TECFLUID
the art of measuring

# Turbine flowmeters
## Series TM

- Suitable for liquids
- Possibility of installation in all flow directions
- Special design for high pressure available
- Excellent relationship flow range / flowmeter size
- Low pressure drop
- Flow rate: 30 l/h ... 650 m³/h
- Accuracy: ±0.5% measured value
- Repeatability: ±0.1%
- Connections:
  - EN 1092-1 DN15 ... DN150 or ASME B16.5 ½" … 6" flange
  - BSP or NPT threaded connection
  - Sanitary couplings according to ISO 2852, SMS 1145, DIN 11851, TRI-CLAMP®

  Other standards on request
- Materials:
  - Body: EN 1.4404 (AISI 316L)
  - Propeller: EN 1.4057 (AISI 431), EN 1.4460 (AISI 329), EN 1.4016 (AISI 430)
  - Shaft / Bearings: Tungsten carbide / Graphite
- Optional:
  - Flow indication, local or remote
  - Volume totalizer, local or remote
  - Electronic transmitter with 4-20 mA analog output. HART and MODBUS protocols available on request
  - Volume preselection for batching applications
  - Repeater, amplifier and pulse divider
  - Relay outputs configurable as alarms
  - ATEX version. Exd protection

HART COMMUNICATION PROTOCOL

Modbus

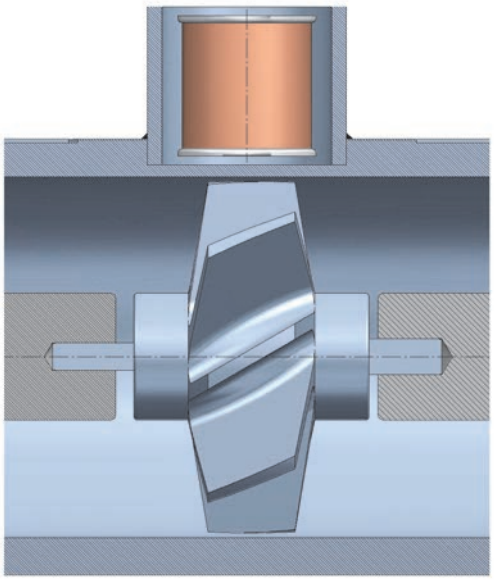
## Working principle

One helicoidal rotor turns freely inside a cylindrical tube.

The working liquid pushes the rotor blades, making them turn at a flow speed which is proportional to the flow rate.

A pick-up coil mounted externally receives the propeller turns and generates an electrical signal which, once treated by the different electronic converters, provides:

- Flow rate indication
- Total or partial volume
- Digital and analog outputs (mA, Hz and V)



## Applications

- **Chemical and petrochemical industry**
- **Tank filling and batching applications**
- **Measurement of steam condensates in boilers**
- **Burners, measurement of fuel consumption**

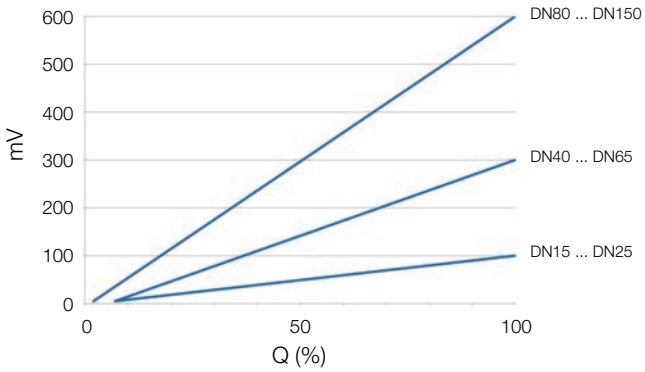
## Technical data

- **Accuracy:** ±0.5% measured value
- **Repeatability:** ±0.1%
- **Response time:** 10 ms
- **Scale range:** 10:1
- **Fluid viscosity:** up to 100 mPa·s approx.
- **Fluid temperature:** -50ºC ... +170ºC
  -30ºC ... +150ºC for G½ (A) and (B) models
- **Working pressure:**
  - G½ / DN15 … DN50: PN40
  - DN65 … DN150: PN16

  Others on request

- **Connections:**
  - EN 1092-1 DN15 ... DN150 or ASME B16.5 ½" … 6" flange
  - BSP or NPT threaded connection
  - Sanitary couplings according to ISO 2852, SMS 1145, DIN 11851, TRI-CLAMP®

  Other standards on request
- **Mounting in a horizontal or vertical pipe, and installation in all flow directions**
- **Output signal:** according to graph




Approximate output voltage (without amplifier), depending on flow rate

## Electronic converters and options

- **CP420 ... CH420:** flow rate indication, volume totalizer and 4-20 mA output, 2-wire system. Compact or remote mounted. HART protocol with model CH420
- **CIP II:** non-resettable volume totalizer, resettable partial volume totalizer. Battery powered. Compact or remote mounted
- **MT03F:** flow rate indication, volume totalizer and 2 relay outputs programmable as volume preselector for batching applications and/or alarm outputs. Pulse repeater. 4-20 mA analog output, 4-wire system. Panel mounted.
  Programmable via USB cable by means of Tecfluid S.A. Winsmeter MT03 software or by means of keyboard
- **DFD420:** pulse amplifier and frequency divider. 4-20 mA analog output, 2-wire system. Compact mounted in aluminium housing or DIN rail remote mounted.
  Programmable via USB cable by means of Tecfluid S.A. Winsmeter DFD software or by means of keyboard
- **Options:**
  - Special connector for other displays (please consult)
  - Exd version for hazardous environments

## Installation

For both horizontal or vertical pipes and installation in all flow directions (horizontal pipe is recommended for DN125 and DN150). A straight pipe run without any disturbing element (elbows, valves, filters, etc.) of 10 x DN before and 7 x DN after the turbine flowmeter is required. The upstream distance can be reduced to 5 x DN if a straightener is installed.

In order to avoid that small particles can damage the turbine propeller it is mandatory to install a filter before the flowmeter with a mesh size of 1 mm up to DN100 and 3 mm for bigger sizes.

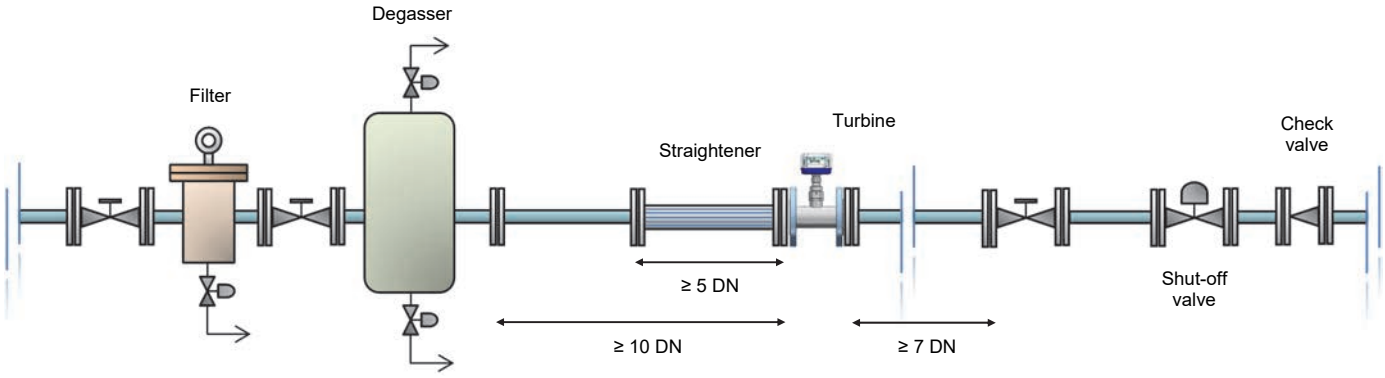
In those processes where air or gases, liquid evaporation, etc. might be present, an air/steam separator must be installed before the turbine flowmeter, in order to avoid measurement errors.

It is essential to avoid cavitation inside the turbine flowmeter. In order to do this, on the outlet of the flowmeter the pressure must be at least twice the pressure drop of the flowmeter, plus 1.25 times the vapour pressure of the liquid.

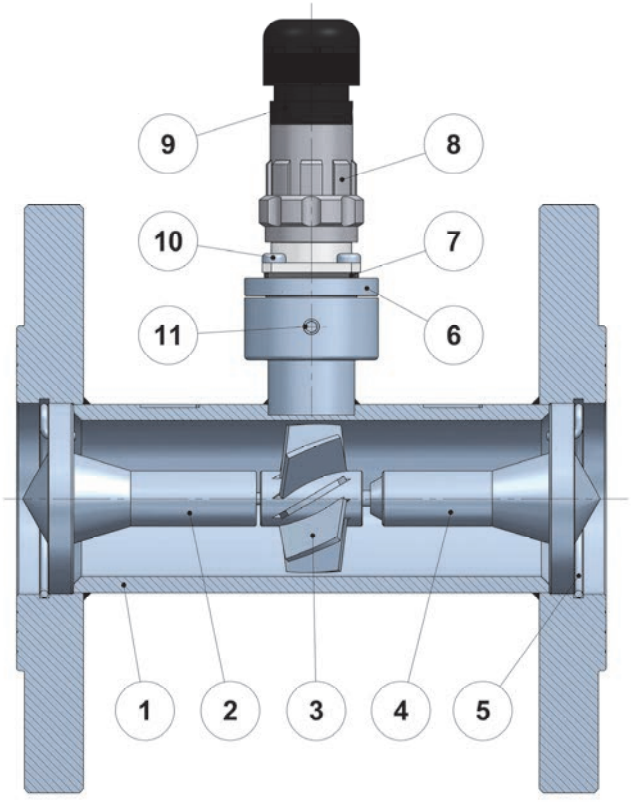
The wiring between the turbine flowmeter and the associated electronic converters must be made so that no mains or power supply cables are placed around the devices, in order to avoid picking up interferences that might affect the reading.

For an optimal signal transmission the following is recommended:

- up to 30 m, without any associated converter
- up to 3000 m, by means of CP420 … CH420 or DFD420 converters, compact mounted




## Materials



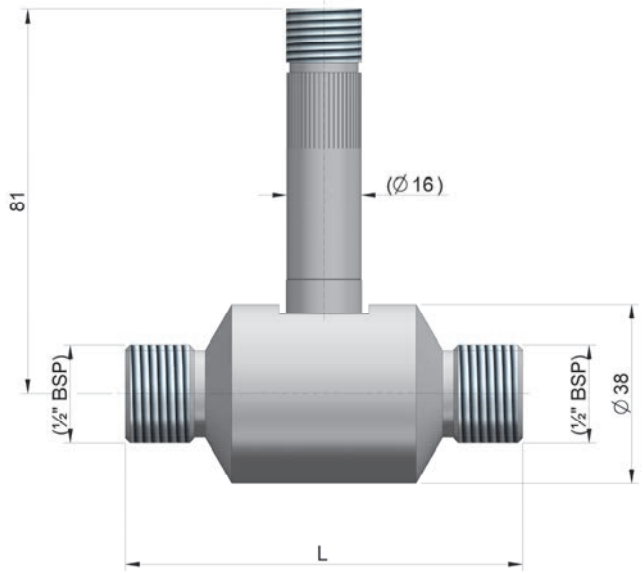

| Nº | Description | Materials |
|---|---|---|
| 1 | Measuring body | EN 1.4404 (AISI 316L) |
| 2 | Inlet deflector | EN 1.4404 (AISI 316L) + Tungsten Carbide |
| 3 | Propeller | EN 1.4057 (AISI 431) * / EN 1.4460 (AISI 329) ** / EN 1.4016 (AISI 430) *** + Tungsten Carbide + Graphite |
| 4 | Outlet deflector | EN 1.4404 (AISI 316L) + Tungsten Carbide |
| 5 | Circlip | EN 1.4310 (AISI 302) |
| 6 | Coil support | EN 1.4305 (AISI 303) |
| 7 | Gasket | NBR |
| 8 | Connector | Anodized aluminium |
| 9 | Packing gland | Plastic |
| 10 | Screw DIN 7985 M3 x 8 | EN 1.4301 (AISI 304) |
| 11 | Screw DIN 913 M4 x 8 | EN 1.4301 (AISI 304) |

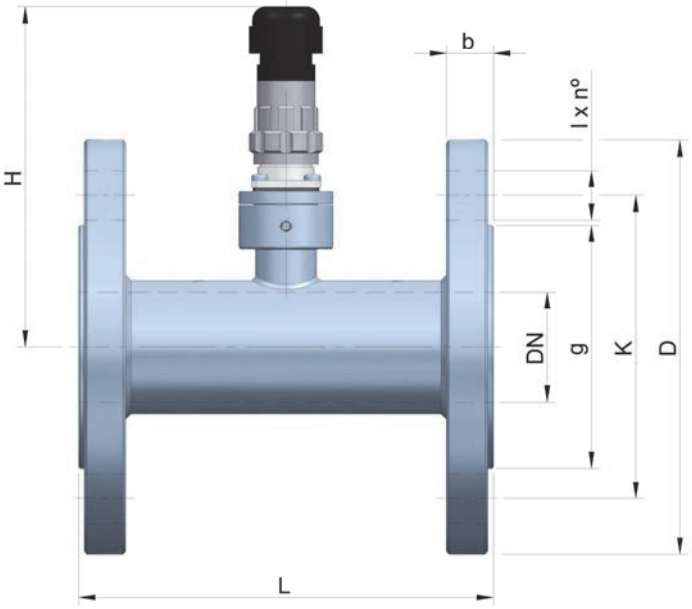
* G½ (A) and (B)

** from DN15 up to DN50 inclusive

*** from DN65 up to DN150

## Dimensions




| DN / G | PN | D | b | K | g | l x n° | L | H | Weight kg |
|---|---|---|---|---|---|---|---|---|---|
| ½" (A) | 40 | | | see above, left | | | 51 | 81 | 1 |
| ½" (B) | 40 | | | see above, left | | | 64 | 81 | 1 |
| 15 | 40 | 95 | 16 | 65 | 45 | 14 x 4 | 100 | 115 | 2 |
| 20 | 40 | 105 | 18.5 | 75 | 58 | 14 x 4 | 100 | 115 | 2.5 |
| 25 | 40 | 115 | 18 | 85 | 68 | 14 x 4 | 130 | 120 | 3.5 |
| 40 | 40 | 150 | 18.5 | 110 | 88 | 18 x 4 | 150 | 125 | 5 |
| 50 | 40 | 165 | 20 | 125 | 102 | 18 x 4 | 160 | 130 | 7 |
| 65 | 16 | 185 | 18 | 145 | 122 | 18 x 8 | 160 | 140 | 10 |
| 80 | 16 | 200 | 20 | 160 | 138 | 18 x 8 | 160 | 145 | 12 |
| 100 | 16 | 220 | 20 | 180 | 158 | 18 x 8 | 180 | 155 | 17 |
| 125 | 16 | 250 | 20.5 | 210 | 188 | 18 x 8 | 200 | 170 | 21 |
| 150 | 16 | 285 | 21 | 240 | 212 | 22 x 8 | 220 | 180 | 27 |

All dimensions in mm (L±1.5 mm)

## Flow ranges

| DN / G | Flow ranges l/h water | K factor (pulses / litre) approx. | ΔP at Qmax mbar |
|---|---|---|---|
| ½" (A) | 30-300 | 17000 | 500 |
| ½" (B) | 120-1200 | 3000 | 500 |
| 15 | 400-3000 | 730 | 750 |
| 20 | 600-6000 | 500 | 750 |
| 25 | 900-13600 | 220 | 700 |
| 40 | 1900-30000 | 60 | 560 |
| 50 | 5000-50000 | 20 | 280 |
| 65 | 9000-90000 | 10 | 240 |
| 80 | 15000-150000 | 5 | 310 |
| 100 | 28000-280000 | 3 | 450 |
| 125 | 45000-450000 | 1.5 | 240 |
| 150 | 65000-650000 | 0.8 | 250 |

The TM turbine flowmeters are calibrated with water (density 1 kg/l and viscosity 1 mPa·s).

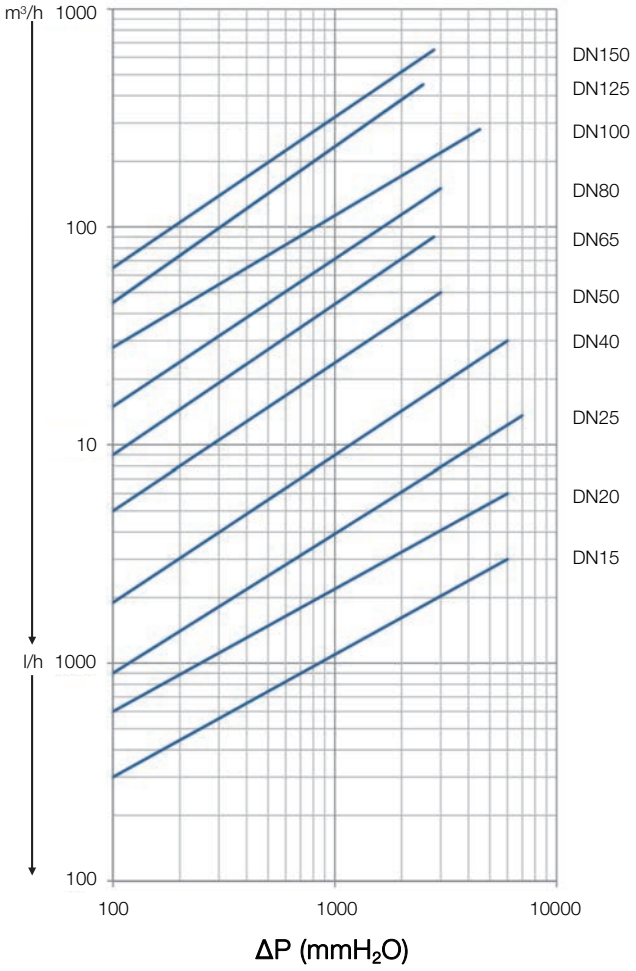
Since the K factor is not constant for all liquids, nor for the full range either, an accurate adjustment can be done by means of re-programming the K factor (pulses / litre) in the different associated converters.

In general, changes in density and viscosity affect the turbine flowmeters. The higher the density and the viscosity are, the lower the initial flow rate required is so that the propeller starts turning, that is, the lower the beginning of the flow range is. In the same way, for lower values of density and viscosity, the beginning of the flow range is higher.

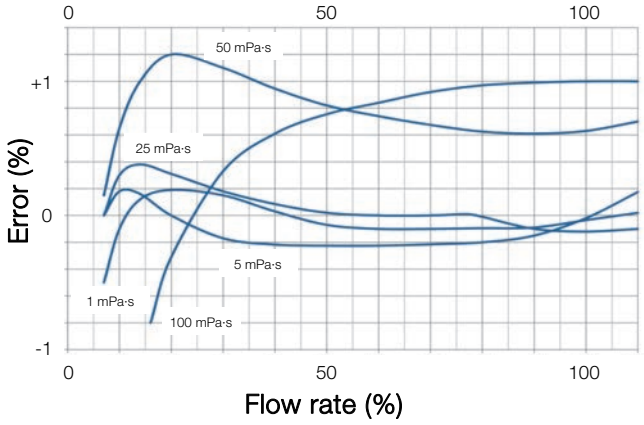
A change in viscosity can modify the K factor. The measurement error due to these changes in viscosity is approximately indicated in the curves on next page.

## Flow rate and pressure drop (ΔP) curves (graph 1)

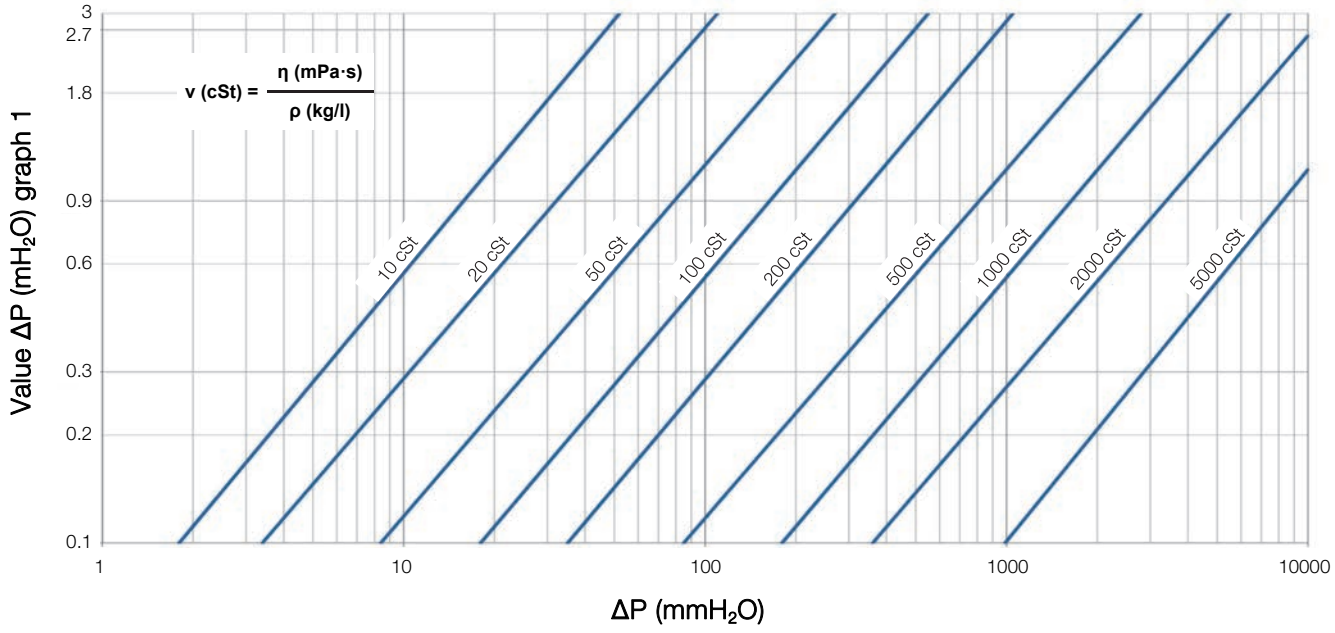
Flow rate H2O




Effect of viscosity for liquids



## Variations of pressure drop due to the effect of density and viscosity (graph 2)



## Electronic converters

### Model CP420 ... CH420

- 4-20 mA transmitter
- System:
  - Compact (CP420L ... CH420L)
  - Remote in DIN rail (CP420R ... CH420R)
- Electronics mounted in a housing with aluminium base and polycarbonate (UV resistant) cover (CP420L … CH420L)
- Power supply:
  - 2-wire, loop powered
  - Nominal voltage: 8 ... 36 VDC
  - Power consumption: ≤20 mA
- Totalizer:
  - Nº of digits: 7
  - Size of digit: 8 mm
  - Reset: by means of keyboard
- Flow rate indication:
  - Nº of digits: 5
  - Size of digit: 5 mm
- Programmable flow range
- Several selectable flow rate indication and totalizer units
- Programmable pulse / litre factor
- Ingress protection:
  - IP65 for CP420L ... CH420L
  - IP30 for CP420R ... CH420R
- Ambient temperature: -10ºC ... +60ºC
- HART protocol available with models CH420L ... R
- Optional Exd certificate (model ADF60 or ADF60V)

CP420L ... CH420L

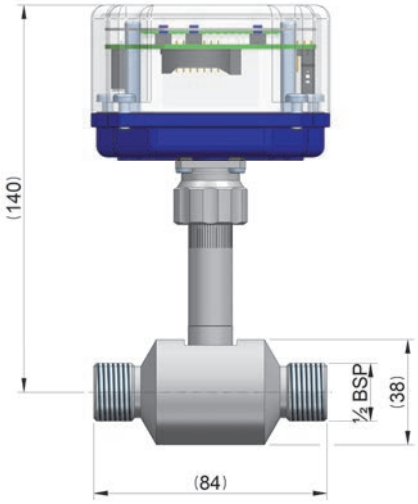
CP420R ... CH420R

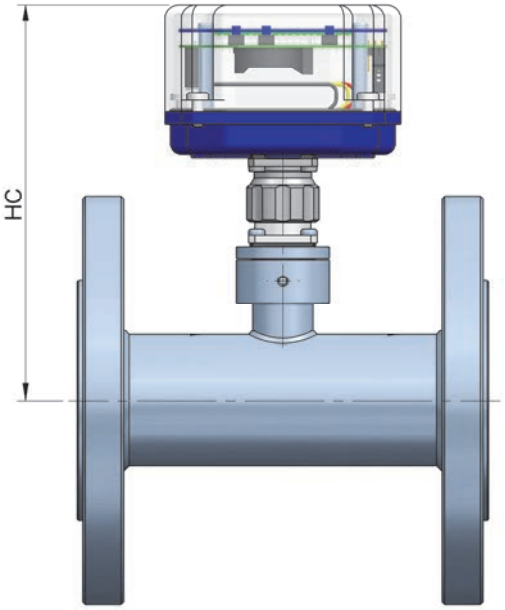
### Model CIP II

- Non-resettable totalizer and resettable partial
- Compact or remote system
- Electronics mounted in a housing with aluminium base and polycarbonate (UV resistant) cover (compact system)
- Battery powered (CR-2450):
  - Nominal voltage: 3 V
  - Load: 560 mAh
  - Power consumption: 8 µA
  - Battery life: 5 years approx.
- Totalizer:
  - Nº of digits: 7
  - Size of digit: 8 mm
- Partial totalizer:
  - Nº of digits: 5
  - Size of digit: 5 mm
  - Reset: by means of key or magnet
- Programmable pulse / litre factor
- Ingress protection: IP65
- Ambient temperature: -10ºC ... +60ºC
- Optional Exd certificate (model ADF60 or ADF60V)

TM44 with CIP II converter

## Dimensions TM44 + CIP II / CP420L ... CH420L




| DN | HC |
|---|---|
| 15 | 140 |
| 20 | 140 |
| 25 | 145 |
| 40 | 150 |
| 50 | 155 |
| 65 | 165 |
| 80 | 170 |
| 100 | 180 |
| 125 | 195 |
| 150 | 205 |

## Model DFD420

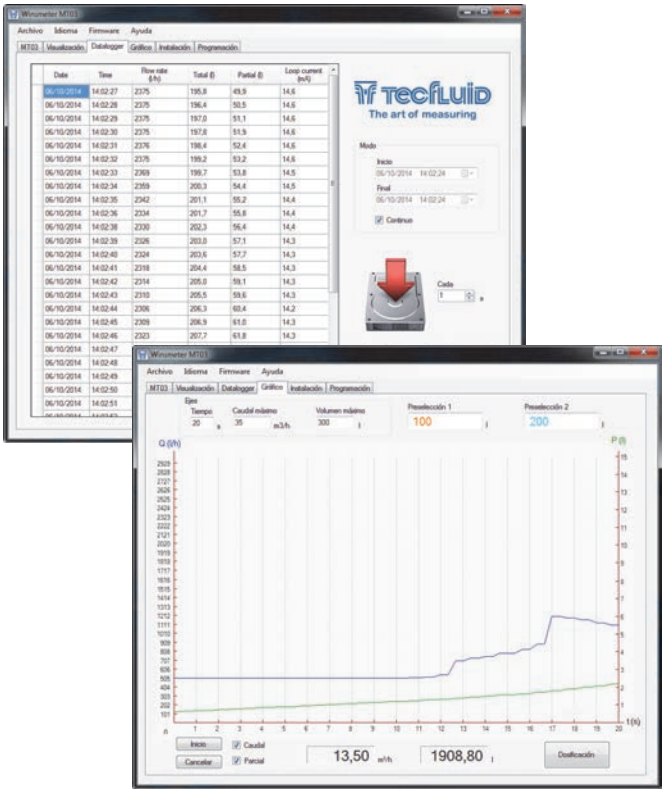
- Frequency divider and pulse amplifier
- Pulse and pick-up coil inputs
- Fully programmable via USB cable by means of Tecfluid S.A. Winsmeter DFD software
- Compact mounted in an IP68 aluminium housing or DIN 46277 rail remote mounted
- Acts as an interface between the series TM flowmeters and systems with 4-20 mA or frequency limited pulse inputs, such as some PLCs or mechanical counters.
- Power supply: 12 … 36 VDC, 2-wire system
- Power consumption: 0.8 W max.
- Possibility of 6-point linearization flow rate-frequency
- Outputs:
  - 4-20 mA analog output
  - Optoisolated pulse output max. 30 VDC
- Ingress protection: IP68 (when supplied in aluminium housing)
- Ambient temperature: -20ºC ... +85ºC
- Optional Exd certificate (model ADF40)

DFD420 converter

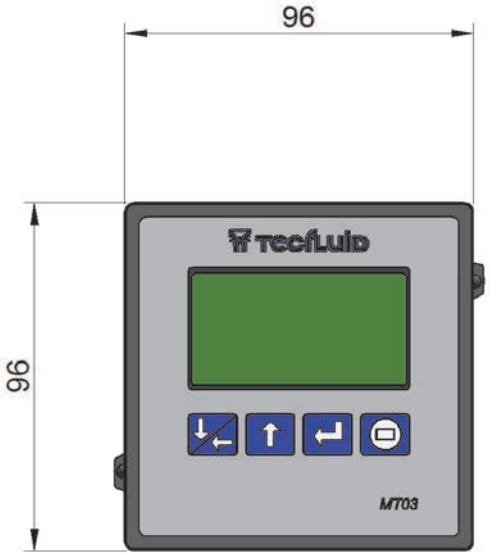
TM44 with IP68 aluminium housing and DFD420 compact converter

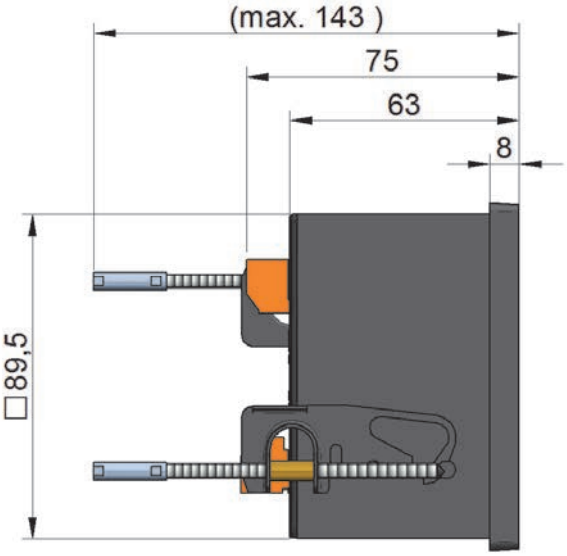
## Model MT03F

- Electronic converter
- Pulse and pick-up coil inputs
- Programmable via USB cable by means of Tecfluid S.A. Winsmeter MT03 software or by means of keyboard and graphic display with intuitive menus
- Panel mounting with dimensions 96 x 96 mm DIN 43700
- Power supply: 100 … 240 VAC 50 / 60 Hz
  18 … 36 VDC
- Full diagnosis. User selectable password protection
- Possibility of 10-point linearization flow rate-frequency
- Preselection and relay outputs for batching applications
- 5 digits local flow rate indication and 8 digits totalizer and partial totalizer. Possibility of remote reset
- Pulse output (input signal repeater)
- Programmable 4-20 mA analog output
- 2 x relay outputs programmable as flow rate alarms
- Mass flow rate can be measured by programming the product density
- Ingress protection: IP50 front, IP30 back
  (Optional IP65 front with silicone cover)
- Ambient temperature: -20ºC ... +60ºC
- MODBUS RTU RS485 protocol on request
- Optional Exd certificate




## Dimensions MT03F converter



## ATEX version

The TM turbine flowmeter is suitable for its installation in ATEX hazardous area, that is, in those zones where a potentially explosive atmosphere can be generated. There are two types of protection available: Exi intrinsically safe or Exd ExProof.

### Exia protection

This device is considered as “simple apparatus” according to EN 60079-11 standard clause 5.7, since it does not contain its own source of ignition.

Pick-up coil technical data:

- Li ≤ 235 mH
- Ci ≤ 30 pF
- Internal resistance 640 Ohm < R < 700 Ohm
- Ui ≤ 9,5 V

According to these data, the flowmeter can be installed in hazardous area when an appropriate zener barrier (please consult) is installed between the hazardous and the safe area. The Tecfluid electronic converters must always be installed in safe area, except Exd versions. Other Exia converters for compact mounting are available on request.

Exd housing model ADF60V with CIP II converter

### Exd protection

These devices conform the 2014/34/UE directive (Devices and protection systems for use in potentially explosive atmospheres) as indicated in the CE certificate type LOM 14ATEX2008 X and its corresponding marking.

**This protection is not available for G½ (A)/(B) models.**

The instrument belongs to group II, therefore it is intended for use in places where there is a risk of generation of an explosive atmosphere, except in mining.

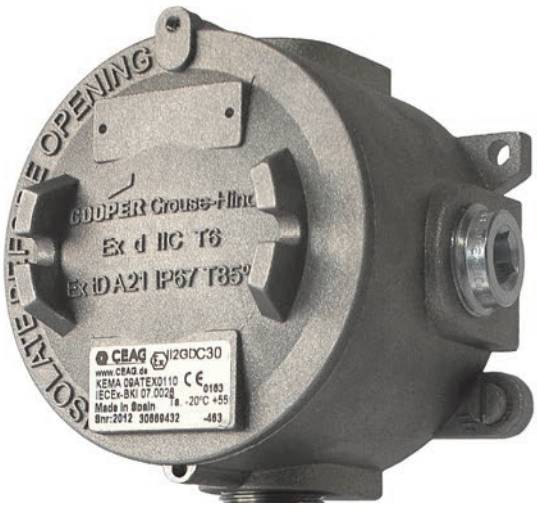
Being category 2GD it can be used in an environment where it is probable to generate an explosive atmosphere due to air and gases mixtures, vapours, mist and dust as well.

Four different types of Exd housings are available:

- Model ADF40: IP68 blind housing with reduced dimensions for DFD420 converter
- Model ADF30: IP67 blind housing with reduced dimensions
- Model ADF60V: IP67 housing with window, can include the CIP II or CP420L ... CH420L converters
- Model ADF60: IP67 blind housing, can include the CIP II or CP420L ... CH420L converters

Exd version technical data:

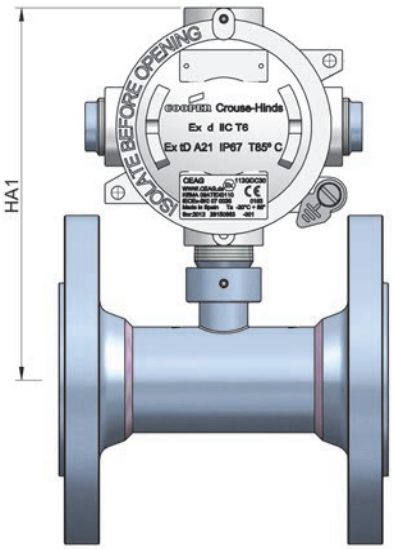
- Ambient temperature: -20ºC ... +60ºC
- Electrical wiring inside the Exd housing
- Standard cable entries ¾” NPT. On request ATEX packing glands for standard or shielded cable
- Associated electronics:
  - DFD420: frequency divider, pulse amplifier and 4-20 mA transmitter
  - CIP II: totalizer battery powered
  - CP420 … CH420: transmitter 2-wire system with flow rate indication, volume totalizer and 4-20 mA output. HART protocol optional for model CH420
- ATEX certificate Ex d IIC T6 Gb / Ex tb IIIC T85ºC Db



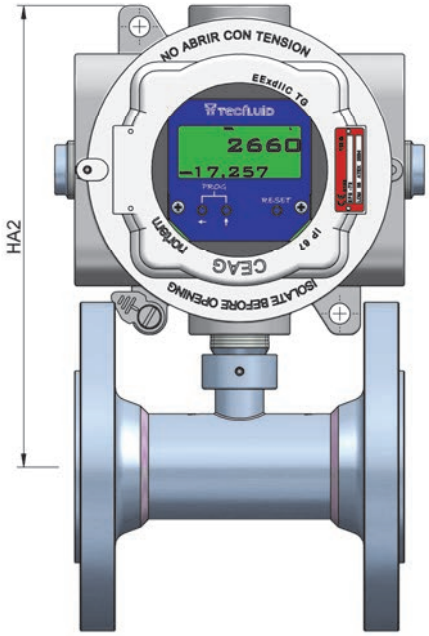

Exd housing model ADF30

## Dimensions

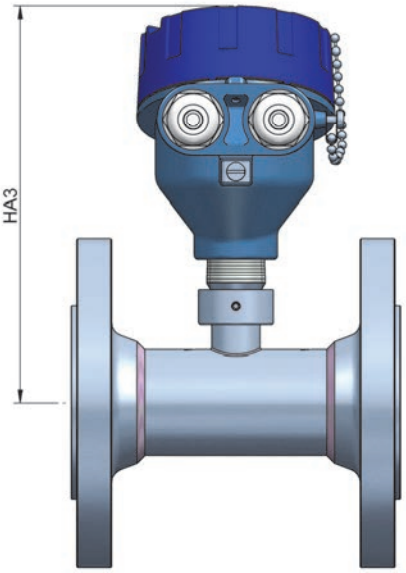
### Exd housing model ADF30




### Exd housing model ADF60V




### Exd housing model ADF40




| DN | HA1 | HA2 | HA3 |
|---|---|---|---|
| 15 | 160 | 205 | 170 |
| 20 | 160 | 205 | 170 |
| 25 | 165 | 210 | 175 |
| 40 | 170 | 215 | 180 |
| 50 | 175 | 220 | 185 |
| 65 | 185 | 230 | 195 |
| 80 | 190 | 235 | 200 |
| 100 | 200 | 245 | 210 |
| 125 | 215 | 260 | 225 |
| 150 | 225 | 270 | 235 |

All dimensions in mm (±1,5 mm)

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Quality Management System ISO 9001 certified by

Pressure Equipment Directive certified by

ATEX European Directive certified by

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