SKZ111J Infrared Online Moisture Analyzer

Operational Manual

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Catalog

I. Summary

SKZ111J moisture meter for professional infrared moisture meter. Can provide a complete solution for users to configure. In this product, we use a number of new technologies, new processes, and have been greatly improved in the course of use and square pseudo aspects, such as:

●Head of imported high-speed processing chip circuitry and digital gain control
●Head procedure more intelligent, and status indicators
●Full-cast aluminum housing, and installation of air-cooled unit
●The controller and PC have a longer link distances, more communication protocols
●More configuration options

For users not yet installed Please read II. Installation Manual, IV. Technical Manual-1. Structure configuration and IV. Technical Manual- 4. Parameters Function Introduction-⑼, Slope, intercept.

For user already installed, need to add new measurement object can read III. Operation Manual, IV. Technical Manual-4. Parameters Function Introduction-⑾. Channel Copy and ⑼, Slope, intercept.

For equipment failure, refer to IV. Technical Manual--3. Working principle-⑵. Control box working principle and also 4. Parameters Function Introduction

For maintenance, carefully read all the contents of III. Operation Manual, IV. Technical Manual and V. Appendix

●General manual:

1. Dynamic modification when installing for the first time.

Moisture meter for dynamic modification is essential when installing for the first time. When installed for the first time, sampling must be carried out at the test site, and then calibrated with the oven method. This is because although moisture meter has been calibrated at the factory, but it is the laboratory's static calibration, and test site to many conditions and laboratory is not the same. For example: differences in the texture of the measured material, differences in work environments, measured material level differences, static and dynamic display differences, and so on.

Above is determined by the difference of the infrared moisture Analyzer different from common instrument, it has to be at the time of first installation, dynamic calibration again. Dynamic calibration must be carried out at the work site. Method: test site dynamic sampling, meanwhile, record the displayed value of the instrument, the

samples that were taken, using “two-hour dry oven method” to calculate the actual moisture content values, then compared with the dry oven moisture values and displays the value of the instrument, use its differences to increase or decrease the margin between the intercept, so that the instrument display and dry oven moisture values remain the same.

2. Dynamic modification of operational procedures

When installed for the first time, dynamic modification is essential. Also, if during the normal test and found moisture Analyzer displays a marked deviation, user should also compare the dry oven got value with the instrument display, and its method of operation is exactly the same, mostly by modifying the control box on the keyboard "intercept" to correct. To achieve the instrument display and oven moisture values remain the same.

⑴**.** Oven operation necessary conditions:

①**.** Oven with automatic temperature control, and with an air blast.
②**.** Balance precision of 1 per thousand grams, best use of electronic scales. (1% larger error).
③**.** Drying cylinder to be sealed with lids, dry desiccant in the cylinder to prevent dried materials absorb moisture from the air.
④**.** Dry ware of the item being measured, preferably with aluminum cans. (Thermal conductivity is better).
⑤**.** Oven method in accordance with the standards, namely: setting the temperature is 100 degrees, dry time is 2 hours. (Note: the material when first got into the oven, the oven temperature will drop, wait for the oven temp climbed to 100 degrees and then timing).

⑵**.** Dynamic sampling should pay attention to following issues

①**.** Correction oven method for moisture meter display, must be dynamic sampling at the test site, and each sampling time, preferably in 1 hour after normal work, because

moisture meter and production line both has entered the stable operating system state. Do not sampling once after the boot , otherwise the results may be inaccurate.

②**.** Each sampling, should try to carry on when display is stable, water fluctuations do not exceed 0.2. If the sampled moisture value showed a big jump, then the sample is void need to take it again. Sampling point cannot be arbitrarily should be 20-40 centimeters of the probe beam irradiation position of material surface (Because infrared penetration is poor, so it is measured moisture of material surface and material surface and internal moisture sure not the same). Note: during sampling, the hand cannot reach into the spot light.

③**.** One time corrected, samples quantity cannot taken too little, a recommended number of samples must be greater than 5. During the sample test to take the false and true, identify statistical law to be amended. Sampling quantity more, higher reliability and accuracy, but it will greatly increase the workload of the oven. When handling oven results, general is to remove 1 sample of minimum and 1 sample of maximum error. Finds the average errors of all samples and corrected. Moisture Analyzer must not be allowed to take only one sample to finish the correction.

④**.** Samples can be collected in plastic bags (such as sealed bags used in refrigerators or other containers), and also record a number, after sampling, bag must be tied tightly to prevent moisture loss of material. Sampling about 40 grams per bag at a time, and record the current moisture values are displayed, End of sampling, preferably get weighed, and put into the oven immediately.

⑶**.** Oven operation points for attention:

①**.** Oven follow standards, namely: setting the temperature is 100 degrees, dry time is 2 hours. Every large sample can be divided into 2 small samples, respectively, get the value, then averages values of these 2 small sample as the large sample’s moisture value, If 2 samples of moisture varied by 0.3 percent, the large sample is void

②**.** Turn on the oven, open the air-blast, when the temperature rose to 100 degrees, place into the material. Materials metal box lid must be opened, and when material

are placed in the oven temperature drops, when the temperature rose to 100 degrees once again, start the timer.

③. Materials stored in metal boxes must be numbered, each small boxed with 3 to 5 grams, well weighing records and moisture value displays records, so as not to mistaken identity.

④. Stay dry after 2 hours, turn off the oven and air-blast, cover with lid, placed in a closed drying cylinder cooling. After about 15 minutes, cooled to room temperature, it can be weighing.

⑤. Calculation formulas:

$$\text{Moisture content of materials} = \frac{\text{Material before drying} - \text{Dried materials}}{\text{Material before drying}} \text{X}100\%$$

⑥. Calculation error. Remove error of one of the largest and one of the smallest from the test value. And then get the average of all left samples errors, this is the difference of the instrument display and actual moisture (oven value).

⑷. Modify the display of moisture Analyzer (that is, modifying the intercept):

①. In normal working conditions, press “Set” key of the control box, the display " -01-" (that is, the current channel number).

②. Press "intercept" key, will display a value (previous intercept values)

③. If need to make its display value larger, press "increase" key. If needs display smaller, press "reduce" key. The value increase or decrease is the differences (average error) between instrument display and actual moisture (oven value).

④. Press the "OK" key to confirm, display box panel show "---16"

⑤. Press the "set" key, the moisture Analyzer display moisture corrected value.

3. Modify the water display by the oven method (that is, the intercept), example:

No.	Display vaule	Oven value	Error
1	7.5	8.0	-0.5
2	7.9	8. 3	-0.4
3	8.2	8.4	-0.2
4	8.5	10.0	-1.5 (Uneven material)
5	9.2	9.8	-0.6

In the example above, need the moisture meter display value (that is, the intercept) increased by 0.4. And the 4th test sample should be removed because it does not meet the statistical law. Revised moisture meter display value and the actual moisture content values remain the same.

No.	Display vaule	Oven value	Error
1	8. 5	7.9	+0.6
2	8.8	8. 3	+0. 5
3	9.0	8.4	+0.6
4	9.8	8. 5	+1. 3(Uneven material)
5	10.0	9.6	+0.4

In the example above, need the moisture meter display value (that is, the intercept) reduce by 0.5. And the 4th test sample should be removed because it does not meet the statistical law. Revised moisture meter display value and the actual moisture content values remain the same.

4. Main point of Use and maintenance

⑴. Moisture meter power on about 30 minutes before regular production assembly line first opens, give the instrument a warm-up and stabilization process.

⑵. Optical probe window should always use alcohol-water-free or sanitary paper wipe clean, to keep the optical window clean. Otherwise it will make a big error.

⑶. Moisture meter installation must meet the requirements: translucent glass of the probe to the material surface about a distance of 250 mm is advisable. (Allow 220---280 mm) should not be too high or too low.

⑷. If the probe installation position has steam, then probe gas nozzle must be equipped an external compressed air and gas filter (FRL), 0.1-0.2Mpa pure compressed air driven by pressure of steam and dirt. Otherwise probe transparent glass coated with sawdust and water vapor, the instrument does not work.

⑸. Installation position place to select backlight, because sunlight or strong lamp light in the infrared light energy is large, reflected into the probe within thereby increasing the measurement error. So if have the Sun or strong lights to probe must be fitted with the hood, (or block light). Around the hood, it's best to put on black cloth, otherwise, due to the influence of light, test results will be a lot of errors. Best State is that the flashing light at the bottom of the probe can be seen at any time, thus eliminating the interference effects of light on tests. Otherwise, possible for days and nights, mornings and afternoons to make testing results quite different.

⑹**.** Daily calibration is necessary. After in use for a long period of time or moved its testing position, if users feel its displayed values have a major error. The moisture Analyzer needs to be dynamic correction, its methods, as described in 2 and 3.

5. Current signal output

After the moisture Analyzer is installed, in order to facilitate the operator to observe the situation of moisture and 4-20mA are specially designed current signal output. Resistance to external electromagnetic interference, the Assembly line must be in the multiple RVVP of 2-core shielded cable, wire cross-sectional area greater than 0.3 mm square. Current outputs red (+), current output yellow (-).

6. Judgment and solutions to common troubleshooting problems

Problems	Reason and solving methods
Boot is not displayed.	1. the power is disconnected, power switch is bad.
	2. display fuse circuit breaker inside the box.
	3. display box for power supply Board bad. .
	4. display box connecting digital flat cable loose.
	5. display box at the power supply connectors contact is not good.
After used for a period of time, the display deviation becomes large.	1. the glass of probe is dirty, wipe with alcohol without water.
	2. after sampling, compared with the oven method, to revise the intercept.
Moisture change little, but in day and night the deviation displayed is large.	1. sunlight or the light is too strong in the workshop, the light reflected by the surface inside the probe to form additional error, solution: equipped with a lens hood. On the hood surrounded by black cloth.
	2. Hood distance from the material surface is too high. Shading effect is not good. Lower the hood height
	3. gain settings are too large or too small. resetting the gain.
Moisture display upper and lower volatility is very large.	1. damping time is set too small. suggested increase. normally 10-35
	2. casing poor grounding or earthing resistance is too large.
	3. slope of the instrument was changed. Restore the original value of 1.00.
	4. inappropriate gain settings, 8 voltage value is too large or too small. Using the command 23-3, as described in the head
	5. exposure to sunlight or strong lights on the probe, shade should be taken.
Probe not to see the Green blinking light	1. halogen lamps within the probe is damaged. Replace the halogen lamp.
	2. display box power supply is damaged. replacing the power supply Board.

	3. the motor does not rotate in the probe. No AC 110 volts.
	4. damaged motor, winding way.
	5. modulation plate of the motor inside the probe loose screws
	6. modulation plate is blocked by opto-coupler, Reseat the plate location.
Main display box display normal, but second meter displays error	1. the second meter signal wire polarity reversed or wiring errors.
	2. the second meter output line and the voltage line broken at the joint,
	3. display box at the secondary power supply Board is not tight or come off.
	4. the secondary current in the display box for damage.
	5. secondary meter is set incorrectly or damaged.
Output and the main display shows error (i.e.: out of sync)	1. display box 4-20mA output with large deviation. Recalibrate.
	2. upper and lower limit for secondary meter is not adjusted
	3. set upper and lower limits of the primary display be changed (should be lower limited 4%, upper limited to 20%)/. Reset the upper and lower limits.
	4. the secondary current output Board bad.
Main display showed instability, output beats great	1. line output did not use the shielded wire. Strong electrical interference signal into a second meter.
	2. grounding line of shielded cable is not connect the ground cord or fall off
First power on the main display shows "UUUU"	1. gain of main Boards in the probe is too high, and signal saturation. Solution: reduce the gain.
	2. auto gain change to manual gain.
Display "9--1" repeatedly cycles	1. Optical coupling signal wires to disconnect.
	2. Optical coupling signal is not plugged.
Display a fixed value	1.Moisture value exceed the upper and lower limits, showing overflow.
	2. the upper and lower limits of moisture setting is wrong, recheck and set.
	3. press "OK" to exit the "sampling" state.
	4. slope was set to 0, it should be set to 1. 00.
	5. the head of the motherboard is bad
After booting display stays in "1111"	1. display box not communication with the head, the motherboard of head is bad, or 232 communications chip is damaged.
	2. poor contact of communication cables or plugs, 232 communications chip
	3. the aging probe motor to slow rotation.

7. Digital moisture meter function

After head replaced the motherboard, or after the recalibration of light paths, or 8 voltage value is too large or too small to make the display values jumps, then user require reference moisture tester functions, specific steps are as follows:

⑴. Tested materials (such as concrete) placed under probe flashing light. Glass from the probe to the surface material about a distance of about 250 mm. Material must be still (that is, static, surrounded by light to dark).

⑵. Connect well the display box and the probe cables, power on for 2-3 minute.

⑶. Press “Set” key on the Panel of the display box, should display the current channel number "—01--". I.e.: channel 1.

⑷. Press "Sample" key to display the parameter number"-00"

⑸. Press "reduce" key, adjust the serial number to "-23".

⑹. Press "OK" key will display "0".

⑺. Press "increase” key, adjust the number to "3".

⑻. Press "OK" key, enter the state of the internal adjusted count, for about half a minute, showing values increase from 1 to 30, after counting to 30, the instrument will automatically return to normal moisture display. (Other operations are not allowed during this period).

⑼. In General, after the operation, the instrument will return to a stable state.

⑽. If after above operation, moisture Analyzer working is still not stable enough, consider further increase appropriate time of damping. Then observe whether the moisture Analyzer installing position exposure to sunlight or strong light (this is important), if any, equipped with shading device. And also check the head of transmission if the glass is very dirty, and if so, please use a waterless alcohol swab.

II. Installation Manual

1.Brief description

General standard configuration, a standard foam carton packs two main components: the control box and the probe and also some accessories: manual, the connection cable between the head and the control box, as well as lifting the head with a connection and so on.

⑴. Electromagnetic Compatibility

EMC performance of the installation, briefly guide as follows:

①. Ensure "clean" power source (instrument power);

②. The signal cables installed in a small electrical conduit, the total installed power lines in the weak supply conduit;

③. Ensure the various parts of the probe or the system is not close to strong sources of electromagnetic interference (EMI), such as:

A. Big horsepower electric motor B. Welding Equipment
C. Strong electrostatic discharge D. Infrared heaters
E. Microwave F. Large transformers
G. Transportation equipment H. Power control circuit

⑵. Unpacking procedure

The device is packaged specially made box. Should save this box, if you need to transport the equipment somewhere else, using this package will be able to ensure the safety of the device.

Be careful unpacking and remove every component. Each part into a clean place for inspection. Check whether the various components of external damage or not; socket is clean or not; cable is damaged or knotted or not.

Check whether the parts is consistent with the items listed in the packing list, during transport if there is obvious external damage. If there are missing or damaged, please contact us.

⑶. Storage

Before installing, place the probe in 0 ° C ~ 35 ° C environment and kept dry. If condensate produced, need to be equipped desiccant. The equipment before installing should be consistent with its temperature and ambient temperature.

⑷. Installation Considerations

①. Probe:

Mounting bracket of the probe (user supplied, usually with the 冂 shape or ㄱ shape) Or the object connected with the mounting bracket, can not be significantly vibration and request to good ground, otherwise it will lead the probe of the light bulb premature damage. The probe must be installed a position for easy maintenance.

Only if the devices are correctly installed and used in an appropriate environment, the probe can be measured accurately. During the detection process, the probe should ensure balance and stability to continuous testing of representative materials.

②. Ambient light

Since the irradiation intensity of natural light, will reduce the sensitivity of the probe, therefore, the probe should avoid strong natural light. Lighting circuits powered by artificial light, such as incandescent and fluorescent light, will not have an impact on the detection of the probe, thus allowing normal lighting. However, the light source is not applied directly to the glass window of the probe.

③. Temperature

Operating temperature is 0 ° C ~ 60 ° C, without forced cooling, the probe can work. When adding water to cool, the upper limit operating temperature can be increased.

④. Compressed air

Probe surrounding, if there is dust and dirt, needs to use air compressor to clean to prevent dirt, dust or other impurities in the air pollution in the window, otherwise, it will impact of test accuracy.

The air enter into the window, must be kept dry and clean. Otherwise, it will affect the measurement accuracy of the probe. Recommend the air pressure is maintained at 30p.s.i, flow rate of 2 liters per minute.

2.Head mounted

Probe for mounting on top of the material to be measured, mounting height from the bottom probe (excluding blackout barrel) to material distance is 250mm.

The top of the mounting structure of the probe allows the user a plurality of directions on the actual installation. Between the probe and the control box cable standard configuration for the 2.5 m / 5 m in two sizes.

⑴. Mechanical installation

Installed in the measurement site, required the probe to the surface of the measured object distance is 250mm, fluctuations of materials is less than ± 50mm, material fluctuations greater than + 50mm display value creates larger volatility.

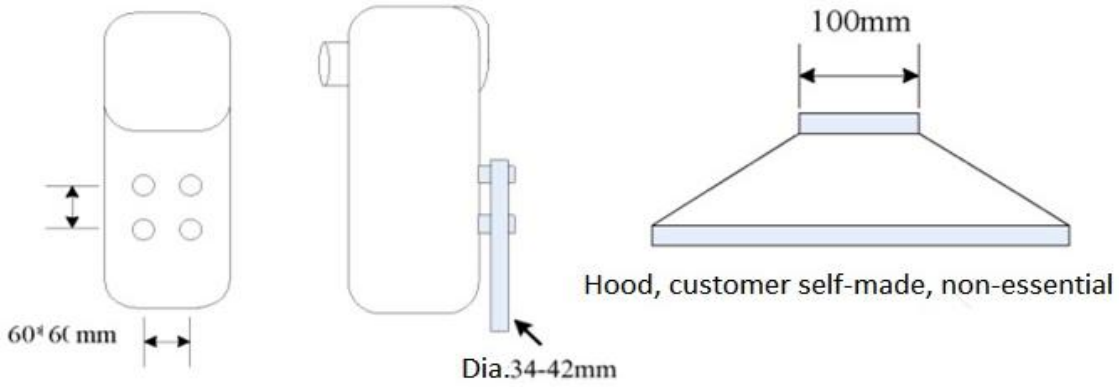


Figure 1: Probe and Hood Dimensions

For larger steam station, need to install air compressor, which shall be subjected to decompression and oil and gas separation, pressure for 0.1--0. 2MP:

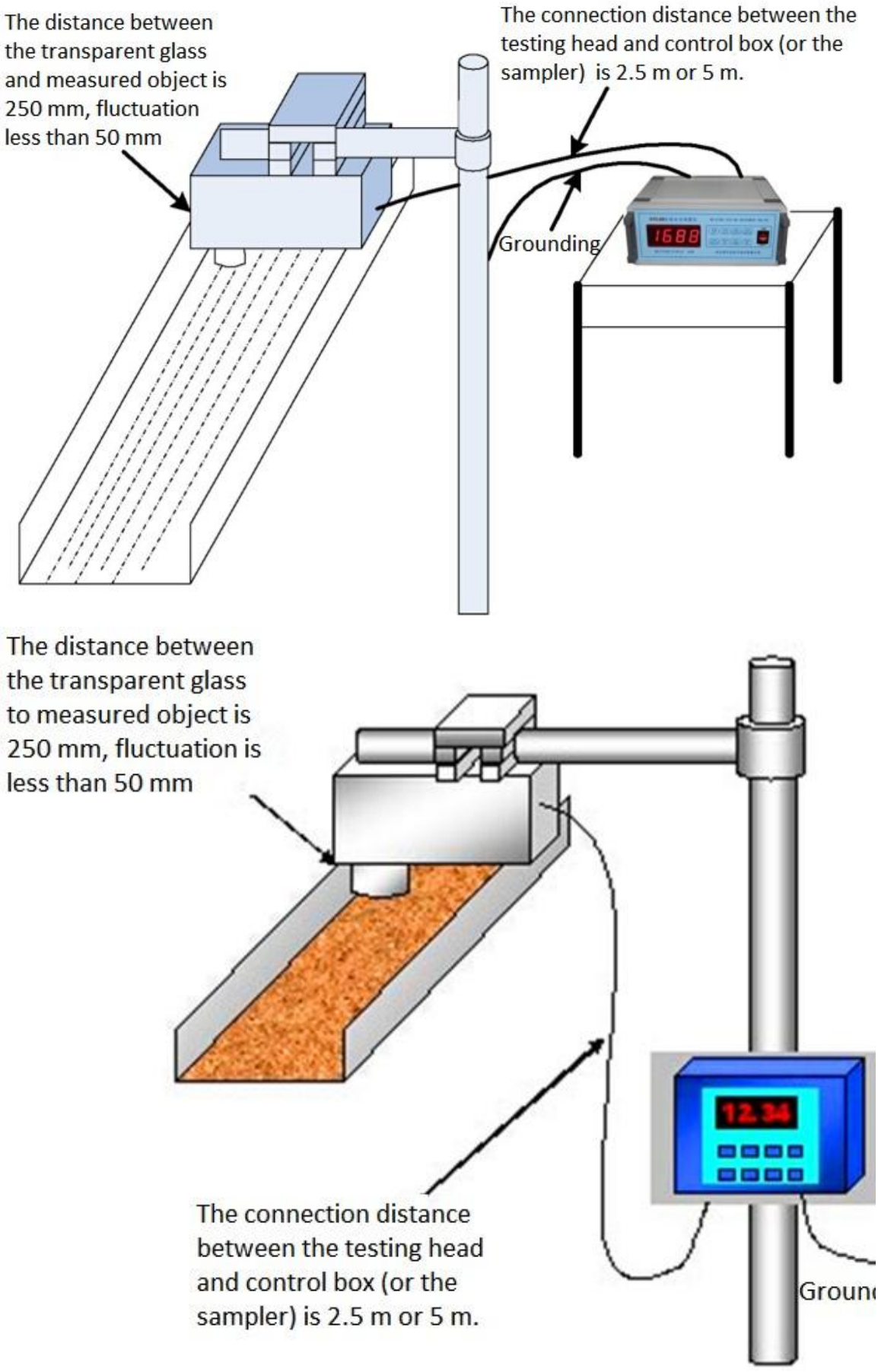


Figure 2: Installing Sample

For the measurement of non-reflective material (such as concrete), the test head of the measuring beam to be directed perpendicular to the article so that the reflected energy the largest returns to the detector.
For the measurement of strong reflected measurement items (such as chemical raw materials, powders, paper), Test head must be installed at an angle and measurement goods position, the optimum angle of 17 degrees. If the bottom of the test point is reflected strong when there is no materials (eg. stainless steel), then need to adjust the angle of the probe to avoid the water vale shown when there is no material.
Due to the probe is used ceiling- mounted, and the lifting direction of the module variable, so we can easily adjust the moisture meter head to the desired angle.

⑵. Electrical connection
Need to connect the control box and the test head with provided 2.5 / 5 m long cable (15 core dedicated shielded cable, with a 20-pin plug), Generally not allowed to arbitrarily change the cable length and cable type.
Moisture meter head cable lines can be divided into four categories: light power, motor power supply, Circuit power, Digital signal.

Table1:

	No	Content
Light Power	1	2-core white docking plug, usually around 5.8V voltage
	2	
The motor Power	1	Black docking plug, connect the motor end is three core, voltage around 110V
	2	
Head circuit power (control panel P1)	1	Digital Power Supply (8V)
	2	Digital Ground (0V)
	3	Simulate positive supply (+ 15V)
	4	Simulate ground (0V)
	5	Simulate negative power supply (-15V)
Head circuit digital interface (control panel P2) In the control box has this indicator display, and its function details check in Appendix	1	Head serial port signal output (TXD)
	2	Head serial port signal input (RXD)
	3	Head serial port signal ground (GND)
	4	Status Indicator 0
	5	Status Indicator 1
	6	Status Indicator 2
	7	Status Indicator 3

3. Control box installed

⑴. Mechanical installation
Control box should be easy to observe
Control box should be easy to operate, such as: sampling work
Control box for the entire system, man-machine exchange interface. The head of the

working condition, the output signal of the control box itself and the display processing by CPU.

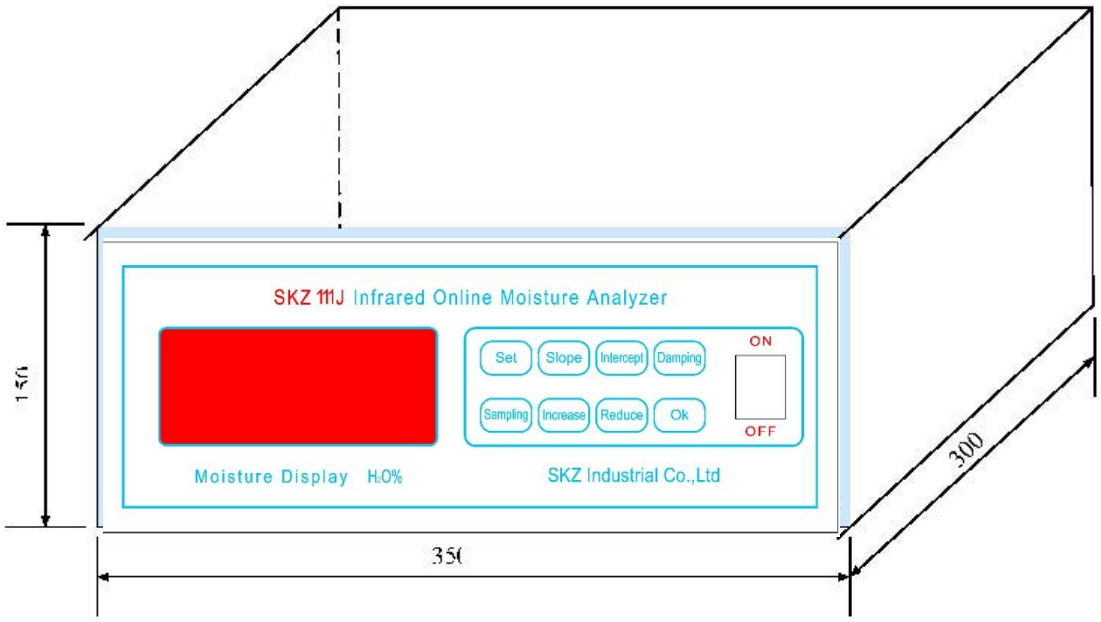


Figure 3: Control Box Dimensions

Control box and head connection standard configuration for 2.5 m or 5 m, therefore the position of general control box installed to facilitate the observation and operation is appropriate. Control box installation method: the control box is placed on a stable surface (on the ground), (ensure reliable casing ground, otherwise produce static electricity burnt the machine).

⑵. Electrical connection

At the rear of the control box, there is a row of wiring holes, some have been connected, some require on-site connection, some are reserved, sealed with a metal nut. The following cable needs to be connected:

Head connecting cable (provided with 15-core dedicated cable)

Power cord (provided with 3 core cable)

Simulate signal lines (on-site connection) - Black Line: (-), Red Line: (+)

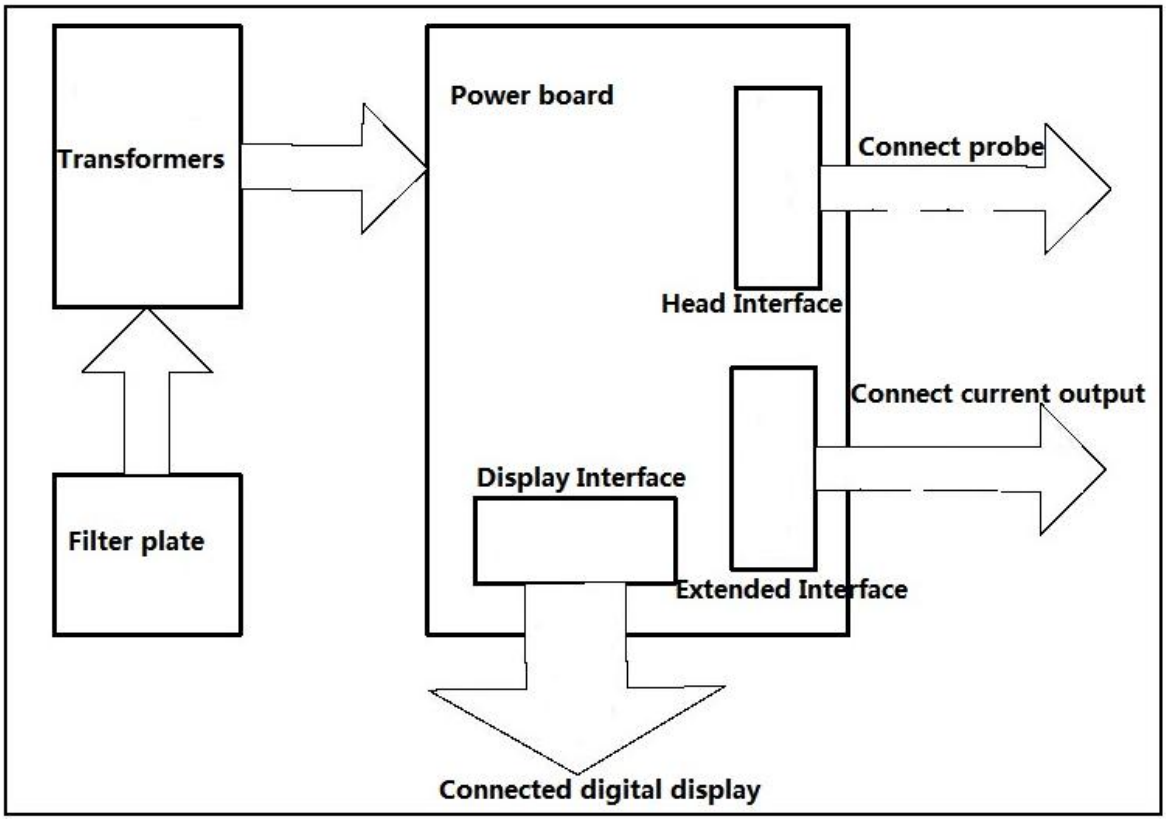


Figure 4: The control box connection diagram

⑶. Power debugging

Before starting the power, first check the input power is meet the requirements, after boot, should display "9999", "8888" --- "1111" and then display the measurement of moisture.

Generally, measuring position when there is a material and moisture values are displayed, if displayed as a fixed moisture value (upper or lower limits) , user can check whether the probe with voltage output (communication under normal circumstances), and the output value is normal or not.

4 head status indicator light-emitting diodes inside the control box, user can observe the bright, off situation to determine whether there is failures. Another 4 power status indicator shows the power status of the control box.

III. Operation Manual

1. Digital control box keyboard operation

⑴. Summary

Infrared moisture meter normal running state can be divided into the following two categories: dynamic and static. "Dynamic": real-time display of moisture or voltage state of controller. "Static" : be in waiting "keyboard" or "PC" command state.

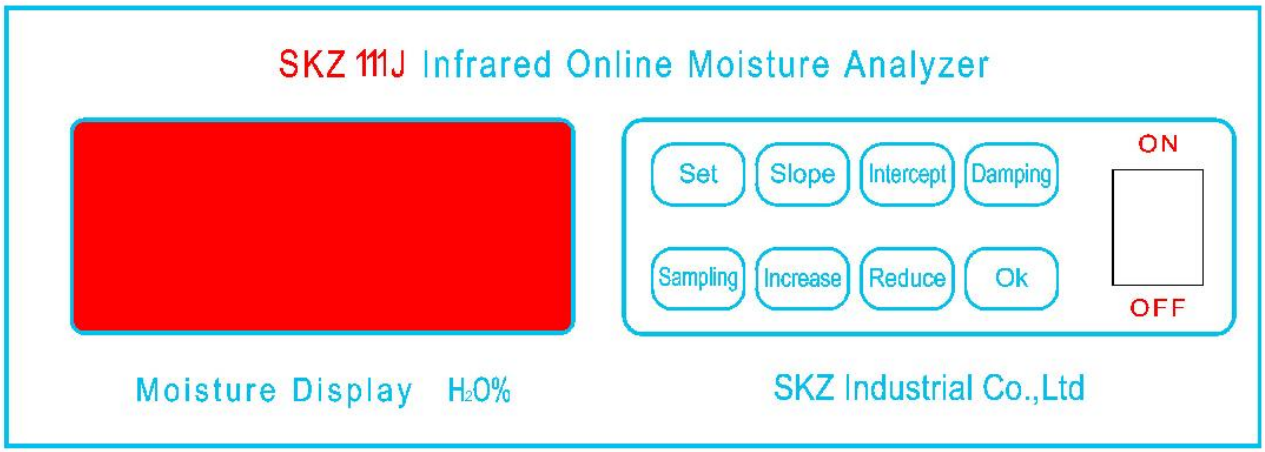


Figure 5: The digital control box interface

Moisture analyzer boot, the "initialization." (display "9999", "8888" --- "1111" and then enter into display the measurement of moisture). Meanwhile, the head of the infrared band signal acquisition of materials, calculated according to the parameters have been selected channel, and the information is transmitted to the control box, which receives the head of dynamic information and displays it.

For digital tube control box, which is based on dynamic content display to the corresponding sub-mode word. User can press [increase], [reduce] keys to change the sub-state word, press [OK] key to return to the mode of moisture display. If user forget the current sub-state, can press [slope], [intercept] and [damping] key to confirm.

Dynamic Parameter No.	Content
0	Damping moisture
1	Inside 1, outside 1
2	Inside 2, outside 2
3	Inside 3, outside 3
4	Inside 4, outside 4
5	Ground
6	Ratio one
7	Ratio 2
8	Ratio 3
9	Ratio 4
10	Real moisture

Table 2: Dynamic sub-mode table

⑵. Dynamic display keyboard operation

①. sampling

This function is mainly used when the need for Moisture analyzer to adjust. During working condition, press [sampling] key for its operation. Proceed as follows:

● Press [sampling] key to enter the sampling function (Note: Once in this function, only press the [OK] key to exit).

●Display - countdown state: MN, (users can "command state" Modify count length: Allow the count length of 10-100 times, not necessarily in 10 units), prompts sampling operation.

●If finished sampling operation, (countdown to zero) displays a flashing moisture figures, the average moisture within the period of the sample. Record this number in order to obtain the actual moisture content of the sample to adjust the analyzer.

●Press again [sampling] key for the next sampling or press the [OK] key to exit the sampling function, analyzer back to moisture display.

②. Observe other dynamic parameters

●In the "dynamic" state, press [increase], [reduce] key to change the display sub-state dynamic character, in accordance with the "dynamic sub-mode word table", normally not use this function, only if finding the meter unusual circumstances, the maintenance staff will generally require records the data after number 1 of the table, to analyze the situation.

●If forget the corresponding number, during pressing [increase], [reduce] key, hold pressing any key of [slope], [intercept], [damping], to display the parameter number.

●When display any number of data, press [OK] key to return to moisture display.

⑶. The basic parameter modification Operation

Any parameter modification operation requires the instrument to enter static operating state. That is need to press the [Set] key to enter. "Basic parameters" refers to the no need to enter a password, any operator can modify parameters, including the "current channel", "slope", "intercept", "damping":

①. Channel switching

If the texture of the material installed have a larger change (such as changing grades), user needs to use different materials for different calibration parameters (stored in a different channel numbers), When measuring this material of "current channel" to switch to the corresponding channel number. Switching process is as follows:

●Press the [Set] key, the moisture meter enter in channel switching state, and display "-NN-" (NN) indicates that the current use of the channel number.

Press [increased], [reduce] key to change its number size. After changing, the new channel number flashes (if exchange for the original channel numbers flashes disappear).

●Press [OK] to confirm the changes, then the channel numbers stop flashing, then press [Set] key to return to moisture display.

●If user give up this changing, press [SET] key to return to moisture to display status.

②. Modify the intercept and slope

If the moisture content of Moisture analyzer display error has occurred, it is necessary to adjust the calibration parameters. Proceed as follows:

●Press the [Set] key to make Moisture analyzer enter in channel switching state, then display "-NN-" (NN) indicates that the current use of the channel number. According to requirement by pressing the [slope] or [intercept] key to display the corresponding parameters.

●Press [increased], [reduce] key to change its number size, for a larger amount of modifications, press and hold [increase] or [reduce] key, which will gradually accelerate the speed. If press [sampling] key to return to the original display data.

● Press [OK] key to confirm this modifications, return to the display channel numbers, "-NN-"

● If give up this changes, press [Set] key to return to state display channel numbers, "-NN-"

③. Modify damping

Meaning of damping parameters: Displayed moisture is the average value of changing that the Moisture analyzer detected in the damping time:

● Press [Set] key to enter in channel switching state, then display "-NN-" (NN) indicates the current use of the channel number.

● Press [damping] key to display "NN", which represents the current damping.

● Press [increase], [reduce] key to change its number size, which range is 1-99 (seconds). Press [sampling] key to return to display the original damping data.

● Press [OK] key to confirm this modification, state returned to the display channel numbers, "-NN-"

● If give up this modification, press [Set] key to return to state display channel numbers, "-NN-"

⑷. Other functions Operation

All parameters within the system can be modified according to the parameter number corresponds to the definition of location, including the "slope", "intercept" and "damp" and its modification method is essentially similar. Listed in the General section is as follows:

● Press [set] key, in "-NN" state and then press again [set] key to return to the moisture display status; Press [sampling] key to return to displaying the current channel "-NN-" State.

⑸. Special Function Operation

If parameter number is 23, press [Ok] key to enter "special function" State. Function number is displayed.

● Press [increase], [reduce] key to modify special function number.

● Press [Ok] key to enter the corresponding special function, as shown in the following table.

No.	Function	Return to the content
1	Background learning	Returns - background characteristics data
2	Material Learning	Returns - Material characterization data
3	Synchronization delay learning	Return from 1--31 learning process information
4	User password settings	Enter to modify user password status, similar to enter a password
5	Parameter Initialization	No
6	Parameter backup	No
7	Parameter Recovery	No

Table 3:Special Function comparison table

No.	Name	Remarks		Range
0	Gain I	1st path detector adjustable gain		0~99
1	Gain 2	2nd path detector adjustable gain (non-standard configuration)		0 ~99
2	Display accuracy	Display moisture Accuracy: 0 to 2 indicates display digits after the decimal point		0~2
3	Standard current output	Set standard analog signal output of 4~20mA		4~20
4	Moisture lower limit	Set display the lowest moisture content corresponds to the lower limit of the analog output (current signal: 4mA)		0-99
5	Moisture upper limit	Set display the highest moisture content corresponds to the upper limit of the analog output (current signal: 20mA)		0-99
6	Parameter RX10	Calibration of the parameters of the system, modification is not allowed. Parameters RX less than 99, for moisture step value judgments. More than 100, larger part used for the delay setting for background, i.e. RX=102, background signal display the lowest moisture content after 2 seconds.		0-199
7	Parameter A			-99.9-99.9
8	Parameter B			
9	Parameter C			
10	Parameter N1			0.0-1.0
11	Parameter N2			
12	Parameter N3			
13	Formula No.			0-4
14	Machine No.	/		0-255
15	Slope	Factory default is 1.00		0.10-9.99
16	Intercept	Factory default is 0		-99.9-99.9
17	Damping	Recommend 10-50		1-199
18	Channel Copy	The current channel is copied to the specified channel		1-18
19	Sampling times	Samples points numbers taken when sampling		1-255
20	Analog lower limit	1st path 4-20mA output of 4mA correspond to values		1-512
21	Analog upper limit	1st path 4-20mA output of 20mA correspond to values		512-1023
22	Version number	Version number of the control box		Un-modify
23	Special Function	0	retains	Un-modify
		1	Background Learning	

		2	Materials Learning	
		3	Synchronization delay learning	
		4	User Password Set	
		5	Parameter Initialization	
		6	Parameter backup	
		7	Parameter Recovery	
24	Version number	Head program version		Un-modify
25	Analog lower limit	2nd path 4-20mA output of 4mA correspond to values (non-standard configuration)		1-512
26	Analog upper limit	2nd path 4-20mA output of 20mA correspond to values (non-standard configuration)		512~ 1023
27	Low alarm limit	Current moisture lower than the set value, the output lower limit alarm signal		lower limit
28	Upper alarm limit	Current moisture larger than the set value, the output upper limit alarm signal		upper limit
29	Synchronization delay 1	Delay time when optocoupler of head acquisition outside optical path		0x0E0~0x0FF
30	Synchronization delay 2	Delay time when optocoupler of head acquisition inside optical path		0x0E0~0x0FF

Table 4: SKZ111J Infrared Moisture analyzer parameter

IV. Technical Manual

1. Structure configuration

Composition: "probe" and "Control box". The "probe" used to measure moisture signal, the "control box" used to provide the power needed to head and basic user interface.

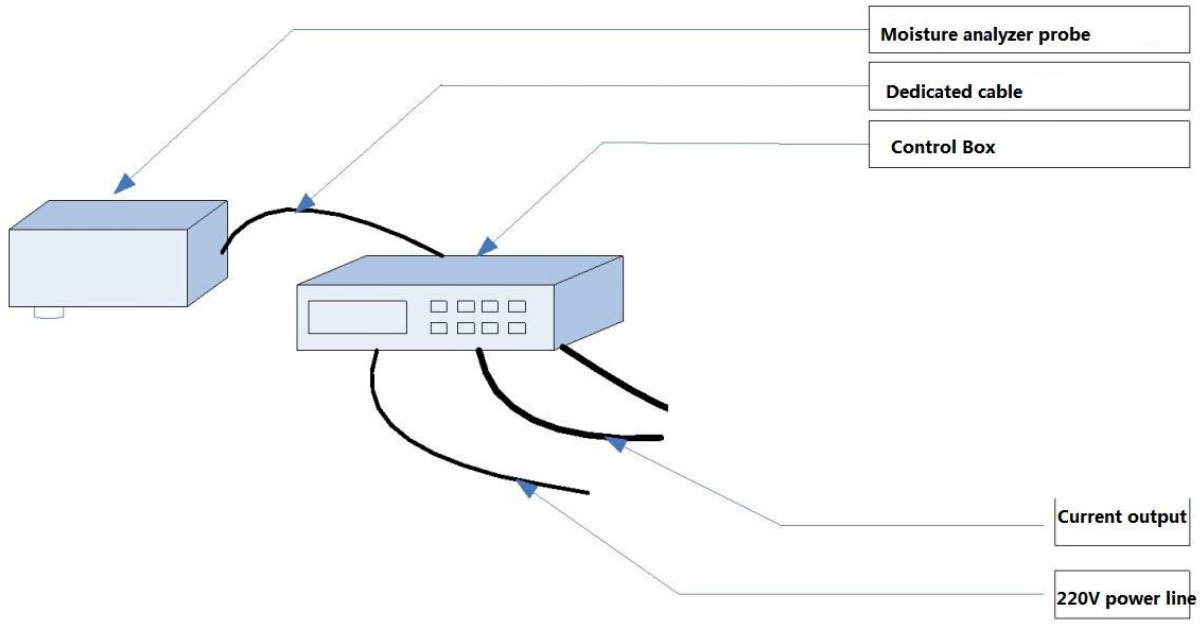
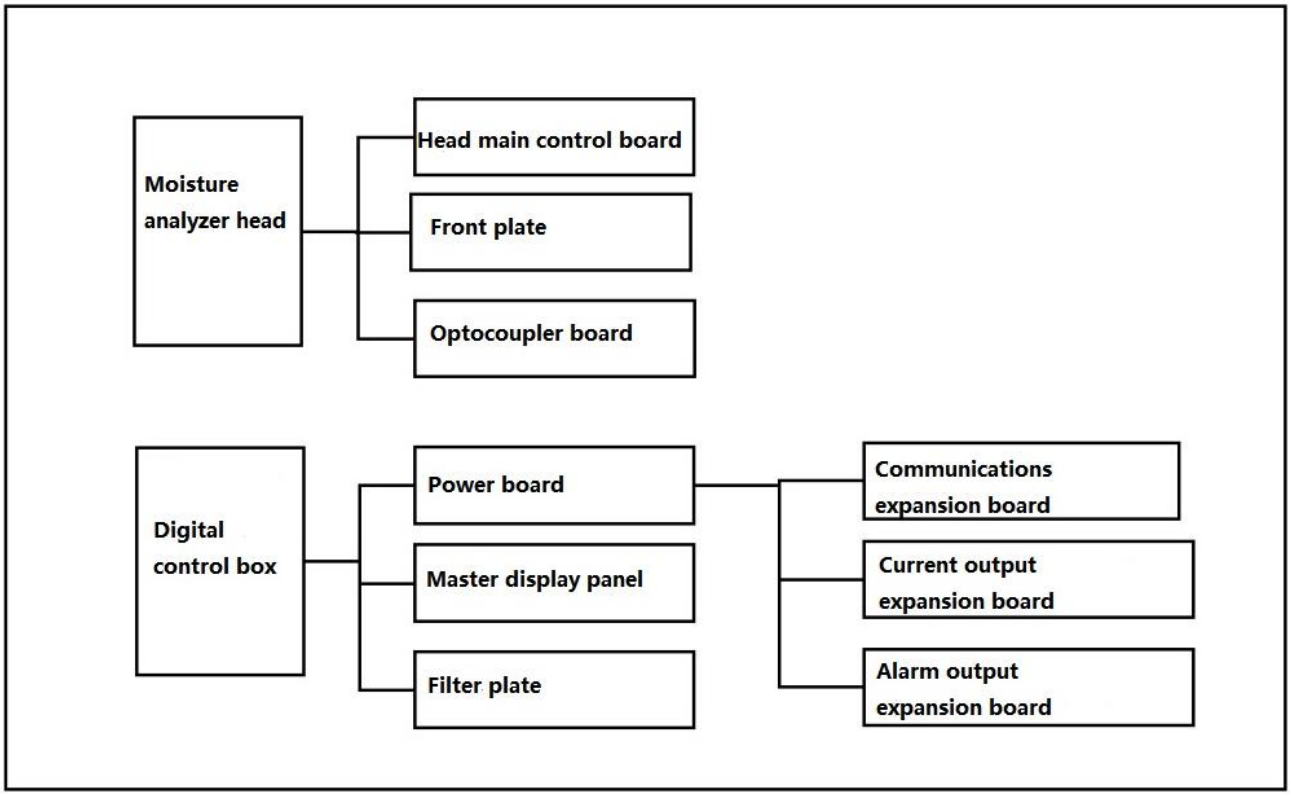


Figure 6: moisture meter connection configuration diagram

2. Circuit board configuration



3. Working principle

Infrared moisture meter is the use of IR absorption characteristics of water molecules to measure the moisture content of the object to be measured. As known in the infrared (wavelengths of electromagnetic waves in the range of 0.78~2.5 μg m) water absorption rate is uneven, in a certain band is strong, but weak in other bands. Take advantage of this feature, emit different wavelengths of infrared light infrared moisture meter (4 beams, 6 beam, 8 beam and 10 beams) and receive the reflected signals for the item to be measured, to calculate the moisture content of the object to be measured.

⑴. Head working principle

Head using the power provided by the control box. Installed need to detect location and measured message to the control box. Head of optics and electronics works can be divided into two parts:

①. Optical principle:

Head optical structures as shown below:

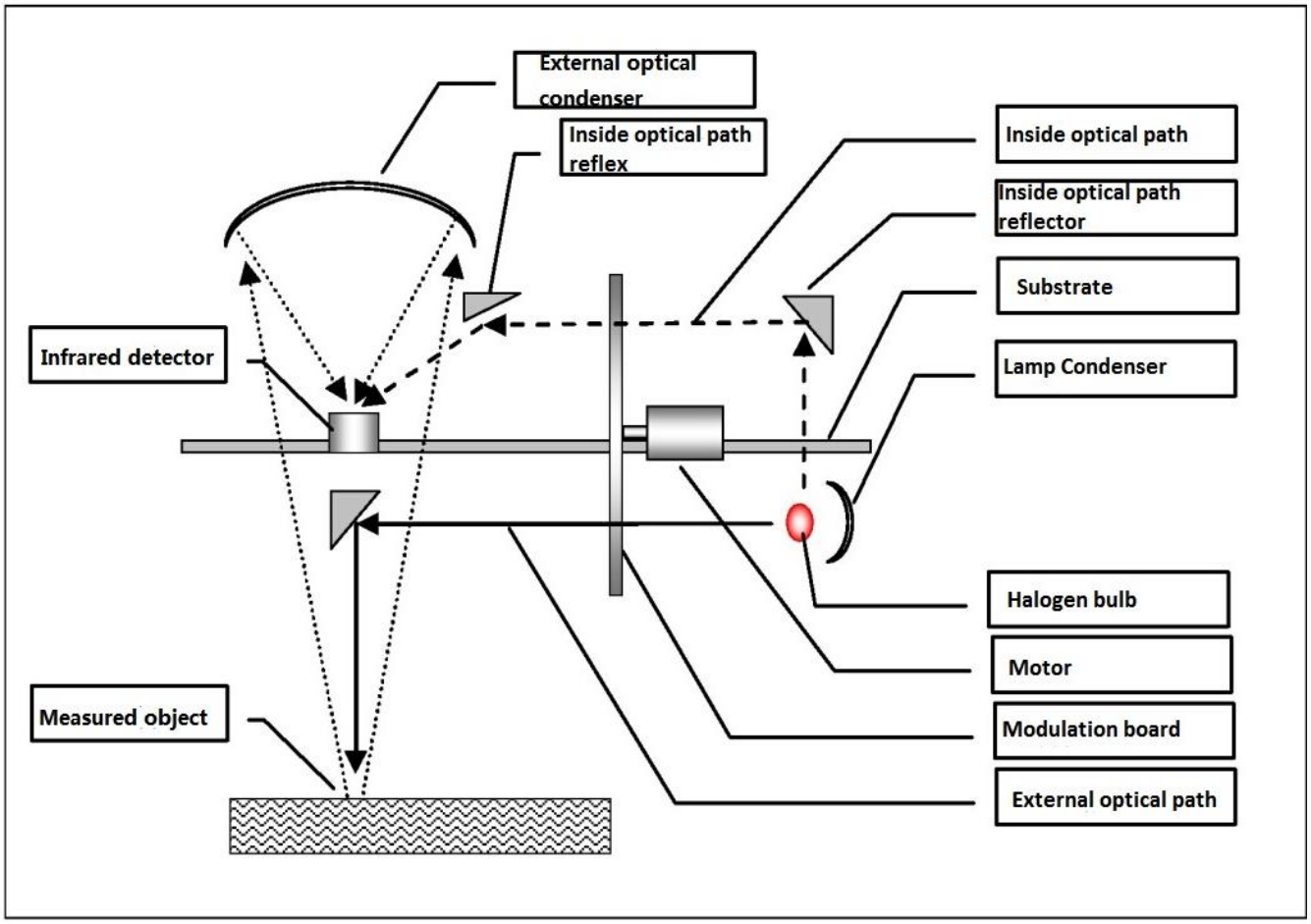


Figure 7: moisture meter head optical structure

Optical works as follows:

By lamp (halogen bulb) sent IR light is divided into two-channel optical path: Outside the optical path through the modulation board will be divided by the light emitted by the continuous signal into a particular frequency of the serial signal projected onto the surface of the object to be measured, and then "outside condenser optical path" to collect objects and reflected signals into infrared detectors.

Inside the optical path by reflector and modulation board, signal directly onto an infrared detector. Infrared detector converts the received optical signals to electrical signals.

②. Circuit works

"Probe" circuit portion constituted by the following diagram:

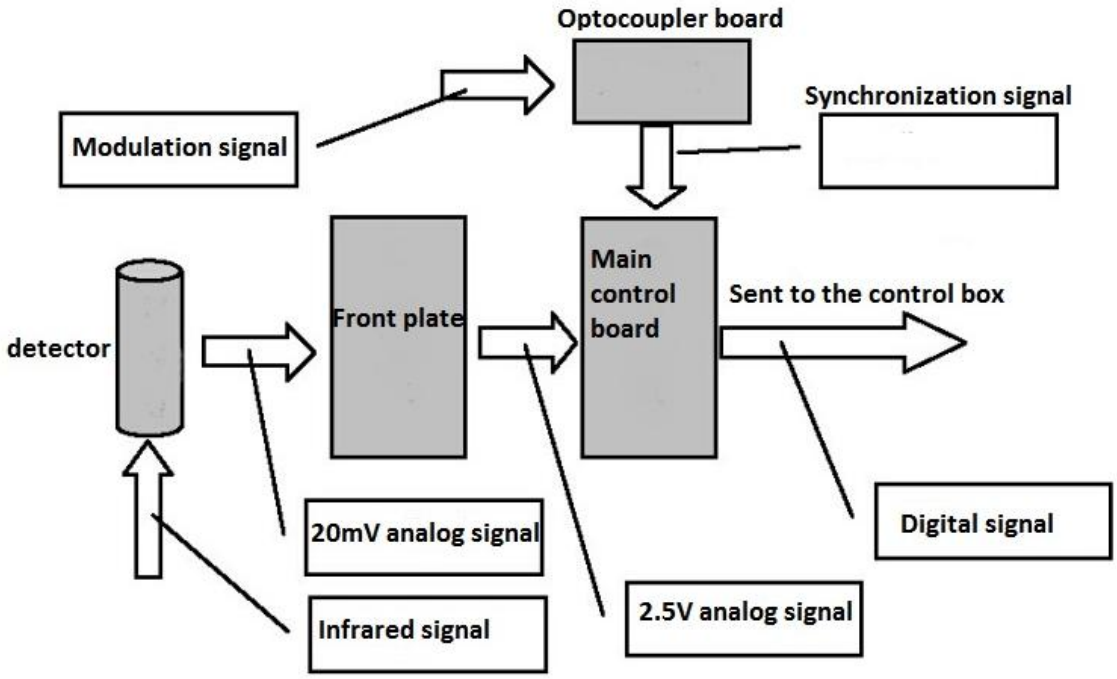


Figure 8: moisture meter head circuit structure

Infrared detector receives the infrared signal and converted to electrical signals sent to the "front plate". "front plate" after finishing signal amplification send to the "Control Board". "The main control board," according to the synchronization signals that every band voltage digital signals, then follow the calibration formula to calculate the moisture content of detected objects, finally sending information via a standard RS232 interface to the "control box".

⑵. Control box working principle

The "control box" in addition to providing user-interactive features, as well as "probe" power supply. Normally, the control box is displayed through the damp moisture values, and after performing a sampling function, shows the average moisture during the sampling period, users do not have to worry about damping settings can affect measurement accuracy. While the "control box" also provides a 4~20mA of analog output, RS232 and RS422 digital signal interface.

Control box for the digital displays, based on MC 03/04 universal Control Panel, one address switch on the control panel. Its purpose is as follows:

S0	ON: Use with CRC validation PC communication encoding
	OFF: Use common PC communication encoding
S1	ON: Use MCT0.3 control board
	OFF: Use MCT-04 control board
S2	ON: Use alarm output
	OFF: Do not use the alarm function

S3	Spare

Table 5: inside the control box control board address switch menu

In the control box bottom edge has a 7 cores spring socket for outputting information. Defined as follows:

No	Content
1	First path 4 ~ 20mA current (+)
2	Second path 4 ~ 20mA current (+) (non-standard)
3	Empty
4	Public 4 ~ 20mA current loop current (-)
5	Control box serial port - sent
6	Control box serial port - received
7	Control box serial port - ground

Table 6: control box signal output interface definition table

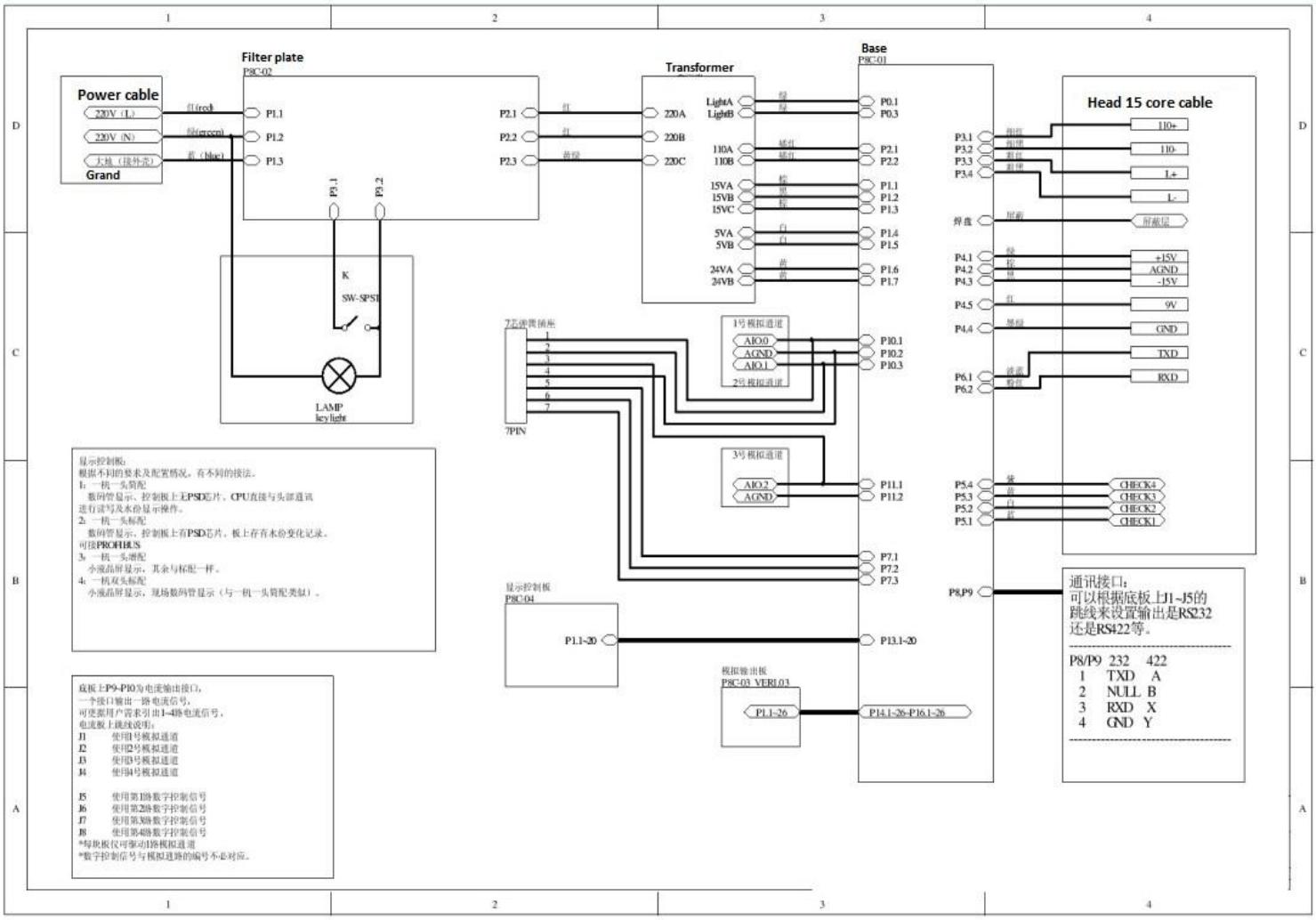


Figure 9: control box wiring diagram

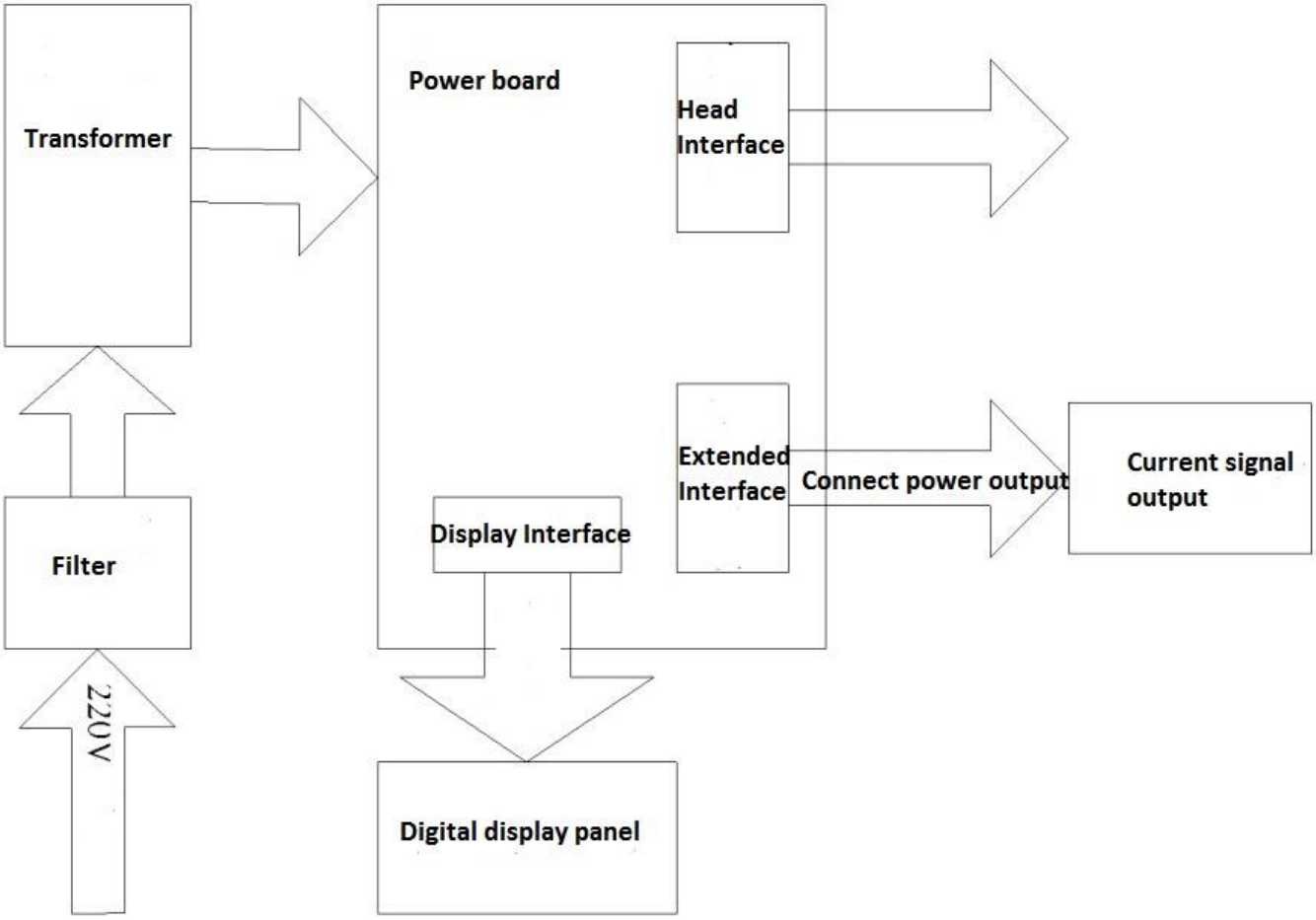


Figure 10: control box internal structure

Port	No.	Definition	Description
P2	1	110V+	Transformer output: 110V AC power
	2	110V-	
P3	1	110V-	Power board output to the head drive motor 110V AC
	2	110V+	
	3	L+	Power board 5.8V DC output to the head lamp power
	4	L-	
P4	1	+15V	Power board analog power output to the head
	2	AGND	
	3	-15V	
	4	GND	Digital ground
	5	AV	8.5V digital power supply
P5	1	LED1	Head lights output signal 1,2,3,4
	2	LED2	
	3	LED3	
	4	LED4	
P6	1	TXD	Control box is sent to the head of the RS232 serial port signal
	2	RXD	Control box receives the head of the RS232 serial port signal
	3	GND	RS232 serial port ground wire
P7	1	TXD	Control box is sent to the PC of RS232 serial port signal

	2	RXD	Control box receiving PC of RS232 serial port signal
	3	GND	RS232 serial port ground wire
P8/P9	1	TX+/TXD	RS422 / RS232 PC terminals, P8, P9 definition phase Same for multi-machine in series.
	2	TX-/GND	
	3	RX+/RXD	
	4	RX-/GND	
	5	GND	Serial port ground wire
P12	1	WarmUp+	Upper limit alarm relay output
	2	WarmUp-	
	3	WarmDown+	Lower limit alarm relay output
	4	WarmDown-	
	5	GND	Grounding
	6	24V-	DC 24V loop
	7	24V+	DC 24V
P10	1	ALI	First 4 ~ 20mA analog output
	2	AGND	Public 4 ~ 20mA output circuit
	3	AL2	Second analog 4 ~ 20mA output (non-standard)
	4	CK1	Spare 1
	5	CK2	Spare 2
P13	Main control board interface of control box		
P14~16	Control box I / O expansion interface		
P17/P1	Communication expansion interface of control box		

Table 7: control box terminals definition table

4. Parameters Function Introduction

To the control box, the user can modify various parameters, some parameters are saved in the head, some stored in the control box. Details are as follows:

⑴. Channels

Total 18 channels, numbered from 1 to 18, each channel number represents a group of the above-mentioned channel parameters, change the channel number, choose a different channel parameters to adapt the same instrument to measure the needs of different types of materials. The factory default settings is generally channel 1.

In the digital control box, the user can switch to channel 0, but because there are special purpose, do not use this function normally.

⑵. Gain 1, 2

Used to set the detector's two magnification (2 amplification). The setting range is from 1 to 100, if set to 0, indicating that equipment using automatic gain. (Factory default settings as automatic gain), if not equipment failure, recommended to use automatic gain, do not arbitrarily change. The gain adjustment, the voltage may be reflected in the displayed value. The smaller the gain value, the signal voltage value is smaller, and vice versa.

In general (room temperature environment, the air humidity is less than 30%, no direct sunlight) if the gain is set to 10, the voltage should be maintained within the normal

range (all voltages less than 6V, any voltage greater than 1V). If the voltage is set to 1, it should be in addition to "ground" is about 0.7V, other voltage less than 0.5V.
On the “front plate” of the head , there is a "1 amplification address switch", if when the gain is 10, the voltage is not within the normal range, user can manually adjust this switch, so that the voltage to meet the requirements.

⑶. Display accuracy
At present only for digital display useful. Data range 0 to 2.
0 indicates that the data is not displayed after the decimal point, 1 shows a display one decimal data, 2 Show 2 data after the decimal point.
Changing the display will not affect the accuracy of the output precision analog signals.

⑷. Standard current output
Standard 4 ~ 20mA output current. Range of 4 to 20, corresponding to current output value 4--20mA, I.e.: Shows 4, the output is 4mA, shows 20, output current is 20mA.
This function is mainly used to adjust the secondary instruments analog signal reception / display device. When the correspondence between the receiving apparatus can not be completed, the user can appropriately change the analog output of the lower limit so as to correspond to the parameters (refer to (13): Analog lower the upper limit).

⑸. Moisture upper and lower limits
Used to set display range of moisture. Displays the set upper and lower limits, corresponding to 4~20mA current output, I. e: moisture display lower limit, the current output of 4mA, moisture display upper limit, the current output of 20mA. Relatively smaller range between the upper and lower limits, the higher the accuracy of the analogue output. General scope of the upper and lower limits set at 10.
When the result of the measurement is less than the lower limit of the current display settings or larger than the upper limit of the current display settings, the instrument can only display the set upper or lower limit, and flashing. To know the actual moisture, when the instrument is displayed on the upper or lower limit, user may be used the sampling function, it will display the current of moisture after the end of sampling, without restriction on the lower limit.
For example:
The moisture content of the currently measured 3.5, and the lower limit is set to 4, then 4 is displayed and flashes instead of displaying 3. After pressing the "Sampling" key to sampling, the moisture will show 3.5 and flashes until user press the "Ok" key to return to the dynamic of moisture display (display 4 and flashing).

⑹. Parameters RX
When the value is less than RX 100, this parameter controls the instrument to change the current threshold moisture judgment, when moisture more than threshold change, the instrument will respond quickly.
For example: When the RX = 25, the moisture change more than 2.5, the moisture

display will rapidly into place, And when the moisture change is less than 2.5, the display changes based on moisture damping parameters.
When RX is more than 100, this parameter is controlled by the instrument's response to the background, (background: when measurements of cutting material). This feature can be used to line velocity unevenness or cutting of materials, stop signal on the display the influence of moisture. For example: when RX=105, when the probe beam exposure on the background when showing moisture to maintain the original value intact, after 5 seconds, if the spot is still light in the background, display changes to display the lower limits of moisture. If within 5 seconds, spot back on exposure to the material, and moisture continues to proceed in numerical changes are displayed.

⑺. Parameters A, B, C, NL N2 ~ N3, Formula No.
Parameters listed above for calibration parameters, each channel group. The adjustment requires the use of the parameter calibration calculation software, users generally do not modify

x = f (N1, N2, N3, NO formula, Vi)…… Formula 1.

Vi: The current probe acquired signals voltage
X: Signal voltage according to N1, N2,N3, and formulas to calculate moisture

⑻. Machine No.
Machine inside number, in1 machine with multi-heads configuration, this number is the sub-station number, User need a communication bus between moisture meter set a different station.(Non-standard, not provided)

⑼, Slope, intercept
Y '= K × Y + L ..... Formula 2.

K: slope
L: intercept
Y: calculated moisture: The current probe to get the signal, according to the current "channel number" calibration parameters calculated from data stored within.
Y ': displayed Moisture

⑽. Damping
By adjusting the damping time, user can change the rate of fluctuation of water shows, to make the output control signal is more smooth. Can be understood as instruments to moisture content of material response time. Moisture uniformity good, and damping can be a little bit of time, recommend is set in 5-10. Moisture uniformity worse, damping time may be appropriately wide, set in 10-50.
Damping function is to filter out mutation due to part of aggregate moisture in materials, so that caused moisture arising from the displayed value jumps. Damping time is small, responsive, but moisture value changes too fast. Damping is too large, the reaction will be a little sluggish, but is conducive to observe moisture change.

General 5-20 as well.

⑾. Channel Copy

Parameter of the current channel is copied to the specified channel. Due to the new installation, it is impossible to calibrate all objects to be measured. General calibrate some of the most commonly used or the largest quantity of material, when the present channel parameters measurement of new material, if there is some error, users can set up a new channel with the corresponding. Can copy the channel parameters which have been calibrated to the new, unused channel, and then corrected based on this amended to meet the measurement needs.

⑿. Sampling times

When samples, the number of sampling points can be adjusted according to the actual situation. In General, when the material moisture large fluctuations, it would be appropriate to increase sampling frequency. When the material's moisture fluctuation is small, may be appropriate to reduce the sampling frequency. General number of sample set at around 30~60.

⒀. Simulate lower limit, upper limit

Inside there is 1 way 4 ~ 20mA current loop output

Output upper Limit: corresponding to 20mA (can be considered 4~20mA the full scale of the current regulation)

Output lower limit: corresponding to 4mA (can be considered as 4～20mA adjust zero point)

Specific adjustment, adjust the display value of upper limits output, so that it corresponds to the ammeter display 20mA. Adjust lower limits output display values, so that it corresponds to the ammeter display 4mA.Eg: lower limits output display value 180, ammeter shows 3.96 mA, then make the lower limit output increased to 184, ammeter shows the corresponding adjustment to 4mA. Output upper limits displays a value of 990, ammeter displays was 20.02, then reduced upper limits output to 988, current displayed the corresponding adjustments to 20mA.

⒁. Version number

Parameter number 22: the control box the program version number.

Parameter number 24: head program version number.

This feature is primarily used to control software version upgrade coordination. The LCD on the control box, which displays the version number of the control box when boot, and digital tube control box, need to enter a static state, select the corresponding parameter number to view.

⑮. Special features

In digital control box has a set of special functions, classified to the parameter number 23, each feature is described below:

①. Background:

The purpose of this feature is to extract moisture meter beam exposure on the background (belts, channels, etc) information.

②. Material item:

Extracting feature information on the beam spot on the material to be measured. This function and above function are complementary, and RX is greater than 100 reflects its role in parameters (see 4. (6). parameters RX). Attention: above 2 items are extracting feature information, if find that feature information quite close, the parameter RX is more than 100 functions will not be well reflected..

③. Synchronization delays:

The modulation board of the head, there is a coupling plate in one side and provides optical modulation signal sample synchronization information. Due to the optical and mechanical reasons, relations between synchronization signals and optical modulation signal cannot be fixed, so we determine the best synchronization delay time via this function. Refer to the figure below to understand delay time synchronization works.

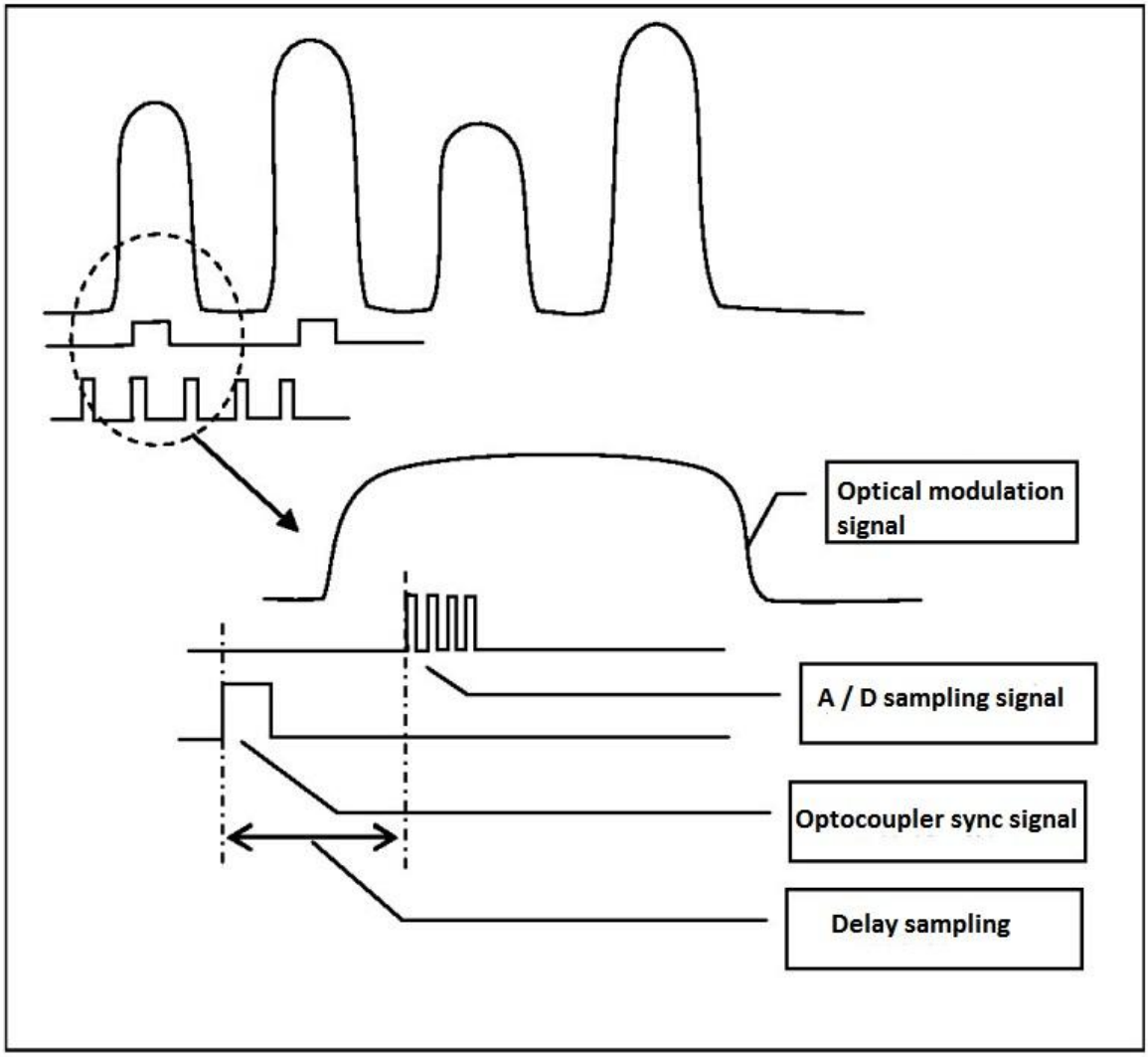


Figure 11: synchronization delay works diagram

The parameters in the instrument is factory-set, while if replacement the circuit of head needs to be re-entered (see (17): synchronize synchronization delay 1, delay 2), after replaced the optical components such as motors, light bulbs, also need this feature

Carrying out this function to ensure that the following conditions:
● Environment without interference source of light.
● Reference does not change during the period.
● Strong reflection or absorption of substances cannot be used as references.
● Signal voltage must not be too small or too big (saturation).
● Finished, if found the signal voltage not to meet the requirements, should adjust the gain once again.

④. User password settings
When the user wants to modify some important parameters, the system prompts the user to enter a password to protect important parameters are not free to modify, after

the input of a password, parameters can be modified multiple times until the instrument off after reboot, will not require users to enter a password again.

⑤. Parameter initialization
Parameters used when debugging instrument, users generally do not perform this function.

⑥. Parameter backup
Currently 18 channels of calibration parameters are all backups on the instrument's image buffer, used for recovery.
Note: the upper, lower alarm and simulations lower, upper limits will not be backed up.

⑦. Parameter recovery
Corresponding to the parameter backup, restore a previously backed up arguments to the current parameter. Note: once you perform the recovery operation, the original argument will all be covered in all channels!!! The parameter is also useful if a channel, you will need to separately and re-enter after the recovery.
Note: once you perform the recovery operation, the original argument of all channels will all be covered!!! If parameter of 1 channel is useful, need to separately record and re-enter after the recovery.

V. Appendix

1. Head failures

There are four LEDs on the motherboard of the head, can be observed the situation, understand the running status of equipment

No.	Name	Remarks
D1	ERR/ZN	Gain adjusting
D2	LINE SYN	Optocoupler synchronization
D3	AD READY	AD sampling
D4	COMMONLINE	Communication Index

Table 8: Head Status Indicator comparison table

⑴. Light does not light
Possible cause: the bulbs, lamp power supply is damaged, the light bulb disconnect from the power supply. (Also possible that the motor does not rotate).
Phenomenon: No light to shoot from the head, the control box "display voltage" interface in the voltage display is very small. Moisture is not displayed properly.

⑵. Lights not flashing
Possible cause: the motor does not turn (motor is stuck, motor damage, the electrical power failure, the electrical cable circuit breaker).
Phenomenon: there is no spot to shoot or spot without blinking, head Board frequent reset (Board 4 led lights, full brightness or full off), not communication, control box and

the samplers showed no moisture value.
Opto-coupler damaged
The head Board frequent reset (Board 4 lights full brightness or full off), not communication, control box and the samplers showed no moisture value.

2. Control box failures

There are 4 status indicator light with head indicator lights, on bottom plate of the control box, user can observe the LED to find out the running status of the instrument.
D21: 24V power supply
D20: 8V Power
DI9, DI8, D17, D16 corresponding to head Dl, D2, D3, D4. Can be understand the operation of the head without opening it. Refer to Table 8: Head status indicator table.

⑴. Digital tube does not light
Possible cause: control box has no power, single-chip not working, digital tube connection is bad

⑵. Digital tube full brightness or strange characters
Possible cause: CPU is not working properly or digital tube drive circuit failure, if the main indicator light on the control panel flashes at a rate of about 1 second, it means that the main Control Board is in the work, the main control board with LCD circuit wires loose.

⑶. Digital display fixed content
May be a communication failure, if the head is working properly (communication with flashing lights, then the fault may be the receiving end) inspection head, samplers or control box ground communication cable with or without open circuit or short circuit, communication chip damage or not.

⑷. No analog current output
If the control box has moisture show that it may be driven analog output Board fault, including: poor contact and the add-on board driver transistor breaks down.

⑸. Display does not follow the control box change
If the control box display, but sampler display unchanged, sampler's communications chip inside may be damaged, or communication line connection is bad. If there is changing, just change too slowly, there may be a wiring connection is bad or poor grounding.

Judging by the led:
D21 is not light: power supply module 24V output fault.
D20 is not light: power supply module 8V output fault.
D19 is not blinking: Communication between the head and the control box has a problem (dynamic operating mode).
D17 is not blinking: no optical coupling signal.

D16 has been flashing: the signal voltage is too big or too small.

3. Fault diagnosis process

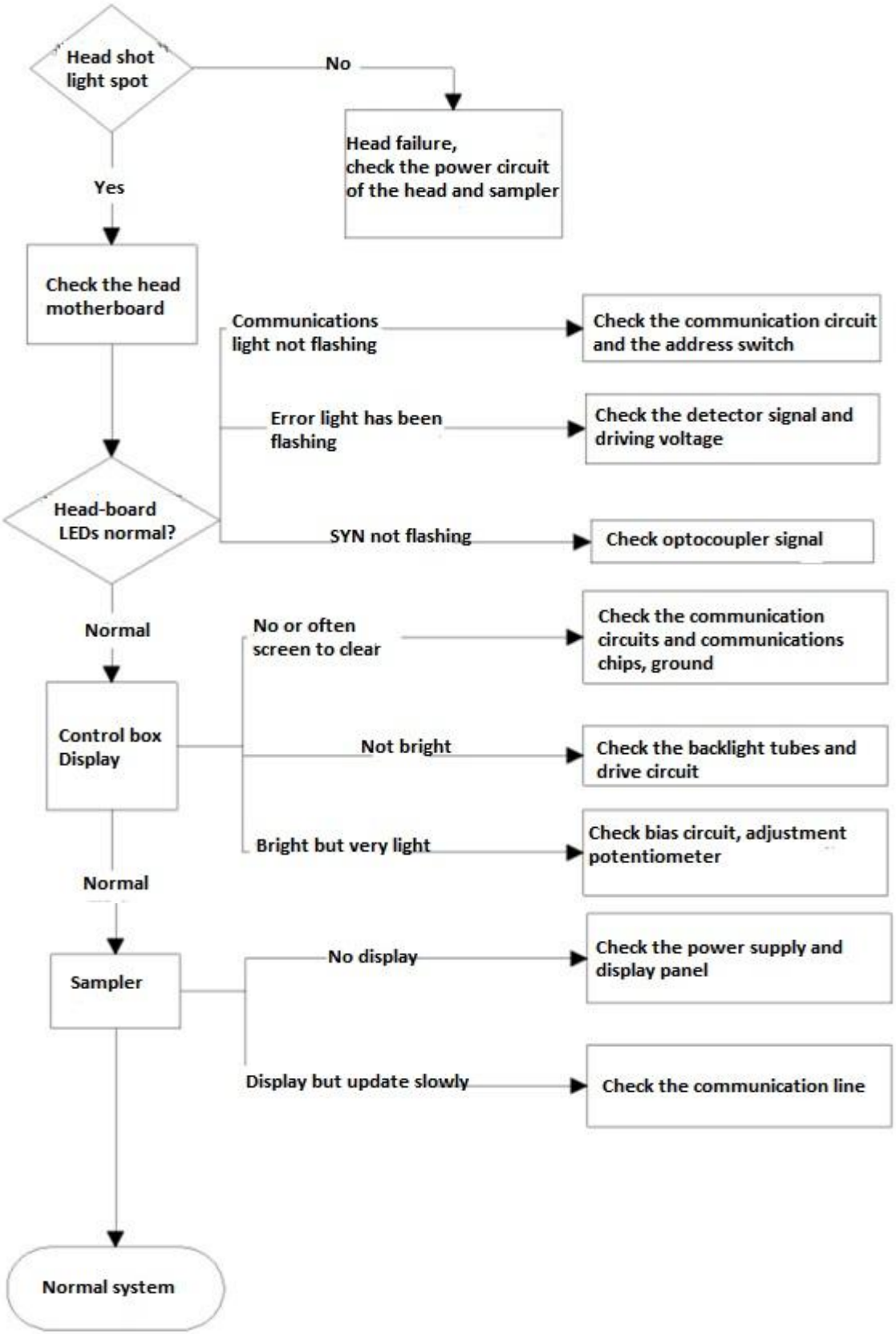


Figure12: diagnosis flowchart

4. Term Explanation

(1). Probe

Mainly used for installation at the site, measuring material moisture content changes. Includes: infrared detector, infrared filters, light source and optics, signal acquisition circuit.

(2). Detector

Infrared sensors installed in the probe to measure the moisture content changes of the material

(3). Filter

On a semiconductor crystals coated with multilayer polymer, made only a very narrow band of wide-band optical signal can be passed, allowed us to very precise measurements in a band of energy changes.

(4). Modulation plate

By a motor-driven round plate, whose top has different wavelengths of infrared filter, through the rotation of the disc, the IR signal is modulated irradiation to the surface of the material being measured, thereby excluding interference, more precise measurements.

(5). Channels

Usage is corresponds to different measured object (different numbers and grade) needed different calculation parameter, Old-fashioned analog moisture meter, for calculation using analog circuitry. Switch between different parameters and detector signals need to be switched to a different circuit, hence the term "switching channels". New moisture meter are digital switch channel is actually selects a set of calculation parameters.

(6). Calibration

By use of the channel, showed that different subjects need different kinds of calculation parameters. The works of calculate the parameters called "calibrate".

5. Image catalog