

Maximum rating 2000 A, high-stability, high-accuracy, wideband DC to 1 MHz, high-CMRR, high-performance fluxgate technology, pass-through type



German iF Design Award

## Features

- ✓ 10 ppm linearity
- ✓ 5 ppm offset
- ✓ Voltage output
- ✓ CT coil structure for broadband and superior frequency characteristics
- ✓ Built-in machined solid aluminum shield for excellent noise resistance (high CMRR)
- ✓ Large aperture  $\phi 80\text{mm}$  for cables and bus-bars
- ✓ The Power Analyzer PW8001 automatically recognizes the current sensor's information (phase shift data, sensor model name, rated current, serial number) when connected.

## Applications

- ✓ Automotive (e.g. xEV R&D and manufacturing)
- ✓ Renewable energy (power conditioner R&D and manufacturing)
- ✓ Efficiency measurement of high-efficiency energy converters
- ✓ Analysis of industrial inverter motors
- ✓ Calibration of shunt resistors
- ✓ Measurement of minute superimposed current in battery systems
- ✓ For feedback control in medical devices (MRI, CT, X-ray)

Specification highlights	Symbol	Unit	Min.	Typ.	Max.
Nominal primary DC current	$I_{PN\ DC}$	A	-2000		2000
Nominal primary AC current	$I_{PN\ AC}$	Arms			2000
Measurement range	$I_{PM}$	A	-2200		2200
Nominal output voltage	$V_{out}$	V	-2		2
Primary/secondary ratio	Ratio	V/A	0.001	0.001	0.001
Linearity error	$\epsilon_L$	ppm		$\pm 10$	
Offset error	$\epsilon_O$	ppm		$\pm 5$	
DC amplitude error	$\epsilon_G$	ppm		$\pm 15$	
Bandwidth ( $\pm 3\text{dB}$ )	f	MHz		1	
Withstand voltage (1 mA, 50/60Hz for 1 minute)	$U_d$	kV			7.4
Power supply voltages	$U_C$	V	$\pm 11.5$		$\pm 15$
Operating temperature range	$T_A$	$^{\circ}\text{C}$	-40		85
Output cable length	$L_{cable}$	m		CT6877A: 3m CT6877A-1: 10m	

**Electrical specifications at T<sub>A</sub> = 23°C ±5°C, supply voltage (by using external PSU) = ±12 V unless otherwise stated**

Parameter	Symbol	Unit	Min.	Typ.	Max.	Comment
Nominal primary DC current	I <sub>PN</sub> DC	A	-2000		2000	Refer to "Figure 1. Frequency derating"
Nominal primary AC current	I <sub>PN</sub> AC	Arms			2000	Refer to "Figure 1. Frequency derating"
Measuring range	I <sub>PM</sub>	A	-2200		2200	Refer to "Figure 1. Frequency derating"
Maximum input current	I <sub>MAX</sub>	Apeak	-3200		3200	Not exceeding derating curve shown in Figure 1 However, it is allowable for up to 20 ms at 40°C or less
Nominal output voltage	V <sub>out</sub>	V	-2		2	
Primary/secondary ratio	Ratio	V/A	0.001	0.001	0.001	
Bandwidth (-3dB)	f	MHz		1		Refer to "Figure 2. Frequency characteristics"
Output resistance			40	50	60	
Linearity error	ε <sub>L</sub>	ppm		±10		Refer to "Figure 3. Linearity error characteristics"
Offset error	ε <sub>O</sub>	ppm		±5		
DC amplitude error	ε <sub>G</sub>	ppm		±15		
AC amplitude error 10 Hz - 100 Hz 100 Hz - 1 kHz 1 kHz - 10 kHz 10 kHz - 100 kHz 100 kHz - 300 kHz 300 kHz - 700 kHz	ε <sub>G</sub>	%		±0.01 ±0.04 ±0.25 ±1 ±2 ±10		
Output noise	noise	μVrms			300	Measurement bandwidth: DC to 1 MHz
Effects of temperature Amplitude sensitivity Offset voltage		ppm of reading/°C ppm of full scale/°C	-15 -0.5		15 0.5	Within the range of -40°C to 0°C or 40°C to 85°C
Effects of magnetization		mA			10	Input equivalent, after 2000 A DC is inputted
Common mode rejection ratio 50/60 Hz 100 kHz	CMRR	dB	140 120			(Effect on output voltage/common-mode voltage) Refer to "Figure 4. CMRR characteristics"
Effects of conductor position DC 50/60 Hz 1 kHz 10 kHz 100 kHz		% of reading	-0.01 -0.01 -0.05 -0.2 -0.8		0.01 0.01 0.05 0.2 0.8	When wire of outer diameter 10 mm is used
Effects of external magnetic field		mA			80	Input equivalent, under a magnetic field of 400 A/m, DC
					80	Input equivalent, under a magnetic field of 400 A/m, 60 Hz
Effects of radiated radio-frequency electromagnetic field		% of full scale			5	10 V/m
Effects of conducted radio-frequency electromagnetic field		% of full scale			1	10 V
Fluxgate excitation frequency	f <sub>Exc</sub>	kHz		10.4		
Power supply voltages	U <sub>c</sub>	V	±11.5		±15	
Positive current consumption	I <sub>ps</sub>	mA			500	DC + 2000 A with ±12V
Negative current consumption	I <sub>ns</sub>	mA			-500	DC - 2000 A with ±12V

**Isolation specifications**

Parameter	Unit	Value	Comment
Rated insulation RMS voltage, basic insulation	V	1000	IEC 61010-1 conditions • over voltage CAT III • pollution degree 2
Rated insulation RMS voltage, reinforced insulation	V	1000	
RMS voltage for AC isolation test, 50/60 Hz, 1 minute	kV	7.4	Between primary and secondary (and shield) Sensed current: 1 mA
Clearance	mm	23.2	Shortest distance through air
Creepage distance	mm	23.2	Shortest path along device body
Comparative tracking index (CTI)	V	< 250	Performance level category (PLC) = 3
Standards			Safety: EN 61010 EMC: EN 61326

### Environmental and mechanical characteristics

Parameter	Symbol	Unit	Min.	Typ.	Max.	Comment
Operating environment (altitude)		m			2000	Indoor use, pollution degree 2
Ambient operating temperature range	T <sub>A</sub>	°C	-40		85	
Ambient storage temperature range	T <sub>Ast</sub>	°C	-40		85	
Relative humidity	RH	%			80	Non-condensing
Measurable conductor diameter	D <sub>meas</sub>	mm			80	
Dimensions	W	mm		229		Refer to Figure 5. Dimensions
	H			232		
	D			112		
Output cable length	L <sub>cable</sub>	m		3		
CT6877A-1				10		
Mounting hole diameter	D <sub>mout</sub>	mm		φ6		M5 hexagon socket head cap screws, recommended tightening torque: 1.5 Nm to 2.0 Nm
Weight	m	kg		5		
CT6877A-1				5.3		

### Measurement accuracy (total accuracy including uncertainty in calibration system etc.)

Electrical specifications at T<sub>A</sub> = 0°C to 40°C, supply voltage (by using external PSU) = ±12 V unless otherwise stated

Frequency [Hz]	Amplitude		Phase [°]
	[±% of reading]	[±% of full scale]	
DC	0.04	0.008	—
DC < f < 16	0.1	0.02	0.1
16 ≤ f < 45	0.05	0.01	0.1
45 ≤ f ≤ 66	0.04	0.008	0.08
66 < f ≤ 100	0.05	0.01	0.1
100 < f ≤ 500	0.1	0.02	0.2
500 < f ≤ 1 k	0.2	0.02	0.4
1 k < f ≤ 10 k	0.5	0.02	0.3 + 0.1 × f
10 k < f ≤ 50 k	1.5	0.05	0.3 + 0.1 × f
50 k < f ≤ 100 k	2.5	0.05	0.3 + 0.1 × f
100 k < f ≤ 700 k	0.025 × f	0.05	0.3 + 0.1 × f
Frequency range	1 MHz (±3 dB typical)		—

- The variable f in accuracy equations is expressed in kHz.
- Accuracy of amplitude and phase is specified with 110% of full scale input or less and not exceeding derating curve in Figure 1. Accuracy in range of DC < f < 10 Hz are design values.
- Add ±0.01% of reading to amplitude accuracy when input is 100% to 110% of full scale.
- For the CT6877A-1, add the following values to accuracy in the range of 1 kHz < f ≤ 700 kHz.  
Amplitude accuracy: ±(0.005 × f [kHz])% of reading  
Phase accuracy: ±(0.015 × f [kHz])°

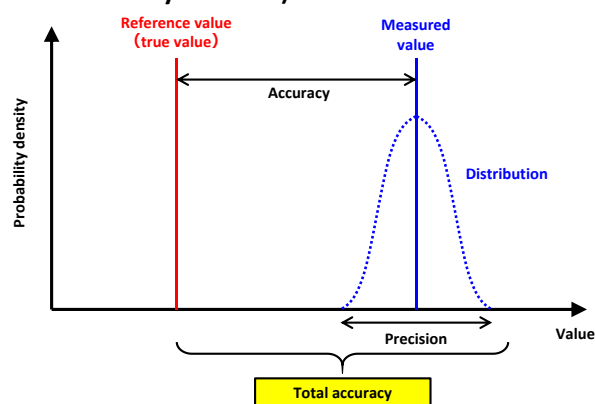
### Definition of accuracy (total accuracy including uncertainty in calibration system etc.)

**Reading (displayed value) error:** Indicates the value displayed by the instrument. Limit values for reading errors are expressed as a percentage of the reading (“% of reading” or “% rdg.”).

**Range error:** Indicates the instrument’s range. Limit values for range errors are expressed as a percentage of the range (“% of range”).

**Full scale (rated current) error:** Indicates the rated current. Limit values for full-scale errors are expressed as a percentage of full scale (“% of full scale” or “% f.s.”).

**Calibration:** The accuracy of HIOKI products includes all factors that affect the measurement results, such as calibration system errors, ambient temperature, and secular change, as “uncertainty”.







HIOKI is accredited as an official ISO/IEC 17025 calibrator.

### Specific accuracy calculation example

How to measure the current of **DC 1800 A** of a conductor with a diameter of  $\phi$  75 mm or less with high accuracy.

Guaranteed specifications at  $T_A = 23^\circ\text{C} \pm 5^\circ\text{C}$

Measuring instrument configuration	CT6877A, CT6877A-1	CT9555	L9217 + 9704	DM7276
External view				
Range (connection)	2000 A (2 V)	Front OUTPUT terminal (BNC terminal)	✓	10 V
Output voltage	$1800 \text{ A} \times 2 \text{ V} / 2000 \text{ A} = 1.8 \text{ V}$			—
Error (reading)	0.04%	—	—	0.0009%
Error (full scale)	0.008%	—	—	12 $\mu\text{V}$
Total error	$1.8 \text{ V} \times (0.04 + 0.0009)\% + 2 \text{ V} \times 0.008\% + (12 \mu\text{V} \times 10^{-6}) \text{ V} = 0.0009082 \text{ V}$			
Total error (input equivalent)	$0.0009082 \text{ V} / 2 \text{ V} \times 2000 \text{ A} = 0.9082 \text{ A}$			
Error range	$1800 \text{ A} \pm 0.9082 \text{ A} \Rightarrow 1799.0918 \text{ A to } 1800.9082 \text{ A}$			

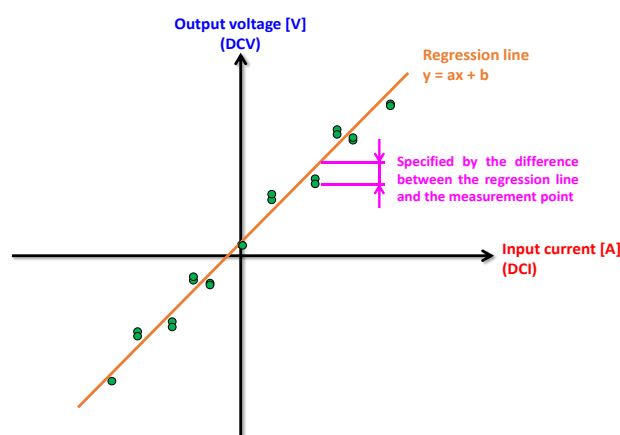
### Definition of linearity error

**Linearity error  $\epsilon_L$ :** Indicates that the output (current or voltage) changes linearly in response to the input current.

A regression line is attained by measuring the output voltage in the sequence below in 400 A intervals:

+2000 A  $\rightarrow$  0 A  $\rightarrow$  -2000 A  $\rightarrow$  0 A  $\rightarrow$  +2000 A

It is defined as the difference between the regression line calculated from the above measurements and the measurement points.



### Definition of offset error

**Offset error  $\epsilon_0$ :** Specified by the ratio of the average value ( $\mu$ ) of the measured values of the offset voltage and the rated current ( $I_{max}$ ) of each current sensor.

$$\epsilon_0 = \mu / I_{max} \text{ [ppm]}$$

### Definition of amplitude error

**Amplitude error  $\epsilon_G$ :** An index showing the degree of flatness of the frequency characteristics of gain.

DC error is defined as (linearity error + offset error).

AC error is defined as deviation from the 55 Hz measurement point.

$$\epsilon_{G \text{ DC}} = \epsilon_L + \epsilon_0 \text{ [ppm]}$$

$$\epsilon_{G \text{ AC}} = \frac{\text{Gain (f)} - \text{Gain (55 Hz)}}{\text{Gain (55 Hz)}} \times 100 \text{ [%]}$$

Figure 1. Frequency derating

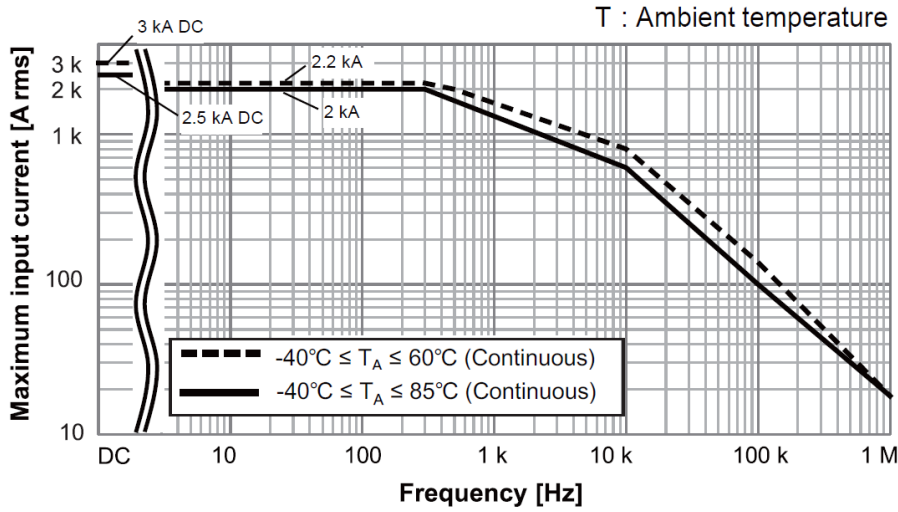
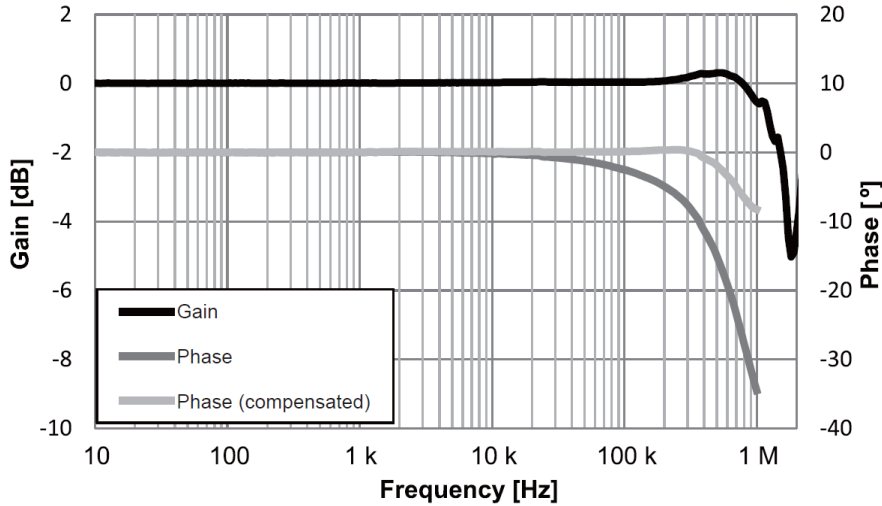


Figure 2. Frequency characteristics



### Phase Compensation Values

Enter the following values (representative values) when performing phase compensation on the PW6001 or PW3390. When connecting to the PW8001, it will be set automatically.

CT6877A: 100 kHz, -2.63°

CT6877A-1: 100 kHz, -3.34°

Figure 3. Linearity error characteristics

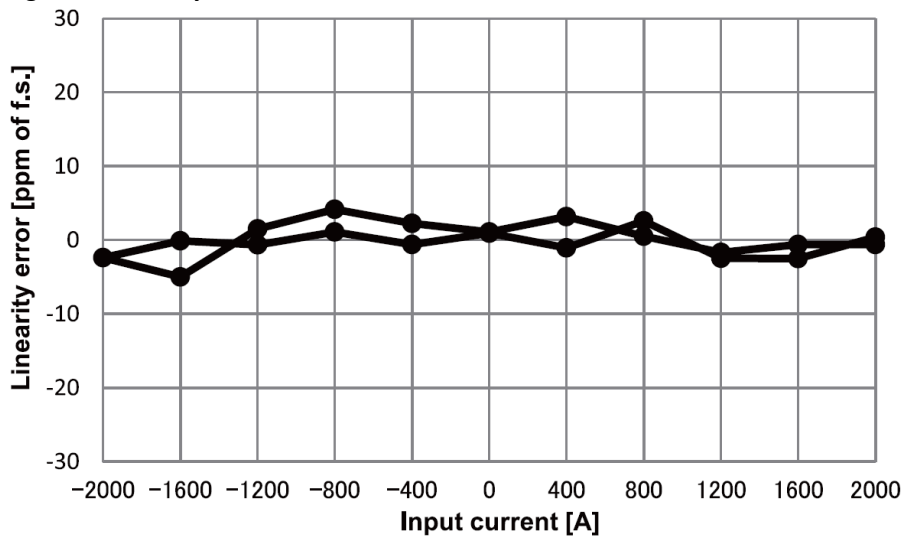


Figure 4. CMRR characteristics

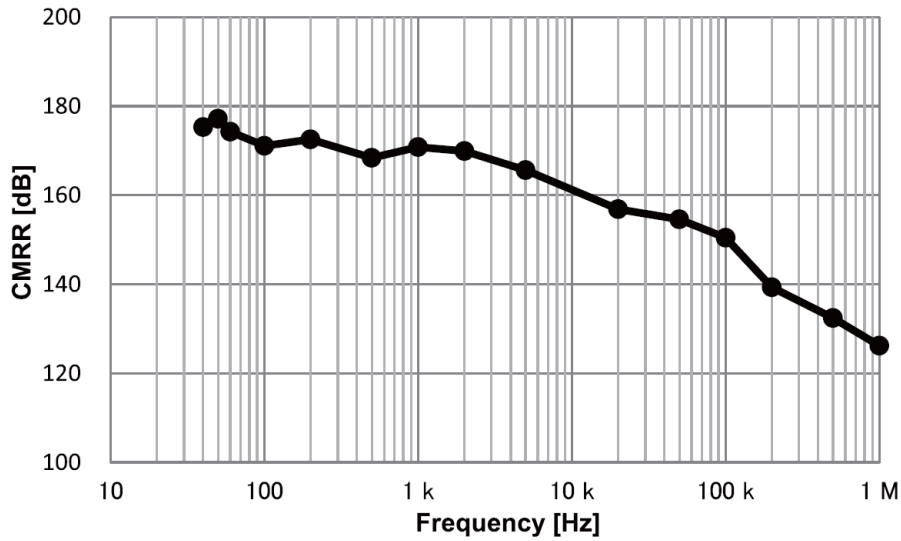


Figure 5. Dimensions

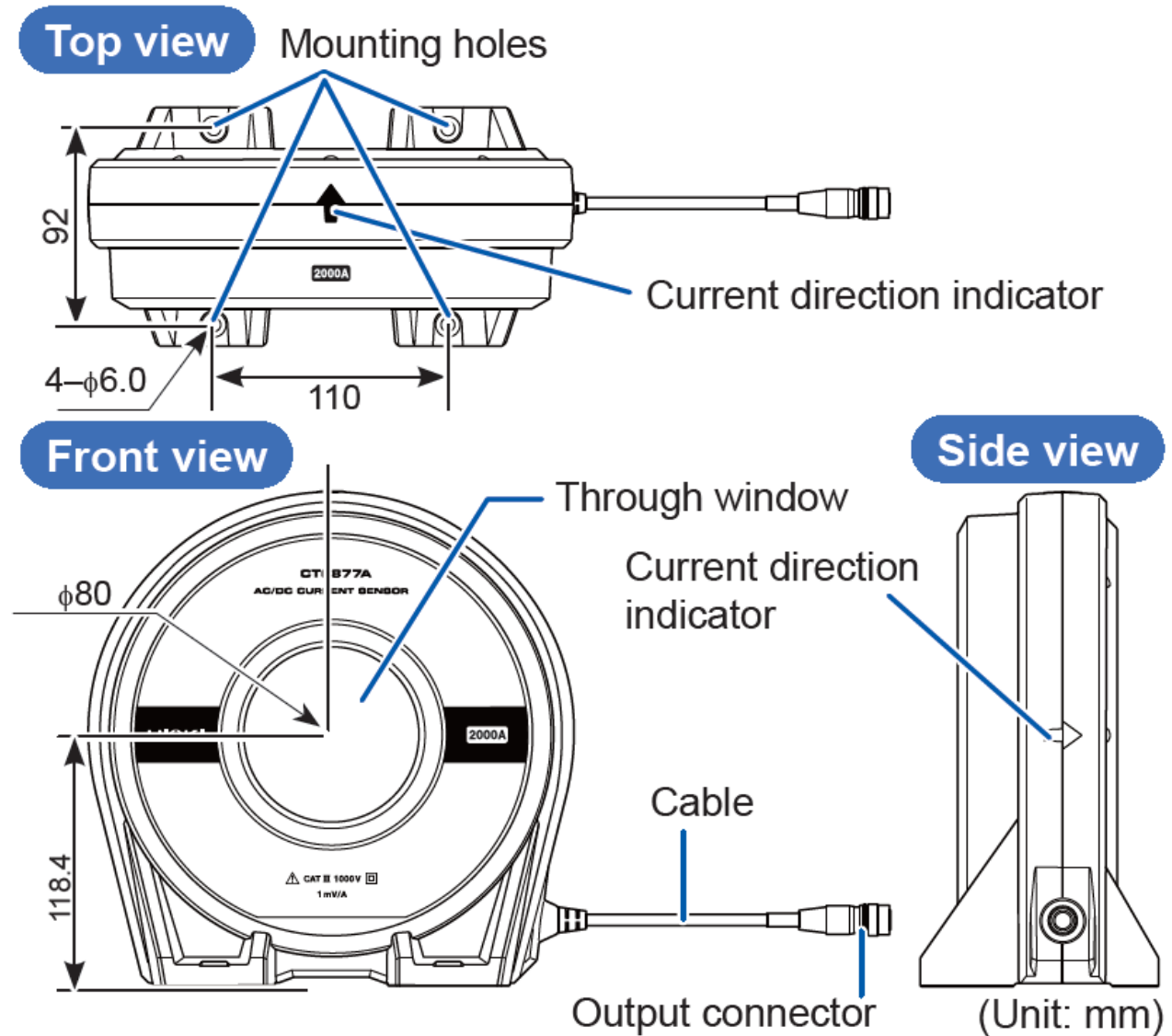


Figure 6. Pin assignment (when not using the sensor units CT9555, CT9556, or CT9557)

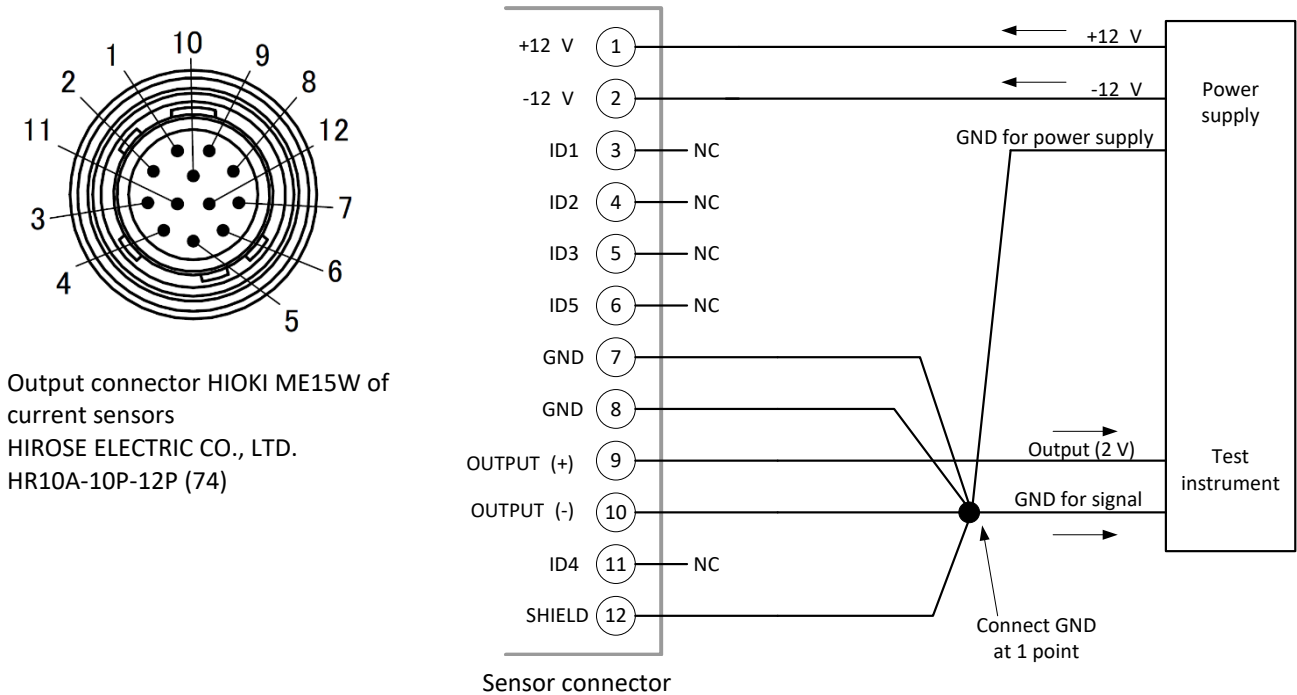
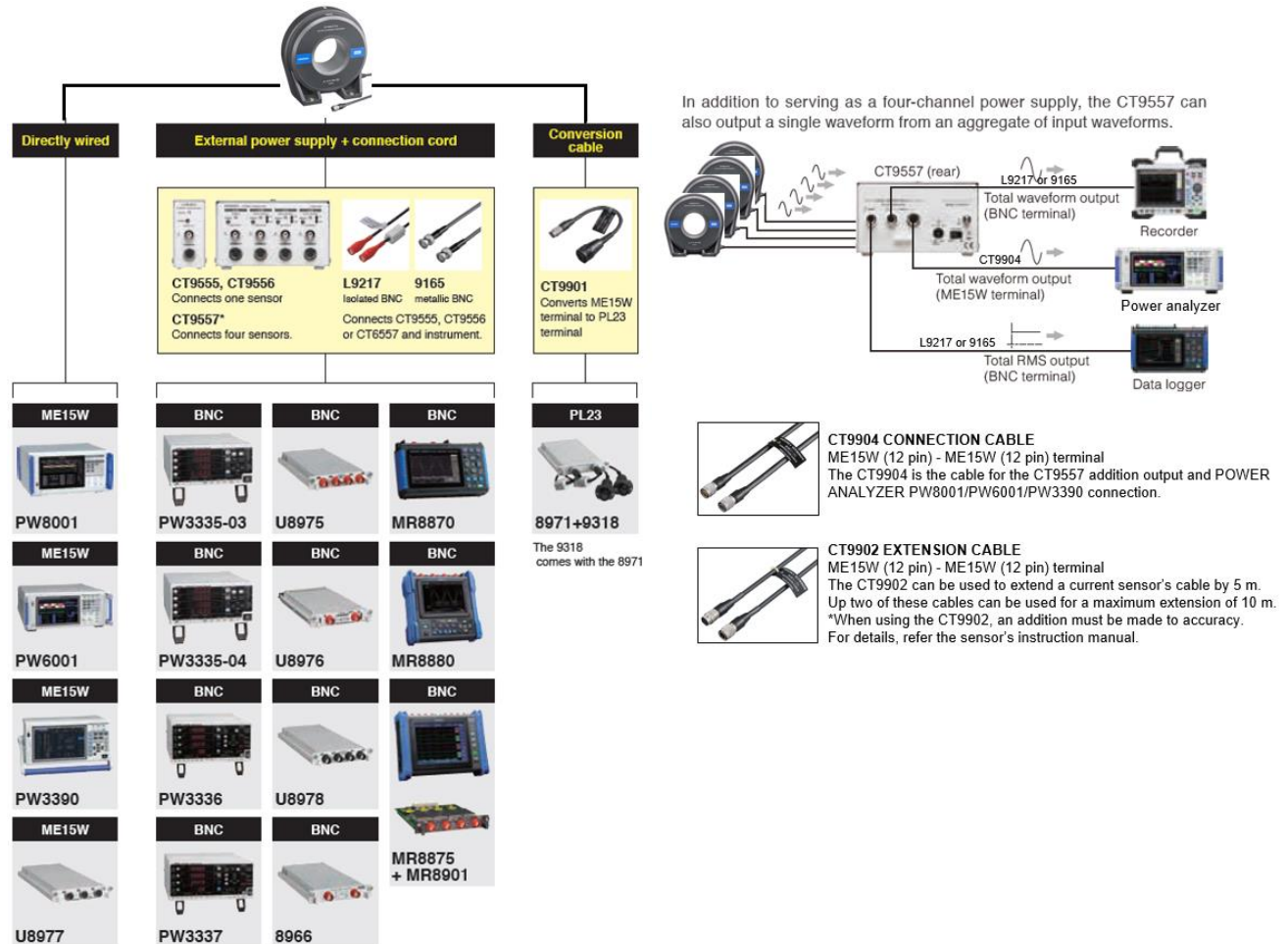


Figure 7. Options and main combination





**Links**

## 1. Web site

[AC/DC CURRENT SENSOR CT6877A | HIOKI](#)

## 2. Accuracy calculation tools

[POWER ANALYZER PW8001 & CT](#)[POWER ANALYZER PW6001 & CT](#)[POWER ANALYZER PW3390 & CT](#)

Files and information such as the Power Analyzer accuracy calculation tools are updated regularly.

Instead of downloading them once and using them for a long time, download them from the download link just before using them.