Fuji Electric

FCX-AII

ABSOLUTE AND GAUGE PRESSURE TRANSMITTER FOR REMOTE SEAL

DATASHEET **FKP, FKH...F**

The FCX-AII pressure transmitters accurately measure absolute, gauge pressure or level and transmit a proportional 4-20 mA output signal.
The transmitters use an unique micro-capative silicon sensor in combination with a state-of-the-art digital signal processing to provide exceptional performances in terms of accuracy and stability.

FEATURES

1. High accuracy
The Fuji Electric's micro-capacitive sensor provides in standard ±0.1% and ± 0.2% accuracies for gauge and absolute pressure respectively, for all elevated or suppressed calibration ranges without additional adjustments.

2. Minimum inventory and design
Electronics unit, local indicators and electronics housing are interchageable among all FCX-AII transmitters.
Gauge and absolute pressure transmitters with remote seals are based on a welded design with a reduced and optimized volume flange to guarantee a perfect vaccum tightness and high pressure services.

3. Minimum environmental influence
The Advanced Floating Cell technology provides a high immunity against temperature variations and overpressure commonly found in the process industry and substantially reduces the overall measurement error.

4. HART/Fuji Electric communication protocols
FCX-AII V5 series of pressure transmitters can communicate using either the universal HART or the proprietary and faster Fuji Electric communication protocol.
By the use of Device Description files, HART compatible devices can communicate with any FCX-AII V5 transmitter.

5. Application flexibility
Various options are available to address most of the process industry applications, including :
- Full range of hazardous area approvals
- Built-in RFI filter and lightning arrester
- Analog or 5 digits local display with engineering units
- Stainless steel electronics housing
- Wide selection of wetted part materials

6. Programmable output Linearization Function
The output signal can be linearized using up to 14 pair-points.

7.Burnout current flexibility
The burnout current value can be adjusted in the ranges of [3.2 ; 4.0] and [20.0 ; 22.5] mA and can be compliant with NAMUR NE43 recommandations.

FUNCTIONAL SPECIFICATIONS

Type :
FKH or FKP : Smart, 4-20 mA + HART/Fuji Electric communication protocolsl

Service :
Liquid, gas or vapour

Span, range and overrange limits :

Model	Span limits (bar)		Range limits (bar)	Overrange limits (bar)
	Minimum	Maximum		
	FKP			
F□P□01	0.08125	1.3	-1 to +1,3	10
F□P□02	0.3125	5	-1 to +5	15
F□P□03	1.875	30	-1 to +30	90
F□P□04	6.25	100	-1 to +100	150
	FKH (bar abs)		(bar abs)	(bar abs)
F□H□02	0.08125	1,3	0 to +1.3	5
F□H□03	0.3125	5	0 to +5	15
F□H□04	1.875	30	0 to +30	90

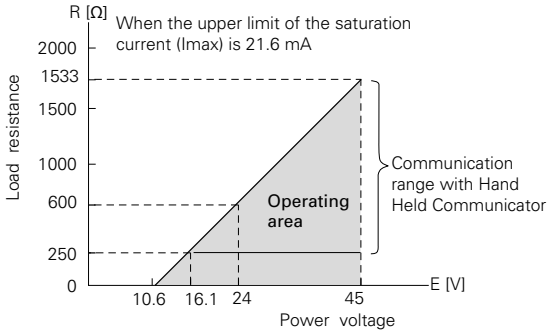
Note :
To minimise environmental influence, span should be greater than 1/10 of the maximum span in most applications.

Output signal :
4-20 mA with digital signal superimposed on the analogic signal.

Power supply :

10.5 to 45 V DC at transmitter terminals.
10.5 to 32 V DC with the optional arrester.
Refer to hazardous location table for specific limitations

Load limitations : see figure below



Note 1 : The load resistance varies with the upper limit of the saturation current [I max]

$$R\,[\Omega] = \frac{E\,[V] - 10.5}{(I\ max\ [mA] + 0.9) \times 10^{-3}}$$

Note 2 : For communication with HHC (FXW model), a minimum load of 250 Ω is required.

Hazardous locations :

Marking (Digit 10 =)		Protection type
ATEX		Intrinsic Safety "i" :
		Ex II 1G/D
		Ex ia IIC T4 Ga (-40°C ≤ Ta ≤ +70°C)
		Ex ia IIC T5 Ga (-40°C ≤ Ta ≤ +50°C)
	(K)	Ex ia IIIC T135°C Da (-40°C ≤ Ta ≤ +70°C)
		Ex ia IIIC T100°C Da (-40°C ≤ Ta ≤ +50°C)
		IP 66/67
		Electrical Parameters :
		Ui ≤ 28 Vdc, Ii ≤ 94.3 mA, Pi ≤ 0.66 W
		Ci = 26 nF(1) / 36 nF(2), Li = 0.6 mH(3) / 0.7mH(4)
		Flameproof Enclosure "d":
		Ex II 2G/D
		Ex d IIC T5 Gb (-40°C ≤ Ta ≤ +85°C)
	(X)	Ex d IIC T6 Gb (-40°C ≤ Ta ≤ +65°C)
		Ex tb IIIC T100°C Db (-40°C ≤ Ta ≤ +85°C)
		Ex tb IIIC T85°C Db (-40°C ≤ Ta ≤ +65°C)
		45 Vdc max
		Increased Safety "e" :
		Ex II 3G/D
	(P)	Ex ec IIC T5 Gc (-40°C ≤ Ta ≤ +70°C)
		Ex tc IIIC T100°C Dc (-40°C ≤ Ta ≤ +70°C)
		45 Vdc max
	(M)	Combination (K) + (X)
IECEx		Intrinsic Safety "i":
		Ex ia IIC T4 Ga (-40°C ≤ Ta ≤ +70°C)
		Ex ia IIC T5 Ga (-40°C ≤ Ta ≤ +50°C)
		Ex ia IIIC T135°C Da (-40°C ≤ Ta ≤ +70°C)
	(T)	Ex ia IIIC T100°C Da (-40°C ≤ Ta ≤ +50°C)
		IP 66/67
		Electrical Parameters :
		Ui ≤ 28 Vdc, Ii ≤ 94.3 mA, Pi ≤ 0.66 W
		Ci = 26 nF(1) / 36 nF(2), Li = 0.6 mH(3) / 0.7mH(4)
		Flameproof Enclosure "d":
		Ex d IIC T5 Gb (-40°C ≤ Ta ≤ +85°C)
		Ex d IIC T6 Gb (-40°C ≤ Ta ≤ +65°C)
	(R)	Ex tb IIIC T100°C Db (-40°C ≤ Ta ≤ +85°C)
		Ex tb IIIC T85°C Db (-40°C ≤ Ta ≤ +65°C)
		45 Vdc max
		Increased Safety "e" :
		Ex ec IIC T5 Gc (-40°C ≤ Ta ≤ +70°C)
	(Q)	Ex tc IIIC T100°C Dc (-40°C ≤ Ta ≤ +70°C)
		45 Vdc max
	(N)	Combination (T) + (R)
cCSAus		Intrinsic safety / Non Incendive / Class 1 Division 2 :
		IS Class I Division 1, Groups ABCD Ex ia
		Class II Groups EFG; Class III
		NI Class I Division 2, Groups ABCD
	(J)	(Per control drawing TC522873)
		Class I Division 2, Groups ABCD
		T4 (-40°C ≤ Ta ≤ +70°C)
		T5 (-40°C ≤ Ta ≤ +50°C)
		Ui ≤ 28 Vdc, Ii ≤ 94.3 mA, Pi ≤ 0.66 W
		Ci = 26 nF(1) / 36 nF(2), Li = 0.6 mH(3) / 0.7mH(4)
		Explosion proof
		XP Class I Division 1, Groups CD
	(E)	Class II Groups EFG; Class III
		T5 (-40°C ≤ Ta ≤ +85°C)
		T6 (-40°C ≤ Ta ≤ +65°C)
		Vmax = 42.4 Vdc
	(L)	Combination (J) + (E)
ATEX IECEx cCSAus	(W)	Combination (K) + (X) + (T) + (R) + (J) + (E)

(1) Without optional arrester
(2) With optional arrester
(3) Without analog indicator
(4) With analog indicator

Configuration :

Configuration of the FCX-AII V5 series of pressure transmitters can be carried out by either using a Hand Held Communicator (ie. Fuji Electric FXW or third party HART terminal) or the 3 push-buttons optional indicator.

A third party HART hand held communicator can be used in combination with Fuji Electric FCX-AII V5 HART Device Description files (https://fieldcommgroup.org).

Functions		Fuji Electric FXW		Third party HART HHC		3 push buttons optional indicator	
		Display	Set	Display	Set	Display	Set
Tag Nb		v	v	v	v	v	v
Model Nb		v	v	v	v	v	v
Serial Nb & Software revision		v	—	v	—	v	—
Engineering units		v	v	v	v	v	v
Upper Range Value		v	—	v	—	v	—
Measuring Range		v	v	v	v	v	v
Damping		v	v	v	v	v	v
Output signal type	Linear	v	v	v	v	v	v
	Square Root	v	v	v	v	v	v
Burnout current		v	v	v	v	v	v
Calibration		v	v	v	v	v	v
Output Adjust		—	v	—	v	—	v
Measuring Value		v	—	v	—	v	—
Self Diagnosis		v	—	v	—	v	—
Printer (option)		v	—	—	—	—	—
External Adj Screw Lock		v	v	v	v	v	v
Transmitter Display		v	v	v	v	v	v
Linearization		—	—	v	v	v	v
Rerange		v	v	v	v	v	v
Saturation Current		v	v	v	v	v	v
Write Protect		v	v	v	v	v	v
History – Calibration History – Ambient T° History		 v v	 v —	 v v	 v —	 v v	 v —

Note 1 : The FXW firmware revision must be higher than 7.0 in order to address FCX-AII V5 "Saturation Current", "Write Protect" and "History" functions.

Note 2 : The "Linearization" function is not accessible throught the 3 puh-buttons optional indicator.

Zero and span adjustment :

Zero and span are adjustable with a Hand Held Communicator or locally with the external adjustment screw.

Damping :

The damping time constant can be adjusted within the range of [0.06 to 32] seconds.

Zero elevation/suppression :

-1 bar to 100% of URL for FKP
0 kPa abs to +100 % of URL for FKH

Normal/reverse action :

Selectable from a Hand Held Communicator.

Local indicator :

One optional analog or 5-digits digital indicator.

Burnout direction and saturation currents :

If the self-diagnostic functions detect a transmitter a failure, the burnout function will drive the output signal to either “Output Hold”, “Output Overscale” or “Output Underscale” modes.

When “Output Hold” :

The output signal is held as the last value just before the failure happens.

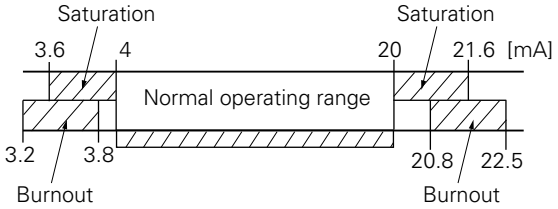
When “Output Overscale” :

The output signal is set within the range of [20.0 to 22.5] mA

When “Output Underscale” :

The output signal is set within the range of [3.2 to 4.0] mA

Both burnout and saturation current can be adjusted within the range of [3.2 ; 4.0] and [20.0 ; 22.5] mA



Loop-check / fixed output current :

The transmitter can be configured to provide a constant output signal from 3.2 up to 22.5 mA.

Temperature limit :

Ambient :

- 40 to + 85°C
- 20 to + 80°C (with optional LCD unit)
- 40 to + 60°C (with optional arrester)
- 10 to + 80°C (fluorinated oil filling of the cell)

Please refer to the hazardous locations table for ambient temperature limitations according to the standard and type of protection.

Process :

Check in the seal datasheet with the specific temperature conditions

Storage :

- 40 to + 90°C

Humidity :

0 to 100% RH (Relative Humidity)

PERFORMANCE SPECIFICATIONS

Reference conditions, silicone oil filling, SS 316L isolating diaphragms, 4-20 mA analog output in linear mode

Accuracy rating : (Including linearity, hysteresis & repeatability)

For span > 1/10 of URL :

±0.1 % of calibrated span (FKP)

±0.2 % of calibrated span (FKH)

For span < 1/10 of URL :

$\pm(0.05 + 0.005 \times \frac{URL}{span})$ % of span (FKP)

$\pm(0.1 + 0.01 \times \frac{URL}{span})$ % of span (FKH)

Stability :

±0.2% of URL for 10 years

Temperature effect :

Effect per 28°C change between the limits of -40 and +85°C.

Model FKP :

Zero shift :

$\pm(0.4 + 0.1 \times \frac{URL}{span})$ % / 28°C

Total effect :

$\pm(0.475 + 0.1 \times \frac{URL}{span})$ % / 28°C

Model FKH :

Zero shift :

$\pm(0.4 + 0.2 \times \frac{URL}{span})$ % / 28°C

Total effect :

$\pm(0.475 + 0.2 \times \frac{URL}{span})$ % / 28°C

Overrange effect :

Zero shift :

±0.3% of URL

(max. overrange pressure = 1.5% max span)

Supply voltage effect :

< 0.005% of calibrated span per 1 V.-

RFI effect :

< 0.2% of the URL for the frequencies from 20 up to 1000 MHz with an electrical field strength of 10 V/m and housing covers in place. (Classification : 2-abc : 0.2% of span according SAMA PMC 33.1).

Response time : (at 63.3% of output signal without damping)

Time constant :

200 msec

Dead time :

About 300 msec

Response time = time constant + dead time

Mounting position effect :

Zero shift :

<10mm WC for 10° incline in any position.

This shift can be corrected with the zero adjustment.

(Effect is doubled for fluorinated oil filling).

No influence on span adjustment.

Vibration effect:

< ±0.25% of span for spans greater than 1/10 of URL.

Frequency 10 to 150 Hz, acceleration 39.2 m/sec^2 .

Material fatigue:

Please consult Fuji Electric.

Dielectric strength :

500 V AC 50/60 Hz during 1 minute between circuit and earth. (except with optional arrester).

Insulation resistance :

> 100 MΩ at 500 V DC.

Turn on time :

4 seconds

Internal resistance for external field indicator :

12 Ω maxi (connected to test terminal CK+ and CK-)

Pressure equipment directive (PED) 2014/68/EU

According to Article 4.3

PHYSICAL SPECIFICATIONS

Conduit connection :

1/2 - 14 NPT, Pg13.5 or M20 x 1.5

Non wetted parts material :

Electronics housing :

Low copper die cast aluminium alloy finished with polyester coating (standard), or SS 316L (option).

Bolts and nuts :

Standard : Cr-Mo alloy

Option : SS 316(L)

Filling fluid :

Standard :

Silicone oil

Mounting bracket :

SS 304L

Environmental protection :

IP66/IP67 and Type 4X

Mounting :

Without mounting bracket :

Direct mounting

With optional mounting bracket :

For 50 mm (2") pipe or direct wall mounting

Weight :

Refer to the page 9 and 10

Diaphragm seal(s) :

For seal selection, please refer to enclosed datasheet for diaghragm seals.

ACCESSORIES

Hand Held Communicator :

Model FXW, refer to datasheet n° EDS8-47

OPTIONAL FEATURES

Local indicator :

A plug-in analog indicator (2.5% accuracy) can be mounted into the electronics compartment or the terminal box of the housing.

An optional 5 digit indicator with engineering units is also available.

Local configuration with the 3 push-buttons indicator :

A local configuration can be carried out with the optional 3 push-buttons 5-digits indicator.

Arrester :

A built-in arrester protects the electronics from lightning surges.

Lightning surge immunity :

±4 kV (1.2 × 50 µs)

NACE specifications :

Metallic materials for all pressure boundary parts comply with NACE MR 0175 / ISO 15156.

SS 660 or SS 660/660 bolts and nuts comply with NACE MR 0175 / ISO 15156.

Optional tag plate:

An extra stainless steel tag with customer tag data is wired to the transmitter.

Vacuum service :

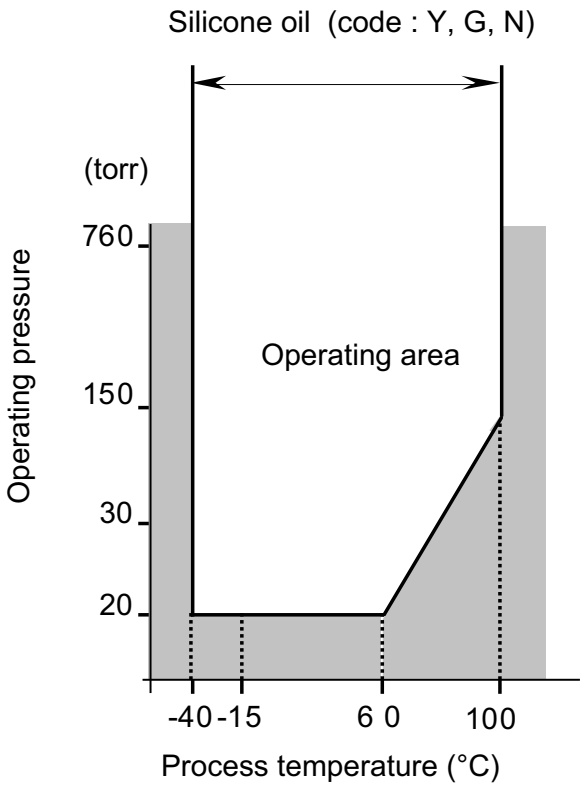


Fig.1
Relation between process temperature and operating pressure

ELECTROMAGNETIC COMPATIBILITY

All FCX-AII series of pressure transmitters are in conformity with the provision of the EMC Directive 2014/30/EU on the harmonization of the laws of the Members States relating to electromagnetic compatibility.

All these models of pressure transmitters are in accordance with the following harmonized standards :

• **EN 61326-1** *(Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements).*

• **EN 61326-2-3** *(Particular requirements - Test configuration, operational conditions and performance criteria for tranducers with integrated or remote signal conditioning).*

Emission limits (according to EN 55011 / CISPR 11, Group 1 Class A)

Frequency range (MHz)	Limits	Basic standard
30 to 230	40 dB (µV/m) quasi peack, measured at 10 m distance	Passed
230 to 1000	47 dB (µV/m) quasi peack, measured at 10 m distance	

Immunity

Phenomenon	Test value	Standard	Required Performance criteria	Result of criteria
Electrostatic Discharge	±4 kV (Contact) ±8 kV (Air)	EN/IEC 61000-4-2	**B**	**A**
Radiated, Electromagnetic Field	10 V/m (0.08 to 1.0 GHz) 3 V/m (1.4 to 2.0 GHz) 1 V/m (2.0 to 2.7 GHz)	EN/IEC 61000-4-3	**A**	**A**
Fast transients (burst)	2 kV (5/50 ns, 5 kHz	EN/IEC 61000-4-4	**B**	**A**
Surge Transients	1 kV Line to line 2 kV Line to ground	EN/IEC 61000-4-5	**B**	**A**
Conducted RF Disturbances	3 Vrms (150 kHz to 80 MHz) 80% AM @ 1 kHz	EN/IEC 61000-4-6	**A**	**A**
Power Frequency Magnetic Field	30 A/m (50 Hz, 60 Hz)	EN/IEC 61000-4-8	**A**	**A**

Performance criteria (A & B): according to IEC 61326

MODEL CODE SYMBOLS FKP...F

1	2	3	4	5	6	7	8		9	10	11	12	13		DESCRIPTION
F	K	P					F	-					Y		
															Type
															Gauge pressure with remote seal - Smart, 4-20 mA+ HART/Fuji Electric communication protocol

	Conduit connection	**Enclosure type**
T	1/2 - 14 NPT	"L" shape
V	Pg 13,5	
W	M20 x 1,5	
5	G 1/2	"T" shape
6	1/2 -14 NPT	
7	Pg13,5	
8	M20 x 1,5	

		Diaphragm seal rating
2		PN 25
4		PN 20 - 150 lbs
6		PN 50 - 300 lbs
8		PN 40
9		PN 16
L		PN 100 - 600 lbs

		Measuring range
1	V	0.08125 to 1.3 bar
2	V	0.3125 to 5 bar
3	V	1.875 to 30 bar
4	V	6.25 to 100 bar

					Indicator	**Arrester**
F	-	A			None	none
F	-	B		(*2)	Analog, 0-100% linear scale	
F	-	D		(*2)	Analog, Custom scale	
F	-	J		(*2)	Analog, double scale	
F	-	E			None	yes
F	-	F		(*2)	Analog, 0-100% linear scale	
F	-	H		(*2)	Analog, Custom scale	
F	-	K		(*2)	Analog, double scale	
F	-	L			Digital, 0-100%	none
F	-	P			Digital, Custom scale	
F	-	Q			Digital, 0-100%	yes
F	-	S			Digital, Custom scale	
F	-	1			Digital, 0-100% with push button	none
F	-	2			Digital, Custom scale with push button	
F	-	4			Digital, 0-100% with push button	yes
F	-	5			Digital, Custom scale with push button	

			Hazardous location approvals
A			None
X		(*1)	ATEX - Flameproof
K			ATEX - Intrinsic Safety
P			ATEX - Increased Safety
M		(*1)	ATEX - Combination Flameproof and Intrinsic Safety
E		(*1)	cCSAus - Explosion proof
J			cCSAus - Intrinsic Safety and Non Incendive
L			cCSAus -Combination Explosion proof, Intrinsic Safety and Non Incendive
R		(*1)	IECEx - Flameproof
T			IECEx - Intrinsic Safety
Q			IECEx - Increased Safety
N		(*1)	IECEx - Combination Flameproof and Intrinsic Safety
W		(*1)	IECEx - ATEX - cCSAus - Explosion/flameproof, Intrinsic Safety and Non Incendive

		Mounting design	**Ambiant temperature correction**
B		Capillary	Transmitter and diaphragm seal assembly
G			Transmitter
L		Rigid	Transmitter and diaphragm seal assembly
S			Transmitter

			Stainless steel parts	
			Tag plate	**Housing**
Y	Y		None	None
B	Y		Yes	
C	Y	(*3)	None	Yes
E	Y	(*3)	Yes	

Notes* :

1- Only with Digit 4 = "T", "W","6", "8"

2- Except Digit 10 = "P", "Q"

3- SS 316L enclosure not available for "T" shape version

4- The flange rating is according to the Maximum Working Pressure

MODELS CODE SYMBOLS FKH...F

1	2	3	4	5	6	7	8		9	10	11	12	13		DESCRIPTION		
F	K	H					F	-					Y				
															Type		
															Absolute pressure with remote seal - Smart, 4-20 mA+ HART/Fuji Electric communication protocol		
															Conduit connection	**Enclosure type**	
			T												1/2 - 14 NPT	"L" shape	
			V												Pg13,5		
			W												M20 x 1,5		
			5												G 1/2	"T" shape	
			6												1/2 - 14 NPT		
			7												Pg13,5		
			8												M20 x 1,5		
														(*4)	**Diaphragm seal rating**		
				2											PN 25		
				4											PN 20 - 150 lbs		
				6											PN 50 - 300 lbs		
				8											PN 40		
				9											PN 16		
				L											PN 100 - 600 lbs		
					2	V									**Measuring range**		
					3	V									0.08125 to 1.3 bar abs		
					4	V									0,.3125 to 5 bar abs		
															1.875 to 30 bar abs		
							F	-	A						**Indicator**	**Arrester**	
							F	-	B					(*2)	None	None	
							F	-	D					(*2)	Analog, 0-100% linear scale		
							F	-	J					(*2)	Analog, Custom scale		
							F	-	E						Analog, double scale		
							F	-	F					(*2)	None	yes	
							F	-	H					(*2)	Analog, 0-100% linear scale		
							F	-	K					(*2)	Analog, Custom scale		
							F	-	L						Analog, double scale		
							F	-	P						Digital, 0-100%	None	
							F	-	Q						Digital, Custom scale		
							F	-	S						Digital, 0-100%	yes	
							F	-	1						Digital, Custom scale		
							F	-	2						Digital, 0-100% with push button	None	
							F	-	4						Digital, Custom scale with push button		
							F	-	5						Digital, 0-100% with push button	yes	
															Digital, Custom scale with push button		
										A					**Hazardous location approvals**		
										X				(*1)	None		
										K					ATEX - Flameproof		
										P					ATEX - Intrinsic Safety		
										M				(*1)	ATEX - Increased Safety		
										E				(*1)	ATEX - Combination Flameproof and Intrinsic Safety		
										J					cCSAus - Explosion proof		
										L				(*1)	cCSAus - Intrinsic Safety and Non Incendive		
										R				(*1)	cCSAus -Combination Explosion proof, Intrinsic Safety and Non Incendive		
										T					IECEx - Flameproof		
										Q					IECEx - Intrinsic Safety		
										N				(*1)	IECEx - Increased Safety		
										W				(*1)	IECEx - Combination Flameproof and Intrinsic Safety		
															IECEx - ATEX - cCSAus - Explosion/flameproof, Intrinsic Safety and Non Incendive		
											B				**Mounting design**	**Ambiant temperature correction**	
											G				Capillary	Transmitter and diaphragm seal assembly	
											L					Transmitter	
											S				Rigid	Transmitter and diaphragm seal assembly	
																Transmitter	
												Y	Y		**Stainless Steel parts**		
															Tag plate	**Housing**	
												Y	Y		None	None	
												B	Y		Yes		
												C	Y	(*3)	None	Yes	
												E	Y	(*3)	Yes		

Notes* :

1- Only with Digit 4 = "T", "W","6", "8"

2- Except Digit 10 = "P", "Q"

3- SS 316L enclosure not available for "T" shape version

4- The flange rating is according to the Maximum Working Pressure

SEAL DIAPHRAGMS

Fuji Electric seal diaphragms are dedicated to accurately measure liquid level on open tanks and line pressure in pipes with heavy process conditions.
The use of remote seal diaphragms avoids the measuring cell to be directly in contact with the process conditions.
The various diaphragm architectures and the welded seal construction provide to the Fuji Electric remote seal diaphragm offer an excellent reliability in harsh processing conditions such as high temperature or corrosiveness as weel as viscous, crystallizable or abrasive process.

FEATURES

1- Construction

Connection of the remote seal to the measuring cell diaphragms can be done either by a rigid (direct) or capillary architectures.
The full welded Fuji Electric design a free of gasket path between the remote seal and the gauge or absolute measuring cell of the FCX-AII V5 pressure transmitters.
Depending the nature of the process, specific filling fluids are available to ensure the optimal transmission of the process pressure to the measuring cell.

2- Operating principle

The pressure is applied on the remote seal diaphrag and transfered by the filling to the measuring cell of the pressure transmitter.

3- Wide variety of materials selection

Depending the process conditions, wetted parts and filling fluids can be selected thanks to the model code definitions.
Wetted parts material : AISI 316L, Tantalum, Hastelloy, Monel, Titanium, Zirconium, AISI 316L with Gold or PFA coating.
Non wetted parts material : AISI 316L.
Filling fluids : standard silicone, fluorinated, sanitary, high temperature and vacuum specific oils.
For specific process conditions, please consult Fuji Electric.

4- Diaphragm seal types

According to the mounting and operating conditions different seal types can be useful :
- Flush mounting design for DN40 to DN125.
- Seals with extensions (50 to 200 mm).
- Seals for sanitary applications according DIN, SMS, Tri-Clamp standards.
- Flange type adaptors, with welded or screwed tip
- For specific flanges, consult Fuji Electric.

SPECIFICATIONS

Seal diaphragm application :

The remote seal can be assembled on the transmitter either by a direct (rigid) connection (as for level measurement at the bottom of the tank) or capillary (distant measuring point or high temperature process).
The rigid assembling can be either "long design" (in line) or "short design" (90°) as shown in the outline dimensions drawings.

Temperature limit :

Ambiant temperature :
-40 to 85°C for transmitter
Process temperature :
-40 to 150°C for rigid mounting,
0 to 350°C for capillary design, and according the filling fluid limitations.

Capillary tube specifications :

Standard capillary lengthes :
1,5 / 3 / 6 m (other upon request)
Inside diameter :
1 mm standard
2 mm for vacuum service (high process temperature applications), short response time requirements.
Smallest bending radius of the capillary :
100 mm

Capillary tube shealding possibilities :

For the 2 capillary tube versions :
Temperature limit :
PVC sleeve : -10 to 80°C
Stainless steel sheald : -40 to 350°C

Pressure limits :

Working pressure :
Limited to the smallest between the nominal flange rating of the seal diaphragm and the maximum working pressure of the transmitter.
Vacuum limit :
Depends on the limit of the measuring cell and the filling fluid of the remote seal.
The lowest vacuum is 20 Torr or 27 mbar abs for gauge presure transmitters.

PERFORMANCE SPECIFICATIONS

To evaluate the global performances, both the transmitter and the seal diaphragm performances must be considered under the reference conditions : standard silicone oil , SS 316L seal diaphragm, 4-20 mA output in linear mode.

Accuracy :

The assembling of a diaphragm seal on a transmitter increases the accurancy error at reference conditions of 0,1% of the span.

Ambient temperature effect :

Effect when only the transmitter is corrected.
(See digit 11 codes G, S of the transmitters model codes).

Seals	Effect	Effet on capillary
DN50/2" (SS diaphragm)	2.03	1.5
DN80/3" (SS diaphragm)	0.11	0.08
DN80/3" (other diaphragm material)	0.22	0.2
DN100/4" (SS diaphragm)	0.04	0.03
Adaptor (SS diaphragm)	0.11	0.08
Clamp 2"	2.06	
DN 50 or 2" (SMS or DIN 11851)	2.85	
No dead volume	5.16	
G 1" 1/2	5.16	
G 2"	2.03	

Note : the indicated values are in mbar/10°C for capillary length of 1m and internal capillary tube ø of 1 mm.

Effect when both the transmitter and the seal assembly are corrected.
(See digit 11 codes B, L of the transmitters model code).

The correction of the zero drift can be done at the factory level on the complete system (trasnmitter and seal assembly) by a thermal isolation or a heating of the capillaries minimises the ambient temperature effect.

Process temperature effect :

Seals	Effect (mbar/10°C)
DN50/2" (SS diaphragm)	1.24
DN80/3" (SS diaphragm)	0.17
DN80/3" (other diaphragm material)	0.73
DN100/4" (SS diaphragm)	0.08
Adaptor (SS diaphragm)	0.17
Clamp 2"	2.61
DN 50 or 2" (SMS or DIN 11851)	4.22
No dead volume	5.16
G 1" 1/2	1.42
G 2"	1.24

Response time : (mean values)

The indicated values are in seconds per meter of capillary length with internal tube diameter Ø 1 mm. The indicated response time is based on a pressure change of 0 to 100% of the calibrated span at reference temperature of 20°C. The indicated values do not include the response time of the transmitter.

Oil filling	Code digit 7	Response time 0 to 1.3 bar
Standard silicone oil	Y, G	0.037
Fluorinated oil	W,A,D	0.04
Oil for vaccul service or high temperature	U, V, X	0.065

Filling fluid of the diaphragm seals :

Code digit 7	Designation	Temperature resistance (°C)		Density (25°C)
		P abs ≥ 1bar	P abs < 1bar	
Y	Silicone oil	-40 to +150	-40 to +120	0.95
W	Fluorinated oil	-20 to +100	-20 to +80	1.84
F	Sanitary fill fluid	-10 to +150	-10 to +120	0.94
V	Silicone oil	20 to +200		1.07
U	Silicone oil	0 to +300	0 to +200	1.07
X	Silicone oil	20 to +350	0 to +200	1.09

These values and limits are indicated for the most common applications (standard filling fluids).
Please ask Fuji Electric for special applications indicating your temperature, pressure and vacuum conditions (vacuum and temperature can occure together); other filling fluids can be used for your applications.

MODEL CODE SYMBOLS - S

1	2	3	4	5	6	7		8			DESCRIPTION		
S							-				**Remote seal diaphragms**		
											Flange / Capillary connection		
	A										Axial		
	R										Radial - Not possible with rigid assembling design (digit 6 = "R")		
	W										Wafer type - Not possible with rigid assembling design (digit 6 ="R")		
										(*1)	**Flanges RF (flange size and rating)**		
		4									ANSI-150 Lbs 3" / ISO PN20 DN80		
		5									ANSI-150 Lbs 4" / ISO PN20 DN100		
		6									ANSI-300 lLbs 3" / ISO PN50 DN80		
		7									ANSI-300 Lbs 4" / ISO PN50 DN100		
		8									DIN PN40 DN80		
		9									DIN PN16 DN100		
		H								(*2)	ANSI-150 lbs 2" / ISO PN20 DN50		
		J								(*2)	ANSI-300 lbs 2" / ISO PN50 DN50		
		G								(*2)	DIN PN40 DN50		
		K								(*11)	G 2" screwed seal		
		L								(*11)	G 1 1/2" screwed seal		
		U									PN25 DN50 - coupling nuts	DIN 11851	Digit 4 = "V" only
		V									PN40 DN50 - coupling nuts	SMS	Digit 4 = "V" only
		W									PN40 DN50 - seal only	Clamp	Digit 4 = "V" only
		X									No dead volume	Sanitary	Digit 4 = "V" only
		A								(*3)	Flange adapter PN40 DN25		Digit 4 = "V" only - others upon request
		B								(*3)	Flange adapter ISO PN20 DN25 (1"-150 ANSI)		Digit 4 = "V" only - others upon request
		C								(*3)	Flange adapter ISO PN50 DN25 (1"- 300 ANSI)		Digit 4 = "V" only - others upon request
		D								(*3)	Flange adapter PN40 DN40		Digit 4 = "V" only - others upon request
		E								(*3)	Flange adapter ISO PN20 DN40 (1"1/2 - 150 ANSI)		Digit 4 = "V" only - others upon request
		F								(*3)	Flange adapter ISO PN50 DN40 (1"1/2 - 300 ANSI)		Digit 4 = "V" only - others upon request
		S								(*3)	Screwed 1/2 NPTE		Digit 4 = "V" only - others upon request
		T								(*3)	To be welded (2"1/2 pipe)		Digit 4 = "V" only - others upon request

											Seal diaphragm design		
											Diaphragm	**Seal land surface**	**Flange**
			V							(*4)	SS 316L	SS 316L	SS 316L
			H								Hastelloy-C	Hastelloy-C	
			B								Monel	Monel	
			T								Tantalum	Tantalum	
			P							(*9)	Titanium	Titanium	
			R							(*9)	Zirconium	Zirconium	
			C								SS 316L + gold coating	SS 316L	
			F							(*5)	SS 316L + PFA lining	SS 316L + PFA lining	

											Seal diaphragm design	
											Flush mounting	
										(*6)	Diaphragm extension 50 mm	Digit 4 = "V"
										(*6)	Diaphragm extension 100 mm	Digit 4 = "V"
										(*6)	Diaphragm extension 150 mm	Digit 4 = "V"
										(*6)	Diaphragm extension 200 mm	Digit 4 = "V"
										(*6)	Diaphragm extension 50 mm	Digit 4 = "H"
										(*6)	Diaphragm extension 100 mm	Digit 4 = "H"
										(*6)	Diaphragm extension 150 mm	Digit 4 = "H"
										(*6)	Diaphragm extension 200 mm	Digit 4 = "H"
										(*6)	Diaphragm extension 50 mm	Digit 4 = "B"
										(*6)	Diaphragm extension 100 mm	Digit 4 = "B"
										(*6)	Diaphragm extension 150 mm	Digit 4 = "B"
										(*6)	Diaphragm extension 200 mm	Digit 4 = "B"
										(*6)	Diaphragm extension 50 mm	Digit 4 = "T"
										(*6)	Diaphragm extension 100 mm	Digit 4 = "T"
										(*6)	Diaphragm extension 150 mm	Digit 4 = "T"
										(*6)	Diaphragm extension 200 mm	Digit 4 = "T"

											Remote seal assembling characteristics		
											Mounting assembly	**Length**	**Protection**
											Capillary	1,5 m	PVC sleeve
												3 m	
												6 m	
												Upon request	
										(*7)		1,5 m	Stainless steel sleeve
										(*7)		3 m	
										(*7)		6 m	
										(*7)		Upon request	
											Rigid assembly for FKB, FKD & FKM - Not possible with digit 2 = "R", "W" - Maximum process temperature: 150 °C		
											Rigid assembly for FKP & FKH - Not possible with digit 2 = "R", "W" - Maximum process temperature: 150 °C		

											Specific applications and filling fluids for the remote seal	
											Treatment	**Filling fluids**
											None (standard)	Silicone oil
											None (standard)	Fluorinated oil
											None (standard)	Sanitary fill fluid
											Chlorine service	Fluorinated oil
											Degreasing	Silicone oil
											Oxygen service	Fluorinated oil - Digit 4 = "V" only
											NACE MR 0175 / ISO 15156	Silicone oil
										(*8)	Vacuum service - maximum T° 200°C	Silicone oil
										(*8)	Very high temperature (0 to 300°C) - No vacuum	
										(*8)	Very high temperature (20 to 350°C) - No vacuum	

											Special options
								-	*	(*10)	Special, no code available

Notes* :

1- Standard seal land surface finishing (stock finish). Other finishing (recess, groove…): please consult Fuji Electric. For material codes "H", "B", "T", "P", "R", "F" : smooth finishing

2- Only available for P > 1 bar. Please consult Fuji Electric regarding the process conditions

3- Only for axial seal diaphragm connection - No extension possible

4- SS 316L for DN50, DN80, DN100 and flange adapter

5- Not possible with digit 7 = "V", "U" and "X"

6- All wetted parts in the same material (diaphragm, extension and seal land surface). Available for Digit 3 = 4, 5, 6, 7, 8, 9, H, J, G. Other remote seal on demand

7- Vacuum service and high temperature > 120°C : internal capillary diameter = 2mm

8- Please consult Fuji Electric regarding the process conditions (minimum pressure, maximum temperature)

9- Maximum process temperature: 150°C

10- When no code can be found in the current model code, place "*" in the corresponding digit code as well as in the 16th digit.

11- Only for FKP, FKH and rigid assembly. P > 1.3 bar

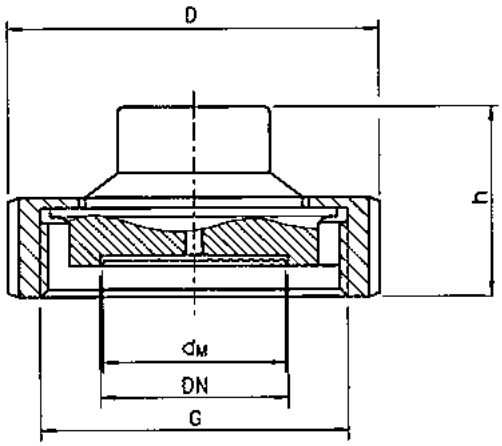
Outline dimensions of sanitary diaphragm seals (units : mm)

The seals for the sanitary and pharmaceutical applications are available according DIN, SMS and Tri-Clamp standards

Seals according DIN 11851 et SMS

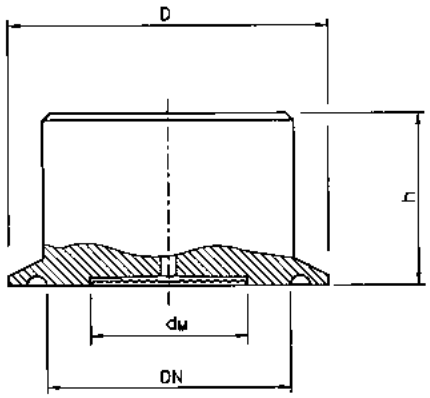
2 differents design exist for DIN 11851 and SMS :

Coupling nut design



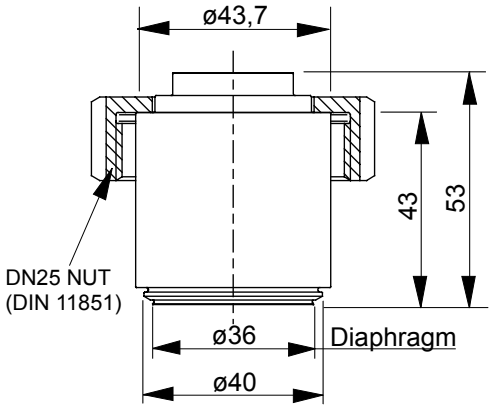
DIN 11851					
DN	PN (Max)	D	h	d_M	G
25	40	63	36	25	Rd 52 x 1/6
32	40	70	36	32	Rd 58 x 1/6
40	40	78	36	40	Rd 65 x 1/6
50	40	112	36	52	Rd 78 x 1/6
65	40	112	36	65	Rd 95 x 1/6
80	40	127	36	76	Rd 110 x 1/4
SMS					
38	40	74	38	40	Rd 48 x 1/6
51	40	84	38	52	Rd 60 x 1/6
63,5	40	100	38	65	Rd 85 x 1/6
76	40	114	38	76	Rd 98 x 1/6

Tri Clamp design

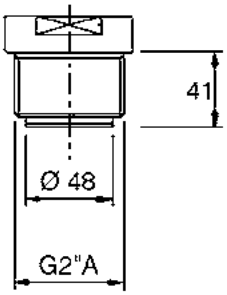


DN	PN (Max)	D	h	d_M
1"1/2	40	50	35	32
2"	40	64	35	40
2"1/2	40	77.5	35	50
3"	40	91	35	65

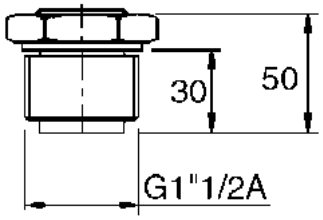
Dead volume seal



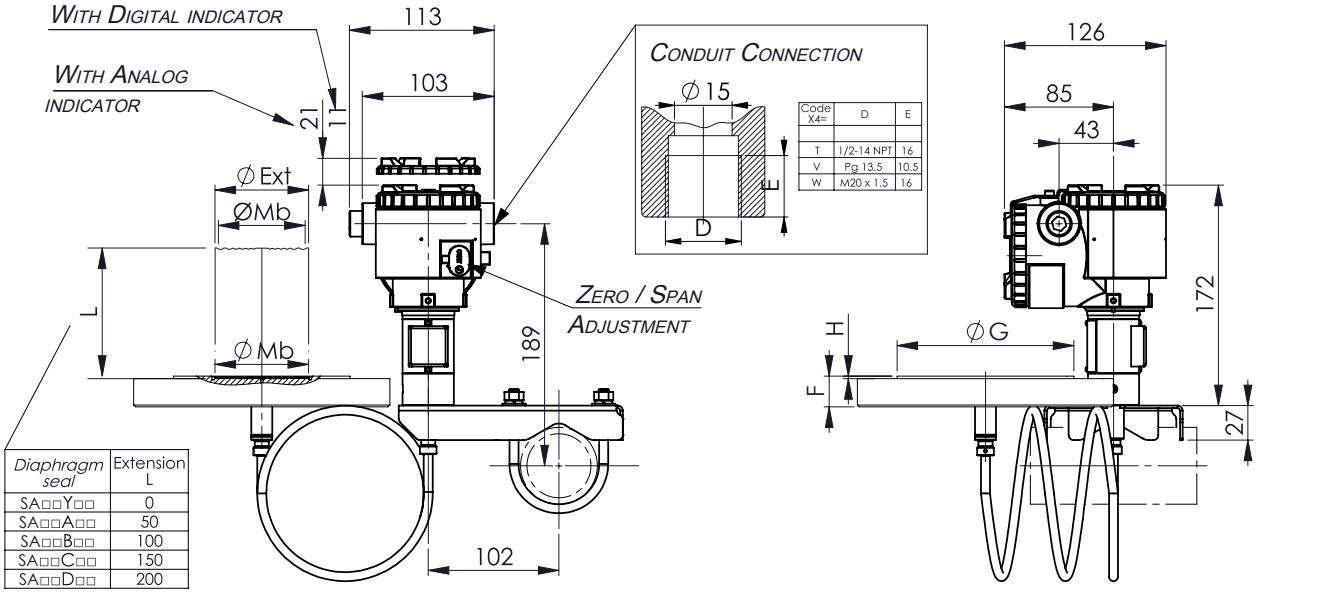
Screwed G 2"A



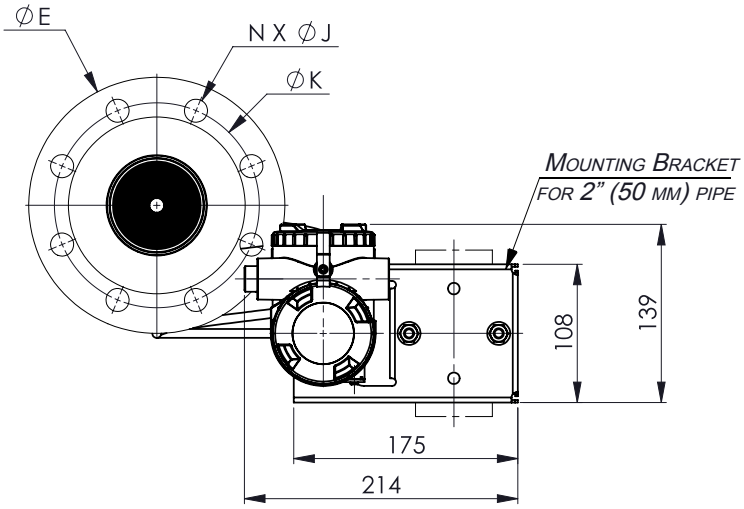
Screwed G 1"1/2 A



OUTLINE DIMENSIONS FOR CAPILLARY MOUNTED DIAPHRAGM SEAL ON A ABSOLUTE PRESSURE TRANSMITTER (units : mm)



Diaphragm seal	Extension L
SA□□Y□□	0
SA□□A□□	50
SA□□B□□	100
SA□□C□□	150
SA□□D□□	200



WEIGHT : - 2 KG (WITHOUT OPTION)
ADD - FLANGES' WEIGHT (SEE TABLE)
- 1 KG PER 50 MM EXTENSION
- 0,3 KG FOR INDICATOR OPTION
- 2 KG FOR STAINLESS STEEL HOUSING OPTION

FLANGES DIMENSIONS ACCORDING TO EN 1092-1 & EN 1759-1										SS 316L		Exotic material	
diaphragm seal	EN 1092-1	EN 1759-1	ØE	F min	ØG	H	N x ØJ	ØK	Weight (kg)	L=0 ØMb	L≠0 ØExt=ØMb	L=0 ØMb	L≠0 ØExt(ØMb)
SAG□□□□	DN50 PN40		165	20	102	2	4 x 18	125	3,3	59	48	59	48,3 (47)
SAH□□□□		2" CLASS 150	152	21	92	1,6	4 x 19	120,6	2,7	59	48	59	48,3 (47)
SAJ□□□□		2" CLASS 300	165	22,5	92	1,6	8 x 19	127	3.7	59	48	59	48,3 (47)
SA8□□□□	DN80 PN40		200	24	138	2	8 x 18	160	5,8	73	73	89	76 (72)
SA4□□□□		3" CLASS 150	190	24	127	1,6	4 x 19	152,4	5,3	73	73	89	76 (72)
SA6□□□□		3" CLASS 300	210	28,5	127	1,6	8 x 22,2	168,3	7,8	73	73	89	76 (72)
SA9□□□□	DN100 PN16		220	22	158	2	8 x 18	180	5,9	96	96	89	94 (89)
SA5□□□□		4" CLASS 150	229	24	157	1,6	8 x 19	190,5	7,7	96	96	89	94 (89)
SA7□□□□		4" CLASS 300	254	32	157	1,6	8 x 22,2	200	12,7	96	96	89	94 (89)

ØMb = Ø diaphragm
ØExt = extension

Wetted parts material

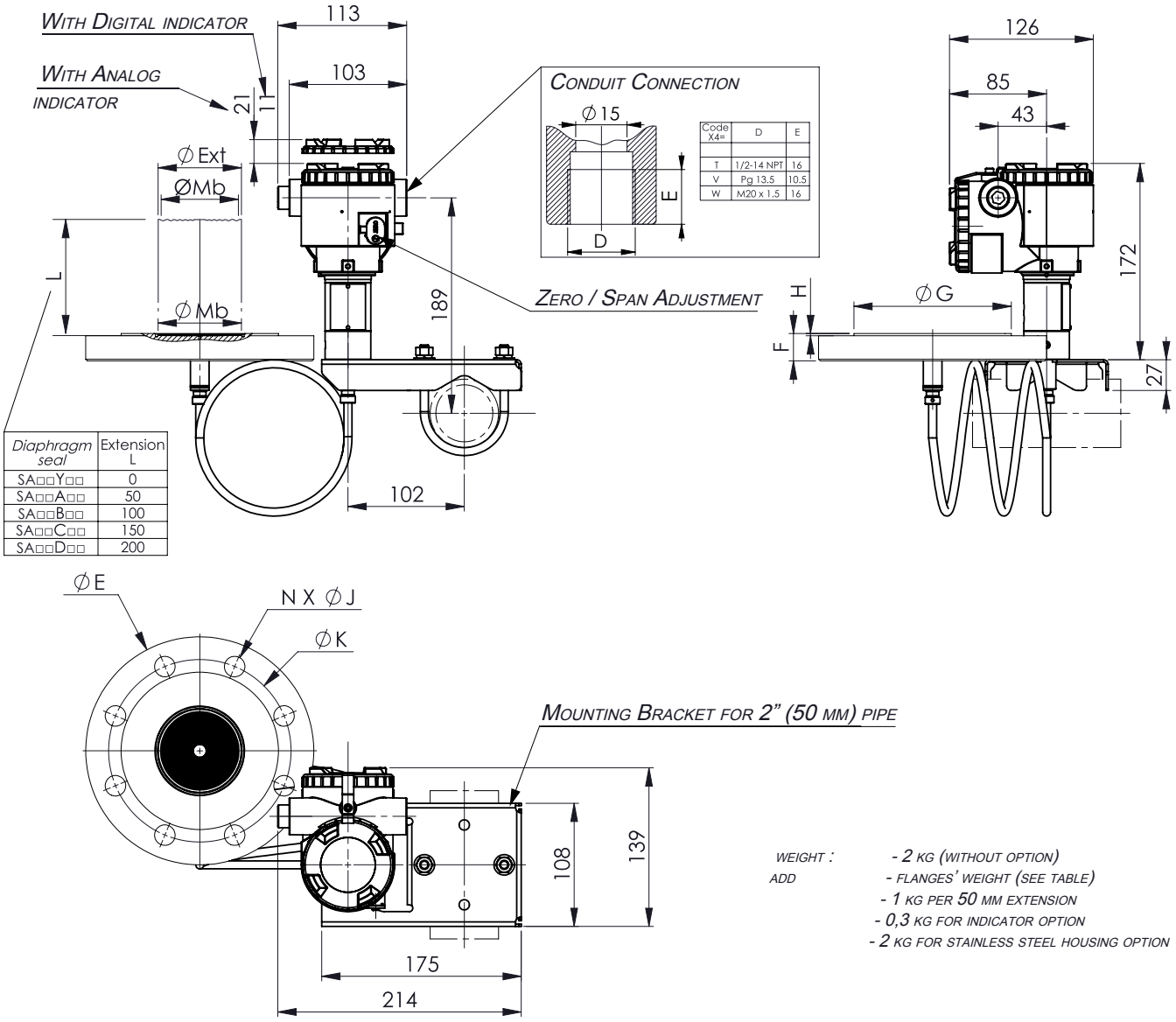
Diaphragm seal :

X_1 X_2 X_3 X_4 X_5 X_6 X_7 X_8 - X_9 X_{10} X_{11} X_{12} X_{13}
F K H □□□ V F - □□□□ Y
X_{11} = B, G

X_1 X_2 X_3 X_4 X_5 X_6 X_7
S A □□□□□
X_{11} = A, B, C, D, G, H, K, L

	SPAN LIMIT	
	Min.	Max.
FKH□□2	8,125 kPa (81,25 mbar)	130 kPa (1300 mbar)
FKH□□3	31,25 kPa (0,3125 bar)	500 kPa (5 bar)
FKH□□4	187,5 kPa (1,875 bar)	3000 kPa (30 bar)

OUTLINE DIMENSIONS FOR CAPILLARY MOUNTED DIAPHRAGM SEAL ON A GAUGE PRESSURE TRANSMITTER (units : mm)



WEIGHT : *- 2 KG (WITHOUT OPTION)*
ADD *- FLANGES' WEIGHT (SEE TABLE)*
- 1 KG PER 50 MM EXTENSION
- 0,3 KG FOR INDICATOR OPTION
- 2 KG FOR STAINLESS STEEL HOUSING OPTION

FLANGES DIMENSIONS ACCORDING TO EN 1092-1 & EN 1759-1										*SS 316L*		*Exotic material*	
diaphragm seal	EN 1092-1	EN 1759-1	ØE	F min	ØG	H	N x ØJ	ØK	*Weight* (kg)	L=0 ØMb	L≠0 ØExt=ØMb	L=0 ØMb	L≠0 ØExt(ØMb)
SAG□□□□	DN50 PN40		165	20	102	2	4 x 18	125	3,3	59	48	59	48,3 (47)
SAH□□□□		2" CLASS 150	152	21	92	1,6	4 x 19	120,6	2,7	59	48	59	48,3 (47)
SAJ□□□□		2" CLASS 300	165	22,5	92	1,6	8 x 19	127	3.7	59	48	59	48,3 (47)
SA8□□□□	DN80 PN40		200	24	138	2	8 x 18	160	5,8	73	73	89	76 (72)
SA4□□□□		3" CLASS 150	190	24	127	1,6	4 x 19	152,4	5,3	73	73	89	76 (72)
SA6□□□□		3" CLASS 300	210	28,5	127	1,6	8 x 22,2	168,3	7,8	73	73	89	76 (72)
SA9□□□□	DN100 PN16		220	22	158	2	8 x 18	180	5,9	96	96	89	94 (89)
SA5□□□□		4" CLASS 150	229	24	157	1,6	8 x 19	190,5	7,7	96	96	89	94 (89)
SA7□□□□		4" CLASS 300	254	32	157	1,6	8 x 22,2	200	12,7	96	96	89	94 (89)

ØMb = *Ø diaphragm*
ØExt = extension

Wetted parts material

X_1 X_2 X_3 X_4 X_5 X_6 X_7 X_8 - X_9 X_{10} X_{11} X_{12} X_{13}
F K P □□□ V F - □□□□ Y

X_{11} = B, G

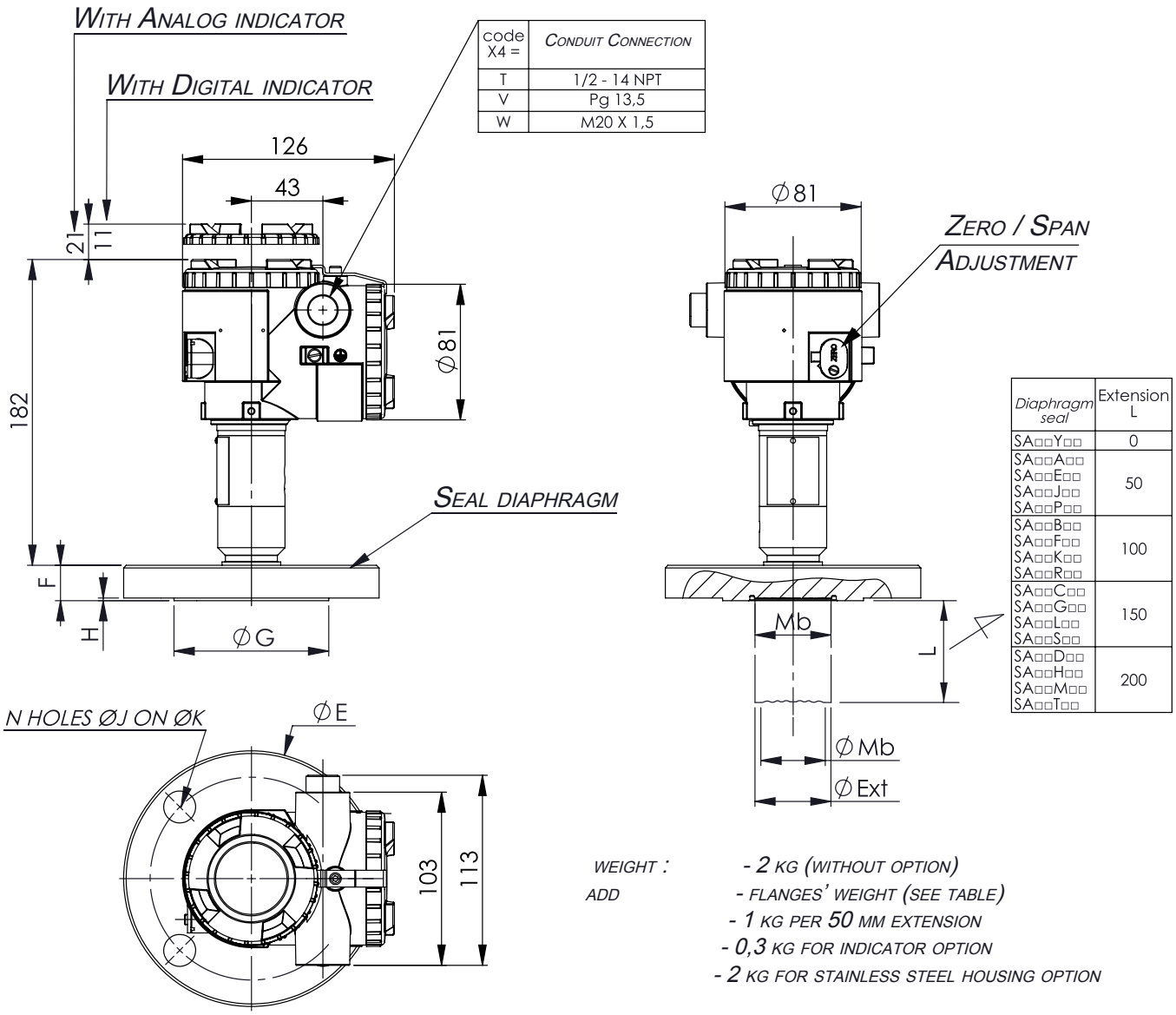
Diaphragm seal :

X_1 X_2 X_3 X_4 X_5 X_6 X_7
S A □□□□□

	SPAN LIMIT	
	Min.	Max.
FKP□□1	8,125 kPa (81,25 mbar)	130 kPa (1300 mbar)
FKP□□2	31,25 kPa (0,3125 bar)	500 kPa (5 bar)
FKP□□3	187,5 kPa (1,875 bar)	3000 kPa (30 bar)
FKP□□4	625 kPa (6,25 bar)	10000 kPa (100 bar)

OUTLINE DIMENSIONS FOR RIGID MOUNTED ON A GAUGE OR PRESSURE PRESSURE TRANSMITTER

(units : mm)



code X4 =	CONDUIT CONNECTION
T	1/2 - 14 NPT
V	Pg 13,5
W	M20 X 1,5

Diaphragm seal	Extension L
SA□□Y□□	0
SA□□A□□ SA□□E□□ SA□□J□□ SA□□P□□	50
SA□□B□□ SA□□F□□ SA□□K□□ SA□□R□□	100
SA□□C□□ SA□□G□□ SA□□L□□ SA□□S□□	150
SA□□D□□ SA□□H□□ SA□□M□□ SA□□T□□	200

WEIGHT : - 2 KG (WITHOUT OPTION)
ADD - FLANGES' WEIGHT (SEE TABLE)
- 1 KG PER 50 MM EXTENSION
- 0,3 KG FOR INDICATOR OPTION
- 2 KG FOR STAINLESS STEEL HOUSING OPTION

FLANGES DIMENSIONS ACCORDING TO EN 1092-1 & EN 1759-1										SS 316L		Exotic material	
seal Diaphragm	EN 1092-1	EN 1759-1	ØE	F min	ØG	H	N x ØJ	ØK	Weight (kg)	L=0 ØMb	L≠0 ØExt=ØMb	L=0 ØMb	L≠0 ØExt(ØMb)
SAG□□□□	DN50 PN40		165	20	102	2	4 x 18	125	3,3	59	48	59	48,3 (47)
SAH□□□□		2" CLASS 150	152	21	92	1,6	4 x 19	120,6	2,7	59	48	59	48,3 (47)
SAJ□□□□		2" CLASS 300	165	22,5	92	1,6	8 x 19	127	3.7	59	48	59	48,3 (47)
SA8□□□□	DN80 PN40		200	24	138	2	8 x 18	160	5,8	73	73	89	76 (72)
SA4□□□□		3" CLASS 150	190	24	127	1,6	4 x 19	152,4	5,3	73	73	89	76 (72)
SA6□□□□		3" CLASS 300	210	28,5	127	1,6	8 x 22,2	168,3	7,8	73	73	89	76 (72)
SA9□□□□	DN100 PN16		220	22	158	2	8 x 18	180	5,9	96	96	89	94 (89)
SA5□□□□		4" CLASS 150	229	24	157	1,6	8 x 19	190,5	7,7	96	96	89	94 (89)
SA7□□□□		4" CLASS 300	254	32	157	1,6	8 x 22,2	200	12,7	96	96	89	94 (89)

Wetted parts material

ØMb = *Ø diaphragm*
ØExt = extension

X_1 X_2 X_3 X_4 X_5 X_6 X_7 X_8- X_9 $X_{10}$$X_{11}$$X_{12}$$X_{13}$

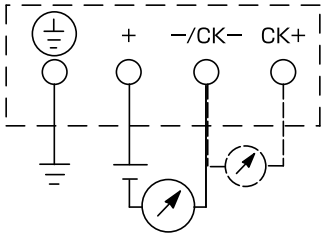
Model : F K P □□□ V F -□□□□ Y

X_{11} = L, S

seal Diaphragm — X_1 X_2 X_3 X_4 X_5 X_6 X_7 : S A □□□ S □

	SPAN LIMIT	
	Min.	Max.
FKP□□1	8,125 kPa (0,08125 bar)	130 kPa (1,3 bar)
FKP□□2	31,25 kPa (0,3125 bar)	500 kPa (5 bar)
FKP□□3	187,5 kPa (1,875 bar)	3000 kPa (30 bar)
FKP□□4	625 kPa (6,25 bar)	10000 kPa (100 bar)

CONNECTION DIAGRAM



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