ＩＮＳＴＲＵＣＴＩＯＮ　ＭＡＮＵＡＬ

FOR

GUIDED PULSE LEVEL MEASUREMENT

MODEL: ＧＷ２００

Revised 2021-12-23

Read this manual carefully for safe usage.

- This manual applies to general purpose equipment. For equipment intended for use in potentially explosive atmospheres, see applicable manuals.
- This manual contains important information on handling, inspection and operation of the equipment indicated on the cover page. Before handling the equipment, read this manual carefully.
- Instructions in documents submitted by Nohken or its representative have higher priority than those in this manual.
- Keep this manual within easy access.
- Depending on environment, the equipment may not satisfy specifications shown in this manual. Check the application conditions carefully beforehand.
- Please contact our sales office for any questions or comments about the equipment or this manual. Sales offices are shown on the back of the manual.

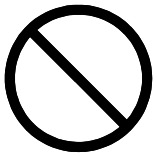
Safety Symbols:

⚠ WARNING	Means a potentially hazardous situation which, if necessary precautions are not observed, can result in death, serious injury and/or considerable material damage.
⚠ CAUTION	Means a hazardous situation which, if necessary precautions are not observed, can result in minor or moderate injury or damage to the device.

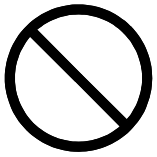
	Means prohibited actions.
	Means mandatory actions.

⚠ WARNING

This equipment is NOT intended for use in potentially hazardous atmospheres. Never use it where flammable gas or vapor may be present. Failure to observe this may result in ignition of flammable gas or vapor, causing disaster.



Do not alter or disassemble the equipment, unless you have been instructed to do so by Nohken or its representative.
Failure to observe this may result in:
- malfunction of or damage to the equipment or connected devices;
- ignition;
- electric shock or user injury.



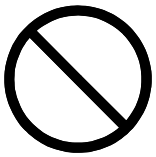
Turn off the equipment before wiring or inspection. Otherwise leakage or short circuit may cause ignition or electric shock.

After wiring is complete, always check for its correctness. Wrong wiring may cause:
- damage to or malfunction of the equipment or connected devices;
- ignition;
- electric shock or user injury.

Turn off the equipment immediately in case smoke, unusual smells or sounds are noticed. Do not supply power until problems are solved.

⚠ CAUTION

Handle the equipment with care. Do not drop, throw, or give a strong shock to avoid damage.



Observe operation conditions specified in the manual. Use outside the specified conditions may result in malfunction of or damage to the equipment or connected devices, ignition, user injury, or electric shock.

Perform operation tests before actual application to ensure performance. Install back-up instruments based on different technologies if failure of this equipment is expected to result in a serious incident.

⚠ CAUTION

Check carefully for chemical compatibility of materials of construction before installation.

Use the flange, thread or somewhere close to the process connection to handle the equipment. Do not use the housing to avoid dropping the equipment, and resultant damage to the equipment or user injury.

Equipment 50cm or longer:
Lay the equipment when not in use. Otherwise it may fall and damage itself or things around it, and cause user injury.

Always ground the equipment. (Ground resistance: 100Ω max.)
Without grounding, electric shock may occur in case excessive voltage is applied to the housing.

When connecting to inductive or lamp loads:
Ensure the maximum voltage/current ratings will not be exceeded to avoid damage to the relay contacts.

Use lightening arrestors or surge absorbers to prevent:
- malfunction, damage, or ignition of the equipment and connected instruments;
- electric shock or injury.

INTRODUCTION

A) This manual applies to standard models. Please note that information in this manual may not be applied to customized versions.
B) We are willing to help customers select a suitable model or provide information about chemical compatibility of materials used, but the customer is responsible for the decisions made.
C) We always welcome suggestions and comments about this manual. Please contact our sales office when you have questions or comments.
D) Component replacement:
The equipment design is regularly reviewed and improved. The same components therefore may not be available when replacement is required. In such cases, different components or products may be supplied. Please contact our sales office for detail.
E) The contents of this manual are subject to change without prior notice as a result of improvement of the equipment.

WARRANTY & DISCLAIMER

A) Nohken warrants the equipment against defect in design or material, and workmanship for a period of one (1) year from the date of original shipment from Nohken's factory.
B) Nohken will not assume liability for loss nor damage resulting from the use of the equipment.
C) Nohken will not assume liability for damage resulting from:
  C-a) not observing instructions in this manual;
  C-b) installation, wiring, operation, maintenance, inspection, or storing in a manner not outlined in this manual;
  C-c) unauthorized alterations and repairs;
  C-d) the use of or replacement with components not provided by Nohken;
  C-e) devices or instrument other than those manufactured by Nohken;
  C-f) the use not described in *Chapter 1 Purpose of Use* of the manual;
  C-g) force majeure including, but not limited to, fire, earthquake, tsunami, lightning strike, riot, commotion, war, armed conflict or terrorist attack, radioactive pollution, act of God, governmental decisions or actions, and compliance with laws and regulations.

THE PROVISIONS OF THIS SECTION DO NO LIMIT YOUR LEGAL RIGHTS.

Table of Contents

1. PURPOSE OF USE

Guided Pulse Level Measurement GW is a sensor designed to continuously measure liquid level and provide output for alarms, or to control pumps. Do not use the product for any other purpose.

2. DESCRIPTION

2.1 Product Overview

GW comprises of an electronics in the housing, process connection (threaded connection* or flange*) and probe*. The probe is inserted into the tank and used to measure the distance to the material surface.
The probe assembly has no moving parts, so the material buildup and resultant adverse affection to measurement are minimized. The user can cut off the end of the rod or wire type probe to a desired length. The sensor is easy to program without needing a tester or other devices to configure the zero level and span.

2.2 Principle of Operation

The sensor electronics transmits high frequency signals that travel down on the probe. The signals are reflected on the material surface, where the dielectric constant* changes, and then received by the sensor electronics. The sensor electronics measures the time taken from transmission to reception of the signals, and calculates the distance from the reference point to the material surface. The distance is then converted to analog output of 4 to 20mA.

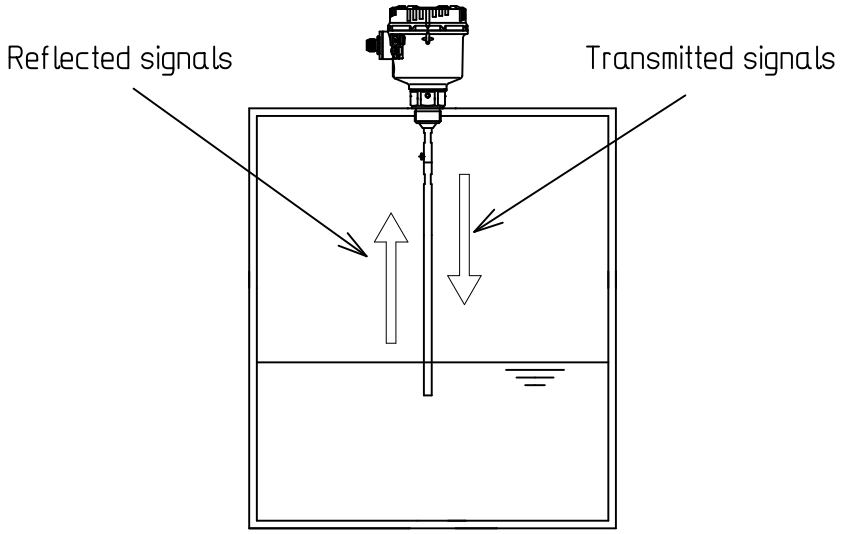


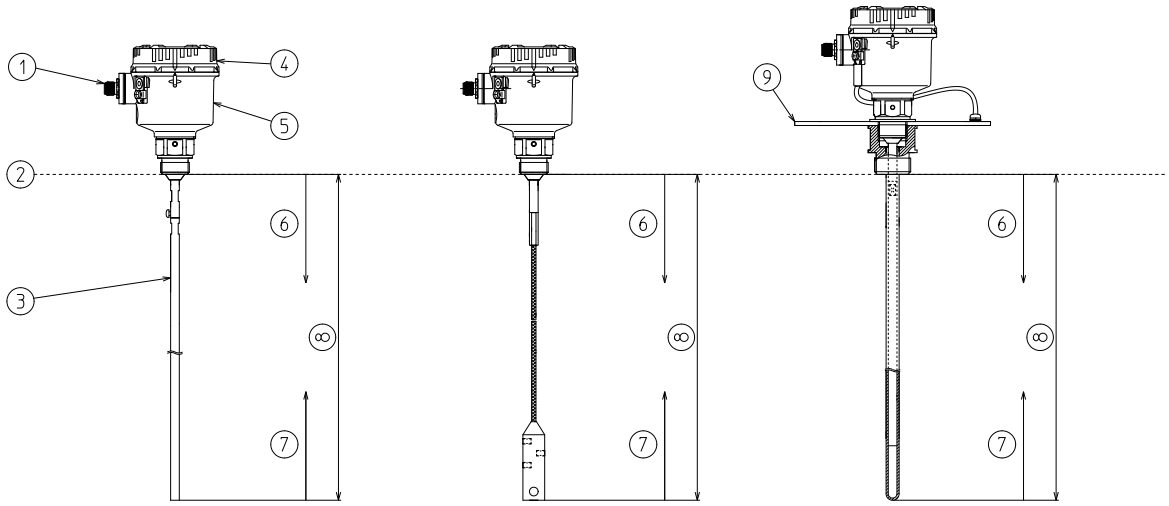
Fig. 2-1

* See *11.1 Glossary*.

3. SPECIFICATIONS

3.1 Parts Name and Function

GW200NR□□	GW200NW□□	GW200NP□□
Rod probe type	Wire probe type	Tubed rod probe type
Threaded connection (G3/4)	Threaded connection (G3/4)	Threaded connection(G1)



① Connector : For power connection. M12, 8 pins, A-code, male
② Reference point : Point referenced to when deciding the measurement range. Location is model dependent.
③ Probe : Component in rod or wire that is inserted in the tank and detects liquid surface.
④ Cover : Clear cover
⑤ Housing : Protects the electronics.
⑥ Upper blanking : Area immediately below the process connection where measurement is not possible or accuracy low.
⑦ Lower blanking : Area immediately above the probe end where measurement is not possible or accuracy low.
⑧ Probe length : Distance from the reference point to the probe end.
⑨ Earth plate : Metal plate to stabilize operation. Required for non-metallic mounting connection such as plastic vessel applications.

3.2 Model Numbering

GW200 □ □ □ □

Configuration	
0*1	Without probe
1	With probe

Temperature rating/O-ring material	
A	Standard (100℃ max.)/FKM
B	Standard (100℃ max.)/custom
T	High temperature (150℃ max.)/FKM
U	High temperature (150℃ max.)/custom

Probe type and material	
R	Rod 316 stainless steel, PEEK, FKM
W	Wire 316 stainless steel, PEEK, FKM
P	Tubed rod PFA, PTFE
Z	Custom

Process connection	
N	Threaded
F	Flange
S	Sanitary fitting
Z	Custom

*1 Available only for Probe type and material option “R” (rod).

Configurations other than GW200□R□0, GW200□W□1 are NOT factory assembled.

3.3 Specifications

Model	GW200□R□□	GW200□W□□	GW200□P□□
Measured material	Liquids		
Linearity*1	up to 2000mm from reference point: ±3mm / remainder of range: ±10mm		
Analog output accuracy	±0.5% of span		
Temperature characteristics	±0.02% of span/℃		
Dielectric constant*	$\varepsilon_r \geqq 1.8$		
Probe length*2	300 to 4000mm	300 to 8000mm	300 to 4000mm
Upper blanking*2 with water ($\varepsilon_r = 80$)*3	25mm min.	80mm min.	25mm min.
Lower blanking*2 with water ($\varepsilon_r = 80$) *3	10mm min.	165mm min.	(2% x Probe length +30) mm min. or 40mm min., whichever is greater
Electrical connection*4	M12 connector		
Power supply	24V DC ±10%		
Power consumption	1.0W max., excluding open collector output		
Output signal	Analog output, 1 point, 4 to 20mA DC, 3 wire		
Alarm output	Open collector (NPN/PNP, selectable), 5 points, 26.4V, 50mA DC Voltage drop: 2V max. for NPN, 2.5V max. for PNP		
Load resistance	500Ω max. at 24V DC (Fig.3-1)		
Pressure (static), excluding process connection	-0.1 to +3.0 MPa See figure 3-2 for high temperature versions.		-0.1 to 0.2 MPa
Working temperature	- Process: Standard version -20 to +100℃ (no freezing) High temperature version -20 to +150℃ (no freezing)		
	- Ambient: -20 to +60℃ (no condensation)		
Relative humidity	85% max.		
Protection class	Probe: IP68 (4.5MPa, 10 min.) / Housing: IP65/67		
Material - wetted	316SS, 316LSS, PEEK, FKM	316SS, 316LSS, PEEK, FKM	PFA, PTFE (not wetted - 316SS, 316LSS, PEEK, FKM)
- housing	Glass reinforced PBT (with anti-static agent), stainless steel, pc (clear), VQM, CR, PBT, EPDEM, brass (C3604BD, nickel plated)		
Lateral load	1.5Nm	-	1.5Nm
Tensile load	4kN	4kN	-
Housing rotation	300°		
Cable	0.25 mm^2 x 8C (M12, A-code, female)		

*1 Reference conditions
- Environmental: +25℃, 60%RH
- Application: water (ε_r = approx. 80), for 4 seconds, metal tank (84.1mm I.D.), between 60mm below the reference point and 10mm above the probe end

*2 See *3.4 Outline Drawing*.

*3 The lower the dielectric constant of the material, the longer the blanking will be.
- With Kerosene (ε_r = 1.8) upper blanking 200mm min., lower blanking 200mm min.

*4 See *6. Wiring*.

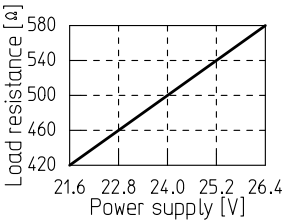


Fig.3-1: Load Resistance

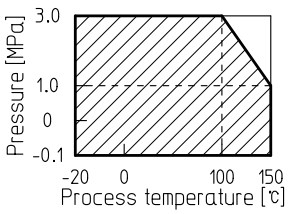


Fig.3-2 : Pressure , static , excluding process connection

* See *11.1 GLOSSARY*.

3.4 Outline Drawing

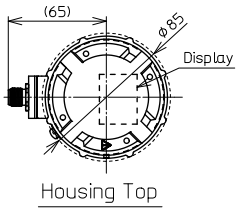


Fig.3-3: Housing

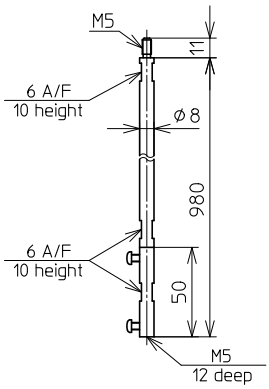


Fig.3-4: Component-E

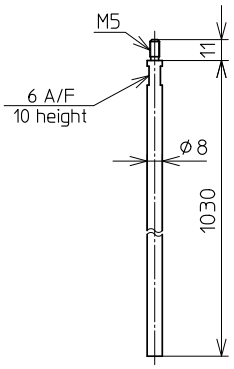


Fig.3-5: Component-L1M

3.4.1 GW200□R□0

All parts except for the finned pipe of GW200NRT0 are factory installed.

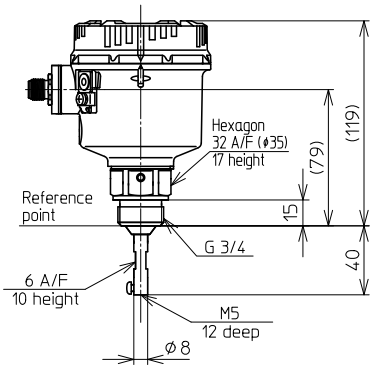
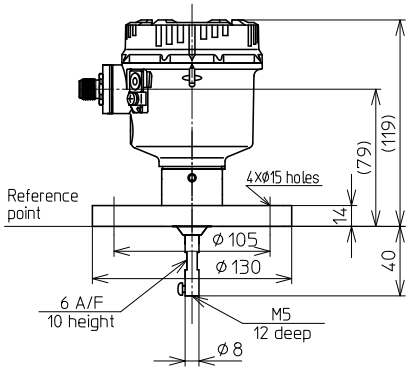
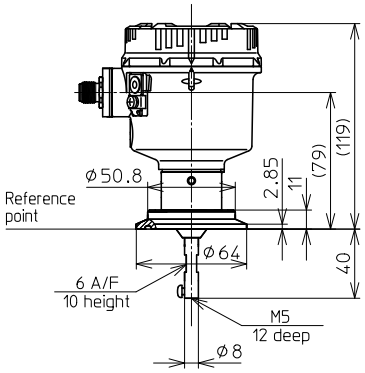


Fig.3-6: GW200NR□0
(□=A or B)



Flange size: JIS 5K 50A
Fig.3-7: GW200FR□0
(□=A or B)



Sanitary fitting: ISO 2S or equivalent
Fig.3-8: GW200SR□0
(□=A or B)

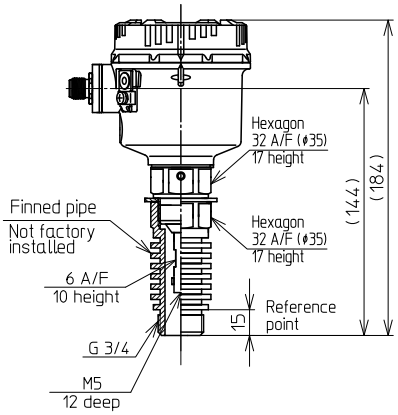
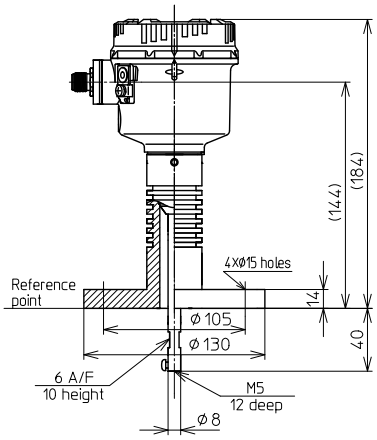
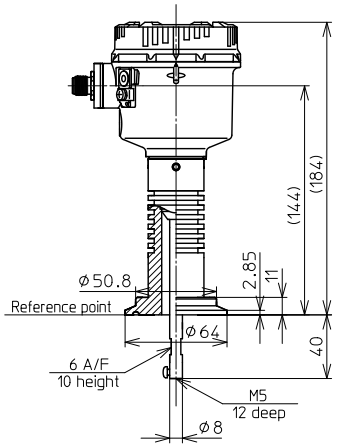


Fig.3-9: GW200NR□0
(□=T or U)



Flange size: JIS 5K 50A
Fig.3-10: GW200FR□0
(□=T or U)



Sanitary fitting: ISO 2S or equivalent
Fig.3-11: GW200SR□0
(□=T or U)

3.4.2 GW200□R□1

Additional components to GW200□R□0 (page 5) are not factory installed.

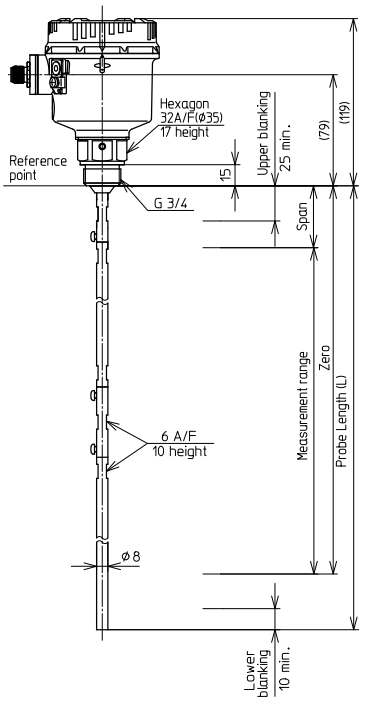


Fig.3-12: GW200NR□1
(□=A or B)

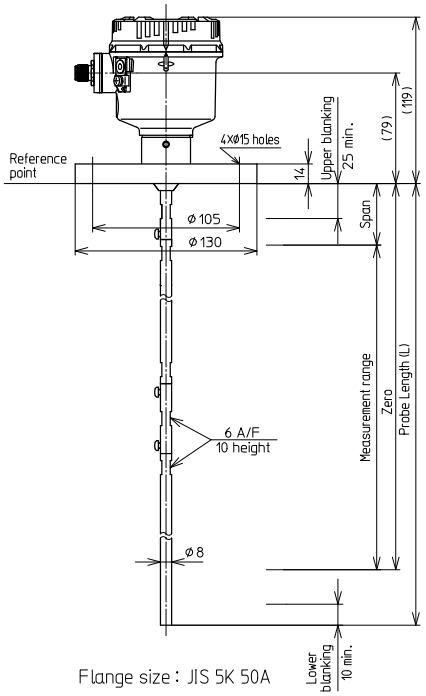


Fig.3-13: GW200FR□1
(□=A or B)

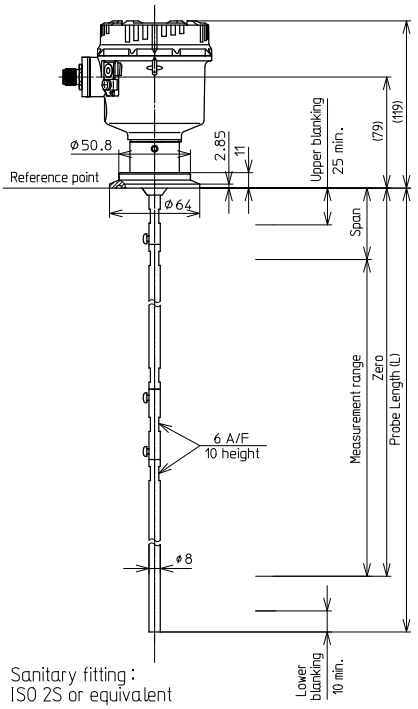


Fig.3-14: GW200SR□1
(□=A or B)

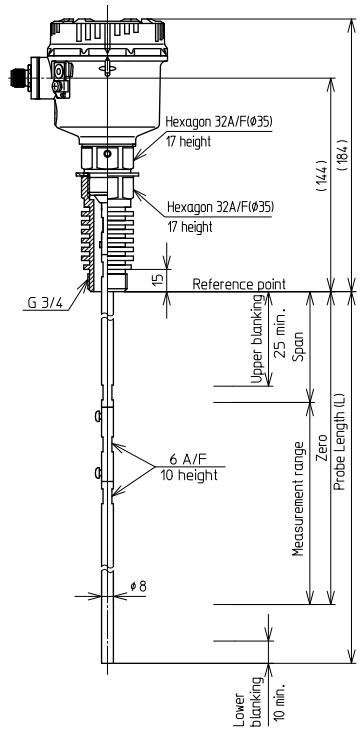


Fig.3-15: GW200NR□1
(□=T or U)

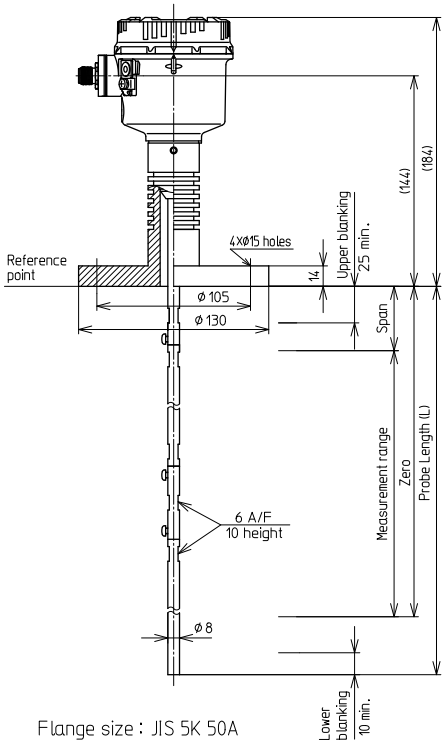


Fig.3-16: GW200FR□1
(□=T or U)

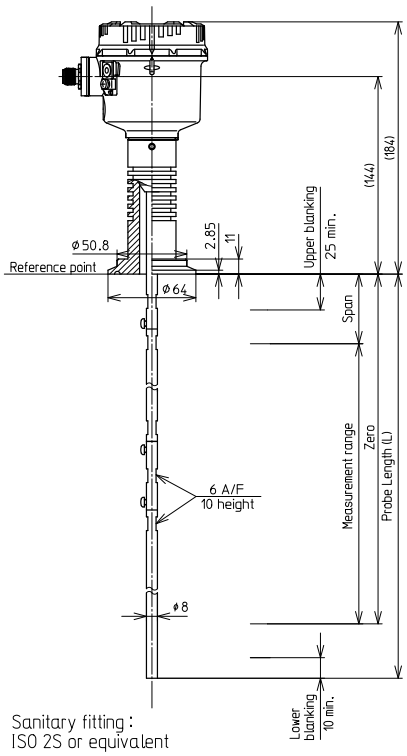
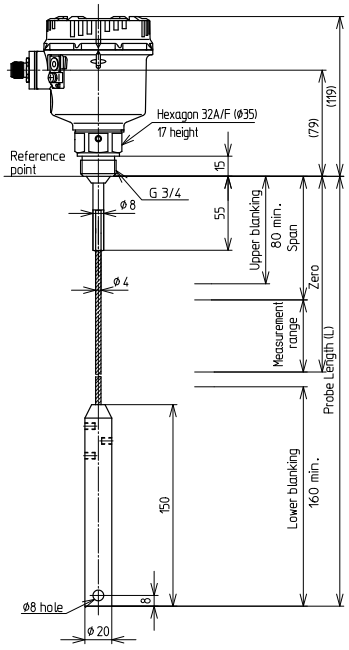


Fig.3-17: GW200SR□1
(□=T or U)

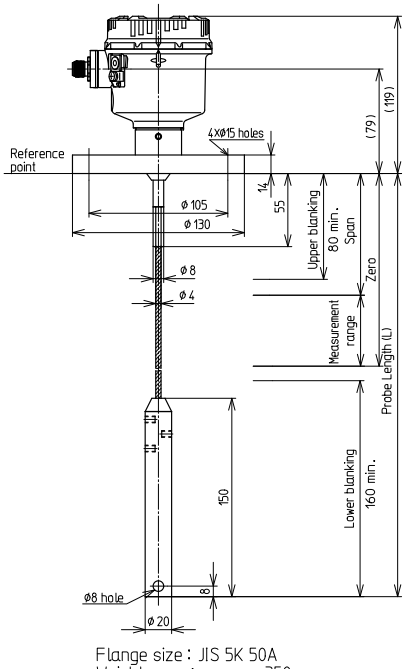
3.4.3 GW200□W□1

Factory assembled.



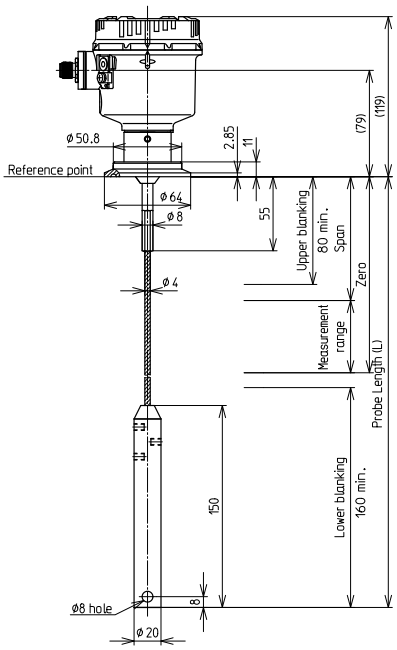
Weight mass : approx. 350g

Fig. 3-18: GW200NW□1
(□=A or B)



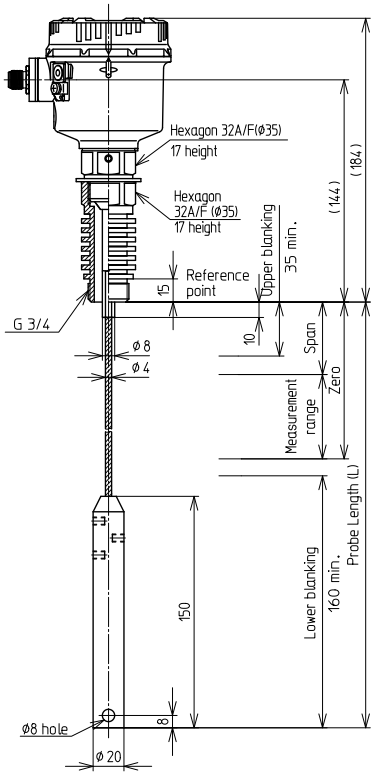
Flange size : JIS 5K 50A
Weight mass : approx. 350g

Fig. 3-19: GW200FW□1
(□=A or B)



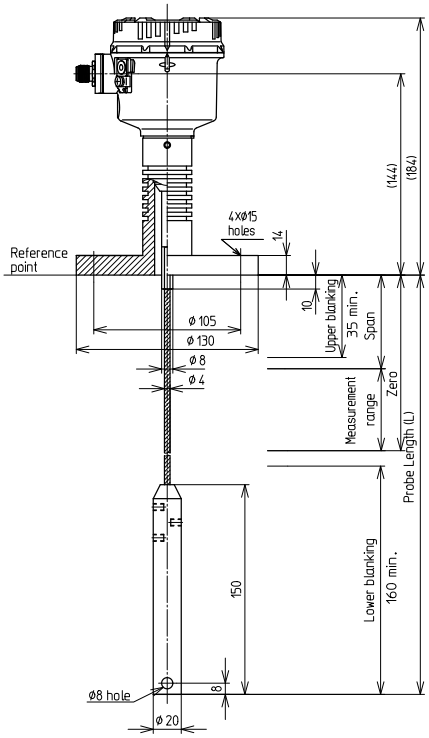
Sanitary fitting : ISO 2S or equivalent
Weight mass : approx. 350g

Fig. 3-20: GW200SW□
(□=A or B)



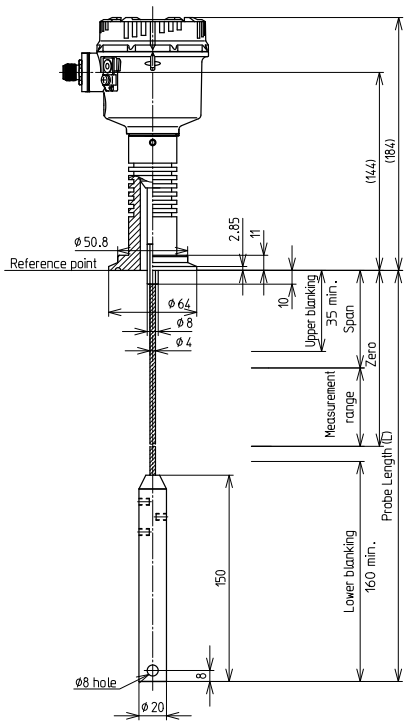
Weight mass : approx. 350g

Fig. 3-21: GW200NW□1
(□=T or U)



Flange size : JIS 5K 50A
Weight mass : approx. 350g

Fig. 3-22: GW200FW□1
(□=T or U)



Sanitary fitting : ISO 2S or equivalent
Weight mass : approx. 350g

Fig. 3-23: GW200SW□1
(□=T or U)

<For non-metallic process connection>

Additional components to GW200□R□0 (page 5) are not factory installed.

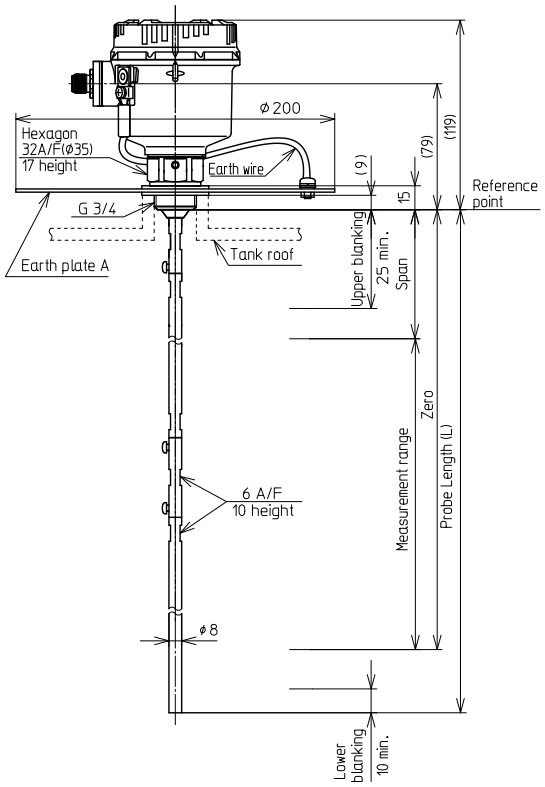


Fig.3-14: GW200NRA1 with Earth plate A

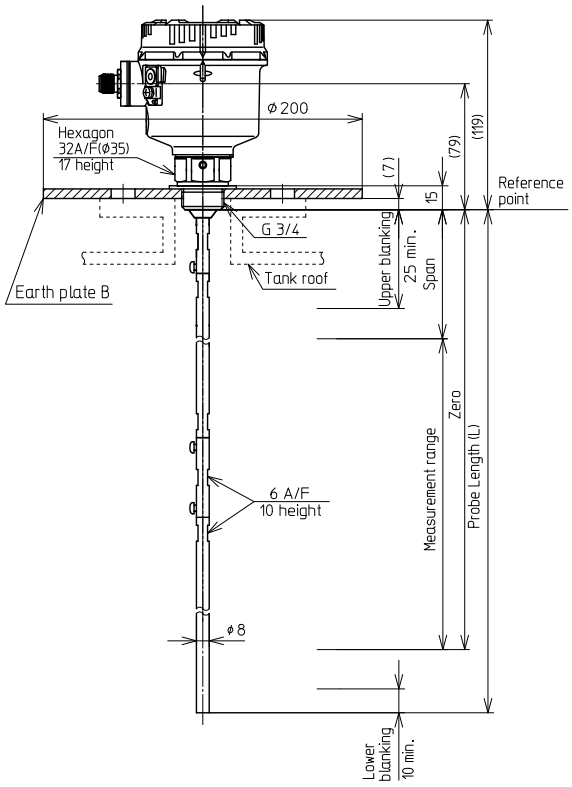


Fig.3-25: GW200NRA1 with Earth plate B

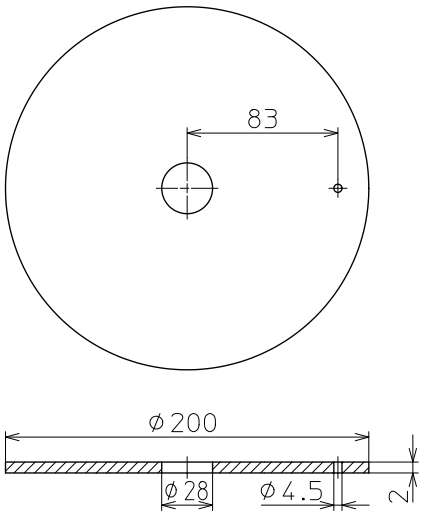
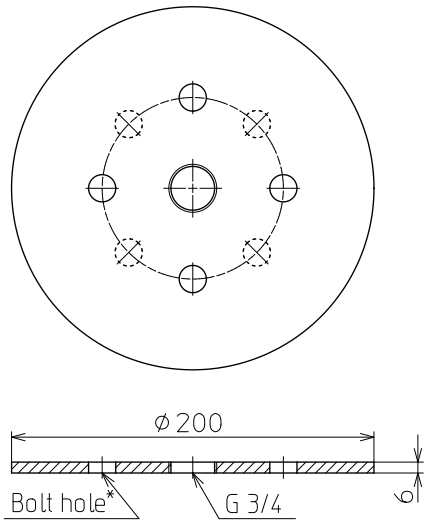


Fig.3-26: Earth plate A (optional)



*Bolt hole pattern to match that of customer flange

Fig.3-27: Earth plate B (optional)

3.4.4 GW200□P□1

Additional components to GW200□R□0 (page 5) are not factory installed.

*1 (2% of Probe Length + 30) or 40, whichever is greater
*2 2% of Probe Length or 10, whichever is greater

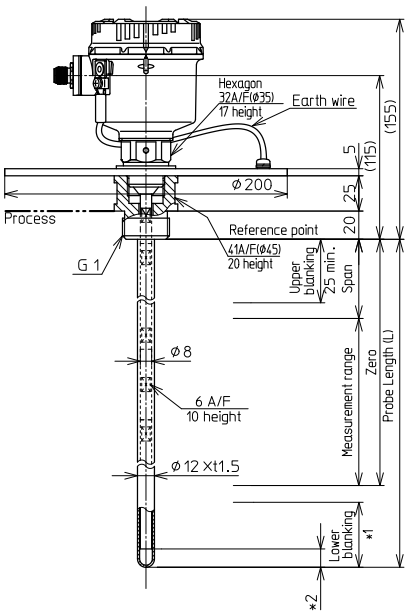
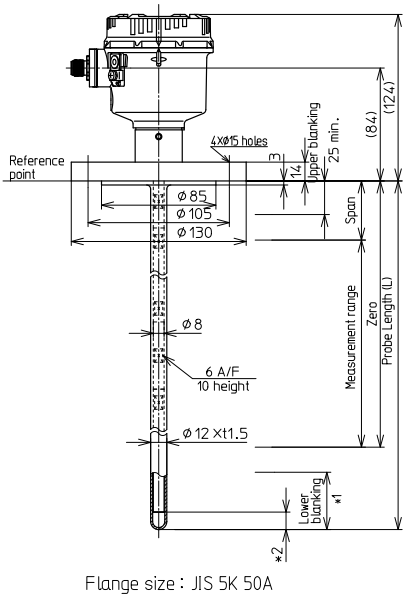
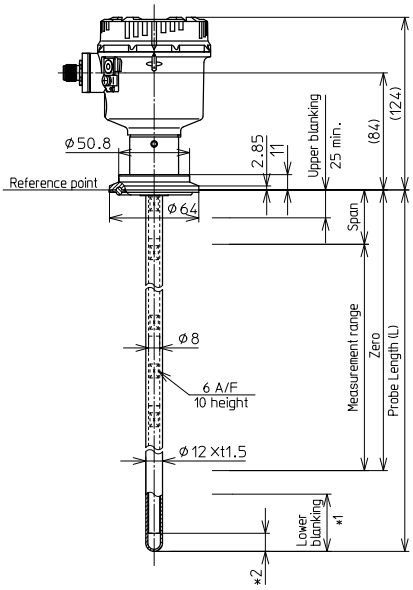


Fig. 3-28: GW200NP□1
(□=A or B)



Flange size: JIS 5K 50A

Fig. 3-29: GW200FP□1
(□=A or B)



Sanitary fitting: ISO 2S or equivalent

Fig. 3-30: GW200SP□1
(□=A or B)

*1 (2% of Probe Length + 30) or 40, whichever is greater
*2 2% of Probe Length or 10, whichever is greater

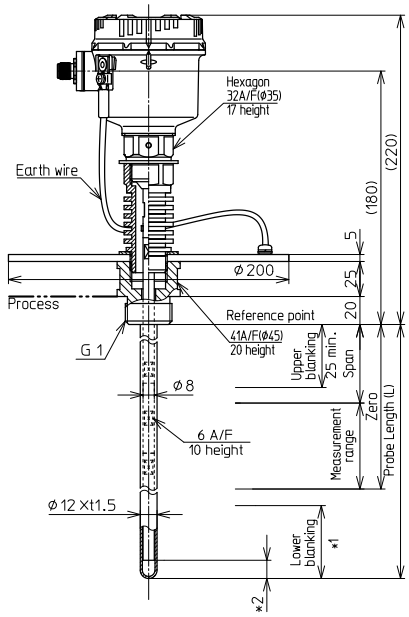
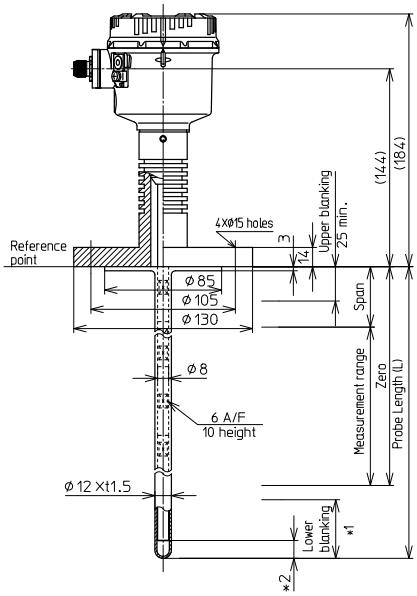
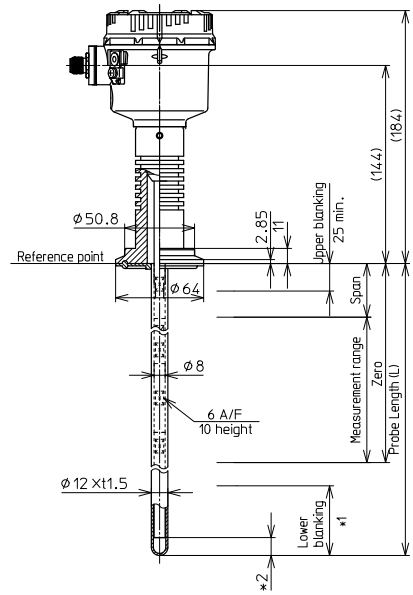


Fig. 3-31: GW200NP□1
(□=T or U)



Flange size: JIS 5K 50A

Fig. 3-32: GW200FP□1
(□=T or U)



Sanitary fitting: ISO 2S or equivalent

Fig. 3-33: GW200SP□1
(□=T or U)

3.5 Probe Length and Components

See below for which table to check for your probe.

Process connection	Probe	Temperature rating	Table
Threaded	Rod	Standard	1
		High temperature	2
Flange, Sanitary fitting	Rod	Standard	1
		High temperature	1

1: GW200□R□□ (except for GW200NRT1 AND GW200NRU1)

Probe length (L) in mm	Quantity		End rod in mm
	Component E	Component L1M	
300 to 1070	0	1	L - 80
1071 to 2050	1	1	L - 1020
2051 to 3030	2	1	L - 2000
3031 to 4000	3	1	L - 2980

2: GW200NRT1 and GW200NRU1

Probe length (L) in mm	Quantity		End rod in mm
	Component E	Component L1M	
300 to 1005	0	1	L + 25
1006 to 1985	1	1	L - 955
1986 to 2965	2	1	L – 1935
2966 to 3945	3	1	L – 2915
3946 to 4000	4	1	L - 3895

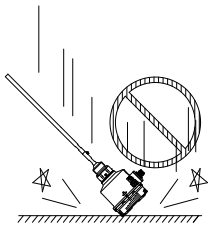
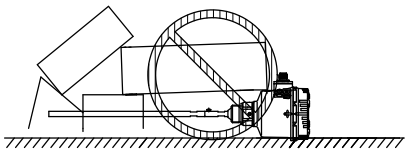
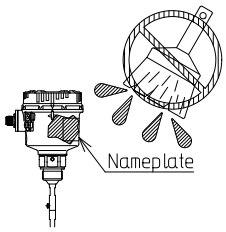
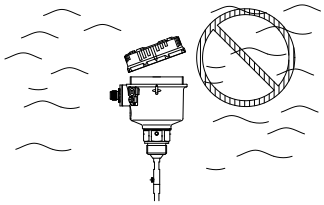
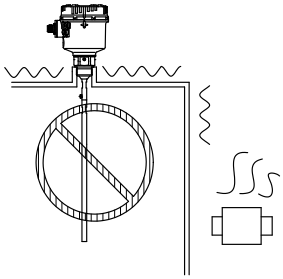
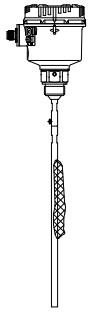
3.6 Optional Components

Item	Description	Remarks
Component E	Extension rod (930mm, 316SS) x 1 Connection rod (50mm, 316SS) x 1 Screw (M4 x 5mm, 316LSS) x 2	980mm extension kit for rod versions (GW200□R□□).
Component L1M	End rod (1030mm, 316SS) x 1	Extends the probe length of GW200NRT1 to 1005mm, and the other rod versions (GW200□R□□) to 1070mm.
Component L2M	Component E x 1 Component L1M x 1	Extends the probe length of GW200NRT1 to 1085mm, and the other rod versions (GW200□R□□) to 2050mm.
Component L3M	Component E x 2 Component L1M x 1	Extends the probe length of GW200NRT1 to 2965mm, and the other rod versions (GW200□R□□) to 3030mm.
Component L4M	Component E x 3 Component L1M x 1	Extends the probe length of GW200NRT1 to 3945mm, and the other rod versions (GW200□R□□) to 4010mm.
Component L5M	Component E x 4 Component L1M x 1	Extends the probe length of GW200NRT1 to 4925mm.
Component C1	Cable ($0.25mm^2$x8c, 5m, PVC, cable diameter 6.0mm, M12, A-code, female) x 1	PVC sheathed sensor cable. Good for water, fair for oil Bend radius - Dynamic*: 72mm (-5 to +70℃) - Static: 36mm (-40 to +70℃) * With no pulling force applied.
Component C2	Cable ($0.25mm^2$x8c, 10m, PVC, cable diameter 6.0mm, M12, A-code, female) x 1	
Component C3	Cable ($0.25mm^2$x8c, 5m, PUR, cable diameter 5.8mm, M12, A-code, female) x 1	Polyurethane sheathed sensor cable. Fair for water, good for oil Bend radius - Dynamic*: 58mm (-25 to +80℃) - Static: 29mm (-40 to +80℃) * With no pulling force applied.
Component C4	Cable ($0.25mm^2$x8c, 10m, PUR, cable diameter 5.8mm, M12, A-code, female) x 1	
Component G1	Gasket (No.6500, VALQUA, LTD.) x 1 (ϕ42mm, ϕ27mm, 2mm thick)	For G3/4. Standard accessory to GW200N□□□.
Component G2	Gasket (No.7020, VALQUA, LTD.) x 1 (ϕ49mm, ϕ34.5mm, 2mm thick)	For G1. Standard accessory to GW200NP□□.
Component E1 (Earth plate A)	G3/4 threaded earth plate x 1 (ϕ200, 2mm thick, 304SS)	Comes with a gasket for G3/4 thread.
Earth plate B	Earth plate for flange x 1 (ϕ200, 6mm thick, 304SS)	Specify the size of mating flange at the time of order.
Threaded tubing	PFA tubing with G1 threaded connection in PTFE x 1	Standard accessory to GW200NP□□ versions. Specify probe length at the time of order.
Flared tubing	PFA flared tubing for JIS 5K 50A x 1	Standard accessory to GW200FP□□ versions. Specify probe length at the time of order.
Tubing with gasket	PFA tubing with a PTFE gasket to fit ISO 2.0S connections x 1	Standard accessory to GW200SP□□. Specify probe length at the time of order.

* Probe can be cut to the specified length at factory upon request.

4. HANDLING NOTES

Observe instructions below when handling the sensor, or faulty operation or injury may result.

Do not drop, throw, drag, or give a strong shock to the sensor to avoid damage.	
Do not place anything on the sensor to avoid deformation or damage.	
The nameplate contains maintenance and other important information. Keep it legible when painting the sensor.	
Avoid corrosive atmosphere (NH_3, SO_2, Cl_2). Such atmosphere may penetrate the housing and damage internal components.	
Avoid or protect against vibration.	
Avoid proximity to a large motor or ultrasonic cleaners that may cause faulty operation.	
Periodically remove buildup on the probe to avoid false low readings.	

5. INSTALLATION

⚠ WARNING

This product is not intended for use in hazardous areas*. Never use it in areas where flammable or explosive gases or vapors may be present.

5.1 Tools for Mounting

Rod versions are not factory assembled. Assemble the product before application. Table 5-1 shows the tools required to assemble each model.

Table 5-1: Tools for mounting

Model	GW200□R□□ (rod) GW200□P□1 (tubed rod)	GW200□R□□ (rod) GW200□P□1 (tubed rod)	GW200N□□□ (threaded, G3/4 or G1)	GW200NP□1 (threaded, G1)
Tool	 Phillips screwdriver x 1	 Spanner (6mm A/F) x 2	 Spanner (38mm A/F) x 1	 Spanner (41mm A/F) x 1
Used on	Screws	Rod	Threaded connection	Threaded tubing

Other tools than those mentioned above are necessary for flange fasteners, or the sanitary clamp. Use suitable tools for your sensors.

* See *11.1 GLOSSARY.*

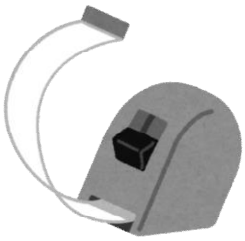
5.2 Tools for Probe Trimming

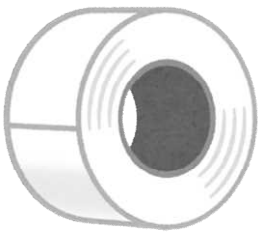
Rod or wire probes can be cut on site to the desired length. In addition to tools in Table 5-1, those in Table 5-2 are necessary to cut the probe. See *5.5 Cutting Probe* on page 21 for how to cut the probe.

⚠ CAUTION

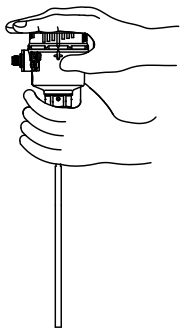
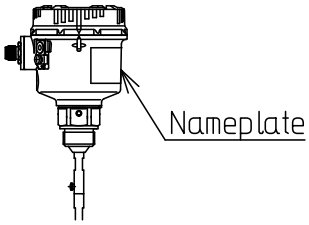
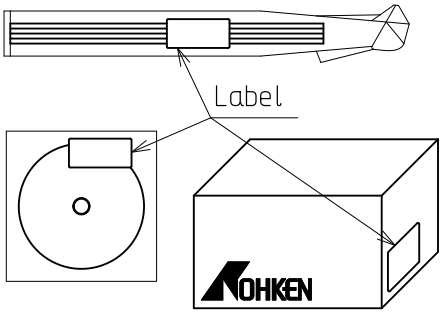
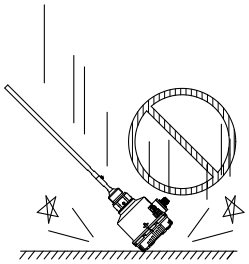
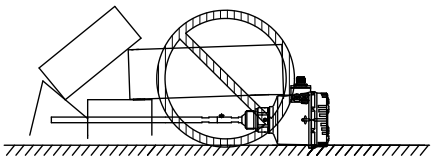
Do not cut tubed rod probes.

Table 5-2: Tools to cut the probe

Model	All	GW200□R□□ (rod)	GW200□R□□ (rod)	GW200□W□□ (wire)
Tool	 Tape measure x 1	 Saw or grinder x 1	 Metal file or sandpaper	 Wrench (3mm A/F) x 1
Used to	Measure the probe length.	Cut the rod.	Remove burrs.	Tighten or loosen weight screws.

Model	GW200□W□□ (wire)	GW200□W□□ (wire)
Tool	 Grinder x 1	 Plastic tape
Used to	Cut off the wire.	Bind cut wire tip.

5.3 Unpacking

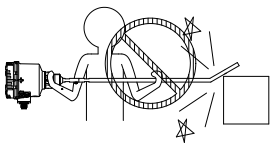
Open the packaging and take out the sensor. Hold the sensor by the process connection and somewhere else.	
Completely remove tape, vinyl, cardboard, and other packing materials to prevent contamination or faulty operation.	
Check against the nameplate that the sensor is what you have ordered. If not, please contact our sales office.	
Check the sensor for visible damage. If any, please keep the packaging and contact our sales office.	
The packaging of the sensor and its accessories has a label with a number. The components belonging to the same unit share the same number. When assembling, use the components with the same number.	
Do not drop, throw, drag, or give a strong shock to the sensor to avoid damage.	
Do not place anything on the sensor to avoid deformation or damage.	

5.4 Assembling

Sensors with the rod probe are NOT factory assembled. Assemble the sensor before installation. If the space above the tank is not large enough for the overall sensor size, start from the end rod and insert the assembly into the tank, and then connect the probe assembly to the housing.

⚠ WARNING

Not to damage the sensor, handling sensors with a rod probe longer than 1500mm requires more than one person. Bent probe will result in faulty operation.

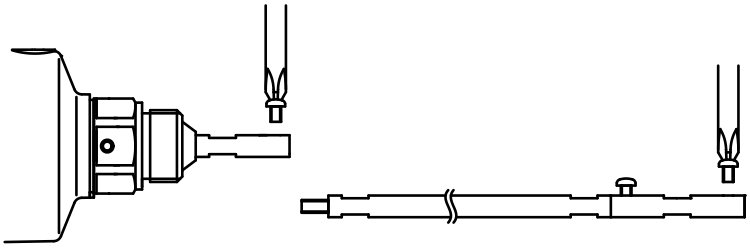


⚠ CAUTION

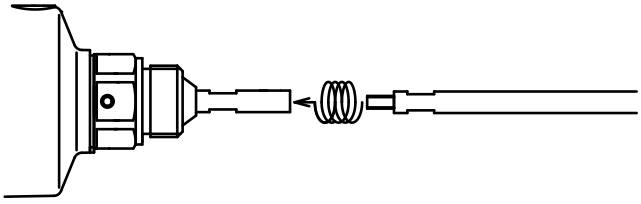
Be careful not to drop components or tools into the tank.

5.4.1 Rod probe (GW200□R□□)

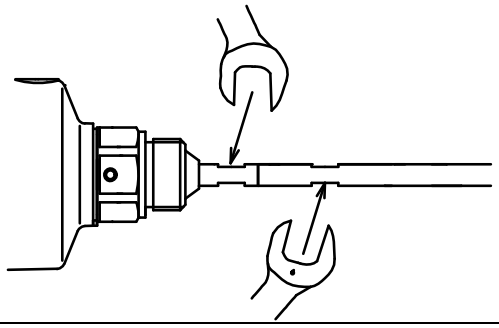
(1) Remove the screws at the female threaded end of the sensor and the connection rod in Component E.



(2) Connect Component E (extension rod and connection rod) and Component L1M (end rod) to the sensor.

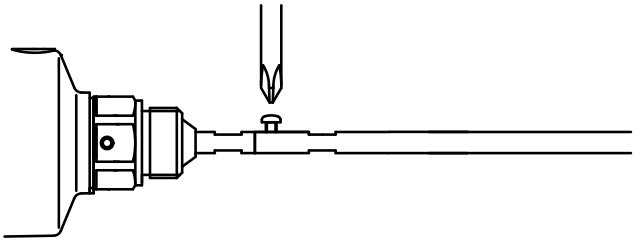


(3) Hold the assembly by the recesses (6mm A/F) with a spanner, and tighten all the components connected in step 2. (Torque: 4.5Nm)



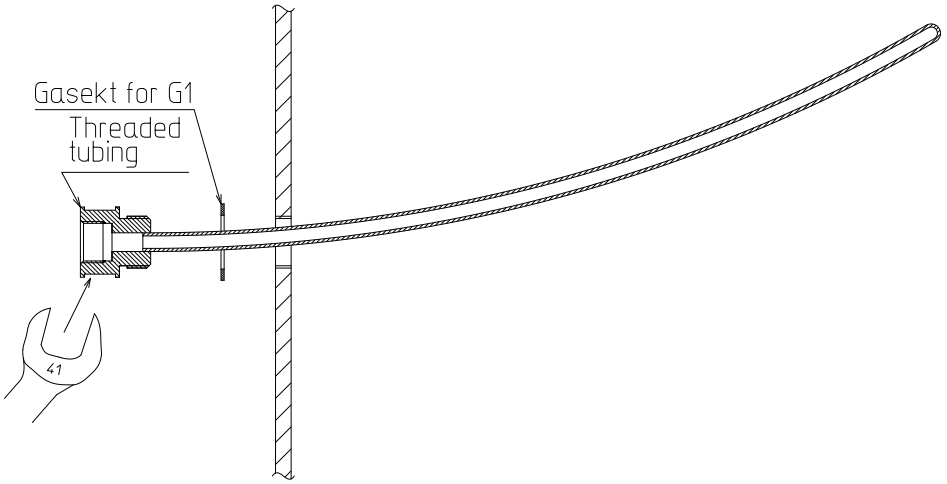
(4) Secure the connection rod with screws (M4, 5mm) with a screwdriver. Use two screws per rod. (Torque: 2.2Nm)

* If the space above the tank is not large enough for the overall sensor size, start from the end rod, place the assembly inside the tank, and then connect the other components.

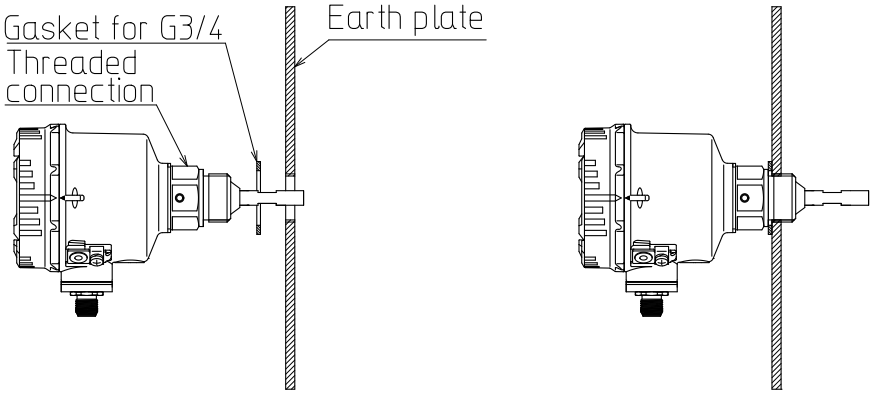


5.4.2 Threaded tubing (GW200NP□□)

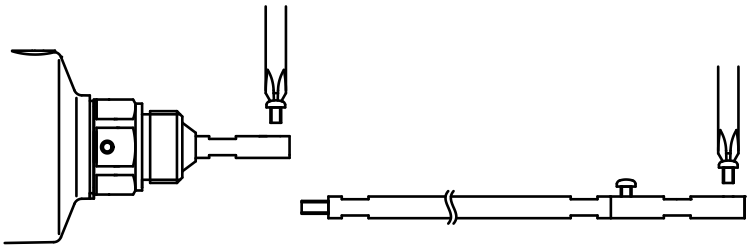
(1) Place the gasket for G1 thread on the tubing, and screw the tubing into the tank with a spanner (41mm A/F).



(2) Place the gasket for G3/4 thread on the sensor assembly, and then fit the earth plate to the threaded connection.



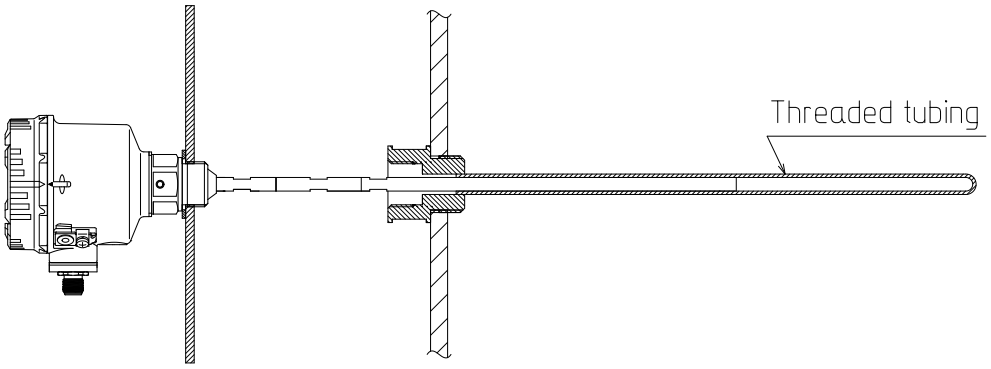
(3) This version does not require screws (M4, 5mm). Remove the screws on the connection rod, if any.



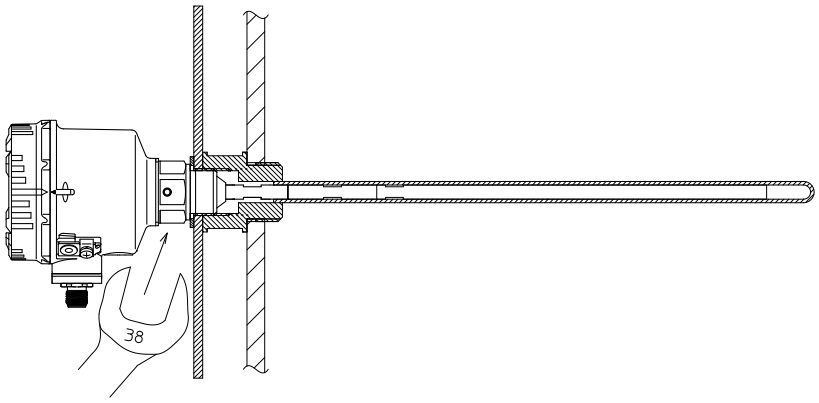
(4) Follow Steps 2 and 3 in *5.4.1 Rod probe* on page 16.

* If the space above the tank is not large enough for the overall sensor size, start from the end rod, insert the assembly into the tubing, and then connect the other components.

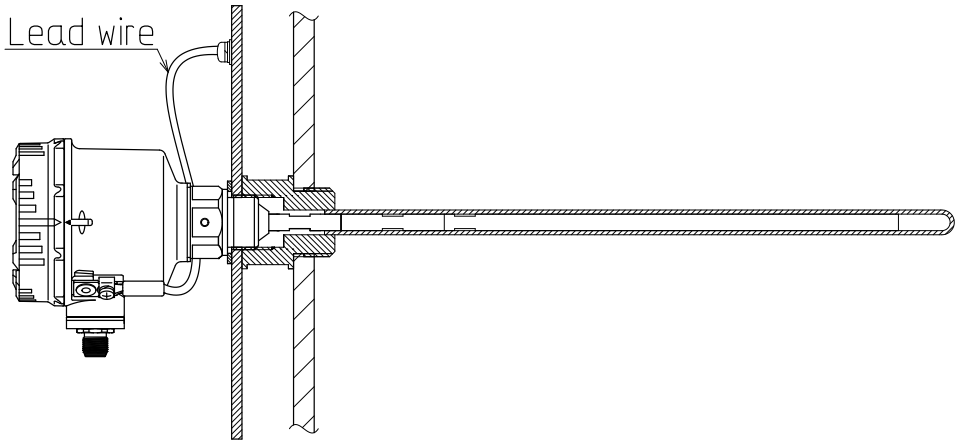
(5) Place the probe in the tubing mounted in Step 1.



(6) Hold the sensor by the hexagon (38mm A/F) with a spanner, and screw the sensor in the tubing.

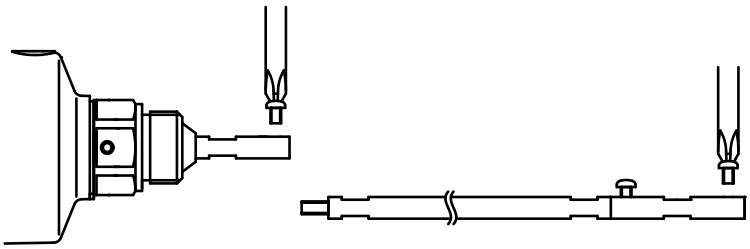


(7) Connect the external earth terminal on the housing and the earth plate with the supplied earth wire.



5.4.3 Flared tubing and tubing with gasket (GW200FP□□, GW200SP□□)

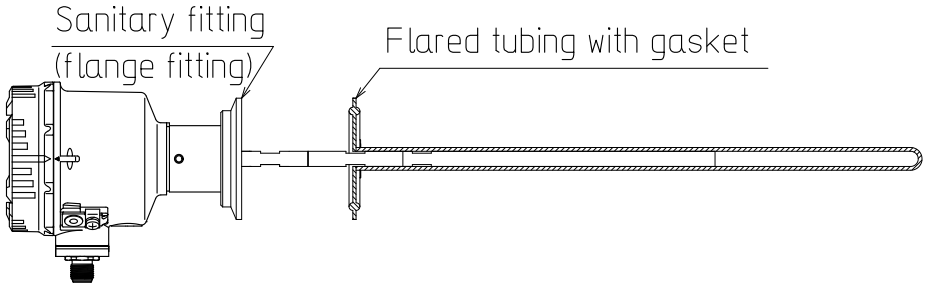
(1) This version does not require screws (M4, 5mm). Remove the screws on the connection rod, if any.



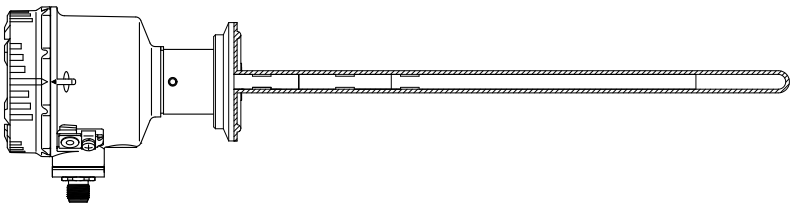
(2) Follow Steps 2 and 3 in *5.4.1 Rod probe* on page 16.

* If the space above the tank is not large enough for the overall sensor size, mount the tubing with gasket first, assemble the probe, and then insert the assembly into the tubing before connecting other components.

(3) Place the probe in the tubing.



(4) Closely fit the sanitary fitting and the tubing.



5.5 Cutting Probe

⚠ WARNING

Disconnect the end rod from the sensor before cutting it.
Cutting while the rod connected to the sensor may damage the sensor or deform the rod.

Remove burrs on the cut rod with a metal file to prevent injury.

See the outline drawing for the reference point and the probe length of your sensor.

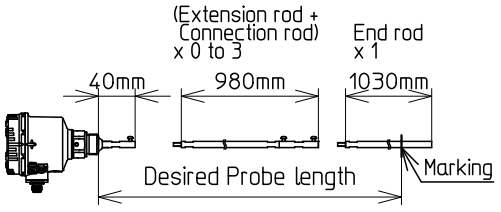
Always follow the steps in this manual when cutting the probe.
Otherwise the sensor may be damaged.

Wire tip has sharp edges. Wear gloves when handling the wire probe to prevent injury.

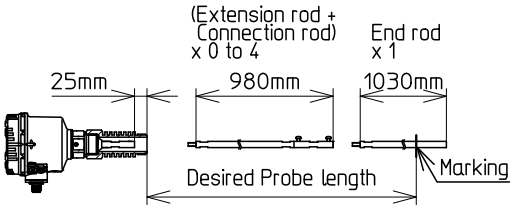
Wire probes cannot be disconnected or replaced. If the wire is cut too short, the whole sensor has to be replaced.
Make sure you have marked the wire probe at the correct length and cut it carefully. If the required length is not known, leave long enough length so the size can be adjusted later.

5.5.1 Rod probe (GW200□R□□)

(1) Mark the end rod at the desired length. See below for the size of each component.
See *3.5 Probe Length and Components* on page 10 for the probe length and end rod details.

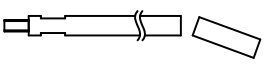


GW200□R□□



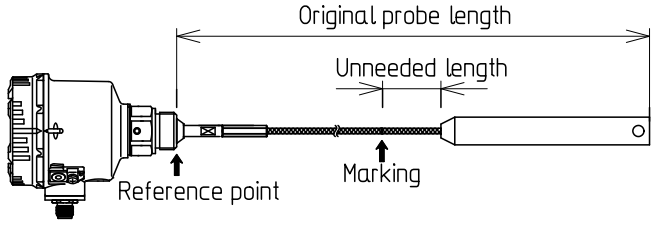
GW200NRT1,GW200NRU1

(2) Cut the probe vertically at the marking with a saw or grinder.
Remove burrs with a metal file or sandpaper.

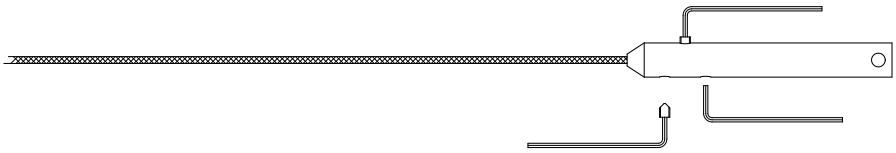


5.5.2 Wire probe (GW200□W□□)

(1) Mark the wire at the length you wish to shorten, referencing from the weight top. For example, if you wish to shorten a 2000 mm probe to 1500 mm, mark the point 500mm away from the weight top. This is where the weight top will come after the desired length is achieved.

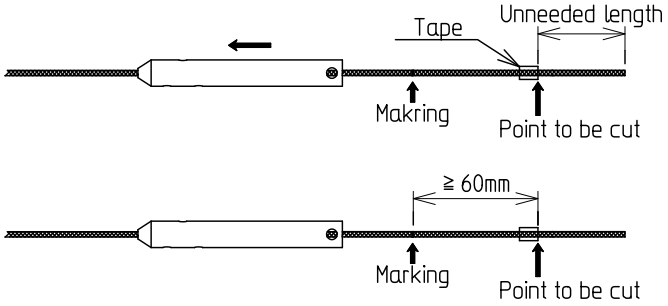


(2) Remove 3 screws (M6, 5mm, pointed) on the weight with a wrench.



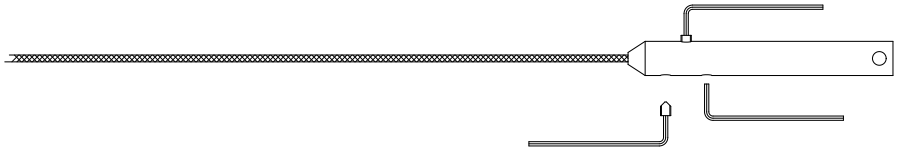
(3) Slide the weight on the probe to expose the wire tip, and straighten the wire. Wrap the point to be cut with tape so the wire tip is kept bundled after the wire is shortened. Make sure that the point to be cut is at least 60mm away from the marking, as this is the length required to prevent the weight from dropping down. Now cut off the unneeded length. If the unneeded length is not known, leave long enough length and adjust when securing the weight.

If you wish to shorten a 2000mm probe to 1500mm for example, cut on the point 500mm away from the probe end.



(4) Slide the weight back until its top comes to the marking.

(5) Tighten 3 screws with a tool (3mm A/F) on the weight to secure it (Torque: 7.8Nm)



5.6 Mounting Sensor

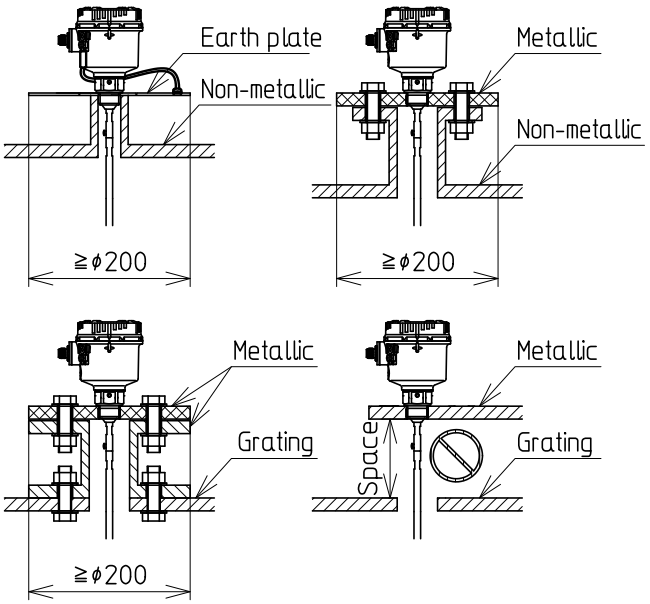
5.6.1 Location

Observe the following, or faulty operation may result.

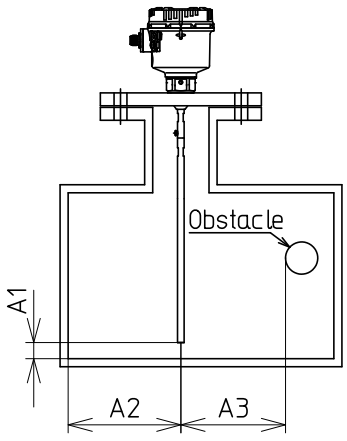
<Metallic connection>
Use metal process connection and ensure electrical continuity between the sensor process connection and the tank.
If the tank connection is metallic but smaller than ϕ200mm, then use a metal flange (≧100A/DN100) or an earth plate* (≧ϕ200mm), and connect it to the metallic connection of the tank.

<Non-metal connection>
Use a metal flange (≧DN100) or an earth plate (≧ ϕ200mm) and connect it to the metallic connection of the tank.

<Grating>
Provide an opening in the grating so that it does not make contact with the probe or the insulator, and install an earth plate (≧ϕ200mm). Secure the grating since changing its orientation may adversely affect performance. Make sure there is no gap between the grating and the earth plate.

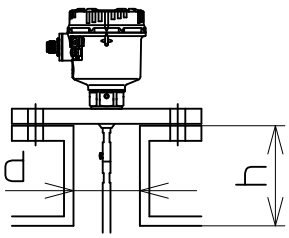


<Clearance in tank>
Observe the following.
- A1 ≧10mm
- A2 ≧30mm
- A3 ≧30mm

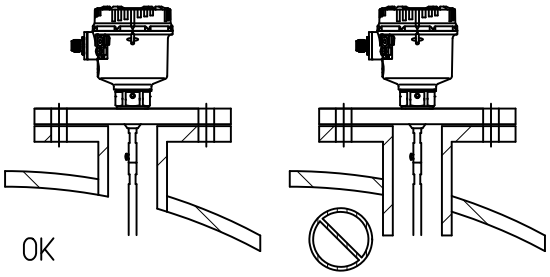
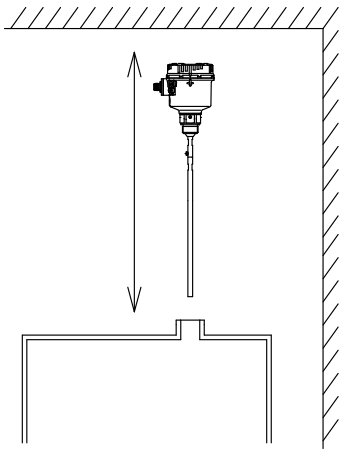
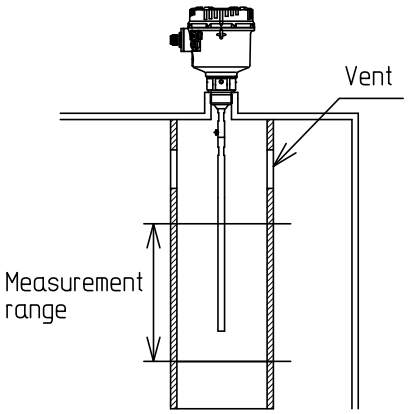
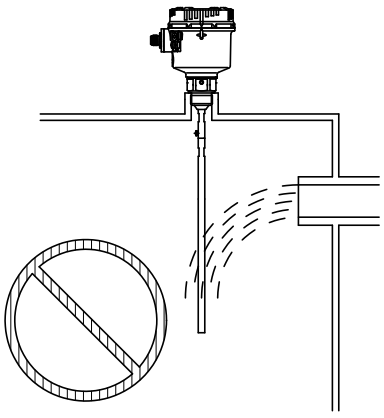


<Standpipe/nozzle design>
Size (d): DN50 to DN200
Height (h) : ≦200mm

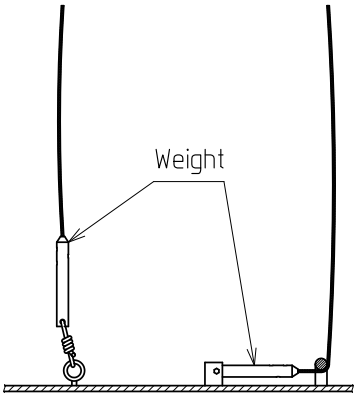
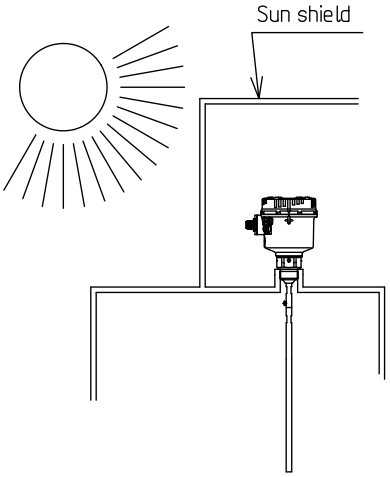
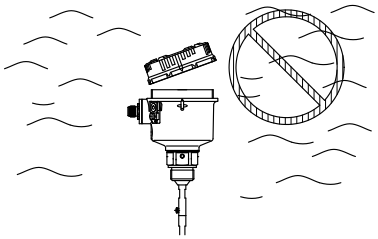
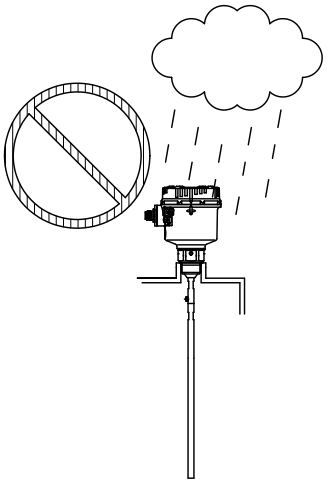
Contact our sales office for other sizes.



* See *11.1 GLOSSARY.*

<Note on standpipe/nozzle design> Cut off the standpipe/nozzle protruding into the tank.	
Ensure ample space around the mounting location for easy handling and maintenance. Ensuring space large enough for the overall length of the sensor is recommended for easy handling.	
Avoid proximity to inlets/outlets, agitators, or other sources of turbulence, or provide a metal stillpipe*. Ensure electrical continuity between the stillpipe and the sensor process connection. Always provide a vent on the stillpipe at a level higher than the highest expected material level. No vent or one in the measurement range will prevent smooth level change inside the pipe.	
Avoid filling streams to prevent faulty operation.	

* See *11.1 GLOSSARY.*

Secure the weight at the end of wire probe to the tank when high flow is expected. When fixing the weight to the tank, ensure either electrical continuity or complete isolation between the weight and tank to avoid faulty operation. Do not apply tension to the wire.	
Avoid high temperatures. Maximum allowed ambient temperature is +60℃. Avoid direct sun light. Provide a sun shield* not to exceed ambient temperature ratings.	
Avoid corrosive atmosphere (NH_3, SO_2, Cl_2). Such atmosphere may penetrate the housing and damage internal components.	
Properly tighten the cover and seal the cable inlet. Water enter may cause faulty operation. The IP rating (IPX5/7) is achieved only when the cover is properly tightened and the cable inlet properly sealed.	

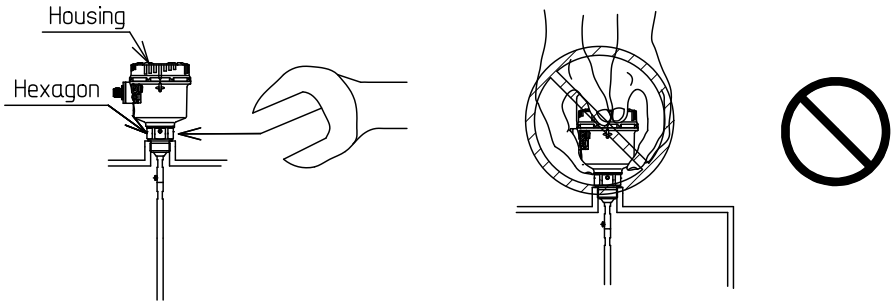
* See *11.1 GLOSSARY.*

5.6.2 Mounting

(1) Threaded version

⚠ WARNING

Never hold the sensor by the housing to avoid damage. Use a tool on the hexagon to mount the threaded version.



Take measures to prevent a leak by using a gasket for example. Ensure electrical continuity between the sensor process connection and the tank at the same time.

(2) Sanitary

Use a metal clamp to mount the sensor. Tubing has an integral gasket, so no additional gasket is needed. Note that the clamp is an optional component.

⚠ CAUTION

Ensure electrical continuity between the sensor process connection and the piping to avoid faulty operation.

The gasket is integral to the tubing and not replaceable. Contact our sales office for replacement of the tubing with gasket.

(3) Flange version

Fit the flanges and secure them using a suitable tool and fasteners according to applicable standards. Ensure the sensor is mounted vertically.

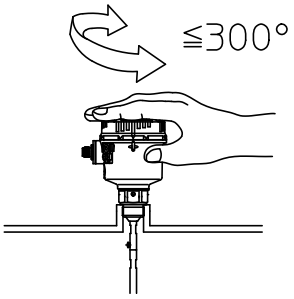
Use a gasket suitable for working conditions to prevent a leak. Ensure electrical continuity between the sensor process connection and the tank.

Note that fasteners and gaskets are optional components.

(4) Housing can be rotated for 300 degrees. Secure the process connection, and rotate the housing.

⚠ CAUTION

Do not over-rotate the housing, or the sensor may be damaged.



6. WIRING

6.1 Before Wiring

Disconnect power to the sensor.

⚠ WARNING

Disconnect power before wiring, or electric shock may result. Ignition or short circuit may also result due to leakage or charged components contacting each other.

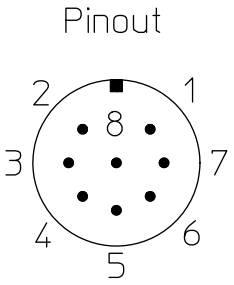
⚠ CAUTION

Do not exceed load resistance ratings for the analog output (500Ω max. at 24V DC) to avoid startup failure or faulty operation.

The sensor requires at least 300mA for stable operation. With lower current values, the sensor may not start up or output properly depending on the connected load or the number of configured output points.

6.2 Wiring

A M12 A-code female connector is required for this product. See below for the detail.



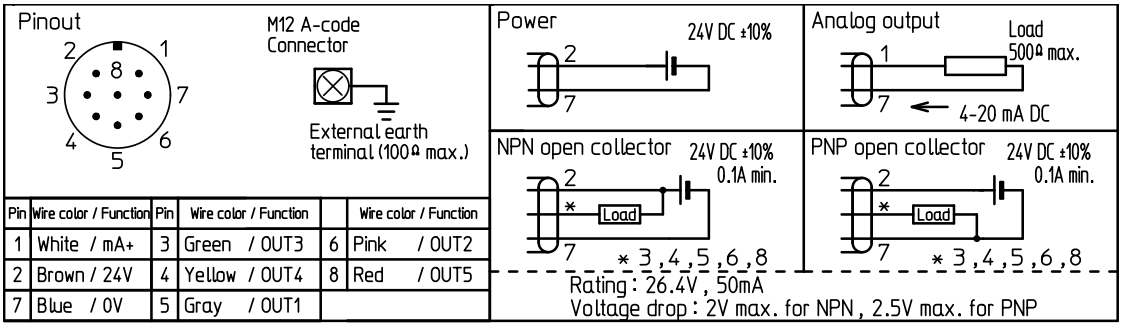
Pin	Wire color / Function	Pin	Wire color / Function
1	White / mA+	3	Green / OUT3
2	Brown / 24V	4	Yellow / OUT4
7	Blue / 0V	5	Gray / OUT1
		6	Pink / OUT2
		8	Red / OUT5

The following cables are optionally available. See *3.6 Optional Components* on page 11.

- Straight, PVC sheathed, 5m or 10m
- Straight, polyurethane sheathed, 5m or 10m

Notes:

1. Remove the protective cap on the connector before wiring.
2. Securely tighten the nut on the connector.
3. Use an instrument power supply.
4. Avoid proximity to inverters, power supplies, or other noise sources.
5. If the input and output lines are longer than 10 meters, use shielded cables, and connect them in a junction box. Connect the shielded cable to the ground at the power supply end. Do not run them with power lines or magnetic switch cable.
6. Properly ground the instruments. (Ground resistance: 100Ω max.)
7. Use a socket equivalent to 11PFA from OMRON for Power Unit PU2000.
8. Depending on the load connected or number of outputs configured, power supplies may not supply enough current.
   Current rating: PU2000 – 120mA maximum at 24V DC
   MP2000 – 200mA maximum at 24V DC
9. Properly treat the end of unused cable to prevent short-circuit.



Pin	Wire color / Function	Pin	Wire color / Function		Wire color / Function
1	White / mA+	3	Green / OUT3	6	Pink / OUT2
2	Brown / 24V	4	Yellow / OUT4	8	Red / OUT5
7	Blue / 0V	5	Gray / OUT1		

Fig.6-1: GW200

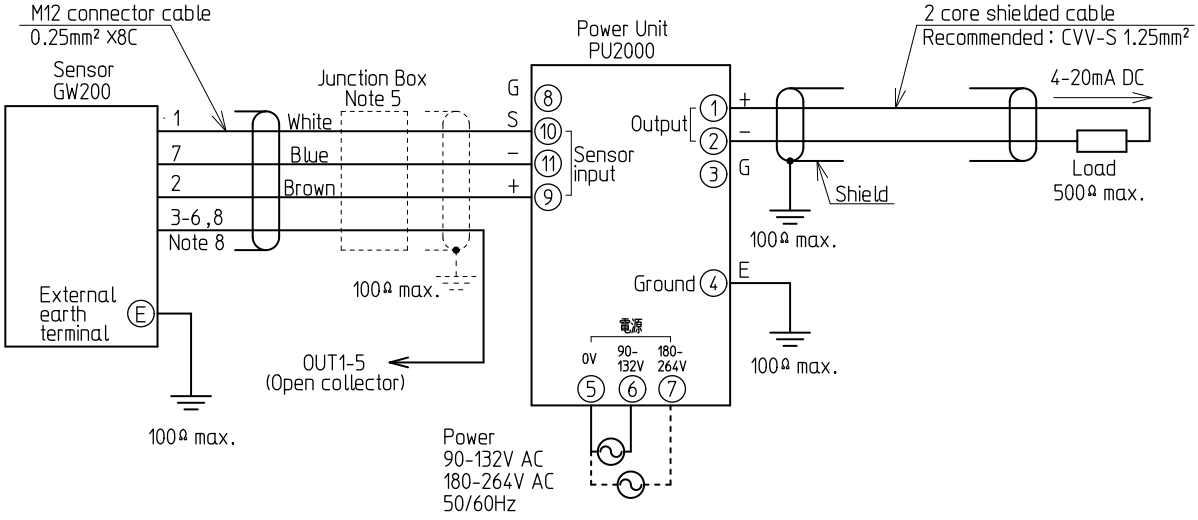


Fig.6-2: GW200 and PU2000

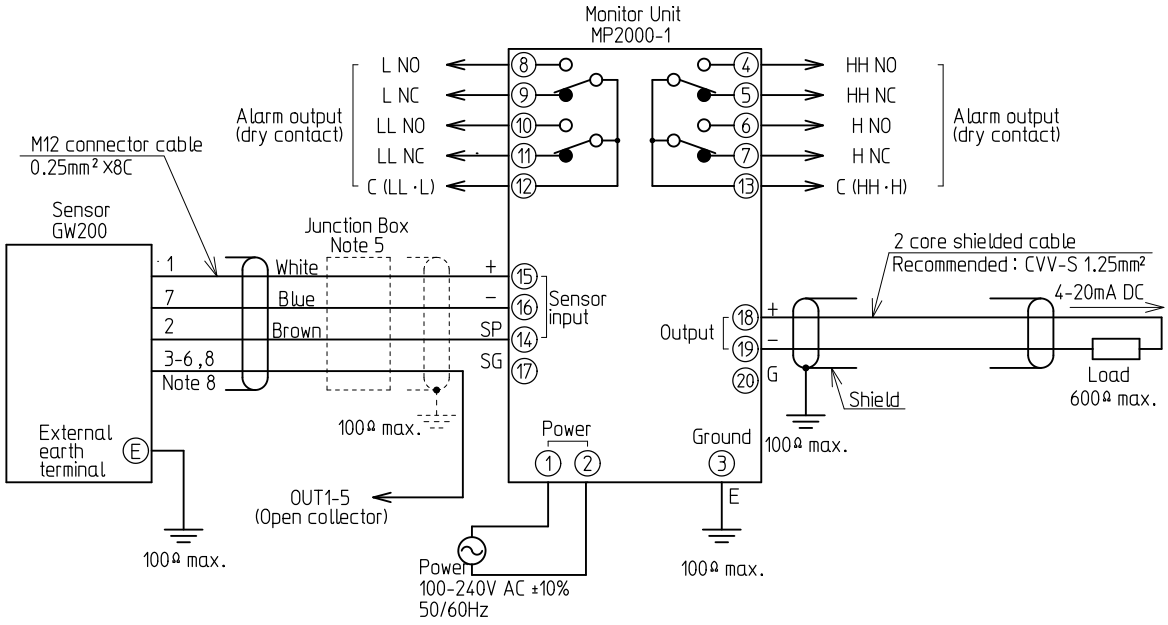


Fig.6-3: GW200 and MP2000-1

10. Make sure dust or water will not enter inside the housing. Lead the cable downwards in front of the inlet to prevent water entry. Putty the joint as necessary.

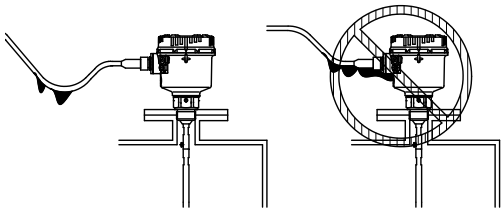


Fig.6-4

7. OPERATION

⚠ CAUTION

Program the sensor before operation. See *7.2 Commissioning* on page 32.

7.1 Before Programming

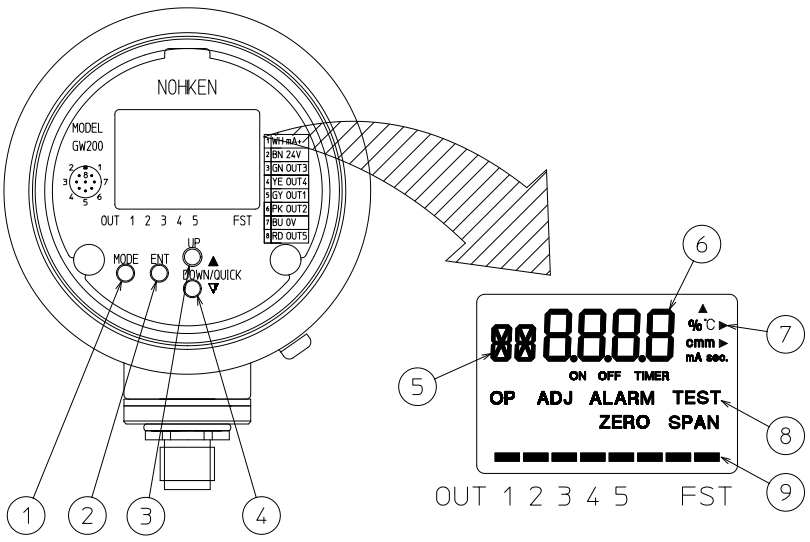
Open the cover.

⚠ CAUTION

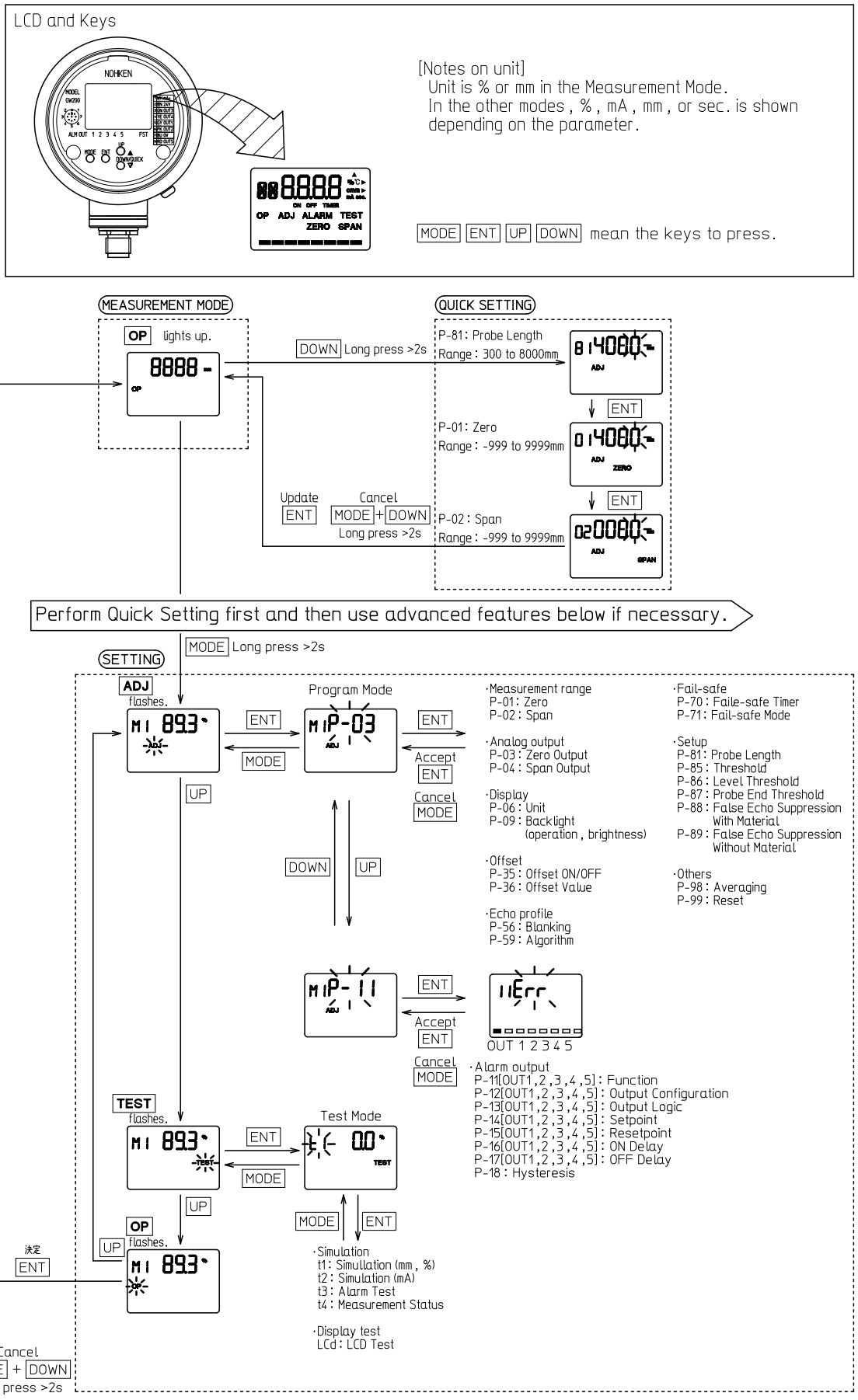
When removing the cover to program the sensor, hold the sensor by the housing. If held by another component, the housing rotates along with the cover and may be damaged due to applied stress.

7.1.1 Key name and function

	Name	Function
1	MODE key	Cancels the entered value and moves to a higher menu. Changes modes.
2	ENT key	Moves to a lower menu. Accepts the entered value.
3	UP key	Scrolls up modes, parameters, and values.
4	DOWN key	Scrolls down modes, parameters, and values. Opens quick setting mode when pressed long.
5	Maintenance Mode area	Displays maintenance modes and parameters.
6	Data area	Displays measured values, settings, and parameter numbers.
7	Unit area	Displays the unit.
8	Mode area	Displays the current mode.
9	Bar graph	Lights up when outputs 1 to 5 or failsafe timer is in operation. For outputs 1 to 5, the segment lights up when the contacts close in the normally open mode, and open in normally closed mode.



7.1.2 Modes and operation flow



7.1.3 Startup behavior

Ensure correct wiring, and supply power to the sensor.

The sensor will display bars and output 3.8mA. In approximately 10 seconds, the sensor will start measurement, displaying the measured value in the data area and “OP” in the mode area.

* Value shown as example.

Fig. 7-1: Start-up behavior

⚠ WARNING

Ensure controlled devices are not adversely affected while the sensor is being programed.

⚠ CAUTION

The sensor starts measuring approximately 10 seconds after power-up.

Allow 30 minutes before starting programming.

Pressing ENT while “OP” is flashing updates the parameter data and changes the modes to the Measurement Mode.
To cancel all the entered values, press MODE and DOWN for 2 seconds or longer while “ADJ” and “TEST” are flashing. Program the sensor again if necessary.

In the case of power interruption during programming, data that has not been updated will be lost. Program the sensor again after supplying power.

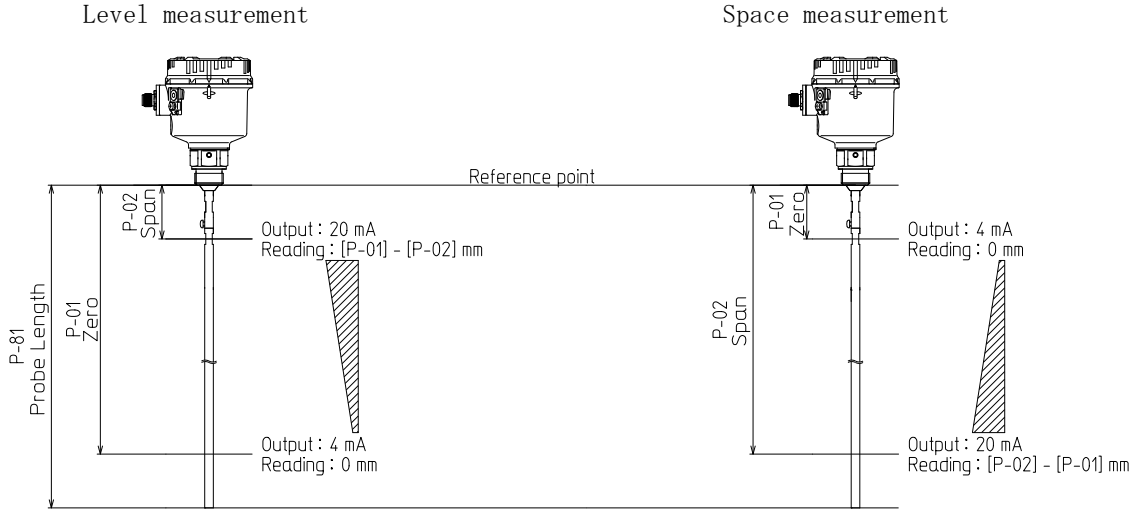
7.2 Commissioning

Mandatory	Recommended	Possible Error → Corrective action
Supply power ↓ Quick Setting		
		"E" or "LoE" is displayed and measurement not possible, or reading fluctuates. → Set P-85 Threshold to "Lo".
	P-56 Blanking Cancel echoes in the nozzle.	
	P-70 Fail-safe Timer Set according to the speed of process change.	Reading is incorrect. →Carry out: P-88 False Echo* Suppression With Material or P-89 False Echo Suppression Without Material.
	P-71 Fail-safe Mode Ensure safety is not compromised.	
Complete		

See *10. TROUBLESHOOTING* when trouble occurs.

7.3 Quick Setting

Program three basic parameters, P-81 Probe Length, P-01 Zero, and P-02 Span, and the sensor will be ready for typical level or space measurement applications.
See *7.3.1 Procedures* on page 33.
Perform a reset beforehand when installing an already programmed sensor on a different tank. See *7.6.9 Reset* on page 47.

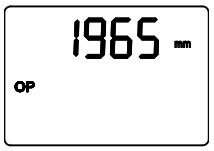
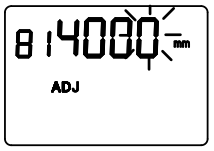
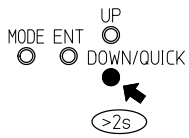
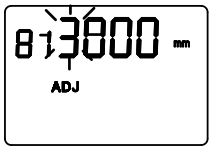
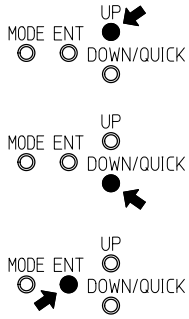
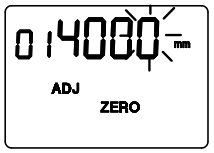
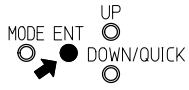
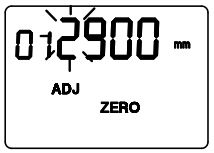
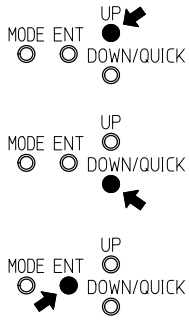
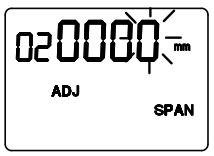
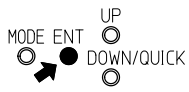


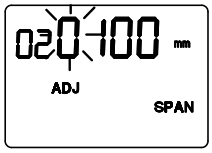
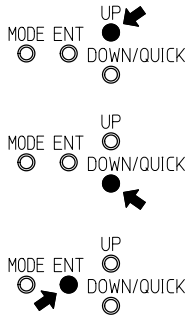
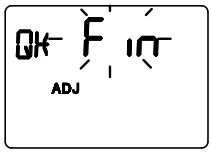
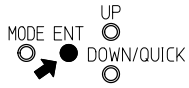
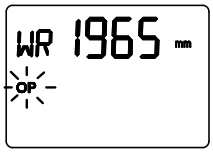
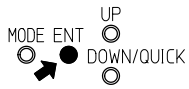
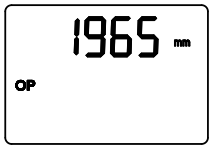
When % is selected as the unit, the zero level will be displayed as 0% and full level 100%.

* See *11.1 GLOSSARY*.

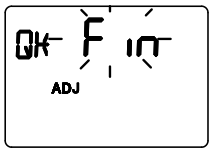
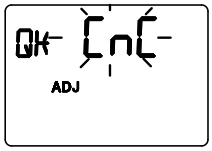
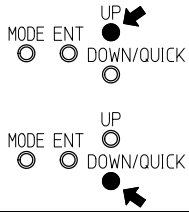
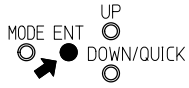
7.3.1 Procedures

See *7.4.1 Program mode parameter* on page 35 for parameter details.

Description	LCD	Keys
(1) Ensure that the sensor is in the Measurement Mode ("OP" displayed). If not, see *10 TROUBLESHOOTING* on page 66.	 Example value shown.	
(2) Press DOWN for longer than 2 seconds. "81" will light up, and the right end digit of the probe length flashes.		
(3) <Setting probe length> Set the probe length (distance from the reference point to the probe end). Press UP to increase and DOWN to decrease the value. Press ENT to accept the value and move to the next digit. ≪Range: rod type - 300 to 4000 mm wire type – 300 to 8000 mm≫ * If a wrong value has been accepted, proceed to Step 8 and complete the Quick Setting, and then start from the beginning again. Or, cancel the Quick Setting. See *7.3.2 Canceling Quick Setting* on page 34.		
(4) Press ENT once. "01" and "ZERO" will light up, and the right end digit of the current zero level will flash.		
(5) <Setting the zero level> Set the zero level (distance from the reference point). Press UP to increase and DOWN to decrease the value. Press ENT to accept the value and move to the next digit. ≪Range: -999 to 999 mm≫ * If a wrong value has been accepted, proceed to Step 8 and complete the Quick Setting, and then start from the beginning again. Or, cancel Quick Setting. See *7.3.2 Canceling Quick Setting* on page 34.		
(6) Press ENT once. "02" and "SPAN" will light up, and the right end digit of the current span will flash.		

Description	LCD	Keys
(7) <Setting the span> Set the distance from the reference point to the process full level. Press UP to increase and DOWN to decrease the value. Press ENT to accept the value and move to the next digit. ≪Range: -999 to 999 mm≫ * If a wrong value has been accepted, proceed to Step 8 and complete the Quick Setting, and then start from the beginning again. Or, cancel Quick Setting. See *7.3.2 Canceling Quick Setting* on page 34.		
(8) Press ENT once. "Qk" will light up, and "Fin" will flash.		
(9) <Updating the values> Press ENT once. After the values are updated, "WR" will replace "Qk", and "OP" will flash.		
(10) When "WR" goes off and "OP" lights continuously, Quick Setting is complete. Check the sensor displays and outputs as it should. If it does not, see *10. TROUBLESHOOTING* on page 66.	 * Example value shown. * "E" displayed for empty tank.	

7.3.2 Canceling Quick Setting

Description	LCD	Keys
(1) At Step 8 in *7.3.1 Procedure* on page 33, "Qk" lights up and "Fin" flashes.		
(2) Press UP or DOWN once. "CnC" flashes.		
(3) Press ENT once. Flashing "OP" means the settings have been cancelled. Go back to *7.3.1 Procedure* if necessary.		

7.4 Parameter Reference

7.4.1 Program mode parameters

After performing Quick Setting, advanced setting is available in the Program Mode. The sensor will continue to measure and give output according to the current settings while programing.
See *7.6 Program Mode* for how to use this mode.

Default value in the parameter tables are indicated with an asterisk (*) unless explicitly stated.

P-01 Zero

Values	Range	-999 to 9999 mm
	Default	4000 mm

Sets distance from the reference point to the zero level.
See *7.3.1 Procedure* on page 33 for detail.

P-02 Span

Values	Range	-999 to 9999 mm
	Default	0 mm

Sets distance from the reference point to the process full level.
See *7.3.1 Procedure* on page 33 for detail.

P-03 Zero Output

Values	Range	3.80 to 20.50 mA
	Default	4.00 mA

Sets analog output value for the zero level.
Usually the value needs not to be changed.

P-04 Span Output

Values	Range	3.80 to 20.50 mA
	Default	20.00 mA

Sets analog output value for the process full level.
Usually the value needs not to be changed.

P-06 Unit

Values	mm	*	
	%		

Sets the unit for reading in the Measurement Mode.

P-09 Backlight

Operation

Values	ALYS	*	Always on.
	60		Goes out after 60 seconds of no key operation

Brightness

Values	Range	Lu 1 to Lu 8
	Default	Lu 3

Sets the backlight operation and brightness. See *7.8.1 Backlight* on page 57.

** See *7.7 Alarm Output* on page 48 to set the following alarm output parameters. (P-11 to P-18).

P-11 Function

Values	OFF	*	
	SPO		Setpoint
	LOE		Measurement error (no echo)
	Err		Sensor error (electronics damage etc.)

Sets control function for each of the 5 output points (OUT 1 to OUT 5).

P-12 Output Configuration

Values	nPn	*	NPN
	PnP		PNP

Sets output type for each of the 5 output points (OUT 1 to OUT 5).

P-13 Output Logic

Values	nO	*	Normally open
	nC		Normally closed

Sets output logic for each of the 5 output points (OUT 1 to OUT 5).

P-14 Setpoint

Values	Range	-999 to 999 mm
	Default	9999 mm

Sets the setpoint for each of the 5 output points (OUT 1 to OUT 5).
Enter distance from the zero level (P-01).

P-15 Resetpoint

Values	Range	-999 to 999 mm
	Default	9990 mm

Sets the resetpoint for each of the 5 output points (OUT 1 to OUT 5).
Enter distance from the zero level (P-01).

P-16 ON Delay

Values	Range	0000 to 0060 seconds
	Default	1 second

Sets ON delay time for each of the 5 output points (OUT 1 to OUT 5).

P-17 OFF Delay

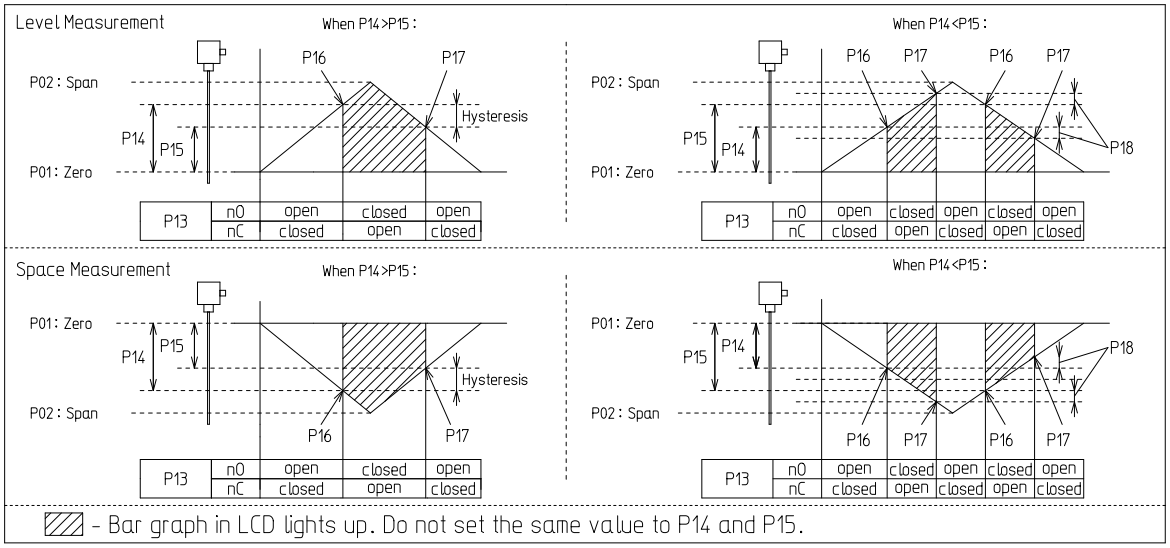
Values	Range	0000 to 0060 seconds
	Default	1 second

Sets OFF delay time for each of the 5 output points (OUT 1 to OUT 5).

P-18 Hysteresis

Values	Range	0000 to 0100 mm
	Default	10 mm

Sets hysteresis for the output points.
The value is applied to all the 5 points (OUT 1 to OUT 5)



▨ - Bar graph in LCD lights up. Do not set the same value to P14 and P15.

P-35 Offset ON/OFF

Values	non	*	No offset.
	diSP		Offsets reading.
	ALL		Offsets reading and analog output.

Determines what to offset.

P-36 Offset Value

Values	Range	-999 to 9999 mm
	Default	0 mm

Sets a constant value to add to the measured value.
If the current reading is 2000mm, and the setting in this parameter is changed from “0” to “500”, the reading will be 2000+500 = 2500mm.
☆ If P-35 is set to “non”, the value in this parameter has no effect on reading nor output.

P-56 Blanking

Values	Range	0 to 8000 mm
	Default	0 mm

Sets the area in which the sensor ignores echoes. Enter the distance from the reference point. This feature is useful when the false echo from nozzle adversely affects operation. Set a value at least 10 mm away from the zero (P-01) or full (P-02) levels. Ensure the material surface will not reach this area.
See *7.6.4 Blanking* on page 43.

P-59 Algorithm

Values	L	*	Large peak
	F		First peak

Sets the algorithm.
The default settig covers most applications. To measure the top level in interface applications, set this parameter to “F”.

P-70 Fail-safe Timer

Values	Range	1 to 5400 seconds
	Default	60 seconds

Sets the time elapsed before the sensor goes into the fail-safe mode.
While the Fail-safe Timer is activated, a rectangular is displayed at the right bottom corner of the display. The sensor uses the last valid measurement to display and output.
See *7.6.5 Fail-safe* on page 44 for detail.

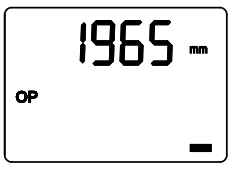


Fig. 7-2
*Example value shown.

P-71 Fail-safe Mode

Values	Hi		20.5mA
	Lo		3.8mA
	HoLd	*	Last valid value

Sets the output value when the sensor is in the fail-safe mode.
Select the one the safest in your application.
For example:

1) To avoid overfill in a level measurement application, select “Hi” and stop the filling pump.
2) To prevent pump from running dry in a level measurement application, select “Lo” to stop the discharge pump.

See *7.6.5 Fail-safe* on page 44 for detail.

P-81 Probe Length

Values	Range	Rod - 300 to 4000 mm / Wire – 300 to 8000 mm
	Default	4000 mm

Sets the probe length of the sensor in millimeters.
Keep the deviation from the actual length within 10 millimeters.
See *7.3.1 Procedure* on page 33.
☆ Enter the distance from the reference point to the probe end, including the weight.
☆ Enter the distance from the reference point to the tank bottom if the probe end is connected and electrically continued to the metal tank bottom.

⚠ CAUTION

Tubed rod can NOT be shortened by the user. Specify the length at the time of order for this probe type.

P-85 Threshold

Values	Hi	*	
	Lo		

Sets the measurement threshold.
If the measurement is not possible or the output fluctuates with the default setting, set this parameter to “Lo”.

P-86 Level Threshold

Values	Range	5 to 995 mV
	Default	100 mV

Sets the threshold for reflection from the material surface.
This parameter needs not be changed in most applications.

P-87 Probe End Threshold

Values	Range	-995 to -5 mV
	Default	-100 mV

Sets the threshold for the reflection from probe end.
This parameter needs not be changed in most applications.

P-88 False Echo Suppression With Material

Values	Range	300 to 8000 mm
	Default	-----

Enter the distance from the reference point to the material surface in millimeters.
See *7.6.6 Enabling False Echo Suppression With Material* on page 45.

Echo from the area set in this parameter is canceled to stabilize operation.
Ensure the material surface is at least 300mm below the reference point before setting this parameter.
If the sensor is mounted on a nozzle, ensure the material surface is at least 300mm below the nozzle end.
If foam covers the material surface, enter the distance to the foam surface instead of the material surface.

If the material level is below the probe end, or it is possible to empty the tank, use *P-89 False Echo Suppression Without Material* on page 45.

P-89 False Echo Suppression Without Material

Value	Default	run

Cancels the false echo in the range from the reference point to the probe end to stabilize operation.
Set *P-81 Probe Length* first and then use this parameter.
See *7.6.7 False Echo Suppression Without Material* on page 46.

If the probe is in contact with the material, or the probe end is connected and electrically continued to the metal tank bottom, use *P-88 False Echo Suppression With Material*.

P-98 Averaging

Values	0		No averaging.
	1	*	1 second
	2		2 seconds
	3		3 seconds
	4		4 seconds
	5		5 seconds
	10		10 seconds
	20		20 seconds
	30		30 seconds
	60		60 seconds
	120		120 seconds
	180		180 seconds

Measurements over the set time are averaged.
☆ Longer averaging time will improve measurement fluctuations, but decreases response to level changes.

P-99 Reset

Values	Range	1965
	Default	1999

Resets all the settings to factory defaults.
Enter “1965” in this parameter, and press ENT.
See *7.6.8 Reset* on page 47.

⚠ CAUTION

If parameters are specified at the time of order, the specified values replace the default settings in this manual.

7.4.2 Test mode parameter

t1 Simulation (mm, %)

Values	Range	-999 to 9999 mm
	Default	Last displayed value before accessing this parameter

Use this parameter to simulate analog output.
Analog output corresponding to the value entered in this parameter will be given. Enter a level or space value depending on the operation mode.
If *P-06 Unit* is set to “%”, input range will be 0.00 to 100.0%.
See *7.9.3 Simulation* (mm, %) on page 60.

t2 Simulation (mA)

Values	Range	3.80 to 20.50 mA
	Default	Last output value before accessing this parameter

Use this parameter to force the sensor to output a specified value.
See *7.9.5 Simulation (mA)* on page 62.

t3 Alarm Test

Values	CLOS	*	ON
	OPEn		OFF

Switches output of the specified point (OUT1 to OUT5).
See *7.9.5 Alarm Test* on page 62.

t4 Measurement Status

Values	6 - 10	Good
	3 – 5	Not good enough
	0 - 2	Bad

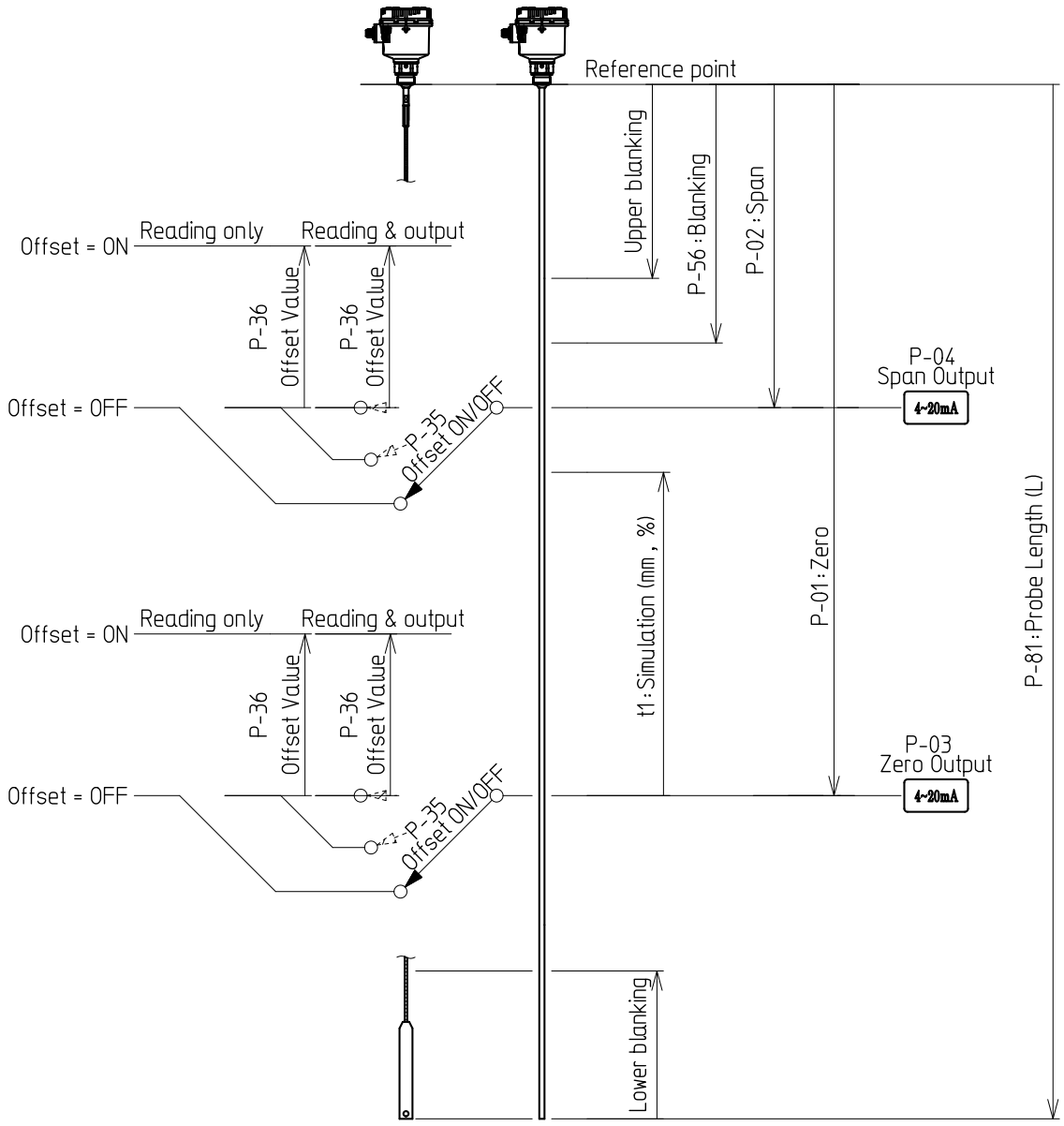
Displays echo confidence.
If a “2” or lower value is displayed, perform false echo suppression (P-88, 89 on page 39).
See *7.9.6 Measurement Status* on page 63.

LCd LCD Test

Tests operation of the LCD.
In this test mode, all segments light up, and then each segment lights up and goes out one after another.
See *7.9.7 LCD Test* on page 63.

7.5 Reference Drawing

GW200NW GW200NR

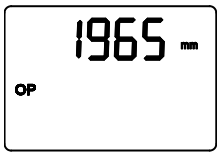
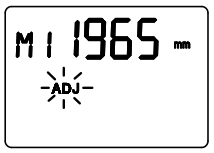
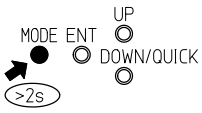
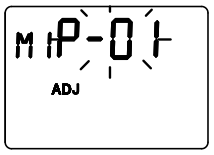


* Level application shown.

7.6 Program Mode

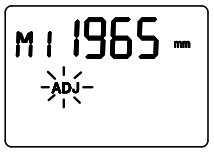
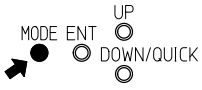
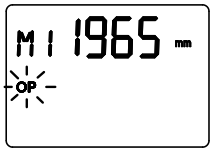
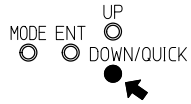
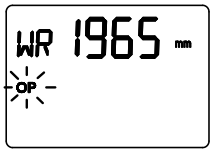
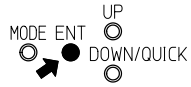
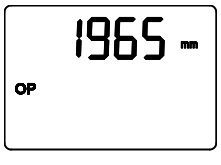
Table of contents:

7.6.1 Switching to Program Mode

Description	LCD	Keys
(1) Ensure that the sensor is in the Measurement Mode ("OP" displayed). If not, see *10 TROUBLESHOOTING* on page 66.	 Example value shown.	
(2) <Switching to the Program Mode> Press MODE for longer than 2 seconds. "M1" will light up, and "ADJ" flash.		
(3) Press ENT. "ADJ will light continuously, and the parameter for zero level "P-01" will flash. Now the sensor is in the Program Mode.		

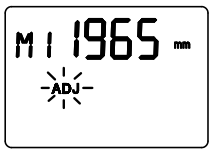
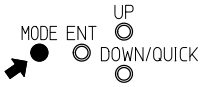
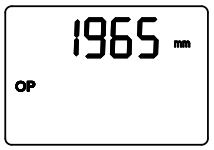
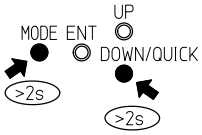
7.6.2 Updating data

The entered values can be cancelled any time until the data is updated according to the instruction in this section.

Description	LCD	Keys
(1) <Updating the data> Press MODE once. "ADJ" will flash.		
(2) Press DOWN once. "OP" will flash.		
(3) Press ENT. "M1" goes out and "WR" will light up while the data is being updated.		
(4) "OP" will light continuously when data update is complete.		

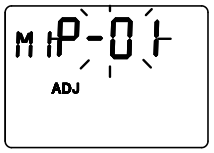
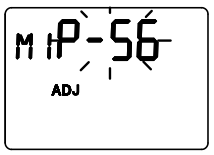
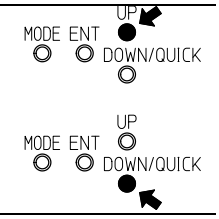
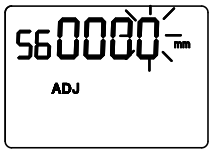
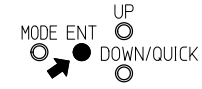
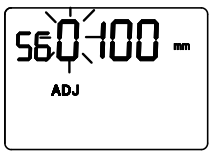
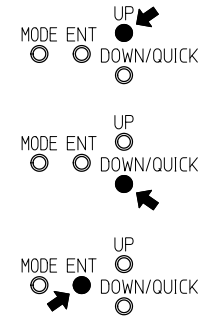
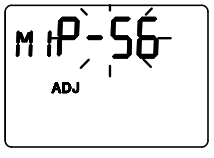
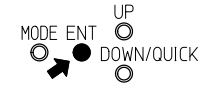
7.6.3 Canceling entry

Before updating the data, the entered values can be cancelled and the last updated value restored.

Description	LCD	Keys
(1) Press MODE until “ADJ” or “TEST” flashes. Proceed to Step 2 if “OP” is flashing.		
(2) Press MODE and DOWN simultaneously for longer than 2 seconds. “OP” will light up when the entry is cancelled.		

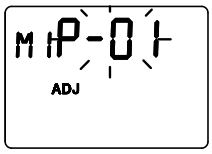
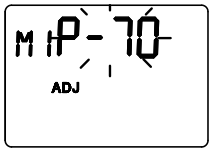
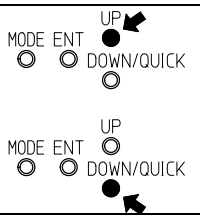
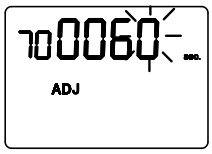
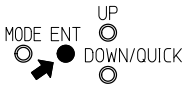
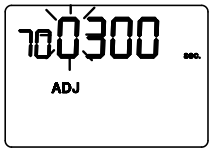
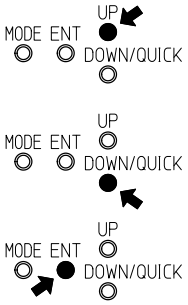
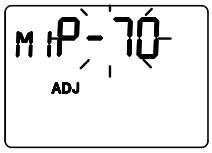
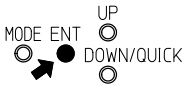
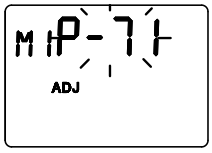
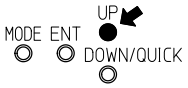
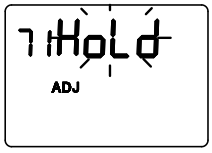
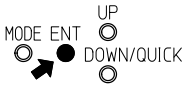
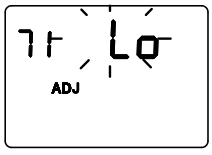
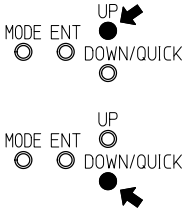
7.6.4 Blanking

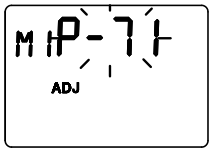
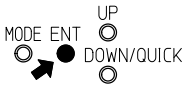
See *7.4.1 Program mode parameter* on page 35 for detail.

Description	LCD	Keys
(1) <Switching to the Program Mode> Follow steps in *7.6.1 Switching to Program Mode* on page 42.		
(2) <Scrolling parameters> Press UP or DOWN until “P-56” flashes. UP scrolls forwards and DOWN backwards.		
(3) <Setting the blanking> Press ENT once. “56” will light up, and the right end digit of the value will flash.		
(4) Set the blanking distance in 4 digits. UP increases, and DOWN decreases the value. ENT accepts the value and moves the cursor to the next digit. <Range: 0 to 8000mm> * Make sure the end of blanking is at least 10 mm away from the zero or full levels (P-01, P-02). If a wrong value is accepted, press MODE to cancel the entry, or proceed to Step 5 to accept the change and then go back to Step 3 to enter the correct value.		
(5) Press ENT once. “P-56” will flash again. The change has now been accepted. Note that at this stage the data has not been updated. Proceed to the next step.		
(6) <Updating the data> Follow steps in *7.6.2 Updating data* on page 42.		

7.6.5 Fail-safe

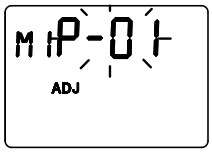
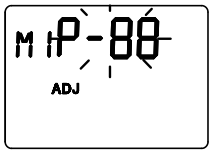
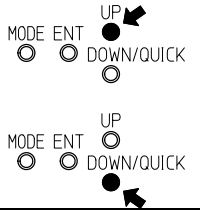
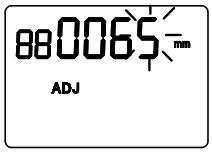
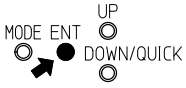
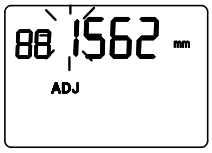
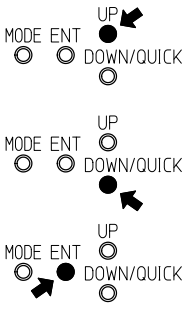
This section shows how to set Parameters *P-70 Fail-safe Timer* and *P-71 Fail-safe Mode*. See *7.4.1 Program mode parameter* on page 35 for detail.

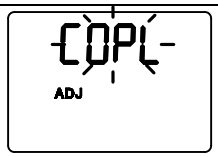
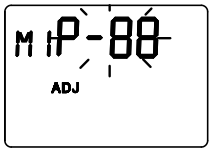
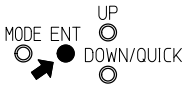
Description	LCD	Keys
(1) <Switching to the Program Mode> Follow steps in *7.6.1 Switching to Program Mode* on page 42.		
(2) <Scrolling parameters> Press UP or DOWN until "P-70" flashes. UP scrolls forwards and DOWN backwards.		
(3) <Setting the fail-safe timer> Press ENT once. "70" will light up, and the right end digit of the value will flash.		
(4) Set the fail-safe timer. UP increases, and DOWN decreases the value. ENT accepts the value and moves the cursor to the next digit. <Range: 1 to 5400 sec.> If a wrong value is accepted, press MODE to cancel the entry, or proceed to Step 5 to accept the change and then go back to Step 3 to enter the correct value.		
(5) Press ENT once. "P-70" will flash again.		
(6) <Scrolling parameters> Press UP once. "P-71" will flash.		
(7) <Setting Fail-safe Mode> Press ENT once. "71" will light up, and the right end digit of the value will flash.		
(8) Set the fail-safe mode. UP will scroll forwards and DOWN backwards. <Options: Hi, Lo, HoLD>		

Description	LCD	Keys
(9) Press ENT once. "P-71" will flash again. The change has now been accepted. Note that at this stage the data has not been updated. Proceed to the next step.		
(10)<Updating the data> Follow steps in *7.6.2 Updating data* on page 42.		

7.6.6 False echo suppression with material

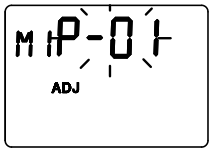
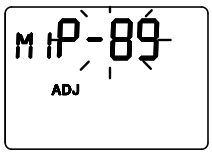
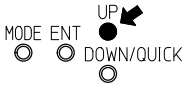
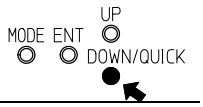
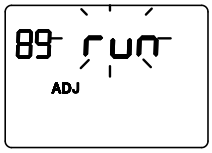
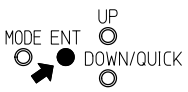
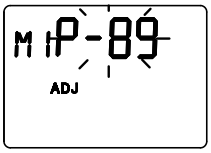
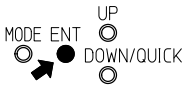
See *7.4.1 Program mode parameter* on page 35 for detail.

Description	LCD	Keys
(1) <Switching to the Program Mode> Follow steps in *7.6.1 Switching to Program Mode* on page 42.		
(2) <Scrolling parameters> Press UP or DOWN until "P-88" flashes. UP scrolls forwards and DOWN backwards.		
(3) Using another tool, measure the distance between the reference point and the material surface. If foam covers the surface, measure the distance to the foam surface. If the probe end is connected to the bottom of metal tank and the tank is empty, measure the distance to the tank bottom.		
(4) <False echo suppression with material> Press ENT once. "88" will light up, and the right end digit of current reading will flash.		
(5) Enter the distance measured in Step 3. If the probe end is connected to the metal tank bottom and electrically continued, enter the probe length. UP increases, and DOWN decreases the value. ENT accepts the value and moves the cursor to the next digit. <Range: 300 to 8000mm> If a wrong value is accepted, press MODE to cancel the entry, or proceed to Step 4 to accept the change and then go back to Step 3 to enter the correct value.		

Description	LCD	Keys
(6) Press ENT once. When the change is accepted, “COPL” and then “P-88” will flash. The echo suppression range is now configured. Proceed to the next step to update the data, and return to the Measurement Mode.	 	
(7) <Updating the data> Follow steps in *7.6.2 Updating data* on page 42.		

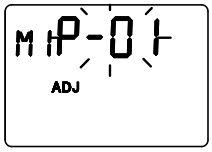
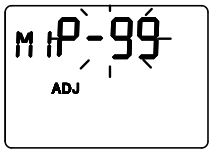
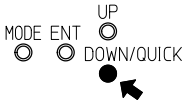
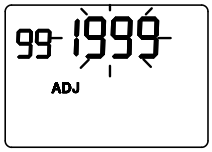
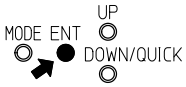
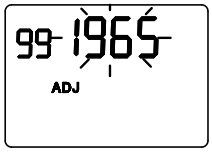
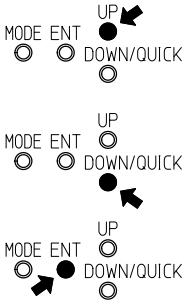
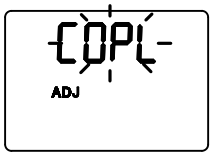
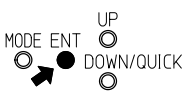
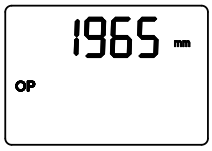
7.6.7 False echo suppression without material

See *7.4.1 Program mode parameter* on page 35 for detail.

Description	LCD	Keys
(1) <Switching to the Program Mode> Follow steps in *7.6.1 Switching to Program Mode* on page 42.		
(2) <Checking probe length> Press UP or DOWN until “P-81” flashes. Press ENT. The current value flashes. Ensure the correct probe length is entered. If the probe is in contact with the material, or the probe end is connected to the metal tank bottom, follow steps in *7.6.6 False echo suppression with material* on page 45.		
(3) <Scrolling parameters> Press UP or DOWN until “P-89” flashes. UP scrolls forwards and DOWN backwards.		 
(4) <False echo suppression without material> Press ENT once. “89” will light up, and “run” will flash.		
(5) Press ENT once. When the change is accepted, “COPL” and then “P-88” will flash again. The echo suppression range is now configured. Proceed to the next step to update the data, and return to the Measurement Mode.		
(6) <Updating the data> Follow steps in *7.6.2 Updating data* on page 42.		

7.6.8 Reset

Perform a reset when the sensor is relocated, or before reprograming the sensor.

Description	LCD	Keys
(1) <Switching to the Program Mode> Follow steps in *7.6.1 Switching to Program Mode* on page 42.		
(2) <Scrolling parameters> Press DOWN once. "P-99" will flash. If another parameter flashes, press UP or DOWN until "P-99" flashes. UP scrolls forwards and DOWN backwards.		
(3) <Performing a reset> Press ENT once. The right end digit will flash.		
(4) Enter the pass code (1965). UP increases, and DOWN decreases the value. ENT accepts the value and moves the cursor to the next digit. * If a wrong value is accepted, press MODE once to cancel the entry, or proceed to Step 5 to update the data and then go back to Step 4 to enter the correct value.		
(5) Press ENT once. Parameter settings will be reset to the factory defaults. "COPL" will flash, and then the sensor will switch to the Measurement Mode.		
(6) "OP" will light up when the reset is complete.		

7.7 Alarm Ooutput

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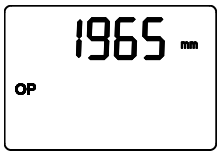
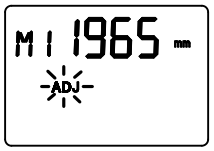
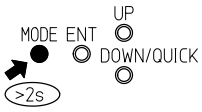
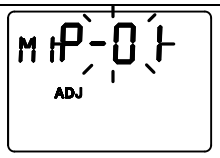
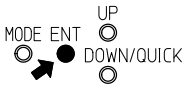
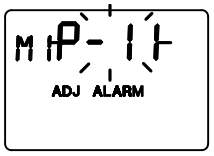
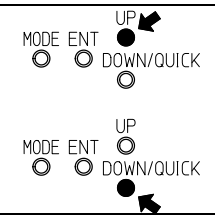
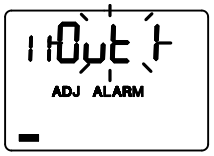
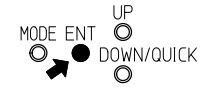
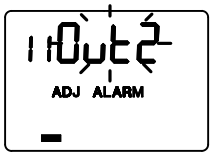
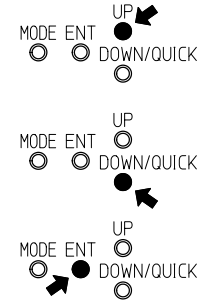
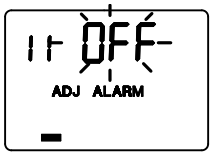
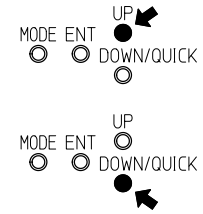
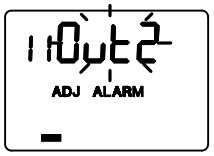
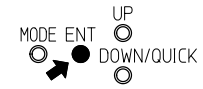
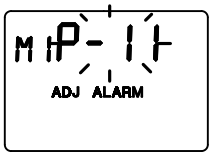
7.7.1 Switching to Program Mode

Description	LCD	Keys
(1) Ensure that the sensor is in the Measurement Mode ("OP" displayed). If not, see *10 TROUBLESHOOTING* on page 66.	 Example value shown.	
(2) <Switching to the Program Mode> Press MODE for longer than 2 seconds. "M1" will light up, and "ADJ" flash.		
(3) Press ENT. "ADJ" will light continuously, and "P-01" will flash. The sensor is now in the Program Mode.		

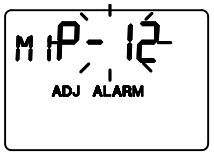
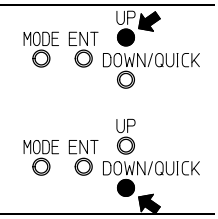
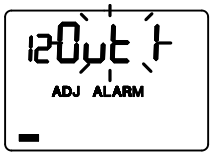
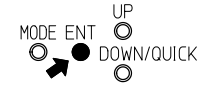
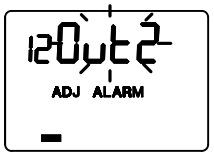
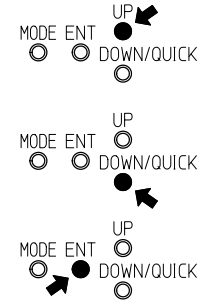
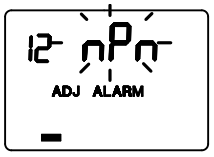
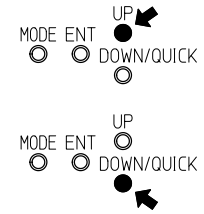
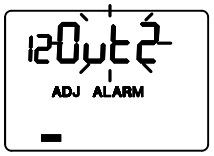
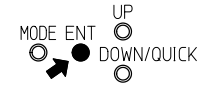
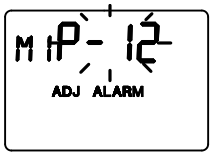
7.7.2 Function

See *7.4.1 Program mode parameter* on page 35 for detail.

Description	LCD	Keys
(1) <Opening the parameter> Press UP or DOWN until "P-11" flashes. UP scrolls forwards and DOWN backwards.		
(2) Press ENT once. "11" will light up, and "Out 1" flash.		
(3) <Selecting alarm point> Press UP or DOWN until the desired alarm point flashes, and then press ENT. The current setting wil flash. UP scrolls forwards and DOWN backwards. <Options: Out1 to Out5>		
(4) <Selecting a function> Press UP or DOWN until the desired option flashes. UP scrolls forwards and DOWN backwards. <Options: OFF, SPO, LOE, ERR>		
(5) Press ENT once. The selected output point will flash again.		
(6) Repeat Steps 3 to 5 to program the other output points. When all points are programed, press MODE to set P-12 Output Confuguration.		

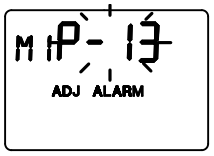
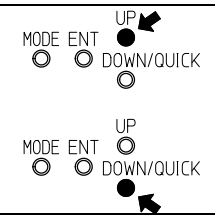
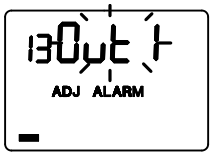
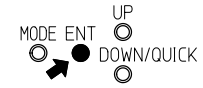
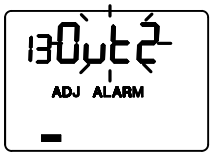
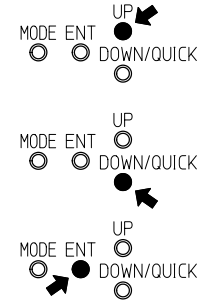
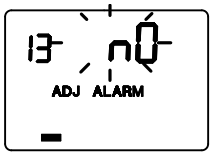
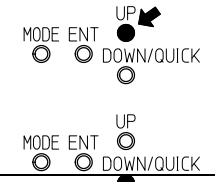
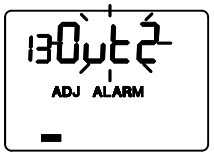
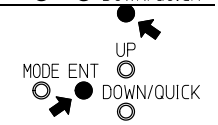
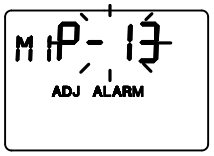
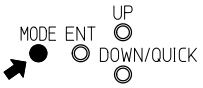
7.7.3 Output configuration

See *7.4.1 Program mode parameter* on page 35 for detail.

Description	LCD	Keys
(1) <Opening the parameter> Press UP or DOWN until "P-12" flashes. UP scrolls forwards and DOWN backwards.		
(2) Press ENT once. "12" will light up, and "Out 1" flash.		
(3) <Selecting alarm point> Press UP or DOWN until the desired alarm point flashes, and then press ENT. The current setting will be displayed. UP scrolls forwards and DOWN backwards. <Options: Out1 to Out5>		
(4) <Selecting the configuration> Press UP or DOWN until the desired option flashes. UP scrolls forwards and DOWN backwards. <Options: nPn, PnP> NOTE: Always change wiring accordingly if this parameter is altered. Wrong wiring may damage the sensor.		
(5) Press ENT once. The selected output point will flash again.		
(6) Repeat Steps 3 to 5 to program the other output points. When all points have been programed, press MODE to set P-13 Output Logic.		

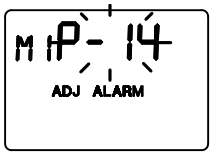
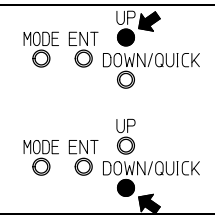
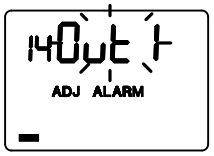
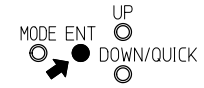
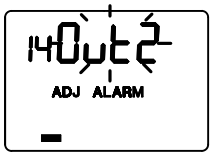
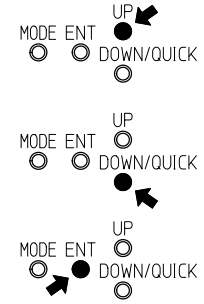
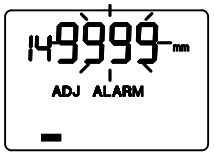
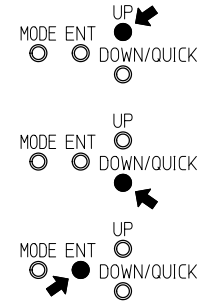
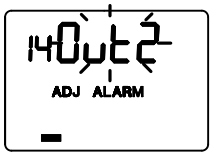
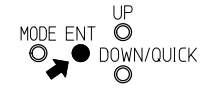
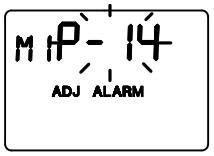
7.7.4 Output logic

See *7.4.1 Program mode parameter* on page 35 for detail.

Description	LCD	Keys
(1) <Opening the parameter> Press UP or DOWN until "P-13" flashes. UP scrolls forwards and DOWN backwards.		
(2) Press ENT once. "13" will light up, and "Out 1" flash.		
(3) <Selecting alarm point> Press UP or DOWN until the desired alarm point flashes, and then press ENT. The current setting will be displayed. UP scrolls forwards and DOWN backwards. <Options: Out1 to Out5>		
(4) <Selecting the logic> Press UP or DOWN until the desired option flashes. UP scrolls forwards and DOWN backwards. <Options: nO, nC>		
(5) Press ENT once. The selected output point will flash again.		
(6) Repeat Steps 3 to 5 to program the other output points. When all points are programed, press MODE to set P-14 Setpoint.		

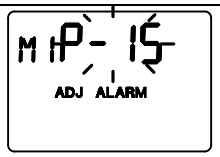
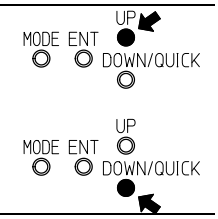
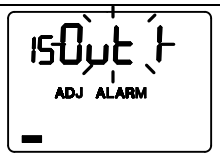
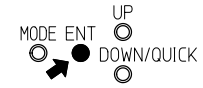
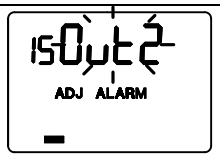
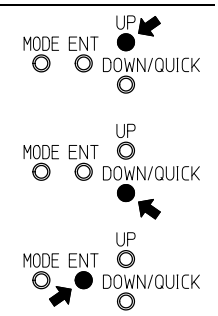
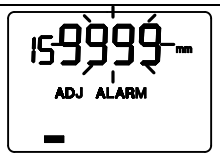
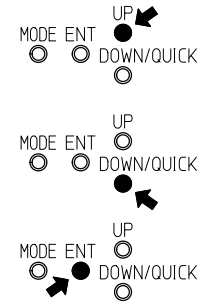
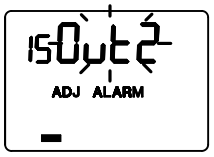
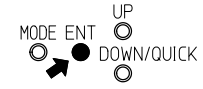
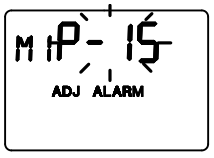
7.7.5 Setpoint

See *7.4.1 Program mode parameter* on page 35 for detail.

Description	LCD	Keys
(1) <Opening the parameter> Press UP or DOWN until "P-14" flashes. UP scrolls forwards and DOWN backwards.		
(2) Press ENT once. "14" will light up, and "Out 1" flash.		
(3) <Selecting alarm point> Press UP or DOWN until the desired alarm point flashes, and then press ENT. The current setting will be displayed. UP scrolls forwards and DOWN backwards. <Options: Out1 to Out5>		
(4) <Determining the setpoint> Press UP or DOWN until the desired value (distance from P-01 Zero) flashes. UP increases and DOWN decreases the value. ENT accepts the value and moves the cursor to the next digit. <Range: -999 to 9999 mm> * Enter a different value from the resetpoint (P-15). If a wrong value is accepted, press MODE to cancel the entry, or proceed to Step 5 to accept the change and then go back to Step 3 to enter the correct value.		
(5) Press ENT once. The selected output point will flash.		
(6) Repeat Steps 3 to 5 to program the other output points. When all points have been programed, press MODE to set P-15 Restpoint.		

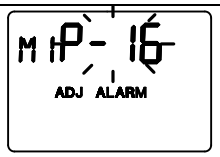
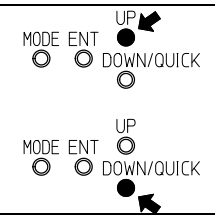
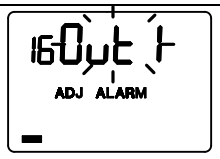
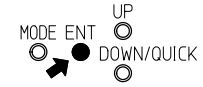
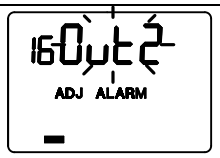
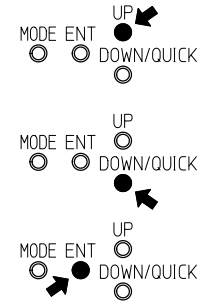
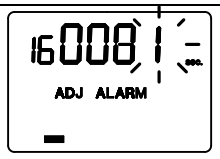
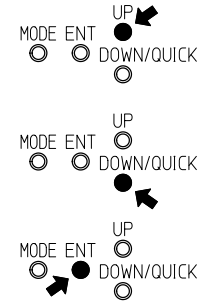
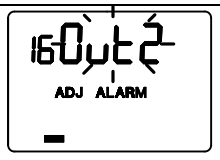
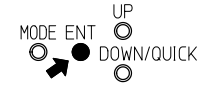
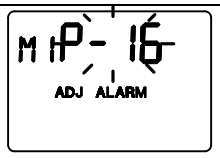
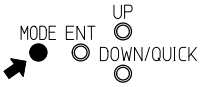
7.7.6 Resetpoint

See *7.4.1 Program mode parameter* on page 35 for detail.

Description	LCD	Keys
(1) <Opening the parameter> Press UP or DOWN until "P-15" flashes. UP scrolls forwards and DOWN backwards.		
(2) Press ENT once. "15" will light up, and "Out 1" flash.		
(3) <Selecting alarm point> Press UP or DOWN until the desired alarm point flashes, and then press ENT. The current setting will flash. UP scrolls forwards and DOWN backwards. <Options: Out1 to Out5>		
(4) <Determining the resetpoint> Press UP or DOWN until the desired value (distance from P-01 Zero) flashes. UP increases and DOWN decreases the value. ENT accepts the value and moves the cursor to the next digit. <Range: -999 to 9999 mm> * Enter a different value from the setpoint (P-14). If a wrong value is accepted, press MODE to cancel the entry, or proceed to Step 5 to accept the change and then go back to Step 3 to enter the correct value.		
(5) Press ENT once. The selected output point will flash.		
(6) Repeat Steps 3 to 5 to program the other output points. When all points are programed, press MODE to set P-16 ON Delay.		

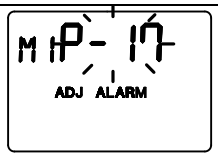
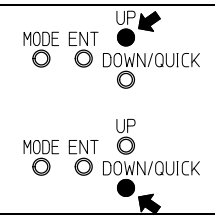
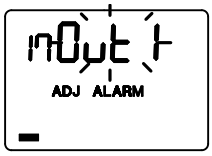
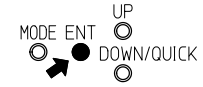
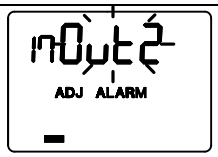
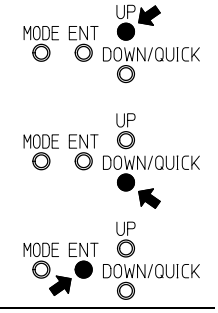
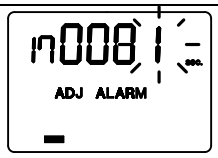
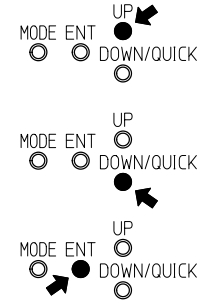
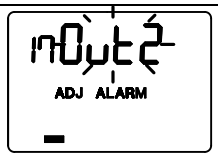
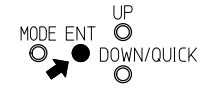
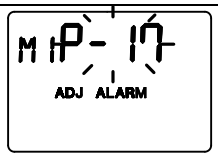
7.7.7 ON delay

See *7.4.1 Program mode parameter* on page 35 for detail.

Description	LCD	Keys
(1) <Opening the parameter> Press UP or DOWN until "P-16" flashes. UP scrolls forwards and DOWN backwards.		
(2) Press ENT once. "16" will light up, and "Out 1" flash.		
(3) <Selecting alarm point> Press UP or DOWN until the desired alarm point flashes, and then press ENT. The current setting will flash. UP scrolls forwards and DOWN backwards. <Options: Out1 to Out5>		
(4) <Determining delay time> Press UP or DOWN until the desired value flashes. UP increases and DOWN decreases the value. ENT accepts the value and moves the cursor to the next digit. <Range: 0000 to 0060 sec.> * If a wrong value is accepted, press MODE to cancel the entry, or proceed to Step 5 to accept the change and then go back to Step 3 to enter the correct value.		
(5) Press ENT once. The selected output point will flash again.		
(6) Repeat Steps 3 to 5 to program the other output points. When all points are programed, press MODE to set P-17 OFF Delay.		

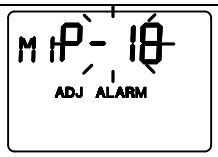
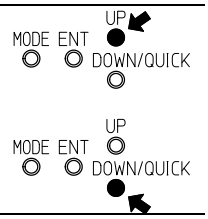
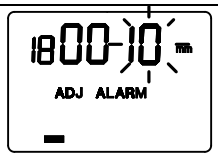
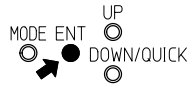
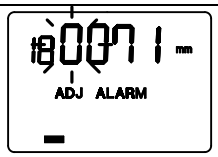
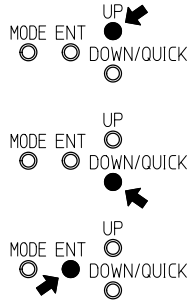
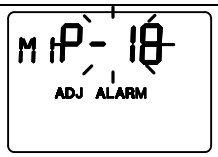
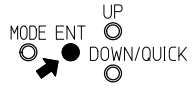
7.7.8 OFF delay

See *7.4.1 Program mode parameter* on page 35 for detail.

Description	LCD	Keys
(1) <Opening the parameter> Press UP or DOWN until "P-17" flashes. UP scrolls forwards and DOWN backwards.		
(2) Press ENT once. "17" will light up, and "Out 1" flash.		
(3) <Selecting alarm point> Press UP or DOWN until the desired alarm point flashes, and then press ENT. The current value will be displayed. UP scrolls forwards and DOWN backwards. <Options: Out1 to Out5>		
(4) <Determining delay time> Press UP or DOWN until the desired value flashes. UP increases and DOWN decreases the value. ENT accepts the value and moves the cursor to the next digit. <Range: 0000 to 0060 sec.> * If a wrong value is accepted, press MODE to cancel the entry, or proceed to Step 5 to accept the change and then go back to Step 3 to enter the correct value.		
(5) Press ENT once. The selected output point will flash again.		
(6) Repeat Steps 3 to 5 to program the other output points. When all points are programed, press MODE to set P-18 Hysteresis.		

7.7.9 Hysteresis

See *7.4.1 Program mode parameter* on page 35 for detail.

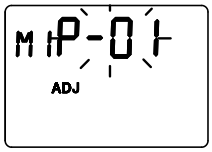
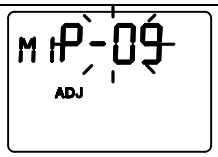
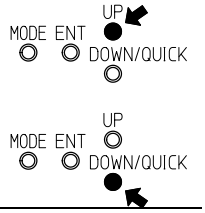
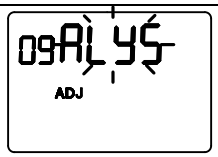
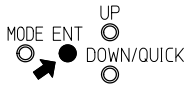
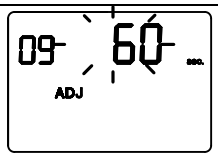
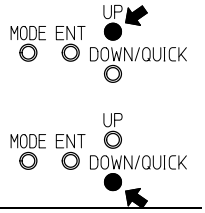
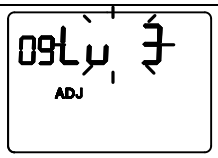
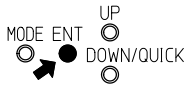
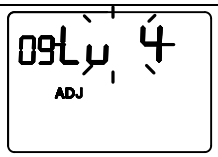
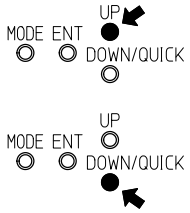
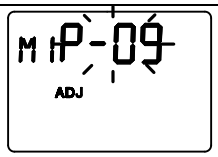
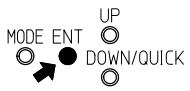
Description	LCD	Keys
(1) <Opening the parameter> Press UP or DOWN until "P-18" flashes. UP scrolls forwards and DOWN backwards.		
(2) <Setting hysteresis> Press ENT once. "18" will light up, and the right end digit of the current value will flash.		
(3) Press UP or DOWN until the desired value flashes. UP increases and DOWN decreases the value. ENT accepts the value and moves the cursor to the next digit. <Range: 0000 to 0100 mm> * If a wrong value is accepted, press MODE to cancel the entry, or proceed to Step 5 to accept the change and then go back to Step 3 to enter the correct value.		
(4) Press ENT once. "P-18" will flash.		
(5) <Updating the data> Follow steps in *7.6.2 Updating data* on page 42.		

7.8 Other Parameters

Table of contents:

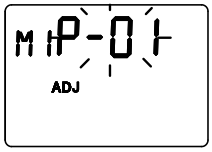
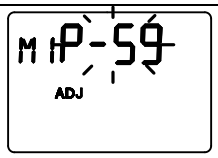
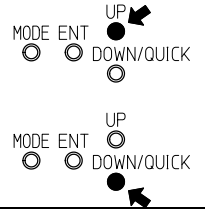
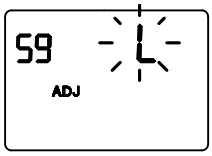
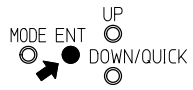
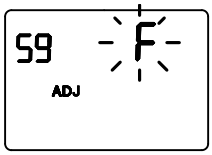
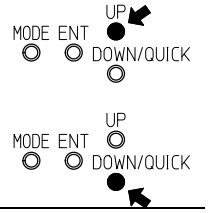
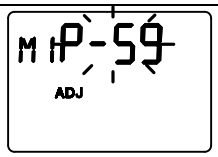
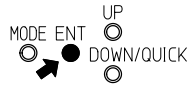
7.8.1 Backlight

See *7.4.1 Program mode parameter* on page 35 for detail.

Description	LCD	Keys
(1) <Switching to the Program Mode> Follow steps in *7.6.1 Switching to Program Mode* on page 42.		
(2) <Scrolling parameters> Press UP or DOWN until "P-09" flashes. UP scrolls forwards and DOWN backwards.		
(3) Press ENT once. "09" will light continuously, and the current setting will flash.		
(4) Set the backlit duration. UP scrolls forwards, and DOWN backwards. <Options: ALYS, 60 sec.>		
(5) Press ENT once. Selected option will flash.		
(6) <Determining brightness> Press UP or DOWN until the desired option flashes. UP scrolls forwards, and DOWN backwards. The larger the number is, the brighter the backlight will be. <Options: Lu1 to Lu8>		
(7) Press ENT once. "P-09" will flash again.		
(8) <Updating the data> Follow steps in *7.6.2 Updating data* on page 42.		

7.8.2 Algorithm

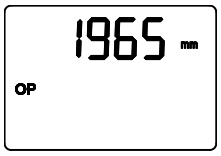
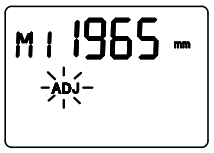
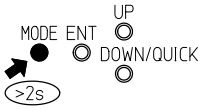
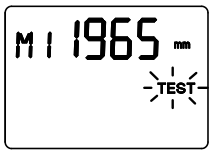
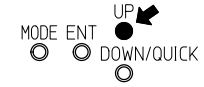
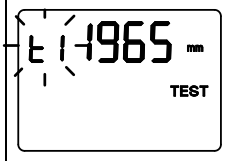
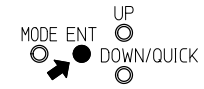
See *7.4.1 Program mode parameter* on page 35 for detail.

Description	LCD	Keys
(1) <Switching to the Program Mode> Follow steps in *7.6.1 Switching to Program Mode* on page 42.		
(2) <Scrolling parameters> Press UP or DOWN until "P-59" flashes. UP scrolls forwards and DOWN backwards.		
(3) Press ENT once. "59" will light continuously, and the current setting will flash.		
(4) <Selecting the algorithm> Press UP or DOWN until the desired option flashes. UP scrolls forwards, and DOWN backwards. <Options: L, F>		
(5) Press ENT once. "P-59" flash again.		
(6) <Updating the data> Follow steps in *7.6.2 Updating data* on page 42.		

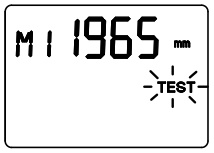
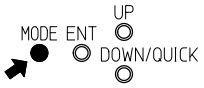
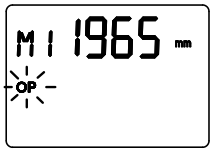
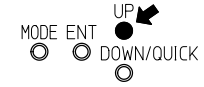
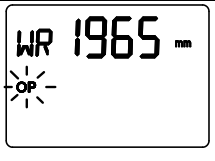
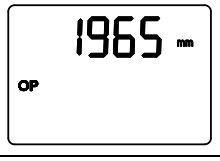
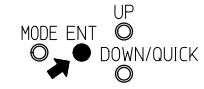
7.9 Test Mode

Table of contents:

7.9.1 Switching to Test Mode

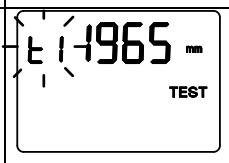
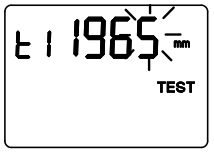
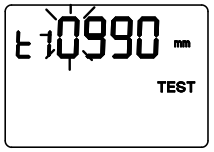
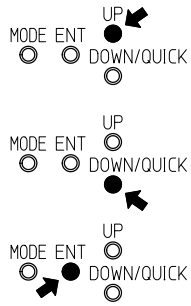
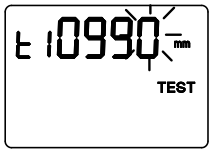
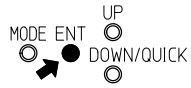
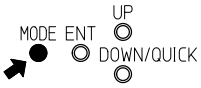
Description	LCD	Keys
(1) Ensure that the sensor is in the Measurement Mode ("OP" displayed). If not, see *10 TROUBLESHOOTING* on page 66.	 Example value shown.	
(2) <Switching to the Test Mode> Press MODE for longer than 2 seconds. "M1" will light up, and "ADJ" flash.		
(3) Press UP once. "TEST" will flash.		
(4) Press ENT. "TEST" will light continuously, and "t1" will flash. Now the sensor is in the Test Mode.		

7.9.2 Exiting Test Mode

Description	LCD	Keys
(1) <Returning to the Measurement Mode> Press MODE once. "TEST" will flash.		
(2) Press UP once. "OP" will flash. * Long pressing MODE and DOWN at once also switches the modes, but without updating the data.		
(3) Press ENT once. "M1" will go out and "WR" light up while the data is being updated. "WR" then will go out, and "OP" will light up. Now the sensor is in the Measurement Mode.	 	

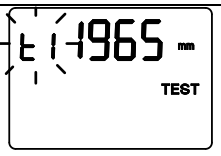
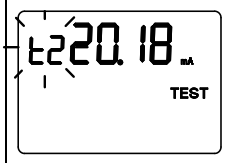
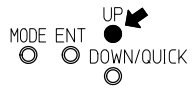
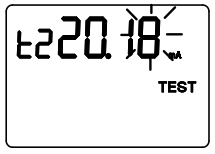
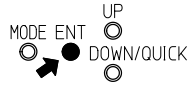
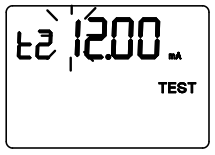
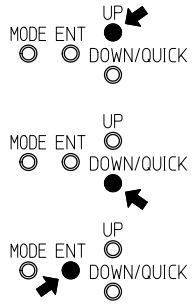
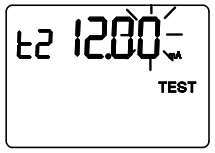
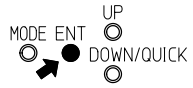
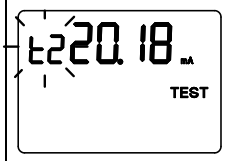
7.9.3 Simulation (mm, %)

See *7.4.2 Test mode parameter* on page 40 for detail.

Description	LCD	Keys
(1) <Switching to the Test Mode> Follow steps in *7.9.1 Switching to Test Mode* on page 59.	 * Example vale shown.	
(2) <Simulation (mm, %)> Press ENT once. "t1" will light up, and the right end digit of current value flash. Default value is the reading when the ENT is pressed.		
(3) Enter the desired value. UP increases, and DOWN decreases the value. ENT accepts the value and moves the cursor to the next digit. <Range: -999 to 9999mm, 000.0 to 100.0%>		
(4) Press ENT once. The sensor will output according to the entered value, and on the display the right end digit will flash. Repeat Steps 3 and 4 to simulate other values.		
(5) <Ending Simulation (mm, %)> Press MODE once. The sensor stops simulation, and "t1" will flash again.		
(6) <Returning to the Measurement Mode> Follow steps in *7.9.2 Exiting Test Mode* on page 59.		

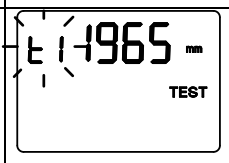
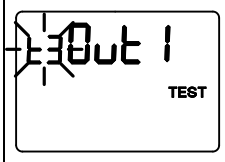
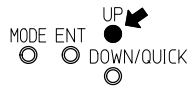
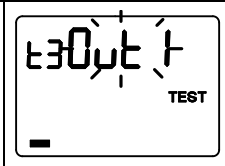
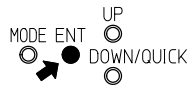
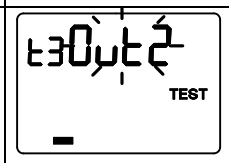
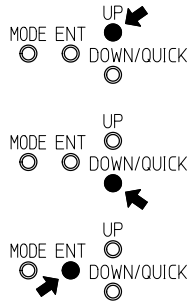
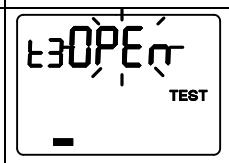
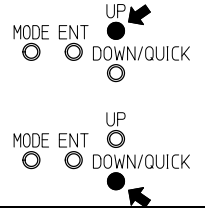
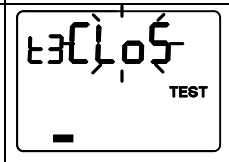
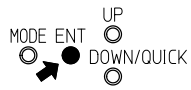
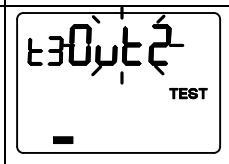
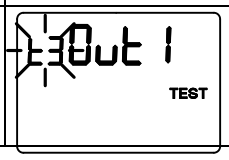
7.9.4 Simulation (mA)

See *7.4.2 Test mode parameter* on page 40 for detail.

Description	LCD	Keys
(1) <Switching to the Test Mode> Follow steps in *7.9.1 Switching to Test Mode* on page 59.	 * Example vale shown.	
(2) <Simulation (mA)> Press UP once. "t2" will flash.		
(3) Press ENT once. "t2" will light continuously, and the output value will be displayed with the right end digit flashing. Default value is the output value when the ENT is pressed.		
(4) Enter the desired value. UP increases, and DOWN decreases the value. ENT accepts the value and moves the cursor to the next digit. <Range: 3.80 to 20.50mA>		
(5) Press ENT once. The sensor will output the entered value, and on the display the right end digit will flash. If the entered value is outside the input range, this parameter does not affect the output and the last valid value will be displayed. Try Steps 4 and 5 again with a valid value. Repeat Steps 4 and 5 to simulate other values.		
(6) <Ending Simulation (mA)> Press MODE once. The sensor stops simulation, and "t2" will flash again.		
(7) <Returning to the Measurement Mode> Follow steps in *7.9.2 Exiting Test Mode* on page 59.		

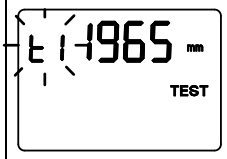
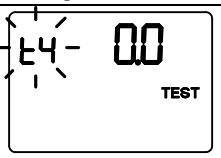
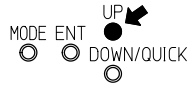
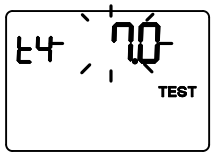
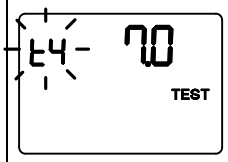
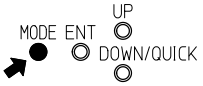
7.9.5 Alarm test

See *7.4.2 Test mode parameter* on page 40 for detail.

Description	LCD	Keys
(1) <Switching to the Test Mode> Follow steps in *7.9.1 Switching to Test Mode* on page 59.	 * Example vale shown.	
(2) Press UP twice. "t3" will flash.		
(3) Press ENT once. "t3" will light continuously, and "Out1" will flash.		
(4) <Selecting alarm point> Press UP or DOWN until the desired alarm point flashes, and then press ENT. The current setting of the selected point will be displayed. UP scrolls forwards and DOWN backwards. <Options: Out1 to Out5>		
(5) <Alarm test> Press UP or DOWN until the desired option flashes. UP scrolls forwards, and DOWN backwards. <Options: OPEn, CLoS>		
(6) Press ENT once. The selected alarm point will operate.		
(7) Press MODE once. Repeat Steps 4 to 6 to simulate other output points.		
(8) <Ending alarm test> Press MODE once. "t3" will flash.		
(9) <Returning to the Measurement Mode> Follow steps in *7.9.2 Exiting Test Mode* on page 59.		

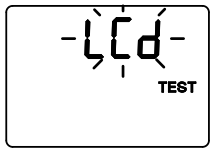
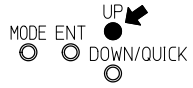
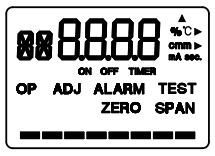
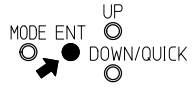
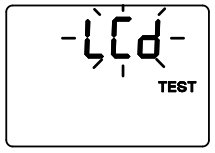
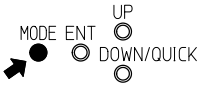
7.9.6 Measurement status

See *7.4.2 Test mode parameter* on page 40 for detail.

Description	LCD	Keys
(1) <Switching to the Test Mode> Follow steps in *7.9.1 Switching to Test Mode* on page 59.	 Example value shown.	
(2) Press UP three times. "t4" will flash.		
(3) Press ENT once. "t4" will light continuously, and confidence level of the current echo profile flash.		
(4) <Ending status check> Press MODE once. "t4" will flash again.		
(5) <Returning to the Measurement Mode> Follow steps in *7.9.2 Exiting Test Mode* on page 59.		

7.9.7 LCD test

See *7.4.2 Test mode parameter* on page 40 for detail.

Description	LCD	Keys
(1) <Switching to the Test Mode> Follow steps in *7.9.1 Switching to Test Mode* on page 59.	 Example value shown.	
(2) <LCD test> Press UP 4 times. "LCd" will flash.		
(3) Press ENT once. All the segments will light up, and go off. Then each segment will light up one after another.		
(4) <Ending LCD test> Press MODE once. The test will stop and "LCd" will flash.		
(5) <Returning to the Measurement Mode> Follow steps in *7.9.2 Exiting Test Mode* on page 59.		

8. MAINTENANCE AND INSPECTION

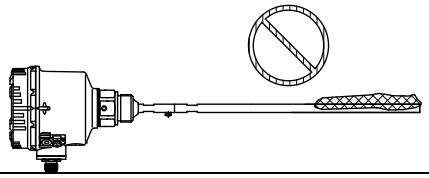
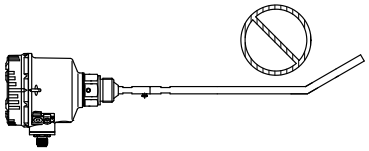
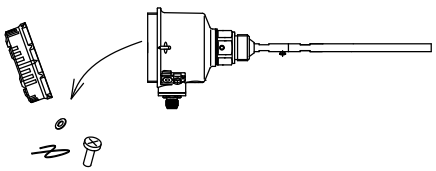
Remove the sensor from the tank and read through *4. HANDLING NOTES* on page 11 before starting maintenance. Ensure ample space.

⚠ WARNING

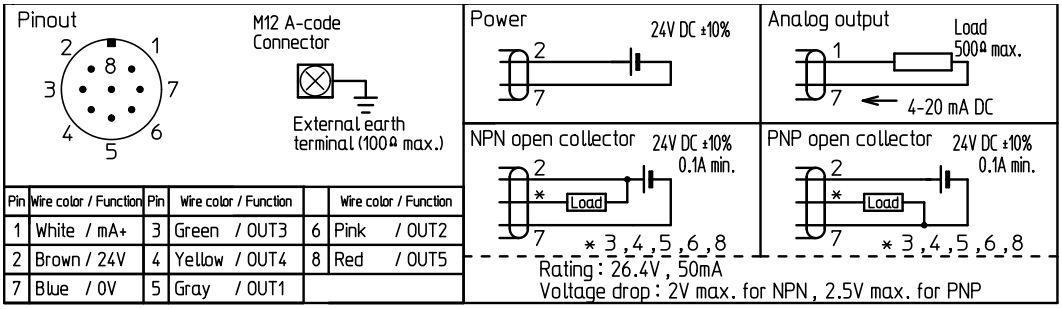
Disconnect power before wiring, or electric shock may result. Ignition or short circuit may also result due to leakage or charged components contacting each other.

8.1 Maintenance Procedure

Perform maintenance every half or one year. More frequent maintenance will be required depending on frequency of use, material type, temperature, pressure and other conditions.

Remove buildup on the probe.	
Check the senor for visible damage that may impair performance. If any, repair or replace the damaged components.*1	
Remove condensation, dust, and metal particles in the housing.	

Follow steps in *7.9 Test Mode* on page 59 to simulate analog and alarm output operation. If the sensor does not operate as it should, check for adequate supplied voltage and load resistance. If the sensor has some kind of problem, reqair is required.



Pin	Wire color / Function	Pin	Wire color / Function		Wire color / Function
1	White / mA+	3	Green / OUT3	6	Pink / OUT2
2	Brown / 24V	4	Yellow / OUT4	8	Red / OUT5
7	Blue / 0V	5	Gray / OUT1		

*1: Please contact our sales office for repair or replacement.

8.2 When to Replace Components

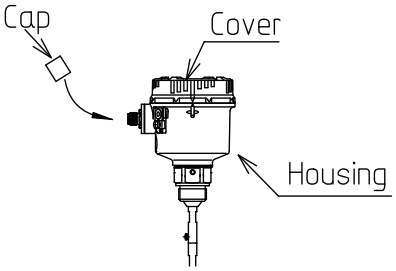
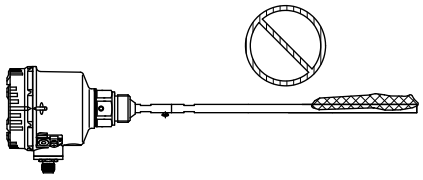
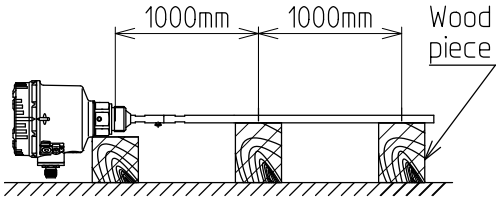
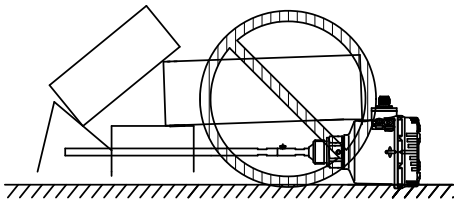
Replace components when they exhibit corrosion or damage that may impair functionality.
Rod of the rod version can be supplied by the user. All the other components must be of the same specifications as the original ones and provided by Nohken. Be careful of components looking the same but of different specifications.

9. STORING

Observe the following instructions when storing the sensor before use, or after removing from service. Failure to do so may result in faulty operation.

9.1 Conditions

- Temperature: -10 to +60 ℃ (no dew condensation)
- Relative humidity: 85% max.
- Atmosphere: not corrosive (without NH_3, SO_2, or Cl_2) or dusty
- No vibration, no shock

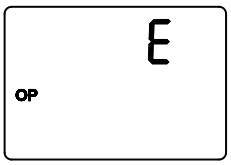
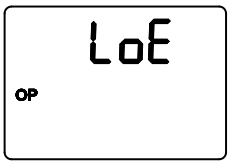
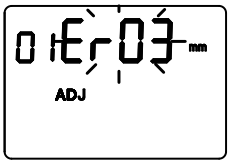
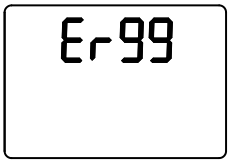
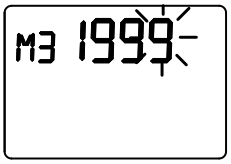
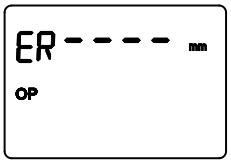
Tighten the housing cover and cover the cable inlet with a cap to prevent dust entry.	
Remove buildup, or it may solidify and adversely affect operation the next time the sensor is used.	
Support the rod probe with wood piece to prevent rolling, bent, or damage. Support sensors with a rod probe longer than 2000mm at a 1000mm interval to prevent sagging.	
Do not place anything on the sensor to prevent deformation or damage.	

NOTE:

Wrap the sensor in sheet and seal it to protect from moisture and dust. If the sensor is stored where temperature change is enormous, enclose desiccant such as silica gel in the sheet.

10. TROUBLESHOOTING

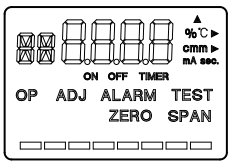
10.1 Error Code

Code	LCD	Description
E (empty)		Material surface is below the probe or in the lower blanking, and cannot be measured. Probe end signal*1 will be output.
LoE* (loss of echo*)		Measurement error. Causes include too weak reflection from the material surface. The sensor will output the value set in *P-71 Fail-safe Mode*.
Er03 (error 03)		Zero level (P-01) and full level (P-02) are too close to each other (<50mm). Change either of the setting.
Er99 (error 99)		Sensor cannot successfully start up or has some kind of problem. The sensor will output the value set in *P-71 Fail-safe Mode*. This error will be automatically cleared when the cause disappears.
M3		Maintenance mode for the manufacturer. Press MODE and DOWN for longer than 2 seconds to return to the Measurement Mode.
ER (error)		The data could not be updated successfully. Cycle power. If error persists, contact our sales office.

*1 Between 3.8mA and 20.5mA.

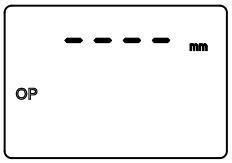
* See *11.1 GLOSSARY*.

Blank LCD.



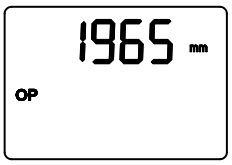
Possible cause	Corrective action	Reference
Incorrect wiring	- Connect a voltmeter between “2/24V” (brown) and “7/0V” (blue) terminals on the sensor, and see if 24V DC±10% is supplied.	6.2 Wiring (p.27)
Power too low	- Change the power supply. Power consumption is 1.0W at maximum, without open collector output.	
Sensor damaged.	- Contact our sales office.	

“OP” not displayed after switching to Program Mode.



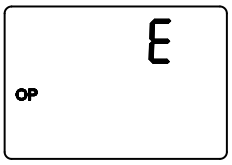
Possible cause	Corrective action	Reference
Key was pressed inadvertently, or parameters were not updated the previous time.	- Update the data if necessary. - Cancel the entry or cycle power and program the sensor.	7.6.2 Updating data (p.42) 7.6.3 Canceling entry (p.43)
Power too low	- Change the power supply. Power consumption is 1.0W at maximum, without open collector output.	
Sensor damaged.	- Perform the LCD test. If “OP” does not light up during the test, the sensor may be damaged. Contact our sales office if this is the case.	7.9.7 LCD test (p.63)

Level reported when the sensor is dry.



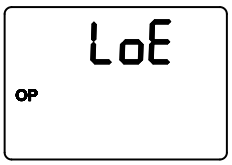
Possible cause	Corrective action	Reference
False echo	- Ensure the probe does not make contact with the tank wall or installations. - Perform False Echo Suppression (P-88, P-89). - Ensure correct nozzle size (inner diameter, height). - Cut off the nozzle protruding into the tank and perform False Echo Suppression (P-88, P-89).	7.6.6 False echo suppression with material (p.45) 7.6.7 False echo suppression without material (p.46)

Displays “E” when the sensor is wet.



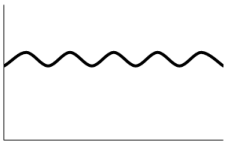
Possible cause	Corrective action	Reference
Low dielectric constant.	- Set threshold (P-85) to “Lo”.	

“LoE” displayed.



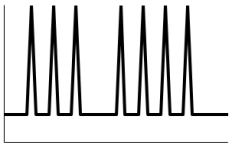
Possible cause	Corrective action	Reference
Low dielectric constant.	- Set threshold (P-85) to “Lo”.	
Foam	- Thick foam attenuates the signal and the sensor cannot measure the level. Set the P-85 Threshold to “Lo”. If error persists, lower the inlet location or use additives to prevent foam.	
Incorrect Probe Length setting	- Ensure deviation between the value in P-81 and the actual length of your probe is 10mm or smaller.	7.3.1 Quick setting (p.33)
Material surface in the blanking area	- The sensor ignores reflections from the blanking area. Reduce the blanking or ensure the material surface will not reach the blanking area.	7.6.4 Blanking (p.43)

Reading fluctuates.



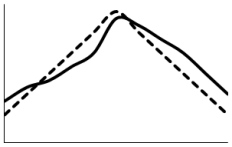
Possible cause	Corrective action	Reference
Low dielectric constant.	- Set threshold (P-85) to “Lo”.	
Zero and full levels (P-01, P-02) set too close to each other.	- Correct P-01 or P-02 settings.	7.3.1 Quick setting (p.33)
Probe too close to or makes contact with tank wall or installations.	- Install the sensor correctly.	5.6 Mounting Sensor (p.23)
Weight keep making and breaking contact with tank wall.	- Secure the weight to ensure it is in or never comes into contact with the tank.	5.6 Mounting Sensor (p.23)
Turbulent surface.	- Increase the value in P-98 Averaging.	
Zero and span output set too close to each other.	- Correct P-03 or P-04 settings.	

Output spikes



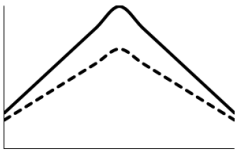
Possible cause	Corrective action	Reference
Zero and full levels (P-01, P-02) set too close to each other.	- Correct P-01 or P-02 settings.	
Zero and span output set too close.	- Correct P-03 or P-04 settings.	
False echo	- Perform False Echo Suppression (P-88, P-89). - Ensure correct nozzle size (inner diameter, height). - Cut off the nozzle protruding into the tank and perform False Echo Suppression (P-88, P-89). - If error persists, increase the blanking (P-56).	7.6.6 False echo suppression with material (p.45) 7.6.7 False echo suppression without material (p.46)
Foam	- Thick foam on a material surface can cause multiple echoes and thus spikes in output. Lower the inlet location or use additives to prevent foam.	
Probe too close to tank wall or installation	- Install the sensor correctly.	5.6 Mounting Sensor (p.23)
Weight keep making and breaking contact with tank wall.	- Secure the weight to ensure it is in or never comes into contact with the tank.	5.6 Mounting Sensor (p.23)
Probe in the filling streams.	- Relocate the sensor, or change the inlet location.	5.6 Mounting Sensor (p.23)

Poor linearity



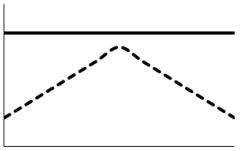
Possible cause	Corrective action	Reference
Zero and full levels (P-01, P-02) set too close to each other.	- Correct P-01 or P-02 settings.	
Zero and span output set too close.	- Correct P-03 or P-04 settings.	
False echo	- Perform False Echo Suppression (P-88, P-89). - Ensure correct nozzle size (inner diameter, height). - Cut off the nozzle protruding into the tank and perform False Echo Suppression (P-88, P-89).	7.6.6 False echo suppression with material (p.45) 7.6.7 False echo suppression without material (p.46)

Output and reading not corresponding



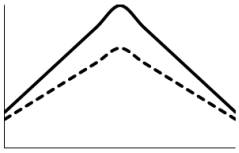
Possible cause	Corrective action	Reference
Incorrect wiring	- Wire correctly. - Connect a voltmeter between “2/24V” (brown) and “7/0V” (blue) terminals on the sensor, and see if 24V DC±10% is supplied.	6.2 Wiring (p.27)
Load resistance too large.	- Connect an ammeter between white and blue wires. If the sensor outputs properly, reduce the load resistance.	7.9.4 Simulation (mA) (p.61)
Offset feature activated.	- Deactivate offset (P-35, P-36) if not required.	

Reading stays same regardless of the level.



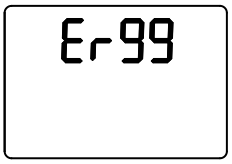
Possible cause	Corrective action	Reference
False echo	- Perform False Echo Suppression (P-88, P-89). - Ensure correct nozzle size (inner diameter, height). - Cut off the nozzle protruding into the tank and perform False Echo Suppression (P-88, P-89). - If error persists, increase the blanking (P-56).	7.6.6 False echo suppression with material (p.45) 7.6.7 False echo suppression without material (p.46)
Low dielectric constant.	- Set P-85 Threshold to “Lo”.	
Foam	- The sensor normally detects the material surface below the foam. If foam poses problem, lower the inlet location or use additives to prevent foam.	

Reading changes along with the level but is faulty.



Possible cause	Corrective action	Reference
Incorrect zero level or span.	- Ensure parameter P-01 and P-02 are correctly entered.	
Foam	- The sensor normally detects the material surface below the foam. If foam poses problem, lower the inlet location or use additives to prevent foam.	
Buildup on the probe.	- Buildup can cause false low readings. Clean the probe periodically.	
Low dielectric constant.	- Low dielectric constant can increase offset error. Select “ALL” in P-35. Check deviation at a point 300mm away from the reference point and also 200mm away from the probe end, and enter the value in P-36.	7.4.1 Program mode parameter (p.35)
Offset feature activated.	- Deactivate offset (P-35, P-36) if not required.	7.4.1 Program mode parameter (p.35)
Material surface in the blanking area.	- Decrease the blanking or ensure the material will not reach the blanking area. The sensor ignores reflections from the blanking area, and detects multiple echoes instead. In this case the sensor reading will be ‘correct level times integer’.	7.6.4 Blanking (p.48)

“Er99” is displayed.



Possible cause	Corrective action	Reference
Power too low	- Change the power supply. Power consumption is 1.0W at maximum, without open collector output.	
Noise	- Take adequate measures.	
Damaged sensor	- Contact our sales office.	

11. APPENDIX

11.1 Glossary

Terms used in this manual are listed below. Those that have already been defined earlier in this manual are not included.

Earth plate	Metal plate attached to the sensor to stabilize echo from the material surface.
Echo	Reflection of high frequency signals the sensor has transmitted.
Dielectric constant	The ability of a dielectric to store electrical potential energy under the influence of an electric field. Increase in the dielectric constant is directly proportional to increase in echo amplitude. Dielectric constant of air is 1, and water 80,
Sun shield	Component placed over the housing to protect it from direct sunlight and prevent temperature rises.
False echo	Reflection from something that is not the material surface, such as nozzle/tank wall or installation in the tank.
Threaded connection	Threaded component to mount the sensor on the tank.
Flange	Component to mount the sensor on the tank with bolts and nuts.
Probe	Rod or wire that detects material level.
Hazardous area	Areas where explosive gas or vapor exists or is likely to exist. Equipment used in hazardous areas has to be designed to prevent ignition to such atmosphere. **This sensor is NOT intended for use in hazardous areas.**
Stillpipe	Pipe to protect the probe from excessive turbulence or flow, to prevent faulty operation or increase accuracy. Use a metallic one for GW200.
LOE	Stands for Loss Of Echo. State in which the sensor cannot make measurements due to too small echo for example.

11.2 Parameter List

Use this list to record parameter values.

See *7.4 Parameter Reference* from pages 35 on for detail.

No.	Parameter	Default	Unit	Range	Value
P-01	Zero	4000	mm	-999 to 9999	
P-02	Span	0	mm	-999 to 9999	
P-03	Zero Output	4.00	mA	3.80 to 20.50	
P-04	Span Output	20.00	mA	3.80 to 20.50	
P-06	Unit	mm	-	mm, %	
P-09	Backlight Operation	ALYS	-	ALYS, 60	
	Brightness	Lu 3	-	Lu 1 to 8	

No.	Parameter	Default	Unit	Range	Value
P-11	Function	OFF	-	OFF, SPO, LOE, Err	
P-12	Output Configuration	nPn	-	nPn, PnP	
P-13	Output Logic	nO	-	nO, nC	
P-14	Setpoint	9999	mm	-999 to 999	
P-15	Resetpoint	9990	mm	-999 to 999	
P-16	ON Delay	1	sec.	0000 to 0060	
P-17	OFF Delay	1	sec.	0000 to 0060	
P-18	Hysteresis	10	mm	0000 to 0100	

No.	Value				
	OUT1	OUT2	OUT3	OUT4	OUT5
P-11					
P-12					
P-13					
P-14					
P-15					
P-16					
P-17					
P-18					

No.	Parameter	Default	Unit	Range	Value
P-35	Offset ON/OFF	non	-	non, diSP, ALL	
P-36	Offset Value	0	mm	-999 to 9999	
P-56	Blanking	0	mm	0 to 8000	
P-59	Algorithm	L	-	L, F	
P-70	Fail-safe Timer	60	sec.	1 to 5400	
P-71	Fail-safe Mode	HoLd	-	Hi, Lo, HoLd	
P-81	Probe Length	4000	mm	Red - 300 to 4000 Wire - 300 to 8000	
P-85	Threshold	Hi	-	Hi, Lo	
P-86	Level Threshold	100	mV	5 to 995	
P-87	Probe End Threshold	-100	mV	-995 to -5	
P-88	False Echo Suppression With Material	-	mm	300 to 8000	
P-89	False Echo Suppression Without Material	run	-	-	
P-98	Averaging	1	sec.	0 (OFF), 1, 2, 3, 4, 5, 10, 20, 30, 60, 120, 180	
P-99	Reset	1999	-	1965	
t1	Simulation (mm, %)	-	P-06	-999 to 9999	
t2	Simulation (mA)	-	mA	3.80 to 20.50	
t3	Alarm Test	CLOS	-	CLOS, OPEn	
t4	Measurement Status	-	-	0 to 10	
LCd	LCD Test	-	-	-	

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