

# Quick and Safe Expert Ground-Loop Testing



**Clamp-on  
ground  
resistance  
testers**

IP  
40

600 V CAT IV

OLED Screen visible over an  
angle of 180° and in all lighting  
conditions

- Display of the ground voltage\*
- Force compensation system\*
- Automatic Pre-Hold mode
- Automatic calibration of jaw opening
- Possibility of recalibration without returning to the factory
- Programmable alarms on  $\Omega$ , A and V
- Dangerous Voltage alarm
- Loop resistance measurement from 0.01 to 1,500  $\Omega$
- Ground inductance measurement from 10 to 500  $\mu\text{H}$
- Leakage current measurement from 0.2 mA to 40 A
- Storage of up to 2,000 time/date-stamped measurements
- GTC and DataView® analysis and report generation software

\*Patents pending

Bluetooth



# A clamp unlike any other.

## Ergonomics

The rugged **C.A 6416** and **C.A 6417** clamps are designed for day-to-day use. Their weight has been limited by using high-performance magnetic materials. To ensure more comfortable use, the clamp's jaw benefits from a new feature: a force compensation system installed on the trigger. Minimal effort is required to keep the clamp open in order to optimize handling of the product while reducing user fatigue.

As an additional safety feature, a protective guard prevents the hand slipping during measurements. The moulded-silicone rotary switch is easy to operate even when wearing safety gloves. The large function keys on the front of the clamp give direct access to the various functions.



The measuring head is the key component of the ground clamp which guarantees the performance of the product. These Chauvin Arnoux® ground clamps comprise two independent, shielded magnetic circuits which ensure excellent rejection of measurement noise. The smooth finish of the surfaces in contact prevents the accumulation of particles which might affect the measurements. Lastly, the centring system ensures optimum alignment of the 2 parts of the head in order to offer measurements that remain accurate over time.

## An exceptional display!

The **C.A 6416** and **C.A 6417** clamps benefit from a top-quality display based on **OLED** technology, which offers better contrast, a sharper image and better colour rendering. With its 180° viewing angle, it is easy to read in all circumstances.

There are two display modes available:

- **Standard mode** to display a single screen with measurement results
- **Advanced mode** to display 3 separate screens:



- Measurement result
- Ground voltage
- Resistance and loop inductance values



Standard mode: Impedance and leakage current

Example:



Screen 1: Impedance and leakage current



Screen 2: Ground voltage



Screen 3: value of the the resistive and inductive part of the impedance measured

## PRE-HOLD

The measurement display can be frozen by pressing the **HOLD** key.

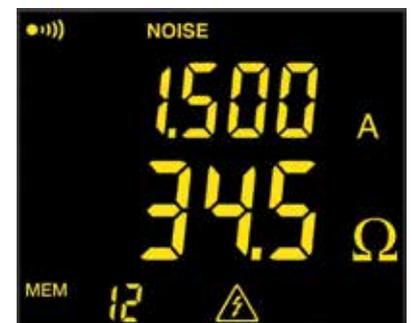
The **PRE-HOLD** mode is even quicker and more practical: when the clamp's jaws are opened, the values from the current measurement are automatically frozen on the display.

## Safety

**Safety first: the Ground Voltage function**

By multiplying the loop impedance by the value of the leakage currents, the clamp provides an estimate of the ground voltage.

To ensure user safety, if the voltage exceeds the stored threshold value, the alarm symbol and the alarm threshold are displayed, flashing. If the alarm is active, the buzzer sounds a (high) alert signal when the ground voltage measured is greater than the threshold.



The Ground Voltage function is active whatever the measurement mode (standard or advanced).

## Transposed impedance

These new clamps calculate the impedance transposed to the network frequency, a very useful feature when measuring low resistance values. By reducing errors due to the inductive part of the installation, this function ensures excellent measurement accuracy.

# Operation

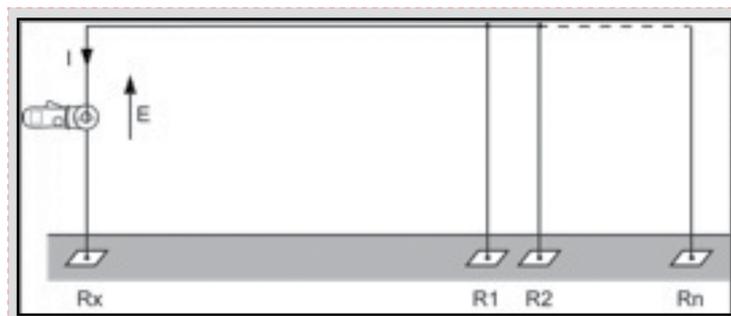
The **C.A 6416** and **C.A 6417** clamps are simple to use and are designed to measure the loop impedance in a parallel ground network.



## Classic method

The diagram illustrates the general case involving measurement of a loop resistance comprising:

- The ground connection  $R_x$ ;
- The ground;
- Several ground connections with a resistance  $R_i$ ;
- A protective ground wire looping all these grounds together, contributing an inductive component.



The clamp includes two functions grouped in the measurement head:

- The clamp's generator winding applies an AC voltage with a constant level  $E$ .
- The receiver winding (current measurement) "sees"  $I = E/Z$  loop.

## The advantage of our ground clamps' method

Knowing  $E$  imposed by the generator and  $I$  which is measured, the  $Z$  loop value can be deduced. This value is the one displayed on the instrument. The **Advanced** mode can be used to distinguish between the resistive and inductive portions and to transpose the impedance to the network frequency, i.e. low frequency. This method is very useful when measuring impedances comprising a small resistive portion.

More generally, this principle can be used to search for faulty grounds. The loop resistance is made up of:

- $R_x$  (the value sought);
- $Z_{\text{ground}}$  (normally very low – below  $1 \Omega$ );
- $R_1 // R_2 \dots // R_n$  (negligible: case of multiple grounds in parallel);
- $Z_{\text{protective ground wire}}$  (normally very low – less than  $1 \Omega$ ).
- $R_{\text{loop}} = R_x + Z_{\text{ground}} + (R // R \dots // R) + Z_{\text{protective ground}}$ ;

By approximation,  $Z_{\text{loop}}$  can be assimilated to  $R_x$ .

If this value is very high, you are strongly advised to inspect the ground connection involved.

# Applications

Ground measurements in urban areas are often difficult because it is not possible to set up ground stakes. These ground clamps can be used to perform selective measurements on a parallel ground system without disconnecting conductors or even setting up stakes.

In the case of regularly-spaced ground connections or an underground ground loop, the use of ground clamps to measure low values allows you to check the continuity of the loop conductor tested.

## Measurement of grounds in parallel on MV/LV installations

To ensure the quality of the ground present on the whole distribution network, an extended ground is set up using all the local grounds in parallel: grounds of electricity poles, building grounds, etc.

## Ground measurements in urban areas and/or on buildings with Faraday cages

On buildings in urban areas where the grounding system comprises numerous ground connections in parallel and in buildings equipped with sensitive electronic equipment, a network of ground conductors connected to multiple grounds helps to equalize the potential of the chassis-grounds, particularly in the event of storms.

## Measurements on telecommunications lines

To protect their line from disturbances, the telecommunications line provider isolates the cable by means of a conducting sheath connected to the ground over its whole length. Indeed, under the influence of external electromagnetic fields, telecommunication cables, which comprise several conductors, are subject to a stray current which disturbs the devices connected. This current, called the common mode, often drains to ground.

## Measurements in the rail sector

Railways are particularly well protected against lightning and voltage surges. The poles bearing the catenary, the rails and sometimes even the fences are connected to the ground. In addition, to obtain a lower ground resistance, the poles, rails and fences are interconnected to create a network of multiple grounds set up in parallel.

## Ground measurement on buried or surface pipelines

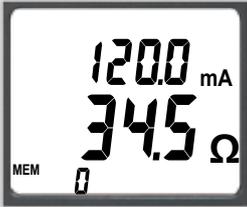
The ground connection of the pipeline is checked with a ground clamp by ground-loop and low-current or leakage-current measurements. In the case of pipelines, the presence of several independent but neighbouring ground networks may cause a significant difference in potential leading to dangerous stray currents. In order to prevent this, specific connections are set up to interconnect the various ground networks, thus guaranteeing their equipotentiality.



# Functions

## Loop impedance and leakage current measurement ( $\Omega$ +A)

### Standard mode



Impedance and leakage current

### Advanced mode with simultaneous display!



Screen 1: Impedance and leakage current



Screen 2: Ground voltage



Screen 3: Value of the resistive and inductive part of the impedance measured



Explanation: the inductive part is negligible  
R=Z

## Alarms



### Voltage alarms



### Impedance alarms

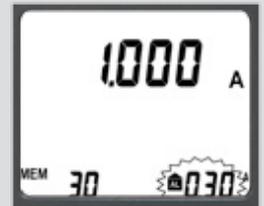
Low impedance threshold



High impedance threshold



### Current alarms



## Current **A**

### Current measurement



## Time/date-stamped measurements



All the measurements are time/date-stamped thanks to the real-time clock 

2 modes available: 12 hrs or 24 hrs

Indication of the date, time, number of recordings and the mode

## Rereading

### MR Rereading in standard mode



### MR Data rereading in advanced mode



# Software

The comprehensive **DataView® processing software** or the **GTC software** can be used to set up and calibrate the **C.A 6416** and **C.A 6417** clamps, and to parameterize the measurement, the frequency, etc....

## GTC & DataView®

**The simple-to-use DataView® software gives you direct access to:**

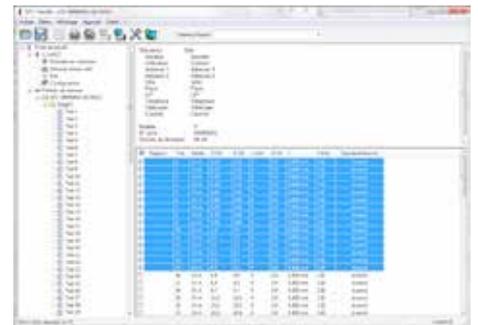
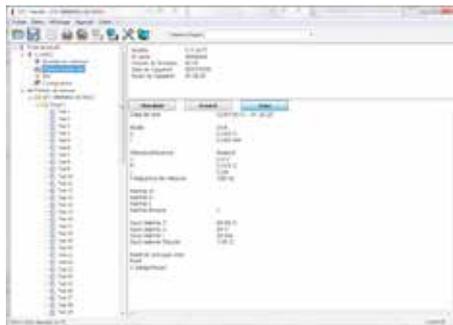
- The data recorded in the clamp
- The clamp set-up
- The various measurements in real time



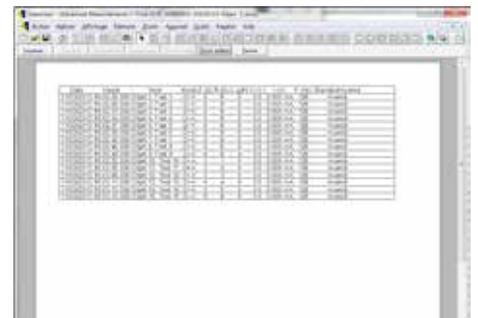
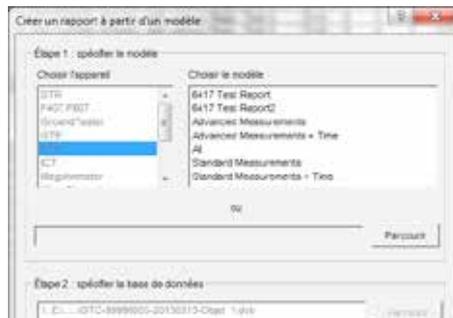
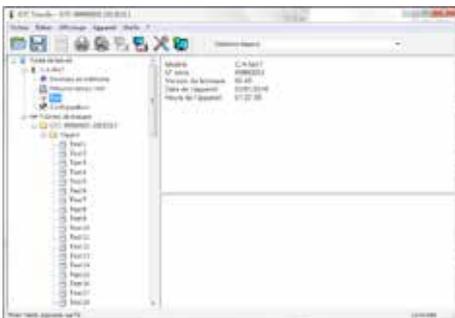
**The SMART NAME for quick connection of the clamp**

**Real-time data**

**Selection of a measurement campaign**



Once the measurements have been made, the data are recovered for analysis and processing or to create automatic or customizable reports with the comprehensive DataView® software.



**Compatible with ANDROID**

- Retrieve your measurements directly on your tablet PC or smartphone and use GPS geolocation to find the site corresponding to the measurements instantaneously.
- Send reports by email.



# Technical specifications

	C.A 6416	C.A 6417
Loop ohmmeter ( $\Omega$ ) 1,500-count display	<b>Measurement ranges / Resolution / Accuracy</b>	
	0.010 to 0.099 / 0.001 / $\pm 1.5\% \pm 0.01$	
	0.10 to 0.99 / 0.01 / $\pm 1.5\% \pm 2r$	
	1.0 to 49.9 / 0.1 / $\pm 1.5\% \pm r$	
	50.0 to 99.5 / 0.5 / $\pm 2\% \pm r$	
	100 to 199 / 1 / $\pm 3\% \pm r$	
	200 to 395 / 5 / $\pm 5\% \pm r$	
	400 to 590 / 10 / $\pm 10\% \pm r$	
Frequencies	600 to 1,150 / 50 / Approx. 20%	
	1,200 to 1,500 / 50 / Approx. 25%	
Loop inductance measurement	Measurement frequency 2,083 Hz /	
	Transposition frequency 50, 60, 128 or 2,083 Hz	
Ground voltage	<b>Measurement ranges (V) / Resolution (V)</b>	
	10 to 100 / 1 / $\pm 5\% \pm r$	
Ammeter 4,000-count display	100 to 500 / 1 / $\pm 3\% \pm r$	
	<b>Measurement ranges (A) / Resolution (A) / Accuracy</b>	
	0.200 to 0.999 mA / 1 $\mu$ A / $\pm 2\% \pm 50\mu$ A	
	1.000 to 2.990 mA - 3.00 to 9.99 mA / 10 $\mu$ A / $\pm 2\% \pm 50\mu$ A	
	10.00 to 29.90 mA - 30.0 to 99.9 mA / 100 $\mu$ A / $\pm 2\% \pm r$	
	100.0 to 299.0 mA - 0.300 to 0.990 A / 1 mA / $\pm 2\% \pm r$	
	1.000 to 2.990 A - 3.00 to 39.99 A / 10 mA / $\pm 2\% \pm r$	
<b>Setup</b>		
Modes	Standard or advanced	
Alarms	Configurable on Z, V and A	
Buzzer	Active	
HOLD	Manual or automatic PRE-HOLD	
Automatic power-off	Active / Inactive	
<b>General specifications</b>		
Display	152-segment OLED. Active area 48 x 39 mm.	
Max. clamping diameter	$\varnothing$ 35 mm	
Storage	300 time/date-stamped measurements	2,000 time/date-stamped measurements
Communication	-	Bluetooth class 2
Power supply	4 x 1.5 V LR6 (AA) alkaline batteries or 4 x NiMH batteries	
Battery life	1,440 measurements of 30 seconds each	
Calibration	Automatic at start-up	
Electrical safety	IEC 61010 600 V CAT IV	
Protection	IP40	
Dimensions	55 x 95 x 262 mm	
Weight	Approx. 935 g with batteries	

## To order

### C.A 6416 > P01122015

1 clamp delivered in a carrying case with 4 x 1.5V batteries, 1 CD-Rom containing the operating manual in 5 languages

### C.A 6417 > P01122016

1 clamp delivered in a carrying case with 4 x 1.5V batteries, 1 CD-Rom containing the operating manual in 5 languages and the software with a simplified GTT driver

## Accessories & replacement parts

- CL1 calibration loop > P01122301
- DataView® > P01102095
- Bluetooth modem USB > P01102112
- Hard case > P01298080



Distributor



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