

Instruction Manual

Model SC4A
Conductivity Sensors
19mm 2-electrode



(BG)

Всички улътвания за продукти от серията ATEX Ex се предлагат на английски език. Ако се нуждаете от улътвания за продукти от серията Ex на родния ви език, се свържете с най-близкия офис или представителство на фирма Yokogawa.

(CZ)

Všechny uživatelské příručky pro výrobky, na něž se vztahuje nevýbušné schválení ATEX Ex, jsou dostupné v angličtině. Požadujete-li pokyny týkající se výrobků s nevýbušným schválením ve vašem lokálním jazyku, kontaktujte prosím vaši nejbližší reprezentační kancelář Yokogawa.

(D)

Alle Betriebsanleitungen für ATEX Ex bezogene Produkte stehen in den Sprachen Englisch. Sollten Sie die Betriebs- anleitungen für Ex-Produkte in Ihrer Landessprache benötigen, setzen Sie sich bitte mit Ihrem örtlichem Yokogawa-Vertreter in Verbindung.

(DK)

Alle brugervejledninger for produkter relateret til CE er tilgængelige på engelsk. Skulle De ønske yderligere oplysninger om håndtering af CE produkter på eget sprog, kan De rette henvendelse herom til den nærmeste Yokogawa afdeling eller forhandler.

(EST)

Kõik ATEX Ex toodete kasutamishendid on esitatud inglise keeles. Ex seadmete muukeelse dokumentatsiooni saamiseks pöörduge lähima lokagava (Yokogawa) kontori või esindaja poole.

(E)

Todos los manuales de instrucciones para los productos antiexplosivos de ATEX están disponibles en inglés. Si desea solicitar las instrucciones de estos artículos antiexplosivos en su idioma local, deberá ponerse en contacto con la oficina o el representante de Yokogawa más cercano.

(F)

Tous les manuels d'instruction des produits ATEX Ex sont disponibles en langue anglaise. Si vous nécessitez des instructions relatives aux produits Ex dans votre langue, veuillez bien contacter votre représentant Yokogawa le plus proche.

(GB)

All instruction manuals for ATEX Ex related products are available in English. Should you require Ex related instructions in your local language, you are to contact your nearest Yokogawa office or representative.

(GR)

Όλα τα εγχειρίδια λειτουργίας των προϊόντων με ATEX Ex διατίθενται στα Αγγλικά. Σε περίπτωση που χρειάζεστε οδηγίες σχετικά με Ex στην τοπική γλώσσα παρακαλούμε επικοινωνήστε με το πλησιέστερο γραφείο της Yokogawa ή αντιπροσωπο της.

(H)

Az ATEX Ex műszerek gépkönyveit angol nyelven adjuk ki. Amennyiben helyi nyelven kérik az Ex eszközök leírásait, kérjük keressék fel a legközelebbi Yokogawa irodát, vagy képviselőt.

(I)

Tutti i manuali operativi di prodotti ATEX contrassegnati con Ex sono disponibili in inglese. Se si desidera ricevere i manuali operativi di prodotti Ex in lingua locale, mettersi in contatto con l'ufficio Yokogawa più vicino o con un rappresentante.

(LV)

Visas ATEX Ex kategorijas izstrādājumu Lietošanas instrukcijas tiek piegādātas angļu valodās. Ja vēlaties saņemt Ex ierīšu dokumentāciju citā valodā, Jums ir jāsazinās ar firmas Yokogawa (Yokogawa) tuvāko ofisu vai pārstāvi.

(LT)

Visos gaminio ATEX Ex kategorijos Eksploataavimo instrukcijos teikiami anglo kalbomis. Norėdami gauti prietaisø Ex dokumentacijà kitomis kalbomis susisiekitè su artimiausiu bendrovės Yokogawa biuru arba atstovu.

(M)

Il-manwali kollha ta' l-istruzzjonijiet għal prodotti marbuta ma' ATEX Ex huma disponibbli bl-Ingliż. Jekk tkun tehtieg struzzjonijiet marbuta ma' Ex fil-lingwa lokali tiegħek, għandek tikkuntattja lill-qrebb rappreżentant jew ufficiju ta' Yokogawa.

(NL)

Alle handleidingen voor producten die te maken hebben met ATEX explosiebeveiliging (Ex) zijn verkrijgbaar in het Engels. Neem, indien u aanwijzingen op het gebied van explosiebeveiliging nodig hebt in uw eigen taal, contact op met de dichtstbijzijnde vestiging van Yokogawa of met een vertegenwoordiger.

(P)

Todos os manuais de instruções referentes aos produtos Ex da ATEX estão disponíveis em Inglês. Se necessitar de instruções na sua língua relacionadas com produtos Ex, deverá entrar em contacto com a delegação mais próxima ou com um representante da Yokogawa.

(PL)

Wszystkie instrukcje obsługi dla urządzeń w wykonaniu przeciwwybuchowym Ex, zgodnych z wymaganiami ATEX, dostępne są w języku angielskim. Jeżeli wymagana jest instrukcja obsługi w Państwa lokalnym języku, prosimy o kontakt z najbliższym biurem Yokogawy.

(RO)

Toate manualele de instructiuni pentru produsele ATEX Ex sunt in limba engleza. In cazul in care doriti instructiunile in limba locala, trebuie sa contactati cel mai apropiat birou sau reprezentant Yokogawa.

(S)

Alla instruktionsböcker för ATEX Ex (explosionssäkra) produkter är tillgängliga på engelska. Om Ni behöver instruktioner för dessa explosionssäkra produkter på annat språk, skall Ni kontakta närmaste Yokogawakontor eller representant.

(SF)

Kaikkien ATEX Ex-tyyppisten tuotteiden käyttöohjeet ovat saatavilla englannin-. Mikäli tarvitsette Ex-tyyppisten tuotteiden ohjeita omalla paikallisella kielellänne, ottakaa yhteyttä lähimpään Yokogawa-toimistoon tai -edustajaan.

(SK)

Všetky návody na obsluhu pre prístroje s ATEX Ex sú k dispozícii v jazyku anglickom. V prípade potreby návodu pre Ex-prístroje vo Vašom národnom jazyku, skontaktujte prosím miestnu kanceláriu firmy Yokogawa.

(SLO)

Vsi predpisi in navodila za AEX Ex sorodni pridelki so pri roki v anglišèini. Èe so Ex sorodna navodila potrebna v vašem tukejnem jeziku, kontaktirajte vaš najbliži Yokogawa office ili predstavnika.

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1. PREFACE

1.1 Introduction

Model SC4A sensors, available in a Stainless Steel or Titanium version with fixed cable or Variopin connector, in combination with WU10/WE10-cable are intended for the low conductivity applications. These sensors are designed in a convenient compact style and can be inserted directly in process pipework using fittings, adapters or compression gland. Some sensors have wetted materials approved by FDA. This makes them ideally suited for the monitoring of pure water systems used in the preparation of injectable solutions. For this kind of application, sanitary clamp mountings are most often used.

All sensors have a pre-calibrated cell constant and a built-in temperature element for automatic temperature compensation. Sensors with the Variopin connector are equipped with an ID-chip in which calibration information is stored for easy setup when connected to a SENCOM Smart Adapter model SA11-C1. The model with Variopin connector can also be connected to an analog transmitter.

For metal sensors, a 3.1 material certificate is included. The sensors are certified for hazardous area when connected to a certified intrinsically safe Yokogawa analyzer (model SC202S, FLXA-series, SA11 Smart Adapter) or when connected to a certified intrinsically safe circuit with defined output parameters.

1.2 Unpacking and Checking

Upon delivery, unpack the sensor carefully and inspect it to ensure it was not damaged during shipment. If damage is found, retain the original packing materials, and then immediately notify the carrier and the relevant Yokogawa sales office.

Make sure the Model Code and Serial Number on the sensor are the same as on the packing list. Also, check any option(s) that were ordered are included and correct.

For some specific sensor information, the size of the sensor label is not sufficient. For that reason, a separate label is delivered with intrinsically safety compliance information (ATEX, IECEx, FM-United States and FM-Canada). This label needs to be connected onto the sensor cable close to the sensor.

1.3 Warranty and Service

Yokogawa products and parts are guaranteed free from defects in workmanship and material under normal use and service for a period of (typically) 12 months from the date of shipment from the manufacturer. Individual sales organizations can deviate from the typical warranty period, and the conditions of sale relating to the original purchase order should be consulted. Damage caused by wear and tear, inadequate maintenance, corrosion, or by the effects of chemical processes are excluded from this warranty coverage. In the event of warranty claim, the defective goods should be sent (freight paid) to the Service Department of the relevant sales Organization for repair or replacement (at Yokogawa's discretion).

The following information must be included in the letter accompanying the returned goods:

- Model Code and Serial Number.
- Original Purchase Order and Date.
- Length of time in service and description of the process.
- Description of the fault and circumstances of the failure.
- Process/environmental conditions that may be related to the failure of the sensor
- Statement as to whether warranty or non-warranty service is requested.
- Complete shipping and billing instructions for return of material, plus the name and phone number of a contact person that can be reached for further information.
- Clean Statement.

Returned goods that have been in contact with process fluids must be decontaminated and disinfected prior to shipment. Goods should carry a certificate to this effect, for the health and safety of our employees. Material Safety Data sheets must be included for all components of the process to which the sensor(options) have been exposed.

1.4 Serial number

The Serial number is defined by nine (9) alphanumeric characters:

X ₁ X ₂	Production location
X ₃ X ₄	Year/Month code
X ₅ X ₆ X ₇ X ₈ X ₉	Tracking number

Example: N3X205325

Table 1: Production Year code

Year	Year code	Year	Year code
2014	P	2026	3
2015	R	2027	4
2016	S	2028	5
2017	T	2029	6
2018	U	2030	7
2019	V	2031	8
2020	W	2032	9
2021	X	2033	A
2022	Y	2034	B
2023	Z	2035	C
2024	1	2036	D
2025	2	2037	E

Table 2: Production Month code

Month	Month code
January	1
February	2
March	3
April	4
May	5
June	6
July	7
August	8
September	9
October	A
November	B
December	C

2. GENERAL SPECIFICATIONS

2.1 Measuring method

: 2-electrode

2.2 Measuring element

: Pt1000 temperature sensor

2.3 Wetted parts

Sensor Body and electrodes	SC4A-T-AD	: Titanium grade 2 or 3
	SC4A-S-AD	: Stainless Steel AISI 316L
	SC4A-E-SA (SB, SC)	: Stainless Steel AISI 316L
	SC4A-T-PR	: Titanium grade 2 or 3
	SC4A-S-PR	: Stainless Steel AISI 316L
O-ring	SC4A-*-AD	: Viton
	SC4A-E-SA (SB, SC)	: EPDM FDA approved
	SC4A-*-PR	: Viton
Insulation	: All models	: PEEK 450G, FDA migration tested
Connector Variopin	: Contacts	: gold plated
	Material	: Nickel-plated brass
	Insulation	: PEEK, UL94-V0
Wetted parts adapters/fitting	/PS, /FF for SC4A-*-AD	: Stainless Steel AISI 316L
	/PF for SC4A-*-AD	: PVDF
	/SA1(2), /SB1(2), /SC1 for SC4A-E-SA (SB, SC)	: Stainless Steel AISI 316L
Cable ¹	: Conductors	: tinned copper 0.6 mm ²
	Outside shield	: braid, tinned copper, 85% coverage
	Insulator	: Polyester for conductor*

* for colors see Section 5.1, TPE-O for outer jacket, color black

Note 1 : Cable is not considered as wetted part

2.4 Functional specifications (at 25 °C)

Temperature element² : Pt1000 to IEC 751

Nominal Cell Constant : 0.02 cm⁻¹ or 0.01 cm⁻¹

Note 2 : The temperature sensor included in the sensor is designed for process compensation and for indication. It is **NOT** designed for process temperature control.

2.5 Dynamic specifications

Response time temperature (t₉₀) : < 1 min.

2.6 Operating range

Conductivity range* at actual process temperature : 1 μ S x C.C. – 200 mS x C.C.
See Fig. 1

* measurement range dependent on input range analyzer.

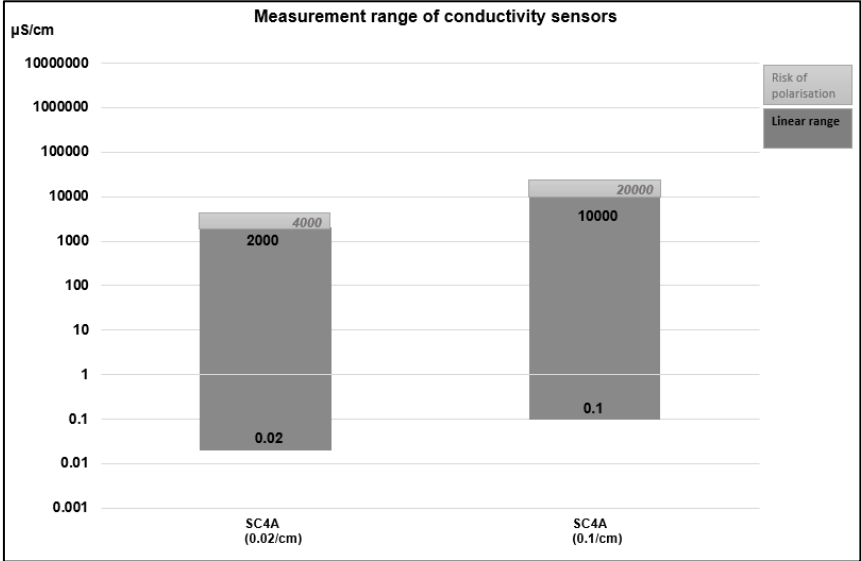


Fig. 1 Measuring range of conductivity sensors section

Temperature @ 100 KPa (1 Bar, 14.5 PSI) : 0 °C ... 125 °C (32 °F to 257 °F)
For VarioPin type sensors

0 °C ... 100 °C (32 °F to 212 °F)
For fixed cable type sensors

Remark:

For all types 135°C (275 °F) max. for a short period of time during sterilization.
In combination with a fitting or option, the specification of the most critical part is leading.

Pressure @ 25 °C : Stainless Steel & Titanium type
Over pressure 0 to 10 barg (7 to 142 PSIG)*
Under pressure 0 to 0.5 barg (0 to 7 PSIG)*

* Unit definition: barg = bar gauge, over pressure against atmosphere.
barneg = under pressure against atmosphere

Process Pressure in combination with PVDF fitting: See Fig. 2

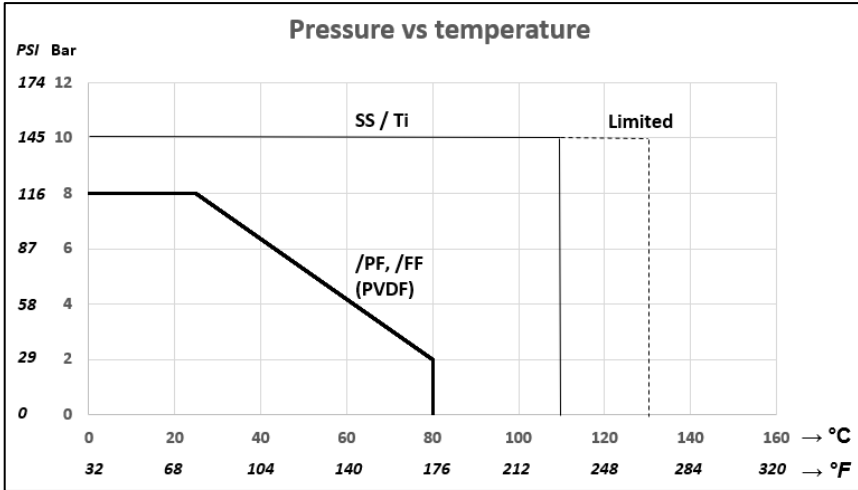


Fig. 2 Process pressure in combination with fitting

2.7 Shipping details

Package size (LxWxH)

220 x 220 x 90 mm (8.7 x 8.7 x 3.6 inch)
Fixed cable version

300 x 100 x 75 mm (11.8 x 3.9 x 3.0 inch)
VarioPin type version

Package weight (max.)

SC4A-***
connection type: -03/VS -05 -10 -15 -20
0.63 0.78 1.13 1.48 1.83 kg
1.4 1.7 2.5 3.0 4.0 lbs

2.8 Environmental conditions

Storage temperature : -30 °C to +50 °C (-22 °F to +122 °F)
Ingress Protection fixed cable type : IP65 (conform IEC 60529)
Ingress Protection VarioPin type : IP67 (conform IEC 60529)

2.9 Mechanical specifications

Surface roughness SC4A-*-AD : max. 0.8 µm
SC4A-E-SA/SB/SC : max. 0.5 µm
SC4A-*-PR : max. 0.8 µm

2.10 Regulatory standards

IECEX

Applying standards	: IEC 60079-0 : IEC 60079-11
Certificate no.*	: IECEX DEK 14.0032X, issue 1 Ex ia IIC T4...T6 Ga
Electrical data	: See Note 3
Specific conditions of use	: See Note 4

CE

- **ATEX** : Directive 2014/34/EU
Applying standards : EN IEC 60079-0
EN 60079-11
Certificate no.* : DEKRA 14ATEX0074X, issue 2
Ⓢ II 1 G Ex ia IIC T4...T6 Ga
Electrical data : See Note 3
Specific conditions of use : See Note 4
- **ROHSII** : Directive 2011/65/EU
Applying sensors, detectors and (ion sensitive) electrodes
- **PED** : Directive 2014/68/EU
Applying article 4.3 (Sound Engineering Practice)
- **LVD** : Directive 2014/35/EU
Applying standards : NEN-EN-IEC 61010-1
ANSI/ISA 61010-1
CAN/CSA-C22.2 No. 61010-1

Note 3 : Sensor input circuits when connected to an analog intrinsically safe certified SC transmitter (e.g. Yokogawa transmitter Model FLX21/FLX202 series or Yokogawa transmitter Model SC202S series):
In type of protection intrinsic safety Ex ia IIC maximum input values are:
 $U_i = 14.4 \text{ V}$, $I_i = 116.5 \text{ mA}$, $P_i = 0.3424 \text{ W}$,
 $L_i = 0.1 \text{ mH}$ (models with fixed cable) or $L_i = 0 \text{ mH}$ (VS type)
 $C_i = 150 \text{ nF}$ (models with fixed cable) or $C_i = 0.4 \text{ nF}$ (VS type)
For cable parameters refer to control drawing FM-Unites States
Page 14-16.

Sensor input circuits when connected to a digital intrinsically safe certified SA11-C1 Smart Adapter:
In type of protection intrinsic safety Ex ia IIC maximum input values are:
 $U_i = 6.6 \text{ V}$, $I_i = 100 \text{ mA}$, $P_i = 165 \text{ mW}$, $L_i = 0 \text{ mH}$ and $C_i = 0.4 \text{ nF}$.
For cable parameters refer to control drawing FM-Unites States
Page 14-16.



When the sensor has been connected to non-intrinsically safe equipment which exceeds the restrictions regarding the sensor input circuits, the sensor is not suitable anymore for intrinsically safe use.

Note 4 : Ambient temperature:

- 30°C to +40°C for temperature class T6,
- 30°C to +95°C for temperature class T5,
- 30°C to +125°C for temperature class T4 (VS type),
- 30°C to +130°C for temperature class T4 (models with fixed cable).



Electrostatic charges of the sensor enclosure part and label shall be avoided, especially in the case that the process medium is non-conductive. Use a damp cloth for cleaning the equipment. From the safety point of view the circuits shall be assumed to be connected to earth.

* Certification is subject to change, due to new regulations or changes in the product itself. When a certificate is updated, the certificate is released with a new issue number.

- ATEX:
 - DEKRA14ATEX0074 X, issue 1 (effective from 06-2014)
 - DEKRA11ATEX0074 X, issue 2 (effective from 02-2021)
- IECEx:
 - IECEx DEK 14.0032X, issue 0 (effective from 06-2014)
 - IECEx DEK 14.0032X, issue 1 (effective from 02-2021)

Label information:

All statutory required information is written on a metallized product label. This includes MS-code, serial number, and process operating specifications.

Example of a product label on see Fig. 3



Fig. 3 Sensor product label

Remarks:

1. Position of text/logos can deviate from the figure as shown
2. Number of non-intrinsically safe related text/logos can deviate from the figure as shown
3. Specific Ex marking depends on certification region
4. If product is too small to fit a label with necessary text, this text will be on a Metallized Polyester label placed on a plastic carrier for affixing adjacent to the product.

For sensors with IS certification (like SC4A) a separate plastic label card is provided. (For example, see Fig. 4)

This label contains information on IS for:

- ATEX
- IECEx
- FM-United States
- FM-Canada

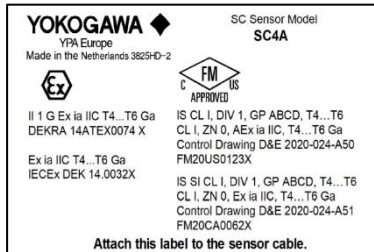


Fig. 4 Product label FM-US and FM-CAN

FM-United States

Applying standards	: FM Class 3600 FM Class 3610 FM Class 3810 ANSI/ISA 60079-0 ANSI/ISA 60079-11
Certificate no.*	: FM20US0123X IS CL I, DIV 1, GP ABCD, T4...T6 CL I, ZN 0, AEx ia IIC, T4...T6 Ga Control Drawing: D&E 2020-024-A50
Electrical data	: See Note 5
Specific conditions of use	: See Control Drawing D&E 2020-024-A50. Temperature classes for SC4A models are defined T4...T6, see Note 5.

Note 5 : Intrinsically safe, entity, for Class I, Division 1, Groups A, B, C and D;
Class I, Zone 0, AEx ia IIC, Ga (entity) for hazardous (classified) locations
when installed per control drawing D&E 2020-024-A50.
Maximum sensor input parameters:
 $U_i = 14.4 \text{ V}$; $I_i = 116.5 \text{ mA}$; $P_i = 0.3424 \text{ W}$;
 $L_i = 0.1 \text{ mH}$ (models with fixed cable) or $L_i = 0 \text{ mH}$ (VS type);
 $C_i = 150 \text{ nF}$ (models with fixed cable) or $C_i = 0.4 \text{ nF}$ (VS type).

Ambient temperature:

- 30°C to +40°C for temperature class T6,
- 30°C to +95°C for temperature class T5,
- 30°C to +125°C for temperature class T4 (VS type),
- 30°C to +130°C for temperature class T4 (models with fixed cable).



WARNING When the sensor has been connected to non intrinsically safe equipment which exceeds the restrictions regarding the sensor input circuits, the sensor is not suitable anymore for intrinsically safe use.

* Certification is subject to change, due to new regulations or changes in the product itself. When a certificate is updated the certificate is released under the same number with a new date.

- FM-United States:
FM20US0123X (effective from 03-2021)

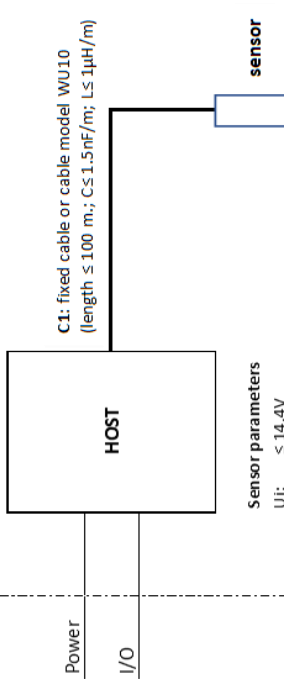
Control drawing: D&E 2020-024-A50 (part 1)

Non-hazardous Location

Hazardous Location

IS CL I, DIV 1, GP ABCD T2 / T3 / T4 / T5 / T6
 CL I, ZN 0, AEx ia IIC, T2... T6 Ga
 Ta 275°C / 165°C / 130°C / 95°C / 40°C

Remark: For sensors with connector (including ID-chip) Ta is limited to 125°C for T2, T3 and T4



Sensor parameters

- Ui: ≤ 14.4V
- Ii: ≤ 116.5mA
- Pi: ≤ 342.4mW
- Ci: ≤ 0nF for sensor models with connector (without ID-chip)
 ≤ 0.4nF for sensor models with connector (including ID-chip)
 ≤ 150nF for sensor models with permanent cable

Remark:

Sensor Ci (in case of an integral cable the Ci includes the capacitance of the cable) shall not exceed the Co of the HOST.

- Li: ≤ 0mH for sensor models with connector (without ID-chip)
 ≤ 0mH for sensor models with connector (including ID-chip)
 ≤ 0.1mH for sensor models with permanent cable

Remark:

Sensor Li (in case of an integral cable the Li includes the inductance of the cable) shall not exceed the Lo of the HOST.

Remarks:

1. No revision to this drawing without prior approval of FM.
2. Installation must be in accordance with the National Electrical Code (ANSI/NFPA 70), ANSI/ISA-RP12.06.01, and relevant local codes.
3. The sensor shall be installed to a certified intrinsically safe HOST with the following maximum values: $U_o = 14.4\text{ V}$, $I_o = 116.5\text{ mA}$, $P_o = 342.4\text{ mW}$.
4. The sensor does not provide isolation from earth. Installers shall take necessary measures to prevent the possibility of sparking resulting from differing earth potentials between the sensors and interconnecting equipment. This can be realized for example by selecting interconnecting equipment which provides input-to-output and input-to-earth isolation up to 500 V rms.
5. Sensor Model code:

Table 3

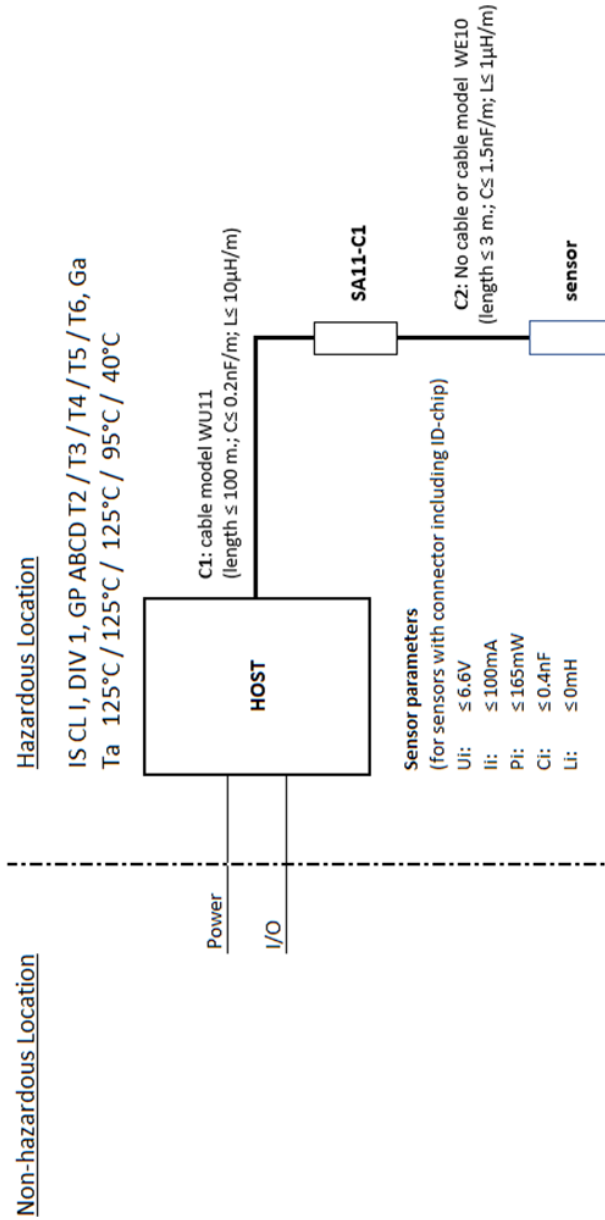
Model	Suffix Codes	Option Codes
SC4A	-a-bc-de-fgh-ij-kl	/m
a	Material	T Titanium S Stainless Steel, Viton sealing E Stainless Steel, EPDM sealing
bc	Fitting type	Two alphanumeric characters (A to Z, 0 to 9 or a hyphen)
de	Sensor length	Two alphanumeric characters (A to Z, 0 to 9 or a hyphen)
egh	Cell Constant	Three alphanumeric characters (A to Z, 0 to 9 or a hyphen)
ij	Connection type	VS Connector with ID-chip. Two alphanumeric characters identifying the length of the permanent cable, each character from 0 to 9
kl	Temp. sensor + Region	T1 Pt1000, IS for ATEX/IECEX, FM-US, FM-CAN
m	Option code	Up to ten alphanumeric characters (A to Z, 0 to 9 or hyphen)

6. **WARNING—POTENTIAL ELECTROSTATIC CHARGING HAZARD – SEE INSTRUCTIONS**
pH sensors containing accessible plastic parts and/or external conductive parts, must be installed and used in such a way, that dangers of ignition due to hazardous electrostatic charges cannot occur, especially in the case that the process medium is non-conductive.

WARNING—POTENTIAL IGNITION HAZARD – SEE INSTRUCTIONS

Contact Conductivity sensors containing light metals, must be installed, and used in such a way that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

Control drawing: D&E 2020-024-A50 (part 2)



Remarks:

1. No revision to this drawing without prior approval of FM.
2. Installation must be in accordance with the National Electrical Code (ANSI/NFPA 70), ANSI/ISA-RP12.06.01, and relevant local codes.
3. The sensor shall be installed to a certified intrinsically safe Smart Adapter, model SA11-C1, with the following maximum values: $U_o = 6.6 \text{ V}$, $I_o = 100 \text{ mA}$, $P_o = 165 \text{ mW}$.
4. The Installers shall take necessary measures to prevent the possibility of sparking resulting from differing earth potentials between the sensors and interconnecting equipment. The sensor itself does not provide 500 V rms isolation from earth, the interconnecting equipment Model SA11-C1 Smart Adapter however provides this required isolation.
5. Sensor Model code:

Table 4

Model	Suffix Codes	Option Codes
SC4A	-a-bc-de-fgh-ij-kl	/m
a	Material	T Titanium S Stainless Steel, Viton sealing E Stainless Steel, EPDM sealing
bc	Fitting type	Two alphanumeric characters (A to Z, 0 to 9 or a hyphen)
de	Sensor length	Two alphanumeric characters (A to Z, 0 to 9 or a hyphen)
efg	Cell Constant	Three alphanumeric characters (A to Z, 0 to 9 or a hyphen)
ij	Connection type	VS Connector with ID-chip.
kl	Temp. sensor + Region	T1 Pt1000, IS for ATEX/IECEX, FM-US, FM-CAN
m	Option code	Up to ten alphanumeric characters (A to Z, 0 to 9 or hyphen)

6. **WARNING—POTENTIAL ELECTROSTATIC CHARGING HAZARD – SEE INSTRUCTIONS**

pH sensors containing accessible plastic parts and/or external conductive parts, must be installed and used in such a way, that dangers of ignition due to hazardous electrostatic charges cannot occur, especially in the case that the process medium is non-conductive.

WARNING—POTENTIAL IGNITION HAZARD – SEE INSTRUCTIONS

Contact Conductivity sensors containing light metals, must be installed and used in such a way that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

FM-Canada

Applying standards	: CAN/CSA-C22.2 No. 60079-0 CAN/CSA-C22.2 No. 60079-11
Certificate no.*	: FM20CA0062X IS CL I, DIV 1, GP ABCD, T4...T6 CL I, ZN 0, Ex ia IIC, T4...T6 Ga Control Drawing: D&E 2020-024-A51
Electrical data	: See Note 6
Specific conditions of use	: See Control Drawing D&E 2020-024-A51. Temperature classes for SC4A models are defined T4...T6, see Note 6.

Note 6 : Intrinsically safe, entity, for Class I, Division 1, Groups A, B, C and D;
Class I, Zone 0, Ex ia IIC, Ga (entity) for hazardous (classified) locations
When installed per control drawing D&E 2020-024-A51.
Maximum sensor input parameters:
U_i= 14.4 V; I_i= 116.5 mA; P_i= 0.3424 W;
L_i= 0.1 mH (models with fixed cable) or L_i= 0 mH (VS type);
C_i= 150 nF (models with fixed cable) or C_i= 0.4 nF (VS type).

Ambient temperature:

- 30°C to +40°C for temperature class T6,
- 30°C to +95°C for temperature class T5,
- 30°C to +125°C for temperature class T4 (VS type),
- 30°C to +130°C for temperature class T4 (models with fixed cable).

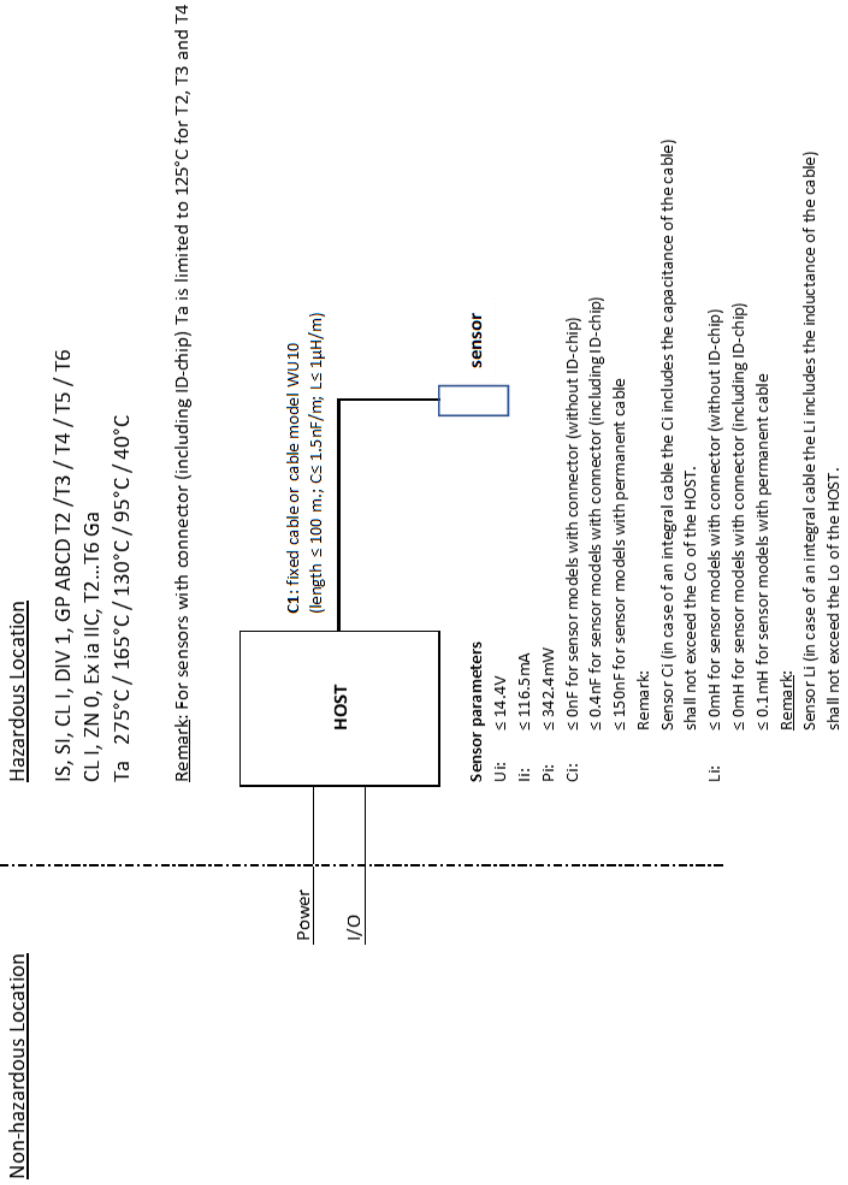
**WARNING**

When the sensor has been connected to non intrinsically safe equipment which exceeds the restrictions regarding the sensor input circuits, the sensor is not suitable anymore for intrinsically safe use.

* Certification is subject to change, due to new regulations or changes in the product itself.
When a certificate is updated the certificate is released under the same number with a new date.

- FM-Canada:
FM20CA0062X (effective from 03-2021)

Control drawing: D&E 2020-024-A51 (part 1)



Remarks:

1. No revision to this drawing without prior approval of FM.
2. Installation must be in accordance with the National Electrical Code (CEC) CSA22.1 and relevant local codes.
3. The sensor shall be installed to a certified intrinsically safe HOST with the following maximum values: $U_0 = 14.4 \text{ V}$, $I_0 = 116.5 \text{ mA}$, $P_0 = 342.4 \text{ mW}$.
4. The sensor does not provide isolation from earth. Installers shall take necessary measures to prevent the possibility of sparking resulting from differing earth potentials between the sensors and interconnecting equipment. This can be realized for example by selecting interconnecting equipment which provides input-to-output and input-to-earth isolation up to 500 V rms.
5. Sensor Model code:

Table 5

Model	Suffix Codes	Option Codes
SC4A	-a-bc-de-fgh-ij-kl	/m
a	Material	T Titanium S Stainless Steel, Viton sealing E Stainless Steel, EPDM sealing
bc	Fitting type	Two alphanumeric characters (A to Z, 0 to 9 or a hyphen)
de	Sensor length	Two alphanumeric characters (A to Z, 0 to 9 or a hyphen)
egh	Cell Constant	Three alphanumeric characters (A to Z, 0 to 9 or a hyphen)
ij	Connection type	VS Connector with ID-chip. Two alphanumeric characters identifying the length of the permanent cable, each character from 0 to 9
kl	Temp. sensor + Region	T1 Pt1000, IS for ATEX/IECEX, FM-US, FM-CAN
m	Option code	Up to ten alphanumeric characters (A to Z, 0 to 9 or hyphen)

6. **WARNING – POTENTIAL ELECTROSTATIC CHARGING HAZARD – SEE INSTRUCTIONS**
pH sensors containing accessible plastic parts and/or external conductive parts, must be installed and used in such a way, that dangers of ignition due to hazardous electrostatic charges cannot occur, especially in the case that the process medium is non-conductive.

AVERTISSEMENT – DANGER POTENTIEL DE CHARGES ÉLECTROSTATIQUES – VOIR LES INSTRUCTIONS

Les sondes de conductivité de contact contenant des pièces en plastique accessibles et / ou des pièces conductrices externes doivent être installées et utilisées de manière à éviter tout risque d'inflammation dû à des charges électrostatiques dangereuses, en particulier dans le cas où le fluide de procédé n'est pas conducteur.

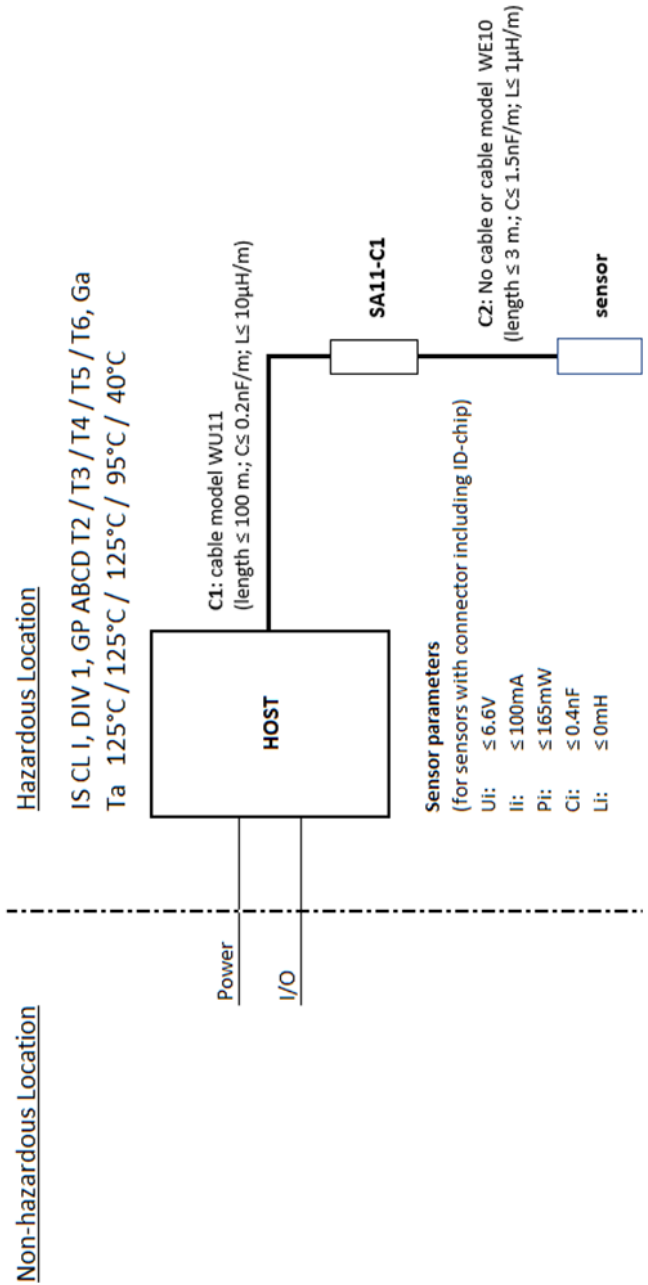
WARNING – POTENTIAL IGNITION HAZARD – SEE INSTRUCTIONS

Contact Conductivity sensors containing light metals, must be installed and used in such a way that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

AVERTISSEMENT – RISQUE POTENTIEL D'ALLUMAGE – VOIR LES INSTRUCTIONS

Les capteurs de conductivité de contact contenant des métaux légers doivent être installés et utilisés de telle sorte que, même en cas d'incidents rares, les sources d'allumage dues aux chocs et aux étincelles de friction soient exclues.

Control drawing: D&E 2020-024-A51 (part 2)



Remarks:

1. No revision to this drawing without prior approval of FM.
2. Installation must be in accordance with the National Electrical Code (CEC) CSA22.1 and relevant local codes.
3. The sensor shall be installed to a certified intrinsically safe Smart Adapter, model SA11-C1, with the following maximum values: $U_o = 6.6 \text{ V}$, $I_o = 100 \text{ mA}$, $P_o = 165 \text{ mW}$.
4. The Installers shall take necessary measures to prevent the possibility of sparking resulting from differing earth potentials between the sensors and interconnecting equipment. The sensor itself does not provide 500 V rms isolation from earth, the interconnecting equipment Model SA11-C1 Smart Adapter however provides this required isolation.
5. Sensor Model code:

Table 6

Model	Suffix Codes	Option Codes
SC4A	-a-bc-de-fgh-ij-kl	/m
a	Material	T Titanium S Stainless Steel, Viton sealing E Stainless Steel, EPDM sealing
bc	Fitting type	Two alphanumeric characters (A to Z, 0 to 9 or a hyphen)
de	Sensor length	Two alphanumeric characters (A to Z, 0 to 9 or a hyphen)
egh	Cell Constant	Three alphanumeric characters (A to Z, 0 to 9 or a hyphen)
ij	Connection type	VS Connector with ID-chip.
kl	Temp. sensor + Region	T1 Pt1000, IS for ATEX/IECEX, FM-US, FM-CAN
m	Option code	Up to ten alphanumeric characters (A to Z, 0 to 9 or hyphen)

6. **WARNING—POTENTIAL ELECTROSTATIC CHARGING HAZARD – SEE INSTRUCTIONS**

pH sensors containing accessible plastic parts and/or external conductive parts, must be installed and used in such a way, that dangers of ignition due to hazardous electrostatic charges cannot occur, especially in the case that the process medium is non-conductive.

AVERTISSEMENT – DANGER POTENTIEL DE CHARGES ÉLECTROSTATIQUES – VOIR LES INSTRUCTIONS

Les sondes de conductivité de contact contenant des pièces en plastique accessibles et / ou des pièces conductrices externes doivent être installées et utilisées de manière à éviter tout risque d'inflammation dû à des charges électrostatiques dangereuses, en particulier dans le cas où le fluide de procédé n'est pas conducteur.

WARNING—POTENTIAL IGNITION HAZARD – SEE INSTRUCTIONS

Contact Conductivity sensors containing light metals, must be installed and used in such a way that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

AVERTISSEMENT – RISQUE POTENTIEL D'ALLUMAGE – VOIR LES INSTRUCTIONS

Les capteurs de conductivité de contact contenant des métaux légers doivent être installés et utilisés de telle sorte que, même en cas d'incidents rares, les sources d'allumage dues aux chocs et aux étincelles de friction soient exclues.

3. INSTALLATION OF SC4A sensors

For optimum measurement results, the SC4A sensor should be installed in a location that offers an acceptable representation of the process composition and DOES NOT exceed the specifications of the sensor.

3.1 Typical installation SC4A-*AD with standard options

The SC4A-*AD sensor can be installed in the process using optional 3/4" NPT adapters. These adapters are available in Stainless Steel (/PS) and in PVDF (/PF); see Fig. 5 for the mounting sequence. The sensor can also be installed in an optional Stainless-Steel flow fitting (/FF) using option /PS, see Fig. 6 for details.

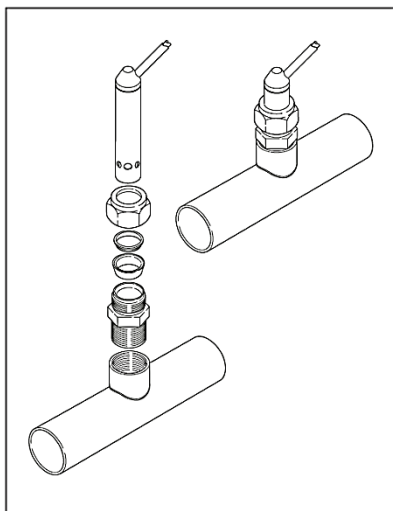


Fig. 5 Mounted sensor with option /PF and /PS

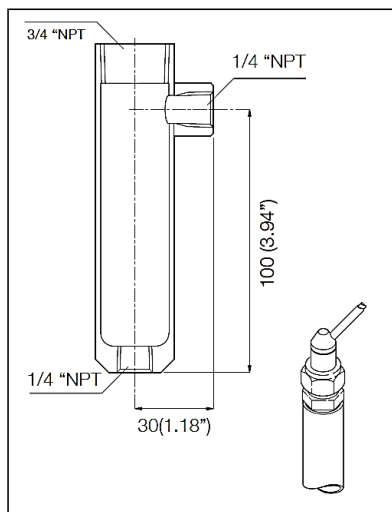


Fig. 6 Dimensional drawing /FF with option /PS

3.2 Typical installation SC4A-E-SA (SB, SC) with standard options / spare parts

The typical installation of the SC4A-E-SA sensor is done by using a standardized 25 mm port. Stainless Steel welding sockets are available as straight version (spare part /SA1) or 15° angled version (spare part /SA2). Both versions are delivered with mounting nut. In Fig. 7 an example is shown how to install the sensor using spare part /SA1. Sensors SC4A-E-SB and SC4A-E-SC are installed by tri-clamp method, see Fig. 8. For the SB version two Stainless Steel tri-clamps are available, in a 1" size (spare part /SB1) or in a 1½" size (spare part /SB2). The SC version has just one Stainless Steel tri-clamp in a 2" size (spare part /SC1).

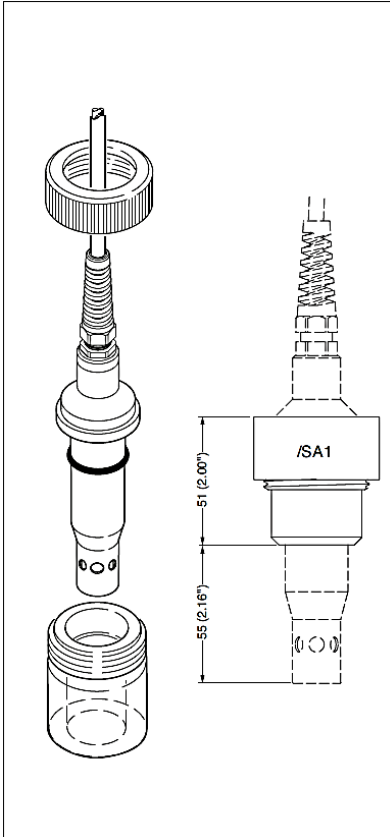


Fig. 7 Mounted SC4A-E-SA sensor with spare part/ SA1

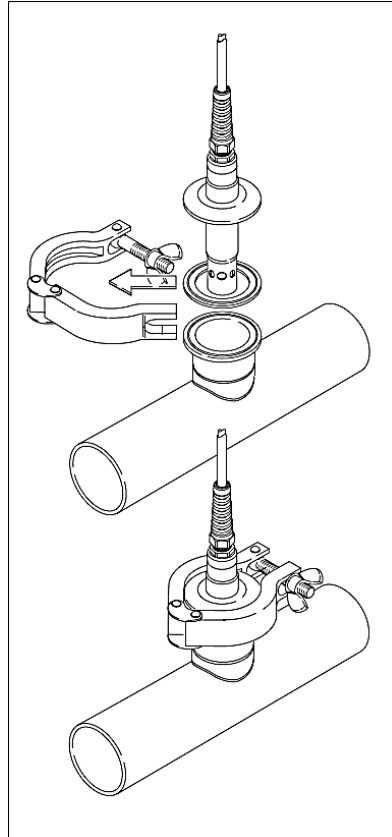


Fig. 8 Mounted SC4A-E-SB(-SC) sensor

3.3 Typical installation SC4A-*-PR

The installation of the SC4A-*-PR sensor is done using the Model PR10 retractable fitting. The mounting procedure of the sensor is explained in the Instruction Manual of this fitting.

4. DIMENSIONS

Dimensions in mm (inches)

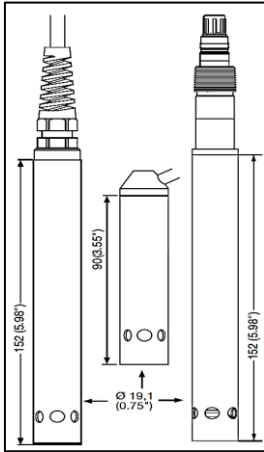


Fig. 9 SC4A-AD

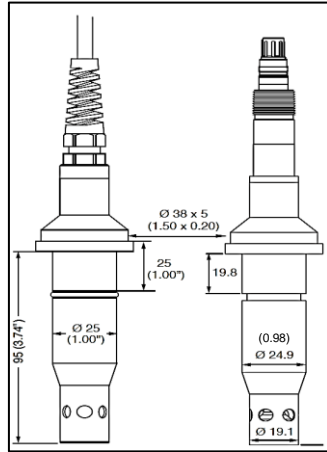


Fig. 10 SC4A-SA

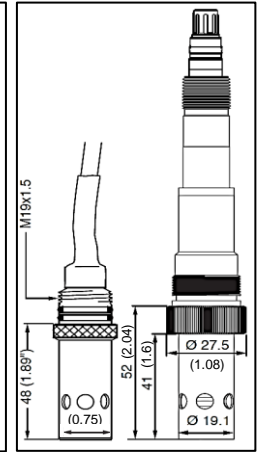


Fig. 11 SC4A-PR

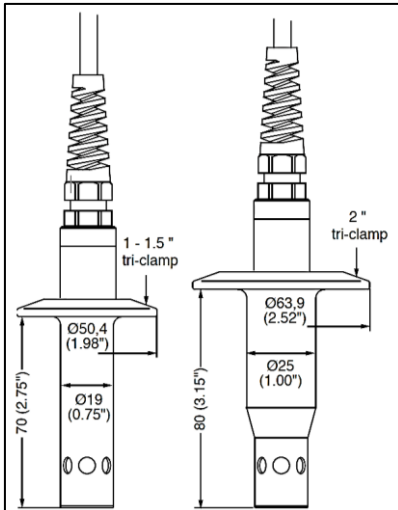


Fig. 12 SC4A-SB sensor

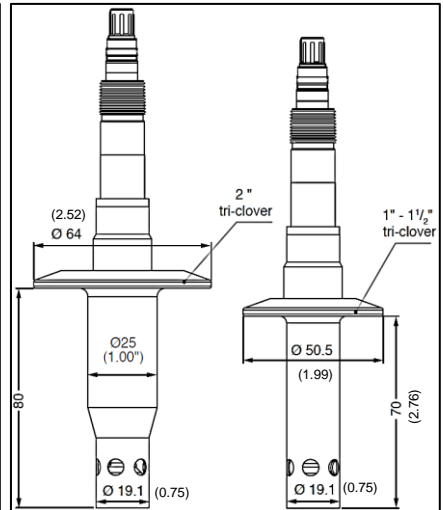


Fig. 13 SC4A-SC sensor

5. WIRING

The SC4A sensors are provided with a fixed sensor cable or Variopin connector to fit the WU10/WE10 cable up to 20 meters.

When a longer cable run is necessary (maximum cable run is 60 meters for the analog sensor setup), this can be done by using the WF10/WE10 extension cable in combination with the BA10 connection box. The connection of the integral cable and WF10/WE10 cable to the Yokogawa Contact Conductivity analyzer are given in table 7.

When even longer cable runs are required, we recommend using the digital SENCOM concept where cables run up to 200 meters are possible.

This can be done using the VarioPin sensor types in combination with a SA11 Smart adapter, WU11 digital connection cables and BA11 Active Junction Box.

For a complete overview of products and possibilities for connecting multiple sensors to a host using the digital SENCOM concept: Please see: SA11 GS12A06S01-00EN

5.1 Connecting conductivity sensor to analog host system

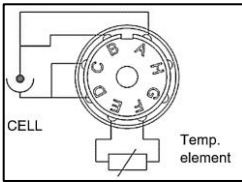


Fig. 14 Top view Vario pin connector types

Table 7: Definition fixed cable (+ BA10 with WF10/WE10) and analyzer

Cable wire color SC4A	Cable wire color WF10 / WE10	Terminal / wire #	Signal Description
White	Red	11	Temperature
Brown	Blue	12	Temperature
Green	White (Core of coax)	13	Uo (outer electrode)
Yellow	White (Shield of core)	14	Io (outer electrode)
Black	Brown (Core of coax)	15	Ui (inner electrode)
Pink	Brown (Shield of core)	16	Ii (inner electrode)

Table 8: Definition VP sensor cable, WU10/WE10 with analyzers

VP connector	Cable wire color WU10-V-D ^{7/8} / WE10-H-D 8	Terminal / wire #	Signal Description
A	Brown (Core of coax)	15	Ui (inner electrode)
B	Brown (Shield of core)	16	Ii (inner electrode)
C	White (Core of coax)	16	Uo (outer electrode)
D	White (Shield of core)	14	Io (outer electrode)
E	Red	11	Temperature
F	Blue	12	Temperature
G	Yellow	///	VCC ID chip
H	Green	///	Data ID chip
Drain wire	Black	63 / Gnd	Overall shield

Note 7 : WF10 and WU10-V-D have the same color definition, therefore connection to a BA10 can be done connecting corresponding colors.

Note 8 : Preferred connection cable is Yokogawa Model WU10-V-D or Model WE10 IM 12D07J04-01EN-P

5.2 Connecting conductivity sensor to the digital SENCOM smart adapter SA11

Direct mounting of the sensor to SA11

The SA11 can be installed directly on top of the Yokogawa labelled sensor by means of the Variopin connection system

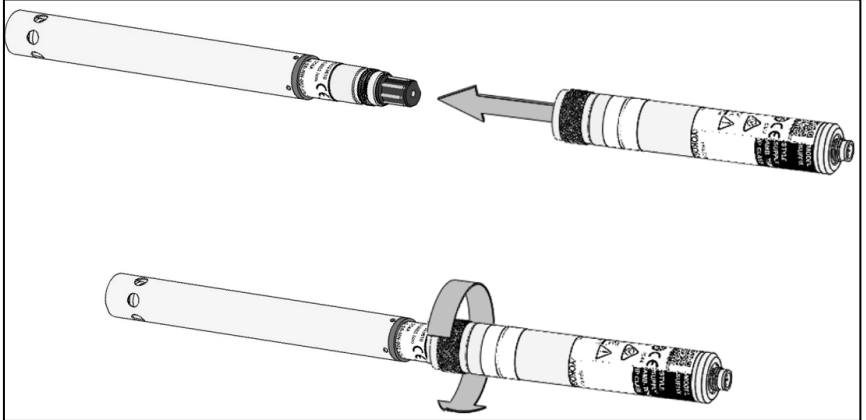


Fig. 15 Sensor + SA11 Smart adapter

Cable mounting

When there is less room to install the SA11 on top of the Yokogawa labelled sensor, an alternative mounting method is to install the SA11 using the optional wall/pipe mounting hardware. The SA11 in this case is connected to the sensor using the dedicated extension cable model WE10 with a fixed length of 2.99 meter.

Use the correct Variopin cable. For correct measurement without loss of specification the SA11-C1 must be used with WE10-H-D-003-V2.

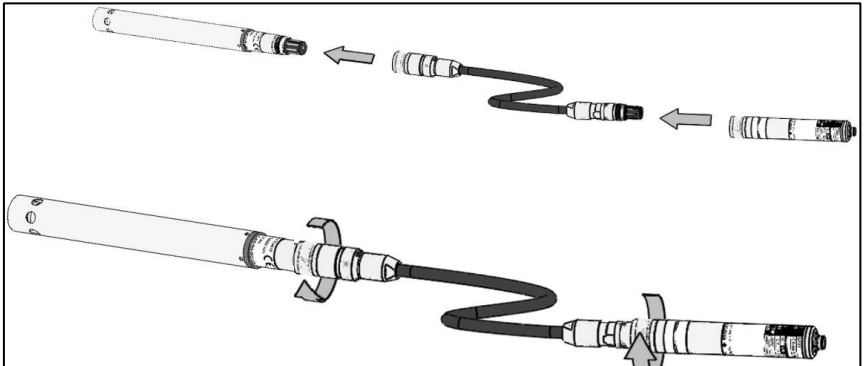


Fig. 16 Example of cable mounting of Sensor to SA11

6. GENERAL CALIBRATION & MAINTENANCE PROCEDURE

6.1 Calibration of the sensor

The conductivity sensors are factory calibrated traceable to NIST standards. The cell constant values are indicated on the sensor or on the integral cable of the sensor. The cell constant value can be entered directly in the Yokogawa analyzer. The procedure is explained in the Instruction Manual of the analyzer⁹. If the sensor has been subject to abrasion (erosion or coating) in the process, re-calibration of the sensor may be necessary. Refer to the Instruction Manual of the analyzer for a detailed description.

Note 9 : During calibration the temperature compensation is still active. This means that the display reading refers to the default reference temperature (25 °C). Calculations for calibrations (CC, TC, or temp) make use of the uncompensated raw measurement data.

Calibration is normally carried out by measuring a solution with a known conductivity value at a known temperature. These solutions are commercially available. You can make your own solution by dissolving an amount of salt in water. Table 9 and 10 show some typical conductivity values for Sodium Chloride (NaCl) and Potassium Chloride (KCl) solutions which can be made, preferably in a laboratory. The tables are derived from the standards laid down in 'International Recommendation No. 56 of the Organisation Internationale de Métrologie Legale'.

6.2 Periodic maintenance of the sensor

In general conductivity sensors do not need much periodic maintenance. In case the sensor has become fouled, an insulating layer may be formed on the surface of the electrodes, and consequently giving a measuring error. Cleaning the sensor will solve this

problem. Effective cleaning methods are given below¹⁰:

1. Normal applications: hot water with some commercially available washing-up liquid.
2. Lime, hydroxides or similar applications: 5 % solution of hydrochloride acid.
3. Organic (e.g. oils, fats) applications: alcohol or iso-propanol.
4. Algae, bacteria or fungus: solution of commercially available bleach (hypochlorite).

Note 10 : Read the instructions on the package of the cleaning agents for safe use.

Table 9: Conductivity values of KCl at 25 °C (OIML)

Weight %	Molal (m)	mg of KCl / kg of sol.	Conduct. in mS/cm
0.3	0.001	74.66	0.1469
0.5	0.002	149.32	0.2916
1	0.005	373.29	0.7182
3	0.01	745.263	1.4083
5	0.1	7419.13	12.852
10	1.0	71135.2	111.31

Table 10: NaCl values @ 25 °C (IEC 746-1)

Weight %	mg/kg	Conductivity
0.001	10	21.4 µS/cm
0.003	30	64.0 µS/cm
0.005	50	106 µS/cm
0.01	100	210 µS/cm
0.03	300	617 µS/cm
0.05	500	1.03 mS/cm
0.1	1000	1.99 mS/cm
0.3	3000	5.69 mS/cm
0.5	5000	9.48 mS/cm
1	10000	17.6 mS/cm
3	30000	48.6 mS/cm
5	50000	81.0 mS/cm
10	100000	140 mS/cm

7. MODEL CODES

Table 11:

Model	Suffix Code	Option code	Description
SC4A			19 mm conductivity sensor
Material	-T -S -E		Titanium Grade 2 or 3 Stainless steel AISI 316L (SS) Stainless steel AISI 316L (SS) with EPDM FDA sealing
Fitting-type	-AD -PR -SA -SB -SC		For adapter mounting For retractable mounting For sanitary purposes 1-1/2" tri-clamp 2" tri-clamp
Sensor-length	-09 -15 -NN		9 cm ¹¹ 15 cm Fixed length
Cell constant	-002 -010		0.02/cm 0.1/cm
Connection type	-03 -05 -10 -15 -20 -VS		Fixed cable with wirepins, 3 m Fixed cable with wirepins, 5 m Fixed cable with wirepins, 10 m Fixed cable with wirepins, 15 m Fixed cable with wirepins, 20 m No Cable; Variopin connector with SENCOM ID-chip
Temperature element	-T1		Pt1000, IS for ATEX/IECEx/FM-US/FM-CAN
		/PS /PF /FF	3/4" stainless steel adapter 3/4" PVDF adapter Flow fitting (SS) AISI 316L ¹²

Note 11 : Suffix -AD-09 not available with -VS.

Note 12 : With option /FF: option /PS is mandatory.

8. SPARE PARTS

Table 12

Adapters SC4A-*-AD sensor				
Part no.	Description	Process connection	Material	Quantity
K1542DF	/PS	3/4" NPT adapter	Stainless Steel	1
K1542CW	/PF	3/4" NPT adapter	PVDF	1
K1598AC	/FF	Flow fitting	Stainless Steel	1
Adapters SC4A-E-SA sensor				
Part no.	Description	Process connection	Material	Quantity
K1542FA	/SA1	Straight welding socket	Stainless steel	1
K1542FB	/SA2	Angled welding socket	Stainless steel	1
Spare parts for adapters SC4A-E-SA sensor				
Part no.	Description			Quantity
K1520EJ	Straight weld-in adapter without mounting nut, Stainless Steel			1
K1520EK	Angled weld-in adapter without mounting nut, Stainless Steel			1
Spare parts for SC4A-E-SA sensor				
Part no.	Description			Quantity
K1542DL	O-ring set, EPDM FDA, 20.3 x 2.62			3
K1542DK	O-ring set, Viton, 20.3 x 2.62			3
Adapters SC4A-E-SB sensor				
Part no.	Description	Process connection	Material	Quantity
K1542FC	SB1	Tri-clamp 1"	Stainless Steel	1
K1542FF	SB2	Tri-clamp 1½"	Stainless Steel	1
Spare parts for adapters SC4A-E-SB sensor				
Part no.	Description			Quantity
K1500BN	Clamp seal ring, EPDM FDA, 1" ~ 1½"			1
K1542DG	Clamp seal ring, Viton, 1"			3
K1542DH	Clamp seal ring, Viton, 1½"			3
Adapters SC4A-E-SC sensor				
Part no.	Description	Process connection	Material	Quantity
K1542FE	/SC1	Tri-clamp 2"	Stainless Steel	1
Spare parts for adapters SC4A-E-SC sensor				
Part no.	Description			Quantity
K1500BP	Clamp seal ring, EPDM FDA, 2"			1
K1542DJ	Clamp seal ring, Viton, 2"			3
Spare parts for SC4A-*-PR sensor				
Part no.	Description			Quantity
K1500BE	O-ring set, Viton, 15.6 x 1.78			10
K1500ED	O-ring set, Kalrez, 15.6 x 1.78			1

9. CHEMICAL COMPATIBILITY CHART

Table13

		Material																
				Viton		Kalrez		EPDM		Ti		SS 316(l)		PEEK		PVDF (Kynar)		
		Conc. %	Temp. °C															
Inorganic acid	Sulfuric acid	10	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	
		50	o	o	o	o	o	o	x	-	-	-	x	x	x	o	o	o
		95	o	o	o	o	o	o	x	-	-	-	x	x	x	-	-	-
		fuming	o	o	o	o	o	o	-	-	-	-	-	-	-	-	-	-
	Hydrochloric acid	10	o	o	o	o	x	o	o	o	-	-	-	-	o	o	x	o
		sat.	o	o	o	o	o	x	x	x	x	-	-	-	o	o	x	o
		25	o	o	x	o	o	o	x	-	o	o	x	x	x	o	o	o
	Nitric acid	50	-	-	-	o	o	o	-	-	o	o	o	x	x	x	x	o
		95	-	-	-	o	o	x	-	-	o	o	o	o	o	-	-	o
		fuming	-	-	-	o	o	x	-	-	-	-	-	-	-	-	-	-
	Phosphoric acid	25	o	o	o	o	o	o	o	o	x	x	-	-	-	-	o	o
		50	o	o	o	o	o	o	o	o	x	-	-	-	x	x	o	o
95		x	x	-	o	o	o	o	o	x	-	-	o	o	o	o	o	
Hydrofluoric acid	40	o	o	o	o	o	x	-	-	-	-	-	-	-	-	-	o	
	75	o	o	x	o	o	x	-	-	-	-	-	-	-	-	-	o	
Acetic acid	10	-	-	-	o	o	o	o	o	o	o	o	o	x	o	o	o	
	glacial	-	-	-	o	o	o	x	x	x	o	o	o	o	x	o	x	
Formic acid	80	-	-	-	o	o	x	o	x	x	-	x	x	x	x	o	o	
Citric acid	50	o	o	o	o	o	o	o	o	x	x	o	o	o	o	o	o	
Alkali	Calcium hydroxide	sat.	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	
	Potassium hydroxide	50	o	o	o	o	o	o	x	-	o	x	-	o	o	o	o	
	Sodium hydroxide	40	x	x	x	o	o	o	x	-	x	x	-	o	o	o	o	
	Ammonia in water	30	x	x	x	o	o	o	o	o	x	x	-	o	o	o	o	
Acid salt	Ammonium chloride	sat.	o	o	o	o	o	o	o	o	o	o	x	x	x	o	o	
	Zinc chloride	50	o	o	o	o	o	o	o	o	o	o	x	x	x	o	o	
	Iron(III) chloride	50	o	o	o	o	o	o	o	o	o	o	-	-	-	o	o	
	Sodium sulfite	sat.	-	-	-	o	o	o	o	o	o	o	o	o	o	o	o	
Basic salt	Sodium carbonate	sat.	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	
	Potassium chloride	sat.	o	o	o	o	o	o	o	o	o	x	x	x	o	o	o	
	Sodium sulfate	sat.	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	
	Calcium chloride	sat.	o	o	o	o	o	o	o	o	o	o	x	x	x	o	o	
Neutral salt	Sodium chloride	sat.	o	o	o	o	o	o	o	o	o	o	x	x	x	o	o	
	Sodium nitrate	50	o	o	o	o	o	o	o	o	o	o	x	x	x	o	o	
	Aluminium chloride	sat.	o	o	o	o	o	o	o	o	x	-	-	-	o	o		
Oxidizing agent	Hydrogen peroxide	30	o	o	o	o	o	o	x	o	o	o	o	o	o	o	o	
	Sodium Hypochlorite	50	o	o	x	o	o	o	o	x	-	-	x	x	x	o	o	
	Potassium dichromate	sat.	o	o	o	o	o	o	o	o	o	o	o	o	o	o	x	
	Chlorinated lime					x	-	-	-	-	-	-	x	x	x	x	o	
Organic solvent	Ethanol	80	x	-	-	o	o	o	o	o	o	o	o	o	o	o	o	
	Cyclohexane		o	o	o	o	o	o	-	-	-	o	o	o	o	o	o	
	Toluene		-	-	-	o	o	o	-	-	-	o	o	o	o	o	o	
	Trichloroethane		x	x	x	x	-	-	-	-	-	o	o	x	o	o	x	
	Water		o	o	o	o	o	x	o	o	o	o	o	o	o	o	o	

Note 13 : Information in this list is based on our general experience and literature data and given in good faith. However, Yokogawa is unable to accept responsibility for claims related to this information

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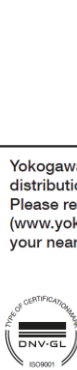
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