

Surf™ USER MANUAL

Laboratory Device for Testing the
Surface Electrical Resistivity of Concrete



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PACKAGE CONTENTS

Item	Qty	Photo
Surf™ Measurement Device	1X	
Surf™ Cell with Connector Cable	1X	
Verification Dongle (High Range +Low Range)	2X	
Handheld probe (optional accessory)	1X	
Surf™ Data Monitor Software	1X	
External Power Supply	1X	

USB Communication Cable 1X



Conductive Gel 1X



Conductive pads 16X



Note: Figures displayed above are not in scale.

WARRANTY

LIMITED WARRANTIES

Giatic warrants the Product against defects in materials and workmanship under normal use (the “Warranty”) for a period of 12 months from the Delivery Date (the “Warranty Period”), on the condition that the Product has been completely paid for. Unless as otherwise mandated by local law, the Warranty Period does not restart if Customer receives a replacement appliance and/or replacement Software. This Warranty does not apply: (a) to consumable parts, such as batteries, Plexiglas cell units and cables unless damage has occurred due to a defect in materials or workmanship; (b) to cosmetic damage, including but not limited to scratches, dents and broken plastic on ports; (c) to damage caused by accident, abuse, misuse, neglect or failure to properly maintain (to include but not limited to water damage and/or condensation or improper temperatures during storage), or improper installation; (d) to damage caused by electrical disturbances or acts of God, to include but not limited to civil disturbance, war, flood, fire, rodents or insects; (e) where manufacturer’s serial numbers and security labels have been removed from the Product; and (f) to damage caused during shipment (due to Customer’s improper packaging) from Customer to Giatic in the case of Product returns for repair.

Giatic disclaims all other warranties, express or implied, including without limitation implied warranties of merchantability, fitness for a particular purpose, or against hidden or latent defects. Giatic’s responsibility for warranty claims is limited to repair or replacement. Giatic reserves the right to modify this Warranty at any time, at its sole discretion, and with notice to Customer.

Giatic does not warrant that the operation of the Product will be uninterrupted or error-free. Giatic is not responsible for damage arising from failure to follow instructions relating to the Product’s use. This Warranty is voided immediately if repair, modification (to include upgrades, expansions or usage or addition of non-manufacturer parts or accessories), alteration or other service is attempted other than by Giatic. In this regard, the integrity

of the appliance casing (aka the box) should not be violated for any reason, unless expressly authorized by Giatec in writing.

THE WARRANTY SET FORTH IS EXCLUSIVE AND NO OTHER WARRANTY, WHETHER WRITTEN OR ORAL, IS EXPRESSED OR IMPLIED. GIATEC SCIENTIFIC INC. SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.


* Please refer to the complete Terms and Conditions of Giatec's products for more details.

* The information contained in this document is subject to change without notice.

SAFETY INSTRUCTIONS

This chapter contains important safety instructions that you must follow when operating Surf™ and keeping it in storage. Read the following before any operation to ensure your safety and to keep the instrument in good condition. Keep the user manual in a safe place for future reference.

SAFETY SYMBOLS

In order to ensure the safety of the operator, and increase the service life of the instruments, pay attention to safety precautions described in this manual. These messages are indicated by a  symbol throughout this manual.

WARNING:	Identifies conditions or practices that could result in injury or loss of life.
CAUTION:	Identifies conditions or practices that could result in damage to Giatec Surf™ or to other properties.
ATTENTION:	Refer to the User Manual

GENERAL GUIDELINES

1. Always follow basic safety precautions when using this product to reduce risk of injury from fire or electric shock.
2. Read and understand all instructions in the documentation that come with Giatec Surf™.
3. Observe all warnings and instructions marked on the product.

DEVICE HANDLING



CAUTION

Giatec Surf™ device is a delicate testing instrument. The electronic parts and test cells are sensitive components. Please handle them with care.

- Do not place any heavy object on the Surf™ device.
- Avoid severe impact or rough handling that leads to damaging Surf™.
- Do not discharge static electricity to Surf™.
- Do not disassemble Surf™.

- Install the product in a protected location where no one can step on, or trip over the power cord. Keep the device in a location where the power cord cannot be damaged.

OPERATION



WARNING

- Device AC Input Voltage: 5V, 250 mA
- Only use the provided power supply adapter for operating Surf™.
- Do not perform measurement at circuits directly connected to Mains (Live circuit).
- Place the instrument in a place where the chance of spilling liquids on the device is negligible.

CLEANING THE INSTRUMENT



ATTENTION

- Unplug this device from wall outlets before cleaning.
- Use a soft cloth dampened in a solution of mild detergent and water.
- Do not use chemicals or cleaners containing harsh products such as benzene, toluene, xylene, and acetone.

OPERATION ENVIRONMENT



ATTENTION

- Location: Indoor, no direct sunlight
- Relative Humidity: 30% to 80%
- Temperature: 15°C to 45°C

STORAGE ENVIRONMENT



ATTENTION

- Location: Indoor
- Relative Humidity: 5% to 90%
- Temperature: 0°C to 60°C

INTRODUCTION TO GIATEC Surf™

Giater Surf™ is an advanced laboratory test device for measuring the surface electrical resistivity of hardened concrete cylinders or cores using the Four-Electrode measuring technique. Surface electrical resistivity technique has been standardized by AASHTO T 358.

The device can be operated as a stand-alone unit for measuring electrical resistivity in concrete samples. Alternatively, it can be controlled using Data Monitor software (for PC). This software provides a user-friendly tool to setup and run different test programs. The software provides real-time data visualization (tabulated data and live chart), and provides a convenient way to save the test results and generate report files.

ELECTRICAL RESISTIVITY OF CONCRETE

Durability of concrete depends largely on the properties of its microstructure such as pore network size and interconnections. A finer pore network with fewer connectivity, leads to lower permeability. Porous microstructure with a larger degree of interconnections, on the other hand, generally results in higher permeability and reduced durability.

The principle idea behind the electrical resistivity techniques is to quantify the conductive properties of the microstructure of concrete. The electrical resistivity of concrete can be described as the ability of concrete to withstand the transfer of ions subject to an electrical field. In other words, resistivity is the inverse of conductivity, which can be attributed to the degree of ionic movement in the pores. In this context, resistivity measurement can be used to assess the size and extent of the interconnectivity of pores. Electrical resistivity measurement provides a non-destructive approach to testing concrete materials, making it suitable for various quality control projects, condition assessment purposes, and research programs. Electrical resistivity is an inherent characteristic of concrete, and is independent of the geometry of the concrete sample.

APPLICATIONS

Electrical resistivity of concrete is well correlated with certain performance characteristics of concrete such as the chloride diffusion coefficient, water absorption, and the corrosion rate of embedded steel.

Electrical resistivity can be used as a measure of concrete resistance to chloride penetration. Similar to the Rapid Chloride Permeability (RCP) test, electrical resistivity measurement can be used in evaluating the ionic mobility within the pore solution of concrete. The RCP test was originally developed to quantify the chloride penetrability based on the electric charge passing through concrete over a specific period of time. Experiments show that there is good correlation between the surface electrical resistivity and the Rapid Chloride Permeability (RCP).

The qualitative relation between rapid chloride penetrability, RCP (ASTM C1202) and the surface electrical resistivity of concrete is presented in Table 1.

Table 1: Relationship between surface resistivity and chloride penetrability*

Chloride Penetration	56-Day Rapid Chloride Penetrability Charge Passed as per ASTM C1202	28-Day Surface Resistivity**
	(Coulombs)	(kΩ.cm)
High	>4,000	<10
Moderate	2,000-4,000	10-15
Low	1,000-2,000	15-25
Very Low	100-1,000	25-200
Negligible	<100	>200

* Adapted from Kessler et al. 2005

** At 23 °C

Surf™ is a laboratory device for measuring the surface electrical resistivity of concrete samples or concrete cores. This technique can be utilized for various applications such as:

- Performance-based quality control of concrete
- Estimation of the chloride diffusion coefficient in concrete
- Service life design of concrete structures
- Estimation of the remaining life of concrete structures
- Crack detection in concrete elements under load
- Monitoring the setting time in fresh concrete

MEASUREMENT CONCEPT

Concrete is a porous composite material, and depending on the moisture content (i.e., degree of the saturation of the pores), it may exhibit conductive or insulated characteristics. For example, a concrete sample might exhibit very high electrical resistance when it is dry, but the same concrete can have much lower resistance in saturated condition. Moreover, concrete has capacitive properties, which means it can hold electrical charge.

In engineering terminology, the concept of ‘impedance’ should be used to account for the impeding effect of the electrostatic storage of charge in concrete in addition to the normal resistance of concrete. Impedance, \mathbf{Z} , is described as a complex quantity that has an imaginary component called reactance, \mathbf{X} , and a real component called resistance, \mathbf{R} . In other words, the vector summation of these two components would result in an impedance vector, \mathbf{Z} . Therefore, the electrical impedance \mathbf{Z} can be also represented by a magnitude (Z) and a phase angle (φ) (Fig.1). Both the magnitude and phase angle of such a vector could vary depending on the frequency of the applied current.

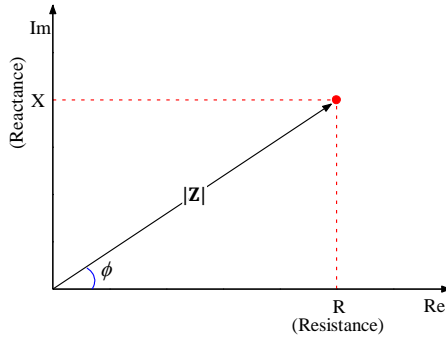


Figure 1: Impedance vector: Real and Imaginary components

Fig. 2 depicts the general concept behind the measurement of surface electrical resistivity using Giatec Surf™.

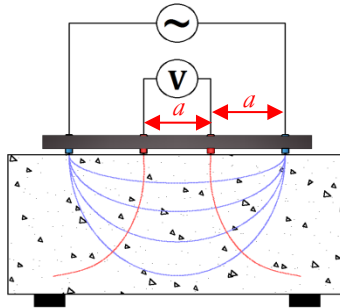


Figure 2: Schematic view of the test setup and the concept

One widely accepted setup is the Wenner array where the four electrodes are situated in a straight line and equally spaced; the two inner electrodes measure the electrical potential, V , created when the exterior electrodes insert an AC current, I , into the concrete. For a semi-infinite, homogeneous concrete, the surface electrical resistivity is calculated as:

$$\rho = 2\pi a \frac{V}{I}$$

where a is the distance between the electrodes (equally spaced).

DEVICE OVERVIEW

Giatic Surf™ has two main components: A measuring device (Fig. 3), and a sample holder. (Fig. 6). The measuring device can be used as a stand-alone equipment to perform the tests. It can also be connected to a personal computer (PC) using the USB connection port. The Data Monitor software, provided in the package, controls the device and can be used to record the test data. In this section, the key functions of these components are described.

Measuring Device

Surf™ measuring device can be used as a standalone data logger. The user can select the test method, and perform the test by using the control keys on the front panel of the device. The back panel provides connection terminals to the sample holder of the device.



Figure 3: Surf™ Measuring Device

The front panel of the measuring device includes display, as well as, the control keypad. The sample holder electrodes are connected to the measuring device using the cables included in the package.

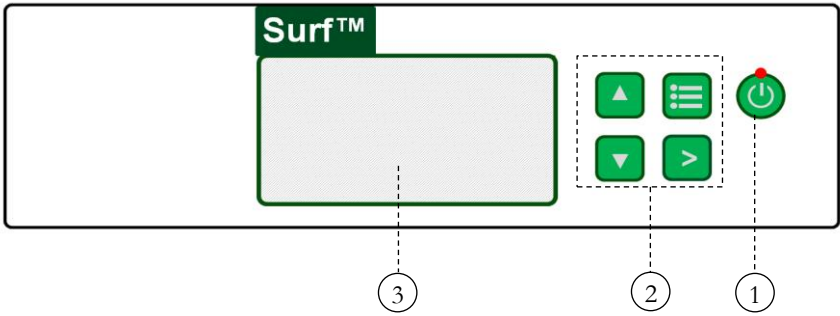


Figure 4: Front Panel

1. Main Power Key
2. Control Keypad
3. Display

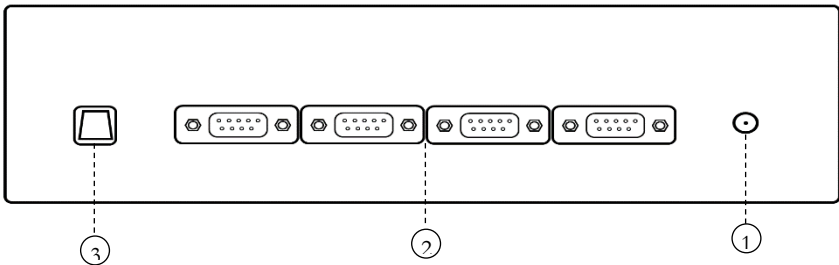


Figure 5: Back Panel

1. Power Inlet
2. Channels (1 to 4)
3. USB Communication Port

Sample Holder

Surf™ sample holder is designed to facilitate the eight time measurements of resistivity around the test sample as specified by AASHTO T 385 standard. It also reduces evaporation rate during the test. The sample holder has four sets of electrodes, placed at 90° array.

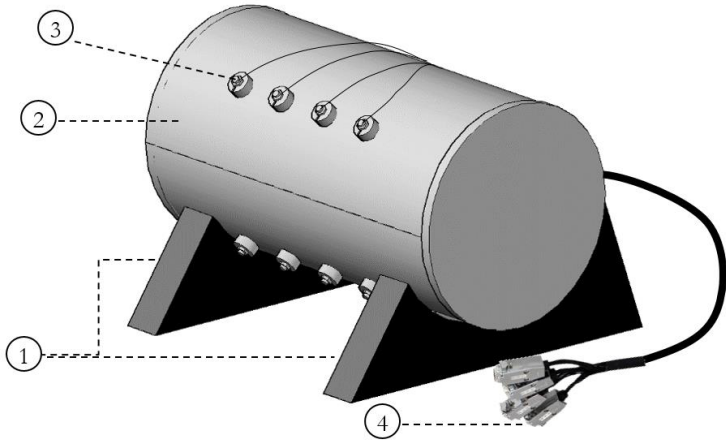


Figure 6: The Surf™ sample holder

1. Sample holder supports
2. Sample holder lid
3. Electrode(s)
4. Connection cables

Handheld Probe (optional)

Handheld probe is design to test concrete samples which do not fit in the sample holder. It can also be used to perform in-situ tests on concrete components.



Figure 7: The Surf™ Handheld probe

1. Handheld probe
2. Electrodes
3. Connection port

TEST SETUP

To start using Surf™, the user must set up the concrete sample in the sample holder. Surf™ sample holder provides a convenient approach to setting up concrete samples. The sample holder reduces the rate of evaporation, and eliminates the need for marking and rotating concrete samples.

Preparing the Sample Holder

Step 1: Connect the sample holder to the back panel of the measuring device. If you want to use the device with the Data Monitor program (PC), you need to use the USB cable provided in the package.

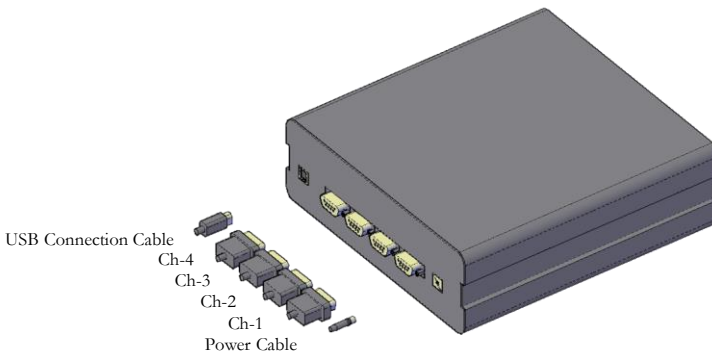


Figure 8: Connecting the sample holder and the USB cable to the measuring device

Step 2: Remove concrete sample from the curing room and place it in the sample holder. Align the top and bottom end of the concrete cylinder with the rubber supports inside the sample holder.

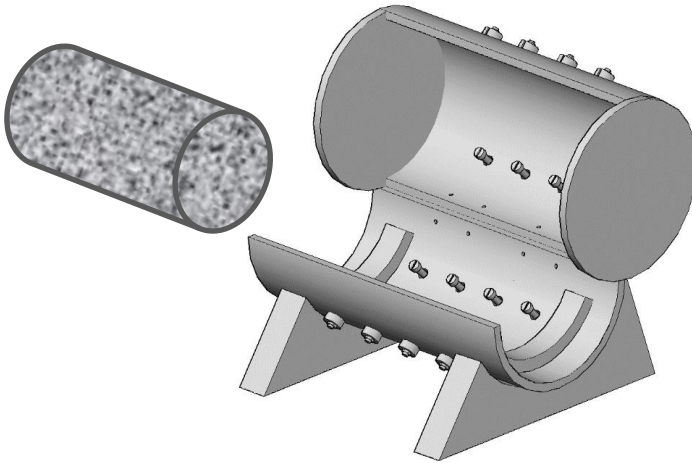


Figure 9: Place the concrete sample inside the sample holder

Preparing the Handheld Probe (Optional)

Step 1: Using the connection cable, connect the one end of the cable to the handheld probe.

Step 2: Follow the instructions in Fig. 8 to connect the other end of the cable to any of the channels on the back of the surf device.

Step 3: Wet the sponges and place them at the tip of the electrodes.

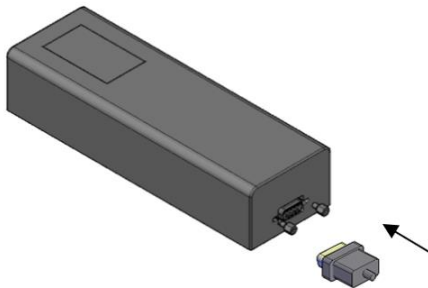


Figure 10: Connecting handheld probe to the surf measurement device


DEVICE OPERATION

Giatic Surf™ can either be used as a stand-alone unit, or it can be controlled using a computer. The stand-alone operation is a quick and simple way to start the test, while using the device in remote mode provides more testing options, data logging, and data visualization.



Before turning on the device, make sure that the sample holder is appropriately connected to the device.

STAND-ALONE OPERATION

The main power switch of Surf™ is located on the front panel of the device. Press and hold the power key  to turn on the device. The LED light on the power key, as well as, the device display will turn on, showing the test parameters.

Please note that if this is the first time you are using the device, the default test parameters will appear on the device display (ASTM Test Method). For future use, the test method selected in your previous tests will appear on the screen.



Figure 11: Test Parameters on the LCD display

Main Menu




The system setup can be changed by pressing the **Menu** key  from the front panel. The menu options will then appear on the LCD display. Using the **Up** and **Down**  **Down**  keys on the front panel, the user can access these options.



Figure 12: Main Menu

Test Method

The user can select the appropriate test method by selection one of the following available options: 1) AASHTO TP95, 2) ASTM and 3) Custom. Using the **Up** and **Down** keys on the front panel. User should select their preferred test method procedure.

Note: AASHTO TP95 is the previous standard name for the ASSTHO T358.



Figure 13: Test Method

AASHTO TP95: When you select to run the test according to the AASHTO T358 standard test procedure, the default settings of the device are set to meet the specifications and requirements of the standard. The signal frequency is set to 13 Hz and the nominal voltage is limited to 25 V in

accordance with the requirements of the standard. The electrode spacing on the sample holder is set to 38.1 mm as specified by AASHTO.

To start the test, press the Menu key  on the front panel to go to the **Test Parameters** page. Then press the Start key.

The measurements are performed in two rounds for each set of electrodes, making a total of 8 readings for each sample. The average electrical resistivity ($\bar{\rho}$) is calculated and displayed on the screen.

Ch	Rnd1	Rnd2	(kΩ.cm)
1:	24.9	24.8	$\bar{\rho}$: 25.3
2:	25.1	24.9	
3:	25.0	25.1	
4:	26.5	26.0	


> Start
 Menu

Figure 14: Test Method

ASTM: When you select to follow the proposed ASTM procedure, the default settings of the device are changed to values proposed by the work group. The signal frequency range (10Hz – 10kHz) meets the requirements of the proposed procedure. The spacing of the electrodes on the sample holder is set to 38mm (and 50mm), as specified by the ASTM. The user should select from the two different sample holder sizes provided in the **Sample Holder** menu by pressing **Up** and **Down** buttons (Fig 13). The sample size and the electrode spacing affect the geometry factor used in calculating the resistivity value.

Sample Holder	
• Type I : 100mm (4")	
Type II: 150mm (6")	



> Select
 Back

Figure 15: Sample Holder

To start the test, press the Menu key  on the front panel to go to the **Test Parameters** page. Then press the Start key. $\bar{\rho}$ represents the average resistivity and ρ represents the average resistivity modified by the shape factor.

Ch	Rnd1	Rnd2	(kΩ.cm)
1:	24.9	24.8	$\bar{\rho}$: 25.3
2:	25.1	24.9	
3:	25.0	25.1	ρ : 12.9
4:	26.5	26.0	



> Start
 Menu

Figure 16: Sample Holder

Custom: In the custom mode, the user has the option to change the frequency. The frequency can be selected in the range of 13 Hz to 100 Hz. In the custom mode, only the ‘resistance’ of the test sample will be displayed. The user needs to apply the appropriate geometry factors for calculating the ‘resistivity’ of concrete.

Test Frequency

13
Hz

> Select
 Back

Test Parameters

Method: Custom

Frequency: 30Hz

Unit: Ω


> Start
 Menu

Figure 17: Sample Holder

To start the test, press the Menu key  on the front panel to go to the **Test Parameters** page. Then press the Start key.

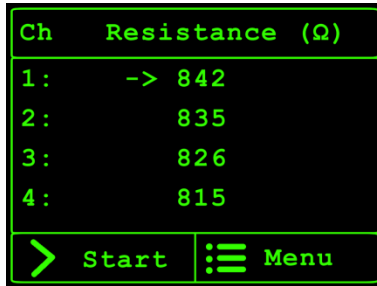


Figure 18: Sample Holder

The resistance values will be displayed on the screen.

Screen Contrast

The user can adjust the contrast of the LCD screen through **Screen Contrast** option available in the **Main Menu** (Fig. 17). You can adjust the contrast of the LCD using the **Up** and **Down** keys.



Figure 19: The Screen Contrast menu

DATA MONITOR SOFTWARE OPERATION

Click on the Surf™ Data Monitor icon on the desktop to launch the software. Alternatively, you can open the software from **Programs** in the Windows **Start Menu**.



You should first install Data Monitor Software on your computer. Please refer to the Installing Data Monitor Software section of the user manual.

The device should be connected to the PC with the USB cable, and turned on before launching the Data Monitor software.

The Surf™ Data Monitor home window will appear on the screen. If the device is not connected to the PC, or if the device has not been turned on, a message box will appear on the screen. The user is asked to turn on the device and check the connection cable. Click on the refresh button to connect to the device. Once it is connected, the menu strip box at the top of this form will be enabled.

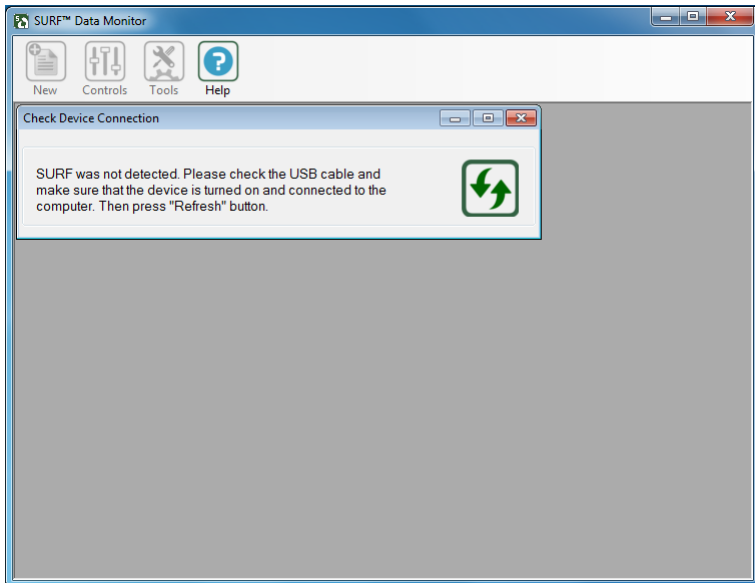


Figure 20: Check for Device Connection

In the main menu, Click on **New** menu item, and select **New Project** to start a new test session.

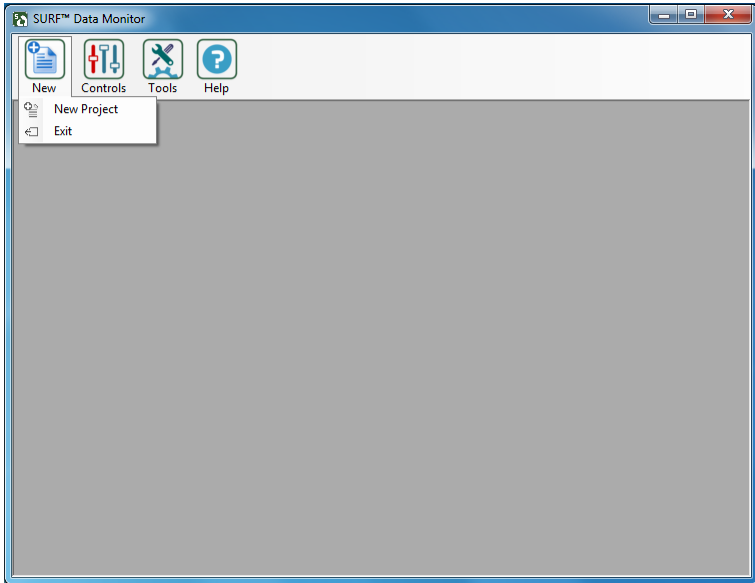


Figure 21: Start a New Test Session

In the new wizard form (Fig. 20), enter the project name, and project description such as; the source of cylinders, operator, and special notes.

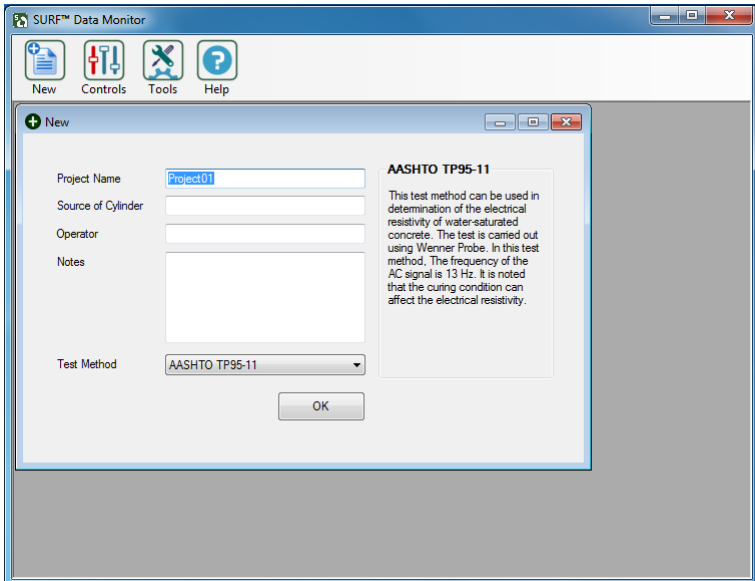


Figure 22: New Project Wizard

Select the test method. There are different test methods available in the Data Monitor program: AASHTO TP95, ASTM, and the Custom method.

Note: AASHTO TP95 is the previous standard name for the ASSTHO T358.

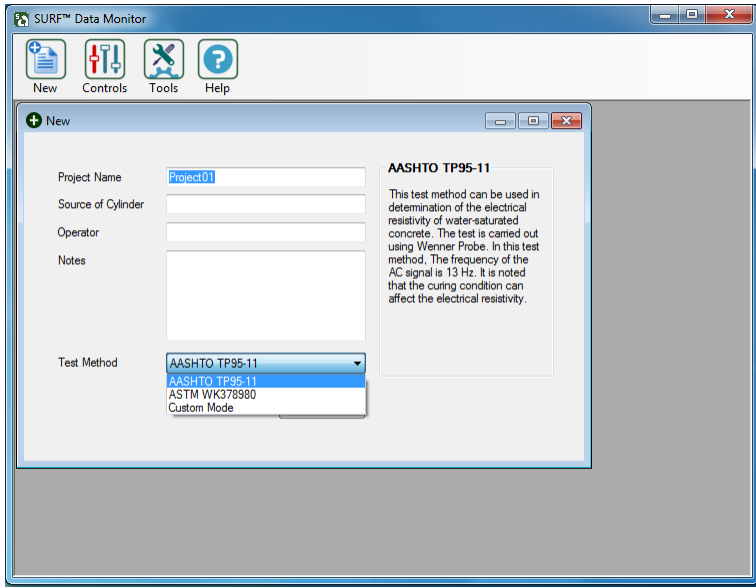


Figure 23: Select the test method

AASHTO TP95

The AASHTO TP95 form has two main parts (see Fig. 22). The top section of the form is dedicated to the test setting and control keys. The bottom section of the form is designed to display the real-time measurements, as well as the tabulated data (when the data logger is running).

Test Setting

The user can select the concrete sample size and the curing condition. The measurements will be modified according to the standard requirements.

The user can select the test sample (i.e., A, B, or C) and perform the test. The measurements will be performed in two rounds, and the data will be stored in the table. If you need to repeat the test, reselect the same sample name, and start the measurements again.

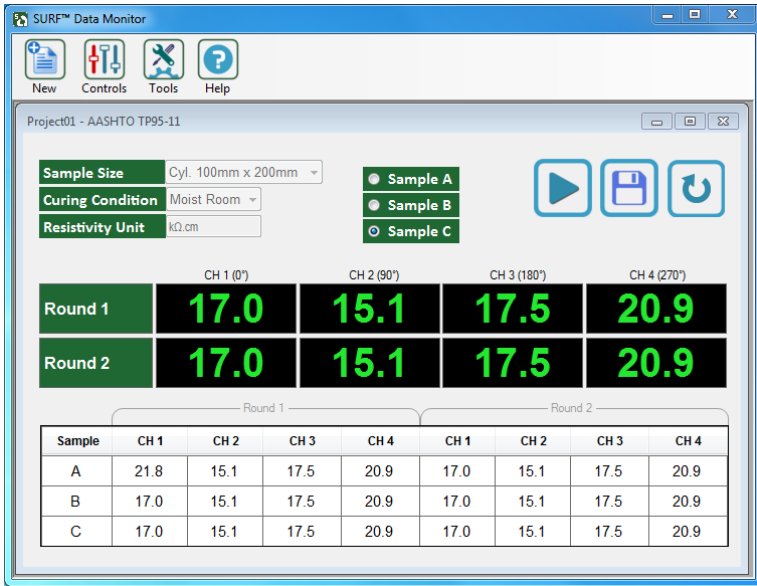








Figure 24: The AASHTO test mode screen

Control Keys

On the top right corner of the form, the user can find the control keys. The control keys can be used to start/stop a test (i.e. logging the measurements), display the test results and generate test reports.

Table 2. Summary of Control Keys

Icon Name	Default	Enabled	When
Start			Default
Save			When the test is successfully completed or after pressing Stop
Stop	-		After pressing Start
Reset		-	Reset the test parameters/Clears all recorded data

Alternatively, the user can use the control keys under the Controls menu item to proceed with the test.

ASTM

The ASTM form also has two main parts (see Fig. 23). The top section of the form is dedicated to the test setting and control keys. The bottom section of the form is designed to display the real-time measurements, as well as the tabulated data (when the data logger is running).

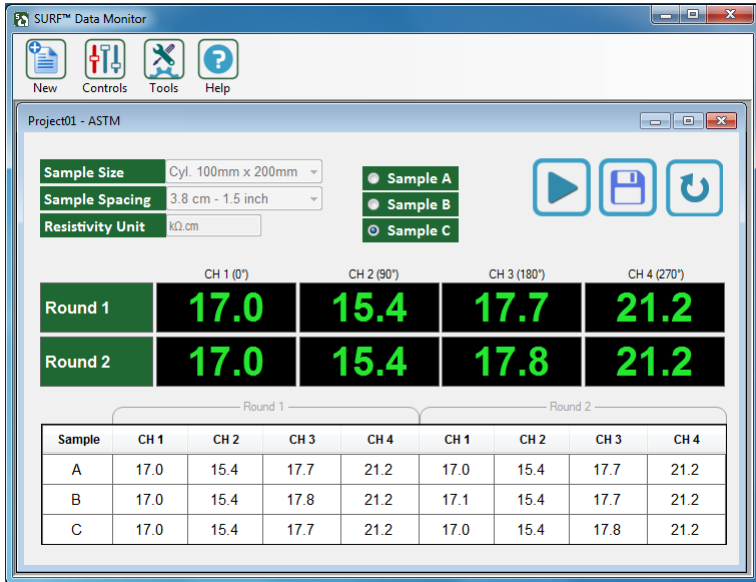


Figure 25: The ASTM test mode screen

Test Setting

The user can select the size of concrete samples, and the electrode spacing (38 mm, and 50mm). The user can also select the test sample (i.e., A, B, or C) and perform the test. The measurements will be performed in two rounds, and the data will be stored in the table. If you need to repeat the test, reselect the same sample name, and start the measurements again.

Custom Mode

The custom mode form (Fig. 24) is designed to control the test parameters such as signal frequency (13Hz – 100 Hz), and data log interval. The user can also select any custom combination of the test channels.

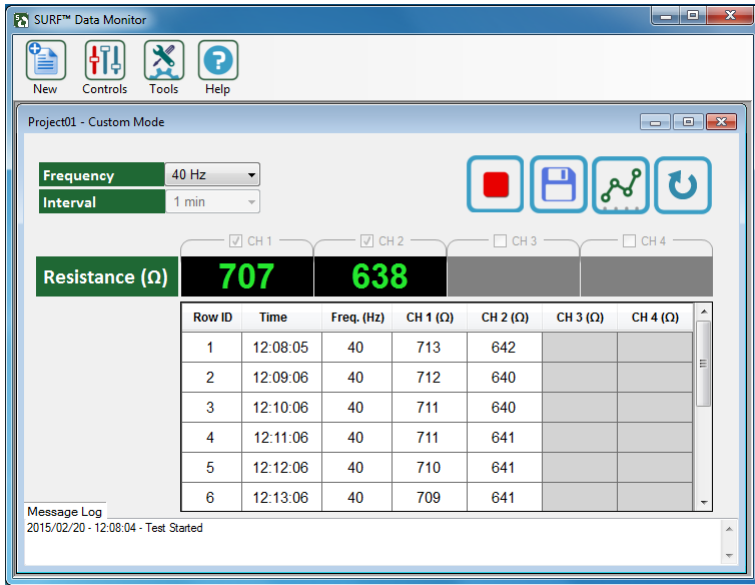


Figure 26: The Custom mode screen

The test can theoretically adapt any sample size, with different probe spacing; hence, electrical resistance (instead of resistivity) is recorded in this mode. The Custom mode benefits from real-time data plotting (chart) which makes data visualization more convenient.

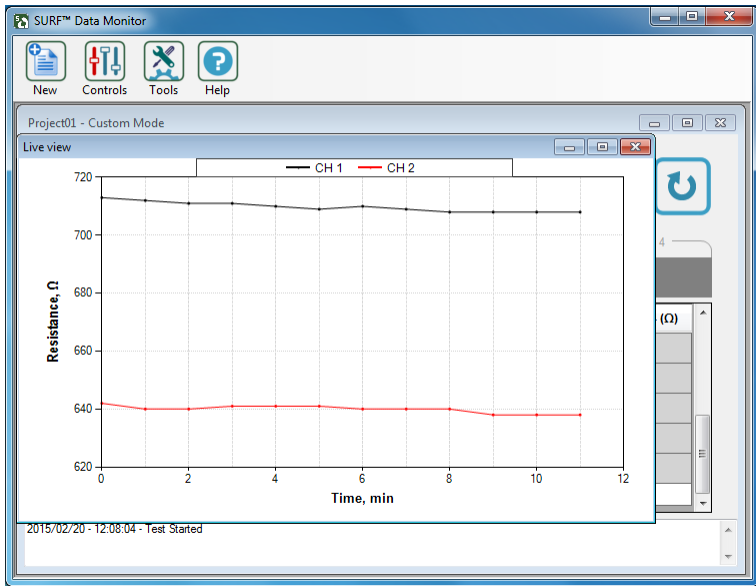


Figure 27: Real-time visualization of data in Custom mode

FIRMWARE UPGRADE

If there is any update for the firmware of the Giatec Surf™ device, the firmware upgrade files will be sent to the customers. These files will be used to upgrade the firmware of the device. You can access the firmware upgrade from the Tools menu item.

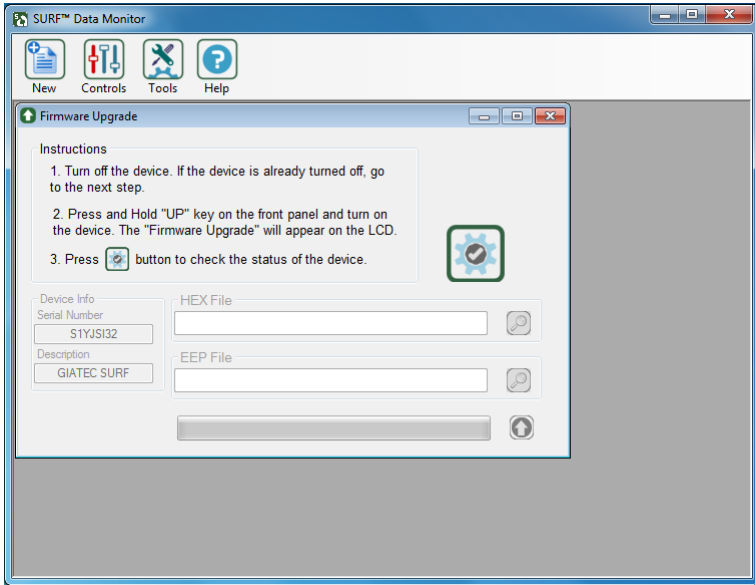



Figure 28: Firmware Upgrade

The user has to turn on the device in the Firmware upgrade mode. To do so, hold the Up key  and press the power switch on the front panel.

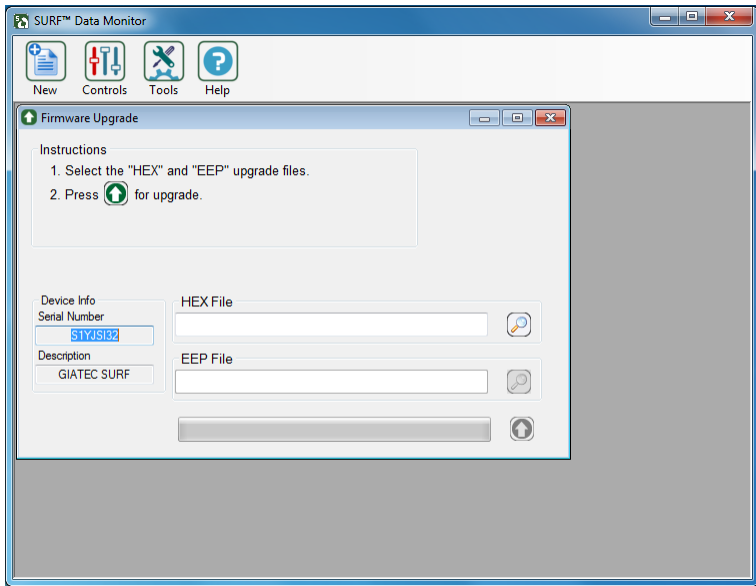


Figure 29: Firmware Upgrade

If the device is not in the correct mode, the user is asked to follow the instructions and try again. Click on the verify button to check the status of the device. If the device is appropriately set to **Firmware Upgrade** mode, the following screen will appear.

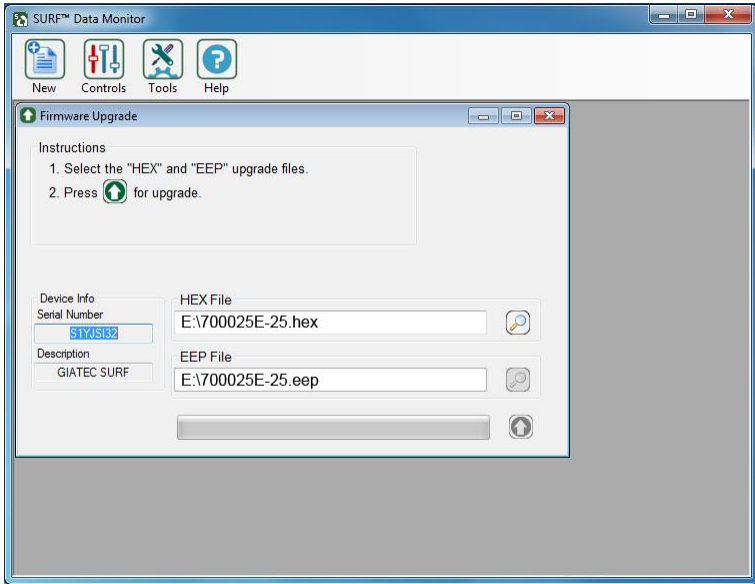


Figure 30: Select Hex and Eep Upgrade files

Select the appropriate .Hex and .Eep files provided by Giatec Scientific Inc. Click on the Upgrade button to start the upgrade. Upon completion, the following screen will appear and the device will return to the test mode:

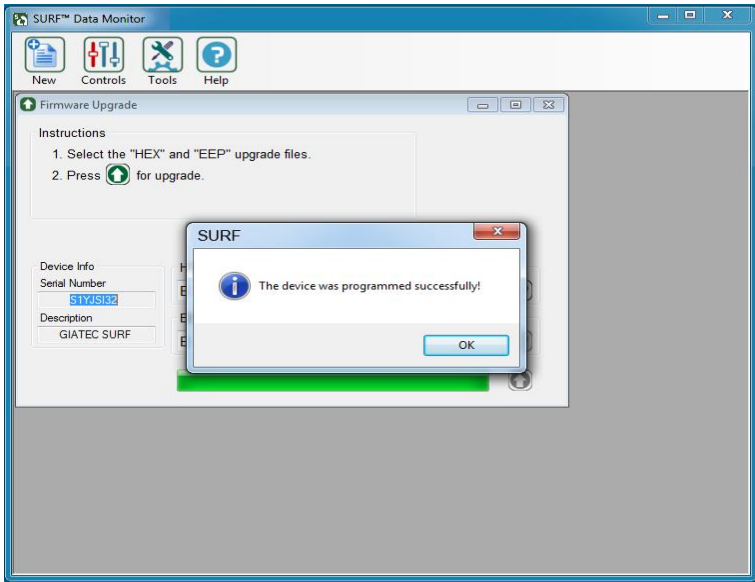


Figure 31: Firmware Upgrade

DEVICE VERIFICATION

Two different dongles are provided with Surf™ that can be used to ensure the appropriate functionality of the device. One dongle is designed to verify the accuracy of low range measurements (less than 100 kΩ.cm); while the other dongle is for the high range measurement (typically in the range of 100 kΩ.cm to 1,000 kΩ.cm).

Verify the device and measurement accuracy of the device using the high and low dongles. If the device does not pass the verification procedure, it should be returned to Giatec for hardware calibration. The hardware calibration is also advised to be conducted once per year to ensure the appropriate functionality and accuracy of the measurements.

The verification process can be performed using any of the following two procedures:

Using the Front Panel

Using the **Up** and **Down** keys on the front panel, select the **Device Verification** from the Main Menu.



Figure 32: Device verification

Follow the instruction on the display to verify the accuracy of each channel in low and high range of resistivity (see Fig 31).

Connect the low range dongle to Channel 1 and press **Next**. Continue the verification for all 4 channels. After all channels have been tested in the low range, remove the low range dongle, and replace it with the high range dongle. Follow the same procedures for channels 1 to 4.

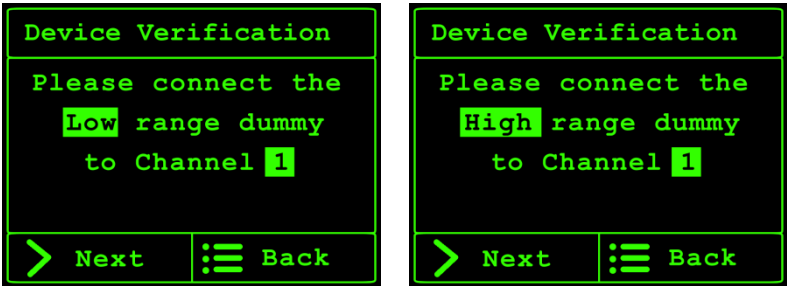


Figure 33: Device verification procedure

After the verification process is finished, the results are displayed for each channel at low and high ranges.

Ch	Range->	Low	High
1:		Pass	Pass
2:		Pass	Pass
3:		Pass	Fail
4:		Pass	Pass

At the bottom of the table, there is a right arrow button and a menu icon button labeled "Back".

Figure 34: Device verification results



A Failure message (i.e., **Fail**) indicates that the device requires recalibration or service. Please contact technical support.

Using Data Monitor Software

The user can also verify the accuracy of the device using the Data Monitor software. Select the Device Verification from Tools menu, and follow the instruction to perform the verification process. The results of the verification will be displayed in front of the channel name (Fig. 33).

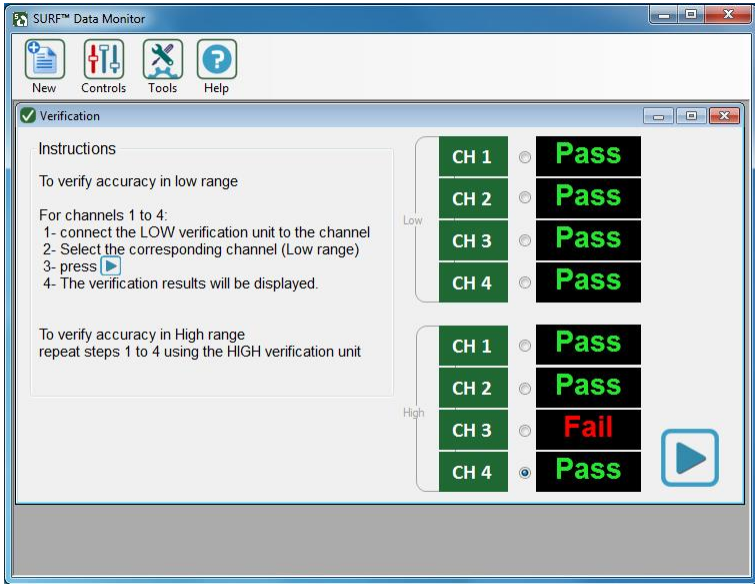


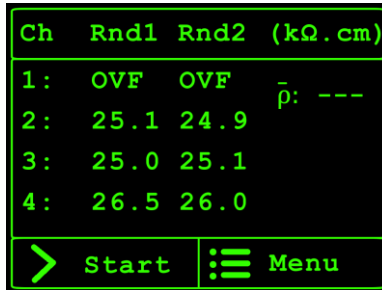
Figure 35: Device verification results

MESSAGES

The user may encounter error notifications while performing the test using the Surf™ device.

OVF

The OVF message (see Fig. 34) appears when the device is reading high electrical resistivity values. The high values can be attributed to poor connection between the electrodes and the surface of concrete, or to the loose connection between channels and the connecting cables. This error can also appear when the surface of concrete sample is too dry.



Ch	Rnd1	Rnd2	(kΩ.cm)
1:	OVF	OVF	$\bar{\rho}$: ---
2:	25.1	24.9	
3:	25.0	25.1	
4:	26.5	26.0	

> Start
☰ Menu

Figure 36: OVF error message during the test

If this notification appears on the screen, follow the procedure below to resolve the issue:

Apply generous amount of conductive gel to the tip of the electrodes in order to improve the electrical connectivity of the electrodes and the surface of concrete. Repeat the test to check if the issue is resolved.

If the error message still exists, turn off the device; check the connecting cables to the electrodes, and the connection plugs to the rear panel of the device and then turn on the device again to verify if the error has been resolved.

If the previous procedures did not solve the problem, try testing another concrete sample with a lower electrical resistivity. If the error message disappears, it indicates that the resistivity of the testing sample is higher than the device measurement range.

After trying all these trouble shooting steps, if the problem persists, please contact Giatec Scientific Inc. technical support for assistance.

CEE

The CEE message appears when the inner electrodes are not in contact with the surface of concrete, or there is a water flow between the two electrodes. If this error message appears, check if the electrodes in the corresponding channel are properly sitting on the concrete surface (full contact). Make sure that there is no excess water in between the electrodes on the surface of concrete.

Ch	Rnd1	Rnd2	(k Ω .cm)
1:	24.9	24.8	$\bar{\rho}$: ---
2:	CEE	CEE	
3:	25.0	25.1	
4:	26.5	26.0	

> Start ≡ Menu

Figure 37: OVF error message during the test

If the surface of the concrete is too dry, conductive gel can be applied on the tip of the electrodes to improve the electrical connectivity between the electrodes and the surface of concrete sample.

If these procedures did not resolve the issue, please contact the technical support of Giatec Scientific Inc. for assistance.



If there is any error in any of the channels, the device will not show any average value.

INSTALLING DATA MONITOR SOFTWARE

Surf™ Data Monitor software can be used to control the measuring device, perform the tests, and log the test data on your computer. In order to be able to use the Surf™ Data Monitor, you must install the software on your PC. You should also connect the measuring device to the PC using the USB cable provided.

DEVICE DRIVER

When you connect the Surf™ measuring device to your computer for the first time, Microsoft Windows will automatically install the required driver if your computer has access to internet. A pop-up message will appear on the lower right corner of the screen (Windows taskbar).

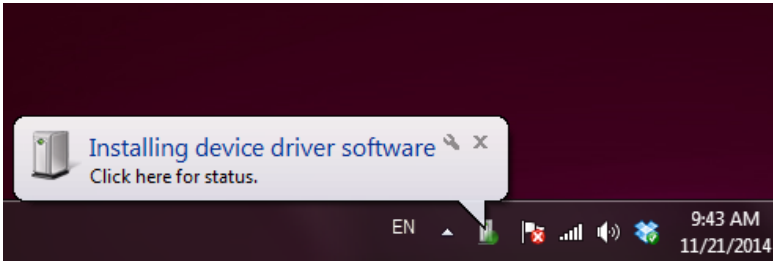


Figure 38: Installing the device driver

When the installation has successfully completed, a message will appear to confirm:

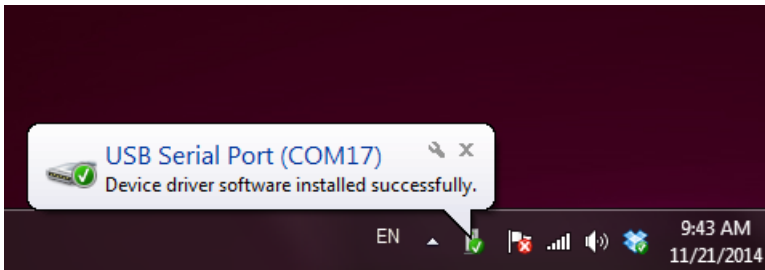


Figure 39: USB Serial Port successfully installed on the computer

If your computer is running an older version of Windows (i.e., XP or 2000), or if your computer does not have internet access, you have to install the driver manually. The driver file is located on the Surf™ Data Monitor CD. In order to install, or update a previously unsuccessful installation, go to the

Device Manager. In Windows, you can access **Device Manager** under **System** in the **Control Panel**.

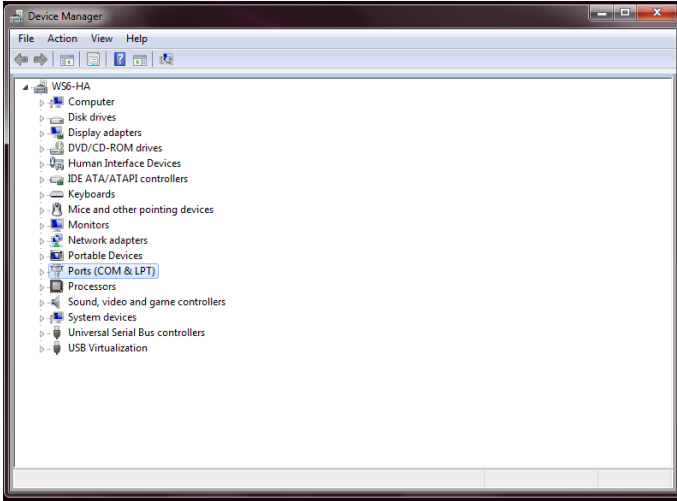


Figure 40: Device Manager window

Right click on the **USB Serial Port**, and select **Update Driver Software**.

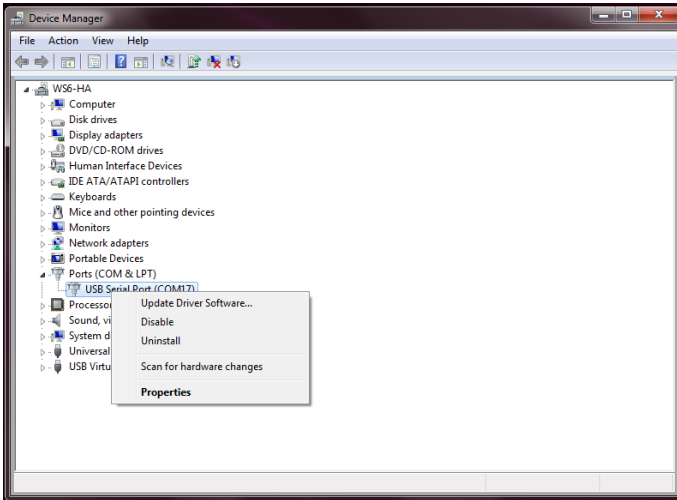


Figure 41: Update Driver Software

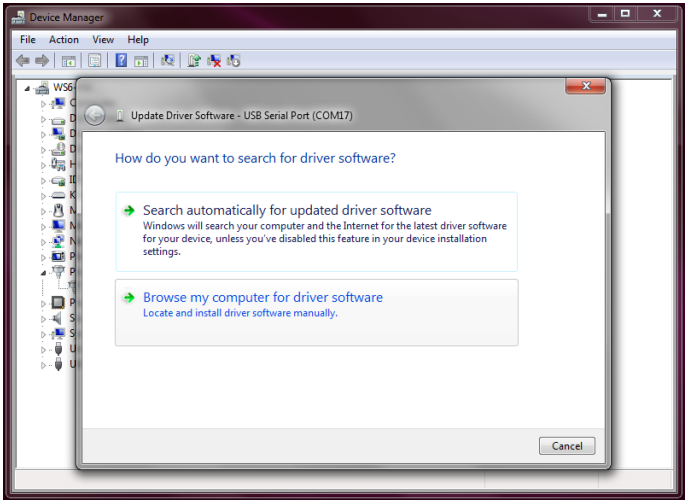


Figure 42: Select Browse my computer

Select the Driver provided on the software CD and click on Next to install the driver.

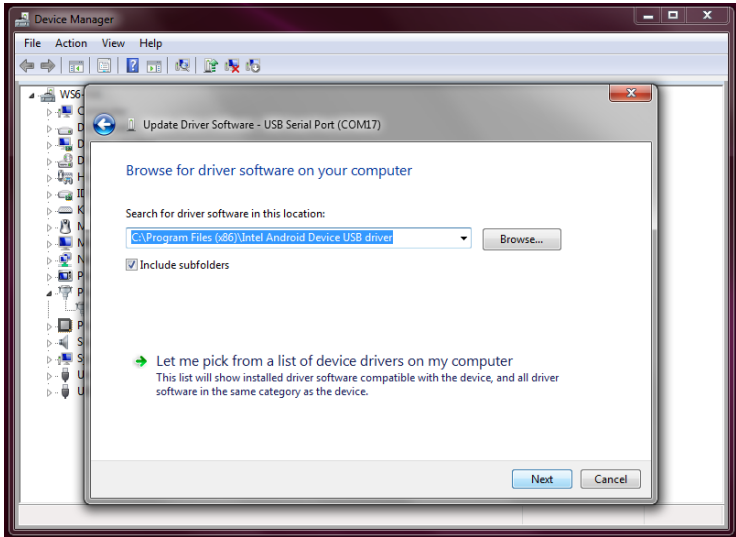


Figure 43: Select the driver file and browse for the file on the CD

INSTALLING DATA MONITOR SOFTWARE

Insert the Surf™ Data Monitor software CD in your computer's CD-ROM drive. The Setup file is an autorun application. If the autorun did not start automatically, start the setup by clicking on the setup file in the installation CD.

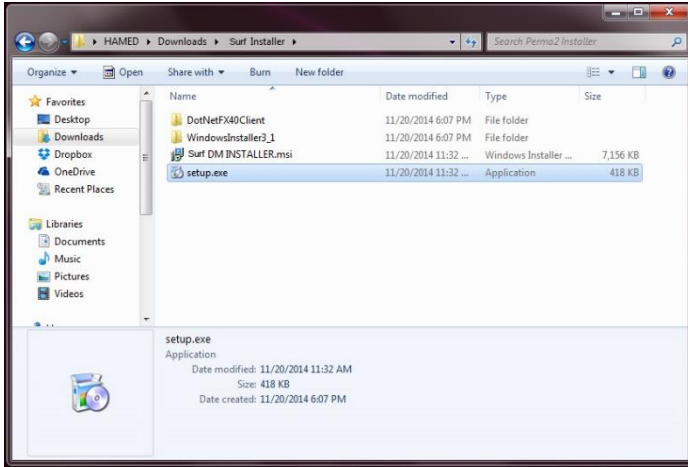


Figure 44: Click on Setup to start installing the Surf Data Monitor

The setup wizard will guide you through the rest of the installation process. Follow the instructions on your screen to install the software. This process may be different depending on the version of your operating system (Windows XP, 2000, 7 or 8). Following a successful installation, a Surf™ Data Monitor icon will be created on your desktop. Click on this icon to run the software.

MAINTENANCE

Repairs and servicing not covered in this user manual should only be performed by qualified personnel. Periodically wipe the case with a damp cloth. Do not use abrasives or solvents.

SERVICE

If Surf™ does not turn on; check the power supply cord to see if it is connected properly. If Surf™ still does not work properly; review this user manual to make sure you are operating it correctly.

If Surf™ malfunctions, first try to check its functionality using the verification dongles. If that fails, call Giatec Scientific technical support's number provided on the back of this manual. After consulting with our technical support department, if return is required, the instruction for packaging and returning the device will be provided.

REPLACEMENTS

For Surf™ service use only the replacement part specified. The USB communication cable is intended to be used only by Surf™ device and connecting it to other instruments might damage the cable. To order replacement parts, call Giatec Scientific Inc. using the number provided on the back of the user manual or on the back of the device.

For latest updates, please refer to the Giatec website.

Surf™ TECHNICAL SPECIFICATIONS

General

Type	Value
Measurement Channels	4
Measurement Display on LCD	Yes
LCD Display Area	65×33 mm
Dimensions of Device	200×160×70 mm
Software	Surf™ Data Monitor

Reading Range and Accuracy

Reading Range	Frequency range	Accuracy
0.1 – 100 KΩ.cm	13 – 100 Hz	± (0.1+1%)
100 – 1000 KΩ.cm	13 – 100 Hz	± (1+1%)

Measurement Time

Frequency	Single measurement time	Testing time (8 measurements)
13 – 100 Hz	1.5 seconds	<15 seconds

Operating Conditions

Type	Value
Operating temperature	15 ~ 45 °C
Operating humidity	30 ~ 80%
Storage temperature	0 ~ 60°C
Operating voltage/current	100-250 V, 50/60Hz

TERMS AND CONDITIONS OF SALE ("SALE AGREEMENT")

Please read this Sale Agreement before using the Giatec Scientific Inc. ("Giatec") product (the "Product"). By finalizing Your purchase order, You, the purchaser of the Product, and, if applicable, any end user ("End User") on whose behalf You are making this purchase for (You and the End User are hereafter collectively referred to as "Customer"; Customer and Giatec are hereafter together referred to as "Parties") agree to be bound by and accept the terms and conditions provided below. If You and/or the End User, as the case may be, disagree with these terms and conditions, do not finalize Your order, or if the order has been placed, return the Product immediately upon receipt without using it.

Payment; Purchase Price and Associated Charges. Payment must be made at the time of order unless otherwise agreed to by the Parties. Customer will pay the total purchase price plus shipping and handling, if any, as specified on the emailed invoice. Customer is also responsible for all taxes related to this purchase and to the import of the Product, if applicable, to include but not limited to all sales taxes, value-added taxes, import taxes/customs/duties and any other similar taxes imposed by any governmental entity.

Title; Risk of Loss. Title to the Product passes to Customer when the Product is paid for in full. However, Giatec bears all responsibility for loss of or damage to the Product during initial shipment after purchase and until Product is received by Customer, unless Customer selects its own mode of shipping. In repair cases, risk of loss is borne by Customer for return of the Product, but by Giatec following repair and upon return to Customer.

Limited Warranties. Giatec warrants the Product against defects in materials and workmanship under normal use (the "Warranty") for a period of 12 months (#) from the Delivery Date (the "Warranty Period"), on the condition that the Product has been completely paid for. Unless as otherwise mandated by local law, the Warranty Period does not restart if Customer

receives a replacement appliance and/or replacement Software. This Warranty does not apply: (a) to consumable parts, such as batteries, Plexiglas cell units and cables unless damage has occurred due to a defect in materials or workmanship; (b) to cosmetic damage, including but not limited to scratches, dents and broken plastic on ports; (c) to damage caused by accident, abuse, misuse, neglect or failure to properly maintain (to include but not limited to water damage and/or condensation or improper temperatures during storage), or improper installation; (d) to damage caused by electrical disturbances or acts of God, to include but not limited to civil disturbance, war, flood, fire, rodents or insects; (e) where manufacturer's serial numbers and security labels have been removed from the Product; and (f) to damage caused during shipment (due to Customer's improper packaging) from Customer to Giatec in the case of Product returns for repair.

Giatec disclaims all other warranties, express or implied, including without limitation implied warranties of merchantability, fitness for a particular purpose, or against hidden or latent defects. Giatec's responsibility for warranty claims is limited to repair or replacement. Giatec reserves the right to modify this Warranty at any time, at its sole discretion, and with notice to Customer.

Giatec does not warrant that the operation of the Product will be uninterrupted or error-free. Giatec is not responsible for damage arising from failure to follow instructions relating to the Product's use. This Warranty is voided immediately if repair, modification (to include upgrades, expansions or usage or addition of non-manufacturer parts or accessories), alteration or other service is attempted other than by Giatec. In this regard, the integrity of the appliance casing (aka the box) should not be violated for any reason, unless expressly authorized by Giatec in writing.

Technical Support. Giatec will provide technical support to Customer in accordance with the then-current support policy in effect and in accordance with the Warranty provided herein, unless full payment for the purchase of the Product is not received. Giatec will respond to Customer support problems by phone or by email inquiry. If a support problem cannot be

rectified via phone or email, Customer will be provided with return instructions.

Customer agrees and understands that it may be necessary for Giatec to collect, process and use Customer data to perform the support and repair obligations identified herein. This may include the necessity to transfer data to affiliate third parties that are contracted with Giatec to assist in meeting these obligations. In doing so, Giatec will (i) protect and keep confidential such information, (ii) not use such information for reasons other those discussed above, and (iii) not sell, distribute or pass on such information to any third party.

Repair. Customer should carefully inspect the Product upon its delivery. Customer should maintain all original packaging upon receiving the Product until the Product has been installed and is found to be in proper working order.

If the Product arrives to Customer (the date of arrival is referred to herein as the “Delivery Date”) damaged or defective at initial delivery, Customer must notify Giatec Technical Support within 30 days from the Delivery Date of the condition of the Product and obtain return instructions if needed. Product must then be returned immediately to Giatec for repair or replacement at Giatec’s discretion. Giatec will then arrange for delivery of temporary or Permanent replacement Product. Customer is responsible for properly packing the return shipment of the Product. Giatec will arrange for shipping and insurance.

If Customer fails to notify Giatec within 30 days of the Delivery Date, (i) the Refund Policy below will not apply, (ii) Customer will bear the cost of returning the Product for repair, and (iii) damaged Product will not be accepted.

If during the Warranty Period (as described herein) but following the initial 30 day period the Product is not working properly, Customer must contact Giatec Technical Support to confirm the problem and obtain return

instructions if needed. Customer will pay shipping and insurance costs when returning the Product for repair.

If the Product is returned for repair or replacement at any time following purchase by Customer and Giatec discovers that the Warranty is inapplicable due to the reasons provided above (see the “Limited Warranties” section hereof), the Product will not be repaired and will be returned to Customer at Customer’s expense, unless Customer authorizes and pays for repair. Whether Customer authorizes repair or not, Giatec reserves the right to charge a “No Fault Found” fee where the Product is found not to be defective due to any fault of Giatec.

Any Giatec reseller or distributor involved in the purchase of the Product is not authorized to make any modification, extension, or addition to the Limited Warranties provided by Giatec herein, although any such reseller or distributor may provide its own warranty in addition to the warranty coverage provided by Giatec.

Refund Policy and Product Return. On a case-by-case basis, Giatec reserves the right to authorize a full refund of any Product purchase made where a refund is requested within 30 days of the Delivery Date. In such cases where a refund is approved, End User will return the Product to Giatec if the End User made such order itself. If the Product was ordered by a distributor or reseller, such distributor or reseller will coordinate with Giatec for the return of the Product. In either case, Customer is responsible for shipping and insurance charges and any damage to the Product which takes place en route to Giatec. Giatec reserves the right to charge a nominal restock fee for any such returns.

Limitation of Liability. Giatec is not liable under any other agreement between End User and a Giatec reseller or distributor for the provision of support (to include but not limited to an extended warranty or any support, service or repair agreement).

If found to have breached this Sale Agreement, Giatec is not liable for any amount above the aggregate dollar amount paid by Customer for the

purchase of the Product under this Sale Agreement. Except as provided in the Warranty and to the extent permitted by law, Giatec is not responsible for indirect, special, incidental or consequential damages resulting from any breach of this Sale Agreement, including but not limited to loss of use; loss of revenue; loss of actual or anticipated profits (including loss of profits on contracts); loss of the use of money; loss of anticipated savings; loss of business; loss of opportunity; loss of goodwill; loss of reputation; loss of, damage to or corruption of data or software programs; or any indirect or consequential loss or damage howsoever caused including the replacement of equipment and property, any costs of recovering, programming, or reproducing any program or data stored or used with the Product and any failure to maintain the confidentiality of data stored on the product. The foregoing limitation shall not apply to death or personal injury claims, or any statutory liability for intentional and gross negligent acts and/or omissions.

Not For Resale. The Product may not be purchased for resale purposes by Customer unless Customer is a legal and authorized reseller of Giatec products.

High Risk Uses. Customer will not purchase the Product for usage in connection with any high risk or strict liability activity (including, without limitation, air travel, space travel, firefighting, police operations, vehicle operations, power plant operations or power generation applications, transport management systems, military operations, rescue operations, hospital and medical operations or the like) whereby such usage could cause or contribute to damage to property or injury to persons.

Software License. The Product is and contains, the intellectual property of Giatec, and is protected by Canadian, U.S. and international copyright, patent, trade secret laws and international treaties. This Agreement is not intended to grant, and shall in no way be construed to grant, to Customer any rights in the intellectual property of Giatec, including the intellectual property in the Products. The Customer shall obtain a non-exclusive license to use the software contained in the Product (the “Software”) only in accordance with the terms of the Software License Agreement, attached hereto as Exhibit A, and the Customer shall agree with its terms prior to installing the Software.

Customer acknowledges that the Software is the intellectual property of Giatec and respects Giatec's rights as the intellectual property rights holder. Customer may not and customer agrees not to, or to enable others to, copy, decompile, reverse engineer, disassemble, attempt to derive the source code of, decrypt, modify, or create derivative works of the Software or any part thereof (except as and only to the extent any foregoing restriction is prohibited by applicable law). Any attempt to do so is a violation of the rights of Giatec. By virtue of this Sale Agreement, Customer acquires only the right to use the Software as contained in the Product and does not acquire any rights of ownership. All rights, title and interest in the Software shall at times remain the property of Giatec.

Product Disposal/Recycling. Giatec is unable to dispose of or recycle the Product following use. End User may dispose of recycle the Product or arrange for the same through the Giatec distributor or reseller which made the Product sale. Any disposal or recycling of the Product must be done in accordance with local government directives.

Export. Customer must comply with all export laws and restrictions and regulations of Canada. Furthermore, Customer will not export, or allow the export or re-export of the Product in violation of any such restrictions, laws or regulations. Additionally, Customer agrees to comply with the above and represents and warrants that it is not located in, under the control of, or a resident of any restricted country.

Entire Agreement. This Sale Agreement constitutes the entire understanding of the Parties as to the subject matter hereof and supersedes all prior offers, agreements, arrangements, negotiations and understanding, written or oral between the parties relating to that subject matter.

Severability; Assignment. If any provision of this Sale Agreement is held to be unenforceable for any reason, the legality or enforceability of the remaining terms shall not be affected or impaired. The failure of Giatec to act with respect to a breach of this Sale Agreement by Customer or others does not constitute a waiver and shall not limit Giatec's rights with respect to such breach or any subsequent breaches. Giatec expressly reserves the right

to assign this Sale Agreement and to delegate any of its obligations hereunder. Customer may not assign, delegate or otherwise transfer (whether by operation of law or otherwise) this Sale Agreement or any of Customer rights or obligations hereunder without the prior written consent of Giatec. Giatec may assign the provision of repair services to third parties.

Governing Law; Dispute Resolution. All disputes arising out of or in connection with this Sale Agreement shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce by one or more arbitrators appointed in accordance with the said Rules. The place of arbitration shall be Ottawa, Ontario, Canada. The language of the arbitration shall be English. For the purposes of this arbitration, this Sale Agreement shall be governed by and construed under Ontario law as such law applies to agreements between Ontario residents entered into and to be performed within Ontario, Canada. The decision of the arbitrators shall be binding upon the parties hereto, and the expense of the arbitration (including without limitation the award of attorneys' fees to the prevailing party) shall be paid as the arbitrators determine. The decision of the arbitrators shall be executory, and judgment thereon may be entered by any court of competent jurisdiction.

Any non-English language translation of this Sale Agreement is done for local requirements and in the event of a dispute between the English and any non-English versions, the English version of this Sale Agreement shall govern.

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PLEASE READ THE TERMS AND CONDITIONS OF THIS SOFTWARE LICENSE AGREEMENT CAREFULLY BEFORE AGREEING TO INSTALL THE SOFTWARE. THIS IS A LEGAL AGREEMENT BETWEEN GIATEC AND THE END USER ("CUSTOMER").

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This Agreement constitutes the entire agreement between you and Giatec and supersedes any prior agreement concerning the Software. Giatec is not bound by any provision of any purchase order or any other type of correspondence (written or verbal). Should any court of competent jurisdiction find any provision in this Agreement to be illegal, unenforceable, invalid, or to be overreaching, in whole or in part and for any reason, such illegal, unenforceable, invalid or overreaching provisions or part thereof shall be stricken from this Agreement, and such provision shall not affect the legality, enforceability, or validity of the remainder of this Agreement. This Agreement is governed by the laws of the Province of Ontario and any disputes or claims arising hereunder shall be under the exclusive jurisdiction of the courts situated in the City of Ottawa, Province of Ontario.

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