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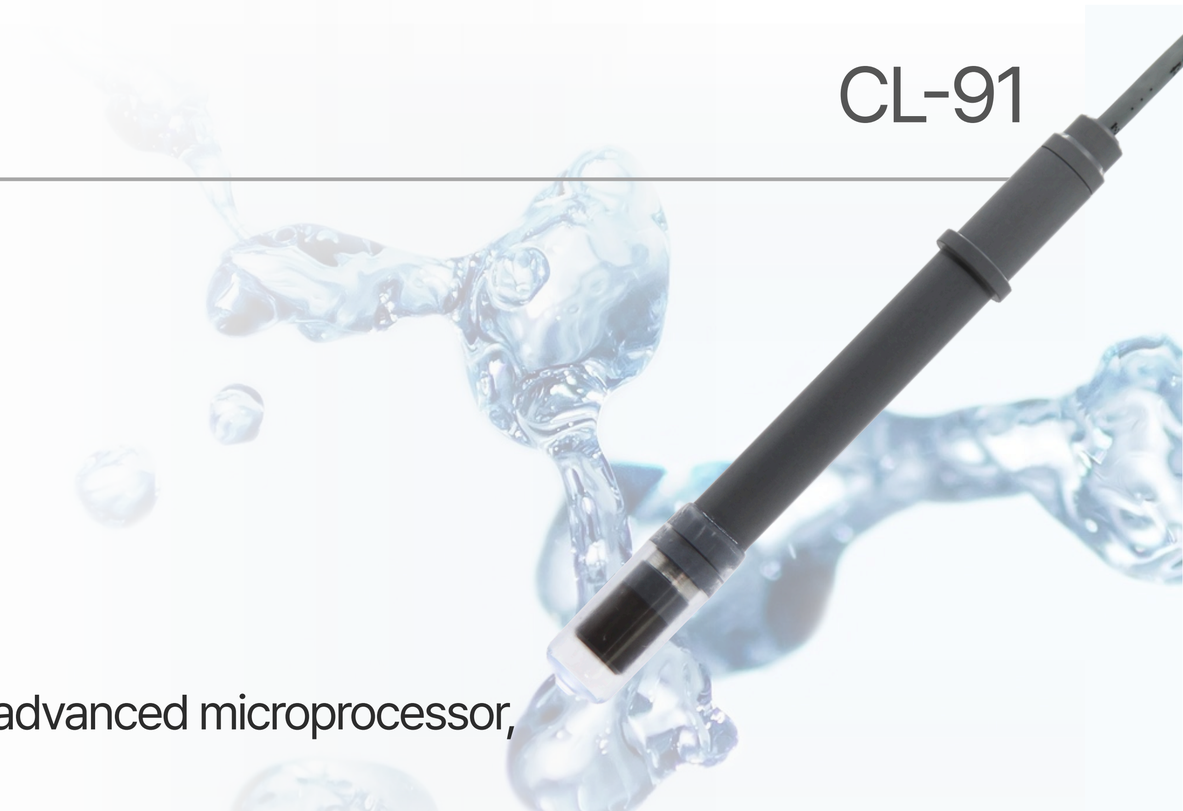
RESIDUAL CHLORINE Controller

Operating & Instruction Catalog

CL-91

Sensory



Residual Chlorine Controller CL-91

Overview

The CL-91 is a high-performance controller equipped with an advanced microprocessor, designed to measure free residual chlorine in water.
This device operates without the use of reagents by amplifying signals directly received from the sensor.
It enables real-time indication and control through a precisely engineered internal circuit.
This reagent-free configuration allows for continuous chlorine monitoring across various industrial processes.
The CL-91, part of the Sensory Series, features a clear digital display and adopts the DIN 96 mm panel format, ensuring convenient installation and on-site readability. It includes both manual and automatic temperature compensation options based on the electrode configuration, and temperature values can be checked directly using the keypad.
The device supports isolated 4–20 mA analog output and includes upper and lower alarm contact relays. The sensor is based on a galvanic-type, reagent-free electrode, and calibration is performed by comparing with colorimetric methods.
A sampling holder system is used to continuously measure the chlorine concentration in extracted sample liquid.
It also supports optional installation of pH and ORP sensors, and the holder should be installed in a location where maintenance can be performed easily.

Features

- Microprocessor-based control
- Large 7-segment, 8-digit display with status LEDs
- Isolated DC 4–20 mA output
- Two programmable relay outputs
- Panel-mounted design (96 × 96 mm, DIN standard)
- One-touch temperature display
- Manual and automatic temperature compensation
- Temperature display via keypad
- High and Low alarm outputs
- Calibration by comparison with colorimetric method
- Built-in RS-485 communication port (optional)

Typical Applications

- Municipal water supply systems and water purification plants
- Disinfection water supply for swimming pools, households, and factories
- Contaminated wastewater treatment systems
- Water quality control in pharmaceutical and food processing lines
- Other industrial environments requiring reliable chlorine monitoring

◇ Residual Chlorine Controller

◇ Residual Chlorine Electrode

KR-100

◇ Electrode HOLDER

KRH-100

Specifications

Item	Specification
Product Name	DIN96 Panel-Mount Residual Chlorine Auto Analyzer
Model	CL-91
Measuring Range	0~1.00 / 2.00 / 5.00 ppm & Custom Range (Option)
Option Note	Low concentration measurement range: 0.000~1.000 ppm (Option)
P-Con	Residual chlorine proportional control (Option)
Display	7-Segment 8 Digit
Display Unit	Residual Chlorine (RC): 0.01 ppm
Operating Temperature	-5 ~ 40 °C
Power Supply	AC 85 ~ 250V, 50/60Hz
Signal Output	Isolated 4~20mA DC (Max. Load 750 ohms)
Relay Output	2 Relay OR 4 Relay (Option) SPDT AC 250V 3A Max.
Communication Output	RS-485 (MODBUS RTU) – Optional
Ambient Conditions	Storage Temp: -20 ~ 60 °C Operating Humidity: 0 to 95%, Non-condensing
Accuracy	±1 % F.S
Repeatability	±1 % F.S
Response Time	60 sec (90% Saturation)
Temp. Compensation	Manual / Auto Temp. Comp. (RTD Pt 1000Ω)
Power Consumption	Approx. 5 VA
Enclosure Material	Case – Steel Front – ABS Keypad – Membrane
Dimensions	96(W) × 96(H) × 110(D) mm
Panel Cut Size	92(W) × 92(H) mm
Installation Method	Panel Front Mount
Weight	Approx. 500 g

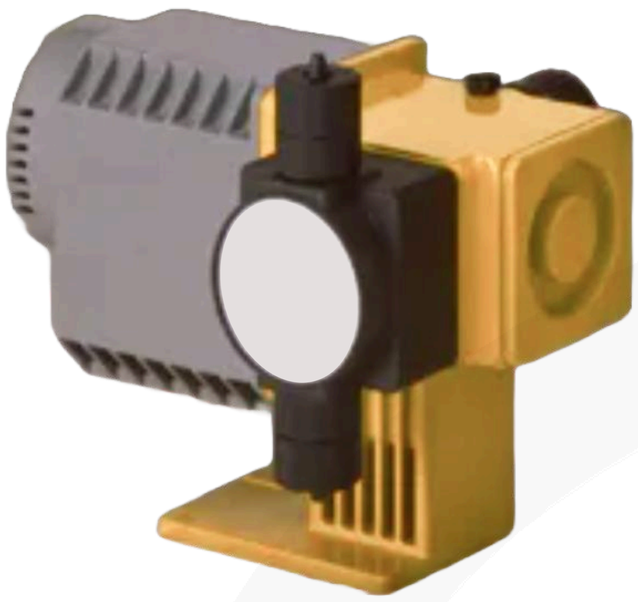
Sensor

- ▢ Model: KR-100
- ▢ Measurement Method: Reagent-free measurement using galvanic electrode method
- ▢ Measurement Range: 0~1, 0~2, 0~5, 0~10 ppm
- ▢ Electrodes: Pt(+), Ag · AgCl(–)
- ▢ Measurement Conditions: 0~40°C · pH 6~8
- ▢ Transmission Cable: 5m
- ▢ Temperature Compensation: None

Holder

- ▢ Model: KRH-100
- ▢ Flow Rate: 0.5~1 L
- ▢ Pressure: IN 3 kg · f/cm², OUT atmospheric open
- ▢ Mounting: Indoor wall mounting
- ▢ Additional Function: Supports pH and ORP electrode installation

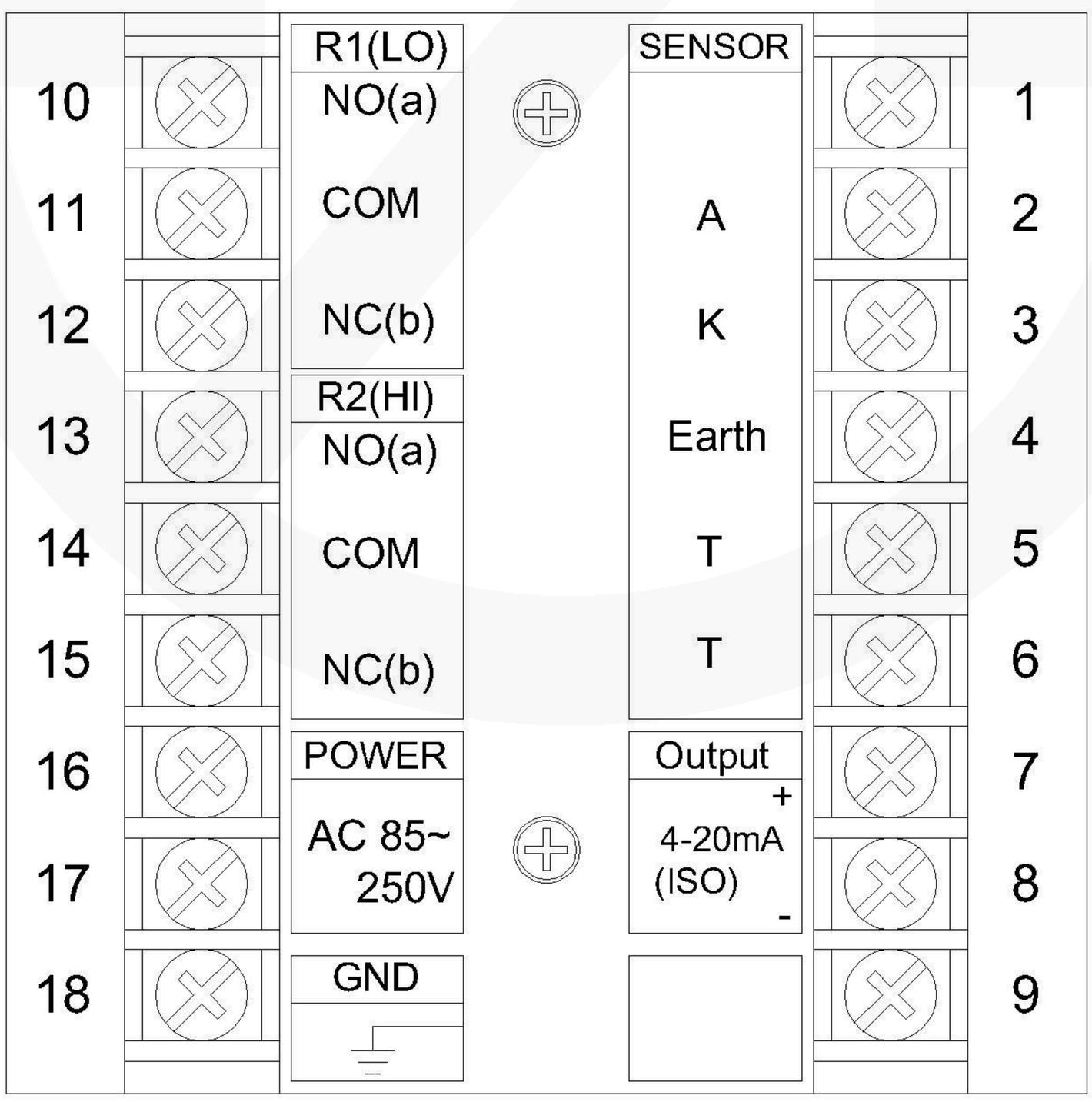
◇ Metering Pump



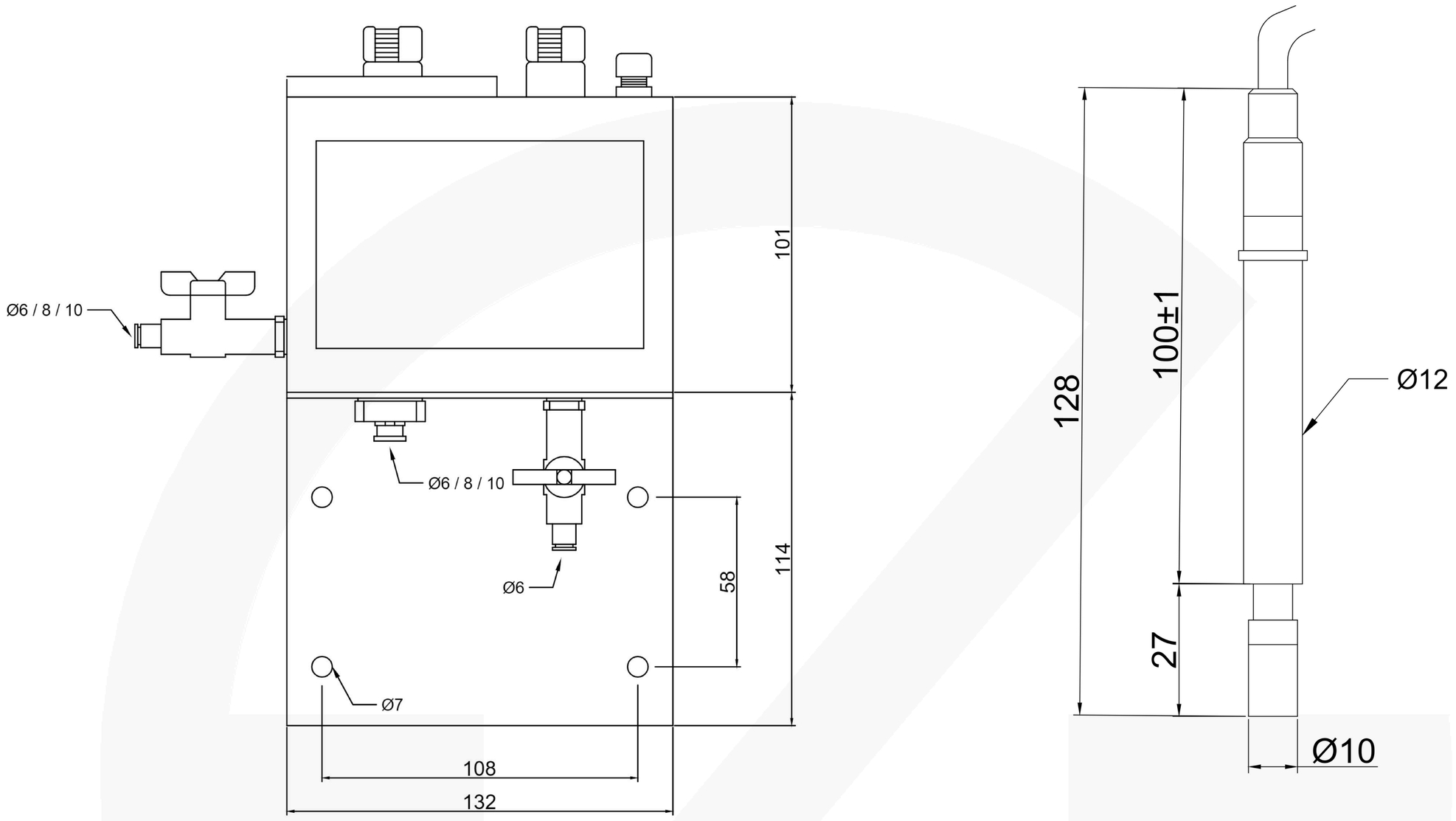
Specifications

Item	Specification	
Function	ON/OFF Pump	Proportional Pump
Model	AK-, TNX-	DL-LIS
Input	-	DC 4–20mA
Power	AC 220V, 60Hz	AC 220V, 60Hz
Capacity	30 cc/min	60 cc/min
	60 cc/min	83 cc/min
	150 cc/min	150 cc/min
	300 cc/min	300 cc/min

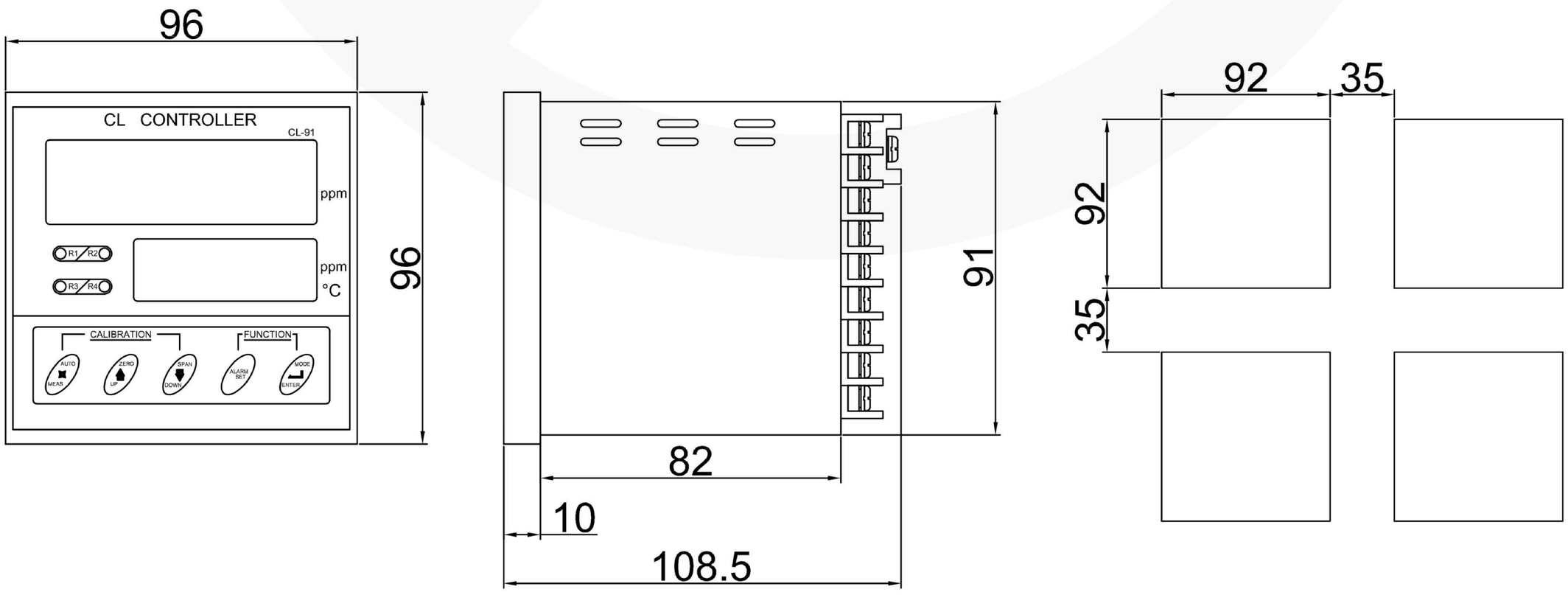
◇ Terminal Board



◇ Sensor & Holder Dimension



◇ Controller Dimension



◇ Residual Chlorine Electrodes: KR-100

Model: KR-100

Measurement Method: Reagent-free measurement using galvanic electrode method

Measurement Range: 0 ~ 10 mg/l (ppm) & custom specification

Electrode Materials:
- Outer Body: CPVC
- Measuring Part: Anode – Gold, Cathode – Platinum
  (+ : Pt / – : Ag·AgCl)

Measurement Conditions:
- Temperature: 0 ~ 40°C
- pH: 6 ~ 8
- Pressure: 0 ~ 1 Kg/cm²

Sample Flow Rate Range: 0.5 ~ 1 L/min (※ Flow rate must be stable)

Transmission Cable: 5 m

Temperature Compensation: Optional (RTD pt 1000 ohm)

◇ Installation Example: Custom-Built Control System Panel

Sensory's control system panel is a custom-built box designed to integrate various controllers such as pH, Cl, ORP, DO, and more.
The enclosure size and components are flexibly configured according to the installation environment and user requirements.
Upon customer request, both pH and Residual Chlorine (CL) controllers can be installed simultaneously.

- **Compatible with all Sensory models: CL-9N, PH-1N, EC-4N, PH-1, PH-11, ORP-5, CL-9, etc.**
- **Panel size and internal layout are adjustable depending on installation space, control targets, and number of sensors**
- **Pre-wired and ready for use: internal wiring and terminal block configuration minimize on-site installation time**
- **Equipped with manual/automatic switch and valve control function**
- **Optional support for multi-display extension available**

This product can be applied to various industrial sites such as factories, water treatment facilities, and wastewater systems,
and is manufactured to suit each customer's operating environment.

※ Detailed specifications are finalized based on design consultation. Delivery time and optional features are available upon request.

Example Model: PH CONTROL SYSTEM, CL & PH CONTROL SYSTEM

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Manual

RESIDUAL CHLORINE Controller

Operating & Instruction Manual

CL-91

Sensory

Table of Contents

Residual Chlorine Controller CL-91

Thank you for purchasing this product.
The CL-91 has passed through strict quality assurance and inspection procedures prior to shipment.
Before use, please check the external condition and included accessories once again, and read this manual thoroughly to understand the basic functions and operation methods.
If you have any questions during use, please contact your distributor or our company.

1. Features

This is a high-performance controller equipped with a built-in microprocessor.
It offers easy calibration and highly accurate control, functioning as a super digital indicating controller.

1-1. Multi-functional High-performance CPU
- Equipped with a microprocessor for high data reliability.
- Designed for easy operation with one-touch setup.

1-2. Versatile Output Signals
- Provides signal and alarm outputs required for water quality TMS.

1-3. Display of Measurement and Parameter Settings
- Uses a 3-digit display for easy reading of concentration values.
- Messages are shown during setup for simple operation.

1-4. Direct Connection to PC and Data Logger (OPTION)
- Supports isolated DC 4–20 mA output → enables stable data transmission.

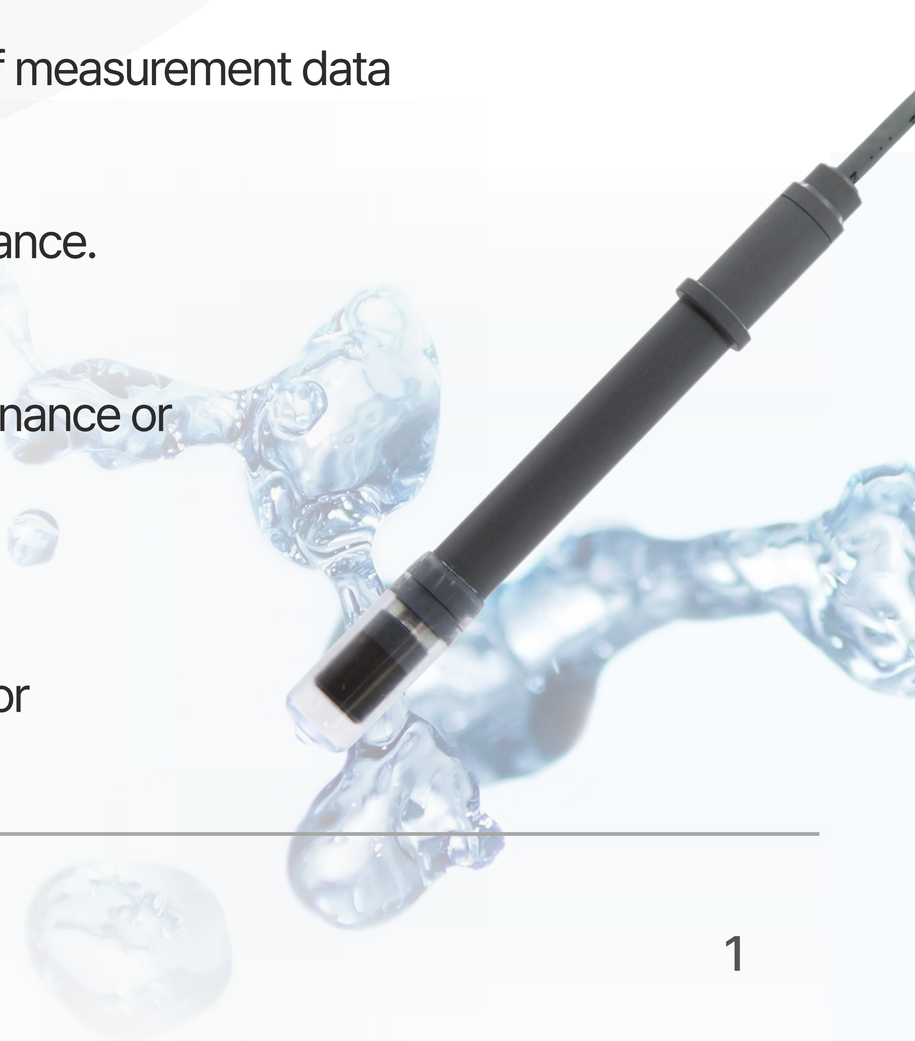
1-5. High/Low Alarm and Control Functions
- High and Low alarms can be configured
  → applicable to a wide range of control environments such as wastewater treatment.
- Built-in sensitivity (S.A) and SHIFT functions → allows precise control under any condition.

1-6. Built-in Automatic Temperature Compensation (ATC)
- Includes ATC functionality → ensures high accuracy and repeatability of measurement data

1-7. DIN 96 × 96 Standard Size
- Simple structure with DIN 96 × 96 size → easy installation and maintenance.

1-8. Built-in AC Power Switch
- Equipped with power switch → allows ON/OFF operation during maintenance or servicing to protect the instrument.

1-9. Memory Backup Function
- Saves all setting and calibration values even when powered OFF.
- Upon power recovery, the system resumes with the previous settings for continuous measurement and control.



2. Specification

2-1. CR CONTROLLER

Item	Specification
Product Name	DIN96 Panel-Mount Residual Chlorine Auto Analyzer
Model	CL-91
Measuring Range	0~1.00 / 2.00 / 5.00 ppm & Custom Range (Option)
Option Note	Low concentration measurement range: 0.000~1.000 ppm (Option)
P-Con	Residual chlorine proportional control (Option)
Display	7-Segment 8 Digit
Display Unit	Residual Chlorine (RC): 0.01 ppm
Operating Temperature	-5 ~ 40 °C
Power Supply	AC 85 ~ 250V, 50/60Hz
Signal Output	Isolated 4~20mA DC (Max. Load 750 ohms)
Relay Output	2 Relay OR 4 Relay (Option) SPDT AC 250V 3A Max.
Communication Output	RS-485 (MODBUS RTU) – Optional
Ambient Conditions	Storage Temp: -20 ~ 60 °C Operating Humidity: 0 to 95%, Non-condensing
Accuracy	±1 % F.S
Repeatability	±1 % F.S
Response Time	60 sec (90% Saturation)
Temp. Compensation	Manual / Auto Temp. Comp. (RTD Pt 1000Ω)
Power Consumption	Approx. 5 VA
Enclosure Material	Case – Steel Front – ABS Keypad – Membrane
Dimensions	96(W) × 96(H) × 110(D) mm
Panel Cut Size	92(W) × 92(H) mm
Installation Method	Panel Front Mount
Weight	Approx. 500 g

2-2. Measurement Method and Conditions

- Measurement Method: Reagent-free measurement using galvanic electrode method
- Measurement Conditions:
  Sampling Flow Rate – Minimum 500 CC ~ 1,000 CC
  pH Range – 6 to 8
  Temperature Range – 0 to 40 °C

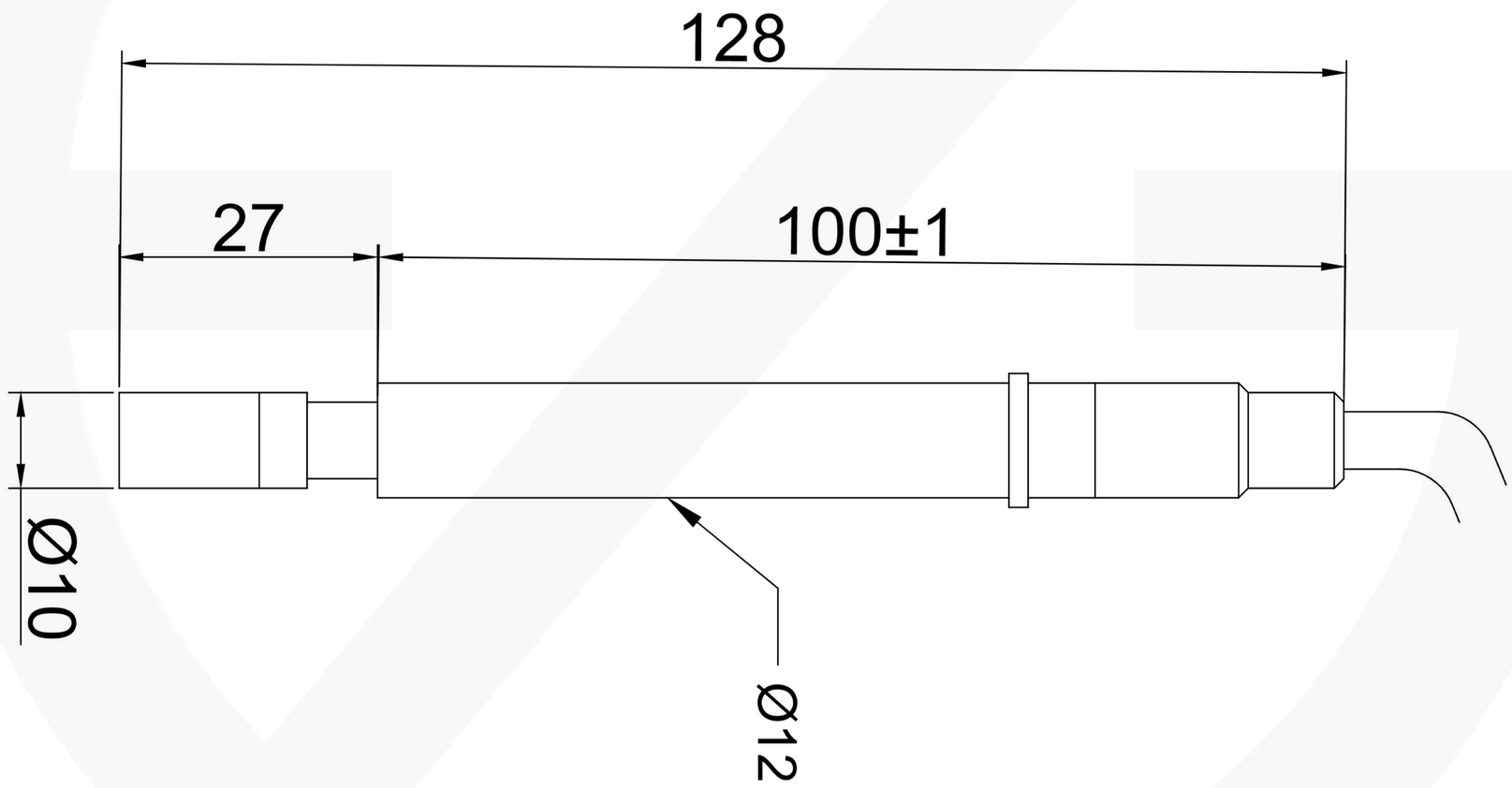
2-3. Transmission Cable

- Connects the controller and relay box using a dedicated CL-series transmission cable
- Standard cable length: 5 m
- Maximum extension length: 20 m

2-4. Relay Box

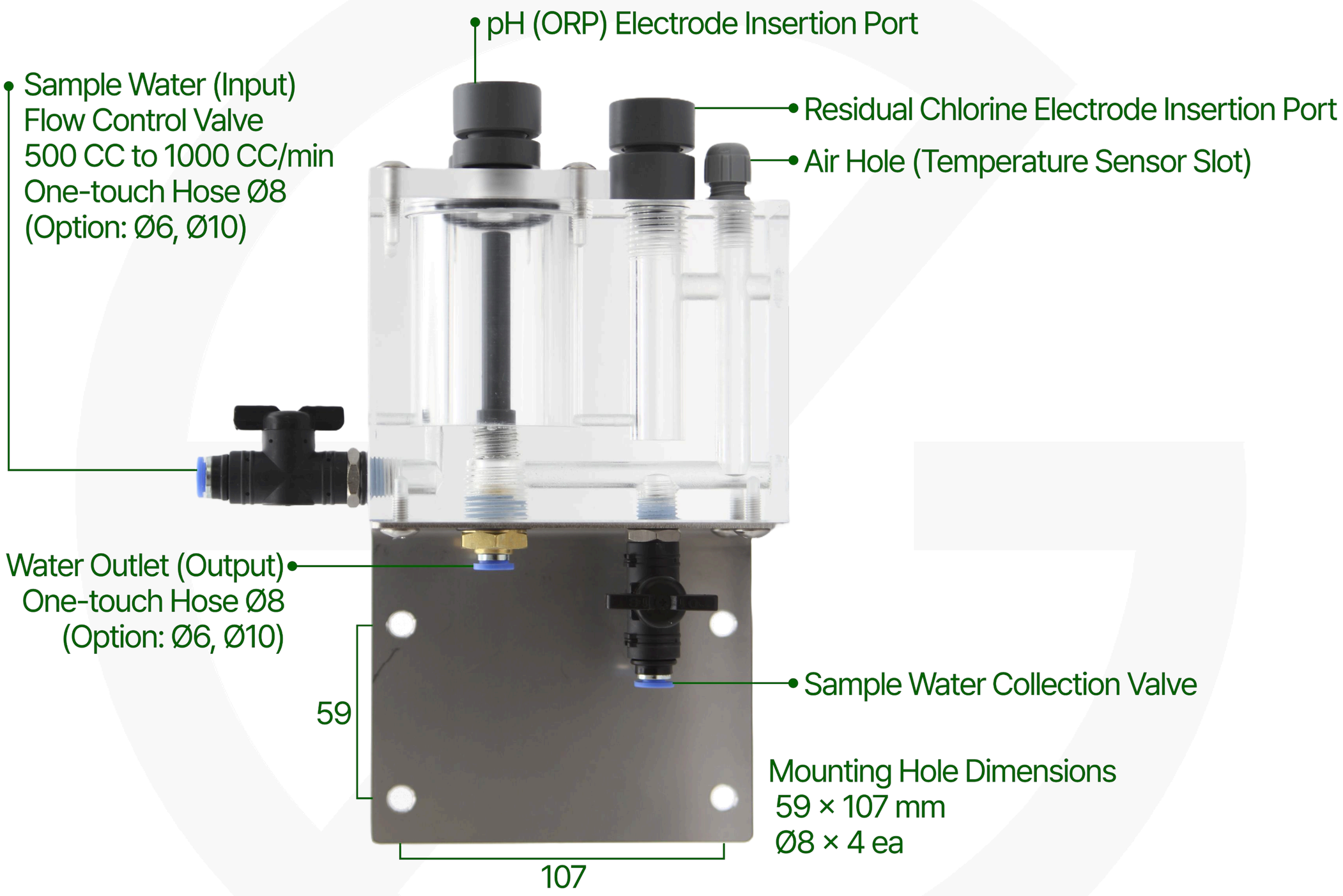
- Used when the distance between the controller and electrode holder exceeds 4 m
- Install the relay box near the electrode holder and connect to the controller using the dedicated cable

2-5. CL Electrode (Chlorine Electrode)



Item	Specification
MODEL	KR-100
Operating Temperature	0 ~ 40°C
Type	Galvanic Electrode Type (Non-Amperometric)
Temperature Compensation	Not available (Optional feature. Please contact us before connecting to main unit)

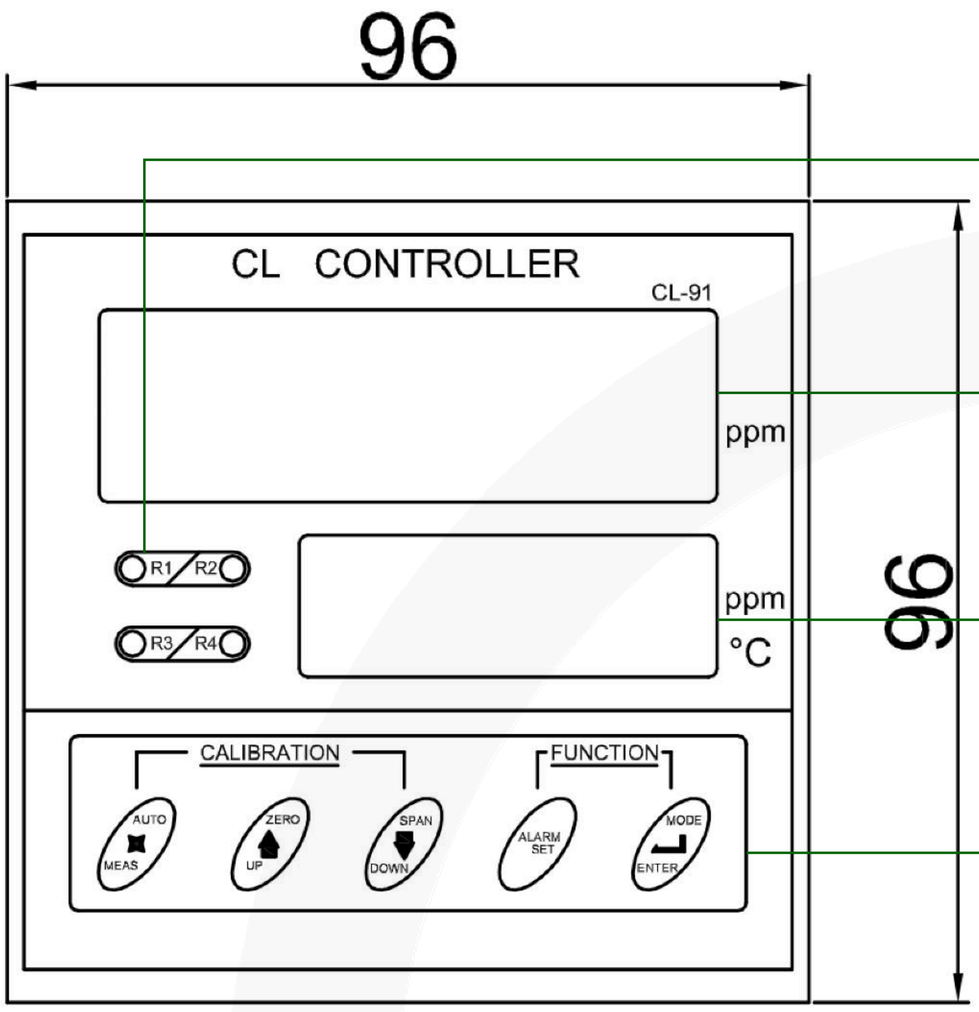
2-6. HOLDER



Item	Specification
MODEL	KRH-100
Flow Rate	0.5 ~ 1ℓ
Pressure	IN: 3kg.f/cm² / OUT: Open Drain
Installation Location	Mounted on indoor wall
Additional Function	Compatible with pH and ORP electrode installation

3. Part Names and Functions

3-1. Front Panel Layout



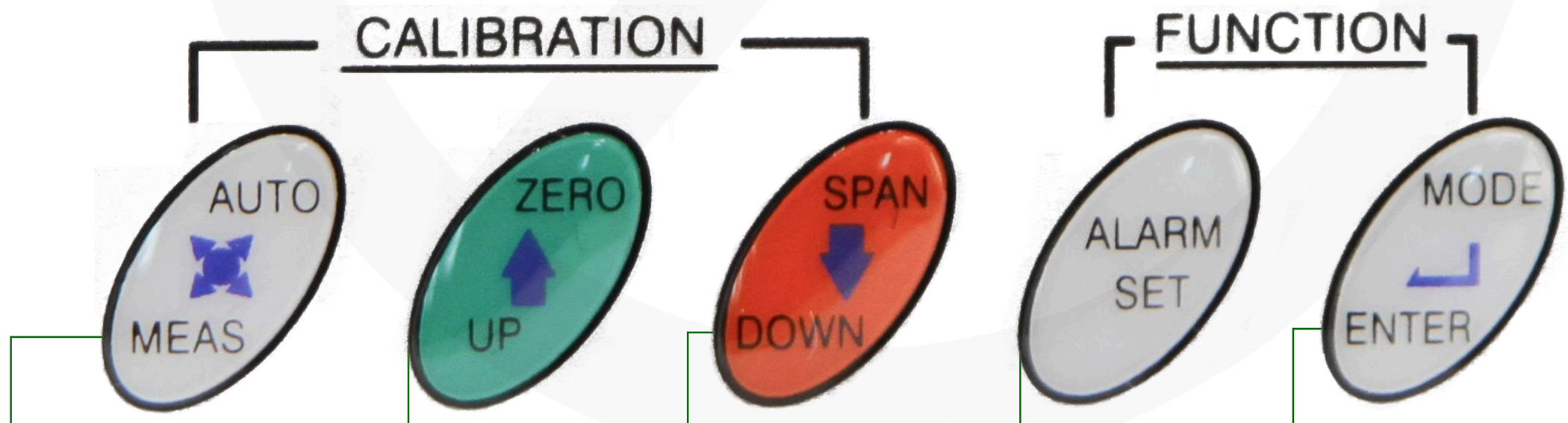
1. **Alarm Point Indicator LED**
   Lights up when an alarm point is reached.

2. **PV (Process Value) Display**
   Displays the current measured value in ppm.

3. **Temperature & Setting Indicator Display**
   Displays reference information such as the set temperature.

4. **Set-Key Group Switch**
   Keys used for mode change and parameter configuration.

3-2. Key Switch Function Description



1. **MEAS.**
   Manual calibration key and ESC function

2. **ZERO-Up**
   Increases the set point value

3. **SPAN-Down**
   Decreases the set point value

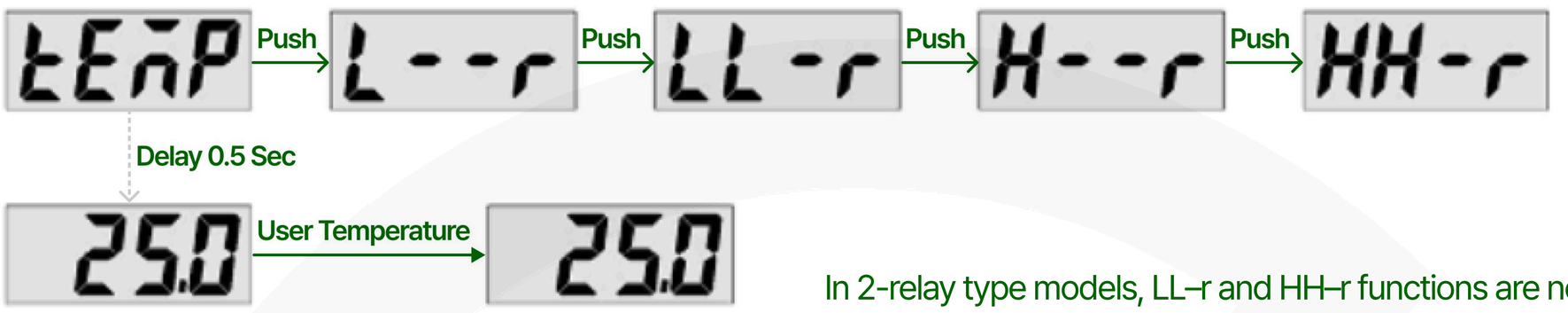
4. **Alarm-Set**
   Enters the alarm setting menu and changes alarm point

5. **Mode-Enter**
   Enters internal menu and stores configuration

4. Operating Instructions

4-1. How to Change the Auxiliary Display

By pressing the left SLP Push Button Switch, the auxiliary display changes as shown below.
The default display mode is set to temperature display.

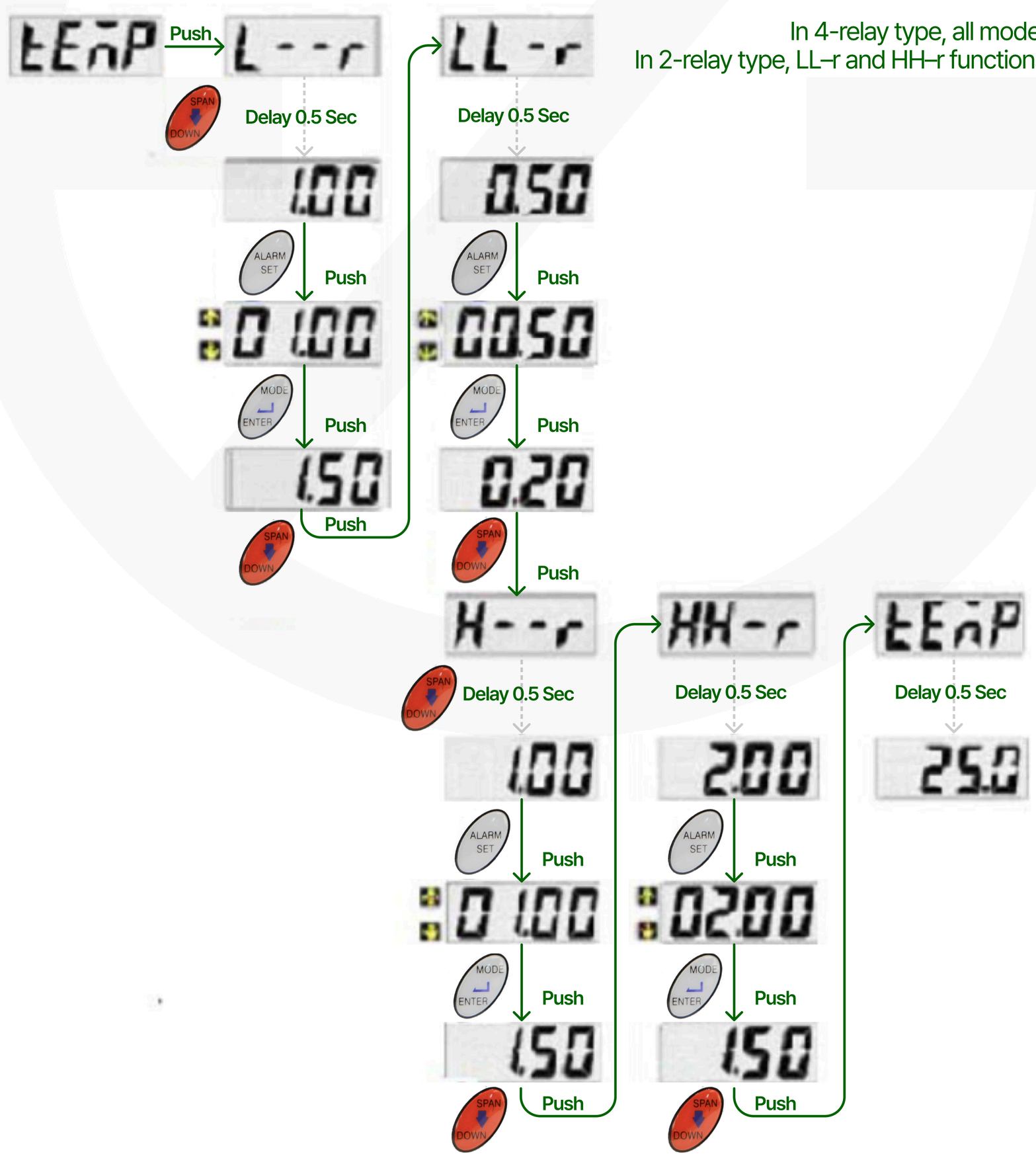


In 2-relay type models, LL–r and HH–r functions are not available.

4-2. How to Set Alarm Control Set Points

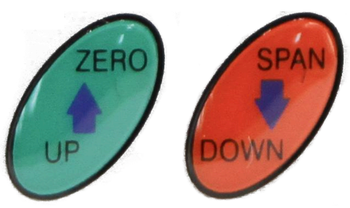
Following the display change method from 4-1, press to enter each set point mode such as L–r, and adjust the values accordingly. Setting and saving is done through the Flow-Chart shown below.

4-RELAY TYPE Flow-Chart



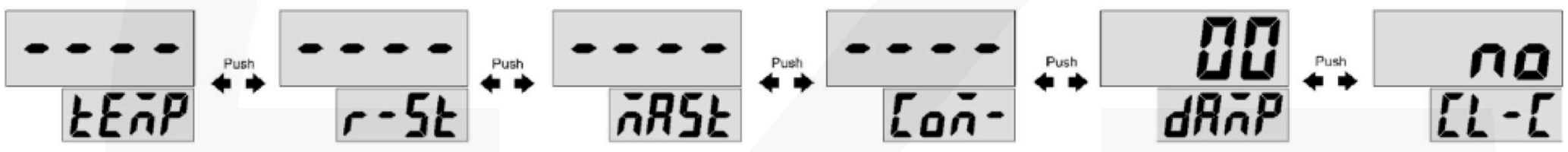
4-3. SV Mode Description and Configuration

The internal mode (SV MODE) allows you to configure and save settings such as temperature compensation sensor type, relay time-proportional output, and cleaning output.
To enter SV Mode, press and hold the Push Button Switch shown on the left for 1 second.



After entering SV Mode, use the Push Button Switches shown on the left to navigate through the menu and to increase or decrease values.

To return from SV Mode to PV Mode, use the Push Button Switch shown on the left.



4-4. SV Mode Item Descriptions

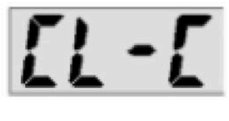
Temperature Compensation Setting Mode

Relay Output Setting Mode

Analog Output (Current) Setting Mode

RS-485 Communication Setting Mode

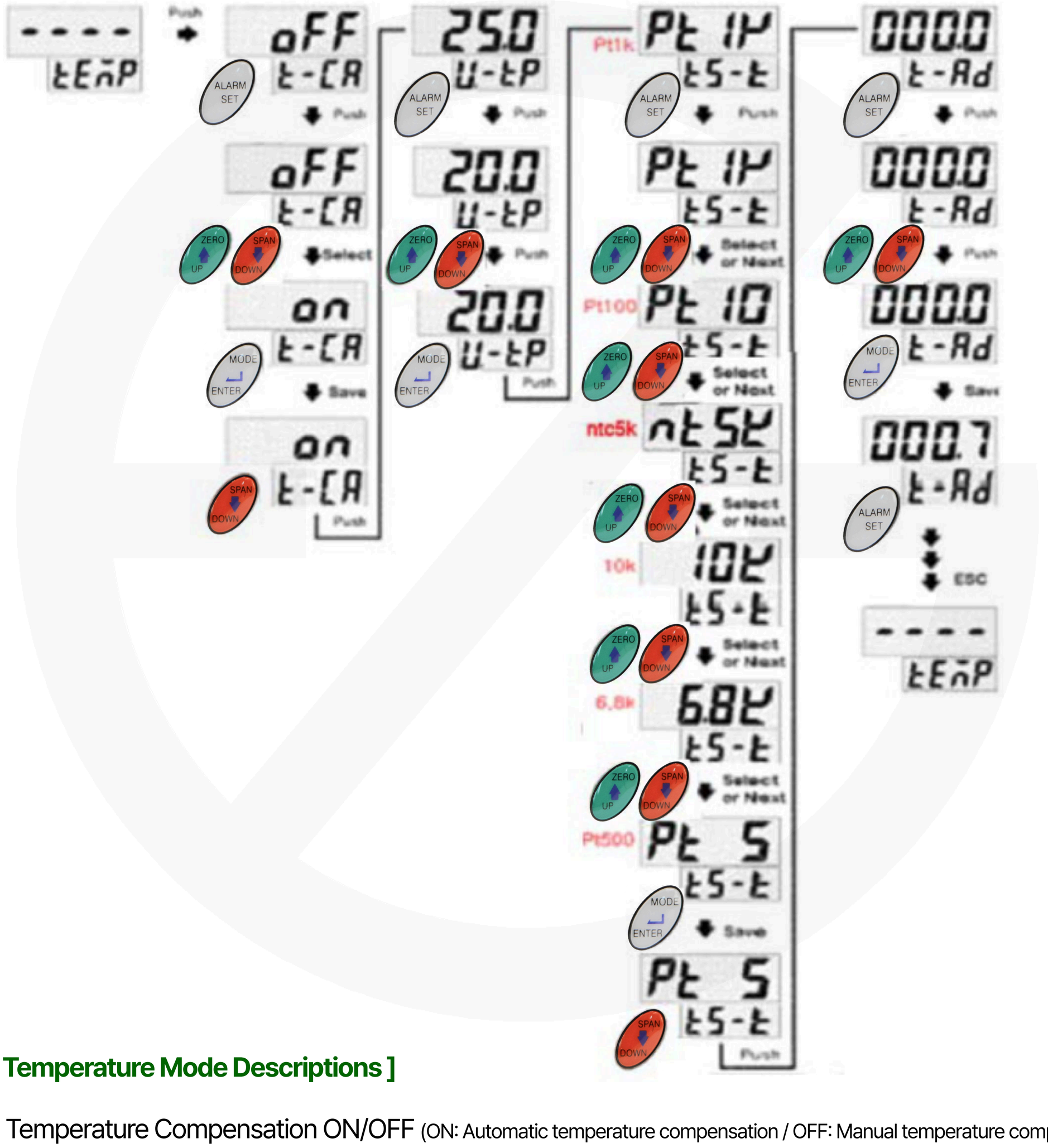
Damping (Anti-Fluctuation) Function Mode



Auto Calibration Initialization Setting Mode

4-5. Internal Temperature Mode Settings

Enter the temperature setting mode (tEnP) using the same method described in section 4-3.
To change or save settings, follow the chart below to configure the temperature type setting mode (used for temperature offset compensation).

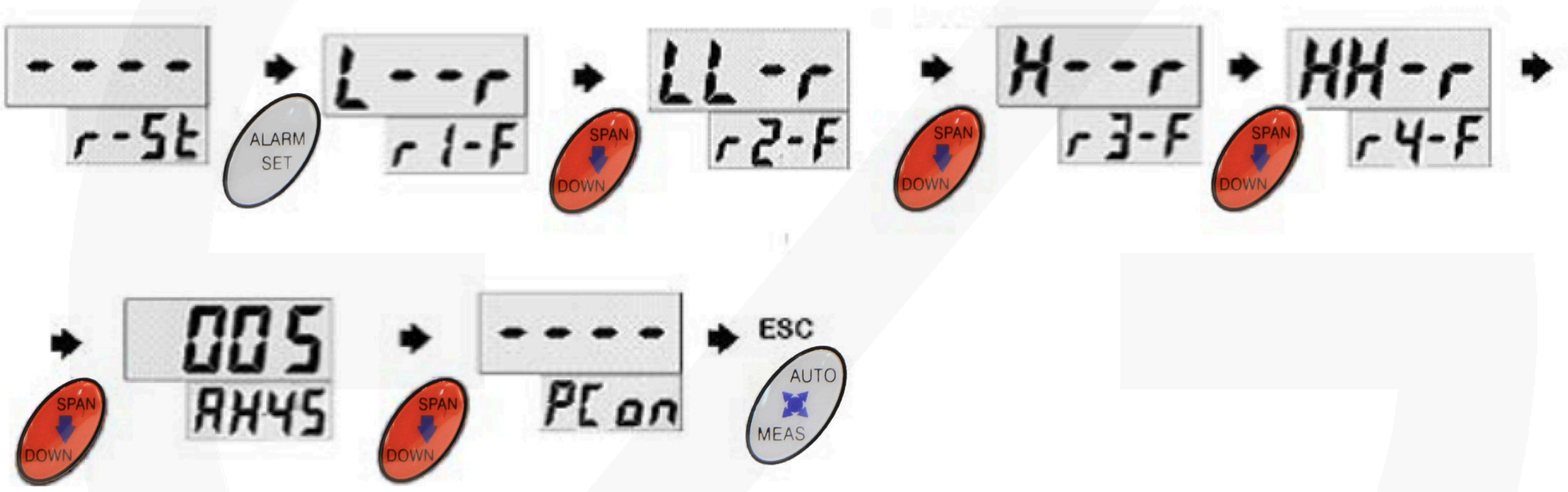


[Internal Temperature Mode Descriptions]

t-CA	Temperature Compensation ON/OFF (ON: Automatic temperature compensation / OFF: Manual temperature compensation)
U-tP	User Temperature Setting (Default: 25.0°C at shipment)
tS-t	Temperature Sensor Type Selection (Pt 1kΩ, Pt 100Ω, 10k, NTC 5k, 6.8k, Pt 500Ω)
t-Ad	Temperature Sensor Calibration

4-6. Internal Relay Attribute Settings

Enter the relay setting mode (r-St) using the same method described in section 4-3.
To access the mode below r-St, use the Push Button Switch shown on the left to enter internal mode.
Setting changes and saving are performed according to the flow chart below.

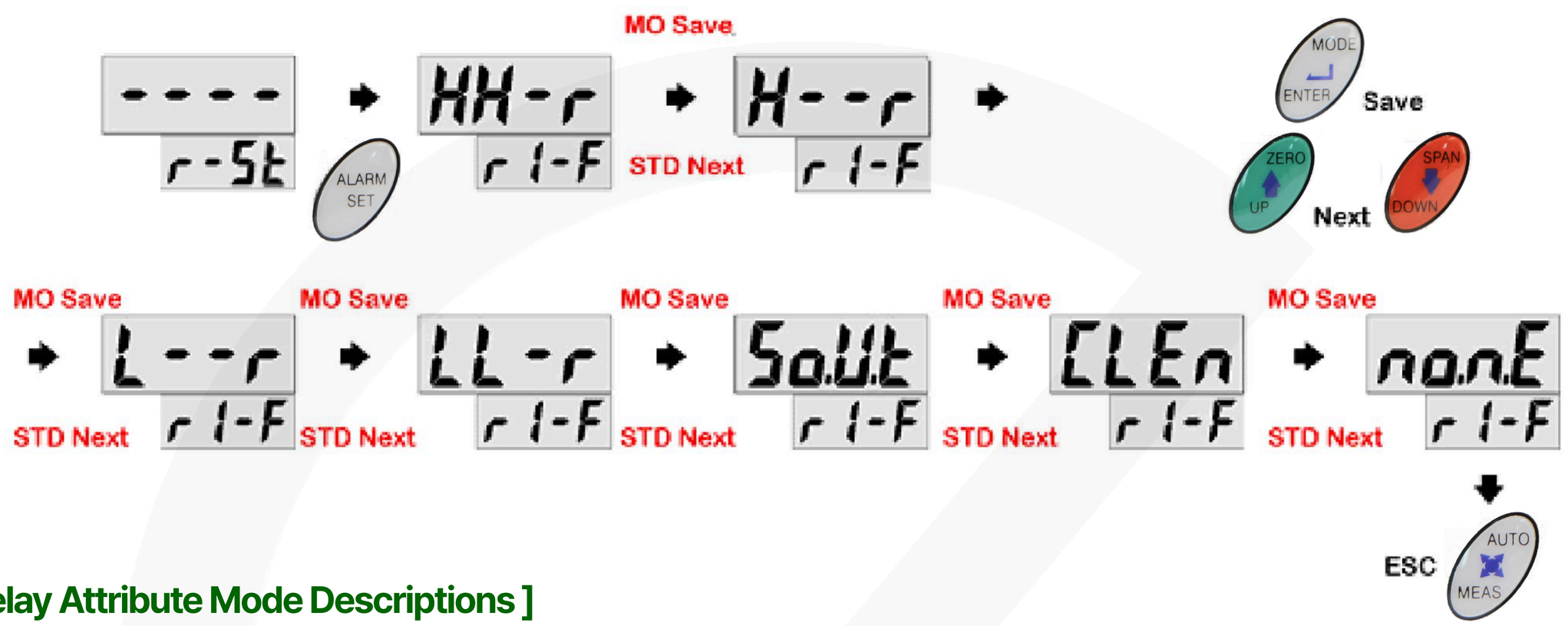


[Internal Relay Attribute Mode Descriptions]

r1-F	Relay 1 MODE setting function
r2-F	Relay 2 MODE setting function
r3-F	Relay 3 MODE setting function
r4-F	Relay 4 MODE setting function
AHYS	Alarm ON/OFF and sensitivity bandwidth setting
PCon	Time-proportional output setting function

4-7. 릴레이 기능 설정

Setting changes and saving are performed according to the flow chart below.
(Since the configuration method is identical for all relays, Relay 1 is used here as an example.)



[Relay Attribute Mode Descriptions]

HH-r	High High Relay function setting
H--r	High Relay function setting
L--r	Low Relay function setting
LL--r	Low Low Relay function setting
SoUt	Time-proportional output function mode setting
CLEn	Use as Cleaner Relay
nonE	Do not use contact (Contact disabled)

***4 RELAY TYPE Default Configuration**

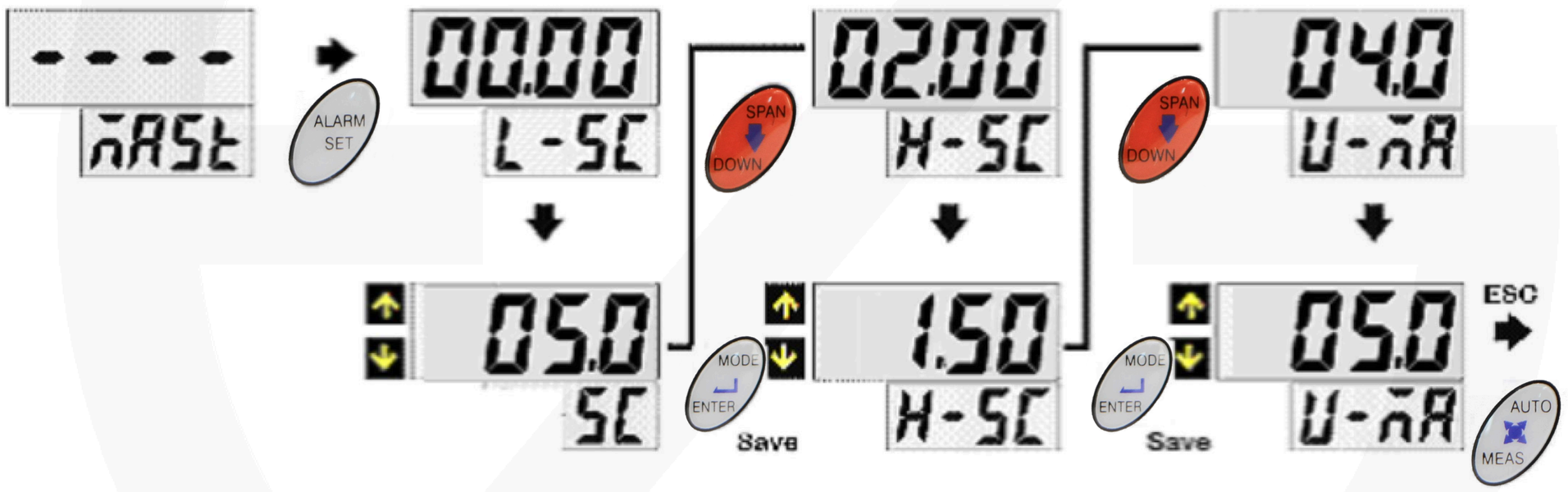
Relay 1 L - RELAY
Relay 2 L – RELAY
Relay 3 H - RELAY
Relay 4 H H – RELAY

***2 RELAY TYPE Default Configuration**

Relay 1 L- RELAY
Relay 2 H – RELAY
Relay 3 NONE
Relay 4 NONE

4-8. Current Output Range Scale Setting

Enter the mASt Scale setting mode using the same method described in section 4-3.
To enter mASt mode, use the Push Button Switch shown on the left to access internal mode.
Setting changes and saving are performed according to the flow chart below.

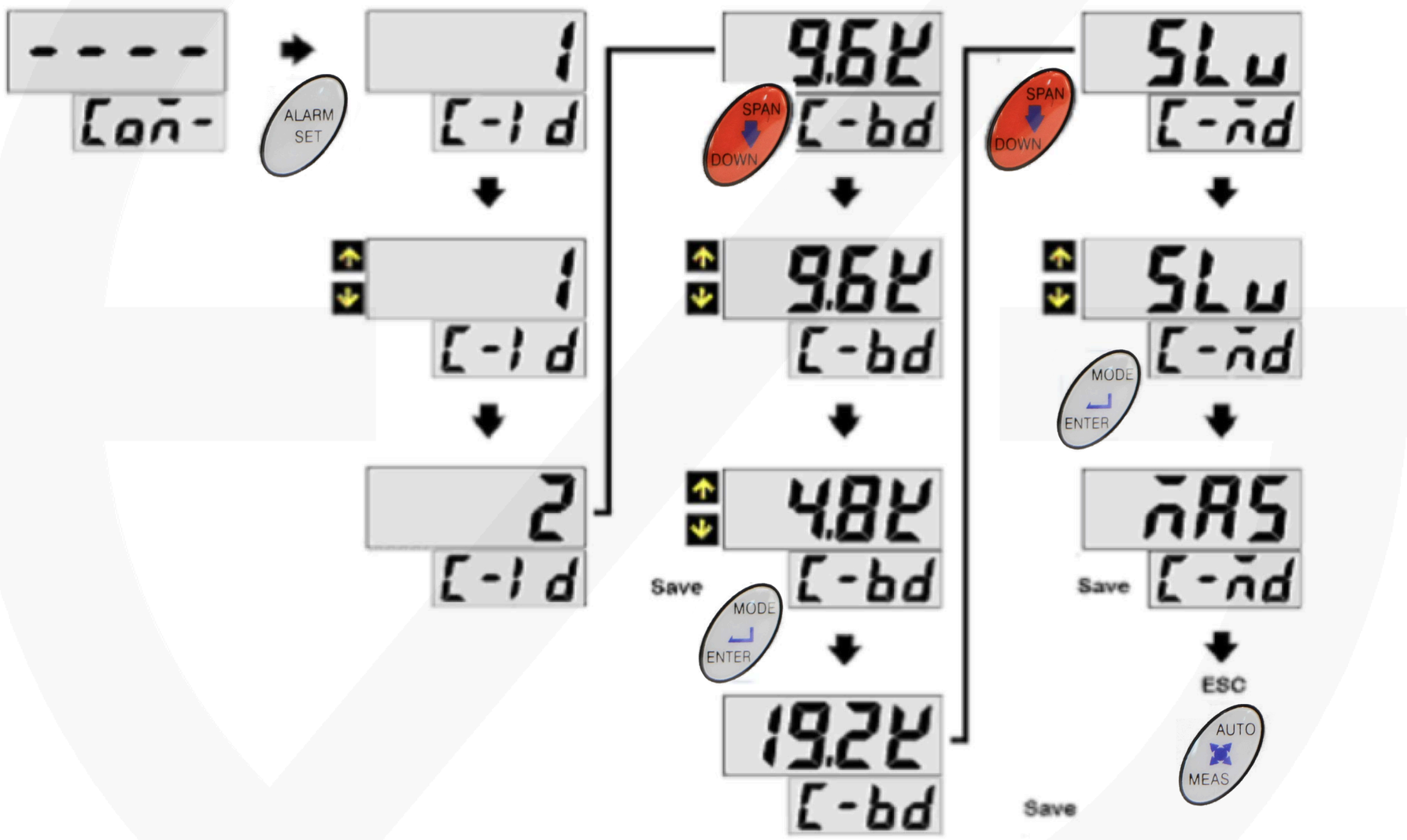


[Range Scale Mode Descriptions]

L-SC	Set the lower measurement range
H-SC	Set the upper measurement range
U-mA	Function for generating current output arbitrarily to check output status (Output is generated while the numbers are flashing between 3.0 mA ~ 20.0 mA)

4-9. Communication Attribute Settings

Enter the communication setting mode (Com-) using the same method described in section 4-3.
To access modes under Com-, use the Push Button Switch shown on the left to enter internal mode.
Setting changes and saving are performed according to the flow chart below.



[Internal Communication Mode Descriptions]

C-1 d	RS-485 communication device address setting function (0–9)
C-bd	RS-485 communication baud rate setting function (4800–19200)
C-md	SLAVE: Sends data when indicator is requested during RS-485 communication MASTER: Sends data continuously without request during RS-485 communication

4-10. Damping Setting

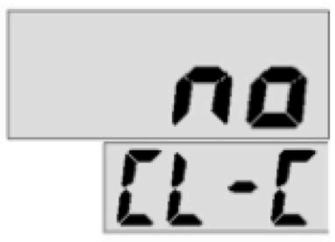
Enter the dAmP damping setting mode using the same method described in section 4-3.
To access modes under dAmP, use the Push Button Switch shown on the left to enter internal mode.

Follow the same method as described in the previous flow chart to increase/decrease data, modify, and save.
The damping function is used to select the display cycle for input signals received from the sensor, acting as a snubber for unwanted rapid fluctuations in the signal.

* Snubber: A function to eliminate noise or unwanted sharp variations in measured signals.

4-11. Auto Calibration Reset Mode Setting

Enter the CL-C auto calibration reset mode using the same method described in section 4-3.
To access modes under CL-C, use the Push Button Switch shown on the left to enter internal mode.



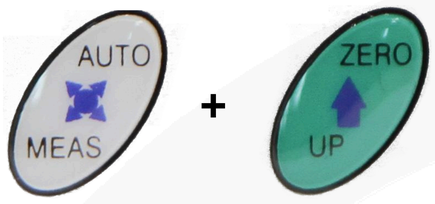
Follow the same method as the previous flow chart and toggle the display on/off to modify and save the setting.

5. Calibration Method

Manual calibration allows the user to input and save reference values measured by reagent test kits.
ZERO calibration is disabled in automatic calibration mode as it is not required.

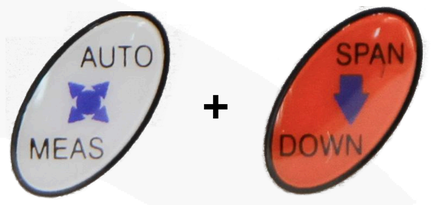
5-1. Manual Calibration

ZERO CALIBRATION



Enter ZERO calibration mode through key combination.

SPAN CALIBRATION



Enter SPAN calibration mode through key combination.

Manual calibration mode can be accessed using the key combinations as shown above,
and should be performed according to the sequence in the flow chart below.

- **ZERO Calibration**

ZERO calibration must be performed with the sensor removed from the holder and exposed to ambient air.

If an ERROR message is displayed, it indicates that the measurement range is significantly exceeded.
In this case, inspect the CR sensor.

- **SPAN Calibration**

To perform SPAN calibration, prepare a DPD chlorine test kit.
(For best results, calibrate with a sample water concentration of 0.5 ppm or higher.)

If an ERROR message is displayed, it indicates that the measurement range is significantly exceeded.
In this case, inspect the CR sensor.

5-2. Residual Chlorine Meter Calibration Method (Quick Calibration)

- **Manual Calibration (ZERO Calibration)**

Remove the electrode from the residual chlorine holder and dry it in ambient air.

Press the AUTO MEAS + ZERO UP keys simultaneously and "ZERO" will be displayed, then the numbers will start blinking.

At this time, use the ZERO UP SPAN DOWN (Up, Down) keys to input 0.00, then press MODE ENTER to complete ZERO calibration.

- **Manual Calibration (SPAN Calibration)**

Insert the electrode into the residual chlorine holder and wait for about 15–20 minutes.

Then, using a colorimeter or another measuring device, open the sample water valve and check the chlorine value.

When it reads above 0.4–0.5 ppm, perform SPAN calibration.

Press the SPAN DOWN + AUTO MEAS keys simultaneously and "SPAn" will be displayed, then the numbers will start blinking.

At this time, use the ZERO UP SPAN DOWN (Up, Down) keys to input the SPAN value, then press MODE ENTER to complete SPAN calibration.

5-3. Input Method for Residual Chlorine Control Values (Quick Setting Method)

Each time you press the SPAN DOWN key, it cycles through: temp , L--r , H--r

↓ ↓ ↓

Example) 25.0, 0.40, 0.60

°C, ppm, ppm

- **LOW Setpoint Input Method**

Press the SPAN DOWN key until L--r appears and a number is displayed, then press ALARM SET.

When the setpoint value blinks, use the ZERO UP SPAN DOWN (Up, Down) keys to enter the value, then press MODE ENTER to confirm.

- **HIGH Setpoint Input Method**

Press the SPAN DOWN key until H--r appears and a number is displayed, then press ALARM SET.

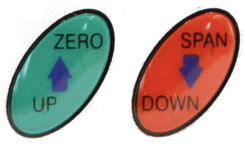
When the setpoint value blinks, use the ZERO UP SPAN DOWN (Up, Down) keys to enter the value, then press MODE ENTER to confirm.

5-4. Relay Sensitivity Range Setting Method

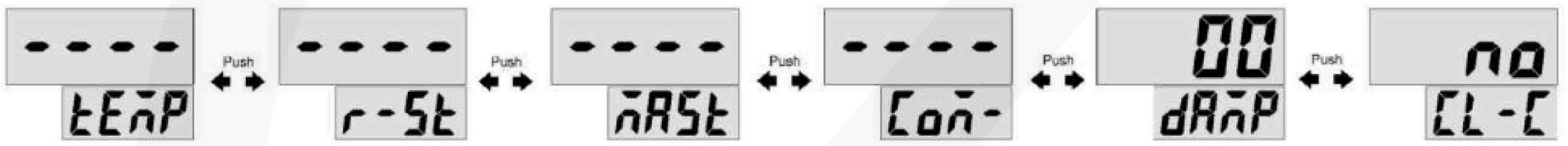
[Caution] The internal mode (SV Mode) contains internal programming for configuring temperature compensation sensor type, relay time-proportional output, cleaning output, etc. Do not alter settings unrelated to intended functions.

- **How to Enter Relay Sensitivity Setting Mode**

Press and hold the Push Button Switch for 5 seconds to enter.



After entering internal mode, you can navigate through the menu using the Push Button Switch shown on the left, and adjust values using the increase/decrease keys.



Temperature Compensation Setting | **Relay Output Setting** | **Analog Output (Current) Setting** | **RS-485 Communication Setting (Optional)** | **Anti-Fluctuation (Damping) Setting** | **Auto Calibration Reset Setting Mode**

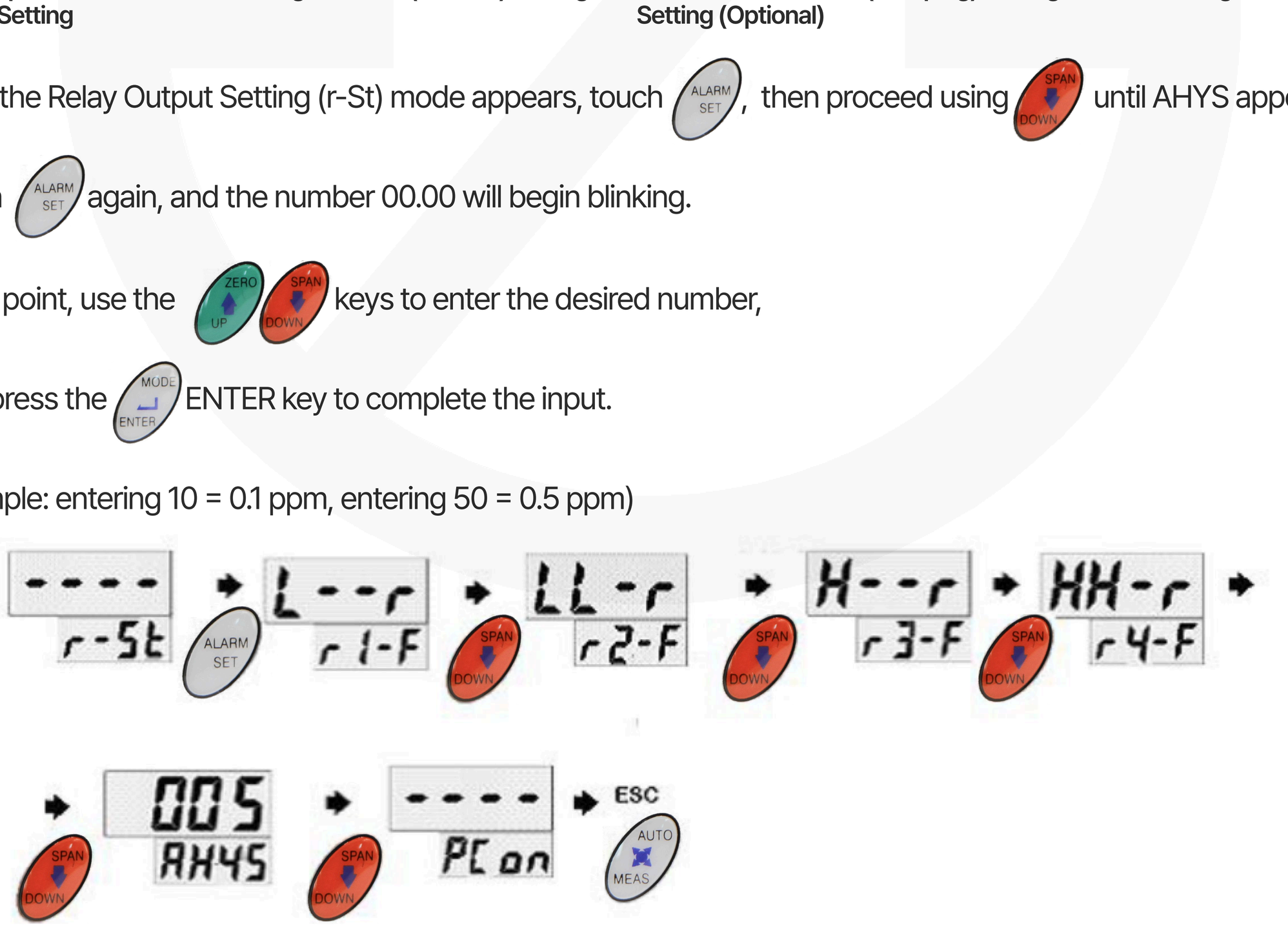
When the Relay Output Setting (r-St) mode appears, touch ALARM SET, then proceed using SPAN DOWN until AHYS appears.

Touch ALARM SET again, and the number 00.00 will begin blinking.

At this point, use the ZERO UP / SPAN DOWN keys to enter the desired number,

then press the MODE ENTER key to complete the input.

(Example: entering 10 = 0.1 ppm, entering 50 = 0.5 ppm)



To return to measurement mode after all inputs are complete, touch MEAS (AUTO) twice.

◇ Calibration Guide and Sensor Handling for Residual Chlorine Meter

1. Calibration Guide

- If calibration is performed too soon after installation, there may be significant error or deviation in the reading.
  After installation, be sure to adjust the inlet valve so that sample water flows steadily into the holder.
  (Recommended flow: 500–1000 CC/min, approximately 3 cups based on instant coffee paper cup size.)
- Inject an appropriate amount of hypochlorous acid (HOCl) into the pool or storage tank (at least 0.4–0.5 ppm),
  then open the sample valve on the holder and discard water 2–3 times before taking a colorimetric reading.
  If the colorimeter indicates 0.4–0.5 ppm, calibration can proceed.

1) ZERO Calibration

- Although the procedure outlined in the manual is ideal, it may not be practical to follow exactly at every site.
- Here is a simplified method:

a. Remove the residual chlorine sensor from the holder and gently remove any moisture.
   (Do not wipe with cloth or tissue – this may generate static electricity.)
b. With the sensor left exposed to air, turn the ZERO volume knob until the controller reads 0.00 ppm.
c. Reinsert the sensor into the holder to complete ZERO calibration.

2) SPAN Calibration – Important Notes

- Before performing SPAN calibration, it's important to wait for the sensor to stabilize.
  After ZERO calibration, keep the sensor inside the holder for 15–20 minutes to allow for complete electrochemical stabilization.
  Only after this period can accurate SPAN calibration be performed.

※ Installation Caution Example:

- In some cases, chlorine is added while alkaline or cement residues remain in the pool.
  If the pH is outside the allowable range of 6–8, residual chlorine values will be incorrect.
- For instance, if you calibrate SPAN when the chlorine level is only 0.2 ppm, the SPAN volume may be fully turned to one side.
  This is not a true calibration — it is merely a forced fit to an incorrect value.
  The SPAN calibration should be performed at 0.4–0.5 ppm or higher, as also stated in the manual.
- If SPAN is calibrated at 0.2 ppm and the pool stabilizes after a few days, the actual chlorine value will be inaccurate.
- Do not adjust the sensor sensitivity volume at the rear terminal of the meter during this state.
  Doing so will distort the original calibration. Avoid touching the sensitivity volume unless absolutely necessary.

SPAN Calibration Procedure:

a. After ZERO calibration, insert the sensor back into the holder and wait 15–20 minutes.
b. Open the sample water valve, discard water 2–3 times, and measure the chlorine level using a colorimeter.
c. Enter the chlorine value measured by the colorimeter into the controller to complete SPAN calibration.

2. Sensor Handling Guidelines

- The residual chlorine sensor consists of an anode (+) and a cathode (–).
  Excessive cleaning or physical impact may result in damage to the electrode.
- Rubbing the sensor may generate static electricity, which can cause it to momentarily lose functionality.

Cleaning Instructions:

- Use cleaning alcohol available at chemical supply stores.
- Submerge the sensor in alcohol until both anode and cathode are fully covered. Soak for 3–5 minutes.
- Gently swirl the sensor in the alcohol to remove foreign substances.
- Use a soft toothbrush (e.g., for children) to lightly clean the platinum surface.
  (Caution: Excessive force can detach or wear off the platinum layer, rendering the sensor unusable.)
- Rinse thoroughly with clean water, remove moisture, and verify that the reading shows 0.00 ppm.
- For further calibration, refer to the “Residual Chlorine Meter Calibration Guide” section.

3. Residual Chlorine Electrode Storage Guide

Equipment installed at outdoor pools or amusement facilities is often not used until summer.
In such cases, proper management of the chlorine meter and sensor is critical.

When storing the residual chlorine controller:

- It is not recommended to leave the power turned off for extended periods.
- The controller contains electronic components, and circuit drift may occur if power is completely disconnected.
- Internal parts such as the transformer generate slight heat to keep components dry and functional, so keeping the power ON is advised whenever possible.
- The front panel switch is especially vulnerable to moisture or gas exposure.
  If left unused in a damp environment, the buttons may fail due to corrosion or contact issues.
- If keeping the system powered ON is not feasible, separate the panel from the controller and store it in a dry, ventilated location.

When storing the residual chlorine sensor:

- Sensors are often stored either immersed in water or left dry, but both are suboptimal.
- The correct storage procedure is as follows:

a. Thoroughly clean the sensor using cleaning alcohol.
b. Short the A and K terminals.
c. Soak the sensor in a 100 ppm hypochlorous acid solution and seal it in a container for storage.

By following the above procedures for calibration, cleaning, and storage,
you can ensure high accuracy and long-term stability of your residual chlorine measurements.

◇ Terminal Board – 2 Relay Contact Type

- **2-Relay Contact Control Configuration**

R1 (LO) = Low relay contact

NO (a) = Normally Open contact
COM = Common
NC (b) = Normally Closed contact

R2 (HI) = High relay contact

NO (a) = Normally Open contact
COM = Common
NC (b) = Normally Closed contact

- **Residual Chlorine Sensor Wiring**

A = Terminal 2
K = Terminal 3
E = Terminal 4 (Earth/Ground)

Connect the sensor terminals A, K, and E
to the corresponding controller terminal markings:
A → A, K → K, E → Earth

◇ Terminal Board – 4 Relay Contact Type

- **4-Relay Contact Control Configuration**

R1 (L) = Low relay contact

NO (a) = Normally Open contact
COM = Common
NC (b) = Normally Closed contact

R2 (LL) = Low-Low relay contact

NO (a) = Normally Open contact
COM = Common
NC (b) = Normally Closed contact

R3 (H) = High relay contact

NO (a) = Normally Open contact
COM = Common
NC (b) = Normally Closed contact

R4 (HH) = High-High relay contact

NO (a) = Normally Open contact
COM = Common
NC (b) = Normally Closed contact

- **Residual Chlorine Sensor Wiring**

A = Terminal 2
K = Terminal 3
E = Terminal 4 (Earth/Ground)

Connect the sensor terminals A, K, and E
to the corresponding controller terminal markings:
A → A, K → K, E → Earth

◇ P-Con Type – Proportional Residual Chlorine Controller

- **Residual Chlorine Sensor Wiring**

A = Terminal 2
K = Terminal 3
E = Terminal 4 (Earth)

Connect sensor terminals A, K, and E
to the controller terminal board as labeled:
A → A, K → K, E → Earth

Proportional Control Output Terminals
- Terminal 25 = A+
- Terminal 26 = B–

Note:
RS-485 output is not available when using proportional control mode.
At the time of shipment:
Terminal 25 is labeled as P+,
Terminal 26 is labeled as P–.

6. Installation and Wiring

6-1. Installation Environment
Install the device in locations that meet the following conditions:

6-1-1. Well-ventilated area
Ambient temperature between –5 °C and 40 °C

6-1-2. Area with minimal heat
Avoid direct sunlight and high radiant heat sources

6-1-3. Area with low humidity
Install in environments with ambient humidity below 85%

6-1-4. Area with minimal mechanical vibration

6-1-5. Area with easy access for maintenance and wiring

6-1-6. Area free from dust, corrosive gas, or electromagnetic interference

6-2. Installation Method

6-2-1.
This instrument is designed for panel-type installation.
Refer to the PANEL CUTTING diagram for installation dimensions.

6-2-2.
Insert the mounting brackets into the mounting holes located on the top and bottom of the case, then tighten them by turning the Phillips screwdriver to the right.

6-3. Electrode Cable Connection
Avoid damage or contamination of the cable and terminal block with water, oil, or heat.
Contamination may lower insulation resistance and cause unstable readings.
Always keep the cable and terminal area clean and dry.

6-3-1.
The standard electrode cable length is 5 meters.
If extension is required, use the dedicated extension cable and relay box.
The maximum extension length is 20 meters.

6-3-2.
Install the electrode cable away from areas subject to induced voltage, vibration, static electricity, or high voltage.

6-3-3.
Keep the cable away from machines or motor power lines that generate induction.

- **A : ANODE**
- **K : CATHODE**
- **E : Shield**
- **T.T : NO CONNECTION**

※ Refer to the terminal wiring diagram for details.

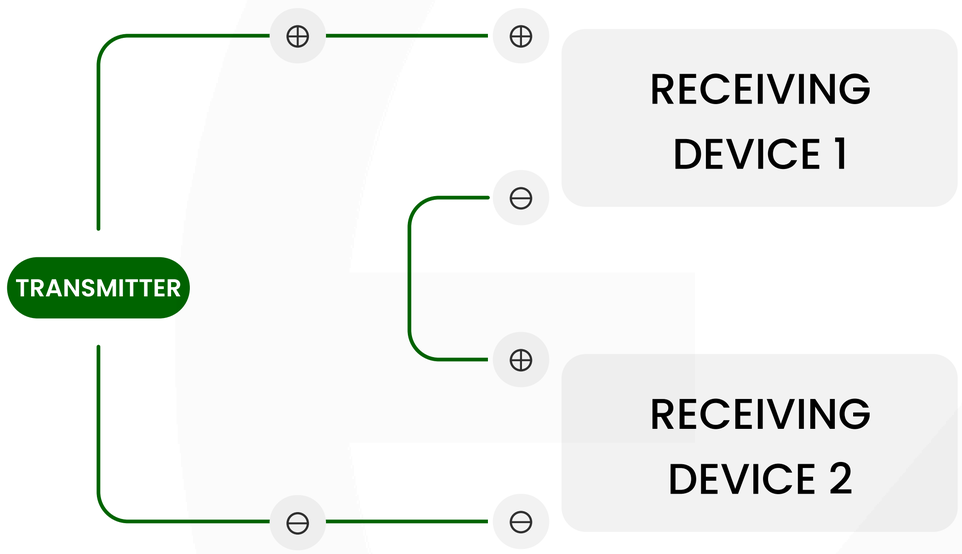
6-4. Transmission Output (OUTPUT) Cable Connection

6-4-1.
A DC 4–20 mA output signal is generated corresponding to the measurement range.

Maximum load resistance: 500 Ω

Concentration(ppm)		Output Current
0.00 ppm	→	4 mA
0.50 ppm	→	8 mA
1.00 ppm	→	12 mA
1.50 ppm	→	16 mA
2.00 ppm	→	20 mA

6-4-2. OUTPUT



※ The total resistance of all receiving devices must not exceed 500 Ω.

6-5. POWER Cable Connection

Operating the device outside of the specified voltage range may cause malfunction.
Always verify the power supply voltage and ensure it is within the allowable fluctuation range.

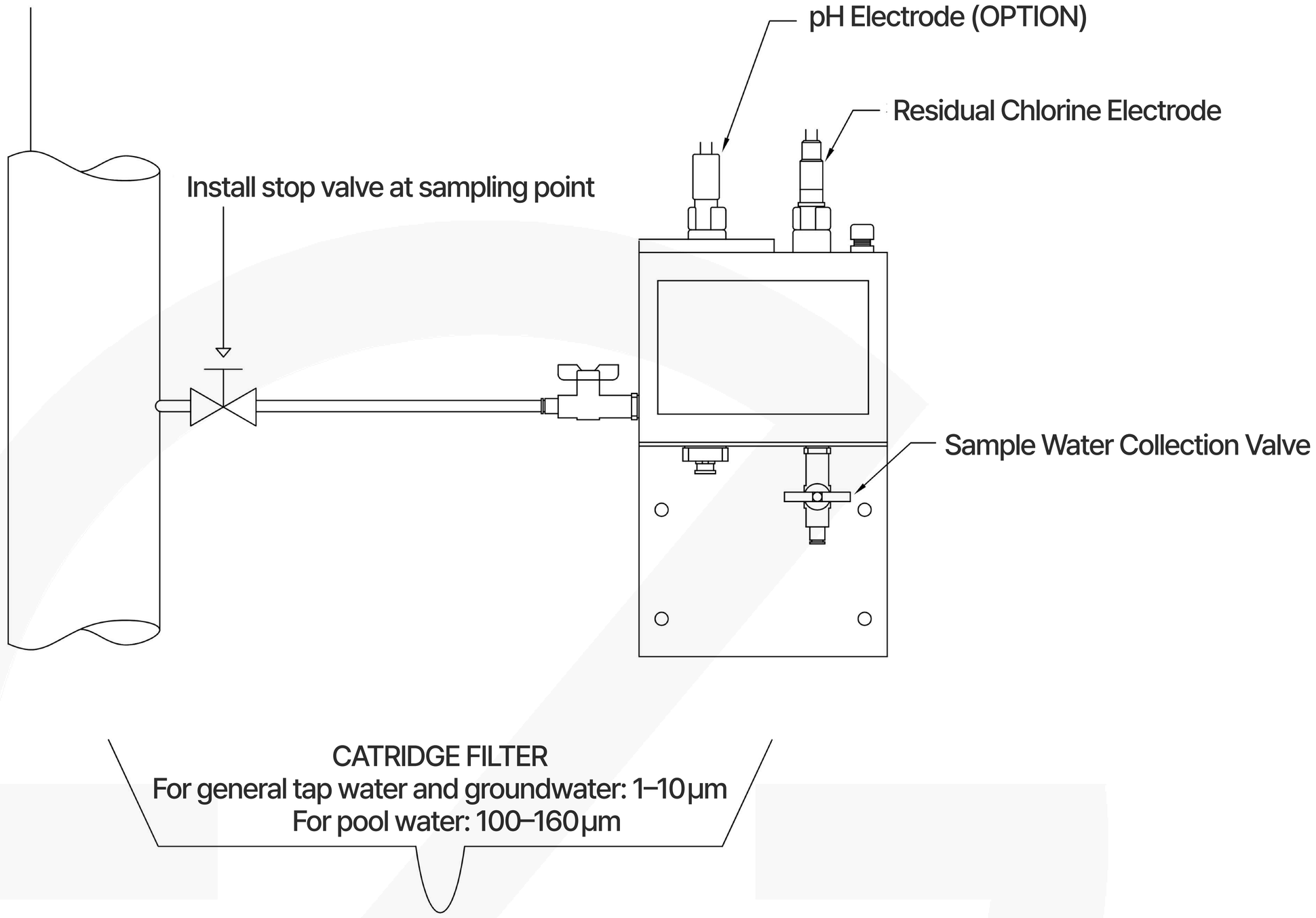
6-5-1.
This unit is equipped with a power switch (POWER S/W) mounted on the terminal block.

6-5-2.
For safety, make sure to ground (GND) the unit properly.

6-6. Alarm (Control) Relay Output Connection

The contact rating is AC 250V / 4A (resistive load).
For switching loads that exceed this rating, be sure to use a separate power relay.

◇ Piping Connection and Installation Precautions



Installation Precautions

1. Use PVC or resin-based piping materials for the sampling line components.
   Using metal components may cause rust or foreign substances, leading to malfunctions.
2. Minimize the distance between sampling line fittings and the sensor/holder.
   This improves response time.
3. After completing piping work, be sure to flush the inside of the pipe before mounting the electrode to the holder.
   This will remove any debris. Mount the sensor only after flushing.
4. Although the holder has an air vent, do not perform sampling if air bubbles are present in the main pipe.
   Contact between air bubbles and the electrode may cause measurement error.
5. If the sampling point in the main pipe is subject to sudden changes in pH or temperature,
   use a sampling system where such fluctuations do not occur.
6. If the holder and sensor are installed outdoors, make sure to provide a protective cover.
7. Install the holder sensor section in a location free from vibration.
8. If there is a risk of freezing in the sampling line, apply thermal insulation.
9. Select a sampling point where there is no pressure fluctuation.

7. Operation (CR Calibration)

7-1. ZERO Calibration

(When residual chlorine concentration is below 0.5 ppm):
Close the stop valve on the sampling line to prevent water from entering the holder.
After 15–20 minutes, electrolysis will reduce the chlorine level toward zero.
Once the reading stabilizes at 0.00, adjust the controller's ZERO VR (dial) to match 0 ppm.

(When residual chlorine concentration is above 0.5 ppm):
Even if the stop valve is fully closed, it will take a long time to reach zero.
In this case, fill a beaker with tap water that contains 0 ppm residual chlorine
and submerge the residual chlorine electrode in it.
Once the reading stabilizes, adjust the ZERO VR to 0 ppm.

7-2. SPAN Calibration

After completing ZERO adjustment and stabilizing the reading by adjusting the drain valve,
open the sampling valve and collect sample water.
Measure its chlorine concentration using a colorimeter,
then adjust the controller's SPAN VR (dial) to match the measured value.

If the chlorine concentration of the sample water is too low,
prepare a SPAN solution of 0.5–1 ppm using tap water.
Add small amounts into the holder and wait for the reading to stabilize,
then adjust the SPAN VR accordingly.

7-3. Final Step

After calibration, adjust the drain valve to resume continuous measurement.
Perform ZERO and SPAN calibration once every 1–2 weeks.

8. Electrode Regeneration and Storage

8-1. Regeneration

If calibration is not possible due to decreased electrode sensitivity,
follow the procedure below to regenerate the electrode:

8-1-1.
Clean the anode and cathode thoroughly using a soft brush
in an HCl solution (approx. 3%).

8-1-2.
Rinse thoroughly with HCl solution.

8-1-3.
Prepare 100 ppm sodium hypochlorite solution in a beaker (about 100 cc)
and place the electrode into the solution.
Short the anode and cathode leads, and soak for approximately 1 day.

8-1-4.
After regeneration, operate the electrode for at least 3 hours before performing calibration.

8-2. Storage

If the unit will be stopped for a long period, remove the electrode from the holder and place it into the electrode protection cap filled with tap water so the sensing surface is submerged.
Also, short the anode (A) and cathode (K) leads before storage.
Do not leave the electrode exposed to air.

9. Cartridge Filter Replacement in Sampling Line

The cartridge filter installed in the sampling line plays a crucial role in preventing various foreign substances in the water from adhering to the electrode.
This helps reduce sensor contamination and supports stable and accurate measurement.
However, if the filter becomes clogged or dirty, it can lead to flow rate reduction and excessive residual chlorine consumption,
resulting in unstable readings or decreased measurement accuracy.
Therefore, be mindful of the replacement cycle, and check the filter periodically.
If contamination is observed, replace it promptly to maintain optimal measurement conditions.

10. Causes of Malfunction in Instrument and Electrode

If any abnormality occurs in the CL-9 Residual Chlorine Controller,
please check the following items before inspecting the device:

① Is the instrument being used to measure free residual chlorine, generated by injecting chlorine gas or sodium hypochlorite into water?

② In control applications, is there any design flaw in the system configuration?

③ Does the water contain a high concentration of ammonia compounds, which may result in a majority of the measured chlorine being combined residual chlorine rather than free chlorine?

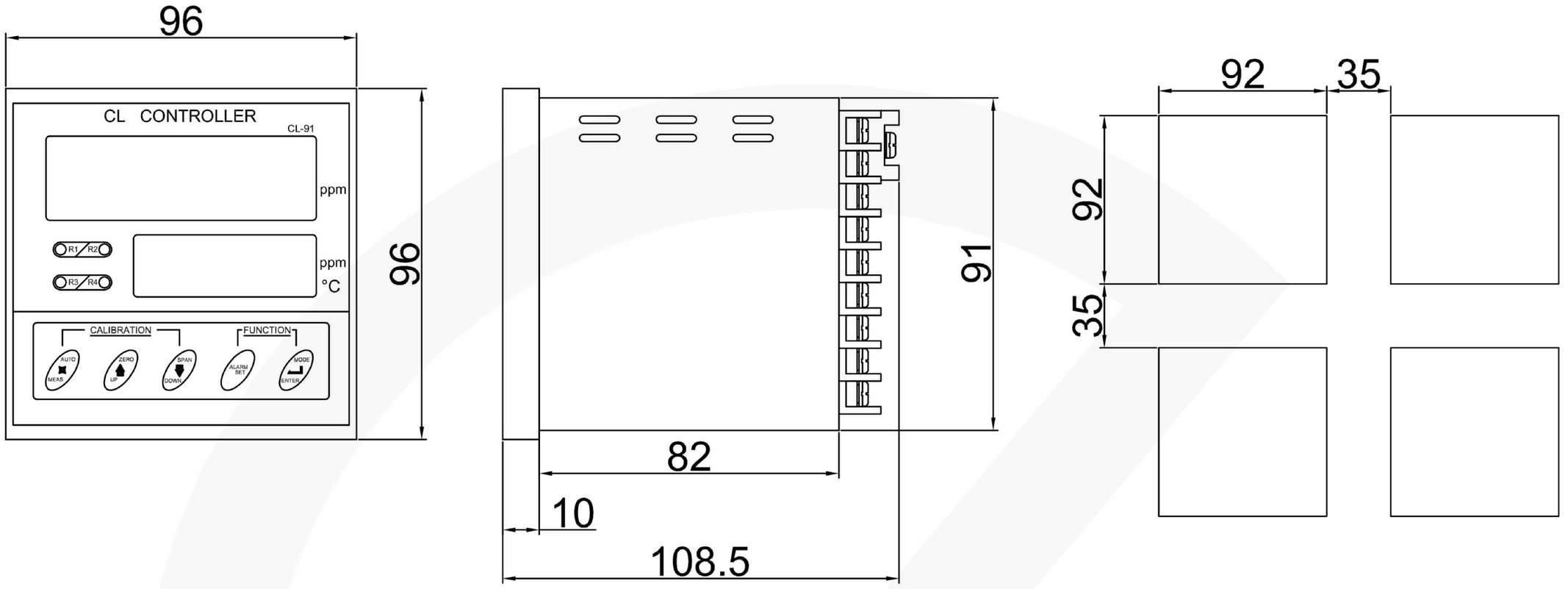
Item	Check Point	Solution
No indication at all	Is power being supplied to the instrument?	Turn on the power switch on the control panel.
	Is the calibration properly adjusted?	Recalibrate according to the operation section of the manual.
	Are the cables connected correctly?	Check the rear terminal connections.
	Is the water level in the holder and overflow normal?	Check the connection of the rear piping.
	Is there residual chlorine in the sample water?	Adjust the stop valve.
	Is the filter clogged or contaminated?	Check with a colorimeter.
	Is the sample water pH value over 8?	Replace the filter. Adjust pH (recommend: pH 6~8).
Calibration fails or i ndication drops	Has the electrode been contaminated by foreign substances?	Clean the electrode. If still not working, regenerate the electrode.
	Has the electrode been left in open air for a long time?	Keep running the system continuously.
	Is there no free chlorine, and mostly combined chlorine in the water?	Adjust with tap water and confirm again.

11. Communication Format

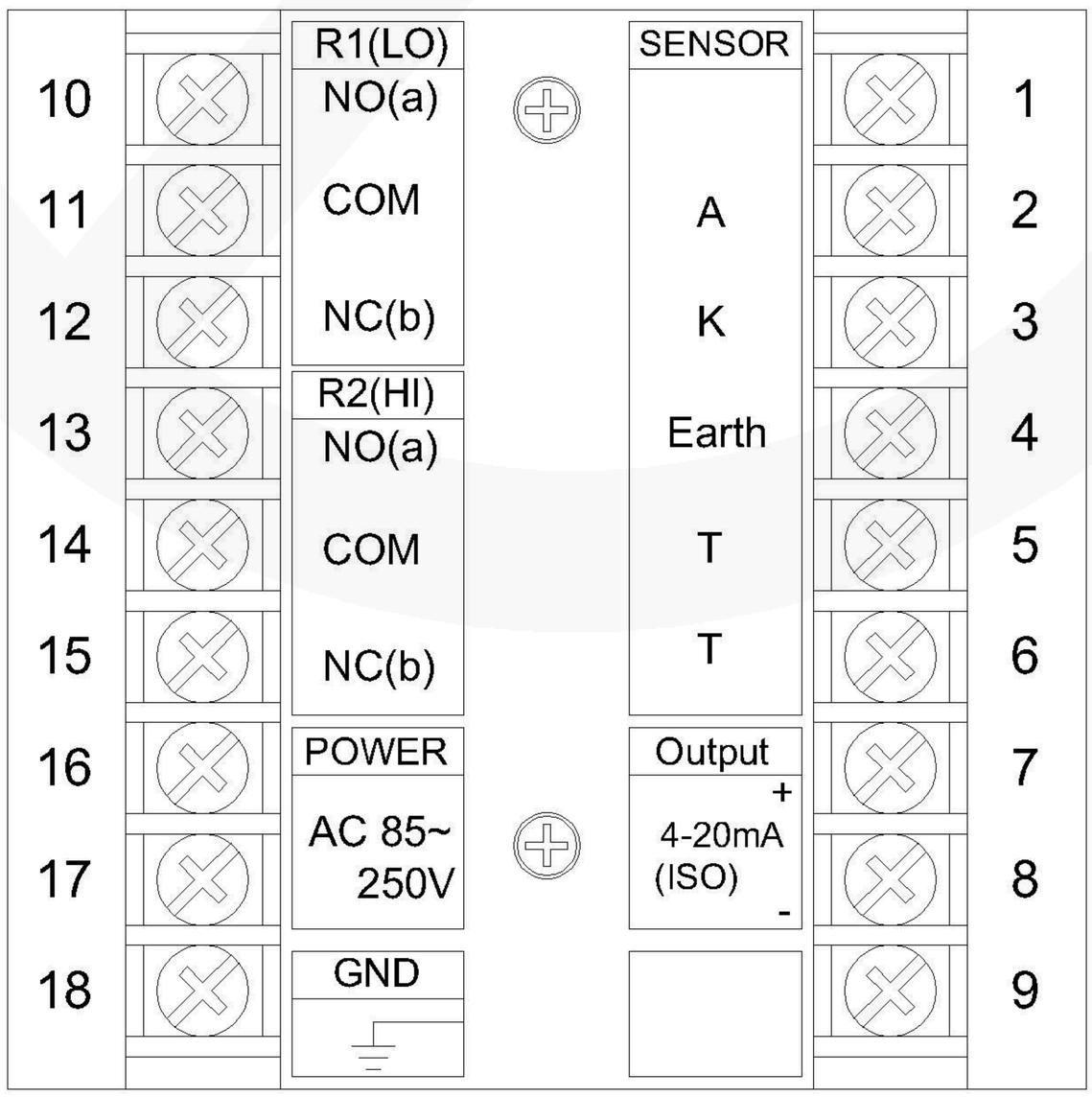
PV 요청(PC > Device) 길이 : 4 bytes STX “D” ID EXT STX : 0x02 COMMAND :”D”(0x44) ID : ‘1’ ~ ‘9’(ASCII) ETX : 0x03	PV 전송(Device > PC) 길이 : 10 bytes STX “D” ID SIGN DATA DOT ETX STX : 0x02 COMMAND :”D”(0x44) ID : ‘1’ ~ ‘9’(ASCII) SIGN : 부호(‘+‘, ‘−‘) DATA : “9999”(ASCII) DOT : Data의 Dot Position(ASCII) ETX : 0x03 EX) Display값이 “07.23”, ID 1 0x02, 0x44,0x31,0x2b,0x30,0x37,0x32,0x33,0x32,0x03
Set Value 설정(PC > Device) 길이 : 9 bytes STX “S” ID DATA ETX STX : 0x02 COMMAND :”S”(0x53) ID : ‘1’ ~ ‘9’(ASCII) SIGN : 부호(‘+‘, ‘−‘) DATA : “9999”(ASCII) ETX : 0x03 EX) Pre-set값을 1234로 설정 요청, ID 1 0x02,0x53, 0x31,0x2B,0x31,0x32,0x33,0x34,0x03	High Alarm 설정(PC > Device) 길이 : 9 bytes STX “H” “V” ID DATA ETX STX : 0x02 COMMAND :”H”(0x48) “V”(0x56) ID : ‘1’ ~ ‘9’(ASCII) SIGN : 부호(‘+‘, ‘−‘) DATA : “9999”(ASCII) ETX : 0x03 EX) Pre-set값을 1234로 설정 요청, ID 1 0x02,0x48,0x31, 0x2B,0x31,0x32,0x33,0x34,0x03

H_High Alarm 설정(PC > Device) 길이 : 9 bytes STX “I” ID DATA ETX STX : 0x02 COMMAND :”I”(0x49) “H”(0x48) ID : ‘1’ ~ ‘9’(ASCII) SIGN : 부호(‘+‘, ‘-‘) DATA : “9999”(ASCII) ETX : 0x03 EX) Pre-set값을 1234로 설정 요청, ID 1 0x02,0x49,0x31, 0x2B,0x31,0x32,0x33,0x34,0x03	Low Alarm 설정(PC > Device) 길이 : 9 bytes STX “J” ID DATA ETX STX : 0x02 COMMAND :”J”(0x4A) “V”(0x56) ID : ‘1’ ~ ‘9’(ASCII) SIGN : 부호(‘+‘, ‘-‘) DATA : “9999”(ASCII) ETX : 0x03 EX) Pre-set값을 1234로 설정 요청, ID 1 0x02,0x43,0x31, 0x2B,0x31,0x32,0x33,0x34,0x03
L_ Low Alarm 설정(PC > Device) 길이 : 9 bytes STX “K” ID DATA ETX STX : 0x02 COMMAND :”K”(0x4B) “L”(0x4C) ID : ‘1’ ~ ‘9’(ASCII) SIGN : 부호(‘+‘, ‘-‘) DATA : “9999”(ASCII) ETX : 0x03 EX) Pre-set값을 234로 설정 요청, ID 1 0x02,0x4B,0x31, 0x2B,0x30,0x32,0x33,0x34,0x03	온도 전송(Device > PC) 길이 : 10 bytes STX “T” ID SIGN DATA DOT ETX STX : 0x02 COMMAND :”T”(0x54) ID : ‘1’ ~ ‘9’(ASCII) SIGN : 부호(‘+‘, ‘-‘) DATA : “9999”(ASCII) DOT : Data의 Dot Position(ASCII) ETX : 0x03 EX) 온도“22.3”, ID 1 0x02,0x54,0x31,0x2b, 0x30,0x32,0x32,0x33,0x31,0x03
온도 요청(PC > Device) 길이 : 4 bytes STX “T” ID EXT STX : 0x02 COMMAND :”T”(0x54) ID : ‘1’ ~ ‘9’(ASCII) ETX : 0x03	*포트설정 Baud Rate : 9600bps Data Bits : 8 Stop Bit : 1 Parity Bits : NONE

◇ PANEL CUT



◇ Terminal Board



◇ Importance and Management Guidelines of Residual Chlorine Meters

Chlorine, a halogen-based chemical, is introduced into drinking water sources and swimming pools, where it reacts with water to perform sterilization and oxidation functions.
However, excessive dosing of chlorine can lead to serious health hazards.
Conversely, insufficient dosing may result in inadequate sterilization, leading to bacterial growth in drinking water or swimming pools.
Such contamination can cause incidents including business suspensions or legal penalties.
Therefore, residual chlorine management is extremely important, and it is essential to understand proper management procedures that enable prompt response to changing conditions.

1. **Upon installation and handover of the residual chlorine system, each facility must ensure that personnel receive adequate training and are fully informed of management procedures.**
2. **Although the residual chlorine system operates automatically, facilities must be equipped with a chlorine colorimeter, and should manually check chlorine levels daily or on a regular basis.**
3. **The most critical practice is to ensure that swimming instructors measure chlorine concentration using the colorimeter before pool access begins. This verification and instruction process is essential for preventing accidents.**
4. **Refer to the product operating manual to fully understand the calibration procedures.**
5. **Electrode Cleaning Instructions**

At the bottom of the electrode, there is an extremely thin platinum wire. If rubbed excessively, it may break.

- **Soak the electrode in cleaning alcohol for approximately 2 minutes.**
- **Stir gently without damaging the platinum coil.**
- **Rinse with clean water, remove moisture, and then use the electrode.**

The residual chlorine sensor detects concentration values in water.
However, chlorine readings may be inaccurate if the sensor is exposed to contaminants such as:

- Urine, sweat, body lotion (common in pools)
- Cement residue (common during initial operation)

To prevent such issues, the sensor must be kept clean at all times through daily or routine cleaning.

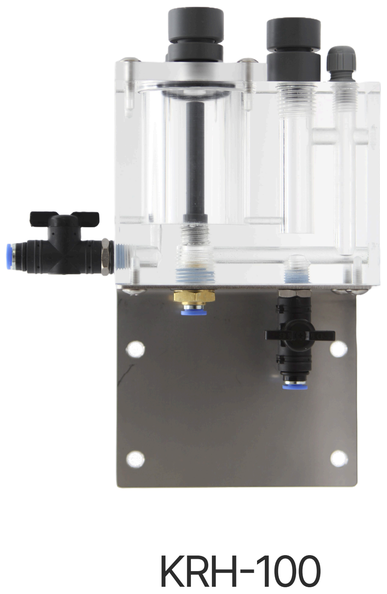
◇ Residual Chlorine Controller

CL-91

◇ Residual Chlorine Electrode

KR-100

◇ Electrode HOLDER



KRH-100

When the Residual Chlorine Value Fluctuates at the Second Decimal Place

First,
Check whether the inflow rate into the residual chlorine holder is stable.
If the flow rate fluctuates, the measured value will become unstable.

Recommended Action:
Adjust the inlet valve to reduce the amount of incoming water.
Although the normal flow is between 500 CC ~ 1000 CC/min,
lower flow rates (closer to 500 CC/min) are preferred when using high-quality sensors.

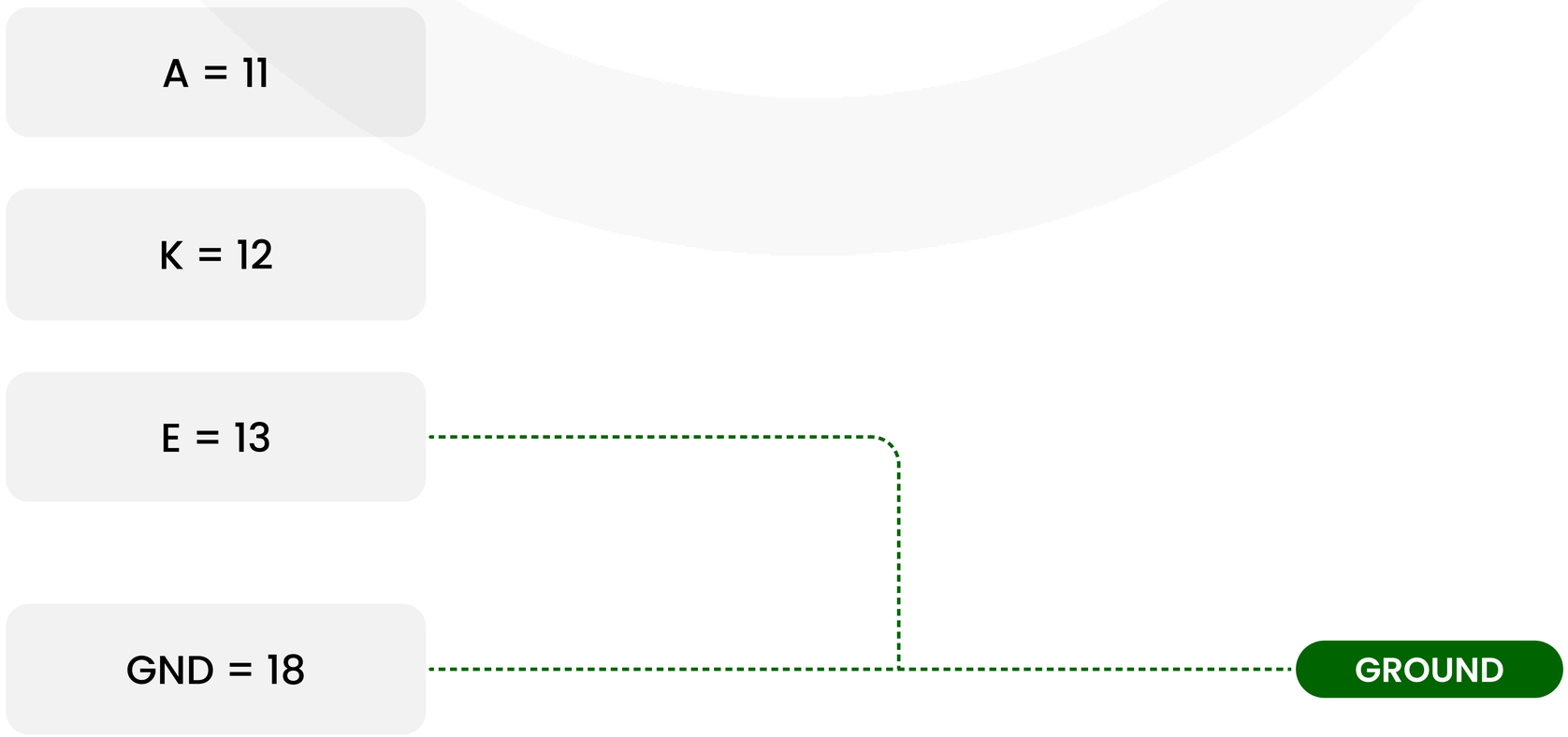
Second,
Depending on field conditions, external noise or static electricity may interfere with the system.
This often occurs when the sensor sends a very fine signal to the controller, which can be affected by external factors.

Recommended Action:

1. Prepare a grounding wire (approx. 1 meter long).
2. Try connecting this wire to Terminal No. 18 (GND) on the residual chlorine controller.
   If it is already connected, remove and inspect it.
3. Check the sensor input terminals on the controller: A, K, E → Terminals 11, 12, 13
   Then, connect a wire between Terminal 13 (E) and Terminal 18 (GND).
4. Next, take the wire from Terminal 18 and try connecting it to the panel frame or external ground.

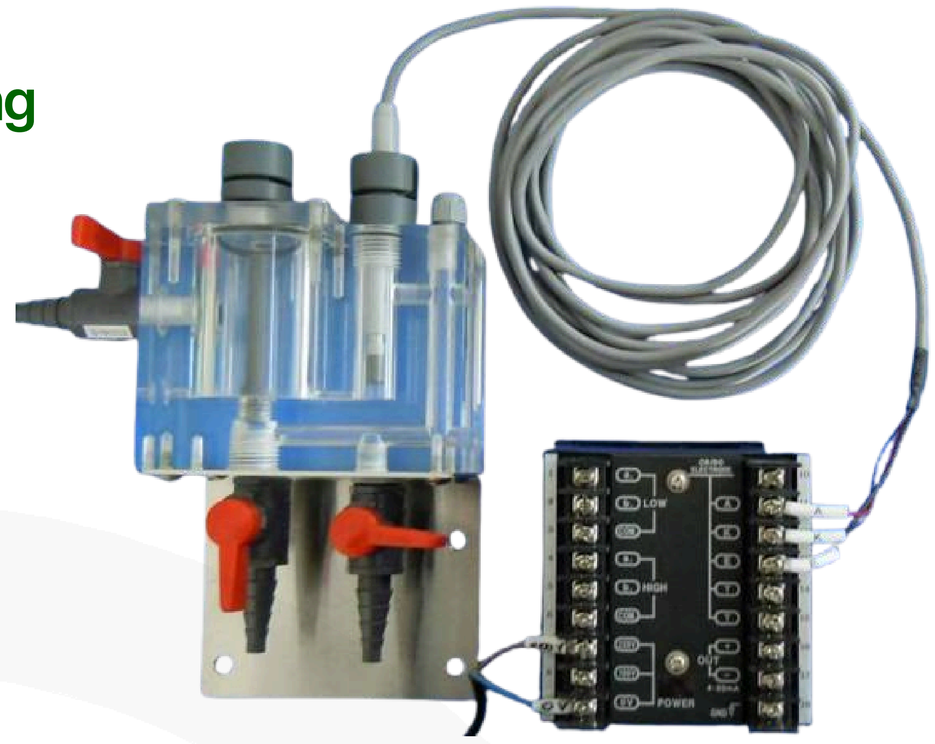
You may need to try grounding in multiple locations to find where a stable ground is achieved.
Once found, securely fix the ground wire at that location.

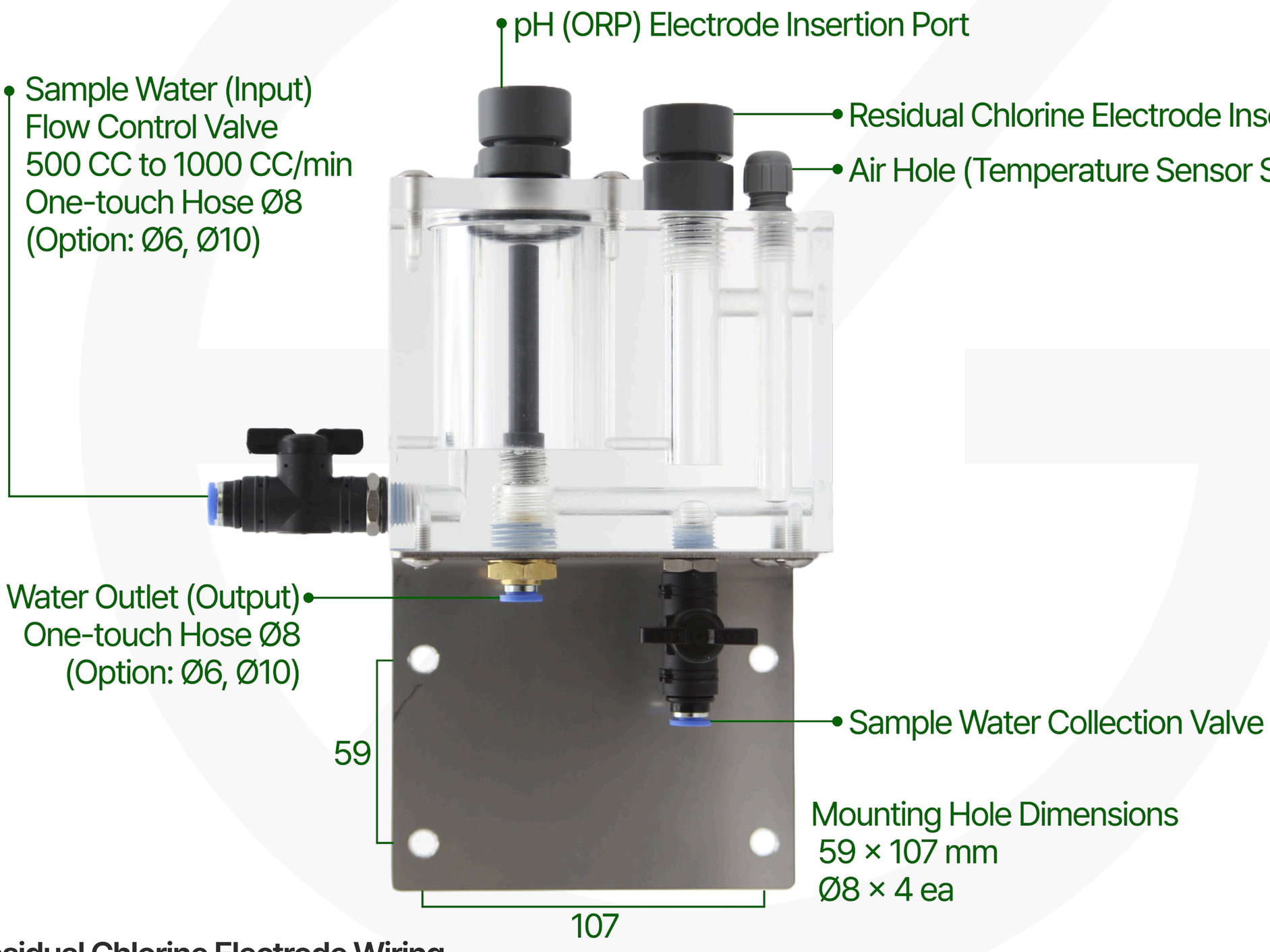
Note:
A ground point does not have to be fixed in one standard location. Suitable grounding points may vary even within the same panel, so testing multiple spots is recommended.



◇ Example of Residual Chlorine Meter Terminal Wiring

- Model: CL-9
- Sample Water IN / Drain Water OUTPUT
- Recommended Hose Size: Braided Hose 10–12 mm





● Residual Chlorine Electrode Wiring

- Terminal 11 ← A (Red)
- Terminal 12 ← K (Black)
- Terminal 13 ← E (Shield = Black with heat-shrink tube)

● Power Input Wiring

- For AC 220V → Connect to Terminals 7 and 9
- For AC 110V → Connect to Terminals 8 and 9

◇ Importance of pH Meter (Hydrogen Ion Concentration Meter) in Swimming Pools

- The pH Meter (Controller) is commonly referred to as a Hydrogen Ion Concentration Meter.
- Surprisingly, many people do not fully recognize the importance of maintaining proper pH levels in swimming pools.
- Although equipment is typically installed and used at the beginning,
  it is often neglected over time when either the meter or the sensor becomes faulty or stops functioning.
- However, this is when it becomes most critical.
- The residual chlorine level in a pool is highly sensitive to the pH level.
  Most systems around the world are designed to measure residual chlorine accurately only when the pH is between 6 and 8.
  If the pH deviates from this range, the chlorine reading can vary significantly.
- When the pH drifts toward alkalinity, acid must be added to bring it back to the proper range.
  On the other hand, if you attempt to correct chlorine levels by overdosing with hypochlorous acid,
  the pH will naturally rise, shifting further toward alkalinity.
- To prevent such issues, it is essential to install both a pH Meter and pH Sensor.
- But installation alone is not enough—
  the pH sensor must be cleaned regularly and calibrated periodically using pH standard buffer solutions to maintain accurate and reliable operation.

Sensory