Special Documentation
MARSIC300

Ship Emission Measuring Device
Maintenance

Endress+Hauser
People for Process Automation

Described product

MARSIC300

Manufacturer

Endress+Hauser SICK GmbH+Co. KG
Bergener Ring 27
01458 Ottendorf-Okrilla
Germany

Legal information

Original document

This document is an original document of Endress+Hauser SICK GmbH+Co. KG.

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Contents

1 About this document

1.1 Function of this document

This document is an Addendum to the MARSIC300 Ship Emission Measuring Device Operating Instructions.

It supplements the Operating Instructions with all important information required for device maintenance that deviates from the Operating Instructions.

1.2 Target group

This document is intended for technicians (persons with technical understanding) who maintain the measuring system.

Requirements for the maintenance personnel

- The technician must be familiar with the exhaust gas technology of the operator's plant (overpressure, toxic and hot sample gases) and be able to avoid hazards when working on gas ducts.
- The technician must be familiar with handling compressed gas cylinders (test gases).
- The technician must be able to avoid hazards caused by noxious test gases.
- The technician must be familiar with gas lines (PTFE lines) and their screw fittings (be able to ensure gas-tight connections).
- Only allow an authorized electrician to work on the electrical system or electrical subassemblies.

1.3 Further information

- Operating Instructions MARSIC300
- Technical Information MARSIC300
- Operating Instructions SFU Gas Sampling System
- Operating Instructions Sample Gas Line
- System documentation
- Short instructions for MARSIC300
- Safety information (for analyzer devices)

1.4 Symbols and document conventions

1.4.1 Warning symbols

Table 1: Warning symbols

Symbol	Significance
	Hazard (general)
	Hazard by electrical voltage
	Risk of explosion
	Hazard by acidic substances
	Hazard by noxious substances

Symbol	Significance
	Hazard by high temperature
	Hazard for the environment/nature/organic life

1.4.2 Warning levels / Signal words

DANGER

Risk or hazardous situation which will result in severe personal injury or death.

WARNING

Risk or hazardous situation which could result in severe personal injury or death.

CAUTION

Hazard or unsafe practice which could result in less severe or minor injuries.

Notice

Hazard which could result in property damage.

Note

Hints

1.4.3 Information symbols

Table 2: Information symbols

Symbol	Significance
	Important technical information for this product
	Important information on electric or electronic functions

2 Safety information

- This document is only valid in conjunction with the documentation listed in Section 1.1. Read and observe the safety instructions and warnings contained therein.
- Only maintain the device when this document and the Operating Instructions have been read and understood. Contact Endress+Hauser Service if you have any questions.
- Refer to the device's Declaration of Conformity for the applicable standards and directives.
- Keep this document, together with the Operating Instructions, available for reference and pass these on to a new owner.

3 Maintenance

3.1 Maintenance plan

NOTICE
This Maintenance plan describes the maintenance work specified by the manufacturer.
Inspections according to guidelines to be applied by the operator (e.g. MARPOL Annex VI) shall be carried out according to the intervals described therein.

NOTE
Spare parts list: see "Consumable, wearing and spare parts", page 13

Table 3: Maintenance intervals

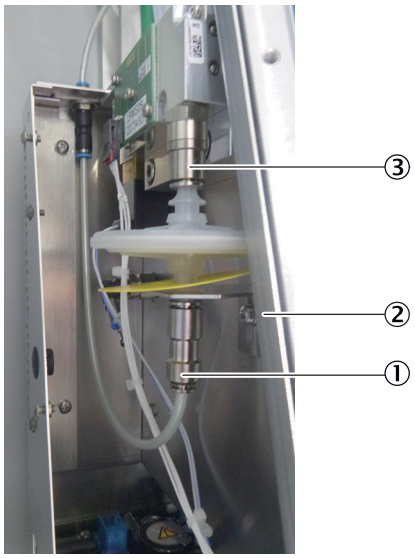
Interval[1)]	Maintenance work	Remark
1 W	Check pending messages (control unit).	See Operating Instructions, Section 12.1
	Check the system	See Operating Instructions, Section 8.3
	Gas sampling unit • Check the gas sampling filter by checking the gas flow on the analyzer display. • Replace the gas sampling filter if the gas flow shown in measuring mode <120 l/h.	See Operating Instructions, Section 8.6
1 M	Analyzer cabinet • Check the filter pads. • Clean or replace the filter pads as necessary.	See Operating Instructions, Section 8.5
	• Check the exhaust hose to see if blocked or kinked. • Clean or replace the exhaust hose as necessary.	See Operating Instructions, Section 3.3.4, Fig. 5, position ⑧ See Operating Instructions, Section 8.1.2
3 M	Conditioning of instrument air: Option FRL-SF0025 without using pre-filter • Replace carbon filter.	See Operating Instructions, Section 8.4
6 M	Gas sampling unit • Replace the gas sampling filter. <120 l/h.	See Operating Instructions, Section 8.6
	Electronics module • Replace the filter pad.	see "Replacing the Electronics module filter pad", page 11
	Perform a leak tightness check.	See Operating Instructions, Section 8.12

Interval[1]	Maintenance work	Remark
1 Y[2]	**Gas sampling unit** • Replace the non-return valve. • Clean the probe tube. • Clean the sample gas line. • Clean the housing.	See Operating Instructions, Section 8.6
	Electronics module • Replace the water trap.	see "Replacing the water trap", page 9
	Analyzer cabinet • Replace the exhaust gas hose.	See Operating Instructions, Section 3.3.4, Fig. 5, position ⑧ See Operating Instructions, Section 8.1.2
	Analyzer cabinet • Check setting of pressure reducer module.	See Operating Instructions, Section 8.8
	Maintain the instrument air conditioning.	See Operating Instructions, Section 8.4
	Check H_2O correction.	Training required[2]
	Check the reference energy.	Training required[2]
	Check Modbus communication to the customer.	see "Checking Modbus communication", page 9
	Save device data.	See Operating Instructions, Section 7.4.6
	Complete Service Report and Checklist.	
2 Y[2] [3]	**Analyzer cabinet** • Replace the filter pads	See Operating Instructions, Section 8.5
	Measuring cell • Replace the cell inlet filter. • Replace the non-return valve. • Replace expendable and wearing parts.	See Operating Instructions, Section 8.9 See Operating Instructions, Section 8.10 Training required[2]
	Photometer • Replace the light source • Replace the drying agent.	See Operating Instructions, Section 8.11 See Operating Instructions, Section 8.7
	Ejector module • Replace expendable and wearing parts.	Training required[2]

1) 1 D = Daily, 1 W = Weekly, 1 M = Monthly, 3 M = Every 3 months, 6 M = Every 6 months, 1 Y = Yearly, 2 Y = Every 2 years
2) Maintenance must be performed by Endress+Hauser Service, service partner or certified customer.
3) Include all annual maintenance activities as well.

3.2 Replacing the water trap

Overview



① Retaining ring, hose connection
② Screws
③ Retaining ring, water trap

Prerequisites

- Analyzer in “Stand-by”
- System flushed for 10 minutes
- Electronic module housing removed

Procedure

On the water trap

1. Remove the hose connection (DN 2/4) by pressing retaining ring ① on the hose connection down.
2. On the bracket: Loosen screws ②.
3. Press retaining ring ③ at the top of the water trap down.
4. Slide the water trap with bracket down and remove.
5. Remove the water trap from the bracket by pressing the bracket down onto the connection.
6. Note the date of installation on the new water trap.
7. Insert the new water trap together with the bracket into the connection.
   NOTICE | Observe the flow direction of the water trap. Labeling “GAS-IN” must point upwards.
8. Mount the water trap with “GAS-IN” facing upwards.
9. Push the bracket upwards and tighten the screws.
10. Reattach the hose connection.

Finishing work

1. Reattach the electronic module housing.
2. Reset stand-by and maintenance signal.

3.3 Checking Modbus communication

Prerequisites

- Modbus simulation must be available.

Procedure

Open Modbus simulation

1. Menu: Parameterization → Select Formulas
2. Mark formula **Modbus Simulation**.
3. Press [Edit].

✓ Window **Formulas** opens.

Adjust formula

1. Mark **Initial activation**.
2. Select and change values to be checked.
   Example: “rv1 = 10 ; rv2 = 20 ; rv = 30”
3. Press [Save].

Check changes

1. Menu: Parameterization → Select Formulas.
2. In formula **Modbus Simulation**: Check whether the new values are displayed.
3. The values of the new formula are displayed on one of the Measuring Screens.
4. Swap the register when the values were not transferred correctly.

In case of incorrect transfer, swap the register

1. Menu: Parameterization → Select Modbus.
2. **Register Swap**: Use the drop-down list to change the register sequence.
   Example: Instead of (AB_CD) → Select (CD_AB).
3. Press [Activate configuration].

3.4 Cell inlet filter maintenance

NOTICE

Device damage through work on the device when hot.

The cell can be damaged when the screws on the cell inlet filter are unscrewed while hot.

► Allow the device to cool down.
► Only unscrew and remove the screws when cold.

Procedure

► See Operating Instructions, Section 8.9

3.5 Replacing the Electronics module filter pad

Overview

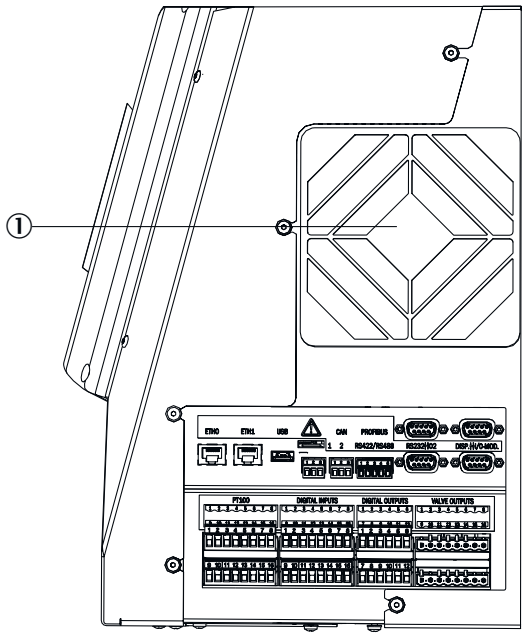


Figure 1: Electronic housing (right side)

Important information

NOTICE
Dirt can get into the device when replacing the filter pad.

► Only replace the filter pad when the device is switched off.

Prerequisites

- The device is switched off.

Procedure

1. Pull cover ① off.
2. Replace the filter pad inside.

3.6 Reference energy

NOTICE
Reference energy must not be reset **without checking**. Details will be explained during a training session.

4 Troubleshooting

4.1 Replacing the Electronics module

NOTE
The old SD card can only be used when the firmware versions of the old and new device are identical.

Procedure

► See Operating Instructions, Section 9.14

5 Consumable, wearing and spare parts

5.1 Housing

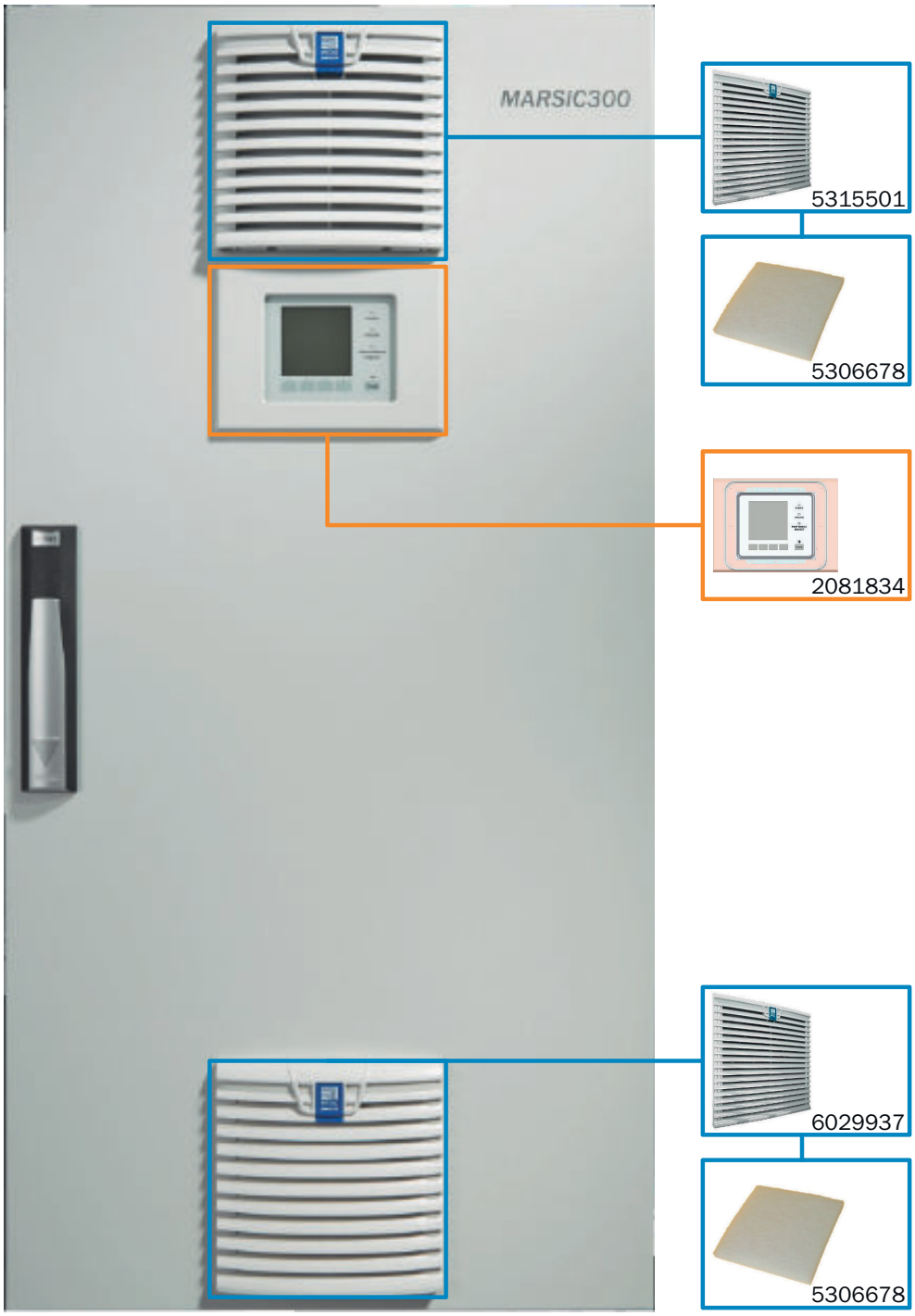


Figure 2: Overview, exterior

Table 4: Spare parts, housing

Description	Part No.
Display module, complete	2081834
Filter fan, 230 V	6029937
Filter pad, 173 mm x 173 mm	5306678
Cabinet outlet filter, 204 mm x 204 mm x 30 mm	5315501

5.2 Analyzer

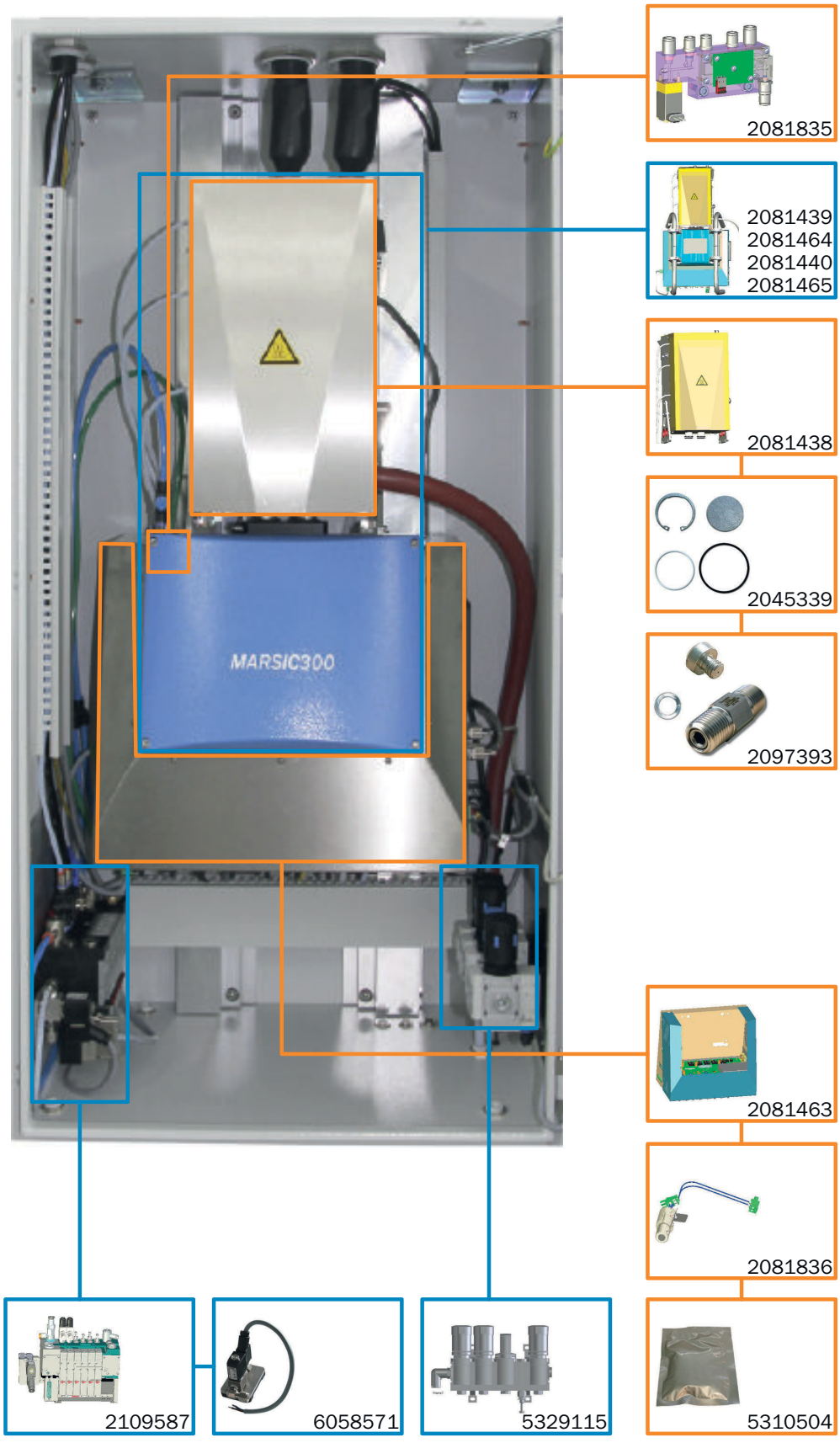


Figure 3: Overview, interior

Table 5: Analyzer spare parts

Description	Part No.
Spare analyzer, “Emission”, calibrated	2081439
Replacement analyzer, “Emission”, calibrated	2081464
Spare analyzer, “DeSOx”, calibrated	2081440
Replacement analyzer, “DeSOx”, calibrated	2081465
Long path cell, complete	2081438
Electronics module, complete	2081463
Pressure control module, complete	2081835
Light source, incl. connection cables and drying agent sachet	2081836
Drying agent sachet	5310504
Pressure reducer module, complete	5329115
Valve block, complete, incl. test gas valve	2109587
2/2-way solenoid valve for test gas	6058571
Maintenance kit, “Cell input filter	2045339
Non-return valve, cell filter, incl. nozzle and spring washer	2097393
Hose kit, material PTFE, incl. fitting material	2114206
Maintenance kit for annual maintenance	2107123
Maintenance kit for two year maintenance	2107124

5.3 Gas sampling unit, SFU

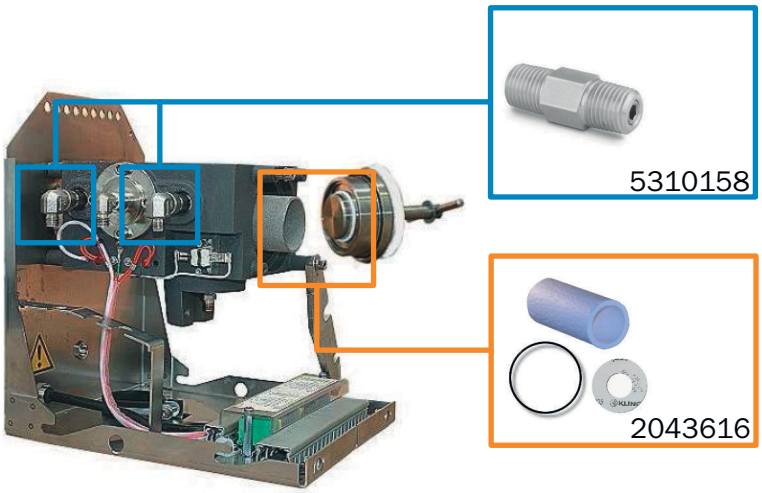


Figure 4: Overview, gas sampling unit, SFU

Table 6: Spare parts, gas sampling unit, SFU

Description	Part No.
Non-return valve	5310158
Maintenance kit, “Gas sampling filter”	2043616

5.4 Accessories for external instrument air conditioning, FRL-SF0025

Part No. 5320896

Figure 5: Overview, instrument air conditioning

Table 7: Spare parts, instrument air conditioning

Description	Part No.
External instrument air conditioning, FRL-SF0025, complete incl. pre-filter	5320896
Filter element kit, for instrument air conditioning (5320896)	5327075
Activated coal element, for instrument air conditioning (5320896)	5341738
Activated carbon filter, complete with sight glass, for instrument air conditioning (5320896)	5342518
Replacement filter glass, with O-ring, for pre-filter PE and ultra-fine filter SMF	5342744
Pressure gauge, connection G 1/2″	5342228
Prefilter for oil mist separator for FRL-SF0025	2082301
Maintenance kit, “Pre-filter DF-S 0035 SP (2082301)”	5341430
Filter element, “UltraPleat-S”	5332124

5.5 Accessories for external instrument air conditioning, SPN0024

Part No. 6070177

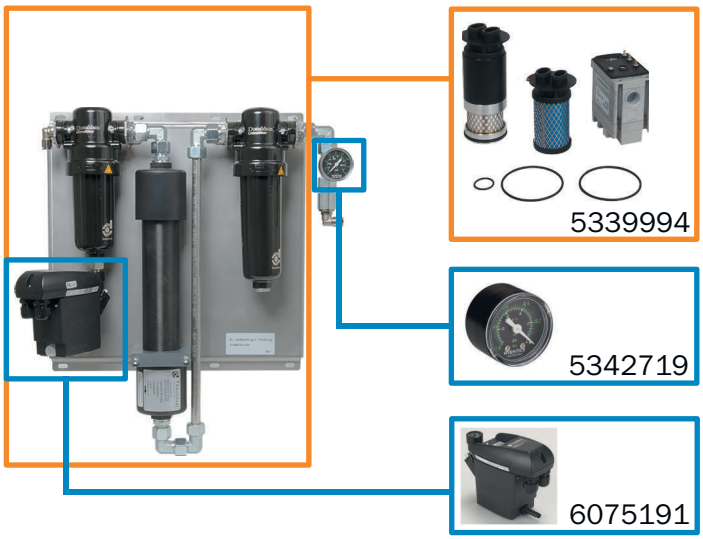


Figure 6: Overview, instrument air conditioning

Table 8: Spare parts, external instrument air conditioning

Description	Part No.
External instrument air conditioning, SPN0024, complete	6070177
Maintenance kit, “Instrument air conditioning (6070177)”	5339994
Condensation trap, UFM-D05	6075191
Pressure gauge, connection G 1/4″	5342719

5.6 Sample gas lines and accessories

Table 9: Spare parts, sample gas lines and accessories

Description	Part No.
Heated sample gas line 1 m, 115 V	6035901
Heated sample gas line 5 m, 115 V	6035905
Heated sample gas line, 10 m, 115 V	6035910
Heated sample gas line, 15 m, 115 V	6035915
Heated sample gas line, 20 m, 115 V	6035920
Heated sample gas line, 25 m, 115 V	6035925
Heated sample gas line, 30 m, 115 V	6035930
Heated sample gas line, 35 m, 115 V	6035935
Intermediate lengths up to 35 m, 115 V	60359XX[1)]
Heated sample gas line, 1 m, 230 V	6031101
Heated sample gas line, 5 m, 230 V	6031105
Heated sample gas line, 10 m , 230 V	6031110
Heated sample gas line, 15 m, 230 V	6031115
Heated sample gas line, 20 m, 230 V	6031120
Heated sample gas line, 25 m, 230 V	6031125
Heated sample gas line, 30 m, 230 V	6031130
Heated sample gas line, 35 m, 230 V	6031135
Intermediate lengths up to 35 m, 230 V	60311XX[1)]
Hose bundle line, sold by the meter	6058443

Description	Part No.
Hose, outer Ø 6 mm, inner Ø 4 mm, length 10 m, material PTFE	2099754
Hose, outer Ø 10 mm, inner Ø 8 mm, length 10 m, material PTFE	2099756

1) XX = length in meters

5.7 Installation sets

Table 10: Spare parts, installation sets

Description	Part No.
Installation set (included in MARSIC300): • Tool for hose fitting/removal • Drying agent sachet • Sealing plugs, 6 mm, 8 mm, 10 mm • Silicon hose, 12 x 6 mm • Plug cap, 10 mm • Cable ties	2081755
Hose kit, material PTFE, incl. fitting material • 2 m hose, outer Ø 6 mm, inner Ø 4 mm, material PTFE • 5 m hose, outer Ø 10 mm, inner Ø 8 mm, material PTFE • Hose cutter • 2 x cap nuts, clamping rings, support sleeve, 6 mm • 1 x cap nut, clamping rings, support sleeve, 10 mm	2081839
Screw fitting kit, Swagelok®, 6 mm	2075791
Screw fitting kit, Swagelok®, 6 mm, 8 mm, 10 mm, 12 mm	2099753
Hose cutter, for hoses with outer Ø 4 mm ... 14 mm, material plastic	5329980

Table 11: Installation kits for accessories

Description	Part No.
HovaCAL light	6075033
Accessory kit, HovaCAL light	2118334

6 Technical data

6.1 Connections in analyzer

Power supply

The power supply is located on the left on the analyzer.

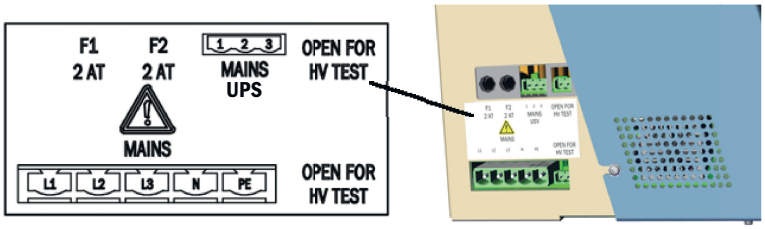


Figure 7: Connections, power supply

Table 12: Connections, power supply

Designation	Supply
MAINS UPS (3-pole)	Power supply for electronics unit (internal)
MAINS (5-pole)	External power supply
F1	Internal
F2	Internal

More information

Connections and interfaces of further modules

► See Operating Instructions, Section 11.10

6.2 Torques

Tighten all screw connections, for which no tightening torque or no pretension force is specified in drawings or Assembly Instructions, according to VDI 2230.

Exceptions to this rule are all connections with screws that are not screw connections in the real sense. This includes hose clips, cable glands, screw fittings, gas connections, screws for circuit boards etc. Tighten these screw fittings as evenly as possible with a much lower torque (hose clips 1 Nm, other screw fittings according to manufacturer specifications).

Select the next lowest torque valid for the screw for mixed materials and special screws such as relieved screws.

The friction coefficient serving as basis is (screw fitting without lubrication) μk=μG=0.14. The calculated values are valid for room temperature (T=20 °C).

Table 13: Torques

Dimension	Slope P	Tightening torque M_A (Nm) according to strength class (see screw head)							
		3.6	4.6 A2-50 A4-50	5.6 Alu	A2-70 A4-70	A2-80 A4-80	8.8 Titan	10.9	12.9
M 1.6	0.4	0.05	0.05	0.05	0.11	0.16	0.19	0.26	0.31
M 2	0.45	0.1	0.1	0.11	0.22	0.32	0.39	0.55	0.66
M 2.5	0.45	0.21	0.22	0.23	0.46	0.67	0.81	1.13	1.36
M 3	0.5		0.54	1	1.2	1.39	1.51	1.98	2.37
M 3.5	0.6		0.85	1.3	1.54	1.75	1.9	2.6	3.2
M 4	0.7		1.02	2	2.5	3	3.3	4.8	5.6
M 5	0.8		2	2.7	4.2	5.6	6.5	9.5	11.2
M 6	1		3.5	4.6	7.3	9.7	11.3	16.5	19.3
M 8	1.25		8.4	11	17.5	23.3	27.3	40.1	46.9
M 10	1.5		17	22	35	47	54	79	93
M 12	1.75		29	39	60	79	93	137	160
M14	2		46	62	94	126	148	218	255
M 16	2		71	95	144	192	230	338	395
M 18	2.5		97	130	199	266	329	469	549
M 20	2.5		138	184	281	374	464	661	773
M 22	2.5		186	250	376	508	634	904	1057
M 24	3		235	315	485	645	798	1136	1329
M 27	3		350	470	708	947	1176	1674	1959
M 30	3.5		475	635	969	1289	1597	2274	2662
M 33	3.5		645	865	1319	1746	2161	3078	3601
M 36	4		1080	1440	1908	2350	2778	3957	4631
M 39	4		1330	1780	2416	3016	3597	5123	5994

7 Annex

7.1 Adjustment: Behaviour during zero adjust

To comply with MARPOL Annex 6/MEPC.259(68) requirements, the SO_2/CO_2 ratio must be determined continuously. During zero point adjustment or reference point adjustment, the displayed values are not usable for compliance monitoring.

The behavior of the measured values during adjustment can be determined.

The following options are available:

- Factory setting
- Option “Freeze measured values”

7.1.1 Adjustment procedure

- The bellows valve on the gas sampling unit SFU is closed.
- The maintenance signal is activated.
- The measuring system is purged with instrument air.
- Zero point adjustment or reference point adjustment is performed.
- The bellows valve is opened again.
- The measuring system is flooded with measuring gas.
- The maintenance signal is deactivated as soon as the measurement is meaningful.

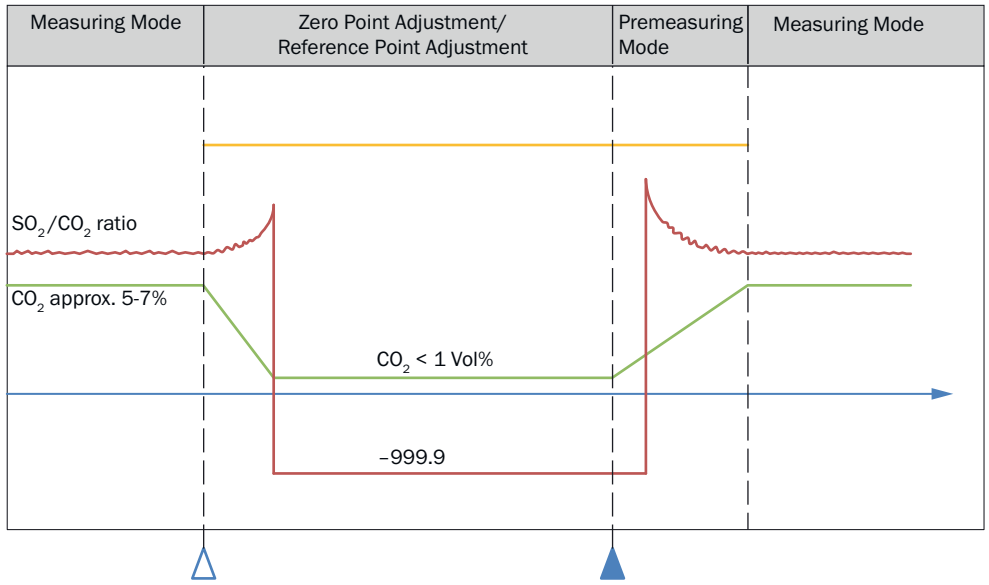
7.1.2 Factory setting

During zero point adjustment or reference point adjustment, the SO_2/CO_2 ratio cannot be used for compliance monitoring as long as the maintenance signal is active.

The ratio value describes the SO_2/CO_2 ratio. If the CO_2 value <1 Vol% drops towards zero, the ratio value would become infinitely large.

To avoid misinterpretation, the MARSIC300 is factory set so that the ratio value automatically jumps to -999 as soon as the CO_2 value is <1 Vol%.

The SO_2/CO_2 ratio returns to normal after the adjustment is completed. The maintenance signal goes out and measuring operation can be continued when the initial state is reached.



SO_2/CO_2 ratio

CO_2

Maintenance signal active

Adjustment starts.

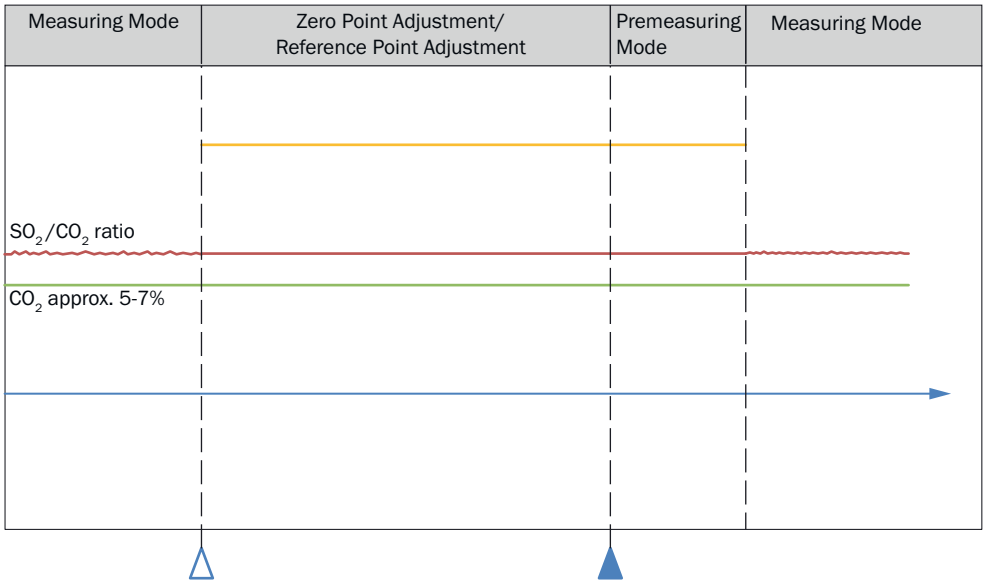
Adjustment ends.

7.1.3 Option: “Freeze measured values”

As an alternative to the factory setting, the option “Freeze measured values” can be set by Service during commissioning.

With this option, measured values are stopped and frozen during zero point adjustment or reference point adjustment.

It takes some time after adjustment is completed until the measured values are activated. The maintenance signal goes out and measuring operation can be continued when the initial state is reached.



SO_2/CO_2 ratio

CO_2

Maintenance signal active

△ Adjustment starts.

▲ Adjustment ends.

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