RHE42

Field Mount All-Digital High Performance Multifunction Mass Flow Transmitter

Features

- ***All-Digital*** Coriolis Transmitter incl. ***real time clock*** with advanced signal processing for ultimate measurement performance
- Integral/compact or remote mount
- IECEx/ATEX and CSA North America hazardous area certifications
- 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)
- Two 4-20mA (active or passive), pulse, frequency, status plus digital inputs. Intrinsically safe (is) option available
- ***Multiple interfaces including Ethernet*** provides connection options for every application: HART, Foundation Fieldbus H1, Profibus PA, Modbus RTU and Ethernet (Modbus TCP/IPv4)
- ***License-free RHECom Software*** package version for configuration and servicing
- ***RHEComPro+ Software Suite*** for extended diagnostics
- Display with ***Color back-lit display*** with 3 through-glass buttons for local configuration and operation through an intuitive user menu

Applications

- Filling and batching – transmitter includes ***batch controller***
- Any high accuracy/reliability plant flow or density measurement
- Oil and Gas
- Mixing and blending of chemicals – transmitter includes ***PID controller***
- PU Industries – panels, foam, polymers
- Paint – any pressure class application
- High pressure flow measurements - sensors up to 1400 bar / 20000 psi available

Benefits

- Wide range of I/O and availability of many common digital communications interfaces ensures connectivity
- Peace of mind with ***Assurance Factor®*** and ***Assurance View®*** advanced diagnostic capabilities
- Color changing graphic display gives instant indication of measurement reliability
- Cost savings in maintenance and training with the premium ***RHEComPro+ Software Suite*** including offline application simulation
- Selectable I/O and programming options provide a cost effective solution

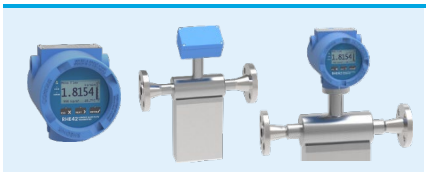
RHE42 General Specification

Enclosure Material	Powder coated aluminum	
Enclosure Rating	IP65/Type 4, optional IP66-67/Type 6	
Ambient Temperature	-20 to +60°C / -4 to +140°F, optional -40°C to +65°C / -40°F to 149°F Integral version depends upon fluid temperature, refer to next page	
Dimensions	Enclosure approx. 144 x 108 x 139 mm / 5.67 x 4.25 x 5.47 in	
User Interface and Configuration	Local Display Version High contrast backlit LCD color display and 3 x through-glass operator buttons. Configure locally or with RHECom software *Reduced display visibility below -10°C / 14°F*	Blind Transmitter Version No local controls. Configure through RHECom software package
Connection to Sensor	Integral/Compact to sensor or remote mount with 3m/10m cable	
Cable Entries	2 x ½" NPT for power and I/O	
Computer Connection	Via Modbus RTU to PC	
Totalizers	6 x resettable forward, reverse and net totalizers for mass and volume 2 x non-resettable totalizers for mass and volume	
Analog Outputs	Up to 2 x 4-20mA outputs, active or passive. Intrinsically safe versions available	
Pulse/Freq/Status Outputs	Up to 2 configurable pulse/frequency/status outputs (IEC60946). Max. 10kHz. Intrinsically safe versions available (open collector)	
Digital Inputs	Up to 2 configurable control inputs (IEC60946). Intrinsically safe versions available	
Digital Data Communications	HART, Modbus RTU, Ethernet (Modbus TCP/IPv4), Foundation Fieldbus H1 (FISCO), Profibus PA	
Power Supply	12-24 VDC +/- 10%, 2W typical, 4W maximum	
Hazardous Area Approvals	ATEX/IECEx and cCSAus	

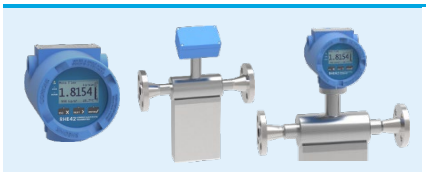
Hazardous Area Installation Overview

Zone 0

Zone 1 / Class I, Div. 1



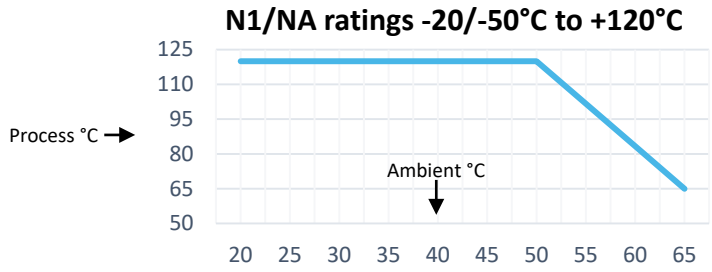
Zone 2 / Class I, Div. 2

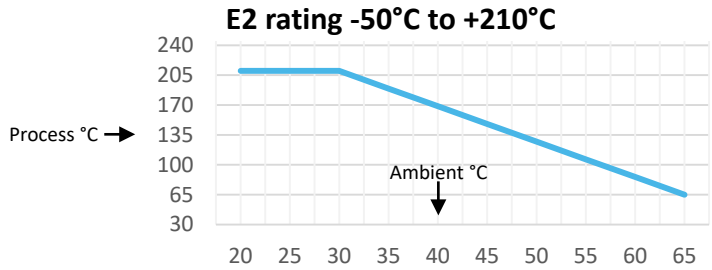


Sensor and transmitter must have matching approvals

RHE42 Temperature Specifications

Integral/compact RHE42 transmitters are available on RHM06S to RHM20S sensors with seal less construction types and N1/NA/E2 process temperature ratings. For other sensor types, the RHE42 transmitter must be remotely mounted.





RHE42 Output Configurations

The RHE42 is available with a variety of standard I/O configurations to provide the ultimate in flexibility and value for all users. Rheonik also offers a custom configuration option to provide I/O combinations not listed below.

Part Number Code	DO pulse/freq /status	DI	AO 4-20mA	Modbus RS485	Modbus TCP/IPv4 (wired)	HART	FFH1 FISCO	Profibus PA
B1	2	2		Y				
EB	2	2		Y	Y			
EA	2	1	1 (a/p)	Y	Y	Y		
S1	2	1	1 (a/p)	Y				
1H	2	1	1 (a/p)	Y		Y		
S2	2		2 (a/p)	Y		Y		
i1	2 (is)		1 (p/is)	Y		Y		
i2	1 (is)	1 (is)	2 (p/is)	Y		Y		
FF				Y			Y	
F2	1 (is)		1 (p/is)	Y			Y	
PA				Y				Y
P2	1 (is)		1 (p/is)	Y				Y
XX	Customer Specified							

is – intrinsically safe, a – active, p – passive
uncertainty of analog outputs is +/- 0.1% of reading, +/- 10µA

Program Packages and Features

The RHE42 is available with six different programming packages, each with specific features and functions suited to typical user applications

Mass Flow Measurement Package (Part Number Code SO)

The RHE42 Mass Flow Measurement package provides all the basic measurement functions and features for accurate mass flow measurement:

Direct Mass Flow Measurement

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

Temperature Measurement

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

Density and Volumetric Flow Functions

Density and volumetric flow rate can be calculated, displayed and output from a transmitter by initiating one of several options for indirect density measurement:

1) Fix or Norm Density value entry. A fix or Norm Density value is entered into the transmitter either through the keypad or via Modbus. This value is used to calculate a volumetric flow rate in addition to the live mass flow measurement. The density value could be updated as needed; via Modbus continuously if wanted. This particular function is often used to display a gas flow in normalized or standard gas volume units such as Nm^3/h or SCF/h.
2) Calculated density based upon temperature. A flowing density value is calculated based upon a reference density value, a change per unit temperature coefficient and measured tube temperature in the sensor. Based upon the tube temperature, the reference value is modified with the entered change coefficient to generate a calculated density value. This calculated density value can be used to provide a volumetric flow rate of the fluid in the sensor.

Password Protection

All setup and calibration parameters within the meter are protected with multi-level passwords.

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. Batch control can be configured and initiated from the instrument user interface, remotely via operator switches, or through digital communication from a connected supervisory control system. The controller can be 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 can also be configured for a self-learning mode where it monitors over/under delivery and adjusts valve timing accordingly to further refine delivery accuracy.

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 what include e.g. frequency, frequency jitter, signal conditions, gain etc., are quickly accessed through dedicated menu displays – the user gets all important flow measurement "health" information at a glance.

Program Packages and Features

Multifunction Measurement Package (Part Number Code DO)

The RHE42 Multifunction Measurement package (or Density Operating System) includes all features from the Mass Flow Measurement 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. The unit can also be configured to read out in °Brix or °Baume. °Brix is used extensively in the sugar and beverage industries. °Baume (light and heavy) is used to measure salt solutions etc.

Partially Filled Pipe Management – Lite Version

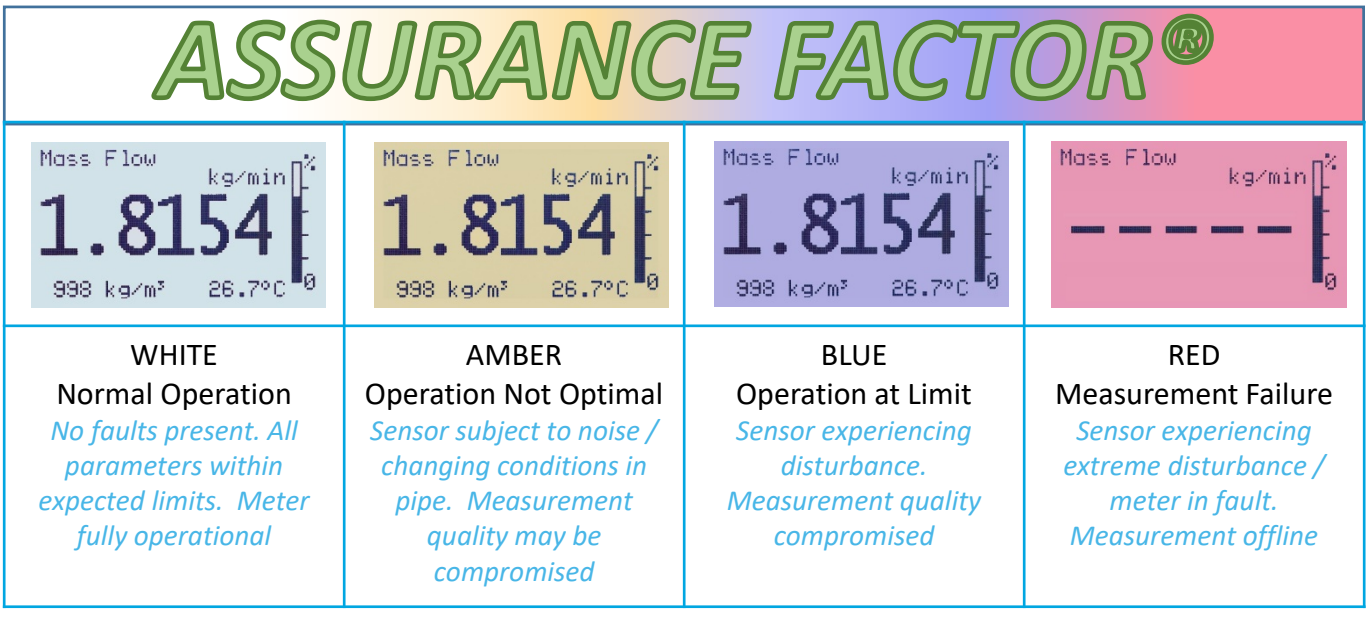
Often referred to as multiphase flow, the flow regime in a partially filled pipe can cause large measurement errors and even create a measurement fault condition in a Coriolis flow meter. When PFPM is activated, density measurement is continuously compared to preset limits to determine if the sensor 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.

Advanced Diagnostics Package (Part Number Code AF)

The RHE42 Advanced Diagnostics Package (or Assurance Factor Operating System) includes everything from the Multifunction Measurement Package plus a suite of advanced diagnostic functions:

Assurance Factor® Advanced Diagnostics Tool

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 RHE42 (White – Amber – Blue – Red), providing highly visible wide area condition indication.



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*

Program Packages and Features

Assurance Diagnostics Package (*continued*)

Zero Point Setting History/Statistics

All RHE42 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.

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.

Data Recording

The fluid transfer package contains fully featured onboard data recording with a capacity 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 RHE42 Oil and Gas Function Package includes everything from the Assurance Diagnostics 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 inputs (there is also a simplified version with temperature consideration only). Both inputs can be supplied through manual user menu entries or through Modbus updates to the transmitter. Alternatively, the internal tube temperature of the sensor can be used. Volume flow and totalization at standard conditions are generated using the calculated standard density value.

Program Packages and Features

Oil and Gas Function Package (*continued*)

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. Updates to these values should be made as these standard densities change (through changing salt or sand content, for instance) to ensure the best performance from the unit. Net oil total is accumulated in the built in totalizer set.

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.

Fluid Transfer Package (Part Number Code CT)

The RHE42 Fluid Transfer or 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 it is necessary to apply a seal to prevent change of the transmitter parameters and settings, the RHE42 can be supplied with a configuration lock switch. 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.

Program Packages and Features

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 RHE42 transmitter offers a unique Fast Response Package.

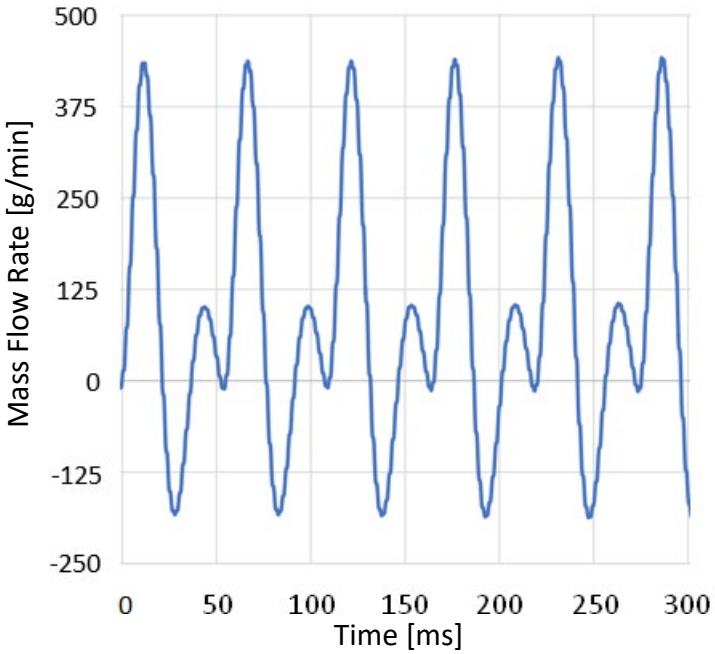
For extremely fast fill applications down to 5-10 ms measurements, a patented fast response filter technology is employed within the transmitter to speed up measurement update time to better 1 ms. With an additional internal fast sampling mode this allows a 4kHz measurement update rate to maintain very 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 RHE42 Fast Response Package includes all functions and features of the Fluid Transfer Package.

Mass Flow Measurement of 10ms Injections

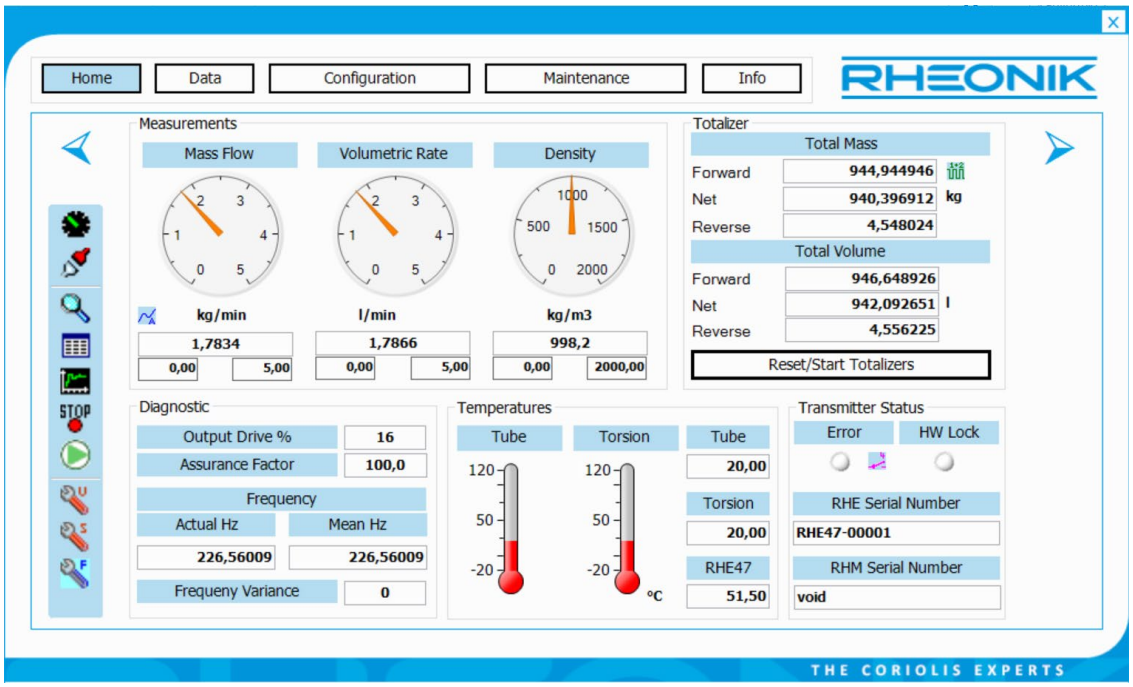


Program Package Function Summary

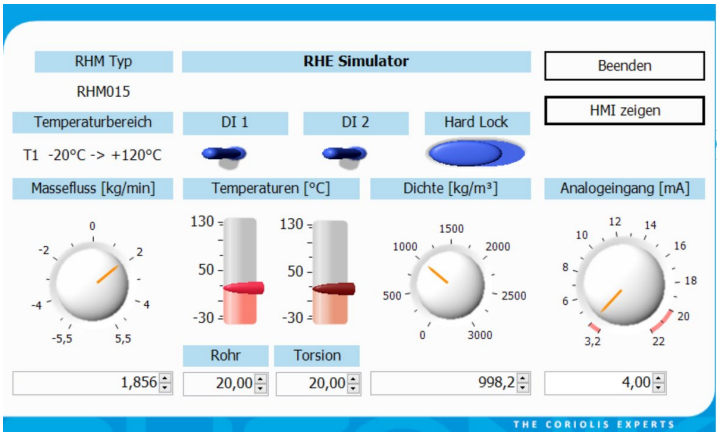
Feature	Program Package Code					
	SO	DO	AF	OG	CT	FR
Live Mass Flow Measurement	X	X	X	X	X	X
Live Temperature Measurement	X	X	X	X	X	X
Inferred Density by Reference Density and Temp.	X	X	X	X	X	X
Fixed or Norm Density Value (e.g. kg/Nm³)	X	X	X	X	X	X
Volumetric Flow from Inferred/Fixed/Norm Density	X	X	X	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
Onboard Data Recording			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

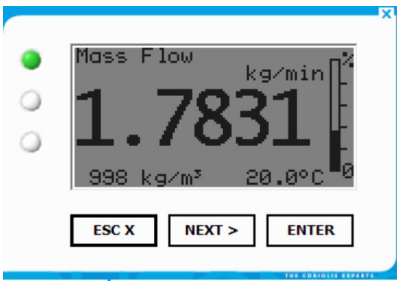
RHECom PC Software

Rheonik 40 Series Transmitters are fully featured devices with many useful functions. ***RHECom*** software provides a convenient interface for transmitter configuration. ***RHECom*** is available with three levels – ***Free***, ***Pro*** and ***Pro+***. ***RHEComFree*** is available for download at **no extra cost** or on USB flash drive. ***RHEComFree*** allows full setup of all transmitter parameters plus includes a simple data logging function.



For a one-time license fee, ***RHEComPro*** and ***RHEComPro+*** offer additional insight and setup convenience menus. ***RHEComPro*** includes fully featured 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 configure and test your application from the convenience of your desk by adjusting transmitter settings and setting alarms and filters. Finally, create a transmitter configuration file for upload into the actual unit. The simulator is ideal for training operators and maintenance personnel - 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!

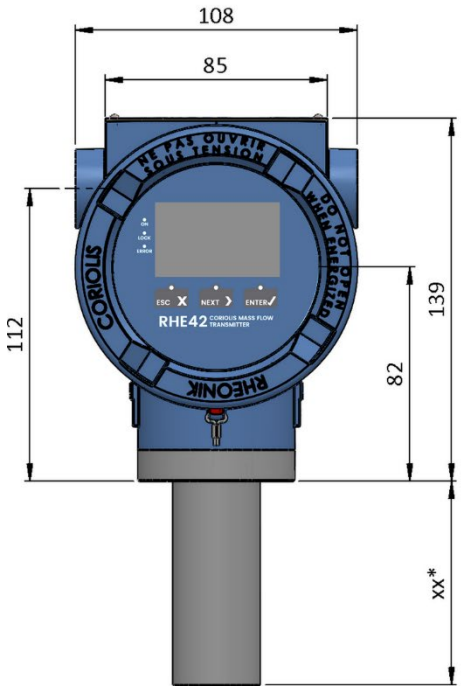




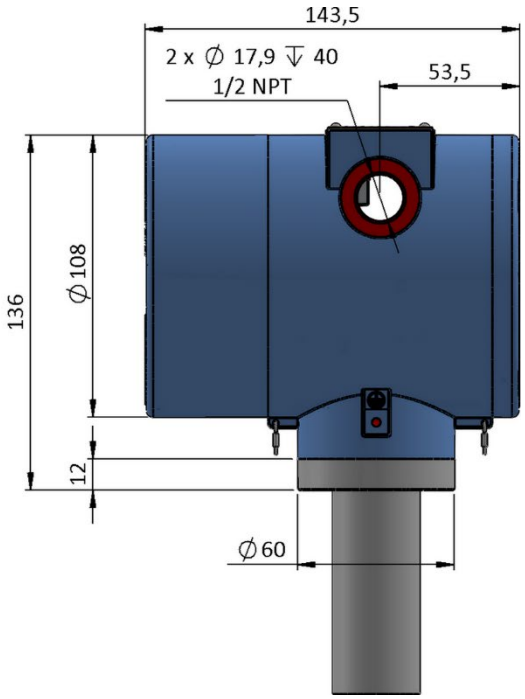
RHECom software is designed to ensure simple and expedient setup of Rheonik 40 Series Transmitter features and functions – a real time saver and a valuable tool.

RHE42 Dimensions Integral/Compact Mount (C*)

Front view

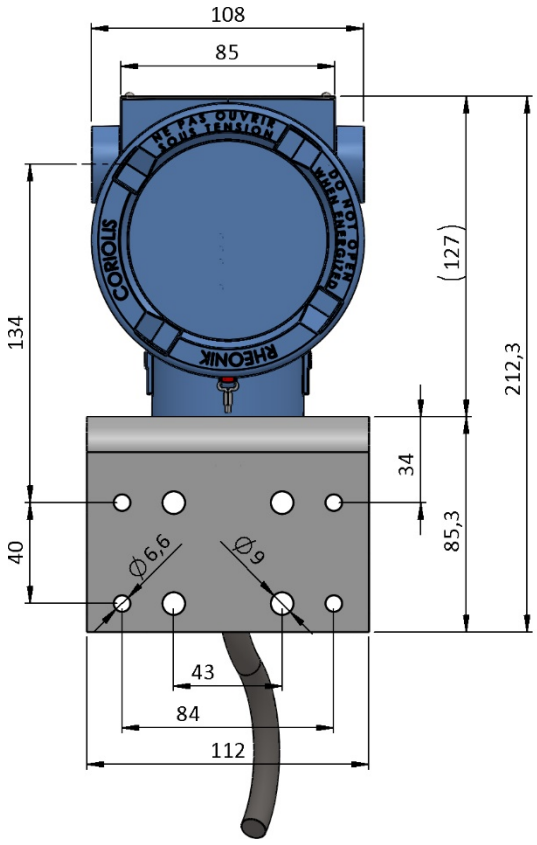


Side view

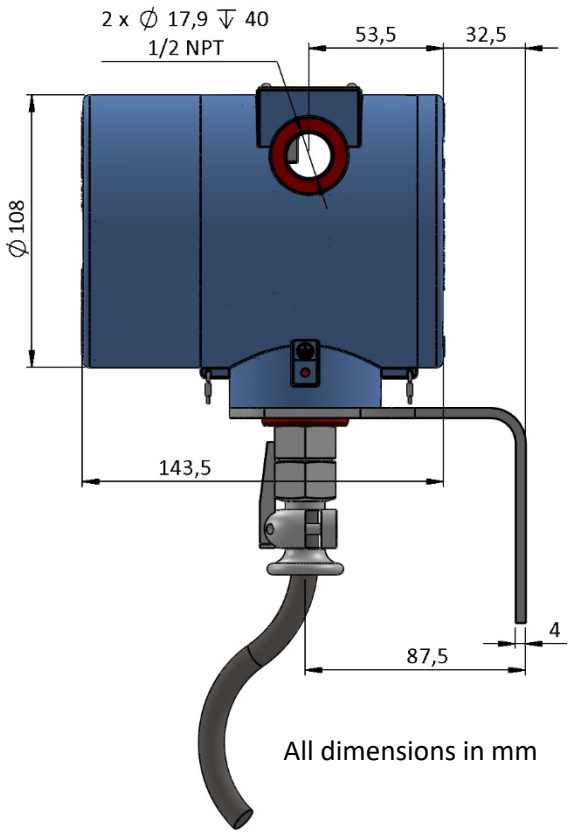


RHE42 Dimensions Remote Mount (R*)

Back view



Side view



All dimensions in mm

RHE42 Part Number Code

Construction Type

- **RB** Remote Mount Enclosure, IP65/Type 4, Exd(e), with 3m integral cable
- **RC** Remote Mount Enclosure, IP65/Type 4, Exd(e), with 10m integral cable
- **RD** Remote Mount Enclosure, IP65/Type 4, Exd(e), with HMI and 3m integral cable
- **RE** Remote Mount Enclosure, IP65/Type 4, Exd(e), with HMI and 10m integral cable
- **C1** Integral/Compact Mount Enclosure at Sensor IP65/Type 4, Exd(e)
- **CD** Integral/Compact Mount Enclosure at Sensor IP65/Type 4, Exd(e) with HMI

Program Package

- **SO** Mass Flow Measurement Package
- **DO** Multifunction Measurement package
- **AF** Advanced Diagnostics Pacakge
- **OG** Oil and Gas Function Package
- **CT** Fluid Transfer Package
- **FR** Fast Respose Package

I/O Configuration

- **B1** 2 x DO (Pulse/Freq/Status), 2 x DI, RS485 (Modbus)
- **EB** 2 x DO (Pulse/Freq/Status), 2 x DI, RS485 (Modbus), Modbus TCP/IPv4
- **EA** 2 x 4-20mA (a/p), 2 x DO (Pulse/Freq/Status), 2 x DI, RS 485 (Modbus), Modbus TCP/IPv4, HART
- **S1** 1 x 4-20mA (a/p), 2 x DO (Pulse/Freq/Status), 1 x DI, RS485 (Modbus)
- **1H** 1 x 4-20mA (a/p), 2 x DO (Pulse/Freq/Status), 1 x DI, RS485 (Modbus), HART
- **S2** 2 x 4-20mA (a/p), 2 x DO (Pulse/Freq/Status), RS485 (Modbus), HART

Instrinsically safe output options

- **i1** 1 x 4-20mA (is, p), 2 x DO (Pulse/Freq/Status - is), RS485 (Modbus - non is), HART
- **i2** 2 x 4-20mA (is, p), 1 x DO (Pulse/Freq/Status - is), 1 x DI (is), RS485 (Modbus - non is), HART
- **FF** Foundation Fieldbus FFH1 (FISCO), RS485 (Modbus - non is)
- **F2** Foundation Fieldbus FFH1 (FISCO), 1 x 4-20mA (is, p), 1 x DO (is), RS485 (Modbus - non is)
- **PA** Profibus PA, RS485 (Modbus - non is)
- **P2** Profibus PA, 1 x 4-20mA (is, p), 1 x DO (is), RS485 (Modbus - non is)

Hazardous Area Approval

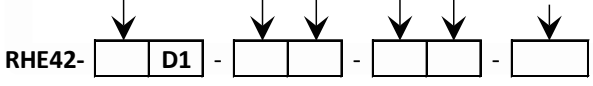
- **AS** ATEX/IECEx, RHM in hazardous location, RHE in ordinary location
- **A2** ATEX/IECEx, RHE in zone 2
- **A1** ATEX/IECEx, RHE in zone 1
- **CS** cCSAus, RHM in hazardous location, RHE in ordinary location
- **C2** cCSAus, RHE in Class I, Div. 2
- **C1** cCSAus, RHE in Class I, Div. 1

Performance Certification

- **NN** Without
- **AB** ABS approval for Marine applications
- **R7** Custody transfer certification MID MI-005 / OIML R117

Options

- **NNN** None
- **N67** Enhanced rating IP66-67/Type 6, ambient -40°C to +65°C
- **NNH** Hardware Lock Switch Function (included with CT and FR Packages)



RHE42 Accessories

Rheonik 40 Series Transmitters are supported by a range of connectivity, installation and operation accessories that can be ordered along with the transmitter.

Part Number	Description
ARHE-SO	RHECom PC software on USB flash drive. Includes digital version of all ordered sensor/transmitter production documentation plus calibration documentation and transmitter configuration file
ARHE-MO	Modbus RS485 to PC USB Converter
ARHE-HM	HART modem – USB connection to PC
ARHE-PR	PC software RHEComPro license key
ARHE-PP	PC software RHEComPro+ license key
ARHE-SI	Configuration service - factory presetting of transmitter to customer supplied specifications

Flow Sensor Range

Some of the many RHM Omega Tube mass flow sensors available

The RHM Omega Tube mass flow sensor range features:

Line Sizes	From DN1 to DN300 / 1/24" to 12“
Pressure Ratings	Up to 1400 bar / 20000 psi
Temperature Ratings	From -200°C to 400°C / -328°C to 752°F
Wetted materials	Stainless Steel, Alloy C22, Duplex, Super Duplex, Tantalum, Others

Rheonik 40 Series Transmitters can be connected to all flow sensors in the Rheonik RHM Omega Tube range. Together they make a high performance measurement package suitable for many applications.
For specific details on any sensor size, please see the relevant specification sheet.

About Rheonik

Rheonik has a 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. 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 each and 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 product range, our exclusive ***AnyPipeFit Commitment*** can have your flow sensor customized with any size or type process connection you need.

No matter what control system you use as the backbone in your enterprise, with ***Multiple Interfaces including Ethernet***, you can be sure that connection and communication will not be a problem. Alongside a wide variety of discrete analog or digital signal connections, we can also provide just about any network/bus interface available (for example: HART, Modbus RTU, Modbus TCP, Foundation Fieldbus H1, Profibus PA) with our 40 Series family of transmitters. Rheonik 40 Series Transmitters can connect to your system – no headache and no conversion needed.