



## EW 140 and DIC 413

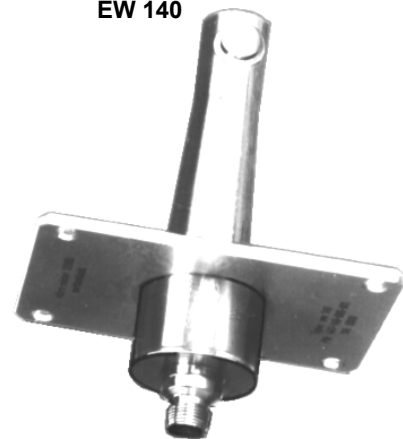
### Ice detection system for gas turbines

#### FEATURES

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- 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
- Certified for use in potentially explosive atmospheres
- Measurement range: 0.2 to 2.0 mm
- Choice of three probe lengths
- 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)
- Suitable for offshore applications

EW 140



DIC 413



#### DESCRIPTION

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The ice detection system for gas turbines is based upon the EW 140 ice sensor and the DIC 413 de-icing controller.

##### EW 140 ice sensor

The EW 140 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.

Meggitt SA has patented the simple and reliable method of measuring ice, that is used by the EW 140. This is based upon the principle that the natural (resonant) frequency of a solid body will be modified



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**DESCRIPTION** *(continued)*

with a change in its mass or stiffness. See the Sensor operating principle section of the data sheet for more information.

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 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.

**DIC 413 de-icing controller**

The DIC 413 is a controller with an integrated signal conditioner, designed for operation with the EW 140 ice sensor. It provides power to and reads the current-modulated signal from the sensor. The controller then converts this signal into an analog voltage. The DIC 413 allows intrinsically safe operation of the EW 140 in an explosive atmosphere and meets ATEX requirements for class [Ex ib] IIB equipment.

The DIC 413 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.

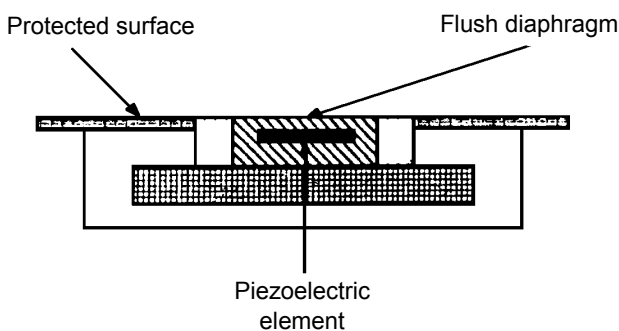
The ice detection system contains a simple but extensive system self-test feature. This continuously checks the complete measurement chain up to (but not including) the output relays of the controller. An internal or external power supply failure is considered as a failure and will deactivate the OK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

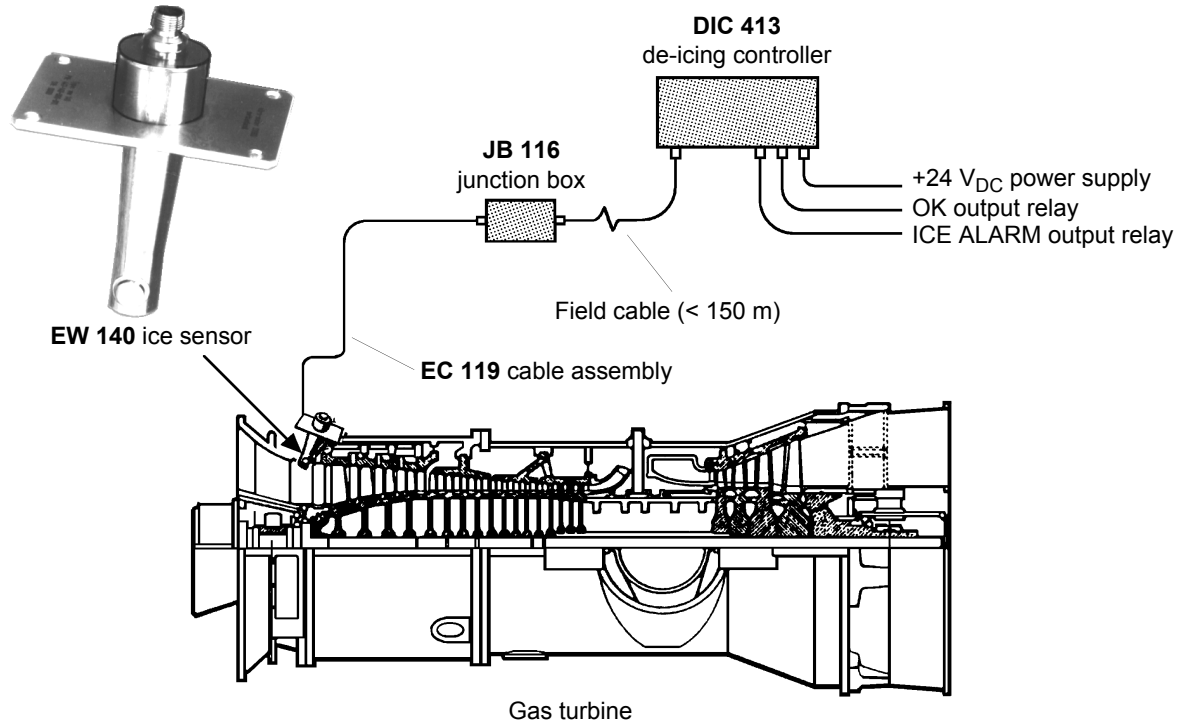
The corrosion resistant alloys used for the EW 140 sensor and the protective coating used for the DIC 413 controller's enclosure allow the system to withstand damp and corrosive atmospheres. This allows the system to be used in harsh industrial environments, such as offshore or petrochemical applications.

**SENSOR OPERATING PRINCIPLE**



The natural frequency of the 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

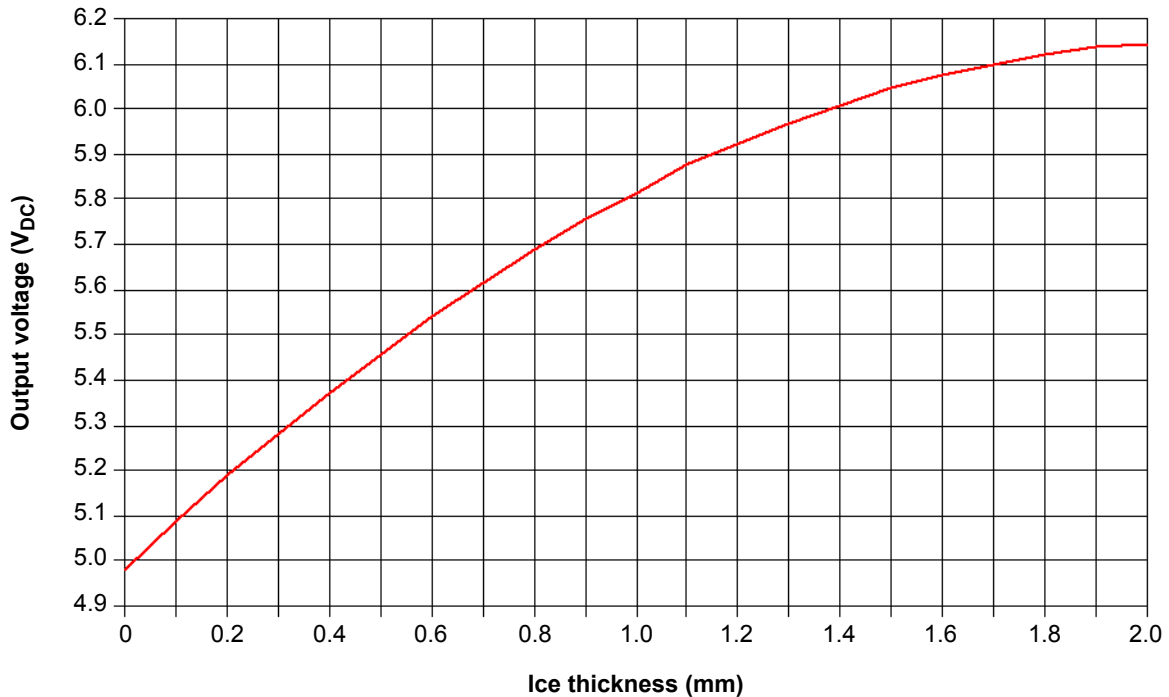
Overall ice detection system

OPERATION

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

SPECIFICATIONS (continued)

Typical transfer function curve



EW 140 ice sensor

ELECTRICAL

Power requirements	: 10 mA at 24 V <sub>DC</sub> nominal voltage
Type of supply	: Voltage power supply with current-modulated output signal. This enables the same two-wire connection (to the DIC 413) to be used for the sensor supply and the signal output.
Electrical insulation	: Case grounded
Connector	: Two-pin, hermetic connector made by Meggitt Sensing Systems, 7/16" 27 UNS-2A

MECHANICAL

Material and finish	
• Sensor housing	: Made of INCONEL® alloy 600 (2.4816)
• Sensor diaphragm	: Manufactured from a corrosion-resistant BzAl 75 (1.1121) alloy
Protection rating	: IP68, according to IEC 60529
Dimensions	: See Mechanical drawings

**SPECIFICATIONS** *(continued)*

Weight (nominal)

- P/N 447-140-000-01x : 330 g
- P/N 447-140-000-11x : 370 g
- P/N 447-140-000-12x : 450 g

**ENVIRONMENTAL**

Operating temperature range

- *Standard operation* : -55 to 120°C (-67 to 250°F)
- *Required for intrinsic safety* : -55 to 60°C (-67 to 140°F)

Storage temperature range : -55 to 130°C (-67 to 266°F)

Humidity : Sensor housing is hermetically sealed,  
100% RH at 43°C (110°F)

Vibration : 10 g pk (0.75 mm pk) from 10 to 500 Hz, sine wave

Shock : 15 g pk, 11 ms, 3 shocks/axis, half sine wave

Electromagnetic compatibility (EMC) : Conforms to EN 61000-6-2 and EN 61000-6-4

**Explosive atmospheres**

Available in Ex approved versions for use in hazardous locations

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 T <sub>amb</sub> maximum = +60°C
North America	CSA certificate of compliance	Certificate 2424154 (LR62075-3) Class I, Groups C and D, Ex ia

 **For specific parameters of the mode of protection concerned and special conditions for safe use, please refer to the certificates, which are available from Meggitt SA on demand.**

**DIC 413 de-icing controller**

**GENERAL**

Operating principle : Conversion of current-modulated sensor signal into an analog voltage

Power requirements : +22 to +30 V<sub>DC</sub> (+24 V<sub>DC</sub> nominal).  
Within this range, maximum current consumption is 100 mA.

Connection to EW 140 ice sensor : Via an EC 119 cable assembly (length 5 m), JB 116 junction box and a customer supplied field cable (2-core, twisted, shielded cable with maximum length 150 m)

**SPECIFICATIONS** *(continued)*

**OUTPUTS**

F/V output (frequency-to-voltage)

• *Function* : Analog voltage providing an indication of ice thickness.  
See the Typical transfer function curve for details.

• *Output impedance* : 1 kΩ

Discrete outputs (relays)

• *OK output* : Relay driven by the DIC 413 controller's built-in test circuitry

• *ICE ALARM output* : Relay switched when the pre-selected ice thickness is exceeded

**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.

Cover seal (gasket) : Silicone rubber (VMQ), resistant to weathering, ozone, chemicals and oils.

Mounting : Four Allen screws, size M6 x 30 mm, in stainless steel

Protection rating : IP65, according to IEC 60529 (corresponds to NEMA type 12)

Dimensions : See Mechanical drawings

Weight : Max. 2.2 kg (4.85 lb)

**ENVIRONMENTAL**

Operating temperature range : 0 to 60°C (32 to 140°F)

Humidity : Protected against splashing water and humidity up to 100%

**Explosive atmospheres**

Available in Ex approved versions for use in hazardous locations

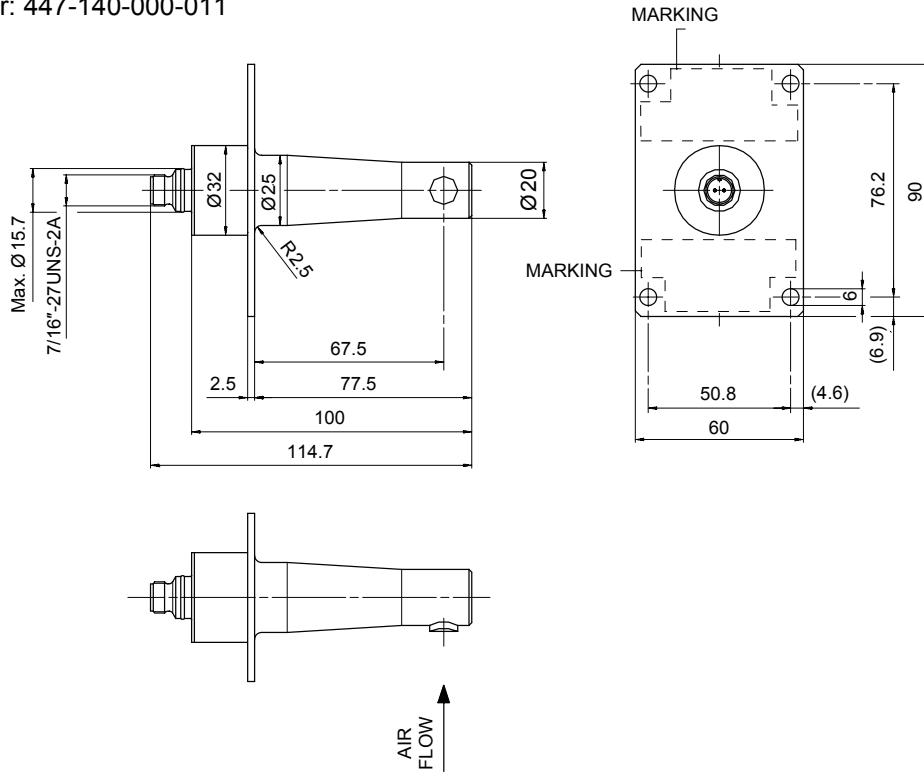
Type of protection Ex i: intrinsic safety		
Europe	EC type examination certificate	LCIE 02 ATEX 6091 X II (2) G (outside potentially explosive zone) [Ex ib] IIB Tamb max. = +60°C
North America	CSA certificate of compliance	Certificate 2424154 (LR62075-3) Class I, Groups C and D, [Ex ia]

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MECHANICAL DRAWINGS

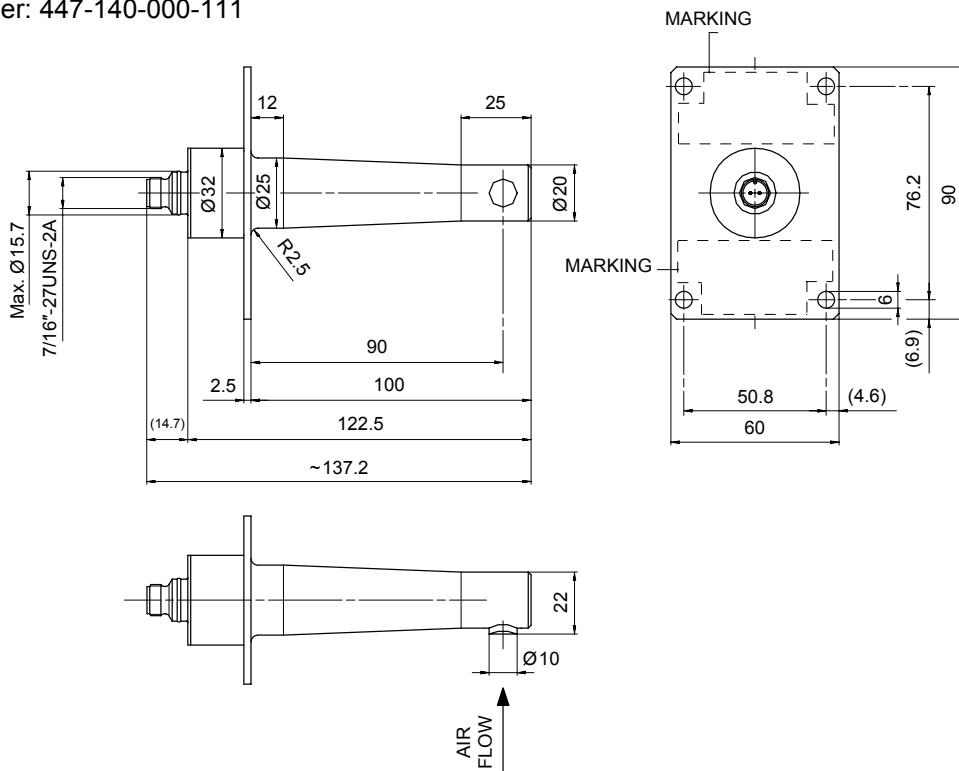
**EW 140 ice sensor with 77 mm probe length**

Ordering number: 447-140-000-011



**EW 140 ice sensor with 100 mm probe length**

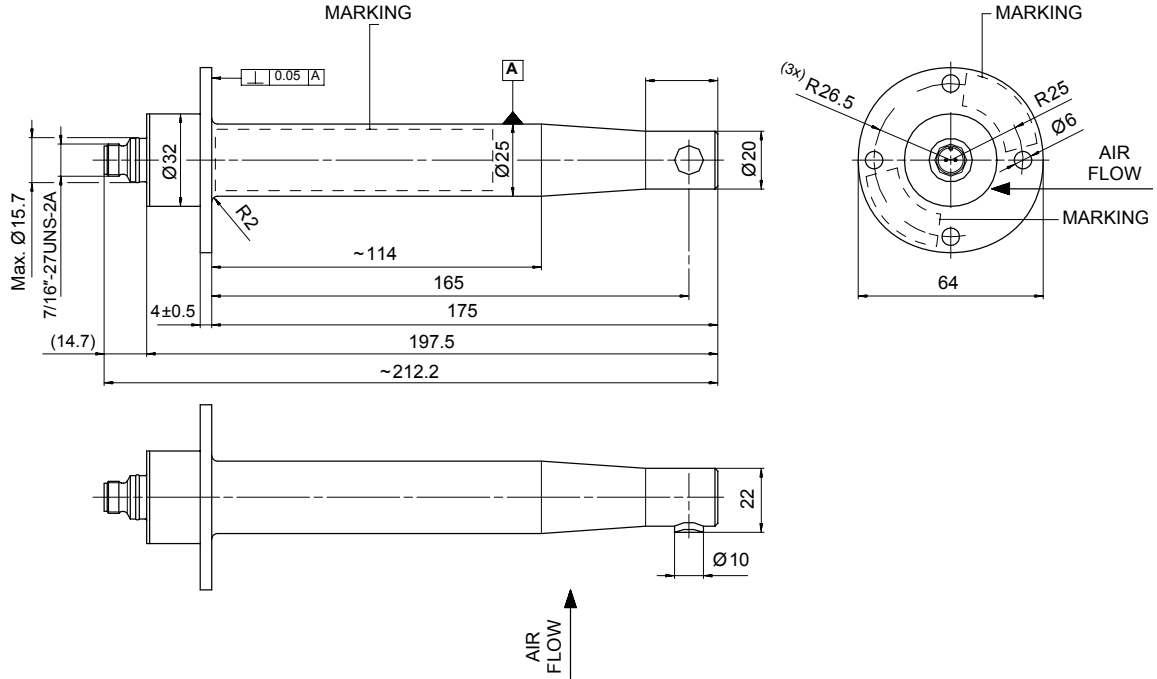
Ordering number: 447-140-000-111



**MECHANICAL DRAWINGS** (continued)

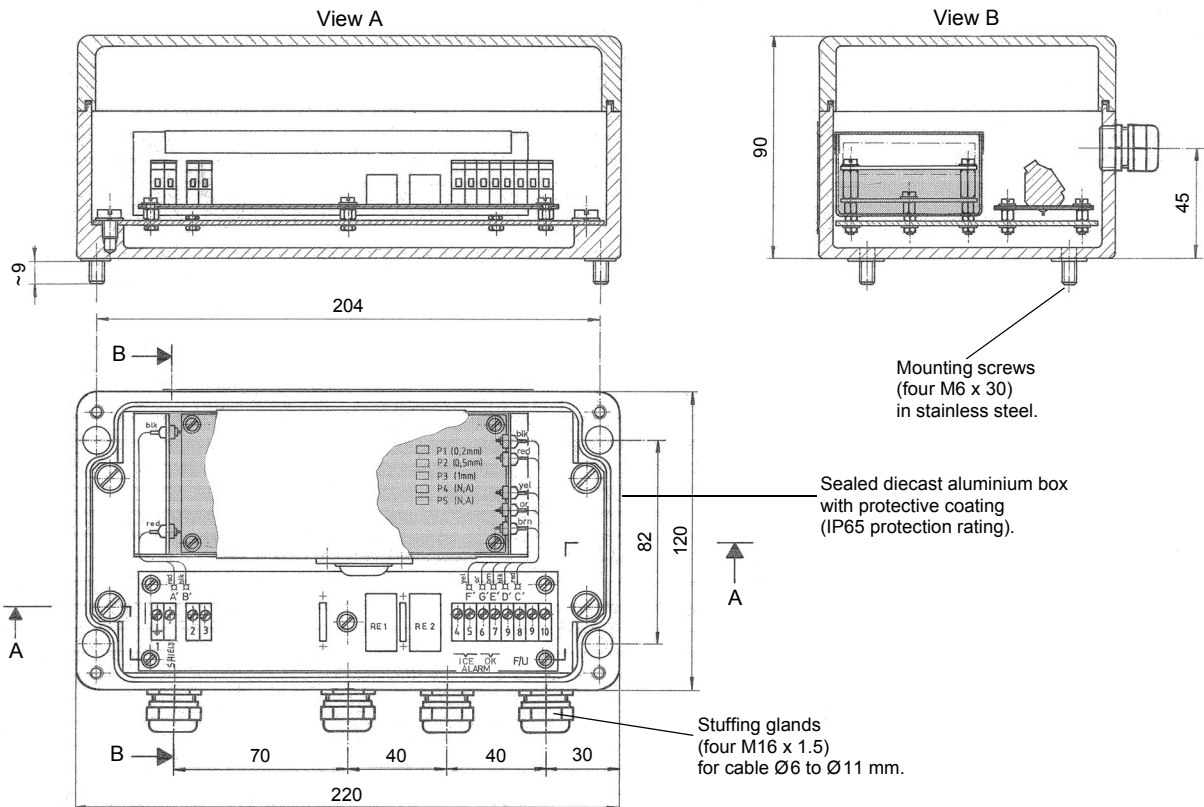
**EW 140 ice sensor with 175 mm probe length**

Ordering number: 447-140-000-121



**DIC 413 de-icing controller**

Ordering number: 241-413-000-023



### ORDERING INFORMATION

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To order please specify:

Type	Designation	Ordering Number
EW 140	Ice sensor with 77 mm probe length, suitable for most gas turbines	447-140-000-011
	Ice sensor with 100 mm probe length, suitable for most gas turbines	447-140-000-111
	Ice sensor with 175 mm probe length, suitable for thick-walled gas turbines	447-140-000-121
DIC 413	De-icing controller	241-413-000-023

### MOUNTING ACCESSORIES

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JB 116 Junction box : Refer to the corresponding data sheet

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