TY-KJ91-001A

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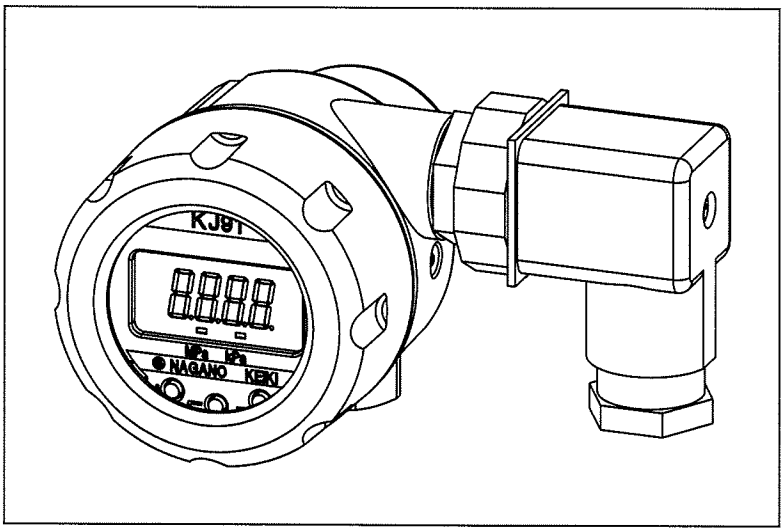
Intrinsic Safety Explosion-Proof Construction

Model KJ91 Pressure Transmitter

Instructions Manual

(Ver.5.0)



NAGANO KEIKI CO., LTD.

Contents

1. Preface

Thank you very much for purchasing this intrinsic safety explosion-proof construction KJ91 pressure transmitter. In order to utilize this product sufficiently, safely and correctly, please read this instructions manual well.

⚠ WARNING	**Improper handling could cause death or serious injury to the user.**

⚠ CAUTION	**Improper handling could cause personal or physical damage.**

2. Attention

We shall have no liability for the failure or trouble of this product, or physical injury resulting from the following:

- Modification and repair performed by any person other than our company's employee.
- Trouble of this product caused by the product of any other company.
- Misuse that the instructions, use conditions or methods indicated in this instructions manual are not observed.
- Natural disasters, such as a fire, an earthquake, flood damage, and a thunderbolt.

Please do not implement the use, installation, storage, or the work that may damage the explosion proof in the following environment:

⚠ **WARNING**	**① Application of the pressure that exceeds the maximum allowable pressure.** **② Use of the gas or liquid which may corrode the wetted part.** **③ Installation which may damage the explosion proof of the intrinsically safe circuit** **・ Places exceeding 60 °C of ambient temperature※1** **・ Places which receive direct sunlight※1** **・ Places exposed to liquid such as rainwater※2** **・ Places of the atmosphere containing humidity, salt, sulfur etc.※2** **④ Places exposed to excessive load, vibration, or shock※3** **⑤ Wiring which may damage the explosion proof of the intrinsically safe circuit※4** **⑥ Maintenance & inspection work for this product in a hazardous area※5**

※1 By receiving direct sunlight, the intrinsically safe allowable temperature of 60 °C will be exceeded or the terminal box made of resin will be deteriorated damaging the intrinsically safe protection performance.

※2 Under the influences of rainstorm, sea breeze, dew condensation, etc., the container can corrode damaging the intrinsically safe protection performance or the air humidity can permeate into the container damaging the intrinsically safe insulation performance. Please install in a place without those influences.
※3 Please do not give an excessive shock or drop to this product during transportation and installation etc.
※4 Please refer to "9-3 Wire Connection of the device."
※5 ・The inspection of this product in a hazardous area should be limited to the visual inspection and the display check by key operation. Other maintenance & inspection works must be performed in "safety areas" and must not be carried out in hazardous areas.
・Please avoid electrostatic charging. When cleaning this product, please use the soft cloth containing water.

3. Outline

This product is a two-wire type pressure transmitter with display, which has the semiconductor evaporation form pressure (SS) sensor that reliability is high to a detecting element and has a microcomputer in its transmission circuit. Combining with the insulated safety barrier, the model KJ91 is the technological standard intrinsic safety explosion-proof construction that is officially approved based on the International IEC Standards.
This device is designed for reduction in size and weight in order to contribute to laborsaving of installation construction, and can be used in gas steamy hazardous areas in which explosive gas exists at a general factory etc. including a petrochemical factory.

4. Features

(1) Since this product has the **intrinsic safety explosion-proof construction**, it can be used in the hazardous areas of Zone 0, Zone 1, and Zone 2 where almost all explosive gases exist.

(2) A pressure sensor is the **semiconductor evaporated type (SS) sensor**, which already has a record of achievements in various industrial fields, has the same construction up to the semiconductor distortion gauge part and sensing part and pressure connection parts. Since no adhesives and corrosive materials are used, it has superior durability and stability.

(3) Since the **linear scaling function** is equipped, which is to change a pressure signal into an arbitrary physical quantity by the digital calculation method, the linear (scaling) value is displayed in addition to the actual differential pressure and the analog output (4 to 20mADC) is output.

(4) Since the **hold indication function** is equipped, it is memorize the maximum and the minimum of regular pressure.

(5) Since the **digital filter function** by the moving average is equipped, the display wobbling due to pulsation etc. or the analog output is smoothed.

(6) Though the LCD display is two wire type, it is clear enough to read even in dark places or at night because of its **LED back light**.

(7) Because of the **loop check function**, the analog signal corresponding to the pressure display and the linear display can be output arbitrarily without applying pressure. This makes maintenance easy.

(8) **Zero point adjustment** can be easily performed due to zero adjustment function by a single keystroke.

(9) The case is **compact** and **lightweight** with the cable outlet available from right and left and the pressure inlet available from top and bottom, facilitating the installation works.

(10) The noise suppression complies with the EMC Directive.

(11) The case for the main body has **IP65 jet proof structure**(10MPa or more) of aluminum die-casting that is possible to install in outdoors.

5. Specification

5－1. General Specification

Item	Description
1. Fluid	Gas or Liquid (not corrosive to the wetted material)
2. Pressure range	－0.1～0.1, 0.2, 0.3, 0.5, 1MPa 0～0.3, 0.5, 1, 2, 3.5, 5, 10, 20, 35, 50, 「(70, 100, 120)※1」MPa
3.Allowable maximum	200% of pressure range But; 35, 50MPa range: 1.5 times. 「(70, 100, 120)※1」MPa range: 1.2times.
4. Power supply	24VDC±10%F.S.
5. Output	4 to 20mA DC(two wires, Output range: 3.2 to 20.8mA DC) Responsiveness: 30 ms (with 1 times filter setting) Resolution: 0.1%F.S., Load resistance: 500Ω max.
6. Pressure output accuracy	±0.25%F.S. or ±0.5%F.S. at 23℃ (0.5 to 50MPa)※1 ±0.5%F.S. at 23℃ (0.3MPa or less)
7. Pressure output accuracy range of guaranteed accuracy	Operating temperature range (-10 to 60 °C) ±1.0%F.S. or less
8. Pressure output adjustment range	Zero point: -10 to +110% of the full span (To pressure range) Span point: -10 to + 110% of the full span (To pressure range)
9. Pressure display accuracy	±(0.25%F.S.＋1digit) or ±(0.5%F.S.＋1digit) at 23℃ (It follows pressure output accuracy.)
10. Numeric display	Six-digit LCD : (Character height: 10mm, with LED backlight) Pressure display, Linear display※: Four LCD digits max., Display cycle: 500 ms
11. Unit display	LCD bar display (with LED backlight) Pressure unit: kPa, MPa Linear unit: arbitrary set

Item	Description
12. Setting	With internal key switches (Mode, ▲, ▼) Scaling function: Linear display / output Holding function: Both the maximum value (peak) and the minimum value (Bottom) can be indicated. Filter function: Moving average time interval, Select from 1, 2,4, 8, and 16 Loop check function: Arbitrary setting output (4 to 20mA DC) Zero adjustment function: Pressure sensor zero adjustment
13. Pressure conversion joint	Rc1/4 (50MPa or less, Standard) Rc1/2 (With Rc1/4+FJ10-973 joint, Option) G3/8B (With Rc1/4+FJ12-373 joint, Option) G1/2B (With Rc1/4+FJ12-473 joint, Option) G1/4 female screw (Option)※2 9/16-18UNF (Option) : Equivalent of F250C (made by Autoclave)※2
14. Wetted parts material	Diaphragm : SUS630 (17-4PH) Co-Ni allow (high corrosion-proof use)※3 Joint : SUS316
15. Casing protection structure	Casing material : Aluminum die cast. IP65 10MPa or more Equivalent of IP65 5MPa or less (With air inlet port)
16. Mounting system	Direct mounting Connection : Lower side (standard), Upper side, Right side, Left side Outlet for electric wire : Right side (standard), Left side Panel mounting (Option) Connection : Lower side Outlet for electric wire : Right side (standard), Left side
17.Cable connection	Terminal box (DIN type terminal) Outlet port cable ground Application cable : 2-wire shielded cable Sheath outside diameter 6～9mm (Center conductor sectional area:0.5～1.25mm^2) Internal connection terminal board: Number of poles : 4 poles (+, -, Ground, NC) Applicable crimp terminal : Round bare terminal, R1.25-3 (nominal size)
18. Memory protection	Permanently stored by EEP-ROM (nonvolatile memory)
19. EMC Directive	Application standard :EN61326/1997,A1/1998,A2/2001
20. Operating temperature and humidity	-10 to 60℃、35 to 85%RH(No icing or condensation)
21. Storage temperature and humidity	-20 to 70℃、35 to 85%RH(No icing or condensation)

Item	Description
22. Resistance to Vibration	10 to 150Hz, multi-amplitude 0.7mm (60Hz or less) Acceleration :50m/s^2 (60Hz or more) Vibrating direction: x, y, z (2.5 hours for each)
23. Resistance to shock	Impact acceleration:100m/s^2 (60Hz or more) Impact direction: x, y, z (3 times into forward and backward directions for each)
24. Insulation resistance	50VDC 100MΩ or more
25. Mounting location	It is possible to install in outdoors. (Places away from direct sunlight or direct rainstorm)
26. Weight	Approx.520g

※1 Please contact NAGANO KEIKI separately, concerning the70,100,120MPa ranges.

※2 Please contact NAGANO KEIKI separately, concerning G1/4 female screw, 9/16-18UNF.

※3 Please contact NAGANO KEIKI separately, concerning high corrosion resistance material (Co-Ni alloy).

5－2. Specification of intrinsic safety explosion-proof construction

■ Model KJ91 Pressure Transmitter (Hazardous Area)

1. Type approval number	Technology Institution of Industrial Safety Intrinsically safe explosion-proof construction approved product Type approval number / Pressure range (MPa) No. TC17267 / 0～70, 100, 120※ No. TC17346 / 0～5, 10, 20, 35, 50 No. TC17347 / －0.1～0.1, 0.2, 0.3, 0.5 0～0.3, 0.5, 1, 2, 3.5 ＊ Please contact NAGANO KEIKI separately, concerning the 70,100, 120MPa ranges.
2. Intrinsic Safety Explosion-Proof Construction type	Exia IIC T4 T4 — Temperature class IIC — Gas group Exia — Technological standard intrinsically safe explosion-proof construction
3. Safety maintenance Rating	Max. allowable voltage of intrinsically safe circuit (Ui) : 28V Max. allowable current of intrinsically safe circuit (Ii) : 93mA Max. allowable power of intrinsically safe circuit (Pi) : 651mW Internal inductance of intrinsically safe circuit (Li) : 0.47mH Internal capacitance of intrinsically safe circuit (Ci) : 0.067μF Ambient temperature : 60°C
4. External transmission cable	Max. allowable inductance : 2mH Max. allowable capacitance : 0.015μF
5. Container protection class	Matched to IP20 (with cover open) The setting switches can be operated by opening the cover.
6. Withstand voltage	500V AC、1min

■ Insulated（Safety area）

The specifications of the recommended safety barrier (insulated barrier) which is combined with the KJ91 pressure transmitter are shown in the table below.

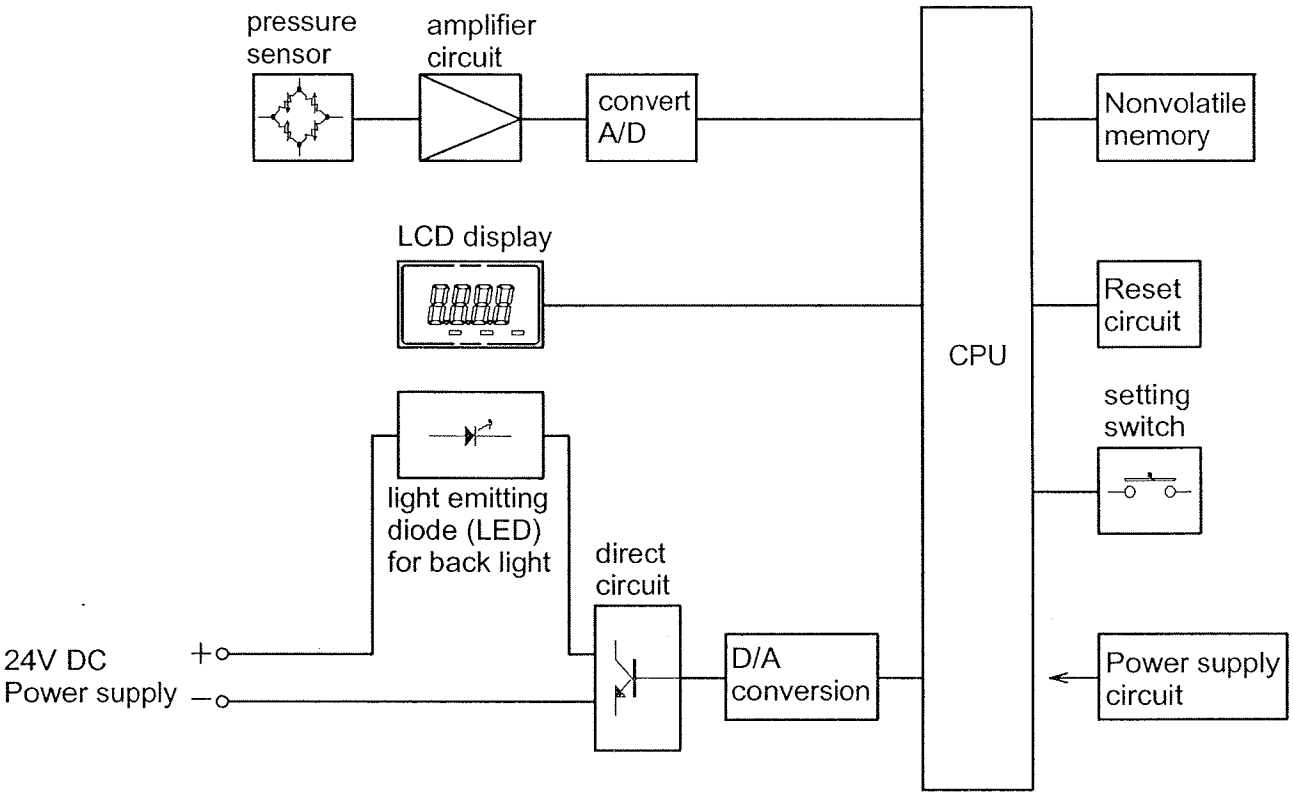
Moreover type A intrinsic safety ground work is unnecessary.

1. Manufacturer	Pepperl + Fuchs K. K.
2. Type	KFD2-STC4-Ex1
3. Type approval number	No.C16232
4. Intrinsic Safety Explosion-Proof Construction type	Exia ⅡC T4
5. Safety maintenance Rating	Max. allowable voltage of intrinsically safe circuit (Uo) : 25.4V Max. allowable current of intrinsically safe circuit (Io) : 86.8mA Max. allowable power of intrinsically safe circuit (Po) : 551mW Max. allowable inductance of intrinsically safe circuit (Lo) : 4.6mH Max. allowable capacitance of intrinsically safe circuit (Co) : 0.093μF Ambient temperature : 60℃ Max. allowable voltage of non-intrinsically safe circuit :250VAC (50/60Hz)

※ The safety barrier can be selected by the customer.

6. Principle of Operation

This product which has intrinsic safety explosion-proof construction is installed mainly in hazardous areas, such as a factory plant, measures a pressure to indicate it with the liquid crystal (LCD) display, and outputs 4 to 20mA DC through the safety barrier installed in the non-hazardous area.
When the measurement pressure acts on the pressure sensor module, the voltage signal proportional to the distortion by a film gauge is obtained.
This voltage signal by an amplifier circuit and convert A/D and input it into one chip CPU.
The CPU calculates the pressure signal to an arbitrary physical quantity by the scaling function with the digital computation method based on the set value beforehand written in the nonvolatile memory by the setting switch.
The calculated digital signal is indicated with the liquid crystal (LCD) display and is output as the direct-current signal 4 to 20mA DC through the transmission circuit after D/A conversion,.
By using 4 to 20mA DC, the LCD display turns on the light emitting diode (LED) for back light.



Block diagram

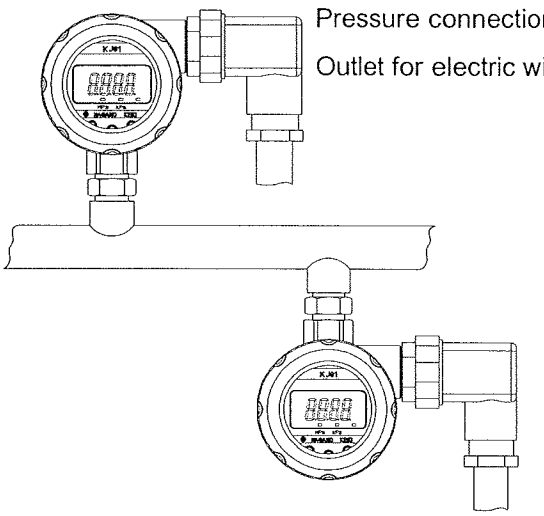
7. Mounting

7－1. Mounting system

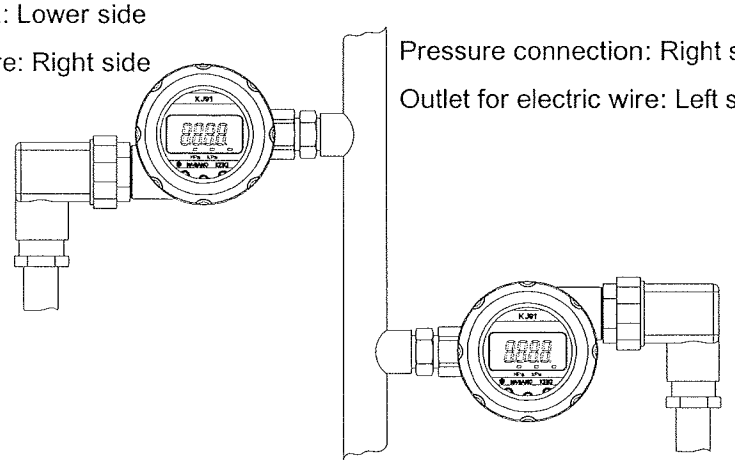
Mounting method has panel installation form to be able to possess direct connection form and the bracket which can possess the direct plumbing.
Both types assume the perpendicular installation that lowered a cable ground of outlet for electric wire (terminal box) a principle.

(1) Direct mounting

In correspondence with the various plumbing, wiring connection, as for the pressure admission port, downward-facing (standard) looks up like chart below, and, in addition, a cable ground is worsening, and direct connection form can choose outlet for electric wire among turning to the right (as standard equipment) and two directions of turning left from turning left, four directions of turning to the right. In addition, outlet for electric wire please refers in the case of an upswing and downward installation. But it limited than pressure range 10MPa without an atmosphere admission port in the case of an upswing



Pressure connection: Lower side
Outlet for electric wire: Right side



Pressure connection: Right sid
Outlet for electric wire: Left side

Pressure connection: Upper side
Outlet for electric wire: Right side

Pressure connection: Left side
Outlet for electric wire: Right side

(2) Panel mounting

A pressure admission port is only downward-facing, and panel installation form can choose outlet for electric wire among turning to the right (standard) and two directions of turning left like a figure of external form (eight q.v.).

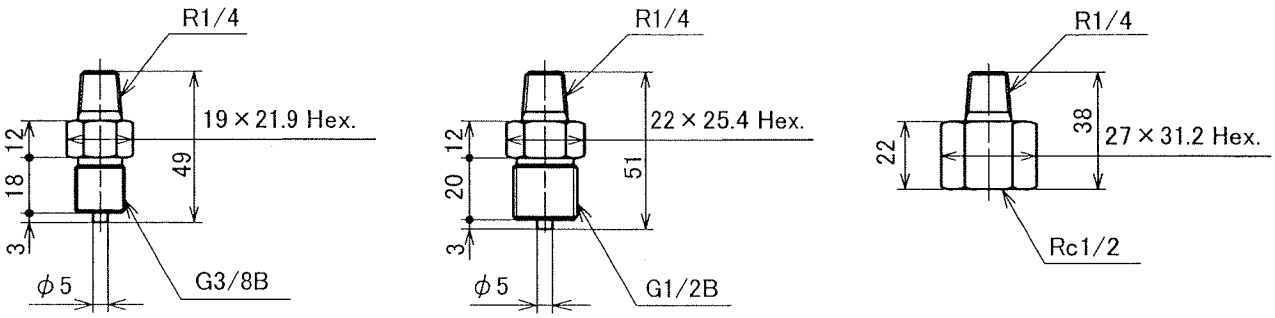
⚠ CAUTION	• Please lower a cable ground to prevent invasion of water from a cable. Please wam enough in particular invasion of water because a hole of an atmosphere admission port opens in the terminal box side (a figure of Clause 8 Overall Figure) in the case of less than pressure range 5MPa. • When I want to change a direction of pressure admission port and outlet for electric wire, I ask by factory return.

7−2. Connection plumbing

(1) Pressure connection joint

It choose a pressure connection coupling of this container among taper Rc1/4 female (standard), parallel G1/4 female (option) and three kinds of 9/16-18UNF female (option) (cf. figure of Clause 8 Overall Figure).

In addition, three kinds of conversion joint (option) are prepared for taper Rc1/4 female like chart below.



(2) Pressure plumbing

① It use a spanner for spanner credit of hexagon region by all means, and please possess it without the main body of pressure transmitter, and installing it when pressure lays pipes.

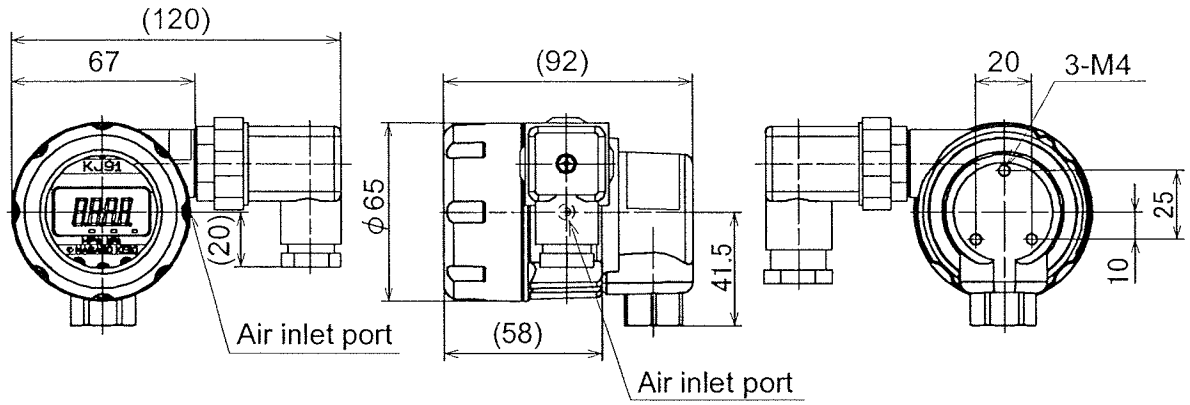
② The pressure plumbing of panel installation form uses a flexible thing, and the main body of pressure transmitter please does not increase impossible power.

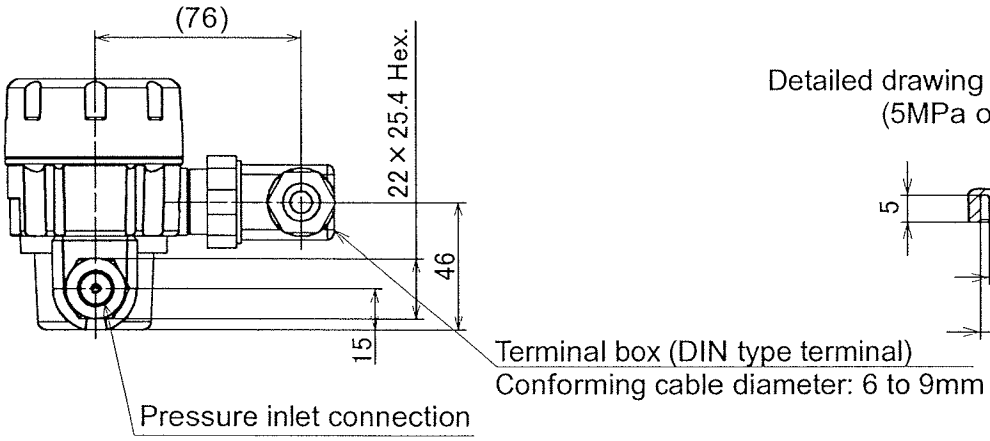
⚠ **CAUTION**	• In transportation at the time of the establishment and plumbing installation, I hit this container, and please do not give an excessive shock to drop. In addition, I step over the main body after the establishment, and please do not increase impossible power. • I can give length of a tube room, and please lay pipes it's twisted and take you to a coupling or a tube, and not to take moment load. • I perform an air blow or washing before the plumbing enough, and please remove drill powder in the plumbing, cutting oil, garbage. • I wind up seal tape, and please install a taper screw for pipes so that leaking out have much it. • When I use a parallel screw, I confirm garbage, dirt and that there are not wounds, and please possess packing and a seal side so that leaking it out has much it.

8. Overall Figure

(1) Direct mounting (Standard)

Pressure inlet connection: Lower side　Outlet for electric wire: Right side



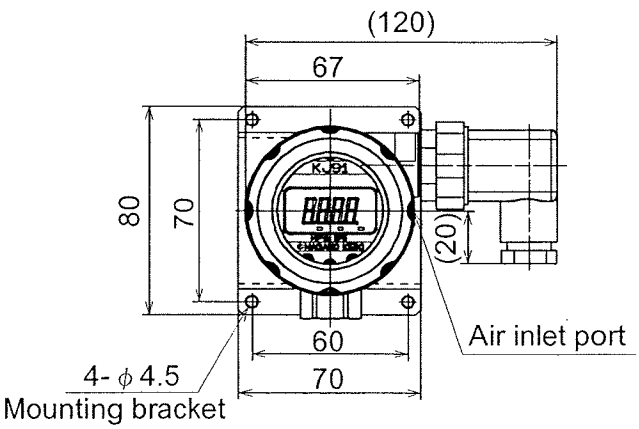


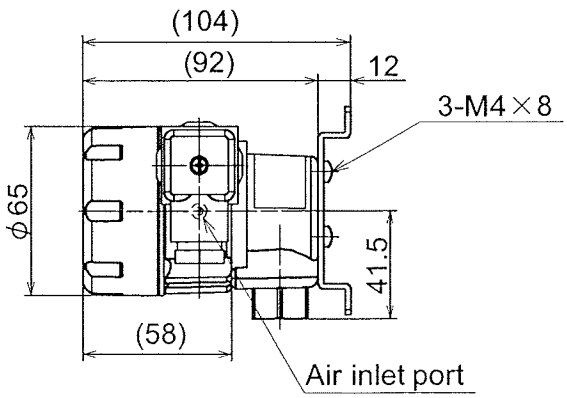
Detailed drawing of air inlet port
(5MPa or less)

Pressure connection joint: Rc1/4(Standard)
G1/4 female screw(Option)
9/16-18UNF (Option)

(2) Panel mounting (Standard)

Pressure inlet connection: Lower side　Outlet for electric wire : Right side





9. Wiring

Please connect this product with the receiving machine (including 24VDC power supply) in the following procedure:

9-1. Transmission cable

(1) Suitable transmission cable

The transmission cable used between this product and the safety barrier (insulated barrier) should be 2-wire shielded cable and should be selected as suitable for the conditions below.

① The cable's sheath outer diameter suits the cable ground of the terminal box (DIN type terminal) of this product and the cable's center conductor sectional area suits the internal terminal block of this product. Moreover, the cable suits the withstand voltage between the cable's conductors (center conductors) and the withstand voltage between the conductor and the ground.

Number of center conductors (Core)	Sheath outer diameter (mm)	Center conductor sectional area (mm^2)	Withstand voltage AC (V) For 1 minute	
			Between conductors	Between conductor and ground
2	6～9	0.5～1.25	1000	500

② The allowable parameters specified for the external wiring of the intrinsically safe circuit (Refer to paragraph 5-2 Specification of intrinsic safety explosion-proof construction) Use the following:

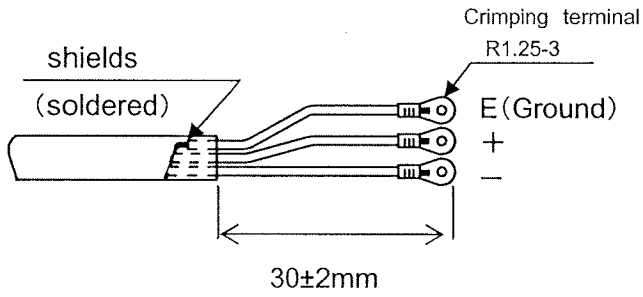
Allowable capacitance (μF)	Allowable inductance (mH)
0.015	2

(2) Processing of transmission cable

① Remove the sheath of 2-wire shielded cable and connect all the shields with the insulated electric wire (center conductor sectional area: 0.5 to 1.25mm^2) (soldered).

② Squeeze the sheath edge and put the soldered part inside so that the shielded cable may not stick out.

③ A crimping terminal is attached to the tip of E (GND) line, + line, and - line. In addition, the round uninsulated terminal R1.25-3 should be used as suitable crimping terminal.



⚠ CAUTION	Since the soldering of shielded wire can not be done in hazardous area, please be sure to carry it out in non-hazardous area.

9−2. Wiring of the terminal box

Please perform the wiring to the socket of this product's terminal box (DIN type terminal) in the following procedure, referring to the wiring assembly figure of the fifteen page.

(1) Disassembly of the socket

① The setscrew ⓐ is loosened and extracted, the housing ⓓ is pulled in the direction of the setscrew ⓐ, the socket is drawn out from the plug attached to the device, and the gasket ⓑ is removed.

② Insert a small flat-blade screwdriver etc. in the notch (marked by ➔) of the bottom of the terminal block ⓒ and twist it to remove the terminal block ⓒ from the housing ⓓ.

③ The cable ground ⓔ is loosened and removed, and the internal washer ⓕ and the rubber packing ⓖ are removed.

(2) Wiring of the terminal block

① After running the transmission cable ⓗ through the cable ground ⓔ, the washer ⓕ, and the rubber packing ⓖ in this order, insert it in the housing ⓓ.

② Fasten ant connect the crimping terminal of + line into the No. 1 terminal of the terminal ⓒ (marked by "1" on the bottom) using the screw with washer ⓒ1 (M3x8).Similarly, fasten ant connect the crimping terminal of - line into the No. 2 terminal (marked by "2" on the bottom), and fasten ant connect the crimping terminal of the shielded cable into the E (GND) terminal (marked by ⏚ on the bottom)

⚠ CAUTION	● The crimping terminal should be a round uninsulated terminal that is unremovable. A Y-shaped terminal, which is easy to remove, or bare wire, which is easy to protrude, should not be connected. ● Please tighten the screw with washer ⓒ1 of the crimping terminal within a torque of 0.5 N·m±15%.

(3) Assembly of the terminal box

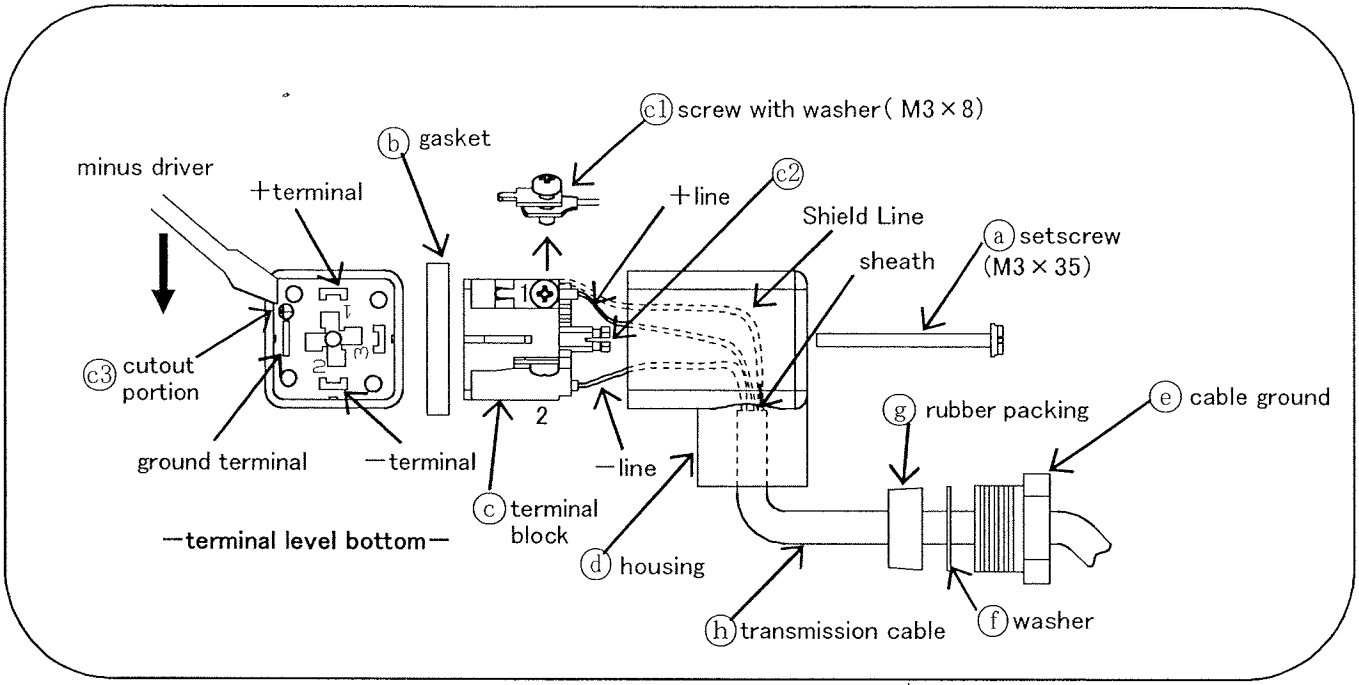
① With the cable ground downward, aligning the E terminal of the terminal block ⓒ with the earth terminal on the side of the plug (wider terminal), push the terminal block ⓒ until it snaps.

② Put the rubber packing ⓖ and the washer ⓕ into the cable inlet of the housing ⓓ, and tighten the cable ground ⓔ firmly.
Then, please push in the cable until the rubber packing ⓖ sticks to the sheath.

③ Fit the gasket ⓑ into the housing ⓓ, insert the assembled socket into the device's plug, insert the E terminal into the mark, and put in the setscrew ⓐ for tightening.

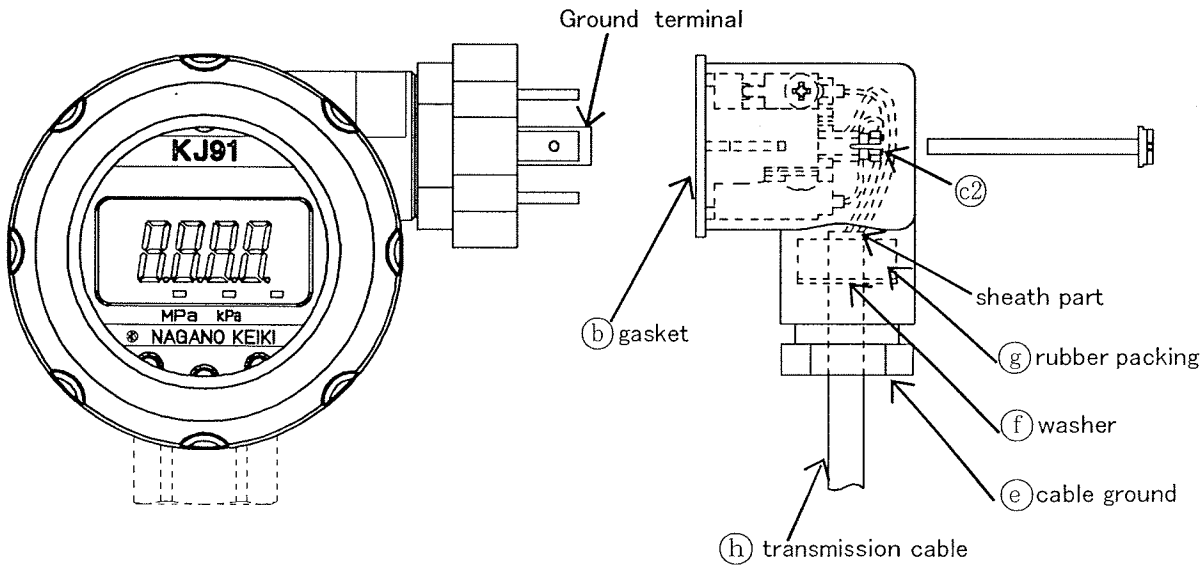
⚠ CAUTION	● When returning the terminal block, insert the three center conductors carefully enough not to be caught between the protruding portion ⓒ2 of the terminal block bottom and the housing ⓓ because the space which contains electric wire is narrow. ● Although the orientation of the socket can be arbitrarily changed depending on how to assemble the terminal block ⓒ and the housing ⓓ, please be sure to assemble so that the cable ground is downward. ● Please tighten the setscrew ⓐ within a torque of 0.5 N·m±15%. (Exploded wiring diagram of the socket)

■ Resolution wiring diagram of a socket



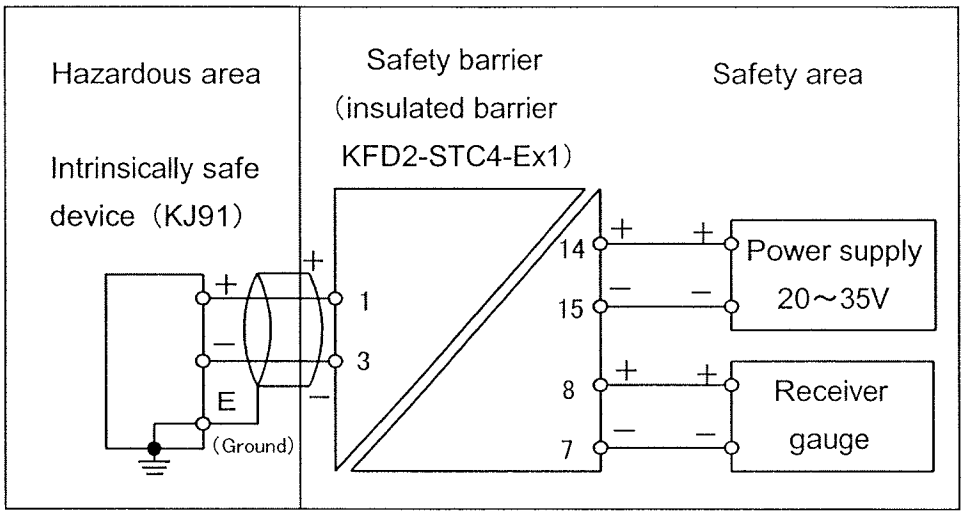
■ Assembling drawing of a terminal box

Plag **Socket**



9－3. Wire connection of the device

(1) As shown in the following connecting diagram, please install the intrinsically safe device (KJ91) in the hazardous area and install the safety barrier (insulated barrier) and the general devices (power supply and receiver gauge) in the non-hazardous area before wire connection. In addition, Type A intrinsic safety ground work is unnecessary because the barrier is insulated.



(2) If the intrinsically safe device and the safety barrier are not so combined as to satisfy the conditions shown in the following two tables, they cannot assure the intrinsic safety explosion proof.(Refer to paragraph 5-2 Specification of intrinsic safety explosion proof construction)

Combination conditions for the safety maintenance rating

Safety maintenance rating of the intrinsically safe device	Combination conditions	Safety maintenance rating of the safety barrier
Max. allowable voltage of intrinsically safe circuit	≧	Max. allowable voltage of intrinsically safe circuit
Max. allowable current of intrinsically safe circuit	≧	Max. allowable current of intrinsically safe circuit
Max. allowable electricity of intrinsically safe circuit	≧	Max. allowable electricity of intrinsically safe circuit

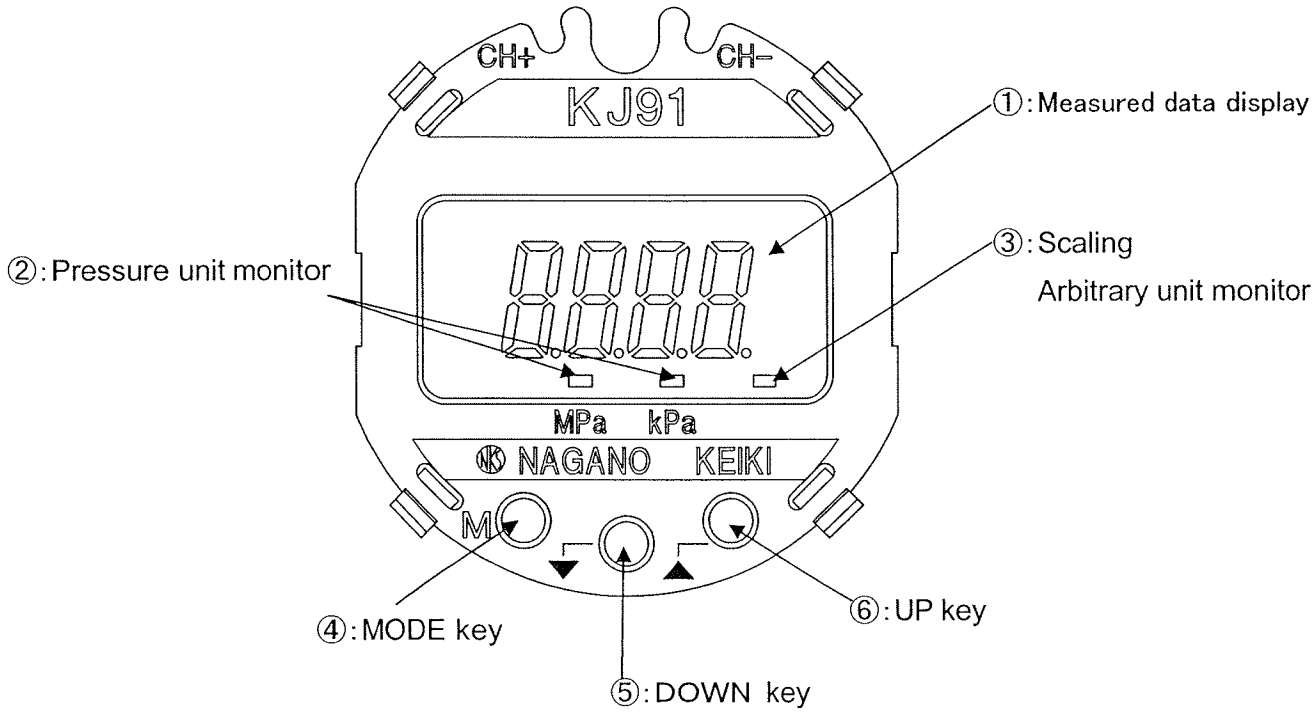
Combination conditions for parameters

Parameters of intrinsically safe device and wiring	Combination conditions	Parameters for safety barrier
Input inductance of intrinsically safe device ＋Inductance of wiring	≦	Max. allowable inductance of intrinsically safe circuit
Input capacitance of intrinsically safe device ＋capacitance of wiring	≦	Max. allowable capacitance of intrinsically safe circuit

(3) The wiring of the intrinsically safe device and the safety barrier should be performed so that voltage and current which may damage the intrinsic safety explosion proof construction of the intrinsically safe circuit are not generated by electromagnetic or electrostatic induction.

⚠CAUTION	Intrinsically safe wiring work etc. should follow the "Guide to Factory Explosion-Proof Electrical Equipment for the Users (Gas Explosion-Proof 1994)" published by the Technology Institution of Industrial Safety.

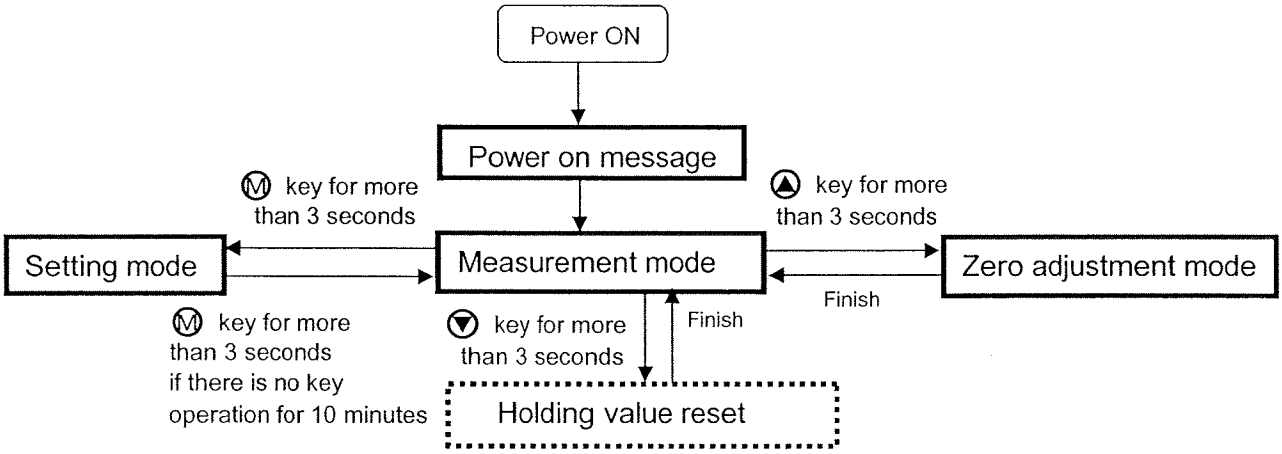
10. Designation and Function of Panel



Designation	Function
① Measured data display	Pressure, linear scaling value, peak holding value, bottom holding value, etc. are displayed.
② Pressure unit monitor	When either kPa or MPa of this unit monitor is ON, the pressure of the unit is indicated on the measured data display.
③ Scaling Arbitrary unit monitor	When this unit monitor is ON, the linear scaling value of an arbitrary unit is indicated on the measured data display.
④ MODE key (Ⓜ)	This key is used to switch the setting mode and the measurement mode and to change the setting item.
⑤ DOWN key (▼)	This key is used to change (decrease) and select the set value and to zero-reset the holding value.
⑥ UP key (▲)	This key is used to change (increase) and select the set value and to shift from the measurement mode to the zero adjustment mode.

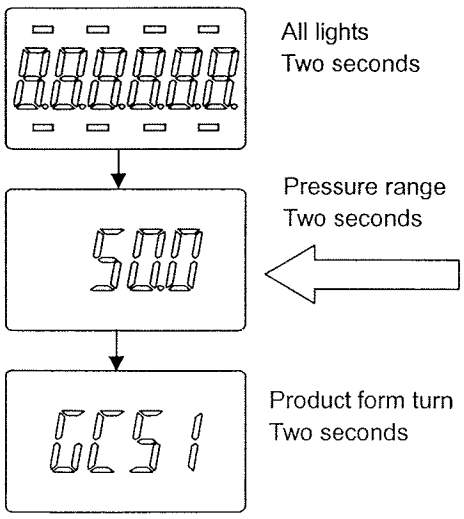
11. Shift of Each Mode

- The switching in the measurement mode (paragraph 13) and the setting mode (paragraph 15) is performed by pressing the MODE (Ⓜ) key for more than 3 seconds. Moreover, if there is no key operation for 10 minutes in the setting mode, it will shift to the measurement mode automatically.
- The shift from the measurement mode to the zero adjustment mode (paragraph 14) is performed by pressing the UP (▲) key for more than 3 seconds.



12. Power-on Message

After the power is turned on, the power-on message is displayed for 6 seconds as shown below and then the display is shifted to the measurement mode (paragraph 13).
In addition, the analog output during power-on message is at zero point (4mA).



Pressure range and Indication

Indication (maximum)	Pressure range MPa (Indication span)	Indication (maximum)	Pressure range MPa (Indication span)
0.300	0.3 (0～0.300)	50.0	50 (0～50.0)
0.500	0.5 (0～0.500)	70.0	70 (0～70.0)
1.000	1 (0～1.000)	100.0	100 (0～100.0)
2.00	2 (0～2.00)	120.0	120 (0～120.0)
3.50	3.5 (0～3.50)	0.100	-0.1～0.1 (-0.100～0.100)
5.00	5 (0～5.00)	0.200	-0.1～0.2 (-0.100～0.200)
10.00	10 (0～10.00)	0.300	-0.1～0.3 (-0.100～0.300)
20.0	20 (0～20.0)	0.500	-0.1～0.5 (-0.100～0.500)
35.0	35 (0～35.0)		

※ More than pressure range 3.5MPa; (in a bold line frame),there is not kPa unit indication.
※ Please contact NAGANO KEIKI separately, concerning the 70, 100, 120MPa ranges.

13. Measurement Mode

The measurement mode includes pressure display mode, linear (scaling) display mode.
For the setting items ① to ⑬, please refer to the Setting Mode (paragraph 15).

13－1. Filter

Please set the filter before setting pressure display mode or linear (scaling) display mode.
The **filter** is based on the moving averaging of the pressure data to decrease display wobbling and to smooth the analog output when the pressure fluctuated violently.
Select from five moving average times (1, 2, 4, 8, and 16 times).
In the case of 1 time, the filter is not applied.

Filter setting	⇒ Setting item ①

13－2. Pressure Display Mode

This mode is used for display / analog output of the actual pressure.

(1) Analog output

The **analog output** can set the **zero point** (4mA) and the **span point** (20mA) in the scope of -10 to 110%F.S. of the pressure range.

※ Usually, the zero point is set as 0%F.S. and the span point is set as 100%F.S., but the zero point can be reversed to 100%F.S. and the span point can be reversed to 0%F.S.

(2) Pressure display

- The **pressure display** has a display span between the zero point and the span point in the analog output set by above (1), and can display the range of -5 to 105%F.S. of the display span. In addition, the decimal point position of the pressure display is fixed for each pressure range. (Refer to paragraph 12)
- A **pressure unit monitor,** Ⓜ I break reshuffling in turn, and MPa and a kPa unit turn on whenever they push a key.
  But more than pressure range 3.5MPa cannot do reshuffling of a kPa unit only by a MPa unit.
  (cf. Clause 12 power on message).

Output zero point and span point setting	⇒ Setting item ③,④

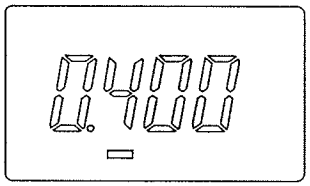
■ Setting example 1 : Pressure display mode

The setting to use the pressure range 0 to 1MPa and to display the zero point and span point of the analog output as -0.1MPa and 0.9MPa respectively is as follows:
Moreover, in the case of the filter (moving average time) set as 8 times, the pressure display and the analog output are based on the moving average equivalent to the pressure data per 30ms for the past 8 times (240ms)

・Select the filter of "8 times"	⇒ Setting item①
・Select the "Pressure display mode"	⇒ Setting item②
・Set output zero point as "-10.0%F.S." (-0.1MPa)	⇒ Setting item③
・Set output span point as "90.0%F.S." (0.9MPa)	⇒ Setting item④

Pressure display and Analog output

Pressure: 0.4MPa
・Pressure display:0.400(MPa)
・Analog output:12(mA)



MPa

	Pressure display (MPa)		Analog output (mA)
Output span point	0.900	⇒	20
	∫		∫
	0.400	⇒	**12**
	∫		∫
Output zero point	-0.100	⇒	4

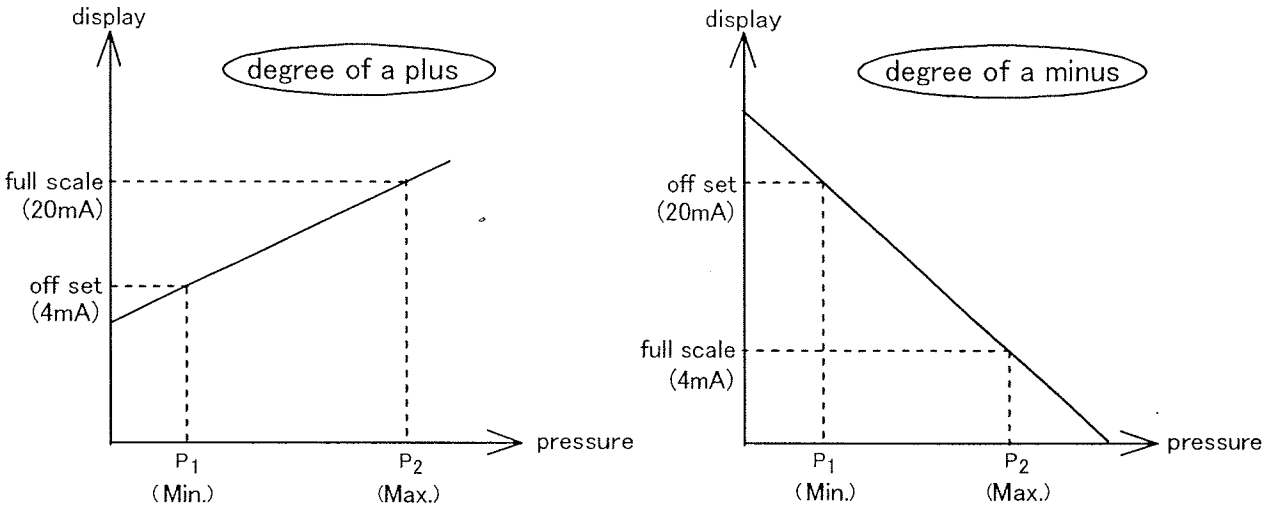
13－3. Linear Display Mode

This mode is used for display / analog output of the scaling value where the pressure is linearly converted to an arbitrary physical quantity.

(1) Linear display

By setting the OFFSET to the minimum pressure P_1 and the FULL SCALE to the maximum pressure P_2, the linear display indicates the value on the line between the two points (the maximum display span). The actual linear display span depends on the setting of the zero point and span point of the analog output as shown in (2) of the next page.
It can display the range of -5 to 105%F.S. of the linear display span.

- The setting range for the **minimum pressure P_1** and the **maximum pressure P_2** is 0 to 100%F.S. of the pressure range, and the maximum pressure P_2 is set from the value which is more than 25%F.S. of the pressure range above the minimum pressure P_1.
- The setting range for the **OFFSET** and **FULL SCALE** values is -1999 to 1999, and the decimal point can be set arbitrarily. At this time, the arbitrary unit monitor turns on.



Min. pressure P_1 & max. pressure P_2 setting
⇒ Setting item⑥,⑦

OFFSET & FULL SCALE setting
⇒ Setting item⑧,⑨,⑩

(2) Analog output

The **zero point** (4mA) and **span point** (20mA) of analog output can be set in the range of -10 to 110%F.S. of the maximum display span (between OFFSET and FULL SCALE).
The span between the zero point and the span point in this analog output is the linear display span.

Analog output zero point & span point setting ⇒ Setting item ⑪,⑫

※ As shown in the left figure of an upper figure, usually, the OFFSET is set as Output zero point (4mA) and the FULL SCALE is set as Output span point (20mA), but the OFFSET can be reversed to Output span point (20mA) and the FULL SCALE can be reversed to Output zero point (4mA).

■ Setting example 2 : Linear display mode

In the load meter using a pressure range of 0 to 10MPa, the linear display setting to display the OFFSET for minimum pressure 1MPa as 0.00, the FULL SCALE for maximum pressure 6MPa as 5.00, the unit as arbitrary unit (ton), the zero point (4mA) of analog output as 0.00, and the span point (20mA) as 5.00 is as follows.

・For display mode, select "Linear display mode"	⇒	Setting item②
・Set min. pressure P_1 as "1.00MPa"	⇒	Setting item⑥
・Set max. pressure P_2 as "6.00MPa"	⇒	Setting item⑦
・Set decimal point position of linear display as "two digit"	⇒	Setting item⑧
・Set OFFSET of linear display as "0.00ton"	⇒	Setting item⑨
・Set FULL SCALE of linear display as "5.00ton"	⇒	Setting item⑩
・Set output zero point as "0.0%F.S." (0.00ton) of max. display span *	⇒	Setting item⑪
・Set output span point as "100.0%F.S." (5.00ton) of max. display span *	⇒	Setting item⑫

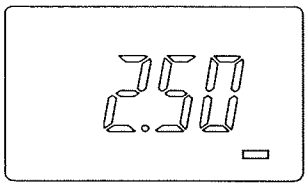
※ Maximum display span: OFFSET to FULL SCALE

Linear display and Analog output

Pressure: 3.5MPa

・Pressure display:2.50(ton)

・Analog output:12(mA)



ton ※1

Pressure (MPa)		Linear display (ton)		Analog output (mA)	
		Span poit			
6.0	⇒	5.00	⇒	20	4
∫		∫		∫	
3.5	⇒	**2.50**	⇒	**12**	12
∫		∫		∫	
		Zero point			
1.0	⇒	0.00	⇒	4	20

※1 Put the arbitrary unit sticker.

※2 By setting the output span point as 100%F.S. (5.00ton) and the output zero point as 0%F.S. (0.00ton) as shown in [ ], 4 to 20mADC can be reversed.

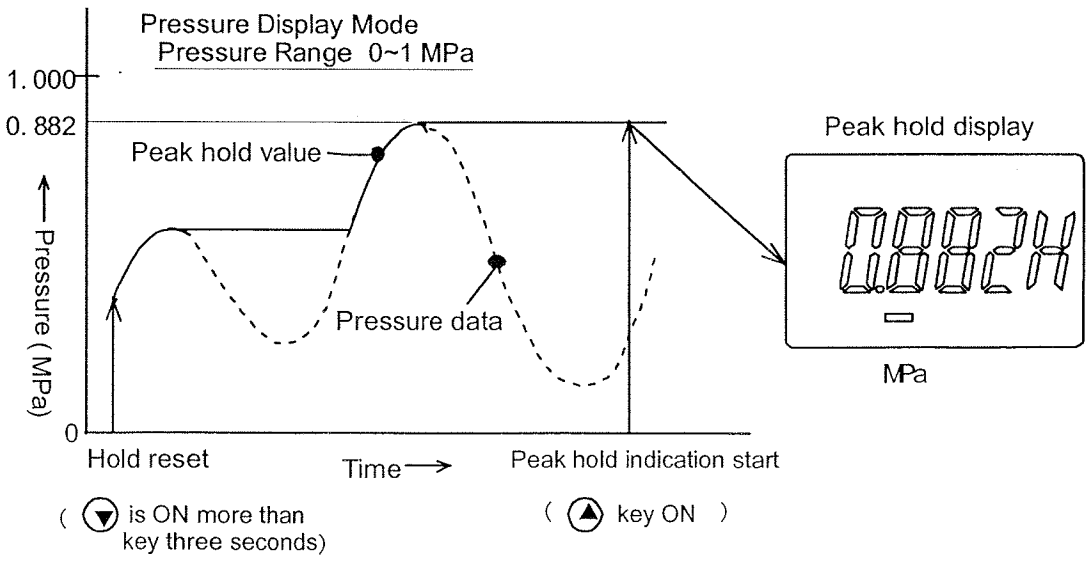
13－4. Hold Display

In a pressure indication mode and a linear indication mode, I detect a regular **peak** (a **maximum**) **value** and **bottom** (a **minimum**) **value** and memorize it in nonvolatile memory (EEP-ROM). When I want to let you display a peak value and a bottom value, I perform it by key operation as follows.

(1) Peak hold display

By the end of a pressure indication mode or a linear indication mode, ▲ display a peak value (a last figure, H) when it push a key. Once again ▲ key; or Ⓜ Peak hold is removed when it push a key and returns to original indication.

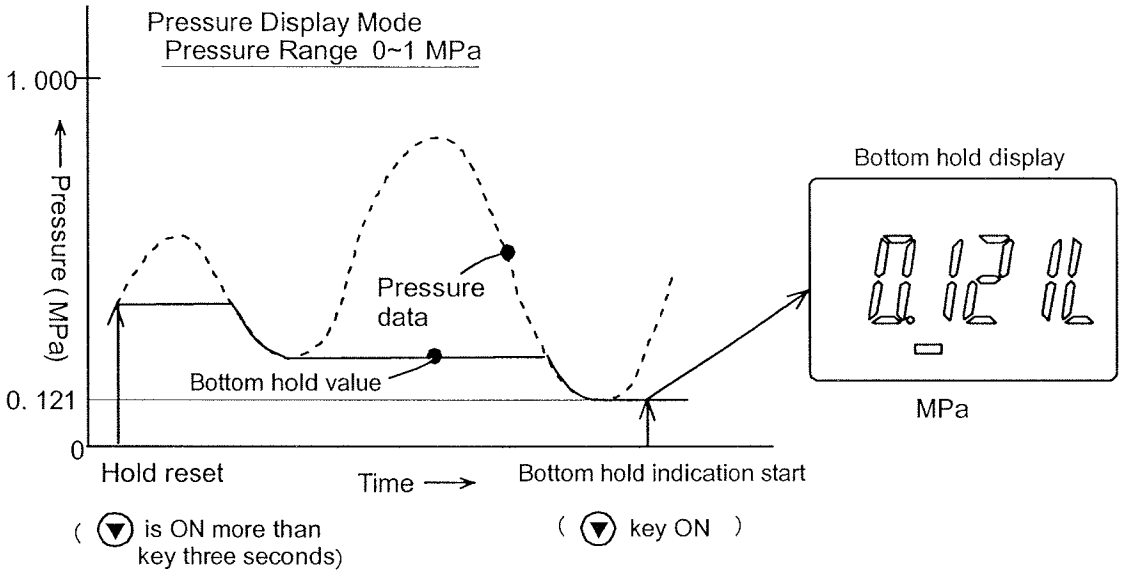
※ I maintain peak hold value of a case beyond 105%F.S. of an indication span with a value of 105%F.S.



(2) Bottom hold display

By the end of a pressure indication mode or a linear indication mode, ▼ display a bottom value (a last figure, L) when I push a key. Once again ▼A key; or Ⓜ Bottom hold is removed when I push a key and returns to original indication.

※ I maintain peak hold value of a case beyond -5%F.S. of an indication span with a value of -5%F.S.

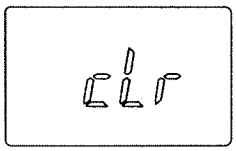


(3) Hold reset

During a pressure indication mode, a linear indication mode and hold indication, ▼ when push a key more than three seconds, display "cLr" two seconds and; the hold (a peak, a bottom) value that memorizes in nonvolatile memory I do reset (elimination). I update reset for a hold price from a present value afterward.

In addition, I do not disappear even if hold value does power supply OFF.

－Hold reset message－



⚠ **CAUTION**	● When I start hold indication, please carry out hold reset operation by all means. At the time of factory shipment, please be in particular careful at the establishment because hold value is a memory state. ● I memorize the value in nonvolatile memory greatest one minute later after I update hold value, and displaying it. Please be careful when I do power supply OFF in the meantime because I cannot memorize the hold value.

13－5. Over Display

(1) Range Over display

In the pressure display mode, the linear display mode or the square root display mode, if the pressure is below -15%F.S. of the pressure range, "-FFF" will be displayed, and if it is more than 115%F.S., "FFF" will be displayed announcing pressure range OVER.

(2) Span Over display

The display range in each display mode is -5 to 105%F.S. of the display span.
In the case where this range is exceeded, the value of -5%F.S. or 105%F.S. will be held with blinking state announcing display span OVER.

(3) Analog output

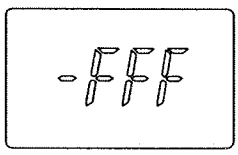
The analog output is linked with the display. Moreover, it is equal to a fixed value of 3.2mA at the time of blinking display when the display span is -5%F.S. exceeded and it is equal to a fixed value of 20.8mA at the time of blinking display when the display span is 105%F.S. exceeded.

Over display

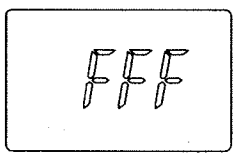
Pressure display (Pressure range: 0～1MPa)
Pressure display span: 0～1MPa
Span point: 1.000
Zero point: 0.000

- **Range Over display**

－15%F.S. (-0.15MPa) or less

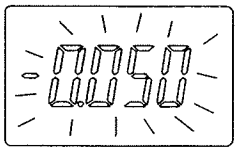


115%F.S. (1.15MPa) or more

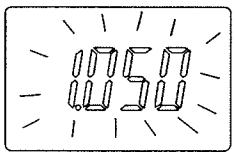


- **Span Over display**

－5%F.S. (-0.05MPa) or less



105%F.S. (1.05MPa) or more



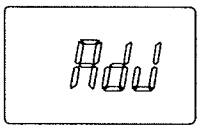
14. Zero Adjustment Mode

In the measurement mode, the pressure connection port is open to the atmosphere and ▲ key is pressed for more than 3 seconds in order to shift to zero adjustment mode (refer to paragraph 11) for zero point adjustment of the pressure sensor.

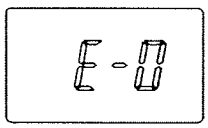
- If the zero point adjustment is normally performed, the normality message "AdJ" will be displayed for 2 seconds, and the display will return to the measurement mode. Then check the zero point.

- If zero point adjustment is performed in the state where the pressure over ±10%F.S. of the pressure range is applied, the error message "E-0" will be displayed for 2 seconds, and the display will return to the measurement mode without completing the zero point adjustment.

−Normal message−



−Error message−



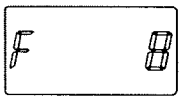
⚠ **CAUTION**	Please perform zero point adjustment after the pressure connection air is certainly open to the atmosphere. This adjustment performed during pressure application will influence the accuracy.

15. Setting Mode

The setting modes include pressure display mode setting, linear display mode setting and square root display mode setting. Moreover, loop check (refer to paragraph 15-4) can be performed in each mode setting.
For the setting procedure of each display mode, refer to paragraph 15-3.

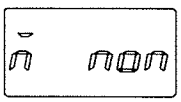
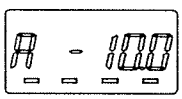
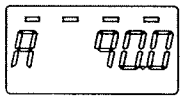
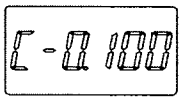
15－1. List of Setting Items for Pressure Display Mode

Set the filter before setting the pressure setting mode.

No.	Setting item	LCD display	Setting description	Setting range	Default※
①	Filter		Selection of moving average time of pressure : 8 (times)	1,2,4,8,16 times	4

※The default is the factory default.

The setting of the following table is the Setting example 1
: pressure display mode of paragraph 13-2.

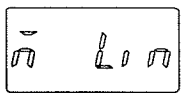
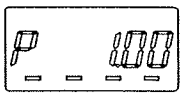
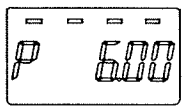
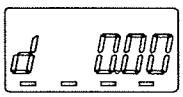
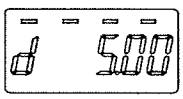
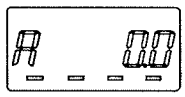
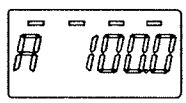
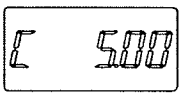
No.	Setting item	LCD display	Setting description	Setting range	Default
②	Display mode		Selection of pressure display mode : non	non :pressure display mode Lin: Linear display mode	non
③	Output zero point※1		Pressure of analog output zero point (4mA) : -10.0(%F.S.)	Pressure range: -10 to 110%F.S.	0.0
④	Output span point※1		Pressure of analog output span point (20mA) : 90.0(%F.S.)	Pressure range: -10 to 110%F.S.	100.0
⑤	Loop Check※2		Arbitrary change of pressure display & analog output : -0.100 (MPa)	Display: Output zero point pressure to Span point pressure Analog output : 4 to 20mA	-0.100 (4.0mA)

※1 For setting of zero point and span point in the analog output, input the percent value over the pressure range. Its decimal point position can be set up to one digit after decimal point as fixed point.

※2 Regardless of generated differential pressure, the loop check can be changed by arbitrarily linking the pressure display with the analog output using ▲, ▼ key. (Refer to paragraph 15-4). This example of LCD display shows the zero point display at the time of loop check start.

15－2. List of Setting Items for Linear Display Mode

Please set the filter before setting the linear display mode (Refer to the preceding paragraph 15-1).
The setting of the following table is the Setting example 2 :
Linear display mode of paragraph 13-3. (Arbitrary unit: ton)

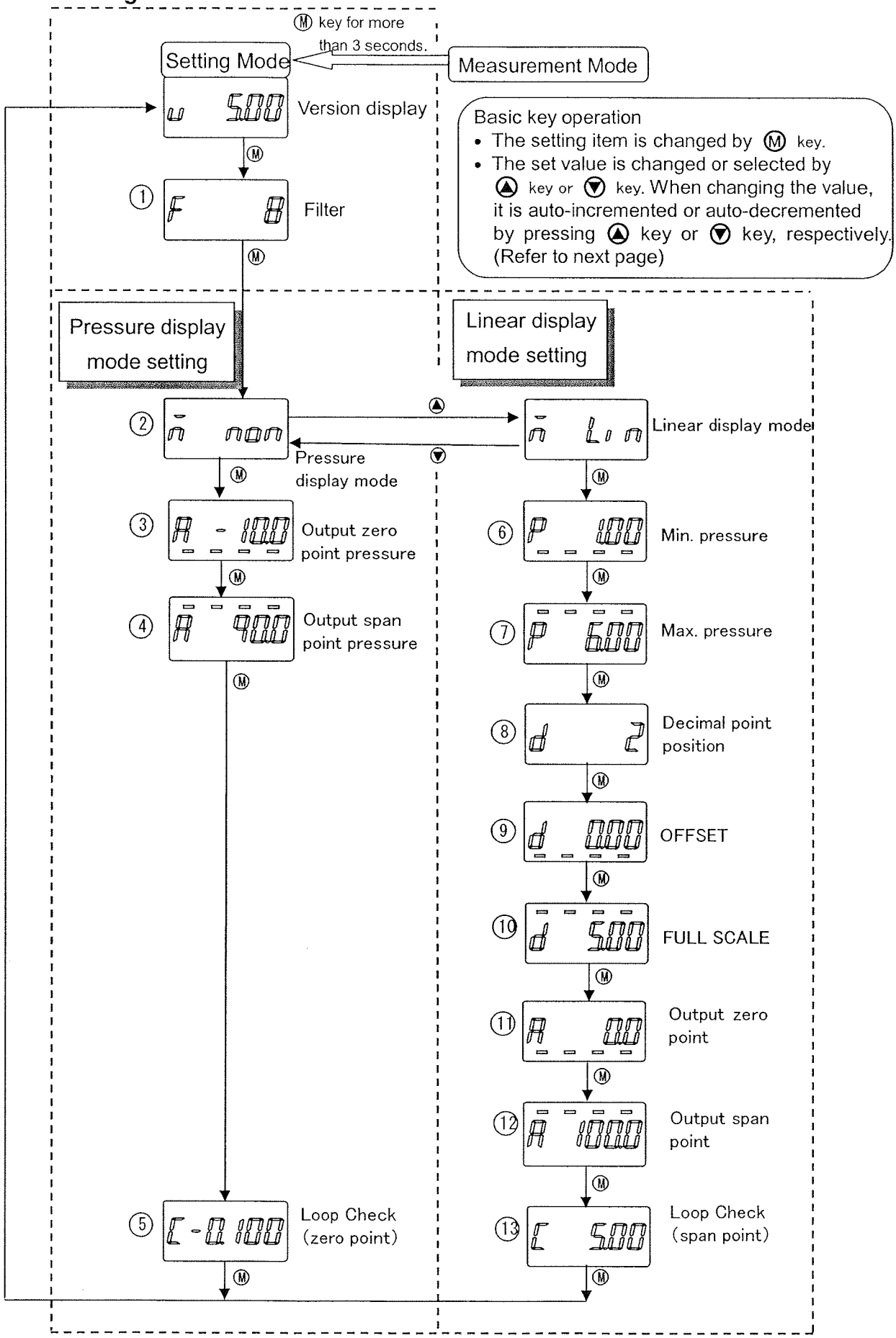
No.	Setting item	LCD display	Setting description	Setting range	Default
②	Display mode		Selection of linear display mode :Lin	non:Pressure display mode Lin:Linear display mode	non
⑥	Min. pressure※1		Min. Pressure corresponding to OFFSET ⑨ :1.00(MPa)	Pressure range: 0 to 75%F.S.	0.0
⑦	Max. pressure※1		Max. Pressure corresponding to FULL SCALE ⑩ :6.00(MPa)	Pressure range: 25 to 100%F.S.	100.0
⑧	Decimal point position		Display after decimal point Number of digits :2 (digit)	0,1,2,3digit	0
⑨	OFFSET		OFFSET corresponding to min. pressure ⑥ :0.00 (ton)	-1999 to 1999	0
⑩	FULL SCALE		FULL SCALE corresponding to max. pressure ⑦ :5.00 (ton)	-1999 to 1999	1000
⑪	Output zero point※1		Analog output zero point (4mA) : 0.0(%F.S.)	Maximum display span :-10 to 110%F.S.	0.0
⑫	Output span point※1		Analog output span point (20mA) : 100.0(%F.S.)	Maximum display span :-10 to 110%F.S.	100.0
⑬	Loop Check※2		Arbitrary change of linear display & analog output : 5.00 (ton)	Display: linear display Analog output : 4 to 20mA	0.00 (4.0mA)

※1 In the setting of a pressure, the decimal point position is fixed for each pressure range. (Refer to paragraph 12, Power-on Message)
The maximum pressure can be set from the value which is more than 25%F.S. of the pressure range above the minimum pressure.
The values under 25%F.S. cannot be increased or decreased by ▲, ▼ key.

※2 For setting of zero point and span point in the analog output, input the percent value over the maximum display span (between OFFSET and FULL SCALE). Its decimal point position can be set up to one digit after decimal point as fixed point.

※3 Regardless of generated differential pressure or low-cut, the loop check can be changed by arbitrarily linking the momentary flow rate display with the analog output using ▲, ▼key. (Refer to paragraph 15-4). This example of LCD display shows the display set to span point.

15−3. Setting Procedure



15－4. Loop Check

In each display mode, regardless of applied pressure, the loop check can be changed by arbitrarily linking the display with the analog output using the key operation.

Since the key operation can be used in hazardous areas, it is easy to check this product and remote receivers, wiring, etc.

■ Loop check method (at the time of linear display mode)

① Turn and remove the lid of this product.

② Shift to the linear display mode in the setting item ②. (Refer to paragraph 15-3, Setting Procedure). The display at the time of loop check start (zero point) and the analog output (4mA) are held.

③ If ▲ key continues to be pressed, the linear display will auto-increment by linkage betweer the linear display and the analog output. On the contrary, by continuing to press ▼ key auto decrement will occur. Release the key at the desired indication.

For example, if the key is released at 2.50ton, the display will stop and be held at analog output 12mA corresponding to the indication.

Loop check / linear display

	▲		▲		
Linear display ton	0.00	→	2.50	→	5.00
(Analog output)	(4mA)	←	(12mA)	▼	(20mA)

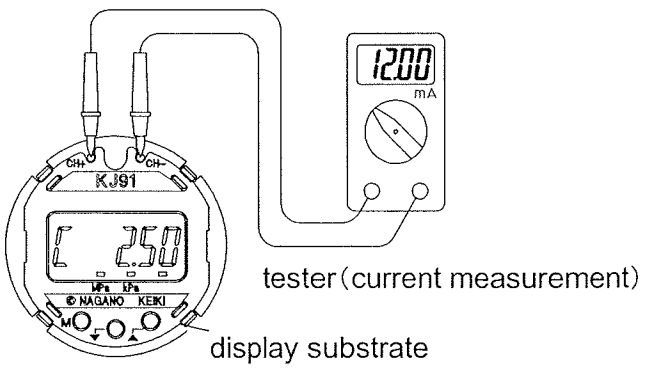
■ Analog output check terminal (used in safety areas)

When the front lid is removed, the analog output check terminal (pad: CH+, CH-) is visible at the upper part of the display substrate.

Without doing the wiring work, the analog output can be easily checked during measurement mode or loop check only by applying a probe (Φ2 or less), such as a tester for current measurement, onto the check terminal of the substrate, as shown in the following figure. In addition, receivers are not affected by application of a tester's probe. However, the work to apply a probe cannot be done in hazardous areas.

Loop check / linear display

Safety areas



tester (current measurement)

display substrate

⚠ CAUTION	The work in hazardous areas (inspection etc.) should be limited to the key operation. The work to apply a tester etc. onto the analog output check terminal must be done in non-hazardous areas.

16. Maintenance Service

■Periodic inspection

This product, which does not have movable portions in its detectors and circuits, undergoes no misalignment. However, since it may deteriorate with age according to the status of use, periodic inspection is recommended at least once half a year.

Please refer to the following check items for periodic inspection:

① Appearance
② Switch / display check
③ Display / output check by pressure reference instrument※1
④ Display / output check by loop check※2
⑤ Leak check of connection joint etc.

※1 If the pressure zero point is misaligned, please adjust zero point.
(Refer to paragraph 14, Zero Adjustment Mode).
※2 In addition to this product, remote receivers can be easily checked.
(Refer to paragraph 15-4, Loop Check).

⚠ **WARNING**	Inspection of this product in hazardous areas should be limited to display check by visual inspection and key operation. Other maintenance & inspection works must be done only in "non-hazardous areas," not in any hazardous areas.

⚠ **CAUTION**	● Avoid electrostatic charging. When cleaning this product, please use soft and damp cloth. ● Do not use thinner, benzene, etc. which may cause deterioration and failure.

■Service

In the case of failure, please contact your vendor or your local sales office after confirming disconnection of transmission cable, power supply voltage, etc. Moreover, please pack up the product concerned to prevent damage during transportation and include the written details of the failure.

■Product warranty

Except as otherwise provided, the product warranty of this product is as follows:

Period: 12 months after delivery

Warrantable defects: Defects resulting from the design and manufacture of our company, the quality of the material, etc.

Implementation of warranty: This warranty will be completed by substitution or repair of the product concerned.

We will not take responsibility for consequential damages caused by product defects.

- If you have any questions about this document, please contact the sales office or distributor nearest you.
- This document is subject to change without notice due to upgrade etc.