MEGGiTT
smart engineering for
extreme environments

EW140 and DIC413

Ice-detection system for gas turbines

FEATURES

- From the Vibro-Meter® product line
- Ice detection for gas turbines, with discrimination between ice and water, or other liquid contaminants
- High reliability, with no moving parts
- Measurement range: 0.2 to 2.0 mm
- Analog output (voltage) indicating ice thickness
- ICE ALARM output (relay) indicating when preset ice thickness threshold is exceeded
- OK output (relay) indicating result of built-in system test (OK system)
- Ex certified for use in potentially explosive atmospheres
- Suitable for offshore applications
- Choice of three probe lengths

EW140

DIC413

DESCRIPTION

The ice-detection system for gas turbines is based upon the EW140 ice-detection sensor and the DIC413 de-icing controller.

EW140 ice-detection sensor

The EW140 ice-detection sensor is designed for use with turbomachinery operating in an environment where intake air is moisture-laden and the ambient temperature is below +5°C (+41°F). Typically, the sensor is mounted at the turbine inlet, where the air velocity is at its highest.

The EW140 sensor uses a simple and reliable method of measuring ice, patented by Meggitt SA. The operating principle is based on the fact that the natural (resonant) frequency of a solid body changes as its mass or stiffness is modified.

DESCRIPTION *(continued)*

As shown in **Sensor operating principle on page 2**, ice is detected using a continuously vibrating sensor diaphragm which is forced into oscillation at its natural frequency by a piezoelectric component. This is driven at an ultrasonic frequency (above 70 kHz) and the oscillation amplitude is very small (below 1 µm (micrometre)). So, in effect, there are no moving parts.

Ice growth on the sensor diaphragm substantially increases its stiffness and hence increases the natural frequency. Water or other liquid contaminants increase the sensor diaphragm's mass without increasing the stiffness, thus decreasing the natural frequency. A clear discrimination between ice and liquid is therefore ensured.

DIC413 de-icing controller

The DIC413 de-icing controller is a controller with an integrated signal conditioner, designed for operation with the EW140 ice-detection sensor. It provides power to and reads the current-modulated signal from the sensor. The controller then converts this signal into an analog voltage suitable for connection to an external monitoring system. The DIC413 allows intrinsically safe operation of the EW140 in hazardous areas (potentially explosive atmospheres) and meets the ATEX requirements for class [Ex ib Gb] IIB equipment.

The DIC413 can be used as an actuator for a visible or audible alarm system and as an automatic controller of an engine de-icing system, which could supply bleed air to de-ice the inlet. An ice alarm is activated if the ice thickness exceeds a preselected value. Jumper connections inside the controller's enclosure allow five different alarm levels to be set for ice thicknesses from 0.2 to 2.0 mm.

The ice-detection system contains a simple but extensive system self-test feature. This continuously checks the complete measurement chain up to (but not including) the output relays of the controller. An internal or external power supply failure is considered as a failure and will deactivate the OK output relay.

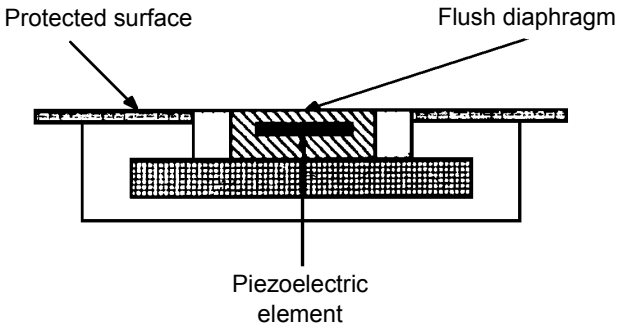
Applications information

The ice-detection system is suitable for gas turbines in a wide range of industrial applications, including power generation and driving rotating equipment.

The corrosion resistant alloys used for the EW140 sensor and the protective coating used for the DIC413 controller's enclosure allow the system to withstand damp and corrosive atmospheres. This allows the system to be used in harsh industrial environments, such as offshore or petrochemical applications.

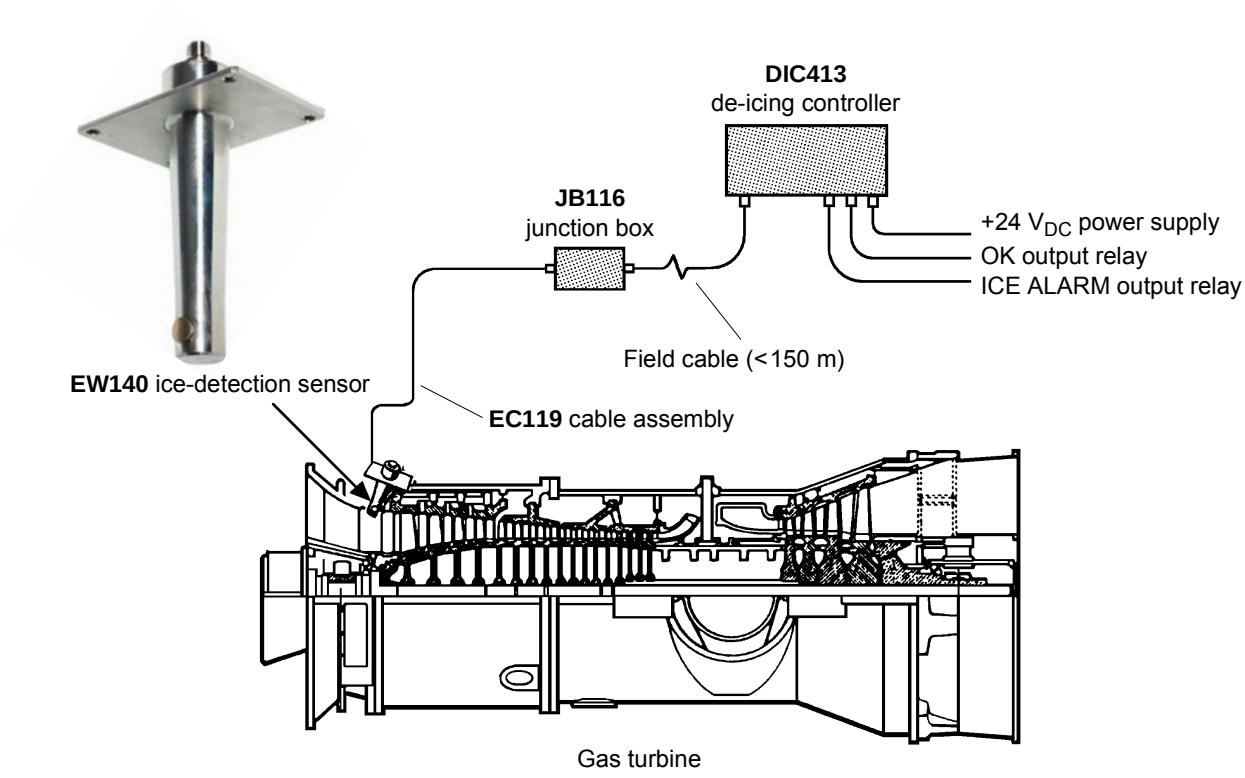
For specific applications, contact your nearest Meggitt Sensing Systems representative.

SENSOR OPERATING PRINCIPLE



The natural frequency of the EW140 ice-detection sensor's vibrating diaphragm is raised by a layer of ice (due to increased stiffness) and lowered by water or contaminants (due to increased mass).

SYSTEM OVERVIEW



SPECIFICATIONS

Overall ice-detection system

Operation

Measurement range (ice thickness)	: 0.2 to 2.0 mm (8 to 80 mils)
Accuracy (from 0 to 1.5 mm of ice)	: ±0.2 mm
Linearity	
• *From 0 to 0.5 mm ice thickness*	: ≤ ±2.5% of FSD
• *From 0 to 1.0 mm ice thickness*	: ≤ ±5% of FSD
• *From 0 to 2.0 mm ice thickness*	: ≤ ±12% of FSD
Interchangeability of elements	: All system components are interchangeable
Transfer function	: See **Typical transfer function curve on page 5**

SPECIFICATIONS *(continued)*

Potentially explosive atmospheres

Ex approved for use in hazardous areas

EW140 ice-detection sensor

Type of protection Ex i: intrinsic safety		
Europe	EC type examination certificate	LCIE 02 ATEX 6096 X II 2 G (Zones 1, 2) Ex ib IIB T5 Gb
North America	CSA certificate of compliance	CSA 2424154 Class I, Groups C and D Ex ia
Russian Federation	TR CU certificate of conformity*	TC RU C-CH.МШ06.B.00134 1Ex ib IIB T5 Gb

DIC413 de-icing controller

Type of protection Ex i: intrinsic safety		
Europe	EC type examination certificate	LCIE 02 ATEX 6091 X II (2) G (outside potentially explosive zone) [Ex ib Gb] IIB
North America	CSA certificate of compliance	CSA 2424154 Class I, Groups C and D [Ex ia]
Russian Federation	TR CU certificate of conformity*	TC RU C-CH.МШ06.B.00134 [Ex ib Gb] IIB

*Not engraved on the product marking.

⚠ **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.**

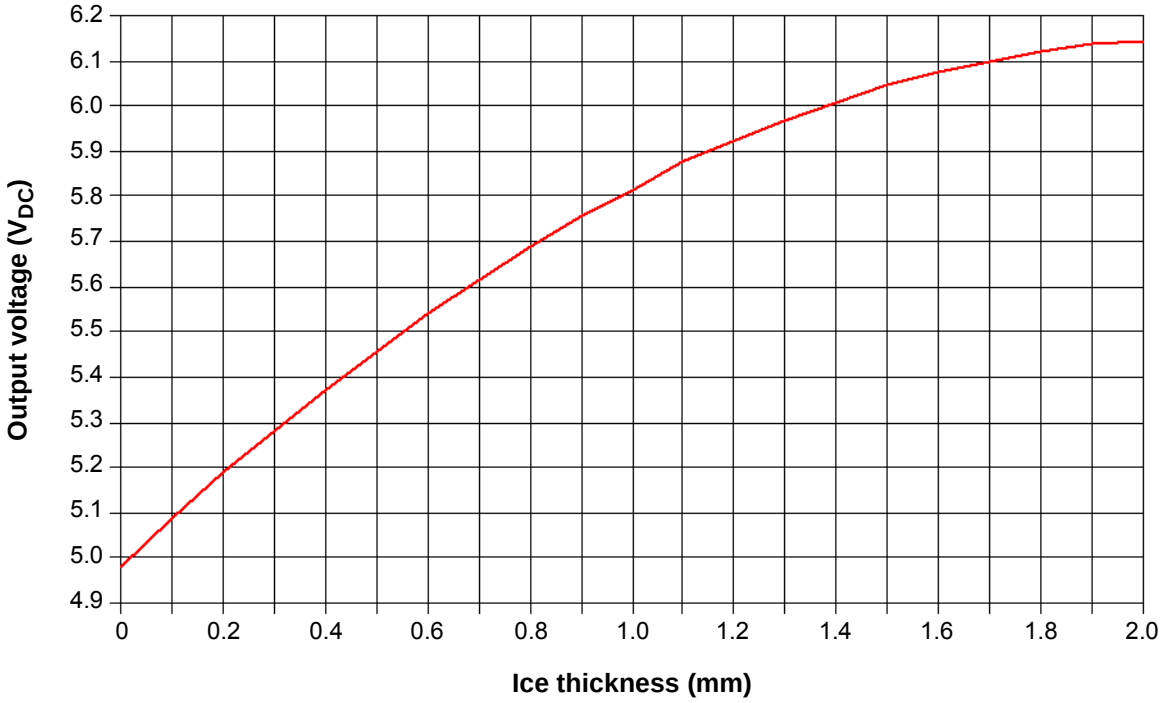
⚠ **For the most recent information on the Ex certifications that are applicable to this product, refer to the *Ex product register (PL-1511)* that is available from Meggitt SA.**

Approvals

Conformity	:	CE marking, European Union (EU) declaration of conformity. EAC marking, Eurasian Customs Union (EACU) certificate/declaration of conformity.
Electromagnetic compatibility (EMC)	:	EN 61000-6-2:2005. EN 61000-6-4:2007 + A1:2011. TR CU 020/2011.
Electrical safety	:	EC 61010-1:2010. TR CU 012/2011.
Environmental management	:	RoHS compliant (2011/65/EU)
Hazardous areas	:	Ex (see **Potentially explosive atmospheres on page 4**)

SPECIFICATIONS *(continued)*

Typical transfer function curve



SPECIFICATIONS *(continued)*

EW140 ice-detection sensor

Electrical

Operating principle	: See **Sensor operating principle on page 2**
Power supply	
• *Voltage*	: +24 V_{DC} nominal
• *Current*	: 10 mA at 24 V_{DC} nominal voltage
• *Type*	: Voltage power supply with current-modulated output signal. This enables the same two-wire connection to the DIC413 de-icing controller to be used for both the sensor's power supply and output signal.
Electrical insulation	: Case grounded
Connector	: CG505 type (7/16″ 27 UNS-2A) – rugged, circular, threaded-coupling, two-pin, hermetic connector. Mates with CG505 type connectors (7/16″ 27 UNS-2B) used by the recommended cable assemblies.
Recommended cable assemblies	: EC119 and EC222 (see **Accessories on page 10**)

Environmental

Operating temperature	
• *Standard operation*	: −55 to 120°C (−67 to 250°F)
• *Required for intrinsic safety*	: −55 to 60°C (−67 to 140°F)
Storage temperature	: −55 to 130°C (−67 to 266°F)
Humidity	: Sensor housing is hermetically sealed, 100% RH at 43°C (110°F)
Vibration	: 10 g_{PEAK} (0.75 mm_{PEAK}) from 10 to 500 Hz, sine wave
Shock	: 15 g_{PEAK}, 11 ms, 3 shocks/axis, half sine wave

Note: See also **Approvals on page 4**.

Mechanical

Material and finish	
• *Sensor housing*	: INCONEL® alloy 600 (2.4816)
• *Sensor diaphragm*	: Corrosion-resistant BzAl 75 (1.1121) alloy
Protection rating (according to IEC 60529)	: IP68
Dimensions	: See **Mechanical drawings on page 8**
Weight	
• *77 mm probe length (PNR 447-140-000-01x)*	: 0.33 kg (0.73 lb) approx.
• *100 mm probe length (PNR 447-140-000-11x)*	: 0.37 kg (0.82 lb) approx.
• *175 mm probe length (PNR 447-140-000-12x)*	: 0.45 kg (0.99 lb) approx.

SPECIFICATIONS *(continued)*

DIC413 de-icing controller

General

Operating principle	: Conversion of current-modulated sensor signal into an analog voltage
Power supply	
• *Voltage*	: +24 V_{DC} nominal (+22 to +30 V_{DC})
• *Current*	: 100 mA maximum
Connection to EW140 ice-detection sensor	: Typically connected via a EC119 cable assembly (length 5 m), a JB116 junction box and suitable field wiring (2-core, twisted-pair, shielded cable, length up to 150 m) such as the K210 transmission cable. Refer also to the *Ice-detection system for gas turbines installation manual*.

Outputs

Analog output	
• *F/V output (frequency-to-voltage converter)*	: Analog voltage providing an indication of ice thickness. See **Typical transfer function curve on page 5** for details.
• *Output impedance*	: 1 kΩ
Discrete outputs (relays)	
• *OK output*	: Relay driven by the DIC413 controller's integrated test circuitry
• *ICE ALARM output*	: Relay switched when the configured ice thickness is exceeded. Note: The required ice-thickness alarm level is selected using jumpers on the DIC413 controller.

Environmental

Operating temperature	: 0 to 60 °C (32 to 140 °F)
Humidity	: Protected against splashing water and humidity up to 100 %

Note: See also **Approvals on page 4**.

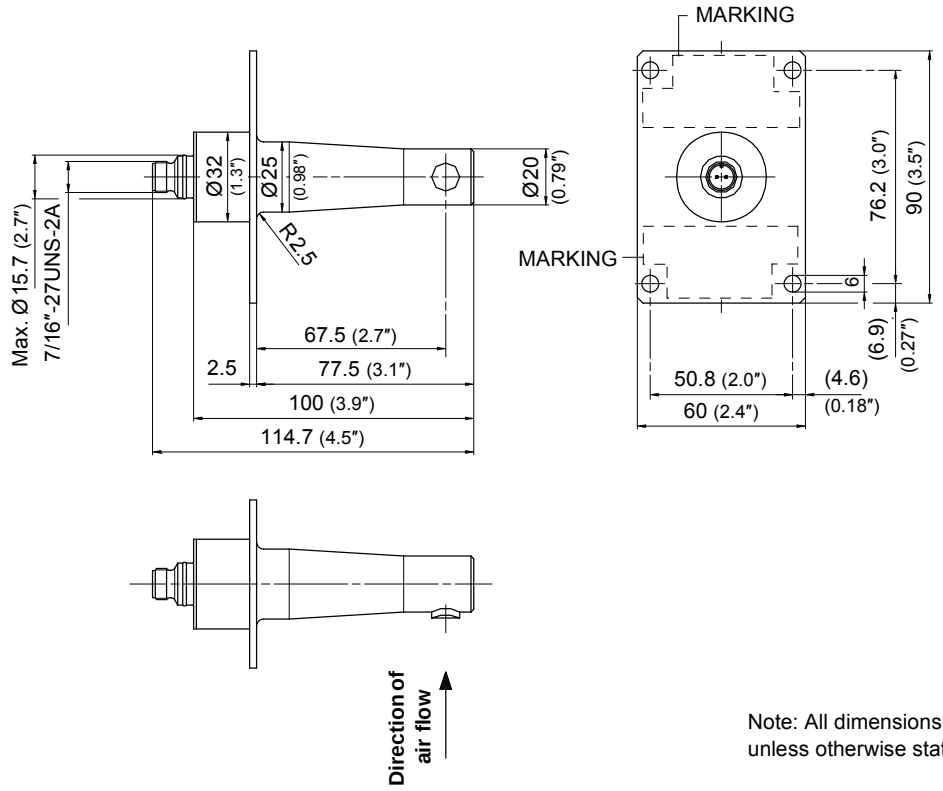
Mechanical

Enclosure	: Sealed two-part (housing and cover) die-cast aluminium enclosure with protective coating
Protective coating	: Multi-component treatment produces an (elastic) enamel that is resistant to rubbing and scratching, and provides resistance against chemicals and corrosion. Suitable for use under extreme conditions.
Seal	: Silicone rubber (VMQ) gasket, resistant to weathering, ozone, chemicals and oils
Mounting	: Four stainless steel Allen screws, size M6 x 30 mm, in
Protection rating (according to IEC 60529)	: IP65 (corresponds to NEMA enclosure type 12)
Dimensions	: See **Mechanical drawings on page 8**
Weight	: 2.2 kg (4.85 lb) max.

MECHANICAL DRAWINGS

EW140 ice-detection sensor with 77 mm probe length

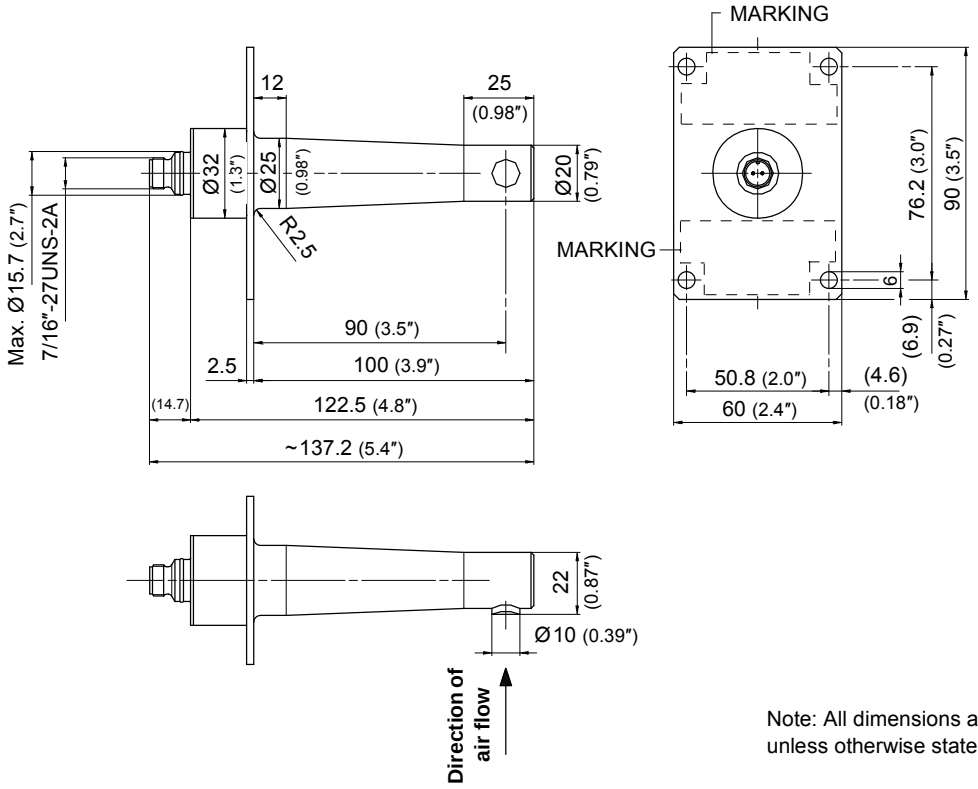
Ordering number: 447-140-000-011



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

EW140 ice-detection sensor with 100 mm probe length

Ordering number: 447-140-000-111

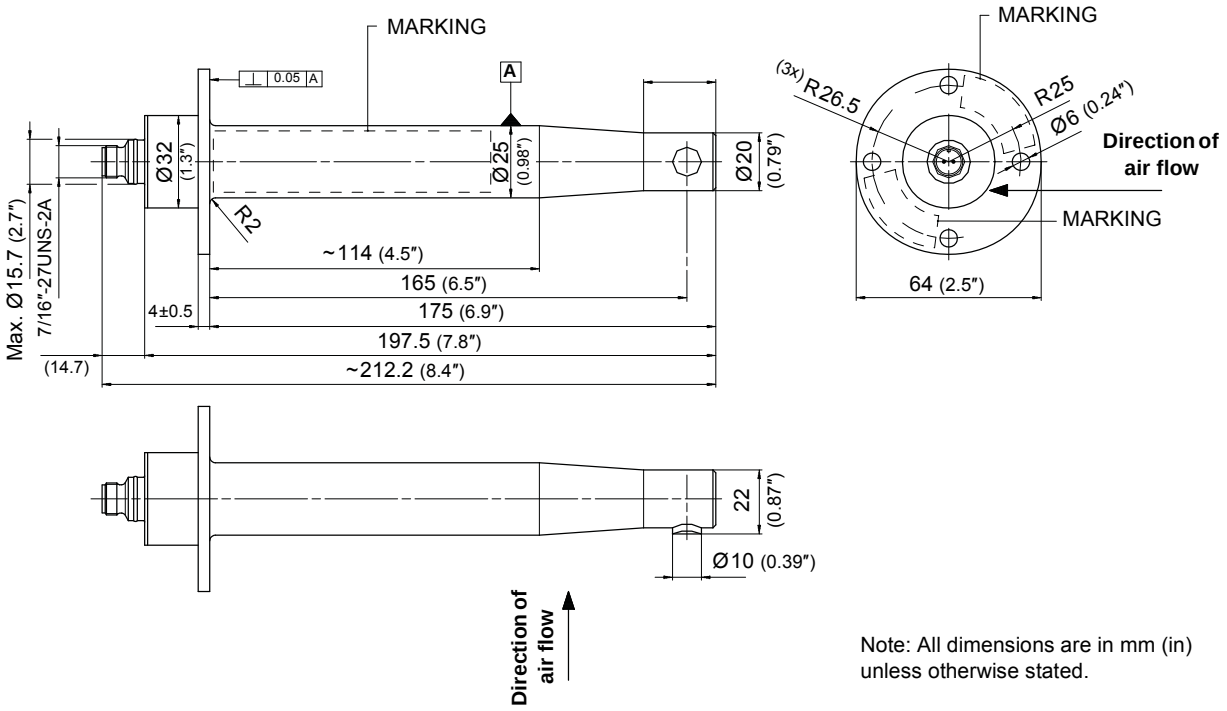


Note: All dimensions are in mm (in) unless otherwise stated.

MECHANICAL DRAWINGS *(continued)*

EW140 ice-detection sensor with 175 mm probe length

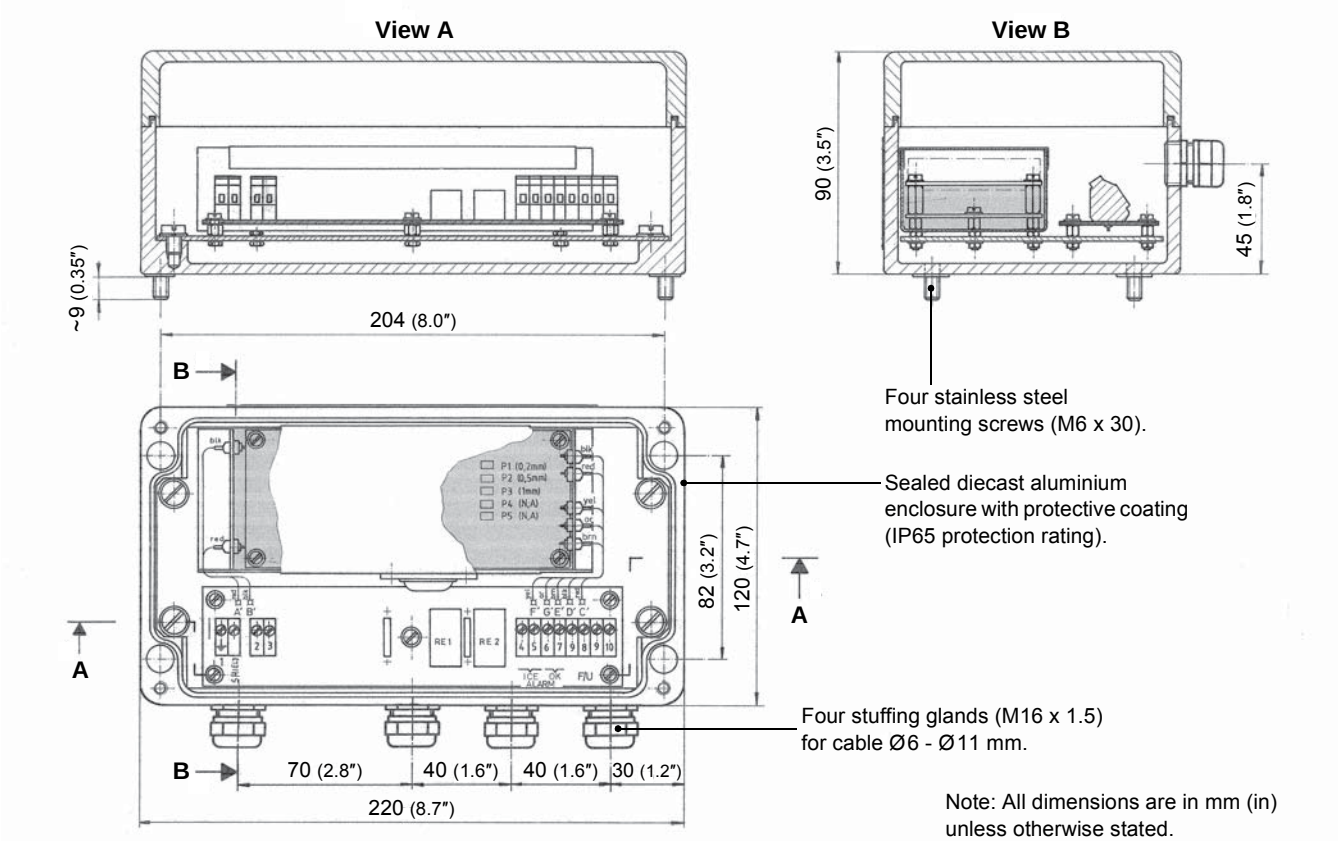
Ordering number: 447-140-000-121



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

DIC413 de-icing controller

Ordering number: 241-413-000-024



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

ORDERING INFORMATION

To order please specify

Type	Designation	Ordering number (PNR)
EW140	Ice-detection sensor with 77 mm probe length, suitable for most gas turbines	447-140-000-011
	Ice-detection sensor with 100 mm probe length, suitable for most gas turbines	447-140-000-111
	Ice-detection sensor with 175 mm probe length, suitable for thick-walled gas turbines	447-140-000-121
DIC413	De-icing controller	241-413-000-024

ACCESSORIES

Item	Type	Part number (PNR)
• *Cable assemblies*	EC119 Splashproof cable assembly with a CG505 type connector (7/16″ 27 UNS-2B), K205A 2-wire cable, and a sealed protection tube (leaktight). Refer to the corresponding product drawing for further information.	922-119-000-003
	EC222 Standard cable assembly with a CG505 type connector (7/16″ 27 UNS-2B) and K221 2-wire cable. Refer to the corresponding product drawing for further information.	922-222-000-002
Note: The cable length must be specified when ordering a cable assembly.		
• *Junction box*	JB116 Refer to the corresponding data sheet.	809-122-000-012

Headquartered in the UK, Meggitt PLC is a global engineering group specializing in extreme environment components and smart sub-systems for aerospace, defence and energy markets.

Meggitt Sensing Systems is the operating division of Meggitt specializing in sensing and monitoring systems, which has operated through its antecedents since 1927 under the names of ECET, Endevco, Ferroperm Piezoceramics, Lodge Ignition, Sensorex and Vibro-Meter. Today, these operations are integrated under one strategic business unit called Meggitt Sensing Systems, headquartered in Switzerland and providing complete systems, using these renowned brands, from a single supply base.

The Meggitt Sensing Systems facility in Fribourg, Switzerland operates as the legal entity Meggitt SA (formerly Vibro-Meter SA). This site produces a wide range of vibration, dynamic pressure, proximity, air-gap and other sensors capable of operation in extreme environments, electronic monitoring and protection systems, and innovative software for aerospace and land-based turbomachinery.

In this publication, a dot (.) is used as the decimal separator and thousands are separated by thin spaces. Example: 12345.67890.

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