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Safety Instructions
Liquiline CM42

Two-wire transmitter for hazardous areas

FM IS NI Cl.I Div.1&2, Groups A-D
CSA IS NI Cl.I,II,III Div.1&2, Groups A-G

Endress+Hauser
People for Process Automation

Liquiline CM42

Two-wire transmitter for hazardous areas

Table of contents

Associated documentation

This document is an integral part of Operating Instructions BA00382C.

Connection requirements for the USA

Note: In addition to the information provided in this control drawing, the FM labelled measurement transmitter CM42 and the cCSAus labelled sensors covered and referenced by this section may be connected and used with transmitters and sensors listed in control drawing no. 139689, based on certificate no. FM16US0145X issued by FM.

Equipment Ratings valid for the USA

Intrinsically Safe for Class I, Division 1, Groups A, B, C and D; Class I, Zone 1, AEx ib [ia Ga] IIC; Type 4, IP66/67

Non Incendive for Class I, Division 2; Groups A, B, C and D; Class I, Zone 2, Group IIC with Nonincendive field wiring connections to Class I, Division 2, Group A, B, C, and D and Class I, Zone 2, Groups IIC, Type 4; IP66/67

Ambient: $-20\ °C < T_a < +50\ °C$(T6)

Devices using 4-20mA / HART outputs

Intrinsically safe (Entity), Class I, Div. 1 Groups A, B, C, D Hazardous location installations

1. Control room equipment may not use or generate over 250 Vrms.
2. Use entity-approved intrinsic safety barrier or other associated equipment with V_{oc} or $V_f \leq V_{max}$, I_{sc} or $I_f \leq I_{max}$, $C_a \geq C_i + C_{cable}$, $L_a \geq L_i + L_{cable}$.

Entity parameters are as follows (current controlled circuits):

Terminals	V_{max}	I_{max}	P_{max}	C_i	L_i
133 and 134	30 V	100 mA	800 mW	1.2 nF	29 µH
233 and 234	30 V	100 mA	800 mW	0.2 nF	24 µH

3. Installation should be in accordance with ANSI/ISA RP12.06.01 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electric Code (ANSI/NFPA70).
4. NOTICE

   Substitution of components may impair intrinsic safety!
   - ▶ Observe.
5. Ex ia is defined as Intrinsically Safe.

Division 2 and Zone 2 installation (current controlled circuit)

6. The nonincendive field wiring circuit concept allows interconnection of nonincendive field wiring apparatus with associated nonincendive field wiring apparatus, using any of the wiring methods permitted for unclassified locations.

Entity parameters are as follows (current controlled circuits):

Terminals	V_{max}	I_{max}	C_i	L_i
133 and 134	30 V	[1]	1.2 nF	29 µH
233 and 234	30 V	[1]	0.2 nF	24 µH

1) For this current controlled circuit, the parameter (I_{max}) is not required and need not be aligned with parameter (I_{sc} or I_t) of the barrier or associated nonincendive field wiring apparatus.

7. $V_{max} \geq V_{oc}$ or V_t , $C_a \geq C_i + C_{cable}$, $L_a \geq L_i + L_{cable}$
8. Installation shall be in accordance with the NEC.

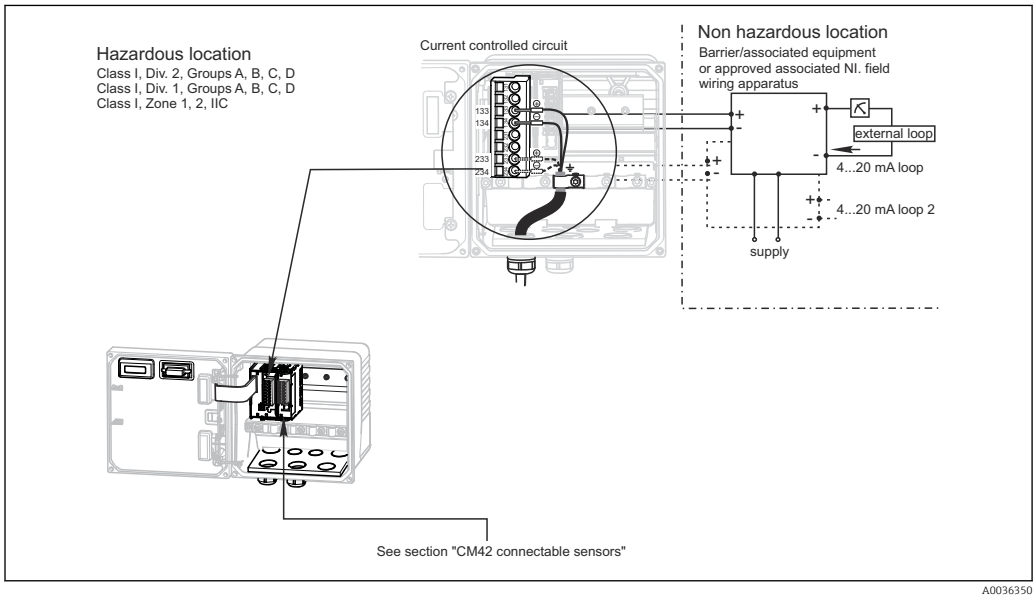
9. **NOTICE**

Substitution of components may impair suitability for class I division 2 or class I zone 2!

► Observe.

Functional ratings

These ratings do not supersede hazardous locations values.
Normal current = 3.6 to 22 mA
Normal voltage = 12.5 to 30 V



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Devices using PROFIBUS and FOUNDATION FIELDBUS outputs

FISCO-Concept

The FISCO concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination.
The criteria for interconnection is that the voltage (U_i or V_{max}), the current (I_i or I_{max}) and the power (P_i or P_{max}) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (U_o or V_{oc} or V_t), the current (I_o or I_{sc} or I_t) and the power (P_o or P_{max}) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitances (C_i) and inductances (L_i) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH respectively.
In each segment, only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system.
The voltage (U_o or V_{oc} or V_t) of the associated apparatus has to be limited to the range of 14 V to 17.5 VDC. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50 µA for each connected device. Separately powered equipment needs a galvanic isolation to assure the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices needs to have the parameters in the following range:

loop resistance R':	15 ... 150 Ω/km
inductance per unit length L':	0.4 ... 1 mH/km
capacitance per unit length C':	80 ... 200 nF/km

C' = C' line/line + 0.5C' line/screen, if both lines are floating or
C' = C' line/line + C' line/screen, if the screen is connected to one line

length of spur cable:	≤ 30 m
length of trunk cable:	≤ 1 km
length of splice:	≤ 1 m

At the end of the trunk cable an approved infallible line termination with the following parameters is suitable:

R = 90 ... 100 Ω

C = 0 ... 2.2 µF.

One of the allowed terminations might already be integrated in the associated apparatus.
The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, up to a total length of 1000 m (sum of the length of trunk cable and all spur cables), the inductance capacitance of the cable will not impair the intrinsic safety of the installation.

NONINCENDIVE CLASS 1, DIV.2, GROUP A.B.C.D HAZARDOUS LOCATION INSTALLATION

1. Install per national electric code (NEC) using threaded metal conduit. Intrinsic safety barrier not required. Max. supply voltage 30 V. For T-code see table.

2. **⚠ WARNING**

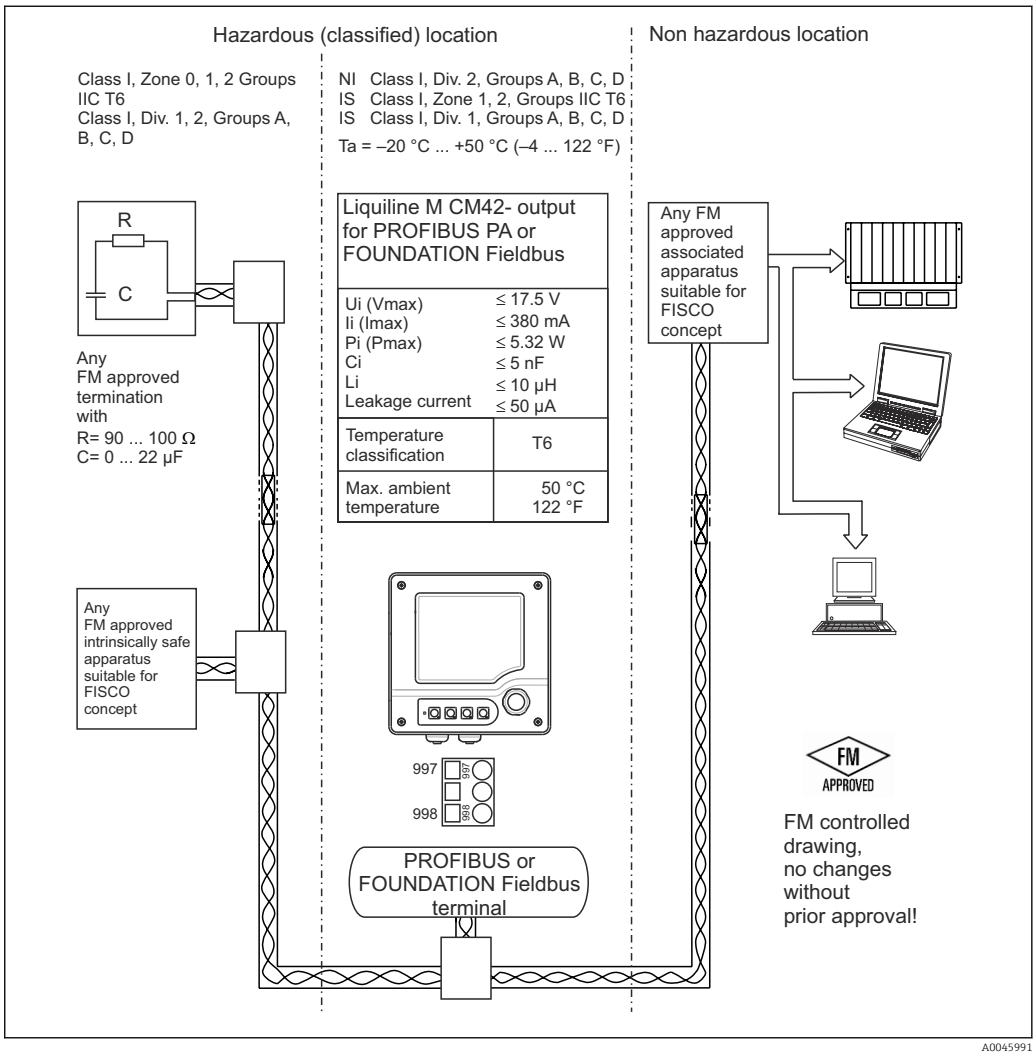
Explosion Hazard!

- ▶ Do not disconnect equipment unless power has been switched off or the area is known to be Non Hazardous.

NOTICE

Substitution of components may impair suitability for CLASS I, Division 2!

- ▶ Observe.



For sensor connection: → 🖹 11

Connection requirements for Canada

Note: In addition to the information provided in this control drawing, the CSA labelled measurement transmitter CM42 and the cCSAus labelled sensors covered and referenced by this section may be connected and used with transmitters and sensors listed in control drawing no. 139711, based on certificate no. 1718339 issued by CSA.

Equipment Ratings valid for Canada

Class I, Division 1, Groups A, B, C, D; Class II, Groups E, F, G, Class III, Type 4; IP66/67

Class I, Division 2, Groups A, B, C and D, Type 4; IP66/67

Ambient: -20 °C < T_a < +50 °C(T6)
-20 °C < T_a < +55 °C(T4)

Devices using 4-20mA / HART outputs

Transmitter Intrinsically Safe and Non-incendive Entity Parameters:

Terminals	V_{max}	I_{max}	C_i	L_i
133 and 134	30 V	100 mA	1.2 nF	29 µH
233 and 234	30 V	100 mA	0.2 nF	24 µH

Notes for CL. I, II and III Intrinsically Safe Installation:

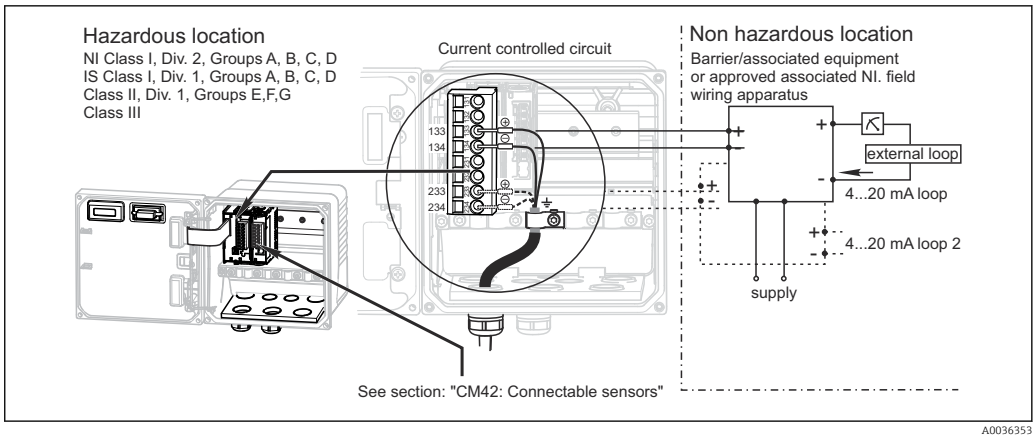
1. Install per the Canadian Electrical Code, Part I.
2. Control room equipment connected in the non-hazardous location must not use or generate voltages greater than 250 Vrms.
3. 4-20 mA circuit(s) must be connected to Certified Associated Equipment where the following conditions are met for each loop: $V_{oc} \leq V_{max}$, $I_{sc} \leq I_{max}$, $C_a \geq C_i + C_{cable}$, $L_a \geq L_i + L_{cable}$.
4. Each 4-20 mA circuit must use twisted, shielded pairs. Cable insulation and shielding must be maintained to within 10 mm from terminal block connection.
5. Sensor wiring is intrinsically safe for connection to the specified sensors.

Notes for CL. I, Div.2 Non-incendive Field Wiring Installation:

1. Install per the Canadian Electrical Code, Part I.
2. Control room equipment connected in the non-hazardous location must not use or generate voltages greater than 250 Vrms.
3. 4-20mA circuit(s) must be connected to Certified Associated Equipment (I.S. barriers) or Certified equipment that provides non-incendive field wiring circuits where the following conditions are met for each loop: $V_{oc} \leq V_{max}$, $I_{sc} \leq I_{max}$, $C_a \geq C_i + C_{cable}$, $L_a \geq L_i + L_{cable}$ (The 4-20 mA loops are current controlled circuits and therefore the Isc parameter and Imax parameter need not be aligned.).
4. Each 4-20 mA circuit must use twisted, shielded pairs. Cable insulation and shielding must be maintained to within 10mm from terminal block connection.
5. Sensor wiring is non-incendive field wiring for connection to the specified sensors.

Notes for CL. I, Div. 2 Installation:

1. Install per the Canadian Electrical Code, Part I.
2. 4-20 mA circuits must be installed using CL. I, Div. 2 wiring methods.
3. Only cable entry thread NPT ½" is applicable.
4. Sensor wiring is non-incendive field wiring for connection to the specified sensors.



Devices using PROFIBUS and FOUNDATION FIELDBUS outputs

PROFIBUS PA and FOUNDATION Fieldbus Installation in Class I, Div 1, GROUP A, B, C, D Hazardous Locations
FISCO-Concept
The FISCO concept allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination.
The criteria for interconnection is that the voltage (U_i or V_{max}), the current (I_i or I_{max}) and the power (P_i or P_{max}) which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage (U_o or V_{oc} or V_t), the current (I_o or I_{sc} or I_t) and the power (P_o or P_{max}) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitances (C_i) and inductances (L_i) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 10 µH respectively.
In each segment, only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system.
The voltage (U_o or V_{oc}) of the associated apparatus has to be limited to the range of 14 V to 24 V DC.
All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50 µA for each connected device.
Separately powered equipment needs a galvanic isolation to assure the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices needs to have the parameters in the following range:

loop resistance R':	15 ... 150 Ω/km
inductance per unit length L':	0.4 ... 1 mH/km
capacitance per unit length C':	80 ... 200 nF/km

C' = C' line/line + 0.5C' line/screen, if both lines are floating or
C' = C' line/line + C' line/screen, if the screen is connected to one line

length of spur cable:	≤ 30 m
length of trunk cable:	≤ 1 km
length of splice:	≤ 1 m

At the end of the trunk cable an approved infallible line termination with the following parameters is suitable:

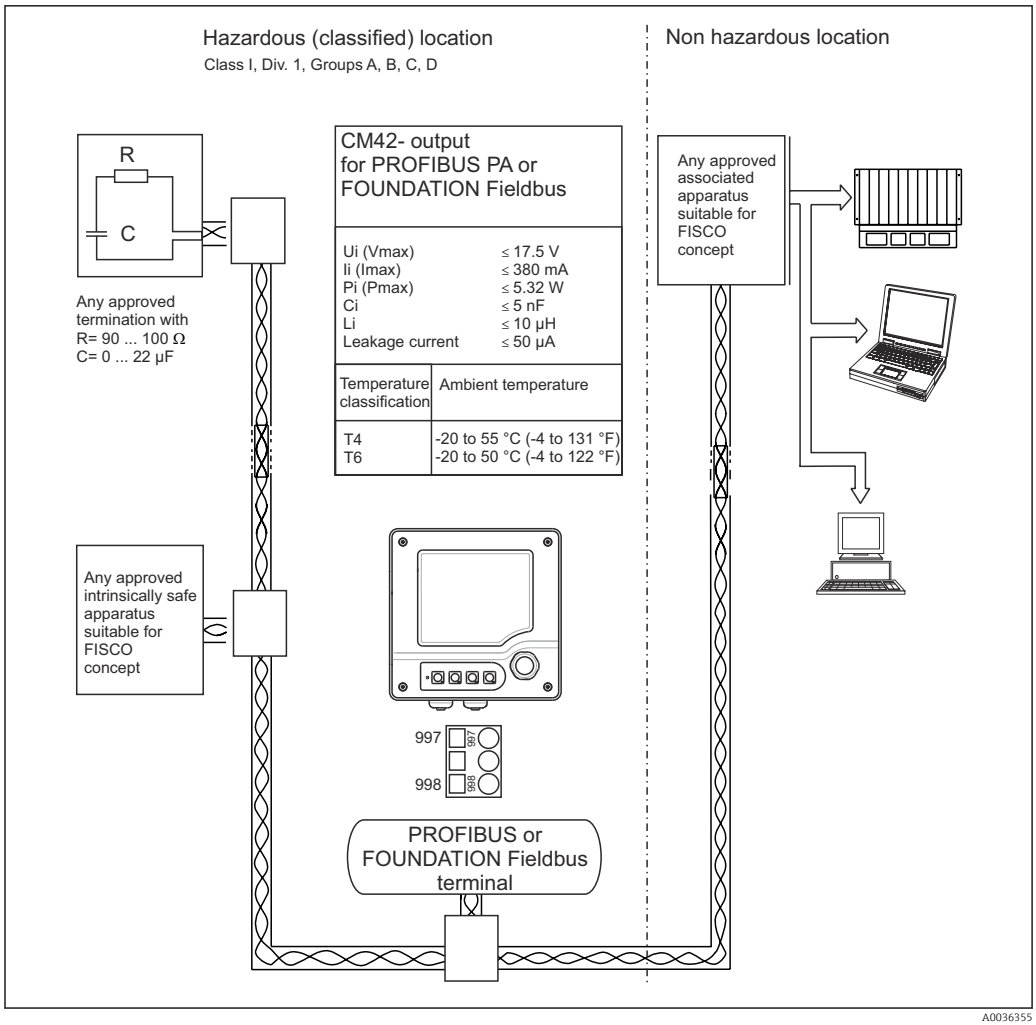
R = 90 ... 100 Ω

C = 0 ... 2.2 µF.

One of the allowed terminations might already be integrated in the associated apparatus.

One of the allowed terminations might already be integrated in the associated apparatus. The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, up to a total length of 1000 m (sum of the length of trunk cable and all spur cables), the inductance capacitance of the cable will not impair the intrinsic safety of the installation.

- Install per the Canadian Electrical Code, Part I for intrinsically safe field wiring.



For sensor connection: → 🖹 11

PROFIBUS PA and FOUNDATION FIELDBUS INSTALLATION IN CLASS I, DIV 2, GROUP A, B, C, D HAZARDOUS LOCATIONS

The FNICO concept allows interconnection of non-incendive apparatus to associated apparatus not specifically examined in such combination.

The criteria for interconnection is that the voltage (U_i or V_{max}), the current (I_i or I_{max}) and the power (P_i or P_{max}) which non-incendive apparatus can receive and remain non-incendive, considering faults, must be equal or greater than the voltage (U_o or V_{oc}), the current (I_o or I_{sc}) and the power (P_o or P_{max}) levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitances (C_i) and inductances (L_i) of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to 5 nF and 20 µH respectively.

In each segment, only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system.

The voltage (U_o or V_{oc}) of the associated apparatus has to be limited to the range of 14 V to 24 V DC.

All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50 µA for each connected device.

Separately powered equipment needs a galvanic isolation to assure the non-incendive fieldbus circuit remains passive.

The cable used to interconnect the devices needs to have the parameters in the following range:

loop resistance R':	15 ... 150 Ω/km
inductance per unit length L':	0.4 ... 1 mH/km
capacitance per unit length C':	80 ... 200 nF/km

C' = C' line/line + 0.5C' line/screen, if both lines are floating or
C' = C' line/line + C' line/screen, if the screen is connected to one line

length of spur cable:	≤ 30 m
length of trunk cable:	≤ 1 km
length of splice:	≤ 1 m

At the end of the trunk cable an approved infallible line termination with the following parameters is suitable:

R = 90 ... 100 Ω

C = 0 ... 2.2 µF.

One of the allowed terminations might already be integrated in the associated apparatus.

One of the allowed terminations might already be integrated in the associated apparatus. The number of passive devices connected to the bus segment is not limited due to N.I. reasons. If the above rules are respected, up to a total length of 1000 m (sum of the length of trunk cable and all spur cables), the inductance capacitance of the cable will not impair the non-incendive installation.

- Install per the Canadian Electrical Code, Part I for non-incendive field wiring.

CLASS I, DIV 2, GROUP A, B, C, D HAZARDOUS LOCATION INSTALLATION.

1. Install per the Canadian Electrical Code, Part I.
2. Bus wiring must be installed using CLASS I, DIV 2 wiring methods.
3. Only cable entry thread NPT ½" is applicable.
4. Associated apparatus suitable for FNICO is not required. Max. supply voltage 32 V.
5. **⚠ WARNING**

   Explosion Hazard!

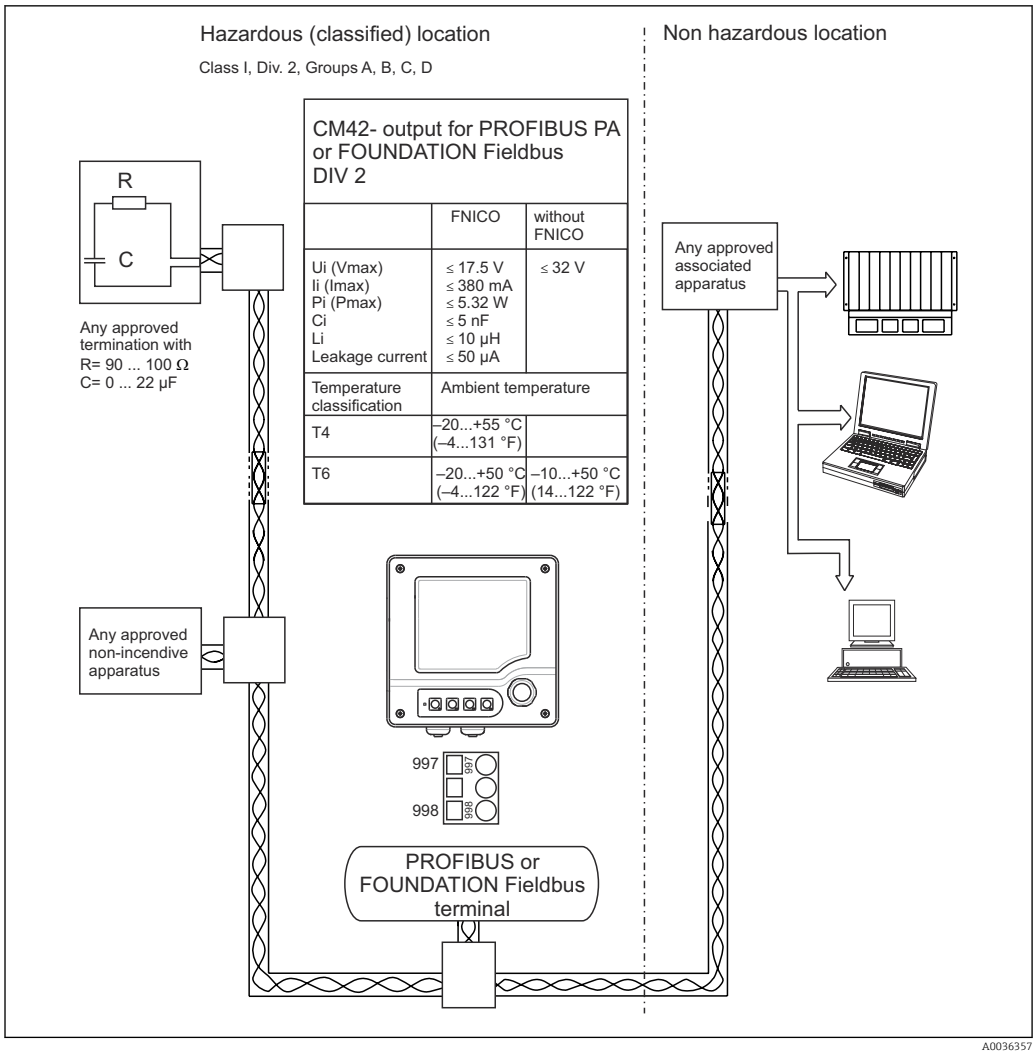
   - Do not disconnect equipment unless power has been switched off or the area is known to be Non Hazardous.

   NOTICE

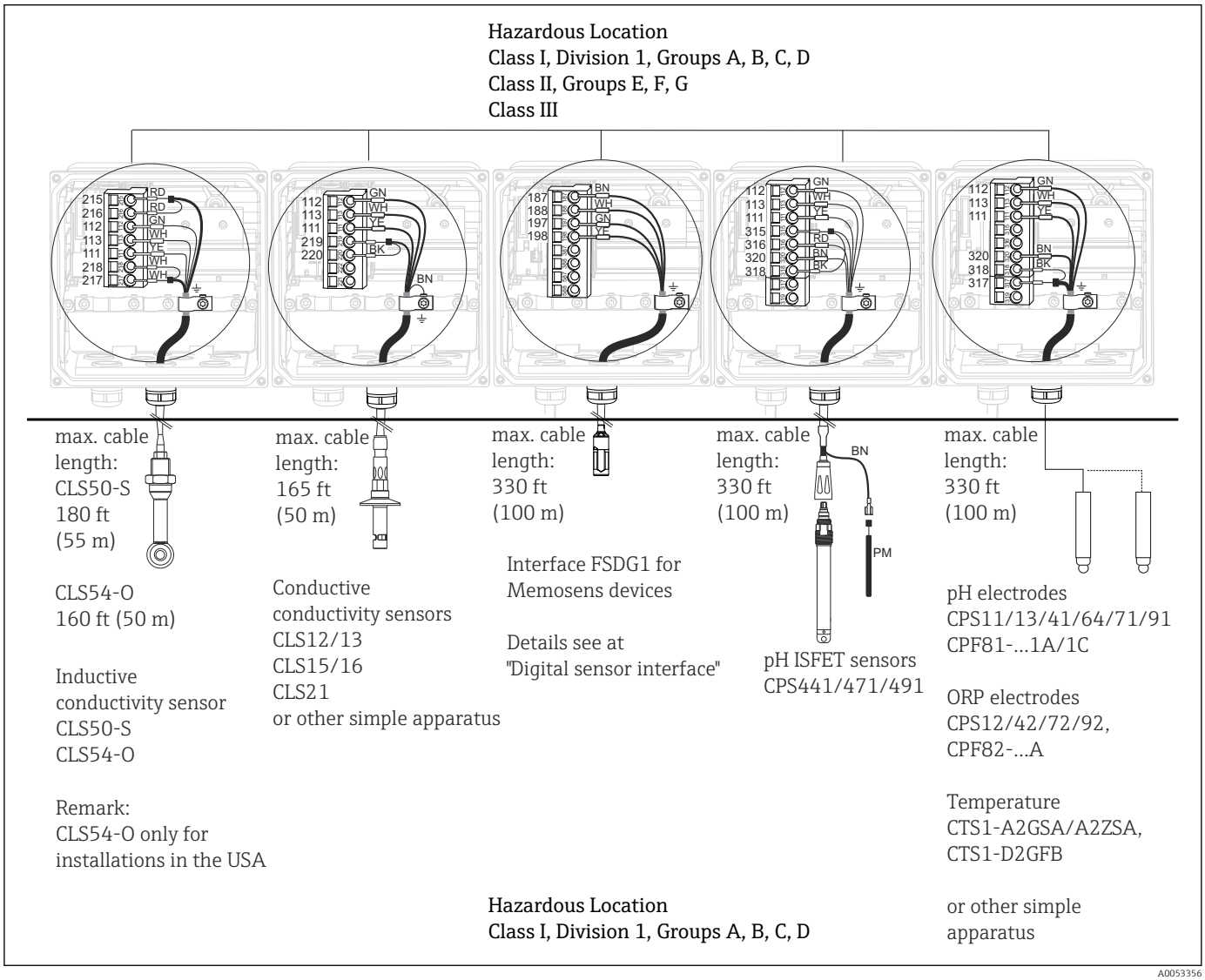
   Substitution of components may impair suitability for CLASS I, Division 2!

   - Observe.

   Sensor wiring is non-incendive field wiring for connection to specified sensors (→ 🖹 11).


Hazardous (classified) location
Class I, Div. 2, Groups A, B, C, D
Non hazardous location
CM42- output for PROFIBUS PA or FOUNDATION Fieldbus DIV 2
FNICO
without FNICO
Ui (Vmax) ≤ 17.5 V ≤ 32 V
Ii (Imax) ≤ 380 mA
Pi (Pmax) ≤ 5.32 W
Ci ≤ 5 nF
Li ≤ 10 µH
Leakage current ≤ 50 µA
Temperature classification
Ambient temperature
T4 –20...+55 °C (–4...131 °F)
T6 –20...+50 °C (–4...122 °F) –10...+50 °C (14...122 °F)
R
C
Any approved termination with
R= 90 ... 100 Ω
C= 0 ... 22 µF
Any approved non-incendive apparatus
Any approved associated apparatus
997
998
PROFIBUS or FOUNDATION Fieldbus terminal
A0036357

CM42 Connectable sensors For devices using 4-20mA / HART, PROFIBUS and FOUNDATION FIELDBUS outputs.



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- Sensors shall not be operated in dust-ex-area. Only the transmitter can be used in dust-ex-area of Class II, groups E, F, G and Class III.
- Install a separation wall between gas-ex and dust-ex area.

Digital sensor interface

Terminals	187-188, 197-198
Maximum output voltage U_o	5.04 V
Maximum output current I_o	80 mA
Maximum output power P_o	112 mW
Effective internal capacitance C_i	12,400 nF (only internally, not effective)
Effective internal inductance L_i	160.4 µH (only internally, not effective)

Analog pH or ORP sensors

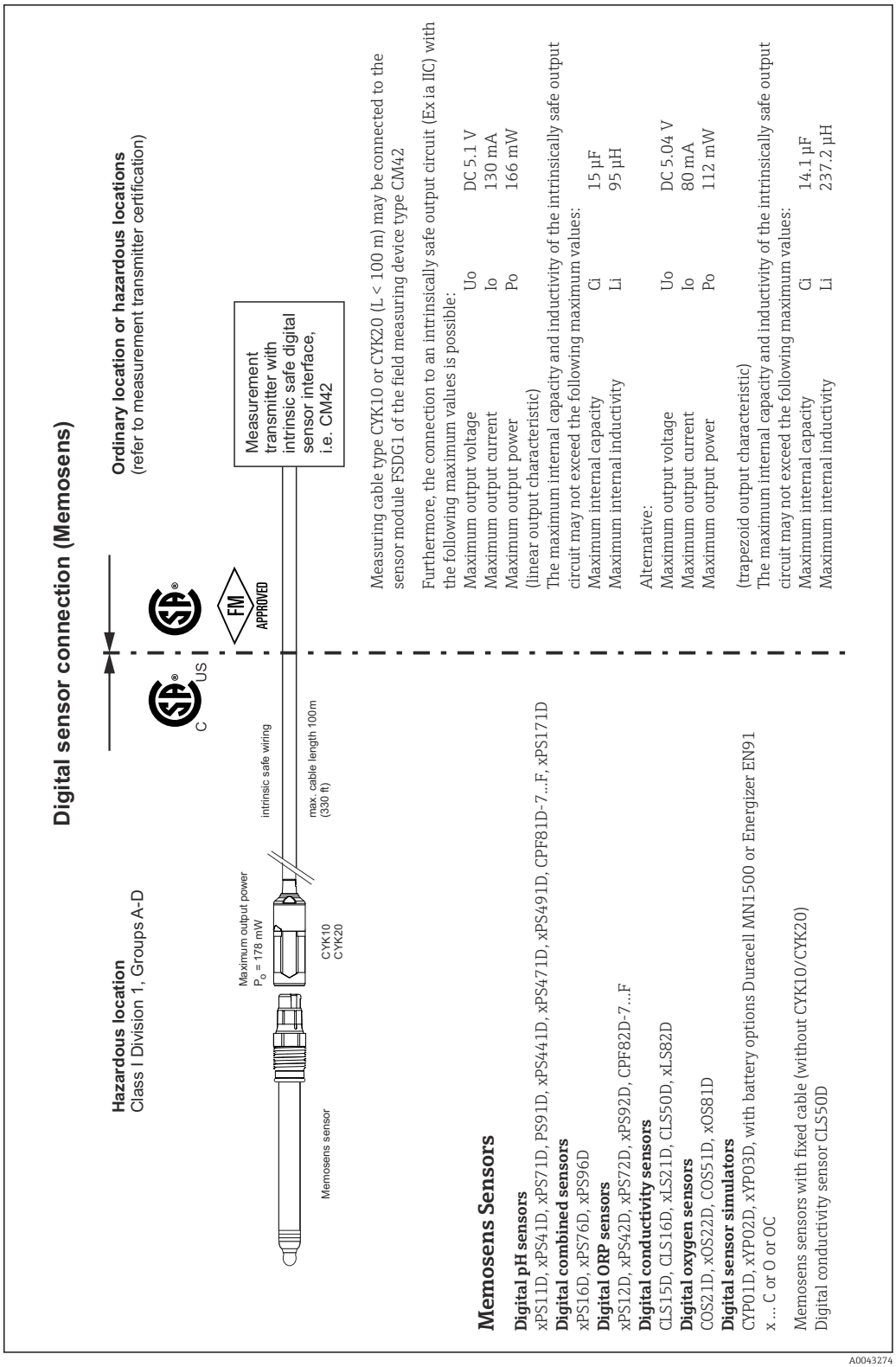
	Glass	**ISFET**
Max. output voltage U_o	10.08 V	10.08 V
Max. output current I_o	4.1 mA	50.7 mA
Max. output power P_o	10.2 mW	128 mW
Max. external capacitance C_o	250 nF	250 nF
Max. external inductance L_o	1000 µH	1000 µH

Analog sensors with conductive measurement of conductivity

Max. output voltage U_o	10.08 V
Max. output current I_o	23 mA
Max. output power P_o	57 mW
Max. external capacitance C_o	50 nF
Max. external inductance L_o	300 µH

Analog sensors with inductive measurement of conductivity

Max. output voltage U_o	10.08 V
Max. output current I_o	64 mA
Max. output power P_o	128 mW
Max. external capacitance C_o	1800 nF
Max. external inductance L_o	100 µH


Digital sensor connection (Memosens)
Hazardous location
Class I Division 1, Groups A-D
Ordinary location or hazardous locations
(refer to measurement transmitter certification)
C US
FM APPROVED
Measurement transmitter with intrinsic safe digital sensor interface, i.e. CM42
Maximum output power
P_o = 178 mW
intrinsic safe wiring
max. cable length 100m (330 ft)
CYK10
CYK20
Memosens sensor
Measuring cable type CYK10 or CYK20 (L < 100 m) may be connected to the sensor module FSDG1 of the field measuring device type CM42
Furthermore, the connection to an intrinsically safe output circuit (Ex ia IIC) with the following maximum values is possible:
Maximum output voltage Uo DC 5.1 V
Maximum output current Io 130 mA
Maximum output power Po 166 mW
(linear output characteristic)
The maximum internal capacity and inductivity of the intrinsically safe output circuit may not exceed the following maximum values:
Maximum internal capacity Ci 15 µF
Maximum internal inductivity Li 95 µH
Alternative:
Maximum output voltage Uo DC 5.04 V
Maximum output current Io 80 mA
Maximum output power Po 112 mW
(trapezoid output characteristic)
The maximum internal capacity and inductivity of the intrinsically safe output circuit may not exceed the following maximum values:
Maximum internal capacity Ci 14.1 µF
Maximum internal inductivity Li 237.2 µH
Memosens Sensors
Digital pH sensors
xPS11D, xPS41D, xPS71D, PS91D, xPS441D, xPS471D, xPS491D, CPF81D-7...F, xPS171D
Digital combined sensors
xPS16D, xPS76D, xPS96D
Digital ORP sensors
xPS12D, xPS42D, xPS72D, xPS92D, CPF82D-7...F
Digital conductivity sensors
CLS15D, CLS16D, xLS21D, CLS50D, xLS82D
Digital oxygen sensors
COS21D, xOS22D, COS51D, xOS81D
Digital sensor simulators
CYP01D, xYP02D, xYP03D, with battery options Duracell MN1500 or Energizer EN91
x ... C or O or OC
Memosens sensors with fixed cable (without CYK10/CYK20)
Digital conductivity sensor CLS50D
A0043274

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