

## Introduction

The LF502 electromagnetic flowmeter uses Faraday's Law of electromagnetic induction in the same way as conventional electromagnetic flowmeters to measure the flow rate. Position of electrodes in the LF502 is so designed that it can be used even in a partially-filled pipe to measure the flow rate.

Improved functional magnetic field distribution technique enables a high-precision flow measurement continually from low-level to fully-filled flow conditions. This eliminates unnecessary piping work such as lifting the downstream pipe section to fill the detector pipe.

Compared with flowmeters measuring the flow rate by means of flow level, the obstructionless LF502 flowmeter does not usually allow mud, sands and other solid sediment stay at the bottom of the detector pipe and is unaffected by wave or floating solids on the fluid surface.

The AF100 hand-held terminal or the Model 275 HART communicator can be used to communicate with the flowmeter from remote places using the HART communications protocol. See the communications output specifications for details about the HART protocol.



**Figure 2. LF502 Electromagnetic Flowmeter for Partially-filled Pipes**

### Fluid-level range:

- 30 mm (1 1/4") to fully-filled condition for Meter sizes 150 mm (6") to 300 mm (12")
- 10% of inside tube diameter to fully-filled condition for Meter sizes 350 mm (14") to 600 mm (24")

**Accuracy:** ±2 % FS (when measurement range is standard)

**Note:** The accuracy is measured under standard operating conditions at Toshiba's calibration facility.

### Required straight pipe length:

10D minimum on upstream side and  
5D minimum on downstream side

**Note:** D is a nominal meter size.

**Fluid conductivity:** 100µS/cm minimum

**Fluid temperature:** 0 to 55 °C (32 to 131 °F)

**Ambient temperature:** -10 to 50 °C (14 to 122 °F)

### ■ Detector Specifications

**Meter sizes:** 150 mm (6"), 200 mm (8"), 250 mm (10"), 300 mm (12"), 350 mm (14"), 400 mm (16"), 500 mm (20"), and 600 mm (24")

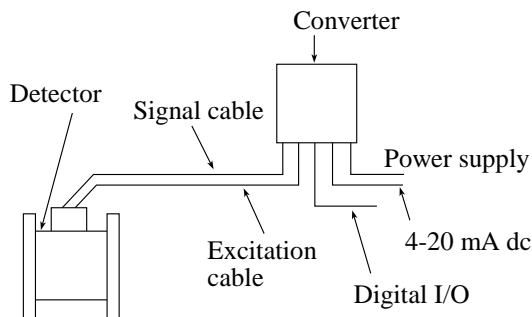
**Fluid pressure:** 0 to 2.0 MPa under fully-filled fluid condition for flange-connected flowmeters

**Connection flange standards:** ANSI 150, BS 16, DIN PN16 and others.

**Structure:** NEMA 4 (IP 67) Watertight (standard), NEMA 6 (IP 68) Submersible (option)

### Coating:

Phthalic acid resin coating, pearl-gray colored (standard for watertight type) or black tar epoxy (option for watertight type and specified exclusively for submersible type)



**Figure 1. LF502 Configuration**

## Specifications

### ■ Overall Specifications

#### Measurement range:

Meter size in mm (inch)	Measurement range
150 mm (6")	0 – 60 m <sup>3</sup> /h (std) to 0 – 300m <sup>3</sup> /h
200 mm (8")	0 – 110 m <sup>3</sup> /h (std) to 0 – 550m <sup>3</sup> /h
250 mm (10")	0 – 175 m <sup>3</sup> /h (std) to 0 – 875m <sup>3</sup> /h
300 mm (12")	0 – 250 m <sup>3</sup> /h (std) to 0 –1250m <sup>3</sup> /h
350 mm (14")	0 – 350 m <sup>3</sup> /h (std) to 0 –1750m <sup>3</sup> /h
400 mm (16")	0 – 450 m <sup>3</sup> /h (std) to 0 –2250m <sup>3</sup> /h
500 mm (20")	0 – 710 m <sup>3</sup> /h (std) to 0 –3550m <sup>3</sup> /h
600 mm (24")	0 –1000 m <sup>3</sup> /h (std) to 0 –5000m <sup>3</sup> /h

**Principal materials:**

**Case** — carbon steel

**Linings** — The following are the standards:  
Teflon PFA for Meter sizes 150 mm (6") to 400 mm (16"), chloroprene rubber for Meter sizes 500 mm (20") and 600 mm (24")

**Electrodes** — 316L stainless steel (standard)

**Grounding rings** — 316 stainless steel (standard)  
See Table 1 for optional materials and other related information.

**■ Converter Specifications****Input signals**

**Analog input:** voltage signal from detector and is proportional to process flow rate

**Digital input (DI)**

Voltage signal: High level 20 to 30 V dc  
Low level 2 V dc or less

Input resistance: 2.7 k $\Omega$

Number of inputs: one point

**DI function** — One of the following functions can be assigned to DI signal:

- **Unidirectional 2-range switching signal**  
(lower range with high DI voltage level)
- **Bidirectional 2-range switching signal**  
(lower range with high DI voltage level)
- **Totalizer start/stop** — Starts and stops the built-in totalizer. (Totalizer starts with high DI voltage level and stops with low DI voltage level.)
- **Zero adjustment** — Starts zero adjustment (on-stream at zero flow rate) when DI voltage level goes low after remaining high for 10 to 20 seconds.
- **Fixed-value outputs** — Outputs fixed values for current output (and pulse output if used).  
Outputs fixed values when DI voltage is high.

**Output signals**

**Analog output:** 4–20 mA dc;  
Load resistance 0 to 1 k $\Omega$

**Digital outputs:** — 2 points (D1 and D2)

Output type: Solidstate relay contact outputs  
(non polarity)

Capacity: 150 V dc, 150 mA maximum or  
150 V ac, 100 mA maximum (peak)

Number of outputs: Two points

**D1 and D2 functions** — Two of the following functions can be assigned to D1 and D2.

- **Pulse output (available only for D1)**  
Pulse rate: 3.6 to 360000 pulses/hour  
Pulse width: 5 to 100 ms (but less than half of the period for 100 % flow rate)
- **Multi-range selection outputs**
  - (1) **One point (D1 or D2) output**  
Unidirectional 2-range automatic selection signal or bidirectional 2-range automatic selection signal
  - (2) **Two point (D1 and D2) outputs**  
Unidirectional 4-range automatic selection signal or bidirectional 4-range automatic selection signal
- **High and/or low limit alarm outputs**  
Outputs an alarm signal if the flow rate output goes above high limit value or below low limit value  
Setting range: –10 to 110 % of range  
Output status: Contact ON when alarm occurs.
- **Empty pipe alarm output**  
Outputs an alarm signal if the detector pipe is emptied.  
Output status: Contact ON when alarm occurs
- **Preset point output**  
Outputs a signal when the built-in totalizer count reaches the preset point.  
Setting range: 1 to 999999 counts  
Output status: Contact ON when alarm occurs
- **Converter failure alarm output**  
Outputs an alarm signal if the converter detects an erroneous condition other than high/low limit or empty pipe alarm conditions.

**Communications output** — A digital signal is superimposed on 4–20 mA dc current signal (conforms to the HART protocol).

Load resistance: 240  $\Omega$  to 1 k $\Omega$

Load capacitance: 0.22  $\mu$ F maximum

**Note:** HART (Highway Addressable Remote Transducer) protocol is a communications protocol for industrial sensors recommended by HCF (HART Communication Foundation).

**Output display:** 2-line, 16-character LCD display (backlit) shows flow rate and total flow in various engineering units. Up to two set of data can be displayed.

**Damping:** 5 to 600 s

**Parameter settings:** Configuration parameters can be set using the control keys on the LCD display.

**Zero and span calibration:**

Built-in calibration signal source allows converter unit check.

**Zero adjustment:** Zero point adjustment can be started by pressing a combination of control keys on the LCD display.

**Conditions when power fails:**

The output and display will remain as follows when power fails. Parameter setting values are stored in non-volatile memory and the values will be re-stored when the power returns to normal condition.

- Current output: 0 mA dc
- LCD display: No display
- Digital output: OFF

**Power supply:** One of the following power supply specifications can be selected:

- 100 to 120 V ac (90 to 132 V ac), 50/60 Hz
- 200 to 240 V ac (180 to 264 V ac), 50/60 Hz (option)
- 24 V dc (22 to 27 V dc) (option)

**Power consumption:** approximately 24 VA

**Surge protection:** Surge protectors are installed in the power supply and current signal output circuit.

**Case:** Cast aluminum

**Coating:** Melamine resin

**Painting color:** Light gray (munsell N7)

**Structure:** NEMA 4 (IP 67) Watertight

**Cable connection port:** Rc(PT) 3/4 male screw

**Vibration resistance:**

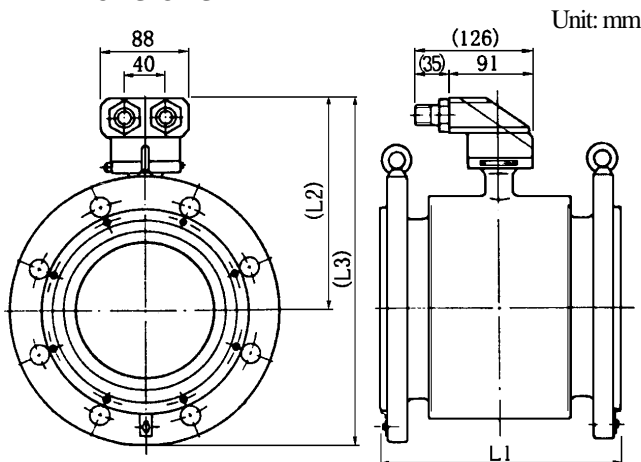
No resonance to the following levels of vibration:

- 5 to 33 Hz with acceleration of 9.8 m/s<sup>2</sup>

**Note:** Avoid using the flowmeter in an environment with constant vibration.

## Installation

### ■ Dimensions



**Figure 3. Detector Dimensions for Meter Sizes 150 mm (6'') and 200 mm (8'')**

See the following tables for dimensions of L1, L2 and L3 in Figure 3 above, and the number of bolts required for each flange.

#### BS16 and DIN PN16 flange dimensions:

Meter size (mm)	L1 (mm)	L2 (mm)	L3 (mm)	No. of bolts	Mass (kg)
150	266	245	388	8	approx. 35
200	300	271	441	12	approx. 80

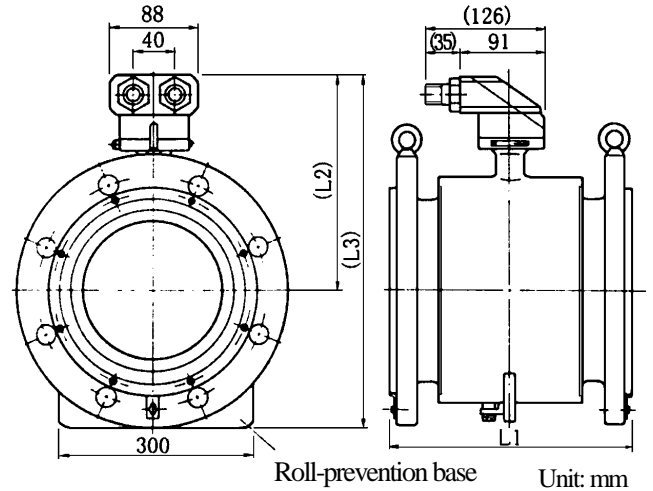
#### ANSI class 150 flange dimensions:

Meter size (inch)	L1 (inch)	L2 (inch)	L3 (inch)	No. of bolts	Mass (lb)
6	10 1/2	9 5/8	15 1/8	8	approx. 78
8	11 3/4	10 5/8	17 1/2	8	approx. 178

### JIS 10K flange dimensions:

Meter size (mm)	L1 (mm)	L2 (mm)	L3 (mm)	No. of bolts	Mass (kg)
150	266	245	385	8	approx. 35
200	300	271	436	8	approx. 80

### ■ Dimensions



**Figure 4. Detector Dimensions for Meter Sizes 250 mm (10'') to 600 mm (24'')**

See the following tables for dimensions of L1, L2 and L3 in Figure 4 above, and the number of bolts required for each flange.

#### BS16 and DIN PN16 flange dimensions:

Meter size (mm)	L1 (mm)	L2 (mm)	L3 (mm)	No. of bolts	Mass (kg)
250	350	306	509	12	approx. 110
300	400	329	559	12	approx. 120
350	450	351	611	16	approx. 130
400	500	386	676	16	approx. 180
500	600	401	758	20	approx. 190
600	600	452	872	20	approx. 250

#### ANSI class 150 flange dimensions:

Meter size (inch)	L1 (inch)	L2 (inch)	L3 (inch)	No. of bolts	Mass (lb)
10	13 3/4	12	20 1/8	12	approx. 244
12	15 3/4	13	22 3/4	12	approx. 267
14	17 3/4	13 7/8	24 7/8	12	approx. 289
16	19 5/8	15 1/4	27 3/8	16	approx. 400
20	23 5/8	15 3/4	30 3/8	20	approx. 422
24	23 5/8	17 3/4	34 5/8	20	approx. 556

### JIS 10K flange dimensions:

Meter size (mm)	L1 (mm)	L2 (mm)	L3 (mm)	No. of bolts	Mass (kg)
250	350	306	506	12	approx. 110
300	400	329	551	12	approx. 120
350	450	351	596	16	approx. 130
400	500	386	666	16	approx. 180
500	600	401	738	16	approx. 190
600	600	452	849	24	approx. 250

■ Dimensions (Converter)

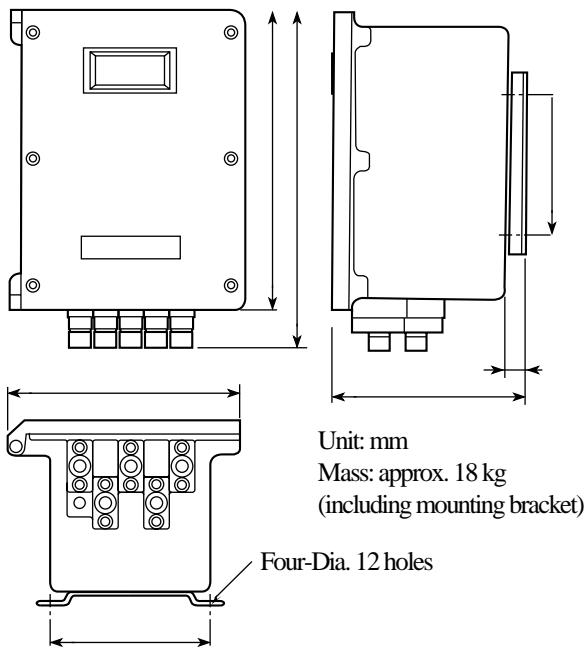


Figure 5. Converter Dimensions

■ Piping Precautions

(1) Flange connection

The flowmeter has upstream and downstream flanges on the ends of detector pipe. Connect these flanges with the flanges on both sides of pipeline bore using connection bolts after inserting a packing between them. See Figure 6. Tighten the bolts in even increments diagonally across.

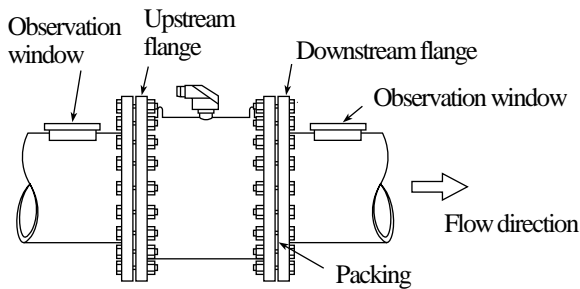
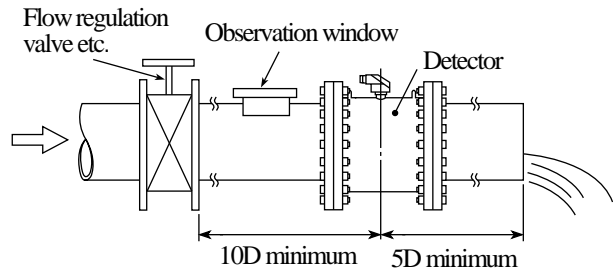


Figure 6. Flange Connection

(2) Required straight pipe length

The straight pipe length is required to prevent uneven flow velocity and a disturbance on the fluid surface in the detector pipe. The required straight pipe length should be as follows:

- Downstream side:  $L = 5D$  minimum
  - Upstream side:  $L = 10D$  minimum
- where,  
 $L$  = straight pipe length (straight pipeline length + half length of detector pipe length)



Note: The length of reducers, if used, can be counted as a part of straight pipe length.

Figure 7. Required Straight Pipe Length on Upstream and Downstream Sides

■ External Connections

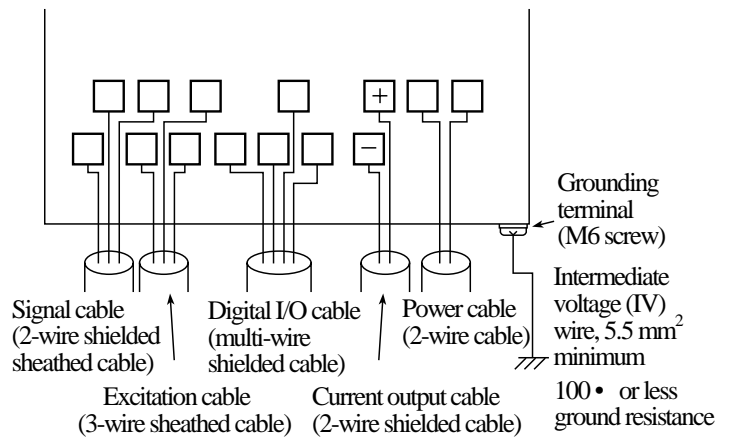


Figure 8. Converter Terminal Connections

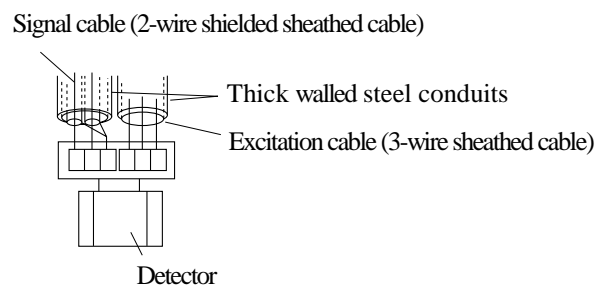


Figure 9. Detector Terminal Connections

■ Wiring Precautions

- (1) Be sure to use thick walled steel conduit (22 mm) for signal and excitation cable wiring between the detector and converter. The conduit screw is R(PT)1/2. Use flexible conduits at the cable outlets of the detector as needed.
- (2) Make the grounding wire as short as possible. Do not use a common ground shared with other equipment where earth current may flow. An independent earth ground is recommended.

# Ordering Information

1. When ordering the LF502 flowmeter, refer to Table 1 and 2 (Type Specification Codes). An entry must be made for each of the columns in each of these tables.
2. Fluid characteristics:
  - (1) Type of fluid to be measured and its characteristics
  - (2) Fluid temperature
  - (3) Fluid pressure
  - (4) Electrical conductivity of the fluid
3. Measuring range
4. Digital I/O specifications
5. Ordering scope:
  - (1) Actual flow calibration data: (required or not)
6. Other items  
Specifications other than standard items

**Table 1. Type Specification Code  
( Model LF502 Flowmeter)**

Model	Specification Code						Description	Size	
								A	B
							LF502 Electromagnetic Flowmeter		
	K						Meter size		
	L						150 mm (6")		
	M						200 mm (8")		
	N						250 mm (10")		
	P						300 mm (12")		
	Q						350 mm (14")		
	R						400 mm (16")		
	S						500 mm (20")		
							600 mm (24")		
		C					Connection flange standard		
		F					ANSI 150		
		H					BS16		
		J					DIN PN16		
		Z					JIS 10K other		
			B				Electrode and Grounding Ring Material		
			C				SUS316L+SUS316 (standard.)		
			D				SUS316L+SUS316L		
			E				Ti (titanium)+Ti (titanium)		
			F				Hastelloy C+Hastelloy C		
			Z				SUS316L+SUS304 other		
				T			Lining Material		
				C			Teflon PFA		
				Z			Chloroprene rubber other		
					A		Power Supply		
					B		100 to 120 V ac, 50/60 Hz (standard)		
					C		24 V dc		
					Z		200 to 240 V ac, 50/60 Hz other		
						A	Converter Mounting Bolts and Nuts		
					B		Panel, wall mount (carbon steel SS400)		
					C		Panel, wall mount (304 stainless steel)		
					D		Pipe mount (carbon steel SS400)		
					Z		Pipe mount (304 stainless steel) other		
						A	Detector Connection Bolts, Nuts and		
					Z		Packings not provided other		
						B	Dedicated Preformed Cable		
					C		30 m provided other lengths, provided		
						B	Coating of detector		
						B	Phthalic acid resin		
						C	Black tar epoxy resin 0.3 mm		
						D	Black tar epoxy resin 0.5 mm		
						E	Black tar epoxy resin 0.5 mm (for submersible type)		
						Z	other		

Size groups.

A: 150 mm (6") to 400 mm (16")

B: 500 mm (20") and 600 mm (24")

Size code explanation:

Standard      Option    – Not available

■ **Year 2000 Compliance:**

This equipment does not have any clock in itself. Thus, there is no problem in the year 2000 compliance.



Misuse of this product can result in damage to property or human injury.  
Read related manuals carefully before using this product.

Specifications are subject to change without notice  
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