

Load cell with one built in amplifier

KOSD-FA

KIMD-FA

KEND-FA

Load cell with two built in amplifiers

KOSD-FAD

KIMD-FAD

KEND-FAD



User manual

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PRECAUTIONS

READ this manual BEFORE operating or servicing this unit.
FOLLOW these instructions carefully.
SAVE this manual for future reference.



WARNING

Only qualified personnel are permitted to install and service this unit. Exercise care when making checks, tests and adjustments that must be made with power on. Failing to observe these precautions could result in bodily harm.

DO NOT allow untrained personnel to operate, clean, inspect, maintain, service, or tamper with this unit.

INTENDED USE

KxxD-FA(D) line of load cells are intended for industrial systems. Its basic function is force measuring or weighing applications. The built in amplifiers(s) converts the measured mechanical load to an outgoing, 4 to 20 mA signal.

Changes to current manual version

The load cells have been approved for use as safety components. Functional safety information and reference to safety certificate added. DOC is updated accordingly.

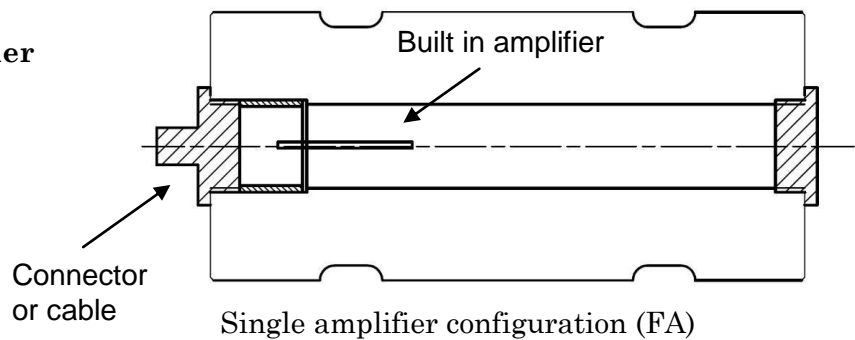
General

KxxD-FA(D) is a line of load cells (KIMD, KOSD and KEND) with a high degree of protection. They incorporate resistive strain gauges, measuring the shear force or tension. They are equipped with one or two amplifiers each using 2-wire 4 - 20 mA current loop output with low NAMUR error signalling.

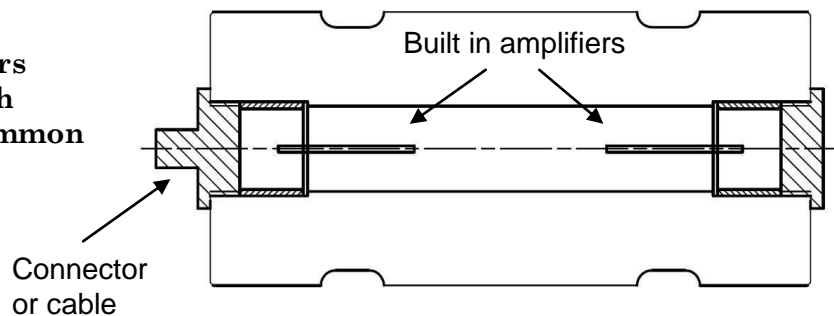
The FA-versions have one electrical circuit and the FAD-version two separate electrical circuits. For the FAD-version the safety parameters are applicable to each circuit individually. The current loops are insulated from each other.

The following KxxD-FA(D) load cell configurations are available:

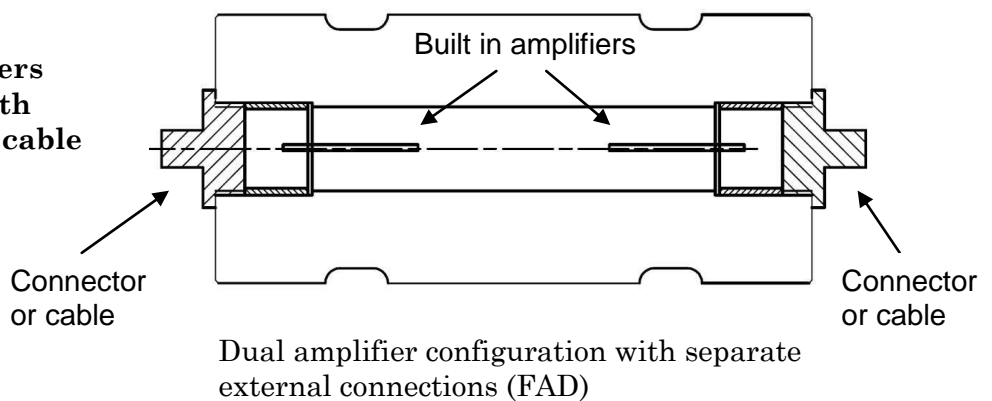
Single bridge and amplifier with connector or cable connection



Dual bridge and amplifiers (primary/secondary) with common connector or common cable connection



Dual bridge and amplifiers (primary/secondary) with individual connector or cable connections.



The load cells can be supplied with connector or cable connection (see also page 6 and 7).



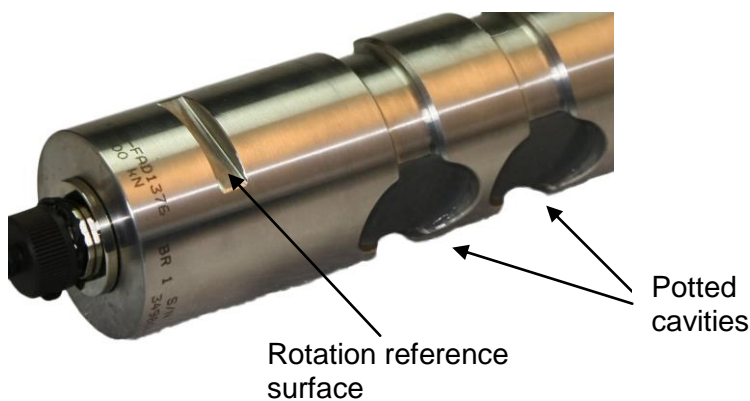
4-pin connector



Cable connection

- KxxD-FA with one 4-pin connector or cable (only 2 pins/wires used)
- KxxD-FAD with one 4-pin connector or cable connection
- KxxD-FAD with two 4-pin connectors or dual cable connections (only 2 pins/wires used)
- KxxD-FAD with one 4-pin connector and single cable connection (only 2 pins/wires used)

These load cells are approved for use in an explosive hazardous area, provided that suitable intrinsic safety barriers or insulators are used and no rubbing with electrostatic materials occurs on outside potted cavities surfaces.



CE-marking according to ATEX and EMC Directives, see appendix 1.

Specifications

Approvals:				
ATEX intrinsic safety	EN 60079-0, EN 60079-11, EN 50303 Ex ia I Ma, Ex ia IIC T5 Ga, Ex ia IIIC T84°C Da			
U _i	30V			
P _i	0.7W			
I _i	100mA			
C _i	56.5nF (≤66nF including cable)			
L _i	4.4 μH			
IECEX intrinsic safety	IEC 60079-0, IEC 60079-11			
Electromagnetic compatibility (EMC)	EN 61326-1			
Emission	CISPR 11 class B			
Immunity	EN 61000-4-2 Electrostatic discharge EN 61000-4-3 RF electromagnetic field EN 61000-4-4 Fast transients EN 61000-4-6 RF conducted disturbances EN 61000-4-8 Power frequency magnetic field			
Functional safety	EN ISO 13849 and EN 61508			
Environmental conditions:				
PARAMETER	Min.	Typ.	Max.	UNIT
Environmental protection / IP rating		IP 67		
Operating Temperature (T _{amb})	-45 -49		+70 +158	°C °F
Operating Temperature in functional safety application (T _{amb})	-40 -40		+70 +158	°C °F
Analog output:				
Current	3.6		21	mA
Rated output (RO)		20		mA
Zero		4		mA
System parameters:				
Accuracy	See LC calibration data sheet			
Response time (10% – 90%)		3.5		ms
Noise		0.06		% of RO
Supply voltage (E)				V
Standard application	E = 0.0236*R+10.5	24	42	V
Intrinsic-safe application		24	30	V
Load impedance (R)	0	250	R = (E-10.5)/0.0236	Ohm
Insulation resistance	1			Gohm
Load cell strain gauge:				
Impedance		2000		Ohm
ATEX conditions:				
Cable length (L) for group IIC			L = 9.5 / (nF/m) ⁽¹⁾	m
Cable length (L) for Group IIB and III			L = 500 / (nF/m) ⁽¹⁾	m
Cable length (L) for Group I			L = 3000 / (nF/m) ⁽¹⁾	m
Insulation test		500		Vrms

(1) Cable capacitance value in nF per meter.

Intrinsic safety

All load cells KxxD-FA(D) can be approved for use in explosive gas or dust area. The last 'X' in the type code (see load cell ATEX label) is a number to identify the specific model. They can be ordered either with a cable connector or with an integrated cable. The safety description is labelled on the load cell. For the -FAD version, the safety description and connection is applicable to each current loop circuit (amplifier).

Internal capacitance and inductance are $C_i=56.5\text{nF}$ and $L_i=4.4\mu\text{H}$. Following condition applies for external cable connection:

1. Total cable capacitance must not exceed 9.5nF for use in Group IIC
2. Total cable capacitance must not exceed 0.5 μF for use in Group IIB and III
3. Total cable capacitance must not exceed 3 μF for use in Group I

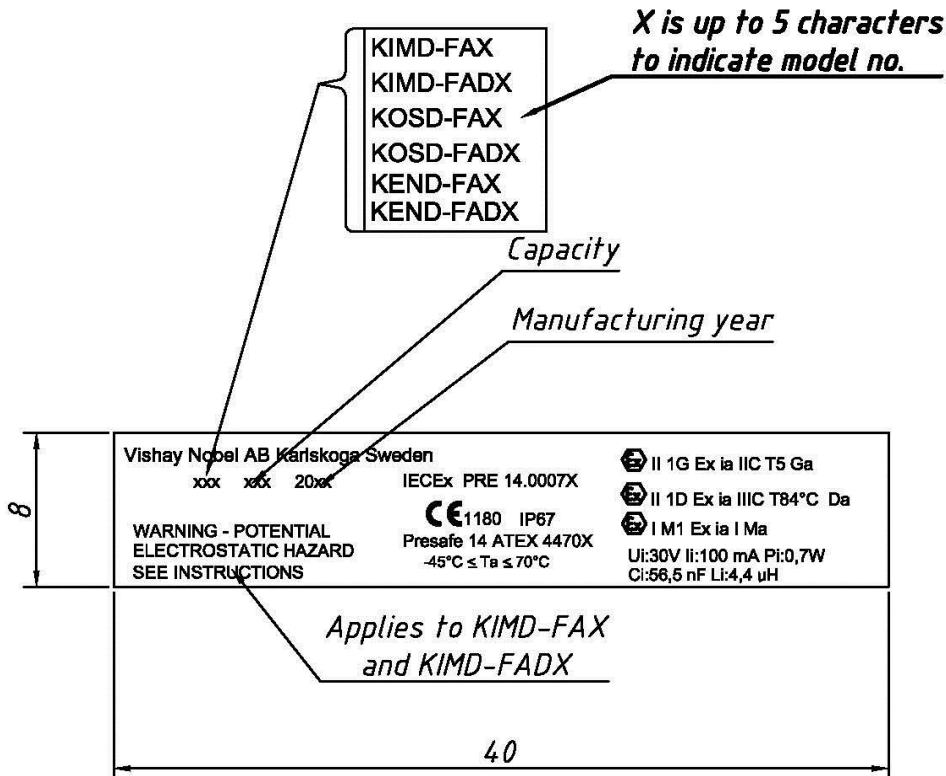
The 4-wire cable inductance is negligible compared to the allowed upper limit.

The 'X' conditions in the ATEX certificate are listed in item 17.

1. Potential electrostatic charging hazard. No rubbing with electrostatic materials is allowed on outside potted cavities surfaces (see page 2)
2. The free end of the cable must be installed such that the terminals afforded a degree of protection of at least IP20 according to IEC 60529:2004
3. The load cell shall only be connected to equipment that has adequate safety parameters according to the load cell's safety parameters

Only load cells used as instructed in this manual and according to amended certificate DNV Nemko Presafe 14ATEX4470X are intrinsically safe.

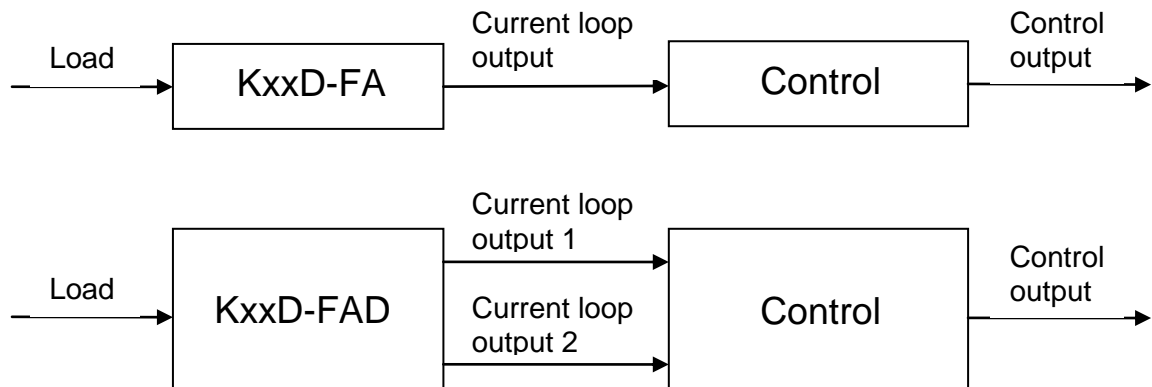
Load cell ATEX Label



Functional safety

From a safety point of view is the KxxD-FA(D) load cell an individual safety component connected to a overall safety control unit. Each individual amplifier current loop output shall be connected to separate control system input(s) as view in figure below, see also application examples.

For double channel system, cross monitoring of measurement signals is assumed to be implemented in the overall measuring instrument. The hardware reliability figures for the double channel load cell are valid when the overall measuring instrument is fulfilling correct monitoring of the load cell(s).



KxxD-FA load cell safety parameters

According to EN ISO 13849-1:

- Category = B
- $MTTF_d = 45$ year
- Maximum performance level, PL = b

KxxD-FAD load cell safety parameters

1. According to EN ISO 13849-1:

- Category = 3
- $MTTF_d = 45$ year
- Maximum performance level, PL = d

The achievable performance level assumes that the double channel load cell shall be connected to an overall measuring instrument in a category 3 structure with a diagnostic coverage, $DC \geq 90\%$. (Value of DC level is according to Annex E, table E.1). The comparison tolerance must be selected with respect to the specified element safety function.

2. According to EN 61508:

- $HFT = 1$
- $SFF = 99.5\%$
- $PFH = 2,65 \cdot 10^{-10}$
- $\lambda_s = 1,32 \cdot 10^{-6}$
- $\lambda_{dd} = 1,3 \cdot 10^{-6}$
- $\lambda_{du} = 1,32 \cdot 10^{-8}$
- Maximum SIL = 2

The overall measurement system must implement the following diagnostic technique: "Input comparison/voting (1oo2, 2oo3 or better redundancy)" with DC = High (99%) according to IEC 61508-2 Table A.13. The comparison tolerance must be selected with respect to the specified element safety function.

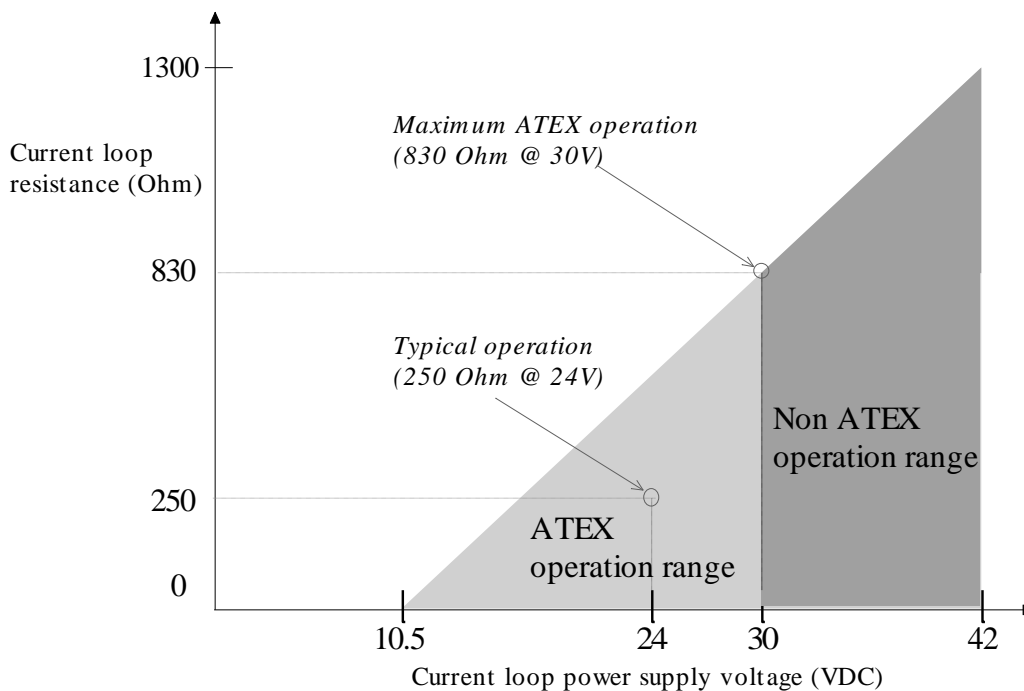
Electrical connection and supply voltage

A two-wire circuit is used to connect the load cell amplifier to a suitable power supply and measuring equipment. The amplifier(s) in the load cell have current loop output, calibrated to 4 mA at zero load and 20 mA at nominal load.

Connector pin-out and wires color code:	
<u>Electrical connection</u>	
Connector: (Binder p/n: 09-3431-700-04 or equivalent IP67 qualified)	
Cable: Shielded 4-wire 0,35mm ² cable through IP67 qualified cable gland	
<u>Connector pin number</u> *	<u>Cable: Cable wire color</u> *
1: Secondary current loop return - (FAD)	Yellow: Secondary current loop return - (FAD)
2: Secondary current loop input + (FAD)	Green: Secondary current loop input + (FAD)
3: Primary current loop input +	White: Primary current loop input +
4: Primary current loop return -	Brown: Primary current loop return -

* Deviations may occur in customer specific types.

A current loop resistance up to 1300 Ohm can be used, provided the supply voltage is high enough, see figure below. For maximum allowed current loop resistance, use load impedance calculation formula on page 3.



Load cell connection

The load cell two-wire 4-20mA current loop shall be connected using a shielded cable. The cable should be routed at least 100 mm from other cables, so that electromagnetic interference is avoided. Cable shield is connected to the load cell body and shall not be grounded in the other end. The load cell connector housing is connected to the load cell body and the cable shield shall be connected in the cable connector but not be grounded in the other end. Cable shield is then grounded in one point only (load cell).

If used in a noisy 50Hz..60Hz environment with isolated power, it is recommended to connect a plastic 220nF/630V capacitor between current loop return signal (current loop -) and ground. For FAD this is applicable on each individual circuit.

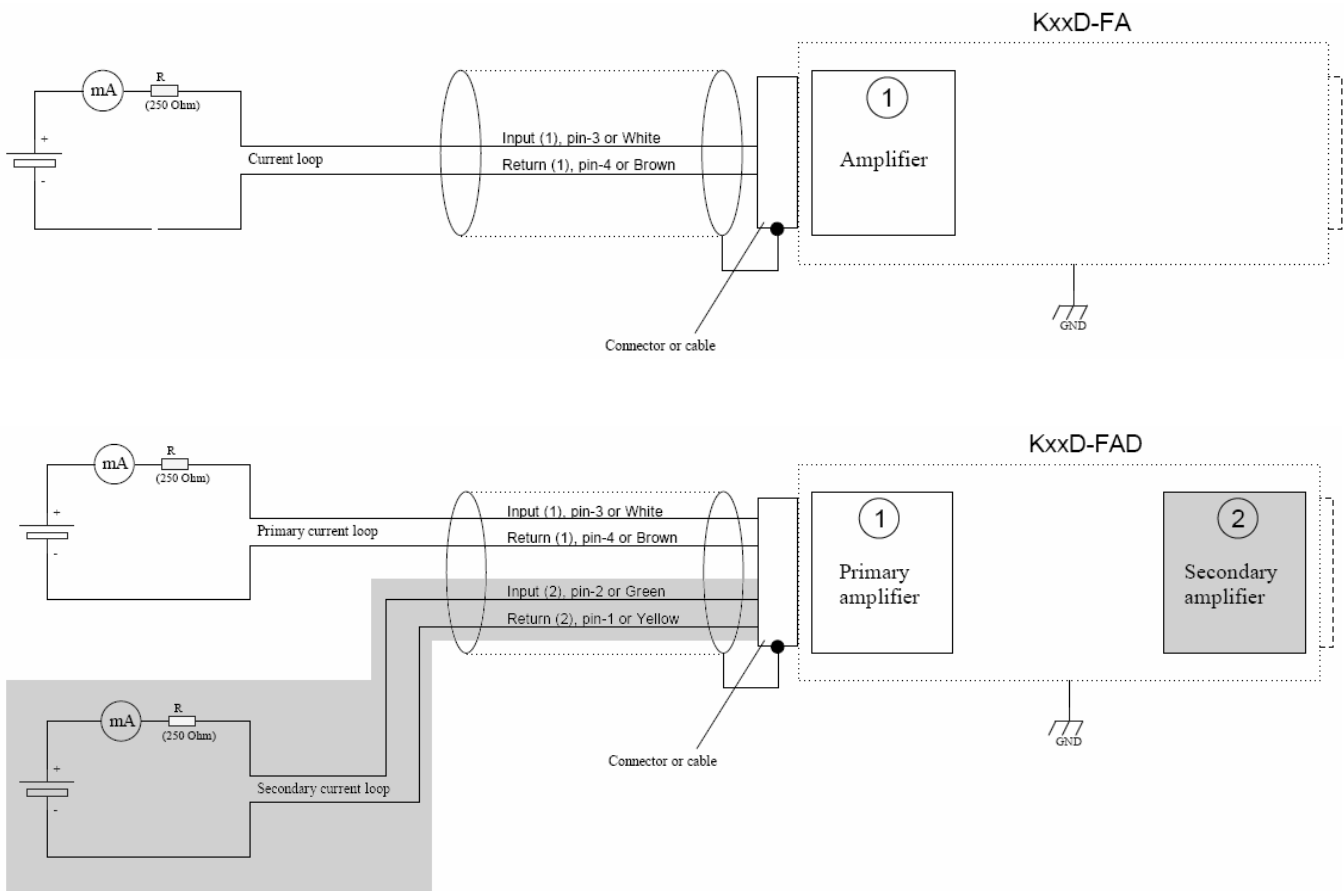


NOTE: The 50Hz..60Hz environment filter capacitors shall not be connected when the load cell is used in ATEX hazardous area

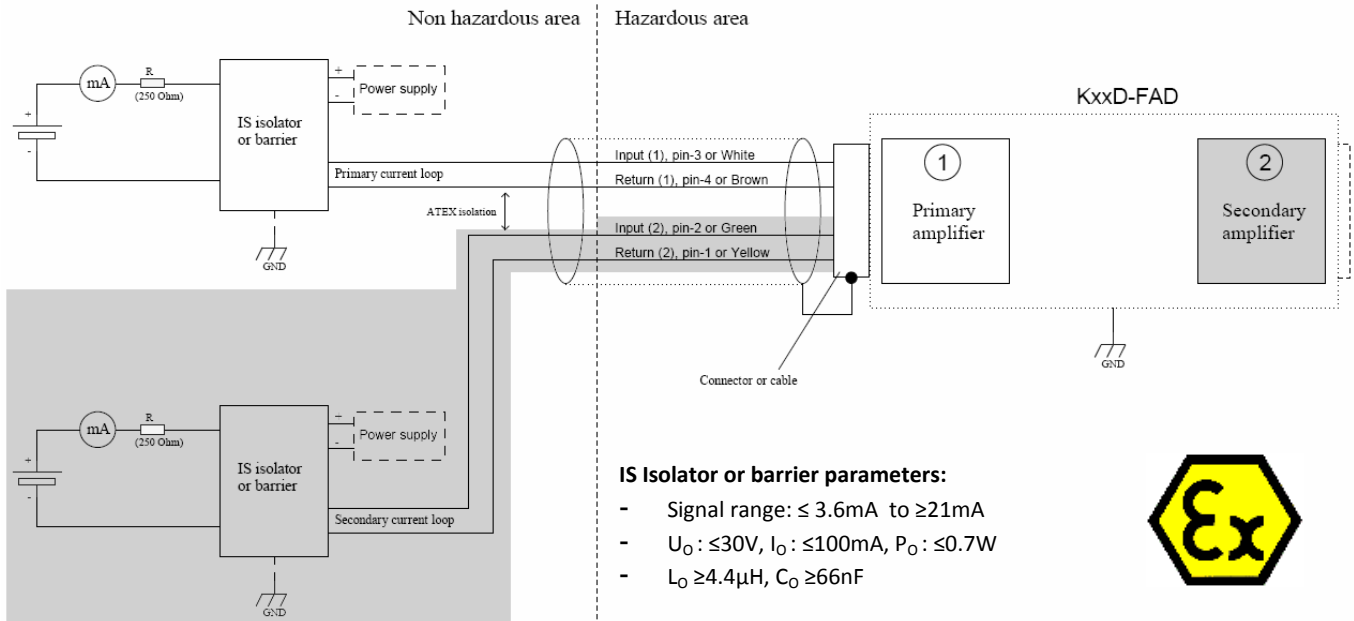
For installation in an explosive gas/dust or mining area, only trained personnel may perform dimensioning of cables and barriers. A descriptive system document should be prepared by the system designer.

Application examples

Load cell KxxD-FA (one built in amplifier) and KxxD-FAD (two built in amplifiers), used in a **non-hazardous** area, are shown below. The load cell connector inputs are polarity and over voltage protected.



Load cell used in **hazardous** area is shown below. The cable shield is connected to the load cell body and shall not be connected in the other end. Connection to barrier or isolating IS unit is shown in the example below.



Load cell as a safety component can be used in both **hazardous** and **non-hazardous** areas and be connected to the measuring control system as a passive transmitter.

Mechanical installation and maintenance

Load cells of the line KxxD-FA(D) are designed to be supported at both ends and loaded at the middle of the cylindrical body (KIMD, KOSD) or being pulled in both ends were the load cell is measuring the tension force (KEND). An arrow on one or both ends defines the correct direction of the resulting force from the applied load.

At the cable/connector end of the load cell, a flat reference surface is provided (KIMD, KOSD). It should be used to prevent the cylindrical load cell body from rotating in the supports (see page 2)

Standardized adapters for some load cell types are available, others can be custom designed and produced by Vishay Nobel. On request the mechanical shape of a load cell can also be altered to suit an existing structure.



Potential electrostatic hazard on KIMD-FA(D), do not rub with electrostatic materials.

Mechanical data

KxxD-FA(D) series of load cells are often custom made for specific applications. For complete mechanical data on these load cells, refer to the detailed technical specification.

EU Declaration of Conformity

We Vishay Nobel AB
P.O. Box 423, SE-691 27 KARLSKOGA
Skrantahöjdsvägen 40, SE-691 46 KARLSKOGA SWEDEN
declare under our sole responsibility that the products

Load Cell KOSD-FA
Load Cell KIMD-FA
Load Cell KEND-FA
Load Cell KOSD-FAD
Load Cell KIMD-FAD
Load Cell KEND-FAD

to which this declaration relates are in conformity with the following standards
or other normative documents:

The essential requirements for safety component in the Machine Directive 2006/42/EG
EN ISO 13849-1:2015. KxxD-FA up to PLb and KxxD-FAD up to PLd
EN 61508:2010. KxxD-FAD up to HWSIL 3
Function safety Certificate: TÜV 968/FSP 1462.00/17

The essential requirements in the EMC Directive 2014/30/EU
EN 61326-1:2013

The essential requirements in the ATEX Directive 2014/34/EU with later amendments
EN 60079-0: 2012 + A11: 2013¹⁾
EN 60079-11: 2012
EN 50303: 2000

Group I Category M1: Ex ia I Ma

Group II Category 1: Ex ia IIC T5 Ga, Ex ia IIIC T84°C Da

¹⁾ EN 60079-0 A11: 2013 was compared to EN 60079-0: 2012 that were used for the original
certification and no changes in the "state of art" apply to this equipment.

IEC – Type examination Certificate: IECEx PRE 14.0007X

EC – Type examination Certificate: Presafe 14ATEX4470X

Notified body for EC type Examination: DNV Nemko Presafe, NB No. 0470, Oslo Norway

Notified Body for production: SGS Baseefa, NB No. 1180, Buxton UK

The essential requirements in the RoHS Directive 2011/65/EU Restriction of the use of certain
hazardous substances in electrical and electronic equipment.
EN 50581:2012

The product is supplied by up to 42 VDC (30 VDC intrinsic safety) and is therefore not
covered by the requirements in the Low Voltage Directive 2014/35/EU.

On behalf of the above named company, I declare that, on the date the equipment
accompanied by this declaration is placed on the market, the equipment conforms to all
technical and regulatory requirements of the above listed directives.

KARLSKOGA, 21th of August 2017



Per Fredriksson, Managing Director



EC-Type Examination Certificate

- [2] EQUIPMENT OR PROTECTIVE SYSTEM INTENDED FOR USE IN POTENTIALLY EXPLOSIVE ATMOSPHERES DIRECTIVE 94/9/EC
- [3] EC-Type Examination Certificate Number: Presafe 14 ATEX 4470X Issue 1
- [4] Equipment or Protective System: Load cell with integrated amplifier(s)
- [5] Applicant – Manufacturer or Authorized representative: Vishay Nobel AB
- [6] Address: Box 423
69127 Karlskoga
SWEDEN
- [7] This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.
- [8] DNV Nemko Presafe AS, notified body number 2460 in accordance with Article 9 of Council Directive 94/9/EC of 23 March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.
The examination and test results are recorded in confidential reports listed in section 14.
- [9] Compliance with the Essential Health and Safety Requirements has been assured by compliance with: EN 60079-0: 2012, EN 60079-11: 2012 and EN 50303: 2000
- [10] If the sign “X” is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.
- [11] This EC-TYPE EXAMINATION CERTIFICATE relates only to the design and construction of the specified equipment or protected system. If applicable, further requirements of this Directive apply to the manufacturer and supply of this equipment or protective system.
- [12] The marking of the equipment or protective system shall include the following:

	I M1	Ex ia I Ma	- 45°C ≤ Ta ≤ +70°C
	II 1 G	Ex ia IIC T5 Ga	- 45°C ≤ Ta ≤ +70°C
	II 1 D	Ex ia IIIC T84°C Da	- 45°C ≤ Ta ≤ +70°C


Bjørn Spongsveen
For DNV Nemko Presafe AS
Information on electronic signature www.presafe.com



Date of issue: 2015-01-14



EC-Type Examination Certificate

[13]

Schedule

[14] **EC-TYPE EXAMINATION CERTIFICATE No.:** Presafe 14 ATEX 4470X Issue 1

[15] Description of Equipment or Protective System

KxxD-FA(D) is a series of load cells of different size. This certificate covers three different enclosures made of stainless steel or zinc coated toughened steel: KIMD, KOSD and KEND. Three different end terminations are included: cable connector, permanent connected cable and blind plug.

They incorporate resistive strain gauges, measuring the shear force (KIMD, KOSD) and tension (KEND). They are equipped with one or two integrated amplifiers, each with 2-wire, 4-20mA current loop output. All housed in an IP67 approved enclosure.

These load cells are approved for use in an explosive gas and dust area, provided that suitable intrinsic safety barriers are used.

Type Identification

The following type identification is included:

- KIMD-FA(D)
- KOSD-FA(D)
- KEND-FA(D)

The FA-versions have one electrical circuit and the FAD-version two separate electrical circuits. For the FAD-version the safety parameters are applicable to each circuit. Connection is made by two-wires, separated from each other in a common external connector or fixed cable for each amplifier.

Electrical Data

Safety parameters for intrinsically safe connection:

Maximum input voltage, $U_i=30V$

Maximum input current, $I_i=100mA$

Maximum input power, $P_i=0.7W$

Maximum internal capacitance, $C_i=56.5nF$

Maximum internal inductance, $L_i=4.4\mu H$

- Total cable capacitance must not exceed 9.5nF for use in Group IIC.
- Total cable capacitance must not exceed 0.5 μF for use in Group IIB and Group III.
- Total cable capacitance must not exceed 3 μF for use in Group I.

Degrees of protection (IP Code)

IP67 according to IEC 60529.

Additional manufacturing locations.

Manufacturers HQ address: Vishay Nobel AB Skrantahöjdsvägen 40 691 46 Karlskoga SWEDEN	Manufacturers Production address: Vishay Nobel AB Gjúterigatan 12 693 35 Degerfors SWEDEN
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EC-Type Examination Certificate

[16] Project No.: D0001188 Rev 1

Descriptive Documents

Number	Title	Rev.	Date
270204	ATEX & IECEx document list, KxxD-FA(D) Load cell	2	2015-01-07

Certificate History

Issue	Description	Report no.	Issue date
0	Original issue	D0001188	2014-05-07
1	Minor changes of the design and reduction of the ambient temperature from -40°C to -45°C.	D0001188 Rev 1	2015-01-14

[17] Special Conditions for Safe Use

- The load cell shall only be connected to equipment that has adequate safety parameters according to the load cell's safety parameters [15].
- The models KIMD-FA(D) have outside potted cavities. No rubbing on these non-metallic surfaces are allowed.
- The free end of the connected external cable must be installed such that the terminations are afforded according to Cl. 6.1 and 6.2 of the standard EN 60079-11.

[18] Essential Health and Safety Requirements

See part 9 of this certificate

END OF CERTIFICATE

IECEX Certificate

The IECEX certificate for the KxxD-FA(D) Load cell can be found on the official IECEX web site: <http://iecex.iec.ch>

Certificate number: IECEX PRE 14.0007X Issue No: 1.

Function safety Certificate

The functional safety certificate for the KxxD-FA(D) Load cell can be found on TÜV Rheinland web site: www.fs-products.com and www.certipedia.com/fs-products

Certificate number: 968/FSP 1462.00/17 Issue No: 0.

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