

- Ohmmètre de terre et de résistivité
- Earth & Resistivity Ohmmeter
- Erdungs- und Bodenwiderstandsmesser
- Ohmmetro di terra e di resistività
- Óhmetro de tierra y de resistividad

# C.A 6460

# C.A 6462




ENGLISH

User's manual


 CHAUVIN  
ARNOUX

## English

**Meaning of symbol** 

**Caution! Please consult the User Manual before using the device.**

In this User Manual, failure to follow or carry out instructions preceded by this symbol may result in personal injury or damage to the device and the installations.

**Meaning of symbol** 

This appliance is protected by double insulation or reinforced insulation. It does not have to be connected to an earth protection terminal for electrical safety.

Thank you for purchasing this **C.A. 6460** or **C.A. 6462** ohmmeter for earth and resistivity measurement.

To obtain the best possible service from your instrument:

- **read** this operation manual carefully
- **comply** with the precautions for use.

### **PRECAUTIONS FOR USE**

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- Comply with the conditions for use: temperature, humidity, pollution level.
- This instrument can be used on category III installations: Category III meets severe reliability and availability requirements, corresponding to permanent use on fixed industrial installations (see IEC 664-1 Ed. 92).
- Only use the instruments on installations that are not live.
- To prevent the using mistakenly touching the terminal linked to the mains electricity supply, you are advised to check the voltage on the sockets before connecting the instrument.
- Do not perform any measurements when the leads are connected and the instrument's buzzer is sounding.
- Check that all the terminals are disconnected before replacing the fuse or the batteries (C.A 6460).
- Recharge the battery in accordance with the mains voltage (C.A 6462).
- Make sure that you replace the battery pack (C.A 6462) with an appropriate battery pack.
- Respect the value and type of the fuse to avoid damaging the instrument and cancelling the warranty.

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## 1. PRESENTATION

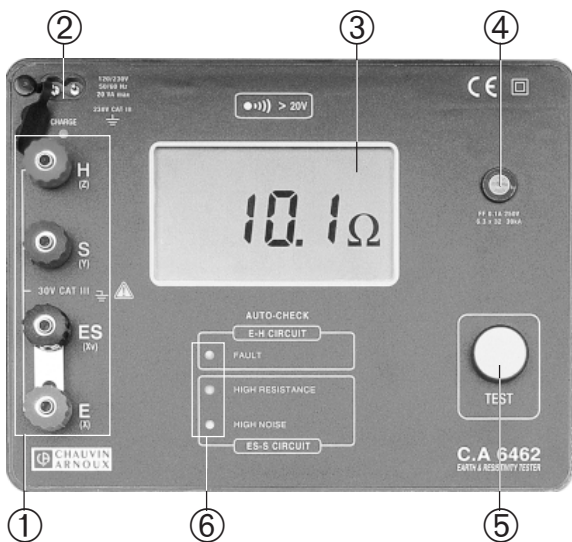
The **C.A 6460** and **C.A 6462** are ohmmeters equipped with digital displays for earth and resistivity measurements in the field.

They are particularly well-adapted to use in difficult conditions, in the presence of interference voltages, high earth currents or highly resistive auxiliary connections, in accordance with standards NF EN 61010-1 + A2, NF EN 61557 parts 1 and 5, NF EN 61326-1 + A1.

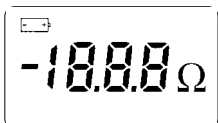
For easier handling, the instrument is equipped with:

- a single pushbutton for activation of measurement,
- an automatic switching system for the measurement calibre,
- a large-size backlit liquid crystal display,
- three LEDs indicating the presence of faults which may invalidate the measurement result,
- four coloured screw terminals to simplify connection of the leads,
- a captive connection strap.

## 2. DESCRIPTION




- ① Four measurement terminals marked E (X), ES (Xv), S (Y) and H (Z)
- ② Mains socket equipped with a cover to protect it from dust (only on C.A 6462).  
Battery charge LED (only on C.A 6462); when it is lit continuously, it indicates that the battery is being charged. It changes colour when charging has finished.
- ③ LCD display with backlighting which lights up whenever the ⑤ pushbutton is pressed.



The liquid crystal display includes the digital display of the measured values, the related units and symbols. The “minus” sign indicates reversal of the measurement conditions.

The “1” sign alone on the left of the screen indicates that the measured resistance is greater than 1999 Ω.

 indicates that the power supply is too low to make a correct measurement.

- ④ Fuse holder
- ⑤ Fleeting control measurement pushbutton used for starting up the equipment and tripping the measurements. As soon as the pushbutton is released, the equipment is turned off.
- ⑥ Three indicator lights that flash when the measurement is not valid (see § 3.5 fault signalling).
  - “FAULT” : if the current circuit resistance is too high  
if the current circuit resistance is too high  
if the fuse is defective
  - “HIGH RESISTANCE” : means that the measurement is liable to be over-affected by the resistance in the S.ES voltage circuit.
  - “HIGH NOISE” : if there is too much interference in the S.ES voltage circuit, it means that the electronics saturated and the measurement is no longer valid.

The equipment is also provided with a cover and a transport handle.

## ■ Buzzer

The equipment features a buzzer which buzzes when the terminals of the equipment are connected to a voltage source. The sound volume is proportional to the voltage up to approximately 30 V then becomes stable.

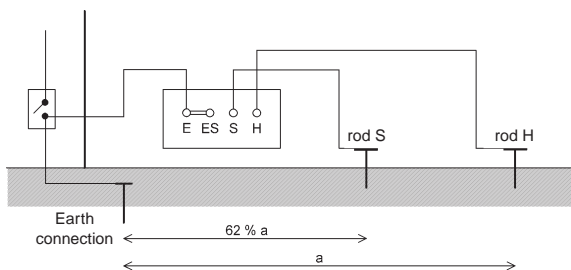
## 3. USE

### 3.1 Implementation

- Connect the cords to the equipment using the forked terminals and in compliance with the terminal colours.
- Pay out the cords and set the stakes at the ends.
- Connect the cords to the stakes using the alligator clips.
- Return to the equipment, press the pushbutton and read the measurement results.

### 3.2 Earth resistance measurement

To measure the earth resistance, it is advisable to use the “62%” method (method using two stakes). This measurement requires the use of the earth Kit components (*see paragraph 7 to order*).



**Turn off the installation power supply and disconnect it from the earth by opening the ground terminal bar.**

1. Short-circuit the terminals E and ES using the corresponding terminal bar and connect them to the earth point to be measured.
2. Push rod H as deep as possible into the ground at a distance “a” from the earth to be measured.  
**Note:** the deeper the earth the greater this distance should be (larger area of influence). If possible, it is advisable to have a distance “a” > 25 m
3. Insert rod S into the ground on a line between the earth connection E and rod H, at a distance of 62% of “a”.

- Connect the rods to their respective terminals on the instrument, using the leads.
- Press the ⑤ button until the measurement is displayed. Make sure that none of the three indicators is flashing, otherwise check the setup (see § 3.5 Fault signalling) and start measuring again.

#### Checking the measurement:

- Note the measurement value previously obtained.
- Redo a measurement a few moments later.
- Move rod S toward H over a distance of 10% of "a". Measure and note the result.
- From the initial position, move the rod S toward E over a distance of 10% of "a". Measure and note the result.

If the three measurements are of the same magnitude, the measurement is correct. Otherwise, increase "a" and start the entire operation again.

**Note:** To counter the resistance of the lead E (approximately  $22.5 \text{ m}\Omega / \text{m}$  for the lead supplied in the kit), it is better to disconnect the terminal bar and connect the ES terminal to the earth to be measured.

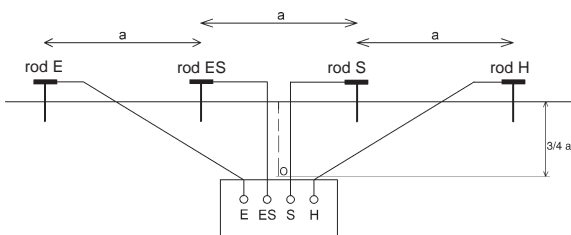


**Remember to reconnect the earth terminal strip once you have finished measuring !**

### 3.3 Measurement of earth resistivity

This measurement is used for choosing, when possible, the best location and shape of the earth point before it is built.

This measurement is made using the WENNER method described below. It requires the use of the components of the resistivity kit (see para. 7 of order).

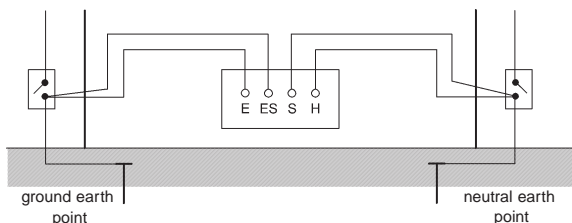


- Check that the terminal bar is disconnected between the terminals E and ES.
- Set out the four rods in a straight line at a constant interval "a",

3. Connect the rods to their respective terminals on the instrument, using the leads.
4. Press the ⑤ button until the measurement is displayed. Make sure that none of the three indicators is flashing, otherwise check the setup (see § 3.5 Fault signalling) and start measuring again.
5. Make a note of the measured resistance R.
6. The ground resistivity at point O is obtained by calculation:  
 $\rho = 2\pi \times R \times a$  (with  $\rho$  in  $\Omega\text{m}$ , R in  $\Omega$  and a in metres)

### 3.4 Measurement of coupling

This measurement can be made to determine the coupling resistance between two earth points. For instance, between the neutral earth point and the ground earth point (EDF distribution).



**⚠ Cut off the installation power supply and disconnect the earth points.**

1. Open the terminal bar between the E and ES terminals.
2. Using separate leads, connect the E and ES terminals to the ground earth point and the H and S terminals to the neutral earth point.
3. Press the ⑤ button until the measurement is displayed. Make sure that none of the three indicators is flashing, otherwise check the setup (see § 3.5 Fault signalling) and start measuring again.
4. Note the  $R_{mn}$  value displayed.
5. By also measuring  $R_m$  (ground earth resistance) and  $R_n$  (neutral earth resistance) using the 62% method described in § 3.2, the coupling coefficient can be calculated:

$$k = \frac{R_c}{R_m} \text{ hence } R_c = \frac{R_m + R_n + R_{mn}}{2}$$



This coupling coefficient  $k$  must be  $< 0.15$  (EDF recommendation)



**Remember to reconnect the earth terminal strip once you have finished measuring !**

### 3.5 Fault signalling

■ **If the FAULT indicator light flashes:**

- either the fuse is defective
- or the circuit is cut off.
- or the rod resistance is too high or the spurious voltage is excessive.

To check the fuse continuity, short circuit the H and E terminals and make a measurement. If the indicator light continues to flash, replace the fuse from the front panel (see para. 5.1.3. Maintenance) If the indicator light no longer flashes, the fuse is serviceable. You then need to check the connections.

■ **If the HIGH RESISTANCE indicator light flashes:** the resistance in the voltage circuit (between the S and ES terminals) is too high, or the voltage circuit is cut off. You then need to check the connections.

■ **If the HIGH NOISE indicator light flashes:** the spurious voltage is too high in the voltage circuit In this case, move the rods because they are in an area where there is too much interference.

■ **If there is interferences and the measurement fluctuates** (and none of the indicator lights is flashing). Measure the minimum and maximum then calculate the average to obtain the result.

To be more sure, make two consecutive measurements at intervals of a few seconds

## 4. FUNCTIONAL CHARACTERISTICS

### 4.1 Reference conditions

Influence quantities	Reference values
Temperature	23°C ±3 K
Relative humidity	45 to 55% HR
Supply voltage	9.5 V ±0.2 V
Auxiliary resistances RH, RS, RES and RE	zero
Spurious voltages (Ac and DC)	zero
Serial inductances	zero
Electrical field	< 1 V/m
Magnetic field	< 40 A/m

### 4.2 Metrological properties

#### 4.2.1 Voltage detection

Measurement range: 20 to 250 V<sub>AC</sub> between the H and E terminals or between the S and E terminals.

Frequency: DC at 450 Hz

#### 4.2.2 Resistance

Measurement range: 0 to 2000 Ω

Rating (Ω)	0.00 - 19.99	20.0 - 199.9	200 - 1999
Resolution (Ω)	0.01	0.1	1
Intrinsic error	±2% ±1 pt	±2% ± 1pt	±2% ±3 pt
Measuring current	10 mA	1 mA	0.1 mA
No load voltage	≤ 42 V <sub>peak</sub>		

Response time: 4 to 8 seconds

When the unit is locked on the second rating, the characteristics are as follows:

Rating (Ω)	0.0 – 199.9
Resolution	0.1 Ω
Intrinsic error	±2% ±1 pt
Measuring current	1 mA
No load voltage	≤ 42 V <sub>peak</sub>

## 4.3 Power supply

The equipment power supply is obtained from:

C.A 6460 : 8 1.5 V LR 14 batteries or rechargeable cells of the same size, NiMH or NiCd

C.A 6462 : NiMH rechargeable cell

External recharge : 120-230 V / 50-60 Hz, 20 VA

Charge time 6 h for charging to 80% of the battery capacity (cf § 5.1.2)

Equipment	C.A 6460 (8 LR14 cells)	C.A 6460 (8 x1,2 V, 2 Ah cells)	C.A 6462 (Battery pack)
Battery charge life average in continuous operation*	4500 measurements 15 s or 18 h 45	1180 measurements 15 s or 4 h 45	2,000 measurements 15 s or 9 h 35

\* at the rating consuming most power

The load limit of the power supply is indicated by the display



The capacity after this display is approximately 50 measurements of which only 20 are with rechargeable cells.

## 4.4 Environmental parameters

### 4.4.1 Climatic

#### ■ Nominal range of use

- from -10°C to +55°C

- from +20°C to +90 % HR without condensation

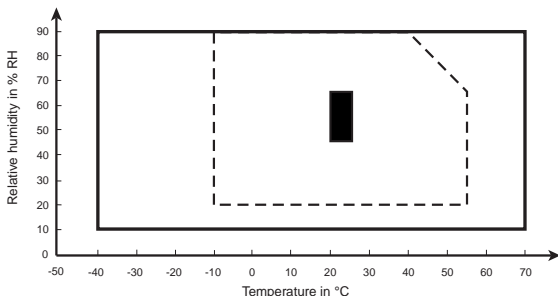
#### ■ Storage (without battery or rechargeable cell but with battery depending on model):

- 40 to +70 °C

- from +20°C to 90 % HR without condensation

#### ■ Climatic conditions:


■ Reference range      — Storage range      - - - Operating range



## 4.5 Construction specifications

- Overall dimensions of the unit (L x W x H):  
273 x 247 x 127 mm  
273 x 280 x 127 mm with handle extended
- Weight: 2.850 kg (C.A 6460)  
3.350 kg (C.A 6462)

## 4.6 Compliance with international standards

- Electrical safety as per: EN 61010-1 + A2 (ed. 95),  
EN 61557 (ed. 97)
- Dual insulation: 
- Pollution level 2
- Installation category III
- maximum operating voltage: 30 V rms

### 4.6.1. Electromagnetic compatibility

As per NF EN 61326-1, ed. 98)

### 4.6.2 Mechanical protection

The C.A 6460 and 6462 have successfully undergone all the required mechanical tests (vibration/ rigidity / resistance to impact / free fall) and therefore meet all the requirements of the standards NF EN 61557 and NF EN 61010-1.

## 4.6.3 Variations in operating range

Influence quantities	Operating range limits	Typical measurement variations	Maximum measurement variations
Temperature	-10 to +55°C	(0.% ±1 pt)/10 °C	(1% ±1 pt)/10°C
Relative humidity	20 to 90% RH	1% ±3 pt	2% ±5 pt
Supply voltage	7.5 to 13 V	0.5% ±1 pt/V	1% ±1 p/V
Rvoltage (Rs + Rx + RES)	50 kΩ	-0.6%/10 kΩ ±2 pt	-1%/10 kΩ ±4 pt
Rcurrent (RH + Rx + RE)	Calibre 1...30 kΩ <sup>(1)</sup> 2...30 kΩ 3...50 kΩ	0,5%/10 kΩ ±1 pt	1%/10 kΩ ±2 pt
Resistance into the 4k rods (RH = RS = RES = RE)	Calibre 1...15 kΩ <sup>(1)</sup> 2...15 kΩ 3...25 kΩ	(0.% ±0,3 Ω)/10 kΩ 0.%/10 kΩ 0.5%/10 kΩ	(1% ±0,6 Ω)/10 kΩ 1%/10 kΩ 1%/10 kΩ
DC voltage in series with Rx	0 to 20 V <sup>(2)</sup>	-	Negligible
Spurious voltages AC in series with H (50 Hz, 60 Hz or their harmonics)	0 to 3 Vrms or 0 to 32.5 Vpeak at 16,67, 50, 60 or 400 Hz	1% ±1 pt	2% ±2 pt
AC spurious voltages in series with S (50 Hz or their harmonics)	0 to 9 Vrms or 0 to 13 Vpeak at 16,67, 50, 60 or 400 Hz	0.2 % ± 1 pt	0.5 % ± 2 pt
Inductance in series with H and S	0 to 13 mH	-	Negligible

(1) Beyond 3 kΩ, the unit switches to calibre 2.

(2) Risk of flashing HIGH RESISTANCE indicator light flashing beyond 4.5 V.

#### 4.6.4 Typical measurements

The following measurements are representative on-site

##### **Common measurement conditions**

- Ambient temperature
- 10.5 V power supply voltage

##### **Measurement of three wire ground resistance**

- with 5 k $\Omega$  in each of the rods H and S,
  - with 5 V<sub>RMS</sub> sinusoidal spurious voltage at 50 Hz in H and in S,
- The error with respect to the real R<sub>x</sub> values is less than 4%  $\pm$ 5 pt. (For resistance included between 0 and 20  $\Omega$ , the measurement can be displayed for calibre 2).

##### **Four wire resistivity measurement**

- with 5 k $\Omega$  in each of the four rods,
  - with 5 V<sub>RMS</sub> sinusoidal spurious voltage at 50 Hz in H and in S,
- The error with respect to the real R<sub>x</sub> values is less than 4%  $\pm$ 5 pt. (For resistance included between 0 and 20  $\Omega$ , the measurement will be displayed for calibre 2).

**Note:** The same measurements with rod resistances of 1 k $\Omega$  instead of 5 k $\Omega$  would give an error of less than 1%  $\pm$ 2 pt.

#### 4.6.5 Limits

According to NF EN 61557 part 5, free of damage when connected to 120 % of the network voltage to which it is assigned. The user must not be exposed to voltage exceeding the contact voltage and the protection devices must not activate.

C.A 6460 and C.A 6462 are designed to operate with the network de-energised but if wrong manoeuvres are carried out, the equipment is designed to withstand and overload applied permanently between any two terminals for: 250 V<sub>AC</sub> or 100 V<sub>DC</sub>, with the possible blowing of the fuse.

## 5. MAINTENANCE


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**For maintenance, use only specified spare parts. The manufacturer will not be held responsible for any accident occurring following a repair done other than by its After Sales Service or approved repairers.**

### 5.1 Servicing



**When the  symbol is displayed, replace all the batteries of the CA 6460 or recharge the battery of the CA 6462. Check that no other terminals are connected before opening the equipment.**

#### 5.1.1 Replacing the batteries or rechargeable cells (C.A 6460 only)

- Detach the four captive screws under the housing
- Then remove the shell + front panel assembly of the yellow housing
- Then undo the two screws closing the battery compartment cover
- Take out the 8 cells and replace them

**Note:** It is possible to replace the batteries by rechargeable cells (1.2 V - 2 Ah or above, NiCd or NiMH, of same size):

- Remove the plug under the batteries
- Set the switch to the position: NiCd / NiMH
- Replace the plug.
- Insert the 8 rechargeable cells

Then in both cases:

- Replace the battery cover
- Undo the two screws closing the battery compartment cover.
- Replace the shell + front panel assembly in the yellow housing then tighten the four captive screws under the housing

#### 5.1.2 Recharging all replacing the battery (C.A. 6462)

- Connect the battery charge connector to the mains
- The CHARGE indicator light comes on steadily in red
- When the battery is charged, the CHARGE indicator light comes on steadily in green
- The charge time is approximately six hours for charging to 80% of the battery capacity. It is possible to top up the charge.

- disconnect the mains power cord; the green LED takes approximately 20 s to go out.
- connect the mains lead again. The charge will resume and at the end of the second charge, capacity will be optimum.

■ The charge time is approximately six hours for charging to 80% of the battery capacity. It is possible to top up the charge.

- disconnect the mains power cord; the green LED takes approximately 20 s to go out.
- connect the mains lead again. The charge will resume and at the end of the second charge, capacity will be optimum.



**In the event of the unit not being used for some time, recharge the battery before use.**

**Note:** ½ h charge provides self-sufficiency for one day of measurements (approximately 135 measurements lasting 15 s).

**The battery should be replaced by Manumasure or by a repairer approved by CHAUVIN ARNOUX.**

**Important:** Replacement must be carried out using the model recommended by CHAUVIN ARNOUX (see § 7. To order)

### 5.1.3 Replacing the fuse

To check the fuse continuity, short circuit the H and E terminals and make a measurement. If the FAULT indicator light flashes, it means that the fuse has blown.

The fuse is on the front panel.

- Using a screwdriver, turn the screw through a quarter turn
- Take out the support containing the fuse
- Replace the fuse (FF 0.1 A - 250 V – 6.3 x 32 - 30 kA)
- Replace the support and screw it back.

## 5.2 Cleaning



**The instrument must be disconnected from any source of electricity.**

Clean the housing of the equipment Carry out cleaning using a damp cloth or soapy water. Do not use alcohol, solvents or hydrocarbons.

## 5.3 Storage

If the C.A 6460 instrument is not used for a long period (more than two months), remove the batteries and store them separately.



## 5.4 Metrological verification



**It is essential that all measuring instruments are regularly calibrated.**

For checking and calibration of your instrument, please contact our accredited laboratories (list on request) or the Chauvin Arnoux subsidiary or Agent in your country.

### **Maintenance**

Repairs under or out of guarantee: please return the product to your distributor.

## 6. WARRANTY

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Our guarantee is applicable for **twelve months** after the date on which the equipment is made available (extract from our General Conditions of Sale, available on request).

## 7. TO ORDER

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■ **C.A 6460 earth and resistivity ohmmeter .... P01.1265.01**  
*Supplied with batteries, this operation manual and a technical booklet*

■ **C.A 6462 earth and resistivity ohmmeter .... P01.1265.02**  
*Supplied with batteries, this operation manual and a technical booklet*

### **Spare parts for C.A 6460 or C.A 6462 :**

- High breaking capacity  
fuse 0.1 A - 250 V (set of 10) ..... P01.2970.12
- Battery 1.5 V alkali LR14 (set of 8) ..... P01.2960.27
- Battery pack NiMH 9.6 V / 3.5 Ah ..... P01.2960.21
- Europe mains power cord ..... P01.2951.74

### **Measuring accessories**

- **PRESTIGE EARTHING ACCESSORIES Kit P01.1018.24**  
*semi-rigid case containing:*
  - two smooth t-shaped earth rods
  - 100 m of red lead on reel
  - 60 m of blue lead on reel
  - 10 m of green lead on reel
- **RESISTIVITY COMPLEMENT Kit ..... P01.1018.26**  
*Completes earthing kit with:*
  - two smooth T-shaped earth rods
  - 20 m of black lead on reel
- **EARTHING ACCESSORIES kit /  
PRESTIGE RESISTIVITY ..... P01.1018.25**  
*Semi-rigid case containing the parts of the PRESTIGE  
EARTHING kit and the RESISTIVITY COMPLEMENT kit*

### **Spare parts for measurement accessories:**

- Semi-rigid case ..... P01.2980.26
- Smooth T-shaped rod ..... P01.1018.29
- 100 m of red lead on reel ..... P01.2950.45
- 60 m of blue lead on reel ..... P01.2950.44
- 20 m of black lead on reel ..... P01.2950.42
- 10 m of green lead on reel ..... P01.2950.41





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