TOSHIBA

6F8A0916

ELECTROMAGNETIC FLOWMETER DETECTOR

MODEL LF150

INSTRUCTION MANUAL

TOSHIBA CORPORATION

NOTES

Before using the equipment, please read this manual carefully and understand the contents, and then use the equipment correctly.

- **NEVER attempt to operate the equipment in any ways that are not described in this instruction manual.**
- **After reading this manual, store it with care in a place where it can be referred to whenever needed.**
- **Please be sure that this manual is delivered to the personnel who will use this product.**

NOTICE

This manual is designed to assist in installing, operating, and maintaining the LF150 flange-type electromagnetic flowmeter detector. For safety reasons, and to obtain the optimum performance of the flowmeter detector, read this manual thoroughly before working with
the product. For a converter to be used with this detector, read the instruction manual prepared for each converter.

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SAFETY PRECAUTIONS

Safety signs and labels affixed to the product and/or described in this manual give important information for using the product safely. They help prevent damage to property and obviate hazards for persons using the product.
Make yourself familiar with signal words and symbols used for safety signs and labels. Then read the safety precautions that follow to prevent an accident involving personal injury, death or damage to property.

Explanation of signal words
The signal word or words are used to designate a degree or level of hazard seriousness.
The signal words used for the product described in this manual are WARNING and CAUTION.

⚠ **WARNING**	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ **CAUTION**	Indicates a potentially hazardous situation which, if not avoided, may result in minor to moderate injuries or in property damage.

Safety symbols
The following symbols are used in safety signs and labels affixed to a product and/or in the manual for giving safety instructions.

	Indicates an action that is prohibited. Simply DON'T do this action. The prohibited action is indicated by a picture or text inside or next to the circle
	Indicates an action that is mandatory. DO this action. The mandatory action is indicated by a picture or text inside or next to the circle.
	Indicates a potential hazard. The potentially hazardous situation is indicated by a picture or text inside or next to the triangle.

SAFETY PRECAUTIONS (continued)

Safety Precautions for Installation and Wiring

⚠ WARNING

- Do not use the LF150 in an **explosive atmosphere**.

Using this product in an explosive atmosphere can cause **explosion**.

⚠ CAUTION

- **Turn off mains power** before working on pipes.

Working on pipes while power is applied can cause **electric shock**.

- Use an **appropriate device** to carry and install the LF150.

If this product **falls to the ground**, injury, or malfunction of or damage to the product, can be caused.

- **Install a switch and fuse** to isolate the LF150 from mains power.

Power supply from mains power can cause **electric shock** or **circuit break-down**.

- **Do not modify or disassemble** the LF150 unnecessarily.

Modifying or disassem-bling this product can cause **electric shock**, **malfunction of or damage to this product**.

- **Turn off mains power** before conducting wiring work.

Wiring while power is applied can cause **electric shock**.

- **Ground** the LF150 **independently from power equipment.**

Operating this product without grounding can cause **electric shock** or **malfunction**.

- Do not conduct wiring work **with bare hands**.

Remaining electric charge even if power is turned off can still cause **electric shock.**

- Use **crimped terminal lugs** for the terminal board and GND terminal.

Loose connections can cause **electric shock**, **fire from excessive current or system malfunction**.

- Do not work on piping and wiring **with wet hands**.

Wet hands may result in **electric shock**.

The label shown left is placed near the terminal board for power input. Be alert to **electric shock**.

SAFETY PRECAUTIONS (continued)

Safety Precautions for Maintenance and Inspection

⚠ CAUTION

■ Do not touch the LF150 main body when **high temperature fluid** is being measured.

The fluid raises the main body temperature and can cause **burns** when touched.

■ Do not conduct wiring work when **power is applied**.

Wiring while power is applied can cause **electric shock**.

■ Do not conduct wiring work **with wet hands**.

Wet hands may result in **electric shock**.

The label shown left is placed near the terminal board for power input. Be alert to **electric shock**.

■ Do not use a **fuse other than the one specified**.

Using a fuse other than the one specified can cause **system failure**, **damage or malfunction**.

Disclaimer

Toshiba does not accept liability for any damage or loss, material or personal, caused as a direct or indirect result of the operation of this product in connection with, or due to, the occurrence of any event of force majeure (including fire or earthquake) or the misuse of this product, whether intentional or accidental.

Safety and Handling Precautions

■ For safety reasons, observe the following precautions.

(1) Do no work on piping or wiring while power is applied. Otherwise, it may result in electric shock. Even if the power is turned off, remaining electric charge may still cause electric shock. Therefore, wear nonconductive gloves whenever you work on piping or wiring.

(2) Do not use the LF150 detector in a way other than those specified in this manual. It may cause malfunction or damage to this product.

(3) When high temperature fluid is being measured, the fluid raises the detector pipe temperature. Do not touch the elevated temperature detector pipe. It may cause injury to personnel when touched.

(4) As this detector is heavy, observe the following precautions:

✧ Wear protective gloves.

✧ Do not work on piping or wiring when the detector is wet and slippery.

✧ A crane is needed to carry and install the detector.

✧ To put the detector temporarily on the floor, place it with an appropriate support to prevent it from falling down.

■ To obtain the optimum performance of the LF150 detector for years of continuous operation, observe the following precautions.

(1) Do not store or install the detector in a place such as:

• where there is direct sunlight. If this is unavoidable, use an appropriate sunshade.

• where excessive vibration or mechanical shock occurs.

• under high temperature or high humidity condition.

• under corrosive atmospheres.

(2) Ground the detector and converter with less than 100 ohm ground resistance. Avoid a common ground used with other equipment where earth current may flow. An independent ground is preferable.

(3) The retaining screws for the terminal housing cover and the cable connections are tightened securely at the time of shipment to keep the terminal housing airtight. Do not remove these screws or connections unless it is necessary to wire new cables or replace old ones. Otherwise, it may cause gradual deterioration of circuit isolation or cause damage to this product.

(4) Make sure the fluid to be measured will not freeze in the detector pipe. It may cause damage to the detector pipe.

Table of Contents

1. Product Inspection and Storage

Upon arrival of the product package, open the package and check the items contained inside. If you do not install the product shortly afterward, store the product and other related items in a place as described in 1.2 below.

1.1 Product Inspection

The LF150 electromagnetic flowmeter detector is shipped in a container filled with shock-absorbing materials. Open the package carefully and check as follows:

- Make sure the following items are included in the package.

  For the separate type (when a converter and detector are separated)

Electromagnetic flowmeter converter---------- 1 unit Electromagnetic flowmeter detector ---------- 1 unit Instruction manual---------- Once each for the converter and detector

- Inspect the detector for indications of damage that may have occurred during shipment.
- Make sure the type and specifications of the detector (meter size, wetted materials, protective coating, etc.) are in accordance with the ordered specifications.

If you can not find the items listed above or any problem exists, contact your nearest Toshiba representative.

1.2 Storage

To store the LF150 detector after opening the package but you will install it at a later date, select a storing place as follows and keep it under the conditions as described:

(1) Avoid the place where there is direct sunlight, rain or wind.

(2) Store the product in a well-ventilated place. Avoid the place where it is extremely high in humidity, extremely high or low in temperature. The following environment is recommended.
   - **Humidity range: 10 to 90% RH (no condensation)**
   - **Storage temperature range: –15 to +65 °C**

(3) Avoid the place where vibrations or mechanical shock occurs.

(4) Do not open the terminal housing cover of the detector. Open it only when you actually wire cables. Leaving the cover open may cause gradual deterioration of circuit isolation. Note that the detector whose cables are wired already at the time of shipment is not needed to open the detector housing cover.

2. Overview

The electromagnetic flowmeter measures the volumetric flow rates of electrically conductive materials based on Faraday's Law of electromagnetic induction.
The device consists of two units: detector, through which the fluid to be measured flows, and converter, which receives the electromotive force signals from the detector, then converts and outputs the signals as the industry-standard output signals.
The detector and converter can be mounted separately as independent units.

Features

The LF150 flange-type electromagnetic flowmeter has the following features:

- There is no pressure loss even if a flowmeter detector is installed in the pipeline.
- It is possible to measure the flow of the fluid containing solid materials such as sludge or slurries.
- Even fluids containing solid abrasives or process slurry noise can be measured with excellent performance.
- No moving parts means a quick indication of flow and even a small amount of flow can be measured with high accuracy.
- Its size and weight was reduced further compared to the conventional type.
- A submersible type is available as optional specification.

3. Names of Parts

The outline drawing of the LF150 detector is shown in Figures 3.1.

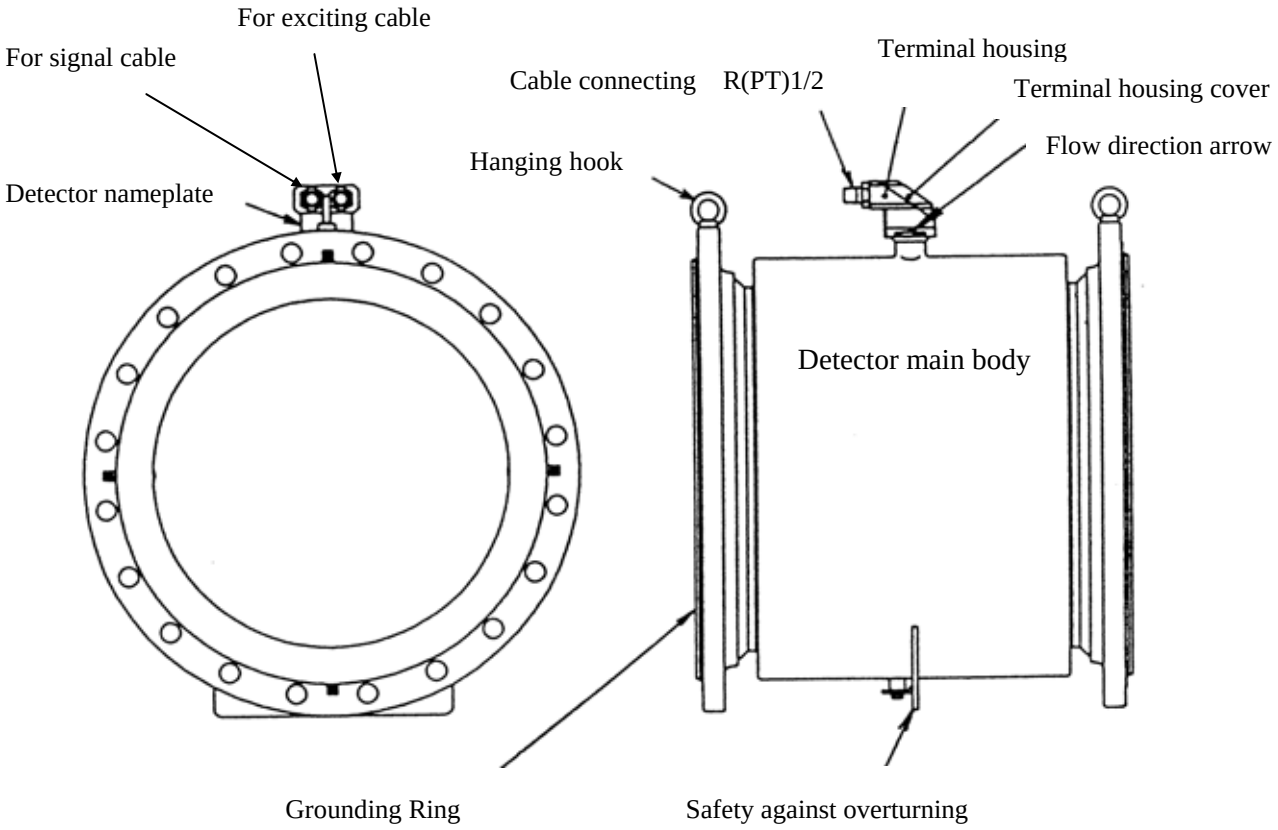


Figure 3.1 Outline drawing of the LF150 detector

4. Installation

Piping connections and cable wiring for the LF150 detector are described in the following sections.

4.1 Piping Connections

The LF150 detector has flanges on both ends of detector main body. To mount the LF150, refer to Figure 4.1 and follow the procedure below:

1. Place one of the flange packing next to the upstream(or downstream) pipe flange. Align the holes of the packing with those of the flange so that the holes are not obstructed.
2. Insert the LF150 detector in pipeline in accordance with the flow direction arrow on the detector.

> **IMPORTANT**
> A crane is needed to carry and install the detector.

3. Insert the bolts, one at a time, through the hole in the upstream pipe flange and packing, and then through the hole of the detector flange. Then thread nuts, one at a time, on each end of the bolts, finger-tighten. This will help support the detector on one side.
4. Insert the downstream (or upstream) packing between the detector flange and the downstream pipe flange. Align the holes of the packing with those of the flanges so that the holes are not obstructed.
5. Inert the bolts, one at a time, through the hole in the downstream pipe flange and packing, and then through the hole of the detector flange. Then thread nuts, one at a time, on each end of the bolts, finger-tighten. This will help support the detector.
6. While centering the detector with the longitudinal axis of the pipeline, tighten the bolts with a wrench diagonally across in even increments. Bolt torque should be limited to that shown in Table 4.1

Table 4.1 Number of bolts, size and recommended bolt torque

Meter size [mm]	JIS 10K	
	No. of bolts × Size × Length [mm]	Bolt torque [N· m] (Note)
500 mm	20 ×M24 ×120	150～190
600 mm	24 ×M30 ×130	220～260
700 mm	24 ×M30 ×140	280～320
800 mm	28 ×M30 ×140	310～350
900 mm	28 ×M30 ×150	400～440
1000 mm	28 ×M36 ×160	600～640

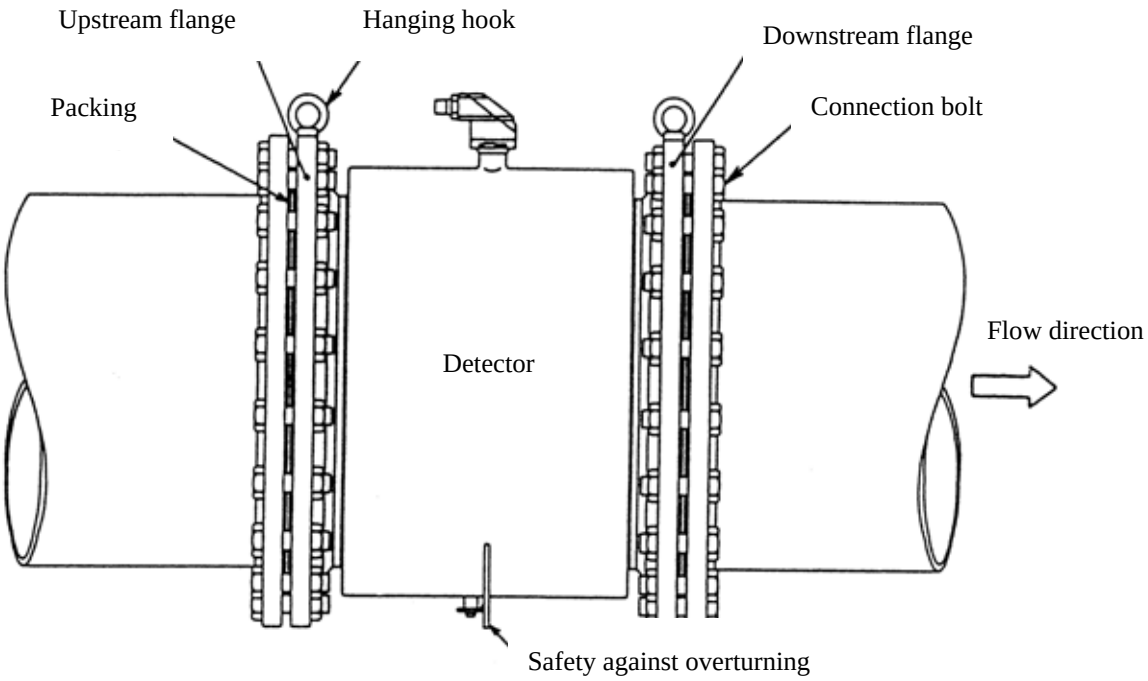


Figure 4.1 The LF150 detector piping connections

4.1.1 Location

To select the installation site, follow the precautions described below:

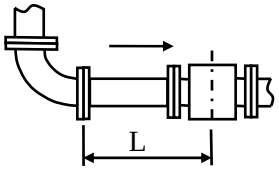
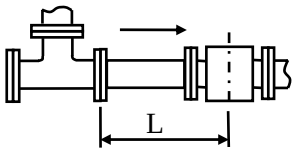
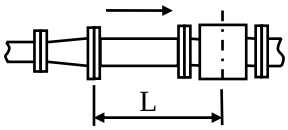
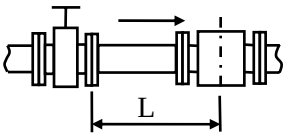
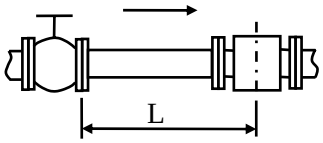
- Avoid the place where fluid runs in pulsating current.
- Avoid the place within the immediate proximity of equipment producing electrical interference (such as motors, transformers, radio transmitters, electrolyte cells, or other equipment causing electromagnetic or electrostatic interference).
- Avoid the place where excessive pipe vibration occurs.
- Avoid the place where there is direct sunlight. If this is unavoidable, use an appropriate shade. For information concerning a shade, contact Toshiba's Engineering Department.
- Avoid the place under corrosive atmospheres or under high humidity condition.
- Avoid the place high or a constricted area where clearance for installation or maintenance work is not provided.
- Design piping so that the detector pipe is always filled with fluid, whether the fluid is flowing or not.
- The LF150 detector has no adjustable piping mechanism. Install an adjustable short pipe where needed.
- Chemical injections should be conducted on the downstream side of the detector.

4.1.2 Precautions on Piping

(1a) Ideal Upstream Straight Pipe Length Installation Requirements

If various joints are used upstream of the detector outlet, the straight pipe length as shown in Table 4.2 is required.

Table 4.1 Ideal straight pipe length on the upstream side

L=5D	L=10D
(1) 90 ° bent  (2) Tee  (3) Diffuser  (4) Fully opened sluice 	(5) Other valves (not fully opened) 

L: Required straight pipe length—straight pipe length plus half length of the detector.
D: Nominal bore size (diameter)

NOTES

The length of a reducer, if connected, can be counted as a part of the straight pipe length.
No straight pipe length is needed on the downstream side. If a butterfly valve is installed downstream of the detector, do not let the valve plate protrude into the pipe of the detector.

(1b) Optional "Mount Anywhere" Installation

Mount-Anywhere Technology:

With Toshiba's unique magnetic field distribution technology, the meter is highly immune to upstream flow disturbances. A minimum of 3D (diameter) length of upstream straight pipe from the flange is required to maintain the performance specification.

NOTE

The test results were obtained and demonstrated at Toshiba's flow calibration facility, Fuchu Japan.

(2) Pipe Orientation

The detector may be installed in horizontal, vertical or sloping pipe runs as shown in Figure 4.2. However, except for horizontal installation, fluid should flow from lower to upper directions. If no air bubble, Vertical down flow application are acceptable under pressured piping conditions. See Figure 4.2.

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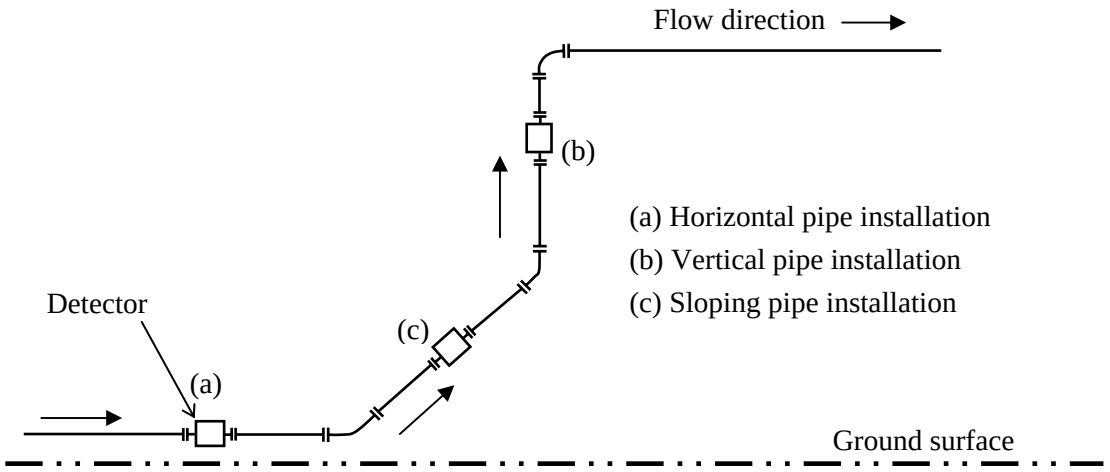


Figure 4.2 Detector Piping Orientation

The electrodes should be positioned horizontally relative to the ground surface in any piping installation. See Figure 4.3.

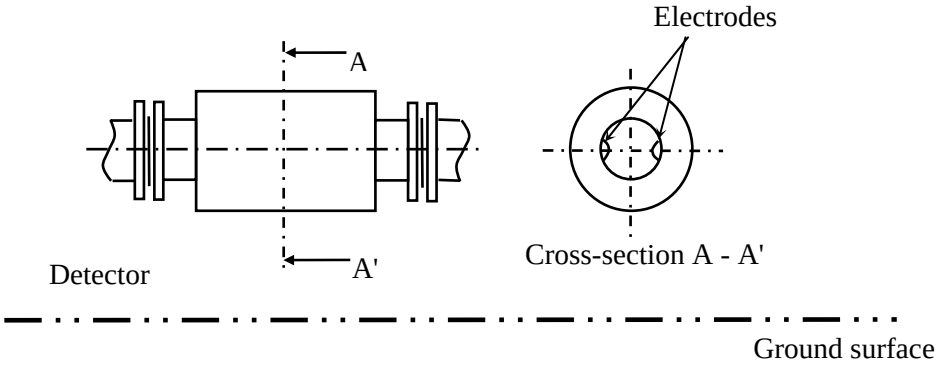


Figure 4.3 Installation position of the detector

(3) Flow Direction

Install the detector in accordance with the flow direction arrow on the detector.

(4) Full Pipe Condition

Design an upright pipe run (Figure 4.4) or enough water head (Fig. 4.5) at the downstream detector outlet if there is a possibility of the detector pipe being emptied.

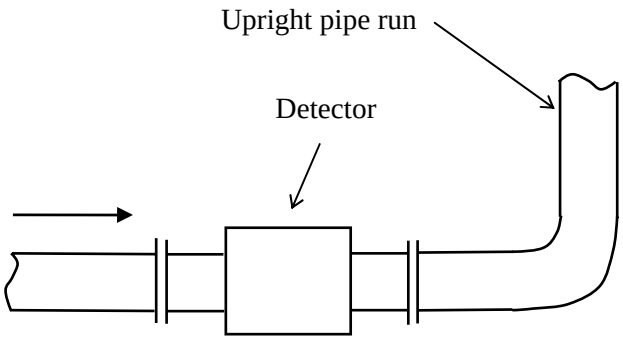


Figure 4.4 Detector with an upright pipe run at the downstream outlet

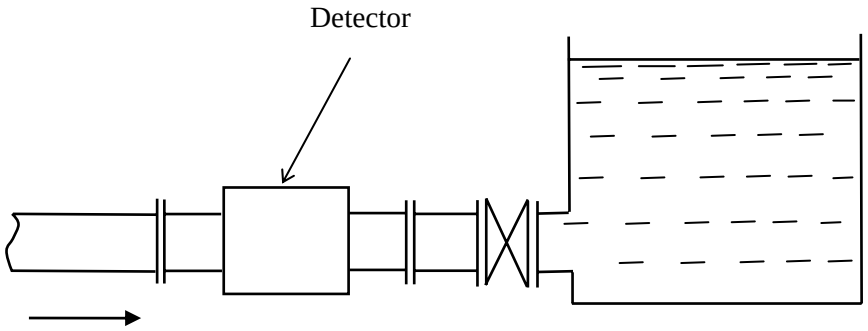


Figure 4.5 Detector with enough water head at the downstream outlet

4.2 Wiring

IMPORTANT
The grounding terminal of the LF150 detector must be grounded with less than 100 ohm ground resistance. A grounding wire should be as short as possible. Avoid a common ground used with other equipment where earth current may flow. An independent ground is preferable.

The flowmeter accuracy may be affected by the way wiring is conducted. Proceed with wiring with following precautions:

■ Select the cable runs away from electrical equipment (motors, transformers, radio transmitters or electrolyte cells) which causes electromagnetic or electrostatic interference.

■ Deterioration of the circuit insulation occurs if the converter interior or cable ends get wet or humidified. It causes malfunction to the flowmeter or a problem of noise occurs. Avoid a rainy day if the flowmeter is to be installed outdoors. Even if indoors, avoid water from sprinkling over the device and try to finish the wiring as quickly as possible.

■ As the signal and exciting cables carry low-level signals, run these cables in thick walled steel conduit separated from other large current wiring. Also do not run these cables in parallel with other large current wiring.

■ For the detector whose cables are already wired at the time of shipment, the terminal housing is closed securely to keep it airtight. Therefore, do not remove the terminal housing cover or cables. If it is necessary to replace cables for repair work etc., see Sections 4.2.1 and 4.2.2

IMPORTANT
When you replace cables, use new packings for the housing cover and cable connection.
Contact your nearest Toshiba representative to purchase these packings.

4.2.1 Cables

Use cables shown in Table 4.3 to wire the detector.

Table 4.3 Cables

Name	Cable type	Nominal cross-sectional area	Overall diameter
Signal cable	2-wire shielded chloroprene sheathed cable (Rubber covered cable)	0.75 mm^2	12 mm
Exciting cable	3-wire chloroprene sheathed cable (Rubber covered cable)	1.25 mm^2 or 2 mm^2 **(Note)**	12 mm or 13 mm **(Note)**

Note: Nominal cross-sectional area and overall diameter for exciting cable are dependent on the cable length. Refer to the type specification code table 8.4.

4.2.2 Wiring Procedure

IMPORTANT
For the detector whose cables are already wired at the time of shipment, the following wiring procedure is not needed. Therefore, do not open the terminal housing cover.

■ Signal Cable Termination

Use a signal cable specified in Table 4.3 and follow the procedure below referring to Figure 4.6.

(1) Strip the cable sheath about 40 mm to expose two shielded wires.

(2) Unravel the shield screen at the base of each shielded wire to have an opening large enough to extract the internal wire. Then extract the black wire and white wire through its opening at the base of each shielded wire.

(3) Put the two shield screens (internal wires are already extracted) together into one shield wire and put it through a heat-shrink tube. The heat-shrink tube should be heated later when instructed to protect the shield screen from touching other wires causing a short circuit.

(4) Strip each end of wire (except the shield wire) about 5 mm to expose stranded copper wire and attach an M4-size ring lug terminal on each end of wire. The lug terminal should have an insulating sleeve and the lug terminal should be pressed firmly onto the end of each wire with a compression tool.

(5) Put the heat-shrink tube of the shield wire in place as shown in Figure 4.6 and heat it with radiated heat using a soldering iron etc.

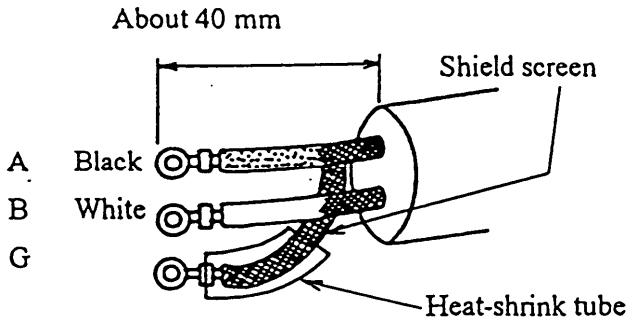


Figure 4.6 Termination of signal cable

■ Exciting Cable

Use an exciting cable specified in Table 4.3 and follow the procedure below referring to Figure 4.7.

(1) Strip the cable sheath about 40 mm to expose black, white and red wires.

(2) Strip each end of wire about 5 mm to expose stranded copper wire and attach an M4-size ring lug terminal on each end of wire. The lug terminal should have an insulating sleeve and the lug terminal should be pressed firmly onto the end of each wire with a compression tool.

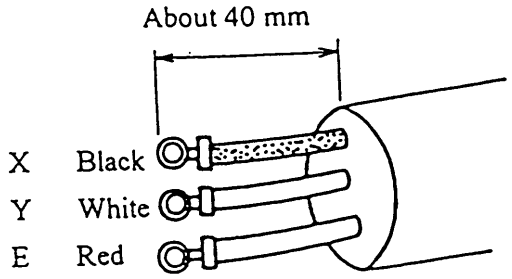


Figure 4.7 Termination of exciting cable

■ Cable Connections

Connect the terminated signal cable and exciting cable to the terminal board in the terminal housing through the cable connections. There are two cable connections: for signal cable and for exciting cable. See Figure 3.1

(1) Remove the four retaining screws of the terminal housing cover shown in Figure 3.1. Then open the cover. The terminal board is located inside the housing.

(2) Remove the cable connection from the terminal housing. Then put the terminated signal cable through the cable connection, slip ring and packing.

(3) Put the above signal cable through the hole on the terminal housing and connect each ring lug of the cable to the terminal board pin A, B and G as shown in Figure 4.6. Then tighten the screws securely with a phillips screwdriver. Loose connection may result in unsatisfactory flowmeter performance. Check the wiring by pulling each wire after the connection to make sure the three wires are securely connected..

(4) After the terminal board connection, pull the cable outward so that the cable is wired straight from the terminal without unnecessary winding.

IMPORTANT
Do not pull the cable too hard. If the sheath-stripped part goes as far as where the packing is located, air may leave through there and the airtight structure may not function.

Then tighten the cable connection with a wrench. Tightening torque should be limited to
that which is sufficient to produce a positive seal for the cable connection.

(5) Repeat (2) to (4) to wire the exciting cable.

(6) Making sure both cables are wired correctly, close the terminal housing cover with the four retaining screws.

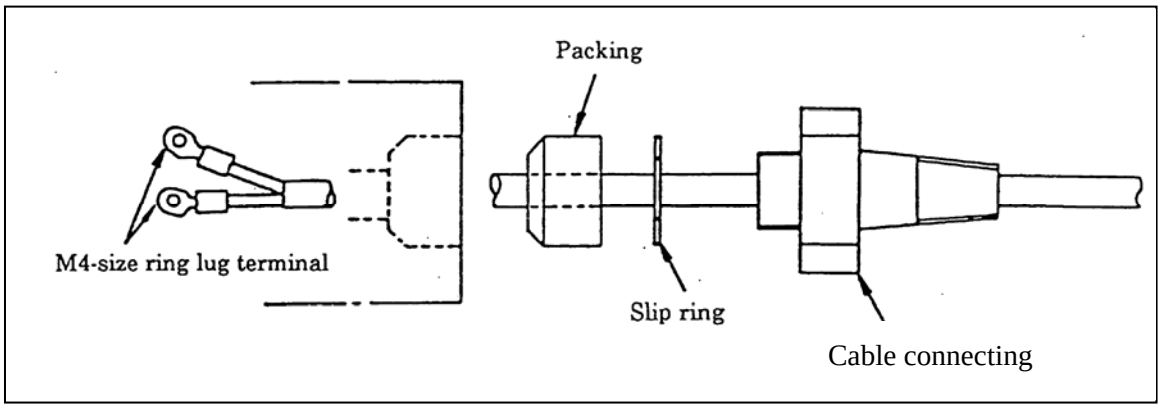


Figure 4.8 Cable connections

NOTE
To wire signal and exciting cables to the converter, see the instruction manual provided for each converter.

5. Operation

Follow the procedure described below to prepare before starting the flow measurement.

System Check

- Check the wiring between the detector and converter.
- Check the wiring between the converter and related instruments.
- Make sure all the bolts of connection flanges to mount the detector are securely tightened.
- Make sure the direction of flow arrow is in accordance with actual flow.
- Make sure the detector and converter is grounded with less than 100 ohm ground resistance.

Placing System On-Stream

- Let the fluid go through the detector pipe. When the detector is filled with the fluid, stop the fluid and keep still the fluid in the detector pipe.

Supplying Electric Power

- Make sure the power supply is as specified.

Checking Converter Parameters

- Check the converter parameter settings. Refer to the instruction manual of the converter.

Zero Adjustment

- Wait for 30 minutes to warm up the flowmeter internal circuitry. Then making sure the fluid holds still in the detector pipe, adjust the zero point of the flowmeter. Refer to the instruction manual of the converter.

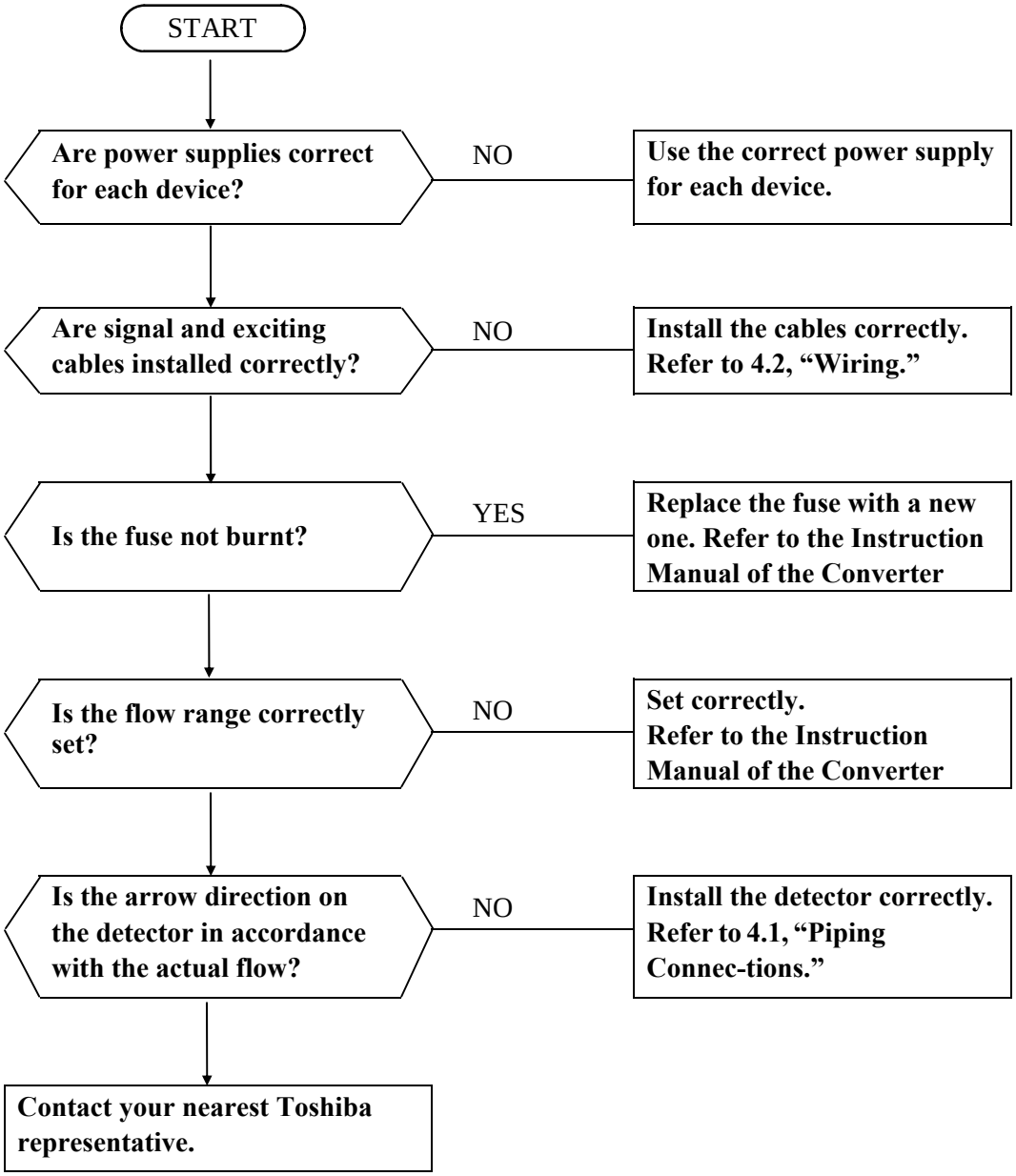
On-line measurement

After checking the items and conducting the zero adjustment as listed above, let the fluid go through the detector pipe. The output (such as 4–20 mA dc) directly proportional to the flow rate can be obtained.

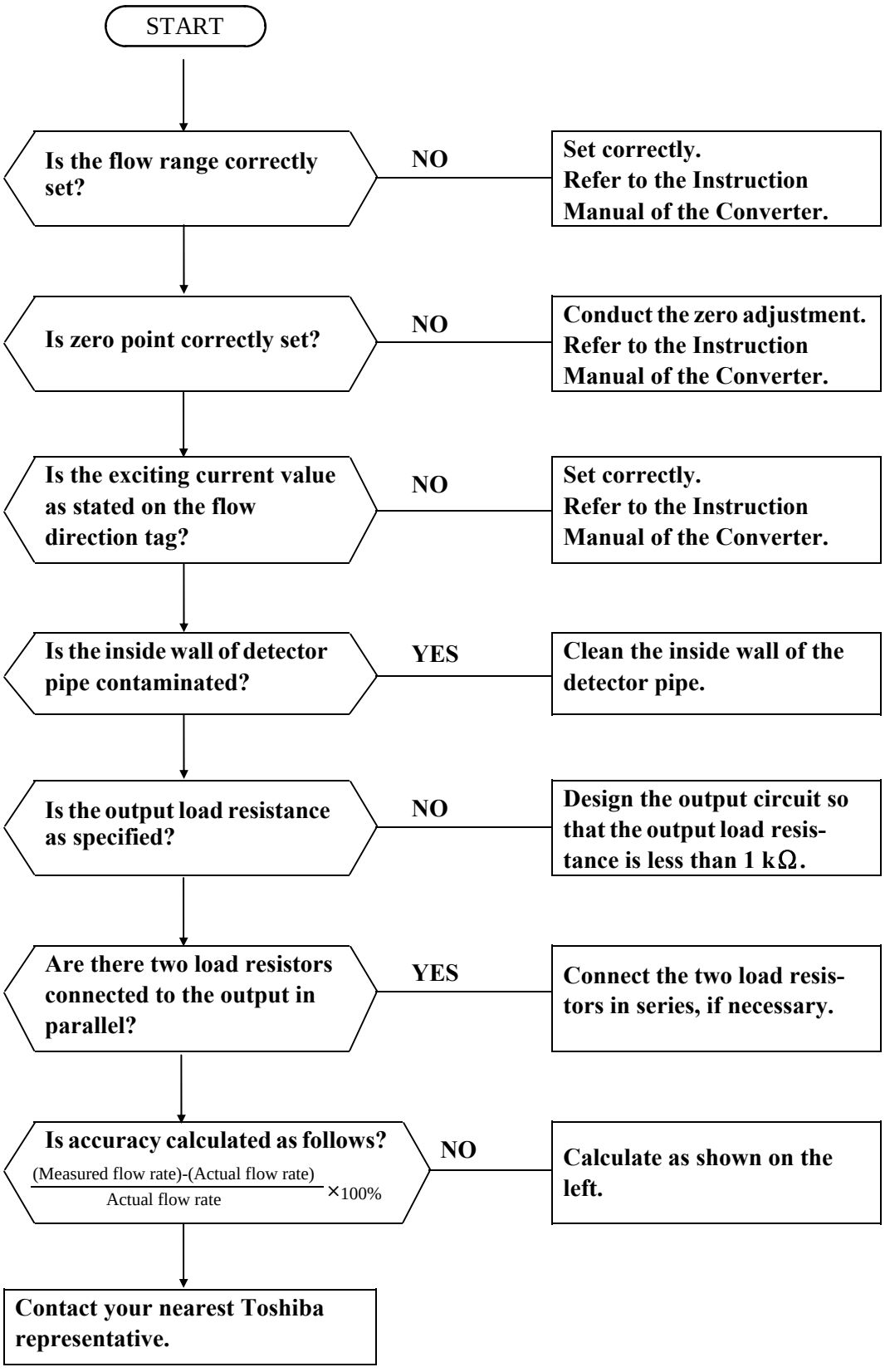
6. Maintenance and Troubleshooting

If a problem occurs while using the LF150, follow the flowcharts described below. You may find a way to solve the problem. The flowcharts are based on five symptoms 6.1 to 6.3. If you cannot solve the problem, contact your nearest Toshiba representative.

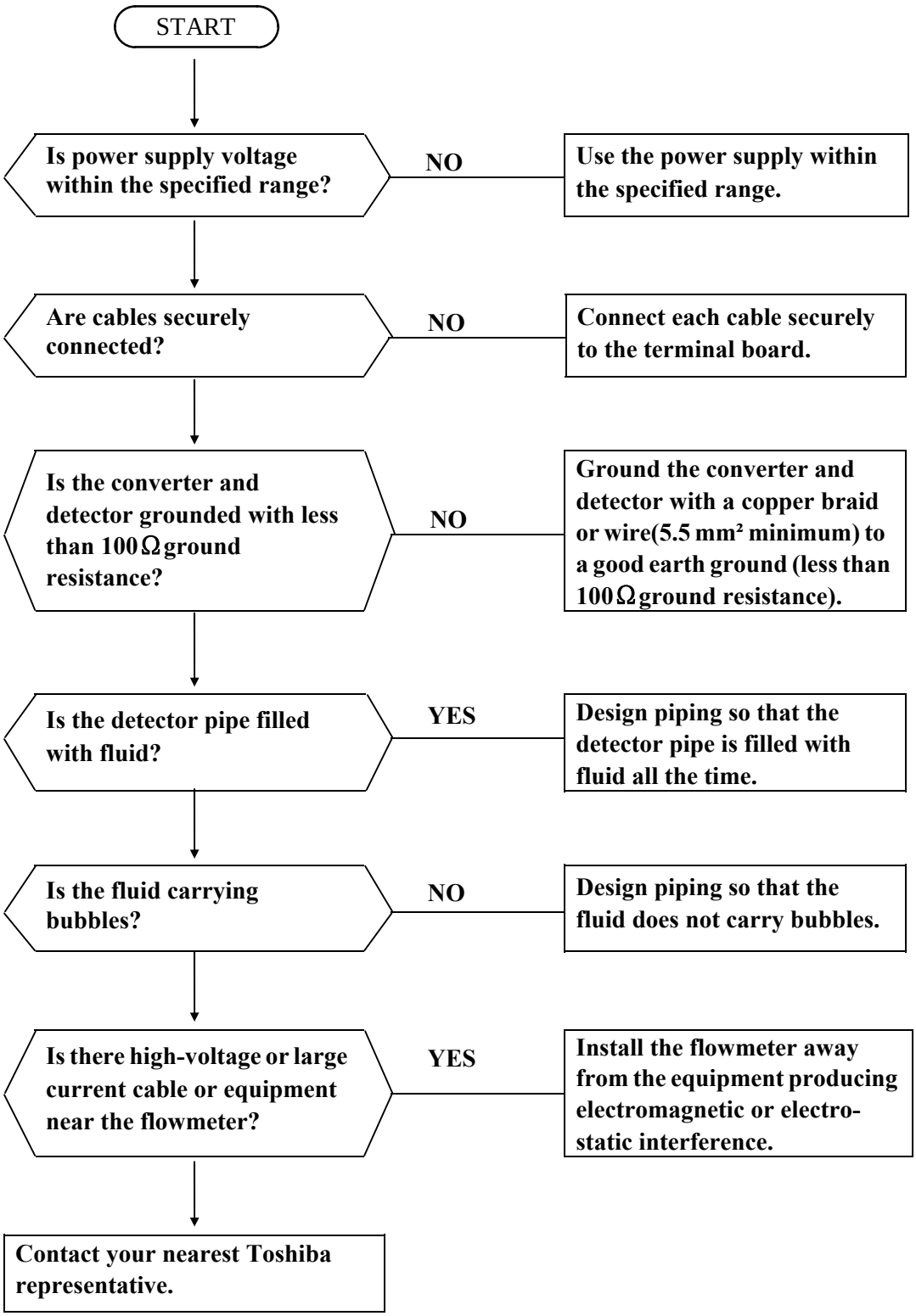
6.1 Flow rate is not indicated.



6.2 Flow rate indication is not correct.



6.3 Flow rate indication is not stable.



7. Principle of Operation

The operating principle of the electromagnetic flowmeter is based on Faraday's Law of electromagnetic induction and it is designed to measure the volumetric flow rate of fluid. An insulated pipe of diameter D is placed vertically to the direction of a magnetic field with flux density B (see Figure 7.1). When an electrically conductive fluid flows in the pipe, an electrode voltage E is induced between a pair of electrodes placed at right angles to the direction of magnetic field. The electrode voltage E is directly proportional to the average fluid velocity V.

The following expression is applicable to the voltage

$$E = K \times B \times D \times V \text{ [V]} \quad \text{..... (Eq. 7.1)}$$

E = induced electrode voltage [V]
K = constant
B = magnetic flux density [T]
D = meter pipe diameter [m]
V = fluid velocity [m/s]

Volumetric flow rate Q [m^3/s] is:

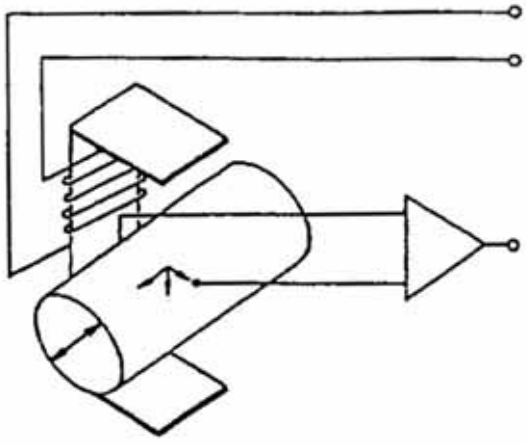
$$Q = \frac{\pi \times D^2}{4} \times V \quad \text{.....(Eq. 7.2)}$$

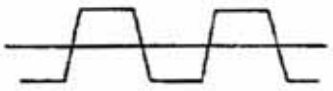
Using Equation 7.1 and 7.2

$$E = K \times B \times D \times \frac{4}{\pi \times D^2} \times Q$$

$$E = \frac{4 \times K \times B}{\pi \times D} \times Q \quad \text{.....(Eq. 7.3)}$$

Therefore, volumetric flow rate is directly proportional to the induced voltage.





Square Wave Excitation Method

Figure 7.1 Principle of Operation

The LF150 flange-type electromagnetic flowmeter uses square-wave excitation method, which provides a long-term stable operation. With square-wave excitation, the LF150 offers reliable measurement without being affected by electrostatic or electromagnetic interference, or electrochemical polarization between the electrode and the fluid to be measured.

8. Specifications

Overall specifications of the LF150 detector and type specification code tables to specify each item of the detector specifications are described in the following sections.

8.1 Specifications

Meter size: 28”, 32”, 36”, 40”, 44”, 48”, 54”, 60”, 64”, 72”, 80”, 88”, 96”, 104”, 112”, 120” (700, 800, 900, 1000, 1100, 1200, 1350, 1500, 1600, 1800, 2000, 2200, 2400, 2600, 2800, 3000mm)

Measurement range in terms of flow velocity: 0–1.0 ft/s to 0–32.8 ft/s (0–0.3 m/s to 0–10 m/s)

Accuracy: ± 0.5% of Rate *

* This pulse output error result is established under standard operating conditions at Toshiba’s flow calibration facility, Fuchu Japan.

* Individual meter’s measurement error may vary up to ± 0.8 % of Rate at 3.28 ft/s (1.0 m/s) or more and ± 0.4% of Rate ±0.157 inch/s (4 mm/s) at 3.28 ft/s (1.0m/s) or less.

* Current output: plus ±8 μ A(0.05% of span.)

* Refer to individual calibration data for each meter’s measurement error.

Fluid conductivity: 5 μS/cm minimum

Fluid temperature: 28” to 40” (700 to 1000mm);14 to 140 °F (–10 to +60 °C)

44” (1100mm) or greater; 14 to 104 °F (–10 to +40 °C)

Ambient temperature: 14 to 140 °F (–10 to +60 °C)

Fluid pressure: −0.1 to the pressure limited by flange standard

Structure: IP 67 and NEMA 4X Watertight

Option: IP68 and NEMA 6P Submersible type

The coating for this type is black tar epoxy resin coating 0.5 mm.

This type of flowmeter is sub-mersible to 5 m in water.

Connection flange standard: AWWA class D

JIS 10K

Principal materials:

Case • • • • carbon steel

Lining • • • Chloroprene rubber (std.)

Electrodes • • • 316L stainless steel (std.)

Note: See Table 9.2 for optional materials and other related information.

Grounding rings • • • 304 stainless steel (std.)

Note: See Table 9.2 for optional materials and other related information.

Measuring tube • • • 304 stainless steel

Coating: phthalic acid resin coating (std.), pearl-gray colored

Note: If the optional IP68 and NEMA 6P structure is specified, the coating is black tar epoxy resin coating 0.5 mm

Cable connection port: R (PT 1/2) male screw for both signal cable and exciting cable

NOTE
Allowable cable length between the converter and the detector varies with the electrical conductivity of fluid. See Figure 8.1

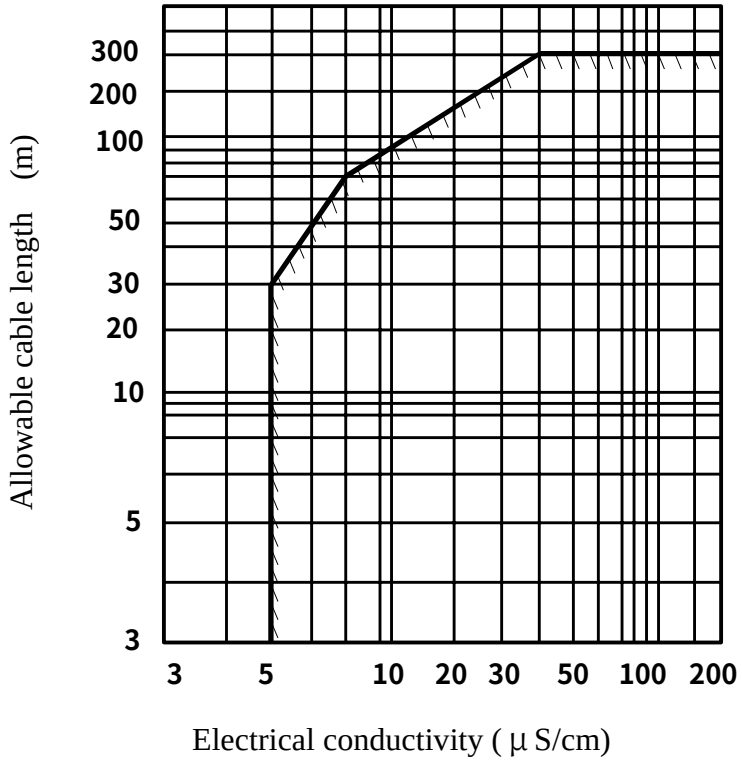


Figure 8.1 Electrical Conductivity vs. Cable Length

8.2 Type Specification Code

Table 8.2 Type Specification Code (Model LF150 Detector)

Model	Specification Code										Size	
12345	6	7	8	9	10	11	12	13	14		A	B
LF150										LF150 Detector		
	0	7								Meter size 28" (700 mm)		
	0	8								32" (800 mm)		
	0	9								36" (900 mm)		
	1	0								40" (1000 mm)		
	1	1								44" (1100 mm)		
	1	2								48" (1200 mm)		
	1	3								54" (1350 mm)		
	1	5								60" (1500 mm)		
	1	6								64" (1600 mm)		
	1	8								72" (1800 mm)		
	2	0								80" (2000 mm)		
	2	2								88" (2200 mm)		
	2	4								96" (2400 mm)		
	2	6								104" (2600 mm)		
	2	8								112" (2800 mm)		
	3	0								120" (3000 mm)		
			M							Connection flange standard AWWA class D		
			J							JIS 10K		
				B						Electrode Material 316L stainless steel	●	●
				C						Ti (titanium)	○	○
					E					Lining Material EPDM rubber	○	–
					C					Chloroprene rubber	●	●
						B				Grounding Ring Material 304 stainless steel	●	●
						C				316 stainless steel	○	○
						D				316L stainless steel	○	○
							A			Bolt, Nuts, and Gaskets None		
								A		Dedicated Preformed Cable not provided	●	●
								B		30-m cable, provided	○	○
								C		other lengths, provided **(Note)**	○	○
									A	Coating phthalic acid resin	●	●
									B	black tar epoxy resin 0.3 mm	○	○
									C	black tar epoxy resin 0.5 mm	○	○
									D	black tar epoxy resin 0.5 mm (for submersible type)	○	○

Size groups.
A: 28” to 40” (700 to 1000mm)
B: 44” to 120” (1100 to 3000mm)

Size code explanation:
● Standard, ○ Option, – Not available

Note: Specify desired length of cable from 1 to 300m in 1 meter increments.

Table 8.3 Type Specification Code (Bolts, Nuts and Packings)

Model	Specification Code							Description
1 2 3	4	5	6	7	8	9	10	
B N P								Bolts, Nuts and Packings
	F							Flange type
								Meter size
		0	5	0				20” (500mm)
		0	6	0				24” (600mm)
		0	7	0				28” (700mm)
		0	8	0				32” (800mm)
		0	9	0				36” (900mm)
		1	0	0				40” (1000mm)
		1	1	0				44” (1100mm)
		1	2	0				48” (1200mm)
		1	3	5				54” (1350mm)
		1	5	0				60” (1500mm)
		1	6	0				64” (1600mm)
		1	8	0				72” (1800mm)
		2	0	0				80” (2000mm)
		2	2	0				88” (2200mm)
		2	4	0				96” (2400mm)
		2	6	0				104” (2600mm)
		2	8	0				112” (2800mm)
		3	0	0				120” (3000mm)
								Pipe flange rating
					J			JIS 10K
					Z			Other
								Bolt and Nut Material
						A		SS400 (standard)
						B		304 stainless steel
						C		not provided
						Z		Other
								Packing Material
							A	Chloroprene rubber
							B	EPDM rubber
							C	not provided
							Z	Other

Table 8.4 Type Specification Code (Exciting Cable and Signal Cable)

Model	Specification Code					Description
1 2 3	4	5	6	7	8	
A C C						Dedicated preformed cable
						Nominal cross-sectional area of Exciting cable **(Note 1)**
	A					1.25 mm²
	B					2 mm²
						Nominal cross-sectional area of Signal cable **(Note 2)**
		A				0.75 mm²
						Cable length
			0	0	1	1 m
			0	0	2	2 m
			0	0	3	3 m
			0	0	4	4 m
			0	0	5	5 m
			0	0	6	6 m
			0	0	7	7 m
			0	0	8	8 m
			0	0	9	9 m
			0	1	0	10 m
			0	1	5	15 m
			0	2	0	20 m
			0	2	5	25 m
			0	3	0	30 m
			0	3	5	35 m
			0	4	0	40 m
			0	4	5	45 m
			0	5	0	50 m
			0	6	0	60 m
			3	0	0	300 m

From 1 to 10 meters (3.3 to 32.8 feet), Cable can be ordered in 1 meter increments.

From 10 to 50 meters (32.8 to 164 feet), cable can be ordered in 5 meters increments.

From 50 to 300 meters (164 to 984 feet), cable can be ordered in 10 meters increments.

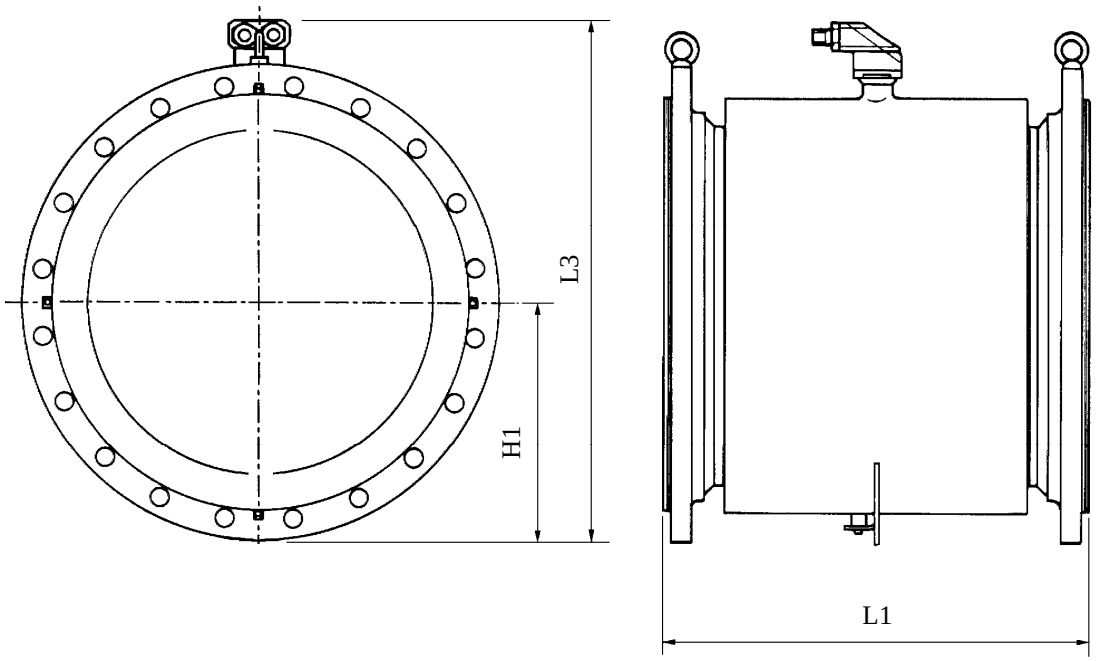
Notes:

1. Exciting cable is a 3-wire chloroprene sheathed cable. For a nominal cross-sectional area of 1.25 mm², the overall diameter will be 12 mm (15/32 inch): for 2 mm², 13 mm(1/2 inch).
2. Signal cable is a 2-wire shielded chloroprene sheathed cable with a nominal cross-sectional area of 0.75 mm² and an overall diameter of 12 mm (15/32 inch).
3. Relation between exciting cable length and its nominal cross-sectional area and overall diameter is as follows.

Exciting cable length	Nominal cross-sectional area	Overall diameter
1 to 200 m	1.25 mm²	12 mm
210 to 300 m	2 mm²	13 mm

9. Outline Dimensions

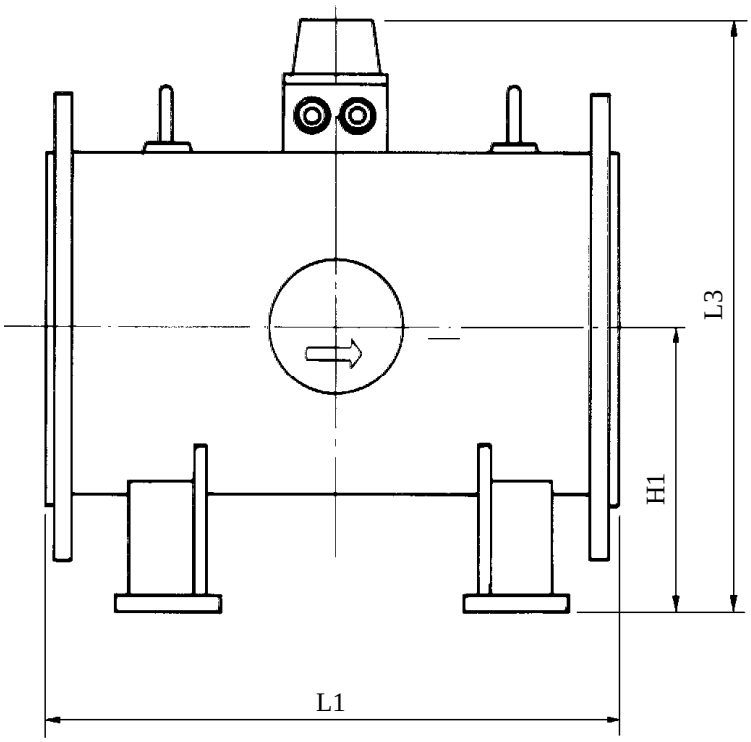
■ Meter size 28” to 40” (700 to 1000mm)



JIS 10K and AWWA class D dimensions:

Meter size inch (mm)	L1 inch (mm)	H1 inch (mm)	L3 inch (mm)	Weight lb(kg)
28 (700)	27-1/2 (700)	17-7/8 (453)	38 (966)	772 (350)
32 (800)	31-1/2 (800)	20-1/8(510)	42-1/2 (1079)	992 (450)
36 (900)	35-3/8 (900)	22 (560)	46-3/8 (1179)	1213 (550)
40 (1000)	39-3/8 (1000)	24-3/8 (618)	50-3/4 (1288)	1543 (700)

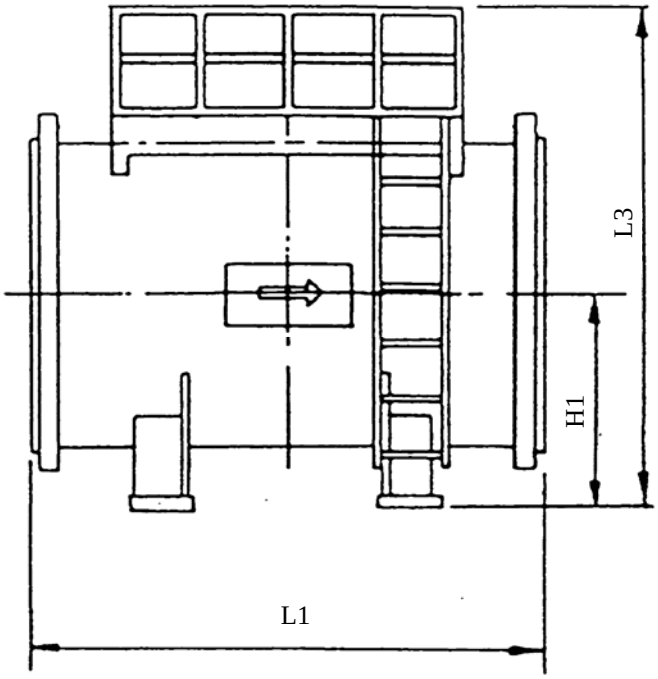
■ Meter size 44” to 60” (1100 to 1500mm)



JIS 10K and AWWA class D dimensions:

Meter size inch (mm)	L1 inch (mm)	H1 inch (mm)	L3 inch (mm)	Weight lb(kg)
44 (1100)	63 (1600)	29-1/2 (750)	58-1/2 (1487)	3307 (1500)
48 (1200)	66-7/8 (1700)	31-1/2 (800)	62-1/2 (1586)	4630 (2100)
54 (1350)	74-3/4 (1900)	37-3/8 (950)	71-1/2 (1817)	6173 (2800)
60 (1500)	82-5/8 (2100)	43-1/4 (1100)	86-5/8 (2200)	7939 (3600)

■ Meter size 64” to 80” (1600 to 2000mm)



JIS 10K and AWWA class D dimensions:

Meter size inch (mm)	L1 inch (mm)	H1 inch (mm)	L3 inch (mm)	Weight lb(kg)
64 (1600)	86-5/8 (2200)	47-1/4 (1200)	86-5/8 (2201)	9260 (4200)
72 (1800)	94-1/2 (2400)	51-1/8 (1300)	94-1/2 (2401)	11685 (5300)
80 (2000)	102-3/8 (2600)	55-1/8 (1400)	102-1/2 (2602)	13890 (6300)

Write down the address and phone number of the distributor from which you purchased this product, the product code, SER.NO. and so on.

Distributor Address _____

Name _____

Phone number ( ) —

Product code LF _____

SER.NO._____

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