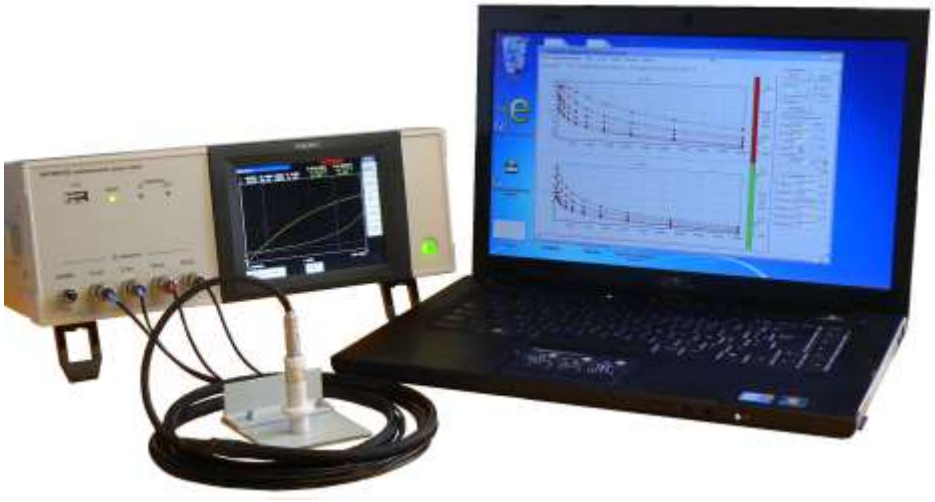
sciensoria
Electromagnetic solutions

Conducsens™

Eddy current thickness measurement system

USER'S MANUAL

V190210



35170 BRUZ France - www.sciensoria.fr

1 What is Conducsens™?

Conducsens™ is a quantitative eddy current nondestructive evaluation system. It allows to measure several parameters of a conductive target in absolute mode. ‘’Absolute mode’’ means that the measurement system does not need to be calibrated before each measurement, in opposition with ‘’comparative mode’’ that requires standard calibration gauges. This greatly facilitates user’s life, since standard calibration gauges are not always available and can be very expensive.

Conducsens™ is composed of a special eddy current probe, an impedance analyzer capable of frequency sweeping, and an analysis software installed on a computer under Windows OS. The impedance analyzer is connected to the PC via a USB interface.

The software uses a mathematic model which simulates precisely the behavior of the probe placed above a conductive target. The target thickness, probe lift-off and conductivity are taken into account. The medium under the target must be considered as infinitely thick and nonconductive, with relative permeability μ_r=1, like air.

In order to obtain measurement of high sensitivity and precision , the Conducsens™ system uses the multi-frequency analysis method. This method enables complementary data acquisition and avoids ambiguity in interpretation. User can choose a range of sweeping frequency following the target properties in order to reveal the features which characterize the difference of a target compared to others.

2 Unpacking and Preparation

2.1 Hardware list

1. Impedance analyzer and its accessories (power cord, USB cable, probe cable)
2. Measurement stand equipped with the eddy current probe pre-mounted and the Intelli_SW interface box.
3. Laptop personal computer with Conducsens™ software pre-installed, and its accessories (power adapter)

The pictures of these items can be found in appendices.

2.2 Hardware connection

1. Eliminate the static electric charge from your body by touching an earth terminal
2. Verify that none of the equipment are turned on before the connections.
3. Connect the probe cable to the four BNC in the front of the impedance analyzer as follows :
    a. The black BNC cable to the ‘’LCUR’’ BNC connector.
    b. The blue BNC cable to the ‘’LPOT’’ BNC connector.
    c. The green BNC cable to the ‘’HPOT’’ BNC connector.
    d. The red BNC cable to the ‘’HCUR’’ BNC connector.
4. Connect the impedance analyzer power cord to the mains, but keep it turned off
5. Connect the USB cable between the computer and the impedance analyzer
6. Connect the USB cable between the computer and the Intelli_SW.
7. Turn on the impedance analyzer first
8. Turn on the computer. Default user’s name is **SCIENSORIA**, and default user’s password is **Ab12345678**

Note : the mains cords are for French standard. You will need to use adapter to connect to the mains outlet of your country.

3 Use of the Conducsens™ software step by step

3.1 Before to start

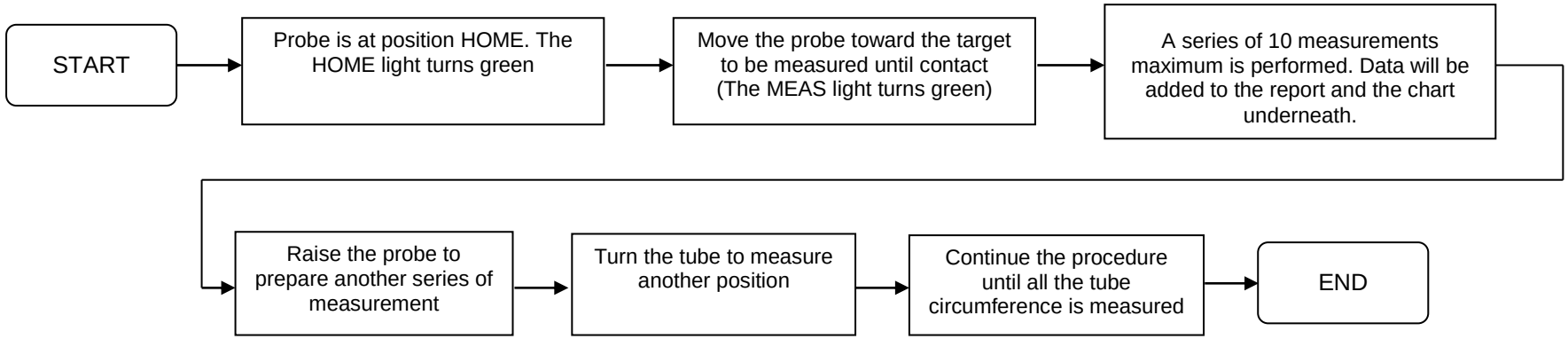
BEFORE TO START, CHECK THE TEMPERATURE OF THE MEASUREMENT ROOM. IT IS PROVEN THAT THE BEST TEMPERATURE RANGE IS BETWEEN 16 AND 20°C.

IF TEMPERATURE IS HIGHER OR LOWER THAN THE LIMITS, CAREFULLY PERFORM CALIBRATION ON KNOWN THICKNESS STANDARDS AND CHECK THE MATERIAL ELECTRICAL CONDUCTIVITY (SEE “ADVANCED OPERATIONS” SECTION.

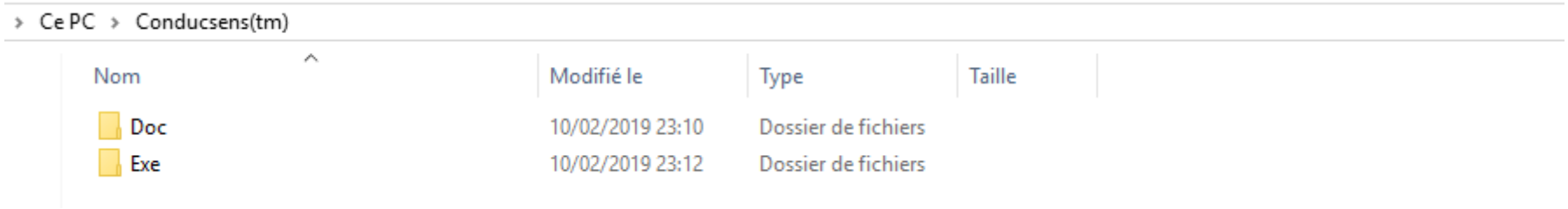
IF THERE ARE DOUBT ABOUT THE MATERIAL (ALUMINUM) TEMPER, ALSO CHECK THE MATERIAL ELECTRICAL CONDUCTIVITY.

3.2 Basic measurement procedure

The following flow chart shows the basic procedure to measure the thickness of metallic tubes (in the case of Mahle, pistons).

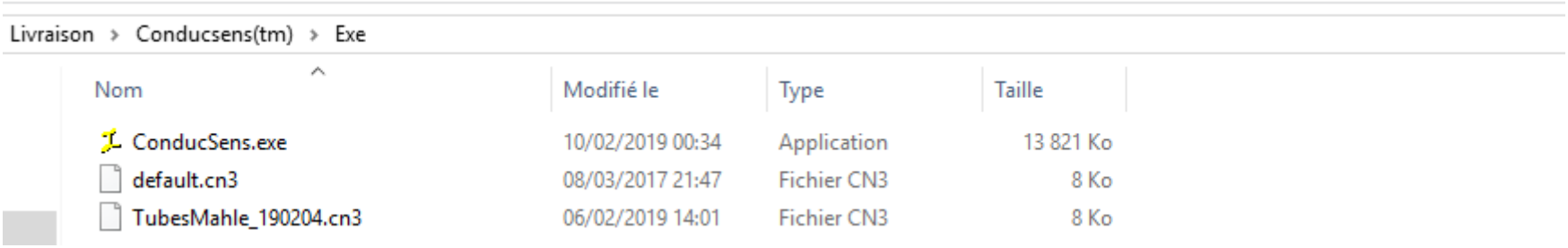


3.3 Access the Conducsens™ executable file



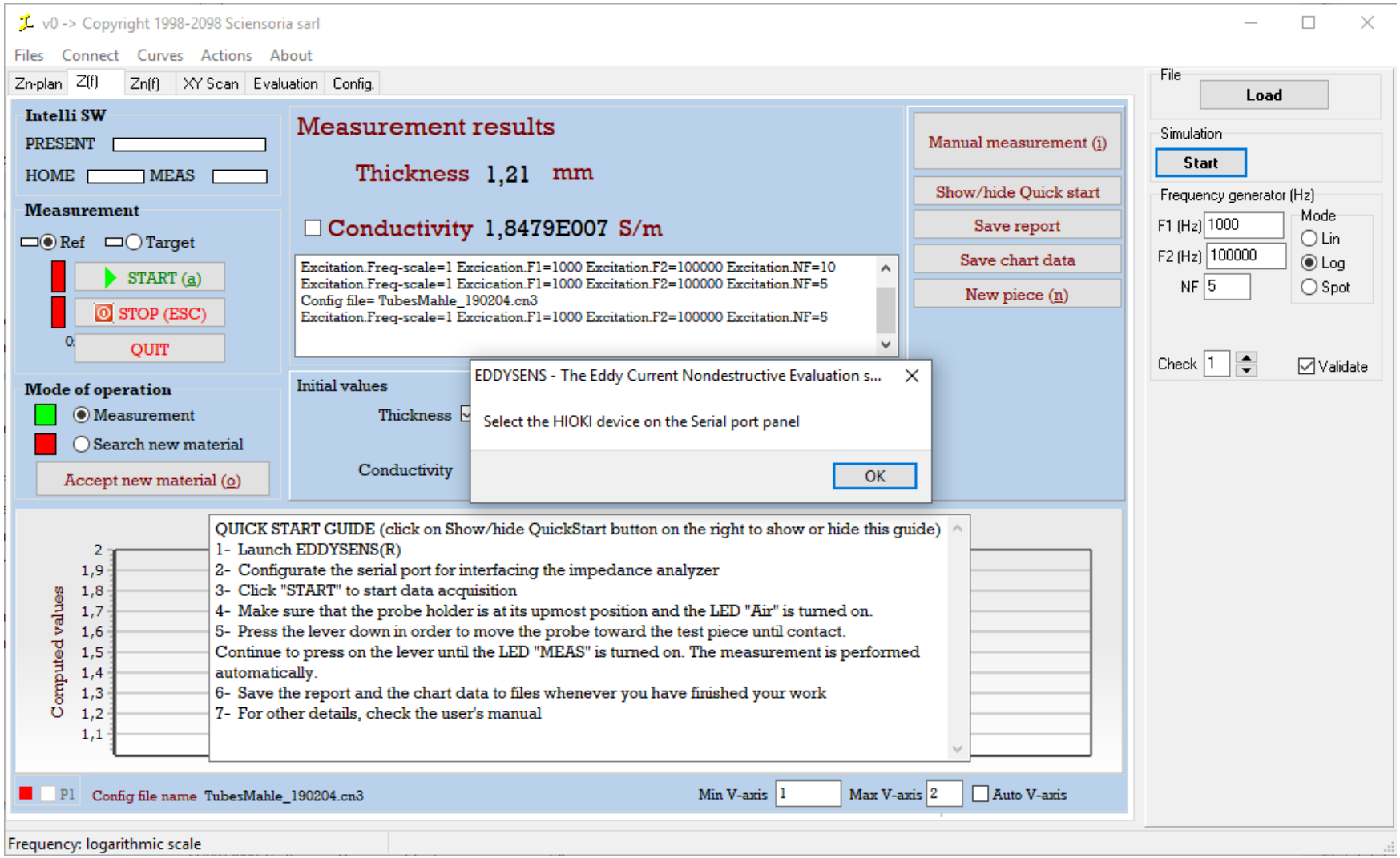
The Conducsens™ software is installed in the Conducsens(tm) folder in your PC. Access the folder and find the subfolders as shown in the figure above. Open the ‘’Exe’’ folder and double click on the Conducsens.exe file with the left button of your mouse.

3.4 Launch Conducsens™ application



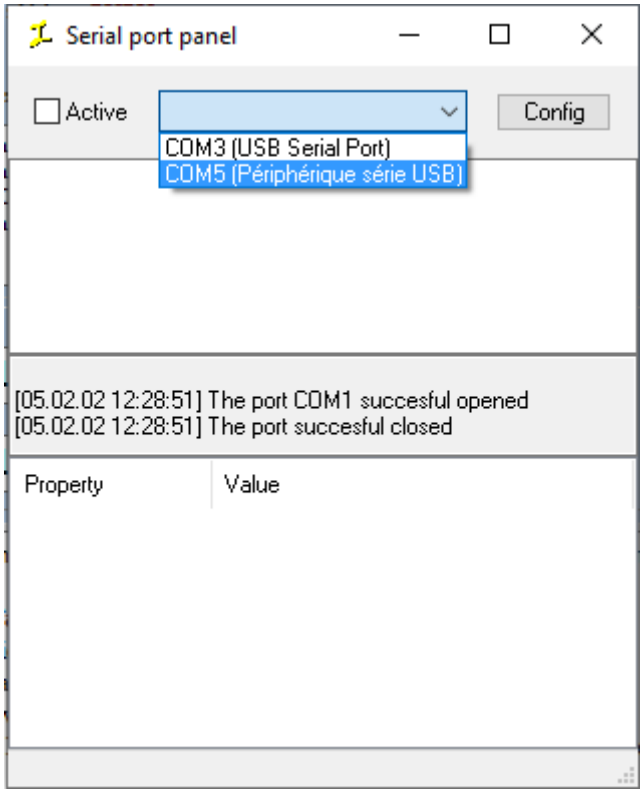
Inside the Exe folder, there are several files, among them the Conducsens.exe file. Double-click on the file to launch the application. The figure on the next page shows the start screen which appears after the launch of Conducsens™. After approximately 1 second, a message appears and invites to select the right serial port for the impedance analyzer. Click on the button OK to acknowledge.

3.5 Conducsens™ start screen

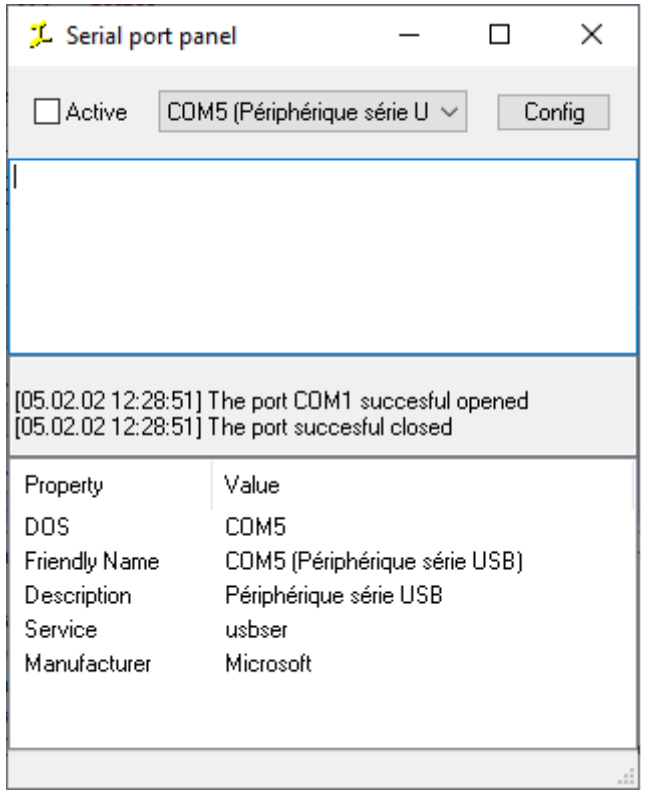


3.6 Select the serial port for interfacing with the impedance analyzer

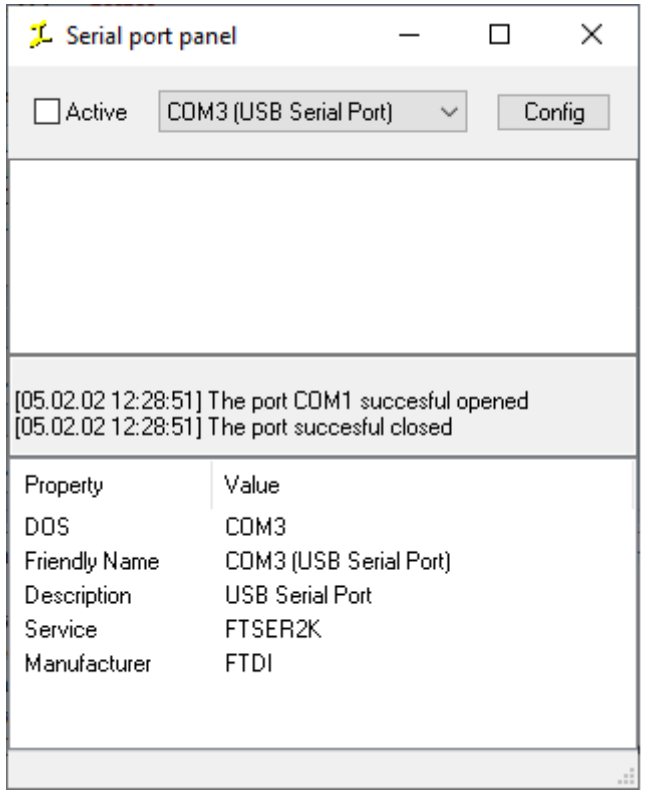
A serial port configuration panel appears. Normally, there are 2 serial ports, one pour interfacing with the impedance analyzer, the other for the Intelli_SW™. User should check each port in order to determine which one is destined to the impedance analyzer, otherwise an error message will occurs.



Only select the port whose **service** field is **usbser** (COM5 in this case). The other port is reserved to the Intelli_SW™.

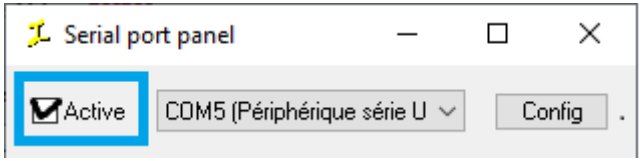


Select this port (**Service = usbser**)



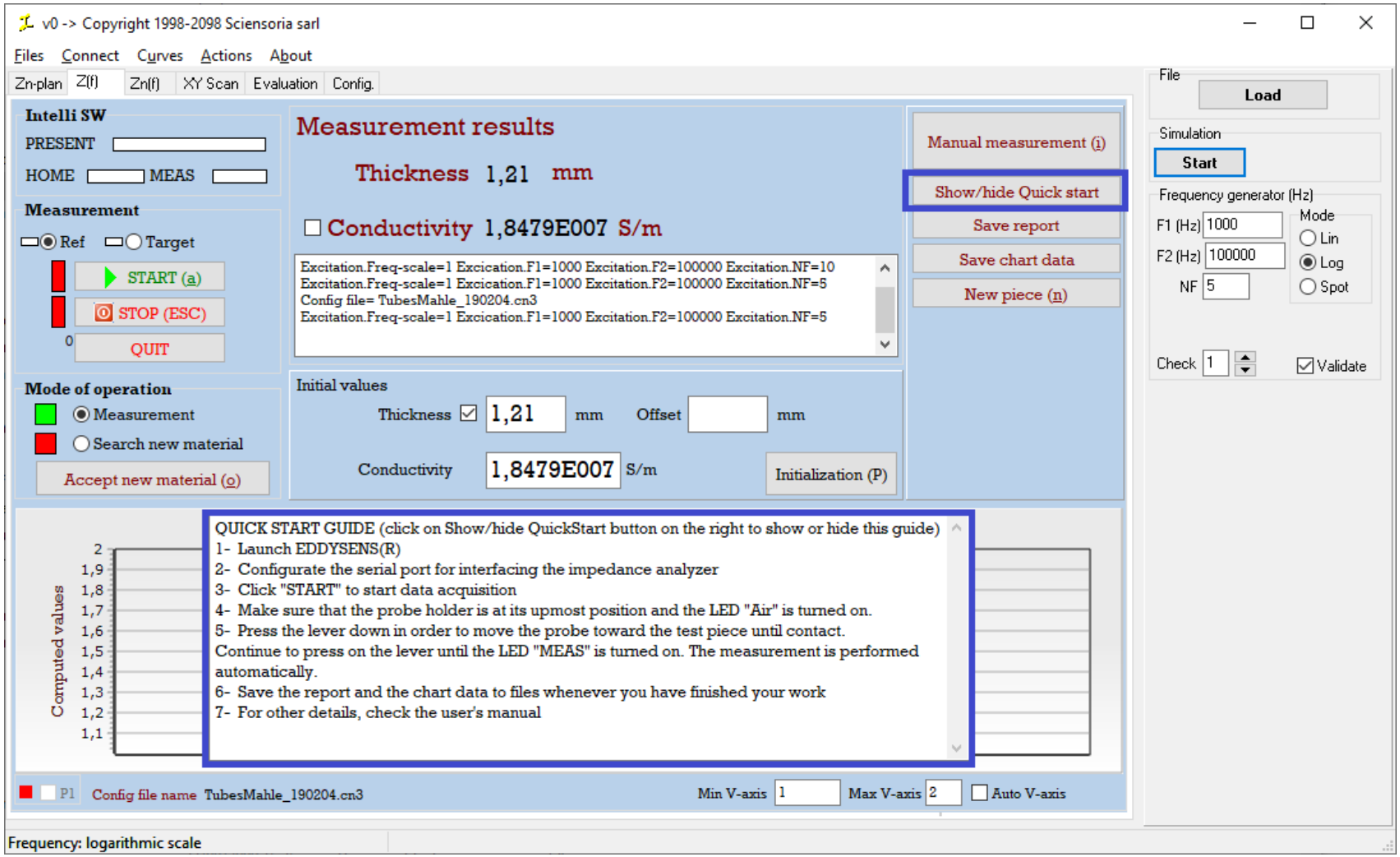
… Don't select this port (Service = FTSER2K)

After selecting the right port, check the "Active" case to activate it as below. The serial port panel will disappear automatically. The impedance analyzer is now connected and is ready for measurement.



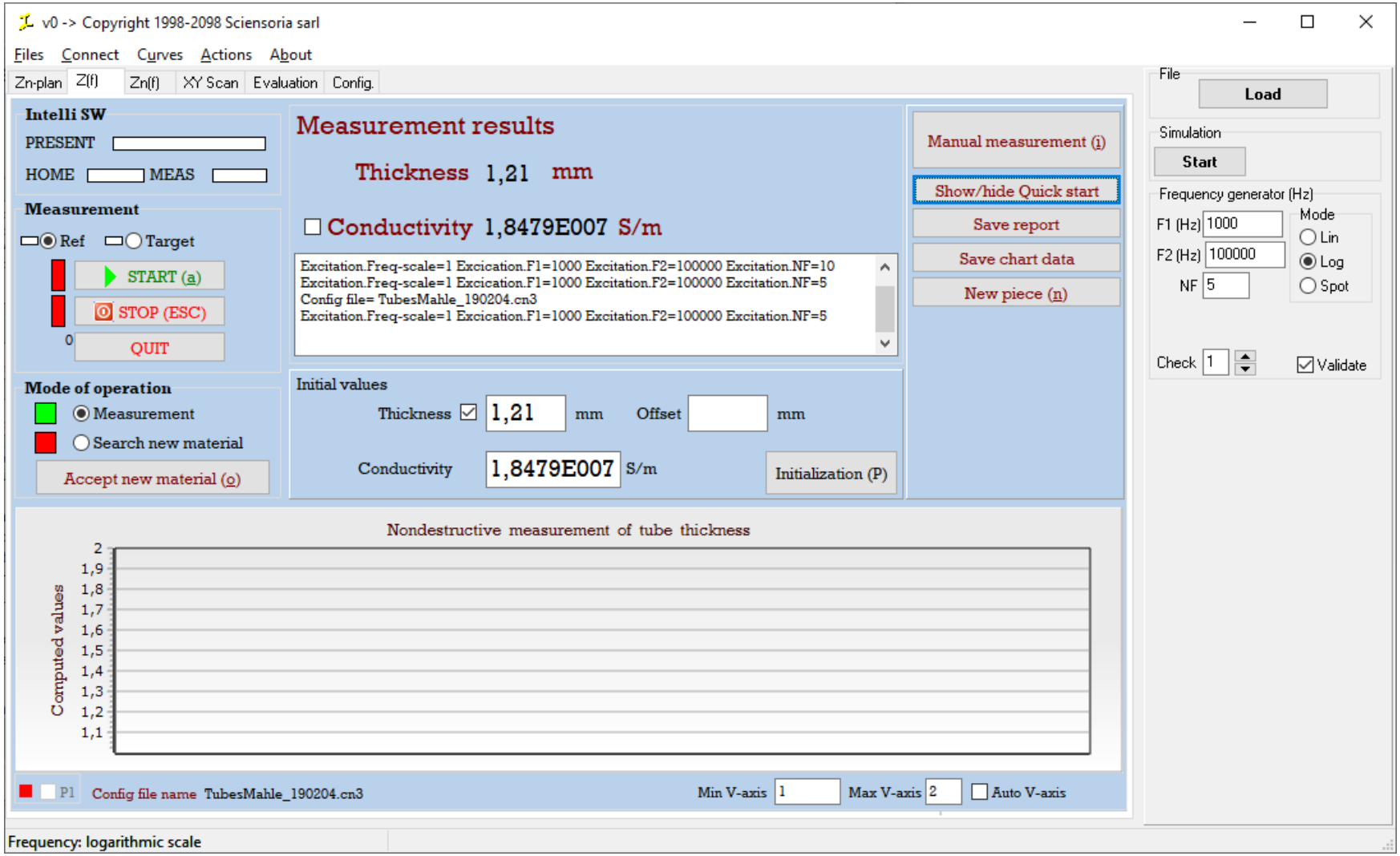
3.7 Show/hide Quick start guide

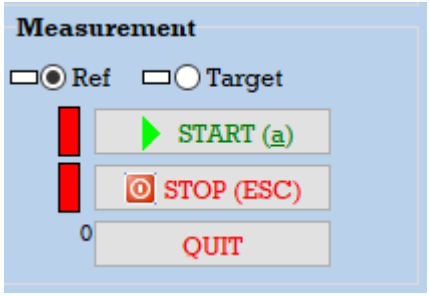
User can refer to the Quick start guide which is shown on the front of the Conducsens™ window as below. In order to make it disappear, click on the button Show/hide Quick start



3.8 Start data acquisition

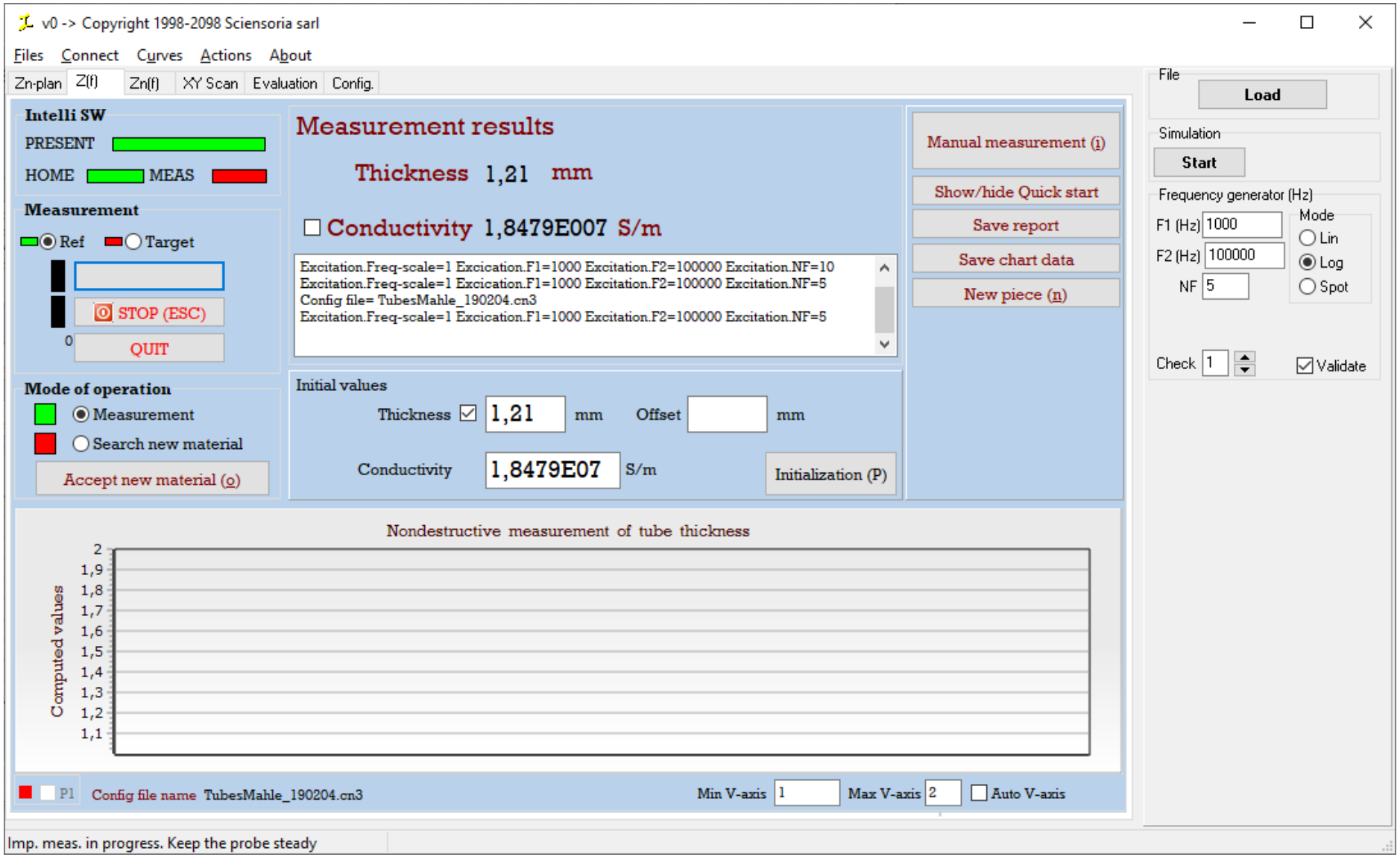
The main window of Conducsens™ is shown below. In order to start data acquisition, click on the button **START** on the **Measurement** panel.





The **Measurement** panel

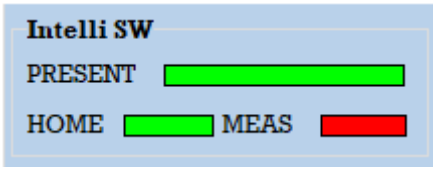
Data acquisition will start and the measurement count will appear in the place of the caption of the START button.

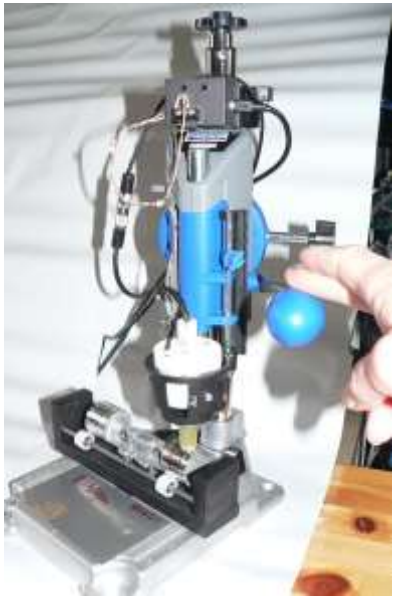


3.9 Perform thickness measurement

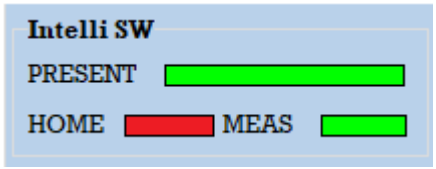
3.9.1 Basic operation

Make sure that in the rest position of the lever of the measurement stand (highest position), the HOME light is green. If it is not the case, press the Intelli_SW™ box down with your hands until the HOME switch touches the support axis and is activated.

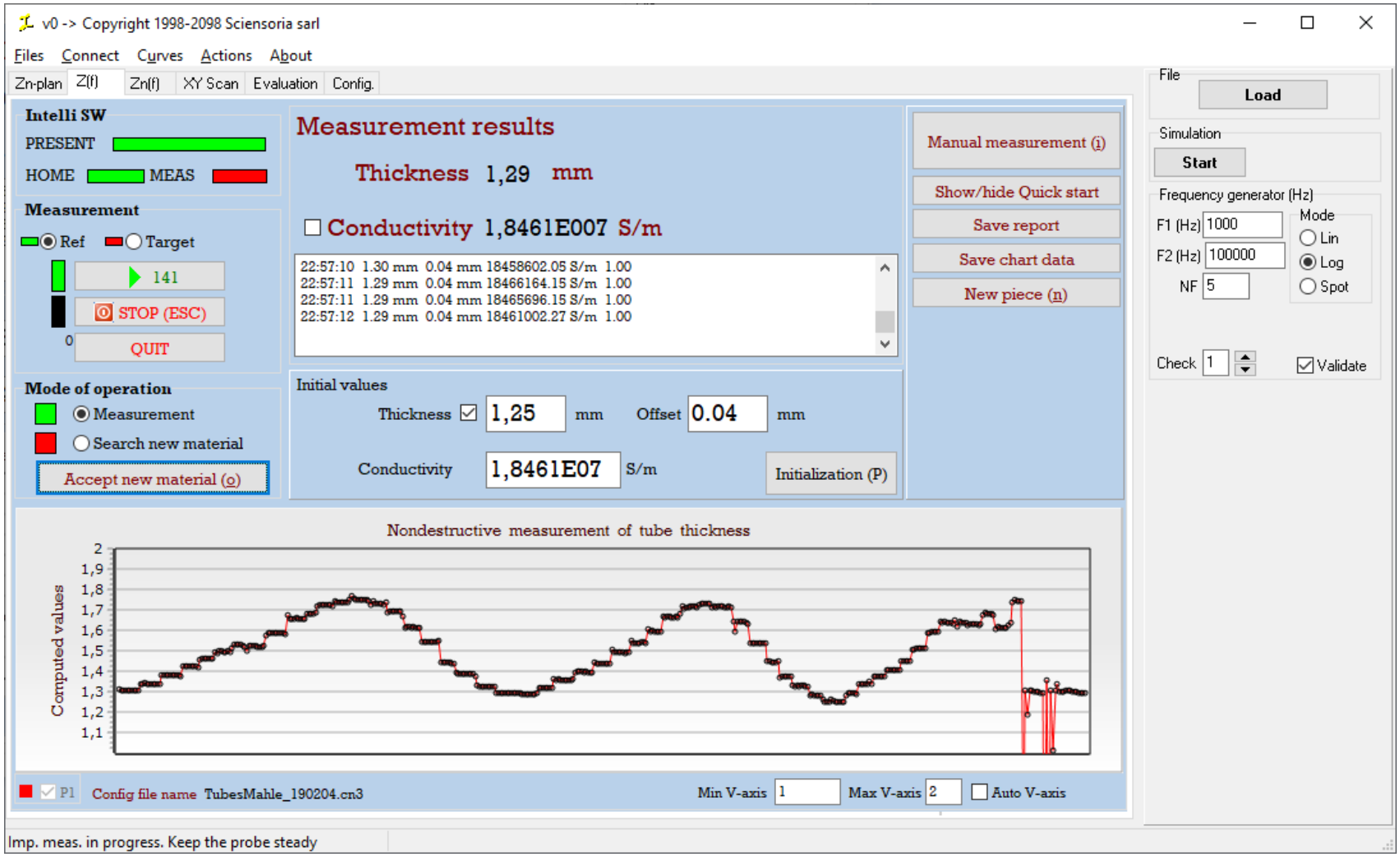




Press the lever down to move the probe toward the tube to be measured until it touches the tube (the HOME light will turn red). Continue to press until the MEAS light turns green. This means that a series of thickness measurements (10 at maximum) has been started



The measurement values are shown on the top of the main window. They are also added to the report box and the chart underneath (see next page). When a series of 10 measurements is done, make another by slightly raising the lever until the MEAS light turns red (the MEAS switch will emit a “click” sound at this moment), then lower it again until the MEAS light turns green. One can base to the switch sound to start and stop different series of measurements.



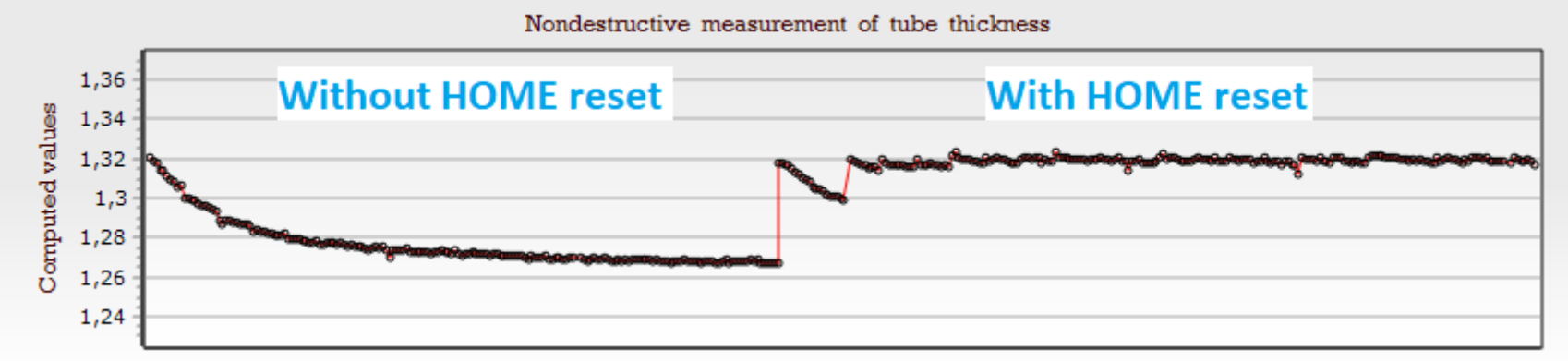
3.9.2 Quick measurement

In order to get a quick sight at the wall thickness all over its circumference, just slightly raise the probe from the surface of the tested piece and turn it by a small step. Press the probe on the piece again to start a new measurement series.

3.9.3 High precision measurement

In order to make high precision measurement, raise the lever to bring the probe to its highest (HOME) position. This resets the system and to remove drifts. The figure below shows how this action can enable high quality measurement without drifts.

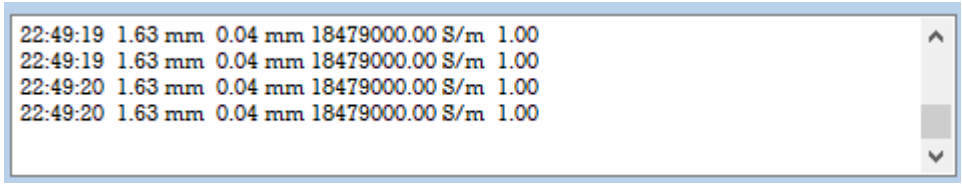
Note: make sure that HOME light should turn green when doing this operation.



3.10 Report and chart

3.10.1 Report

The report area is an editable text box that enables user to add custom comments. Measurement values and time of measurement are automatically added.



When starting to measure a new piece, click on the “New piece (n)” button or hit the key n on the keyboard. This will add a the line “NEW PIECE ADDED” in the report.

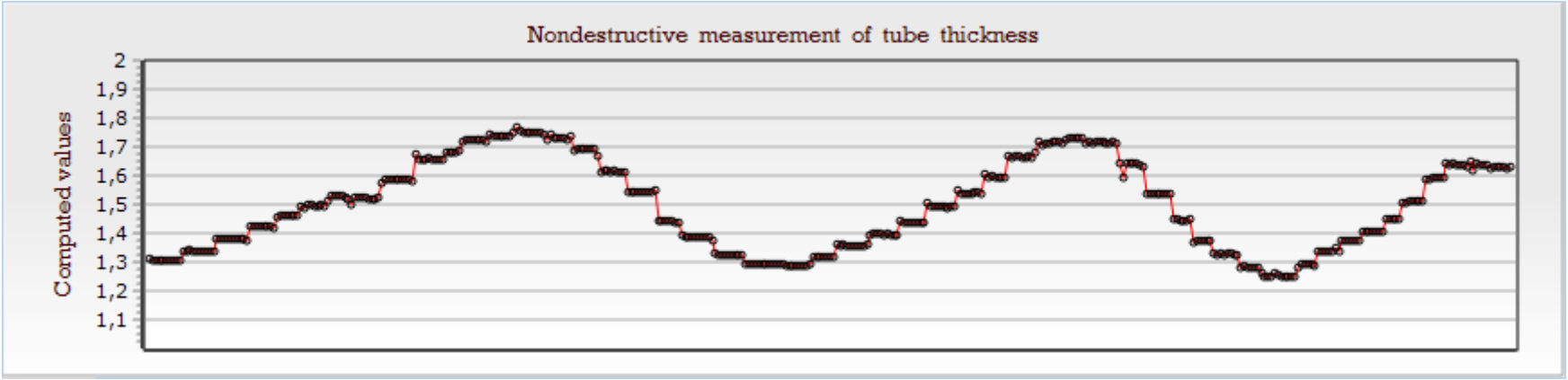
The report format is as follows:

Time Thickness Thickness offset Electrical conductivity Coefficient (reserved to manufacturer)

When quitting the program, a dialog box appears and invites to save the report before quitting. Enter the file name and click OK to save the report file.

3.10.2 Chart

A chart is provided on the bottom of the Conducsens™ window. It represents the measured thickness values over time.



When the button “New piece (n)” is clicked, the chart is cleared, so only the measurement values on the new piece are shown. This enables to concentrate on only the thickness values of this piece.

User can edit the chart by clicking on the button “Save chart data”. This opens the chart’s editor box. Many commands are available to customize and export chart data as graphical file or data file in different formats (text, Excel, XML, etc).

3.11 Advanced operations

Basic measurement operations consist of launching the Conducsens™ program, connect the impedance analyzer and perform thickness measurements on tubes or flat objects.

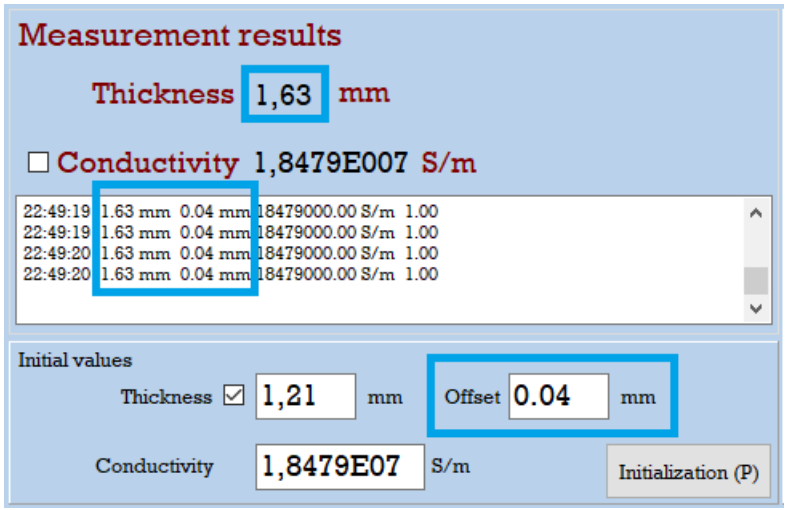
However, users sometimes need to realize advanced operations such as:

1. Calibration measurements with respect to standards
2. Determination of material conductivity of the tube to be measured

3.11.1 Calibration

For high precision measurement, calibration has to be carried out as often as possible. The calibration operation consists of making measurement on a known thickness object and compare the measurement result with the known thickness value. If there is any difference, add an offset value that makes the two values equal.

The example below shows an offset value of 0.04 mm, so the measurement result after correction is 1.63 mm while the measurement result before correction is 1.59 mm.

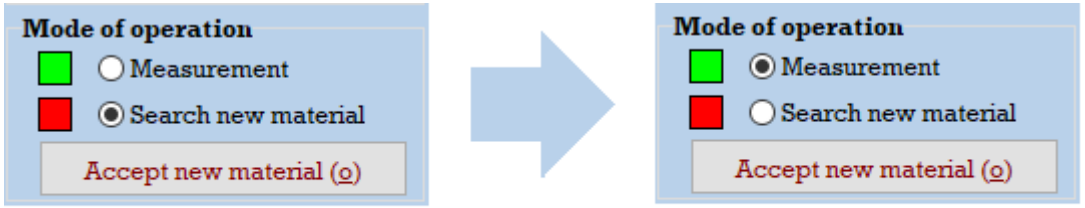


3.11.2 Determination of material conductivity

For eddy current testing, electrical conductivity and thickness are closely related. If there are any changes in conductivity, thickness measurement results will be affected. In aluminum part production, different batches may have different values of conductivity, because the raw material may have small variations. That is why user has to check the conductivity when starting measurement on a new batch.

Conducsen™ can simultaneously measure thickness and conductivity. However, measuring both parameters at a time is time consuming, that is why in the “Measurement” mode, the conductivity is considered as constant. In order to make a conductivity measurement in addition to a thickness measurement, check the radio button “Search new material” mode. The system then starts a series of 10 measurements of both thickness and conductivity. At the end of the series, the “Search new material” mode automatically becomes inactive, and the “Measurement” mode becomes active.

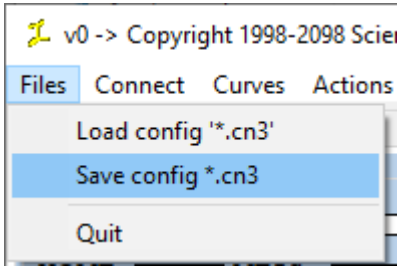
Validate the found thickness and conductivity values by clicking the button “Accept new material” (or hitting the key o on the keyboard). Thus, when the measurement stand is in the HOME position, the initial values will be reset with these new values.



Start searching new material

End of material search, accept new material

Save the new values in a configuration file for later use. To do this, open the *File* menu and select *Save config *.cn3*. The configuration file is of *.cn3* type.



4 Precaution of use

- **For the impedance analyzer**: follow the indications given by the impedance analyzer manufacturer in the user's manual
- **For the probe:** avoir to bend the cable; avoid to disconnect/reconnect the probe Binder 712 connector and BNCs too often; when reconnecting the Binder 712 connector, seek gently the holes matching by rotating the connector bodies, do not force the connectors to enter.
- **For the personal computer:** observe precautions given by the manufacturer.
- **For the measurement stand:** do not drop; avoid humidity and water condensation.

5 Troubleshooting

- **For the impedance analyzer**: refer to its user's manual
- **For the Conducsens™ software**: some known problems and issues are reported here after
    - "**Floating point operation error**": Conducsens™ uses complex algorithms to search the values of thickness and other parameters of targets. Sometimes, the computation meets aberrant values and needs to be reset. Just release the lever so that the probe stand is in the HOME position and click on the button START again to resume data acquisition.
    - Aberrant measurement values: sometimes, the measured values are very different from expected values. Just reset by leaving the measurement stand at its HOME position.

6 Technical support

6.1 Technical support contact

Sciensoria sarl

7, rue Ravel 35170 BRUZ

phone: 33 2 99 57 19 71 fax: 33 2 99 57 18 78

email: info@sciensoria.fr

www.sciensoria.fr

6.2 Remote assistance

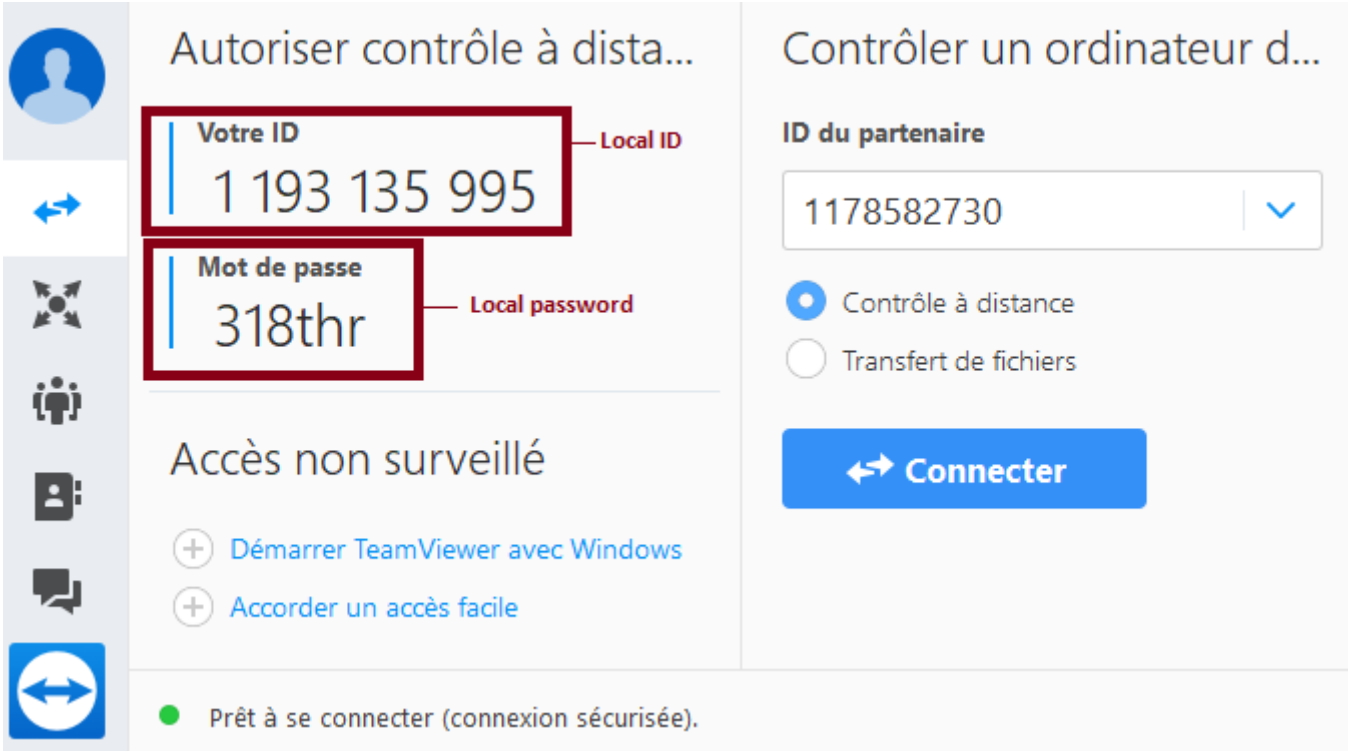
The laptop computer delivered in the package has the Teamviewer software installed. It enables a remote control from Sciensoria's office. Teamviewer account information is given below:

Teamviewer ID: **ID1178 582 730**

Computer name: **LAPTOP-L4QFD500**

Password: **xM701-kz10;**

Note: Teamwiever for professional use is not free. User has to purchase a licence to use it.



Teamviewer screen

7 Technical specifications

7.1 **Conducsens™ version:** 4.1.0.0 190211

7.2 **Probe:** ZX950TRNS

7.3 **Impedance analyzer:** HIOKI IM3533-01

7.4 **Computer:**

HP 15-da0093nf 15.6" Intel core i5 7200U, MS Windows 10 4GB Ram, 128GB SSD, 1Tb HD

User's name: SCIENSORIA

User's password (administrator session): Ab12345678

Secret questions 1 answer: DOG

Secret question 2 answer: Budapest

Secret question 3 answer: Attila

Teamviewer ID: ID 1178 582 730

Teamviewer computer name: LAPTOP-L4QFD500

Teamviewer password: xM701-kz10;

7.5 Thickness measurement

- Measurement range: 0.5 mm to 2 mm on aluminum
- Precision (with temperature comprise between 15°C and 20°C)
    - Range 1, 0.5 mm≤ thickness ≤ 1.3 mm: **+/- 0.05 mm**
    - Range 2, 1.3 mm ≤ thickness: **-0.1 to -0.3 mm**

7.6 Temperature operating range

- Measurement fully tested at temperature comprise between 15°C to 20°C
- For temperature out of this range: calibration required

7.7 Environmental conditions

- See instruction manual of impedance analyzer IM3533-01, page 341

8 Software licence agreement

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Payment: Payment of the license fee shall be made upon delivery of the Software within thirty (30) days following invoice from SCIENSORIA. In the event any overdue amount owed by Customer is not paid following ten (10) days written notice from SCIENSORIA, then in addition to the amount due, SCIENSORIA may impose and Customer shall pay a late payment charge at the rate of one percent (1%) per month on any overdue amount.

Taxes: In addition to all other amounts due hereunder, Customer shall also pay to SCIENSORIA, or reimburse SCIENSORIA as appropriate, all amounts due for sales, use, excise taxes or other taxes on the Software which are measured directly by payments made by Customer to SCIENSORIA.

Warranty of Title: SCIENSORIA hereby represents and warrants to Customer that SCIENSORIA is the owner of the Software or otherwise has the right to grant to Customer the rights set forth in this Agreement.

In the event any breach or threatened breach of the foregoing representation and warranty, Customer's sole remedy shall be to require SCIENSORIA to either: i) procure, at SCIENSORIA's expense, the right to use the Software, ii) replace the Software or any part thereof that is in breach and replace it with Software of comparable functionality that does not cause any breach, or iii) refund to Customer the full amount of the license fee upon the return of the Software and all copies thereof to SCIENSORIA.

Warranty of Functionality: For a period of twelve (12) months following delivery of the Software to Customer (the "Warranty Period"), SCIENSORIA warrants that the Software shall perform in all material respects according to SCIENSORIA’s specifications concerning the Software when used with the appropriate computer equipment. In the event of any breach or alleged breach of this warranty, Customer shall promptly notify SCIENSORIA and return the Software to SCIENSORIA at Customer's expense.

Customer's sole remedy shall be that SCIENSORIA shall correct the Software so that it operates according to the warranty.

This warranty does not apply if the software (a) has been altered, except by SCIENSORIA, (b) has not been installed, operated, repaired, or maintained in accordance with instructions supplied by SCIENSORIA, (c) has been subjected to abnormal physical or electrical stress, misuse, negligence, or accident, or (d) is used in ultra hazardous activities.

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