



FRIDURIT fume scrubbers C75 and C180

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Our product specifications are based on extensive technical development and the results from stringent tests. We have many years' experience in different application areas which provides additional safety with regard to the durability of FRIDURIT environmental equipment. However, it is the responsibility of the user to check our specifications and recommendations and conduct his own tests to confirm that they are suitable for his intended purpose.

The statutory warranty provisions apply. We also refer to our General Terms and Conditions of Supply and Payment.

We reserve the right to make technical changes.

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1 PREFACE

When you use a FRIDURIT fume scrubber, you are actively contributing towards corporate environmental protection. Cleaning waste air contaminated with chemicals preserves both your laboratory and building structure. The device achieves highest absorption efficiencies with minimum noise levels and very economical operation.

The FRIDURIT fume scrubber allows for compliance with the following legal requirements:

- Observance of emission limit values for vaporous and gaseous inorganic compounds (Regulation by TA Luft, German Technical Instructions on Air Quality)
- Minimisation of harmful effects on the environment in accordance with German BImSchG (Federal Immission Control Act)
- Exhaust air cleaning directly at the fume cupboard (in accordance with EN 14175 part 7)
- Minimisation of emissions from laboratory fume cupboards (see DGUV German Social Accident Insurance, Information 213-850 "Working Safely In Laboratories")
- Preventing the formation of toxic gases in the event of fire

The FRIDURIT fume scrubber is characterised by sophisticated technology, high-quality components from leading manufacturers and a simple and reliable design allowing easy maintenance. It is constructed in accordance with DVGW guidelines (German Technical and Scientific Association for Gas and Water) making it suitable for connection to the service water system. Certificates of inspection in accordance with TÜV (Technical Inspection Association) are available for absorption efficiencies.

2 HOW TO USE THIS INSTRUCTION MANUAL

2.1 About this instruction manual

This manual contains instructions for both operation and assembly. The operating instructions have been listed first, as they are likely to be used more frequently. As a user of the FRIDURIT fume scrubber be sure to

- read the instruction manual carefully before use
- keep the instruction manual throughout the entire service life of the device
- make it available to personnel at all times.

If you have any further questions, contact the staff at FRIDURIT technical department environmental equipment. See the front page for contact details.

2.2 Symbols and markings


The instructions are divided into four different text elements: pure information text, procedural instructions, indications and safety instructions. Each text element can be identified as follows:

Information text: running text without markup



Indications: blue information symbol and text description

Safety instructions: yellow danger symbol with text description highlighted in grey

Symbol	Signal word	Meaning
	Warning!	Indicates a potentially hazardous situation caused by electrical voltage. There could be considerable damage to health or material if this warning is ignored.




Symbol	Signal word	Meaning
	Warning!	Indicates a potentially hazardous situation caused by aggressive chemicals. There could be considerable damage to health or material if this warning is ignored.
	Caution!	Indicates a potentially hazardous situation. This could result in minor injuries and material damage if this situation is not avoided.
	Attention!	Indicates a potentially harmful situation. The device or objects in the vicinity could be damaged if this is not avoided.

Table 1

3 INTENDED USE

If combined with a fume cupboard, the FRIDURIT fume scrubber absorbs the aggressive and toxic gases extracted in a chemical laboratory and similar environments thus contributing to maintaining clean air and preserving the building structure. The FRIDURIT fume scrubber is available in four variants:

Fume scrubbers type C54 and C90 were developed for mounting in the laboratory fume cupboard.

Fume scrubbers types C75 and C180 are intended as free-standing units for installation next to the laboratory fume cupboard. They can, however, also be installed in other workplaces where pollutants are emitted.

This instruction manual relates to built-in types C75 and C180.

3.1 Operating data / Limit values

Limit values:

Gas temperatures at scrubber inlet: +10°C to +40°C

Ambient temperature: +10°C to +35°C

Absorbable gases:

The FRIDURIT fume scrubber absorbs aggressive and toxic gases produced from substances commonly used in chemical laboratories, in particular hydrochloric acid, sulphuric acid, nitric acid, perchloric acid, hydrofluoric acid and mixtures thereof as well as water-soluble or mixable hydrocarbons such as acetone.

Mass flows up to 500 grams per hour allow absorption efficiencies exceeding 90%, depending on the pollutant. Higher concentrations can reduce absorption efficiencies.

Improper use:

The following is considered improper use of the device:

- Gases at high or low temperatures which are not permitted
- Gases containing hazardous concentrations of substances that could attack or destroy the construction or materials of the fume scrubber
- Sticky or fibrous components in the waste air
- Elements that are particularly dusty or contain solid particles in the waste air

Contact the staff at FRIDURIT technical department environmental equipment to discuss your specific requirements. See the front page for contact details.

3.2 Relevant documentation

- Technical description of the FRIDURIT fume scrubber
- Circuit diagrams of the FRIDURIT fume scrubber
- Technical data and pressure loss diagram
- Spare parts list
- Service information

3.3 Maintenance instructions

Please note the instructions given in the following section of this manual when carrying out servicing and maintenance work on the FRIDURIT fume scrubber.

4 GENERAL SAFETY INSTRUCTIONS

This section specifies the general safety instructions. Please read them carefully. They are intended to prevent injury and material damage. You will also find these and more safety instructions at the respective positions in the text.

4.1 Product safety

The certified quality management system (ISO 9001:2008) of FRIDURIT Laboratory Technology guarantees high quality standards of the products manufactured. Prior to dispatch each device is subjected to a final inspection.

The FRIDURIT fume scrubber must be operated only when in perfect functional condition and in accordance with its intended use; being aware of risks and hazards and in compliance with the instruction manual.

Immediately correct any failures that could affect safety. Use only original FRIDURIT Laboratory Technology spare parts for repairs.

Consider the applicable national, regional and corporate regulations particularly with regard to explosion protection, safety and accident prevention.

4.2 Use



Warning!

Corrosive aerosols! Risk of chemical burns from acid fog leakage! Do not take the cover off the device during operation!

4.3 Assembly and installation



Attention!

Make sure that the assembly and any other work on the FRIDURIT fume scrubber are carried out by specialised personnel only. Comply with this instruction manual and the standards applicable at all times.



Warning! Electrical voltage!

Risk of electric shock due to improper connection!

The electrical connection of the FRIDURIT fume scrubber must only be carried out by a qualified electrician. Consider and comply with the standards applicable at all times.



Warning! Corrosive chemicals!

Risk of chemical burns and material damage due to leaking scrubbing liquid!

Do not reduce the cross-section of the drain and overflow pipes and do not fit with a shut-off device (e.g. a ball valve)! Do not damage seal rings during assembly!



Warning! Corrosive chemicals!

Risk of chemical burns from acid fog leaking from the fume cupboard when exceeding the maximum fan air-flow capacity!

Ensure correct fan dimensioning!

4.4 Maintenance



Warning! Electrical voltage!

Risk of electric shock and material damage when working on the electrical parts of the fume scrubber!

First set the main switch to position "0" or disconnect from the main power supply!



Warning! Corrosive chemicals!



Risk of chemical burns from accidents with chemicals!

Wear protective goggles, gloves and clothing when carrying out any work (especially cleaning) on the FRIDURIT fume scrubber! Consider local safety guidelines! Avoid skin contact with the scrubbing liquid!

5 TECHNICAL SPECIFICATIONS

5.1 System properties

Materials:

All construction parts of the FRIDURIT fume scrubber in contact with media are made of chemically stable plastics. The fume scrubber's housing and parts of the spray wheel in contact with media are made of polypropylene (PP). Other construction materials are acrylic glass (PMMA), fluoropolymer (FPM) and ethylene / propylene rubber (EPDM).

Control system:

The control and monitoring elements necessary for use are accommodated in a compact plastic switch box that has been fully integrated in the fume scrubber housing. The use of a modern, electronic control systems

guarantees safe operation of the FRIDURIT fume scrubber. Numerous interfaces allow the control system to be linked simply and flexibly to other components and customer equipment.

Corrosion protection:

The FRIDURIT fume scrubber can be used to prevent corrosion damage to exhaust air pipes, fire protection and control flaps, silencers as well as the roofing and other parts of a building. It contributes considerably to enhancing the service life of parts.

Fire behaviour:

When the spray wheel rotates, the FRIDURIT fume scrubber virtually acts as a flame arrester. Polypropylene is the material that is mainly used. It does not release toxic gases in case of fire.

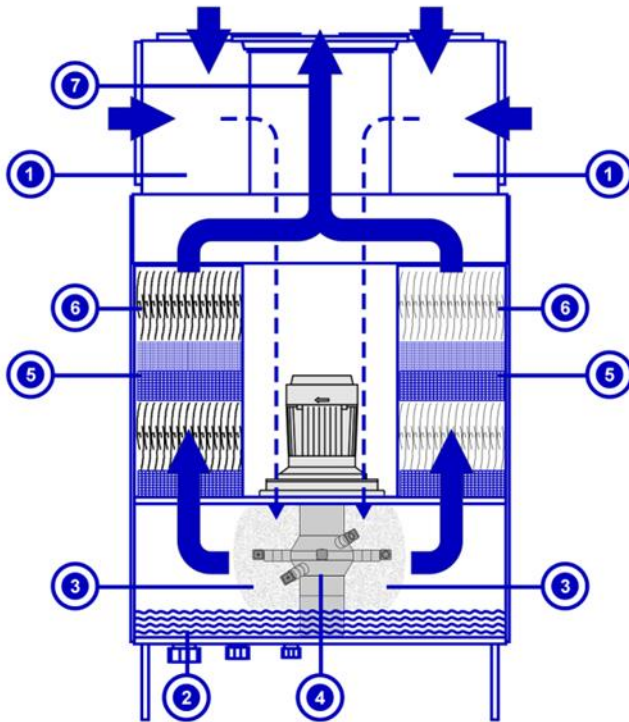
5.2 Scope of supply

The FRIDURIT fume scrubber comprising an integrated control system is supplied complete and ready for use. The scope of supply comprises:

- FRIDURIT fume scrubbers C75 and C180 with integrated spray wheel and built-in, pre-installed separators ready for use.
- FRIDURIT switch box comprising the electronic control system and a pre-assembled supply cable (partly pre-assembled with plug-in connector).
- Accessories included (mating connector for plug-in connector, fixing devices).
- Technical documentation comprising instruction and assembly manual, fume scrubber and accessories, circuit diagrams etc.

6 DESCRIPTION OF EQUIPMENT

6.1 Operation of the equipment



Equipment components:

- ❶ Noxious gas tubes
- ❷ Scrubbing liquid reservoir
- ❸ Absorption chamber
- ❹ Spray wheel with Spray nozzles
- ❺ Agglomerators
- ❻ Droplet separators
- ❼ Clean air tube

Airstreams in the device are illustrated with arrows.

Figure 1: Description of operation

Negative pressure generated by the fan absorbs the noxious gases produced during the process via two noxious gas sockets ❶ and releases them into the absorption chamber ❸ of the FRIDURIT fume scrubber. The patented spray wheel ❹, which has been developed especially for this purpose, performs two functions at the same time:

It absorbs the scrubbing liquid from the reservoir tank ❷.

Spray nozzles ❹ nebulise the scrubbing liquid distributing it evenly into the absorption chamber (**Fehler! Verweisquelle konnte nicht gefunden werden.**).

This ensures that the noxious gases are optimally mixed with the scrubbing liquid leading to a highly effective degree of absorption. The intense swirling and mixing of waste air, noxious gases and liquid fog allows absorption efficiencies in excess of 90% for acids most commonly used in laboratories.

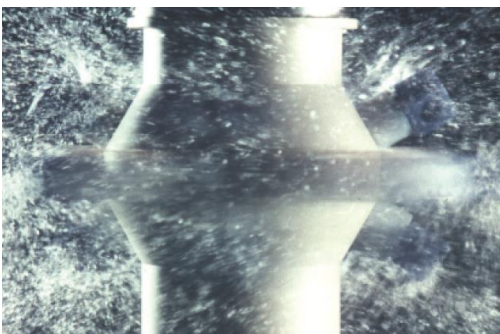


Figure 2: The atomised spray system

Separators i.e. agglomerators ⑤ and droplet separators ⑥ separate the atomised spray from the waste air. The scrubbed waste air is dried at the separators before leaving the fume scrubber through a clean air socket ⑦.

The fine droplets of scrubbing liquid spray enriched with chemicals condense on the plastic netting of the agglomerators becoming larger drops of water that are fed back through the droplet separators into the scrubbing liquid reservoir.

Two level switches regulate the level of scrubbing liquid. Reaching a preset filling level, the controlled solenoid valve stops the water supply automatically. In order to prevent unlimited overfill in the event of a fault in the operation of the level switches or the solenoid valve, the water supply automatically cuts off after a preset period of time. The scrubbing liquid is changed automatically after the preset conductance (lower limit value) has been reached. The FRIDURIT fume scrubber remains fully effective when the scrubbing liquid is being changed.

A fan is required for operation. It is not integrated in the scrubber, and must be installed by the customer on the clean air side of the building wall.

6.2 Electronic control system

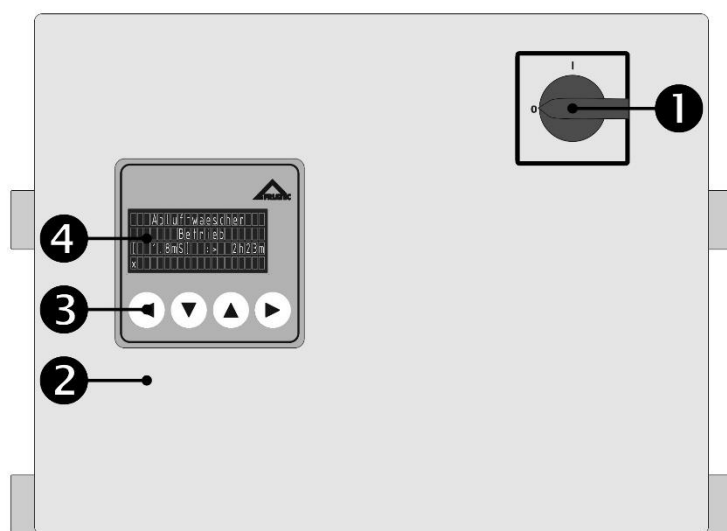


Figure 3: Switch box

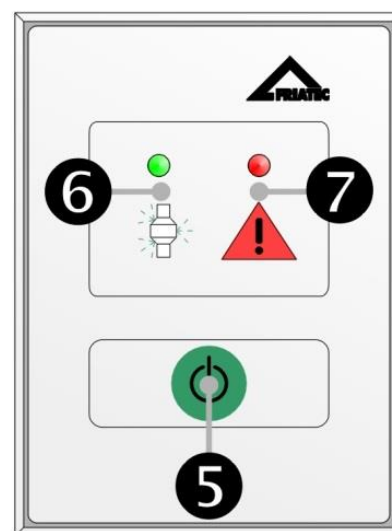


Figure 4: Operating module

The main switch (1) is used to turn the entire control system on or off.

The integrated transmitter (2) shows the current measured value of the scrubbing liquid and monitors the preset limit values via the electronic control system inside the switch box. The face membrane keyboard (3) is required for service functions, such as setting of limit values. The alphanumeric text display (4) shows measured values, unit status and failure modes.

The operating module button (5) allows the user to switch off the fume scrubber when requested by ventilation. This function may be deactivated due to requirements from the laboratory operators. The operating light (6) and fault light (7) on the operating module allow the unit status to be monitored. In the event of a failure, the cause is shown in the bottom line of the text display. Please refer to the error table in Chapter 7.6 to identify faults and the measures to be taken to correct them.

7 USE (OPERATING INSTRUCTIONS)

7.1 Before starting

Before first putting into service, please observe the following requirements and indications. See also Chapter 9.3 *Sanitary connections* and Chapter 10 *Putting into service*):



Attention! Risk of damage to equipment due to improper installation!

Ventilation, electrical and sanitary connections may only be carried out by qualified personnel.



Attention! Risk of damage to equipment due to improper putting into service!

First putting into service should be carried out by a qualified technician from FRIDURIT service organisation. See the front page for more information.



Attention! Risk of scaling!

Water quality should have a maximum total hardness of 10°dH (German degree of hardness) i.e. 12.522°eH (English degree of hardness/UK) or 10.426 gr/gal (US). If this value is exceeded, we recommend feeding the fume scrubber with purified water such as deionised water!

7.2 Use

When operating the FRIDURIT fume scrubber, the following procedure is recommended:

1. Switch on the control system of the FRIDURIT fume scrubber by turning the main switch to position “1”. Make sure that the main switch is always in position “1” and only set to position “0”, i.e. switch off, when carrying out work on the electrical control system.
2. Generally, the fume scrubber and ventilation system switch on automatically. The scrubbing liquid is changed automatically after a preset time. If conductivity measuring is installed, this can start the liquid change before the set time.
3. Open the stop valve of the fume scrubber to ensure water supply.

7.3 Setting setpoints

Use the keypad on the front of the control system to set setpoints. Optional settings depend on additional components. Basically, the devices are factory set and not all settings are displayed.

No.	Setting	Function	Range
1	Limit value of conductance in the scrubbing liquid (OPTION)	As a function of conductance, part of the scrubbing liquid is drained off and replaced by fresh water reducing the concentration of pollutants in the liquid. Note: if you do not use any conductivity probe, do not set the time value for the scrubbing liquid change to 0.	Min: 1.0 mS Max: 50.0 mS Step: 1.0 mS Preset: 2.,0 mS
2	Time value for scrubbing liquid change	As a function of operating time, part of the scrubbing liquid is drained off and replaced by fresh water reducing the concentration of pollutants in the liquid. Note: setting 0 h deactivates the time-controlled scrubbing liquid change.	Min: 0 h Max: 999 h Step: 1 h Preset: 16 h
3	Monitoring the neutralisation unit (OPTION)	The scrubbing liquid change is blocked, if the optional neutralisation unit is not ready to be filled. If the monitoring time is exceeded, this could result in a failure caused by the neutralisation unit. Note: for further information about possible causes of failure, please see the neutralisation unit documentation.	Min: 60 min Max: 1440 min Step: 60 min Preset: 600 min

No.	Setting	Function	Range
4	Reminder for scheduled maintenance	In the long run, regular cleaning and maintenance is required for reliable functionality of all units, even if they are not used very often. The maintenance indicator reminds the user to have the required work carried out.	Min: 60 days Max: 720 days Step: 30 days Preset: 360 days
5	Time to activate the pump for chemical dosing (OPTION)	The scrubbing liquid can be mixed with chemicals to improve absorption or reduce mineral deposits. The time to activate the dosing pump can be variably set. Note: setting 0 sec deactivates the time-controlled scrubbing liquid change.	Min: 0 sec Max: 600 sec Step: 1 sec Preset: 0 sec (deactivated)
6	Lower pH value used for dosing (OPTION)	An optional pH value measurement starts the scrubbing liquid change after the neutral value has been reached. This value marks the lower pH limit value. Note: the lower pH value must be below the upper limit value.	Min: pH 0.0 Max: pH 14.0 Step: pH 0.5 Preset: pH 6.0

7.4 Settings with optional serial interface (option)

The settings described above can be changed using a serial interface. You can use commercial devices that support the MODBUS RTU Master Protocol. The table in Chapter 11.2 describes the registers used for data import and export.

7.5 Changing the scrubbing liquid

Automatic change

Appropriate device settings allow the scrubbing liquid to be changed automatically. This requires an effective downstream neutralisation unit that is usually monitored by the fume scrubber control system. The scrubbing liquid change function will not start if there is any failure.

By law the scrubbing liquid must be discharged into a neutralisation unit, as the liquid can have an acid content of up to 2%.

The automatic scrubbing liquid change of FRIDURIT fume scrubbers starts in accordance with the limit value set in the device control system.

Manual change (manual operation)



Caution! Corrosive chemicals!

Risk of chemical burns and material damage due to leaking scrubbing liquid!

Check that the neutralisation unit is fully effective before manually starting the scrubbing liquid change!

Only service personnel may carry out manual complete emptying for maintenance and repair purposes.

Please note that when changing the scrubbing liquid manually using the keypad, the downstream unit will not be monitored by the fume scrubber control unit. Check that the neutralisation unit is fully functional before starting to change the scrubbing liquid and prevent possible leakage of scrubbing liquid.

7.6 Troubleshooting

If the FRIDURIT fume scrubber does not function as described in the manual, please check common fault sources and remedies in this overview of faults and errors.

If necessary, please contact FRIDURIT service. Please see front page for contact details.

Failure	Cause	Remedy
The device does not switch on.	The mains plug is not connected to the power supply.	Connect the mains plug to the mains supply by plugging it into the mating connector.
	Control system switches are not in the correct position.	Turn the main switch to position "1" (Attention! Scrubber may start immediately)
	The supply cable to the fume cupboard is not energised. Have it checked by an electrician.	Switch on the operating voltage.
	Ventilation is not enabled.	Check ventilation interface.
No scrubbing liquid is fed.	The feed ball valve on the left-hand side of the fume scrubber is closed.	Open the feed ball valve slowly.
	The connection plug is not screwed onto the solenoid valve correctly.	Screw the connection plug on tightly.
	No water feed after successful recovery of fault sources 1 and 2.	Contact FRIDURIT service.
The red fault light on the FRIDURIT operating module flashes.	The text display shows the cause of the failure. The causes can be:	
	"motor protection on"	Contact FRIDURIT service.
	"filltime exceeded >>"	Check the tightness of the feed connector. See above for other tests.
	„neutra interlock >>"	Check the neutralisation unit.
	"elec. phase failure"	Check the power supply and see if a phase has failed or if the phase sequence is wrong.
The green operating light on the operating module flashes.	The text display indicates the message. The messages can be:	
	„drain time limit“	It has taken too long to empty the scrubber. If this message occurs several times, the device should be inspected by service staff.
	„refill chemicals“	The dosing unit is fitted with an optional chemical tank. Refill it.
	"maintenance necess."	The preset time interval for maintenance has been reached. Contact FRIDURIT service to carry out maintenance work.

8 MAINTENANCE AND SERVICING

8.1 Maintenance

The FRIDURIT fume scrubber requires very little maintenance due to its design and high-quality components. If devices are not used very often, maintenance must be carried out at least every 12 months, as damage can occur due to material fatigue.

Servicing operations may only be carried out by specialised personnel i.e. members of FRIDURIT service organisation. See the front page for further information. Further regular inspections of the device can be carried out by the operator.

Please comply with the safety instructions. KYOCERA Fineceramics Solutions GmbH does not assume any liability or warranty for damage or consequential damage arising from non-compliance with these instructions!



Warning! Electrical voltage!

Risk of electric shock and material damage when working on the electrical parts of the fume scrubber!

Turn the main switch to position “0” to disconnect the control system from the main power supply!



Warning! Corrosive chemicals!



Risk of chemical burns from accidents with chemicals!

Wear protective goggles, gloves and clothing when carrying out any work (especially cleaning) on the FRIDURIT fume scrubber! Consider local safety guidelines! Avoid skin contact with the scrubbing liquid!



Attention! Risk of water damage caused by leakage!

Check the feed hose regularly for brittleness caused by ageing and replace it in good time (see Chapter 9.3).

8.2 Maintenance plan

The maintenance and inspection plan gives an overview of maintenance and inspection operations that should be carried out regularly. You can find the spare parts list in the Appendix.

Maintenance and inspection work	Performed by	Maintenance interval*
Visual check for leaks in the valves, housing and connection hoses.	Operator	Monthly
Check that plug-in connections on the fume scrubber and the valves are seated firmly.	Operator	Annually
Check the functionality of conductance measuring and cleaning. Calibrate if necessary.	Operator	Annually
Make a visual check of the absorption chamber for deposits (sludge) on the floor.	Operator	Annually
If deposits are found, drain off scrubbing liquid as fully as possible and thoroughly hose out the interior.	FRIDURIT service personnel	If required
Clean the feed strainer located in front of the solenoid feed valve (see Figure 6).	Operator	If required

Maintenance and inspection work	Performed by	Maintenance interval*
Complete inspection of the unit i.e. cleaning the interior, absorption systems and spray wheel. Check the entire control system.	FRIDURIT service personnel	Annually*

*) Intensively used units (e.g. 24-hour operation) require shorter maintenance intervals. Reduce the maintenance intervals if the unit is exposed to severe chemical contamination by concentrated acids and alkalis or if extremely dirty.

8.3 Cleaning

The interior, spray wheel and absorption systems will be cleaned when the FRIDURIT service personnel carries out servicing operations (see *Maintenance and inspection plan*).



Attention! The surface of the equipment is scratch-sensitive!

The housing can be scratched if aggressive and abrasive detergents are used! Use only mild detergents when cleaning the housing.

9 ASSEMBLY AND INSTALLATION (ASSEMBLY INSTRUCTIONS)

9.1 Before mounting

Quality control

Each FRIDURIT fume scrubber leaves the factory in perfect condition and has been subjected to strict quality control. Make sure that the device you have received is complete and undamaged and make a

visual inspection of the packaging for signs of external damage

visual inspection of the equipment for external defects after unpacking

Checking delivery

Should any defects be found, please submit a written complaint within five working days after delivery, stating the order number and reason for the complaint. Send it to FRIDURIT technical department environmental equipment. See the front page for contact details. Our service personnel will either repair the equipment on your premises or, if necessary, replace it.

Unpacking

When transporting and unpacking the equipment, please consider the following safety instructions and precautions to prevent damage to the device and injury to personnel.



Caution during transport! The equipment is heavy!

Risk of injury and damage to the equipment!

Secure the equipment during transport against collisions to prevent it from falling!



Caution when loosening the transport straps! The straps have sharp edges!

Risk of hand and eye injuries when loosening the transport straps!

Please wear protective gloves and goggles!





Attention! The surface of the equipment is sensitive!

The housing can suffer damage if sharp or pointed objects are used!

Please remove the packing carefully!

Environmental protection and packing

- FRIDURIT laboratory equipment has been used to protect the environment and building structure for many years. The packing required for safe transport has been reduced to a minimum contributing towards environmental protection. Please consider these recommendations when disposing of packing materials:
- Please take the packaging cardboard to your local recycling facility.
- The packing foil consists of polyethylene (PE). Please have it also recycled.
- The transport straps are plastic reinforced with fibre-glass to ensure the required stability. They must be disposed of as residual waste.
- Municipal waste disposal companies will dispose of the wooden pallets. Please contact your municipal or local authority.

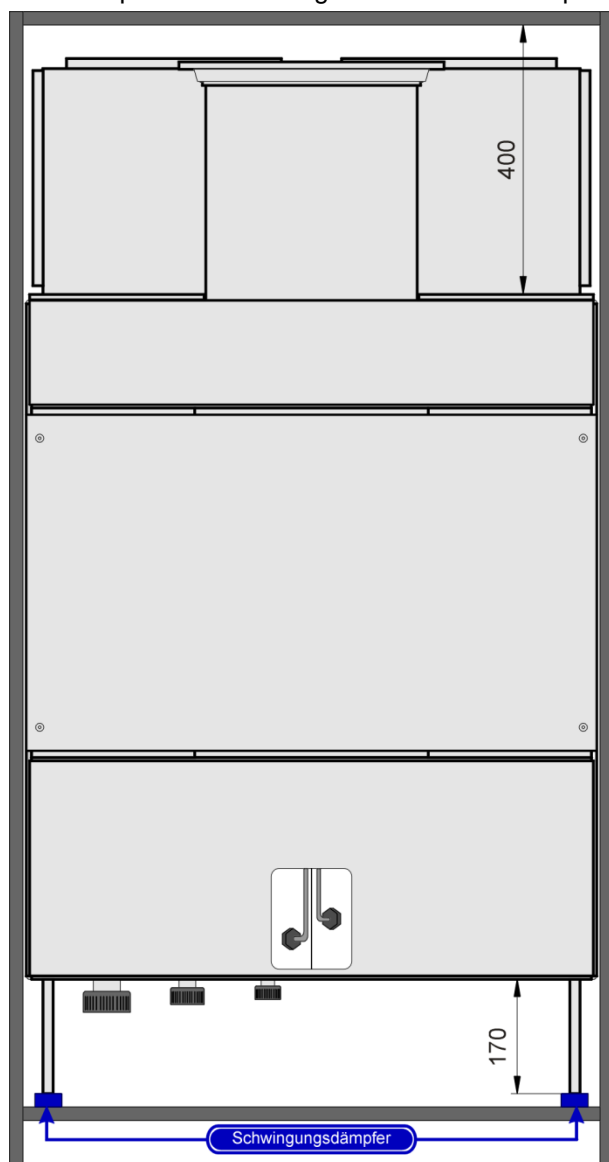
9.2 Mounting

FRIDURIT fume scrubbers are kept as compact as possible for mounting in fume cupboards. Types C54 and C90 are usually installed directly into the cupboard ceiling, types C75 and C180 next to the fume cupboard. They can be easily incorporated into existing units.

This manual refers to stand by types C75 and C180. Please note the following to ensure fault-free operation of these scrubber types:

- The base for the FRIDURIT fume scrubber must allow level installation of the equipment.
- When designing the base and fixtures, the filled weight of the fume scrubber must be taken into account (see Technical data in the Technical description).
- For better vibration decoupling, the device should be fitted with vibration dampers at appropriate points. (see Figure 5).

Provide space for servicing and maintenance operations:

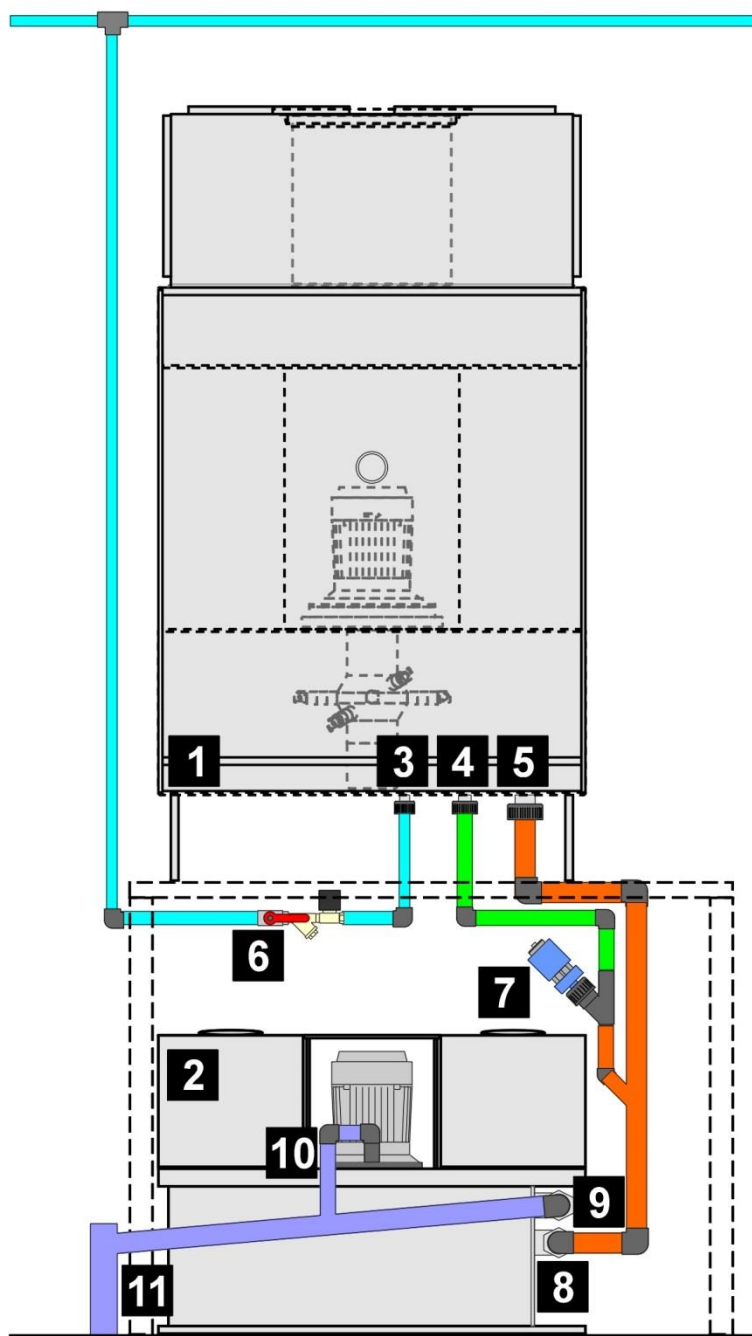


- 400 mm above the inspection openings.
- Ladder width (at least 600 mm) in front of the installation space for maintenance.

Figure 5: Mounting

9.3 Sanitary connections

Inlet



- 1 Housing fume scrubber (seen from behind)
- 2 Housing neutralization system (option)
- 3 Inlet connection d15 with union nut 1 "
- 4 Drain connection d20 with union nut 1 ¼ "
- 5 Overflow connection d32 with union nut 2 "
- 6 Fresh water inlet with hand ball valve, dirt trap and solenoid valve
- 7 Drain solenoid valve d20
- 8 Intake neutralization system Internal thread G 1 ½ "
- 9 Overflow neutralization system Internal thread G 1 ½ "
- 10 Drain connection Neutralization system Hose nozzle d15
- 11 Transition to sanitary pipe

Color coding of lines:

- | | |
|------------|---------------------------|
| light blue | fresh water supply |
| green | drain fume scrubber |
| orange | overflow fume scrubber |
| violet | wastewater neutralization |

Figure 6: Sanitary connections – feed fittings

The sanitary connections are illustrated by way of example for the construction of a fume scrubber C180 and a neutralization system C100.

The water inlet is connected to the fresh water line by means of a pressure hose or pipe connection. The inlet solenoid valve is connected to the controller via a connector

If the water supply interrupts while the fume scrubber is working, a message will appear after 30 minutes indicating a fault in the operation. See overview of possible faults and errors in Chapter 7.6.

Water pressure should be at least 2.5 bar in the inlet. It is recommended that the scrubbing water inlet is connected to the drinking water supply. Hard water with total hardness >10°dH (German degree of hardness) i.e.

12.522°eH (English degree of hardness/UK) or 10.426 gr/gal (US) could damage the unit and result in scaling. Always use purified water.



Attention! Risk of contamination when feeding with polluted water!

Only use purified or drinking water. Feed with purified water such as deionised water if total hardness exceeds 10°dH (German degree of hardness) i.e. 12.522°eH (English degree of hardness/UK) or 10.426 gr/gal (US)!

The FRIDURIT fume scrubber's outlet is used to empty the device when automatically changing the scrubbing liquid and as a safety overflow. When connecting to the downstream neutralisation unit, we recommend using a PVC fabric tube (Ø inside 25 mm for the discharge hose, Ø inside 38 mm for the overflow hose), i.e. a drain hose. This hose is resistant enough to the chemicals contained in the scrubbing liquid. A suitable hose set for feed and drain with stainless steel hose clips is available as an accessory. Contact KYOCERA for orders (see *Accessories*).

The solenoid valves for the control of the inlet and outlet are mounted in a well accessible location. Please observe the installation direction, this is indicated with arrows on the valves. Please observe the preferred installation direction of the drain valve according to the sketch. Other installation directions can lead to functional problems.

Please note the safety instructions before assembly:



Warning! Corrosive chemicals!

Risk of chemical burns and material damage due to leaking scrubbing liquid!

Do not reduce the cross-section of the drain and overflow pipes and do not fit a shut-off device!

Do not damage seal rings during assembly!

9.4 Electrical connections

Connecting the FRIDURIT fume scrubber



Warning! Electrical voltage!

Risk of electric shock due to improper connection!

Have a qualified electrician carry out the electrical connection of the FRIDURIT fume scrubber. Please note and apply the applicable DIN-VDE specifications and standards (DIN German Institute for Standardization / VDE Association for electrical, electronic & information technologies).

The FRIDURIT fume scrubber is connected with the mains supply using a GST 18i5 or CEE 16 amps plug connector. The plug connection allows reliable disconnection of the control system from the power supply when it is serviced. The neutral wire must be used in all cases. Otherwise faults in the operation could occur or the individual components can be destroyed.



Warning! Electrical voltage!

Risk of electric shock due to improper work!

This work requires the control system housing to be open. Its connections L1, L2 and L3 are energised, even when disconnected from power!

Disconnect the fume scrubber and its plug-in connection from the main power supply to achieve best possible safety from electric shock!

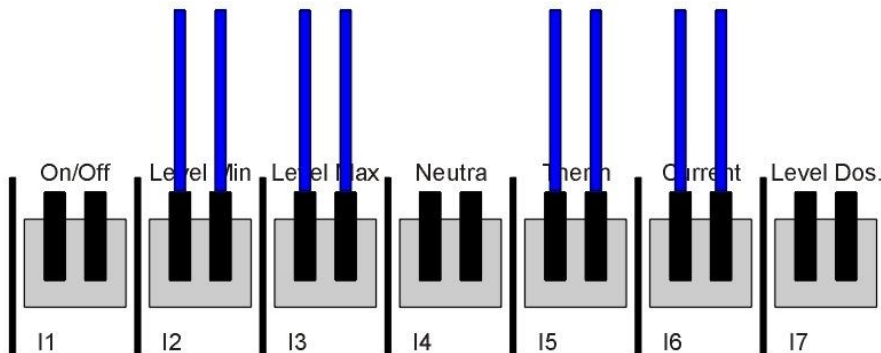
Quick connection terminals process the inputs and outputs of the electronic control system. Permissible terminal cross section is between 0.25mm² and 1.5mm². Use wire end sleeves with insulating flanges to avoid short circuits.

The switching voltage of inputs is 24V DC and the current is approx. 10 mA.

Voltage-free contacts may not exceed 30V DC. The permissible current of relay contacts is 5 amps.

Wiring inputs

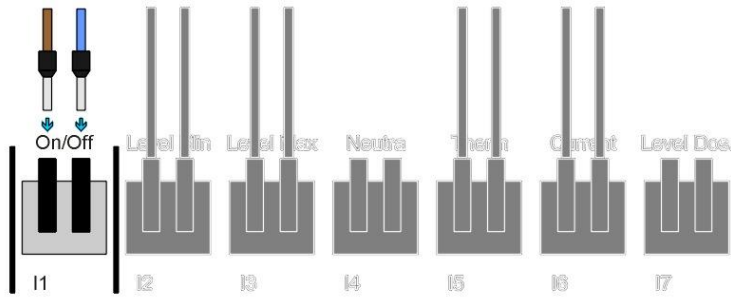
The figure shows the terminal strips of inputs. Terminals marked as wired have been connected by the manufacturer.



The functions of electronic control system inputs are:

Terminal	Description	Function
I1	On/Off	If the input is activated while a contact is closed, the fume scrubber will switch on.
I2	Level Min	The level switch is connected with the terminal and will stop the automatic scrubbing liquid change.
I3	Level Max	The level switch is connected with the terminal and regulates the scrubbing liquid level.
I4	Neutra	Please note the following section.
I5	Therm	The contact of the thermal over-current circuit breaker is connected with the terminal. It reports switching off of the spray wheel motor if the power consumption is exceeded.
I6	Current	The contact of the phase monitoring relays is connected with the terminal. It reports any failure in the fume scrubber's connection to the power supply. The reason could be a wrong phase sequence, for example.
I7	Level Dos.	This input is connected with the reservoir level switch if an optional chemical dosing unit is connected. The contact opens if the filling level inside the tank is too low.

Connecting the ventilation release contact



If the input is activated while a contact is closed, the device will switch on. Otherwise the device switches off. The contact can be connected with the ventilation unit installed by the customer or with the frequency converter controlling the fan.

Note: Sometimes this contact is wired by the manufacturer.

Connection of the neutralisation unit C100 interlock



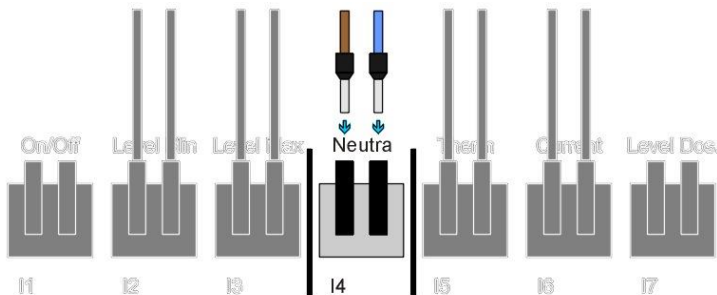
Caution! Corrosive chemicals!

Risk of chemical burns and material damage due to overflowing neutralisation unit! Connect the neutralisation unit with the fume scrubber!

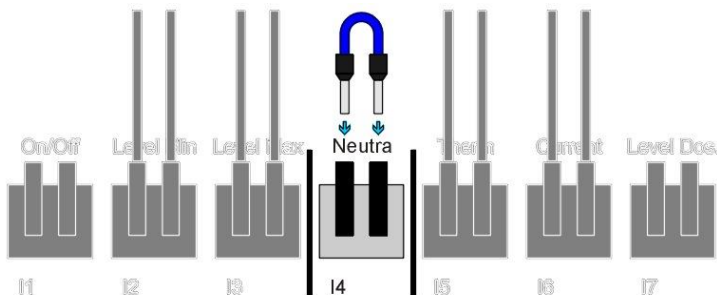


Attention! Risk of faults in the operation!

If the device is not connected as described below, the automatic change of the scrubbing liquid will not be started. This will reduce the absorption capacity of the scrubbing liquid! As a result it might not reach its absorption efficiency as described.



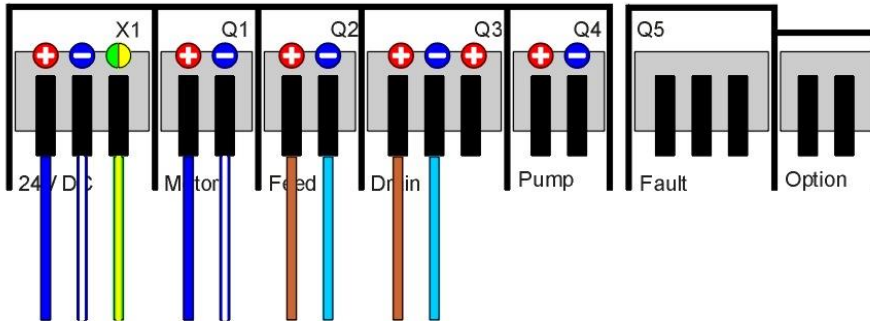
If the input is activated while a contact is closed, the automatic scrubbing liquid change is released. Otherwise the fume scrubber recognises that the neutralisation unit cannot absorb liquid and will not release the scrubbing liquid.



If the neutralisation unit is not connected, a wire bridge must be inserted.

Wiring outputs

The figure shows the output terminal strips. Terminals marked as wired have been connected by the manufacturer.



The functions of electronic control system outputs are:

Terminal	Description	Function
X1	24V DC	All electrical components are connected to the power supply using these terminals.
Q1	Motor	The coil motor contactor is connected to these terminals.
Q2	Feed	The coil solenoid feed valve is connected to these terminals.
Q3	Drain	The coil solenoid feed valve, a motor ball valve or a drain pump are connected to these terminals. The voltage at terminal "0" switches when the scrubbing liquid needs to be changed. Otherwise voltage is released at terminal "C".
Q4	Pump	Voltage for controlling the dosing pump is switched on if an optional chemical dosing unit has been connected.
Q5	Fault	The voltage-free changeover contact switches in the event of faults.
Q6	Option	The voltage-free contact is activated according to user specifications.

Plug connection supply solenoid valve

The inlet solenoid valve gone be wired with a connector GST18i3 (in the accessory pack):

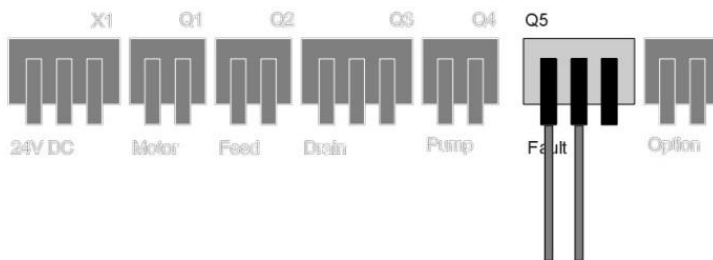
Terminal	Voltage	Funktion
L	24V DC L+	Supply voltage for the magnetic coil. Turns on when valve opens.
N	24V DC M	Ground connection for the magnetic coil.
PE	Grounding	Protector, connected to metallic parts of the magnetic coil.

Plug connection Drain solenoid valve

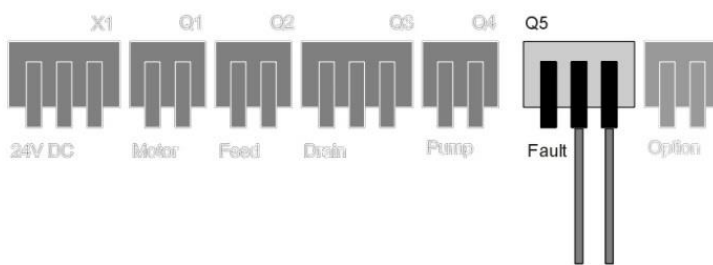
The drain solenoid valve gone be wired with a connector GST18i4 (in the accessory pack):

Terminal	Voltage	Funktion
1	24V DC L+	Supply voltage for the magnetic coil. Turns on when valve opens.
2	---	Contact is not connected
N	24V DC M	Ground connection for the magnetic coil.
PE	Grounding	Protector, connected to metallic parts of the magnetic coil.

Voltage-free connection of failure messages



Contact closed when fault-free,
open in the event of faults



Contact open when fault-free,
closed in the event of faults

Connecting the serial interface

Terminal	Description	Function
RTS	Request Send	This function is currently not supported.
CTS	Enable Send	This function is currently not supported.
TXD	Send Data	Sends data to another device.
RXD	Receive Data	Receives data from another device.
GND	Mass	Reference mass for above mentioned signals.

9.5 Activating or deactivating the operating module button



Warning! Electrical voltage!

Risk of electric shock due to improper work!

This work requires the control system housing to be open. Its connections L1, L2 and L3 are energised, even when disconnected from power!

Disconnect the fume scrubber and its plug-in connection from the main power supply to achieve best possible safety from electric shock!

The switch activating the operating module function is on the conductor board. The plug connector used for the operating module protrudes over the back of the controller.

Pull the switch toward the connection plug to deactivate the operating module button. Push the switch towards the outside of the conductor board to activate the operating module button.

9.6 Ventilation connections

Building requirements



Warning! Corrosive aerosols!

Risk of chemical burns from acid fog leaking from the fume cupboard when the maximum fan airflow capacity is exceeded!

Ensure correct fan dimensioning!

With regard to the size of the fan, its performance should be dimensioned in such a way that perfect operation is guaranteed even if there is an increase of up to 30% in the pressure loss caused by contamination in the separators. The pressure loss values given in the technical data (see Technical description) refer to fume scrubbers as supplied to the customer.

If necessary for safety reasons, it may be necessary to use a fan or fume scrubber with larger dimensions. Please contact FRIDURIT technical department environmental equipment for specific questions. See the front page for contact details.

Connecting the ventilation and exhaust air unit

Air enters the FRIDURIT fume scrubber through two sockets at the back. Air exits the fume scrubber through a central socket on the top of the device (see

, Chapter 6.1). The fitting and installation company must connect the fume scrubber to the laboratory ventilation unit.



Attention! Risk of operation impairment due to contamination of separators!

Check the agglomerators and droplet separators for contamination after connecting the FRIDURIT fume scrubber and test running it with water. If necessary, have it cleaned by service personnel.



Servicing due to excessive pressure loss in soiled separators is not covered by the warranty.

Only an experienced ventilation technician may plan the laboratory ventilation unit. This guarantees reliable and fault-free operation of the exhaust air unit. The exhaust air unit and scrubber require specific processes. In addition to basic rules on planning and designing a ventilation unit, the following should be considered:

All materials coming into contact with exhaust air must be resistant to the chemicals used. The same applies to fume scrubber piping, fans, butterfly valves, and fire protection flaps, etc. as the scrubbed fumes contain chemical residues which can condense to form a corrosive layer on downstream unit components.

Depending on the process, the scrubbed fumes may contain residual moisture that very quickly clogs up the downstream filter elements such as particle filters or similar increasing significantly pressure loss. Filter elements are therefore not recommended.

Highly contaminated exhaust air, e.g. caused by sticky substances, leads to clogging of the absorption systems and hence to an increase in pressure loss above the fume scrubber. If contamination cannot be avoided, make sure that the absorption systems are cleaned regularly by a member of FRIDURIT service organisation.

10 PUTTING INTO SERVICE

Putting into service should be carried out by a qualified technician from FRIDURIT service organisation. See the front page for more information. This can only be carried out when the FRIDURIT fume scrubber and its components have been fully assembled. The place of installation must be freely accessible, and any materials needed, such as a ladder, tools, etc. should be available. Consider the instructions on the order confirmation. Before putting into service, a FRIDURIT service technicians will check that all the necessary prerequisites are given.

Putting into service includes:

- Checking the installation and operational test of the spray wheel
- Briefing the operator
- Test run in the presence of the user and operator.
- Answering any other questions



FRIDURIT servicing personnel will only put the FRIDURIT fume scrubber and parts supplied by FRIDURIT Laboratory Technology into service. Please understand that our service does not include putting the fume cupboard or the ventilation unit into service.



We recommend that the components used with the fume scrubber are set up on the same day. This allows the interaction of the individual parts to be tested. FRIDURIT Laboratory Technology will always do its best to fit in with your time schedules.

11 APPENDIX

11.1 Glossary

Drain fittings. Include all parts required for installing the scrubbing liquid drain i.e. outlet, drain pump with one-way valve and corresponding piping. The fittings are fixed to the side of the fume scrubber.

Exhaust air unit. Refers to the fume cupboard with built-in fume scrubber.

Fume scrubber. Cleans air enriched with chemicals absorbing suitable carrier material such as water spray inside the fume cupboard of FRIDURIT fume scrubbers. Cleaned air leaves the laboratory area.

Absorption efficiency. Refers to the ratio of chemical concentration in the waste air resp. exhaust air before and after fume scrubbing. Indicator for cleaning efficiency of the fume scrubber.

Absorption system. Refers to fume scrubber components that recover water from atomised spray in the absorption chamber. The FRIDURIT fume scrubber uses its agglomerators and droplet separators to absorb the water.

Absorption chamber. An area in the fume scrubber where carrier material, such atomised spray from water, absorbs the chemical substances from the waste air. The patented spray wheel is the key component inside the absorption chamber of the FRIDURIT fume scrubber.

Agglomerator. A component of the absorption system consisting of several layers of coarsely meshed plastic net. The fine droplets of atomised spray condense on the plastic net and agglomerate to form water drops. The exhaust air flows upwards through the coarse meshed net and exits the air outlet.

Connection plug. A plug used to connect the solenoid valves to the control system.

Pressure loss. A decrease in negative or positive pressure inside the device. The decrease is caused by friction on the inner walls and by obstructions affecting the airstream such as reduced cross-sections of air piping, e.g. absorption systems in the fume scrubber. Deposits of harmful substances in the absorption systems of the fume scrubber additionally increase the internal pressure loss which is a feature of the equipment.

Ball valve. A specific stop valve used to regulate the water feed. Turning the locking device by 90° operates the valve while a ball fully opens or closes the stop valve. There is no intermediate position; the valve is either open or closed.

Conductivity. Electrical conductivity is a physical quantity that indicates a material's ability to transport electric current. The higher the concentration of ions, and thus the chemical contamination of the scrubbing liquid in the fume scrubber, the higher its conductivity. Conductivity can be used as an indicator of the chemical contamination of the scrubbing liquid.

Ventilation unit. Equipment that supplies service rooms with fresh air and discharges polluted air. Its efficiency and assembly is adapted to the structural part of the building.

Airflow. Refers to the quantity of air moved by a fan.

Solenoid valve. A valve that is operated by an electric magnet. The solenoid valves at the water inlet and outlet automatically control the water flow.

Neutralisation unit. Used to neutralise acid and alkaline waste water produced in the laboratory, such as the scrubbing liquid in FRIDURIT fume scrubbers. It is usually installed downstream of the scrubber using a hose and electrical connection.

Emergency overflow. A safety installation on the scrubbing liquid outlet, i.e. a safety overflow. Used to secure the outlet with an alternative hose connection preventing blockage of the drain in the event of a failure in the solenoid valve.

Polypropylene (abbreviation PP). A plastic made of hydrocarbon resulting from propane polymerisation. The material is resistant to corrosion and ageing and burns without residue.

Plug-in connection. A dismountable connection.

Droplet separators. A component of the absorption system comprising plastic lamellae with smooth, folded surfaces running vertically. Water drops develop in the agglomerator layer, sliding down the smooth surfaces of the droplet separator and flow back into the scrubbing liquid reservoir.

11.2 Modbus Functions

Data Register (Read: Modbus function 4 / Write: Modbus function 6)

Label	Register	Byte (H/L)	Definition	Read/Write	Description
Setpoints					
Special_register	1	0 / 1	0	Setpoint (R/W)	Special register multifunction
R_def_tchange	2	2 / 3	+16 (h)	Setpoint (R/W)	Setpoint Scrubbing liquid time
R_def_ms	3	4 / 5	+200 (mS _{T10})	Setpoint (R/W)	Limit value Conductance measurement
R_def_check	4	6 / 7	+600 (min)	Setpoint (R/W)	Setpoint Release check
R_def_maint	5	8 / 9	+365 (d)	Setpoint (R/W)	Maintenance interval for Message
R_def_pump	6	10 / 11	+0 (sec)	Setpoint (R/W)	Pump Activation time (0 = deactivated)
R_def_pH1	7	12 / 13	+65 (pH _{T10})	Setpoint (R/W)	pH Limit value (lower value) for dosing
R_def_pH2	8	14 / 15	+90 (pH _{T10})	Setpoint (R/W)	pH Limit value (upper value) for dosing
Actual values Word register					
R_val_ms_ph	9	16 / 17	(val _{T10})	Actual (R)	Conductance / Current pH value
R_val_tchange_h	10	18 / 19	(h)	Actual (R)	Time since last Water change (h)
R_val_tchange_min	11	20 / 21	(min)	Actual (R)	Time since last Water change (min)
R_val_top_h	12	22 / 23	(h)	Actual (R)	Unit Total Operating hours
R_val_top_min	13	24 / 25	(min)	Actual (R)	Minute meter Operating hours
R_val_tfill	14	26 / 27	(sec)	Actual (R)	Current Fill time / Last Fill
R_val_trefill	15	28 / 29	(sec)	Actual (R)	Current Refill time
R_val_tdrain	16	30 / 31	(sec)	Actual (R)	Current Drain time / Last Drain
R_val_tcheck	17	32 / 33	(min)	Actual (R)	Current Release check
R_val_pump	18	34 / 35	(sec)	Actual (R)	Current Pump time
R_val_cycles	19	36 / 37	(x)	Actual (R)	Total Drain cycles
R_val_maint	20	38 / 39	(d)	Actual (R)	Days since last Maintenance
Actual values Fault register					
R_val_ftherm	21	40 / 41		Actual (R)	Failure time Motor protection
R_val_ffill	22	42 / 43		Actual (R)	Failure time Fill time Overrun
R_val_frefill	23	44 / 45		Actual (R)	Failure time Refill time Overrun
R_val_mdRAIN	24	46 / 47		Actual (R)	Failure time Drain time Overrun
Bit register					
F_therm	25 Bit 0	49		Actual (R)	Failure bit Motor protection
F_fill	25 Bit 1			Actual (R)	Failure bit Fill time check
F_check	25 Bit 2			Actual (R)	Failure bit Release check
F_current	25 Bit 3			Actual (R)	Failure bit Rotating field check
M_drain	26 Bit 0	51		Actual (R)	Message bit Drain time Overrun
M_check	26 Bit 1			Actual (R)	Message bit Release check
M_dosing	26 Bit 2			Actual (R)	Reserved for dosing
M_level_min	26 Bit 3			Actual (R)	Reserved for dosing
M_level	26 Bit 4			Actual (R)	Message bit Level switch
M_maint	26 Bit 7			Actual (R)	Message bit Maintenance necessary
S_feed	27 Bit 0	53		Actual (R)	Fill Scrubber
S_operate	27 Bit 1			Actual (R)	Operate Scrubber

Label	Register	Byte (H/L)	Definition	Read/Write	Description
S_drain	27 Bit 2			Actual (R)	Empty Scrubber
R_onoff	28 Bit 0	55		Actual (R)	External release
R_lsmin	28 Bit 1			Actual (R)	Lower Level switch
R_ismax	28 Bit 2			Actual (R)	Upper Level switch
R_neutra	28 Bit 3			Actual (R)	Interlock Neutra unit
R_therm	28 Bit 4			Actual (R)	Bimetal Motor protective switch
R_rotation	28 Bit 5			Actual (R)	Reserve
R_option	28 Bit 6			Actual (R)	Phase monitoring Relay
R_button	28 Bit 7			Actual (R)	Operating module Button
R_motor	29 Bit 0	57		Actual (R)	Motor Operation
R_feed	29 Bit 1			Actual (R)	Fill Solenoid valve
R_drain	29 Bit 2			Actual (R)	Empty Solenoid valve
R_pump	29 Bit 3			Actual (R)	Exit Pump
R_faultrly	29 Bit 4			Actual (R)	Relay Failure
R_optionrly	29 Bit 5			Actual (R)	Relay Option
R_LED_green	29 Bit 6			Actual (R)	Green LED Operating module
R_LED_red	29 Bit 7			Actual (R)	Red LED Operating module
R_language	30	59		Actual (R)	Operating language

11.3 Spare parts list

Article No.:	Description:	C75*	C180*
L-386759	Agglomerator 250x250x50 coarse (wire thickness 0.4mm)		4
L-386760	Agglomerator 340x250x50 coarse (wire thickness 0.4mm)		4
L-386630	Agglomerator 250x250x50 fine (wire thickness 0.22mm)	2	2
L-386463	Agglomerator 340x250x50 fine (wire thickness 0.22mm)	2	2
L-AWB	Operating module comprising foil and conductor board with key switch, red and green LED	1	1
L-Sprührad	Complete spray wheel with nozzles	1	1
L-AWLZ	Conductance sensor c=1.0 including protective tube	1	1
L-227**	Solenoid valve DN 20 PVC with plain male ends / 24V DC	1	1
L-386995	Level switch (black) with R1/2" thread	2	2
L-384712	Tangential full-cone nozzle	8	8
L-386333	Sealing spray wheel flange EPDM	1	1
L-227**	Brass solenoid feed valve G1/2" 24V DC including soil trap and ball valve	1	1
L-227**	Stainless steel solenoid feed valve G1/2" 24V DC including soil trap and ball valve	1	1
L-385795	Intermediate piece PP	10	22

* Amount of pieces used in the device

** Please specify device number or order number when ordering