

smar
First in Fieldbus

DF47-12 / DF47-17

FEB / 24
DF47

INSTALLATION MANUAL

INTRINSIC SAFETY BARRIER FOR FIELDBUS



smar
NOVA SMAR S/A
www.smar.com.br

Specifications and information are subject to change without notice.
Up-to-date address information is available on our website.

web: www.smar.com/contactus.asp

AVOIDING ELECTROSTATIC DISCHARGES



ATTENTION

Electrostatic discharges may damage semiconductor electronic components in printed circuit boards. They usually occur when touching components or connector pins from modules and racks, without wearing the appropriate equipment to prevent discharges. It is recommended to take the following precautions:

- Before handling modules and racks, remove the electrostatic charge from your body by wearing a proper wristband or touching grounded devices;
- Avoid touching electronic components or connector pins from racks and modules.

DF47-12/DF47-17 – INTRINSIC SAFETY BARRIER FOR FIELDBUS

Description

The Intrinsically Safe (I.S.) technology incorporated in the DF47-12 and DF 47-17 totally isolates the control network on the hazardous side of the barrier. The I.S. values of the power supply are designed for fieldbus devices, which are in compliance with the FISCO model.

The incorporation of a Fieldbus repeater in compliance with IEC 61158-2 (31.25 kbits/s) essentially filters and boosts the incoming communication signal transmitting it to hazardous environment. The networks of the hazardous and safe sides of the DF47-12 and DF47-17 are completely independent from one another.

In addition, the bus termination for the hazardous network is incorporated into the DF47-12 and DF47-17, which means that only a single far terminator is required.

NOTES

If the terminator of the DF53 module is not being used, it is necessary to install another external terminator in the safe area.

The model DF47 was discontinued due to the new FISCO recommendations. The replacement by DF47-12 or DF47-17 models should be evaluated according to the current limits. The model DF47-17 supports up to 7 Smar's devices of the 302 series. If the replacement is using the DF47-12 model, it supports up to 5 Smar's devices of the 302 series.

- H1 isolated barrier and I.S. power supply in compliance with the FISCO model;
- H1 fieldbus signal repeater;
- In compliance with the IEC 61158-2, 31.25 kbits/s standard for Fieldbus. (FOUNDATION fieldbus and PROFIBUS PA);
- IEC, FM & CENELEC intrinsic safety standards certified;
- In compliance with IEC 60079-27, FISCO and FNICO power supply;
- Dual marking in compliance with IEC 60079-11 and IEC 60079-27;
- Bus termination on hazardous area.

Installation

The selection and installation of the barrier should always be accomplished by competent technical personnel. Please contact Smar or our local representative if further information is required.

According to the hazardous standards the barrier DF47-12 or DF47-17 must be installed out of hazardous location. The inputs parameters for installation in hazardous location are in the Approvals for Hazardous Areas topic.

The barrier has to be installed on DF1A, DF93, or DF9 and fixed in a DIN rail. For further details see the section Installing.

Installation Principles

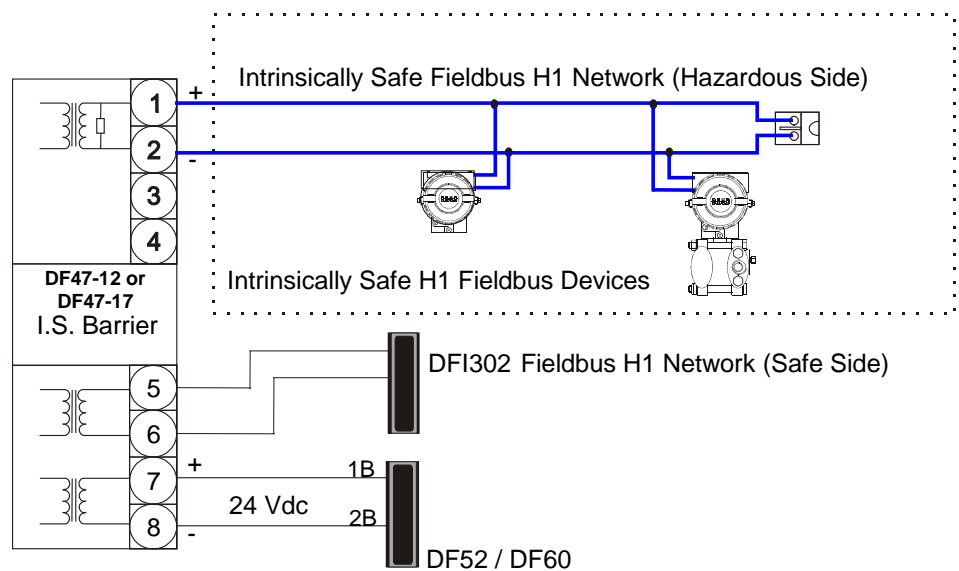
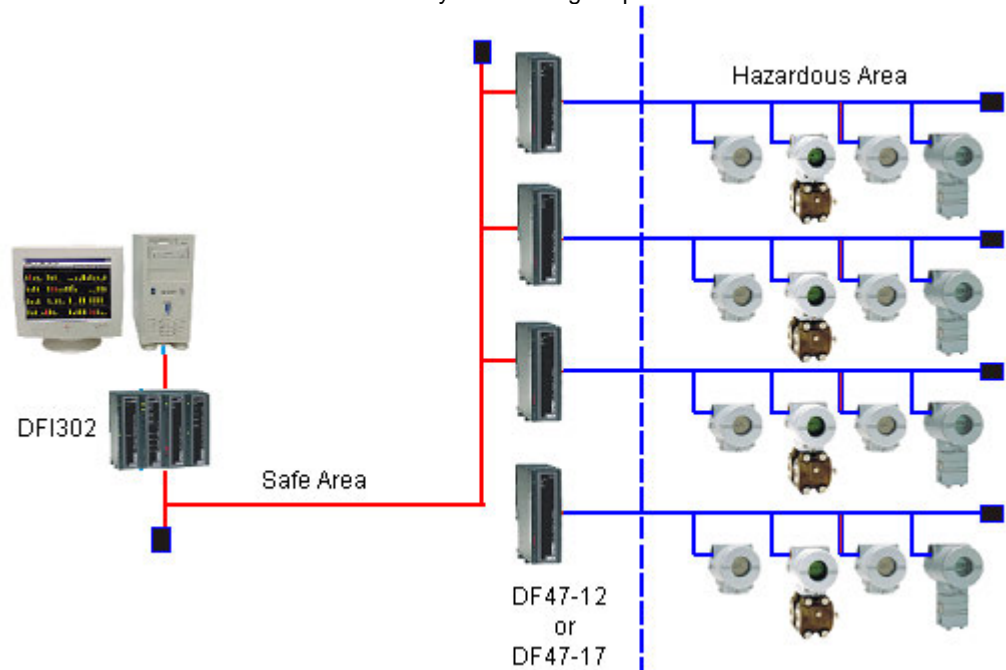
1. Ensure that there is an appropriate separation of intrinsically safe and non-intrinsically safe circuits (more than 50 mm or 1.97 inches), so the ignition energy from non-intrinsically safe circuit does not intrude into the intrinsically safe circuit.
2. Ensure that the limiting parameters of system design, total inductance and capacitance for example, upon which system approval is based are not exceeded.
3. Ensure that power system faults and ground potential differences do not generate system ignition.

Location

The barrier is normally installed in a dust-free and moisture-free enclosure located in the non-hazardous area. The enclosure should be as close as possible to the hazardous area to reduce cable runs and increased capacitance. If the barrier is installed in a hazardous area, it must be in a proper enclosure suited for the intended area. The only intrinsically safe terminals are at the barrier output.

Wiring

Intrinsically safe circuits may be wired in the same manner as conventional circuits installed for hazardous areas with two exceptions summarized as separation and identification. The intrinsically safe conductors must be separated from all other cables by placing them in separate conduits or by a separation of more than 50 mm or 1.97 inches of air. The raceways, cable trays, open wiring, and terminal boxes must be labeled "Intrinsically Safe Wiring" to prevent interference with other circuits.



Technical Specifications

POWER	
Power Supply Input	Voltage: 24Vdc \pm 5%
	Current (max.): 350mA @ 24Vdc

HAZARDOUS AREA	
Power Supply Output	Maximum voltage available at the barrier terminals: $U_s = 13.8$ Vdc.
	Maximum current in typical operation (considering $U_s = 13.8$ Vdc) DF47-12: $I_s = 65$ mA DF47-17: $I_s = 90$ mA
	Current limiting resistor (typical) DF47-12: $R_i \geq 247.5 \Omega$ DF47-17: $R_i \geq 176.22 \Omega$
	Maximum output power DF47-12: $P_o = 1.2$ W DF47-17: $P_o = 1.72$ W
Safety Parameters (Hazardous Area)	Refer to the item "Hazardous locations approvals.
Internal Dissipation	3 W maximum at 24 Vdc input, nominal conditions (for non intrinsically safe circuits).
Cable Length, Number of Devices	Maximum cables lengths are determined by IS requirements, and depend on both the number of devices attached and the maximum acceptable voltage drop along the cable. Use FISCO cable.
Digital Signal Transmission	Compatible with 31.25 kbps - Fieldbus systems.
Fuse	In order to guarantee the product safe, the internal fuse change must be executed only by the manufacturer.
Terminals	Accommodate conductors up to 2.5 mm ² (22 AWG)
Isolation	2500 V galvanic isolation between input, output, and power supply terminals. Tested at 1500 Vrms minimum between hazardous and safe area terminals

PHYSICAL	
Ambient Temperature	0 to +60°C (operation)
	-30°C to 70°C (storage)
Humidity	-5% to 95% relative humidity

IMPORTANT	
By using active junction boxes you must consider their current consumption to calculate the total consumption of segment.	

CERTIFICATIONS INFORMATION

European Directive Information

Consult www.Smar.com for the EC declarations of conformity and certificates.

Authorized representative/importer located within the Community:

Smar Europe BV De Oude Wereld 116 2408 TM Alphen aan den Rijn Netherlands

Hazardous locations general information

Ex Standards:

IEC 60079-0 General Requirements
IEC 60079-1 Flameproof Enclosures "d"
IEC 60079-7 Increased Safe "e"
IEC 60079-11 Intrinsic Safety "i"
IEC 60079-18 Encapsulation "m"
IEC 60079-26 Equipment with Separation Elements or combined Levels of Protection
IEC 60079-31 Equipment dust ignition protection by enclosure "t"
IEC 60529 Classification of degrees of protection provided by enclosures (IP Code)
IEC 60079-10 Classification of Hazardous Areas
IEC 60079-14 Electrical installation design, selection and erection
IEC 60079-17 Electrical Installations, Inspections and Maintenance
IEC 60079-19 Equipment repair, overhaul and reclamation
ISO/IEC 80079-34 Application of quality systems for equipment manufacture

Warning:

Explosions could result in death or serious injury, besides financial damage.

Installation of this instrument in hazardous areas must be in accordance with the local standards and type of protection. Before proceedings with installation make sure that the certificate parameters are in accordance with the classified hazardous area.

Maintenance and Repair

The instrument modification or replaced parts supplied by any other supplier than authorized representative of Smar is prohibited and will void the Certification.

Marking Label

The instrument is marked with type of protection options. The certification is valid only when the type of protection is indicated by the user. Once a particular type of protection is installed, do not reinstall it using any other type of protection.

Intrinsic Safety / Non Incendive application

In hazardous areas with intrinsic safety or non-incendive requirements, the circuit entity parameters and applicable installation procedures must be observed.

The instrument must be connected to a proper intrinsic safety barrier. Check the intrinsically safe parameters involving the barrier and equipment including the cable and connections. Associated apparatus ground bus shall be insulated from panels and mounting enclosures. Shield is optional, when using shielded cable, be sure to insulate the end not grounded.

Cable capacitance and inductance plus C_i and L_i must be smaller than C_o and L_o of the Associated Apparatus.

It is recommended do not remove the housing covers when powered on.

GENERAL NOTES

Intrinsically safe conductors must be blue, based on IEC standards.

If an intrinsically safe system component is not FISCO compliant, it is necessary to match all parameters between cable, equipment and barrier.

Designed for connection to a Fieldbus system according to the FISCO model with the following parameters:

Intrinsically safe equipment interconnected to the power supply circuit (Fieldbus) must be passive current consumer (sink), not supplier (source) and the internal effective inductance/capacitance must be between the following maximum values:

$$L_i \leq 10 \mu\text{H}$$

$$C_i \leq 5 \text{ nF}$$

Length parameters for Fieldbus interconnect cables must be within the following ranges:

PARAMETER	VALUE
Resistance per Unit Length	$15 \Omega/\text{km} \leq R' \leq 150 \Omega/\text{km}$
Indutance per Unit Length	$0.4 \text{ mH}/\text{km} \leq L' \leq 1 \text{ mH}/\text{km}$
Capacitance per Unit Length (including shielding)	$80 \text{ nF}/\text{km} \leq C' \leq 200 \text{ nF}/\text{km}$

Where:

$C' = C'_{\text{wire}} / \text{wire} + 0.5 \times C'_{\text{wire}} / \text{shield}$ When the Fieldbus circuit is isolated.

$C' = C'_{\text{wire}} / \text{wire} + C'_{\text{wire}} / \text{shield}$ when the shield is connected to the Fieldbus power supply output.

Maximum length for each cable branch: 60m in IIC/IIB.

A Fieldbus data signal terminator, which provides a capacitance less than or equal to 1.1 μF connected in series with a resistor greater than or equal to 100 Ω , is integrated into the DF47-12 and DF47-17 barriers. A similar terminator can be connected to the other end of the Fieldbus circuit.

When find the parameter mentioned above, the maximum allowable length including the lengths of all branches for Group IIC is 1000 m.

When find the parameter mentioned above, the maximum length allowed, including the lengths of all branches for Group IIB and Group I, is 5000 m.

* C_i : Input capacitance; L_i : Input inductance; C_o : Output capacitance; L_o : Output inductance.

Hazardous Locations Approvals

FM Approvals

<p>DF47-12 FISCO Power Supply Associated Intrinsic Safety (FM 3017363) AIS Class I, Division 1, Groups A, B, C and D AIS Class II, Division 1, Groups E, F and G AIS Class III, Division 1 AIS Class I, Zone 0 [AEx ia], Group IIC Ambient Temperature: $-20^{\circ}\text{C} \leq T_a \leq +60^{\circ}\text{C}$</p> <p>Entity FISCO Trapezoidal Characteristic: Terminals 1 and 2 Groups A/B IIC: Voc (Uo)= 15.0 V, Isc (Io)= 140 mA, Iknee (Is)= 82 mA, Po= 1.2 W, Ca (Co)= 0.23 μF, La (Lo)= 0.15 mH Terminals 1 and 2 Groups C IIB Voc (Uo)= 15.0 V, Isc (Io)= 140 mA, Iknee (Is)= 82 mA, Po= 1.2 W, Ca (Co)= 0.75 μF, La (Lo)= 0.5 mH Integral Terminator: R = 100 Ω, C = 1.0 μF, Ci = 0, Li= 0</p> <p>Note: The Fieldbus Isolated Barrier shall be installed in compliance with the enclosure, mounting, spacing and segregation requirements of the ultimate application, including a tool removable cover.</p>	<p>DF47-17 FISCO Power Supply Associated Intrinsic Safety (FM 3017363) AIS Class I, Division 1, Groups A, B, C and D AIS Class II, Division 1, Groups E, F and G AIS Class III, Division 1 AIS Class I, Zone 0 [AEx ia], Group IIC Ambient Temperature: $-20^{\circ}\text{C} \leq T_a \leq +60^{\circ}\text{C}$</p> <p>Entity FISCO Trapezoidal Characteristic: Terminals 1 and 2 Groups A/B IIC: Voc (Uo)= 15.0 V, Isc (Io)= 197 mA, Iknee (Is)= 115 mA, Po= 1.72 W, Ca (Co)= 0.21 μF, La (Lo)= 0.15 mH Terminals 1 and 2 Groups C IIB Voc (Uo)= 15.0 V, Isc (Io)= 197 mA, Iknee (Is)= 115 mA, Po= 1.72 W, Ca (Co)= 0.7 μF, La (Lo)= 0.5 mH Integral Terminator: R = 100 Ω, C = 1.0 μF, Ci = 0, Li= 0</p> <p>Note: The Fieldbus Isolated Barrier shall be installed in compliance with the enclosure, mounting, spacing and segregation requirements of the ultimate application, including a tool removable cover.</p>
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Drawing 102A-0948, 102A-0949, 102A-0946, 102A-0942, 102A-0944

DEKRA

Non Intrinsically safe circuits Parameters:
Power Supply Un = 24 Vdc, Um = 250 Vac, Pn = 3 W
Fieldbus signal circuits Um = 250 Vac

<p>DF47-12 FISCO Power Supply Associated Intrinsic Safety (BVS 03ATEX E 411X) Group II, Category (1) G, [Ex ia, EPL Ga], Groups IIB/ IIC FISCO Power Supply Group I, Category (M2) [Ex ia, EPL Mb], Group I</p> <p>Intrinsically safe fieldbus supply and signal circuit (FISCO-Model): Safety parameters: Uo = 15.0 Vdc, Io = 140.12 mA, Is = 80 mA, Po = 1200 mW, Ri \geq 247.5 Ω, Characteristics trapezoidal Ambient Temperature: $-20^{\circ}\text{C} \leq T_a \leq +60^{\circ}\text{C}$</p>	<p>DF47-17 FISCO Power Supply Associated Intrinsic Safety (BVS 03ATEX E 411X) Group II, Category (1) G, [Ex ia, EPL Ga], Groups IIB/ IIC FISCO Power Supply Group I, Category (M2) [Ex ia, EPL Mb] Group I</p> <p>Intrinsically safe fieldbus supply and signal circuit (FISCO-Model): Safety parameters: Uo = 15.0 Vdc, Io = 197 mA, Is = 115 mA, Po = 1720 mW, Ri \geq 176.22 Ω, Characteristics trapezoidal Ambient Temperature: $-20^{\circ}\text{C} \leq T_a \leq +60^{\circ}\text{C}$</p>
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Special conditions for safe use:

The Fieldbus-Isolated Barrier type DF47 -** shall be installed outside the hazardous area.

Wiring in the terminal box must satisfy the conditions of clause 6.3.11 and clause 7.6.e of EN 60079-11:2007

Terminals or connectors for the intrinsically safe fieldbus supply and signal circuit circuits shall be arranged according to clause 6.21 or 6.2.2 of EN 60079-11:2007 respectively.

Local installation rules to determine Lo and Co are replaced by apparatus- and cable-parameters in clause 15.3.2.

For Group I application interconnection of fieldbus-apparatus to an intrinsically safe electrical system shall be assessed in a System Certificate, if required in local installation rules.

The Essential Health and Safety Requirements are assured by compliance with:

EN 60079-0:2009 General Requirements

EN 60079-11:2007 Intrinsic Safety "i"

EN 60079-26:2007 Equipment with equipment protection level (EPL) Ga

EN 60079-27:2008 Fieldbus intrinsically safe concept (FISCO)

Drawing 102A-0948, 102A-0949, 102A-0946, 102A-0942, 102A-0944


CEPEL

Segurança Intrínseca Associado (CEPEL 06.1095X)

- Valores nominais dos terminais não intrinsecamente seguros (comuns a todos os modelos):
 $U_n = 24 \text{ Vcc}$; $U_m = 250 \text{ Vca}$; $P_n = 3 \text{ W}$

- Valores nominais dos terminais intrinsecamente seguros:

DF47-12	DF 47-17
$U_n = 14 \text{ V cc}$	$U_n = 14 \text{ V cc}$
$I_n = 75 \text{ mA cc}$	$I_n = 110 \text{ mA cc}$
$P_n = 1200 \text{ mW}$	$P_n = 1700 \text{ mW}$

 Segurança CEPEL 06.1095X	
Modelo DF47-12 Fonte de alimentação FISCO [Ex ia Ga] IIB $U_o = 15 \text{ Vcc}$ $I_o = 140,12 \text{ mA}$ $P_o = 1200 \text{ mW}$ $I_s = 80 \text{ mA}$ $R_i \geq 247,5 \Omega$ Tamb: $-20 \text{ }^\circ\text{C}$ a $+60 \text{ }^\circ\text{C}$	Modelo DF47-17 Fonte de alimentação FISCO [Ex ia Ga] IIB $U_o = 15 \text{ V}$ $I_o = 197 \text{ mA}$ $P_o = 1720 \text{ mW}$ $I_s = 115 \text{ mA}$ $R_i \geq 176,22 \Omega$ Tamb: $-20 \text{ }^\circ\text{C}$ a $+60 \text{ }^\circ\text{C}$

Nota: I_s – Corrente a 15 Vcc

Observações:

- 1) A validade deste Certificado de Conformidade está atrelada à realização das avaliações de manutenção e tratamento de possíveis não conformidades, de acordo com as orientações do Cepel, previstas no Regulamento de Avaliação da Conformidade. Para verificação da condição atualizada de regularidade deste Certificado de Conformidade deve ser consultado o banco de dados de produtos e serviços certificados do Inmetro.
- 2) O número do certificado é finalizado pela letra "X" para indicar que:
 - a) O equipamento foi projetado para conexão a um sistema Fieldbus de acordo com o modelo FISCO, conforme a Norma ABNT NBR IEC 60079-11:2013: Os dispositivos Fieldbus intrinsecamente seguros conectados ao barramento Fieldbus devem ser consumidores passivos de corrente (não geradores) e devem apresentar $C_i \leq 5 \text{ nF}$ e $L_i \leq 10 \mu\text{H}$;
 - b) Os cabos de interconexão do barramento devem obedecer às seguintes condições:
 - Resistência: $15 \Omega/\text{km} \leq R_c \leq 150\Omega/\text{km}$;
 - Capacitância (incluindo a malha): $45 \text{ nF}/\text{km} \leq C_c \leq 200 \text{ nF}/\text{km}$;
 - Indutância: $0,4 \text{ mH}/\text{km} \leq L_c \leq 1 \text{ mH}/\text{km}$.
 - c) O comprimento máximo permitido para o cabo Fieldbus é 5000 m para o Grupo IIB.
- 3) É responsabilidade do fabricante assegurar que os transformadores tenham sido submetidos com sucesso ao ensaio de rotina de tensão aplicada de 1500V eficaz, 60 Hz entre os enrolamentos primário e secundário.
- 4) Este certificado é válido apenas para os produtos dos modelos avaliados. Qualquer modificação nos projetos, bem como a utilização de componentes ou materiais diferentes daqueles definidos pela documentação descritiva dos produtos, sem a prévia autorização do Cepel, invalidará este certificado.
- 5) É responsabilidade do fabricante assegurar que os produtos fornecidos ao mercado nacional estejam de acordo com as especificações e documentação descritiva avaliada, relacionadas neste certificado.
- 6) As atividades de instalação, inspeção, manutenção, reparo, revisão e recuperação dos equipamentos são de responsabilidade dos usuários e devem ser executadas de acordo com os requisitos das normas técnicas vigentes e com as recomendações do fabricante.
- 7) A marcação é executada conforme a Norma ABNT NBR IEC 60079-0:2020 e o Requisito de Avaliação da Conformidade de Equipamentos Elétricos para Atmosferas Explosivas nas Condições de Gases e Vapores Inflamáveis (RAC), e é fixada na superfície externa do equipamento, em local visível. Esta marcação é legível e durável, levando-se em conta possível corrosão química.

Normas Aplicáveis:

ABNT NBR IEC 60079-0:2020 Atmosferas explosivas - Parte 0: Equipamentos – Requisitos gerais



ABNT NBR IEC 60079-11:2013 Atmosferas explosivas - Parte 11: Proteção de equipamento por segurança intrínseca "i"

ABNT NBR IEC 60079-26:2022 Atmosferas explosivas - Parte 26: Equipamento com elementos de separação ou níveis de proteção combinados



Desenhos 102A1126, 102A1127

Identification Plate

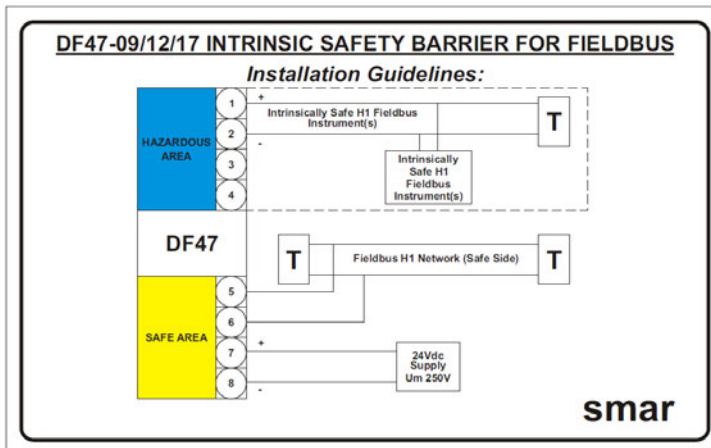
FM Approvals / DEKRA

DF47-12 INTRINSIC SAFETY BARRIER FOR FIELDBUS	
Safety Parameters:	
 APPROVED	Intrinsically Safe Connections for, CL I, DIV1, GP ABCDEFG and CL I, ZONE 0, GP IIC [AEx ia] IIC "See Installation drawing 102A0948 for FM FISCO parameters"
	BVS 03 ATEX E 411 X II (1)G [Ex ia Ga] IIB / IIC FISCO Power Supply I (M2) [Ex ia Mb] I
Non Intrinsically Safe Fieldbus signal circuits. Voltage Um AC 250 V - Max. Tamb. 60 °C	
Intrinsically Safe Fieldbus supply - and signal circuit (FISCO).	
Voltage	(Uo) Voc DC 15.0 V
Short circuit current	(Io) Isc 140 mA
Supply current at 15V	(Is) Iknee 82 mA
Power	Po 1.2 W
Current limiting resistor	Ri ≥ 247.5 ohm
Characteristics	trapezoidal




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DF47-17 INTRINSIC SAFETY BARRIER FOR FIELDBUS	
Safety Parameters:	
 APPROVED	Intrinsically Safe Connections for, CL I, DIV1, GP ABCDEFG and CL I, ZONE 0, GP IIC [AEx ia] IIC "See Installation drawing 102A0949 for FM FISCO parameters"
	BVS 03 ATEX E 411 X II (1)G [Ex ia Ga] IIB / IIC FISCO Power Supply I (M2) [Ex ia Mb] I
Non Intrinsically Safe Fieldbus signal circuits. Voltage Um AC 250 V - Max. Tamb. 60 °C	
Intrinsically Safe Fieldbus supply - and signal circuit (FISCO).	
Voltage	(Uo) Voc DC 15.0 V
Short circuit current	(Io) Isc 197 mA
Supply current at 15V	(Is) Iknee 115 mA
Power	Po 1.72 W
Current limiting resistor	Ri ≥ 176.22 ohm
Characteristics	trapezoidal

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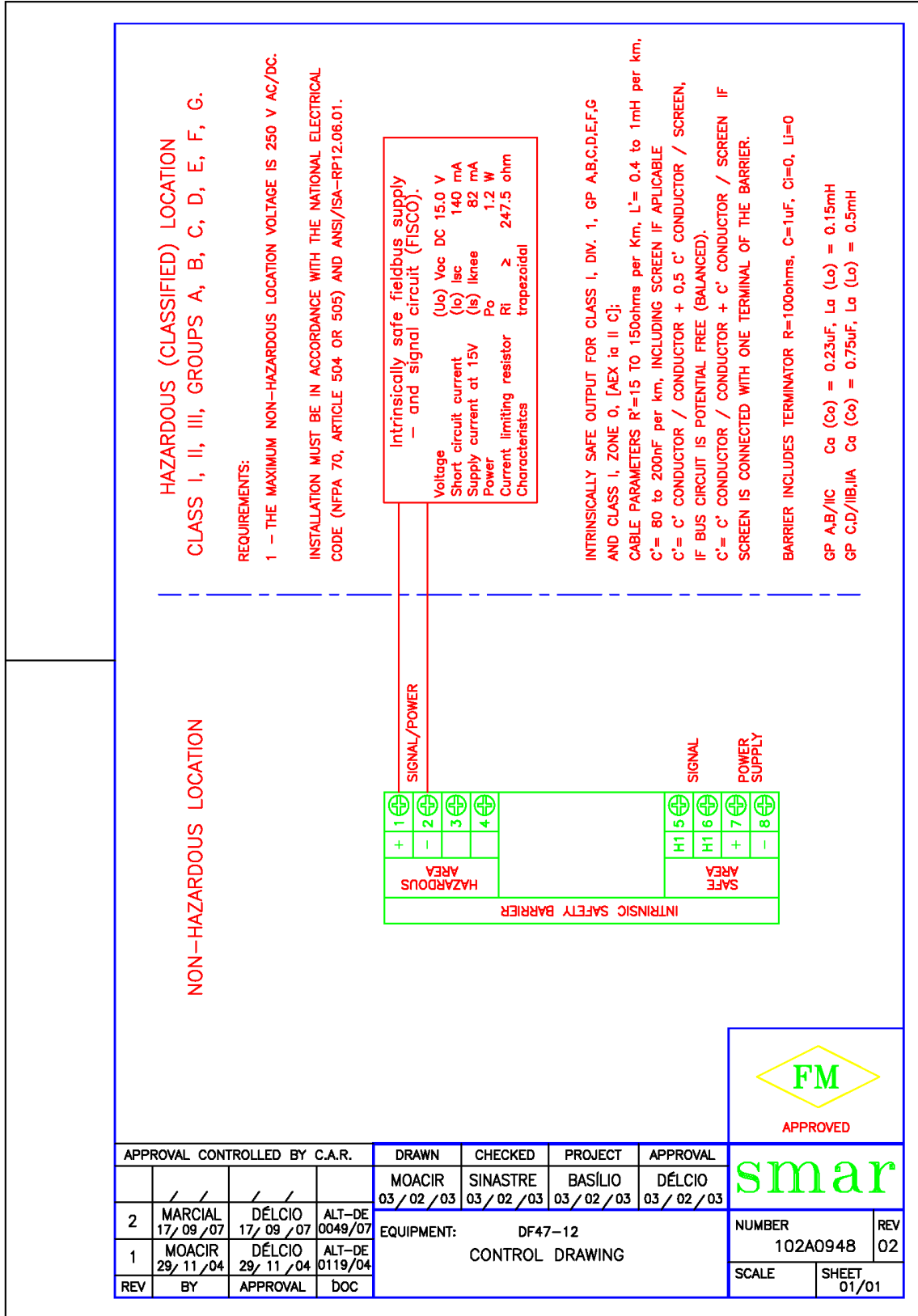


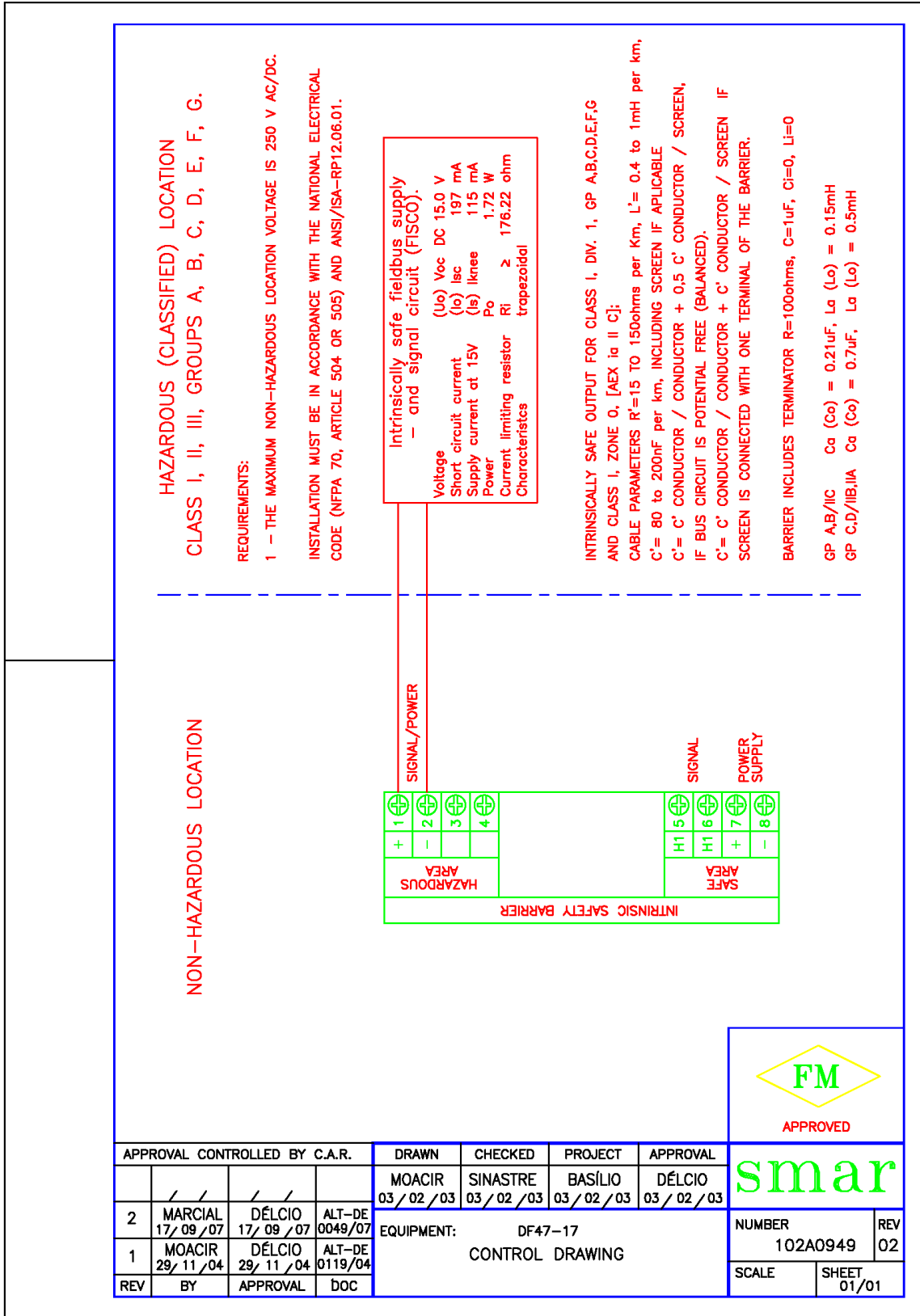
CEPEL

DF47-12 Barreira de Segurança Intrinseca Fieldbus	
FISCO Power Supply [Ex ia Ga] IIB CEPEL 06.1095 X $U_m = 250Vca$ $T_{amb}: -20^{\circ}C$ a $60^{\circ}C$	
 	Valores Nominais [Ex ia Ga] IIB CEPEL 06.1095 X $U_N = 14Vcc$ $U_o = 15V$ $I_N = 75mA$ $I_o = 140,12mA$ $P_N = 1200mW$ $P_o = 1200mW$ $I_s = 80mA$ $R_i \geq 247,5 \Omega$ $T_{amb}: -20^{\circ}C$ a $60^{\circ}C$
Circuito não Intrinsecamente Seguro $U_m = 250Vca$ $U_N = 24Vcc$ $P_N = 3W$ 	
smar	

DF47-17 Barreira de Segurança Intrinseca Fieldbus	
FISCO Power Supply [Ex ia Ga] IIB CEPEL 06.1095 X $U_m = 250Vca$ $T_{amb}: -20^{\circ}C$ a $60^{\circ}C$	
 	Valores Nominais [Ex ia Ga] IIB CEPEL 06.1095 X $U_N = 14Vcc$ $U_o = 15V$ $I_N = 110mA$ $I_o = 197mA$ $P_N = 1700mW$ $P_o = 1720mW$ $I_s = 115mA$ $R_i \geq 176,22 \Omega$ $T_{amb}: -20^{\circ}C$ a $60^{\circ}C$
Circuito não Intrinsecamente Seguro $U_m = 250Vca$ $U_N = 24Vcc$ $P_N = 3W$ 	
smar	

FM Approvals





Appendix B

smar	SRF – Service Request Form	
	DFI302 – Fieldbus Universal Bridge	Proposal Nº: _____
COMPANY INFORMATION		
Company: _____		
Unit: _____		
Invoice: _____		
COMMERCIAL CONTACT		
Full Name: _____		
Phone: _____		Fax: _____
E-mail: _____		
TECHNICAL CONTACT		
Full Name: _____		
Phone: _____		Extension: _____
E-mail: _____		
EQUIPMENT DATA		
Model: _____		
Serial Number: _____		
PROCESS DATA		
Process Type (Ex. boiler control): _____		
Operation Time: _____		
Failure Date: _____		
FAILURE DESCRIPTION		
(Please, describe the failure. Can the error be reproduced? Is it repetitive?)		

OBSERVATIONS		

USER INFORMATION		
Company: _____		
Contact: _____		
Section: _____		
Title: _____	Signature: _____	
Phone: _____	Extension: _____	
E-mail: _____	Date: ____/____/____	
For warranty or non-warranty repair, please contact your representative. Further information about address and contacts can be found on https://www.smar.com.br/en/support		

