

MAC800 / MAC GMS800
Multi-component Analysis System



Installation
Operation
Maintenance



Document Information

Described Product

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Guarantee Information

Specified product characteristics and technical data do not serve as guarantee declarations.

Original Documents

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Glossary

Wiring diagram: Optionally comprising wiring plan, terminal diagram, gas flow diagram, parts list, view drawings, graphic wiring and function diagram for LOGO! / PLC logic control.

Optical waveguide module: Fiber optics module

DAU: Data acquisition unit (DAU), acquisition of measured data, editing and transmission to the emission PC. Alternatively, the use of field modules is possible for smaller applications.

EPC: Emissions PC with "Windows XP" operating system. Optional connection of up to 16 devices (DAU, field modules, Modbus, OPC etc.). Receiving/sending data from/to a process control system possible.

MEAC 2000 software: Processing, storage and representation of all calculated values. Operation in Windows standard. Optional display of data in local network possible.

Control: A LOGO! small control system or a PLC control can be optionally used as analyzer cabinet control.

PLC: (Program Logic Controller)

LOGO!: Small control system from the Siemens AG.

Cabinet cooling unit: Referred to as cabinet climate control (air conditioner).

Sample gas probe: Gas sampling probe / probe

Sample gas line: Heating hose / analysis hose

LEL: Lower Explosion Limit (minimum concentration in combustible gas or steam above which the gas mixture can be ignited)

UPS: Uninterrupted Power Supply

Raschig rings: Raschig rings are used as filling in gas washers.

CAN Bus: Control Area Network. A field bus.

NOx converter: Gas converter (referred to as NO₂ / NO converter.)

CompactFlash® disc: Memory card.

Ethernet: Computer networking technology. Basis for network protocols, such as TCP/IP.

ESD: Electrostatic Discharge

Fieldbus: An industrial communication system to connect a variety of field equipment such as analyzers, measuring sensors, actuators and drives with a control unit.

Firewall: Safety concept of software and hardware components to restrict access to computer networks.

Modbus®: Field bus communication protocol

PROFIBUS®: Field bus communication protocol

OLE: Object Linking and Embedding. Standardized data interface (Microsoft Corporation)

OPC: Openness, Productivity, Collaboration. Standardized data interface (OPC Foundation).

Span gas: Test gas with a concentration of approx. 75% of the upper measuring range limit.

SOPAS: (SICK Open Portal for Applications and Systems): SICK Parameter Setting and Data Calculation Software.

SOPAS ET: SOPAS PC Engineering Tool. Configuration protocol.

TCP/IP: Network protocol.

Warning Symbols



Hazard (general)



Hazard by voltage



Hazard by acidic substances



Hazard by toxic substances



Hazard by explosive substances/mixtures



Hazard by high temperature or hot surface



Hazard for the environment/nature/organic life

Information Symbols



Important technical information for this product



Important information on electrical or electronic functions



Nice to know



Supplementary information



Link to information at another place

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 personal injury or property damage.

NOTICE

Hazard which *could* result in material damage.

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MAC800

1 Important Information

Main operating information
Intended use
Own responsibility

1.1 Main hazards



CAUTION: Health risk by dangerous measuring medium

The operator is responsible for safe handling of the measuring medium.

- ▶ In addition to these Operating Instructions, follow all local laws, technical regulations and company-internal operating directives applicable at the installation location of the MAC800.
- ▶ Only install the MAC800 in areas with adequate ventilation OR suitable gas monitoring.
- ▶ Feed and discharge the measuring medium safely.
- ▶ Carry out regular leak tests (e.g. with leak detection spray).



WARNING: Risk of explosions when hydrogen is fed to the system

Risk of explosions when lines are leaky.

- ▶ Do not plug or block exhaust air openings in the cabinet cover.
- ▶ Do not operate the MAC800 in closed areas OR install hydrogen monitoring (H₂-Sensor) (< 25% LEL).
- ▶ Carry out regular leak tests with leak detection spray.

1.2 Intended use

1.2.1 Purpose of the device

The MAC800 is a multi-component analysis system for continuous monitoring of flue gas and emissions in industrial combustion plants and during processes.

The sample gas is extracted at a sampling point, conditioned and passes to the respective integrated gas analyzers (extractive measurement).

Performance-tested version (EN 15267-3): MAC GMS800 (similar to MAC800).

1.2.2 Application limitations



WARNING: Risk of explosions

- ▶ Do not operate the device in potentially explosive atmospheres.

1.3 Responsibility of user

Intended users

The MAC800 may only be installed and put into operation by skilled persons who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the dangers involved.

Correct use



- Basis of this Manual is the delivery of the MAC800 according to the preceding project planning (e.g. based on the SICK application questionnaire) and the relevant delivery state of the MAC800 (→ delivered system documentation).
 - ▶ If you are not sure whether the MAC800 complies with the planned state or the delivered system documentation: Contact SICK Customer Service.

- ▶ Use the device only as described in these Operating Instructions. The manufacturer bears no responsibility for any other use.
- ▶ Carry out the specified maintenance work.

- ▶ Do not remove, add or change any components in or on the device unless such changes are officially allowed and specified by the manufacturer. Otherwise
 - the manufacturer's guarantee becomes invalid
 - the device could become dangerous

Special local conditions

- ▶ Follow all local laws, regulations and company-internal operating directives applicable at the installation location.

Responsibility for dangerous sample gases



WARNING: Mortal/health danger as a result of gas path leakage

When the device measures toxic gases: A leak in the gas path can cause acute danger for persons.

- ▶ Take suitable safety precautions.
- ▶ Make sure these safety precautions are followed.

Keeping documents

These Operating Instructions:

- ▶ Must be available for reference.
- ▶ Must be passed on to new owners.

1.4

Additional documentation/information

The following documents are applicable in addition to these Operating Instructions:

Instructions delivered with the system

- Operating Instructions of the analyzers fitted
- Electronic Device Passports of the analyzers fitted
- MAC800 analysis system wiring diagram (control cabinet)

System component instructions accompanying the system documentation

Supplementary instructions (optional):

- Operating Instructions, sampling probe (option)
- Operating Instructions / Data Sheets, sample gas line (option)
- Operating Instructions of the supply unit / components for temperature control of external (heated under control) sample gas line (option)
- Operating Instructions, NOx converter (option)
- Operating Instructions / Data Sheets for components for sample gas conditioning and test gas feeding, such as:
 - Sample gas pump
 - Sample gas cooler (including condensate pump)
 - Test gas valves (solenoid valves)
 - Washing bottles (option)
 - Humidifier container (zero gas humidification) (option)
 - Sample gas monitoring (flow, humidity)
 - Water traps (humidity separator)
 - Cylinder pressure reducer
- Operating Instructions / Data Sheets for system control, such as:
 - SCU (with operator panel)
- Operating Instructions / Data Sheets for components of the control cabinet climate control and lighting, such as:
 - Control cabinet cooler (option)
 - Antifreeze heater (option)
 - Cabinet fan (option)
 - Control cabinet light
- Operating Instructions / Data Sheets for components supplementing the system (option)
- Operating Instructions / Data Sheets for gas warning systems for monitoring toxic gases and the LEL (option), such as:
 - Gas monitor / Gas measurement computer
 - Visual and acoustic signal reporting devices
- Data Sheets for additional components for power supply / mains supply and (electr.) protection devices, such as:
 - Transformers (option)
 - Lightning protection / overvoltage element (option)
- Operating Instructions for modules for measured value computer connection (option)
- Project-specific measured data recording and processing
 - Operating Instructions MEAC2000 (option)
 - Data Sheet, computer hardware (emission PC / EPC) (option)

MAC800

2 Product Description

Product identification

Functional principle

Characteristics

2.1 Product identification

Product name	MAC800 Performance-tested version: MAC GMS800 (similar to MAC800)
Manufacturer	SICK AG Erwin-Sick-Str. 1 · 79183 Waldkirch · Germany

The type plate is normally located at the top on the right cabinet side.

The type plate can however be located somewhere else on special versions.



The MAC800 has an individual configuration.

- ▶ Refer to the system documentation (→ page 10, § 1.4) delivered with your MAC800 for the individual configuration of your system.

2.2 Characteristics

The multi-component analysis system MAC800 is an analysis system for measuring and monitoring gaseous components.

The MAC800 operates extractive, i.e. the gas to be measured is extracted from the gas duct using a gas sampling probe or probes and then passed to the analysis system via a (heated) sample gas line or lines.

Refer to the wiring diagram, system overview and delivered system records / system documentation for the individual system-specific equipment or project-specific version of the MAC800 analysis system.

2.3 System overview

The system overview can be seen in or derived from the system documentation as well as the wiring diagram.

2.3.1 Functional units

The MAC800 contains the following independent functional units:

- The respective analyzers.
The analyzers record measured values and deliver these to the SCU.
- The SCU (System Control Unit) that manages the MAC800 analyzers and contains the operator panel.
The SCU reads the measured values of the analyzers in and carries out any conversions required (e.g.: Scaling, averaging, etc.).
The SCU contains the programs (formulas) that control the MCS100FT analyzer process flow.
The settings of the SCU and the measured values calculated by the SCU can be viewed and set (with password protection) using the “*System Control Unit*” menu item.



Refer to the “SCU” Operating Instructions for operating the “SCU” operator panel.

2.3.2 Remote control

2.3.2.1 Ethernet

Standard: Ethernet (Modbus TCP/IP).

Operation via SOPAS ET (option)

Operator menus and Measuring Screens are also available on an external PC via Ethernet for user comfort (with the engineering tool SOPAS ET → Operating Instructions “SCU”).

2.3.2.2 Modbus

Modbus® is a communication standard for digital controls to connect a »Master« device with several »Slave« devices. The Modbus protocol defines the communication commands only but not their electronic transfer; therefore it can be used with different digital interfaces (for MAC800: Ethernet).



Further information on Modbus:

- Setting parameters → Operating Instructions “SCU”
- Further information: → Technical Information “SCU”

2.3.2.3 OPC (option)

OPC is a standardized software interface that supports exchanging data between applications of different manufacturers.

The SICK OPC server is required.

System bus: Ethernet.



Further information on OPC:

- Setting parameters → Operating Instructions “SCU”
- Further information: → Technical Information “SCU”

2.4 Method of operation

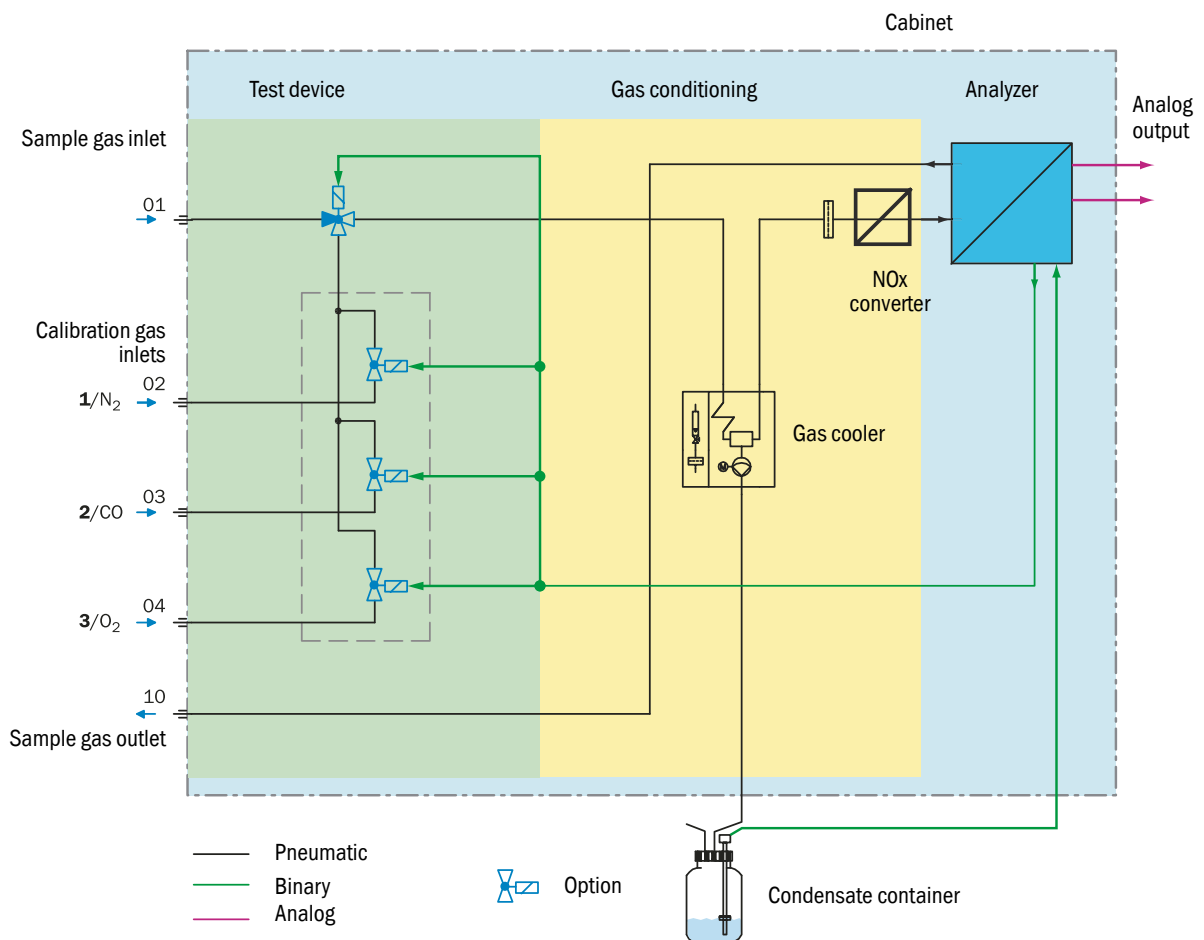
The MAC800 operates independently.

- Backflushing the sampling probe and test gas feed are performed cyclically and can also be started manually.
- The MAC800 signals the *uncertain operating state* with status indicators (→ page 41, § 5.4.1). The MAC800 continues measuring operation.
- When a *malfunction* occurs, the MAC800 switches automatically to “Stand-by”(→ page 53, § 8.3).

Operating states are signaled by status signals and entered in a logbook.

2.4.1 Functional principle

Fig. 1 MAC800 functional principle (example)



2.5 Internal functional units of the MAC800 analysis system

- Components for supply / regulation of heated (external) sample gas lines and heated gas sampling probes (option)
- Sample gas delivery unit comprising:
 - Sample gas pump(s)
 - Control valve(s) / needle valve(s) (option)
 - Flowmeter (option)
- Sample gas conditioning comprising:
 - Sample gas cooler(s) (optional with: Flowmeter and needle valve, condensate pump, filter, humidity sensor)
 - Sample gas filter(s) (option)
 - Washing bottles / gas washer (option)
 - Absorption pad(s) (option)
 - Condensate pump(s) (option)
 - Condensate collection container with level monitor
 - Water trap(s)
 - Liquid alarm sensor(s) after the cooler (option)
 - Sample gas monitoring (flow, moisture)
- Span gas / test gas feed unit comprising:
 - Solenoid valves
 - Humidifier container (option)
 - Absorption pad(s) (option)
 - Drying pad(s) (option)
- Analyzer(s) S810, modular enclosure S830/S831
- (NO_x) Sample gas converter (option)
- Terminal strips for connection/interfaces by customer
- Interface modules (option)
- SCU (with operator panel)
- Connection for measured value computer (option) via field modules, such as:
 - Analog input modules (2 channels; 0...8)
 - Digital input modules (4 channels; 0...8)
 - Analog output modules (2 channels; 0...8)
 - Digital output modules (4 channels; 0...8)
 - Field module EPC connection
- Gas warning device / systems (option)

2.5.1 External functional units

- Gas sampling probe(s) (option)
- Backflush unit(s) for gas sampling probe(s) (option)
- Sample gas line(s) (option)

External components supplementing the system

- Temperature sensors (option, for temperature measurement)
- Pressure sensors (option, for pressure measurement)
- Gas velocity measuring devices (option)
- Dust measuring devices (option)
- Other project-specific peripherals (option)



The external functional units are project-specific / system-specific. Refer to the wiring diagram as well as the system documentation for details.

2.5.2 Measuring components

Possible measuring components ^[1]	CO, NO, SO ₂ , CO ₂ , H ₂ , CH ₄ , O ₂ and others
--	--

[1]According to built-in analyzer and MAC800 system equipment

For system-specific details and information on the measuring components, refer to the Electronic Device Passport of the analyzer and the wiring diagram of the MAC800 analysis system.

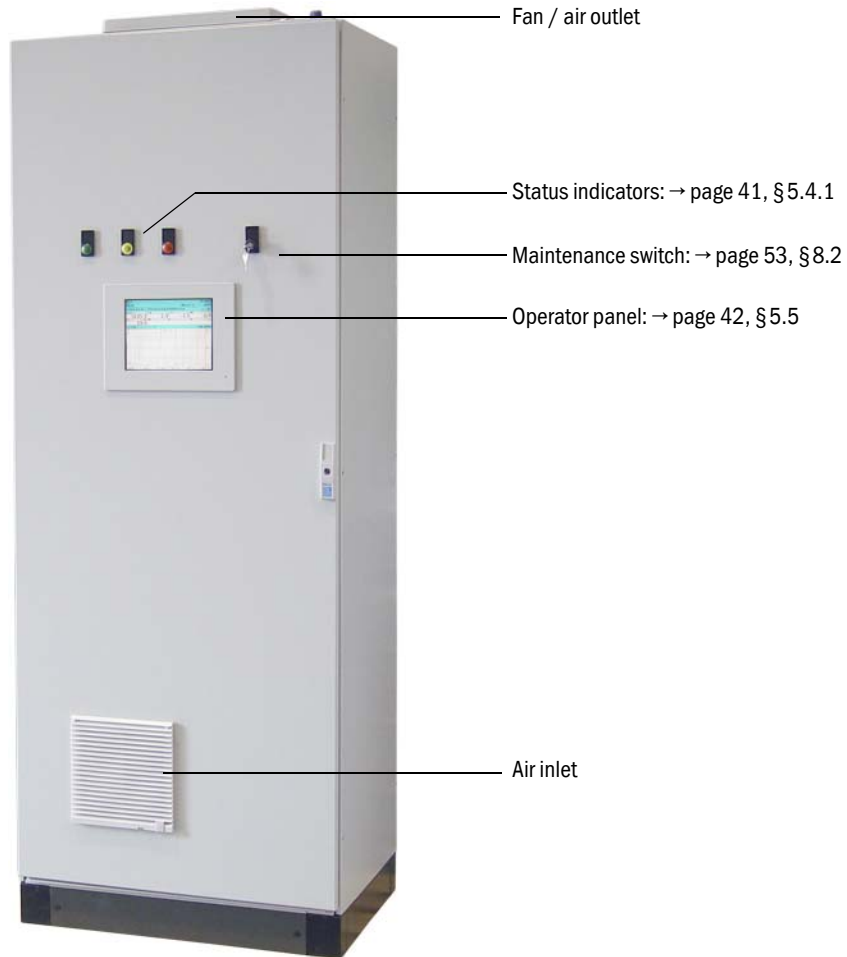
2.6 Interfaces

- Measured value, status and control outputs
 - Measured value outputs (analog), freely selectable (0 / 2 / 4 ... 20 mA linear)
 - Status and control outputs
- Measured value and control inputs
 - Measured value inputs (analog)
(0 / 2 / 4 ... 20 mA or 0 ... 10V)
- Digital interfaces (option)
 - RS232
 - RS422
 - RS485
- Bus interfaces / field bus modules (option)
 - Modbus
 - Profibus
- Optical waveguide module (option)
- Voltage supply (system-specific)
 - 400V, 50Hz
 - 400V, 60Hz
 - 230V, 50Hz
 - 230V, 60Hz
 - 115V, 50Hz
 - 115V, 60Hz
- UPS connection / supply (option)

2.7 Description of subassemblies

2.7.1 Exterior view

Fig. 2 Front side view (without air conditioner)

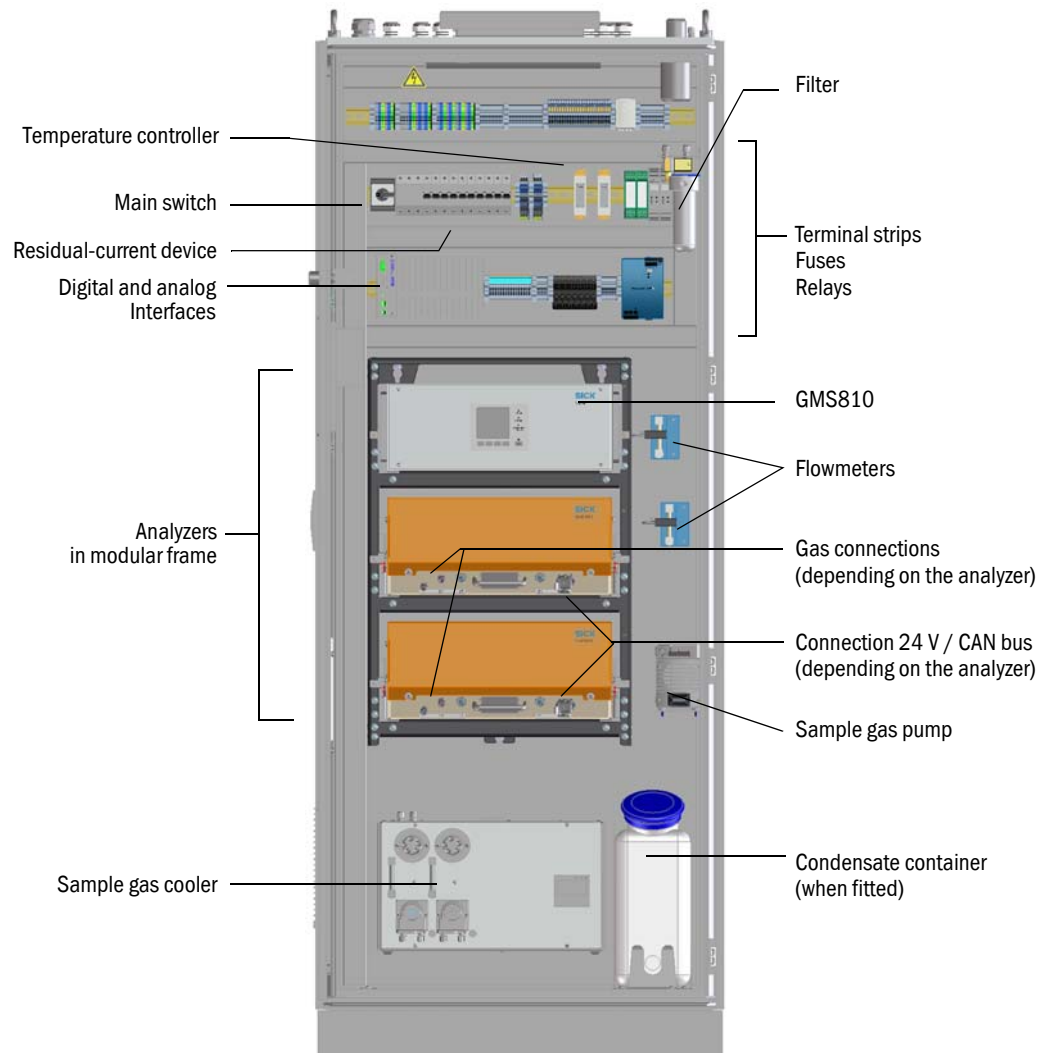


- The layout can vary specific to the system.

2.7.2 Interior view

The MAC800 has a module frame fitted on an assembly plate to accommodate analyzers. Refer to the wiring diagram of the MAC800 analysis system for the specific interior view. A typical MAC800 system layout is shown in the following.

Fig. 3 Interior view



- The layout can vary specific to the system.

2.7.3 Parts list

Refer to the wiring diagram of the MAC800 analysis system for system-specific parts lists of system components.

2.8

Gas flow plan

- ▶ Refer to the wiring diagram of the MAC800 analysis system for the system-specific gas flow diagram.

The typical layout of a MAC800 variant with sample gas line and span gas feed at the sample gas probe is shown in the following.

- The layout can vary specific to the system.
- The designations of system components can vary specific to the system.
- Refer to the system-specific wiring diagram or the parts list contained therein for the applicable designations.

System elements legend		
Designation	Description	
A1, A2, A3	Analyzers	Use / quantity / type = optional
14, B1	Condensate collection container with level switch	
G8	System control	
E1	Gas sampling probe	Provision / type = optional
E2, E3	Sample gas lines	Provision / type = optional
E4	Sample gas cooler	Type = optional
E5	NO _x converter	Use / quantity / type = optional
M1	Sample gas pump	Type = optional
K01	Main valve	Type = optional
K02-K06	Test gas valves	Use / quantity / type = optional
K07	(Test gas) vent valve	Type = optional
K08	Test gas feed valve (for test gas feeding at the probe)	Use / type = optional
O7	Sample gas outlet (collector)	
23, B3	Flow monitoring (for test gas feeding at the probe)	Use / quantity / type = optional
13, B2	Flow monitoring (bypass)	Use / quantity / type = optional
17	Water trap	
18, 19	Washing bottle and air filter	Use / type = optional

Designations of system components can vary specific to the system.

- ▶ Refer to the system-specific wiring diagram or the parts list contained therein for the system-specific designations.

MAC800

3 Preparation for Initial Start-up

Installation
Assembly

3.1 Scope of delivery

Refer to the delivery documents for the scope of delivery.

3.2 Project planning and installation information



NOTICE: Risk of damage by inadmissible measuring medium

Certain media can affect the measuring precision of the measuring system and damage the device.

- ▶ Ensure that only media designed for the measuring system are supplied to the measuring system (see system documentation).
- ▶ In case of doubt, let SICK Customer Service check whether the measuring system can be used with the medium present at your location.

3.2.1 Preparing the installation location



NOTICE:

- ▶ Connection to the gas supply may only be performed by skilled persons who, based on their technical training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the hazards involved.

The operator is responsible for preparing the installation location.

- Observe ambient conditions (→ „Technical Data“).
(Conditions: Under a roof or protected against direct heat radiation, heavy dust loads and corrosive atmospheres).
- Cabinet dimensions (refer to the view drawings / wiring diagram in the system documentation).
- Ensure adequate load carrying capacity of the floor (minimum 550 kg/m²).
- Install the measuring system in an environment almost free from vibrations. Vibrations can influence measurement and therefore, in case of doubt, plan onsite vibration damping.
- Install the measuring system as close as possible to the sampling point.
 - Short sample gas lines mean short T-90 times. Max. sample gas line length: 35 m (Longer sample gas line are possible under certain conditions. The components of the MAC800 analysis system must have been planned accordingly during project planning.)
 - ▶ Observe the information in the assembly guidelines for fitting heating hoses.
- Installation location for test gas cylinders (when used).
Provide a suitable installation location for the test gas cylinders.
Note:
 - Observe local provisions governing gas cylinder installation.
 - Provide a suitable installation location for the pressure regulator unit.
- Provide a suitable installation location for the instrument air conditioning system (option)
- Air outlet of the control cabinet ventilation / climate control
 - ▶ Do not block the air outlet of the control cabinet ventilation nor the cabinet climate control of the MAC800 analyzer cabinet.
- Provide (individual) attachments for the system cabinet.
- For installation on gratings: Parts could drop or liquids (e.g. condensate) could drip and cause injuries. Provide a suitable base plate.

3.3 Transport and installation



NOTICE:

- ▶ The MAC800 analysis system may only be transported and installed by skilled persons who, based on their device-specific training and knowledge of the device as well as knowledge of the relevant regulations, can assess the tasks given and recognize the dangers involved.

- ▶ Only use suitable hoisting equipment (e.g. crane) to install the MAC800 (weight of the MAC800 approx. 250 to 350 kg).
- ▶ Observe current applicable MAC800 analyzer cabinet transport and load information.
- ▶ Use the lugs / transport strapping points located on the cabinet roof.
- ▶ Secure the MAC800 immediately against falling over.

3.4 Removing transport safety devices

- ▶ Check the system for transport safety devices and remove these.



NOTICE:

- ▶ Remove transport safety devices on control cabinet, filters, washing bottles and other parts before start-up.

3.5 Checking attachments and connections

- ▶ Check whether hose connections and screw connections have become loose during transport.

3.6 Inserting filter elements and bubbling frits (option)

- ▶ To avoid damage during transport, certain components are disassembled and delivered in separate packing in the control cabinet (e.g.: bubbling frit in washing bottles / humidifier container or Raschig rings in special gas washers). Assemble or insert these before start-up.



NOTICE:

- Insert or fill filter elements, bubbling frits as well as Raschig rings before start-up.

3.7

Inserting the NOx converter cartridges (option)

- ▶ Check that the catalyzer cartridge is inserted in the NOx converter.
Normally, the converter fitted in the MAC800 analysis system is delivered with the catalyzer cartridge already fitted and ready for operation.

**NOTICE:**

- Observe the NOx converter Operating Instructions when inserting the catalyzer cartridge.
- Insert the catalyzer cartridge of the NOx converter before start-up.

**WARNING: Hot converter or hot catalyzer cartridge**

The surface of the converter or catalyzer cartridge can be hot.

- ▶ Take appropriate protective measures (e.g. wear gloves).
- ▶ Protect parts against unauthorized access.

3.8

Preparing for start-up of gas sampling probes

Observe the Operating Instructions / Assembly Instructions for the gas sampling probes when preparing for installation or start-up.

**WARNING: Overpressure in gas duct**

When opening the gas duct, gas flows out when overpressure exists.

- ▶ Take appropriate protective measures.

3.9

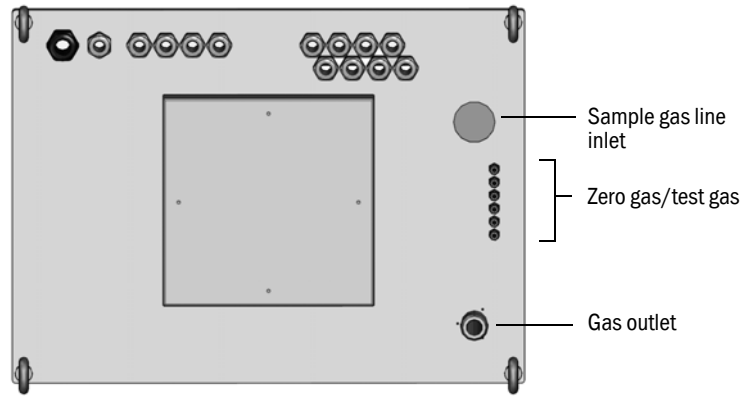
Gas lines

Gas connections for the standard MAC800 analyzer cabinet are located on the side or top of the control cabinet.

Refer to the view drawings or wiring diagram for the system-specific version of the MAC800 analyzer cabinet that can vary.

Fig. 5

Gas connections (example: Top view)



- The layout can vary specific to the system.



WARNING: Noxious sample gas

The gases can contain components harmful to health or irritating.

- ▶ Lead the measuring system gas outlets outdoors or into a suitable flue.
- ▶ Protect the sample gas outlet from frost.
- ▶ Sample gas must not penetrate the control cabinet.
- ▶ Observe information from the plant operator.



WARNING: Acidic condensate

Condensate created at the gas outlet and its deposits can be acidic.

- ▶ Channel condensate off safely.
- ▶ Observe suitable safety measures when disposing of condensate.



WARNING: Risk of explosions when explosive sample gas is used

Risk of explosions when the gas path is not gas-tight.

- ▶ Do not put the detonation flame arrester function integrated in the system out of operation when using the MAC800 analysis system for measuring explosive gases. (Sample gas supply line and outlet)

**NOTICE:**

- ▶ Make sure only the media for which the measuring system is designed are fed.
If necessary, have this checked by SICK Customer Service.
- ▶ Gas lines to the MAC800 may only be laid by skilled persons who, based on their training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the dangers involved.
- ▶ Gas lines / sample gas lines may only be connected to the MAC800 analysis system by SICK Customer Service or skilled personnel.
- ▶ Risk of damage to the MAC800 and adjacent equipment if the sample gas is corrosive or could generate corrosive liquids in combination with water (e.g. humidity).
- ▶ Measured values could possibly be erroneous when the gas path is leaky (dilution effect).
- ▶ Measured values could possibly be erroneous when a partial vacuum exists in the gas duct and when the gas path is leaky (dilution effect).
- ▶ No strong pressure fluctuations may occur at the sample gas outlet.
- ▶ Make sure sample gas can flow out »freely« (without pressure).
- ▶ No significant counterpressure may occur at the sample gas outlet.

3.10 Preparing the electrical installation



WARNING: Health risk by voltage

- ▶ Electrical connection of the MAC800 may only be carried out by electricians who, based on their training and knowledge as well as knowledge of the relevant regulations, can assess the tasks given and recognize the dangers involved.
- ▶ For operation, the measuring system must always be grounded.
- ▶ Never disconnect or remove the protective conductors in the measuring system or in the power supply line.

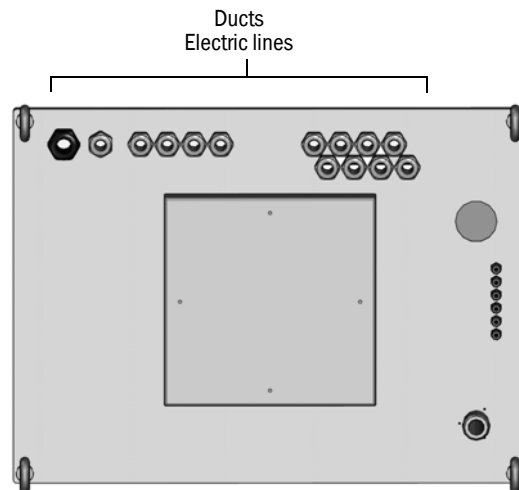
- ▶ Refer to the terminal layout in the wiring diagram for a description of the terminal strips.

3.10.1 View of cable ducts on the control cabinet (symbolic)

The cable ducts of the MAC800 analyzer cabinet are located on the side or top of the control cabinet.

Refer to the view drawings or wiring diagram for the system-specific version of the MAC800 analyzer cabinet that can vary.

Fig. 6 Cable ducts (example: Top view)



- The layout can vary specific to the system.

3.10.2 Preparing the mains supply

- Lead the mains supply to the analyzer cabinet
- The wiring system to the mains supply voltage of the system must be installed and fused according to the relevant regulations.
- Provision of UPS (option)
- Before start-up, check the mains properties for rated current/rated voltage/rated capacity for system supply (auxiliary power) match the system-specific specifications of the MAC800 analysis system.
- ▶ Refer to the system-specific wiring diagram or the system documentation for details on the mains supply connection as well as specifications on nominal power/voltage/rating.

3.10.3 **External components and signal generators**

Carry out electrical and mechanical connection of project-related external components and signal generators and other project-specific peripherals to be integrated and then put these into operation.

- ▶ Refer to the system-specific wiring diagram and the corresponding Data Sheets or Operating Instructions of the respective components for details on the mains supply connection or connection to the MAC800 analysis system as well as specifications on auxiliary power required (rated current/rated voltage/rated capacity).

3.11 **Connecting to the customer plant**

3.11.1 **Integration of the MAC800 analysis system in the customer plant.**

- Lay all necessary connections according to the system documentation:
 - Voltage supply
 - Signal lines
 - Integration of all external components

MAC800

4 Start-up

Switching on
Start-up of system components

4.1 Persons authorized to carry out start-up



NOTICE:

- ▶ The MAC800 may only be put into operation by skilled persons who, based on their device-specific training and knowledge of the device as well as knowledge of the relevant regulations, can assess the tasks given and recognize the dangers involved.

4.2 Start-up of washing bottles / humidifier containers (option)

- Insert the bubbling frits in the washing bottles / humidifier containers (option) (remove any transport safety devices still fitted (option))
- Fill the washing bottles / humidifier containers with solution or distilled water. Recommended filling level approx. 50%. The bubbling frit must be constantly immersed.
- Fill gas washer with Raschig rings. (option). (Remove any transport safety devices still fitted (option).)
- Due to application conditions (option), washing bottles / gas washers with the option of automatic media exchange are used. Refer to the wiring diagram of the MAC800 analysis system for the corresponding specifications.

4.3 Adsorption pads (option)



WARNING: Noxious adsorbent

Depending on the sample gas or application, the adsorbent can be contaminated with noxious and / or highly flammable substances.

- ▶ Observe applicable health and safety regulations.



NOTICE:

- ▶ Regeneration of the adsorbent is not allowed when it is contaminated with dangerous substances.



NOTICE:

- ▶ Dispose of used adsorbent as hazardous waste according to the applicable disposal regulations.

- ▶ Fill the empty cartridge of the "FT-AP" filter fitting with the adsorbent planned for the application (e.g. silica gel / M&C "90F5110"). Observe the corresponding product information or the Data Sheet of the universal filter (FP / FP-AP) when filling or replacing adsorbent. The adsorption pad is used to adsorb water vapor in certain applications. The adsorbent becomes colorless with increasing absorption of moisture (silica gel "90F5110" with color indicator orange).
 - ▶ Replace the adsorbent when it is completely colorless.

4.4 **Before switching on ...****NOTICE:**

Before start-up, the system must have been installed for at least 24 hours in its intended operating position at the installation location to achieve optimum operating conditions and prevent damage to system components.

- ▶ Check: Have all transport safety devices been removed (option)?
- ▶ Observe the ambient temperature for operating the MAC800 analyzer or system components (→ „Technical Data“).
- ▶ Check: Is the MAC800 analysis system dry and clean inside?
- ▶ Check: Are all filters, filter elements and inserts fitted and ready for operation?
- ▶ Check: Have hose connections become loose during transport?
- ▶ Check: Are all project-specific external components and signal generators to be integrated, e.g. sample gas probes and lines, temperature and pressure sensors or other external signal and measured value sensors, connected and ready for operation?
- ▶ Check the catalyzer cartridge is inserted in the NOx converter.

4.5 **Switch the MAC800 analysis system on**

- ▶ Switch the MAC800 analysis system on using the main switch (→ page 18, Fig. 3) (position “ON”).
Refer to the wiring diagram for the applicable designation.
- ▶ Switch the residual-current device (RCD) on → page 18, Fig. 3).
Refer to the system-specific wiring diagram for the relevant designations (see system documentation).
- ▶ Switch all circuit breakers (MCB) on (→ page 18, Fig. 3).
Refer to the system-specific wiring diagram for the relevant designations (see system documentation).
- ▶ The MAC800 analysis system starts the warming-up phase.
Depending on the components to be measured and the measuring ranges, and the drift, the warming-up phase takes up to 24 hours.
However, the typical case is that certain system components can cause a measurement at an earlier timepoint after, for example, reaching the required operating temperature even under consideration of possible drift and compliance with switch-on conditions (→ page 65, §9.4).
- ▶ Check external AC-operated components as well as components (optional) supplied by the MAC800 measuring system, for example purge air units, fans, compressors, for the correct direction of rotation / rotating fields.

4.6 **Start-up for the sample gas cooler (option)**

- ▶ For start-up, observe the sample gas cooler Operating Instructions.
- ▶ Wait for the cooler warm-up phase to end (duration: approx. 30 minutes).
A green LED indicates when the operating temperature has been reached.
- ▶ Switch on the sample gas cooler at the front of the device.

4.7 **Start-up of the analyzers**

- ▶ For start-up, observe the analyzer Operating Instructions.
- ▶ Connect the plug for the 24 V supply voltage on the device front (→ page 18, Fig. 3).
- ▶ Wait for the analyzer start-up phase to end (duration: approx. 15 minutes).
- ▶ Inquire the device status using the SCU operator panel. Proceed according to the Operating Instructions (→ Operating Instructions “SCU”).
- ▶ Set or control the required gas throughput according to the analyzer Operating Instructions.



This is, at the same time, start-up monitoring of the complete analysis system to determine any possible malfunctions.

Refer to the details on clearing malfunctions in this system description as well as in the Analyzer Operating Instructions.

4.8 **Start-up for the NO_x converter (option)**

- ▶ For start-up, observe the NO_x converter Operating Instructions.
- ▶ Check that the cartridge is inserted.
- ▶ Wait for the converter start-up phase to end (duration: approx. 15 to 30 minutes).
- ▶ The converter is ready for operation after the preset operating temperature is reached.

4.9 **Start-up of the SCU (MEAC2000 connection) (option)**

Refer to the “MEAC2000” Operating Instructions and the specific project documents as well as the wiring diagram for technical details.

Start-up for the cabinet climate control (option)



NOTICE:

- ▶ Avoid frequent, short starts of the control cabinet cooling unit or opening the control cabinet door frequently for short periods.
- ▶ Observe the minimum switch-off times when switching the control cabinet cooling unit or the complete MAC800 analysis system on or off.
Nonobservance can damage the control cabinet cooling unit.
- ▶ Refer to the specific Operating Instructions of the control cabinet climate control for the recommended minimum switch-off time.

- ▶ Observe the respective Operating Instructions and Data Sheets in the system documentation when starting-up the climate control components.
- ▶ Adapt the settings for operating parameters / temperatures to local conditions. Otherwise MAC800 analysis system components could fail or be damaged.
- ▶ Wait for a certain time after installation or initial start-up to ensure optimum lubrication and cooling of the control cabinet cooling unit. Refer to the specific Operating Instructions of the control cabinet cooling unit for details on this wait time.

The corresponding cabinet climate control components are fitted on the MAC800 analysis system depending on the planned installation location (local conditions). The following will be used, for example:

- Control cabinet fan (option)
- Control cabinet cooling unit (option)
- Control cabinet heating (option)
- ▶ Refer to the relevant Operating Instructions for details on start-up and operation of the individual components or the wait time for the control cabinet cooling unit.
- ▶ The climate control components are set at the factory to the following operating parameters / temperatures:
 - Control cabinet fan / cabinet thermostat: 25 °C
 - Control cabinet cooling unit: 25 °C
 - Heating: Approx. 15 °C to 20 °C
- ▶ These settings must be adapted to local conditions. Internal system components of the MAC800 analysis system can fail or be damaged when operating / ambient temperatures are too low or high.

Information on operation / function of the control cabinet cooling unit

An additional door limit switch is normally fitted to avoid higher condensate levels when the control cabinet door is open.

Switching the cooling function off and on is delayed automatically to avoid a possible cyclic operation when the door is opened and closed. Refer to the Operating instructions of the control cabinet cooling unit for duration and further details on the switching delay.

Avoid frequent, short starts of the control cabinet cooling unit or opening the control cabinet door frequently for short periods.

4.11

Start-up for the gas warning system (option)

System-specific gas warning systems are used (gas monitor, gas measurement computer) as well as the associated visual and acoustic signal reporting devices depending on the measuring medium and the type of application.

Limit and threshold values (alarm thresholds) are already set at the factory. These must be adapted onsite by the operator to local conditions and safety regulations during start-up.

- ▶ Observe the relevant information in the Operating Instructions and the Data Sheets in the system documentation.
- ▶ The operator must check the limit or threshold values (alarm thresholds) set at the factory locally and adapt these to local conditions.

**WARNING: Hazards through erroneous settings**

The settings must meet relevant regulations and safety regulations as well as laws on monitoring toxic gases and / or LEL monitoring.

4.12

Start-up of the heated gas sampling probe

- ▶ The sample gas probe is a system-specific / project-specific external functional unit (option). Observe the Operating Instructions / Assembly Instructions for the gas sampling probe during start-up.
- ▶ Wait for the heating up time for the gas sampling probe to end (duration: Approx. 2 hours).
- ▶ Check the nominal value setting on the built-in thermostat or on the external controller (option regulated heating) (refer to the wiring diagram for the nominal values).
- ▶ Make sure the built-in ball valve is closed on gas sampling probes with ball valve (option).

**WARNING: Hot probe and hot filter**

The surfaces of the probe or filter can be hot.

- ▶ Take appropriate protective measures (e.g. wear gloves).
- ▶ Protect parts against unauthorized access.

**WARNING: Hazard by overpressure in the gas duct**

When opening the gas duct, gas flows out when overpressure exists.

- ▶ When necessary: Take suitable protective measures.

**WARNING: Risk of explosions when explosive sample gas is used**

Risk of explosions when the gas path is not gas-tight.

**WARNING: Hazard by noxious sample gases**

The sample gases can contain components harmful to health or irritating.

- ▶ When necessary: Take suitable protective measures.

4.13

Restarting after longer shutdown

Restarting after a longer shutdown (several weeks) requires cooperation between Service technicians and the planning engineers responsible for the plant environment.

- ▶ Contact SICK Customer Service to clarify individual precautionary measures required for a restart after a longer shutdown (several weeks).
- ▶ Ensure the following as preparatory work for clarification: Check that the system and system components are in a ready for operation state according to the instructions on start-up (→ page 31, §4) and maintenance (→ page 51, §8), as described in these MAC800 Operating Instructions and the Operating Instructions for the system components.

System component(s)	(What to check)	Check
Lines / hoses		Free of condensate, blocked, contaminated, cracks, porous, brittle, tight and correct seat.
Filter		Free of condensate, not contaminated, ready for operation. Note: Replace the filter elements / inserts / wool when discolored.
Washing bottles, gas washers, humidifier containers		Ready for operation (fill when necessary).
Adsorption pads		Ready for operation (fill / replace when necessary).
Sample gas pump		Ready for operation.
Water trap		Free from condensate (replace the water trap when necessary). Note: If condensate is present, the water trap blocks and must be replaced.
Analyzers		Ready for operation.
NOx converter (option)		Ready for operation (including cartridge).
Gas cooler		Ready for operation.
Span gases		Use-by date, remaining reserves, pressures.
Cabinet climate control		Ready for operation.
Gas monitor / Gas measurement computer		Ready for operation.
Detonation flame arrester		Ready for operation (check for contamination).
Condensate collection container (with level switch)		Ready for operation (empty when necessary).
Sample gas outlet, sample gas recirculation		Free from blockages.
Sampling probe		Ready for operation.
External components and signal generators		Ready for operation.

- ▶ In addition to this list, also observe the information and conditions for particular system components in Sections “Start-up” (→ page 31, §4) and “Maintenance” (→ page 51, §8) in these MAC800 Operating Instructions.
- ▶ Refer to the Operating Instructions for individual system components for further details and information.

MAC800

5 Operation

Operating system components

5.1 Operating system components

The MAC800 analysis system is a user-friendly and low-maintenance measuring system that functions with self-monitoring. Refer to the Operating Instructions of individual system components as described in these Operating Instructions for operating details. (→ page 10, §1.4)



WARNING: Risk of explosions when hydrogen is fed to the system

Risk of explosions when lines are leaky.

- ▶ Do not plug or block exhaust air openings in the cabinet cover.
- ▶ Carry out regular leak tests with leak detection spray.

5.2 Layout and functions of system components

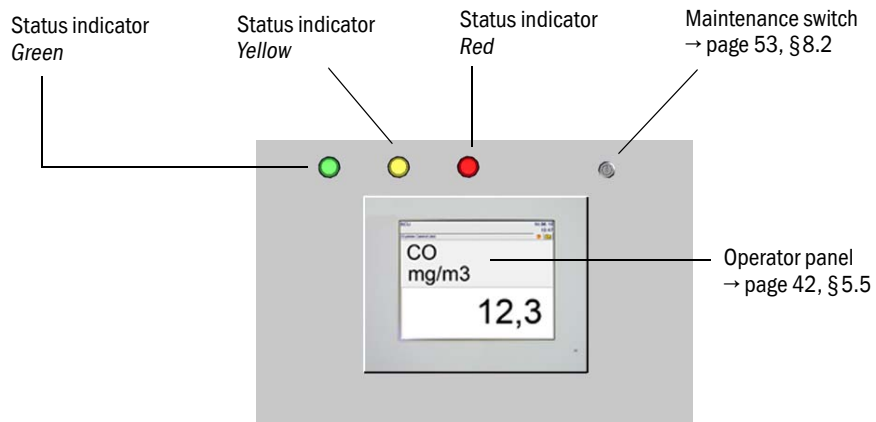
Refer to the wiring diagram for the layout and function of individual system components in the MAC800 analysis system.

5.3 System parameters

Refer to the system documentation as well as the wiring diagram of the MAC800 analysis system details on setting system parameters.

5.4 Operating and display elements

Fig. 7 Controls and indicators/displays



5.4.1 Significance of status indicators

Status indicator ^[1]	Operational state ^[2]	Significance	Measuring screen	Analog outputs	Set status signal ^[3]	Necessary action
Green	Measuring	Measuring in progress	Current	Current	None	None
Green/ yellow	Maintenance request	Maintenance request	Current	Current	Maintenance request	Measurement is running but the MAC800 is in an unsafe state. Cause, refer to the SCU Logbook.
Yellow	Maintenance	Maintenance	Current, but invalid	Held ^[4]	Maintenance	None MAC800 performs an internal function check.
	Initialization	Initialization				
	Transparent	No measuring				
	Maintenance	Maintenance				
	Zeroadjust	Zero adjust				
	Calibration	Calibration				
	DriftCheck	Drift check				
	QAL3	QAL3 check				
	O2_Calibration	O2 calibration				
	O2_DriftCheck	O2 drift check				
IRC alignment	Interferometer adjustment					
Background	Zero spectrum recording					
Red	Stand-by	Malfunction	Held ^[4]	Held ^[4]	Failure	MAC800 is in "Stand-by" state (→ page 53, § 8.3) Cause, refer to the SCU Logbook.

[1] Status indication of the lights on the front door of the device.

[2] The operating state is shown in the message line of the operator panel.

[3] Refer to the delivered system documentation for the assignment of status outputs.

[4] The last valid measured value is output on the analog outputs.

5.5 Operator panel

The MAC800 is operated via a touchscreen where you can perform inputs by touching the monitor.

5.6 Measuring screen

Typical Measuring screen:

The screenshot shows the Measuring screen interface. At the top right, the date and time are displayed as 25.05.10 14:01. Below this, the current menu level is shown as /.../Measuring Screen/Measuring Screen 1. The main area contains a table with the following structure:

Name	Unit	NN	NN
Unit	Unit	absorption units	absorption units
701	17.3	NN	NN
absorption units	absorption units	absorption units	absorption units
NN	NN	NN	NN
absorption units	absorption units	absorption units	absorption units
NN	NN	NN	NN
absorption units	absorption units	absorption units	absorption units

Annotations on the right side of the screenshot:

- Date and Time (dd.mm.yy)
- Switch to higher menu level. Instead of “Date and Time”, the field “Measure” is displayed:

A button labeled **Measure** is shown below the table. Below the button, it states: "By touching “Measure”, you return to the Measuring screen."

- ▶ To exit the menu: Touch .
- Setting the Measuring Screen → Operating Instructions SCU

MAC800

6 Adjusting

Adjustment

6.1 When is adjustment necessary?

The MAC800 measuring system or analyzer must be adjusted:

- After start-up.
- In regular intervals during operation (about weekly to monthly is recommended).
- For emission measurement required by law according to the Certification or legal specifications.

The specific adjustment cycles depend on the application and are not the responsibility of SICK AG.

6.2 Basic variants of the adjustment procedure

Two span gas feeding options exist:

- External test gas feed directly at the gas sampling probe (option)
- Internal test gas feed in the MAC800 analysis system at the sample gas cooler
- ▶ Refer to the wiring diagram of the MAC800 analysis system in the project documentation for system-specific variants.

Adjustment can be performed either with automatic or manual control:

- Automatic calibration
- Manual calibration with automatic feeding of test gases
- Manual calibration with manual feeding of test gases
- ▶ Depending on the analyzer, adjustment can be performed with external span gases, with internal calibration cuvette and / or ambient air.
- ▶ Refer to the Operating Instructions of the corresponding analyzer for further details describing adjustment variants.

6.3 Performing the adjustment procedure

- ▶ Refer to the Operating Instructions of the corresponding analyzer and the wiring diagram of the MAC800 analysis system for further details on performing adjustment resp. the description of the respective analyzer adjustment.

General information on adjustment

- Span gases must be connected or fed in the specified concentrations as well as with the specified maximum pressures.
- Consider the test gas delay time as well as the adjustment measuring interval specific to the application (e.g.: Consider the line length).

Information on automatic adjustment:

- ▶ Adapt the factory settings made for the start time and time interval for automatic adjustment starts to the system-specific/project-specific conditions.
- ▶ Adapt the factory settings for test gas delay time and adjustment measuring interval to the application-specific conditions.

6.4 Adjustment

Adjusting (or possible calibration) external components and signal generators.

External components and signal generators connected to the MAC800 measuring system or fed by the MAC800 measuring system must be adjusted or calibrated according to the individual component characteristics and applications, independent from the MAC800 measuring system.

MAC800

7 Shutdown

- Standby operation
- Switch-off procedure / switching off
- Shutdown
- Storage
- Disposal

7.1 General information



NOTICE:

- ▶ Comply with the safety information, applicable health and safety measures and instruction sequence during shutdown.

7.2 Switch-off procedure / switching off

7.2.1 Safety measure: Secure connected locations

- 1 Shutting down the MAC800 analysis system / gas analyzer can affect external locations. Inform external locations as required.
- 2 Make sure automatic contingency measures are not triggered when shutting down. It may be necessary to take into consideration with which switching logic the switching outputs of the MAC800 analysis system / gas analyzer function.
 - ▶ Observe the Operating Instructions for the gas analyzer.
- 3 If a data processing system is connected, it may be required to manually indicate a planned shutdown, so that the system will not interpret the shutdown as a MAC800 analysis system malfunction.

7.2.2 Safety measure: Completely remove the sample gas



WARNING: Hazard by noxious sample gases

If the MAC800 analysis system was used to measure toxic or dangerous gases:

- ▶ When necessary: Take suitable protective measures.
- ▶ Purge the measuring system sufficiently long with a neutral gas (e.g. with nitrogen)



NOTICE:

- ▶ Consider the maximum allowable (sample) gas pressure of the analyzer when purging with a neutral gas.
- ▶ Refer to the Operating Instructions or the Data Sheet of the analyzer for the applicable maximum sample gas pressure.

7.2.2.1 When measuring toxic, dangerous or wet gases

If the MAC800 analysis system was used to measure toxic, dangerous or wet gases, gas paths as well as components carrying sample gas must be purged thoroughly with a neutral gas before shutting down.

- 1 Purge all gas paths of the MAC800 analysis system, including external sample gas lines, for several minutes with a »dry« neutral gas - e.g. with nitrogen (techn.)
 - ▶ Consider the maximum allowable sample gas pressure of the analyzer when purging with a neutral gas. Refer to the Operating Instructions or the Data Sheet of the analyzer for the applicable maximum sample gas pressure.
 - Purging with ambient air could also be considered depending on the application and ambient conditions.
In this case, it suffices when the system suctions in ambient air for several minutes on the sample gas probe side.
(It may be necessary to pull the sample gas probe out of the duct here.
Attention! Application conditions and safety information must be observed.)
- 2 Now stop sample gas feed, close off all gas connections of the MAC800 analysis system, or close the relevant valves in the purged gas path.
Sample gas feed (resp. sample gas suctioning in) can be interrupted by switching the

sample gas pumps / analyzers off or via a corresponding manual analyzer menu function. Refer to the Operating Instructions of the relevant analyzer for details on operation and menu functions.



It is recommended to activate the »Maintenance« status output per menu function on the analyzer. This switches the sample gas pump off and sends a maintenance signal to a possible external location to signal that the MAC800 analysis system is no longer in regular measuring operation.

7.2.2.2

When measuring harmless gases**WARNING:**

In case of doubt, contact the plant operator or SICK Customer Service to clarify or classify the sample gas as a harmless medium.

- 1 Stop sample gas feed to the MAC800 analysis system by switching off the sample gas pumps / analyzers or using a corresponding manual analyzer menu function as well as by closing off any shutoff fittings installed.
 - ▶ Refer to the Operating Instructions of the respective analyzer for details on operating:



It is recommended to activate the »Maintenance« status output per menu function on the analyzer. This switches the sample gas pump off and sends a maintenance signal to a possible external location to signal that the MAC800 analysis system is no longer in regular measuring operation and pending measurement signals are therefore implausible.

- 2 Separate the MAC800 analysis system from the external sample gas paths so that no sample gas and test gas can flow into the MAC800 analysis system. (E.g. with overpressure in the measuring channel.)
- 3 Now close off all gas connections, lines and valves on the MAC800 analysis system.

7.2.3

Switch off

- ▶ Switch the MAC800 analysis system off using the main switch (→ page 18, Fig. 3) (position "OFF").
Refer to the wiring diagram for the corresponding designation and location / position of the main switch.

**NOTICE:**

With control cabinet climate control devices (option):

- ▶ Observe the minimum switch-off times of the control cabinet cooling unit when switching the MAC800 analysis system on or off.

Non-observance can damage the control cabinet cooling unit.

- ▶ Refer to the specific Operating Instructions of the control cabinet cooling unit for the recommended minimum switch-off time.

7.3

Shutdown

- ▶ Disconnect the MAC800 measuring system completely from the power supply.
- ▶ Disconnect the sample gas line from the probe and cabinet.

**WARNING: Hazard by noxious sample gases**

If the MAC800 analysis system was used to measure toxic or dangerous gases:

- ▶ When necessary: Take suitable protective measures.
- ▶ Purge the measuring system sufficiently long with a neutral gas (e.g. with nitrogen)

- ▶ Dispose of the condensate.

**WARNING: Acidic condensate**

- ▶ Observe suitable safety measures when disposing of condensate
- ▶ Dispose of condensate according to local regulations.

- ▶ Empty and dispose of adsorbent.

**WARNING: Noxious adsorbent**

Depending on the sample gas or application, the adsorbent can be contaminated with noxious and / or highly flammable substances.

- ▶ Observe applicable health and safety regulations.
- ▶ Regeneration of the adsorbent is not allowed when it is contaminated with dangerous substances.
- ▶ Dispose of used adsorbent as hazardous waste according to the applicable disposal regulations.

- ▶ Empty washing bottles / humidifier containers (option).
- ▶ Close off the gas inlet/outlet on the analyzer.
- ▶ Close off the end of the sample gas line on the probe side.
- ▶ Dismantle the sample gas probes and close off the connections with blind flanges.
- ▶ Disconnect or close off any other optional connections (e.g. instrument air, water connections, connections for condensate outlet).

7.4

Storage

Storage conditions:

- Indoors.
- Ambient temperature: -20 - + 55 °C.
- Relative humidity max. 80%, without condensation.
- Recommendation: Store the MAC800 as dry as possible.



To prevent condensate occurring, purge the internal sample gas path thoroughly with a »dry« neutral gas before shutting down.

7.5

Disposal

Observe the relevant local conditions for the disposal of industrial waste.



- The liquid in the dismantled storage container is acidic and contains inorganic or organic substances that are toxic or harmful to the environment. This waste must be disposed off according to legal regulations and as hazardous waste when necessary.
- Dispose of used adsorbent as hazardous waste according to the applicable disposal regulations.

The following subassemblies could contain substances that have to be disposed of separately:

- *Electronics*: Condensers, rechargeable batteries, batteries.
- *Display*: Liquid of LC display.
- *Sample gas filters*: Sample gas filters could be contaminated by pollutants.
- *Adsorption pads*: Adsorption pads could be contaminated with pollutants.
- *Sample gas paths*: Toxic materials in the sample gas could have been absorbed or trapped in »soft« gas path materials (e.g. hoses, sealing rings). Check whether such effects have to be considered during disposal.
- *Analyzer modules*
 - Observe the information on disposal in the Operating Instructions of the relevant analyzer.
- *Cabinet cooling unit (option)*:
 - Correct disposal of refrigerants of the cabinet climate unit.
 - Observe the information on disposal in the Operating Instructions of the relevant cabinet cooling unit.

MAC800

8 Maintenance

Maintenance, information

Maintenance signal

Maintenance recommendation

Spare and wearing parts

8.1

Important maintenance information**WARNING:**

- Whenever possible, only replace components with the equipment switched off.
(Maintenance work could also be carried out conditionally in “Maintenance mode” under consideration of all safety regulations and information).
- If you have to open the device for adjustment or maintenance work, repair or replacement of parts, disconnect it first from all voltage sources.
- If the open device must be live for adjustment or maintenance, this work has to be performed by skilled persons who are familiar with potential hazards.
- Never interrupt the protective conductor connections inside or outside the device. The interruption can cause the device to become dangerous.
- If you have reason to suspect that safe operation of the device is no longer possible, put the device out of operation and secure it against unauthorized start-up.
- No components may be removed, added or changed on the device unless described and specified in the official manufacturer information. Otherwise:
 - Any warranty by the manufacturer becomes void
 - The approval could become void
- If you feed combustible or explosive sample gas through the analyzer: There is risk of explosions when the gas path is leaky or when closed gas paths or lines are opened.
- Do not put the detonation flame arrester function integrated in the system in the sample gas supply line as well as the sample gas outlet out of operation when using the MAC800 analysis system to measure explosive gases.
- Depending on the measuring medium, toxic deposits could be contained in the feeders with media contact.
- Acidic solutions (condensate) can occur.
- Attention: Depending on the sample gas or application, the adsorbent can be contaminated with noxious and / or highly flammable substances.
- Surfaces of system components can be hot.
(E.g.: converter enclosure, converter cartridge, gas sampling probe, sample gas line, and others.)



- The liquid in the dismantled storage container is acidic and contains inorganic or organic substances that are toxic or harmful to the environment.
- Used adsorbent is hazardous waste.
- ▶ This waste must be disposed off according to legal regulations and as hazardous waste when necessary.



Refer to the Operating Instructions of the respective system components for further details on maintenance and warning / safety information.

8.2 Maintenance signal (Maintenance mode)

The »Maintenance« status output can be activated manually to signal to external locations that the MAC800 analysis system is no longer in regular measuring operation, for example because maintenance work is being carried out.

Activation is done per analyzer menu function or via a separate maintenance switch → page 17, Fig. 2) depending on the version of the MAC800 analysis system.

Refer to the Operating Instructions of the relevant analyzer or the wiring diagram for version and details.

- Activating »Maintenance« mode per analyzer menu function switches off the sample gas pump and a maintenance signal informs a possible external location that pending measurement signals are implausible.
- If operating mode »Maintenance« is activated per optional maintenance switch (system-specific equipment), the sample gas pump function is not put out of operation and only the maintenance signal is set.
- ▶ Remember to switch the maintenance signal off again when it is no longer needed.

8.3 Stand-by

- Sample gas feed is stopped.
- The system is purged with instrument air.
- The red lamp on the system cabinet goes on.
- Relay "Failure" is active.
- Measured values are retained at the last current values.

Refer to the Operating Instructions of the analyzer for details on operation and the relevant menu functions.

8.4 Visual inspection / function control

- ▶ It is recommended to carry out this visual check weekly.
- ▶ For the complete analysis system
Regular checks of screw connections, hose connections, gas lines and other connections to the MAC800, the probe and further system components.
- ▶ Check enclosure and condensate pump for possible damage by acids.

8.5 Description of maintenance work

8.5.1 Maintenance recommendations / maintenance intervals

- Maintenance intervals depend on the application.
- In principle, the maintenance recommendations in the respective Operating Instructions of the system components are applicable. The recommendations depend on the process and are not within SICK's area of responsibility.
 - Refer also to the Operating Instructions of the respective system components.
- SICK recommends the following checks. (Based on average operation.)

System components	Recommended check / Description of maintenance	Recommended maintenance intervals		
		Weekly	Monthly	Yearly
Gas sampling probe (option)	Check filters and seals. Replace filters regularly depending on wear. Remark: Observe the Operating Instructions of the gas sampling probe.		X	
Sample gas line (option)	Check heating function. Clean regularly. Remark: Observe respective Operating Instructions or Assembly Guidelines on fitting heating hoses.		X	
Filter (option)	Check filter condition / degree of contamination. (Filter wear can vary depending on the application.) Check for condensate in filter housing bottom. Drain off condensate when necessary. Remark: Observe relevant Operating Instructions / Data Sheets.	X		
Corrosion inhibitor filter (option) (Brass wool filter)	Check filter condition. (Filter wear can vary depending on the application.) (Replacement criterion depending on the application: 2/3 colored dark / or strong wool degradation) Attention: When replacing brass or glass wool, make sure no particles can penetrate the control cabinet.	X		
Glass wool filter (option)				
Gas washer (option) Washing bottles (option) Humidifier container (option) (Water pads)	Check function. Check liquid reserves (solution resp. distilled water) in washing bottles / humidifier containers and top up as necessary. (Recommend filling quantity approx. 50% of container volume.) Check function of gas washer with automatic media replacement (ensure feed/drainage). Check for contamination / blockage. Clean bottles and bubbling frits resp. Raschig rings regularly. Note: Bubbling frits / Raschig rings - rings are fragile.	X		
Sample gas pump (option)	Check pump function. Remark: Observe relevant Operating Instructions.		X	
Water trap	Replace water trap at least once a year. Note: Water trap blocks when condensate occurs and must be replaced. In this case, the system reports "System error" because the gas flow is interrupted.			X
Filter fan of cabinet vent (option)	Check filter fan function. Clean heavily contaminated filter pads and replace as necessary. Set filter pad replacement interval individually depending on dust volume and operating time. Attention: Replace filters in good time. Dirty filter pads lead to temperature increases in control cabinets. Filter pads can be cleaned by flushing or blowing out. Remark: Observe Operating Instructions of filter fan.		X	
Cabinet thermostat (option)	Check function in connection with the filter fan.		X	
Condensate collection container (with level switch)	Check container condition. Empty when necessary. (Warning message) Note: Sample gas condensate is hazardous waste. Observe regulations on condensate disposal according to the Water Resources Law (WHG). Attention: The liquid contains acid. Observe applicable health and safety regulations.		X	
System components	Recommended check / Description of maintenance			

Adsorption pads (universal filter) (option)	<p>The adsorption pad is used to adsorb water vapor in certain applications. The adsorbent becomes colorless as it absorbs more and more moisture (e.g. silica gel / M&C "90F5110" with color indicator orange). Replace the adsorbent when it is completely colorless. The state of the adsorbent can be seen from the outside without having to unscrew the filter.</p> <p>Remark: Observe the relevant product information resp. Data Sheet of the universal filter ("FT-AP" Filter fitting) when filling filter cartridges with the adsorbent planned for the application.</p> <p>Attention: Depending on the sample gas resp. application, the adsorbent can be contaminated with noxious and / or highly flammable substances.</p> <p>Dispose of used adsorbent as hazardous waste according to the applicable disposal regulations.</p> <p>Attention: Observe the applicable health and safety regulations.</p> <p>Note: Regeneration of the adsorbent is not allowed when it is contaminated with dangerous substances.</p>
Sample gas cooler (including condensate pump)	<p>Check enclosure and condensate pump for any possible damage. Replace the Teflon filter cartridge, when fitted as an option, regularly depending on wear and contamination. Regulate refrigerant condensers regularly depending on contamination. Replace condensate pump hoses regularly depending on wear but at least once a year. It is recommended to replace hoses every three months as precautionary measure.</p> <p>Attention: The condensate can be acidic.</p> <p>Check screw connections / connections.</p> <p>Remark: Observe Operating Instructions of sample gas cooler</p>
Condensate pump (option)	<p>Check enclosure and condensate pump for any possible damage. Replace condensate pump hoses regularly depending on wear but at least once a year. It is recommended to replace hoses every three months as precautionary measure.</p> <p>Attention: The condensate can be acidic.</p> <p>Check screw connections / connections.</p> <p>(Remark: Observe Operating Instructions for condensate pump.)</p>
Analyzer	Refer to Operating Instructions of relevant analyzer.
NOx converter (option)	<p>Note: Make sure the correct cartridge type is used when replacing / exchanging catalyzer cartridges (differing temperature ranges).</p> <p>Refer to Operating Instructions of converter for details on exchanging catalyzer cartridges.</p> <p>Warning: Very hot catalyzer cartridge. Risk of burns when exchanging.</p>
Gas monitor / Gas measurement computer (option) (Gas warning system)	<p>Have it tested in appropriate intervals with test gas by skilled Service personnel.</p> <p>Remark: Observe Operating Instructions of gas monitor.</p> <p>Attention: The operator must check the limit or threshold values (alarm thresholds) set at the factory locally and adapt these to local conditions. The settings must observe the relevant regulations and safety regulations as well as laws on monitoring toxic gases and / or LEL monitoring.</p> <p>Recommendation: Conclude a maintenance contract with the Service department of the device manufacturer.</p> <p>Note: In case of an alarm, sample and test gas feed are interrupted and a visual as well as acoustic warning message triggered.</p>
Detonation flame arrester (option)	<p>Inspect detonation flame arresters regularly for contamination and clean as necessary.</p> <p>Note: Intervals depend on media flowing through. A minimum inspection interval of one year is generally recommended. The operator must determine maintenance intervals. If no operating experience is available, the operator must initially check the equipment with regularly inspections during the start-up phase to determine when contamination occurs and then define the maintenance intervals.</p> <p>Attention: Observe laws and protective regulations applicable at the installation location. Operator and responsible supervisors are responsible for compliance with these regulations. Maintenance work must be carried out by qualified skilled persons.</p> <p>Remark: Observe maintenance information in Operating Instructions.</p>
Lines / hoses	<p>Check for possible blockages, contamination, cracks. Check for possible porous or brittle condition. Check for tight, correct seat. Clean or replace lines / hoses as necessary.</p>
Control cabinet cooler (option)	Refer to Operating Instructions of respective system components.
Span gases (option)	<p>Check condition and availability of span gases regularly (e.g.: Feed pressure from central gas supply, remaining reserves in pressure cylinders, use-by date).</p> <p>(Option: Monitor cylinder pressure with contact pressure gauge.)</p>

8.6 **Cleaning information**

- ▶ Use a soft cloth to clean the cabinet on the outside and inside.
- ▶ Do not use any mechanically or chemically aggressive cleaning agents.
- ▶ Do not allow any liquids to penetrate the control cabinet or housings of system components.

8.7 **Recommended spare parts (SP) / wearing parts (WP)**8.7.1 **SP/WP for internal components**

- Wearing and spare parts depend on the analyzer and application.
- Service life of wearing parts depends on the application.
- ▶ Store parts in a dry, ventilated area protected against dust.
- ▶ Avoid long storage times.

Sample gas filter / SICK filter					
Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)
Filter diaphragm made of glass fiber 55 mm diameter Sales unit=25 pcs.	5 312 005	Front fitted filter FI56NK3 (2028590) ext. filter	X		1 pc./ 1 y.
Brass wool, approx. 12 g	2 028 844	Corrosion inhibitor filter (2028305)	X		2 pcs./ 1 y.
Coupling GL18 - DN4/6 - PVDF	5 312 119	Corrosion inhibitor filter (2028305)		X	2 pcs./ 2 y.
Filter tube DURAN L=200 mm D=18 mm 2xGL18	4 039 113	Corrosion inhibitor filter (2028305)		X	1 pc./ 2 y.
Corrosion inhibitor filter, complete - incl. filling (brass wool) - incl. 2 connections DN4/6 PVDF (l=230 mm, D =16, glass)	2 028 305			X	1 pc./ 2 y.
Filter wool, glass No. 70311 µm Sales unit=500 g	5 311 940	Glass wool filter	X		1 pc./ 1 y.
Coupling GL32 - DN4/6 - PVDF	5 312 284	Glass wool filter		X	2 pcs./ 2 y.
Filter tube DURAN L=250 mm D=40 mm 2xGL32	4 039 232	Glass wool filter		X	1 pc./ 2 y.
Water trap WT20.5K	5 313 317	Water trap		X	1 pc./ 2 y.
Filter element (front panel)	5 317 730	(2 028 590) FI56NK3 Front fitted filter Diaphragm fine filter (view filter)	X		1 pc./ 1 y.

Sample gas filter / filter M&C					
Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)

Filter element F-0,1GF50 (glass fiber) 0.1 µm	2 038 474	Front fitted filter FPF-0,1GF (5311705)	X		1 pc./ 1 y.
Filter element F-2T (PTFE) 2 µm	5 312 341	Universal filter FP, FT, FS	X		1 pc./ 1 y.
Filter glass F-120G	5 312 766	Universal filter FP, FT, FS		X	1 pc./ 2 y.
Filter glass F-240G	5 312 707	Universal filter FP, FT, FS		X	1 pc./ 2 y.
Spare Viton ring 26	5 312 775	Universal filter FP, FT, FS	X		1 pc./ 1 y.
Filter element for filter CLF-5	5312349/ 5 311 437	Aerosol filter CLF-5 (5311101)	X		1 pc./ 1 y.
Spare parts set I for filter CLF-5/W (filter frit, diaphragm filter, flat ring disc, O-ring)	5 312 359	Aerosol filter CLF-5/W (5311436)	X		1 pc./ 1 y.
Spare parts set II for filter CLF-5/w (diaphragm filter, flat ring disc)	5 312 360	Aerosol filter CLF-5/W (5311436)	X		1 pc./ 1 y.
Adsorption pad / filter FT-AP 03F5200 (M&C)	5 322 648	----		X	1 pc./ 2 y.
Adsorption material For adsorption pad Sorbeads with humidity indicator. (silica gel) Color: orange, quantity: 1000 ml	5 603 168	Adsorption pad FT-AP 03F5200 (M&C)	X		As required

Sample gas filter / filter Bühler

Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)
Filter element S2 (glass fiber) 2 µm Sales unit=5 pcs.	5 312 243	Fine filter AGF-PV-30-S2 (5312425)	X		1 pc./ 1 y.
Filter element F2L (PTFE) 2 µm Sales unit=1 pc.	5 317 771	Fine filter AGF-PV-30-F2L (0730459)	X		1 pc./ 1 y.
Filter element F25 (PTFE) 25 µm Sales unit=5 pcs.	5 311 943	Fine filter AGF-PV-30-F25 (5312424)	X		1 pc./ 1 y.
Filter element F25L (PTFE) 25 µm Sales unit=1 pc.	0 026 797	Fine filter AGF-PV-30-F25L (0026796)	X		1 pc./ 1 y.
Filter element F2 (PTFE) 2 µm Sales unit=5 pcs.	5 322 649	Fine filter AGF-T-30-F2 (5312703)	X		1 pc./ 1 y.
Filter element DRG25VA-V (1.4301) 25 µm Sales unit=1 pc.	5 312 687	Fine filter AGF-VA-23V (5312686)	X		1 pc./ 1 y.
Filter element 12-57-C (borsilicate fiber) Sales unit=1 pc.	5 312 319	Coalescence filter K-AGF-PV-30-A (5317088)	X		1 pc./ 1 y.

Filter pad for cabinet fan

Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)
Replacement filter pad for outlet filter and filter fan W 173 x H 173 x D 17	5 306 678	Outlet filter SK3323.xxx (5 315 501)	X		As required
Replacement filter pad for outlet filter and filter fan W 221 x H 221 x D 17	5 309 684	Outlet filter SK3325.xxx (5 309 240)	X		As required
Replacement filter pad for outlet filter and filter fan W 289 x H 289 x D 17	5 308 584	Outlet filter SK3326.xxx (5 314 520)	X		As required
Fine filter pad for filter fan (ventilator, filter) W 173 x H 173 x D 12	5 306 678	Filter fan SK3323.xxx (6 029 938)	X		As required
Fine filter pad for filter fan (ventilator, filter) W 221 x H 221 x D 12	5 309 684	Filter fan SK3325.xxx (6 027 778)	X		As required

Fine filter pad for filter fan (ventilator, filter) W 289 x H 289 x D 12	5 312 422	Filter fan SK3326.xxx (6 034 702)	X		As required
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Washing bottles / humidifier containers					
Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)
Humidifier container, complete FP-BF (G1/4) (03F5700)	5 320 642			X	As required
Washing bottle, complete FP-W (G1/4) (03F5300)	5 311 644			X	As required
Washing bottle, complete FP-W (GL18) (03F5500)	5 314 373			X	As required
Gas washer, complete Gas washer bottle DURAN D=50,L=280.3xGL14 incl. Raschig rings approx. 5 x 5 mm, approx. 120 ml incl. screw cap and O-ring ID=48, S=4	2 038 449			X	As required

Sample gas pump, Bühler					
Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)
Bellow, complete with threaded pin, for sample gas pump P2.3SP, PTFE (4200059)	5 312 043	Sample gas pump P2.3SP/-V (6032166 / 6026333)		X	1 pc./ 2 y.
Set of inlet/outlet valves for sample gas pump P2.x, max. 80°C (4201002)	5 311 455	Sample gas pump P2.3SP/-V (6032166 / 6026333)		X	1 pc./ 2 y.
Set of inlet/outlet valves for sample gas pump P2.x, max. 140°C (4202002) 0 743 493 ET	5 312 793	Sample gas pump P2.3SP/-V (6032166 / 6026333)		X	1 pc./ 2 y.
Spare parts set: Tappet; excenter, screw and ball bearing (4200075)	2 027 980	Sample gas pump P2.3SP (6032166)		X	1 pc./ 2 y.
Sample gas pump, complete, Bühler P2.3SP	6 032 166			X	1 pc./ 3 y.
Sample gas pump, complete, Bühler P2.3SP-V	6 026 333			X	1 pc./ 3 y.

Sample gas pump KNF					
Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)
Spare parts set for pump N86KT.18 comprising: 1 pc. structure diaphragm, 2 pcs. valve plate, 2 pcs. sealing ring	5 312 317	Sample gas pump	X		1 pc./ 1 y.
Sample gas pump, complete N86 KT.18 230 VAC, in housing, flow rate approx. 250 l/h	6 027 252	Sample gas pump		X	1 pc./ 3 y.
Sample gas pump, complete N86 KT.18 115 VAC, in housing, flow rate approx. 250 l/h	6 035 992	Sample gas pump		X	1 pc./ 3 y.

NOx converter M&C					
Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)
Heater CG-2 (95A9057), 230V 50/60Hz	6 027 894	NOx converter CG2		X	1 pc./ 2 y.
Converter cartridge CG-2-C (95A9003) carbon filling, T=350°C with spare O-ring-set	5 320 289	NOx converter CG	X		1 pc./ 1 y.
Converter cartridge CG-2-SS (95A9004) stainless steel wool filling, T=660°C, with spare O-ring-set	5 315 396	NOx converter CG	X		1 pc./ 1 y.

Analyzer S800					
Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)

Spare parts set, mains plug combination 1 device plug element 1 protective cover, 1 drawer 2 G fuses 5x20, M 4.0A 2 G fuses 5x20, M 2.0A	2 028 437	S700 / SIDOR		X	1 pc./ 2 y.
Safety filter FI64 glass, 2 µm, for hose diameter=4 mm	2 027 973	S700 / SIDOR		X	1 pc./ 2 y.
Spare parts set, pump parts TYP123 diaphragm set EPDM/ozone resistant with 4 rings to hang up	2 028 438	S700 / SIDOR		X	1 pc./ 2 y.

Sample gas cooler AGT (MAK10)

Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)
Spare filter cartridge, Teflon	5 320 090	Sample gas cooler MAK10	X		1 pc./ 2 y.
Hose pump SR25, complete 115/230V 50/60Hz IP00, 5 rpm, incl. hose Novoprene and 2 pcs. hose sockets	6 039473	Sample gas cooler MAK10		X	1 pc./ 2 y.
Hose pump spare parts set SR25 consisting of 5 pump hoses 4.8x1.6 Novoprene, 1 pc. wrapping tape roll	2 050 587	Sample gas cooler MAK10	X		3 pcs./ 2 y.

Condensate pump SR25

Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)
Hose pump SR25, complete 115/230V, 50/60Hz, IP00, 5 rpm. 1 duct, 2 rollers on assembly bracket Hose 4.8 x 1.6 Novoprene - 0.4 l/h with 2 hose sockets 5 mm	6027 131			X	1 pc./ 2 y.
Hose pump spare parts set SR25 comprising: 5 pcs. pump hose 4.8 x 1.6 Novoprene 1 pc. wrapping tape roll	2 027 976	Hose/condensate pump SR25	X		3 pcs./ 2 y.

8.7.2 SP/WP for external components

Sample gas probe SP10, SP10-H					
Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)
Stainless steel filter frit, type V10	5 313 358	Gas sampling probe SP10		X	1 pc./ 2 y.
Stainless steel filter frit, type V10-1 with volume displacer	6 012 394	Gas sampling probe SP10		X	1 pc./ 2 y.
Seal 1" for SP10 V10	5 306 553	Gas sampling probe SP10		X	1 pc./ 2 y.
Flange seal DN65 PN6B [67]	5 313 427	Gas sampling probe SP10		X	1 pc./ 1 y.
Heating cartridge HLP for SP10H, filter H/H0, L=130 mm, 230 VAC / 315W	6 012 395	Gas sampling probe SP10-H		X	2 pcs./ 1 y.
Heat-conductive paste for heating cartridge insertion	5 602 693	Gas sampling probe SP10-H		X	1 pc./ 1 y.
Excess temperature limiter	6 012 401	Gas sampling probe SP10-H		X	1 pc./ 1 y.

Sample gas probe SP210-H; SP210-H/W					
Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)
Parts set SP210, comprising: 4 pcs. Viton flat seal [30] (5306634) 2 pcs. filter element SP-2K (5308926) 2 pcs. O-ring set (5308928) 2 pcs. O-ring set [94], Viton (5312366) 2 pcs. lid seal (5312367)	2 031 994	Gas sampling probe SP210-H	X		1 pc./ 1 y.
Flange seal DN65 PN6B [67]	5 313 427			X	1 pc./ 1 y.
Thermostatic switch	6 027 810			X	1 pc./ 1 y.
Heating cartridge HLPSR	6 027 809			X	2 pcs./ 1 y.
Heat-conductive paste for heating cartridge insertion	5 602 693			X	1 pc./ 1 y.

Sample gas probe SP2000; SP2000-H					
Description	Part No.	Fitted in	WP	SP	Requirement per x year(s)
Parts set SP2000, comprising: 4 pcs. Viton flat seal [30] (5306634) 2 pcs. filter element S-2K150 (6012411) 2 pcs. O-ring [55], Viton (5306625) 2 pcs. O-ring [39], Viton (5306624)	2 031 994	Gas sampling probe SP2X00	X		1 pc./ 1 y.
Flange seal DN65 PN6B [67]	5 313 427	Gas sampling probe SP2000		X	1 pc./ 1 y.
Heating cartridge HLP	6 012 408	Gas sampling probe SP2000-H		X	2 pcs./ 1 y.
Heat-conductive paste for heating cartridge insertion	5 602 693	Gas sampling probe SP2000-H		X	1 pc./ 1 y.

8.8

Further and supplementary spare/wearing parts

Refer to Data Sheets / Operating Instructions of the respective system components for further information on spare/wearing parts as required.

MAC800

9 Clearing Malfunctions

Fuses

Status messages / group alarms

Implausible measuring results

9.1 **Fuses**

- ▶ Check correct condition of fuses according to the wiring diagrams
- ▶ Refer to the Operating Instructions / Data Sheets of the system components for details

9.2 **Status indicators / group alarms**

The following messages are displayed resp. output:

- Creation of a group alarm on the analysis system (refer to wiring diagram of the MAC800 analysis system for details)
- Status indicators on the analyzer display (display messages, significance, cause / information and service information, refer to Operating Instructions of analyzer)
- Status indicators / plain-text messages on the LOGO control display

9.3 **Implausible measuring results**

First check the following for implausible measuring results:

- ▶ Whether the specified and elementary process conditions are complied with
- ▶ Whether the sample gas path shows any leaks

Refer to the Operating Instructions of the analyzer for further possible causes and information on implausible measuring results resp. on measured values that are obviously incorrect or fluctuate for no apparent reason.

Switch-on conditions / additions to clearing malfunctions

Note:

Switch-on conditions are already defined for the MAC800 analysis system. These serve the safety resp. function monitoring of particular analysis system components and are realized using signal status queries for these components.

Depending on the version of the MAC800 analysis system, status signal queries run either via:

- A signal series connection
- I/O interface module of the SCU (→ page 18, Fig. 3)
- ▶ Refer to the wiring diagram of the MAC800 analysis system for the specific parameter settings and version resp. determination of switch-on conditions.



NOTICE:

- Switch-on conditions configured at the factory must not be deactivated.
- Non-observance resp. deactivation of switch-on conditions can cause severe damage.

The following status parameters are queried, for example, to fulfill the switch-on conditions:

- Gas sampling probe (option)
 - Nominal temperature monitoring for heated gas sampling probes (option)
 - Monitoring runs via a low temperature alarm contact integrated in the sample gas probe.
 - A status signal is enabled confirming fulfillment of the switch-on conditions when the nominal value setting is maintained.
 - Refer to the wiring diagram of the MAC800 analysis system or the Operating Instructions of the sample gas probe for the nominal values set or to be set depending on the probe type and system version.
- Sample gas line (option)
 - Heating function monitoring for regulated, heated sample gas lines (option)
 - A status signal is enabled by the temperature controller confirming fulfillment of the switch-on conditions when the nominal value setting is maintained. Refer to the wiring diagram of the MAC800 analysis system for the system-specific nominal values set.
- NOx converter (option)
 - Function monitoring of converter
 - When no operating malfunction of the converter is present, a status signal to confirm fulfillment of the switch-on condition is enabled when the operating temperature (nominal temperature) is reached.
- Sample gas cooler
 - Function monitoring of cooler (status query)
 - When no operating malfunction of the cooler is present, a status signal to confirm fulfillment of the switch-on condition is enabled when the operating temperature (cooling temperature) is reached.
- Level sensor
 - Monitoring of filling level in condensate collection container.
 - A status signal to confirm fulfillment of the switch-on condition is enabled as long as the specified maximum filling level of the condensate collection container has not been reached.

- Analyzer
Appropriate messages are sent to the SCU via CAN bus for failure monitoring of the analyzer or for monitoring / inquiring its self-diagnostic function (for internal monitoring parameters such as temperature, throughflow, humidity) depending on the probe type and system version.
Refer to the analyzer instructions for the criteria for creating an interference signal in the analyzers.
- Pump function
The pump function of the sample gas pump is controlled by the analyzer. A status signal confirming fulfillment of the switch-on condition is enabled when the sample gas pump is activated (operation). When using a LOGO! / PLC control (optional), this can also monitor the pump function (gas flow).

MAC800

10 Specifications

Declaration of conformity
Approvals
Parameter lists
Technical Data

10.1 Compiances

The technical version of this device complies with the following EU directives and EN standards:

- EU Directive: LVD (Low Voltage Directive)
- EU Directive: EMC (Electromagnetic Compatibility)

Applied EN standards:

- EN 60439-1/A1: Low voltage switchgear and control gear assemblies.
- According to Paragraph 13 of the EMC Directive, conformity based on an EMC evaluation is assumed.



10.1.1 Electrical protection

- Contamination: The device operates safely in an environment up to contamination level 2 according to EN 60439-1 (usual, non-conductive contamination and temporary conductivity by occasional moisture condensation).
- Electrical power: The wiring system to the mains supply voltage of the system must be installed and fused according to the relevant regulations.

10.1.2 Suitability test

Performance-tested Version (EN 15267-3) of the MAC800: MAC GMS800.

10.2 Dimensions



Refer to the view drawings resp. wiring diagram in the system documentation for dimensions.

10.3 **Technical Data**

Refer to the Operating Instructions and / or Data Sheets of the respective system components as well as the wiring diagram or view drawings of the system documentation for the system and project-specific technical data of the MAC800 analysis system and system components.

Technical Data	MAC800
Versions	<ul style="list-style-type: none"> ● Standard version ● Version with NO/ NOx converter (option) ● Cabinet climate control and/or heating (option)
Analyzer	<ul style="list-style-type: none"> ● Modular gas analyzer(s) S800 (see product information)
Measuring components (possible)	CO, NO, SO ₂ , CO ₂ , H ₂ , CH ₄ , O ₂ and others (according to the analyzer, see system documentation)
Output and status signals	Typically 4 ... 20 mA (according to the analyzer, see system documentation)
Sample Requirements	
Sample gas throughput	Approx. 30 ... 100 l/h (larger sample throughput possible depending on the system)
Sample gas temperature	Max. 200 °C (390 °F) at cabinet inlet
Dew point H ₂ O	Max. 65 °C (150 °F)
General Data	
Conditions at installation location	<ul style="list-style-type: none"> ● Under a roof with protection against direct heat radiation, heavy dust load and corrosive atmosphere. ● Not suitable for potentially explosive atmospheres
Auxiliary power supply	Refer to the system-specific wiring diagram resp. system documentation for specifications on rated current/rated voltage/rated capacity. Possible variants are e.g.: <ul style="list-style-type: none"> ● 400V, 50Hz (optional) • 400V, 60Hz (optional) • 230V, 50Hz (optional) ● 230V, 60Hz (optional) • 115V, 50Hz (optional) • 115V, 60Hz (optional) ● UPS (optional)
Frost protection (optional)	Nominal capacity 500 VA
Ambient temperature in operation	+5 ... +35 °C ^[1] (+40...+95 °F) With built-in cooling unit: +5 ... 50 °C (+40...+120 °F)
Transport and storage temperature	-20 ... +55 °C (+0...+200 °F)
Relative humidity	Class F (DIN 40040), 75 % yearly average, 95 % short-term, non-condensing
Sample gas pump	<ul style="list-style-type: none"> ● Pump (internal) in analyzer conditionally adequate for up to 15 m (50 ft) sample gas line ● Pump (external) in analysis system cabinet (option) conditionally adequate for up to 35 m (115 ft) sample gas line (optional longer lengths with more powerful pumps)
Dimensions (W x H x D)	(See view drawings resp. wiring diagram in the system documentation)
Protection class	<ul style="list-style-type: none"> ● IP 54 ● With cooling unit: IP 34
Weight	Approx. 250 kg (550 lb) to 350 kg (770 lb)
Material	<ul style="list-style-type: none"> ● Sheet steel housing (see system documentation) ● GRP (see system documentation)
Color	<ul style="list-style-type: none"> ● RAL 7035 (standard) • (other colors optional)
Calibration	<ul style="list-style-type: none"> ● Manual, test gas feed manual or automatic ● Automatic (according to the analyzer, see system documentation)
Signals	1 analog output / component
Interfaces	<ul style="list-style-type: none"> ● RS232 (optional), RS422 (optional), RS485 (optional)
Bus interfaces	<ul style="list-style-type: none"> ● CAN bus / Modbus

[1]No direct sunlight

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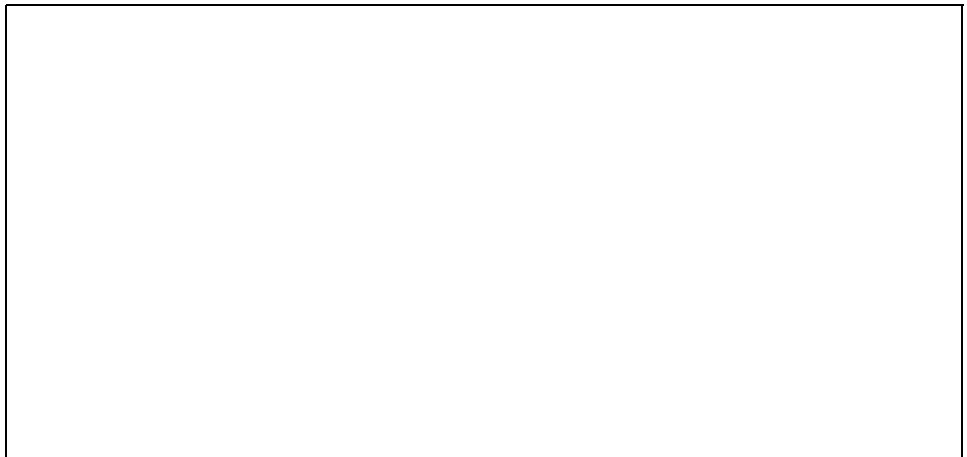
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