
Schleibinger ASR Reactor

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1 Introduction

Congratulations for buying the Schleibinger ASR/AKR tester. In this test chamber concrete specimen are stored at a temperature between 20°C and 65°C at nearly 100% rel. Humidity according to the French standard NF P18-454 (Decembre 2004) : Beton - Reactivite d'une formule de beton vis-À-vis de l'alcali-reaction - Essai de performance and the RILEM test method TC 101-ARP AAR-4 -Detection of Potential Alkali-Reactivity- Accelerated method for testing aggregate combinations using concrete prisms. The temperature is registered continuously and displayed graphically. Over an internet interface, the Schleibinger ASR-tester maybe controlled remotely. Some benefits of the Schleibinger ASR machine are:

- stainless steel inside resistant to corrosion
- inner bath welded in protective gas
- perfect insulation to ensure that the outside temperature does not exceed 30 °C
- freely programmable temperature curves from room temperature up to 65°C
- very small temperature deviation
- two stainless steel temperature sensors inside. Up to 4 extra sensors may be connected (option).
- fulfilling of all RILEM and national standards
- graphical color display showing the temperatures over time.
- SD card inside for recording all temperature over time.
- USB connection to copy temperature data to USB.
- Network and internet connection for checking all parameters and temperatures remotely, and world-wide if the customer likes!
- two 6 kW heating units with backup functionality (machine can also run with one unit)
- triple overheating protection: mechanical switch, electronically and by software
- contactless and therefore wear-free switching of the heating unit
- additional breaker in case the electronic switch causes a fault.
- residual current circuit breaker for maximum electrical safety
- fog generating system for realization of almost 100% humidity even at room temperature (option)

- upon request, the customer will receive a list of all components and necessary spare parts including a complete circuit diagram.
- free lifelong software update.
- Schleibinger is not only supplies the machine, but also all the accessories, such as specimen containers, formwork, high precision length measuring gauge etc.

2 Alkali-Silica Reactivity

Alkali-silica reactivity is the process in which certain minerals (usually glass type silica) are converting in the presence of moisture and highly alkaline environment of the concrete, creating a gel like material. The formation of gel causes an increase in volume with the formation of tensile forces within the concrete matrix and thus leads to the formation of cracks. Cracking then allows more water to penetrate into the concrete matrix, resulting in more gel formation and hence more expansion, thereby resulting in failure of the concrete matrix.

Typical indicators of ASR are random-map cracking, and, in advanced cases, closed joints and associated concrete splitter. Cracks due to ASR usually occur in areas where moisture is often present, e.g. near the waterlines in pillars, near the ground behind retaining walls, near joints and free edges of sidewalks, or in columns. Petrographic examination can conclusively identify ASR.

(Portland Cement Assosication, Skokie, IL, USA,

http://www.cement.org/tech/cct_dur_AAR.asp)

3 Important Safety and Security Hints

- Be sure the valve on the bottom of the inner bath (tank) is closed before you fill the water in.
- Do not open the drain valve when the water in the tank is hot!
- Be sure there is at least 200 liters of water are in the tank before starting operation.
- Attention! When the lids open, hot steam is evaporated. Use safety glasses, gloves and suitable clothings!
- The sample containers are hot and heavy! Use safety gloves and use a crane for container handling!
- Switch off the power supply and unplug the power supply before opening the control cabinet!
- Do not increase operating temperature above 70°C!
- Use the shelves! Do not place any specimen or similar directly into the water bath!

4 Installation of the device

4.1 Mechanical installation and setup

The ASR reactor is delivered in a wooden box size 200 x 170 x 165 cm (length x width x height). The weight of the box is about 750 kg. Please use an appropriate fork lifter to handle the box.

To open the box, please open first the screws on the top of the box. Then please remove the lid. Remove the side walls. At least 2 persons are necessary for this work.

After removing the blanket and the side walls, the ASR reactor stands on a pallet. Use a fork lifter to lift the ASR reactor from the pallet.

Attention!

Take the machine from the side which is opposite to the white electrical cabinet.

There is a ball valve to drain the ASR near one of the feet on the far outer right side of the machine. Be careful do not shear off this valve with the fork lifter. Place the forks of the fork lifter about 60..90 cm (2..3 feet) away from the stands on each side.

4.2 Launching the machine

Place the machine on a level stable surface. Compensate for unevenness with the adjustable stands. Close the drain plug under the tank.

4.3 Mounting the display

During the transport the display is stored in the control cabinet. Mount the display before starting the operation. Please follow the steps shown in the pictures below (fig. 1 - 7).

4.4 Electric installation

Important!

The device requires a rotary WYE current 3x32A / 208V..230V / 360..400V 50..60 Hz with a CEE plug or open wires. L1, L2, L3 and Neutral have black wires (Fig. 8). The wires are labeled with numbers 1...4. The protective ground is yellow/green. The power consumption is about 12,5 kW maximum. The control system is assembled in an electric cabinet at the side. This may only be opened by electrical service staff, if the main switch is turned off. Attention: The orange cables between the filter and the mains switch are on voltage even if the mains switch is off!



Figure 1: Remove display from cabinet



Figure 2: Unwrap the display



Figure 3: Thread the cables through the mounting hole



Figure 4: Mount the display support at the support



Figure 5: Fix the display with a 6 mm Allen key, delivered with the machine



Figure 6: Connect the DIN connector and the D-Sub connector at the control unit



Figure 7: Connect the USB to the controll unit

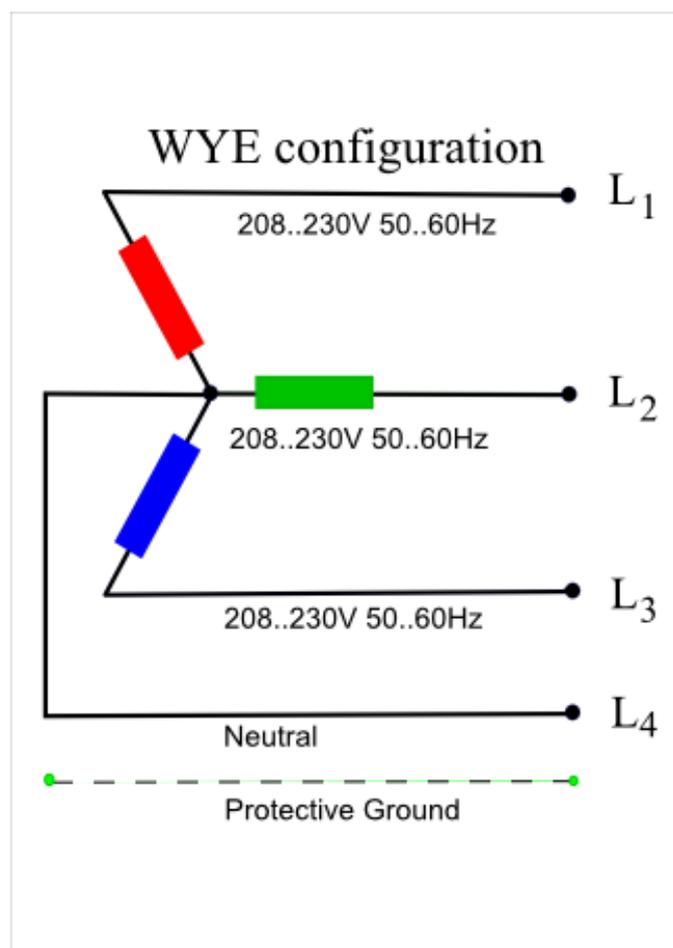


Figure 8: Mains WYE configuration

Two heaters with 6 kW each are installed. These are separately switched through solid-state contactors. Both heaters are protected by a circuit breaker 3x16 A. Additionally all heaters come with an over-temperature protection, which disconnects the heater from the mains by a power contactor- independent from the electronic control unit. The over temperature protection can be adjusted directly at the connection boxes of the heaters EH1 and EH2. To do this, please remove the box and its screws with an Allen key. Do not tune the over temperature protection over the maximum temperature of 70°C. Furthermore the water temperature is monitored by a RTD / PT100 temperature sensor (T-bath). The water temperature is displayed together with the air temperature. Besides, both heaters are protected by a RCD circuit breaker with a release current of 30mA.

4.5 Filling the ASR reactor

Fill the machine with about 260 liters of tap water or demineralized water. The exact liquid level is marked in the water tank with the label MAX in the middle of the bath. Then close the lid. The machine can now be connected to the power supply (see chapter 4.4) and activated. With the setting item 'target temperature' you can choose your required temperature. Or enter a suitable temperature profile or program and select it.

4.6 The fog machine

The fog machine consists of an electric valve and a double-high-pressure-pump with an output pressure of 20 bar. The two fog injectors of the type 150 provide round about 1,4 liters per hour and per injector. Furthermore an exchangeable filter is installed in the injector with a mesh aperture of 20 μ m. The water is taken from the main bath, cooled down by a ventilated cooler and injected into the test chest again. The fog machine is only necessary at temperatures below 50 °C. At higher temperatures the humidity by water evaporation from the bath is high enough.

4.7 Connecting the computer network

The ASR Reactor is equipped with an Ethernet TCP/IP interface and comes with a already installed WEB server. Connect the network interface to the control cabinet. The network address can be changed with the software 'chiptool.exe' delivered with the ASR machine (please see also chapter 9).

4.8 Additional temperature sensors

Additional empty tubes for temperature sensors are placed in the control cabinet. The cable bushings in the tank have to be necessarily sealed with dummy plugs, otherwise water vapor may penetrate from the water tank into the control cabinet.

Important!

4.9 Strip recorder (optional)

The temperatures can also be exported by a analogue voltage signal 0..10V. A 25-pin D-Sub connector is used here.

The connection plug arrangement:

channel		Pin
1	bath temperature	9
2	target temperature	10
3	air temperature	23
4		24
	ground	7

0V = 0°C; 10V = 100°C

5 Starting the machine

5.1 Opening the Lids

The lids of the ASR reactor are locked by two latches. Please move up the small lock in the middle before you are opening the latch.

5.2 Filling

Fill the tank with water to the mark *MAX*, at least until the heaters are clearly covered with water.

Important!

If the machine is not sufficiently filled with water or if there is no water in it, the entire machine may be destroyed!

Do not forget to close the drain plug before you fill the tank.

5.3 The setup of the security-maximum-temperature

At the heating elements (behind the two green boxes near the botton on both sites of the machine) the maximum temperature can be set. The factory setup is 70°C. Do not tune it higher!

6 Basic operation

Two common programs are installed: The test at 60°C without add. humidification called ASR60 and the test at 40°C with add. humidification called ASR40.

- Start ASR machine.
- Select the program from the main manu setup → profile
- Go back to the main menu setup → set point and select profile.
- Go back to the main menu and choose start.

The ASR reactor will run the selected test at 40°C or 60°C. The data are recorded on the internal SD card. The current temperature is shown graphically on the touch screen, or in the web browser numerical and graphical.

7 Control

The controlling system of the ASR Reactor is equipped with the latest internet technology. A touchscreen with a TFT colour display is used for operating the machine.

7.1 Basic Menu

After switching the controlling system on, press 'continue' to enter the base menu.

menu item	function
start	Starts the temperature control and the measurement
status	read in temperature and switch inputs manually
cycle time	specify the program runtime for choosed temperature program.
USB	copy measurement data etc to a USB memory stick. The connector is below the display.
setup	presettings, target temperature, display configuration etc.

7.1.1 Setup

menu item	function
target value	set the setpoint temperature at a fixed value or select the temperature program.
profile input	enter a table of set temperature values. Here you can also enter the length of the humidification interval (pulse range) in minutes. The switch-on time of the pump informs you how long the pump is in operation within the humidification interval
display	online display, background lighting etc.
cooling	not available for ASR reactor
time setup	set the time
system menu	further inputs, which are locked by PIN (2603)

Target Value

The type of setpoint temperature or target value can be chosen.

menu item	function
thermocouple	(optional)
fix value	you can force a fixed temperature value.
profile	The number of the current program is shown on display. You can enter a profile in the system menu.

Profile Input

In so-called profiles, a maximum of 8 temperature programs can be stored. These can be entered directly via display or via an internet browser. All profiles are stored on the SD card.

Select the profile ((Fig. 9)). Profiles 1..8 are freely programmable.

profile	input (Fig. 9)
1..8	at the touch-screen.

Select a profile 1..8. After leaving the main menu the selected profile is activated. For changing the profil press **prof. input** (Fig. 9).

In the header of the menu the selected profile is shown. From the display (Fig. 10) profile as table time/h versus temperature is shown (Fig. 11). The graphical representation is shown in Fig. 12.

Each profile is defined by 5 lines and contains of 99 cycles. According to this the ASR reactor performs this profile with the length of 24h 99 times and fix then the target temperature to 20°C. For an endless running choose 32000 cycles (about 87 years).

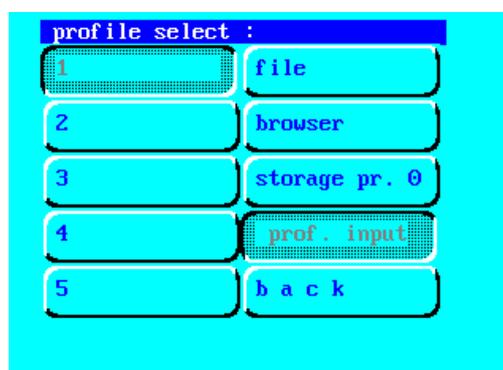


Figure 9: Profile select

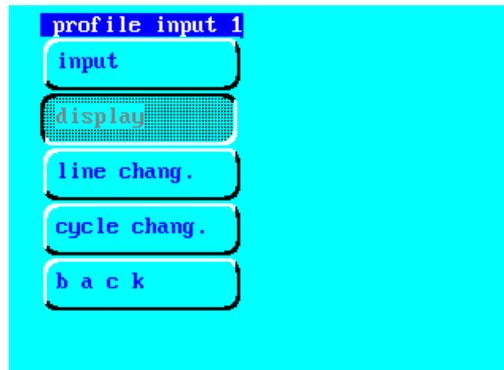


Figure 10: Profile input menu

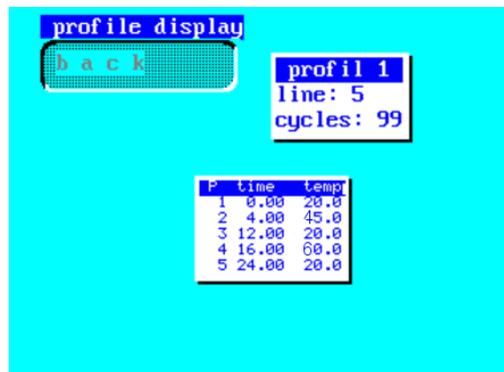


Figure 11: Profile display

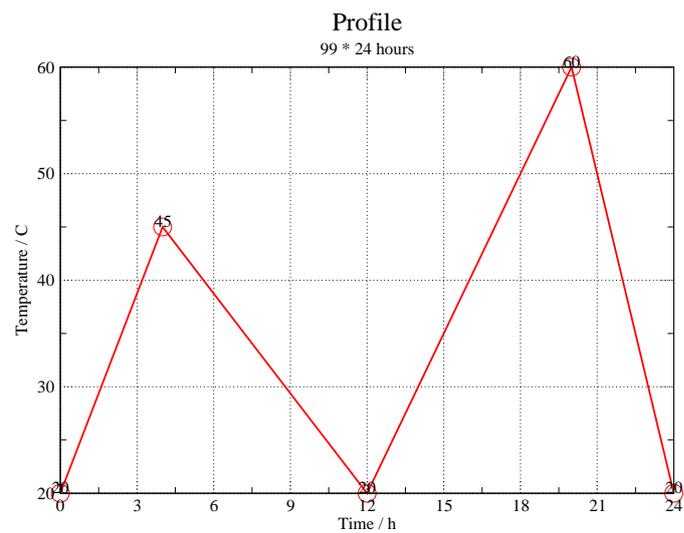


Figure 12: plotted profile

Display

menu item	function
brighter	The background lighting will become brighter
darker	or darker
graphic display	pan and zoom of the graphical display values
Online display	During the measuring the display shows either a graphic, a text or nothing

Graphic Display

During the measuring the temperature values are displayed graphically as with a strip recorder.

menu item	function	exemplary value
t-range.h	time range per graphic page in hours	24
t-grid.	time-line-grid in h	6
T-range.°C	temperature range in °C	80
T-grid °C	temperature-line-grid in °C	10
interv.	Updating rate of the display in s	60
X0	position of the graphic in pixel (x-value)	10
Y0	position of the graphic in pixel (y-value)	80
width	width of the graphic in pixel	300
height	height of the graphic in pixel	150

7.1.2 Servicemode(option)

With the AS 40/100 control the heating for room 1 or 2 can be switched off temporarily during the test run. Do this by operating the touch screen. Choose between service 1 and service 2. The service mode is signaled with an extra window and registered in the log-file.

7.1.3 System Menu

Further settings can be made in the system menu. The system menu is protected by a PIN interrogation. The code is 2603

menu item	Function
manual	operating the heating manually
controller	control parameter input
temp-preas	calibration of the temperature sensors
RAM-Reset	Resets the setup back to factory setup
DA-calib	testing of the strip recorder output
diverse	automatic restart, maximum temperature, key lock
print supervision.	(option)

The setup in the system menu should only be changed after an inquiry call with 'Schleibinger Geraete' (+49 8086 94731 10). The only values, which could possibly be changed are the values for the temperature calibration of the two PT100-sensors. With the ASR 40/100 control, the control parameter for both rooms can be adjusted separately.

Calibration of Temperature

menu item	function
air (room 2)	air sensor, calibrated ex works, sensor room 2
bath (room 1)	bath sensor or sensor room 1
thermocouple 2	option
pressure	option

standard values

menu item	function	standard values
Offs1+	offset for temperatures higher than 0°C	0
Offs1-	offset for temperatures lower than 0°C	0
v1+	slope of temperatures over 0°C	51
v1-	slope of temperatures lower 0°C	51
meas.values	displays the measured values and the raw values	

The inputs are equivalent for both temperature sensors. Usually only the offset should be adjusted.

The setup in the system menu and in the setup menu are saved on a SD card. This will be only done by changing from the setup menu to the main menu. Following message will appear: Savingconst data. The saved files can be found in the file B:\httpd\htdocs\par\pini.txt.

8 Recording the Measuring Data

The ASR-Reactor saves the target values and current values on the SD card. The date and the time of the target temperature and the current temperature, as well as the bath temperature will be recorded.

8.1 Reading the measured data

Please select the USB option in the main menu. Then connect a USB storage device (no hard drive!) to the USB port on the bottom side of the display box. Then select `data->USB`. The file `data0.txt` will be copied to the USB device. Please use the USB stick delivered with the ASR reactor.

The measured data file is a text file. Open the file with MS-Excel. Format the second column as the date: time of the value of the form 37673,632083 will be converted into the format 21.02.2003 15:10:12.

content of the columns:

seconds since 1.1.1980	cycle time in s	Excel time function.	T.target	T.bath (T.room1)	T.air (T.room2)	T.add1	T.add2
742558833	12385	37815,430	20,00	21,20	22,20	0,0	0,0

Additionally a file `FEHLER.TXT`, which is recording start and stop time as well as some service messages will be recorded. It can be copied to the USB stick with the command `info->USB` in the USB menu.

9 Network Operation

The ASR-Reactor has an integrated WEB, FTP and Telnet Server. You can connect the ASR-Reactor to your own network to monitor the measurement, to download the measured data and to display it numerically and graphically.

9.1 Configuration of the Network access

The Schleibinger data logger, the Slabtester, CDF machine and the ASR reactor are equipped with a *100 BaseT* network interface. It can be integrated within a local Intranet or globally into the Internet. The network configuration can be done with the program Chiptool which can be found on USB stick delivered with the equipment or downloaded from the page www.schleibinger.com/chiptool.

Example of Default Settings:

```
Device: Data logger for the shrinkage cone
Customer: Miximaxi AG
Serial Nr: 201312324
MAC-ID: 00:30:56:90:7D:C3
Hostname: Scone_201312324
[] Obtain an IP-Address automatically
[] Use the following IP-Adresse: IP adresse:.....
Subnet mask:.....
```

9.2 Network configuration between the data logger and PC

There are two options for the network configuration of the data logger and PC available:

- by automatically getting an IP address = default setting at time of delivery
- by using a static IP address

Automatically getting IP address

Connection of the data logger into a local network with DHCP- and DNS-Server is the simplest and fastest method.

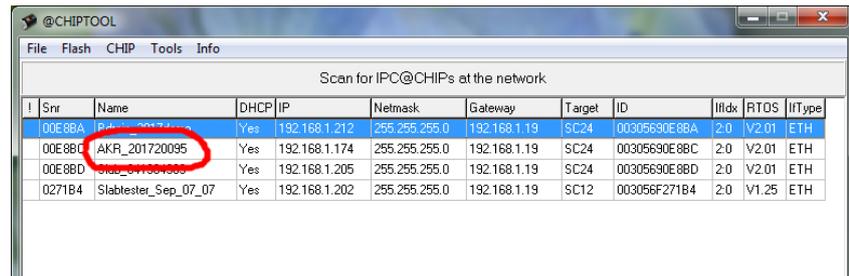
- Connect the equipment with your local network (switch) using the network cable which was delivered with the device and switch on the equipment.
- Enter the host name into the address line of your browser in a form "**http://...**". The host name can be found on the equipment, from the supplied document folder or can be read out using the program Chiptool (Fig. 13.)

A DHCP-Server assigns a free IP address to the data logger. Hint: DHCP server are scanning the network from time to time assigning a IP address and a symbolic name to all computers in the network. This procedure may take some time. So please wait some minutes until you try to access the data logger with its host name.

Alternatively, in the case the host name - DNS-server does not work or supported in your network the connection with the data

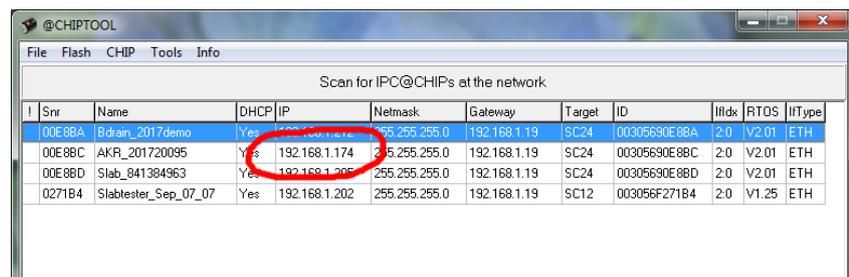
logger can be done by using of the assigned IP address. This IP address can be found from the program Chiptool, mentioned above (Fig. 14).

Make sure the data logger always getting the same IP address from the DHCP server. Enter the IP address assigned by the DHCP server into the address line of the browser instead of the host name (Fig. 15).



l	Snr	Name	DHCP	IP	Netmask	Gateway	Target	ID	lflidx	RTOS	lflType
00E8BA		Bdrain_2017demo	Yes	192.168.1.212	255.255.255.0	192.168.1.19	SC24	00305690E8BA	2.0	V2.01	ETH
00E8BC		AKR_201720095	Yes	192.168.1.174	255.255.255.0	192.168.1.19	SC24	00305690E8BC	2.0	V2.01	ETH
00E8BD		Slab_841384963	Yes	192.168.1.205	255.255.255.0	192.168.1.19	SC24	00305690E8BD	2.0	V2.01	ETH
0271B4		Slabtester_Sep_07_07	Yes	192.168.1.202	255.255.255.0	192.168.1.19	SC12	003056F271B4	2.0	V1.25	ETH

Figure 13: Reading out of the host name of the equipment.



l	Snr	Name	DHCP	IP	Netmask	Gateway	Target	ID	lflidx	RTOS	lflType
00E8BA		Bdrain_2017demo	Yes	192.168.1.212	255.255.255.0	192.168.1.19	SC24	00305690E8BA	2.0	V2.01	ETH
00E8BC		AKR_201720095	Yes	192.168.1.174	255.255.255.0	192.168.1.19	SC24	00305690E8BC	2.0	V2.01	ETH
00E8BD		Slab_841384963	Yes	192.168.1.205	255.255.255.0	192.168.1.19	SC24	00305690E8BD	2.0	V2.01	ETH
0271B4		Slabtester_Sep_07_07	Yes	192.168.1.202	255.255.255.0	192.168.1.19	SC12	003056F271B4	2.0	V1.25	ETH

Figure 14: Readout the IP address to the data logger with the program chiptool.

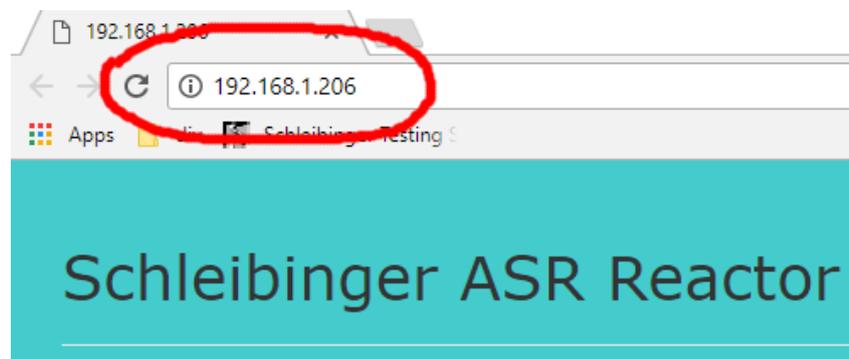


Figure 15: Accessing the data logger with a fix IP address.

using static IP address

If no network available or you are not allowed to connect a measurement device into your local network, the Schleibinger data logger can be connected directly to a PC, e.g. with an older notebook. Most of the PCs are configured in a way, that they take an IP address automatically assigned by the DHCP server. In case of a direct connection between data logger and PC, both peers are missing the DHCP server. For this chase use a static IP address.

a) set static IP address on the computer:

Open Control Panel → Network and Internet → LAN-Connection → Properties and set a static IP-address from the so called private area e.g. 192.168.1.1 and a sub net mask 255.255.255.0. Gateway doesn't has to be set. See figure 16

b) set static IP address on the data logger:

Connect the data logger and the PC with the static IP address with a cross-wired Ethernet cable (Cat5, RJ45)- not delivered with the equipment, and start the program chiptool. The program is searching for the data logger and if the PC is configured correctly and the right connection cable is used, the Schleibinger device appears in the window of the program.

Click with the right mouse button on the entry within the window and choose IP configuration. A small window appears. Enter an other static IP address from the same private area as well [Fig. 17). This IP address has to be different from one of PC e.g. 192.168.1.2 and the same sub net mask. Finally click on Config.

Enter the new IP address of the data logger in the header of the browser. The main page of the data logger should appear.

For the integration of the data logger into the network infrastructure, please, ask your network administrator.

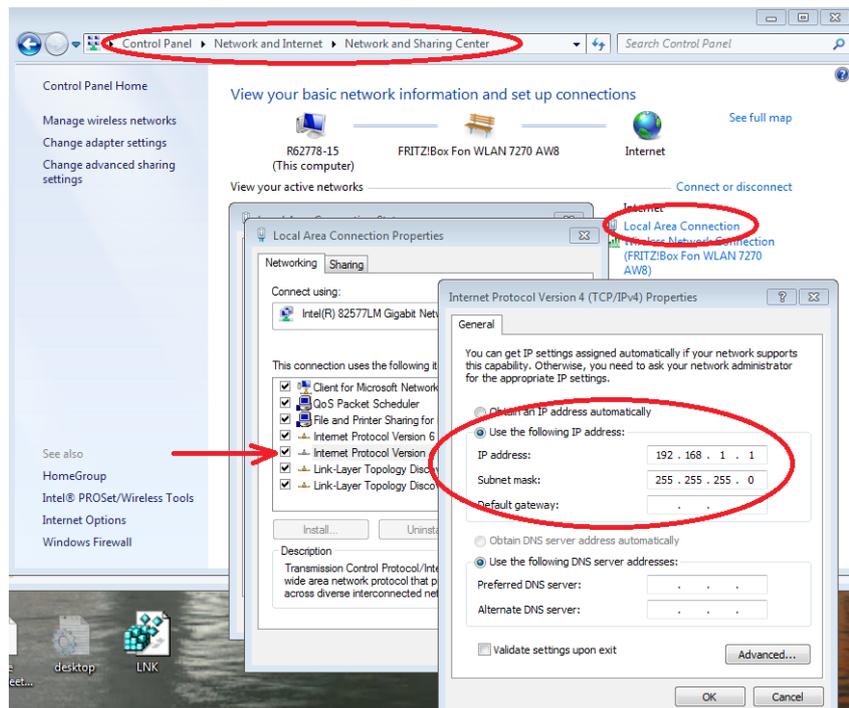


Figure 16: Configuration of PC for a direct connection with data logger.

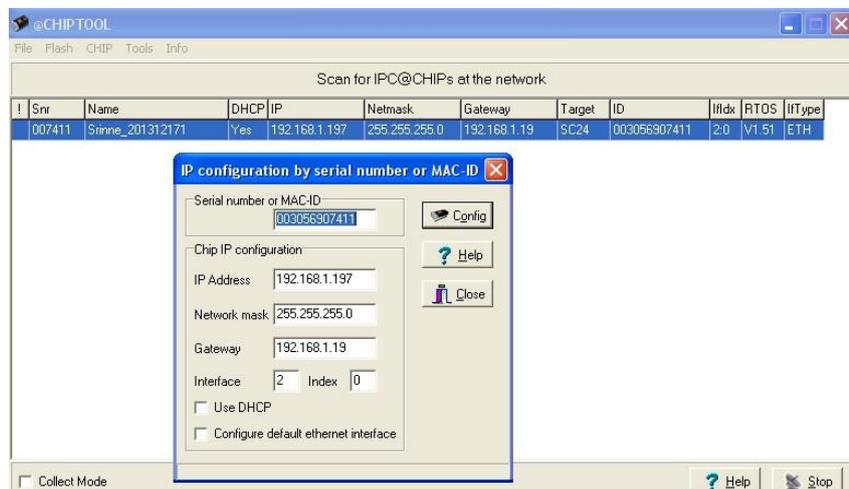


Figure 17: Configuration of the data logger for direct connection using program chiptool.

10 Software Handling

The temperature profile input, graphical display of the data and measurement data export from the ASR reactor can be also done by a Web-Browser-Software. To communicate with the reactor connect the ASR-Reactor to your network. The ASR-Reactor requires a definite IP address. Open the Internet web browser on the computer from the network. Enter the IP address into the address line (see also chapter 9).

A start screen will appear (Fig. 18).

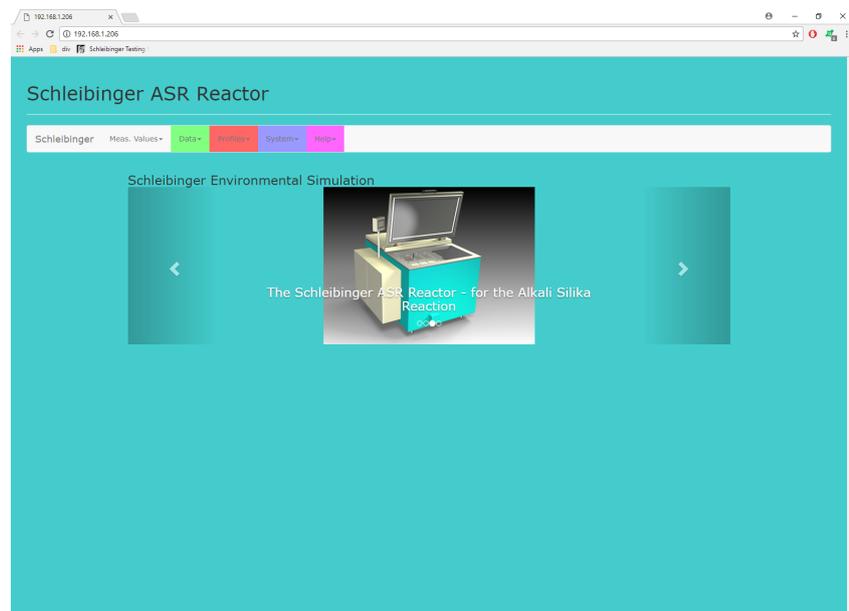


Figure 18: Start screen

In the header tabs such as **Meas.Values**, **Data**, **Profiles**, **System** and **Help** can be found.

10.1 Profile Input from web browser

The profile input can be done from the web-browser. Connect the ASR machine with the network or computer and start web browser. Get an access to the reactor and choose in the header tab **Profiles**. A maximum of 8 profiles can be defined (Fig. 19).

Two common programs are installed: **Profile 1** - the test at 60°C without add. humidification (Fig. 20) and **Profile 2** - the test at 40°C with add. humidification.

By selecting of profiles input and change of the profile can be done (Fig. 21, 22). The parameter input take place in the lines of the lower part of the window.

- Enter the name of the profile in the first line

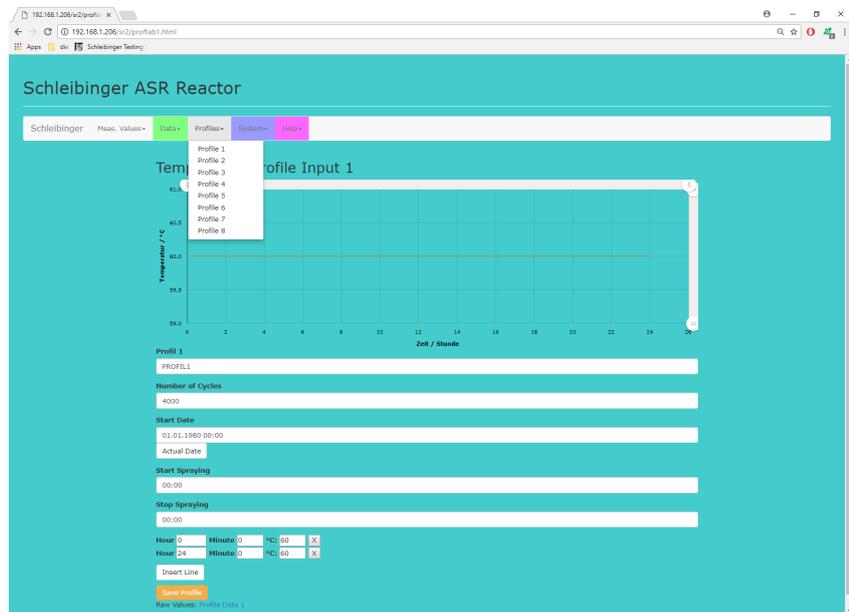


Figure 19: Temperature profiles input from the web browser

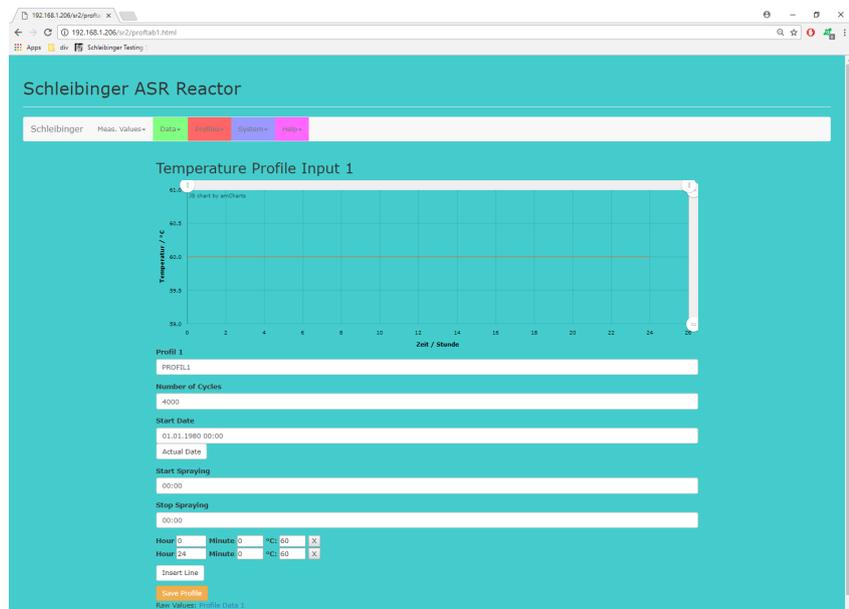


Figure 20: Temperature profile 1 - test at 60 °C.

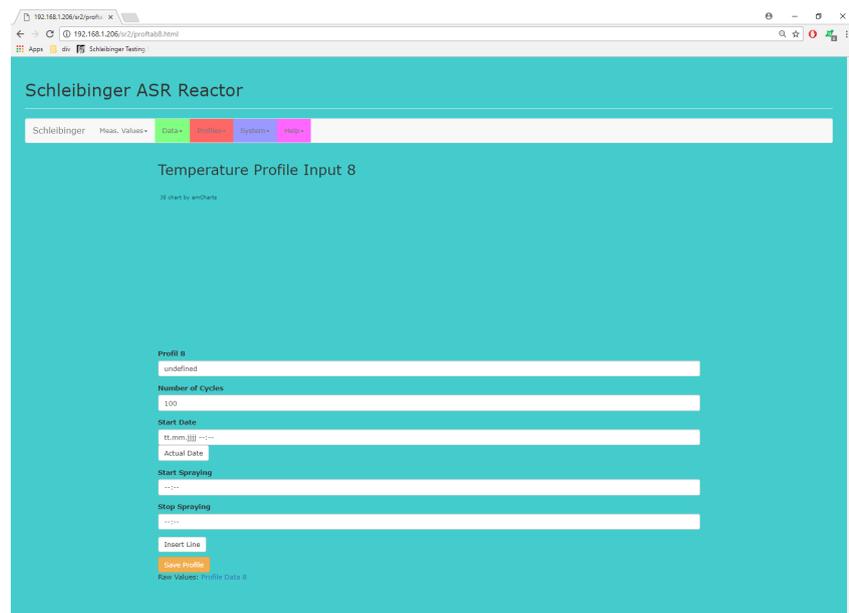


Figure 21: Temperature profile input (1)

- Enter the number of cycles in the second line named **Number of Cycles**
- Enter the date for start in the line **Start Date** or choose **Actual Date**
- For the spraying enter start and stop in the next two lines
- Insert lines for edit the temperature values by click on **Insert Line**
- Save profile if finished.

10.2 Measured Values

The measured values can be displayed in the web browser numerical and graphical. Select **Meas. Values** and click on **Numerical** (Fig. 23). Select **Start** to display the current measurement values. The values will be automatically updated. To stop the update choose **Stop**.

Select **Meas. Values** and choose **Graphical** to display graphic (Fig. 24).

10.3 Data

The measured data can be shown from the tab **Data**. Select **Measurement Data** and click on **Load** to display all the measured data (Fig. 25).

For deleting the measurement data select **Measurement Erase** and click on **Erase** (Fig. 26).

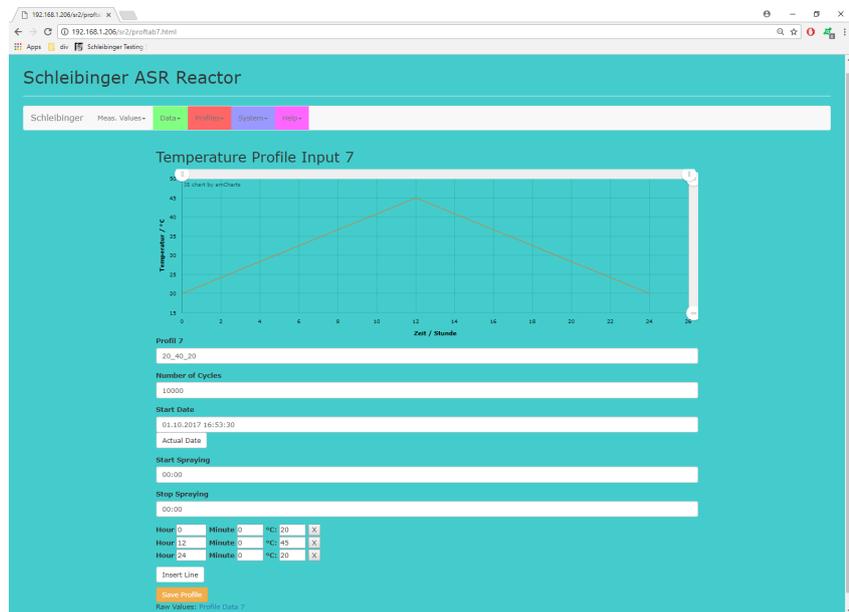


Figure 22: Temperature profile input (2)

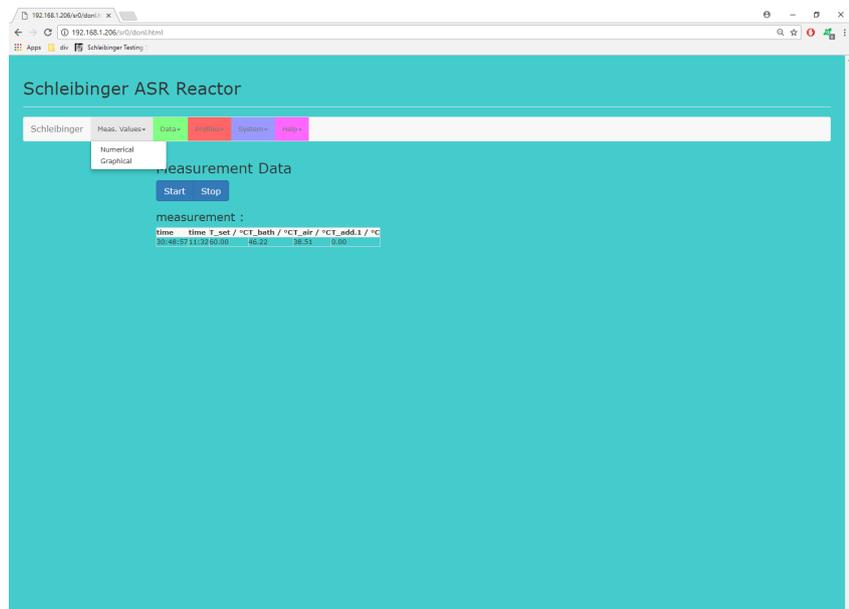


Figure 23: Measured values numerical display

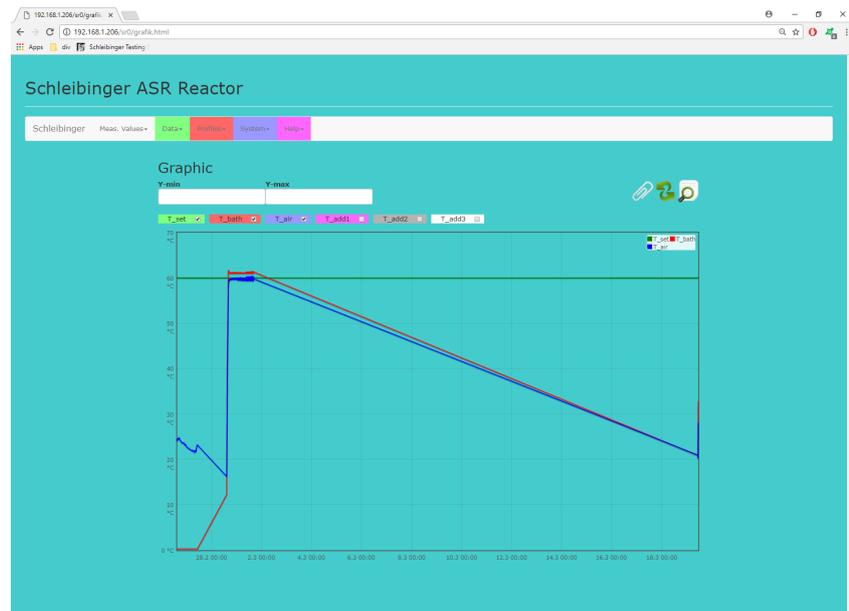


Figure 24: Measured values graphical display

The data logfile with the error codes can be shown from the tap **Data**. Select the tab **Data** and choose **Data Logfile**. Click on **Load** for loading the informations, select **Clear Screen** to remove the data from the screen and **Save Link As ..** for saving the information (Fig. 27).

10.4 System

The system setup can be shown from the **System**. Select the tab **System** and click on **Show Setup**. Click on the tab **Load** for loading the setup information, on the tab **Clear Screen** for removing the data from the screen and on the tab **Save Link As..** for saving of the setup parameters (Fig. 28).

10.5 Help

For help please select **Help** and **Open PDF Help File** to open the user manual (Fig. 29) or contact Schleibinger Geräte GmbH via mail or telefon.

11 Control Parameter

For the controller there are two setup sections, the system parameter and the bath-parameter. With the ASR 40/100 control the parameters can be input separately for both rooms.

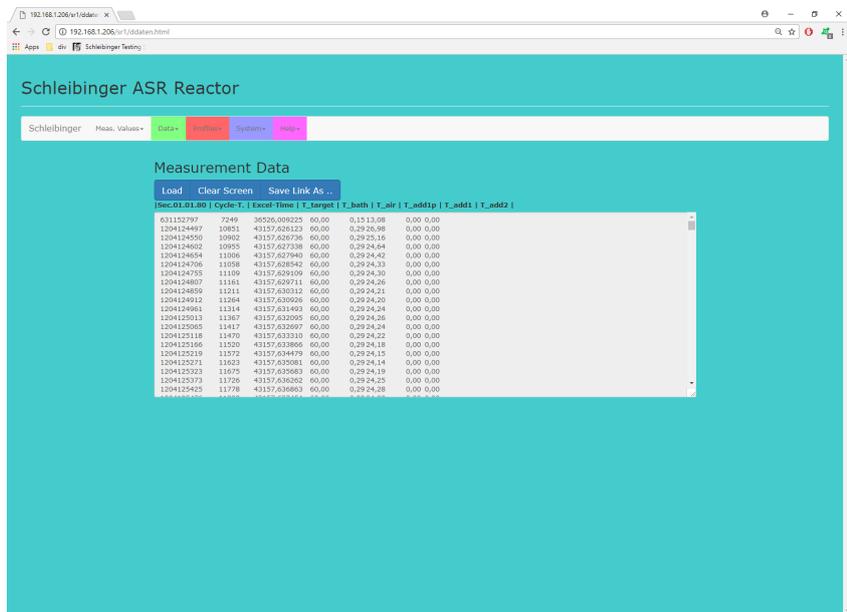


Figure 25: Measurement data

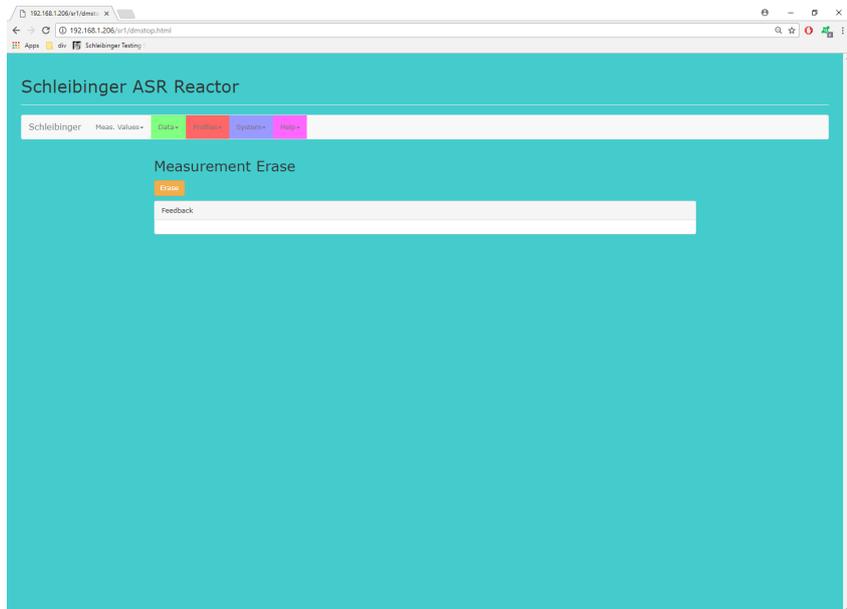


Figure 26: Delete measurement

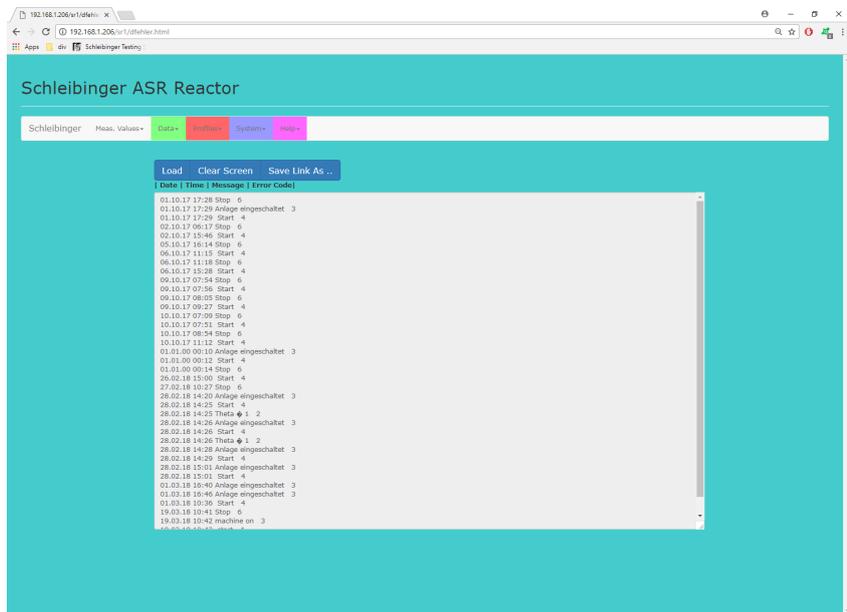


Figure 27: Data logfile

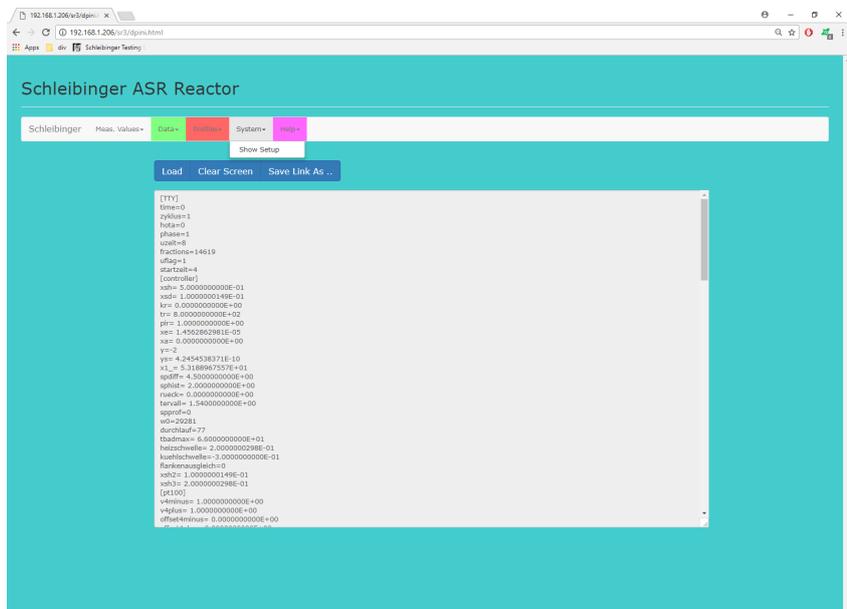


Figure 28: System setup

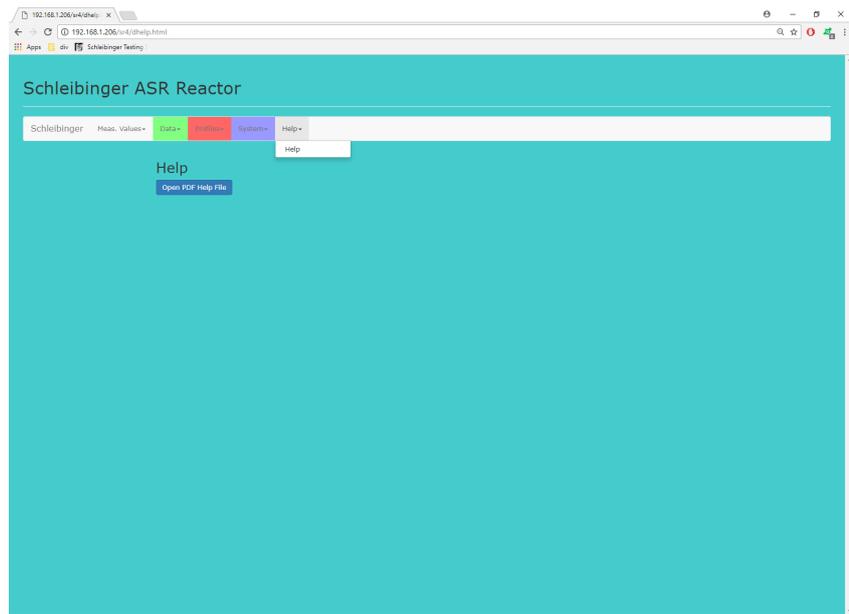


Figure 29: User manual

11.1 System Parameter

dead time	240	dead time	water	400	water amount
kohne	-0.04	cooling if not heating	Hz	0.40	measure for the temperature rise of the heating
K.H2O	-0.0133		beobkorr	0.13	influence of the control path on the observer
K_aggr	-0.02	set like kohne, because no active cooling exists			

11.2 bath parameter

x_Sh	0.02	width of hystereses, cooling, not active, heating	ts	1.0	sampling rate, appraised automatically
x_Sh2	0.1	not used	pi/p	600	if the lid is opened the heating will be deactivated in x seconds
x_sdp	0.2	not used	heizs	0.05	only used with a profile to prevent contra-heating when cooling
x_sd	0.05	hysteresis for the heating	kuehls	-0.5	if the temperature at the air cooler falls faster than x K/min, the lid is open
kr	0.0	(not used)	fls	0	if it is > 0 , then - dependent from the gradient- the target value moves by the value of the hystereses
tr	800	not used			

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References

- [1] Dr.-Ing. T. Reschke, Bundesanstalt fuer Wasserbau und Feuchtetag '99 Umwelt Messverfahren · Anwendungen 7./8. Oktober 1999, BAM, Berlin Kurzfassung · DGZfP-Berichtsband BB 69-CD Poster 3 Bedeutung der relativen Feuchtigkeit fur die Alkali-Kieselsaure- Reaktion (AKR) an einem chemischen Modell fuer diese Reaktion W. Wieker, C. Hilbert, R. Ebert, D. Heidemann, WITEGA Angewandte Werkstoff- Forschung g.GmbH, Berlin-Adlershof