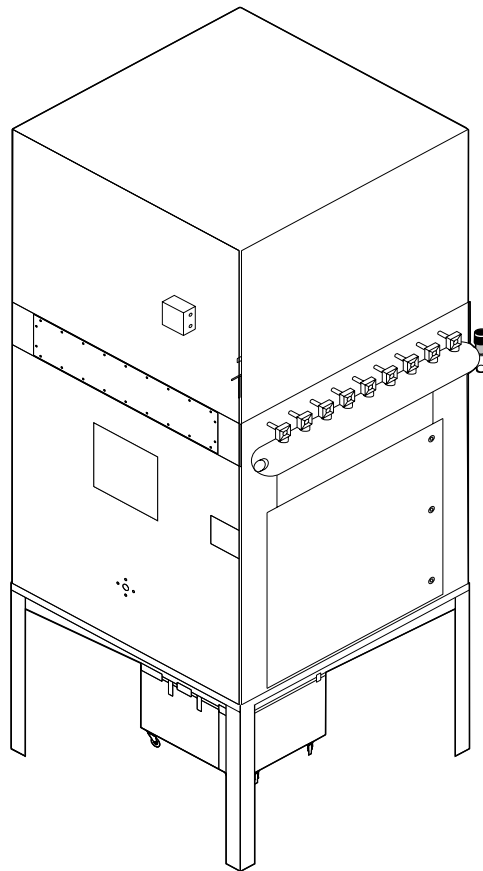


Operating Instructions and Spare Parts List

After Filter with Filter control



Translation of the original operating instructions

Table of contents

Safety Instructions

Technical Data

After Filter	1
Field of operation	1
After Filter versions	1
Grounding	2
Description of Function	3
Operating principle	3
Principle of the Rotating jet nozzle	4
Start up	5
After longer standstill	5
Notes for switching the equipment on / off	5
Check the direction of rotation of the fan	6
Safety notice:	6
Check the direction of rotation	6
Differential pressure display	7
Filter cleaning	7
MFS 04 Filter control (Standard version)	8
Field of operation	8
MFS 04 N Filter control (Standard version)	9
Field of operation	9
Technical Data	10
Faults on MFS 04 / MFS 04 N	10
Status displays (LED) - MFS 04 / MFS 04 N	10
High Speed Run	10
MFS 08 Filter control (Standard version)	11
Description of Function	11
Technical Data	12
Troubleshooting Guide - After Filter	13
Inspection and Maintenance plan	14
Replacing Filter elements	15
Cleaning / replacing a solenoid valve	16

(continued)

Table of content (cont.)

Spare parts list	17
Ordering Spare Parts	17
After Filter with Powder recovery container	18
After Filter with Powder recovery tray	19
Filter Unit	20
Differential pressure display unit	21
MFS 04 / MFR 04 N Filter control	22
MFS 08 Filter control	23
Solenoid valve	24
NOTES	25

Safety Instructions

Safety rules for electrostatic powder coating operations

1. This equipment is dangerous when not operated according to the following standards: EN 50 050 (or VDE 0745, Part 100), EN 50 053, Part 2 (or VDE 0745, Part 102).
2. All electrostatically conductive parts located within 5 m of the coating area and especially the workpieces *must* be properly grounded.
3. The floor in the coating area *must* be electrostatically conductive. Normal concrete is generally conductive
4. The operating personnel *must* wear electrostatically conductive footwear (e.g. leather soles).
5. The operating personnel should hold the gun in the bare hand. If gloves are worn, they *must* be electrostatically conductive.
6. Connect the grounding cable (yellow/green), supplied, to the grounding terminal on the control module. The grounding cable *must* have a good metal to metal connection with the coating booth, recovery unit, and the workpiece conveyor system, especially with the workpiece suspension.
7. The electrical and the powder feed lines to the guns must be laid out so that they are protected from possible mechanical damage.
8. The powder coating equipment should only be switched on after the booth is in operation. If the booth breaks down then the powder coating equipment *must* also switch off.
9. Check the grounding of all electrostatic conductive parts at least once a week.
10. When cleaning the gun or changing nozzles the control module *must* be switched off

Safety notice

The Operating Instructions contain elementary safety instructions, which are to be observed during operation and maintenance of the plant.

Nonobservance of these instructions can lead to injury to personnel and/or damage to the plant, and also to the environment.

Specifically, nonobservance of the instructions can bring the following dangers with it:

- Failure of important functions of the plant/equipment parts.
- Danger to personnel through electrical, and mechanical influences.

Therefore:

- Read the Operating Instructions.
- Train the operating personnel properly.
- Make sure that the contents of the Operating Instructions are fully understood by the operating staff.
- Designate responsibilities, and authorization.

On operating the plant

- Keep the Operating Instructions at the booth.
- Observe the safety instructions.
- Only operate the plant to the corresponding performance specifications.

In case of uncertainty

- Consult an ITW Gema Service centre.



All installation work is to be carried out by trained personnel only!

Technical Data

After Filter housing (Standard version)

Material:	Steel sheet
Surface treatment:	EPS Plastic coating
Colour:	RAL 7035 (light grey)
Seals:	Natural rubber
Permissible operating temperature:	max. +60° C (+140° F)

Energy requirements

Electrical

Fan motor:	15 / 18.5 / 22 / 30 / 37 kW (according to the Air flow volume/Number of filter cartridges)
Solenoid valve:	24 VDC, 12 W
Control unit:	230 VAC, 50 Hz

Pneumatic

Compressed air:	3 - 4 bar, dehydrated
Minimum compressed air quality:	Water content: max. 1.3 g/m ³ Oil content: max. 0.1 mg/kg (Oil/Air)

Noise Emission

Continuous noise level:	< 80 dB(A)
-------------------------	------------

Explosion precautions

Possible explosions hazards to be avoided:

- Installing the After Filter in an explosive atmosphere
- Creating an explosive powder/air mixture

Prerequisites for a powder/air explosion are:

- Inflammable powder,
- Ignition source and
- a sufficient concentration of oxygen.

 **NOTICE**

**For safety reasons the plant must be fitted with CO₂ Fire Extinguishing equipment.
The booth end-user is responsible for the choice of the required explosion prevention precautions.**

After Filter

Field of operation

The After Filter with Rotating jet nozzle have been designed for removing particles from powder laden air. The filter elements are cleaned automatically during the powder coating operation.

This plant must only be operated according to the instructions set out in the operating manual. Using the equipment for any other purpose than that designated will render any agreements invalidate.

ITW Gema is not responsible for damage resulting from incorrect or improper use.

After Filter versions

ITW Gema supplies two versions of After Filters (*Figs. 1, and 2 are the same scale*):

- Version 1 (Fig. 1 below) is fitted with a powder recovery container
- Version 2 (Fig. 2 - see next page) is fitted with a powder recovery tray and is lower than version 1, with powder recovery container

(continued)

After Filter with Powder recovery container

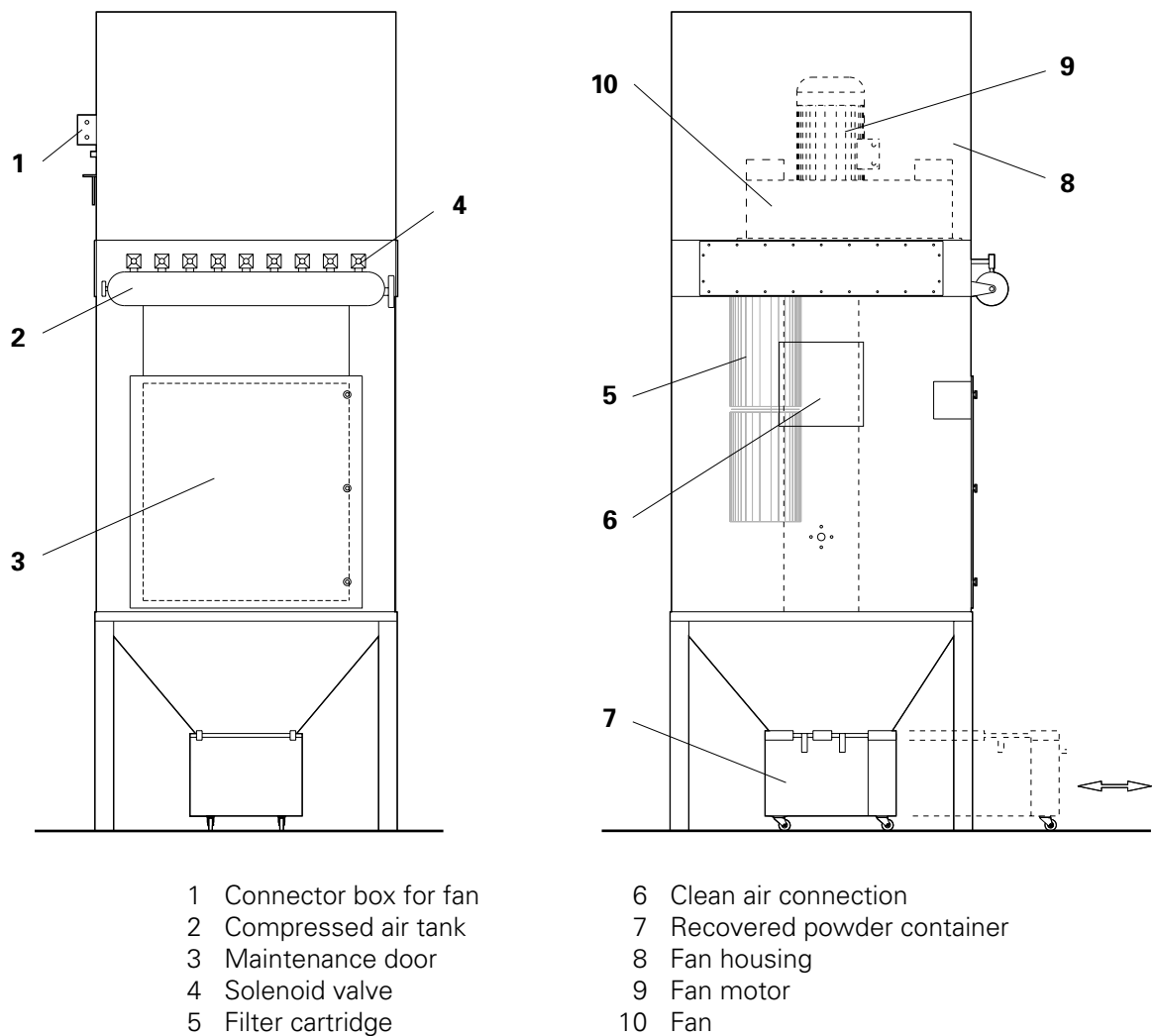


Fig. 1

After Filter versions (continued)

Grounding

The Powder recovery container or Powder recovery tray (7 - Fig. 1, page 1 / Fig. 2, page 2) is grounded with a grounding lead on the After Filter funnel. This lead must be detached every time the container or tray is emptied. *After emptying the lead must be reconnected.*

After Filter with powder recovery tray

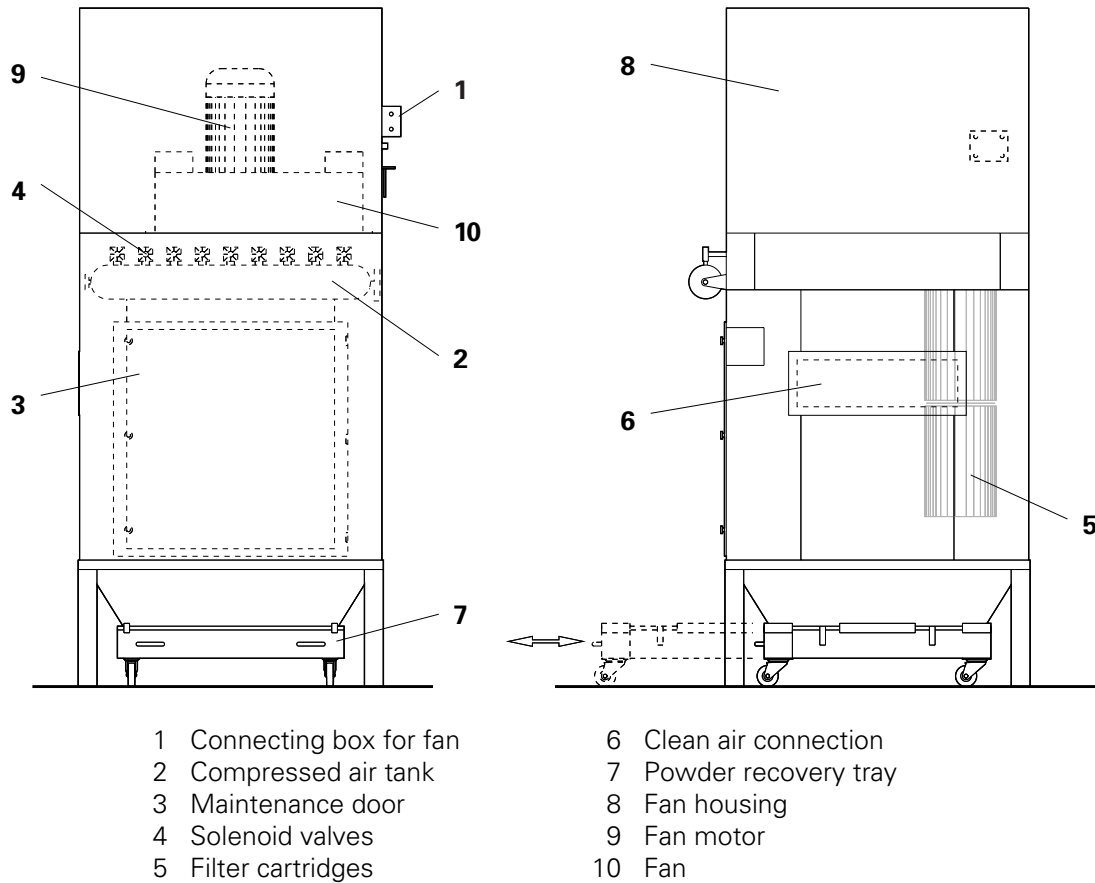


Fig. 2

Description of Function

Operating principle

Filtration (Fig. 3) in coating operation

- The powder laden air flows into the clean air space (1). The shut-off valve is open.
- The powder particles are separated (2) on the filter elements
- The filtered air passes into the clean air space (3)

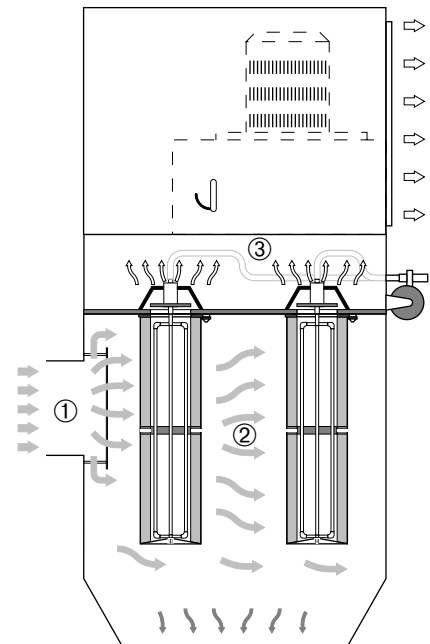


Fig. 3

Cleaning (Fig. 4) in coating operation

- The filter elements are either cleaned individually or in groups by the rotating jet nozzle (4).
- The cleaning causes uniform detachment of the filter cake (5).
- The accumulated powder falls downwards (6).
- The filtering process (7) does **not** need to be interrupted during cleaning.

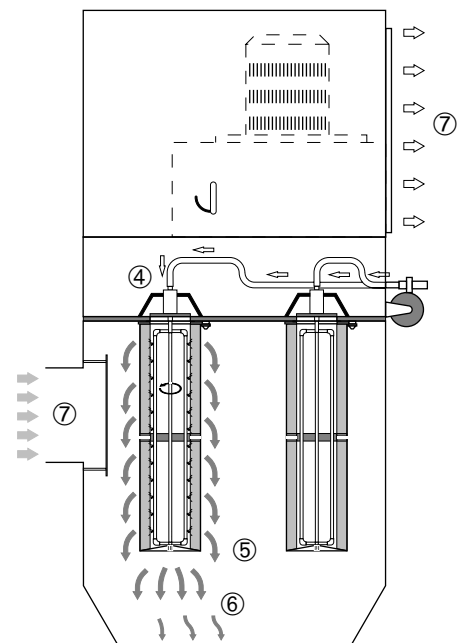
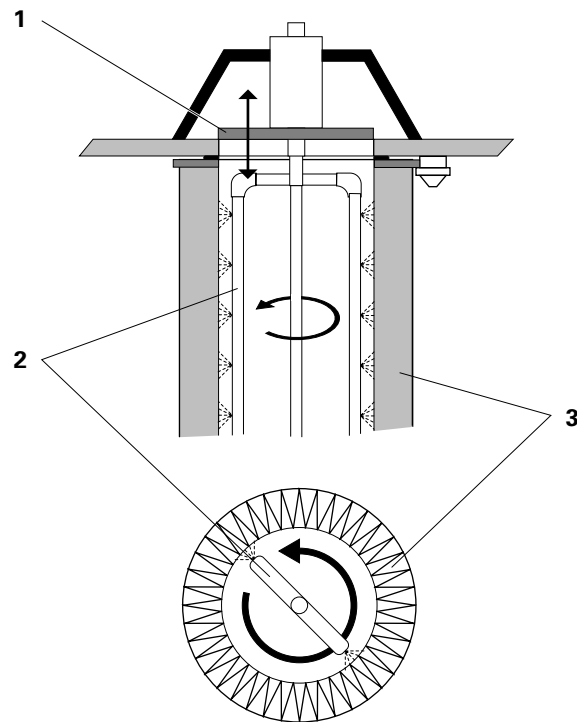


Fig. 4

Principle of the Rotating jet nozzle

- The shut-off valve interrupts the air flow during cleaning
- The rotating jet nozzles blow out the folds of the filter elements radially
- The rotation causes a lateral vibrations on the folds
- After cleaning, the shut-off valve opens again



- 1 Shut-off valve (closed)
- 2 Rotating jet nozzles
- 3 Filter element

Fig. 5

Start up

 **CAUTION**

All installation work is to be carried out by trained personnel only!

After longer standstill

- Inspect all the plant components
- Remove all foreign material from the filter (i.e. tools, assembly waste, etc.)
- Check pipe/hose connections
- Tighten all screws
- Check the conductivity between all booth components!
- Maximum resistance value = $R < 10^6 \Omega$
- On-site grounding to be done by the customer

Notes for switching the equipment on / off

Safety notes:

- Only **authorized** personnel are permitted to switch the plant on or off.
- The After Filter **must not** be operated **without** higher hierarchy safety equipment being connected.
- Check that the powder spraying equipment cannot be operated without the After Filter.

 **NOTICE**

When starting up the plant do not exceed the permitted air flow volume.

Normal operation

In normal operation with MFS 04 (N) / 08 Filter control unit the After Filter operates largely automatically.

 **NOTICE**

The plant must be monitored according to the After Filter repair and maintenance plan.

Checking the direction of rotation of the fan

 **CAUTION**

All installation work is to be carried out by trained personnel only!

Safety notice:

 **CAUTION**

During inspection of the fan there is an increased danger of injury through the rotating fan flywheel!

Never reach into the fan housing when the fan flywheel is rotating!

Because of its centrifugal mass the flywheel still rotates **5 minutes** after the fan has been switched off!

A strong draught can be present at the inspection opening (exhaust air filter grid).

Notice:

A fan with **the wrong direction of rotation** has a **low suction performance**.

Therefore, **check** the direction of rotation of the fans after all **work on the drive unit** or its **power supply cables!**

Check the direction of rotation

- Depending to the type of After Filter there is an inspection opening (exhaust air filter grid) above in the fan housing. Remove the exhaust air filter grid *after switching off* the After Filter.
- Switch on the fan briefly.
The fan does not have to reach its running speed.
- *Make sure the After Filter cannot be switched on by mistake!*

 **CAUTION**

**Rotating fan flywheel!
Strong air current!**

- Check the direction of rotation of the fan, with the arrow on the fan motor cooling hood, and of the fan flywheel.
- If necessary, the direction of rotation must be changed by a trained electrician.
- After the check replace the exhaust air filter grid.

Differential Pressure Gauge

- Fit the differential pressure gauge in a vibration-free location.
- Connect with pneumatic hoses (Measuring points):
 - Clean air side: "1" (Fig. 6)
 - To the Fan: "2" (Fig. 6)
 - Clean air side "3" (Fig. 6)

The numbers "1, 2 and 3" are found on the back of the pressure measuring gauge.

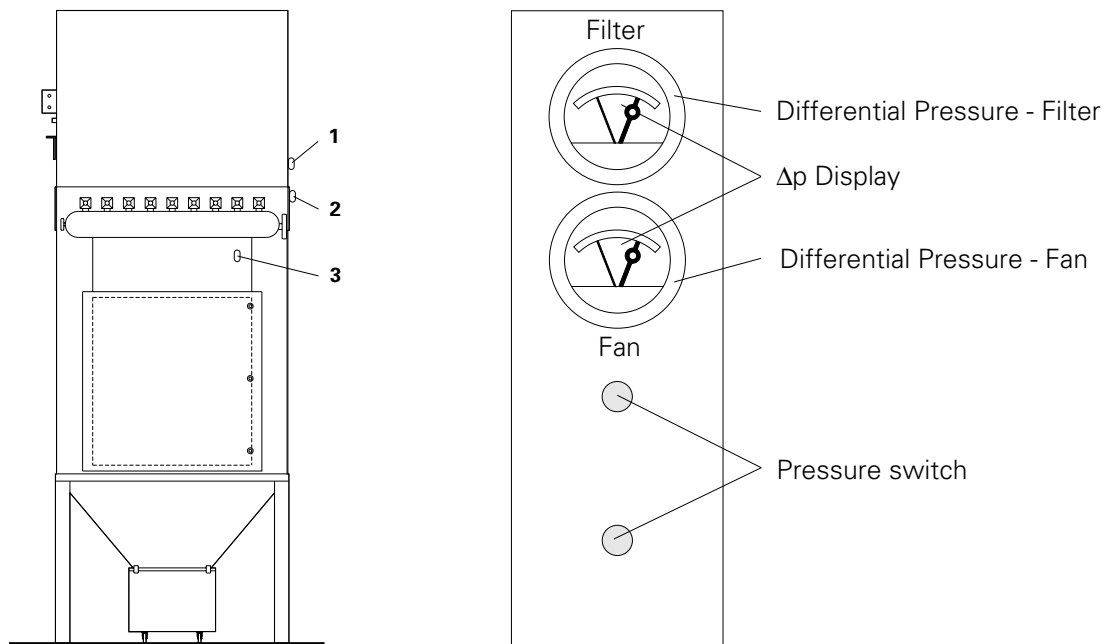


Fig. 6

Filter cleaning

The filter cartridges are cleaned in cycles during operation from the inside, outwards. The times which determine the cycle are set before start-up*, but must be reset on repeated overstepping of the max. differential pressure (at which the Alarm is released).

The differential pressure is displayed on the pressure monitoring gauges:

- "Pressure monitoring on the Filter" - is only optically displayed on the pressure gauge
- "Pressure monitoring on the Fan" - is optically displayed and the Alarm is released through two pressure switches, visually, and acoustically (See Fig. 6).

The upper and lower limits, at which the Alarm is released, is plant-specific and are set on assembly by our trained service personnel*.

**The setting of the cycle times are only to be done by trained personnel*

MFS 04 Filter control (Standard version)

(For After Filters **up to** 12'000 m³/h Air volume flow)

The control functions and parameters are set before the Start-up and **must not** be changed by the customer.

However, if the parameters must be changed, then **only in consultation with the ITW Gema Service Department**

Field of operation

The MFS 04 Filter control has been designed for cleaning the After Filter. Powder accumulated on the filter elements in the filter plant are periodically cleaned by rotating jet nozzles. Solenoid valves on the compressed air pressure tank are opened for a short time.

The filter elements are individually cleaned in cycles.

The pulse, and pause times are dependent on the process.

MFS 04 Function characteristics

- up to 10 valves
- Adjustable pulse time
- Adjustable pause time
- Manual High Speed Run possible
- Time controlled cleaning

Setting the pause, and pulse times - MFS 04 / MFS 04 N

(according to the number of filter cartridges)

PAUSE	Pause time between two valve openings	8-200 s
PULSE	Valve opening time	0.3-3 s

MFS 04 Filter control

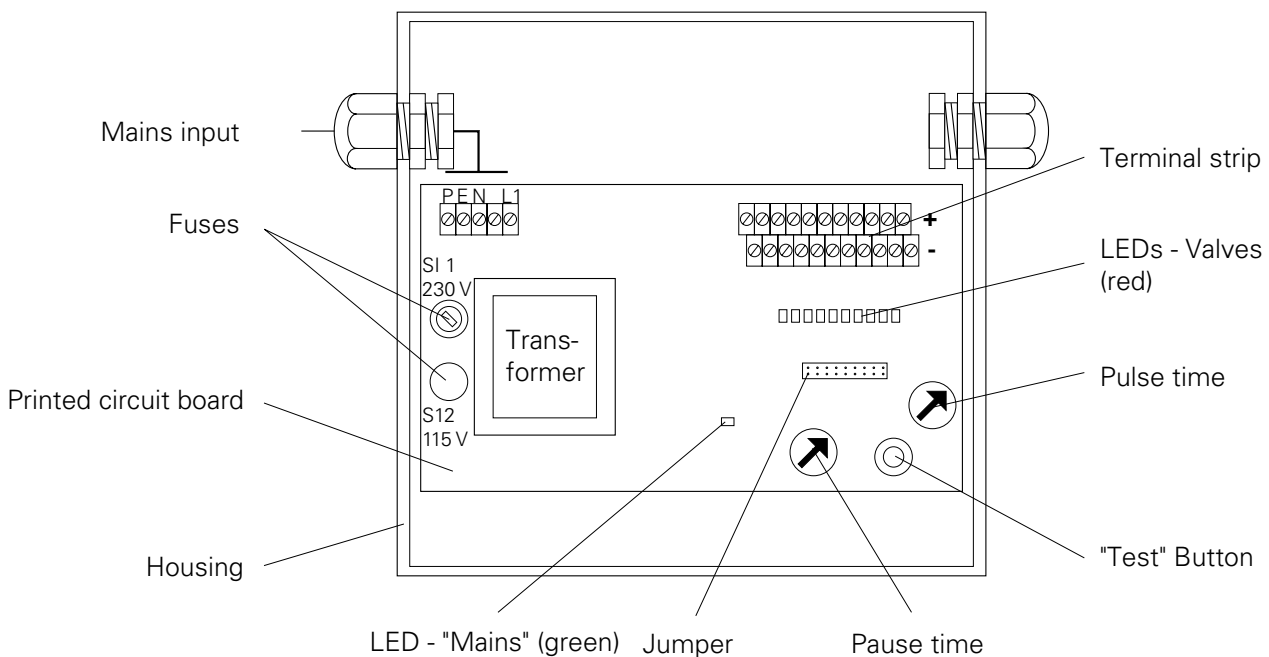


Fig. 7

MFS 04 N Filter control (Standard version)

(For After Filters **up to** 12'000 m³/h Air flow volume)

The control functions, and parameters are set before the Start-up and **must not** be changed by the customer.

However, if the parameters must be changed, then **only in consultation with the ITW Gema Service Department**

Field of operation

The MFS 04 Filter control has been designed for cleaning the After Filter. Powder accumulated on the filter elements in the filter plant are periodically cleaned by rotating jet nozzles. Solenoid valves on the compressed air pressure tank are opened for a short time. On reaching a max. differential pressure the filter elements are individually cleaned in cycles. The pulse, and pause times are dependent on the process.

MFS 04 N Function characteristics

- up to 10 valves
- Adjustable pulse time
- Adjustable pause time
- Manual High Speed Run possible
- Differential pressure controlled or time controlled cleaning

MFS 04 N Filter control

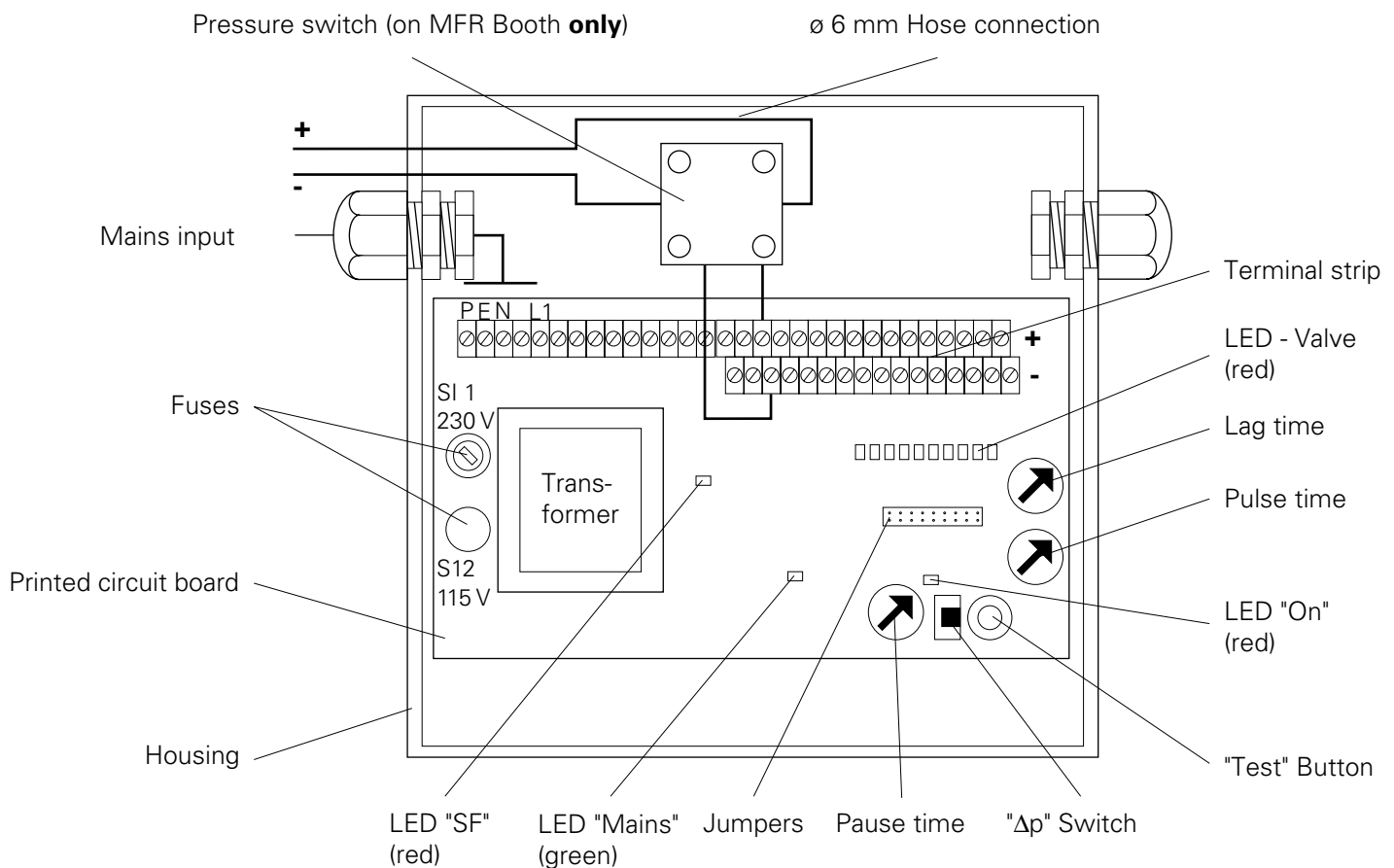


Fig. 8

MFS 04 N Filter control (Standard version)

(For After Filters **up to** 12'000 m³/h Air flow volume)

Technical Data

Mechanical

Switching point of the pressure switch (option): 5 mbar

Electrical

Voltage (Type MFS 04 N): 230 / 115 V AC (± 10 %)

Frequency: 50 / 60 Hz

Consumption: approx. 6 VA

Output voltage: 24 V DC

Output current: max. 1 A

Max. number of valves: 10

Environmental requirements

Ambient temperature: - 20° C (- 4° F) to + 60° C (+ 140° F)

Faults on MFS 04 / MFS 04 N (See Fig. 7 and 8, pages 8 and 9)

Mains LED does not illuminate	- Power supply in order? - Fuse defect?
Does not clean	- Bridge for correct number of valves? <i>(See Fig. 7 and 8 - Jumper)</i> - Power supply in order? - Δp Switch (MFS 04 N)? - Solenoid valves in working order?

Status displays (LED) - MFS 04 / MFS 04 N (See Figs. 7, and 8, Pages 8, and 9)

LED	Colour	Meaning
MAINS	green	Power supply connected
Valve (1...10)	red	Corresponding valve (1 10) open
ON	red	Control in cleaning mode
SF	red	Continuous light: Switch point 1 ON (Signal output 1 ON)
		Blinking light: Switch point 2 ON (Signal output 2 ON)

High Speed Run

For Function test or intermediate cleaning cycle:

- Press "High Speed Run" key
- Pause time is set down to 8 s
- Valves are cleaned in High Speed Run pulses of 8 s

MFS 08 Filter control (Standard version)

(For After Filters **over** 12'000 m³/h Air flow volume)



All installation work is to be carried out by trained personnel only!

Description of Function

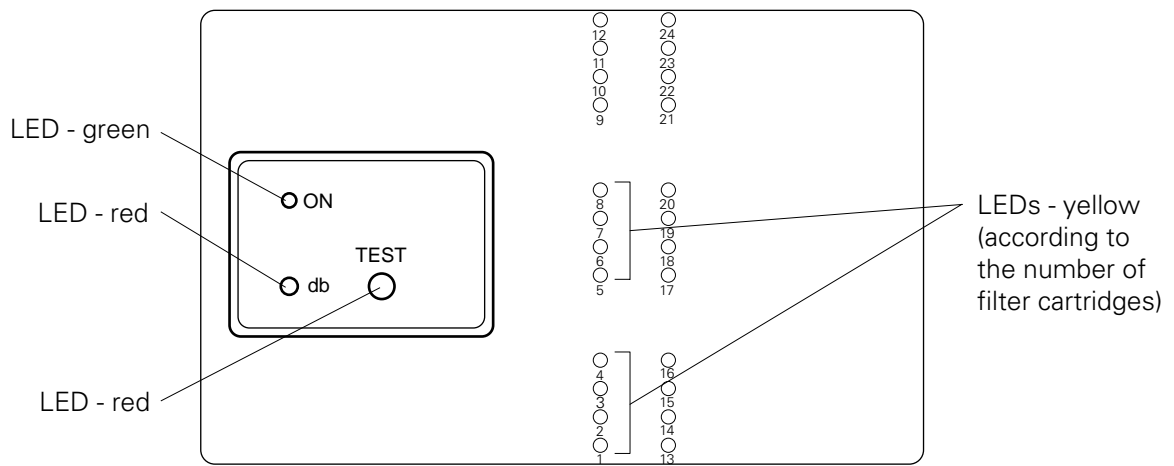
The valve control serves the cleaning of filter cartridges. Exactly metered and repetitive compressed air pulses largely free the filter elements of deposited powder and thereby retain the function of the filter.

After switching on the mains voltage the green LED (see Fig. 9) illuminates. Simultaneously, Valve output 1 switches. After the elapse of the set pause time Valve 2 opens, then Valve 3 etc. The pulses can be checked visually on the yellow LEDs, which are connected to the valve outputs. Through the Button "Test" the valves can be opened manually, one after the other, a valuable aid at Start up or inspection to check the plant for proper functioning. A High Speed Run with minimum pause time (8 s) is cleaned with a closed external switch.

MFS 08 Function characteristic

- up to 24 valves
- Adjustable pulse time
- Adjustable pause time
- Manual High Speed Run possible
- Time controlled cleaning

MFS 08 Filter control



MFR 08 Filter control - Monitoring unit

Fig. 9

MFS 08 Filter control (Standard version)

(For After Filters **over** 12'000 m³/h Air flow volume)

Technical Data

Mechanical

Switch point pressure switch (option): 5 mbar

Electrical

Connection voltage: 230 / 115 V AC (± 10 %)

Frequency: 50/60 Hz

Consumption: approx. 38 VA

Output voltage: 24 V DC

Output current: max. 1 A

Max. number of valves max. 24 valves, programmable to the number of valves connected, by means of a Coding switch

Checking the valves: by means of key "Test", visual check through the yellow LEDs

Setting to 8-200 s
linear adjustment range - 270°

Type of protection: IP 65

High Speed Run: with Pause time 8 s with closed external switch

Mains check: LED - green

Ambient temperature: -20° C (-4° F) to +60° C (+140° F)

Explosion protection

 **NOTICE**

**For safety reasons the plant must be fitted with CO₂ Fire Extinguishing equipment.
The booth end-user is responsible for the choice of the required explosion prevention precautions.**

Troubleshooting Guide - After Filter

Fault	Possible causes	Remedies
"Mains" LED does not illuminate	Power supply not correct	Check power supply Compare with the voltage on the name plate
	Fuse defect	New fuse
Does not clean	Jumper not set	Set the jumper for the corresponding number of valves on the jumper strip (<i>Fig. 7 and 8</i>)
	Power supply not correct	Check power supply
	Δp Switch is ON without Differential pressure switch	Switch Δp Switch OFF
	Solenoid valves not correct	Check signal feed
		Check compressed air supply
Check the valve		
Insufficient fan performance on start-up	Fan motor incorrectly connected	Check the direction of rotation of the fan motor
Suction decreases	Too little compressed air	Compressed air available (3-4 bar)
	Strong powder build up or depositing	Check the filter elements
	Rotating jet nozzle damaged or stiff	Check the cleaning function
	Shut-off valve damaged or stiff	Contact an ITW Gema Service centre
Powder depositing on the clean air side	Filter elements leak	Check seating Check the filter elements for leaks/cracks Contact an ITW Gema Service centre
	Defect seal	Check, replace the filter elements, if necessary

Maintenance

On maintenance difficulties:

1. Switch off the plant
 - Clean filter elements in High Speed Run
 - Main switch (Switch cabinet) OFF
 - Disconnect compressed air supply
 - Empty compressed air tank (e.g. Start cleaning manually)
Empty the compressed air network of the booth:
To do this close the compressed air input valve and set the booth in operation and run so long until all compressed air is bled from the compressed air tank on the fan housing; the pressure gauge of the compressed air tank must read **0 (Zero)**.
2. Ensure that the plant *cannot* be switched on accidentally!!
3. Take the necessary safety precautions
4. Carry out the necessary maintenance
5. Set the plant in operation again
6. Observe the operation of the plant. Is normal operation achieved?

Inspection and Maintenance plan

Frequency	Aggregate / Component	Function	Measurable range
Weekly	After Filter	Visual check	
	On site compressed air maintenance unit	Visual check Drain water separator	
	Powder container, if necessary, 1x daily	Visual check, if necessary, empty*	
		<i>* with high powder volumes, check continually</i>	
Monthly	Filter elements	Check motor starting torque	> 6 Nm
	After Filter	Visual check Cracks Check the conductivity of all plant parts to each other	< 10 ⁶ Ω
Annually	Compressed air connections	Check	

Replacing Filter elements

1. Initiate High Speed Run cleaning (Clean the filter elements 2x).
2. Switch off all plant elements and ensure that they cannot be switched on accidentally.
3. Knock on the maintenance door with the flat of the hand so that the deposited powder falls down.
4. Allow the powder to settle for a few minutes then open the maintenance door.
5. Remove the residual powder with an industrial vacuum cleaner.
6. Unscrew the nut (2) with suitable spanner in the anticlockwise direction.
7. Remove the lower filter element (with the double centering ring) **vertically downwards**.
8. Remove the upper filter element by turning it (30°) in the anticlockwise direction from the locked position and **vertically downwards**.
9. Check that the rotating jet nozzles rotate easily.
10. Replace the new original filter elements (with the double centering ring) in the clockwise direction and screw on the nut (2), also in the anticlockwise direction.
11. Tighten the nut (2) with a suitable spanner to a medium torque (approx. 15 Nm).
12. The used filter elements must be disposed of in an environmentally friendly way.

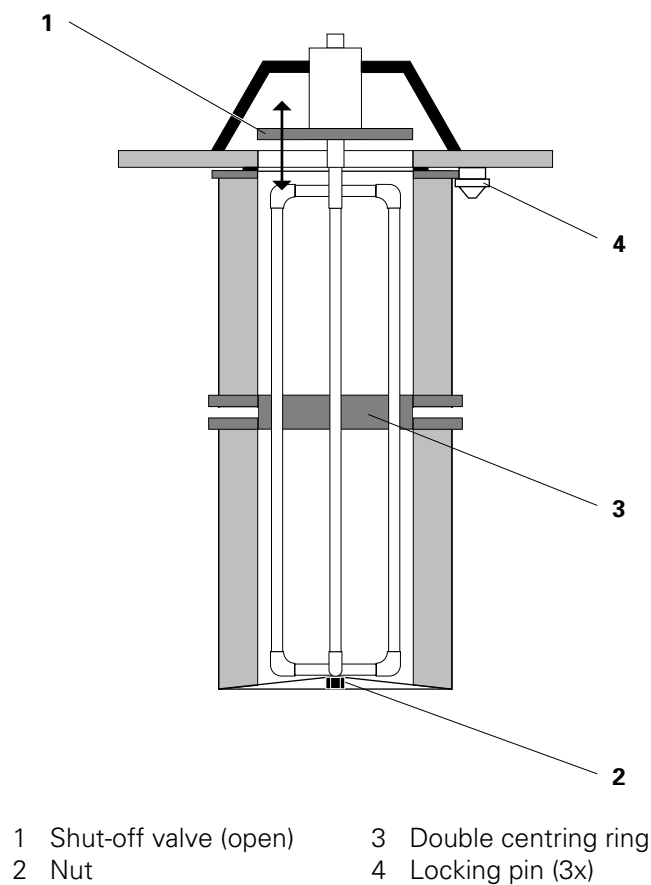
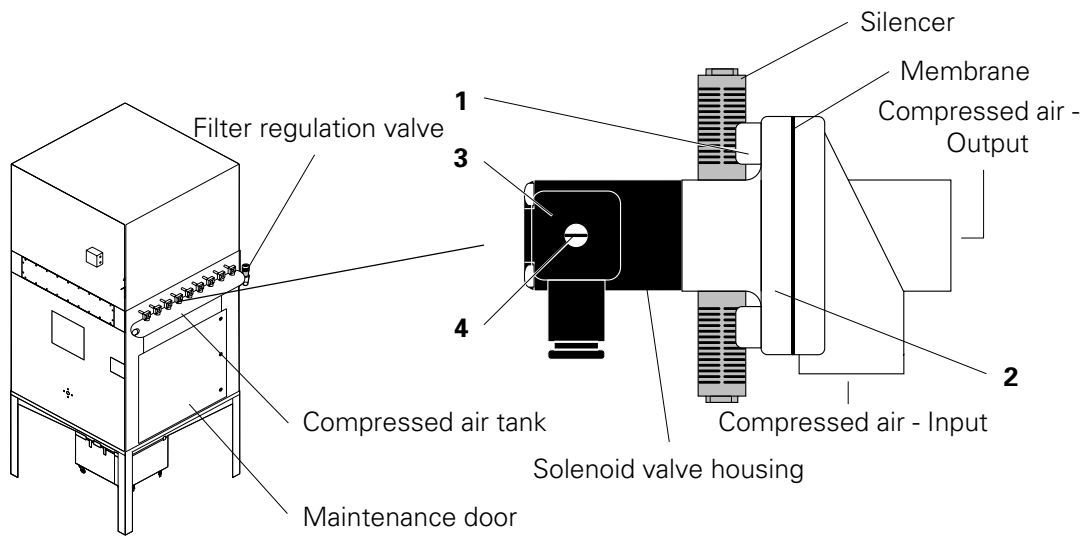


Fig. 10

Cleaning / replacing a solenoid valve



Solenoid valve, operated electromagnetically

Fig. 11

The solenoid valves for jet cleaning are found on the compressed air tank above the maintenance door (see Fig. 11 above). With faulty solenoid valves it is often sufficient to clean the visible part of the valve where the membrane is fitted. If the fault is not eliminated with this, then the solenoid valve must be replaced completely.

Procedure:

1. Close the filter regulation and bled the compressed air network of the booth.
Take precautions to prevent the Mains being switched on by accident!
Do not alter the cleaning pressure of the filter regulation!
2. Put the booth in operation and run it so long until all the compressed air is bled from the compressed air tank on the fan housing.
The pressure gauge on the compressed air tank must read **0** (Zero).
3. Switch off the booth and disconnect the Mains power supply.
4. Loosen the screw (**4** - Fig. 11 above) from the control cable plug (**3**) and remove from the defect solenoid valve housing.
5. Unscrew the screws (**1**) from the membrane holder (**2**).
6. Remove the solenoid valve with the valve plate and sealing ring.
Check if:
 - the membrane is cracked or swollen
 - the sealing surface of the tube, and/or the membrane are dirty
 - the spring is broken
7. Reassemble in the reverse order.
Before reassembling, coat the screw threads with "Locktite blue".
8. Tighten the screws (**1**) diagonally.
9. Replace all connections.
10. Open the compressed air input and check the functioning of the booth.

Spare Parts List

Ordering Spare Parts

When ordering Spare Parts for your powder coating equipment, we require the following information:

1. Type and Production No. of your powder coating equipment
2. Order No., quantity, and description of *each* part required

Example:

1. **Type** *After Filter* **Production No. :** *xxxx.xxxx*
2. **Order No.:** *246 573, 1 piece, T piece - 1/8"-ø 8-ø 8 mm*

When ordering cables and hoses the length required must always be given. These „Meter material“ spare part numbers are always marked with an *.

The wear parts are always marked with a #.

All dimensions of plastic hoses are given with the outside diameter, and then the inside diameter :

e. g. ø 8 / 6 mm = 8 mm Outside diameter / 6 mm Inside diameter.

After Filter with Powder recovery container

- | | | |
|---|--|------------|
| 1 | Solenoid valve (see also Fig. 18, page 24) | On request |
| 2 | Maintenance door seal | On request |
| 3 | Fan motor | On request |
| 4 | Exhaust filter pad | On request |

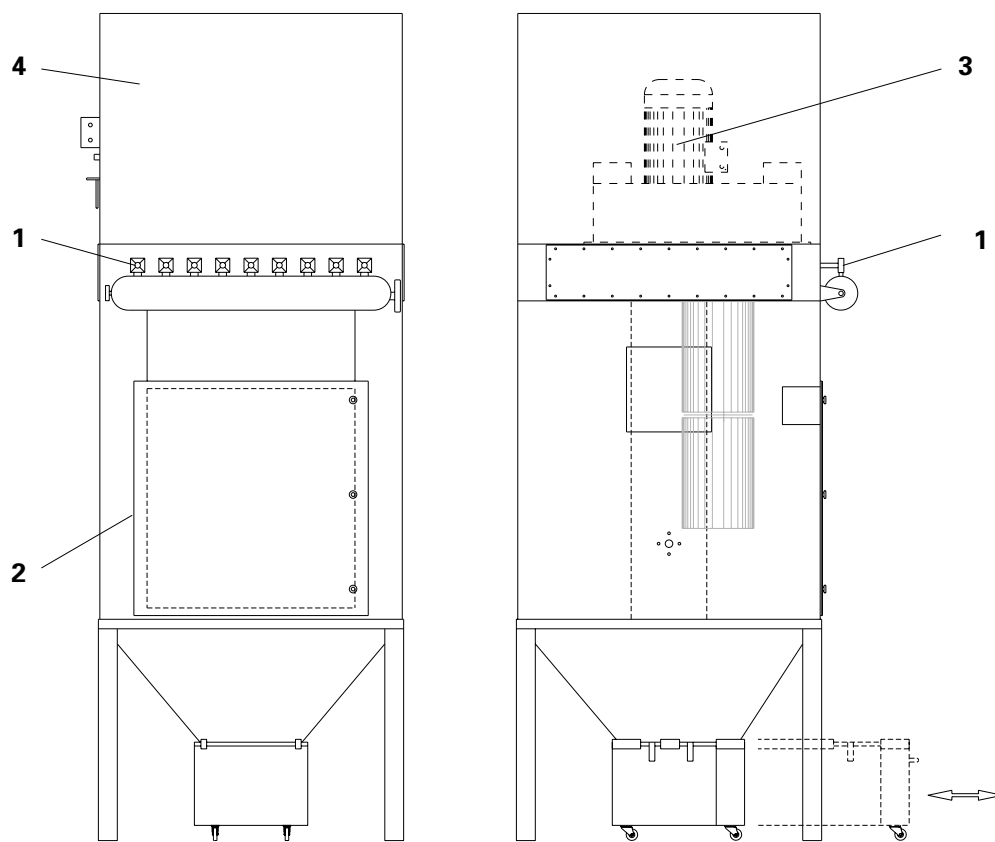


Fig. 12

After Filter with Powder recovery tray

- | | | |
|---|---|------------|
| 1 | Solenoid valves (see also Fig. 18, page 24) | On request |
| 2 | Maintenance door seal | On request |
| 3 | Fan motor | On request |
| 4 | Exhaust filter pad | On request |

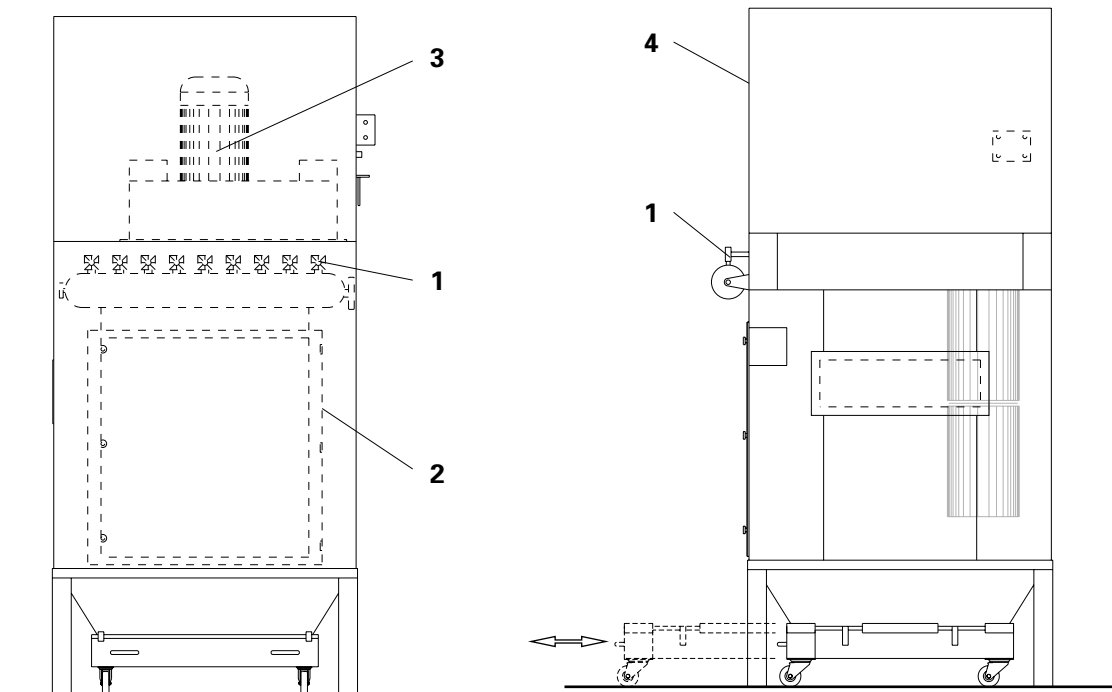


Fig. 13

Filter Unit

1	Shut-off valve (with Rotary jet nozzles) - complete	On request
2	Nut	On request
5	Filter cartridge (Upper and lower sections are identical - order individually)	011 649

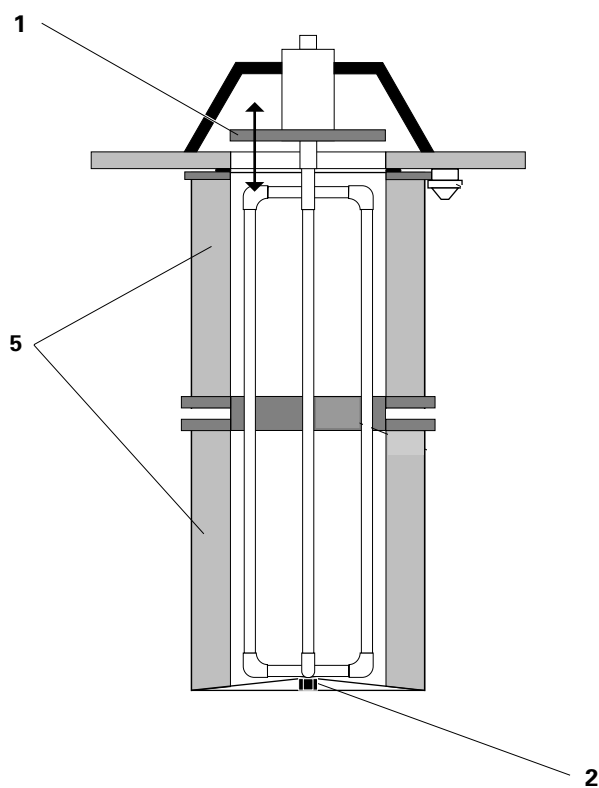


Fig. 14

Differential pressure display unit

1	Pressure gauge - 0-2.5 kPa - Filter	243 760
2	Pressure gauge - 0-5 kPa - Fan	243 779
3	Pressure switch - 0.75-5.6 kPa	243 744

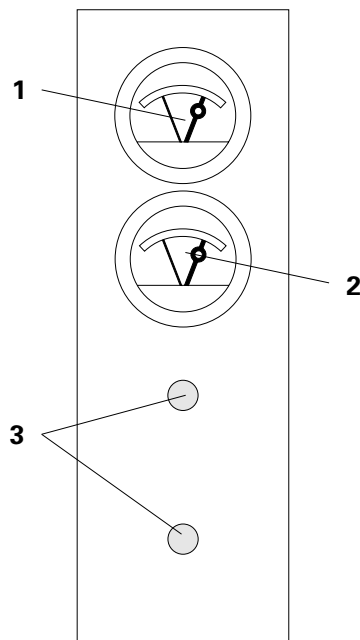
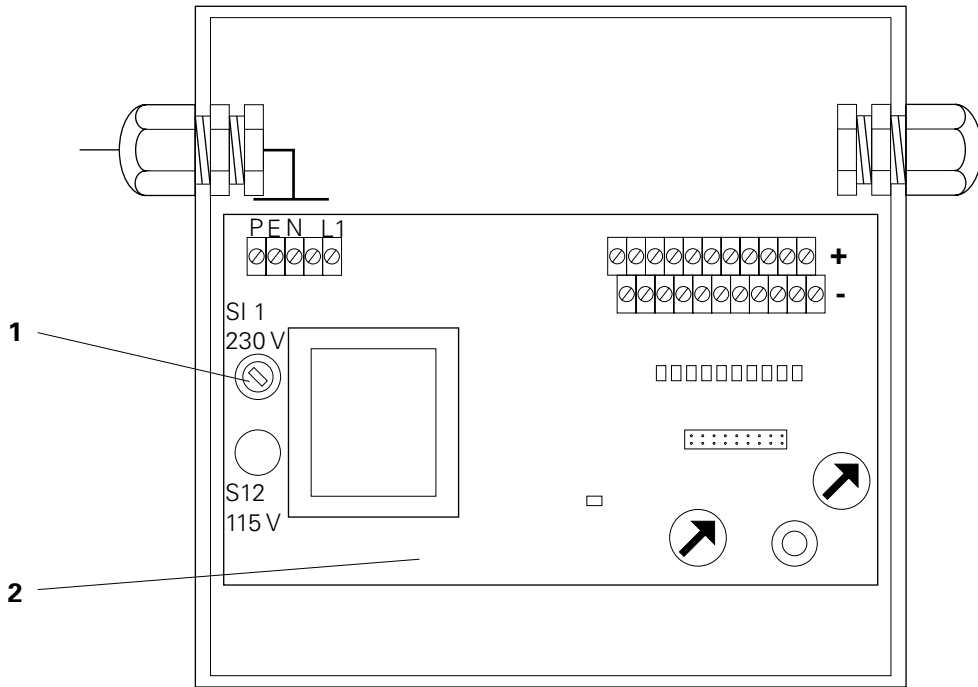


Fig. 15

MFS 04 / MFR 04 N Filter control

- | | | |
|---|---|------------|
| 1 | Printed circuit board - MFS 04 - complete | On request |
| | Printed circuit board - MFS 04 N - complete | On request |
| 2 | Fuse - 230 V. / 0.16 AT | On request |
| | Fuse - 115 V. / 0.25 AT | On request |
| 3 | Pressure switch (with MFR booths only) | On request |

MFS 04



MFR 04 N

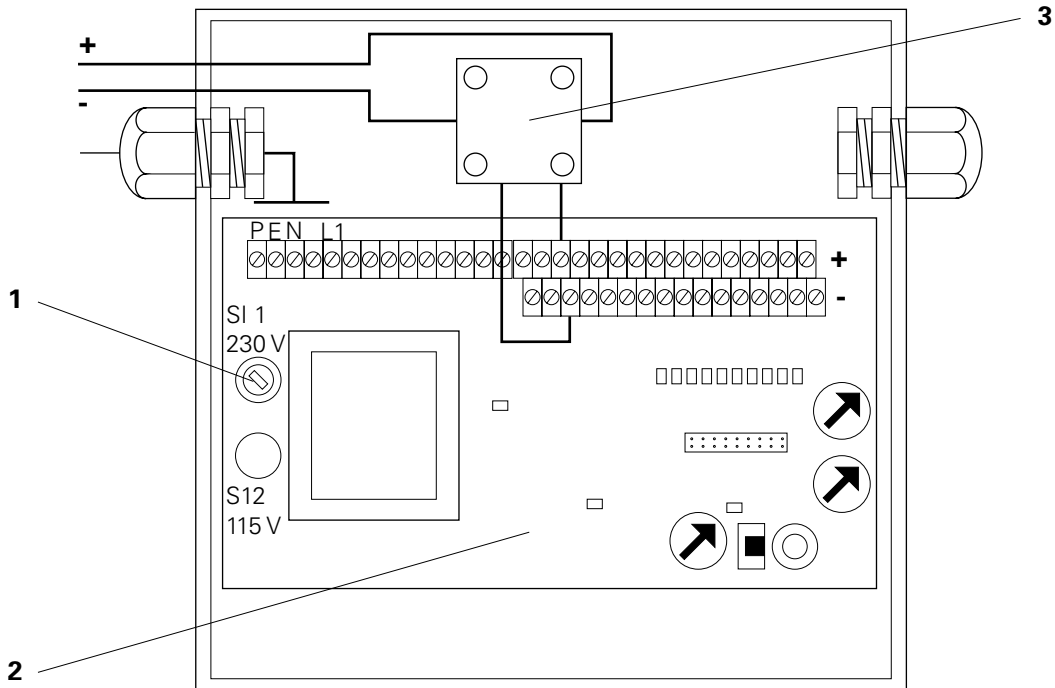


Fig. 16

MFS 08 Filter control

1 Printed circuit board - complete

On request

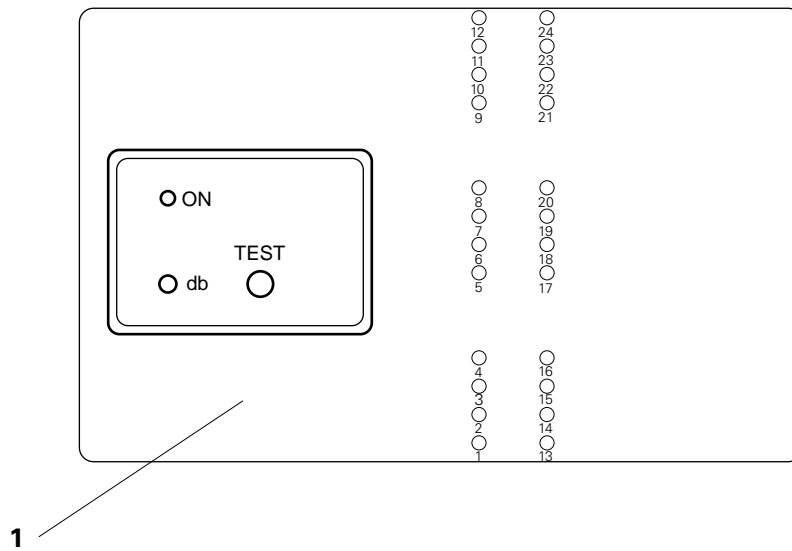


Fig. 17

Solenoid valve

- 1 Solenoid valve (with plug, without cable) - complete
- 2 Solenoid valve plug (without cable)

On request
227 919

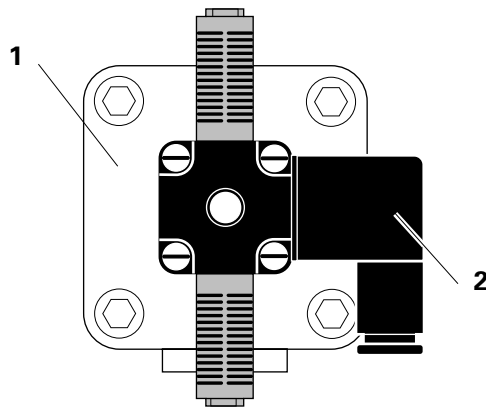


Fig. 18

NOTES:

Documentation After Filter

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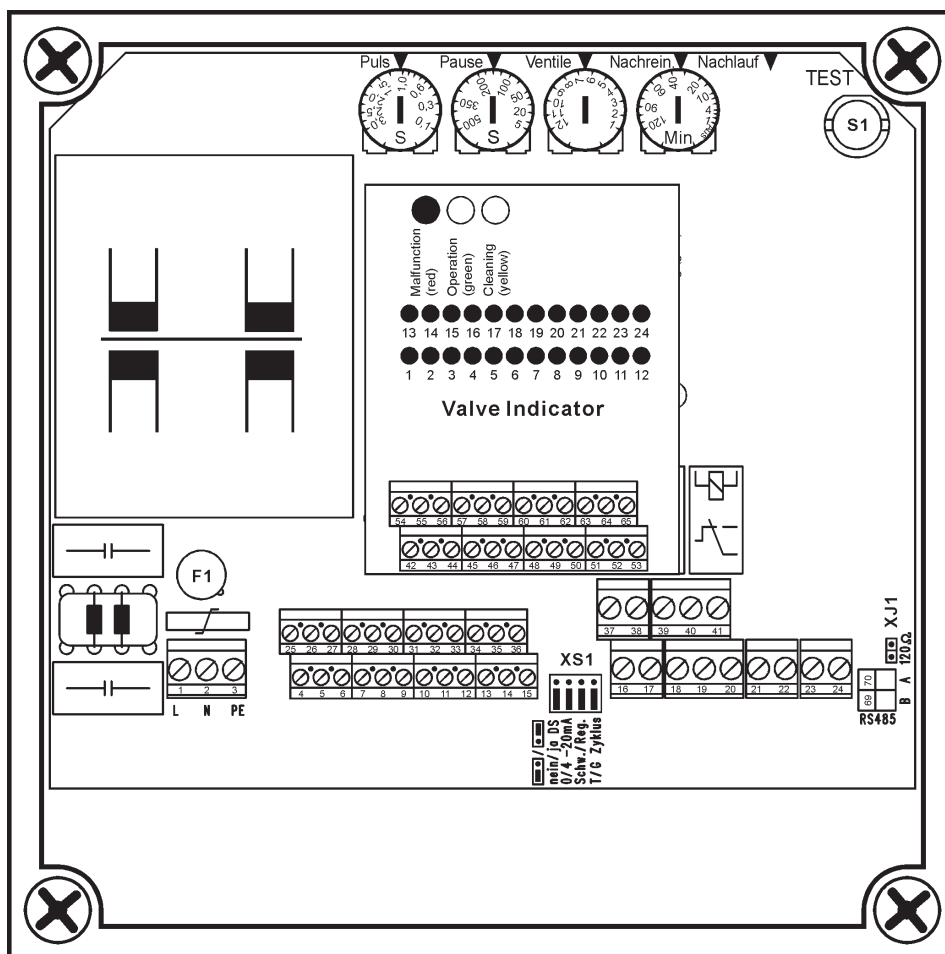
All technical products from ITW Gema AG are constantly being developed based on our continuing research and applications.

The data in this documentation may therefore change at any time without prior notice.

Printed in Switzerland

INSTRUCTION MANUAL

Filter - Controller TYPE MFS 05



List of Contents

INSTRUCTION MANUAL: MFS 05

Date: 22.7.99

S	General Safety Instructions	S
1	General Description	3
1.1	General	3
1.2	Option	3
1.3	Range of types	3
2	Installation and Housing	4
2.1	Instrument Dimensions	4
2.2	Power Supply	4
3	Filter Control Unit	5
3.1	Operating and Display Elements	5
3.2	Inputs	6
3.3	Outputs	6
3.4	Functions	7
3.4.1	Release / Stop (Post-cleaning)	7
3.4.2	Start / ΔP In	7
3.4.3	Rapid Cleaning	7
3.4.4	Malfunction Acknowledgement	7
3.4.5	Pressure Switch	8
3.4.6	Cleaning Message	8
3.4.7	Cleaning Cycle	8
3.5	Pause Control	8
3.6	Time Control	8
4	Connecting Diagram	10
5	Technical Data	11
Appendix		
A	Serial Interface RS 485	12
B	Set of instruments leads	13

General Safety Instructions

Instrument Safety

This instrument was built and tested according to production-specifications and was shipped in safe condition. The protection class mentioned in the operating instructions is applicable. In order to maintain this condition and to ensure a safe operation, the applicant must follow the hints and warnings given in these safety notes.

The instrument must be operated only by trained personnel. Maintenance and repair should be carried out only by trained, qualified personnel familiar with the relevant hazards.

The instrument may be operated within the specified environmental conditions (see data sheet) without impairing its safety.

The instrument is intended for mounting in an enclosure. Its contact safety is ensured by installation in a housing (switch cabinet, panel etc.).

Unpacking the Instrument

Remove instrument and accessories from the packing. Enclosed standard accessories: Operating notes or operating instructions for the instrument (if necessary, fixing elements). Check, if the shipment is o.k. and complete and if the instrument was damaged by improper handling during transport and storage.

One instruction manual will be attached to each shipment.



Warning!



Caution!

Mounting

In order to have a proper function each instrument has to be placed in dustfree and dry rooms, either in a panel or in the relevant socket of a 19-inch instrument carrier.

The ambient temperature at the place of installation should not exceed the permissible nominal operational temperature specified in the data sheet.

When mounting several instruments at high packing density, sufficient ventilation must be provided to ensure a correct function.

The sealing devices (e.g. sealing ring) required for the relevant protection type must be applied.

Two captive screws are provided at the instrument front for fixing the 19-inch module in the instrument carrier. Generally, the fixing elements delivered with the instrument must be applied.

The instrument may be mounted and operated only outside the explosion-hazarded area!

General Safety Instructions

Electrical Connections

All electrical wiring must conform to local Electrical Standards (e.g. VDE 0100 in Germany). The input leads must be kept separate from signal and mains leads. The protective earth must be connected to the relevant terminal (in the instrument carrier). In order to prevent electrical interferences, we recommend using twisted and screened cables. The electrical connections must be made according to the relevant connecting diagrams.

Commissioning

Before instrument switch-on, ensure that the advices and specifications given below are followed:

Ensure that the supply voltage corresponds to the specification on the instrument label.

All covers required for contact safety must be applied.

Before instrument switch-on, check if other equipment and / or facilities connected in the same signal loop is / are not affected. If necessary, appropriate measures must be taken. For instruments with protection class I, the protective earth must be connected with the relevant terminal in the instrument carrier.

The instrument may be operated only when mounted in its enclosure.

Operation

Switch on the supply voltage. The instrument is now ready for operation. If necessary, a warm-up time of approx. 15 min. should be taken into account.



Warning!

Any interruption of the protective earth in the instrument carrier can impair the instrument safety. Purposeful interruption is not permissible.



Warning!

If the instrument is damaged to an extent that safe operation seems impossible, shut it down and protect it against accidental operation.

Trouble Shooting

Before checking the instrument, all possibilities of error in other equipment and connections (input leads, wiring, equipment connected in the output circuit) should be checked. If the trouble cannot be located by checking these points, we recommend returning the instrument to the manufacturer.



Hint

Note that primary elements (especially thermocouples) connected to the energized transmitter are grounded in many cases, i.e. that the insulation resistance during operation can be reduced considerably. In these cases, additional connection to earth is not permissible.

General Safety Instructions

Shut-Down

For permanent shut-down, disconnect the instrument from all voltage sources and protect it against accidental operation.

Before instrument switch-off, check that other equipment and / or facilities connected in the same signal loop is / are not affected. If necessary, appropriate measures must be taken.

Maintenance, Repair and Modification

The instrument needs no particular maintenance.

Any instrument with electro-mechanical relays have a limited durability (ask for data-sheet).



Warning!

When opening the instruments, or when removing covers or components, live parts or terminals can be exposed.

Before carrying out such work, the instrument must be disconnected from all voltage sources. After completing such work, re-shut the instrument and re-fit all covers and components.

Check, if the specifications on the instrument label are correct!



When opening the instruments, electrostatically sensitive components can be exposed.

Therefore any checking or putting into operation of the instrument should be carried out at workstations which are protected against ESD.

Modifications, maintenance and repair may be carried out only by trained, authorized persons. Any repair or trouble-shooting by the applicant during the guarantee-period will result in losing the claim of guarantee. It is not permitted to operate or apply the instrument if the recommended specifications, warnings or conditions are not observed. If a default was found due to a blown fuse, the cause must be determined and removed. For replacement, only fuses of the same type and current rating as the original fuse must be used.

Using repaired fuses, or short-circuiting the fuse socket is inadmissible!

Explosion Protection

As this instrument is not intrinsically safe (Ex-proofed), it must not be operated in explosion-hazardous areas. Moreover, the circuits from and to the instrument / instrument carrier may not be taken into explosion-hazardous areas. No particular regulations for the intrinsically safe area are applicable.

Storage

The storage-room for the instrument must be dry, dustfree and free of vibrations. The range of the storage-temperature is 0 to 70 C°. Any direct UV-radiation to the instrument must be avoided.

Transport

If no other recommendations are mentioned in the instruction manual the packing material used should have the quality that no damage to the instrument will occur even if it drops from a height of 80 cm.

Right of modification reserved!

1 General Description

1.1 General

The filter control unit MFS 05 is used for pulse activation of solenoid valves in air pollution control systems.

The MFS 05 permits numerous controlling and monitoring functions.

Cleaning can be effected on either a time-controlled or differential pressure basis with switching thresholds or pause time control.

The valves are monitored to detect open or short-circuits. Optionally, the valve function can be checked mechanically by means of a pressure switch.

The MFS 05 is equipped with 1 relay 'operating / malfunction' and 1 relay 'cleaning message'.

1.2 Option

Extension card for valve extension 13 to 24 valves.

1.3 Range of types

	AC 230 V	DC 24 V
Standard	974.296.6	974.299.0
2 relay outputs	974.299.0	974.347.7

Valve extension 13 to 24 Valves 974.298.2

Pressure switch set 834.761.9

Set of instrument leads 834.198.4

2 Installation and Housing

The instrument should be installed in such a way that it is not exposed to moisture/humidity and dirt. It must also be ensured that the permissible maximum ambient temperature (50° C) is not exceeded. The device has to be protected against direct sunshine.

Electrical connections should be made in accordance with the relevant VDE (Verein Deutscher Elektrotechniker = Association of German Electrical Engineers) regulations and/or locally applicable regulations.

Power relays installed in the control cabinet should be interference-suppressed by means of RC-combinations.

The instrument features its own built-in mains filter. An additional external mains filter may be necessary if voltage transients occur.

2.1 Instrument Dimensions

Dimensions of the filter control unit MFS 05:

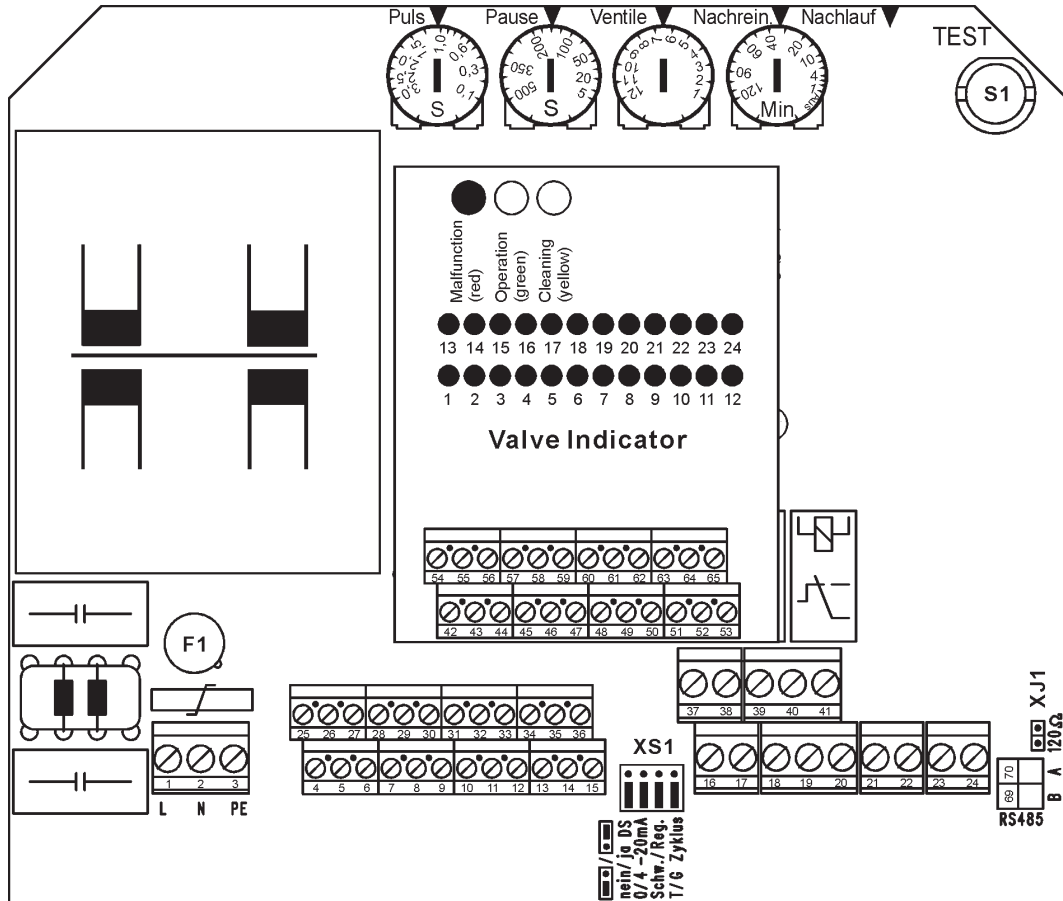
- Macrolon housing: 175 x 175 x 75 mm (w x h x d)

2.2 Power Supply

The MFS 05 is designed for mains operation at AC 230 V , 50 to 60 Hz or DC 24 V)

3 Filter Control Unit

3.1 Operating and Display Elements



- Potentiometer:** The time settings are divided logarithmically.
 - Pulse time: 0.1 ... 3.0 s
 - Pause time: 5... 500 s
 - Number of valves: 1...12 valves,
12 + 1...12 valves if the valve extension board is used.
 - If the number of valves is set between two valves, two adjacent valve LEDs flash !
 - Post-cleaning time: 1...120 minutes

- Jumper XS1:**

	i	!	XS1
Pressure switch	no	no <small>(Function not supported)</small>	nein / ja DS
Analog input	0-20 mA	4-20 mA	0 / 4-20 mA
Type of cleaning	Threshold (Schw.)	Control (Reg.)	Schw. / Reg.
Cleaning Cycle	Partial	Total (G)	T / G Zyklus

- **Push-button S1: ('Test')** Starts cleaning the next valve, terminates the pause of the current valve.
If 'total cycle' is selected, cleaning is carried out up to the last valve
- **LED indicators:**
 - Operation (green) or malfunction (red)
 - Cleaning (yellow)
 - Pulse indication for each valve (red)
- **Valve error indication:** The valve LED flashes.
Cause: short-circuit, breakage or error at mechanically valve function monitoring by means of a pressure switch.

3.2 Inputs

- **Analog:** Start or ΔP input 0(4)-20 mA
The analog signal is measured between terminal 17 + and terminal 18 - (GND). Terminal 16 can be used as an additional source of current (25 mA).
- **Digital:**
 - Release (contact closed) / Stop (contact open)
 - Rapid cleaning
 - Malfunction acknowledgement (signal from push-button)
 - Pressure switch for mechanically checking the valve function*The inputs are active if they are switched to ground (terminal 18 GND).*

3.3 Outputs

- **Valves:** 1...12 with DC 24 V / 1A (0,5 A)
(extendible to 1...24 valves)
- **Relays:** AC 250 V / 5 A
 - 1 SPDT for operating/malfunction message (fail-safe-circuit)
 - 1 SPST for activating the cleaning message



***The inputs are not potentially separated !
Provide an external potential separation, if required !***

3.4 Functions

3.4.1 Release/Stop (Post-cleaning)

The input releases activation of the valves. If the contact is open, cleaning is stopped and an automatic post-cleaning is started for the time adjusted with post-cleaning potentiometer.

If the function 'pause control' (XS1 = Regelung) is selected, the post-cleaning will be carried out with a fixed pause time of 30 s. Post-cleaning will not be carried out if the post-cleaning potentiometer is set to position 'OFF' ('AUS').

3.4.2 Start / Δp IN

The control system can operate in 2 operating modes. They are selected by means of the jumper 'XS1 Type of cleaning'.

1. Switching threshold: Cleaning is effected as long as the switching contact is closed, e. g. between the upper and the lower threshold of a ΔP controller.
2. Control: Cleaning is effected permanently with variable pause times.
→ cf. pause control

The (analog) input signal for cleaning can be connected externally:

- External signal: 'threshold' for type of cleaning (XS1) 'switching threshold'
'control' for type of cleaning (XS1) 'pause control'

A 0(4)-20 mA signal is required for controlling.
In order to serve as a 'switching threshold', the signal must be switched between 0(4) mA and ≥ 20 mA. Terminal 16 can be used as source of current for a switching contact.
The current output of a PLC can be used as an external signal.
The current output must be connected to terminal 17 + and terminal 18 - (GND).

3.4.3 Rapid cleaning

The signal 'rapid cleaning' is used for carrying out a cleaning cycle with a pause time of 8 s. Cleaning is effected as long as the switching contact is closed.

3.4.4 Malfunction acknowledgement

A signal at the input 'malfunction acknowledgement' restores a valve error message (LED and malfunction relay). When the cause of error has been eliminated, the error message is automatically removed (Mindestkontaktzeit 1 s).

3.4.5 Pressure Switch

This function is not supported. The Jumper XS1 have to be in the "Druckschalter nein" position.

3.4.6 Cleaning message

The message (LED and relay) is given at the beginning of a cleaning cycle (even if the push-button S1 Test is actuated). The message is reseted when the cleaning cycle is finished.

3.4.7 Cleaning Cycle

The cleaning cycle can be selected by means of the jumper XS1:

- 'Partial cycle' = Cleaning is effected as long as the start signal is active.
- 'Total cycle' = Cleaning is always executed up to the last valve.

3.5 Pause Control

The control system is able to carry out a ΔP -dependent pause control. This function is selected by means of the jumper XS1 'Regl'.

The operator selects an individual controller characteristic by means of the pause potentiometer. For controlling, the current differential pressure must be signalled to the control system as an analog signal. The signal can be made available externally as a 0(4)-20 mA signal at the terminals 17 + and 18 - (cf. also 'Start input').

The control system determines the current pause time from the current differential pressure and the selected characteristic curve.

When the differential pressure increases, the pause time is shortened; when the differential pressure decreases, the pause time is prolonged.

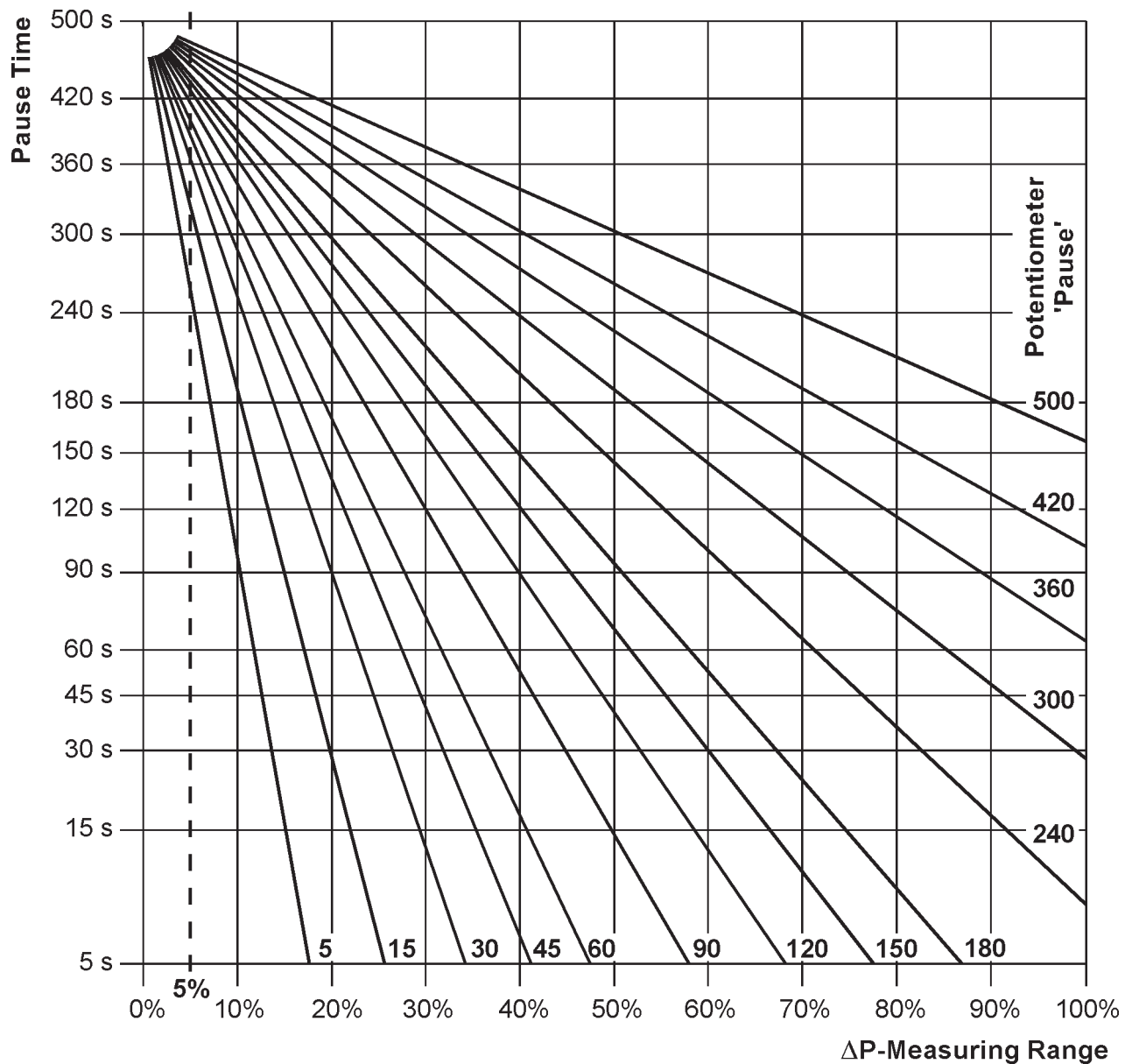
The variation of the pause time is not linear.

Cleaning is terminated when the differential pressure falls below approx. 5% of the measuring range.

3.6 Time Control

The time controlled cleaning will be started when the contacts 16 - 17 and 18 - 19 are closed.

Controller Characteristics



Example: The filter is to be cleaned at a differential pressure of 60% of the ΔP measuring range with a pause time of approx. 30 sec.

Selection of the characteristic curve: The intersection of the curves '60% of the measuring range' and '30 sec.' is on characteristic curve 150. The pause potentiometer is set to 150 sec.

The control system controls the pause time along characteristic curve 150. The cleaning capacity is increased progressively due to the shape of the characteristic curve. Additionally, a larger amount of dust per impulse is cleaned if the differential pressure is higher (= higher resistance of filter).

For shorter pause times, the capacity of the pneumatic system must be considered.

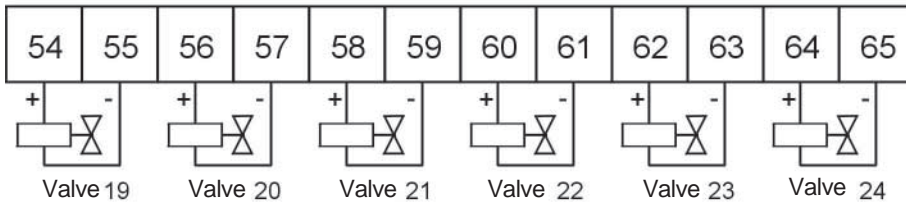
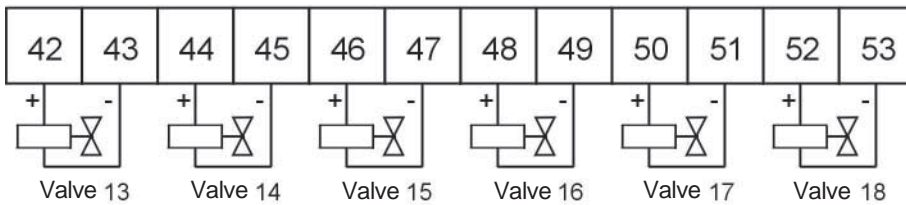
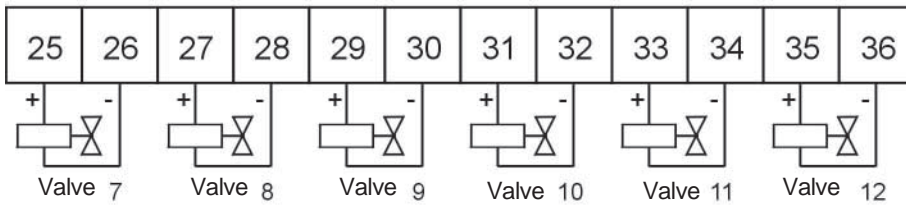
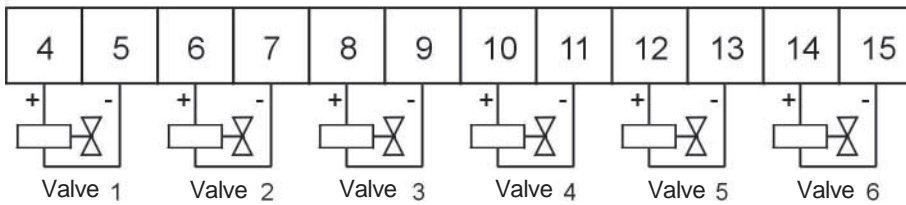
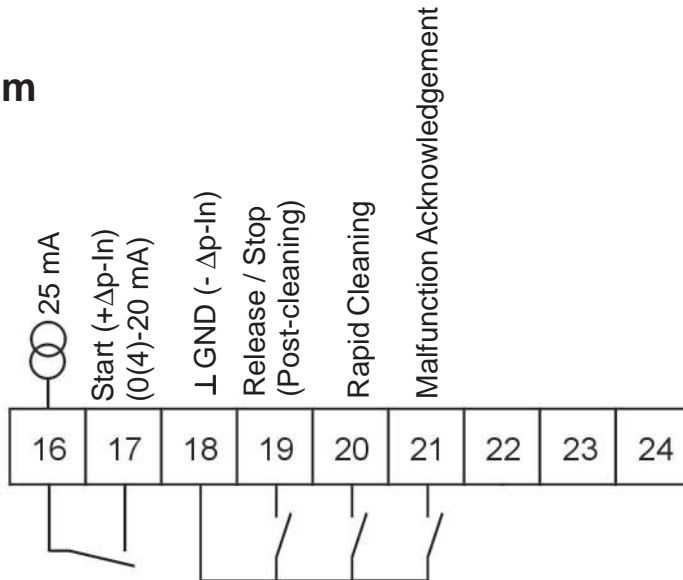
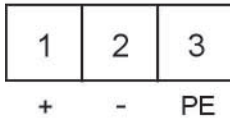
Connecting Diagram

4 Connecting Diagram

AC 230 V

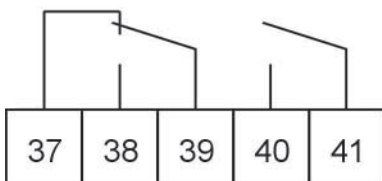


DC 24 V

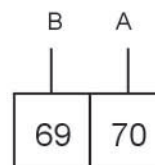


Valve extension

Malfunction/ Operating Cleaning



RS 485



5 Technical Data

Inputs:	<ul style="list-style-type: none">• Start- or ΔP-input 0(4)-20 mA• Release (contact closed) / Stop (contact open)• Rapid cleaning• Malfunction acknowledge (pulse signal)• Pressure switch for mechanically valve function monitoring	
Valve outputs:	12, extendible to 24	
Valve voltage:	24 V DC $\pm 10\%$	
Valve current:	1 A at a pulse time ≤ 1 s and a pause time of \geq the pulse time, otherwise 0,5 A	
Relay outputs:	250 V AC / 5 A, <ul style="list-style-type: none">• 1x SPDT for operating signal or malfunction signal (fail-safe)• 1x SPST for triggering of signal for cleaning	
Power supply:	AC 230 V, 50-60 Hz	DC 24 V
Tolerance:	$\pm 10\%$	$\pm 10\%$
Main fuse:	0.315 A, slow reaction	3.15 A, slow reaction
Power consumption:	30 VA	42 W
LED indicators:	<ul style="list-style-type: none">• Operation (green)• Cleaning (yellow)• malfunction (red)• Pulse indication for each valve (red)	
Electrical connection:	screw-type terminal strips 2.5 mm ² , valve connections 1.0 mm ²	
Ambient temperature:	0...50 °C	
Humidity:	$\leq 75\%$ rel. humidity, no condensation	
Housing:	dust-tight macrolon housing (IP65) with PG flange, without PG screw-type joints (max. 3 x PG 21 possible), 175 x 175 x 75 mm (w x h x d)	

Subject to technical alterations !

A.1 Serial Interface RS 485

The valve control unit provides a serial interface. The actual settings of the instrument can be sent e. g. to a PC via this serial interface.

Data format: 1 start bit, 8 data bits, no parity, 1 stop bit

Baudrate: 19200 Baud

Protocol: For data query 1 byte ('A', 'B', etc.) is sent to the valve control unit. The valve control unit responds with 1 Word (16-Bit). The reply must be converted into the corresponding unity by the PC.

Connection: Terminal 69: RS485-B
Terminal 70: RS485-A

	Request	Reply	Description	Unit	Remark
20 mA-input	"A" 65hex	0-1020	x / 45	mA	Start input
Configuration	"B" 66hex	0-1020	not possible, see programm version		
Configuration2	"C" 67hex	0-1020	nicht möglich, siehe Programmversion		
Pulse	"D" 68hex	0-1020	$((x \text{ div } 4)^2 \text{ div } 44) * 2 + 100) / 1000$	s	
Pause (Poti)	"E" 69hex	0-1020	$((x \text{ div } 4)^2 \text{ div } 64) + 10) / 2$	s	
Valves	"F" 70hex	0-1020	$(x+46) / 92 + 0.5$		
Post-cleaning	"G" 71hex	0-1020	$((x \text{ div } 4)^2 \text{ div } 53) / 10$	min.	<1 minute = off
Follow-up time	"H" 72hex	0-1020			
Delta-P	"I" 73hex	0-1020	x/204	V	0 - 5 V = measuring range
Inputs	"J" 74hex	0-31	2 ⁰ = Release 2 ¹ = Rapid cleaning 2 ² = Malfunction acknowledgem. 2 ³ = Pressure switch 2 ⁴ = Push-button 'Test'		
Program version	"K" 75hex	16000	$(x \text{ div } 32) / 100 + 45$ 2 ⁰ = 4 mA 2 ¹ = Pressure-switch 2 ² = Pressure-switch version 2 ³ = Total cycle 2 ⁴ = Controller		
Act. pause time	"L" 76hex	20-2052	x/4	s	
Valve error	"M" 77hex	0-248	2 ⁰ -2 ⁴ = Valve 2 ⁵ = Disconnection 2 ⁶ = Over-current 2 ⁷ = Pressure monitoring		
	other signs	32000			unknown request

Note: div = integer division without modulo

B Set of instrument leads

Ident-Nr. 834.198.4

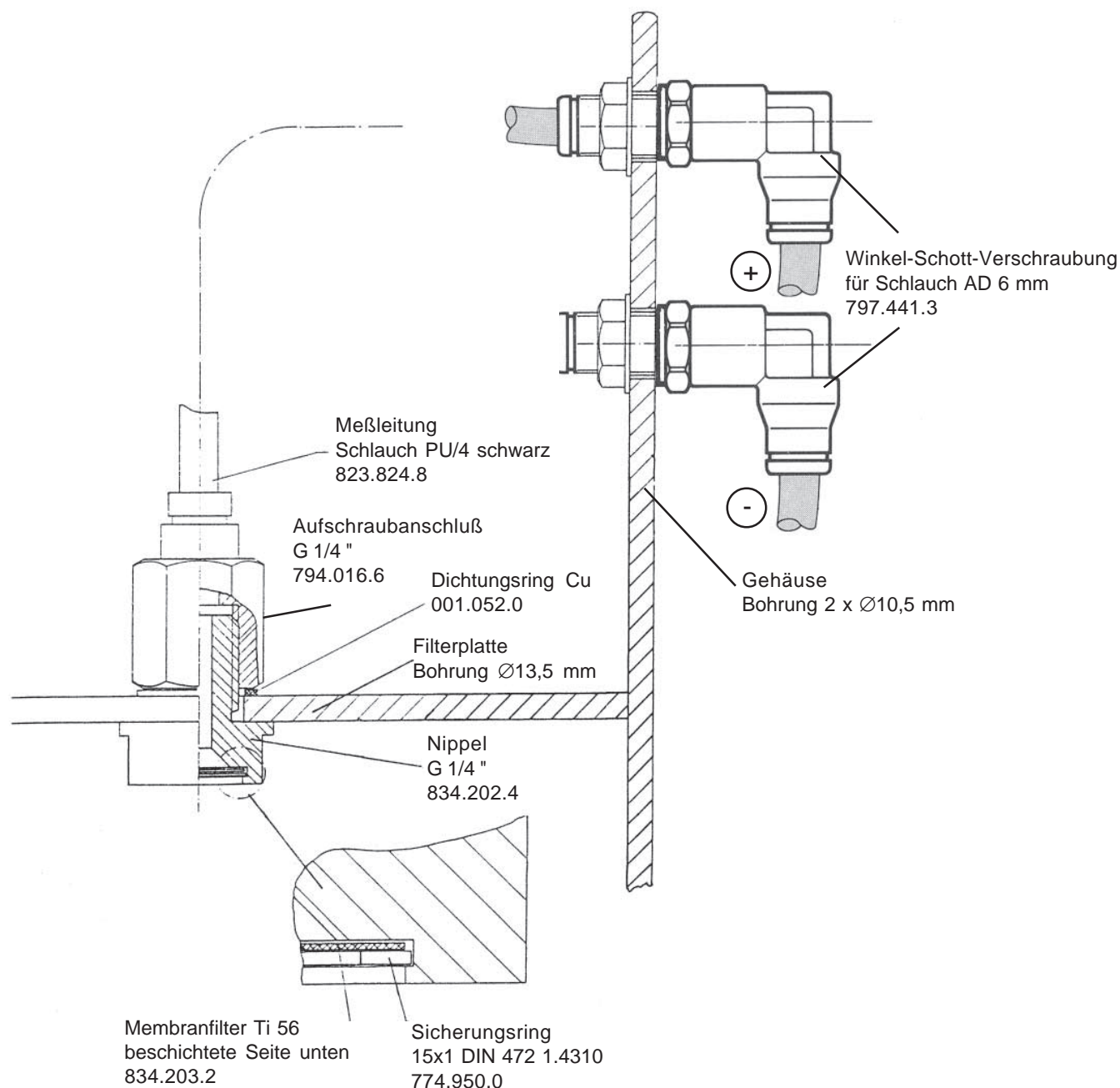
Zur Messung des Differenzdruckes wird der eingebaute Sensor mittels Meßleitungen mit den Meßstellen vor und nach der Filterplatte verbunden. Die Meßleitung soll an geschützter Stelle knickfrei so verlegt werden, da sich kein Kondensat sammeln kann. Bei vorhersehbarer Kondensatbildung ist bauseits eine Kondensatfalle vorzusehen.

Die rohgasseitige Meßleitung wird durch einen Membranschutzfilter vor eindringenden Staubpartikeln sicher geschützt. Ein Staubschutz der Reingasleitung ist im Regelfall nicht erforderlich.

 Undichte oder verschmutzte Leitungen führen zu Meßfehlern und Betriebsstörungen.

Note

Montageskizze und Ersatzteile



Appendix C

Einbauhinweise für Druckschalterset

C Einbauhinweise für Druckschalterset Ident-Nr. 610.965.6

