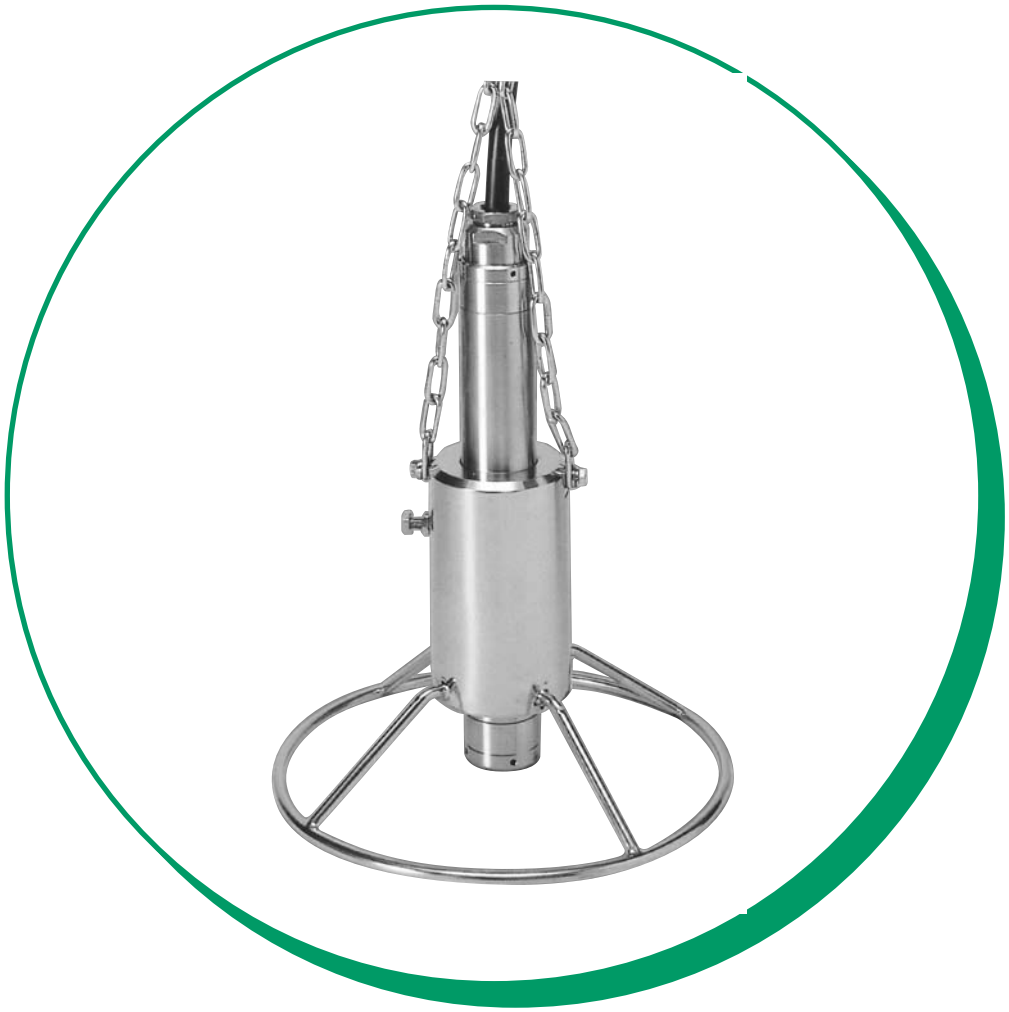
azbil

Smart ALTJ3000
Immersion-type
Liquid-Level Transmitter

Model: JTL220/230/221/231/222/232

User's Manual



Azbil Corporation

OM2-5380-3100
5th edition

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Safety

About this manual

To operate the smart ALTJ3000 Immersion-type Liquid-Level Transmitter safety, the information and precautions stated in this manual must be adhered to. Correct installation, proper operation and regular maintenance are essential to ensure safety while using this device.

For the correct and safe use of this device it is essential that both operating and service personnel follow the standard safety procedures in addition to the safety precautions specified in this manual.

The following symbols are used herein to alert you of possible hazards:

⚠ WARNING

Denotes a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Failure to observe these precautions may produce dangerous conditions that could result in operator injury or in damage to the device.

Safety precautions

Cautions on installation

⚠ WARNING

- When installing the transmitter with the sink and chain, always hold the transmitter by its chain and not to hold it by the cable. Holding the transmitter by its cable could result in physical injury.
- Never use the instrument beyond its rated pressure, connection specifications or the rated temperature specified for the instrument. This may result in damaging the instrument and could lead to a hazardous situation.

⚠ CAUTION

- Do not use the installed instrument as a foothold, etc. This may damage the instrument or may result in physical injury
- Avoid hitting the glass part of the display with tools. This may damage the glass and result in physical injury.
- Ensure that the instrument is installed correctly. Incomplete installation may result in output errors or violate applicable regulations.
- This product is heavy. Pay attention to the scaffolding and always wear safety shoes.

Cautions on wiring

⚠ WARNING

Never perform wiring with wet hands or with power turned on. This may result in electrical shock. Always work with dry hands or wear gloves. Always turn the power off before conducting any wiring.

⚠ CAUTION

- Carefully check the specifications and on sure proper wiring. Incorrect wiring may damage the instrument or cause the instrument to malfunction.
- Use only a power supply that conforms to the specifications. Using the wrong power supply may damage the instrument.

Cautions on maintenance

⚠ WARNING

- When removing this instrument from the process line for maintenance, be especially careful of residual pressure or any residual fluid remaining in the process line or in the instrument.

⚠ CAUTION

This instrument is shipped under strict product control by Azbil Corporation. Do not modify the instrument under any circumstances as this may damage the instrument.

Verifying the Instrument

Upon receiving the instrument, immediately check it for any damage which might have been sustained while being shipped. Also verify that the accessories as shown in "Table S-1: Accessories" are included with the instrument. If any signs of damage to the instrument are found or if any accessories are missing, immediately notify the shipping company and your Azbil Corporation representative.

Table S-1: Accessories

2 inch pipe stanchion mount type (specification selection T)		Wall mount type (specification selection S)	
1	Pipe mounting bracket 1	1	Bracket for wall mount 1
2	U-bolt 1	2	Hex bolts 2
3	Hex nuts 2	3	Spring washers 2
4	Hex bolts 2		
5	Spring washers 2		

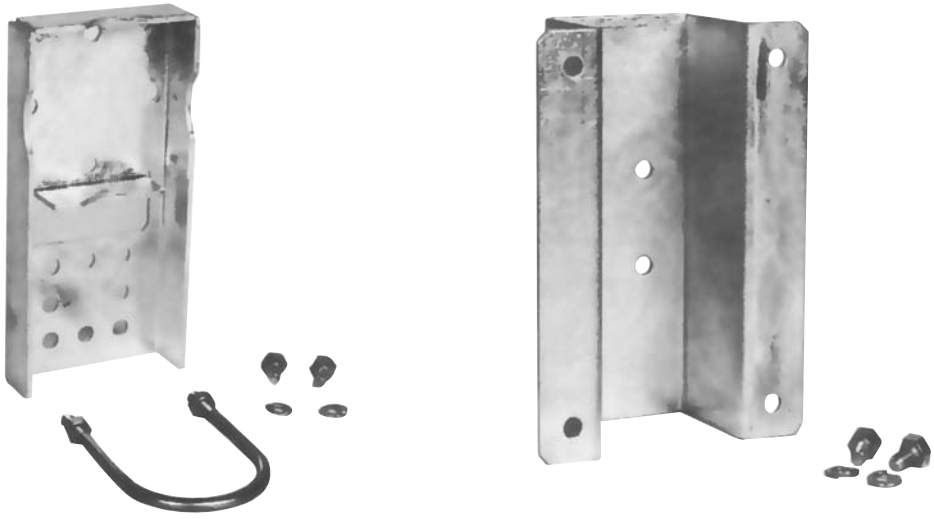
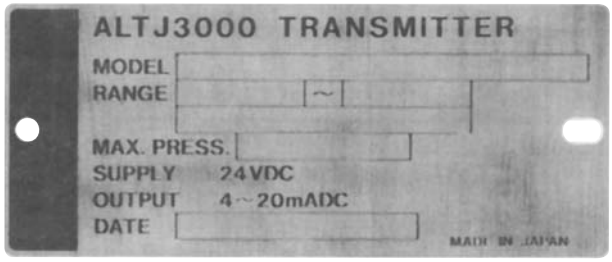


Figure S-1 Accessories

Verifying the specifications

Primary specifications are written on the nameplate found on the top panel of the junction box (see Figure S-2). Check that the specifications confirm with the ones shown in the model number table by referring to Appendix A-1, A-2 “Standard Specifications” and Appendix A-3 “Model Number Table”.

When making any inquires regarding the instrument, please include the model number (MODEL) which is given on the nameplate and the product number (PROD NO) which can be found inside the junction box. These can be also identified by using a SFC (Smart Field Communicator). Refer to “Verifying the product number (PROM NO)” on page 3-11.



←Model No.
←Measuring range
←Maximum working pressure
←Supply voltage
←Output
←Date of manufacture

Figure S-2 Nameplate

Notes

On transportation

To insure the instrument does not become damaged by mishandling, it is recommended to transport the instrument packed as it was received to the place of installation.

On storage

When storing the instrument, ensure the following:

- Store the instrument in a place where it is subjected to minimal vibration and shock, and where ambient temperature and humidity are within the limits mentioned below. Ideally, store the instrument in a place of normal temperature and dry atmosphere.

  Temperature: Transmitter and junction box ……. - 40° C to + 85°C

  Power supply box ……. -40°C to + 70 °C

  Humidity: 95% RH or less (excluding the detector)
- When storing the instrument for a long period of time, store the instrument packaged as it was delivered.
- Avoid storing the instrument for a long period in a place where the atmosphere is highly humid or contains chlorine or other corrosive gases.

On installation

When installing the instrument, the conditions given in "Chapter 2 : Installation" must be met.

On the transmitter

The transmitter is shipped after being precisely adjusted at the factory. Avoid disassembling it whenever avoidable. (If it is unavoidable to disassemble it for inspection or maintenance, observe the instructions given in “Disassembling the transmitter” on page 4-1.)

On electrical connections

- Be sure to securely ground the junction box and power supply box.
- If large induction lightning surges are predicted, use a shielded cable for the connection between the junction box and the power supply box. For grounding the cable at both ends, refer to “2-4 :Wiring” on page 2-4.

Using a transceiver

If you use a transceiver near the level meter transmitter, the radio frequency noise generated by the transceiver may interfere with the level meter signal. To prevent this, use the transceiver at a location sufficiently distant from the level meter transmitter.

Maintenance

Provide maintenance service for the instrument as described in “4-2 :Inspection” on page 4-8.

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Chapter 1 : Introduction

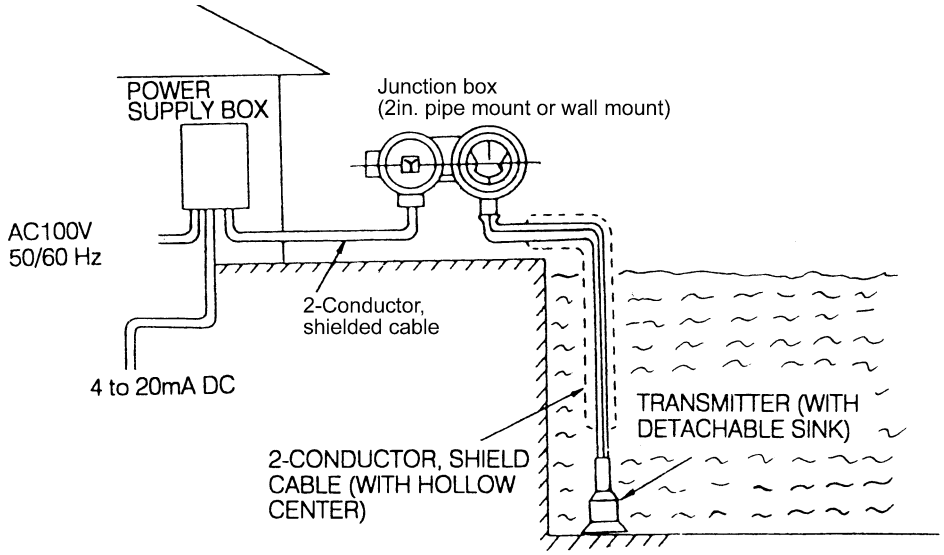


Figure 1-1 Measuring system configuration

1-1 : Overview

The ALTJ3000 Immersion-type Liquid Level Meter is a microprocessor-based instrument which detects water head pressure with a semiconductor sensor and transmits a current signal which represents the liquid's level. The level meter is primarily comprised of a transmitter, a junction box, and a power supply box (in the case 24V DC power supply being used, this box is not used).

In order to prevent errors in measurement which could be caused by atmospheric pressure change, an air tube is provided in the transmitter cable to relieve the detector's reference chamber of atmospheric pressure.

Various transmitter parameters (range, damping time constant, constant-current output, etc.) can be set or modified remotely with an SFC (Smart Field Communicator) in the instrumentation room. Refer to CM2-SFC100-2001 "SFC Smart Field Communicator model SFC160/SFC260 User's Manual".

1-2 : Description of individual units

Transmitter

The transmitter, which is installed underwater, is comprised of a pressure sensing section and a transmitting section. The sensing section detects the water head pressure exercised on its metallic seal diaphragm and conveys the pressure via a metallic seal diaphragm to the transmitting section. The transmitting section converts the pressure signal into an electrical signal and transmits a 4-20mA DC output signal.

The transmitter is provided with a lightening arrester as a standard feature. A detachable sink and chains are available as options.

Junction box

The junction box, which is installed above the ground, connects the transmitter's special cable (a cable with an air tube inside) to the regular cable of the power supply box. (The air tube constantly releases the reference pressure of the pressure sensor to the atmosphere).

The junction box also is provided with a lightning arrester as a standard feature.

Power supply box (option)

The power supply box, which is installed in an instrumentation room, operates on a 100V AC line power and provides a 24V DC constant-voltage power for the transmitter. The signal for the receiver instrument also is fed via the power supply box.

A lightning arrester is provided for each of the primary and secondary circuits of the power supply unit, as a standard feature.

The DC type of power supply unit, which operates on a 24V DC power source, has no AC/DC converter, otherwise it is identical to the AC power supply unit. (The lightning arrester of the primary circuit is eliminated.)

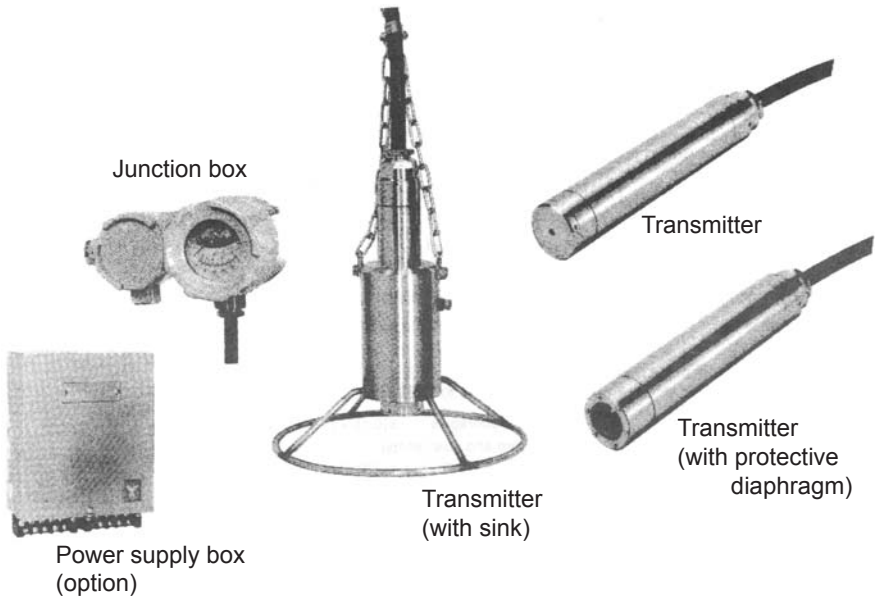


Figure 1-2 External views of the system components

1-3 : Measuring principles

The water head pressure to be determined is exercised on the metallic diaphragm of the transmitter and fed via a seal liquid to the semiconductor sensor whose electrical resistance changes in response to the pressure applied to it. The resistance change is detected and sent as a voltage signal by a whetstone bridge, converted into a digital signal by an A/D converter, and then fed to the transmitting section. At the same time, the static pressure and ambient temperature also are detected by their respective sensing elements on the same semi-conductor sensor (which is of a complex design having three sensing elements) and are fed to the transmitting section in the same manner as the resistance change. These digitized signals, as well as the range factor as a parameter, are processed by the microprocessor in the transmitting section and then transmitted out via the D/A converter in the form of a 4-20mA DC signal which represents the water head.

For each individual transmitter, data on its dynamic and static pressure characteristics and temperature characteristics is acquired while it is being manufactured by the production line computer and then the data is stored in the PROM of the transmitter. Data on the input/output characteristics of the various sensing elements is also stored in the PROM. These pieces of data are employed by the microprocessor to calculate correction values for various factors in order to provide a signal which more accurately represents the actual liquid level.

The lightning arresters for the transmitter, junction box and power supply box are comprised of zinc oxide varistors and resistors, with which control the circuit voltage with reference to the ground and absorb the line-to-line potential.

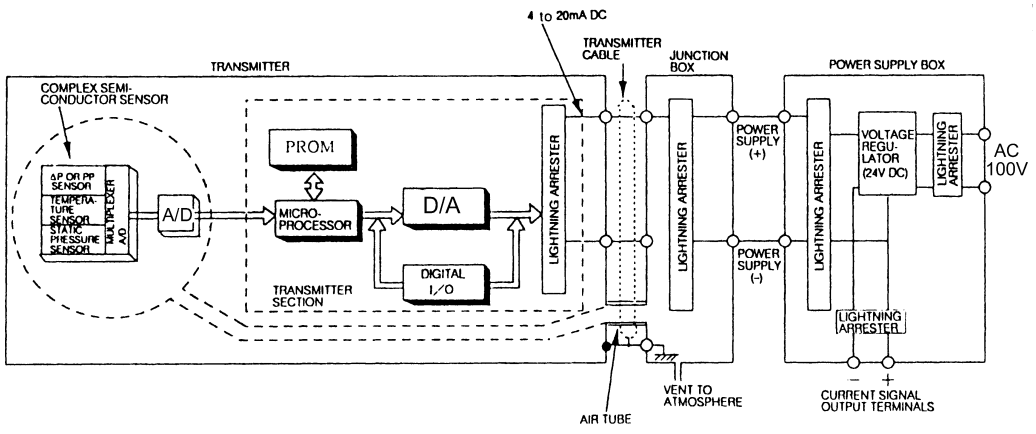


Figure 1-3 Overall block diagram of the level meter

Chapter 2 : Installation

2-1 : Transmitter

~Note

- *Only submerge the transmitter in water where temperature is within the range of -5 to +55 °C and where temperature variation is minimal.*
- *Avoid installation a place where water flows at a high velocity or where the transmitter will be subjected to vibration*

⚠ CAUTION

- If the transmitter is provided with a sink and chains, lower the transmitter slowly into the water by holding the transmitter by its chains. Never hold it by its cable lest the cable conductors should open or its seals should be damaged and water should get into the transmitter.
- If the transmitter is not provided with a sink and chains, suspend the transmitter in the water. It is recommended to suspend the transmitter in a protective pipe to prevent the transmitter from swaying.

~Note

- *If the transmitter is provided with a sink, place it on a flat, horizontal surface at the bottom of the wafer. If the transmitter is installed on a slant, measuring errors may occur.*
- *Do not bend the transmitter cable than a 30 cm radius.*
- *For installation using a cable hold flange, see Figure 2-1*

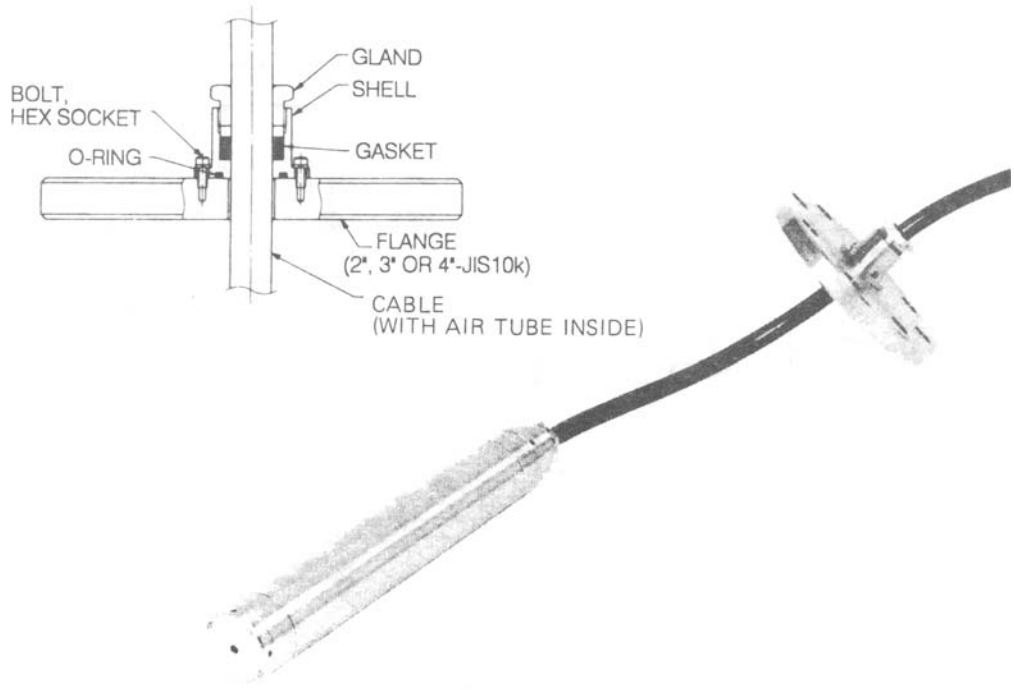


Figure 2-1 The cable hold flange

2-2 : Junction box

For installation dimensions, refer to the attached specification sheets in the appendix.

⚠ CAUTIONS

- Install the junction box in a place where the ambient temperature is within the range of -5 to 55°C.
- Do not install the junction box in a highly humid atmosphere or in chlorine gas or other corrosive gas atmospheres, lest corrosion should expose the circuitry, imperfect the contacts, or incur any other damages to the junction box.

~Note

- *The function of the vent pipe on the side of the junction box is to release the pressure in the air tube to atmospheric air. If the vent pipe becomes clogged, measuring errors will occur. Ensure that no water gets into the vent pipe or any other foreign matter become entrapped in it.*
- *The junction box can be installed on a 50 mm (2-in) vertical or horizontal pipe by using the mounting bracket (U-shape bolt). Make sure that the foundation of the pipe is secure and the pipe will not sway. The locations of the bracket mounting screw holes are shown in Figure 2-2.*

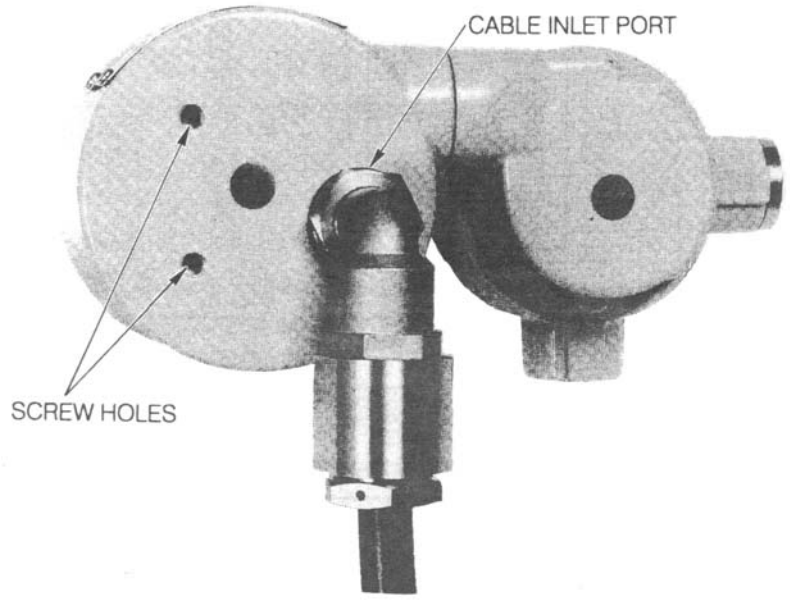


Figure 2-2 Rear view of the terminal box

2-3 : Power supply box

For installation dimensions, refer to the attached specification sheets in the Appendix.

⚠ CAUTIONS

- Install the power supply box in a place where the ambient temperature is within the range of 10 to 40°C
- Do not install the power supply box in a highly humid atmosphere or in chlorine gas or any other corrosive gas atmospheres, lest corrosion should expose the circuitry the contact, or incur other damage to the power supply box.

2-4 : Wiring

Connection system

The level meter employs a 2-wire system and the these wires are used in common for both signal and power supply. A 24V DC power supply is needed for the transmission loop. The model KLPS Power Supply Box which is dedicated for this purpose is optionally available from Azbil Corporation. The electrical connections (customer connections) for the transmitter, junction box, and power supply box are shown in Figure 2-3.

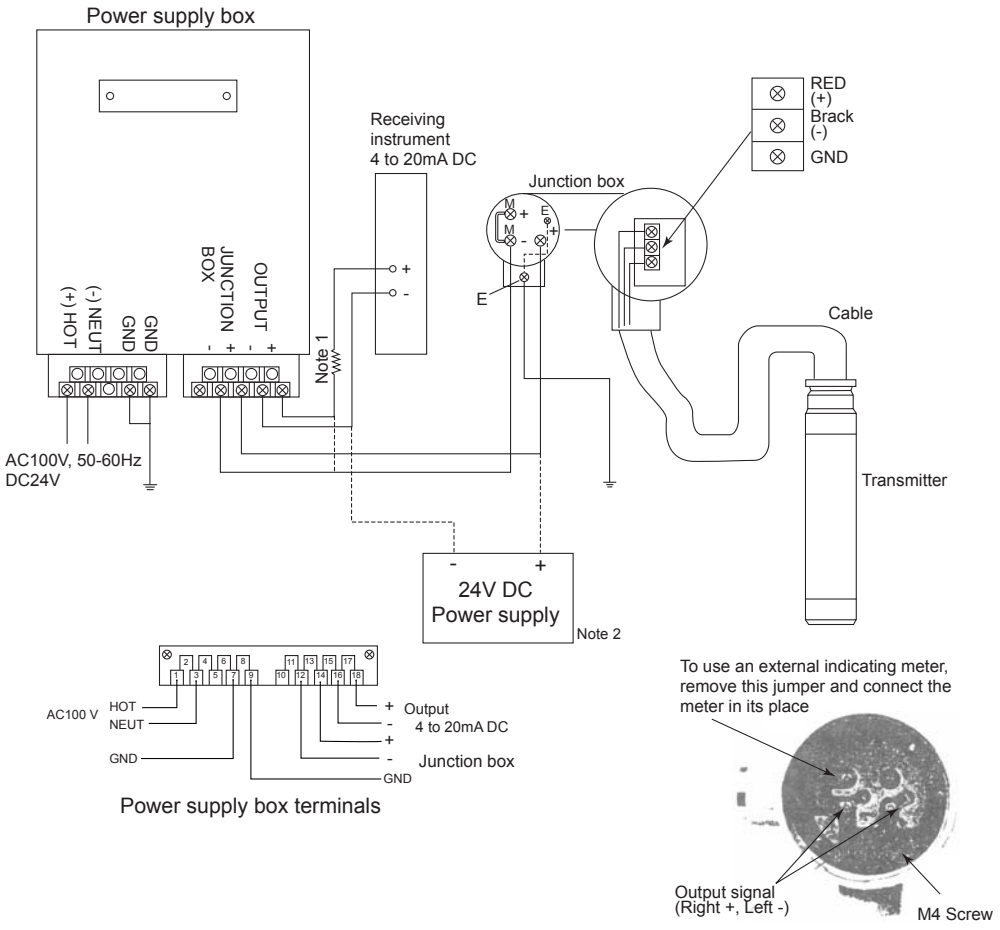


Figure 2-3 Electrical connections for the transmitter, junction box and power supply

~Note 1. For communication employing the SFC, a load resistance of 250Ω or more is needed.
2. In case of 24V DC power supply, connection is as shown the figure

Supply voltage and load resistance

Note that the total load resistance of the instruments and transmission wires connected in the loop must be within the range shown in Figure 2-4.

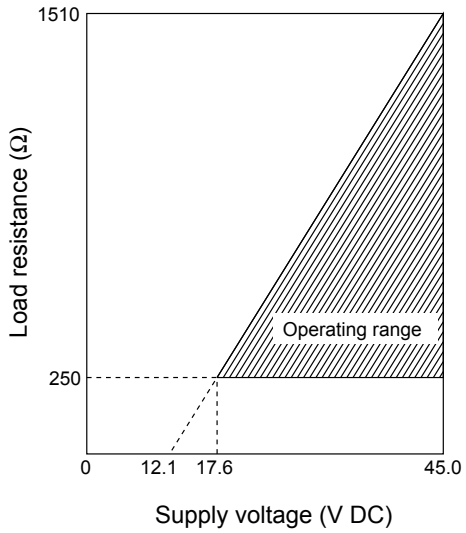


Figure 2-4 Supply voltage vs. load resistance characteristics

Cables for electrical connections

Cable between transmitter and junction box

For electrical connections between the transmitter and the junction box, only use the transmitter cable which is provided with the instrument. This cable has an air tube in it. Do not use other cable or wires.

Cable between power supply box and junction box

- For electrical connections between the power supply box and the junction box in order to guard against induction lightning surge and noise, use a 600V 2-conductor instrumentation-purpose soft-copper-tape-shielded vinyl-insulated vinyl-sheathed cable CVVS (JCS 258A) or an equivalent cable. For the recommended outer diameter and conductor cross-section area of the cable, see Table 2-1.

Table 2-1 Recommended outer diameter and cross-section of conductor

Outer diameter of cable	Cross-section area of each conductor
11.5 mm or less	1.25 to 2 mm2

- When none of the above cable types are available and it is unavoidable to use a non-shielded cable, use a 600 V 3-conductor vinyl-insulated cable (JIS C 3307) or an equivalent cable or use stranded wires and ground one of the conductors or wires at both ends.
- Ensure that the cable or the wires used are sufficiently resistant against high ambient temperature, corrosive atmosphere, and other adverse environments.

General notes on electrical connections

Connections between the transmitter and junction box

- The transmitter and junction box are shipped being already connected electrically. No further electrical connections are needed.
- If they have been disconnected for installation, reconnect them as they were originally. In this case, be sure to connect the leadwire of the shielding wire to the GND terminal in the junction box.
- Do not bend the transmitter cable to a radius smaller than 30 cm. If the air tube of the transmitter cable is crushed, measuring errors may occur.
- Be sure to connect the air tube of the transmitter cable to the atmospheric vent pipe using the rubber tube provided.

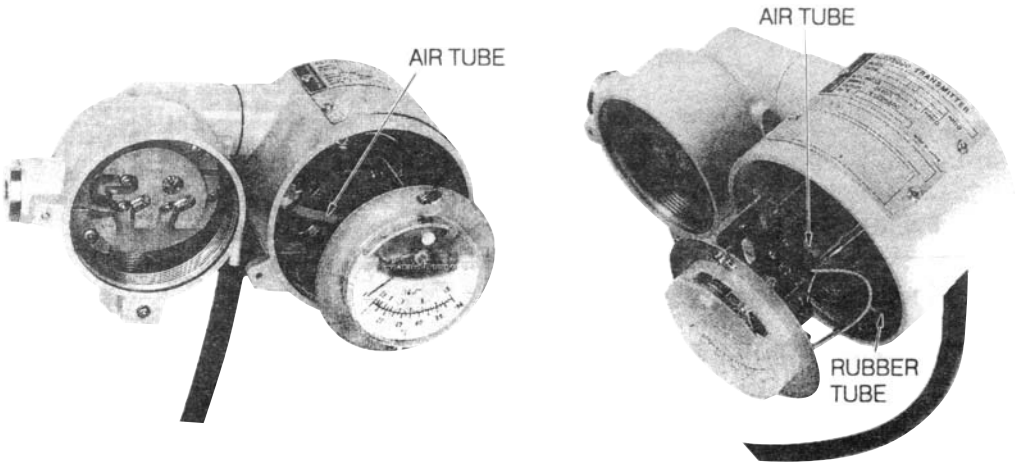


Figure 2-5 Connection with rubber tube

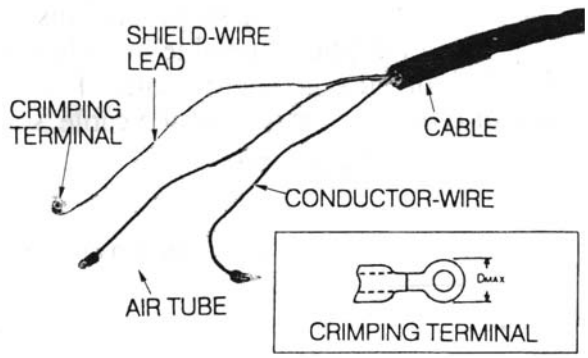


Figure 2-6 Cable end processing

Connections between junction box and power supply box

- At the end of each of the conductors, connect a crimping terminal which has an insulation sleeve. The outer diameters (D) of the crimping terminals must be as shown in Table 2-2.

Table 2-2 Outer diameters of crimping terminals

	Screw	Dmax
Junction Box	4 mm screw	8 mm
Power Supply box	3.5 mm screw	8.5 mm

- Connect the shielding wire of the shielded cable or the extra wire of the non-shielded cable to the terminals shown in Table 2-3.

Table 2-3 Shielding wires and extra wires

	Shielding wire of shielded cable or extra wire of non-shielded cable
Junction Box	Internal ground terminal (E) or external ground terminals
Power supply box	GND terminal

- In order to prevent noise, lay the cable apart from motors, transformers, and other heavy duty equipment.
- It is best to use conduits and ducts to protect the cables against damage and water ingression.
- Be sure to tightly secure the cover of the junction box after electrical connections have been completed.

Other connections

For electrical connections between the power supply box and the receiving instrument and for the AC line power connection, observe the same notes as mentioned in “Connections between junction box and power supply box” on page 2-7.

Grounding

Grounding is essential to prevent damage to instruments resulting from induction lightning surge. Be sure to ground the instruments correctly.

- Provide grounding for the junction box and power supply box. When large and frequent induction lightning surges are predicted, provide a better grounding work so that the functions of the internal lightning arresters are maximized.
- For the grounding cables, use 600 V vinyl-sheathed cables.

Transmitter

When the junction box is grounded, the transmitter will also be grounded. No grounding for the transmitter itself is required.

Junction box

- Be sure to ground the junction box. (If the junction box is grounded, the transmitter will also be grounded.)
- To ground the junction box, use either the internal ground terminal (E terminal of the terminal block) or the external ground terminal on the casing.

Power supply box

Two ground terminals are provided on the customer connection terminal block. Either one of the ground terminals may be used.

Connecting the field-type current indicator

A field-type current indicator may be connected to the junction box or to a point along the connection line between the junction box and the power supply box, to monitor the output current signal locally. To install the current indicator, proceed as follows:

(1) Remove the cover of the junction box.

(2) Remove the plug of the external indicating meter connection port on the top of the case using a hex bar wrench.

(3) Disconnect the jumper from between the M+ terminal and the (M-) terminal of the customer connection terminal block at the left-hand side and connect the current indicator to these terminals as shown in Figure 2-7.

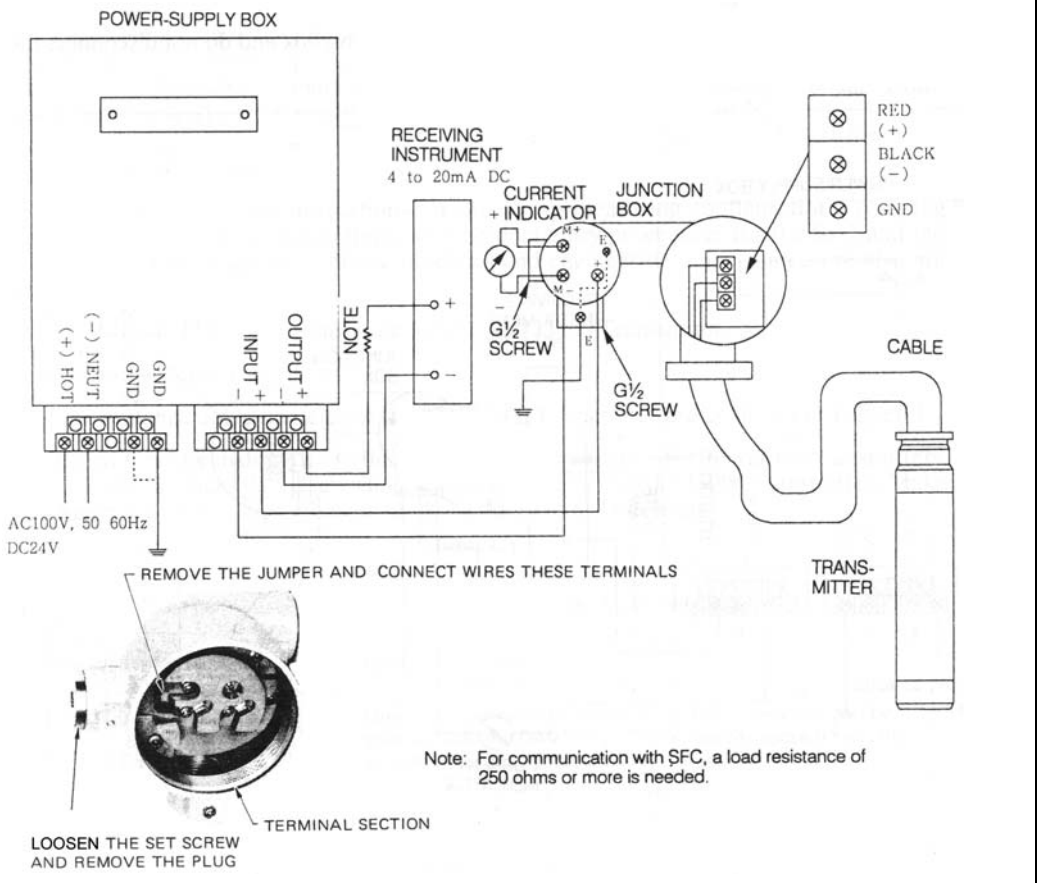


Figure 2-7 Connection for field-type current indicator (1)

(4) As an alternative to the method explained in step (3), the current indicator may be connected as shown in Figure 2-8.

In this case, do not remove the plug from the junction box and do not disconnect the jumper.

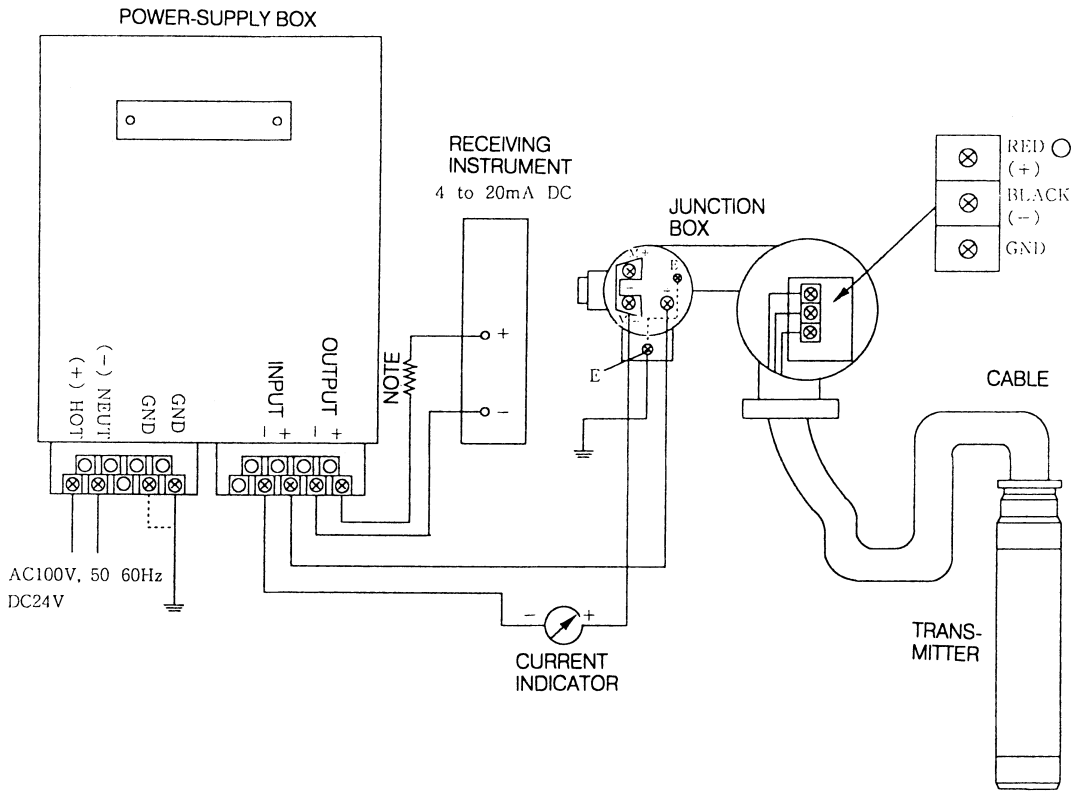


Figure 2-8 Connections for field- type current indicator (2)

Chapter 3 : Operation

This section covers the operating procedures for the ALTJ3000 Immersion-type Liquid Level Transmitter. When operating the transmitter, refer also to CM2-SFC100-2001 “SFC Smart Field Communicator model SFC160/SFC260 User’s Manual”.

3-1 : Configuration setup

This section provides the instructions for setting up configurations for measurement, covering the descriptions of five configuration items and the data entry procedures for the SFC and the transmitter. The ranges of available functions and engineering units are also covered.

The MENU ITEM key can not be used with the ALTJ3000 Transmitter.

Configuration data items

The configuration data items for the ALTJ3000 Transmitter are as listed in "Table 3-1: The configuration data items".

The SFC has been designed so that it can be used with various types of transmitters. Thus, the SFC includes data items which are not needed by the ALTJ3000 Transmitter. Use only the items which are required by the ALTJ3000 Transmitter.

Table 3-1: The configuration data items

Data Item	Setting or Selecting
Transmitter tag No.	Up to 8 characters
Damping time constant	One of the below-mentioned values (unit in seconds) can be selected with the DAMP key. The actual response time is the selected time plus approximately 0.4 seconds. 0.00 1. 16. 0.16 2. 32. 0.32 4. 0.48 8.
Type of Output	Linear/Square-root
Unit for pressure measurement	One of the engineering units of measure as follows can be selected. KPa, Mpa, hpa, Pa, mbar, bar, inH_2O, inHgPSI, mH_2O, mH_2O, kgf/cm^2, gf/cm^2, mmHg
LRV (lower range limit value): (process input for 4mA DC output (0% output)	Enter an LRV value into the transmitter from the Keyboard or enter the pressure value being read by the SFC.
URV (upper range limit value): (process input for 20mA DC output (100% output)	Enter a URV value into the transmitter from the keyboard or enter the pressure value being read by the SFC.

Entry of transmitter tag no.

A tag number (a tag name) can be designated using up to 8 characters employing the numeric, alphabetic and symbol keys on the SFC keypads.

Damping time constant

One of 10 different time constants in the unit of seconds can be selected.

Range values

URV and LRV can be specified in an engineering unit of measure.

Unit of measure

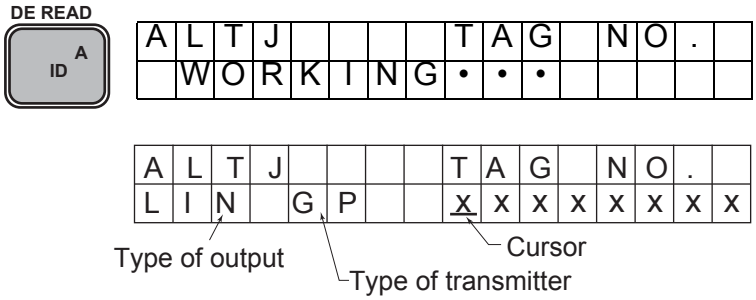
One of the engineering units of measure stored in SFC memory can be selected. A special unit of measure can be specified by programming it from the SFC.

Entering configuration data

Four items of configuration data can be entered into SFC memory or transmitter memory.

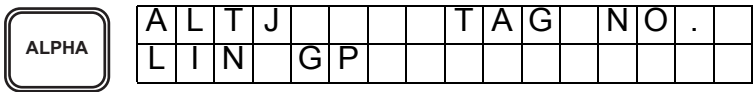
~Note
- *To enter data into SFC memory only, the SFC is not required to be connected to the transmitter. Press the SHIFT key and follow the same procedure as that for the entry of data directly into the transmitter, and the data will be entered into SFC memory. Note that you must press the SHIFT key before pressing any of the ID, DAMP, LRV and URV keys.*
- *When entering configuration data directly into the transmitter which is connected to the SFC, identify the Tag No. by pressing the ID key.*

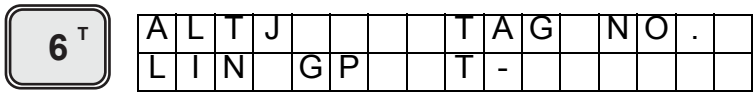
Transmitter tag no.



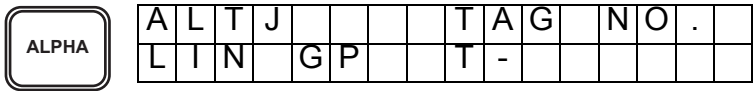
~Note
- *When the transmitter is shipped from the factory, the tag No. is set as "XXXXXXXX"*
- *LIN denotes a linear type of output*
- *As the ALTJ, in principle, is a pressure meter, it is denoted by the letters GP.*

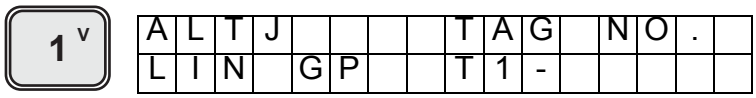
Set to alphabetic mode.

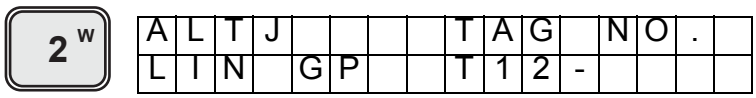


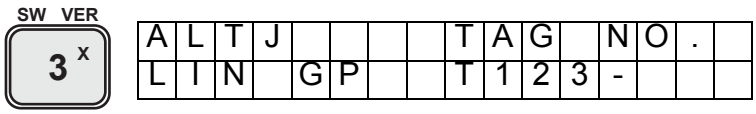


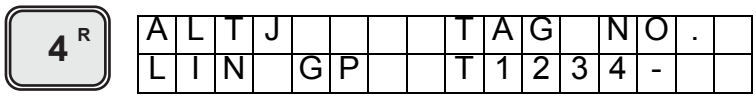
Reset from alphabetic mode

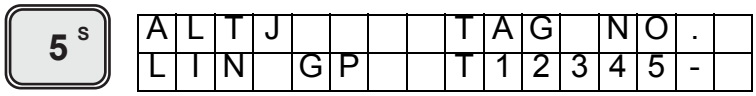


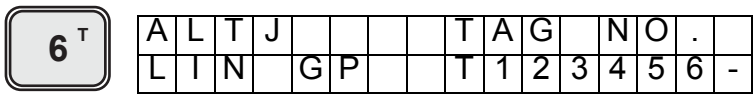


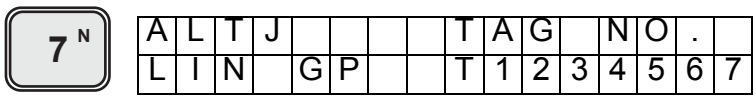




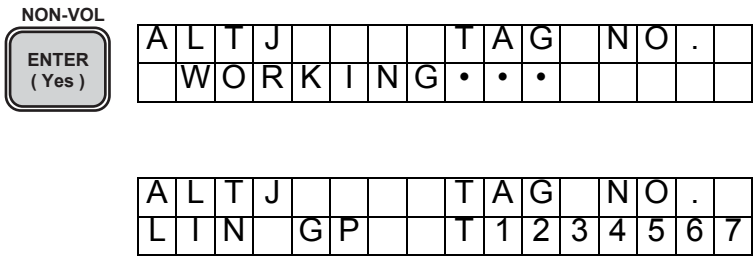








Enter the above data into transmitter memory and SFC memory.



After calibrating the zero point and span, save the calibration data into the nonvolatile memory (NVM) by following the procedure described below.

~Note

- *Data saved in the NVM of the transmitter is stored even when the transmitter power is turned off. The transmitter work memory data can be saved with a priority in the NVM.*
- *Even when no save command is given, the transmitter work memory data is automatically saved in the NVM within approximately 30 seconds after any alteration of a work memory data item. Note, however, that the current signal may be disturbed temporarily when saving is being performed.*

					S	H	I	F	T	-				

A	L	T	J					T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

Data is save in NVM. It takes approximately 8 seconds.

A	L	T	J					T	1	2	3	4	5	6	7
D	A	T	A		N	O	N	V	O	L	A	T	I	L	E

End of data save

Type of output

C	O	N	F	O	R	M		T	1	2	3	4	5	6	7
					L	I	N	E	A	R					

or

C	O	N	F	O	R	M		T	1	2	3	4	5	6	7
		S	Q	U	A	R	E		R	O	O	T			

The type of output of the transmitter currently selected is displayed each time you press the LIN/$\sqrt{\ }$ key, “LINEAR” or “SQUARE ROOT” is displayed alternately.

NON-VOL
ENTER (Yes)

C	O	N	F	O	R	M		T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

C	O	N	F	O	R	M		T	1	2	3	4	5	6	7
					L	I	N	E	A	R					

or

C	O	N	F	O	R	M		T	1	2	3	4	5	6	7
		S	Q	U	A	R	E		R	O	O	T			

By pressing the ENTER key, “LINEAR” or “SQUARE ROOT” can be entered as the type of the output

Damping time constant

C
DAMP

D	A	M	P	I	N	G		T	1	2	3	4	5	6	7
	1	.	0					S	E	C	O	N	D	S	

The selected one (1.0 second in this example) of 10 different selectable time constants is displayed.

▲ H
NEXT

D	A	M	P	I	N	G		T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

D	A	M	P	I	N	G		T	1	2	3	4	5	6	7
	2	.	0					S	E	C	O	N	D		

or

The time constant, which is greater by an one second increment, is displayed and entered into transmitter memory and SFC memory.

▼ L
PREV

D	A	M	P	I	N	G		T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

The time constant, which is smaller by an one second increment, is displayed and entered into transmitter memory and SFC memory.

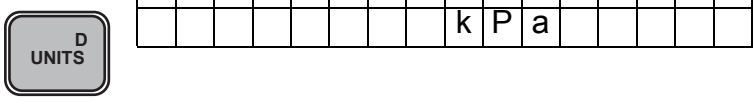
D	A	M	P	I	N	G		T	1	2	3	4	5	6	7
	0	.	4	8				S	E	C	O	N	D		

As you press the keys, the time constants are sequentially changed.

Save data in nonvolatile memory. (Refer to Note on page 3-4)

Engineering unit of measure

Regular Engineering Units of Measure



The selected engineering units of measure (kPa in this example) is displayed and stored into SFC memory. As you press the UNITS key, units are changed sequentially.

Range limit values

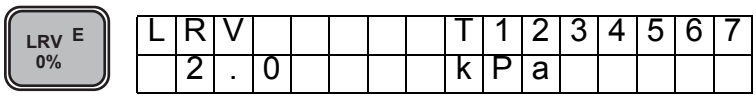
The range limit values (LRV and URV) can be entered either by specifying the values from the keyboard or by applying pressures (corresponding to LRV and URV) directly to the transmitter.

~Note

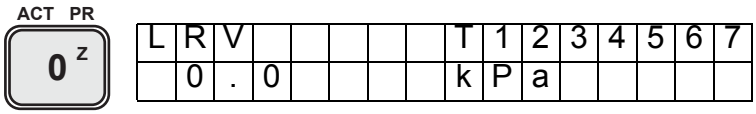
- *To invert the range, enter the upper range limit value for LRV and the lower range limit value for URV. For example, if the original range is 50 kPa (5mH_2O) to 0 kPa (0 mH_2O) and its inverted range is needed, specify 50 for LRV and 0 to URV.*
- *As you alter the value of LRV, the value of URV is automatically altered keeping the span unchanged.*
- *When both LRV and URV are needed to be change, always change the alter LRV first.*

Setting the LRV and URV with the SFC.

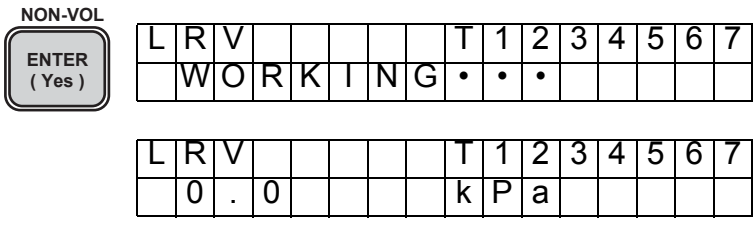
• Setting the LRV (pressure for 0% output (4mA DC)



SFC displays the current LRV.



The LRV to be entered.



The LRV is shown on the display and is recorded into both SFC memory and transmitter memory.

• Setting the URV (pressure for 100% output (20mA DC)

U	R	V						T	1	2	3	4	5	6	7
	2	.	0					k	P	a					

SFC displays the current URV.

U	R	V						T	1	2	3	4	5	6	7
	8	.	0					k	P	a					

The URV to be entered.

U	R	V						T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

L	R	V						T	1	2	3	4	5	6	7
	8	.	0					k	P	a					

The URV is shown on the display and is recorded into both SFC memory and transmitter memory.

Save data in nonvolatile memory (Refer to Note on page 3-4)

Setting the LRV and URV by applying pressures

To set the LRV and URV by applying the corresponding pressures to the transmitter, proceed as follows:

• Setting the LRV (pressure for 0% output (4mA DC)

Apply to the transmitter a pressure corresponding to the LRV, read the pressure value, and then proceed as follows:

L	R	V						T	1	2	3	4	5	6	7
	0	.	0					k	P	a					

SFC displays the current LRV.

L	R	V						T	1	2	3	4	5	6	7
				S	E	T		L	R	V		?			

SFC will ask you whether the LRV is to be set to the pressure currently applied to the transmitter or not.

L	R	V						T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

L	R	V						T	1	2	3	4	5	6	7
	0	.	0					k	P	a					

Upon pressing the ENTER key, the LRV is entered into both transmitter memory and SFC memory. The newly entered LRV is displayed.

• Setting the URV (pressure for 100% output (20mADC)

Apply to the transmitter a pressure corresponding to the URV, read the pressure value, and then proceed as follows:

U	R	V						T	1	2	3	4	5	6	7
	8	.	0					k	P	a					

SFC displays the current URV.

U	R	V						T	1	2	3	4	5	6	7
				S	E	T		U	R	V		?			

SFC will ask you whether the URV is to be set to the pressure currently applied to the transmitter or not.

U	R	V						T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

Upon pressing the ENTER key, the URV is entered into both transmitter memory and SFC memory.

U	R	V						T	1	2	3	4	5	6	7
	8	.	0					k	P	a					

The newly entered URV is displayed.

Save data in nonvolatile memory (Refer to Note on page 3-4)

Saving and restoring configuration data

Configuration data can be copied to the SFC's memory from the transmitter's memory and can be recopied to the transmitter's memory from the SFC's memory.

To copy all data from transmitter work memory to SFC hold memory.

DE READ / A ID

A	L	T	J					T	A	G		N	O	.	
	W	O	R	K	I	N	G	•	•	•					

A	L	T	J					T	A	G		N	O	.	
L	I	N		G	P			T	1	2	3	4	5	6	7

Current save ID.

A	L	T	J					T	A	G		N	O	.	
			S	A	V	E		D	A	T	A		?		

SFC will ask you whether the configuration data is to be saved from the transmitter or not.

NON-VOL / ENTER (Yes)

A	L	T	J					T	A	G		N	O	.	
	W	O	R	K	I	N	G	•	•	•					

As you press the ENTER key, data is saved into SFC hold memory

A	L	T	J					T	A	G		N	O	.	
			D	A	T	A		S	A	V	E	D			

To restore all data from SFC hold memory to transmitter work memory

DE READ
A
ID

A	L	T	J					T	A	G		N	O	.	
	W	O	R	K	I	N	G	•	•	•					

A	L	T	J					T	A	G		N	O	.	
L	I	N		G	P			T	1	2	3	4	5	6	7

Current save ID

A	L	T	J					T	A	G		N	O	.	
	R	E	S	T	O	R	E		D	A	T	A	?		

SFC will ask you whether the configuration data is to be saved from the transmitter or not.

NON-VOL
ENTER
(Yes)

A	L	T	J					T	A	G		N	O	.	
	W	O	R	K	I	N	G	•	•	•					

As you press the ENTER key, data is copied from SFC hold memory into transmitter work memory.

A	L	T	J					T	A	G		N	O	.	
	D	A	T	A		R	E	S	T	O	R	E	D		

DE READ
A
ID

A	L	T	J					T	A	G		N	O	.	
	W	O	R	K	I	N	G	•	•	•					

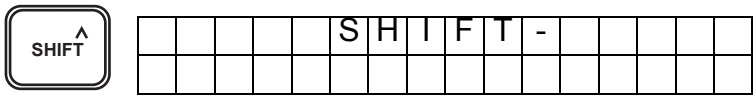
Confirm ID. If necessary, enter a new Tag no.

A	L	T	J					T	A	G		N	O	.	
L	I	N		G	P			T	1	2	3	4	5	6	7

3-2 : Verifying the product number (PROM NO) and software number

Verifying the product number (PROM NO)

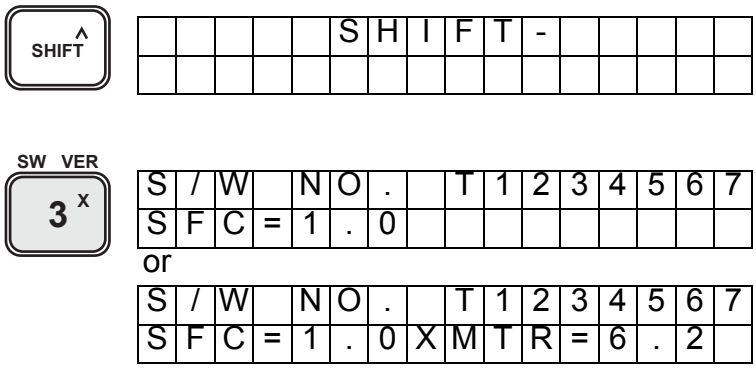
The product number can be found in the junction box and can be verified with the SFC using the following procedure.



Transmitter PROM NO is displayed on the bottom row. (The top row is for Tag no.)

Verifying the software version

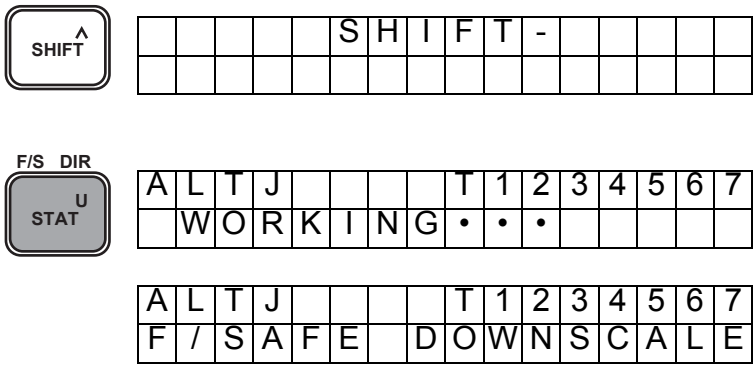
Software versions of SFC and transmitter can be verified using the SFC as follows:



When SFC is not connected to a transmitter, software version of only the SFC is displayed. When SFC is connected to a transmitter, software versions of both SFC and transmitter are displayed.

3-3 : Verifying the burnout protection direction

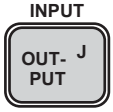
The burnout protection direction can be verified with the SFC using the following procedure.



3-4 : Constant-current source mode

The transmitter can be used as a constant-current signal source. For this mode of operation, proceed as follows with the SFC.

~Note
- *If the transmitter is in constant-current source mode, it will not operate as a transmitter.*
- *The constant-current output signal is as specified in terms of percentage (%).*



O	U	T	P	U	T			T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	1	0	.	0	0		%								

The output signal (%) currently being sent is displayed.

Setting the required output (%)

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	5	-						%							

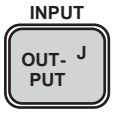
Enter the required output (%).

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	5	0	-				%								

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	5	0					%								#

"#" indicates that the transmitter is operating in constant current source mode (12 mA in this example).

Switching off the constant-current source mode



O	U	T	P	U	T			T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

To switch off the constant current source mode, press the OUTPUT key.

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	5	0	-				%								#

The output signal (%) is displayed.

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

Next, press the CLR key.

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	R	E	A	D	Y	•	•	•							

"#" will disappear indicating completion of constant current source mode termination.

3-5 : Preparation

Checking transmitter operation

Make sure that the objective transmitter loop is functioning normally.

Communication setup

Prepare a communication setup by connecting the SFC and a precision milliammeter to the transmitter junction box (or to a terminal box in the instrumentation room) as shown in "Figure 3-1 Communication setup".

~Note *Instead of the milliammeter, you may insert a precision resistor on the signal line and a digital voltmeter across the resistor. The signal current value can be established by measuring the voltage drop across the resistor. When this is done, note that the process control loop must be operating in manual mode lest the 4-20mA DC signal line should be disturbed by the digital signal of the SFC.*

For communication setup, proceed as follows:

(1) Remove the junction box cover.
(2) Connect the SFC leadwires to the tabs on the 4-20mA DC signal terminals, while correctly observing their polarity.
(3) Connect the milliammeter leadwires to the test terminals, which are located on the terminal block, while observing the polarity of the wires.

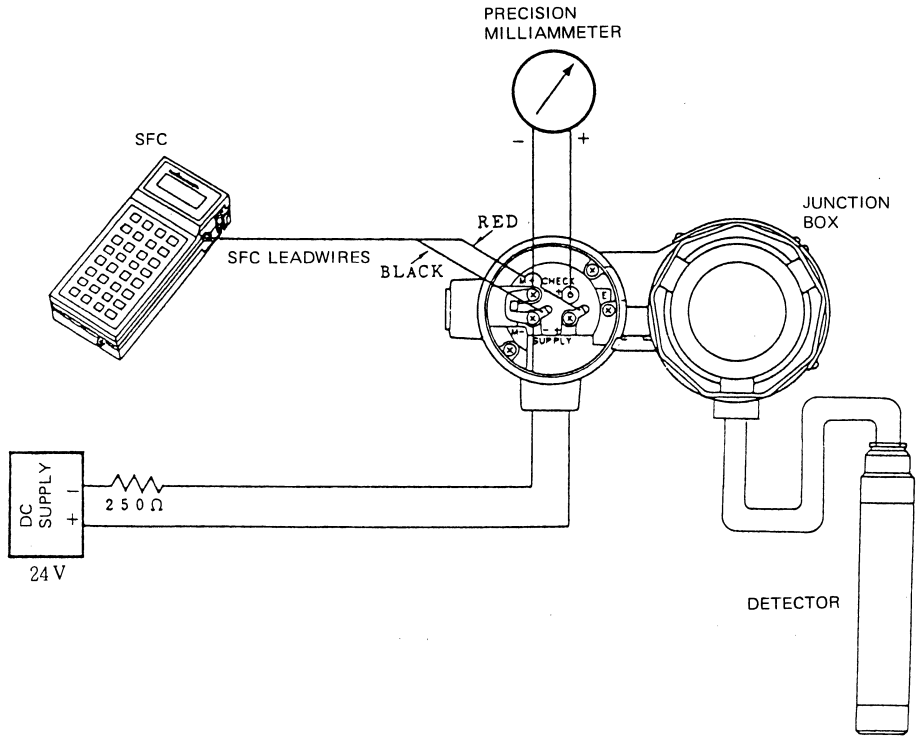


Figure 3-1 Communication setup

Communication test

After preparing a communication setup as described in "Communication setup" on page 3-13, check the setup once more to ensure that the setup has been properly prepared. Then, verify the parameters and perform communication for test.

~Note *After preparing a communication setup, first press the ID key to verify the tag no. of the transmitter. Unless this is done, none of the functions will operate.*

For the communication test, proceed as follows:

(1) Turn the SFC power switch on. The readout will indicate a prompt for setting the process control loop to manual mode. If it has not been set to manual mode, set it to manual mode.

L	O	O	P		I	N		M	A	N	U	A	L	?	

(2) Press the ID key, The type of output, type of transmitter (GP for gauge pressure transmitter), and tag no. will be displayed.

A	L	T	J					T	A	G		N	O	.	
	W	O	R	K	I	N	G	•	•	•					

A	L	T	J					T	A	G		N	O	.	
L	I	N		G	P			x	x	x	x	x	x	x	x

Type of output
Type of transmitter
Cursor

When the transmitter is shipped from its manufacturer, the tag no. is set to "xxxxxxxxx"

(3) If a message as shown below is displayed on the readout, communication was unsuccessful. In this case, diagnose the communication items as described in "Communication diagnosis" on page 3-15.

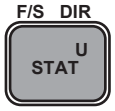
Example

A	L	T	J					T	1	2	3	4	5	6	7
N	O		X	M	T	R		R	E	S	P	O	N	S	E

Communication diagnosis

Check the condition of the communication setup as follows:

(1) Press the STAT key. The communication system will be automatically diagnosed.
(2) If a message other than “STATUS CHECK = OK” is displayed on the screen, refer to "Chapter 5 : Troubleshooting" and follow the necessary procedures.



A	L	T	J					T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

A	L	T	J					T	1	2	3	4	5	6	7
S	T	A	T	U	S		C	H	E	C	K	=	O	K	

or

A	L	T	J					T	1	2	3	4	5	6	7
		(Diagnosis message)													

next

A	L	T	J					T	1	2	3	4	5	6	7
S	T	A	T	U	S		R	E	C	E	I	V	E	D	

Note that the most probable causes of communication failure are:

- The communication setup is incorrect.
- The process loop is not operating normally.
- The detecting resistor connected between SFC and power source is more than 250Ω.

Verification of configuration data and output signal

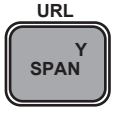
To make sure that the transmitter has been correctly setup, check the upper limit of the adjustable range and the configuration data.

Verifying the upper limit of adjustable range

To check if the range which is set for the transmitter is valid, verify the upper limit value of the adjustable range as follows:

- Displaying the upper limit value of the adjustable range of the transmitter.

					S	H	I	F	T	-					



R	A	N	G	E				T	1	2	3	4	5	6	7
	1	0	0	0	0			k	P	a					

• Check that the upper limit value specified as the configuration data is within the adjustable range of the transmitter. If the value is not within range, replace the transmitter with another transmitter which can handle a wider range.

Verifying the configuration data

Check the configuration data items by displaying them one by one on the SFC screen. If an incorrect item is found, correct it as required.

~Note *When performing this verification, a new range can be entered irrespective of the range which has already been calibrated.*

For configuration data verification, proceed as follows:

• Type of output, type of transmitter, and tag. no.

A	L	T	J					T	A	G		N	O	.	
	W	O	R	K	I	N	G	•	•	•					

A	L	T	J					T	A	G		N	O	.	
L	I	N		G	P			T	1	2	3	4	5	6	7

• Damping Time Constant

D	A	M	P	I	N	G		T	1	2	3	4	5	6	7
	1	.	0					S	E	C	O	N	D	S	

• LRV (Lower Range Limit Value)

L	R	V						T	1	2	3	4	5	6	7
	2	.	0					k	P	a					

• URV (Upper Range Limit Value)

U	R	V						T	1	2	3	4	5	6	7
	1	0	.	0				k	P	a					

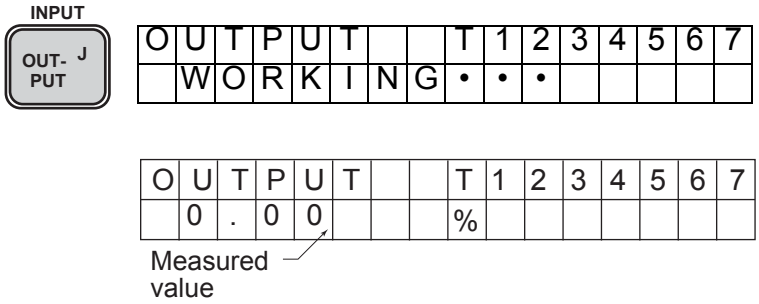
Verifying the output signal

Set the transmitter to constant-current mode and check its output signal at 0% and 100%.

~Note *Make sure that the transmitter output is being correctly received by the receiver instrument.*

To verify the output signal, proceed as follows:

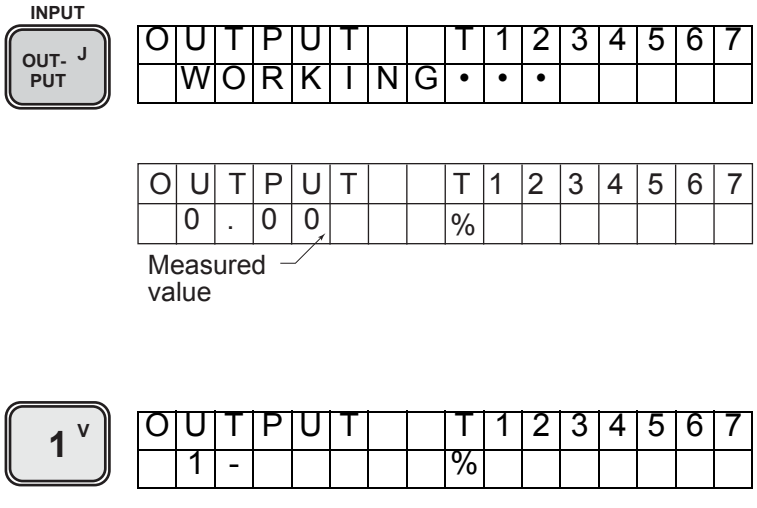
(1) Set the transmitter to constant-current mode and let it deliver a 0% output signal.



(2) Check that the value displayed on the screen conforms with a 0% signal (4mA).

~Note *The "#" mark means that the transmitter is in constant-current mode.*

(3) Set the transmitter to constant-current mode and let it deliver a 100% output signal.



ACT PR
0 Z

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	1	0	-					%							

ACT PR
0 Z

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	1	0	0	-				%							

NON-VOL
ENTER (Yes)

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	1	0	0	.	0	0		%							

(4) Check that the value displayed on the screen conforms with a 100% signal (20mA)
(5) After verifying the above, exit the constant-current mode. If there are any abnormalities, proceed by referring to "Chapter 5 : Troubleshooting" or "3-6 : Calibration".

INPUT
OUT- PUT J

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	1	0	0	.	0	0		%							#

CLR (No)

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

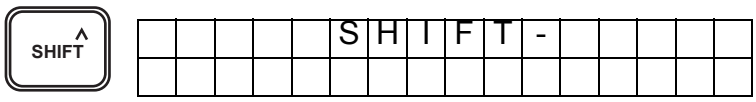
O	U	T	P	U	T			T	1	2	3	4	5	6	7
	R	E	A	D	Y	•	•	•							

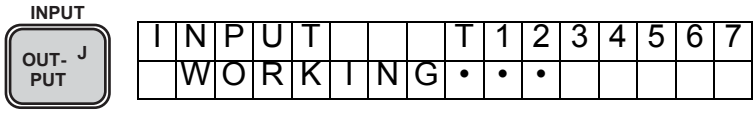
~Note *The "#" mark will disappear, indicating that the transmitter is no longer in constant-current mode.*

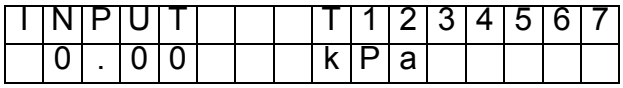
Adjustment prior to operation

Before starting transmitter operation, verifying the input and output.

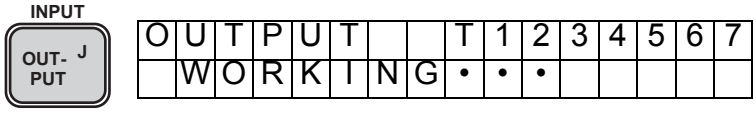
(1) Read the input on the SFC.

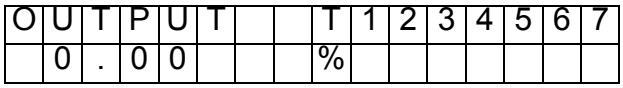






(2) Read the 0% output on the SFC and also on the milliammeter, and check that the two readings conform.





(3) If the above two readings of (1) and (2) do not correspond, correct them with the SFC as follows:
Apply to the transmitter the actual process pressure. Check the input/output relationship by reading the input and output from the SFC (or by reading the output from the milliammeter). If they do not conform, verify the transmitter has been properly installed. If no satisfactory relationship is obtained between input and output, check all items of the configuration data base and check the range of the transmitter. If the problem persists, refer to "Chapter 5 : Troubleshooting".

Starting operation

The level meter will start operating as you turn on the POWER switch on the power supply box. When the switch is initially turned on or it is turned on after it has been turned off for approximately 1 second or more, the output will be approximately 12mA for several seconds and then it will become the value corresponding to the input.

3-6 : Calibration

This section covers the procedure for the calibration of the ALTJ3000 Transmitter. From the viewpoint of the measuring accuracy, it is best to calibrate the transmitter at the range which will be used for process control. Allow a stabilization period of approximately 30 minutes before starting calibration.

Calibration setup

For the calibration of the transmitter, prepare the following instruments.

- Standard input signal source, accuracy 0.04% FS or better
- Milliammeter or voltmeter, accuracy 0.03% FS or better (including accuracy of resistor used for current measurement by voltage drop)
- SFC
- Prepare a test setup as shown in Figure 3-2. Perform a communication test as described in "Communication test" on page 3-14 to verify that the SFC and the transmitter are connected for the correct communication status.

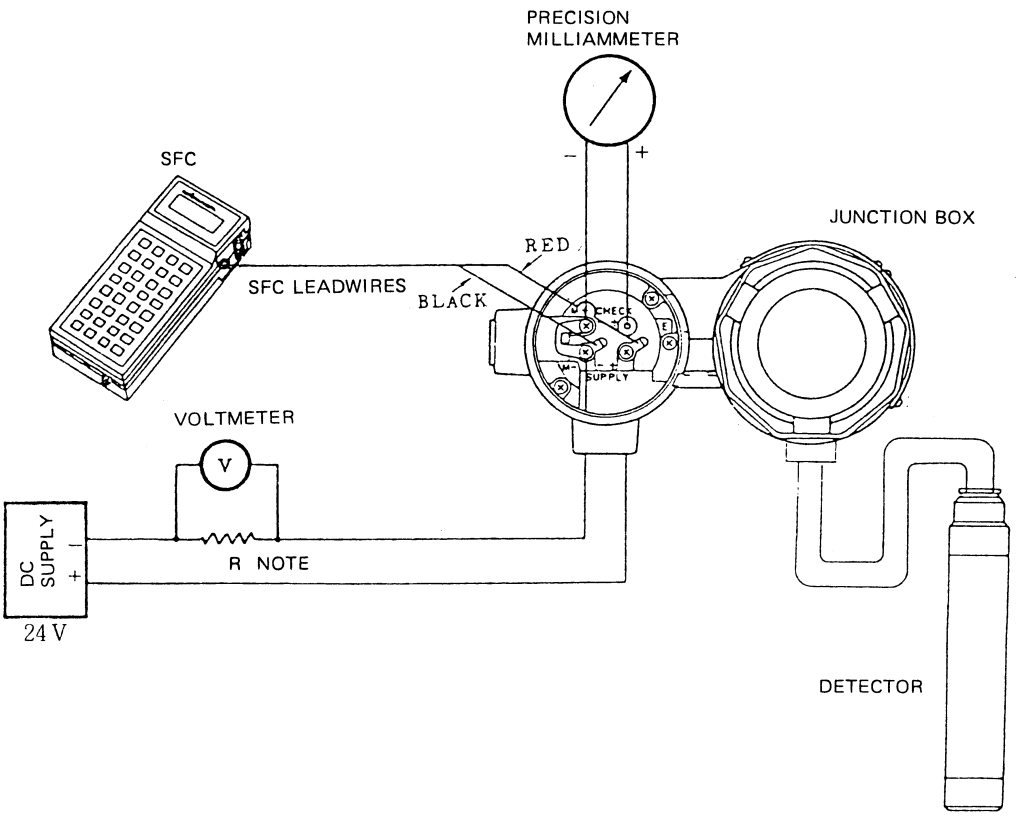


Figure 3-2 Calibration setup

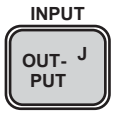
Check the configuration data items as described in "Entering configuration data" on page 3-2.

Calibration of output signal

Calibrate the output circuit (D/A converter) of the transmitter as described in this section.

Calibrating a 0% output signal

Setting data for 0% from the keypads.



O	U	T	P	U	T			T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	0	.	0	0				%							#

The current output signal error (%) will be displayed.

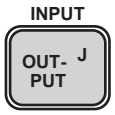
O	U	T	P	U	T			T	1	2	3	4	5	6	7
	0							%							

Enter “0” with the keypad.

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	0	.	0	0				%							#

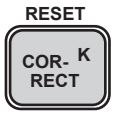
The transmitter will operate as a constant current signal source mode of 0%.



O	U	T	P	U	T			T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	0	.	0	0				%							#

The current output is 0%.



A	L	T	J				T	1	2	3	4	5	6	7	
C	O	R	R	E	C	T		D	A	C		Z	E	R	#

By pressing the CORRECT key, the output current is automatically calibrated to 0%.

If the meter reading is lower than 4mA or IV (with a voltage drop resistor of 250 ohms), proceed as follows:

A	L	T	J					T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

A	L	T	J					T	1	2	3	4	5	6	7
I	N	C	R	E	A	S	E	D		4	m	A			#

Gradually increases the output.

If the meter reading is higher than 4mA or 1V (with a voltage drop resistor of 250 ohms) proceed as follows:

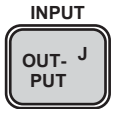
A	L	T	J					T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

Gradually decreases the output.

A	L	T	J					T	1	2	3	4	5	6	7
D	E	C	R	E	A	S	E	D		4	m	A			#

Calibrating a 100% output signal

Setting data for 100% from the keypads.



O	U	T	P	U	T			T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

The output signal of 0% will be displayed.

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	0	.	0	0				%							#

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	1	-						%							#

Enter “100” with the keypads.

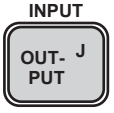
O	U	T	P	U	T			T	1	2	3	4	5	6	7
	1	0	-					%							#

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	1	0	0	-				%							#

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

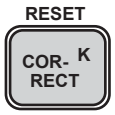
O	U	T	P	U	T			T	1	2	3	4	5	6	7
	1	0	0	.	0	0		%							#

The transmitter will operate as a constant current signal source mode set to 100%.



O	U	T	P	U	T			T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	1	0	0	.	0	0		%							#



O	U	T	P	U	T			T	1	2	3	4	5	6	7
C	O	R	R	E	C	T		D	A	C		S	P	A	#

As you press the CORRECT key, the output current is automatically calibrated at 100%.

If the meter reading is lower than 20mA or 5V (with a voltage drop resistor of 250Ω), proceed as follows:

A	L	T	J					T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

Gradually increases the output.

A	L	T	J					T	1	2	3	4	5	6	7
I	N	C	R	E	A	S	E	D		4	m	A			#

If the meter reading is higher than 20mA or 5V (with a voltage drop resistor of 250Ω), proceed as follows:

A	L	T	J					T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

Gradually decreases the output.

A	L	T	J					T	1	2	3	4	5	6	7
D	E	C	R	E	A	S	E	D		2	0	m	A		#

After adjusting the output signal at 0% and 100%, save the data into the nonvolatile memory (NVM) with the procedure described below.

~Note

- *Data saved in the NVM of transmitter is not lost even if the transmitter power is turned off. The data in the transmitter work memory can be saved with a priority into the NVM.*
- *Even when a no save command is given, data of transmitter work memory is automatically saved into NVM within approximately 30 seconds after modifying of any item of work memory data. Note, however, that the current signal may be disturbed temporarily when this is being performed.*

					S	H	I	F	T	-					

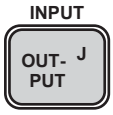
A	L	T	J					T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

Data is saved in NVM. It takes approximately 8 seconds.

A	L	T	J					T	1	2	3	4	5	6	7
D	E	C	R	E	A	S	E	D		2	0	m	A		#

End of data save.

To reset the transmitter from constant-current mode, proceed as follows:



O	U	T	P	U	T			T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	0	.	0	0				%							#

The current output level is displayed.

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

Resetting from constant current mode.

A	L	T	J					T	1	2	3	4	5	6	7
	R	E	A	D	Y	•	•	•	•						

Resetting complete.

~Note *The "#" will disappear, indicating that the transmitter has been reset from the constant-current mode.*

Range calibration

To calibrate the zero point and span with the LRV and URV, observe the instructions given in this section.

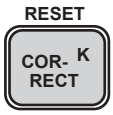
Calibrating the LRV

To calibrate the LRV (lower range limit value), apply to the transmitter a reference input pressure corresponding to the LRV. Calibrate the LRV for the transmitter with the SFC. If the reference input pressure does not correspond to the LRV, adjust the reference input pressure so that it accurately corresponds to the LRV.

~Note *Even when calibrating an inverted span for the transmitter, be sure to calibrate the LRV first and then the URV.*

L	R	V						T	1	2	3	4	5	6	7
	2	0						k	P	a					

The LRV stored in transmitter memory is displayed.



L	R	V						T	1	2	3	4	5	6	7
		C	O	R	R	E	C	T		L	R	V	?		

The SFC will ask you whether the LRV is to be calibrated with the reference input pressure or not.

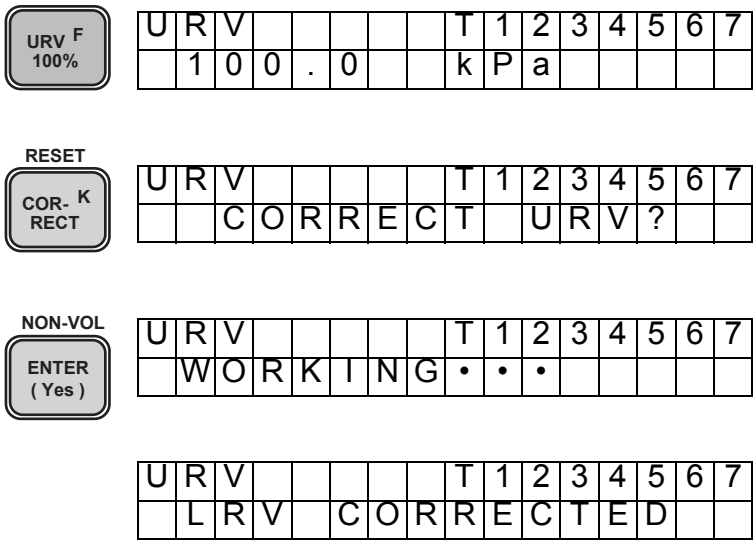
L	R	V						T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

As you press the Enter key, the LRV will be calibrated with the reference input pressure (for zero point calibration).

L	R	V						T	1	2	3	4	5	6	7
	L	R	V		C	O	R	R	E	C	T	E	D		

Calibrating the URV

To calibrate the URV (upper range limit value), apply to the transmitter a reference input pressure corresponding to the URV. Calibrate the URV for the transmitter with the SFC. If the reference input pressure does not correspond to the URV, adjust the reference input pressure so that it accurately corresponds to the URV.



The URV stored in transmitter memory is displayed.

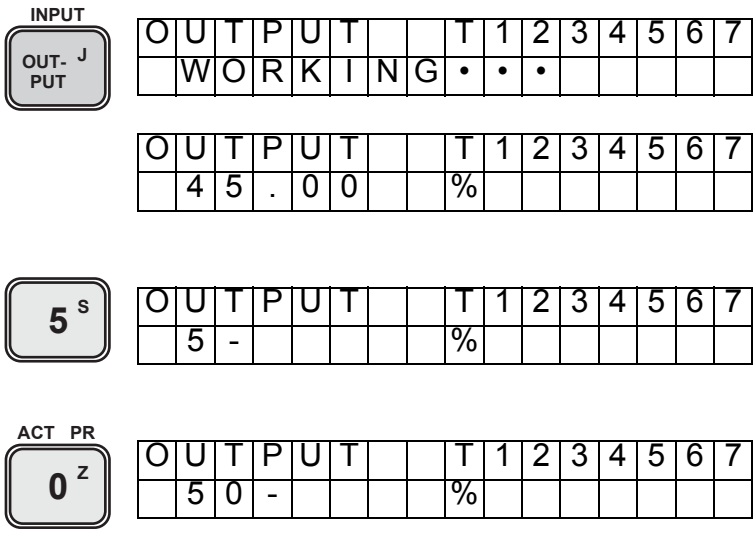
The SFC will ask you whether the URV is to be calibrated with the reference input pressure or not. As you press the ENTER key, the URV will be calibrated with the reference input pressure (for span calibration).

After the above calibration of the LRV and URV are finished, save the data into the nonvolatile memory (NVM). Refer to Note on page 3-4.

Adjusting the zero point for liquid level measurement

For liquid level measurement, the zero point can be easily set to an intermediate point along the span (such as at the 50% point of the span) with the following procedure:

Read the actual liquid level on the level gauge in the field. (In the following example, it is assumed that the zero point is to be set to the 50%-point of the original span.)



Assume that transmitter is currently 45% of the span.

Enter 50% with the keypads.

O	U	T	P	U	T			T	1	2	3	4	5	6	7
	S	E	T	,	R	E	Q		L	E	V	E	L	?	

The SFC will ask you whether to set the zero point to the 50% point of the original span.

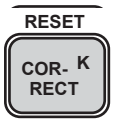
O	U	T	P	U	T			T	1	2	3	4	5	6	7
	5	0	.	0	0			%							

The zero point has been set at the 50% point of the original span.

Erasing calibration data

If incorrect data has been entered by mistake, it can be corrected as follows:

					S	H	I	F	T	-					



A	L	T	J					T	1	2	3	4	5	6	7
R	E	S	E	T		C	O	R	R	E	C	T	?		

The SFC will ask you whether the entered data (calibration value or setting value) is to be reset for correction or not.

A	L	T	J					T	1	2	3	4	5	6	7
	C	O	R	R	E	C	T	S		R	E	S	E	T	#

Data has been reset for correct entry.

Chapter 4 : Maintenace

This section covers the calibration, adjustment, disassembly and reassembly procedures of a level meter for maintenance and inspection.

The components of a level meter are constructed as a single unit for ease of inspection and maintenance. Inspect the sealing of the transmitter and check that the O-rings are in the good condition and no water has gotten into the transmitter at regular intervals depending on the conditions of use.

4-1 : Disassembly and reassembly

To disassemble or reassemble the instrument to check sealing, to replace parts or to clean the instrument, proceed as explained in this section.

Disassembling the transmitter

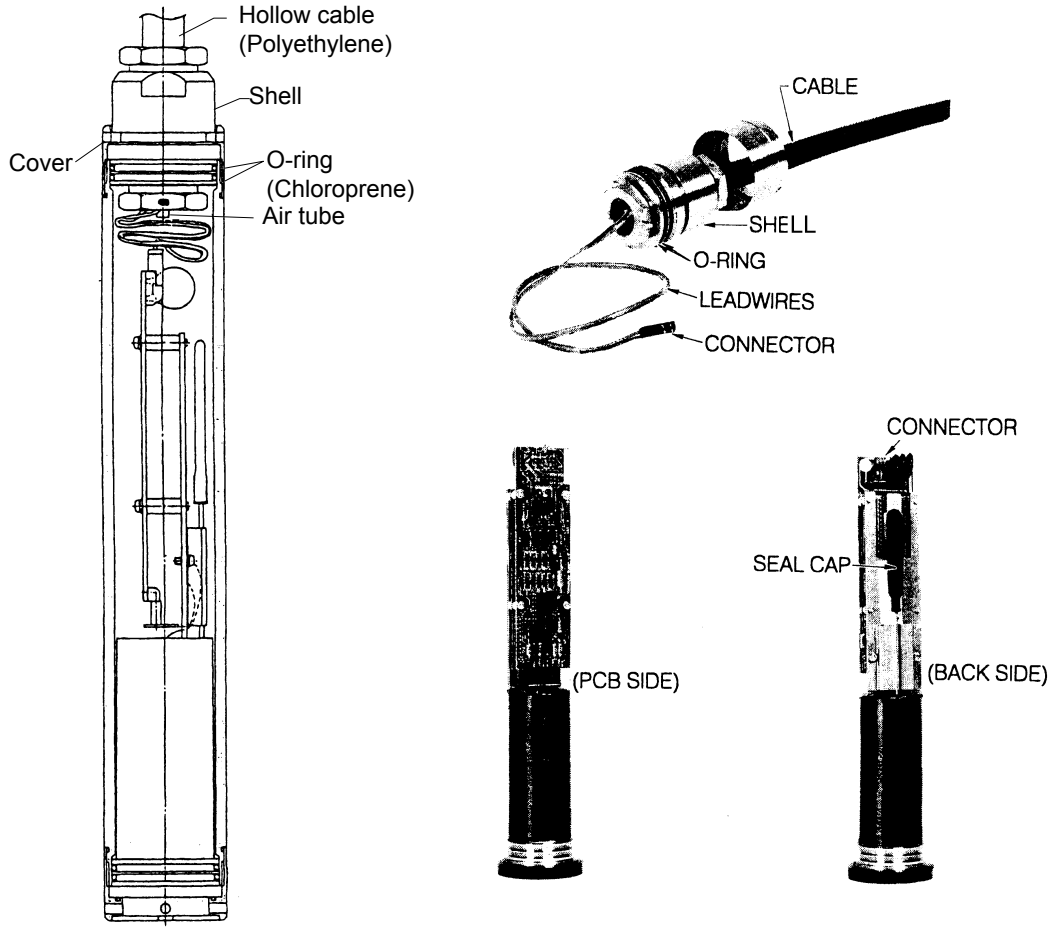


Figure 4-1 Construction of the transmitter

Avoid disassembling the transmitter if it is possible so it remains water tight.

Be sure to turn off the power before starting to disassemble the transmitter.

If the transmitter has been immersed in water, wipe it dry with a cloth before starting to disassemble it.

• Removing the Sink

(1) Loosen the two nuts on the sides of the sink,

(2) Loosen the bolts and pull out the transmitter from the sink.

• Disconnecting the Transmitter Cable

(1) Remove the transmitter's top cover by turning it.

(2) Pull out the shell slowly and carefully. While doing this, do not rotate the shell more than one turn.

(3) Disconnect the connector for the internal PC board of the transmitter. When doing this, be sure to hold the connector itself. Never attempt to disconnect it by pulling its leadwires lest they should be broken.

• Removing the Body and Housing

(1) Remove the transmitter's bottom cover by turning it.

(2) Pull out the body slightly from the housing by prying it with a screwdriver or another appropriate tool with the tool in the groove shown in Figure 4-2. When the body has been pulled out of the housing to a point it can be held by hand, slowly and carefully remove the body from the casing. Exercise care so that no large force is applied to the diaphragm lest it should become damaged.

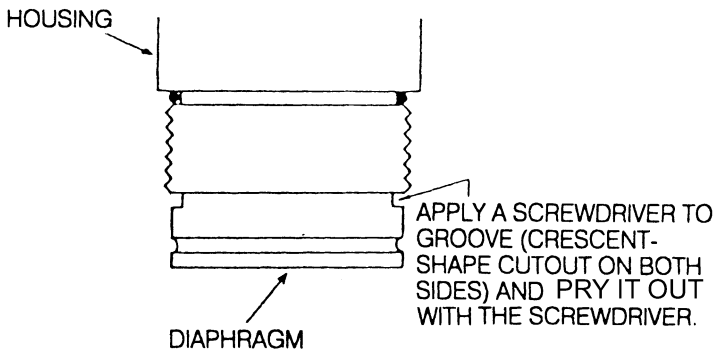


Figure 4-2 Removing the body from the housing

Reassembling the transmitter

When reassembling the transmitter, check that the O-rings and their mating surfaces are clean. If they are dirty, clean them with a clean cloth and apply silicone oil sparingly. If they have any signs of damage, replace them with new ones.

• Reassembling of Body and Housing

(1) Insert the body into the housing until the flanged section of the body touches the housing. When doing this, position the end of the seal cap directed upward as shown in Figure 4-3.

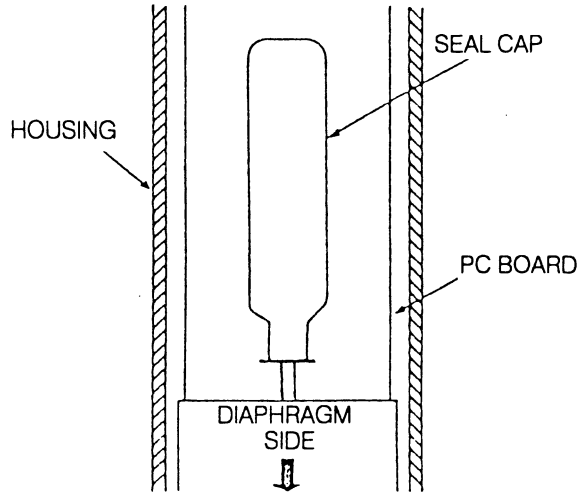


Figure 4-3 Reassembling the body and housing

(2) Fix the covers until the O-rings become completely hidden.

• Reconnecting the cable

(1) Connect the connector of the end of the leadwires to the connector in the transmitter.

(2) Lay the leadwires in the transmitter, in such manner that they will not be caught by internal components of the transmitter in future disassembling.

(3) Insert the shell in the housing until the flanged section of the shell touches the housing.

(4) Fix the cover securely until the O-ring of the housing becomes completely hidden.

(5) For an airtightness test, proceed as follows:

- Apply an air pressure of 50 to 100 kPa {0.5 lo 1 kg/cm^2} to the air tube of the transmitter cable from its end of the junction box side,
- Submerge the entire transmitter in water and check that no air bubbles come out of the transmitter.

~Note *The sensor may be damaged if an unreasonably large pressure is applied to it. Never apply to the air tube a pressure higher than 100 kPa (1 kg/cm^2}.*

Disassembling the junction box

- Removing the Covers

  Remove the covers of the junction box and terminal box by turning the covers.

- Removing the Meter (optional meter) (See Figure 4-4 and Figure 4-5 and Table 4-1.)

  (1) Make sure that the power has been turned off.

  (2) Disconnect connector A (of the two wires which run from the meter) from pins B on the PC board of the terminal block.

  (3) Disconnect connector C (of the two power supply wires which run from the terminal board) from pin D of the meter.

  (4) Loosen the two fixing-screws of the meter and remove the meter from the bracket of the PC board. (When installing the meter, follow the above procedure in the reverse order.)

  (5) If you want to operate the instrument with the meter removed, connect connector C directly to pin B.

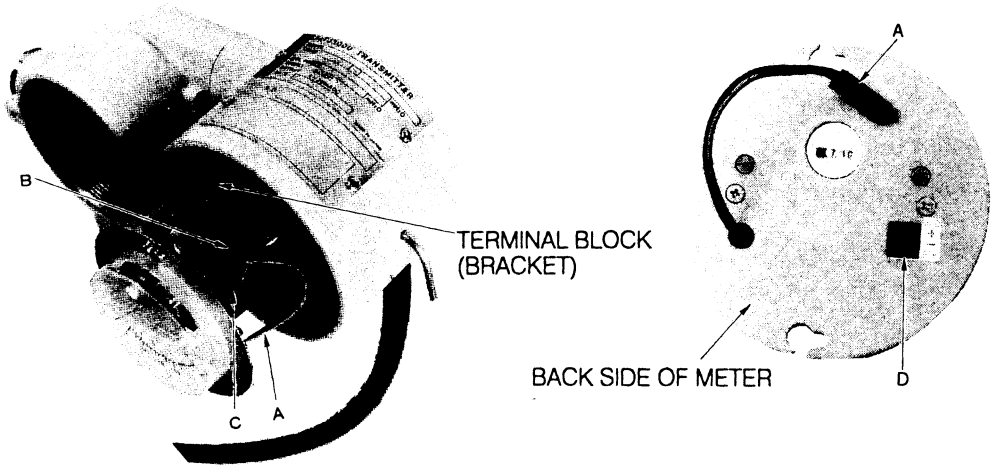


Figure 4-4 Removing the indicating meter

Table 4-1 Connections of connectors and pins

Without meter	With meter
Connect C to B	Connect A to B Connect C to D

~Note *When connecting a connector to pins, be sure to connect them to the correct polarity by adherring to the "RED+' and "BLK-" markings on the pin label. (See "Table 4-1 Connections of connectors and pins".)*

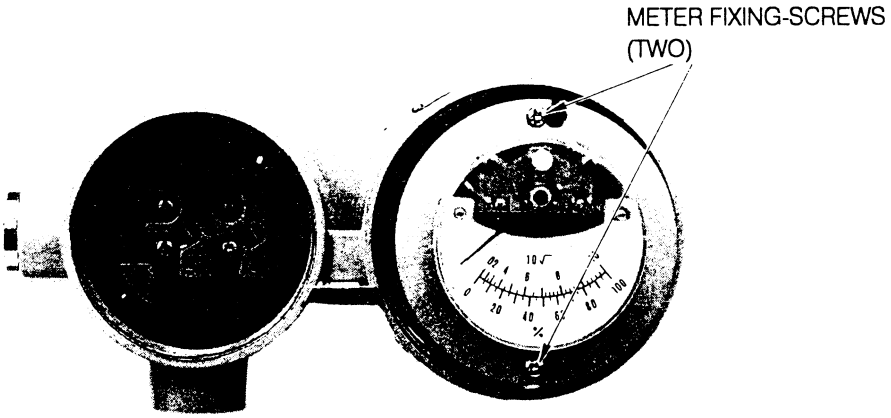


Figure 4-5 Locations of meter fixing-screws

Disconnecting the transmitter cable

(1) Remove the screws from the terminal block and disconnect the leadwires from the terminal block.

(2) Disconnect the rubber tube which connects the air tube to the atmospheric vent pipe of the junction box. (See "Figure 2-5 Connection with rubber tube" on page 2-6.)

(3) Pull out the air tube through the fixing-hole of the bracket.

(4) Loosen with a wrench, the hex gland at the end of the transmitter cable inlet nipple on the junction box rear panel. Carefully pull out the transmitter cable. (See "Figure 2-2 Rear view of the terminal box" on page 2-2.)

Removing the terminal block bracket (Figure 4-6)

(1) Turn off the instrument power.

(2) If a meter is provided, proceed as follows: If the meter is required to be removed, remove it by following the procedure in. If the meter is not required to be removed, disconnect from the meter pins the connector of the two power supply wires which run from the terminal board.

(3) If no meter is provided, disconnect from the PCB pins the connector of the two power supply wires which run from the terminal board.

(4) Loosen the two bracket fixing-screws and pull out the bracket carefully from the case.

Removing the terminal board (Figure 4-6)

To remove the terminal board, remove its three fixing-screws (a, b and c). The PCB (for noise damper and lightning surge arrester) and the leadwires for connection to the meter and terminal block are provided on the back side of the terminal board. Exercise care so that these components do not come into contact with other components when removing the terminal board.

The metal plate, which is located on the back of the terminal block and on which the through-type capacitor is installed, acts also as a grounding plate. Exercise care so that the plate does not become deformed.

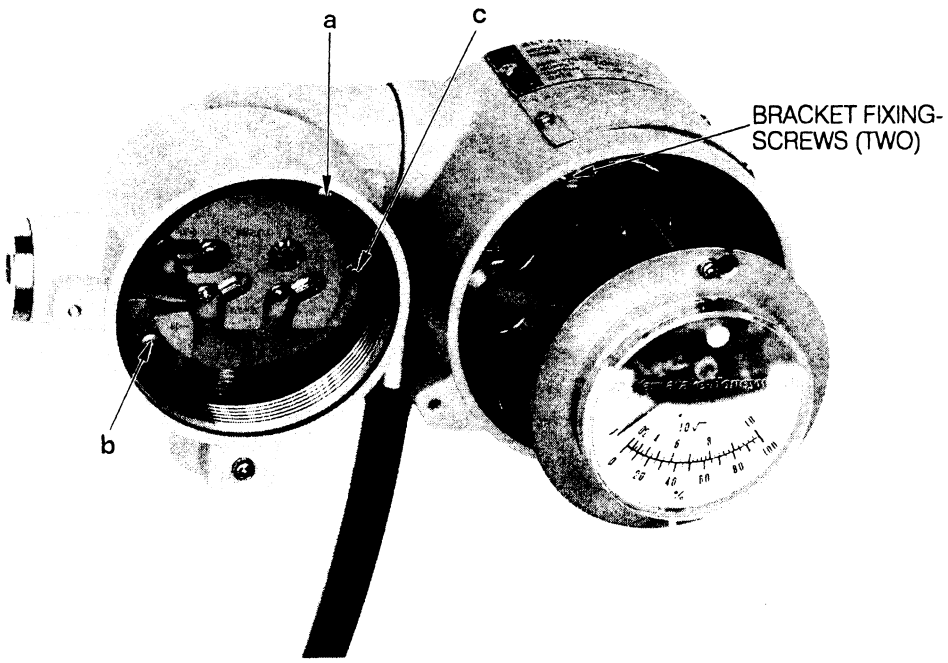


Figure 4-6 Locations of bracket and terminal board fixing-screws

Removing the transmitter cable inlet nipple

(1) Remove the bolt and washer with which the transmitter cable inlet nipple is fixed to the case.

(2) Carefully pull out the nipple from the back of the case.

Reassembling the junction box

The reassembly procedure of the junction box basically is the reverse of its disassembly procedure. To reassemble the junction box, refer to " Disassembling the junction box" on page 4-4 and proceed as follows:

• Installing the Transmitter Cable Inlet Nipple

(1) Carefully insert the transmitter cable inlet nipple from the back of the case.

(2) Fix the nipple with its bolt and washer,

Tightening torque; l2.5±1.9N-m (125± 19 kgf-cm)

• Installing the Terminal Board

Connect the red leadwire and black leadwire (Figure 4-4) from the terminal box to the main unit of the junction box. Replace the terminal board to its original position while pulling the leadwires, and fix the terminal board with the three screws.

When fixing the terminal board, you may find that the metal plate (earth plate) on the back of the terminal board is bent into a shape of a slightly open angle. The

open angle of the plate is for contacting (grounding) by using the plate as a leef spring by employing its elasticity. Be sure that the earth plate contacts the case with elasticity. Pay attention so that no leadwires are caught on the earth plate.

Tightening torque: 1.2±0.1 $N \cdot m$ {12 + 1 $kgf \cdot cm$}

• Terminal Block Bracket

(1) Fix the bracket to the case with the two screws.

Tightening Torque: 1.2 $N \cdot m$ {12 $kgf \cdot cm$}

• Connecting the Transmitter Cable

(1) Lead the three leadwires and air tube of the transmitter cable to the front of the case through the cable inlet nipple on the back of the case, exercising care not to damage the leadwires.

(2) Pull the leadwires from the front and carefully pass the sheathed end of the transmitter cable to the point where the sheathed end stops in the transmitter cable connector shell, exercising care so that no leadwires are not caught.

(3) Fix the transmitter cable by lightening the hex gland at the end of the transmitter cable connector (inlet nipple).

(4) Fix the leadwire to the terminal block with the screws.

(5) Pass the air tube through the fixing-hole of the terminal block bracket.

(6) Connect the air tube and the atmospheric vent pipe of the junction box with the rubber tube. Be sure to connect them securely,

• Installing the Meter

(1) If a meter is to be used, install it by referring to “ Disassembling the junction box” on page 4-4”

Tightening torque of meter fixing-screws: 0.6 ± 0.1 $N \cdot m$ {6 ± 1 $kgf \cdot cm$}

(2) If a meter is not to be used, connect the connector of the two power supply wires (which run from the mounting board) to the plug of the PCB.

• Installing the Covers

Securely install the covers of the main body and junction box, making sure that the O-rings are accurately positioned and properly flattened.

4-2 : Inspection

Insulation resistance test and withstanding voltage test

⚠ CAUTION

As a rule, do not perform an insulation resistance test and a withstanding voltage test on the level meter lest the lightning arresters incorporated in the transmitter, junction box and power supply box should be damaged.

If such tests are unavoidable, proceed as explained in this section.

(1) Disconnect all external connections for the instruments,
(2) The test points are as follows:
Transmitter:

If a transmitter cable with an air tube is provided:

The shield wire between the conductors (two core wires).

If the transmitter alone is to be tested:

Between connector terminals and the transmitter's casing or sensor bracket.

Junction box: Between GND terminal and other terminals

Power supply box: Between GND terminal and other terminals

(3) For test voltages and judgement references, see Table 4-2. To protect the instruments against any damage, do not apply any voltages higher than those stated in the table.

Table 4-2 Limit value of test

	Insulation resistance test	Withstanding voltage test
Transmitter and junction box	20MW or over, with 25V DC	50V AC, 1 minute, current setting 2mA
Power supply box	(Junction box terminal, output terminal) 20MΩ or over, with 25VDC	(Junction box terminal, output terminal) 50V AC, 1minute, current setting 2mA
	(AC terminal) 30 MΩ or over, with 250V DC	(AC terminal) 200 V AC, 1 minute, current setting 1mA

Checking the lightning arrester of the junction box

The lightning arrester of the junction box employs zinc oxide varistors of large surge withstanding capacity and they rarely deteriorate. To check the lightning arrester for periodical inspection or other maintenance, proceed as follows:

(1) Disconnect all of the following external connections of the junction box.
- External wiring for terminal board
- Connections of terminal block for transmitter
- If a meter is provided, the 2-pin connector of the meter board

(2) Prepare a test setup for each varistor as shown in Figure 4-7 (RV1), Figure 4-8 (RV2) or Figure 4-9 (RV3), and feed a 1mA DC current and check the voltage across each of the zinc oxide varistors to be tested. The varistors are normal if the voltage reading is within 74 to 90V.

~Note **: Be sure to connect the 1kΩ resistor for protection.*

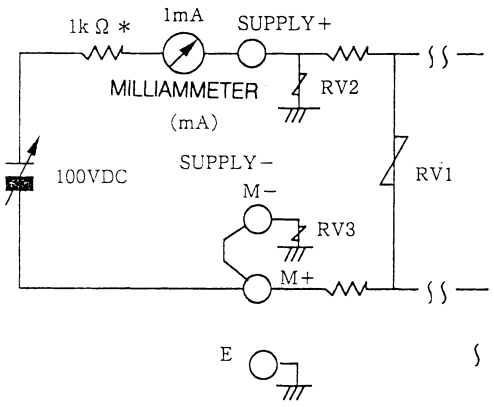


Figure 4-7 Test setup for RV1

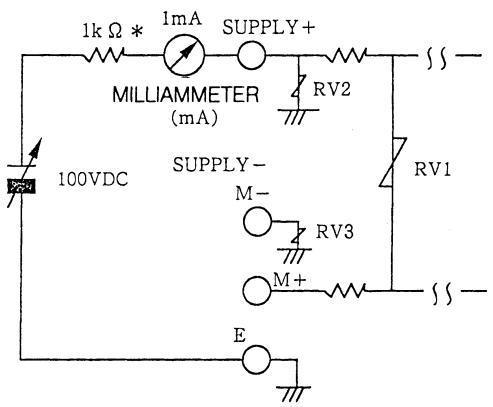


Figure 4-8 Test setup for RV2

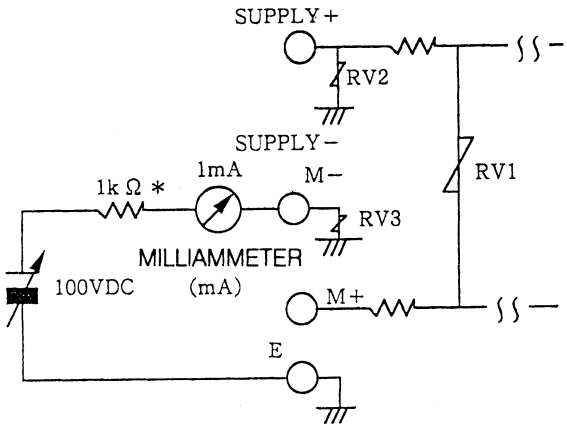


Figure 4-9 Test setup for RV3

Table 4-3 Varistors

Varistor	Dwg.No.	Voltmeter connection points	
		+	-
RV1	8.7	SUPPLY+	M +
RV2	8.8	SUPPLY+	E
RV3	8.9	SUPPLY-	E

~Note *To check VR2 or VR3, disconnect the jumper from between M+ and M-.*

(3) If the voltage reading is not within the tolerance stated above, replace the terminal board (PC board).

Recommended spare parts

Table 4-4 Recommended spare parts

Parts	Replacement period*
Seal cap	Every 2 years
O-ring	When disassembling transmitter.
Rubber diaphragm	Every 2 years / wherever removed

~Note * *Depending on temperature or measuring fluids, it the replacement period might be shortened.*

4-3 : Muddy-water and seawater transmitters

The muddy-water and seawater transmitters (optional specification -P) have at their ends an additional rubber diaphragm protector unit in order to protect the metallic seal diaphragm (metallic pressure-sensing diaphragm) against solid particles and other harmful substances contained in the measured water. To disassemble and reassemble the protector unit for cleaning or for the replacement of the rubber diaphragm or other parts, proceed as explained in this section,

Disassembly

(1) Remove the fixing-screws (six) from the end of the transmitter.
(2) Remove the retainer ring and then remove the rubber diaphragm- (See Figure 4-10.)
(3) Remove the cover by turning it.

~Note *Exercise care not to damage the metallic diaphragm when disassembling the unit.*

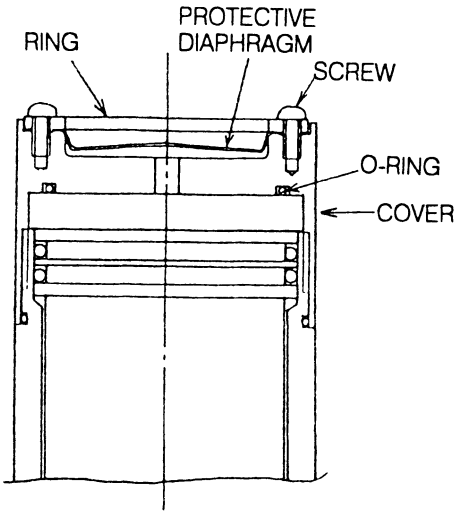


Figure 4-10 Transmitter with diaphragm protector

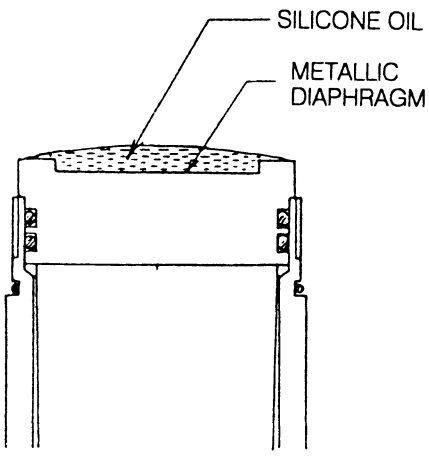


Figure 4-11 Applying silicone oil on metallic diaphragm

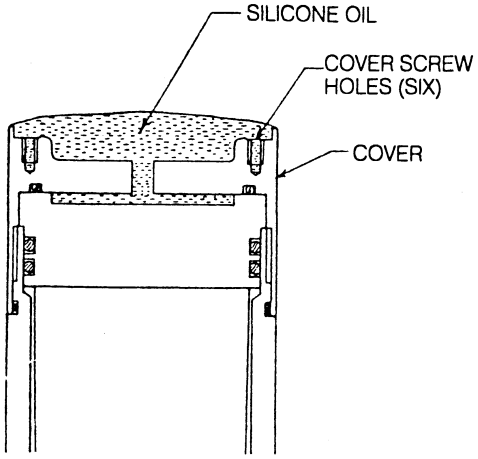


Figure 4-12 View of transmitter's end with cover on.

Reassembly

(1) Position the transmitter with its end facing upright. Pour silicone oil or distilled water into the metallic diaphragm until it overflows. (See Figure 4-11.)
(2) Install the cover. By using a syringe or some other tool, inject silicone oil or distilled water until it overflows. (See Figure 4-12.)

~Note *Be careful not to damage the O-ring when installing the cover.*

(3) Air may be entrapped in the screw holes of the cover. Expel such air by using a needle or some other pointed tool.
(4) While paying attention so that no air is entrapped underneath the protective rubber diaphragm, place it carefully onto the cover.
(5) Place the retainer ring and fix it with the fixing-screws (six).

Tightening torque: $0.63 \pm 0.1\ N \cdot m\ \{63 \pm 1\ kgf \cdot cm\}$

~Note
- *Pay attention so that no air is entrapped between the protective rubber diaphragm and the metallic diaphragm.*
- *Be sure that the center of the protective rubber diaphragm is higher by approximately 1 mm than its peripheral, (See Figure 4-10.)*

Calibration

Calibrate the transmitter by referring to “3-6 : Calibration” on page 3-20.

4-4 : Diagnosis

The SFC and ALTJ3000 perform diagnosis constantly, regardless of whether they are in normal running status or in communication status. The diagnosed items include the functions and statuses of the control loop and communication link between the SFC and transmitter.

Diagnosed items

The items subjected to diagnosis can be classified into four categories as given below.

Non-critical failures

Operation

- The functions commanded by the SFC remain enabled.
- The transmitter tag number is displayed on the top row of the LCD screen and an error message on the bottom row. At the same time, a "#" mark appears in the 16th column of the bottom row.

Messages

Messages	Description
CORRECT RESET #	Recalibration is necessary to attain the required accuracy.
EXCESS ZERO CORR #	The calibration value for zero is too large (shift is larger than characterization).
EXCESS SPAN CORK #	Span correction is too large (shift is larger than characterization).
M-B. OVERLOAD OR METER BODY FAULT #	The input pressure is greater than 2 times the allowable range or the detector has failed.
SENSOR OVER TEMP#	The sensor temperature is too high.
STATUS UNKNOWN #	Status is unknown.

Critical failures

Operation

- Even if a critical status for the transmitter is detected, the ID, OUTPUT, and STATUS functions remain operable,
- The critical status message is displayed for 3 seconds and then the PRESS STATUS message is displayed,
- The transmitter tag number is displayed on the upper row of the LCD screen and an error message on the bottom row,
- The output is driven high beyond the full scale.

Messages

Messages	Description
CHAR FROM FAULT	PROM failure
ELECTRONIC FAULT	Electronics module failure
METER BODY FAULT	Detector has failed
SUSPECT INPUT	The input may be incorrect.

Communication errors

Operation

- The functions commanded by communication are disabled.
- Communication error messages are displayed alternately at 2-second intervals.
- Message “NO RESPONSE” is displayed on the top row of the LCD Screen and an error message on the bottom row.

Messages

Messages	Description
FAILD COMMCHK	Communication is unsuccessful.
HI RES/LO VOLT	The loop load resistance is too large or the supply voltage is too low.
ILLEGAL RESPONSE	Communication failure between SFC and transmitter.
INVALID REQUEST	The request is invalid.
LOW LOOP RES	The loop resistance is too low.
NO XMTR RESPONSE	No response by transmitter.

Invalid key entry errors

Operation

- The functions which are commanded by invalid SFC key entries are disabled.
- Nothing is displayed on the top row of the LCD screen and an error message is displayed on the bottom row.

Messages

Messages	Description
ENTRY > SEN RANGE	Range setting has been attempted with a value greater than 1.5 times the high limit value.
EXCESSIVE OUTPUT	The value set for constant-current source is beyond the allowable range.
KEY NOT ALLOWED!	Invalid key operation
> RANGE	The result of calculation by SFC is greater than which can be displayed.

Diagnosis Procedure

Connect the SFC to the transmitter and check the status of the transmitter with the procedure described in the following.

A	L	T	J					T	1	2	3	4	5	6	7
	W	O	R	K	I	N	G	•	•	•					

Details of failure status of the transmitter sensor section are not displayed. Deduce them from the statuses of the diaphragm and sensor.

A	L	T	J					T	1	2	3	4	5	6	7
S	T	A	T	U	S		C	H	E	C	K	=	O	K	

The transmitter and SFC are operating normally.

or

A	L	T	J					T	1	2	3	4	5	6	7
S	E	N	S	O	R		O	V	E	R	T	E	M	P	#

The current status of the transmitter is displayed. For the meaning of the messages, refer to " Messages" on page 4-16.

then

A	L	T	J					T	1	2	3	4	5	6	7
S	T	A	T	U	S		R	E	C	E	I	V	E	D	.

This means that the messages have ended. When you press the “STAT” key again, the last message will be displayed again. When there are two or more error messages, they are displayed alternately at 5-second intervals.

Display messages

When either of these three messages are displayed the current display on the SFC will be interrupted.

Message	Description	Action
A L T J T 1 2 3 4 5 6 7 C R I T I C A L S T A T U S	For message meanings, refer to “ Messages” on page 4-16.	Press the “STAT” key and refer to “ Messages” on page 4-16.
: :	The colon means that the SFC battery is running low	Charge the battery.
# #	The “#” mark means a non-critical error	Press the “STAT” key. (For the meaning of the error messages, see “ Messages” on page 4-16). Rectify the cause of the failure and then press the “STAT” key to check that the “#” mark has disappeared.

Messages

The messages used by the ALTJ3000 Smart Transmitter are listed alphabetically in the following table.

No.	Messages	Description	Action to be taken
1	CHAR PROM FALUT	PROM has failed	To change PROMs, find the serial number of the old PROM by pressing the “SHIFT” key and “1” key, and procure a new PROM whose characteristics are identical with those of the old one.
2	CORRECT DAC SPAN	Correct the output at 20mA.	Calibrate the output signal. (See “ Calibration of output signal” on page 3-21.)
3	CORRECT DAC ZERO	Correct the output at 4mA.	Calibrate the output signal. (See “ Calibration of output signal” on page 3-21.)
4	CORRECT LRV?	Is lower range value (0% input) correct?	Check the 0% input pressure. (See “ Verifying the configuration data” on page 3-16.)
5	CORRECT URV?	Is upper range value (100% input) correct?	Check the 100% input pressure. (See “ Verifying the configuration data” on page 3-16.)
6	CORRECT RESET #	Recalibration is necessary to attain the required accuracy	Calibrate the LRV and URV. (See “ Range calibration” on page 3-24.)
7	DATA NON-VOLATILE	Data is stored into non-volatile memory.	
8	DATA RESTORED	Saved data is stored into transmitter memory	
9	DATA SAVED	Data is saved from transmitter to SFC.	
10	ELECTRONIC FAULT	Electronics module has failed.	Change electronics module. Do not save any data.
11	ENTRY > SEN RANGE	Range setting has been attempted with a value greater than 1.5 times of the transmitter range.	Repeat range setting by pressing the “CLR” key and entering a valid value.
12	EXCESS SPAN CORR#	Span correction is too large.	Check the 100% range calibration input pressure. Calibrate the URV. (See “ Range calibration” on page 3-24.)
13	EXCESS ZERO CORR#	Zero correction is too large.	Check the 0% range calibration input pressure. Calibrate LRV. (See “ Range calibration” on page 3-24.)
14	EXCESSIVE OUTPUT	The value set for constant-current source is beyond the allowable range. (-1.25% to 105%)	Press the “CLR” key and enter a valid value.
15	FAILED COMM CHK	Communication was unsuccessful. (SFC electronics failure or incorrect connections)	Check the polarity of connector connection.
16	HI RES/LOW VOLT	The loop load resistance is too large or the supply voltage is too low.	Check the polarity, wiring, supply voltage.
17	ILLEGAL RESPONSE	Communication failure between SFC and transmitter.	Check the load resistance, wiring.
18	IN OUTPUT MODE#	The transmitter is in constant current mode.	To reset the transmitter from the constant current mode, press the “OUTPUT” key and then the “CLR” key. (See “3-4 : Constant-current source mode” on page 3-12.)

No.	Messages	Description	Action to be taken
19	INPUT ZEROED	Calibration in the sensor balance state (equilibrium with atmospheric pressure) is complete.	
20	INVALID COMM	Transmitter has failed to receive or send messages from or to SFC. Or, transmitter operation is abnormal, or noise is interfering with the communication loop thereby preventing normal response from the transmitter	1. Repeat communication 2. Press the "STAT" key and take the required action. 3. Check the communication loop. 4. Replace the SFC.
21	INVALID DATABASE	Transmitter database was invalid when power was turned on.	1. Repeat communication 2. Check the database, calibrate the transmitter, and store data into non-volatile memory.
22	INVALID REQUEST	The request is invalid.	Follow the correct SFC operating procedure.
23	KEY NOT ALLOWED	Invalid key operation	Press the "CLR" key and follow the correct SFC operating procedure.
24	LINEAR	The output characteristics are linear.	
25	LOAD CONF DATA?	Is configuration data to be loaded to transmitter?	Confirm the configuration data.
26	LOOP IN MANUAL?	Is the loop for communication in manual mode?	Set the loop to manual mode.
27	LOW LOOP RES	The loop resistance is too low.	Check the loop resistance.
28	LRV CORRECTED	Calibration of LRV is complete.	
29	M.B. OVEROAD OR METER BODY FAULT	The input pressure is 2 times the allowable range.	Check the range and, if required, replace the transmitter with one which has a larger range. It is possible that the transmitter sensor has been damaged. Check its performance.
30	NO XMTR RESPONSE	No response from transmitter. (Transmitter failure or loop failure)	1. Repeat communication. 2. Press the "STAT" key and take the required action. 3. Check loop line and SFC connection.
31	PRESS STATUS	Press the diagnostic key "STAT".	
32	READY	Ready to operate (standby)	
33	RESET CORRECT?	Is the calibration data to be erased.	
34	RESTORE DATA?	Is the saved data to be restored onto the transmitter?	
35	SAVE DATA?	Is the transmitter data to be saved?	
36	SENSOR OVER TEMP#	The sensor temperature is too high. (If the sensor is left at this temperature, the sensor will deteriorate and the measuring accuracy will degrade.)	Change the mounting in order to lower the temperature.
37	SET LRV?	Is the LRV to be set to the input pressure currently applied?	

No.	Messages	Description	Action to be taken
38	SET URV?	Is the URV to be set to the input pressure currently applied?	
39	SFC FAULT	SFC failure	Repeat communication. Replace the SFC as required.
40	SHIFT	White characters are selected for SFC.	
41	STATUS CHECK-OK	Status check (diagnosis) is normal.	
42	STATUS RECEIVED	Status check (diagnosis) of transmitter is complete.	
43	STATUS UNKNOWN	Status is unknown.	
44	SQUARE ROOT	The output is with square root extraction.	
45	SUSPECT INPUT	The input may be incorrect. The cause may be in the process, or in the sensor or electronics of the transmitter. It also may be caused by an imperfect connection of the transmitter sensor connector to the electronics.	Set the transmitter to constant current mode and press the “STAT” key. If no message appears, the most probable cause is failure of the transmitter sensor. Check the sensor.
46	URV CORRECTED	Calibration of URV is complete.	
47	WORKING	The instrument is in operation.	
48	ZERO INPUT?	Is the input zero?	Check that the sensor is in the balanced state (equilibrium at atmospheric pressure).
49	> RANGE	The result of calculation by SFC is greater than which can be displayed.	Press the “CLR” and restart the SFC.
50	:	The SFC battery is dead.	Charge the battery.
51	#	Non-critical failure	Press the “STAT” key and check messages. After eliminating the cause of the failure, press the “STAT” key to check that the “#” mark has disappeared.

Chapter 5 : Troubleshooting

To troubleshoot the liquid level meter, check for the cause of the trouble as follows:

- Perform the following by employing the diagnostic functions.
    - Confirm the configuration data.
    - Check the detector operation.
    - Check the loop.
- When the cause of the failure has been found, take the steps necessary to remedy it by referring to “4-4 : Diagnosis” on page 4-13.

Document Number:	OM2-5380-3100
Document Name:	Smart ALTJ3000 Immersion-type Liquid-Level Transmitter Model: JTL220/230/221/231/222/232 User's Manual
Date:	5th edition: Aug. 2012
Issued/Edited by:	Azbil Corporation

Azbil Corporation