
User's Manual

CL360
Leakage Clamp-on Tester
リーククランプテスタ

IM CL360

保証書付

YOKOGAWA ◆

横河計測株式会社

Yokogawa Test & Measurement Corporation

IM CL360

2021.11 9 版 (KYOU)

■ Precautions for Safe Use of the Instrument

When handling the instrument, ALWAYS observe all of the cautionary notes on safety given below. Yokogawa Meters & Instruments Corporation is not at all liable for damage resulting from misuse of this product by the user that is contrary to these cautionary notes.

Various symbols are used on the instrument and in this manual to ensure the product is used safely and to protect operators and property from possible hazards or damage. The following safety symbols are used where appropriate. Read the explanations carefully and familiarize yourself with the symbols before reading the text.

The instrument and this manual use the following safety symbols:

Danger! Handle with Care.



This symbol indicates that the operator must refer to an explanation in the User's Manual in order to avoid the risk of personal injury or death and/or damage to the instrument.



Double Insulation

This symbol indicates double insulation.



AC Voltage/Current

This symbol indicates AC voltage or current.



Ground

This symbol indicates ground (earth)



Indicates that this instrument can clamp on bare conductors when measuring a voltage corresponding to the applicable Measurement Category, which is marked next to this symbol.



WARNING

Indicates that there is a possibility of serious personal injury or loss of life if the operating procedure is not followed correctly and describes the precautions for avoiding such injury or loss of life.



CAUTION

Indicates that there is a possibility of serious personal injury or damage to the instrument if the operating procedure is not followed correctly and describes the precautions for avoiding such injury or damage.

NOTE

Draws attention to information essential for understanding the operation and features.

WARNING

- Never make measurement on a circuit above 600V AC.
- Do not use the instrument in an atmosphere where any flammable or explosive gas is present.
- Do not attempt to make measurement in the presence of flammable gasses, fumes, vapor or dust. Otherwise, the use of the instrument may cause sparking, which can lead to an explosion.
- Avoid using the instrument if it has been exposed to rain or moisture or if your hands are wet.
- Do not exceed the maximum allowable input of any measurement range.
- Never open the battery compartment cover when making measurement.
- Do not use the instrument if there is any damage to the casing or when the casing is removed.
- Do not install substitute parts or make any modification to the instrument. Return the instrument to Yokogawa Meters & Instruments or your distributor for repair or re-calibration.
- Always switch off the instrument before opening the battery compartment cover for battery replacement.

WARNING

To avoid damage to the instrument or electric shock!

The restrictions on the maximum voltage level for which the CL360 testers can be used, depend on the measurement categories specified by the safety standards. These category specifications are formulated to protect operators against transient impulse voltage in power lines.

Function	Maximum Allowable Input	
	MEASUREMENT CATEGORY II	MEASUREMENT CATEGORY III
\sim A	AC 1000A rms Measuring circuit voltage : AC 600V rms	AC 1000A rms Measuring circuit voltage : AC 300V rms

O (None, Other)

applies to measurement of circuits that are not directly connected to a main power supply.

Measurement category II (CAT II)

applies to measurement of circuits that are connected to low-voltage installations.

Measurement category III (CAT III)

applies to measurement of facility circuits.

Measurement category IV (CAT IV)

applies to measurement of power source circuits for low-voltage installations.



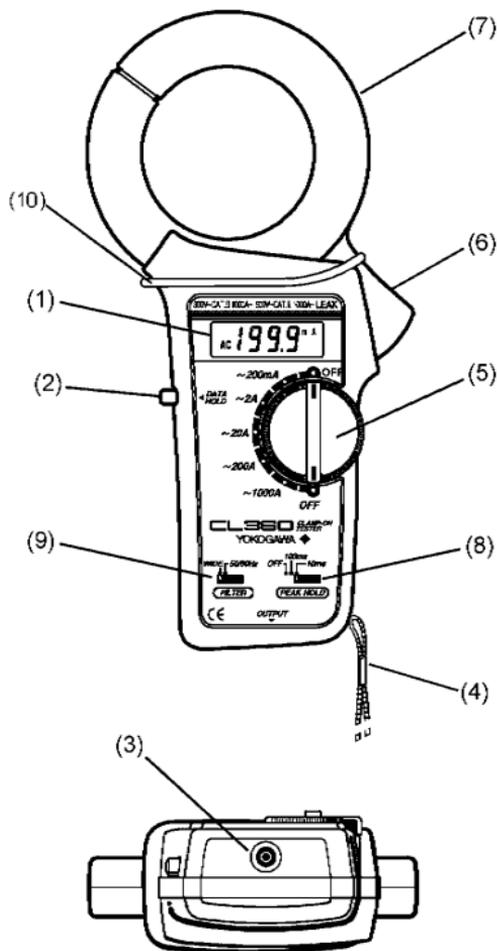
CAUTION

- Be sure to set the Range switch to the "OFF" position after use. When the instrument will not be in use for a long period of time, place it in storage after removing the battery.
- Do not expose the instrument to the direct sun, extreme temperatures or dew fall.
- Never apply voltage to the OUTPUT terminal. The terminal is not electrically isolated from the internal circuits of the instrument.
- Using this instrument is limited to under residential, commercial and light-industrial environment.

This instrument may not be able to measure accurately if it is near other equipment generating strong electromagnetic interference or a strong magnetic field caused by large current.

- Use a damp cloth and detergent for cleaning the instrument. Do not use Abrasives or solvents.
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1. Instrument Layout



- (1) LCD Display : Field effect type of liquid crystal display with maximum counts of 1999. Range symbol (mA, A) and decimal point automatically appear as the Range switch is turned. "B" is displayed on the lower left corner for low battery warning and "1" is displayed only at the higher digit for overrange indication (except for 1000A range).
- (2) Data Hold Button : Allows for easy reading in dimly lit or hard-to-reach locations. The display can be observed away from the conductor after pushing in the button.

- (3) Two-way Analogue OUTPUT Terminal : AC current picked up by transformer jaws (7) is converted and output as AC and DC voltage output. (See Analogue Output in chapter 4. Specifications) Insert output cord Model 91020 into this terminal for monitoring waveform with an oscilloscope, making RMS measurements or connecting to a recorder.
- (4) Safety Hand Strap : Prevents the instrument from slipping off the hand during use.
- (5) Range Switch : Selects range. It is also used to turn power on or off.
- (6) Open/Close Lever : Operates the transformer jaws. Press to open the transformer Jaws.
- (7) Transformer Jaws : Pick up current flowing through the conductor.
- (8) Peak Hold Selector Switch : Selects 10ms or 100ms response time. Set the switch back to the OFF position to release peak hold or make normal measurements.
- (9) Frequency Selector Switch : Makes frequency response selection. Selects "WIDE" or "50/60Hz".
- (10) Barrier : It is a part providing protection against electrical shock and ensuring the minimum required air and creep age distances.

2. Measurement

2.1 Preparation for Measurement

CAUTION

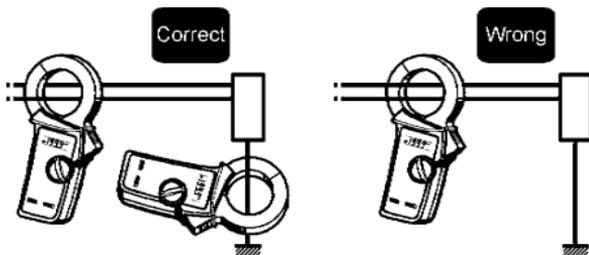
- The jaw section is a delicate, precision sensor. Do not subject the jaw to unreasonably strong shock, vibration, or force when using it.
- If dust gets into the tops of the jaws, remove it immediately. Do not close the jaws when dust is trapped in its joints as the sensor may break.
- Please check that the range is set to the desired setting before measurement.

2.2 AC Current Measurement

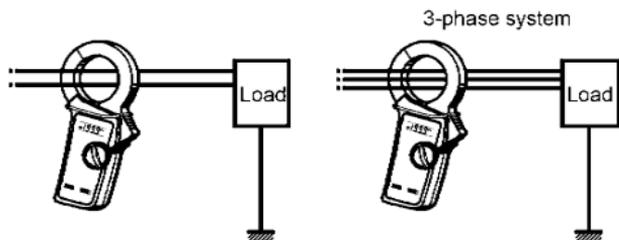
WARNING

- Do not make measurement on a circuit above 600V AC. This may cause shock hazard or damage to the instrument or equipment under test.
- Keep your fingers and hands behind the barrier during measurement.

- (1) Set the range switch to the desired position. Do not exceed the maximum allowable input current for the selected range.
- (2) For normal measurement, press the open/close lever to open the transformer jaws and clamp onto one conductor only. Earth leakage current or small current that flow through a grounded wire can also be measured by this method. It is recommended that the conductor is placed at the center of the closed transformer jaws.



- (3) To measure out of balance leakage current, clamp onto all conductors except a grounded wire. The leakage current measured will be indicated on the display.



In case of 1-phase 3-wire system, clamp three wires for measurement.
In case of 3-phase 4-wire system, clamp four wires for measurement.

CAUTION

When measuring large current, observe the time limit specified in chapter 4, Specifications. Otherwise, the transformers jaws may overheat, resulting in damage to the instrument.

NOTE

- During current measurement, keep the transformer jaws fully closed. Otherwise, accurate measurement cannot be made. The maximum measurable conductor size is approx. 68mm in diameter.
- Frequency selector switch is designed to select the "50/60Hz" and "WIDE" frequency ranges. For further details, refer to section 2.3 for operation of frequency selector switch.
- The transformer jaws may buzz when measuring large current. This has no effect on the instrument's performance or safety.

2.3 How to Use The Frequency Selector Switch

Model CL360 has a very good frequency response because of the electromagnetic property of its transformer jaws. Therefore, it measures AC current not only of fundamental frequency of 50Hz or 60Hz, but of high frequencies and harmonics superimposed on the fundamental frequency. To eliminate these superimposed components and measure only in the fundamental frequency, Model CL360 has a high-cut filter circuit, which can be activated by setting the frequency selector switch to the 50/60Hz position. The high-cut filter has a cut-off frequency of approx. 100Hz and an attenuation characteristics of approx. -24dB/octave.

NOTE

-24dB/octave means that the magnitude of a signal declines by a factor of 16 when its initial frequency doubles.

The frequency selector switch has the following two positions.

- **WIDE** (40Hz to over 1kHz) :
Covers a wide frequency band from mains supply to high frequencies generated by such equipment as inverters.
- **50/60Hz** (40 to Approx. 100Hz) :
Filters out high frequency components to restrict measurement in mains frequency band.

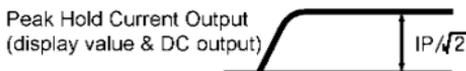
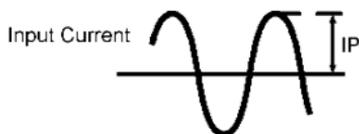
NOTE

Selection with the frequency selector switch does not apply to AC output of the two-way analogue output.

2.4 How to Use Peak Hold Function

10ms or 100ms response time can be selected for peak hold measurement. Make selection according to your application needs.

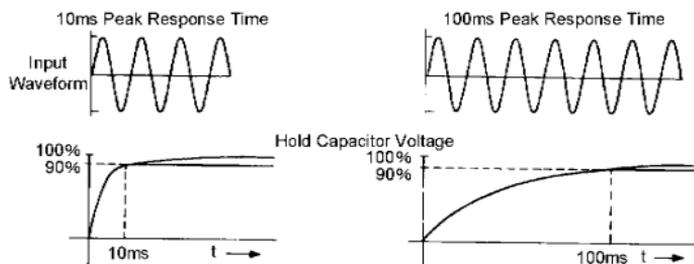
- (1) With the transformer jaws clamped onto the conductor under test, slide the peak hold switch from the OFF position to the desired peak response time position.
- (2) The peak hold display reads $1/\sqrt{2}$ of the peak current value. Therefore, an RMS reading will be obtained when the current under test has a sinusoidal waveform.



- (3) Slide the peak hold switch back to the OFF position for a reset.

NOTE

- Model CL360 uses an analogue peak hold circuit to ensure a quick response to input current. Because of the nature of this circuit, the peak hold reading may gradually fall, or in a rare case, rise with time. This is likely to be apparent when the instrument is used in a high temperature and high humidity environment. Therefore, the instrument will not be suitable for making peak measurement over an extended period of time. In case of such a need, connect a recorder to the instrument via the analogue output terminal.
 - If it is necessary to read the display away from the conductor in a peak hold measurement, press the data hold switch first and then remove the instrument from the conductor. Otherwise, the peak hold reading may be higher than the actual value due to the electrical noise caused by the opening and closing of the transformer jaws. Press the data hold switch again for a reset.
- (4) Difference between 10ms and 100ms Peak Response Time. The peak hold circuit in this instrument charges the peak-hold capacitor after rectifying the input waveform. The time for the voltage of the capacitor to reach its peak value varies according to its capacitance and the output impedance of the charging circuit. Model CL360 sets the time for the voltage of the capacitor to reach 90% of its peak value to 10ms or 100ms by switching between two output impedances.

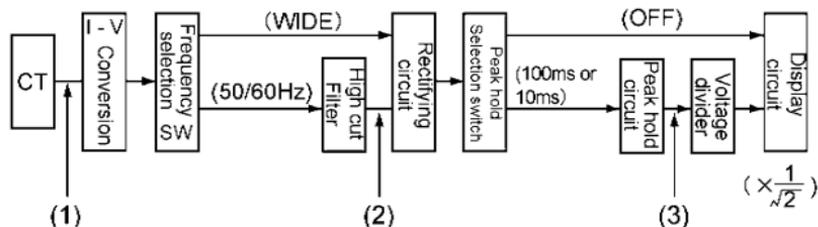


For instance, select the 10ms response time when measuring a surge current that will occur when a power supply device is switched on. The 100ms response time is recommended for measuring the starting current of a motor or similar equipment. A stable measurement can be made on the 100ms second response time setting as the peak hold circuit does not readily respond to the surge current.

2.5 How to Use Peak Hold Frequency Selector Switch

Indicated value may vary according on input signal (waveform) when the frequency selector switch is set to 50/60Hz. In this case, make measurement referring to the block diagram below.

Circuit flowchart is shown below.



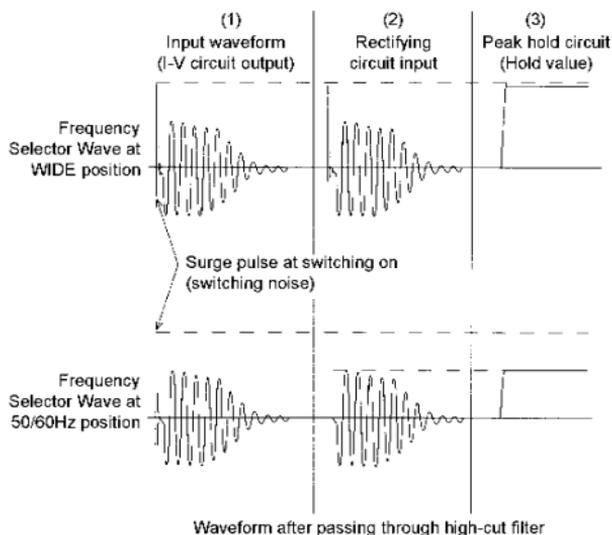
The signal (current) picked up by transformer jaws is converted from current signal to voltage signal in I-V conversion circuit, and it enters the frequency selector switch. If the frequency selector switch is set to WIED, it enters the rectifying circuit. If set to 50/60Hz, enters the rectifying circuit after passing through high-cut filter (cut-off frequency of approx. 100Hz and attenuation characteristics of approx. -24dB/octave). If the peak hold selector switch is set to OFF, the rectified signal enters the indication circuit. If set to 100ms or 10ms, passes through the peak hold circuit, picks up the peak value of input signal, and outputs $1/\sqrt{2}$ of the peak value into the indication circuit.

Different examples of peak hold statuses when the frequency selector switch is set to WIDE or 50/60Hz are described below.

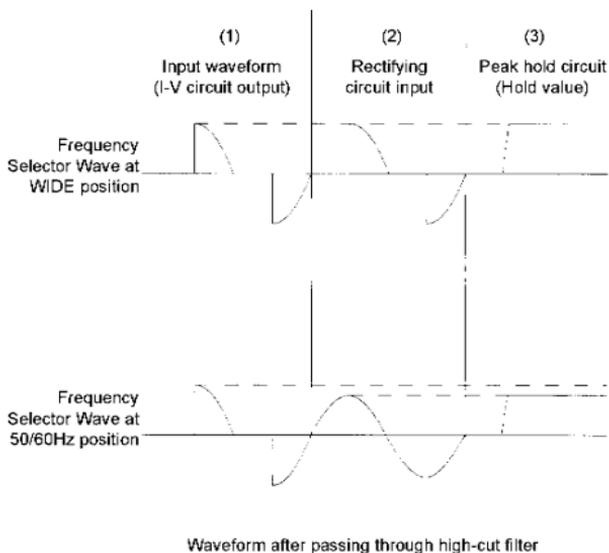
NOTE

If the frequency selector switch is switched after the peak hold switch is set to 100ms or 10ms, the over indication appears. Make sure that first set the frequency selector switch, then, set the peak hold switch to 100ms or 10ms.

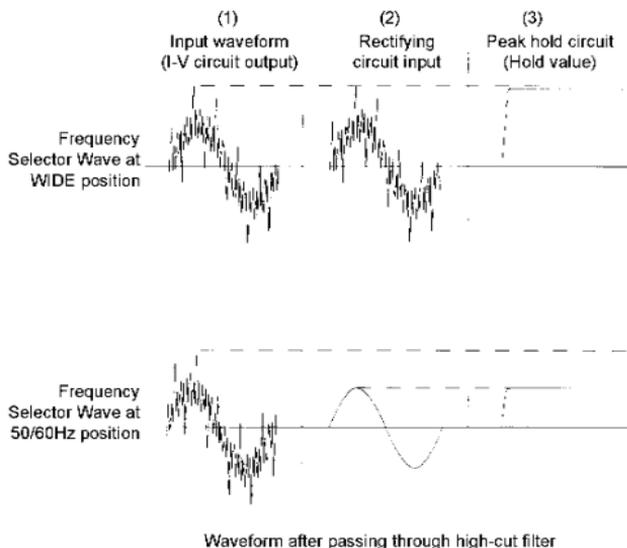
Example 1 When measuring the peak of starting current of motor:



Example 2 When measuring the peak current of thyristor:



Example 3 When measuring the peak current of inverter (where harmonic are superimposed on the fundamental frequency):



NOTE

The indicated value at 50/60Hz may be higher than that at WIDE because of the phase difference between superimposed harmonics and fundamental frequency.

2.6 How to Use Data Hold Function

Push in the Data Hold button to freeze the reading. This is especially useful for taking a reading a dimly lit or hard-to-reach locations. The display can be observed away from the conductor. Push the button again to release the reading.

2.7 How to Use OUTPUT terminal

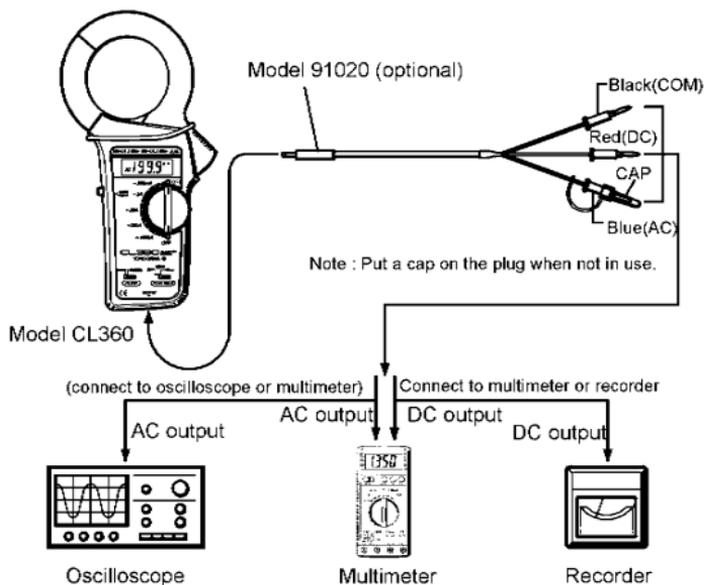
AC and DC outputs can be obtained by inserting optional Model 91020 output cord into the two-way analogue output terminal.

AC Output :

Can be monitored by connecting a digital multimeter to analogue output terminal or observed as waveform by connecting an oscilloscope.

DC Output :

Can be monitored by connecting a digital multimeter, or a recorder, which enables many hours of monitoring. With the CL360 in the peak hold mode, DC voltage corresponding to $1/\sqrt{2}$ of a peak current value can be held and outputted.



3. Battery Replacement

WARNING

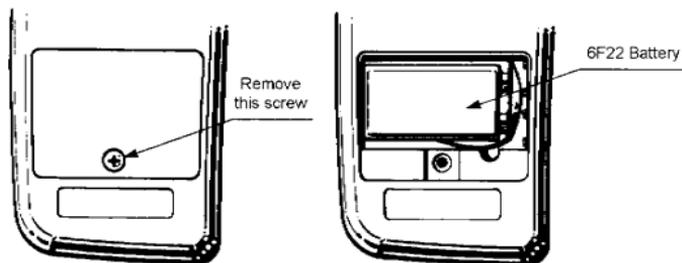
To avoid electric shock hazard, make sure to set the Range switch to "OFF" and remove the test leads from the instrument before trying to replace battery.

CAUTION

Make sure to install battery in correct polarity as indicated in battery compartment.

Replace the battery when "B" symbol appears on the LCD display.

- (1) Set the Range switch to the "OFF" position.
- (2) Unscrew and remove the battery compartment on the bottom of the instrument.
- (3) Replace the battery observing correct polarity. Use a new 6F22 or 6LR61 battery.
- (4) Re-place and screw the battery compartment cover.



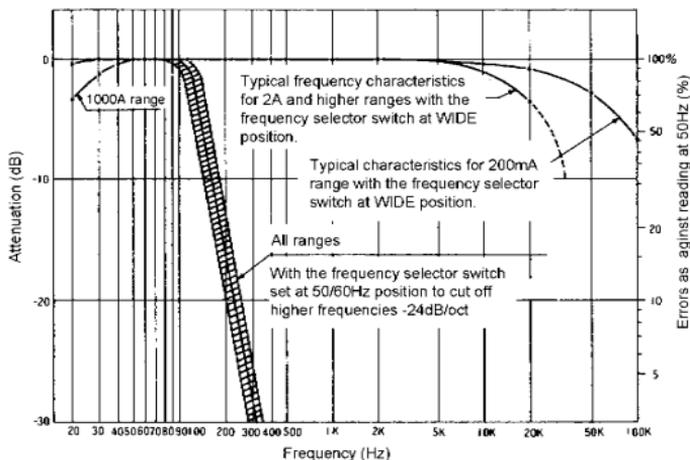
4. Specifications

■ Instrument Specifications

- Measuring Ranges and Accuracy (at $23 \pm 10^\circ\text{C}$, 85% relative humidity or less)

AC Current $\sim A$

Ranges	Measuring range	Accuracy		Time limit for Measurements
		Frequency		
		WIDE	50/60Hz	
200mA	0 to 199.9mA	$\pm 1.0\%$ rdg ± 2 dgt (50/60Hz) $\pm 3.0\%$ rdg ± 2 dgt (40 to 1kHz)	$\pm 1.5\%$ rdg ± 2 dgt	Continuous
2A	0 to 1.999A			
20A	0 to 19.99A			
200A	0 to 199.9A	$\pm 1.5\%$ rdg ± 2 dgt (50/60Hz) $\pm 3.5\%$ rdg ± 2 dgt (40 to 1kHz)	$\pm 2.0\%$ rdg ± 2 dgt	
1000A	0 to 500A	$\pm 1.5\%$ rdg ± 2 dgt (50/60Hz) $\pm 3.5\%$ rdg ± 2 dgt (40 to 1kHz)	$\pm 2.0\%$ rdg ± 2 dgt	
	501 to 1000A	$\pm 5\%$ rdg (50/60Hz) $\pm 10\%$ rdg (40 to 1kHz)	$\pm 5.5\%$ rdg	



Analogue Output (Output impedance: Approx. $1k\Omega$)

AC Output

Range	Measuring range	AC Output Voltage	Accuracy
200mA	0 to 200mA	0 to 200mV	$\pm 2.0\%$ rdg
2A	0 to 2A		
20A	0 to 20A		
200A	0 to 200A		
1000A	0 to 500A	0 to 50mV	$\pm 3.0\%$ rdg
	501 to 1000A	50 to 100mV	$\pm 5.0\%$ rdg

Voltage proportional to the current under test is output with "WIDE" frequency characteristics regardless of the setting of the frequency selector or peak hold switch.

DC Output

Range	Measuring range	DC Output Voltage	Accuracy (Frequency Range)	
			Freq. Selector Switch at WIDE position	Freq. Selector Switch at 50/60Hz position
200mA	0 to 200mA	0 to 200mV	$\pm 3.0\%$ rdg	$\pm 3.5\%$ rdg
2A	0 to 2A			
20A	0 to 20A			
200A	0 to 200A			
1000A	0 to 500A	0 to 50mV	$\pm 5.0\%$ rdg	$\pm 5.5\%$ rdg
	501 to 1000A	50 to 100mV	$\pm 7.0\%$ rdg	$\pm 7.5\%$ rdg

■ General Specifications

- Operating System : Dual integration
- Measurement Function : AC current
- Display : Field effect 3 - 1/2 digit liquid crystal display with maximum count of 1999
- Range selection : Manual
- Overrange Indication : "1" is displayed on the highest digit except for 1000A AC range.
- Response Time : Approx. 1 seconds.
- Sample Rate : Approx. 3 times per second.
- Temperature and Humidity for Guaranteed Accuracy : $23^{\circ}\text{C} \pm 10^{\circ}\text{C}$, relative humidity up to 85% without condensation
- Operating Temperature and Humidity : 0 to 40°C , relative humidity up to 85% without condensation

- Storage Temperature and Humidity : -10 to 50°C, relative humidity up to 80% without condensation
- Effect of conductor position: Within 2% difference between maximum and minimum values to a 10 mm-dia conductor, at every part inside the jaws
- Effect of External Magnetic Field :
15mA AC max. in proximity to a 10mm-dia conductor carrying 100AAC.
- Effect of Residual Current : 10mA AC max. when clamping on two 10mm-dia conductors, each carrying supply or return 100AAC current.
- Power Source : 6LR61 or 6F22 DC9V battery
- Battery Life : Approx. 60 hours (continuity)
- Current Consumption : Approx. 5mA max.
- Withstanding Voltage : 4240V AC, 50/60Hz for 5 sec. between electrical circuit and housing case or metal part of the jaws
- Insulation Resistance : 10MΩ or greater at 1000V between electrical circuit and housing case or metal part of the jaws
- Conductor Size : Approx. 68mm diameter max.
- Dimensions : Approx. 130(W) x 250(H) x 50(D) mm
- Weight : Approx. 570g
- Safety Standard: EN 61010-1
EN61010-2-032
Measurement category III AC 300V
Measurement category II AC 600V
Pollution degree2, indoor use, altitude 2000m or less
- EMC Standard: EN 61326-1 Class B Table 1, EN 61326-2-2,
EN 55011 Class B Group 1
- Environmental standard:
EU RoHS Directive compliant
For conformity to environmental regulations and/or standards other than EU, contact your nearest YOKOGAWA office (PIM113-01Z2).
- Accessories : 6F22 battery 1
Carrying case Model 93031 1
User's Manual 1
- Optional Accessories : Output cable with banana plug Model 91020
- Peak Hold : Response time selectable from approx. 10ms and 100ms.
 $1/\sqrt{2}$ of the peak current is displayed, which means an RMS reading will be obtained when current having sinusoidal waveform is measured.
Peak hold reading varies by approximately $\pm 1\%$ max of full scale in the first minute at 23°C $\pm 10^\circ\text{C}$ and relative humidity of 75% without condensation.

5. Calibration and After-sales Service

Should any failure occur while you are using the tester, follow the instructions given below. If the tester still fails to operate correctly and needs repair, contact the vendor from whom you purchased the instrument or the nearest Yokogawa Meters & Instruments sales office.

Condition	Possible Cause	Remedy
Display blanks after power-on	Battery is improperly installed. Battery is exhausted.	Install the battery correctly. Replace the battery.
Display reading remains frozen.	Data hold button is pressed in. Peak hold switch is at ON position.	Release data hold button. Set peak hold switch to OFF position.
Transformer jaws buzz when measuring large current.	-----	This is not a failure
The lowest digit of reading is unstable	-----	This is not a failure. The instrument is highly accurate, so it senses slight variations in the current under test.
Output cable (Model 91020) does not output voltage.	The cable is open circuit.	Check the cable for an open circuit.

Calibration

It is recommended that the instrument be calibrated once every year.

Waste Electrical and Electronic Equipment (WEEE)

(EU WEEE Directive valid only in the EEA* and UK WEEE Regulation in the UK)

This product complies with the WEEE marking requirement.

This marking indicates that you must not discard this electrical/electronic product in domestic household waste.

When disposing of products in the EEA or UK, contact your local Yokogawa office in the EEA or UK respectively. (*EEA: European Economic Area)



User's Manual

CL Series Clamp-on Tester For Standard

Supplement

This paper supplements the User's Manual of Clamp-on Testers (except for Model CL420).

CL Series: CL120, CL150, CL155, CL220, CL250, CL255,
CL320, CL340, CL345, CL360

This document contains explanations for standard.

Manual of the CL Series

The following manuals are provided as manuals for the CL Series (except for Model CL420).
Read them along with this manual.

Manual Title	Manual No.	
	IM 00C01C01-01Z1	Safety manual (European languages)
CL Series	IM CL-S03	For Standard (this manual)
CL Series	IM CL-S04-EN	Disposing the Battery (EU Battery Directive) For Model: CL150, CL155, CL220, CL250, CL255, CL320, CL340, CL345, CL360
CL120 and CL235	IM CL120-S01-EN	Disposing the Battery (EU Battery Directive) For Mode: CL120
CL Series	IM CROHS-CL	Document for China For Mode: CL120, CL220, CL320, CL340, CL345, CL360
CL Series	IM CL-93Z2	Document for Korea

Contact information of Yokogawa offices worldwide is provided on the following sheet.

Document No.		
PIM 113-01Z2	Inquiries	List of worldwide contacts

Precautions for Safe Use of the Instrument

This product is designed to be used by a person with specialized knowledge.
The general safety precautions described herein must be observed during all phases of operation.
If the instrument is used in a manner not specified in this manual, the protection provided by the instrument may be impaired.
This document and the user's manual of clamp-on tester are an essential part of the product; keep it a safe place for future reference.
YOKOGAWA assumes no liability for the customer's failure to comply with these requirements.

⚠ WARNING

- The instrument is a current measurement instrument.
Do not use this instrument for any other purpose.
- Be careful not to make the device (conductor) under test short-circuit with metal part of the jaws or test leads.

⚠ CAUTION

- The use of this instrument is limited to residential, commercial, and light-industrial environments.
This instrument may not be able to measure accurately if it is near other equipment generating strong electromagnetic interference or a strong magnetic field caused by large current.
- To verify the instrument's functionality, check that the measured value is update after turning on the power. If the measured value is not updated, the reading will be incorrect and may lead to possible electrical shock or personal injury.

Measurement Category of the Test leads

⚠ WARNING

- When you use the test leads, attach or remove the caps according to the measurement category.
- If the signal cable of the test leads is torn and the inner metal is exposed or if a color different from the outer sheath appears, stop using the cable immediately.

With Caps*: 1000V 10A CAT III/600V 10A CAT IV

Without Caps*: 1000V 10A CAT II/600V 10A CAT II

Model: 98072 *Caps of Test leads



When the test lead (98072) is used*1: Model CL150, CL155, CL250, CL255

■ General Specifications

Safety Standards

All models: EN 61010-1, EN IEC 61010-2-032

Models that use test leads*1: EN 61010-031

Indoor use, operating altitude 2000 m or less, pollution degree 2

EMC Standards

EN 61326-1 Class B Table 1, EN 61326-2-2

EN 55011 Class B Group 1

Group 1: Equipment that does not intentionally generate or use radio-frequency (RF) energy

EMC Regulatory Arrangement in Australia and New Zealand

Korea Electromagnetic Conformity Standard (한국 전자파적합성기준)

Environmental standards

EU RoHS Directive compliant
For conformity to environmental regulations and/or standards other than EU, contact your nearest YOKOGAWA office (PIM113-01Z2).

Authorized Representative in the EEA

Authorized Representative in the EEA Yokogawa Europe B.V. is the authorized representative of Yokogawa Test & Measurement Corporation for this product in the EEA.

(EEA: European Economic Area)

To contact Yokogawa Europe B.V., see the separate list of worldwide contacts, PIM 113-01Z2.

Clamp-on Tester

Model: CL150, CL155
CL220, CL250, CL255
CL320, CL340, CL345, CL360

How to Replace and Dispose the Batteries

Batteries and Waste Batteries

(EU Battery Directive/Regulation valid only in the EEA* and UK Battery Regulation in the UK)

Batteries are included in this product.

When you remove batteries from this product and dispose them,
discard them in accordance with domestic law concerning disposal.

Take a right action on waste batteries, because the collection systems in the EEA and UK on
waste batteries are regulated. (*EEA: European Economic Area)

CL150, CL155 CL250, CL255, CL340, CL345, CL360	CL220, CL320
Battery type: Manganese dry cell  Pb Criterion value (weight percent): Lead (Pb) 0.004%	Battery type: Alkaline cell 

Notice:

This marking indicates they shall be sorted out and collected as ordained in the EU battery
Directive/Regulation and UK battery Regulation.

The chemical symbol beneath the marking means relevant chemical substance is
contained more than criterion value in battery.

How to remove batteries safely:

For further details, see "Battery Replacement" in the User's Manual.