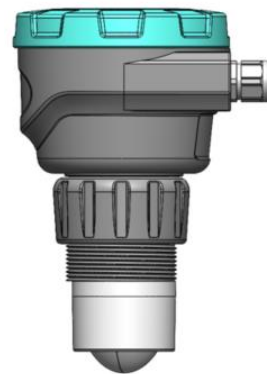
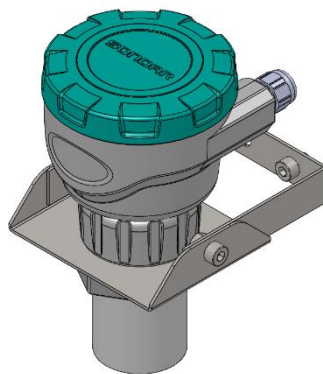
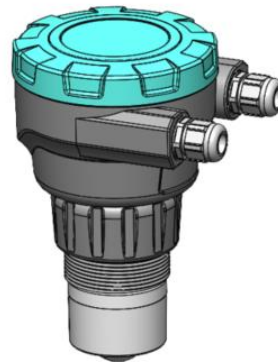


RM150 User's Manual

1'st Edition



2024-11-11
IS Technologies, Co., Ltd.

Index

Introduction	4
Chapter 1	5
Overview	5
Chapter 2	7
Installation	7
2.1 How to install	7
2.1.1 Installation with mounting bracket	8
2.1.2 Installation with screw in a flange	9
2.2 General cautions	10
2.2.1 Avoidance of obstacles	10
2.2.2 Keep the distance for the radar path	10
2.2.3 Installation of right angle	11
2.2.4 Needed to enough the blind distance	11
2.3 Cautions as the installation environments	12
2.3.1 When installed in an open space	12
2.3.2 When installing in a place with severe vibration	12
2.3.3 When the tank has to be sealed	12
2.3.4 When there is much floating matter or foam	13
2.3.5 When there is an obstacle that cannot remove	13
Chapter 3	14
RM150 programming	14
3.1 Introduction of RM150	15
3.1.1 Specification	15
3.1.2 Dimension	16

3.1.3 Wiring	17
3.2 How to check after installing	18
3.3 Control panel	18
3.3.1 How to set the button	19
3.3.2 Example setting.....	21
3.4 Settings menu	22
3.4.1 General settings.....	22
3.4.2 Output settings.....	25
3.4.3 Detection settings.....	26
3.5 Check the status	27
Chapter 4.....	28

Introduction

This is the operating manual for the radar level meter RM150. Before installing and operating the level meter, and before servicing or inspecting it, you should read this manual and be familiar with its contents.

This product is definitely needed to install in an environment that meets the waterproof and explosion-proof ratings. We are not responsible for any accidents that occur due to installation in an environment that requires a higher level of rating than the waterproof or explosion-proof rating of this product.

The following symbols are used to call the user's attention to important matters in this manual.



warning

If you do ignore warnings, the product can be damaged



caution

If you do ignore cautions, the measurement value can be inaccurate



note

It provides an additional information

Please note that the contents of this manual are subject to change without prior notice if the product is modified, upgraded or improved.

Chapter 1

Overview

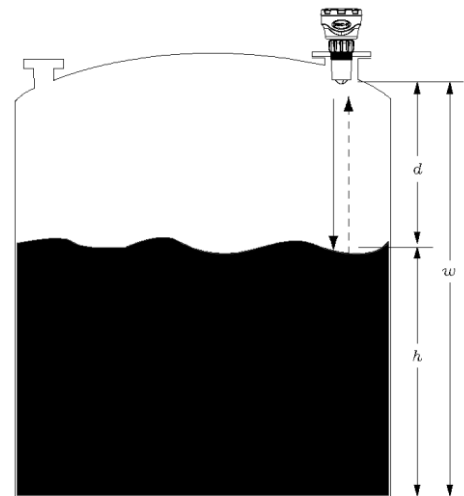
The RM series is a radar level meter that calculates distance by measuring the time it takes for a radar pulse transmitted from a transducer to reflect from the surface of the object being measured and return. The measured value is displayed on the LCD of the level meter. Also, the measured value is converted into a current value and output through the output terminal for connecting with an external device.

$$\text{Distance} = (\text{Time of Flight} \times \text{radar velocity}) / 2$$

d: from the radar lens empty to surface of the target

h: Height of the target

w: from the radar lens to empty of the tank



The configuration of the RM series level meter is as shown in the following.

Radar lens sends the microwave and detects the target.

Transmitter sends the microwave and then it measures the time of flight that reflected the objects. It can be displayed on the LCD or sent its currents on the output terminal.

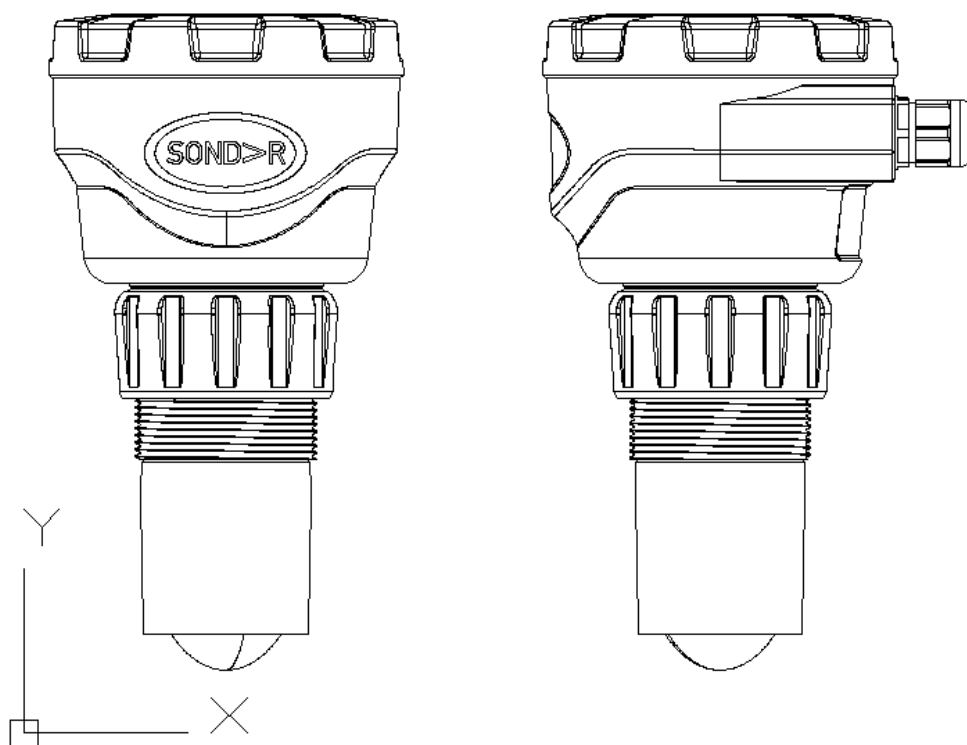


Figure 1.1 RM150

	RM150
Application	Liquid, Bulk solid, etc
Measuring Range	0.2 ~ 15m
Thread	2" NPT or 2"PF
Terminal type	2-wire looped powered
Material	PP(Body), PVDF(Radar)
Water proof	IP67
Frequency	60.5GHz
Signal output	DC 4 ~ 20 mA
Operating Temperature	-30 ~ 70°C
Working Pressure	up to 2.5 Bar
Accuracy	±5mm
Resolution	1mm
Power	Nominal 24V DC at Max.550 Ω Max. 30V DC 4 to 20mA

Table 1.1 Specifications of RM150

Chapter 2

Installation



It makes sure to refer to the specifications if the environment of installation is suitable before installing. Refer to chapter 1 for the specifications. Please note the following during installation.



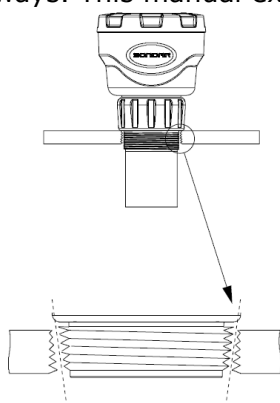
- (1) Please remove an obstacle between the transducer and the target.
- (2) Please the level meter far away from an inside wall of tank or other obstacles so that it can measure correctly.
- (3) Please the level meter far away from a device which has a strong electromagnetic wave.
- (4) The surface of the lens should view the right angle with the target.
- (5) The water level has to be higher than the blind level.
- (6) It is good for the level meter to avoid a direct sunlight or a strong wind.



Please contact us if the environment of installation is weird, special, and difficult.

2.1 How to install

RM150 can be mounted with a mounting bracket or with screw in flange or in many other ways. This manual explains two typical mounting types of RM150.



If the equipment is installed or used in a manner not specified in this manual, then the protection provided by the equipment may be impaired. The thread specifications are as following.

Model	Thread
RM150	2" NPT
	2" PF

2.1.1 Installation with mounting bracket

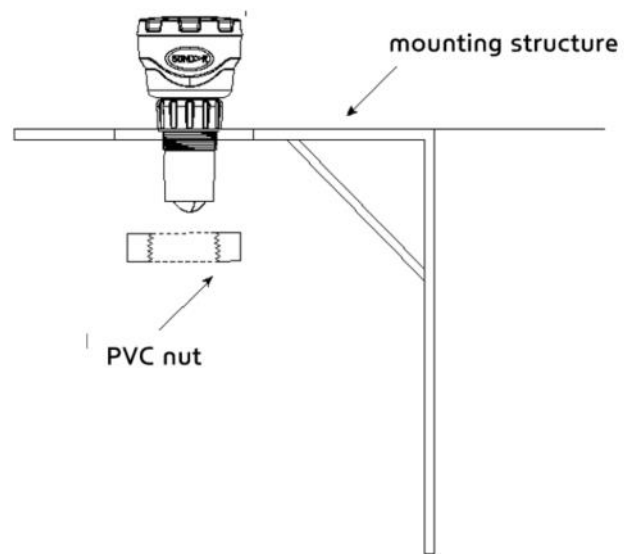


Figure 2.1 How to install with mounting bracket



note

Please contact us if you need PVC nut that is an extra component.

2.1.2 Installation with screw in a flange

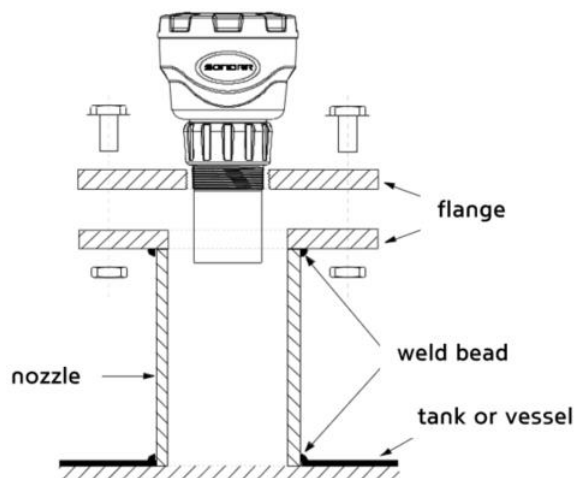
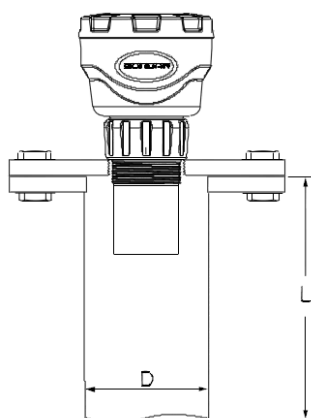


Figure 2.2 How to connect with screw in a flange



The nozzle length shouldn't be exceeded the maximum length above. Shorter setting is better. The recommended nozzle specification is as following.

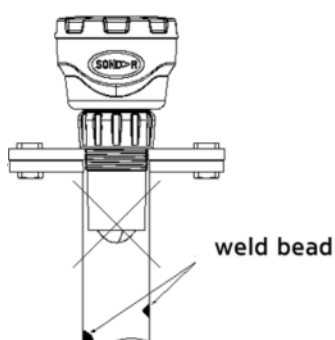
Table 2.1 Recommended Nozzle length (unit: mm)

inner diameter(D)	length(L)
80	234
100	290
150	430
200	570



caution

The above table shows the maximum length based on the inner diameter of the nozzle, and the inner diameter and length do not necessarily have to be proportional. In other words, when the inner diameter is 80mm, it is better for the length is shorter than 234mm.



The nozzle should be free of obstructions such as weld seams..

If there is a seam or the internal weld cannot be removed, an extension pipe should be installed internally to eliminate the irregular reflection caused by the seam.

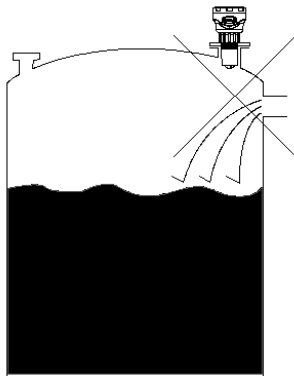
2.2 General cautions

The general cautions is as following during installing.



- (1) Please remove an obstacle between the transducer and the target.
- (2) Please the level meter far away from an inside wall of tank or other obstacles so that it can measure correctly.
- (3) Please the level meter far away from a device which has a strong electromagnetic wave.
- (4) The surface of the lens should view the right angle with the target.
- (5) The water level has to be higher than the blind level.
- (6) It is good for the level meter to avoid a direct sunlight or a strong wind.

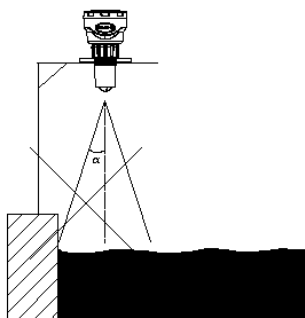
2.2.1 Avoidance of obstacles



Do not install the sensor in or above a filling flow outlet. Secure enough distance from the filling flow.

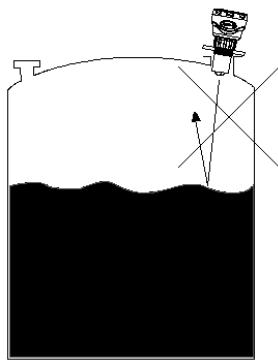
Do not install the sensor close to a device that has a strong electromagnetic wave as motor, or something like that.

2.2.2 Keep the distance for the radar path



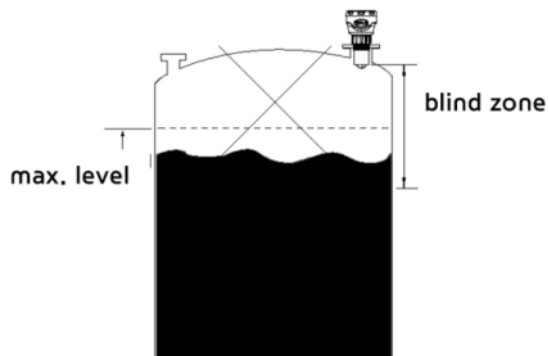
When mounting the sensor, keep the distance to the vessel wall.

2.2.3 Installation of right angle



The level meter should be installed so that the target is perpendicular. It should be considered the slope of the target if the sensor measures a bulk solid or sediment.

2.2.4 Needed to enough the blind distance



The maximum level should not be much than the blind level. If needed, you can install another place using the pipe. Refer to 2.3.4 for installing of using pipe

The blind zone means the range that does not measure. The minimum blind distance is about 20cm. It depends on the installation environment.

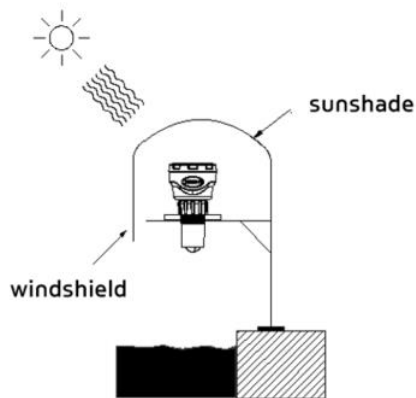
2.3 Cautions as the installation environments



note

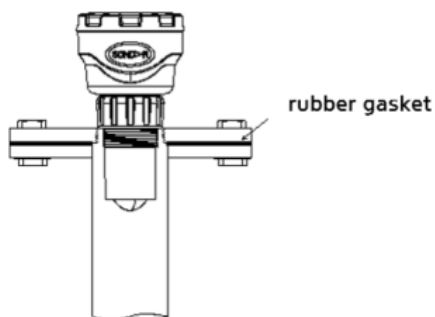
Please contact us if the installation place is weird or you choose it difficult.

2.3.1 When installed in an open space



The level meter should be installed in no direct sunlight. Also, the level meter might be damaged inside electronic circuit by a strong sunlight. So it is good to set up a sunshade to take care of the sensor. In addition, it is good for the sensor to install at no strong wind places as much as possible. Be careful to shake the sensor by the wind. The sensor cannot measure well. If needed, it is good to set up a wind shield as much as possible.

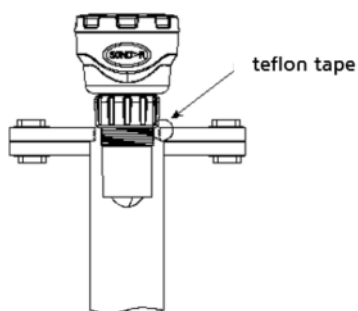
2.3.2 When installing in a place with severe vibration



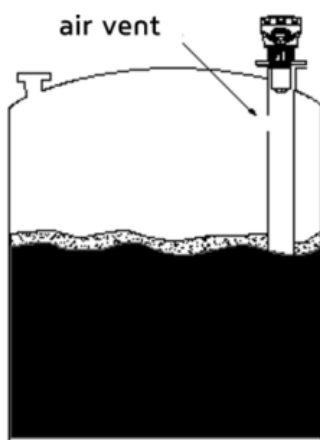
You should use rubber gaskets or vibration dampers to absorb vibration and shock because the severe shocking and vibration can trigger damage to the level meter.

2.3.3 When the tank has to be sealed

If the tank needs to be sealed, apply sealant to the threaded area or wrap Teflon tape.



2.3.4 When there is much floating matter or foam



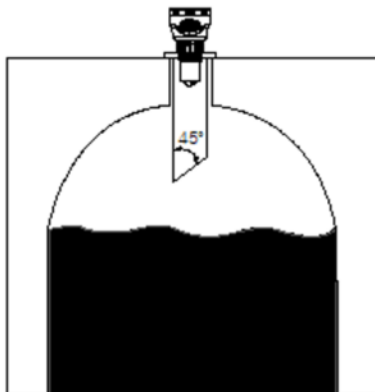
1. Prepare a pipe long enough to reach the floor.
(It recommends the single pipe like the PVC.)
2. It needs hole on top of the pipe to flow the air as the water level.



caution

- ♦ The pipe should be a single-piece one without any joints.
- ♦ If you need to connect two or more pipes, there should be no protrusion or dent parts inside the pipes.

2.3.5 When there is an obstacle that cannot remove



caution

1. Use a connecting pipe when there is an obstacle which cannot remove.
(It recommends the single-piece pipe as PVC)
2. Cut the end of pipe the 45° angle

The pipe should be a single-piece one without any joints.

Chapter 3

RM150 programming

After finished the installation, you can set each menu and then have to confirm the level meter works normally. This chapter describes all of the menu options in RM150, in numerical order. Press the menu button, can be set the menu option. From menu 1 to menu 12 it can be moved with up or down key.

3.1 Introduction of RM150

3.1.1 Specification

Measuring objects	Liquid /solid
Measuring range	20 ~ 1,500 cm
Blind range	20 cm
Beam angle	10°
Response rate	0.1 ~ 100 m/min
Accuracy	5mm
Resolution	1mm
Display	5 digits LCD
Signal output	DC 4 ~ 20mA (Max. load 550Ω)
Frequency	60 GHz
Water proof	IP67
Material	PP(body), PVDF(sensor)
Weight	Nominal 0.55 kg
Thread	2" NPT or 2"PF
Wiring	2-wire loop powered
Operating Temperature	-30 ~ 70°C
Working Pressure	Up to 2.5 Bar
	Nominal 24V DC at Max.550 Ω
Power	Max. 30V DC
	4 to 20mA

Table 3.1 RM150 specifications

3.1.2 Dimension

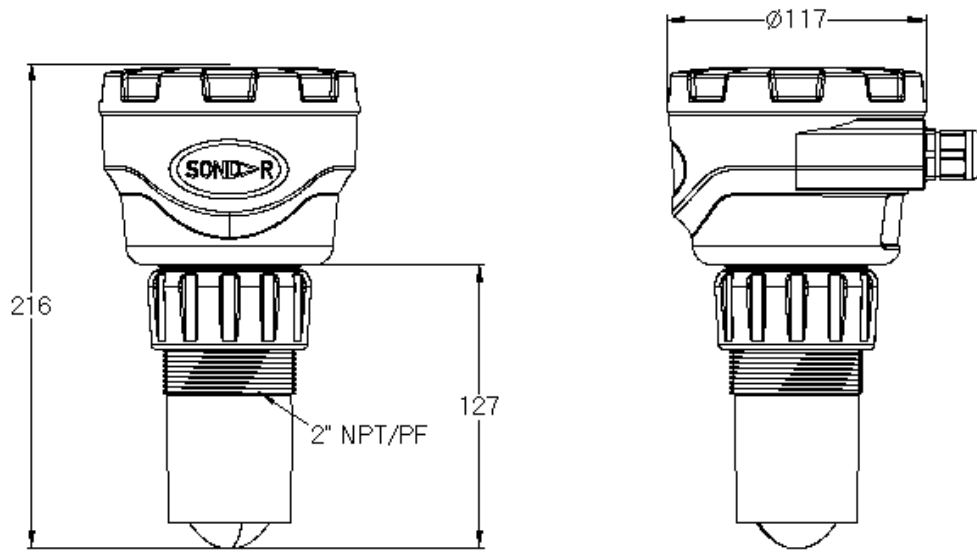
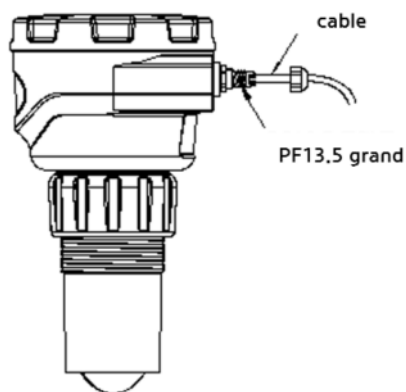


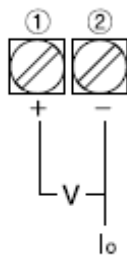
Table 3.1 RM150 dimension

3.1.3 Wiring

RM150 cable outlet does not prevent water from penetrating permanently. The wire should be bent downwards to connect to the RM150 to prevent water from entering.

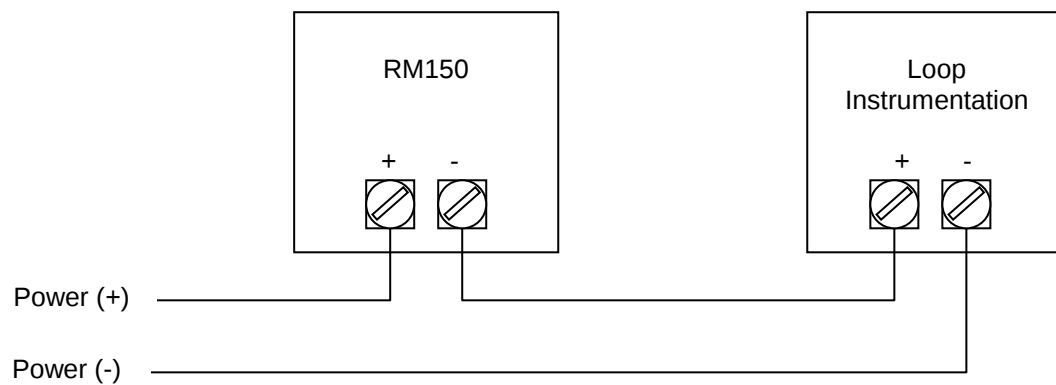


Insert the wire into the PG13.5 cable gland.

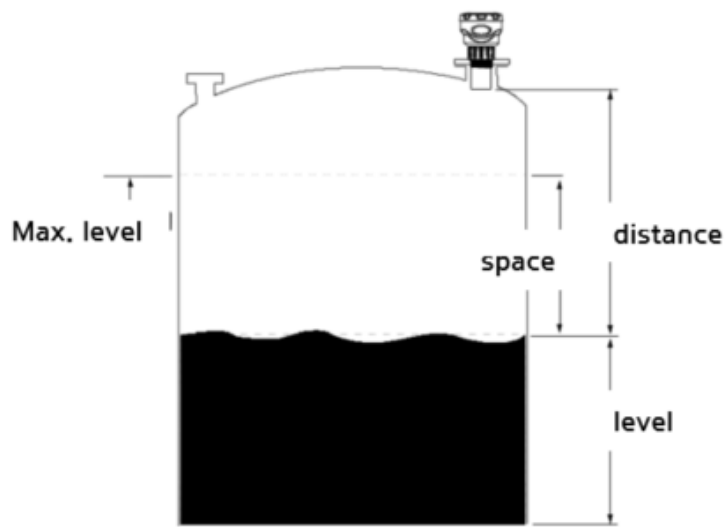


V: 20 ~30V power (Generally 24V) are available.

Io: Measurement value outputs as the current on (-) terminal.



3.2 How to check after installing



After installing, the RM150 starts with the initial value. The display shows the level value, which is the distance between the empty distance and the measuring surface of the water.

When it seems to be different the LCD value and the real value, verify if there is an obstacle at the place.

It shows normal when both status LED light on at the same time as the below table.

You can set each menu and then should close the cover after finishing the menu.

Detect	Level
○	○

3.3 Control panel

The control panel consists of the LCD, status lamps, and buttons. Refer to Chapter 3.5 for the status lamps.

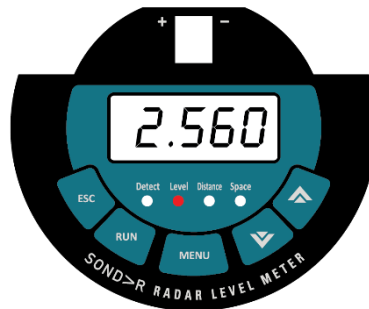


Figure 3.2 RM150 control panel

The LCD can show a number with 5-digits.

The distance unit has the meter and the feet.

It shows 2.560m when you select the meter unit as the above picture.

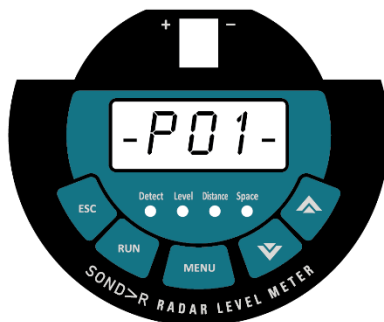
Refer to how to select the unit type of the menu.

3.3.1 How to set the button

The following table shows how to set the button. Push the MENU button for entering the setting menu. The moving of the menu is the circulation type, and press the RUN button when you will finish a setting. So the RM150 will be start with the changed setting value.

Start menu	MENU
Menu moving	UP / DOWN
Start setting	MENU
Changing setting	UP / DOWN
Changing digit position	MENU
Return menu	ESC
End of setting	RUN / ESC

How to display menu numbers



The MENU number is displayed after the English letter P.

How to display setting



Settings are displayed right-aligned.

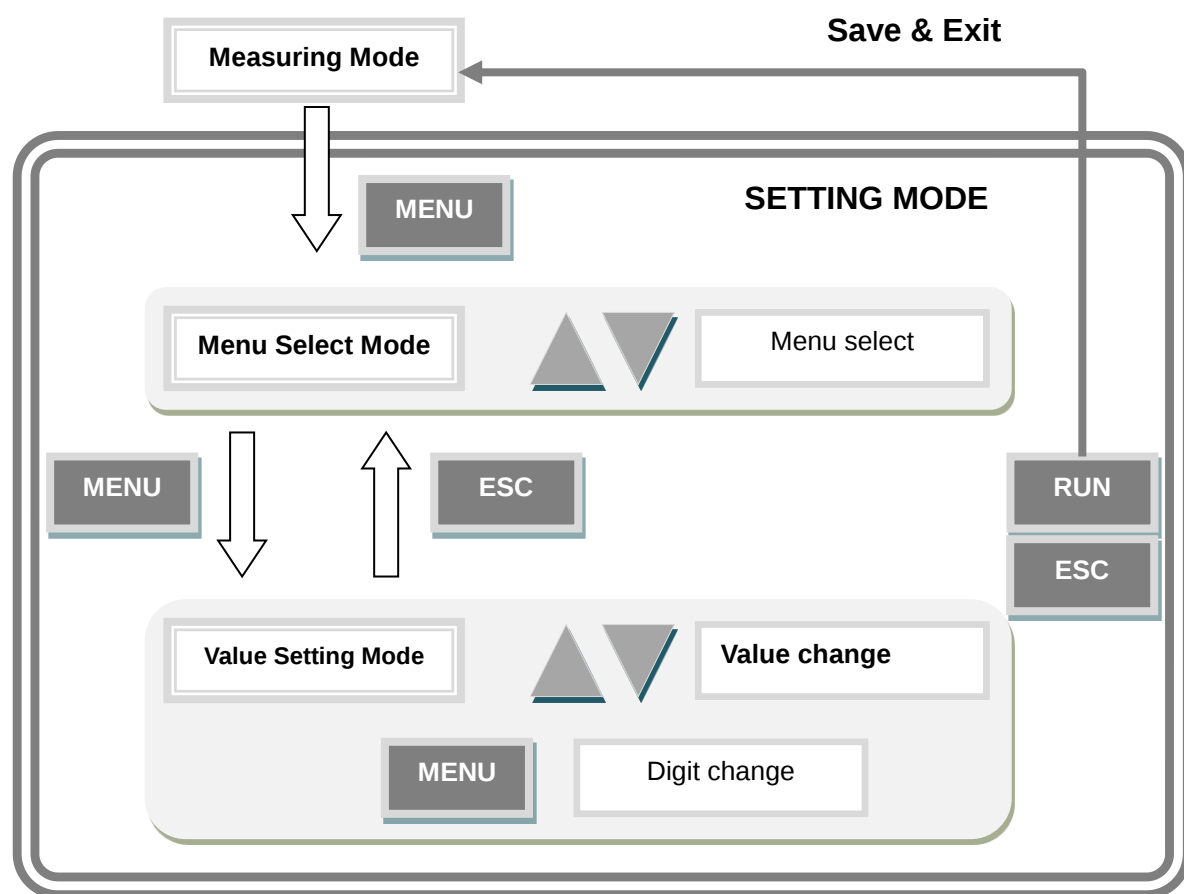
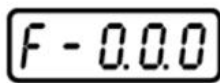


Figure 3.3 How to control button

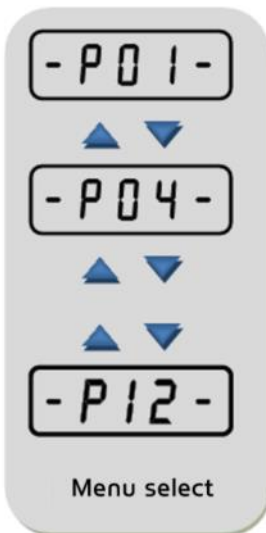
3.3.2 Example setting

If you change the empty distance from 10m to 9m.



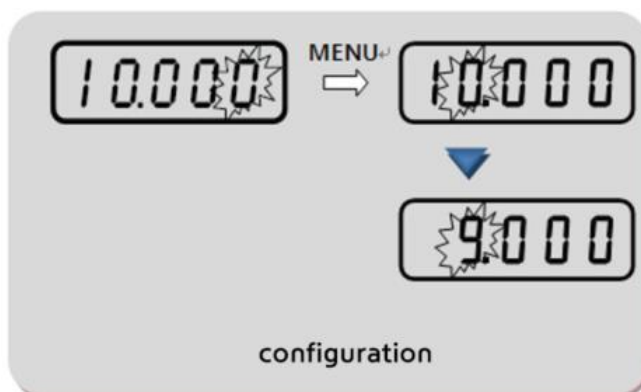
1. To change settings during measurement, press the MENU button.

2. The firmware version is displayed for about 2 seconds. (P01 will be displayed automatically, after 2 seconds)



3. When the menu is displayed, use the UP or DOWN buttons to select the desired menu. (Select P04 in case of the empty distance)

Please refer to the settings menu table for the settings menu numbers and settings functions.



4. When settings are displayed, the lowest number is displayed.

5. Use the MENU button to select the number you want to change.

6. After selecting the number of digits, use the UP or DOWN buttons to set the desired value.

7. After the settings are complete, press the RUN button to reset the measurements to the settings.

8. Press ESC button to go to the upper menu.

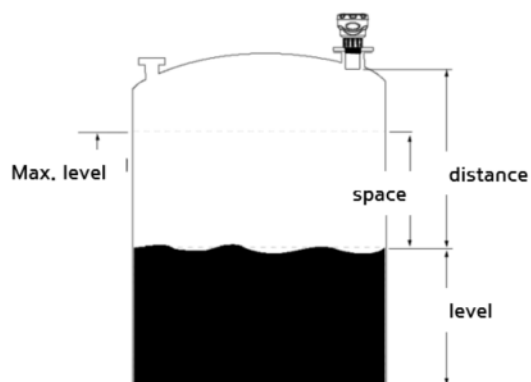
3.4 Settings menu

Type	Menu number	Function
General settings	P01	Measurement type
	P02	Unit type
	P03	Display type of measurement
	P04	Empty distance
	P05	Blind distance
Output settings	P06	4mA output point
	P07	20mA output point
	P08	Error output
	P09	Error keeping time
Detection settings	P10	Detection type
	P11	Object type
	P12	Damping rate

Table 3.2 RM150 settings menu

3.4.1 General settings

[P01] measurement type



You can select the measuring type. The default is 1.

value	mean
0	Level
1	Distance
2	Space

Level: Distance from the empty to the water surface

Distance: Distance from the sensor to the water surface:
 distance from the current water surface to the maximum water level

Figure 3.4 measurement type

[P02] Unit type

Value	Function
0	Meter
1	feet

You can choose the distance display unit.

The default is 0.

1 ft = 0.3048 m

1 m = 3.2808 ft

[P03] Display type of measurement

Value	Function
0	Distance
1	current (mA)
2	Percent (%)

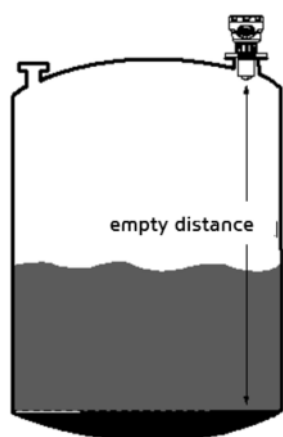
You can select the display type about the measuring value. The default is 0.

Distance: The measurement value shows that it is converted to the unit selected in menu number [P02]

Current (mA): The measuring value displays as the current.

Percent (%): The measured value is converted and displayed as a percentage of the 4 to 20 mA set value.

[P04] empty distance



Sets the distance between the transducer and the empty. The default is the 5 meters (16.4 feet). It can be set up to the 15 meters (49.2 feet).

Model	default (m)
RM150	5.000

Figure 3.5 empty distance



caution

If you set the menu number [P01] to height (Level) measurement, you have to enter the empty distance correctly to measure accurately. Therefore, recommend to measure the current water level using another tool and then enter the floor distance as follows.

Empty distance = current water level + measuring distance

[P05] blind distance

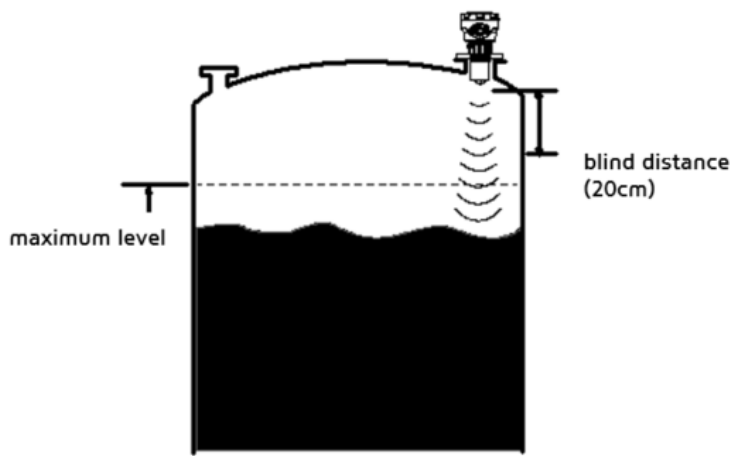


Figure 3.6 Blind distance

The blind distance is a distance that cannot be measured. The default is as the following.

Model	Value (m)
RM150	0.200

3.4.2 Output settings

[P06] 4mA output point

The output range of the current is 4 ~ 20mA. You can set a point to output 4mA. If the 4mA output point is set as the lowest point, the 20mA output point should be the highest point. However, the opposite setting is also possible. The default is 0.

[P07] 20mA output point

model	value(m)
RM150	5.000

The output range of the current is 4 ~ 20mA. You can set a point to output 20mA. If the 20mA output point is set as the highest point, the 4mA output point should be the lowest point. However, the opposite setting is also possible. The initial value is the table on the left.



caution

When changing the empty distance in menu number [P04], the 4mA / 20mA output points also need to be changed accordingly so that the current output matches the actual measured value.

[P08] error output

Value	Mean
0	3.8 mA
1	hold
2	22 mA

If the level meter is wrong installed, the transducer is broken, or the measurement environment changes, then it exactly can't measurement. At this time, it happens the error output. You can select the error output properly to fit your application. The default is 22mA.

The hold value continues to output the current for the measurement value just before the error occurred. If the current of 3.8mA or 22mA is connected in a way that can directly affect the operation of another device, even though a fault occurs for the moment, that device may stop or malfunction. You should select the option 2 to avoid this problem.

[P09] error keeping time

Most errors are transient, so the level meter will continue to search until it returns to normal. However, if it does not return to normal after the time set here, it will be considered an error. The range of setting is about 20 ~ 900s, and the default is 1.

Value	Sec	Value	sec
0	20	5	500
1	100	6	600
2	200	7	700
3	300	8	800
4	400	9	900

3.4.3 Detection settings

[P10] detection type

Value	Mean
0	Closest
1	Strongest

The reflected signal depends on the target that can receive a strong or a weak signal. Or it can be received another signal that does not want because of obstacles. You can choose which signal is available. The initial value is 0.

Closest: It detects the first signal.

Strongest: It detects the strong signal

[P11] Object type

Value	Mean
0	Bulk solid
1	Liquid

The signal quality is dependent on the objects (liquid, foam or solid). You can select the object type that you want to measure. The default is 1.

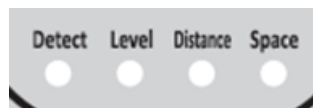
[P12] Damping rate

Value	mean	
0	0.1 m/min	Slow
1	1 m/min	↑
2	10 m/min	↓
3	100 m/min	fast

The measurements are not displayed in real time, but displayed as an average for a period of time. It helps to get much more accuracy. However, the accuracy could be reduced when the water level would change rapidly. For getting correct value, it is good to select the damping rate to suit the velocity of water level. The default is 1.

3.5 Check the status

The indicators show the operating status of the RM150. If an error occurs, all displays turn off and an error message appears on the display. If you are not able to resolve the issue with the solution for the error message, please contact us for service.



Indicator Status	Indicator		
	Detect	Level, Distance, Space	
Normal operate	○	●	
Searching echo		●	
error			

○ blink ● lit

Searching echo

- When the water level changes rapidly all of a sudden
- When there is an obstacle into the radar wave path for the moment
- When the normal measurement is not possible due to electric noise.
- When the RM150 turns on for the first time

The level meter starts to operate normally after a few seconds, if the above conditions release.

Error type

This condition happens during no echo signal or abnormal cases. It displays error current output and error messages on the LCD.

Error message	mean
E-Err	If there is no echo signal

If a system error occurs, the following error message will be displayed on the LCD.

Error message	mean
S-Err	If there are the system or the sensor occurs the fault

See Chapter 4, if an error occurs.

Chapter 4

How to solve the problem

If you encounter any problems while using it, refer to this chapter to try to resolve the problem. If you cannot solve the problem using the manual alone, please contact us for service.



note

When you request a service to us, please provide as much detailed information as possible about the installation environment and symptoms of the failure so that the problem can be resolved quickly.

Problem	Cause	Action
♦ No numbers are displayed on the LCD. ♦ No current outputs	Power is not supplied	1. Check the connection status of the terminal block and wires. 2. Check the input power (DC 20 ~ 30V) 3. Check the degree of submersion and corrosion of terminal blocks. If all of the above checks are normal, request service from us.
♦ All status indicators are lighted off ♦ An error is output ♦ The E-Err shows on the LCD	It cannot detect reflected waves	1. Make sure the high water level is set lower than the empty distance 2. Check the empty distance 4. Make sure Detect lights up. If it does not blink, check the installation status and adjust the detection type 5. If there is an obstacle between the radar lens and the water surface, remove it. 6. If there is foreign matter on the sensor surface, remove it.

Problem	Cause	Action
♦ All status indicators are lighted off ♦ The S-Err shows on the LCD	The transducer is defective	Request our service
♦ Continue printing out measurements for previous numbers.	The water level fluctuates severely or the surface of water is rough	Set the damping rater is higher than the current setting
♦ The measured water level is higher than the actual water level. ♦ Outputs a fixed measurement value regardless of water level ♦ It works well at close range.	There is an obstacle above the water.	1. Remove obstacles. 2. If the obstacle is higher than the highest water level, you have to set the blind distance as the distance of the obstacle
♦ The measured water level is lower than the actual water level. ♦ Measurement is not accurate ♦ It seems to work only well at a distance.	There are a lot of reflect echoes so it detected another signal	1. Set the blind distance again 2. Set the detection type again.
♦ S-Err appears on the display.	The sensor has not been powered for a few days If the empty distance setting is smaller than the actual measured distance If the blind distance is bigger than the empty distance In case of radar sensor failure	If the sensor is supplied the voltage, it does work normally in a few minutes. Set the empty distance again Set the blind distance again Request service from us

Problem	Cause	Action
♦ The measured water level varies considerably and periodically.	Rotating bodies such as motors and generators are installed.	1. Set the damping rate is lower than the current setting. 2. Move and install the level meter to a location where it will not be affected by the rotating body
♦ The measured water level changes irregularly.	An obstacle appears in the sensor path	1. Set the damping rate is lower than the current setting. 2. Set the detection type again. 3. If there is any foreign matter on the sensor, remove it.
♦ The measurement value only displays the blind distance.	This problem is caused by a protrusion inside the nozzle.	1. Check the inner surface of the nozzle. 2. Make sure the nozzle size meets the minimum recommended specifications. 3. Increases the blind distance within a range that is satisfied with the highest water level.
♦ If the sensor is a closed space, measurements have error ratio.	The pressure raised for being occurring the gas	1. Install a ventilation fan.



If you are having trouble connecting to an external device

note

Problem	Cause	Action
♦ The level meter display does not match the external device display.	The setting range of output current is different each other	Check the 4mA/20mA output points and match the settings of both devices.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device should be installed and operated with minimum 20 cm between the radiator and your body.

IS Technologies, Co., Ltd.
M-1602, Songdogwahak-ro 32 Yeonsu-gu
Incheon, Republic of KOREA (21984)
TEL: +82-32-850-2600
FAX: +82-32-850-2612
E-MAIL: sales@istec.co.kr
Homepage: <http://www.istec.co.kr> Issue date: November 11th 2024 (1st Edition)