YOKOGAWA

Compact Size & Superior Cost Performance Transducers

0.5 Class Transducer for Power Application

2371A – 2378A

Mounting available for panel or DIN rail

- Screw mounting
- 40 mm width (DC-DC Isolator, AC Voltage / Current / Frequency)
- 55 mm width (Power / Reactive Power / Phase / Power Factor)
- Selective from various kind of output
- 600 V AC input rating available
- Compliance with JIS C1111-1989

Bulletin 2370A-E

0.5 Class Transducer Lineup

- Available for DIN rail or panel mounting.
- Please contact with Yokogawa if not found the required transducer in this lineup.
- Multi-transducer (2479) is described in separate catalog.

Application		Model		Input rating	Output rating / External load	Tole-rance	Output ripple	*1 Respo-nce	Frequ-ency	Input power	Auxiliary power	Input range	Weight
DC-DC Isolator (photo-coupler isolation)		2371A	00	DC50 mV 1 V 5 V 1-5V 1 mA 4-20 mA	5 V/1 kΩ or more 10 V/2 kΩ or more 1-5 V/1 kΩ or more 1 mA/10 kΩ or less 5 mA/2 kΩ or less 4-20 mA/500 Ω or less	±0.5% of span	1%p-p MAX	0.5 s	DC	V: 1 mA A: 500 mV drop	required	——	380g
AC voltage, current (average rectified)		2372A	00	AC1 A 5 A 110 V 120 V 150 V 220 V 240 V 300 V 480 V 600 V	5 V/2 MΩ or more 10 V/2 kΩ or more 1-5 V/1 kΩ or more 1 mA/*4 5 mA/2 kΩ or less 4-20 mA/500 Ω or less	±0.5% of span	1%p-p MAX	1 s	45-65 Hz	1 VA	*4 not req'd for 5 V, 1 mA, but req'd for others	——	350g
AC voltage, current (RMS rectified)		2373A	00		10 mV/10 kΩ or more 5 V/2 MΩ or more 10 V/2 kΩ or more 1-5 V/1 kΩ or more 1 mA/*4 5 mA/2 kΩ or less 4-20 mA/500 Ω or less	±0.5% of span	1%p-p MAX	1 s	45-65 Hz	1 VA		——	350g
AC volt, current (true RMS rectified)		2374A	00		same as 2371 A	±0.5% of span	1%p-p MAX	0.5 s	45-10 kHz	0.5 VA	required	——	320g
Power	1ø2w	2375A	10		*2 (±) 10 mV/10 kΩ or more (±) 5 V/1 kΩ or more (±) 10 V/2 kΩ or more 1-5 V/1 kΩ or more (±) 1 mA/10 kΩ or less (±) 5 mA/2 kΩ or less 4-20 mA/500 Ω or less 4-12-20 mA/500 Ω or less	±0.5% of span	1%p-p MAX	0.7 s	45-65 Hz	V: 3 VA in w/o aux power, 1 VA in w/ aux power A: 1 VA	not required	V: ± 10% w/o aux power, 0-120% w/ aux power A: 0-200% of rating	450g
	1ø3w		20										
	3ø3w		30										
	3ø4w		40										
Reactive power	1ø2w	2376A	10	110 V/1 A 110 V/5 A 220 V/1 A 220 V/5 A	± 10 mV/10 kΩ or more ± 5 V/1 kΩ or more ± 10 V/2 kΩ or more 1-5 V/1 kΩ or more ± 1 mA/10 kΩ or less ± 5 mA/2 kΩ or less 4-12-20 mA/500 Ω or less	±0.5% of span	1%p-p MAX	0.7 s	45-65 Hz			V: ± 10% w/o aux power, 20-120% w/ aux power A: 0-200% of rating	450g
	1ø3w		20										
	3ø3w		30										
	3ø4w		40										
Phase	1ø2w	2377A	10	120 V/1 A 120 V/5 A 240 V/1 A 240 V/5 A	± 10 mV/10 kΩ or more ± 6 V/1.2 kΩ or more 1-5 V/1 kΩ or more ± 1 mA/10 kΩ or less ± 5 mA/2 kΩ or less 4-12-20 mA/500 Ω or less	±2°	1%p-p MAX	0.5 s	45-65 Hz	V: 2.5 VA in w/o aux power, 0.5 VA in w/ aux power A: 1 VA		V: ± 10% w/o aux power, 50-120% w/ aux power A: 10-140% of rating	370g
	1ø3w		20										
	3ø3w		30										
	3ø4w		40										
Power factor	1ø2w	2377A	11		same as 2376 A	±3° (when ±60°)	1%p-p MAX	0.5 s	45-65 Hz		or required		370g
	1ø3w		21										
	3ø3w		31										
	3ø4w		41										
Frequency		2378A	01	45-55 Hz 110,220 V 120,240 V	same as 2371 A	±0.1Hz	1%p-p MAX	1 s	45-55 Hz	1.5 VA in w/o aux power, 0.5 VA in w/ aux power		V: ± 10% w/o aux power, 50-120% w/ aux power	320g
			02	55-65 Hz 110,220 V 120,240 V					55-65 Hz				
			03	45-65 Hz 110 V 120 V 220 V 240 V	5 V/2 kΩ or more 10 V/2 kΩ or more 1-5 V/1 kΩ or more 1 mA/10 kΩ or less 5 mA/2 kΩ or less 4-20 mA/500 Ω or less 4.5-6.5 V/2 kΩ or more 4.5-6.5 mA (1500 Ω or less)	±0.2Hz	1%p-p MAX	1 s	45-65 Hz				

Auxiliary power supply: AC 100/110 V, 120 V, 200/220 V, 240 V ±15%, consumption: 2 VA
DC 24 V/48 V ±15%, 85-143 V consumption: 1.5 W

*1 Response time is to reach 99% of output.
*2 Power flow measurement results in output of + or - polarity. Output polarity code to be specified.
*3 Type of no auxiliary power needs auxiliary power code to be specified.
*4 5V/1 kΩ or more and 1 mA/10 kΩ or less: auxiliary power required.

0.5 Class Transducer Model Coding System

237□A□□ — □□ — □□□ — □ — □

1. Model	2. Input rating	3. Output rating	4. Aux. power supply	5. Out polarity
[first 3 digits] 237 : [last 4 digits] 0A00 : model series 1A00 : DC-DC isolator 2A00 : AC Voltage, current (average rectified) 3A00 : AC Voltage, current (RMS rectified) 4A00 : AC Voltage, current (true RMS rectified) 5:□□: power 6:□□: reactive power 7:□□: phase 10 : 1ø2w 20 : 1ø3w 30 : 3ø3w 40 : 3ø4w 7:□□: power factor 11 : 1ø2w 21 : 1ø3w 31 : 3ø3w 41 : 3ø4w 8:□□: frequency 01 : 45-55 Hz 02 : 55-65 Hz 03 : 45-65 Hz	01: DC50 mV 02: DC1 V 03: DC5 V 04: DC10 V 05: DC25 V 06: DC60 V 07: DC1-5 V 21: DC1 mA 24: DC4-20 mA 31: AC110 V 32: AC150 V 33: AC220 V 34: AC300 V 35: AC1 A 36: AC5 A 37: AC120 V 38: AC240 V 39: AC480 V 40: AC600 V 41: 110 V/1 A 42: 110 V/5 A 43: 220 V/1 A 44: 220 V/5 A 45: 120 V/1 A 46: 120 V/5 A 47: 240 V/1 A 48: 240 V/5 A	VLS : 0-5 V VMT : 0-10 V VHB : ±10 mV VLU : ±5 V VLY : ±6 V (phase meter) VMS : ±10 V VMB : 4.5-6.5 V (frequency meter) VLR : 1-5 V AFA : 0-1 mA AFX : 0-5 mA AFB : ±1 mA AFZ : ±5 mA AHE : 4-20 mA AGF : 4.5-6.5 mA (frequency meter)	1: AC100/110 V (50/60Hz) ±15% 2: AC120 V (50/60Hz) ±15% 3: AC200/220 V (50/60Hz) ±15% 4: AC240 V (50/60Hz) ±15% 7: DC24/48 V±15% 8: DC85 V-143 V N: none	2375A N : non polarity R : polarity(power flow) 2376A, 2377A M : negative polarity (-) at lead (+) at lag P : positive polarity (+) at lead (-) at lag lead : advance current lag : advance voltage

Specified item at order

- model
- input rating, output rating
- reactive power, phase, power factor needs relation of input(lead, lag) and output polarity.
- auxiliary power supply
- cariblation power, reactive power (for power, reactive power meter)
- VT ratio, CT ratio

Fig-2 Relation of product model and specfication code (input rating)

input / rating / code / model	DC voltage, current									AC voltage, current, frequency										power, reactive, phase, factor							
	50mV	1V	5V	10V	25V	60V	1-5V	1mA	4-20mA	110V	120V	150V	220V	240V	300V	480V	600V	1A	5A	110V 1A	110V 5A	220V 1A	220V 5A	120V 1A	120V 5A	240V 1A	240V 5A
	01	02	03	04	05	06	07	21	24	31	37	32	33	38	34	39	40	35	36	41	42	43	44	45	46	47	48
2371A	○	○	○	○	○	○	○	○	○																		
2372A										○	○	○	○	○	○	○	○	○	○								
2373A										○	○	○	○	○	○	○	○	○	○								
2374A										○	○	○	○	○	○	○	○	○	○								
2375A																				○	○	○	○	○	○	○	○
2376A																				○	○	○	○	○	○	○	○
2377A																				○	○	○	○	○	○	○	○
2378A										○	○		○	○													

○ : standard product

Fig-3 Relation of product model and specfication code (output rating)

output / rating / code / model	DC voltage								DC current					
	5V	10V	±10mV	±5V	±6V	±10V	4.5-6.5V	1-5V	1mA	5mA	±1mA	±5mA	4-20mA	4.5-6.5mA
	VLS	VMT	VHB	VLU	VLY	VMS	VMB	VLR	AFA	AFX	AFB	AFZ	AHE	AGF
2371A	○	○						○	○	○			○	
2372A	○	○						○	○	○			○	
2373A	○	○						○	○	○			○	
2374A	○	○						○	○	○			○	
2375A	○	○	○	○		○		○	○	○	○	○	○	
2376A			○	○		○		○			○	○	○	
2377A□0			○	○	○			○			○	○	○	
2377A□1			○	○		○		○			○	○	○	
2378A 01 02	○	○						○	○	○			○	
2378A 03	○	○					○	○	○	○			○	○

○ : standard product

Specific Features

- Compact width 40 mm

40 mm: DC-DC Isolator, AC current, AC voltage and Frequency.
55 mm: Power, Reactive power, Phase and power Factor
Terminal cover: provided for every type.

- Auxiliary power applications

Applicable from non auxiliary power to AC or DC auxiliary power.

- Various output signals

Constant voltage outputs: 5 V, 10 V, 1 - 5 V
Constant current outputs: 1 mA, 5 mA, 4-20 mA
Especially, the constant current type canconnect a load corresponding to 10 V. So, it can stand with long distance wiring for such telemeter transmission and general industrial measurement.

- True RMS rectified type 2374A

For general application and high harmonic distortion wave caused by thyristor, the true RMS rectified type with logarithm conversion is recommended.

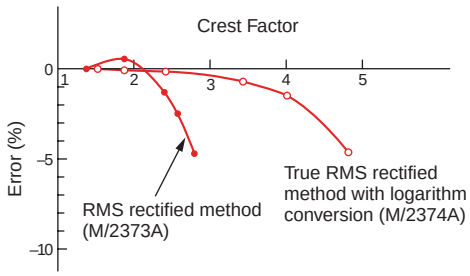

Fig-1 Relation between Crest factor and error in alternating current transducer

General Specification (JIS C1111-1989 complied)

Type of Input:	Floating
Working Temp.:	–10-+50°C
Working Humidity:	20-85% R.H.
Storage Temp.:	–20-+60°C
Instant Over-load:	Current - - - 10 times 5sec at rating 40 times 1sec at rating Voltage - - - 2 times 10sec at rating
Output adjustable range:	more than ±3% (depend on rating) External adjustment is available.
Insulation:	500 V DC, more than 100 MΩ - between terminal and case. - between each terminal (input, output, ground and auxiliary power terminal)
Withstand:	1) 2,600 V AC, 50/60 Hz, 1 minutes - between input terminal and case (including ground) - between input and output terminal - between auxiliary power terminal and input terminal or case (including ground) 2) 1,000 V AC, 50/60 Hz, 1 minutes - between output terminal and case (including ground)
Impulse:	5,000 V, (1.2 × 50) µsec - between whole of input and power terminal and external case - between whole of input and output and external case
Casing:	1) Case Firing retardant ABS resin (equal to UL94-V0) 2) Terminal board Glass-fiber contained PBT (equal to UL94-V0) 3) Terminal cover Clear poly-carbonade 4) Color : Black
Terminal screw:	M4
Dimensions:	Refer to outline drawing
Accessary:	Instruction Manual

Manufacturing variation of power/reactive power transducer

The transducer without specification code is adjusted by the following.

	Standard Rating		1 phase 2 wires	1 phase 3 wires 3 phase 3 wires 3 phase 4 wires
	Voltage	Current		
Power	110 V	1 A	(±) 100 W	(±) 200 W
	110 V	5 A	(±) 500 W	(±) 1,000 W
	220 V	1 A	(±) 200 W	(±) 400 W
	220 V	5 A	(±) 1,000 W	(±) 2,000 W

(±) means polarity of power.

	Standard Rating		1 phase 2 wires	1 phase 3 wires 3 phase 3 wires 3 phase 4 wires
	Voltage	Current		
Reactive power	110 V	1 A	± 100 var	± 2200var
	110 V	5 A	± 500 var	± 1,000var
	220 V	1 A	± 200 var	± 400var
	220 V	5 A	±1,000 var	± 2,000var

In case of model with external CT, VT, the followoing will be manufacturable.

	Standard Rating		Manufacturable Calibration Watts	
	Voltage	Current	1 phase 2 wires	1 phase 3 wires 3 phase 3 wires 3 phase 4 wires
Power	110 V	1 A	(±) 72 - (±) 164W	(±) 125 - (±) 285W
	110 V	5 A	(±)360 - (±) 820W	(±) 625 - (±) 1,400W
	220 V	1 A	(±)144 - (±) 328W	(±) 250 - (±) 570W
	220 V	5 A	(±)720 - (±)1,640W	(±)1,250 - (±) 2,850W

(±) means polarity of power.

	Standard Rating		Manufacturable Calibration Vars	
	Voltage	Current	1 phase 2 wires	1 phase 3 wires 3 phase 3 wires 3 phase 4 wires
Reactive power	110 V	1 A	± 72 - ± 164var	± 125 - ± 285var
	110 V	5 A	± 360 - ± 820var	± 625 - ± 1,400var
	220 V	1 A	± 144 - ± 328var	± 250 - ± 570var
	220 V	5 A	± 720 - ± 1,640var	±1,250 - ± 2,850var

Also manufacturable with the following condition

Input Power (Reactive) Range	Tolerance	Response
40 to less than 65%	± 1.0% of span	less 1 sec
25 to less than 40%	± 2.0% of span	less 1 sec

100% input 1ø 2 wires = rating voltage × rating current
1ø 3 wires = 2 × rating voltage (PI-N) × rating current
3ø 3 wires = $\sqrt{3}$ × rating voltage × rating current
3ø 4 wires = 3 × rating phase voltage × rating current

Calculation for extarnal mounting VT, CT

Power transducer input (p) = $\frac{\text{Rating}}{\text{VT ratio} \times \text{CT ratio}}$

Please check that the results of the above culculation is within manufacturing varientionn.

Ex.1 In case of rating 3ø 3 wires 20 kW, VT440/110 V, CT30/5 A

$P=\frac{20\text{ kW}}{(440/110)\times(30/5)}$ =833 W - - - Available

Ex.2 In case of 1ø 2 wires 7.5 kW, VT660/110 V, CT20/5 A

$P=\frac{7.5\text{ kW}}{(660/110)\times(20/5)}$ =312 W

Torelance is ±1.0% of span

In case of reactive power, the same calculation shall be applied.