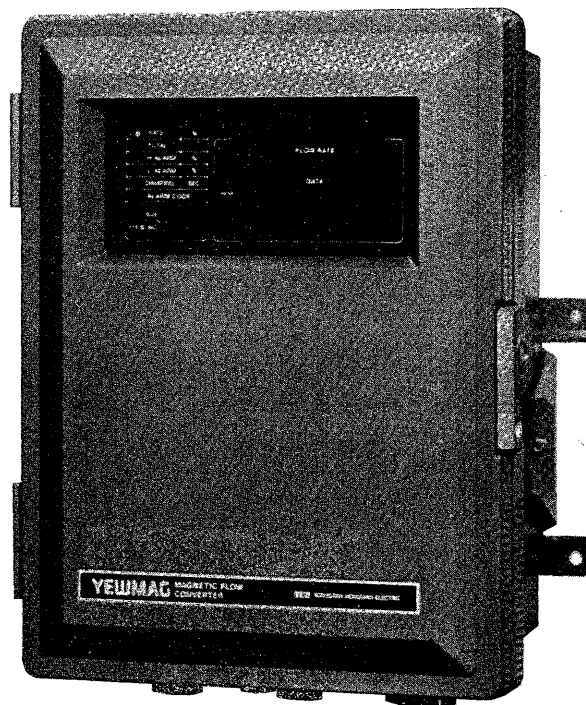


YEW MAG

Instruction Manual

**Model YMA 11
MAGNETIC FLOW CONVERTER**



YOKOGAWA ◆

3rd Edition
IM 1E4B0-01E

YMA 11 METER FACTOR TABLE FOR ADMAG FLOWTUBE

When connecting a YMA11 flow converter to an ADMAG flowtube, perform the following steps.

1. Record the "low" meter factor and size of the ADMAG flowtube.
2. On the chart below, calculate the new meter factor for the YMA11.
 example. low meter factor for a 2" admag flowtube : 0.8203
 1/8 mode meter factor: $0.8203 \times 0.9725 = 0.7974$
 1/2 mode meter factor: $0.8203 \times 0.9705 = 0.7961$
 YMA11 excitation current = 0.13 amp.
3. Record the new meter factors and excitation current in the YMA11.

ADMAG flowmeter size (inch)	YMA 11 Excitation Current (AMP)	To obtain meter factor for YMA11, multiply "low meter factor" of ADMAG flowmeter by the data below.	
		standard 1/8 mode excitation	slurry 1/2 mode excitation
0.1	0.12	1.0162	1.006
0.2	0.14	0.9788	0.975
0.4	0.23	0.9403	0.9335
0.5	0.23	0.9419	0.9399
1	0.15	0.9760	0.9747
1.5	0.13	0.9719	0.9708
2	0.13	0.9725	0.9705
3	0.17	0.9726	0.9674
4	0.14	0.9625	0.9526
6	0.11	0.9779	0.9613
8	0.12	0.9759	0.9468
10	0.5	0.9925	0.9483
12	0.5	0.9855	0.9265
14	0.5	*	*
16	0.5	0.9841	0.9193

1. Explosion proof rating can not be obtained with YMA 11/ ADMAG combination.
2. Excitation current must be set to the data in the table above.

CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>	<u>Section</u>	<u>Title</u>	<u>Page</u>
1.	HANDLING CAUTIONS.	1-1	5-4-1.	Selecting Functions.	5-7
1-1.	Models and Specifications.	1-1	5-4-2.	Setting Span.	5-12
1-2.	Cautions for Storage.	1-1	5-4-3.	Setting Nominal Flowmeter Size, Meter Factor, and Exciting Current.	5-13
1-3.	Installation Area Selection.	1-1	5-4-4.	Setting Output Pulse and Totalizer Factor.	5-14
2.	GENERAL.	2-1	5-4-5.	Setting Low Cut and Hysteresis Width Percentages.	5-15
2-1.	Standard Specifications.	2-2	5-4-6.	Selecting Alarm Outputs.	5-16
2-2.	Options.	2-3	5-4-7.	Setting Rate Limit Function.	5-17
2-3.	Model and Suffix Codes.	2-3	5-4-8.	Setting Frequency.	5-18
2-4.	Accessories.	2-3	5-5.	Operation.	5-19
2-5.	Functional Combinations.	2-4	5-5-1.	Zero Adjustment.	5-19
2-6.	External Dimensions.	2-5	5-5-2.	Resetting Totalizer Counts.	5-20
3.	INSTALLATION.	3-1	5-5-3.	Multi-range Measurement.	5-20
3-1.	Mounting.	3-1	5-5-4.	Direct and Reverse Flow Measurement.	5-21
3-2.	Wiring.	3-2	5-5-5.	Operation during Power Failure.	5-21
3-2-1.	Cautions for Wiring.	3-2	5-6.	FAIL and ALM Lamps.	5-21
3-2-2.	Wiring for Power Supply and Exciting Current Output.	3-3	5-6-1.	Action to be Taken when FAIL Lamp Lights.	5-21
3-2-3.	Wiring for Signal.	3-3	5-6-2.	Action to be Taken when ALM Lamp Lights.	5-21
3-2-4.	Grounding.	3-3	5-6-3.	Action to be Taken when ALM Lamp Flashes.	5-21
3-2-5.	Connection to Transducer.	3-5	5-6-4.	Alarm (ALM) Code Details.	5-22
3-2-6.	Other Connections.	3-7	6.	MAINTENANCE.	6-1
3-2-7.	Checking Connections.	3-8	6-1.	Testing.	6-1
4.	PRINCIPLE.	4-1	6-1-1.	Checking INPUT.	6-1
4-1.	Principle.	4-1	6-1-2.	Setting Output.	6-3
4-2.	Model YMA11 Converter: Circuit and Its Features.	4-2	6-1-3.	Setting STATUS OUTPUT.	6-3
5.	OPERATION.	5-1	6-1-4.	Displaying STATUS IN Condition.	6-4
5-1.	Front Panel Features.	5-1	6-2.	Calibrating Span.	6-5
5-2.	Main and Auxiliary Data Specifications and Writing Them in Data Card.	5-5	6-3.	Replacing Fuse.	6-7
5-3.	Preparation for Operation.	5-5	6-4.	Replacing Data Memory Backup Battery.	6-7
5-3-1.	Checking Special Parts Mounted.	5-5			
5-3-2.	Setting Decimal Point.	5-5			
5-3-3.	Setting Data.	5-5			
5-3-4.	Data Setting ENABLE/ INHIBIT Procedure.	5-5			
5-3-5.	Setting Main Data.	5-6			
5-3-6.	Setting Auxiliary Data.	5-6			
5-3-7.	Indicating Engineering Units and Scale Factors.	5-6			
5-3-8.	Setting Switches on Front Panel.	5-6			
			•	PARTS LIST	PL 1E4B0-01

1. HANDLING CAUTIONS.

The Model YMA11 Magnetic Flow Converter is thoroughly tested at the factory before shipment. When this instrument is delivered, perform a visual check to ascertain that no damage occurred during shipment.

This section describes important cautions in handling this instrument. Read carefully the section before using the instrument.

If you have any problem or question, contact your nearest YEW service center or sales representative.

1-1. Models and Specifications.

The model and important specifications are indicated on the data plate attached to the rear face of the door. Verify that they are the same as those specified in the original order, referring to subsection 2-4, Model and Suffix Codes. In any correspondence, always state the model (MODEL) and serial number (NO.) marked on the data plate.

1-2. Cautions for Storage.

If the instrument is to be stored for a prolonged period after delivery, observe the following:

- (1) Where possible, store the converter without unpacking.
- (2) Select the storing place that is
 - protected against rainfall and water,
 - relatively free from mechanical vibration or impact shock,
 - in the following temperature and humidity range,
 Temperature: -40 to $+70^{\circ}\text{C}$ (-40 to $+158^{\circ}\text{F}$)
 Humidity : 5 to 80% R.H.

though it is preferable to normal temperature and humidity (about 25°C and 65% R.H.) as far as possible.

1-3. Installation Area Selection.

To ensure stable and accurate operation for a long term, the following cautions must be observed in selecting an installation area.

- (1) Ambient temperature
 Avoid an area which has wide temperature variations. When the installation area is subjected to heat radiation from process plant, ensure adequate heat shielding or ventilation.
- (2) Atmospheric condition
 Avoid installing the converter in corrosive atmosphere. When the converter is obliged to be installed in corrosive atmosphere, adequate ventilation must be provided.

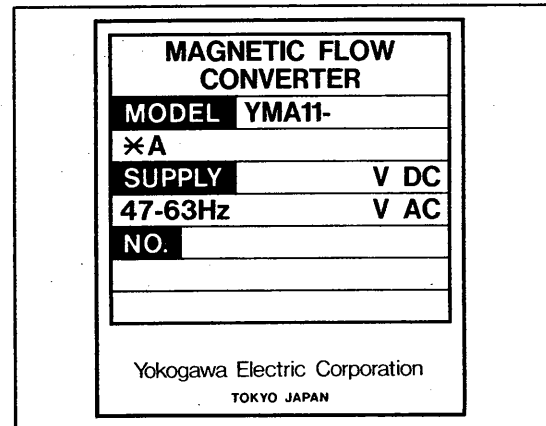


Figure 1-1. Data Plate.

2. GENERAL.

A magnetic flowmeter is an instrument which measures flow (rate) of conductive liquids using Faraday's law of electromagnetic induction. It has many features such as obstruction less metering tube, no pressure loss, capability of measuring corrosive liquids, etc.

A YEW MAG magnetic flow converter amplifies and converts a minute voltage obtained from a YEW MAG magnetic flowmeter into a DC analog sig-

nal (4 to 20 mA or 1 to 5V) or a series of pulse signals for totalization.

A YEW MAG magnetic flow converter is an all-in-one type field mounting magnetic flow converter with sophisticated "intelligence".

It can be combined with commercial frequency excited magnetic flowmeters and conventional low frequency excited magnetic flowmeters as well as YEW MAG series magnetic flowmeters.

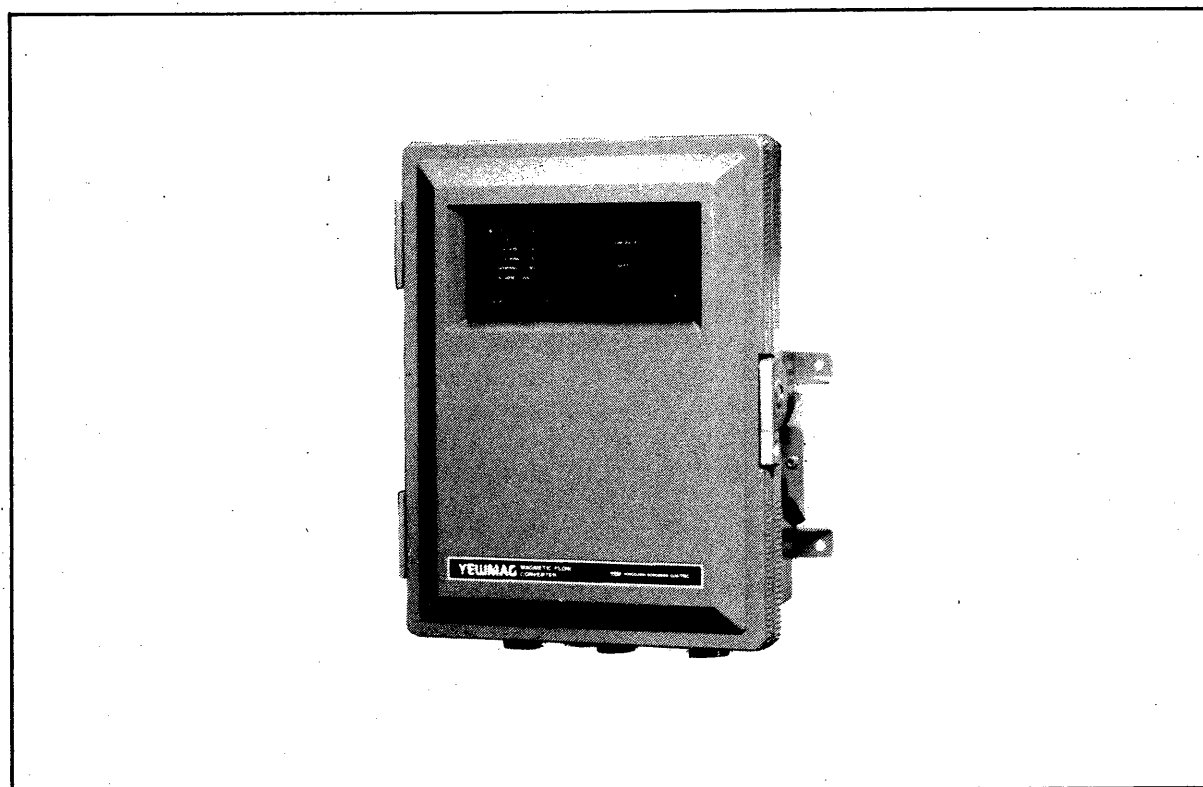


Figure 2-1. External View.

2-1. Standard Specifications.

Input Signals:

Flow signal: Signal proportional to flow from transducer.

On-off or voltage signal: Span switching signal, "output zero" clamp signal (both unpowered contact, solid state switch or voltage level signals)

Output Signals:

Current output: 4 to 20 mA DC (load resistance 0 to 600 ohms)

Voltage output: 1 to 5V DC

Pulse output: Open-collector transistor switch

Rating 30V DC, 200 mA

Output rate 0.0004 to 1000 pps

Alarm contact On-off output: High/low limit alarms (open collector transistor switch)

Self-diagnosis alarms (open collector transistor switch)

Rating 30V DC, 200 mA

Status contact On/off output: Forward and reverse flow measurement (open collector transistor switch)

Automatic multi-range output (open collector transistor switch)

Rating 30V DC, 200 mA

Span Setting Functions:

Volumetric flow span setting is available by setting volume units, time units, flow span and nominal flowmeter sizes.

Volume units: m³, L, cm³, gallon, bbl

Time units: hour, min., sec.

Flow rate indication: 5 significant digits from 0.0000 to 30000.

Flowmeter nominal size: 5 significant digits from 1.0 to 3000.0 mm or 0.1 to 300.00 inches.

For gravimetric flow, set the reciprocal of liquid density with 5 significant digits.

Multiple Range Function:

Max. 4 ranges selectable with external range-selecting on-off inputs in the multi-range measuring mode.

Automatic range switching available between 2 ranges.

Damping:

Damping time range: 1 to 100 sec. (63% response)

Forward and Reverse Flow Measurement Function:

Reverse flow measurement available in the forward and reverse flow measurement mode.

In reverse flow measurement, a minus sign is added to the flow display and the status on-off output changes from open to closed.

Instantaneous Flow Rate Display Function:

Ten-segment bar graph display.

Flow rate display in an engineering unit or in % (4 significant digits) available.

Totalized Counts Display Function:

Totalized volume can be displayed by setting the number of pulses per unit volume.

Totalized flow counts for forward or reverse flow and difference between both direction flows available.

Pulse Output Function:

Flow pulses after scaling are output by setting the number of pulses per unit volume.

Pulse duration: Freely selectable the following:

Duty 50%; 0.5, 1, 20, 33, 50 and 100 ms

Power Backup Functions:

Totalizer function at power recovery: Normal (continues totalizing).

Data protection during power failure: Internal battery.

On-off outputs by contacts are all open (OFF) during power failure.

Battery life: At least 10 years (in normal operation at ambient temperature 40°C (104°F))

At least 6 years (in backup mode at ambient temperature (104°F))

Self-Diagnostic Functions:

Microprocessor failure: RAM data volatilization.

A/D failure: A/D converter failure.

Coil disconnection: Cable or coil disconnected.

Input signal error: Detection of empty flowmeter tube.

High limit alarm: Flow rate over high limit setting.

Low limit alarm: Flow rate under low limit setting.

Output pulse overflow: Output pulse memory over.

Invalid setting: Erroneous parameter setting.

Battery failure: Battery is not mounted or voltage drop.

Zero Adjustment Function (automatic): Automatic zero adjustment initiated by pressing RESET switch when liquid flow is zero.

Calibration Function (automatic span adjustment): Span can be adjusted by connecting reference flow signal obtained from the TEST terminal to the input terminal and by pressing RESET switch.

Signal Lock Function (at 0% flow): Output can be locked at 0% by external on-off signal when flow rate display and flow totalization are desired to be completely stopped.

Rate Limit Function:

Rate limit function removes abruptly changing noises superimposed to a flow signal.

Two User-Selectable Excitation Modes:

The usual three-state excitation mode offers low drift, low power consumption. Two-state excitation mode provides good rejection of slurry noise, for slurry flow measurement.

Surge Arrestors: Surge arrestors are incorporated at terminals for power supply, excitation, analog output, pulse output, and on-off input/output.

Mounting and Construction:

Mounting: 50 mm (2-inch) pipe mounting, panel or surface mounting.

Electrical connection: JIS PF1/2 female or ANSI 1/2NPT female.

Wiring terminals: ISO M4 screws (4 mm).

Case material: Aluminum alloy.

Finish: Light grayish green, backed polyurethane resin paint.

Enclosure classification: Conforming to JIS C 0920 deck water-tight and NEMA type 4 water-tight and dust-tight.

Weight: Approx. 9.5 kg (21 lb).

Standard Performance

Accuracy (when used with flowmeter) :

Nominal size	Span(m/s)	Accuracy
2.5 to 15 mm (1/10 to 1/2 inches)	0.3(1.0ft/s) or more and less than 0.5(1.6ft/s)	1.5% of span
	0.5(1.6ft/s) or more and less than 1.0(3.3ft/s)	1.0% of span
	1(3.3ft/s) to 10(33 ft/s) (both including)	1.0% of flow rate (at indication 50% of span or more) 0.5% of span (at indication below 50% of span)
25 to 400 mm (1 to 16 inches)	0.3(1.0ft/s) or more and less than 0.5(1.6ft/s)	1.0% of span
	0.5(1.6ft/s) or more and less than 1.0(3.3ft/s)	0.5% of span
	1(3.3ft/s) to 10(33 ft/s) (both including)	0.5% of flow rate (at indication 50% of span or more) 0.25% of span (at indication below 50% of span)
500 to 1000 mm (20 to 40 inches)	0.3(1.0ft/s) or more and less than 0.5(1.6ft/s)	1.5% of span
	0.5(1.6ft/s) or more and less than 1.0(3.3ft/s)	1.0% of span
	1(3.3ft/s) to 10(33 ft/s) (both including)	1.0% of flow rate (at indication 50% of span or more) 0.5% of span (at indication below 50% of span)
1100 mm or more (44 inches or more)	1(3.3ft/s) to 10(33 ft/s) (both including)	1.0% of span

Power Consumption: 18 VA or 11 W (without excitation to flowmeter).

Insulation Resistance: 100 Mohms at 500V DC between power and ground terminals.

100 Mohms at 500V DC between power terminal and each terminal of excitation, analog output, pulse output, and on-off input and output.

Dielectric Strength:

- Power supply 100V version: 1000V AC for one minute between power and ground terminals.
- Power supply 200V version: 1500V AC for one minute between power and ground terminals.

Normal Operating Conditions:

Ambient temperature: -10 to +60°C

Ambient humidity: 5 to 95% R.H. (no condensing)

Supply voltage: DC or AC (Changing the converter is not necessary)

- 100V version DC drive: 20 to 130V, No polarity AC drive: 80 to 138V, 47 to 63 Hz
- 200V version AC drive: 138 to 264V, 47 to 63 Hz

2-2. Options.

Air Purge Connection: Pressure 1.4 kgf/cm² (20 psi) or less

Connector JIS PT1/4 female or 1/4NPT female (as specified)

Suffix code: APC

Waterproof Gland: Waterproof glands are provided for electrical power and signal connections.

Unavailable for 1/2NPT connection

Suffix code: ECG

Waterproof Gland with Union: Waterproof glands with unions are provided for electrical power and signal connections.

Unavailable for 1/2NPT connection

Suffix code: ECU

Stainless Steel Tag Plate: Stainless steel (JIS SUS304) tag plate is fixed with screws on the front face of the case.

Suffix code: SCT

2-3. Model and Suffix Codes.

Model	Suffix code	Description
YMA11		Magnetic Flow Converter
Power supply	-A1	For both 100V AC and 24V DC systems
	-A2	For 200V AC systems
Electrical connection	J	JIS PF1/2 female
	A	ANSI 1/2NPT female
Style code	•A	Style A
Options	/APC ...	Air purge connection (Note 1)
	/ECG ...	Waterproof gland
	/ECU ...	Waterproof gland with union
	/SCT ...	Stainless steel tag plate

(Note 1) Main specifications for air purge connecting port should be the same as those for wiring ports.

2-4. Accessories.

Fuse (3A) 1 pc.

Engineering unit label 1 set

2-5. Functional Combinations.

	100V AC/24V DC	200V AC	4 to 20 mA	1 to 5V	Pulse output	Incorporated totalization	Forward, signal range	Forward, 2 ranges, external	Forward, 3 ranges, external	Forward, 4 ranges, external	Forward, 2 ranges, automatic	Reverse, signal range	Reverse, 2 ranges, external	Reverse, 3 ranges, external	Reverse, 4 ranges, external	Variable damping	Rate limit	High and low alarms	Empty tube detection	Alarm contact	Output in failure	Alarm contact selection	Signal lock at 0%	Slurry mode	Semi-automatic zero adjust	Calibrator	Surge arrester
100V AC/24V DC	X																										
200V AC																											
4 to 20 mA																											
1 to 5V																											
Pulse output																											
Incorporated totalization																											
Forward, signal range																											
Forward, 2 ranges, external																											
Forward, 3 ranges, external																											
Forward, 4 ranges, external																											
Forward, 2 ranges, automatic																											
Reverse, signal range																											
Reverse, 2 ranges, external																											
Reverse, 3 ranges, external																											
Reverse, 4 ranges, external																											
Variable damping																											
Rate limit																											
High and low alarms																											
Empty tube detection																											
Alarm contact																											
Output in failure																											
Alarm contact selection																											
Signal lock at 0%																											
Slurry mode																											
Semi-automatic zero adjust																											
Calibrator																											
Surge arrester																											

2-6. External Dimensions.

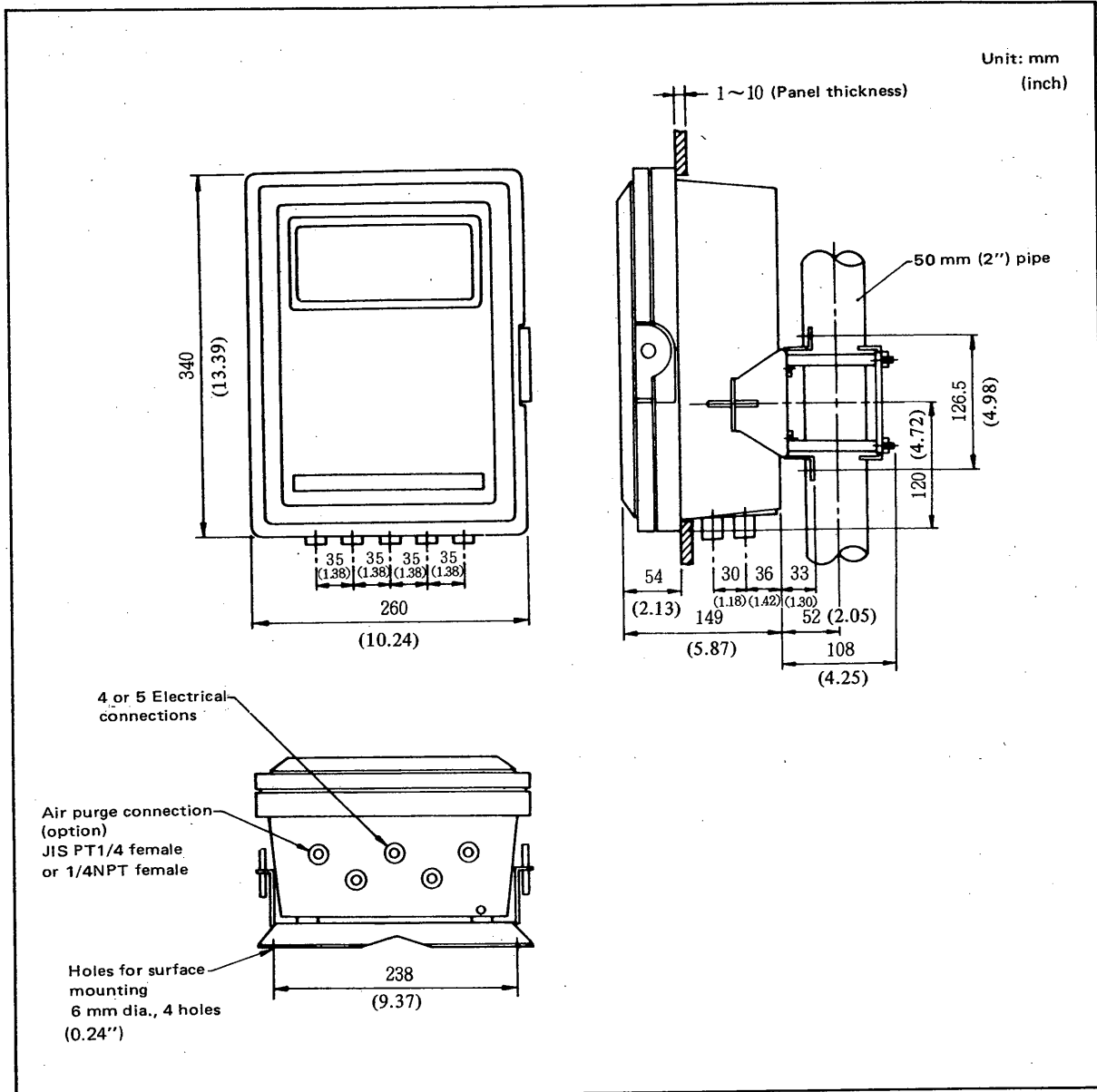


Figure 2-2. External Dimensions.

3. INSTALLATION.

When installing the converter, refer to subsection 1-3, "installation Area Selection", and subsection 2-1 "Standard Specifications".

3-1. Mounting.

Three mounting methods—50 mm (2-inch) pipe mounting, panel mounting, or surface mounting—are selectable depending on the installation area.

Refer to Figure 3-1 for panel cutout dimensions and surface mounting hole dimensions.

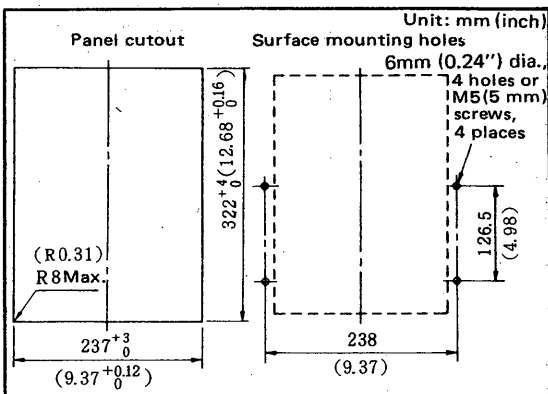


Figure 3-1. Panel Cutout and Surface Mounting Holes.

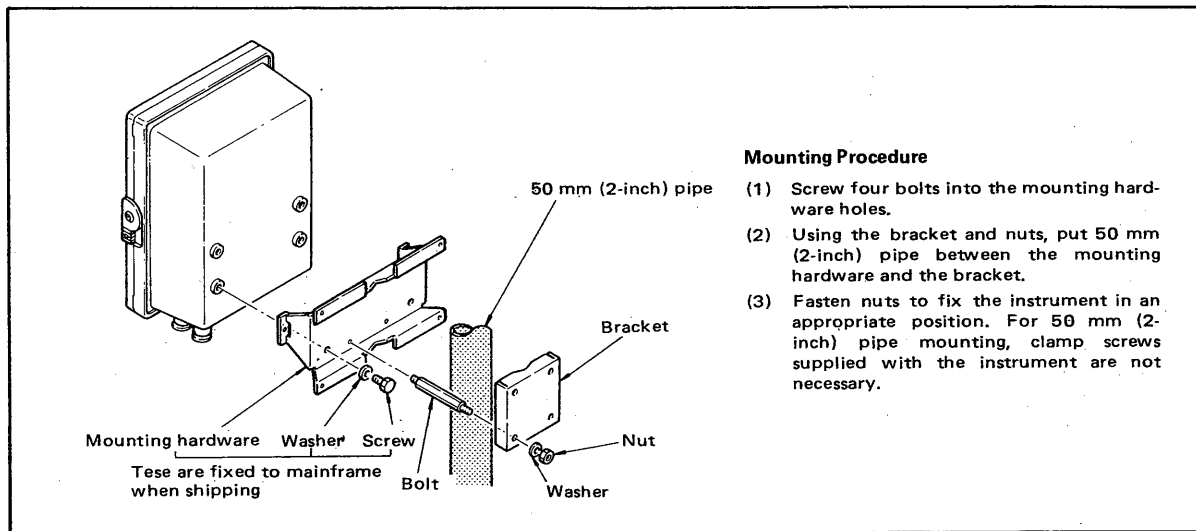


Figure 3-2. 50 mm (2-inch) Pipe Mounting.

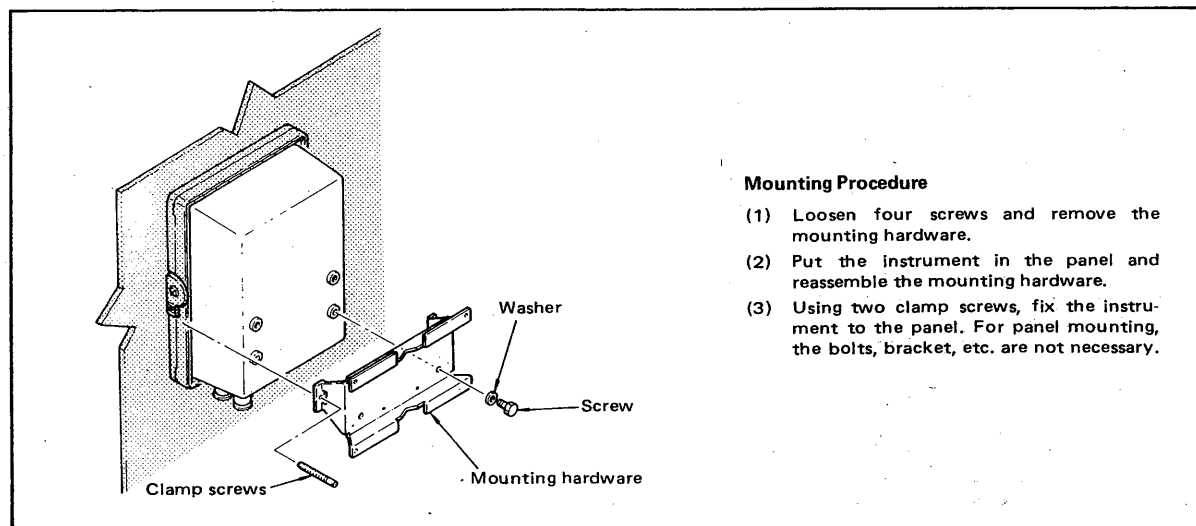
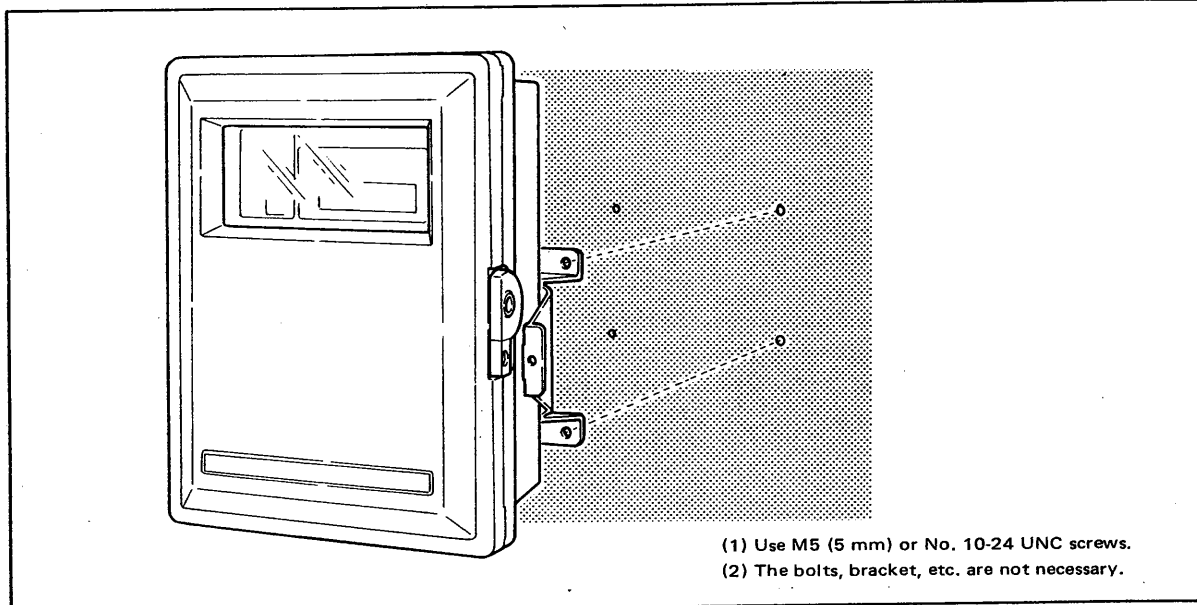


Figure 3-3. Panel Mounting.



- (1) Use M5 (5 mm) or No. 10-24 UNC screws.
- (2) The bolts, bracket, etc. are not necessary.

Figure 3-4. Surface Mounting.

3-2. Wiring.

The external signal wires to the instrument must be connected to the terminal board inside the instrument.

Open the door and swing open the display panel, and then the terminal board appears (see Figure 3-5 and 3-6).

Carry out the terminal wiring according to Figure 3-7. M4 (4 mm) size screws are used for the instrument terminal screws.

3-2-1. Cautions for Wiring.

- (1) Be sure to terminate all leadwire connections using solderless crimp-on lugs.
- (2) It is recommended to carry out wiring through conduits. Use the rigid steel conduit 16 (see JIS C 8305) or flexible metal conduit 15 (see JIS C 8309) for conduit wiring.
- (3) Be sure to carry out separate conduit wirings for input signal, output signal, and power supply.

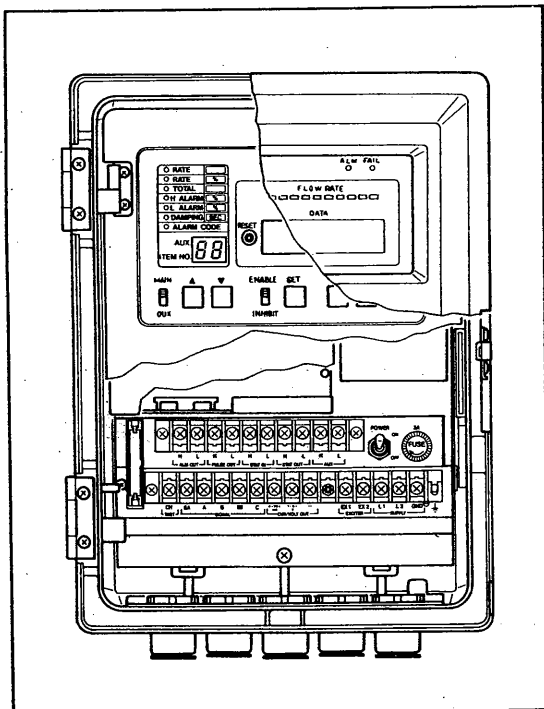


Figure 3-5. Terminal Board Location.

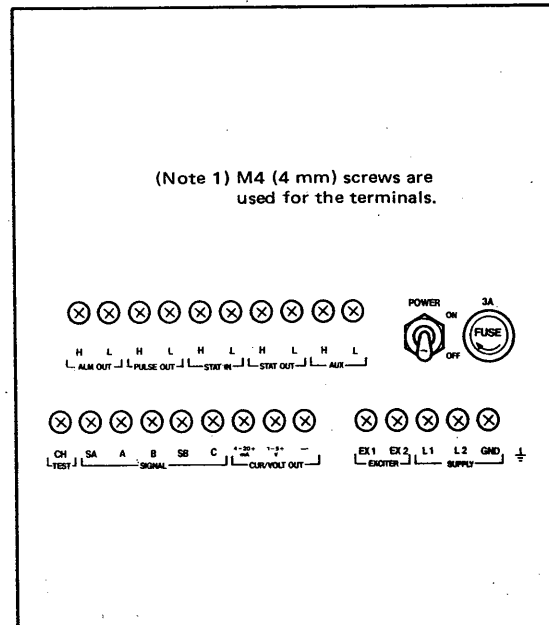


Figure 3-6. Terminal Configuration.

Terminal designation	Remarks	Terminal designation	Remarks
TEST -CH	Standard flow signal output	ALM OUT [H] +	Alarm on-off output
		[L] -	
SIGNAL [SA, A, B, SB, C]	Flow signal input	PULSE OUT [H] +	Pulse output
		[L] -	
CUR/VOLT OUT [4-20+ mA, 1-5+V, -]	4 to 20 mA DC current output 1 to 5V DC voltage output	STAT IN [H] +	Selector switch input for ranges 1 and 2
		[L] -	
EXCITER [EX1, EX2]	Exciting current output	STAT OUT [H] +	Forward/reverse status on-off output or Automatic 2-range status on-off output
		[L] -	
SUPPLY [L1, L2, GND]	+ Power supply - Ground	AUX [H] +	Selector switch input for ranges 3 and 4 or 0% signal lock on-off input
		[L] -	

Figure 3-7. Terminal Wiring.

3-2-2. Wiring for Power Supply and Exciting Current Output.

Cable:

Use the following cables or cables equivalent to them. PVC insulated and sheathed control cable CVV (JIS C 3401), or 600V grade PVC insulated and sheathed portable power cables (JIS C 3312).

Specifications:

Nominal conductor cross-section 2.0 mm²
Finished O.D. 10.5 mm

3-2-3. Wiring for Signal (between Transducer and Converter).

Special signal cable (Model YM011):

The flow signal is transmitted by this special cable. This cable is of 2-conductor double shielded construction, whose outer sheath is made of heat-resistant PVC and its finished O.D. is 10.5 mm (0.41 inches)

Cable length:

The max. extendable length of the special cable is 300 m (1,000ft). If the max. extendable cable length is longer than a practically required length, do not round the cable of full extendable length between the flowmeter and the converter but cut off the remainder and make end-treatment as shown in Figure 3-9.

CAUTION

- To prevent a shield from contacting with the other shield or case, cover the exposed parts of each shield with PVC tubes or wrap them with PVC tapes.

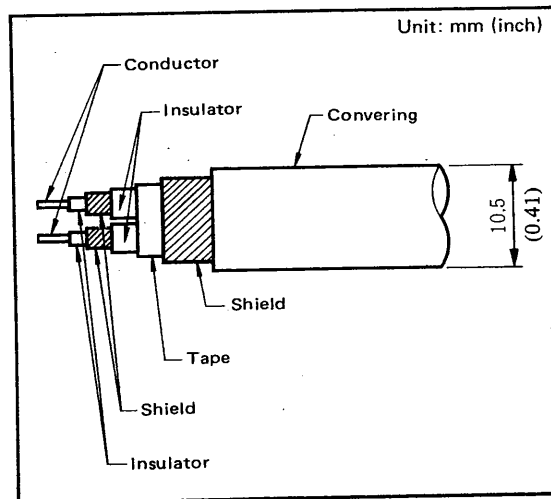


Figure 3-8. Special Signal Cable YM011.

- Connect the conductor A and B, shields of each conductor (SA and SB), and the outer shield C to the specified converter terminals. Avoid wiring via repeating terminals, and clamp the cable.

3-2-4. Grounding.

Be sure to perform grounding equivalent to Class 3 grounding which requires grounding resistance of 100 ohms or less at three points of flowmeter, converter, and receiving instrument respectively. When surge arrestors are employed, be sure to perform grounding equivalent to Special Class 3 grounding which requires grounding resistance of 10 ohms or less.

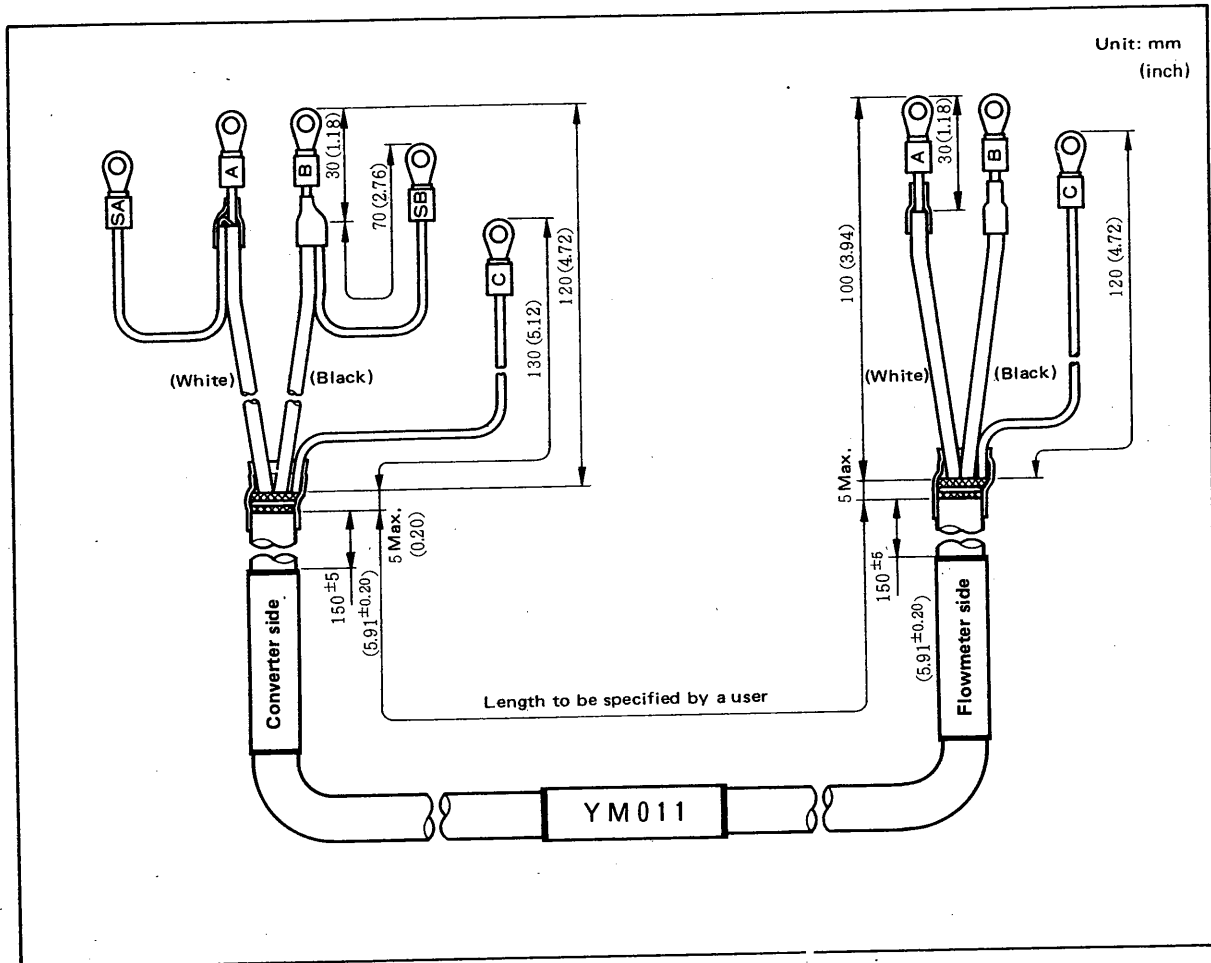


Figure 3-9. End-Treatment for Special Signal Cable.

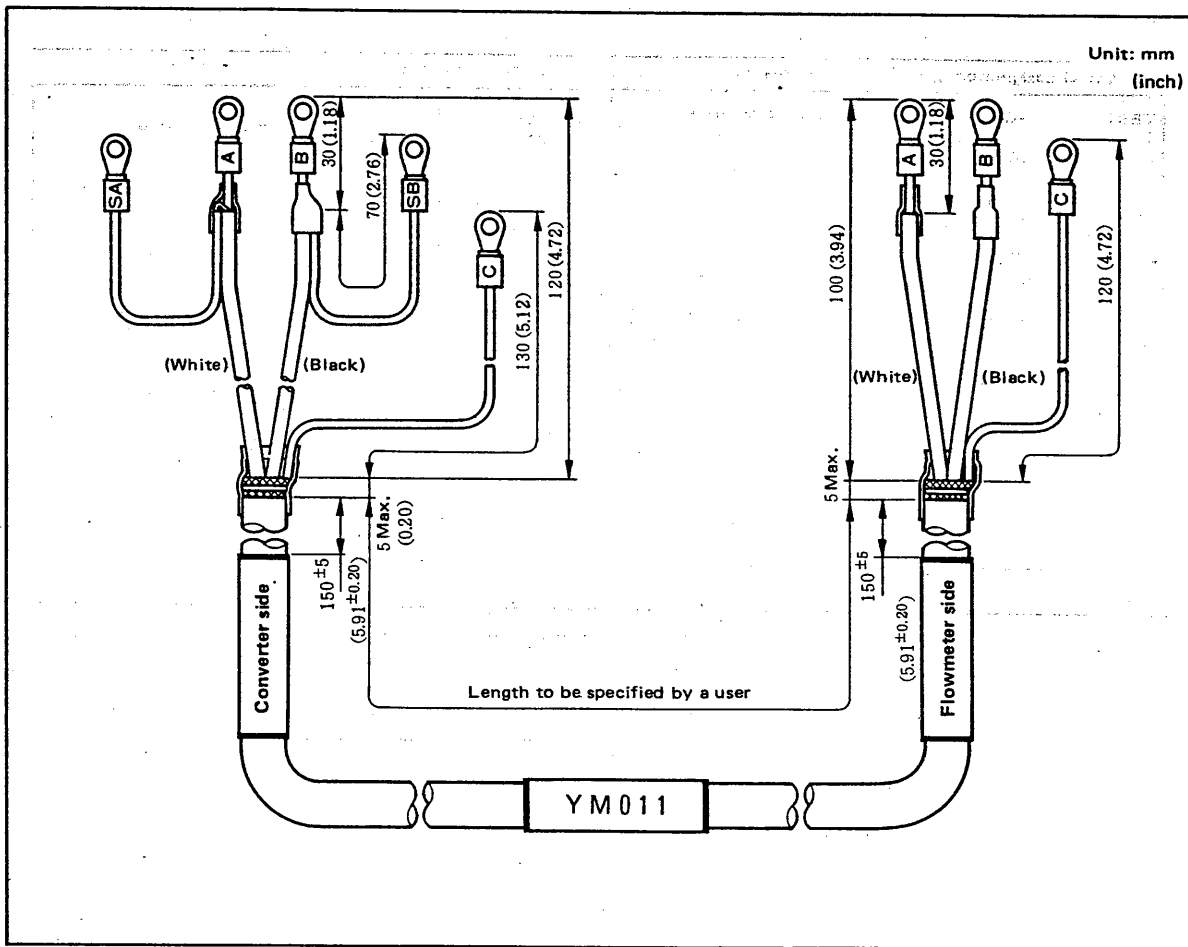


Figure 3-9. End-Treatment for Special Signal Cable.

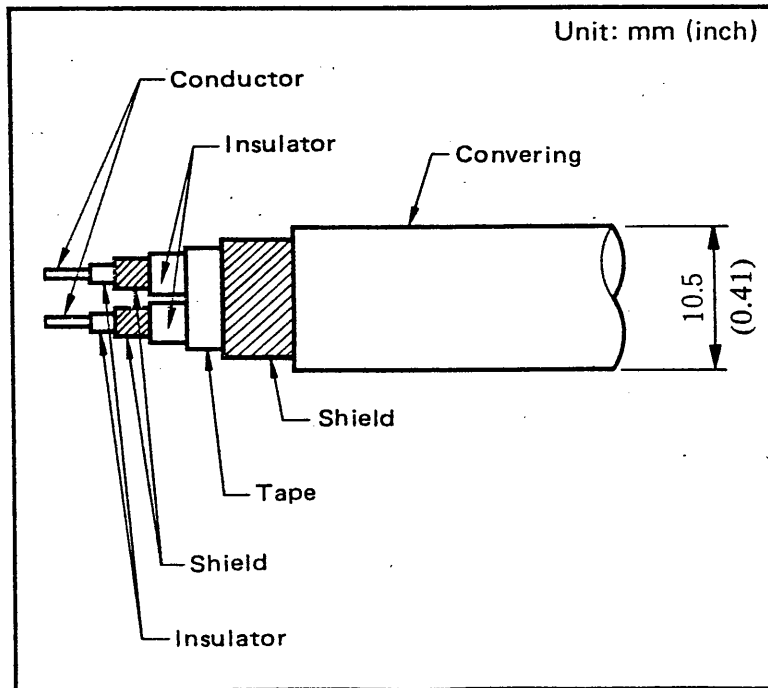
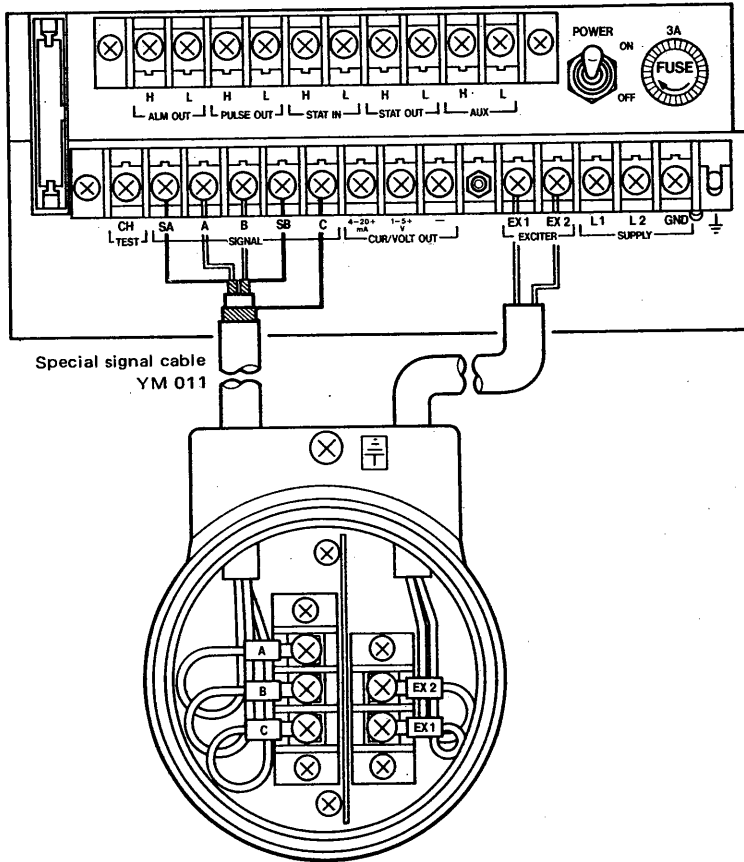


Figure 3-8. Special Signal Cable YM011.

3-2-5. Connection to Flowmeter.

The connection methods are shown below. Connect cables after acknowledging the flowmeter model to be combined.

- (1) Combination with flowmeter model YM100, 200, 300, or 400.



Terminal Correspondence List.

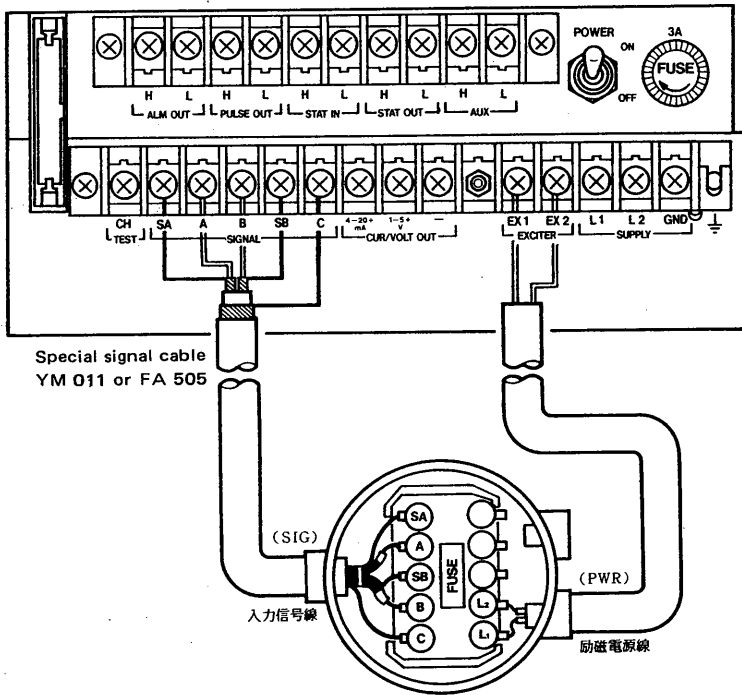
Converter	Flowmeter YM100, 200, 300 and 400
SA	Taping*
A	A
B	B
SB	Taping*
C	C
EX1	EX1
EX2	EX2

* Separately tape the shield wires corresponding to SA and SB to make insulation treatment.

Figure 3-10. Connection (1).

Exciting current is 0.7A.

(2) Combination with flowmeter model F553 or F556.



Terminal Correspondence List.

Converter	Flowmeter F553 or F556
SA	SA*
SB	SB*
A	A
B	B
C	C
EX1	L1
EX2	L2

* Shields corresponding to SA and SB may be separately taped to make insulation treatment without connecting them to SA and SB terminals of the flowmeter.

Figure 3-11. Connection (2).

Exciting Current.

Nominal size		Exciting current (A)
(mm)	(inch)	
1100	44	0.45
1200	48	0.5
1350	54	0.5
1500	60	0.6
1600	64	0.6
1800	72	0.7
2000	80	0.7
2200	88	0.75
2400	96	0.8
2600	104	0.9

3-2-6. Other Connections.

(1) Analog signal output.

Both 4 to 20 mA DC and 1 to 5V DC can be sent out.

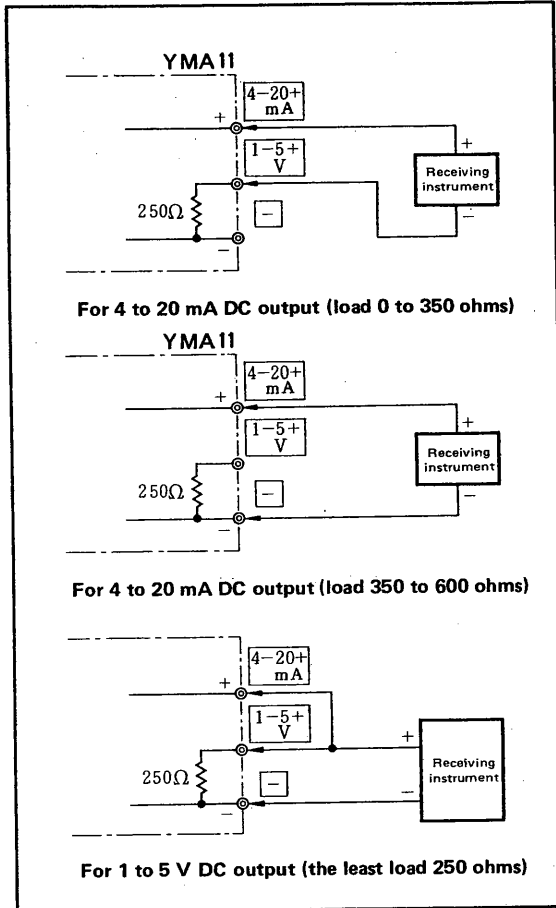


Figure 3-12. Connection for Analog Signal Output.

(2) Pulse output.

Make wiring taking care of voltage and polarity because this output is a transistor switch (isolated type).

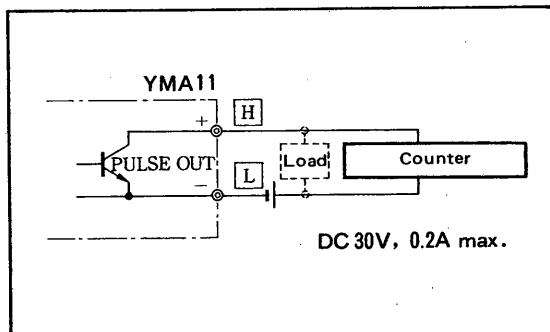


Figure 3-13. Pulse Output Connection.

(3) On-Off Input (by contact).

Both powered and unpowered voltage inputs can be received.

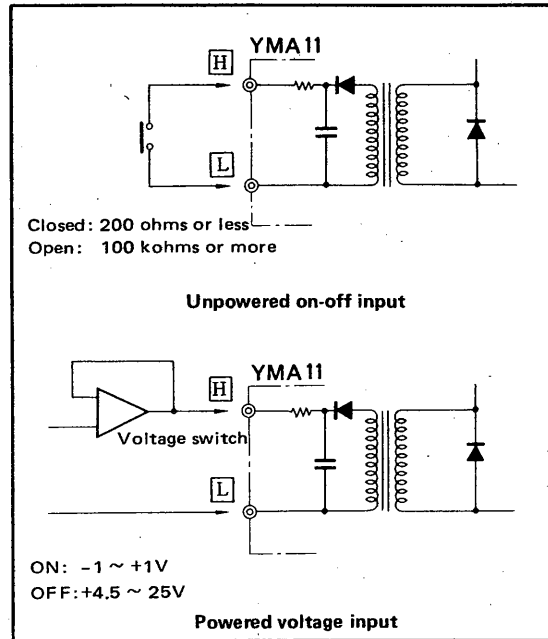


Figure 3-14. On-Off Input Connection (by Contact).

(4) On-Off output.

Make wiring taking care of voltage and polarity because this output is a transistor switch (isolated type).

This switch output cannot directly turn ON and OFF the AC loads. For this purpose, provide a repeating relay or equivalent as shown in Figure 3-15.

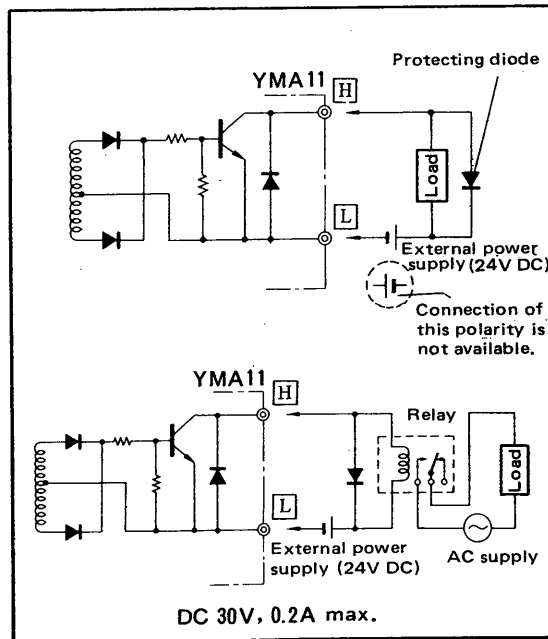


Figure 3-15. On-Off Output Connection.

3-2-7. Checking Connections.

When all connections are completed, check again that these connections are entirely correct. With the converter power supply turned ON, the following items concerning connection become checkable.

(1) Are receiving instruments (analog signal and pulse output signal) properly connected?

Since the converter has a function of signal generator capable of outputting any value in the range 0 to 106%, the connection can be checked by seeing whether or not the receiving instruments are working normally.

(2) Is an instrument which receives an on-off output (alarm or status output) properly connected?

Since the alarm or status on-off output can be set to the desired state either open or closed, the connection can be checked by seeing whether or not the required action is taken.

(3) Is an instrument which outputs an on-off signal (range selection or 0% signal lock) properly connected?

The connection can be checked by a function indicating whether or not the on-off signal is received.

For the procedures which operates the functions, see Section 6. MAINTENANCE; 6-1. Testing.

4. PRINCIPLE.

4-1. Principle.

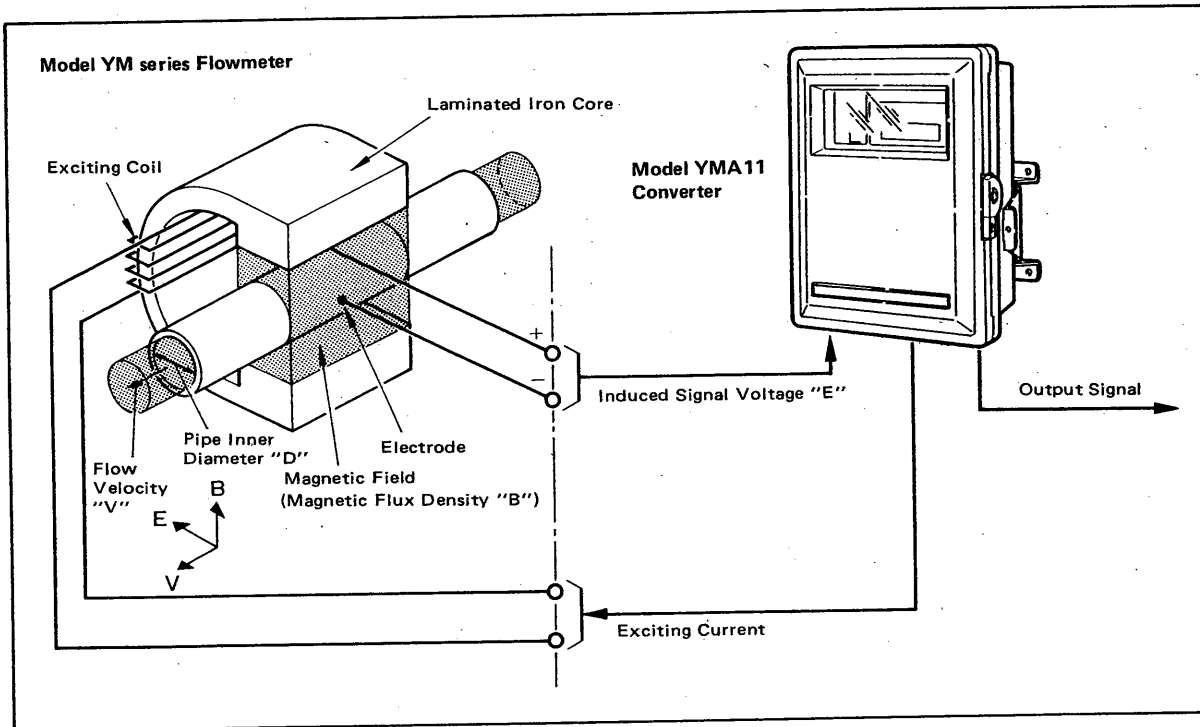


Figure 4-1. Principle Diagram.

The principle of the magnetic flowmeter is based on the "law of electromagnetic induction" which states that, when a conductor moves in a magnetic field, an electromotive force is induced perpendicular to the directions of conductor movement and magnetic field and its strength is proportional to the conductor moving velocity and the magnetic flux density.

In Figure 4-1, if a conductive liquid flows at an average velocity of V(m/s) through a pipe whose inner diameter is D(m), in which a uniform magnetic field of the flux density B(T esla) exists, an electromotive force E(volt) is generated perpendicular to the directions of the magnetic field and the flow.

$$E = D \cdot V \cdot B \text{ (V)} \dots\dots\dots (1)$$

The volumetric flow rate Q is given by the following equation:

$$Q = \frac{\pi}{4} \cdot D^2 \cdot V \text{ (m}^3\text{/sec)} \dots\dots\dots (2)$$

From equations (1) and (2),

$$Q = \frac{\pi}{4} \cdot \frac{D}{B} \cdot E \text{ (m}^3\text{/sec)} \dots\dots\dots (3)$$

Therefore, E is expressed as shown below.

$$E = \frac{4}{\pi} \cdot \frac{B}{D} \cdot Q \text{ (V)} \dots\dots\dots (4)$$

If B is a constant, E will be proportional only to Q or E will be a measure to know Q.

4-2. Model YMA11 Converter: Circuit and Its Features.

(Power Supply and Excitation)

The switching regulator is the power supply circuit unique to YEW. The converter operation is not affected by supply voltage variation because the regulator employs the method in which a microprocessor always controls the exciting circuit secondary voltage in addition to the fact that the regulator can be applied to both AC and DC supply.

YEW MAG series converters provide highly stable excitation at the minimum power consumption by rationally changing the secondary voltage with a microprocessor.

(Signal Processing)

Relationship between excitation system and signal processing system is not separable. The YEW MAG series converter incorporates two excitation systems and can stably take out flow signals being interfered

with various noises by conducting signal processings appropriate to each excitation system.

(Functions)

In YEW MAG series converters, the microprocessor capability is utilized to the full extent by software engineering. Functions worthy of all-in-one type are packaged as standard specifications such as span setting in engineering units, multi-range selection, and various alarm/detecting functions including empty flowmeter tube detection as well as excitation and signal processings.

(Electromagnetic Compatibility)

The converter is designed to be immune to noises from outside by a few measures such as measures against impulse noises by means of double shielded box, measures against high frequency noises, and against lightning. In addition, consideration not to send out noises to the outside is taken by providing noise filters.

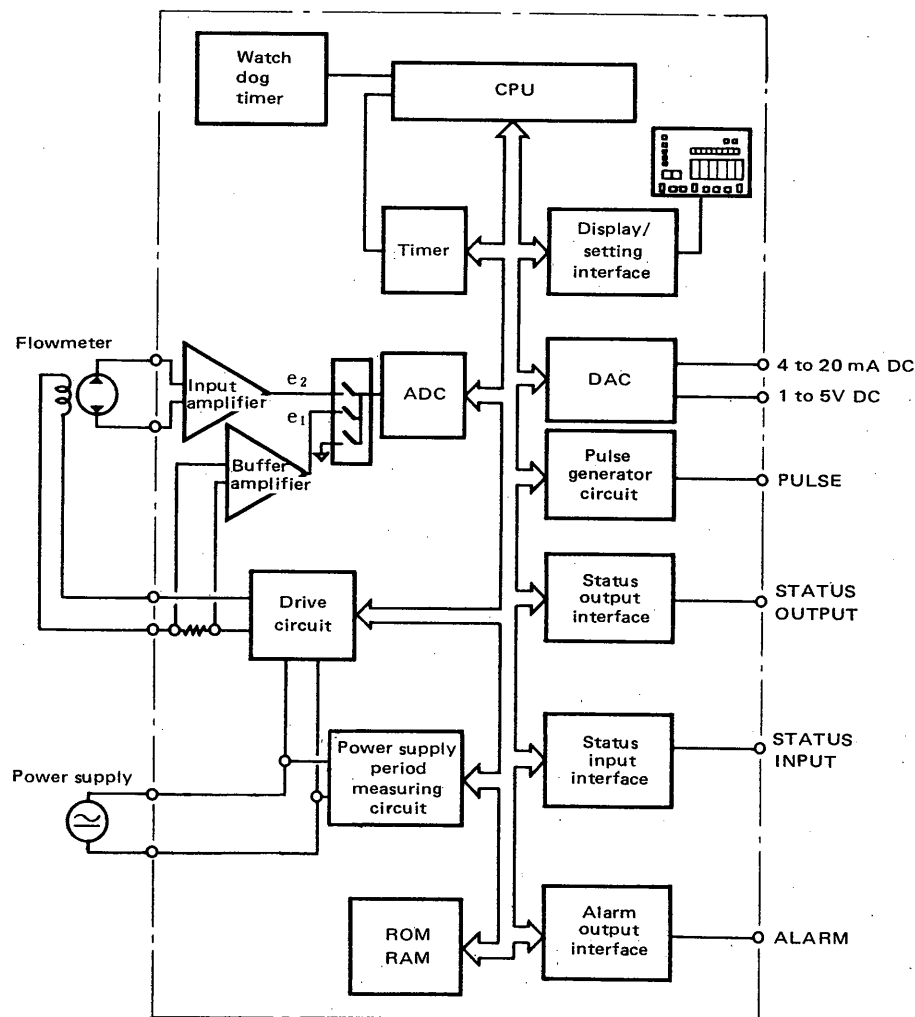


Figure 4-2. Circuit Diagram.

5. OPERATION.

5-1. Front Panel Features.

Figure 5-1 shows the front panel displays and switches.

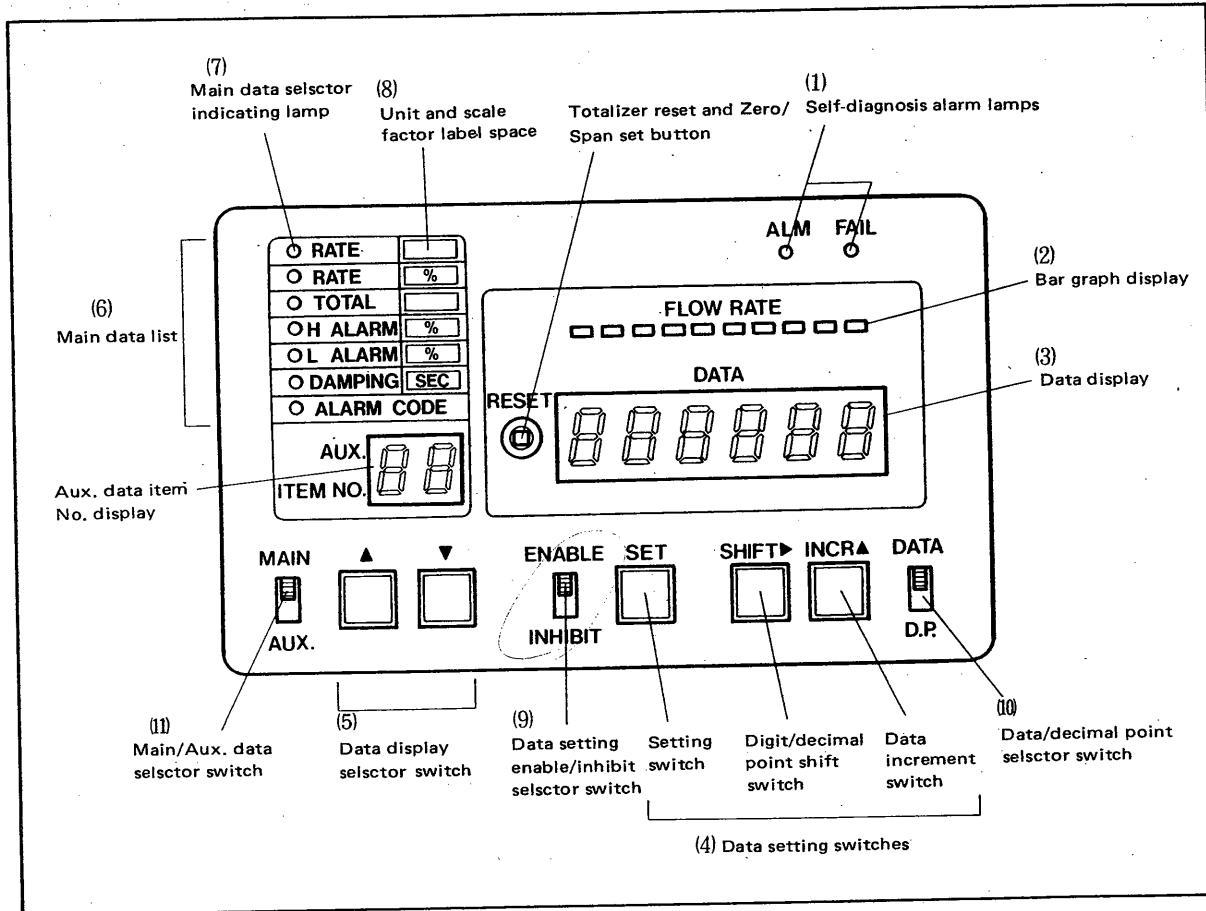


Figure 5-1. Front Panel.

- (1) **Self-diagnosis alarm lamps.**
 FAIL lamp (red): Goes ON if the instrument fails.
 ALM lamp (yellow): Goes ON if an alarm status occurs. This lamp flashes when the data memory backup battery is not mounted or its voltage drops below the predetermined level.
- (2) **Flow rate bar graph display.**
 A flow rate is displayed by a bar graph consisting of 10-segment LEDs.
- (3) **Data display.**
 The data display is a six-digit digital display. The main data necessary in normal operation, such as flow rate and totalized counts, (items

shown in the main data list on the front panel) or the auxiliary data, such as parameters, (items shown in the data card inserted in the rear pocket of the door) are indicated in this data display by selecting the position of the Main/Aux. data selector switch.

In normal operation, set this selector switch to MAIN (main data). Using the data display selector switches \blacktriangle and \blacktriangledown , select the main data item, then the data of that item is indicated in the DATA display. The selected data item is presented by the main data selector indicating lamp (see Figure 5-2).

To display an auxiliary data item, set the Main/Aux. data selector switch to AUX. In this situation, the auxiliary data item is indicated in the left-hand AUX.ITEM NO. display and the corresponding data is presented in the right-hand DATA display. Select the desired item No. using the data display selector switches ▲ and ▼ (see Figure 5-3).

The DATA display is used for displaying set-points and parameters as well as for displaying data.

(4) **Data setting switches** (SET, SHIFT▶, INCR▲).

These are used for data setting.

(5) **Data display selector switches** (▲, ▼).

These are used for selecting main or auxiliary data items to be displayed in the data display.

(6) **Main data list.**

A list containing items necessary for daily operation among the data to be indicated in DATA display. A desired item can be selected using the display selector switches.

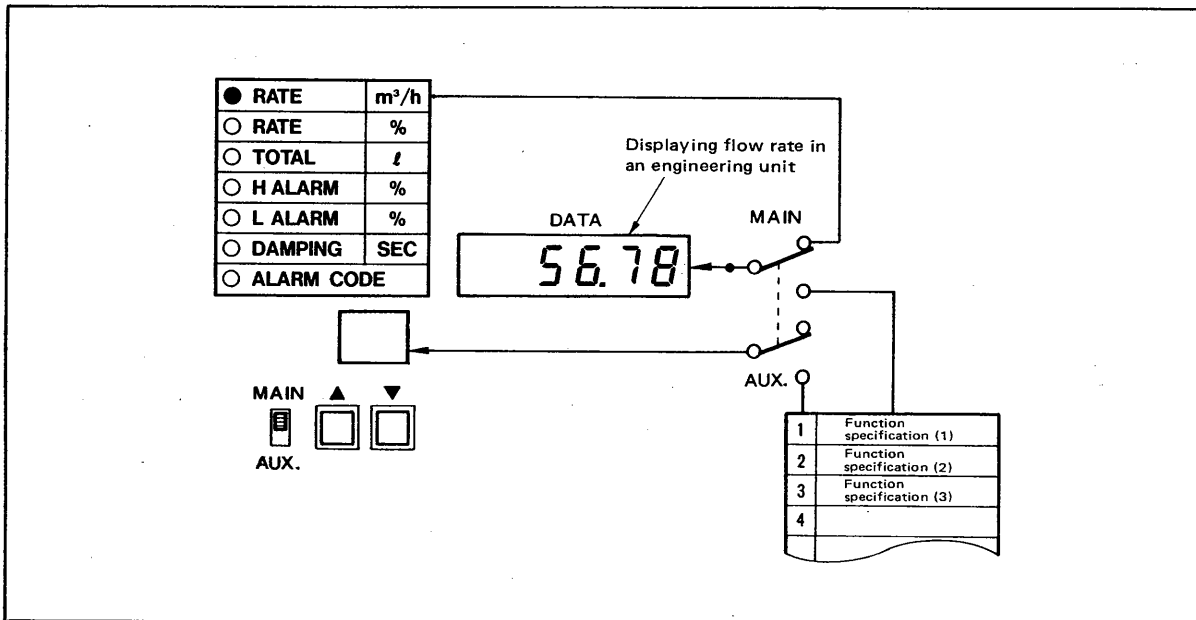


Figure 5-2. Data Display Function for Main Data.

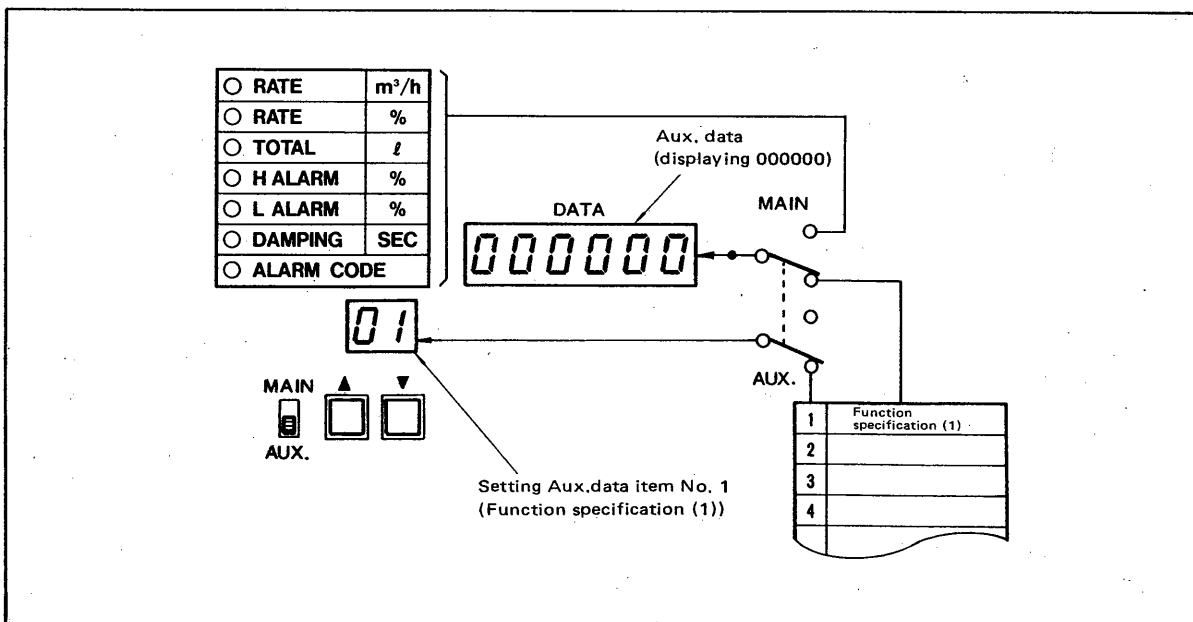


Figure 5-3. Data Display Function for Aux. Data.

YEW MAG Magnetic Flow Converter							
RATE	Flow rate in engineering unit			11	Flowmeter nominal size		
RATE	Flow rate in %		%	12	Meter factor	0.5	mΩ
TOTAL	Totalized flow			13	Exciting current	0.1	A
H ALARM	High flow alarm setpoint		%	14	Totalizing pulse output low cut		%
L ALARM	Low flow alarm setpoint		%	15	Analog output low cut		%
DAMPING	Damping time constant second		sec	16	Automatic multi-range switching hysteresis width		%
ALARM CODE	Code designation of alarm contents			17	Forward/reverse flow switching hysteresis width		%
1	Function specification (1)	000001		18	Rate limit dead time second		sec
2	Function specification (2)	001000		19	Rate limit value %		%
3	Function specification (3)	041220		20	ALM output selection		
4	Forward flow span 1			21	Frequency to be synchronized		Hz
5	Forward flow span 2			22	Reverse flow span 1		
6	Forward flow span 3			23	Reverse flow span 2		
7	Forward flow span 4			24	Reverse flow span 3		
8	Unit conversion factor	1.0		25	Reverse flow span 4		
9	Pulse output factor	1.0		26	Test mode	0-0000	
10	Totalizer factor	1.0		27	Key code	77	

Function Specification Details

Function specifications (1) A B C D E F

A Excitation mode
 0: Standard mode
 1: Slurry mode

B Forward flow, multi-range mode
 0: Forward, single range
 1: Forward, single range
 2: Forward, 2 ranges, external selection
 3: Forward, 3 ranges, external selection
 4: Forward, 4 ranges, external selection
 5: Forward, automatic 2 range switching

C Reverse flow, multi-range mode
 0: Reverse flow measurement not required
 1: Reverse, single range
 2: Reverse, 2 ranges, external selection
 3: Reverse, 3 ranges, external selection
 4: Reverse, 4 ranges, external selection

D Totalizer display
 0: Forward flow, totalizer display
 1: Reverse flow, totalizer display
 2: Flow difference, totalizer display

E Totalizer reset/semi-automatic zero and span adjust
 0: Valid
 1: Invalid

F 0% signal lock
 0: Not provided
 1: Provided

Function specifications (2) 0 0 1 0 K L

I Flowmeter nominal size unit
 0: mm
 1: inch

K Failure current output
 0: 2 mA or less
 1: Hold
 2: 22 mA or more

L Selection of alarm output
 0: Not provided
 1: Provided

Function specifications (3) 0 N P Q R S

N Flow units
 0: m³
 1: l
 2: cm³
 3: 10³ gallon
 4: 10⁰ gallon
 5: 10⁻³ gallon
 6: 10³ bbl
 7: 10⁰ bbl
 8: 10⁻³ bbl

P Flow rate time unit
 0: */H
 1: */min
 2: */sec

Q Output pulse factor
 0: 10⁻⁶ pulse/*

1: 10⁻³ pulse/*
 2: 10⁰ pulse/*
 3: 10³ pulse/*
 4: 10⁶ pulse/*

S Output pulse factor
 0: Duty 50%
 1: 0.5 ms
 2: 1 ms
 3: 20 ms
 4: 33 ms
 5: 50 ms
 6: 100 ms

*: (Unit selected in the digit N) x (Unit conversion factor)

Alarm details code display		
Code	Lamp	Diagnostic details
good	—	Normal
FAIL- 1	FAIL	RAM data volatilization
Err - 2	ALM	A/D converter
Err - 3	ALM	Coil disconnection
Err - 5	ALM	Input signal error (Empty tube detection)
Err - 6	ALM	High flow alarm
Err - 7	ALM	Low flow alarm
Err - 8	ALM	Output pulse overflow
Err - 9	ALM	Erroneous setting
Err -10	ALM (flashing)	No mounting of battery or battery voltage drop

Fig. 5-4. Data Card.

Main Data:

RATE..... in engineering unit
 RATE..... in %
 TOTAL totalized flow
 H ALARM high flow alarm setpoint
 L ALARM low flow alarm setpoint
 DAMPING damping time constant
 in second
 ALARM CODE..... code designation of
 alarm contents

- (7) **Main data selector indicating lamp.**
 This lamp indicates the main data item selected with the data display selector switches.
- (8) **Unit and scale factor label space.**
 Spaces for presenting the engineering units of main data, used by attaching the "unit and scale factor label" provided as accessories.
- (9) **Data setting enable/inhibit selector switch (ENABLE/INHIBIT).**
 This switch inhibits the data setting by switch operation in its INHIBIT position.
- (10) **Data/decimal point selector switch (DATA/D.P.).**

This switch is used when the decimal point place of a set data is to be set. Setting the switch in the D.P. position allows the decimal point to be set with the data setting switches (**SHIFT**, **SET**).

- (11) **Main/Aux, data selector switch (MAIN/AUX.).**

This switch selects the categories of the data to be indicated in DATA display; either main or aux.data.

MAIN: Main data

AUX.: Auxiliary data

- (12) **Data card.**

The data card is a list of main data and auxiliary data items, such as measuring flow span, meter factor, function specifications, etc. It is used by writing the determined data and units in vacant fields. Figure 5-4 shows the data card (in which the details of aux. data function specifications are included), inserted in the rear pocket of the door together with the unit and scale factor labels.

5-2. Main and Auxiliary Data Specifications and Writing Them in Data Card.

Before using the YMA11 Magnetic Flow Converter, the required main and auxiliary data items, such as function specification data, measuring flow span, pulse factor (weighting), meter factor, and others, must be determined and written in the data card.

Using this data card as a check list allows the data settings without omission and also is useful for maintenance work.

5-3. Preparation for Operation.

Perform preparation works with the converter mounted in the installation place or removed from the place and put on a workbench.

5-3-1. Checking Special Parts Mounted.



Make sure that the fuse and data memory backup battery are mounted in place.

If not, mount them referring to the replacing procedures described later (Section 6, MAINTENANCE).


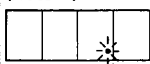



5-3-2. Setting Decimal Point.


Turn ON power and set the "data set ENABLE" according to the data set ENABLE/INHIBIT procedure described in 5-3-4.

Set the data/decimal point (DATA/D.P.) selector switch to D.P.

Next, using the data display selector switch  or , select the data item No. in the display, whose decimal point is to be set. Then carry out the following operations.

(Example of setting decimal place)



Switch operation	Display	Description
		The initial or existing setpoint is displayed.
	(Note 1)	
SHIFT▶		The decimal point of the above setpoint flashes.
SHIFT▶		When the SHIFT switch is continued to be depressed, the decimal place changes digit by keeping flashing. When the decimal point reaches the desired place, release the switch.
	(Note 2)	
SET		The whole displayed data flashes.
SET		Decimal point setting is completed.

(Note 1) The * mark represents a flashing decimal point.
 (Note 2) The shaded portion  represents the flashing displayed data.

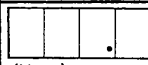
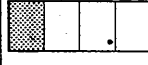
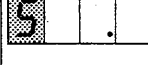




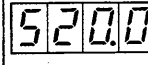
5-3-3. Setting Data.

Turning ON power and set "the data set ENABLE" according to the data set ENABLE/INHIBIT procedure described in 5-3-4.

Set the data/decimal point (DATA/D.P.) selector switch to DATA.

Then, using the data display selector switch  or , select the data item NO. in the display, whose data is to be set. Next, carry out the following operations.

(Example of setting data and display)

Switch operation	Display	Description
		The initial or existing setpoint is displayed.
	(Note)	
SHIFT▶		The enabled most significant digit flashes.
INCR▲		Set the desired data. If setting is not needed, go to the next step.
SHIFT▶		The next significant digit flashes.
INCR▲		Set the desired data. If setting is not needed, go to the next step.
INCR▲		Repeat the above setting operation to the least significant digit.
SET		The whole displayed data flashes.
SET		Data setting is completed.

(Note) The shaded portion  represents the flashing displayed digit(s).

5-3-4. Data Setting ENABLE/INHIBIT Procedure.

Data setting ENABLE/INHIBIT should be required for both hardware and software.

Hardware setting is performed with the data setting enable/inhibit selector switch on the front panel; Data can be set in ENABLE position of the switch, while data setting is inhibited in INHIBIT position.

Software setting is implemented by the data set in AUX. ITEM NO. 27. Data can be set for the data displayed with "77", while data setting is inhibited for the data display of "0". Use the setting procedure described in 5-3-3 for setting "77" or "0".

When all the settings are completed, it is preferable to place both hardware and software in data INHIBIT status to prevent setting error due to mis-operation.

5-3-5. Setting Main Data.

In the main data list of the converter, RATE (flow rate) and TOTAL (totalized flow) items are not required to be set because these are only displayed. However, in the item TOTAL, its decimal place can be shifted. For three items of high flow alarm (H ALARM), low flow alarm (L ALARM), and damping (DAMPING), however, set the required values.

Main data item	Item details	Data range	Decimal point place	Default value
H ALARM	High flow limit alarm setpoint	- 110.0 to + 110.0	Fixed	110.0
L ALARM	Low flow limit alarm setpoint	- 110.0 to + 110.0	Fixed	- 110.0
DAMPING	Damping time const.	3 to 100	Fixed	10

5-3-6. Setting Auxiliary Data.

This includes the works to set each data written in the data card in subsection 5-2.

Make settings selecting the required data according to subsection 5-4.

5-3-7. Indicating Engineering Units and Scale Factors.

Peel off the required engineering unit and scale factor labels from the engineering unit label sheet supplied as the accessories and apply them to the engineering unit and scale factor label spaces in the main data list (see Figure 5-5).

If a required engineering unit or scale factor is not found, fill a blank label of the sheet with the desired unit or scale factor to apply it to the main data list.





<input type="radio"/> RATE	
<input type="radio"/> RATE	%
<input type="radio"/> TOTAL	
<input type="radio"/> H ALARM	%
<input type="radio"/> L ALARM	%
<input type="radio"/> DAMPING	SEC
<input type="radio"/> ALARM CODE	
AUX.  	
ITEM NO.  	

Figure 5-5. Presentation of Engineering Units and Scale Factors.

5-3-8. Setting Switches on Front Panel.

Refer to Figure 5-1.

- (1) **Data setting ENABLE/INHIBIT selector switch.**
Set this switch to INHIBIT in normal operation.
- (2) **DATA/D.P. selector switch.**
Set this switch to DATA in normal operation.
- (3) **MAIN/AUX.-data selector switch.**
Set this switch to MAIN (main data) in normal operation.

5-4. Auxiliary Data Details.

5-4-1. Selecting Functions.

The YMA11 converter is provided with various functions. Setting these functions are described below.

(1) Auxiliary data item No. 1: Function specifications (1)

Display

A	B	C	D	E	F
---	---	---	---	---	---

 *: Default value

A : Excitation mode

- * 0 : Standard mode Exciting frequency of 1/8 of the commercial frequency.
- 1 : Slurry mode Exciting frequency of 1/2 of the commercial frequency, used if noises are too much in standard mode.

B : Forward flow, multi-range mode

- * 0 : Forward, single range measurement
- 1 : Forward, single range measurement
- 2 : Forward, 2 ranges, external selection Ranges are selected with external on-off input.
- 3 : Forward, 3 ranges, external selection Ranges are selected with external on-off input.
- 4 : Forward, 4 ranges, external selection Ranges are selected with external on-off input.
- 5 : Forward, automatic 2 range switching Output signal level is always compared with 100% level and, if 100% is exceeded, is switched to the second range.

C : Reverse flow, multi-range mode

- * 0 : Reverse flow measurement not required
- 1 : Reverse, single range measurement
- 2 : Reverse, 2 ranges, external selection
- 3 : Reverse, 3 ranges, external selection
- 4 : Reverse, 4 ranges, external selection

D : Totalizer display mode at the bidirectional flow measurement

Display can be obtained in reverse flow measurement.
Since data are stored for all the three models, the desired value can be displayed.

- * 0 : Forward flow, totalizer display
- 1 : Reverse flow, totalizer display
- 2 : Flow difference in bidirectional measurement, totalizer display

E : Totalizer reset/semi-automatic zero adjust./semi-automatic span adjust.

Reset pushbutton operation is valid or invalid.













- * 0 : Valid
- 1 : Invalid

**F : 0% Signal lock Output signal is forced to be fixed to 0% with an external on-off input.
(Note) If code B or C, 3 or 4 is selected, this digit is automatically set to "0".**

- * 0 : Not provided
- 1 : Provided

Example: Setting of Aux. Data Item No. 1 "Function Specification (1)"

- A = 0 : Standard excitation mode
- B = 5 : Forward, automatic 2 range switching
- C = 0 : Reverse flow measurement not required
- D = 0 : Forward flow, totalizer display
- E = 0 : Reset "Valid"
- F = 1 : 0% signal lock, provided

Switch operation	Display	Description
Carry out operation for releasing data setting inhibition.		
 	AUX. 01 ITEM NO. 01	Select Aux. Data Item No. 1.
	000000	The initial setting is displayed in all zeros.
	000000	The most significant digit (first digit from the left) flashes indicating "0".
	000000	The second digit flashes indicating "0".
 5 times	050000	The second digit flashes indicating "5".
	050000	The third digit flashes indicating "0".
	050000	The 4th digit flashes indicating "0".
	050000	The 5th digit flashes indicating "0".
	050000	The 6th digit flashes indicating "0".
	050001	The 6th digit flashes indicating "1".
	050001	The whole set data flashes.
	050001	Data setting is completed.

