HITROL CO., LTD.

HEAD OFFICE.FACTORY.R&D INSTITUDE
HITROL CO., LTD 141, Palhakgol-gil, Jori-eup
Paju-si, Gyeonggi-do, Korea
TEL. : (+82)-31-950-9700
FAX. : (+82)-31-943-5600
www.hitrol.com

INSTRUCTION MANUAL

CAPACITANCE TYPE LEVEL SWITCH

HCC-95T Series

Doc. no.: HCC95T_IM_Eng_Rev.0

Issue date: 2024. 08

Table of Contents

Overview · 3

Characteristics · 3

Operation principle and composition · · · · · · · · · 3

Specifications · 4

Dimensions and technical data · · · · · · · · · 5

Installation · 7

Precautions for Installation · · · · · · · · · · · · · · · · · 7

Precautions for Attachment · · · · · · · · · · · · · · · · · 8

Wiring · 8

Failure Check and Maintenance · · · · · · · · · · · · · 9

Precautions for Removal · · · · · · · · · · · · · · · · · · · 9

Precautions for Use · 9

Precautions for Ground · 10

Safety and Environment · · · · · · · · · · · · · · · · · · · 10

Marking· 11

Warranty and Contact · 11

APPENDIX

APPENDIX X · · · · · · · HCC-95T Setting Guide

APPENDIX H · · Serial USB Terminal Install Guide

You should be well-informed of the contents where WARNING is marked before carrying out the work.

You should be careful where CAUTION is marked to carry out the work.

You should be aware of where NOTICE is marked to carry out the work.

Overview

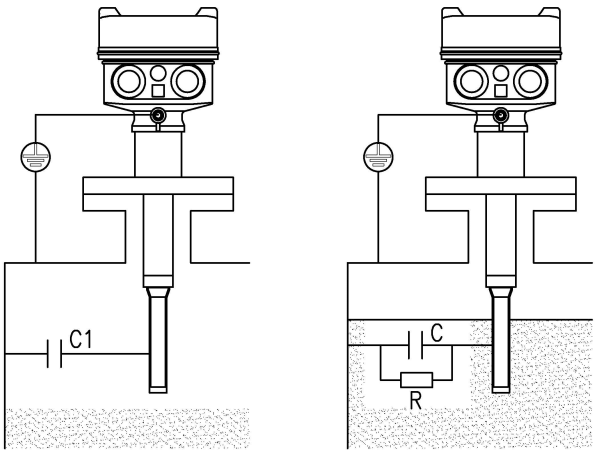
The HCC-95T Series is a separate capacitance type level switch device that can be installed on the top and side of the tank and converts, measures, and detects the intrinsic dielectric constant of the measured object into a capacitance value to output the level level in the tank as a 2-Wire Loop current.

Characteristics

- Can detect different types of liquids and powder levels
- Robust construction and no mechanical drive for semi-permanent use
- Easy to use in corrosive liquids (water solution)
- Easy to install when using wire type products (HCC-95TW)
- Operational status can be checked
- Available with various operating devices such as I-Control Unit and PLC

Operating Principle & Composition

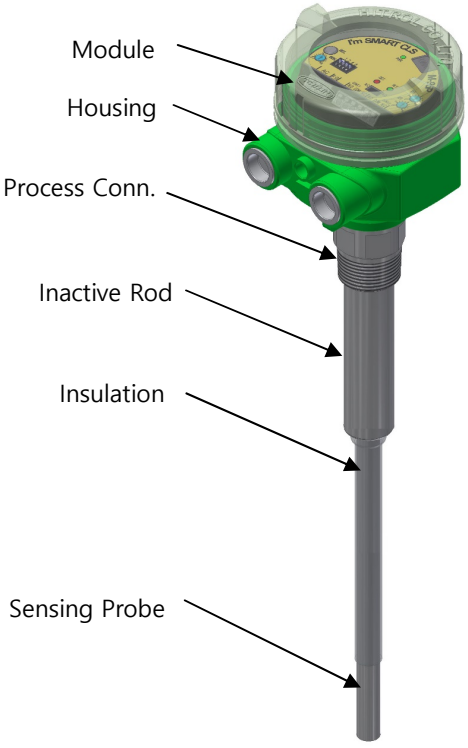
By applying the principle that the capacitance value between the conductor and the conductor changes depending on the measurement object, the frequency received changes depending on the difference between the capacitance value of the gas and the measurement object, such as air and gas between the probe and the tank , and outputs the presence or absence of the measurement object to the relay contact according



C: Capacitance of the measurement

C1: Capacitance in the initial state

R : Conductivity of the measured material



[Referring to the principle of motion]

Specification

Product Specifications

Model	HCC-95T	HCC-95TH	HCC-95TW	HCC-95TWH
Probe Type	Rod		Rope	
Mounting	Screw or Flange			
Ambient temperature	-20℃ ~ +60℃			
Process temperature	-40℃~+80℃	-40℃~+150℃ (Opt. 400℃)	-40℃~+80℃	-40℃~+150℃
Process Pressure	Vacuum~ 20kg/cm2(300#)			
Power Source	DC +24V			
Enclosure	Weather-Proof (PBT; IP65, AL; IP66)			
Wetted Parts Material	SUS 304, 316L with Teflon			
Process Connection	PT 1"(M) Screw			
Housing; Cable Entry	PBT;PF1/2"(F),IP65 / AL;PF1/2"(F),IP66	AL;PF1/2"(F),IP66	PBT;PF1/2"(F),IP65 / AL;PF1/2"(F),IP66	AL;PF1/2"(F),IP66
Combination Unit	I-Control Unit or PLC			
Combination Cable	A.W.G 16~26 (+ : DC Power, - : Current Out)			

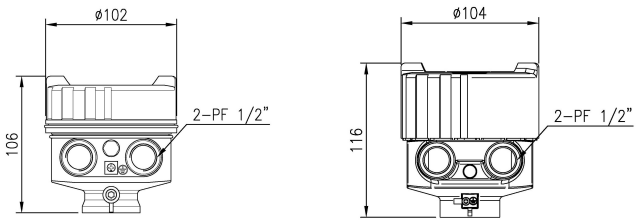
Electrical Specifications

Module	M-95T	
Microprocessor	16 Bit Microprocessor	
Oscillation Frequency	1MHz	
Dielectric Constant	2 @ Min. (Powder/Liquid)	
Sensitivity Resolution	0.1pF	
Current Out	Current Control – N.C	■ Non Detection: 8mA ■ Detection: 16mA
	Current Control – N.O	■ Non Detection: 16mA ■ Detection: 8mA
Current Control	Normal Close @ Default 8mA	
Status Indicator	Bi-Color LED [Green/Red/Orange]	
Detection Indicator	RED LED	
Relay Control Indicator	GREEN LED	
Dimension	80mm x 65mm x 54mm	
UART	Monitoring	
Ambient Temperature	-20℃ ~ +80℃	

Dimensions and Technical Data

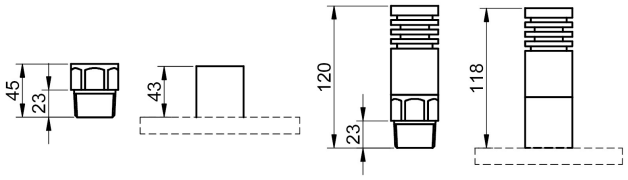
The dimensions on the following pages are indicated in [mm].

[Housing]



Material: PBT **Material: Aluminum**

[Connection]



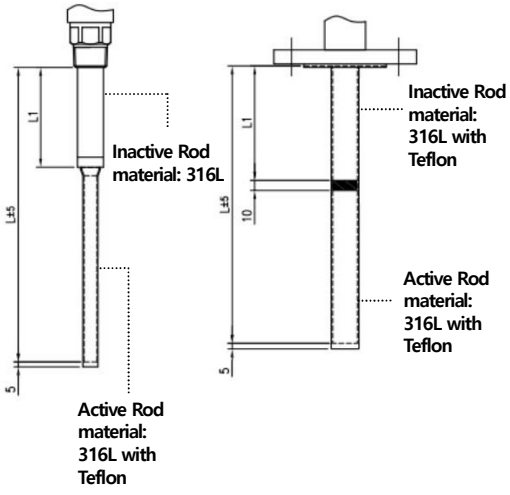
High Temp. Version

■ Connection Type
-Screw: PT 1" (Std.), NPT 1", PF 1", Others
-Flange: ANSI, JIS, DIN
-Tri-Clamp

■ Material
-SUS 316L, Others

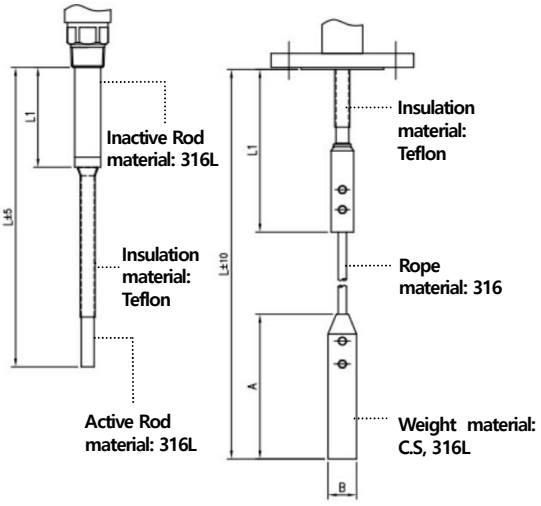
[Probe]

For Liquids



Rod Type **Rod Type (Fully insulated w/ TEFLON)**

For Solids



Rod Type **Rope Type**

NOTICE **There may be some tolerance with the actual product.**

		For Liquids		For Solids			
		Rod Probe	Rod Probe Fully insulated w/ TEFLON	Rod Probe	Rope Probe		
Total length(L)		100~2,500	300~1,000	100~2,500	Min. 1,000, Max. 10,000		
					≤2,500	≤4,500	>4,500
Active Rod Length (L-L1)		100~1,000	150~500	100~1,000	-		
Inactive Rod Length(L1)		~1,500	150~500	~1,500	-		
Active Rod dia.		Φ15 (including Teflon)	Φ28 (including Teflon)	Φ15 (including Teflon)	-		
Inactive Rod dia.		Φ25.4	Φ28 (including Teflon)	Φ25.4	-		
Weight	A	-	-	-	170	300	300
	B	-	-	-	Φ28	Φ28	Φ40
For acid liquids		-	O	-	-		
For high-viscosity liquids		O	O	-	-		

Dielectric Constant Value

Air	1
Nitrogen (Liquid)	1~2
Fuel Oil: Gasoline, Diesel……)	2
Hydrogen chloride	4.6~12
Hexane (Liquid)	6
Butanol	17~18
Ammonia	16~25
Alcohol	16~31
Acetone	20
Caustic soda	22~26
Ethanol	25
Methanol	32~33
Glycerin	47~68
Water.	81
Sulfuric acid	84

Information on the relative dielectric constant can be downloaded from the technical materials by accessing the headquarters website www.hitrol.com .

(Some fluids may vary in dielectric constant depending on temperature .)

Installation

Capacitive level switches have screws (PT, NPT, PF, etc.) and flanges (ANSI, JIS, DIN, etc.) and can be installed in Tri-Clamp and various types of flanges .

The following points should be noted when installing:

■ **Tank Side (Horizontal) Installation**

Because the level is detected throughout the electrode, sensitive measurements are possible. However, because of the malfunction caused by the Build-Up, the electrode ends must be slanted downwards relative to the horizontal .

■ **Install tank top (vertical)**

Although the installation method is less affected by the Build-Up, the level is detected only at the end of the electrode, so it may be unsuitable for measurements with

Precautions for Installation

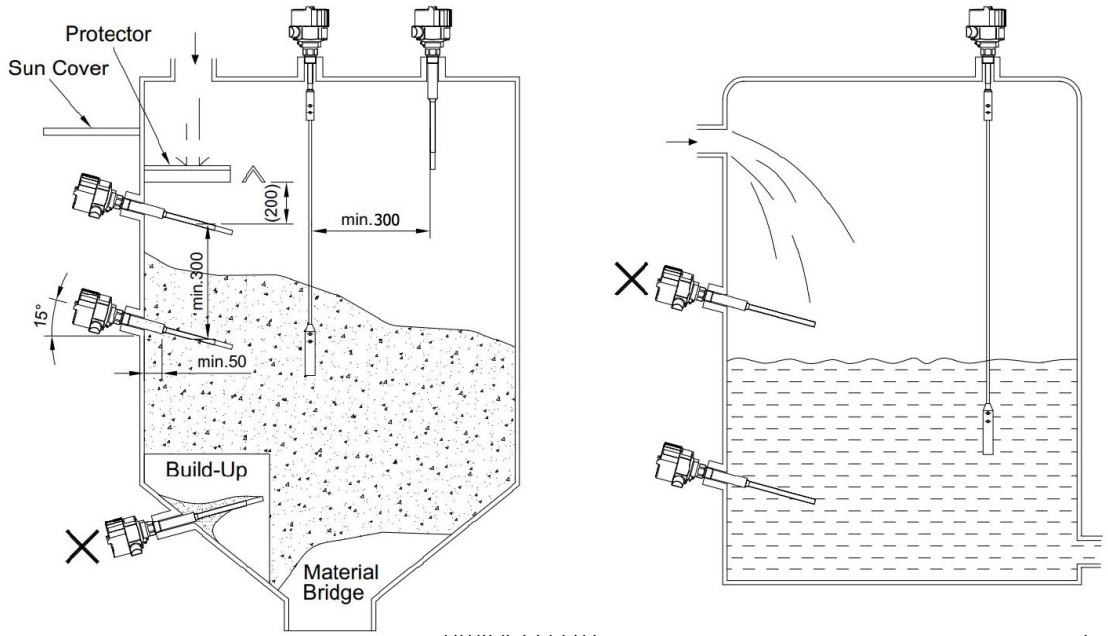
-If more than one level switch is installed in a container, the distance between each probe must be at least 300 mm apart. (Short distance between probes can cause instability in operation due to the mutual influence of the instruments.)

- When installing on the side, the Inactive Rod should be located inside the tank at least 50mm , and it is recommended to install the probe by tilting it about 15° relative to the horizontal plane. (A malfunction may occur between the nozzle and the probe due to foreign substances.)

- The probe must be installed to avoid entering the measuring material and a protector must be installed to prevent damage to the probe . The protective tube should be sufficient to protect the probe from incoming measurements and should be installed at a distance that does not affect the probe behavior.

-When installing on the side, the wire inlet must be installed facing the ground to maintain rain protection.

- When installing at a low level, be careful with the Dead Stock and Material Bridge.

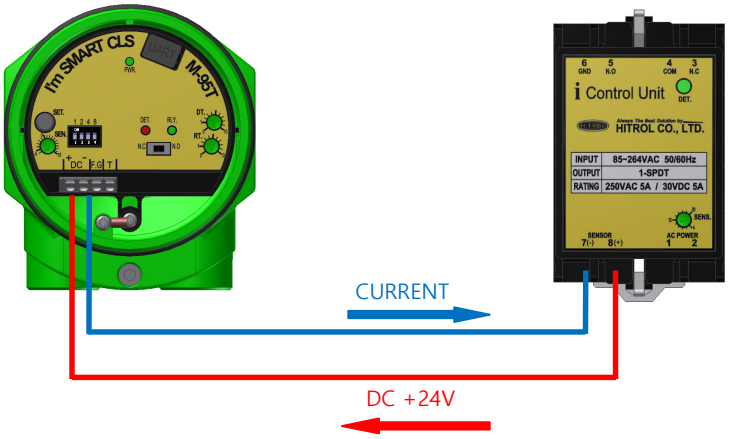


Precautions for Attachment

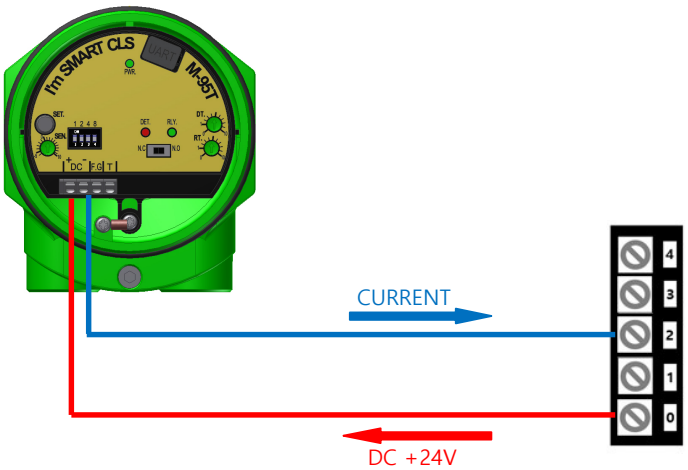
- When installing the sensor, avoid shaking areas or obstacles.
- Installation near the outlet should be avoided as fluid flow is severe and is likely to cause mechanical damage or chattering .
- The temperature and pressure generated inside the tank must be checked to meet the specifications.
- If the temperature of the housing differs significantly from the ambient temperature, condensation may occur, so dehumidifier filling or Gortex should be applied before use.
- The flange or screw engagement should be of the same specification.

WARNING **In the case of explosion-proof products, they must be**

- Be careful not to change the polarity of the + - when connecting DC power .
- No connection should be made with power applied.
- It is recommended to use AWG 16 to 26 cables.



[HCC-95T with I-Control Unit]



[HCC-95T with PLC]

Failure Check & Maintenance

■ **product inspection**

The main inspection part of the capacitive level switch is the sensor unit. The life of key parts depends on your environment and can be used in optimal condition through periodic inspection. Therefore, the user should maintain it through periodic inspections at least once a year. Inspection of the appearance of the product is visually checked for damage, etc., and measurements and foreign substances are attached to the sensor to deteriorate the accuracy, so it should be removed regularly. Be careful not to damage the Teflon when removing it.

■ **Failure Check**

1) Is the power connection correct?
2) Is the power and voltage supplied correctly?
3) Is cable wiring correct?
4) Is the Fail-Safe Mode transition correct?
5) Is the green LED lit?

During maintenance, the product should be checked with the power

Precautions for Removal

■ It should be separated after checking the water level and the presence of measurements in the tank.

■ The product may overheat and burn, so it should be separated using gloves or the like.

■ Demolition work should be done with the power off.

When moving and transporting the product, do not make a big impact on the product.

Precautions for Use

■ Do not bend or arbitrarily cut and extend the sensor, which is the measuring part.

■ The power is applied after the installation is completed and the product is covered.

■ It should not be used when the temperature range around the installation (-20°C to +60°C) is exceeded.

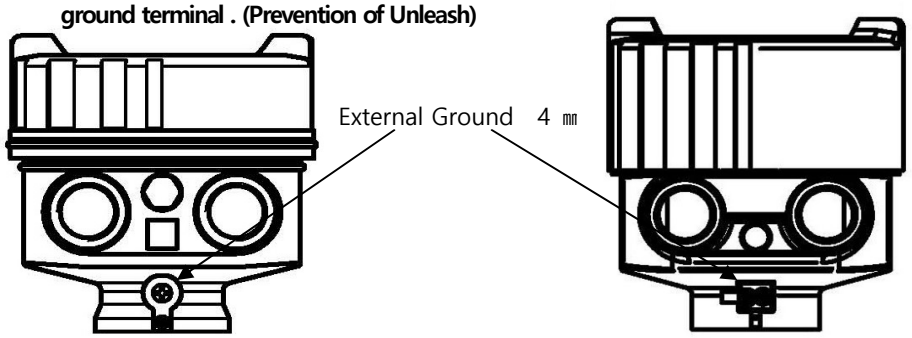
■ It should not be used when the protection level is higher than the IP66 (PBT IP65) condition.

Precautions for Ground

-The ground has an external ground and an internal ground. The position of the external ground shall be as follows and the size of the ground wire shall be 4 ㎟ (4 mmSQ) when connected to the external ground. (The internal grounding will be connected to the same specifications as the cable.)

-The internal ground wire should be the same size as the power wire, the internal ground lug should be 3. 1 ㎟ (3.1 mmSQ) in size, and if the power wire is greater than 3.1 ㎟, the ground wire can be connected without the terminal lug being removed .

CAUTION **The washer must be used when disconnecting and reconnecting the terminal lug to the internal ground terminal . (Prevention of Unleash)**



HEAD External Ground HEAD External Ground

Safety and Environment

■ Precautions during use

- When fastening a product to a container, it must be fastened to ensure maximum bonding with a tool or the like.

- It should not have a big impact on the product.

■ Precautions for product run-off

- The connection shall be made to the appropriate terminal for the location of the contact. (See Line Method)

- The power voltage of the instrument must be connected after checking the specifications, checking, and then turning it on.

- Incorrect power supply voltage can cause damage or failure to the device.

- There is a risk of an electric shock, so you have to be careful about your safety.

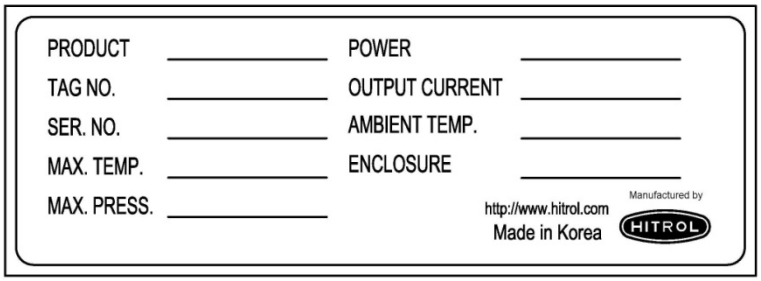
■ disposal of products

-When discarding because the product cannot be used, separate the AMP and body parts in the product housing from the metal and non-metal materials of the product and discard them. There are no accessories that affect the environment, so there is no need to be extra careful. (e.g. mercury switch)

Marking

■ Show product awareness

The product recognition mark is attached to the housing and displays the model name, serial number, temperature of use, pressure of use, output, etc. of the product. The serial number is the manufacturing unique number that distinguishes the product.



Warranty and Contact

■ Quality **Assurance and Services**

- The warranty period for this product is two years after the product is shipped, and in case of failure that occurs under normal use, you can receive free service. If the product is not broken, requesting service may result in charges regardless of the warranty period.
- You can apply for aftersales service through the website or the headquarters .

■ **Contact information of headquarters, factories, and research institutes**

Address: 141 Palhakgol-gil , Jori-eup, Paju-si, Gyeonggi-do (98) High Roll
HITROL CO., LTD 141, Palhakgol-gil, Jori-eup, Paju-si, Gyeonggi-do, Korea

TEL: 031-950-9700 (head office and A/S)

Fax: 031-943-5600 (head office and A/S)

APPENDIX X

HCC-95T

Setting Guide

2Wire Separation Capacitance Type Level Switch

Doc. no. : Rev0.0

Issued Date : 2024.08.06

Always The Best Solution

HITROL CO., LTD.

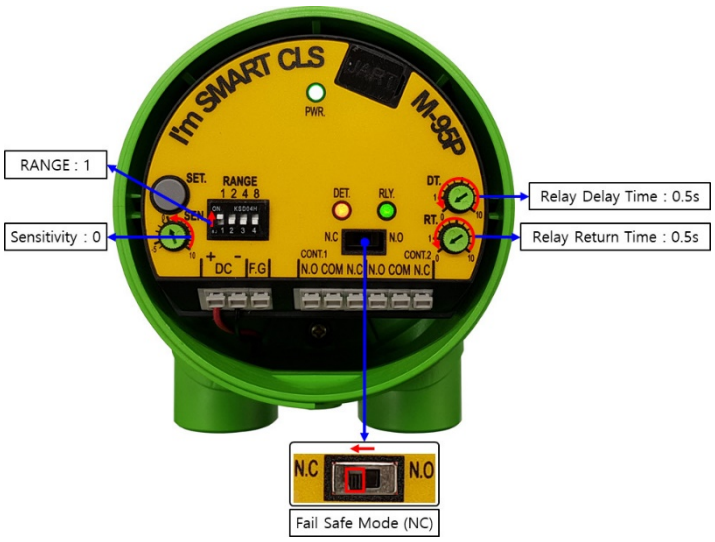
1. M-95T Configuration and Function

No	Configuration	Function
1	**SET.**	■ Autoset ○ Automatic Measurement and Standard of Capacitance on Tank
2	**RANGE**	■ Capacitive Measurement Sensitivity Range Setting ○ Sensitivity Setting Range: 10pF ~ 150pF ○ Sensitivity Setting Range: BCD Dip Switch
3	**SEN.**	■ Fine Tuning of Capacitance Measurement Sensitivity ○ Dry Contact Sensitivity Fine Adjustment Range: △10pF ○ Wet Contact Sensitivity Fine Adjustment Range: △-5pF
4	**DT.**	■ Relay Delay Time Adjustment ○ Time Range: 0.5s, 1s ~ 10s @ Adjustment 0.1s
5	**RT.**	■ Relay Return Time Adjustment ○ Time Range: 0.5s, 1s ~ 10s @ Adjustment 0.1s
6	**Fail Safe Mode**	■ Relay Transformation Adjustment ○ N.C ↔ N.O
7	**DET.**	■ Measurement Status LED ○ OFF → Red
8	**RLY.**	■ Relay Status LED ○ N.C: OFF → Green ○ N.O: Green → OFF
9	**PWR**	■ Power & Status Display
10	**UART**	■ M-95P Status Setting and Status Communication Port
11	**Power**	■ DC+24V 2Wire Loop

2. M-95T Setting and Adjustment

■ Initialization Setting Method

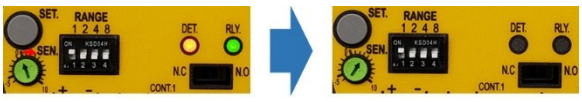
☐ After installing it on the tank, set it to the initial state for quick response.



■ Tuning Setting 1

☐ Setting method according to the "Sensitivity Adjustment after Autoset Setting".

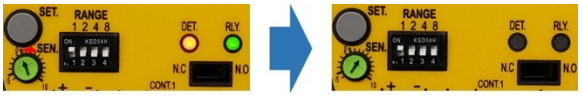
[SET. Push & Pull] [Adjusting *SEN.* VR] [Complete]

No	Function	Method
1	SET.	■ Press the tact switch (*SET.*) for 1 second, the PWR. LED turns on and off. ■ The reference value is set by automatically measuring the capacitance value in the tank.  [SET. Tact Switch Autoset]
2	SEN.	■ Set the sensitivity change value of the measuring medium with *SEN.* VR.  [Before Adjusting *SEN.* VR] [Adjusting *SEN.* VR clockwise] ■ Refer to "Adjust Sensitivity".

■ Tuning Setting 2

☐ Setting method according to the “Autoset after Sensitivity Adjustment”.

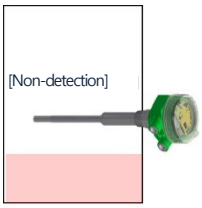
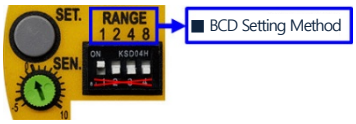
[Adjusting *SEN.* VR] [SET. Push & Pull] [Complete]

No	Function	Method
1	SEN.	■ Set the sensitivity change value of the measuring medium with *SEN.* VR.  [Before Adjusting *SEN.* VR] [Adjusting *SEN.* VR clockwise] ■ The LED may be on. ■ Refer to “Adjust Sensitivity”.
2	SET.	■ Press the tact switch (*SET.*) for 1 second, the PWR. LED turns on and off. ■ The reference value is set by automatically measuring the capacitance value in the tank.  [SET. Tact Switch Autoset]

■ Adjust Sensitivity

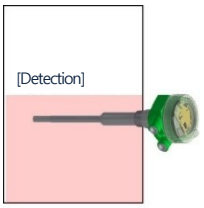
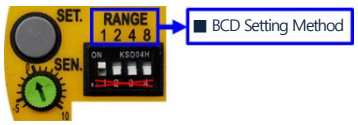
☐ Measurement sensitivity can be adjusted when installing in a dry contact environment.

[Setting Range] [Adjusting *SEN.* VR] [Complete]

No	Function	Method
1	Dry Contact Environment	■ The measurement medium is not in contact.  [Dry Contact Status]
2	SET.	■ It can be adjusted after pressing the tact switch (*SET.*). ■ After setting and adjusting sensitivity, Press the tact switch (*SET.*).
3	RANGE	■ RANGE: Setting Range of the Capacitance Measurement Sensitivity. ■ Measurement Sensitivity Adjustment Range: 10pF ~ 150pF ■ How to Adjust Measurement Sensitivity 
4	SEN.	■ SEN. : The Fine Adjustment Range within the Measurement Sensitivity Setting RANGE. ■ Sensitivity Fine Adjustment Range: △10pF 

☐ Measurement sensitivity can be adjusted when installing in a wet contact environment.

[Setting Range] [Adjusting *SEN.* VR] [Complete]

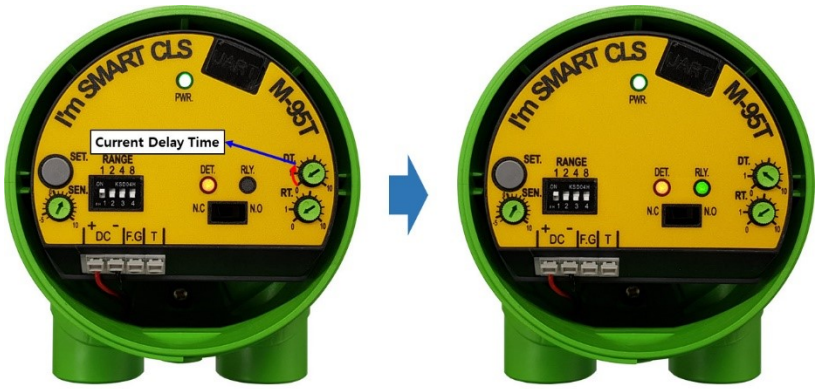
No	Function	Method
1	Wet Contact Environment	■ The contact state of the measuring medium.  [Dry Contact Status]
2	SET.	■ It can be adjusted after pressing the tact switch (*SET.*). ■ After setting and adjusting sensitivity, Press the tact switch (*SET.*).
3	RANGE	■ RANGE: Setting Range of the Capacitance Measurement Sensitivity. ■ Measurement Sensitivity Adjustment Range: 10pF ~ 150pF ■ How to Adjust Measurement Sensitivity 
4	SEN.	■ SEN. : The Fine Adjustment Range within the Measurement Sensitivity Setting RANGE. ■ Sensitivity Fine Adjustment Range: △-5pF 

☐ Measurement Sensitivity Setting and Fine Adjustment Area

SETTING	RANGE (Sensitivity Setting Range)	SEN. (Sensitivity Fine Adjustment Range)		REMARK
		Wet Contact	Dry Contact	
	10pF	0pF ~ -5pF	0pF ~ 10pF	SENSITIVE
	20pF	-5pF ~ -10pF	10pF ~ 20pF	
	30pF	-15pF ~ -20pF	20pF ~ 30pF	
	40pF	-25pF ~ -30pF	30pF ~ 40pF	
	50pF	-35pF ~ -40pF	40pF ~ 50pF	
	60pF	-45pF ~ -50pF	50pF ~ 60pF	
	70pF	-55pF ~ -60pF	60pF ~ 70pF	
	80pF	-65pF ~ -70pF	70pF ~ 80pF	
	90pF	-75pF ~ -80pF	80pF ~ 90pF	
	100pF	-85pF ~ -90pF	90pF ~ 100pF	
	110pF	-95pF ~ -100pF	100pF ~ 110pF	
	120pF	-105pF ~ -110pF	110pF ~ 120pF	
	130pF	-115pF ~ -120pF	120pF ~ 130pF	
	140pF	-125pF ~ -130pF	130pF ~ 140pF	
	150pF	-135pF ~ -140pF	140pF ~ 150pF	INSENSITIVE

■ Relay Operation Time Adjustment Method

☐ You can adjust the relay operation time after detecting the medium.



[Operating Status According to Relay Delay Time]

No	Function	Method
1	DT.	■ Relay Delay Time ■ Time Range: 0.5s, 1s ~ 10s @ Adjustment 0.1s 

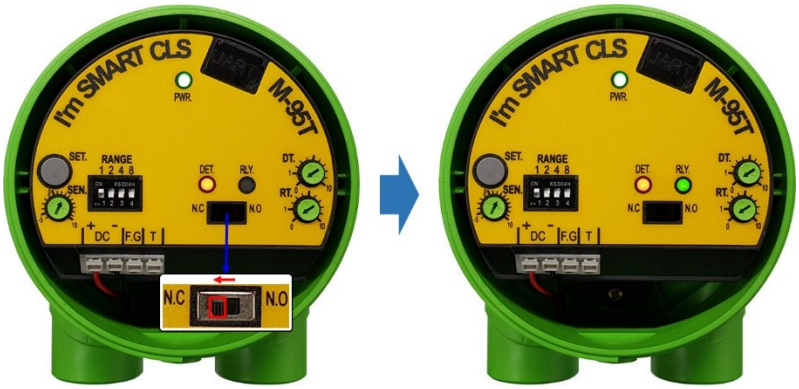
☐ You can adjust the relay return time after undetecting the medium.

[Operating Status According to Relay Return Time]

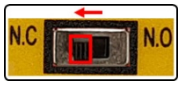
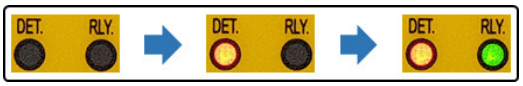
No	Function	Method
1	RT.	■ Relay Return Time ■ Time Range: 0.5s, 1s ~ 10s @ Adjustment 0.1s 

■ Adjust Fail Safe Mode

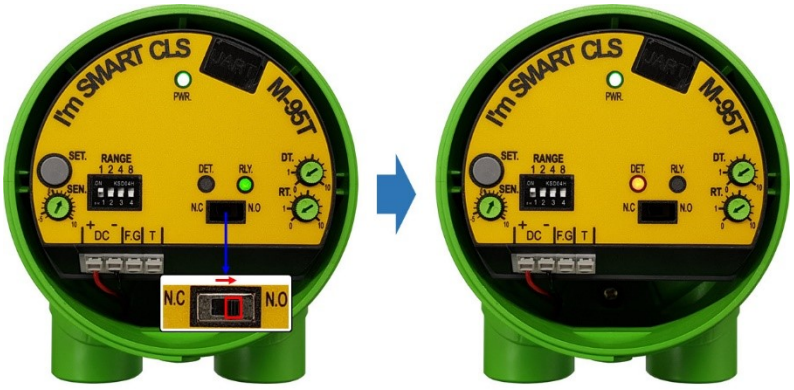
☐ You can adjust the contact status to Relay Contact N.C.



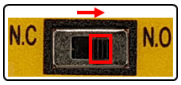
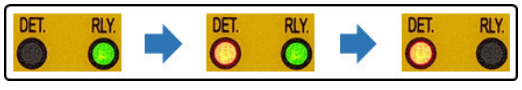
[Operating Status According to Relay Contact [N.C]]

No	Function	Method
1	N.C	■ Relay Contact Out Default Status  ■ After detecting the medium, the contact point changes from N.C to N.O. ■ LED Status 

☐ You can adjust the contact status to Relay Contact N.O.



[Operating Status According to Relay Contact [N.O]]

No	Function	Method
1	N.O	■ Relay Contact Out Opposite Status  ■ After detecting the medium, the contact point changes from N.O to N.C. ■ LED Status. 

3. M-95T UART Monitoring

■ Monitoring Method

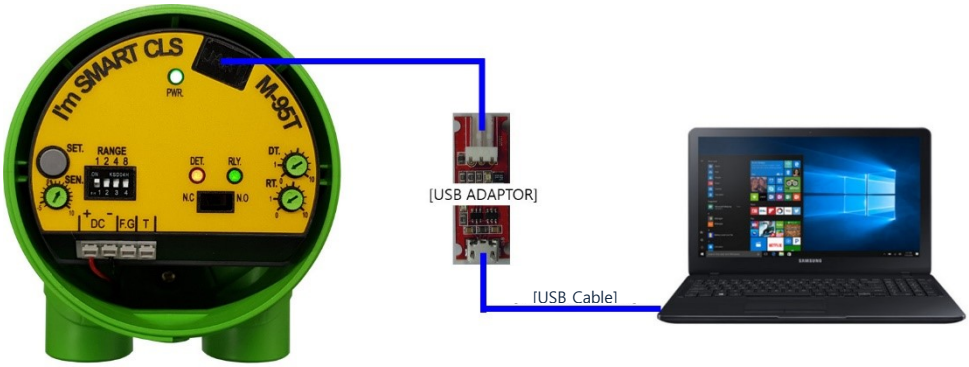
☐ You can only check the state of the adjusted setting values using your PC or Smartphone.

☐ The execution method is the same using your PC or Smartphone. (Password: 1975)

☐ Run Screen Component: You can check the sensor measurement status, sensitivity setting value, relay setting, etc.

■ Monitoring Method Using PC

☐ Component: PC, USB Cable (typical USB to Micro USB B), UART ADAPTOR.



[M-95T PC UART Component]

```
**********************************
01. Measurement capacitance      : 157.6 pF
02. Measurement sensor frequency : 223.190 KHz
03. Reference capacitance        : 157.9 pF
04. Activation capacitance       : 68.3 pF
05. Relay delay time             : 0.5 Sec
06. Relay return time            : 0.5 Sec
07. Relay contact                : Normal close
08. Sensor connected state       : Connected
09. Capacitance sensing range    :
      positive range : 60.0 ~ 70.0 pF
      negative range : -60.0 ~ -55.0 pF
10. Measuring temperature        : 25.0 ℃
( Refresh : R, Repeat : RR, Exit : exit
  Return to menu or stop repeat : ESC  )
**********************************
Select Menu(03) :
```

[M-95T PC UART Run Screen]

```
**********************************
01. Measurement capacitance      : 157.6 pF
02. Measurement sensor frequency : 223.190 KHz
03. Reference capacitance        : 157.9 pF
04. Activation capacitance       : 68.3 pF
05. Relay delay time             : 0.5 Sec
06. Relay return time            : 0.5 Sec
07. Relay contact                : Normal close
08. Sensor connected state       : Connected
09. Capacitance sensing range    :
      positive range : 60.0 ~ 70.0 pF
      negative range : -60.0 ~ -55.0 pF
10. Measuring temperature        : 25.0 ℃
( Refresh : R, Repeat : RR, Exit : exit
  Return to menu or stop repeat : ESC  )
**********************************
Select Menu(03) :
```

☐ Current Measurement Capacitance Value

☐ Frequency according to Current Measurement Capacitance Value

☐ Reference Capacitance Value

☐ Activation Capacitance Value Range

☐ Relay Delay Time Adjustments

☐ Relay Return Time Adjustments

☐ Relay Contact Status

☐ Sensor Connected Status

☐ Measurement Sensitivity Setting Range

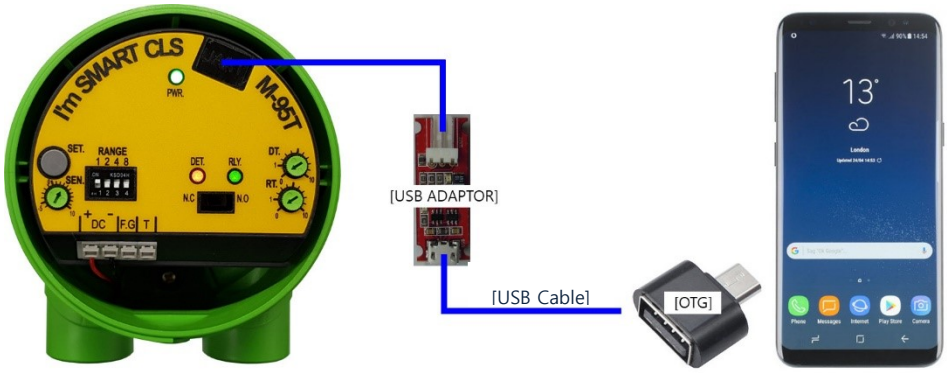
☐ Board Measuring Temperature

[M-95T PC UART Run Screen Component Function]

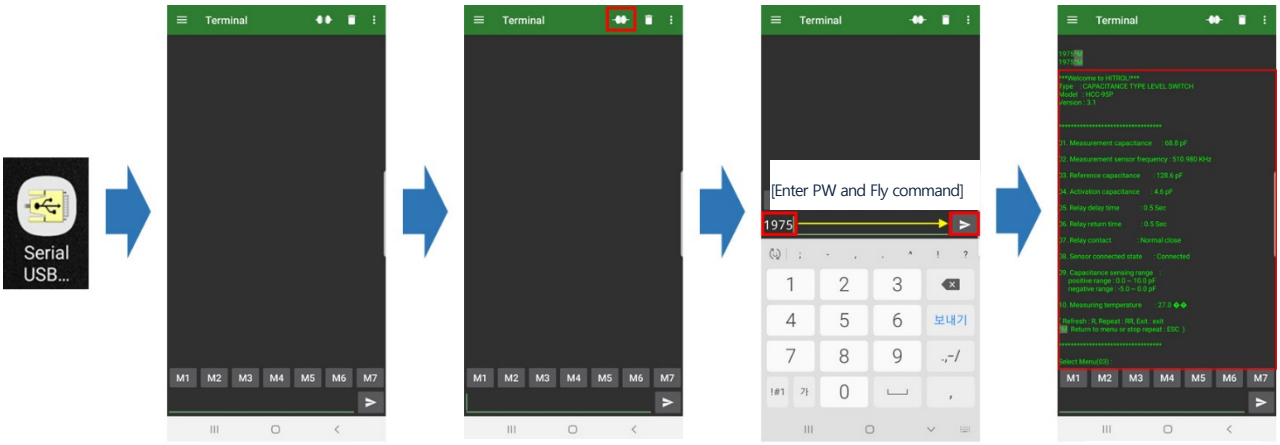
■ Monitoring Method Using Smartphone

☐ Component: Smartphone(Android OS), OTG, USB Cable(typical USB to Micro USB B), UART ADAPTOR.

☐ App: Refer to “Serial USB Terminal Install & Setting Guide”

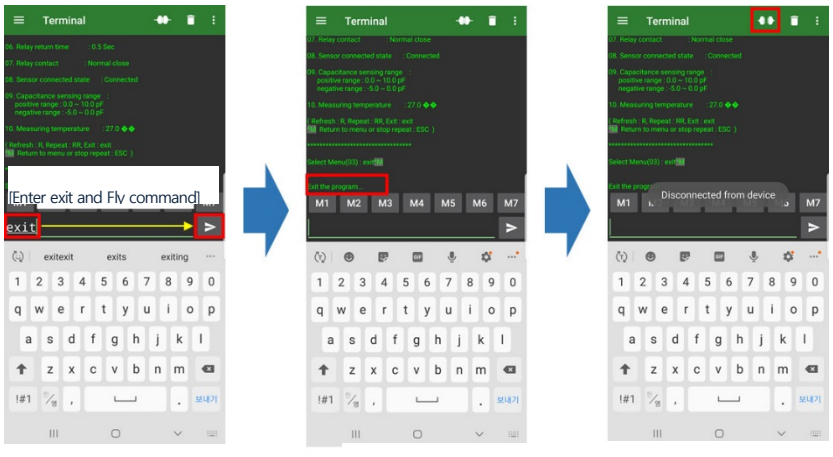


[M-95T Smartphone UART Component]



Open App] [Home Screen] [Select UART Connection] [Enter Password] [Run Screen]

[M-95T Smartphone UART Execution]



[Enter exit command] [Exit Program] [Select UART Disconnection]

[M-95T Smartphone UART Exit]

APPENDIX H

Serial USB Terminal

Serial USB Terminal Install & Setting Guide

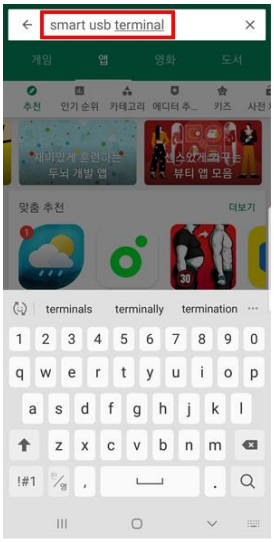
Application : Level Switch / Level Transmitter

Always The Best Solution
HITROL CO., LTD.

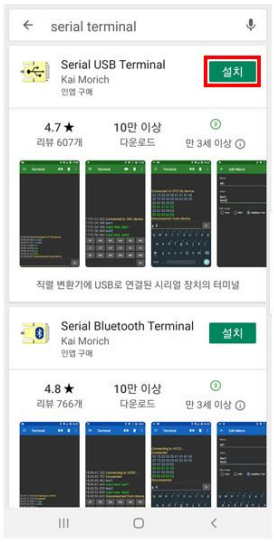
Doc. no. : Rev0.0
Issued Date : 2020.04.29

■ Installing Serial USB Terminal App

☐ Search and Install a App that "Serial USB terminal" in the App Store.



[Search]



[Install]

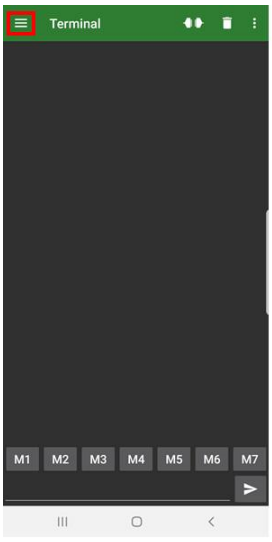
[Icon]

■ Serial USB Terminal Setting

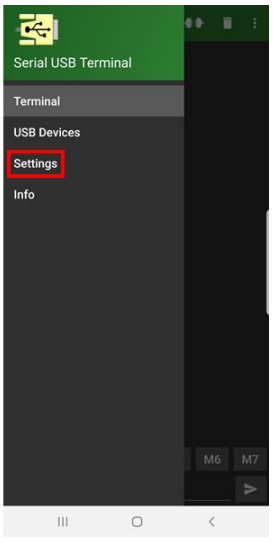
☐ Run The Serial USB Terminal Icon

☐ Four types of environments must be set up for normal operation of Serial USB Terminal.

- ▶ Serial
- ▶ Terminal
- ▶ Receive
- ▶ Send



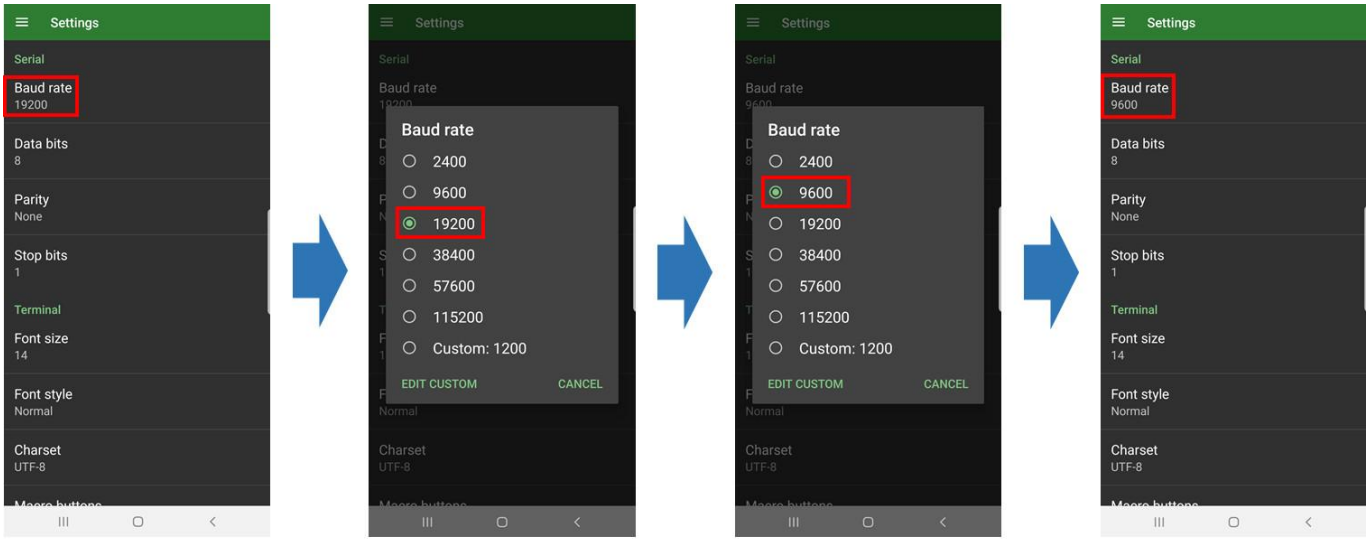
[Configuration]



[Setting]

■ Serial – Baud rate Setting

☐ **Baud rate : 19200 -> 9600**



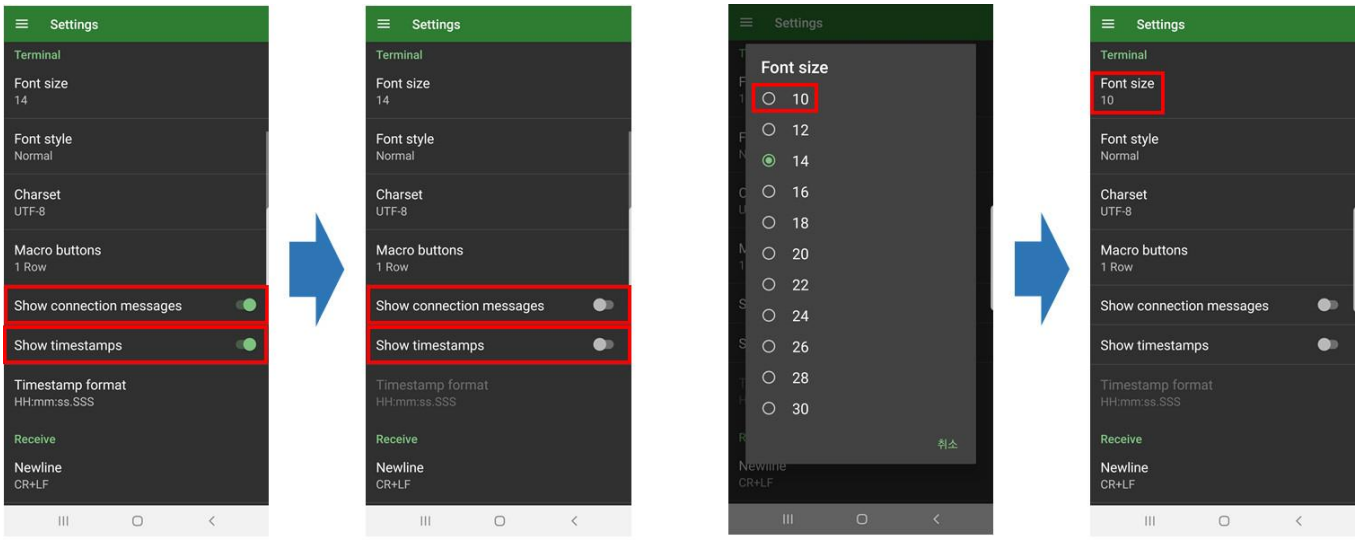
[Select Baud rate] [Default] [Setting] [Complete]

■ Terminal - Show connection message / Show timestamps Setting

☐ **Show connection message : ON -> OFF**

☐ **Show timestamps : ON -> OFF**

☐ **The size of the Terminal Font is the size set in the Smartphone.**

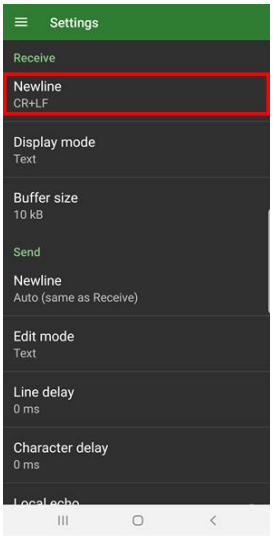


[Default] [Complete] [Terminal Setting]

[Default] [Complete] [Terminal Font Setting]

■ Receive – Newline Setting

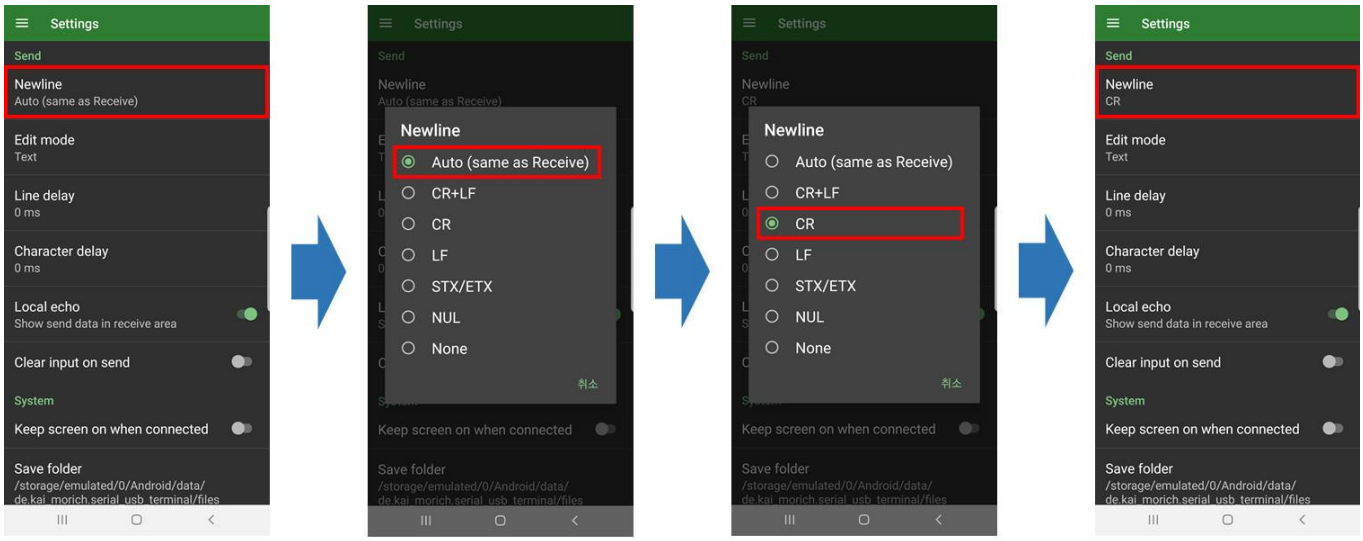
☐ Newline : CR+LF (Carriage Return + Line Feed) Check



[Default]

■ Send - Newline Setting

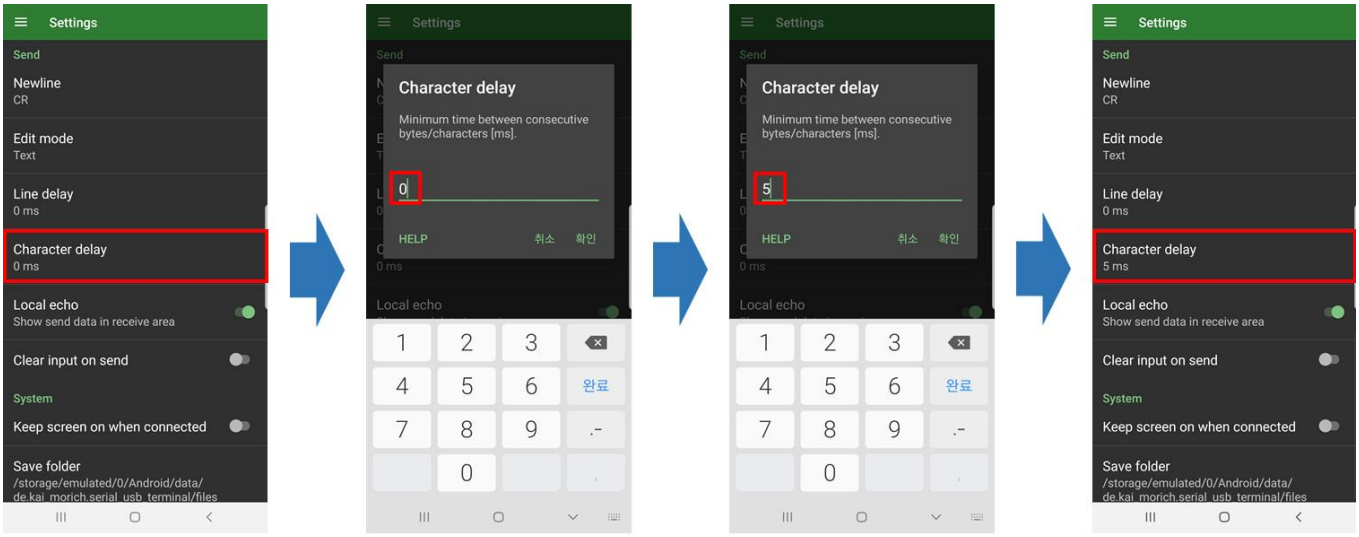
☐ Newline : Auto(same as Receive) -> CR



[Select Newline] [Default] [Setting] [Complete]

■ Send - Character delay Setting

☐ Character delay : 0ms -> 5ms

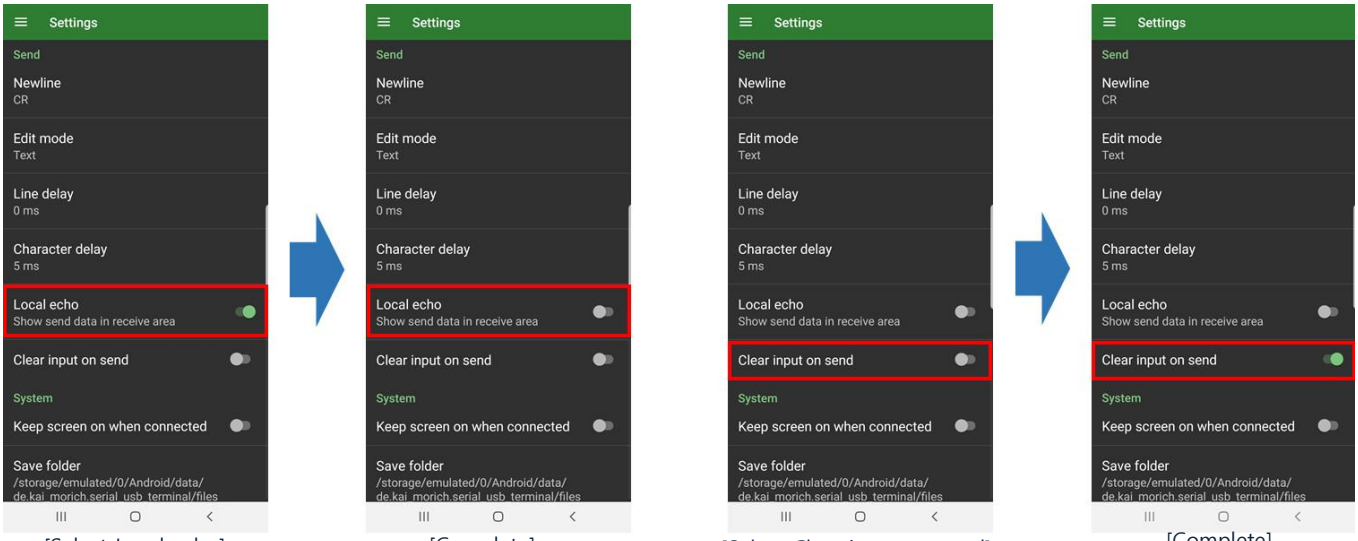


[Select Character delay] [Default] [Setting] [Complete]

■ Send – Local echo / Clear input on send Setting

☐ Local echo : ON -> OFF

☐ Clear input on send : OFF -> ON



[Select Local echo] [Complete] [Select Clear input on send] [Complete]

[Local echo Setting] [Clear input on send Setting]

※ For detailed instructions, refer to the manual of each product.