

ABB MEASUREMENT & ANALYTICS | DATA SHEET

# System components for sample gas conditioning



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## Measurement made easy

### System components for sample gas conditioning

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#### Careful treatment of the sample gas ensures perfect measurement results in the gas analyzer

- In most cases, the sample gas taken from the process cannot be processed by the gas analyzer without further treatment. Excessive dust content, temperature and dew point as well as excessively high or low pressure and, last but not least, interfering components in the sample gas can impair the operability of the gas analyzer and falsify the measurement result.
- System components such as the sample gas cooler, pumps and filters ensure that regardless of the process and local conditions, the gas inlet conditions of the connected gas analyzers are met and perfect measurement results are obtained.

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#### System components for sample gas conditioning

- SCC-C Sample gas cooler
- SCC-F Sample gas feed unit
- SCC-S Sample gas feed unit
- Diaphragm pump 4N
- SCC-K Converter
- SCC-U Utility unit
- Membrane filter
- CGKW Condensate monitor
- Acid filter
- Disposable filter
- Flow meters, flow monitors
- ER-144A/Ex Switching unit
- KFA Isolated switch amplifier
- Cylinder pressure reducers
- Multi-way test gas cock

## SCC-C Sample gas cooler



- Compressor sample gas cooler
- Constant outlet dew point
- 1 or 2 gas paths
- Heat exchanger made from glass, PVDF or stainless steel, exchangeable without tools
- Corrosion-resistant gas lines
- High pressure version up to 1 MPa (10 bar)
- Temperature display
- Suitable for ambient temperatures up to 50 °C
- Compact surface-mounting housing (width ½ 19 inches, 6 height units)
- System solutions in connection with the SCC-F sample gas feed unit
- Suitable for use in measuring equipment conforming with 17th BImSchV (German Federal Immission Protection Law)
- Explosion-proof versions with ATEX and CSA certifications

### Sample gas inlet conditions

#### Sample gas pressure

Heat exchanger (HE) material	Sample gas pressure $p_{abs}$	
	w/o peristaltic pump	with peristaltic pump
Glass	50 to 200 kPa (0.5 to 2.0 bar)	50 to 150 kPa (0.5 to 1.5 bar)
PVDF	50 to 250 kPa (0.5 to 2.5 bar)	50 to 150 kPa (0.5 to 1.5 bar)
Stainless steel	0.05 to 1 MPa (0.5 to 10 bar)	50 to 150 kPa (0.5 to 1.5 bar)

#### Sample gas flow rate

1 × 250 l/h (HE250) or 1 × 125 l/h (HE125) or 2 × 125 l/h, relating to sample gas pressure  $p_{abs} = 100$  kPa (1 bar) and 25 °C

#### Sample gas inlet temperature

Max. 140 °C

#### Sample gas inlet dew point

Max. 70 °C, max. 60 °C for HE250 at sample gas flow rate > 200 l/h

### Operating data

#### Sample gas outlet temperature

Factory-set to +3 °C

#### Dew point stability

±0.3 °C per 10 °C temperature change,  
±0.3 °C per 10 l/h change in flow rate

#### Refrigeration capacity

40 W at +10 to 50 °C

#### Warm-up time

Approx. 15 min

#### Pressure drop in heat exchanger

Approx. 1 hPa (1 mbar), approx. 4 to 8 hPa (4 to 8 mbar) for HE125

#### Dead volume in heat exchanger

Heat exchanger material	Dead volume in heat exchanger	
	HE125	HE250
Glass	40 ml	140 ml
PVDF	25 ml	100 ml
Stainless steel	30 ml	100 ml

#### Gas tightness

$5 \times 10^{-6}$  hPa l/s

### Display and status signal

#### Temperature display

Digital display in °C

#### Status signal

< 0 °C and > 8 °C, 2 potential-free two-way switches, switching capacity 250 V AC, 2 A

### Construction

#### Design

Surface-mounting housing ½ 19 inch, 6 height units

#### Mounting

On the wall with mounting brackets supplied or in a 19-inch cabinet/rack

#### Housing material and color

Sheet steel; light gray (RAL 7035), basalt gray (RAL 7012)

#### Degree of protection of housing

IP20 to EN 60529

#### Dimensions

See page 5

#### Weight

Approx. 15.6 or 16.5 kg with 1 or 2 heat exchangers

#### Refrigerant

R 134a

## ... SCC-C Sample gas cooler

### Materials of gas-conducting parts

PVDF, PTFE, PP, glass, FPM, stainless steel (high pressure version)

### Gas connections

#### Heat exchanger

Heat exchanger material	Sample gas inlets & outlets	Condensate outlet
Glass	Screwed pipe or hose connection GL18 <sup>1)</sup>	Pipe nipple GL25
PVDF	6 mm tube	G $\frac{3}{8}$ female thread
Stainless steel	G $\frac{3}{4}$ female thread	G $\frac{3}{8}$ female thread

1) 2 GL coupling nuts per heat exchanger with insert 6 × 4 × 1 mm threads for a hose or pipe are supplied with the unit

#### Peristaltic pump (option)

Condensate outlet PVDF, DN 4/6

### Electrical connections

#### Power supply

Cable, 3 m long, permanently fixed

#### Status signal

Cable, 3 m long, permanently fixed

### Safety

Testing to EN 61010-1

#### Protective class

I

#### Overvoltage category / degree of contamination

II / 2

#### Protective separation

Electrical isolation of the 115/230 V AC power supply from the other current circuits by means of reinforced or double insulation. Functional extra-low voltages (PELV) on the low voltage side

### Electromagnetic compatibility

#### Emitted interference

Testing to EN 61000 Part 6-3, Class B

#### Immunity to interference

Testing to EN 61000 Part 6-2, Industrial environment

### Mechanical capabilities

Testing to EN 60068-2-27 and EN 60068-2-6

#### Transport

Shock: 30 g / 18 ms / 18 shocks

Vibration: 1 g / ±0.15 mm / 5 to 150 Hz, 3 × 5 cycles

#### Operation

Vibration: 1 g / ±0.07 mm / 5 to 55 Hz, 3 × 2 cycles

### Ambient conditions

#### Ambient temperature

Operation: +5 to 45 °C,

Storage and transport: -25 to +60 °C

#### Relative humidity

≤ 75 % annual average, occasional and slight condensation permitted, ≤ 95 % on 30 days per year

### Power supply

#### Input voltage

230 V AC or 115 V AC -15 to +15 %, 50 to 60 Hz

#### Power consumption

Max. 200 VA

#### Starting current

2.5 A at 230 V AC

### Options

#### Metering device

In gas path 1 by means of a peristaltic pump installed in the SCC-C sample gas cooler or in the SCC-F sample gas feed unit, feed tank as accessory, for small SO<sub>2</sub> measuring ranges (< 1000 mg/m<sup>3</sup>) or to avoid acid aerosols

#### Peristaltic pumps

1 or 2 peristaltic pumps for discharging condensate (flow rate approx. 300 ml/h, 5 rpm) and metering (flow rate approx. 15 ml/h), pressure resistance p<sub>abs</sub> = 50 to 150 kPa (0.5 to 1.5 bar), peristaltic tube service life approx. 5 months, power consumption 3.5 VA, weight approx. 0.6 kg

### Certifications


#### IECEE CB Scheme – Safety

The SCC-C sample gas cooler is certified to the 'IEC system for mutual recognition of test certificates for electrical equipment'. It complies with standard IEC 61010-1 (3rd Edition). Certificate No. SI-4210

#### CSA – Safety

The SCC-C sample gas cooler is certified for use in general purpose environment, evidenced by full compliance with standards CAN/CSA-C22.2 No. 61010-1-12 und UL Std. No. 61010-1 (3rd Edition). Certificate No. 70006295

#### ATEX – Explosion protection

The SCC-C sample gas cooler in the category 3G explosion-proof version is suitable for use in zone 2 hazardous areas. Testing to EN 60079-0, EN 60079-7 and EN 60079-15. Designation:  II 3G Ex eC nC IIC T4 Gc Type examination certificate No. BVS 16 ATEX E 056 X

#### CSA – Explosion protection

The SCC-C sample gas cooler is certified to

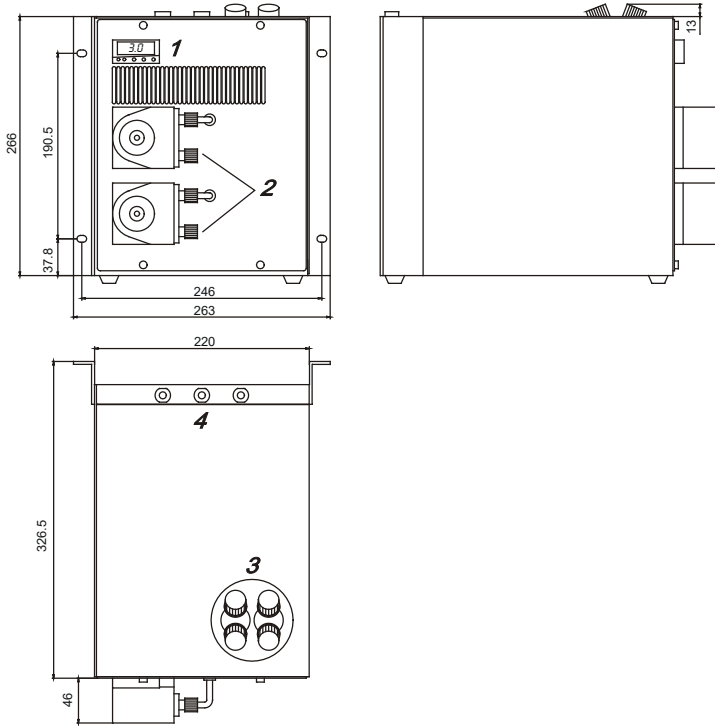
- Class 2258 02 Process Control Equipment – For Hazardous Locations – Certified to Canadian Standards and
- Class 2258 82 Process Control Equipment – For Hazardous Locations – Certified to U.S. Standards

Class 1, Div. 2, Groups A, B, C and D, Temperature code T4, maximum ambient temperature +50 °C. Certificate No. 1105720

#### GOST – Import and operation permission

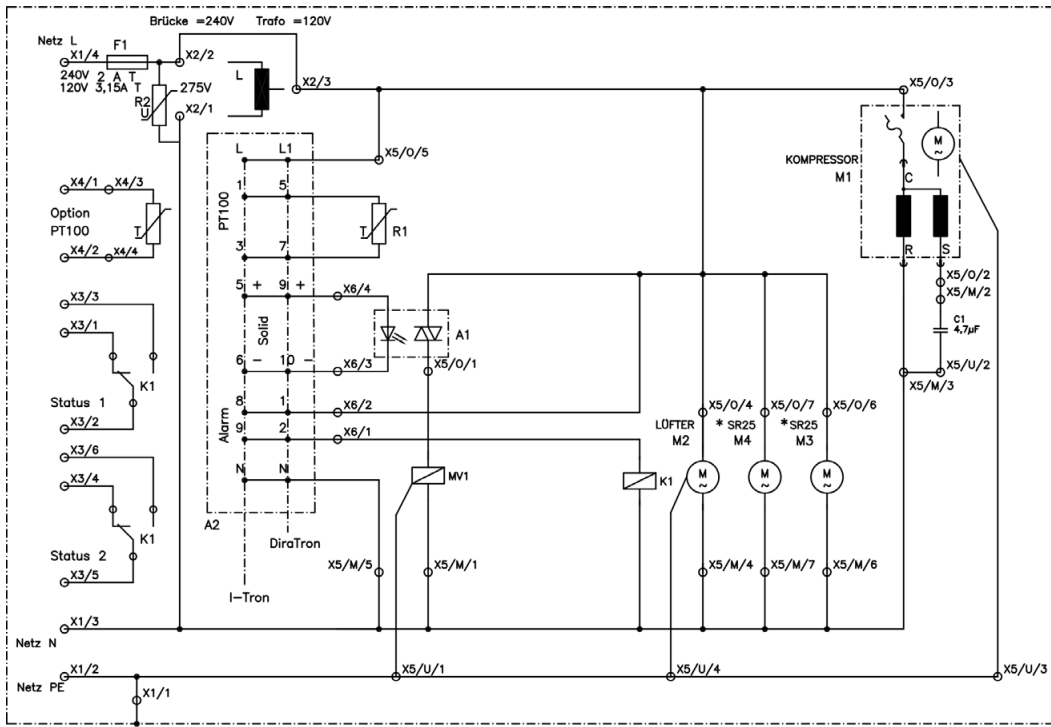
Declaration of conformity No. EAЭC N RU Д-DE.AB72.B.04753

**Dimensions** (in mm)



- 1 Temperature display
- 2 Condensate outlet (for option with peristaltic pumps)
- 3 Gas connections of heat exchangers
- 4 Conduits for the (permanently-connected) electrical connection lines

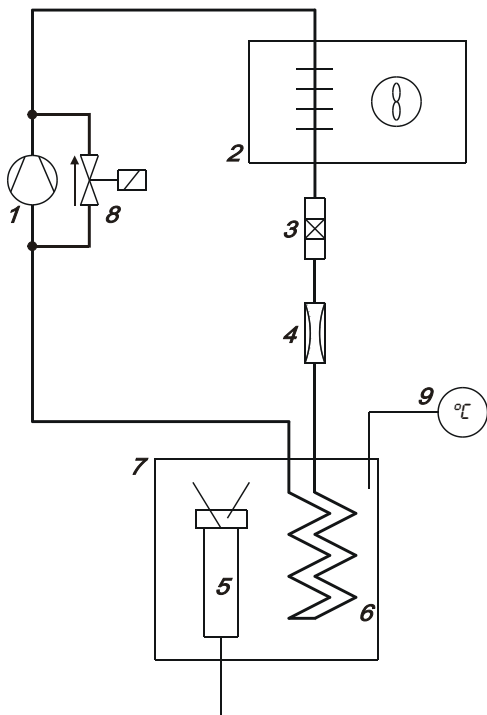
**Circuit and connection diagram**



\* SR25 = Schlauchpumpe

## ... SCC-C Sample gas cooler

### Refrigerant circuit



- 1 Refrigerant compressor
- 2 Refrigerant condenser
- 3 Refrigerant dryer
- 4 Capillary tube
- 5 Heat exchanger
- 6 Evaporator
- 7 Cooling block with temperature sensor
- 8 Valve
- 9 Temperature controller

### Accessories for condensate disposal

#### Time relay

##### Run time and off period settings

0.6 to 60 sec., recommended setting: cyclic duration factor 40 %, i.e. run time 5 minutes and off period 7.5 minutes

##### Degree of protection

Terminals IP20, housing IP50 to EN 60529

##### Weight

Approx. 0.125 kg

##### Power supply

12 to 240 V AC/DC, 40 to 440 Hz

#### Condensate collecting bottle

##### Volume

10 l

##### Material

LDPE/PVC

##### Connections

Sample gas: 1 connecting piece for hose with ID 4 to 5 mm

Condensate: 2 connecting pieces for hose with ID 12 to 13 mm

Condensate drain: SW 22

##### Weight

Approx. 1 kg

#### Level monitor

##### Switching voltage

30 V

##### Switching current

1 A

##### Switching power

30 VA

##### Connecting cable

2 × 0.25 mm<sup>2</sup>, length 5 m

### Ordering information

	Catalog No.
Timer relay	90805-4-0741607
Reagent and condensate bottle	23234-5-8328972
Level monitor condensate	23005-4-0741239
Level monitor reagent	90805-5-8308994
Condensate trap, filter surface 20 cm <sup>2</sup>	23065-5-8018512

## Ordering information

	Catalog No. 23070-0-									0	0	0	0
<b>Design</b>													
Wall-mounted housing ½ 19 Inch		1											
<b>Preparation</b>													
without			0										
with dosing unit			1										
<b>Heat exchanger</b>													
Glass				1									
PVDF				2									
Stainless steel				3									
<b>Gas paths</b>													
1 gas path 250 l/h					1								
1 gas path 125 l/h					2								
2 gas paths 2 × 125 l/h					3								
<b>Condensate drain</b>													
without						0							
1 peristaltic pump						1							
2 peristaltic pumps (2 × condensate)						2							
2 peristaltic pumps (1 × condensate, 1 × dosing)						3							
2 peristaltic pumps (1 × condensate, 1 × precondensation)						4							
<b>Display</b>													
Temperature display and monitoring							1						
Temperature display and monitoring and Pt 100							2						
<b>Power supply</b>													
230 V, 50/60 Hz								1					
115 V, 50/60 Hz								2					
<b>Certification</b>													
without										0			
with CSA certification										1			
with ATEX certification, Zone 2										2			
with GOST certification										3			

## SCC-F Sample gas feed unit



- Complete sample gas conditioning in connection with the SCC-C sample gas cooler
- 2 independent gas paths
- Corrosion resistant, metal-free gas lines
- Compact surface-mounting housing (width ½ 19 inches, 6 height units)
- Service-friendly due to easy access to the modules

### Sample gas inlet conditions

The SCC-F sample gas feed unit is designed for continuous dosed feeding of sample gas.

The SCC-F sample gas feed unit must not be used:

- for feeding mixtures of gas/air or oxygen that are capable of ignition during normal service.
- for feeding flammable gas, which can ignition-capable mixture, or
- in a potentially explosive atmosphere or hazardous areas.

#### Sample gas pressure

$p_{\text{abs}} = 70 \text{ to } 105 \text{ kPa (0.7 to 1.05 bar)}$

#### Sample gas flow rate

Gas paths 1 and 2 max. 100 l/h, bypass max. 200 l/h

#### Sample gas inlet temperature

+10 to 50 °C

#### Sample gas inlet dew point

The dew point of the sample gas must be at least 5 °C lower than the lowest ambient temperature in the whole sample gas path. Otherwise a sample gas cooler or a condensate trap is required.

### Operating data

#### Warm-up time

Approx. 10 minutes (plus warm-up time of sample gas cooler)

#### Dead volume

Approx. 10 cm<sup>3</sup> (plus dead volume of heat exchanger)

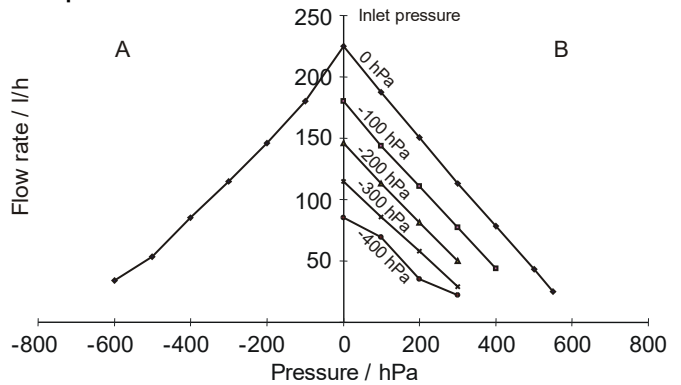
#### Gas tightness

$5 \times 10^{-6} \text{ hPa l/s}$

#### Flow rate display and adjustment

Rotameter 10 to 100 l/h with needle valve (metal-free)

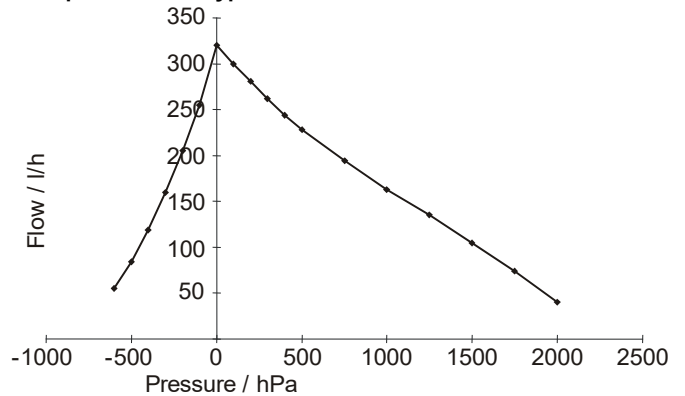
### Feed performance standard



A Inlet: negative pressure, outlet: atmospheric pressure

B Inlet: acc. to chart, outlet: positive pressure

### Feed performance bypass



### Status signals

#### Status signals

Flow rate and condensate monitors, one potential-free two-way switch each, switching capacity:

Version without I/O card: 250 V AC, 2 A per sample gas path, version with I/O card option: 30 V, 1 A



## Construction

### Design

Surface-mounting housing ½ 19 inch, 6 height units

### Mounting

On a mounting plate with the mounting brackets supplied or in a 19 inch cabinet/rack

### Housing material and color

Sheet steel; light gray (RAL 7035), basalt gray (RAL 7012)

### Degree of protection of housing

IP20 to EN 60529

### Dimensions

See page 10

### Weight

Max. 15 kg

## Material of gas-conducting parts

PVDF, PTFE, PVC, EPDM, FPM, PP-EPDM elastomer

## Gas connections

PVDF coupling for tube of 6 × 4 × 1 mm

## Electrical connections

### Power supply

Screw clamp terminals for stranded or solid wire max. 2.5 mm<sup>2</sup>

### Status signals

Screw clamp terminals for stranded or solid wire max. 1.5 mm<sup>2</sup>

## Safety

Testing to EN 61010-1

### Protective class

I

### Overvoltage category/degree of contamination

II/2

### Protective separation

Electrical isolation of the 115/230 V AC power supply from the other current circuits by means of reinforced or double insulation. Functional extra-low voltages (PELV) on the low voltage side

## Electromagnetic compatibility

Tested to EN 61326-1

### Emitted interference

Class B

### Immunity to interference

Industrial environment

## Mechanical capabilities

Testing to EN 60068-2-27 and EN 60068-2-6

### Transport

Shock: 30 g / 18 ms / 18 shocks

Vibration: 1 g / ±0.15 mm / 5 to 150 Hz, 3 × 5 cycles

### Operation

Vibration: 1 g / ±0.07 mm / 5 to 55 Hz, 3 × 2 cycles

## Ambient conditions

### Installation site

The SCC-F sample gas feed unit is only intended for installation indoors. The max. altitude of the installation site may not exceed 2000 m above sea level.

### Ambient temperature

Operation: +5 to 45 °C,

Storage and transport: -25 to +60 °C

### Relative humidity

≤ 75 % annual average, occasional and slight condensation permitted, ≤ 90 % on 30 days/year

## Power supply

### Input voltage

230 V AC or 115 V AC, 50 Hz or 60 Hz

### Power consumption during operation

Max. 185 VA

## Options

### Metering unit

By means of peristaltic pump, flow rate 15 ml/h, feed tank as accessory, for small SO<sub>2</sub> measuring ranges (< 1000 mg/m<sup>3</sup>) or to avoid acid aerosols

### I/O card

To connect the SCC-F sample gas feed unit and the SCC-C sample gas cooler to the AO2000 Series continuous gas analyzers via the system bus

- Display and monitoring of the cooler temperature
- Monitoring and processing of status signals of the SCC-F sample gas feed unit (condensate, flow rate)
- Control of up to three external solenoid valves for zero gas connection, 230 V, 50 Hz
- Digital inputs for monitoring condensate collecting bottles and reagent reservoirs

## Certifications

### IECEE CB Scheme – Safety

The SCC-F sample gas feed unit with I/O card option is certified to the 'IEC system for mutual recognition of test certificates for electrical equipment'. It complies with standard IEC 61010-1 (3rd Edition). Certificate No. DE1-55251

### CSA – Safety

The SCC-F sample gas feed unit with I/O card option is certified for use in general purpose environment, evidenced by full compliance with standards CAN/CSA-C22.2 No. 61010-1-12 and UL Std. No. 61010-1 (3rd Edition). Certificate No. 70010607

### CSA – Explosion protection

The SCC-F sample gas feed unit is certified to

- Class 2258 02 Process Control Equipment – For Hazardous Locations – Certified to Canadian Standards and
  - Class 2258 82 Process Control Equipment – For Hazardous Locations – Certified to U.S. Standards
- for use in hazardous areas Class 1, Div. 2, Groups A, B, C and D, temperature code T4, maximum ambient temperature +50 °C. Certificate No. 1105720

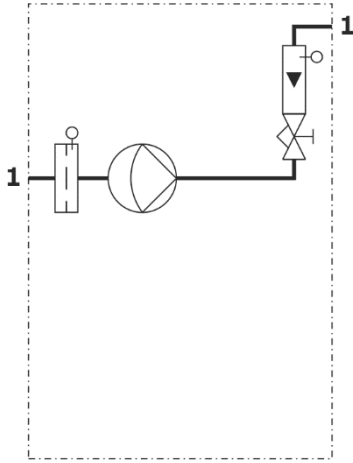
### GOST – Import and operation permission

Declaration of conformity No. EAЭC N RU Д-DE.AB72.B.04753

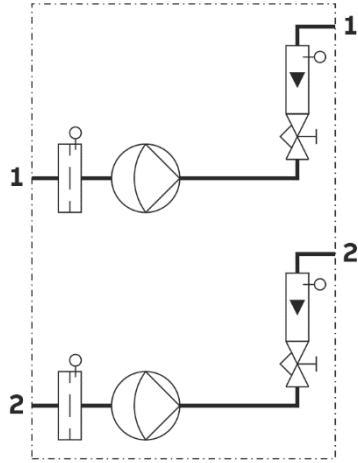
... SCC-F Sample gas feed unit

Pneumatic diagrams

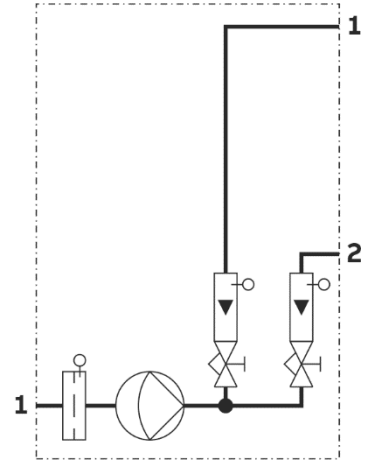
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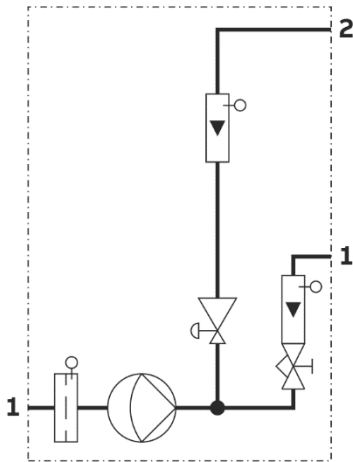
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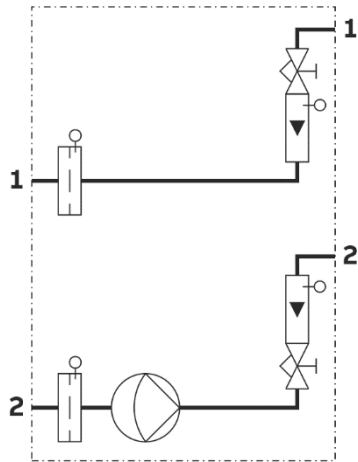
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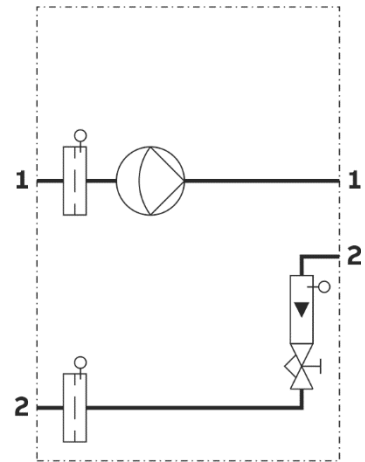
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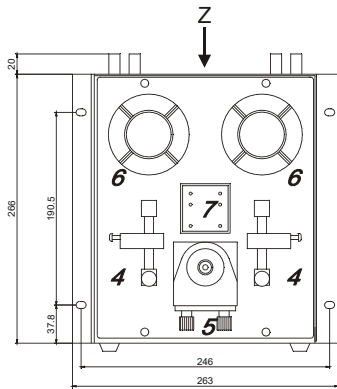
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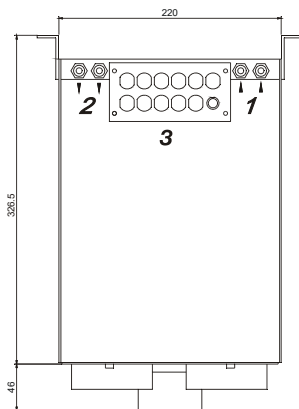
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Dimensions (in mm)



Ansicht / View Z



- 1 Sample gas inlet
- 2 Sample gas outlet
- 3 Electrical connections
- 4 Flow rate monitor with needle valve
- 5 Metering pump
- 6 Condensate monitor
- 7 LED display and reset button of switching amplifiers

Note: The illustration shows options. The scope and features of the ordered design may differ.



## SCC-S Sample gas feed unit



- **Process-proven modules**
  - Diaphragm pump for feed-in of the gas
  - Membrane filter/condensate monitor
  - Flow monitor with needle valve
  - Ball valve/solenoid valves for feed-in of the test gas
  - Peltier cooler with condensate pump
- Ideal for use in simple processes (non-corrosive sample gas)
- Simple installation and connection
- Housing designed for 19-inch rack mounting and wall mounting (4 height units, IP20)
- Attractively priced system solution in combination with gas analyzers of the EasyLine series

### Sample gas inlet conditions

#### Sample gas pressure

$p_{abs} = 70$  to 105 kPa (0.7 to 1.05 bar)

#### Sample gas flow rate

Gas path: 7 to 70 l/h,  
Bypass: 15 to 150 l/h (not in version with Peltier cooler)

#### Sample gas inlet temperature

+10 to 50 °C

#### Sample gas inlet dew point

Version with Peltier cooler: max. +50 °C (at max. +25 °C ambient temperature)  
Version without Peltier cooler: The dew point of the sample gas must be at least 5 °C lower than the lowest ambient temperature in the whole sample gas path.

### Operating data

#### Warm-up time

Version with Peltier cooler: approx. 10 minutes  
Version without Peltier cooler: ready for immediate use

#### Gas tightness

$5 \times 10^{-6}$  hPa l/s

#### Flow rate display and adjustment

Rotameter with needle valve (metal-free)

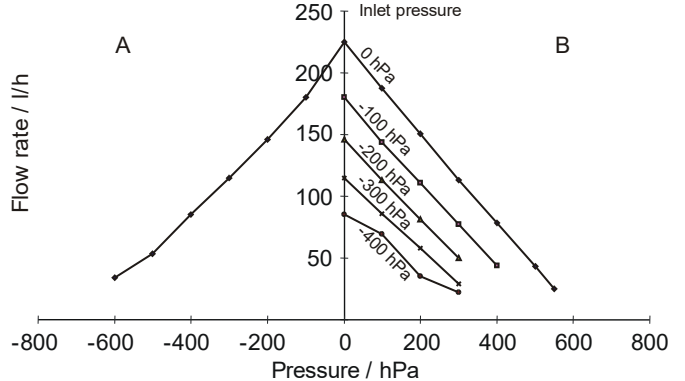
#### Outlet dew point (versions with Peltier cooler)

+3 °C

#### Condensate discharge (versions with Peltier cooler)

Peristaltic pump: feed performance approx. 300 ml/h at 5 rpm, pressure resistance  $p_{abs} = 50$  to 150 kPa (0.5 to 1.5 bar), peristaltic tube material TPE, peristaltic tube service life approx. 5 months, power consumption 3.5 VA, weight approx. 0.6 kg

### Feed performance of the diaphragm pump



- A Inlet: negative pressure, outlet: atmospheric pressure
- B Inlet: acc. to diagram, outlet: positive pressure

### Display and status signals

#### Temperature control and display (versions with Peltier cooler)

Temperature controller with digital display of the cooler temperature in °C; set point factory-set at +3 °C, can be altered on site.

#### Status signals

Collective status signal of the condensate, flow and cooler monitoring; potential-free changeover contact, contact load 24 V DC/AC, 1 A. Status display of the condensate monitoring: Red LED on the front panel

### Applications: Peltier cooler for combustion gases

#### Application 1

SO<sub>2</sub> 0 to 75 mg/m<sup>3</sup>, NO 0 to 100 mg/m<sup>3</sup>, measurement with Uras26

Sample gas inlet dew point at the cooler inlet	Ambient temperature	Flow rate		
		30 l/h	60 l/h	90 l/h
30 °C	+10 °C	X	X	X
	+20 °C	X	X	-
	+30 °C	X	X	-
	+40 °C	-	-	-
50 °C	+10 °C	X	X	X
	+20 °C	X	X	-
	+30 °C	X	-	-
	+40 °C	-	-	-

X: permitted, -: not permitted

#### Application 2

SO<sub>2</sub> 0 to 400 mg/m<sup>3</sup>, NO 0 to 100 mg/m<sup>3</sup>, measurement with Uras26 (also for CO, CO<sub>2</sub> and O<sub>2</sub>)

Sample gas inlet dew point at the cooler inlet	Ambient temperature	Flow rate		
		30 l/h	60 l/h	90 l/h
30 °C	+10 °C	X	X	X
	+20 °C	X	X	X
	+30 °C	X	X	X
	+40 °C	X	X	X
50 °C	+10 °C	X	X	X
	+20 °C	X	X	X
	+30 °C	X	X	X
	+40 °C	X	X	X

## Construction

### Design

19-inch housing (4 height units) for rack and wall mounting

### Mounting

Rack mounting on mounting rails, wall mounting with pre-assembled mounting brackets on the housing. The gas and electrical connections are located on the back of the housing for rack mounting and on the top of the housing for wall mounting. They can be altered on site. Comply with the distances from the wall during installation: left and right-hand side panels at least 35 mm, back panel at least 25 mm. A distance of at least 1 height unit from devices which develop heat is required for the version with Peltier cooler. Max. inclination of the instrument 5°.

### Housing material and color

Sheet steel, galvanized, basalt gray (RAL 7012), front panel light gray (RAL 7035)

### Degree of protection of housing

IP20 to EN 60529

### Dimensions

See page 16

### Weight

Approx. 17 kg

## Material of gas-conducting parts

Glass, glass fiber, EPDM, ETFE, FPM, PP, PPH, PVC, PVDF, TPE

## Gas connections

### Sample gas inlet

PVDF angled screw fitting for tube 6 × 4 × 1 mm

### Test gas inlets

PPH coupling for tube 6 × 4 × 1 mm

### Gas outlets

PPH coupling for tube 6 × 4 × 1 mm

## Electrical connections

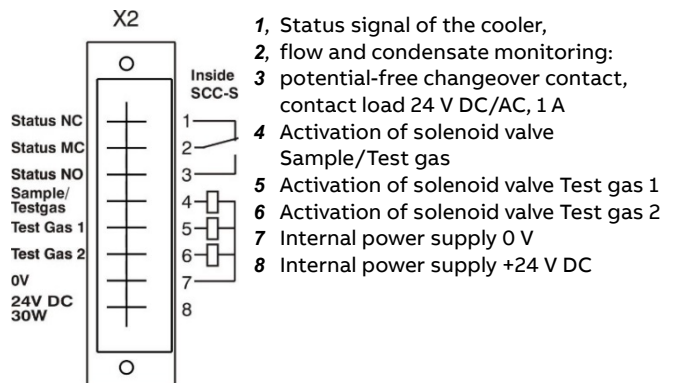
### Power supply

Connector for non-heating apparatus (cable with grounding plug, length 2 m, supplied)

### Status signal (standard) and external solenoid valves (option)

8-pin plug receptacle (see connection diagram, mating plug supplied)

## Connection diagram



The connection diagram shows the internal wiring of the sample gas feed unit.

The integrated power supply can also be used for the supply of external solenoid valves: Terminal 7 = 0 V, terminal 8 = +24 V, maximum capacity 30 VA at 24 V DC.

## Safety

Testing to EN 61010-1

### Protective class

I

### Overvoltage category/degree of contamination

II/2

### Protective separation

Electrical isolation of the 115/230 V AC power supply from the other current circuits by means of reinforced or double insulation. Functional extra-low voltages (PELV) on the low voltage side

## Electromagnetic compatibility

Tested to EN 61326-1

### Emitted interference

Class B

### Immunity to interference

Industrial environment

## ... SCC-S Sample gas feed unit

### Ambient conditions

#### Ambient temperature

Operation: +10 to 40 °C,  
Storage and transport: -25 to +60 °C

#### Relative humidity

≤ 75 % annual average, occasional and slight condensation permitted, ≤ 90 % on 30 days/year

### Power supply

#### Input voltage

230 V AC ± 10 %, 50 Hz or 115 V AC ± 10 %, 60 Hz

#### Power consumption during operation

230 V AC, 50 Hz, max. 300 VA

#### Protection of the instrument

Fine-wire fuse, 3.15 A, slow-blow

### Options

#### Internal power supply/power stage

For the activation of max. 3 internal or external solenoid valves, operating voltage 24 V DC, capacity max. 30 VA, 3 A fine-wire fuse

#### Solenoid valves for internal test gas infeed

3/2-way solenoid valve: 1 ea., for switching over sample gas/test gas, valve type is pivoted armature valve, material PVDF and FPM, power supply 24 V DC, activation via a digital output of the gas analyzer or a PLC.

2/2-way solenoid valve: max. 2 ea., for test gas infeed, valve type is rocker valve with separating diaphragm, material PPH and FPM, power supply 24 V DC, activation via a digital output of the gas analyzer or a PLC.

#### Condensate discharge for external cooler

Peristaltic pump: flow rate approx. 300 ml/h at 5 rpm, pressure resistance  $p_{abs} = 50$  to 150 kPa (0.5 to 1.5 bar), peristaltic tube material TPE, peristaltic tube service life approx. 5 months, power consumption 3.5 VA, weight approx. 0.6 kg

### Certifications

#### IECEE CB Scheme – Safety

The SCC-S sample gas feed unit is certified to the 'IEC system for mutual recognition of test certificates for electrical equipment'. It complies with standard IEC 61010-1 (3rd Edition).

Certificate No. SI-6537

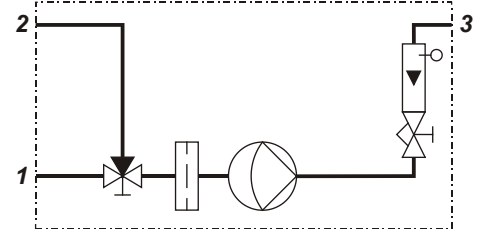
#### CSA – Safety

The SCC-S sample gas feed unit is certified for use in general purpose environment, evidenced by full compliance with standards CAN/CSA-C22.2 No. 61010-1-04 und UL Std. No. 61010-1 (2nd Edition).

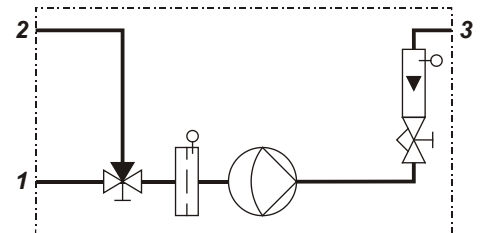
Certificate No. 2504652

### Pneumatic diagrams

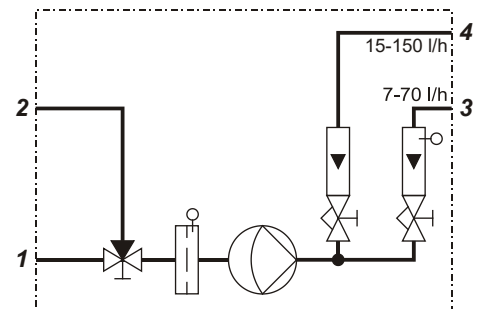
#### Version 1 Catalog No. 23236-0-X11000XX0000



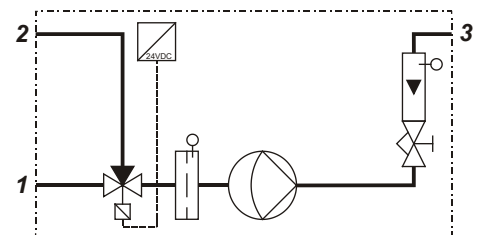
#### Version 2 Catalog No. 23236-0-X21000XX0000



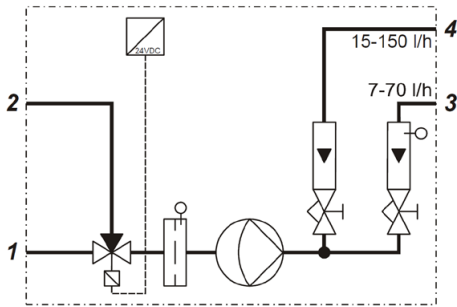
#### Version 3 Catalog No. 23236-0-X31000XX0000



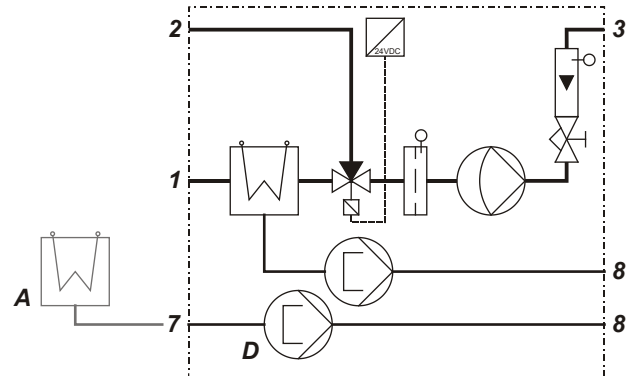
#### Version 4 Catalog No. 23236-0-X22000XX0000



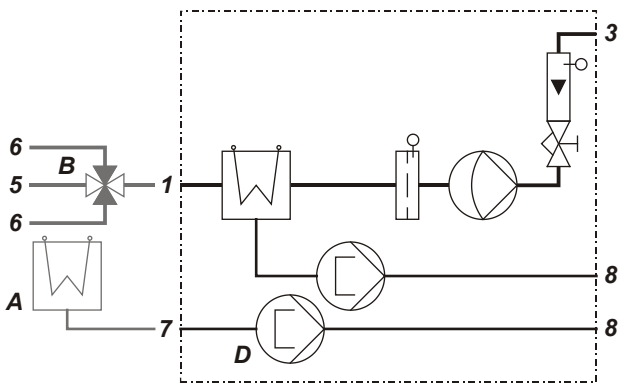
**Version 5** Catalog No. 23236-0-X32000XX0000



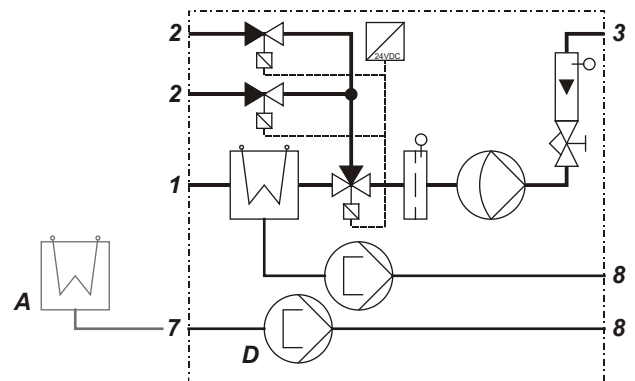
**Version 8** Catalog No. 23236-0-X2201XXX0000



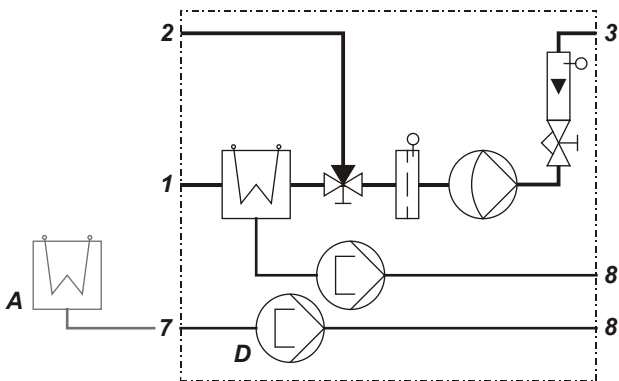
**Version 6** Catalog No. 23236-0-X2001XXX0000



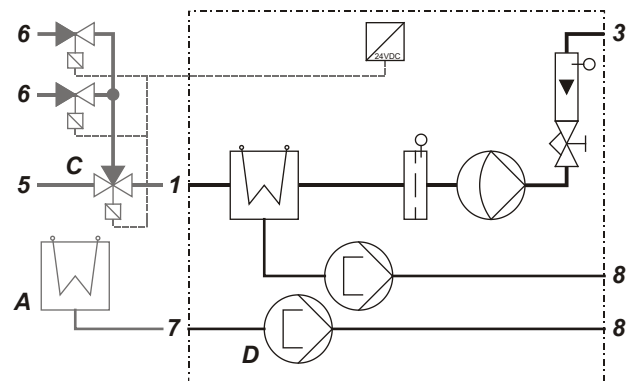
**Version 9** Catalog No. 23236-0-X2301XXX0000



**Version 7** Catalog No. 23236-0-X2101XXX0000



**Version 10** Catalog No. 23236-0-X2011XXX0000

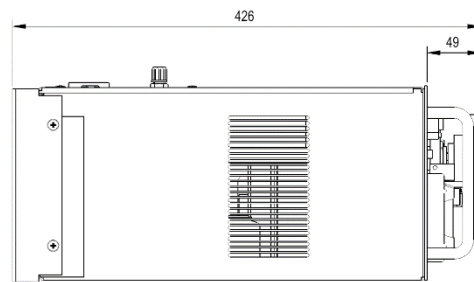
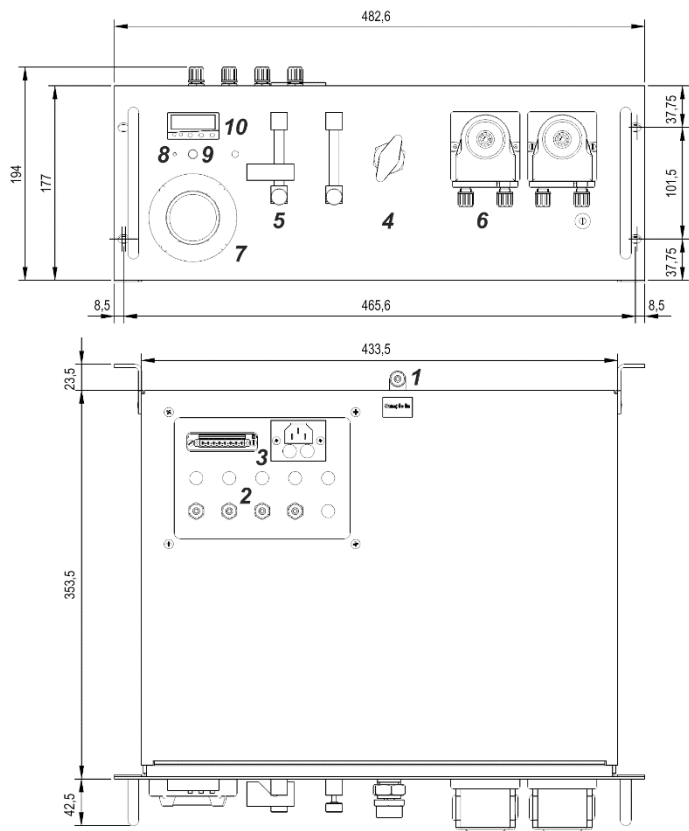


- 1 Sample gas inlet
- 2 Test gas inlet
- 3 Gas outlet
- 4 Bypass outlet
- 5 Sample gas inlet for external infeed
- 6 Test gas inlet for external infeed
- 7 Condensate inlet from the external cooler
- 8 Condensate outlet

- Not supplied:
- A External cooler
- B External multi-way cock
- C External solenoid valves
- Option:
- D Additional condensate pump for external cooler

## ... SCC-S Sample gas feed unit

### Dimensions (in mm)



- 1 Sample gas inlet
- 2 Sample gas outlet, bypass outlet and test gas inlets via ball valve or solenoid valve
- 3 Power supply connection and electrical connection for status signal, solenoid valve control and 24 V DC
- 4 Ball valve for infeed of test gas
- 5 Flow monitor with needle valve (option: second flow monitor for bypass)
- 6 Peristaltic pump (option: second peristaltic pump for external cooler)
- 7 Membrane filter or condensate monitor
- 8 LED indicator for condensate alarm, red
- 9 Pump switch
- 10 Temperature controller for cooler

Note: The illustration shows options. The scope and features of the ordered design may differ.





## Diaphragm pump 4N



- Feed in of the sample gas
- Compact unit with degree of protection of housing IP20 or IP54

### Operating data

#### Inlet pressure

$p_{\text{abs}} = 70$  to 105 kPa (0.7 to 1.5 bar)

#### Flow rate

Max. 250 l/h at atmospheric pressure

#### Inlet temperature

+5 to 50 °C

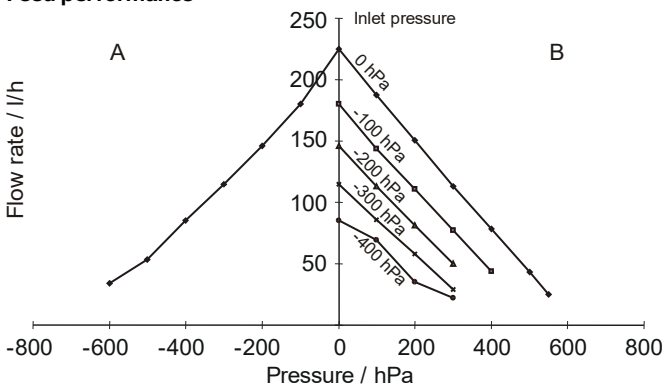
#### Inlet dew point

Below room temperature

#### Tightness

Pressure drop 0.1 hPa/min

### Feed performance



- A** Inlet: negative pressure, outlet: atmospheric pressure  
**B** Inlet: according diagram, outlet: positive pressure

### Construction

#### Design

Surface-mounting case for wall attachment, motor axis horizontal

#### Housing material and color

Plastic, RAL 7035

#### Degree of protection of housing

IP20 or IP54 to EN 60529

#### Class of protection

I

#### Dimensions

See page 19

#### Weight

Approx. 1.8 kg

### Materials of gas-conducting parts

Valve plate, diaphragm: EPDM (ethylene-propylene); pump body: PP (polypropylene); hose: FPM; nozzles: ETFE (ethylene-tetrafluoroethylene)

### Gas connections

G $\frac{1}{4}$  female thread for male fittings, nozzles for hose inside diameter 4 mm are supplied with the unit.

### Electrical connections

Terminals via cable connection M20

### Mechanical capabilities

Testing to DIN EN 60068-2-27 and DIN EN 60068-2-6

#### Transport

Shock: 30 g / 18 ms / 18 shocks

Vibration: 2 g /  $\pm 0.15$  mm / 5 to 150 Hz, 3  $\times$  5 cycles

#### Operation

Vibration: 2 g /  $\pm 0.07$  mm / 4 to 7 Hz, 3  $\times$  2 cycles

### Ambient conditions

#### Ambient temperature

Operation: IP54 +5 to 40 °C, IP20 +5 to 50 °C

Storage and transport: -25 to +65 °C

#### Relative humidity

$\leq 90$  % annual average, condensation permitted

#### Climatic class

3K4 to EN 60721-3-3

### Power supply

#### AC voltage

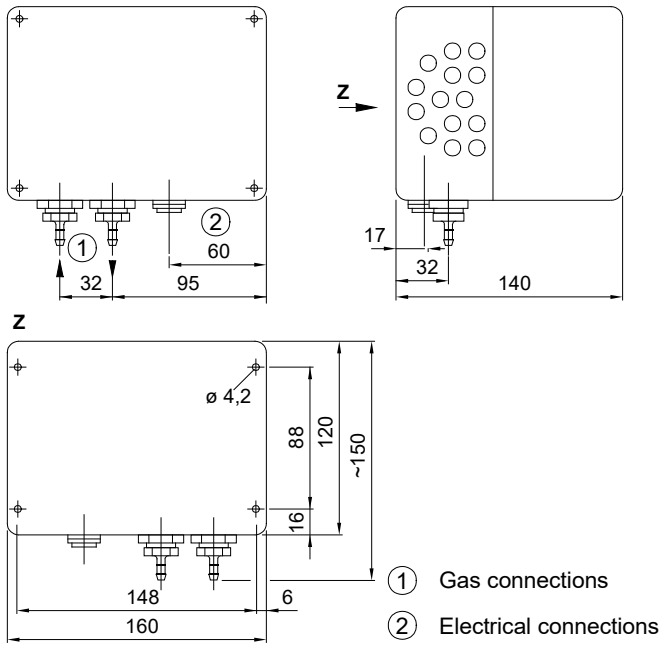
230 V  $\pm 10$  %, 50 Hz or 60 Hz

115 V  $\pm 10$  %, 50 Hz or 60 Hz

#### Power consumption

Approx. 50 VA

**Dimensions** (in mm)



Z-14185

**Ordering information**

	<b>Catalog No.</b>
Diaphragm pump 4N, IP20; 230V, 50/60 Hz	<b>23134-5-8018545</b>
Diaphragm pump 4N, IP20; 115V, 50/60 Hz	<b>23134-5-8018546</b>
Diaphragm pump 4N, IP54; 230V, 50/60 Hz	<b>23134-5-8018547</b>
Diaphragm pump 4N, IP54; 115V, 50/60 Hz	<b>23134-5-8018548</b>

## SCC-K Converter



### NO<sub>2</sub>/NO converter

- Catalytic converter based on carbon-molybdenum
- High catalyst service life
- Catalyst cartridge can be changed without tools
- Option: Version with heated sample gas inlet
- Application: Reduction of NO<sub>2</sub> to NO in emission monitoring

### Thermal converter with quartz-glass reaction tube

- Thermal converter for operation temperatures up to 680°C
- No consumable parts
- PVDF fittings
- Applications:
  - Conversion of certain carbon, sulfur and halogen compounds into measurable components
  - Removal of interfering components from the sample gas without the other gas components being affected

### Operating data of NO<sub>2</sub>/NO converter

#### Sample gas flow rate

Max. 150 l/h

#### Temperature range

Depending on sample gas flow rate:  
30 l/h: 320 °C; 60 l/h: 320 °C; 90 l/h: 340 °C, 150 l/h: 360 °C

#### Effectivity

≥ 95 % with new catalyst

#### Service life of catalyst

The service life of the catalyst depends on its operating temperature as well as the flow rate and the NO<sub>2</sub> and O<sub>2</sub> content of the sample gas. It is > 6 months for 320 °C, 30 l/h, 10 ppm NO<sub>2</sub> and 5 Vol.-% O<sub>2</sub>.

#### Sample gas pressure

p<sub>abs</sub> ≤ 200 kPa (2 bar)

#### Pressure drop

≤ 2 kPa (20 mbar) at 90 l/h

#### Warm-up time

Approx. 30 min

#### 90% time

T<sub>90</sub> ≤ 10 s at 60 l/h

### Operating data of thermal converter

#### Sample gas flow rate

Normally 60 l/h, max. 120 l/h

#### Sample gas inlet temperature

Max. 80 °C (dew point dry)

#### Temperature range

Max. 680 °C at 120 l/h sample gas flow rate

#### Effectivity

≥ 99 %

#### Sample gas pressure

p<sub>abs</sub> ≤ 120 kPa (1.2 bar)

#### Pressure drop

≤ 0.5 kPa (5 mbar)

#### Warm-up time

Approx. 60 min

#### 90-% time

T<sub>90</sub> ≤ 10 s at 60 l/h

### Applications of thermal converter

#### Pulp and paper industry

TRS measurement, oxidation of sulfur-organic and non-organic compounds. Analyzer: Uras26. Operating temperature: 650 °C. Sample gas flow rate: 60 l/h.

#### Chlorine plants

Conversion of H<sub>2</sub> to HCl using Cl<sub>2</sub>. Analyzer: Caldos25 (flowing reference gas). Operating temperature: 450 °C or 500 °C. Sample gas flow rate: 60 l/h or 120 l/h.

#### Chlorinated hydrocarbons (CHC), PVC plants

Oxidation of chlorine components. Analyzer: upon request, measurement of HCl. Operating temperature: 650 °C. Sample gas flow rate: 60 l/h.

### Status signal

#### Status signal for temperature deviation

1 NO potential-free contact, capacity 24 V DC, 1 A

### Construction

#### Design

19 inch slide-in housing, 3 height units

#### Mounting

In 19 inch cabinet/rack or with mounting brackets (accessories) on the wall, distance above min. 1 height unit

#### Housing material and color

Sheet steel; light gray (RAL 7035), basalt gray (RAL 7012)

#### Degree of protection of housing

IP20 to EN 60529

#### Dimensions

See page 23

#### Weight

Approx. 8 to 9 kg

## Materials of gas-conducting parts

NO<sub>2</sub>/NO converter: Stainless steel 1.4571 (SAE 316Ti), PVDF, PTFE, FPM, PFA.

Thermal converter: PTFE, PVDF, PFA, quartz glass.

## Gas connections

### Sample gas inlet and outlet unheated

G<sup>3</sup>/<sub>4</sub> female thread (PVDF in thermal converter)

### Heated sample gas inlet (optional in NO<sub>2</sub>/NO converter)

Swagelok® screwed connection for pipes with 6 mm inner diameter

## Electrical connections

### Power supply

Connector for non-heating apparatus, cable with grounding plug, length 2 m

### Status signal

9 pin Sub-D female connector with counter-plug

## Safety

Testing to EN 61010-1

### Protective class

I

### Overvoltage category / degree of contamination

II / 2

### Protective separation

Electrical isolation of the 120/240 V AC power supply from the other current circuits by means of reinforced or double insulation. Functional extra-low voltages (PELV) on the low voltage side

## Electromagnetic compatibility

Tested to EN 61326-1

### Emitted interference

Class B

### Immunity to interference

Industrial environment

## Ambient conditions

### Ambient temperature

Operation: +10 to 50 °C,

Storage and transport: -25 to +65 °C

### Relative humidity

≤ 75 % annual mean, occasional and slight condensation permitted

## Power supply

### Input voltage

240 V AC, -15/+10 %, 48 to 62 Hz or

120 V AC, -10/+10 %, 48 to 62 Hz

### Power consumption

240 V AC: 575 VA; 120 V AC: max. 560 VA

## Certifications

### IECEE CB Scheme – Safety

The SCC-K converter is certified to the 'IEC system for mutual recognition of test certificates for electrical equipment'. It complies with standard IEC 61010-1 (3rd Edition) and IEC 61010-2-010 (3rd Edition).

Certificate No. SI-6661

### CSA – Safety

The SCC-K NO<sub>2</sub>/NO converter is certified for use in general purpose environment, evidenced by full compliance with standards CAN/CSA-C22.2 No. 61010-1-04 and UL Std. No 61010-1 (2nd Edition).

Certificate No. 2298365

### GOST – Import and operation permission

Declaration of conformity No. EAЭC N RU Д-DE.AB72.B.04753

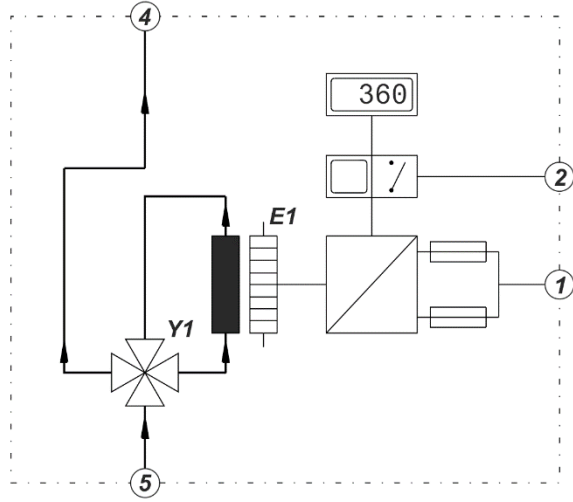
## Ordering information

	Catalog No.
Converter SCC-K, cock PVDF, 240 V AC	<b>23093-4-0801974</b>
Converter SCC-K, 2 solenoid valves, 240 V AC	<b>23093-4-0801975</b>
Converter SCC-K, heated, 1 solenoid valve, 240 V AC	<b>23093-4-0801976</b>
Converter SCC-K, cock PVDF, 120 V AC	<b>23093-4-0801977</b>
Converter SCC-K, 2 solenoid valves, 120 V AC	<b>23093-4-0801978</b>
Converter SCC-K, heated, 1 solenoid valve, 120 V AC	<b>23093-4-0801979</b>
Converter SCC-K, quartz-glass reaction tube, 240 V AC	<b>23093-4-3KXG801000U0100</b>
Converter SCC-K, quartz-glass reaction tube, 120 V AC	<b>23093-4-3KXG801001U0100</b>
<b>Accessories</b>	
Wall mounting bracket	<b>23009-4-0801980</b>
Carbon catalyst set	<b>23009-4-0801981</b>

... SCC-K Converter

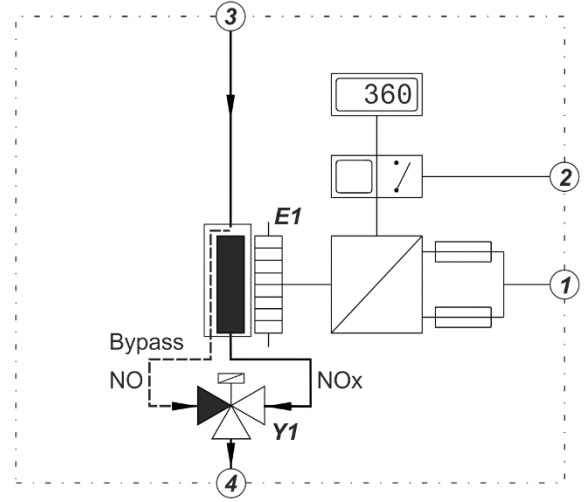
Pneumatic diagrams

NO<sub>2</sub>/NO converter, standard version with 4-way ball valve



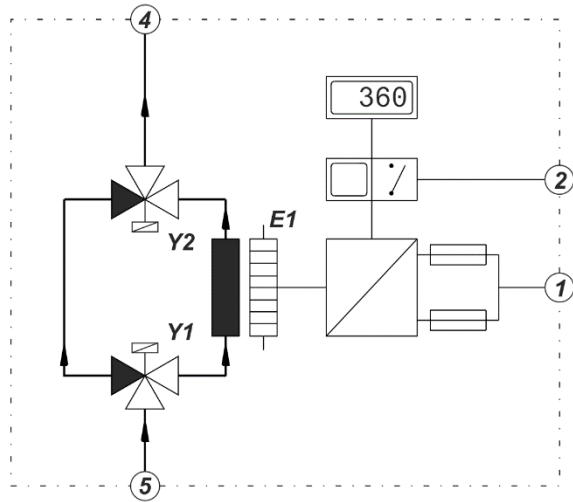
- 1 Power supply
- 2 Status signal
- 4 Sample gas outlet
- 5 Sample gas inlet
- E1 Tube furnace
- Y1 4-way ball valve

NO<sub>2</sub>/NO converter, option with heated sample gas inlet



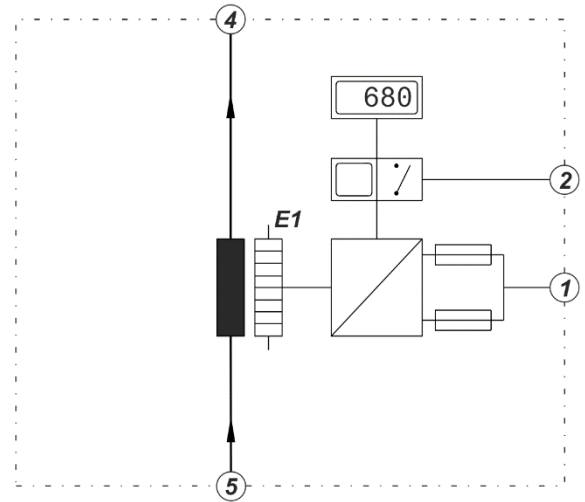
- 1 Power supply
- 2 Status signal
- 3 Heated sample gas inlet
- 4 Sample gas outlet
- E1 Tube furnace
- Y1 3/2-way solenoid valve

NO<sub>2</sub>/NO converter, option with two solenoid valves



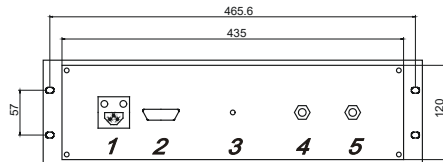
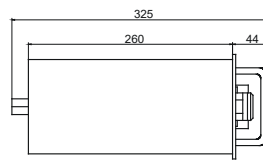
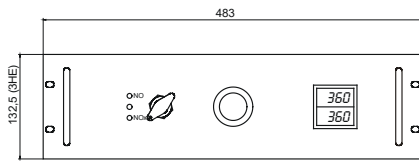
- 1 Power supply
- 2 Status signal
- 4 Sample gas outlet
- 5 Sample gas inlet
- E1 Tube furnace
- Y1 3/2-way solenoid valve
- Y2 3/2-way solenoid valve

Thermal converter with quartz-glass reaction tube



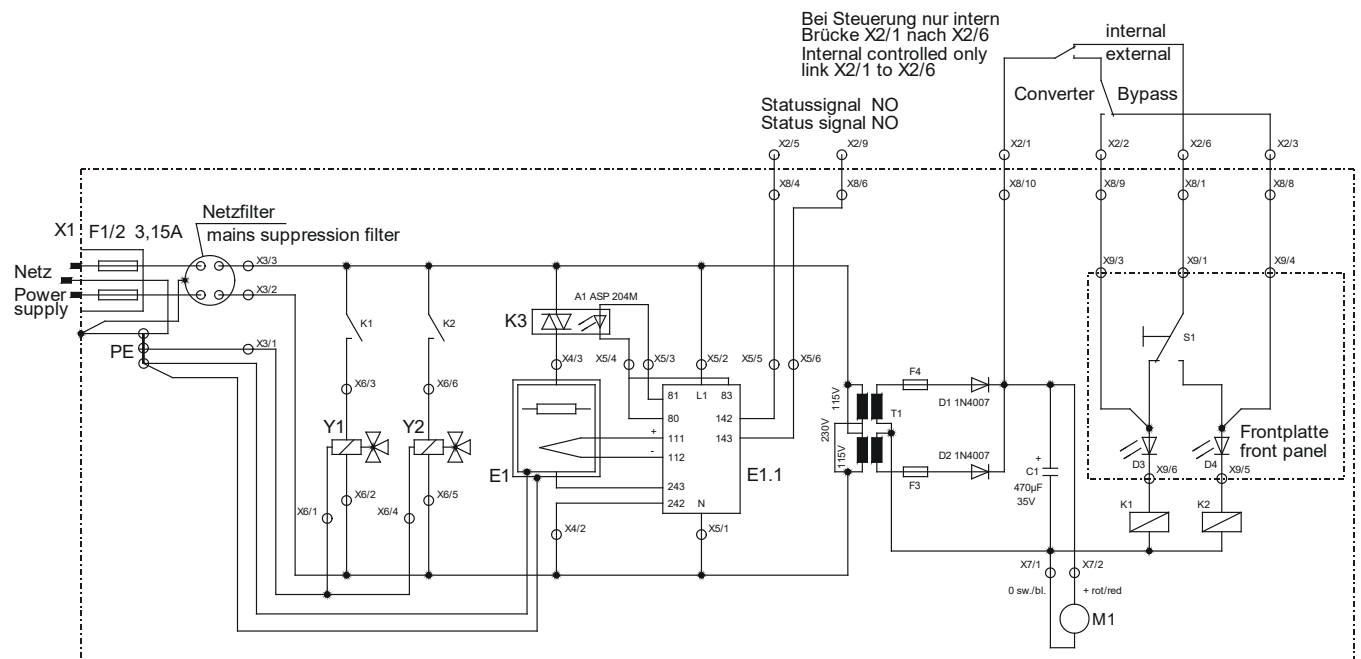
- 1 Power supply
- 2 Status signal
- 4 Sample gas outlet
- 5 Sample gas inlet
- E1 Heated reaction tube

**Dimensions (in mm)**

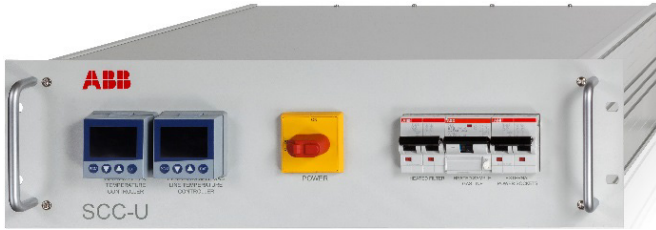


- 1 Power supply input X1
- 2 Status signal output X2  
(9-pin Sub-D female connector)
- 3 Heated sample gas inlet 6 mm  
(only in NO<sub>2</sub>/NO converter)
- 4 Sample gas outlet G<sup>1</sup>/<sub>4</sub> female thread
- 5 Sample gas inlet G<sup>1</sup>/<sub>4</sub> female thread

**Circuit and connection diagram**



## SCC-U Utility unit



- Power supply and control unit for use in small extractive gas analyzer systems
- Power distribution for gas analyzers, gas sampling devices, heated sample probe filter units, heated sample gas lines
- Temperature controllers for heated sample gas line and heated sample probe filter (optional)
- Solenoid valves for control of automatic calibration with test gases (optional)

### Power distribution

Single-phase power supply output for:

- ABB Continuous gas analyzers
- SCC Gas sampling devices
- SCC-K NO<sub>2</sub>/NO converter
- PFE2 or PFE3 Heated filter unit
- TBL01-S Heated sample gas line
- CGWB13 Heated sample gas line

### Calibration control

Solenoid valves for switching up to three test gases according to following configurations (see 'Pneumatic diagrams' on page 26):

- Calibration with calibration cells:
  - 1 solenoid valve for switching ambient air
- Calibration with test gas feeding at sample gas cooler:
  - 3 + 1 solenoid valves for switching up to three test gases
- Calibration with test gases feeding at gas sampling probe:
  - 3 + 1 solenoid valves for switching up to three test gases and ambient air

### Note

EL3000 Analyzers to be configured via APC with the second Digital I/O board for valve control according to the wiring diagrams. For valve activation and the implementation of alarms ECT software is required. Take care of the correct operation when carrying out the engineering.

AO2000 Analyzers to be configured via APC with the necessary Digital I/O's in according to the wiring diagrams. For valve activation and the implementation of alarms FB-programming is required. Take care of the correct operation when carrying out the engineering.

### Sample gas inlet conditions

The sample gas must be non-corrosive, non-flammable and non-toxic. The utility unit has one gas path.

### Sample gas pressure

$p_{\text{abs}} = 70$  to 105 kPa (0.7 to 1.05 bar)

### Test gas pressure

$p_{\text{abs}} \leq 200$  kPa (2 bar)

### Sample gas flow rate

70 l/h with SCC-S

100 l/h with SCC-C and SCC-F

### Sample gas inlet temperature

10 to 50 °C

### Note

The relevant data in the gas analyzer data sheets must be considered as well for the sample handling components.

### Power supply

#### Input voltage

230 V AC  $\pm 10\%$ , 50 Hz or 115 V AC  $\pm 10\%$ , 60 Hz

#### Note

The unit is prepared to support both voltage ranges. Take care to have the connected components in the correct voltage range available, when carrying out the engineering.

#### Power consumption

230 V AC 50 Hz: max. 3500 VA, max. 16 A.

115 V AC 60 Hz: max. 1750 VA, max. 16 A.

Internal fuse protection: 10 A (sample gas line), 6 A (filter unit), 10A (internal 24 V supply, external devices).

External fuse protection by customer: 16 A.



## Display and status signals

### Temperature control and display (optional)

Temperature controllers with digital display for heated filter unit PFE2 or PFE3 and heated sample gas line TBL01-S

#### Note

The temperature controllers are pre-configured for PFE2 or PFE3 and TBL01-S. In case the CGWB13 or third party devices are used the configuration needs to be adapted to the settings of the components which comes to application. The settings of the temperature controllers can be modified by following the instructions of the operator manual, in case the adaption to other heaters is required.

Take care of the maximum power consumption and the correct operation when carrying out the engineering.

#### Status signals

- Status signal transmission between the analyzer and the SCC-U via terminal block -X32.
- Failure messages via the connected analyzer<sup>1)</sup>

<sup>1)</sup> Signal wiring needs to meet the hard wired linkage of signals inside the SCC-U.

## Construction

### Design

19-inch housing (3 height units)

### Mounting

Rack mounting on mounting rails. The gas and electrical connections are located on the rear side of the housing. Consider the distances from the wall during installation: Left- and right-hand side panels at least 35 mm, rear panel at least 200 mm. A distance of at least 1 height unit from devices which develop heat is required.

### Housing material and color

Aluminum, front panel light gray (RAL 7035)

### Degree of protection of housing

IP20 to EN 60529

### Dimensions

See page 27 and the **Technical drawings** SCC-U on page 41

### Weight

Approx. 15 kg

## Materials of gas-conducting parts

PVDF, PTFE, PA, EPDM, ETFE, FPM, PP, PPH, PVC, TPE

## Gas connections

### Sample gas inlet

1 PVDF coupling for tube 6 x 4 x 1 mm

### Test gas inlet

3 PVDF couplings for tube 6 x 4 x 1 mm

### Gas outlet

2 PVDF couplings for tube 6 x 4 x 1 mm

## Electrical connections

See also the **Wiring diagram** on page 45.

### Power supply input

Male connectors (socket plug) for non-heating apparatus.

### Power supply output

Female connectors (socket plugs) for non-heating apparatus for:

- 4 socket plugs are available
- ABB Continuous gas analyzers
- SCC Gas sampling devices
- 1 socket plug<sup>2)</sup> (-X20) fix assigned for:  
Heated sample probe filter unit PFE2 or PFE3
- 1 socket plug<sup>2)</sup> (-X21) fix assigned for:  
Heated sample gas line

<sup>2)</sup> The power supply output is available only if the unit is configured with temperature controllers.

#### Note

For the maximum power consumption please refer for the chapter power supply and the wiring diagrams which are part of the drawing package.

### Cables

- Cables with mating plugs, length 2 m, to connect the external devices are supplied per order.  
Type: H05VV-F 3 x 1mm<sup>2</sup>, CE, VDE, 300V
- Mating plugs are supplied only for TBL01-S and PFE2/PFE3.

### Digital input and output signals

15 pin Sub-D female connector (-X32). Cable with length 2 m, for connection to the gas analyzer is supplied.

## ... SCC-U Utility unit

### Safety

Tested to EN 61010-1:2010

### Protective class

I

### Overvoltage category/degree of contamination

II/2

### Electromagnetic compatibility

Tested to EN 61326-1:2013

### Emitted interference

Class B

### Immunity to interference

Industrial environment

### Ambient conditions

#### Ambient temperature

Operation: 10 to 40 °C, storage and transport: -25 to 60 °C

#### Relative humidity

≤ 75 % annual average

#### Installation location

Installation in general purpose environment only

### Certifications

#### IECEE CB Scheme – Safety

The SCC-U utility unit is certified to the IEC system for mutual recognition of test certificates for electrical equipment'. It complies with standard IEC 61010-1 (3rd Edition).

#### CSA – Safety

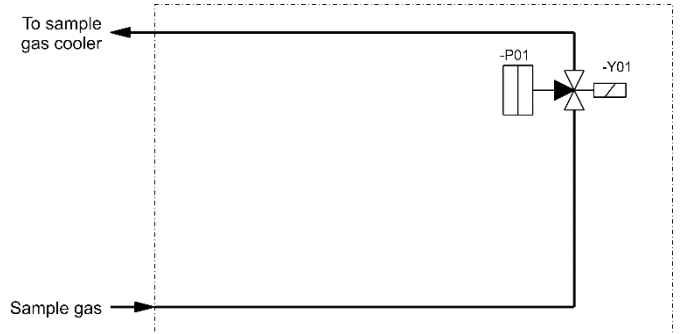
The SCC-U utility unit is certified for use in general purpose environment, evidenced by full compliance with standards CAN/CSA-C22.2 No. 61010-1-04 und UL Std. No. 61010-1 (3rd Edition).

### Pneumatic diagrams

See also the **Piping diagram** on page 44.

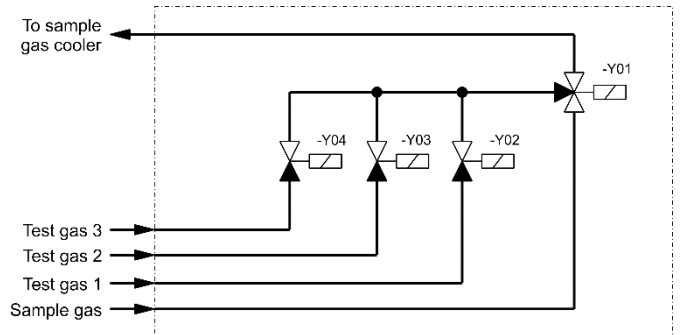
#### Catalog No. 23940-0-1100011X000

Version with 1 solenoid valve for switching ambient air for calibration using calibration cells



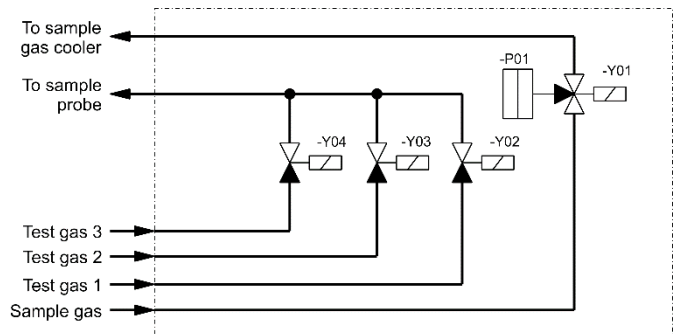
#### Catalog No. 23940-0-1100012X000

Version with 3 + 1 solenoid valves for switching up to three test gases for calibration with test gas feeding at sample gas cooler

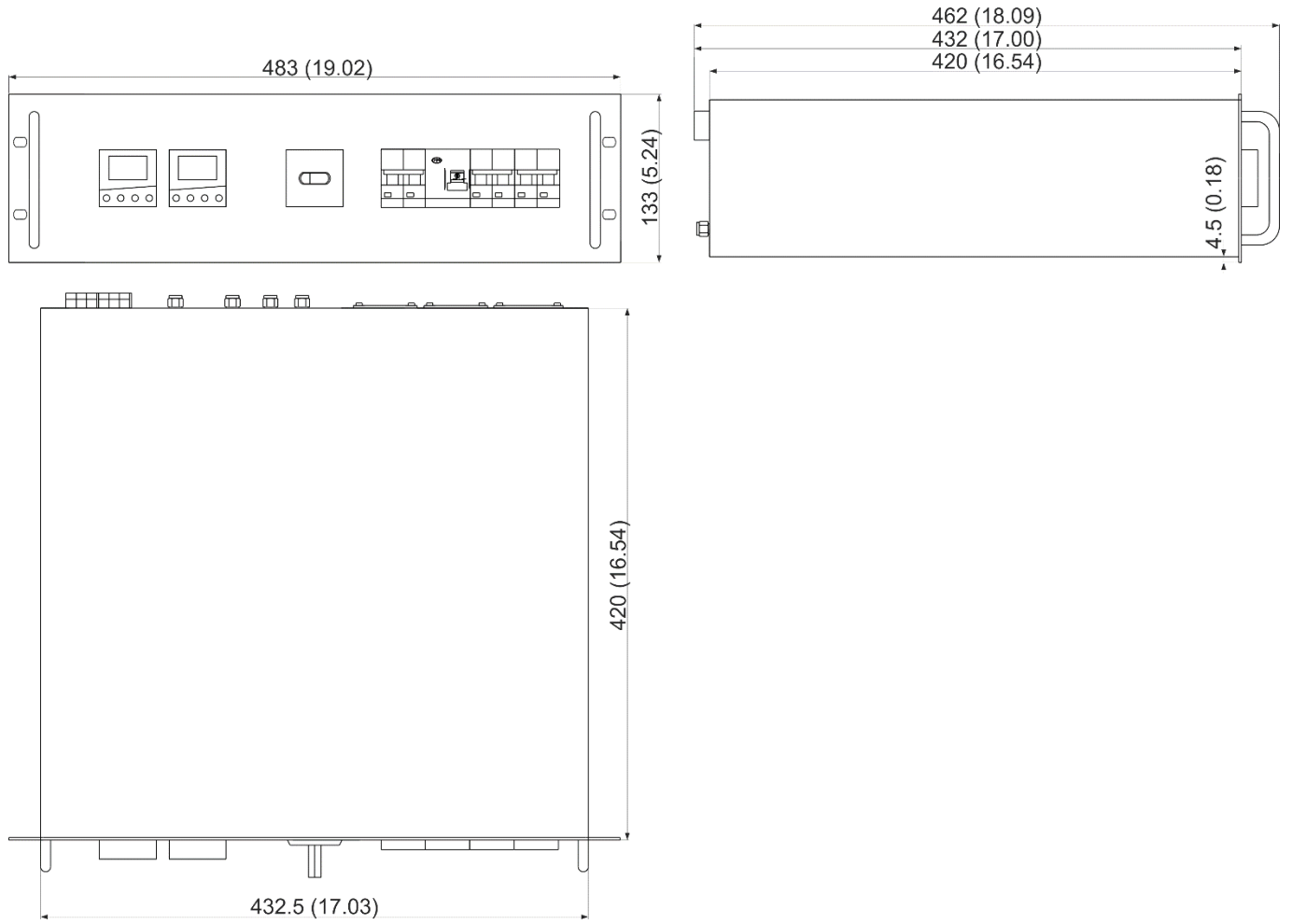


#### Catalog No. 23940-0-1100013X000

Version with 3 + 1 solenoid valves for switching up to three test gases and ambient air for calibration with test gas feeding at gas sampling probe

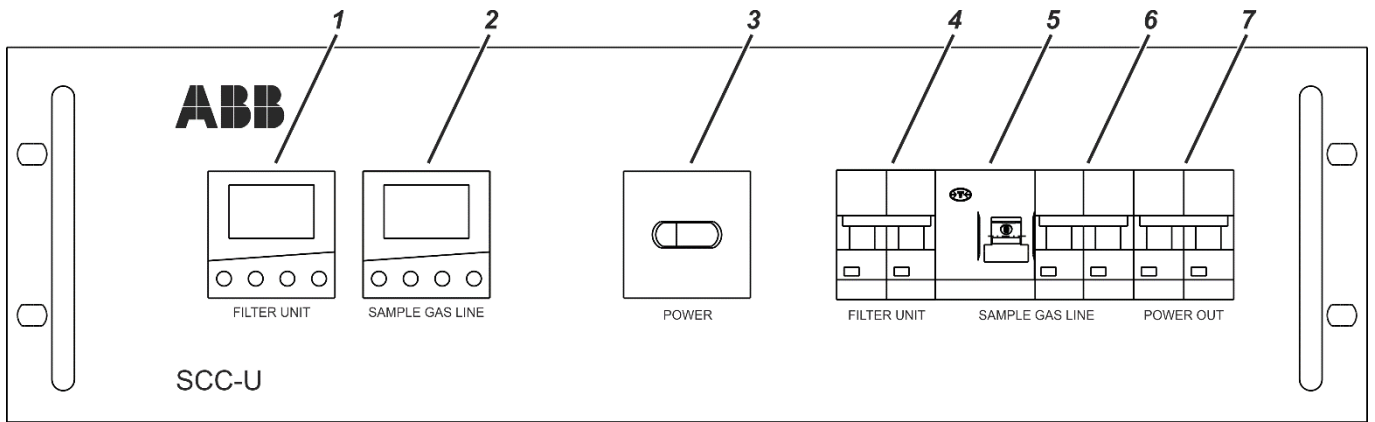


**Dimensions** (in mm [in])



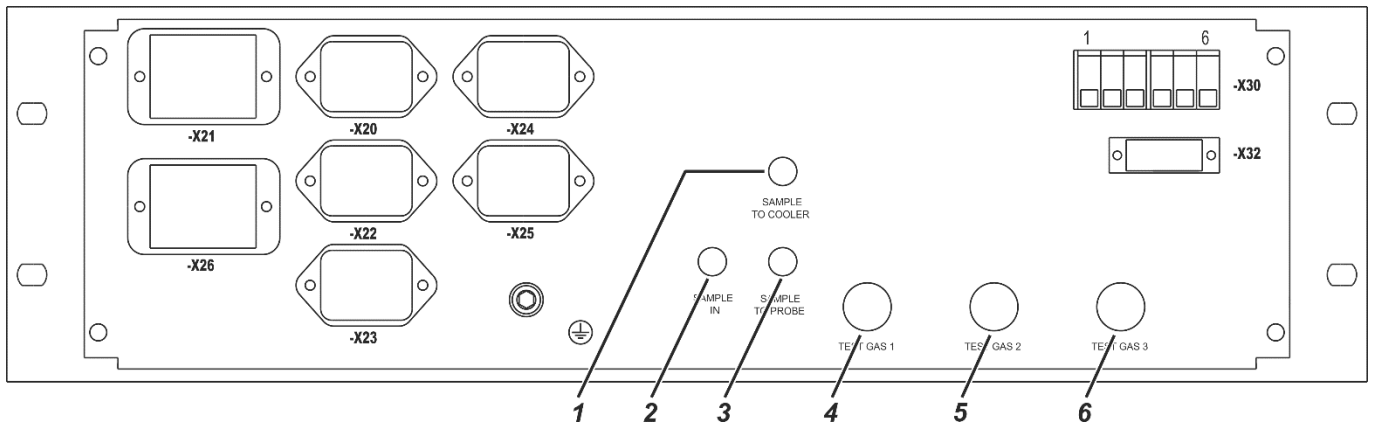
... SCC-U Utility unit

Front panel



- 1 Heated filter unit temperature controller (optional)
- 2 Heated sample gas line temperature controller (optional)
- 3 Main switch
- 4 Heated filter unit circuit breaker (6 A)
- 5 Heated sample gas line residual current breaker with overcurrent protection (10 A / 0.03 A)
- 6 Heated sample gas line circuit breaker, 10A
- 7 External power sockets and 24 VDC power supply circuit breaker (10 A)

Rear panel



RUBBER CONNECTORS

- X20 POWER OUT FILTER UNIT
- X21 POWER OUT SAMPLE GAS LINE
- X22 POWER OUT ANALYZER EASY LINE OR AO2000
- X23 POWER OUT SAMPLE GAS COOLER OR SAMPLE GAS FEED UNIT
- X24 POWER OUT NO-CONVERTER OR OTHER SAMPLE HANDLING DEVICE
- X25 POWER OUT SPARE
- X26 POWER SUPPLY INLET

-X30 Pt100 TERMINAL (SCREW TERMINALS)

- 1 Pt100 FILTER UNIT white
  - 2 Pt100 FILTER UNIT red
  - 3 Pt100 FILTER UNIT red
  - 4 Pt100 SAMPLE GAS LINE white
  - 5 Pt100 SAMPLE GAS LINE red
  - 6 Pt100 SAMPLE GAS LINE red
- 1) EARTHING SCREW

-X32 STATUS SIGNALS (D-SUB 15-PIN)

- 1 TO ANALYZER 1ST DI/DO MODULE DI3:5
  - 2 TO ANALYZER 1ST DI/DO MODULE DI3:4
  - 3 FROM NO-CONVERTER D-SUB 9-PIN:5
  - 4 TO ANALYZER 1ST DI/DO MODULE DI4:1
  - 5 TO ANALYZER 1ST DI/DO MODULE DI4:3
  - 6 FROM SAMPLE GAS COOLER :3/ SAMPLE GAS FEED UNIT X3:3
  - 7 TO ANALYZER 1ST DI/DO MODULE DO4:13
  - 8 TO ANALYZER 1ST DI/DO MODULE DO4:15
  - 9 ANALYZER 2ND DI/DO MODULE DO3:16
  - 10 ANALYZER 2ND DI/DO MODULE DO3:14
  - 11 ANALYZER 2ND DI/DO MODULE DO2:21
  - 12 ANALYZER 2ND DI/DO MODULE DO2:19
  - 13 ANALYZER 2ND DI/DO MODULE DO1:22
  - 14 ANALYZER 2ND DI/DO MODULE DO1:20
  - 15 SAMPLE GAS COOLER :2/ SAMPLE GAS FEED UNIT X3:2 AND NO CONVERTER D-DUB 9-PIN:9
- } FAILURE FILTER UNIT/ SAMPLE GAS LINE  
 } FAILURE CONVERTER  
 } FAILURE GAS COOLER/ CONVERTER  
 } FAILURE GAS COOLER  
 } SWITCHING SAMPLE GAS VALVE  
 } SWITCHING TEST GAS VALVE 3  
 } SWITCHING TEST GAS VALVE 2  
 } SWITCHING TEST GAS VALVE 1  
 } FAILURE GAS COOLER/ CONVERTER AND CONVERTER

## Ordering information

	Catalog No. 23940-0-	1	0	0	0	0	0	0	0	0
<b>Design</b>										
19-inch housing for rack mounting, 3 height units, IP20		1								
<b>Power supply</b>										
Power supply 115 V AC and 230 V AC									1	
<b>Solenoid valves</b>										
Solenoid valve for calibration with calibration cells and ambient air										1
Solenoid valves for calibration with test gases at the sample gas cooler										2
Solenoid valves for calibration with test gases at the sampling probe										3
<b>Temperature controllers</b>										
Without										0
With 2 temperature controllers for heated filter unit and heated sample gas line										1

## Engineering information

The following engineering information shall be taken into consideration when designing a small extractive gas analyzer system with the SCC-U utility unit.

### Arrangement of the devices in a rack or cabinet (examples)

SCC-K NO <sub>2</sub> /NO converter	SCC-U Utility unit
SCC-U Utility unit	EL3020 Gas analyzer
EL3020 Gas analyzer	SCC-S Sample gas feed unit
SCC-S Sample gas feed unit	

When installing the devices into a rack or cabinet, provide a distance of at least 1 height unit between the devices.

An SCC-K NO<sub>2</sub>/NO converter must always be installed as the top-most device.

An SCC-F sample gas feed unit and an SCC-C sample gas cooler can be installed side-by-side instead of the SCC-S sample gas feed unit.

### Engineering hint

Take care of sufficient heat dissipation of your system. Avoid heat buildups inside the cabinet.

### Laying the sample gas line

Lay the heated sample gas line inclined downwards. Avoid water pockets when laying the sample gas line.

### Ambient temperature

Consider the ambient temperature at the installation location of the analyzer system. A fan with inlet and outlet filter is required in any case. Installation of a cooling unit may be necessary depending on the prevailing ambient temperature. Avoid radiated heat and harsh conditions (e.g. dust).

## Multi-way test gas cock



### Technical data

#### Flow rate

Approx. 1000 l/h at 50 hPa pressure difference and 20 °C

#### Gas pressure

$p_{\text{abs}} \leq 17.6 \text{ MPa (176 bar)}$

#### Leakage rate

$\leq 5 \times 10^{-3} \text{ hPa l/s}$

#### Materials of gas-conducting parts

PTFE, stainless steel SS 316, suitable for pure oxygen

#### Weight

Approx. 0.8 kg

#### Mounting

Wall mounting (with accessories) or panel mounting

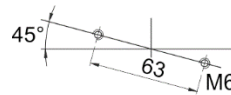
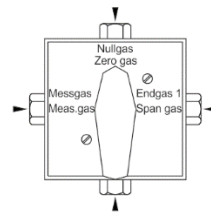
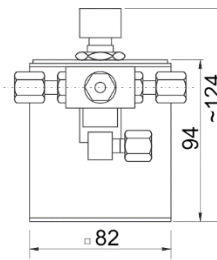
#### Gas connections

$\frac{1}{8}$  NPT and screw fitting for pipes with 6 mm outer diameter

#### Ambient temperature

+10 to 65 °C

### Dimensions (in mm)



Montagebohrung  
Bore holes

### Ordering information

	Catalog No.
Test gas cock stainless steel for wall mounting	23177-5-8308581

## Membrane filter

### Application

The membrane filter is used in gas conditioning systems of analyzer equipment for fine filtering of dust particles  $\geq 1 \mu\text{m}$ , in order to protect the analysis instruments from contamination in the event of disturbances in the sample gas conditioning chain.

### Technical data

#### Flow rate

Max. 300 l/h (air)

#### Gas pressure

PVC:  $p_{\text{abs}}$  max. 150 kPa (1.5 bar),  
stainless steel:  $p_{\text{abs}}$  max. 200 kPa (2 bar)

#### Gas temperature

PVC: max. 55 °C, stainless steel: max. 100 °C

#### Retention rate

100 % for particles  $\geq 1 \mu\text{m}$

#### Pressure drop

2.5 to 20 hPa (mbar) at a flow rate of 30 to 250 l/h (air)

#### Materials of gas-conducting parts

Case: PVC or stainless steel 1.4571 (SAE 316Ti), gas connections: PTFE, round cord rings: FPM, filter membrane: glass fiber

#### Filter surface

Approx. 24 cm<sup>2</sup>

#### Dead volume

Approx. 15 cm<sup>3</sup>

#### Weight

PVC: approx. 0.6 kg, stainless steel: approx. 1.4 kg

#### Mounting

Panel and wall mounting (with mounting bracket)

#### Gas connections

G $\frac{1}{4}$  female thread or nozzles for hose internal diameter 4 mm

#### Scope of delivery

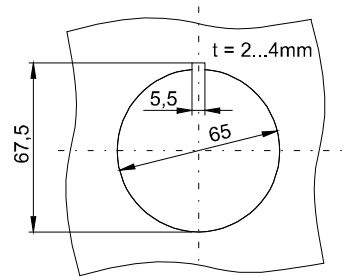
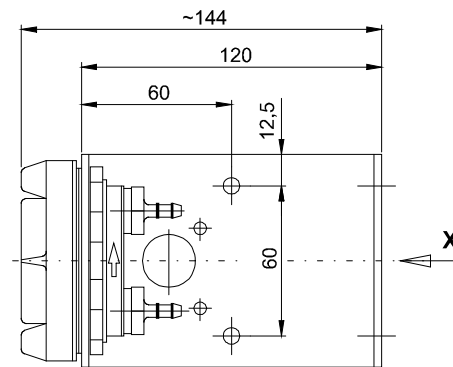
Membrane filter, mounting bracket, 2 nozzles, 2 round cord rings

### Ordering information

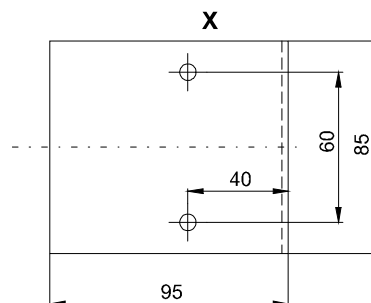
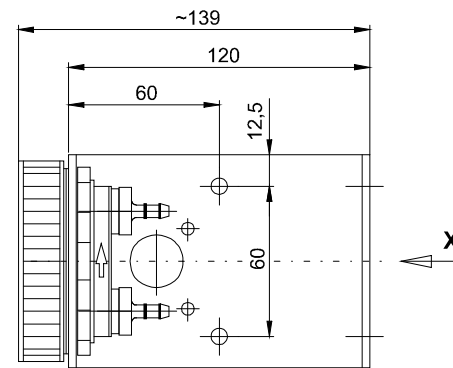
	Catalog No.
<b>Membrane filter</b>	
Membrane filter, PVC	23145-5-8018438
Membrane filter, stainless steel	23147-5-8018439
<b>Condensate monitor</b> (see page 32)	
Condensate monitor, PVC	23158-5-8018440
Condensate monitor, stainless steel	23157-5-8018039

### Dimensions (in mm)

#### Membrane filter, PVC version



#### Membrane filter, stainless steel version



## CGKW Condensate monitor

### Application

The condensate monitor CGKW is used to indicate moisture (condensate) or any other electrically-conducting liquid which penetrates into the sample gas line to the gas analyzer. At the same time, the condensate monitor is a membrane filter and it therefore satisfies the double function of fine filtering the sample gas as well as of signaling moisture. The filter membrane holds back the penetrated concentrate for a short while. An independent condensate barrier (see application examples) can be constructed with the condensate monitor as sensor element and the switching unit ER-144A/Ex (see page 37).

### Technical data

#### Flow rate

Max. 300 l/h (air)

#### Gas pressure

PVC:  $p_{abs}$  max. 150 kPa (1.5 bar),

stainless steel:  $p_{abs}$  max. 200 kPa (2 bar)

#### Gas temperature

Max. 55 °C

#### Retention rate

100 % for particles  $\geq 1 \mu\text{m}$

#### Pressure drop

2.5 to 20 hPa (mbar) at a flow rate of 30 to 250 l/h (air)

#### Materials of gas-conducting parts

Case: PVC or stainless steel 1.4571 (SAE 316Ti), gas connections:

PTFE, electrodes: stainless steel 1.4305 (SAE 303), round cord

rings: FPM, filter membrane: glass fiber

#### Filter surface

Approx. 24 cm<sup>2</sup>

#### Dead volume

Approx. 15 cm<sup>3</sup>

#### Dimensions

As for membrane filter (see page 31)

#### Weight

PVC: approx. 0.7 kg, stainless steel: approx. 1.5 kg

#### Mounting

Panel and wall mounting (with mounting bracket)

#### Gas connections

G $\frac{1}{4}$  female thread or nozzles for hose inside diameter 4 mm

#### Electrical connections

Two-core cable, approx. 1 m, for connecting to the switching unit ER-144A/Ex (see page 37)

#### Mounting orientation

Safety nose at top, electrode below

#### Scope of delivery

Condensate monitor, mounting bracket, 2 nozzles, 2 round cord rings, 25 filter membranes, operating manual

#### Ordering information

See page 31

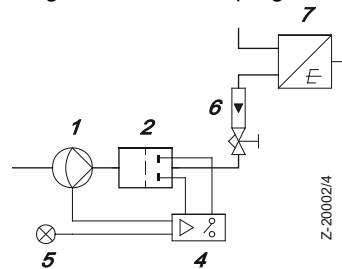
### Explosion protection (only with stainless steel case)

The condensate monitor is a device without voltage source. If the condensate monitor is being operated in the intrinsically-safe control circuit of the switching unit ER-144A/Ex, the apparatus is permitted in hazardous areas of Zones 1 and 2 up to a gas and ambient temperature of 55 °C without restriction of the explosion groups and temperature classes.

### Application examples

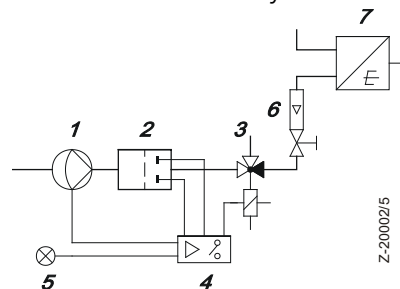
#### The process gas is present at zero pressure or with negative pressure

Sample gas feeding by pump. Condensate barrier by switching off the pump. Condensate monitor and analyzer must be arranged above the sample gas conditioning chain.



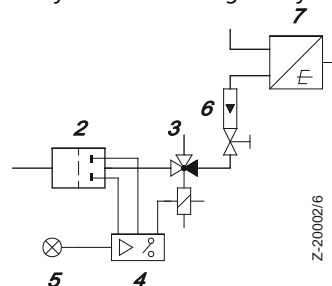
#### The process gas is present at zero pressure or with weak positive pressure

Sample gas feeding by pump. Condensate barrier by switching off the pump and switching over a 3/2-way solenoid valve. Condensate monitor and analyzer can be arranged as you wish.



#### The process gas is present with positive pressure

Sample gas feeding by positive pressure. Condensate barrier by switching over a 3/2-way solenoid valve. Condensate monitor and analyzer can be arranged as you wish.



- |                                |                  |            |
|--------------------------------|------------------|------------|
| 1 Membrane pump                | 4 Switching unit | 7 Analyzer |
| 2 Condensate monitor           | 5 Pilot lamp     |            |
| 3 Solenoid valve <sup>1)</sup> | 6 Flow meter     |            |

1) The sample gas path to the analyzer is blocked in the de-energized condition.



## Acid filter

### Application and description

The acid filter is used in the gas conditioning system. Its purpose is to collect the sulfuric acid aerosols entrapped in the sample gas. The acid filter may always be required where the  $\text{SO}_3$  content in the sample gas is greater than  $1 \text{ mg/m}^3$  or the  $\text{SO}_2$  content is greater than  $1000 \text{ mg/m}^3$  – for example in flue gas from heavy-oil or hard coal firings.

The filter element is made up of borosilicate fibers. An influencing and 'hang-up' of the measuring component in the sample gas is not detectable with this material.

### Technical data

#### Flow rate

Max. 250 l/h (air)

#### Gas pressure

$p_{\text{abs}} = 50$  to  $200 \text{ kPa}$  (0.5 to 2 bar)

#### Sample gas temperature

Max.  $150 \text{ }^\circ\text{C}$

#### Sample gas dew point

Max.  $70 \text{ }^\circ\text{C}$

#### Retention rate

99.99 % for particles  $\geq 0.1 \text{ }\mu\text{m}$

#### Pressure drop

10 hPa at 250 l/h, 50 hPa at 250 l/h

#### Dead time

Approx. 20 s

#### Materials of gas-conducting parts

Connection cap: PVDF; vessel: glass; filter element: borosilicate glass micro fiber

#### Dead volume

Approx. 130 ml

#### Weight

Approx. 0.6 kg

#### Mounting

Wall mounting with mounting bracket, mounting orientation vertical

#### Gas connections

Male fitting (PVDF) for 4/6/1 mm, drainage connection GL14 with terminal fitting 4/6/1 mm (PVDF)

#### Ambient temperature

$+5$  to  $50 \text{ }^\circ\text{C}$

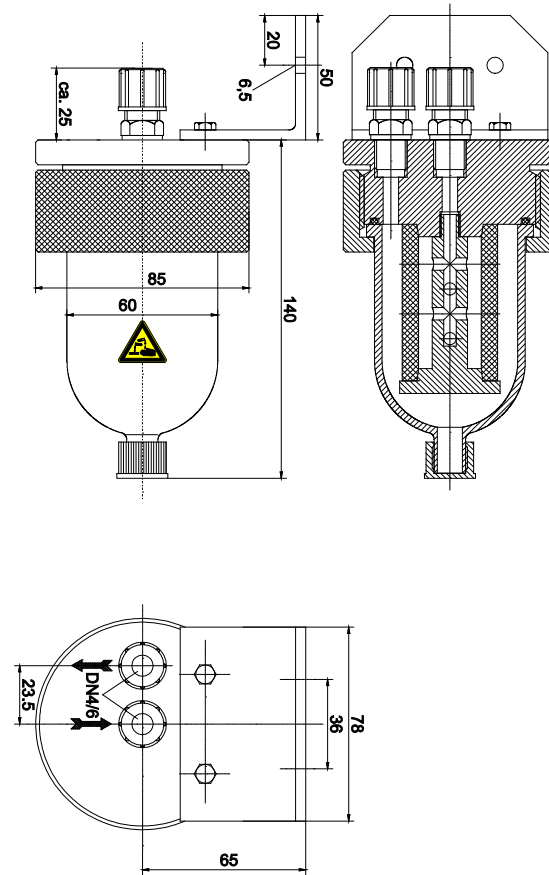
#### Service life

Change element if there is contamination and perceptibly higher pressure drop

#### Scope of delivery

Filter vessel with filter element, two male fittings, drainage connection GL14, mounting bracket, mounting and replacement instructions

### Dimensions (in mm)



### Ordering information

	Catalog No.
Acid filter	23045-5-8018419

## Disposable filter

### Application and description

The disposable filter is used in the gas conditioning system. It is mounted in the sample gas line upstream of the gas analyzer.

The disposable filter consists of a micro fiber filter pipe which is welded into a plastic case.

### Technical data

#### Flow rate

Max. 250 l/h (air)

#### Gas pressure

$p_{\text{abs}} \leq 200 \text{ kPa}$  (2 bar)

#### Sample gas temperature

+5 to 50 °C

#### Retention rate

99.99 % for particles  $\geq 0.1 \mu\text{m}$

#### Pressure drop

Approx. 2 hPa at 60 l/h

#### Dead time

Approx. 3 s at 60 l/h

#### Materials of gas-conducting parts

Case: PA, Filter element: borosilicate glass micro fiber

#### Case volume

11.5 cm<sup>3</sup>

#### Weight

Approx. 0.1 kg

#### Mounting

Mounting orientation preferably vertical

#### Gas connections

Two pipe nipples, outside diameter 6.3 mm

#### Ambient temperature

+5 to 50 °C

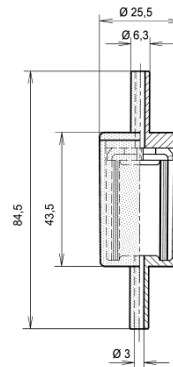
#### Service life

Change filter if there is condensate accumulation (acid), and in any case every 6 months

#### Scope of delivery

Disposable filter, mounting and replacement instructions

### Dimensions (in mm)



### Ordering information

	Catalog No.
Disposable filter	23044-5-8018418

## Flow meters, flow monitors



- Flow measurement using float-type flow meters
- Replaceable measuring tube
- Integral needle valve
- Flow monitor with inductive contact

### Flow meter 7 to 70 l/h

#### Measuring range

7 to 70 l/h nitrogen at 20 °C and 1013 hPa (mbar)

The following flow rates are obtained with other gases under the same conditions at the 60 l/h mark (approximate values):

Sulfur dioxide	SO <sub>2</sub>	49 l/h	Hydrogen	H <sub>2</sub>	159 l/h
Carbon dioxide	CO <sub>2</sub>	55 l/h	Helium	He	77 l/h
Carbon monoxide	CO	60 l/h	Argon	Ar	49 l/h
Oxygen	O <sub>2</sub>	54 l/h	Air		59 l/h
Methane	CH <sub>4</sub>	86 l/h			

#### Measuring deviation

±5 % of the full-scale value

#### Gas inlet conditions

Pressure max. 10 MPa (10 bar), temperature 100 °C

#### Flow rate adjustment

With integral needle valve

#### Materials of gas-conducting parts

Measuring tube	Borosilicate glass
Float	Stainless steel 1.4401 (SAE 316)
Float catcher	PTFE
Fitting	Stainless steel 1.4571 (SAE 316Ti)
Needle valve	Stainless steel 1.4571 (SAE 316Ti)
Seals	FPM
Nozzles	PTFE

#### Weight

Approx. 0.5 kg

#### Mounting

Panel or wall mounting by means of mounting bracket

#### Gas connections

¼ NPT female thread or sleeve for hose 4 mm inner diameter

#### Scope of delivery

Flow meter, mounting bracket, 2 nozzles

### Flow monitor 1.6 to 16 l/h, 7 to 70 l/h

#### Measuring range

1.6 to 16 l/h or 7 to 70 l/h nitrogen at 20 °C and 1013 hPa (mbar)

#### Measuring deviation

±5 % of the full-scale value

#### Flow rate adjustment

With integral needle valve

#### Materials of gas-conducting parts

As with flow meter 7 to 70 l/h

#### Weight

Approx. 0.8 kg

#### Mounting

Panel or wall mounting by means of mounting bracket

#### Gas connections

¼ NPT female thread or sleeve for hose 4 mm inner diameter

#### Signaling

With inductive contact RC 10-14-NO

Float catcher set to 5 l/h or 20 l/h

#### Electrical connections

Terminal boxes with EMC filter and cable gland M16

#### Scope of delivery

Flow monitor, mounting bracket, 2 nozzles, O-ring

### Flow monitor for chlorine 7 to 70 l/h

#### Measuring range

7 to 70 l/h chlorine at 20 °C and 1013 hPa (mbar)

#### Measuring deviation

±5 % of the full-scale value

#### Gas inlet conditions

Pressure max. 4 MPa (4 bar), temperature 100 °C

#### Flow rate adjustment

With integral needle valve PEEK

#### Materials of gas-conducting parts

Measuring tube	Borosilicate glass
Float	PEEK with lining
Float catcher	PTFE, set to 20 l/h
Case	PVDF
Seals	FFKM

#### Weight

Approx. 0.5 kg

#### Mounting

Panel or wall mounting by means of mounting bracket

#### Gas connections

¼ NPT female thread

#### Signaling

With inductive contact RC 10-14-NO

Float catcher set to 20 l/h

#### Electrical connections

Terminal boxes with EMC filter and cable gland M16

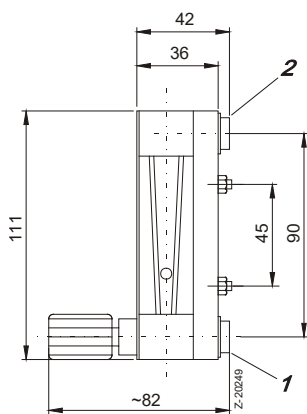
#### Scope of delivery

Flow monitor, mounting bracket, 2 nozzles, O-ring

## ... Flow meters, flow monitors

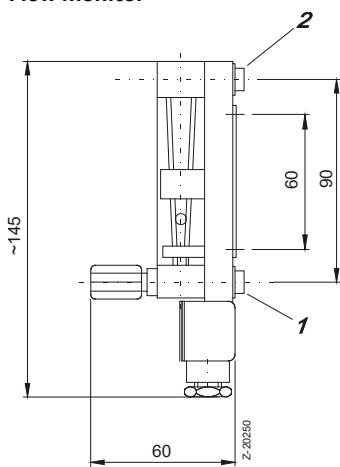
### Dimensions (in mm)

#### Flow meter



- 1 Gas inlet  
2 Gas outlet

#### Flow monitor



- 1 Gas inlet  
2 Gas outlet

### Ordering information

	Catalog No.
Flow meter 7 to 70 l/h	23151-5-8018474
Flow monitor 1.6 to 16 l/h	23155-5-8018476
Flow monitor 7 to 70 l/h	23155-5-8018475
Flow monitor for chlorine 7 to 70 l/h	23155-5-8018477

## ER-144A/Ex Switching unit

### Application and description

The switching unit ER-144A/Ex acts as switching amplifier for the condensate monitor CGKW (see page 32). The intrinsically-safe circuit of the switching unit ER-144A/Ex enables the condensate monitor also to be installed in hazardous areas.

The ER-144A/Ex switching unit operates in closed-circuit operation. The alarm positions of the output contacts correspond to those of the device in a non-voltage state or exceeding the adjustable measurement current value (electric conductance) or disconnection of the sensor lead. In the 'Ready' status, the output contacts have changed over to the corresponding counter-position (internal relay picked-up).

A 100-k $\Omega$  resistor (1 %/0.25 W) must be installed at the sensor in order to monitor the signal line between the sensor and the electrode relay. Without the resistor, the switching unit will change to the 'Line break' position.

### Technical data

Input	'ia'	'ib'
No-load voltage $U_0$	$\leq 13.1$ V	$\leq 13.1$ V
Short-circuit current $I_0$	$\leq 5$ mA	$\leq 5$ mA
Power $P_0$	$\leq 65$ mW	$\leq 65$ mW
Permissible external capacitance $C_0$	$\leq 0.97$ $\mu$ F	$\leq 6$ $\mu$ F
Permissible external inductance $L_0$	$\leq 0.9$ H	$\leq 1$ H

### Output

2 potential-free changeover contacts, max. 250 V AC, 5 A

### Indication

One LED each for line breakage and condensate penetration

### Construction

Surface-mounting case

### Degree of protection

Housing IP40, terminals IP20 to EN 60529

### Safety

Protection class II, over-voltage category III, degree of pollution 2

### Weight

Approx. 0.2 kg

### Mounting

Snap fastening on standard rail 35 mm (EN 50022)

### Ambient temperature

-25 to +60 °C

### Power supply

230 V AC or 115 V AC  $\pm 10$  %, 48 to 62 Hz,  $\leq 1$  VA

### EC type examination certificate

TÜV 00 ATEX 1604

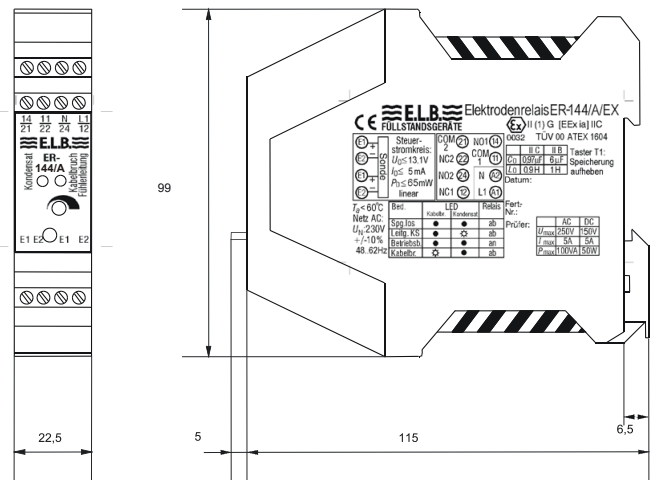
### Designation

II (1) G [Ex ia Ga] IIC

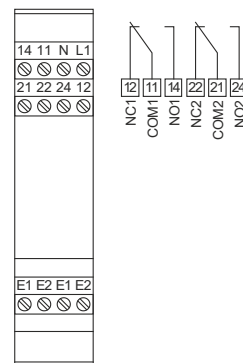
### Installation location

Outside the hazardous area

### Dimensions (in mm)



### Electrical connections



Relays are shown in the unpowered state.

### Ordering information

	Catalog No.
Switching unit ER-144A/Ex, 230 V AC	23371-4-0730637
Switching unit ER-144A/Ex, 115 V AC	23371-4-0730638

## KFA Isolated switch amplifier



### Application and description

The KFA isolated switch amplifier is used as switch amplifier for the flow monitor (see page 35). The control circuit is monitored for line breakage and short circuit. External faults are indicated by a red flashing LED.

### Technical data

#### Input (intrinsically safe)

$U_0 \leq 10.6 \text{ V}$ ,  $I_0 \leq 19.1 \text{ mA}$ ,  $P_0 \leq 51 \text{ mW}$

#### Permissible connection values

	IIA	IIB	IIC
Explosion group	IIA	IIB	IIC
External capacitance	72 $\mu\text{F}$	16.2 $\mu\text{F}$	2.32 $\mu\text{F}$
External inductance	780 mH	390 mH	97 mH

#### Output relays

Potential-free changeover contacts, max. 253 V AC, 2 A;  $\cos \varphi > 0.7$ ; switching frequency < 10 Hz

#### Construction

Surface-mounting case

#### Degree of protection of housing

IP20 to EN 60529

#### Weight

Approx. 0.15 kg

#### Mounting

On standard rail 35 mm to EN 60715

#### Ambient temperature

-20 to +60 °C

#### Power supply

207 to 253 V AC or 103.5 to 126 V AC, 45 to 65 Hz,  $\leq 1 \text{ VA}$

#### EC type examination certificate

PTB 00 ATEX 2081

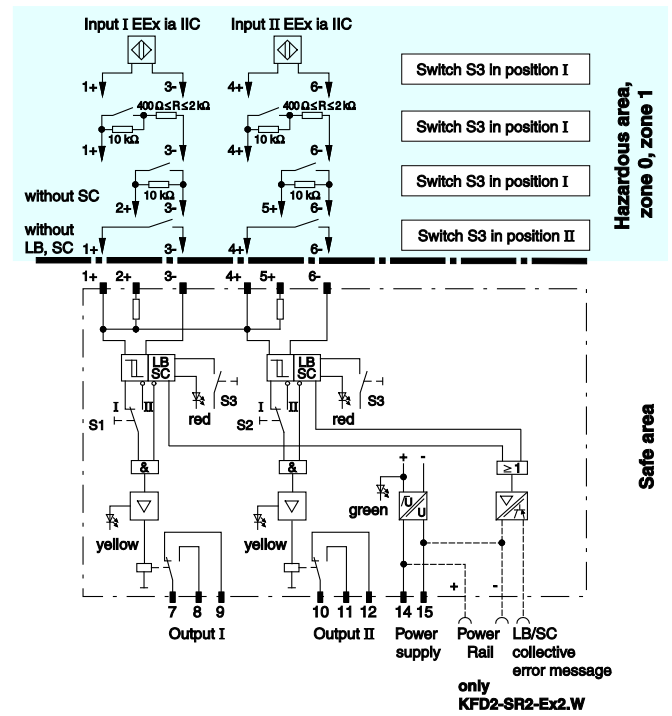
#### Designation

- II (1)G [Ex ia Ga] IIC,
- II (1)D [Ex ia Da] IIIC

#### Installation location

Outside the hazardous area

### Electrical connections



### Ordering information

	Catalog No.
KFA6-SR2-Ex1.W, 1 channel, 230 V AC	23372-5-8328644
KFA6-SR2-Ex2.W, 2 channels, 230 V AC	23372-5-8328645
KFA5-SR2-Ex1.W, 1 channel, 115 V AC	23372-5-8328851
KFA5-SR2-Ex2.W, 2 channels, 115 V AC	23372-5-0730651

## Cylinder pressure reducers

### Application and description

Cylinder pressure reducers are used to reduce the filling pressure in pure gas and test gas cylinders to the required operating pressure. Material compatibility must be observed in respect of the test gas (see technical data). Two-stage cylinder pressure reducers are employed where very constant pressure and flow are required at low operating pressure – for example where the subsequent gas paths are switched over using solenoid valves. Pressure reducers with minimum contact at the high-pressure gauge give an indication when the cylinder pressure has dropped to such a level that it is necessary to replace the gas cylinder.

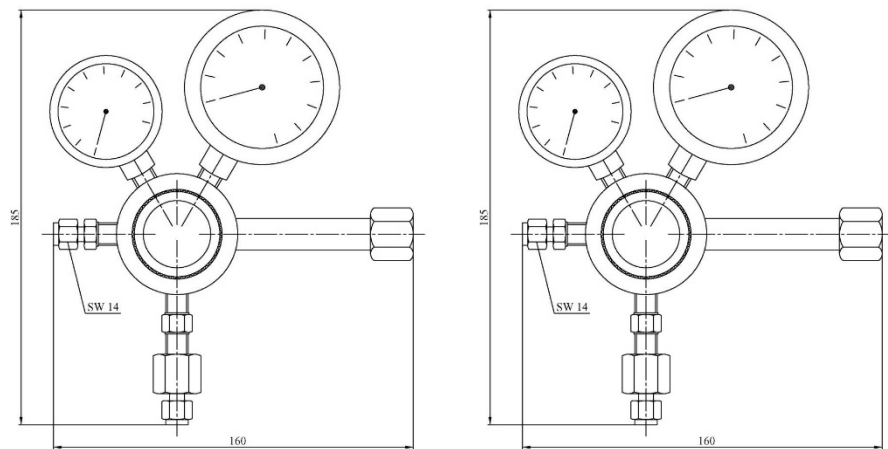
### Ordering information

	Catalog No.
2-stage for nitrogen	23422-5-8018376
2-stage for non-corrosive test gases	23422-5-8018377
2-stage for corrosive test gases	23422-5-8018378
1-stage for nitrogen, brass	23422-4-0730654

### Technical data

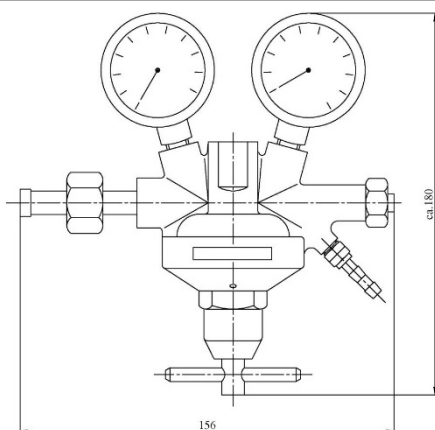
Catalog No.	23422-5-8018376	23422-5-8018377	23422-5-8018378
Gas type	Nitrogen	Non-corrosive test gases	Corrosive test gases
Construction	2-stage, brass, with minimum contact		2-stage, stainless steel, with min. contact
Inlet pressure	Max. 21 MPa (210 bar)		Max. 21 MPa (210 bar)
Outlet pressure (adjustable)	10 to 150 kPa (0.1 to 1.5 bar)		10 to 150 kPa (0.1 to 1.5 bar)
Safety valve set to	Approx. 1.6 MPa (16 bar)		Approx. 1.6 MPa (16 bar)
Relief valve set to	Approx. 200 kPa ( 2 bar)		Approx. 200 kPa (2 bar)
Pressure gauge indication inlet pressure	0 to 25 MPa (0 to 250 bar)		0 to 25 MPa (0 to 250 bar)
Pressure gauge indication outlet pressure	-100 to +300 kPa (-1 to +3 bar)		-100 to +300 kPa (-1 to +3 bar)
Flow rate	25 to 500 l/h		25 to 500 l/h
Control action	Back pressure increase with falling cylinder pressure down to 3 bar equals zero		Back pressure increase with falling cylinder pressure down to 3 bar equals zero
Status signal	Reed contact 100 V, 0.5 A		Reed contact 100 V, 0.5 A
Membrane material	Stainless steel		Stainless steel
Seal material	ETFE, PVDF, EPDM		ETFE, PVDF, EPDM
Case material	Brass chromium plated		Stainless steel 1.4401 (SAE 316)
Dimensions (W × H × D)	Approx. 160 × 185 × 167 mm		Approx. 160 × 185 × 167 mm
Weight	Approx. 2.1 kg		Approx. 2.1 kg
Connection to cylinder (thread to DIN 477)	Hexagon		Hexagon
Gas outlet connection	Clamping ring screw fitting Swagelok® for pipe with 6 mm outside diameter		Clamping ring screw fitting Swagelok® for pipe with 6 mm outside diameter
Safety valve connection	Clamping ring screw fitting Swagelok® for pipe with 6 mm outside diameter		Clamping ring screw fitting Swagelok® for pipe with 6 mm outside diameter
Relief valve connection	¼ NPT male thread		¼ NPT male thread
Ambient temperature	-5 to +75 °C		-5 to +75 °C
Scope of delivery	Pressure reducer, pressure gauge, safety valve and clamping ring screw fitting attached; replacement seals, manual		Pressure reducer, pressure gauge, safety valve and clamping ring screw fitting attached; replacement seals, manual

Dimensions (in mm)



## ... Cylinder pressure reducers

<b>Catalog No.</b>	<b>23422-4-0730654</b>
Gas type	Nitrogen
Construction	1-stage, brass
Inlet pressure	21 MPa (210 bar)
Control range	0 to 250 kPa (2.5 bar)
Pressure gauge	31.5 MPa (315 bar)
Outlet pressure gauge indication range	0 to 400 kPa (0 to 4 bar)
Body material	Brass
Membrane material	NBR
Case seal material	NBR
Filter	100 µm
Bottle connection	DIN 477, No. 10
Safety relief valve	1
Ambient temperature	-5 to +75 °C
Weight	2.1 kg
Dimensions (in mm)	



Sales



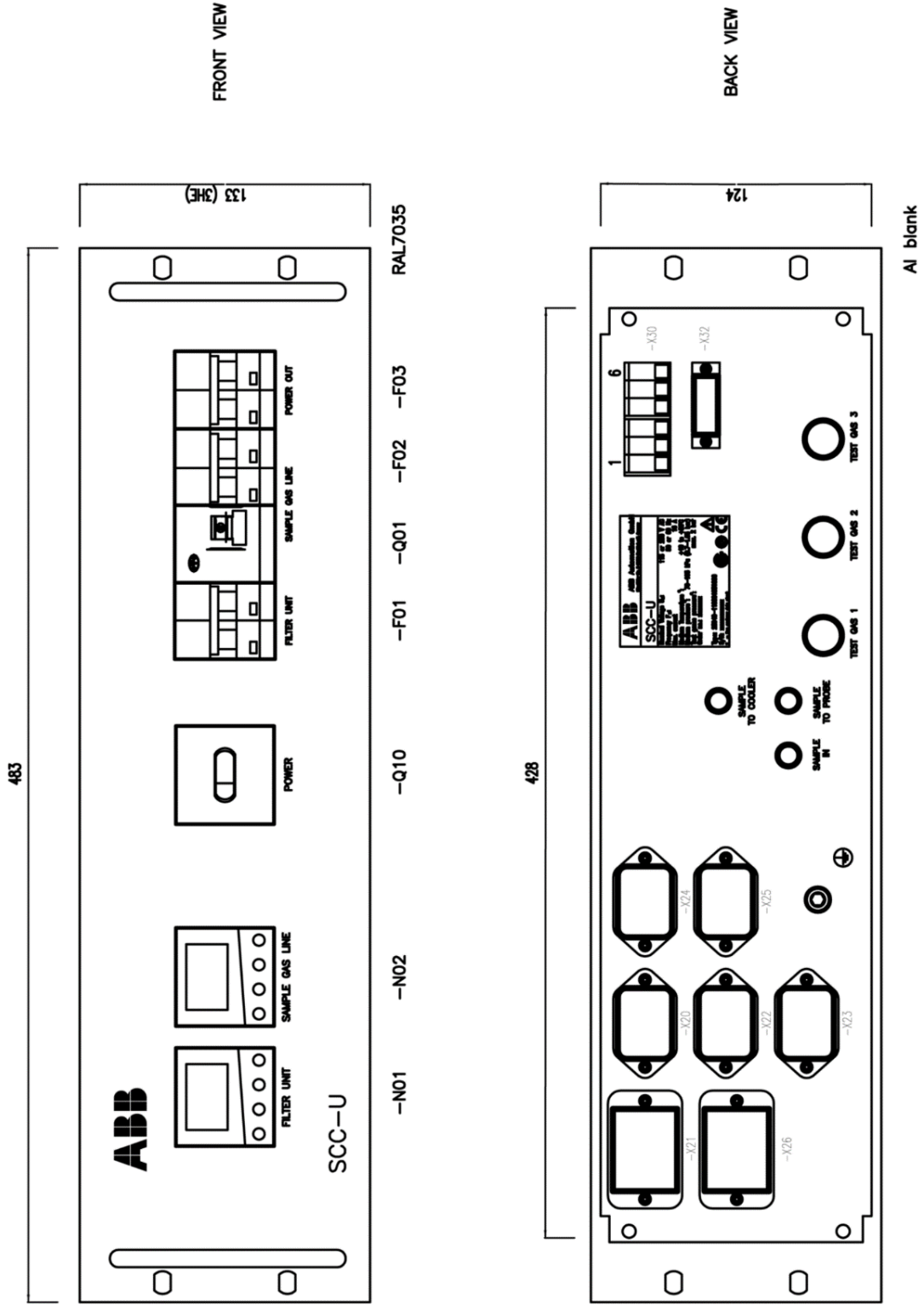
Service





Appendix

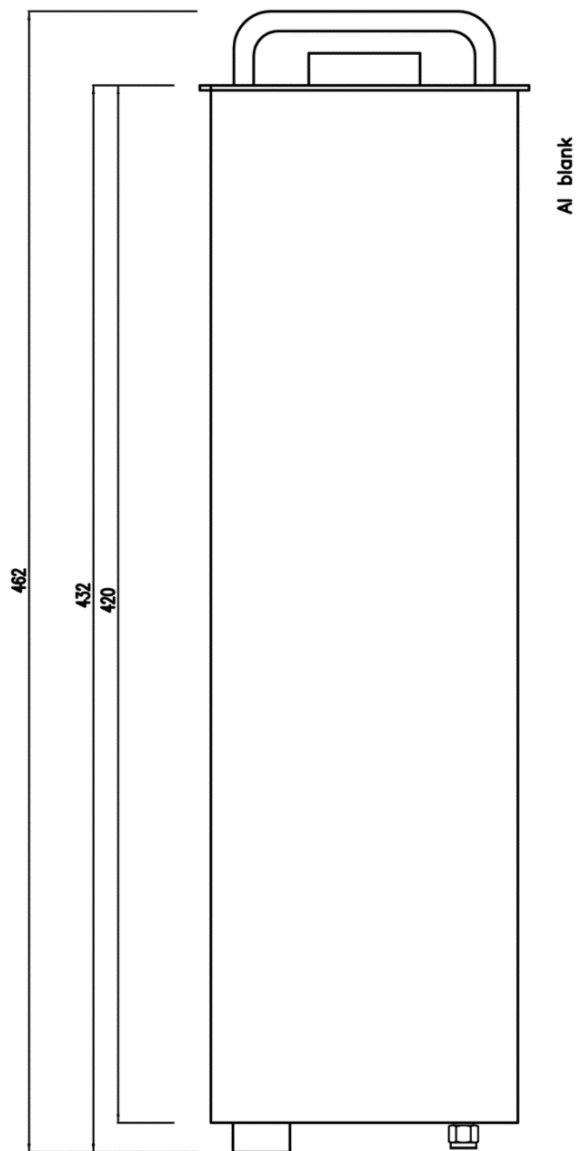
Technical drawings SCC-U

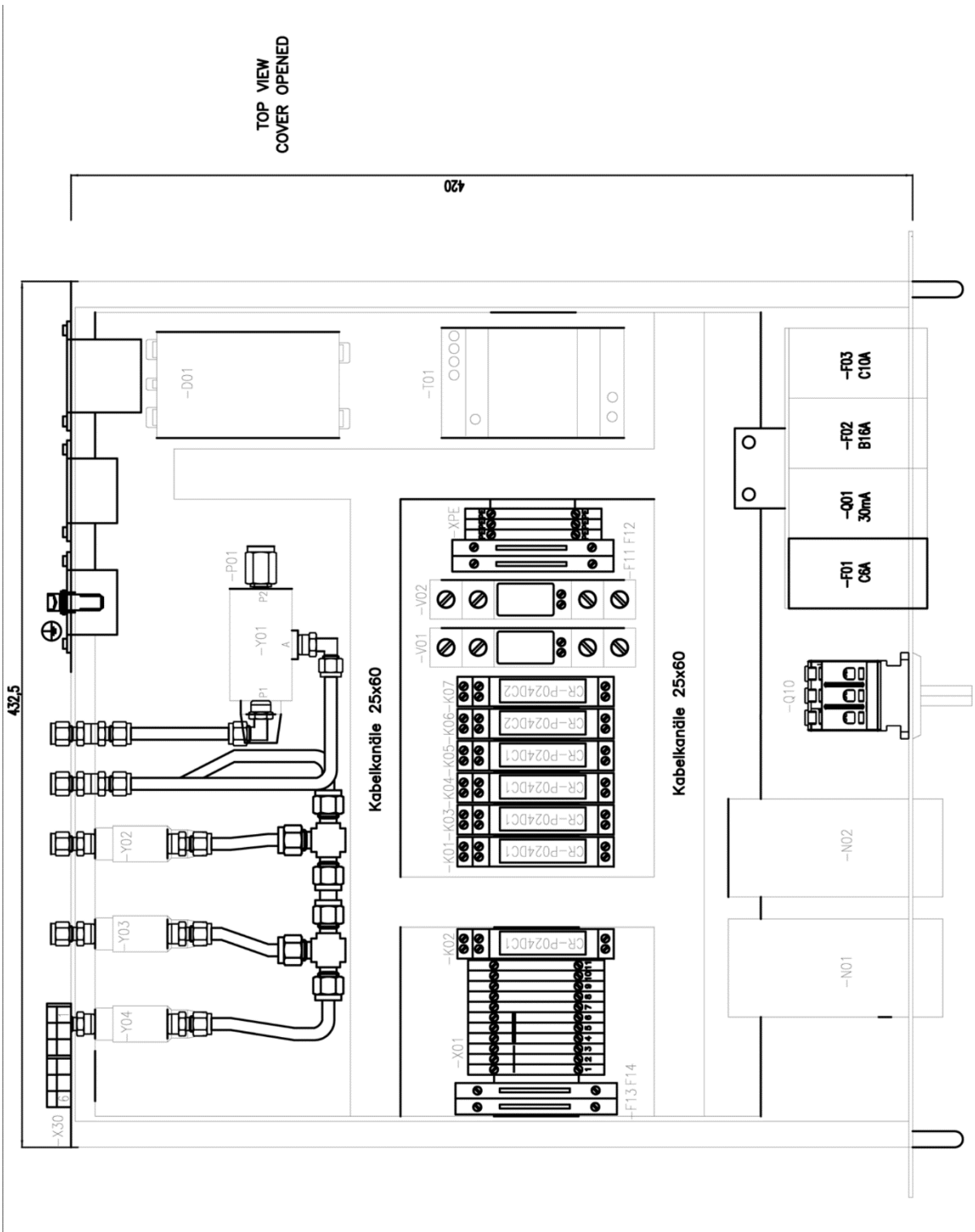


... Appendix

... Technical drawings SCC-U

LEFT VIEW

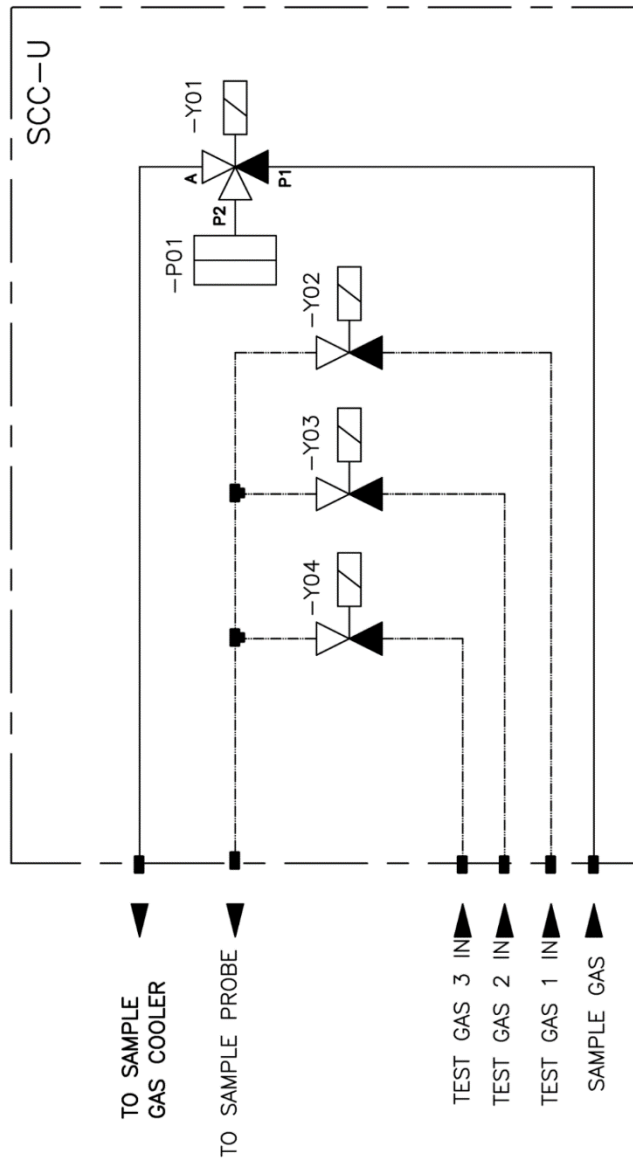




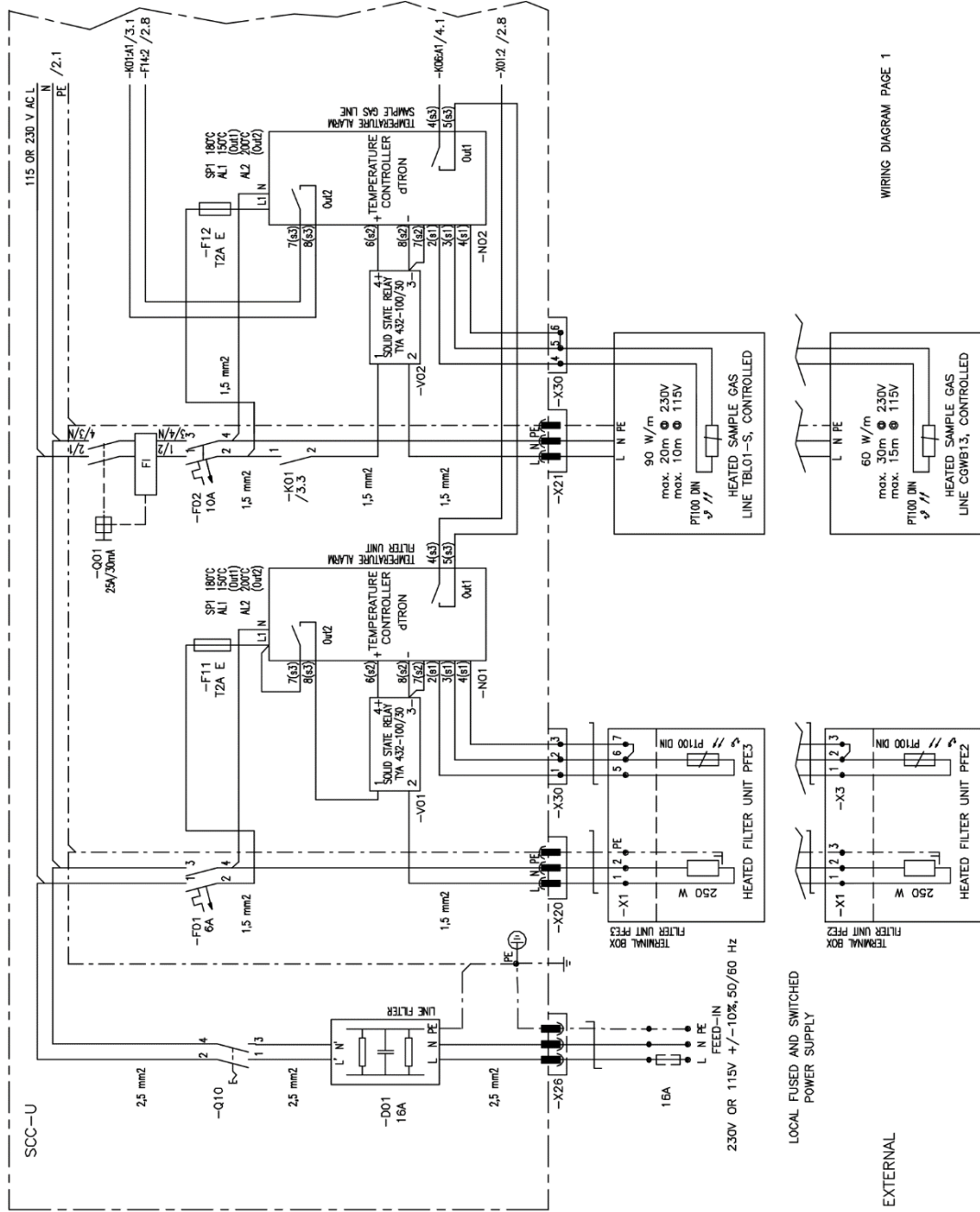
... Appendix

... Technical drawings SCC-U

CALIBRATION WITH TEST GASES AT SAMPLE GAS PROBE

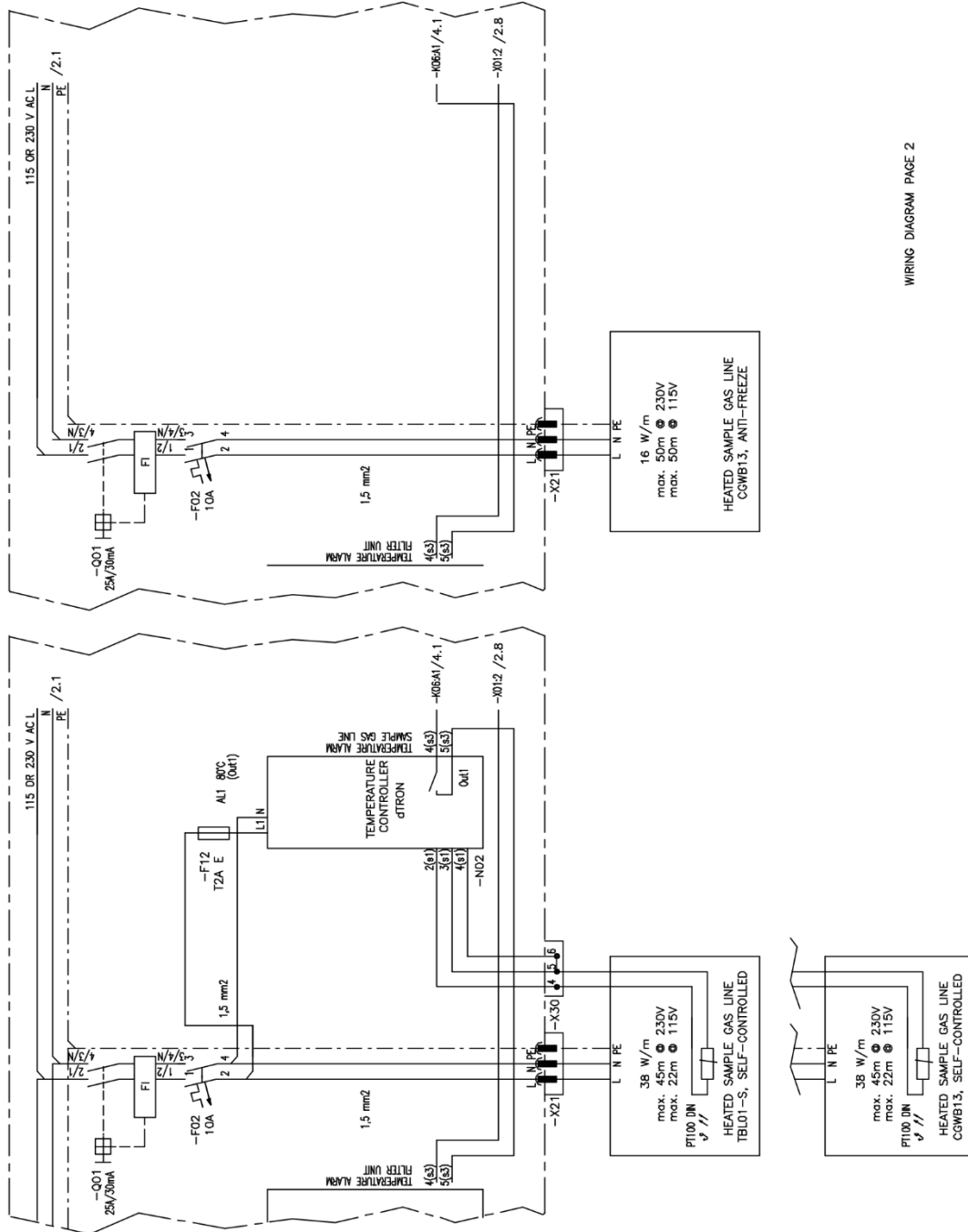


- HOSE PTFE 4/6x1mm
- HOSE Viton FPM 4/6mm
- BULKHEAD UNION PVDF 4/6mm
- T UNION PVDF 4/6mm

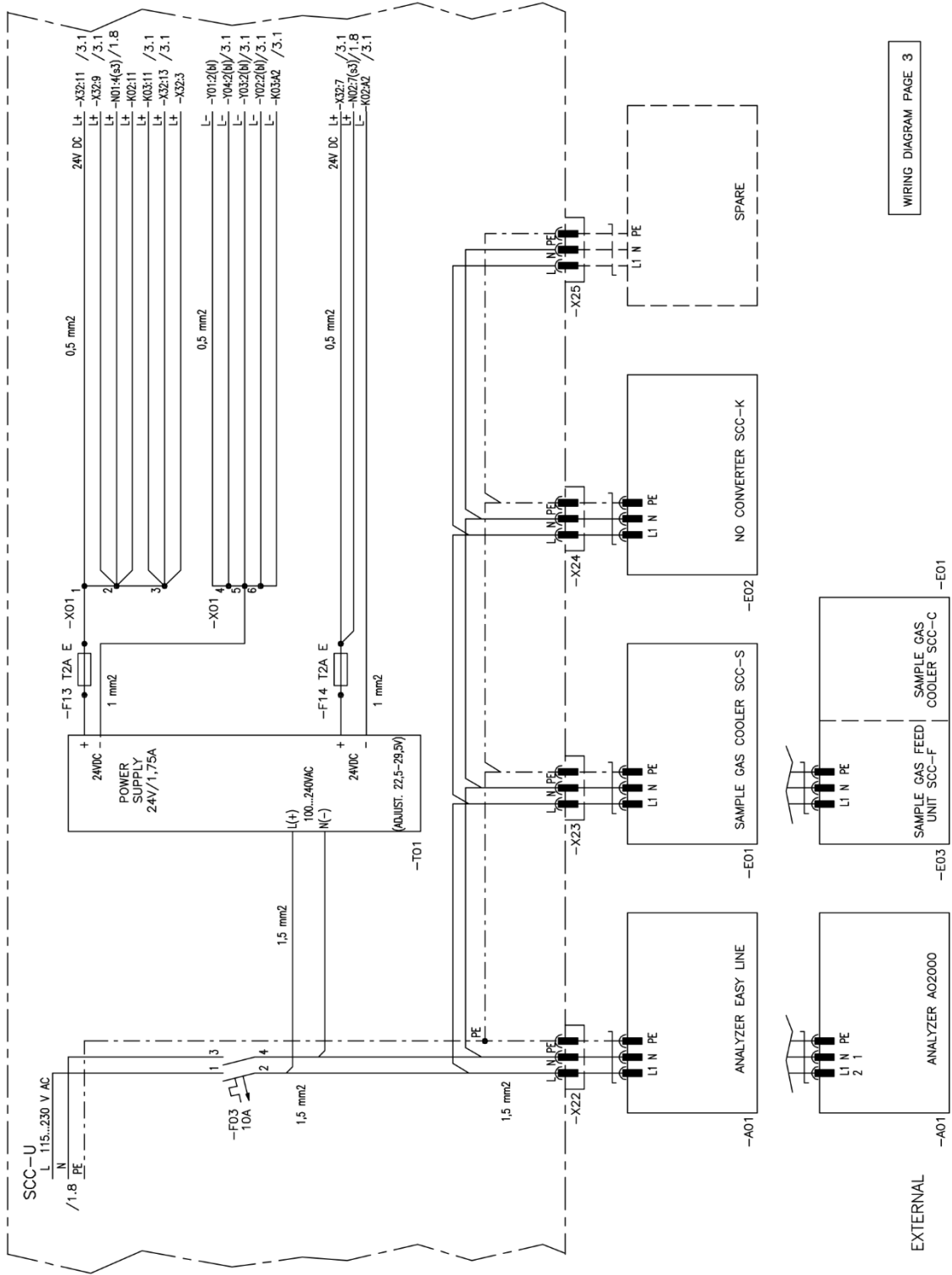


### ... Appendix

### ... Technical drawings SCC-U



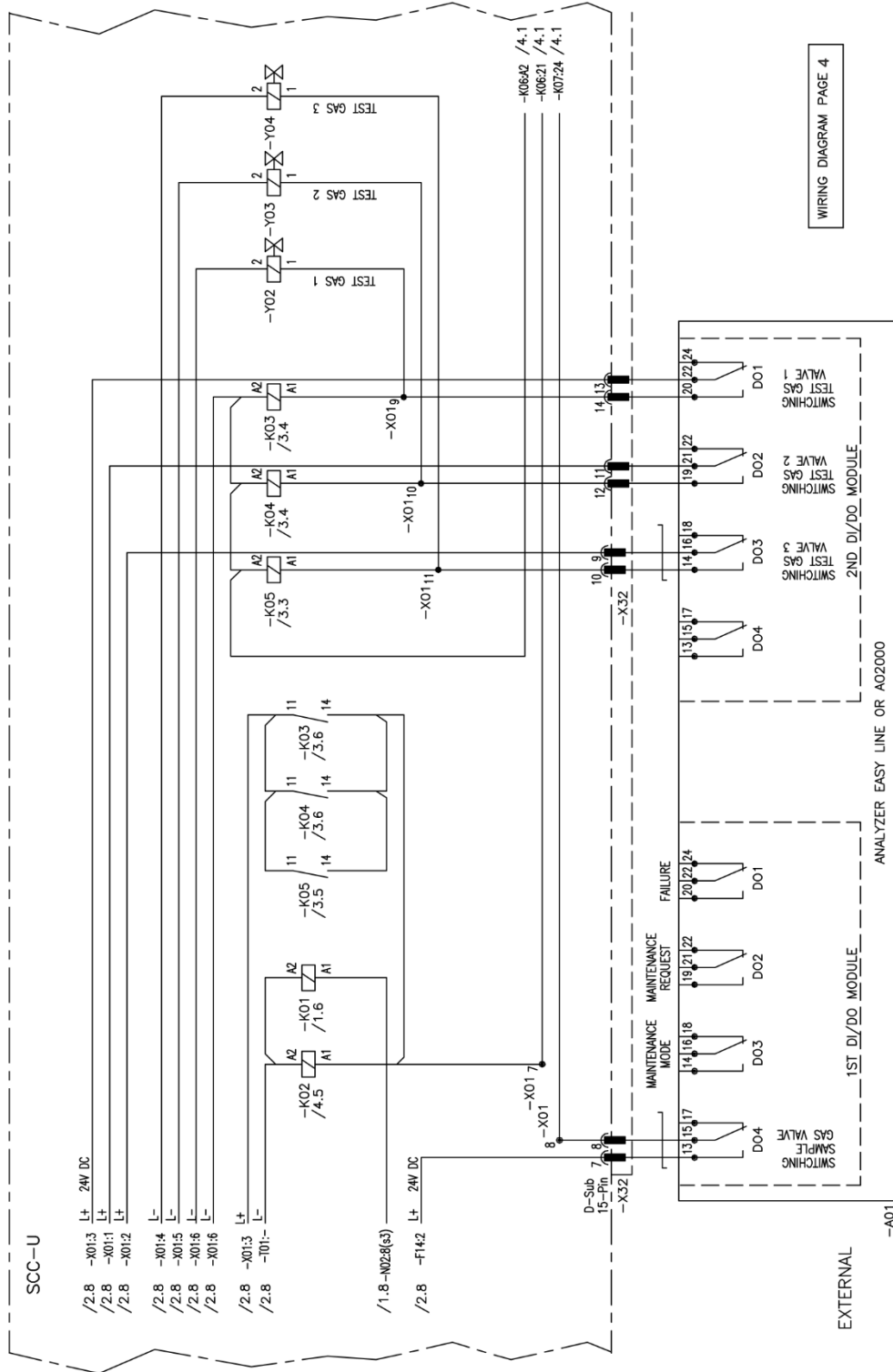
WIRING DIAGRAM PAGE 2



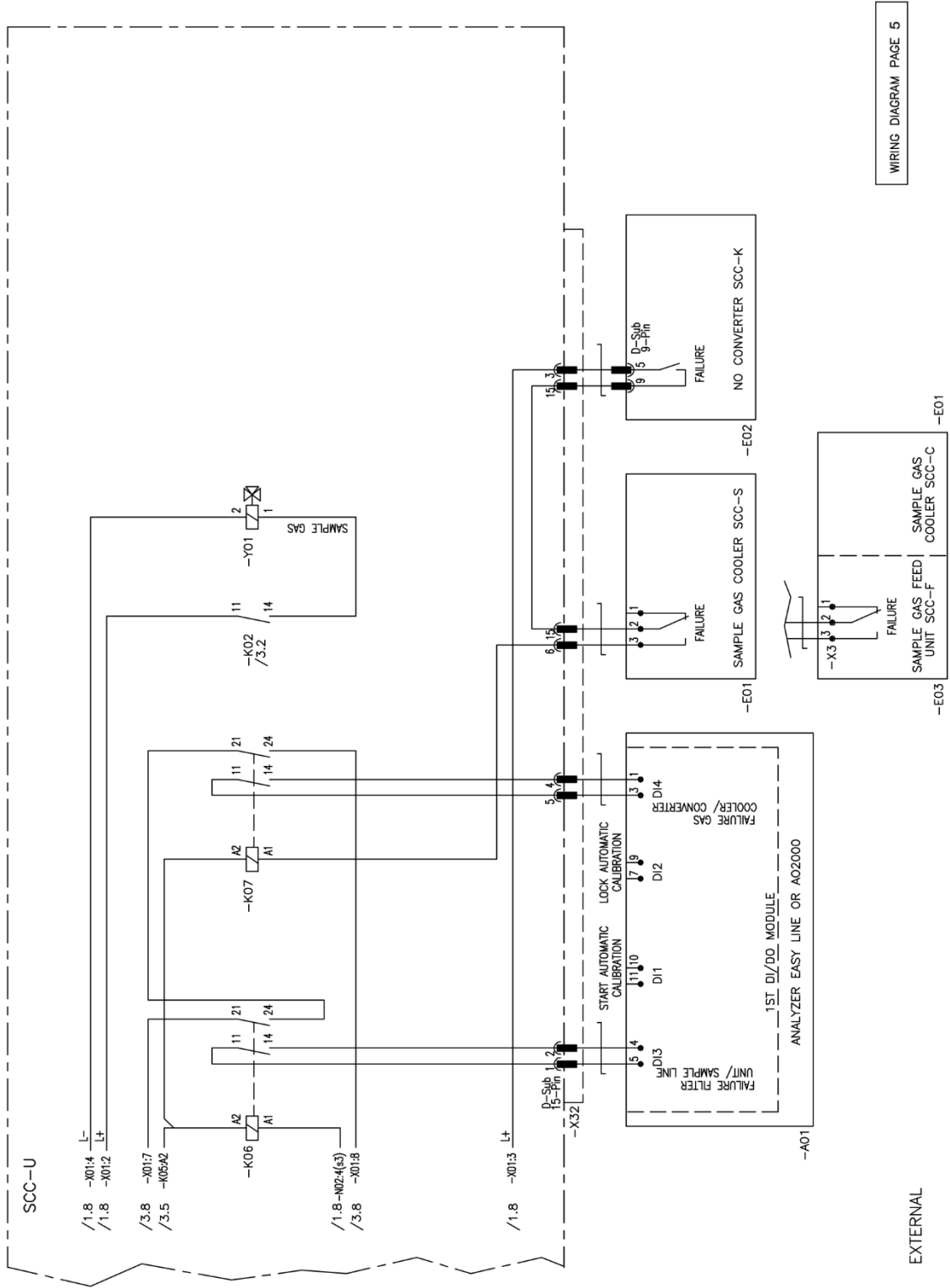
WIRING DIAGRAM PAGE 3

# ... Appendix

## ... Technical drawings SCC-U







WIRING DIAGRAM PAGE 5

EXTERNAL



## Notes



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