



RHE 28

Field and Wall Mount Multifunction Mass Flow Transmitter

General process flow measurement / Batching and Mixing / Feed stocks and transfers / Custody transfer / Allocation metering





Features

- Wall or pipe/ hook mount
- Epoxy Coated Aluminum, IP65 / IP66
- Operates RHM sensors in hazardous areas, RHE28 fits in Zone 2 / Div. 2 areas
- Selectable Units for Mass, Volume, Density and Temperature
- Positive, negative and net totalizers for both volume and mass flow
- Two configurable pulse/frequency/status outputs – double pulse available
- Two configurable analog outputs
- Two configurable digital status outputs
- Two configurable digital inputs
- Analog input for pressure or density
- Advanced functions: Net Oil, Baume/Brix, % Solids, Concentration, Standard Density and Standard Volume (API MPMS Ch. 11)
- Connectivity to control systems through Modbus RTU and HART
- Custody transfer version with lockout switch and seal point
- Simple user interface – Backlit Color LCD display and 3 operator buttons with intuitive menu design
- Quick service & settings via USB / PC
- Built-in Assurance View® Advanced Diagnostic Set – simple publication of measurement status with Assurance Factor® and/or color changing display
- Password Protected Setup
- Upload and download of configuration files
- Power consumption less than 5 W

General Specification Overview

Enclosure Material	Coated cast aluminum universal field mount enclosure
Enclosure Rating	IP65 / NEMA 4. Optionally IP66 / NEMA 4X
Cable Entries	2 x M16, 2 x M20 as standard. Optional metric and NPT available
Ambient Temperature	-20°C (optionally -40°C) to +60°C / -4°F (-40°F) to +140°F (reduced visibility below -20°C)
Dimensions	170 x 272 x 93 mm / 6.7 x 10.7 x 3.7 in
Display	Large high contrast backlit LCD 128 x 24. Screen changes color to indicate warning or error
Weight	2.4 kg / 5.3 lb
Operation	3 x front panel operator buttons for all menu navigation and settings
Sensor Connection	Cage clamp terminals. Cable available in lengths up to 100m for connection to remote sensor
Analog Outputs	Up to 2 x 4-20mA outputs, active or passive
Digital Outputs	Up to 2 x configurable status outputs (IEC60946)
Pulse/Freq/Status Outputs	Up to 2 x configurable pulse/frequency/status outputs (IEC60946), max 10 kHz
Digital Inputs	Up to 2 x configurable control inputs (to IEC60946)
Analog Input (optional)	1 x 4-20mA analog input (active) for two-wire pressure or density sensor
Digital Data Communications	Modbus RTU (RS485); Connection to PC (USB) with Rheonik RHECom software HART over analog output
Power Supply	100-240 VAC (48 to 62 Hz), 5W and/or 12-24 VDC +/- 10%, 4W
Hazardous Area Approvals	ATEX/IECEX for RHE in ordinary locations (code AS), RHM in all zones ATEX/IECEX for RHE in zone 2 (code AB, A2), RHM in all zones cCSAus for RHE in ordinary locations (code CS), RHM in all divisions cCSAus for RHE in Div. 2 (code CB, C2), RHM in all divisions

Hazardous Area Installation Overview

Zone 0,1 / Class I, Div. 1



Zone 2 / Class I, Div. 2



Ordinary Locations



Sensor and Transmitter must have matching certification

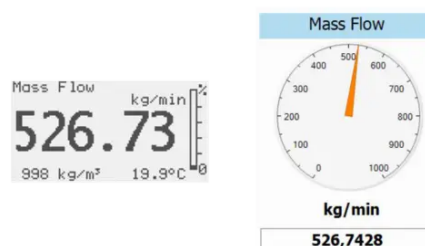
Software Function Packages and Features

Standard Operation Package (Part Number Code S0)

The RHE28 Standard Operation Package provides the following measurement and function features:

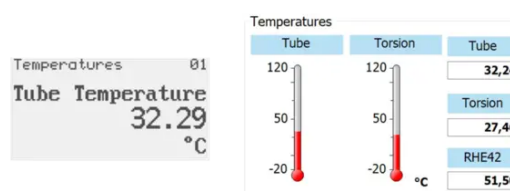
Direct Mass Flow Measurement

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

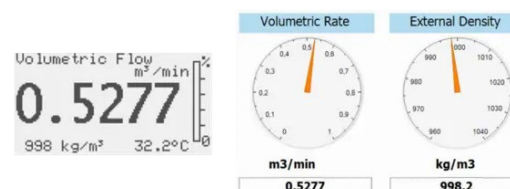
Each Omega Tube Coriolis Sensor provides a temperature measurement from built in sensors.



Fixed and Calculated Density Function

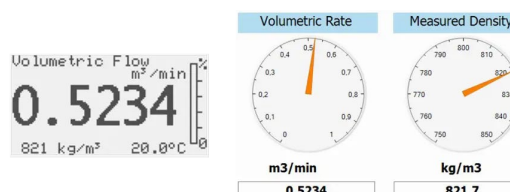
The Fixed Density function allows to enter a fixed density value for volumetric flow calculations.

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.



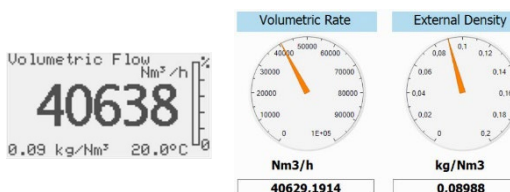
Calculated Actual Volume Measurement for Liquids and Gas

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 S0) continue

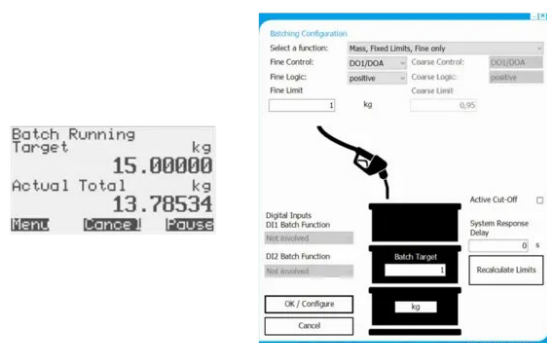
Password Protection

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 RHE28 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 RHE28 Assurance Factor Package includes all features from the Density Operation Package plus the following advanced diagnostic functions:

Assurance Factor®

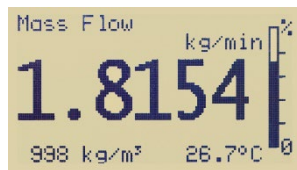
Assurance Factor® is a numeric value generated by an internal algorithm that indicates the overall health of the flow meter and measurement. Assurance Factor® value can be used to trigger changes in screen color when the optional display is fitted to the RHE28 (White – Amber – Blue – Red), providing highly visible wide area condition indication.



WHITE

Normal Operation

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



AMBER

Operation Not Optimal

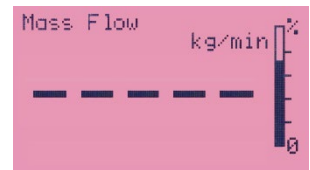
Sensor subject to noise / changing conditions in pipe. Measurement quality may be compromised



BLUE

Operation at Limit

Sensor experiencing disturbance. Measurement quality compromised



RED

Measurement Failure

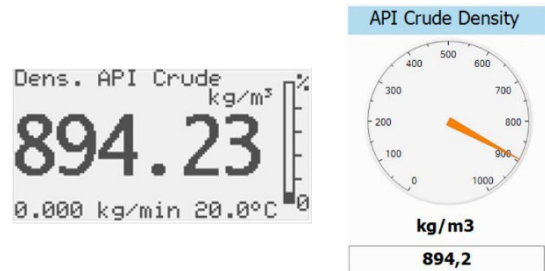
Sensor experiencing extreme disturbance / meter in fault. Measurement offline

Oil and Gas Function Package (Part Number Code GV)

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 know 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.

NET OIL



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.

Data View/Monitoring			
Address	Name	Value	Unit
0x480C	VolPercentMainSubstance	53,96152	%

Fluid Transfer Package (Part Number Code CT)

The 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 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.



Power Supply Options

The RHE28 can be configured with one of three power supply options:

- Universal AC Power - 100-240 VAC $\pm 10\%$ (48 to 62 Hz) (Part Number Code A1)
- Wide Tolerance DC Power - 12-24 VDC $\pm 10\%$, 4W (Part Number Code D1)
- Dual Supply - 100-240 VAC $\pm 10\%$ (48 to 62 Hz) / 12-24 VDC $\pm 10\%$, 4W (Part Number Code U1)
This unique option provides inputs for simultaneous connection of both a universal AC and separate DC supply. The transmitter utilizes AC power when available but will switch to the DC supply in the event of AC power outage. The DC supply can be a battery source. As an example, an RHE27 transmitter and connected sensor will operate for 10 days or more on a typical automobile battery.

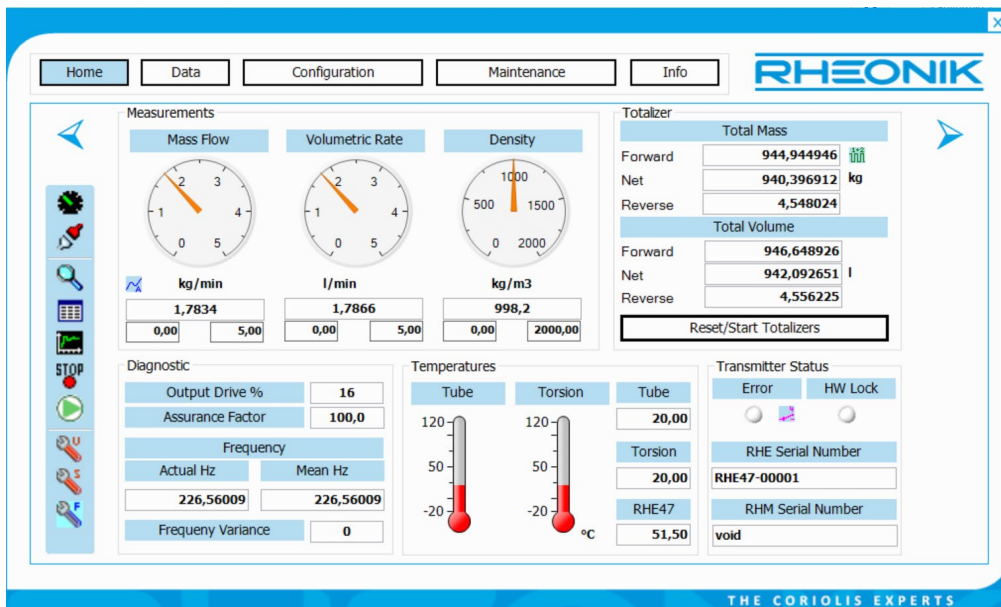
Program Package Function Summary

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

RHECom Software

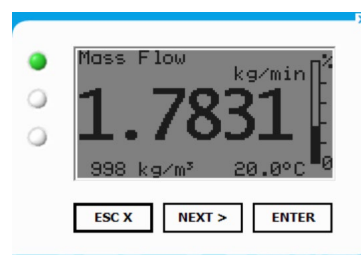
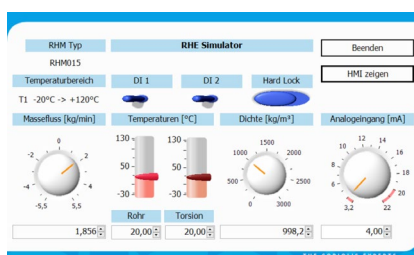
The RHE28 transmitter is a fully featured device with many sophisticated functions and configuration is necessary for proper performance of these functions. RHECom software is available in three versions – Free, Pro and Pro+.

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.



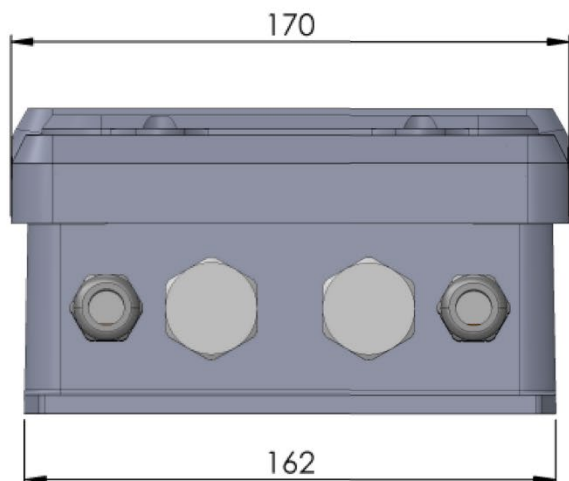
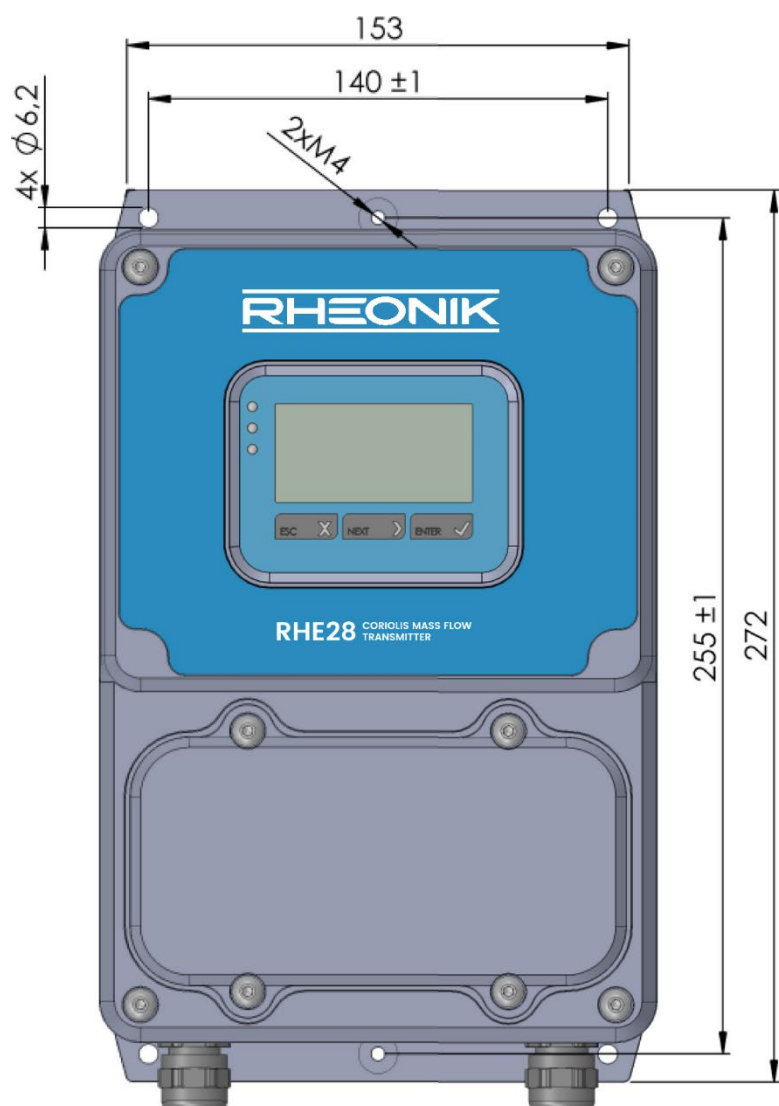
For a small one-time license fee, RHEComPro and RHEComPro+ offer additional insight and setup convenience menus. RHEComPro includes data logging, trending and broad diagnostic capabilities.

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.

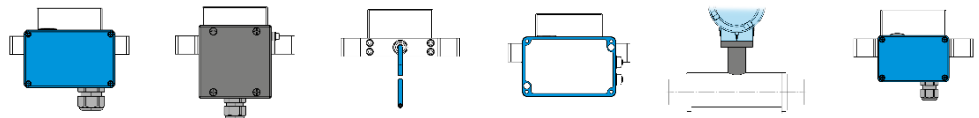
Mechanical Construction



Dimensions in mm

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.



	Order Code	JM	SM	TM	J5	C2	PM
	RHE 21	✓	✓	✓	-	-	✓
	RHE 26	✓	✓	✓	-	-	✓
	RHE 27	✓	✓	✓	-	-	✓
	RHE 28	✓	✓	✓	-	-	✓
	RHE 42	✓	✓	✓	-	✓	✓
	RHE 45	-	-	-	✓	-	-
	RHE 46	✓	✓	✓	-	-	✓

RHE 28 Part Number Code

Construction Type

- E1 Standard IP65/NEMA 4 (-20 to +60° C), 2* M16 glands, 2* M20 x 1.5 blind cover
- E2 Endurance IP66/NEMA 4 (-40 to +60° C), 2* M16 glands, 2* M20 x 1.5 blind cover

Supply Voltage

- D1 12 to 24 VDC (+/- 10%)
- A1 100 to 240 VAC (48 to 62 Hz)
- U1 12 to 24 VDC (+/- 10%) and/or 100 to 240 VAC (48 to 62 Hz)

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® Function (AF)
- GV Enhanced OP system plus AF and API std. Vol. and Net Oil (add CH for all functions)
- CT Enhanced OP system as GV plus hardware lock switch function

I/O Configuration

- S1 Standard One - 1*4/20mA (a/p), 2*DO (Pulse/Freq/Status), 1*DI, RS485 (Modbus)
- S2 Standard Two - 2*4/20mA (a/p), 2*Pulse/Freq, 2*DO, 2*DI, RS485 (Modbus)
- SH HART - as Standard Two plus HART
- CH Premium - as Standard Two plus HART and analogue input

Hazardous Area Certifications (details see page 15)

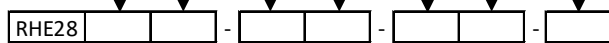
- NN Without - RHM and RHE in ordinary locations
- AS ATEX/IECEX approval Ex II (1)G [Ex ia Ga] IIC - RHE in ordinary locations
- AB ATEX/IECEX Ex II 3(1)G Ex nA [ia Ga] IIB T4 Gc - RHE in zone 2 (excl. H2, acetylene)
- A2 ATEX/IECEX Ex II 3(1)G Ex nA [ia Ga] IIC T4 Gc - RHE in zone 2 (incl. H2, acetylene)
- CS cCSAus Class I, Associated Equipment [Ex ia Ga] - RHE in ordinary locations
- CB cCSAus Class I, Div. 2, Groups C,D - RHE in division 2 (excl. H2, acetylene)
- C2 cCSAus Class I, Div. 2, Groups A,B,C,D - RHE in division 2 (incl. H2, acetylene)

Performance Certification

- NN Without
- MH OIML R137 approval incl. special labelling and docu. - requires hardware lock switch
- R9 OIML R139 approval incl. special labelling and docu. - requires hardware lock switch

Options for RHE28

- NNN Without
- NNH Hardware lock switch function



Options and Accessories

Part Number	Description
	Construction Type E1, E2 (aluminum terminal box) - only with two M16 glands Ex e (no options available) Construction Type E3, E4, EP, E5, H3 (SS316 terminal box) - M16 glands Ex e, others optional Construction Type H1, H2, H3 - power supply and I/O only via 1/2" NPT cable entries
ORHE28-E1	1/2" NPT cable entries (instead of M20 x 1.5) plus sealing plugs for M16 glands
ORHE28-E4	Sealing plugs for M16 glands
ORHE-SI	Pre-setting of pulse, analog outputs according to setting instructions.
ARHE11/21/28-HS	Bracket for pipe mounting (max.D=50mm / 2") in stainless steel
ARHE11/21/28-H6	Bracket for pipe mounting (max.D=50mm / 2") in SS316

General Options

Part Number	Description
ARHE-C4	Standard sensor cable, halogen free, -50 to +105°C, 9 wires - not for RHE16
ARHE-C6	Steel armoured sensor cable, halogen free, -50 to +105°C, 9 wires - not for RHE16
ARHE-P3	3m pre-assembled C4 cable (cable ends ready for connection terminals) - not for RHE16
ARHE-P0	10m pre-assembled C4 cable (cable ends ready for connection terminals) - not for RHE16
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-TC	Complete labelling (type information, TAG, Ex label) in Stainless Steel
MAN-	Additional RHE manual printout

Hazardous Area Certifications

Code	Zone / Division	Approval	Labeling
A2	Zone 2	ATEX IECEX	II 3(1)G Ex nA [ia Ga] IIC T4 Gc Ex nA [ia Ga] IIC T4 Gc
AB	Zone 2	ATEX IECEX	II 3(1)G Ex nA [ia Ga] IIB T4 Gc Ex nA [ia Ga] IIB T4 Gc
AS	safe area	ATEX IECEX	II (1)G [Ex ia Ga] IIC [Ex ia Ga] IIC
C2	Div 2, Zone 2	USA Canada	Class I, Div2, Zone 2, AEx nA [ia Ga] IIC T4 Gc; Ex nA [ia Ga] IIC T4 Gc
CS	safe area	USA Canada	[Ex ia] [Ex ia Ga] IIC



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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