

Introduction

The electromagnetic flowmeter uses Faraday’s Law of electromagnetic induction to measure the process flow. The device consists of two units: a detector, through which the fluid to be measured flows and in which low-level signals proportional to flow rates are obtained; and a converter, which supplies excitation current to the detector, and amplifies the signals from the detector and then processes and converts the signals into the 4–20 mA dc current signal.

The LF232 offers various outputs such as totalization output and multi-range selection outputs. With its patented **Noise-Sentry** original noise-suppression circuit and advanced algorithms. The LF232 is highly resistant to noise and provides a stable output even when measuring fluids contain slurries. The LF232 can be used with a separately mounted detector such as the LF150 or LF470. The LF232 can also be used with conventional models of detectors.

The AF900 hand-held terminal (HART*¹ communicator) can be used to communicate with the flowmeter from a remote place. See the Communications signal specification for details about HART protocol.

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

Specifications

Overall Specifications

Measurement range in terms of flow velocity:

Combination LF150, LF470

0 – 1.0 ft/s to 0 – 32.8 ft/s (0 – 0.3 m/s to 0 – 10 m/s)

Fluid conductivity: 5µS/cm or more

Ambient temperature: -4 to 140 °F (-20 to 60 °C)

(Storage temperature: -13 to 149 °F (-25 to 65 °C))

Structure: IP67 and NEMA 4X Watertight



Figure 1. LF232 Converter

Accuracy: the accuracy is dependent on the type of detector combined with the LF232. See the following tables for accuracy when combined with specified detectors.

• **Detector combined**

LF470 (Meter size 1/10", 1/6", 1/4" (2.5 to 6 mm))

Flow rate as a percent of range	Accuracy	
	0.3–1.0m/s	1.0–10m/s
0~50%	±0.8%FS	±0.4%FS
50~100%	±0.8%FS	±0.8% of rate

• **Detector combined**

LF150 (Meter size 28" to 120" (700 to 3000 mm))

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 (4mm/s) at 3.28 ft/s (1.0 m/s) or less.

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

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

Power supply:

One of the following can be selected

- 100 to 240 Vac
(Allowable voltage 80 to 264 Vac, 50/60Hz)*¹
- 24 Vdc
(Allowable voltage 21 to 27 Vdc)*²

*1 When the 7th digit of specification code is “B”,
power supply is 100 to 120Vac
(Allowable voltage range is 80 to 132VAC, 50/60Hz)

*2 When the 7th digit of specification code is “B”,
24Vdc cannot be selected.

Power consumption:

- 17W (27VA) or less
(When 7th digit of specification code is “A”)
- 35W (120VA) or less
(When 7th digit of specification code is “B”)

■ Converter Specifications**Input signals**

Analog signal — the voltage signal from detector,
proportional to process flow rate.

Digital input DI (opt.)

(added when 9th digit of specification code is “3”)

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

Input resistance: 2.7 kΩ

Number of inputs: 2 points (DI1 and DI2)

DI functions:

For digital input function, either of the following
functions can be selected.

• Range switching

One Digital Input is used: switching between large
and small ranges of forward/reverse, 2-range
measurement.

Two Digital Inputs are used: switching between
ranges of single direction, 4-range measurement.

• Totalizer control input

Totalizer Start/Stop control or Reset/Start

• Output hold input

Fixed with set value for current output and pulse
output (loop check)

• 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.

Output signals**Current output:**

4–20mA_{dc} (load resistance 0 to 1KΩ)

Digital output (DO) — One point (std.) and three
more point is optionally available as follows.

Digital output DO1 (std.):

Output type: Transistor open collector

Number of outputs: One point

Output capacity : 30Vdc, 200mA maximum

Digital output DO2~DO4 (opt.)

(Added when 9th digit of specification code is “3”)

Output type: Solid-state relay output (non polarity)

Number of outputs: 3 points

Output capacity: 150Vdc, 150mA maximum or
150Vac (peak to peak),
100mA maximum

DO functions—Four digital output function, either
of the following functions can be selected.

• Totalizer pulse output

DO1 or DO2 can be selected (Forward direction
pulse and reverse direction pulse can be assigned
independently)

In the case of DO1

Pulse rate: 3.6 to 3,600,000 pulses/h

Pulse width: Settable within the range of 0.3 to
500ms

In the case of DO2

Pulse rate: 3.6 to 360,000 pulses/h

Pulse width: Settable within the range of 4 to
500ms

• Range switching output

One Digital Output (DO) is used

- Single direction, 2-range switching signal
- Forward/reverse direction switching signal

Two Digital Outputs (DO) are used

- Single direction, 4-range switching signals
- Forward/reverse 2-range switching signals

• High/low limit alarm output

An alarm is output when flow rate goes above or
below the set-point value

Setting range: -10 to 110% of the settable
maximum range

High limit 2 points, low limit 2 points can be set

At the time of alarm output, Normally Open or
Normally Closed contact can be selected

• Preset point output

Contact ON when totalizer count exceeds the set
value

Setting range: 1 to 99999999 count

• Converter error alarm

An alarm is output when an operation error is
detected by self-diagnosis.

At the time of alarm output, Normally Open or
Normally Closed contact can be selected

Communications signal:

A digital communications (HART protocol) signal is superimposed on 4 to 20 mA dc analog output signal.

Load resistance: 240 Ω to 1 k Ω

Load capacitance: 0.25 μ F or less

Load inductance: 4mH or less

(For maximum cable length, about 2km is a guideline length when CVV-S 1.25mm² is used under standard installation condition.)

Note: HART (Highway Addressable Remote Trans-ducer) is a communications protocol for industrial sensors recommended by the HCF (HART Communication Foundation).

Output display:

16-character \times 2-line dot-matrix LCD

(With back light).

2 units can be selected from the flowing units: flow velocity, instantaneous flow rate, total flow (forward/reverse/difference flow), total count, %, custom unit.

Parameter settings—Parameters can be set as follows

•**IR Switches:** Various parameters can be set without opening the converter housing using 4 infrared switches (password can be set)

•**Zero adjustment:** Zero point adjustment can be started by pressing the switch in the converter.

•**Digital communication:** The AF 900 hand-held terminal is needed to set parameters.

•**Damping:** 0.5 to 60 s (selectable in 1s increments)

•**“Field re-verification” Mag-Prover** – Toshiba’s Zero span calibration tool allows unit to be re-calibrated and verified using internal software program. (For more information contact Toshiba International Corp.)

Conditions when power fails:

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

Current output: 0 mA

Digital output: OFF (contact open)

LCD display : No display

Surge protection: Surge protectors are installed in the power supply, excitation circuit, current signal output and digital I/O circuit.

Terminal block structure: 21-pole, screw connection type (M4 screw)

Housing: Aluminum alloy

Coating: Acrylic resin-baked coating, pearl-gray colored

Cable connection ports :

A cable gland is provided for each port.

OD of cable ϕ 11 to 13 mm

Material Nylon 66

G (PF) 1/2 male screws.

Vibration resistance:

No resonance to the following levels of vibration:

- 10 to 55Hz with amplitude of 0.07mm
- Vibration of 30Hz with 29.4 m/s² in 4h in each direction will not cause any defect to unit.

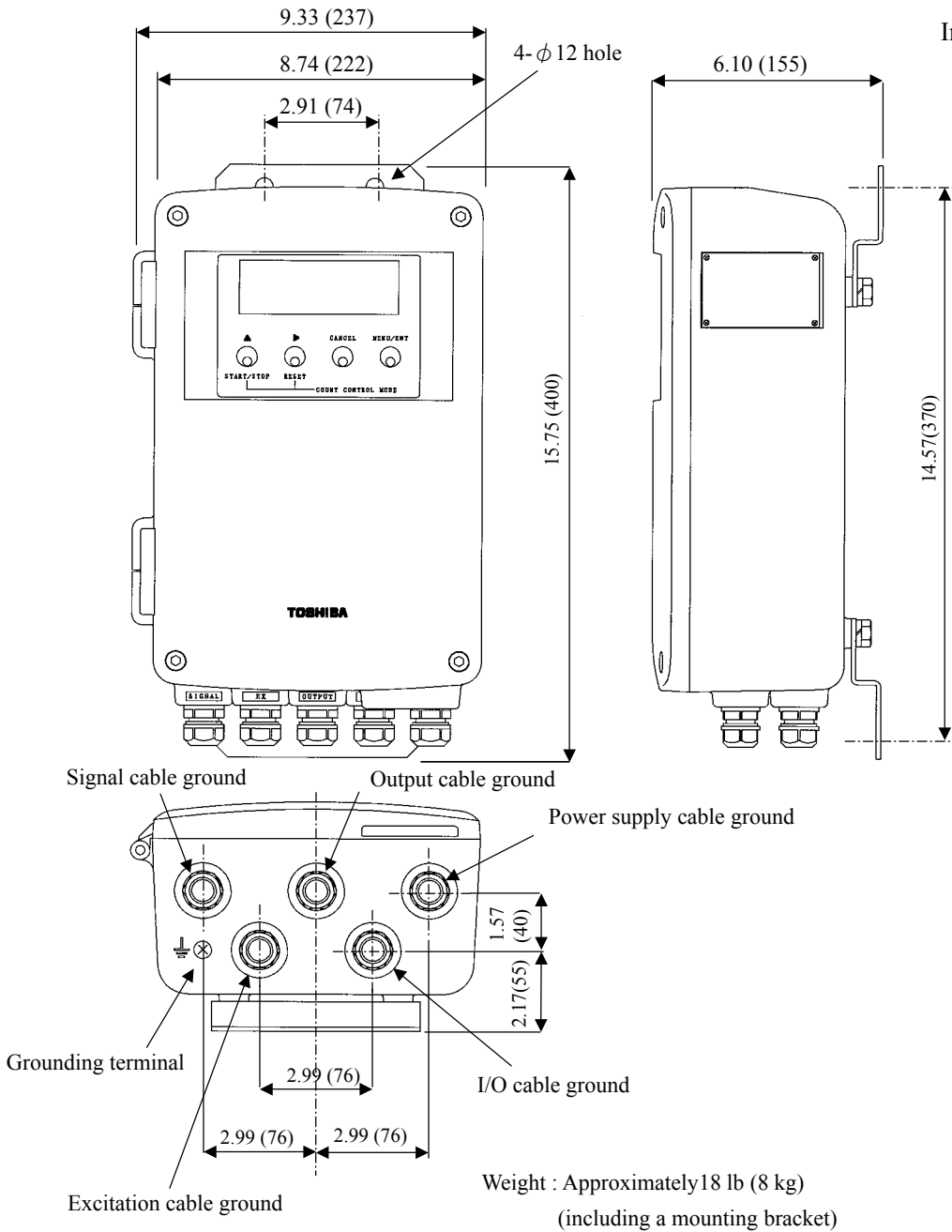
Note: If the flowmeter is intended to be used in a location where vibration is applied constantly contact Toshiba.

Dimension and Weights:

See Figure 2

Installation

■ Dimensions



Installation method

- Installed by panel or pipe
- Appointed bout and nut for installation is attached.

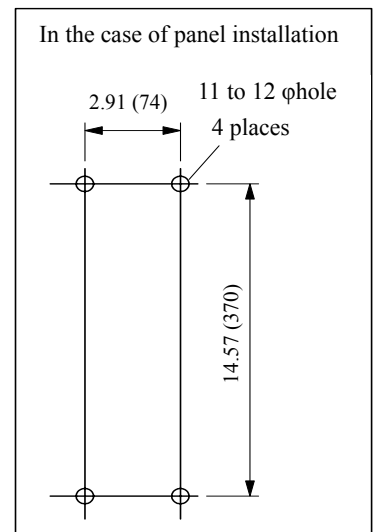
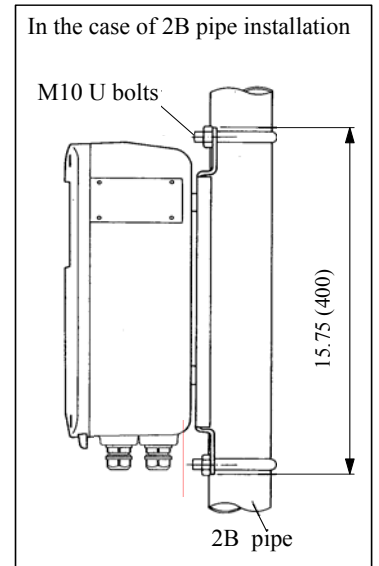


Figure 2. Separate type converter LF232

External Connections

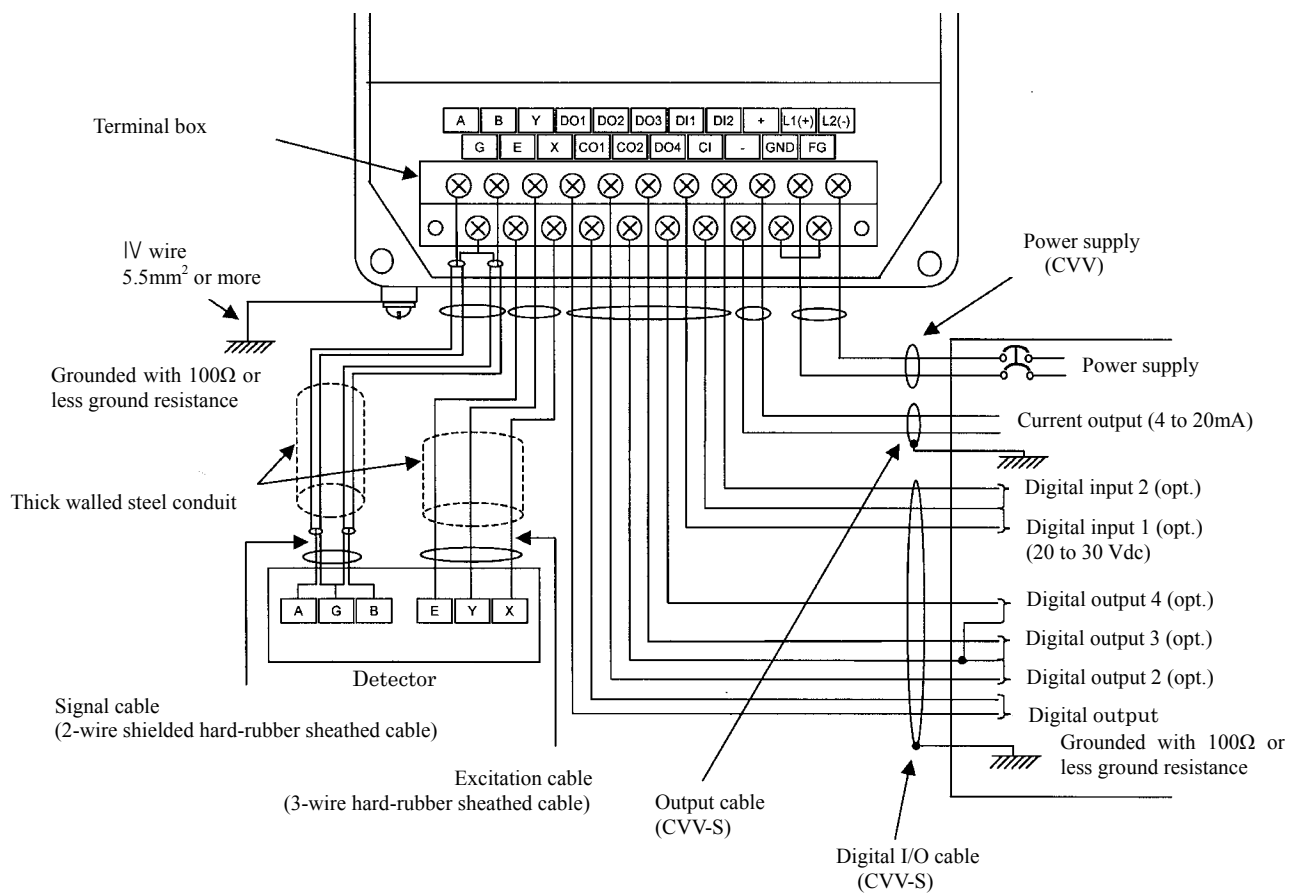
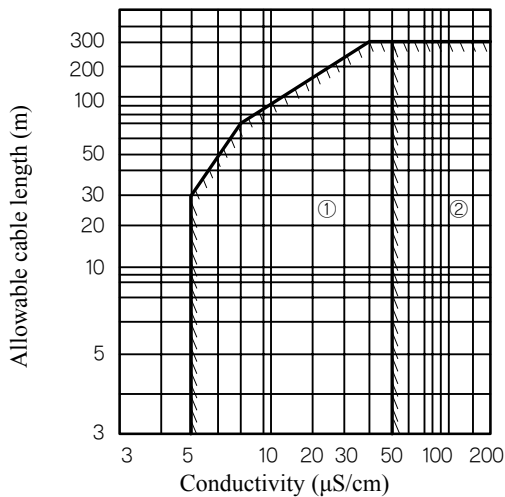


Figure 3. External Wiring Diagram

■ Wiring Precautions

- (1) Be sure to use thick walled steel conduit (22mm) for signal and excitation cable wiring between the detector and converter. Use flexible conduit at the cable outlets of the detector and converter.
- (2) Connect the grounding wire (IV wire 5.5mm² or more) to a good earth ground (100Ω or less ground resistance). Make the 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.
- (3) The allowable cable lengths between the detector and converter for the separate type flowmeter depend on the electrical conductivity of the object fluid. See Figure 4 below.
- (4) Digital output 1, digital output 2 to 4, digital output 1 to 2 are insulated mutually.



- (1) When combined with LF150.
- (2) When combined with LF470.

Figure 4. Electrical Conductivity and Cable length

■ About establishment environment

Do not store or install the flowmeter:

- Where there is direct sunlight.
- Where excessive vibration or mechanical shock occurs.
- Where high temperature or high humidity conditions exist.
- Places where corrosive atmospheres exist.
- Places submerged under water.
- Place where there is sloped floor. To put the flowmeter temporarily on the floor, place it carefully with something, such as stopper, to support it so that the flowmeter will not topple over.

In areas like the following, there may be the case that infrared switches do not function correctly. (If these are unavoidable, use an appropriate cover.)

- (1) Where unit (operation panel) is exposed to direct sunlight, reflection of light onto window pane and diffused light reflection.
- (2) Where smoke and steam may occur.
- (3) Where exposed to direct snow, ice or mud.

Ordering Information

1. When ordering the LF232 converter, refer to Tables 1 (Type Specification Code). An entry must be made for each of the columns in each of these tables.
2. Measuring range
3. I/O function specifications.
4. Ordering scope:
Actual flow calibration data: (required or not)
5. Specification of combined detector
6. Other scope:
Specification other than standard items.

Consult a Toshiba representative before ordering.

Table 1. Specification Code for converters (LF232)

Model				Specification Code										Contents
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
L	F	2	3	2										Separate type converter
						A								Purpose Standard
						A								Compatible detectors (Note1,2,3) Medium to small-size detectors: Meter size 1/10" to 18" (2.5 to 450 mm) Large-size detectors: Meter size 28" to 120" (700 to 3000 mm)
						B								
						C								Mounting nuts and bolts Panel, wall mounting (BNP material : SUS304) Pipe mounting (BNP material : SUS304)
						E								
									1					Digital input/output Current output + Digital output points (1 point) Current output + Digital output points (4 points) + Digital input points (2 points)
									3					
													1	Communication function HART communication
													1	Power supply 100Vac-240Vac, 50/60Hz (Note 2) 24Vdc (Note 3)
													2	
													A	Standard

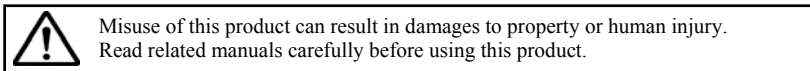
Note 1: For applicable detector code, select one from the following table.
To combine with an existing detector, select one depending on the type of replaceable converters.
For combination with detectors not listed below, contact Toshiba.

Applicable detector code	Applicable detector	Applicable detector (discontinued model)	Replaceable converters
A	LF470 type	334, 335 type (Converters of types shown right)	372, LF200, LF220, LF420, LF230* A type
B	LF150 type	337, 335 type (Converters of types shown right)	373, 378, LF230* B type

Note 2: When the 7th digit is "B" and power supply specification code is "1", power supply specification is 100 to 120VAC.

Note 3: 24VDC can be specified only when the 7th digit is "A".

ISO9001 and ISO14001 are certified.



Specifications are subject to change without notice.
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