RHEONIK.

RHE 49

Compact Multifunction Mass Flow Transmitter

Filling and batching /Any high accuracy/Reliable plant flow or density measurement / Mixing and blending of chemicals / PU and Paint

GET FLOW MEASURED

Features

- Extremely compact, always integrated, Fully Digital Coriolis Transmitter
- All-Digital Coriolis Transmitter incl. real time clock with advanced signal processing for ultimate measurement performance
- Connects to any Rheonik Coriolis sensor
- Multifunction performance provides simultaneous mass flow, volumetric flow, density and temperature measurements
- 8 totalizers - 2 non-resettable, 6 for mass/volume (positive, negative, net flow)
- 4-20mA (active or passive), pulse, frequency, status outputs plus digital input
- Wide interface choices from USB over Modbus RTU to Modbus TCP, ProfiNet and EtherNet/IP
- License-free RHECom Software package version for configuration and servicing
- RHEComPro+ Software Suite for extended diagnostics

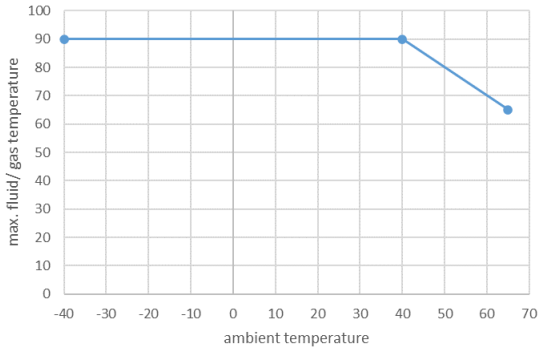
General Specification Overview

Enclosure Material	Coated aluminum or SS 316
Enclosure Rating	Alu IP66 / NEMA 4, optional SS 316 w/ IP66
Ambient Temperature	-20 to +60°C / -4 to +140°F (enhanced –40 to +65°C)
Dimensions	Up to 150 x 100 x 61 mm / 5.91 x 3.94 x 2.40 in – for details see page 13
Display	Optional high contrast backlit LCD color display available
User Interface and Configuration	Plug and play set-up by factory. Change configuration by RHECom software package or display (if ordered)
Cable Entries	M20 x 1.5 cable gland (Alu), M16 x 1.5 cable gland (SS 316) standard
Computer Connection	Via Modbus RTU, TCP, ProfiNet, EtherNet/IP or USB to PC
Electrical Connection	Via M12 male connector instead of cable gland
Totalizers	6 x resettable forward, reverse and net totalizers for mass and volume, 2 x non-resettable totalizers for mass and volume
Analog Outputs	One 4-20mA output, active or passive, as an option All analog outputs acc. to NAMUR NE43
Pulse/Freq/Status Outputs	2 pulse/frequency or status outputs (IEC60946) w/ max. 10 kHz
Digital Inputs	1 configurable control input (IEC60946).
Digital Data Communications	Modbus RTU, Ethernet (Modbus TCP/IPv4), ProfiNet, EtherNet/IP, HART
Power Supply	12-24 VDC +/- 10%, 2W typical, 4W maximum
Hazardous Area Approvals	Zone 2 or Class 1 Div 2 – for details see page 16

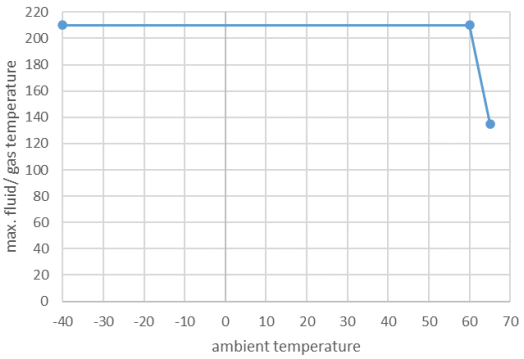
Temperature Specification

Only available for temperature ranges N1, NA, E2

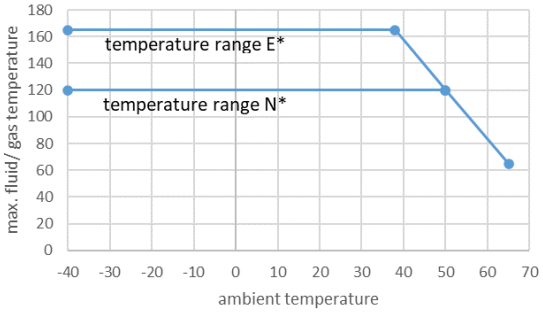
Operating temperature range for close coupled RHE49



Operating temperature range for set-off RHE49



Operating temperature range for top mount RHE49



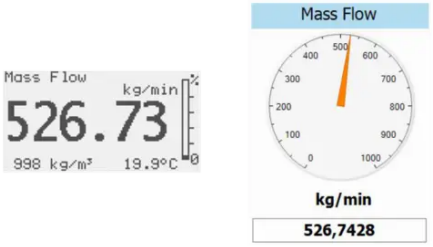
Software Function Packages and Features

Standard Operation Package (Part Number Code SO)

The RHE49 Standard Operation Package provides the following measurement and function features:

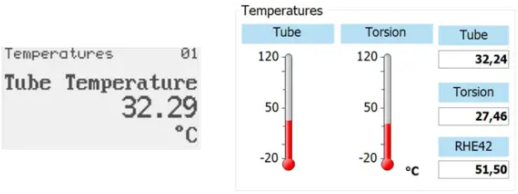
Direct Mass Flow Measurement

Mass flow is calculated using the Coriolis principle to provide a high accuracy Mass Flow measurement of the fluid flowing through an Omega Tube Coriolis Meter.



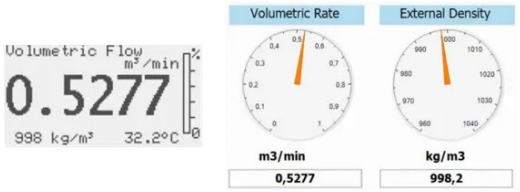
Temperature Measurement

Each Omega Tube Coriolis Sensor provides a temperature measurement from built in sensors.



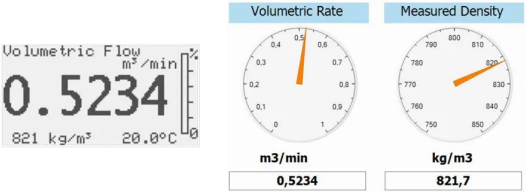
Fixed and Calculated Density Function

The Fixed Density function allows to enter a fixed density value for volumetric flow calculations.
The Calculated Density function allows density to be generated based upon process temperature. A base/reference density at a known temperature is entered for the fluid being measured along with a coefficient describing the change in density per temperature unit. The firmware in the transmitter calculates flowing density based upon this information to use for volumetric flow calculations.



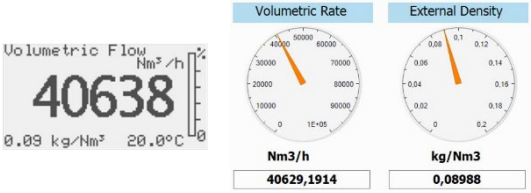
Calculated Actual Volume Measurement for Liquids and Gas

Volume measurement is calculated by dividing direct mass flow measurement by the Fixed Density.



Standardized/Normalized Volume Measurement for Gas

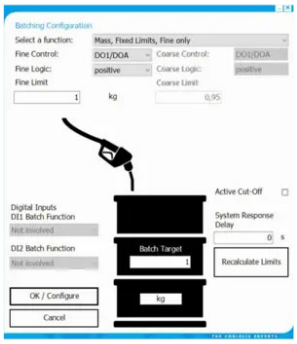
This function calculates the volume of gas passing through the meter at standard conditions. The density of the gas at standard conditions is entered into the transmitter and the volume is calculated using this in conjunction with the flowing mass.



Standard Package (Part Number Code SO) continue

Password Protection
All setup and calibration parameters within the meter are protected with passwords to prevent unintentional or unauthorized change once installed.

Batch Controller
The transmitter is equipped with an onboard batch controller that, in conjunction with external pumps and/or valves allows the precise delivery of a preset mass or volume of process fluid on demand. Operated from the instrument front panel, remotely via operator switches or through digital communication from a connected supervisory control system, the controller is configured to utilize either a one stage or a two stage delivery strategy in ensuring the right amount of fluid is batched through the meter. The electronics self-learns, adjusting shut off times as more and more batches are delivered to further refine the amount of delivery, saving material costs and improving quality.

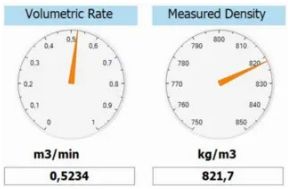


Assurance View® Diagnostics
Inbuilt self-monitoring functions are available that can be used to determine the reliability of the flow meter readings at all times. Diagnostics are quickly accessed through dedicated menu displays, RHECom software and the MODBUS interface.

ASSURANCE View®

Density Operation Package (Part Number Code DO)
The RHE49 Density Operation Package includes all features from the Standard Operation Package plus the following measurement and function features:

Direct Density and Volume Measurement
The flowing density of the fluid in an Omega Tube Coriolis Sensor is determined from the measured resonant frequency of the sensor and used to calculate instantaneous volumetric flowrate.



Density Package (Part Number Code DO) continue

Brix/Baume Units

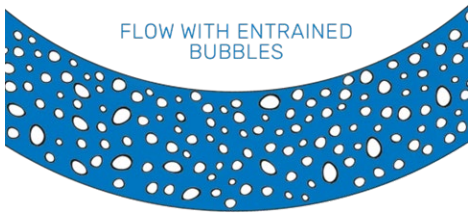
The unit can be configured to read out in °Brix or Baume. °Brix or Baume are used extensively in the sugar and beverage industries.

°Brix

°Bé

Partially Filled Pipe Management – Lite Version

Often referred to as multiphase flow, the flow regime in a partially filled pipe can cause large measurement errors and even create a measurement fault condition in a Coriolis flow meter. When PFPM is activated, density measurement is continuously compared to preset limits to determine if the sensor is seeing a liquid/gas mixture running through it. When multiphase flow is detected, it can be signaled, e.g. by a DO, to alert users and allow action to be taken to minimize error. The full version of PFPM is available with the Assurance Diagnostics Package – see the next section for details.



Assurance Factor Package with Assurance Diagnostics Suite (Part Number Code AF)

The RHE49 Assurance Factor Package includes all features from the Density Operation Package plus the following advanced diagnostic functions:

Assurance Factor®

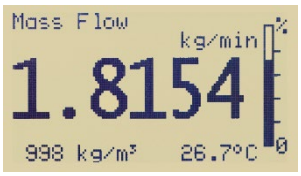
Assurance Factor® is a numeric value generated by an internal algorithm that indicates the overall health of the flow meter and measurement. Assurance Factor® value can be used to trigger changes in screen color when the optional display is fitted to the RHE49 (White – Amber – Blue – Red), providing highly visible wide area condition indication.

ASSURANCE
Factor®

WHITE

Normal Operation

No faults present. All parameters within expected limits. Meter fully operational



AMBER

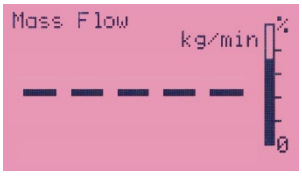
Operation Not Optimal

Sensor subject to noise / changing conditions in pipe. Measurement quality may be compromised

BLUE

Operation at Limit

Sensor experiencing disturbance. Measurement quality compromised



RED

Measurement Failure

Sensor experiencing extreme disturbance / meter in fault. Measurement offline

Assurance Factor Package (Part Number Code AF) continue

Zero Point Setting History/Statistics

All RHE49 transmitters with the AF advanced diagnostics package log the last 10 zero points for inspection and troubleshooting. Zero point setting is very dependent upon installation conditions and is therefore specific to each sensor in the field. Comparing zero point history can help identify installation and operation issues that could effect accuracy and performance of the flow meter.

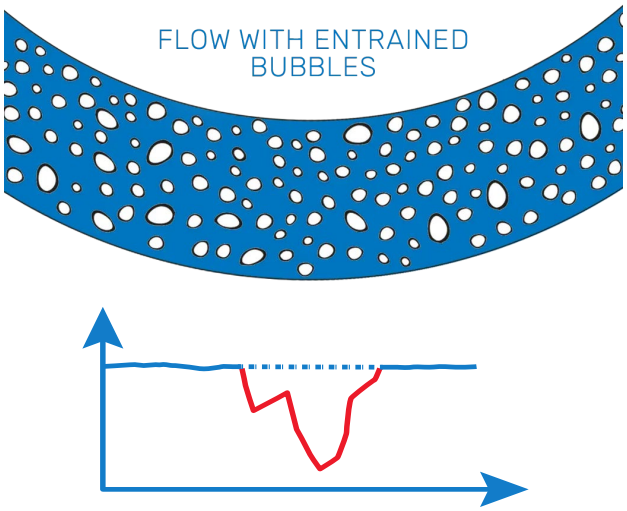
```
**** Zero Point 3 ***
Date:2022-03-18 11:27
Run Time:          646
Zero Point:      -0.03
Tube Temp.:      20.00
Torsion Temp.:   20.00
Var. Phase:   0.573977
Var. Period:   1.37525
```

History of Zero Points stored in the RHE

Time	Run Time	¿Zero Point [ΔTicks=8ns]	Zero Point [kg/min]	Tube Temp. °C	Torsion Temp. °C	RHM Freq. (Hz)	Drive (m
2022-03-18 11:27:04	640	-0,04186	-0,01582283	20,02	19,98	89,54103	851,9
2022-03-18 11:27:11	646	-0,02913	-0,01101117	20,00	20,00	89,54103	858,7
2022-03-18 11:27:18	654	-0,02209	-0,008349222	19,93	20,07	89,54104	846,3
2022-03-18 11:27:25	661	-0,01942	-0,007339118	20,04	19,96	89,54103	840,4

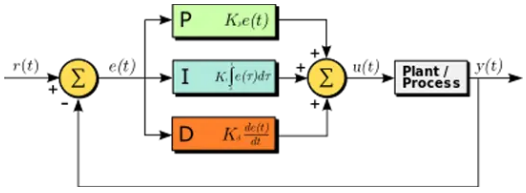
Partially Filled Pipe Management – Full Version (PFPM)

In this full version of the PFPM function, two different monitoring methods are used, either separately or in conjunction with each other, to detect when mixed phase fluid is flowing through the Coriolis flow sensor. When the PFPM function is in operation, density measurement and/or sensor pickup voltage levels are closely monitored to determine if the sensor is seeing a liquid/gas mixture running through it. Upon detection, actions can be taken to minimize measurement inaccuracy and process disruption. The program feature also allows “bridging” an interrupted measurement (e.g. heavy gas bubbles) for up to 60 s with the last valid measurement values.



PID Controller

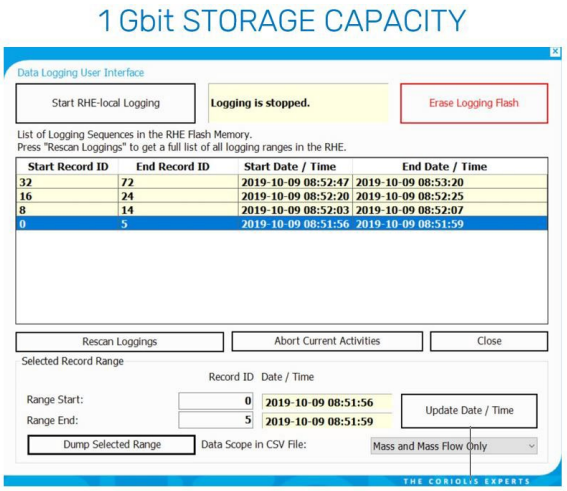
A PID controller is implemented in the transmitter to provide direct control to a valve or pump via a 4-20mA output for flow control purposes. The PID controller function features fully tunable PID parameters for either mass or volumetric flow rate. Set-point can be established via the front keypad/display or remotely via digital communication.



Assurance Factor Package (Part Number Code AF) continue

Data Recording

The fluid transfer package contains fully featured onboard data recording with a capacity of 1 Gbit to record over 500,000 time stamped records. Records include all measured variables and totalizers along with diagnostic data. Recording interval can be set from 1 to 600 seconds and recording started and stopped through the display user menu or via Modbus. Data is downloaded by request through Modbus. The RHECom software package provides a simple interface to configure the data recorder and download recorded data.

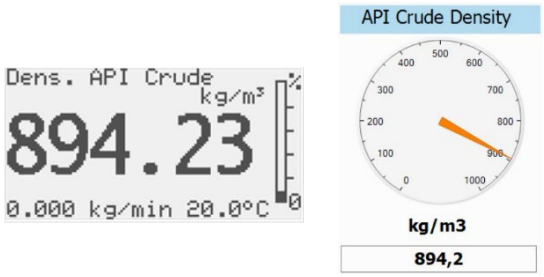


Oil and Gas Function Package (Part Number Code OG)

The Oil and Gas Function Package includes all features from the Assurance Factor Package plus the following advanced measurement applications:

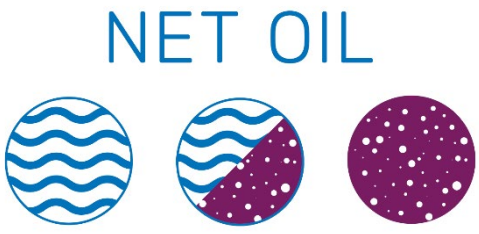
API Standard Density/Volume

When configured for this application, the transmitter will calculate density at standard conditions to API MPMS Chapter 11. All three product groups – crude oil, refined products and lubricants can be metered using this built-in application. Precise calculation requires temperature and pressure input. Both inputs can be supplied through manual user menu entries or through Modbus updates to the transmitter or the internal tube temperature of the sensor. Volume flow and totalization at standard conditions are generated using the calculated standard density value.



Net Oil Calculation

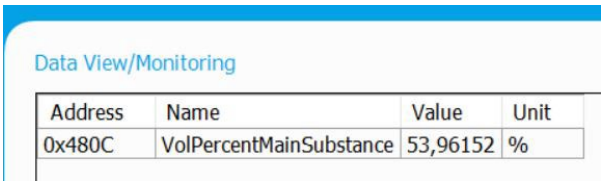
Crude Oil is often mixture of oil and water and it is desirable to known the actual oil content. With this function, it is possible to calculate the net oil amount in a flowing stream using a live density measurement. The standard density (at standard temperature and pressure) of both the crude oil and the water/other portions of the stream must be provided as inputs for the calculation. These can be entered manually through the transmitter's user menu or digitally via Modbus.



Oil and Gas Function Package (Part Number Code OG) continue

Percent Concentration Calculation

Percent concentration of a fluid in a mixture of two fluids (i.e. alcohol in water) or solids in liquid can be determined using the percent concentration function. With this function, the density of both components in the stream must be provided as inputs for the calculation. These values are entered manually through the transmitter's user menu or digitally via Modbus and should be updated as temperature conditions change to obtain the best performance.



Custody Transfer Package (Part Number Code CT)

The Custody Transfer Package includes everything from the Oil and Gas Function Package plus the following features:

Precision Flow Analysis (PFA)

For fast fill applications down to 0.5s duration measurements, transmitter update time can be increased to 4ms. This allows a 250Hz totalizer update rate (50Hz is standard) to maintain very fast tracking of actual volume/mass delivered, and e.g. through the internal batch control function, results in a maximum signal delay of 10-20ms to a connected control valve once the batch set-point is reached. Depending upon the speed of operation of the fill valve, repeatable accuracies of better 1% are achievable for filling operations of 500ms duration and less.

Hardware Lock Switch

For applications such as custody transfer where sealing is required. This switch, when engaged, prevents change of any setting within the transmitter through both the user panel interface and through a digital communications port. To accommodate some special customer needs the Lock Switch configured to leave a totalizer reset and/or a zero calibration possible.
Once the Lock Switch is set, a tamperproof seal can be applied to the transmitter case to indicate if the transmitter has not been opened since sealing.

Fast Response Package (Part Number Code FR)

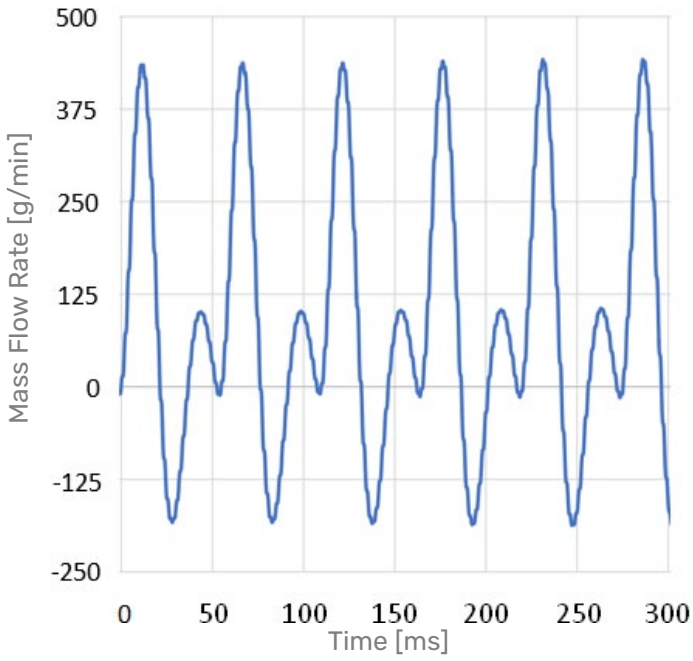
For applications requiring an extremely fast response to flow e.g. extremely fast filling applications of less than 500 ms, the transmitter offers a unique Fast Response Package.

Fast Response Package

For extremely fast fill applications down to 5-10 ms measurements, a patented fast response filter technology is employed within the transmitter to speed up measurement update time to better 1 ms. With an additional internal fast sampling mode this allows a 4kHz measurement update rate to maintain very fast tracking of actual volume/mass delivered, and e.g. through the internal batch control function, results in a maximum signal delay of 1ms to a connected control valve once the batch set-point is reached. Depending upon the speed of operation of the fill valve, repeatable accuracies of 0.5% are achievable for filling operations of 500ms and less.

The fast fill function has a variety of tuning parameters and their setting will largely depend on the operating conditions (temperature, pressure, density, target delivery, etc.) of the filling system. For users of the Fast Response Package, Rheonik will provide assistance with initial configuration and tuning of the transmitter. The tuning parameters can be further optimized on site using the Precision Flow Analysis Tool.

Mass Flow Measurement of 10 ms Injections



The unique Precision Flow Analysis (PFA) tool allows data sampling of up to 4 kHz (requires a Modbus TCP/IPv4 connection) and subsequent analysis. By transferring the data into a calculation spread sheet the fluid dynamics can be graphically reviewed – a powerful help to optimize a sophisticated fluid handling system e.g. such as a satellite engine.

The Fast Response Package includes all functions and features of the Fluid Transfer Package.

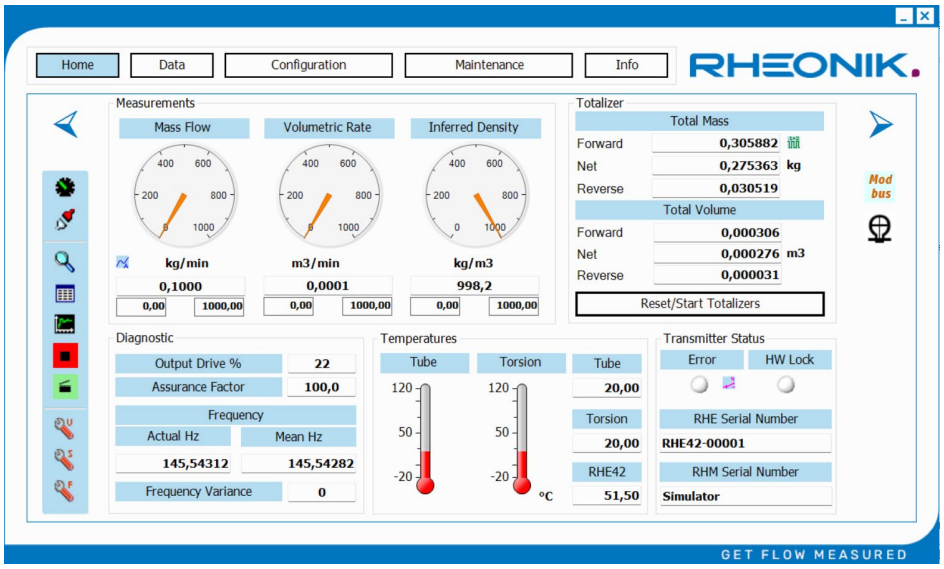
Program Package Function Summary

	Program Package Code					
Feature	**SO**	**DO**	**AF**	**OG**	**CT**	**FR**
Live Mass Flow Measurement	X	X	X	X	X	X
Live Temperature Measurement	X	X	X	X	X	X
Inferred Density by Reference Density and Temp.	X	X	X	X	X	X
Fixed or Norm Density Value (e.g. kg/Nm³)	X	X	X	X	X	X
Volumetric Flow from Inferred/ Fixed/Norm Density	X	X	X	X	X	X
Standardized Gas Volume Calculation	X	X	X	X	X	X
Resettable Mass / Volume Totalizers	X	X	X	X	X	X
Non-Resettable Mass / Volume Totalizers	X	X	X	X	X	X
Single and Two Stage Batch Control	X	X	X	X	X	X
Self Learning Batch Control	X	X	X	X	X	X
Assurance View® Diagnostics	X	X	X	X	X	X
Setup/Configuration Password Protection	X	X	X	X	X	X
Live Density Measurement		X	X	X	X	X
Volume using Mass and Measured Density		X	X	X	X	X
Brix / Baume Units		X	X	X	X	X
Assurance Factor® Calculation and Diagnostics			X	X	X	X
Zero Point Monitoring and History			X	X	X	X
Onboard Data Recording			X	X	X	X
PID Controller for Analog Output (e.g. Pump, Valve)			X	X	X	X
Partly Filled Pipe Management			X	X	X	X
API Standard Density/Volume				X	X	X
Net Oil Calculation				X	X	X
Concentration/Percent Substance Calculation				X	X	X
Precision Flow Analysis / up to 250 Hz Update Rate					X	X
Hardware Lock Switch					X	X
Super Fast Response / Filling Firmware Set						X
Precision Flow Analysis / 4 kHz Update Rate						X

RHECom Software

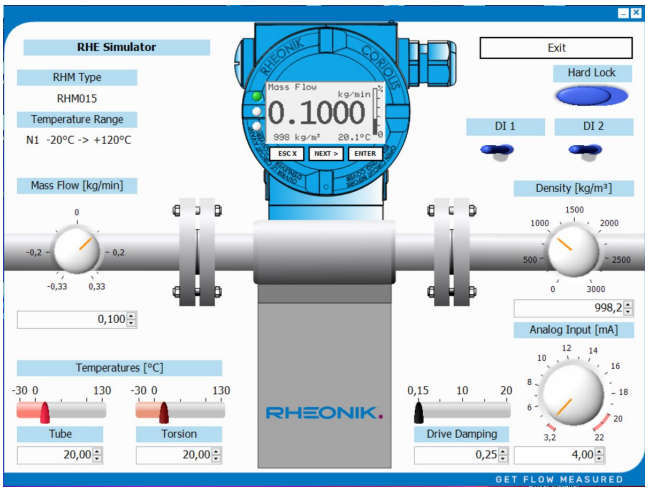
The RHE49 transmitter is a fully featured device with many sophisticated functions and configuration is necessary for proper performance of these functions. RHECom software is available in three versions – Free, Pro and Pro+.

RHEComFree is available for download at no extra cost or on USB flash drive. RHEComFree allows full setup of transmitter parameters and includes a useful datalogging function for monitoring performance of the meter.



For a small one-time license fee, RHEComPro and RHEComPro+ offer additional insight and setup convenience menus. RHEComPro includes data logging, trending and broad diagnostic capabilities.

RHEComPro+ takes flow meter management one step further with a **revolutionary fully functioning simulator application**. With the simulator, you can trial run your application from the convenience of your office, adjusting transmitter settings, setting alarms and filters, and creating transmitter configuration files for upload into the actual unit. The simulator is also ideal for training - it exactly mimics the front panel of the instrument display and buttons when clicked and includes controls for adjusting flow, density and temperature readings just like the unit was in line!

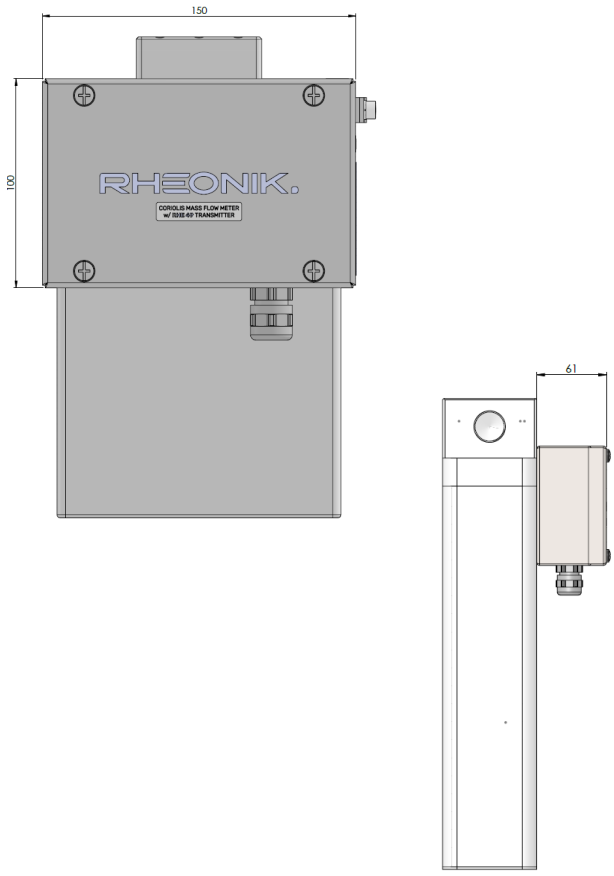


RHECom software is designed to ensure simple and expedient setup of Rheonik transmitter features and functions – a real time saver and a valuable tool.

Mechanical Construction

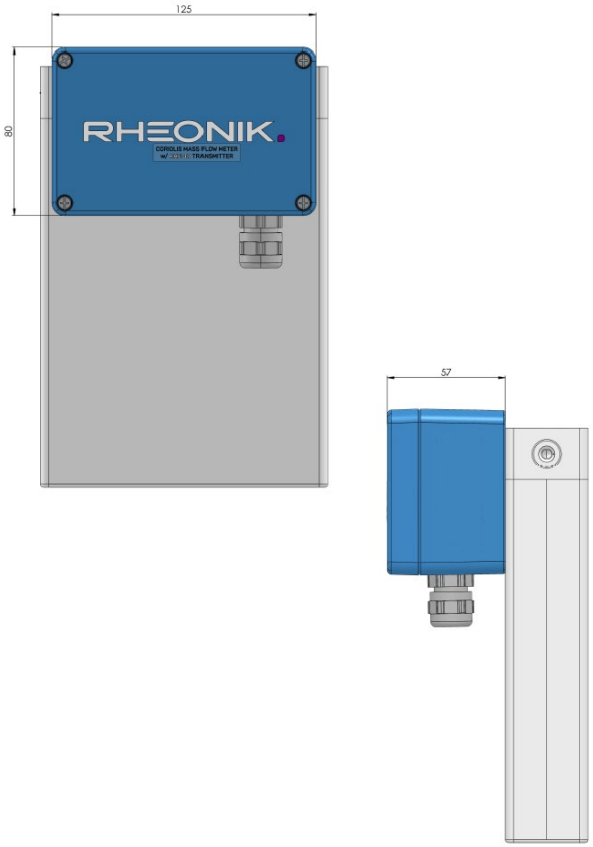
RHE49 SS316 enclosure size

150 x 100 x 61 mm (5.91 x 3.94 x 2.40 in)



RHE49 Alu enclosure size

125 x 80 x 57 mm (4.92 x 3.15 x 2.24 in)



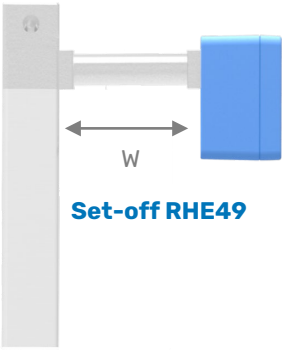
Mounting

For RHM015S to RHM20S sensors, RHE49 transmitters are mounted either close coupled to or set-off from the sensor body depending upon temperature range selected.

For RHM30S to RHM160 sensors, RHE49 is always installed set-off from the sensor body.

Close Coupled RHE49

	W mm	W in
RHM015S to RHM04S Temperature Range N1, NA	2	0.08
RHM015S to RHM04S all other Temperature Ranges	100	3.94
RHM06S to RHM20S Temperature Range N1, NA	2	0.08
RHM06S to RHM20S all other Temperature Ranges	100	3.94
RHM30S to RHM160 all Temperature Ranges	100	3.94



Set-off RHE49

RHE 49 Part Number Code

Construction Type

C1 Compact mount at sensor IP66, with M20*1.5 cable gland - requires J9 option at RHM

CD Compact mount at sensor IP66, with display, M20*1.5 cable gland - requires J9 option at RHM

S1 Compact mount at sensor IP66, SS316 enclosure with M16*1.5 cable gland - requires S9 option at RHM

Supply Voltage

D1 12 to 24 VDC (+/- 10%)

Software Function Package

SO Standard OP system - mass flow, normalized density / volume, Assurance View® Diagnostics

DO Enhanced OP system - SO plus measured density / volume

AF Enhanced OP System plus Assurance Factor®, ZP History, Data Recording, PID Controller, PFPM

OG Enhanced OP System plus AF, API Standard Density/Volume, Net Oil Calculation, Concentration

CT Enhanced OP System plus OG, Precision Flow Analysis, Hardware Lock Switch

FR Enhanced OP System plus CT, Super Fast Response Firmware with 4 kHz Update Rate

I/O Configuration

B1 RS485 (Modbus), 2 x DO (pulse/freq./status), 1 x DI

EB Modbus TCP, 2 x DO (pulse/freq./status), 1 x DI, RS485 (Modbus)

EP ProfiNet RT/Class B, 2 x DO (Pulse/Freq/Status), 1 x DI, RS485 (Modbus)

EN EtherNet/IP, 2 x DO (pulse/freq./status), 1 x DI, RS485 (Modbus)

S1 1*4/20mA (a/p) acc. NAMUR NE43, 2*DO (pulse/freq./status), 1*DI, RS485 (Modbus)

1H 1*4/20mA (a/p) acc. NAMUR NE43, 2*DO (pulse/freq./status), 1*DI, RS485 (Modbus), HART

Hazardous Area Certifications (details see page 16)

NN Without - RHM and RHE in ordinary locations

A2 ATEX/IECEx Ex II 3(1)G Ex db ec [ia Ga] IIC T4 Gc

C2 cCSAus Class I, Div. 2/Ex db ec [ia Ga] IIC T4 Gc

Performance Certification

NN Without

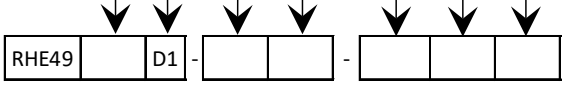
Options for RHE49

NNN None / All standard

N67 Enhanced enclosure dual rating IP66/67 NEMA 4X/6, ambient -40°C to +65°C

BMN Base Configuration with M12 connector (5-pin) - 1*DO, 1*RS485

AMN Analog Configuration with M12 connector (5-pin) - 1* 4-20 mA (a), HART, 1*RS485



Configuration Service

Order Code ORHE-	
SI	Pre-setting of pulse, analog outputs according to setting instructions / purchase order

Accessories

Order Code ARHE-	
RS	5m PC cable (Mini USB to PC USB) - to connect PC / RHECom PC software for RHE2x/4x
MO	Modbus RS485 terminals to PC USB Converter for RHE2X/4X
PR	PC Software RHEComPRO two years license key (upgrades for two years are included)
PP	PC Software RHEComPRO+ license key (upgrade for two years are included)

Order Code ARHE49-	
CA	M12 plug (5-pin) with 3m Cable
CE	M12 plug (5-pin) with 5m Cable, Ex certified for use in Zone 2

Cable Entry Configuration

Order Code ORHE49-	
E1	Optional M20 x 1.5 cable entry instead of M12 glands
E2	Optional ½" NPT cable entry instead of M12 glands
E6	Optional ½" NPT cable entry in SS316 instead of M12 glands

Stainless Steel Plates

Order Code ORHE-	
TP	Plate with TAG number in Stainless Steel (other labelling standard)
TC	Complete labelling (type information, TAG, Ex label) in Stainless Steel

Hazardous Area Certifications

Order Code	Zone / Division	Approval	Labeling
A2	Zone 2	ATEX IECEx	Ex II 3G Ex ec IIC T4 Gc Ex ec IIC T4 Gc
C2	Div 2, Zone 2	USA Canada	Class I, Div 2, Groups A, B, C and D, T4 Class I, Zone 2, AEx ec IIC T4 Gc Ex ec IIC T4 Gc

About Rheonik

Rheonik has but one single purpose: to design and manufacture the very best Coriolis meters available.

Our research and engineering resources are dedicated to finding new and better ways to provide cost effective accurate mass flow solutions that provide value to our customers. Our manufacturing group care for each and every meter we produce from raw materials all the way to shipping, and our service and support group are available to help you specify, integrate, start-up and maintain every Rheonik meter you have in service. Whether you own just one meter or have hundreds, you will never be just another customer to us. You are our valued business partner.

Need a specific configuration for your plant? Don't compromise with a "standard" product from elsewhere that will add extra cost to your installation. If we can't configure it from our extensive and versatile product range, our exclusive **AnyPipeFit Commitment** can have your flow sensor customized with any size/type of process connection and face to face dimension you need.

No matter what control system you use as the backbone in your enterprise, with our **AnyInterface Commitment**, you can be sure that connection and communication will not be a problem. Alongside a wide variety of discrete analog and digital signal connections, we can also provide just about any network/bus interface available (for example: HART, ProfibusDP, ProfiNet, EtherCAT, PowerLink, EtherNet/IP, CAN, ….) with our RHE 40 Series family of transmitters. Rheonik RHE 40 Series transmitters can connect to your system – no headache and no conversion needed.

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