

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



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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

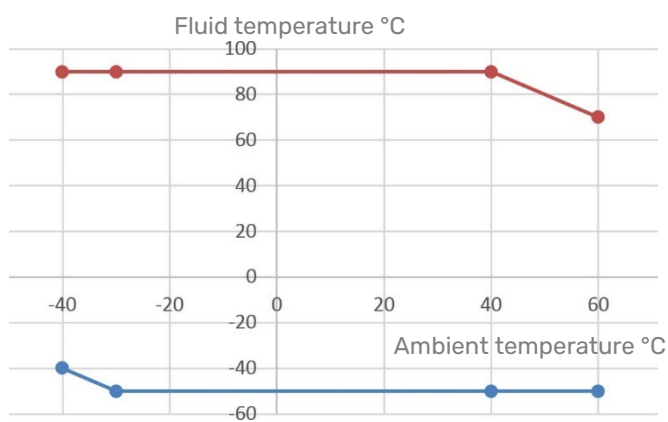
General Specification Overview

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
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

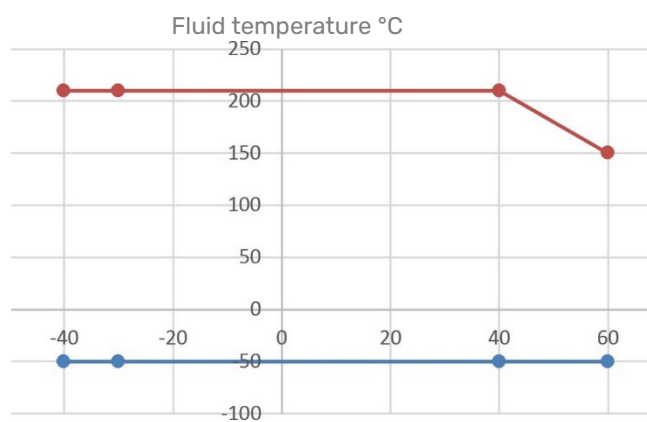
Only available for temperature ranges N1, NA, E2

Operating temperature range for close coupled RHE45



—●— RHE45 maximum —●— RHE45 minimum

Operating temperature range for set-off RHE45



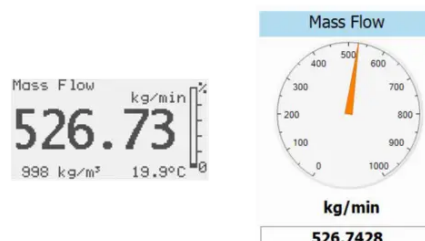
Software Function Packages and Features

Standard Operation Package (Part Number Code S0)

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

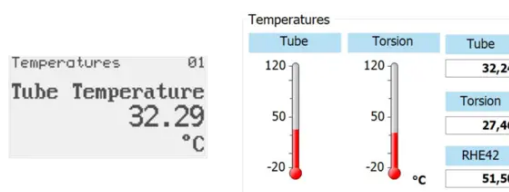
Direct Mass Flow Measurement

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

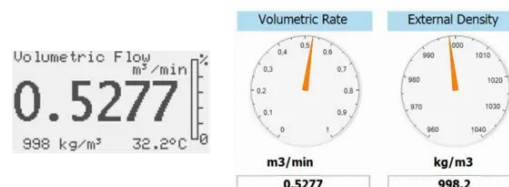
Each Omega Tube Coriolis Sensor provides a temperature measurement from built in sensors.



Fixed and Calculated Density Function

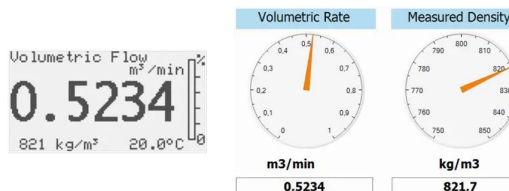
The Fixed Density function allows to enter a fixed density value for volumetric flow calculations.

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.



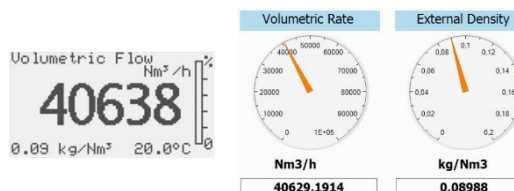
Calculated Actual Volume Measurement for Liquids and Gas

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.



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.



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.



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.



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.



WHITE

Normal Operation

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



AMBER

Operation Not Optimal

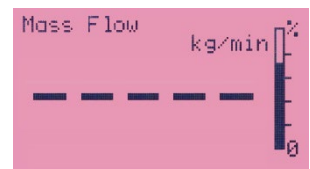
Sensor subject to noise / changing conditions in pipe. Measurement quality may be compromised



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 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.

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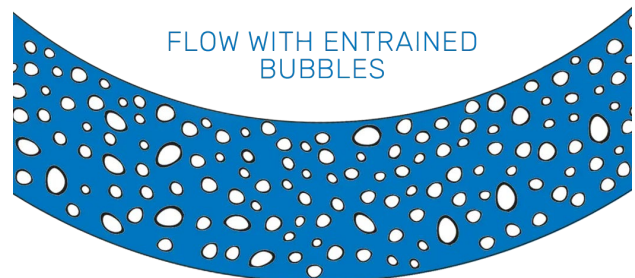
**** Zero Point 3 ****
Date: 2022-03-18 11:27
Run Time: 646
Zero Point: -0.03
Tube Temp.: 20.00
Torsion Temp.: 20.00
Var. Phase: 0.573977
Var. Period: 1.37525
    
```

History of Zero Points stored in the RHE

Time	Run Time	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

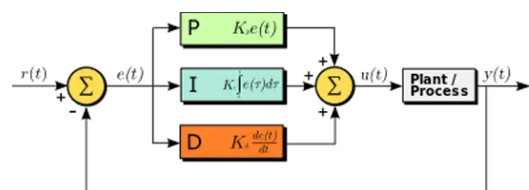
Partially Filled Pipe Management – Full Version (PFPM)

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:
 Range End:

Update Date / Time

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.

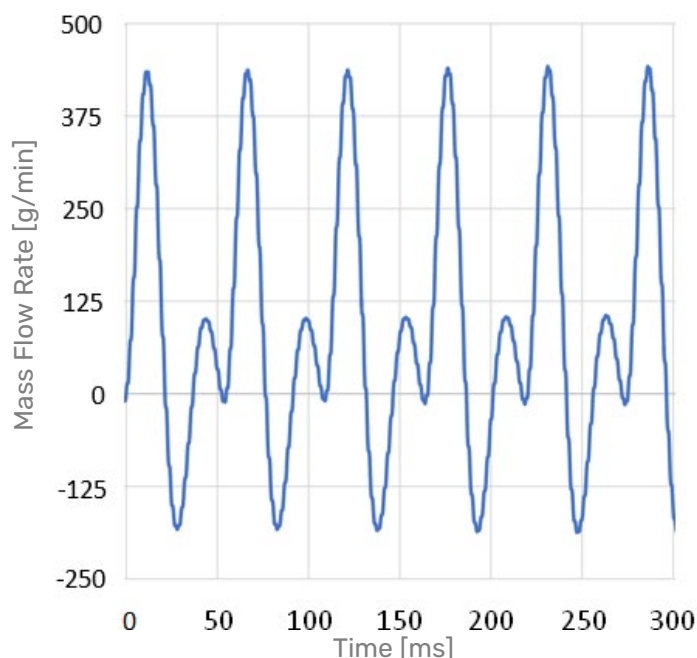
The fast fill function has a variety of tuning parameters and their setting will largely depend on the operating conditions (temperature, pressure, density, target delivery, etc.) of the filling system. For users of the Fast Response Package, Rheonik will provide assistance with initial configuration 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 spreadsheet 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**



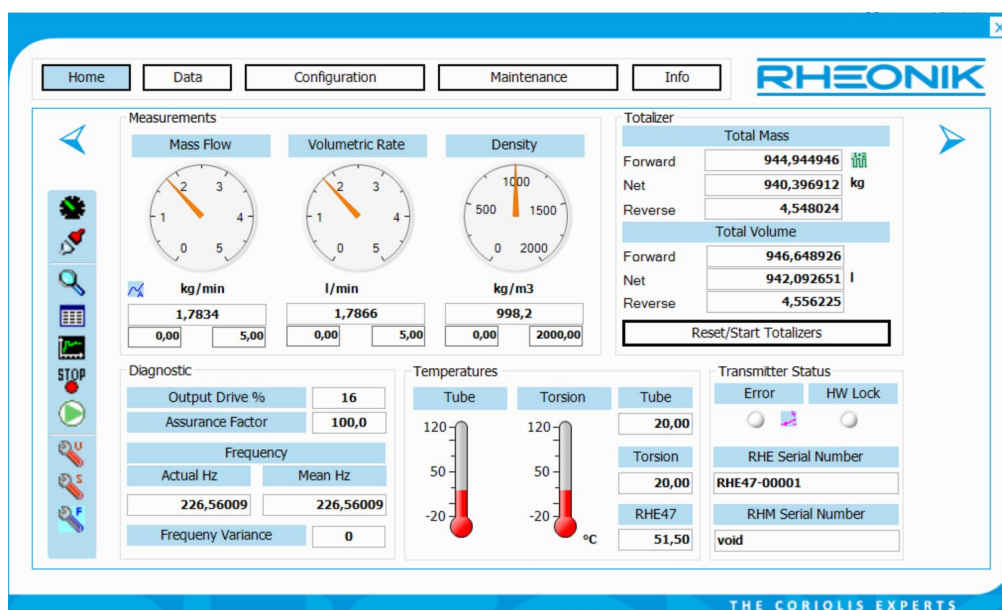
Program Package Function Summary

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
Onboard Data Recording			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

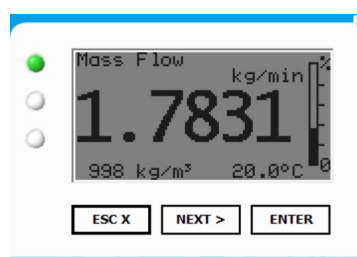
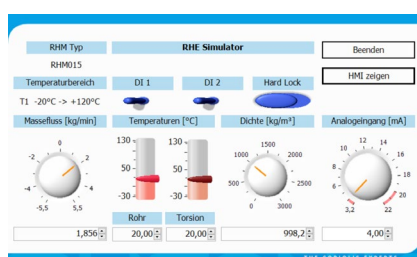
The RHE45 transmitter is a fully featured device with many sophisticated functions and configuration is necessary for proper performance of these functions. RHECom software is available in three versions – Free, Pro and Pro+.

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!

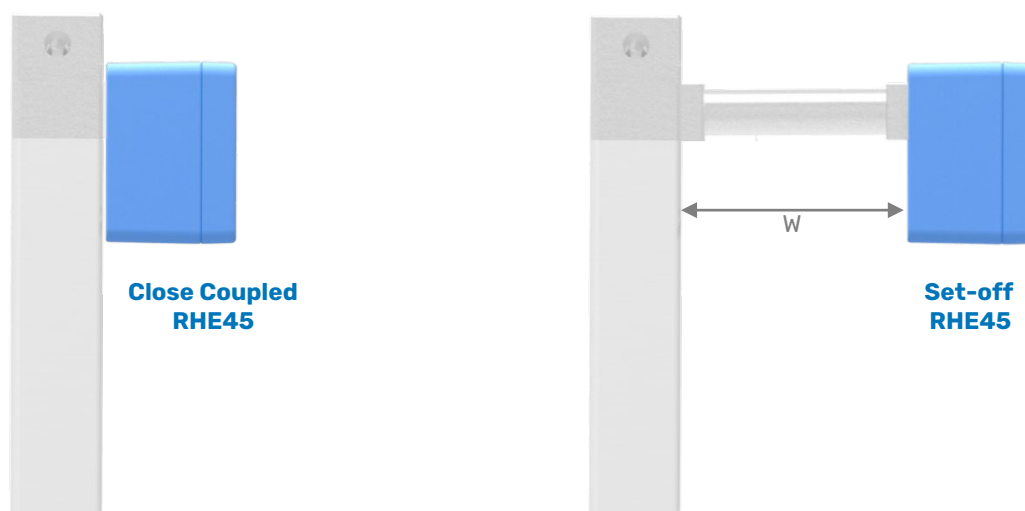


RHECom software is designed to ensure simple and expedient setup of Rheonik transmitter features and functions – a real time saver and a valuable tool.

Mechanical Construction

RHE45 enclosure size

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



Mounting

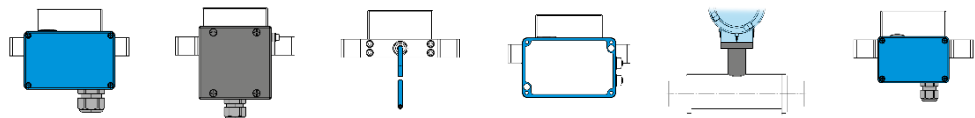
For RHM015S to RHM20S sensors, RHE45 transmitters are mounted either close coupled to or set-off from the sensor body depending upon temperature range selected.

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

Transmitter Range

Any Rheonik Mass Flow Transmitter model can be combined with any Rheonik Mass Flow Sensor to provide an overall mass flow measurement system to suit any requirement. Rheonik Coriolis Transmitters are available in versions specifically designed for process, industrial and OEM applications. Economical blind front versions of some transmitters are available where displays and keypads are not required. The wide range of sensors and transmitters provide tremendous options for system designers and end users alike.



Product Code	JM	SM	TM	J5	C2	PM
 RHE 21	✓	✓	✓	-	-	✓
 RHE 26	✓	✓	✓	-	-	✓
 RHE 27	✓	✓	✓	-	-	✓
 RHE 28	✓	✓	✓	-	-	✓
 RHE 42	✓	✓	✓	-	✓	✓
 RHE 45	-	-	-	✓	-	-

RHE 45 Part Number Code

Construction Type

- C1 Compact mount at sensor without display, with M12 socket(s), plug(s) and cable(s) - requires J5 option at RHM
- CD Compact mount at sensor with display, M12 socket(s), plug(s) and cable(s) - requires J5 option

Supply Voltage

D1 12 to 24 VDC (±10%)

Software Function Package

- SO Standard OP system - mass flow, normalized density / volume
- DO Enhanced OP system - mass flow, measured density / volume - requires RHM density calib.
- AF Enhanced OP system plus Assurance Factor®, ZP data logging, partly filled pipe manager etc.
- FR Ultra-fast signal tracking OP System plus all features of AF system

I/O Configuration

- B1 RS485 (Modbus RTU), 2 x DO (pulse/freq./status), 1 x DI - 1x M12-12 pin
- P1 RS485 (Modbus RTU), 1 x 4-20mA (passive), 2 x DO (pulse/freq./status), 1 x DI - 1x M12-12 pin
- P2 RS485 (Modbus RTU), 2 x 4-20mA (passive), 2 x DO (pulse/freq./status), 1 x DI - 1x M12-12 pin
- S1 RS485 (Modbus RTU), 1 x 4-20mA (active), 2 x DO (pulse/freq./status), 1 x DI - 1x M12-12 pin
- S2 RS485 (Modbus RTU), 2 x 4-20mA (active), 2 x DO (pulse/freq./status), 1 x DI - 1x M12-12 pin
- EB Modbus TCP, 2 x DO (pulse/freq./status), 2 x DI, RS485 (Modbus RTU) - 1x M12-12 pin, 1x M12-8 pin
- EA Modbus TCP, 2 x 4-20mA (a), 2 x DO (p./fr./st.), 2 x DI, RS485 (Modbus RTU) - 1x M12-12 pin, 1x M12-8 pin
- EN EtherNet/IP, Modbus TCP, 2 x DO (p./fr./st.), 1 x DI, RS485 (Modbus RTU) - 1x M12-12 pin, 1x M12-8 pin
- EP Profinet, 2 x DO (pulse/freq./status), 1 x DI, RS485 (Modbus RTU) - 1x M12-12 pin, 1x M12-8 pin
- EC EtherCAT, 2 x DO (pulse/freq./status), 1 x DI, RS485 (Modbus RTU) - 1x M12-12 pin, 1x M12-8 pin
- EL PowerLink, 2 x DO (pulse/freq./status), 1 x DI, RS485 (Modbus RTU) - 1x M12-12 pin, 1x M12-8 pin
- DP Profibus DP, 2 x DO (pulse/freq./status), 2 x DI, RS485 (Modbus RTU) - 1x M12-12 pin, 1x M12-8 pin
- DN DeviceNet, 2 x DO (pulse/freq./status), 2 x DI, RS485 (Modbus RTU) - 1x M12-12 pin, 1x M12-8 pin
- DO CAN Open, 2 x DO (pulse/freq./status), 2 x DI, RS485 (Modbus RTU) - 1x M12-12 pin, 1x M12-8 pin
- XX Customized configuration of I/O Interface

Hazardous Area Approval

NN For Installation in Safe Area

Performance Certification

- NN Without
- R7 Custody transfer certification OIML-CS R117 - requires Hardware Lock Switch
- 9R Custody transfer certification OIML-CS R139 - requires Hardware Lock Switch

Options for RHE45

- NNN None / All standard
- NNH Additional Hardware Lock Switch



Options and Accessories

Part Number	Description
ORHE-SI	Pre-setting of pulse, analog outputs according to setting instructions.
ARHE45-M1	Spare / replacement 3m cable assembly - M12 plug (IP67) with 12 pins in A config./ 12 free ends
ARHE45-M2	Spare / replacement 2m cable assembly - M12 plug (IP67) with 8 pins in A config./ 12 free ends
ARHE45-M3	M12 plug with 12 pins in A config. for self wiring to individual cable length
ARHE45-M4	M12 plug with 8 pins in A config. for self wiring to individual cable length
ARHE45-M6	10m cable assembly - M12 plug (IP67) with 12 pins in A config. / 12 free ends. HALF PRICE when included in delivery with RHE45 as substitute for standard 3m cable
ARHE45-M7	10m cable assembly - M12 plug (IP67) with 8 pins in A config. /8 free ends. HALF PRICE when included in delivery with RHE45 as substitute for standard 2m cable
ARHE45-MS	M12 plug (IP67) with 12 pins in A config. incl. 3m of cable with 13-terminal test interface
ARHE45-MY	M12 plug (IP67) with 8 pins incl. 2m CAT5 cable with two RJ45 sockets for Ethernet 100Base TX

General Options

Part Number	Description
ARHE-RS	5m PC cable (Mini USB to PC USB) - to connect PC / RHECom PC software for RHE16/2x/4x
ARHE-SO	USB flash drive with PC software RHEComFree, operation manual, calibration certificate(s), csv configuration file(s). One USB drive per order is sufficient. For RHE16/2X/4X
ARHE-PW	DIN Rail Power Supply Module 85 to 250 V to 24 VDC / 15 W (Non Ex) for RHE16/26/27/42
ARHE-MO	Modbus RS485 terminals to PC USB Converter for RHE16/2X/4X
ARHE-PR	PC Software RHEComPRO license key (upgrade for two years are included)
ARHE-PP	PC Software RHEComPRO+ license key (upgrade for two years are included)
ORHE-TP	Plate with TAG number in Stainless Steel (other labelling standard)
ORHE-TP-C	Complete labelling (type information, TAG, Ex label) in Stainless Steel
MAN-	Additional RHE manual printout



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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