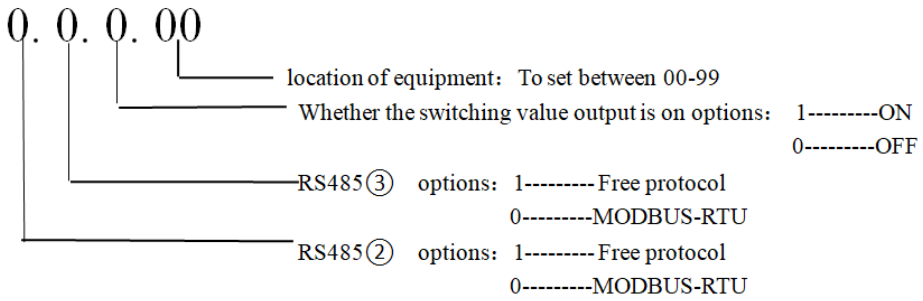
(4) SET4: Defined as filter time, this parameter affects the stability of the display of the moisture meter. If the number of filter points is too large, the moisture display is stable, but the time delay for a display is too long to reflect the actual moisture change of the material in time. If, on the other hand, the filter point is too small, the moisture displayed will fluctuate greatly, making it difficult for users to refer to.

(5）SET5: Defined as filter range, this parameter affects the stability of the moisture meter display. If the filter range is too large, the moisture display is stable, but the time delay for a display is too long to reflect the actual moisture change of the material in time. If, on the other hand, the filter range is too small, the moisture displayed will fluctuate greatly, making it difficult for users to refer to.

(6) SET6: Defined as password function, this parameter is used to encrypt the instrument. After setting a password, you will need to enter the password to modify the parameters. The default for the parameter is initially 0000, and the FUN and SET parameters can be accessed without a password. To change the default to, for example,0001, just press the FUN button to display P0000, then you need to enter 0001 to enter the parameter setting.

(7) SET7: Defined as software version, this parameter cannot be adjusted and is only used by the manufacturer to check the software version.

(8) SET8: Labeled as communication format, the parameter has a total of five digits, as follows：



Note: Please ask our company for a detailed introduction of the communication protocol if needed.

(9) SET9: The parameter is defined as the corresponding value of the lower limit of the analog quantity. When the moisture value is lower than this value, 4-20mA will generate the minimum current of output.

(10) SET10: The parameter is defined as the corresponding value of the upper limit of the analog quantity. When the moisture value is higher than this value, 4-20mA will generate the maximum current of output.

(11) SET11: Defined as decimal point, its value ranges from 0 to 3, with 0 meaning no decimal point, and 3 meaning three digits after the decimal point, for example: 18.123.

(12) SET12: Defined as the lower limit of switching value, the default is that when reached, the interface OUT2 will supply a 24V current, and the No. 8 LED light on the meter surface will flash.

(13) SET13: Defined as the upper limit of switching value, the default is that when reached, the interface OUT2 will supply a 24V current, and the No. 7 LED light on the meter surface will flash.

(14) SET14: Defined as the switch value threshold, this value is used to designate the advancement of the automatic control valve. When used for upper and lower limit alarms, it is recommended to set this value to 0.00.

(15) SET15: Defined as the correction coefficient, its default setting is 1.00. When 2.00 is set, the display will show *2.00

(16) SET16: Defined as the ID code, the parameter is used for programming the IC. Not to be used by the user.

(17) SET17: Defined as special operation, the parameter allows for the following operations when entered with corresponding values.

5550: Reset all parameters to their original factory values
6660: Save all parameters to default values
7770: Reset all parameters to default values

4.1.4 Table of Empirical Parameters

Parameters	Definitions	Factory reset	Ranges
SET1	Channel number (class number, measuring different classes of samples with preset parameters)	1	00-49
SET2	Translation amount (zero position)	20	-99.00to 99.99
SET3	Sensitivity（span, gradient）	2.5	0.000-9.999
SET4	filter time	2	0-15
SET5	Filter range	2	0-9
SET6	password	0	0000-9999
SET7	version number	Not settable	Not settable
SET8	communication protocol	0.0.0.01	0.0.0.01-1.1.1.99
SET9	Moisture value corresponding to the lower limit of analog quantity	4	0.00-99.99

SET10	Moisture value corresponding to the upper limit of analog quantity	20	0.01-99.99
SET11	Decimal places selection（0　0.0 0.00 0.000）	2	0-3
SET12	Switch value lower limit	4	0.00-99.99
SET13	Switch value upper limit	20	0.01-99.99
SET14	Switch value threshold	0.5	0.00-99.99
SET15	correction factor	1	0.00-99.99
SET16	ID code	20	
SET17	Special function operation	Display：0000	

4.1.5 Use of External Signal Input

When the IN1 and GND of the 9-pin aviation socket are short-circuited, the meter stops measuring the moisture, with the display showing 0.00. This function is applied to some occasions when a conveyor which is used to carry material to measure comes to a full stop, making it necessary for the meter to produce a reading of 0.00.

4.2 Calibration

The installation is usually followed by the calibration of the machine, which therefore needs to be discussed here. The following general preparations should be performed first before calibration:

(1) If the moisture meter is installed for the first time, the begotten results may vary greatly in the sense of fluctuating between two extreams such as f "0" or "30". The user should first make the measured moisture close to the normal level of the material to measure by roughly adjusting the translation amount to, for example, "9", before sampling;

(2) Collect samples and measure data in the laboratory;

(3) Calculate the new translation amount and process the calculated data;

(4) If it is necessary to adjust the instrument, enter a new translation amount and store this new data.

Caution：

Before calibrating the instrument, please make sure that the channel, sensitivity, and number of filter points have been set correctly.

4.2.1 Sampling Considerations

Accurate calibration is to be achieved through multiple samplings and laboratory standard measurements of the samples.

When sampling, pay attention to the following aspects:

- Only the material that are covered by the machine can be collected and sampled;
- Sampling must be taken 0.5 m behind the probe measurement area, and the material to measure is moving on the production line in the same direction as from the sampling point to the probe’s measuring point;
- Take the surface layer of the material when sampling;
- It is particularly important to sample when production is stable and there is no major change tren;
- The sample must be packed in a sealed bag immediately;
- In the laboratory, at least use the double-sampling method and use the standard method to measure

the true value of the sample;

- Ignore and discard any group of samples demonstrating significant error in double-sampling;
- At least use 5 (groups of) samples to calibrate the machine. The more samples are used, the more accurate the debugging is;
- Compare the recorded reading with the analytical value of the standard method to retrieve the average error between the two. This error is the correction amount for accurate calibration.

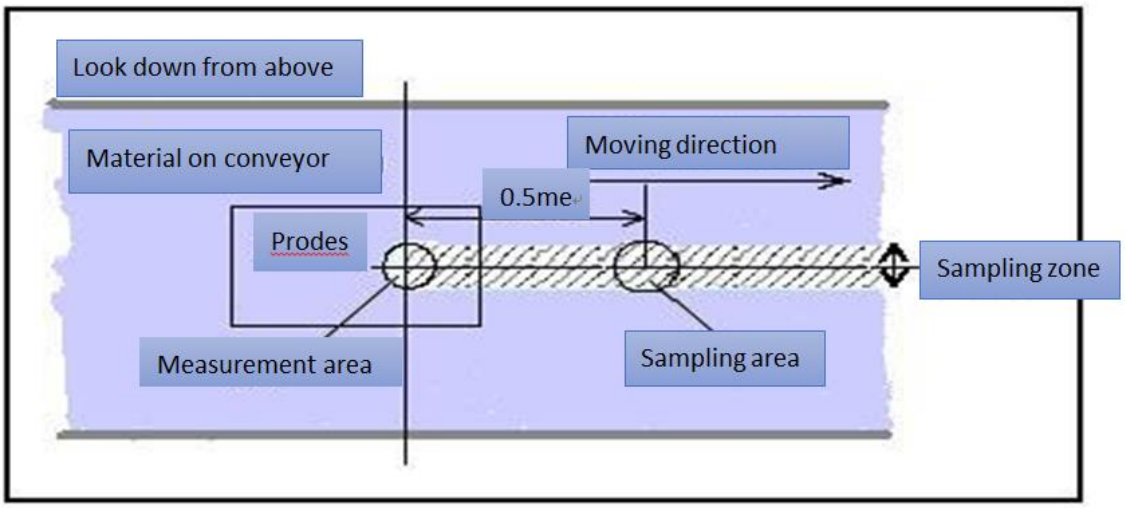


Figure 4.2 Schematic diagram of sampling location

4.2.2 Sampling process

- When the production is stabilized and the material to measure is in its normal status, the operator starts sampling;
- Sampling stage: The operator acquires the sample right from the production line. The sampling position must be behind the probe's measuring point and in the same direction with the movement of the material itself, so as to ensure that the sample taken is consistent with the measured material. Samples should be stored in sealed containers. For small products moving on the production line, grab every 5 seconds and put them in sealable polyethylene plastic bags;
- Repeat the above sampling process at least 5 times. The more sampling times, the more accurate the machine debugging;
- When testing the moisture of samples in the laboratory, the technique of double sampling should be applied to each sample;
- For each measurement being calibrated, it is necessary to calculate the laboratory assay mean (Y) and the instrument measurement mean (X) of all samples.

4.2.3 Data processing

A table similar to the following is recommended for recording and calculating data.

Table 4.1 Moisture Meter Calibration Data Sheet

No.	Display value（%）	Oven measurements（%）	Double-sampling error（%）	Double-sampling mean（%）	Error（%）
1	12.53	13.11 12.98	0.13	13.045	0.515
2	13.01	13.76 13.79	0.03	13.775	0.765
3	12.15	12.88 12.77	0.11	12.825	0.675
4	12.71	12.65 12.11	0.54	12.38	0.67
…	…	…	…	…	…
N	12.47	13.7 13.79	0.09	13.745	1.275
	X ： 12.574			Y ： 13.154	Average: 0.58

For samples with larger double-sampling errors, such as sample No. 4 in this example, one can simply discard them according to one's own standard. The influence of random factors can be eliminated by removing both the largest error sample and the smallest error sample.

Calculate the new translation amount:
Error mean = lab's assay mean (Y) - instrument's measurement mean (X)
New translation amount = original translation amount + error average

4.2.4 Setting the Zero Position (Translation Adjustment)

Basic conditions: The probe has been installed and is working normally on the production line, sample and calculate the new translation according to the above method, and set the new translation on the display panel.

To use data from Table 4.1 for exemplary calculation:

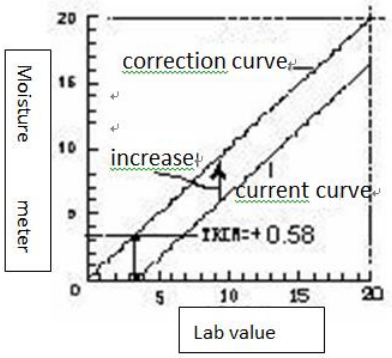
original translation = 1.8, error mean = 0.58,

New translation amount=1.8+0.58=2.38

Follow the steps below to adjust the amount of translation:

When the average error is less than 0.5%, no adjustment is necessary;

When the average value of the error is > 0.5%, adjust the translation amount (by resetting the value of the SET 02 parameter);



Press the FUN button twice to perform the SET parameter setting function. Now the instrument panel shows SET 1.

Press the CYCLE button to change the display to SET 2. Then press the CONFIRM button to show: ***. ** such as 20.00, on the display panel. The last digit is now flashing. It means that the digit is available for modifying. Use the MOVE button to move the flashing digit, and the CYCLE button to modify the value at the same time. The same goes to the setting of other SET parameters.

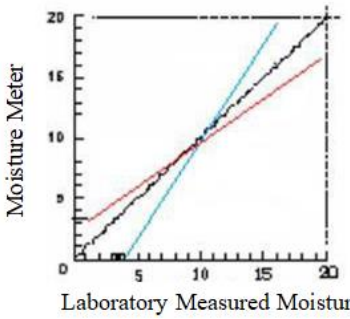
Note: When entering SET2 to modify the parameters and when using the Move button to move between the digits, note that the value always sets out to be positive. Take 20.00, for example. When flashing it first (i.e., the leftmost) digit, the figure is automatically displayed as ⊣ 20,00, meaning +20.00. To change it to negative, simply press the CYCLE button and display -20.00. That is to say, when the first digit is on flash, the CYCLE button has the function of switching between the positive and negative signs. For some setting items that require negative parameters such as SET2, the user needs to carefully choose between the positive and negative signs. It is important for avoiding some parameter setting errors.

4.2.5 Setting the Sensitivity (gradient)

When the reading of the moisture meter and the laboratory measured moisture of the same material are distributed in a way similar to what is as shown in the right figure, it is necessary to adjust the SET3 parameter of the meter.

For example, in the blue curve, when the material is high in moisture, the instrument display is larger than the actual value; when the material is low in moisture, the instrument display is smaller than the actual value, and the value of SET3 needs to be reduced. After making the curve parallel to the actual curve, adjust SET2.

For example, in red curve, when the material is high in moisture, the instrument display is larger than the actual value, and when the material is low in moisture, the instrument display is smaller than the actual value. At this time, increase the value of SET3 to make the curve parallel to the actual curve, and then adjust SET2.



Black: curve of the laboratory measured moisture
Red: instrument display curve 1
Blue: instrument display curve 2

4.2.6 Filter Time and Filter Range

When the material moisture fluctuates greatly, in order to have a stable value that can be read manually, the instrument can achieve it by filtering. When the filtering time and filtering range are increased, the value displayed by the instrument can be more stable, but at the same time there will be a corresponding delay. The user can adjust it according to his own site conditions. It is recommended to adjust SET4 (filter time) first.

4.2.7 Type Number (channel number, recipe number)

The parameters of SET1 can be set between 00-49; that is to say, 50 class numbers can be selected for different (groups of) materials.When SET1 is set to different values, the corresponding subsequent SET2-SET17 can have 50 different settings.

Chapter 5 Structure of Moisture Meter

5.1 Probe

The main components of probe: reflection optical components, emission optical components, probe matherboard, power supply board.

① Probe matherboard: Process the output signal of the detector. The reflected components are fixed on the circuit board. The user is not allowed disassemble it by himself. The company will not be responsible for the maintenance of the probe caused by disassembly of the board.

② Reflecting optical components: including focusing mirror, elliptical mirror, spherical mirror, detector, etc.. Optical components are strictly forbidden to be disassembled. Slight changes in optical components will lead to irreversible failure of the moisture meter itself.

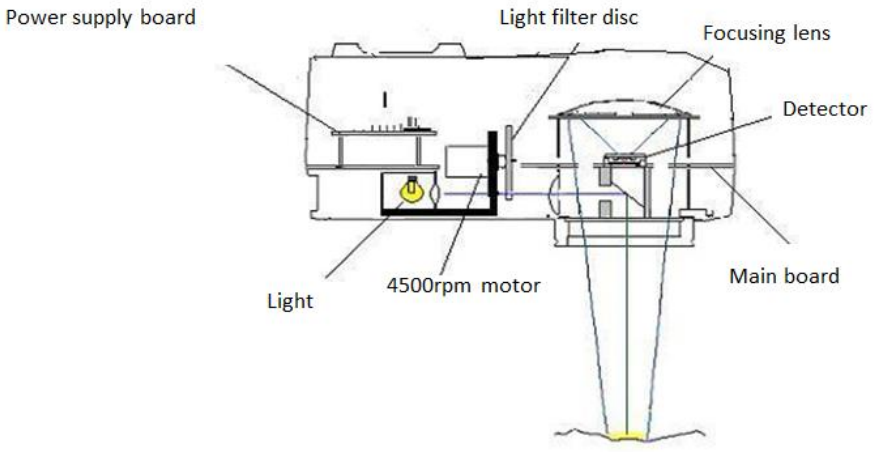
③ Emitting optical components: including light source, focusing mirror, filter disc, etc., which are assembled in the aluminum alloy module under the power board.

Light source: The bulb is powered by the transformer (AC 5 V/3A) in the probe. The replacement of the bulb must be in accordance with the instructions.

Filter disc: The infrared interference filter is one of the key components in the infrared moisture meter. The lens is strictly prohibited from wiping as it is specially coated. Acts of wiping will cause irreversible and permanent damage.

④ Power supply board: supply power to the synchronous motor, light source, and probe main board. There is a corresponding DIP switch in the power board. It is forbidden to change it during maintenance after leaving the factory, or the instrument may not work normally until the motor or light source is damaged.

Structure diagram of probe: The probe has built-in dual MPUs, which allows for fully digital signal transmission, no longer in need for the old synchronization mechanism. The MPU can automatically identify the wavelength signal and automatically amplify the signal without manual adjustment.



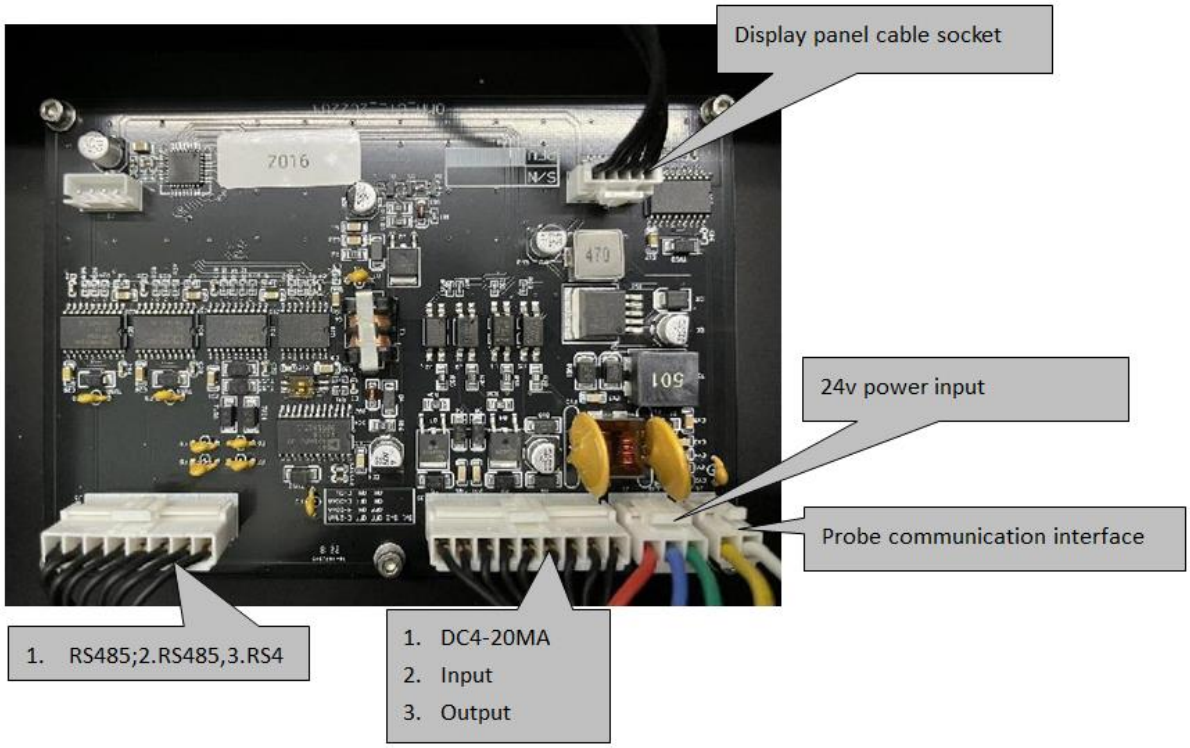
5.2 Instrument panel

The main components of meter: motherboard, display board.

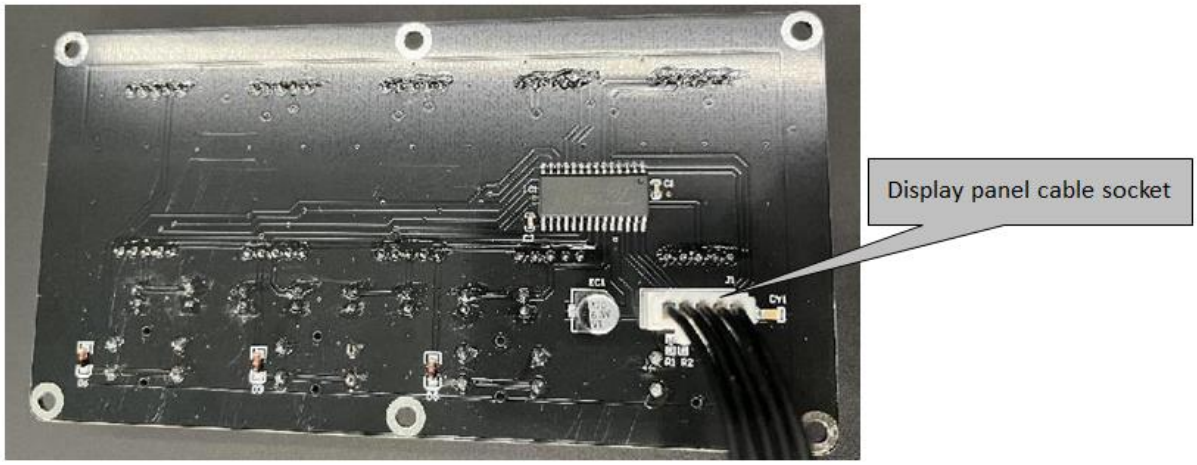
①Motherboard: CPU processor, digital communication interface, analog interface, all fixed on the bottom case of the meter;

②Display board: including 5 digital tubes, 8 LEDs, and four buttons, which are fixed on the metet panel.

Motherboard of the Instrument Panel:



Display board:



Chapter 6 Maintenance

6.1 Daily Maintenance

① Since the light source of the instrument probe is a tungsten halogen lamp, which relies for its light emission on heated melting, frequent acts of switching on and off will greatly affect the life of the light source. So it is not recommended to cut off the power when sent back to the manufacturer for short-term maintenance (less than 3 days).

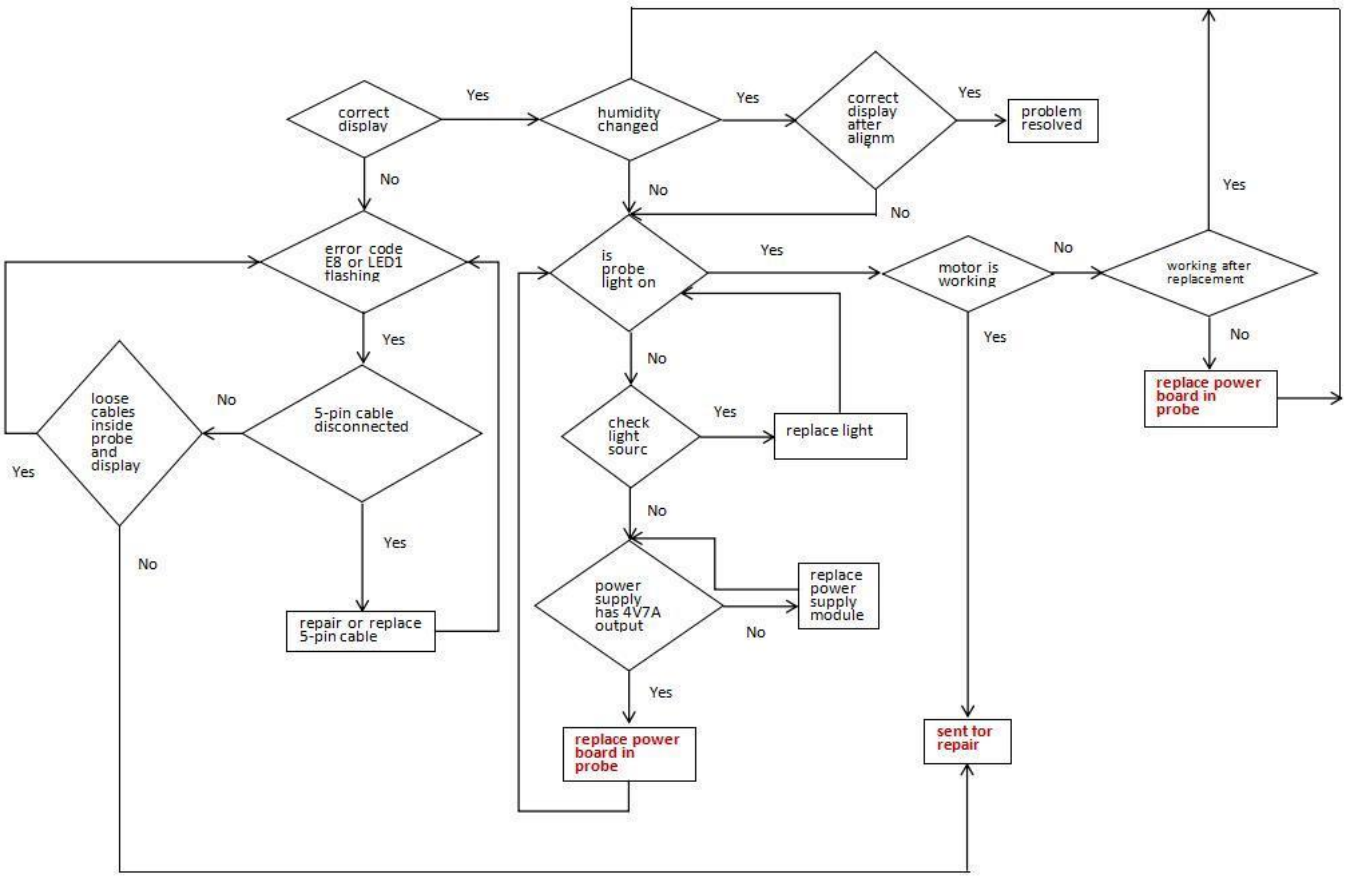
②The lens of the probe emits and receives light, so stains or water vapor should be avoided. In daily use, users should choose the best way to keep the lens clean according to their working environment. Keep away from hard-surfaced material such as sandpaper or wire brush.

③The instrument enjoys sufficient International Protection Marking or IP Code protection. Water drops and dirt on the instrument shell, connecting cables, plugs and other parts should be avoided. Daily cleaning can greatly extend the service life of the machine.

④ The power supply module of the machine adopts the global voltage applicable design, which can meet different voltage ranges such as AC110-240V 50/60HZ, but the stability of and no interference in power supply are also necessary for securing accurate measurements. During unplugged maintenances, the power supply and grounding terminals of the meter should be checked to avoid any poor contact and situations of grounding resistance greater than 5Ω.

6.2 Troubleshooting

Common faults can be judged according to the following figure:



Troubleshoot according to the specific situation.

① The light bulb is a wearing part, with a normal service life of 10,000 hours. However, if it is still workable, it does not need to be replaced.

②The service life of the motor is 30,000 hours, but if it can be used normally, with no obvious noise or jamming, there is no need to replace it.

6.2.1 Replacing the light source bulb

Precautions:

(1) Do not touch the bulb as it will shorten its life;

(2) Never disassemble the meter in a room where is filled with dust and steam such as a production workshop. Also make sure to prevent static electricity during disassembling.

(3) Replacing the bulb involves replacing the whole bulb assembly, including bulb, bulb ceramic base, and lead wire. Do not disassemble the bulb separately.

Warning: Do not touch the bulb until it has cooled down.

Disassemble and install the bulb assembly as follows:

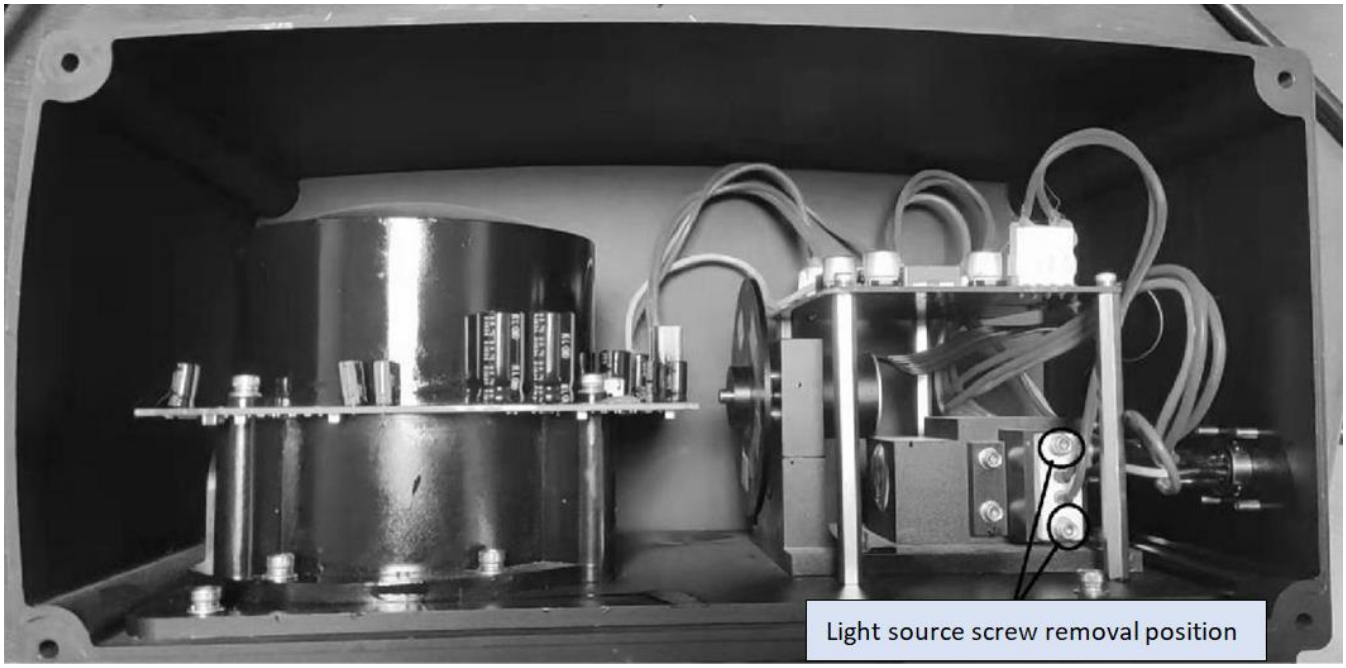
Disassembly procedure of the bulb assembly:

① Put the probe flat on the workbench, with the lid on the side of the 5-pin socket facing the maintenance personnel, and loosen the 4 fixing screws. Keep these screws and the cover nearby in case of misplacing;

② Place the meter in a position where it is easy to disassemble the bulb. The bulb assembly can be seen fixed on the bulb holder by 2 hexagon socket screws;

③ Unplug the bulb assembly from the circuit board;

Use an Allen wrench to loosen the two Allen screws that secure the bulb ceramic base, and carefully remove the bulb assembly.



The installation of the bulb assembly:

- Take out the new bulb assembly from the box;

- Carefully put the new bulb assembly into the bulb holder. Do not touch the bulb glass during operation;
- Tighten the two screws that are used to fix the ceramic base of the bulb. Be careful to avoid excessive force when fastening, so as not to break the ceramic base;
- Plug the lead wire of the bulb assembly into the bulb power socket on the circuit board;
- Put the lid back on the probe and fasten the four fastening screws.

Note:

The bulb assembly has to be replaced as a whole, meaning the bulb or lead cannot be disassembled separately.

The height from the bottom of the ceramic base of the bulb to the midpoint of the filament is 44mm.

6.2.2 Replacing the Filter Disc Motor

WARNING: DO NOT POWER THE PROBE WITH THE CASE OPEN.

Note: When removing the filter disc motor, do not damage or touch the filter on the turntable. The removed filter turntable must be placed in a clean plastic bag with the optics facing upwards, otherwise the filter may be damaged.

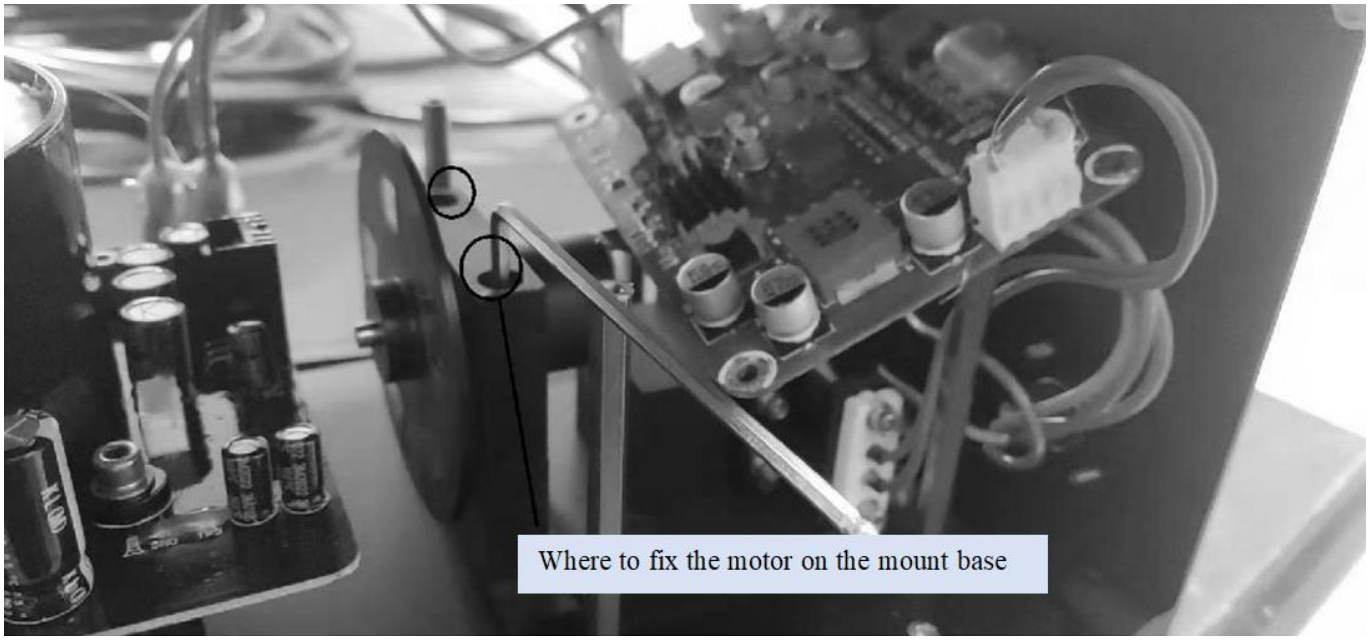
Disassembly and assembly of the filter turntable motor: see the below figure

Proceed as follows:

① Place the probe on the workbench and loosen the cover fixing screws on both sides of the probe. Put the screws and the cover together in case of misplacing;

② Remove the power supply board by unscrewing from the lower female stud pillars the 4 M3 hexagon socket screws used to fix it on the power supply board. Unplug the corresponding plug, and open the power board, you can see the motor and the motor fixing seat and 2 fastening screws;

③ Pull out the motor cable plug from the power supply board;



④ Loosen the two M4×8 stainless steel screws that fix the motor and take it out;

⑤ Carefully take out the motor and filter turntable assembly, because the filter turntable is worn on the motor shaft, so be very careful when taking it out;

⑥ See the pictures for information. Unscrew the filter turntable fixing top screw, remove the filter turntable assembly from the motor shaft, and put the filter turntable in a clean plastic bag, with the optical part up, otherwise the filter may be damaged.

⑦ Remove the four M3 socket head cap screws from the motor base and remove the motor.

⑧ Take out the new motor, fix it on the motor base as it is, install the filter turntable assembly on the motor shaft as it is, adjust the distance between the filter disc and the motor base, and tighten the filter turntable fixing top wire;

⑨ Press the motor and filter turntable assembly on the motor fixing frame of the main board, and tighten two M4×8 stainless steel screws to fix the motor. In order to assemble the motor firmly, the stainless steel screws must be tightened;

- Insert the motor plug into the socket on the power supply board;
- To reinstall the power supply board, tighten the 4 fastening screws;
- Check if friction occurs when the filter turntable is rotating;
- Power on to check if the motor is running normally and whether the light source is lit normally;
- Cover the lids on both sides of the probe, and tighten the 8 fastening screws.

Note:

- **When fixing the motor, the filter turntable fixing top tightening screws should be pressed tightly on the motor shaft.**
- **When fixing the filter disc, make sure to avoid rubs between the filter disc and the motor base.**
- **The two stainless steel screws that fix the motor base must be tightened.**

6.2.3 Check Cables and Cable Connectors

Check your system's cables regularly for mold, damage, and twists, etc., and fix them as you go. Keep them away from waste and dirt, as these can cause mechanical or chemical damage to them. Make sure that the cable connectors are fully tightened at all times to avoid causing interference with the meter.

6.2.4 On-site Troubleshooting for Interferences with the Moisture Meter

When the displayed value of the instrument is unstable and the fluctuation range is large, the user should first check whether there are sources of on-site interference. First turn off the product line and move the moisture meter to an office environment, place a sample at a distance of 250mm under the probe, and

observe the change of the moisture display. If the moisture display is stable, it means that the moisture meter is working normally and there is interference on site. Check whether the ground wire is connected well, or there is a frequency converter or a large motor close to the moisture meter at the production site. Static electricity derived from the brackets and mounts on the site may also interfere with the signal of the moisture analyzer probe. It is necessary to wrap the round tube bracket with insulating rubber tape in order to ensure that the probe is insulated against environmental static.

6.2.5 Troubleshooting for Communication Failures

When the instrument panel displays "E8", meaning faulty communication, check if the No. 1 LED light flickering? Check if the dual 5P air sockets connecting the probe with the monitor are disconnected or are suffering poor contact.

Infrared Moisture Meter Calibration Result Record Table (Recommended)

Sample No.	Laboratory oven measured value	Double-sampling mean	Moisture meter displayed value	Error
1	(1)			
	(2)			
2	(1)			
	(2)			
3	(1)			
	(2)			
4	(1)			
	(2)			
5	(1)			
	(2)			
6	(1)			
	(2)			
7	(1)			
	(2)			
8	(1)			
	(2)			
9	(1)			
	(2)			
10	(1)			
	(2)			
Averages				
Original Translation Amount				
Calculated new translation				
Original sensitivity				
Notes：				

Sample Name: Inspector:

Date: