HIGH PRESSURE TRANSMITTER (DIRECT MOUNT TYPE)

DATA SHEET FKR···6

The FKR model of FCX-AIV series of high pressure transmitters accurately measures a gauge pressure and transmits a proportional 4-20 mA output signal.

The transmitter uses an unique piezoresistive silicon sensor in combination with a state-of-the-art digital signal processing to provide exceptional performances in terms of accuracy and stability.

FCX-AIV series of pressure transmitters comply with Safety Integrity Level2 or 3 according to IEC 61508 and IEC61511 standards.

FEATURES

1. **High accuracy**
   Fuji Electric's piezoresistive silicon sensor provides in standard ± 0.065% accuracy for all elevated or suppressed calibration ranges without additional adjustments.
2. **HART 7 communication protocol**
   FCX-AIV series of pressure transmitters can communicate using the universal HART communication protocol.
   By the use of the HART Device Description files, HART compatible devices can communicate with any FCX-AIV transmitter.
3. **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
   – 5 digits local display with engineering units
   – Stainless steel electronics housing
4. **Programmable output Linearization Function**
   The output signal can be linearized using up to 14 pair-points.
5. **Burnout current flexibility**
   The burnout current value can be adjusted in the ranges of [3.4 ; 3.8] and [20.8 ; 22.5] mA and can be compliant with NAMUR NE43 recommendations.
6. **Contacless local adjustment**
   An optional local configurator with 3 magnetic switches allows to configure the transmitter without opening the indicator cover (flameproof approvals for hazardous locations).
   The Magnetic pen is required to enable the 3 magnetic switches (Please refer to ACCESSORIES).

FUNCTIONAL SPECIFICATIONS

Type:
FKR: Smart, 4-20 mA with HART communication protocol

Service:
Liquid, gas, or vapour

Span, range and over range limit:

Type	Span limit MPa {bar}		Range limit MPa {bar}	Overrange limit MPa {bar}
	Min.	Max.		
FKR□06	4.375 {43.75}	70 {700}	−0.1 to +70 {−1 to +700}	105 {+1050}
FKR□07	9.375 {93.75}	150 {1500}	−0.1 to +150 {−1 to +1500}	225 {+2250}

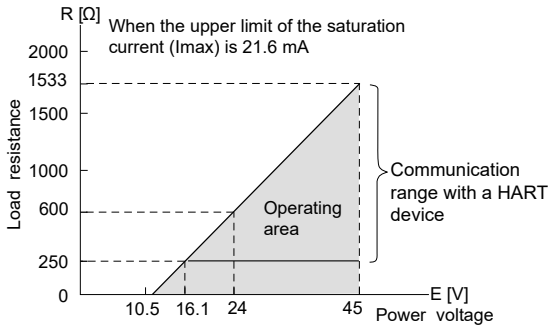
Note: Span higher than 1/10 of the URL is recommended for optimal accuracy.

Lower range limit: (vacuum limit)
See Figure 1 for details

Output signal:
4-20 mA with HART communication protocol.

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 a HART device, a minimum load of 250Ω is required.

Hazardous locations: (Appling for certificate)

Marking (Digit 10 =)		Protection type
ATEX		Intrinsic Safety "i":
		Ex II 1G/D
		Ex ia IIC T4 Ga (-40°C ≤ Ta ≤ +60°C)
		Ex ia IIC T5 Ga (-40°C ≤ Ta ≤ +50°C)
	(K)	Ex ia IIIC T_{200}135°C Da (-40°C ≤ Ta ≤ +60°C)
		Ex ia IIIC T_{200}100°C Da (-40°C ≤ Ta ≤ +50°C)
		IP 66/67
		Ui ≤ 28Vdc, Ii ≤ 110mA, Pi ≤ 0.77W
		Ci = 14.9nF(1)/26.0nF(2) Li = 0.181mH
		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 T_{200}100°C Db (-40°C ≤ Ta ≤ +85°C)
		Ex tb IIIC T_{200}85°C Db (-40°C ≤ Ta ≤ +65°C)
		45 Vdc max
	(M)	Combination (K) + (X)
IECEx		Intrinsic Safety "i":
		Ex ia IIC T4 Ga (-40°C ≤ Ta ≤ +60°C)
		Ex ia IIC T5 Ga (-40°C ≤ Ta ≤ +50°C)
	(T)	Ex ia IIIC T_{200}135°C Da (-40°C ≤ Ta ≤ +60°C)
		Ex ia IIIC T_{200}100°C Da (-40°C ≤ Ta ≤ +50°C)
		IP 66/67
		Ui ≤ 28Vdc, Ii ≤ 110mA, Pi ≤ 0.77W
		Ci = 14.9nF(1)/26.0nF(2) Li = 0.181mH
		Flameproof Enclosure "d":
		Ex d IIC T5 Gb (-40°C ≤ Ta ≤ +85°C)
	(R)	Ex d IIC T6 Gb (-40°C ≤ Ta ≤ +65°C)
		Ex tb IIIC T_{200}100°C Db (-40°C ≤ Ta ≤ +85°C)
		Ex tb IIIC T_{200}85°C Db (-40°C ≤ Ta ≤ +65°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)
		Class I Division 2, Groups ABCD
		T4 (-40°C ≤ Ta ≤ +60°C)
		T5 (-40°C ≤ Ta ≤ +50°C)
		Ui ≤ 28Vdc, Ii ≤ 110mA, Pi ≤ 0.77W
		Ci = 14.84nF(1)/25.94nF(2) Li = 0.18mH
		Explosion proof
		XP Class I Division 1, Groups CD
		Class II Groups EFG: Class III
	(E)	T5 (-40°C ≤ Ta ≤ +85°C)
		T6 (-40°C ≤ Ta ≤ +65°C)
		Vmax = 42.4Vdc
	(L)	Combination (J) + (E)
ATEX IECEx cCSAus	(W)	Combination (K) + (X) + (T) + (R) + (J) + (E)

(1) Without optional arrester
(2) With optional arrester

Configuration:

Configuration of the FCX-A IV series of pressure transmitters can be carried out by either using a HART device or an optional local configurator.

A third party HART device can be used in combination with Fuji Electric FCX-A IV HART Device Description files. (https://fieldcommgroup.org).

Functions		HART Protocol		Local configurator	
		Display	Set	Display	Set
Tag Nb		*v*	*v*	*v*	*v*
Model Nb		*v*	*v*	*v*	*v*
Serial Nb & Software revision		*v*	—	*v*	—
Engineering units		*v*	*v*	*v*	*v*
Upper Range Value		*v*	—	*v*	—
Measuring Range		*v*	*v*	*v*	*v*
Damping		*v*	*v*	*v*	*v*
Output signal type	Linear	*v*	*v*	*v*	*v*
	Square Root	*v*	*v*	*v*	*v*
Burnout current		*v*	*v*	*v*	*v*
Calibration		*v*	*v*	*v*	*v*
Output Adjust		—	*v*	—	*v*
Measuring Value		*v*	—	*v*	—
Self Diagnosis		*v*	—	*v*	—
External Adj Screw Lock		*v*	*v*	*v*	*v*
Transmitter Display		*v*	*v*	*v*	*v*
Linearization		*v*	*v*	*v*	*v*
Rerange		*v*	*v*	*v*	*v*
Saturation Current		*v*	*v*	*v*	*v*
Write Protect		*v*	*v*	*v*	*v*
History – Calibration History – Ambient T° History		 *v* *v*	 *v* —	 *v* *v*	 *v* —

Zero and span adjustment:

Zero and span are remotly adjustable by a HART device or locally by the local configurator or the external adjustment screw.

Damping:

The damping time constant can be adjusted within the range of [0.04 to 32] seconds.

Zero elevation/suppression:

Zero can be adjusted within the range of -1 bar to 100% of the URL of the sensor.

Normal/reverse action:

Selectable by range setting

Local indicator:

Optional 5-digits LCD or local configurator with 3 magnetic switches and push-buttons.

Saturation currents:

Lower limit: 3.6 to 4.0mA, Default value: 3.8mA

Upper limit: 20.0 to 21.6mA, Default value: 20.8mA

Burnout direction and output current:

If the self-diagnostic functions detect a transmitter 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 latest value just before the failure happens.

When "Output Overscale":

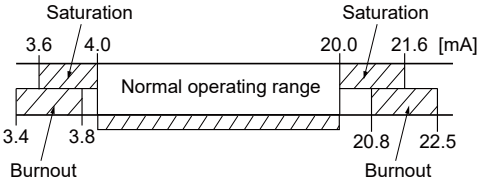
The output signal is set within the range of [20.8 to 22.5] mA, Default value: 21.6mA

When "Output Underscale":

The output signal is set within the range of [3.4 to 3.8] mA, Default value: 3.6mA

IEC 61508 considerations:

For safety applications, the "Output Hold'' MUST NOT be used. Only "Output Overscale" and "Output Underscale" must be used to clearly notify a "failure'' state.



Loop-check / fixed output current:

The transmitter can be configured to provide a constant output signal from 3.4 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)

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

Process: -40 to +100°C for silicone filling oil

-20 to +80°C for fluorinated oil fill sensor

Storage: -40 to +90°C

Humidity limit:

0 to 100% RH (Relative Humidity)

PERFORMANCE SPECIFICATIONS

Reference conditions, silicone oil filling, Alloy 625 diaphragm, 4-20 mA analog output in linear mode.

Accuracy rating:

(including linearity, hysteresis, and repeatability)

For spans greater than 1/10 of URL:

±0.065% of span

For spans below 1/10 of URL:

$$\pm \left(0.015+0.05\times 0.1 \frac{\text{URL}}{\text{Span}} \right) \% \text{ of span}$$

Stability:

±0.1% of Upper range limit (URL) for 5 years

Temperature effect:

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

Zero shift: $\pm(0.075+0.0125\frac{\text{URL}}{\text{Span}})\%$ / 28°C

Total effect: $\pm(0.095+0.0125\frac{\text{URL}}{\text{Span}})\%$ / 28°C

Overrange effect:

Zero shift, 0.2% of URL for any overrange to maximum limit

Supply voltage effect:

Less than 0.005% fo calibrated span per 1 V

Update rate:

40 msec

Turn on time:

6 sec

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

Time constant: 0.08 sec (at 23°C)

Dead time: about 0.06 sec

Response time = time constant + dead time

Electromagnetic compatibility:

FCX-A IV transmitters are in accordance with the following harmonized standards:

EN 61326-1

EN 61326-2-3

EN 61326-3-1

Mounting position effect:

Zero shift:

Less than 0.1kPa (1mbar) for a 10° tilt in any position.

This error can be corrected by adjusting zero.

(Double the effect for fluorinated fill sensors.)

No effect on span.

Vibration effect:

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

Frequency 10 to 2kHz, acceleration 29.4 m/s^2

Dielectric strength:

500 V AC, 50/60 Hz 1 min., between terminal lines and earth (except with the optional arrester)

Insulation resistance:

More than 100 MΩ at 500 V DC.

Internal resistance for external field indicator:

12Ω Max (connected to terminal block CK+ and CK-)

PED (2014/68/EU) ··· Appling for certificate

FKR□06: CategoryIII, ModuleH

FKR□07: CategoryIV, moduleH1

RoHS (2011/65/EU)+(EU)2015/863

EN IEC 63000

PHYSICAL SPECIFICATIONS

Electrical conduit connection:

1/2-14 NPT, M20 × 1.5 or Pg13.5

Process connections:

Autoclave F250C

Process-wetted parts material:

Model code		Process connection	Diaphragm	Wetted cell body
6th digit	7th digit			
6	G	SS 318LN (1.4462)	Alloy 625 (2.4856)	SS 316L (1.4404)
	N	Alloy 625 (2.4856)	Alloy 625 (2.4856)	Alloy 625 (2.4856)
	P	SS 318LN (1.4462)	Alloy 625 (2.4856) + Au	SS 316L (1.4404)
	R	Alloy 625 (2.4856)	Alloy 625 (2.4856) + Au	Alloy 625 (2.4856)
7	N	Alloy 625 (2.4856)	Alloy 625 (2.4856)	Alloy 625 (2.4856)
	R	Alloy 625 (2.4856)	Alloy 625 (2.4856) + Au	Alloy 625 (2.4856)

Non-wetted parts material:

Electronics housing:

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

Filling fluid:

Silicone oil or Mineral oil

Mounting bracket:

Stainless steel

Environmental protection:

IEC IP66 & IP67 and Type 4X

Mounting:

Direct mount or DN50(2") pipe using the mounting bracket.

Mass {weight}:

Transmitter only: 1.5 kg without options.

Add: 0.3 kg for indicator (option)

0.5 kg for mounting bracket (option)

1.5 kg for stainless steel housing (option)

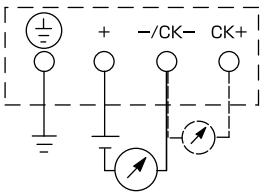
ACCESSORIES

Magnetic stick:

To be used with the 3 push-buttons optional indicators.

Order number = ZZP*TQ507742C1

CONNECTION DIAGRAM



OPTIONAL FEATURES

Local indicator:

An optional 5 digit indicator with engineering units is available.

A local configuration can be carried out using the 3 magnetic switches and push-buttons.

A separately ordered magnetic stick is required for adjustment using the 3 magnetic swithes.

Arrester:

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

Lightning surge immunity: ±4 kV (1.2 × 50 µs)

NACE specification:

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

Optional tag plate:

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

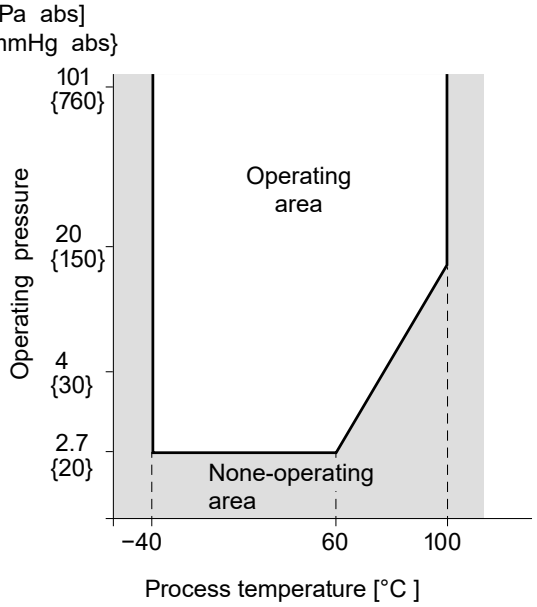


Fig. 1 Relation between process temperature and operating pressure

MODEL CODE SYMBOLS

1	2	3	4	5	6	7	8	-	9	10	11	12	13	-	14	15	-	16	Note	DESCRIPTION
F	K	R		0			6	-						-			-			**Type** **High pressure (gauge) transmiter, direct mounting - Smart, 4-20 mA with HART communication protocol**
																				Connections
																				Conduit connection / **Enclosure type**
			T																	1/2-14 NPT / "L" Shape
			V																	Pg13.5 / "L" Shape
			W																	M20×1.5 / "L" Shape
			6																	1/2-14 NPT / "T" Shape
			7																	7 Pg13.5 / "T" Shape
			8																	M20×1.5 / "T" Shape
				0	6														(1)	**Measuring ranges**
				0	7															-1...43.75 to 700 barg (-0.1...4.375 to 70 MPag)
																				-1...93.75 to 1500 barg (-0.1...9.375 to 150 MPag)
																			(2)	**Wetted parts**
																				Process connection / **Diaphragm** / **Cell body**
						G														SS 318LN (1.4462) / Alloy 625 (2.4856) / SS 316L (1.4404)
						N														Alloy 625 (2.4856) / Alloy 625 (2.4856) / Alloy 625 (2.4856)
						P														SS 318LN (1.4462) / Alloy 625 (2.4856) + Au / SS 316L (1.4404)
						R														Alloy 625 (2.4856) / Alloy 625 (2.4856) + Au / Alloy 625 (2.4856)
							6													**Design version**
																				Indicator / **Arrester**
									A											None / None
									E											None / Yes
									L											Digital, 0-100% linear scale / None
									P											Digital, custom scale / None
									Q											Digital, 0-100% linear scale / Yes
									S											Digital, custom scale / Yes
									1											Digital, 0-100% linear scale (Local configurator) / None
									2											Digital, custom scale (Local configurator) / None
									4											Digital, 0-100% linear scale (Local configurator) / Yes
									5											Digital, custom scale (Local configurator) / Yes
																				Hazardous location approvals
										A										None
										X									(3)	ATEX - Flameproof
										K										ATEX - Intrinsic Safety
										M									(3)	ATEX - Combination Flameproof and Intrinsic Safety
										E									(3)	cCSAus - Explosion proof
										J										cCSAus - Intrinsic Safety and Non Incendive
										L									(3)	cCSAus - Combination Explosion proof, Intrinsic Safety and Non Incendive
										R									(3)	IECEx - Flameproof
										T										IECEx - Intrinsic Safety
										N									(3)	IECEx - Combination Flameproof and Intrinsic Safety
										W									(3)	IECEx - ATEX - cCSAus - Explosion/Flameproof, Intrinsic Safety and Non Incendive
																				Mounting bracket
											A									None
											C									SS 304L
											K									SS 316L
																				Stainless steel parts
																				TAG plate / **Housing**
													Y							None / None
													B							Yes / None
													C							None / Yes
													E							Yes / Yes
																				Special applications & Filling fluids
																				Application / **Filling fluid**
														Y					(4)	Standard / Silicone oil
														G					(4)	Degreasing / Silicone oil
														J						Standard / Mineral oil
														K						Degreasing / Mineral oil
																				Process connection - Material - Conversion fitting
																				Process connection / **Material** / **Conversion fitting**
															Y					F250C (F) / See 7th digit / None
															A				(4)	1/4-18 NPT (F) / SS 318LN (1.4462) / F250C (M) to 1/4-18 NPT (F)
															B				(4)	1/4-18 NPT (F) / Alloy 625 (2.4856) / F250C (M) to 1/4-18 NPT (F)
															C					F250C (M) / SS 318LN (1.4462) / F250C (M) to F250C (M)
															D					F250C (M) / Alloy 625 (2.4856) / F250C (M) to F250C (M)
																				Special options
																L				None
																		*	(5)	Special, no code available

Note
(1): A turn down ration ≤ 10 is recommended for optimal accuracy.
(2): Only N and R if digit 6 = "7"
(3): Only M20x1.5 and 1/2-14 NPT electrical conduits
(4): MWP ≤ 70 MPa
(5): When no code can be found in the current model code, place "*" in the corresponding digit code as well as in the 16th digit.

OUTLINE DIAGRAM (Unit : mm)

<CASE SHAPE T> < 4TH DIGIT = 6, 7, 8>

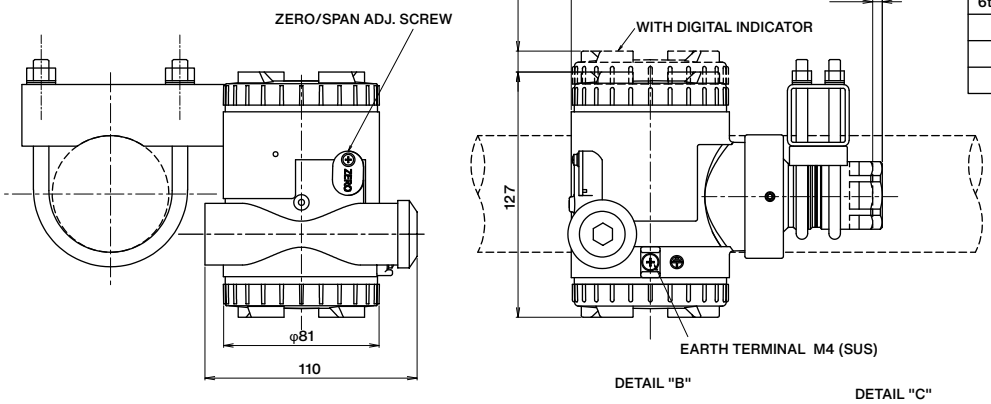
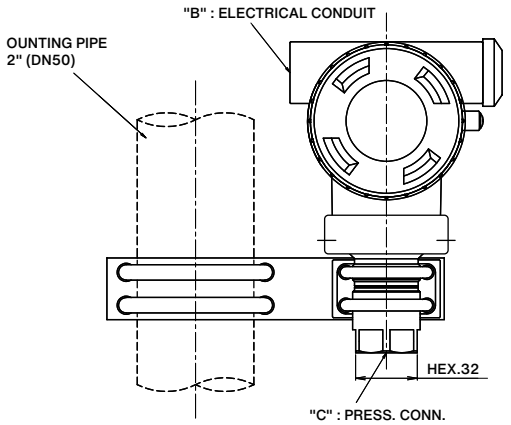


TABLE 1

Model code		A
6th digit	7th digit	
6	G, P	161
6	N, R	156
7	N, R	156



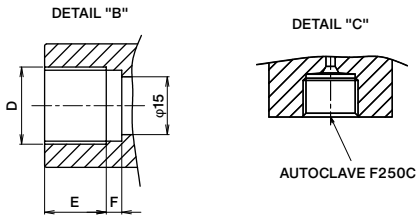
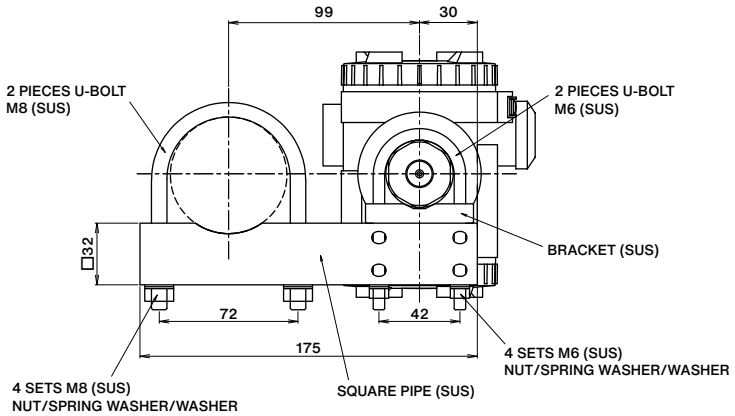


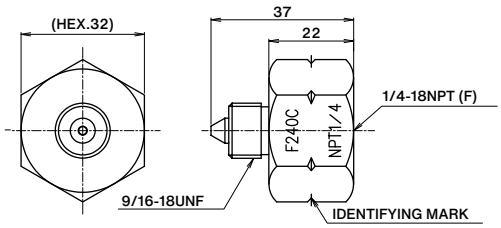
TABLE 2

Model code 4th digit	Electrical Conduit		
	D	E	F
6	1/2-14NPT	16	4
7	Pg13.5	10.5	4.5
8	M20×1.5	16	4

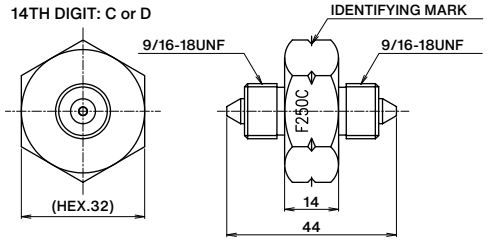
◇ OPTIONAL MOUNTING BRACKET (11TH DIGIT "C")



◇ OPTIONAL CONVERSION FITTING (14TH DIGIT)
14TH DIGIT: A or B



14TH DIGIT: C or D



◇ OPTIONAL TAG PLATE (12TH DIGIT)

TABLE 4

Model code 12th digit	Amp.case material	Mass
Y, B	Aluminum alloy. with polyester coating	Approx. 1.5 kg
C, E	SS 316L	Approx. 3 kg

TABLE 3

Model code 14th digit	Material	Identifying mark
Y	—	—
A	SS 318LN (1.4462)	Mark
B	Alloy 625 (2.4856)	No mark
C	SS 318LN (1.4462)	Mark
D	Alloy 625 (2.4856)	No mark

OUTLINE DIAGRAM (Unit : mm)

<CASE SHAPE L> < 4TH DIGIT = T, V, W>

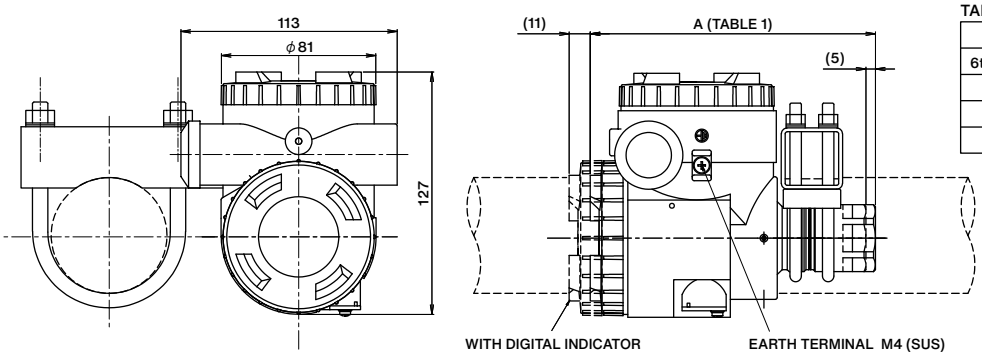


TABLE 1

Model code		A
6th digit	7th digit	
6	G, P	149
6	N, R	144
7	N, R	144

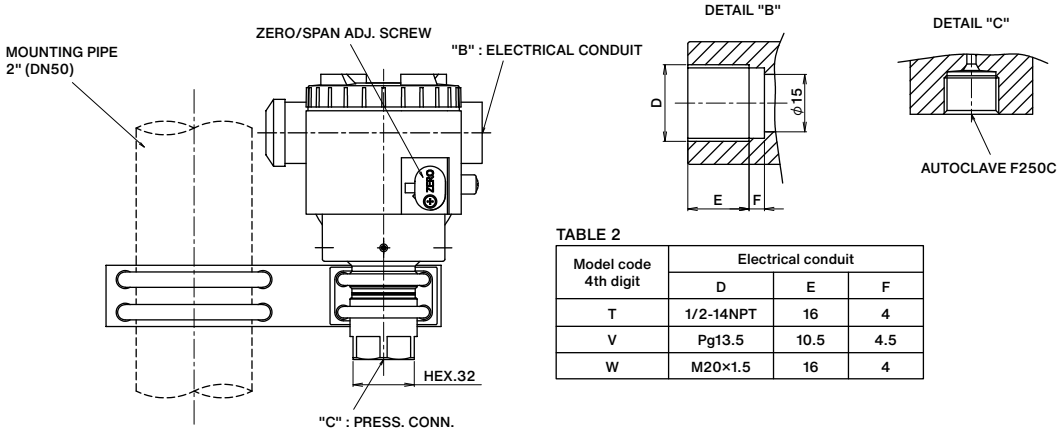
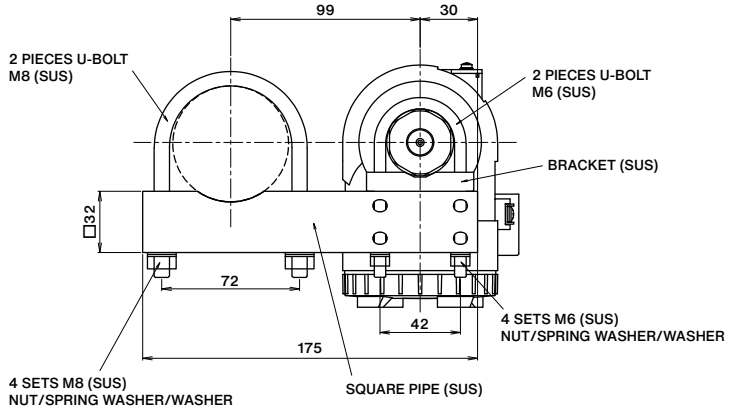


TABLE 2

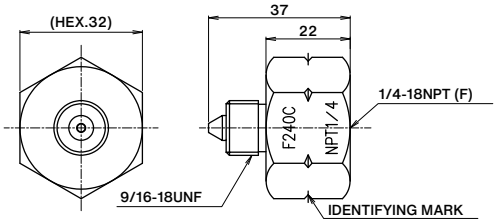
Model code 4th digit	Electrical conduit		
	D	E	F
T	1/2-14NPT	16	4
V	Pg13.5	10.5	4.5
W	M20×1.5	16	4

◆ OOPTIONAL TAG PLATE (12TH DIGIT)

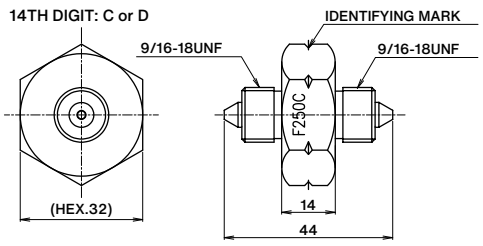


◆ OPTIONAL CONVERSION FITTING (14TH DIGIT)

14TH DIGIT: A or B



14TH DIGIT: C or D



◆ OPTIONAL TAG PLATE (12TH DIGIT)

TABLE 4

Model code 12th digit	Amp.case material	Mass
Y, B	Aluminum alloy with polyester coating	Approx. 1.5 kg
C, E	SS 316L	Approx. 3 kg

TABLE 3

Model code 14th digit	Material	Identifying mark
Y	—	—
A	SS 318LN (1.4462)	Mark
B	Alloy 625 (2.4856)	No mark
C	SS 318LN (1.4462)	Mark
D	Alloy 625 (2.4856)	No mark

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