INST.No.INE-227-1A

CHINO

IR-GMEG Series

MODEL:IR-GMEG1

SETTING DISPLAY UNIT

INSTRUCTIONS

Always keep these instruction with the unit.

Please be sure to deliver these instructions
with the unit to the end user.

CHINO

■ PREFACE Requests and notices

Thank you for your purchase of IR-GMEG Setting Display Unit.
Please read this instruction manual without fail for using this instrument correctly and safely and also preventing troubles in advance.

Request to designers, instrument controllers, and sale agents

Delivery this instruction manual to the operator of this instrument without fail.

Request to the operator of this instrument

This instruction manual is necessary for maintenance, too. Keep this manual with due care until the instrument is discarded.

Note

1. For the contents of this manual, alteration is reserved without notice in the future.
2. **T**his manual has been prepared by making assurance doubly sure about its contens However, if any question arises or if any error, an omission, or other ficiencies were found, please inform your nearest CHINO's sales agent of them.
3. **Y**ou are requested to understand that CHINO is not responsible for any operation results.

■ FOR SAFE USE

For the purpose of using this unit safely, observe the following cautions for safety during the operation, maintenance, and repair of this unit without fail.
Take safety measures separately against wrong operation, troubles, and other ircumstances of this unit.

● The following warning mark is struck to this unit to enable users to use this unit safely.

This warning mark is struck to the portions being subject to an electric shock accident. Turn off the power supply of the feed source without fail before starting wiring, maintenance, and repair.

● This instruction manual uses the following symbol marks for safe use.

DANGER

Observe this caution item strictly for avoiding a danger, otherwise negligence of this caution may cause an electric shock accident or other accidents resulting in operator's death or injuries.

Warning

Observe this caution item strictly for avoiding a danger, otherwise negligence of this caution maypossibly cause troubles of this unit and accidents

Caution

Observe this caution item strictly, otherwise negligence of this caution may cause the damage of the unit or measuring errors.

This mark is described in each title covering **DANGER** or **Warning** instructions.

■ CAUTIONS FOR SAFETY ⚠

● Power supply

Make sure that the power voltage of this unit meets the feed power voltage without fail before feeding power to this unit.

● Protective grounding

Perform the protective grounding without fail before turning on the power supply of this unit for the purpose of preventing an electric shock accident.

● Necessity of protective grounding

Don’t cut the internal or external protective grounding wire of this unit nor disconnect the wiring at the protective grounding terminal.

● A defect of protective functions

Don’t operate this unit, if the protective grounding, fuse, or other protective functions seem to be defective. Check the protective functions for defects before operating this unit.

● Use in a gaseous atmosphere

Never operate this unit at a place where a combustible gas, an explosive gas or their vapors exist., otherwise a very dangerous accident will occur.

● Never touch the interior by hand.

This unit is internally provided with high-voltage circuits. Never touch the interior by hand when the voltage is applied to this unit.

● External connections

Perform the protective grounding securely without fail before connecting this unit to a measuring object and/or an external control circuit.

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Caution

1. Read the items marked with ⚠ in the title without fail. These paragraphs comprise DANGER and Warning items.

1. Introduction

1.1 General

Setting display unit "IR-GMEG" is combined with infrared moisture meter IR-M □□□□ series. It is connectable to max.9 moisture meter detectors for setting the parameters of moisture meter detectors variously and indicating the moisture value. It also provides an external communication, external contact switching, and other functions.

This instruction manual covers the operation method of the setting display unit only.

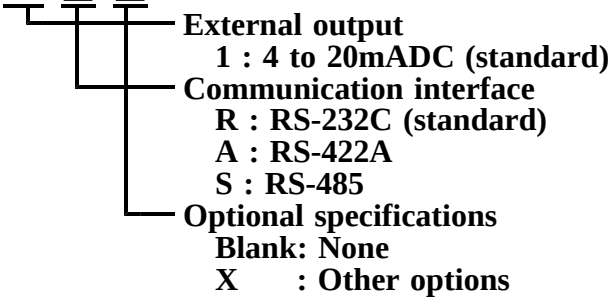
Please read the instruction manual for [Instruction manual for infrared moisture meter IR-M □□□□], too.

1.2 Configuration

2. Model And Accessaries

2.1 Model

● **Setting display unit IR-GMEG 1 □ □**



2.2 Accessories

● **Setting display unit**

Article names	Quantity	Remarks
Mounting bracket	1 set	
Internal unit pull-out tool	1 pc.	
Instruction manual	1 copy	This manual
Instruction manual for communication	1 copy	
Inspection certificate	1 sheet	

3. Installation And Connections ⚠

3.1 Setting of DIP switches ⚠

Set the internal dip switches before mounting this unit.

3.1.1 How to draw out the internal unit

● When the internal unit is not mounted on the panel;

(1) Remove the water-proof packing from the internal unit lock. Insert the L-part of the attached internal unit pull-out tool to the internal unit lock, while holding the meter.

(2) By deflecting the internal unit pull-out tool laterally under this condition, the meter front panel is protruded forward by 2 to 3mm and the internal unit can be removed.

(3) After setting the DIP switches, return the internal unit into the case, and mount the water-proof packing securely.

● When the internal unit is mounted on the panel;

(1) Remove the water-proof packing from the internal unit lock. Insert the L-part of the attached internal unit pull-out tool to the internal unit lock, while holding the meter.

(2) By pressing the internal unit pull-out tool downward under this condition, the meter front panel is protruded forward by 2 to 3mm and the internal unit can be removed.

(3) After setting the DIP switches, return the internal unit into the case, and mount the water-proof packing securely.

DANGER

Turn off the feed source power supply without fail before removing the internal unit.

3.1.2 Setting of DIP switches

Set DIP switches according to the specifications.

DIP switch No	Functions	SW		Initial setting
		OFF	ON	
1	No. of connected detector	1 unit	2 or more units	OFF
2	Not used			OFF
3	Not used			OFF
4	Not used			OFF

3. Installation And Connections ⚠

3.2 Installation

This unit is mounted on a panel (instrument panel).
Mount the unit to the panel by fastening two attached mounting brackets until they turn idly.

● **External dimensions and panel cutout** ● Panel mounting method

Caution

Don't mount the unit at the following places
(1)A place being fully filled with dust particles, corrosivegases, etc.
(2)A place where the ambient temperature is higher than50°C or lower than 0°C
(3)A wet place or a place where the ambient temperature changes abruptly
(4)A place near a strong power circuit or a place subjected to noticeable induction interference
(5) A place subjected to vibrations and/or impacts

3. Installation And Connections ⚠

3.3 Connections ⚠

The terminal board is mounted on the rear panel. Turn off the feed source power supply and connect cables as illustrated below.

DANGER Turn off the feed source power supply without fail for the purpose of preventing an electric shock accident before connecting the power terminals.

● Contact input terminals

Terminal No.	Items	Contents
14	BCD IN 1	Detector number/calibration curve number 1 Input
15	BCD IN 2	Detector number/calibration curve number 2 Input
16	BCD IN 4	Detector number/calibration curve number 4 Input
17	BCD IN 8	Detector number/calibration curve number 8 Input
18	HEAD/CH	Detector number/calibration curve number switching
24	BCD IN 1*10	Detector number/calibration curve number 1*10 Input
25	BCD IN 2*10	Detector number/calibration curve number 2*10 Input
26	BCD IN 4*10	Detector number/calibration curve number 4*10 Input
27	BCD IN 8*10	Detector number/calibration curve number 8*10 Input
31	K2	No. 2 calibration is done when the contact turns on.
32	K1	No. 1 calibration is done when the contact turns on.
33	PRESET	Preset output is sent when the contact turns on.
34	HOLD	Hold when the contact turns on.
35	COM	Contact common terminal

3. Installation And Connections

3.4 Cautions on connections

Be careful with the following cautions.

● Termination of wiring

Use crimp style terminals each having an insulation sleeve so as to prevent a slip-out failure and an inter-wire contact. (M3.5 terminal screws are used.)

● Mounting of power switch and fuse

This unit is not provided with a built-in power supply and fuse. Mount them externally.

● Power supply

This unit uses a free power supply. However, don't use the following power supplies
(1) Power supply whose voltage fluctuates noticeably
(2) Power supply whose waveform is distorted noticeably

● Noise source

Separate the unit from a strong power circuit and a powerful noise generation source as far as possible.

3.5 Analog output and alarm output

This unit is applicable to multi-detectors and it can connect plural moisture meter detectors. Detector outputs can be set by DIP switches as follows. (For the setting of DIP switches, see [3.1 Setting of DIP switches])

Output terminals	**Setting of DIP switches**	
	1 detector	**2 or more detectors**
OUT1	Detector No. 1 analog output	Detector No. 1 analog output
OUT2	Detector No. 1 analog output	Detector No. 2 analog output
AL1	Detector No. 1 higher-limit alarm	Detector No. 1 higher-limit alarm
AL2	Detector No. l lower-limit alarm	Detector No. l lower-limit alarm
ERROR	Detector No. 1 self-diagnostic error	Self-diagnostic error of all connected detectors

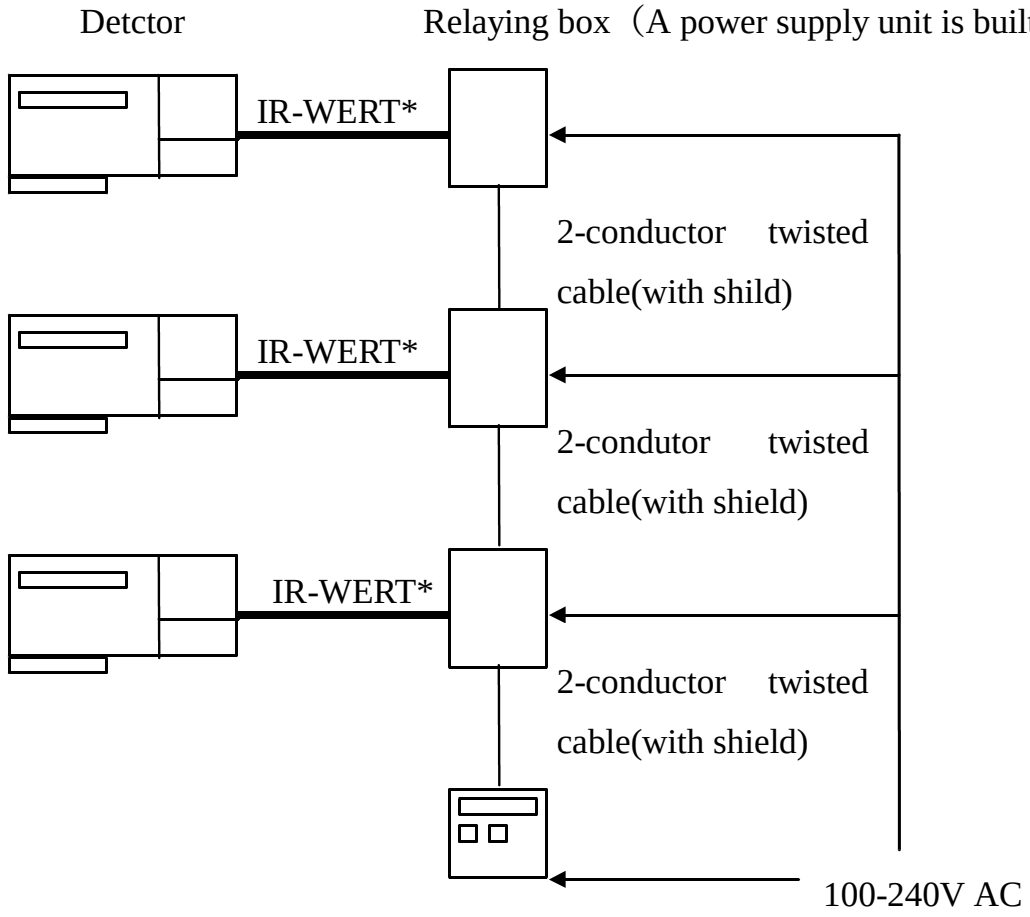
3. Installation And Connections

3.6 Multi-detector connections

Multi-detectors can be connected in two ways. Don't overlap any detector numbers of individual detectors before turning on the power supply of the setting display units in these connection methods.

For the setting method of detector numbers, see the instruction manual for moisture meter.

3.6.1 Method of using the relaying box



Caution

Be careful with the following cautions wheen connecting cables.

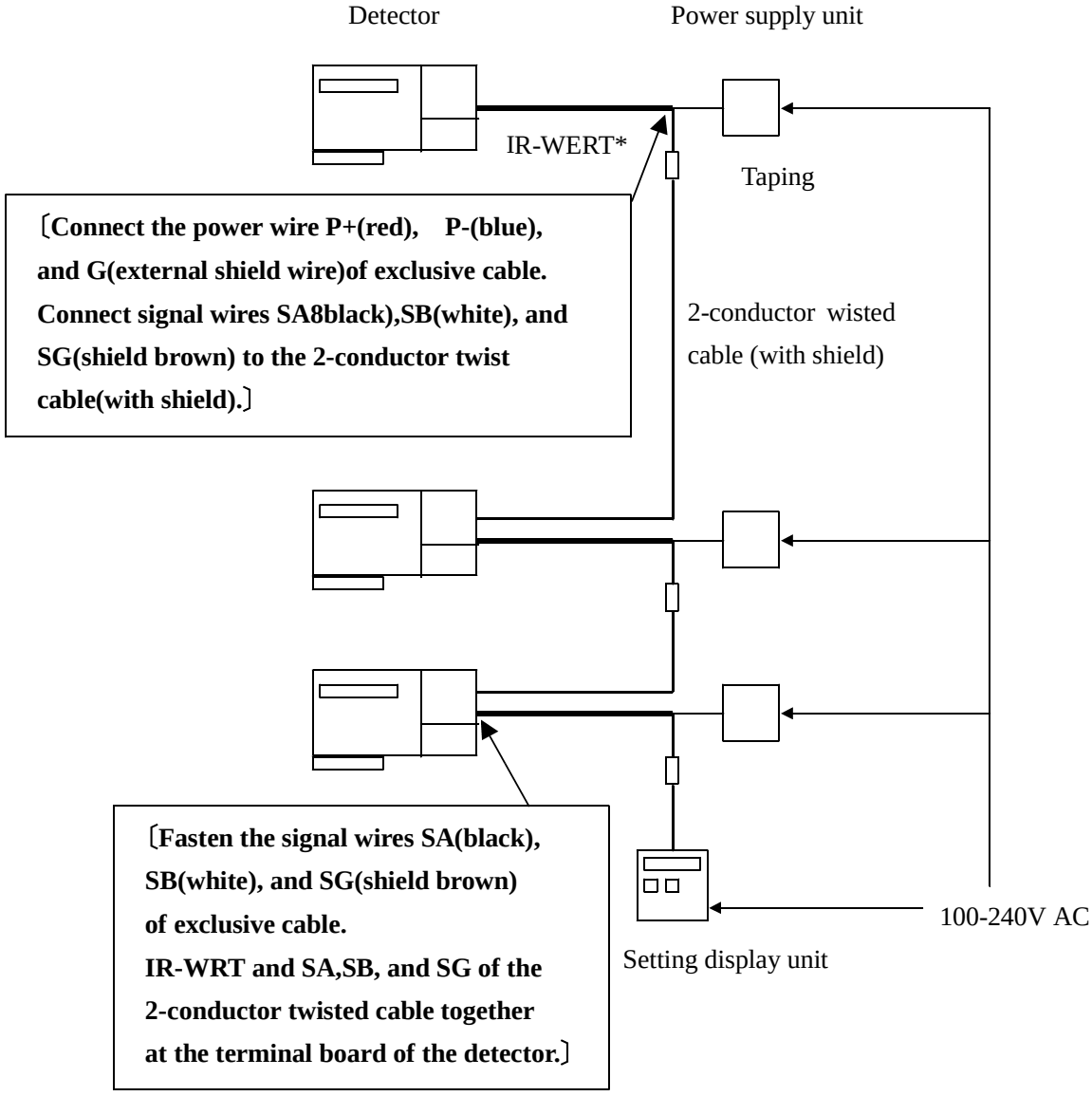
1.Separate the cables from the induction heating oscillator and power line.
2.Keep cables free of dposit of water, oil,etc.
3.Don't bend any cables extrmely nor apply any excessive force to them.
4.Protect them with a conduit when they are cpnnected permanently.

Caution

1. Shorten the asterisked cables as much as possible.
4. For the connection method of the relaying box, refer to [Instruction manual of relaying box].

3. Installation And Connections

3.6.2 Method without using any relaying box



Caution

Be careful with the following cautions wheen connecting cables.
1.Separate the cables from the induction heating oscillator and power line.
2.Keep cables free of dposit of water, oil,etc.
3.Don't bend any cables extrmely nor apply any excessive force to them.
4.Protect them with a conduit when they are cpnnected permanently.

Caution

1. Shorten the asterisked cables as much as possible.
4. For the connection method of the relaying box, refer to [Instruction manual of relaying box].

4.Names And Functions Of Component parts

4.l Names and functions of component parts

● **Data display**

Indicates the moisture value under the measuring condition and the setting data under the setting condition. Indicates an error number when an error occurs.

● **Detector No. display**

Indicates the present detector number of the moisture meter. When the detector number has been changed, the moisture meter data of its detector number is indicated.

● **Calibration curve No. display**

Indicates the calibration curve number under the measuring condition and the calibration curve setting condition. Indicates a mode number when setting the mode or a time constant when setting the time constant.

The first-digit decimal point lights under the key lock condition.

4.Names And Functions Of Component parts

4.l Names and functions of component parts

● Setting lamps

HEAD	Lights under the detector number setting condition.
CH	Lights under the calibration curve number setting condition.
MODE	Lights under the mode number setting condition.
T	Lights under the time constant setting condition.

● Measuring conditions lamps

AH	Lights under the higher-limit alarm condition
AL	Lights under the lower-limit alarm condition.
HOLD	Lights under the hold condition.
REMOTE	Lights under the calibration curve number remote setting condition.
REAL	Lights under the real (without smoothing) measuring condition.
PRESET	Lights under the preset output condition.

● Setting keys

HEAD : Used for setting detector numbers.

CH : Used for setting calibration curve numbers.

MODE : Used for setting mode numbers.

HOLD/- : Turns on or off the hold under the measuring condition.
Serves as a (-) input key under the setting condition.

PRESET/7 : Turns on or off the preset output under the measuring condition.
Serves as a 7 input key under the setting condition.

R/L/8 : Switches the remote/local modes under the measuring condition.
Serves as an 8 input key under the setting condition.

S/R/9 : Switches the smoothing/real modes under the measuring condition.
Serves as a 9 input key under the setting condition.

T/. : Used for setting the time constant under the measuring condition.
Serves asa decimal point input key under the setting condition.

0 to 6 : 0 to 6 input keys

SEL : Used for selecting the setting condition or switching the setting screen.

CLR : Used for clearing data during setting.
Data are cleared starting with the lower order digit, each time this key is pressed once.

ENT : Used for entering a set value.

5.Operation

5.1 Check before starting operation

Check the following three items before turning on the power supply.

(1)Have the DIP switches been set. (See [3.1 Setting of DIP switches])

(2)Are the connections correct. (See [3.3 Connections])

(3)Have the detector numbers been set in case of multi-detector connections?
(See [Instruction manual for infrared moisture meter IR-M □□□□])

Caution

Turn on the power supply of the setting display unit together with the detector power supply or after the detector power supply.
If it is turned on before turning on the detector power supply, the detector is not recognized to cause Er18 error (Detector number error).

5.2 Setting of detector numbers

When turning on the power supply, moisture meter data of the detector number indicated on the detector number display **" HEAD "** is indicated.

For changing the detector number, set it according to the following procedure.

(1)Press [HEAD] key, setting lamp [HEAD] lights to be ready for setting the detector number.

(2)Input a detector number by numeric keys [1] to [9] .

(3)By pressing [ENT] key, the moisture meter data of the changed detector number is indicated. In this case, the calibration curve number and moisture value display conform to the changed setting conditions of the moisture meter. (Time constant, No. of decimal digits of moisture display, etc.)

5.Operation

5.3 Setting of calibration curves

The output characteristic of the infrared moisture meter depends upon the measuring objects. It may also change according to the process conditions and sample moisture measuring conditions. It is necessary for accurate moisture measurement to perform a sample test every measuring object and obtain the correlation between the moisture value (%H_2O) obtained by the drying method or other measuring methods and the absorbance "x" measured by the moisture meter (this is called calibration curve). This paragraph describes the calibration curve data setting method, assuming that calibration curves are already obtained.

If the calibration curves are not obtained yet, refer to [6. Preparation of calibration curves].

5.3.1 Setting data

Set the following data for setting calibration curves.

Data name	Display	Setting range	Initial value	Remarks
Calibration curve No.	CH	1 ～ 99	1	Effective numeric: 5 digits
Polynomial coefficient a_0	A0	0 ～ ±9999.9	0.0000	〃
Polynomial coefficient a_1	A1	0 ～ ±9999.9	0.0000	〃
Polynomial coefficient a_2	A2	0 ～ ±9999.9	0.0000	〃
Polynomial coefficient a_3	A3	0 ～ ±9999.9	0.0000	〃
Correction expression coefficient b_0	b0	0 ～ ±9999.9	0.0000	〃
Correction expression coefficient b_1	b1	0 ～ ±9999.9	1.0000	〃
Output lower-limit moisture	Lo	0 ～ 9999.9	0.00	For the decimal digits, see the specification.
Output higher-limit moisture	Hi	0 ～ 9999.9	100.00	〃
Lower-limit alarm moisture	AL	0 ～ 9999.9	0.00	〃
Higher-limit alarm moisture	AH	0 ～ 9999.9	100.00	〃
Preset moisture	PS	0 ～ 9999.9	0.00	〃

● Calibration curve numbers

An optional number of 1 to 99 can be designated as the calibration curve number.
It is designated sequentially from 1 usually.

● Polynomial coefficients "a_0 to a_3"

Assume that the calibration curve is represented by a polynomial of degree three or less as shown below. $y = a_3x^3 + a_2x^2 + a_1x + a_0$

where, "y" is the moisture value (%H_2O) and "x" is the absorbance (CH0 data of this moisture meter).

● Correction expression coefficients "b_0 to b_1"

These coefficients are provided for primary expression correction with reference to moisture value "y". Assuming that the moisture value after correction be "Y", we obtain;

$$Y = b_1y + b_0$$

● Output lower-limit moisture, output higher-limit moisture

These moisture values serve as the output lower-limit and output higher-limit on the analog output scaling. These values are scaled to be 4mA at the output lower-limit moisture and 20mA at the output higher-limit moisture.

5.Operation

5.3.1 Setting data

● Lower-limit alarm moisture, higher-limit alarm moisture

The lower-limit alarm occurs if a measured value is lower than the lower-limit alarm moisture, while the higher-limit alarm occurs if a measured value is higher than the higher-limit alarm moisture.

● Preset moisture

By turning on the preset output, the moisture value being set as preset moisture is displayed and output.

5.3.2 Setting method

(1) Set a detector number.
[HEAD] [ ] [ENT]

(2) By pressing [SEL] key for 2 seconds, the calibration curve number becomes CH to be ready for setting the calibration curve.

(3) Set a calibration curve number.
[ ] [ ] [ENT]

(4)By pressing [SEL] key, the setting condition of polynomial coefficient a_0 is selected. Set the coefficient.

(5)Select the setting condition of the next data by pressing [SEL] key.

(6)Set all setting data by repeating the above procedure.

(7)After the above setting, return the unit to the measuring condition by pressing the [SEL] key for 2 seconds.
The unit returns to the measuring condition automatically, if no key operation is done for one minute.

5.Operation

5.4 Setting of broken point approximation calibration curve

If a calibration curve is obtained by a graph but it is not represented by a polynomial of degree three or less, the calibration curve can be approximated by broken lines.

5.4.1 Preparation of broken point data

(1)Assume that the calibration curve graph is as shown in the following figure.

(2)Approximate the knee point data by suitably dividing the calibration curve.

(3)In this case, the first and last knee point should sufficiently include the measuring range. Max. 20 knee points including the first and last points can be plotted. Determine intermediate knee points suitably according to the approximation accuracy.

(4)Assume that the knee point data obtained as above are as shown below.

First knee point $\mathbf{d_1: (X_1, Y_1)}$

$\mathbf{d_2: (X_2, Y_2)}$

Last knee point $\mathbf{d_n: (X_n, Y_n)}$

↑

Data No.

5.4.2 Knee point setting data

Set the following data for setting the broken point approximation calibration curve.

Data name	Display	Setting range	Initial value	Remarks
Calibration curve number	CH	1~99	1	
No. of data	n	3~20	3	
Data number	dn	1~20	1	
Sample data x_n	Hn	0~ 9999.9	0.0000	Effective numeric: 5 digits
Sample data y_n	yn	0~ 9999.9	0.0000	Effective numeric: 5 digits
Regression/broken line	Pb	1~4	1	1~3: Polynomial degree (regression) 4:Knee point data
Standard deviation	Sd	0~ 999.99	0.0000	Setting is not required for knee point data approximation

● **Calibration curve numbers**

Optional numbers can be designated out of 1 to 99 optionally as calibration curve numbers. However, the calibration numbers are sequentially designated by starting them with 1 usually.

5.Operation

5.4.2 Knee point setting data

● **No. of data**

No. of knee point data Max. 20 points

● Data number, sample data x_n, sample data "y_n"

Input the knee point data obtained by [5.4.1 Preparation of knee point data].

● Regression/broken line

Obtain the polynomial of the degree by regression operation from the above sample data after inputting 1 to 3. Approximate the knee point data, if 4 is input.

● Standard deviation

A standard deviation is displayed when regression is designated. This setting is not necessary for knee point data approximation.

5.4.3 Setting method

(1) Set a detector number.
HEAD [ ] ENT

(2)By pressing SEL key and CH key together for 2 seconds, the calibration curve number display becomes CH to be ready for setting sample data.

(3)Set a calibration curve number.
[ ] [ ] ENT

(4)By pressing SEL key, the setting condition of No. of data n is selected. Set No. of data.

(5)Select the setting condition of the data number by pressing SEL key.

(6)By pressing SEL key after the above setting, the setting condition of sample data x_n is selected.

(7)By pressing SEL key after the above setting, the setting condition of sample data y_n is selected.

(8)By pressing CH key after the above setting, the unit returns to the setting condition of data number in (5). Set the next data number.

(9)Set all broken point data by repeating the above procedure. Press SEL key after setting broken point data.

(10)Input "4" in regression/knee pointselection.

(11)Return the unit to the measuring condition by pressing SEL key for 2 seconds after the above setting. The unit returns to the measuring condition automatically if key operation is not executed for one minute.

5.Operation

5.5 Setting of operating conditions

Set the calibration curve number, time constant, and other operating conditions of moisture meter.

● Setting of calibration curve numbers

Set the calibration curve numbers according to the measuring objects.

CH [ ] [ ] ENT

● Time constant

If a measured value fluctuates noticeably, the signal can be set to be dull by delaying the response of this moisture meter. Set the smoothing time (equivalent to the time constant of analog instruments) every 0.1sec in case of shorter than 10 seconds or every second in case of longer than 10 seconds.

T/. [ ] [ ] ENT

● Hold ON/OFF

Press HOLD/- key when holding a measured value. Analog output is also held.

The hold is reset by pressing HOLD/- key again.

● Preset output ON/OFF

By turning on the preset output, this moisture meter indicates a preset moisture value.

The analog output corresponds to the preset moisture value.

For turning on the preset output, press PRESET/7 key. The preset output is reset by pressing PRESET/7 key again.

● No. of decimal digits in moisture display

The number of decimal digits can be set for easily monitoring the display.

(1)Set the calibration curve number to 0.

CH 0 ENT

(2)Select mode 14.

MODE 1 4 ENT

(3)Set No. of decimal digits.

[ ] ENT (Setting range: 0 to 4)

5.Operation

5.6 Calibration

Carry out the calibration by the output checker plate. For using this moisture meter accurately, calibrate it periodically once every 3 months or so.

(1) Preheat the unit for longer than one hour by supplying power to the unit before starting calibration.

(2)Set the calibration curve number to 0.
By this setting, absorbance "**x**" is displayed as data.

CH 0 ENT

(3) Mount the output checker plate to the tip of the air purge hood, and face No. 1 side of output checker plate.

Note: For transparent type fiber(IR-2X5XX) Empty the inside of measuringcell by disassembling and cleaning it.

(4) Carry out the calibration by following keys operation. Make sure that the absorbance "**x**" is within 0.0000 0.0010.
Calibration is completed.

MODE 1 ENT

5.7 Correction of calibration curve

If the actual moisture value is different from the moisture value of the preset calibration curve due to the difference of the on-line and off-line and other causes, correct the correction expression coefficients "$\mathbf{b_0}$", "$\mathbf{b_1}$" in [5.3 Setting of calibration curves].

5.7.1 In case of shift correction only

Shift correction is usually done with "$\mathbf{b_0}$" only.

[**Example**] Assume that the measured value of the moisture meter is 15 (%H_2O) before correction and the actual moisture value is 13 (%H_2O), for example, set "$\mathbf{b_0}$"= -2(%H_2O).

5.7.2 In case of zero and span correction

Since this moisture meter provides the regression operation function by the method of least square, the correction expression can be obtained by the regression operation if there is a difference between measured value "**y**" of the moisture meter and actual moisture value "Y".

Assume that "n" groups ("$\mathbf{y_n}$", "$\mathbf{Y_n}$") of measured values "**y**" of moisture meter and actual moisture values "Y" of sample data exist. ("**n**": Less than 20 inclusive)

5.Operation

5.7.2 In case of zero and span correction

(1)Set a detector number.
HEAD [ ] ENT

(2)By pressing SEL key and CH key together for 2 seconds, the calibration curve number display becomes CH to be ready for setting sample data.

(3)By pressing MODE key, the sample data setting condition of the correction expression is selected.

(4) Set a calibration curve number.
[ ] [ ] ENT

(5)By pressing SEL key, the setting condition of No. of data n is selected. Set No. of data.

(6) Select the setting condition of the data number by pressing SEL key.

(7) By pressing SEL key after the above setting, the setting condition of sample data **"y_n"** is selected.

(8)By pressing SEL key after the above setting, the setting condition of sample data **"Y_n"** is selected.

(9)By pressing CH key after the above setting, the unit returns to the setting condition of data number in (6). Set the next data number.

(10)Set all sample data by repeating the above procedure. Press SEL key after setting sample data.

(11)The correction expression can be obtained by inputting "1" in regression/broken line selection.

(12)By pressing SEL key, the standard deviation of the above correction expression (approximation accuracy of correction expression) is displayed.

(13)Return the unit to the measuring condition by pressing SEL key for 2 seconds after the above setting. The unit returns to the measuring condition automatically if key operation is not executed for one minute.

5.Operation

5.8 Mode setting

For setting various operating conditions of the moisture meter, use the mode setting.
This mode setting can be done only when the calibration curve number is "0".
For terminating the mode setting, press [SEL] key for 2 seconds. If no operation is done for one minute, the unit returns to the measuring condition automatically. If an invalid mode number has been input, "Er" is displayed for one second in the calibration curve number display, and the unit returns to the measuring condition automatically.

● Calibration

This is used for calibrating the moisture meter. Refer to [5.6 Calibration].

[MODE] [1] [ENT] : No. 1 calibration

[MODE] [2] [ENT] : No. 2 calibration

(**Note**) No.2 calibration is not done usually. (It depends upon the setting of DIP switches of the detector.)

● Weight "α", calibration constant

Weight "α" is the value for determining the ratio of two comparative wavelengths in 3-wavelength operation. The calibration constant is obtained by the above calibration.

[MODE] [6] [ENT]

AF: Weight α
k1: Calibration constant during No. 1 calibration
k2: Calibration constant during No. 2 calibration

(**Note**) No.2 calibration is not done usually. (It depends upon the setting of DIP switches of the detector.)

● No. of decimal digits of moisture display

The number of decimal digits can be set for easily monitoring the display.

[MODE] [1] [4] [ENT]
[ ] [ENT] (Setting range 0 to 4)

● Calibration curve remote input Binary/BCD

Whether external contact input data are processed by binary codes or BCD codes can be selected by calibration curve remote setting.

[MODE] [1] [7] [ENT]
[ ] [ENT] (0:Binary 1: BCD Initialize: BCD)

● Calibration curve data clear

This is used for clearing calibration curve data. □□

[MODE] [1] [8] [ENT]
[ ] [ ] [ENT] (Calibration curve number [][] is cleared.
[ ] [ ] [HOLD/-] [ ] [ ] [ENT] (Calibration curve No. [][] to [][] are cleared)

● Communication speed, parity, data length, stop bit length

These data are provided as the communication conditions setting data when connecting the moisture meter to the personal computer, sequencer, etc.

[MODE] [8] [0] [ENT]

SP :Communication speed (Setting range 1:1200 to 5: 19200)
P :Parity (Setting range 1:nonE 2:odd 3:EVEn)
d :Data length (Setting range 7 to 8)
Sb :Stop bit length (Setting range 1 to 2)
bC :Whether BCC is provided or not (Setting range 0:no 1:YES)

5.Operation

5.9 External contact input

Calibration curve number setting and other operation can be done by using external contacts.

● Detector number setting/calibration curve number setting

By setting numerics to the BCD IN terminal in either BCD code or binary code, the detector number and calibration curve number can be set.

The BCD code is initialized. For setting numerics in the binary code, change the code by mode setting. [See 5.8 Mode setting]

When HEAD/CH terminal is turned on, the numeric at the BCD IN terminal is set as a detector number. When HEAD/CH terminal is turned off, the numeric at the BCD IN terminal is set as a calibration curve number.

● Calibration

When k1 terminal is turned on, No. 1 calibration is done. When k2 terminal is turned on, No. 2 calibration is done.

However, No.2 calibration is not done usually. (It depends upon the setting of DIP switches of the detector.)

● Preset

The preset output condition is selected by turning on the PRESET terminal and reset by turning off the PRESET terminal.

● Hold

The hold condition is selected by turning on the HOLD terminal and reset by turning off the HOLD terminal.

5.10 Key lock

The key lock condition is selected and the 1st digit decimal point of the calibration curve number display lights by pressing MODE and SEL keys together for 2 seconds when the calibration curve number is other than 0. No key input is acceptable under this condition, but the calibration curve data can be checked. For resetting the key lock condition, press MODE and SEL keys together for 2 seconds.

6.Preparation Of Calibration Curves

6.Preparation of calibration curves

The output characteristics of the infrared moisture meter depends upon the measuring objects. Also, the output characteristics may also change according to the process conditions and moisture measuring conditions of samples in case of certain measuring objects. It is, therefore, necessary for accurately measuring the moisture to carry out the sample test every measuring object in advance and obtain the correlation between the moisture value (%H_2O) obtained by the drying method or other measuring methods and the absorbance x measured by the moisture meter (this is called calibration curve).

This chapter describes the measurement of the moisture value by the drying method. However, the method of obtaining the calibration curves remains unchanged even if the moisture value is measured by the Karl Fischer method or other methods.

6.1 Sample preparation

6.1.1 In case of pulverulent or granular samples

(1)Take a sample of about 2 to 4 liters from the measuring object.
(2)Dry up the sample up to the absolute dry condition by a dryer. Particularly be careful with the heating temperature so as not to denature the sample.
(3)Divide the dry sample every 100 to 200cc into 5 to 6 samples separately, although it is recommendable to divide the sample into many samples.
(4)Moisten each of these 5 to 6 samples bit by bit so that its moisture divides the measuring range almost evenly.
(5)Stir each moistened sample sufficiently, and put it into a polyethylene bag.
(6)Leave each sample for about 2 days until its moisture is stabilized.

Caution

If a sample cannot be heated or if it is hardened by moistening to be not measurable, adjust the moisture correspondingly according to the procedure in case of a paper shown below.

6.1.2 In case of paper (sheet substance)

(1)Cut nine sheets of samples each having a size of about 100 x 100mm by using a cutter or the like.
(2)Divide nine cut samples into 3 groups, each consisting of 3 sheets and adjust the moisture under the following conditions, respectively.

Drying: Leave the samples in a desiccator containing silica gel for 2 days.
In the air: Leave the samples in an indoor atmosphere. In case of paper, the moisture becomes about 7%H_2O in summer or about 5%H_2O in winter.
Moistening: Leave the samples in a desiccator containing salt water for 2 days. In case of paper, the moisture becomes 8 to 9%H_2O usually or about 11%H_2O at the most.

Caution

Wear clean gloves when handing samples so as not to touch them by naked hands directly. It is recommended for convenient measurement to mark the samples in such a way as their front and rear surfaces as well as the flow directions can be known.

6.Preparation Of Calibration Curves

6.2 Sample measurement

Be careful with the following cautions during measurement.

(1)Place a sample at the same position as in actual measurement, set the calibration curve number to 0, and read the display (absorbance "**x**").

(2)Perform the measurement rapidly.

(3)The visible light is radiated form the detector. Make sure that the sample covers the measuring area completely.

6.2.1 In case of pulverulent or granular samples

(1)Prepare the trays (Diameter 100 to 150mm ϕ, Depth 20mm or so) by the same quantity as the measuring sample quantity.

(2)Weigh the weight w_0 of each sample.

(3)Spread the sample being sealed in the polyethylene bag on the tray in such a way as the tray bottom is fully covered with a flat sample surface.

(4)Put the tray at the measuring position, set the calibration curve to 0, and read the display (absorbance "**x**"). If the measured value cannot be read easily, delay the response by smoothing function.

(5)Stir the sample rapidly with a spoon and measure it again. Repeat this measurement 2 or 3 times per sample.

(6)Weigh the weight w_1 of the tray together with the sample.

(7)Perform the same measurement sequentially about all samples.

(8)Put each sample together with its tray into a dryer, and dry it out to the absolute dry condition (for longer than 2 hours at 105 to 110°C usually).

(9)Cool down the sample after drying, and weigh the weight w_2 of each tray together with the sample.

(10)Record the measured value in the following table every measurement, and obtain the moisture value by the following formula.

$$\frac{W1\text{-}W2}{W1\text{-}W0} \times 100(\%H_2O)$$

NO.	Absorbance **x**	w_0	w_1	w_2	Moisture value (%H_2O)
1	x_1				y_1
2	x_2				y_2
3	x_3				y_3
n	x_n				y_n

6.Preparation Of Calibration Curves

6.2.2 In case of paper (sheet substance)

(1)Weigh the weight w_1 of the sample before measurement.

(2)Hold a sample by a paper holder, put it at the measuring position by tilting it at 15°, set the calibration curve number to 0, and read its display (absorbance x). In this case, set the front and rear surfaces and flow direction of the samples to meet each other.

(3) Weigh the weight w_2 of the sample after measurement. Perform the measurement from (1) to (3) as soon as possible.

(4)Perform the same measurement sequentially about all samples.

(5)Put each sample together with its tray into a dryer , and dry it out to the absolute dry condition (for 2 hours at 105°C usually).

(6)Cool down all samples in a desiccator containing silica gel after drying.

(7) Weigh the weight w_3 of each sample.

(8)Record the measured value in the following table every measurement, and obtain the moisture value by the following formula.

$$\frac{(W1+W2)/2-W3}{(W1+W2)/2} \times 100(\%H_2O)$$

NO.	Absorbance **x**	w_1	w_2	w_3	Moisture value (%H_2O)
1	x_1				y_1
2	x_2				y_2
3	x_3				y_3
n	x_n				y_n

6.3 Preparation of calibration curves

Obtain a calibration curve by plotting data obtained by the above measurement on a graph. Plot the absorbance **"x"** of the moisture meter on the "x-axis" and also plot the moisture value (%H_2O) on the "y-axis". Obtain a curve to minimize errors from this graph as a calibration curve.

The curve to minimize errors is normally obtained by the regression operation.

If a graph contains inflection points, the knee point approximation is used.

The following description covers the method of obtaining the calibration curve by the regression operation. For the broken line approximation, refer to [5.4 Setting of knee point approximation calibration curve].

6.Preparation Of Calibration Curves

6.3.1 Calculation of regression formula

Since this moisture meter provides the regression operation function by the method of least square, the polynomials of degree one to three can be obtained by inputting data obtained in [6.2 Sample measurement].

Assume that sample data ("x_n", "y_n") exist by n groups. (**"n"**: Less than 20 inclusive)

(1) Set a detector number.
HEAD [ ] ENT

(2)By pressing SEL key and CH key together for 2 seconds, the calibration curve number display becomes CH to be ready for setting sample data.

(3)Set a calibration curve number.
[ ] [ ] ENT

(4)By pressing SEL key, the setting condition of No. of data n is selected. Set No. of data.

(5)Select the setting condition of the data number by pressing SEL key.

(6)By pressing SEL key after the above setting, the setting condition of sample data x_n is selected.

(7)By pressing SEL key after the above setting, the setting condition of sample data y_n is selected.

(8)By pressing CH key after the above setting, the unit returns to the setting condition of data number in (5). Set the next data number.

(9) Set all sample data by repeating the above procedure. Press SEL key after setting sample data.

(10) The polynomial of the corresponding degree can be obtained by inputting "1" to "3" in regression/knee point selection.

(11)By pressing SEL key, the standard deviation of the above regression formula (approximation accuracy of regression formula) is displayed.

(12)Return the unit to the measuring condition by pressing SEL key for 2 seconds after the above setting. The unit returns to the measuring condition automatically if key operation is not executed for one minute.

6.Preparation Of Calibration Curves

6.3.2 Regression formula check

For checking the coefficients of the regression formula obtained above, observe the following procedure.

(1)Select the calibration curve setting condition by pressing SEL key for 2 seconds.

(2)Set the calibration curve number for which the regression formula has been obtained.

(3)By pressing SEL key, coefficient a_0 of the regression formula is displayed.

(4)By pressing SEL key, **"a_1"** to **"a_3"** are displayed in the same way.

(5)After check, return the unit to the measuring condition by pressing the SEL key for 2 seconds. The unit returns to the measuring condition automatically, if no key operation is done for one minute.

7.Check And Maintenance

7. Check and maintenance

7.1 Periodical check

Perform the following check periodically or according to the circumstances.

● **Looseness of connections**

Check the detector, setting display unit, and receiving instrument for looseness of terminals.

● **Calibration**

Perform the calibration once every 3 months or so by using the output checker plate.

7.2 Self diagnostic function

This moisture meter provides the self diagnostic function, and an error number is displayed in the occurrence of an error. Error numbers are applicable to the detector and setting display unit in common.

○

Error No	Items	Contents	Remedial measures	Self-diagnostic errors
-----	Higher-limit over-range	Measured value exceeds the display range.	Check calibration curve data. Check the output by the output checker plate.	X
-----	Lower-limit over-range	Measured value is lower than the display range.	Check calibration curve data. Check the output by the output checker plate.	X
Er01	Calibration data error	Calibration data breakage	RAM clear	○
Er02	RAM error	Detector RAM data breakage	RAM clear	○
Er03	Abnormal motor rotation	Motor stop or abnormal rotation	Motor exchange	○
Er04	Lamp power down	Lamp power supply was broken.	Replace the lamp power supply.	○
Er05	Abnormal A/D	Over-range of A/D	Check the output by the output checker plate.	○
Er06	Arithmetic operation error	Occurrence of overflow in arithmetic operation	Check the output by the output checker plate.	○
Er07	Abnormal element temperature	Element temperature is abnormal.	Send back for repair.	○
Er10	Calibration curve data error.	Calibration curve data are improper.	Reset calibration curve data	X
Er11	Broken line approximation error	Absorbance x is out of the scope of broken line approximation.	Reset the broken line approximation data.	X
Er12	Excessively high ambient temperature	Ambient temperature of detector is high.	Lower the ambient temperature.	X
Er13	Excessively low ambient temperature	Ambient temperature of detector is low.	Raise the ambient temperature.	X

7.Check And Maintenance

7.2 Self diagnostic function

Error No	Items	Contents	Remedial measures	Self-diagnostic errors
Er14	Excessively high sample temperature	Sample temperature is higher than the correction range.	Widen the correction range	X
Er15	Excessively low sample temperature	Sample temperature is lower than the correction range.	Widen the correction range	X
Er16	Low reflection of sample	Reflectance of sample is low or the lamp is broken.	Shorten the distance to the sample Replace the lamp, if broken.	X
Er17	Regression operation error	An error occurs in regression operation	Check calibration curve sample data.	X
Er18	Detector number error	Non-connected detector number is set.	Set the detector number again.	X
Er99	RAM error	Setting display unit RAM data breakage	RAM clear	○

(Note) For the items marked with ○ in the self-diagnostic error column, a self-diagnostic error alarm output is sent from the setting display unit.

7.3 Remedial measures to the troubles which are not contained in self diagnosis

If a trouble occurred, take remedial measures referring to the corresponding items of this instruction manual after checking the following points. For moisture meter detector errors, see [Instruction manual for infrared moisture meter IR-M □□□□].

● A measured value remains unchanged

(1) Is the hold turned on?
(2) Is the preset turned on?
(3) Are calibration curve data correct?
(4) Turn off the power supply once and turn it on again.
(5) Does the display change when checking the display with the calibration curve number 0 by using the output checker plate?
(6) Try clearing RAM if no change occurs. If the trouble cannot be recovered yet, send back for repair.

● Measured values fluctuate

(1)Is the measuring surface free of being uneven?
(2)Does the detector face the measuring position correctly without showing the bottom face of the belt conveyor or the like?
(3) Is the disturbance light radiated onto the measuring surface?
(4)Is the smoothing time suitable? Certain smoothing time is necessary for stable measurement.
(5)Is a noise source absent from the vicinity of detector or connection cables?
(6) Does the display fluctuate when checking the display with calibration curve number 0 by using the output checker plate?
(7) Clear RAM, if display fluctuates. If the trouble cannot be recovered yet, send back for repair.

7.Check And Maintenance

7.3 Remedial measures to the troubles which are not contained in self diagnosis

● **Measured value is slightly higher than or lower than the actual value**

(1) Is the calibration curve number correct?
(2) Are calibration curve data correct?
(3) Is the hold or preset turned on?
(4) Does the detector face the measuring position correctly?
(5) Is the detector cover glass surface free of dirt and fogging?

7.4 Maintenance parts

Part name	Quantity	Exchange intervals	Remarks
Lithium battery (Note)	1	3 to 10 years	10 years under normal operation or 3 years when no power is applied

(Note) For replacing the lithium battery, it is taken back by our company. Please contact our agent or sales office.

7.5 RAM clear

If a trouble cannot be repaired by all means, try clearing the RAM contents.

(1)Turn on the power supply by pressing MODE and CLR keys together.
(2)The RAM contents have been initialized. Set data again.

8.Specifications

8. Specifications

8.1 Setting display unit IR-GMEG1 □

Item	Contents
Detector input	RS485 Max. 9 detectors can be connected
Analog output:	4 to 20mA DC (Load resistance: Lower than 500 Ω) 2 outputs
Output accuracy:	±0.5%FS
Communication output:	RS232C, RS485 or RS422A is also available, if designated so
Output update cycle:	28 x (No. of connected detectors) msec
Display:	Data LED 5 digits Calibration curve No. LED 2 digits Detector number LED 1 digit
External setting:	Detector number, Calibration curve number, Calibration, Preset output, Hold setting by external contacts
Alarm:	Higher-limit/lower-limit alarm Contact 2 outputs (common)
Self-diagnosis:	Contact 1 output
Working temperature range:	0 to 50 ℃
Power supply:	100 to 240VAC 50/60Hz
Allowable voltage fluctuations	+10% to (-)15% of the rated value
Power consumption:	Max. about 15VA
Case:	ABS resin Front panel: Drip-proof structure (Conforming to IP65)
Mounting method:	Panel flush-mount
Weight:	Approx. 600g
Accessories:	Mounting brackets 1 set Internal unit pull-out tool 1 pc.

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