

TRICOR CORIOLIS MASS FLOW METERS



ADDITIONAL OPTIONS

- Net oil software
- High pressure designs available up to 345 bar/15,000 PSI
- Integrated pressure compensation
- Customizable installation length and process connections
- Extended warranty and startup program



▶ TECHNICAL SPECIFICATIONS

TEMPERATURE

Temperature Repeatability	±0.36°F (±0.2°C)	
Temperature Accuracy	±1.8°F ±0.5 % of reading (±1°C ±0.5 % of reading)	
	40°F +212°F (-40°C +100°C) (standard)	
Process Temperature (Non Ex)	-40°F +302°F (-40°C +150°C) (optional)	
	-76°F +392°F (-60°C +200°C) (optional)	
	meter mount -40°F +158°F (-40°C +70°C) (T4) (n/a for the TCM 230K)	
Process Tomporature (Ev)	remote version -40°F +158°F (-40°C +70°C) (T4)	
Process Temperature (Ex)	-40°F +275°F (-40°C +135°C) (T3)	
	-76°F +392°F (-60°C +200°C) (T2)	
Ambient Temperature	-40°F +158°F (-40°C +70°C)	
Storage Temperature	-40°F +212°F (-40°C +100°C)	

PROCESS CONNECTIONS

Model Number	Process Connections	Max. Pressure Standard (option)	Pressure Drop at Max. Flow
TCM 0100	1/4" NPT, 1/2" NPT, 1/4" tube compression	345 bar/5000 psi standard	1 bar at 1/2 max flow rate with water
TCM 0325	female thread 1/2" adaptors for flanges, dairy and tri-clamp	200 bar/2900 psi (345 bar/5000 psi)	For detailed information please contact us.
TCMH 0450	3/8" Autoclave (MP), other connections available	1050 bar (15,200 psi)	
TCM 0650	female thread 1/2" adaptors for	200 bar/2900 psi	
TCM 1550	flanges, dairy and tri-clamp	(345 bar/5000 psi)	
TCM 3100			
TCM 5500	flanges EN1092, ANSI B16.5,		
TCM 7900	DIN2512, tri-clamp	100 bar/1450 psi	
TCM 028K			
TCM 065K			
TCM 230K			

Remote Electrical Connections	Screw type and spring type terminals
Meter Mount Electrical Connections	None (internally connected to the electronics)
Ingress Protection	IP65 (IP66/IP67 on request)





HAZARDOUS AREA CLASSIFICATIONS

Designed to meet ratings and/or certifications specified. CSA/cUS Hazardous Area - US & Canada

ATEX

IEC Ex

TR (EAC)









EX CERTIFICATIONS

ATEX (Ex)

Zone 1: Group IIC or IIB, T2-T4

ATEX (Exn)

Zone 2: II 3G Ex nA IIC T2-T4 Gc

IECEx (Ex)

Zone 1: Group IIC or IIB, T2-T4

cCSAus (Ex1)⁴

Class 1, Division 1: Group A, B, C, D or C, D, T2-T4

ATEX + IECEx + cCSAus Triple Approval (Ex3)^{4,5}

Zone 1: Group IIC or IIB, T2-T4 and

Class 1, Division 1: Group A, B, C, D or C, D, T2-T4

EAC (TR-CU)

Group IIC or IIB, T2-T4

⁴⁾ For cCSAus and triple Ex-approval the Ex-approvals for remote electronics in 1.4404/316L is pending.

⁵⁾ Only with remote electronics



► TECHNICAL DATA FOR LIQUIDS

FLOW RATE FOR LIQUIDS

Model Number	Max. Flow (water) (Lbs/Min)		Basic Accuracy (% o.r.)	Zero Stability (% f.s.)	Repeatability (% o.r)
TCM 0100	1.84	50	±0.2	±0.02	±0.1
TCM 0325	12	325	±0.1	±0.1	±0.05
TCMH 0450**	6.6	180	±0.2	±0.012	±0.1
TCM 0650	24	650	±0.1	± 0.01	±0.05
TCM 1550	57	1550			
TCM 3100	114	3100			
TCM 5500	202	5500			
TCM 7900	290	7900			
TCM 028K	1029	28000			
TCM 065K	2388	65000			
TCM 230K	8450	230000			

Density Measuring Range Density Accuracy		Density Repeatability
0 - 2500 kg/m³, 2.5 g/cm3	±1.0 kg/m3 , ±0.001 g/cm3	±0.5 kg/m3, ±0.0005 g/cm3
(higher ranges on request)	(special calibration on request)	±0.3 kg/1113, ±0.0003 g/C1113

GENERAL

Model Number	Internal Tube Diameter (in) (mm)		Tube Arrangement	Tube Material	Housing Material
TCM 0100	0.06"	1.52 mm	2 parallel	316Ll 1.4404/AISI	316L 1.4404/AISI
TCM 0325	0.157"	4 mm*	2 serial	316L 1.4404/AISI	316L 1.4404/AISI
TCMH 0450	0.095"	2.40 mm	2 parallel		
TCM 0650	0.157"	4 mm	2 parallel		
TCM 1550	0.315"	8 mm*	2 serial		
TCM 3100	0.315"	0.315" 8 mm			
TCM 5500	0.276" 7 mm		2 parallel		
TCM 7900	0.354"	9 mm	2 parallel		
TCM 028K	0.630"	16 mm	2 parallel		1.4301/AISI 304
TCM 065K	1.1"	28 mm	2 parallel		Optional: 1.4404/AISI 316L
TCM 230K	1.693"	43 mm	2 parallel		316L 1.4404/AISI

^{*}Double loop design.

Calibration for Liquids and Gases:

The TRICOR flowmeters are always factory calibrated with water.

Calibration Conditions: Water: 68°F ... 77°F (20°C ... 25°C), ambient temperature: 68°F ... 77°F (20°C ... 25°C)

All specifications are based on above mentioned calibration reference conditions, a flow calibration protocol is attached to each instrument.

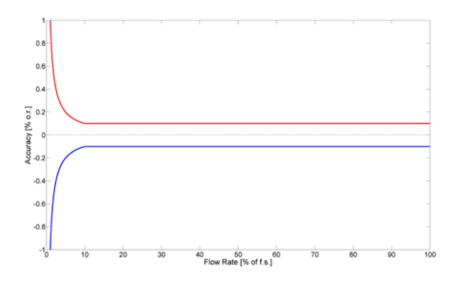
Stated accuracy combines the effects of repeatability, linearity and hysteresis.

Typical flow dynamics based on max. flow rate is 100:1.

^{** @ 1} cSt



ACCURACY FOR LIQUIDS



Flow Rate of full Scale	Accuracy
>10%	± Base Accuracy
<10%	± Zero Point Measured Value * 100

Example for a TCM 0325:

325 kg/h * Zero Point (0.01 %) = 0.0325 kg/h 325 kg/h * Basic Accuracy (0.1 %) = 0.325 kg/hResult: (0.0325 / 0.325) * 100 = 10 % (32.5 kg/h)

12 lb/min * 0.5 % = 0.012 lb/min 12 lb/min * 0.01 % = 0.0012 lb/min (0.0012 / 0.012) * 100 = 10 % (1.2 lb/min)

All flow rates ≥ 10 % or 32.5 kg/h (1.2 lb/min): Measured error = Basic Accuracy All flow rates < 10 % or 32.5 kg/h (1.2 lb/min): Measured error = (Zero Point / Measured Value) * 100



► TECHNICAL DATA FOR GASES

FLOW RATE FOR GASES

Model		Normal Flow Rate				Basic Accuracy	Repeatability
Number	(kg/h) ^{1,3}	(lbs/min)	(nm³/h)	(SCFM) ^{1,2}	kg/h (lb/min)	(% o.r.)	(% o.r.)
TCM 0100	22	0.82	70	11	0.01 (0.0037)	±0.25	±0.1
TCM 0325	78	3	109	64	0.0325 (0.0012)	±0.5	±0.25
TCMH 0450	394	14.5	549	320	0.45 (0.0165)	±1.0	±0.5
TCM 0650	177	7	247	146	0.065 (0.0024)	±0.5	±0.25
TCM 1550	333	12	464	273	0.155 (0.0057)		
TCM 3100	740	27	1031	607	0.31 (0.0114)		
TCM 5500	910	34	1268	747	0.55 (0.020)		
TCM 7900	1430	53	1993	1173	0.79 (0.029)		
TCM 028K	5100	188	7109	4184	2.8 (0.103)		
TCM 065K	15650	575	21813	12838	6.5 (0.029)		
TCM 230K	48900	1797	68157	40115	23 (0.845)		

Density Measuring Range	Density Accuracy	Density Repeatability	
See comment ³⁾	±2.0 kg/m3, ±0.002 g/cm3 (special calibration on request)	±1 kg/m3, ±0.001 g/cm3	

GENERAL

Model Number	Internal Tube Diameter (in) (mm)		Tube Arrangement	Tube Material	Housing Material
TCM 0100	0.06"	1.52 mm	2 parallel	316LI 1.4404/AISI	316L 1.4404/AISI
TCM 0325	0.157"	4 mm*	2 serial	316L 1.4404/AISI	316L 1.4404/AISI
TCMH 0450	0.095"	2.40 mm	2 parallel		
TCM 0650	0.157"	4 mm	2 parallel		
TCM 1550	0.315"	8 mm*	2 serial		
TCM 3100	0.315"	8 mm	2 parallel		
TCM 5500	0.276"	7 mm	2 parallel		
TCM 7900	0.354"	9 mm	2 parallel		
TCM 028K	0.630"	16 mm	2 parallel		1.4301/AISI 304
TCM 065K	1.1"	28 mm	2 parallel		Optional: 1.4404/AISI 316L
TCM 230K	1.693"	43 mm	2 parallel		316L 1.4404/AISI

^{*}Double loop design.

Max. allowed flow velocity (Ma 0.5)

For gas applications, flow rate and pressure drop for individual sensor sizes are dependent on operating temperature, pressure and fluid composition.

Therefore, when selecting a sensor for any particular gas application, please use the TSP (TRICOR Sizing Program) or contact us.

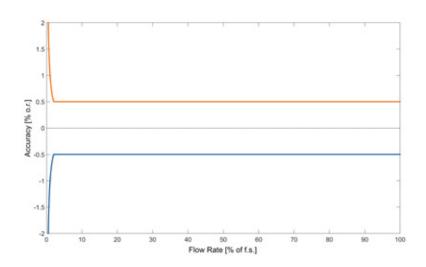
¹⁾ Nominal flow rates that produce approximately 3 bar (43 psi) pressure drop for natural gas at 50 bar (725 psi) operational pressure.

²⁾ Normal reference conditions (Nm3/h) are 1.013 bar and 0°C. Standard (SCFM) reference conditions are 14.7 psi and 60°F.

³⁾ Flow rate and density range depend on the gas density and the pressure range.



ACCURACY FOR GASES



Flow Rate of full Scale	Accuracy
>10%	± Base Accuracy
<10%	± Zero Point Measured Value * 100

Analogous to calculation for liquids.

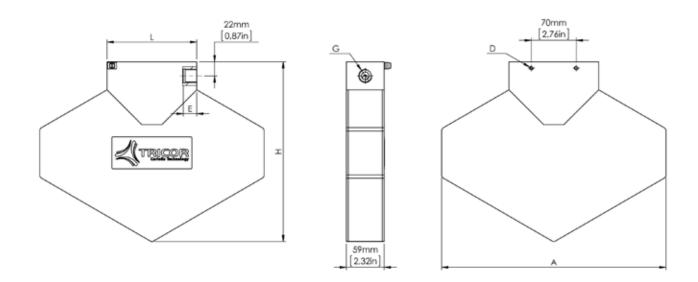
Only the basic accuracy value (% o. r.) is deviant from the calculation for liquids.

Example for a TCM 0325: 325 kg/h * Zero Point (0.01 %)= 0.0325 kg/h 325 kg/h * Basic Accuracy (0.5 %) = 1.6325 kg/h Result: (0.0325 / 1.6325) * 100 = 2 % (6.5 kg/h) 12 lb/min * 0.01 % = 0.0012 lb/min 12 lb/min * 0.5 % = 0.06 lb/min (0.0012 / 0.06) * 100 = 2% (0.24 lb/min)

All flow rates ≥ 2 % or 6.5 kg/h (0.24 lb/min): Measured error = Basic Accuracy All flow rates < 2 % or 6.5 kg/h (0.24 lb/min): Measured error = (Zero Point / Measured Value) * 100



TCM 0325 TO TCM 3100



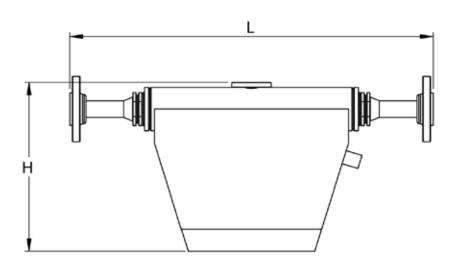
Sensor Type	Α	С	D	Е	Н	L*	G**
TCM 0225	8.43 in	6.30 in	M6 v 1 O	0.59 in	7.17 in	4.33 in	G ½"
TCM 0325	(214 mm)	(160 mm)) mm) M6 x 1.0 (15	(15 mm)	(182 mm)	(110 mm)	G //2
TCM OGEO	8.43 in 6.30 in M6 x 1.0	0.59 in	7.17 in	4.33 in	G ½"		
TCM 0650	(214 mm)	(160 mm)	1VIO X 1.U	(15 mm)	(182 mm)	(110 mm)	G /2
TCM 1FFO	13.78 in	10.16 in	N/C / 1 O	0.71 in	11.02 in	5.51 in	G ½"
TCM 1550	(350 mm)	(258 mm)	M6 x 1.0	(18 mm)	(280 mm)	(140 mm)	G /2
TCM 3100	13.78 in	10.16 in	M6 v 1 O	0.71 in	11.02 in	5.51 in	G ½"
	(350 mm)	(258 mm)	M6 x 1.0	(18 mm)	(280 mm)	(140 mm)	G //2

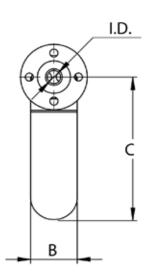
^{*} Other connections on request

^{**} Further lengths on request



TCM 5500 TO TCM 065K



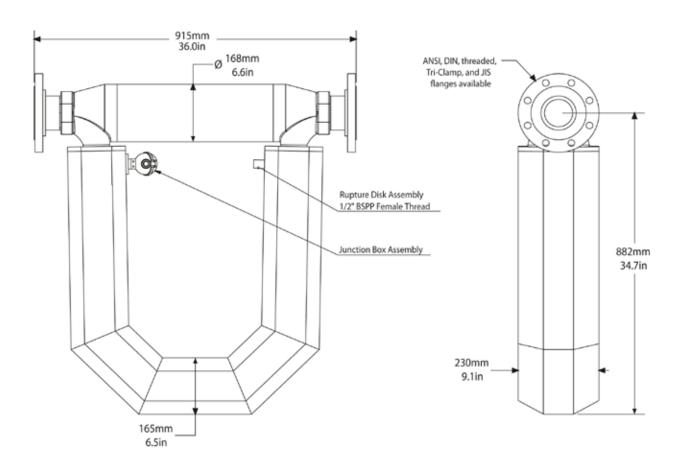


Sensor Type	В	С	Н	L*	I.D.	Connection
TCM 5500	2.40 in	8.03 in	10.24 in	18.11 in	Ø 0.51 in	on request
	(61 mm)	(204 mm)	(260 mm)	(460 mm)	(Ø 13 mm)	
TCM 7900	2.40 in	8.03 in	10.24 in	18.11 in	Ø 0.51 in	on request
	(61 mm)	(204 mm)	(260 mm)	(460 mm)	(Ø 13 mm)	
TCM 028K	3.15 in	9.96 in	12.40 in	24.61 in	Ø 0.91 in	on request
	(80 mm)	(253 mm)	(315 mm)	(625 mm)	(Ø 23 mm)	on request
TCM 065K	5.94 in	15.24 in	18.90 in	32.68 in	Ø 1.57 in	on request
	(151 mm)	(387 mm)	(480 mm)	(830 mm)	(Ø 40 mm)	on request

^{*} Other connections on request

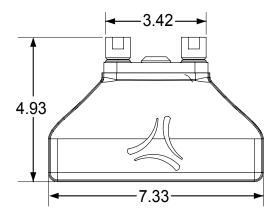


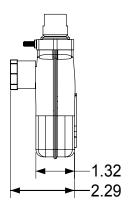
TCM 230K





TCM 0100









ELECTRONICS

FEATURES TCE 8000/8100 TRANSMITTER

The TCE-8000 electronic transmitters come in 3 different mounting options:

Meter Mount

Wall Mount

Panel Mount

Display: Graphic, 132 x 32 dot

Supply voltage: 24 V DC (±20%) or 90-264 V (version dependent) **Programming:** via front keyboard or Windows-based TRICOR

configurator program (MODBUS)

Interface: RS485 (MODBUS-RTU), Option HART®, other options

on request

EMC: according to EN 61000-6-4 and 61000-6-2

Power consumption: max. 6 W

TECHNICAL DATA - TCE 8000/8100 TRANSMITTER

Analog Output			
2 Current Outputs	4-20 mA passive, two-wire isolated		
Resolution	14 bit		
Linearity	+0.05% of full scale		
Temperature Drift	0.05% per 10K		
Load	< 620 Ohm (at 24 V supply)		
Output Value	programmable: flow, total, density, temperature		

Pulse Output:		
Frequency Range	0.5 - 10,000 Hz	
Output Signal	Active push-pull output for flow rate	

Status In- and Output:			
Status Output	push pull programmable TOTAL		
	mode: 0.5-100 Hz; FREQUENCY		
	mode: 0.5-10,000 Hz)		
Control Input	programmable		

Analog Input (option)		
Input Type	4-20 mA active for two-wire passive pressure sensor	
Resolution	12 bit	
Linearity	±0.05 % of full scale	
Temperature Drift	0.05 % per 10 K	
Supply Voltage	> 20 V (at 20 mA sensor current)	

TRICOR FLOW METERS - LOW FLOW RANGES

TRICOR's Diamond Shape Coriolis Mass Flow Meters range in flow rate from 325 to 3100 kg/hr (12 lb/min) and withstand pressures up to 2900 psi (200 bar). The diamond shape (D-shape) tube design has the best overall performance of any Coriolis tube shape. The mechanical advantages of this design include the best signal-to-noise ratio and reduced effects of external vibrations, thus improving zero stability. Each meter is mechanically balanced to ensure the best in class density measurement and overall performance.

TCM 0325

Mass Flow Rate (max): 325 kg/h, 12 lb/min

Volumetric Flow Rate (max): 325 l/h, 1.31 gpm, 49 bbl/d

Standard Pressure Rating: up to 200 bar, 2900 psi

Nominal Meter Size: DN4, 1/8"



TCM 0650

Mass Flow Rate (max): 650kg/h, 24 lb/min

Volumetric Flow Rate (max): 650 l/h, 2.64 gpm, 98 bbl/d

Standard Pressure Rating: up to 200 bar, 2900 psi

Nominal Meter Size: DN4, 1/8"



TCM 1550

Mass Flow Rate (max): 1550 kg/h, 57 lb/min

Volumetric Flow Rate (max): 1550 l/h, 6.59 gpm, 234 bbl/d

Standard Pressure Rating: up to 200 bar, 2900 psi

Nominal Meter Size: DN6, 1/4"



TCM 3100

Mass Flow Rate (max): 3100 kg/h, 114 lb/min

Volumetric Flow Rate (max): 3100 l/h, 13.19 gpm, 467 bbl/d

Standard Pressure Rating: up to 200 bar, 2900 psi

Nominal Meter Size: DN6, 1/4"

TRICOR FLOW METERS - MID & HIGH FLOW RANGES

TRICOR's U-Shape Coriolis Mass Flow Meters range in flow rate from 5500 to 230,000 kg/hr and withstand pressures up to 1450 psi (100 bar). The TCM 5500 is rated at a maximum pressure of 5,000 psi (345 bar). These meters have good overall accuracy, zero stability, and pressure drop. The simple self-draining U-shape tube design provides for easy cleaning/flushing.



TCM 5500

Mass Flow Rate (max): 5500 kg/h, 202 lb/min

Volumetric Flow Rate (max): 5500 l/h, 24.3 gpm, 830 bbl/d

Standard Pressure Rating: up to 345 bar, 5,000 psi

Nominal Meter Size: DN15, 1/2"



TCM 7900

Mass Flow Rate (max): 7900 kg/h, 290 lb/min

Volumetric Flow Rate (max): 7900 l/h, 34.8 gpm, 1190 bbl/d

Standard Pressure Rating: up to 100 bar, 1450 psi

Nominal Meter Size: DN15, 1/2"



TCM 028K

Mass Flow Rate (max): 28000 kg/h, 1029 lb/min

Volumetric Flow Rate (max): 28000 l/h, 126.6 gpm, 4226 bbl/d

Standard Pressure Rating: up to 100 bar, 1450 psi

Nominal Meter Size: DN25 / 1"



TCM 065K

Mass Flow Rate (max): 65000 kg/h, 2388 lb/min

Volumetric Flow Rate (max): 65000 l/h, 288 gpm, 9812 bbl/d

Standard Pressure Rating: up to 100 bar, 1450 psi

Nominal Meter Size: DN50, 2"



TCM 230K

Mass Flow Rate (max): 230000 kg/h, 8450 lb/min

Volumetric Flow Rate (max): 230000 l/h, 1012 gpm, 34700 bbl/d

Standard Pressure Rating: up to 100 bar, 1450 psi

Nominal Meter Size: DN80, 3"

TRICOR FLOW METERS - SPECIALITY METERS



TCM 0100

The MicroTRICOR TCM 0100 Low Flow Coriolis Mass Meter can accurately measure low flows down to 5 cc/min, which makes it ideal for dosing, blending and batching applications such as chemical injection and precision painting/coating, as well as batch processing. The unique compact dual tube design provides for a more balanced system with greater resistance to external vibration and pulsing flow.

Mass Flow Rate (max): 50 kg/h, 1.84 lb/min Volumetric Flow Rate (max): 50 l/h, 0.22 gpm Standard Pressure Rating: up to 350 bar, 5,000 psi

Nominal Meter Size: 1/16"



TCMH 0450

The TCMH 0450 is TRICOR's High Pressure Coriolis Mass Flow Meter, offered in three pressure ratings: 6,000 psi, 10,000 psi or 15,200 psi. The material choices for the U-shape tubes are either 316 stainless steel for chemical injection applications or Sandvik® Alloy HP 160, chosen to eliminate hydrogen embrittlement, such as in Hydrogen fueling stations.

Technical Specifications for Liquids:

Nom. Flow Rates: (@850 kg/m3, Pressure Drop Max. 2 bar):

- 180 kg/h @ 1 cSt, 6.6 lb/min @ 1 cSt
- 150 kg/h @ 10 cSt, 5.5 lb/min @ 10cSt
- 65 kg/h @ 30 cSt, 2.4 lb/min @30 cSt

Standard Pressure Rating:

• TCMH 0450-HC- SPOS: 1050 bar, 15,200 psi

• TCMH 0450-HC-SROS: 690 bar, 10,000 psi

• TCMH 0450-HC-SSOS: 414 bar, 6000 psi

Connection: 3/8" Autoclave (MP)

Technical Specifications for Gases:

Nom. Flow Rates: (@ 20°C air, pressure drop 10 bar):

- 394 kg/h @ 1050 bar, 14.5 lb/min @ 15,200 psi
- 362 kg/h @ 690 bar, 13.3 /min @ 10,000 psi
- 316 kg/h @ 414 bar, 11.6 lb/min @ 6000 psi

Nom. Flow Rates: (@ 20°C H2, pressure drop 50 bar):

- 254 kg/h @ 1050 bar, 9.30 lb/min @ 15,200 psi
- 240 kg/h @ 875 bar, 8.80 lb/min @ 12690 psi
- 222 kg/h @690 bar, 8.15 lb/min @ 10,000 psi
- 184 kg/h @ 414. bar, 6.75 lb/min @ 6000 psi

Standard Pressure Rating: up to 1050 bar, 15,200 psi

Connection: 3/8" Autoclave (MP), other connections available

TRICOR FLOW METERS - FLOW TRANSMITTERS & REMOTE DISPLAY

TCE 8000 ELECTRONICS

The multi-variable TCE 8000 Series of Mass Flow Transmitters from TRICOR outputs flow rate, flow total, density or temperature data. The TCE 8000 transmitters are also offered in a variety of mounting styles, including local mount, panel mount, and wall mount; as well as multiple outputs and interfaces to choose from. These transmitters are certified for use in hazardous areas: cCSAus, ATEX, IECEx, and EAC (TR-CU). Optional features include net oil calculations and integrated pressure compensation.

Outputs available: Analog (up to 2), Pulse/Frequency (0.5 -10,000 Hz), Status

Programmable control inputs

Interfaces available: RS485, HART®, Foundation Fieldbus

LCD Display

Hazardous area approvals: ATEX, IECEx, cCSAus

TCE 8000 Meter Mount



TCE 8000 Wall Mount









TCE 8501

The TCE 8501 Mass Flow Transmitter from TRICOR incorporates patented digital signal processing (DSP) that allow for continuous 2-phase measurement, partially empty tube conditions, startfrom-empty batching, online flow sensor verification, and online pressure compensation.

Outputs available:

- Analog current output and alarm
- Frequency or scaled pulse output
- Contact output

Programmable control inputs

Interfaces available: HART®, Modbus

LCD Display

Hazardous area approvals: ATEX, IECEx, cCSAus

Other approvals: CE



TCE 6000

The TCE 6000 Mass Flow Transmitter is ready for ESTA applications. Outputs available include Analog current output, pulse/frequency output (0.5 to 10,000 Hz), and status output. Choose from either RS485 or HART® interfaces. It works with the TRD 8001 Remote Display.

Outputs available:

- Analog current output
- Pulse/frequency output (0.5-10000 Hz)
- Status output

Programmable control inputs

Interfaces available: RS485, HART®





The TRD 8001 Coriolis Flow Remote Display was designed for applications where a display is needed further away from the meter than is possible with the TCE 8000 electronics, which only go up to 3280 feet (1000 meters). It features a flame retardant plastic housing with a back-lit LCD screen and front programming buttons.

Display: Back-lit LCD screen, 132x132 dot

Supply Voltage: Via interface Interface to TCE: RS485

Electrical Connections: Connectors M12, B coded

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