SimModulo

SMS-AQA

- up to 3 galvanically isolated 0/4..20 mA inputs
- up to 3 galvanically isolated 0/4..20 mA outputs

Processing functions:

- multi-channel 0/4..20 mA isolators, from 1 to 3 channels
- signal splitter with 2 or 3 outputs
- arithmetic module: A − B, A + B, MIN, MAX
- converter with a user-defined nonlinear characteristic (up to 20 points)

SimModulo One is a line of multi-channel signal converters enclosed in a single-module design. They provide full galvanic isolation between all input circuits, output circuits, and the power supply.
The design of the converters allows flexible configuration of the number of available device inputs and outputs. Thanks to this, the device can function as a multi-channel isolator as well as a signal splitter. Additionally, built-in arithmetic and logic functions enable mathematical operations on input signals, such as SUM A + B (+C) and DIFFERENCE A − B (−C), as well as outputting the MIN or MAX value from any number of input signals. An option for non-linear scaling of the input signal to the output according to a 20-point user-defined characteristic is also available.

TECHNICAL DATA

Power supply Current consumption	16V ÷ 30V DC; isolated; external fuse (required): T - type, max. 1 A max. 10 W
Input Accuracy Temperature stability	max. 3; range 0..20 mA or 4..20 mA (max. 0..22 mA), input resistance < 50 Ω (typically 40 Ω), protected against overload 0,1%@25°C 50 ppm/°C
Output Sensor power supply output Temperature stability	max. 3; range 0..20 mA or 4..20 mA (max. 0..22 mA), load resistance: max. 700 Ω 24V DC ±5% / max 35 mA 70 ppm/°C
Galvanic separation	all inputs and outputs are galvanically isolated from each other, and from the power supply and the RS-485 signals
Communication interface	RS-485, 8N1, 1200 ÷ 115200 bit/s, galvanically isolated on the power supply side (for service purposes only)
Data memory	non-volatile memory, EEPROM type
Operating temperature	0°C ÷ +50°C (standard), -20°C ÷ +50°C (option)
Storage temperature	-10°C ÷ +70°C (standard), -20°C ÷ +70°C (depending on option)
Humidity	5% ÷ 90%, no condensation
Protection class	IP 20 (housing and connection clips)
Mounting	DIN rail (35 mm)
Dimensions	22,5 x 125 x 125 mm

ORDERING

SMS-AQA-X-XX-XXX-XXX-0-XX1

- device type
- number of inputs
- number of outputs
- signal of input channel 1
- signal of input channel 2
- signal of input channel 3
- signal of output channel 3
- signal of output channel 2
- signal of output channel 1
- options:
  - 00 : no options
  - 08 : operating temperature -20°C ÷ +50°C

CONFIGURATIONS

Processing function: signal splitter

SMS-AQA-1: signal splitter with 2 or 3 outputs

Input / output modules		
Name	SMS-AQA-1-12	SMS-AQA-1-13
Function		
Number and type of inputs	1 x 0/4..20 mA 1 x 20..0/4 mA	
Input signal		
Number and type of outputs	2 x 0/4..20 mA 2 x 20..0/4 mA	3 x 0/4..20 mA 3 x 20..0/4 mA
Output signal		

Ordering:

SMS-AQA-1-12-X00-XX0-0-XX1: 2-channels splitter
SMS-AQA-1-13-X00-XXX-0-XX1: 3-channels splitter

options:
00 : no options
08 : operating temperature -20°C ÷ +50°C

X - signal types for individual channels:
1 : 0..20 mA
2 : 4..20 mA
3 : 20..0 mA
4 : 20..4 mA

Processing function: signal isolator

SMS-AQA-2: isolator, from 1 to 3 channels in one device

Input / output modules			
Name	SMS-AQA-2-11	SMS-AQA-2-22	SMS-AQA-2-33
Function			
Number and type of inputs	1 x 0/4..20 mA 1 x 20..0/4 mA	2 x 0/4..20 mA 2 x 20..0/4 mA	3 x 0/4..20 mA 3 x 20..0/4 mA
Input signal			
Number and type of outputs	1 x 0/4..20 mA 1 x 20..0/4 mA	2 x 0/4..20 mA 2 x 20..0/4 mA	3 x 0/4..20 mA 3 x 20..0/4 mA
Output signal			

Ordering:

SMS-AQA-2-11-X00-X00-0-XX1: 1-channel isolator
SMS-AQA-2-22-XX0-XX0-0-XX1: 2-channels isolator
SMS-AQA-2-33-XXX-XXX-0-XX1: 3-channels isolator

options:
00 : no options
08 : operating temperature -20°C ÷ +50°C

X - signal types for individual channels:
1 : 0..20 mA
2 : 4..20 mA
3 : 20..0 mA
4 : 20..4 mA

Processing function: mathematical functions

SMS-AQA-3: converter with a user-defined nonlinear characteristic (up to 20 points), processing from 1 to 3 channels

Input / output modules			
Name	SMS-AQA-3-11	SMS-AQA-3-22	SMS-AQA-3-33
Function			
Number and type of inputs	1 x 0/4..20 mA 1 x 20..0/4 mA	2 x 0/4..20 mA 2 x 20..0/4 mA	3 x 0/4..20 mA 3 x 20..0/4 mA
Input signal			
Number and type of outputs	1 x 0/4..20 mA 1 x 20..0/4 mA	2 x 0/4..20 mA 2 x 20..0/4 mA	3 x 0/4..20 mA 3 x 20..0/4 mA
Output signal			

Ordering:

SMS-AQA-3-11-X00-X00-0-XX1: 1-channel converter with a user-defined characteristic *
SMS-AQA-3-22-XX0-XX0-0-XX1: 2-channels converter with a user-defined characteristic *
SMS-AQA-3-33-XXX-XXX-0-XX1: 3-channels converter with a user-defined characteristic *

options:
00 : no options
08 : operating temperature -20°C ÷ +50°C

X - signal types for individual channels:
1 : 0..20 mA
2 : 4..20 mA
3 : 20..0 mA
4 : 20..4 mA

** - user-defined characterisac supplied by the customer during the ordering process*

SMS-AQA-4: arithmetic module with the A-B function (optionally -C), processing 2 or 3 channels
SMS-AQA-5: arithmetic module with the A+B function (optionally +C), processing 2 or 3 channels

Input / output modules				
Name	SMS-AQA-4-21	SMS-AQA-4-31	SMS-AQA-5-21	SMS-AQA-5-31
Function	a-b	a-b-c	a+b	a+b+c
Number and type of inputs	2 x 0/4..20 mA 2 x 20..0/4 mA	3 x 0/4..20 mA 3 x 20..0/4 mA	2 x 0/4..20 mA 2 x 20..0/4 mA	3 x 0/4..20 mA 3 x 20..0/4 mA
Input signal				
Number and type of outputs	1 x 0/4..20 mA 1 x 20..0/4 mA	1 x 0/4..20 mA 1 x 20..0/4 mA	1 x 0/4..20 mA 1 x 20..0/4 mA	1 x 0/4..20 mA 1 x 20..0/4 mA
Output signal				

Ordering:

SMS-AQA-4-21-XX0-X00-0-XX1: arithmetic module with the A-B function
SMS-AQA-4-31-XXX-X00-0-XX1: arithmetic module with the A-B-C function
SMS-AQA-5-21-XX0-X00-0-XX1: arithmetic module with the A+B function
SMS-AQA-5-31-XXX-X00-0-XX1: arithmetic module with the A+B+C function

options:
00 : no options
08 : operating temperature -20°C ÷ +50°C

X - signal types for individual channels:
1 : 0..20 mA
2 : 4..20 mA
3 : 20..0 mA
4 : 20..4 mA

SMS-AQA-6: averaging summator (arithmetic mean) from 2 or 3 inputs
SMS-AQA-7: arithmetic module - MIN value from 2 or 3 inputs
SMS-AQA-8: arithmetic module - MAX value from 2 or 3 inputs

Input / output modules						
Name	SMS-AQA-6-21	SMS-AQA-6-31	SMS-AQA-7-21	SMS-AQA-7-31	SMS-AQA-8-21	SMS-AQA-8-31
Function	$\overline{X}$	$\overline{X}$	MIN	MIN	MAX	MAX
Number and type of inputs	2 x 0/4..20mA 2 x 20..0/4mA	3 x 0/4..20mA 3 x 20..0/4mA	2 x 0/4..20mA 2 x 20..0/4mA	3 x 0/4..20mA 3 x 20..0/4mA	2 x 0/4..20mA 2 x 20..0/4mA	3 x 0/4..20mA 3 x 20..0/4mA
Input signal						
Number and type of outputs	1 x 0/4..20mA 1 x 20..0/4mA		1 x 0/4..20mA 1 x 20..0/4mA		1 x 0/4..20mA 1 x 20..0/4mA	
Output signal						

Ordering:

SMS-AQA-6-21-XX0-X00-0-XX1: arithmetic mean from 2 input channels
SMS-AQA-6-31-XXX-X00-0-XX1: arithmetic mean from 3 input channels
SMS-AQA-7-21-XX0-X00-0-XX1: MIN value from 2 input channels
SMS-AQA-7-31-XXX-X00-0-XX1: MIN value from 3 input channels
SMS-AQA-8-21-XX0-X00-0-XX1: MAX value from 2 input channels
SMS-AQA-8-31-XXX-X00-0-XX1: MAX value from 3 input channels

options:
00 : no options
08 : operating temperature -20°C ÷ +50°C

X - signal types for individual channels:
1 : 0..20 mA
2 : 4..20 mA
3 : 20..0 mA
4 : 20..4 mA

Processing function: special versions

SMS-AQA-R

Function: psychrometric transducer - relative humidity measurement transducer based on wet- and dry-bulb temperature sensors
2 galvanically isolated 0/4..20 mA inputs
1 galvanically isolated 0/4..20 mA output

SMS-AQA-R is a transmitter equipped with two 4..20 mA current inputs, to which signals corresponding to the following are supplied:
- temperature from the dry-bulb sensor,
- temperature from the wet-bulb sensor.

The device has one 4..20 mA output on which the calculated value of relative humidity is provided.
Built-in mathematical functions enable automatic calculation of humidity based on the temperature difference and psychrometric relationships. The temperature difference between the dry and wet thermometers makes it possible to determine the intensity of evaporation, and thus the amount of water vapor in the air. The transmitter uses known psychrometric relationships to convert this difference into relative humidity.

Psychrometric formula

$$RH = 100 \times \frac{e_w - A \times p \times (T_s - T_m)}{e_s}$$

where:
RH - relaəve humidity [%],
T_s - dry-bulb temperature [°C],
T_m - wet-bulb temperature [°C],
e_s - saturaəon vapor pressure at T_s,
e_w - saturaəon vapor pressure at T_m,
p - atmospheric pressure,
A - psychrometric coe cient (approx. 0,00066 \ K [1])

The transmiğer calculates the values of e_s and e_w using the Tetens equaəon, then determines the relaəve humidity and converts it into a 4..20 mA signal.

Module inputs:
IN1: dry-bulb sensor (4..20 mA from the temperature transmitter)
IN2: wet-bulb sensor (4..20 mA from the temperature transmitter)

Module output:
OUT1: relative humidity (% RH)

SMS-AQA-N

Function: calculation of normal gas flow (Nm³/h)
3 galvanically isolated 0/4..20 mA inputs
1 galvanically isolated 0/4..20 mA output

SMS-AQA-N is a transmitter equipped with a function that enables the calculation of normal gas flow (Nm³/h). The device uses known psychrometric relationships to convert the volumetric gas flow into normal flow, taking into account temperature and, optionally, pressure. This is a commonly used solution in industrial installations where accurate monitoring of gas consumption is essential.

Normal gas flow (Q_N)

$$Q_N = Q \times \left(\frac{P \times 273}{1{,}013 \times T} \right)$$

where:
Q - volumetric flow rate
P - pressure measured in the installaəon
T - temperature measured in K

At the same əme, it is possible to:
- totalize gas consumpəon in Nm³ (totalizer)
- monitor the flow in real əme in Nm³/h and m³/h

Module inputs:
IN1: flow (4..20 mA from the flowmeter)
IN2: pressure (4..20 mA from the pressure transmitter)
IN3: temperature (4..20 mA from the temperature transmitter)

Module output:
OUT1: normal flow rate

SMS-AQA-T

Function: intelligent ballast tank mass calculation module for floating vessels
3 galvanically isolated inputs 0/4..20 mA
3 galvanically isolated outputs 0/4..20 mA

The SMS-AQA-T module is an advanced device for processing 4..20 mA signals, designed for calculating trim on maritime vessels. It combines scaling, filtering, nonlinear conversion, and mathematical functions, enabling precise ballast mass calculations without the need for additional controllers.In ballast systems, the module converts water level and density measurements into the actual ballast mass, taking into account the tank geometry and water temperature. It provides a stable 4..20 mA output signal ready for use in trim and stability systems, improving the accuracy of moment calculations and enhancing the efficiency of ballast management.

The Trim & Stability System plays a critical role on ships, maintaining the vessel's longitudinal stability. It performs the following calculations:
- summing the masses of all ballast tanks,
- calculating longitudinal moments,
- determining the current trim,
- simulations such as "what happens if 50 t is transferred from the bow to the stern?",
- recommendations like "to achieve optimal trim of 0.3 m, add 80 t to tank X."

Without an accurate ballast mass, these calculations would be prone to significant errors.

The SMS-AQA-T module thus becomes a key element in the trim calculation and ballast control chain on board.

With precise ballast mass measurements:
- trim is calculated correctly,
- longitudinal stability is reliable,
- the system can automatically control ballast pumps.

Module inputs:
IN1: level (4..20 mA from level transmitter)
IN2: density (4..20 mA from conductivity/density transmitter)
IN3: temperature (4..20 mA from temperature transmitter)

Module outputs:
OUT1: mass [t]
OUT2: volume [m³]
OUT3: retransmission / level

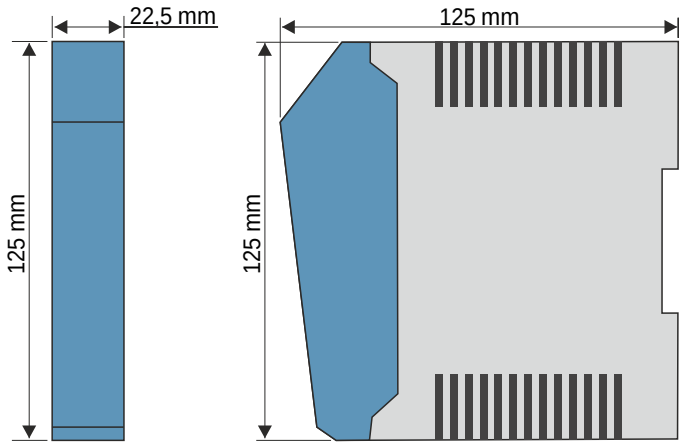
ORDERING

SMS-AQA-R-21-XX0-X00-0-XX1: special function module, relative humidity measurement
SMS-AQA-N-31-XXX-X00-0-XX1: special function module, calculation of normal gas flow
SMS-AQA-T-33-XXX-XXX-0-XX1: special function module, intelligent ballast tank mass calculation

options:
00 : no options
08 : operating temperature -20°C ÷ +50°C

X - signal types for individual channels:
1 : 0..20 mA
2 : 4..20 mA
3 : 20..0 mA
4 : 20..4 mA

DIMENSIONS



Front view

Side view

ELECTRICAL CONNECTION