

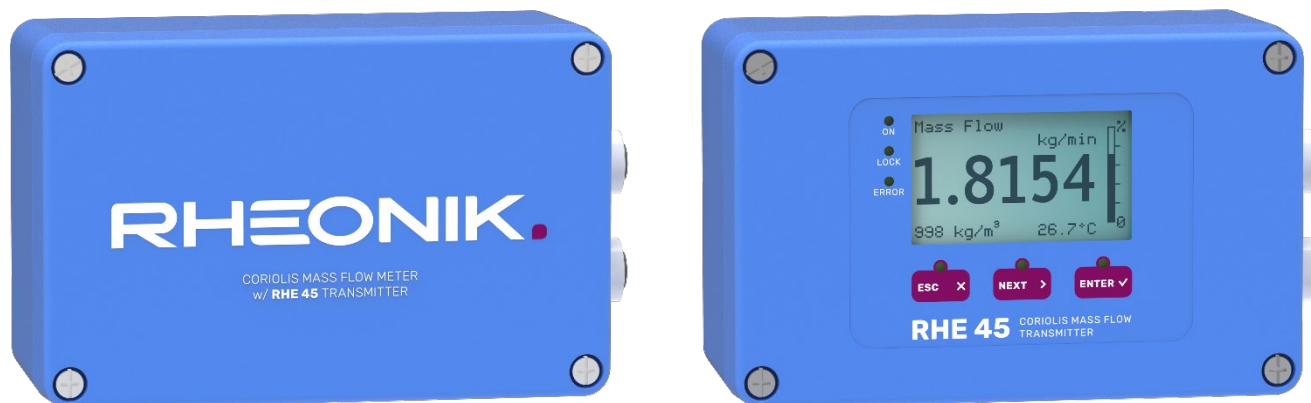


RHE 45

Compact Mount Digital High Performance Mass Flow Transmitter

High pressure, low flow chemical injection measurements – sensors up to 1400 bar (20000 psi) available / Filling and batching / Robot mounted flow measurement / Mixing and blending of chemicals / PU and Paint / Compact flow measurement for OEM's and skid manufacturers





Features

- Extremely compact Fully Digital Coriolis Transmitter
- Excellent signal to noise ratio for ultimate performance
- Selectable outputs for mass flow, volumetric flow, density and temperature
Positive, negative and net totalizers for both volumetric and mass flow
- Discrete I/O includes 4-20mA, pulse, frequency, status plus analog and digital inputs for remote control and measurement packages
- The Rheonik **AnyInterface Commitment** – a wide variety of communication options for seamless connection to your control or SCADA system. Options include Ethernet, Modbus, ProfiNet, EtherCat, PowerLink, Profibus and others!
- Fast and easy electrical installation with plug in connectors
- Optional color backlit display including 3 button keypad for local configuration and operation through an intuitive user menu

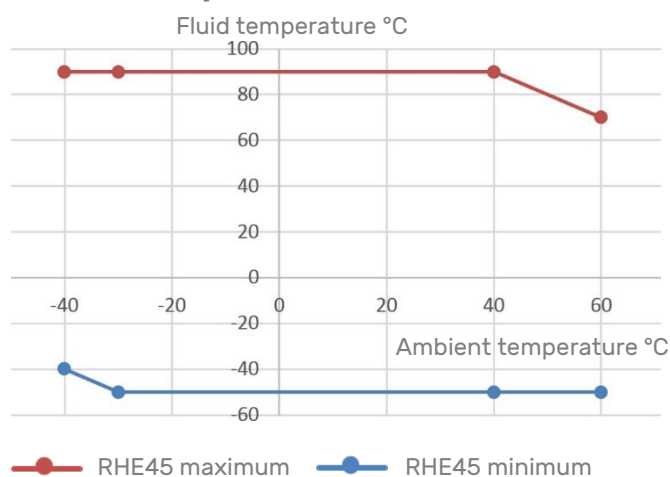
General Specification Overview

Enclosure Material	Coated aluminum enclosure
Enclosure Rating	IP66 / NEMA 4
Ambient Temperature	-40 to +60°C (-40 to +140°F) Reduced display visibility at temperatures below -10°C (14°F)
Dimensions	Aluminum enclosure: 125 x 80 x 57 mm / 4.92 x 3.15 x 2.24 in
Display	Optional high contrast backlit LCD color display available
Operation	Via RHECom configuration software 3 x front panel operator buttons with optional LCD display
Electrical Connection	Via 12 pin and 8 pin A-coded plug in connectors USB for PC connection
Totalizers	Forward, reverse and net flow totalizers for both mass and volume
Analog Outputs	Up to 2 x 4-20 mA (active/passive) for flow, density or temperature All analog outputs acc. to NAMUR NE43
Pulse/Freq/Status Outputs	Up to 2 x configurable pulse/frequency/status outputs (IEC60946). Max. frequency 10kHz
Digital Inputs	Up to 2 x configurable control inputs (to IEC60946)
Digital Data Communications	Modbus RTU/TCP, Ethernet IP, Profinet, EtherCAT, PowerLink, Profibus DP, DeviceNet, CANopen. Others on request
Power Supply	12-24 VDC +/- 10%, 4W
Hazardous Area Approvals	N/A

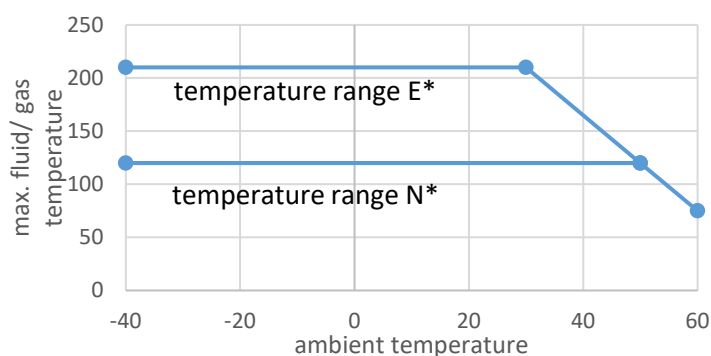
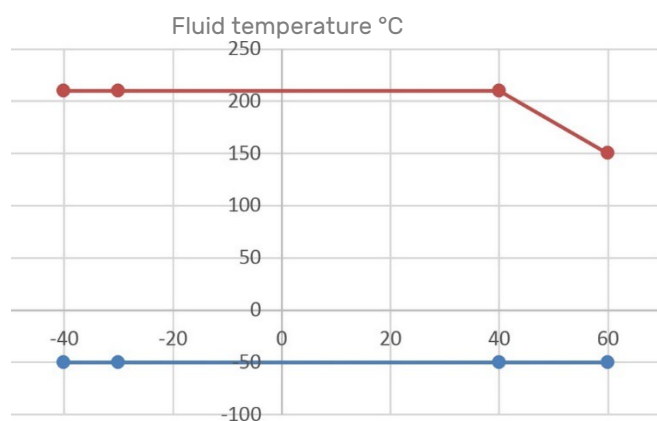
Temperature Specification

Only available for RHM Coriolis flow sensor temperature ranges N1, NA, E2

Operating temperature range for close coupled RHE45



Operating temperature range for set-off RHE45



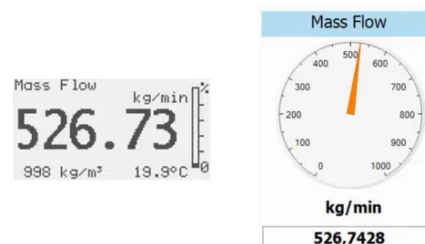
Software Function Packages and Features

Standard Operation Package (Part Number Code S0)

The RHE45 Standard Operation package provides the following measurement and function features:

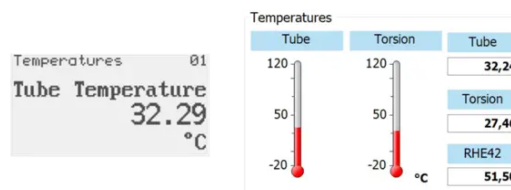
Direct Mass Flow Measurement

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 Sensor.



Temperature Measurement

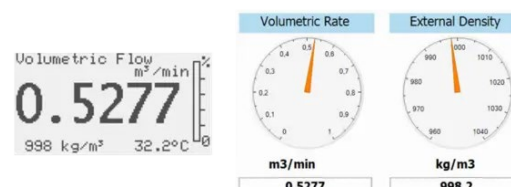
Each Omega Tube Coriolis Sensor provides a temperature measurement from built in sensors.



Fixed and Calculated Density Function

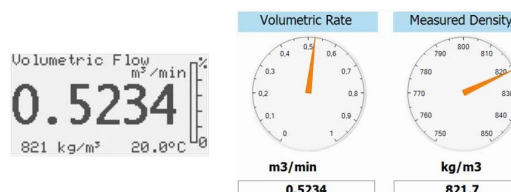
The Fixed Density function allows to enter a fixed density value for volumetric flow calculations.

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.



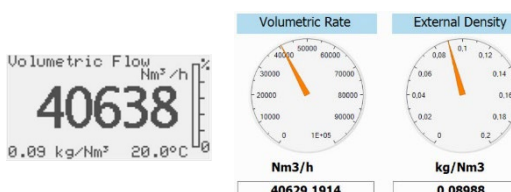
Calculated Actual Volume Measurement for Liquids and Gas

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 S0) continue

Password Protection

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

RHEONIK RHE42
User Login
PWD: 0000
User Passcode?

Role Selector

Select role and enter corresponding password:

☐ None / Readonly

* User

☐ Service

Password: ****

☐ Also use setting for next program start

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.

Batch Running
Target 15.00000 kg
Actual Total 13.78534 kg
Wait Cancel Pause

Batching Configuration

Select a function: Mass, Fixed Limits, Time only

Flow Control: DO/DOA Coarse Control: DO/DOA

Flow Logic: positive Coarse Logic: positive

Flow Limit: 1 kg Coarse Limit: 0.95

Digital Inputs

DI1 Batch Function: Stop function

DI2 Batch Function: Stop function

OK / Configure Cancel

Active Cut-Off ☐

System Response Delay: 0 s

Recalculate Limits

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

Pickup1 (mU): 81
Pickup2 (mU): 99.8
Drive Volt (mU): 1106
Sens-Drv (mU): 28.1
Drive Gain (%): 21
Drive Stab.: 100.0

Assurance View

Freq. (Hz): 83.541
Pres.Stab. (%): 100.00
Elect. Imp. (°C): 51.5
Zero Pt. (Gss): 0.0
Lost Zero (Sns): 0.0
Phase Variance: 0.6
Period Unit: 1.4



ASSURANCE
View®

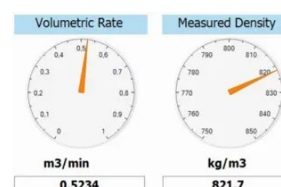
Density Operation Package (Part Number Code D0)

The RHE45 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.

Volumetric Flow
0.5234
821 kg/m³ 20.0°C



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

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

The RHE45 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 RHE45 (White – Amber – Blue – Red), providing highly visible wide area condition indication.



Mass Flow kg/min 1.8154 998 kg/m³ 26.7°C	Mass Flow kg/min 1.8154 998 kg/m³ 26.7°C	Mass Flow kg/min 1.8154 998 kg/m³ 26.7°C	Mass Flow kg/min ----- 0
WHITE	AMBER	BLUE	RED
Normal Operation	Operation Not Optimal	Operation at Limit	Measurement Failure
No faults present. All parameters within expected limits. Meter fully operational	Sensor subject to noise / changing conditions in pipe. Measurement quality may be compromised	Sensor experiencing disturbance. Measurement quality compromised	Sensor experiencing extreme disturbance / meter in fault. Measurement offline

Assurance Factor Package (Part Number Code AF) continue

Zero Point Setting History/Statistics

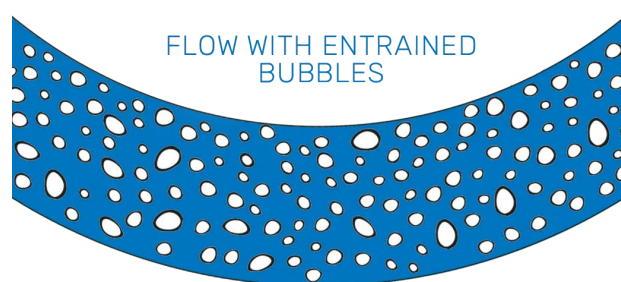
All RHE45 transmitters with the AF advanced diagnostics package log the last 10 zero points for inspection and troubleshooting. Zero point setting is very dependent upon installation conditions and is therefore specific to each sensor in the field. Comparing zero point history can help identify installation 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
```

Time	Run Time	i Zero Point [Ticks=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

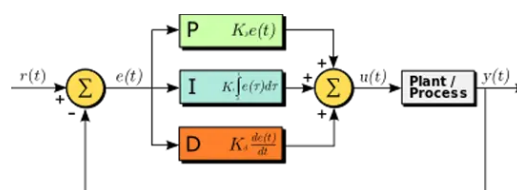
Partially Filled Pipe Management – Full Version (PFPM)

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.

1 Gbit STORAGE CAPACITY

Data Logging User Interface

Start RHE-local Logging **Logging is stopped.** Erase Logging Flash

List of Logging Sequences in the RHE Flash Memory.
Press "Rescan Loggings" to get a full list of all logging ranges in the RHE.

Start Record ID	End Record ID	Start Date / Time	End Date / Time
32	72	2019-10-09 08:52:47	2019-10-09 08:53:20
16	24	2019-10-09 08:52:20	2019-10-09 08:52:25
8	14	2019-10-09 08:52:03	2019-10-09 08:52:07
0	5	2019-10-09 08:51:56	2019-10-09 08:51:59

Rescan Loggings Abort Current Activities Close

Selected Record Range

Record ID Date / Time

Range Start: 0 2019-10-09 08:51:56 Update Date / Time

Range End: 5 2019-10-09 08:51:59

Dump Selected Range Data Scope in CSV File: Mass and Mass Flow Only

THE CORIOLIS EXPERTS

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.

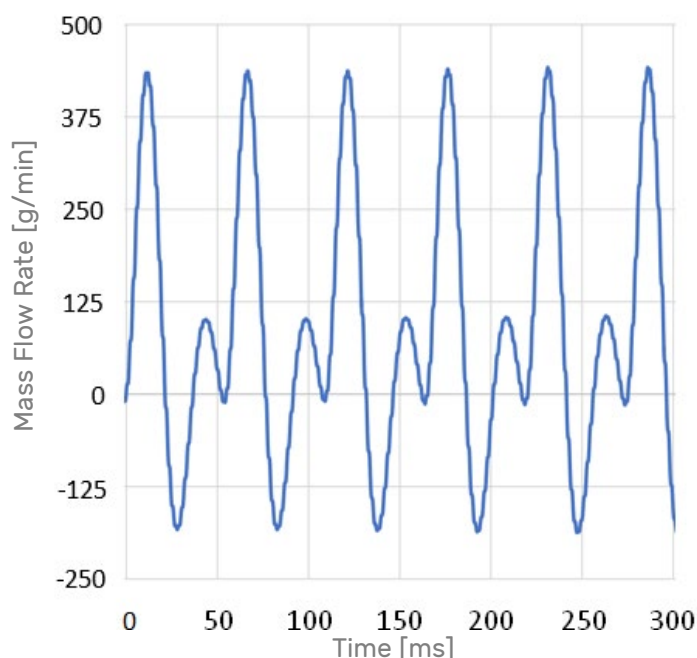
The fast fill function has a variety of tuning parameters and their setting will largely depend on the operating conditions (temperature, pressure, density, target delivery, etc.) of the filling system. For users of the Fast Response Package, Rheonik will provide assistance with initial configuration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

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.



**Mass Flow Measurement
of 10 ms Injections**



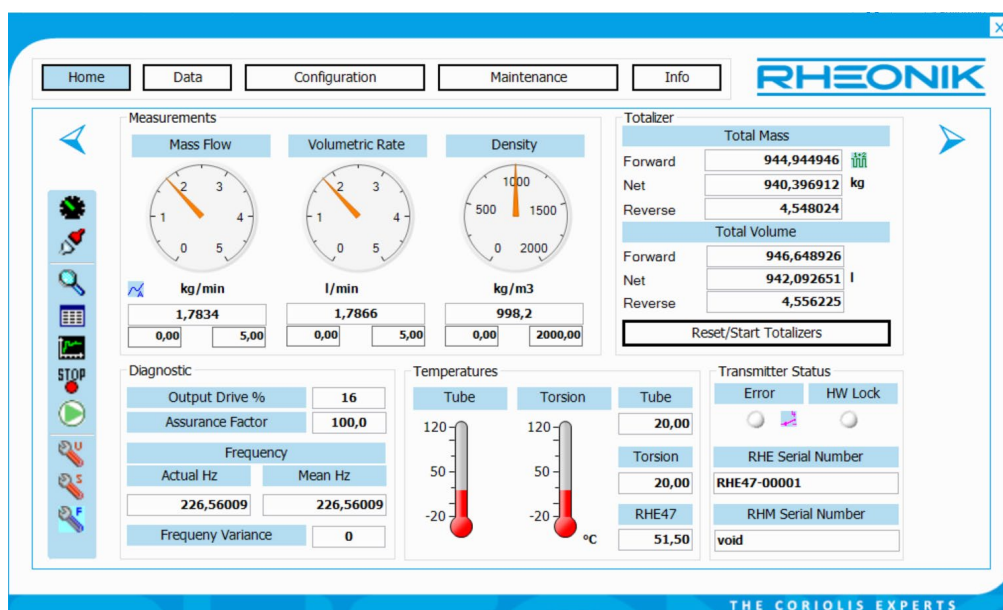
Program Package Function Summary

Feature	Program Package Code			
	SO	DO	AF	FR
Live Mass Flow Measurement	X	X	X	X
Live Temperature Measurement	X	X	X	X
Inferred Density by Reference Density and Temp.	X	X	X	X
Fixed or Norm Density Value (e.g. kg/Nm ³)	X	X	X	X
Volumetric Flow from Inferred/ Fixed/Norm Density	X	X	X	X
Standardized Gas Volume Calculation	X	X	X	X
Resettable Mass / Volume Totalizers	X	X	X	X
Non-Resettable Mass / Volume Totalizers	X	X	X	X
Single and Two Stage Batch Control	X	X	X	X
Self Learning Batch Control	X	X	X	X
Assurance View® Diagnostics	X	X	X	X
Setup/Configuration Password Protection	X	X	X	X
Live Density Measurement		X	X	X
Volume using Mass and Measured Density		X	X	X
Brix / Baume Units		X	X	X
Assurance Factor® Calculation and Diagnostics			X	X
Zero Point Monitoring and History			X	X
Onboard Data Recording			X	X
PID Controller for Analog Output (e.g. Pump, Valve)			X	X
Partly Filled Pipe Management			X	X
API Standard Density/Volume				X
Net Oil Calculation				X
Concentration/Percent Substance Calculation				X
Precision Flow Analysis / up to 250 Hz Update Rate				X
Hardware Lock Switch				X
Super Fast Response / Filling Firmware Set				X
Precision Flow Analysis / 4 kHz Update Rate				X

RHECom Software

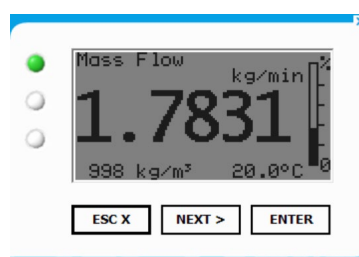
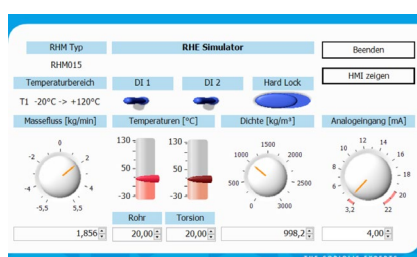
The RHE45 transmitter is a fully featured device with many sophisticated functions and configuration is necessary for proper performance of these functions. RHECom software is available in three versions – Free, Pro and Pro+.

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!

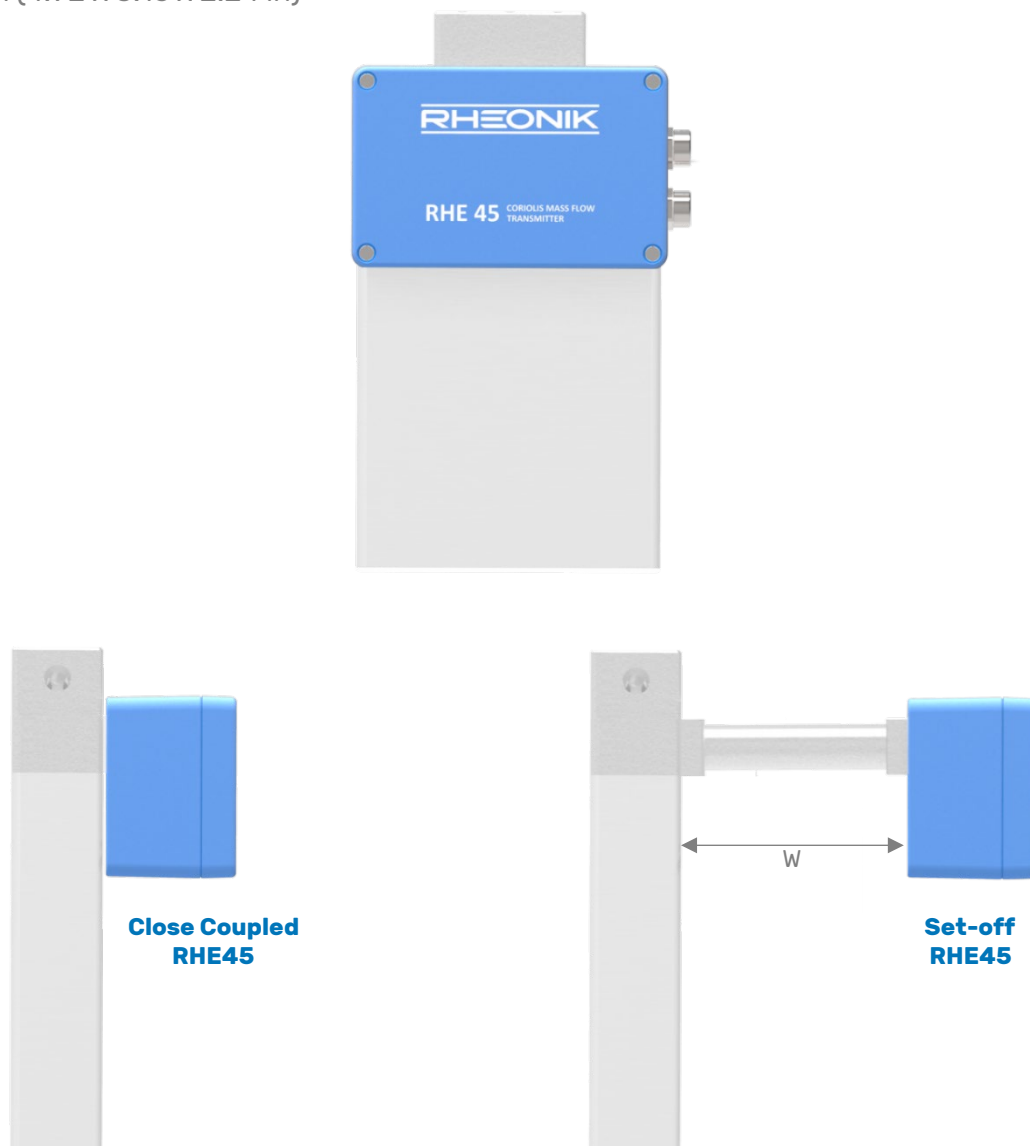


RHECom software is designed to ensure simple and expedient setup of Rheonik transmitter features and functions – a real time saver and a valuable tool.

Mechanical Construction

RHE45 enclosure size

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



Mounting

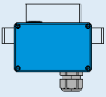
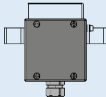
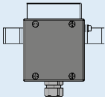
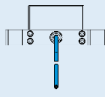
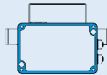
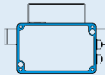
For RHM015S to RHM20S sensors, RHE45 transmitters are mounted either close coupled to or set-off from the sensor body depending upon temperature range selected.

For RHM30S to RHM160 sensors, RHE45 is always installed set-off from the sensor body.

	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	0	0
RHM06S to RHM20S all other Temperature Ranges	100	5.91
RHM30S to RHM160 all Temperature Ranges	100	5.91

Electrical connection to transmitter compatibility

Electrical connection option selections are compatible with the transmitter range according to the following table. Note that economical blind front versions of some transmitters are available where displays and keypads are not required. The wide range of Rheonik sensors and transmitters provide tremendous options for system designers and end users alike.

Sensor Connection Options								
Order Code		JM	SM	S9	TM	J2 ¹	J5	J9
	RHE 21	✓	✓	—	✓	—	—	—
	RHE 26	✓	✓	—	✓	—	—	—
	RHE 27	✓	✓	—	✓	—	—	—
	RHE 28	✓	✓	—	✓	—	—	—
	RHE 42	✓	✓	—	✓	✓	—	—
	RHE 45	—	—	—	—	—	✓	—
	RHE 46	✓	✓	—	✓	—	—	—
	RHE 49	—	—	✓	—	—	—	✓

¹ Only with RHM design types PF, PT. Refer to section “order codes” in the corresponding RHM datasheet.

RHE 45 Part Number Code

E45-	1	2	3	4	5	6	7	8
Example part number code								
E45-	C1	D1	AF	B1	NN	NN	MC	NNN
1	Housing type							
C1	Compact mount at sensor without display, with M12 socket(s), plug(s) and cable(s)							
CD	Compact mount at sensor with display, M12 socket(s), plug(s) and cable(s)							
2	Power supply voltage							
D1	12 to 24 VDC (+/- 10%)							
3	Software function package							
SO	Standard operation System - mass flow, normalized density / volume, Assurance View® Diagnostics							
DO	mass flow, measured density / volume requires RHM density calibration							
AF	DO configuration, additional Assurance Factor®, ZP History, Data Recording, PID Controller, PFPM							
FR	AF configuration, additional Ultra-fast signal tracking operation System							
4	I/O and interface configuration							
B1	Base Configuration - 2*DO, 1*DI, RS485 (Modbus)							
EB	Base TCP Configuration - 2*DO, 2*DI, Modbus TCP / IPv4, RS485 (Modbus)							
EA	TCP All - 2* 4..20 mA (a/p) acc. NAMUR NE43, 2*DO, 2*DI, Modbus TCP / IPv4, RS 485 (Modbus)							
EN	EtherNet/IP, Modbus TCP, 2 x DO, 1 x DI, RS485 (Modbus)							
EP	Profinet, 2*DO , 1 x DI, RS485 (Modbus)							
EC	EtherCAT, 2*DO , 1 x DI, RS485 (Modbus)							
EL	PowerLink, 2*DO , 1 x DI, RS485 (Modbus)							
DP	Profibus DP, 2*DO , 2 x DI, RS485 (Modbus)							
DN	DeviceNet, 2*DO , 2 x DI, RS485 (Modbus)							
DO	CAN Open, 2*DO , 2 x DI, RS485 (Modbus)							
S1	1*4..20 mA (a) acc. NAMUR NE43, 2*DO , 1*DI, RS485 (Modbus)							
S2	2 *4..20 mA (a) acc. NAMUR NE43, 2 x DO , 1 x DI +RS485 (Modbus)							
P1	1*4..20 mA (p) acc. NAMUR NE43, 2*DO , 1*DI, RS485 (Modbus)							
P2	RS485 (Modbus), 2 *4..20 mA (p) acc. NAMUR NE43, 2 x DO , 1 x DI							
5	Hazardous area approval transmitter							
NN	Without approval							
6	Performance / compliance certification							
NN	Without							
R7	Custody transfer certification OIML-CS R117 requires Hardware Lock Switch							

RHE 45 Part Number Code

7	Cable entry / glands
MC	M12 Connector (IP67) with 12 pins / 8 pins
CM	M12 Connector (IP67) with 12 pins / 8 pins - Display rotated 180° for gas installation
8	Options
NNN	None / all standard
NNH	Hardware Lock Switch
NSI	Pre-setting instructions, customized I/O configuration

RHE 45 Accessories

NN	Without
RS	5 m PC cable (Mini USB B to USB A) - to connect PC / RHECom PC software
MO	RS485 (Modbus) terminals to USB A Converter
PR	PC Software RHEComPRO license key (upgrades for two years are included)
PP	PC Software RHEComPRO+ license key (upgrades for two years are included)
M1	3 m cable assembly - M12 plug (IP67) with 12 pins in A config./ 12 free ends
M2	2 m cable assembly - M12 plug (IP67) with 8 pins in A config./ 12 free ends
M3	M12 plug with 12 pins in A config. for self wiring to individual cable length
M4	M12 plug with 8 pins in A config. for self wiring to individual cable length
M6	10 m cable assembly - M12 plug (IP67) with 12 pins in A config. / 12 free ends
M7	10 m cable assembly - M12 plug (IP67) with 8 pins in A config. / 8 free ends
MS	M12 plug (IP67) with 12 pins in A config. incl. 3 m of cable with test interface
MY	M12 plug (IP67) with 8 pins incl. 2 m cable with two RJ45 sockets for Ethernet 100Base TX



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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