

# Instruction Manual

Model SX42

2-electrode Conductivity Sensors

For High temperature/pressure



(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 η 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 ufficiċju 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

These high temperature conductivity sensors have a stainless-steel body and a ceramic insulation, especially designed to withstand high temperatures (up to 250°C) and pressures (up to 40 bar). A special treatment of the electrodes ensures optimal resistance against polarization.

The flanged model has an integral connection box, the threaded models are provided with a Amphenol connector to fit the Yokogawa WU40 cable, or with a Variopin connector to fit with Yokogawa WU10/WE10-cable.

The sensor and associated fitting program is designed to meet the most common installation requirements in terms of material compatibility, process connections and flow dynamics. The various installation possibilities are described and illustrated in this Instruction Manual.

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. For metal sensors a 3.1 material certificate is included. The sensor is certified for hazardous area when connected to a certified intrinsically safe Yokogawa analyzer, model SC202S or FLXA-series or SA11-C1 or 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 big enough. For that reason and specifically for information related to the intrinsically safety compliance like ATEX, IECEx, FM-United States and FM-Canada, a separate label is delivered. 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 <sub>1</sub> X <sub>2</sub>	Production location
X <sub>3</sub> X <sub>4</sub>	Year/Month code
X <sub>5</sub> X <sub>6</sub> X <sub>7</sub> X <sub>8</sub> X <sub>9</sub>	Tracking number

Example: N3W706543

**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

Principle of measurement : Contact conductivity 2-electrode system

### 2.2 Measuring element

Electrodes : Stainless steel inner and outer electrodes

Temperature element<sup>1</sup> : Pt1000

### 2.3 Wetted parts

Sensor Body : Stainless Steel AISI 316L

Insulation : Ceramic (Aluminum oxide)

Sealing : GYLON® Style 3500 PTFE with Silica

### 2.4 Non-Wetted parts

Connector	: Amphenol	Contacts : gold plated
		Insulation : Polyamide
Terminal box flanged models	: Variopin	Contacts : gold plated
		Material : Nickel-plated brass
		Insulation : PEEK, UL94-V0
		Housing : Aluminum
		Connector : Ceramic

### 2.5 Functional specifications (at 25 °C)

Temperature element<sup>1</sup> : Pt1000 to IEC 751

Nominal Cell Constant : SX42-SX24 = 0.1 cm<sup>-1</sup>  
SX42-SX34 = 0.01 cm<sup>-1</sup>

**Note 1** : The temperature sensor included in the sensor is designed for process compensation and for indication. It is **NOT** designed for process temperature control.

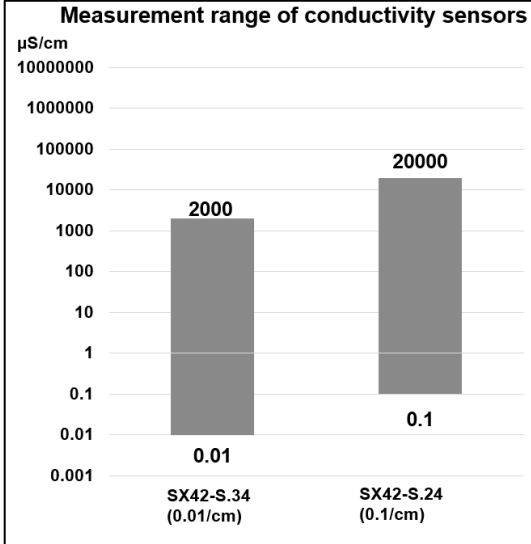
### 2.6 Dynamic specifications

Response time temp. (t <sub>90</sub> )	: SX42-S.24-..	: < 3 min.
	SX42-S.34-..	: < 3 min.

## 2.7 Operating range

Conductivity range\* at actual process temperature : 1  $\mu\text{S}$  x C.C. – 200 mS x C.C.  
See Figure 1

\* measurement range dependent on input range analyzer.



**Figure 1: Measuring range of conductivity sensors section**

Temperature @ 1 Bar (14.5 PSIG) :

Threaded models (-BS, NS) : 0 °C to 200 °C (32 °F to 392 °F)  
Threaded models (-BV, NV) : 0 °C to 125 °C (32 °F to 257 °F)  
Flanged models : 0 °C to 250 °C (32 °F to 482 °F)

Pressure @ 25 °C for all models

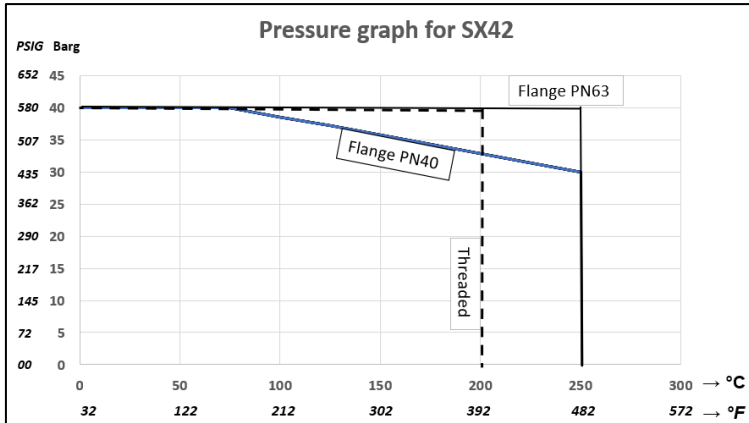
Over pressure\* : 0 to 40 barg (0 to 580 PSIG)  
Under pressure\* : 0 to 0.5 barg (0 to 7 PSIG)

Pressure @ Tmax. °C for models

-BS, -NS, -BV, -NV, -AF, -DF	: Over pressure	Under pressure
	0 to 40 barg	0 to 0.5 barg
	(0 to 580 PSIG)	(0 to 7 PSIG)
-EF	: 0 to 30 barg	0 to 0.5 barg
	(0 to 435 PSIG)	(0 to 7 PSIG)

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





**Figure 2: Pressure vs Temperature**

Cable length:

Threaded models (-BS,-NS)

: max. 60 meter with WU40 cable in combination with WF10 cable and BA10 junction box

Threaded models (-BV,-NV)

- Variopin connector connected to FLXA analyzer.

: max. 60 meter with WU10-V-D/WE10 (possibly in combination with WF10 cable and BA10 junction box)

- Variopin connector connected to SA11 Smart Adapter

: 3 meter WE10 cable (as option) combined with SA11 Smart Adapter  
Smart Adapter directly connected to the analyzer using a WU11 cable up to 100 meters or Connected to a BA11 connection box using WU11 cable up to 100 m. The BA11 connection box is connected to the analyzer using a WU11 cable up to 100m

Flanged models

: max. 60 meter with customer specified high temperature cable

## 2.8 Shipping details

Package size (LxWxH)

: Threaded models 300 x 100 x 75 mm  
(11.8 x 3.9 x 3.0 inch)

Flanged models 480 x 275 x 235mm  
(18.9 x 10.8 x 9.3 inch)

Package weight (max.)

: Threaded models 0.5 to 0.7 kg (1.1 to 1.5 lbs)

Flanged models 5.7 to 6.0 kg (12.6 to 13.2 lbs)

## 2.9 Environmental conditions

Storage temperature

: -30 °C to +50 °C (-22 °F to +122 °F)

Ingress Protection Type Amphenol connector



: IP65 (conform IEC 60529)

Ingress Protection Type Variopin connector

: IP67 (conform IEC 60529)

## 2.10 Regulatory standards


### Equipment ratings:

Item	Description	Values
Electrical parameters	Max. input voltage Max. input current Max. input power Max. internal capacitance Max. internal inductance	$U_i = 14.4 \text{ VDC}$ $I_i = 116.5 \text{ mA}$ $P_i = 342.4 \text{ mW}$ $C_i = 0.0 \text{ nF}$ for connector types without ID-chip $= 0.4 \text{ nF}$ for connector types with ID-chip $= 150 \text{ nF}$ for permanent cable types $L_i = 0.0 \text{ mH}$ for connector types $L_i = 0.1 \text{ mH}$ for permanent cable types
Temperature class	T6 T5 T4 T3 T2	$-30^\circ\text{C} \leq T_a \leq +40^\circ\text{C}$ $-30^\circ\text{C} \leq T_a \leq +95^\circ\text{C}$ $-30^\circ\text{C} \leq T_a \leq +130^\circ\text{C}^{2)}$ $-30^\circ\text{C} \leq T_a \leq +165^\circ\text{C}^{2)}$ $-30^\circ\text{C} \leq T_a \leq +275^\circ\text{C}^{2)}$ <b>Note 2 :</b> Connector types with ID-chip are limited to $+125^\circ\text{C}$
Specific conditions of use (X)	<p>Potential electrostatic charging hazard: Contact Conductivity 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. Use a damp cloth for cleaning the equipment.</p> <p>Potential ignition hazard: 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.</p>	
 WARNING	Electrostatic charges of the sensor enclosure parts 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.	
 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	

Models with and without ID-chip (-BS, -BV, -NS, -NV and \*F types):  
I/O signals are from/to an associated intrinsically safe certified SC transmitter (e.g. Yokogawa transmitter Model FLX21/FLX202 series or Yokogawa transmitter Model SC202S series).

Models with ID-chip (-BV and -NV types):  
I/O signals are from/to an associated intrinsically safe certified SC transmitter, Yokogawa Smart Adapter Model SA11-C1.

**Regulatory compliances:**

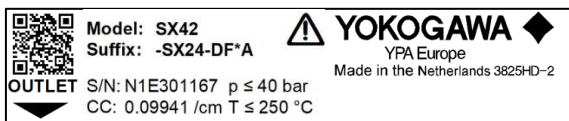
Item	Description, Approval, Certification
LVD <sup>3</sup>	ANSI/ISA 61010-1 CAN/CSA C22.2 No. 61010-1
RoHS	EU Directive 2011/65/EU and Commission Delegated Directive (EU) 2015/863 amending Annex II, per EN-IEC 63000
PED <sup>3</sup>	EU Directive 2011/68/EU applying Article 4.3: Sound Engineering Practice.
WEEE	EU directive 2012/19/EU This sensor is intended to be sold and used only as a part of equipment which is excluded from the WEEE directive, such as large-scale stationary industrial tools, a large-scale fixed installation etc., and therefore it is in principle fully compliant with WEEE directive. The sensor should be disposed in accordance with applicable national legislations/regulations respectively.
ATEX (EU)	EU Directive 2014/34/EU ATEX approval: DEKRA 14ATEX0074 X <b>CE</b> <sub>0344</sub> SX42:  II 1 G Ex ia IIC T2...T6 Ga Applied standards: <ul style="list-style-type: none"> <li>• EN IEC 60079-0</li> <li>• EN 60079-11</li> </ul>
IECEx	IECEx approval: IECEx DEK 14.0032X SX42: Ex ia IIC T2...T6 Ga Applied standards: <ul style="list-style-type: none"> <li>• IEC 60079-0</li> <li>• IEC 60079-11</li> </ul>

**Note 3** : Damaging the screw thread or process connection (e.g. flange) of the sensor might influence the maximum process pressure.

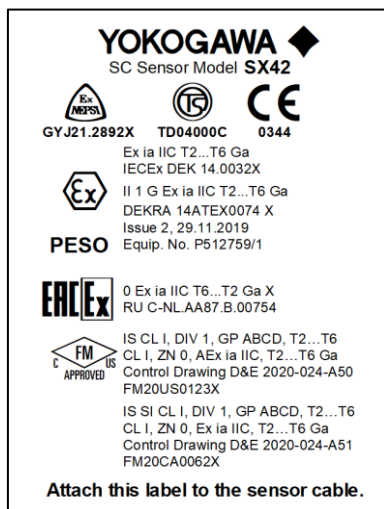
Item	Description, Approval, Certification
FM (Canada)	FM approval Canada: FM20CA0062X SX42: IS SI CL I, DIV1, GPABCD, T2...T6; CL I, ZN0, Ex ia IIC, T2...T6 Ga Control Drawing: D&E 2020-024-A51 Applied standards: <ul style="list-style-type: none"> <li>• CAN/CSA-C22.2 No. 60079-0</li> <li>• CAN/CSA-C22.2 No. 60079-11</li> <li>• CAN/CSA-C22.2 No. 61010-1</li> </ul>
FM (United States)	FM approval United States: FM20US0123X SX42: IS CL I, DIV1, GPABCD, T2...T6; CL I, ZN0, AEx ia IIC, T2...T6 Ga Control Drawing: D&E 2020-024-A50 Applied standards: <ul style="list-style-type: none"> <li>• FM Class 3600</li> <li>• FM Class 3610</li> <li>• ANSI/ISA 60079-0</li> <li>• ANSI/ISA 60079-11</li> <li>• ANSI/ISA 61010-1</li> </ul>
NEPSI (China)	NEPSI approval: GYJ21.2892X SX42: Ex ia IIC T2...T6 Ga Applied standards: <ul style="list-style-type: none"> <li>• GB 3836.1</li> <li>• GB 3836.4</li> <li>• GB 3836.20</li> </ul>
PESO (India)	PESO approval: PESO approval is based on ATEX approval DEKRA 141ATEX0074 X, iss. 2 – 29.11.2019 Equipment reference numbers: P512759/1 Applied standards: <ul style="list-style-type: none"> <li>• EN IEC 60079-0</li> <li>• EN 60079-11</li> </ul>
TS (Taiwan)	TS approval: TS Safety Label is based on IECEx approval IECEx DEK 14.0032X Identification Number: TD04000C Applied standards: <ul style="list-style-type: none"> <li>• IEC 60079-0</li> <li>• IEC 60079-11</li> </ul>
EAC Ex (Russia)	EAC Ex certificate: RU C-NL.AA87.B.00754 SX42: 0Ex ia IIC T6...T2 Ga X Applied standards: <ul style="list-style-type: none"> <li>• GOST 31610.0 (IEC 60079-0)</li> <li>• GOST 31610.11 (IEC 60079-11)</li> <li>• GOST IEC 60079-14</li> </ul>

**Label information:**

All statutory required label information is written on metallized product label(s). This includes MS-code, serial number, and process operating specifications. Example of a sensor product label see figure 3.

**Figure 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 Brady B-435 Thermal Transfer Printable Gloss Metallized Polyester label printed with Brady Series R6000 ribbon, to be placed on a plastic carrier for affixing adjacent to the product. See fig. 4 for additional sensor and certification information.

**Figure 4: Product label certifications**

**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, T2...T6 CL I, ZN 0, AEx ia IIC, T2...T6 Ga Control Drawing: D&E 2020-024-A50
Electrical data	: See Note 4
Specific conditions of use	: See Control Drawing D&E 2020-024-A50. (Page 15-18) Temperature classes for SX42 models are defined T2...T6, see Note 5

**Note 4** : 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:  
 $U_i = 14.4 \text{ V}$ ;  $I_i = 116.5 \text{ mA}$ ;  $P_i = 0.3424 \text{ W}$ ;  $L_i = 0 \text{ mH}$   
 $C_i = 0 \text{ nF}$  (BS, NS and \*F type) or  $C_i = 0.4 \text{ nF}$  (BV and NV type).

**Note 5** : Ambient temperature:  
 $-30^\circ\text{C}$  to  $+40^\circ\text{C}$  for temperature class T6,  
 $-30^\circ\text{C}$  to  $+95^\circ\text{C}$  for temperature class T5,  
 $-30^\circ\text{C}$  to  $+125^\circ\text{C}$  for temperature class T4 (BV and NV type),  
 $-30^\circ\text{C}$  to  $+130^\circ\text{C}$  for temperature class T4 (BS, NS and \*F types),  
 $-30^\circ\text{C}$  to  $+125^\circ\text{C}$  for temperature class T3 (BV and NV type),  
 $-30^\circ\text{C}$  to  $+165^\circ\text{C}$  for temperature class T3 (BS, NS and \*F types),  
 $-30^\circ\text{C}$  to  $+125^\circ\text{C}$  for temperature class T2 (BV and NV type),  
 $-30^\circ\text{C}$  to  $+275^\circ\text{C}$  for temperature class T2 (BS, NS and \*F types).

**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 updated with a new issue number.

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

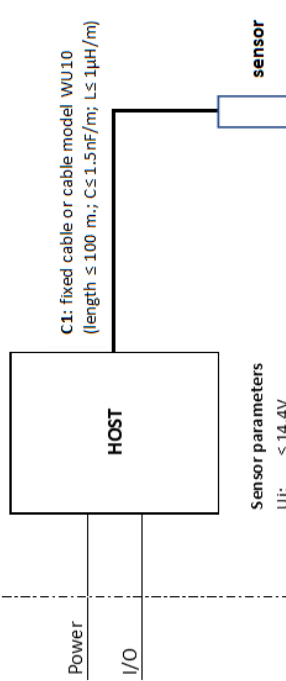
**Control drawing: D&E 2020-024-A50 (part 1)**

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:**

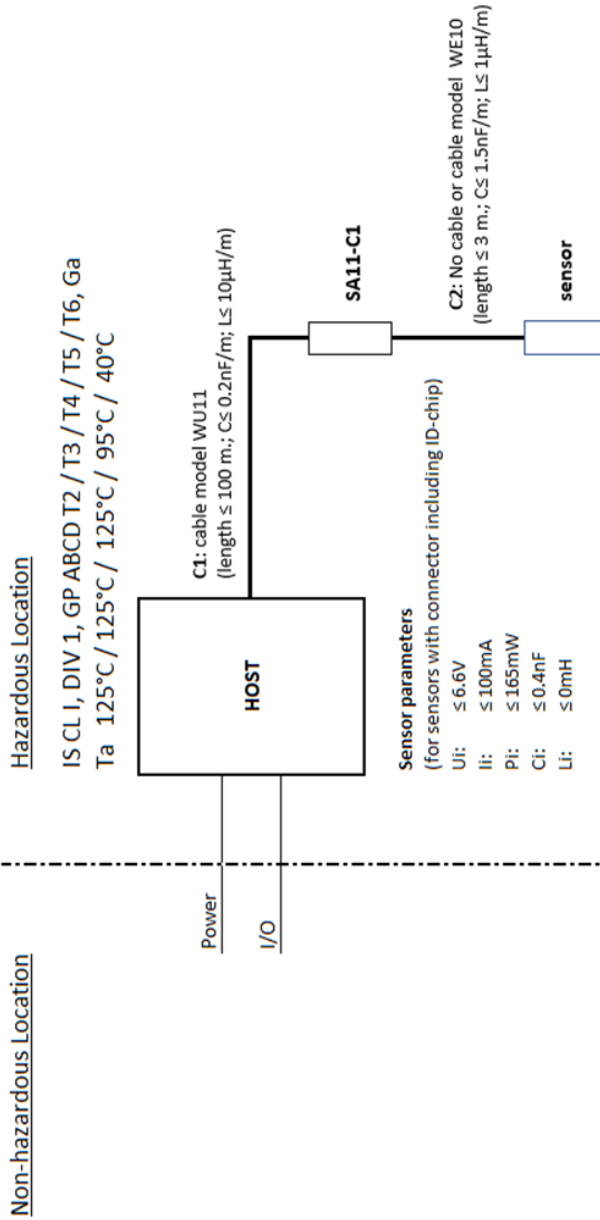
Model	Suffix Codes	Option Codes
SX42	-abcd-efgh	/i
abcd	Cell Constant:	Four alphanumeric character (A to Z, 0 to 9 or a hyphen)
ef	Connection type:	BS ISO7/1-R1 screw thread + connector without ID-chip BV ISO 7/1-R1 screw thread + connector with ID-chip NS NPT screw thread + connector without ID-chip NV NPT screw thread + connector with ID-chip AF 2-inch 600 LBS ANSI flange + terminal block DF DN50-PN63 EN flange + terminal block EF DN50-PN40 EN flange + terminal block
g	Spare code:	Any one character
h	Style code:	A
i	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
SX42	-abcd-efgh	/i
abcd	Cell Constant:	Four alphanumeric character (A to Z, 0 to 9 or a hyphen)
ef	Connection type:	BV ISO 7/1-R1 screw thread + connector with ID-chip NV NPT screw thread + connector with ID-chip
g	Spare code:	Any one character
h	Style code:	A
i	Option code:	Up to ten alphanumeric characters (A to Z, 0 to 9 or hyphen)

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**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, T2...T6  
CL I, ZN 0, Ex ia IIC, T2...T6 Ga  
Control Drawing: D&E 2020-024-A51

Electrical data : See Note 6

Specific conditions : See Control Drawing D&E 2020-024-A51. (Page 20-23)  
of use Temperature classes for SC42 models are defined  
T2...T6, see Note 7.

**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:  
 $U_i = 14.4 \text{ V}$ ;  $I_i = 116.5 \text{ mA}$ ;  $P_i = 0.3424 \text{ W}$ ;  $L_i = 0 \text{ mH}$ ;  
 $C_i = 0 \text{ nF}$  (BS, NS and \*F type) or  $C_i = 0.4 \text{ nF}$  (BV and NV type).

**Note 7** : 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 (BV and NV type),  
-30°C to +130°C for temperature class T4 (BS, NS and \*F types),  
-30°C to +125°C for temperature class T3 (BV and NV type),  
-30°C to +165°C for temperature class T3 (BS, NS and \*F types),  
-30°C to +125°C for temperature class T2 (BV and NV type),  
-30°C to +275°C for temperature class T2 (BS, NS and \*F types).



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 updated with a new issue number.

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



## 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:  $U_o = 14.4$  V,  $I_o = 116.5$  mA,  $P_o = 342.4$  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
SX42	-abcd-efgh	/i
abcd	Cell Constant:	Four alphanumeric character (A to Z, 0 to 9 or a hyphen)
ef	Connection type:	BS ISO7/1-R1 screw thread + connector without ID-chip BV ISO 7/1-R1 screw thread + connector with ID-chip NS NPT screw thread + connector without ID-chip NV NPT screw thread + connector with ID-chip AF 2-inch 600 LBS ANSI flange + terminal block DF DN50-PN63 EN flange + terminal block EF DN50-PN40 EN flange + terminal block
G	Spare code:	Any one character
H	Style code:	A
i	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.

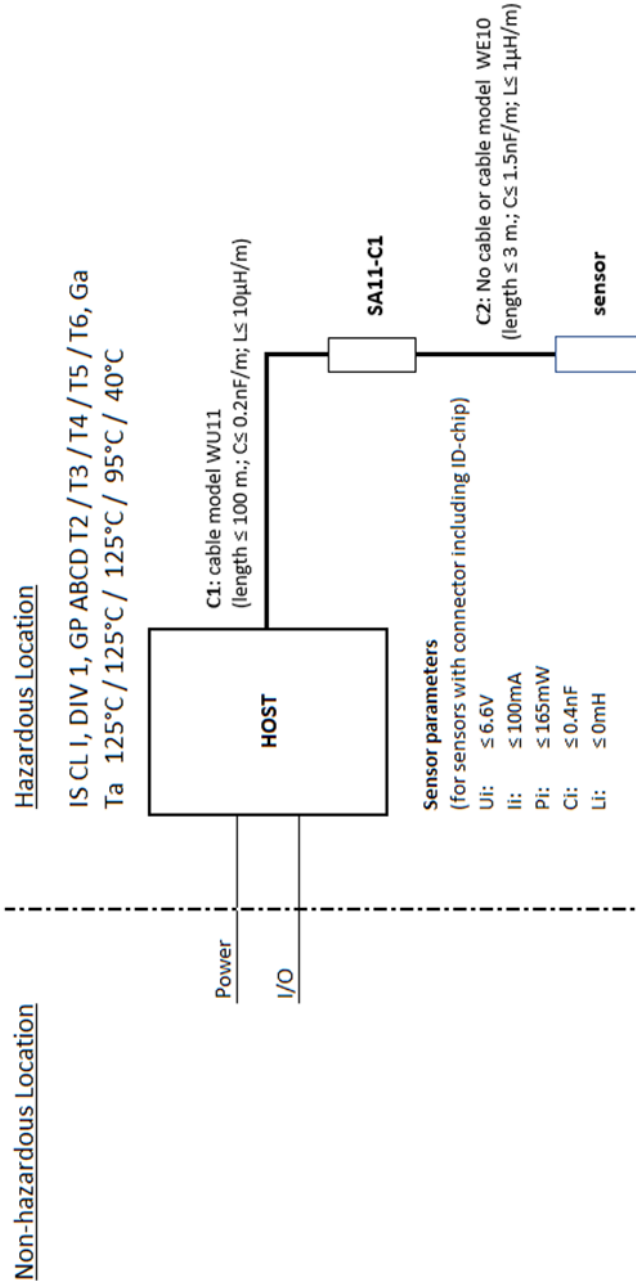
**WARNING—POTENTIAL IGNITION HAZARD – SEE INSTRUCTIONS**

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
SX42	-abcd-efgh	/i
abcd	Cell Constant:	Four alphanumeric character (A to Z, 0 to 9 or a hyphen)
ef	Connection type:	BV ISO 7/1-R1 screw thread + connector with ID-chip NV NPT screw thread + connector with ID-chip
g	Spare code:	Any one character
h	Style code:	A
i	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.

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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.

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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 SX42 sensors

#### 3.1 Typical installation of SX42

SX42 threaded models are installed by screw-in (ISO 7/1-R 1" or 1" NPT), and the SX42 flanged models by using the pre-mounted flange (DN50 PN63, DN50 PN40 or ANSI 2" 600 lbs).

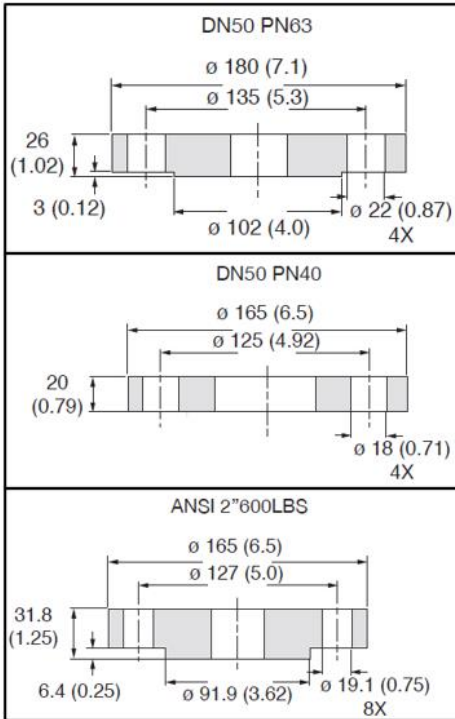


Figure 5: Flange dimensions SX42 flanged model according EN 1092-1



## 4. DIMENSIONS

Dimensions in mm (inches)

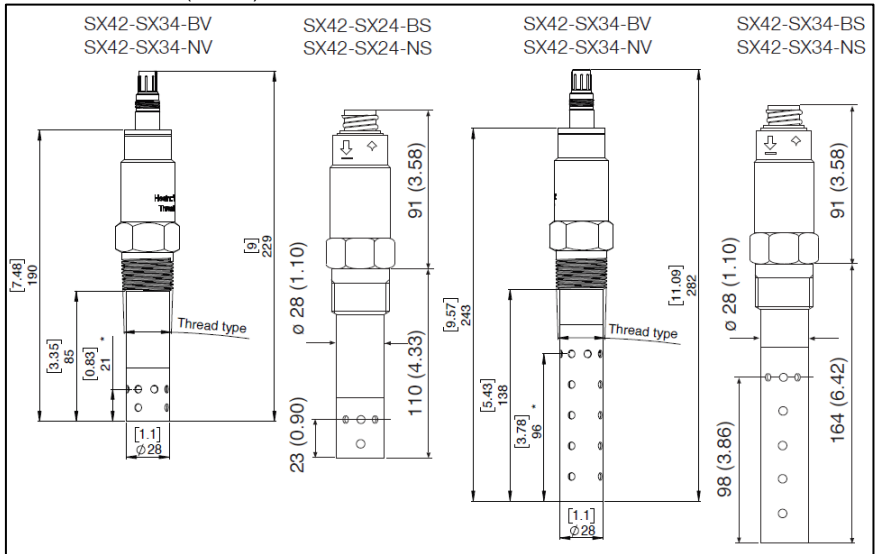
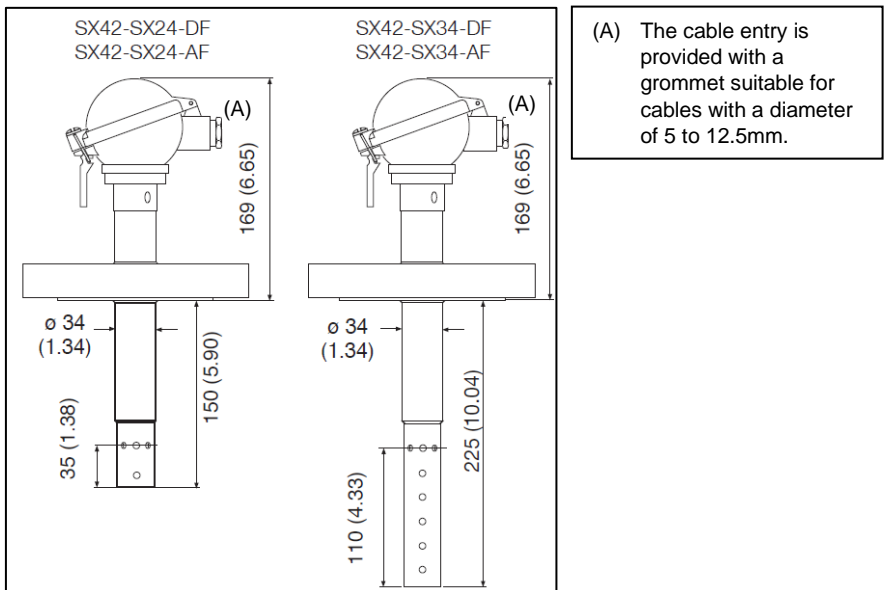


Figure 6: Dimensions SX42 threaded models



(A) The cable entry is provided with a grommet suitable for cables with a diameter of 5 to 12.5mm.

Figure 7: Dimensions SX42 flanged models

## 5. WIRING

The SX42 threaded models are provided with a fixed connector. The standard cable used to connect the sensors with Amphenol connector to the analyzer is the WU40. The standard cable used to connect the sensor with VP connector to the analyzer is the WU10/WE10. These cables are available up to 25/20 meters. When a longer cable run is necessary (maximum cable run is 60 meters), this can be done by using the WF10 extension cable in combination with the BA10 connection box. The connection of the WU40 cable, WU10 cable and WF10 cable to the Yokogawa Contact Conductivity analyzer are given in table 7 and 8.

The sensors with VP connector contain an embedded ID chip allowing direct connection to our SA11 Smart Adapter. The SA11 Smart Adapter can be applied in processes with ambient temperature up to 125°C.

If ambient temperature is higher than 125°C the connection to Smart Adapter should be made using the WE10 extension cable in between the Smart Adapter and the sensor.

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

This can be done using the Vario Pin 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

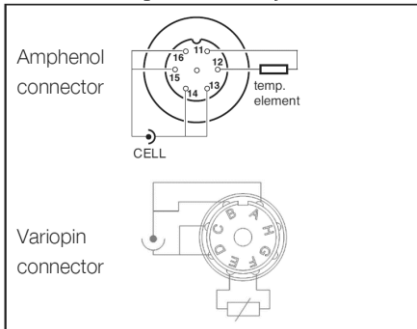


Figure 8: Top view 2-electrode system

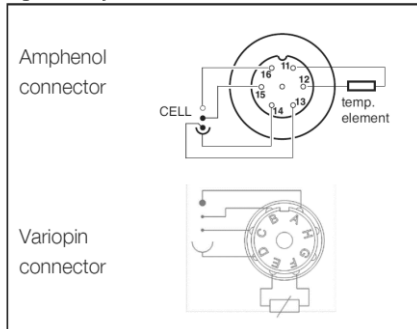


Figure 9: Top view 4- electrode system

**Table 7: Definition WU40 (+ BA10 with WF10/WE10) and analyzer**

Cable wire color WU40	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	li (inner electrode)
N/A	Yellow	-	N/A
N/A	Green	-	N/A

**Note 8** : For the WU40 and WF10 cable the labelled wires must be connected to the corresponding terminal # of the SC analyzer.

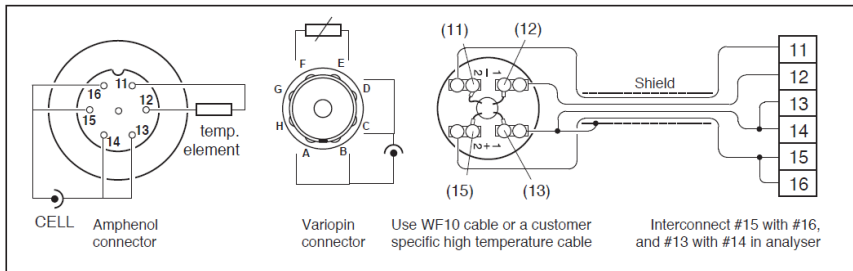
**Table 8: Definition VP sensor cable, WU10/WE10 with analyzers**

VP connector	Cable wire color WU10-V-D <sup>9/10</sup> / WE10-H-D 8	Terminal / wire #	Signal Description
A	Brown (Core of coax)	15	Ui (inner electrode)
B	Brown (Shield of core)	16	li (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 9** : WF10 and WU10 have the same color definition, therefore connection to a BA10 can be done connecting corresponding colors.

**Note 10** : Preferred connection cable is Yokogawa Model WU10-V-D or Model WE10

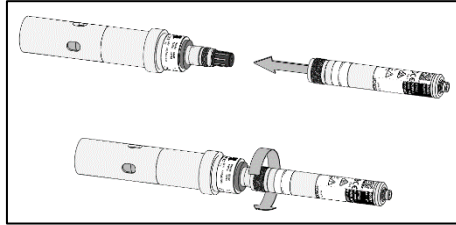
The SX42 flanged models are provided with a connection box. The cable used to connect these sensors to the analyzer has to be a high temperature shielded cable. This cable is not supplied by Yokogawa. The wiring diagram of the flanged models is given in figure.8.

**Figure 10: SX42 models connector (top view)**

## 5.2 Connecting conductivity sensor to the digital SENCOM smart adapter SA11

### Direct mounting of the sensor to SA11

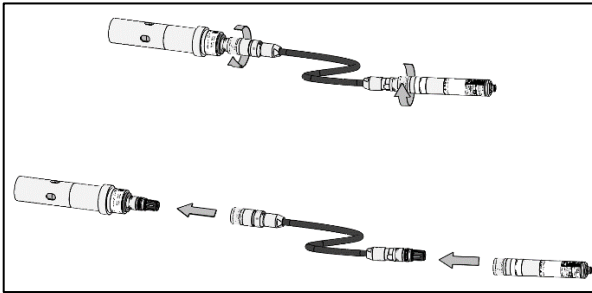
The SA11 can be installed directly on top of the Yokogawa labelled sensor by means of the Variopin connection system. In this case the temperature limit of the device is determined by the process temperature, limited from  $-30\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$ .



**Figure 11: Sensor + SA11 Smart adapter**

### Cable mounting

When there is less space to install the SA11 on top of the Yokogawa labelled sensor or when the process conditions are higher than  $+125\text{ }^{\circ}\text{C}$ , 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. The ambient temperature limit of the device must be within  $-30\text{ }^{\circ}\text{C}$  to  $+55\text{ }^{\circ}\text{C}$ .



**Figure 12: Example of cable mounting of Sensor to SA11**

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

## 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 analyzer<sup>11</sup>. 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 11** : 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 below<sup>11</sup>:

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

**Note 12** : 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
SX42			High temperature conductivity sensor with Pt1000 sensor, IS for ATEX/IECEX/FM-US/FM-CAN
Cell Constant	-SX24 -SX34		Cell constant 0.1/cm Cell constant 0.01/cm
Process Connection	-BS -BV  -NS -NV  -DF -EF -AF		ISO 7/1-R1 screw thread, plug-socket conn. ISO 7/1-R1 screw thread, VarioPin conn. with SENCOM ID-chip 1-11½ NPT screw thread, plug-socket conn. 1-11½ NPT screw thread, Vario Pin conn. with SENCOM ID-chip DN50-PN63 EN flange DN50-PN40 EN flange 2" 600 LBS ANSI flange
Style		*A	Always *A style
Option			N/A

## 8. SPARE PARTS

No spare parts defined for model SX42

## 9. CHEMICAL COMPATIBILITY CHART

Table12:

		Conc. %	Temp. °C	SS 316(l)			GYLON			Ceramic		
				20	80	100	20	80	100	20	80	100
Inorganic acid	Sulfuric acid	10	x	x	x	o	o	o	o	o	o	o
		50	x	x	x	o	o	o	o	o	o	o
		95	x	x	x	o	o	o	o	o	o	o
		fuming	-	-	-	o	o	o	o	o	o	o
	Hydrochloric acid	10	-	-	-	o	o	o	o	x	x	x
		sat.	-	-	-	o	o	o	o	x	x	x
	Nitric acid	25	x	x	x	o	o	o	o	o	o	o
		50	x	x	x	o	o	o	o	o	o	o
		95	o	o	o	o	o	o	o	o	o	o
		fuming	o	o	o	o	o	o	o	o	o	o
	Phosphoric acid	25	-	-	-	o	o	o	o	o	o	o
		50	x	x	x	o	o	x	o	o	o	o
95		o	o	o	o	x	-	o	o	o	o	
Hydrofluoric acid	40	-	-	-	-	-	-	x	x	x		
	75	-	-	-	-	-	-	x	x	x		
Organic acid	Acetic acid	10	o	o	x	o	o	o	o	o	o	
		glacial	o	o	x	o	o	o	o	o	o	
	Formic acid	80	x	x	x	o	o	o	o	o	o	
	Citric acid	50	o	o	o	o	o	o	o	o	o	
Alkali	Calcium hydroxide	sat.	o	o	o	o	o	o	o	o	o	
	Potassium hydroxide	50	o	o	o	o	o	o	o	x	-	
	Sodium hydroxide	40	o	o	o	o	o	o	o	o	o	
	Ammonia in water	30	o	o	o	o	o	o	o	o	o	
Acid salt	Ammonium chloride	sat.	x	x	x	o	o	o	o	o	o	
	Zinc chloride	50	x	x	x	o	o	o	o	o	o	
	Iron(III) chloride	50	-	-	-	o	o	o	o	o	o	
	Sodium sulfite	sat.	o	o	o	o	o	o	o	o	o	
Basic salt	Sodium carbonate	sat.	o	o	o	o	o	o	o	o	o	
	Potassium chloride	sat.	x	x	x	o	o	o	x	x	x	
	Sodium sulfate	sat.	o	o	o	o	o	o	o	o	o	
	Calcium chloride	sat.	x	x	x	o	o	o	o	o	o	
Neutral salt	Sodium chloride	sat.	x	x	x	o	o	o	o	o	o	
	Sodium nitrate	50	x	x	x	o	o	o	o	o	o	
	Aluminium chloride	sat.	-	-	-	o	o	o	o	o	o	
	Hydrogen peroxide	30	o	o	o	o	o	o	o	o	o	
Oxidizing agent	Sodium Hypochloride	50	x	x	x	o	o	o	o	o	o	
	Potassium dichromate	sat.	o	o	o	o	o	o	o	o	o	
	Chlorinated lime		x	x	x	o	o	o	o	o	o	
	Ethanol	80	o	o	o	o	o	o	o	o	o	
Organic solvent	Cyclohexane		o	o	o	o	o	o	o	o	o	
	Toluene		o	o	o	o	o	o	o	o	o	
	Trichloroethane		o	o	x	o	o	o	o	o	o	
	Water		o	o	o	o	o	o	o	o	o	

o = can be used x = shortens useful life - = cannot be used Blank = no data currently available

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Note : 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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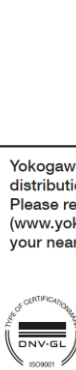
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