CorrSen

User Manual

Server Application

UNIVERSITY OF CHEMISTRY AND TECHNOLOGY PRAGUE

GEMA

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1. CorrSen corrosion monitoring system

CorrSen is a highly sensitive wireless system for the real-time monitoring of atmospheric corrosivity. The device records the electrical resistance of a thin metallic sensor (ER sensor) placed on a non-conductive substrate and exposed to corrosive conditions. As a result of the corrosion process, the thickness of the sensor decreases, resulting in an increase in electrical resistance, which is directly converted to the corrosion depth, actual corrosion rate and environmental corrosivity. Simultaneously with the corrosion rate, the temperature and relative humidity are recorded by the logger, providing an overview of the climatic factor effect on the environmental corrosivity.

The CorrSen monitoring system includes **resistometric sensors**, **loggers**, **gateway**, **mobile application** and **web interface**.
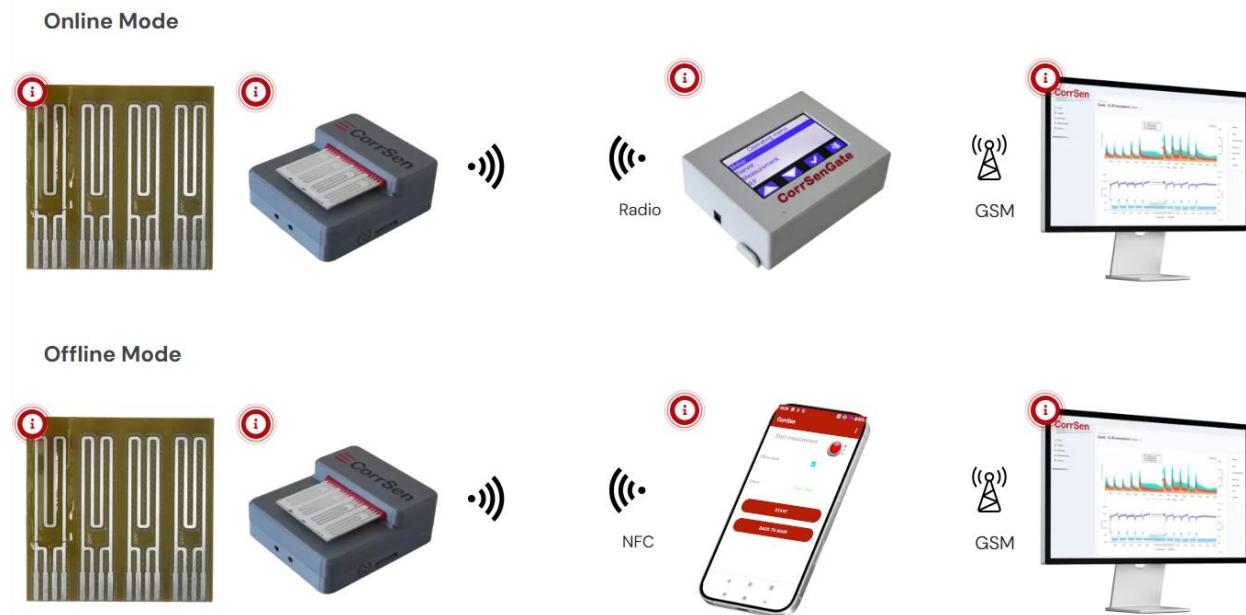

1.1. Resistometric sensors and loggers

Resistometric sensor consists of three measuring and one reference metal track placed on the non-conductive substrate. The sensor is supplied ready to use with the reference part being already covered. Remove the sensor out from the protective packaging before the use.

Caution: Hold the sensor from the sides to avoid touching the sensitive metal part during all manipulations or use the gloves. If you touch the sensitive part of the sensor with bare hands, degrease it immediately by rinsing the sensor with ethanol or acetone and drying it.

Battery-driven wireless **logger** records the electrical resistance of the sensor, ambient temperature and relative humidity. The data is sent to the gateway via radio waves.
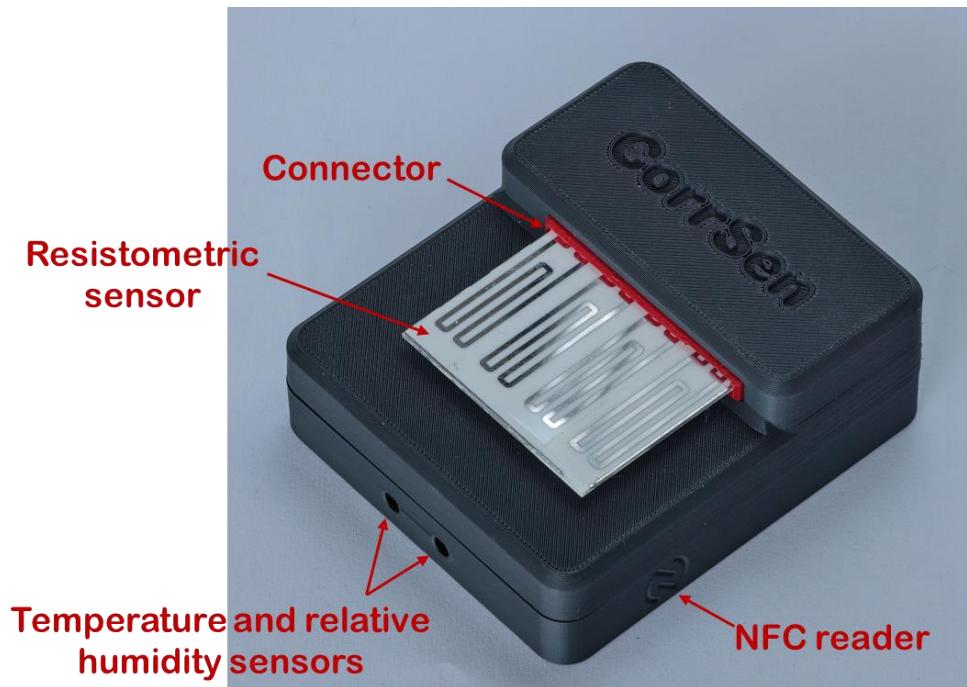
1.2. Gateway

Stationary plugged **gateway** transmits the data from the loggers to the server. Radio waves are used for wireless communication between the gateway and the loggers. Data is sent to the server via GSM. The gateway is supplied with a SIM card installed.

1.3. Mobile application

Mobile application is used to activate the logger and read the logger status. You can also download the data from the logger using the mobile application instead of the gateway.

CorrSen mobile application is available for AndroidOS and iOS (iPhone). **CorrSen** AndroidOS mobile application is available to download for free from Google Play. **CorrSen** iOS mobile application is available to download for free from App Store. The communication between the logger and the mobile phone is realized via an NFC module. Documentation for both applications is available in separate files.

1.4. Web interface

Web interface at **monitoring.corrsen.com** is used for the remote device setup, data reading and processing.

The operations are performed using the Menus on the left side of the screen.
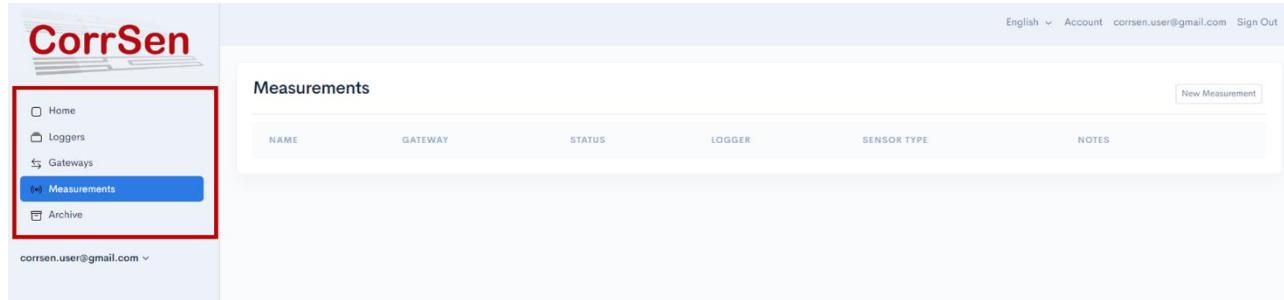
Registered Loggers and Gateways are listed in the appropriate menus. Measurement menu is used to start the new measurement and to follow and edit the running measurement. Archive stores older measurements which can be retrieved for further analysis.

The web interface provides two user roles:

➢ Member has limited rights to view measured data in a simplified form;
➢ Admin has the full owner rights to start and stop the measurements, follow the results in the form of corrosion rate curves and invite new users.

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2. Creating new account

Create a new admin account before starting the measurement.

1. Open monitoring.corrsen.com page
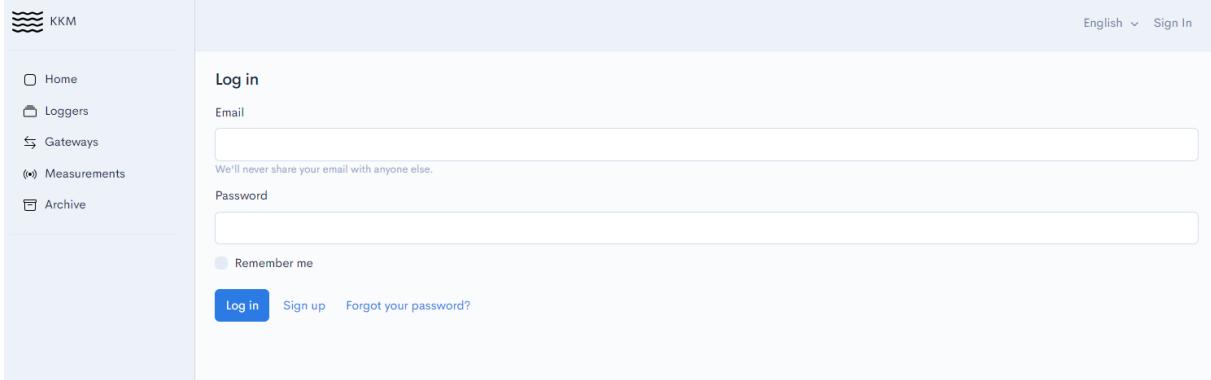
2. Click the *Sign up* button and follow the instructions to fill your login and password.
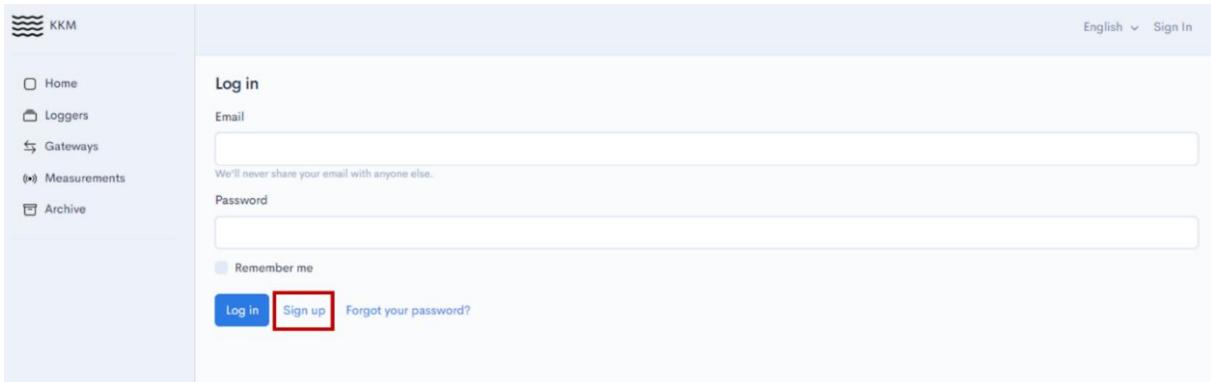
3. Managing your company accounts

To invite new company members and manage your company accounts, click on the *Account* button at the top right of the screen:

You can change your account name in the *Overview* menu:
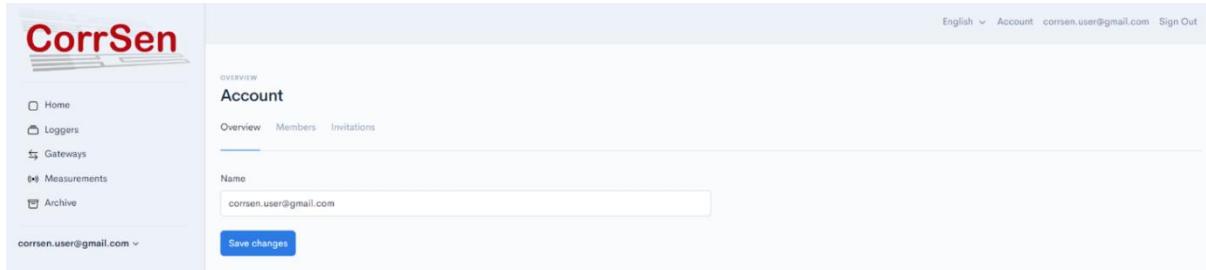
The *Members* menu allows you to view, edit or delete the accounts of your group members:
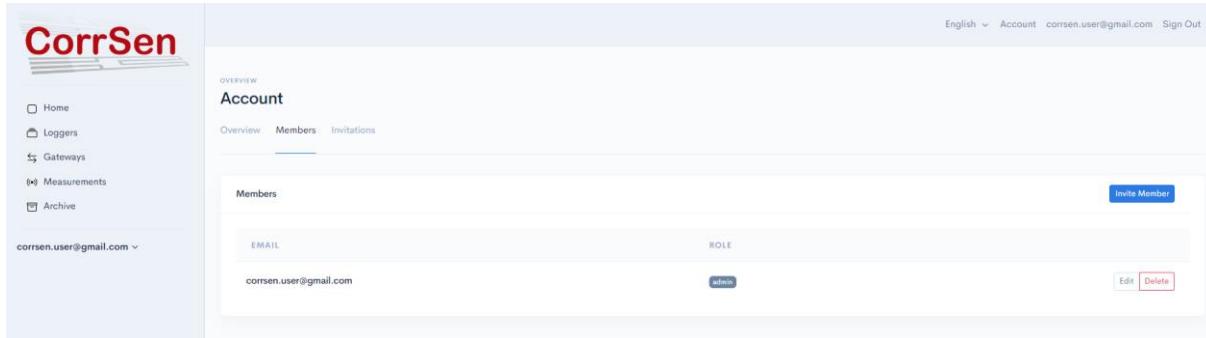
Send an email invitation to invite a new group member by clicking the *Invite Member* button in the *Invitations* menu.

4. Loggers

4.1. Pairing new loggers

To use new loggers, you must first pair them with your account.

1. Open the Loggers menu and click on the *Pair New Logger* button in the top right corner:
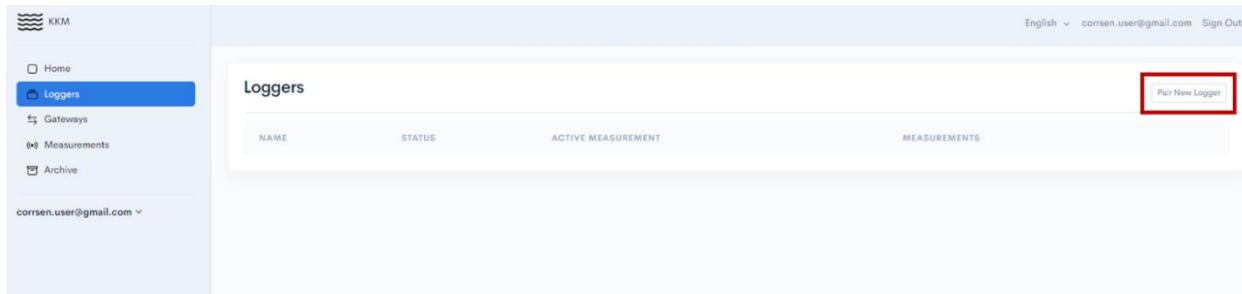
2. Enter the *Pairing code* and *Name* of the new logger. The pairing code is written on the label on the bottom side of the logger. The name of the logger can be, for example, its Serial number (SN) written on the label, or any other name of your choice.

4.2. Loggers menu

In the Loggers menu, you can view the list of loggers in use and pair the new loggers (see above).
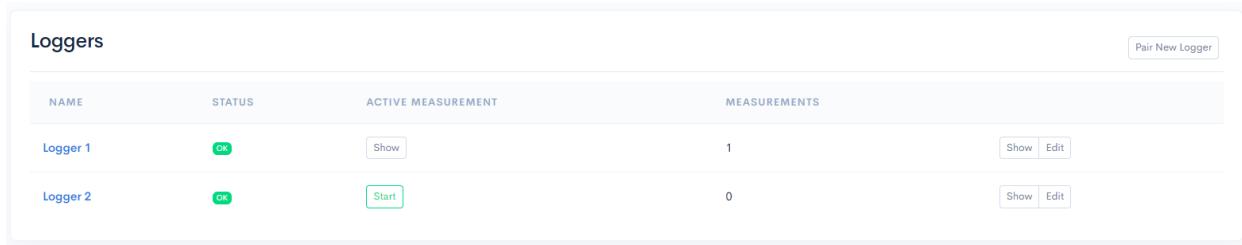
The list of loggers in use shows whether the logger is currently measuring (*Active measurement* column), the logger status (*Status* column) and the total number of measurements (current and previous, *Measurements* column).

Clicking on the *Show* bottom on the right or on the logger name in the first column will display more information about the logger, including the name of the current measurement (if exists) and the processor ID (procid) of the logger.

You can edit the logger name by clicking on the *Edit* button to the right of the <u>Loggers</u> menu:
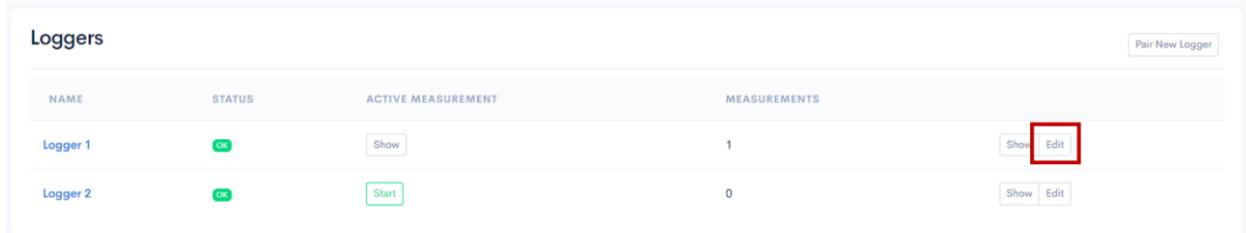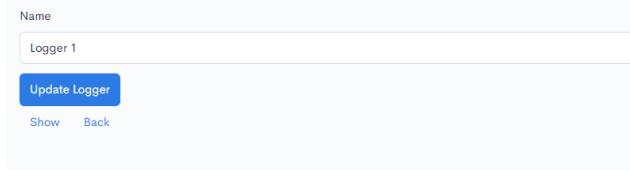
By clicking the *Show* and *Start* buttons in the *Active measurement* column, you can view the results of the current measurement or start a new measurement (see Section 6. Measurements):
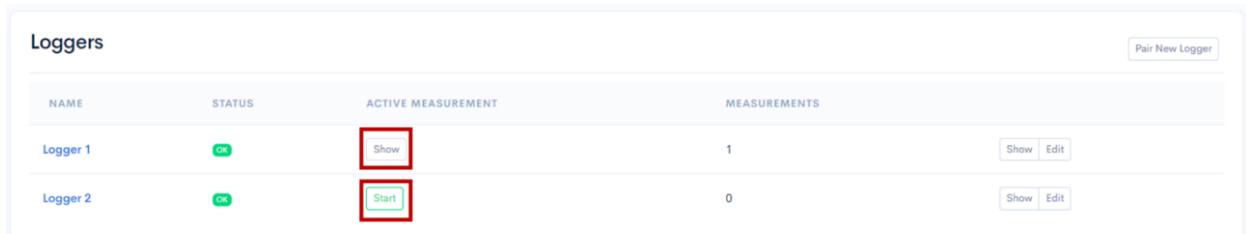
5. Gateways

5.1. Pairing new gateway

To use a new gateway, you must first pair it with your account.

1. Open the Gateways menu and click on the *Pair New Gateway* button in the top right corner:
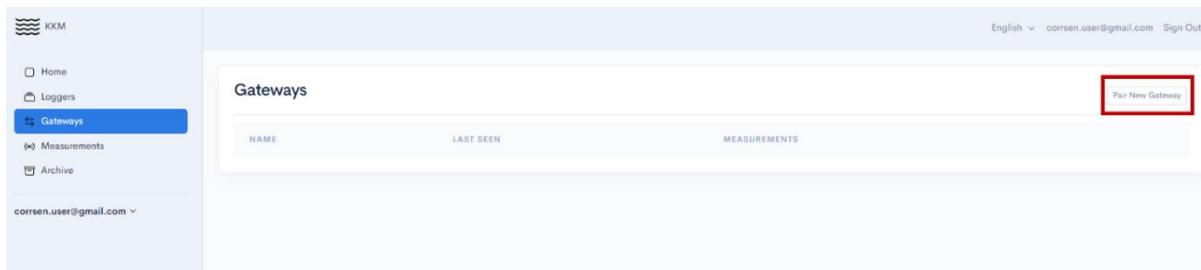
2. Enter the *Pairing code*, *Name* and *Notes* of the new gateway. The pairing code is written on the label on the bottom side of the gateway. The name of the gateway can be, for example, its Serial number (SN) written on the label, or any other name of your choice. Notes in an optional window are for additional information, e.g. the location of the gateway.

5.2. Gateways menu

In the Gateways menu, you can view the list of gateways in use and pair the new ones.
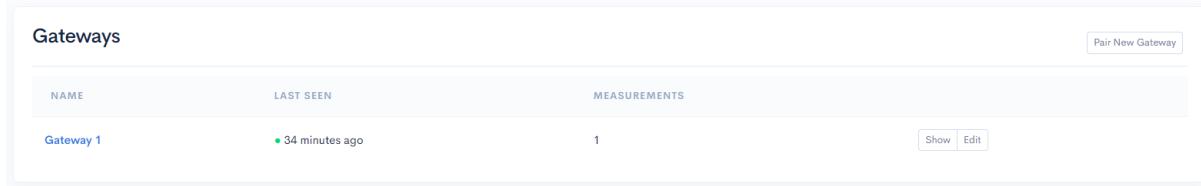
The list of gateways in use shows the last time the gateway communicated with the server (*Last seen* column) and the measurements sent through the gateway (*Measurements* column).

Clicking on the *Show* bottom on the right or on the gateway name in the first column will give you more information about the measurements run through the gateway and the processor ID (procid) of the gateway.
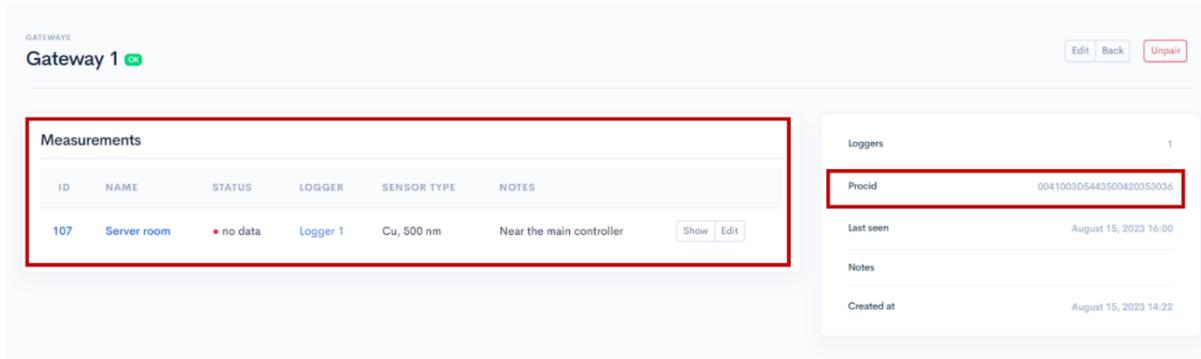
Click on the *Edit* button in the Gateways menu to edit the gateway name and associated notes.

Editing Gateway

Name

Gateway 1

Name of the Gateway.

Notes

Your notes, like where it is placed.

Update Gateway

6. Measurements

6.1. Measurements menu

In the <u>Measurements</u> menu, you can view the list of all currently running measurements and brief information about them, as well as start a new measurement.

Measurements

New Measurement

NAME	GATEWAY	STATUS	LOGGER	SENSOR TYPE	NOTES		
Garáž - Fe 50 venkovní	Gate 230004 (210169) (měřiče 22xxx)	● ok	22-0004	Fe, 50 µm	Garáž Fe 50 venkovní (Weiss)	Show	Edit
Garáž - Fe 50 vytápěná	Gate 230004 (210169) (měřiče 22xxx)	● ok	22-0005	Fe, 50 µm	Garáž Fe 50 vytápěná (Memmert)	Show	Edit
Garáž - Fe 50 nevytápěná	Gate 230004 (210169) (měřiče 22xxx)	● ok	22-0006	Fe, 50 µm	Garáž Fe 50 nevytápěná (lednice)	Show	Edit
Garáž - Zn 50 venkovní	Gate 230004 (210169) (měřiče 22xxx)	● ok	22-0007	Zn, 50 µm	Garáž Zn 50 venkovní (Weiss)	Show	Edit
Garáž - Zn 50 vytápěná	Gate 230004 (210169) (měřiče 22xxx)	● ok	22-0008	Zn, 50 µm	Garáž Zn 50 vytápěnýá (Memmert)	Show	Edit
Garáž - Zn 50 nevytápěná	Gate 230004 (210169) (měřiče 22xxx)	● ok	22-0009	Zn, 50 µm	Garáž Zn 50 nevytápěná (lednice)	Show	Edit

6.2. Starting new measurement

1. For the CorrSen-B logger, insert the sensor into the logger until it's fully inserted as shown in the picture.
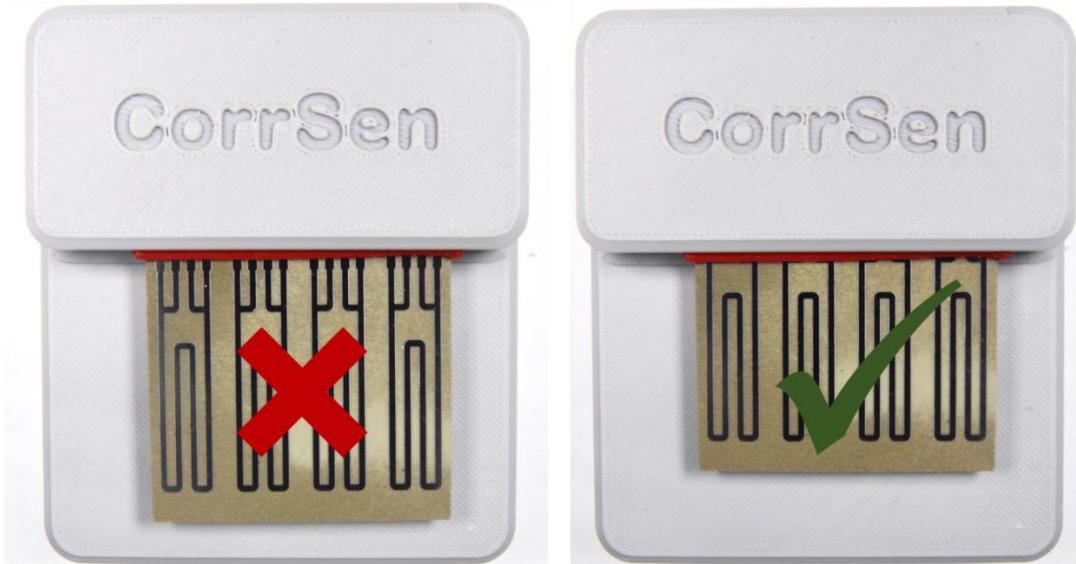
For the sensors on cable, plug the connector into the logger as shown in the picture.

2. Create a New measurement in your account. A measurement is a unique combination of the sensor, logger and gateway. Note that you must create a new measurement after changing the sensor, even if you continue to use the same logger and gateway.

- ➢ Open the Measurements menu
- ➢ Click on the *New Measurement* button in the top right corner

- ➢ Enter the *Name* of the measurement. This can be, for example, the monitored location, the logger number, the sensor type or the test name. Additional information about the measurement can also be written in the *Notes* window below.
- ➢ Follow the instructions to select the logger in the *Logger* list, the gateway in the *Gateway* list and the sensor type in the *Sensor type* list. If the logger is working in off-line mode (Measurements are transmitted using a mobile phone with an app), leave the *Gateway* list empty.

- ➢ Set the Measurement Parameters in the following windows. Of all of the following parameters, the *Measure interval* is the only mandatory parameter. The other parameters are optional.

Measure interval is the basic measurement frequency. It can have values between 2 to 240 minutes.

Caution: Note, that the higher the measurement frequency, the shorter the battery life. A measurement interval of 2 to 10 minutes is recommended for short tests and special applications

only. For the majority of applications, 15 minutes is the lowest recommended measurement interval, which guarantees 3 years of battery life.

Connection interval is the frequency of data transmission from the logger to the gateway. Setting the Connection interval to be longer than the Measure interval means that the logger will store few data points and then send them all together after the specified interval. For example, with a Measure interval of 15 minutes and a Connection interval of 60 minutes, the logger will send 4 data points at the end of each hour. Setting a longer connection interval is intended to prolong battery life. If the *Connection interval* is left blank, it will automatically be set as equal to the Measure interval and the logger will send data after each measurement. The connection interval setting is meaningless when measuring without the gateway.

In the *Sleep until* window, you can set the start time for the measurement. If the window is left blank, the measurement will start automatically after pressing the *Create Measurement* button.

Measurement Parameters

Measure interval

	minutes

Connection interval

	minutes

Sleep until

dd/mm/yyyy --:--	🗓

➢ In the **Notification** window, you can optionally set the limit corrosion rate or corrosivity to be notified by email when the limit is exceeded.

If the *Corrosion rapid limit* notification is set*,* you will receive the notification if the corrosion rate increases rapidly.

Corrosion rate limit is a limit corrosion rate value in µm per year.

Corrosivity class name is the maximum allowed corrosivity class according to ISO 9223:2012 or ISO 11844-1:2020 standard.

To disable notifications, all of this information must be empty.

Notifications

Corrosion rapid limit

Corrosion rate limit

Corrosivity class name

> ➢ Press *Create Meter* button to start the measurement.

3. If measuring with the gateway, **connect the gateway** and place the logger next to the gateway. The gateway can be placed horizontally or mounted vertically on a wall.

Caution: Ensure that the gateway is placed in a clean and dry environment and is not exposed to the risk of mechanical damage.

4. **Activate the logger** and **start the measurement in the mobile application**. Place the mobile phone next to the logger's NFC reader. For ease of use, the logger can be temporarily placed on its side and the phone can be held above or placed on top. Next follow the relevant application documentation (AndroidOS or iOS).

5. Place the logger in the monitoring site. The logger can be exposed either vertically or horizontally, but not on the sideways or upside down, as shown in the picture.

Caution: Ensure that the logger is not exposed to the risk of mechanical damage. CorrSen-B loggers must not be exposed to harsh indoor conditions (direct access to water or chemicals) or outdoor conditions.

6.3. Data transmission

6.3.1. Logger to Gateway communication

Data transmission from the loggers to the gateway is by radio over a maximum distance of tens to 100 meters. This distance can be reduced if there are obstacles such as metal or concrete walls between the logger and the gateway. Data transmission between the logger and the gateway can therefore be implemented in two ways:

1. The logger and gateway can be placed close enough together to allow continuous radio communication and data transfer.

This solution can be particularly useful if the logger and the gateway remain in the same location through the measurement and the real-time information on corrosivity is required to take the necessary measures if it increases; for example, in industrial halls, server rooms, storerooms and museums.

2. The logger is placed away from the gateway measuring and storing the data in its internal memory. Data transfer from the logger to the gateway starts when the logger is moved close to the gateway. Note that the transfer of the larger amount of data may take longer time.

This solution can be used for the applications where the logger is regularly moved away from the gateway and back again; for example, monitoring vehicles that are driven during the day and parked in the garage near the gateway at night.

Data transmission from the logger to the gateway starts automatically when the distance between the devices is short enough to allow the radio communication.

6.3.2. Gateway to Server communication

The Gateway transmits the data to the server continuously via GSM when plugged in.

If there is a problem with data transmission to the server, restart the Gateway by unplugging and replugging it. If the problem persists, contact your CorrSen supplier.

6.3.3. Logger to Mobile Phone communication

Data transfer from the logger to the server via the mobile application is advantageous for the applications where it is not necessary or possible to have a gateway. Data can be then read from the logger from time to time. Note that the presence of the operator is required to read the data and the transfer may take longer time. For data transfer to mobile follow the relevant application documentation (AndroidOS or iOS).

6.4. Running measurement

Measurement results can be viewed online in real time via the web interface.

To view the actual corrosion data, open the <u>Measurements</u> menu. Select the measurement from the list and click either on its name in the list or on the *Show* button to the right.


The interactive graphs show actual corrosion depth, corrosion rate and climatic data. To hide or show the particular curve, click on the curve name in the legend. Move the cursor to view the values of the monitored parameters at individual time points. Select the area of interest on the graph to zoom in. To zoom out, press the *Reset zoom* button in the top right corner of the graph.
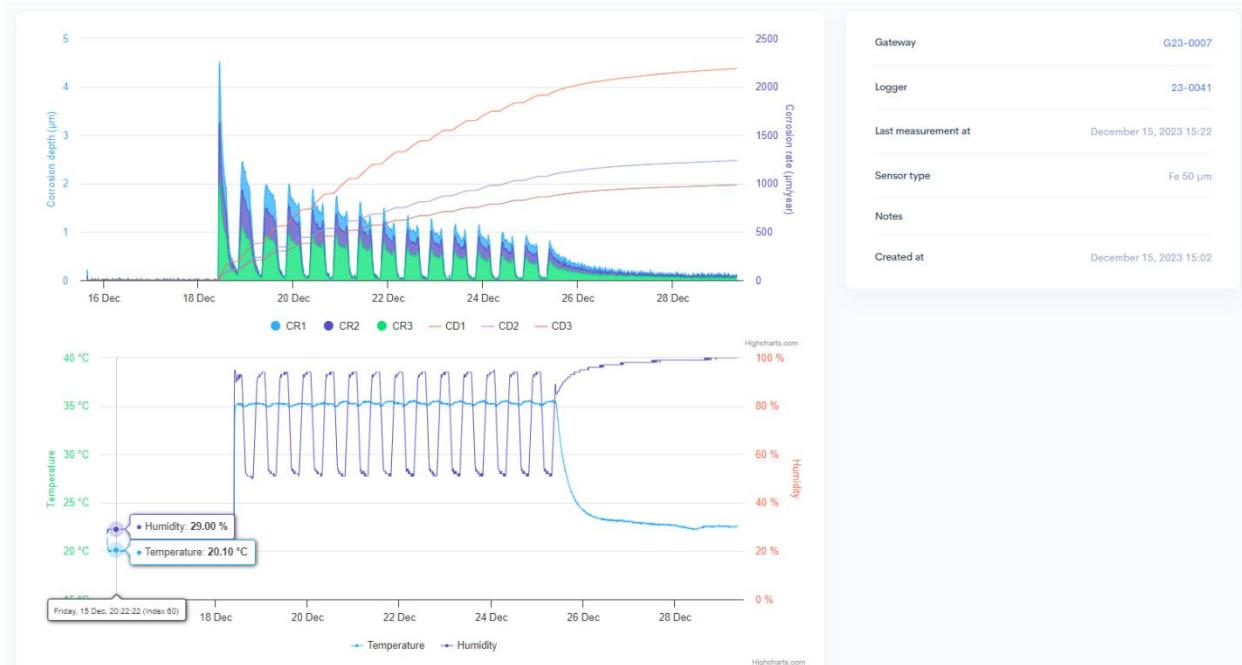
To download the raw electrical resistance, temperature and relative humidity data, press the *Export to XLSX* or *Export to CSV* button in the top right corner.
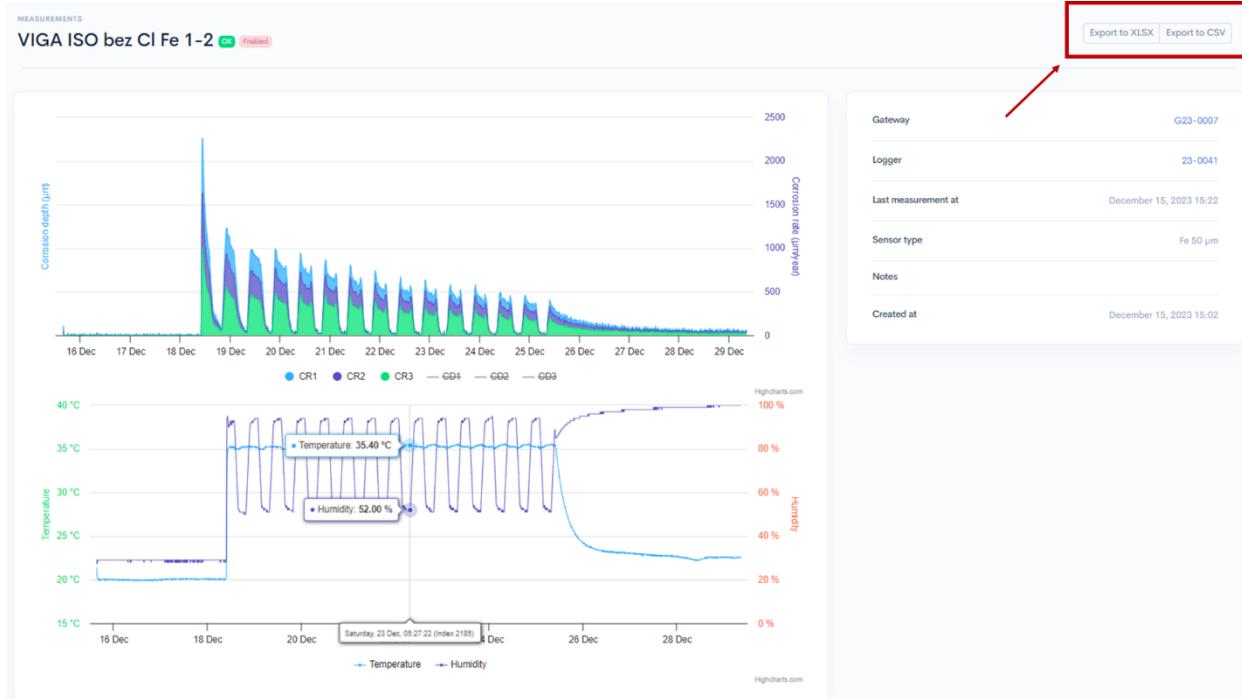
6.5. Editing the measurement

While the measurement is running, it is possible to edit its name, notes and measurement parameters. To edit the measurement, open the Measurements menu and click on the *Edit* button.

The editing menu is similar to that for starting a new measurement (see Section

6.2. Starting new measurement).

6.7. Finalizing the measurement

6.7.1 Finalizing the measurement on the web interface

To finalize the measurement on the web interface, open the measurement in the *Measurement* menu and press *Finalize measurement*.

Confirm finalizing the measurement by pressing the *Suspend meter* and *Stop sending data* buttons.

Suspend meter puts the logger into standby mode. The logger would need to be activated via the NFC mobile application when starting the new measurement.

Stop sending data option locks the measurements so that no more data will be assigned to the current measurement.

Caution: Make sure that all data have been received before finalizing the measurement.

Press *Finalize Measurement* button to confirm. The measured data are automatically stored in the Archive. A new measurement can now be started using the logger and the gateway.

6.7.2 Finalizing the measurement in the mobile application

To finalize the measurement in the mobile application, place the mobile phone next to the NFC reader of the logger and next follow the relevant application documentation (AndroidOS or iOS).

7. Archive

The Archive menu gives access to list of previous (completed and inactive) measurements. The interface of the menu is similar to that of the Measurements menu, but the measurement can only be viewed, but not edited. To view the measurement, click on its name or the *Show* button on the right.

Measurement Archive

NAME	GATEWAY	LOGGER	SENSOR TYPE	NOTES	
Server room	Gateway 1	Logger 1	Cu, 500 nm	Near the main controller	Show