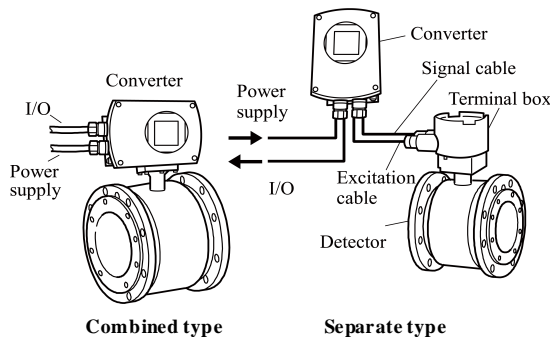


**Introduction**

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 mAdc current signal or communication signal. The meter features a **Mount-Anywhere** magnetic field distribution technology, the meter is highly immune to upstream flow disturbances. Combined with a multi-functional converter LF620 (combined type) or LF622 (separate type) equipped with its patented **Noise-Sentry** original noise-suppression circuit and advanced algorithms. The LF654 has a very high tolerance to noise, giving the unit a very stable output even for slurry fluid measurement. IR (Infrared) switches enable parameter setting of the converter without removing the cover. Flow direction can be set in either way, and its unique 128 x 128 dot matrix LCD display allows the LCD to be rotated electronically to 90, 180 and 270 degrees without opening the cover.

- \*1: HART protocol (Highway Addressable Remote Transducer) is a communication protocol for industrial sensors recommended by the HCF (HART Communication Foundation).  
\*\* DevComm2000 Smart Device Communicator available for performing HART device configurations on PC or laptop is available through the supplier.
- \*2: PROFIBUS is the communications protocol for factory and process automation that the PROFIBUS Organization recommends. Instead of analog control with a conventional analog signal (4-20 mA), it is fieldbus which digitizes all signals. Flowmeters support PROFIBUS-PA.
- \*3: Modbus is the communication protocol that Modicon Inc. developed. Physical layer is RS485.



**Figure1. Configuration**



**Figure2. LF654 Mount-Anywhere Series Flowmeters**



**Specifications**

**Overall Specifications**

**Measurement range in terms of flow velocity:**

- 1.0 ft/s to 39.4 ft/s (0.3 m/s to 12 m/s).
- 0.3 ft/s to 1.0 ft/s (0.1 m/s to 0.3 m/s)  
range is available optionally.

**Accuracy:**

**< 1/2" to 18" ( 15mm to 450mm) >**

- ±0.2 % of Rate\*
- \* This pulse output error result is established under standard operating conditions at Toshiba admitted flow calibration facility. (NIST Traceable)
- \* Individual meter measurement error may vary up to ±0.5% of Rate at 1.64 ft/s (0.5m/s) or more and ±0.3% of rate ±0.039 inch/s (1mm/s) at 1.64 ft/s or less.
- \* Current output: plus ± 8µA (0.05% of span.)
- \* Refer to individual calibration data for each individual meter's measurement error.

**Fluid conductivity:**

3 $\mu$ S/cm minimum

**Fluid temperature:**

-4 to 248 °F (-20 to +120 °C): PFA lining

-4 to 104 °F (-20 to +40 °C): Polyurethane lining

\* Consult Toshiba before using the meter at the high temperature, because the product lifetime may be shortened.

**Ambient temperature:**

-40 to 140 °F (-40 to +60 °C):

Separate type for PFA lined flowmeter

-4 to 140 °F (-20 to +60 °C):

Combined type for PFA lined flowmeter

-4 to 140 °F (-20 to +60 °C):

PU lined flowmeters

**Structure:**

**Standard** — IP 67 and NEMA 4X Watertight

**Option** — IP68 and NEMA 6P Submersible type allows for accidental submergence up to 15m for 48 hours. This option is only available when separate type detector of PU liner is selected.

**Power consumption:**

Standard:10W(14VA)

at AC100V and Excitation current:0.2A

MAX:15W (22VA)

MAX:17W(24VA) with PROFIBUS

**Approved hazardous location certifications:**

Model: LF654/LF620F and LF654/LF622F

cFMus Nonincendive for use in

hazardous (classified) locations:

Class I, II, III, Division 2, Groups A-G

**Detector and converter combination:**

LF654/LF620F: Combined type with Ex approval of Class I, II, III, Division 2 (cFMus).

LF654/LF622F: Separate type with Ex approval of Class I, II, III, Division 2 (cFMus).

**Mount-Anywhere Technology:**

With TOSHIBA's unique magnetic field distribution technology, the meter is highly immune to upstream flow disturbances.

A minimum of 1D (one diameter) length of upstream straight pipe from the flange and 0D (zero diameter) length of downstream straight pipe from the flange are required to maintain the specification performance.

**Note:** The test results were obtained and demonstrated at TOSHIBA's flow calibration facility, Fuchu Japan.

**Drinking water approvals:**

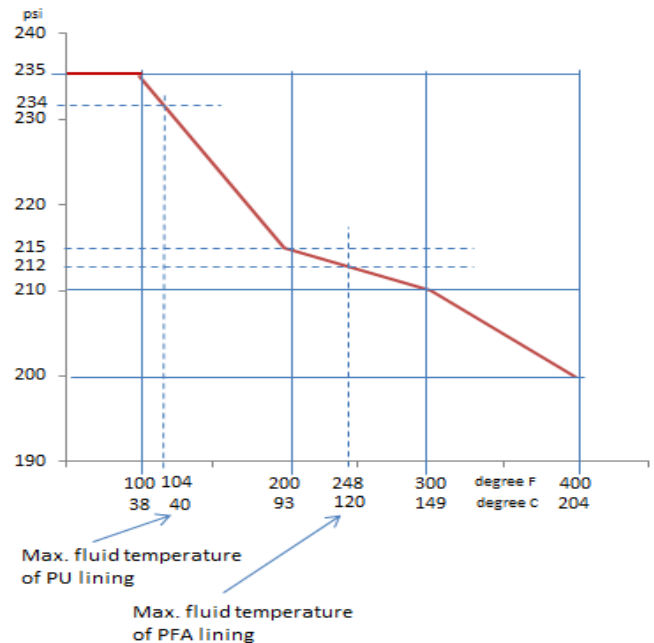
PU liner: NSF/ANSI standard 61

**Model LF654 Detector**

**Mounting style:** Flange connection type

**Fluid pressure:**

-15 psi or -1.0 bar (-0.1 MPa) to the nominal pressure of the connection flange

**Connection flange standards:**

ASME B16.5 class 150, ASME B16.5 class 300

EN1092-1 PN10, EN1092-1 PN16

**Principal materials:**

**Case** — carbon steel

**Flange material** — carbon steel

**Linings** —

1/2" to 18" (15 to 450mm): PFA

1/2" to 18" (15 to 450mm): PU

Note: PFA liners are mechanically retained for full vacuum service (65 to 450 mm).

**Electrodes** —

Type-Super smooth, polished with self cleaning finish, and non stick shape

316L stainless steel (std.) in case of PU lining

Hastelloy C equivalent (std.)

... in case of PFA lining

Note: Electrodes are mechanically buffed and electro-chemically polished.

**Grounding rings** — 316 stainless steel (std.)

**Note:** See Table 4 for optional materials and other related information.

**Measuring tube material** — 304 stainless steel

**Terminal box material** — Aluminum alloy (for separate type)

**Coating:** Corrosion resistant resin coating (std.)  
gray colored

**Dimensions and weights:** See Figure 3, 4, 5 and 6.

**Cable connection port:** for separate type detectors.

**Cable gland** —

LF654(with cFMus):Not provided, 1/2–14NPT  
male screws are required.

## ■ Model LF620 and LF622 converters

### Input signals

**Analog signal** — the voltage signal from detector,  
proportional to process flow rate (for LF622  
separate type converter).

### Digital input DI

Signal type: 20 to 30Vdc voltage signal

Input resistance: 2.7k $\Omega$

Number of inputs: one point

Note: DI cannot be used with the Modbus communication.

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

- **Range switching** — Selects either the higher or  
lower range in the unidirectional or bidirectional  
2-range setting.
- **Totalizer control** — ‘Starts/Stops’ or ‘Resets’  
/Starts’ operation in the built-in totalizer.
- **Fixed-value outputs** — Outputs fixed-values for  
current and pulse outputs for loop check.
- **Zero adjustment** — Executes zero adjustment  
(on-stream at zero flow rate).

### Output signals

#### Current output:

4–20mA<sub>dc</sub> (load resistance 0 to 750 $\Omega$ )

**Note:** The current output cannot be used with the  
PROFIBUS-PA communication.  
(Refer table 6 for details)

**Digital outputs** — Two points are available as  
follows.

#### Digital output DO1:

Output type: Transistor open collector

Number of outputs: One point

Output capacity: 30V<sub>dc</sub>, 200mA maximum

**Note:** DO1 cannot be used if Modbus  
communication connection is 3 lines.  
(Refer table 6 for details)

#### Digital output DO2 :

Output type:

Solid-state relay output (non polarity)

Number of outputs: One point

Output capacity: 150V<sub>dc</sub>, 150mA maximum  
or 150V<sub>ac</sub> (peak to peak), 100mA maximum

**Note:** DO2 cannot be used with the Modbus  
communication. (Refer table 6 for details)

**DO1 and DO2 functions** — One of the following  
functions can be assigned to DO1 and/or DO2 .

#### • Pulse output (available only for DO1, DO2)

Pulse rate: MAX 10kHz (10000pps)(DO1)

MAX 100Hz (100pps)(DO2)

(Over 1kpps, auto-setting)

Pulse width: 0.3 to 500ms (but it is 40% or less  
of the full scale cycle. )

**Note:** The same and simultaneous pulse is not available  
between DO1 and DO2.)

#### • Multi-range selection outputs (Note 1)

#### • High, High high, Low, and/or Low low alarm outputs (Note 2)

#### • Empty pipe alarm output (Note 2)

#### • Preset count output

#### • Converter failure alarm output

**Note 1:** Two outputs (DO1 and DO2) are needed for 4-range  
switching and forward/reverse 2-range switching.

**Note 2:** Normal Open (default set) or Normal Close is selected  
for alarm outputs when programming.

When power failure occurs, unit will be fault to Normal  
Open.

### Communications output:

#### • HART (std.) — Digital signal is superimposed on 4–20mA<sub>dc</sub> current signal as follows:

Conforms to HART protocol

Load resistance: 240 to 750 $\Omega$

Load capacitance: 0.25 $\mu$ F maximum

Load inductance: 4mH maximum

#### • PROFIBUS (opt.)

Protocol: PROFIBUS-PA

Baud rate: 31.25kbps

Bus voltage: 9-30V<sub>DC</sub>

Consumption electric current of bus:

less than 16mA

Manufacture Ident-No.: 093B<sub>HEX</sub>

Standard Ident-No.: 9740<sub>HEX</sub>

Slave address: 0-126 (Default address is 126)

Profile: Profile Ver.3.01 for Process Control  
Devices

Function blocks: AI(Flow)  $\times$  1 , Totalizer  $\times$  1

**• MODBUS (opt.)**

Physical layer : RS485  
 Protocol : Modbus  
 Mode : RTU  
 Baudrate : 4800, 9600, 19200bps  
 Data length : 8bit  
 Parity bit : None, Odd, Even  
 Stop bit : 1bit, 2bit  
 Error check : CRC-16  
 Max. station number : 32(with Master device)  
 Max. cable length : 1.2km (Note)

**Note:** This length is specification of 3 line connection.

**LCD display:**

Full dot-matrix 128×128 dot LCD display  
 (back-light provided)  
 A parameter change will rotate the display.

**Parameter settings** — Parameters can be set as follows:

- **IR Switches:** Three key switches are provided to set configuration parameters.
- **Digital communication:** HART, PROFIBUS or Modbus is needed to set parameters.

**Counter control:** If the digital input is set for counter control, counter control is available for the integrated value and the pulse output.

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

**Damping:** 0.1 , 0.5 to 60 seconds (selectable in one second increments)

**“Field re-verification” Mag-Prover**— Toshiba’s Zero span calibration tool allows unit to be re-calibrated and verified using an 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 outputs and display will remain as follows when power fails.

- Current output: 0mA<sub>dc</sub>
- Digital output: OFF
- LCD display: No display
- HART: No communication
- PROFIBUS: No communication
- Modbus: No communication

**Power supply:**

One of the following can be selected:

- 100 to 240Vac, 50/60Hz  
 (allowable voltage 80 to 264Vac)
- 110Vdc  
 (allowable voltage 90 to 130Vdc)
- 24Vdc (allowable voltage 18 to 36Vdc)

**Surge protection:**

Arresters are installed in the power supply, digital input / outputs circuit and current signal output circuit to help protect the meter from lightning and improve personnel safety.

Confirmed by following tests

- IEC 61000-4-2 Electro static discharge immunity test
- IEC 61000-4- Electrical first transient/burst immunity test
- IEC 61000-4-5 Surge immunity test

**Case:** Aluminum alloy (equal to IP 67)

**Coating:**

Acrylic resin-baked coating, pearl-gray colored

**Cable connection port:****Cable glands** —

LF620F and LF622F with cFMus Approval:

Not provided, 1/2–14NPT male threads are required.

**Vibration resistance:**

No resonance to the following levels of vibration:

- 10 to 150Hz with acceleration of 9.8m/s<sup>2</sup>
- Vibration of 30Hz with 29.4 m/s<sup>2</sup> in 4h in each direction will not cause any defect to unit.

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

**Dimensions and Weights:**

See Figure 7 (for Separate type)

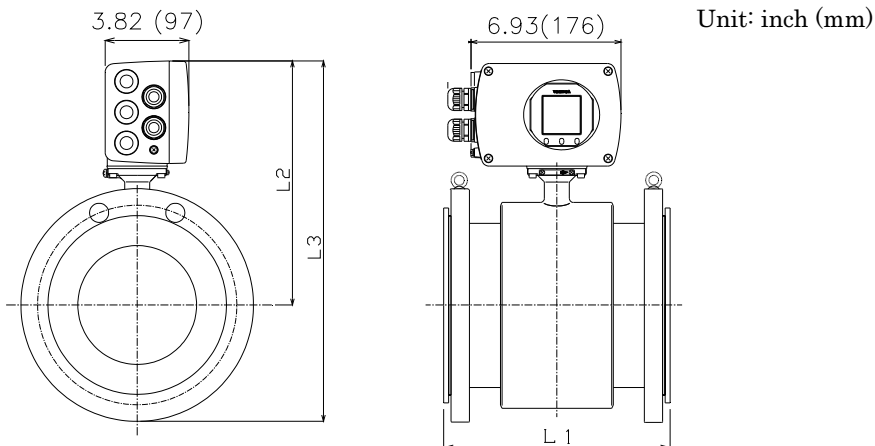
**MTBF:**

Converter: 220,000 hours (25 years) at 77 °F (25 °C)  
 based on strict military specification  
 MIL-HDBK-217F

Detector: 350,000 hours (40 years) at 77 °F (25 °C)  
 based on strict military specification  
 MIL-HDBK-217F

# Installation

## ■ Dimensions



**Note1:** Eye bolts are provided at the top for flowmeters sized 8" (200mm) or above, and further, a roll-prevention base is provided for flowmeters sized 10" (250mm) or larger.

**Note2:** This drawing is the image when LF620 set with cable gland. Cable glands are not provided for LF654 of cFMus approved type. Refer to the cable connection port at converter.

**Note3:** 1 inch = 25.4mm

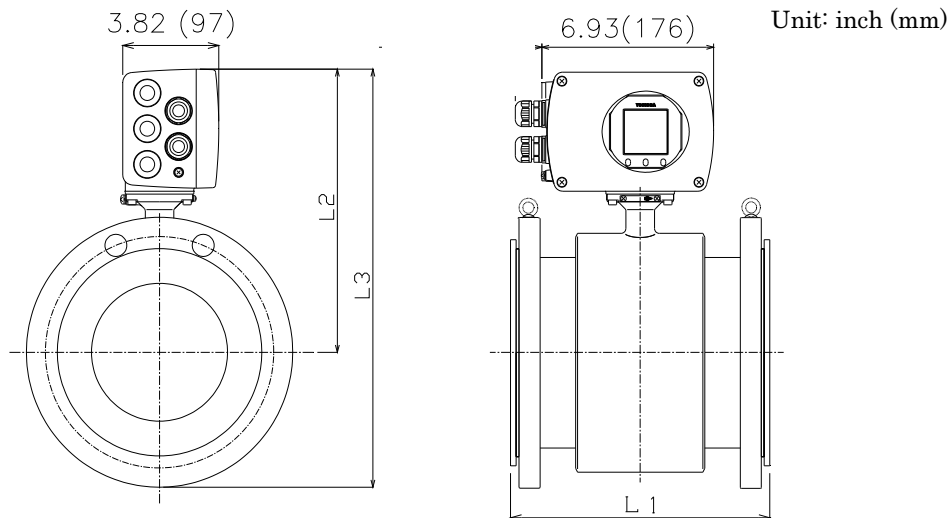
### ASME B 16.5 class 150 dimensions:

Meter size (inch)	L1 (inch)	L2 (inch)	L3 (inch)	No. of bolts	Weight (lbs)
1/2	5.51	8.07	9.84	4	approx. 11.0
1	6.30	8.31	10.43	4	approx. 16.0
1-1/4	7.87	8.62	10.94	4	approx. 20.0
1-1/2	6.69	8.66	11.18	4	approx. 20.0
2	7.09	9.09	12.09	4	approx. 29.0
2-1/2	7.87	9.29	12.80	4	approx. 38.0
3	9.06	9.69	13.43	4	approx. 45.0
4	9.45	10.28	14.80	8	approx. 64.0
5	9.84	10.71	15.71	8	approx. 73.0
6	10.24	11.34	16.85	8	approx. 93.0
8	11.81	12.24	19.02	8	approx. 139.0
10	13.78	13.15	21.14	12	approx. 207.0
12	15.75	14.65	24.13	12	approx. 315.0
14	17.72	14.88	25.39	12	approx. 403.0
16	19.69	15.79	27.20	16	approx. 509.0
18	21.65	16.69	29.21	16	approx. 617.0

### EN 1092-1 PN 16 dimensions:

Meter size (mm)	L1 (mm)	L2 (mm)	L3 (mm)	No. of bolts	Weight (kg)
15	140	203	251	4	approx. 6.0
25	160	209	272	4	approx. 7.5
32	200	217	285	4	approx. 10.0
40	170	218	288	4	approx. 10.5
50	180	232	310	4	approx. 14.5
65	200	237	325	4	approx. 16.5
80	230	255	347	8	approx. 21.5
100	240	262	367	8	approx. 26.5
125	250	273	399	8	approx. 31.0
150	260	285	425	8	approx. 37.5
200	300	310	475	12	approx. 54.0
250	350	335	535	12	approx. 78.0
300	400	365	588	12	approx. 117.0
350	450	374	619	16	approx. 156.5
400	500	397	677	16	approx. 202.5
450	550	420	730	20	approx. 249.5

**Figure 3. LF654/LF620F combined type flowmeters  
Meter Sizes 1/2" (15) to 18" (450mm) for Toshiba lay length**



**Note1:** Eye bolts are provided at the top for flowmeters sized 8" (200mm) or above, and further, a roll-prevention base is provided for flowmeters sized 10" (250mm) or larger.

**Note2:** This drawing is the image when LF620 set with cable gland. Cable glands are not provided for LF654 of cFMus approved type. Refer to the cable connection port at converter.

**Note3:** 1 inch = 25.4mm

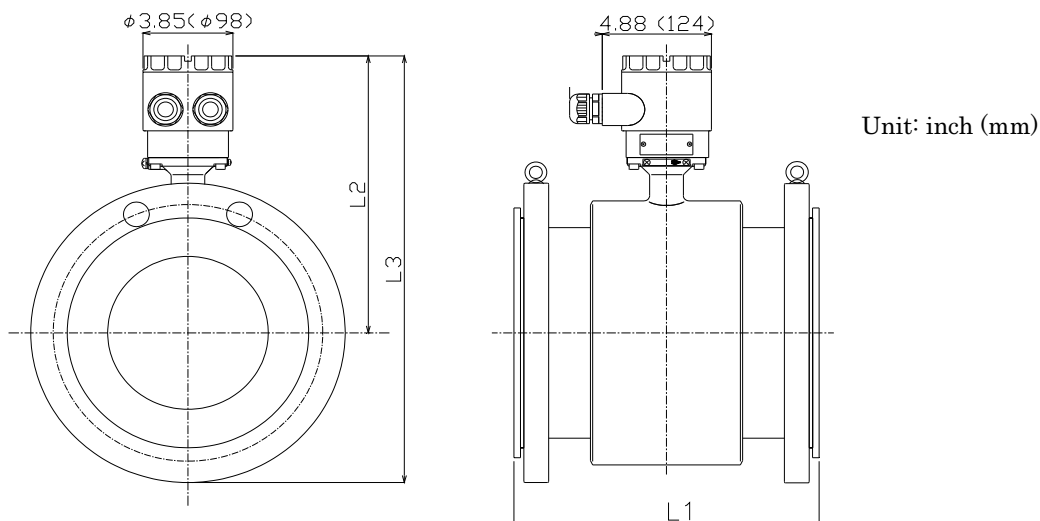
**ASME B 16.5 class 150 dimensions:**

Meter size (inch)	L1 (inch)	L2 (inch)	L3 (inch)	No. of bolts	Weight (lbs)
1/2	7.87	8.07	9.84	4	approx. 11.0
1	7.87	8.31	10.43	4	approx. 16.0
1-1/4	7.87	8.62	10.94	4	approx. 20.0
1-1/2	7.87	8.66	11.18	4	approx. 20.0
2	7.87	9.09	12.09	4	approx. 29.0
2-1/2	7.87	9.29	12.80	4	approx. 38.0
3	7.87	9.69	13.43	4	approx. 45.0
4	9.84	10.28	14.80	8	approx. 64.0
5	9.84	10.71	15.71	8	approx. 73.0
6	11.81	11.34	16.85	8	approx. 93.0
8	13.78	12.24	19.02	8	approx. 139.0
10	17.72	13.15	21.14	12	approx. 207.0
12	19.69	14.65	24.13	12	approx. 315.0
14	21.65	14.88	25.39	12	approx. 403.0
16	23.62	15.79	27.20	16	approx. 509.0
18	23.62	16.69	29.21	16	approx. 617.0

**EN 1092-1 PN16 dimensions:**

Meter size (mm)	L1 (mm)	L2 (mm)	L3 (mm)	No. of bolts	Weight (kg)
15	200	203	251	4	approx. 6.0
25	200	209	272	4	approx. 7.5
32	200	217	285	4	approx. 10.0
40	200	218	288	4	approx. 10.5
50	200	232	310	4	approx. 15.0
65	200	237	325	4	approx. 17.0
80	200	255	347	8	approx. 21.5
100	250	262	367	8	approx. 26.5
125	250	273	399	8	approx. 31.0
150	300	285	425	8	approx. 38.0
200	350	310	475	12	approx. 55.5
250	450	335	535	12	approx. 83.5
300	500	365	588	12	approx. 125.5
350	550	374	619	16	approx. 166.0
400	600	397	677	16	approx. 215.0
450	600	420	730	20	approx. 257.0

**Figure 4. LF654/LF620F combined type flowmeters  
Meter Sizes 1/2" (15) to 18" (450mm) for ISO lay length**



**Note1:** Eye bolts are provided at the top for flowmeters sized 8" (200mm) or above, and further, a roll-prevention base is provided for flowmeters sized 10" (250mm) or larger.

**Note2:** This drawing is the image when LF620 set with cable gland. Cable glands are not provided for LF654 of cFMus approved type. Refer to the cable connection port at converter.

**Note3:** 1 inch = 25.4mm

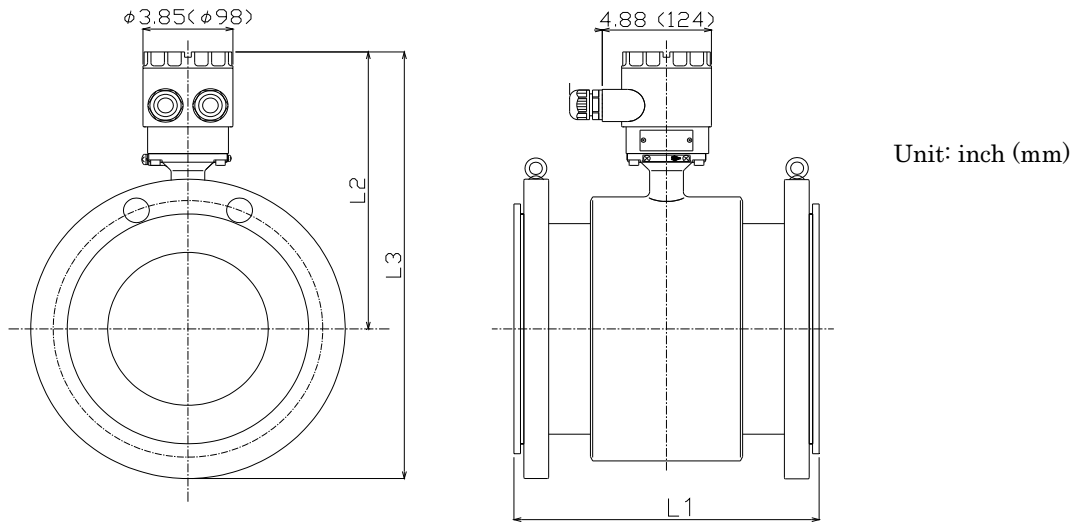
**ASME B 16.5 class 150 dimensions:**

Meter size (inch)	L1 (inch)	L2 (inch)	L3 (inch)	No. of bolts	Weight (lbs)
1/2	5.51	6.77	8.54	4	approx. 9.0
1	6.30	7.01	9.13	4	approx. 14.0
1-1/4	7.87	7.32	9.65	4	approx. 18.0
1-1/2	6.69	7.36	9.88	4	approx. 18.0
2	7.09	7.80	10.79	4	approx. 27.0
2-1/2	7.87	7.99	11.50	4	approx. 36.0
3	9.06	8.39	12.13	4	approx. 42.0
4	9.45	8.98	13.50	8	approx. 62.0
5	9.84	9.41	14.41	8	approx. 71.0
6	10.24	10.04	15.55	8	approx. 91.0
8	11.81	10.94	17.72	8	approx. 137.0
10	13.78	11.85	19.84	12	approx. 205.0
12	15.75	13.35	22.83	12	approx. 313.0
14	17.72	13.58	24.09	12	approx. 401.0
16	19.69	14.49	25.91	16	approx. 507.0
18	21.65	15.39	27.91	16	approx. 614.0

**EN1092-1 PN 16 dimensions:**

Meter size (mm)	L1 (mm)	(L2) (mm)	L3 (mm)	No. of bolts	Weight (kg)
15	140	170	218	4	approx. 4.0
25	160	176	239	4	approx. 5.5
32	200	184	252	4	approx. 8.0
40	170	185	255	4	approx. 8.5
50	180	199	277	4	approx. 12.5
65	200	204	292	4	approx. 14.5
80	230	222	314	8	approx. 19.5
100	240	229	334	8	approx. 24.5
125	250	240	366	8	approx. 29.0
150	260	252	392	8	approx. 35.5
200	300	277	442	12	approx. 52.0
250	350	302	502	12	approx. 76.0
300	400	332	555	12	approx. 115.0
350	450	341	586	16	approx. 154.5
400	500	364	644	16	approx. 200.5
450	550	387	697	20	approx. 247.5

**Figure 5. Separate type detectors LF654  
Meter sizes 1/2" (15) to 18"  
(450mm) for Toshiba lay length**



**Note1:** Eye bolts are provided at the top for flowmeters sized 8" (200mm) or above, and further, a roll-prevention base is provided for flowmeters sized 10" (250mm) or larger.

**Note2:** This drawing is the image when LF620 set with cable gland. Cable glands are not provided for LF654 of cFMus approved type. Refer to the cable connection port at converter.

**Note3:** 1 inch = 25.4mm

**ASME B 16.5 class 150 dimensions:**

Meter size (inch)	L1 (inch)	L2 (inch)	L3 (inch)	No. of bolts	Weight (lbs)
1/2	7.87	6.77	8.54	4	approx. 9.0
1	7.87	7.01	9.13	4	approx. 14.0
1-1/4	7.87	7.32	9.65	4	approx. 18.0
1-1/2	7.87	7.36	9.88	4	approx. 18.0
2	7.87	7.80	10.79	4	approx. 27.0
2-1/2	7.87	7.99	11.50	4	approx. 36.0
3	7.87	8.39	12.13	4	approx. 42.0
4	9.84	8.98	13.50	8	approx. 62.0
5	9.84	9.41	14.41	8	approx. 71.0
6	11.81	10.04	15.55	8	approx. 91.0
8	13.78	10.94	17.72	8	approx. 137.0
10	17.72	11.85	19.84	12	approx. 205.0
12	19.69	13.35	22.83	12	approx. 313.0
14	21.65	13.58	24.09	12	approx. 401.0
16	23.62	14.49	25.91	16	approx. 507.0
18	23.62	15.39	27.91	16	approx. 614.0

**EN1092-1 PN 16 dimensions:**

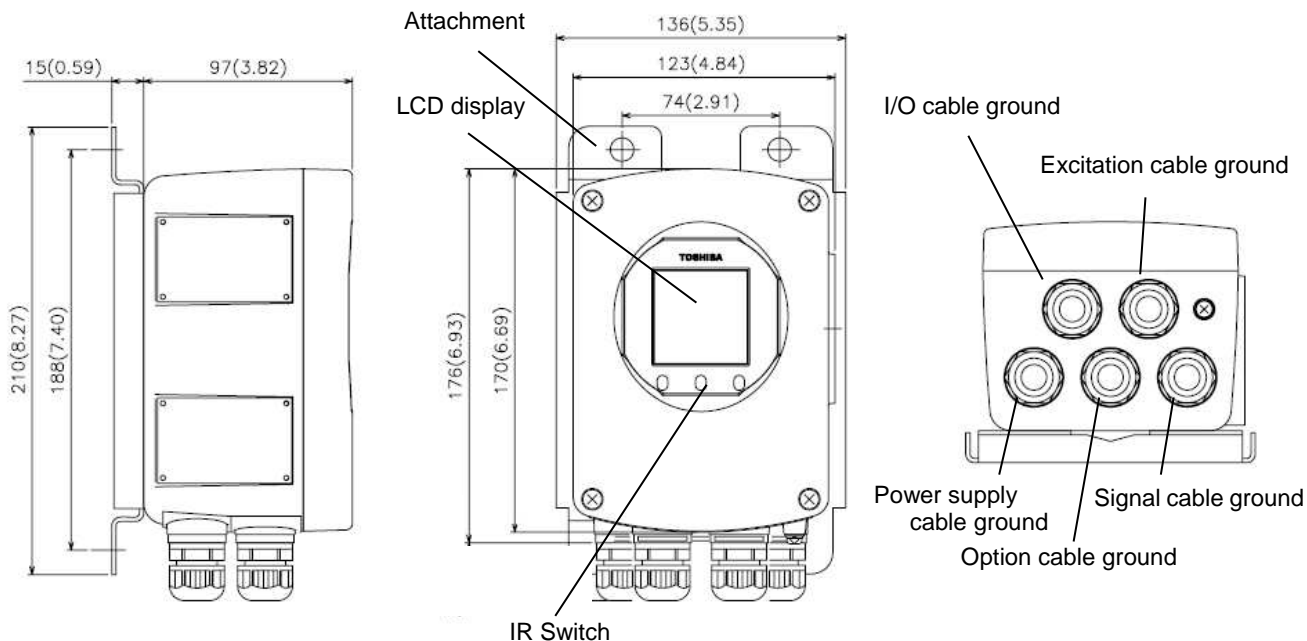
Meter size (mm)	L1 (mm)	(L2) (mm)	L3 (mm)	No. of bolts	Weight (kg)
15	200	170	218	4	approx. 4.0
25	200	176	239	4	approx. 5.5
32	200	184	252	4	approx. 8.0
40	200	185	255	4	approx. 8.5
50	200	199	277	4	approx. 13.0
65	200	204	292	4	approx. 15.0
80	200	222	314	8	approx. 19.5
100	250	229	334	8	approx. 24.5
125	250	240	366	8	approx. 29.0
150	300	252	392	8	approx. 36.0
200	350	277	442	12	approx. 53.5
250	450	302	502	12	approx. 81.5
300	500	332	555	12	approx. 123.5
350	550	341	586	16	approx. 164.0
400	600	364	644	16	approx. 213.0
450	600	387	697	20	approx. 247.5

**Figure 6. Separate type detectors LF654  
Meter sizes 1/2" (15) to 18"  
(450mm) for ISO lay length**



Unit : inch(mm)

Weight: Approx. 7 lb (3.5 kg)



**Note:** This drawing is the image when LF622 set with cable gland. Cable glands are not provided for LF622F cFMus approved type.

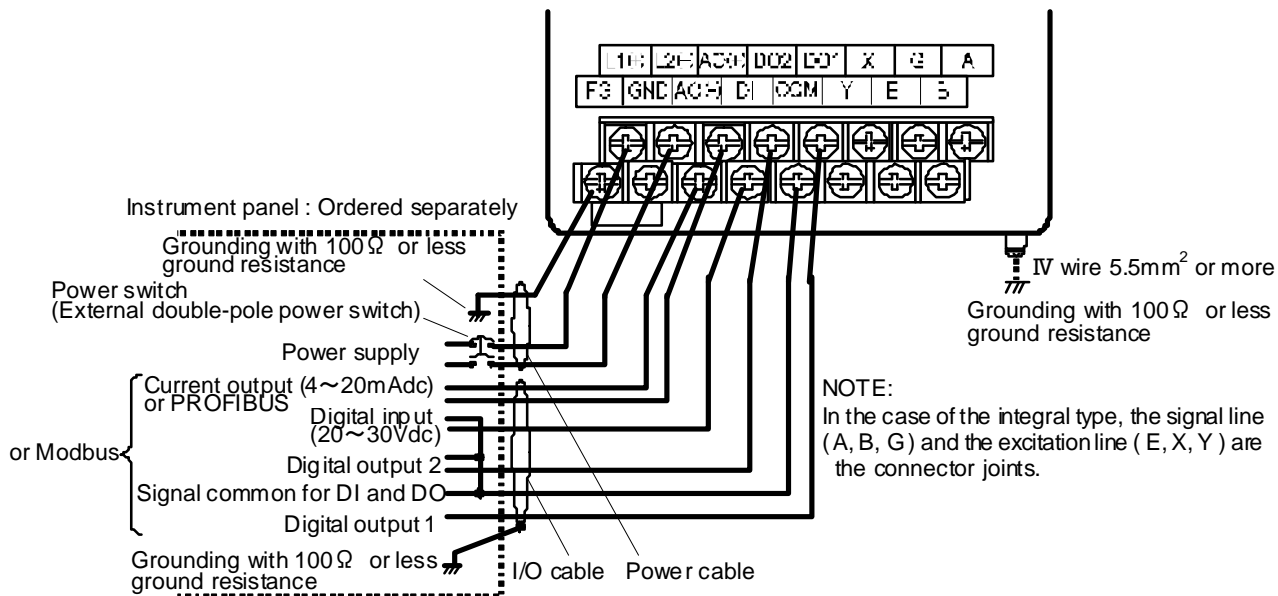
Refer to the part Cable connection port at detector.

**Note:** 1 inch = 25.4mm

**Figure 7. Separate type converter LF622F**

■ External Connections

● Combined type LF654/LF620F flowmeters



\*1 Locate an external double-pole power switch on the power line near the flowmeter within easy reach of operation.  
 Use the appropriate switch rating as shown below:  
 Switch rating: 250Vac, 6A or more  
 In rush current: 15A or more

**Figure 8. Combined type LF654/LF620F flowmeters Wiring Diagram**

• Separate type LF654/LF620F flowmeters

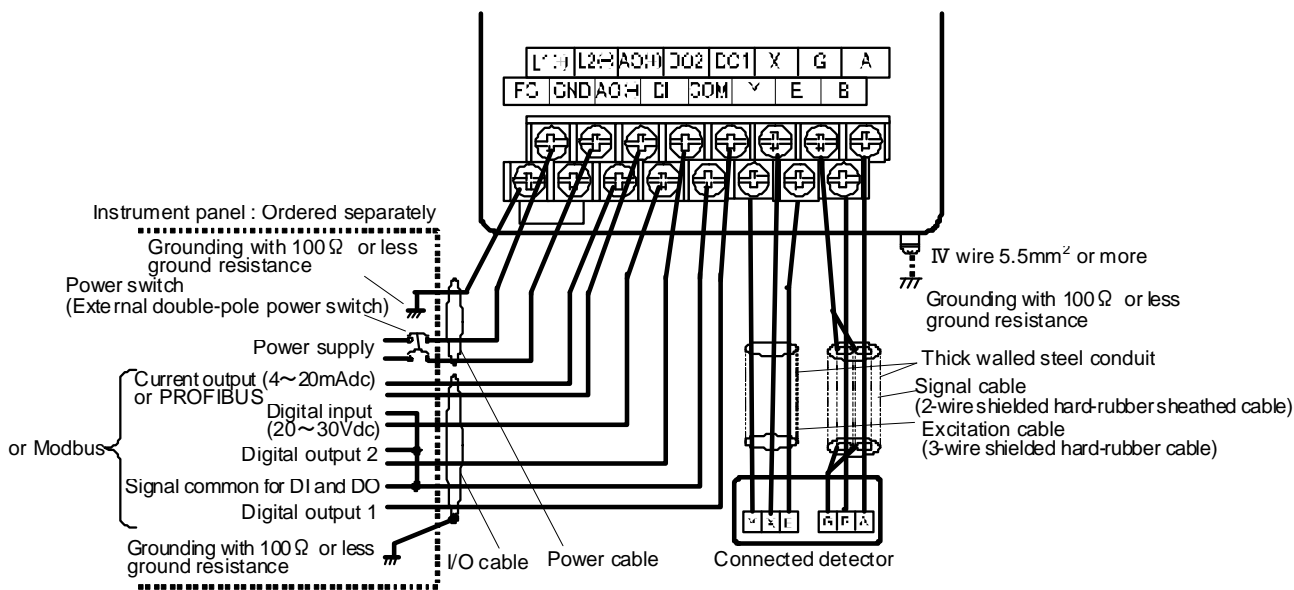


Figure 9. Separate type LF654/LF622F flowmeters wiring Diagram

Table 1. LF620F and LF622F Converters Signal Table

Symbol	Description	Cable
L1 (+)	Power supply	Power cable (CVV)
L2 (-)		
GND	Ground (for arrester)	
FG	Frame ground	
DI	Digital Input (20~30Vdc)	I/O cable (CVV-S)
DO1	Digital Output 1	
DO2	Digital Output 2	
COM	Signal Common for DI, DO1, DO2	
+	Current Output (4~20mAdc) or PROFIBUS	Shielded cable for PROFIBUS-PA
-		
X	Excitation Output	Excitation cable (for LF622,LF622F only)
Y		
E		
A	Signal Input	Signal cable (for LF622,LF622F only)
B		
G		
T+	Modbus(+)	Twisted-pair polyethylene insulated vinyl sheath cable (JKEV,AWG24(0.2mm <sup>2</sup> ))
T-	Modbus(-)	
TG	Modbus(GND)	

Note: Symbol of the terminal is changed as follows for Modbus.

DO2 → T+, DI → T-, COM → TG

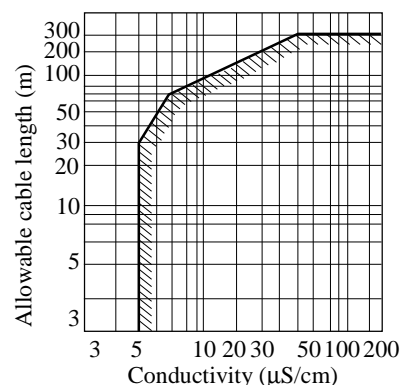
## ■ Wiring Precautions

- (1) Explosion proof type flowmeters are not provided with cable glands.  
Refer to the part Cable connection port at detector and converter.
- (2) Connect the grounding wire (IV wire 5.5mm<sup>2</sup> 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 10.
- (4) DO1, DO2 and DI use the same common terminal (COM). This COM can not be connected to other equipment which have their own ground terminal. (Power supply for connecting to DI or DO, etc...) Need to wire separately.

## ■ Wiring Precautions (PROFIBUS or Modbus)

- (1) For wiring path, avoid places near electrical equipment that may cause electromagnetic induction or electrostatic induction interference (such as a motor, transformer and wireless transmitter).
- (2) Use a PROFIBUS-PA cable or a RS485 twisted-pair cable for signal cable.  
In addition, make sure to use a shielded cable to improve noise resistance. Installation of signal cable in metal conduit is recommended.
- (3) General cables are designed for indoor use where cables are not exposed to humidity, rain, etc. When you install cables, make sure to check the operating conditions such as the operating temperature range of the cable by contacting its manufacturer.
- (4) When you carry out cable end treatment, use a dedicated cable stripper to avoid the core wire of the cable being nicked or damaged. In addition, for cables, be careful of allowable maximum bend diameter. (Do not allow excessive twisting or bending of cables).
- (5) Consider installing a PROFIBUS-PA arrester in the communication path of PROFIBUS-PA so that the electromagnetic path of PROFIBUS-PA will not be affected by lightning, etc.

- (6) The electromagnetic flowmeter is not equipped with terminating resistors. Use the terminating resistor unit for PROFIBUS-PA or junction box, if necessary.
- (7) Only one PROFIBUS-PA cable goes through a cable gland of the Electromagnetic Flowmeter.  
Please use the junction box at system configuration.
- (8) Install a terminator to flowmeter that connected to end of Modbus network.



**Figure 10. Electrical Conductivity and Cable Length**

## ■ Meter Size

### To select the meter size:

See Table 2 and 3 to find meter sizes within the velocity of 0.3 to 39.4 ft/s (0.1 to 12m/s) for a specified full-scale (measuring range high limit) flow. Select one that has its full-scale velocity between 3.0 and 10 ft/s (1 and 3m/s).

**Note:** Make sure the full-scale flow rate used for the final planning stage stays within 39.4ft/s (12m/s) in terms of flow velocity.

**Table 2. Flow Rate and Flow velocity (English unit)**

Size (inch)	Flow rate				
	0.328 ft/s	0.98 ft/s	3.0ft/s	10 ft/s	39.4 ft/s
1/2'	0.2801	0.8403	2.561	8.532	33.61
1	0.7781	2.334	7.115	23.72	93.37
1 ¼	1.275	3.824	11.66	38.86	153.0
1 ½	1.992	5.975	18.21	60.71	239.0
2	3.112	9.337	28.46	94.86	373.5
2 ½	5.260	15.78	48.09	160.3	631.2
3	7.967	23.90	72.85	242.8	956.1
4	12.45	37.35	113.8	379.4	1,494
5	19.45	58.35	177.9	592.9	2,334
6	28.01	84.03	256.1	853.8	3,361
8	49.80	149.4	455.3	1,518	5,975
10	77.81	233.4	711.5	2,372	9,337
12	112.0	336.1	1,025	3,415	13,445
14	152.5	457.5	1,394	4,648	18,300
16	199.2	597.5	1,821	6,071	23,902
18	252.1	756.3	2,305	7,684	30,251

Unit: gal/min

**Table 3. Flow Rate and Flow velocity**  
(SI unit)

Unit: m<sup>3</sup>/h

Size (mm)	Flow rate				
	0.1 m/s	0.3 m/s	1.0 m/s	3.0 m/s	12 m/s
15	0.06362	0.1908	0.6361	1.908	7.634
25	0.1767	0.5301	1.767	5.301	21.21
32	0.2895	0.8686	2.895	8.686	34.74
40	0.4523	1.357	4.523	13.57	54.29
50	0.7067	2.120	7.067	21.20	84.82
65	1.195	3.583	11.95	35.83	143.4
80	1.809	5.428	18.09	54.28	217.1
100	2.827	8.482	28.27	84.82	339.3
125	4.417	13.25	44.17	132.5	530.1
150	6.361	19.08	63.61	190.8	763.4
200	11.31	33.93	113.1	229.3	1,357
250	17.67	53.01	176.7	530.1	2,121
300	25.45	76.34	254.5	763.4	3,054
350	34.64	103.9	346.4	1,039	4,156
400	45.23	135.7	452.3	1,357	5,429
450	57.25	171.7	572.5	1,717	6,871

### ■ 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.
- Where corrosive atmospheres exist.
- Places that can be submerged under water.
- When placing the flowmeter temporarily on the floor, support it, i.e., with a block so that the flowmeter does 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 LF654 series flowmeters, refer to Tables 4 and 5 (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. I/O function setting
5. Ordering scope
  - Flow calibration data
6. Other items
  - Specifications other than standard items

**Consult a Toshiba representative when choosing materials for lining, electrodes, and grounding rings.**

Toshiba International Corp. (Houston) stocks Hazardous location certification type flowmeters as standard inventory.

**Table 4. Specification Code (Flange type detector LF654 Series)**

Model					Specification Code									Description	Lining	
1	2	3	4	5	6	7	8	9	10	11	12	13	14		PU	PFA
L	F	6	5												●	●
			4												√	√
				D											√	√
				E											√	√
				S											√	√
				F											√	√
				G											√	√
				W											√	√
				H											√	√
				J											√	√
				K											√	√
				L											√	√
				M											√	√
				N											√	√
				P											√	√
				Q											√	√
				R											√	√
					L										√	√
					M										√	√
						C									○	○
						D									○	○
						1									●	●
						2									○	○
							B								●	—
							C								○	○
							D								○	○
							E								○	○
							F								—	●
								C							—	●
								N							●	—
									C						●	●
									D						○	○
									E						○	○
									F						○	○
									G						○	○
									H						○	○
										A					●	●
											A				●	●
												F			●	●
												C			○	○
												D			○	○
												E			○	○

Size code explanation: √ : Object ● : Standard ○ : Option — : Not available

- Note1:** In case of LF654 with cFMus approval, Cable glands are not provided.
- Note3:** Consult Toshiba before ordering when choosing materials at the wetting parts.
- Note4:** In case of PU lining with NSF approval, only 316/316L stainless steel are available, and Hastelloy C & Ti are undergoing testing.
- Note5:** User specified range upon request, additional charges apply .
- Note6:** Potting kit is available for submersible option when selecting Detector/Converter remote type with PU lining. Please consult Toshiba for details.
- Note7:** ASME B 16.5 class 300 flange is NOT available in case of 3" & 5" of ISO length.
- Note8:** Pt-Ir and Ta are available for less than 5" (125mm).

**Table 5. Specification Code for converters**

Model					Specification Code									Contents	LF620 type	LF622 type	
1	2	3	4	5	6	7	8	9	10	11	12	13	14				
L	F	6	2												Electromagnetic flowmeter converter		
				0											Combined (Integral) type	●	—
				2											Separate (Remote) type	—	●
					F										Purpose cFMus class I, Division 2 approved	●	●
						A									Shape Standard type with case	●	●
							A								Converter mounting fitting None Panel, Accessory for wall mounting (BNP material: SUS304) Accessory for pipe installation (BNP material: SUS304)	●	○
							C									—	●
							E									—	○
								2							Digital input/output Digital output points 2 (DO1+DO2) +Digital input point 1 (DI)	●	●
									1						Current output and Communication function(Note1) Current output + HART communication PROFIBUS communication Current output + Modbus (RS485) communication	●	●
									2							○	○
									3							○	○
										1					Power supply(Note2) 100Vac-240Vac 50/60Hz, 110Vdc 24Vdc 110Vdc	●	●
										2						○	○
										3						○	○
											E				Instruction manual English	●	●

Code explanation: ●: Standard ○: Option —: Not available

Note 1: When PROFIBUS communication is provided, current output(4-20mA) and HART communication cannot be used.  
When Modbus communication is provided, digital output points 1(DO1) and digital output points (DO2), digital input point 1(DI), HART communication cannot be used.

Refer to Table 6 for more details.

Note2: Select 110Vdc for test report inspected under the condition of 110Vdc.

**Table6. Communication functions and output selection table**

Selection of Function		Availability of outputs			
Code (10 <sup>th</sup> digit)	Selected Communication	4-20mA dc	DO1	DO2	DI
1	HART	✓	✓	✓	✓
2	PROFIBUS	X	✓	✓	✓
3	Modbus	✓	✓ (Note)	X	X

Code explanation: ✓:Available X:Not Available

Note: When digital output 1 function and Modbus communication function are used at one time, TG (signal ground) of the Modbus communication function cannot be connected (2 line connection).

ISO9001 and ISO14001 are certified.

Specifications are subject to change without notice.

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