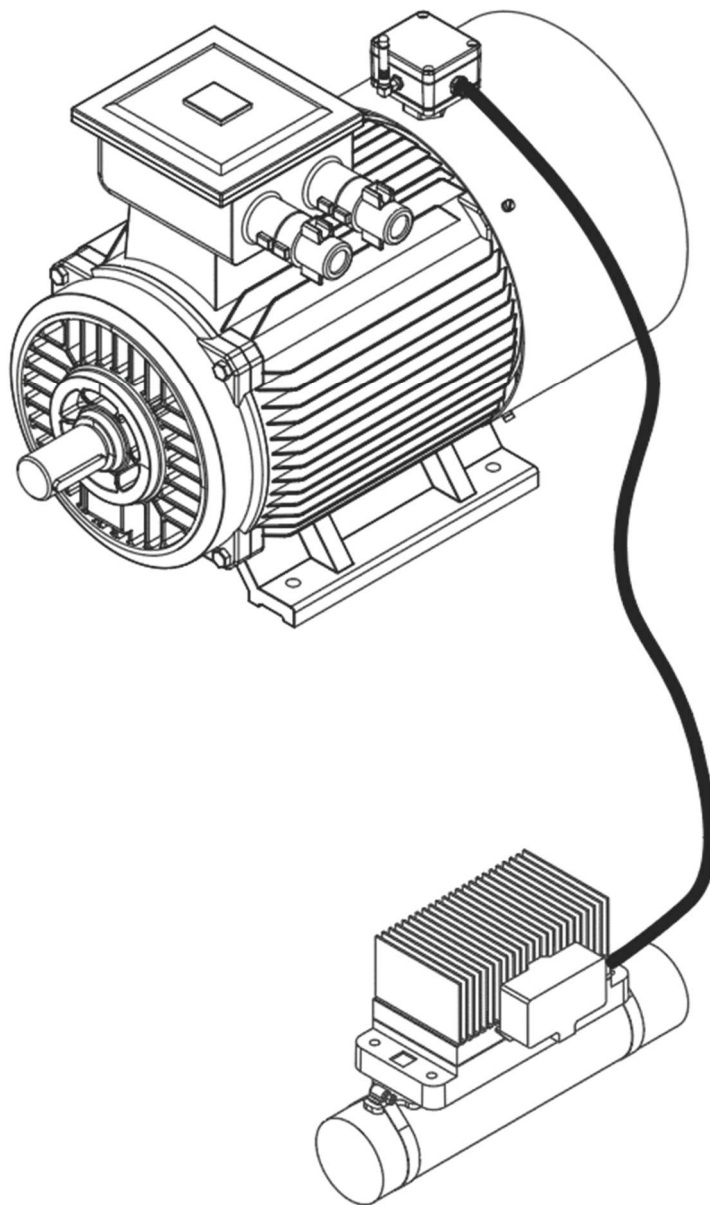




USER MANUAL

AUTONOMOUS WIRELESS SENSOR POWERED BY HEAT



MONITORING VIBRATION & TEMPERATURE

Table of contents

USER MANUAL.....	1
Introduction	6
Regarding this manual.....	6
Safety messages	6
Safety tips and warnings	7
Safety guides	7
Authorised personnel	7
Proper utilisation	7
Warning about incorrect use	7
Family Overview	8
Product Overview	9
Product modules.....	10
Thermoelectric generator (IET)	10
IET Module parts.....	11
Functionality	11
Output variables.....	11
Working areas	11
Installation	12
Commissioning requirements	12
Optimal mounting – Screwing	14
Flat or cylindrical surface mounting (accessory included).....	15
Weldable flat surface (optional accessory).....	18
Output power connections	20
Preparing the connection	20
Physical connectivity.....	21
Generator module start up	24
Servicing, diagnostics, and maintenance	25
Maintenance	25
Troubleshooting	25
Warranty.....	25
Technical data	27
Functional features.....	27
Physical features.....	27
Working conditions	28
Electrical Features	28
Dimensions.....	29
Thermoelectric generator IET dimensions.....	29

Standard Mounting Accessory.....	29
Regulatory compliance statements and marking.....	30
IIoT Wireless and Sensor module (IEPLV3).....	31
Module parts.....	32
Functionality	32
Variables measured	32
Working areas	32
Installation	33
Adhesive mounting (standard).....	34
Motor fin mounting (optional).....	37
Measuring position	38
Powering the IIoT Wireless module and Sensor with the energy generation module.....	39
Preparing the connection	39
Physical connectivity	39
IIoT Wireless and Sensor module commissioning	43
Powering the module with external DC power	43
You must follow the instructions and procedures described in the Powering the IIoT Wireless module and Sensor with the energy generation module section to power the IIoT Wireless and Sensor module (IEPLV3).....	43
Powering multiple IIoT Wireless and Sensor modules (optional)	44
Temperature sensor connection (optional)	45
Servicing, diagnostics, and maintenance	46
Maintenance	46
Troubleshooting	46
Warranty.....	47
Technical data	48
Functional features.....	48
Physical features.....	48
Working conditions	48
Electricals Features	48
Vibration sensor features	49
Temperature sensor features	49
Wireless features	49
Dimensions.....	50
Regulatory compliance statements and marking.....	50
Accessories parts	51
Type of Generator module accessories.....	51
Type of IIoT Wireless and sensor module accessories	53
Recommended adhesives	55
Cables and connectors	56

Introduction

Regarding this manual

This manual provides all the necessary information for assembly, connection, and configuration as well as important instructions for maintenance and user safety.

This manual should be provided to the end user.

All rights reserved. No part of this manual may be reproduced in any form without Alternative Energy Innovations S.L.'s written permission.

Alternative Energy Innovations S.L. makes no warranty of any kind regarding this manual, including, but not limited to, implied warranty of merchantability and fitness for a particular purpose.

If any question arises, errors are found, or if any information is missing from this manual, please contact Alternative Energy Innovations S.L. for further information.

The specifications covered by this manual are limited to those for the standard type under the specified model number breakdown and do not cover custom-made instruments.

Please note that changes in the specifications, construction, or component parts of the module may not immediately be reflected in this manual at the time of change, given postponement of revisions will not cause difficulty to the user from a functional or performance standpoint.

Safety messages

	Hot surface Skin Burn hazard during operation. Do not touch
	Danger of physical burns with the surface of the appliance. Installation or handling of the equipment during operation or recently disconnected is prohibited. It is recommended to measure the surface temperature of the equipment whenever it requires handling to ensure an adequate contact temperature. The use of thermal protection gloves is strongly recommended whenever the equipment is manipulated.
	Danger of cutting by the heat sink of the Thermoelectric generator module. Handle the module with mechanical gloves to prevent cuts on your hands.

Safety tips and warnings

Safety guides

This module conforms with all relevant regulations and standards. Ensure the module is in a perfect technical condition before its use. The operator is responsible for ensuring that the Generator module functions properly. When dealing with highly aggressive or corrosive substances that might cause a dangerous situation if the Generator module fails, the operator must adopt adequate procedures to guarantee the unit is operational.

The user must follow the safety recommendations in these operating instructions manual, the national installation requirements and the applicable safety regulations and accident prevention rules.

For safety and warranty compliance, only authorised personnel are permitted to conduct intrusive maintenance on the Generator module, as outlined in the operating manual. Unauthorised modifications or alterations are strictly prohibited. Additionally, only manufacturer-recommended accessories should be utilised for safety reasons.

To avoid any danger, the safety approval markings and safety tips on the module must also be observed.

Authorised personnel

All operations described in this documentation must be carried out only by skilled personnel authorised by the plant operator.

The required personal protective equipment must always be worn when working on and with the module.

Proper utilisation

The InduEye system is powered by renewable energy modules and utilises the LoRaWan protocol for IIoT monitoring, transmitting data to a gateway. Detailed information on its application area can be found in the "Product overview" chapter. Operational reliability is contingent on adhering to specifications outlined in the operating manual and any supplementary instructions.

Warning about incorrect use

The supplier is not responsible for damage caused by improper installation, incorrect technical conditions and improper use of equipment.

Do not attempt to disassemble or modify the equipment yourself. The equipment has no useful parts for the user.

Make sure that the temperatures do not exceed the recommended values.

It is strictly forbidden to plug the Generator module into any device other than the IIoT Wireless and Sensor module of Alternative Energy Innovations S.L.; neither the safety nor the integrity of the Generator module can be guaranteed.

Family Overview

REFERENCE	DESCRIPTION	<u>THERMOELECTRIC GENERATOR</u> [IET]	<u>NODE SENSOR</u> [IEPLV3]	EXTERNAL SENSOR	COMMUNICATION PROTOCOL	
				<u>TEMPERATURE</u>	LORA WAN	
					EU	AS1
IETLV3	InduEye Termo Lora Vibro 3	✓	✓	(*)	✓	x
IETLV3T	InduEye Termo Lora Vibro 3 Temp	✓	✓	✓	✓	x
IEPLV3	InduEye Power Lora Vibro 3	x	✓	(*)	✓	x
IEPLV3T	InduEye Power Lora Vibro 3 Temp	x	✓	✓	✓	x
IETLV3TAS1	InduEye Termo Lora Vibro Temp 3 AS1	✓	✓	✓	x	✓
IETLV3AS1	InduEye Termo Lora Vibro 3 AS1	✓	✓	(*)	x	✓
IEPLV3TAS1	InduEye Power Lora Vibro Temp 3 AS1	x	✓	✓	x	✓

(*) In this version Indueye can read the signal but the external sensor is not supplied.

Product Overview

The InduEye is an IIoT monitoring equipment. It generates data on the IIoT Wireless and sensor module and sends it to a Gateway via the LoRaWAN protocol. With this technology, multiple processes or machinery can be monitored without the use of batteries or communication cables.

The system requires:

- An InduEye, that consists of:
 - A Generator module which produces electrical energy from renewable sources required in order to power the other modules.
 - A IIoT Wireless and Sensor module which manages sensors and Wireless communications protocols for transmitting data to the communication infrastructure.
- A communication infrastructure, which receives data from all IIoT Wireless and Sensor modules connected to it and sends it to the DAEVIS monitoring system or the end user's SCADA system.
- Cloud: Where data is securely stored and processed, enabling real-time analytics and remote access for enhanced decision-making.

The diagram below **Error! No se encuentra el origen de la referencia.** shows an example of the InduEye full system, which is exemplified by a Thermoelectric generator module as a renewable energy generator module, that uses waste heat to generate electricity and an IIoT Wireless and Sensor module that communicates via the LoRaWAN protocol with a communication infrastructure that sends this data to the cloud to be visualised through the DAEVIS or SCADA platform implemented.

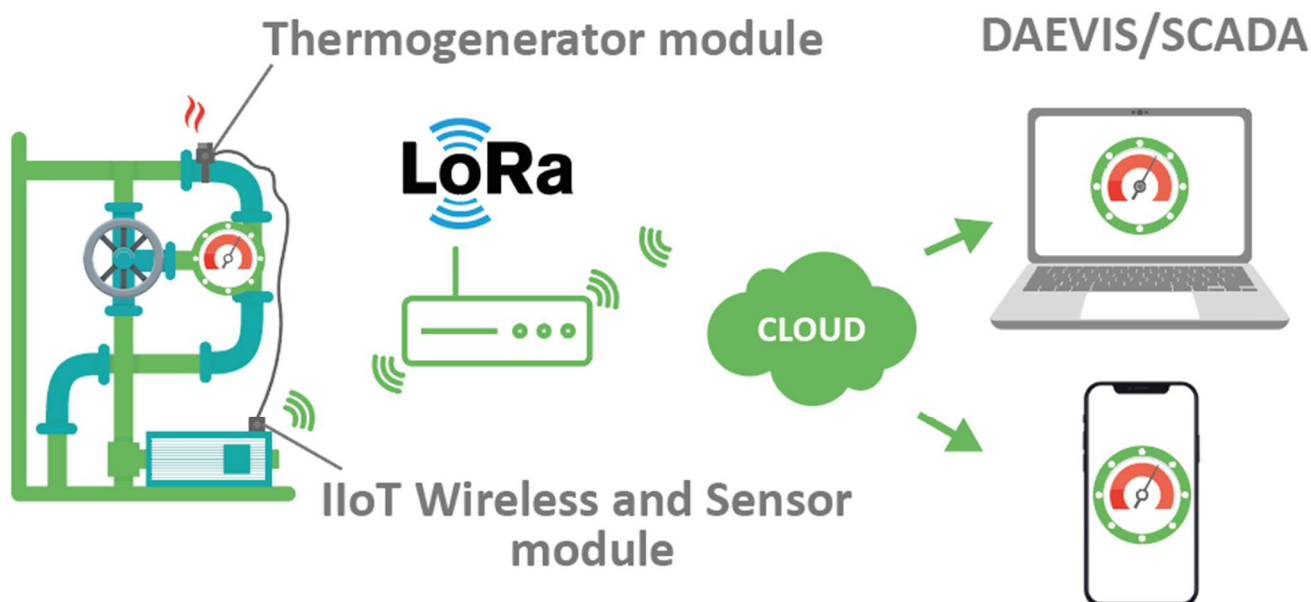


Figure 1.- InduEye System operation diagram

Product modules

Thermoelectric generator (IET)

The Thermoelectric generator is a solution that can be included with the InduEye system to power the IIoT Wireless and Sensor module. The module generates electrical energy by harnessing the waste heat through a temperature differential between the hot surface where it is installed and the ambient temperature.

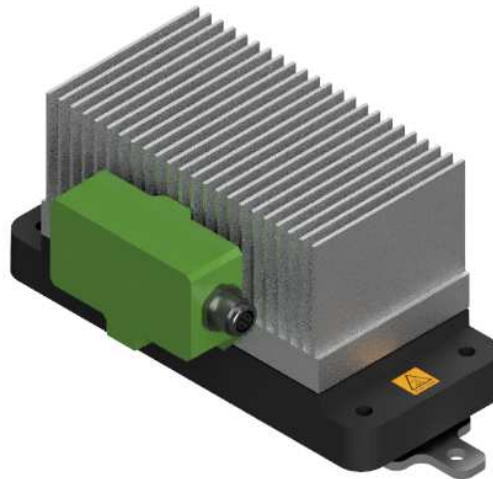


Figure 2.- Thermoelectric generator IET

The module offers uninterrupted, extended power supply for wireless transmitters. It boasts intrinsically safe certification, facilitating quick and hassle-free installation with no maintenance required. It provides redundant power for essential applications and can be attached to heat sources ranging from 50 to 150°C, featuring a durable design suitable for harsh environmental conditions.

! NOTES	You must follow Safety and Warnings notes in 1.2 and 0 Sections.
---	---

IET Module parts

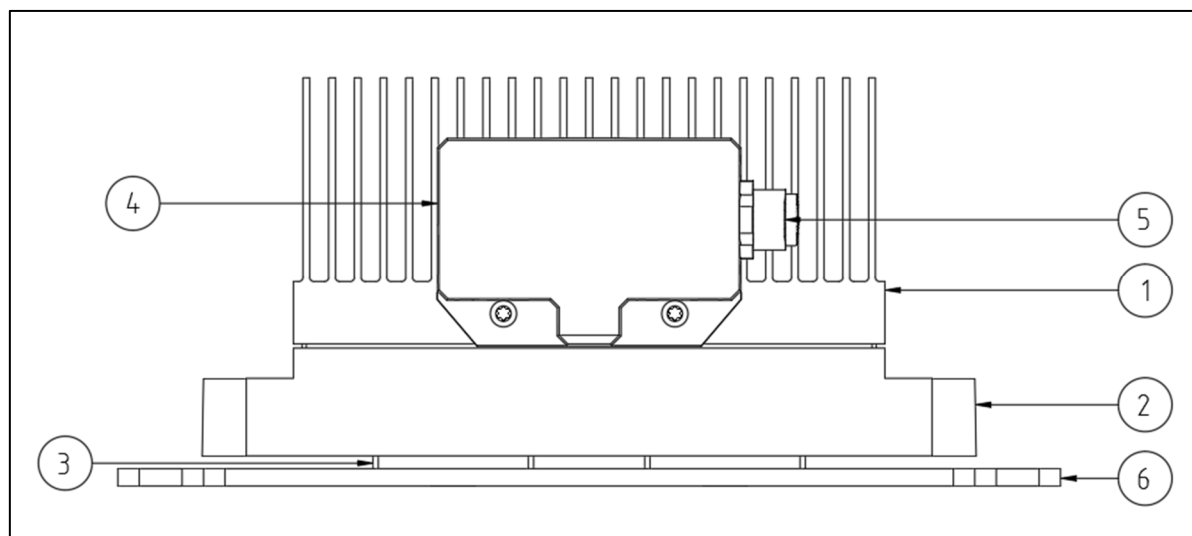


Figure 3 .- Components of Module IET

1. Heat sink.
2. Plastic base.
3. Heat collector.
4. Electronics enclosure.
5. Output power supply connector.
6. Mounting accessory.

Functionality

Output variables

By harvesting waste heat, the module can generate DC electrical energy at constant low voltage and variable current depending on the temperature of the installation surface.

Working areas

The module is suitable for all industries.

The module can work on any surface where heat is present, such as machines, ovens, pipes, hot walls, etc. and can be installed on both flat and circular surfaces.

Installation

Commissioning requirements

Prior to the installation process it is recommended to follow these instructions:

- Make sure that the temperature gradient between the hot surface and the ambient temperature is sufficient for the proper operation of the module, see Table 2 in the section “Technical data”. It is recommended to use calibrated temperature sensors.
- Make sure the distance between the Thermoelectric generator and the IIoT Wireless and Sensor module to be powered is suitable according to the cable length between the different modules.
- Always ensure that the installation hot surface is clean and smooth for the proper heat transfer to the module.
- It is recommended to install the module, if possible, without any accessories and the heat collectors in direct contact with the hot surface to obtain higher thermal efficiency and more electrical energy as shown in Figure 4.
- Performance can also be improved by installing the module with the heat sink fins in a vertical position as shown in Figure 5.
- **Any other type of mounting or use of any accessory is acceptable but can restrict the optimal performance.**

 CAUTION	• The module protection may be compromised if not utilised following the manufacturer’s guidelines. The Thermoelectric generator exposed to ambient temperatures higher than those specified in the section “Technical data” may reduce the lifespan of the module. • Avoid dropping, hammering or impacting the module housing before, during, or after installation. Always keep in mind the following safety instructions: • All electrical connections must be carried out by skilled and authorised personnel. • Only connect or disconnect in a de-energised state. • When installing the module in potentially hazardous locations, ensure that the module is grounded to the machine case. • Failure to follow these installation guidelines may result in injury. Use appropriate tools for all operations.
---	--

 NOTES	Do not install the product in a location with a corrosive atmosphere. If this cannot be avoided, ensure there is adequate ventilation. When installing the Thermoelectric generator, make sure that the heat collectors have good contact with the hot surface and there are no gaps present to avoid poor performance of the module (Figure 4).
---	--

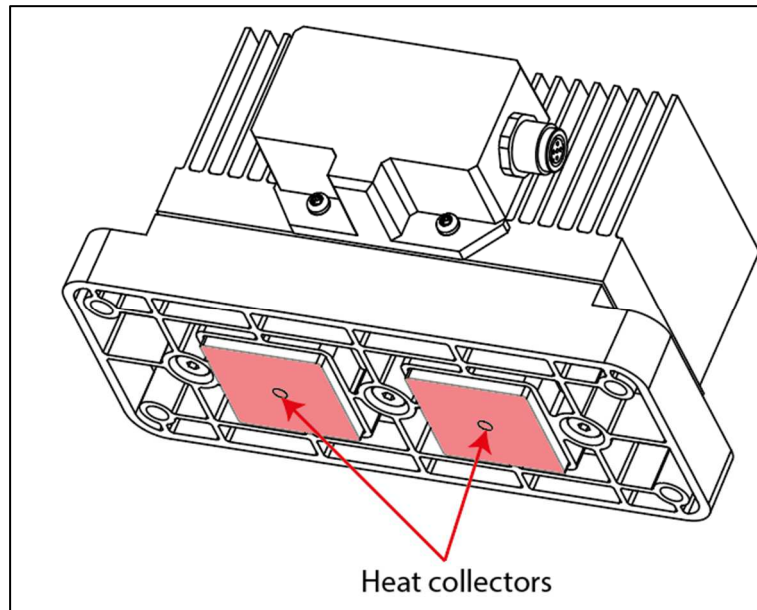


Figure 4.- Bottom view of the Thermoelectric generator (IET)

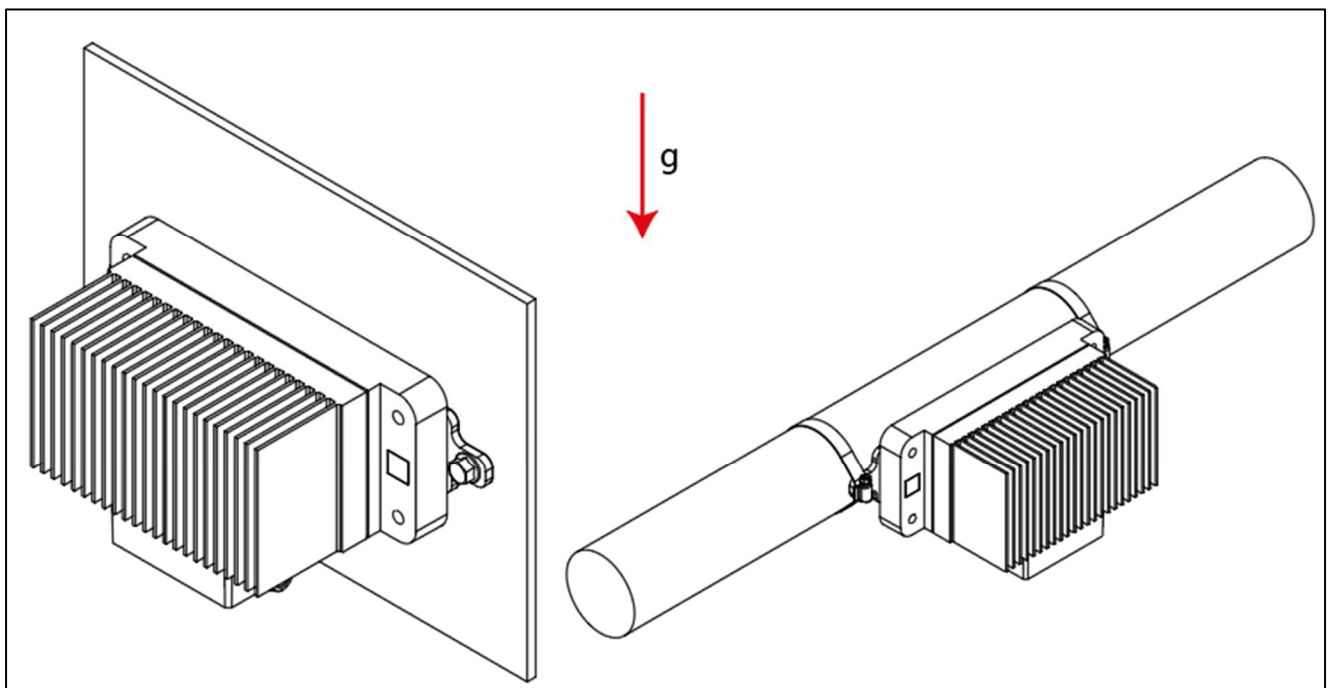


Figure 5.- Thermoelectric generator mounting options (IET) with vertically positioned heat sink fins

Optimal mounting – Screwing

In order to achieve a higher thermal efficiency and to obtain more electrical energy from the module, it is recommended to install the module without any accessories as shown in Figure 4 only on hot flat surfaces, by anchoring the module using the 4 holes available on the plastic base to insert 4 fixing screws as show in Figure 6.

! NOTES	The screwing mounting requires holes to be drilled on the flat surface. • The screwing mounting should only be installed on flat surfaces. • When installing the Thermoelectric generator, make sure that the heat collectors have good contact with the hot surface and there are no gaps present to avoid poor performance of the module (Figure 4).
---	--

Procedure

1. To guarantee optimal contact with the hot surface, clean and remove any residue to obtain a smooth surface.
2. The dimension of the hole diameter in the hot surface will be determined by the type of screw used, e.g., metric screw with M5 bolts or sheet metal screws with a maximum diameter of 5.5 mm and a minimum length of 22 mm. Therefore, select the type of screw that best suits the characteristics of the surface on which to be installed.
3. Insert the screws, with washers, and tighten them without deforming the plastic base of the Thermoelectric generator.

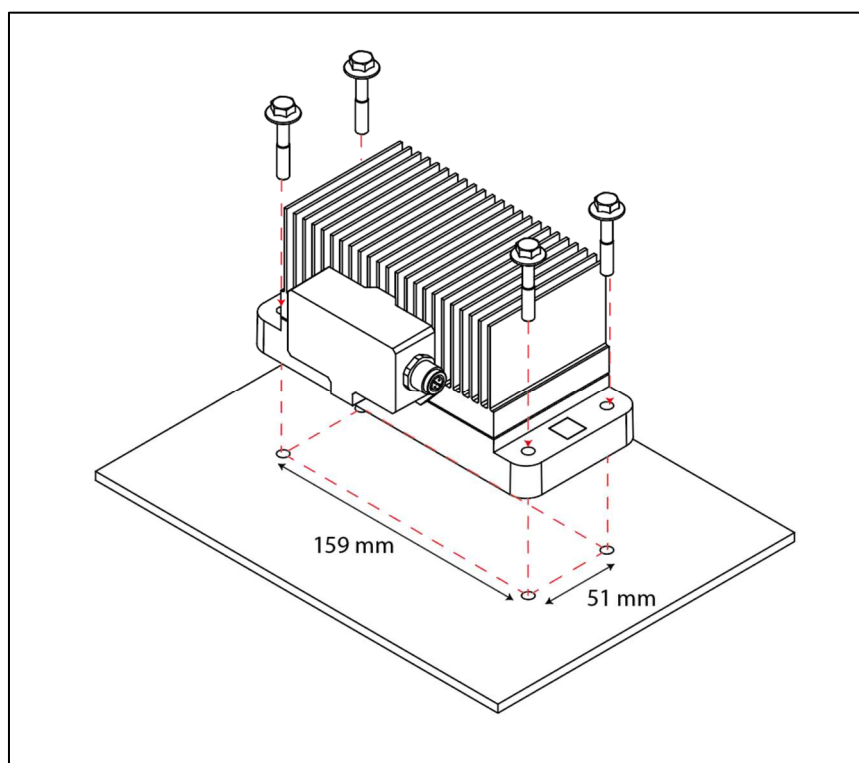


Figure 6.- Thermoelectric generator IET optimal mounting procedure

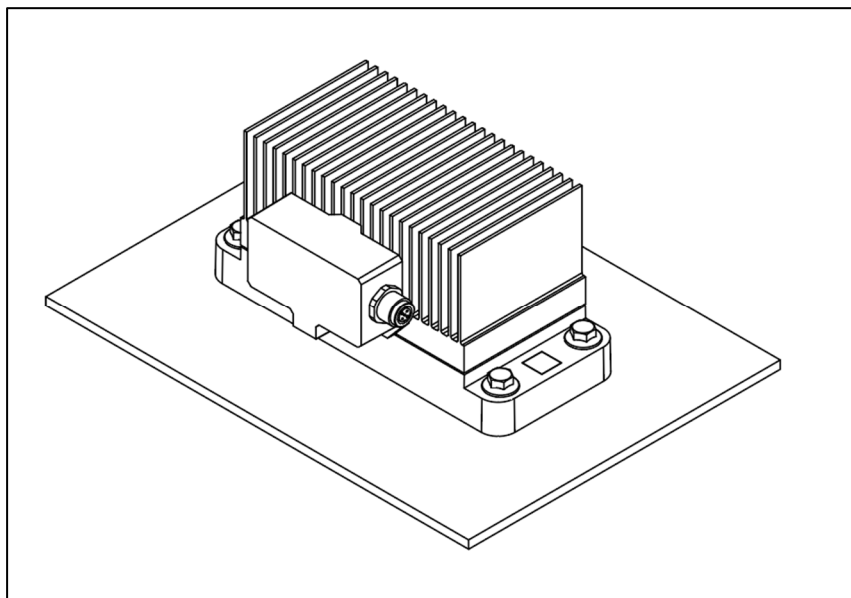


Figure 7.- Thermoelectric generator IET optimal mounting option

Flat or cylindrical surface mounting (accessory included)

The use of this accessory is recommended when it is not possible to machine four holes and a faster assembly is desired.

Parts included in the mounting kit:

- Fixing plate 0017M (Aluminium) – 1 unit (Figure 8). See accessories catalogue MUSPAI-1 for more information.
- Countersunk screw DIN7991 M5x12 – 2 units.

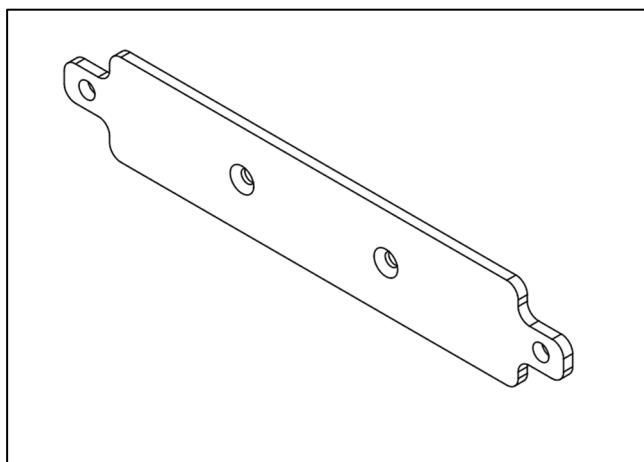


Figure 8.- Mounting kit accessory – fixing plate 0017M



NOTES

- Mounting on flat surfaces requires holes to be drilled on the surface.
- When installing the Thermoelectric generator with the mounting accessory (Figure 8), make sure that the bottom of the mounting accessory surface has good contact with the hot surface and there are no gaps to avoid the poor performance of the module.

Procedure

1. Clean and remove any residue to obtain a smooth surface.
2. For the installation on a circular surface, it is necessary to use a metal clamp that fits the mounting pipe as shown in Figure 9.
3. For installation on a flat surface, it is necessary to drill a hole, taking as a reference the distance between the holes in the top and lower tabs, and insert a screw with a 6 mm maximum diameter through the accessory as shown in Figure 10.
4. Insert the screws or metal clamps on the top and lower tabs, as shown on Figures 9 and 10, and tighten them until the module is properly fixed.

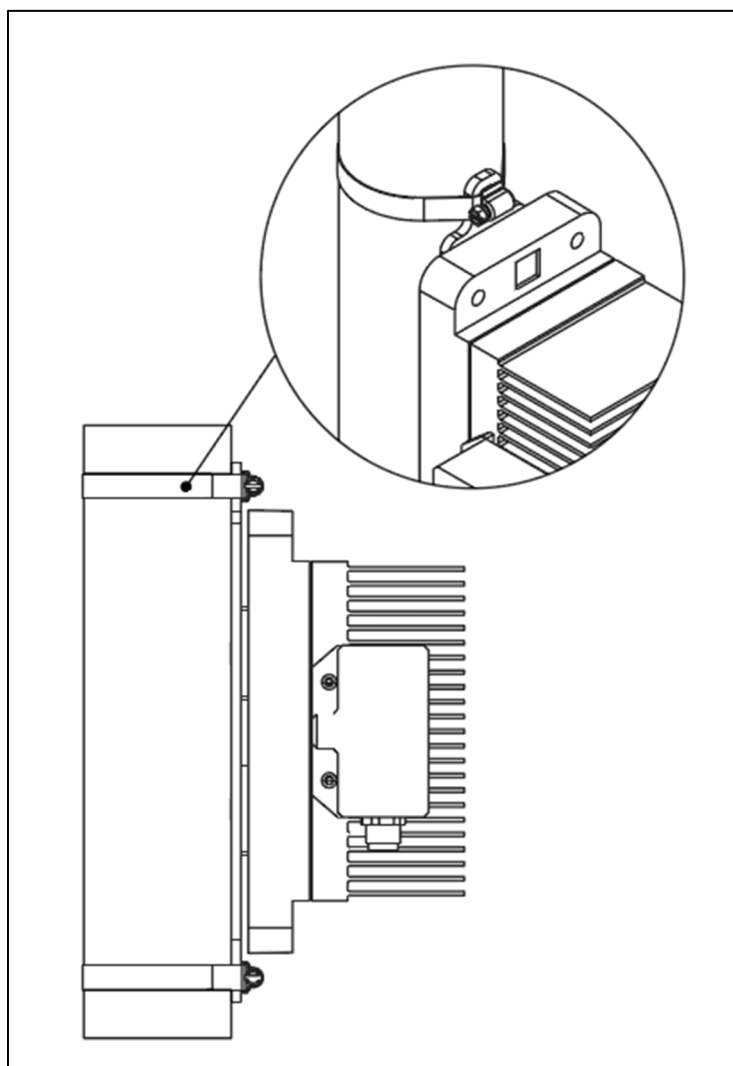


Figure 9.- IET Cylindrical mounting option with a metal clamp

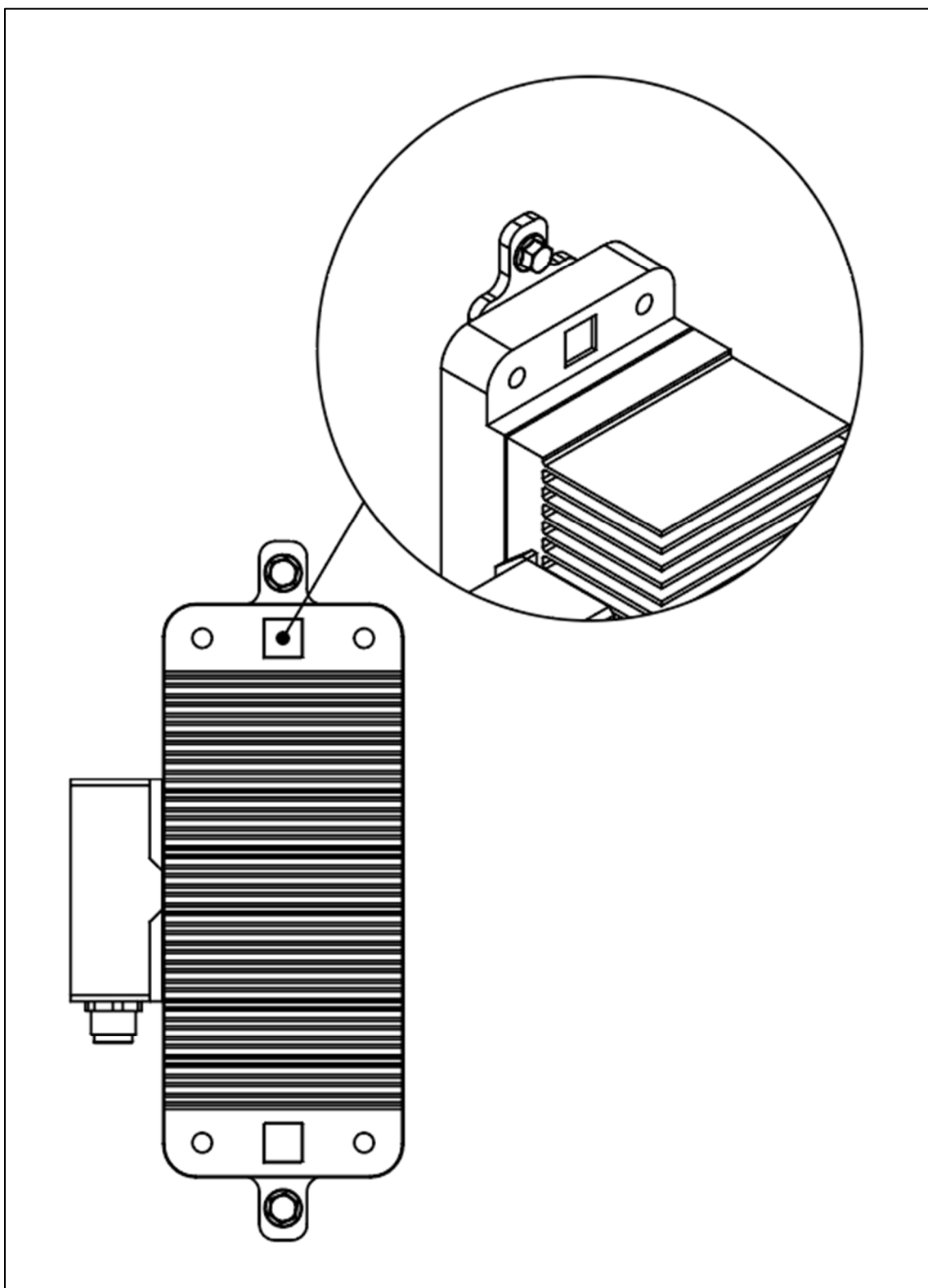


Figure 10.- IET Flat mounting option with a screw

Weldable flat surface (optional accessory)

If it is not possible to mount the module as described in section 0 to obtain a higher thermal and electrical efficiency, use the optional accessory shown in Figure 11, which allows the heat collectors to be in direct contact with the hot surface. No drilling on the surface is required, but welding instead.

Optional parts included in the mounting kit:

- Fixing plate 0018M (AISI304) – 2 units (Figure 11). (See accessories catalogue MUSPAI-1)
- Washer DIN125M5 AISI304 – 4 units.
- Self-locking nut DIN 985 M5 AISI304 – 4 units.

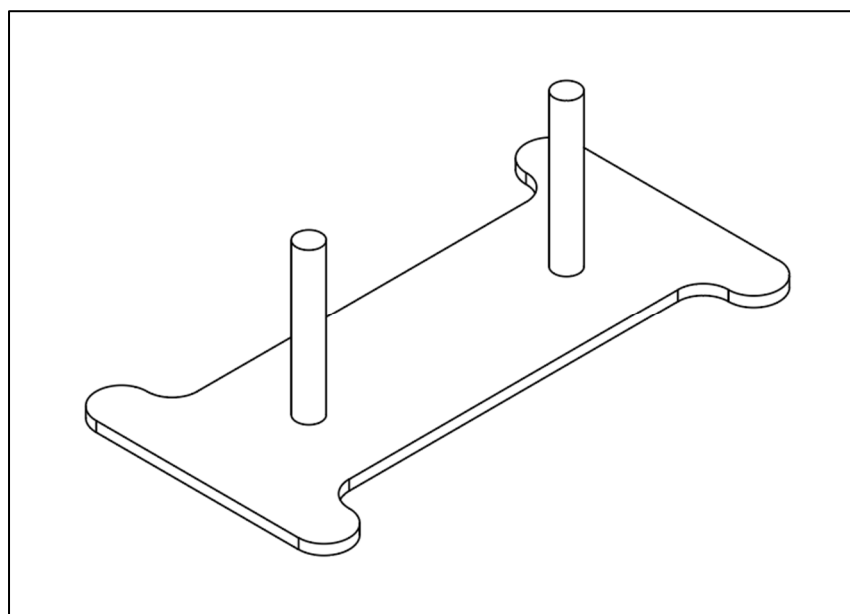


Figure 11.- Weldable mounting kit accessory fixing plate 0018M – Optional accessory

 NOTES	• Mounting in flat surfaces with this accessory requires arc welding on the surface. Check compatibility between materials. • When installing the Thermoelectric generator with the mounting accessory (Figure 11), make sure that the heat collectors have good contact with the hot surface and there are no gaps to avoid the poor performance of the module (Figure 4).
--	--

Procedure

1. To guarantee optimal contact with the hot surface, clean and remove any residue to obtain a smooth surface.
2. To install it, mount the mounting accessory on the Thermoelectric generator IET. Place it in the desired position on the surface and mark the outline of the mounting accessories.
3. Once the outline is marked, remove the mounting accessories, and weld them to the mounting surface as shown in red in Figure 13.
4. Once the mounting accessories have been welded, install the Thermoelectric generator. On each rod, the installation shall consist of a washer and self-locking nut. Once these components have been mounted on the 4 rods, tighten them homogeneously so that the equipment does not have more pressure on one side than on the other.

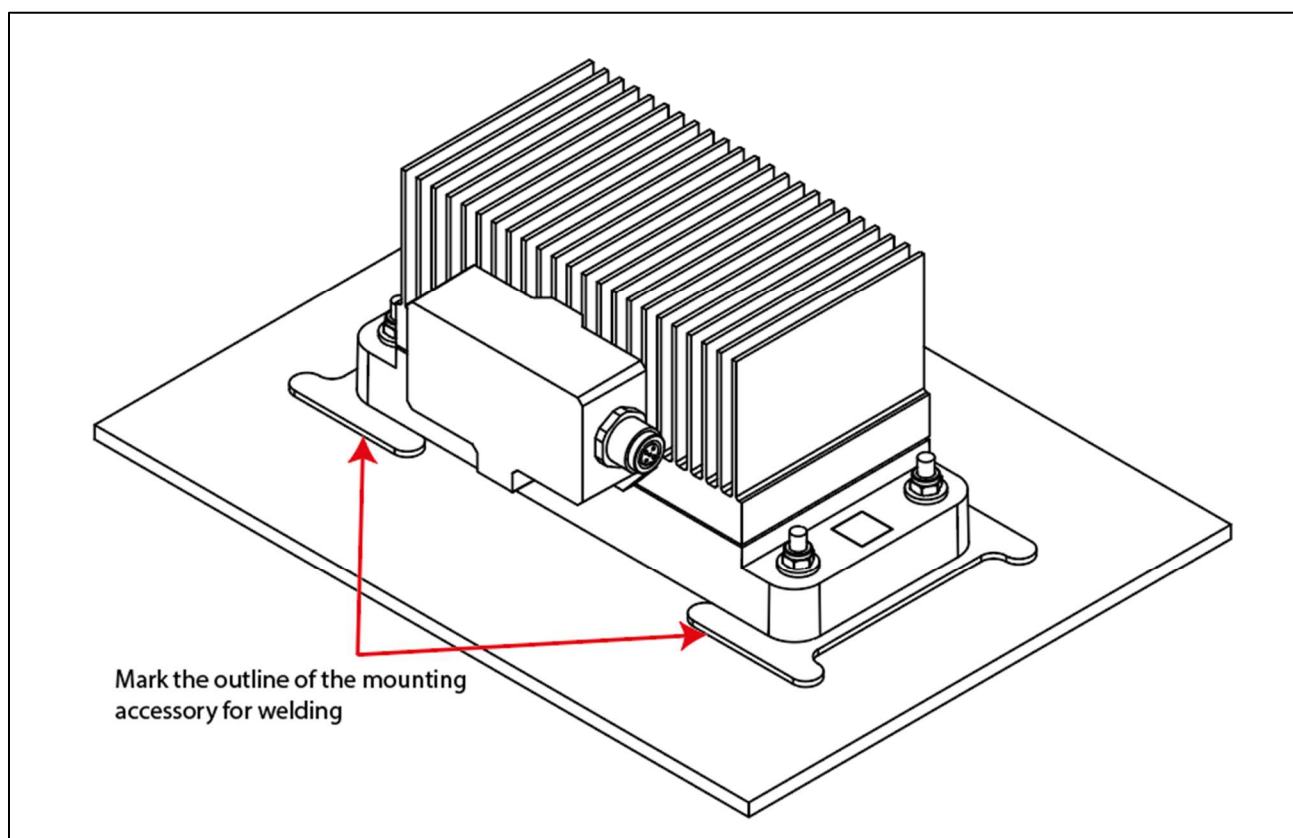


Figure 12.- Weldable mounting accessory used to mark the outline.

!
NOTES

The supports are made of stainless steel, be sure to use proper electrodes when welding.

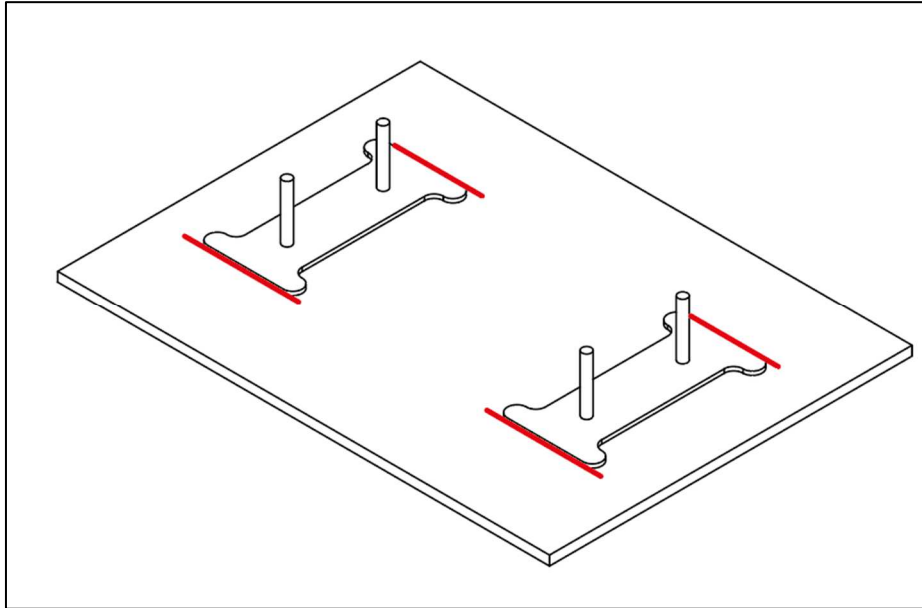


Figure 13.- Welding mounting accessories process

Output power connections

Preparing the connection

 Warning	Always keep in mind the following safety instructions: • All electrical connections must be carried out by skilled and authorised personnel. • Only connect or disconnect the module in a de-energised state.
 NOTES	• Refer to the chapter “Technical data” to consult the power supply output parameters. • Use cable with a circular cross section. To guarantee a secure cable gland, choose the appropriate outside diameter based on the plug connection type. • Always use a cable assembly with a shielded cable and connector. • The output power supply cable must only be connected to the IIoT Wireless and Sensor module once it has been properly anchored.

Physical connectivity

The Thermoelectric generator IET has been designed with safety in mind. The power supply connector is a poka-yoke so that it cannot be inserted incorrectly. If the connector does not fit properly, check the orientation to ensure the terminal is not damaged and then introduce it effortlessly.

The Thermoelectric generator IET power supply connector is an M12x1 female plug, A-Code 4P circular connector, as seen in Figure 14.

 Warning	All wiring should be carried out by a skilled electrician. Wiring must comply with all local standards and regulations. Follow local standards and regulations for wire type, size, colour, insulation voltage rating and other criteria.
---	--

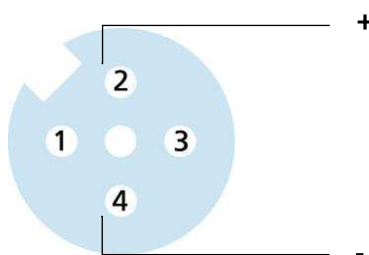


Figure 14.- Thermoelectric generator IET output power supply connector M12x1, A-Code 4P – Pin configuration

Table 1.- Power supply connector pins configurations

Pin	Function
1	Not connected
2	Power supply (+)
3	Not connected
4	Power supply (-)

To supply power from the Thermoelectric generator to the IIoT Wireless and Sensor module, the connection must be done via the aforementioned power supply cable: (0076M) M12x1 A Code 4P Male connector.

Procedure

- Inspect the power supply connector from the module and cable to be inserted for any obvious signs of damage or wear and tear.
- Insert and screw the male cable connector to the Thermoelectric generator output power supply connector, as shown in Figure 15.
- Wait until the IIoT Wireless and Sensor module is charged and the Gateway starts receiving data.
- On the other side, from the power generation module, in this case Thermoelectric generator, ensure proper connection between modules (Figure 16).
- Position the Thermoelectric generator unit to best suit the wireless module position (Figure 17).

- Secure the cable to the machine 120-150 mm away from the mounting location using an appropriately sized cable clamp. Do not coil the cable with a bending radius of less than 100 mm (Figure 18).

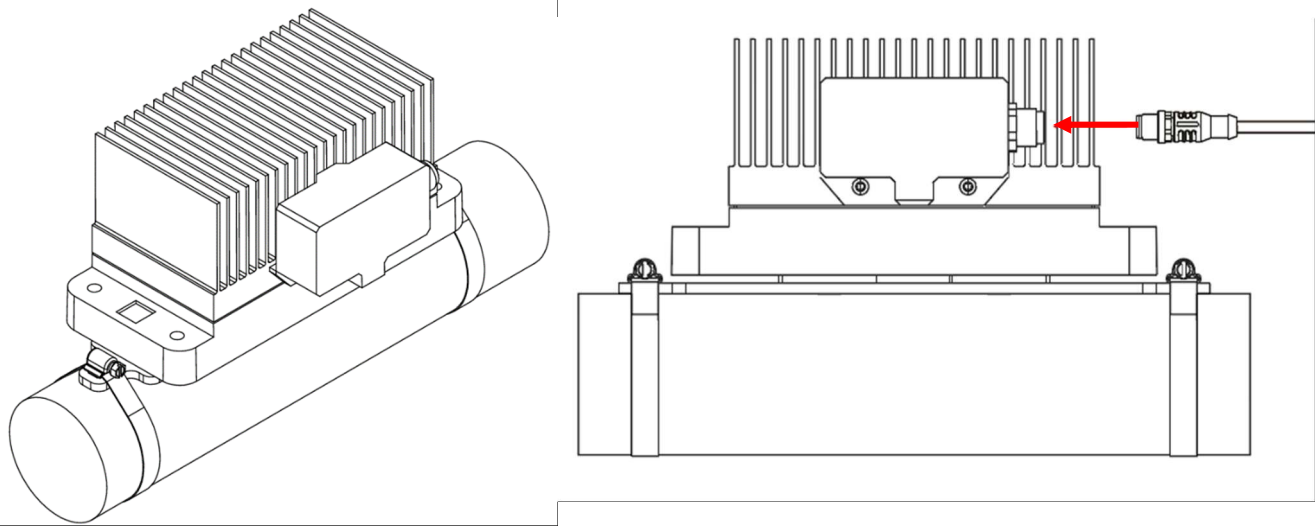


Figure 15.- Power supply (Thermoelectric generator – Tube mounting) connection

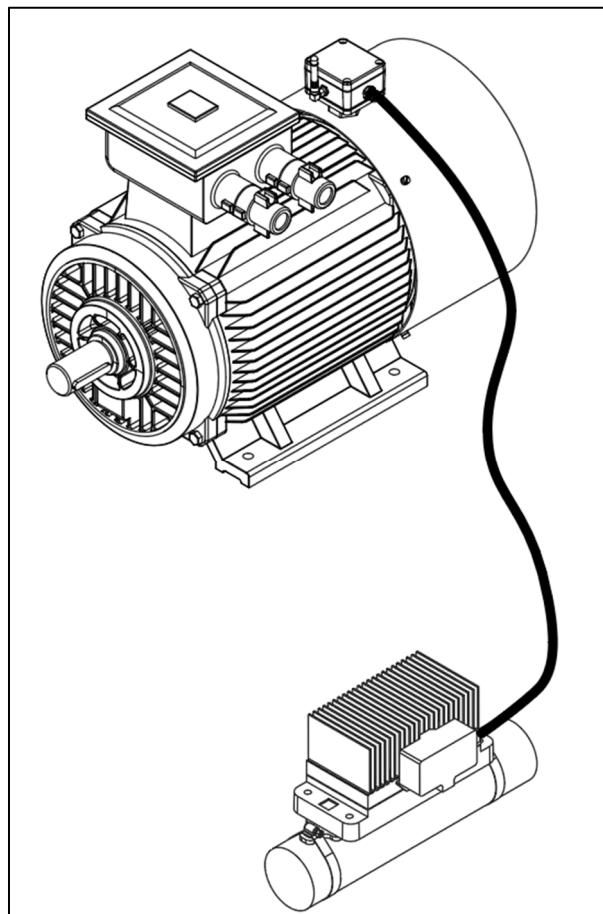


Figure 16.- Connection between the IIoT Wireless and Sensor module and the Generator module (Thermoelectric generator)

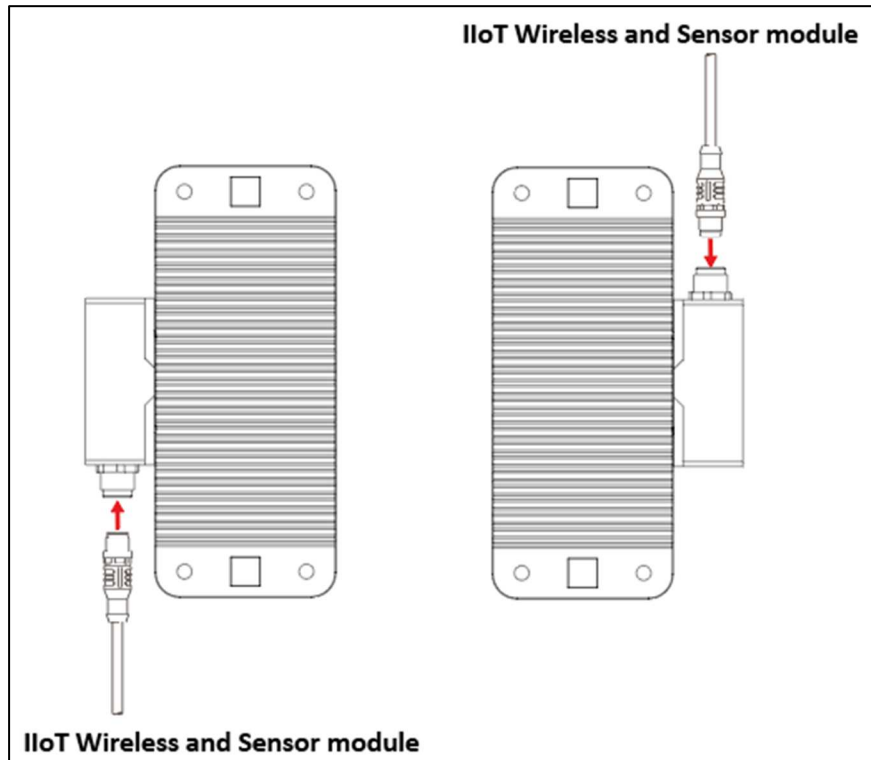


Figure 17.- Correct Thermoelectric generator orientation between modules

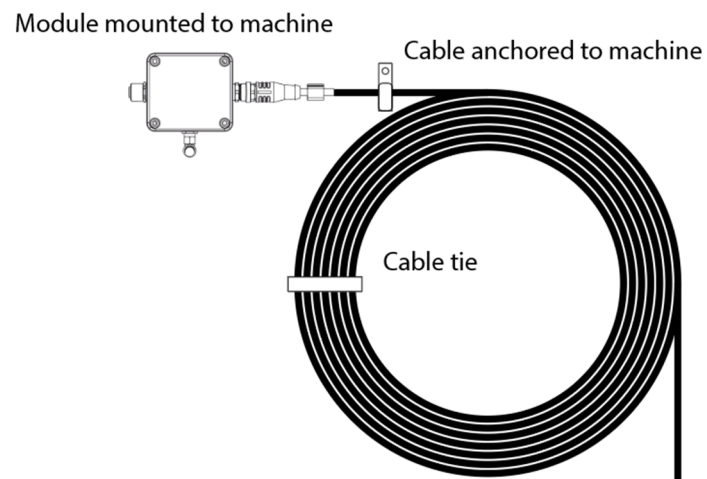


Figure 18.- Cable securing process

Generator module start up

We use the Thermoelectric generator to power the IIoT Wireless and Sensor module, developed by AEInnova to monitor parameters from the process in which it is installed.

Once the modules have been properly installed, commissioning should begin. The process is as follows:

1. The heat-intensive process starts.
2. The hot surface in contact with the Thermoelectric generator heats up.
3. Once the hot surface reaches a temperature differential of approximately 30°C from the ambient temperature, the Thermoelectric generator powers the IIoT Wireless and Sensor module and starts the charging cycle.
4. After the IIoT Wireless and Sensor module has fully charged, it proceeds to transmit data to the platform.

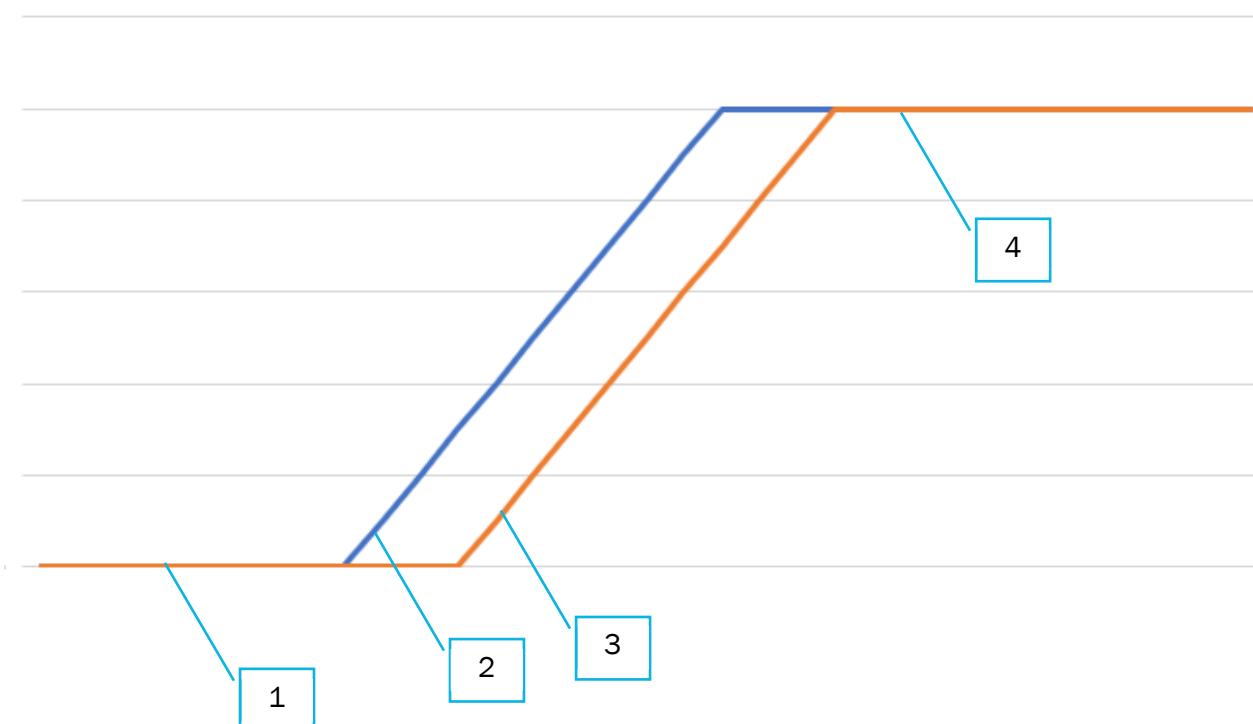


Figure 19.- Commissioning diagram (Temperature variation of the hot surface - blue line; Equipment charging process - orange line).

Servicing, diagnostics, and maintenance

Maintenance

- The responsibility for the safe use of this equipment lies with the user in accordance with the provisions of these instructions for use, as well as the technical documentation of each module supplied. Proper usage of the module eliminates the need for additional maintenance during regular operation.
- It is the user's responsibility to establish an Inspection and Maintenance plan for this equipment to guarantee its proper and safe use.
- Check the installation and cleanliness of the module. If any module becomes dirty or dusty, wipe with a soft cloth moistened with water or mild soap.

Troubleshooting

The system operator is responsible for taking appropriate measures to correct errors.

The InduEye system provides great reliability. However, problems may arise during operation. These can be caused by the following, e.g.:

- Process
- Signal processing
- Voltage supply
- Sensor

First fault rectification measures:

- Evaluation of fault messages
- Checking the output signal
- Treatment of measurement errors

Warranty

- The warranty shall cover the period indicated in the quotation presented to the purchaser or the purchase agreement.
- If any problems are experienced with this product, the customer should contact the Alternative Energy Innovations' representative from which this product was purchased.
- If a problem arises with this product, please inform us of the nature of the problem and the circumstances under which it developed, including the model specification and serial number. Any diagrams, data and other information you can include in your communication will also be helpful.
- The party responsible for the cost of fixing the problem shall be determined by Alternative Energy Innovations following an investigation conducted by Alternative Energy Innovations.

The purchaser shall bear the responsibility for repair costs, even during the warranty period, if the malfunction is due to:

- Improper and/or inadequate maintenance by the purchaser or user.
- Malfunction or damage due to a failure to handle, use, or store this product in accordance with the design specifications.
- Connection of the Thermoelectric generator to other devices different from those supplied by Alternative Energy Innovations.
- Use of this product in a location not conforming to the standards specified by Alternative Energy Innovations, or due to improper maintenance of the installation location.
- Failure or damage due to modification or repair by any party except Alternative Energy Innovations or an approved representative of Alternative Energy Innovations.
- Malfunction or damage from improper relocation of this product after delivery.
- Force majeure such as fires, earthquakes, storms/floods, thunder/lightning, or other natural disasters, or disturbances, riots, warfare, or radioactive contamination.
- Not following any of the instructions indicated in this manual, especially those mentioned in section 0.

Technical data

! NOTES	The safety instructions included with the delivery apply to authorised instruments (e.g., with Ex approval). These instructions may differ from those provided below, such as process conditions or voltage supply. All authorised documentation is available upon request and is supplied with the module.
---------------------------	---

Functional features

Input	Differential temperature between hot surface and ambient temperature.
Output	DC output power supply.

Physical features

Materials	Aluminium (Heat Sink, Heat collector, included mounting accessory), Stainless Steel AISI304 (optional accessory), PP20GF (Electronic enclosure), PPS40GF (Plastic base) and CuZn – Niquel plated (output power supply Connectors).
Weight	1.5 kg
Enclosure rating	IP67
Mounting	Without accessories (For more information see section 0). Flat or cylindrical surface mounting (Standard – For more information see section 0). Weldable flat surface (Optional – For more information see section 0).
Input connections	Cable connector for power supply M12x1 4p A-Code male.
Output connections	Output power supply connector M12x1 4P A-Code Female (Power)
Power Cable length	2 m (standard) to 10 m (on demand).

Working conditions

Ambient temperature	-20°C to 50°C
Ambient humidity	0 to 95% RH
Maximum surface temperature in contact with the module	50°C to 150°C (see operation temperatures Table 2).

Table 2.- Thermoelectric generator IET hot surface temperature range

T_{sur} \ T_{amb}	50	60	70	80	90	100	110	120	130	140	150
50											
40											
30											
20											
10											
0											
-10											
-20											

Electrical Features

Output voltage supply	5 V
Output current supply	0.5 A

Dimensions

Thermoelectric generator IET dimensions

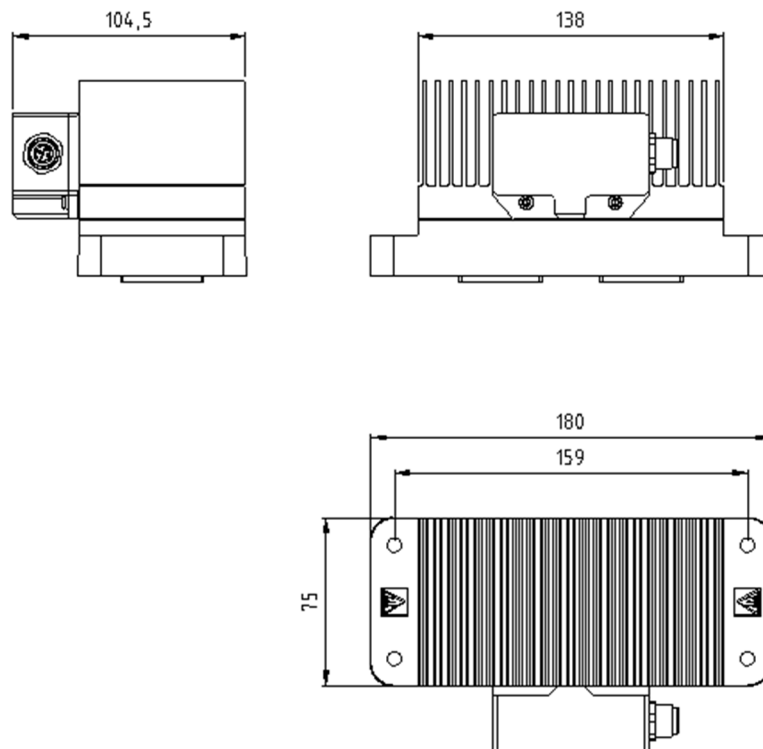


Figure 20.- Thermoelectric generator IET - Dimensions in mm

Standard Mounting Accessory

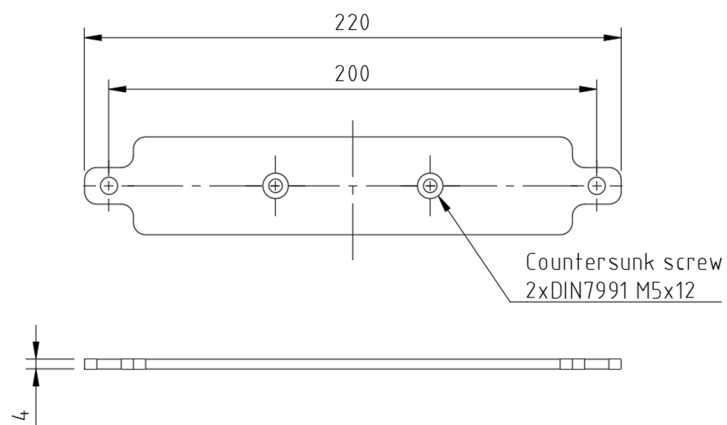


Figure 21.- Thermoelectric generator (IET) standard mounting accessory - Dimensions in mm

Regulatory compliance statements and marking

The equipment has been tested and complies with all relevant directives required for CE marking:

- Electromagnetic Compatibility Directive – 2014/30/UE
- Restriction of Hazardous Substances Directive (RoHS) - 2011/65/EU

The corresponding declaration of conformity is supplied with the product.

IIoT Wireless and Sensor module (IEPLV3)

The IIoT Wireless and Sensor module is the solution provided for accurately monitoring temperature and vibrations, with a high performance 3-axis accelerometer (Vibration sensor).



Figure 22.- IIoT Wireless and Sensor module IEPLV3

It provides a variety of module configurations and features:

- Vibration measurement.
- Temperature measurement.
- Combined vibration and temperature measurement.
- Multiple IIoT Wireless and Sensor IEPLV3 connections with the same power supply line.
- Wireless output data reliability, delivering rich LoRa data, protected by state of the art industrial-grade security (when operated as part of a well-formed network).
- Simple and easy installation.
- Power configurations include a renewable energy generator module power supply as standard and external DC power as an alternative option.

Module parts

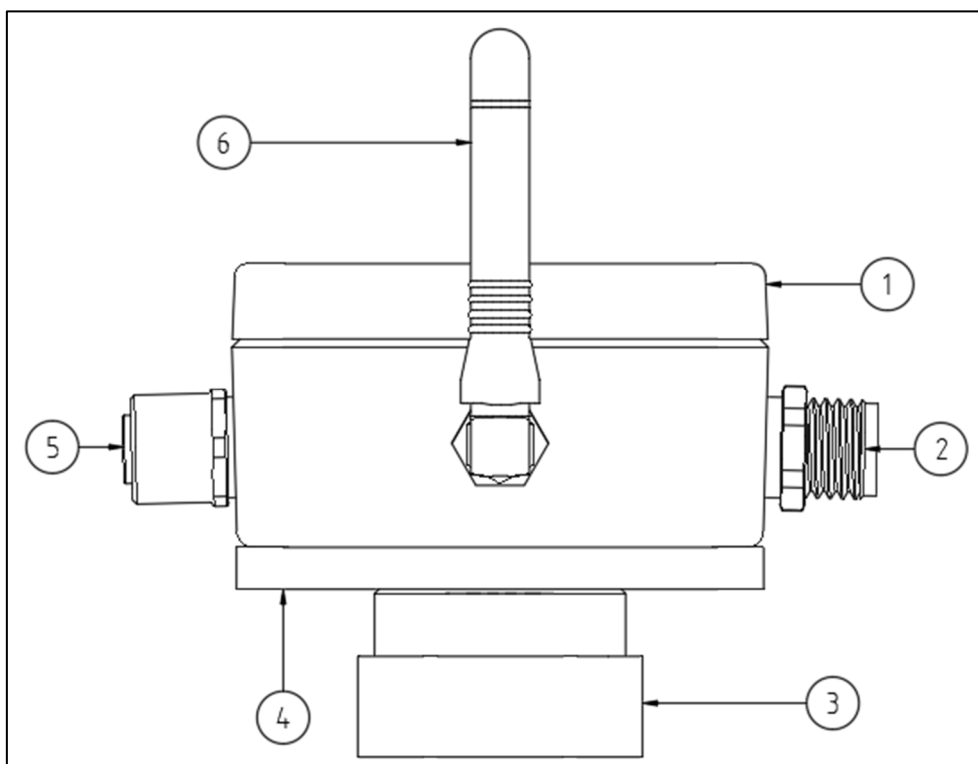


Figure 23 .- Components of IIoT Wireless and Sensor module IEPLV3

1. Electronics enclosure
2. Power supply connector
3. Fixing pad
4. Base mounting enclosure
5. Temperature sensor connector. Bypass power supply option
6. Antenna LoRa – Wireless communication

Functionality

Variables measured

Vibration: tri-axial vibration, in mm/s, based on the International Standard ISO 20816-1, “Mechanical Vibration – Measurement and evaluation of machine vibration”.

Temperature: given in °C.

Working areas

The module is suitable for all industries.

The module is suitable for vibration measurements made on rotating, non-rotating and non-reciprocating parts of any kind of machinery. It is applicable for measuring radial shaft vibration regarding the monitoring of radial clearances but excludes axial shaft vibration.

Installation

Prior to the installation process it is recommended to follow these instructions:

- Install the Wireless Gateway and check that it is working correctly before you activate the InduEye.
- Connect the power supply to the IIoT Wireless and Sensor module only when you are prepared to commission the module.

 CAUTION	• The IIoT Wireless and Sensor module protection may be compromised if not utilised following the manufacturer's guidelines. • The IIoT Wireless and Sensor module has heat-sensitive components inside. Exposure to ambient temperatures above those specified in the section "Technical data" may reduce the lifespan of the module. • Avoid dropping, hammering or impacting the module housing before, during, or after installation. Always keep in mind the following safety instructions: • All electrical connections must be carried out by skilled and authorised personnel. • Only connect or disconnect in a de-energised state. • When installing the module in potentially hazardous locations, ensure that the module is grounded to the machine case. • Failure to follow these installation guidelines may result in injury. • Use appropriate tools for all operations.
---	--

 NOTES	• Install the module where radio signals have no obstacles, avoiding walls, pipes or other emitters. • Do not install the product in a location with a corrosive atmosphere. If this cannot be avoided, ensure there is adequate ventilation.
---	--

Adhesive mounting (standard)

The module must be fixed to the surface of the machine to be monitored, using structural adhesives resistant to temperatures above 100°C (epoxy-based, polyurethane-based, or cyanoacrylate-based structural adhesives are recommended) applied to the bottom of the fixing pad.

Procedure

1. To guarantee optimal adhesive bonding, clean the mounting surface and remove any residue or paint using a wire brush and a suitable cleaner, and proceed to degrease the adhesion area.
2. If said surface has a radius of curvature lower than 150 mm, a smooth and flat surface is required, which can be obtained by milling or polishing the surface where the fixing pad is to be placed (Figure 24). It is highly recommended to carry out this process to ensure a strong bond between the module and the machine to be monitored.
3. Apply a little amount of adhesive to the bottom of the fixing pad (Figure 26).
4. Determine the orientation of the axis on the machine according to the axis present on the module label (Figure 27).
5. Firmly press the fixing pad to the mounting location to remove the excess adhesive from beneath.
6. Secure the module to the surface until the adhesive can sustain its weight. Make sure the fixing pad does not slip on the adhesive.
7. Allow the recommended curing time for the adhesive.
8. Install the cable connections.

 NOTES	- Although for curved surfaces larger than 150 mm it is possible to install the module without machining, it is highly recommended to obtain a flat installation surface whenever possible to obtain a strong bond between the module and the machine to be monitored. - Adhesive cure time will depend on the type of adhesive used. See adhesive manufacturer's datasheet for more information.
--	--

 NOTES	- To remove the module from the machine, it is necessary to apply a debonding agent to the adhesive during the removal process. There is no universal debonding agent available due to the variety of adhesives. See adhesive manufacturer's data sheet for more information. - Another alternative for removing the module is to remove the enclosure by unscrewing it from the fixing pad by hand and supporting the fixing pad with a hexagon spanner 30 (Figure 28). This leaves only the fixing pad, which can be removed with a careful lateral strike.
--	--

Prepare flat surface
with spot face tool



Figure 24.- Flat surface for fixing pad

Fixing pad
Adhesive

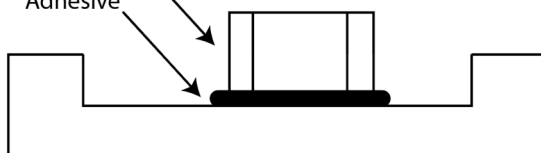


Figure 25.- Adhesive applied on the fixing pad

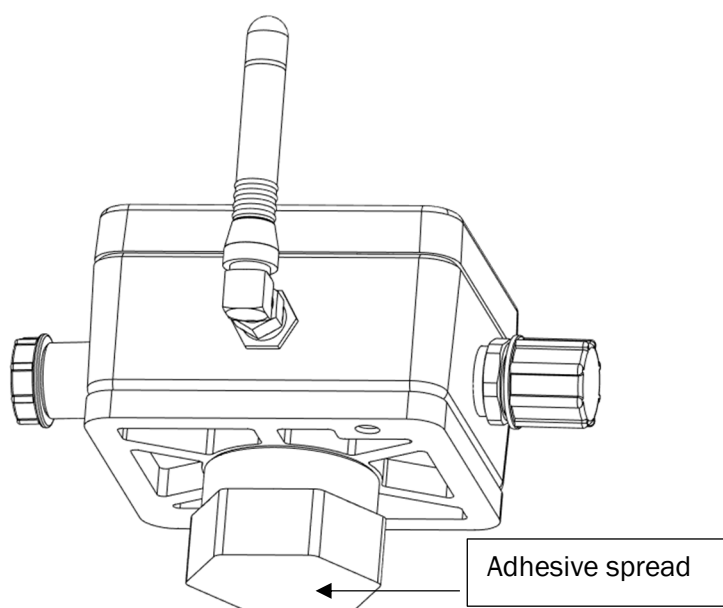


Figure 26 .- Application of the glue on the fixing pad of the module

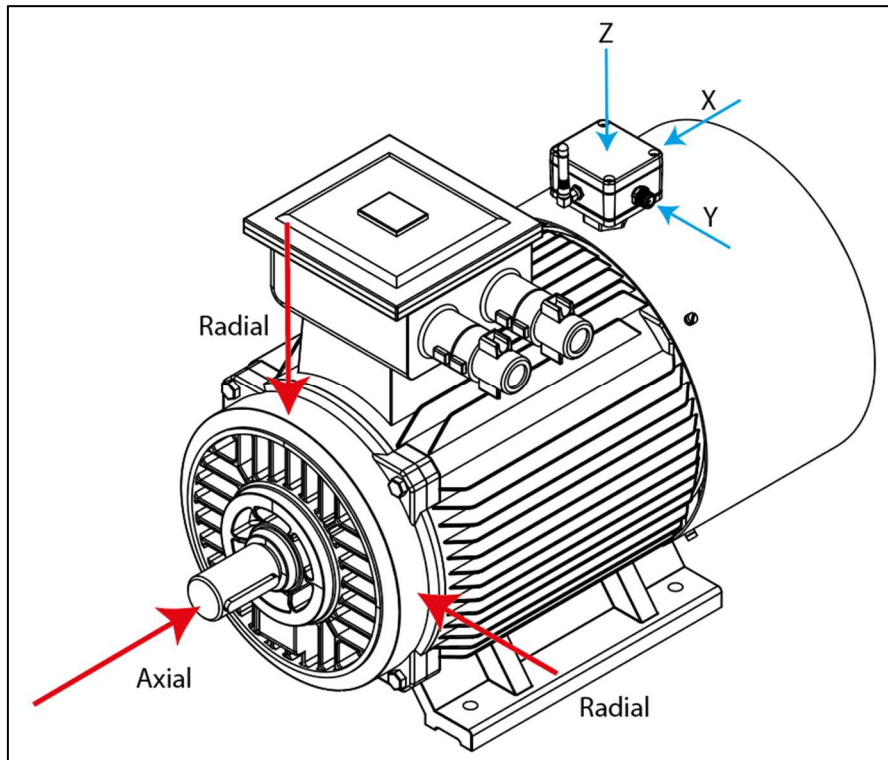


Figure 27.- Module installation – Axis orientation

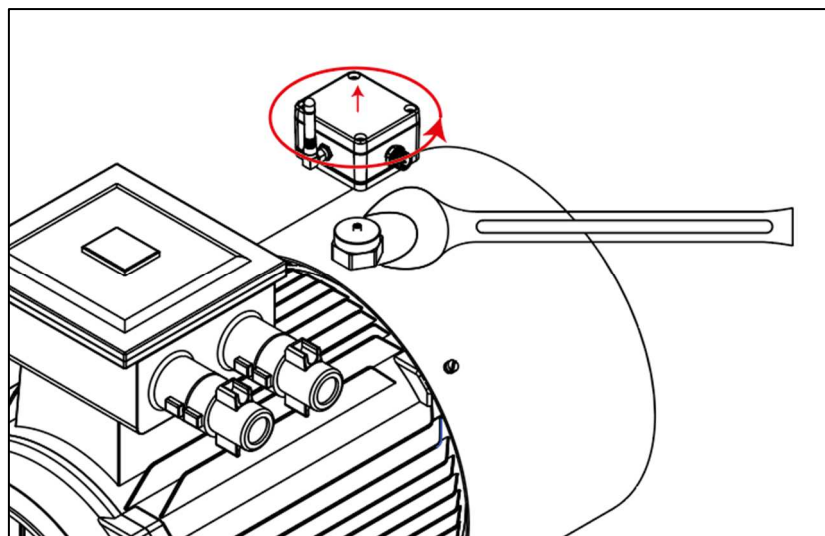


Figure 28.- Unscrewing the enclosure from the fixing pad

Motor fin mounting (optional)



Figure 29.- Motor fin mount pad

Procedure

1. Remove any paint or dirt from the motor cooling fins before installing.
2. Clean the mounting area with a spray degreaser that will not leave a residue.
3. Prepare adhesive following the manufacturer's instructions.
4. Apply adhesive to the sides and the bottom of the motor fin mount pad.
5. Place the motor fin mount pad between the motor fins at the appropriate location.
 - a. The mount pad must fit between the motor fins and contact the motor casing.
 - b. Motor fin mount pads are available for motors (available in the accessories accelerometers market) in various dimensions and heights, e.g., 12.7x31.75 mm, 12.7x50.8 mm, 6.35x44.45 mm, 6.35x25.4 mm, etc. Select the one that fits the available space between the fins to reduce the amount of adhesive.
6. To transfer vibration from the motor to the sensor, press the motor fin mount pad firmly into position, ensuring that the bottom is in contact with the motor casing:
 - a. Avoid placing the motor fin mount pad on the top of the fins, since this may prevent direct contact with the motor casing (see Figure 30 below, left).
 - b. The motor fin mount pad tip should be as flat as possible against the motor casing (see Figure 30).
7. When installing the fin mount pad, use a spatula to redirect any excess adhesive.
8. Fill in any residual spaces with adhesive to ensure the motor fin mount pad remains in place.
9. Secure the motor fin mount pad to the surface until the adhesive can sustain its weight. Make sure the mount pad does not slip on the adhesive.
10. Allow the adhesive to cure completely.
11. Install the module following the adhesive mounting instructions.

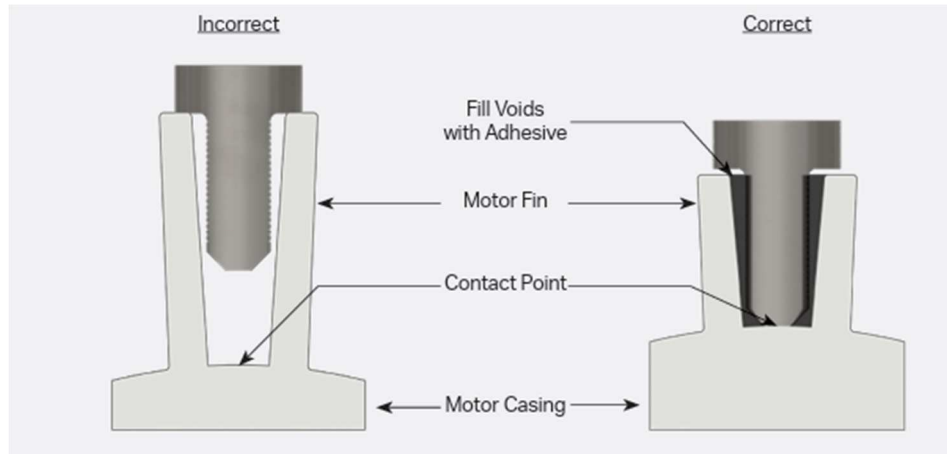


Figure 30.- Motor fin mount pad – Procedure installation

Measuring position

Non-rotating parts, such as small electric motors, bearings and support housing, should be measured to understand the total vibration of the machine as they respond to dynamic forces from rotating elements. Figure 31 and Figure 32 illustrate typical measurement sites.

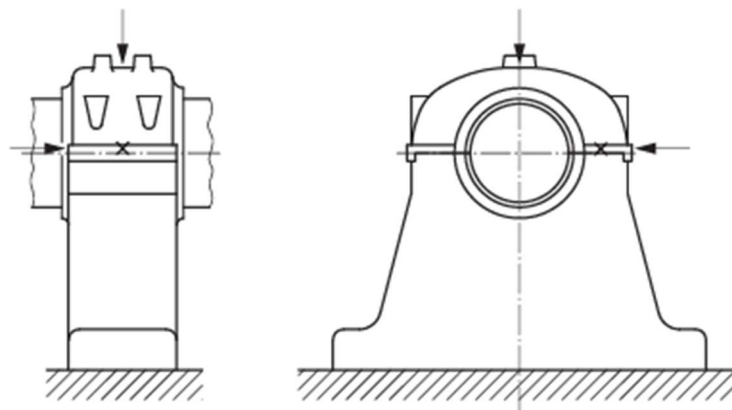


Figure 31.- Measuring points for pedestal bearings

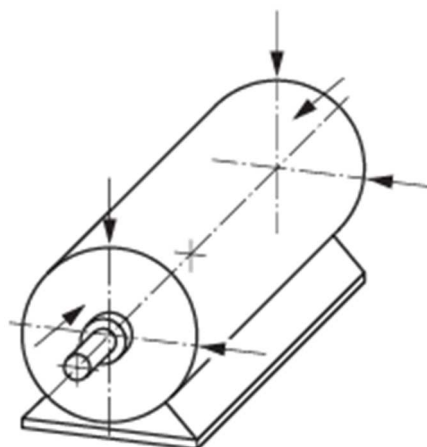


Figure 32.- Measuring points for small electrical machines

Powering the IIoT Wireless module and Sensor with the energy generation module

For typical applications, Alternative Energy Innovations' IIoT modules use renewable energy sources such as heat, air or sunlight. In this section, we use the Thermoelectric generator, a module developed by Alternative Energy Innovations to transform heat into electrical energy, as an example.

For additional information, please refer to the Thermoelectric generator User Manual-MUSIET-1.

Preparing the connection

 Warning	Always keep in mind the following safety instructions: • All electrical connections must be carried out by skilled and authorised personnel • Only connect or disconnect the module in a de-energised state.
--	---

 NOTES	• Refer to the chapter “Technical data” to consult power supply input parameters. • Use cable with a circular cross section. To guarantee a secure cable gland, choose the appropriate outside diameter based on the plug connection type. • Depending on the kind of power supply or signal input connection (for example, temperature), always use a cable assembly with a shielded cable and connector. • The power supply cable must only be connected to the module once it has been properly anchored.
--	---

Physical connectivity

The IIoT Wireless and Sensor module (IEPLV3) has been designed with safety in mind. The power supply connector is a poka-yoke so that it cannot be inserted incorrectly. If the connector does not fit properly, check its orientation to ensure the terminal is not damaged and then introduce it effortlessly.

The IIoT Wireless and Sensor module (IEPLV3) power supply connector is an M12x1 male plug, A-Code 4P circular connector, as seen in Figure 14.

 Warning	All wiring should be carried out by a skilled electrician. Wiring must comply with all local standards and regulations. Follow local standards and regulations for wire type, size, colour, insulation voltage rating, and other parameters.
--	--

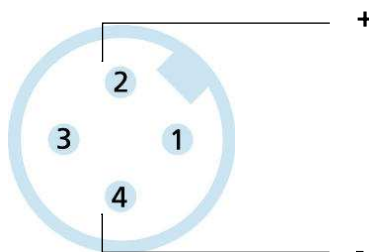


Figure 33.- IIoT Wireless and Sensor module (IEPLV3) Power supply connector M12x1, A-Code 4P – Pin configuration

Table 3.- Power supply connector pins configurations

Pin	Function
1	Not connected
2	Power supply (+)
3	Not connected
4	Power supply (-)

To supply power from the renewable power generator used such as a Thermoelectric generator (Figure 15) to the IIoT Wireless and Sensor module (IEPLV3) the connection must be done via the aforementioned power supply cable (0076M) M12x1 A Code 4P Female connector.

Procedure

1. Inspect the power supply connector from the module and the cable to be inserted for any obvious signs of damage or wear and tear.
2. Insert and screw the cable connection from the power generation module, in this case a Thermoelectric generator (male connector) to the IIoT Wireless and Sensor module power supply connector (female connector), as shown in Figure 34.
3. On the other side, from the power generation module, in this case a Thermoelectric generator, ensure proper connection between the modules (Figure 16).
4. Wait until the IIoT Wireless and Sensor module is charged and the Gateway should start receiving data.
5. Secure the cable connection between the modules to the machine 120-150 mm away from the mounting location using an appropriately sized cable clamp. Do not coil the cable with a bending radius of less than 100 mm (Figure 18).

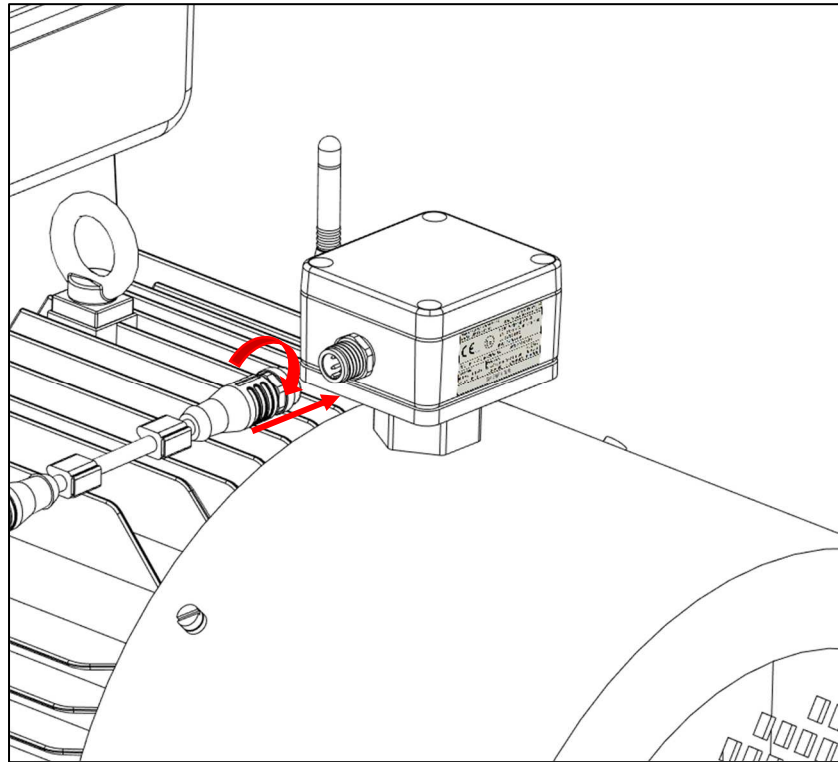


Figure 34.- Connecting the power supply to the InduEye

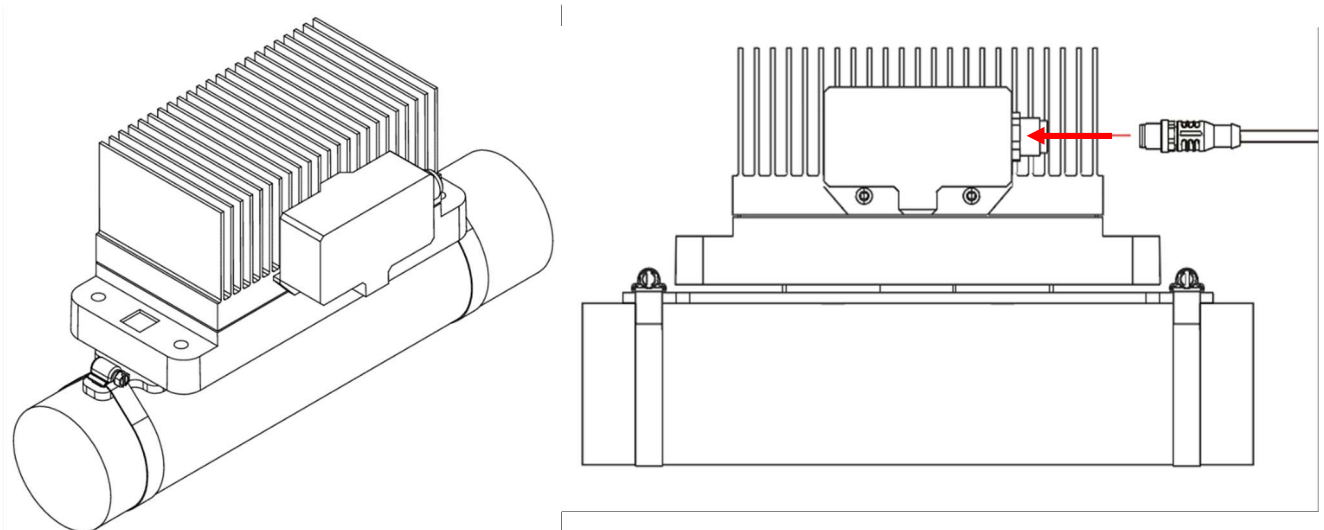


Figure 35.- Power supply (Thermoelectric generator – Tube mounting) connection

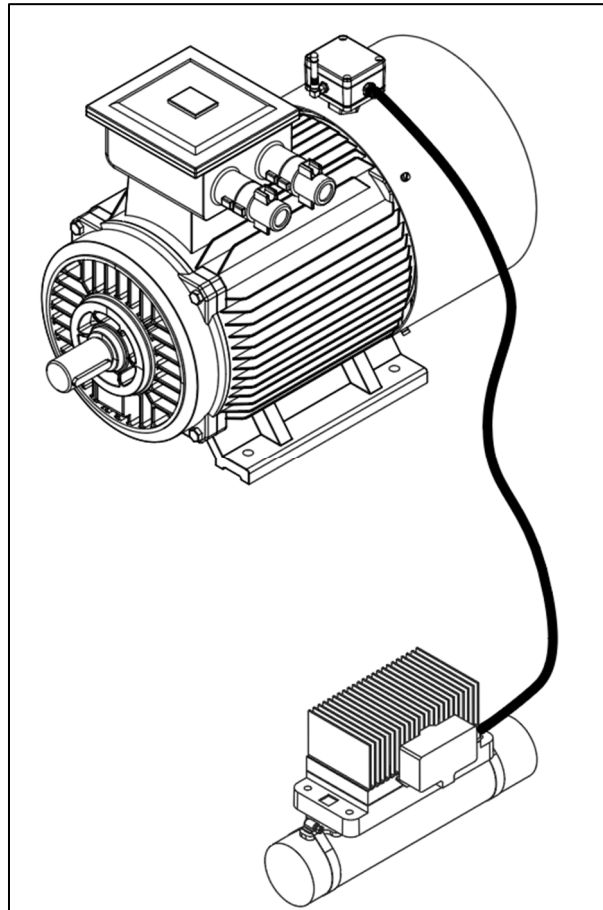


Figure 36.- Connection between InduEye and Power supply (Thermoelectric generator)

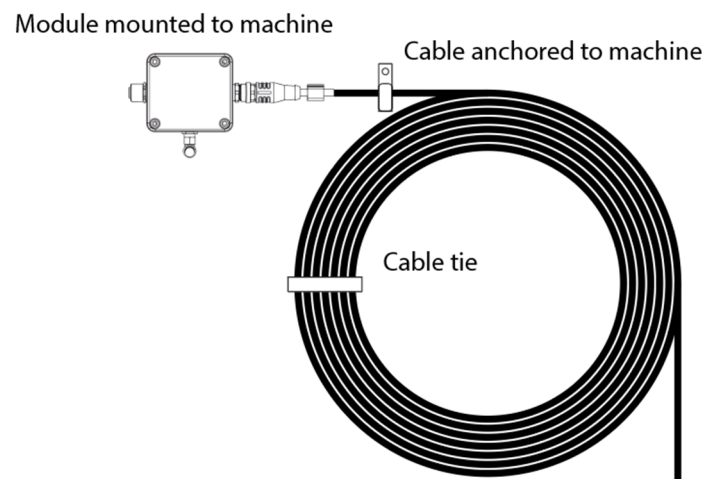


Figure 37.- Cable connection securing process

IloT Wireless and Sensor module commissioning

Once the modules have been properly installed, the commissioning should begin. The process is as follows:

5. The heat-intensive process starts.
6. The hot surface in contact with the Thermoelectric generator heats up.
7. Once the hot surface reaches a temperature differential of approximately 30°C from the ambient temperature, the Thermoelectric generator powers the IloT Wireless and Sensor module and starts the charging cycle.
8. After the IloT Wireless and Sensor module is fully charged, it proceeds to transmit data to the platform.

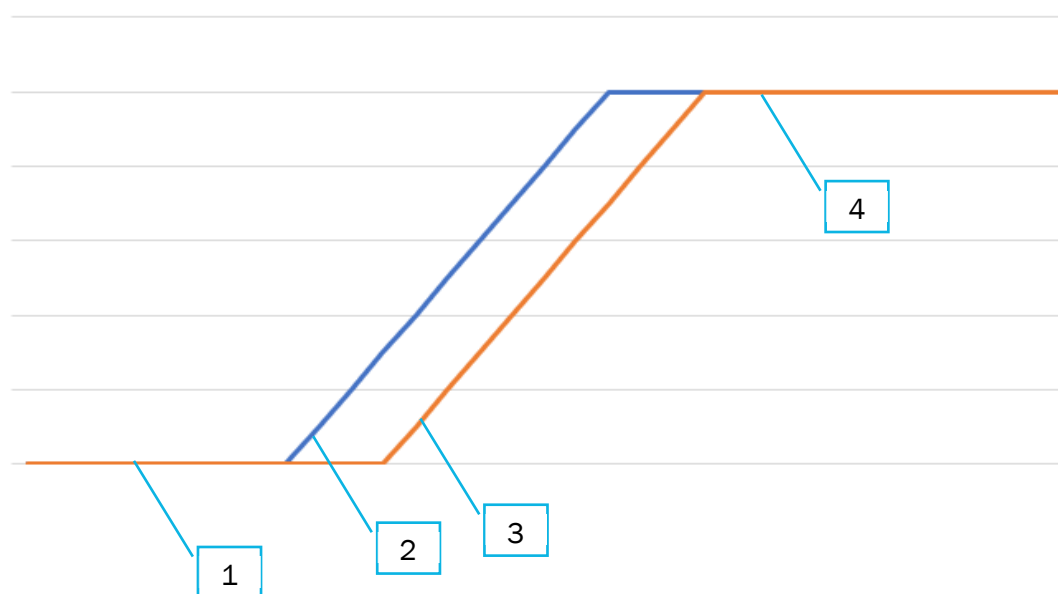


Figure 38.- Commissioning diagram (Temperature variation of the hot surface in contact with the Thermoelectric generator - blue line; IloT Wireless and Sensor module charging process - orange line).

Powering the module with external DC power

The IloT Wireless and Sensor module (IEPLV3) also has the possibility to be powered externally via a DC power supply. Refer to the chapter “Technical data” to consult power supply input parameters and cable features.

The module must be supplied with external DC power via a cable with a M12x1 A-Code 4P female connection (Figure 40). If you decide to mount your own cable with an external connector (Figure 39), you must follow the pin configuration (Figure 40 and Table 1) and the mounting process described in Figure 41.

! NOTES

You must follow the instructions and procedures described in the Powering the IloT Wireless module and Sensor with the energy generation module section to power the IloT Wireless and Sensor module (IEPLV3).



Figure 39.- Field-Wireable female connector for externally powered modules M12x1 4P, A-Code

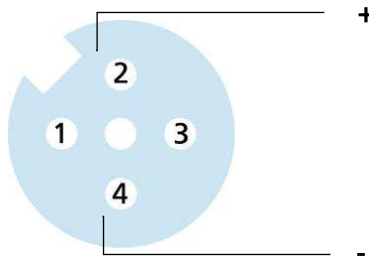


Figure 40.- Cable power supply M12x1 4P, A-Code female connector – Pin configuration

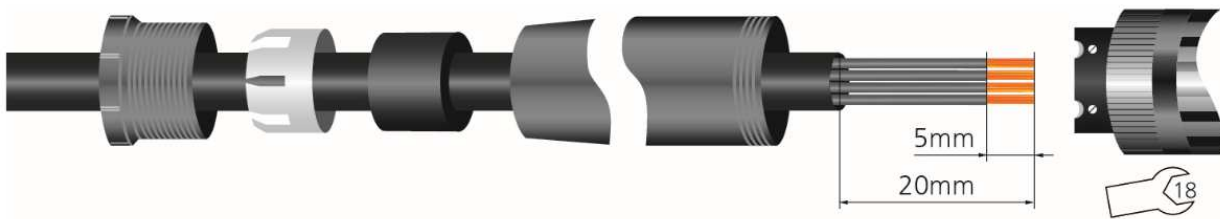


Figure 41.- Connection between cable and field-wireable connector



Warning

Even if the equipment is protected, none of its connectors should be left open and unconnected.

Powering multiple IIoT Wireless and Sensor modules (optional)

One of the features of the InduEye system is that several modules can be powered simultaneously with the same power supply line as shown in Figure 42. This is useful when you have several motors in series or close to each other in the same process.

In order to power the module and routing cables, the instructions and procedures in the Powering the IIoT Wireless module and Sensor with the energy generation module section shall be followed.

Use the same double-sided M12x1 4P A-Code male-female cable connector (0076M) that is used for power supply to connect the IIoT Wireless and Sensor modules, as shown in Figure 43. The connection is made via the power connector and the temperature sensor connector or power supply bypass of each module. See IIoT Wireless and Sensor module (IEPLV3) in Figure 3.

Refer to the chapter “Technical data” to consult the power supply input parameters and cable features.

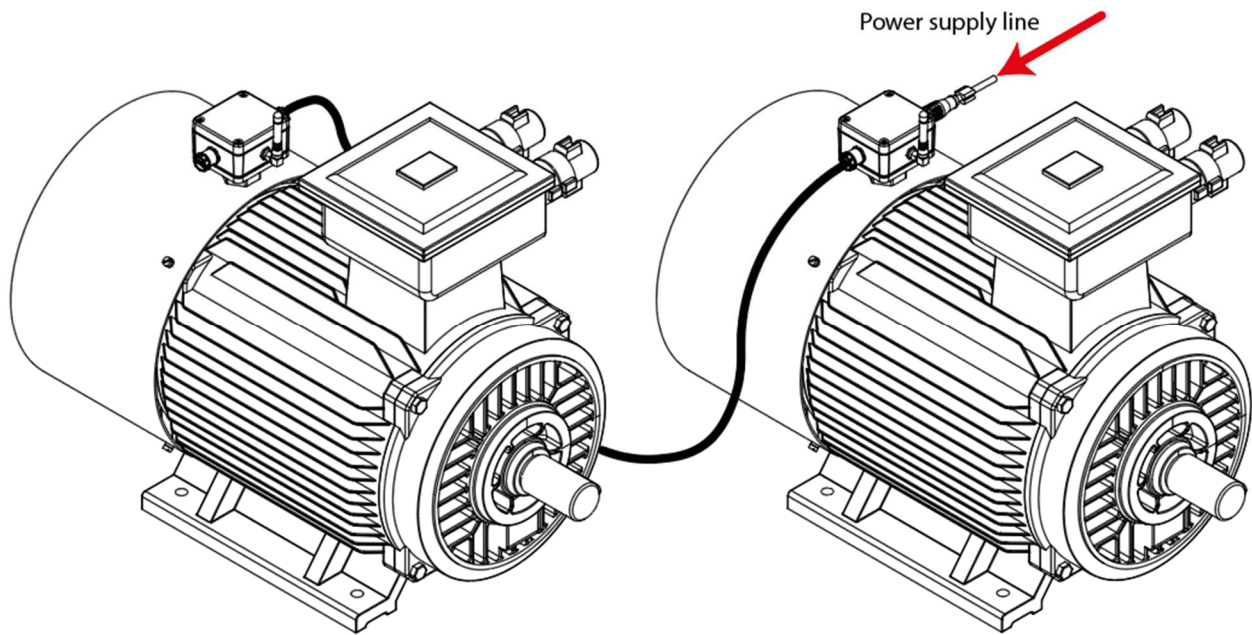


Figure 42.- Powering multiple InduEyes with the same power supply line

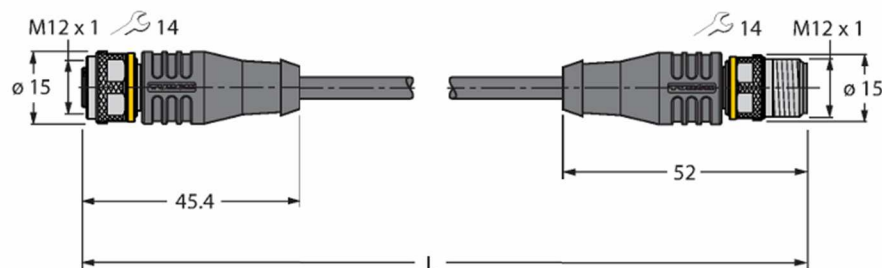


Figure 43.- Standard Male-Female cable M12x1 4P A-Code (0076M) – Dimensions in mm

Temperature sensor connection (optional)

The IIoT Wireless and Sensor module (IEPLV3) can collect temperature measurements. This is achievable since the module temperature sensor connection already has an analogue input.

The temperature sensor to be connected can be a 2, 3, or 4-wire PT100 or PT1000 with shielded cable and installed on a M12x1 5P A-code male Field-Wireable connector with protective shielding.

To assure stable and reliable data transmission, attach the cable shield to the connector housing.

Depending on the number of wires of the temperature sensor, the following connection of the wires must be made on the Field-Wireable connector as shown in Figure 44. If the temperature sensor has two wires, pins 3-4 and 1-5 of the Field-Wireable connector must be connected. If the temperature sensor has 3 wires, pins 3-4 must be connected, as shown in Figure 44 with red lines.

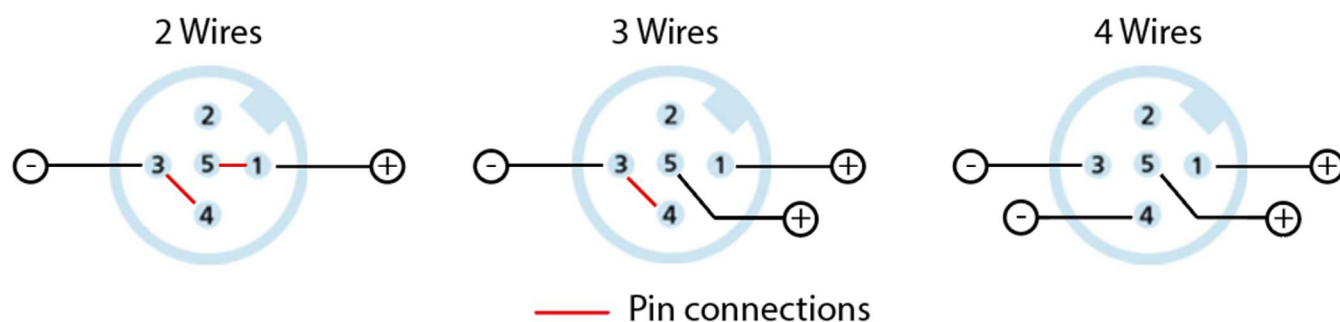


Figure 44.- Cable temperature sensor PT100/PT1000 and Field-Wireable male connector M12x1 5P A-Code – Pin configuration

Servicing, diagnostics, and maintenance

Maintenance

- The responsibility for the safe use of this equipment lies with the user in accordance with the provisions of these instructions for use, as well as the technical documentation of each module supplied. Proper usage of the module eliminates the need for additional maintenance during regular operation.
- It is the user's responsibility to establish an Inspection and Maintenance plan for this equipment to guarantee its proper and safe use.
- Check the installation and cleanliness of the modules. If any module becomes dirty or dusty, wipe with a soft cloth moistened with water or mild soap.

Troubleshooting

The system operator is responsible for taking appropriate measures to correct errors.

The module provides great reliability. However, problems may arise during operation. These can be caused by the following, e.g.:

- Process
- Signal processing
- Voltage supply
- Sensor

First fault rectification measures:

- Evaluation of fault messages
- Checking the output signal
- Treatment of measurement errors

Warranty

- The warranty shall cover the period indicated in the quotation presented to the purchaser or the purchase agreement.
- If any problems are experienced with this product, the customer should contact the Alternative Energy Innovations' representative from which this product was purchased.
- If a problem arises with this product, please inform Alternative Energy Innovations of the nature of the problem and the circumstances under which it developed, including the model specification and serial number. Any diagrams, data and other information you can include in your communication will also be helpful.
- The party responsible for the cost of fixing the problem shall be determined by Alternative Energy Innovations following an investigation conducted by Alternative Energy Innovations.

The purchaser shall bear the responsibility for repair costs, even during the warranty period, if the malfunction is due to:

- Improper and/or inadequate maintenance by the purchaser or user.
- Malfunction or damage due to a failure to handle, use, or store this product in accordance with the design specifications.
- Use of this product in a location not conforming to the standards specified by Alternative Energy Innovations, or due to improper maintenance of the installation location.
- Failure or damage due to modification or repair by any party except Alternative Energy Innovations or an approved representative of Alternative Energy Innovations.
- Malfunction or damage from improper relocation of this product after delivery.
- Force majeure such as fires, earthquakes, storms/floods, thunder/lightning, or other natural disasters, or disturbances, riots, warfare, or radioactive contamination.
- Not following any of the instructions indicated in this manual, especially those mentioned in section 0.

Technical data

! NOTES	The safety instructions included with the delivery apply to authorised instruments (e.g., with Ex approval). These instructions may differ from those provided below, such as process conditions or voltage supply. All authorised documentation is available upon request and is supplied with the module.
---------------------------	---

Functional features

Input	DC input power supply. Temperature measurement or both vibration and temperature.
Output	LoRa Wireless enabled. RMS Velocity vibration in mm/s each axis X, Y and Z. Power supply output for multiple InduEye connected.

Physical features

Materials	Aluminium AlSi12 (Enclosure), Stainless Steel AISI304 (Fixing Pad), CuZn – Niquel plated (Connectors), (Antenna).
Weight	415 g
Enclosure rating	IP67
Mounting	Adhesive mounting with the fixing pad (standard – For more information see section 0). Motor fin mount pad (Optional – For more information see section 0).
Input connections	Input IP67 Power supply connector M12x1 4p A-Code Male (Power). Input IP67 temperature sensor connector M12x1 5P A-Code Female (Sensor).
Output connections	Output power supply connector M12x1 4P A-Code Female (Power).
Power Cable length	2 m (standard) to 10 m (on demand).

Working conditions

Ambient temperature	-20°C to 50°C
Ambient humidity	0 to 95% RH
Maximum surface temperature in contact with the module	0°C to 70°C with 25°C ambient temperature.

Electricals Features

Voltage supply	5 V
Current supply	0.5 A

Output voltage supply	5 V (Only with input power supply connected).
Output current supply	0.5 A (Only with input power supply connected).
Maximum number of modules connected	2
Renewable Energy generator power supply	Yes (standard).
External DC power supply	Yes (optional).

Vibration sensor features

The vibration measurements are based on the International Standard ISO 20816-1 (2-1000 Hz)	
Measurement variables	RMS Velocity in mm/s each axis X, Y and Z.
Precision	± 0.01 mm/S
Resolution	16 bit
Sampling rate	4 kHz
Measurement range	± 16g
Drift from temperature	± 0.005 %/°C
Maximum drift at 0g in temperature	± 0.15 /°C

Temperature sensor features

Sensor type	PT100/PT1000 – 2,3,4 wires.
Maximum contact surface temperature	Manufacturer Technical data.
Resolution	Manufacturer Technical data.
Precision	Manufacturer Technical data.

Wireless features

Communication Protocol	LoraWan class A with LoRa modulation.
Data sending frequency	From 10 minutes.
Coverage range	Up to 2 km
Radio security	AES128 bit encryption.
Data emission frequency	868 MHz.
Plan ID	1. Regional parameter is EU868, and frequency is 863 MHz to 870 MHz
Maximum emission power	11.8 dBm*

* The antenna of the radio equipment must be a monopole antenna of 2dBi peak gain as supplied with the equipment (ref YE0011BA, please contact Alternative Energy Innovations in case you need replacement). If the above guidelines are not met, compliance with the EN 300 220-2 v3.1.1 standard is not guaranteed.

Dimensions

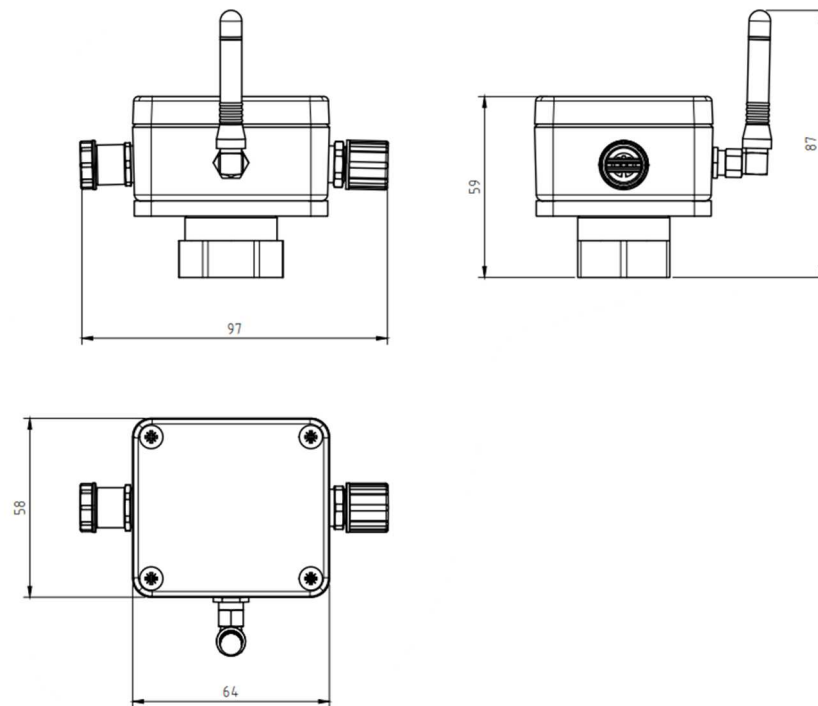


Figure 45.- IIoT Wireless and Sensor module (IEPLV3)- Dimensions in mm

Regulatory compliance statements and marking

The equipment has been tested and complies with all relevant directives required for CE marking:

- Radio Equipment Directive (RED) - 2014/53/EU
- Electromagnetic Compatibility Directive – 2014/30/UE
- Restriction of Hazardous Substances Directive (RoHS) - 2011/65/EU

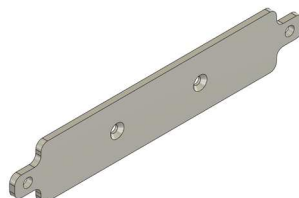
The corresponding declaration of conformity is supplied with the product.

The equipment has been tested and complies with the Telecommunication and Radio Certification (MIC Certification).

Accessories parts

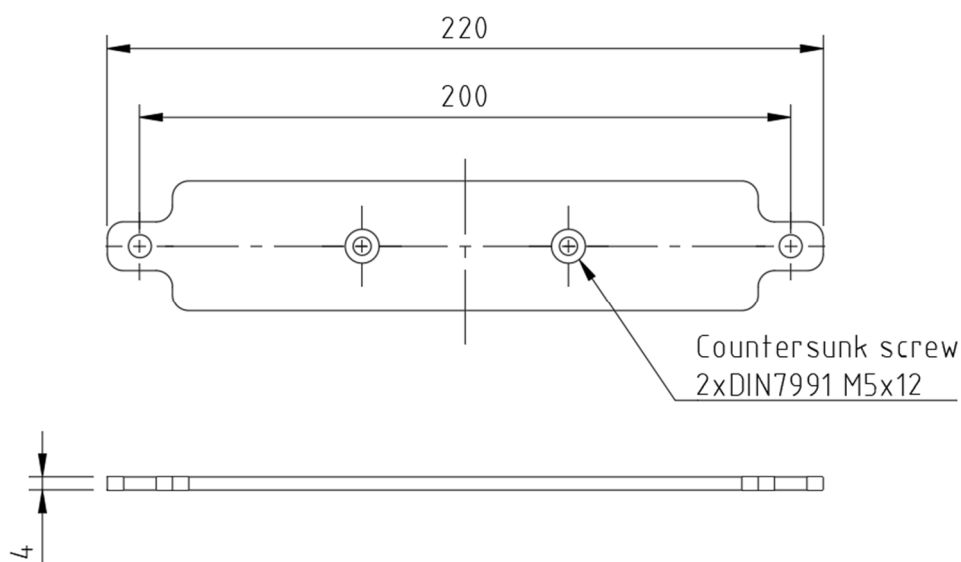
Type of Generator module accessories

Reference: **Fixing plate 0017M**



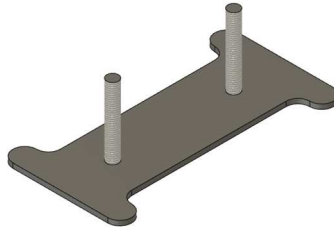
Application module	IET
Applications	Suitable for fixing on cylindrical and flat surface.
Functions	Fixing the module to the hot surface to be in contact with. Works as a heat collector.
Mounting	For cylindrical surface: Tube metal clamp (e.g. DIN3017). For flat surface: screwing with a 6 mm diameter bolt (e.g. DIN933, DIN6928 depending on surface type).
Weight	82 g
Material	Aluminium

Dimensions



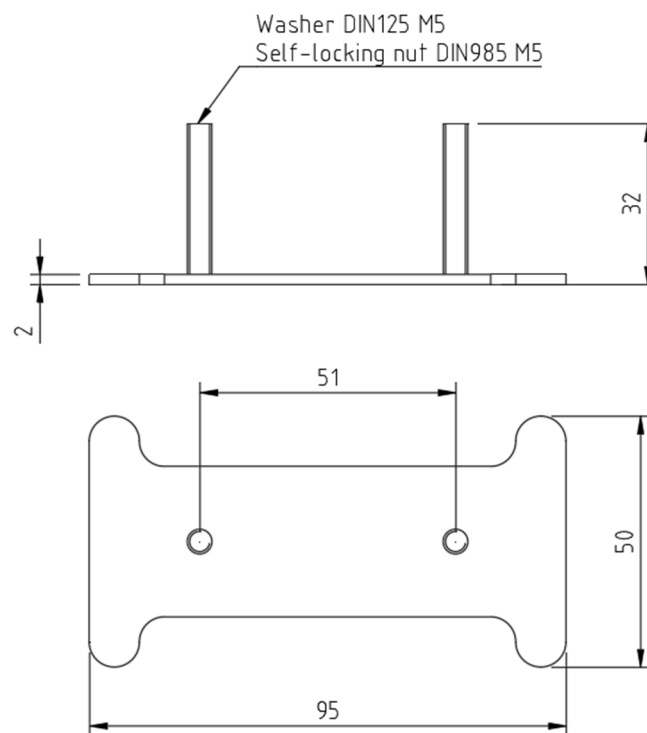
Dimensions in mm

Reference: **Fixing plate 0018M**



Application module	IET
Applications	Suitable for fixing on flat surface.
Functions	Fixing the module to the hot surface to be in contact with
Mounting	On flat surface: welding.
Weight	61 g
Material	Stainless Steel AISI304

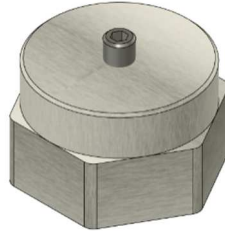
Dimensions



Dimensions in mm

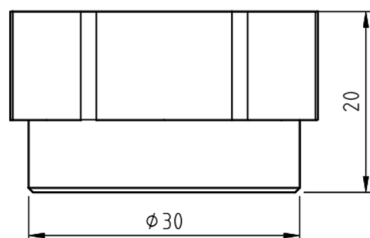
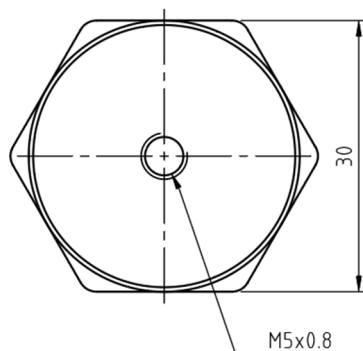
Type of IIoT Wireless and sensor module accessories

Reference: **Fixing pad 0062M**



Application module	IEPLV3
Applications	Suitable for fixing the IIoT Wireless module on motor with flat surface for vibration measurements.
Functions	Vibration sensor fixing pad.
Mounting	For flat surface: adhesive mounting.
Weight	118 g
Material	Stainless Steel AISI304

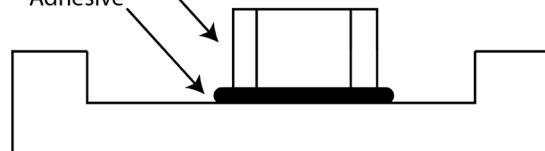
Dimensions



Prepare flat surface
with spot face tool



Fixing pad
Adhesive



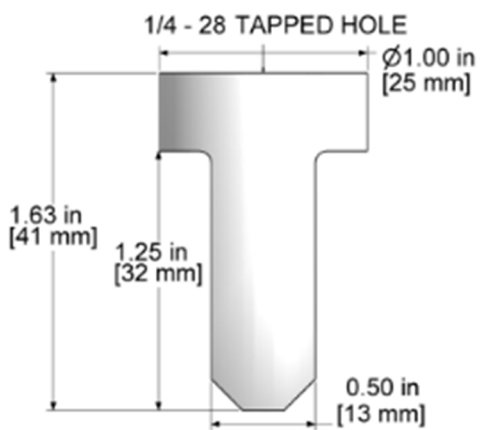
Dimensions in mm

Reference: **Motor fin mount pad**



Application module	IEPV1, IEPLV3
Applications	Suitable for motors where there is no clear access to a bearing casing.
Functions	Vibration sensor motor fin mounting pad.
Mounting	For motor fin: Adhesive mounting.
Weight	N/A
Material	Stainless Steel

Dimensions



Standard dimensions: 12.7x31.75 mm, 12.7x50.8 mm, 6.35x44.45 mm, 6.35x25.4 mm

Recommended adhesives

Vibration sensor accessories must be fixed to the surface of the machine to be monitored using structural adhesives resistant to temperatures above 100°C and industrial environment:

- Epoxy-based
- Polyurethane-based
- Cyanoacrylate-based
- Methacrylate-based

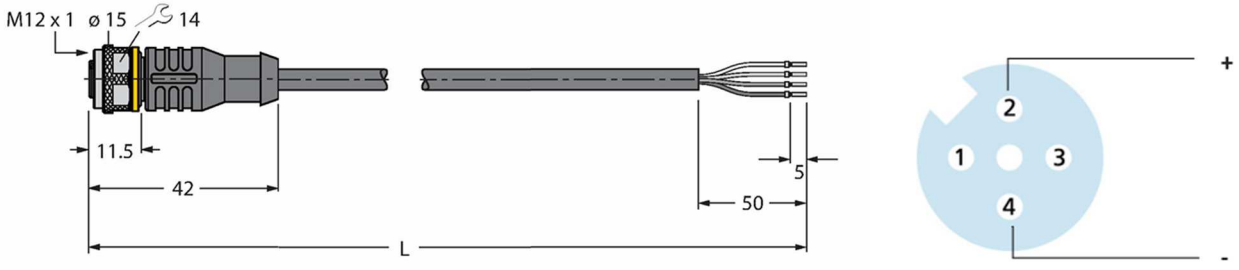
Surface preparation

Clean the surface by using a solvent to wipe any deposits of heavy grease, oil, dirt or other contaminants. Surface can also be cleaned with industrial cleaning equipment such as vapor phase degreasers or hot aqueous baths. If the surface is metallic, sand or roughen the surface to significantly increase the microscopic bond area and optimise the bond strength.

Cables and connectors

Reference: **One side cable connector 0024M**



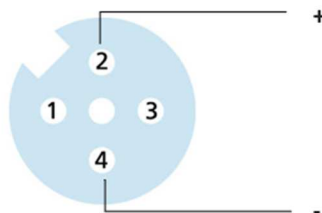
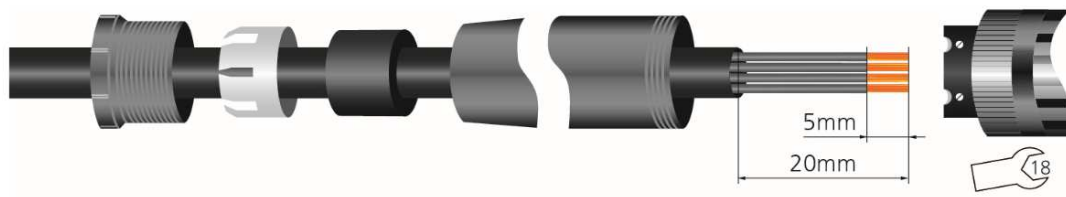
Application module	IEPL1, IEPLV3.
Applications	Suitable for connection between generator and IIoT Wireless modules. Also to connect an external DC power supply for IIoT Wireless modules.
Functions	Power supply cable.
Mounting	Cable connector M12x1 4P A-Code Female. Cable length (L): As standard 2 m. On demand: 3 m, 5 m, 10 m.
Material	As standard (PUR or PVC) with shielding protection.
Dimensions	
 Dimensions in mm	

Reference: **Field-Wireable**



Application module	IEPL1, IEPLV3.
Applications	Suitable for connection between generator and IIoT Wireless modules. Also to connect an external DC power supply for IIoT Wireless modules.
Functions	Power supply cable.
Mounting	Connector M12x1 4P A-Code Female or Male. Cable assembly.
Material	Plastic / metallic.

Dimensions





AEInnova

Alternative Energy Innovations SL
C/ Pare Llauredor, 169,
08224 Terrassa
Barcelona (SPAIN)
www.aeinnova.com
(+34) 930 24 40 21