# TRICOR®

## Control drawing for hazardous areas

TRICOR
Coriolis Technology

**Manual-Version**

TCMP_E90_PRO_E_EN_200305_E002

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# 1. Validity of the Manual

This manual contains the information for installing and operating the TRICOR PRO Mass Flow Meters in hazardous areas.

The knowledge of the standard TRICOR PRO manual is required.

The manual is valid for the following mass flow sensors (remote and compact versions):

TCMP 0050, TCMP 0100, TCMP 0325, TCMP 0450, TCMP 0650, TCMP 1550, TCMP 3100, TCMP 5500, TCMP 7900, TCMP 028K, TCMP 065K, TCMP 230K, TCMP 430K

As well as for the following remote transmitters:

TCD 9010, TCD 9100, TCD 9200, TCD 9210, TCD 9220

# 2. Hazardous Area Installation Instructions

Instructions specific to hazardous area installations.

The following instructions apply to the Transmitters and Sensors.

1. The equipment may be used in a hazardous area with flammable gases and vapors, groups and temperature classes as specified in the equipment specification.
2. The equipment is certified for use in ambient temperature ($T_a$) as specified in the equipment specification and should not be used outside of the specified temperature range.
3. Installation shall be carried out in accordance with the applicable code of practice by suitably trained personnel.
4. The equipment is not intended to be repaired by the user. Repair of this equipment shall be carried out by the manufacturer in accordance with the applicable code of practice.
5. If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection is not compromised.
   - Aggressive Substances - e.g. acidic liquids or gases that may attack metals or solvents that may affect polymeric materials.
   - Suitable Precautions - e.g. regular checks as part of routine inspections or establishing from the material's data sheet that it is resistant to specific chemicals.

# 3. Special Conditions for use

**WARNING!**

ATEX/IECEx: Potential risk of sparking from aluminum alloy enclosure.

**WARNING!**

US/Canada: Potential risk of sparking from aluminum alloy enclosure. In Division 1 or Zone 0 installations, equipment shall be installed in such manner as to prevent the possibility of sparks resulting from friction or impact against the enclosure.

**WARNING!**

Risk of electrostatic sparking. Clean only with a damp cloth.

## 3.1. Standards

EN 60079-0:2018, EN 60079-1:2014, EN 60079-11:2012

IEC 60079-0:2017 Ed.7, IEC 60079-1:2014 Ed.7, IEC 60079-11:2011 Ed.6

CAN/CSA-C22.2 No. 0-10:15, CAN/CSA-C22.2 No. 61010-1-10, CAN/CSA-C22.2 No. 60079-0:15, CAN/CSA-C22.2 No. 60079-1:16, CAN/CSA-C22.2 No. 60079-11:14

ANSI/UL 61010-1:2008, ANSI/UL 60079-0:2013, ANSI/UL 60079-1 :2015, ANSI/UL 60079-11:2014

FM 3615:2018, FM 3600:2018, FM 3810:2005

## 3.2. Warning

**WARNING!**

**Explosion Hazard – Can cause death or serious injury**
Danger of explosion in hazardous areas.
Use only cable glands/plugs that comply with the requirements for the relevant type of protection.
Tighten the cable glands in accordance with the torques specified in technical specifications
Close unused cable inlets for the electrical connections.
When replacing cable glands use only cable glands of the same type.
After installation check the cables are seated firmly.
The equipment shall not be opened when energized.
Substitution of components may impair Intrinsic Safety.

To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

# 4. TCMP with meter-mounted transmitters (Config. 1, 2, 5 )

| Transmitters | System serial number |
|---|---|
| TCD 9010-*-****-**-** | TCMP ****-**-****-****-**-** |
| TCD 9100-*-****-**-** | TCMP ****-**-****-****-**-** |
| TCD 9200-*-****-**-** | TCMP ****-**-****-****-**-** |

For the configurations involving the TRICOR TCD 9*10 transmitter installed with the sensor enclosure, for configurations no. 1 and no. 5, the maximum allowable process fluid temperatures with respect to temperature class for the device when used with potentially explosive gases in the following maximum ambient temperatures are:

| Ta | Maximum Process Temperature per Temperature Class | |
|---|---|---|
| | T4 | T3 |
| 60 °C [140 °F] | 70 °C [158 °F] | 70 °C [158 °F] |
| 55 °C [131 °F] | 100 °C [212 °F] | 100 °C [212 °F] |
| 50 °C [122 °F] | 130 °C [266 °F] | 130 °C [266 °F] |
| 45 °C [113 °F] | 135 °C [275 °F] | 160 °C [320 °F] |
| 40 °C [104 °F] | 135 °C [275 °F] | 190 °C [374 °F] |
| 35 °C [95 °F] | 135 °C [275 °F] | 200 °C [392 °F] |

For the configurations involving the TRICOR TCD 9100/9200 transmitter installed with the sensor enclosure, for configuration no. 2, the maximum allowable process fluid temperatures with respect to the marked temperature class and maximum surface temperature for the device in the following maximum ambient temperatures are:

| Ta | Maximum Process Temperature per Temperature Class | |
|---|---|---|
| | T4 | T3 |
| 60 °C [140 °F] | 80 °C [176 °F] | 80 °C [176 °F] |
| 55 °C [131 °F] | 110 °C [212 °F] | 110 °C [230 °F] |
| 50 °C [122 °F] | 130 °C [266 °F] | 140 °C [284 °F] |
| 45 °C [113 °F] | 135 °C [275 °F] | 170 °C [338 °F] |
| 40 °C [104 °F] | 135 °C [275 °F] | 200 °C [392 °F] |

i. The end user shall contact the manufacturer of the Coriolis units, which be required, in some applications, to be covered in a thermal insulating material. The manufacturer will be able to provide the necessary information on either;
   a) Maintaining the process fluid at a suitable temperature in line with this certificate, or;
   b) When placed near other pipelines at high temperatures, to protect the Coriolis units from the resulting external heat source;

ii. This equipment includes non-conducting parts that may generate an ignition-capable level of electrostatic charges under certain extreme conditions. The user shall ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a build-up of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment shall be done only with a damp cloth;

iii. The end user shall ensure that all cable entries are fitted with any suitably certified cable gland or blanking elements;

iv. The flameproof joints of the TCMP **** series of Coriolis Mass Flow Meter are not intended to be repaired;
v. The end user shall always refer to the TCMP series complete system equipment label before installation in any suitable explosive atmosphere, zone, ambient, and process temperature;
vi. The TCMP **** series of Coriolis Mass Flow Meter shall not be disassembled by the end user, and shall remain in the condition provided by the manufacturer;
vii. The TRICOR TCD 9*00 shall only be electrically powered / connected to an overvoltage category II or better circuit as defined in IEC 60664-1 and required by Annex F of IEC 60079-11
viii. The quoted entity parameters of Co and Lo are applicable for the distributed capacitance and inductance in cables. Where there is circuit capacitance or inductance in the connected equipment (represented by Ci and Li) that both total more than 1% of quoted Co and Lo then these values shall not exceed 50% of the quoted Co and Lo values;
ix. The equipment internal circuits at the 4-Pin Connection – A, B, 0 and 15 V or Connector X700 (Pin 1 = 15 V, Pin 2 = 0 V, Pin 3 = A and Pin 4 = B) are not capable of withstanding a 500 V r.m.s. a.c. test to earth as required by clause 6.3.13 of EN 60079-11:2012. This shall be taken into account in any equipment installation;
x. Intrinsically safe installations only: A temporary connection of the TCD 9*10 to an uncertified programming or data download device is permitted, when the TCD 9*10 is located in the non-hazardous area (typically prior to installation). Alternatively, such a connection may be made when the TCD 9*10 remains in the hazardous area, but the area is declared ‘gas-free’. The uncertified programming or data download device shall be suitably-approved as a SELV supply to IEC 60950-1, IEC 61010-1 or an equivalent standard, with a maximum output voltage of 60 V. The input terminals of the TCD 9*10 have a maximum voltage $U_M$ = 60 V
xi. Suitable equipment certified blanking elements shall be fitted to all unused conduit entries to maintain the explosionproof and environmental characteristics of the equipment.
xii. Remote terminal boxes of the TCM**** may be manufactured from aluminium; in the event of rare incidents, ignition sources due to impact and friction sparks could occur. This shall be considered when the remote version of the TRICOR flow meters are being installed in locations that specifically require group II Zone 0 applications.
xiii. DC powered units shall be supplied with a Limited Energy Circuit (LEC), Class 2 as defined in article 725.121 of NFPA70, or Limited Power Source (LPS) as defined in CAN/CSA C22.2 No. 60950-1.
xiv. The maximum pressure associated with the process medium in the internal pipes shall be limited on the lowest pressure rating of either transducer or process connection (see label information).
xv. If at any time there is a conflict between the system safety provisions and any relevant local (national or regional) requirements, the local requirements always take precedence.

**Entity parameters for TCMP with meter-mounted TCD 9010:**

Exd installation: $U_M$ = 60 V DC

Exi installation:

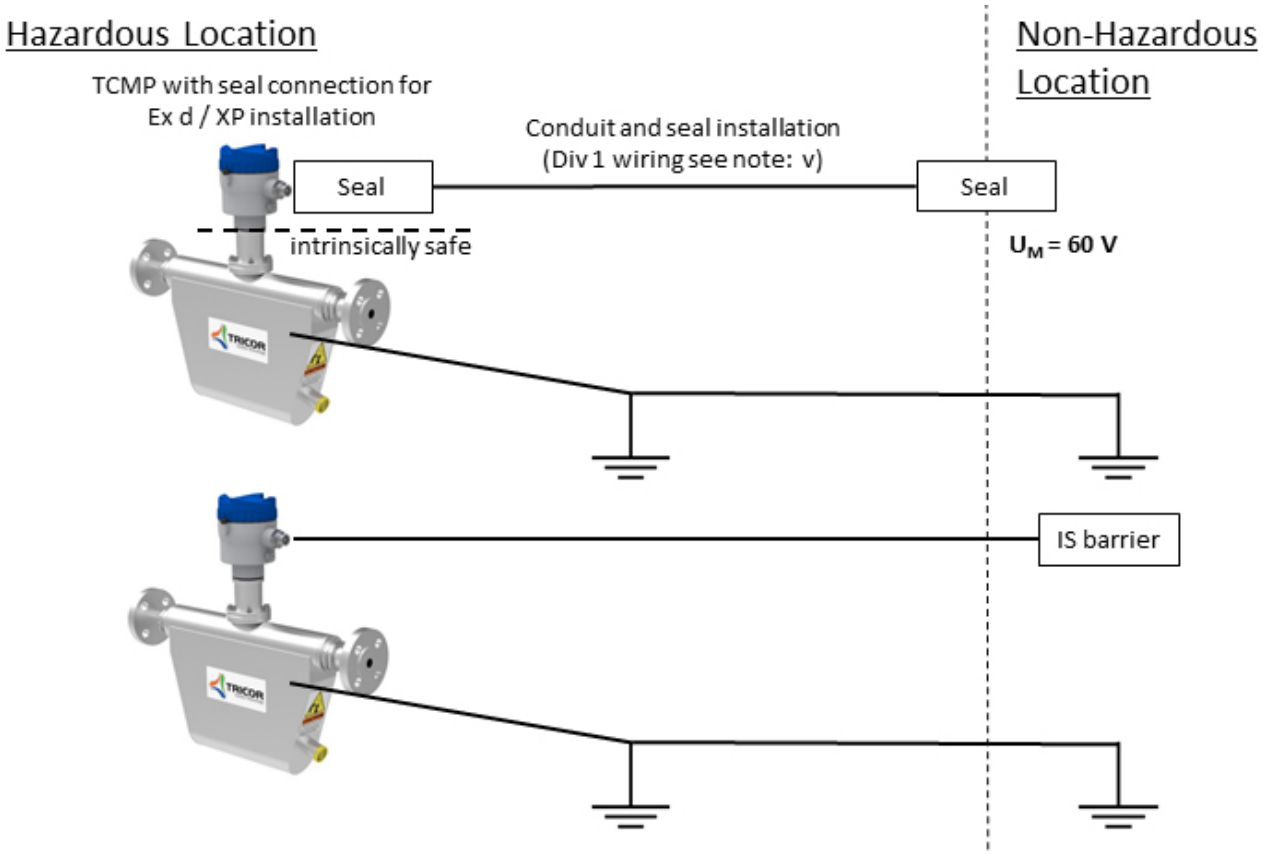
| Terminals | $U_i$ (V) | $I_i$ (mA) | $P_i$ (W) | $C_i$ (nF) | $L_i$ (µH) |
|---|---|---|---|---|---|
| SSL 4 wire IS circuits | 20 | 484 | 2.3 | 1.9 | 0.6 |

**Ratings:**

| ATEX / IECEx | CSA (US) | CSA (Can) |
|---|---|---|
| For TCM 0050 – 7900:<br>Ex db ia [ia Ga] IIC T* Gb<br><br>For TCM 028K – 430K:<br>Ex db ia [ia Ga] IIB T* Gb | For TCM 0050 – 7900:<br>Cl 1, Zone 1 AEx db ia [ia Ga] IIC T* Gb<br>Cl I Div 1 Groups A,B, C and D T*<br><br>For TCM 028K – 430K:<br>Cl 1, Zone 1 AEx db ia [ia Ga] IIB T* Gb<br>Cl I Div 1 Groups C and D T* | For TCM 0050 – 7900:<br>Ex db ia [ia Ga] IIC T* Gb<br><br>For TCM 028K – 430K:<br>Ex db ia [ia Ga] IIB T* Gb |

* see note: i

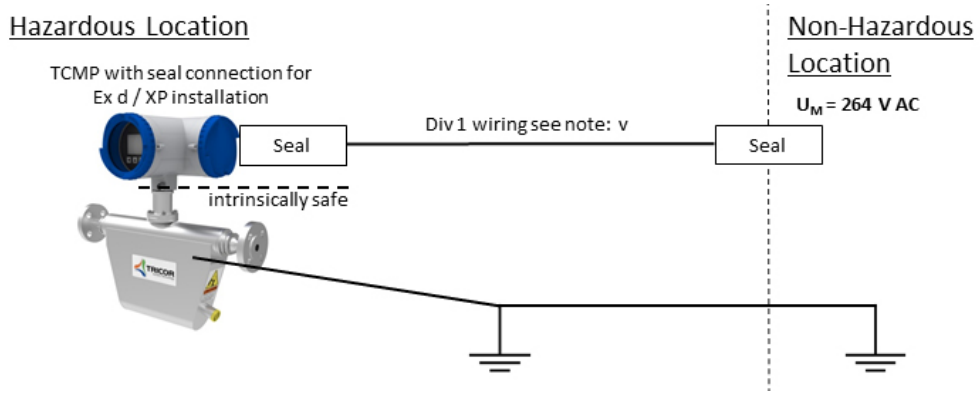
**Housing of Transmitter and Sensor shall always be connected as illustrated below:**



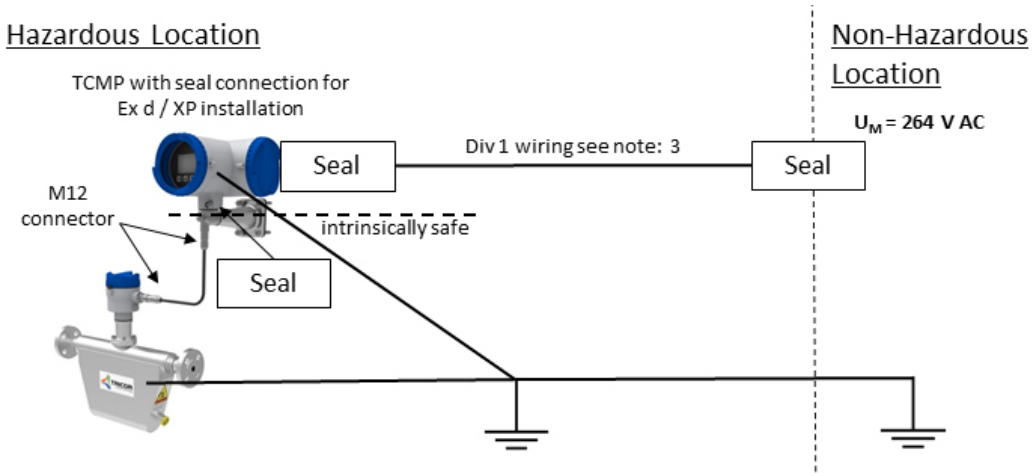
**Entity parameters for TCMP with meter-mounted TCD 9100 and TCD 9200 (IO Ch1 to Ch4):**

| IO Connections | Terminals | Ui (V) | Ii (mA) | Pi (W) | Uo (V) | Io (mA) | Po (W) | Ci (nF) | Li (µH) | Co IIC (nF) | Lo IIC (mH) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HART Active | 4, 5 | NA | NA | NA | 28 | 85 | 0.584 | NA | NA | 72 | 1.64 |
| HART Passive | 5, 6 | 30 | 100 | 1 | NA | NA | NA | 15.8 | 36 | NA | NA |
| Profibus PA | 4, 5 | 30 | 380 | NA | NA | NA | NA | 0.258 | 2.3 | NA | NA |
| Modbus in | 4, 5 | 4.2 | 149 | 156 | NA | NA | NA | 500 | 50 | NA | NA |
| Modbus out | 4, 5 | NA | NA | NA | 4.2 | 117.8 | 124 | NA | NA | 420µF | 2.51 |
| IO 2 Active | 8, 9 | NA | NA | NA | 28 | 87 | 0.601 | NA | NA | 78 | 1.46 |
| IO 2 Passive | 9, 10 | 30 | 1000 | 1 | NA | NA | NA | 7.3 | 36 | NA | NA |
| IO 3 Active | 11, 12 | NA | NA | NA | 28 | 87 | 0.6 | NA | NA | 78 | 1.46 |
| IO 3 Passive | 12, 13 | 30 | 1000 | 1 | NA | NA | NA | 7.3 | 36 | NA | NA |
| IO 3 Relay | 11, 12,13 | 30 | 1000 | 1 | NA | NA | NA | 7.3 | 36 | NA | NA |
| IO 4 Active | 14, 15 | NA | NA | NA | 28 | 87 | 0.6 | NA | NA | 78 | 1.46 |
| IO 4 Passive | 15, 16 | 30 | 1000 | 1 | NA | NA | NA | 7.3 | 36 | NA | NA |
| IO 4 Relay | 14, 15, 16 | 30 | 1000 | 1 | NA | NA | NA | 7.3 | 36 | NA | NA |

**Housing of Transmitter and Sensor shall always be connected as illustrated below:**




**Housing of Transmitter and Sensor shall always be connected as illustrated below:**



# 5. TCMP with remote-mounted transmitters (Config. 3 + 4)

| Transmitters | System serial number |
|---|---|
| TCD 9210-*-****-**-** | TCMP ****-**-****-****-**-** |
| TCD 9220-*-****-**-** | TCMP ****-**-****-****-**-** |

i. The process temperature range for remote versions of the equipment is determined as follows:

ii. -40° C ≤ Tp ≤ +70° C (for T4), -40° C ≤ Tp ≤ +135° C (for T3), -60° C ≤ Tp ≤ +200° C (for T2)

iii. The TCM transducer cable shall not exceed 30 meters when it is not provided by the manufacturer. The cable shall be either Type A or Type B cable as defined in EN 60079-14 and the conductors inside of the cable shall provide an insulation of 0.25 mm thick minimum.

iv. This equipment includes non-conducting parts that may generate an ignition-capable level of electrostatic charges under certain extreme conditions. The user shall ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high-pressure steam) which might cause a build-up of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment shall be done only with a damp cloth;

v. The end user shall ensure that all cable entries are fitted with any suitably certified cable gland or blanking elements;

vi. The flameproof joints of the TCMP **** series of Coriolis Mass Flow Meter are not intended to be repaired;

vii. The end user shall always refer to the TCMP series complete system equipment label before installation in any suitable explosive atmosphere, zone, ambient, and process temperature;

viii. Remote terminal boxes of the equipment may be manufactured from aluminium; in the event of rare incidents, ignition sources due to impact and friction sparks could occur. This shall be considered when the remote version of the TRICOR flow meters are being installed in locations that specifically require group II Zone 0 applications;

ix. The TCMP **** series of Coriolis Mass Flow Meter shall not be disassembled by the end user, and shall remain in the condition provided by the manufacturer;

x. The TRICOR TCD 9220 shall only be electrically powered / connected to an overvoltage category II or better circuit as defined in IEC 60664-1 and required by Annex F of IEC 60079-11

xi. The quoted entity parameters of Co and Lo are applicable for the distributed capacitance and inductance in cables. Where there is circuit capacitance or inductance in the connected equipment (represented by Ci and Li) that both total more than 1% of quoted Co and Lo then these values shall not exceed 50% of the quoted Co and Lo values;

xii. The equipment internal circuits at the 4-Pin Connection – A, B, 0 and 15 V or Connector X700 (Pin 1 = 15 V, Pin 2 = 0 V, Pin 3 = A and Pin 4 = B) are not capable of withstanding a 500 V r.m.s. a.c. test to earth as required by clause 6.3.13 of EN 60079-11:2012. This shall be taken into account in any equipment installation;

xiii. Intrinsically safe installations only: A temporary connection of the TCD 9*10 to an uncertified programming or data download device is permitted, when the TCD 9*10 is located in the non-hazardous area (typically prior to installation). Alternatively, such a connection may be made when the TCD 9*10 remains in the hazardous area, but the area is declared ‘gas-free’. The uncertified programming or data download device shall be suitably-approved as a SELV supply to IEC 60950-1, IEC 61010-1 or an equivalent standard, with a maximum output voltage of 60 V. The input terminals of the TCD 9*10 have a maximum voltage $U_M$ = 60 V.

xiv. Suitable equipment certified blanking elements shall be fitted to all unused conduit entries to maintain the explosionproof and environmental characteristics of the equipment.

xv. Remote terminal boxes of the TCM**** may be manufactured from aluminium; in the event of rare incidents, ignition sources due to impact and friction sparks could occur. This shall be considered when the remote version of the TRICOR flow meters are being installed in locations that specifically require group II Zone 0 applications.

xvi. DC powered units shall be supplied with a Limited Energy Circuit (LEC), Class 2 as defined in article 725.121 of NFPA70, or Limited Power Source (LPS) as defined in CAN/CSA C22.2 No. 60950-1.

xvii. The maximum pressure associated with the process medium in the internal pipes shall be limited on the lowest pressure rating of either transducer or process connection (see label information).

xviii. If at any time there is a conflict between the system safety provisions and any relevant local (national or regional) requirements, the local requirements always take precedence.

**Entity parameters for TCMP with meter-mounted TCD 9210:**

Exd installation: $U_M$ = 60 V DC

Exi installation:

| Terminals | $U_i$ (V) | $I_i$ (mA) | $P_i$ (W) | $C_i$ (nF) | $L_i$ (µH) |
|---|---|---|---|---|---|
| SSL 4 wire IS circuit | 20 | 485 | 2.3 | 1.9 nF | 0.6 |

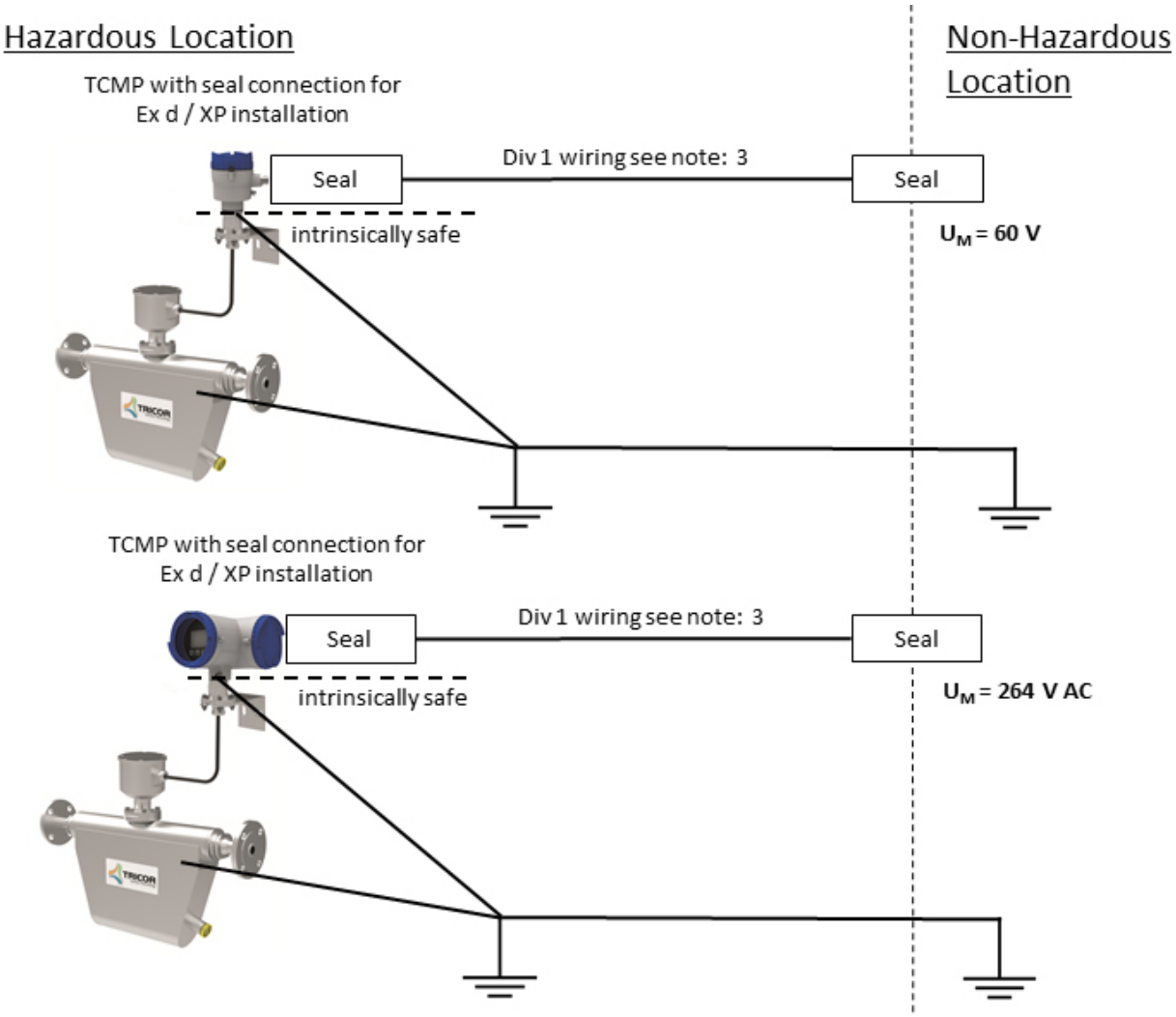
**Entity parameters for TCMP with meter-mounted TCD 9210:**

| IO Connections | Terminals | Ui (V) | Ii (mA) | Pi (W) | Uo (V) | Io (mA) | Po (W) | Ci (nF) | Li (µH) | Co IIC (nF) | Lo IIC (mH) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HART Active | 4, 5 | NA | NA | NA | 28 | 85 | 0.6 | NA | NA | 79 | 4.8 |
| HART Passive | 5, 6 | 30 | 100 | 1 | NA | NA | NA | 3.5 | 33 | NA | NA |
| Profibus PA | 4, 5 | 30 | 500 | 5.32 | NA | NA | NA | 0.26 | 2.3 | NA | NA |
| Modbus RTU | 4, 5 | 4.2 | NA | NA | 4.2 | 117.8 | 124 | 0.1 | 1.0 | NA | NA |
| IO 2 Active | 8, 9 | NA | NA | NA | 28 | 87 | 0.6 | NA | NA | 81 | 4.6 |
| IO 2 Passive | 9, 10 | 30 | 1000 | 1 | NA | NA | NA | 1.6 | 33 | NA | NA |
| IO 3 Active | 11, 12 | NA | NA | NA | 28 | 87 | 0.6 | NA | NA | 81 | 4.5 |
| IO 3 Passive | 12, 13 | 30 | 1000 | 1 | NA | NA | NA | 1.6 | 33 | NA | NA |
| IO 3 Relay | 11, 12,13 | 30 | 1000 | 1 | NA | NA | NA | 1.6 | 33 | NA | NA |
| IO 4 Active | 14, 15 | NA | NA | NA | 28 | 87 | 0.6 | NA | NA | 81 | 4.5 |
| IO 4 Passive | 15, 16 | 30 | 1000 | 1 | NA | NA | NA | 1.6 | 33 | NA | NA |
| IO 4 Relay | 14, 15, 16 | 30 | 1000 | 1 | NA | NA | NA | 1.6 | 33 | NA | NA |

**Ratings:**

| | ATEX /IECEx | CSA (US) | CSA (Can) |
|---|---|---|---|
| TCD | Ex db ia [ia Ga] IIC T4 Gb | Cl 1, Zone 1 AEx db ia [ia Ga] IIC T4 Gb<br>Class I, Div. 1, Groups A, B, C and D or C and D, T4 (see TCM) | Ex db ia [ia Ga] IIC T4 Gb |
| TCM | For TCM 0050 – 0325:<br>Ex ia IIC T4…T2 Ga<br><br>For TCM 028K – 430K:<br>Ex ia IIB T4…T2 Ga | For TCM 0050 – 0325:<br>Cl1, Zone 0 Ex ia IIC T4…T2 Ga<br>Class I, Div. 1, Groups A, B, C and D, T*<br>For TCM 028K – 430K:<br>Cl1, Zone 0 Ex ia IIB T4…T2 Ga<br>Class I, Div. 1, Groups C and D, T* | For TCM 0050 – 0325:<br>Ex ia IIC T4…T2 Ga<br><br>For TCM 028K – 430K:<br>Ex ia IIB T4…T2 Ga |

**Housing of Transmitter and Sensor shall always be connected as illustrated below**



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