KEMPION

Digital EC Controller

MESTAR+ Series

Instruction Manual

전세산업 (주)

Thank you very much for purchasing cheonsei EC controller.

Before beginning operation, please read this instruction manual carefully.

Correct handling, repair & maintenance are described easily.

Please keep this instruction manual at the place where you can see it easily.

※The specification of products can be changed for improvement without prior notice.

※Please refer to the website (www.cheonsei.co.kr) as we always register the latest instruction manual.

CONTENTS

1 Notice for Safety

1-1 Introduction

- To use the products safely, the signs are showed on the manual like below.
- As it is a matter of safety, please be sure to keep the directions in manual
- The signs and indication are as follows.

⚠ Warning

Person death or serious injury will be occurred, if warning is not kept by wrong handling.

⚠ Caution

Person injury or property damage will be occurred, if caution is not kept by wrong handling.

1-2 Cautions for operation condition

⚠ Caution

- Do not use this controller and its components for other purposes.
  Otherwise it may cause trouble.
- Please keep the followings, otherwise it may cause trouble.
  Ambient temperature : -5 ~ 45℃ / Relative humidity : below 80%
  Install location : Indoor and inside of electrical panel
  Temperature of the handling liquid
  : below the working temperature described in the electrode specification
- Gas or moisture, which occur in jobsite, can lead to the internal corrosion of the controller and it may cause reduction of service life and trouble.

1-3 Warning for handling condition

⚠ Warning

- Install this controller beyond the reach of children and/or unauthorized person.
- Turn off the power and stop the controller & other equipments when repairing or disassembling the controller. If power is on during work, it may cause electric shock.
- Controller should be properly grounded and install ELCB(Earth Leakage Circuit Breaker) in order to prevent electric shock.
- In case of installation in the electric panel, install the controller after securing sufficient space in order not to contact with the components inside electric panel.
- Do not touch with wet hands. Electric shock may occur.
- Use only designated parts. If undesignated parts are used to the controller, it may cause accident & trouble.
- Do not arbitrarily reconstruct the controller. If the controller is arbitrarily reconstructed, it may cause accident & trouble.

⚠ Caution

- Do not use the controller of which case was damaged.
  If the controller is used, it may cause trouble to equipment connected with the controller.
- Do not install controller in the heavy moist or dusty place.
  Electric shock and trouble may occur.
- Do not use power other than that specified in controller. Otherwise, it may cause malfunction or fire.
- Refrain from voltage withstand test in order to prevent damage of internal parts.
- Dispose of waste controller in accordance with related national law.

2 Product Confirmation

2-1 Check point when unpacking

Please check following points immediately after receiving the product.
If the defect is found from the product, please request it to local agent or CHEONSEI.

① Is specification correct as ordered?
② Is there any missing parts ?
③ Is there any visible damage caused by vibration or shock during transport?
④ Is there any loosened bolt or nut?

2-2 Components

① Controller
- Digital EC controller : 1Set
- Bracket(SPC-1 M4 x 52) : 2EA
- User manual : 1 Copy

② SET Components
- Refer to section 6.

3 General

This controller is a digital controller built-in micro processor. It can be used by composing circuit with the external devices through dry contact of analog input & output and, as option, it can be composed according to wanted using condition by installing communication card.
This controller is designed only for a high insulation shielded cable.
If you need to extend the electrode cable, refrain from using the general cable in market and use our high insulation shielded cable.

4 Model Code

MESTAR+ E □□ – □

① ② ③ ④

① Controller	② Controller Option	③ Output	④ Electrode
E : EC (Electrical Conductivity)	B : Standard (Temp. Compensation) C : Communication(RS-485)	0 : Standard 1 : Temp.(4~20mA)	0 : None 1 : CPE11 (Standard) 2 : CPE12 (Pipe Mounting)

5 Specification

Specification		Performance	
Measuring range & Display range	EC	0.00 ~ 10.00mS/cm (Display range: 0.00 ~ 20.00mS/cm)	
	Temp	-10.0 ~ 100.0℃	
Resolution & Accuracy	EC	0.01mS/cm / ±0.5% of Full Scale	
	Temp	0.1℃ / 0.5℃	
Ambient Temp. & Humidity		-5℃ ~ 45℃ / Relative humidity: Below 80% (Muse be free from condensation and dew)	
Range of temp. compensation		15.0~35.0℃, 0.0~8.0%/℃	
Calibration method		Auto, Manual, Slope	
Display		3" LCD Segment Display (LED Back Light: White)	
Alarm output	Setting	High, Low	
	Output	Dry Contact 1a1b, Contact capacity: 3A 250VAC / 3A 28VDC	
	Deadband	Setting range: 0.00 ~ 1.00mS/cm	
Analog output	EC	0.00 ~ 20.00mS/cm	4~20mA isolated output (Load resistance 1,000Ω)
	Temp	-10.0 ~ 100℃(Option)	
Memory		EEPROM	
Communication		RS-485 2Wire Half-Duplex(Option)	
Power		AC85 ~ 245V, 50/60Hz (Power consumption: 3W)	
Case		Anti-Static ABS	
Size & Weight		96mm * 96mm * 115mm / Approx.450g	
Installation place		Indoor, inside electric panel	

6 SET Components

6-1 Standard SET Components

SET Model	Components	Specification	Quantity
MESETAR+ EB0-1	Controller	Digital EC Controller	1SET
	Panel Bracket	SPC-1 M4 x 52mm	2EA
	User manual	44Page	1Copy
	Electrode	CPE11	1SET

※Some components may vary depending on the SET model.

6-2 Option Item

① Connection kit and connection cable (Up to 100m) ※non-extendable

② Sampling holder

7 Name & Function of Each Part

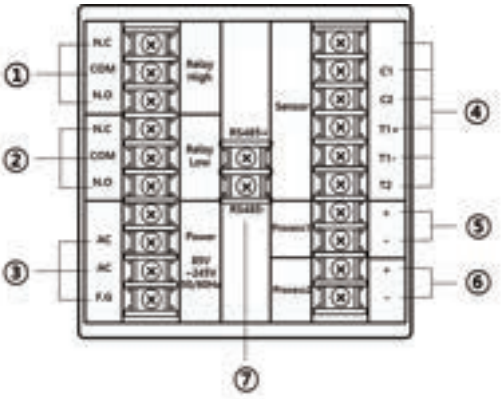
7-1 Screen Layout

① Setup mode
② Measurement mode
③ Calibration mode
④ Zero calibration
⑤ Span calibration
⑥ Main display
⑦ Main display unit
⑧ Sub display unit
⑨ Temp. compensation setting status
⑩ Sub display
⑪ Low alarm status
⑫ High alarm status
⑬ Hold setting status

7-2 Key Fuction

Key	Setup mode	Measurement mode	Calibration mode
CAL	-	Enter calibration mode (5seconds)	Exit
MENU	Return	Enter setup mode	-
▲	Increase	High alarm set value display (3seconds)	Increase
▼	Decrease	Low alarm set value display (3seconds)	Decrease
ENTER	Select	Select	Select

7-3 Rear



① Relay High : High alarm output
② Relay Low : Low alarm output
③ Power : Power Supply
④ Sensor : Electrode connection
⑤ Process1 : 4~20mA Analog output
for 0.00~20.00mS/cm
⑥ Process2 : 4~20mA Analog output
for -10 ~ 100℃(Option)
⑦ Communication
: RS-485 Communication output (Option)

8 Calibration

※Electric conductivity controller is shipped in a state that has been calibrated at the time of shipment, and generally does not require calibration even when electrodes are aging or replaced. It is recommended to calibrate only when it is determined that calibration is absolutely necessary.

8-1 Calibration

The calibration method of this controller is up to 6-point calibration and supports three calibration methods (automatic, manual and Slope). Automatic calibration is an automatic calibration method using a standard solution (1413uS/cm or 12880uS/cm), and manual calibration is a method of manually calibrating a concentration other than the standard solution that supports automatic calibration. Slope compensation is a method of correcting each of 6 points (1, 2, 4, 5, 10, 20mS/cm).

※In case of slop calibration, please get technical support from our company as much as possible.

※The table below shows the characteristics of standard solutions that support automatic calibration and temperature.

※Automatic correction is possible only when the temperature of the standard solution is 15~35℃.

Temp.	1,413uS/cm Soultion	12,880uS/cm Solution
0℃	776	71,50
5℃	896	8,220
10℃	1020	9,330
15℃	1,147	10,480
16℃	1,173	10,720
17℃	1,199	10,950
18℃	1,225	11,190
19℃	1,251	11,430
20℃	1,278	11,670
21℃	1,305	11,910
22℃	1,332	12,150
23℃	1,359	12,390
24℃	1,386	12,640
25℃	1,413	12,880
26℃	1,440	13,130
27℃	1,467	13,370
28℃	1,494	13,620
29℃	1,521	13,870
30℃	1,548	14,120

8-2 Cautions for calibration

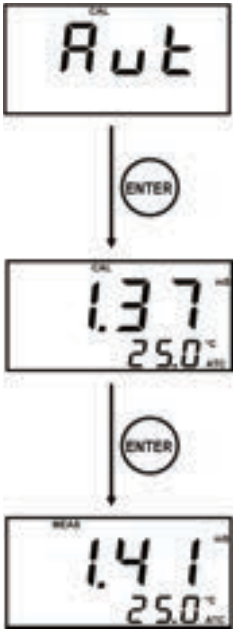
① In calibration mode, it does not change to measurement mode after a few minutes. to exit the calibration mode, should stop calibration by pressing the CAL key or complete calibration by pressing the ENTER key.

② During calibration, if press CAL key to exit calibration mode or the calibration mode is exited in an unusual manner, such as power off, calibration concentrations are not saved.

③ Clean the electrode with clean or distilled water before submerging it or transferring it to a different standard solution.

④ For correct calibration, use it after stirring the standard solution sufficiently.

8-3 Automatic calibration



① Clean the electrode with distilled water.

② Immerse the electrode in the standard solution.(1,413mS/cm, 12,880mS/cm)

③ Wait until the controller has stabilized.(It may take up to 5 minutes)

④ Check that the set temperature matches the temperature of the standard solution.

※If it is not matched, change the setting temperature.

(Refer to 9-10 Temperature measurement calibration)

⑤ In the measurement mode, press the CAL key for 5 seconds to enter the calibration mode.

⑥ Use ▲,▼ keys to select the Auto calibration(Aut) mode and press the ENTER key

⑦ The measured EC concentration is displayed on the main screen.

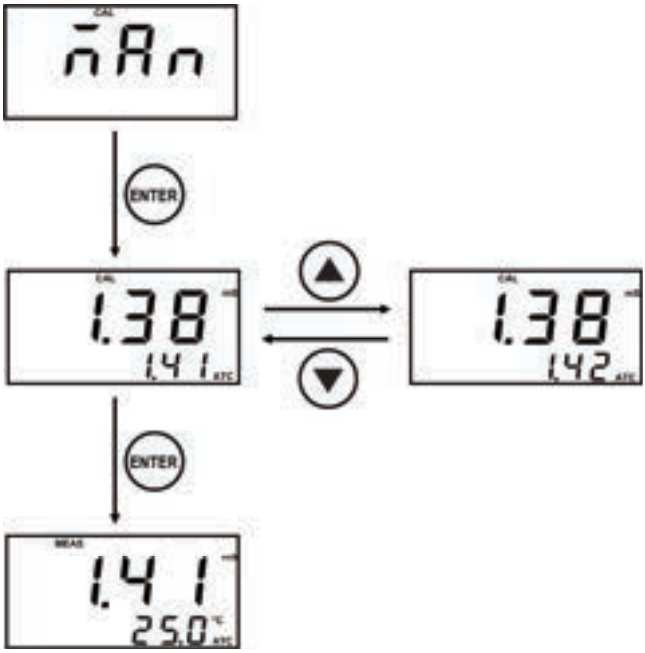
(Concentration of standard solution according to temperature characteristics)

⑧ Press ENTER to complete the calibration.

⑨ Calibration is completed and the concentration of the standard solution corresponding to the current temperature is measured.

※Calibration is possible only when the temperature of the standard solution is in the range of 15 to 35℃.

8-3 Manual calibration



① Clean the electrode with distilled water.

② Immerse the electrode in the standard solution.

※Standard solution that cannot be automatically calibrated.(Excluding 1,413mS/cm, 12,880mS/cm)

③ Wait until the controller has stabilized.(It may take up to 5 minutes)

④ Check that the set temperature matches the temperature of the standard solution.

※If it is not matched, change the setting temperature.

(Refer to 9-11 Temperature measurement calibration)

⑤ In the measurement mode, press the CAL key for 5 seconds to enter the calibration mode.

⑥ Use ▲,▼ keys to select the manual calibration(nAn) mode and press the ENTER key

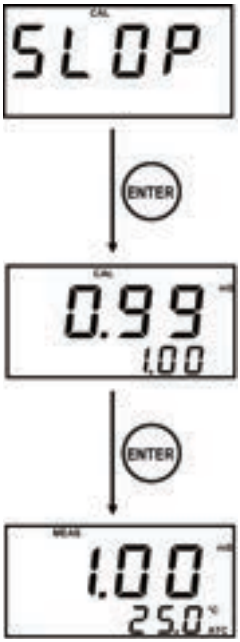
⑦ The measured EC concentration is displayed on the main screen.

⑧ Use ▲,▼ keys to change the concentration in the auxiliary window to a desired concentration

⑨ Press ENTER to complete the calibration.

⑩ The calibration is completed, and the measurement will be made in agreement with the set concentration.

8-4 Slope calibration



① Clean the electrode with distilled water.
② In the measurement mode, press the CAL key for 5 seconds to enter the calibration mode.
③ Use ▲,▼ keys to select the Slope calibration (SLOP) mode and press the ENTER key.
④ Immerse the electrode in the concentration that matches to a slope point (1,2,4,5,10,20mS/cm).
⑤ The measured EC concentration is displayed on the main screen.
⑥ Wait until the controller has stabilized.(It may take up to 5 minutes)
⑦ Use ▲,▼ keys to change the slope concentrations in the sub display.
⑧ After setting the same slope concentrations as the submerged concentrations, press the ENTER key to complete the calibration.
⑨ Basically, calibrations proceed according to the slope points(1,2,4,5,10,20mS/cm).
The process ends when calibration is conducted at the last point(20mS/cm).
however, You can only calibrate some slope points and exit by pressing the CAL key.

※The slope calibration may produce a bigger error unless it is made at accurate concentrations that is why you are advised to seek for our technical support.

9 Setting & Function

9-1 Menu setting

You can enter setup mode by pressing the MENU key in measurement mode, and can cancel the setting or return to measurement mode by pressing MENU key in setup mode. In setup mode, if there is no an keystroke for 20 seconds, return to measurement mode without any storage of the value that is being set. ENTER key must be pressed to save the setting value. The controller supports the following 9 setting functions.

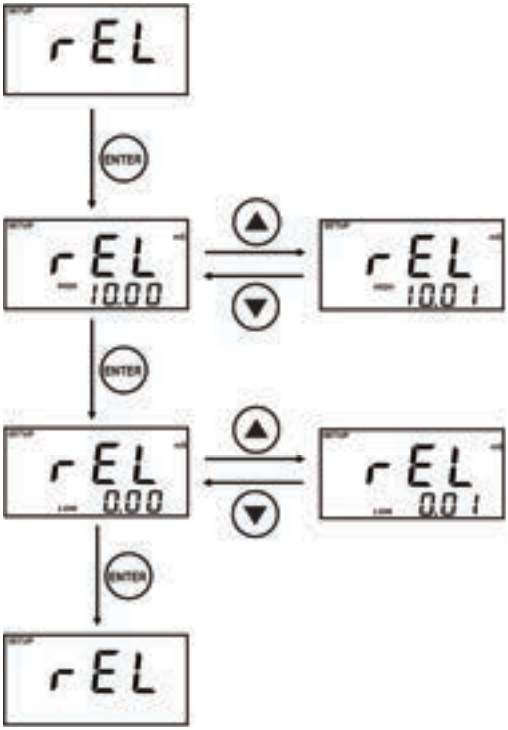
9-2 Menu components

※Some functions are not supported depending on the specifications or settings of the controller.
For detailed setting of each menu item, please refer to the detailed explanation page of 9-3 ~ 9-11.

	9-3 Alarm setting(Relay) It sets the operation value of High, Low alarm. After setting the high alarm, you can set the low alarm. Default: high 10.00mS/cm, Low 0.00mS/cm ※If Low setting is 0, alarm setting is Off.
	9-4 Deadband setting It sets the range when alarm output turns OFF when ON. System errors caused by frequent ON/OFF operation of alarm output can be pevented. Default : 0.00mS/cm
	9-5 Unit setting You can set the temperature unit for your convenience. (℃, ℉) Default : ℃
	9-6 Damping setting Ignores small changes in the controller readings. If there is a problem in the output signal of the electrode under certain circumstances, only the amount of change over the set value is detected. Default : 0.00mS/cm
	9-7 Offset setting Increases or decreases the measured value by the set value. It is used temporarily when the measured values show a certain difference or when it is difficult to immediately proceed with the calibration. Default : 0.00mS/cm
	9-8 Measurement value fixed setting(hold) The measured value is fixed at the set value. System errors can be prevented by fixing the measured values when cleaning or replacing electrodes. Default : Off

	9-9 Automatic temperature compansation(ATC) Compensates the measured value for the temperature measured by the temp sensor. Default : ON
	9-10 Temperature measurement calibration If the temperature measured through the temperature compensation electrode is different from the actual temperature, it is compensated. ※It is not supported when automatic temperature compensation(ATC) is not used.
	9-11 Communication address setting Set the address of the controller for RS-485 communication. Default : 01 ※A controller without communication specification is not supported.
	9-12 Baudrate setting Set the communication Baudrate. Default : 9.6(9600bps) ※A controller without communication specification is not supported.

9-3 Alarm setting(Relay)



① rEL in setup mode is the alarm setting menu.

② When entering the setting screen, the currently set alarm value is displayed.

③ You can change the alarm setting value with the ▲,▼ keys.
(Unit: 0.01mS/cm, Range : 0.00 ~ 20.00mS/cm)

④ After setting the high alarm, you can set the lo alarm.

⑤ The high alarm value cannot be set lower than the low alarm value.

⑥ The low alarm value cannot be set higher than the high alarm value.

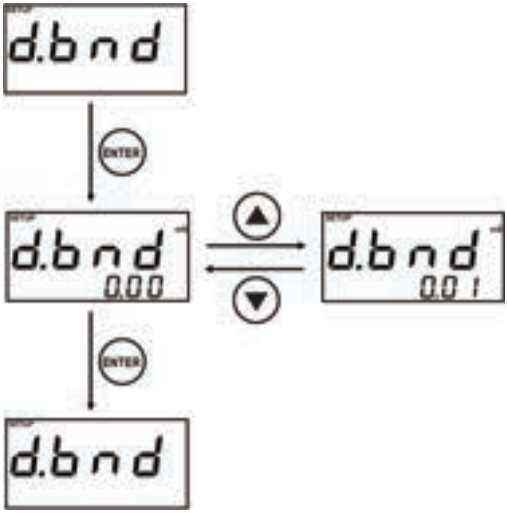
⑦ The deadband setting value is reflected in the alarm setting value. (Refer to 9-5 Deadband setting)
ex) When the deadband is set at 0.30mS/cm and high alarm is set at 2.00mS/cm,
low alarm cannot be set above 1.70mS/cm.

⑧ Alarm ON condition
- High alarm : High alarm setting value ≤ Measured value
- Low alarm : Low alarm setting value ≥ Measured value

⑨ Alarm OFF condition
- High alarm : High alarm setting value > Measured value
- Low alarm : Low alarm setting value < Measured value

※For Deadband setting and its operation, please refer to “9-5 Deadband setting”.

9-4 Deadband setting



① d.bnd in setup mode is the deadband setting menu.

② When entering the setting screen, the currently set alarm value is displayed.

③ You can change the deadband setting value with the ▲,▼ keys.
(Unit: 0.01mS/cm, Max: 1.00mS/cm)

④ Finish the setting by pressing ENTER key.

⑤ The alarm will occur as shown below example.

ex) When setting of 0.10mS/cm

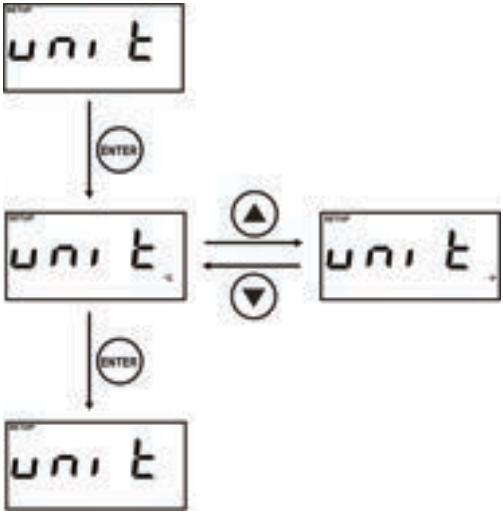
• When setting value of high alarm is 8.00mS/cm
: If measured value is 8.00mS/cm or over, High alarm will occur,
and if measured value become less than 7.90mS/cm, High alarm will be off.

• When setting value of low alarm is 6.00mS/cm
: If measured value is less than 6.00, Low alarm will occur,
and if measured value become 6.10mS/cm or over, Low alarm will be off.

※Deadband setting value can not be set within the difference range of high alarm and low alarm.
(Refer to “9-3 Alarm setting”)

ex) When 7.00mS/cm of high alarm and 6.80mS/cm of low alarm are set,
0.20mS/cm or higher can not be set as deadband.

9-5 Unit setting



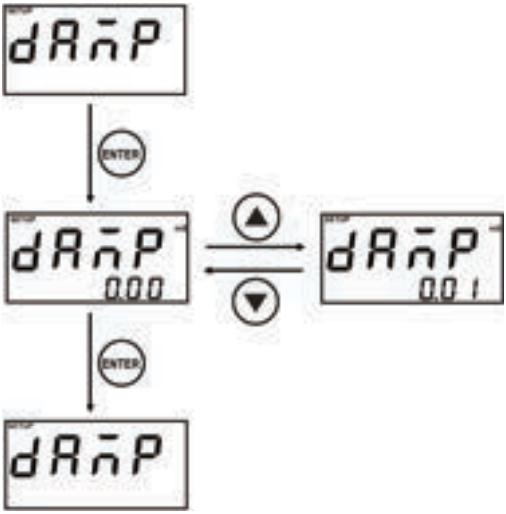
① unit in setup mode is the unit setting menu.

② When entering the setting screen, the currently set unit is displayed.

③ You can change the unit setting with the ▲,▼ keys.
(Two types of units are supported, ℃ and ℉)

④ Finish the setting by pressing ENTER key.

9-6 Damping setting



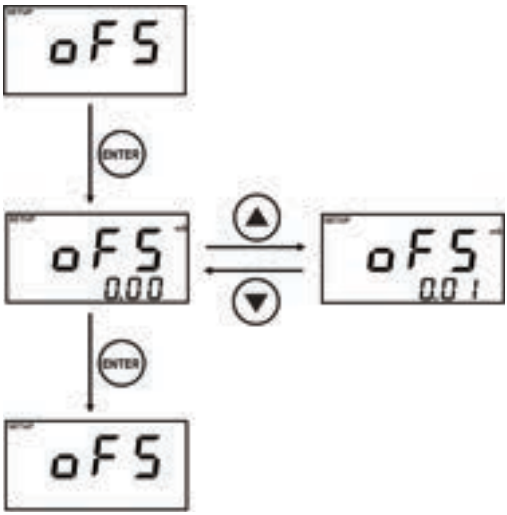
① dAñp in setup mode is the damping setting menu.

② When entering the setting screen, the currently set damping value is displayed.

③ You can change the damping setting value with the ▲,▼ keys.
(Unit: 0.01mS/cm, Max: 1.00mS/cm)

④ Finish the setting by pressing ENTER key.

9-7 Offset setting



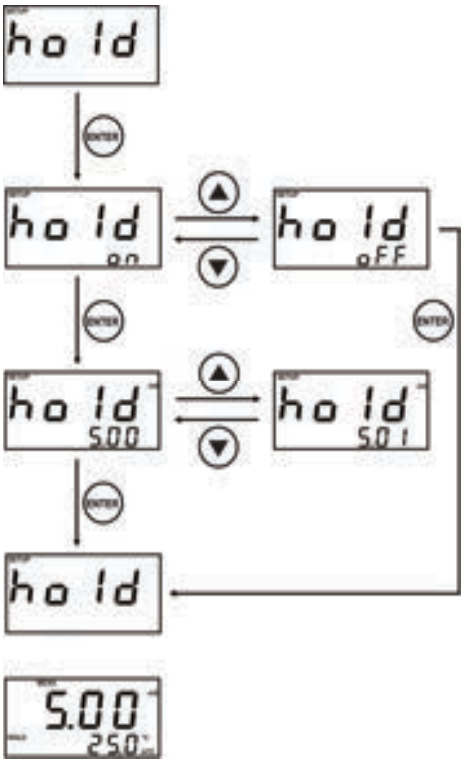
① oFS in setup mode is the offset setting menu.

② When entering the setting screen, the currently set offset value is displayed.

③ You can change the offset setting value with the ▲,▼ keys.
(Unit: 0.01mS/cm, Range: -1.00 ~ 1.00mS/cm)

④ Finish the setting by pressing ENTER key.

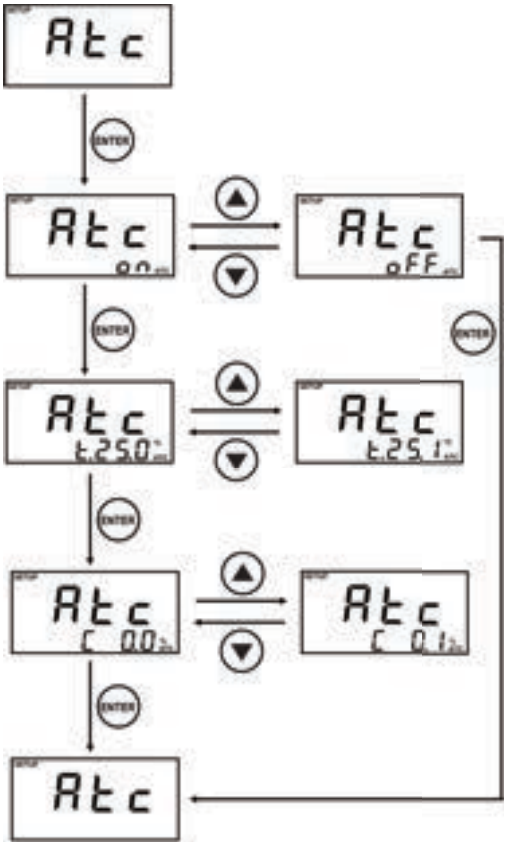
9-8 Measured value fixed setting



① Hold in setup mode is the measurement value fixed setting menu.
② Enter the setting screen and select whether to set the measurement value fixed.
③ You can change ON/OFF with ▲,▼ keys
④ When selecting off, the setting is immediately completed.
⑤ When selecting on, the value to set is displayed.
⑥ You can change the hold setting value with the ▲,▼ keys.
(Unit: 0.01mS/cm, Range: 0.00~20.00mS/cm)
⑦ Finish the setting by pressing ENTER key.
⑧ The measured value is displayed as the setting value and HOLD status is displayed.

※If the hold setting value is higher than the setting value of HIGH Alarm or lower than the setting value of LOW Alarm, alarm will occur, but it will be not effected by Dead band.
※It is impossible to enter the calibration mode, when the measured value is hold state.

9-9 Automatic temperature compensation(ATC)



① Atc in setup mode is the automatic temperature compensation setting menu.

② When in the Setting Menu, you can select automatic temperature compensation setting (on/oFF) buttons using ▲,▼ keys.

③ When you select the “oFF” button, you can disable the automatic temperature compensation setting.

④ When you select the “on” button, you can enter the temperature setting window where you can set temperatures you desire to compensate for.

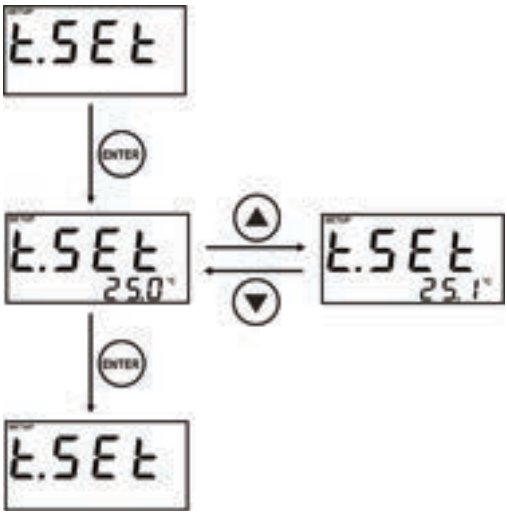
⑤ Use ▲,▼ keys to change the compensation temperature and then save it by pressing ENTER.
※Compensation temperature can be set between 15.0 ~ 35.0℃.

⑥ When temperature setting is finished, the compensation coefficient setting window appears.

⑦ Use ▲,▼ keys to change compensation coefficients and then press ENTER to save them.
The compensation coefficients can be set between 0.0 ~ 8.0%.

⑧ ATC setting is completed if the compensation coefficient setting is done.
※ATC setting status is appeared in the main display.

9-10 Temperatuer measurement calibration



① t.SEt in setup mode is the temperature measurement calibration menu.

② When entering the setting screen, the currently measured temperature is displayed.

③ Change the measured temperature to the actual temperature with the ▲,▼ keys.

④ Finish the setting by pressing ENTER key.

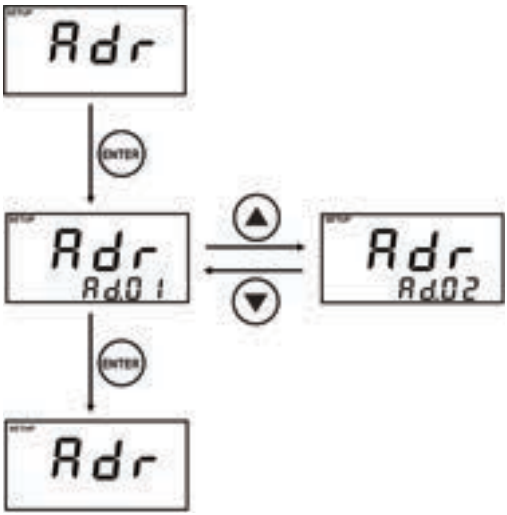
※It works only when automatic temperature compensation setting is on.

※If the temperature sensor is not connected, it will not work.

※The temperature sensor built into the electrode is a heat conduction type, so it may take up to 30 minutes for the temperature measurement to be stable.

※Perform the temperature measurement value correction function when the temperature measurement value of the controller is stable.

9-11 Communication address setting



① Adr in setup mode is the Communication(RS-485) address setting menu.

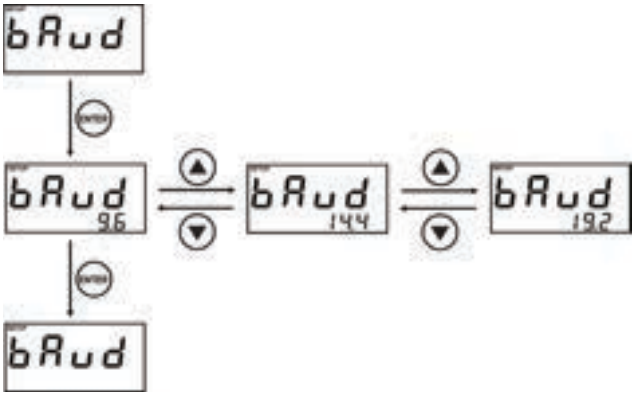
② When entering the setting screen, the currently set address is displayed.

③ You can change the address with the ▲,▼ keys.
(Range: 1 ~ 32)

④ Finish the setting by pressing ENTER key.

※A controller without communication specification is not supported.

9-12 Baudrate setting



① bAud in setup mode is the communcation(RS-485) baudrate setting menu.

② When entering the setting screen, the currently set baudrate is displayed.

③ You can change the baudrate with the ▲,▼ keys.
(9.6: 9600bps, 14.4: 14400bps, 19.2: 19200bps)

④ Finish the setting by pressing ENTER key.

※A controller without communication specification is not supported.

10 Communication Protocol

10-1 Communication Type

1)Channel : RS-485(Multi Drop)

2)Baudrate : 9600bps

3)Transmission : Half-Duplex

4)Protocol : Modbus RTU

10-2 Character Form

1)Character composition

- 0 Start bit
- 8 Data bit (LSB First)
- No Parity bit
- 1 Stop bit

2)Bit Sequence

Start	Data (8bit)								Stop
Bit	D0	D1	D2	D3	D4	D5	D6	D7	Bit
0	x	x	x	x	x	x	x	x	1

10-3 Frame

1)Frame construction

- Each area of the message is called a Field and consists of four fields.

①Address field : 8bit

②Function Code field : 8bit

③Data field : N x 8bit

④CRC(Error Check)field : 16bit

Message				
Slave Address	Function Code	Data	CRC Low	CRC High
8bit	8bit	N x 8bit	8bit	8bit

2)Frame division

- Frames are classified by a waiting time of at least 3.5 character time after transmission of the last character of the frame, and if a new character is received within 3.5 character time, it is judged as a continuation of the frame being transmitted.
- The frame string must be transmitted continuously, and if a waiting time of 1.5 Character time or more occurs between each character, it is judged as an incomplete message and the receive buffer is initialized.

3)Character time (Baud Rate : 9600bps)

- 1Character : 1.04ms
- 3.5Character : 3.64ms

10-4 Field

1)Address field

- In the frame sent by the Master (PC), it is the address of the Slave (controller) to communicate with, The frame sent by the Slave is its own address.
- The address setting of the controller can be set in the Adr item of the menu function. When entering the menu, Ad.01 (initial value) is displayed on the controller screen, and addresses 1 to 31 can be changed with the ▲ and ▼ keys.
  ※It must be saved with the ENTER key, and if there is no key operation for 20 seconds, the setting is terminated without saving.
- The address cannot be changed by any method other than controller operation.

2)Functioin Code field

- Select the type of function to request from the Slave. (Only two functions are supported.)
  ①Register read : 0x03
  ②Register write : 0x06
- If the Master's request is normal, the same function code as the requested function code is returned.
- If the master's request is abnormal, an error response is made by setting the first bit of the requested function code to 1.
  ex) Error respond to 0x03 : 0x83
  Error respond to 0x06 : 0x86

3)Data field

- It consists of the address, number, and data of the register, and the composition of the data field varies depending on the requested function code and response type.
  ①Register read request : Register address to start reading, number of registers to read
  ②Register read respond : Number of byte, data
  ③Register write request, respond : Register address to write, data value to write
  ④Error respond : Exception Code
- All data is composed of 2Byte (16bit) signed Integer type and has a value of '-32768 ~ 32767'.

• In case of negative number, it is treated as a complement and displayed.
(Refer to “7.Data Conversion”.)

• All data are processed as integers without distinction of decimal point and transmitted.
For information on decimal point, refer to “10-7. Data conversion” to convert data.
(Data of 50 and 5.0 are treated as 50 and transmitted in the form of 0x0032.)

• Example of data construction

① 14.00(Decimal)

Data (High)	Data (Low)
0x05	0x78

② -20(Decimal)

Data (High)	Data (Low)
0xFF	0xEC

4)CRC(Error Check) field

- The CRC field consists of 2 bytes, and the transmission order is the lower 1 byte and the upper 1 byte.
- CRC check method is CRC16 (Modbus).
- For how to create CRC16, refer to “10-10.CRC16 creation method”.

10-5 Register Map

Register Address	Contents	Write / Read	Value		Report
0x0001	Controller Status	Read	0x0101		pH measurement mode
			0x0102		ORP measurement mode
			0x0103		RC measurement mode
			0x0104		DO measurement mode
			0x0105		EC measurement mode
			0x0110		Calibration mode entry state
			0x0120		Setup mode entry state
			0x0191		ERROR1 occur
			0x0192		ERROR2 occur
			0x0193		ERROR3 occur
0x0002	Alarm Status	Read	0x0200		No alarms occurred
			0x0201		High alarm occur
			0x0202		Low alarm occur
0x0003	Meas Data	Read			Measured concentration value
0x0004	Temp Meas Data	Read			Measured temp. value
0x0005	High Alarm Data	Write / Read			High alarm set value
0x0006	Low Alarm Data	Write / Read			Low alarm set value
0x0007	Unit	Read	High Byte	0x80	Main unit mV
				0x40	Main unit pH
				0x20	Main unit %
				0x10	Main unit mg/L
				0x08	Main unit ppm
				0x04	Main unit mS
			Low Byte	0x80	Sub unit ℃
				0x40	Sub unit ℉
				0x20	Sub unit %
0x0008	Dead Band	Write / Read			Dead Band set value
0x0009	Offset	Write / Read			Offset set value
0x000A	Damping	Write / Read			Damping set value

10-6 Write data input range

1)pH

High Alarm (0x0005)	Low Alarm (0x0006)	Dead Band (0x0008)	Offset (0x0009)	Damping (0x000A)
0 ~ 14.00	0 ~ 14.00	0 ~ 1.00	-1.00 ~ 1.00	1 ~ 1.00
0x0000 ~ 0x0578	0x0000 ~ 0x0578	0x0000 ~ 0x0064	0xFF9C ~ 0x0064	0x0001 ~ 0x0064

2)ORP

High Alarm (0x0005)	Low Alarm (0x0006)	Dead Band (0x0008)	Offset (0x0009)	Damping (0x000A)
-1999 ~ 1999	-1999 ~ 1999	0 ~ 100	-100 ~ 100	1 ~ 100
0xF831 ~ 0x07CF	0xF831 ~ 0x07CF	0x0000 ~ 0x0064	0xFF9C ~ 0x0064	0x0001 ~ 0x0064

3)RC

High Alarm (0x0005)	Low Alarm (0x0006)	Dead Band (0x0008)	Offset (0x0009)	Damping (0x000A)
0 ~ 4.00	0 ~ 4.00	0 ~ 1.00	-1.00 ~ 1.00	0 ~ 1.00
0x0000 ~ 0x0190	0x0000 ~ 0x0190	0x0000 ~ 0x0064	0xFF9C ~ 0x0064	0x0000 ~ 0x0064

4)DO

High Alarm (0x0005)	Low Alarm (0x0006)	Dead Band (0x0008)	Offset (0x0009)	Damping (0x000A)
0 ~ 20.00	0 ~ 20.00	0 ~ 1.00	-1.00 ~ 1.00	0 ~ 1.00
0x0000 ~ 0x07D0	0x0000 ~ 0x07D0	0x0000 ~ 0x0064	0xFF9C ~ 0x0064	0x0000 ~ 0x0064

5)EC

High Alarm (0x0005)	Low Alarm (0x0006)	Dead Band (0x0008)	Offset (0x0009)	Damping (0x000A)
0 ~ 20.00	0 ~ 20.00	0 ~ 1.00	-1.00 ~ 1.00	0 ~ 1.00
0x0000 ~ 0x07D0	0x0000 ~ 0x07D0	0x0000 ~ 0x0064	0xFF9C ~ 0x0064	0x0000 ~ 0x0064

10-7 Data transfomation

1) Dot Position

	pH	ORP	RC	DO		EC
				ppm	%	
Meas Data (0x0003)	2	0	2	2	1	2
Temp Meas Data (0x0004)	1	None	None	1		1
High Alarm Data (0x0005)	2	0	2	2	1	2
Low Alarm Data (0x0006)	2	0	2	2	1	2
Dead Band (0x0007)	1	0	1	1		1
Offset (0x0008)	1	0	1	1		1
Damping (0x0009)	1	0	1	1		1
Temp Offset (0x000A)	1	0	None	1		1

2) Negative Number

- 65536 + Negative Number = Data

ex) -50

65536 + (-50) = 65486 (0xFFCE)

10-8 Request and response format

1)Read request

- Read consecutive registers of the requested quantity
- Fuction code 0x03
- Start address of register to read -1
- The number of registers to read
- Ex) Request the register value of 0x0003 ~ 0x0007 of Controller 1

Slave Address	Function Code	Starting Address (High)	Starting Address (Low)	No. Of Register (High)	No. Of Register (Low)	CRC (Low)	CRC (High)
0x01	0x03	0x00	0x02	0x00	0x05	0x24	0x09

2)Read response (normal response)

- Number of data bytes
- Data in the requested register
- Ex) Response to the above read request example
  mS/cm: 11.40, Temp:25.0, High Alarm: 9.00, Low Alarm: 4.00, Main unit: mS, Sub unit: ℃

Slave Address	Function Code	Byte Count	Value (High)	Value (Low)	Value (High)	Value (Low)	Value (High)
0x01	0x03	0x0A	0x04	0x74	0x00	0xFA	0x03

Value (Low)	Value (High)	Value (Low)	Value (High)	Value (Low)	CRC (Low)	CRC (High)
0x84	0x01	0x90	0x04	0x80	0x9A	0xF2

3)Write request

- Write a value to one register
- Function code 0x06
- Address of register to be written -1
- Ex) Write the value of 0x0320 (Relay High: 8.00) to the register of 0x0005 of controller address 1.

Slave Address	Function Code	Starting Address (High)	Starting Address (Low)	Value (High)	Value (Low)	CRC (Low)	CRC (High)
0x01	0x06	0x00	0x06	0x03	0x20	0x68	0xE3

4)Write respond

- Respond with the same data as the write request

10-9 Error respond

1)Function Code

- Response by setting the first bit of the requested function code to 1
- Read error 0x83
- Write error 0x86

2)Exception Code

- Information on what kind of error occurred
- 0x01 : Use of unsupported function code
- 0x02 : Register address is invalid
- 0x03 : Invalid data entry

10-10 How to create CRC16

1)Load 0xFFFF into 16Bit register (CRC register).

2)XOR the lower byte and data (8Bit) of CRC register and save the result in CRC register.

3)Shift the CRC register to the right (LSB direction) by 1 bit and check the LSB.

4)If LSB is 0, repeat step 3.

If LSB is 1, XOR the CRC register and 0xA001 and store the result in the CRC register.

5)Repeat steps 3 and 4 8 times.

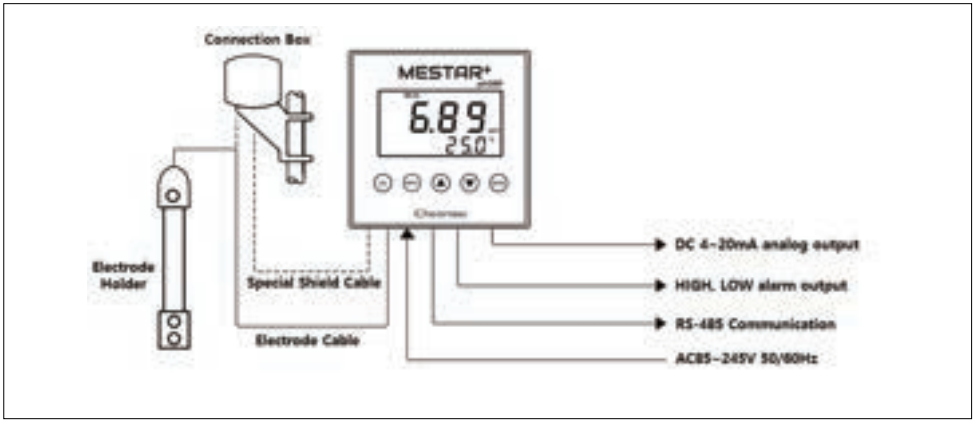
6)Repeat items 1 to 5 as many as the number of bytes in the frame except for CRC 2Byte.

10-11 CRC16 Program example

```
crc16_check(num)
{
    int I, j;
    uint crc_sum=0xffff, carry=0;
    for(i=0; i<num; i++)
    {
        crc_sum = plc_rbuffer[i] ^ crc_sum;
        for( j=0; j<8; j++)
        {
            carry = crc_sum & 0x01;
            crc_sum = crc_sum >> 1;
            if(carry == 1) crc_sum = crc_sum ^ 0xA001;
        }
    }
    sum[0] = crc_sum & 0xff;
    sum[1] = crc_sum >> 8;
    if(sum[0] == plc_rbuffer[num]) return(true);
    else return(false);
}
```

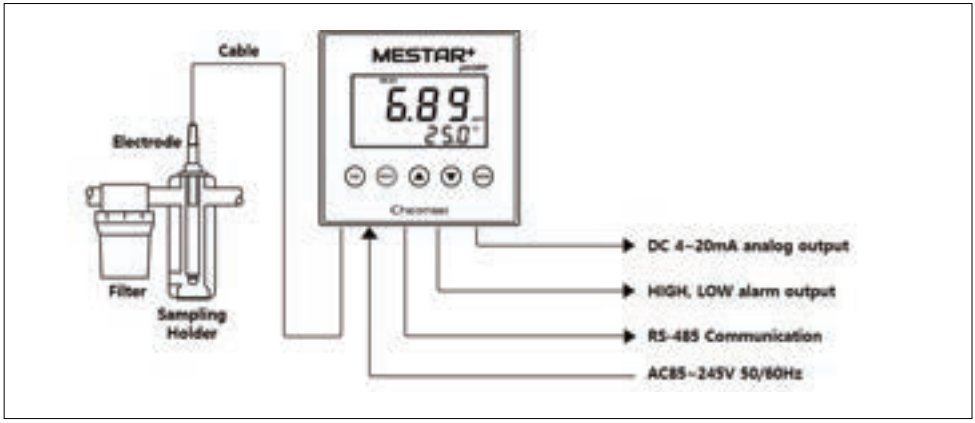
11 System Diagram(Optional product)

11-1 Electrode holder type



※As the number of connections using the connection box increases, the signal sensitivity of the electrode may decrease. Use the connection box to a minimum and install the special shield cable within a maximum length of 100m.

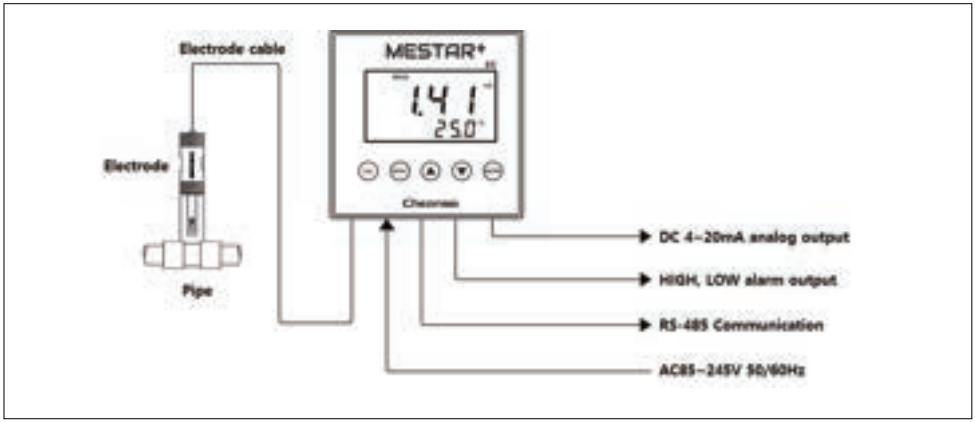
11-2 Sampling holder type



※Not for use with hot, pressurized or corrosive liquids.

※When purchasing the sampling holder, please refer to the separate sampling holder instruction manual.

11-3 Pipe mounting type

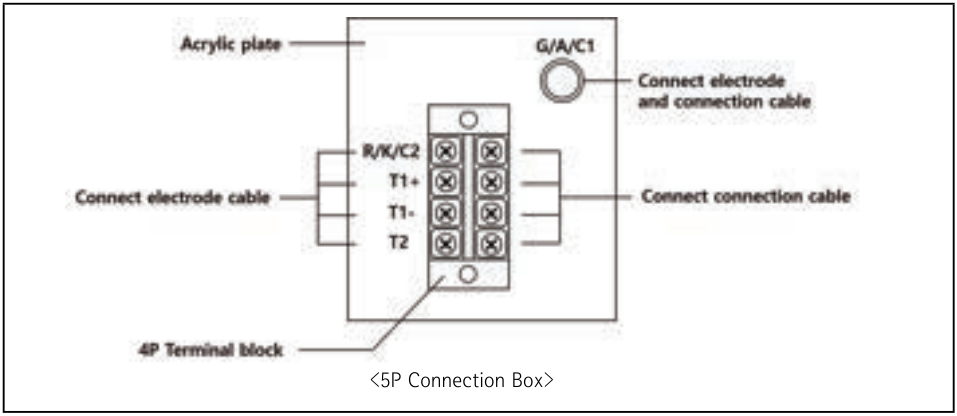


12 Optional component handling

※When purchasing the sampling holder, please refer to the separate sampling holder instruction manual.

12-1 Wiring of connection box

• Be careful not to change the wiring, since the connection of the electrode and the connecting cable must match each other at the terminals inside the connection box.



<5P Connection Box>

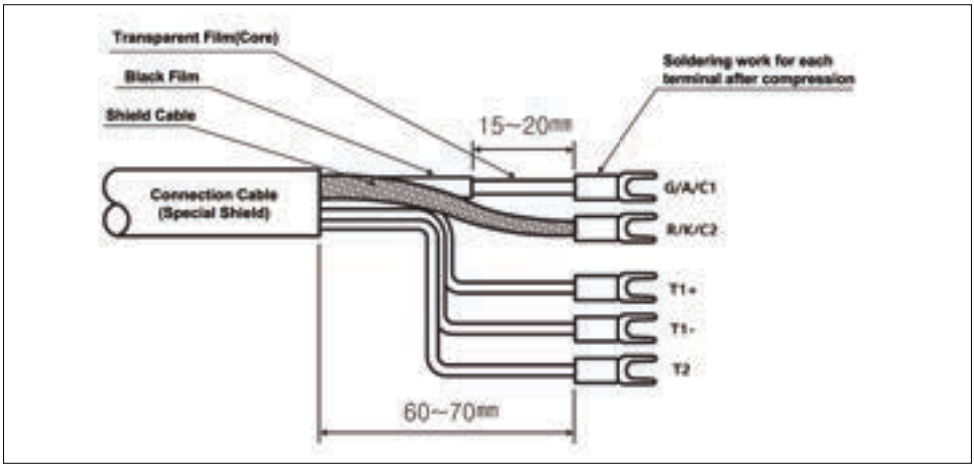
Caution

• Do not istrall controller in the heavy moist, dust or vibration place. The connection may be poor.

• Do not install this connection box at the place where corrosive gas is generated.

• Turn off power before repair & maintenance.
It may cause a damage of controller by static electricity.

12-2 Termination method of connection cable



① Remove the external film & the internal black film as beside figure and solder the Y terminal after compressing the Y terminal(1.5-3Y) to the cable.

② Wrap it with tube or tape after soldering. Specially, wrap shield cable of R terminal with shrink tube(Φ2.0) or tape in order to prevent its exposure.

③ When moving external film & internal black film, be careful that transparent film (G/A/C1) don't be damaged and, if the transparent film is damaged, rework after cutting the damaged part.

⚠ Caution

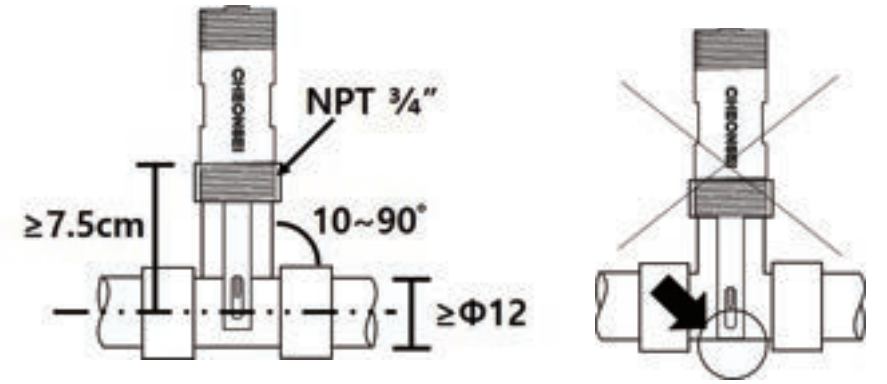
- Remove black film as above figure certainly.
  If not removed, G/A/C1 terminal and R/K/C2 terminal will be short state, The measure is fixed to a random value and is not measured.

12-3 Electrode pipe handling

• Used to measure the electrical conductivity of an aqueous solution in a tank with an open top.

	• Turn the electrode protection tube at the bottom of the electrode to open it. • Insert the electrode from the top of the electrode pipe and pull it out from the bottom.
	• Insert the electrode into the hole of the rubber packing. At this time, watch the direction of the rubber packing carefully and be careful not to insert it in the opposite direction.
	• Insert the rubber packing with the electrode inserted at the bottom of the electrode pipe.
	• Put a washer (P.P) on the rubber packing and assemble the protective tube to fix it.
	• Cover the cap on the top of the electrode to prevent the penetration of foreign substances.

12-3 Install pipe mounting



1)The inner diameter of the pipe to be installed must be at least Φ12.

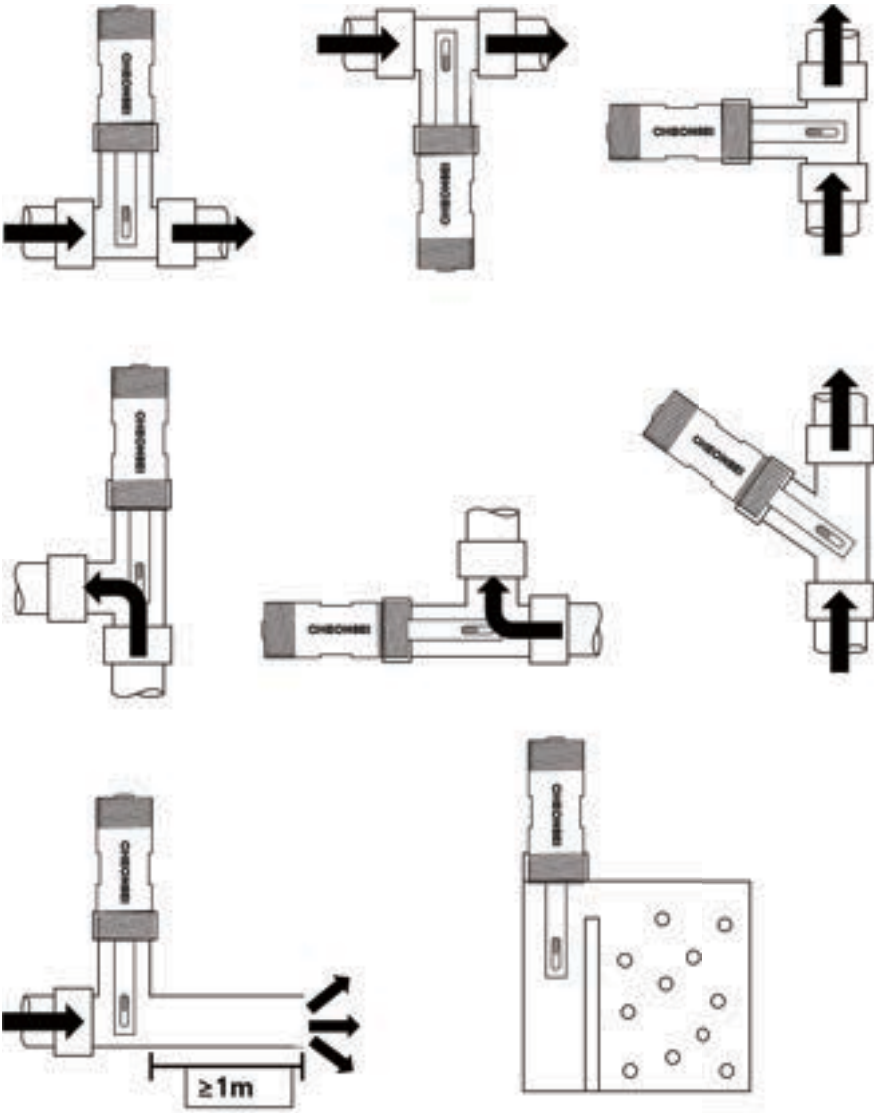
2)The electrode should not touch the bottom of the pipe, and it is recommended to install it so that the measuring part of the electrode is at the center of the pipe.

• If the inner diameter of the pipe is Φ12, the recommended height for electrode connection is 7.5cm.

3)The installation angle of the electrode is 10~90 °

4) The tap size for electrode connection is NPT 3/4"

12-4 Flow direction when installing piping



1) Check the flow direction and install.
2) When installing the pipe at an open point, keep it at least 1m from the open point.
3) When installing in a place where a lot of air bubbles are generated, install a screen to prevent the electrode from being affected by air bubbles.

13 Cause & Solution of problem

Item	Problem	Number of Cause & Solution
A	E.01 on screen (Electronic circuit board is not connected)	1, 2
B	E.02 on screen (Electrode is not calibrated)	3, 4
C	E.03 on screen (Electrode signal error)	3, 4, 5
D	Reading on screen is not changed	3, 4, 5, 6, 7
E	Measuring is difficult reading is not steady	3, 5, 6, 7
F	There is a big difference from the temperature indication	8, 9

No.	Cause	Solution
1	Faulty circuit board connection	Repair the controller
2	Damaged circuit board	Repair the controller
3	Damaged electrodes & Electrode's aging	Exchange electorde
4	Shortage of electrode solution	Supplement of internal liquid
5	Fault of liquid to be measured	Connecting terminal after removing obstacle
6	Poor quality of the measuring liquid	Exchange the measuring liquid
7	The fluid velocity of liquid to be measured is not steady	Makes the fluid velocity steady
8	Temperature sensor calibration required	Performs temperature measurement value correction function of set item
9	Faulty or bad temperature compensation circuit	Temperature compensation PCB replacement

14 Warranty

Caution

- If the product is reconstructed arbitrarily or the undesignated parts are used into the product, CHEONSEI will not warrant and CHEONSEI is not responsible for any expense caused by accident or trouble

① The warranty period of the product is 1 year from the date of sale.

② During the warranty period, we can repair or replace free of charge in case of failure or damage due to problems in our design and manufacturing.

③Repair or replacement in the event of failure or damage due to the following causes will be charged regardless of the warranty period.

1)Failure and damage after the warranty period has expired

2)Problems in use due to careless handling

3)Failure and damage caused by using parts other than those specified by our company or by arbitrarily remodeling

4)Failure and damage caused by repairs or remodeling other than our company or our designated contractor

5)Failure and damage due to force majeure such as fire or natural disaster

15 Repair Service

Caution

- When the product is sent to factory for repair service, do not damage during transport. Also, please make sure that bolts and other components are securely fastened in order not to loss it.

① Contact to CHEONSEI or local agent as shown on back of the manual, if you have any problem or questions.

② If you want to repair, please inform the following.

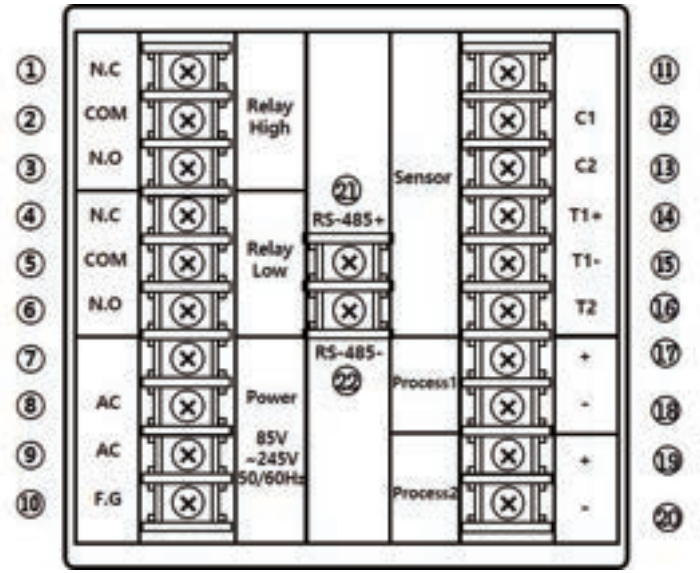
1) Model Name & manufacture number written in name plate

2) Used period, using condition & state

③ If warranty period is over, it may charge according to repair part.
Please contact with sales agent for more information.

④ Minimum retention period of parts for repair is 5 years from the date of production.

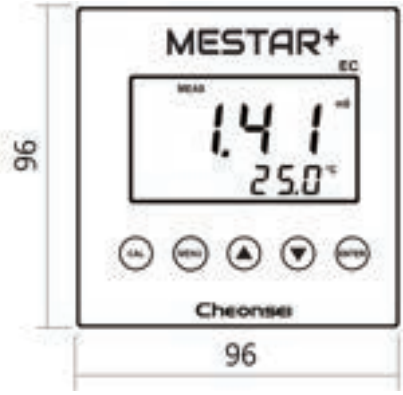
16 Controller Wiring



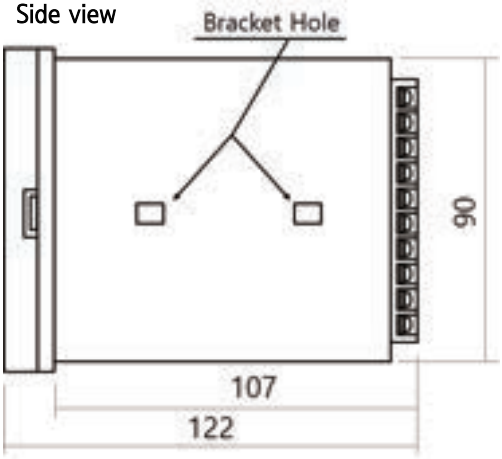
1)HIGH Alarm Normal Close
2)HIGH Alarm Common
3)HIGH Alarm Normal Open
4)LOW Alarm Normal Close
5)LOW Alarm Common
6)LOW Alarm Normal Open
7)None
8)AC input
9)AC input
10)F.G(Frame Ground)
11)None
12)Electrode C1
13)Electrode C2
14)Electrode T1+
15)Electrode T1-
16)Electrode T2
17)EC Analog Output +
18)EC Analog Output -
19)Temp Analog Output +
20)Temp Analog Output -
21)RS-485 Communication +
22)RS-485 Communication -

17 Controller Dimension

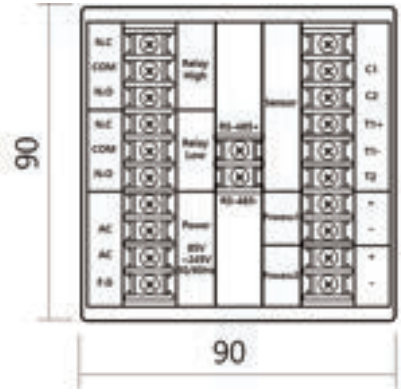
Front view



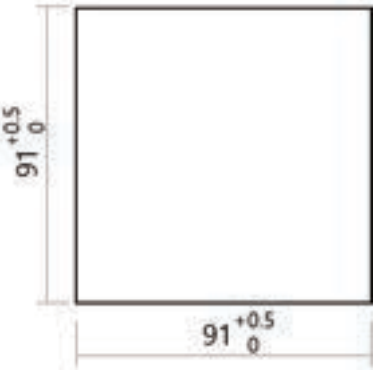
Side view



Rear view

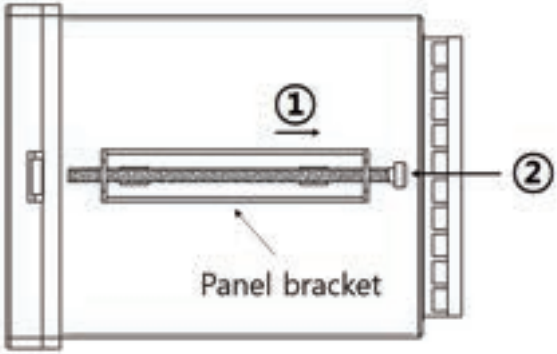


Panel Cutout



18 Controller Installation

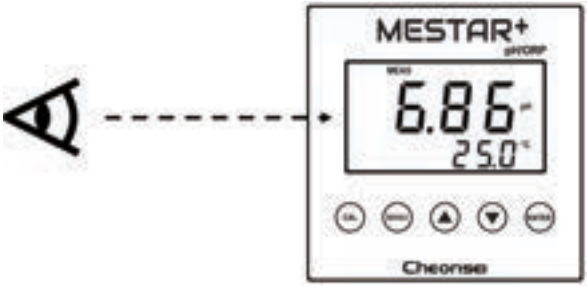
18-1 Panel bracket fixed



1)Insert the panel bracket into the panel bracket mounting holes on both sides of the controller and insert in the direction of ①.

2)Tighten the support bolt in the direction of ② to fix it.

18-2 Installation height



Caution

- Install the controller screen so that it is level with the eye level.
- The controller screen is an LCD type, so if you do not look directly at the screen, visibility is reduced.

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