MITSUBISHI ELECTRIC

Changes for the Better

for a greener tomorrow

eco Changes

MITSUBISHI ELECTRIC
INDICATORS and TRANSDUCERS

Empowering Industries

Table of Contents (Mechanical Indicators)

Mechanical Indicators

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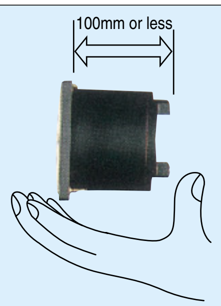
Overview and Features

High Reliability and Abundant Product Line-up

Electric Indicators

Series	Rectangular indicators						Wide-angle indicators	
	Y-2N Series			Y-N Series			L-N Series	
Type	Y-206N	Y-208N	Y-210N	Y-8N	Y-10N	Y-12N	L-80N	L-110N
Size (mm)	64×60	85×75	100×85	82×82	102×102	122×122	80×80	110×110
DC ammeters	A	A	A	A	A	A	A	A
DC voltmeters	V	V	V	V	V	V	V	V
AC ammeters	A	A	A	A	A	A	A	A
AC voltmeters	V	V	V	V	V	V	V	V
Wattmeters	kW	kW	kW	kW	kW	kW	kW	kW
Varmeters	kvar	kvar	kvar	kvar	kvar	kvar	kvar	kvar
Power factor meters	cosϕ	cosϕ	cosϕ	cosϕ	cosϕ	cosϕ	cosϕ	cosϕ
Frequency meters	Hz	Hz	Hz	Hz	Hz	Hz	Hz	Hz
Receiving indicators	%	%	%	%	%	%	%	%

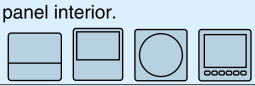
Depth dimension: 100mm or less



Y-2N Series/**Y-N** Series/**L-N** Series
YR-UN Series
ME Series/**LE** Series
DE Series

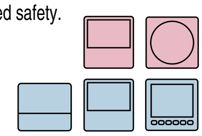
100mm or less for all products

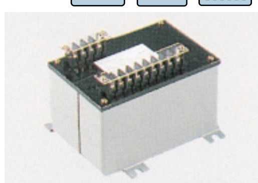
Enables downsizing (thinning) of panel and effective use of panel interior.



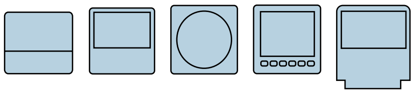
Equipped with isolation barrier and terminal cover

The isolation barrier and terminal cover reinforce isolation between terminals and protect conducting parts, thus preventing accidents and realizing improved safety.

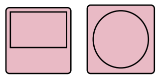




Symbol details



· Depth dimension: 100mm or less
· Equipped with isolation barrier and terminal cover
· Easy mounting and wiring

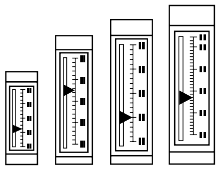


· Equipped with isolation barrier and terminal cover

(Mechanical Indicators)

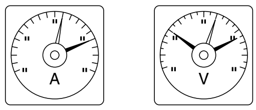
Indicators with changeover switch			Demand meters/Demand meter relays		Meter relays	
YR-UN Series			LB-N Series			
YR-8UN	YR-10UN	YR-12UN	LB-8N	LB-11N	Y-210MRN	L-11MRN
82×99	102×119	122×139	80×80	110×110	100×83	110×110
					A	A
					V	V
A	A	A	A	A	A	A
V	V	V	V	V	V	V
				kW	kW	kW
					kvar	kvar
					cosϕ	cosϕ
					Hz	Hz
				%	%	%

Bar-shaped Indicators			
F-N Series			
F-210N	F-213N	F-215N	F-217N
100×30	130×36	150×40	170×42

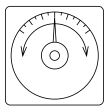


Various indicators for diverse applications

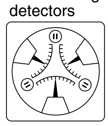
· With maximum and minimum pointers



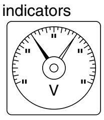
· Synchroscopes



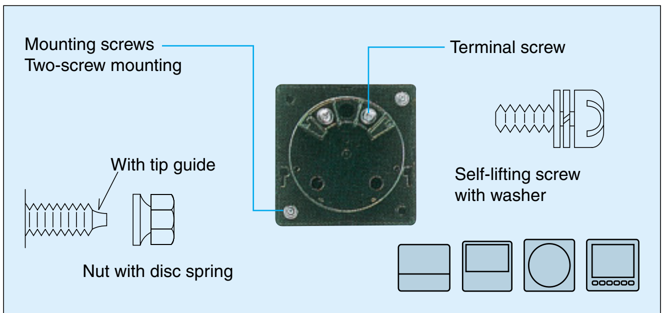
· Earth leakage detectors



· Dual-element indicators



Easy mounting and wiring



Easy-to-read scales

Scales are bright and easy-to-read, allowing them to perform their essential functions.

Safety Precautions

Please follow the following precautions when using Mitsubishi Electric products and be sure to carefully read the explanations regarding safety precautions in the boxes marked “Caution.” In addition, ensure that any stickers or other items with relevant safety information are delivered to the final user.

1. Precautions concerning usage environment and usage conditions

(1) Do not use in the following locations. Use in such locations may lead to malfunction or reduced service life.

- Locations where the ambient temperature is outside the range of -5 to +50°C.
- Locations where the average daily temperature exceeds 35°C.
- Locations where condensation or relative humidity is less than 30% or more than 70% (85% for electronic indicators).
  - ☆ Moisture-proof treatment is available for high-humidity environments for some electrical indicator models. See page 10 of this catalog or contact a Mitsubishi Electric representative for details.
- Locations with excessive dust, corrosive gas, salinity, or oil fumes.
  - * Corrosive gases include sulfur dioxide, ammonia, hydrogen sulfide and other gases that corrode metal, plastic and other materials.
  - ☆ Supplementary anti-corrosion treatment is available for special environments for some electrical indicators. See page 10 of this catalog or contact a Mitsubishi Electric representative for details.
- Locations where indicators are subject to excessive vibration or shock.
  - ☆ When used in a location subject to excessive vibration, moving parts may resonate and this may cause error and fluctuation of indicated values. In such cases, apply anti-vibration measures to the installed panel or change the installation location.
- Locations directly exposed to rain, water drops, ultraviolet rays, or sunlight.
- Locations at an altitude of 2000m or more for electric indicators or 1000m or more for electronic indicators.
- Locations with excessive external noise or radio waves.
- Locations where a large amount of static electricity is generated.
- Locations where there is a high level of waveform distortion or high-frequency waves caused by harmonic/thyristor circuits or other means.

(2) Please consult a Mitsubishi Electric representative regarding the use of indicators for any of the following facilities.

- Nuclear power plants, medical devices, military facilities, airplanes or vehicles.

(3) The products in this catalog are not certified indicators.
They do not comply with the mandatory specifications for electrical meters as specified in the Measurement Act of Japan.

2. Mounting precautions

Please pay attention to the following items during installation.

For safety reasons, installation should only be performed by a professional electrical wiring technician.

- Mount the electrical indicators on metal panels.
- Mount on the panel in such a way that ensures the electrical indicator terminals and charged parts cannot be touched accidently by an operator.
- Install the special accessories for T-100 and T-150 inside the panel. In addition, install them so that it is ensured the accessories cannot be touched accidently by an operator.
- The screws for mounting onto the panel must be tightened by appropriate tools at torques appropriate for the screw size.
  - * Recommended tightening torques　M3 screws: 0.48~0.98N·m
    M4 screws: 0.98~1.47N·m
    M5 screws: 1.47~1.96N·m

3. Connection precautions

Please pay attention to the following items when making connections.

For safety reasons, installation should only be performed by a professional electrical wiring technician.

- The metal panel must be grounded.
- Before using a voltmeter when connecting to a main power-supply circuit, make sure that an appropriate exterior fuse is installed.
- Indicators that require an auxiliary power supply must not be directly connected to/use a main power supply. For these indicators, use a power supply that is isolated from the main power supply circuit via a voltage transformer or other means.

· Varmeters and power factor meters will not operate correctly with a reverse phase sequence. Use with the correct phase sequence.
· Grounding of the secondary side of an instrument voltage transformer or current transformer is not necessary for low-voltage circuits.

⚠ **CAUTION**	· Connections must be made correctly as shown in the connection diagrams of the catalog. Inappropriate connection and installation may cause equipment burnout, fire or leakage of electricity. · For connection, use crimp terminals suited for the electrical quantity and terminal size. · Make sure to use the terminal screws supplied with the product. · The terminal screws must be tightened by appropriate tools at torques appropriate for the screw size. Failure to do so may cause overheating, equipment burnout or fire. * Recommended tightening torques M4 screws: 0.98~1.47N·m M5 screws: 1.47~1.96N·m · Do not perform connection work with live wires. Dangers include electrical shock, electrical burns, equipment burnout and fire. · For safety, make sure to attach the terminal cover. · Indicators combined with a current transformer (CT) must be correctly connected to the CT secondary-side signal. Incorrect connection or opening of the secondary side of the CT will generate high voltage on the secondary side of the CT, which may lead to CT failure, scorching or a fire. · Indicators combined with a voltage transformer (VT) must be correctly connected to the secondary side of the VT. Incorrect connection or short-circuiting of the secondary side of the VT will cause a large overcurrent to flow through the secondary winding of the VT, leading to scorching of the secondary winding and VT failure, scorching or a fire.

4. Precautions concerning preparation before use

Please read the following carefully before use.

(1) Transportation

Be sure to prevent the indicators from vibration or shock as much as possible during transportation.

In situations where it is possible that indicators will be subject to excessive vibration or shock, remove the indicator from the panel before transportation.

When the indicators are received, check the indicators for any abnormalities in appearance or operation that may have been caused as a result of excessive vibration or shock during transportation.

(2) Check the product name and rating

As a precautionary measure, check the product name and rating (e.g., voltage, current, frequency, phase-wire) before use.

(3) Adjustment

If an indication corresponding to an input is to be adjusted in an indicator with a built-in adjustment resistor such as a DC ammeter or receiving indicator, perform adjustment without applying excessive force to the adjuster. Otherwise, the adjuster may break.

Additionally, avoid using the adjuster under normal circumstances.

(4) Insulation resistance test and voltage test

Please read the following carefully before performing an insulation resistance test or voltage test. Not doing so may cause indicator failure.

⚠ **CAUTION**	· When performing an insulation resistance or voltage test between 1) an electrical circuit and an outer casing, or 2) a voltage circuit and a current circuit, short-circuit the input terminals in both the current and voltage circuits. Not doing so may cause the indicator to malfunction. · The applied voltage for the voltage test varies according to the indicator model. Please note the voltages indicated in this catalog. · For the applied voltage of the impulse withstand test, apply a 1.2×50μs standard lightning impulse voltage waveform with a full wave voltage of 5kV six times or less. · Be careful of where voltage is applied; applying voltage across terminals of equal potential, such as across VT input terminals, may cause failure.

Safety Precautions

5. Usage precautions

Please conform to the following during use.

⚠ CAUTION	(1) Use within the rated range. Use outside of the rated range may cause malfunction or failure. · Applying an electric current exceeding the rated value may cause a failure. Note that this excludes certain models (AC ammeters with expanded scales), for which a temporary current (less than one minute at three times the rated value) may be applied. · With the LM-11MRN, LM-11MRHN, LR-11MRN, and LR-11MRHN meter relays, when interruption of the auxiliary power supply occurs, the contact output state immediately before interruption is memorized. Thus, depending on the state during recovery from interruption, the contact output may be abnormal. After recovery from interruption, to return the indicator to normal operation, perform the resetting operation after moving the setting needle past the driving needle using the setting knob (see p.90 of this catalog for details). · With the LM-11ZN and LM-11YN indicators with maximum and minimum needles, LB-8ZN, LB-11ZN, LB-11YN, LB-11ZRN, and LB-11YRN demand meters, and LB-11ZRMN demand meter relay, set the current application time of the electromagnetic remaining needle resetting terminal to "within 5 seconds." Burnout will occur if current application is continued for 5 seconds or longer. (2) If, when using a movable iron-core indicator by connecting it to the output side of an inverter, the carrier frequency of the inverter is set higher than 5kHz, the indicator may generate heat and failure may occur. Use a carrier frequency of 5kHz or less. (3) The upper-limit alarm and lower-limit alarm settings of the meter relay and demand meter relay must be set correctly. If the settings are incorrect, an alarm will not be generated when an alarm is needed. (4) A shunt (SHT) generates heat and must not be touched by bare hands as it will cause a burn. Additionally, select a well-ventilated location for installation and mount the unit giving consideration to heat radiation. (Refer to p.47 of the catalog.) (5) Do not remove or modify the cover of an indicator, otherwise failure, electrical shock or fire may occur.

6. Precautions concerning repair/response in case of failure/abnormality

If an abnormal noise or heat is generated or a failure occurs, take immediate measures such as shutting off the input, and contact the nearest Mitsubishi Electric System & Service Co. Ltd. branch or relevant Mitsubishi Electric branch.

7. Maintenance and inspection

Perform the following inspections to ensure correct use of indicators.

1 Daily inspection

Check for the following:

· Damage to the indicator
· Abnormal functioning
· Abnormal noise or odor
· Presence of debris, dust or water

2 Periodic inspection

In addition to the above items, check for the following:

· Loose mounting or loose terminal wire connections
· Overheating or deformation due to stress to terminals, outer casings or other components.

⚠ CAUTION	· Always perform terminal wire connection inspections when power to the devices has been interrupted. · Do not touch charged parts of the terminals while current is being applied. There is danger of electrical shock, electrical burns, and damage to equipment.

(1) The cover has an antistatic treatment; please follow these precautions when cleaning it.

· Wipe the cover surface with a soft cloth to remove any dust/dirt. If the dust/dirt cannot be removed, the cover should be replaced.
· To prevent cover deformation or discoloration, or peeling of the cover coating, do not use benzene, thinner or similar cleaning agents on the cover and avoid placing any type of chemically-treated cloth on the cover for a long period of time.
· Static electricity can cause unstable needle movement. If this happens, it may be necessary to coat the cover with a commercially available antistatic agent.

8. Storage precautions

(1) Do not store indicators for long periods in the following locations. Long-term storage in such locations may lead to malfunction or reduced service life.

· Locations where the ambient temperature is outside the range of -20 to +60°C.
· Locations where the average daily temperature exceeds 35°C.
· Locations where the humidity is 90%RH or more and dew condensation occurs.
· Locations with excessive dust, corrosive gas, salinity, or oil fumes.
  * Corrosive gases include sulfur dioxide, ammonia, hydrogen sulfide and other gases that corrode metal, plastic and other materials.
· Locations with excessive vibration or shock.
· Locations directly exposed to rain, water drops, ultraviolet rays, or sunlight.

(2) When storing the indicators, turn off the power, remove the wiring and place in a vinyl bag, box or other container.

9. Disposal precautions

(1) Please note that the electric/electronic indicators do not use batteries.
(2) Dispose of the indicators following the procedures for disposal of general industrial waste.

■ Warranty

(1) The warranty period shall be one year from the date of purchase or 18 months from the date of manufacture, whichever is earlier. In addition, the repair of any failure due to a customer's intentional or negligent actions shall incur a service charge, irrespective of whether or not the warranty is still valid.
(2) Mitsubishi Electric shall not be liable for:
  · Damage that cannot be attributed to Mitsubishi Electric; Lost opportunity or earnings resulting from failure of a Mitsubishi Electric product; Damage, secondary damage or compensation for an accident resulting from special circumstances regardless of whether or not the circumstances were foreseeable; Damage to products/Other services for products not manufactured by Mitsubishi Electric.

■ Service life

The expected service life of electric indicators is 10 years.

* The expected service life is the period or number of operations for which the indicator can be used without functions deteriorating to a level that impairs practical use, based on the condition that the equipment or material is used according to standard specification conditions. Please note that the expected service life is only a guide and performance is not guaranteed for this period.
  (Excerpt/Summary of "Expected Service Life of Electrical Equipment," in the September, 1998 issue of the Journal of the Institute of Electrical Installation Engineers of Japan.)

Selection Precautions

1 Selection of indicator ratings

Application of an input exceeding a rating may cause failure or reduced service life.
In cases where a rating value may be exceeded temporarily due to a starting current of a motor or other reason, select an expanded scale indicator.
Meter relays respond instantaneously and thus output a signal immediately when the starting current or other current exceeds a set value.
When it is necessary to temporarily prevent detection, add an external circuit.

2 Distortion of input waveform

Error occurs readily when the input waveform is distorted.
AC ammeter/voltmeter error is comparatively low if the indicator operates using movable iron core or approximate effective value rectifications. However, please note that the internal parts of movable iron core indicators generate heat when a harmonic current is input, which may lead to deformation or scorching of the casing. For this reason, use a carrier frequency of 5kHz or less for inverter circuits.

3 Use a power factor meter for unbalanced loads if the 3-phase load is unbalanced

Power factor meter errors may occur if the load of a balanced circuit becomes unbalanced. Select a power factor meter for unbalanced loads if it is possible that the 3-phase load will be unbalanced.

4 Error may occur due to extremely low input current

Power factor meter errors may occur if the input current is significantly lower than the rated current.
When selecting the rated primary current of a CT, ensure that the secondary current during actual use will be 1/5 or more of the rated secondary current of the CT.

5 Malfunction may occur due to decrease of input voltage

Wattmeters or varmeters may malfunction if the input voltage decreases. Ensure that the input voltage does not decrease to 85% or less of the indicator's rated voltage.

6 Use a special specification product in an environment with high temperature, high humidity, or corrosive gas

Insulation degradation or failure may occur when the product is used under an environment with high temperature, high humidity, or corrosive gas (e.g., in a wastewater treatment plant, sewage treatment plant, chemical plant, rubber manufacturing plant).
Please select a model with special specifications such as anti-corrosion or moisture-proof treatment.

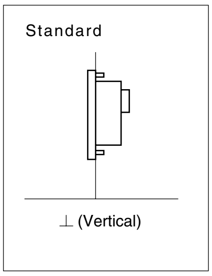
7 Special specification products

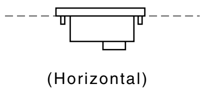
Please specify the necessary specifications or contact a Mitsubishi Electric representative if you require a special-specification model (see p.10).

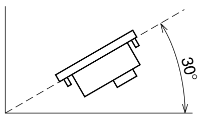
Special Specifications

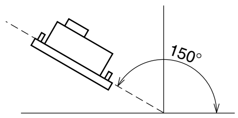
The information in the following table relates to special specifications for mechanical indicators. Please contact a Mitsubishi Electric representative for information regarding special specifications for electronic indicators.

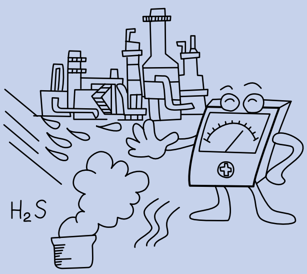
<table>
<tr><th>Application</th><th>Specification</th></tr>
<tr><td>Mounting attitude

</td><td>The standard attitude for mounting indicators is vertical.
Please specify the mounting angle if a non-standard mounting attitude is required.




Example of mounting angle designation ANGL (Horizontal)


Example of mounting angle designation ANGL (30°)


Example of mounting angle designation ANGL (150°)</td></tr>
<tr><td>High humidity
</td><td>Moisture-proof treatment
●Use of indicators in high-humidity environments may cause mold to grow or the insulation resistance to deteriorate. To prevent this, a special moisture-proof coating and anti-corrosion plating are used.
●Applicable models: Y-2N Series, Y-N Series, L-N Series, F-N Series
●A “moisture-proof” sticker is attached to products that have been treated.
●This treatment cannot be applied to some models. Please contact a Mitsubishi Electric representative for details.
Moisture-proof treatment</td></tr>
<tr><td>Corrosive gases

</td><td>Supplementary anti-corrosion treatment
●This treatment is a simplified anti-corrosion treatment for environments where the level of corrosive gases is low. (In environments where there is a high level of corrosive gases such as at sewerage-/water-treatment, rubber or chemical plants, indicators are generally protected with anti-corrosion casings.)
The treatment involves use of a sealed structure and anti-corrosion plating.
●Applicable models: Y-2N Series, Y-N Series, and L-N Series
●A supplementary anti-corrosion sticker is attached to products that have been treated.
●This treatment cannot be applied to some models. Please contact a Mitsubishi Electric representative for details.
Supplementary anti-corrosion treatment</td></tr>
<tr><td>High-frequency circuits
</td><td>●Use the following models for high-frequency circuits with which the commercial frequency of 50 to 60Hz is exceeded.
<table>
<tr><th>Indicator</th><th>Applicable models</th><th>Applicable range (max.)</th></tr>
<tr><td>AC ammeter, AC voltmeter</td><td>Rectifying</td><td>Approx. 1000Hz</td></tr>
<tr><td>Wattmeter, varmeter, power factor meter</td><td>Transducer</td><td>400Hz</td></tr>
<tr><td>Frequency meter</td><td>Transducer</td><td>400Hz (scale: 360~440Hz)</td></tr>
</table>
Please specify the frequency when ordering.</td></tr>
<tr><td>Products complying with foreign standards</td><td>●Products that comply with foreign standards such as ANSI and BS can also be manufactured.
When ordering, please specify the relevant standards and frequency.
●Models with JIS indications comply with IEC standards (no changes necessary).
Please note that the products in this catalog do not have the CE mark.</td></tr>
<tr><td>Special characters and symbols</td><td>●Please clearly specify the language and font settings required (for example, Japanese or English characters; uppercase or lowercase characters).
Orders without language/font settings specified will be manufactured according to Mitsubishi Electric’s standard specifications (lowercase English characters, Helvetica regular font).</td></tr>
<tr><td>Special scale models</td><td>●Special scale models can be manufactured (please submit detailed diagrams).
●In cases where the indicator input and the scale values are not proportional, please submit an input-scale conversion table.</td></tr>
</table>

Selection

Please refer to the following when selecting an electric indicator.

Item	Selection procedure				Page
	Measurement element		Indicator type	Series	
Mechanical indicators	DC electrical quantity measurement	DC ammeters, DC voltmeters	Rectangular indicators	Y-2N Series, Y-N Series	43~48
			Wide-angle indicators	L-N Series	
			Meter relays	YM-210MRN Series	79~80
				LM-11MRN Series	
			With maximum/minimum needles	LM-11ZN Series LM-11YN Series	89~90
			Bar-shaped indicators	F-N Series	97
	AC electrical quantity measurement	AC ammeters, AC voltmeters	Rectangular indicators	Y-2N Series, Y-N Series	49~52
			Wide-angle indicators	L-N Series	
			With changeover switch	YR-UN Series	69~70
			Demand meters	LB-N Series	72
			Demand meter relays		75
			Meter relays	YR-210MRN Series	81~82
				LR-11MRN Series	
			With maximum/minimum needles	LM-11ZN Series LM-11YN Series	89~90
			Bar-shaped indicators	F-N Series	98
		Wattmeters	Rectangular indicators	Y-2N Series, Y-N Series	53~56
			Wide-angle indicators	L-N Series	
			Demand meters	LB-N Series	73~74
			Meter relays	YM-210MRN Series	83~84
				LM-11MRN Series	
		Varmeters	Rectangular indicators	Y-2N Series, Y-N Series	57~60
			Wide-angle indicators	L-N Series	
			Meter relays	YM-210MRN Series	83~84
				LM-11MRN Series	
		Power factor meters	Rectangular indicators	Y-2N Series, Y-N Series	61~65
			Wide-angle indicators	L-N Series	
			Meter relays	YM-210MRN Series	85
				LM-11MRN Series	
		Frequency meters	Rectangular indicators	Y-2N Series, Y-N Series	66
			Wide-angle indicators	L-N Series	
			Meter relays	YM-210MRN Series	86
				LM-11MRN Series	
	Telemetry measurement Receiving indication	Receiving indicators	Rectangular indicators	Y-2N Series, Y-N Series	67~68
			Wide-angle indicators	L-N Series	
			Demand meters	LB-N Series	73~74
			Meter relays	YM-210MRN Series	87
				LM-11MRN Series	
			With maximum/minimum needles	LM-11ZN Series LM-11YN Series	89~90
			Dual-element indicators	LM-11NE	95
			Bar-shaped indicators	F-N Series	97
	Ground voltage measurement	Ground voltmeters	With maximum/minimum needles	LM-11ZN Series LM-11YN Series	89~90, 92
		Earth-leakage detectors	(Special application indicators)	LM-11NGD	91~92
	Synchroscopy	Synchroscope	(Special application indicators)	LI-11NSY	93~94

Item	Indicator type		Selection item	Page
	Selection procedure			
Front face outer dimensions	Rectangular indicators	Y-2N Series	64×60 (Y□-206N□□) , 85×75 (Y□-208N□□) 100×85 (Y□-210N□□) Note 1	35
		Y-N Series	82×82 (Y□-8N□□) , 102×102 (Yh-10N□□) 122×122 (Y□-12N□□) Note 1	36
	Wide-angle indicators	L-N Series	80×80 (L□-80N□□) , 110×110 (L□-110N□□) Note 1	37
	Indicators with changeover switch	YR-UN Series	82×109 (YR-8UN□□) , 102×119 (YR-10UN□□) 122×139 (YR-12UN□□) Note 1	69~70
	Demand meters Demand meter relays	LB-N Series	80×80 (LB-8ZN□□) , 110×110 (LB-11□N□□) Note 1	72~75
	Meter relays	Y-210MRN Series	100×83 (Y□-210MR□N□□) Note 1	78
		L-11MRN Series	110×110 (L□-11MR□N□□) Note 1	
	Bar-shaped indicators	F-N Series	100×30 (F□-210✻N) , 130×36 (F□-213✻N) Note 1 150×40 (F□-215✻N) , 170×40 (F□-217✻N) Note 2	99~100
Scale	DC ammeters, DC voltmeters AC ammeters, AC voltmeters Wattmeters, varmeters Receiving indicators	In common	A selection should be made so that the maximum scale value is approximately 1.2 to 1.5 times the rated value or the steady-state value of the circuit to be measured. For the maximum scale, any of the following values are recommended (or any of these values multiplied by 10 resulting in a whole number). 1, 1.2, 1.5, 2, 2.5, 3, 4, 5, 6, 7.5, 8 (4.5 and 9 are also recommended in the case of voltmeters)	
		DC ammeters	Select a value that is 1.5 times or more than the load current. When combining with a shunt, in general, make a selection that matches the rated value of the shunt.	
		DC voltmeters	Select a value 1.2 to 1.5 times the circuit voltage.	
		AC ammeters	The selection should have a maximum scale value approx. 1.5 times the load current. When combining with a current transformer (CT), make a selection that matches the rated value of the CT.	
		AC voltmeters	Select a value 1.2 to 1.5 times the circuit voltage. When combining with a voltage transformer (VT), select a value approx. 1.36 times the rated value of the VT.	
		Wattmeters, varmeters	Select according to the calculation result of: VT ratio × CT ratio × indicator rating (Po). Refer to the “Scale Selection Reference Table” (wattmeter: p.56; varmeter: p.60).	
		Receiving indicators	Select so as to match the rated value of the device that the indicator is combined with (e.g., transducer, sensor).	
	Power factor meters		The standard scale is LEAD 0.5–1–LAG 0.5. A LEAD 0–1–LAG 0 scale can also be manufactured (values between 0 and 0.5 are for reference only).	
	Frequency meters		Select according to the frequency of the circuit to be measured. In general, for 50Hz, select a 45–55Hz scale; for 60Hz, select a 55–65Hz scale and for 50/60Hz common use, select a 45–65Hz scale.	
	Ground voltmeters		Select so that the maximum scale value is the measured circuit’s voltage or 1.35 times this value.	
Indicator ratings	DC ammeters, DC voltmeters		The indicator rating is the input value corresponding to the maximum scale value.	43~48, 79~80, 97
	AC ammeters, AC voltmeters			49~52, 81~82, 98
	Wattmeters		The secondary side rated voltage of a VT is selected as the rated voltage and the secondary side rated current of a CT is selected as the rated current. Additionally, the rated power (or rated reactive power) Po is selected to be within a range of 0.8 to 1.2 times the secondary side rated power of the transformer (VT, CT).	53~56, 83~84
	Varmeters			57~60, 83~84
	Power factor meters		Generally, the secondary side rated voltage of a VT is selected as the rated voltage and the secondary side rated current of a CT is selected as the rated current.	61~65, 85
	Frequency meters		Generally, the secondary side rated voltage of a VT is selected as the indicator rating.	66, 86
	Receiving indicators		The indicator rating is the input value corresponding to the maximum scale value.	67~68, 87, 97
	Indicators with changeover switch			69~70
	Earth-leakage detectors			91~92
	Synchroscopes		Generally, the secondary side rated voltage of a VT is selected as the indicator rating.	93~94
Cover	Without setting needle		Black (B) needles are standard specification. Transparent (T) and special color (F) needles can also be manufactured. (Transparent cover (G) needles can only be manufactured for the Y-N and Y-2N Series.)	28
	With setting needle		Black (BR), transparent (GR), and special color (FR) needles are available. (Please note that not all options are available for all models.)	
Special specifications	Refer to the “Special Specifications” section on page 10 for information regarding specifications for environments where there are special conditions such as high temperature/humidity (moisture-proof treatment), corrosive gases (supplementary anti-corrosion treatment) or high-frequency circuits.			10

Note 1. The empty squares (□) are replaced with letters/numbers to specify the model and specifications.
Note 2. The asterisks (*) are replaced with S or D to identify whether the indicator has one (S) or two (D) needles.

Products List

1. Rectangular Indicators (Y-2N Series, Y-N Series)

Indicator type	DC ammeters		DC voltmeters		AC ammeters				AC voltmeters			
					Non-uniform scale		Uniform scale		Non-uniform scale		Uniform scale	
Appearance												
Accuracy (class)	2.5	1.5	2.5	1.5	2.5	1.5	2.5	1.5	2.5	1.5	2.5	1.5
Model name / Y-2N Series / Size (mm) 64×60	YM-206NDA	—	YM-206NDV	—	YS-206NAA	—	YR-206NAA	—	YS-206NAV	—	YR-206NAV	—
Model name / Y-2N Series / Size (mm) 85×75	YM-208NDA	—	YM-208NDV	—	YS-208NAA	—	YR-208NAA	—	YS-208NAV	—	YR-208NAV	—
Model name / Y-2N Series / Size (mm) 100×85	YM-210NDA	—	YM-210NDV	—	YS-210NAA	—	YR-210NAA	—	YS-210NAV	—	YR-210NAV	—
Model name / Y-N Series / Size (mm) 82×82	YM-8NDA	—	YM-8NDV	—	YS-8NAA	—	YR-8NAA	—	YS-8NAV	—	YR-8NAV	—
Model name / Y-N Series / Size (mm) 102×102	YM-10NDA	—	YM-10NDV	—	YS-10NAA	—	YR-10NAA	—	YS-10NAV	—	YR-10NAV	—
Model name / Y-N Series / Size (mm) 122×122	—	YM-12NDA	—	YM-12NDV	—	YS-12NAA	—	YR-12NAA	—	YS-12NAV	—	YR-12NAV
Operation principle	Movable coil		Movable coil		Movable iron core		Rectifier		Movable iron core		Rectifier	
Indicator ratings / Direct	Note 1 100, 200, 300, 500μA 1, 3, 5, 10, 20, 50mA 100, 200, 500mA 1, 2, 5, 7.5, 10, 15, 20, 30A		Note 2 1, 3, 5, 10, 15V 30, 50, 100, 150V 300, (500), (600)V		Note 1 500mA 1, 3, 5, 10A 15, 20, 30A		Note 1, 2 (200), (300), 500μA 1, 3, 5, 10, 20, 30, 50mA 75, 100, 200, 500mA 1, 3, 5, 10, 15, 20, 30A		Note 2 50, 150, 300V (600)V		Note 2 5, 10, 30, 50, 75V 100, 110, 150, 190V 260, 300, (400)V (500), (600)V	
Indicator ratings / Combined with shunt, multiplier, or transformer	1~7500A (combined with shunt)		750~2000V (combined with multiplier)		5A, 1A (combined with current transformer)		5A, 1A (combined with current transformer)		150V (combined with instrument voltage transformer)		150V (combined with instrument voltage transformer)	
Scale / Ordinary	◎		◎		◎		◎		◎		◎	
Scale / Expanded	—		—		◎		◎ Note 3		—		—	
Cover / Black (B)	◎		◎		◎		◎		◎		◎	
Cover / Transparent (G)	○		○		○		○		○		○	
Cover / Special color coating (F)	△		△		△		△		△		△	
Special specifications / Red needle	○		○		○		○		○		○	
Special specifications / Special accuracy class Note 4	○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)
Special specifications / Foreign standards	△		△		△		△		△		△	
Special specifications / Special environment	△		△		△		△		△		△	
Special specifications / Double scale	○		○		○		○		○		○	
Special specifications / Colored lines/bands	○		○		○		○		○		○	
Special specifications / Shunt	○		—		—		—		—		—	
Special specifications / Lead wires	○		—		—		—		—		—	
Special specifications / Lead wire adjustment resistor	○		—		—		—		—		—	
Page with specifications table	43		47		49		50		51		52	

Remarks All indicators, excluding special grade and foreign standard specification indicators, comply with the Japanese Industrial Standards relating to direct-acting electrical indicators and have the JIS mark.
However, the JIS mark may not apply depending on the operating circuit voltage or rated voltage. Refer to the Reference Chart for Test Voltages and JIS Mark on p.25/26 for details.

Note 1. The operating circuit voltage is 300V or less for the Y-2N Series and 600V or less for the Y-N Series.
Note 2. Parentheses ( ) indicate that some models cannot be manufactured with this rating. Refer to the specifications tables starting on p.45 for details.
Note 3. Some models cannot be manufactured for some ratings. Refer to the specifications tables starting on p.45 for details.
Note 4. Please designate the frequency if a special accuracy class is required for an AC indicator.

◎	Standard specifications
○	Quasi-standard specifications
△	Special specifications

Indicator type			Wattmeters		Varmeters		Power factor meters		Frequency meters		Receiving indicators			
							Balanced circuit	Unbalanced loads						
Appearance														
Accuracy (class)			2.5	1.5	2.5	1.5	5		1	0.5	2.5	1.5	2.5	1.5
Model name	Y-2N Series	Size (mm) 64×60	YP-206NW	—	YP-206NVAR	—	YP-206NPF	YP-206NPFU	YP-206NF	—	YM-206NRI	—	YR-206NRI	—
		85×75	YP-208NW	—	YP-208NVAR	—	YP-208NPF	YP-208NPFU	YP-208NF	—	YM-208NRI	—	YR-208NRI	—
		100×85	YP-210NW	—	YP-210NVAR	—	YP-210NPF	YP-210NPFU	YP-210NF	—	YM-210NRI	—	YR-210NRI	—
	Y-N Series	82×82	YP-8NW	—	YP-8NVAR	—	YP-8NPF	YP-8NPFU	YP-8NF	—	YM-8NRI	—	YR-8NRI	—
		102×102	YP-10NW	—	YP-10NVAR	—	YP-10NPF	YP-10NPFU	YP-10NF	—	YM-10NRI	—	YR-10NRI	—
		122×122	—	YP-12NW	—	YP-12NVAR	YP-12NPF	YP-12NPFU	—	YP-12NF	—	YM-12NRI	—	YR-12NRI
Operation principle			Transducer		Transducer		Transducer		Transducer		Movable coil		Rectifier	
Indicator ratings	1-phase 2-wire	110V 5A	0.4~0.6kW		—		Note 5 LEAD LAG 0.5~1~0.5	—	45~55Hz 55~65Hz 45~65Hz		100, 200, 300μA 500μA 1, 5, 10, 20mA 1, 3, 5, 10, 15V 30, 50, 100V Zero-suppressed indicator 1-5, 2-10mA 4-20, 10-50mA 1-5V		Note 1, 2 (200), 300, 500μA 1, 3, 5, 10, 20mA 30, 50, 75mA 100, 200, 500mA 1, 3, 5, 10, 15, 20A 5, 10, 30, 50, 75V 100, 150, 300V	
		220V 5A	0.8~1.2kW											
	1-phase 3-wire	100/200V 5A	0.8~1.2kW				—							
	3-phase 3-wire	110V 5A	0.8~1.2kW		0.8~1.2kvar		Note 6 LEAD0.5~1~0.5LAG							
		220V 5A	1.6~2.4kW		1.6~2.4kvar									
	3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V 5A	0.8~1.2kW		0.8~1.2kvar		—							
		110/190V 5A	1.4~2.0kW		1.4~2.0kvar									
		220/380V 5A	2.8~4.0kW		—		—							
Cover	Black	(B)	◎		◎		◎		◎		◎		◎	
	Transparent	(G)	○		○		○		○		○		○	
	Special color coating	(F)	△		△		△		△		△		△	
Special specifications	Red needle		○		○		○		○		○		○	
	Special accuracy class Note 4		○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)	—		—		○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)
	Foreign standards		△		△		△		△		△		△	
	Special environment		△		△		△		△		△		△	
	Double scale		○		○		—		○		○		○	
	Colored lines/bands		○		○		○		—		○		○	
Adjustment resistor			—		—		—		—		○		—	
Accessories			T-150 1 unit	—	T-150 1 unit	—	Note 7 T-100 1 unit	Note 8 T-150 1 unit	—		—		—	
Page with specifications table			53		57		61	63	66		67		68	

Note 5. 1-phase, 2-wire power factor meters can only be manufactured for YP-12NPF.
Note 6. 3-phase, 4-wire power factor meters can only be manufactured for YP-206NPFU, YP-208NPFU, YP-210NPFU, YP-8NPFU, YP-10NPFU and YP-12NPFU.
Note 7. T-100 is provided as an accessory with YP-206NPF, YP-208NPF, and YP-210NPF.
Note 8. T-150 is not provided as an accessory with YP-12NPFU.

■Model Naming System

Y S – 206N AA

Y: Y-N Series
Y-2N Series
(Rectangular indicator)

Operation principle

Code	Operation principle
M	Movable coil
S	Movable iron core
R	Rectifier
P	Transducer

Size (width×height)

Code	Size (mm)	Code	Size (mm)
206N	64×60	8N	82×82
208N	85×75	10N	102×102
210N	100×85	12N	122×122

Indicator type

Code	Indicator type	Code	Indicator type
DA	DC ammeter	VAR	Varmeter
DV	DC voltmeter	PF	Power factor meter (balanced circuit)
AA	AC ammeter	PFU	Power factor meter (unbalanced load)
AV	AC voltmeter	F	Frequency meter
W	Wattmeter	RI	Receiving indicator

Products List

2. Wide-angle Indicators (L-N Series)

Indicator type	DC ammeters		DC voltmeters		AC ammeters				AC voltmeters			
					Non-uniform scale		Uniform scale		Non-uniform scale		Uniform scale	
Appearance												
Accuracy (class)	2.5	1.5	2.5	1.5	2.5	1.5	2.5	1.5	2.5	1.5	2.5	1.5
Model name, Size (mm) 80×80	LM-80NDA	—	LM-80NDV	—	LS-80NAA	—	LR-80NAA	—	LS-80NAV	—	LR-80NAV	—
Model name, Size (mm) 110×110	—	LM-110NDA	—	LM-110NDV	—	LS-110NAA	—	LR-110NAA	—	LS-110NAV	—	LR-110NAV
Operation principle	Movable coil		Movable coil		Movable iron core		Rectifier		Movable iron core		Rectifier	
Indicator ratings: Direct	Note 1 300, 500μA 1, 3, 5, 10, 20, 50, 100mA 200, 500mA 1, 2, 5, 7.5, 10, 15, 20, 30A		1, 3, 5, 10, 30V 50, 100, 150, 300V 500, 600V		Note 1 1, 3, 5, 10A 15, 20, 30A		Note 1 1, 3, 5, 10, 20, 30, 50mA 75, 100, 200, 500mA 1, 3, 5, 10, 15, 20, 30A		Note 3 150, 300V 600V		5, 10, 30, 50, 75, 100V 110, 150, 190, 260V 300, 400, 500, 600V	
Indicator ratings: Combined with shunt, multiplier, or transformer	1~7500A (combined with shunt)		750~2000V (combined with multiplier)		5A, 1A (combined with current transformer)		5A, 1A (combined with current transformer)		150V (combined with instrument voltage transformer)		150V (combined with instrument voltage transformer)	
Scale: Ordinary	◎		◎		◎		◎		◎		◎	
Scale: Expanded	—		—		◎		◎ Note 2		—		—	
Cover: Black (B)	◎		◎		◎		◎		◎		◎	
Cover: Special color coating (F)	△		△		△		△		△		△	
Special specifications: Red needle	○		○		○		○		○		○	
Special specifications: Special accuracy class Note 4	○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)
Special specifications: Foreign standards	△		△		△		△		△		△	
Special specifications: Special environment	△		△		△		△		△		△	
Special specifications: Double scale	○		○		○		○		○		○	
Special specifications: Colored lines/bands	○		○		○		○		○		○	
Special specifications: Shunt	○		—		—		—		—		—	
Special specifications: Lead wires	○		—		—		—		—		—	
Special specifications: Lead wire adjustment resistor	○		—		—		—		—		—	
Page with specifications table	43		47		49		50		51		52	

Remarks All indicators, excluding special grade and foreign standard specification indicators, comply with the Japanese Industrial Standards relating to direct-acting electrical indicators and have a JIS mark.
However, the JIS mark may not apply depending on the operating circuit voltage or rated voltage. Refer to the Reference Chart for Test Voltages and JIS Mark on p.25/26 for details.

Note 1. The operating circuit voltage is 600V or less.
Note 2. Some models cannot be manufactured for some ratings. Refer to the specifications tables starting on p.45 for details.
Note 3. Models with an indicator rating of 600V are provided with the KR-1 accessory.
Note 4. Please specify the frequency if a special accuracy class is required for an AC indicator.

■Model Naming System

L S – 110N AA

L: L-N Series (Wide-angle indicator)

Operation principle

Code	Operation principle
M	Movable coil
S	Movable iron core
R	Rectifier
P	Transducer

Size (width×height)

Code	Size (mm)
80N	80×80
110N	110×110

Indicator type

Code	Indicator type	Code	Indicator type
DA	DC ammeter	VAR	Varmeter
DV	DC voltmeter	PF	Power factor meter (balanced circuit)
AA	AC ammeter	PFU	Power factor meter (unbalanced loads)
AV	AC voltmeter	F	Frequency meter
W	Wattmeter	RI	Receiving indicator

◎	Standard specifications
○	Quasi-standard specifications
△	Special specifications

Indicator type			Wattmeters		Varmeters		Power factor meters		Frequency meters	Receiving indicators			
							Balanced circuit	Unbalanced loads					
Appearance													
Accuracy (class)			2.5	1.5	2.5	1.5	5		0.5	2.5	1.5	2.5	1.5
Model name	Size (mm)	80×80	LP-80NW	—	LP-80NVAR	—	LP-80NPF	LP-80NPFU	LP-80NF	LM-80NRI	—	LR-80NRI	—
		110×110	—	LP-110NW	—	LP-110NVAR	LP-110NPF	LP-110NPFU	LP-110NF	—	LM-110NRI	—	LR-110NRI
Operation principle			Transducer		Transducer		Transducer		Transducer	Movable coil		Rectifier	
Indicator ratings	1-phase 2-wire	110V 5A	0.4~0.6kW		—		Note 5 LEAD LAG 0.5~1~0.5	—		300, 500μA 1, 5, 10, 20mA 1, 3, 5, 10, 15V 30, 50, 100V Zero-suppressed indicator 1-5, 2-10mA 4-20, 10-50mA 1-5V		Note 1, 2 500μA 1, 3, 5, 10, 20mA 30, 50, 75mA 100, 200, 500mA 1, 3, 5, 10, 15, 20A 5, 10, 30, 50, 75V 100, 150, 300V	
		220V 5A	0.8~1.2kW										
	1-phase 3-wire	100/200V 5A	0.8~1.2kW				—						
	3-phase 3-wire	110V 5A	0.8~1.2kW		0.8~1.2kvar		Note 6 LEAD0.5~1~0.5LAG		45~55Hz				
		220V 5A	1.6~2.4kW		1.6~2.4kvar				55~65Hz				
	3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V 5A	0.8~1.2kW		0.8~1.2kvar		—		45~65Hz				
		110/190V 5A	1.4~2.0kW		1.4~2.0kvar								
		220/380V 5A	2.8~4.0kW		—		—						
Cover	Black (B)		◎		◎		◎		◎	◎		◎	
	Special color coating (F)		△		△		△		△	△		△	
Special specifications	Red needle		○		○		○		○	○		○	
	Special accuracy class Note 4		○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)	—		—	○(Class 1.5)	○(Class 1)	○(Class 1.5)	○(Class 1)
	Foreign standards		△		△		△		△	△		△	
	Special environment		△		△		△		△	△		△	
	Double scale		○		○		—		—	○		○	
	Colored lines/bands		○		○		○		○	○		○	
	Adjustment resistor		—		—		—		—	○		○	
Accessories			T-150 1 unit	—	T-150 1 unit	—	—	Note 7 T-150 1 unit	—	—		—	
Page with specifications table			53		57		61	63	66	67		68	

Note 5. 1-phase, 2-wire power factor meters can only be manufactured for LP-110NPF.
Note 6. 3-phase, 4-wire power factor meters can only be manufactured for LP-80NPFU and LP-110NPFU.
Note 7. T-150 is not provided as an accessory with LP-110NPFU.

Products List

3. Indicators with Changeover Switch (YR-UN Series)

Indicator type			AC ammeters		AC voltmeters	
Appearance						
Accuracy (class)			2.5	1.5	2.5	1.5
Model name	Size (mm)	82×99	YR-8UNAA	—	YR-8UNAV	—
		102×119	YR-10UNAA	—	YR-10UNAV	—
		122×139	—	YR-12UNAA	—	YR-12UNAV
Operation principle			Rectifier Note 1		Rectifier	
Indicator ratings	Direct		1, 5, 10, 15, 20, 30A Note 2		150, 300, 600V	
	Combined with transformer		5A, 1A (combined with current transformer)		150V (combined with instrument voltage transformer)	
Scale	Ordinary		◎		◎	
	Expanded		◎		—	
Cover	Black (B)		◎		◎	
	Transparent (G)		○		○	
	Special color coating (F)		△		△	
Terminal configuration	Direct indicator		4 terminals		3 terminals	
	Indicator combined with transformer		3 terminals Note 3 (operation principle: movable iron core)	3 terminals Note 3	3 terminals	
Special specifications	Red needle		○		○	
	Special accuracy class		—		—	
	Foreign standards		—		—	
	Special environment		—		—	
	Double scale		○		○	
	Colored lines/bands		○		○	
Page with specifications table			69		70	

Remarks All indicators, excluding special grade and foreign standard specification indicators, comply with the Japanese Industrial Standards relating to direct-acting electrical indicators and have a JIS mark.

Note 1. The 3-terminal, CT-combined models of YR-8UNAA and YR-10UNAA operate on the principles of the movable iron core.

Note 2. The operating circuit voltage is 600V or less.

Note 3. A 4-terminal AC ammeter to be combined with a transformer can be manufactured if required.

■Model Naming System

Y R – 10 UN AA

YR-UN Series
(With changeover switch)

Operation principle

Code	Operation principle
R	Rectifier (Movable iron core)

Size (width × height)

Code	Size (mm)
8	82×99
10	102×119
12	122×139

Structure

Code	Structure
UN	Changeover switch

Indicator type

Code	Indicator type
AA	AC ammeter
AV	AC voltmeter

◎	Standard specifications
○	Quasi-standard specifications
△	Special specifications

4. Mechanical Demand Meters and Demand Meter Relays (LB-N Series)

Indicator type		Demand meters						Demand meter relays
		AC ammeters		AC voltmeters		Wattmeters	Receiving indicators	AC ammeters
Appearance								
Accuracy class (driving needle)		2.5	1.5	2.5	1.5	1.5	1.5	1.5
Model name	Needle \ Size	80×80	110×110	80×80	110×110	110×110	110×110	110×110
	With needle showing max. value remaining	LB-8ZNAA	LB-11ZNAA	LB-8ZNAV	LB-11ZNAV	LB-11ZNW	LB-11ZNRI	—
	With needle showing min./max values remaining	—	—	—	—	LB-11YNW	LB-11YNRI	—
	With instantaneous meter: With needle showing max. value remaining	—	LB-11ZRNAA	—	—	LB-11ZRNW	LB-11ZRNRI	LB-11ZRMNAA
	With instantaneous meter: With needle showing min./max values remaining	—	—	—	LB-11YRNAV	LB-11YRNW	LB-11YRNRI	—
Operation principle		Bimetal (instantaneous rectifying meter)				Bimetal (instantaneous meter is movable coil)		Bimetal (instantaneous rectifying meter)
Indicator ratings	Note 1	5A (combined with current transformer)		150V (combined with instrument voltage transformer)		1-phase 2-wire: 110V 5A 0.4~0.6kW; 220V 5A 0.8~1.2kW 3-phase 3-wire: 110V 5A 0.8~1.2kW; 220V 5A 1.6~2.4kW 3-phase 4-wire: $\frac{110}{\sqrt{3}}$/110V 5A 0.8~1.2kW	DC 1mA (internal resistance: 1kΩ)	5A (combined with current transformer)
Time interval (minutes)		2, 15	2, 5, 10, 15	2		2, 15	2, 15	10, 15
Cover	Black (B)	◎		◎		◎	◎	◎
	Special color coating (F)	△		△		△	△	△
Contact configuration		—						No-voltage 1C contact
Auxiliary power supply		—				100VAC $^{+10}_{-15}$ % 50-60Hz		both 100-110VAC/DC
Remaining needle resetting		Both manual and electromagnetic resetting (electromagnetic resetting voltage: both 100-110VAC/DC)						
Colored lines/bands		○		○		○	○	○
Accessories		—		—		T-150, T-150LB 1 unit each	T-150LB 1 unit	—
Page with specifications table		72		72		73	73	75

Remarks All indicators, excluding special grade and foreign standard specification indicators comply with the Japanese Industrial Standards relating to direct-acting electrical indicators and have a JIS mark (excluding LB-8ZNAA, LB-8ZNAV and LB-11ZRMNAA).

Note 1. Use an AC indicator in combination with an instrument current transformer and an instrument voltage transformer.

■Model Naming System

L B – 11 ZRN AA

LB: Demand meter
Demand meter relay
(Wide-angle indicator)

Operation principle

Code	Operation principle
B	Bimetal

Size (width×height)

Code	Size (mm)
8	80×80
10	110×110

Needle

Code	Pointer
ZN	With needle showing max. value remaining
YN	With needle showing min./max values remaining
ZRN	With needle showing max. value remaining/ Combined with instantaneous meter
YRN	With needle showing min./max values remaining/Combined with instantaneous meter
ZRMN	With needle showing max. value remaining/ Combined with instantaneous meter/ With needle showing warning settings

Indicator type

Code	Indicator type
AA	AC ammeter
AV	AC voltmeter
W	Wattmeter
RI	Receiving indicator

Products List

5. Meter Relays

Indicator type		DC ammeters		DC voltmeters		AC ammeters		AC voltmeters	
Appearance									
Accuracy class		2.5	1.5	2.5	1.5	2.5	1.5	2.5	1.5
Model name	Setting needle / Size	100X83	110X110	100X83	110X110	100X83	110X110	100X83	110X110
Model name	Upper/Lower-limit settings	YM-210MRNDA	LM-11MRNDA	YM-210MRNDV	LM-11MRNDV	YR-210MRNAA	LR-11MRNAA	YR-210MRNAV	LR-11MRNAV
Model name	Upper-limit setting	YM-210MRHNDA	LM-11MRHNDA	YM-210MRHNDV	LM-11MRHNDV	YR-210MRHNAA	LR-11MRHNAA	YR-210MRHNAV	LR-11MRHNAV
Operation principle		Movable coil		Movable coil		Rectifier		Rectifier	
Indicator ratings	Direct	±0.5mA, 1, 10mA, 1, 3, 5A Zero-suppressed indicator 4-20mA		1, 50, 100, 150V 300, 500V		100, 200, 500mA 1, 5, 10A		10, 30, 50, 75V 100, 150, 300V	
Indicator ratings	Combined with shunt or transformer	1~7500A (combined with shunt)		—		5A, 1A (combined with current transformer)		150V (combined with instrument voltage transformer)	
Scale	Ordinary	◎		◎		◎		◎	
Scale	Expanded	—		—		△		—	
Cover	Black (B)	◎		◎		◎		◎	
Cover	Special color coating (F)	△		△		△		△	
Relay setting range	Upper limit	5~100%	10~100%	5~100%	10~100%	5~100%	10~100%	5~100%	10~100%
Relay setting range	Lower limit	0~95%	0~90%	0~95%	0~90%	0~95%	0~90%	0~95%	0~90%
Contact configuration		1C contact each for upper limit and lower limit or 1C contact for upper limit (contact capacity 250VAC, 3A)							
Auxiliary power supply		100-110VAC/200-220VAC selectable							
Special specifications	Red needle	—		—		—		—	
Special specifications	Foreign standards	—		—		—		—	
Special specifications	Special environment	—		—		—		—	
Special specifications	Double scale	○		○		○		○	
Special specifications	Colored lines/colored bands	○		○		○		○	
Special specifications	Shunt	○		—		—		—	
Special specifications	Lead wires	○		—		—		—	
Page with specifications table		79		80		81		82	

Remarks These models do not have a JIS mark.

■Model Naming System

L R — 11 MRN AA

Y: Rectangular indicator
L: Wide-angle indicator

Operation principle

Code	Operation principle
R	Rectifier
M	Movable coil or transducer

Size (width X height)

Code	Size (mm)
210	100X83
11	110X110

Relay setting

Code	Relay setting
MRN	Upper-limit and Lower-limit settings
MRHN	Upper-limit setting

Indicator type

Code	Indicator type
DA	DC ammeter
DV	DC voltmeter
AA	AC ammeter
AV	AC voltmeter
W	Wattmeter
VAR	Varmeter
PF	Power factor meter (balanced circuit)
PFU	Power factor meter (unbalanced loads)
F	Frequency meter
RI	Receiving indicator

◎	Standard specifications
○	Quasi-standard specifications
△	Special specifications

Indicator type		Wattmeters		Varmeters		Power factor meters		Frequency meters		Receiving indicators	
Appearance											
Accuracy class		2.5	1.5	2.5	1.5	5		1		2.5	1.5
Model name	Setting needle / Size	100×83	110×110	100×83	110×110	100×83	110×110	100×83	110×110	100×83	110×110
Model name	Upper/Lower-limit settings	YM-210MRNW	LM-11MRNW	YM-210MRNVAR	LM-11MRNVAR	YM-210MRNPFU	LM-11MRNPFU	YM-210MRNF	LM-11MRNF	YM-210MRNRI	LM-11MRNRI
Model name	Upper-limit setting	YM-210MRHNW	LM-11MRHNW	YM-210MRHNVAR	LM-11MRHNVAR	YM-210MRHNPFU	LM-11MRHNPFU	YM-210MRHNF	LM-11MRHNF	YM-210MRHNRI	LM-11MRHNRI
Operation principle		Transducer		Transducer		Transducer		Transducer		Movable coil	
Indicator ratings	1-phase 2-wire 110V 5A	0.4~0.6kW		—		—		45~55Hz 55~65Hz 45~65Hz		±0.5mA 1, 10mA Zero-suppressed indicator 4-20mA	
Indicator ratings	1-phase 2-wire 220V 5A	0.8~1.2kW									
Indicator ratings	3-phase 3-wire 110V 5A	0.8~1.2kW		0.8~1.2kvar		Note 1 LEAD0.5~1~0.5LAG					
Indicator ratings	3-phase 3-wire 220V 5A	1.6~2.4kW		1.6~2.4kvar							
Indicator ratings	3-phase 4-wire $\frac{110}{\sqrt{3}}$/110V 5A	0.8~1.2kW		0.8~1.2kvar							
Cover	Black (B)	◎		◎		◎		◎		◎	
Cover	Special color coating (F)	△		△		△		△		△	
Relay setting range	Upper limit	5~100%	10~100%	5~100%	10~100%	5~100%	10~100%	5~100%	10~100%	5~100%	10~100%
Relay setting range	Lower limit	0~95%	0~90%	0~95%	0~90%	0~95%	0~90%	0~95%	0~90%	0~95%	0~90%
Contact configuration		1C contact each for upper limit and lower limit or 1C contact for upper limit (contact capacity 250VAC, 3A)									
Auxiliary power supply		100-110VAC/200-220VAC selectable									
Special specifications	Red needle	—		—		—		—		—	
Special specifications	Foreign standards	—		—		—		—		—	
Special specifications	Special environment	—		—		—		—		—	
Special specifications	Double scale	○		○		—		—		○	
Special specifications	Colored lines/bands	○		○		○		○		○	
Accessories		T-150 1 unit		T-150 1 unit		T-150 1 unit		T-100 1 unit		—	
Page with specifications table		83		83		85		86		87	

Note 1. The YM-210MRNPF, YM-210MRHNPF, LM-11MRNPF, and LM-11MRHNPF models (provided with the T-100 accessory) are for 3-phase, 3-wire balanced circuits.

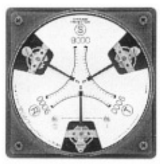
Products List

6. Indicators with Maximum and Minimum Needles

Indicator type		DC ammeters	AC ammeters	AC voltmeters	Receiving indicators
Appearance					
Accuracy class		1.5 (remaining needle: 2)	1.5 (remaining needle: 2)		1.5 (remaining needle: 2)
Size (mm)		110×110	110×110	110×110	110×110
Model name	With max. value remaining needle	LM-11ZNDA	LM-11ZNAA	LM-11ZNAV	LM-11ZNRI
	With max. and min. value remaining needles	LM-11YNDA	LM-11YNAA	LM-11YNAV	LM-11YNRI
Operation principle		Movable coil	Rectifier		Movable coil
Indicator ratings		5, 10, 15, 20mA 1, 3, 5, 10, 15A Note 1	1, 5, 10, 15A 20, 30A	100, 110, 150, 190V 260, 300V	5mA
Response time		0.3 seconds	0.1 seconds	0.1 seconds	0.3 seconds
Cover	Black (B)	◎	◎	◎	◎
	Special color coating (F)	△	△	△	△
Remaining needle resetting		Both manual and electromagnetic resetting (electromagnetic resetting voltage: both 100-110VAC/DC)			
Accessories		—	T-150 1 unit	T-150 1 unit	—
Page with specifications table		89			

Remarks These indicator models do not have the JIS mark.
Note 1. Models with a rating exceeding 15A DC are manufactured as 300mV-shunt-combined units.

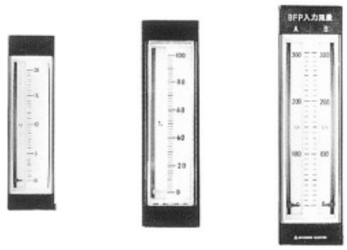
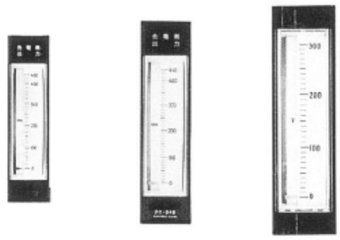
7. Special Application Meters

Indicator type		Earth-leakage detectors	Synchroscopes	Dual-element indicators
Appearance				
Application		Detects earth faults of 3-phase 3-wire circuits	Detects generator-side and bus line-side phases	Measures two elements
Model name	Rectangular indicator	—	—	—
	Wide-angle indicator	LM-11NGD	LI-11NSY	LM-11NE
Accessories		T-150 1 unit	T-150 1 unit	—
Page with specifications table		91	93	95

Remarks The synchroscope and dual-element indicator are compliant with Japanese Industrial Standards relating to direct-acting electrical indicators and therefore have the JIS mark.

◎	Standard specifications
○	Quasi-standard specifications
△	Special specifications

8. Bar-shaped Indicators (F-N Series)

Indicator type		DC indicators				AC indicators			
Appearance									
Accuracy class		1.5 or 2.5	1 or 1.5			2.5	1.5		
Size (mm)		100×30	130×36	150×40	170×42	100×30	130×36	150×40	170×42
Model name	1-needle	FM-210SN	FM-213SN	FM-215SN	FM-217SN	FR-210SN	FR-213SN	FR-215SN	FR-217SN
	2-needle	FM-210DN	FM-213DN	FM-215DN	FM-217DN	—	—	—	—
Operation principle		Movable coil type				Rectifying type			
Indicator ratings	Current input	(100), 500mA Note 1 Note 2 1, 5, 10, 50, 100, 500mA 1, 3, 5, 10A 4-20mA (zero-suppressed indicator)				Note 1 500mA 1, 5, 10, 50, 100, 500mA 1, 3, 5A			
	Voltage input	1, 5, 10, 15, 30, 50, 100, 150, 300V 1-5V (zero-suppressed indicator)				5, 10, 30, 50, 100, 150V			
Cover	Black (B)	◎				◎			
	Special color coating (F)	△				△			
Mounting	Vertical	◎				◎			
	Horizontal	○				○			
Special specifications	Nameplate engraving	△				△			
	Tag number plate engraving	△				△			
	Double scale	○				○			
	Colored lines/bands	○				○			
Page with specifications table		97				98			

Remarks All indicators, excluding special grade and foreign-standard specification indicators, comply with the Japanese Industrial Standards relating to direct-acting electrical indicators and have the JIS mark.

Note 1. The operating circuit voltage is 300V or less.

Note 2. Parentheses around an indicator rating indicate that the rating is only available for certain models. Refer to the specifications for details.

■Model Naming System

F M — 213 DN

F Series (Bar-shaped indicator)

Operation principle

Code	Operation principle
M	Movable coil
R	Rectifier

Size (width × height)

Code	Size (mm)
210	100×30
213	130×36
215	150×40
217	170×42

Pointer

Code	Needle
SN	1-needle
DN	2-needle

Glossary of Terms

Term	Meaning
Electric indicator (direct-acting indicator)	An indicator with a needle driven by a mechanically coupled movable element.
Electronic indicator	An indicator that uses an electronic means to measure and display an electrical quantity or non-electrical quantity.
Fixed indicator (indicator for switchboard)	Indicators that are mounted permanently, connected to an external circuit via fixed conductive wires.
Portable indicator	An indicator that can be transported and used in different places.
Wide-angle indicator	An indicator with a scale spanning a range of 180° or more.
Receiving indicator	Indicators with scales that differ from the quantity of electricity input, but the relationship between the quantity of electricity input and scale values is known.
Zero-suppressed indicator	An indicator with a mechanical zero point outside the range of the scale.
Movable coil indicator	An indicator that operates based on the interaction between magnetic fields produced by a fixed, permanent magnet and by a current inside a movable coil.
Movable iron core indicator	Indicators that have fixed and moving cores made of soft magnetic material and operate based on the repulsive force (and suction) generated as a result of magnetizing the fixed and mobile iron cores by passing an electrical current through the fixed coil.
Rectifier indicator	An indicator combining a DC-operated indicator and a rectifier to measure AC current/voltage.
Transducer indicator	An indicator that converts a quantity of AC electricity to a DC voltage/current using an electronic device or circuit, and then indicates the quantity using a movable coil indicator.
Bimetal indicator	Heat-based indicators that operate by changing the shape of the metal elements, which occurs when they are heated directly/indirectly via an electrical current.
Compatible accessory	An accessory that has special properties/accuracy itself, regardless of whether or not it is combined with the performance of an indicator.
Limited-compatibility accessory	An accessory that has special properties/accuracy itself and can be combined with an indicator that has special performance.
Dedicated accessory (non-compatible accessory)	An accessory that is adjusted considering the electrical characteristics of the indicator it is combined with.

Term	Meaning
Intrinsic error	Error of an indicator in a standard state. Intrinsic error = $\left[\dfrac{\text{target value - reference value}}{\text{base value}}\right] \times 100$ (%)
Standard value	A specified standard-error value used to define the accuracy of an indicator. The value varies according to the type of indicator. · For ammeters, voltmeters, wattmeters and varmeters, the standard value is the upper value of the measurement range. (If there are both mechanical and electrical zero points in the scale [i.e., there is a negative and positive range], the standard value is the sum of the absolute values of the electrical quantity corresponding to the two limits of the measurement range.) (If the scale does not match the quantity of the electricity input, the standard value is the span.) · Frequency meter The upper value of the measurement range. · Power factor meter Electrical angle of 90°.
Span	The algebraic difference between the upper and lower limits of the measurement range.
Overshoot	The difference between the maximum deflection value and the final value when a measured quantity changes suddenly.
Response time	When the measurement value changes suddenly from zero to a specified value, the time (seconds) until the needle stops at its final stationary position.
Residual displacement	The deflection of a mechanically controlled movable element still remaining after the cause of the deflection has been eliminated.
Extent of influence	In general, the potential extent of influence that an external factor has on performance (e.g., ambient temperature, external magnetic field).
Distortion rate (total harmonic distortion rate)	Rate: $\dfrac{\text{Effective value of the harmonics contained}}{\text{Effective value of non-sinusoidal wave}}$
Ripple content	Content: $\dfrac{\text{Effective value of varying component}}{\text{value of DC component}}$
Standby state	Prior to indicator testing, the specified measurement amount supplied to the circuit being measured.

●Abbreviations for items measured

DA : DC current
DV : DC voltage
AA : AC current
AV : AC voltage
W : Power
VAR : Reactive power
PF : Power factor, phase
F : Frequency
SY : Synchroscope

●Standard value

1) DA, DV, AA, AV, W, VAR
The upper limit of the measurement range; the sum of the absolute values of both sides where there is a zero point on the scale [i.e., there are positive and negative ranges]; the span when the scale does not match the quantity of electricity.
2) F
Upper-limit value of the measurement range
3) PF, SY
90° electric angle

●Standby conditions

Prior to testing, the following input is applied to meters that are required to have a standby state.

Measured quantity	Input condition	Time
DA, DV, AA, AV	80% of maximum scale value	15 minutes
W, VAR	Voltage: 100%; power factor (or reactive factor): 1 80% of maximum scale value	
F	Voltage: 100%; maximum scale value	
PF	Voltage: 100%; current: 80%; power factor: 1	
SY	Voltage: 100%; synchronization point	

Standards

Excerpts from Japanese standards

(1) JIS C 1102-1 ~ -9

Influencing item		Test conditions	Performance	Type of measured quantity DA DV	AA AV	W VAR	F	PF	SY
Inherent error		Measure important points under standard conditions	±100% of the accuracy class	○	○	○	○	○	○
Ambient temperature		Temperature varies ±10°C from standard temperature (23°C)	100% of class index	○	○	○	○	○	○
Humidity		Leave for 96hr in states of 25% and 80% relative humidity, respectively	100% of class index	○	○	○	○	○	○
DC measured quantity	Ripple	20% input, and 45–65Hz and 90–130Hz current (AC) superimposed	50% of class index	○					
AC measured quantity	Distortion	AC, DC, W : 20% third harmonic wave content (W: with each measured circuit) PF, F : 15% third harmonic wave content (PF: with each measured circuit)	100% of class index (rectifying type is exempt)		○	○	○	○	○
	Frequency	Vary by ±10% from reference frequency	100% of class index		○	○		○	○
	Voltage component	Vary by ±15% from reference voltage	100% of class index			○	○	○	○
	Current component	Vary by 20 to 120% of rated current	100% of class index					○	
Power factor		Power factor varies from 1 to 0.5 (var: lagging phase angle: 30°)	100% of class index			○			
Phase balance		One current circuit removed	200% of class index			○		○	
Interference between multiple phase indicator elements		One voltage circuit removed	200% of class index			○			
Attitude		Incline of 5°to the front/back/left/right from the standard attitude	50% of class index	○	○	○	○	○	○
External magnetic field		Magnetic field of 0.4kA/m	Movable iron core: 6%; others: 1.5%	○	○	○	○	○	○
Ferromagnetic support		Mounted to a 2mm-thick steel-plate panel	Within limits of inherent error	○	○	○	○	○	○
Conductive support		Mounted to a 1.5mm-thick (or thicker) aluminum panel	Within limits of inherent error	○	○	○	○	○	○
Damping	Overshoot	Input of approx. 2/3 scale length; measure initial overshoot distance	20% or less if the full deflection angle is less than 180°; 25% or less otherwise	○	○	○	○	○	○
	Response time	Input of approx. 2/3 scale length; measure time to settle within 1.5%	4s or less						
Self-heating		Changes at 1 to 3 minutes after and 30 to 35 minutes after applying a 90% input.	100% of class index	○	○	○	○	○	○
Short-time overload	Power supply circuit Voltage circuit	Apply power 10-fold that of the rated power nine times for 0.5s at 60s intervals and one time for 5s. Apply voltage double that of the rated voltage nine times for 0.5s at 60s intervals and one time for 5s.	Within limits of inherent error	○	○	○	○	○	○
Continuous overload	Current circuit Voltage circuit	Apply current 120% that of the rated current for 2h Apply voltage 120% that of the rated voltage for 2h	Within limits of inherent error	○	○	○	○	○	○
Conduction of current circuit after large current overload		Apply current 30-fold that of the CT nominal secondary current for 2s (applies to indicators combined with a CT of 1 to 10A)	Current circuit does not open		○	○			
Temperature limit value		40°C for 16h, -25°C for 8h (repeated three times)	Within limits of inherent error	○	○	○	○	○	○
Deviation from zero point		Measure deviation after applying the maximum value of the measurement range for 30s and zero point setting for 15s.	50% of class index	○	○	○	○	○	○
Mechanical zero-point adjuster		Maximum adjustment value in increasing/decreasing directions	Range: 2% or 2° or more	○	○	○	○	○	○
Synchroscope	Drop-out frequency Pull-in frequency Open circuit	Frequency when rotation stops after increasing and then decreasing the starting circuit frequency. Frequency when rotation starts after increasing and then decreasing the starting circuit frequency. Open starting-circuit or operating-circuit side	For 3-phase: 1.5Hz or more For 1-phase: 1Hz or more Index indicates synchronization point ±30 externally						○
Vibration/Impact	Vibration Impact	10–65–10Hz, amplitude: 15mm Sweeping speed: 1 octave/min., No. of sweeps: 5 490m/s² in X-, Y- and Z-, forward and reverse directions (repeated three times)	100% of class index	○	○	○	○	○	○

(2) JIS C 1010-1 (Measurement Category Ⅲ, Pollution Degree 2)

Test item	Test conditions	Performance/Reference value	Type of measurement DA DV	AA AV	W VAR	F	PF	SY
Voltage test	Between entire measurement circuit and outer casing The test voltage value is defined according to the operating circuit voltage. 50Hz/60Hz effective AC voltage, 5s	Dielectric breakdown and flashover must not occur.	○	○	○	○	○	○
Clearance and creeping distance	Between an external portion that an operator can touch and an internal circuit that is not insulated from the input. The clearance and creeping distance are defined according to the operating circuit voltage.	Metal and resin connected: basic insulation Ungrounded metal: reinforced insulation or double insulation	○	○	○	○	○	○

Representative operating circuit voltages and the clearance and creeping distance required

Operating circuit voltage	Standard insulation			Reinforced insulation or double insulation		
	Clearance	Creeping distance	Test voltage value	Clearance	Creeping distance	Test voltage value
100V	0.5	1.4	840	1.5	2.8	1390
150V	1.5	1.57	1390	3.0	3.14	2210
300V	3.0	3.0	2210	5.9	6.0	3480
600V	5.5	6.0	3320	10.5	12.0	5200

(3) Reference (JIS C 1102-1: 1997 specified standard)

Test item	Test conditions	Performance/reference value	Type of measurement DA DV	AA AV	W VAR	F	PF	SY
Insulation test Note 1	Between entire measurement circuit and outer casing Apply 500VDC and measure	5MΩ or more	○	○	○	○	○	○

Note 1. JIS C 1102-1 is not specified in 2007.

Reference Chart for Test Voltages and

Corresponding test voltages according to indicator type

Indicator type			Model name	Operating circuit voltage or maximum rating	Factory-tested voltage (Note 1)	JIS voltage test (Note 2)	JIS mark indication (Note 3)
DC ammeters			YM-206NDA, YM-208NDA, YM-210NDA	300V or less	2210V, 5s	2000V, 1min	Indicated
				301V~600V	3320V, 5s	2000V, 1min	Not indicated
			YM-8NDA, YM-10NDA, YM-12NDA LM-80NDA, LM-110NDA	600V or less	3320V, 5s	2000V, 1min	Indicated
DC voltmeters			YM-206NDV, YM-208NDV, YM-210NDV	1~300V	2210V, 5s	2000V, 1min	Indicated
				301V~600V	3320V, 5s	2000V, 1min	Not indicated
				601V~1000V	4300V, 5s	3000V, 1min	Not indicated
				1001V~1200V	4950V, 5s	5000V, 1min	Not indicated
				1201V~1500V	5800V, 5s	5000V, 1min	Not indicated
				1501V~2000V	7400V, 5s	5000V, 1min	Not indicated
			YM-8NDV, YM-10NDV, YM-12NDV LM-80NDV, LM-110NDV	1~600V	3320V, 5s	2000V, 1min	Indicated
				601V~1000V	4300V, 5s	3000V, 1min	Not indicated
				1001V~1200V	4950V, 5s	5000V, 1min	Not indicated
				1201V~1500V	5800V, 5s	5000V, 1min	Not indicated
				1501V~2000V	7400V, 5s	5000V, 1min	Not indicated
AC ammeters	Movable iron core		YS-206NAA, YS-208NAA, YS-210NAA	300V or less	2210V, 5s	2000V, 1min	Indicated
				301V~600V	3320V, 5s	2000V, 1min	Not indicated
				Combined with CT	2210V, 5s	2000V, 1min	Indicated
			YS-8NAA, YS-10NAA, YS-12NAA LS-80NAA, LS-110NAA	600V or less	3320V, 5s	2000V, 1min	Indicated
				Combined with CT	2210V, 5s	2000V, 1min	Indicated
	Rectifier		YR-206NAA, YR-208NAA, YR-210NAA	300V or less	2210V, 5s	2000V, 1min	Indicated
				301V~600V	3320V, 5s	2000V, 1min	Not indicated
				Combined with CT	2210V, 5s	2000V, 1min	Indicated
			YR-8NAA, YR-10NAA, YR-12NAA LR-80NAA, LR-110NAA	600V or less	3320V, 5s	2000V, 1min	Indicated
				Combined with CT	2210V, 5s	2000V, 1min	Indicated
AC voltmeters	Movable iron core		YS-206NAV, YS-208NAV, YS-210NAV YS-8NAV, YS-10NAV	50~300V	2210V, 5s	2000V, 1min	Indicated
				Combined with VT	2210V, 5s	2000V, 1min	Indicated
			YS-12NAV	50~600V	3320V, 5s	2000V, 1min	Indicated
				Combined with VT	3320V, 5s	2000V, 1min	Indicated
			LS-80NAV, LS-110NAV	150~600V	3320V, 5s	2000V, 1min	Indicated
				Combined with VT	3320V, 5s	2000V, 1min	Indicated
	Rectifier		YR-206NAV, YR-208NAV, YR-210NAV	5~300V	2210V, 5s	2000V, 1min	Indicated
				301V~600V	3320V, 5s	2000V, 1min	Not indicated
				Combined with VT	2210V, 5s	2000V, 1min	Indicated
			YR-8NAV, YR-10NAV, YR-12NAV LR-80NAV, LR-110NAV	5~600V	3320V, 5s	2000V, 1min	Indicated
				Combined with VT	2210V, 5s	2000V, 1min	Indicated
Wattmeters			YP-206NW, YP-208NW, YP-210NW YP-8NW, YP-10NW, YP-12NW LP-80NW, LP-110NW	1P2W: 110~220V	2210V, 5s	2000V, 1min	Indicated
				1P3W: 100/200V	2210V, 5s	2000V, 1min	Indicated
				3P3W: 110~220V	2210V, 5s	2000V, 1min	Indicated
				3P4W:110/√3/110~220/380V	2590V, 5s	2000V, 1min	Indicated
Varmeters			YP-206NVAR, YP-208NVAR YP-210NVAR YP-8NVAR, YP-10NVAR, YP-12NVAR LP-80NVAR, LP-110NVAR	3P3W: 110~220V	2210V, 5s	2000V, 1min	Indicated
				3P4W: 110/√3/110~110/190V	2210V, 5s	2000V, 1min	Indicated
Power factor meters	Balanced circuits		YP-206NPF, YP-208NPF, YP-210NPF YP-8NPF, YP-10NPF, YP-12NPF LP-80NPF, LP-110NPF	3P3W: 110~220V	2210V, 5s	2000V, 1min	Indicated
	Unbalanced loads		YP-206NPFU, YP-208NPFU YP-210NPFU YP-8NPFU, YP-10NPFU, YP-12NPFU LP-80NPFU, LP-110NPFU	3P3W: 110~220V	2210V, 5s	2000V, 1min	Indicated
				3P4W: 110/√3/110~110/190V	2210V, 5s	2000V, 1min	Indicated
Frequency meters			YP-206NF, YP-208NF, YP-210NF YP-8NF, YP-10NF, YP-12NF LP-80NF, LP-110NF	110~220V	2210V, 5s	2000V, 1min	Indicated
Receiving indicators	DC input	Current input	YM-206NRI, YM-208NRI, YM-210NRI YM-8NRI, YM-10NRI, YM-12NRI LM-80NRI, LM-110NRI	300V or less	2210V, 5s	2000V, 1min	Indicated
		Voltage input	YM-206NRI, YM-208NRI, YM-210NRI YM-8NRI, YM-10NRI, YM-12NRI LM-80NRI, LM-110NRI	1~300V	2210V, 5s	2000V, 1min	Indicated
	AC input	Current input	YR-206NRI, YR-208NRI, YR-210NRI YR-8NRI, YR-10NRI, YR-12NRI LR-80NRI, LR-110NRI	300V or less	2210V, 5s	2000V, 1min	Indicated
		Voltage input	YR-206NRI, YR-208NRI, YR-210NRI YR-8NRI, YR-10NRI, YR-12NRI LR-80NRI, LR-110NRI	5~300V	2210V, 5s	2000V, 1min	Indicated

JIS Mark

Indicator type			Model name	Operating circuit voltage or maximum rating		Factory-tested voltage (Note 1)	JIS voltage test (Note 2)	JIS mark indication (Note 3)
Indicators with changeover switches	AC ammeters		YR-8UNAA, YR-10UNAA, YR-12UNAA	600V or less		3320V, 5s	2000V, 1min	Indicated
	AC voltmeters		YR-8UNAV, YR-10UNAV, YR-12UNAV	150~600V		3320V, 5s	2000V, 1min	Indicated
Demand meters	AC ammeters		LB-8ZNAA	150V or less		2210V, 5s	2000V, 1min	Not indicated
			LB-11ZNAA, LB-11ZRNAA	300V or less		2210V, 5s	2000V, 1min	Indicated
	AC voltmeters		LB-8ZNAV	150V		2210V, 5s	2000V, 1min	Not indicated
			LB-11ZNAV, LB-11YRNAV	150V		2210V, 5s	2000V, 1min	Indicated
	Wattmeters		LB-11ZNW, LB-11ZRNW, LB-11YNW LB-11YRNW	1P2W: 110~200V		2210V, 5s	2000V, 1min	Indicated
				3P3W: 110~220V		2210V, 5s	2000V, 1min	Indicated
				3P4W:110/√3/110~220/380V		2590V, 5s	2000V, 1min	Indicated
	Receiving indicators		LB-11ZNRI, LB-11ZRNRI, LB-11YNRI LB-11YRNRI	300V or less		2210V, 5s	2000V, 1min	Indicated
Demand meter relays	AC ammeters		LB-11ZRMNAA	300V or less		2210V, 5s	2000V, 1min	Not indicated
Meter relays	DC ammeters		YM-210MRNDA, YM-210MRHNDA LM-11MRNDA, LM-11MRHNDA	300V or less	Exterior	2210V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
	DC voltmeters		YM-210MRNDV, YM-210MRHNDV LM-11MRNDV, LM-11MRHNDV	1~300V	Exterior	2210V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
				301~500V	Exterior	3110V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
	AC ammeters		YR-210MRNAA, YR-210MRHNAA LR-11MRNAA, LR-11MRHNAA	300V or less	Exterior	2210V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
	AC voltmeters		YR-210MRNAV, YR-210MRHNAV LR-11MRNAV, LR-11MRHNAV	10~300V	Exterior	2210V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
	Wattmeters		YM-210MRNW, YM-210MRHNW LM-11MRNW, LM-11MRHNW	1P2W: 110~220V	Exterior	2210V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
				3P3W: 110~220V	Exterior	2210V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
				3P4W:110/√3/110 ~220/380V	Exterior	2590V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
	Varmeters		YM-210MRNVAR, YM-210MRHNVAR LM-11MRNVAR, LM-11MRHNVAR	3P3W: 110~220V	Exterior	2210V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
				3P4W:110/√3/110 ~110/190V	Exterior	2210V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
	Power factor meters		YM-210MRNPF, YM-210MRHNPF LM-11MRNPF, LM-11MRHNPF YM-210MRNPFU, YM-210MRHNPFU LM-11MRNPFU, LM-11MRHNPFU	3P3W: 110~220V	Exterior	2210V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
			YM-210MRNPFU, YM-210MRHNPFU LM-11MRNPFU, LM-11MRHNPFU	3P4W:110/√3/110 ~110/190V	Exterior	2210V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
	Frequency meters		YM-210MRNF, YM-210MRHNF LM-11MRNF, LM-11MRHNF	110~220V	Exterior	2210V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
	Receiving indicators	Power supply input	YM-210MRNRI, YM-210MRHNRI LM-11MRNRI, LM-11MRHNRI	300V or less	Exterior	2210V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
		Voltage input	YM-210MRNRI, YM-210MRHNRI LM-11MRNRI, LM-11MRHNRI	1~300V	Exterior	2210V, 5s	2000V, 1min	Not indicated
					Between input and output	1200V, 1min	1200V, 1min	
Indicators with maximum and minimum needles	DC ammeters		LM-11ZNDA, LM-11YNDA	300V or less		2210V, 5s	2000V, 1min	Not indicated
	AC ammeters		LM-11ZNAA, LM-11YNAA	300V or less		2210V, 5s	2000V, 1min	Not indicated
	AC Voltmeters		LM-11ZNAV, LM-11YNAV	100~300V		2210V, 5s	2000V, 1min	Not indicated
	Receiving indicators		LM-11ZNRI, LM-11YNRI	300V or less		2210V, 5s	2000V, 1min	Not indicated
Earth-leakage detectors			LM-11NGD	63.5~150V		2210V, 5s	2000V, 1min	Not indicated
Synchroscopes			LI-11NSY	110~220V		2210V, 5s	2000V, 1min	Indicated
Dual-element indicators			LM-11NE	10V or less	Exterior	2210V, 5s	2000V, 1min	Indicated
					Between terminals	50V, 1min	50V, 1min	
Bar-shaped indicators	DC indicators	Current input	FM-210SN, FM-213SN, FM-215SN FM-217SN	300V or less		2210V, 5s	2000V, 1min	Indicated
			FM-210DN, FM-213DN, FM-215DN FM-217DN	10V or less	Exterior	2210V, 5s	2000V, 1min	Indicated
					Between terminals	500V, 1min	500V, 1min	
		Voltage input	FM-210SN, FM-213SN, FM-215SN FM-217SN	1~300V		2210V, 5s	2000V, 1min	Indicated
			FM-210DN, FM-213DN, FM-215DN FM-217DN	1~10V	Exterior	2210V, 5s	2000V, 1min	Indicated
					Between terminals	500V, 1min	500V, 1min	
	AC indicators	Current input	FR-210SN, FR-213SN, FR-215SN FR-217SN	300V or less		2210V, 5s	2000V, 1min	Indicated
		Voltage input	FR-210SN, FR-213SN, FR-215SN FR-217SN	5~300V		2210V, 5s	2000V, 1min	Indicated

Note 1. The factory-tested voltages are the values for the voltage test at the time of shipment. (The test may be performed at a value higher than the standard value.)
Note 2. Values in JIS C 1102-1 to 7 (1997 version).
Note 3. In some cases, special specification models (special grade, foreign standards) may not have a JIS mark.
Note 4. Models shown in shaded areas do not have the JIS mark.

Mechanical Indicators

Common Specifications

■Common standard specifications

Standards	Direct-acting electrical indicators JIS C 1102-2, JIS C 1102-3, JIS C 1102-4, JIS C 1102-5, JIS C 1102-7
Accuracy (grade)	Class 1.5 or 2.5 (frequency meters: class 0.5 or 1; power factor meters: class 5, synchroscope: class 5)
Usage temperature range	-5°C to 50°C (reference temperature: 23°C)
Usage humidity range	At a relative humidity of 30% to 70%, there are no adverse effects on indications.
Mounting attitude	Vertical (the scale plate is vertical with respect to a horizontal surface)
Scale plate	Background color: white
Cover	Acrylic resin (with antistatic treatment applied)
Case	Steel plate or molded product
Input signal peak-to-rms ratio	Sine wave ($\sqrt{2}$)
Measurement category	CAT Ⅲ (category of measurement performed inside a building facility)
Operating environment pollution rating	2 (non-conductive pollution only)
Installation altitude	2,000m or less
Usage location	Indoors
Mounting panel	Metal panel
Voltage test	Rated voltage 300V: 2210V for 5s; rated voltage 600V: 3320V for 5s[Note 1] (between electrical circuit and outer casing)
Insulation test	10MΩ or more at a test voltage of 500V (between electrical circuit and outer casing)
Storage temperature	-20°C to 60°C

Note 1. Refer to the Reference Chart for Test Voltages and JIS Mark on p.25/26 for information regarding the circuit voltage ranges of respective models and applicable voltage test values.

■Covers

Cover specification	Classification	Y-2N Series	Y-N Series	L-N Series
B design cover (Munsell N 1.5 semi-gloss)	◎			
G design cover (all transparent)	○			——
F design cover Note 1 (special color coating)	△			
Cover with red needle (can be manufactured for B, G, and F designs)	○			

Remarks The B design cover is standard specification. The G and F design covers and covers with red needles can be manufactured if required.

Note 1. When ordering the F-design cover, please use F as the cover code and specify the color coating. Munsell 7.5BG 4/1.5 will be used for orders with no color coating specified.

●Cover codes

Cover specifications	Without red needle	With red needle
B design	B	BR*1
G design	G	GR
F design	F	FR

Remarks For the Y-N Series, a B cover with two red needles (BRR cover) can be manufactured depending on the model (please inquire for details).

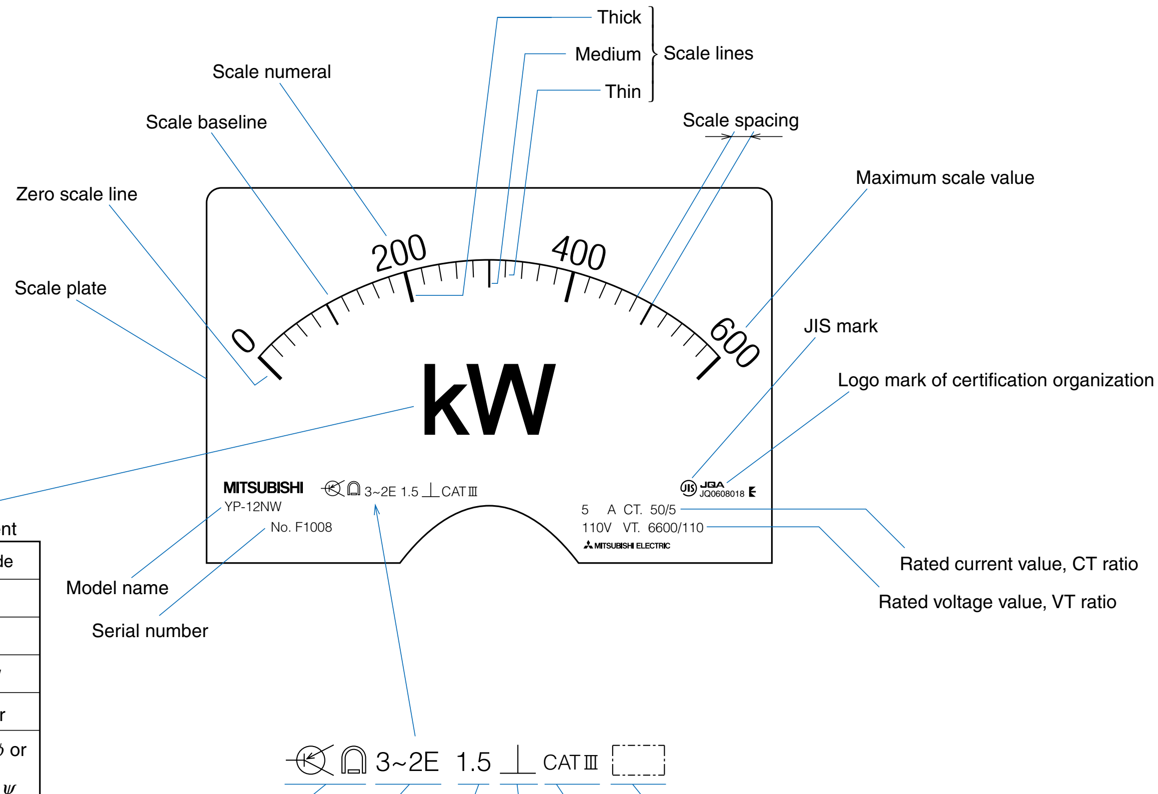
●Accessories

Nuts for mounting screws are provided with all models. T-150 and other special accessories are indicated in the specification columns of the respective indicator types.

Mechanical Indicators

Common Specifications

■Scale plate components and items indicated



Unit of measurement

Item	Code
Ampere	A
Volt	V
Watt	W
Var	var
Power factor	cos ϕ or cos ψ
Hertz	Hz
Prefix	
Mega 10^6	M
Kilo 10^3	k
Milli 10^{-3}	m

Auxiliary symbols

Item	Symbol
Shunt	
Serial resistor	R
Accessory	

Operation principle

Item	Symbol
Permanent magnet/movable coil	
Movable iron core	
Bimetal	
Electronic device in measurement circuit	
Electronic device in auxiliary circuit	
Rectifier	

Type of measurement and number of elements measured

Item	Symbol
DC circuit	
AC circuit	~
3-phase AC circuit	3~
Single element for 3-wire circuit	3~1E
Two elements for unbalanced load 3-wire circuit	3~2E
Two elements for unbalanced load 4-wire circuit	3N~2E
Three elements for unbalanced load 4-wire circuit	3N~3E

Accuracy class

Class index	Code
Class 0.5	0.5
Class 1	1
Class 1.5	1.5
Class 2.5	2.5
Class 5	5
Class 1.5 in the case where the base value corresponds to the span	|1.5|
Class 2.5 in the case where the base value corresponds to the span	|2.5|

Mounting attitude

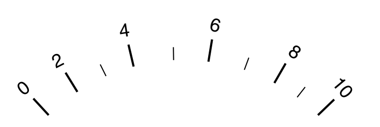
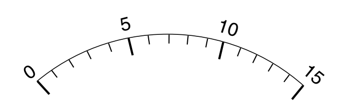
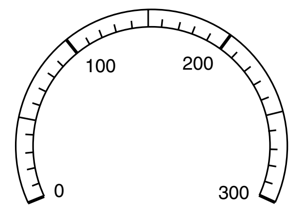
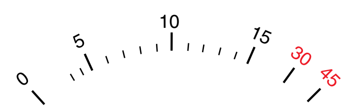
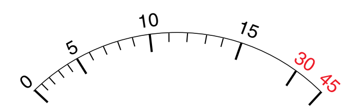
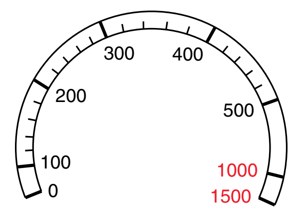
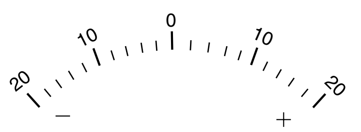
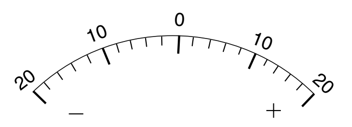
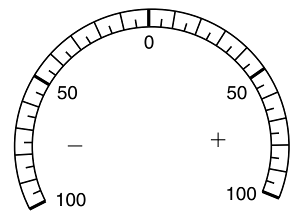
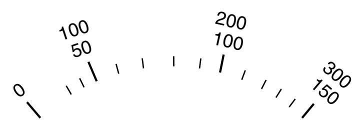
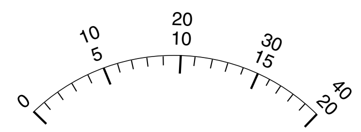
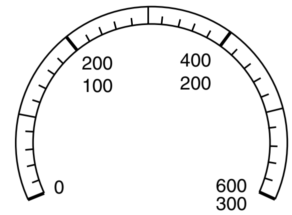
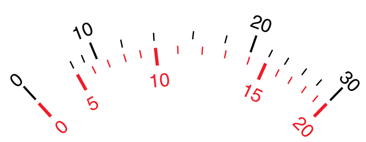
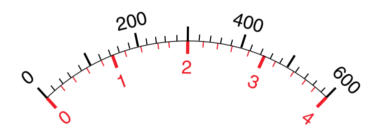
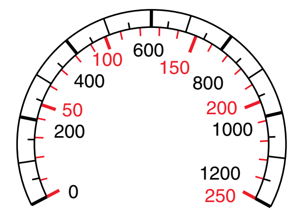
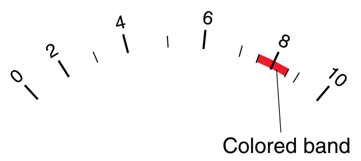
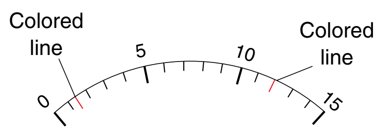
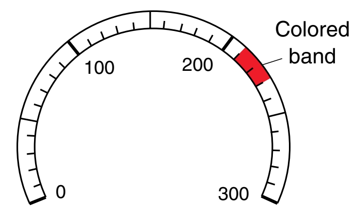
Item	Symbol
Instrument used with scale plate set vertically	⊥
Instrument used with scale plate set horizontally	⊓
Instrument used with scale plate set at a position inclined from the horizontal surface (example: 60°)	∠60°

Measurement category

Classification	Code
Measurement category Ⅲ	CAT Ⅲ

■Scale plate indications

The following tables show the scales, including numerals, colored lines, bands and colors, used as standard specifications.
Red, blue, green and yellow are used for the colored lines/bands.

	Y-2N Series	Y-N Series	L-N Series
Standard scale			
Expanded scale (expanded by 3 times)			
Positive/ Negative scale			
Single scale with double stamp			
Double scale with double stamp			
Colored lines Colored bands			

Remarks (1) See the “Standard Scale Diagrams” on pp.31 to 34 regarding the scale division with respect to the maximum scale value.
(2) Special scales can also be manufactured.

Standard Scale Diagrams

1a. Y-206N ordinary scale indicators

Maximum scale value	Scale specification	Number of divisions	Single space reading
1 / 10 / 100 / 1000	0 2 4 6 8 10	10	0.1 / 1 / 10 / 100
1.2 / 12 / 120 / 1200	0 3 6 9 12	12	0.1 / 1 / 10 / 100
1.5 / 15 / 150 / 1500	0 5 10 15	15	0.1 / 1 / 10 / 100
2 / 20 / 200 / 2000	0 5 10 15 20	20	0.1 / 1 / 10 / 100
2.5 / 25 / 250 / 2500	0 5 10 15 20 25	25	0.1 / 1 / 10 / 100
3 / 30 / 300 / 3000	0 10 20 30	15	0.2 / 2 / 20 / 200
4 / 40 / 400 / 4000	0 10 20 30 40	20	0.2 / 2 / 20 / 200
4.5 / 45 / 450 / 4500	0 10 20 30 40 45	22.5	0.2 / 2 / 20 / 200
5 / 50 / 500 / 5000	0 10 20 30 40 50	10	0.5 / 5 / 50 / 500
6 / 60 / 600 / 6000	0 20 40 60	12	0.5 / 5 / 50 / 500
7.5 / 75 / 750 / 7500	0 20 40 60 75	15	0.5 / 5 / 50 / 500
8 / 80 / 800 / 8000	0 20 40 60 80	16	0.5 / 5 / 50 / 500
9 / 90 / 900 / 9000	0 30 60 90	18	0.5 / 5 / 50 / 500

1b. Y-206N expanded scale indicators

Maximum scale value	Scale specification	Number of divisions	Single space reading
1 / 10 / 100 / 1000	0 5 10 20 30	10	0.1 / 1 / 10 / 100
1.2 / 12 / 120 / 1200	0 3 6 9 12 24 36	12	0.1 / 1 / 10 / 100
1.5 / 15 / 150 / 1500	0 5 10 15 30 45	15	0.1 / 1 / 10 / 100
2 / 20 / 200 / 2000	0 10 20 40 60	20	0.1 / 1 / 10 / 100
2.5 / 25 / 250 / 2500	0 5 10 15 20 25 50 75	25	0.1 / 1 / 10 / 100
3 / 30 / 300 / 3000	0 10 20 30 60 90	15	0.2 / 2 / 20 / 200
4 / 40 / 400 / 4000	0 10 20 30 40 80 120	8	0.5 / 5 / 50 / 500
—	—	—	—
5 / 50 / 500 / 5000	0 10 20 30 40 50 100 150	10	0.5 / 5 / 50 / 500
6 / 60 / 600 / 6000	0 20 40 60 120 180	12	0.5 / 5 / 50 / 500
7.5 / 75 / 750 / 7500	0 25 50 75 150 225	15	0.5 / 5 / 50 / 500
8 / 80 / 800 / 8000	0 20 40 60 80 160 240	16	0.5 / 5 / 50 / 500
9 / 90 / 900 / 9000	0 30 60 90 180 270	9	1 / 10 / 100 / 1000

Remarks The ranges underlined in the Scale specification column of the table above are omitted for indicators where the interval between scale marks are very small close to the zero point (e.g., an indicator with a movable iron core).

2a. Y-208N and Y-210N ordinary scale indicators

Maximum scale value	Scale specification	Number of divisions	Single space reading
1 / 10 / 100 / 1000	0 2 4 6 8 10	20	0.05 / 0.5 / 5 / 50
1.2 / 12 / 120 / 1200	0 3 6 9 12	24	0.05 / 0.5 / 5 / 50
1.5 / 15 / 150 / 1500	0 5 10 15	15	0.1 / 1 / 10 / 100
2 / 20 / 200 / 2000	0 5 10 15 20	20	0.1 / 1 / 10 / 100
2.5 / 25 / 250 / 2500	0 5 10 15 20 25	25	0.1 / 1 / 10 / 100
3 / 30 / 300 / 3000	0 10 20 30	30	0.1 / 1 / 10 / 100
4 / 40 / 400 / 4000	0 10 20 30 40	20	0.2 / 2 / 20 / 200
4.5 / 45 / 450 / 4500	0 10 20 30 40 45	22.5	0.2 / 2 / 20 / 200
5 / 50 / 500 / 5000	0 10 20 30 40 50	25	0.2 / 2 / 20 / 200
6 / 60 / 600 / 6000	0 20 40 60	30	0.2 / 2 / 20 / 200
7.5 / 75 / 750 / 7500	0 20 40 60 75	15	0.5 / 5 / 50 / 500
8 / 80 / 800 / 8000	0 20 40 60 80	16	0.5 / 5 / 50 / 500
9 / 90 / 900 / 9000	0 30 60 90	18	0.5 / 5 / 50 / 500

2b. Y-208N and Y-210N expanded scale indicators

Maximum scale value	Scale specification	Number of divisions	Single space reading
1 / 10 / 100 / 1000	0 5 10 20 30	20	0.05 / 0.5 / 5 / 50
1.2 / 12 / 120 / 1200	0 3 6 9 12 24 36	24	0.05 / 0.5 / 5 / 50
1.5 / 15 / 150 / 1500	0 5 10 15 30 45	15	0.1 / 1 / 10 / 100
2 / 20 / 200 / 2000	0 10 20 40 60	20	0.1 / 1 / 10 / 100
2.5 / 25 / 250 / 2500	0 5 10 15 20 25 50 75	25	0.1 / 1 / 10 / 100
3 / 30 / 300 / 3000	0 10 20 30 60 90	15	0.2 / 2 / 20 / 200
4 / 40 / 400 / 4000	0 10 20 30 40 80 120	20	0.2 / 2 / 20 / 200
—	—	—	—
5 / 50 / 500 / 5000	0 10 20 30 40 50 100 150	25	0.2 / 2 / 20 / 200
6 / 60 / 600 / 6000	0 20 40 60 120 180	12	0.5 / 5 / 50 / 500
7.5 / 75 / 750 / 7500	0 25 50 75 150 225	15	0.5 / 5 / 50 / 500
8 / 80 / 800 / 8000	0 20 40 60 80 160 240	16	0.5 / 5 / 50 / 500
9 / 90 / 900 / 9000	0 30 60 90 180 270	18	0.5 / 5 / 50 / 500

Remarks The ranges underlined in the Scale specification column of the table above are omitted for indicators where the interval between scale marks are very small close to the zero point (e.g., an indicator with a movable iron core).

3a. Y-8N and Y-10N ordinary scale indicators

Maximum scale value	Scale specification	Number of divisions	Single space reading
1 10 100 1000	0 2 4 6 8 10	20	0.05 0.5 5 50
1.2 12 120 1200	0 3 6 9 12	24	0.05 0.5 5 50
1.5 15 150 1500	0 5 10 15	15	0.1 1 10 100
2 20 200 2000	0 5 10 15 20	20	0.1 1 10 100
2.5 25 250 2500	0 5 10 15 20 25	25	0.1 1 10 100
3 30 300 3000	0 10 20 30	30	0.1 1 10 100
4 40 400 4000	0 10 20 30 40	40	0.1 1 10 100
4.5 45 450 4500	0 10 20 30 40 45	22.5	0.2 2 20 200
5 50 500 5000	0 10 20 30 40 50	25	0.2 2 20 200
6 60 600 6000	0 20 40 60	30	0.2 2 20 200
7.5 75 750 7500	0 20 40 60 75	15	0.5 5 50 500
8 80 800 8000	0 20 40 60 80	16	0.5 5 50 500
9 90 900 9000	0 30 60 90	18	0.5 5 50 500

3b. Y-8N and Y-10N expanded scale indicators

Maximum scale value	Scale specification	Number of divisions	Single space reading
1 10 100 1000	0 5 10 20 30	20	0.05 0.5 5 50
1.2 12 120 1200	0 3 6 9 12 24 36	24	0.05 0.5 5 50
1.5 15 150 1500	0 5 10 15 30 45	15	0.1 1 10 100
2 20 200 2000	0 10 20 40 60	20	0.1 1 10 100
2.5 25 250 2500	0 5 10 15 20 25 50 75	25	0.1 1 10 100
3 30 300 3000	0 10 20 30 60 90	15	0.2 2 20 200
4 40 400 4000	0 10 20 30 40 80 120	20	0.2 2 20 200
—	—	—	—
5 50 500 5000	0 10 20 30 40 50 100 150	25	0.2 2 20 200
6 60 600 6000	0 20 40 60 120 180	12	0.5 5 50 500
7.5 75 750 7500	0 25 50 75 150 225	15	0.5 5 50 500
8 80 800 8000	0 20 40 60 80 160 240	16	0.5 5 50 500
9 90 900 9000	0 30 60 90 180 270	18	0.5 10 100 1000

Remarks The ranges underlined in the Scale specification column of the table above are omitted for indicators where the interval between scale marks are very small close to the zero point (e.g., an indicator with a movable iron core).

4a. Y-12N ordinary scale indicators

Maximum scale value	Scale specification	Number of divisions	Single space reading
1 10 100 1000	0 2 4 6 8 10	50	0.02 0.2 2 20
1.2 12 120 1200	0 3 6 9 12	24	0.05 0.5 5 50
1.5 15 150 1500	0 5 10 15	30	0.05 0.5 5 50
2 20 200 2000	0 5 10 15 20	40	0.05 0.5 5 50
2.5 25 250 2500	0 5 10 15 20 25	25	0.1 1 10 100
3 30 300 3000	0 10 20 30	30	0.1 1 10 100
4 40 400 4000	0 10 20 30 40	40	0.1 1 10 100
4.5 45 450 4500	0 10 20 30 40 45	45	0.1 1 10 100
5 50 500 5000	0 10 20 30 40 50	50	0.1 1 10 100
6 60 600 6000	0 20 40 60	30	0.2 2 20 200
7.5 75 750 7500	0 20 40 60 75	37.5	0.2 2 20 200
8 80 800 8000	0 20 40 60 80	40	0.2 2 20 200
9 90 900 9000	0 30 60 90	45	0.2 2 20 200

4b. Y-12N expanded scale indicators

Maximum scale value	Scale specification	Number of divisions	Single space reading
1 10 100 1000	0 5 10 20 30	20	0.05 0.5 5 50
1.2 12 120 1200	0 3 6 9 12 24 36	24	0.05 0.5 5 50
1.5 15 150 1500	0 5 10 15 30 45	15	0.1 1 10 100
2 20 200 2000	0 5 10 15 20 40 60	20	0.1 1 10 100
2.5 25 250 2500	0 5 10 15 20 25 50 75	25	0.1 1 10 100
3 30 300 3000	0 10 20 30 60 90	15	0.2 2 20 200
4 40 400 4000	0 10 20 30 40 80 120	20	0.2 2 20 200
—	—	—	—
5 50 500 5000	0 10 20 30 40 50 100 150	25	0.2 2 20 200
6 60 600 6000	0 20 40 60 120 180	30	0.2 2 20 200
7.5 75 750 7500	0 25 50 75 150 225	15	0.5 5 50 500
8 80 800 8000	0 20 40 60 80 160 240	16	0.5 5 50 500
9 90 900 9000	0 30 60 90 180 270	18	0.5 5 50 500

Remarks The ranges underlined in the Scale specification column of the table above are omitted for indicators where the interval between scale marks are very small close to the zero point (e.g., an indicator with a movable iron core).

Standard Scale Diagrams

5a. L-110N ordinary scale indicators

Maximum scale value	Scale specification	Number of divisions	Single space reading
1 10 100 1000	0 2 4 6 8 10	50	0.02 0.2 2 20
1.2 12 120 1200	0 2 4 6 8 10 12	24	0.05 0.5 5 50
1.5 15 150 1500	0 5 10 15	30	0.05 0.5 5 50
2 20 200 2000	0 5 10 15 20	40	0.05 0.5 5 50
2.5 25 250 2500	0 5 10 15 20 25	25	0.1 1 10 100
3 30 300 3000	0 10 20 30	30	0.1 1 10 100
4 40 400 4000	0 10 20 30 40	40	0.1 1 10 100
4.5 45 450 4500	0 10 20 30 40 45	45	0.1 1 10 100
5 50 500 5000	0 10 20 30 40 50	50	0.1 1 10 100
6 60 600 6000	0 20 40 60	30	0.2 2 20 200
7.5 75 750 7500	0 20 40 60 75	37.5	0.2 2 20 200
8 80 800 8000	0 20 40 60 80	40	0.2 2 20 200
9 90 900 9000	0 30 60 90	45	0.2 2 20 200

5b. L-110N expanded scale indicators

Maximum scale value	Scale specification	Number of divisions	Single space reading
1 10 100 1000	0 5 10 20 30	20	0.05 0.5 5 50
1.2 12 120 1200	0 3 6 9 12 24 36	24	0.05 0.5 5 50
1.5 15 150 1500	0 5 10 15 30 45	30	0.05 0.5 5 50
2 20 200 2000	0 5 10 15 20 40 60	40	0.05 0.5 5 50
2.5 25 250 2500	0 5 10 15 20 25 50 75	25	0.1 1 10 100
3 30 300 3000	0 10 20 30 60 90	30	0.1 1 10 100
4 40 400 4000	0 10 20 30 40 80 120	20	0.2 2 20 200
—	—	—	—
5 50 500 5000	0 10 20 30 40 50 100 150	25	0.2 2 20 200
6 60 600 6000	0 20 40 60 120 180	30	0.2 2 20 200
7.5 75 750 7500	0 25 50 75 150 225	15	0.5 5 50 500
8 80 800 8000	0 20 40 60 80 160 240	40	0.2 2 20 200
9 90 900 9000	0 30 60 90 180 270	18	0.5 5 50 500

Remarks The ranges underlined in the Scale specification column of the table above are omitted for indicators where the interval between scale marks are very small close to the zero point (e.g., an indicator with a movable iron core).

6a. L-80N ordinary scale indicators

Maximum scale value	Scale specification	Number of divisions	Single space reading
1 10 100 1000	0 2 4 6 8 10	50	0.02 0.2 2 20
1.2 12 120 1200	0 2 4 6 8 10 12	24	0.05 0.5 5 50
1.5 15 150 1500	0 5 10 15	30	0.05 0.5 5 50
2 20 200 2000	0 5 10 15 20	40	0.05 0.5 5 50
2.5 25 250 2500	0 5 10 15 20 25	25	0.1 1 10 100
3 30 300 3000	0 10 20 30	30	0.1 1 10 100
4 40 400 4000	0 10 20 30 40	40	0.1 1 10 100
4.5 45 450 4500	0 10 20 30 40 45	22.5	0.2 2 20 200
5 50 500 5000	0 10 20 30 40 50	25	0.2 2 20 200
6 60 600 6000	0 20 40 60	30	0.2 2 20 200
7.5 75 750 7500	0 20 40 60 75	37.5	0.2 2 20 200
8 80 800 8000	0 20 40 60 80	40	0.2 2 20 200
9 90 900 9000	0 30 60 90	45	0.2 2 20 200

6b. L-80N expanded scale indicators

Maximum scale value	Scale specification	Number of divisions	Single space reading
1 10 100 1000	0 5 10 20 30	20	0.05 0.5 5 50
1.2 12 120 1200	0 3 6 9 12 24 36	24	0.05 0.5 5 50
1.5 15 150 1500	0 5 10 15 30 45	30	0.05 0.5 5 50
2 20 200 2000	0 5 10 15 20 40 60	40	0.05 0.5 5 50
2.5 25 250 2500	0 5 10 15 20 25 50 75	25	0.1 1 10 100
3 30 300 3000	0 10 20 30 60 90	30	0.1 1 10 100
4 40 400 4000	0 10 20 30 40 80 120	20	0.2 2 20 200
—	—	—	—
5 50 500 5000	0 10 20 30 40 50 100 150	25	0.2 2 20 200
6 60 600 6000	0 20 40 60 120 180	30	0.2 2 20 200
7.5 75 750 7500	0 25 50 75 150 225	15	0.5 5 50 500
8 80 800 8000	0 20 40 60 80 160 240	40	0.2 2 20 200
9 90 900 9000	0 30 60 90 180 270	18	0.5 5 50 500

Remarks The ranges underlined in the Scale specification column of the table above are omitted for indicators where the interval between scale marks are very small close to the zero point (e.g., an indicator with a movable iron core).

7a. F-210N ordinary scale indicators (Class 2.5)

Maximum scale value	1 10 100 1000	1.2 12 120 1200	1.5 15 150 1500	2 20 200 2000	2.5 25 250 2500	3 30 300 3000	4 40 400 4000	4.5 45 450 4500	5 50 500 5000	6 60 600 6000	7.5 75 750 7500	8 80 800 8000	9 90 900 9000
Scale specification	10 8 6 4 2 0	12 9 6 3 0	15 10 5 0	20 15 10 5 0	25 20 15 10 5 0	30 20 10 0	40 30 20 10 0	45 40 30 20 10 0	50 40 30 20 10 0	60 40 20 0	75 60 40 20 0	80 60 40 20 0	90 60 30 0
Number of divisions	20	24	30	20	25	30	20	22.5	25	30	15	16	18
Single spacing reading	0.05 0.5 5 50	0.05 0.5 5 50	0.05 0.5 5 50	0.1 1 10 100	0.1 1 10 100	0.1 1 10 100	0.2 2 20 200	0.2 2 20 200	0.2 2 20 200	0.2 2 20 200	0.5 5 50 500	0.5 5 50 500	0.5 5 50 500

8a. F-213N, F-215N, and F217N ordinary scale indicators

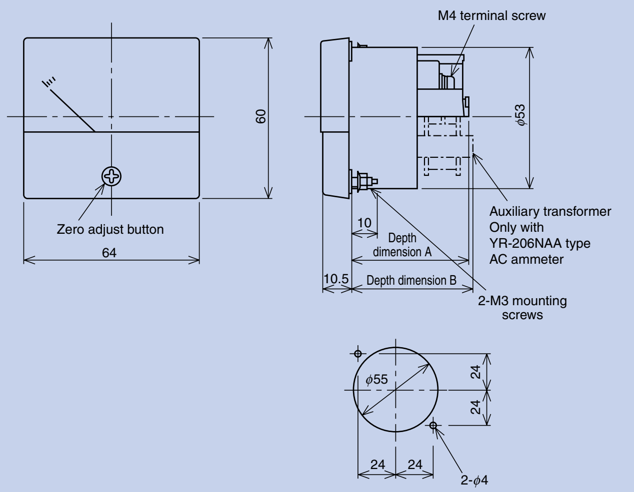
Maximum scale value	1 10 100 1000	1.2 12 120 1200	1.5 15 150 1500	2 20 200 2000	2.5 25 250 2500	3 30 300 3000	4 40 400 4000	4.5 45 450 4500	5 50 500 5000	6 60 600 6000	7.5 75 750 7500	8 80 800 8000	9 90 900 9000
Scale specification	10 8 6 4 2 0	12 9 6 3 0	15 10 5 0	20 15 10 5 0	25 20 15 10 5 0	30 20 10 0	40 30 20 10 0	45 40 30 20 10 0	50 40 30 20 10 0	60 40 20 0	75 60 40 20 0	80 60 40 20 0	90 60 30 0
Number of divisions	50	24	30	40	50	30	40	45	50	30	37.5	40	45
Single spacing reading	0.02 0.2 2 20	0.05 0.5 5 50	0.05 0.5 5 50	0.05 0.5 5 50	0.05 0.5 5 50	0.1 1 10 100	0.1 1 10 100	0.1 1 10 100	0.1 1 10 100	0.2 2 20 200	0.2 2 20 200	0.2 2 20 200	0.2 2 20 200

Outer Dimension Drawings

(Refer to the specification tables regarding models other than the Y-2N series, Y-N series, and L-N series.)

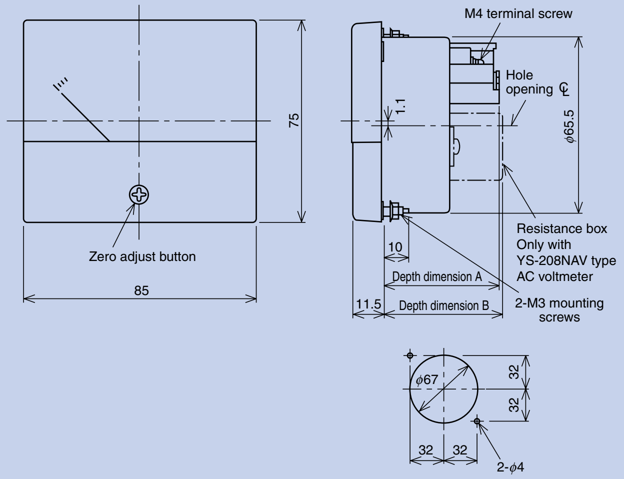
Rectangular indicators (Y-2N Series)

FIG. 1 Y-206N



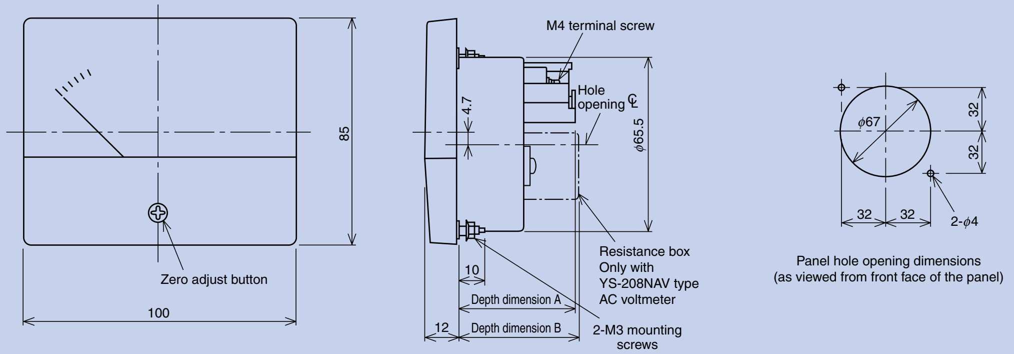
Panel hole opening dimensions
(as viewed from front face of the panel)

FIG. 2 Y-208N



Panel hole opening dimensions
(as viewed from front face of the panel)

FIG. 3 Y-210N



Panel hole opening dimensions
(as viewed from front face of the panel)

●Depth dimension details

Indicator type			Y-206N			Y-208N			Y-210N		
			Type name	A dimension	B dimension	Type name	A dimension	B dimension	Type name	A dimension	B dimension
DC	Ammeters		YM-206NDA	43	—	YM-208NDA	43	—	YM-210NDA	43	—
DC	Voltmeters		YM-206NDV	43	—	YM-208NDV	43	—	YM-210NDV	43	—
AC	Ammeters		YS-206NAA	43	—	YS-208NAA	43	—	YS-210NAA	43	—
AC		Uniform scale	YR-206NAA	43	44	YR-208NAA	43	—	YR-210NAA	43	—
AC	Voltmeters		YS-206NAV	43	—	YS-208NAV	43	45	YS-210NAV	43	45
AC		Uniform scale	YR-206NAV	43	—	YR-208NAV	43	—	YR-210NAV	43	—
AC	Wattmeters		YP-206NW	43	—	YP-208NW	43	—	YP-210NW	43	—
AC	Varmeters		YP-206NVAR	43	—	YP-208NVAR	43	—	YP-210NVAR	43	—
AC	Power-factor meters	Balanced	YP-206NPF	43	—	YP-208NPF	43	—	YP-210NPF	43	—
AC	Power-factor meters	Unbalanced	YP-206NPFU	43	—	YP-208NPFU	43	—	YP-210NPFU	43	—
AC	Frequency meters		YP-206NF	83	—	YP-208NF	83	—	YP-210NF	83	—
Receiving indicators		DC indicators	YM-206NRI	43	—	YM-208NRI	43	—	YM-210NRI	43	—
Receiving indicators		AC indicators	YR-206NRI	43	—	YR-208NRI	43	—	YR-210NRI	43	—

Rectangular indicators (Y-N Series)

FIG. 1 Y-8N

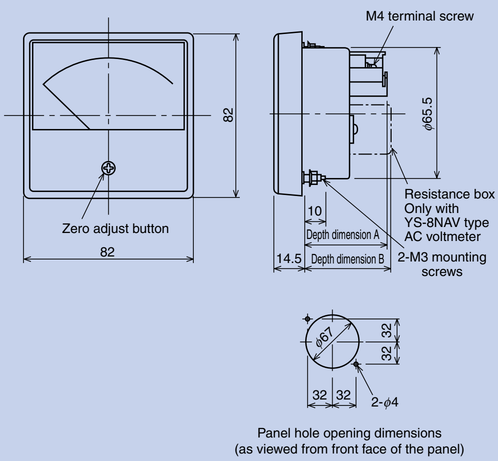


FIG. 2 Y-10N

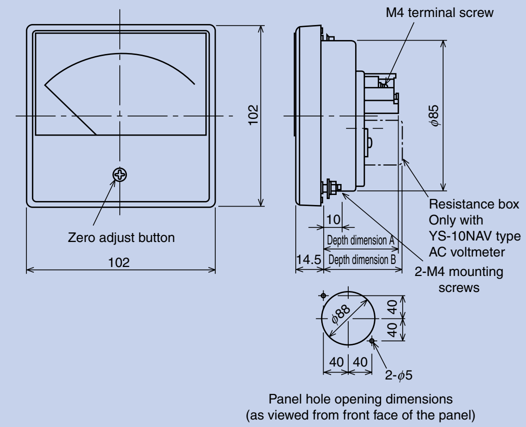
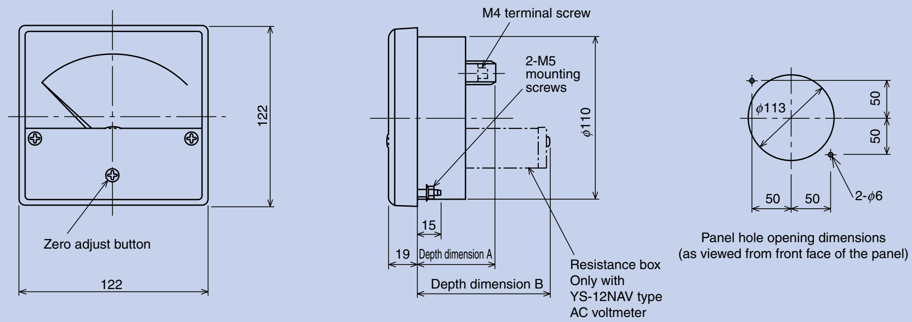


FIG. 3 Y-12N



●Depth dimension details

Indicator type			Y-8N Type name	A dimension	B dimension	Y-10N Type name	A dimension	B dimension	Y-12N Type name	A dimension	B dimension
DC	Ammeters		YM-8NDA	41	—	YM-10NDA	41	—	YM-12NDA	50	—
DC	Voltmeters		YM-8NDV	41	—	YM-10NDV	41	—	YM-12NDV	50	—
AC	Ammeters		YS-8NAA	41	—	YS-10NAA	41	—	YS-12NAA	50	—
AC	Ammeters	Uniform scale	YR-8NAA	41	—	YR-10NAA	41	—	YR-12NAA	50	—
AC	Voltmeters		YS-8NAV	41	43	YS-10NAV	41	43	YS-12NAV	50	85
AC	Voltmeters	Uniform scale	YR-8NAV	41	—	YR-10NAV	41	—	YR-12NAV	50	—
AC	Wattmeters		YP-8NW	41	—	YP-10NW	41	—	YP-12NW	100	—
AC	Varmeters		YP-8NVAR	41	—	YP-10NVAR	41	—	YP-12NVAR	100	—
AC	Power-factor meters	Balanced	YP-8NPF	81	—	YP-10NPF	81	—	YP-12NPF	50 Note	—
AC	Power-factor meters	Unbalanced	YP-8NPFU	41	—	YP-10NPFU	41	—	YP-12NPFU	100	—
AC	Frequency meters		YP-8NF	81	—	YP-10NF	81	—	YP-12NF	50	—
Receiving indicators		DC indicators	YM-8NRI	41	—	YM-10NRI	41	—	YM-12NRI	50	—
Receiving indicators		AC indicators	YR-8NRI	41	—	YR-10NRI	41	—	YR-12NRI	50	—

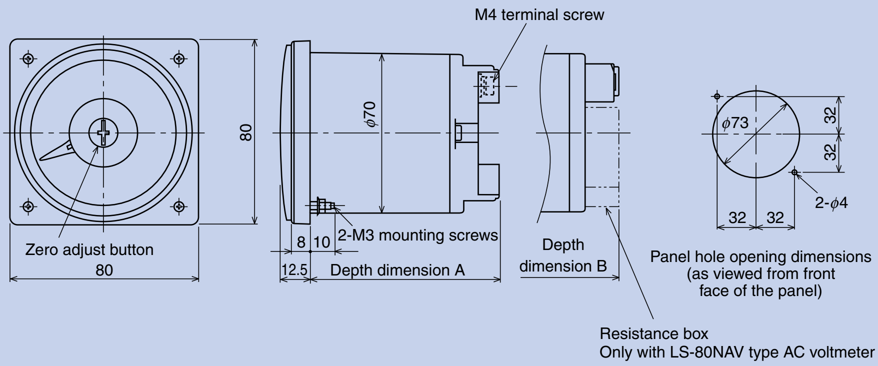
Note. 100mm in the case of a model for 1-phase 2-wire systems.

Outer Dimensional Drawings

(Refer to the specification tables regarding models other than the Y-2N series, Y-N series, and L-N series.)

Wide-angle indicators (L-N Series)

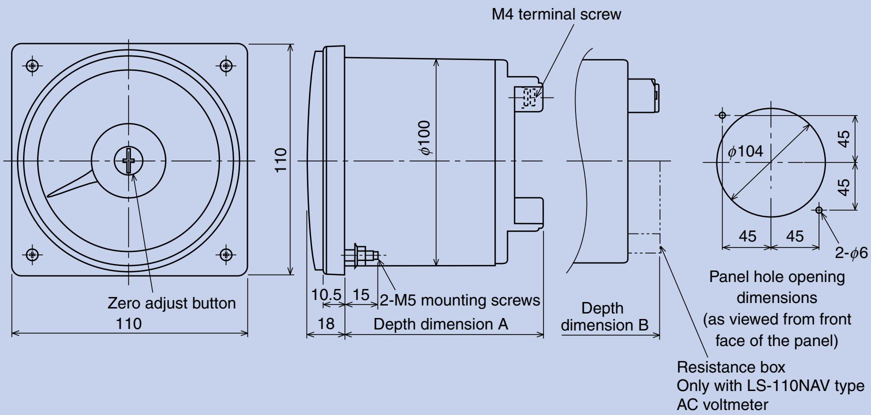
FIG. 1 L-80N



●Depth dimension details

Indicator type			L-80N Type name	A dimension	B dimension
DC	Ammeters		LM-80NDA	81	—
DC	Voltmeters		LM-80NDV	81	—
AC	Ammeters		LS-80NAA	—	81
AC		Uniform scale	LR-80NAA	81	—
AC	Voltmeters		LS-80NAV	—	81
AC		Uniform scale	LR-80NAV	81	—
AC	Wattmeters		LP-80NW	81	—
AC	Varmeters		LP-80NVAR	81	—
AC	Power-factor meters	Balanced	LP-80NPF	92	—
AC	Power-factor meters	Unbalance	LP-80NPFU	81	—
AC	Frequency meters		LP-80NF	92	—
Receiving indicators		DC indicators	LM-80NRI	81	—
Receiving indicators		AC indicators	LR-80NRI	81	—

FIG. 2 L-110N

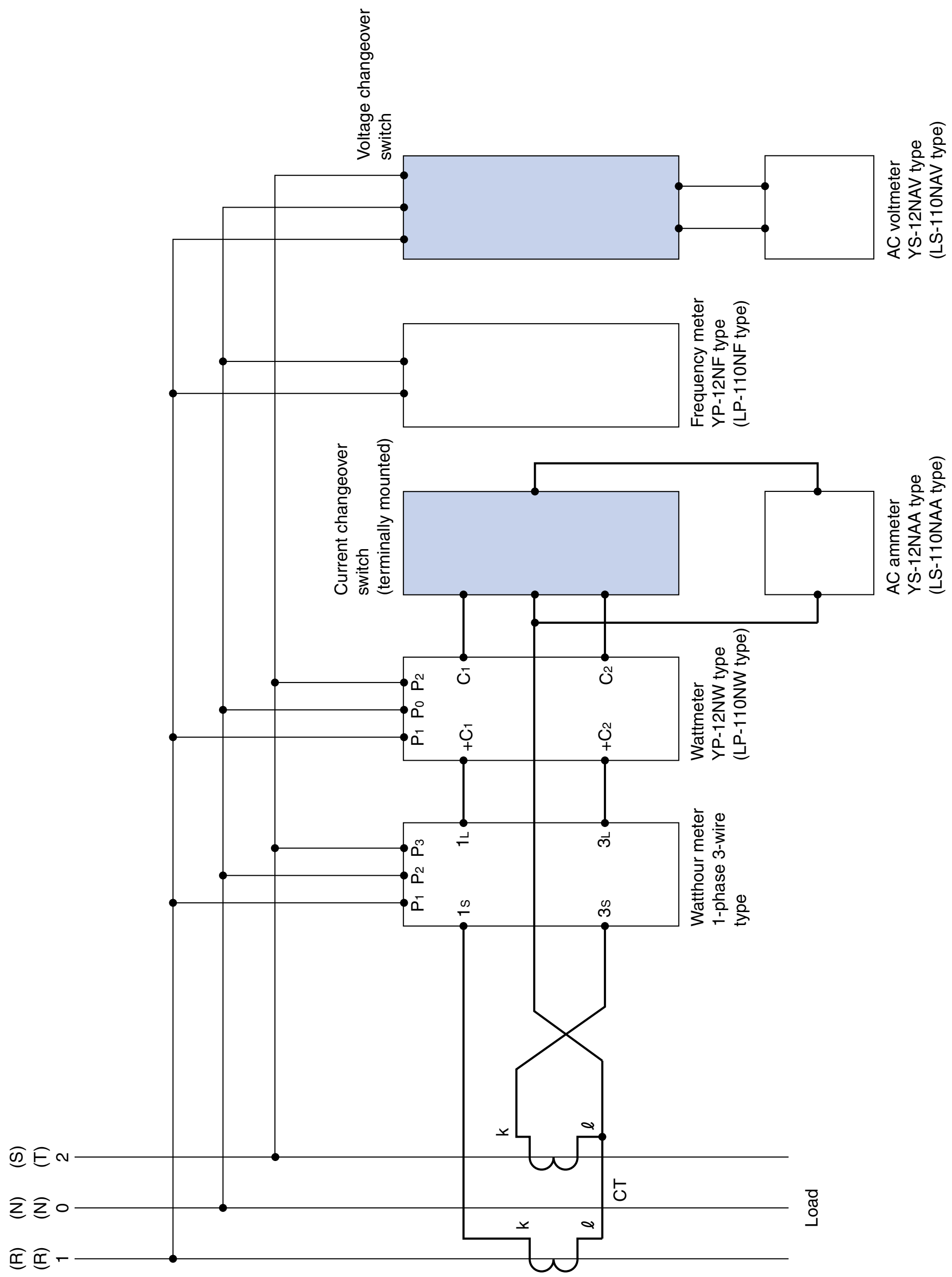


●Depth dimension details

Indicator type			L-110N Type name	A dimension	B dimension
DC	Ammeters		LM-110NDA	92	—
DC	Voltmeters		LM-110NDV	92	—
AC	Ammeters		LS-110NAA	—	92
AC		Uniform scale	LR-110NAA	92	—
AC	Voltmeters		LS-110NAV	—	92
AC		Uniform scale	LR-110NAV	92	—
AC	Wattmeters		LP-110NW	100	—
AC	Varmeters		LP-110NVAR	100	—
AC	Power-factor meters	Balanced	LP-110NPF	92	—
AC	Power-factor meters	Unbalance	LP-110NPFU	100	—
AC	Frequency meters		LP-110NF	92	—
Receiving indicators		DC indicators	LM-110NRI	92	—
Receiving indicators		AC indicators	LR-110NRI	92	—

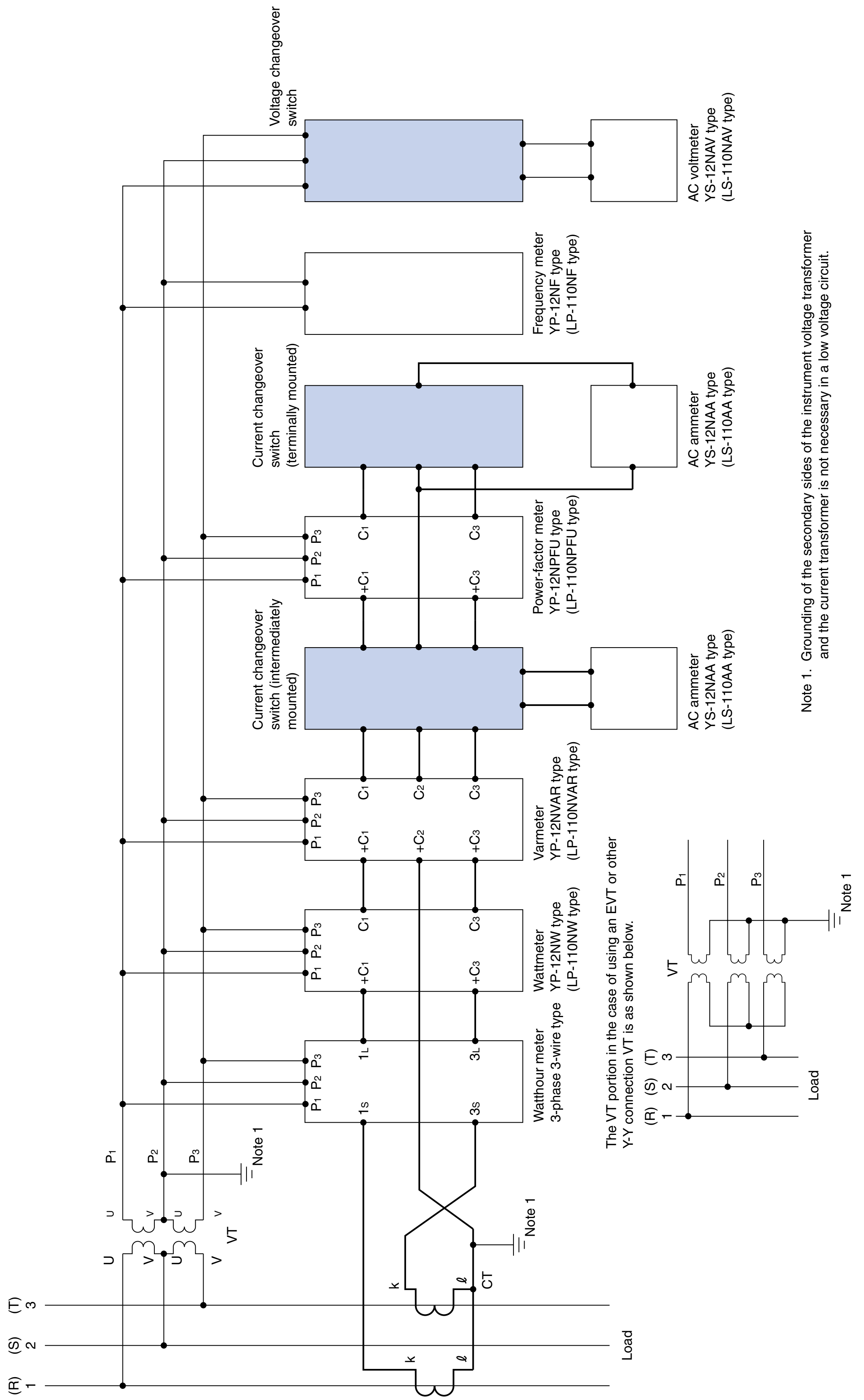
Overall Connection Examples

1. 1-phase, 3-wire circuit

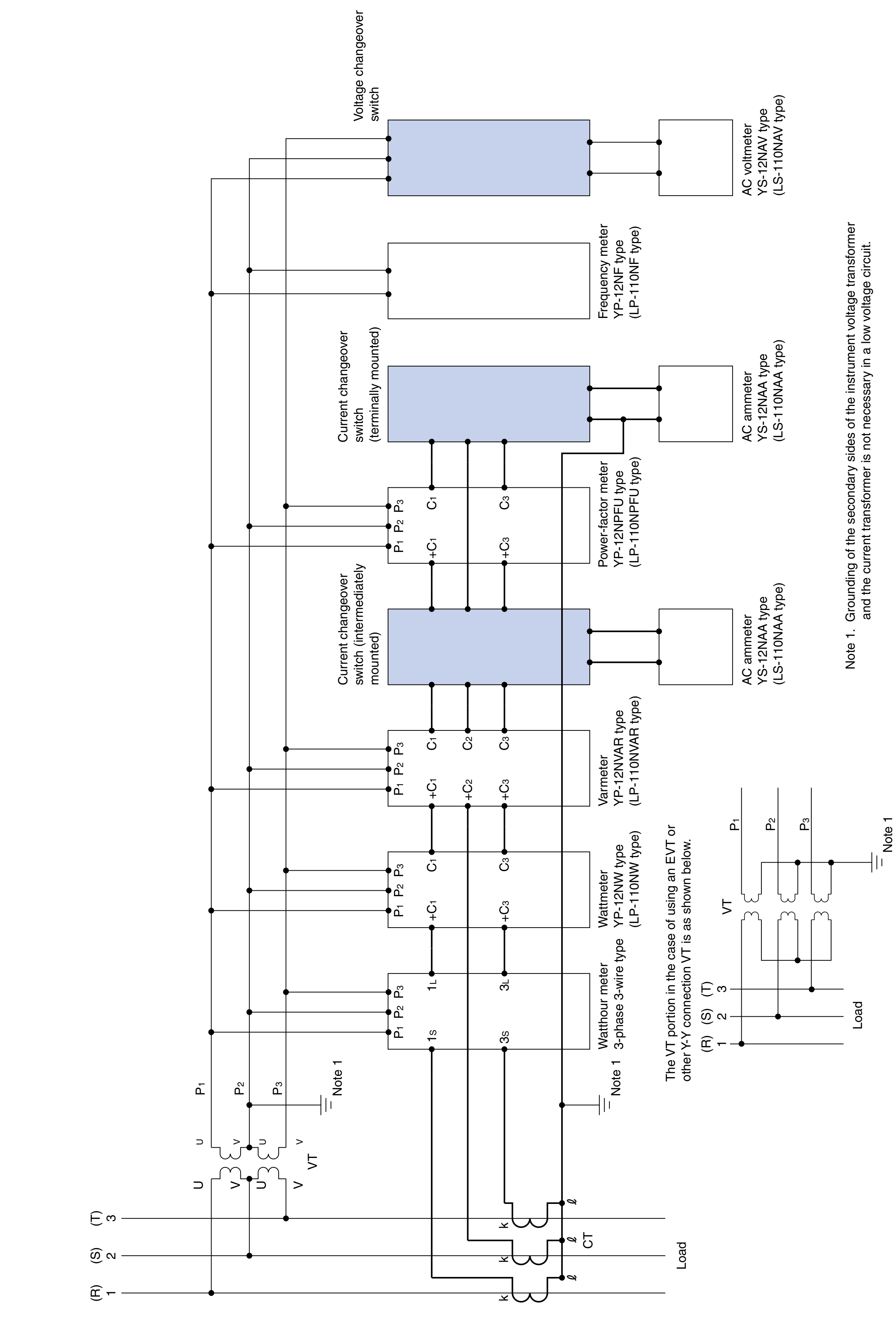


Overall Connection Examples

2. 3-phase, 3-wire circuit (2CT)

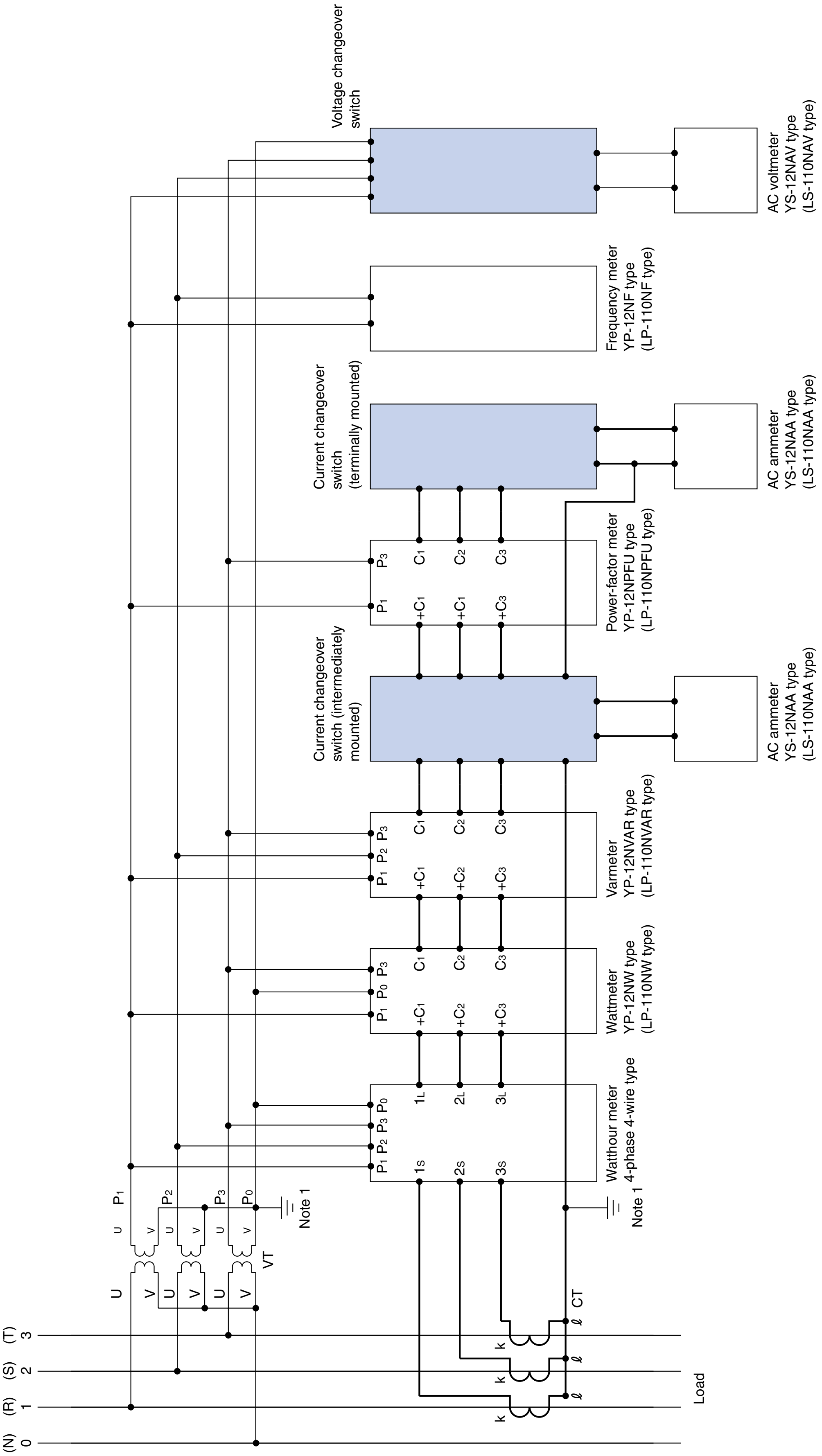


3. 3-phase, 3-wire circuit (3CT)



Overall Connection Examples

4. 3-phase, 4-wire circuit



Note 1. Grounding of the secondary sides of the instrument voltage transformer and the current transformer is not necessary in a low voltage circuit.

DC Ammeters

YM-206NDA

YM-8NDA

LM-110NDA

■Specifications

			Rectangular indicators						Wide-angle indicators	
			Y-2N Series			Y-N Series			L-N Series	
Size (width × height) mm			64×60	85×75	100×85	82×82	102×102	122×122	80×80	110×110
Model name			YM-206NDA	YM-208NDA	YM-210NDA	YM-8NDA	YM-10NDA	YM-12NDA	LM-80NDA	LM-110NDA
Operation principle			Movable coil			Movable coil			Movable coil	
Accuracy (grade)			2.5			2.5		1.5	2.5	1.5
Scale length (mm)			55	70	85	70	90	100	124	175
Weight (kg)			0.07	0.1	0.1	0.1	0.15	0.3	0.3	0.4
Indicator rating and delivery period classification	Maximum scale value	Delivery period	Internal resistance (Ω) or voltage drop							
Direct indicator Note 1	100μA	△	2000Ω			2000Ω		5000Ω	—	
	200μA	△	1200Ω			1200Ω		5000Ω	—	
	300μA	△	1000Ω			1000Ω		1550Ω	920Ω	
	500μA	△	730Ω			730Ω		780Ω	580Ω	
	1mA	○	200Ω			200Ω		250Ω	180Ω	
	3mA	○	70Ω			70Ω		85Ω	60Ω	
	5mA	○	8Ω			8Ω		50Ω	8Ω	
	10mA	○	2Ω			2Ω		25Ω	60mV	
	20mA	○	0.8Ω			0.8Ω		0.8Ω		
	50, 100mA 200, 500mA 1, 2, 5, 7.5A 10, 15, 20, 30A	○	60mV			60mV				
Combined with shunt	1A~7500A	△	60mV, 100mV Note 2 (consumption current: approx. 20mA)			60mV, 100mV Note 2 (consumption current: approx. 20mA)			60mV, 100mV Note 2 (consumption current: approx. 5mA)	
Special specification	With lead wire adjustment resistor	○	Manufacturable			Manufacturable			Manufacturable	
Page with outer dimensions drawing			35			36			37	

Note 1. The operating circuit voltage is 300V or less with the Y-2N Series, and 600V or less with the Y-N Series and L-N Series.

Note 2. In the case of combined use with a shunt, refer to "DC Ammeter Combined with Shunt" on p.44, and specify the lead wire thickness and one-way length or round-trip resistance.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Remarks (1) In the case of a bidirectional deflection indicator, determine the specifications according to the following.

- Direct-rating models can be manufactured if the larger of the left and right scales is 30A or less.
- For combined use with a shunt, select a scale so that the sum of the absolute values of the indicator ratings is 60mV or more.

Example: In the case of a shunt with ratings of 100A and 60mV
Ammeter scale -50~0~+100A
Ammeter rating -30~0~+60mV
(Sum of absolute values=90mV≥60mV)

(2) Refer to "Receiving Indicators" on p.67 concerning zero-suppressed indicators.

(3) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

■Connection diagrams

Fig. 1 DC ammeter (direct) load

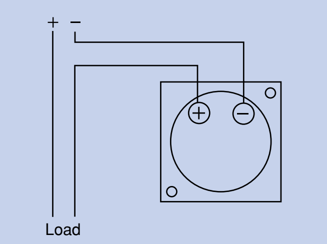
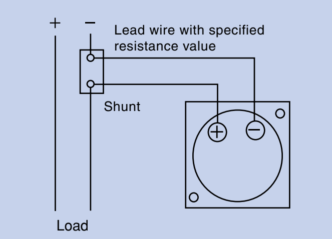


Fig. 2 DC ammeter (combined with shunt)



■Ordering method

The items in [ ] must be specified.

●Indicator combined with shunt

Model name	Indicator rating	Scale	Cover type	Shunt rating + required/not required	Thickness and length of lead wire + required/not-required	Special specifications	Number of units
YM-206NDA	60mV	0-200A	B	SHT 200A 60mV, required	lead wire 3.5mm² 3m, not required	Double scale, colored lines, etc.	10

With lead wire adjustment resistor: VR

●Direct indicators

Model name	Scale	Cover type	Special specifications	Number of units
YM-206NDA	0-20A	B	Double scale, colored lines, etc.	10

DC ammeter combined with shunt

For DC ammeters combined with a shunt, the measured value changes according to the resistance value of the lead wire. Thus, please refer to the following tables and specify the thickness and one-way length or round-trip resistance value of the lead wire connecting the indicator and the shunt.
The lead wire resistance value must be within the “maximum allowable value.”

●Table of maximum allowable values of lead wires for DC ammeters combined with shunts

DC ammeter combined with shunt			Maximum one-way length (m) in the case of a 2mm² lead wire (Mitsubishi Electric standard lead wire)	Maximum one-way length (m) in the case of a 3.5mm² lead wire
Model name	Indicator rating (mV)	Maximum allowable resistance value of lead wire (Ω)		
YM-206NDA, YM-208NDA YM-210NDA YM-8NDA, YM-10NDA	60 or more less than 75	0.72	39	69
	75 or more less than 100	1.55	84	149
	100 or more less than 150	2.37	128	227
	150 or more	4.02	217	384
YM-12NDA	60 or more less than 75	0.40	21	38
	75 or more less than 100	0.90	48	86
	100 or more less than 150	1.40	70	134
	150 or more	2.40	135	230
LM-80NDA LM-110NDA	60 or more less than 75	1.00	54	96
	75 or more less than 100	1.50	80	144
	100 or more less than 150	2.40	135	230
	150 or more	4.00	217	384

Remarks (1) In the case of a bidirectional deflection indicator, the indicator rating is the sum of the absolute values of the respective ratings.
(2) If a lead wire length exceeding the values in the above table is required, use a lead wire with a large cross-sectional area or use a shunt with a high rated voltage.

●Table of round-trip resistance values according to lead wire thicknesses and one-way lengths

One-way length / Cross-sectional area	Round-trip resistance value (Ω) (length: one-way)							Lead wire resistance (Ω/km)
	1m	2m	3m	4m	5m	10m	20m	
1.25mm²	0.033	0.066	0.099	0.132	0.165	0.330	0.660	16.5
2mm²	0.018	0.037	0.055	0.074	0.092	0.184	0.368	9.2
3.5mm²	0.010	0.021	0.031	0.042	0.052	0.104	0.208	5.2
5.5mm²	0.007	0.013	0.020	0.027	0.033	0.066	0.132	3.3

●Lead wires for shunt connection

Lead wires for connecting an indicator with a shunt can be manufactured according to specifications as accessories to the indicator.

The standard is: **two 2mm² - 2m (one-way) 1500V heat-resistant vinyl wires (blue) for electric equipment.**

Remarks (1) Only wires with a cross-sectional area of 2mm² are provided; other types of wires are to be prepared by the customer.

DC ammeter with lead wire adjustment resistor

If a DC ammeter combined with a shunt is to be arranged in advance with the lead wire length being indeterminate, use a DC ammeter with a lead wire adjustment resistor, which can be adjusted according to the lead wire resistance after installation of the indicator.

●Adjustment range of lead wire resistance

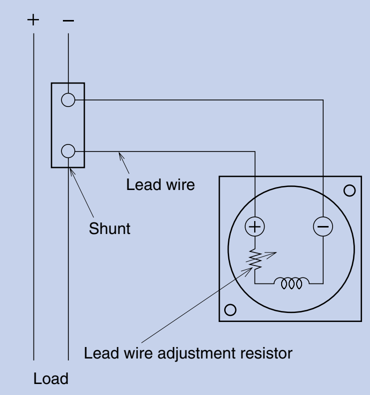
The lead wire resistance adjustment range is the same as the maximum allowable resistance value of lead wire in the “Table of maximum allowable values of lead wires.”

●Adjustment method

●Adjustment by voltage application

Disconnect the lead wires connected to the voltage terminals of the shunt, and adjust with the lead wire adjustment resistor so that the indicator deflects fully when a voltage corresponding to the indicator rating is applied to the respective ends of the lead wires.

DC ammeter with lead wire adjustment resistor



DC Ammeters

Accessories

Shunt for DC ammeter

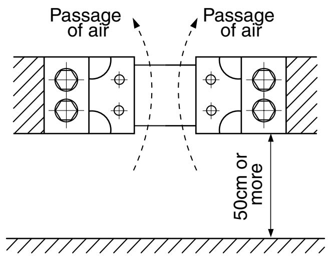
■Specifications

Accuracy	Grade 0.5 Percentage with respect to the rated voltage drop between voltage terminals or the shunt resistance value when the consumption current of the indicator is ignored.
Rated voltage	60mV (standard), 100mV (quasi-standard)
Rated current	1~7500A
Structure	Shunt with base for 150A or less, shunt without base for 200A or more.
Voltage test	3320VAC for 5s (applies only to shunts with base)
Insulation resistance	10MΩ or more at test voltage of 500V (applies only to shunts with base)

Remarks (1) For low-current shunts, the influence of the consumption current may be significant in some cases. If a shunt is ordered separately, it may be necessary to adjust the indicator that is used in combination with it.
(2) Shunts are designed for a temperature rise limit of 80°C at a current that is 80% of the rated current. For this reason, adequate care is required when tightening the bus lines in high-current, large-loss applications.
(3) Shunts with an insulating base can also be manufactured for rated currents greater than 150A and 600A or less.

■Rating selection and mounting

1. **Rating selection**
For the shunt rating, select a current value with adequate allowance, taking into consideration that a shunt is a heat source. (As a general rule, use a shunt for values approximately 1.5 times or more of the continuous operating current.)
2. **Mounting attitude**
Mount the shunt as shown in the diagram.
3. **Voltage terminals**
Two voltage terminals are provided at one side block for shunts with a voltage of 2000A or more. In this case, use the diagonally positioned voltage terminal. (Error may increase by approximately 0.5% when the voltage terminals are used in parallel.)



Vertical mounting for best natural heat radiation

■Outer dimensions

Fig. 1 1~5A (60mV, 100mV)

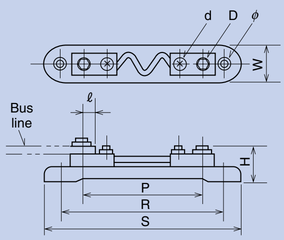


Fig. 2 10~150A (60mV, 100mV)

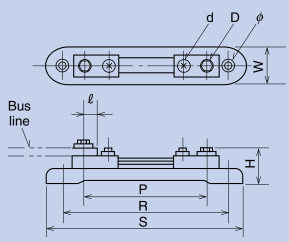


Fig. 3 200~300A (60mV, 100mV)

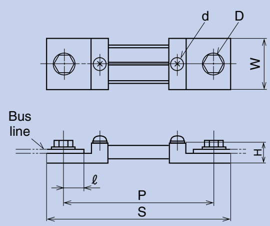


**Fig. 4 400~1000A (60mV)
400~750A (100mV)**

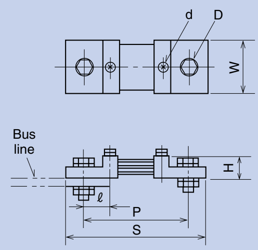


**Fig. 5 1200~1500A (60mV)
1000~1500A (100mV)**

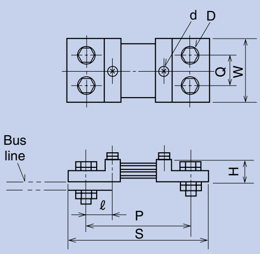


Fig. 6 2000~3000A (60mV, 100mV)

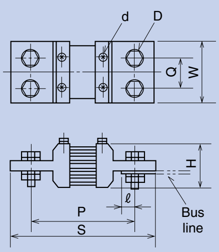
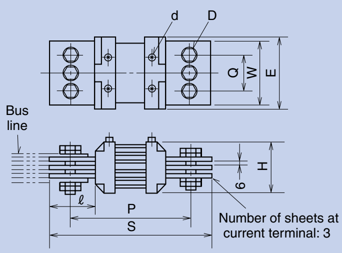


Fig. 7 4000~7500A (60mV, 100mV)



Mechanical Indicators

●Table of dimension variations (rated voltage: 60mV)

Rated current A	Rated voltage mV	Outer dimension drawing No.	Variable dimensions mm: Interval between current terminals P	Q	Current terminal bolt D	Voltage terminal screw d	Block width E	Shunt base mounting hole interval R	Width of shunt (base) W	Shunt base mounting hole diameter ϕ	Height H	Total length S	Contacting part length ℓ	Delivery period classification
1, 2, 3, 5	60	FIG. 1	85	—	M5	M4	—	120	26	4.5	25	140	10	◎
10, 15, 20, 25, 30	60	FIG. 2	85	—	M5	M4	—	120	26	4.5	25	140	10	
40, 50					M6									
60, 75, 100					M8					4.5	30			
150			110					150	30	5.5		175	15	
200	60	FIG. 3	110	—	M8	M4	—	—	33	—	15	135	15	
250						M5			38					
300					M12				43					
400	60	FIG. 4	115	—	M12	M5	—	—	45	—	20	155	35	
500													42.5	
600	60	FIG. 4	130	—	M12	M5	—	—	45	—	30	175	42.5	
750													45	
1000			135						60					
1200	60	FIG. 5	140	35	M12	M5	—	—	70	—	35	185	47	
1500													52.5	
2000	60	FIG. 6	175	45	M12	M5	—	—	85	—	55	230	30	
2500, 3000			180	50					100		70	240		△
4000	60	FIG. 7	180	90	M12	M5	150	—	150	—	80	250	70	△
5000			220								100	280	85	
6000			235				160				110	310	100	
7500												330		

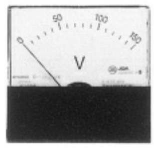
●Table of dimension variations (rated voltage: 100mV)

Rated current A	Rated voltage mV	Outer dimension drawing No.	Variable dimensions mm: Interval between current terminals P	Q	Current terminal bolt D	Voltage terminal screw d	Block width E	Shunt base mounting hole interval R	Width of shunt (base) W	Shunt base mounting hole diameter ϕ	Height H	Total length S	Contacting part length ℓ	Delivery period classification
1, 2, 3, 5	100	FIG. 1	85	—	M5	M4	—	120	26	4.5	25	140	10	△
10, 15, 20, 25, 30		FIG. 2	85	—	M5	M4	—	120	26	4.5	25	140	10	
40, 50					M6						28			
60, 75, 100	100	FIG. 2	125	—	M8	M4	—	180	30	5.5	30	200	10	
150											35			
200	100	FIG. 3	135	—	M8	M4	—	—	33	—	15	165	15	
250						M5			36					
300					M12				43					
400	100	FIG. 4	145	—	M12	M5	—	—	45	—	20	185	35	
500			165	—	M12	M5	—	—	45	—	30	210	42.5	
600														
750			170	—	M12	M5	—	—	60	—	30	210	45	
1000	100	FIG. 5	175	35	M12	M5	—	—	70	—	35	220	47	
1200	100	FIG. 5												
1500			195	40					80		45	250	52.5	
2000	100	FIG. 6	205	45	M12	M5	—	—	85	—	55	260	30	
2500, 3000			210	50					100		70	270		
4000		FIG. 7	210	90	M12	M5	150	—	150	—	80	280	70	
5000			250		M12	M5					100	310	85	
6000		FIG. 7	265				160		150		100	340	100	
7500												360		

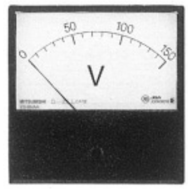
Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

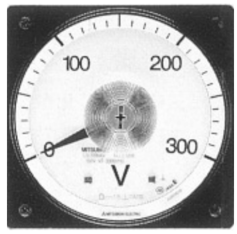
DC Voltmeters



YM-206NDV



YM-8NDV



LM-110NDV

■Specifications

			Rectangular indicators						Wide-angle indicators	
			Y-2N Series			Y-N Series			L-N Series	
Size (width × height) mm			64×60	85×75	100×85	82×82	102×102	122×122	80×80	110×110
Model name			YM-206NDV	YM-208NDV	YM-210NDV	YM-8NDV	YM-10NDV	YM-12NDV	LM-80NDV	LM-110NDV
Operation principle			Movable coil			Movable coil			Movable coil	
Accuracy (grade)			2.5			2.5		1.5	2.5	1.5
Scale length (mm)			55	70	85	70	90	100	124	175
Weight (kg)			0.07	0.1	0.1	0.1	0.15	0.3	0.3	0.4
Indicator rating and delivery period classification: Maximum scale value	Accessory	Delivery period	Consumption current (approx.) (mA)							
1, 3, 5V	—	○	1	1	1	1	1	1	1	1
10, 15, 30V	—	○	1	1	1	1	1	1	1	1
50, 100V	—	○	1	1	1	1	1	1	1	1
150, 300V	—	○	1	1	1	1	1	1	1	1
500, 600V	—	○	(1) Note 1	(1) Note 1	(1) Note 1	1	1	1	1	1
750V	GR-2 multiplier	○	(1) Note 1	(1) Note 1	(1) Note 1	(1) Note 1	(1) Note 1	(1) Note 1	(1) Note 1	(1) Note 1
1000V		○	(1) Note 1	(1) Note 1	(1) Note 1	(1) Note 1	(1) Note 1	(1) Note 1	(1) Note 1	(1) Note 1
1200V	KR-1 3-terminal multiplier	○	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1
1500V		○	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1
1800V		○	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1
2000V		○	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1	(2) Note 1
Page with outer dimensions drawing			35			36			37	

Remarks
(1) If, with a maximum scale of 600V or less, an externally mounted multiplier is desired, the voltmeter will be manufactured with the GR-2 multiplier as an accessory.
(2) Indicators with both positive and negative readings on the scale can be manufactured if the larger of the left and right scales is 2000V or less.
The table above shows whether or not a multiplier is provided.
(3) If a high sensitivity (high input resistance) indicator is desired as a DC voltmeter with a maximum scale of 100V or less, please specify the maximum scale and sensitivity current of the indicator.
Voltmeters can be manufactured with a sensitivity current within the range shown for DC ammeters on p.45.
There may be a maximum difference of approximately ±5% with respect to the value specified for the sensitivity current.
(4) The GR-2 and KR-1 multipliers are dedicated accessories (non-compatible). They can only be used in combination with the indicators specified.
(5) Please make sure to read the “Safety Precautions” (pp.5-8) and the “Selection Precautions” (p.9) to assist in selecting the model and use specifications suited to the application.

Note 1. These voltmeters do not have a JIS mark.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Connection diagrams

Fig. 1 DC voltmeter (direct)

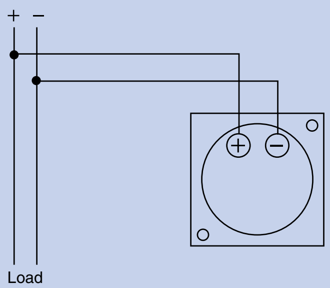


Fig. 2 DC voltmeter (with GR-2 multiplier)

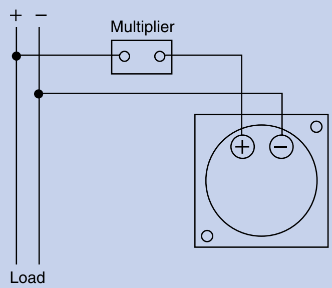
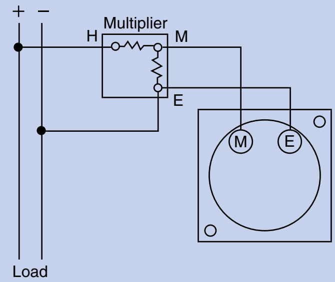


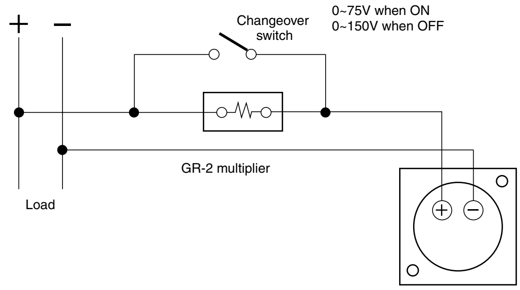
Fig. 3 DC voltmeter (with KR-1 3-terminal multiplier)

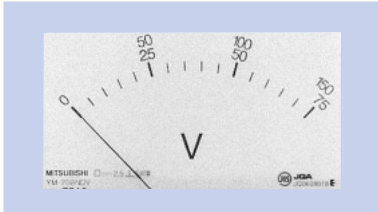


Dual-range indicators

Dual-range indicators with a maximum scale of 600V or less are manufactured with the GR-2 multiplier as an accessory.

[Example] In the case of a dual-range indicator with 0~150V and 0~75V indicator scales.





Example of double rating scale diagram (YM-208NDV)

■Outer dimensions of the accessories

Fig. 1 GR-2 multiplier

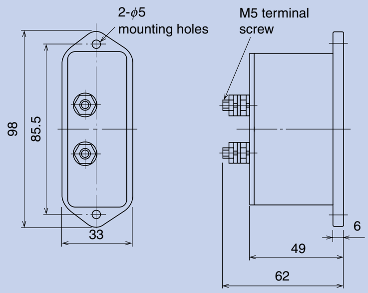
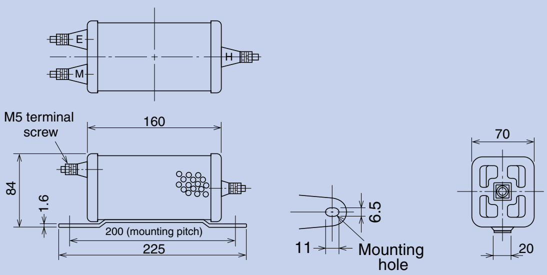


Fig. 3 KR-1 3-terminal multiplier



■Ordering method

The items in [ ] must be specified.

Model name	Multiplier	Scale	Cover type	Special specifications	Number of units
YM-206NDV	GR-2	0-1000V	B	Double scale, colored lines, etc.	10

Specify if a multiplier is to be provided.

AC Ammeters

YS-8NAA

LS-110NAA

■Specifications

	Rectangular indicators												Wide-angle indicators			
	Y-2N Series						Y-N Series						L-N Series			
Size (width × height) mm	64×60		85×75		100×85		82×82		102×102		122×122		80×80		110×110	
Model name	YS-206NAA		YS-208NAA		YS-210NAA		YS-8NAA		YS-10NAA		YS-12NAA		LS-80NAA		LS-110NAA	
Operation principle	Movable iron core						Movable iron core						Movable iron core			
Accuracy (grade)	2.5						2.5				1.5		2.5		1.5	
Frequency	50 and 60Hz															
Scale length (mm)	55		70		85		70		90		100		124		175	
Consumption VA (VA)	1.0		1.0		1.0		1.0		1.0		1.0		2.0		2.0	
Weight (kg)	0.1		0.1		0.15		0.1		0.15		0.3		0.3		0.4	
Indicator rating and delivery period classification: Maximum scale value	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded
Direct indicator: 500mA	○	○	○	○	○	○	○	○	○	○	○	○	—	—	—	—
Direct indicator: 1, 3A	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Direct indicator: 5, 10, 15, 20, 30A	○	◎	○	◎	○	◎	◎	◎	○	◎	◎	○	○	○	◎	◎
Indicator combined with CT: 5/5, 10/5, 15/5, 20/5, 30/5A 40/5, 50/5, 60/5, 75/5A 100/5, 150/5, 200/5, 250/5A 300/5, 400/5, 500/5A	○	◎	○	◎	○	◎	◎	◎	○	○	○	○	○	○	○	○
Indicator combined with CT: Besides the above: /5A (indicator rating 5A)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Indicator combined with CT: Besides the above: /1A (indicator rating 1A)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Page with outer dimensions drawing	35						36						37			

Remarks Please make sure to read the “Safety Precautions” (pp.5-8) and the “Selection Precautions” (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Expanded scale indicator

Use expanded scale indicators in motor circuits or other locations where overcurrents flow temporarily.
The effective measurement range is up to the indicator rating value (1x value). The expanded scale part is for reference only, and the scale numerals are indicated in red.

Remarks Ensure that a current exceeding the rating is applied such that (the applied current (A)/rated current (A))^2×application duration does not exceed 500.

Example of expanded scale diagram (YS-206NAA)

■Specifications

	Rated scale value	Expanded scale value		
		Expanded 2x	Expanded 3x	Expanded 5x
Direct	1A	2A	3A	5A
Direct	3A	6A	9A	15A
Direct	5A	10A	15A	25A
Direct	10A	20A	30A	50A
Direct	15A	30A	45A	75A
Direct	20A	40A	60A	—
Direct	30A	60A	90A	—
Combined with CT	Indicator rating: 5A	CT ratio×10A	CT ratio×15A	CT ratio×25A
Combined with CT	Indicator rating: 1A	CT ratio×2A	CT ratio×3A	CT ratio×5A

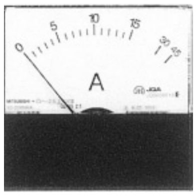
●Mitsubishi Electric uses a three-fold expanded scale indicator as the standard specification.

●Recommended ammeter scale values for motor circuits

200V 3-phase induction motor

Motor output (kW)	Rated current (reference value A)	Recommended scale	
		Ammeter scale (Expanded 3x)	CT ratio
0.2	1.8	0-3-9A	—
0.4	3.2	0-5-15A	5/5A
0.75	4.8	0-7.5-22.5A	7.5/5A
1.5	8	0-10-30A	10/5A
2.2	11.1	0-15-45A	15/5A
3.7	17.4	0-25-75A	20/5A
5.5	26	0-30-90A	30/5A
7.5	34	0-50-150A	40/5A
11	48	0-60-180A	60/5A
15	65	0-75-225A	75/5A
18.5	79	0-100-300A	100/5A
22	93	0-120-360A	120/5A
30	125	0-150-450A	150/5A
37	160	0-200-600A	200/5A

Uniform scale



YR-206NAA

YR-8NAA

■Specifications

	Rectangular indicators												Wide-angle indicators			
	Y-2N Series						Y-N Series						L-N Series			
Size (width × height) mm	64×60		85×75		100×82		82×82		102×102		122×122		80×80		110×110	
Model name	YR-206NAA		YR-208NAA		YR-210NAA		YR-8NAA		YR-10NAA		YR-12NAA		LR-80NAA		LR-110NAA	
Operation principle	Rectifier						Rectifier						Rectifier			
Accuracy (grade)	2.5						2.5				1.5		2.5		1.5	
Frequency	50 and 60Hz															
Scale length (mm)	55		70		85		70		90		100		124		175	
Weight (kg)	0.1		0.1		0.15		0.1		0.15		0.3		0.3		0.5	
Indicator rating: Maximum scale value	Consumption VA or voltage drop															
	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded
Direct indicator (Note 1): 200, 300μA	—	—	1.7V	—	1.7V	—	1.7V	—	1.7V	—	1.7V	—	—	—	—	—
Direct indicator (Note 1): 500μA	1.4V	—	1.4V	—	1.4V	—	1.4V	—	1.4V	—	1.4V	—	—	—	—	—
Direct indicator (Note 1): 1, 3, 5mA	1.4V	—	1.4V	—	1.4V	—	1.4V	—	1.4V	—	1.4V	—	1.4V	—	1.4V	—
Direct indicator (Note 1): 10, 20, 30, 50, 75mA	1.2V	—	1.2V	—	1.2V	—	1.2V	—	1.2V	—	1.2V	—	1.2V	—	1.2V	—
Direct indicator: 100, 200, 500mA	0.06VA	0.3VA	0.06VA	0.3VA	0.06VA	0.3VA	0.06VA	0.3VA	0.06VA	0.3VA	0.06VA	0.3VA	0.2VA	0.2VA	0.2VA	0.2VA
Direct indicator: 1, 3A	0.06VA	0.3VA	0.06VA	0.3VA	0.06VA	0.3VA	0.06VA	0.3VA	0.06VA	0.3VA	0.06VA	0.3VA	0.2VA	0.2VA	0.2VA	0.2VA
Direct indicator: 5, 10, 15, 20A	0.1VA	0.3VA	0.1VA	0.3VA	0.1VA	0.3VA	0.1VA	0.3VA	0.1VA	0.3VA	0.1VA	0.3VA	0.2VA	0.2VA	0.2VA	0.2VA
Direct indicator: 30A	0.2VA	—	0.2VA	—	0.2VA	—	0.2VA	—	0.2VA	—	0.2VA	—	0.2VA	0.2VA	0.2VA	0.2VA
Indicator combined with CT: /5A (indicator rating 5A)	0.1VA	0.3VA	0.1VA	0.3VA	0.1VA	0.3VA	0.1VA	0.3VA	0.1VA	0.3VA	0.1VA	0.3VA	0.2VA	0.2VA	0.2VA	0.2VA
Indicator combined with CT: /1A (indicator rating 1A)	0.06VA	0.3VA	0.06VA	0.3VA	0.06VA	0.3VA	0.06VA	0.3VA	0.06VA	0.3VA	0.06VA	0.3VA	0.2VA	0.2VA	0.2VA	0.2VA
Delivery period classification	○		○		○		○		○		○		○		○	
Page with outer dimensions drawing	35						36						37			

Remarks
(1) Error may occur due to waveform distortion.
(2) LR-110NAA and LR-80NAA models rated 100mA to 30A incorporate an approximate effective value rectifying circuit.
(3) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Note 1. The operating circuit voltage is 300V or less for the Y-2N Series, and 600V or less for the Y-N Series and L-N Series.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Connection diagrams

Fig. 1 AC ammeter (direct)

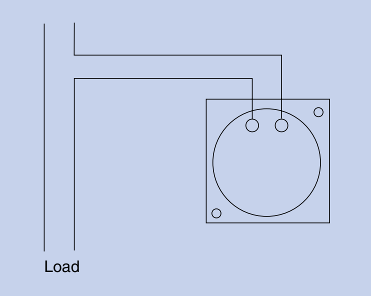


Fig. 2 AC ammeter (combined with CT)

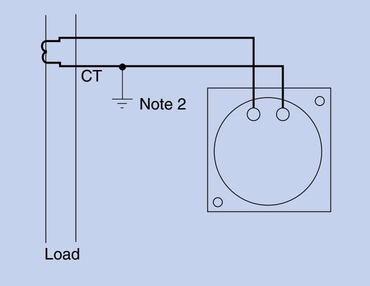
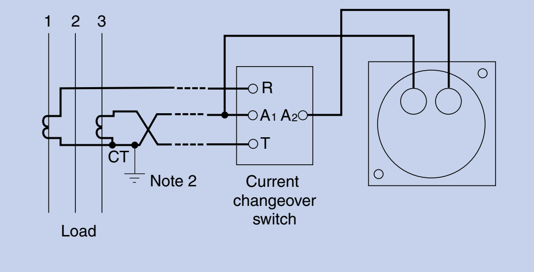


Fig. 3 AC ammeter (combination with 3-phase circuit current changeover switch)



Note 2. For low-voltage circuits, grounding of the secondary side of the current transformer is unnecessary.

■Ordering method

The items in [ ] must be specified.

●Indicator combined with current transformer

Model name	Indicator rating	Scale	CT ratio	Cover type	Special specifications	Number of units
YS-8NAA	5A	0-100-300A	100/5A	BR	Double scale, colored lines, etc.	5

●Direct indicators

Model name	Indicator rating	Scale	Cover type	Special specifications	Number of units
YS-8NAA	20A	0-20-60A	GR	Double scale, colored lines, etc.	5

AC Voltmeters

YS-8NAV

LS-110NAV

■Specifications

		Rectangular indicators						Wide-angle indicators	
		Y-2N Series			Y-N Series			L-N Series	
Size (width × height) mm		64×60	85×75	100×85	82×82	102×102	122×122	80×80	110×110
Model name		YS-206NAV	YS-208NAV	YS-210NAV	YS-8NAV	YS-10NAV	YS-12NAV	LS-80NAV	LS-110NAV
Operation principle		Movable iron core			Movable iron core			Movable iron core	
Accuracy (grade)		2.5			2.5		1.5	2.5	1.5
Frequency		50 and 60Hz							
Scale length (mm)		55	70	85	70	90	100	124	175
Consumption VA (VA)		3	3	3	3	3	6	3	3
Weight (kg)		0.1	0.1	0.15	0.15	0.15	0.4	0.4	0.5
Indicator rating: Maximum scale value		Delivery period classification							
Direct indicator	50V	○	○	○	○	○	○	—	—
Direct indicator	75, 100, 110V	○	○	○	○	○	○	—	—
Direct indicator	150V	◎	○	○	◎	○	○	◎	◎
Direct indicator	190, 260V	○	○	○	○	○	○	—	—
Direct indicator	300V	◎	◎	◎	◎	◎	◎	◎	◎
Direct indicator	400, 500V	—	—	—	—	—	○	—	—
Direct indicator	600V	—	—	—	—	—	◎	○	○
Indicator combined with VT: VT ratio	Scale								
440/110V	600V	○	○	○	◎	◎	◎	○	◎
3300/110V	4500V								
6600/110V	9000V								
Besides the above □/110V	VT ratio × 150V	○	○	○	○	○	○	○	○
Page with outer dimensions drawing		35			36			37	

Remarks (1) A specially rated AC voltmeter with a rectifier indicator and a maximum scale of 600V or less is manufactured.
(2) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Note 1. The LS-110NAV and LS-NAV direct 600V indicators are provided with the KR-1 multiplier as an accessory (power consumption is approximately 6VA). The KR-1 multiplier is a dedicated accessory (non-compatible accessory), and thus cannot be used in combinations other than those designated for the indicators.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Connection diagrams

Fig. 1 AC voltmeter (direct)

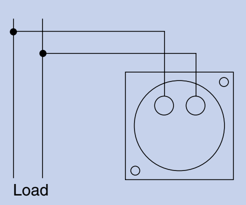


Fig. 2 AC voltmeter (combined with VT)

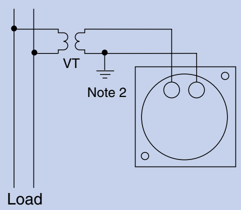


Fig. 3 AC voltmeter (with KR-1 type resistor)

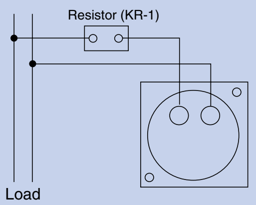
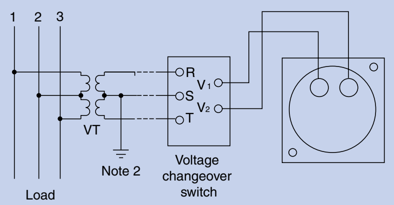


Fig. 4 AC voltmeter (combination with 3-phase circuit voltage changeover switch)



Note 2. For low-voltage circuits, grounding of the secondary side of the instrument voltage transformer is unnecessary.

■Ordering method

The items in [ ] must be specified.

●**Indicator combined with instrument voltage transformer**

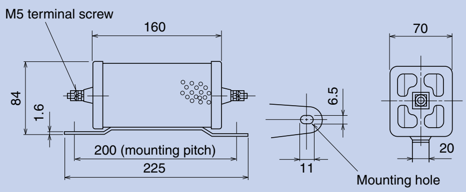
Model name	Indicator rating	Scale	VT ratio	Cover type	Special specifications	Number of units
YS-8NAV	150V	0-9000V	6600/110V	B	Double scale, colored lines, etc.	10

●**Direct indicator**

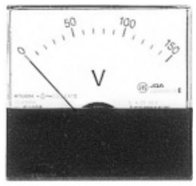
Model name	Indicator rating	Scale	Cover type	Special specifications	Number of units
YS-8NAV	300V	0-300V	B	Double scale, colored lines, etc.	10

■Outer dimensions of accessory

KR-1 multiplier



Uniform scale



YR-206NAV

YR-8NAV

■Specifications

	Rectangular indicators												Wide-angle indicators			
	Y-2N Series						Y-N Series						L-N Series			
Size (width × height) mm	64×60		85×75		100×85		82×82		102×102		122×122		80×80		110×110	
Model name	YR-206NAV		YR-208NAV		YR-210NAV		YR-8NAV		YR-10NAV		YR-12NAV		LR-80NAV		LR-110NAV	
Operation principle	Rectifier						Rectifier						Rectifier			
Accuracy (grade)	2.5						2.5				1.5		2.5		1.5	
Frequency	50 and 60Hz															
Scale length (mm)	55		70		85		70		90		100		124		175	
Weight (kg)	0.07		0.1		0.1		0.1		0.15		0.5		0.4		0.5	
Indicator rating	Consumption current and delivery period classification															
Maximum scale value	Consumption	Delivery period	Consumption	Delivery period	Consumption	Delivery period	Consumption	Delivery period	Consumption	Delivery period	Consumption	Delivery period	Consumption	Delivery period	Consumption	Delivery period
Direct indicator 5, 10, 30V	1mA	○	1mA	○	1mA	○	1mA	○	1mA	○	1mA	○	0.1VA	○	0.1VA	○
50V	1mA	○	1mA	○	1mA	○	1mA	○	1mA	○	1mA	○	0.2VA	○	0.2VA	○
75, 100, 110V	1mA	○	1mA	○	1mA	○	1mA	○	1mA	○	1mA	○	0.5VA	○	0.5VA	○
150V	2mA	○	2mA	○	2mA	○	2mA	○	2mA	○	2mA	○	0.6VA	○	0.6VA	○
190, 260V	1mA	○	1mA	○	1mA	○	1mA	○	1mA	○	1mA	○	1.2VA	○	1.2VA	○
300V	2mA	○	2mA	○	2mA	○	2mA	○	2mA	○	2mA	○	1.2VA	○	1.2VA	○
400, 500, 600V	(1mA) (Note 1)	○	(1mA) (Note 1)	○	(1mA) (Note 1)	○	1mA	○	1mA	○	1mA	○	0.6VA	○	0.6VA	○
Combined with VT: VT ratio×150V	2mA	○	2mA	○	2mA	○	2mA	○	2mA	○	2mA	○	0.6VA	○	0.6VA	○
Page with outer dimensions drawing	35						36						37			

Remarks (1) Although the scale of the rectifier AC voltmeter is substantially uniform with an indicator having a maximum scale value of 10V or less, the divisions are slightly reduced near "0".
(2) Error may occur due to waveform distortion.
(3) LR-110NAV and LR-80NAV models rated 75V to 300V incorporate an approximate effective value rectifying circuit.
(4) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Note 1. These models do not have a JIS mark.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Mechanical Indicators

Wattmeters

YP-208NW

YP-10NW

■Specifications

	Rectangular indicators				
	Y-2N Series			Y-N Series	
Size (width × height) mm	64×60	85×75	100×85	82×82	102×102
Model name	YP-206NW	YP-208NW	YP-210NW	YP-8NW	YP-10NW
Operation principle	Transducer			Transducer	
Accuracy (grade)	2.5			2.5	
Frequency	50 and 60Hz				
Scale length (mm)	55	70	85	70	90
Weight (kg)	0.07	0.1	0.1	0.1	0.15

Indicator rating and delivery period classification (Y-2N Series)

Circuit	Rating: Secondary rating	Rating: Indicator rating (Po) kW	YP-206NW Consumption VA: Voltage circuit	YP-206NW Current circuit I1 / I3	YP-206NW Current circuit I2	YP-206NW Accessory	YP-206NW Delivery period classification	YP-208NW Consumption VA: Voltage circuit	YP-208NW Current circuit I1 / I3	YP-208NW Current circuit I2	YP-208NW Accessory	YP-208NW Delivery period classification	YP-210NW Consumption VA: Voltage circuit	YP-210NW Current circuit I1 / I3	YP-210NW Current circuit I2	YP-210NW Accessory	YP-210NW Delivery period classification
1-phase 2-wire	110V 5A	0.4~0.6	2.2	1.0		T-150	○	2.2	1.0		T-150	○	2.2	1.0		T-150	○
1-phase 2-wire	220V 5A	0.8~1.2	4.4	1.0		T-150	○	4.4	1.0		T-150	○	4.4	1.0		T-150	○
1-phase 3-wire	100/200V 5A	0.8~1.2	1.6	0.5		T-150	○	1.6	0.5		T-150	○	1.6	0.5		T-150	○
3-phase 3-wire	110V 5A	0.8~1.2	1.6	0.5		T-150	○	1.6	0.5		T-150	○	1.6	0.5		T-150	○
3-phase 3-wire	220V 5A	1.6~2.4	3.2	0.5		T-150	○	3.2	0.5		T-150	○	3.2	0.5		T-150	○
3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V 5A	0.8~1.2	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	T-150	○
3-phase 4-wire	110/190V 5A	1.4~2.0	2.8	0.5	1.0	T-150	○	2.8	0.5	1.0	T-150	○	2.8	0.5	1.0	T-150	○
3-phase 4-wire	220/380V 5A	2.8~4.0	3.5	0.5	1.0	T-150	○	3.5	0.5	1.0	T-150	○	3.5	0.5	1.0	T-150	○

Indicator rating and delivery period classification (Y-N Series)

Circuit	Rating: Secondary rating	Rating: Indicator rating (Po) kW	YP-8NW Consumption VA: Voltage circuit	YP-8NW Current circuit I1 / I3	YP-8NW Current circuit I2	YP-8NW Accessory	YP-8NW Delivery period classification	YP-10NW Consumption VA: Voltage circuit	YP-10NW Current circuit I1 / I3	YP-10NW Current circuit I2	YP-10NW Accessory	YP-10NW Delivery period classification
1-phase 2-wire	110V 5A	0.4~0.6	2.2	1.0		T-150	○	2.2	1.0		T-150	○
1-phase 2-wire	220V 5A	0.8~1.2	4.4	1.0		T-150	○	4.4	1.0		T-150	○
1-phase 3-wire	100/200V 5A	0.8~1.2	1.6	0.5		T-150	○	1.6	0.5		T-150	○
3-phase 3-wire	110V 5A	0.8~1.2	1.6	0.5		T-150	○	1.6	0.5		T-150	○
3-phase 3-wire	220V 5A	1.6~2.4	3.2	0.5		T-150	○	3.2	0.5		T-150	○
3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V 5A	0.8~1.2	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	T-150	○
3-phase 4-wire	110/190V 5A	1.4~2.0	2.8	0.5	1.0	T-150	○	2.8	0.5	1.0	T-150	○
3-phase 4-wire	220/380V 5A	2.8~4.0	3.5	0.5	1.0	T-150	○	3.5	0.5	1.0	T-150	○

	Y-2N Series	Y-N Series
Page with outer dimensions drawing	35	36

Remarks (1) In regards to "Indicator rating (Po) kW" in the "Rating" column:

1-phase, 2-wire wattmeters
- Po=110V×5A=550≃0.5kW (Po=0.4 to 0.6kW, taking into account adjustment range multiplying factors of 0.8 to 1.2)
- Po=220V×5A=1100≃1.0kW (Po=0.8 to 1.2kW, taking into account adjustment range multiplying factors of 0.8 to 1.2)

3-phase, 3-wire wattmeters
- Po=√3×110V×5A=953≃1kW (Po=0.8 to 1.2kW, taking into account adjustment range multiplying factors of 0.8 to 1.2)
- Po=√3×220V×5A=1906≃2kW (Po=1.6 to 2.4kW, taking into account adjustment range multiplying factors of 0.8 to 1.2)

3-phase, 4-wire wattmeters
- Po=3×$\frac{110}{\sqrt{3}}$V×5A=√3×110V×5A=953≃1kW (Po=0.8 to 1.2kW, taking into account adjustment range multiplying factors of 0.8 to 1.2)
- Po=3×110V×5A=√3×190V×5A=1650≃1.7kW (Po=1.4 to 2.0kW, taking into account adjustment range multiplying factors of 0.8 to 1.2)
- Po=3×220V×5A=√3×380V×5A=3300≃3.4kW (Po=2.8 to 4.0kW, taking into account adjustment range multiplying factors of 0.8 to 1.2)

(2) Bidirectional deflection indicators can also be manufactured.
(3) Models with a 1A current rating can also be manufactured; the power consumption is basically the same as that of a 5A model. The indicator rating value in this case is calculated by substituting 1A in place of 5A in the equations of Remarks (1).
(4) The T-150 rectifier is a dedicated accessory (non-compatible accessory), and thus cannot be used in combinations other than those designated for the indicators. The distance between the indicator and the T-150 rectifier must be 5m or less, or the round-trip lead wire resistance must be 0.5Ω or less.
(5) The weight of the T-150 accessory rectifier is approximately 1kg.
(6) Use a wattmeter with an input voltage in the range of 85 to 115% of the rated value (rated voltage ±15%). The indication may be unstable when used with an input voltage of 85% or less of the rating or the input voltage is switched on and off.
(7) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

●Scale calculation formula for wattmeter

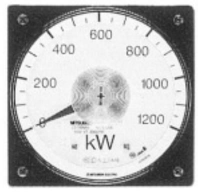
Phase-wire system	Secondary rating	Scale calculation formula for wattmeter	Remarks
1-phase 2-wire	110V 5A	Indicator scale P (kW)=VT ratio × CT ratio × Po (0.4~0.6)	●The value at the left is multiplied by 1/5 in the case of a CT secondary current of 1A.
	220V 5A	Indicator scale P (kW)=CT ratio × Po (0.8~1.2)	
1-phase 3-wire	100/200V 5A	Indicator scale P (kW)=CT ratio × Po (0.8~1.2)	
3-phase 3-wire	110V 5A	Indicator scale P (kW)=VT ratio × CT ratio × Po (0.8~1.2)	
	220V 5A	Indicator scale P (kW)=CT ratio × Po (1.6~2.4)	
3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V 5A	Indicator scale P (kW)=VT ratio × CT ratio × Po (0.8~1.2)	
	110/190V 5A	Indicator scale P (kW)=VT ratio × CT ratio × Po (1.4~2.0)	
	220/380V 5A	Indicator scale P (kW)=VT ratio × CT ratio × Po (2.8~4.0)	

Calculation example: In the case of a 3-phase, 3-wire circuit, VT 6600/110V and CT 100/5A

$$\text{Indicator scale P (kW)}=\frac{6600}{110}\times\frac{100}{5}\times\text{Po }(0.8\sim1.2) = 960\sim1440\text{kW}$$

Therefore, wattmeters can be manufactured with a scale of 960–1440kW.
This varies slightly according to the rating. Refer to the Wattmeter Scale Selection Reference Table on p.58 for details.

YP-12NW



LP-110NW

■Specifications

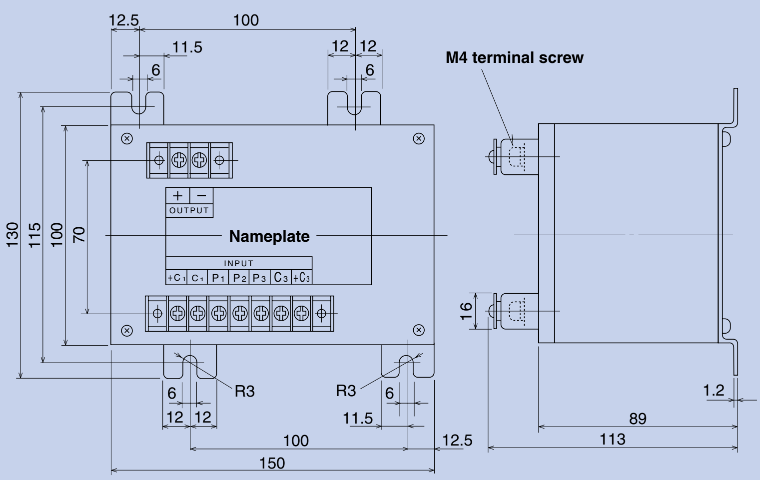
				Rectangular indicators					Wide-angle indicators									
				Y-N Series					L-N Series									
Size (width × height) mm				122×122					80×80					110×110				
Model name				YP-12NW					LP-80NW					LP-110NW				
Operation principle				Transducer					Transducer									
Accuracy (grade)				1.5					2.5					1.5				
Frequency				50 and 60Hz														
Scale length (mm)				100					124					175				
Weight (kg)				0.5					0.3					0.6				
Indicator rating and delivery period classification	Circuit	Rating		Consumption VA			Accessory	Delivery period classification	Consumption VA			Accessory	Delivery period classification	Consumption VA			Accessory	Delivery period classification
		Secondary rating	Indicator rating (Po) kW	Voltage circuit	Current circuit I1 I3	Current circuit I2			Voltage circuit	Current circuit I1 I3	Current circuit I2			Voltage circuit	Current circuit I1 I3	Current circuit I2		
	1-phase 2-wire	110V 5A	0.4~0.6	2.2	1.0		—	○	2.2	1.0		T-150	○	2.2	1.0		—	○
		220V 5A	0.8~1.2	4.4	1.0		—	○	4.4	1.0		T-150	○	4.4	1.0		—	○
	1-phase 3-wire	100/200V 5A	0.8~1.2	1.6	0.5		—	○	1.6	0.5		T-150	○	1.6	0.5		—	○
	3-phase 3-wire	110V 5A	0.8~1.2	1.6	0.5		—	○	1.6	0.5		T-150	○	1.6	0.5		—	○
		220V 5A	1.6~2.4	3.2	0.5		—	○	3.2	0.5		T-150	○	3.2	0.5		—	○
	3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V 5A	0.8~1.2	1.6	0.5	1.0	—	○	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	—	○
		110/190V 5A	1.4~2.0	2.8	0.5	1.0	—	○	2.8	0.5	1.0	T-150	○	2.8	0.5	1.0	—	○
		220/380V 5A	2.8~4.0	3.5	0.5	1.0	—	○	3.5	0.5	1.0	T-150	○	3.5	0.5	1.0	—	○
Page with outer dimensions drawing				36					37									

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Outer dimensions of accessories

T-150 rectifier (for wattmeter)



●Terminal configuration

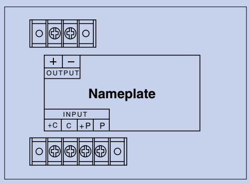


Fig. 1 For 1-phase, 2-wire system

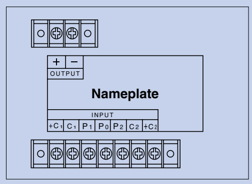


Fig. 2 For 1-phase, 3-wire system

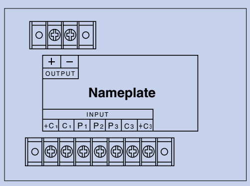


Fig. 3 For 3-phase, 3-wire system

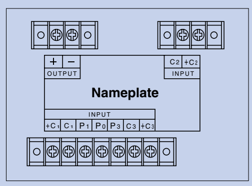


Fig. 4 For 3-phase, 4-wire system

■Ordering method

The items in [ ] must be specified.

Model name	Phase-wire system	Indicator rating	Scale	VT ratio	CT ratio	Cover type	Special specifications	Number of units
YP-12NW	3P3W	110V 5A	0-2400kW	6600/110V	200/5A	B	Double scale, colored lines, etc.	2

(Bidirectional deflection indicator)

-2400-0-2400kW

Wattmeters

■Connection diagrams

●1-phase, 2-wire system

Fig. 1 YP-206NW, YP-208NW, YP-210NW, YP-8NW, YP-10NW and LP-80NW (combined with CT)

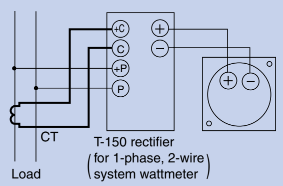


Fig. 2 YP-206NW, YP-208NW, YP-210NW, YP-8NW, YP-10NW and LP-80NW (combined with VT and CT)

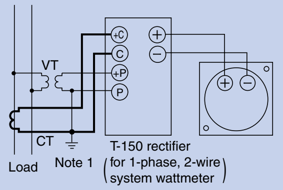


Fig. 3 YP-12NW and LP-110NW (combined with CT)

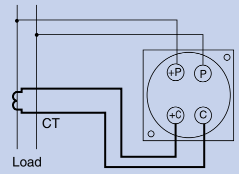
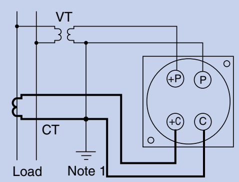


Fig. 4 YP-12NW and LP-110NW (combined with VT and CT)



●1-phase, 3-wire system

Fig. 5 YP-206NW, YP-208NW, YP-210NW, YP-8NW, YP-10NW and LP-80NW (combined with CT)

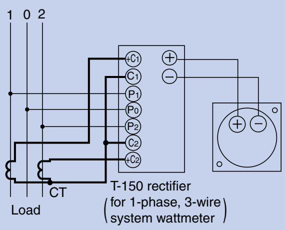
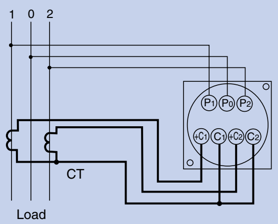


Fig. 6 YP-12NW and LP-110NW (combined with CT)



●3-phase, 3-wire system

Fig. 7 YP-206NW, YP-208NW, YP-210NW, YP-8NW, YP-10NW and LP-80NW (combined with CT)

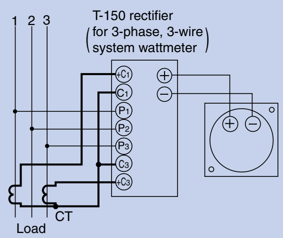


Fig. 8 YP-206NW, YP-208NW, YP-210NW, YP-8NW, YP-10NW and LP-80NW (combined with VT and CT)

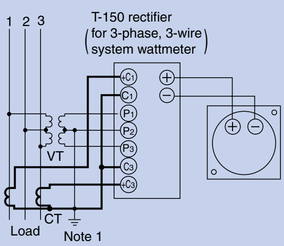


Fig. 9 YP-12NW and LP-110NW (combined with CT)

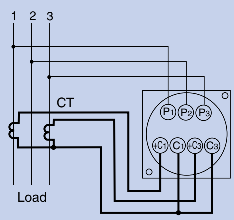
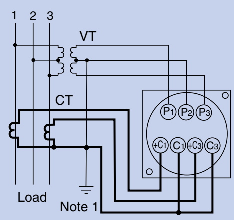


Fig. 10 YP-12NW and LP-110NW (combined with VT and CT)



●3-phase, 4-wire system

Fig. 11 YP-206NW, YP-208NW, YP-210NW, YP-8NW, YP-10NW and LP-80NW (combined with CT)

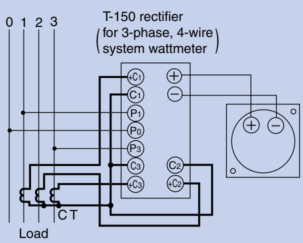


Fig. 12 YP-206NW, YP-208NW, YP-210NW, YP-8NW, YP-10NW and LP-80NW (combined with VT and CT)

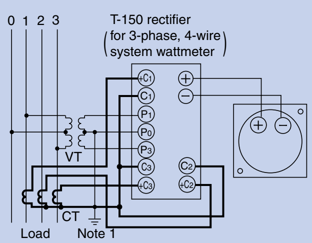


Fig. 13 YP-12NW and LP-110NW (combined with CT)

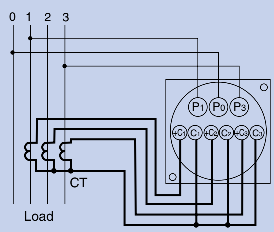
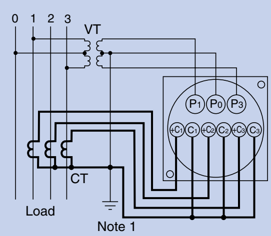


Fig. 14 YP-12NW and LP-110NW (combined with VT and CT)



Note 1. For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

■Wattmeter Scale Selection Reference Table

Although the maximum scale of a wattmeter can be determined by VT ratio × CT ratio × indicator rating (Po), the following table shows the manufacturable scale values (minimum, standard and maximum) for various VT ratios and CT ratios.
If a scale value other than the standard value is desired, please specify a suitable scale within the manufacturable range.

●Table of manufacturable maximum scales for wattmeters

: Scale units kW : Scale units MW

Phase-wire system		1-phase 2-wire			1-phase 3-wire	3-phase 3-wire/3-phase 4-wire								
CT ratio	Manufacturable range \ Voltage	110	220	440	100/200	110	220	440	3300	6600	11000	22000	33000	66000
	VT ratio	—	220/110	440/110	—	—	220/110	440/110	3300 /110	6600 /110	11000 /110	22000 /110	33000 /110	66000 /110
25/5	Minimum	2	4	8	4	4	8	15	120	240	400	800	1200	2400
	Standard	2.5	5	10	5	5	10	20	150	300	500	1000	1500	3000
	Maximum	3	6	12	6	6	12	25	180	350	600	1200	1800	3500
50/5	Minimum	4	8	15	8	8	15	30	240	450	800	1500	2400	4500
	Standard	5	10	20	10	10	20	40	300	600	1000	2000	3000	6000
	Maximum	6	12	25	12	12	25	50	350	750	1200	2500	3500	7500
75/5	Minimum	6	12	24	12	12	24	45	350	700	1200	2400	3500	7000
	Standard	7.5	15	30	15	15	30	60	450	900	1500	3000	4500	9000
	Maximum	9	18	35	18	18	35	75	500	1000	1800	3500	5000	10
100/5	Minimum	8	15	30	15	15	30	60	450	900	1500	3000	4500	9000
	Standard	10	20	40	20	20	40	80	600	1200	2000	4000	6000	12
	Maximum	12	24	50	24	25	50	100	750	1500	2500	5000	7500	15
150/5	Minimum	12	24	45	24	24	45	90	700	1400	2400	4500	7000	14
	Standard	15	30	60	30	30	60	120	900	1800	3000	6000	9000	18
	Maximum	18	35	75	35	35	75	150	1000	2000	3500	7500	10	20
200/5	Minimum	16	30	60	30	30	60	120	900	1800	3000	6000	9000	18
	Standard	20	40	80	40	40	80	160	1200	2400	4000	8000	12	24
	Maximum	25	50	100	50	50	100	180	1500	3000	5000	10	15	30
300/5	Minimum	24	45	90	45	45	90	180	1400	2800	4500	9000	14	28
	Standard	30	60	120	60	60	120	240	1800	3600	6000	12	18	36
	Maximum	35	75	150	75	75	150	300	2000	4000	7500	15	20	40
400/5	Minimum	30	60	120	60	60	120	250	1800	3800	6000	12	18	38
	Standard	40	80	160	80	80	160	320	2400	4800	8000	16	24	48
	Maximum	50	100	180	100	100	180	350	3000	6000	10	18	30	60
600/5	Minimum	45	90	180	90	90	180	380	2800	6000	9000	18	28	60
	Standard	60	120	240	120	120	240	480	3600	7200	12	24	36	72
	Maximum	75	150	300	150	150	300	600	4000	8500	15	30	40	85
800/5	Minimum	60	120	250	120	120	250	500	3800	7500	12	25	38	75
	Standard	80	160	320	160	160	320	640	4800	9600	16	32	48	96
	Maximum	100	180	350	180	180	350	750	6000	12	18	35	60	120
1200/5	Minimum	90	180	380	180	180	380	750	6000	12	18	38	60	120
	Standard	120	240	480	240	240	480	960	7200	14	24	48	72	140
	Maximum	150	300	600	300	300	600	1200	8500	18	30	60	85	180
1500/5	Minimum	120	240	450	240	240	450	900	7000	14	24	45	70	140
	Standard	150	300	600	300	300	600	1200	9000	18	30	60	90	180
	Maximum	180	350	750	350	350	750	1500	10	20	35	70	100	200
2000/5	Minimum	160	300	600	300	300	600	1200	9000	18	30	60	90	180
	Standard	200	400	800	400	400	800	1600	12	24	40	80	120	240
	Maximum	240	500	1000	500	500	1000	1800	15	30	50	100	150	300
3000/5	Minimum	240	450	900	450	450	900	1800	14	28	45	90	140	280
	Standard	300	600	1200	600	600	1200	2400	18	36	60	120	180	360
	Maximum	350	750	1500	750	750	1500	3000	20	40	75	150	200	400

Note 1. Some of the maximum scale values in the table deviate from the VT ratio × CT ratio × adjustment range multiplying factor. This is because the best values are selected, and the values in the table are given priority.

Varmeters

YP-208NVAR

YP-10NVAR

■Specifications

				Rectangular indicators																								
				Y-2N Series															Y-N Series									
Size (width × height) mm				64×60					85×75					100×85					82×82					102×102				
Model name				YP-206NVAR					YP-208NVAR					YP-210NVAR					YP-8NVAR					YP-10NVAR				
Operation principle				Transducer															Transducer									
Accuracy (grade)				2.5															2.5									
Frequency				50 and 60Hz																								
Scale length (mm)				55					70					85					70					90				
Weight (kg)				0.07					0.1					0.1					0.1					0.15				
Indicator rating and delivery period classification	Circuit	Rating		Consumption VA			Accessory	Delivery period classification	Consumption VA			Accessory	Delivery period classification	Consumption VA			Accessory	Delivery period classification	Consumption VA			Accessory	Delivery period classification	Consumption VA			Accessory	Delivery period classification
				Voltage circuit	Current circuit				Voltage circuit	Current circuit				Voltage circuit	Current circuit				Voltage circuit	Current circuit				Voltage circuit	Current circuit			
		Secondary rating	Indicator rating (Po) kvar		I_1 I_3	I_2				I_1 I_3	I_2				I_1 I_3	I_2				I_1 I_3	I_2				I_1 I_3	I_2		
	3-phase 3-wire	110V 5A	0.8~1.2	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	T-150	○
	3-phase 3-wire	220V 5A	1.6~2.4	3.2	0.5	1.0	T-150	○	3.2	0.5	1.0	T-150	○	3.2	0.5	1.0	T-150	○	3.2	0.5	1.0	T-150	○	3.2	0.5	1.0	T-150	○
	3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V 5A	0.8~1.2	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	T-150	○
	3-phase 4-wire	110/190V 5A	1.4~2.0	2.8	0.5	1.0	T-150	○	2.8	0.5	1.0	T-150	○	2.8	0.5	1.0	T-150	○	2.8	0.5	1.0	T-150	○	2.8	0.5	1.0	T-150	○
Page with outer dimensions drawing				35															36									

Remarks (1) The varmeters are bidirectional deflection indicators. Unidirectional deflection indicators can be manufactured upon request.

(2) In regards to "Indicator rating (Po) kvar" in the "Rating" column:

3-phase, 3-wire varmeters

$Po=\sqrt{3}\times 110V\times 5A=953\simeq 1kvar$ (Po=0.8 to 1.2kvar, taking into account adjustment range multiplying factors of 0.8 to 1.2)

$Po=\sqrt{3}\times 220V\times 5A=1906\simeq 2kvar$ (Po=1.6 to 2.4kvar, taking into account adjustment range multiplying factors of 0.8 to 1.2)

3-phase, 4-wire varmeters

$Po=3\times \frac{110}{\sqrt{3}}V\times 5A=\sqrt{3}\times 110V\times 5A=953\simeq 1kvar$ (Po=0.8 to 1.2kvar, taking into account adjustment range multiplying factors of 0.8 to 1.2)

$Po=3\times 110V\times 5A=\sqrt{3}\times 190V\times 5A=1650\simeq 1.7kvar$ (Po=1.4 to 2.0kvar, taking into account adjustment range multiplying factors of 0.8 to 1.2)

(3) Regarding the maximum scale of a varmeter

- With a bidirectional deflection indicator, the left side is LEAD and the right side is LAG with respect to "zero" as the central division, and the standard scale indicates up to 1/2 of the maximum scale value. A scale indicating up to the maximum scale value can also be manufactured.
- With a unidirectional deflection indicator (with "zero" at the left end), the scale indicates up to the maximum scale value. Please specify LEAD or LAG; the standard is LAG.

(4) Models with a 1A current rating; can also be manufactured; the power consumption is basically the same as that of a 5A model.

(5) The T-150 rectifier is a dedicated accessory (non-compatible accessory), and thus cannot be used in combinations other than those designated for the indicators. The distance between the indicator and the T-150 rectifier must be 5m or less, or the round-trip lead wire resistance must be 0.5Ω or less.

(6) Use a varmeter with an input voltage in the range of 85 to 115% of the rated value (rated voltage ±15%).
The indication may be unstable when used with an input voltage of 85% or less of the rating or the input voltage is switched on and off.

(7) The weight of the T-150 rectifier is approximately 1kg.

(8) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

●Scale calculation formula for varmeter

Phase-wire system	Secondary rating	Scale calculation formula for varmeter	Remarks
3-phase 3-wire	110V 5A	Indicator scale P (kvar)=VT ratio × CT ratio × Po (0.8~1.2) × 1/2	●The value at the left is multiplied by 1/5 in the case of a CT secondary current of 1A.
	220V 5A	Indicator scale P (kvar)=CT ratio × Po (1.6~2.4) × 1/2	
3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V 5A	Indicator scale P (kvar)=VT ratio × CT ratio × Po (0.8~1.2) × 1/2	
	110/190V 5A	Indicator scale P (kvar)=VT ratio × CT ratio × Po (1.4~2.0) × 1/2	

Calculation example: In the case of a 3-phase, 3-wire circuit, VT 6600/110V and CT 100/5A, and a bidirectional deflection indicator with a scale indicating up to 1/2 the maximum scale value.

$$\text{Indicator scale P (kvar)}=\frac{6600}{110}\times\frac{100}{5}\times Po\ (0.8\sim1.2)\times 1/2 = 480\sim720\text{kvar}$$

The manufacturable range of the varmeter scale is thus LEAD (480 to 720) ~ 0 ~ LAG (480 to 720) kvar.
The manufacturable range differs slightly according to the rating. For details, refer to the "Varmeter Scale Selection Reference Table" (p.60).

YP-12NVAR

LP-110NVAR

■Specifications

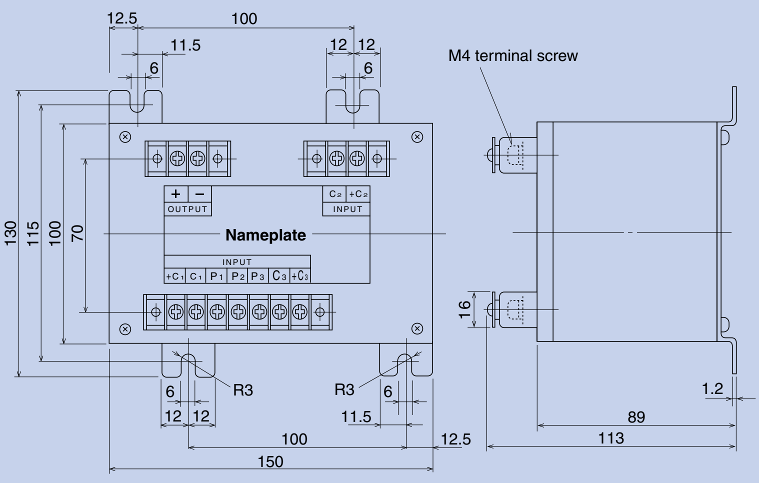
				Rectangular indicators					Wide-angle indicators									
				Y-N Series					L-N Series									
Size (width × height) mm				122×122					80×80					110×110				
Model name				YP-12NVAR					LP-80NVAR					LP-110NVAR				
Operation principle				Transducer					Transducer									
Accuracy (grade)				1.5					2.5					1.5				
Scale length (mm)				100					124					175				
Weight (kg)				0.5					0.3					0.6				
Indicator rating and delivery period classification	Circuit	Rating		Consumption VA			Accessory	Delivery period classification	Consumption VA			Accessory	Delivery period classification	Consumption VA			Accessory	Delivery period classification
				Voltage circuit	Current circuit				Voltage circuit	Current circuit				Voltage circuit	Current circuit			
		Secondary rating	Indicator rating (Po) kvar		I1 I3	I2				I1 I3	I2				I1 I3	I2		
	3-phase 3-wire	110V 5A	0.8~1.2	1.6	0.5	1.0	—	○	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	—	○
		220V 5A	1.6~2.4	3.2	0.5	1.0	—	○	3.2	0.5	1.0	T-150	○	3.2	0.5	1.0	—	○
	3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V 5A	0.8~1.2	1.6	0.5	1.0	—	○	1.6	0.5	1.0	T-150	○	1.6	0.5	1.0	—	○
		110/190V 5A	1.4~2.0	2.8	0.5	1.0	—	○	2.8	0.5	1.0	T-150	○	2.8	0.5	1.0	—	○
Page with outer dimensions drawing				36					37									

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Outer dimensions of accessory

T-150 rectifier (for varmeter)



■Ordering method

The items in [ ] must be specified.

Model name	Phase-wire system	Indicator rating	Scale	VT ratio	CT ratio	Cover type	Special specifications	Number of units
YP-12NVAR	3P3W	110V 5A	LEAD600-0-LAG600kvar	6600/110V	100/5A	B	Double scale, colored lines, etc.	2

(Unidirectional deflection indicator)

0-LAG1200kvar

Varmeters

■Connection diagrams

●3-phase, 3-wire system

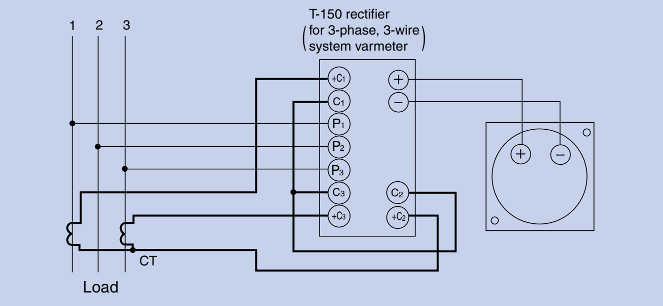


Fig. 1 YP-206NVAR, YP-208NVAR, YP-210NVAR, YP-8NVAR, YP-10NVAR and LP-80NVAR (combined with CT)

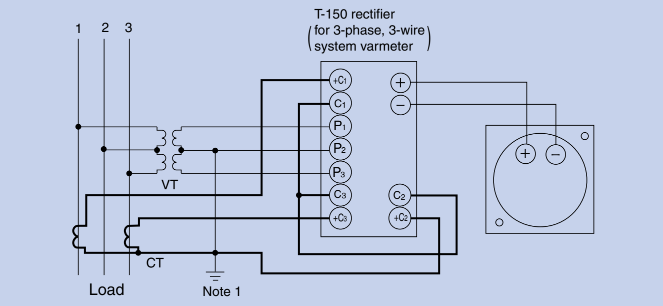


Fig. 2 YP-206NVAR, YP-208NVAR, YP-210NVAR, YP-8NVAR, YP-10NVAR and LP-80NVAR (combined with VT and CT)

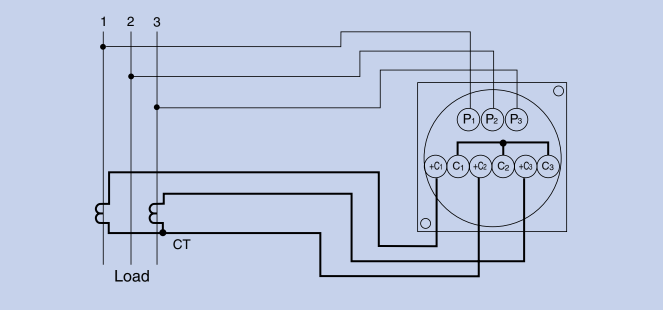


Fig. 3 YP-12NVAR and LP-110NVAR (combined with CT)

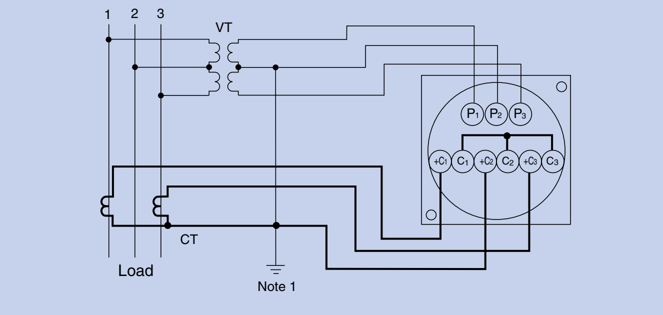


Fig. 4 YP-12NVAR and LP-110NVAR (combined with VT and CT)

●3-phase, 4-wire system

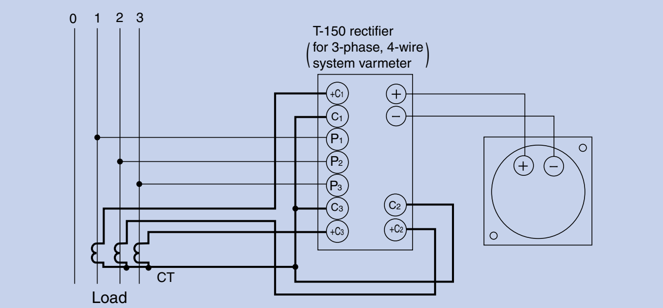


Fig. 5 YP-206NVAR, YP-208NVAR, YP-210NVAR, YP-8NVAR, YP-10NVAR and LP-80NVAR (combined with CT)

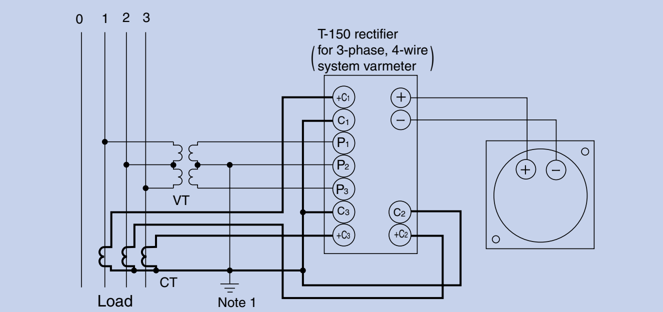


Fig. 6 YP-206NVAR, YP-208NVAR, YP-210NVAR, YP-8NVAR, YP-10NVAR and LP-80NVAR (combined with VT and CT)

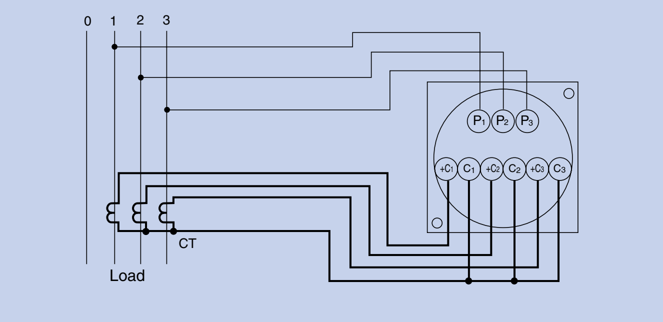


Fig. 7 YP-12NVAR and LP-110NVAR (combined with CT)

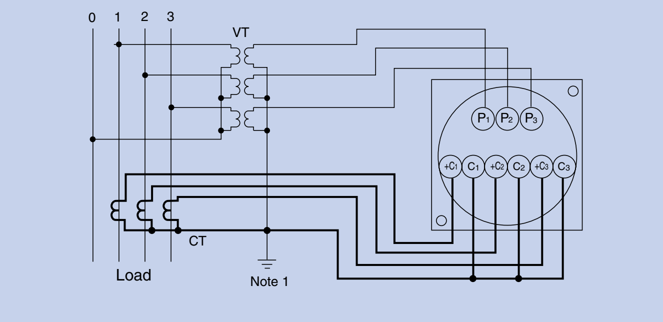


Fig. 8 YP-12NVAR and LP-110NVAR (combined with VT and CT)

Note 1. For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

■Varmeter Scale Selection Reference Table

Although the maximum scale of a varmeter can be determined by VT ratio × CT ratio × indicator rating (Po), the following table shows the manufacturable scale values (minimum, standard and maximum) for various VT and CT ratios.
If a scale value other than the standard scale value is desired, specify a suitable scale within the manufacturable range.

●Table of manufacturable maximum scales for varmeters

: Scale units kvar　　: Scale units Mvar

Indicator scale		When the indicator scale of a bidirectional deflection indicator is to indicate up to 1/2 of the maximum scale value (standard)								When the indicator scale of a unidirectional deflection indicator is to indicate up to the maximum scale value In the case of a bidirectional deflection indicator						
Phase-wire system		3-phase 3-wire/3-phase 4-wire (line voltage)								3-phase 3-wire/3-phase 4-wire (line voltage)						
CT ratio	Manufacturable range \ Voltage VT ratio	220 220/110	440 440/110	3300 3300/110	6600 6600/110	11000 11000/110	22000 22000/110	33000 33000/110	66000 66000/110	220 220/110	440 440/110	3300 3300/110	6600 6600/110	22000 22000/110	33000 33000/110	66000 66000/110
25/5	Minimum	4	8	60	120	200	400	600	1200	8	15	120	240	800	1200	2400
	Standard	5	10	75	150	250	500	750	1500	10	20	150	300	1000	1500	3000
	Maximum	6	12	90	180	300	600	900	1800	12	25	180	350	1200	1800	3500
50/5	Minimum	8	15	120	240	400	800	1200	2400	15	30	240	450	1500	2400	4500
	Standard	10	20	150	300	500	1000	1500	3000	20	40	300	600	2000	3000	6000
	Maximum	12	24	180	350	600	1200	1800	3500	25	50	350	750	2500	3500	7500
75/5	Minimum	12	24	180	350	600	1200	1800	3500	24	45	350	700	2400	3500	7000
	Standard	15	30	220	450	750	1500	2200	4500	30	60	450	900	3000	4500	9000
	Maximum	18	35	270	500	900	1800	2700	5000	35	75	500	1000	3500	5000	10
100/5	Minimum	16	30	240	450	800	1600	2400	4500	30	60	450	900	3000	4500	9000
	Standard	20	40	300	600	1000	2000	3000	6000	40	80	600	1200	4000	6000	12
	Maximum	24	50	350	750	1200	2400	3500	7500	50	100	750	1500	5000	7500	15
150/5	Minimum	24	45	350	700	1200	2400	3500	7000	45	90	700	1400	4500	7000	14
	Standard	30	60	450	900	1500	3000	4500	9000	60	120	900	1800	6000	9000	18
	Maximum	35	75	500	1000	1800	3500	5000	10	75	150	1000	2000	7500	10	20
200/5	Minimum	30	60	450	900	1600	3000	4500	9000	60	120	900	1800	6000	9000	18
	Standard	40	80	600	1200	2000	4000	6000	12	80	160	1200	2400	8000	12	24
	Maximum	50	100	750	1500	2400	5000	7500	15	100	180	1500	3000	10	15	30
300/5	Minimum	45	90	700	1400	2400	4500	7000	14	90	180	1400	2800	9000	14	28
	Standard	60	120	900	1800	3000	6000	9000	18	120	240	1800	3600	12	18	36
	Maximum	75	150	1000	2000	3500	7500	10	20	150	300	2000	4000	15	20	40
400/5	Minimum	60	120	900	1800	3000	6000	9000	18	120	250	1800	3800	12	18	38
	Standard	80	160	1200	2400	4000	8000	12	24	160	320	2400	4800	16	24	48
	Maximum	90	180	1500	3000	5000	10	15	30	180	350	3000	6000	18	30	60
600/5	Minimum	90	180	1400	2800	4500	9000	14	28	180	380	2800	6000	18	28	60
	Standard	120	240	1800	3600	6000	12	18	36	240	480	3600	7200	24	36	72
	Maximum	150	300	2000	4000	7500	15	20	40	300	600	4000	8500	30	40	85
800/5	Minimum	120	250	1800	3800	6000	12	18	38	250	500	3800	7500	25	38	75
	Standard	160	320	2400	4800	8000	16	24	48	320	640	4800	9600	32	48	96
	Maximum	180	350	3000	6000	10	18	30	60	350	750	6000	12	35	60	120
1200/5	Minimum	180	380	2800	6000	9000	18	28	60	380	750	6000	12	38	60	120
	Standard	240	480	3600	7200	12	24	36	72	480	960	7200	14	48	72	140
	Maximum	300	600	4000	8500	15	30	40	85	600	1200	8500	18	60	85	180
1500/5	Minimum	240	450	3500	7000	12	24	35	70	450	900	7000	14	45	70	140
	Standard	300	600	4500	9000	15	30	45	90	600	1200	9000	18	60	90	180
	Maximum	350	750	5000	10	18	35	50	100	750	1500	10	20	75	100	200
2000/5	Minimum	300	600	4500	9000	16	30	45	90	600	1200	9000	18	60	90	180
	Standard	400	800	6000	12	20	40	60	120	800	1600	12	24	80	120	240
	Maximum	500	1000	7500	15	24	50	75	150	1000	1800	15	30	100	150	300
3000/5	Minimum	450	900	7000	14	24	45	70	140	900	1800	14	28	90	140	280
	Standard	600	1200	9000	18	30	60	90	180	1200	2400	18	36	120	180	360
	Maximum	750	1500	10	20	35	75	100	200	1500	3000	20	40	150	200	400

Remarks (1) The standard indicator rating (Po) is 1kvar.
(2) For CT ratio scales not shown in the above table, multiply the ten-fold CT ratio scale values by 0.1 and the 1/10 CT ratio scale values by 10.

Note 1. Some of the maximum scale values in the table deviate from the VT ratio × CT ratio × adjustment range multiplying factor. This is because the best values are selected, and the values in the table are given priority.

Power Factor Meters

For balanced circuits

YP-12NPF

LP-110NPF

■Specifications

		Rectangular indicators																			
		Y-2N Series												Y-N Series							
Size (width × height)	mm	64×60				85×75				100×85				82×82				102×102			
Model name		YP-206NPF				YP-208NPF				YP-210NPF				YP-8NPF				YP-10NPF			
Operation principle		Transducer												Transducer							
Accuracy (grade)		5												5							
Scale		LEAD 0.5~1~0.5 LAG												LEAD 0.5~1~0.5 LAG							
Frequency		50 and 60Hz												50 and 60Hz							
Scale length	(mm)	55				70				85				70				90			
Weight	(kg)	0.07				0.1				0.1				0.2				0.2			
Indicator rating and delivery period classification: Circuit	Rating	Consumption VA: Voltage circuit	Consumption VA: Current circuit I1	Accessory	Delivery period classification	Consumption VA: Voltage circuit	Consumption VA: Current circuit I1	Accessory	Delivery period classification	Consumption VA: Voltage circuit	Consumption VA: Current circuit I1	Accessory	Delivery period classification	Consumption VA: Voltage circuit	Consumption VA: Current circuit I1	Accessory	Delivery period classification	Consumption VA: Voltage circuit	Consumption VA: Current circuit I1	Accessory	Delivery period classification
3-phase 3-wire balanced circuit	110V 5A	1	1	T-100	○	1	1	T-100	○	1	1	T-100	○	1	1	—	○	1	1	—	○
	220V 5A	2	1	T-100	○	2	1	T-100	○	2	1	T-100	○	2	1	—	○	2	1	—	○
Page with outer dimensions drawing		35												36							

		Rectangular indicators				Wide-angle indicators							
		Y-N Series				L-N Series							
Size (width × height)	mm	122×122				80×80				110×110			
Model name		YP-12NPF				LP-80NPF				LP-110NPF			
Operation principle		Transducer				Transducer							
Accuracy (grade)		5				5							
Scale		LEAD 0.5~1~0.5 LAG				LEAD 0.5~1~0.5 LAG							
Frequency		1-phase 2-wire: specify 50Hz or 60Hz 3-phase 3-wire: 50 and 60Hz				1-phase 2-wire: specify 50Hz or 60Hz 3-phase 3-wire: 50 and 60Hz							
Scale length	(mm)	100				124				175			
Weight	(kg)	0.4				0.4				0.5			
Indicator rating and delivery period classification: Circuit	Rating	Consumption VA: Voltage circuit	Consumption VA: Current circuit I1	Accessory	Delivery period classification	Consumption VA: Voltage circuit	Consumption VA: Current circuit I1	Accessory	Delivery period classification	Consumption VA: Voltage circuit	Consumption VA: Current circuit I1	Accessory	Delivery period classification
1-phase 2-wire	110V 5A	1.3	0.5	—	△	—				1.3	0.5	—	△
	220V 5A	2.6	0.5	—	△					2.6	0.5	—	△
3-phase 3-wire balanced circuit	110V 5A	1	1	—	◎	1	1	—	○	1	1	—	◎
	220V 5A	2	1	—	○	2	1	—	○	2	1	—	○
Page with outer dimensions drawing		36				37							

Remarks
(1) Indicators with a LEAD 0–1–0 LAG scale can also be manufactured; however, measured values for power factors of 0.5 or less are for reference only.
(2) Use with an input current of 1/5 (e.g. 1A) or more of the rated current (e.g. 5A). The error increases as the input current decreases.
(3) In a power OFF or no-load state, the pointer of the power factor meter stops at the mechanical zero point; black point near the power factor of 1.
(4) The T-100 rectifier is a dedicated accessory (non-compatible accessory), and thus cannot be used in combinations other than those designated for the indicators.
(5) Models with a current rating of 1A can also manufactured; the power consumption is basically the same as that of a 5A model.
(6) Four-quadrant power factor meters can also be manufactured for LI-1NPF 3-phase, 3-wire balanced circuits. Please contact a Mitsubishi Electric representative for details.
(7) The weight of the T-100 rectifier is approximately 0.9kg.
(8) Cannot use with unbalanced loads.
(9) Please specify the frequency in the case of the power factor meter for 1-phase, 2-wire systems.
(10) Use with a positive phase sequence.
(11) In the case of a negative phase sequence input with a 3-phase, 3-wire circuit, LEAD and LAG are indicated in an inverted manner. Indicators return to normal operation when the connections of the P2 and P3 circuits of the voltage input terminals are interchanged.
(12) Please make sure to read the “Safety Precautions” (pp.5-8) and the “Selection Precautions” (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Ordering method

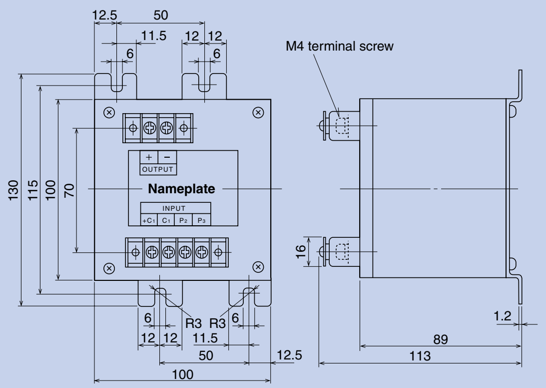
The items in [ ] must be specified.

Model name	Phase-wire system	Indicator rating	Scale	Cover type	Frequency	Special specifications	Number of units
YP-12NPF	3P3W	110V 5A	LEAD0.5-1-0.5LAG	B	50Hz	Colored lines, colored bands, etc.	3

Specify in the case of a 1-phase, 2-wire system.

■Outer dimensions of accessory

T-100 rectifier (for balanced circuit power factor meter)



■Connection diagrams

●1-phase, 2-wire systems

Fig. 1 YP-12NPF, YP-15NPF and LP-110NPF (combined with CT)

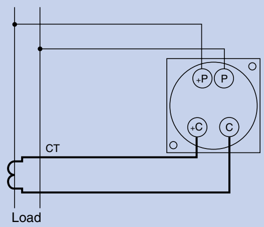
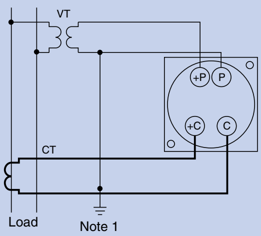


Fig. 2 YP-12NPF and LP-110NPF (combined with VT and CT)



●3-phase, 3-wire systems

Fig. 3 YP-206NPF, YP-208NPF and YP-210NPF (combined with CT)

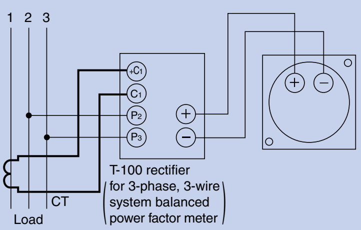


Fig. 4 LP-80NPF and LP-110NPF (combined with CT)

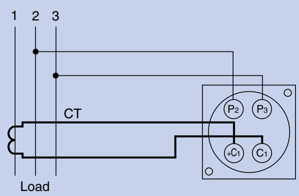


Fig. 5 YP-8NPF, YP-10NPF and YP-12NPF (combined with CT)

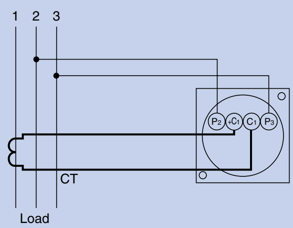


Fig. 6 YP-206NPF, YP-208NPF and YP-210NPF (combined with VT and CT)

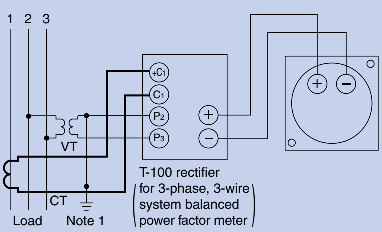


Fig. 7 LP-80NPF and LP-110NPF (combined with VT and CT)

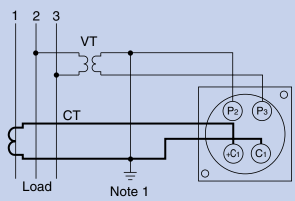
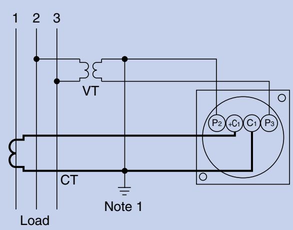


Fig. 8 YP-8NPF, YP-10NPF and YP-12NPF (combined with VT and CT)



Note 1. For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

Power Factor Meters

For unbalanced loads

YP-208NPFU

YP-10NPFU

■Specifications

	Rectangular indicators				
	Y-2N Series			Y-N Series	
Size (width × height) mm	64×60	85×75	100×85	82×82	102×102
Model name	YP-206NPFU	YP-208NPFU	YP-210NPFU	YP-8NPFU	YP-10NPFU
Operation principle	Transducer			Transducer	
Accuracy (grade)	5			5	
Scale	LEAD 0.5~1~0.5 LAG			LEAD 0.5~1~0.5 LAG	
Frequency	50 or 60Hz			50 or 60Hz	
Scale length (mm)	55	70	85	70	90
Weight (kg)	0.07	0.1	0.1	0.1	0.15
Page with outer dimensions drawing	35			36	

Indicator rating and delivery period classification

Circuit	Rating	Model	Consumption VA: Voltage circuit	Consumption VA: Current circuit I1, I3	Consumption VA: Current circuit I2	Accessory	Delivery period classification
3-phase 3-wire unbalanced loads	110V 5A	YP-206NPFU	1	2		T-150	○
		YP-208NPFU	1	2		T-150	○
		YP-210NPFU	1	2		T-150	○
		YP-8NPFU	1	2		T-150	○
		YP-10NPFU	1	2		T-150	○
	220V 5A	YP-206NPFU	2	2		T-150	○
		YP-208NPFU	2	2		T-150	○
		YP-210NPFU	2	2		T-150	○
		YP-8NPFU	2	2		T-150	○
		YP-10NPFU	2	2		T-150	○
3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V 5A	YP-206NPFU	0.7	1	2	T-150	○
		YP-208NPFU	0.7	1	2	T-150	○
		YP-210NPFU	0.7	1	2	T-150	○
		YP-8NPFU	0.7	1	2	T-150	○
		YP-10NPFU	0.7	1	2	T-150	○
	110/190V 5A	YP-206NPFU	1	1	2	T-150	○
		YP-208NPFU	1	1	2	T-150	○
		YP-210NPFU	1	1	2	T-150	○
		YP-8NPFU	1	1	2	T-150	○
		YP-10NPFU	1	1	2	T-150	○

Remarks
(1) A LEAD 0~1~0 LAG scale can also be manufactured; however, the measured power factor values of 0.5 or less are for reference only.
(2) Please specify the frequency.
(3) Use with an input current of 1/5 (e.g. 1A) or more of the rated current (e.g. 5A). The error increases as the input current decreases.
(4) In the power off or no-load state, the needle of the power factor meter stops at the mechanical zero point; black point near the power factor of 1.
(5) The T-150 rectifier is a dedicated accessory (non-compatible accessory), and thus cannot be used in combinations other than those designated for the indicators. The distance between the indicator and the T-150 rectifier must be 5m or less, or the round-trip lead wire resistance must be 0.5Ω or less.
(6) Models with a current rating of 1A can also manufactured; the power consumption is basically the same as that of a 5A model.
(7) The weight of the T-150 rectifier is approximately 1.4kg.
(8) Can also be used for balanced circuits.
(9) Use with a positive phase sequence.
For the following models, indicators will not be function normally when a negative-phase sequence is input. Return the indicators to normal operation by interchanging the voltage and current circuits.

Model name	Indication state	Reset indicator for normal operation
YP-206NPFU, YP-208NPFU YP-210NPFU YP-8NPFU, YP-10NPFU LP-80NPFU	The indicator reading is unclear.	Change the voltage and current circuit connections as follows: ・Switch P1 and P3 ・Switch +C1 and +C3 ・Switch C1 and C3

(10) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

■Ordering method

The items in [ ] must be specified.

Model name	Phase-wire system	Indicator rating	Scale	Cover type	Frequency	Special specifications	Number of units
YP-12NPFU	3P3W	110V 5A	LEAD0.5-1-0.5LAG	B	50Hz	Colored lines, colored bands, etc.	3

YP-12NPFU

LP-110NF

			Rectangular indicators					Wide-angle indicators										
			Y-N Series					L-N Series										
Size (width × height) mm			122×122					80×80					110×110				
Model name			YP-12NPFU					LP-80NPFU					LP-110NPFU				
Operation principle			Transducer					Transducer									
Accuracy (grade)			5					5									
Scale			LEAD 0.5~1~0.5 LAG					LEAD 0.5~1~0.5 LAG									
Frequency			50 or 60Hz					50 or 60Hz									
Scale length (mm)			100					124					175				
Weight (kg)			0.5					0.3					0.6				
Indicator rating and delivery period classification	Circuit	Rating	Consumption VA			Accessory	Delivery period classification	Consumption VA			Accessory	Delivery period classification	Consumption VA			Accessory	Delivery period classification
			Voltage circuit	Current circuit I1 I3	Current circuit I2			Voltage circuit	Current circuit I1 I3	Current circuit I2			Voltage circuit	Current circuit I1 I3	Current circuit I2		
	3-phase 3-wire unbalanced loads	110V 5A	1.5	0.5		—	◎	1	2		T-150	○	1.5	0.5		—	◎
		220V 5A	3	0.5		—	○	2	2		T-150	○	3	0.5		—	○
	3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V 5A	1	0.5	1	—	○	0.7	1	2	T-150	○	1	0.5	1	—	○
		110/190V 5A	2	0.5	1	—	○	1	1	2	T-150	○	2	0.5	1	—	○
Page with outer dimensions drawing			36					37									

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Outer dimensions of accessories

Fig. 1 T-150 rectifier (for 3-phase, 3-wire unbalanced load power factor meter)

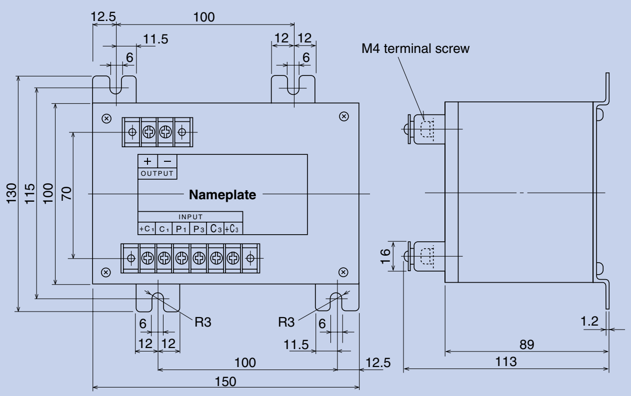
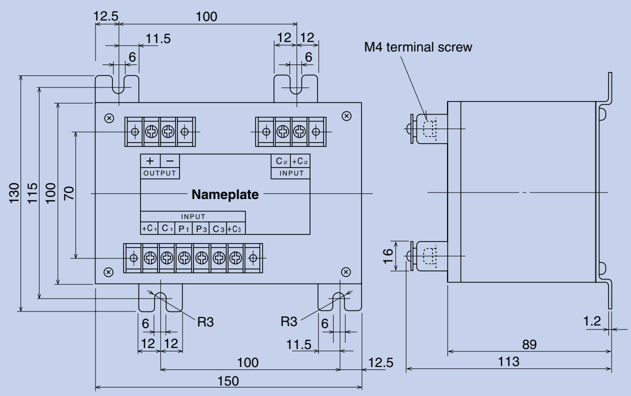


Fig. 2 T-150 rectifier (for 3-phase, 4-wire power factor meter)



Power Factor Meters

■Connection diagrams

●3-phase, 3-wire systems (unbalanced loads)

Fig. 1 YP-206NPFU, YP-208NPFU, YP-210NPFU, YP-8NPFU, YP-10NPFU and LP-80NPFU (combined with CT)

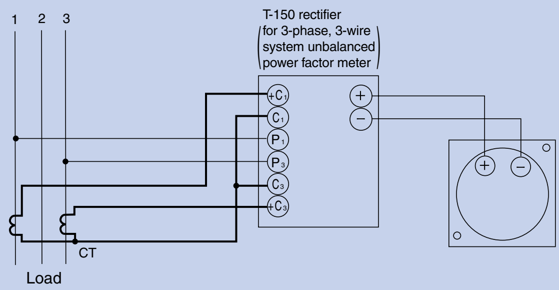


Fig. 2 YP-206NPFU, YP-208NPFU, YP-210NPFU, YP-8NPFU, YP-10NPFU and LP-80NPFU (combined with VT and CT)

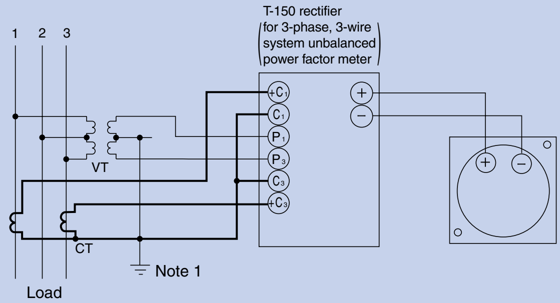


Fig. 3 YP-12NPFU and LP-110NPFU (combined with CT)

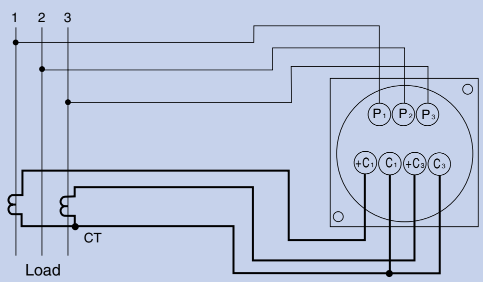
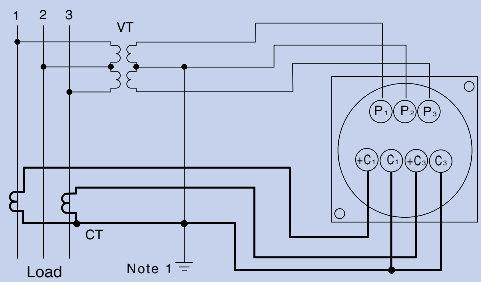


Fig. 4 YP-12NPFU and LP-110NPFU (combined with VT and CT)



●3-phase, 4-wire systems

Fig. 5 YP-206NPFU, YP-208NPFU, YP-210NPFU, YP-8NPFU, YP-10NPFU and LP-80NPFU (combined with CT)

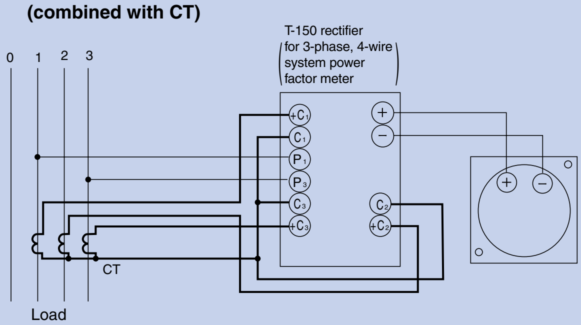


Fig. 6 YP-206NPFU, YP-208NPFU, YP-210NPFU, YP-8NPFU, YP-10NPFU and LP-80NPFU (combined with VT and CT)

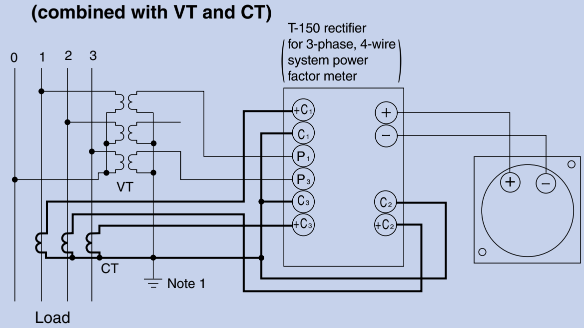


Fig. 7 YP-12NPFU and LP-110NPFU (combined with CT)

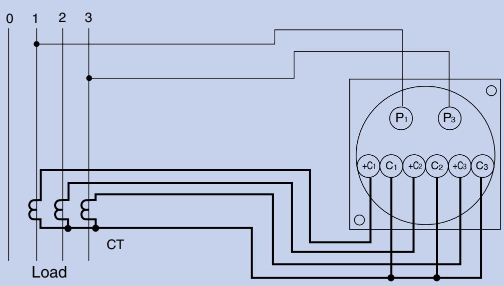
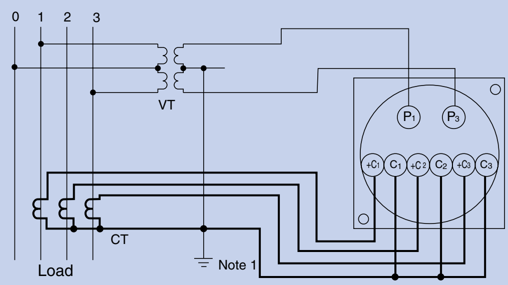


Fig. 8 YP-12NPFU and LP-110NPFU (combined with VT and CT)



Note 1. For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

Frequency Meters

YP-8NF

LP-110NF

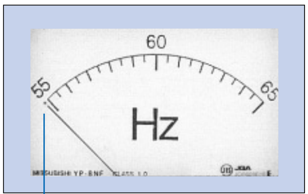
■Specifications

			Rectangular indicators												Wide-angle indicators			
			Y-2N Series						Y-N Series						L-N Series			
Size (width × height) mm			64×60		85×75		100×85		82×82		102×102		122×122		80×80		110×110	
Model name			YP-206NF		YP-208NF		YP-210NF		YP-8NF		YP-10NF		YP-12NF		LP-80NF		LP-110NF	
Operation principle			Transducer						Transducer						Transducer			
Accuracy (grade)			1						1				0.5		0.5			
Scale length (mm)			55		70		85		70		90		100		124		175	
Weight (kg)			0.1		0.15		0.15		0.15		0.2		0.3		0.3		0.5	
Indicator rating and delivery period classification	Rated voltage V	Scale Hz	Consumption VA	Delivery period classification	Consumption VA	Delivery period classification	Consumption VA	Delivery period classification	Consumption VA	Delivery period classification	Consumption VA	Delivery period classification	Consumption VA	Delivery period classification	Consumption VA	Delivery period classification	Consumption VA	Delivery period classification
	110	45~55	2.5	○	2.5	○	2.5	○	2.5	○	2.5	○	2.5	◎	1.5	○	1.5	◎
		55~65	2.5	○	2.5	○	2.5	○	2.5	○	2.5	○	2.5	◎	1.5	○	1.5	◎
		45~65	2.5	○	2.5	○	2.5	○	2.5	○	2.5	○	2.5	○	1.5	○	1.5	○
	220	45~55	5	○	5	○	5	○	5	○	5	○	5	○	3	○	3	○
		55~65	5	○	5	○	5	○	5	○	5	○	5	○	3	○	3	○
		45~65	5	○	5	○	5	○	5	○	5	○	5	○	3	○	3	○
	Special scale		45~75Hz, 170~190Hz 85~110Hz, 360~440Hz															
Page with outer dimensions drawing			35						36						37			

Remarks (1) Allowable voltage variation ranges for 110V: 90~130V; for 220V: 180~260V.
(2) The mechanical zero point of the needle is the black point at the left end of the meter (see scale example below).
(3) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days



Mechanical zero point

■Connection diagrams

Fig. 1 Frequency meter (direct)

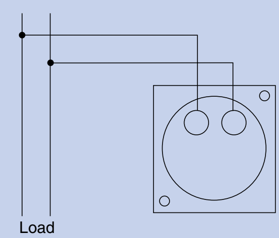
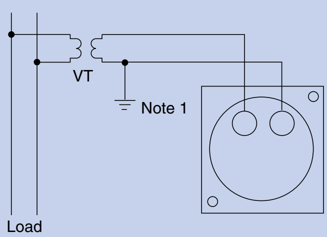


Fig. 2 Frequency meter (combined with CT)



Note 1. For low-voltage circuits, grounding of the secondary side of the instrument voltage transformer is unnecessary.

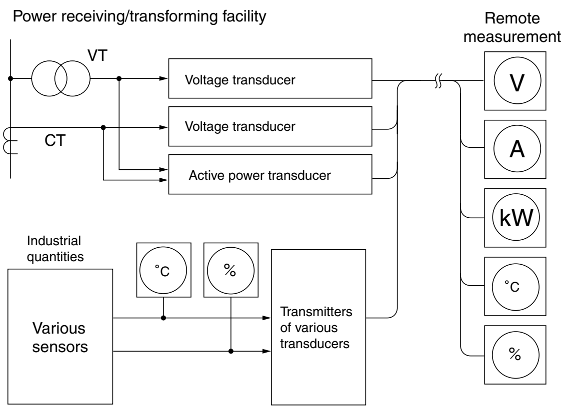
■Ordering method

The items in [ ] must be specified.

Model name	Rated voltage	Scale	Cover type	Special specifications	Number of units
YP-208NF	110V	55-65Hz	B	Colored lines, colored bands, etc.	10

Receiving Indicators

Receiving indicators indicate the quantity measured when an electrical signal is received from the transmitter of a detector of a power/instrumentation transducer. Receiving indicators are used to measure industrial quantities, including remote measurements.



●Measurement of pressure, temperature, speed, rpm and other industrial quantities

●Telemetry measurement (remote measurement) in combination with transducers

(Refer to p.151 onward of this catalog regarding the transducers to be used with receiving indicators.)

YM-8NRI

LM-110NRI

■Specifications

●DC indicators

		Rectangular indicators						Wide-angle indicators	
		Y-2N Series			Y-N Series			L-N Series	
Size (width × height) mm		64×60	85×75	100×85	82×82	102×102	122×122	80×80	110×110
Model name		YM-206NRI	YM-208NRI	YM-210NRI	YM-8NRI	YM-10NRI	YM-12NRI	LM-80NRI	LM-110NRI
Operation principle		Movable coil			Movable coil			Movable coil	
Accuracy (grade)		2.5			2.5		1.5	2.5	1.5
Scale length (mm)		55	70	85	70	90	100	124	175
Weight (kg)		0.07	0.1	0.1	0.1	0.15	0.3	0.3	0.4
Indicator rating and delivery period classification / DC current / Indicator rating	Delivery period	Internal resistance (Ω)							
100μA	△	2000Ω			2000Ω		5000Ω	—	
200μA	△	1200Ω			1200Ω		5000Ω	—	
300μA	△	1000Ω			1000Ω		1550Ω	920Ω	
500μA	△	730Ω			730Ω		780Ω	580Ω	
1mA Note 1	○	200Ω			200Ω		250Ω	180Ω	
5mA	○	8Ω			8Ω		50Ω	8Ω	
10mA	○	2Ω			2Ω		25Ω	6Ω	
20mA	○	0.8Ω			0.8Ω		0.8Ω	3Ω	
±0.5mA Note 1	○	200Ω			200Ω		250Ω	180Ω	
±1mA	○	100Ω			100Ω		125Ω	90Ω	
Zero-suppressed 1~5mA	○	10Ω			10Ω		25Ω	50Ω	
Zero-suppressed 2~10mA	○	4Ω			4Ω		5Ω	15Ω	
Zero-suppressed 4~20mA	○	1Ω			1Ω		5Ω	10Ω	
Zero-suppressed 10~50mA	○	2Ω			2Ω		3Ω	4Ω	
DC voltage / Indicator rating	Delivery period	Consumption current (approx. mA)							
1, 3, 5, 10, 15V 30, 50, 60, 100V	○	1mA			1mA		1mA	1mA	
Zero-suppressed 1~5V	○	1.25mA			1.25mA		1.25mA	1.25mA	
Page with outer dimensions drawing		35			36			37	

Note 1. A 500Ω internal resistance indicator can also be manufactured for models with indicator ratings of 1mA and ±0.5mA.
Please specify an internal resistance of 500Ω.

Note 2. In the case of scales with units of electricity (A, V, W, var, cosø, Hz), AC/DC and three-phase circuit symbols are not displayed. For receiving indicators, the symbol for the quantity input is displayed.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Remarks (1) With a zero-suppressed indicator, the zero point of the needle is suppressed mechanically to eliminate the zero point.
Zero-suppressed indicators can be manufactured for values of 20% or lower of the maximum rating of the indicator.

(2) For cases when the indicator input is DC voltage, an indicator with an adjustment resistor, where the adjustment resistor is added internally to the indicator, can be manufactured. (This type can be used in combination with specific scales.)
- The range of adjustment by the adjustment resistor is ±5% to ±20% with respect to the maximum scale value.
- The adjustment resistor is mounted on the rear face (i.e., face with terminals) of the indicator.

(3) rpm detectors and other industrial quantity detectors are to be prepared by the customer.

(4) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

●AC indicators

		Rectangular indicators						Wide-angle indicators	
		Y-2N Series			Y-N Series			L-N Series	
Size (width × height) mm		64×60	85×75	100×85	82×82	102×102	122×122	80×80	110×110
Model name		YR-206NRI	YR-208NRI	YR-210NRI	YR-8NRI	YR-10NRI	YR-12NRI	LR-80NRI	LR-110NRI
Operation principle		Rectifier			Rectifier			Rectifier	
Accuracy (grade)		2.5			2.5		1.5	2.5	1.5
Scale length (mm)		55	70	85	70	90	100	124	175
Indicator rating and delivery period classification: Indicator rating	Delivery period	Consumption current, consumption VA, or voltage drop							
AC current: 200, 300μA	△	—	1.7V		1.7V		1.7V	—	
AC current: 500μA, 1, 3, 5mA	△	1.4V	1.4V		1.4V		1.4V	1.4V	
AC current: 10, 20, 30, 50, 75mA	△	1.2V	1.2V		1.2V		1.2V	1.2V	
AC current: 100, 200, 500mA	△	0.06VA	0.06VA		0.06VA		0.06VA	0.06VA	
AC current: 1, 3A	○	0.06VA	0.06VA		0.06VA		0.06VA	0.06VA	
AC current: 5, 10, 15, 20A	○	0.1VA	0.1VA		0.1VA		0.1VA	0.1VA	
AC voltage: 5, 10, 30, 50V / 75, 100V	○	1mA	1mA		1mA		1mA	1mA	
AC voltage: 150V / 300V	○	2mA	2mA		2mA		2mA	2mA	
Page with outer dimensions drawing		35			36			37	

Remarks (1) Industrial quantity detectors are to be prepared by the customer.
(2) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Connection examples

Fig. 1 Remote measurement of DC current

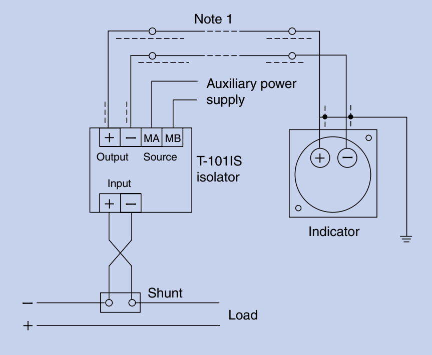


Fig. 2 Remote measurement of AC current

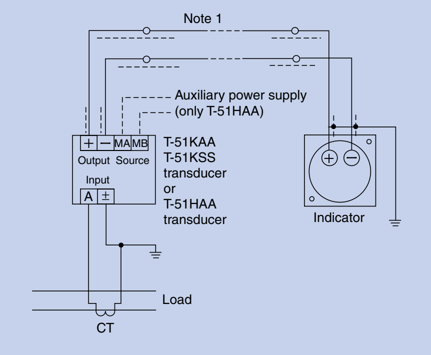
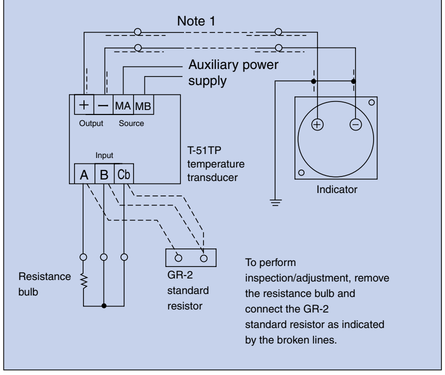


Fig. 3 Measurement of temperature (resistance bulb)



Note 1. Use a shielded wire or twisted wire for connectiing the transducer or other components to the indicator.

●Scale units of receiving indicators (representative examples)

Element	Scale units		Element	Scale units		Element		Scale units	Element		Scale units
DC/AC current	A	kA	Active power	kW	MW	Percent		%	Speed	meters/minute	m/min
						Temperature		°C		meters/second	m/s
DC/AC voltage	V	kV	Reactive power	kvar	Mvar	Length	centimeters	cm	Revolutions		min^{-1}
							meters	m	Pressure		MPa
Frequency	Hz		Power factor	cosϕ		Weight	kilograms	kg	Flow rate		L/min
							tons	t	Concentration		ppm

Models with various types of units besides the above can also be manufactured.

■Ordering method

The items in [ ] must be specified.

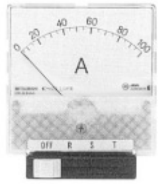
Model name: YM-208NRI
Scale and units: (0-100) % / (0-300) A
Cover type: BR
Indicator rating: FS4-20mA / (AC indicator) FSAC5V
Special specifications: Double scale, colored lines, etc.
Number of units: 5

Indicators with Changeover Switch

AC ammeters

Using AC ammeters with changeover switches, the currents of the respective phases of a 3-phase, 3-wire system (or 1-phase, 3-wire system) circuit can be measured by a single meter.
●Equipped with a protective circuit to protect the CT secondary circuit.

YR-8UNAA



YR-10UNAA

■Specifications

Size (width × height) mm					82×99		102×119		122×139	
Model name					YR-8UNAA		YR-10UNAA		YR-12UNAA	
Operation principle					Rectifier (movable iron core) Note 1				Rectifier	
Accuracy (grade)					2.5		2.5		1.5	
Frequency					50 and 60Hz					
Scale length (mm)					70		90		100	
Weight (kg)					0.2		0.25		0.4	
Indicator rating and delivery period classification		Terminal configuration	Maximum scale	Consumption VA	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded
	Direct	4-terminal	1A	0.2	△	△	△	△	△	△
			5A		○	○	○	○	○	△
			10A		△	△	△	△	△	△
			15A							
			20A	0.3	△	△	△	△	△	△
			30A							
	Combined with CT	3-terminal Note 2	/5A (indicator rating: 5A)	1.5	◎	○	○	○	○	○
			/1A (indicator rating: 1A)							

Note 1. With YR-8UNAA and 10UNAA, the 3-terminal-combined-with-CT model is of the movable iron core type.
Note 2. The 4-terminal configuration can be manufactured for models combined with CT. Please designate as "4-terminal." However, the operation principle will be the rectifying type.

Remarks
(1) A switch nameplate for 1-phase, 3-wire systems can be manufactured. Please specify "with 1-3 nameplate."
Nameplate examples: OFFRNS OFFRNT Make sure to specify the indication contents when ordering.
(2) Expanded scale refers to scales expanded three-fold.
(3) Supplementary anti-corrosion treatment is not possible.
(4) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Outer dimensions

Fig. 1 YR-8UNAA

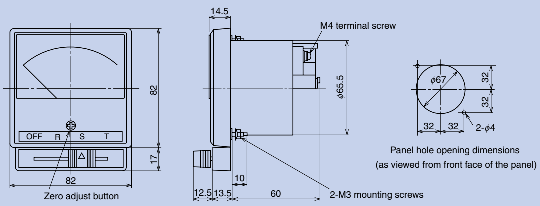


Fig. 2 YR-10UNAA

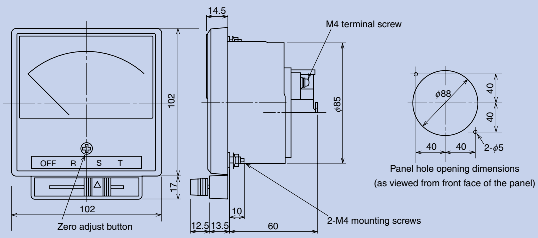
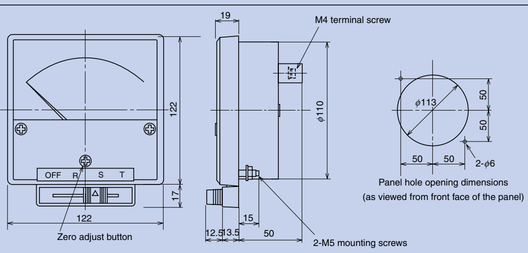


Fig. 3 YR-12UNAA



■Connection diagrams

Fig. 1 Direct

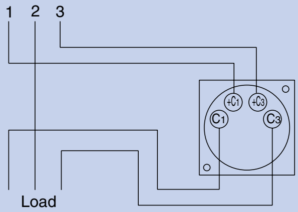


Fig. 2 Combined with CT

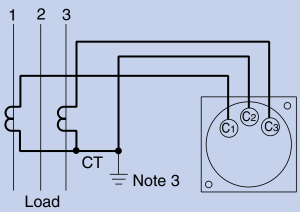
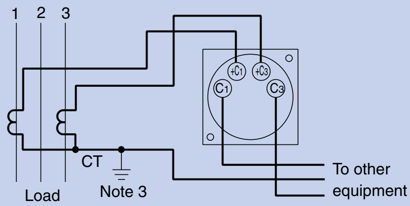


Fig. 3 4-terminal combined with CT (intermediate mounting)



Note 3. For low-voltage circuits, grounding of the secondary side of the current transformer is unnecessary.

■Ordering method

The items in [ ] must be specified.

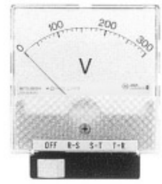
Model name	Indicator rating	Terminal configuration	Scale	CT ratio	Cover type	Special specifications	Number of units
YR-8UNAA	5A	4-terminal	0-100A	100/5A	BR	With 1-3 nameplate, colored lines, colored bands, etc.	10

Terminal configuration: Specify if 4-terminal configuration is required.
CT ratio: Unnecessary in the case of a direct indicator.

AC voltmeters

Using AC voltmeters with changeover switches, the voltages between the respective wires of a 3-phase, 3-wire system (or 1-phase, 3-wire system) circuit can be measured by a single meter.
●Equipped with a protective circuit to protect the VT secondary circuit.

YR-8UNAV



YR-10UNAV

■Specifications

Size (width × height) mm					82×99	102×119	122×139
Model name					YR-8UNAV	YR-10UNAV	YR-12UNAV
Operation principle					Rectifier		
Accuracy (grade)					2.5	2.5	1.5
Frequency					50 and 60Hz		
Scale length (mm)					70	90	100
Weight (kg)					0.15	0.2	0.4
Indicator rating and delivery period classification	Direct	Maximum scale		Consumption VA	Delivery period classification		
		150V		0.5	○	○	○
		300V		1.2	◎	◎	◎
		600V		2.4	○	○	○
	Combined with VT	VT ratio	Scale				
		440/110V	0-600V	0.5	○	○	○
		3300/110V	0-4500V				
		6600/110V	0-9000V				
		besides the above, □110V	VT ratio × 150V	0.5	○	○	○

Remarks (1) In the case of a 1-phase, 3-wire system circuit (100/200V), use a model rated at 300V direct.
(2) A switch nameplate for 1-phase, 3-wire systems can be manufactured. Please specify "with 1-3 nameplate."
Nameplate examples: OFF R-N N-S R-S | OFF R-N N-T R-T Make sure to specify the indication contents when ordering.
(3) Supplementary anti-corrosion treatment is not possible.
(4) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Outer dimensions

Fig. 1 YR-8UNAV

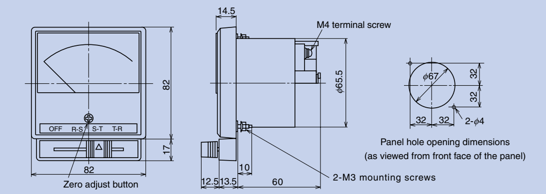


Fig. 2 YR-10UNAV

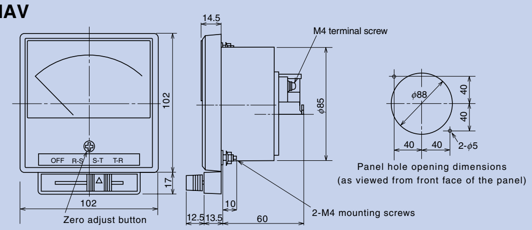
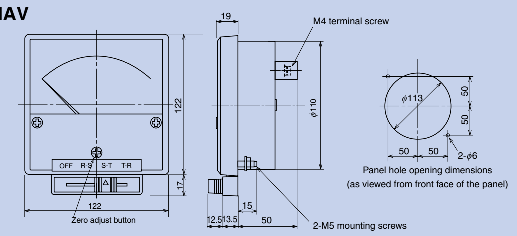


Fig. 3 YR-12UNAV



■Connection diagrams

Fig. 1 Direct

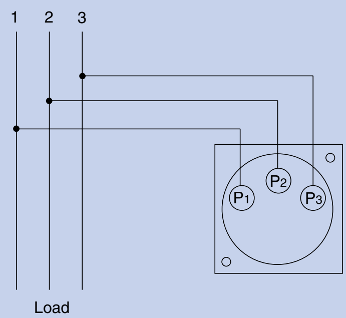
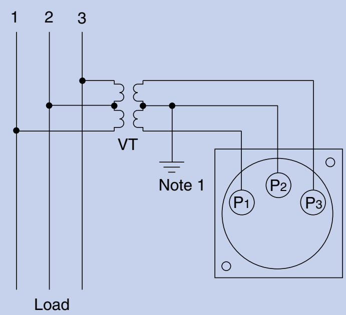


Fig. 2 Combined with VT



Note 1. For low-voltage circuits, grounding of the secondary side of the instrument voltage transformer is unnecessary.

■Ordering method

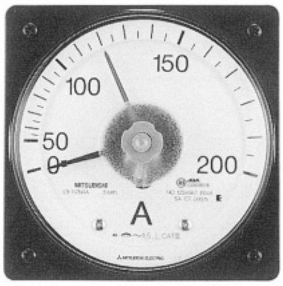
The items in [ ] must be specified.

Model name	Indicator rating	Scale	VT ratio	Cover type	Special specifications	Number of units
YR-8UNAV	150V	0-600V	440/110V	B	With 1-3 nameplate, colored lines, colored bands, etc.	10

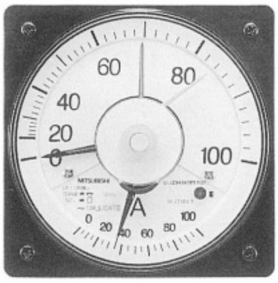
Unnecessary in the case of a direct indicator.

Mechanical Demand Meters

Demand meters measure electricity demand and have marker needles that display the maximum and/or minimum values measured.



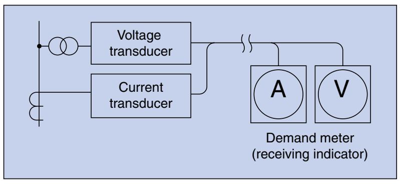
LB-11ZNAA
(AC current demand meter with max. value marker needle)



LB-11ZRMNAA
(AC current demand meter relay)

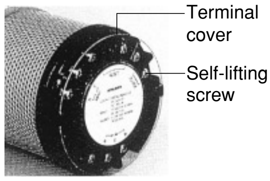
Telemetry measurement (remote measurement) is possible

Receiving indicators can be combined with various transducers to perform remote measurement.



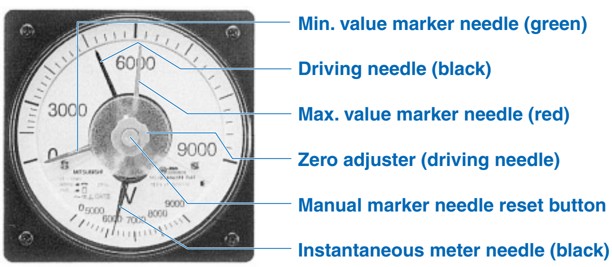
Terminal cover (standard equipment)

Conducting parts are protected to prevent electrical shock.

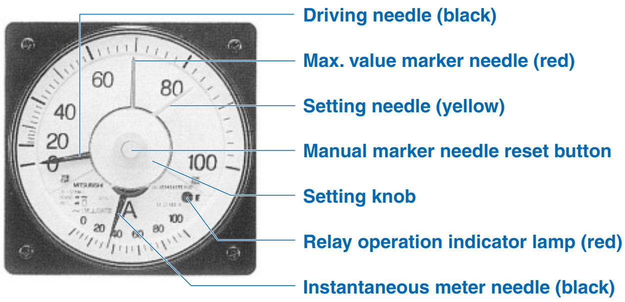


		Demand meters					Demand meter relays
		With max. value needle		With max. and min. value marker needles	With max. value marker needle and instantaneous meter	With max. and min. value marker needles and instantaneous meter	With max. value marker needle and instantaneous meter, with alarm setting needle
Appearance							
Size (width × height)		80×80	110×110	110×110	110×110	110×110	110×110
AC ammeters		LB-8ZNAA	LB-11ZNAA	—	LB-11ZRNAA	—	LB-11ZRMNAA
AC voltmeters		LB-8ZNAV	LB-11ZNAV	—	—	LB-11YRNAV	—
Wattmeters	1-phase, 2-wire 1-phase, 3-wire 3-phase, 3-wire 3-phase, 4-wire	—	LB-11ZNW	LB-11YNW	LB-11ZRNW	LB-11YRNW	—
Receiving indicators		—	LB-11ZNRI	LB-11YNRI	LB-11ZRNRI	LB-11YRNRI	—

●Demand meter needles



●Demand meter relay needles



Mechanical Demand meter and demand meter relay usage precautions

(1) Precautions concerning overload
As malfunctions may occur when an overload input is applied continuously, select a rating that does not cause the demand meter indicator to exceed the scale.

(2) Instantaneous meters do not have a zero adjuster (when combined with an indicator). In addition, demand meter relays do not have a zero adjuster for either demand meters (driving needle) or instantaneous meters.

(3) Although the demand-meter-relay alarm setting needle (yellow) follows the driving needle (black), when the driving needle exceeds the preset alarm value, the alarm setting needle returns to the original state (setting value) when the driving needle returns to the alarm setting value or less.

(4) The demand-meter-relay contact output turns off regardless of the state when the auxiliary power supply is interrupted and returns to normal operation immediately after power is restored.

(5) When transporting a demand meter relay, make sure to move the setting needle (yellow) to 70% or more of the maximum scale value.
(The contact adjustment value may change or a malfunction may occur due to vibration or shock during transport if the needle is close to the zero point.)

(6) When the ambient temperature changes suddenly, the zero point of the demand meter may change (1 to 2mm) temporarily. However, this will return to normal after a few hours.

(7) To reset electromagnetic marker needles, use a switch that “opens” when released. In addition, set the duration of electricity supply to the reset terminal to within five seconds. The maximum/minimum value marker needles can be moved to the position of the driving needle manually or by resetting the electromagnetic marker needle.

AC ammeters/AC voltmeters

●AC ammeters Time intervals: 2, 5, 10 and 15 minutes
(LB-8ZNAA: 2 and 15 minutes)

●The demand current and instantaneous current can be measured and maximum demand current can be recorded. AC ammeters can also be used for load monitoring; for example, monitoring the load of voltage transformers or feeders.

●AC voltmeters Time interval: 2 minutes

●The average and instantaneous voltages can be measured, and maximum and minimum voltages can be recorded. AC voltmeters can also be used to monitor voltage fluctuation in low-voltage bus lines and high-voltage circuits.

LB-11ZRNAA
(with max. value marker needle and instantaneous meter)

LB-11YRNAV
(with max. and min. value marker needles and instantaneous meter)

■Specifications

Indicator type			AC ammeters			AC voltmeters		
Model name			LB-8ZNAA	LB-11ZNAA	LB-11ZRNAA	LB-8ZNAV	LB-11ZNAV	LB-11YRNAV
Needles	Marker needles	Max. value	●	●	●	●	●	●
		Min. value	—	—	—	—	—	●
	Instantaneous meter		—	—	●	—	—	●
Operation principle			Bimetal (Rectifying instantaneous meter)			Bimetal (Rectifying instantaneous meter)		
Accuracy (driving needle) (grade)			2.5	1.5		2.5	1.5	
Scale length (mm)	Demand meter		107	150		107	150	
	Instantaneous meter		—		50	—		50
Indicator rating			5A, 50 and 60Hz			150V, 50 and 60Hz		
Time interval (min)			2 / 15	2 / 5 / 10 / 15	2 / 5 / 10 / 15	2	2	2
Consumption VA	Main indicator unit (VA)		4 / 9	4 / 8.5 / 9 / 9	4.5 / 9 / 9.5 / 9.5	4	4	4.5
	Electromagnetic reset (VA)		approx. 15	approx. 5	approx. 5	approx. 15	approx. 5	approx. 5
Marker needle reset			Manual and electromagnetic reset (electromagnetic reset rating: 100-110VAC/DC ±10%)					
Weight (kg)			1.3	1.4	1.5	1.3	1.4	1.8
Delivery period classification			△	○	○	△	○	○

Remarks (1) The instantaneous meter of the AC ammeter has an ordinary scale.
(2) The scale of the instantaneous meter of the AC voltmeter is magnified for the rated voltage range from approx. 80V to 150V.
(3) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Outer dimensions

Fig. 1 LB-8ZNAA and LB-8ZNAV

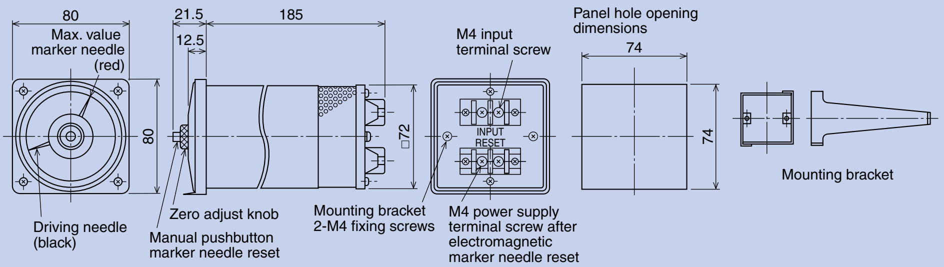
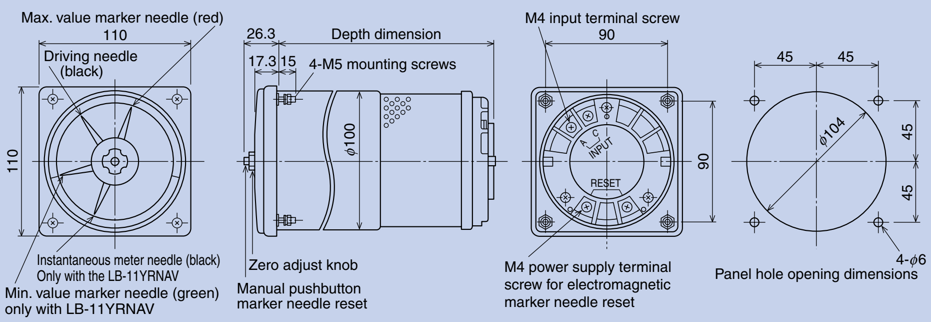


Fig. 2 LB-11ZNAA, LB-11ZRNAA, LB-11ZNAV and LB-11YRNAV



●Depth dimension

AC ammeters			AC voltmeters		
Time interval	LB-11ZNAA	LB-11ZRNAA	Time interval	LB-11ZNAV	LB-11YRNAV
2min/15min	175	195	2min	175	225
5min/10min	202	225			

■Connection diagrams

Fig. 1 AC current demand meter

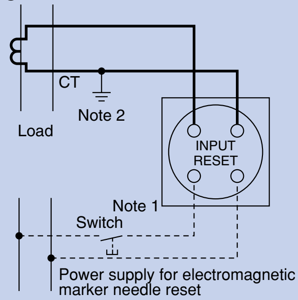
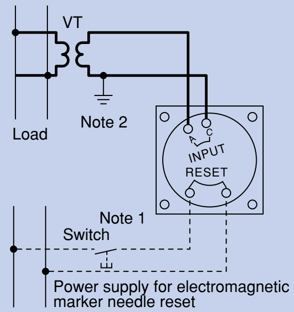


Fig. 2 AC voltage demand meter



Note 1. Connect if an electromagnetic marker needle reset circuit is to be provided. Additionally, use a switch that "opens" when released.

Note 2. For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

■Ordering method

The items in [ ] must be specified.

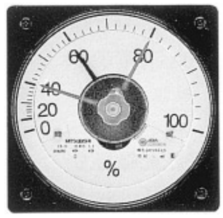
Model name	Indicator rating	Time interval	Scale	CT ratio or VT ratio	Cover type	Special specifications	Number of units
LB-11ZNAA	5A	2M	0-200A	200/5A	B	Colored lines, colored bands, etc.	3

Wattmeters/Receiving indicators

●Wattmeters Time intervals: 2 and 15 minutes
- ●The electricity demand, instantaneous electricity and maximum electricity demand can be recorded. In addition, wattmeters can be used to monitor transformer load and electricity.

●Receiving indicators Time intervals: 2 and 15 minutes
- ●Receiving indicators are used in combination with various electrical transducers or instrumentation transducers, such as those for measuring temperature, to perform telemeter measurements (remote measurement).

LB-11YRNW
(with max. and min. value marker needles and instantaneous meter)



LB-11YNRI
(with max. and min. value marker needles)

■Specifications

Indicator type			Wattmeters				Receiving indicators			
Model name			LB-11ZNW	LB-11YNW	LB-11ZRNW	LB-11YRNW	LB-11ZNRI	LB-11YNRI	LB-11ZRNRI	LB-11YRNRI
Needles	Marker needles	Max. value	●	●	●	●	●	●	●	●
		Min. value	—	●	—	●	—	●	—	●
	Instantaneous meter		—	—	●	●	—	—	●	●
Operation principle			Bimetal (Movable coil instantaneous meter) + transducer				Bimetal (Movable coil instantaneous meter)			
Accuracy (driving needle) (grade)			1.5				1.5			
Frequency			50 and 60Hz				—			
Scale length (mm)	Demand meter		150				150			
	Instantaneous meter		—		50		—		50	
Time interval (min)			2 / 15	2 / 15	2 / 15	2 / 15	2 / 15	2 / 15	2 / 15	2 / 15
Marker needle reset			Manual and electromagnetic reset (electromagnetic reset rating: 100-110VAC/DC ±10%); consumption VA: approx. 5VA							
Accessories	Model name		T-150 rectifier/T-150LB DC amplifier				T-150LB DC amplifier			
	Auxiliary power supply		110V AC$^{+10}_{-15}$%; 50 and 60Hz; consumption VA: approx. 12VA				110V AC$^{+10}_{-15}$%; 50 and 60Hz; consumption VA: approx. 12VA			
Main body weight (kg)			1.2	1.4	1.4	1.5	1.2	1.4	1.4	1.5
Delivery period classification			△	△	△	△	△	△	△	△

Phase-wire	Input	Wattmeters: Indicator rating (Po)	Consumption VA: Voltage circuit	Consumption VA: I_1, I_3	Consumption VA: I_2	Receiving indicators: Indicator rating
1-phase 2-wire	110V 5A	0.4~0.6kW	3	3.2	—	1mA DC Internal resistance: 1kΩ
	220V 5A	0.8~1.2kW	6	3.2	—	
3-phase 3-wire	110V 5A	0.8~1.2kW	3	3.2	—	
	220V 5A	1.6~2.4kW	6	3.2	—	
3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V5A	0.8~1.2kW	1	1.2	2.4	
	110/190V 5A	1.4~2.0kW	1.5	1.2	2.4	
	220/380V 5A	2.8~4.0kW	1.5	1.2	2.4	

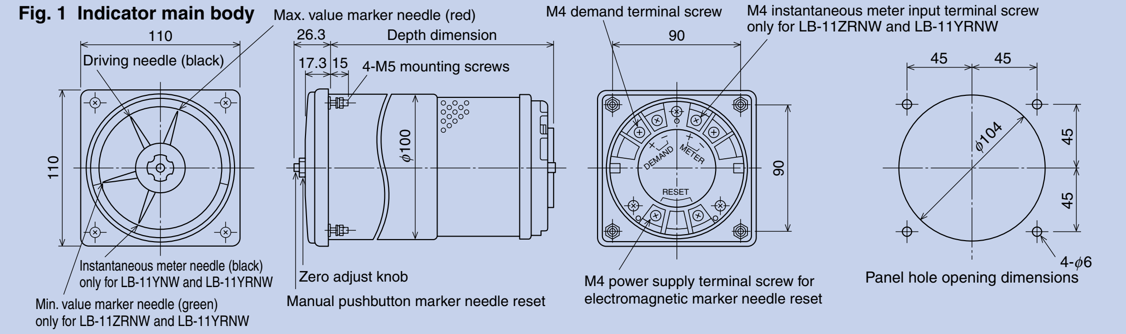
Remarks
(1) Refer to the “Wattmeter Scale Selection Reference Table” (p.56) regarding the manufacturable maximum scale value of a wattmeter.
(2) The T-150 rectifier and T-150LB DC amplifier are dedicated accessories (non-compatible). They can only be used in combination with the indicators specified. The distance between the indicator and the T-150LB DC amplifier/T-150 rectifier must be 5m or less, or the round trip lead wire resistance must be 0.5Ω or less.
(3) Wattmeters cannot be manufactured with both positive and negative readings on the scale.
For receiving indicators with a positive/negative scale, use a transducer to convert positive/negative input to positive output (e.g., convert input of -1,000 to 0 to +1,000W to output of 0 to 0.5 to 1mA).
(4) For scales that measure in electrical units (A, V, W, var, cosø, Hz), AC/DC and three-phase circuit symbols are not displayed. For receiving indicators, the symbol for the quantity to be input is displayed.
(5) Please make sure to read the “Safety Precautions” (pp.5-8) and the “Selection Precautions” (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Outer dimensions

Fig. 1 Indicator main body



●Depth dimensions

Model name	Depth dimension
LB-11ZNW LB-11ZNRI	120
LB-11YNW LB-11YNRI	165
LB-11ZRNW LB-11ZRNRI	145
LB-11YRNW LB-11YRNRI	165

■Ordering method

The items in [ ] must be specified.

●Wattmeter

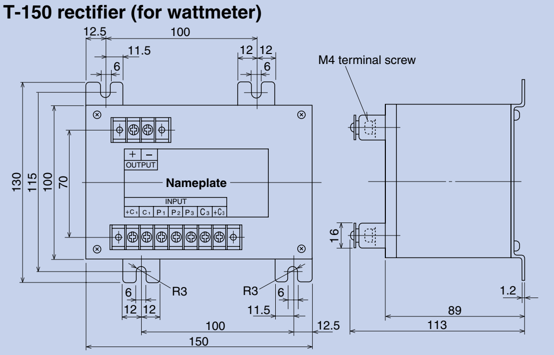
Model name	Phase-wire system	Indicator rating	Time interval	Scale	VT ratio	CT ratio	Cover type	Special specifications	Number of units
LB-11ZNW	3P3W	110V 5A	2M	0-600kW	6600/110V	50/5A	B	Colored lines, colored bands, etc.	2

● Receiving indicator

Model name	Indicator rating	Time interval	Scale	Cover type	Special specifications	Number of units
LB-11ZNRI	1mA	2M	(0-100) A	B	Double scale, colored lines, etc.	2

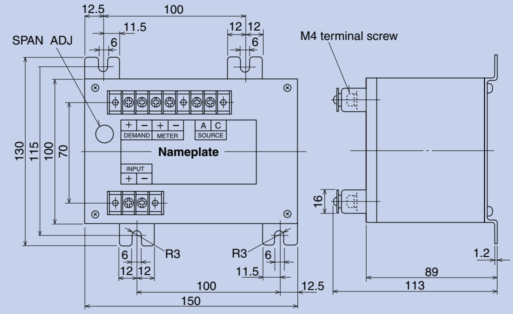
■Outer dimensions of accessories

Fig.1 T-150 rectifier (for wattmeter)



Note. 3-phase, 3-wire system shown in this figure. The number and layout of terminals differ according to the phase-wire system.

Fig. 2 T-150LB DC amplifier



Note. LB-11ZNW and YNW and the LB-11ZNRI and YNRI types do not have a METER terminal.

■Wattmeter connection diagrams

Fig. 1 LB-11ZNW and LB-11YNW (1-phase, 2-wire system)

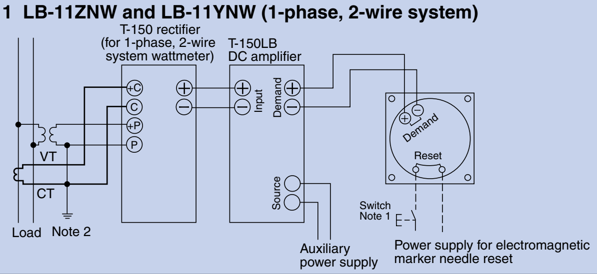


Fig. 2 LB-11ZRNW and LB-11YRNW (1-phase, 2-wire system)

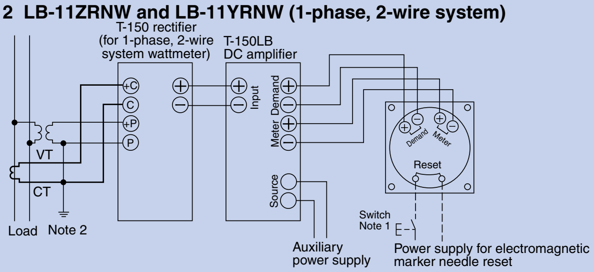


Fig. 3 LB-11ZNW and LB-11YNW (3-phase, 3-wire system)

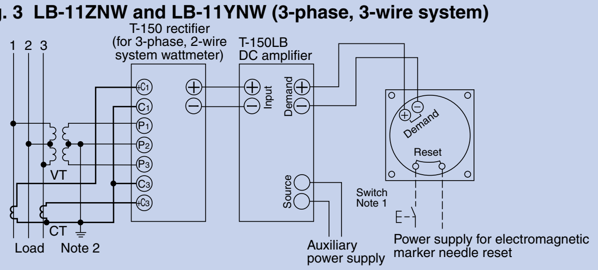


Fig. 4 LB-11ZRNW and LB-11YRNW (3-phase, 3-wire system)

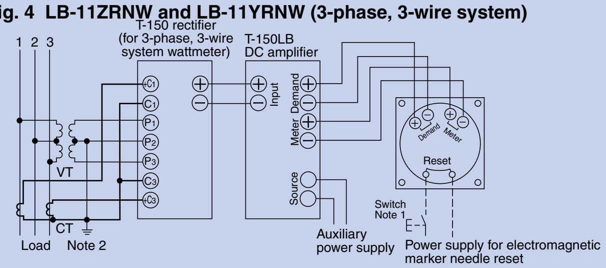


Fig. 5 LB-11ZNW and LB-11YNW (3-phase, 4-wire system)

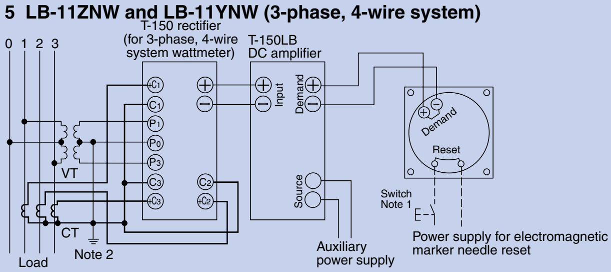
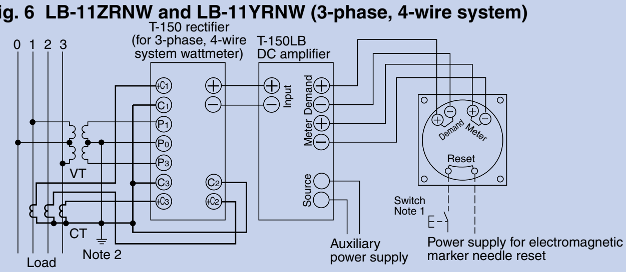


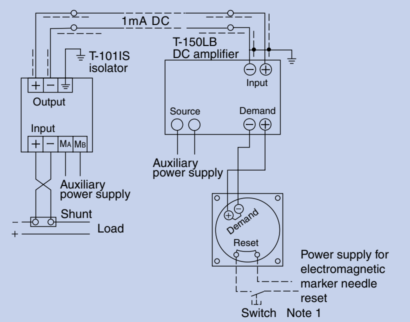
Fig. 6 LB-11ZRNW and LB-11YRNW (3-phase, 4-wire system)



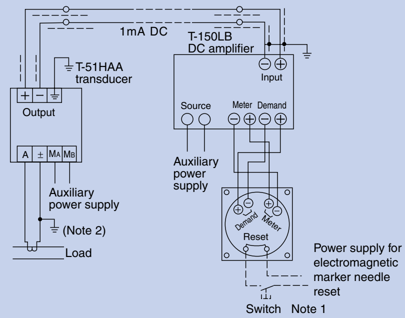
Note 1. Connect if an electromagnetic marker needle reset circuit is to be provided. Additionally, use a switch that "opens" when released.
Note 2. For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

■Connection examples of receiving indicators

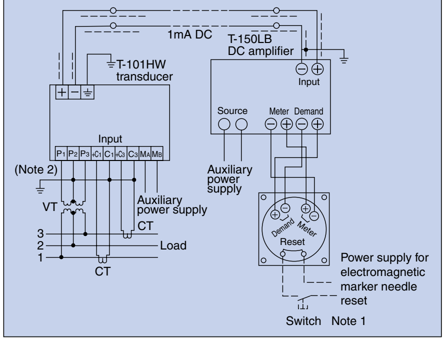
DC current telemetry measurement example



AC current telemetry measurement example



AC active power telemetry measurement example



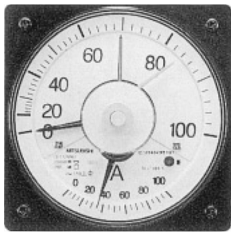
Note 1. Connect when an electromagnetic reset circuit is installed. Additionally, use a switch that opens when disconnected.
Note 2. For low-voltage circuits, secondary-side connections of current transformers/meter transformers are not required.

Mechanical Demand Meter Relays

AC ammeters

Time intervals: 10 and 15 minutes; the 10-minute model complies with the Fundamental Specifications for Electrical Construction of the Ministry of Land, Infrastructure, Transport and Tourism of Japan.

- These indicators are used to measure electricity demand and have a marker needle that displays the maximum value measured, which is used to output an alarm signal.
- AC ammeters can be used to measure electricity demand such as at electric power substations.
- Provided with relay operation indication (LED).



LB-11ZRMNAA

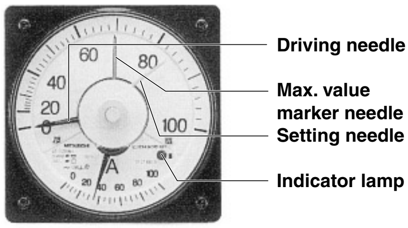
■Specifications

Indicator type		AC ammeters	
Model name		LB-11ZRMNAA	
Needle	Max. value marker needle	●	
	Instantaneous meter	●	
Operation principle		Bimetal (Rectifying instantaneous meter)	
Accuracy (grade)		1.5	
Scale length (mm)	Demand meter	145	
	Instantaneous meter	50	
Indicator rating		5A, 50 and 60Hz	
Time interval (min)		10	15
Consumption VA	Main indicator unit (VA)	10	
	Electromagnetic reset (VA)	5	
Marker needle reset		Manual and electromagnetic reset (electromagnetic reset rating: 100-110VAC/DC ±10%)	
Relay unit	Output signal	No-voltage C contact (sustained output/built-in auxiliary relay)	
	Operation method	Needle passing contact method (with red LED operation indicator)	
	Setting range	25 to 100% of maximum scale value	
	Setting accuracy	±1.5% (with respect to scale length)	
	Contact capacity — Resistive load	250VAC 3A, 100VDC 0.2A	
	Contact capacity — Inductive load	250VAC 1A, 100VDC 0.15A	
Auxiliary power supply		100-110VAC/DC ±10% consumption VA: 1VA	
Weight (kg)		2.5	
Delivery period classification		○	○

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

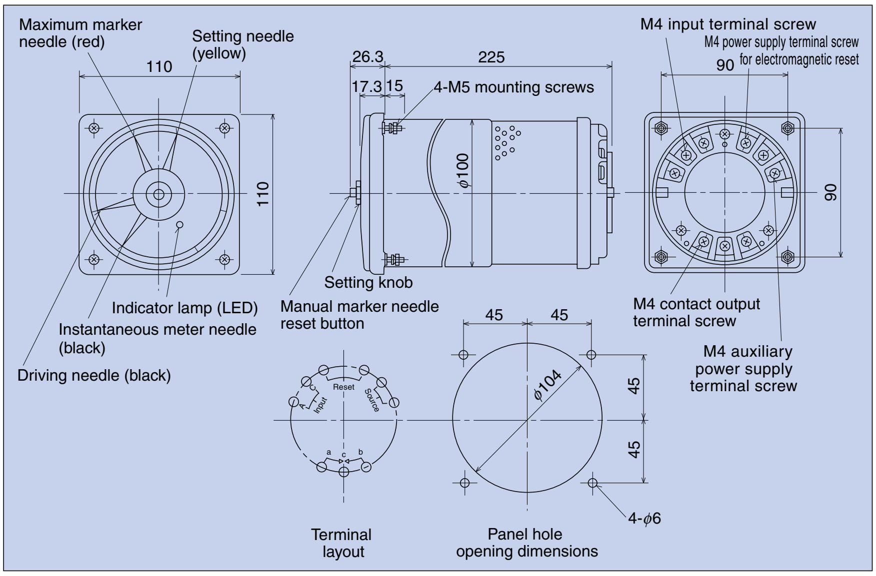
■Needle and relay contact operations



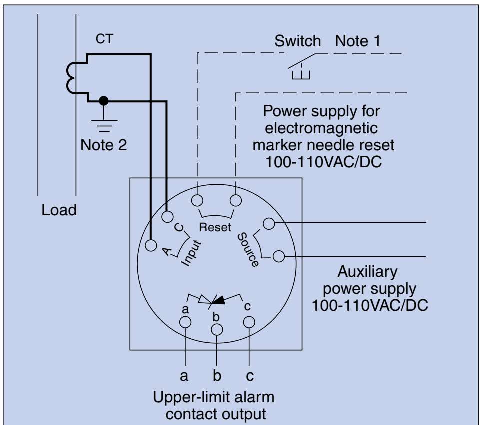
Needle state	State of contacts
When the driving needle is at or below the setting needle.	a b c
When the driving needle pushes the max. value marker needle up and reaches the setting needle.	a b c
When input decreases and the driving needle drops to or below the setting needle.	a b c

Remarks The indicator lamp (red LED) lights up when the relay contacts a-c are ON.

■Outer dimensions



■Connection diagram



Note 1. Connect if an electromagnetic marker needle reset circuit is to be provided. Additionally, use a switch that "opens" when released.

Note 2. For low-voltage circuits, grounding of the secondary side of the current transformer is unnecessary.

■Ordering method

The items in [ ] must be specified.

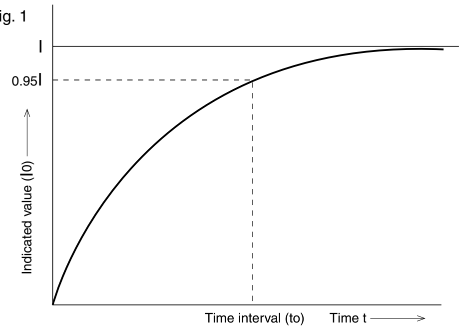
Model name	Indicator rating	Time interval	Scale	CT ratio	Cover type	Special specifications	Number of units
LB-11ZRMNAA	5A	10M	0-200A	200/5A	B	Colored lines, colored bands, etc.	3

Demand Meters/Demand Meter Relays

■Time interval and indications of demand meters

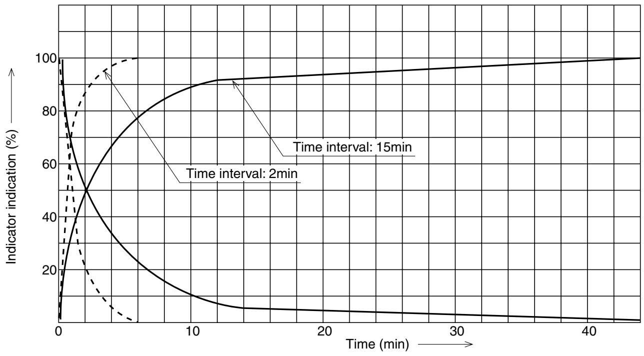
●The time interval (t_0) of a demand meter refers to the time required for an indicated value (I_0) to indicate 95% of a fixed input (I) when the input (I) is supplied continuously. Additionally, for 100% of the input (I) to be indicated, a time of approximately 3 times the time interval (t_0) is required.

Fig. 1



●For mechanical demand meters or demand meter relays, a coiled bimetal is heated by the input current and the thermal change of the bimetal is used for the indication (bimetal). The indicated value is the effective value of the input.

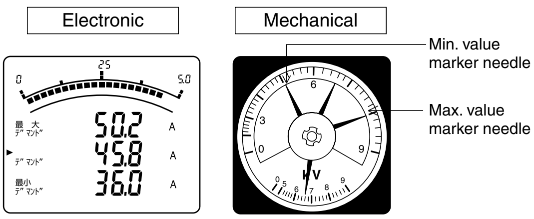
●For electronic demand meters or demand meter relays, the same characteristics are realized via computation using a microcomputer.

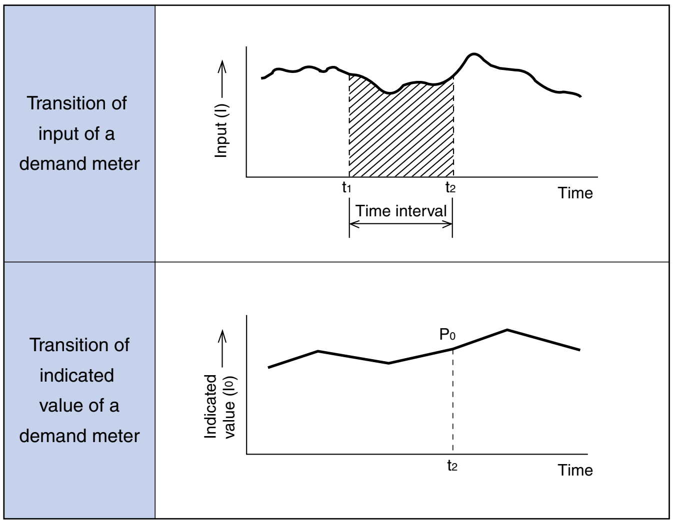


■Indicated value of demand meters

●As described above, demand meters operate over a comparatively long time, and unlike ordinary indicators, they are not directly influenced by factors such as short-time input fluctuations and flicker. Demand meters basically indicate the average value (of demand) for load fluctuation within the time interval.

●The maximum and minimum value marker needles record the maximum and or minimum values indicated by the driving needle, enabling the past maximum demand values to be obtained.



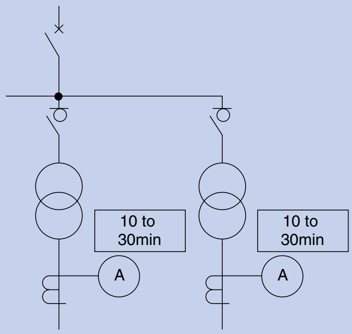


■Selecting the time interval of demand meters

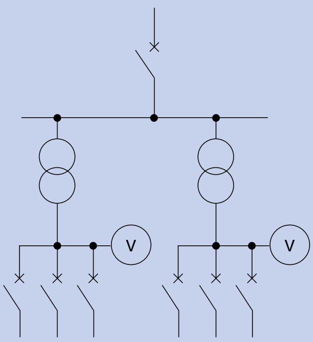
●The time interval of a demand meter is selected according to the facility equipment to be monitored and the purpose of monitoring.

(Demand meter selection example)

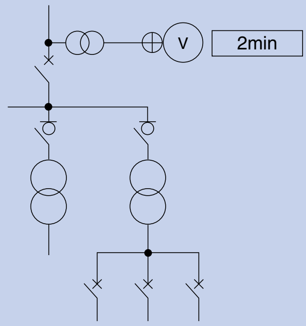
Example 1 Monitoring overload of a voltage transformer



Example 2 Monitoring voltage variation of a low-voltage bus line

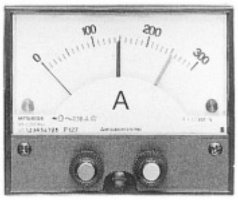


Example 3 Monitoring voltage variation of a high-voltage circuit



Meter Relays

Meter relays enable alarms to be issued and automatic control based on contact outputs at the same time as measurement of voltage, current and other items.



YR-210MRNAA

LR-11MRNAA

Sustained-output models covering the entire scale

Sustained-output needle-pass relays are incorporated, enabling output over the entire scale range to be covered.

100/200VAC switching auxiliary power supply

Can be used with either 100-110VAC or 200-220VAC.

Equipped with relay operation indication lamp

The operating state of the relay can be seen, even from a distance.

■Products list

				Upper/Lower-limit setting				Upper-limit setting			
				Rectangular indicator		Wide-angle indicator		Rectangular indicator		Wide-angle indicator	
Size (width × height) mm				100×83		110×110		100×83		110×110	
Scale length (mm)				72		183		72		183	
Indicator			Operation principle	Model name	Accessory	Model name	Accessory	Model name	Accessory	Model name	Accessory
DC	Ammeter		Movable coil	YM-210MRNDA	—	LM-11MRNDA	—	YM-210MRHNDA	—	LM-11MRHNDA	—
DC	Voltmeter		Movable coil	YM-210MRNDV	—	LM-11MRNDV	—	YM-210MRHNDV	—	LM-11MRHNDV	—
AC	Ammeter		Rectifier	YR-210MRNAA	—	LR-11MRNAA	—	YR-210MRHNAA	—	LR-11MRHNAA	—
AC	Voltmeter		Rectifier	YR-210MRNAV	—	LR-11MRNAV	—	YR-210MRHNAV	—	LR-11MRHNAV	—
AC	Wattmeter	1-phase 2-wire	Transducer	YM-210MRNW	T-150	LM-11MRNW	T-150	YM-210MRHNW	T-150	LM-11MRHNW	T-150
AC	Wattmeter	3-phase 3-wire	Transducer	YM-210MRNW	T-150	LM-11MRNW	T-150	YM-210MRHNW	T-150	LM-11MRHNW	T-150
AC	Wattmeter	3-phase 4-wire	Transducer	YM-210MRNW	T-150	LM-11MRNW	T-150	YM-210MRHNW	T-150	LM-11MRHNW	T-150
AC	Varmeter	3-phase 3-wire	Transducer	YM-210MRNVAR	T-150	LM-11MRNVAR	T-150	YM-210MRHNVAR	T-150	LM-11MRHNVAR	T-150
AC	Varmeter	3-phase 4-wire	Transducer	YM-210MRNVAR	T-150	LM-11MRNVAR	T-150	YM-210MRHNVAR	T-150	LM-11MRHNVAR	T-150
AC	Power factor meter	3-phase 3-wire (balanced)	Transducer	YM-210MRNPF	T-100	LM-11MRNPF	T-100	YM-210MRHNPF	T-100	LM-11MRHNPF	T-100
AC	Power factor meter	3-phase 3-wire (unbalanced)	Transducer	YM-210MRNPFU	T-150	LM-11MRNPFU	T-150	YM-210MRHNPFU	T-150	LM-11MRHNPFU	T-150
AC	Power factor meter	3-phase 4-wire	Transducer	YM-210MRNPFU	T-150	LM-11MRPNFU	T-150	YM-210MRHNPFU	T-150	LM-11MRHNPFU	T-150
AC	Frequency meter		Transducer	YM-210MRNF	T-100	LM-11MRNF	T-100	YM-210MRHNF	T-100	LM-11MRHNF	T-100
Receiving indicator			Movable coil	YM-210MRNRI	—	LM-11MRNRI	—	YM-210MRHNRI	—	LM-11MRHNRI	—
Specifications in common	Relay unit	Output signal		Sustained output							
Specifications in common	Relay unit	Operation method		Pointer passing type							
Specifications in common	Relay unit	Setting needle: Type		Upper limit (H): red; Lower limit (L): green				Upper limit (H): red			
Specifications in common	Relay unit	Setting needle: Minimum setting width		5% of scale length							
Specifications in common	Relay unit	Setting needle: Setting range	Upper limit	5~100%		10~100%		5~100%		10~100%	
Specifications in common	Relay unit	Setting needle: Setting range	Lower limit	0~95%		0~90%		—		—	
Specifications in common	Relay unit	Pickup value		±1.5% or less							
Specifications in common	Relay unit	Auxiliary power supply: Rated voltage		100-110VAC/200-220VAC switching type							
Specifications in common	Relay unit	Auxiliary power supply: Allowable voltage variation range		100-110VAC terminal: 90-120VAC							
Specifications in common	Relay unit	Auxiliary power supply: Allowable voltage variation range		200-220VAC terminal: 180-240VAC							
Specifications in common	Relay unit	Auxiliary power supply: Consumption VA		3.6VA or less		4VA or less		3.6VA or less		4VA or less	
Specifications in common	Relay unit	Contact capacity	Resistive load	250VAC 3A		250VAC 3A		250VAC 3A		250VAC 3A	
Specifications in common	Relay unit	Contact capacity	Resistive load	30VDC 3A, 100VDC 0.2A		30VDC 3A, 100VDC 0.2A		30VDC 3A, 100VDC 0.2A		30VDC 3A, 100VDC 0.2A	
Specifications in common	Relay unit	Contact capacity	Inductive load	250VAC 2A		250VAC 0.3A		250VAC 2A		250VAC 0.3A	
Specifications in common	Relay unit	Contact configuration		Upper limit (H), lower limit (L): no-voltage C contacts				Upper limit (H): no-voltage C contact			
Specifications in common	Withstand voltage (between terminal and case)			2210VAC, 5sec (between input terminal and relay contact terminal: 1200VAC, 1min)							
Specifications in common	Usage temperature range			-5°C~50°C (reference: 23°C)							

■Operation principles

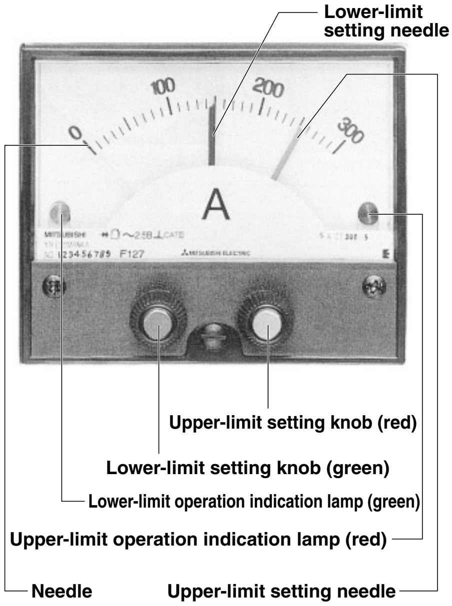
●Non-contact detection

Non-contact detection occurs when the needle reaches the meter relay pick-up value or drop-out value, and is based on changing to the state where the light beam is shielded. For this reason, a protective plate is attached to the needle axis.

●Switching circuit/Output relay section

The signal from the non-contact detection section is amplified via the switching circuit, activating the output relay.

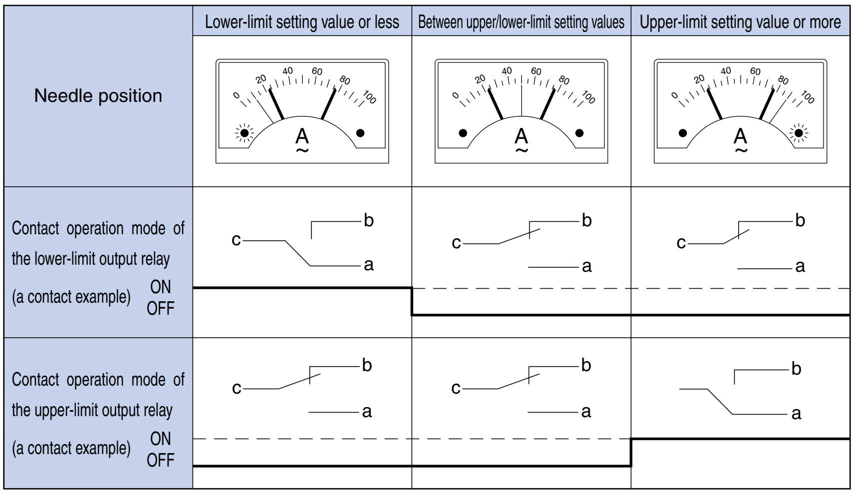
●Names of components



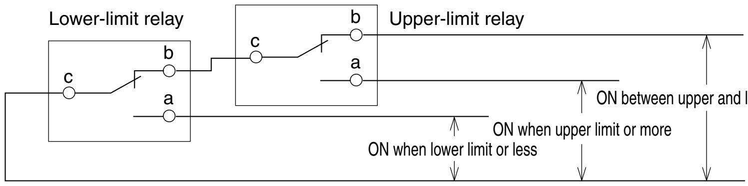
●Upper/Lower-limit operation indication light.

This light turns on as soon as the value set as the upper/lower-limit is reached and stays lit as long as this state is maintained.

●Needle position and output relay operation

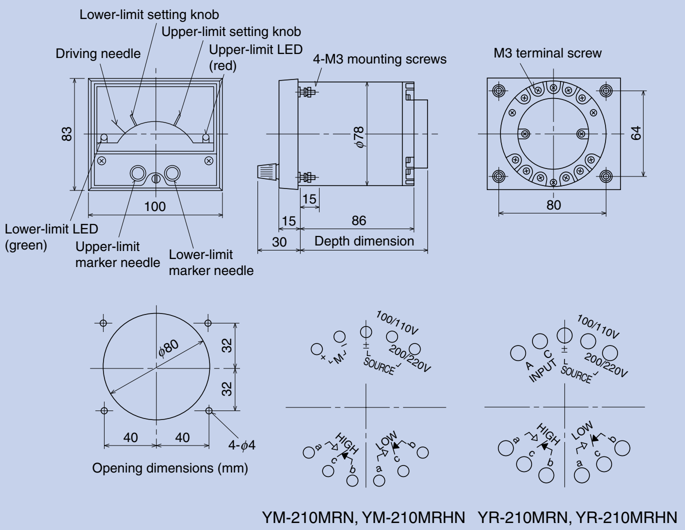


Remarks The needle position across the entire scale can be indicated by combining the contacts of the lower-limit and upper-limit output relays as shown in the diagram below.



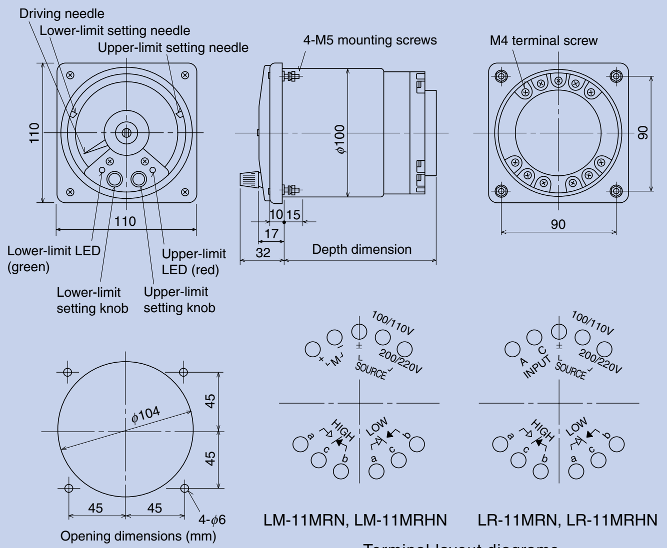
■Outer dimensions

Fig. 1 YM-210MRN and YM-210MRHN
YR-210MRN and YR-210MRHN
(The lower-limit setting needle, the lower-limit setting knob, the lower limit LED, and the LOW output terminals are not provided for YM-210MRHN and YR-210MRHN.)



Terminal layout diagrams

Fig. 2 LM-11MRN and LM-11MRHN
LR-11MRN and LR-11MRHN
(The lower-limit setting needle, the lower-limit setting knob, the lower-limit LED, and the LOW output terminals are not provided for LM-11MRHN and LR-11MRHN.)



Terminal layout diagrams

●Depth dimensions

Model	Depth dimension (mm)
YM-210MRN, YM-210MRHN	96
YR-210MRN, YR-210MRHN	110

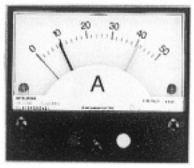
●Depth dimensions

Model	Depth dimension (mm)
LM-11MRN, LM-11MRHN	146
LR-11MRN, LR-11MRHN	159

Note 1. A cover with red needle cannot be manufactured.

Meter Relays

DC ammeters



YM-210MRNDA

LM-11MRNDA

■Specifications

				Rectangular indicators		Wide-angle indicators	
				Upper/Lower-limit setting	Upper-limit setting	Upper/Lower-limit setting	Upper-limit setting
Size (width × height) mm				100×83		110×110	
Model name				YM-210MRNDA	YM-210MRHNDA	LM-11MRNDA	LM-11MRHNDA
Operation principle				Movable coil		Movable coil	
Accuracy (grade)				2.5		1.5	
Scale length (mm)				72		175	
Weight (kg)				0.7		1.8	
Indicator rating	Maximum scale value		Delivery period	Internal resistance (Ω) or consumption current			
	Direct	1mA	○	70Ω		650Ω	
		10mA	○	3Ω		7Ω	
		20mA	○	2.5Ω		10Ω	
		1, 3, 5A	○	60mV(10mA)		100mV(10mA)	
	Combined with shunt	1~7500A	○	60mV(10mA)		100mV(10mA)	

Note 1. In the case of combined use with a shunt, please refer to the table below and specify the lead wire thickness and one-way length or the round trip resistance.

Remarks (1) In the case of a bidirectional deflection indicator, determine the specifications according to the following.
- In the case of a direct rating model, manufacture is possible if the larger of the right and left scales is 5A or less.
- In the case where a shunt is externally attached, determine the scale so that the sum of the absolute values of the indicator ratings is 60mV or more for YM-210MRN and 100mV or more for LM-11MRN.

Example: In the case of a shunt rating of 500A and 60mV
Ammeter scale -500~0~+500A
Ammeter rating -60~0~+60mV (sum of absolute values=120mV≥60mV)

(2) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

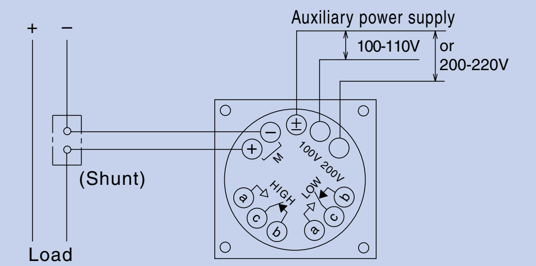
●Table of maximum allowable values of lead wires for DC ammeter relay combined with shunt

DC ammeter relay combined with shunt		
Model name	Indicator rating (mV)	Maximum allowable resistance value of lead wire (Ω)
YM-210MRNDA YM-210MRHNDA	60 or more, less than 75	0.73
	75 or more, less than 100	1.16
	100 or more, less than 150	1.88
	150 or more	3.33
LM-11MRNDA LM-11MRHNDA	100 or more, less than 150	1.50
	150 or more	2.59

Remarks (1) Refer to "DC ammeter combined with shunt" on p.44 regarding the round trip resistance according to the lead wire thickness and one-way length.

■Connection diagram

Fig. 1 YM-210MRNDA and LM-11MRNDA



YM-210MRHNDA and LM-11MRHNDA do not have LOW terminals.

●Lead wires for shunt connection

Lead wires for connecting an indicator with a shunt can be manufactured if specified.

The standard is: **two 2mm^2 - 2m (one-way) 1500V heat-resistant vinyl wires (blue) for electric equipment.**

Remarks (1) The customer is requested to prepare wires besides those of 2mm^2 cross-sectional area.

■Ordering method

The items in [ ] must be specified.

●Indicator combined with shunt

Model name	Indicator rating	Scale	Cover type	Shunt rating + required/not required	Thickness and length of lead wire + required/not-required	Special specifications	Number of units
YM-210MRNDA	60mV	0-200A	B	SHT 200A 60mV, not required	Lead wire 2mm^2 3m, not required	Double scale, colored lines, etc.	2

●Direct indicators

Model name	Scale	Cover type	Special specifications	Number of units
YM-210MRNDA	0-5A	B	Double scale, colored lines, etc.	2

DC voltmeters

YM-210MRNDV

LM-11MRNDV

■Specifications

		Rectangular indicators		Wide-angle indicators	
		Upper/Lower-limit setting	Upper-limit setting	Upper/Lower-limit setting	Upper-limit setting
Size (width × height) mm		100×83		110×110	
Model name		YM-210MRNDV	YM-210MRHNDV	LM-11MRNDV	LM-11MRHNDV
Operation principle		Movable coil		Movable coil	
Accuracy (grade)		2.5		1.5	
Scale length (mm)		72		175	
Weight (kg)		0.7		1.8	
Indicator rating: Maximum scale value	Delivery period	Consumption current			
1, 50, 100V 150, 300, 500V	○	1mA		1mA	

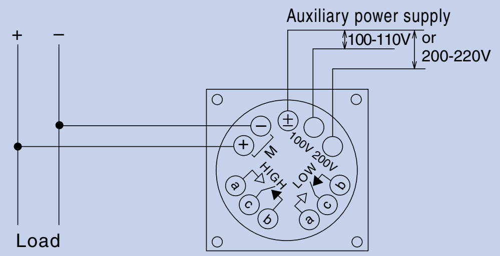
Remarks
(1) If, with a maximum scale of 500V or less, an externally mounted multiplier is desired, the GR-2 multiplier can be attached as an accessory.
(2) In the case of a bidirectional deflection indicator, manufacture is possible if the larger of the right and left scales is 500V or less.
(3) Please make sure to read the “Safety Precautions” (pp.5-8) and the “Selection Precautions” (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

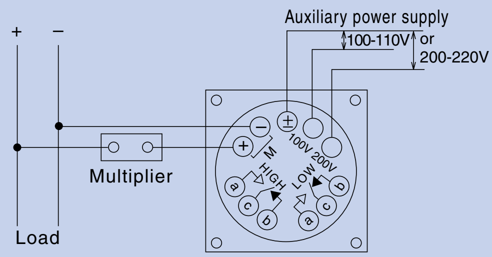
■Connection diagram

Fig. 1 YM-210MRNDV and LM-11MRNDV (direct)



YM-210MRHNDV and LM-11MRHNDV do not have LOW terminals.

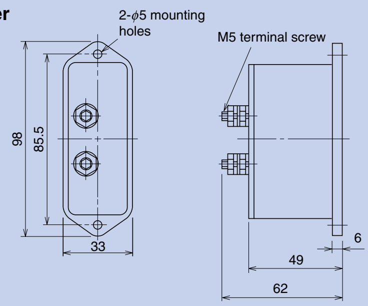
Fig. 2 YM-210MRNDV and LM-11MRNDV (with GR-2 multiplier)



YM-210MRHNDV and LM-11MRHNDV do not have LOW terminals.

■Outer dimensions of accessory

GR-2 multiplier



■Ordering method

The items in [ ] must be specified.

Model name	Multiplier	Scale	Cover type	Special specifications	Number of units
YM-210MRNDV	GR-2	0-100V	B	Double scale, colored lines, etc.	3

Specify if a multiplier is to be provided.

Meter Relays

AC ammeters

YR-210MRNAA

LR-11MRNAA

■Specifications

			Rectangular indicators				Wide-angle indicators			
			Upper/Lower-limit setting		Upper-limit setting		Upper/Lower-limit setting		Upper-limit setting	
Size (width × height) mm			100×83				110×110			
Model name			YR-210MRNAA		YR-210MRHNAA		LR-11MRNAA		LR-11MRHNAA	
Operation principle			Rectifier				Rectifier			
Accuracy (grade)			2.5				1.5			
Frequency			50 and 60Hz							
Scale length (mm)			72				175			
Consumption VA (VA)			0.2				0.1 (0.3 in the case of expanded scale)			
Weight (kg)			0.7				1.8			
Indicator rating and delivery period classification	Maximum scale value		Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded	Ordinary	Expanded
	Direct	100, 200, 500mA	△	△	△	△	△	△	△	△
		1, 5, 10A								
	Combined with CT	5/5, 10/5, 15/5, 20/5, 30/5, 40/5, 60/5, 75/5, 100/5, 150/5, 200/5, 250/5, 300/5, 400/5, 500/5	○	△	○	△	○	△	○	△
	Other	/5A (indicator rating 5A)	○	△	○	△	○	△	○	△
		/1A (indicator rating 1A)	△	△	△	△	△	△	△	△

Remarks (1) The standard expanded scale is the 3x expanded scale. A 2x expanded scale and 5x expanded scale can also be manufactured.
(2) Error may occur due to waveform distortion.
(3) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Connection diagram

Fig. 1 YR-210MRHNAA and LR-11MRHNAA

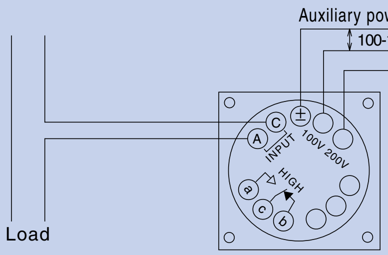


Fig. 2 YR-210MRNAA and LR-11MRNAA

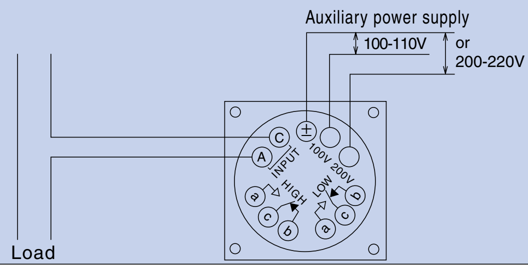


Fig. 3 YR-210MRHNAA and LR-11MRHNAA

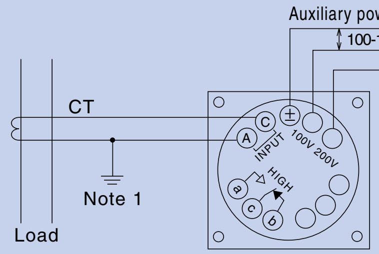
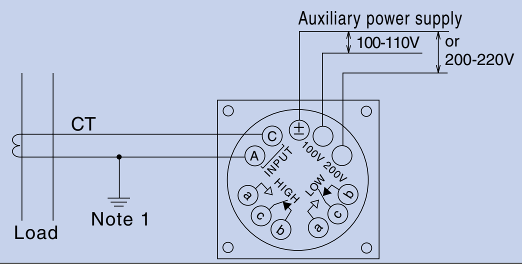


Fig. 4 YR-210MRNAA and LR-11MRNAA



Note 1. In a low voltage circuit, grounding of the secondary side of the current transformer is unnecessary.

■Ordering method

The items in [ ] must be specified.

●Indicator combined with current transformer

Model name	Indicator rating	Scale	CT ratio	Cover type	Special specifications	Number of units
YR-210MRNAA	5A	0-500A	500/5A	B	Double scale, colored lines, etc.	2

●Direct indicators

Model name	Indicator rating	Scale	Cover type	Special specifications	Number of units
YR-210MRNAA	10A	0-10A	B	Double scale, colored lines, etc.	2

AC voltmeters

YR-210MRNAV

LR-11MRNAV

■Specifications

				Rectangular indicators				Wide-angle indicators			
				Upper/Lower-limit setting		Upper-limit setting		Upper/Lower-limit setting		Upper-limit setting	
Size (width × height) mm				100×83				110×110			
Model name				YR-210MRNAV		YR-210MRHNAV		LR-11MRNAV		LR-11MRHNAV	
Operation principle				Rectifier				Rectifier			
Accuracy (grade)				2.5				1.5			
Frequency				50 and 60Hz							
Scale length (mm)				72				175			
Weight (kg)				0.7				1.8			
Indicator rating and delivery period classification	Maximum scale value			Consumption VA and delivery period classification							
				Consumption VA	Delivery period classification	Consumption VA	Delivery period classification	Consumption VA	Delivery period classification	Consumption VA	Delivery period classification
	Direct	10, 30, 50V		0.3VA	○	0.3VA	○	0.1VA	○	0.1VA	○
		75, 100V		0.5VA		0.5VA		0.1VA		0.1VA	
		150V		0.6VA	○	0.6VA	○	0.15VA	○	0.15VA	○
		300V		1.7VA		1.7VA		0.3VA		0.3VA	
	Combined with VT	VT ratio	Scale	0.6VA	○	0.6VA	○	0.15VA	○	0.15VA	○
		440/110V	0~600V								
		3300/110V	0~4500V								
		6600/110V	0~9000V								
		Other □/110V	VT ratio × 150V								

Remarks (1) Error may occur due to waveform distortion.
(2) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Connection diagram

Fig. 1 YR-210MRHNAV and LR-11MRHNAV

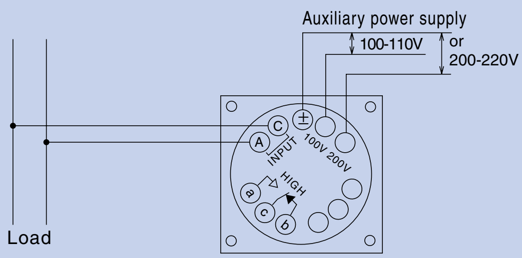


Fig. 2 YR-210MRNAV and LR-11MRNAV

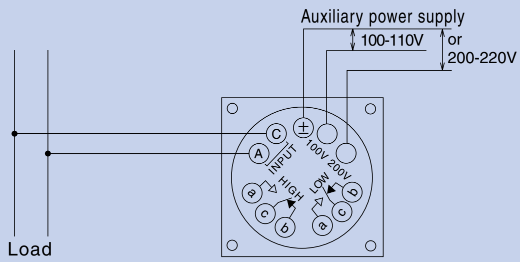


Fig. 3 YR-210MRHNAV and LR-11MRHNAV

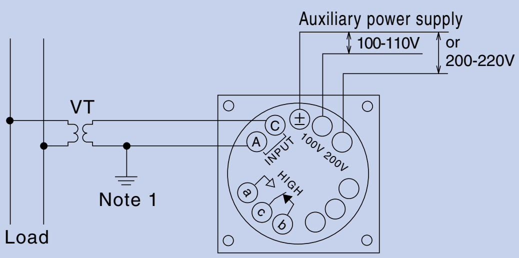
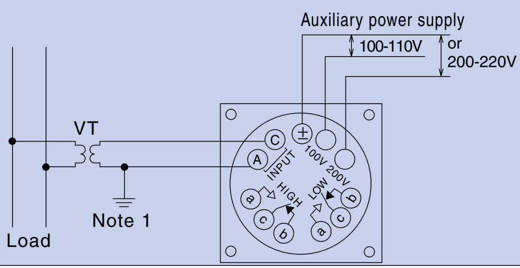


Fig. 4 YR-210MRNAV and LR-11MRNAV



Note 1. In a low voltage circuit, grounding of the secondary side of the instrument voltage transformer is unnecessary.

■Ordering method

The items in [ ] must be specified.

●Indicator combined with instrument voltage transformer

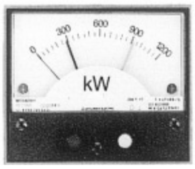
Model name	Indicator rating	Scale	VT ratio	Cover type	Special specifications	Number of units
YR-210MRNAV	150V	0-9000V	6600/110V	B	Double scale, colored lines, etc.	2

●Direct indicators

Model name	Indicator rating	Scale	Cover type	Special specifications	Number of units
YR-210MRNAV	300V	0-300V	B	Double scale, colored lines, etc.	2

Meter Relays

Wattmeters
Varmeters



YM-210MRNW

LM-11MRNW

■Specifications

	Wattmeters				Varmeters			
	Rectangular indicators		Wide-angle indicators		Rectangular indicators		Wide-angle indicators	
	Upper/Lower-limit setting	Upper-limit setting	Upper/Lower-limit setting	Upper-limit setting	Upper/Lower-limit setting	Upper-limit setting	Upper/Lower-limit setting	Upper-limit setting
Size (width × height) mm	100×83		110×110		100×83		110×110	
Model name	YM-210 MRNW	YM-210 MRHNW	LM-11 MRNW	LM-11 MRHNW	YM-210 MRNVAR	YM-210 MRHNVAR	LM-11 MRNVAR	LM-11 MRHNVAR
Operation principle	Transducer				Transducer			
Accuracy (grade)	2.5		1.5		2.5		1.5	
Frequency	50 and 60Hz							
Scale length (mm)	72		175		72		175	
Weight (kg)	0.7		1.8		0.7		1.8	

Indicator rating and delivery period classification

Rating			Wattmeters, Rectangular indicators					Wattmeters, Wide-angle indicators					Varmeters, Rectangular indicators					Varmeters, Wide-angle indicators				
Circuit	Secondary rating	Indicator rating (Po) (kW or kvar)	Consumption VA Voltage circuit	Consumption VA Voltage circuit I1 I3	Consumption VA Voltage circuit I2	Accessory	Delivery period	Consumption VA Voltage circuit	Consumption VA Voltage circuit I1 I3	Consumption VA Voltage circuit I2	Accessory	Delivery period	Consumption VA Voltage circuit	Consumption VA Voltage circuit I1 I3	Consumption VA Voltage circuit I2	Accessory	Delivery period	Consumption VA Voltage circuit	Consumption VA Voltage circuit I1 I3	Consumption VA Voltage circuit I2	Accessory	Delivery period
1-phase 2-wire	110V 5A	0.4~0.6	3	3.2		T-150	△	3	3.2		T-150	△	—	—		—	—	—	—		—	—
1-phase 2-wire	220V 5A	0.8~1.2	6	3.2			△	6	3.2			△										
3-phase 3-wire	110V 5A	0.8~1.2	1.5	1.6		T-150	○	1.5	1.6		T-150	○	1.5	1.2	2.4	T-150	○	1.5	1.2	2.4	T-150	○
3-phase 3-wire	220V 5A	1.6~2.4	3	1.6			○	3	1.6			○	3	1.2	2.4		○	3	1.2	2.4		○
3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V 5A	0.8~1.2	1	1.2	2.4	T-150	△	1	1.2	2.4	T-150	△	1.5	1.2	2.4	T-150	△	1.5	1.2	2.4	T-150	△
3-phase 4-wire	110/190V 5A	1.4~2.0	1	1.2	2.4	T-150	△	1	1.2	2.4	T-150	△	1.5	1.2	2.4	T-150	△	1.5	1.2	2.4	T-150	△
3-phase 4-wire	220/380V 5A	2.8~4.0	1	1.2	2.4	T-150	△	1	1.2	2.4	T-150	△	—	—	—	—	—	—	—	—	—	—

Remarks
(1) Refer to the "Wattmeter Scale Selection Reference Table" (p.54) concerning the manufacturable maximum scale value of a wattmeter relay.
(2) The varmeter relays are bidirectional deflection indicators with "Zero" as the central division and with LEAD at the left side and LAG at the right side. Refer to the "Varmeter Scale Selection Reference Table" (p.60) concerning the manufacturable maximum scale value of a varmeter relay.
(3) Unidirectional deflection indicators can also be manufactured for varmeter relays. Please specify LEAD or LAG (standard is LAG).
(4) 1A current rating models are also manufactured (the consumption VA is similar to that of a 5A model).
(5) The T-150 rectifier is a dedicated accessory (non-compatible accessory) and thus cannot be used in combinations besides those specified for the indicators. The distance between the indicator and the T-150 rectifier must be 5m or less or the round trip lead wire resistance must be 0.5Ω or less.
(6) The weight of the T-150 rectifier is approximately 1kg.
(7) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Ordering method

The items in [ ] must be specified.

●**Wattmeter**

Model name	Phase-wire system	Indicator rating	Scale	VT ratio	CT ratio	Cover type	Special specifications	Number of units
YM-210MRNW	3P3W	110V 5A	0-2400kW	6600/110V	200/5A	B	Double scale, colored lines, etc.	2

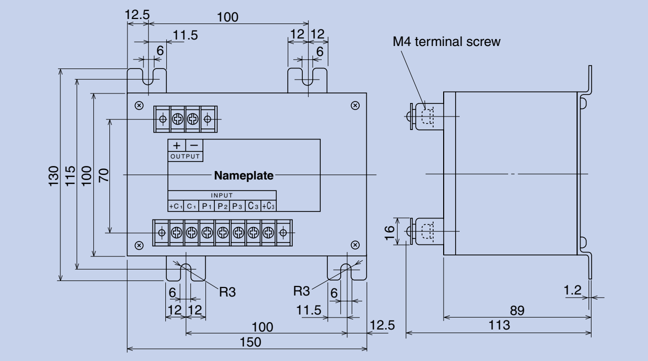
●**Varmeter**

Model name	Phase-wire system	Indicator rating	Scale	VT ratio	CT ratio	Cover type	Special specifications	Number of units
YM-210MRNVAR	3P3W	110V 5A	LEAD600-0-LAG600kvar	6600/110V	100/5A	B	Colored lines, etc.	2

(Unidirectional deflection indicator)
0-LAG1200kvar

■Outer dimensions of accessory

T-150 rectifier (for wattmeter or varmeter relay)



●Terminal layouts

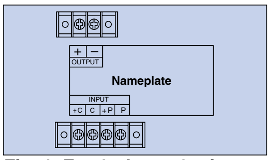


Fig. 1 For 1-phase, 2-wire system wattmeter

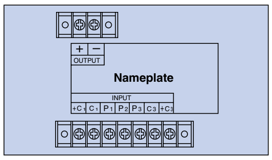


Fig. 2 For 3-phase, 3-wire system wattmeter

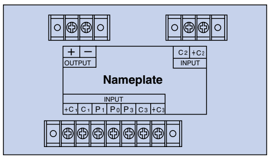


Fig. 3 For 3-phase, 4-wire system wattmeter

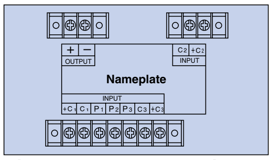


Fig. 4 For 3-phase, 3-wire system varmeter
For 3-phase, 4-wire system varmeter

■Connection diagrams

Fig. 1 Wattmeter relay (1-phase, 2-wire system)

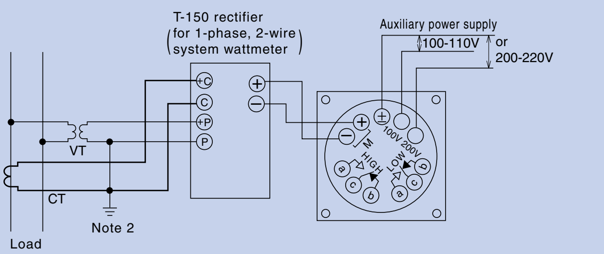


Fig. 2 Wattmeter relay (3-phase, 3-wire system)

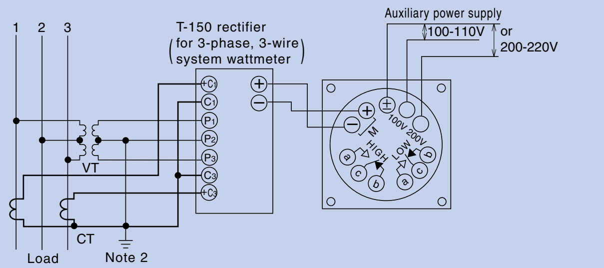


Fig. 3 Wattmeter relay (3-phase, 4-wire system)

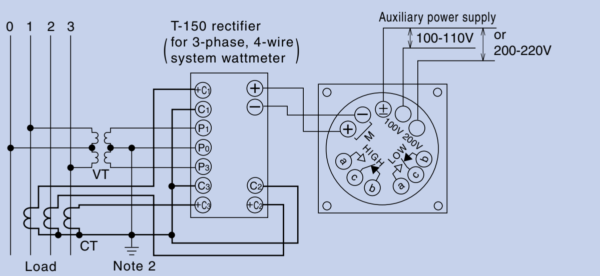


Fig. 4 Varmeter relay (3-phase, 3-wire system)

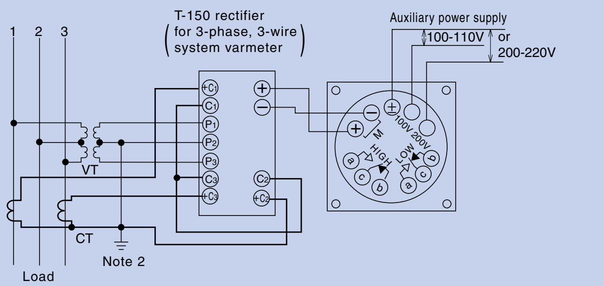
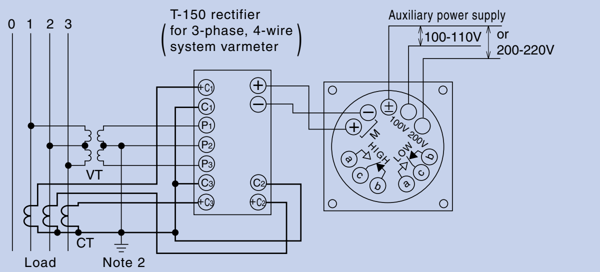


Fig. 5 Varmeter relay (3-phase, 4-wire system)



Note 1. YM-210MRHNW, LM-11MRHNW, YM-210MRHNVAR, and LM-11MRHNVAR do not have LOW terminals.

Note 2. For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

Meter Relays

Power factor meters

YM-210MRNPF

LM-11MRNPF

■Specifications

	Rectangular indicators				Wide-angle indicators			
	Upper/Lower-limit setting	Upper-limit setting	Upper/Lower-limit setting	Upper-limit setting	Upper/Lower-limit setting	Upper-limit setting	Upper/Lower-limit setting	Upper-limit setting
Size (width × height) mm	100×83				110×110			
Model name	YM-210MRNPF	YM-210MRHNPF	YM-210MRNPFU	YM-210MRHNPFU	LM-11MRNPF	LM-11MRHNPF	LM-11MRNPFU	LM-11MRHNPFU
Operation principle	Transducer				Transducer			
Accuracy (grade)	5				5			
Scale	LEAD0.5~1~0.5LAG				LEAD0.5~1~0.5LAG			
Frequency	50 and 60Hz		50 or 60Hz		50 and 60Hz		50 or 60Hz	
Scale length (mm)	72				175			
Weight (kg)	0.7				1.8			

Indicator rating and delivery period classification

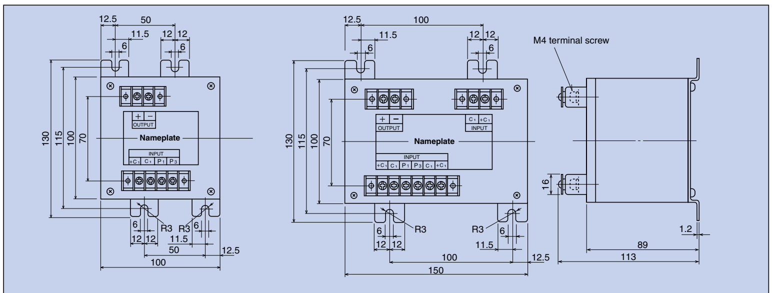
Circuit	Rating	Consumption VA: Voltage circuit	Consumption VA: I1 I3	Consumption VA: I2	Accessory	Delivery period	Consumption VA: Voltage circuit	Consumption VA: I1 I3	Consumption VA: I2	Accessory	Delivery period	Consumption VA: Voltage circuit	Consumption VA: I1 I3	Consumption VA: I2	Accessory	Delivery period	Consumption VA: Voltage circuit	Consumption VA: I1 I3	Consumption VA: I2	Accessory	Delivery period
3-phase 3-wire (balanced)	110V 5A	1	1		T-100	△	—			—	—	1	1		T-100	△	—			—	—
	220V 5A	2	1									2	1								
3-phase 3-wire (unbalanced)	110V 5A	—			—	—	1	2		T-150	△	—			—	—	1	2		T-150	△
	220V 5A						2	2									2	2			
3-phase 4-wire (balanced)	$\frac{110}{\sqrt{3}}$/110V 5A	—			—	—	2	1	2	T-150	△	—			—	—	2	1	2	T-150	△
	110V/190V 5A	—			—	—	2	1	2	T-150	△	—			—	—	2	1	2	T-150	△

Remarks
(1) Use an input current of 1/5 or more than the rated current. The smaller the input current, the larger the error.
(2) 1A current rating models can also be manufactured (the consumption VA is similar to that of a 5A model).
(3) The T-100 and T-150 rectifiers are dedicated accessories (non-compatible accessories) and thus cannot be used in combinations besides those designated for the indicators.
The distance between the indicator and the T-100 or T-150 rectifier must be 5m or less or the round trip lead wire resistance must be 0.5Ω or less.
(4) Weight of accessory T-100 rectifier: approx. 1.4kg
T-150 rectifier: approx. 1.7kg
(5) Please specify the frequency for YM-210MRNPFU and LM-11MRNPFU.
(6) Models for balanced circuits cannot be used with unbalanced loads.
Models for unbalanced loads can be used with balanced circuits.
(7) The mounting order for the VT and CT does not have to be considered.
(8) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions"(p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Outer dimensions of accessory

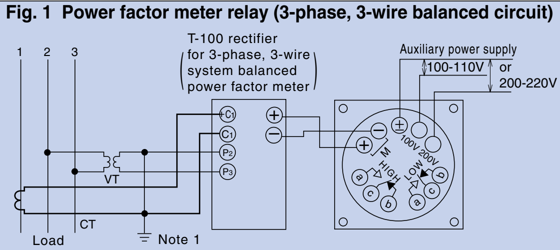


T-100 rectifier

T-150 rectifier (for 3-phase, 4-wire systems)
(The 3-phase, 3-wire system model does not have $+C_2$ and C_2 terminals.)

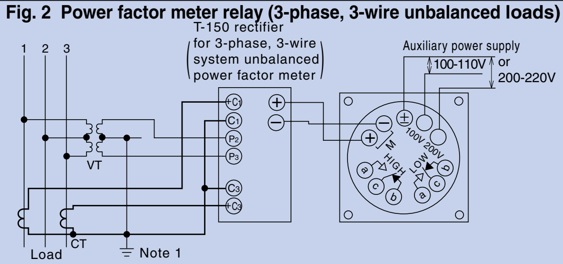
■Connection diagram

Fig. 1 Power factor meter relay (3-phase, 3-wire balanced circuit)



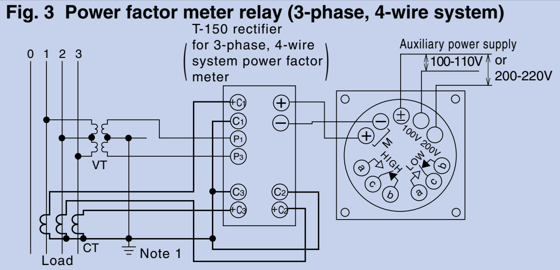
YM-210MRHNPF and LM-11MRHNPF do not have LOW terminals.

Fig. 2 Power factor meter relay (3-phase, 3-wire unbalanced loads)



YM-210MRHNPFU and LM-11MRHNPFU do not have LOW terminals

Fig. 3 Power factor meter relay (3-phase, 4-wire system)



YM-210MRHNPFU and LM-11MRHNPFU do not have LOW terminals.

Note 1. In a low voltage circuit, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

■Ordering method

The items in [ ] must be specified.

Model name	Phase-wire system	Indicator rating	Scale	Cover type	Frequency	Special specifications	Number of units
YM-210MRNPFU	3P3W	110V 5A	LEAD0.5-1-0.5LAG	B	50Hz	Colored lines, colored bands, etc.	3

Specification is unnecessary in the case of a model for 3-phase, 3-wire systems.

Frequency meters

YM-210MRNF

LM-11MRNF

■Specifications

			Rectangular indicators			Wide-angle indicators		
			Upper/Lower-limit setting		Upper-limit setting	Upper/Lower-limit setting		Upper-limit setting
Size (width × height) mm			100×83			110×110		
Model name			YM-210MRNF		YM-210MRHNF	LM-11MRNF		LM-11MRHNF
Operation principle			Transducer			Transducer		
Accuracy (grade)			1			1		
Scale length (mm)			72			175		
Weight (kg)			0.7			1.8		
Indicator rating and delivery period classification	Circuit voltage	Scale	Consumption VA	Accessory	Delivery period	Consumption VA	Accessory	Delivery period
	110V	45~55Hz	1	T-100	△	1	T-100	△
		55~65Hz	1		△	1		△
		45~65Hz	1		△	1		△
	220V	45~55Hz	1.5		△	1.5		△
		55~65Hz	1.5		△	1.5		△
		45~65Hz	1.5		△	1.5		△
	Special scale		45~75Hz, 170~190Hz 85~110Hz, 360~440Hz					

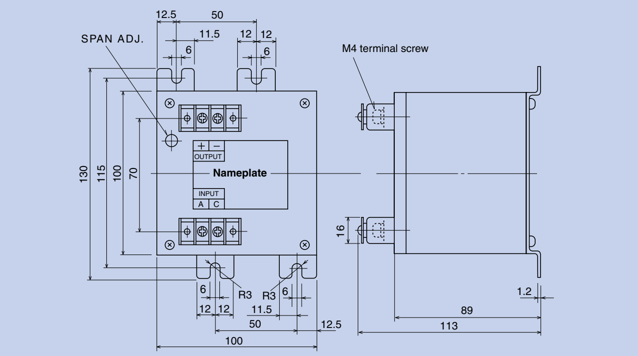
Remarks (1) Allowable operating voltage range - for 110V: 90~130V; for 220V: 180~260V
(2) The T-100 rectifier is a dedicated accessory (non-compatible accessory) and thus cannot be used in combinations besides those specified for the indicators.
The distance between the indicator and the T-100 rectifier must be 5m or less or the round trip lead wire resistance must be 0.5Ω or less.
(3) Weight of accessory T-100 rectifier: approx. 0.9kg
(4) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

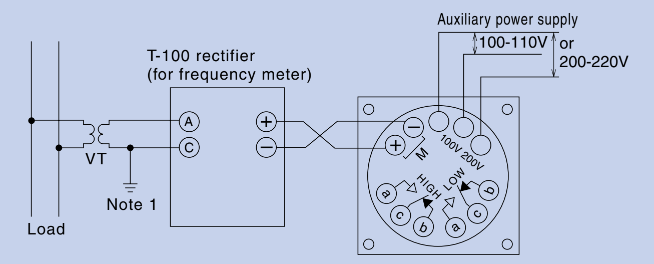
Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Outer dimensional drawings of accessory

T-100 rectifier (for frequency meter)



■Connection diagram



YM-210MRHNF and LM-11MRHNF do not have LOW terminals.

Note 1. In a low voltage circuit, grounding of the secondary side of the instrument voltage transformer is unnecessary.

■Ordering method

The items in ☐ must be specified.

Model name	Rated voltage	Scale	Cover type	Special specifications	Number of units
YM-210MRNF	110V	55-65Hz	B	Colored lines, colored bands, etc.	2

Receiving indicators

YM-210MRNRI

LM-11MRNRI

■Specifications

				Rectangular indicators		Wide-angle indicators	
				Upper/Lower-limit setting	Upper-limit setting	Upper/Lower-limit setting	Upper-limit setting
Size (width × height) mm				100×83		110×110	
Model name				YM-210MRNRI	YM-210MRHNRI	LM-11MRNRI	LM-11MRHNRI
Operation principle				Movable coil		Movable coil	
Accuracy (grade)				2.5		1.5	
Scale length (mm)				72		175	
Weight (kg)				0.7		1.8	
Indicator rating and delivery period classification	Indicator rating		Delivery period	Internal resistance (Ω) or consumption current (mA)			
	Current input	±0.5mA	△	70Ω		650Ω	
		1mA	○	70Ω		650Ω	
		10mA	△	3Ω		7Ω	
		4-20mA (zero-suppressed)	○	2.5Ω		10Ω	
	Voltage input	1, 5, 10V	○	1mA		1mA	

Remarks (1) Refer to p.105 onward of this catalog in regard to transducers to be combined with a receiving indicator.
(2) In the case of an electrical quantity scale (A, V, W, var, cosϕ, Hz), the AC/DC symbol and 3-phase circuit symbol are not indicated on the scale. The symbol of the input quantity of the receiving indicator is indicated.
(3) Please make sure to read the “Safety Precautions” (pp.5-8) and the “Selection Precautions” (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Connection diagram examples

Fig. 1 Combination with current transducer

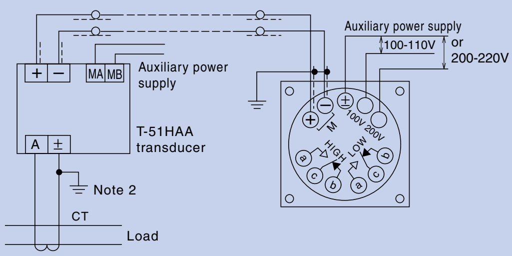
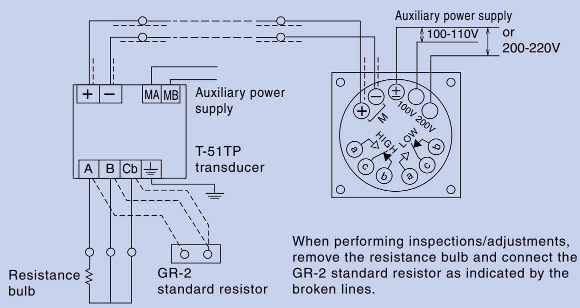


Fig. 2 Combination with temperature transducer



Note 1. YM-210MRHNR1 and LM-11MRHNR1 do not have LOW terminals.

Note 2. In a low voltage circuit, grounding of the secondary side of the current transformer is unnecessary.

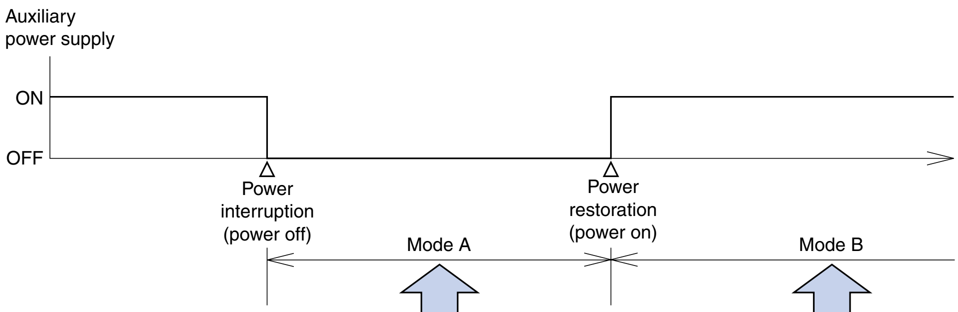
■Ordering method

The items in [ ] must be specified.

Model name	Scale and units	Cover type	Indicator rating	Special specifications	Number of units
YM-210MRNRI	(0-100) %	B	FS4-20mA	Double scale, colored lines, etc	2
	(0-300)A				

■Precautions When Handling Meter Relays

●For meter relays, always keep the auxiliary power supply on. The consequences of turning the auxiliary power supply on/off are described below.

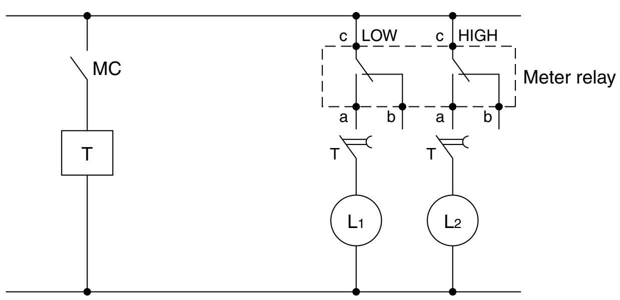


Model name	Relay output (during mode A)	Relay output (during mode B)	
		Indicator input = Setting region immediately before power interruption	Indicator input≠Setting region immediately before power interruption
LM-11MRN LM-11MRHN LR-11MRN LR-11MRHN	The relay state immediately before power interruption is held.	Normal operation is performed immediately.	The relay state immediately before power interruption is output.*
YM-210MRN YM-210MRHN YR-210MRN YR-210MRHN	Both the upper-limit and lower-limit relays are turned off.	Normal operation is performed immediately.	Normal operation is performed immediately.

(Note) *Method for restoring normal operation after restoration from power interruption.
Turn the setting knob to move the needle setting in the order of ①, ② as shown below. After this, reset the needle setting.

Relay output	Lower limit		Upper limit	
Malfunction details	Relay output is ON (when it should be OFF)	Relay output is OFF (when it should be ON)	Relay output is ON (when it should be OFF)	Relay output is OFF (when it should be ON)
Action	② ① Lower limit Upper limit Needle	② ① Lower limit Upper limit Needle	② ① Lower limit Upper limit Needle	② ① Lower limit Upper limit Needle

●If an inrush current that is generated when a motor is started exceeds the setting value even instantaneously, the relay operates during that state.
To prevent unnecessary influence of the relay during such a transition state of the input signal, use a timer to release the output relay terminals for a fixed time during starting to prevent unnecessary operation of a control device.



MC : auxiliary contact of electromagnetic switch for starting motor
T : timer
L1, L2 : control device

Indicators with Maximum and Minimum Needles

These indicators have marker needles indicating the maximum and minimum values. The response time of these indicators is extremely fast.
●The needle response time is 0.1s (0.3s for DC input).
●The maximum value marker needle, minimum value marker needle and driving needle are red, green and black, respectively.
●Using the indicators in combination allows the marker needles to be reset to the driving needle both manually and electromagnetically.

LM-11ZNAA

LM-11YNAV

■Specifications

		DC ammeter			AC ammeter	DC voltmeter	Receiving indicator
Size (width × height) mm		110×110			110×110	110×110	110×110
Model name	With maximum needle	LM-11ZNDA			LM-11ZNAA	LM-11ZNAV	LM-11ZNRI
	With maximum and minimum needles	LM-11YNDA			LM-11YNAA	LM-11YNAV	LM-11YNRI
Operation principle		Movable coil			Rectifier		Movable coil
Accuracy (grade)		1.5 (marker needle: 2)			1.5 (marker needle: 2)		1.5 (marker needle: 2)
Scale length (mm)		175			175		175
Marker needle reset		Manual and electromagnetic marker needle reset (electromagnetic marker needle reset voltage: 100-110VAC/DC ±10%); consumption VA: 6VA					
Frequency		—			50 or 60Hz	50 or 60Hz	—
Weight (kg)		3.2			3.2	3.2	3.2
Indicator rating	Rated voltage or rated current	5, 10, 15 20mA	1, 3, 5 10, 15A	15A Note 1 or more	1, 5, 10, 15, 20, 30A	100, 110, 150, 190 259, 300V	DC 5mA DC4-20mA
	Consumption VA	40Ω (20mA)	300mV	300mV	1VA	5VA	650Ω (DC5mA), 100Ω (DC4-20mA)
	Response time	0.3s			0.1s	0.1s	0.3s
Accessory		—			T-150	T-150	—
Delivery period classification		△			○	○	△

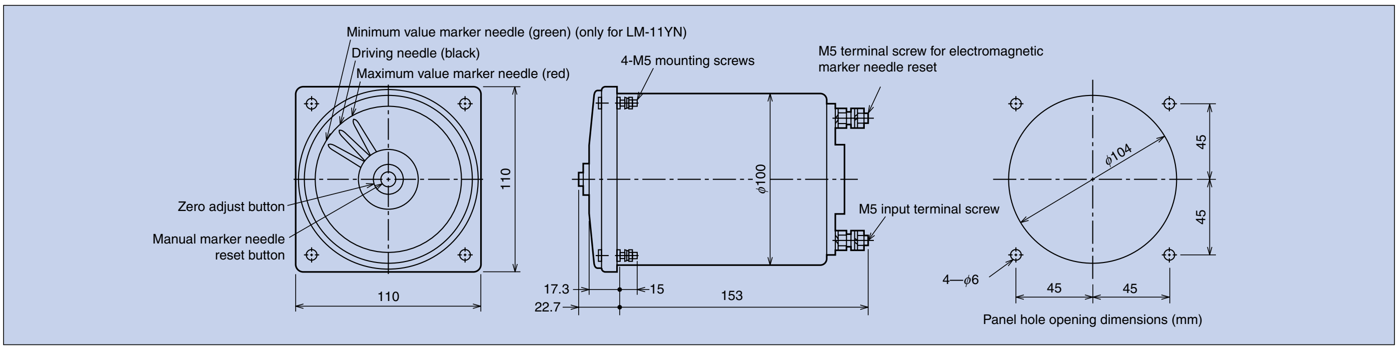
Note 1. Models with a rating exceeding 15ADC are provided with an externally mounted 300mV shunt.
Additionally, in ordering, please specify the resistance value so that the lead wire round trip resistance value is 0.8Ω or less.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Remarks (1) Refer to p.90 and p.92 if an AC voltmeter is to be used as a ground voltmeter.
(2) The T-150 rectifier is a dedicated accessory (non-compatible accessory) and thus cannot be used in combinations besides those specified for the indicators. The distance between the indicator and the T-150 rectifier must be 5m or less or the round trip lead wire resistance must be 0.5Ω or less.
(3) Set the duration of supplying electricity to the electromagnetic marker needle resetting terminal to within 5s. Additionally, use a switch that "opens" when released.
(4) The overload capacity is 2 times the rated current for 2s.
(5) For an AC ammeter or AC voltmeter, please specify the frequency.
(6) An expanded scale cannot be manufactured for an AC ammeter.
(7) Do not use with a circuit through which an inrush current or other current that exceeds the rating flows.
(8) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

■Outer dimensions



■Ordering method

The items in [ ] must be specified.

●**AC ammeter/AC voltmeter**

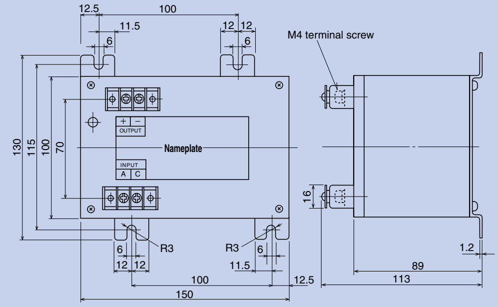
Model name	Indicator rating	Scale	CT ratio or VT ratio	Cover type	Frequency	Special specifications	Number of units
LM-11ZNAA	5A	0-300A	300/5A	B	50Hz	Colored lines, colored bands, etc.	2

●**Receiving indicator**

Model name	Scale	Cover type	Indicator rating	Special specifications	Number of units
LM-11YNRI	0-1200kW	B	FS5mA	Double scale, colored lines, etc.	2

■Outer dimensions of accessory

T-150 rectifier



■Connection diagrams

Fig. 1 AC ammeter

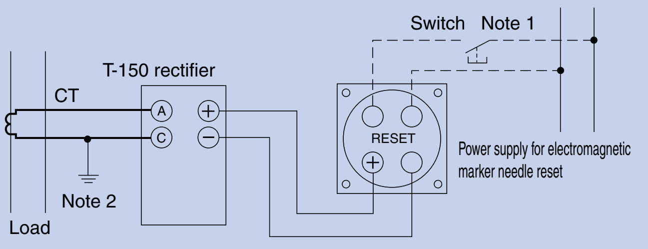


Fig. 2 AC voltmeter

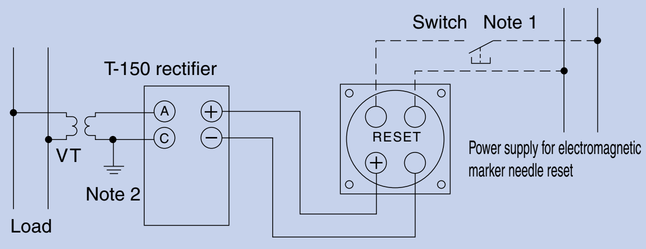


Fig. 3 DC ammeter

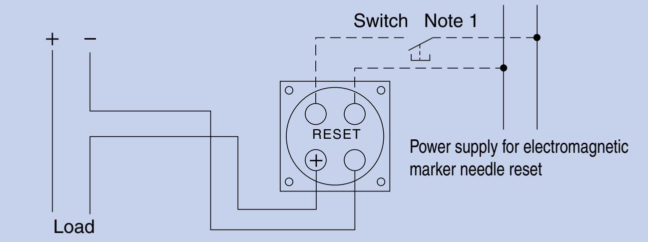
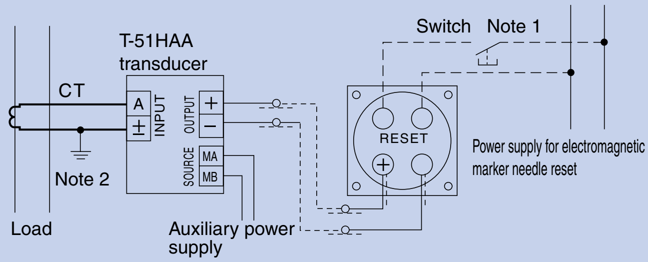


Fig. 4 Receiving indicator

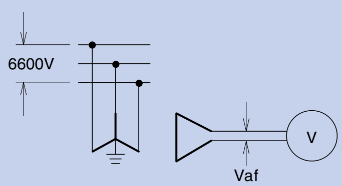


Note 1. Connect if an electromagnetic marker needle resetting circuit is to be provided. Additionally, use a switch that “opens” when released.
Note 2. In a low voltage circuit, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

●Using LM-11ZNAV or LM-11YNAV AC voltmeter as a ground voltmeter

Shown below are connection examples of the LM-11ZNAV AC voltmeter with the maximum needle (or LM-11YNAV AC voltmeter with maximum/minimum needles) as a ground voltmeter.

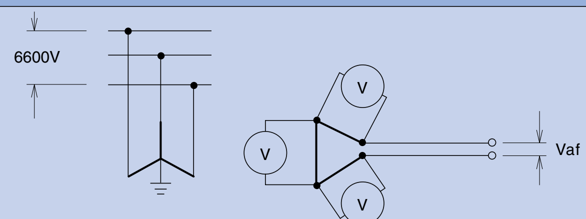
Example of using one LM-11ZNAV (LM-11YNAV) unit



A Vaf voltage (voltage at open end of △ connection) is input into the indicator.

Operation
- For single-wire, grounded state: the indicator gives a reading corresponding to the line voltage.
- After restoration: the degree of grounding can be checked using the maximum value marker needle.

Example of using three LM-11ZNAV (LM-11YNAV) units



The voltages at the respective sides of a △ connected transformer are input into the indicators.

Operation
- Normal — All three indicators indicate a reading corresponding to the primary line voltage × $1/\sqrt{3}$.
- For single-wire, grounded state: the value at the indicator of the phase corresponding the ground phase is zero, and the remaining two indicators give readings corresponding to the line voltage values.
- After restoration — The maximum value marker needles of two units indicate values greater than the driving needles and thus the ground phase and the degree of grounding can be checked.

■Ordering method

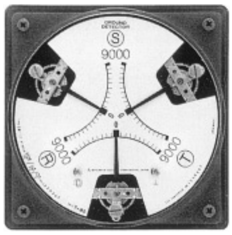
The items in [ ] must be specified.

●Ground voltmeter

Model name	Indicator rating	Scale	VT ratio	Cover type	Zero-phase voltage	Frequency	Number of units
LM-11ZNAV	110V	0-6600V	$\frac{6600}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{110}{3}$ V	B	VAF110V	60Hz	3

Earth-leakage Detectors

- An earth-leakage detector detects an earth fault of an ungrounded 3-phase 3-wire circuit and enables the degree of the earth fault and the ground phase to be judged by deflection of a needle.
- With the instrument voltage transformer, a Y connection is formed at the primary side to directly ground the neutral point and a △ connection with one corner open is formed at the secondary side (or tertiary side).



LM-11NGD

■Specifications

	Wide-angle indicator			
Size (width × height) mm	110×110			
Model name	LM-11NGD			
Operation principle	Rectifier			
Zero-phase voltage	Vaf=110V		Vaf=190V	
Indicator rated voltage	63.5V	86.6V	110V	150V
Frequency	50 or 60Hz			
Consumption VA	1VA		2VA	
Weight (kg)	0.6			
Accessory	T-150 rectifier			
Delivery period classification	△			

Delivery period classification

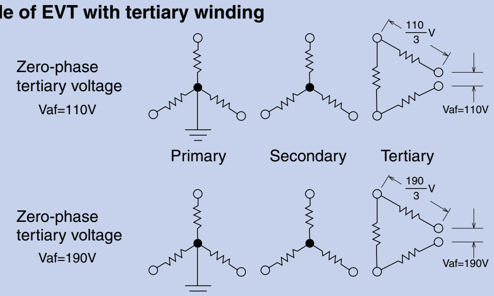
Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Remarks (1) Please specify the VT ratio of the EVT used in accordance with the following examples.

$\frac{6600}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{110}{3}$ V (specification example in the case where Vaf=110V)

$\frac{6600}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{190}{3}$ V (specification example in the case where Vaf=190V)

Example of EVT with tertiary winding



(The secondary winding may be omitted.)

Remarks (2) An alarm contact that is activated by the voltage relay when the zero-phase voltage (Vaf) is 50 to 75V (Vaf=190V) is standard equipment. Contact capacity: 100VAC, 1A (resistive load).

(3) In the case of using a VT that is not specially designed as a zero-phase transformer, a harmonics suppressing resistor (dummy load) is connected between open and delta. The resistor is selected according to the load of the voltage transformer and should comply with the following:

200W 200Ω (200Ω±10%) when Vaf=190V
150W 120Ω (120Ω±10%) when Vaf=110V

(4) Be careful of the following matters in using this indicator for telemetry.

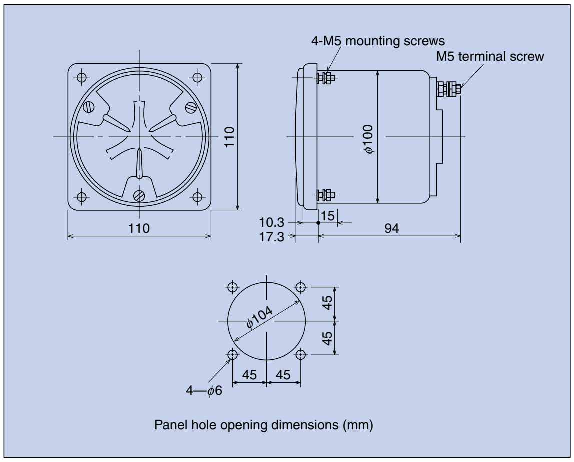
① Please specify the resistance value if the lead wire resistance between the rectifier and the meter exceeds 15Ω (one-way).

② There are three communicating lines between the rectifier and the meter (not including the alarm circuit), and the differences among the resistance values of these lines must be 15Ω or less.

(5) Please specify the frequency.

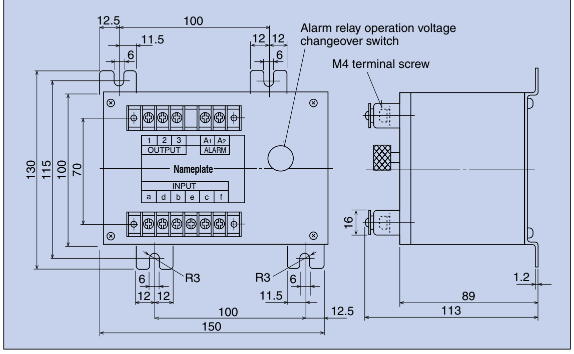
(6) Please make sure to read the “Safety Precautions” (pp.5-8) and the “Selection Precautions” (p.9) to assist in selecting the model and use specifications suited to the application.

■Outer dimensions

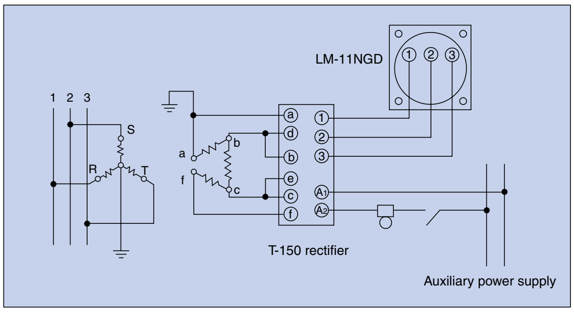


■Outer dimensions of accessories

T-150 rectifier (for earth-leakage detector)



■Connection diagrams



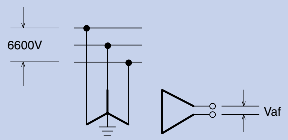
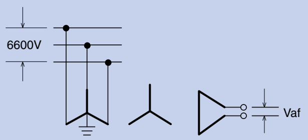
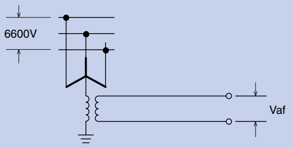
■Ordering method

The items in [ ] must be specified.

Model name	Indicator rating	Scale	VT ratio	Cover type	Zero-phase voltage	Frequency	Number of units
LM-11NGD	150V	0-9000V	$\frac{6600}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{190}{3}$ V	B	VAF190V	60Hz	2

●Connection and VT ratio of EVT to be combined with a ground voltmeter (LM-11ZNAV or 11-YNAV) and an earth-leakage detector (LM-11NGD)

Generally, an EVT with which the zero-phase tertiary voltage in the 1-wire ground state is 110V (or 190V) is used in a YY△ (star-star-delta) connection. Although VAf is the input voltage of the ground voltmeter, the respective line voltages of the △ connection are input in addition to Vaf into an earth-leakage detector.

Connection of VT	VT ratio indication examples (in the case of a 6600V circuit)		
	Type of EVT	When the zero-phase tertiary voltage in the 1-wire ground state is 110V	When the zero-phase tertiary voltage in the 1-wire ground state is 190V
●Without tertiary winding  ●With tertiary winding 	1-phase EVT (without tertiary winding)	$\frac{6600}{\sqrt{3}} / \frac{110}{3}$V	$\frac{6600}{\sqrt{3}} / \frac{190}{3}$V
	1-phase EVT (with tertiary winding)	$\frac{6600}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{110}{3}$V	$\frac{6600}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{190}{3}$V
	3-phase EVT (with tertiary winding)	6600 / 110 / $\frac{110}{3}$V	6600 / 110 / $\frac{190}{3}$V
When the EVT is connected between the transformer neutral point and the earth 	1-phase EVT (without tertiary winding)	$\frac{6600}{\sqrt{3}}$ / 110V	$\frac{6600}{\sqrt{3}}$ / 190V

Note. With an arrangement without the tertiary winding in the above diagram, the voltage at the open end resulting from a secondary winding is considered as the zero-phase tertiary voltage.

●Scales of a ground voltmeter (LM-11ZNAV or 11-YNAV) and an earth-leakage detector (LM-11NGD) and the VT ratio

The earth-leakage detector is used in combination with an YY△-connected EVT, and this table shows the relationship between the line voltage $V_{L\text{-}L}$ and the scale and the VT ratio.

Circuit voltage V V_{L-L}	Indicator maximum scale value (V)	VT ratio (examples): When three 1-phase EVTs are used: Without tertiary winding	VT ratio (examples): When three 1-phase EVTs are used: With tertiary winding	VT ratio (examples): When one 3-phase EVT is used: With tertiary winding	Zero-phase voltage (Vaf)	LM-11ZNAV LM-11YNAV Indicator rating (V): When 3 units are combined	LM-11ZNAV LM-11YNAV Indicator rating (V): In the case of 1 unit	LM-11NGD Indicator rating (V)	LM-11NGD Alarm relay operating voltage (V)
440	600	$\frac{440}{\sqrt{3}} / \frac{110}{3}$	$\frac{440}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{110}{3}$	440 / 110 / $\frac{110}{3}$	110	86.6	150	86.6	30~50
		$\frac{440}{\sqrt{3}} / \frac{190}{3}$	$\frac{440}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{190}{3}$	440 / 110 / $\frac{190}{3}$	190	150	259	150	55~75
	440	$\frac{440}{\sqrt{3}} / \frac{110}{3}$	$\frac{440}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{110}{3}$	440 / 110 / $\frac{110}{3}$	110	63.5	110	63.5	30~50
		$\frac{440}{\sqrt{3}} / \frac{190}{3}$	$\frac{440}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{190}{3}$	440 / 110 / $\frac{190}{3}$	190	110	190	110	55~75
3300	4500	$\frac{3300}{\sqrt{3}} / \frac{110}{3}$	$\frac{3300}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{110}{3}$	3300 / 110 / $\frac{110}{3}$	110	86.6	150	86.6	30~50
		$\frac{3300}{\sqrt{3}} / \frac{190}{3}$	$\frac{3300}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{190}{3}$	3300 / 110 / $\frac{190}{3}$	190	150	259	150	55~75
	3300	$\frac{3300}{\sqrt{3}} / \frac{110}{3}$	$\frac{3300}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{110}{3}$	3300 / 110 / $\frac{110}{3}$	110	63.5	110	63.5	30~50
		$\frac{3300}{\sqrt{3}} / \frac{190}{3}$	$\frac{3300}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{190}{3}$	3300 / 110 / $\frac{190}{3}$	190	110	190	110	55~75
6600	9000	$\frac{6600}{\sqrt{3}} / \frac{110}{3}$	$\frac{6600}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{110}{3}$	6600 / 110 / $\frac{110}{3}$	110	86.6	150	86.6	30~50
		$\frac{6600}{\sqrt{3}} / \frac{190}{3}$	$\frac{6600}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{190}{3}$	6600 / 110 / $\frac{190}{3}$	190	150	259	150	55~75
	6600	$\frac{6600}{\sqrt{3}} / \frac{110}{3}$	$\frac{6600}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{110}{3}$	6600 / 110 / $\frac{110}{3}$	110	63.5	110	63.5	30~50
		$\frac{6600}{\sqrt{3}} / \frac{190}{3}$	$\frac{6600}{\sqrt{3}} / \frac{110}{\sqrt{3}} / \frac{190}{3}$	6600 / 110 / $\frac{190}{3}$	190	110	190	110	55~75

●There are two types of indicator maximum scale values, the nominal line voltage $V_{L\text{-}L}$ and 1.36X$V_{L\text{-}L}$. (1.36 is the value in the case of 150V/110V.)

●The zero-phase voltage Vaf is the voltage at the open end of the open △ connection when the primary side is in the 1-wire ground state.

●The alarm relay operation voltage is related only to the zero-phase voltage (that is, the VT ratio) and has no relationship with the indicator scale.

●Regarding the indicator rating

○In the case of combining three LM-11ZNAV (LM-11YNAV) units or in the case of LM-11NGD - The indicator rating is the line voltage at the △ connection side when the primary side is in the 1-wire ground state (however, the fault phase is excluded).

○In the case of using one LM-11ZNAV (LM-11YNAV) unit - The indicator rating is the voltage corresponding to the zero-phase voltage Vaf.

Synchroscopes

●A synchroscope indicates the synchronization point (scale center) when the frequencies and the phases at a generator side and a bus line side are matched.
●If the frequencies of both sides are equal, the position at which the needle is stationary indicates the phase difference between the two.
●When the generator side (starting side) frequency is f_G and the bus line side (operating side) frequency is f_B, the direction of rotation of the needle is as follows:

When $f_G=f_B$ The needle is stopped.
When $f_G>f_B$ The needle rotates in the FAST direction.
When $f_G<f_B$ The needle rotates in the SLOW direction.

L1-11NSY

■Specifications

		Wide-angle indicators			
Size (width × height) mm		110×110			
Model name		LI-11NSY			
Operation principle		Movable iron core (induction)			
Accuracy (grade)		5			
Frequency		50Hz or 60Hz			
Weight (kg)		2.0			
Indicator type		1-phase		3-phase	
Rated voltage V		110	220	110	220
Consumption VA	Generator side	4	8	4	8
	Bus line side	4	8	4	8
Accessory		T-150 shunt		T-150 resistor	
Delivery period classification		△	△	△	△
Special specification		With phase angle scale (delivery period: △)			

Remarks (1) The pull-in and dropout frequencies are 2 to 3Hz. That is, although the needle rotates up to a frequency difference of 2 to 3Hz according to the difference and indicates whether the generator (or starting side) is slow or fast, when the difference becomes large, the needle moves slightly without rotating.
(2) The needle does not rotate when the frequency difference is large. In this case, judgments should be made using the light shown in the connection diagram. Please note that the light is not supplied; it is to be prepared by the customer if required.
(3) The specifications are continuous rating specifications.
(4) In a state where electricity is not supplied, the needle indicates an arbitrary position exceeding ±30° from the synchronization point.
(5) The lead wire length from the main synchroscope unit to an accessory device must be set to 5m or less.
(6) Please make sure to read the “Safety Precautions” (pp.5-8) and the “Selection Precautions” (p.9) to assist in selecting the model and use specifications suited to the application.
(7) The scale must be specified. The standard specification is: SLOW-FAST.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

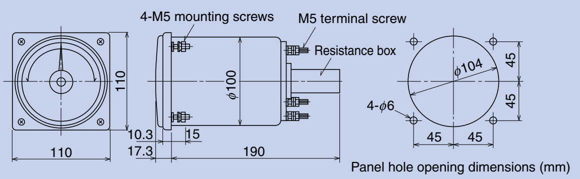
●Phase angle scale

●An indicator with phase angle scale, in which an angle scale centered at the synchronization point (scale center) is drawn, can also be manufactured.
●The needle indicates the phase difference between the generator side and bus line side. The indicator can thus be used for measuring the phase difference when the needle is stationary or for timing of startup.
●The standard phase angle scale is a 30° forward/backward scale.

L1-11NSY with phase angle scale

■Outer dimensions

Fig. 1 LI-11NSY



■Outer dimensions of accessories

Fig. 1 T-150 phase splitter

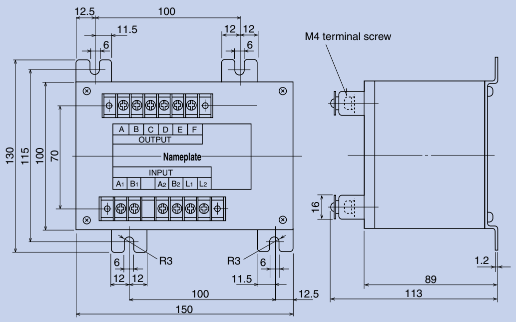
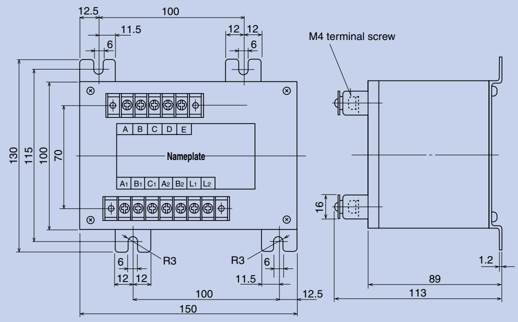


Fig. 2 T-150 resistor



■Connection diagrams

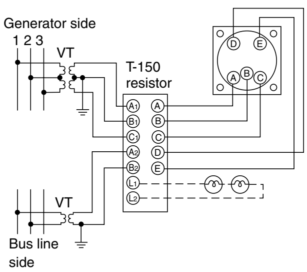


Fig. 1 3-phase system; combined with VT

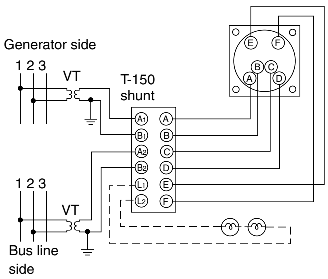


Fig. 2 1-phase system; combined with VT

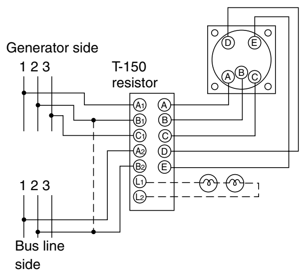


Fig. 3 3-phase system; 220V

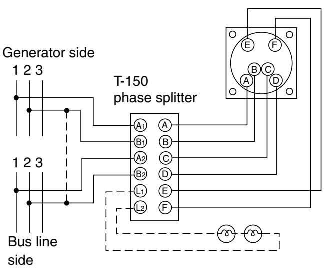


Fig. 4 1-phase system; 220V

Remarks (1) The synchroscope operates normally even if the light shown in the diagrams is not used.

(2) Regarding light connection

- When combined with a VT, the same phase at the secondary side of the VT must be grounded.
- If a VT is not used (direct case), connect the same phases shown in the connection diagrams.

The light will not flash if not connected.

(3) Regarding light rating

- A value twice the circuit voltage is generated between the light connection terminals (between L_1 and L_2). If a light of the same rating as the circuit voltage is to be used, connect two lights in series.

■Example synchroscope light connection (for reference)

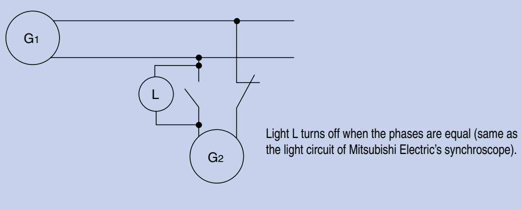


Fig. 1

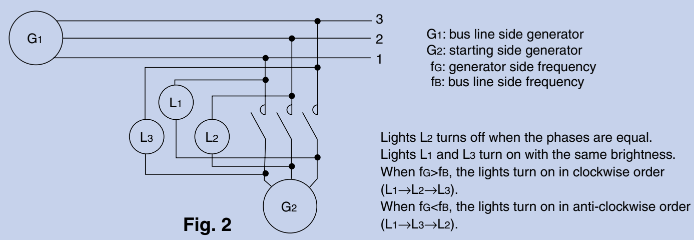


Fig. 2

■Ordering method

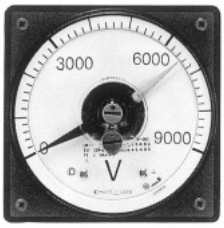
The items in [ ] must be specified.

Model name	Phase-wire system	Rated voltage	Scale	Cover type	Frequency	Number of units
LI-11NSY	1P	110V	SLOW-FAST	B	50Hz	3
			With phase angle scale: SLOW30°-FAST30°			

Dual-element Indicators

Two measured quantities are indicated by the same indicator.

- Two independent movable coil indicators are incorporated, and by combination with a detector and a transmitter, two measured quantities, such as voltage and current, water level and water quantity, power and reactive power can be indicated by the same indicator to enable reduction in panel space. The indicator can be combined with power transducers to enable measurement of various electrical quantities.
- The needle colors are black and red (the front side needle as viewed from the front face of the indicator is black and the rear side needle is red).



LM-11NE

■Specifications

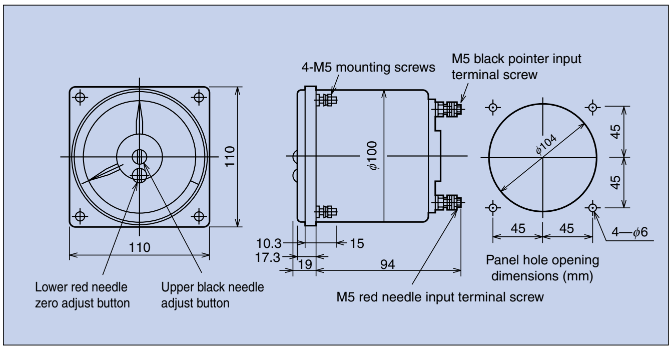
Size (width × height) mm		110×110 wide-angle indicator	
Model name		LM-11NE	
Operation principle		Movable coil	
Accuracy (grade)		1.5	
Scale length (mm)		175	
Weight (kg)		1.0	
Indicator rating (DC)		Approximate internal resistance value (Ω)	Delivery period
Both elements have same ratings	1mA	1200	○
	5mA	50	
	10mA	25	
	4 - 20mA	15	
Respective elements have different ratings	1/5mA	1mA side: 1200, 5mA side: 50	○
	5/10mA	5mA side: 50, 10mA side: 25	
	10/1mA	10mA side: 25, 1mA side: 1200	

Delivery period classification

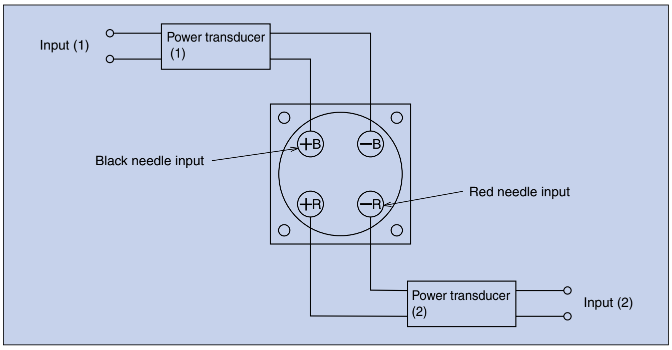
Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Remarks
(1) Indication accuracy: 15% of full scale
(2) Relative deviation between the two needles: 2.0% of full scale
(3) Withstand voltage
Between electrical circuit as a whole and outer casing: 2210VAC, 5s
Mutually between input circuits (indicator alone): 50V AC, 1min
(4) In the case of a double scale, each scale is drawn in the same color as the corresponding needle.
(5) In the case of an electrical quantity scale (A, V, W, var, cosϕ, Hz), the AC/DC symbol and 3-phase circuit symbol of the scale (primary side) are not indicated. The symbol of the receiving indicator is indicated.
(6) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

■Outer dimensions

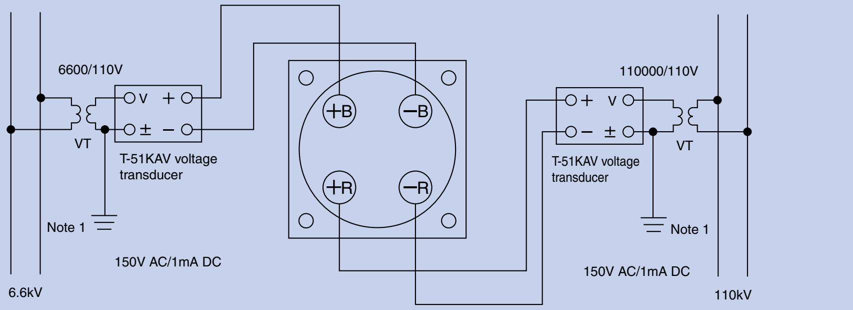


■Connection diagram



■Usage example

Specifications of LM-11NE dual element AC voltmeter
Scales 0 to 9kV (black)
0 to 150kV (red)
The zero point numeral is in black.
Scale divisions: The positions of 6.6kV and 110kV are the same.
Indicator internal resistance: 1.2kΩ (for both elements)



Note 1. For low-voltage circuits, grounding of the secondary side of the instrument voltage transformer is unnecessary.

■Ordering method

The items in [ ] must be specified.

Model name	Scale	Cover type	Indicator rating	Special specifications	Number of units
LM-11NE	0-100A	B	FS1mA	Colored lines, colored bands, etc.	5
	(In the case of separate scales) 0-9000V/0-150kV		(Different rating) FS10/1mA		

Bar-shaped Indicators

■Applications

●Optimal as indicators for various process controls in power generating/transforming systems, steel plants and chemical plants, as well as general panel indicators.
●Useful for changing the panel appearance and significantly reducing panel size.
●Level differences of measured values can be compared easily by coupled mounting of indicators.

■Products list

●There are four types of outer size (length) – 100mm, 130mm, 150mm and 170mm.
●All models are available in vertical and horizontal mount specifications.
●For the FM model, both 1- and 2-needle meters can be manufactured.

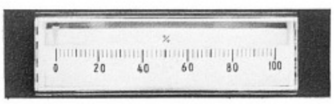
Indicator type \ Outer dimensions			100×30mm	130×36mm	150×40mm	170×42mm
DC indicator FM model	Vertical mount	1 needle	FM-210SN	FM-213SN	FM-215SN	FM-217SN
		2 needles	FM-210DN	FM-213DN	FM-215DN	FM-217DN
	Horizontal mount	1 needle	FM-210SN	FM-213SN	FM-215SN	FM-217SN
		2 needles	FM-210DN	FM-213DN	FM-215DN	FM-217DN
AC indicator FR model	Vertical mount	1 needle	FR-210SN	FR-213SN	FR-215SN	FR-217SN
	Horizontal mount	1 needle	FR-210SN	FR-213SN	FR-215SN	FR-217SN

■Standard specifications in common

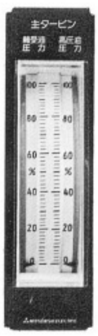
Item	Specification
Standards	Direct-acting electrical indicators JIS C 1102-2
Accuracy (grade)	1, 1.5 or 2.5
Operating temperature range	-5°C~50°C (reference temperature: 23°C)
Operating humidity range	At a relative humidity of 30~70%, there are no adverse effects on indications.
Mounting attitude	Vertical (the scale plate is vertical with respect to a horizontal surface)
Insulation test	10MΩ or more at a test voltage of 500VDC (between electrical circuit and outer casing)
Voltage test	2210VAC for 5s (between electrical circuit and outer casing), 500VAC for 1min (between elements in a 2-needle model)
Crest factor of input signal	Sine wave ($\sqrt{2}$)
Measurement category	CAT Ⅲ (category of measurement performed inside a building facility)
Pollution degree of usage environment	2 (of a level where only a non-conducting pollution occurs)
Installation altitude	2,000m or less
Usage location	Indoors
Mounting panel	Metal panel
Storage temperature	-20°C~60°C
Scale plate	Background color: white
Needle	Large triangular needle (red)
Cover	Acrylic resin (with antistatic treatment applied)
Case	Heat-resistant ABS resin
Accessory	Protective plates (Refer to p.105 for handling method.)

■Panel mounting examples

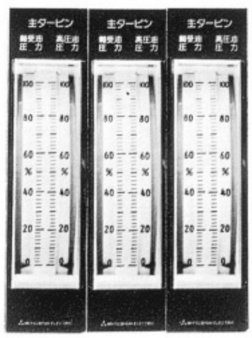
●Horizontal mount



●Vertical mount



●Vertical coupled mount



Bar-shaped Indicators

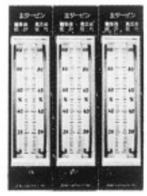
DC indicators

(DC voltage/DC current input)

FM-210DN vertical mount

FM-213SN vertical mount

FM-215DN vertical mount



FM-217DN vertical coupled mount

■Specifications

	1-pointer type				2-pointer type			
Size mm	100×30	130×36	150×40	170×42	100×30	130×36	150×40	170×42
Model name	FM-210SN	FM-213SN	FM-215SN	FM-217SN	FM-210DN	FM-213DN	FM-215DN	FM-217DN
Operation principle	Movable coil				Movable coil			
Accuracy (grade)	1.5 or 2.5	1 or 1.5			1.5 or 2.5	1 or 1.5		
Scale length (mm)	66	88	100	100	66	88	100	100
Outer dimensions	Fig. 1	Fig. 2	Fig. 3	Fig. 4	Fig. 1	Fig. 2	Fig. 3	Fig. 4
Weight (kg)	0.4	0.5	0.6	0.7	0.5	0.6	0.7	0.7

Indicator rating and delivery period classification		Indicator rating	Delivery period classification	Internal resistance (Ω) or voltage drop							
	DC current input	100μA	△	4000	—	—		4000	—	—	
		500μA	△	300	300	300		300	300	300	
		1mA	△	100	100	100		100	100	100	
		5mA	△	20	20	20		20	20	20	
		10mA	△	10	10	10		10	10	10	
		4~20mA (zero-suppressed)	△	10	10	10		10	10	10	
		50mA~10A	△	60mV	60mV	60mV		—			
	DC voltage input	Indicator rating	Delivery period classification	Consumption current (approx.) mA							
		1, 5, 10V	△	1mA				1mA			
		1~5V (zero-suppressed)	△	1.25mA				1.25mA			
		20~300V	△	1mA				—			

Remarks. (1) Models that can be mounted vertically and horizontally can be manufactured; please specify if required.

(2) Use the following table to select the application (instrumentation or panel) and accuracy grade.

Application	FM-210N	FM-213N	FM-215N	FM-217N
Instrumentation	1.5	1.0	1.0	1.0
Panel	2.5	1.5	1.5	1.5

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

(3) The withstand voltage between the input terminals of the L element and the R element of a 2-needle model (D) is 500VAC for 1min. In the case of a DC circuit or other circuit requiring a higher withstand voltage, use an isolator (T-101IS type) at the input.

(4) Provided with span adjuster (adjustment range: approx. ±5%).

(5) In the case of an electrical quantity scale (A, V, W, var, cosϕ, Hz), the AC/DC symbol and 3-phase circuit symbol are not indicated on the scale. The symbol of the input quantity of the receiving indicator is indicated.

(6) Please make sure to read the “Safety Precautions” (pp.5-8) and the “Selection Precautions” (p.9) to assist in selecting the model and use specifications suited to the application.

■Ordering method

The items in [ ] must be specified.

Model name	Cover type	Scale	Input rating	Mounting attitude	Accuracy (grade)	Special specifications	Number of units
FM-215SN	B	0-100%	FS4-20mA	Vertical	1.5	Tag No., nameplate engraving, etc.	3

(in the case where left and right scales differ in a 2-needle model)

Left 0-100%/Right 0-200°C

AC indicators

(AC voltage/AC current input)

FR-213SN
vertical mount

FR-215SN
vertical mount

■Specifications

				100X30	130X36	150X40	170X42
Size mm				100X30	130X36	150X40	170X42
Model name				FR-210SN	FR-213SN	FR-215SN	FR-217SN
Operation principle				Rectifier			
Accuracy (grade)				2.5	1.5		
Scale length (mm)				66	88	100	100
Outer dimensions				Fig. 1	Fig. 2	Fig. 3	Fig. 4
Weight (kg)				0.5	0.6	0.7	0.7
Indicator rating and delivery period classification	AC current input	Indicator rating	Delivery period classification	Consumption VA or voltage drop			
		500μA~100mA	△	1.4V	1.4V	1.4V	1.4V
		100mA~5A	△	0.2VA	0.2VA	0.2VA	0.2VA
	AC voltage input	Indicator rating	Delivery period classification	Consumption current mA			
		5~300V	△	4mA	4mA	4mA	4mA

Remarks. (1) Models that can be mounted vertically and horizontally can be manufactured; please specify if required.
(2) Error may occur when the input waveform is distorted.
(3) Please specify the frequency.
(4) 2x, 3x, and 5x expanded scales can also be manufactured.
(5) In the case of an electrical quantity scale (A, V, W, var, cosϕ, Hz), the AC/DC symbol and 3-phase circuit symbol are not indicated on the scale. The symbol of the input quantity of the receiving indicator is indicated.
(6) Please make sure to read the "Safety Precautions" (pp.5-8) and the "Selection Precautions" (p.9) to assist in selecting the model and use specifications suited to the application.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Ordering method

The items in [ ] must be specified.

Model name	Cover type	Scale	Input rating	Frequency	Mounting attitude	Special specifications	Number of units
FR-215SN	B	(0-3600) rpm	FS5V	50Hz	Vertical	Tag No., nameplate engraving, etc.	2

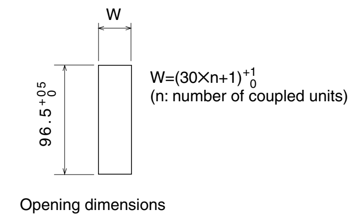
Bar-shaped Indicators

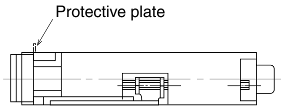
■Outer dimensions

Fig. 1 FM-210N/FR-210N

Terminal layout

No.	Model name	Terminal code						Adjuster	
		1	2	3	4	5	6	L	R
1	FM-210SN				+ L	- L		○	
2	FM-210DN		+ R	- R	+ L	- L		○	○
3	FR-210SN		○	○					





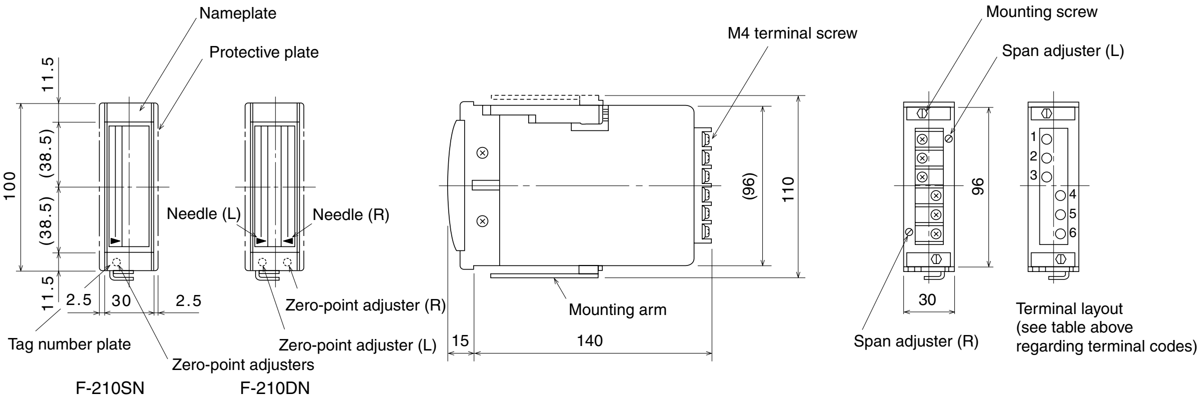
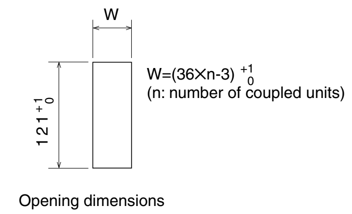
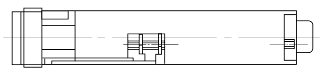


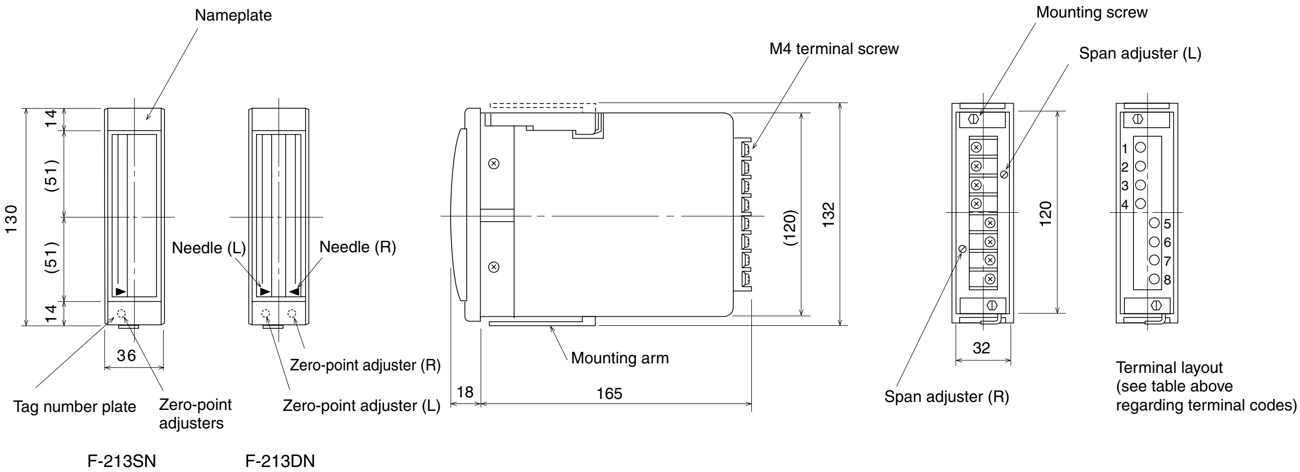
Fig. 2 FM-213N/FR-213N (protective plate unnecessary)

Terminal layout

No.	Model name	Terminal code								Adjuster	
		1	2	3	4	5	6	7	8	L	R
1	FM-213SN					+ L	- L			○	
2	FM-213DN			+ R	- R	+ L	- L			○	○
3	FR-213SN					○	○				





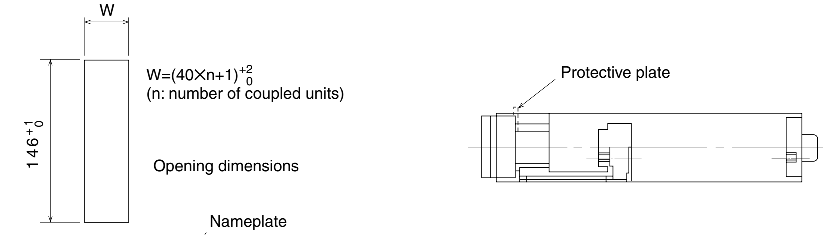


■Outer dimensions

Fig. 3 FM-215N/FR-215N

Terminal layout

No.	Model name	Terminal code								Adjuster	
		1	2	3	4	5	6	7	8	L	R
1	FM-215SN					+ L	- L			○	
2	FM-215DN			+ R	- R	+ L	- L			○	○
3	FR-215SN					○	○				



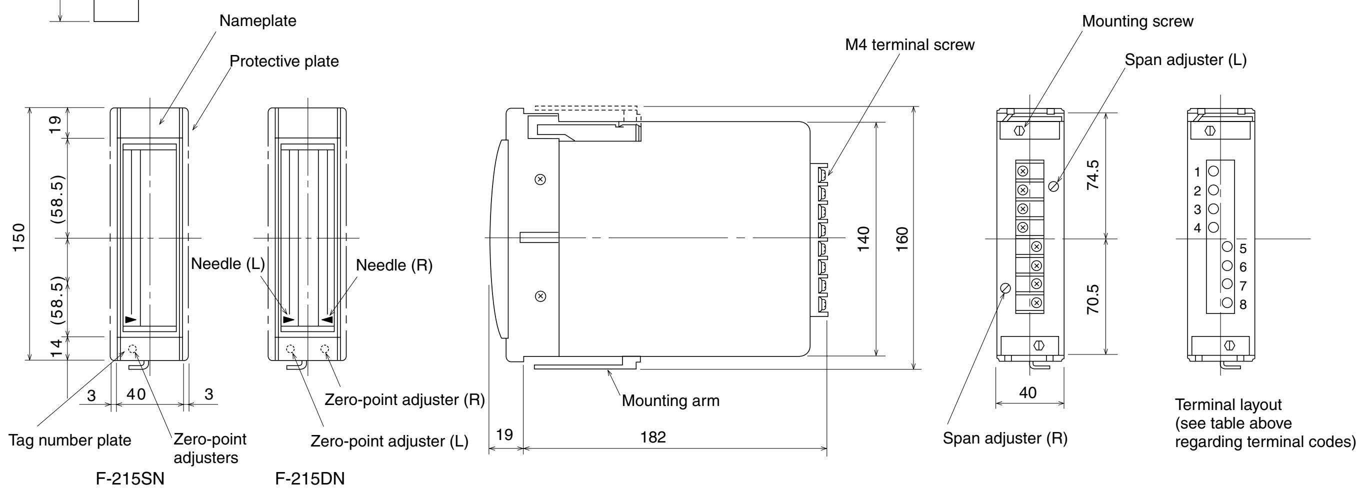
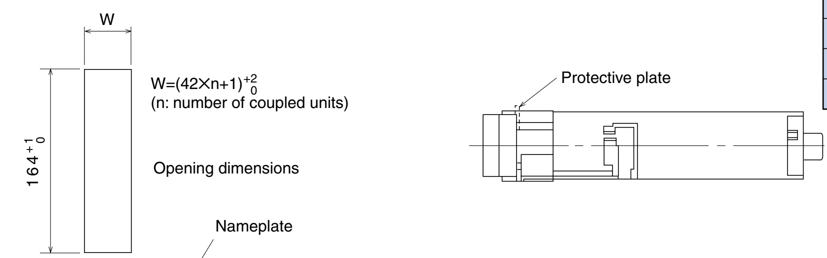
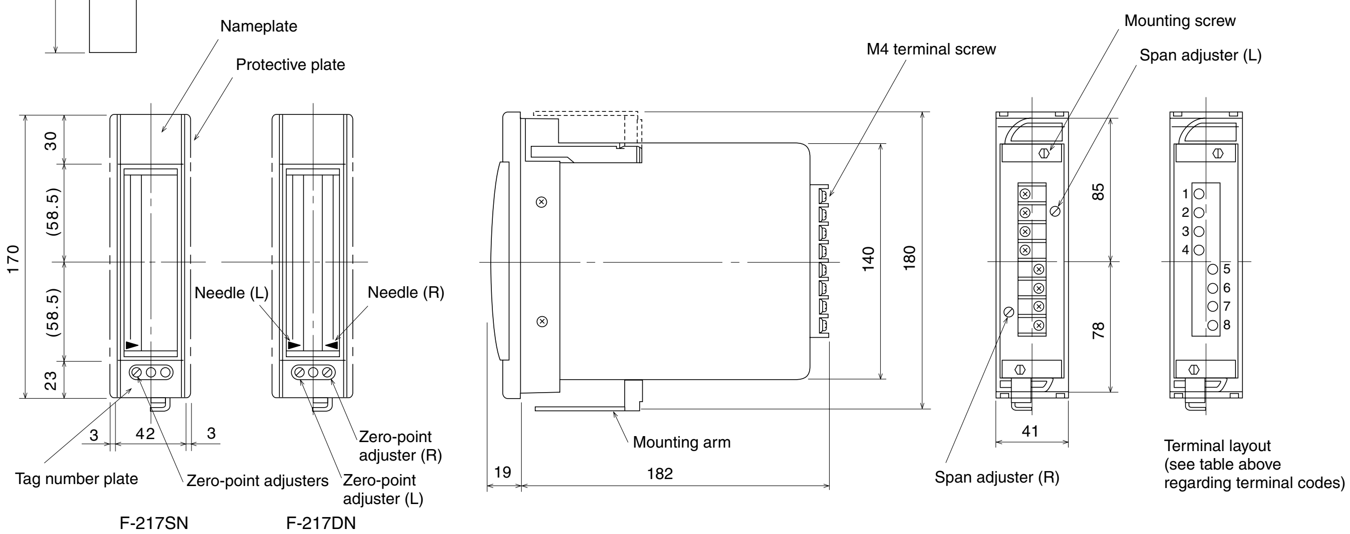


Fig. 4 FM-217N/FR-217N

Terminal layout

No.	Model name	Terminal code								Adjuster	
		1	2	3	4	5	6	7	8	L	R
1	FM-217SN					+ L	- L			○	
2	FM-217DN			+ R	- R	+ L	- L			○	○
3	FR-217SN					○	○				





Bar-shaped Indicators

■Nameplate and tag number plate indication standards

Indications on nameplates and tag number plates shall be engraved according to the following standards.
Orders with no specified nameplates or tag number plates will be delivered without nameplates or tag number plates.

1. Indication method

Method …… Engraved/Ink
Font ………… Round Gothic
Material ….. ABS resin

2. Dimensions/Number of characters/Number of steps (vertical mount)

Plate		F-210N	F-213N	F-215N	F-217N
Nameplate	Effective area	9×28	11×32	15×38	25×38
	Number of characters per column	9	9	9	9
	Number of rows	2	2	3	3
Tag number plate	Effective area	9×28	11×32	10×38	8×38
	Number of characters per column	10	10	10	10
	Number of rows	1	1	1	1

●Effective area ………………… Dimensions enabling effective indication of characters (height × width)
●Number of characters …….. Maximum number of characters that can be entered in a single column
●Number of steps …………….. Number of character strings
●May differ from the standard size/position depending on the combination of the character string.
●Please inquire regarding horizontal mounting.

3. Style/Print color

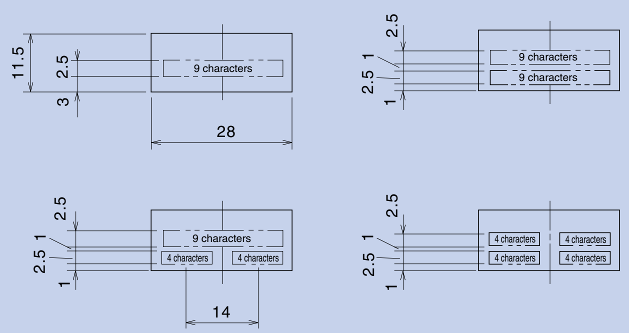
Background color of nameplate • tag number plate	Print color	Outer frame color
(B) Black Munsell N1.5	White	Outer frame: N1.5
(F) Dark blue Munsell 7.5BG4/1.5	White	Outer frame: 7.5BG4/1.5
(W) White Munsell N9/0	Black	Outer frame: N1.5 or 7.5BG4/1.5

●If the background color is not specified, it will be the same color as the outer frame.

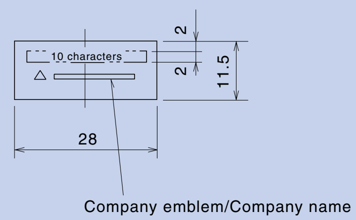
4. Model-wise indication standards

Nameplates

F-210N

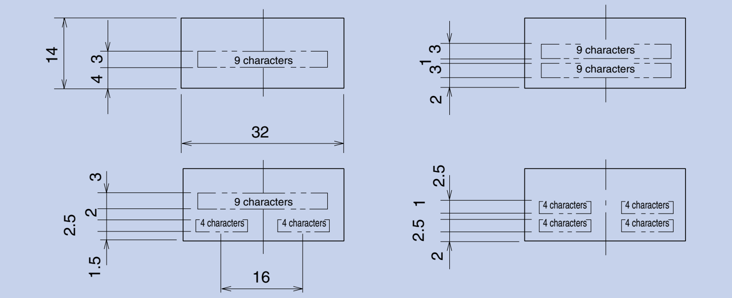


Tag number plates

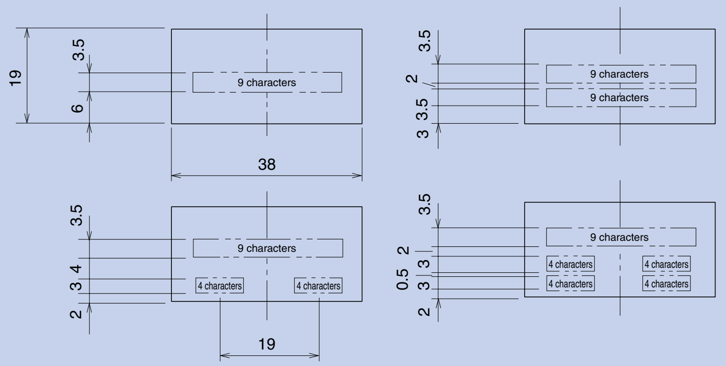


Nameplates

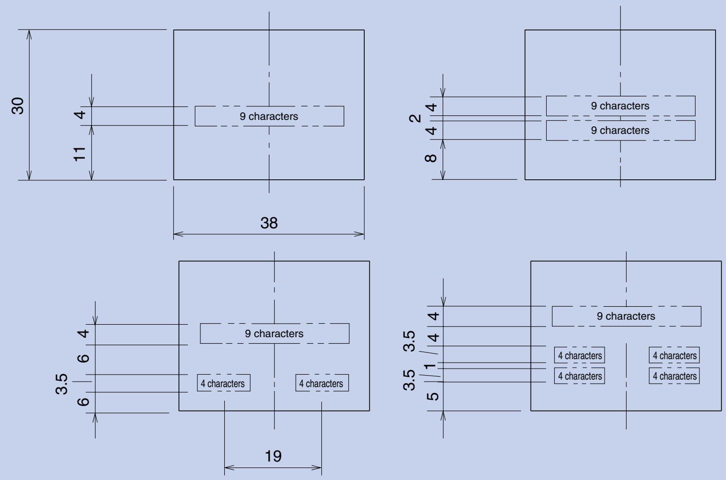
F-213N



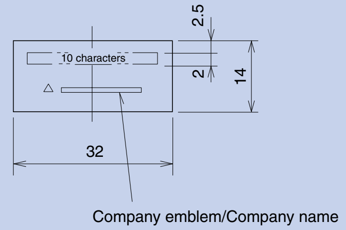
F-215N

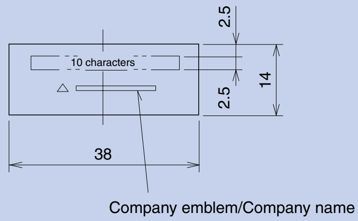


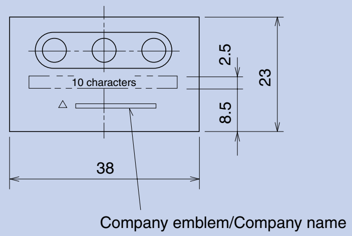
F-217N



Tag number plates





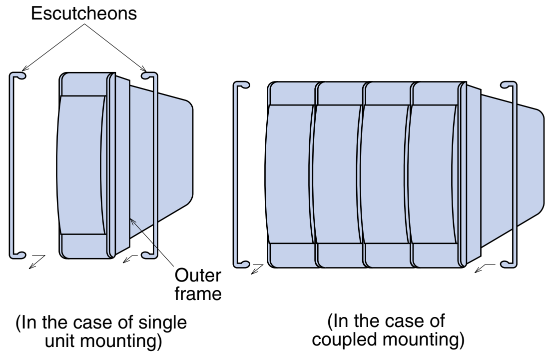


Bar-shaped Indicators

■Handling precautions

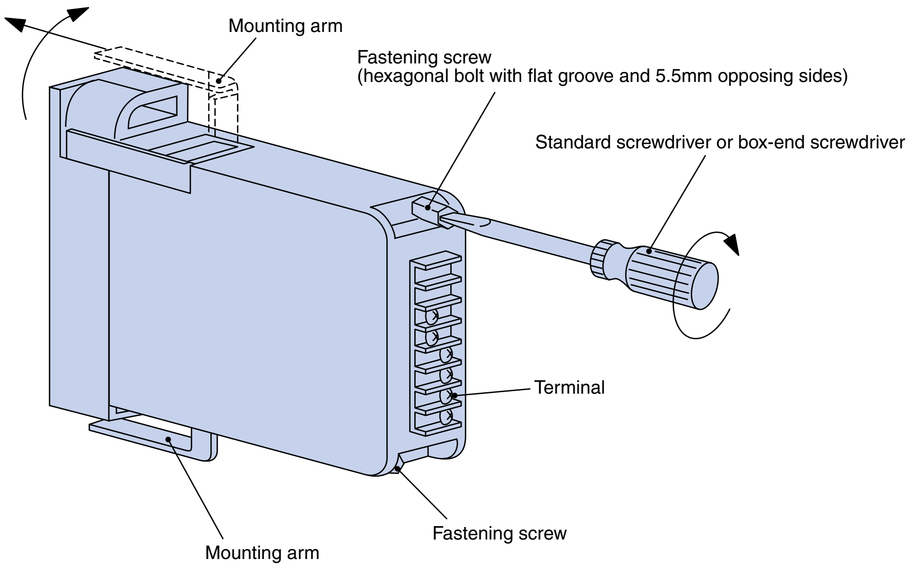
1. Using protective plates

- Protective plates are mounted to indicators so that the gaps between the indicator and panel cannot be seen. They are mounted to both sides of an indicator when a single unit is mounted, and mounted at both ends of the indicator when coupled mounting is used.
- Plate attachment
  Match and insert the upper and lower inner protrusions of each plate in the grooves of the outer frame at the rear of the indicator.
- The plates are coated the same color as the outer frame.
- The plates are packaged together with the indicator.
  F-213N does not have protective plates.



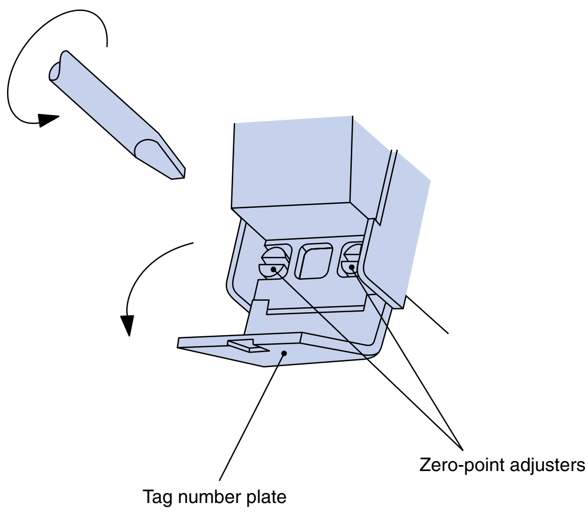
2. Mounting the indicator

- Push on the front face of the panel to insert the unit. Next, turn the fastening screws in the rear face of the main unit clockwise using a standard screwdriver or box-end screwdriver with 5.5mm opposing sides. In doing so, the mounting arms will be set automatically and fixed to the panel (thickness of corresponding panel: 1 to 6mm).



3. Zero-point adjustment

- For indicators other than F-217N, open the tag number plate using a standard screwdriver and use the zero-point adjusters inside to adjust the zero point.
  Be careful not to apply excessive force to the adjusters.
- For zero-point adjustment of the F-217N, use a standard screwdriver to adjust the zero point by turning the zero-point adjusters on the front face.
- If the unit is equipped with a zero-suppressed indicator, perform adjustment while applying electricity equivalent to the minimum scale value; for example, 4mA in the case of 4 to 20mA.

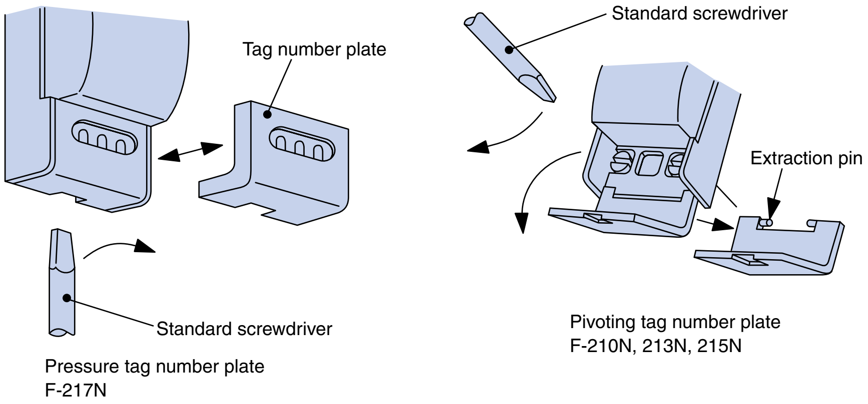


4. Disassembling of nameplates, tag number plates, covers and scale plates

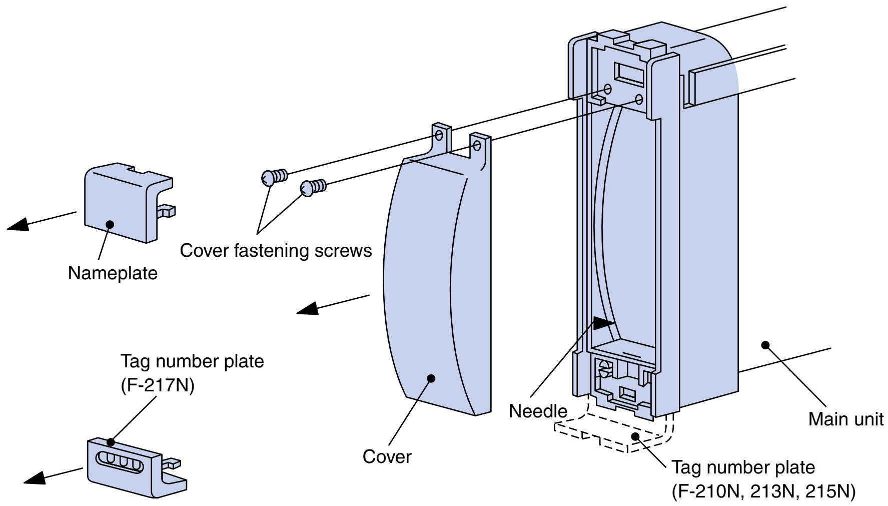
Procedure 1. Remove the nameplate and tag number plate.

For pivoting tag number plates, remove the extraction pins at the rear. Remove while lifting the indicator approximately 5mm from the panel surface.

(The pivoting tag number plate does not need to be removed to remove the scale plate.)

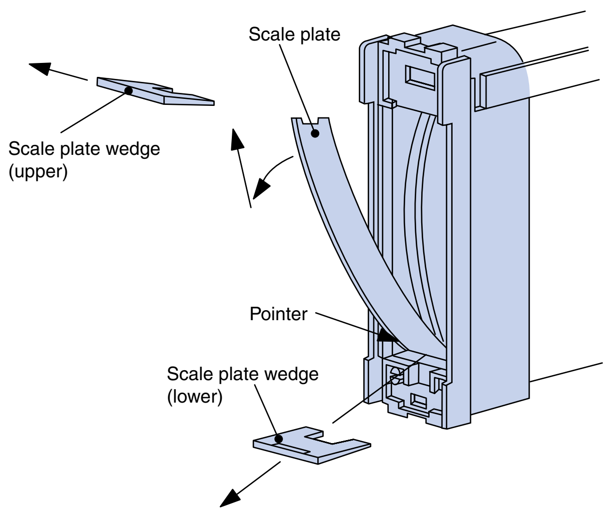


2. Remove the cover fastening screws.
3. To remove the cover, pull the upper side of the cover forward slowly and then lift slightly.



4. To prevent deformation of the needle, turn the zero-point adjuster and move the needle to the lower side.
5. Draw out the scale plate wedge toward the front.
6. The scale plate can be removed when the upper side (nameplate side) of the scale plate is slowly drawn outward and lifted slightly.

Note: Be careful not to deform the needle when removing the scale plate.



Mechanical Indicators

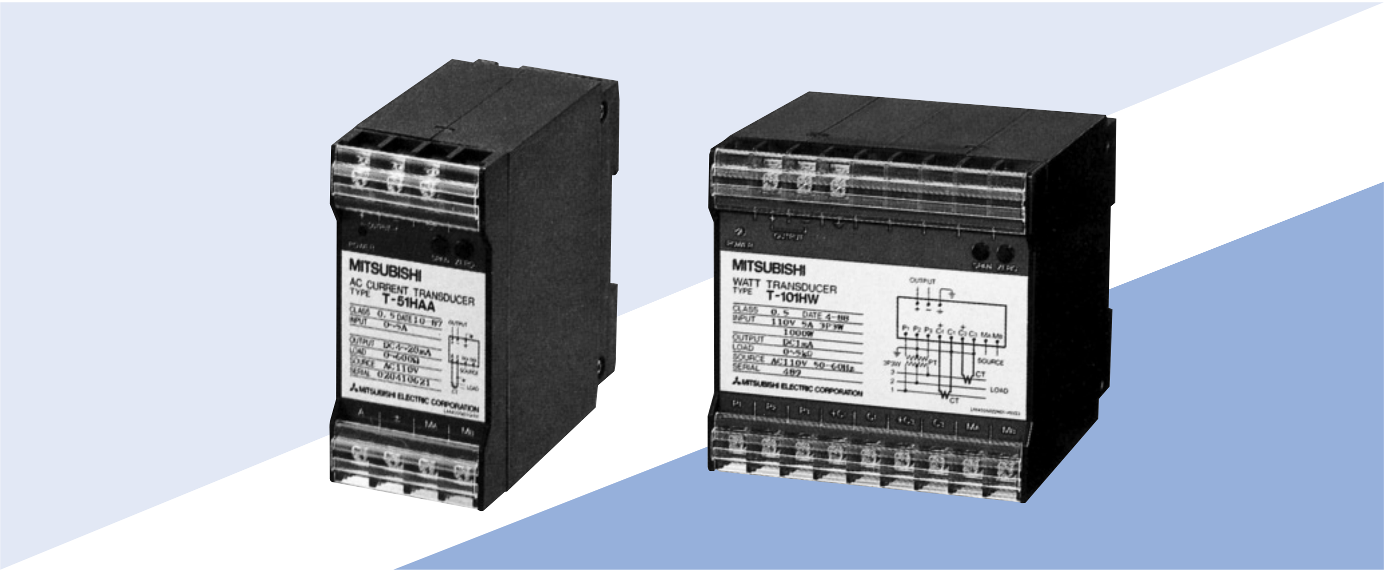
Overview and Features

High performance realized in a compact module.

Single function models T-51/T-101 Series

Power K Series (ordinary class, fixed-load output)
H Series (ordinary class, constant-voltage/constant-current output)
S Series (precision class, constant-voltage/constant-current output)

Instrumentation and Peripheral An assortment of box models with power, instrumentation and peripheral elements arranged in compact modules.



Mitsubishi Electric transducers

Shape \ Product name			Power transducers: Current	Current (saturated power)	Voltage	Active power	Reactive power	Phase angle (3-phase balanced circuit)	Phase angle (3-phase unbalanced loads)	Power factor	Frequency	Voltage phase angle	Harmonic current	Harmonic voltage	Electric energy	Reactive electric energy	Instrumentation transducers: DC level	DC reverse	Isolator	High-speed isolator	Limiter	Adder	Temperature (resistance bulb)	Temperature (thermocouple)	First-order lag	Peripheral transducers: AC current demand (moderate time interval)	AC voltage demand (moderate time interval)	Current with power flow detection	Leakage current	Leakage current (with built-in low-pass filter)	Voltage drop detector	Voltage rise detector	Filter	Special: Harmonics	Active power/Active electric energy
Single function	T-51 Series T-101 Series	K Series (ordinary class)	○	○	○																														
Single function	T-51 Series T-101 Series	H Series (ordinary class)	○	○	○	○	○	○	○	○	○																								
Single function	T-51 Series T-101 Series	S Series (precision class)	○		○	○	○		○	○	○	○																							
Single function																	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		○
Collective	T-120 Series		○		○	○	○			○	○		○	○	○	○																		○	

Now even easier to use.

Collective transducers T-120 Series

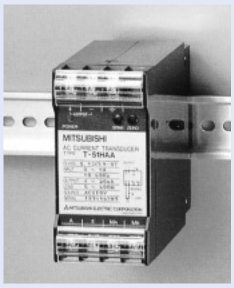
Multi-use transducers that allow the input of various electric quantities from instrument transformers (VT, CT), and output DC signals and pulses.

●4 modes of mounting

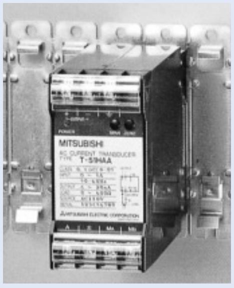
As standard specifications, the T-51, T-101 and T-120 Series can be mounted four ways: mounting legs, IEC rail (35mm), distribution panel breaker mounting plate, and mounting tabs.

Mounting legs

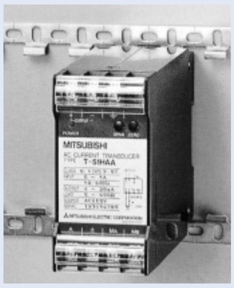
IEC rail (35mm)



Distribution panel breaker mounting plate



Distribution panel breaker mounting tab



●Compact modules that facilitate panel designing

The realization of compact modules was pursued. There are 2 types of outer dimensions.

(T-51/T-101 Series)

●Self-lifting screws utilized for input and output terminals

Wiring work is easier if self-lifting screws are used.

(T-51/T-101/T-120 Series)

●Equipped with power supply indicator

An auxiliary power supply indicator (red LED) that indicates operating state is provided.

(excluding the T-51K and T-120 Series)

●Mitsubishi Electric electronic technologies fully integrated

In addition to carefully selected electronic parts, the design considers lighting/switching surges and noise.

●Select the optimal model according to the application

Single function models ·············· Power, instrumentation and peripheral transducers

- K Series····· Ordinary class, fixed-load output
- H Series····· Ordinary class, constant-voltage/constant-current output
- S Series····· Precision class, constant-voltage/constant-current output

Collective ······························· Multi-use for power applications

Safety Precautions

●Safety Precautions

Please pay attention to the following items when using transducers.
Read the instruction manual attached to the product before performing settings or using the device.
For safety reasons, mounting and connection work should only be performed by a professional electrical wiring technician.

1 Precautions concerning usage environment and usage conditions

Do not use in the following locations. Use in such locations may lead to malfunction, significant error or reduced service life.

- ●Locations where the ambient temperature is outside the range of -10°C~50°C.
- ●Locations where the average daily temperature exceeds 35°C.
- ●Locations where the humidity is outside the range of 30%RH~85% RH (no condensation).
- ●Locations with excessive dust, corrosive gases, salinity or oil fumes.
- ●Locations with excessive vibration or impact.
- ●Locations directly exposed to rain, water drops or sunlight.
- ●Locations with excessive external noise.
- ●Locations at an altitude of 1000m or more.
- ●Locations where a strong electric field or magnetic field is generated.
- ●Locations where there are metal pieces or inductive substances present.

2 Mounting precautions

Please pay attention to the following items regarding mounting.

- ●The transducers must be mounted inside a panel.
- ●Tighten the mounting screws using the following torques:
  M4 iron screws ·········· 1.47~1.86N•m
  M4 brass screws ········ 0.88~1.08N•m
  M5 iron screws ·········· 2.94~3.43N•m
  M5 brass screws ········ 1.67~2.06N•m

3 Connection precautions

Please pay attention to the following items regarding connection.

- ●Use the specified materials and diameters for the electrical wires that connect the output and load of transducers in order to prevent failure due to external noise or surges.
- ●Use the following crimp terminals.

Series	Applicable crimp terminals	Tightening torque
T-51, T-101	Round crimp terminals (outer diameter: ϕ8.5 or less) for M4 screws	0.98~1.47N•m
T-120	Round crimp terminals (outer diameter: ϕ8.3 or less) for M4 screws	
	Round crimp terminals (outer diameter: ϕ7.1 or less) for M3.5 screws	0.61~0.82N•m

- ●Although transmission distances for standard combinations are indicated in this catalog, the values are to be used when there is no interference (e.g., induction voltage, surge) in the transmission line. If installation of the transmission line parallel to power cables is unavoidable and there is a possibility of inductive interference, use a shielded transmission line to avoid interference during use.
- ●Power factor and reactive power transducers will not operate correctly when connected as a reverse phase sequence. Use with the correct phase sequence.
- ●When a device, such as a harmonics transducer for measuring harmonic voltage is connected to a VT, do not remove the auxiliary power supply of multi-use or harmonics transducers from the VT. The harmonic voltage may not be measured correctly.
- ●In regard to grounding in the connection diagrams, grounding of the secondary sides of the VT and CT is unnecessary for low-voltage circuits.

⚠ CAUTION

Connect correctly

Check the connection diagrams carefully before making connections. Erroneous connections may cause equipment to scorch or catch fire.

Fasten terminal connections securely

Fasten electrical wires securely to the terminals. Otherwise, overheating, equipment burnout or fire may occur.

Do not perform work with live wires

Do not perform connection work with live wires. Electrical shock, electrical burns, equipment burnout or fire may occur.

Do not open the secondary side of a CT circuit

Ensure that the signal on the secondary side of the CT is connected correctly to the CT connection terminals. Incorrect connection of the CT or opening the secondary side of the CT will cause high voltage on the secondary side of the CT, and may lead to equipment failure, electrical shock or a fire.

Do not short-circuit the secondary side of a VT circuit

Ensure that the secondary side of the VT is correctly connected to the VT connection terminals. Incorrect connection of the VT or short-circuiting the secondary side of the VT will cause a large overcurrent to flow through the VT secondary winding, which will lead to equipment failure, electrical shock or fire.

4 Precautions concerning preparation before use

Please read the following items before use.

(1) Transport
Avoid application of vibration and impact as much as possible during transport.
In situations where it is possible that transducers will be subject to excessive vibration or shock, remove the transducer from the panel before transportation.

(2) Check the model name and rating
As a precautionary measure, check the model name and specifications such as input, output and auxiliary power supply before use.

(3) Adjustment
Generally, transducers are adjusted before shipment from the factory and do not require adjustment. To perform adjustment for matching with receiving-side equipment, perform adjustment while avoiding the application of excessive force to the adjusters. Not doing so may cause failure of the adjusters.
Avoid touching the adjusters in ordinary circumstances.

(4) Insulation resistance test and withstand voltage test
Please read the following carefully before performing an insulation resistance test or voltage test. Not doing so may cause failure.

⚠ CAUTION

Do not perform a withstand voltage test between input and output for non-isolated models

For instrumentation transducers where the input and output circuits are not insulated, do not perform withstand voltage testing between the input and output. Breakage will occur.
The withstand voltage test will cause the dielectric breakdown of internal elements, and may cause equipment failure or fire.

5 Usage precautions

Please pay attention to the following items during use.

⚠ CAUTION

Use transducers according to their ratings

Use transducers according to their ratings. Not doing so may cause significant error, failure or fire due to overheating.
For input values outside the rating range, the output value will be outside the rating range.

Ensure the settings are correct

For models requiring settings, read the relevant instruction manual carefully before performing settings. Setting errors or unset items may cause abnormal operation and alarms may not function properly for receiving-side equipment; for example, if no value is set, no alarm will be activated for the output signal.

Do not lower the input voltage

With the active power, reactive power, power factor, phase angle and frequency transducers, an error may occur if the input voltage is outside the specified operating range (guaranteed value: 90~110% of the rated voltage).
Additionally, malfunction may occur if the input voltage drop is significant (less than 60% of the rated voltage).

6 Precautions concerning repair upon failure and treatment of abnormality

If an instrument malfunctions contact the nearest branch of Mitsubishi Electric System Service Co., Ltd. or Mitsubishi Electric.

Safety Precautions

7 Maintenance and inspection

Please pay attention to the following items regarding maintenance and inspection.
Refer to p.174 for details.

⚠ CAUTION

Make sure to turn off the power for maintenance and inspections

When performing maintenance and inspections of transducers, be sure to turn off the power supply to the circuit connected to the transducer.
Electrical shock, electrical burns, equipment burnout or fire may occur if removal is attempted in the live-wire state.

8 Storage precautions

Do not store transducers for long periods in the following locations.

- ●Locations where the ambient temperature is outside the range of -20~60°C.
- ●Locations where the average daily temperature exceeds 35°C.
- ●Locations where the humidity is outside the range of 30%RH~85%RH (no condensation).
- ●Locations with excessive dust, corrosive gases, salinity or oil fumes.
- ●Locations with excessive vibration or impact.
- ●Locations directly exposed to rain and/or water drops.
- ●Locations where there are metal pieces or inductive substances present.

When storing transducers, turn off the power, remove the wiring such as those for input/output/auxiliary power supply and place in a plastic bag.

⚠ CAUTION

Make sure to turn off the power before removal

In removing a transducer for storage, make sure to turn off the power supply of the circuit connected to the transducer.
Electrical shock, electrical burns, equipment burnout or fire may occur if removal is attempted in the live-wire state.

9 Disposal precautions

Dispose of the product appropriately according to the “Waste Management and Public Cleansing Law.”
This product does not use batteries.

●WARRANTY

- ●The warranty period is 1 year from the date of purchase or 18 months after manufacture, whichever is earlier. Even during the warranty period, repairs for failure due to an intentional or negligent act by the customer shall be charged.
- ●Mitsubishi Electric shall not be liable for warranty against damages resulting from reasons not attributable to the company, opportunity loss and/or lost earnings on the customer’s part due to malfunction of a Mitsubishi product, damages resulting from special circumstances whether foreseeable or unforeseeable by Mitsubishi, secondary damages, accident compensation, and damages and other services besides those of a Mitsubishi product.

●Product service life

- ●The expected life of a transducer is 10 years.
  * The expected service life is the period or number of operations for which the transducer can be used without functions deteriorating to a level that impairs practical use, on the condition that the equipment or materials are used in accordance with standard specification conditions. Please note that the expected service life is only a guide and performance is not guaranteed for this period. (Excerpt/Summary of “Expected Service Life of Electrical Equipment,” in the September, 1998 issue of the Journal of the Institute of Electrical Installation Engineers of Japan.)

●Recommended exchange period

- ●The recommended exchange period for transducers is seven years.

●Requests Regarding Selection

1 For remote measurement, select a large output value.

When performing remote measurements, as a general rule, use a local transducer and ensure that transmissions are made according to the output side of the transducer; that is, ensure that the output side is not pulled over a long distance. Additionally, select a large output value; for example, 4~20mA.

2 Select an H or S Series model if the load resistance varies.

When the load resistance to be connected to the output terminals of a transducer is unknown, or where there is a possibility for future increases in load, select a constant-voltage, constant-current output transducer such as a model from the H or S series.

3 Select a model with an effective value if the input waveform becomes distorted.

AC-input transducers are calibrated based on sinusoidal input. In addition, depending on the model, error may occur when the input waveform is distorted due to the operating principle. Therefore, if there is waveform distortion, select an effective-value model with comparatively low error such as T-101SAA or T-101SAV.

4 Select a phase-angle transducer for unbalanced loads if the three-phase loads are unbalanced.

Phase-angle transducer errors may occur if the three-phase loads of balanced circuits become unbalanced. Select a phase-angle transducer for unbalanced loads such as T-101HPA(U) or T-101SPA(U) if it is possible that the three-phase load will be unbalanced.

5 Error may occur when the input current is extremely low (phase angle, power factor).

When using a phase angle or power factor transducer, error or malfunction may occur when the input current drops significantly lower than the rated current. Therefore, when selecting the rated primary current of a CT, ensure that the secondary current during actual use is 1/3 or more of the rated secondary current of the CT.

6 Check the electricity pulse unit (active and reactive).

Be certain to first check the restrictions applying to the value to be set for the electricity pulse unit (active and reactive) for multi-use transducers.

7 The standard bias/span ratio of the rated values of a transducer is 1/4 or less.

Cases where the bias/span ratio is larger than 1/4 can be supported by increasing the class index by multiples of 1/4 only.

(Example 1) In the case where the output value is 4~20mA, the bias is 4mA, the span is 16 (=20-4)mA, and the bias/span ratio is thus 4/16=1/4.

(Example 2) In the case where the output value is 12~20mA, the bias is 12mA, the span is 8 (=20-12)mA, and the bias/span ratio is thus 12/8=3/2. This is six times the abovementioned ratio of 1/4 and is accommodated by selecting a model with which the class index is multiplied by six; for example, if the class index is 0.25, 0.25×6 = class 1.5.

Power, Instrumentation and Peripheral

Products list

●Power transducers

Series / Output form / Product name		K Series: Fixed load	K Series: Operation method	H Series: Constant voltage/ constant current	H Series: Operation method	S Series: Constant voltage/ constant current	S Series: Operation method
Current (p.112)		T-51KAA	Average value rectification	T-51HAA	Approximate effective value rectification	T-101SAA	Effective value computation
	Saturated power (p.113)	T-51KSS	Average value rectification	T-51HSS	Approximate effective value rectification	—	—
Voltage (p.114)		T-51KAV	Average value rectification	T-51HAV	Approximate effective value rectification	T-101SAV	Effective value computation
Active power (p.116)		—	—	T-101HW	Time division multiplication	T-101SW	Time division multiplication
Reactive power (p.118)		—	—	T-101HVAR	Time division multiplication	T-101SVAR	Time division multiplication
Phase angle (p.120)	3-phase balanced circuit	—	—	T-101HPA	Phase discrimination	—	—
	3-phase unbalanced loads	—	—	T-101HPA (U)	Positive phase detection phase discrimination	T-101SPA (U)	Positive phase detection phase discrimination (integration type)
Power factor (p.122)	3-phase unbalanced loads	—	—	T-101HPF (U)	Positive phase detection power factor correction	T-101SPF (U)	Positive phase detection power factor computation
Frequency (p.124)		—	—	T-51HF	One-shot	T-101SF	Quartz oscillation frequency division
Voltage phase angle (p.125)		—	—	—	—	T-101SY	Voltage phase discrimination

Model Name Configuration

●Power transducers

T — 51 H AA

- T: Mitsubishi Electric transducers
- 51: Outer shape
- H: Accuracy • output
- AA: Product name

• Outer shape

	Code	Width size
Box	51	50mm
Box	101	100mm

• Accuracy • output

Code	Accuracy	Output
K	Ordinary class	Fixed-load voltage
		Fixed-load current
H		Constant voltage
		Constant current
S	Precision class	Constant voltage
		Constant current

• Product name

Code	Product name
AA	Current
SS	Current (saturated power)
AV	Voltage
W	Active power
VAR	Reactive power
PA	Phase angle (3-phase balanced circuit)
PA(U)	Phase angle (3-phase unbalanced loads)
PF(U)	Power factor (3-phase unbalanced loads)
F	Frequency
SY	Voltage phase angle

• Mitsubishi Electric transducers

●Instrumentation/Peripheral transducers

T — 51 DL

- T: Mitsubishi Electric transducers
- 51: Outer shape

• Outer shape

	Code	Width size
Box	51	50mm
Box	101	100mm

• Mitsubishi Electric transducers

Transducers (Single Function)

●Instrumentation transducers

Product name		Model name
DC level (p.126)		T-51DL
DC reverse (p.127)		T-51DR
Isolator (p.128)		T-101IS
High-speed isolator (p.129)		T-101ISQ
Limiter (p.130)		T-51LM
Adder (p.131)		T-101AD
Temperature (p.132)	Resistance bulb (non-isolated)	T-51TP
	Resistance bulb (isolated)	T-101TPZ
	Thermocouple (non-isolated)	T-101TC
	Thermocouple (isolated)	T-101TCZ
First-order lag (p.136)		T-51DS

●Peripheral transducers

Product name		Model name
AC current demand (moderate time interval) (p.138)		T-101HAA (DS)
AC voltage demand (moderate time interval) (p.139)		T-101HAV (DS)
Current transducer with power flow detection (p.140)		T-101HAA (D)
Leakage current (p.142)		T-51LG
	with built-in low-pass filter	T-51LGF
Voltage drop detector (p.146)		T-101VDL
Voltage rise detector (p.146)		T-101VDH
Filter (p.147)		T-51FA

• Product name (instrumentation)

Code	Product name
DL	DC level
DR	DC reverse
IS	Isolator
ISQ	High-speed isolator
LM	Limiter
AD	Adder
TP	Temperature (resistance bulb) [non-isolated]
TPZ	Temperature (resistance bulb) [isolated]
TC	Temperature (thermocouple) [non-isolated]
TCZ	Temperature (thermocouple) [isolated]
DS	First-order lag

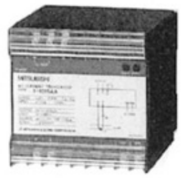
• Product name (peripheral)

Code	Product name
HAA (DS)	AC current demand (moderate time interval)
HAV (DS)	AC voltage demand (moderate time interval)
HAA (D)	Current transducer with power flow detection
LG	Leakage current
LGF	Leakage current (with built-in low-pass filter)
VDL	Voltage drop detector
VDH	Voltage rise detector
FA	Filter

Current Transducers [Insulated]

T-51/T-101 Series

T-51HAA



T-101SAA

Outer shape	Model name	Accuracy (grade)	Input (AC) Current	Input (AC) Frequency	Output (DC) Voltage or current and load	Ripple/ Response speed	Consumption VA	Auxiliary power supply	Weight	Delivery period classification
Box	T-51KAA	0.5	5A 1A	50 and 60Hz	●T-51KAA (*1) 1mA : specify 5kΩ or less 5mA : specify 1kΩ or less 100mV : specify 50kΩ or more 1V : specify 50kΩ or more 5V : specify 50kΩ or more	5% P-P or less 1s or less	0.4	—	0.4kg	○
	T-51HAA	0.5	5A 1A	50 and 60Hz	●T-51HAA, T-101SAA 1mA : 0 ~ 5kΩ 5mA : 0 ~ 1kΩ 4~20mA : 0~600Ω 100mV : 5kΩ ~ ∞ 1V : 5kΩ ~ ∞ 5V : 5kΩ ~ ∞ 10V : 10kΩ ~ ∞ 1~5V : 5kΩ ~ ∞	1% P-P or less 1s or less	0.1	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.4kg	○
	T-101SAA	0.25	5A 1A	50Hz or 60Hz		1% P-P or less 0.5s or less	0.1	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.6kg	△

*1 The load resistance connected to T-51KAA is fixed. In the case of current output, please specify a resistance value no more than that shown in the table above; specify a resistance value no less than that shown in the table above in the case of voltage output.

*2 Error may occur when the input waveform is distorted.
For example, when the third harmonic content is 15%, the error is approx. ±5% for T-51KAA, ±2% for T-51HAA and ±0.2% for T-101SAA.

Delivery period classification

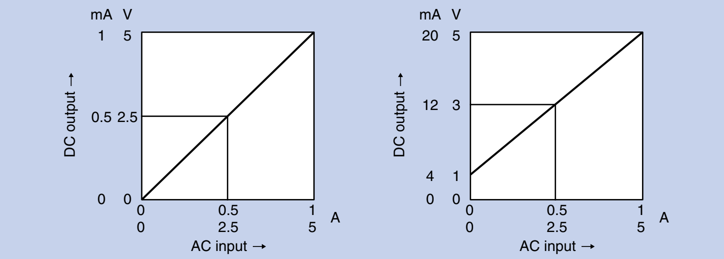
Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Manufacturable range

		T-51KAA	T-51HAA	T-101SAA
Input		0.1~7.5A	0.1~5A	
Output		0.1~5mA 50mV~5V	0.1~20mA 50mV~10V	
Auxiliary power supply	AC	—	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$ %	
	DC	—	24V, 100~120V	24V±10%

The voltage tolerance of a 24VDC auxiliary power supply is ±10%.
The voltage tolerance of a 100~120VDC auxiliary power supply is $^{+15}_{-25}$ %.

■Input/Output relationships



■Connection diagrams (Refer to p.156 for outer dimensions.)

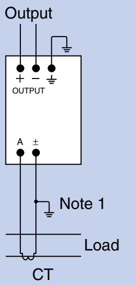


Fig. 1 T-51KAA

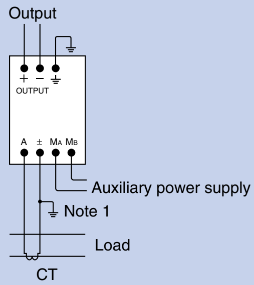


Fig. 2 T-51HAA

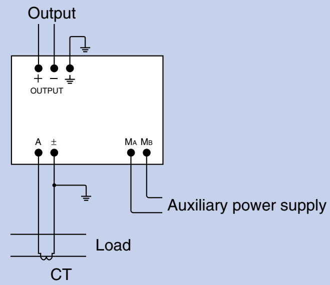


Fig. 3 T-101SAA

Note 1. For low-voltage circuits, grounding of the secondary side of the current transformer is unnecessary.

■Ordering method

● K Series

Model name	Input Current	Output Voltage or current	Load resistance	Number of units
T-51KAA	5A	0-1mA	5kΩ	15

● H Series
S Series

Model name	Input Current	Frequency	Output Voltage or current	Auxiliary power supply	Number of units
T-51HAA	5A		4-20mA	110VAC	20

Specify in the case of S Series.

Current Transducers (Saturated Power) [Insulated]

T-51/T-101 Series

Suited for motor circuits, heater circuits and other circuits in which an overcurrent flows during startup.

When combined with a needle indicator, an indicator with the scale expanded three-fold is realized.

T-51HSS

Outer shape	Model name	Accuracy (grade)	Input (AC) Current	Input (AC) Frequency	Output (DC) Voltage or current and load	Ripple/ Response speed	Consumption VA	Auxiliary power supply	Weight	Delivery period classification
Box	T-51KSS	0.5	0~5~15A 0~1~3A	50 and 60Hz	●T-51KSS (*1) 0~0.8~(1)mA : specify 5kΩ or less 0~4~(5)V : specify 50kΩ or less	5% P-P or less 1s or less	0.4	—	0.4kg	○
Box	T-51HSS	0.5	0~5~15A 0~1~3A	50 and 60Hz	●T-51HSS 0~0.8~(1)mA : 0~5kΩ 4~16~(20)mA : 0~600Ω 0~4~(5)V : 5kΩ~∞ 0~8~(10)V : 10kΩ~∞	1% P-P or less 1s or less	0.1	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.4kg	○

*1 The load resistance connected to T-51KSS is fixed. In the case of current output, please specify a resistance value no more than that shown in the table above; specify a resistance value no less than that shown in the table above in the case of voltage output.

*2 Models with 2- to 5-times expanded saturated power can also be manufactured.

*3 Error may occur when the input waveform is distorted.
For example, when the third harmonic content is 15%, the error is approx. ±5% for T-51KSS and ±2% for T-51HSS.

*4 The tolerance of the maximum saturated power is within ±10% (% in respect to saturated power value).

Delivery period classification

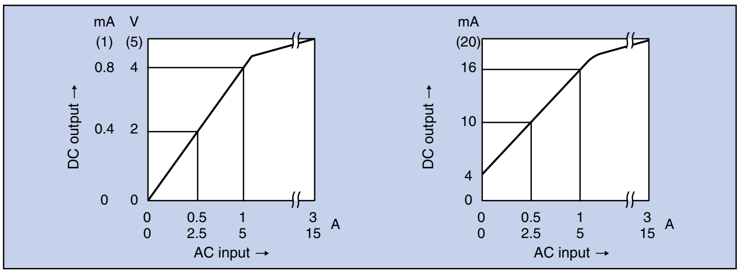
Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Manufacturable range

		T-51KSS	T-51HSS
Input		0.1~7.5A	0.1~5A
Output		Only specifications in the table above	0.1~20mA 50mV~10V
Auxiliary power supply	AC	—	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$ %
Auxiliary power supply	DC	—	24V, 100~120V

The voltage tolerance of a 24VDC auxiliary power supply is ±10%.
The voltage tolerance of a 100~120VDC auxiliary power supply is $^{+15}_{-25}$ %.

■Input/Output relationships



■Connection diagrams (Refer to p.156 for outer dimensions.)

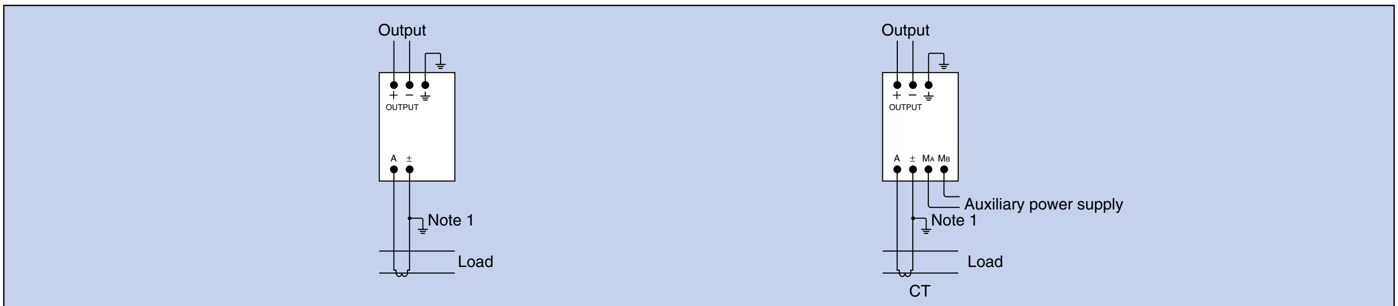


Fig. 1 T-51KSS

Fig. 2 T-51HSS

Note 1. For low-voltage circuits, grounding of the secondary side of the current transformer is unnecessary.

■Ordering method

●K Series

Model name	Input Current	Output Voltage or current	Load resistance	Number of units
T-51KSS	0-5-15A	0-0.8-1mA	3kΩ	10

●H Series

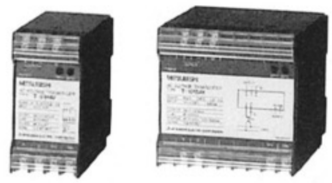
Model name	Input Current	Output Voltage or current	Auxiliary power supply	Number of units
T-51HSS	0-5-15A	4-16-20mA	110VAC	20

Specify three values for the output.

Transducers

Voltage Transducers [Insulated]

T-51/T-101 Series



Outer shape	Model name	Accuracy (grade)	Input (AC)		Output (DC)	Ripple/ Response speed	Consumption VA	Auxiliary power supply	Weight	Delivery period classification
			Voltage	Frequency	Voltage or current and load					
Box	T-51KAV	0.5	150V 300V	50 and 60Hz	●T-51KAV (*1) 1mA : specify 5kΩ or less 5mA : specify 1kΩ or less 100mV : specify 50kΩ or more 1V : specify 50kΩ or more 5V : specify 50kΩ or more	5% P-P or less 1s or less	1.4	—	0.4kg	○
Box	T-51HAV	0.5	150V 300V	50 and 60Hz	●T-51HAV, T-101SAV 1mA : 0 ~ 5kΩ 5mA : 0 ~ 1kΩ 4~20mA : 0~600Ω 100mV : 5kΩ ~ ∞ 1V : 5kΩ ~ ∞ 5V : 5kΩ ~ ∞ 10V : 10kΩ ~ ∞ 1~5V : 5kΩ ~ ∞	1% P-P or less 1s or less	150V : 0.4 300V : 0.8	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.4kg	○
Box	T-101SAV	0.25	150V 300V	50Hz or 60Hz		1% P-P or less 0.5s or less	150V : 0.4 300V : 0.8	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.6kg	△

*1 The load resistance connected to T-51KAV is fixed. In the case of current output, please specify a resistance value no more than that shown in the table above; specify a resistance value no less than that shown in the table above in the case of voltage output.

*2 Error may occur when the input waveform is distorted.
For example, when the third harmonic content is 15%, the error is approx. ±5% for T-51KAV, ±2% for T-51HAV and ±0.2% for T-101SAV.

Delivery period classification

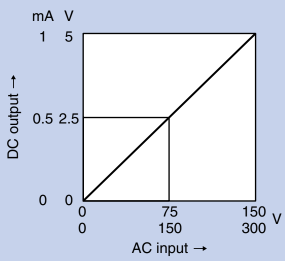
Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

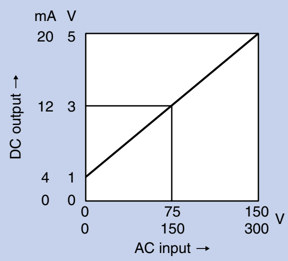
■Manufacturable range

		T-51KAV	T-51HAV	T-101SAV
Input		50~300V		
Output		0.1~5mA 50mV~5V	0.1~20mA 50mV~10V	
Auxiliary power supply	AC	—	100, 105, 110, 115, 120V $^{+10}_{-15}$ % 200, 210, 220, 230, 240V	
	DC	—	24V, 100~120V	24V±10%

The voltage tolerance of a 24VDC auxiliary power supply is ±10%.
The voltage tolerance of a 100~120VDC auxiliary power supply is $^{+15}_{-25}$ %.

■Input/Output relationships





■Connection diagrams (Refer to p.156 for outer dimensions.)

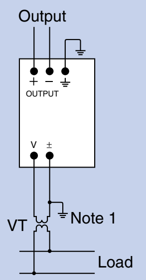


Fig. 1 T-51KAV

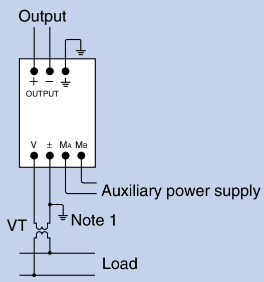


Fig. 2 T-51HAV

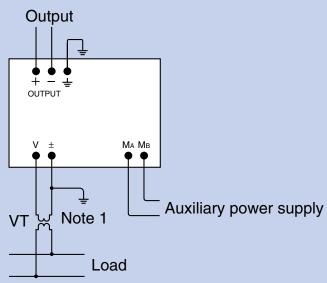


Fig. 3 T-101SAV

Note 1. For low-voltage circuits, grounding of the secondary side of the instrument voltage transformer is unnecessary.

■Ordering method

●K Series

Model name	Input Voltage	Output Voltage or current	Load resistance	Number of units
T-51KAV	150V	0-5V	50kΩ	10

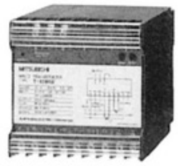
●H Series
S Series

Model name	Input Voltage	Frequency	Output Voltage or current	Auxiliary power supply	Number of units
T-101SAV	150V	60Hz	4-20mA	110VAC	10

Specify in the case of S Series.

Active Power Transducers [Insulated]

T-51/T-101 Series



T-101HW

Outer shape	Model name	Accuracy (grade)	Phase-wire	Voltage	Current	Inherent active power (P0)	Frequency	Output (DC) Voltage or current and load	Ripple/ Response speed	Consumption VA Current circuit	Consumption VA Voltage circuit	Auxiliary power supply	Weight	Delivery period classification
Box	T-101HW	0.5	1-phase 2-wire	110V	5A	0.25~0.6kW	50 and 60Hz	1mA : 0~5kΩ 5mA : 0~1kΩ 4~20mA : 0~600Ω 100mV : 5kΩ~∞ 1V : 5kΩ~∞ 5V : 5kΩ~∞ 10V : 10kΩ~∞ 1~5V : 5kΩ~∞	1% P-P or less 0.5s or less	0.2	0.6	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.6kg	○
					1A	0.05~0.12kW								
				220V	5A	0.5~1.2kW					1.2			
					1A	0.1~0.24kW								
			1-phase 3-wire	100/200V	5A	0.5~1.2kW				I_1 0.1	P_0-P_1 0.3			
					1A	0.1~0.24kW				I_2 0.1	P_0-P_2 0.3			
			3-phase 3-wire	110V	5A	0.5~1.2kW				I_1 0.1	P_1-P_2 0.3			
					1A	0.1~0.24kW					P_2-P_3 0.3			
				220V	5A	1.0~2.4kW				I_3 0.1	P_1-P_2 0.6			
					1A	0.2~0.48kW					P_2-P_3 0.6			
			3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V	5A	0.5~1.2kW				I_1 0.1	P_0-P_1 0.2			
					1A	0.1~0.24kW				I_2 0.2	P_0-P_3 0.2			
				110/190V	5A	0.86~2.07kW				I_3 0.1	P_0-P_1 0.3			
					1A	0.17~0.40kW					P_0-P_3 0.3			
	T-101SW	0.25	1-phase 2-wire	110V	5A	0.25~0.6kW	50Hz or 60Hz	1mA : 0~5kΩ 5mA : 0~1kΩ 4~20mA : 0~600Ω 100mV : 5kΩ~∞ 1V : 5kΩ~∞ 5V : 5kΩ~∞ 10V : 10kΩ~∞ 1~5V : 5kΩ~∞	1% P-P or less 0.5s or less	0.2	0.6	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.6kg	△
					1A	0.05~0.12kW								
				220V	5A	0.5~1.2kW					1.2			
					1A	0.1~0.24kW								
			1-phase 3-wire	100/200V	5A	0.5~1.2kW				I_1 0.1	P_0-P_1 0.3			
					1A	0.1~0.24kW				I_2 0.1	P_0-P_2 0.3			
			3-phase 3-wire	110V	5A	0.5~1.2kW				I_1 0.1	P_1-P_2 0.3			
					1A	0.1~0.24kW					P_2-P_3 0.3			
				220V	5A	1.0~2.4kW				I_3 0.1	P_1-P_2 0.6			
					1A	0.2~0.48kW					P_2-P_3 0.6			
			3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V	5A	0.5~1.2kW				I_1 0.1	P_0-P_1 0.2			
					1A	0.1~0.24kW				I_2 0.2	P_0-P_3 0.2			
				110/190V	5A	0.86~2.07kW				I_3 0.1	P_0-P_1 0.3			
					1A	0.17~0.40kW					P_0-P_3 0.3			

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Manufacturable range

		T-101HW	T-101SW
Input		Within the range of the inherent active power (Po) in the table above *1	
Output		0.1~20mA 50mV~10V *2	
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$ %	
	DC	24V, 100~120V	24V±10%

The voltage tolerance of a 24VDC auxiliary power supply is ±10%.
The voltage tolerance of a 100~120VDC auxiliary power supply is $^{+15}_{-25}$ %.

*1 Please specify an inherent active power value for the transducer (i.e., input rating of the active power transducer) within the range in the table above.

*2 The manufacturable range for bidirectional current output is ±0.1~±5mA.
Positive/negative bidirectional output models for positive/negative bidirectional inputs accompanying power flow and positive direction output-only models can also be manufactured.

(Example)

Input	Output	
-1kW~0~1kW	-1~0~1mA -5~0~5V	0~0.5~1mA 4~12~20mA 0~50~100mV 0~2.5~5V

■"Inherent active power" of active power transducers

An active power transducer can be manufactured if the transducer's inherent active power $\left(P_0 = \dfrac{\textbf{primary-side active power (kW)}}{\textbf{VT ratio} \times \textbf{CT ratio}}\right)$

is within the range of the table on the left.
In the case of positive/negative bidirectional input, calculate using the larger of the positive or negative active powers.

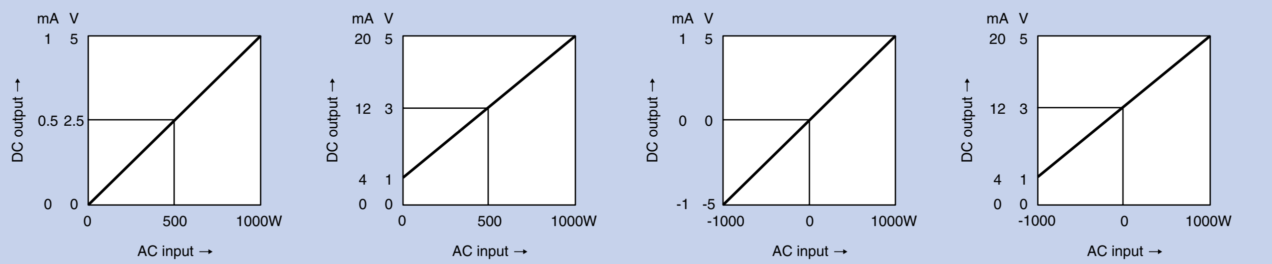
* The primary-side active power (kW) mentioned here is not the full-load active power based on the VT-CT rating. It refers to the active power value kW (i.e., primary-side active power value corresponding to the rated output value) to be controlled according to the load state (e.g., light load). (equivalent to the scale of the indicator)

■Inherent active power value calculation example

In the case of a 3-phase, 3-wire, VT 6600/110V, CT 200/5A arrangement with the primary side power being 2000kW:

$$\textbf{Transducer inherent active power } P_0 = \frac{\textbf{primary-side active power (kW)}}{\textbf{VT ratio} \times \textbf{CT ratio}} = \frac{\textbf{2000kW}}{\textbf{6600/110} \times \textbf{200/5}} = \textbf{0.833 (kW)}$$

■Input/Output relationships



■Connection diagrams (Refer to p.156 for outer dimensions.)

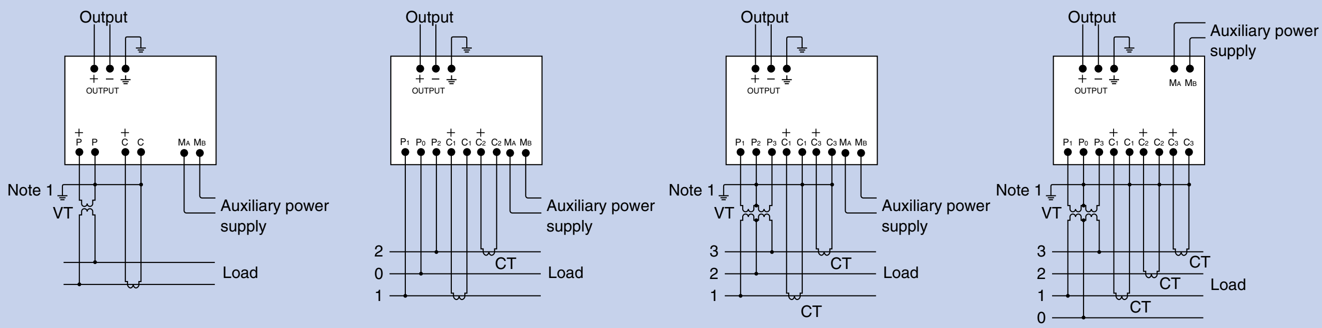


Fig. 1 T-101HW 1P2W
T-101SW 1P2W

Fig. 2 T-101HW 1P3W
T-101SW 1P3W

Fig. 3 T-101HW 3P3W
T-101SW 3P3W

Fig. 4 T-101HW 3P4W
T-101SW 3P4W

Note 1. For low-voltage circuits, grounding of the secondary side of the instrument voltage transfomer and current transformer is unnecessary.

■Ordering method

Model name	Input: Phase-wire	Input: Voltage	Input: Current	Frequency	Transducer inherent active power value	Output: Voltage or current	Auxiliary power supply	Number of units
T-101HW	3P3W	110V	5A		1000W	0–5V	110VAC	3

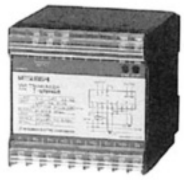
In the case of a 3-phase, 4-wire unit, please specify the phase voltage and line voltage.

Please specify in the case of S Series.

Although manufacturing will be performed even when specified in kW units, the specifications will be converted to W units on the rating nameplate.

Reactive Power Transducers

T-51/T-101 Series



T-101HVAR

Outer shape	Model name	Accuracy (grade)	Input (AC) Phase-wire	Voltage	Current	Inherent active power (Qo)	Frequency	Output (DC) Voltage or current and load	Ripple/ Response speed	Consumption VA Current circuit	Consumption VA Voltage circuit	Auxiliary power supply	Weight	Delivery period classification
Box	T-101HVAR	0.5	3-phase 3-wire	110V	5A	0.5 ~1.2kvar	50 and 60Hz	–1~0~1mA : 0~5kΩ –5~0~5mA : 0~1kΩ –100~0~100mV : 5kΩ~∞ –1~0~1V : 5kΩ~∞ –5~0~5V : 5kΩ~∞ –10~0~10V : 10kΩ~∞ 0~0.5~1mA : 0~5kΩ 0~2.5~5mA : 0~1kΩ 4~12~20mA : 0~600Ω 0~50~100mV : 5kΩ~∞ 0~0.5~1V : 5kΩ~∞ 0~2.5~5V : 5kΩ~∞ 0~5~10V : 10kΩ~∞ 1~3~5V : 5kΩ~∞	1% P-P or less 0.5s or less	I_1 0.1 I_2 0.2 I_3 0.1	P_1-$P_2$0.3 P_2-$P_3$0.3	110VAC $^{+10}_{-15}$% 50 and 60Hz Consumption VA: 3	0.6kg	○
					1A	0.1 ~0.24kvar								
				220V	5A	1.0 ~2.4kvar					P_1-$P_2$0.6 P_2-$P_3$0.6			
					1A	0.2 ~0.48kvar								
			3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V	5A	0.5 ~1.2kvar				I_1 0.1 I_2 0.2 I_3 0.1	P_1-$P_2$0.3 P_2-$P_3$0.3			
					1A	0.1 ~0.24kvar								
				110/190V	5A	0.86~2.07kvar					P_1-$P_2$0.5 P_2-$P_3$0.5			
					1A	0.17~0.40kvar								
	T-101SVAR	0.25	3-phase 3-wire	110V	5A	0.5 ~1.2kvar	50Hz or 60Hz		1% P-P or less 0.5s or less	I_1 0.1 I_2 0.2 I_3 0.1	P_1-$P_2$0.3 P_2-$P_3$0.3	110VAC $^{+10}_{-15}$% 50 and 60Hz Consumption VA: 3	0.6kg	△
					1A	0.1 ~0.24kvar								
				220V	5A	1.0 ~2.4kvar					P_1-$P_2$0.6 P_2-$P_3$0.6			
					1A	0.2 ~0.48kvar								
			3-phase 4-wire	$\frac{110}{\sqrt{3}}$/110V	5A	0.5 ~1.2kvar				I_1 0.1 I_2 0.2 I_3 0.1	P_1-$P_2$0.3 P_2-$P_3$0.3			
					1A	0.1 ~0.24kvar								
				110/190V	5A	0.86~2.07kvar					P_1-$P_2$0.5 P_2-$P_3$0.5			
					1A	0.17~0.40kvar								

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Manufacturable range

		T-101HVAR	T-101SVAR
Input		Within the range of the inherent reactive power (Qo) in the table above. *1	
Output		0.1~20mA, 50mV~10V *2	
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$%	
	DC	24V, 100~120V	24V±10%

The voltage tolerance of a 24VDC auxiliary power supply is ±10%.
The voltage tolerance of a 100~120VDC auxiliary power supply is $^{+15}_{-25}$%.

*1 Please specify the inherent reactive power value of the transducer within the range in the table above.
The reactive power transducer has bidirectional inputs for lead (LEAD) and lag (LAG) of the phase.

*2 The manufacturable range for a bidirectional current output is ±0.1~±5mA.
Unidirectional input and unidirectional output for the lag side (LAG) or the lead side (LEAD) can also be manufactured.
Please specify LAG or LEAD.

(Example)

Input	Output
LAG 0~1kvar LEAD 0~1kvar	0~1mA 4~20mA 0~100mV 0~5V

[Insulated]

■"Inherent reactive power" of reactive power transducers

A reactive power transducer can be manufactured if the transducer inherent reactive power $\left(Q_0 = \dfrac{\text{primary-side reactive power (kvar)}}{\text{VT ratio} \times \text{CT ratio}}\right)$ **is within the range of the table on the left.**
In the case of bidirectional input, calculate using the larger of the lag or lead reactive powers.

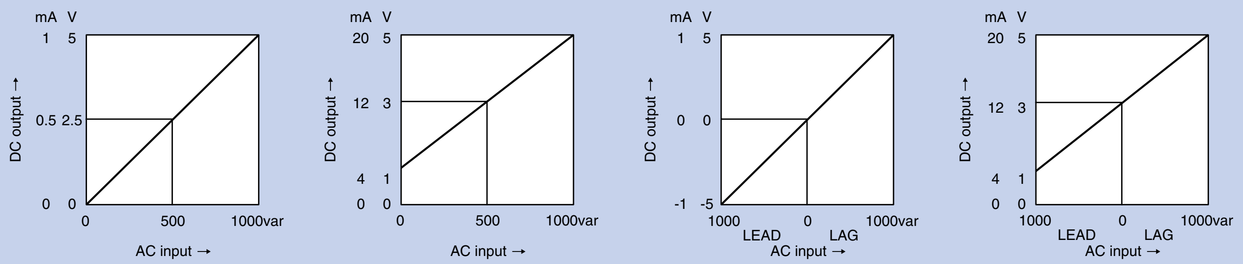
* The primary-side reactive power (kvar) mentioned here is not the full-load reactive power based on the VT-CT rating. It refers to the reactive power value kvar (primary-side reactive power value equivalent to the rated output value) to be controlled according to the power factor.

■Inherent reactive power value calculation example

In the case of a 3-phase, 3-wire, VT 6600/110V, CT 200/5A arrangement with the primary-side reactive power being 1200kvar:

$$\text{Transducer inherent reactive power } Q_0 = \frac{\text{primary-side reactive power (kvar)}}{\text{VT ratio} \times \text{CT ratio}} = \frac{1200\text{kvar}}{6600/110 \times 200/5} = 0.500\ \text{(kvar)}$$

■Input/Output relationships



■Connection diagrams (Refer to p.156 for outer dimensions.)

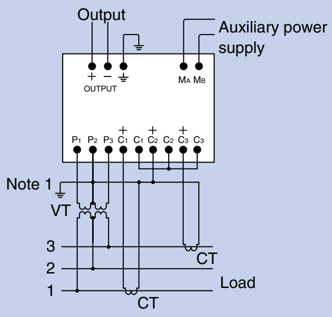


Fig. 1 T-101HVAR 3P3W
T-101SVAR 3P3W

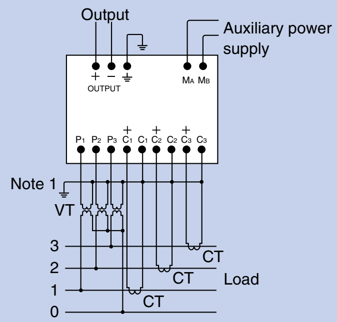


Fig. 2 T-101HVAR 3P4W
T-101SVAR 3P4W

***3** In the case of unidirectional input, the lag side (LAG) is the reactive power unless particularly specified.
***4** A CT must be inserted and used in the current circuit because reactive power transducers are three-current systems.
***5** Operation will be abnormal when the input of the three-phase circuit is a negative-phase sequence.
Note 1. For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

■Ordering method

Model name	Input: Phase-wire	Input: Voltage	Input: Current	Transducer inherent reactive power value	Frequency	Output: Voltage or current	Auxiliary power supply	Number of units
T-101HVAR	3P3W	110V	5A	LEAD1000–0–LAG1000var	60Hz	–5–0–5V	110VAC	3

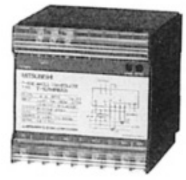
Voltage: In the case of 3-phase, 4-wire, please specify the phase voltage and line voltage.

Transducer inherent reactive power value: Although manufacturing will be performed even when specified in kvar units, the specifications will be converted to var units on the rating nameplate.

Frequency: Please specify in the case of S Series.

Phase Angle Transducers [Insulated]

T-51/T-101 Series



T-101HPA (U)

<table>
<tr><th rowspan="2">Outer shape</th><th rowspan="2">Model name</th><th rowspan="2">Accuracy (grade)</th><th colspan="5">Input (AC)</th><th>Output (DC)</th><th rowspan="2">Ripple/ Response speed</th><th colspan="2">Consumption VA</th><th rowspan="2">Auxiliary power supply</th><th rowspan="2">Weight</th><th rowspan="2">Delivery period classification</th></tr>
<tr><th>Phase-wire</th><th>Voltage</th><th>Current</th><th>Phase angle</th><th>Frequency</th><th>Voltage or current and load</th><th>Current circuit</th><th>Voltage circuit</th></tr>
<tr><td rowspan="20">Box</td><td rowspan="4">T-101HPA</td><td rowspan="4">2.0</td><td rowspan="4">3-phase 3-wire (balanced circuit)</td><td rowspan="2">110V</td><td>5A</td><td rowspan="4">LEAD 60°
~
0°
~
LAG 60°</td><td rowspan="4">50 and 60Hz</td><td rowspan="20">–1~0~1mA : 0~5kΩ
–5~0~5mA : 0~1kΩ
–100~0~100mV : 5kΩ~∞
–1~0~1V : 5kΩ~∞
–5~0~5V : 5kΩ~∞
–10~0~10V : 10kΩ~∞
0~0.5~1mA : 0~5kΩ
0~2.5~5mA : 0~1kΩ
4~12~20mA : 0~600Ω
0~50~100mV : 5kΩ~∞
0~0.5~1V : 5kΩ~∞
0~2.5~5V : 5kΩ~∞
0~5~10V : 10kΩ~∞
1~3~5V : 5kΩ~∞</td><td rowspan="4">1% P-P
or less
1s
or less</td><td rowspan="4">0.1</td><td rowspan="2">0.3</td><td rowspan="12">110VAC
$^{+10}_{-15}$%
50 and 60Hz
Consumption
VA: 3</td><td rowspan="4">0.6kg</td><td rowspan="4">○</td></tr>
<tr><td>1A</td></tr>
<tr><td rowspan="2">220V</td><td>5A</td><td rowspan="2">0.6</td></tr>
<tr><td>1A</td></tr>
<tr><td rowspan="8">T-101HPA (U)</td><td rowspan="8">2.0</td><td rowspan="4">3-phase 3-wire (unbalanced loads)</td><td rowspan="2">110V</td><td>5A</td><td rowspan="8">LEAD 60°
~
0°
~
LAG 60°</td><td rowspan="8">50Hz or
60Hz</td><td rowspan="8">1% P-P
or less
1s
or less</td><td rowspan="4">I_1 0.1
I_3 0.1</td><td rowspan="2">0.3</td><td rowspan="8">0.6kg</td><td rowspan="8">○</td></tr>
<tr><td>1A</td></tr>
<tr><td rowspan="2">220V</td><td>5A</td><td rowspan="2">0.6</td></tr>
<tr><td>1A</td></tr>
<tr><td rowspan="4">3-phase 4-wire</td><td rowspan="2">$\frac{110}{\sqrt{3}}$/110V</td><td>5A</td><td rowspan="4">I_1 0.1
I_2 0.1
I_3 0.1</td><td rowspan="2">0.3</td></tr>
<tr><td>1A</td></tr>
<tr><td rowspan="2">110/190V</td><td>5A</td><td rowspan="2">0.5</td></tr>
<tr><td>1A</td></tr>
<tr><td rowspan="8">T-101SPA (U)</td><td rowspan="8">1.0</td><td rowspan="4">3-phase 3-wire (unbalanced loads)</td><td rowspan="2">110V</td><td>5A</td><td rowspan="8">LEAD 60°
~
0°
~
LAG 60°</td><td rowspan="8">50Hz or
60Hz</td><td rowspan="8">1% P-P
or less
1s
or less</td><td rowspan="4">I_1 0.1
I_3 0.1</td><td rowspan="2">0.3</td><td rowspan="8">110VAC
$^{+10}_{-15}$%
50 and 60Hz
Consumption
VA: 3</td><td rowspan="8">0.6kg</td><td rowspan="8">△</td></tr>
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<tr><td rowspan="2">220V</td><td>5A</td><td rowspan="2">0.6</td></tr>
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<tr><td rowspan="4">3-phase 4-wire</td><td rowspan="2">$\frac{110}{\sqrt{3}}$/110V</td><td>5A</td><td rowspan="4">I_1 0.1
I_2 0.2
I_3 0.1</td><td rowspan="2">0.3</td></tr>
<tr><td>1A</td></tr>
<tr><td rowspan="2">110/190V</td><td>5A</td><td rowspan="2">0.5</td></tr>
<tr><td>1A</td></tr>
</table>

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Manufacturable range

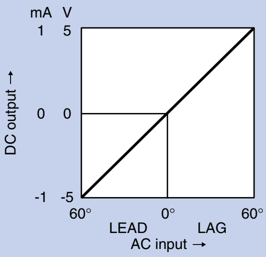
<table>
<tr><th colspan="2"></th><th>T-101HPA,
T-101HPA (U)</th><th>T-101SPA (U)</th></tr>
<tr><td colspan="2">Input</td><td colspan="2">As indicated in the table above. *1</td></tr>
<tr><td colspan="2">Output</td><td colspan="2">0.1~20mA, 50mV~10V *2</td></tr>
<tr><td rowspan="2">Auxiliary power supply</td><td>AC</td><td colspan="2">100, 105, 110, 115, 120V
200, 210, 220, 230, 240V $^{+10}_{-15}$%</td></tr>
<tr><td>DC</td><td>24V, 100~120V</td><td>24V±10%</td></tr>
</table>

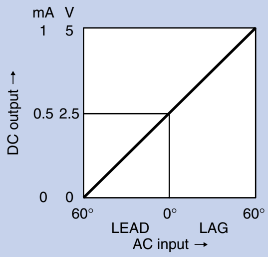
The voltage tolerance of a 24VDC auxiliary power supply is ±10%.
The voltage tolerance of a 100~120VDC auxiliary power supply is $^{+15}_{-25}$%.

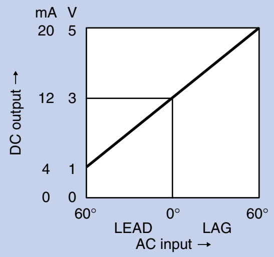
*1 The error increases when the input current decreaes.
- ●T-101HPA ...1/5 of the rated current or less
- ●T-101HPA(U) ... 1/5 of the rated current or less
- ●T-101SPA(U) ...1/10 of the rated current or less

*2 The manufacturable range for a bidirectional current output is ±0.1~±5mA.

■Input/Output relationships







■Connection diagrams (Refer to p.156 for outer dimensions.)

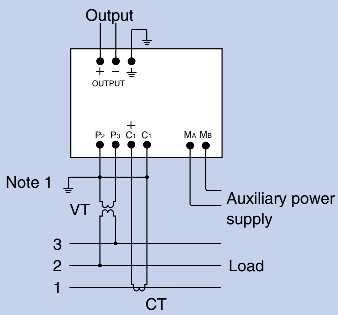


Fig. 1 T-101HPA 3P3W
(for balanced circuits)

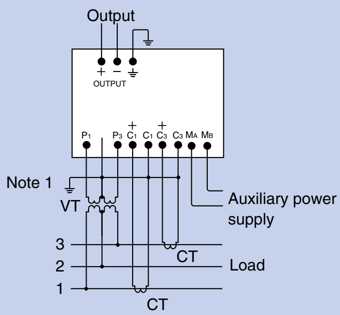


Fig. 2 T-101HPA (U) 3P3W
T-101SPA (U) 3P3W
(for unbalanced loads)

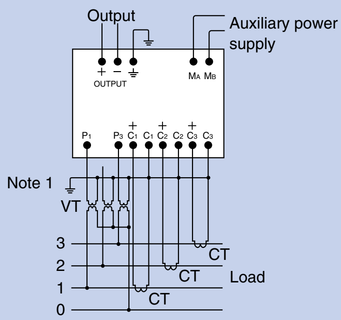


Fig. 3 T-101HPA (U) 3P4W
T-101SPA (U) 3P4W
(for unbalanced loads)

*3 When only the auxiliary power supply is applied, a value close to a phase angle of 0° (power factor of 1) is output.
*4 Use a transducer “for unbalanced loads” if there is a possibility for the 3-phase load to become unbalanced.
*5 With transducers for both balanced circuits and unbalanced loads, an error may occur when the 3-phase voltage becomes unbalanced.
*6 Operation will be abnormal when the input is a negative-phase sequence.
Note 1. For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

■Ordering method

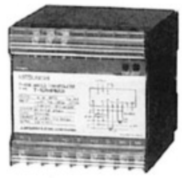
Model name	Input				Frequency	Output	Auxiliary power supply	Number of units
	Phase-wire	Voltage	Current	Phase angle		Voltage or current		
T-101HPA (U)	3P3W	110V	5A	LEAD60°–0–LAG60°	60Hz	4–12–20mA	110VAC	5

In the case of 3-phase, 4-wire models, please specify the phase voltage and line voltage.

Please specify in the case of HPA(U) and SPA(U).

Power Factor Transducers

T-51/T-101 Series



T-101HPF (U)

Outer shape	Model name	Accuracy (grade)	Input (AC) Phase-wire	Voltage	Current	Power factor	Frequency	Output (DC) Characteristics	Voltage or current and load: Output	SGN	Ripple/ Response speed	Consumption VA: Current circuit	Voltage circuit	Auxiliary powersupply	Weight	Delivery period classification
Box	T-101HPF (U)	3.0	3-phase 3-wire 3-phase 3-wire 3-phase 4-wire 3-phase 4-wire	110V 220V $\frac{110}{\sqrt{3}}$/110V 110/190V	5A, 1A 5A, 1A 5A, 1A 5A, 1A	LEAD LAG 0.5~1~0.5 or LEAD LAG 0~1~0	50Hz or 60Hz	3	–1~0~1mA : 0~5kΩ –5~0~5mA : 0~1kΩ –100~0~100mV : 5kΩ~∞ –1~0~1V : 5kΩ~∞ –5~0~5V : 5kΩ~∞ –10~0~10V : 10kΩ~∞ 0~0.5~1mA : 0~5kΩ 0~2.5~5mA : 0~1kΩ 4~12~20mA : 0~600Ω 0~50~100mV : 5kΩ~∞ 0~0.5~1V : 5kΩ~∞ 0~2.5~5V : 5kΩ~∞ 0~5~10V : 10kΩ~∞ 1~3~5V : 5kΩ~∞	–	1% P-P or less 1s or less	3-wire: I1 0.1, I3 0.1 4-wire: I1 0.1, I2 0.1, I3 0.1	0.3 0.6 0.3 0.5	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.6 kg	○
Box	T-101SPF (U)	2.0	3-phase 3-wire 3-phase 3-wire 3-phase 4-wire 3-phase 4-wire	110V 220V $\frac{110}{\sqrt{3}}$/110V 110/190V	5A, 1A 5A, 1A 5A, 1A 5A, 1A	LEAD LAG 0.5~1~0.5 or LEAD LAG 0~1~0	50Hz or 60Hz	1 2 3	1: 0~–1/1~0V : 5kΩ~∞ 0~–5/5~0V : 5kΩ~∞ (input LEAD 0~1~0 LAG only) 2: 0~1~0mA : 0~5kΩ 4~20~4mA : 0~600Ω (input LEAD 0~1~0 LAG only) 3: –1~0~1mA : 0~5kΩ –5~0~5mA : 0~1kΩ –100~0~100mV : 5kΩ~∞ –1~0~1V : 5kΩ~∞ –5~0~5V : 5kΩ~∞ –10~0~10V : 10kΩ~∞ 0~0.5~1mA : 0~5kΩ 0~2.5~5mA : 0~1kΩ 4~12~20mA : 0~600Ω 0~50~100mV : 5kΩ~∞ 0~0.5~1V : 5kΩ~∞ 0~2.5~5V : 5kΩ~∞ 0~5~10V : 10kΩ~∞ 1~3~5V : 5kΩ~∞	1: – 2: LEAD 1Vmax LAG 5V ±0.5V 3: –	1% P-P or less 1s or less	3-wire: I1 0.1, I3 0.1 4-wire: I1 0.1, I2 0.2, I3 0.1	0.3 0.6 0.3 0.5	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.6 kg	△

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Manufacturable range

		T-101HPF (U)	T-101SPF (U)
Input		As indicated in the table above *1	
Output		0.1~20mA, 50mV~10V *2	
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$ %	
	DC	24V, 100~120V	24V±10%

The voltage tolerance of a 24VDC auxiliary power supply is ±10%.
The voltage tolerance of a 100~120VDC auxiliary power supply is $^{+15}_{-25}$ %.

*1 The error increases when the input current decreases.
●T-101HPF(U) ...1/5 of the rated current or less
●T-101SPF(U) ... 1/10 of the rated current or less

*2 The manufacturable range for a bidirectional current output is ±0.1~±5mA.
Output specifications
●As indicated in the "Input/Output relationships," the outputs of a power factor transducer include an output (Output) proportional to the power factor and a lead/lag distinguishing output (SGN). The output characteristics are classified according to characteristics 1 to 3 (only the model with the characteristic of 3 is manufactured as the T-101HPF(U)).
●SGN output
In the case of phase lag ... 5V±0.5V, 2mA (Source: output current)
In the case of phase lead ... 1V max, 5mA (Sink: input current)

*3 When only auxiliary power supply is applied, a power factor close to 1 is output.

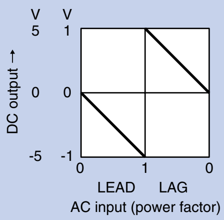
*4 An error may occur when the 3-phase voltage becomes unbalanced.

*5 Operation will be abnormal when the input is a negative-phase sequence.

(for Unbalanced Loads) [Insulated]

■Input/Output relationships

Characteristic 1

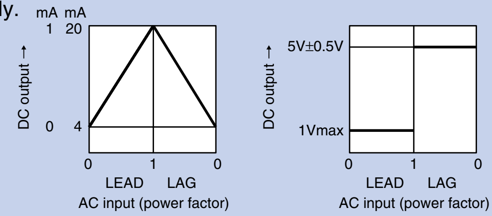


The characteristic 1 model is manufactured only for voltage output.

Characteristic 2

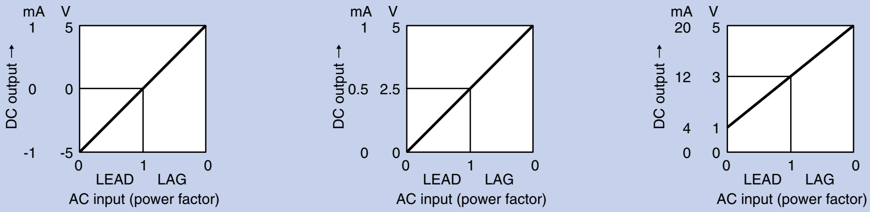
The two outputs shown below are output simultaneously.

The characteristic 2 model is manufactured only for current output.

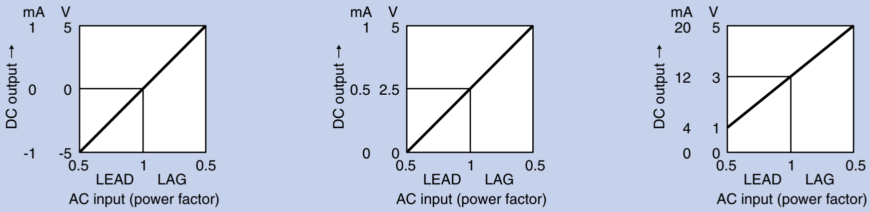


Characteristic 3

●Power factor LEAD 0~1~LAG 0



●Power factor LEAD 0.5~1~LAG 0.5



■Connection diagrams (Refer to p.156 for outer dimensions.)

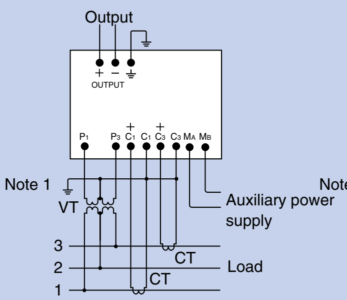


Fig. 1 T-101HPF(U) 3P3W
T-101SPF(U) 3P3W (characteristic 1 or 3)
(for unbalanced loads)

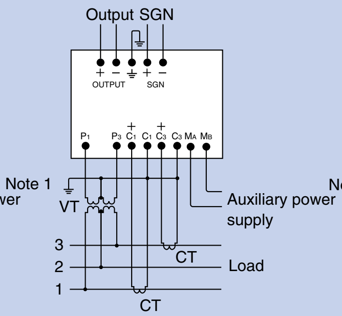


Fig. 2 T-101SPF(U) 3P3W (characteristic 2)
(for unbalanced loads)

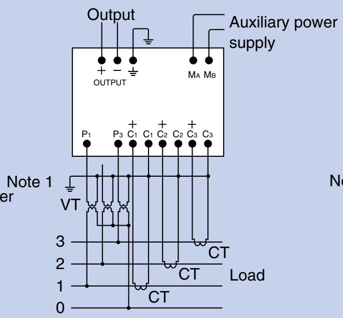


Fig. 3 T-101HPF(U) 3P4W
T-101SPF(U) 3P4W (characteristic 1 or 3)

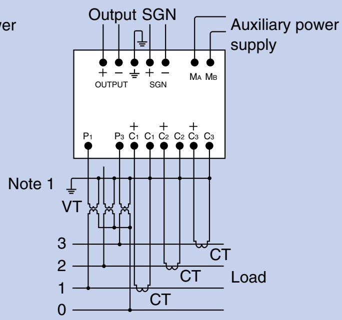


Fig. 4 T-101SPF(U) 3P4W (characteristic 2)

Note 1. For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

■Ordering method

Model name	Input				Frequency	Output	Auxiliary power supply	Number of units
	Phase-wire	Voltage	Current	Power factor		Voltage or current		
T-101HPF (U)	3P3W	110V	5A	LEAD0.5–1–LAG0.5	60Hz	4–12–20mA	110VAC	2

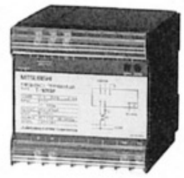
In the case of 3-phase, 4-wire models, please specify the phase voltage and line voltage.

Specify three values for the output.

Frequency Transducers [Insulated]

T-51/T-101 Series

T-51HF



T-101SF

Outer shape	Model name	Accuracy (grade)	Input (AC) Voltage	Input (AC) Frequency	Output (DC) Voltage or current and load	Ripple/ Response speed	Consumption VA	Auxiliary power supply	Weight	Delivery period classification
Box	T-51HF	1.0	110V	45~55Hz 55~65Hz	0~1mA : 0~5kΩ 0~5mA : 0~1kΩ 4~20mA : 0~600Ω 0~100mV : 5kΩ~∞ 0~1V : 5kΩ~∞ 0~5V : 5kΩ~∞ 0~10V : 10kΩ~∞ 1~5V : 5kΩ~∞	1% P-P or less 1s or less	0.3	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.4kg	○
			220V				0.6			
	T-101SF	0.5	110V	45~55Hz	0.45~0.55V : 5kΩ~∞	1% P-P or less 1s or less	0.3	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.6kg	△
			220V	55~65Hz	0.55~0.65V : 5kΩ~∞		0.6			

■Manufacturable range

		T-51HF	T-101SF
Input		50~400Hz *1	
Output		0.1~20mA, 50mV~10V *2	
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$ %	
	DC	24V, 100~120V	24V±10%

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

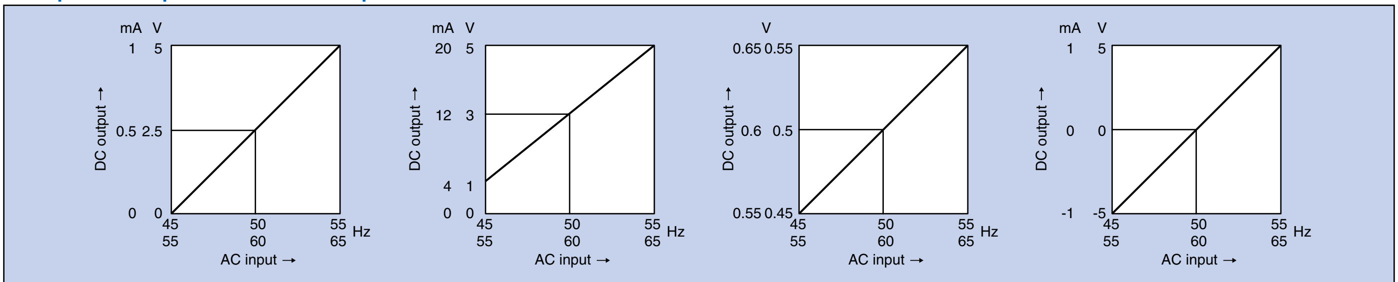
*1 The input range is approximately ±10% of the central frequency.
Example: In the case of 400Hz, input 360~440Hz.

*2 Transducers with positive/negative bidirectional output based on the central frequency can also be manufactured.
However, the manufacturable ranges in regard to output are ±0.1~±5mA and ±50mV~±10V.
Example: Input 45~50~55Hz; Output -1~0~1mA, -5~0~5V.

*3 When only auxiliary power supply is applied, positive-side burnout output occurs.

The voltage tolerance of a 24VDC auxiliary power supply is ±10%.
The voltage tolerance of a 100~120VDC auxiliary power supply is $^{+15}_{-25}$ %.

■Input/Output relationships



■Connection diagrams (Refer to p.156 for outer dimensions.)

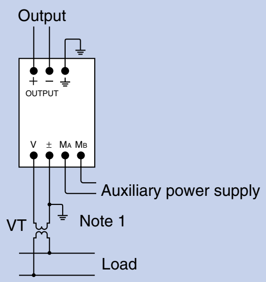


Fig. 1 T-51HF

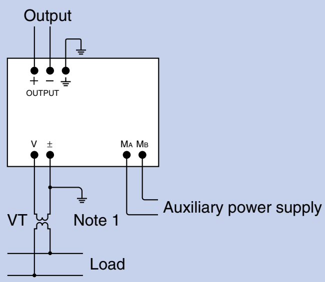


Fig. 2 T-101SF

Note 1. For low-voltage circuits, grounding of the secondary side of the instrument voltage transformer is unnecessary.

■Ordering method

Model name	Input Voltage	Input Frequency	Output Voltage or current	Auxiliary power supply	Number of units
T-51HF	110V	45~55Hz	0~5V	110VAC	2

Voltage Phase Angle Transducers [Insulated]

T-51/T-101 Series

T-101SY

Outer shape	Model name	Accuracy (grade)	Input (AC) Phase angle	Input (AC) Reference voltage	Input (AC) Compared voltage	Input (AC) Frequency	Output (DC) Voltage or current and load	Ripple/ Response speed	Consumption VA Reference side	Consumption VA Compared side	Auxiliary power supply	Weight	Delivery period classification
Box	T-101SY	1.0	LEAD60° ~0°~ LAG60°	$\frac{110}{\sqrt{3}}$/110V switching	$\frac{110}{\sqrt{3}}$/110V switching	50Hz or 60Hz	—1~0~1mA : 0~5kΩ —5~0~5mA : 0~1kΩ —100~0~100mV : 5kΩ~∞ —1~0~1V : 5kΩ~∞ —5~0~5V : 5kΩ~∞ —10~0~10V : 10kΩ~∞ 0~0.5~1mA : 0~5kΩ 0~2.5~5mA : 0~1kΩ 4~12~20mA : 0~600Ω 0~50~100mV : 5kΩ~∞ 0~0.5~1V : 5kΩ~∞ 0~2.5~5V : 5kΩ~∞ 0~5~10V : 10kΩ~∞ 1~3~5V : 5kΩ~∞	1% P-P or less 1s or less	0.3	0.3	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.6kg	△
		2.0	LEAD30° ~0°~ LAG30°										

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Manufacturable range

	T-101SY	
Input		As indicated in the table above. *1
Output		0.1~20mA, 50mV~10V *1
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$ %
	DC	24V±10%

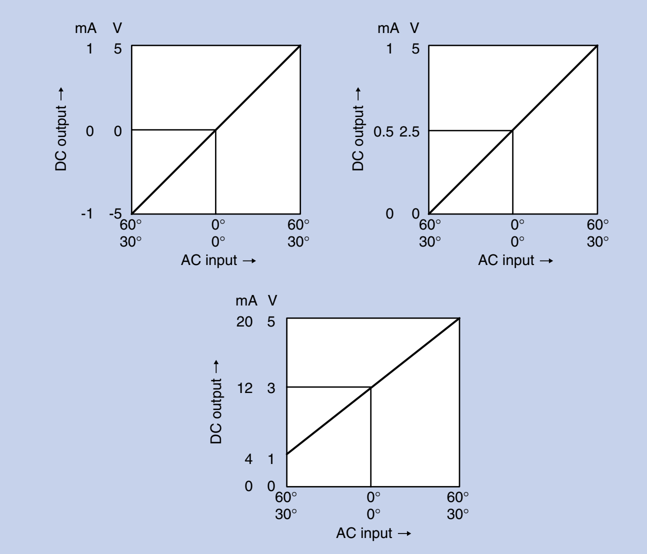
*1 The manufacturable ranges for bidirectional output are ±0.1~±5mA and ±50mV~±10V.

*2 With a voltage phase angle transducer, when the frequencies of the standard voltage and comparative voltage are the same, a DC output proportional to the phase difference between the two is obtained. When the voltages differ in frequency, the output fluctuates continously.

*3 The input terminals can be used for both $\frac{110}{\sqrt{3}}$ and 110V, and either voltage can be input by changing the connection. (Po — P1.... $\frac{110}{\sqrt{3}}$, Po — P2....110V)

*4 If the reference and/or compared voltages fall to a value 1/3 or less than that of the rated voltage while the auxiliary power supply is applied, failure may occur.

■Input/Output relationships



■Connection diagrams (Refer to p.156 for outer dimensions.)

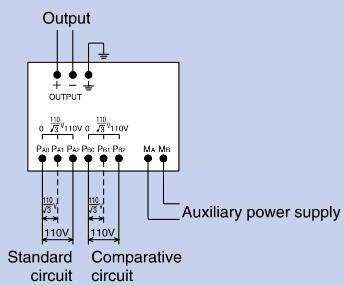


Fig. 1 T-101SY

■Ordering method

Model name	Input Voltage	Input Phase angle	Frequency	Output Voltage or current	Auxiliary power supply	Number of units
T-101SY	110/√3 /110V	LEAD60°~0~LAG60°	60Hz	–100-0-100mV	110VAC	3

Specify three values for the output.

DC Level Transducers [Non-insulated]

T-51/T-101 Series

DC level transducers input DC voltage (or current) and output DC voltage or a DC current proportional to the input, and can be used for level conversion or as a buffer for power transducer output.
Use an isolator when insulation is required between the input and output.

T-51DL

■Applications

●Level conversion or buffer between various equipment
●Level conversion or buffer for power transducer output

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Outer shape	Model name	Accuracy (grade)	Input (DC) and input resistance		Output (DC) Voltage or current and load	Output (DC) Ripple/Response speed	Auxiliary power supply	Weight	Delivery period classification
Box	T-51DL	0.25	100mV 1V 5V 10V 1~5V	100kΩ or more	1mA : 0~10kΩ 5mA : 0~2kΩ 4~20mA : 0~600Ω 100mV : 500Ω~∞ 1V : 500Ω~∞ 5V : 500Ω~∞ 10V : 1kΩ~∞ 1~5V : 500Ω~∞	1% P-P or less 0.2s or less	110VAC $^{+10}_{-15}$% 50 and 60Hz Consumption VA: 3	0.4kg	○
			1mA 5mA 4~20mA	Input voltage drop: 200mV or less					

■Manufacturable range

		T-51DL
Input		60mV~300V, 0.5mA~0.1A *4
Output		0.1~20mA, 50mV~10V
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$%
	DC	24V±10%

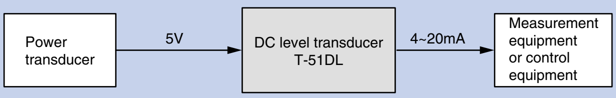
*1 Resistance between input terminals.

Input	60mV~50V	over 50V~300V	0.5mA~0.1A
Input resistance	100kΩ	2kΩ/V	Input voltage drop: 200mV or less

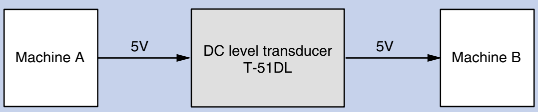
*2 Transducers with positive/negative bidirectional input and positive/negative bidirectional output can also be manufactured.
The manufacturable ranges for bidirectional output are ±50mV~±10V and ±0.1~±20mA.
*3 The input and output are not insulated.
*4 Please inquire separately regarding input specifications exceeding 300V.

■Usage examples

●**To convert the power transducer output**



●**As a buffer between equipment**



■Connection diagrams (Refer to p.156 for outer dimensional drawings)

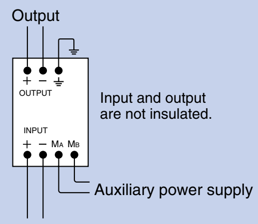
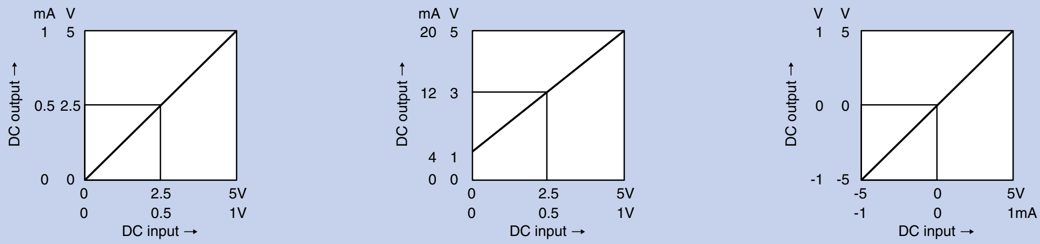


Fig. 1 T-51DL

■Input/Output relationships



■Ordering method

Model name	Input Voltage or current	Output Voltage or current	Auxiliary power supply	Number of units
T-51DL	4-20mA	0-5V	110VAC	2

Specify three values for bidirectional output.

DC Reverse Transducers [Non-insulated]

T-51/T-101 Series

DC reverse transducers input DC voltage (or current) and output DC voltage or DC current inversely proportional to the input; for example, as the input signal increases from 0% to 100%, the output signal decreases from 100% to 0%.

T-51DR

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Applications

●Monitoring of deviation amount in combination with devices such as a position detection sensor or temperature transducer

●To create a fail-safe arrangement in the event of losing control power supply

Outer shape	Model name	Accuracy (grade)	Input (DC) and input resistance		Output (DC) Voltage or current and load	Output (DC) Ripple/Response speed	Auxiliary power supply	Weight	Delivery period classification
Box	T-51DR	0.25	0~100mV 0~1V 0~5V 0~10V 1~5V	100kΩ or more	1~0mA : 0~10kΩ 5~0mA : 0~2kΩ 20~4mA : 0~600Ω 100~0mV : 500Ω~∞ 1~0V : 500Ω~∞ 5~0V : 500Ω~∞ 10~0V : 1kΩ~∞ 5~1V : 500Ω~∞	1% P-P or less 0.2s or less	$110VAC^{+10}_{-15}\%$ 50 and 60Hz Consumption VA: 3	0.4kg	○
			0~1mA 0~5mA 4~20mA	Input voltage drop: 200mV or less					

■Manufacturable range

		T-51DR
Input		60mV~300V, 0.5mA~0.1A *3
Output		0.1~20mA, 50mV~10V
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}\%$
	DC	24V±10%

*1 Resistance between input terminals

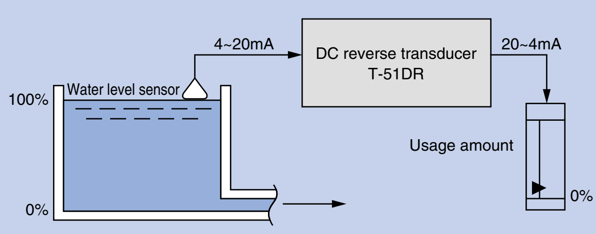
Input	60mV~50V	over 50V~300V	0.5mA~0.1A
Input resistance	100kΩ	2kΩ/V	Input voltage drop: 200mV or less

*2 The input and output are not isolated.

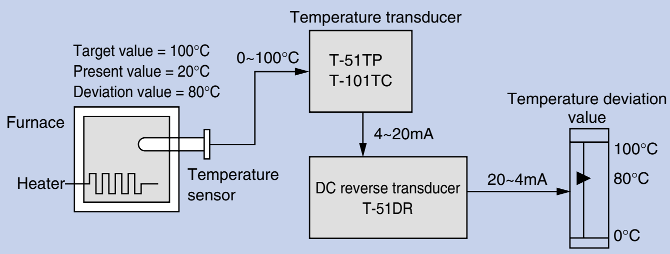
*3 Please inquire separately regarding input specifications exceeding 300V.

■Usage examples

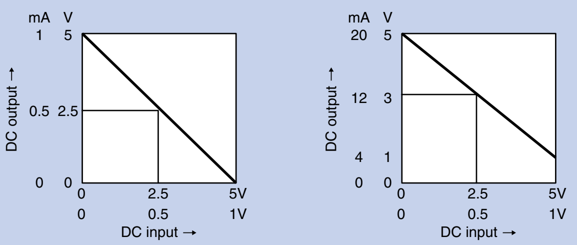
●For usage amount measurement



●For measurement of deviation amount from target value



■Input/Output relationships



■Connection diagrams (Refer to p.156 for outer dimensions.)

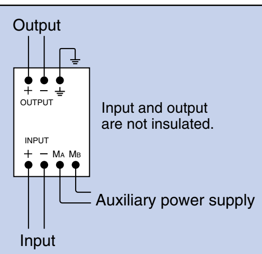


Fig. 1 T-51DR

■Ordering method

Model name	Input Voltage or current	Output Voltage or current	Auxiliary power supply	Number of units
T-51DR	0-5V	20-4mA	110VAC	3

Transducers

Isolators [Insulated]

T-51/T-101 Series

Isolators provide insulation between DC circuits and measurement equipment, and between various sensors and control equipment.
Isolators can be used as a buffer or level exchange between input/output.

T-101IS

■Applications

●Insulation between DC circuits and measurement equipment
●Insulation interface between each sensor and other equipment such as computers or data loggers
●Insulation between separate circuits

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Outer shape	Model name	Accuracy (grade)	Input (DC) and input resistance	Output (DC) Voltage or current and load	Output (DC) Ripple/Response speed	Dielectric strength between input and output	Auxiliary power supply	Weight	Delivery period classification
Box	T-101IS	0.25	60mV, 1V, 5V, 10V, 1~5V } 100kΩ or more 150V : 300kΩ or more 300V : 600kΩ or more 1mA, 5mA, 4~20mA } Input voltage drop: 200mV or less	1mA : 0~5kΩ 5mA : 0~1kΩ 4~20mA : 0~600Ω 100mV : 5kΩ~∞ 1V : 5kΩ~∞ 5V : 5kΩ~∞ 10V : 10kΩ~∞ 1~5V : 5kΩ~∞	1% P-P or less 0.5s or less	2000VAC 2000VDC for 1min	110VAC $^{+10}_{-15}$% 50 and 60Hz Consumption VA: 3	0.6kg	○

■Manufacturable range

		T-101IS
Input		60mV~300V, 0.5mA~0.1A *4
Output		0.1~20mA, 50mV~10V
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$%
	DC	24V±10%

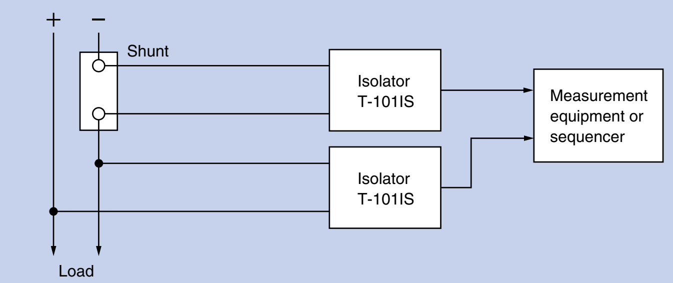
*1 Resistance between input terminals

Input	60mV~50V	over 50V~300V	0.5mA~0.1A
Input resistance	100kΩ	2kΩ/V	Input voltage drop: 200mV or less

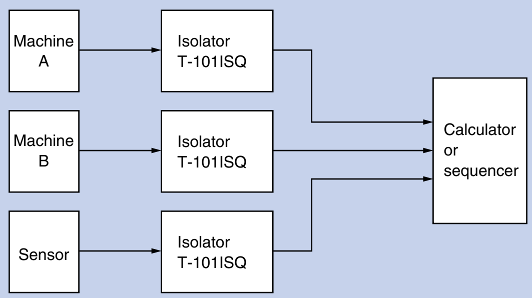
*2 Combine with a shunt if the current input exceeds 0.1A.
*3 Isolators that provide positive/negative bidirectional output or positive direction-only output for positive/negative bidirectional input can also be manufactured.
The manufacturable ranges for a bidirectional output are ±50mV~±10V and ±0.1~±5mA.
*4 Please inquire separately regarding input specifications exceeding 300V.

■Usage examples

●**For measurement of a DC circuit**



●**For input interface of devices such as a calculator**



■Ordering method

Model name	Input Voltage or current	Output Voltage or current	Auxiliary power supply	Number of units
T-101IS	60mV	0-1mA	110VAC	7

Specify three values for bidirectional output.

Transducers

High-speed Isolators [Insulated]

T-51/T-101 Series

(Response speed: 1ms)

High-speed isolators provide insulation between DC circuits and measurement devices, and between various sensors and control equipment. They operate at high response speeds, enabling use in high-speed control circuits and high-speed measurement applications.

T-101ISQ

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Applications

- ●Insulation of real-time measurement signals
- ●Insulation of high-speed control systems

Outer shape	Model name	Accuracy (grade)	Input (DC) and input resistance	Output (DC): Voltage or current and load	Output (DC): Ripple/Response speed	Dielectric strength between input and output	Auxiliary power supply	Weight	Delivery period classification
Box	T-101ISQ	0.25	60mV, 1V, 5V, 10V, 1~5V: 100kΩ or more 150V : 300kΩ or more 300V : 600kΩ or more 1mA, 5mA, 4~20mA: Input voltage drop: 200mV or less	1mA : 0~5kΩ 5mA : 0~1kΩ 4~20mA : 0~600Ω 100mV : 5kΩ~∞ 1V : 5kΩ~∞ 5V : 5kΩ~∞ 10V : 10kΩ~∞ 1~5V : 5kΩ~∞	1% P-P or less 1ms or less	2000VAC 2000VDC for 1min	110VAC $^{+10}_{-15}$% 50 and 60Hz Consumption VA: 3	0.6kg	△

■Manufacturable range

		T-101ISQ
Input		60mV~300V, 0.5mA~0.1A *4
Output		0.1~20mA, 50mV~10V
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$%
	DC	24V±10%

*1 Resistance between input terminals

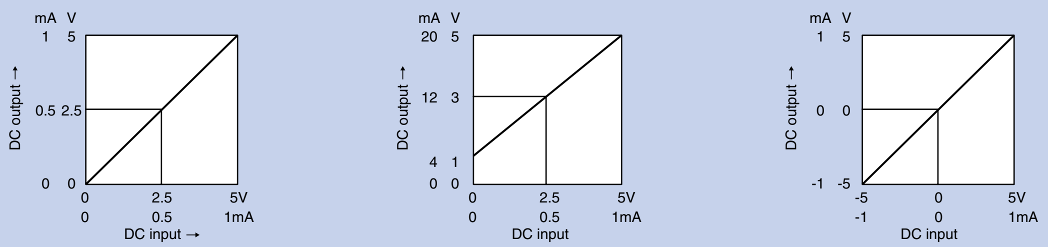
Input	60mV~50V	over 50V~300V	0.5mA~0.1A
Input resistance	100kΩ	2kΩ/V	Input voltage drop: 200mV or less

*2 Combine with a shunt if the current input exceeds 0.1A.

*3 Isolators that provide positive/negative bidirectional output or positive direction-only output for positive/negative bidirectional input can also be manufactured.

*4 The manufacturable ranges for bidirectional output are ±50mV~±10V and ±0.1~±5mA. Please inquire separately regarding input specifications exceeding 300V.

■Input/Output relationships



■Connection diagrams (Refer to p.156 for outer dimensions.)

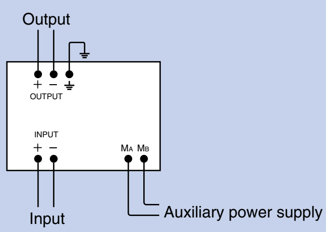


Fig. 1 T-101IS, 101ISQ

■Ordering method

Model name	Input Voltage or current	Output Voltage or current	Auxiliary power supply	Number of units
T-101ISQ	0-5V	4-20mA	110VAC	7

Specify three values for bidirectional output.

Transducers

Limiters [Non-insulated]

T-51/T-101 Series

Limiters restrict the variation range of an output signal and restrict the output to values outside the preset limit range when a signal outside the limit range is input.
CAL signals proportional to setting values are output, allowing accurate settings and set values to be checked.

T-51LM

■Applications

●Maximum and minimum value retention during abnormal operation of a control device
●Prevent full opening/closing of devices such as control valves
●Prevent of off-scale input to computers

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Outer shape	Model name	Accuracy (grade)	Input (DC) and input resistance		Output (DC): Voltage or current and load	Output (DC): Ripple/Response speed	Setting: Accuracy	Setting: Range (CAL output)	Auxiliary power supply	Weight	Delivery period classification
Box	T-51LM	0.25	100mV 1V 5V 10V 1~5V	100kΩ or more	1mA : 0~5kΩ 5mA : 0~1kΩ 0~20mA : 0~600Ω 4~20mA : 0~600Ω 100mV : 5kΩ~∞ 1V : 5kΩ~∞ 5V : 5kΩ~∞ 10V : 10kΩ~∞ 1~5V : 5kΩ~∞	1% P-P or less 0.2s or less	±0.25%	●Unidirectional output LOW : 0~50% (0~5VDC) HIGH : 50~100% (5~10VDC) ●Bidirectional output LOW : -100~0% (-10~0VDC) HIGH : 0~100% (0~10VDC) CAL output load resistance: 10kΩ~∞	110VAC $^{+10}_{-15}$% 50 and 60Hz Consumption VA: 3	0.4kg	○
			1mA 5mA 0~20mA 4~20mA	Input voltage drop: 200mV or less							

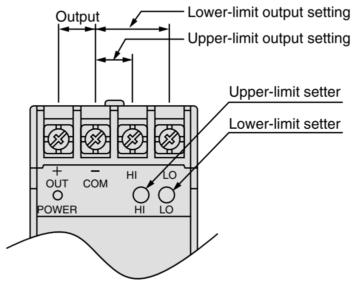
■Manufacturable range

		T-51LM
Input		60mV~10V, 0.5mA~0.1A
Output		0.1~20mA, 50mV~10V *2
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$%
	DC	24V±10%

*1 The input and output are not insulated.
*2 Limiters with bidirectional input and positive/negative bidirectional output can also be manufactured. The manufacturable ranges for bidirectional output are ±50mV~±10V and ±0.1~±5mA.

■Setting procedure (Please carefully read the accompanying instruction manual.)

Lower limit	While measuring the lower-limit setting output voltage (between the LOW CAL. OUT and COM terminals), vary the lower-limit setter (LO) to set the lower limit value.
Upper limit	While measuring the upper-limit setting output voltage (between the HIGH CAL. OUT and COM terminals), vary the upper-limit setter (HI) to set the upper limit value.



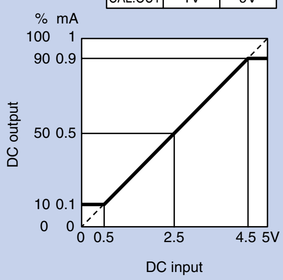
(Layout of setters and output terminals)

■Input/Output relationships

●Unidirectional output

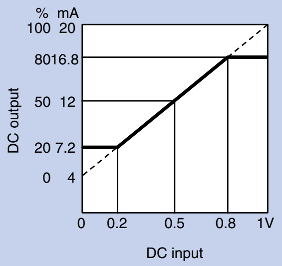
(Example) Upper limit: 90%
Lower limit: 10%

	LOW	HIGH
Setting	10%	90%
CAL.OUT	1V	9V



(Example) Upper limit: 80%
Lower limit: 20%

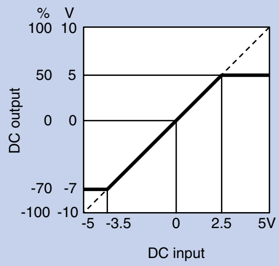
	LOW	HIGH
Setting	20%	80%
CAL.OUT	2V	8V



●Bidirectional output

(Example) Upper limit: 50%
Lower limit: -70%

	LOW	HIGH
Setting	-70%	50%
CAL.OUT	-7V	5V



■Ordering method

Model name	Input Voltage or current	Output Voltage or current	Auxiliary power supply	Number of units
T-51LM	4-20mA	4-20mA	110VAC	5

Specify three values for bidirectional output.

Transducers

Adders [Non-insulated]

T-51/T-101 Series

Adders can be used to input several DC voltages or direct currents, perform addition according to the specified ratio, and output a DC voltage or direct current proportional to the addition result. An adder can also be used to perform actions such as concentrating power when combined with a power transducer.

T-101AD

■Applications

●Synthesis of active powers (reactive powers) of multiple circuits

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Outer shape	Model name	Accuracy (grade)	Input (DC) and input resistance	Number of circuits	Output (DC) Voltage or current and load	Output (DC) Ripple/Response speed	Auxiliary power supply	Weight	Delivery period classification
Box	T-101AD	0.5	100mV, 1V, 5V, 10V, 1~5V: 100kΩ or more 1mA, 5mA, 4~20mA: Input voltage drop: 200mV or less	4 (max.)	1mA : 0~5kΩ 5mA : 0~1kΩ 4~20mA : 0~600Ω 100mV : 5kΩ~∞ 1V : 5kΩ~∞ 5V : 5kΩ~∞ 10V : 10kΩ~∞ 1~5V : 5kΩ~∞	1% P-P or less 0.2s or less	110VAC $^{+10}_{-15}$% 50 and 60Hz Consumption VA: 3	0.6kg	○

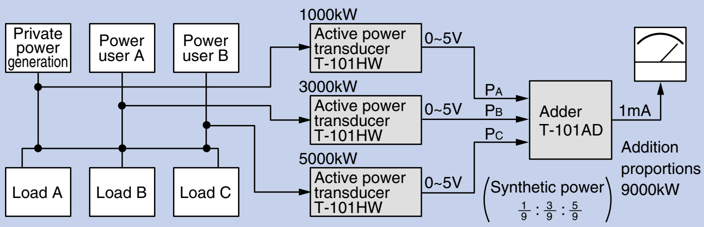
■Manufacturable range

		T-101AD
Input		50mV~10V, 0.5~20mA
Output		0.1~20mA, 50mV~10V
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$%
	DC	24V±10%

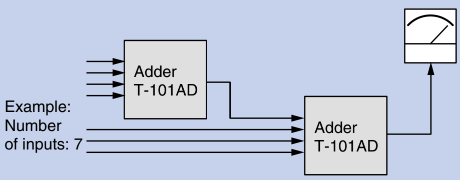
*1 Method for designating addition proportions
For example, if the inputs are P_A=5V (1000kW), P_B=5V (3000kW) and P_C=5V (5000kW), and the output is 5V (9000kW), the addition proportions= $\frac{1}{9}$: $\frac{3}{9}$: $\frac{5}{9}$.
*2 If the number of inputs exceeds four, addition can be performed using 2 or more adders.
*3 Adders that provide positive/negative bidirectional output or positive direction-only output for positive/negative bidirectional input can also be manufactured.
The manufacturable ranges for bidirectional output are ±50mV~±10V and ±0.1~±5mA.
*4 The input and output are not insulated.
*5 For 4–20mA, an input of 0mA is regarded as -4mA for calculations.
*6 For 1–5V, an input of 0V is regarded as -1V for calculations.

■Usage examples

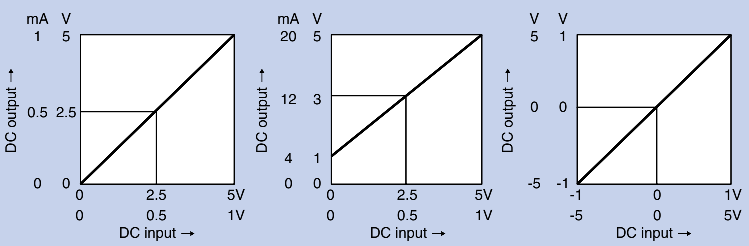
●**For synthesis of active powers of multiple circuits**



●**For more than 4 inputs**



■Input/Output relationships



■Connection diagrams (Refer to p.156 for outer dimensions.)

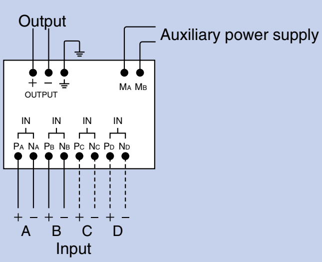


Fig. 1 T-101AD

■Ordering method

Model name	Input Input value/input quantity of each circuit	Output Output value/output quantity	Auxiliary power supply	Number of units
T-101AD	P_A : 5V/1000kW, P_B : 5V/2000kW	5V/3000kW	110VAC	1

Specify three values for bidirectional output.
The “addition proportions” are indicated on the rating nameplate instead of the “input quantity/output quantity” values.

Resistance-bulb Temperature Transducers

T-51/T-101 Series

These temperature transducers measure temperature by the change in resistance value of a resistance bulb and output DC current or DC voltage proportional to the temperature of the part measured.

T-51TP

T-101TPZ

■Applications

●Transmission of temperature signals to temperature monitors or temperature control equipment

●Temperature measurement of things such as voltage transformer oil

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Outer shape	Model name	Accuracy (grade)	Between input and output	Input	Output (DC)				Auxiliary power supply	Weight	Delivery period classification
				Resistance bulb	Voltage or current and load	Ripple	Response speed	Burnout			
Box	T-51TP	0.5	Non-insulated	Pt 100Ω (at0°C) Pt 50Ω (at0°C) Cu 10Ω (at25°C) (besides the above: Ni)	1mA : 0~5kΩ 5mA : 0~1kΩ 4~20mA : 0~600Ω 100mV : 5kΩ~∞ 1V : 5kΩ~∞ 5V : 5kΩ~∞ 10V : 10kΩ~∞ 1~5V : 5kΩ~∞	1% P-P or less	2s or less	Upper limit	110VAC $^{+10}_{-15}$% 50 and 60Hz Consumption VA: 3	0.4kg	○
	T-101TPZ		Insulated				2s or less			0.7kg	○

■Manufacturable range

		T-51TP, T-101TPZ
Input		Input temperature range: -200~500°C
Output		0.1~20mA, 50mV~10V
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$%
	DC	24V, 100~120V

The voltage tolerance of a 24VDC auxiliary power supply is ±10%.
The voltage tolerance of a 100~120VDC auxiliary power supply is $^{+15}_{-25}$%.

*1 Use these temperature transducers in combination with a 3-wire resistance bulb. If a 2-wire resistance bulb is used, error may occur due to the influence of lead-wire resistance.

*2 For 3-wire resistance bulbs, set the resistance values of the respective lead wires between the resistance bulb and the transducer to 10Ω or less. Additionally, set the difference among the lead-wire resistance values to within the values in the table below.

Resistance bulb	Pt100Ω • JPt100Ω	Pt50Ω	Cu10Ω
Difference among lead-wire resistance values	0.2Ω or less	0.1Ω or less	0.02Ω or less

The temperature error due to resistance differences in the table on the left is approximately 0.5K.

*3 The accuracy (grade) indicates the accuracy of the temperature transducer only and does not include the error of the resistance bulb. Additionally, the customer is requested to provide the resistance bulb.

*4 When resistance bulb input stops, burnout output is performed on the positive side.

■Examples of standard input specifications

Resistance bulb	Minimum span	Input measurement range (°C)
Pt100Ω (at0°C) JPt100Ω (at0°C)	50°C	0~100 0~250 -20~ 80 - 50~200 0~120 0~300 -40~ 60 -100~200 0~150 -50~ 50 0~200 -50~150 (Please specify for cases other than listed above.)
Pt50Ω (at0°C)	100°C	
Cu10Ω (at25°C)	100°C	
Ni and resistance bulbs other than the above	Please specify the input temperature range and the temperature/resistance value relationship of the resistance bulb.	

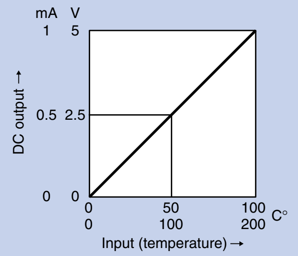
■Selection between insulated/non-insulated (between input and output)

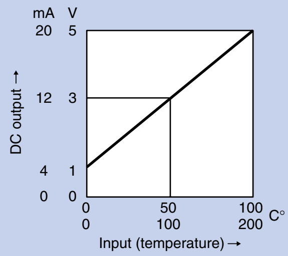
Make a selection according to the temperature sensor configuration explained in the following table.

Temperature sensor	Temperature transducer
Insulated with respect to the object measured	Both insulated and non-insulated units can be used. However, if the temperature sensor is located close to a power supply line or control equipment, common mode noise due to electromagnetic induction may occur. Use an insulated unit in this case.
Non-insulated with respect to the object measured	Make sure to use insulated units to prevent circuit noise interference due to the common potential generated in temperature sensors and the penetration of external noise.

(Insulated/Non-insulated)

■Input/Output relationships





■Inspection and adjustment

Perform the following procedure to check whether or not a transducer is operating normally.

①Install an inspection resistor at (near) the installation location of the resistance bulb and connect the inspection resistor.

②Check whether or not the transducer outputs a value corresponding to the inspection temperature. If there is an error in output, adjust the transducer using the output adjuster.

A GR-2 standard resistor (sold separately) can be used as an inspection resistor (see p.149).

■Connection diagrams (Refer to p.156 for outer dimensions.)

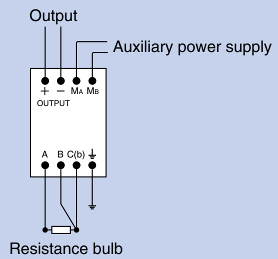


Fig. 1 T-51TP

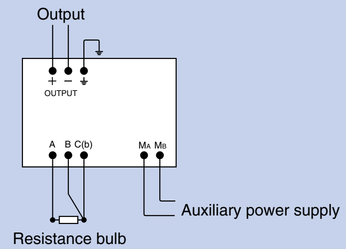


Fig. 2 T-101TPZ

■Ordering method

Model name	Input: Temperature	Input: resistance bulb	Output: Voltage or current	Auxiliary power supply	Number of units
T-101TPZ	0–200°C	Pt100Ω	4–20mA	110VAC	10

Thermocouple Temperature Transducers

T-51/T-101 Series

Thermocouple temperature transducers use the electromotive force of the thermocouple to measure the temperature and output DC current or DC voltage proportional to the temperature of the part being monitored.

T-101TCZ

■Applications

●Temperature measurement of devices such as high-temperature furnaces

●Transmission of temperature signals to temperature monitors or temperature control equipment

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Outer shape	Model name	Accuracy (grade)	Between input and output	Input: Thermocouple	Input: Measurable range	Input: Minimum span	Output (DC): Voltage or current and load	Output (DC): Ripple/Response speed	Output (DC): Burnout	Auxiliary power supply	Weight	Delivery period classification
Box	T-101TC	0.5	Non-insulated	K (Chromel/Alumel)	-200~1200°C	100°C	1mA : 0~5kΩ 5mA : 0~1kΩ 4~20mA : 0~600Ω 0~100mV : 5kΩ~∞ 1V : 5kΩ~∞ 5V : 5kΩ~∞ 10V : 10kΩ~∞ 1~5V : 5kΩ~∞	1% P-P or less 1s or less	Upper limit	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.6kg	○
				T (Copper/Constantan)	-200~ 350°C	120°C						
				J (Iron/Constanan)	-200~ 800°C	100°C						
	T-101TCZ		Insulated	E (Chromel/Constantan)	-200~ 800°C	100°C					0.7kg	○
				R, S (rhodium/platinum)	0~1600°C	500°C						

■Manufacturable range

		T-101TC, T-101TCZ
Input		As indicated in the table above.
Output		0.1~20mA, 50mV~10V
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V
	DC	24V±10%

The voltage tolerance of an AC auxiliary power supply is $^{+10}_{-15}$ %.

*1 Please specify the input temperature range so that it is within the measurable range of the thermocouple and ensure that the span value is at least the minimum span value.
Example: In the case of an R thermocouple, 0~500°C or 100~600°C is specified as the input temperature range.

*2 The input signal source resistance (thermocouple sensor resistance value + compensation wire round trip resistance value) must be 100Ω or less.
Influence of the signal source resistance: approx. 0.1μV/Ω or less with respect to the thermal electromotive force.

*3 The accuracy (grade) indicates the accuracy of the temperature transducer only and does not include the error of the thermocouple sensor. Additionally, the customer is required to provide the thermocouple sensor.

*4 When thermocouple input stops, burnout output is performed on the positive side.

■Examples of standard input specifications

Input sensor	Measurement range (°C)					
K (CA)	0~ 100	0~ 150	0~ 200	0~ 250	0~ 300	0~ 400
	0~ 500	0~ 600	0~ 800	0~1000	0~1200	
	100~ 200	300~ 600	400~ 800	400~1000	600~ 800	600~1200
	-50~ 150	-100~ 300				
T (CC)	0~ 120	0~ 150	0~ 200	0~ 300	0~ 400	
	-50~ 100	-50~ 150	-50~ 200	-100~ 50	-100~ 100	
	-200~ 200	-200~ 400				
J (IC)	0~ 100	0~ 150	0~ 200	0~ 250	0~ 300	
	0~ 400	0~ 500	0~ 600	0~ 800		
	-50~ 100	-50~ 150				
E (CRC)	0~ 100	0~ 300	0~ 500	0~ 600		
	50~ 150	300~ 600				
	-10~ 90					
R • S	0~1000	0~1200	0~1300	0~1400	0~1500	
	0~1600					
	300~1300	400~1400	400~1600	800~1300	800~1600	
	1000~1400	1100~1600	1300~1600			

Transducers

(Insulated/Non-insulated)

■Selection between insulated/non-insulated (between input and output)

Please make a selection according to the temperature sensor configuration explained in the following table.

Temperature sensor	Temperature transducer
Insulated with respect to the measured object	Both insulated and non-insulated units can be used. However, if the temperature sensor is located close to a power supply line or control equipment, common mode noise due to electromagnetic induction may occur. Use an insulated unit in this case.
Non-insulated with respect to the measured object	Make sure to use an insulated unit to prevent circuit noise interference due to the common potential generated in temperature sensors and the penetration of external noise.

■Inspection and adjustment

Perform the following procedure to check whether or not a transducer is operating normally.

(The inspection temperature is the maximum input temperature.)

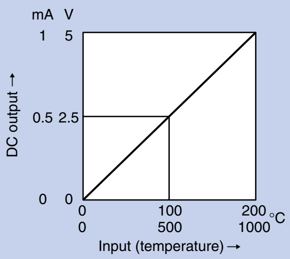
①Measure the temperature (reference temperature) in the immediate vicinity of the transducer.

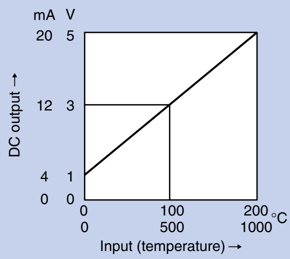
②Using the thermal electromotive force table in JIS C 1602, please note the thermal electromotive forces corresponding to the transducer maximum input temperature and the reference temperature.

③Apply a DC voltage equivalent to (electromotive force of the maximum input temperature – electromotive force of the reference temperature) to the input side of the transducer.

④Check whether or not an output equivalent to the maximum input temperature is output. If there is an error in the output, adjust the transducer using the output adjuster.

■Input/Output relationships





■Connection diagrams (Refer to p.156 for outer dimensions.)

(*5) A cold contact compensator is provided with T-101TC and T-101TCZ.

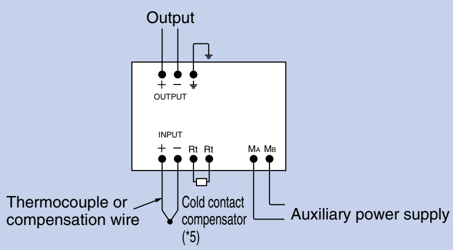


Fig. 1 T-101TC, T-101TCZ

■Ordering method

Model name	Input: Temperature	Input: thermocouple	Output: Voltage or current	Auxiliary power supply	Number of units
T-101TC	0-300°C	T	0-5V	110VAC	10

First-order Lag Transducers [Non-insulated]

T-51/T-101 Series

These transducers apply a time constant to the DC input signal and delay the response speed.
The time constant can be set to any value between 1 and 60 seconds.

T-51DS

■Applications

●Averaging highly fluctuating signals
●Prevents control system oscillation

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Outer shape	Model name	Accuracy class	Input (DC) and input resistance	Output (DC)			Auxiliary power supply	Weight	Delivery period classification
				Voltage or current and load	Time constant	Ripple			
Box	T-51DS	0.5	100mV, 1V, 5V, 10V, 1~5V: 100kΩ or more 1mA, 5mA, 4~20mA: Input voltage drop: 200mV or less	1mA : 0~5kΩ 5mA : 0~1kΩ 4~20mA : 0~600Ω 100mV : 5kΩ~∞ 1V : 5kΩ~∞ 5V : 5kΩ~∞ 10V : 10kΩ~∞ 1~5V : 5kΩ~∞	1 to 60s Accuracy: ±20% (with respect to set value)	1% P-P or less	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.4kg	○

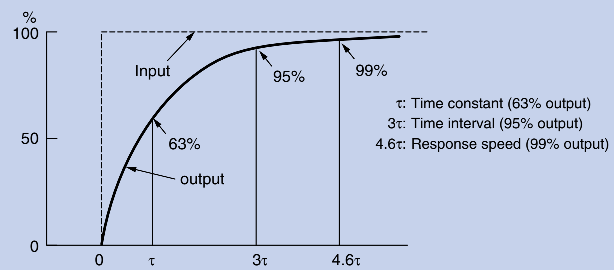
■Manufacturable range

		T-51DS
Input		60mV~10V, 0.5mA~0.1A
Output		0.1~20mA, 50mV~10V
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$ %
	DC	24V±10%

*1 The input and output are not insulated.
*2 The time constant can be set arbitrarily.

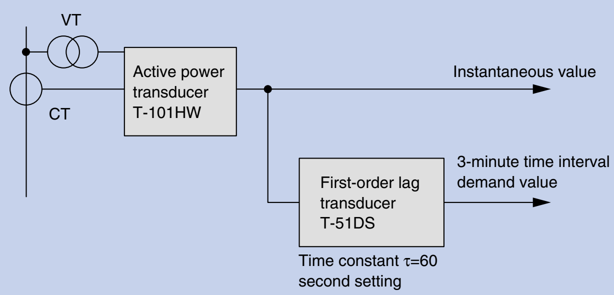
■Time constant, time interval and response speed relationship

The time constant (τ) refers to the time required for an output value to reach 63% of a fixed input value when the input is applied continuously.



■Usage example

●For measurement of moderate time interval active power demand



■Connection diagrams (Refer to p.156 for outer dimensions.)

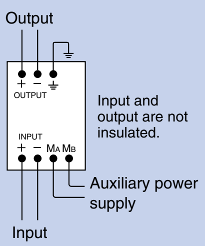


Fig. 1 T-51DS

■Front view

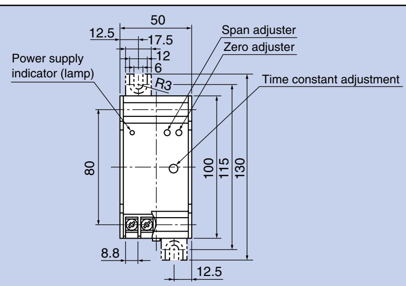


Fig. 1 T-51DS

■Ordering method

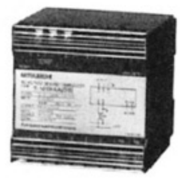
Model name	Input Voltage or current	Output Voltage or current	Auxiliary power supply	Number of units
T-51DS	4-20mA	0-5V	110VAC	2

Transducers

AC Current Demand Transducers (Moderate Time Interval) [Insulated]

T-51/T-101 Series

AC current demand transducers output DC current or DC voltage that is proportional to the average value (demand value) of the AC current within a specified time interval.



T-101HAA (DS)

■Applications

●Protection of transmission lines
●Checking transformer load state

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Outer shape	Model name	Accuracy (grade)	Input (AC)		Output (DC)			Consumption VA	Auxiliary power supply	Weight	Delivery period classification
			Current	Frequency	Voltage or current and load	Time interval (to)	Ripple				
Box	T-101HAA(DS)	0.5	5A 1A	50 and 60Hz	1mA : 0~5kΩ 5mA : 0~1kΩ 4~20mA : 0~600Ω 100mV : 5kΩ~∞ 1V : 5kΩ~∞ 5V : 5kΩ~∞ 10V : 10kΩ~∞ 1~5V : 5kΩ~∞	15s 30s 60s 120s 150s 180s Specify	1% P-P or less	0.1	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 5	0.5kg	○

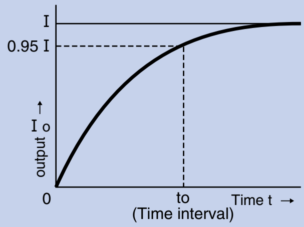
■Manufacturable range

		T-101HAA (DS)
Input		0.1~5A
Output		0.1~20mA, 50mV~10V
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$ %
	DC	24V±10%

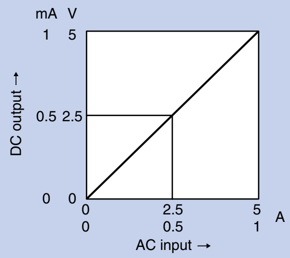
*1 Accuracy of time interval (to): ±20%
The accuracy of the time interval is the accuracy of the time at which the output reaches a value corresponding to 95% of a fixed value when input.

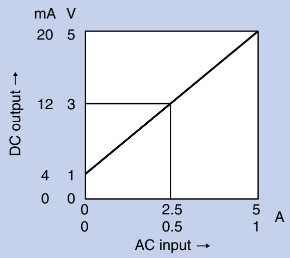
*2 Error may occur when the waveform of the input current is distorted.
For example, when the third harmonic content is 15%, the error is approx. ±2.0%.

The time interval (to) refers to the time required for an output (Io) to reach a value corresponding to 95% of a fixed input value (I) when the input (I) is applied continuously.
The output becomes substantially 100% at 3 times the time interval (3to).



■Input/Output relationships





■Connection diagrams (Refer to p.156 for outer dimensions.)

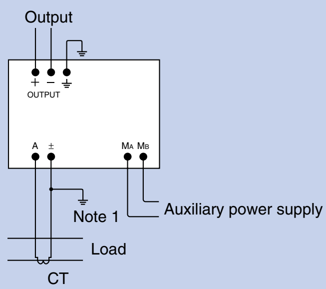


Fig. 1 T-101HAA (DS)

Note 1. For low-voltage circuits, grounding of the secondary side of the current transformer is unnecessary.

■Ordering method

Model name	Input Current	Time interval	Output Voltage or current	Auxiliary power supply	Number of units
T-101HAA (DS)	5A	180 seconds	4-20mA	110VAC	1

Transducers

AC Voltage Demand Transducers (Moderate Time Interval) [Insulated]

T-51/T-101 Series

AC voltage demand transducers output DC current or DC voltage that is proportional to the average value (demand value) of the AC voltage within a specified time interval.

T-101HAV (DS)

■Applications

- ●Monitoring of voltage due to load fluctuation
- ●For detecting abnormal voltages in devices such as small-scale generators
- ●For preventing the detection of error due to flicker

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Outer shape	Model name	Accuracy (grade)	Input (AC)		Output (DC)			Consumption VA	Auxiliary power supply	Weight	Delivery period classification
			Voltage	Frequency	Voltage or current and load	Time interval (to)	Ripple				
Box	T-101HAV (DS)	0.5	150V 300V	50 and 60Hz	1mA : 0~5kΩ 5mA : 0~1kΩ 4~20mA : 0~600Ω 100mV : 5kΩ~∞ 1V : 5kΩ~∞ 5V : 5kΩ~∞ 10V : 10kΩ~∞ 1~5V : 5kΩ~∞	15s 30s 60s 120s 150s 180s Specify	1% P-P or less	150V : 0.4 300V : 0.8	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 5	0.5kg	○

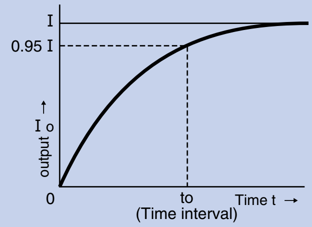
■Manufacturable range

		T-101HAV (DS)
Input		50~300V
Output		0.1~20mA, 50mV~10V
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$ %
	DC	24V±10%

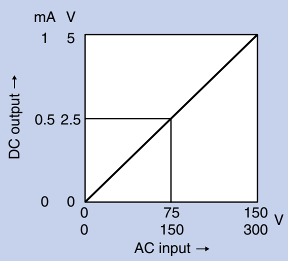
*1 Accuracy of time interval (to): ±20%
The accuracy of the time interval is the accuracy of the time at which the output reaches a value corresponding to 95% of a fixed value when input.

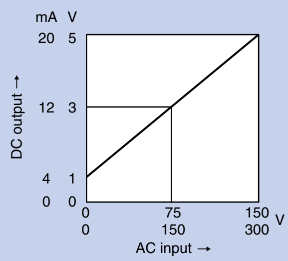
*2 Error may occur when the waveform of the input voltage is distorted.
For example, when the third harmonic voltage is 15%, the error is approx. ±2.0%.

The time interval (to) refers to the time required for an output (Io) to reach a value corresponding to 95% of a fixed input value (I) when the input (I) is applied continuously.
The output becomes substantially 100% at 3 times the time interval (3to).



■Input/Output relationships





■Connection diagrams (Refer to p.156 for outer dimensions.)

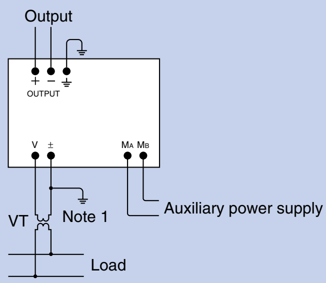


Fig. 1 T-101HAV (DS)

Note 1. For low-voltage circuits, grounding of the secondary side of the instrument voltage transformer is unnecessary.

■Ordering method

Model name	Input Voltage	Time interval	Output Voltage or current	Auxiliary power supply	Number of units
T-101HAV (DS)	150V	30 seconds	5V	110VAC	2

Transducers

Current Transducers with Power Flow

T-51/T-101 Series

Current transducers receive the current and voltage of 3-phase AC circuits as input, distinguish the power flow direction (receiving or sending), and output DC current or DC voltage proportional to the current value that was input.

T-101HAA (D)

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Outer shape	Model name	Accuracy (grade)	Circuit	Input (AC)				Output (DC)	Ripple/ Response speed	Consumption VA		Auxiliary power supply	Weight	Delivery period classification
				Voltage	Current	Frequency	Distinguishable phase angle range	Voltage or current and load		Current circuit	Voltage circuit			
Box	T-101HAA (D)	0.5	3-phase AC circuit	110V	(Sending) (Receiving) -5A~0~5A	50 and 60Hz	●Receiving -85°~0°~85° (275°) ●Sending 95°~180°~265°	(Sending) (Receiving) -1~0~1mA : 0~5kΩ -5~0~5mA : 0~1kΩ -20~0~20mA : 0~600Ω -100~0~100mV : 5kΩ~∞ -1~0~1V : 5kΩ~∞ -5~0~5V : 5kΩ~∞ -10~0~10V : 10kΩ~∞	1% P-P or less 1s or less	0.1	0.3	110VAC $^{+10}_{-15}$ % 50 and 60Hz Consumption VA: 3	0.6kg	○
				220V							0.6			
				110V	(Sending) (Receiving) -1A~0~1A						0.3			
				220V							0.6			

■Manufacturable range

		T-101HAA (D)
Input		As indicated in the table above.
Output		0.1~20mA, 50mV~10V
Auxiliary power supply	AC	100, 105, 110, 115, 120V / 200, 210, 220, 230, 240V $^{+10}_{-15}$ %
	DC	24V±10%

*1 An error may occur when the waveform of the input current is distorted. For example, when the third harmonic content is 15%, the error is approx. ±2.0%.

*2 The power flow distinguishing function operates at 50% or more of the rated voltage. At less than 50% of the rated voltage, output with the input being regarded as a receiving current.

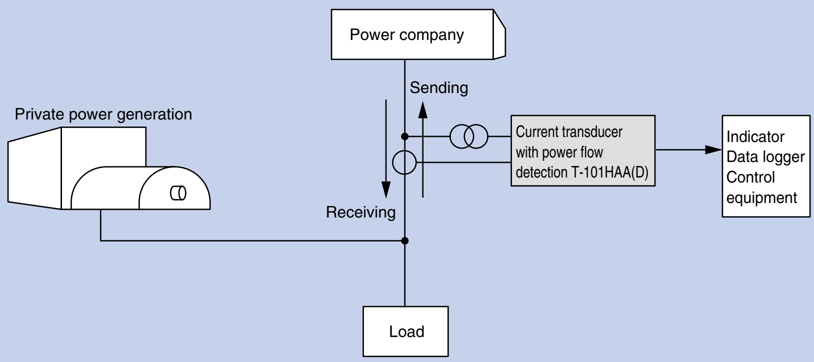
*3 For the power flow, the detected current phase is distinguished.

*4 A model with unidirectional output specifications can also be manufactured.

Input	Output
(Sending) (Receiving) -5~0~5A -1~0~1A	0~50~100mV 0~2.5~5V 4~12~20mA

■Application example

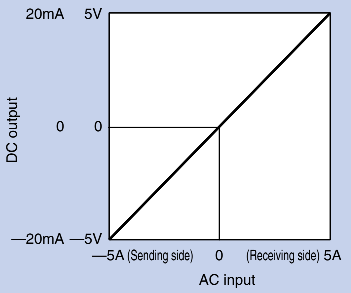
●For measuring receiving or sending currents



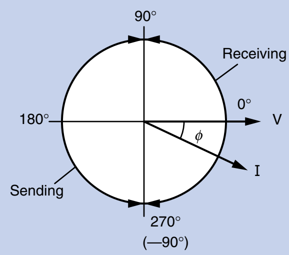
Transducers

Detection [Insulated]

■Input/Output relationships



■Receiving-sending phase relationship



Receiving: -90 °< ϕ <90°
Sending: 90 °< ϕ <270°

(V and I represent vector relationships of the three respective phases and differ from the actual input.)

■Connection diagrams (Refer to p.156 for outer dimensions.)

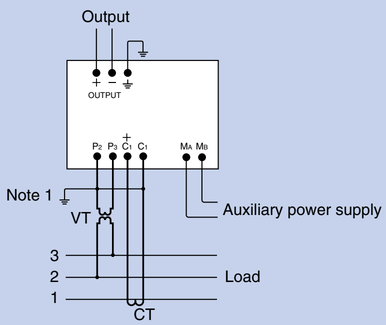


Fig. 1 T-101HAA (D)

Note 1. For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

■Ordering method

Model name	Input Voltage	Input Current	Output Voltage or current	Auxiliary power supply	Number of units
T-101HAA (D)	110V	-5-0-5A	-5-0-5V	110VAC	10

Specify three values for the output.

Leakage Current Transducers [Insulated]

T-51/T-101 Series

Leakage current transducers detect leakage current in AC cables using a Zero-current transformer (ZCT) and output DC current or DC voltage proportional to the leaking current value.

T-51LG

ZCT

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

■Applications

●Preventive and predictive maintenance management of insulation degradation in electrical equipment

●Detection of leakage current in AC cables

Outer shape	Model name	Accuracy (grade)	ZCT Input (AC)		Output (DC)		Auxiliary power supply	Weight	Accessory (ZCT)	Delivery period classification
			Current	Frequency	Voltage or current and load	Ripple/Response speed				
Box	T-51LG	1.0	15mA 30mA 100mA 200mA 500mA 1A 5A	40Hz~2kHz	1mA : 0~5kΩ 5mA : 0~1kΩ 4~20mA : 0~600Ω 100mV : 5kΩ~∞ 1V : 5kΩ~∞ 5V : 5kΩ~∞ 10V : 10kΩ~∞ 1~5V : 5kΩ~∞	1% P-P or less 1s or less	110VAC $^{+10}_{-15}$% 50 and 60Hz Consumption VA: 3	0.4kg (main unit only)	ZT15B ZT30B ZT40B ZT60B ZT80B ZT100B (Specify)	○

■Manufacturable range

		T-51LG
Input		15mA~5A
Output		0.1~20mA, 50mV~10V
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}$%
	DC	24V±10%

*1 Lead wire specifications (between ZCT and transducer)
Make sure to use shielded wires.
Connect the shield (drain line) to the "±" input terminal.

Shielded wire specifications	Allowable lead length
Two-core shielded wire of 0.5~2.0mm² (CVVS, etc.)	25m or less one way

*2 When a harmonic component is contained in the measured circuit, the T-51LG measures the effective value of the leakage current including the harmonic component.

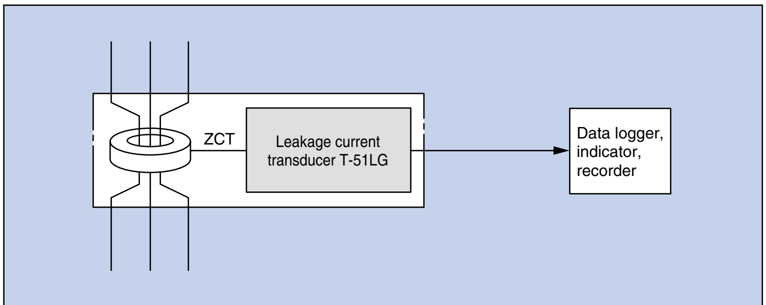
*3 The ZCT is a dedicated accessory, and thus cannot be used in combinations other than those specified for the transducer.

*4 If the power supply frequency (fi) and output frequency (fo) are connected close to each other in the inverter circuit, a beat may occur in the leakage current and the output may fluctuate.

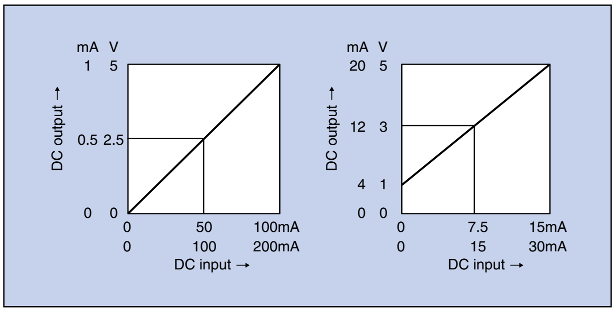
*5 Influence of external magnetic field
An error of approximately 0.4% may occur if an external magnetic field of 200A/m is applied to the main unit and ZCT.

*6 Insulation between the input circuit and output circuit.
The input terminals and output terminals of the main unit are not insulated.
The measurement circuit (input side) and output circuit can be insulated using an accessory ZCT.

■Usage example



■Input/Output relationships



■Connection diagrams (Refer to p.156 for outer dimensions.)

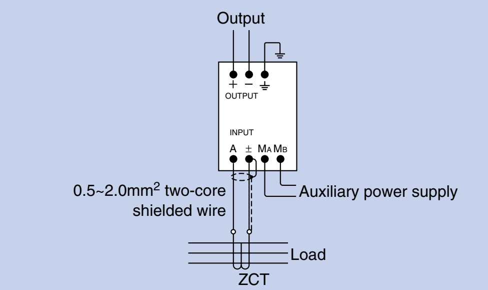


Fig. 1 T-51LG

(Refer to p.146 for outer dimensions of the ZCT.)

Reference : Rated input current value selection method

1 Monitoring leakage current due to insulation degradation of loaded equipment

Install the ZCT in the immediate vicinity of the loaded equipment.

The sensitivity current of an earth leakage circuit breaker is determined as indicated below. Select an input current value that is 1 to 1.5 times the value indicated below.

Example: Selecting a sensitivity current according to the electrical shock protection of an earth-leakage circuit breaker.

When using metal-encased, low-voltage equipment that exceeds 60V

- Room air conditioner, chilling unit, electric water heater, thermal storage heater, large-size refrigerator, factory fan, electric washing machine, electric water boiler, electric dishwasher, well pump, supply and drainage pump, freezer showcase, electric drier, electric brooder, electric floor heater, automatic vending machine, general electric motor appliance, easily accessible lighting duct wiring, under-carpet duct wiring
  - Earth resistance value: 500Ω or less → 30mA or 15MA
- Large-size motorized equipment
  Large-size supply and drainage pump
  Outdoor plant electric equipment
  General electric equipment (such as for control centers)
  - Earth resistance value: 500Ω or less → 100mA
  - Earth resistance value: 250Ω or less → 200mA
  - Earth resistance value: 100Ω or less → 500mA

2 Monitoring leakage current in a long cable wiring

Even if the insulation resistance (meg) is normal, floating capacitance is present between the electric line and earth, and some leakage current flows constantly. This must be taken into account when selecting the input current value. An example of a 3-phase, 3-wire 200V circuit is shown in Table 1.

The rated current value is the sum of the value determined in Table 1 and the value determined in Reference 1 above.

Table 1 Leakage currents when 1km of 600V vinyl cable (IV) for △ connection 3ϕ 3w 200V cable wiring is installed.

Distance from earth portion / Cable size	Ⓐ 4m or more	Ⓑ 10cm or more	Ⓒ 1.5mm or more	Ⓓ Close contact
	●1st floor roof wiring of a wooden building ●Wiring for 2nd floor or higher of a wooden building ●Aerial wiring (excluding Ⓒ or Ⓓ)	●Wiring inside a reinforced concrete line ●Vinyl pipe wiring or exposed wiring inside a steel beam (excluding Ⓒ or Ⓓ)	●Vinyl pipe-embedded work ●Vinyl pipe work in close contact with steel beam inside a steel building	●Metal pipe wiring work ●Metal duct work
8 mm^2 or less	0.60mA/km	1.29mA/km	19.9mA/km	100mA/km
14	0.66	1.44	22.1	110
22	0.72	1.55	23.9	120
38	0.81	1.75	26.9	135
50	0.91	1.97	30.3	152
80	1.02	2.21	34.0	170
100	1.14	2.46	37.9	189
150	1.25	2.72	41.8	209
250	1.46	3.16	48.6	243
325	1.52	3.29	50.7	253
500	1.71	3.69	56.8	284

*1 With respect to the values shown above, the value for rubber-insulated cable (RB) is approximately 70% and that for a three-core 600V crosslinked polyethylene insulated cable (CV) is approximately 50%.
*2 With respect to the values shown above, the value in the case of 50HZ is 84%.
*3 For the leakage current of other cables, multiply the value in Table 1 by a factor of 2.
*4 For the length of the cable run, add all parts beyond the point of installation of the ZCT.

Table 2
Leakage current conversion table

Type of cable wiring	Factor
1-phase 100V cable run	0.3
1-phase 3-wire 200V cable run	0.3
3-phase 415 cable run (Y connection)	0.7

■Ordering method

Model name	Input Current	Output Voltage or current	Combined ZCT	Auxiliary power supply	Number of units
T-51LG	15mA	4-20mA	ZT15B	110VAC	10

Specify the primary side current of the ZCT.

Leakage Current Transducers

T-51/T-101 Series

These transducers detect the leakage current in AC cables using a ZCT, attenuate the harmonic component contained in the current using a built-in low-pass filter, and output DC current or DC voltage proportional to the fundamental leakage current value.

T-51LGF

ZCT

■Applications

●Measurement of the fundamental leakage current in inverters, thyristor control circuits, or other AC circuits that contain a harmonic component.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Outer shape	Model name	Accuracy (grade)	ZCT Input (AC)		Output (DC)		Auxiliary power supply	Weight	Accessory (ZCT)	Delivery period classification
			Current	Frequency	Voltage or current and load	Ripple/Response speed				
Box	T-51LGF	1.0	15mA 30mA 100mA 200mA 500mA 1A 5A	50 and 60Hz	1mA : 0~5kΩ 5mA : 0~1kΩ 4~20mA : 0~600Ω 100mV : 5kΩ~∞ 1V : 5kΩ~∞ 5V : 5kΩ~∞ 10V : 10kΩ~∞ 1~5V : 5kΩ~∞	1% P-P or less 1s or less	$110VAC^{+10}_{-15}\%$ 50 and 60Hz Consumption VA: 5	0.4kg (main unit only)	ZT15B ZT30B ZT40B ZT60B ZT80B ZT100B (Specify)	○

■Manufacturable range

		T-51LGF
Input		15mA~5A
Output		0.1~20mA, 50mV~10V
Auxiliary power supply	AC	100, 105, 110, 115, 120V 200, 210, 220, 230, 240V $^{+10}_{-15}\%$
	DC	24V±10%

*1 Lead wire specifications (between ZCT and transducer)
Make sure to use shielded wires.
Connect the shield (drain line) to the "±" input terminal.

Shielded wire specifications	Allowable lead length
Two-core shielded wire of 0.5~2.0mm² (CVVS, etc.)	25m or less one way

*2 The ZCT is a dedicated accessory and thus cannot be used in combinations other than those specified for the transducers.

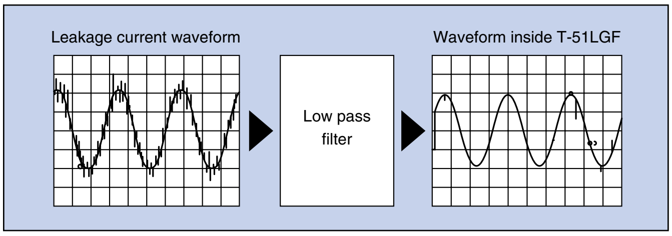
*3 When the power supply frequency (fi) and the output frequency (fo) are close to each other in the inverter circuit, beating may occur in the leakage current and the output may fluctuate.

*4 Influence of external magnetic field
An error of approximately 0.4% may occur due to application of an external magnetic field of 200A/m to the main unit and ZCT.

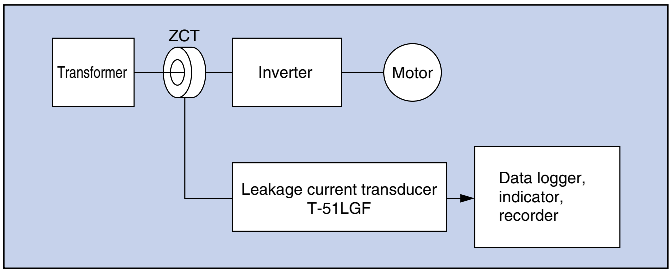
*5 Isolation between the input circuit and output circuit
The input and output terminals of the main unit are not insulated.
The measurement circuit (input side) and output circuit can be isolated by using the accessory ZCT.

*6 The grade indicates the accuracy when only a fundamental wave is input.
The influences of harmonic components are basically as follows.
●Third harmonic content 30% .... approx. +2.0%
●Fifth harmonic content 30% .... approx. +0.5%
●Eleventh harmonic content 30% .... approx. +0.1%

■Harmonic attenuation waveform of low-pass filter



■Application example



(with Built-in Low-pass Filter) [Insulated]

■Connection diagrams (Refer to p.156 for outer dimensions.)

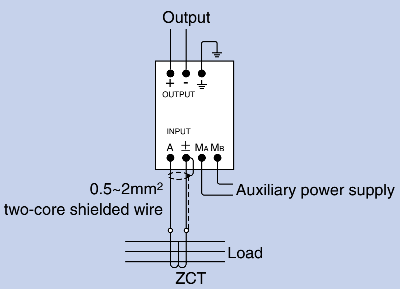


Fig. 1 T-51LGF

■Outer dimensions of the ZCT unit

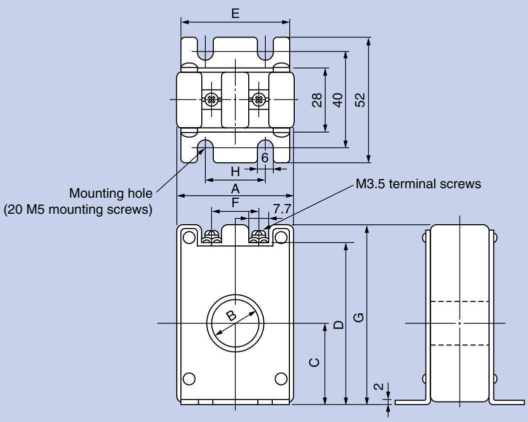


Fig. 1 ZT15B/30B/40B types

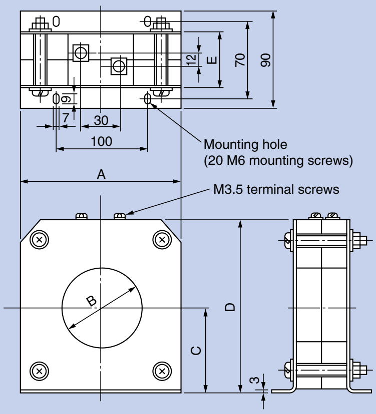


Fig. 2 ZT60B/80B/100B types

Table of dimension variations for ZT15B/30B/40B

	ZT15B	ZT30B	ZT40B
A	48	68	85
B	15	30	40
C	29	37	43
D	62	82	92
E	46	66	81
F	15	30	40
G	70	90	100
H	25	50	50

Table of dimension variations for ZT60B/80B/100B

	ZT60B	ZT80B	ZT100B
A	140	160	185
B	60	80	100
C	73	82	93
D	150	169	190
E	46	48	50

■Ordering method

Model name	Input Current	Output Voltage or current	Combined ZCT	Auxiliary power supply	Number of units
T-51LGF	500mA	4-20mA	ZT60B	110VAC	5

Specify the primary-side current (leakage current) of the ZCT

Voltage (Rise/Drop) Detectors [Insulated]

T-51/T-101 Series

<1-phase/3-phase>

These detectors instantaneously detect a voltage drop (or rise) compared to a previously set value, an open phase or a reverse phase (only for 3-phase) in 1-phase or 3-phase AC circuits and output a contact signal.
A "CAL signal" proportional to a preset value is output to enable accurate setting and checking of the value set.

T-101VDL

■Applications

●Detecting flicker and instantaneous power interruption
●Monitoring computer power supply
●Detecting open phases, reverse phases (only 3-phase AC circuits)

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

Outer shape	Model name	Function	Circuit	Rated voltage	Setting range and accuracy: Variable setting range	CAL output	Accuracy	Detection: Method and detection time	Output	Auxiliary power supply	Weight	Delivery period classification
Box	T-101VDL	Drop detection	1-phase or 3-phase	110VAC or 220VAC 50 and 60Hz Consumption VA (between lines) 110V: 0.2 220V: 0.4	●110V circuit 30~130V	DC 0.3~1.3V	±5%	●Method Voltage crest value detection method ●Method Detection time 1 cycle	●Form no-voltage 1c relay contact ●Contact capacity 250VAC 3A 30VDC 3A (resistive load) ●Alarm indication lamp Red LED	110VAC$^{+10}_{-15}$% 50 and 60Hz Consumption VA: 3	0.6kg	○
					●220V circuit 60~260V	DC 0.6~2.6V						
Box	T-101VDH	Rise detection			●110V circuit 90~180V	DC 0.9~1.8V					0.6kg	○
					●220V circuit 180~360V	DC 1.8~3.6V						

*1 Manufacturable range
Auxiliary power supply···100/110/120/200/220/240VAC (voltage tolerance$^{+10}_{-15}$%)
24VDC (voltage tolerance±10%), 100~120VDC (voltage tolerance$^{+15}_{-20}$%)
*2 The detection accuracy is the percentage compared to the rated voltage.
*3 Output indicator lamp···A red lamp lights when the output contact is operating.
*4 Output time
●When the drop (or rise) time is 1s or less ··········· 1±0.5s
●When the drop (or rise) time exceeds 1s ············drop (or rise) time
●For open or reverse phase ································duration of open or reverse phase
*5 A contact signal is output when the voltage of one phase drops significantly (to approx. 50% or less of the rated voltage) in a three-phase AC circuit.
*6 Due to the voltage crest value detection method, error may occur when the input waveform is distorted. Should this happen, calibrate the setting value in accordance with the actual equipment.
*7 A model that operates when abnormal operation lasts for three cycles can also be manufactured. (Detection time: 40~70ms)
*8 Continuous application of up to 180V is possible for the 110V rating, and up to 360V is possible for the 220V rating.
*9 Dielectric strength
●Between input terminal and contact output terminal: 2000VAC for 1min.
●Between contact output terminal and CAL output terminal: 2000VAC for 1min.
*10 CAL output load resistance: 5kΩ~∞.
*11 Drop detection cannot be performed if the auxiliary voltage drops at the same time. The auxiliary power supply should thus be taken from a circuit where voltage drop does not occur.

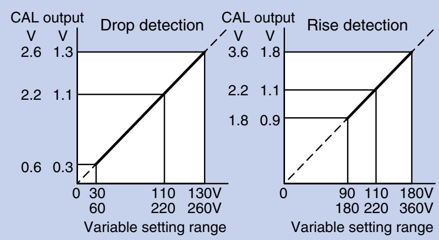
■Detection voltage setting (Please carefully read the accompanying instruction manual)

While measuring the output voltage between the (+) and (-) CAL outputs, set the output to the target value.

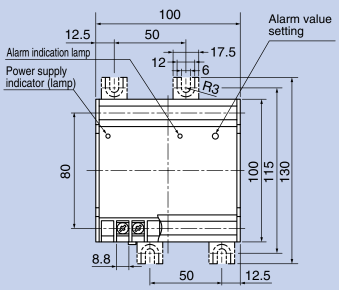
(Setting example)

Example	Specification	Rated voltage	Detection voltage	CAL output
1	Drop detection	110VAC	90VAC	0.9VDC
2	Rise detection	220VAC	260VAC	2.6VDC

Relationship between alarm value and CAL output



Alarm value setting



■Connection diagrams (Refer to p.156 for outer dimensions.)

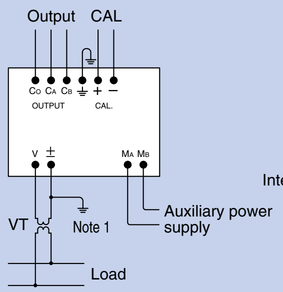
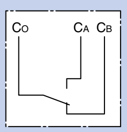


Fig. 1 T-101VDL (1-phase)
T-101VDH (1-phase)



Internal contact circuit

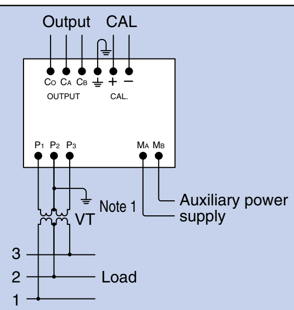
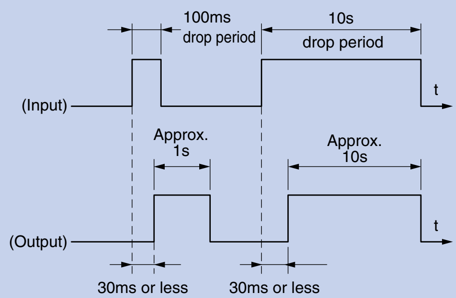


Fig. 2 T-101VDL (3-phase)
T-101VDH (3-phase)

■Detection – output time example



Note 1. For low-voltage circuits, grounding of the secondary side of the instrument voltage transformer is unnecessary.

Transducers

Filters

T-51/T-101 Series

A ripple (AC component) of approximately 5% P-P is contained in the output of K Series models. Use this filter if the ripple is to be reduced to 1% P-P or less.

Delivery period classification

Symbol	◎Standard product	○Quasi-standard product	△Special product
Reference delivery period	Immediate delivery	Within 20 days	21 to 60 days

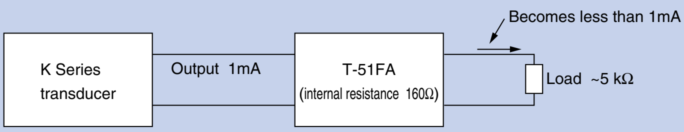
Model name	Input and output		Internal resistance	Output ripple	Weight	Delivery period classification
T-51FA	Voltage	±20V max.	approx. 160Ω	1% P-P or less	0.5kg	◎
	Current	±30mA max.				

*1 The H Series and S Series transducers do not require the use of T-51FA because the output ripple is 1% P-P or less.
*2 T-51FA is not necessary when a transducer and an indicator (Mitsubishi Electric L or Y models) are used in combination.

Warning

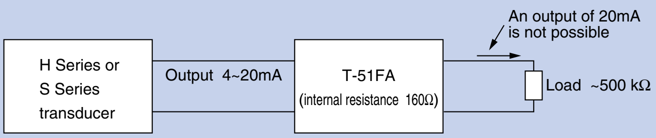
The internal resistance of T-51FA is approximately 160Ω. Please note that problems such as the examples listed below may occur.

Example 1: Combination with a K Series transducer (current output)



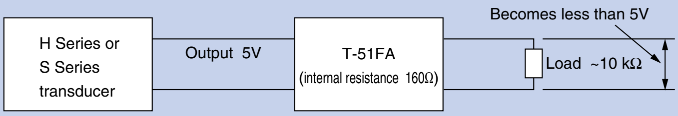
In the case shown to the left, the total load resistance connected to the output of the K Series transducer is 5.16kΩ (5kΩ+160Ω) and the output thus becomes smaller than the normal value.

Example 2: Combination with an H Series or S Series transducer (current output)



In the case shown to the left, the total load resistance connected to the output is 660Ω (500Ω+160Ω) and exceeds the allowable limit. For an output of 4~20mA, a load in the range of 0 to 440Ω can be connected to an H Series or S Series transducer.

Example 3: Combination with a voltage output transducer



In the case shown to the left, the output of the H Series or S Series transducer is divided between the 160Ω and 10kΩ resistances, and thus the output becomes less than the normal value. The same phenomenon may also occur with a K Series transducer.

■Connection diagrams (Refer to p.156 for outer dimensions.)

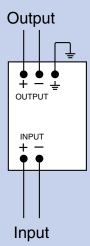


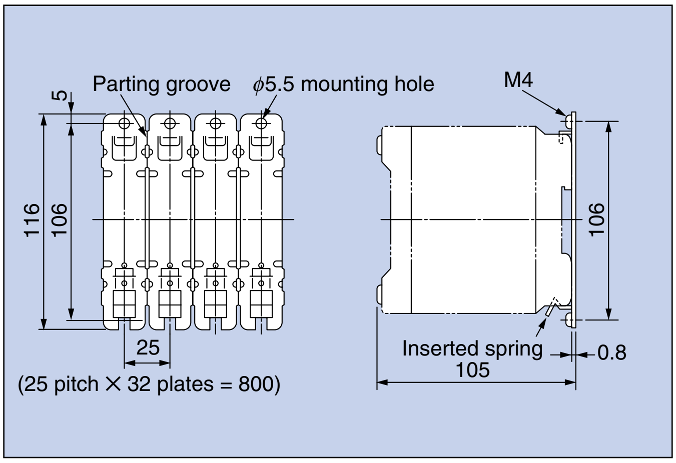
Fig. 1 T-51FA

Auxiliary Parts

T-51/T-101 Series

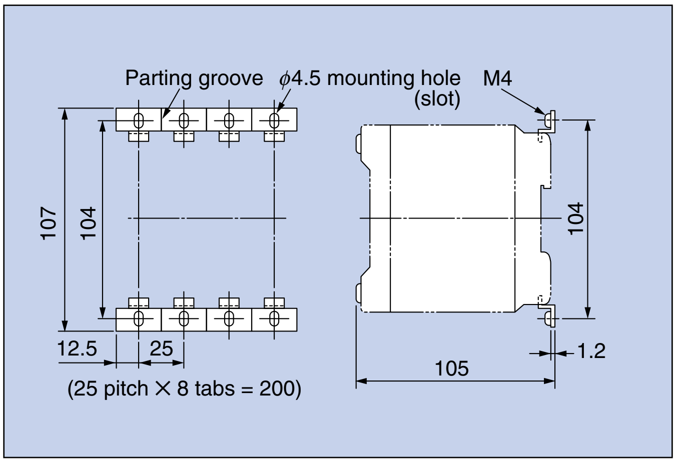
1. T-51/T-101 Series mounting parts

●Breaker mounting plate for distribution panel



* Please specify “BH-K plate” when purchasing.
10 sheets/box (32 plates/sheet)

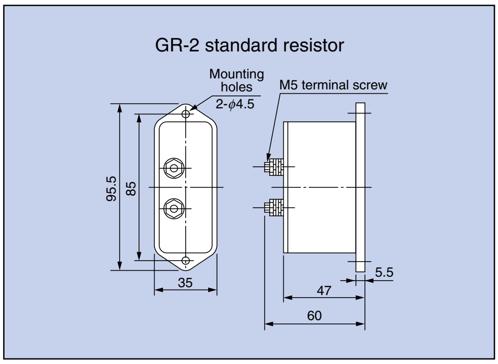
●Breaker coupling/mounting tabs for distribution panel



* Please specify “BH-K coupling tabs” when purchasing.
80 sheets/box (8 tabs/sheet)

2. GR-2 standard resistor

Used to inspect resistance-bulb temperature transducers (T-51TP, T-101TPZ). Incorporates a resistance value corresponding to the rated input temperature.



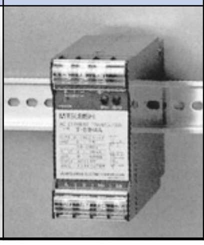
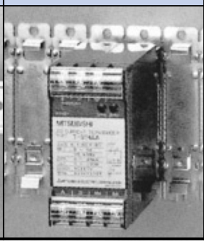
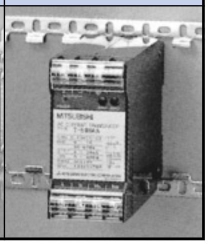
Handling

T-51/T-101 Series

■Method for mounting inside panels

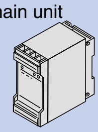
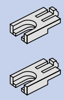
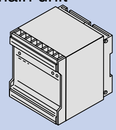
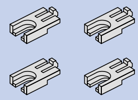
Mounting work is to be performed by a person with the proper technological expertise.

●The following four types of mounting can be performed for models with standard specifications. The mounting parts can be used according to application.

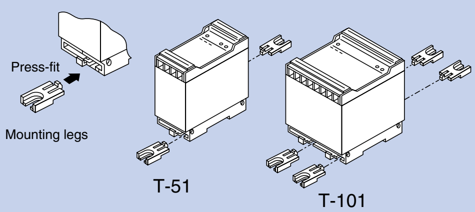
(1) Mounting legs	(2) IEC 35mm rail	(3) Breaker mounting plate for distribution panel	(4) Breaker coupling/mounting tabs for distribution panel
			

■Accessories

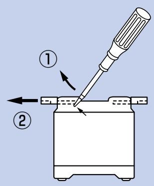
Mounting legs are packaged together with the main unit as accessories.

T-51	One main unit 	Two mounting legs 
T-101	One main unit 	Four mounting legs 

(1) Using mounting legs

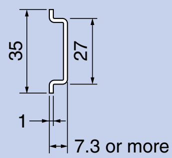


●A "mounting leg" can be removed by pulling out the leg while lifting the root portion of the leg with a standard screwdriver.



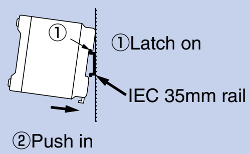
(2) Using an IEC 35mm rail

●Applicable IEC 35mm rail

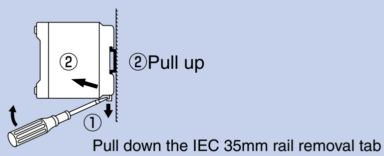


(unit : mm)

●Mounting



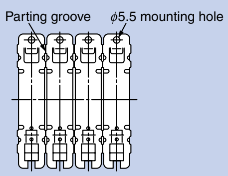
●Removal



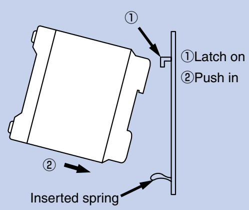
* When mounting using an IEC 35mm rail, affix the unit using a stopper to prevent sliding to the side.

(3) Using a breaker mounting plate for distribution panel

●Outer shape of mounting plate

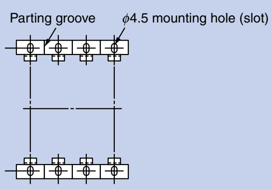


●Mounting

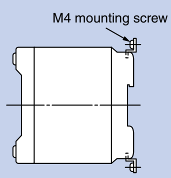


(4) Using a breaker coupling/mounting tabs for distribution panel

●Outer shape of mounting tabs



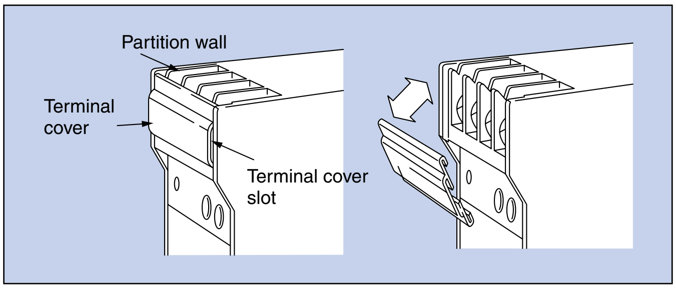
●Mounting

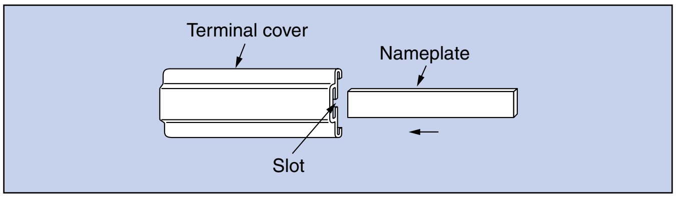


Transducers

■Snap-fit terminal cover

- The terminal cover is fitted onto the partition walls of the terminal section and can be easily removed.
  The cover can also be removed by placing the tip of a standard screwdriver into a slot along the side edge of the terminal cover.
- To attach the terminal cover, simply push the cover back into place.
- A nameplate can be inserted in the slot along the side edge of the terminal cover to indicate a signal name or equipment number.
  The customer is requested to provide the nameplate.



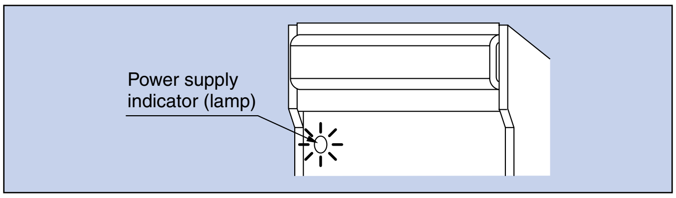


Outer shape	Nameplate dimensions
T-51	t0.8~1×7.5×45
T-101	t0.8~1×7.5×95

For safety reasons, use an insulating material as the material of the nameplate.

■Power supply indicator (lamp)

An indicator (red LED) that shows current is being in supplied from an auxiliary power supply is provided (except for K Series).
Use this for daily inspection and as a guideline for judging whether or not the device is operating.



Transducers

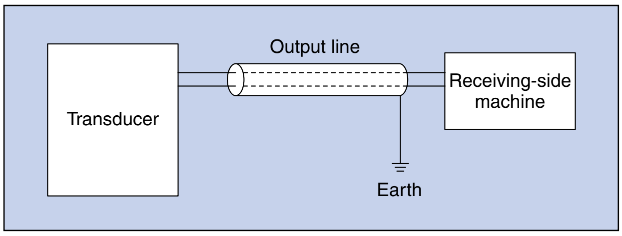
Handling

T-51/T-101 Series

■Wiring

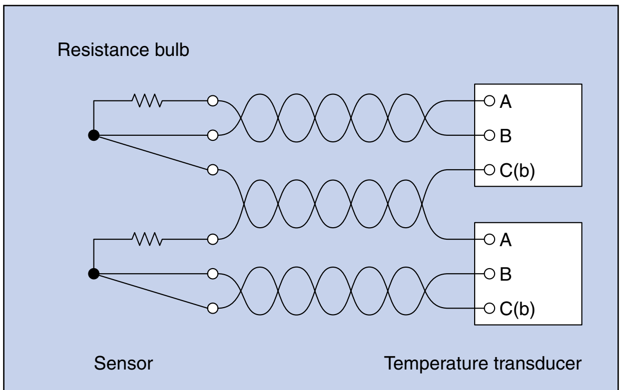
Connection work is to be performed by a person with the proper technological expertise.

- ●Connections must be made correctly and securely. Be careful because erroneous wiring not only causes malfunctions and damages equipment, but may also spread problems to other power equipment.
- ●As the lead wires for connecting the output and load of a transducer, use two-core shielded wires or twisted-pair wires to prevent malfunction and failure due to transmission noise and disturbance surge. If the transmission distance exceeds 100m, current output specifications; for example, 4~20mA DC are recommended.
- ●Do not bring the output line close to or bundle it together with other power lines and the input lines (i.e., VT, CT and auxiliary power supply).
- ●Although the H Series, S Series, instrumentation and peripheral transducers are provided with auxiliary power supply terminals, if the voltage of the measured circuit is comparatively stable and within the allowable range of the auxiliary power supply, the voltage can be supplied from the measured circuit (VT secondary side). However, if the voltage of a generator is supplied from the measured circuit, the transducer output may fluctuate when the voltage during operation such as starting or stopping of the generator falls below the rated value.
- ●Ground the shield line of a shielded cable on the receiving side. However, depending on the circumstances of external noise, it may be better to ground it on the transducer side.

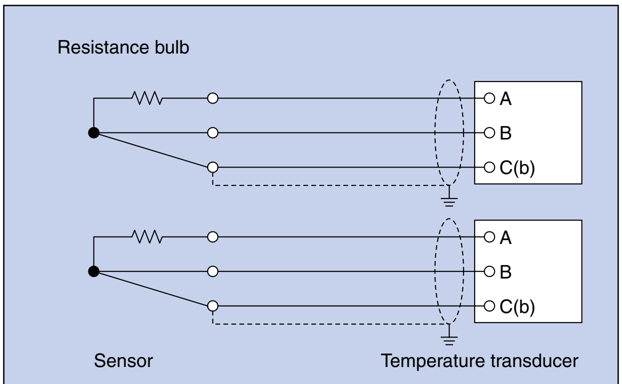


●Connecting the input line

For temperature transducers, isolators, DC level transducers or other transducers that handle minute input signals, arrangements must be made to prevent interference such as noise and surge in the input line. For input lines such as these, in order to prevent incorrect operation and failure due to transmission or noise interference, please use shielded or twisted cables. Additionally, avoid installation alongside power lines or other noise sources as well as pairing different input lines with each other and other lines as shown below.



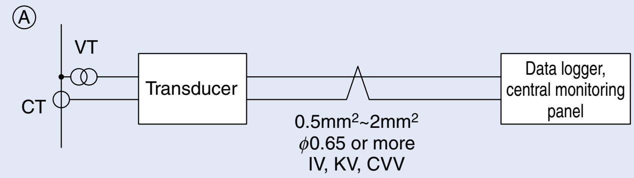
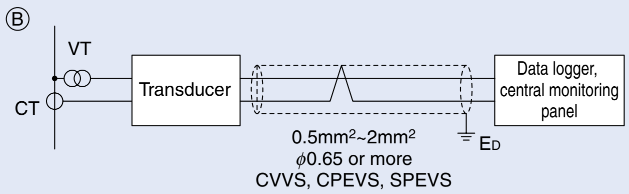
<Example of erroneous pairing>

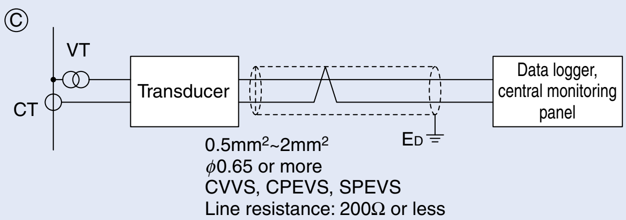


<Example of correct pairing>

● **Signal line connection distance**

The connection distance depends on conditions such as the output signal line specifications of the transducer, signal line installation method, external magnetic field and electric field, and cannot be determined unconditionally. However, empirically speaking, the lengths shown below should be used as a reference.

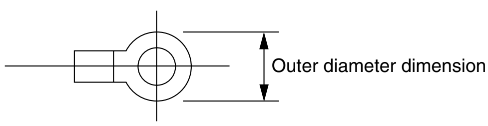
<table>
<tr><th>Transducer output</th><th>Connection conditions</th><th>Connection distance</th></tr>
<tr><td rowspan="2">Voltage signal output</td><td>
</td><td>10mm or less</td></tr>
<tr><td>

If the signal line runs in parallel to a power line, secure the separation distance in the table on the right.
<table>
<tr><th>Condition</th><th>Distance</th></tr>
<tr><td>Low-voltage power lines of 600V or less</td><td>30cm or more</td></tr>
<tr><td>Other high-voltage power lines</td><td>60cm or more</td></tr>
</table></td><td>300m or less</td></tr>
<tr><td>Current signal output</td><td>

If the signal line runs in parallel to a power line, secure the separation distance shown in the table above. If this is not possible, provide electromagnetic shielding by using a shield plate or conduit.</td><td>2km or less</td></tr>
</table>

■Applicable crimp terminals and tightening torques

Series	Applicable crimp terminals	Tightening torque
T-51, T-101	Round crimp terminals (outer diameter: ϕ8.5 or less) for M4 screws	0.98~1.47N•m



Handling

T-51/T-101 Series

■Short-circuiting and opening of output terminals

●Terminals for current output ··········· Although the terminals may be opened/short-circuited, a voltage of 8~50V is generated when they are opened.

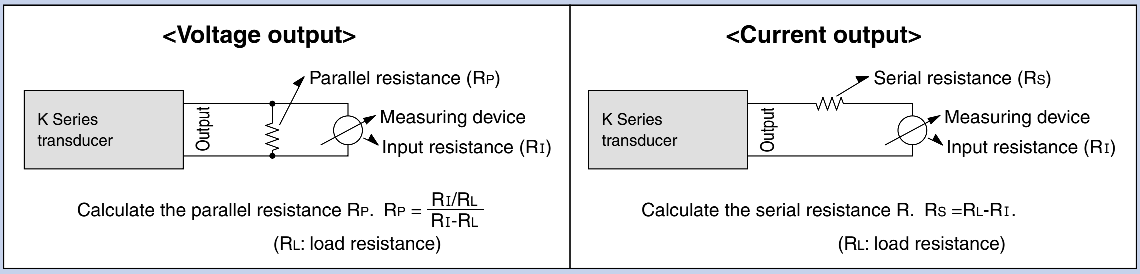
●Terminals for voltage output ··········· Although the terminals may be opened, do not short-circuit them.

■Checking output

Release the load and measure with a voltmeter or ammeter using an input resistance within the specified load range (except the K Series).

K Series transducer

Measure with a voltmeter or ammeter using the same input resistance as the specified load resistance.
If such an indicator is not available, check using the following method.



■Output adjustment

● Although the transducer output is adjusted according to the predetermined specifications, use the span adjuster or zero adjuster on the transducer surface to perform readjustment for matching.
Ordinarily, do not touch these except in special cases.

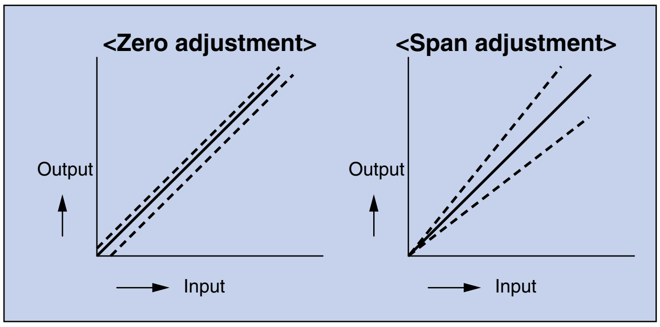
● With the T-51 and T-101 series, output adjustment is performed upon removing the cap. For dust prevention, put the cap back on after adjustment.

● Adjustment method

①With the span adjuster and zero adjuster, the output increases when turned clockwise and decreases when turned counterclockwise.

②With the zero adjuster, the output range is increased or decreased by a fixed value (approximately ±0.3~±5% with respect to the span) as shown in the figure on the right.

③With the span adjuster, the output increases or decreases at the same proportion (±3%~±15% with respect to the rated output) with zero input as the base point.



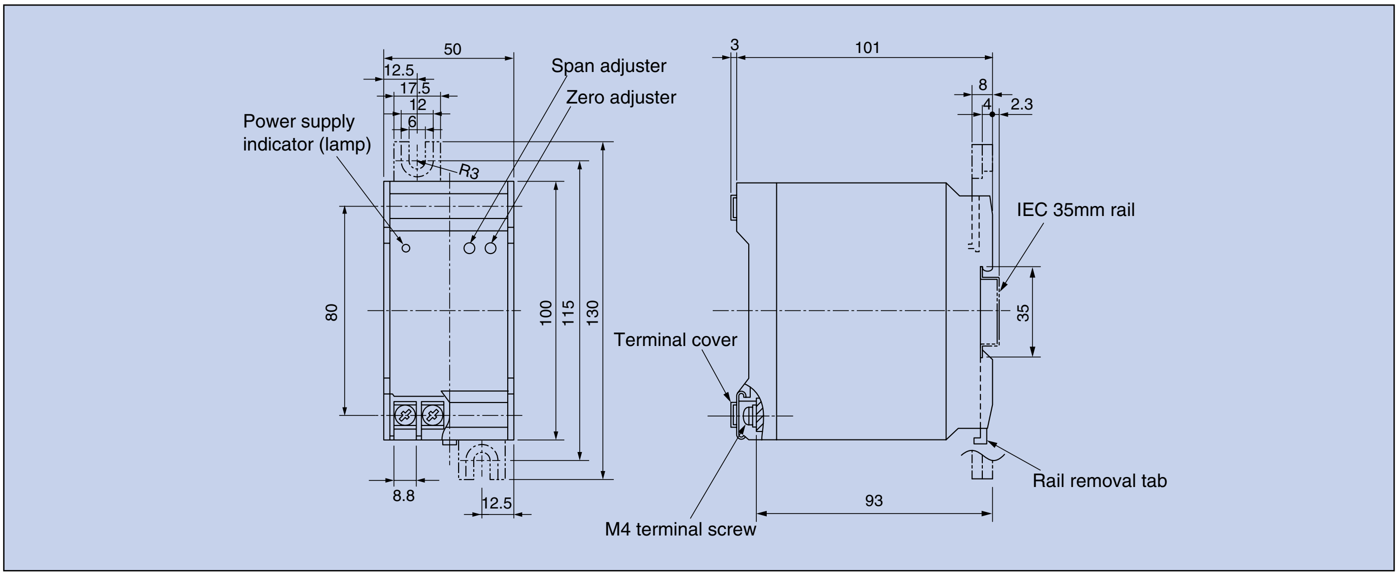
● Standard adjustment procedure

Apply the auxiliary power supply and perform zero adjustment so that the predefined output is output in a state where an input is not applied. Then, apply the rated input and perform span adjustment so that the rated output is output.
However, zero adjustment of a frequency transducer is performed with the lower-limit frequency being input, and span adjustment is performed with the upper-limit frequency being input.

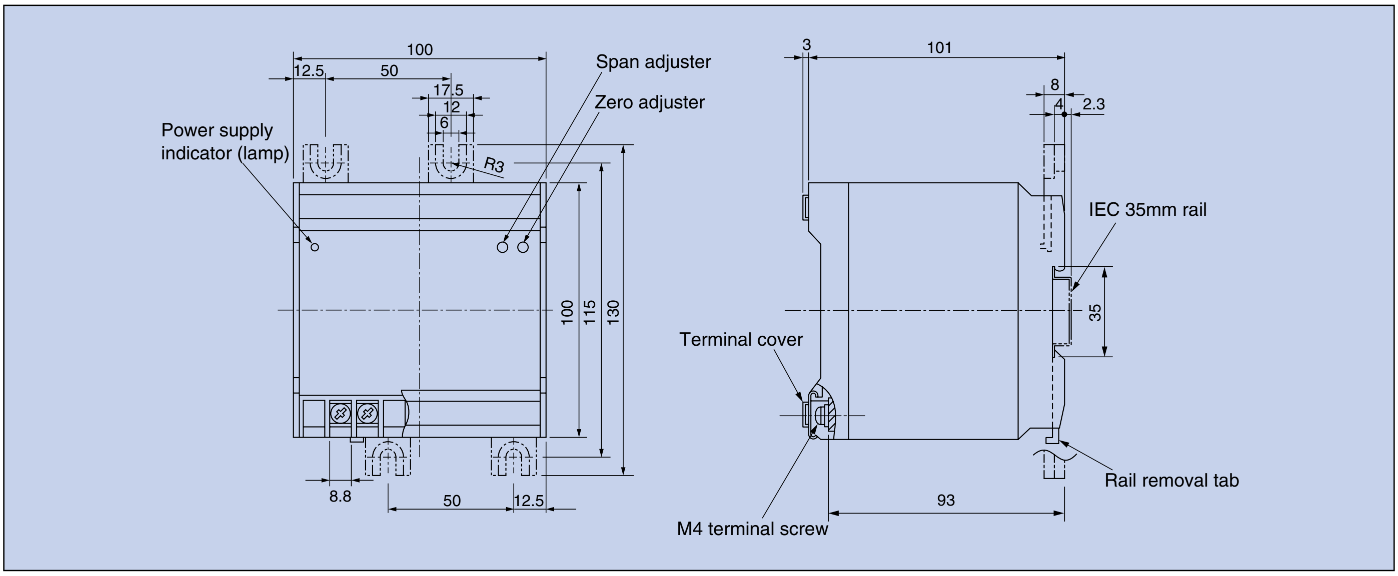
● Do not apply an excessive force to the adjusters.

Outer Dimensions

●Fig. 1 T-51 Series



●Fig. 2 T-101 Series



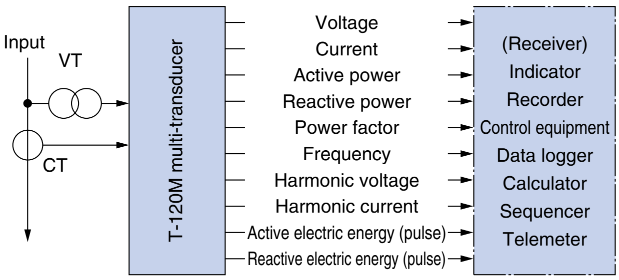
Transducers

T-120M collective Multi-transducers

With multi-transducers, the required AC electric quantities can be measured by inputting the secondary sides of a VT and CT.

●Measurement elements
- Analog outputs
  AC voltage, AC current, active power, reactive power
  Power factor, Frequency
  Harmonic voltage, harmonic current
- Pulse outputs
  Active electric energy, reactive electric energy

●Block diagram



■Features

●Various elements can be measured with one unit.
●A liquid-crystal display and buttons enable setting flexibility.
●Supports power flow measurement (sending, receiving) and can be used for monitoring power generating equipment.
(Active power, reactive power, power factor, active electric energy, reactive electric energy)
●Compact size realizes reducted mounting space.

■Analog output patterns

Phase-wire system	Analog output pattern	Measurement element											
		Analog output										Pulse output	
		CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12
3-phase 3-wire system 1-phase 3-wire system	P01	V_{12}	V_{23}	V_{31}	I_1	I_2	I_3	W	PF	var	Hz	Wh, Varh (set using switch)	
	P02	V_{12}	HV_{12}	V_{31}	I_1	I_2	HI_1	W	PF	var	Hz		
	P03	V_{12}	V_{23}	V_{31}	I_1	I_2	I_3	W	PF	HV_{12}	HI_1		
1-phase 2-wire system	P01	V_{12}	HV_{12}	–	I_1	–	HI_1	W	PF	var	Hz		

The output pattern is fixed at P01 for 1-phase, 2-wire systems.
HI: Harmonic current, HV: Harmonic voltage, -: No measurement element (fixed at lower limit output)

[Insulated]

■Specifications

Item			Grade	Specification
Model name				T-120M
Indicator rating				110V/220V 5A 50/60Hz
Phase-wire system				Can be used in common with 1-phase, 2-wire, 1-phase, 3-wire and 3-phase, 3-wire systems
Number of output points				Analog output: 10, pulse output: 2
Measurement elements	Analog (complies with JIS C 1111)	AC voltage	Grade 0.5	1-phase, 2-wire, 3-phase, 3-wire: Secondary voltage 110V: 0~150V×VT ratio; Secondary voltage 220V: 0~300V phase, 3-wire: 0~150V/0~300V (set using switch) V_{31} is fixed at 300V
		AC current	Grade 0.5	0~5A×CT ratio
		Active power	Grade 0.5	0~+PkW or -P~0~+PkW (set using switch) (P: rated power) Positive side: Can be set in the range of approx. 40~120% of the rated power. Negative side: Can be set in the range of approx. -20~-100% of the rated power. (power flow measurement is enabled)
		Reactive power	Grade 0.5	Q (lead) ~0~Q (lag) kvar (Q: rated reactive power) Can be set in the range of approx. 40~120% of the rated reactive power. (power flow measurement is enabled)
		Power factor	Grade 1.5	Lead 0.5~1~Lag 0.5/Lead 0~1~Lag 0 (set using switch) (power flow measurement is enabled)
		Frequency	Grade 1.0	45~55Hz/55~65Hz (set using switch)
		Harmonic voltage: Overall (2nd to 15th-order) content (%)	Grade 2.0	0~30V×VT ratio (when 110V is selected as secondary voltage)/0~60V (when 220V is selected as secondary voltage) (Fixed at 0~30V in the case of 1-phase 3-wire.) 0~20% (switching between effective value and content (%) is enabled)
		Harmonic current: Overall (2nd to 15th-order) content (%)	Grade 2.0	0~1A×CT ratio/0~3A×CT ratio/0~5A×CT ratio (set using switch) 0~100% (switching between effective value and content (%) is enabled)
	Pulse	Active electric energy		Complies with JIS C 1216 (ordinary class) (switching between sending and receiving directions is enabled)
		Reactive electric energy		Complies with JIS C 1263 (switching between sending and receiving directions is enabled)
Analog output specifications (resistive load)				4~20mA (0~666kΩ) or 0~5V/1~5V (set using switch) (5kΩ~∞), specify when ordering * With limiter function and zero and span adjustment functions
Ripple				1% P-P or less
Response speed	Effective value			1s (demand time interval can be switched for current and power)
	Harmonics			7s (demand time interval can be switched)
	Demand time interval setting			0~60s (in 10s intervals), 1~10min (in 1min intervals), 10~30min (in 5min intervals) (0s setting is instantaneous output.)
Pulse output specifications				Output form: semiconductor relay, no-voltage contact Contact capacity: Leak current for 110VAC or less, 0.1A or less: 15μA for 110VAC Leak current for 100VDC or less, 0.1A or less: 1μA for 100VDC (on resistance is 12Ω or less) Pulse width: 0.125s/0.5s/1s±20% (set using switch) Pulse units: Selected from 4 types according to full-load active power (set using switch; see "Setting method" for details)
Display				Liquid-crystal display is lit while power is supplied (RUN, analog output pattern display) Various settings are possible (set as primary side values)
Auxiliary power supply				Can use any of 100-240VAC $^{+10}_{-15}$ %, 50-60Hz, 100VDC $^{+40}_{-25}$ %
Consumption VA	Voltage circuit			0.1VA when approx. 110V, 0.2VA when approx. 220V (all phases)
	Current circuit			Approx. 0.1VA (all phases)
	Auxiliary power supply			Approx. 10VA (110VAC), approx. 12VA (220VAC), approx. 6W (100VDC)
Outer dimensions (mm)				W120×H100×D101
Terminal screws				Input terminals: M4, output terminals: M3.5
Weight				0.6kg
Commercial frequency withstand voltage				Between input/output terminals as a whole and outer casing, between auxiliary power terminals as a whole and outer casing Between voltage input terminals as a whole and current input terminals as a whole, between auxiliary power terminals as a whole and input terminal as a whole Between input terminals as a whole and output terminals as a whole, between auxiliary power terminals as a whole and output terminal as a whole 2000VAC (50/60Hz) 1min
Insulation resistance				10MΩ or more at the same locations as the above (500VDC)

Rated voltage (active power / reactive power):

Phase-wire system	Secondary voltage	Rated voltage
1-phase 2-wire	110V	500W×VT ratio×CT ratio
	220V	1000W×CT ratio
1-phase 3-wire		1000W×CT ratio
3-phase 3-wire	110V	1000W×VT ratio×CT ratio
	220V	2000W×CT ratio

The unit for reactive power is var.

Remarks (1) Regarding the harmonic output, measurement of harmonics cannot be performed unless the fundamental wave content is 75% or more of the rated voltage.
(2) An analog output of approximately 100% or more may be output for a few seconds immediately after turning on the auxiliary power supply (until the internal voltage stabilizes).

■Mounting method

Four types of mounting are available.

The mounting methods are the same as those of the T-51 and T-101 series. Refer to the "Mounting method for T-51 and T-101 series" on p.151.

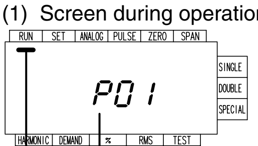
■Names and number of accessories

Mounting legs ···············4pcs.

Instruction manual ········1 copy

■Operation method

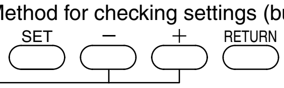
(1) Screen during operation



The analog output pattern is displayed.

The RUN indication is lit.

(2) Method for checking settings (button functions)



When the ⊕ button or ⊖ button is pressed for 1s or more, the setting value checking mode is entered. The respective setting values are displayed by consecutively pressing the ⊕ button or ⊖ button (refer to "Setting method" in regard to the screen).

Primary voltage ⟷ Primary current ⟷ Active power measurement range ⟷ Active power measurement range (negative side) ⟷ Power factor ⟷ Reactive power measurement range ⟷ Frequency ⟷ Harmonic voltage ⟷ Harmonic current ⟷ Pulse output CH11 ⟷ Pulse output CH12 ⟷ Operation screen ⟷ Primary voltage

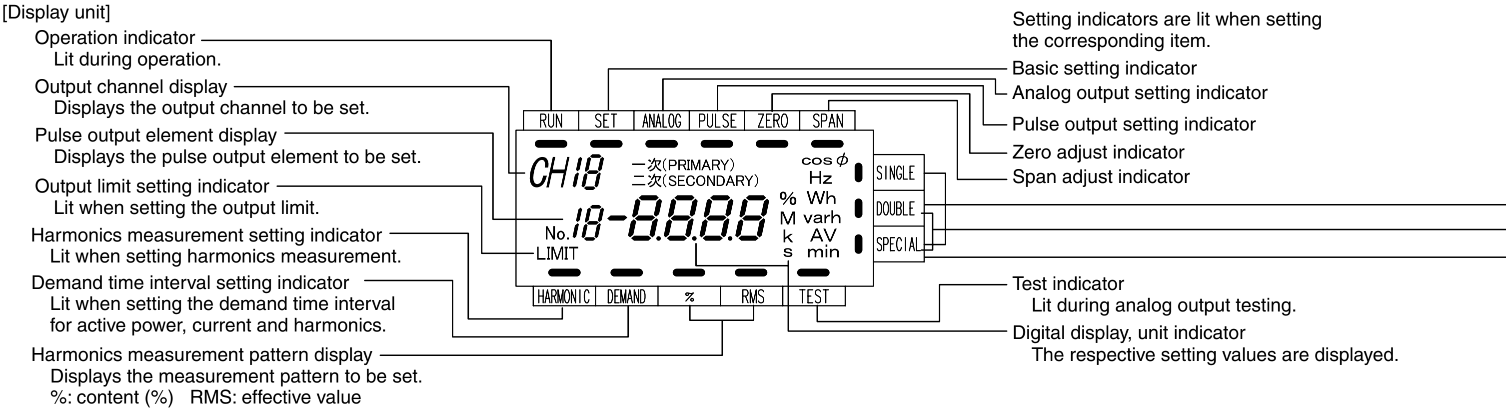
- The active power measurement range (negative side) is displayed when the special bidirectional setting is set for active power.
- The harmonic voltage and harmonic current are not displayed when the analog output pattern is P01.
- The reactive power measurement range and frequency are not displayed when the analog output pattern is P03.

Transducers

Setting Method

●Setting method

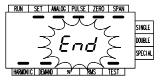
[Display unit]



1 Setting mode

Press the SET button for 2s or more to enter the set up mode (setting menu will be displayed and "End" will blink).

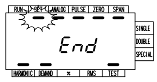
Use the ⊕and⊖buttons to select the item to be set, press the SET button to display the set up screen, and then use the ⊕and⊖buttons to set the contents.
When the SET button is pressed for 1s or more while setting an item, setting of the remaining items is skipped and returns to the setting menu.



2 Basic settings (analog output pattern, phase-wire system, frequency, primary/secondary voltages, primary current)

⊕⊖buttons
①Setting menu
RETURN SET

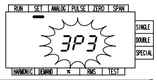
①Change the setting menu to indicate SET.



⊕⊖buttons
②Phase-wire system
RETURN SET

②Set the phase-wire system. (When this setting is changed, all other settings are set back to the default settings at the time of factory shipment.)

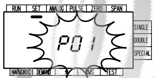
→3P3 (3-phase 3-wire system) ⟷ 1P3 (1-phase 3-wire system) ⟷ 1P2 (1-phase 2-wire system) ←



⊕⊖buttons
③Analog output pattern
RETURN SET

③Set the analog output pattern.

→P01⟷P02⟷P03←



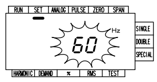
Phase-wire system	Analog output pattern	Measurement elements									
		CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10
3-phase 3-wire system 1-phase 3-wire system	P01	V_{12}	V_{23}	V_{31}	I_1	I_2	I_3	W	PF	var	Hz
	P02	V_{12}	HV_{12}	V_{31}	I_1	I_2	HI_1	W	PF	var	Hz
	P03	V_{12}	V_{23}	V_{31}	I_1	I_2	I_3	W	PF	HV_{12}	HI_1
1-phase 2-wire system	P01	V_{12}	HV_{12}	—	I_1	—	HI_1	W	PF	var	Hz

The pattern is fixed at P01 in the case of the 1-phase 2-wire system
HI: harmonic current, HV: harmonic voltage,
-: no measurement element (fixed at lower limit output)

⊕⊖buttons
④Frequency
RETURN SET

④Set the frequency.

→50Hz⟷60Hz←



⊕⊖buttons
⑤Secondary voltage
RETURN SET

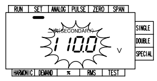
⑤Set the secondary voltage.

→110V⟷220V←

When this is changed, the measurement ranges for active power and reactive power are set back to the default settings at the time of factory shipment.

If the 1-phase 3-wire system is set in ②, the input rating will differ according to the secondary voltage setting.

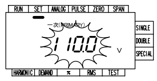
Secondary voltage setting	Input rating	
	V_{12} V_{23}	V_{31}
110V	0~150V	0~300V
220V	0~300V	



⊕⊖buttons
⑥Primary voltage
RETURN SET

⑥Set the primary voltage. (When this is changed, the measurement ranges for active power and reactive power are set back to the default settings at the time of factory shipment.)

110V	6600V	66kV	220kV
220V	11kV	77kV	275kV
440V	13.2kV	110kV	550kV
1100V	16.5kV	132kV	SP
2200V	22kV	154kV	
3300V	33kV	187kV	

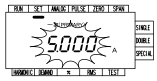


- If the 1-phase 3-wire system is set in ②, setting of the primary voltage will be skipped.
- If the secondary voltage is set to 220V in ⑤, setting of the primary voltage will be skipped.
- When SP is selected, setting of the special primary voltage is entered, in which the upper three digits can be set in the range of 110V to 550kV.

⊕⊖buttons
⑦Primary current
SET

⑦Set the primary current. (When this is changed, the measurement ranges for active power and reactive power are set back to the default settings at the time of factory shipment.)

5A	25A	120A	750A	3000A	20kA
6A	30A	150A	800A	4000A	25kA
7.5A	40A	200A	1000A	5000A	30kA
8A	50A	250A	1200A	6000A	SP
10A	60A	300A	1500A	7500A	
12A	75A	400A	1600A	8000A	
15A	80A	500A	2000A	10kA	
20A	100A	600A	2500A	12kA	

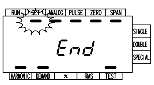


- When SP is selected, setting of the special primary current is entered, in which the current can be set in the range of 5A to 30kA in the following steps.
  5A~100A : in steps of 5A
  100A~1000A : in steps of 10A
  1000A~10kA : in steps of 100A
  10kA~30A : in steps of 1kA

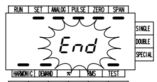
⊕⊖buttons
⑧Setting menu

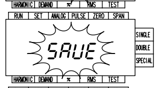
⑧Continue set up in another setting menu or end set up.

■ To change to another setting menu, use the ⊕and⊖buttons to select the setting menu in which set up is to be performed.

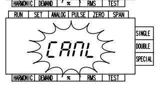


■ To end set up
Use the ⊕and⊖buttons to select End.
Use the SET button to display SAVE, and then save the settings by pressing the SET button again.





■ To cancel the settings
When SAVE is displayed, use the ⊕and ⊖buttons to select CANL and then press the SET button to cancel the settings.



Active power measurement direction setting indicator.
Indicates the active power measurement direction to be set.
SINGLE: unidirectional, DOUBLE: bidirectional,
DOUBLE SPECIAL: special bidirectional

Indication of measurement direction of power factor and reactive power during power flow
Indicates the measurement direction of power factor and reactive power during power flow.
DOUBLE: Without power flow expansion.
SPECIAL: With power flow expansion.

Special primary voltage/current setting indicator

[Button functions]

SET : The set up mode is entered when this is pressed for 2s or more. Used for selecting an item to be set, and setting various items.

+ or − : Used for increasing/decreasing a setting value during set up, and for checking setting values.

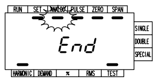
RETURN : Used for selecting (setting back) an item to be set.

3 Analog output settings

The underline in the setting specifications indicates the default value at the time of factory shipment.

+ − buttons

①Setting menu — ①Change the setting menu to indicate ANALOG.

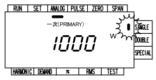


RETURN SET

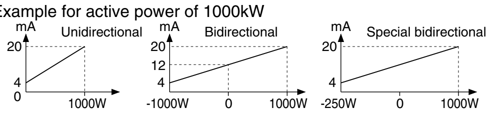
+ − buttons

② Unidirectional, bidirectional, or special bidirectional setting for active power — ②Set the unidirectional, bidirectional, or special bidirectional setting for active power measurement.

→ SINGLE: unidirectional ⟷ DOUBLE: bidirectional ⟷ DOUBLE SPECIAL: special bidirectional ←



Example for active power of 1000kW



RETURN SET

+ − buttons

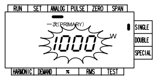
③Power — ③Set the active power measurement range.

(A) Setting of the upper three digits can be performed in a range of approx. 40~120% of the rated active power (table on the right).

(B) If the special bidirectional setting is set, the negative side measurement range can be set in a range of approx. -20~-100% of the rated active power (-25% at the time of factory shipment) in continuation to (A).

Phase-wire system	Secondary voltage	Rated active power
3-phase 3-wire system	110V	1000W×VT ratio×CT ratio
	220V (Direct)	2000W×CT ratio
1-phase 3-wire system		1000W×CT ratio
1-phase 2-wire system	110V	500W×VT ratio×CT ratio
	220V (Direct)	1000W×CT ratio

The unit will be var in the case of reactive power.

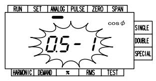


RETURN SET

+ − buttons

④Power factor — ④Set the value of the power factor with respect to the maximum output value (see "⑧ Power flow" for an output example).

→ 0.5-1 (LEAD0.5-1-LAG0.5) ⟷ 0-1 (LEAD0-1-LAG0) ←

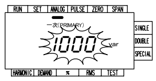


RETURN SET

+ − buttons

⑤Reactive power — ⑤Set the reactive power measurement range (see "⑧ Power flow" for an output example).

- The upper three digits can be set in a range of approx. 40~120% of the rated reactive power (setting at the time of factory shipment: 100%).



RETURN SET

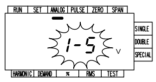
+ − buttons

⑥ Analog output 0-5 or 1-5 — ⑥Set the analog output to 1-5V or 0-5V.

→ 1-5V (1-5V output) ⟷ 0-5V (0-5V output) ←

(When this is changed, the zero adjust and span adjust are set back to the default settings at the time of factory shipment.)

- This setting is not available with the 4-20mA specifications for analog output.
- The same specifications are applied to all analog output CHs. Setting according to CH cannot be performed.



RETURN SET

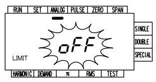
+ − buttons

⑦Output limit — ⑦Set the analog output when the full scale is exceeded.

→ oFF (no limit) ⟷ on (with limit) ←

oFF (no limit): The upper-limit output is output to approx. +5% and the lower-limit output is output to approx. -5%.

on (with limit): The upper-limit output is output to approx. +1% and the lower-limit output is output to approx. -1%.



RETURN SET

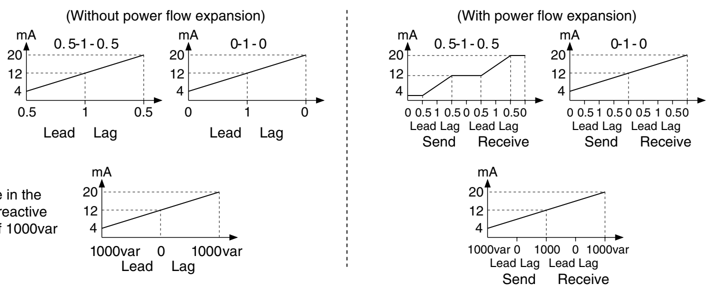
+ − buttons

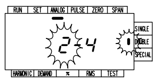
⑧Power flow — ⑧Set the measurement direction of power factor/reactive power during power flow.

→ 2-4 DOUBLE (without power flow expansion) ⟷ 2-4 SPECIAL (with power flow expansion) ←

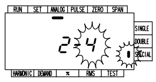
Power factor

Example in the case of reactive power of 1000var





(Without power flow expansion)

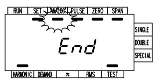


(With power flow expansion)

SET

+ − buttons

⑨Setting menu — ⑨Continue set up in another setting menu or end set up.
(Refer to ⑧Setting menu of " 2 Basic settings.")

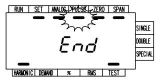


Transducers

Setting Method

4 Pulse output settings (pulse output elements, pulse unit, pulse width)

① Setting menu (+ − buttons) — ①Change the setting menu to indicate PULSE.

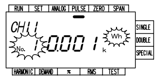


RETURN SET

② Pulse output CH11 element (+ − buttons) — ②Set the element (No.) to be output to the pulse output CH11 (C1A-C1B).

Element that can be set

Element (indication)	Pulse output element (measurement range)
No 1 Wh	Active electric energy (receiving) (pulse output CH11)
No 2 Wh	Active electric energy (sending)
No 3 varh	Reactive electric energy (receiving, lag) (pulse output CH12)
No 4 varh	Reactive electric energy (receiving, lead)
No 5 varh	Reactive electric energy (sending, lag)
No 6 varh	Reactive electric energy (sending, lead)
No 7 varh	Reactive electric energy (receiving, lag + sending, lead)
No 8 varh	Reactive electric energy (receiving, lead + sending, lag)
None	No pulse output element



RETURN SET

③ Pulse output CH1 pulse unit (+ − buttons) — ③Set the pulse unit for the pulse output CH11 (C1A-C1B).

Select from the table below in accordance with the full-load active power.

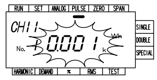
Full-load active power (kW)	Pulse unit (Wh/pulse) that can be set			
Less than 10	1k	0.1k	0.01k	0.001k
10 or more and less than 100	10k	1k	0.1k	0.01k
100 or more and less than 1000	100k	10k	1k	0.1k
1000 or more and less than 10000	1000k	100k	10k	1k
10000 or more and less than 100000	10M	1M	0.1M	0.01M
100000 or more	100M	10M	1M	0.1M

Full-load active power (kW)= $\frac{\alpha \times \text{(primary voltage)} \times \text{(primary current)}}{1000}$

(α: 1 for 1-phase, 2-wire system; 2 for 1-phase, 3-wire system; $\sqrt{3}$ for 3-phase, 3-wire system)

However, calculate with the primary voltage being 100V for the 1-phase, 3-wire system.

For reactive power, the unit W is changed to var.



RETURN SET

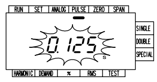
④ Set the element and pulse unit for pulse output CH2 in the same manner. — ④The same elements as those of CH11 can be set for the pulse output CH2 (C2A-C2B).

RETURN SET

⑤ Pulse width (+ − buttons) — ⑤Set the pulse width

→0.125s⟷0.500s⟷1.000s←

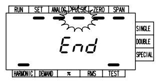
- The same specifications are applied to all pulse output CHs. Setting according to CH cannot be performed.
- If the load is large when the pulse width is set to 0.500s or 1.000s and the pulse unit is set to the minimum value, the number of pulse outputs may decrease because the pulse output cannot follow. Use the following relationships to calculate the setting for which the OFF time of the pulse output will not be shorter than the ON time for all loads.
- When 0.500s is set: full-load active power/pulse unit≤3600
- When 1.000s is set: full-load active power/pulse unit≤1800



SET

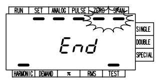
⑥ Setting menu (+ − buttons) — ⑥Continue set up in another setting menu or end set up.

(Refer to ⑧Setting menu of " 2 Basic settings.")



5 Analog output adjustment (zero adjust, span adjust)

① Setting menu (+ − buttons) — ①Change the setting menu to indicate ZERO SPAN.



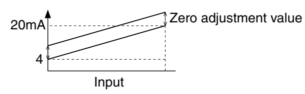
RETURN SET

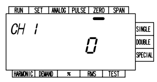
② Analog output CH1 zero adjustment (+ − buttons) — ② Perform zero adjustment of the analog output CH1.

Set in the range of -30~0~30

- During current output, adjustment of approx. ±0.16mA can be performed.
- During voltage output, adjustment of approx. ±0.05V can be performed.

Movement of zero adjustment value





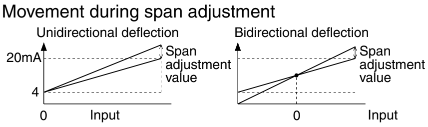
RETURN SET

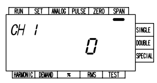
③ Analog output CH1 span adjustment (+ − buttons) — ③ Perform span adjustment of the analog output CH1.

Set in the range of -75~0~75.

- During current output, adjustment of approx. ±0.48mA can be performed.
- During voltage output, adjustment of approx. ±0.15V can be performed.

Movement during span adjustment





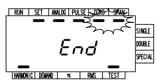
RETURN SET

④ Perform zero adjustment and span adjustment of analog output CH2~CH10 in the same manner

SET

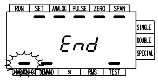
⑤ Setting menu (+ − buttons) — ⑤Continue set up in another setting menu or end set up.

(Refer to ⑧Setting menu of " 2 Basic settings.")



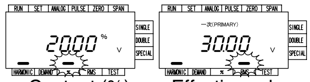
6 Harmonics measurement settings (harmonic voltage, harmonic current)

① Setting menu — ⊕⊖ buttons — ① Change the setting menu to indicate HARMONIC.



RETURN / SET

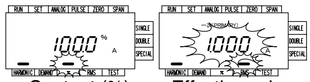
② Harmonic voltage — ⊕⊖ buttons — ② Set the harmonic voltage measurement pattern.
% indication (content (%)) ⟷ RMS indication (effective value)



<Content (%)> <Effective value>

RETURN / SET

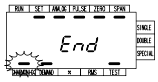
③ Harmonic current — ⊕⊖ buttons — ③ Set the harmonic current measurement pattern.
% indication (content (%)) ⟷ RMS indication (effective value) 1AXCT ratio
RMS indication (effective value) 5AXCT ratio ⟷ RMS indication (effective value) 3AXCT ratio



<Content (%)> <Effective value>

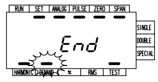
SET

④ Setting menu — ⊕⊖ buttons — ④ Continue set up in another setting menu or end set up.
(Refer to ⑧Setting menu of " 2 Basic settings.")



7 Demand time interval setting (demand power, demand current, harmonic demand voltage/current)

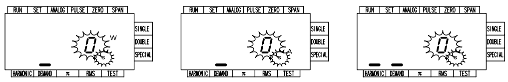
① Setting menu — ⊕⊖ buttons — ① Change the setting menu to indicate DEMAND.



RETURN / SET

② Demand power time interval — ⊕⊖ buttons — ② Set the demand power time interval.

0 seconds	40 seconds	3 minutes	7 minutes	15 minutes
10 seconds	50 seconds	4 minutes	8 minutes	20 minutes
20 seconds	1 minute	5 minutes	9 minutes	25 minutes
30 seconds	2 minutes	6 minutes	10 minutes	30 minutes



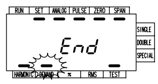
〈Demand power time interval〉 〈Demand current time interval〉 〈Harmonic demand voltage/current time interval〉

RETURN / SET

③ Set the demand current time interval and the harmonic demand voltage/current time interval in the same manner

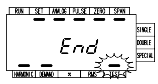
SET

④ Setting menu — ⊕⊖ buttons — ④ Continue set up in another setting menu or end set up.
(Refer to ⑧Setting menu of " 2 Basic settings.")



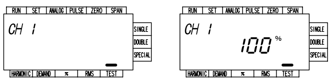
8 Analog output test

① Setting menu — ⊕⊖ buttons — ① Change the setting menu to indicate TEST.



RETURN / SET

② Analog output CH1 test — ⊕⊖ buttons — ② Perform the analog output CH1 test.
Wait for the test to start → 0% output ⟷ 50% output ⟷ 100% output



<Wait for the test to start> <100% output>

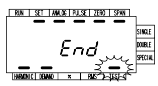
- While waiting for the analog output test to start, the measured value of the set analog output element is output.
- During analog output testing, output is performed without any relationship to the analog output element setting.
- After leaving the analog output CH1 test mode, the analog output returns to the ordinary operation state.
- The test mode is for checking the connection of the analog output when there is no input.
- The output during this test cannot be varied by analog output adjustment (zero adjust, span adjust).

RETURN / SET

③ Perform the analog output tests for CH2~CH10 in the same manner

SET

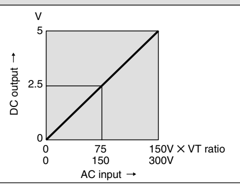
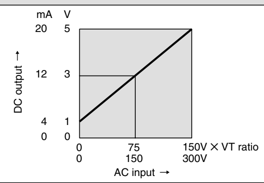
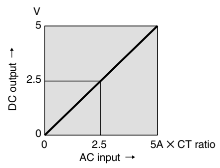
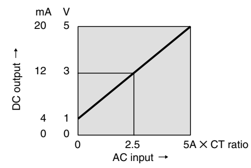
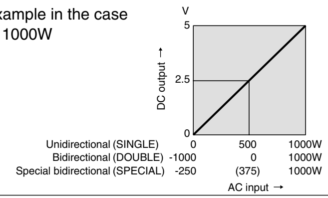
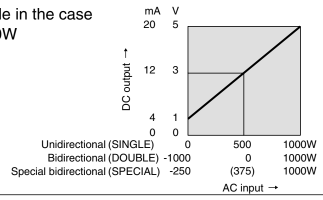
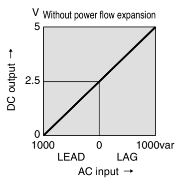
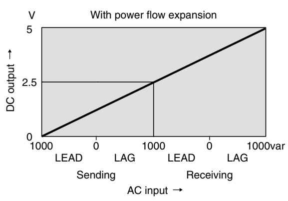
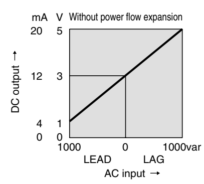
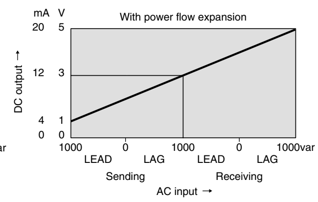
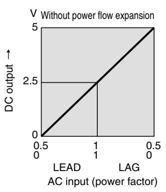
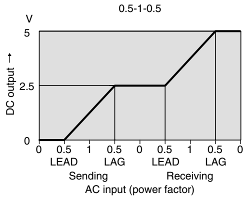
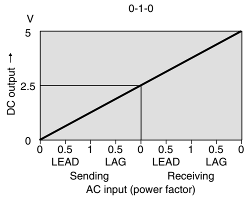
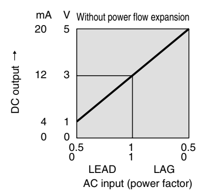
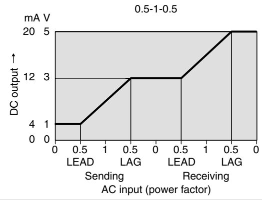
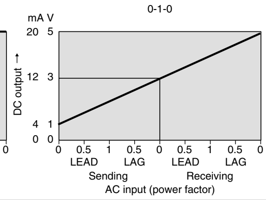
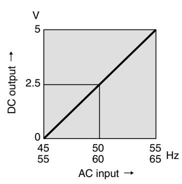
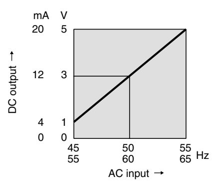
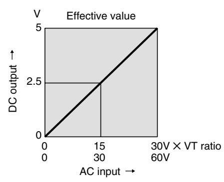
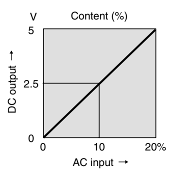
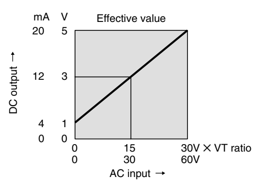
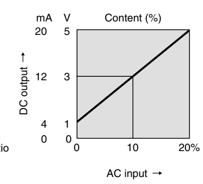
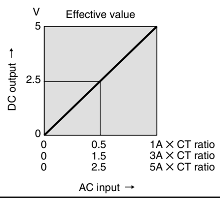
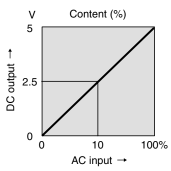
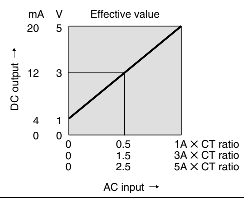
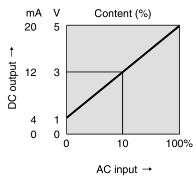
④ Setting menu — ⊕⊖ buttons — ④ Continue set up in another setting menu or end set up.
(Refer to ⑧Setting menu of " 2 Basic settings.")



Remarks: Refer to "Operation method" on p.158 regarding the method for checking settings.

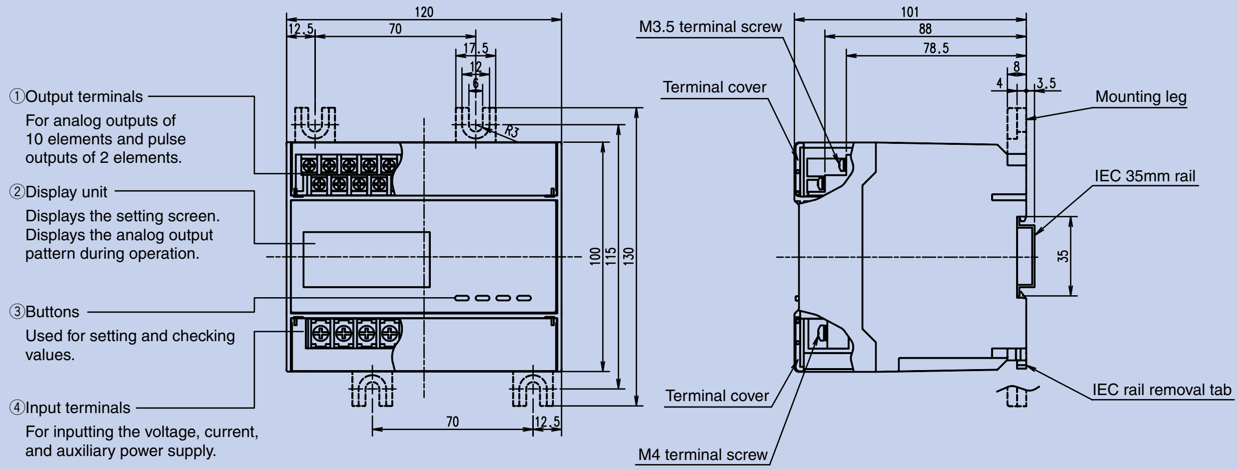
Input/Output Relationships

■Input/Output relationships

	Output	0~5V	4~20mA, 1~5V
Measurement element	Voltage		
	Current		
	Active power	Example in the case of 1000W 	Example in the case of 1000W 
	Reactive power	Example in the case of 1000var  	Example in the case of 1000var  
	Power factor	 With power flow expansion  	 With power flow expansion  
	Frequency		
	Harmonic voltage	 	 
	Harmonic current	 	 

Outer Dimensions/Connection Diagrams

●Outer dimensions, and names and functions of respective parts



■Connection diagrams

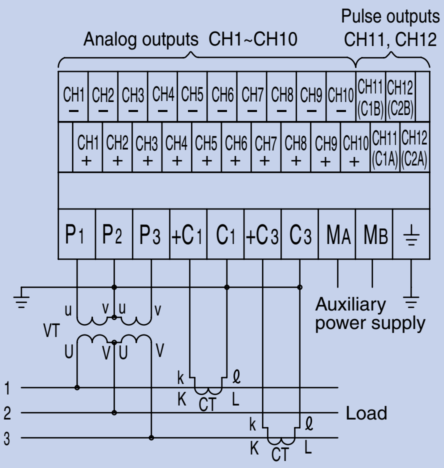


Fig. 1 3-phase 3-wire system (with VT and CT)

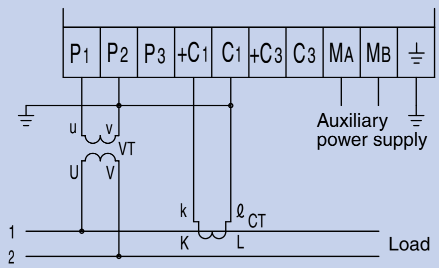


Fig. 2 1-phase 2-wire system (with VT and CT)

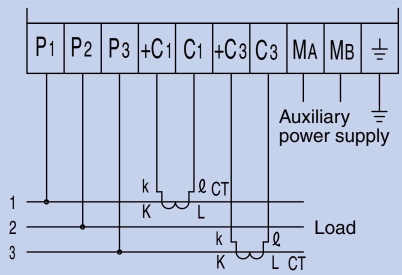


Fig. 3 1-phase 3-wire system (with CT)

- ●For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.
- ●Make sure to use after grounding the earth terminal (⏚). Provide a D earth (earth resistance: 100Ω or less) for grounding. Inadequate grounding may cause a malfunction.
- ●As the lead wires for connecting the output and load of a transducer, use two-core shielded wires or twisted-pair wires to prevent malfunction and failure due to transmission noise and disturbance surge. If the transmission distance exceeds 100m, current output specifications are recommended.
- ●Do not bring the output line close to or bundle it together with other power lines or the input lines (VT, CT, and auxiliary power supply).
- ●Ground the shield line of a shielded cable on the receiving side. However, depending on the circumstances of external noise, it may be better to ground it on the transducer side.

■Ordering method

Model name	Output Voltage or current	Number of units
T-120M	0-5V	3

Transducers

Special Application Transducers

T-120HA harmonics transducers [Insulated]

■Applications

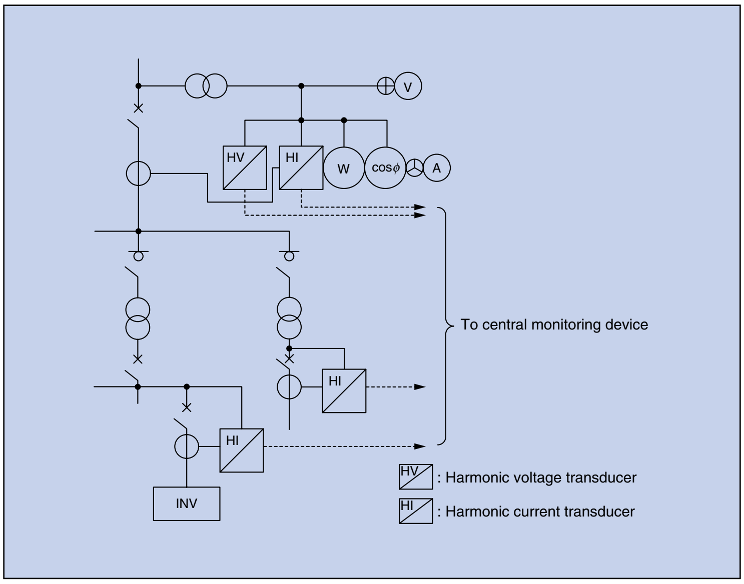
Harmonics transducers perform constant monitoring of the harmonic voltage and harmonic current of a power system, and help to prevent disorder due to harmonics in advance.

■Features

- ●Various harmonics measurement elements (10 elements) can be measured with one unit.
- ●The harmonic voltage and current can be measured with one unit.
- ●The harmonic voltage (current) effective value and content (%) can be measured (*).
- ●The instantaneous value and average value can be measured. (Switching)

* : Output selected by setting

■Usage example



■Analog output patterns

Analog output patterns	Measurement element									
	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10
P01	$V_{(1)}$	$V_{(3)}$	$V_{(5)}$	$V_{(7)}$	$V_{(11)}$	$V_{(13)}$	ΣV_H	ΣI_H	Vrms	Irms
P02	$I_{(1)}$	$I_{(3)}$	$I_{(5)}$	$I_{(7)}$	$I_{(11)}$	$I_{(13)}$	ΣV_H	ΣI_H	Vrms	Irms
P03	$V_{(3)}$	$V_{(5)}$	$V_{(7)}$	$I_{(3)}$	$I_{(5)}$	$I_{(7)}$	ΣV_H	ΣI_H	Vrms	Irms

(1) (3) (5) (7) (11) (13): order of harmonic wave, Σ: overall harmonic wave, rms: overall effective value

■Specifications

Item			Specification		
Model name			T-120HA		
Indicator rating			110V/220V 5A 50/60Hz		
Phase-wire system			1-phase, 2-wire system		
Number of output points			Analog output: 10 points		
Measurement elements (complies with JIS C 1111)	AC voltage	Effective value	Grade 0.5	110/220V	Secondary voltage 110V: 0~150V×VT ratio Secondary voltage 220V: 0~300V
		Fundamental wave component	Grade 2.0		
	AC current	Effective value	Grade 0.5	5A	0~5A×CT ratio
		Fundamental wave component	Grade 2.0		
	Harmonic voltage	Orders measured	3rd, 5th, 7th, 11th, 13th, and overall (2nd to 15th-order) harmonics		
		n-th order (overall) effective value	Grade 2.0	110/220V	Secondary voltage 110V: 0~30V×VT Secondary voltage 220V: 0~60V
		Content (%)			0~20% (switching between effective value and content (%) is enabled)
	Harmonic current	Orders measured	3rd, 5th, 7th, 11th, 13th, and overall (2nd to 15th-order) harmonics		
		n-th order (overall) effective value	Grade 2.0	5A	0~1A×CT ratio/0~3A×CT ratio/0~5A×CT ratio
		Content (%)			0~100% (switching between effective value and content (%) is enabled)
Analog output specifications (resistive load)			4~20mA (0~600Ω) or 0~5V/1~5V (set using switch) (5kΩ~∞), specify when ordering *With limiter function and zero and span adjustment functions		
Ripple			1% P-P or less		
Response speed		Overall effective value	1s		
		Fundamental wave component	7s		
		n-th order/content (%)	7s (demand time interval can be set)		
		Demand time intervals	0~60s (in 10s intervals), 1~10min (in 1min intervals), 10~30min (in 5min intervals)		
Display			Liquid-crystal display lights when electricity is supplied (RUN, analog output pattern display). Various settings are possible (set as primary-side values).		
Auxiliary power supply			Can use any of 100-240VAC $^{+10}_{-15}$%, 50-60Hz, 100VDC $^{+40}_{-25}$%		
Consumption VA		Voltage circuit	0.1VA when approx. 110V, 0.2VA when approx. 220V (all phases)		
		Current circuit	Approx. 0.1VA (all phases)		
		Auxiliary power supply	Approx. 10VA (110VAC), approx. 12VA (220VAC), approx. 6W (100VDC)		
Outer dimensions (mm)			W120×H100×D101		
Terminal screws			Input terminals: M4, output terminals: M3.5		
Weight			0.6 kg		
Commercial frequency withstand voltage			Between input/output terminals as a whole and outer casing Between auxiliary power terminals as a whole and outer casing Between voltage input terminals as a whole and current input terminals as a whole Between auxiliary power terminals as a whole and input terminal as a whole Between input terminals as a whole and output terminals as a whole Between auxiliary power terminals as a whole and output terminal as a whole		2000VAC (50/60Hz) 1min
Insulation resistance			10MΩ or more at the same locations as above (500VDC)		

Remarks (1) Regarding harmonic output, the measurement of harmonics cannot be performed unless the fundamental wave content is 75% or more of the rated voltage.
(2) An analog output of approximately 100% or more may be output for a few seconds immediately after turning on the auxiliary power supply (until the internal voltage stabilizes).

■Mounting method

Four types of mounting are available.

The mounting methods are the same as those of the T-51 and T-101 series. Refer to the "Mounting method for T-51 and T-101 series" on p.151.

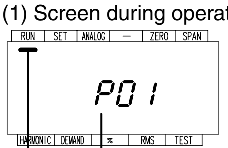
■Names and numbers of accessories

Mounting legs ···············4pcs.

Instruction manual ········1 copy

■Operation method

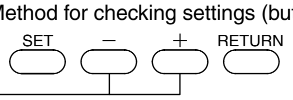
(1) Screen during operation



The analog output pattern is displayed.

The RUN indicator is lit.

(2) Method for checking settings (button functions)



When the ⊕ button or ⊖ button is pressed for 1s or more, the setting value checking mode is entered.
The respective setting values are displayed by consecutively pressing the ⊕ button or ⊖ button (see the "Setting method" for the screen).

Primary voltage ⟷ Primary current ⟷ Harmonic voltage ⟷ Harmonic current ⟷ Operation screen

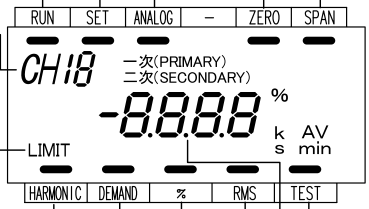
Transducers

T-120HA harmonics transducers [Insulated]

●Setting Method

[Display unit]

Setting indicators are lit when setting the corresponding item.

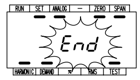


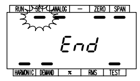
- Operation indicator: Lit during operation.
- Output channel display: Displays the output channel to be set.
- Output limit setting indicator: Lit when setting of output limit.
- Harmonics measurement setting indicator: Lit when setting harmonics measurement.
- Demand time interval setting indicator: Lit when setting of demand time interval for harmonics.
- Harmonics measurement pattern display: Displays the measurement pattern to be set. %: content (%) RMS: effective value
- Basic setting indicator
- Analog output setting indicator
- Zero adjust indicator
- Span adjust indicator
- Test indicator: Lit during analog output testing.
- Digital display, unit indicator: The respective setting values are displayed.

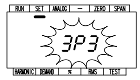
1 Setting mode

Press the SET button for 2s or more to enter the set up mode (setting menu will be displayed and "End" will blink).

Use the ⊕ and ⊖ buttons to select the item to be set, press the SET button to display the set up screen, and then use the ⊕ and ⊖ buttons to set the contents.
When the SET button is pressed for 1s or more while setting an item, setting of the remaining items is skipped and returns to the setting menu.







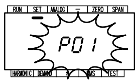
2 Basic settings (analog output pattern, primary/secondary voltages, primary current)

①Setting menu — ⊕⊖ buttons — ①Change the setting menu to indicate SET.

RETURN / SET

② Analog output pattern — ⊕⊖ buttons — ②Set the analog output pattern.

→P01⟷P02⟷P03←



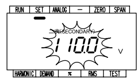
Analog output pattern	Measurement elements									
	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10
P01	$V_{(1)}$	$V_{(3)}$	$V_{(5)}$	$V_{(7)}$	$V_{(11)}$	$V_{(13)}$	ΣV_H	ΣI_H	Vrms	Irms
P02	$I_{(1)}$	$I_{(3)}$	$I_{(5)}$	$I_{(7)}$	$I_{(11)}$	$I_{(13)}$	ΣV_H	ΣI_H	Vrms	Irms
P03	$V_{(3)}$	$V_{(5)}$	$V_{(7)}$	$I_{(3)}$	$I_{(5)}$	$I_{(7)}$	ΣV_H	ΣI_H	Vrms	Irms

(1) (3) (5) (7) (11) (13): order of harmonic wave,
Σ: Overall harmonic wave, rms: Overall effective value

RETURN / SET

③Secondary voltage — ⊕⊖ buttons — ③Set the secondary voltage.

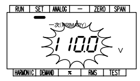
→110V⟷220V←



RETURN / SET

④Primary voltage — ⊕⊖ buttons — ④Set the primary voltage.

110V	6600V	66kV	220kV
220V	11kV	77kV	275kV
440V	13.2kV	110kV	550kV
1100V	16.5kV	132kV	SP
2200V	22kV	154kV	
3300V	33kV	187kV	

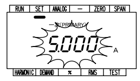


- If the secondary voltage is set to 220V in ③, setting of the primary voltage will be skipped.
- When SP is selected, setting the special primary voltage is required, in which the upper three digits can be set in the range of 110V to 550kV.

RETURN / SET

⑤Primary current — ⊕⊖ buttons — ⑤Set the primary current.

5A	25A	120A	750A	3000A	20kA
6A	30A	150A	800A	4000A	25kA
7. 5A	40A	200A	1000A	5000A	30kA
8A	50A	250A	1200A	6000A	SP
10A	60A	300A	1500A	7500A	
12A	75A	400A	1600A	8000A	
15A	80A	500A	2000A	10kA	
20A	100A	600A	2500A	12kA	

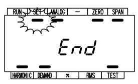


- When SP is selected, setting of the special primary current is required, in which the current can be set in the range of 5A to 30kA in using the following steps.
  - 5A~100A : in steps of 5A
  - 100A~1000A : in steps of 10A
  - 1000A~10kA : in steps of 100A
  - 10kA~30A : in steps of 1kA

SET

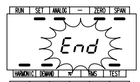
⑥Setting menu — ⊕⊖ buttons — ⑥ Continue set up in another setting menu or end set up.

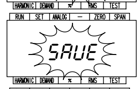
■ To change to another setting menu, use the ⊕ and ⊖ buttons to select the setting menu in which set up is to be performed.

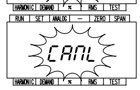


■ To end set up
Use the ⊕ and ⊖ buttons to select End.
Use the SET button to display SAVE, and then save the settings by pressing the SET button again.

■ To cancel the settings
When SAVE is displayed, use the ⊕ and ⊖ buttons to select CANL and then press the SET button to cancel the settings.







[Button functions]

SET − + RETURN

SET : The set up mode is entered when this is pressed for 2s or more.
Used for selecting an item to be set, and setting various items.

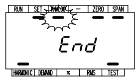
+ or − : Used for increasing/decreasing a setting value during set up, and for checking setting values.

RETURN : Used for selecting (setting back) an item to be set.

The underline in the setting specifications indicates the default value at the time of factory shipment.

3 Analog output settings (Analog output 1-5V/0-5V, output limit)

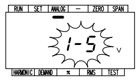
①Setting menu — + − buttons — ①Change the setting menu to indicate ANALOG.



RETURN SET

②Analog output 0-5 or 1-5 — + − buttons — ②Set the analog output to 1-5V or 0-5V.
→ 1-5V (1-5V output) ⟷ 0-5V(0-5V output) ←

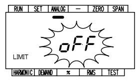
When this is changed, the zero adjust and span adjust are returned to the default values at the time of factory shipment.



- This setting is not available with the 4-20mA specifications for analog output.
- The same specifications are applied to all analog output CHs. Setting according to CH cannot be performed.

RETURN SET

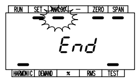
③Output limit — + − buttons — ③Set the analog output when the full scale is exceeded.
→ oFF (no limit) ⟷ on (with limit) ←



oFF (no limit): The upper-limit output is output to approx. +5% and the lower-limit output is output to approx. -5%.
on (with limit): The upper-limit output is output to approx. +1% and the lower-limit output is output to approx. -1%.

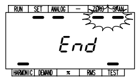
SET

④Setting menu — + − buttons — ④Continue setting in another setting menu or end setting.
(Refer to ⑥Setting menu of " 2 Basic settings.")



4 Analog output adjustment (zero adjust, span adjust)

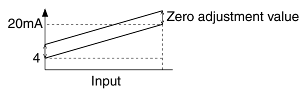
①Setting menu — + − buttons — ①Change the setting menu to indicate ZERO SPAN.

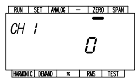


RETURN SET

②Analog output CH1 zero adjustment — + − buttons — ②Perform zero adjustment of the analog output CH1.
Set in the range of -30~0~30
- During current output, adjustment by approx. ±0.16mA can be performed.
- During voltage output, adjustment by approx. ±0.05V can be performed.

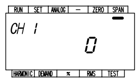
Movement of zero adjustment value



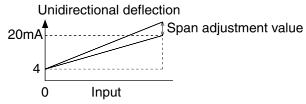


RETURN SET

③Analog output CH1 span adjustment — + − buttons — ③Perform span adjustment of the analog output CH1.
Set in the range of -75~0~75
- During current output, adjustment by approx. ±0.48mA can be performed.
- During voltage output, adjustment by approx. ±0.15V can be performed.



Movement during span adjustment

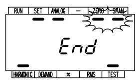


RETURN SET

④Perform zero adjustment and span adjustment of analog output CH2~CH10 in the same manner

SET

⑤Setting menu — + − buttons — ⑤Continue set up in another setting menu or end set up.
(Refer to ⑥Setting menu of " 2 Basic settings.")

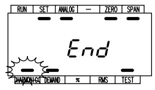


T-120HA harmonics transducers [Insulated]

●Setting method

5 Harmonics measurement settings (harmonic voltage, harmonic current)

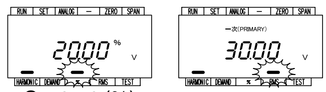
⊕⊖ buttons
①Setting menu — ①Change the setting menu to indicate HARMONIC.



RETURN SET

⊕⊖ buttons
②Harmonic voltage — ②Set the harmonic voltage measurement pattern.

% indication (content (%)) ⟷ RMS indication (effective value)

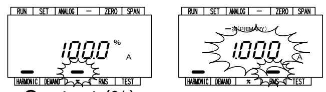


<Content (%)> <Effective value>

RETURN SET

⊕⊖ buttons
③Harmonic current — ③Set the harmonic current measurement pattern.

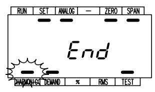
% indication (content (%)) ⟷ RMS indication (effective value) 1AXCT ratio
RMS indication (effective value) 5AXCT ratio ⟷ RMS indication (effective value) 3AXCT ratio



<Content (%)> <Effective value>

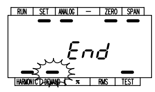
SET

⊕⊖ buttons
④Setting menu — ④Continue set up in another setting menu or end set up.
(Refer to ⑥Setting menu of "2 Basic settings.")



6 Demand time interval setting (harmonic demand time interval)

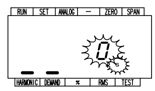
⊕⊖ buttons
①Setting menu — ①Change the setting menu to indicate DEMAND.



RETURN SET

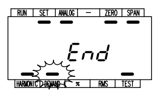
⊕⊖ buttons
②Harmonic demand time interval — ②Set the harmonic demand time interval.

0 seconds	40 seconds	3 minutes	7 minutes	15 minutes
10 seconds	50 seconds	4 minutes	8 minutes	20 minutes
20 seconds	1 minute	5 minutes	9 minutes	25 minutes
30 seconds	2 minutes	6 minutes	10 minutes	30 minutes



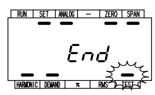
SET

⊕⊖ buttons
③Setting menu — ③Continue set up in another setting menu or end set up.
(Refer to ⑥Setting menu of "2 Basic settings.")



7 Analog output test

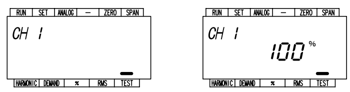
⊕⊖ buttons
①Setting menu — ①Change the setting menu to indicate TEST.



RETURN SET

⊕⊖ buttons
②Analog output CH1 test — ②Perform the analog output CH1 test.

Wait for the test to start → 0% output ⟷ 50% output ⟷ 100% output



<Wait for the test to start> <100% output>

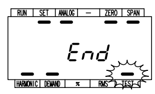
- While waiting for the analog output test to start, the measured value of the set analog output element is output.
- During analog output testing, output is performed without any relationship to the analog output element setting.
- After leaving the analog output CH1 test mode, the analog output returns to the ordinary operation state.
- The test mode is for checking the connection of the analog output when there is no input.
- The output during this test cannot be varied by analog output adjustment (zero adjust, span adjust).

RETURN SET

③Perform the analog output tests for CH2~CH10 in the same manner

SET

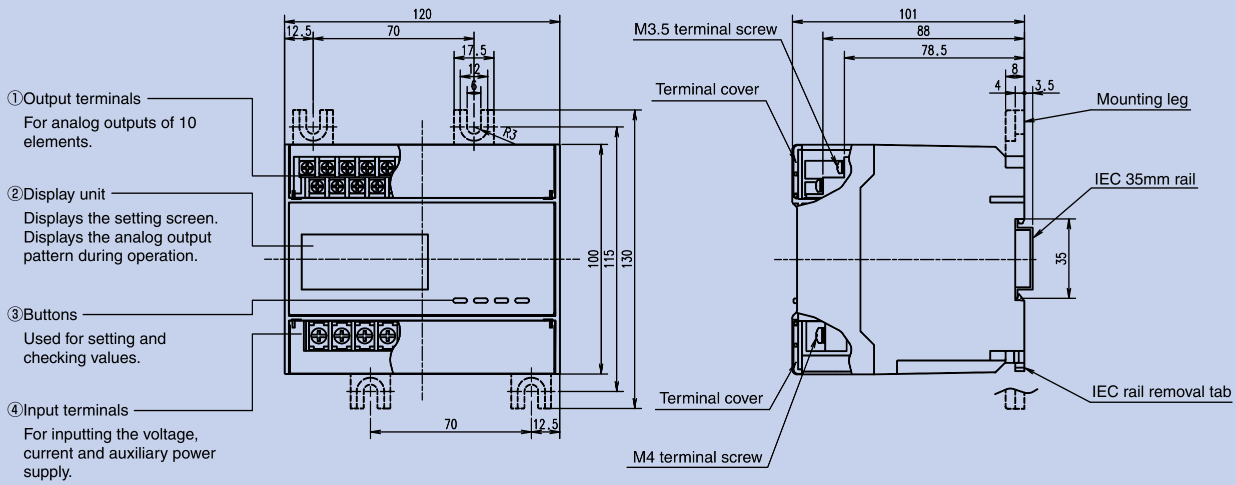
⊕⊖ buttons
④Setting menu — ④Continue set up in another setting menu or end set up.
(Refer to ⑥Setting menu of "2 Basic settings.")



Remarks: Refer to "Operation method" on p.166 regarding the method for checking settings.

Transducers

●Outer dimensions, and names and functions of respective parts



■Connection diagrams

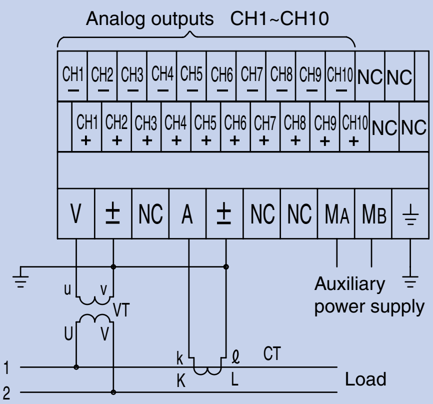


Fig. 1 With VT and CT

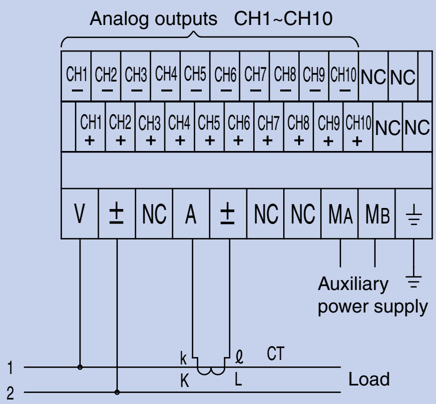


Fig. 2 With CT

- ●For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.
- ●Make sure to use after grounding the earth terminal (⏚). Provide a D earth (earth resistance: 100Ω or less) for grounding. Inadequate grounding may cause a malfunction.
- ●As the lead wires for connecting the output and load of a transducer, use two-core shielded wires or twisted-pair wires to prevent malfunction and failure due to transmission noise and disturbance surge. If the transmission distance exceeds 100m, current output specifications are recommended.
- ●Do not bring the output line close to or bundle it together with other power lines or the input lines (VT, CT, and auxiliary power supply).
- ●Ground the shield line of a shielded cable on the receiving side.
  However, depending on the circumstances of external noise, it may be better to ground it on the transducer side.
- ●NC is a connection-forbidden terminal.

■Ordering method

Model name	Output Voltage or current	Number of units
T-120HA	4~20mA	5

Special Application Transducers

Active power/active energy transducers [Insulated]

■Applications

Needs for measuring power and electric energy in various power generating equipment and factory production lines, monitoring operating conditions of power generating equipment, ascertaining generated active electric energy, and performing energy-specific unit management of factory production lines are increasing in recent years.

Needs for detailed monitoring of electricity usage quantities according to respective divisions for carrying out factory energy-saving measures and ascertaining the results of energy-saving measures are also increasing.

The Mitsubishi Electric T-51WWH transducer can be used for such applications.

■Features

●Compact and lightweight

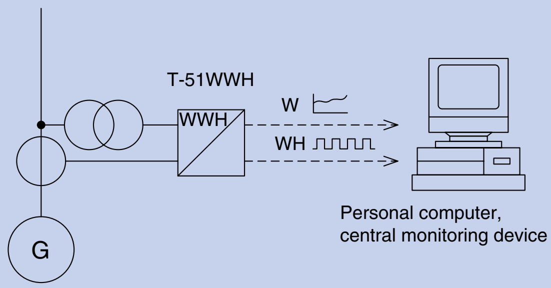
- The outer dimensions are 50(W)×100(H)×118mm(D).
- Weights only 0.5kg.
  Does not take up mounting space.

●Dual output of active power and active electric energy

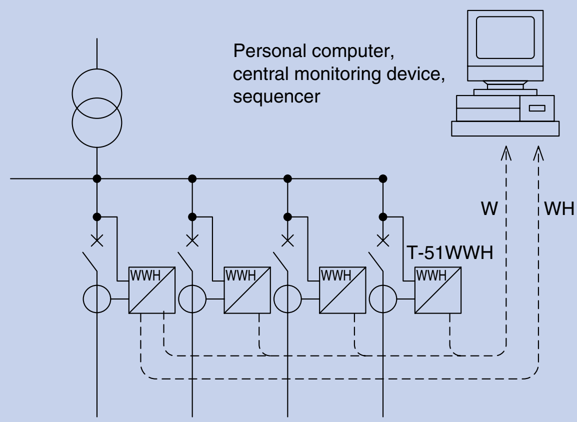
- Can measure the active power and active electric energy of a circuit and deliver two outputs with one unit. A signal of 4~20mA DC is output for active power and a pulse signal is output for active electric energy.
- Less expensive, more compact and more space-saving than a watthour meter and active power transducer combination.

■Usage examples

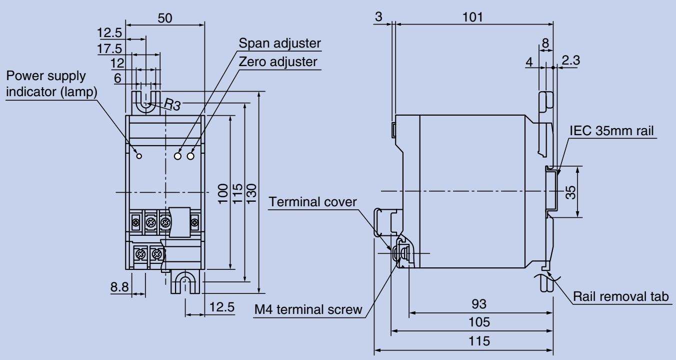
Measuring electricity produced by power generating equipment



Monitoring active power used by a production line



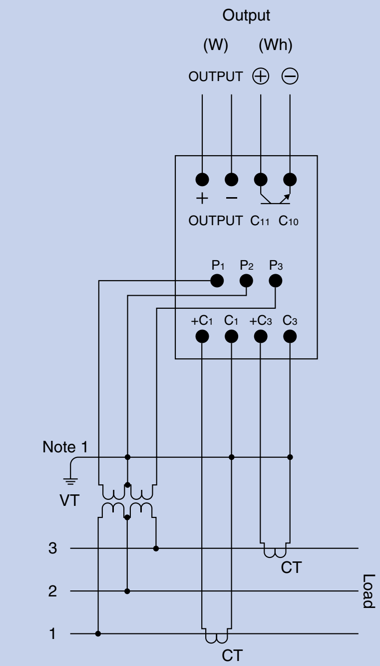
■Outer dimensions



■Specifications

Item	Specification	
Model name	T-51WWH	
Measurement element	Power	Electric energy
Input range	0~1000W (for 110V 5A input) 0~2000W (for 220V 5A input)	———
Phase-wire system	3-phase, 3-wire system or 1-phase, 3-wire system (Please specify when ordering)	
Ratings	110V 5A 50-60Hz or 220V 5A 50-60Hz (Please specify when ordering)	
Output	4~20mA DC (analog output) Load resistance: 0~525Ω	(1) Pulse unit: □kWh/P (primary side) (2) Pulse output ①Output form : open collector ②Output current : I_{OL} 30mA max ③Withstand voltage between collector and emitter : V_{CE} 35V max ④Pulse width : 100~150ms ⑤Leakage current : 100μA or less (V_{CE}=35V) (3) Measure only in positive direction
Accuracy	0.5	(Normal)
Auxiliary power supply	Unnecessary (supplied from input voltage between P_1~P_3, load: 5VA)	
Weight	0.5kg	
Consumption VA	Current circuit I_1 0.1VA I_3 0.1VA	Voltage circuit P_1-P_2 2.5VA P_2-P_3 2.5VA

■Connection diagram



Note 1. For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

■Manufacturable range

(1) Secondary side (available) power value

Input	Secondary side power value (available power value)	
	Standard specifications	Manufacturable range
110V 5A	0-1000W (standard specification)	VT, CT secondary-side power value: 500~1200W
220V 5A	0-2000W (standard specification)	VT, CT secondary-side power value: 1000~2400W

*VT, CT secondary side power value (available power value) $= \dfrac{\text{primary-side power value (W)}}{\text{VCT ratio}}$

(2) Pulse unit ······ Specify from among three of pulse units according to the full-load active power

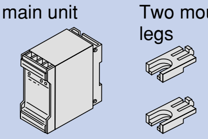
Full-load active power (kw)	1~less than 10kW	10~less than 100kW	100~less than 1000kW	1000~less than 10000kW	10000~less than 100000kW
Pulse unit (specify)	0.001kWh/P 0.01kWh/P 0.1kWh/P	0.01kWh/P 0.1kWh/P 1kWh/P	0.1kWh/P 1kWh/P 10kWh/P	1kWh/P 10kWh/P 100kWh/P	10kWh/P 100kWh/P 1000kWh/P

Example: 3-phase, 3-wire 200V 100/5A circuit

Full-load active power $= \dfrac{\sqrt{3}\times200\times100}{1000} = 34.6\text{kW}$ Based on the above table, specify from among 0.01kWh/P, 0.1kWh/P and 1kWh/P.

■Accessories

Parts included	One main unit	Two mounting legs



■Ordering method

Model name	Phase-wire	VT ratio	CT ratio	Primary side power value	Output	Output pulse unit	Number of units
T-51WWH	3P3W	440/110V	750/5A	0~600kW	4~20mA DC	1kWh/P	3

For △-Y connection, please specify as such.

Usage/Care/Storage/Request for

●Usage

- ●Install transducers in panels and use them as interface equipment for inputting DC signals corresponding to items measured into various devices such as central monitor panels, data loggers and measuring equipment.
- ●Transducers do not have any particular items requiring operation.

●Care

During periodic maintenance that accompanies power interruption, use a soft cloth to wipe off the dust and debris that collects on the surface of the transducer.
In the case of severe soiling, dip a cloth in a neutral detergent diluted with water, wring well, and then wipe the transducer surface.
Do not wipe using a chemically-treated dust cloth or cleanser such as benzene or thinner, otherwise discoloration or deformation of the surface may occur.

●Storage

Store transducers according to the following procedures. Removal work is to be performed by a person with proper technological expertise in electric works.

1 Removing a transducer

- ●Turn off the power to the circuits (input, auxiliary power) connected to the transducer. Confirm that no voltage is applied.
- ●Use a screwdriver to loosen and remove the terminal screws of the transducer.
- ●Perform the “Method for mounting” procedure on p.151 in reverse to remove the transducer.

2 Storage

For storage, refer to section 8 on p.109.

Maintenance and Inspection

●Request for maintenance and inspection

Perform maintenance and inspection as below to ensure continued use of transducers. (Inspection while power is interrupted must be performed either every six months or every year.)

1 Daily inspection

- ●Are there any broken parts in the outer peripheral portion?
- ●Are there any abnormal noises or odors?
- ●Have debris, dust or water drops accumulated?
- ●For the T-51 and T-101 series, is the power-on indicator lamp lit?
- ●For the T-120 series, is there any abnormality in the LCD screen?
- ●Is there any indication, record or alarm related to abnormal measurement data in central monitor, data logger or measurement equipment, that receives transducer output signals?

2 Periodic inspection

Inspect the following in addition to the above.

- ●Is there any abnormality in the output of the transducer? (Check during inspection of receiving/transforming equipment or plant.)
- ●Are any of the terminal screws loose? (Before performing this check, ensure that equipment is in the power interrupted state.)
- ●Is there any overheating or deformation due to stress to various components such as the terminals or outer casing?

Refer to “Checking output” on p.155 concerning inspection procedures.

Performance

Classification			Power transducers					
Product name			Current transducers		Voltage transducers		Active power transducers	
Model name	Box		T-51KAA T-51KSS T-51HAA T-51HSS	T-101SAA	T-51KAV T-51HAV	T-101SAV	T-101HW	T-101SW
Grade			0.5	0.25	0.5	0.25	0.5	0.25
Performance	Tolerance	% with respect to basal value	±0.5%	±0.25%	±0.5%	±0.25%	±0.5%	±0.25%
Performance	Influence of temperature	% with respect to basal value upon change of ±10° from 23°C	±0.5%	±0.25%	±0.5%	±0.25%	±0.5%	±0.25%
Performance	Influence of frequency *1	% with respect to basal value upon change of ±5% from rated frequency	±0.25% (both)	±0.13%	±0.25% (both)	±0.13%	±0.25% (both)	±0.13%
Performance	Influence of voltage	% with respect to basal value upon change of ±10% from rated voltage	—	—	—	—	±0.25%	±0.13%
Performance	Influence of current	% with respect to basal value upon change of 20% and 120% of the rating from rated frequency	—	—	—	—	—	—
Performance	Influence of power factor (reactive factor)	% with respect to basal value upon change from a power factor (reactive factor) of 1 to a LAG and LEAD of 0.5 each	—	—	—	—	±0.5%	±0.25%
Performance	Continuous overload		120% of rated input value		120% of rated input value		120% of rated input voltage 120% of rated current	
Performance	Instantaneous overload (input)	1.5 times rated voltage	—		Supply electricity for 10s duration 10 times at 10s intervals		Supply electricity for 10s duration 10 times at 10s intervals	
Performance	Instantaneous overload (input)	2 times rated current	Supply electricity for 10s duration 10 times at 10s intervals		—		Supply electricity for 10s duration 10 times at 10s intervals	
Performance	Instantaneous overload (input)	10 times rated current	Supply electricity for 3s duration 5 times at 5min intervals		—		Supply electricity for 3s duration 5 times at 5min intervals	
Performance	Withstand voltage	between electric circuit and outer casing	2000VAC for 1min					
Performance	Withstand voltage	between input circuit and auxiliary power supply	2000VAC for 1min (units without an auxiliary power supply are excluded)					
Performance	Withstand voltage	between input circuit and output circuit	2000VAC for 1min					
Performance	Withstand voltage	between output circuit and auxiliary power supply	2000VAC for 1min (units without an auxiliary power supply are excluded)					
Performance	Insulation resistance	Test voltage: 500VDC	10MΩ or more (at relative humidity of 80% or less)					
Performance	Noise resistance	Auxiliary power supply	±1500V, pulse width: 1μs					
Performance	Noise resistance	Input	±1500V, pulse width: 1μs (current input circuits are exempt)					
Performance	Impact resistance		490m/s² (50G), in 3 directions, 6 times with mounting legs mounted					
Performance	Vibration resistance		16.7Hz, double amplitude 4mm, in 3 directions, 1h each (corresponding to approx. 2.2G) with mounting legs mounted					
Usage conditions	Usage temperature range		-10~50°C (daily mean temperature: 35°C or less)					
Usage conditions	Storage temperature range		-20~60°C					
Usage conditions	Humidity		30~85% relative humidity					

***1** For models with the "both" specified, the % with respect to basal value that is the maximum value of the mutual difference between output values when the frequency is changed from 45 to 65Hz.

	Power transducers								
	Reactive power transducers		Phase angle transducers		Power-factor transducers		Frequency transducers		Voltage phase angle transducers
	T-101HVAR	T-101SVAR	T-101HPA T-101HPA(U)	T-101SPA(U)	T-101HPF(U)	T-101SPF(U)	T-51HF	T-101SF	T-101SY
	0.5	0.25	2.0	1.0	3.0	2.0	1.0	0.5	1.0
	±0.5%	±0.25	±2% (±2.4°)	±1% (±1.2°)	±3%	±2%	±1% (±0.1Hz)	±0.5% (±0.05Hz)	±1% (±1.2°)
	±0.5%	±0.25	±2% (±2.4°)	±1% (±1.2°)	±3%	±2%	±1% (±0.1Hz)	±0.5% (±0.05Hz)	±0.7% (±0.84°)
	±0.25% (both)	±0.13%	±1% (±1.2°)	±0.5% (±0.6°)	±1.5%	±1%	—	—	±0.5% (±0.6°)
	±0.25%	±0.13%	±1% (±1.2°)	±0.5% (±0.6°)	±1.5%	±1%	±0.5% (±0.05Hz)	±0.25% (±0.025Hz)	±0.5% (±0.6°)
	—	—	±2% (±2.4°)	±1% (±1.2°)	±3%	±2%	—	—	—
	±0.5%	±0.25%	—	—	—	—	—	—	—
	120% of rated input voltage 120% of rated current		120% of rated input voltage, 120% of rated current				120% of rated voltage		
	Supply electricity for 10s duration 10 times at 10s intervals		Supply electricity for 10s duration 10 times at 10s intervals				Supply electricity for 10s duration 10 times at 10s		
	Supply electricity for 10s duration 10 times at 10s intervals		Supply electricity for 10s duration 10 times at 10s intervals				—		
	Supply electricity for 3s duration 5 times at 5min intervals		Supply electricity for 3s duration 5 times at 5min intervals				—		
	2000VAC for 1min								
	2000VAC for 1min								
	2000VAC for 1min								
	2000VAC for 1min								
	10MΩ or more (at relative humidity of 80% or less)								
	±1500V, pulse width: 1μs								
	±1500V, pulse width: 1μs (current input circuits exempt)								
	490m/s² (50G), in 3 directions, 6 times with mounting legs mounted								
	16.7Hz, double amplitude 4mm, in 3 directions, 1h each (corresponding to approx. 2.2G) with mounting legs mounted								
	-10~50°C (daily mean temperature: 35°C or less)								
	-20~60°C								
	30~85% relative humidity								

***2** The performance value of the phase angle transducer in parenthesis ( ) corresponds to input conversion values for inputs of LEAD 60°~0~LAG 60°.
***3** The performance value of the frequency transducer in parenthesis ( ) corresponds to input conversion values for inputs of 45 to 55Hz or 55 to 65Hz.
***4** The performance value of the voltage phase angle transducer in parenthesis ( ) corresponds to input conversion values for inputs of LEAD 60°~0~LAG 60°.

Performance

Classification			Power transducers										
Product name			DC level transducers	DC reverse voltage transducers	Isolators	High-speed isolators	Limiter	Adders	Temperature transducers				First-order lag transducers
									Resistance bulb		Thermocouple		
Model name	Box		T-51DL	T-51DR	T-101IS	T-101ISQ	T-51LM	T-101AD	T-51TP	T-101TPZ	T-101TC	T-101TCZ	T-51DS
Grade			0.25	0.25	0.25	0.25	0.25	0.5	0.5	0.5	0.5	0.5	0.5
Performance	Tolerance	% with respect to basal value	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%
	Influence of temperature	% with respect to basal value upon change of ±10° from 23°C	±0.25%	±0.25%	±0.25%	±0.25%	±0.25%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%
	Influence of frequency *1	% with respect to basal value upon change of ±5% from rated frequency	—	—	—	—	—	—	—	—	—	—	—
	Influence of voltage	% with respect to basal value upon change of ±10% from rated voltage	—	—	—	—	—	—	—	—	—	—	—
	Continuous overload		120% of rated input value										
	Instantaneous overload	1.5 times rated voltage	Supply electricity for 10s duration 10 times at 10s intervals (temperature transducers excluded)										
		2 times rated current	Supply electricity for 10s duration 10 times at 10s intervals (temperature transducers excluded)										
	Withstand voltage	between electric circuit and outer casing	2000VAC for 1min *2										
		between input circuit and auxiliary power supply	2000VAC for 1min										
		between input circuit and output circuit	—		2000VAC/DC for 1min	2000VAC/DC for 1min	—			2000VAC/DC for 1min	—	2000VAC/DC for 1min	—
		between output circuit and auxiliary power supply	2000VAC for 1min										
	Insulation resistance	Test voltage: 500VDC	10MΩ or more (at relative humidity of 80% or less)										
	Noise resistance	Auxiliary power supply	±1500V, pulse width: 1μs										
		Input	±500V, pulse width: 1μs (current input specifications are exempt)										
	Impact resistance		490m/s² (50G), in 3 directions, 6 times with mounting legs mounted										
	Vibration resistance		16.7Hz, double amplitude 4mm, in 3 directions, 1h each (corresponding to approx. 2.2G) with mounting legs mounted										
Usage conditions	Usage temperature range		-10~50°C (daily mean temperature: 35°C or less)										
	Storage temperature range		-20~60°C										
	Humidity		30~85% relative humidity										

*1 For models with the "both" specified, the % with respect to basal value that is the maximum value of the mutual difference between output values when the frequency is changed from 45 to 65Hz.

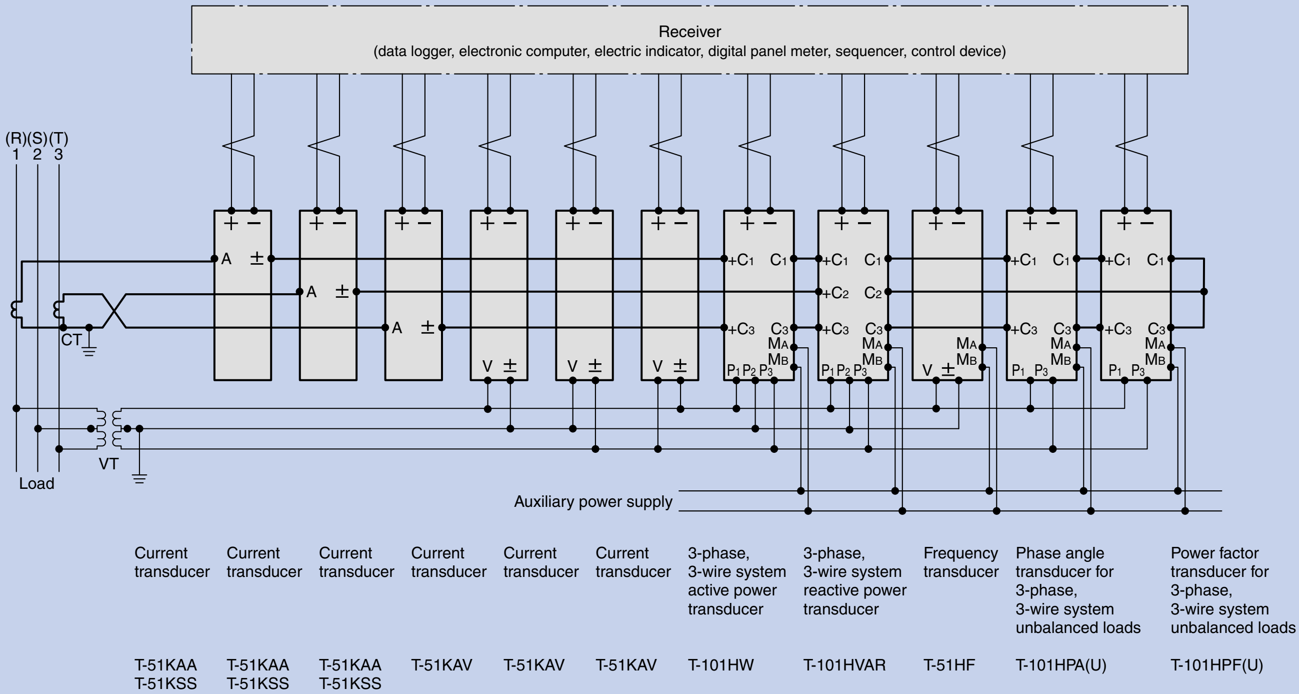
	Peripheral transducers				
	AC current demand transducers (moderate time interval)	AC voltage demand transducers (moderate time interval)	Current transducers with power flow detection	Leakage current transducers	Voltage drop detectors Voltage rise detectors
	T-101HAA(DS)	T-101HAV(DS)	T-101HAA(D)	T-51LG T-51LGF	T-101VDL T-101VDH
	0.5	0.5	0.5	1.0	—
	±0.5%	±0.5%	±0.5%	±1.0%	setting accuracy ±5%
	±0.5%	±0.5%	±0.5%	±1.0%	—
	±0.25% (both)	±0.25% (both)	±0.25% (both)	±1.0% *3	—
	—	—	±0.25%	—	—
	120% of rated input value				
	Supply electricity for 10s duration 10 times at 10s intervals (temperature transducers excluded)				
	Supply electricity for 10s duration 10 times at 10s intervals (temperature transducers excluded)				
	2000VAC for 1min				
	2000VAC for 1min				
	2000VAC/DC for 1min (in combination with a ZCT for leakage current transducers)				
	2000VAC for 1min				
	10MΩ or more (at relative humidity of 80% or less)				
	±1500V, pulse width: 1μs				
	±1500V, pulse width: 1μs (leakage current transducers exempt)				
	490m/s² (50G), in 3 directions, 6 times with mounting legs mounted				
	16.7Hz, double amplitude 4mm, in 3 directions, 1h each (corresponding to approx. 2.2G) with mounting legs mounted				
	-10~50°C (daily mean temperature: 35°C or less)				
	-20~60°C				
	30~85% relative humidity				

***2** For T-51LG, the % with respect to basal value that is the maximum value of the mutual difference between output values when the frequency is changed from 40 to 2kHz.
For T-51LGF, the % with respect to basal value that is the maximum value of the mutual difference between output values when the frequency is changed from 45 to 60Hz.

Overall Connection Diagrams

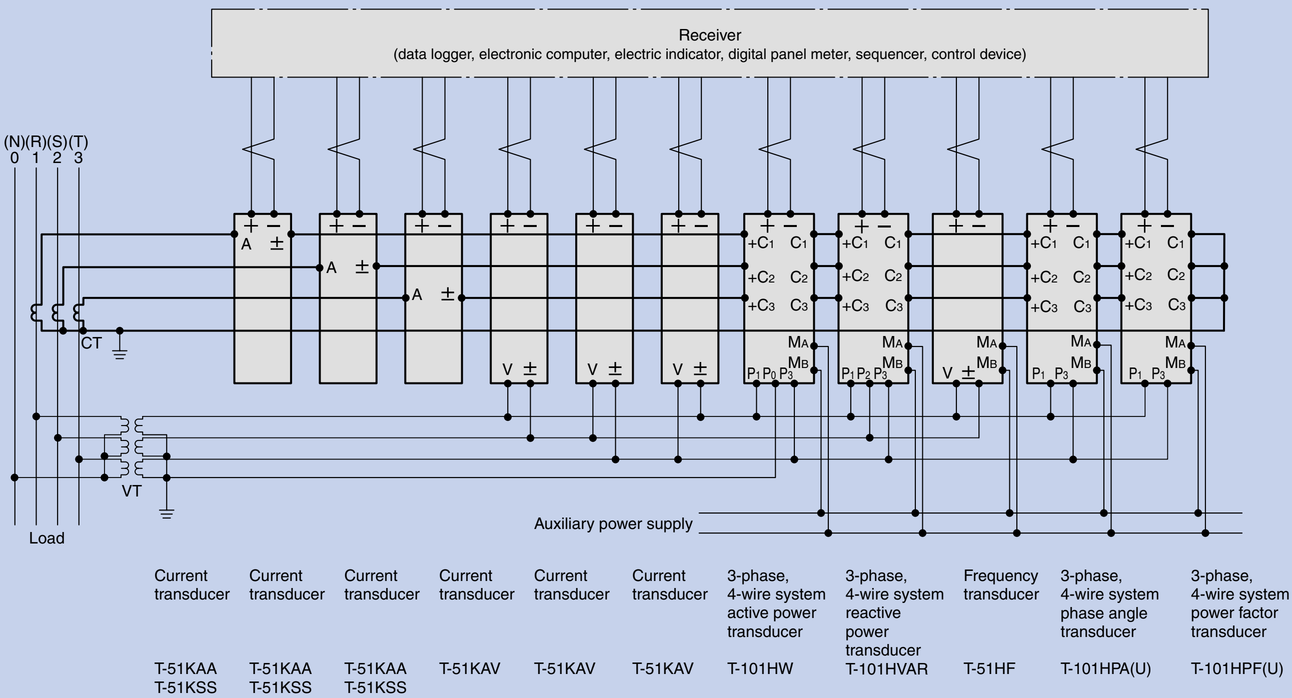
●Fixed-load output (K Series)

Fig. 1 3-phase, 3-wire circuit



- The active power, reactive power, frequency, phase angle, and power factor transducers are H Series transducers.
- For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

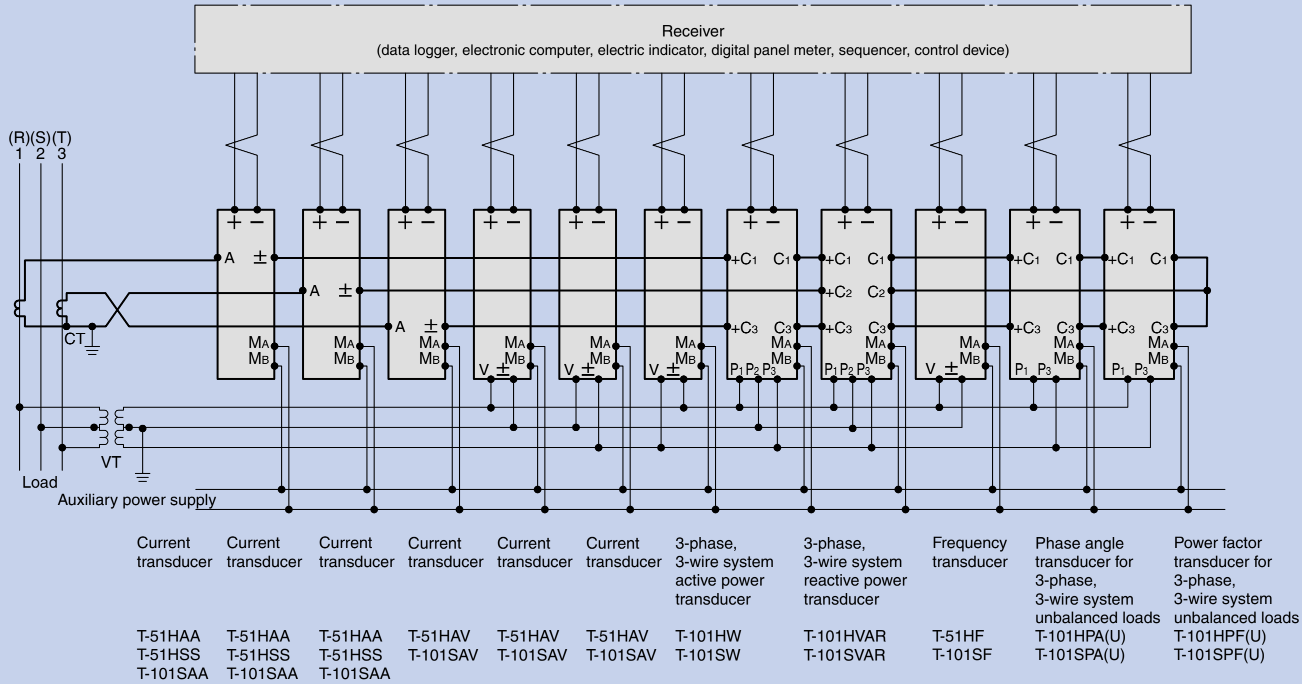
Fig. 2 3-phase, 4-wire circuit



- The active power, reactive power, frequency, phase angle, and power factor transducers are H Series transducers.
- For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.

●Constant-current/Constant-voltage output (H Series, S Series)

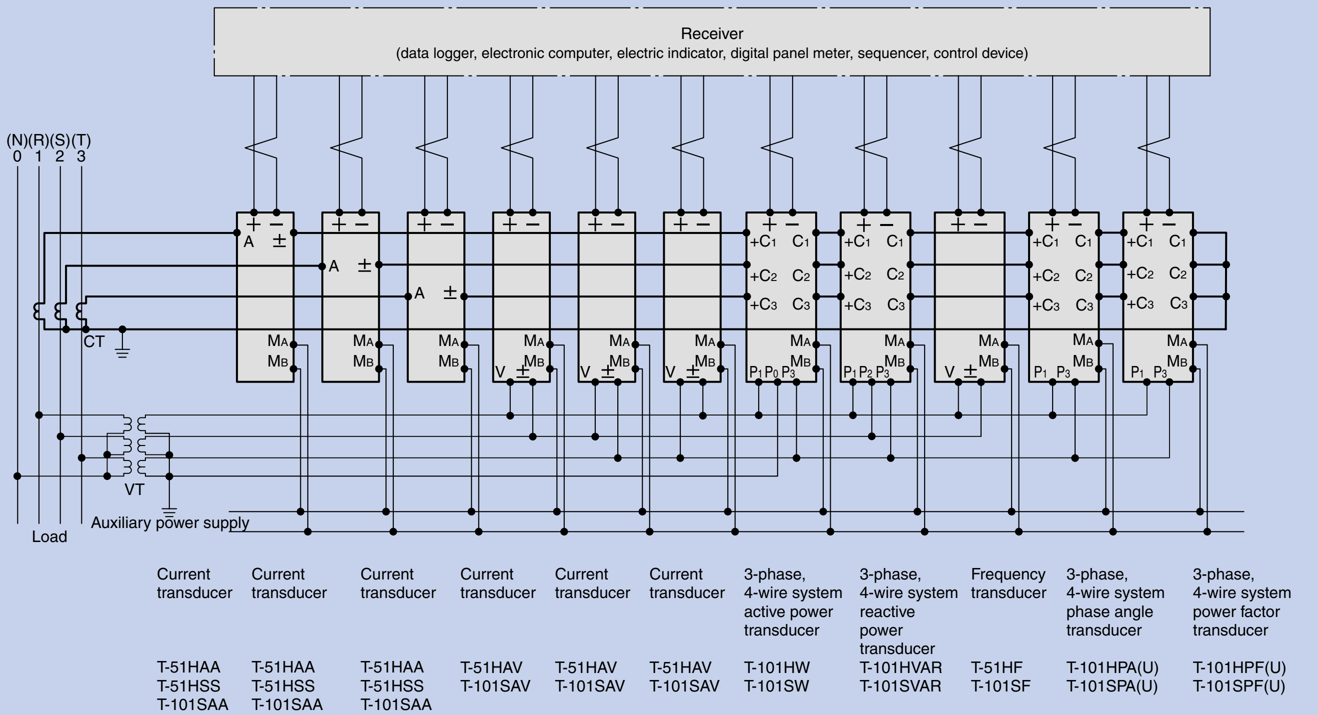
Fig. 3 3-phase, 3-wire circuit



• **For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.**

If the auxiliary power supply is DC, connect the ⊕ side to "MA" and the ⊖ side to "MB".

Fig. 4 3-phase, 4-wire circuit



• **For low-voltage circuits, grounding of the secondary sides of the instrument voltage transformer and current transformer is unnecessary.**

If the auxiliary power supply is DC, connect the ⊕ side to "MA" and the ⊖ side to "MB".

Glossary of Terms

●Fixed-load output

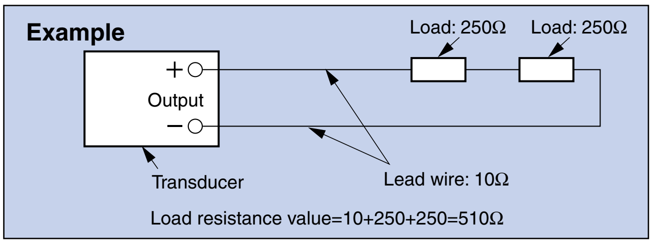
An output system that can be used only with the load resistance value connected to the output being a single, predetermined value and with which an error occurs if the load resistance value differs from the specified value.

●Constant-voltage output/Constant-current output

An output system that can be used if the load resistance value connected to the output is within a predefined range, and is suited for cases where the load resistance value is unspecified and cases where future load increase is predicted.

●Load

The full load resistance value connected to the output terminals of a transducer.



●Output span

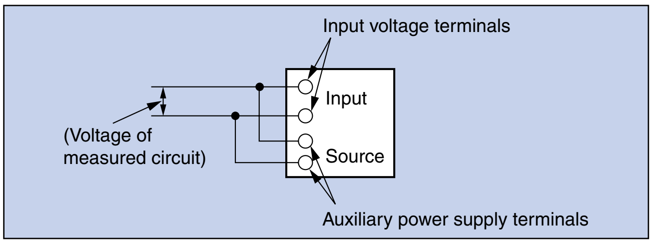
The difference between the upper-limit value and lower-limit value of an effective output range.

Example 1: For an output of 5V, the span is 5V.
Example 2: For an output of 4~20mA, the span is 16mA.
Example 3: For an output of -5~0~5V, the span refers respectively to the + side span of +5V and the – side span of -5V.

●Auxiliary power supply (control power supply)

An AC power supply or DC power supply necessary for operation of the transducer and supplied from the exterior (i.e., not supplied from the measured circuit). If the voltage of the measured circuit is comparatively stable, it can be used for connection to the auxiliary power-supply terminals.

Example: Connection to auxiliary power supply from a measured circuit.



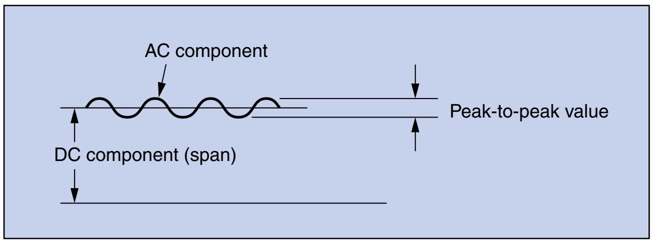
●Accuracy (grade)

A term expressing the accuracy of a transducer classified according to the tolerance and limits of influence (influence of temperature, influence of frequency and other allowable limits of performance).

Example: The tolerance of a grade 0.5 transducer is within ±0.5%.
The tolerance for an input of 1000W and output of 5V is: 5V×(±0.5%)=±25mV.

●Output ripple (P-P)

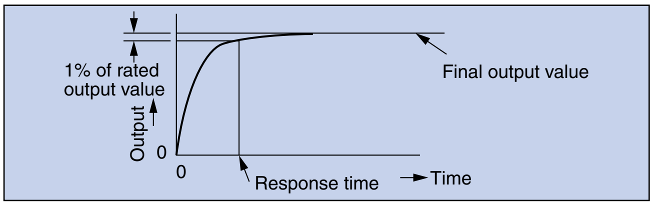
An AC component contained in the output expressed by a ratio of the peak-to-peak value of the AC component and the span.



●Response time

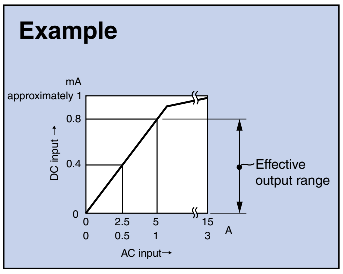
The time it takes for the output to settle within a specified range of a final stationary value when the input changes suddenly from one fixed value to another.

Ordinarily refers to the time it takes for the output to settle within ±1% of the rated output value centered at a final output value when a step input that gives rise to an output change of from 0% to approximately 90% of the effective output range or from 100% to approximately 10% of the effective output range is applied.



●Effective output range

A range within the output range in which predefined performance is guaranteed.



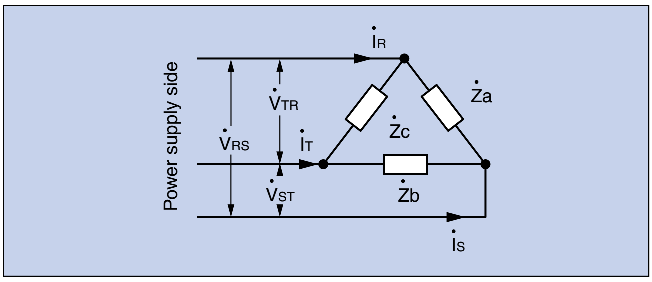
The diagram to the left is an input-output characteristics diagram for T-51KSS and T-51HSS. The effective output range is 0~0.8mA (the output range of 0.8~1mA is not an effective output range).

Saturation output

Although the output in the range 0~0.8mA is proportional to the input in the diagram above, the proportion of change of output gradually decreases and saturates with respect to the proportion of change of input in the 0.8~1mA region. Such an output is called “saturation output”.

●3-phase balanced circuit

When loads $\dot{Z}a$, $\dot{Z}b$ and $\dot{Z}c$ that are connected to a 3-phase power supply are all equal, the respective voltages $\dot{V}_{RS}$, $\dot{V}_{ST}$ and $\dot{V}_{TR}$ are all equal in magnitude and phase difference among the respective voltages. The respective line currents $\dot{I}_R$, $\dot{I}_S$ and $\dot{I}_T$ are also all equal in magnitude and phase difference. Such a circuit is called a 3-phase balanced circuit.



●3-phase unbalanced loads

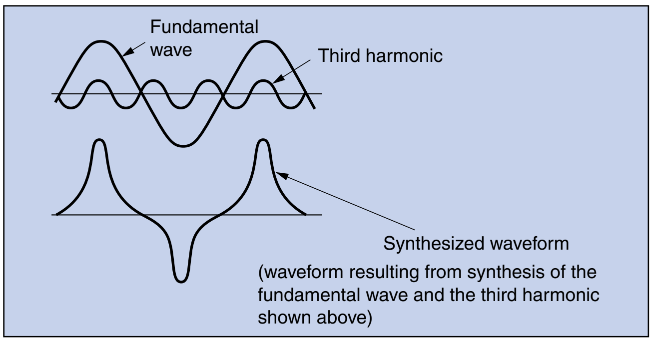
When loads $\dot{Z}a$, $\dot{Z}b$ and $\dot{Z}c$ that are connected to a 3-phase power supply are not equal, the respective line currents $\dot{I}_R$, $\dot{I}_S$ and $\dot{I}_T$ are also not equal in magnitude and phase difference among the respective currents. Such loads are called 3-phase unbalanced loads.

Among phase angle transducers, there are those that can be used with 3-phase unbalanced loads (for 3-phase unbalanced loads) and those that cannot be used with 3-phase unbalanced loads (for 3-phase balanced circuit).

●Third harmonic

A voltage or a current with frequency that is 3 times that of the fundamental frequency voltage or current (fundamental wave: a 60Hz AC voltage or current in the case of an input frequency of 60Hz).

When a third harmonic or other harmonic is contained, the waveform becomes distorted and becomes a cause of measurement error.



●Burnout

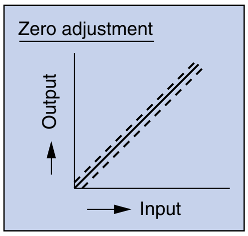
A term often used with temperature transducers and refers to a function by which, when an input line into the temperature transducer or a temperature sensor beyond the input line, becomes disconnected, the output is rises above the effective output range (normally, the output is increased ... positive burnout).

●Cold junction compensator

A thermocouple sensor's electromotive force is input to a thermocouple temperature transducer. The voltage corresponds to a temperature less than T°C, the temperature measured at the point only affected by the ambient temperature, Ta°C, thereby compensating for the Ta°C part. This action is performed by a cold junction compensator, which is either attached externally to the transducer or built-in.

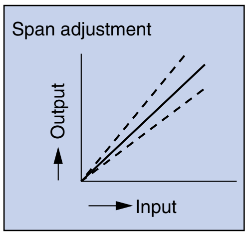
●Zero adjuster

With a zero adjuster, the output range is increased or decreased by a fixed value (approximately ±0.3~±5% with respect to the span) as shown in the figure below.



●Span adjuster

With a span adjuster, the output increases or decreases at the same proportion (±3%~±15% with respect to the rated output) with zero input as the base point.



eco Changes for a greener tomorrow

Eco Changes is the Mitsubishi Electric Group's environmental statement, and expresses the Group's stance on environmental management. Through a wide range of businesses, we are helping contribute to the realization of a sustainable society.

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