MEGGITT

DATA SHEET

Vibro-Meter®

IPC707
signal conditioner

CE Ex IECEx SP KGS SIL Safety

KEY FEATURES AND BENEFITS

- From the Vibro-Meter® product line
- For CAxxx piezoelectric accelerometers and CPxxx dynamic pressure sensors
- Configurable high-pass and low-pass filters (independent of transfer function)
- Frequency range: 0.5 Hz to 20 kHz
- Optional integrator to produce a velocity output
- pC to µA transfer function for current-signal transmission over longer distances
- pC to mV transfer function for voltage-signal transmission over shorter distances
- Certified for use in potentially explosive atmospheres
- Optional diagnostic circuitry detecting sensor, cable and/or signal conditioner problems
- Suitable for use in functional safety contexts: SIL 2 in accordance IEC 61508 and PL c Cat 1 in accordance with ISO 13849

KEY BENEFITS AND FEATURES *(continued)*

- Removable screw-terminal connectors
- DIN-rail mounting

APPLICATIONS

- Vibration measurement chains using CAxxx piezoelectric accelerometers
- Pressure measurement chains using CPxxx piezoelectric pressure sensors
- Safety-related applications

DESCRIPTION

The IPC707 is a signal conditioner from Meggitt's Vibro-Meter® product line. It is designed for operation with sensors containing a piezoelectric sensing element that provide a charge output and require an external signal conditioner (charge amplifier).

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DESCRIPTION *(continued)*

The IPC707 signal conditioner is a versatile and highly configurable device that converts and processes the charge- based signal from a piezoelectric-based sensor into a current output or a voltage output signal, suitable for transmission to a monitoring system via a standard current (2-wire) or voltage (3-wire) transmission cable.

The IPC707 is designed for operation with vibration measurement chains using CAxxx piezoelectric accelerometers and pressure measurement chains using CPxxx dynamic pressure sensors. It can also be used with other piezoelectric-based sensors and cabling assemblies that meet the required input characteristics.

Note: The installation of a CAxxx or CPxxx measurement chain using an IPC707 signal conditioner configured with a current output and a GSI127 galvanic separation unit, allows transmission over distances up to 1 km – longer than any other solution.

As shown in the **Block diagram on page 3**, the IPC707 signal conditioner includes RFI filters to protect the input and output against radio-frequency and other electromagnetic interference (EMI), optional hazardous area protection, a differential (symmetrical) charge amplifier, configurable high-pass (HP) and low-pass (LP) filters, an optional integrator to give a velocity output, a configurable amplifier and a configurable output stage to provide a current output or a voltage output, as required. Optionally, the IPC707 signal conditioner includes diagnostic circuitry (that is, built-in test equipment (BITE)) that is used to indicate problems with a measurement chain consisting of a sensor, cabling and the IPC707 signal conditioner.

The output signal from the IPC707 is an analogue signal consisting of a dynamic measurement component (AC) on a quasi-static diagnostic component (DC). When the optional diagnostics are used, the nominal value of the diagnostic component (DC) is one value to indicate normal operation, and other values to indicate problems with the sensor and/or cabling, or the signal conditioner itself. The machinery protection and/or condition monitoring system connected to the IPC707 can monitor the nominal value and provide an alarm to indicate a problem (non-normal operation).

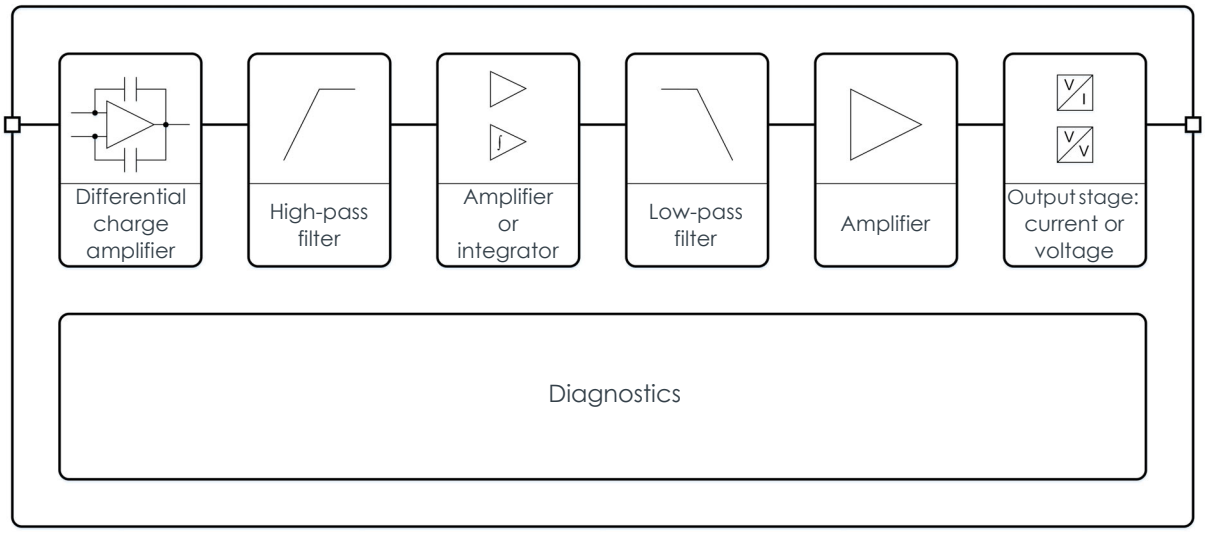
An IPC707 signal conditioner with optional diagnostics continuously monitors the status of the measurement chain, which allows operators to always know the status of their machinery monitoring system – automatically and remotely. In this way, the diagnostics helps to ensure that machinery is operated safely and reliably, extending its life and reducing costs. Equally importantly, the diagnostics also make the IPC707 suitable for use in functional safety contexts, such as SIL 2 in accordance with IEC 61508 and PL c Cat 1 in accordance with ISO 13849.

The electronic circuitry of the IPC707 signal conditioner is incorporated in a moulded aluminium housing. The IPC707 can be installed using screws through the mounting holes in the body of the housing (same dimensions as an IPC704) or it can be mounted on a DIN rail using the optional DIN-rail mounting adaptor. The IPC707 housing also features removable screw-terminal connectors that can unplugged from the main body of the housing to simplify installation and mounting. For applications that require additional environmental protection against dust, oil and/or water, the IPC707 can also be installed in an ABA17x industrial housing.

The IPC707 signal conditioner is compatible with different piezoelectric materials and replaces the previous versions of the IPC704 signal conditioner (PNR 244-704-000-xxx).

For specific applications, contact your nearest Meggitt representative.

BLOCK DIAGRAM



SPECIFICATIONS

Environmental

General

Temperature	
• *Operating and storage*	: −40 to 85°C (−40 to 185°F)
Humidity	: 95% max. non-condensing
Protection rating (according to IEC 60529)	: IP40. Note: The IPC707 is suitable for indoor use only unless it is installed in an industrial housing or enclosure that ensures a higher level of environmental protection.
Chemical resistance	: Suitable for environments containing trace levels of chemicals such as hydrogen sulfide or ammonia
Flammability	: UL94 V-0
Vibration (according to IEC 60068-2-6)	: 5 g peak above resonant frequency and 0.35 mm peak below (10 to 500 Hz, 6 hours/axis)
Shock acceleration (according to IEC 60068-2-27)	: 15 g peak (half-sine wave, 11 ms duration, 9 shocks/axis)
Altitude	: 4000 m (13100 ft) max. Note: Reduced air density affects cooling ability.

SPECIFICATIONS *(continued)*

Potentially explosive atmospheres

Available in Ex approved versions for use in hazardous areas

Type of protection Ex ia: intrinsic safety (**ordering option code A2**)		
Europe	EU type examination certificate	LCIE 18 ATEX 3026 X II 1 G (Zones 0, 1, 2) Ex ia IIC T6…T4 Ga
International	IECEx certificate of conformity	IECEx LCIE 18.0023X Ex ia IIC T6…T4 Ga
North America	cCSAus certificate	cCSAus 70198728 Class I, Division 1, Groups A, B, C and D T6…T4 Ex ia IIC T6…T4 Ga Class I, Zone 0 AEx ia IIC T6…T4 Ga
Korea	KGS certificate of conformity	KGS 18-GA4BO-0549X Ex ia IIC T6…T4

Type of protection Ex ec: increased safety, Ex nA: non-sparking (**ordering option code A3**)		
Europe	Type examination certificate	LCIE 18 ATEX 1012 X II 3 G (Zone 2) Ex ec IIC T6…T4 Gc
International	IECEx certificate of conformity	IECEx LCIE 18.0023X Ex ec IIC T6…T4 Gc
North America	cCSAus certificate	cCSAus 70198728 Class I, Division 2, Groups A, B, C and D T6…T4 Ex ec IIC T6…T4 Gc Class I, Zone 2 AEx ec IIC T6…T4 Gc
Korea	KGS certificate of conformity	KGS 18-GA4BO-0548X Ex nA IIC T6…T4

⚠ **For specific parameters of the mode of protection concerned and special conditions for safe use, refer to the Ex certificates that are available from Meggitt SA.**

⚠ **When using protection mode "Ex ec" (increased safety) or "Ex nA" (non-sparking), the user must ensure that the signal conditioner is installed in an industrial housing or enclosure that ensures a protection rating of at least IP54 (or equivalent).**

⚠ **For the most recent information on the Ex certifications that are applicable to this product, refer to the *Ex product register* (*PL-1511*) that is available from Meggitt SA.**

Approvals

Conformity	: CE marking, European Union (EU) declaration of conformity
Electromagnetic compatibility	: EN 61000-6-2:2005. EN 61326-1:2013. EN 61326-3-2:2008 (SIL).
Electrical safety	: EN 61010-1:2010
Environmental management	: RoHS compliant (2011/65/EU)

SPECIFICATIONS *(continued)*

Hazardous areas	: Ex approved versions (see **Potentially explosive atmospheres on page 4**)
Functional safety	: SIL 2 in accordance with IEC 61508. PL c Cat 1 in accordance with ISO 13849.

Power supply (to IPC707)

Input voltage range	: 24 V_{DC} ±25% (18 to 30 V_{DC})
Current consumption (with nominal 24 V_{DC} supply)	: 20 mA max.

Note: The IPC707 should be powered (energised) using a low-voltage power supply such as a sensor power supply output provided a VM600 or VibroSmart® monitoring and/or protection system, a GSI127 galvanic separation unit or other suitable power supply.
In safety-related applications, an IPC707 must be powered using a power supply with a safe limitation of 40 V_{DC}, even in the event of a single fault with the power supply.

Transfer function (ordering option codes C and D)

Transfer sensitivity

• *Standard values without integrator*	: 0.1, 0.2, 0.5, 1, 2, 5, 10, 20 and 50 µA/pC or mV/pC
• *Standard values with integrator*	: 981, 1962, 4905, 9810, 19620, 49050 and 98100 µA/pC•s or mV/pC•s
• *Non-standard values without integrator*	: 0.1 to 110 µA/pC or mV/pC
• *Non-standard values with integrator*	: 981 to 98100 µA/pC•s or mV/pC•s

Note: For further information on transfer sensitivity values, see **Transfer sensitivities (ordering option code C) on page 8** and **Ordering information on page 12**.

Accuracy (at ambient temperature)

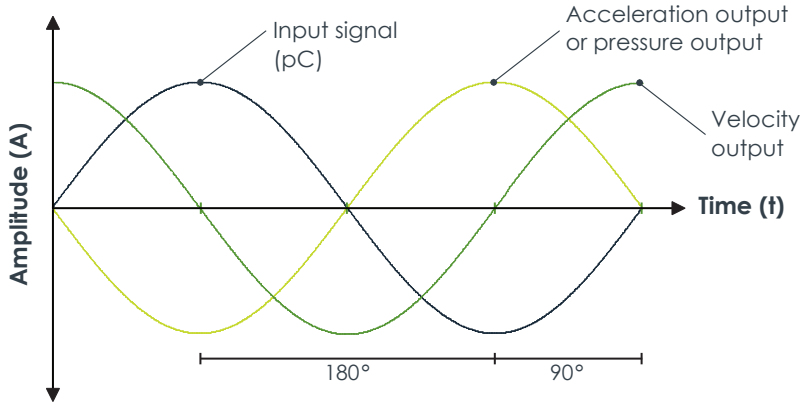
• *Without integrator*	: ±2%
• *With integrator*	: ±3%
Linearity error (INL)	: <0.2%

Temperature stability (over whole temperature range)

• *Without integrator*	: <100 ppm/°C typical
• *With integrator*	: <150 ppm/°C typical

Phase

• *Without integrator*	: 180° between the input signal and an acceleration output. 180° between the input signal and a pressure output.
• *With integrator*	: 270° between the input signal and a velocity output. (That is, 90° between acceleration and velocity outputs.)



SPECIFICATIONS *(continued)*

Input characteristics

RFI filter	: Symmetrical LC network
Charge amplifier	: Differential (symmetrical)
Dynamic range	
• *<10 kHz*	: 50000 pC
• *10 to 20 kHz*	: 25000 pC
Insulation resistance (sensor and cabling)	: >20 kΩ. Note: This is the minimum insulation resistance between HI (IN+) and LO (IN−) that is required by the optional diagnostics.
Capacitance (sensor and cabling)	: <15 nF. Note: This is the maximum capacitance between HI (IN+) and LO (IN−) that is allowed by the optional diagnostics.
Serial resistance (cabling)	: <100 Ω (2 x 50 Ω) when capacitance (sensor and cabling) is >10 and ≤15 nF. <200 Ω (2 x 100 Ω) when capacitance (sensor and cabling) is >5 and ≤10 nF. <500 Ω (2 x 250 Ω) when capacitance (sensor and cabling) is ≤5 nF. Note: This is the maximum serial resistance of the HI (IN+) and the LO (IN−) cabling that is allowed by the optional diagnostics.
Connection resistance (cabling)	: <100 mΩ. Note: This is the maximum connection resistance between the shield of the cabling and the shield of the IPC707 (SHD) that is allowed by the optional diagnostics.

Note: The cabling consists of the cables and connectors between the sensor and the IPC707 which can be any combination of integral and/or external cables, such as mineral-insulated (MI) cables and/or low-noise cables.

Compatible sensors	: Any piezoelectric-based sensor with a symmetrical (differential) signal, whether case grounded or insulated. Vibration measurement chains using CAxxx piezoelectric accelerometers and pressure measurement chains using CPxxx dynamic pressure sensors are compatible. Refer to the *CAxxx vibration sensors (piezoelectric accelerometers) installation manual* or the *CPxxx dynamic pressure sensors (piezoelectric pressure sensors) installation manual*, as appropriate, for further information. In addition, use of the optional diagnostics requires that the sensor, the cabling and the complete measurement chain meet specific electrical requirements, including the input characteristics specified above. Refer to the *IPC707 signal conditioner safety manual* for further information.

SPECIFICATIONS *(continued)*

Output characteristics

General

RFI filter : Symmetrical LC network

Current output (2-wire transmission)

Dynamic signal (AC) : ±5 mA peak (max.)
Dynamic range (max.) : 5 mA peak / output sensitivity
Output sensitivity : See **Ordering information on page 12**
Nominal signal (DC)
• *Without diagnostics* : 12 mA_{DC} ±0.2 mA_{DC}
• *With diagnostics* : 13 mA_{DC} ±0.2 mA_{DC} indicates normal operation.
11 mA_{DC} ±0.2 mA_{DC} indicates a problem with the sensor and/or cabling.
10 mA_{DC} ±0.2 mA_{DC} indicates a problem with the signal conditioner.
<8 mA_{DC} indicates another problem with the measurement chain or power supply.
Other current values indicate other problems with the signal conditioner not detected by the diagnostics.
Output impedance : >60 kΩ

Voltage output (3-wire transmission)

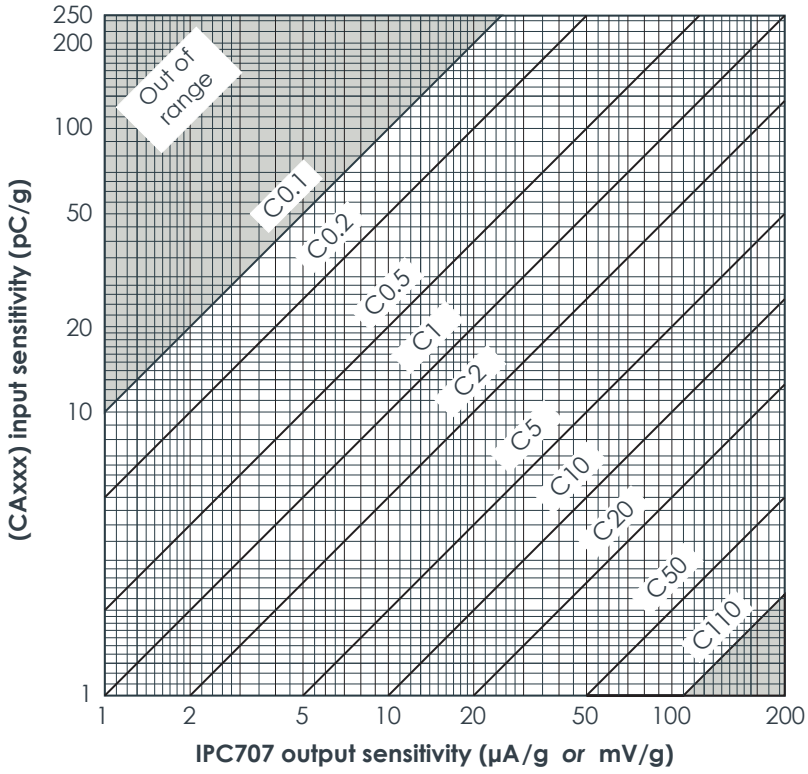
Dynamic signal (AC) : ±5 V peak (max.)
Dynamic range (max.) : 5 V peak / output sensitivity
Output sensitivity : See **Ordering information on page 12**
Nominal signal (DC)
• *Without diagnostics* : 7.0 V_{DC} ±0.2 V_{DC}
• *With diagnostics* : 8.0 V_{DC} ±0.2 V_{DC} indicates normal operation.
6.0 V_{DC} ±0.2 V_{DC} indicates a problem with the sensor and/or cabling.
5.0 V_{DC} ±0.2 V_{DC} indicates a problem with the signal conditioner.
<3.0 V_{DC} indicates another problem with the measurement chain or power supply.
Other voltage values indicate other problems with the signal conditioner not detected by the diagnostics.
Output impedance : <500 Ω

⚠ **The use of a GSI127 galvanic separation unit is strongly recommended for applications/installations that are likely to be affected by frame voltage.**
CPxxx dynamic pressure sensors should always be used with a GSI127 galvanic separation unit.

SPECIFICATIONS *(continued)*

Transfer sensitivities (ordering option code C)

IPC707 with acceleration output (ordering option codes D1 and D2) – for CAxxx accelerometers



Notes

This chart (left) shows the standard transfer sensitivity values (**Cx**) without integrator.

To configure an IPC707 with an acceleration output in g, transfer sensitivity (trans sens (**C**)) is calculated as follows.

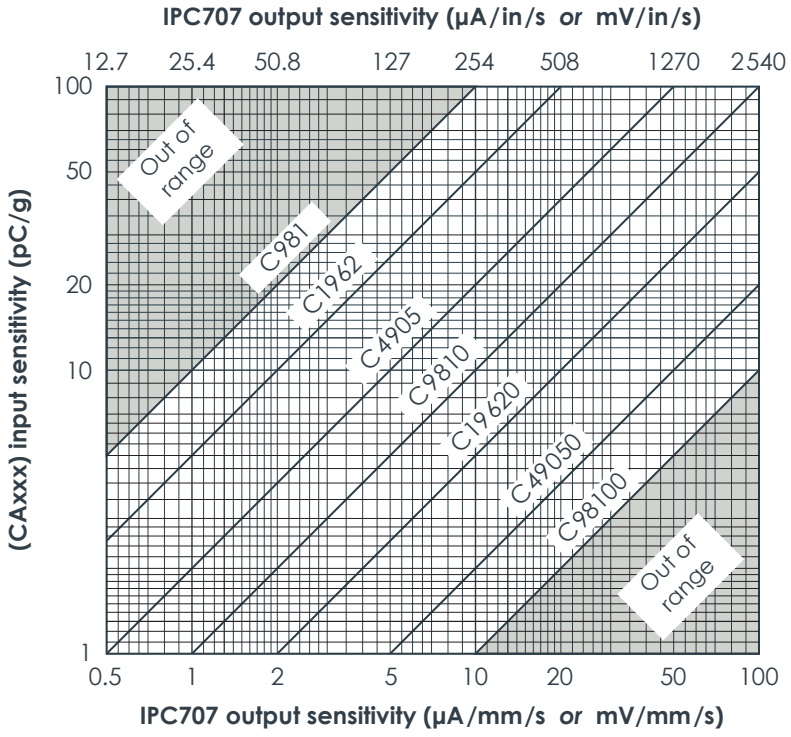
D1 current output (µA/pC):

$$\textit{Trans sens (}\mathbf{C}\textit{)} = \frac{\textit{(out sens (µA/g))}}{\textit{(in sens (pC/g))}}$$

D2 voltage output (mV/pC):

$$\textit{Trans sens (}\mathbf{C}\textit{)} = \frac{\textit{(out sens (mV/g))}}{\textit{(in sens (pC/g))}}$$

IPC707 with velocity output (ordering option codes D3 and D4) – for CAxxx accelerometers



Notes

This chart (left) shows the standard transfer sensitivity values (**Cx**) with integrator.

To configure an IPC707 with a velocity output in mm/s, transfer sensitivity (trans sens (**C**)) is calculated as follows.

D3 current output (µA/pC•s):

$$\textit{Trans sens (}\mathbf{C}\textit{)} = \frac{\textit{(out sens (µA/mm/s) × 9810)}}{\textit{(in sens (pC/g))}}$$

D4 voltage output (mV/pC•s):

$$\textit{Trans sens (}\mathbf{C}\textit{)} = \frac{\textit{(out sens (mV/mm/s) × 9810)}}{\textit{(in sens (pC/g))}}$$

To configure an IPC707 with a velocity output in in/s, transfer sensitivity (trans sens (**C**)) is calculated as follows.

D3 current output (µA/pC•s):

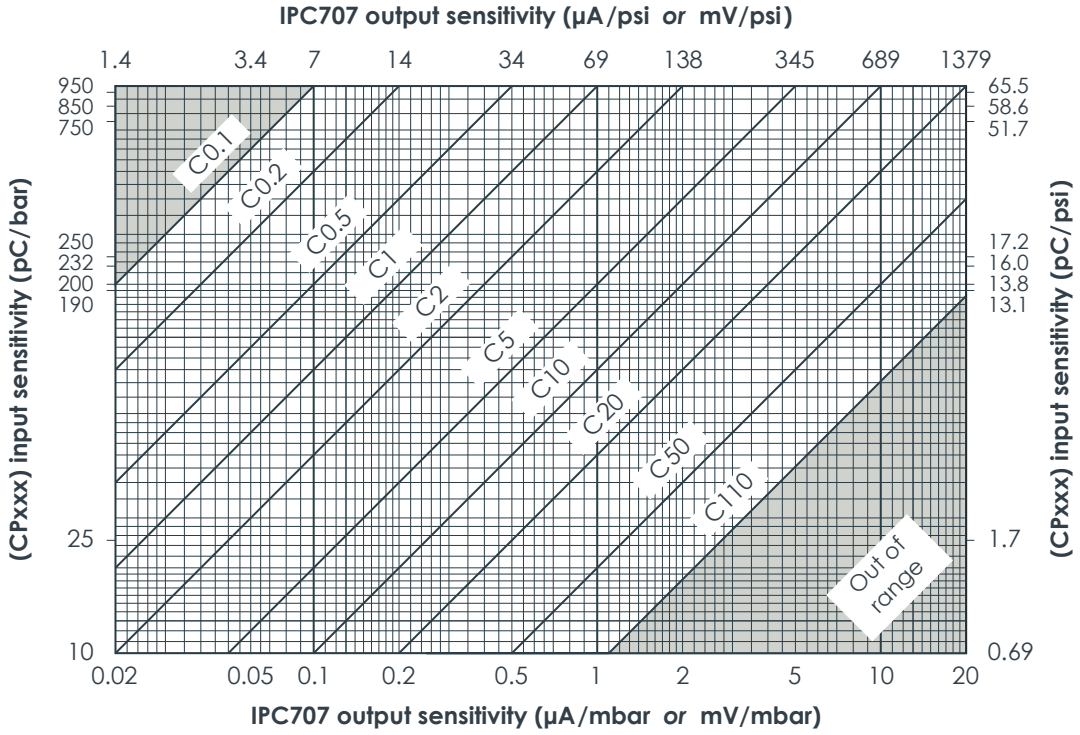
$$\textit{Trans sens (}\mathbf{C}\textit{)} = \frac{\textit{(out sens (µA/in/s) × 9810)}}{\textit{(in sens (pC/g) × 25.4)}}$$

D4 voltage output (mV/pC•s):

$$\textit{Trans sens (}\mathbf{C}\textit{)} = \frac{\textit{(out sens (mV/in/s) × 9810)}}{\textit{(in sens (pC/g) × 25.4)}}$$

SPECIFICATIONS *(continued)*

IPC707 with pressure output (ordering option codes D1 and D2) – for CPxxx dynamic pressure sensors



Notes

This chart (above) shows the standard transfer sensitivity values (**Cx**) without integrator.

To configure an IPC707 with a pressure output in mbar, transfer sensitivity (trans sens (**C**)) is calculated as follows.

D1 current output (µA/pC):

$$\textit{Trans sens (}\mathbf{C}\textit{)} = \frac{\textit{(out sens (µA/mbar) × 1000)}}{\textit{(in sens (pC/bar))}}$$

D2 voltage output (mV/pC):

$$\textit{Trans sens (}\mathbf{C}\textit{)} = \frac{\textit{(out sens (mV/mbar) × 1000)}}{\textit{(in sens (pC/bar))}}$$

To configure an IPC707 with a pressure output in psi, transfer sensitivity (trans sens (**C**)) is calculated as follows.

D1 current output (µA/pC):

$$\textit{Trans sens (}\mathbf{C}\textit{)} = \frac{\textit{(out sens (µA/psi))}}{\textit{(in sens (pC/psi))}}$$

D2 voltage output (mV/pC):

$$\textit{Trans sens (}\mathbf{C}\textit{)} = \frac{\textit{(out sens (mV/psi))}}{\textit{(in sens (pC/psi))}}$$

Note: For further information on transfer sensitivity values, see **Transfer function (ordering option codes C and D) on page 5** and **Ordering information on page 12**. Contact Meggitt for information on non-standard values.

SPECIFICATIONS *(continued)*

Filter characteristics

High-pass filter (ordering option code E)

Type	: 3rd order Butterworth high-pass (HP) filter
Cutoff frequency (−3 dB)	
• *Standard values without diagnostics*	: 0.5, 1, 2, 5, 10 or 20 Hz
• *Standard values with diagnostics*	: 1, 2, 5, 10 or 20 Hz
• *Non-standard values without diagnostics*	: 0.5 to 110 Hz
• *Non-standard values with diagnostics*	: 1 to 110 Hz Contact Meggitt for information on non-standard values.
Slope	: −60 dB/decade (−18 dB/octave) min.
Accuracy	
• *<5 Hz*	: For a high-pass filter <5 Hz, the cutoff frequency (−3 dB) has an accuracy of ±20% over the whole temperature range
• *≥5 Hz*	: For a high-pass filter ≥5 Hz, the filter attenuation is compliant with the ISO 2954 standard over the whole temperature range

Note: The IPC707 high-pass filter is not affected by the transfer function and can be configured independently.

Low-pass filter (ordering option code F)

Type	: 3rd order Butterworth low-pass (LP) filter
Cutoff frequency (−3 dB)	
• *Standard values*	: 500, 1000, 2000, 5000, 10000 or 20000 Hz
• *Non-standard values*	: 200 to 20000 Hz Contact Meggitt for information on non-standard values.
Slope	: −60 dB/decade (−18 dB/octave) min.
Accuracy	
• *>2000 Hz*	: For a low-pass filter >2000 Hz, the cutoff frequency (−3 dB) has an accuracy of ±10% over the whole temperature range
• *≤2000 Hz*	: For a low-pass filter ≤2000 Hz, the filter attenuation is compliant with the ISO 2954 standard over the whole temperature range

Connectors

Screw-terminal connector (input)	: 4 contacts for sensor-side signals
Screw-terminal connector (output)	: 4 contacts for monitor-side signals
Electrical connections	
• *IEC*	: 320 V / 17.5 A / 0.2 to 1.5 mm^2
• *UL*	: 300 V / 10 A / 28 to 16 AWG
Clamping range	: 1.5 mm^2 (max.), rated connection

Note: The IPC707 features removal screw-terminal connectors that can unplugged from the main body of its housing to simplify installation and mounting.

SPECIFICATIONS *(continued)*

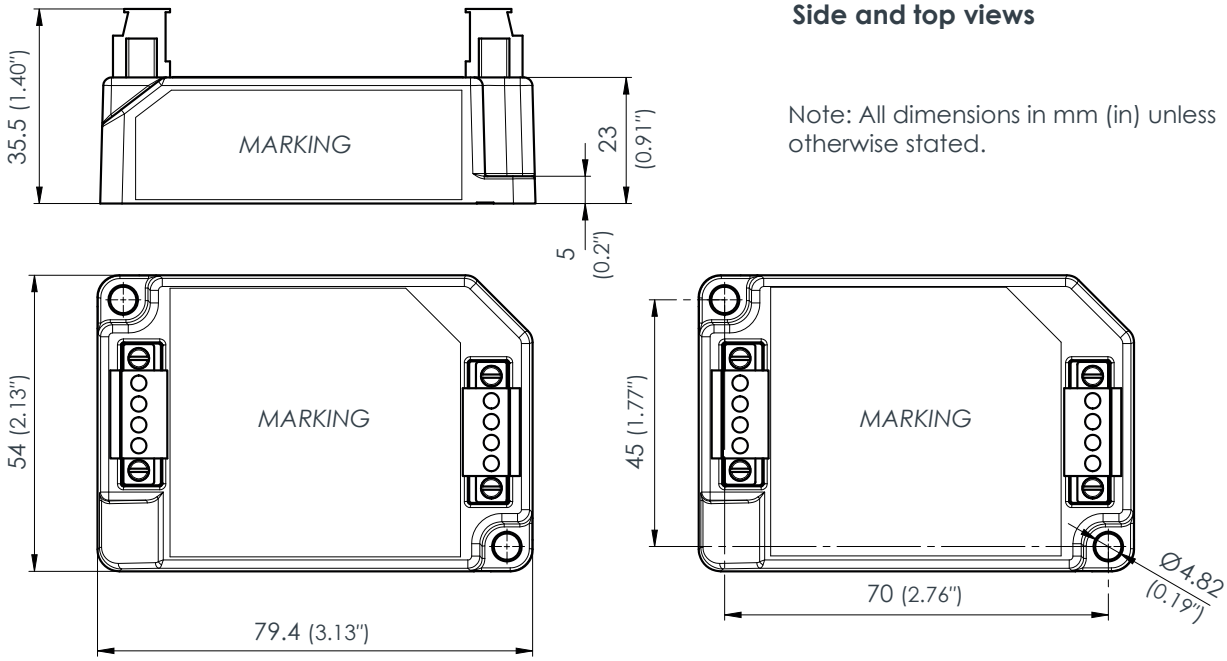
Physical

Electrical connections	: Removable screw-terminal connectors (see **Connectors on page 10**)
Housing material	: Injection-moulded aluminium, painted
Dimensions	: See **Mechanical drawings on page 11**
Weight	: 175 g (0.39 lb) approx.
Mounting	
• *Without DIN-rail mounting adaptor*	: Two M4 screws
• *With DIN-rail mounting adaptor (ordering option code G2)*	: TH 35 DIN rail (according to EN 50022 / IEC 60715). For example, TH 35-15 or TH 35-7.5.

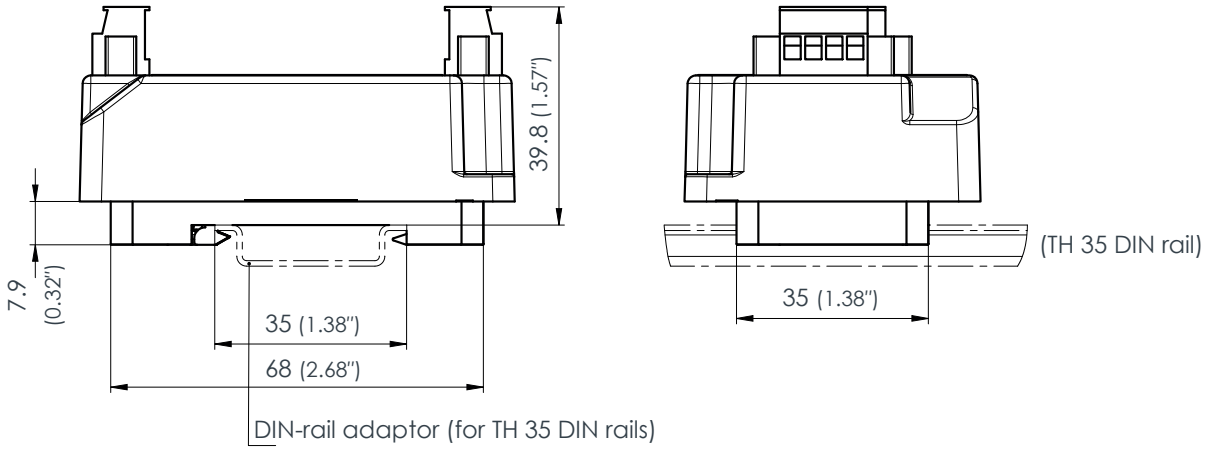
MECHANICAL DRAWINGS

Side and top views

Note: All dimensions in mm (in) unless otherwise stated.



Side and end views with DIN-rail mounting adaptor (ordering option code G2)



ORDERING INFORMATION

Ordering number:
244 - 707 - 000 - 012

A	B	C	D	E	F	G

Environment (A)

Standard	1
Explosive Ex ia	2
(1) Explosive Ex ec/nA	3

Diagnostics (B)

Without diagnostics	1
With diagnostics (SIL)	2

(2) **Transfer sensitivity (C)**

Without integrator	0.1
	0.2
	0.5
	1
	2
	5
	10
	20
	50
With integrator	981
	1962
	4905
	9810
	19620
	49050
	98100

(3) **Transfer units (D)**

Without integrator	µA/pC	1
	mV/pC	2
With integrator	µA/pC•s	3
	mV/pC•s	4

(4) **High-pass filter (E)**

Value in Hz	0.5
	1
	2
	5
	10
	20

(5) **Low-pass filter (F)**

Value in Hz	500
	1000
	2000
	5000
	10000
	20000

Installation (G)

Without DIN-rail adaptor	1
With DIN-rail adaptor	2

Notes

1. With ordering option code **A3** ("Ex ec" or "Ex nA"), the user must ensure that the IPC707 signal conditioner is installed in an industrial housing or enclosure that ensures a protection rating of at least IP54 (or equivalent), such as an ABA17x industrial housing.

2. Ordering option code **C** specifies the sensitivity of the IPC707's transfer function. For further information on permitted transfer sensitivity values (**Cx**), see **Transfer function (ordering option codes C and D) on page 5** and **Transfer sensitivities (ordering option code C) on page 8**. Ordering option code **C** is limited to a maximum of 4 significant digits (not including trailing zeros), with a maximum of 5 digits before the decimal separator and 2 digits after the separator (that is, xxxxx.xx). Example calculated transfer sensitivity to non-standard ordering option code values: 51252 becomes C51250, 7553.7 becomes C7554, 5.4 becomes C5.4 and 0.826 becomes C0.83.

3. Ordering option code **D** specifies the units of the IPC707's transfer function, including use of the optional integrator required to produce a velocity output (**D3** or **D4**).

4. Ordering option code **E** specifies the high-pass filter. For further information on permitted high-pass filter values (**Ex**), see **High-pass filter (ordering option code E) on page 10**. Ordering option code **E** is limited to a maximum of 3 significant digits (not including trailing zeros), with a maximum of 3 digits before the decimal separator and 1 digit after the separator (that is, xxx.x).

5. Ordering option code **E** specifies the low-pass filter. For further information on permitted low-pass filter values (**Fx**), see **Low-pass filter (ordering option code F) on page 10**. Ordering option code **F** is limited to a maximum of 3 significant digits (not including trailing zeros), with a maximum of 5 digits before the decimal separator and no digits after the separator (that is, xxxxx).

Two tools (spreadsheets) are available to help specify IPC707 ordering numbers and ordering option codes: (1) *IPC707 ordering number/codes definition tool* and (2) *IPC704 to IPC707 ordering number/codes conversion tool*. Contact Meggitt for further information.

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