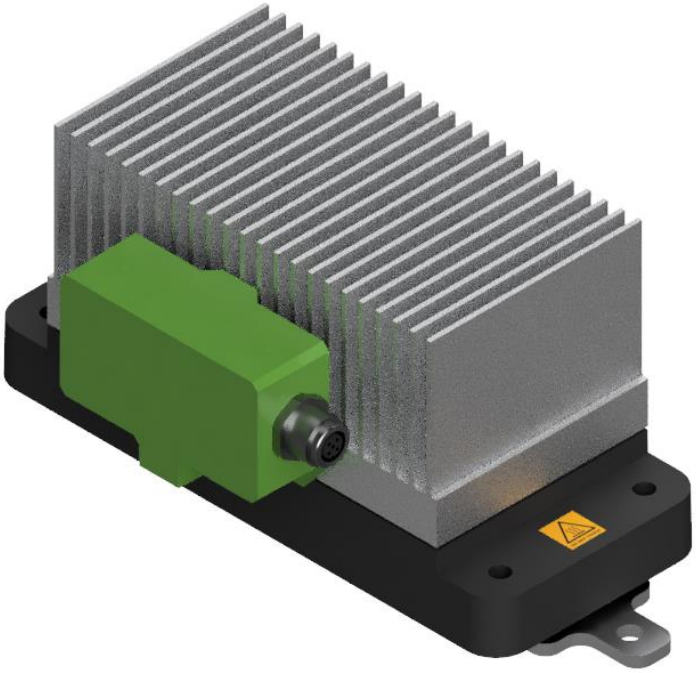
InduEye® TG Duo

User Manual



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Safety Instructions for Ex Zones:

For Ex applications, it is essential to follow the specific Ex safety instructions provided. These instructions are included as documentation with each module carrying Ex certification and are an integral part of the user manual.

1 Introduction

1.1 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.

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.

1.2 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 heatsink of the InduEye® TG Duo module. Handle the module with mechanical gloves to prevent cuts on your hands**.**

1.3 Safety tips and warnings

1.3.1 Safety guides

This module conforms with all relevant regulations and norms. Ensure the module is in a perfect technical condition before its use. The operator is responsible for ensuring that the module functions properly. When dealing with highly aggressive or corrosive substances that might cause a dangerous situation if the module fails, the operator must take 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 authorized personnel are permitted to conduct intrusive maintenance on the module, as outlined in the operating manual. Unauthorized modifications or alterations are strictly prohibited. Additionally, only manufacturer-recommended accessories should be utilized for safety reasons.

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

1.3.2 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.

1.3.3 Proper utilization

The InduEye system is powered by renewable energy modules and utilizes 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.

1.3.4 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 modules of Alternative Energy Innovations S.L.; neither the safety nor the integrity of the Generator module can be guaranteed.

1.4 Model overview

Reference	Model	Description
IAP024005	InduEye ® TG Duo Ex	Thermoelectric Generator Ex ib
GEN-0001	InduEye ® TG Duo Ex	Thermoelectric Generator Ex ic
GEN-0002	InduEye ® TG Duo Ex	Thermoelectric Generator Ex ia
GEN-0004/IET	InduEye ® TG Duo	Thermoelectric Generator
GEN-0005	InduEye ® TG Duo	Thermoelectric Generator

1.5 Packing list

Before setting up the system, ensure that the following elements are present and in good condition. If an item does not match, please contact your dealer immediately.

- 1x InduEye® TG Duo
- 1x 2m Power Supply Cable (CAB-0001)
- 1x Ex-specific "Safety instructions" (with Ex versions)

2 Product overview

2.1 InduEye® TG Duo module

The InduEye® TG Duo is a solution that can be included with the InduEye® system to power the IIoT Wireless modules. 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.

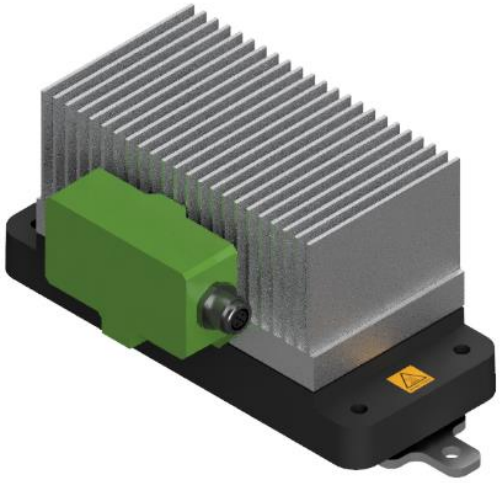


Figure 1.- InduEye® TG Duo module

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 200 °C, featuring a durable design suitable for harsh environmental conditions.

! NOTES	You must follow Safety and Warnings notes in 1.2 and 1.3 Sections.

2.2 InduEye® TG Duo module parts

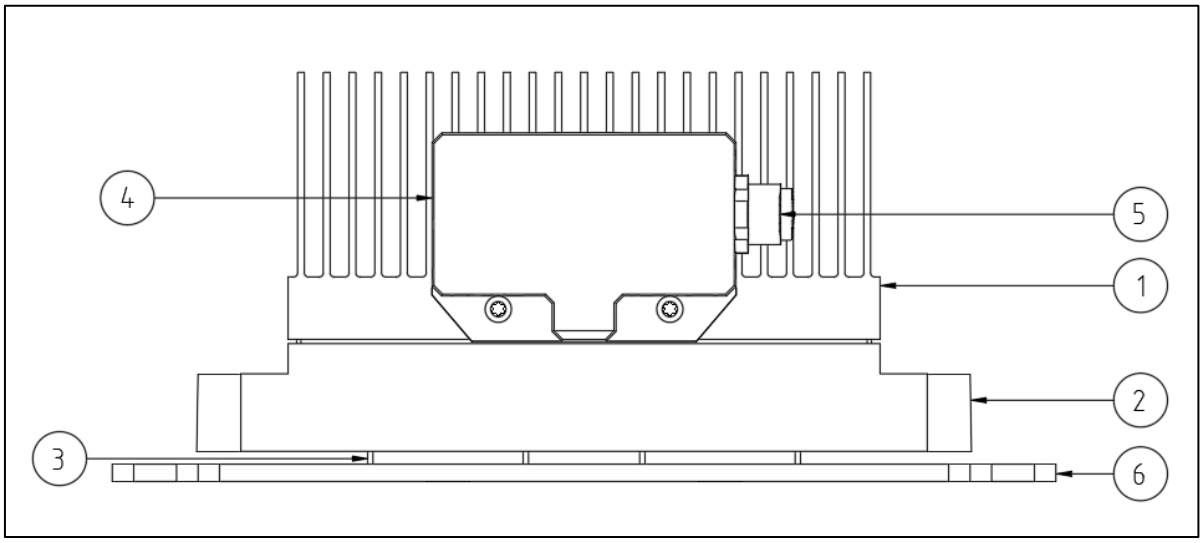


Figure 2 .- Components of the InduEye® TG Duo module

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

2.3 Functionality

2.3.1 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.

2.3.2 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.

3 Installation

3.1 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 InduEye® TG Duo and the IIoT Wireless 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 3.
- Performance can also be improved by installing the module with the heatsink fins in a vertical position as shown in Figure 4.
- **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 utilized following the manufacturer's guidelines. • The InduEye® TG Duo 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 made by skilled and authorised personnel. • Only connect or disconnect in de-energized 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 InduEye® TG Duo, 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 3).**

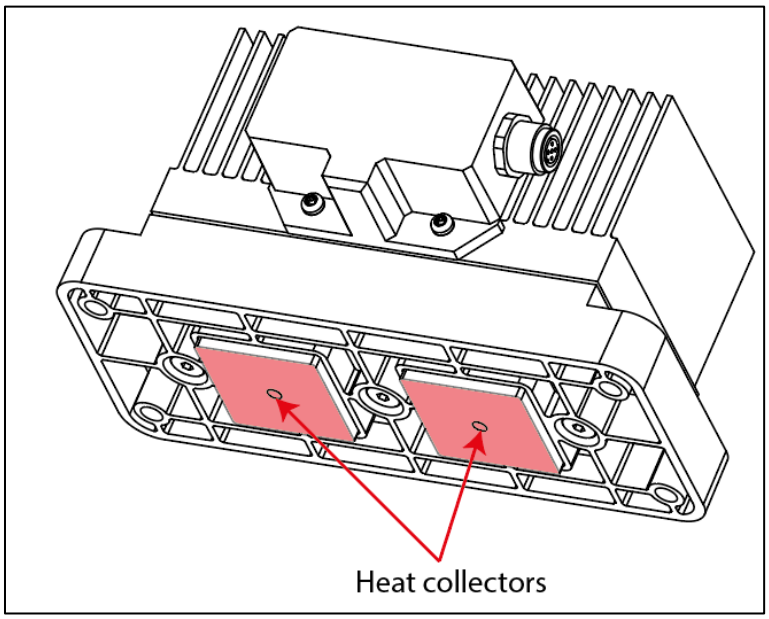


Figure 3.- Bottom view of the InduEye® TG Duo module

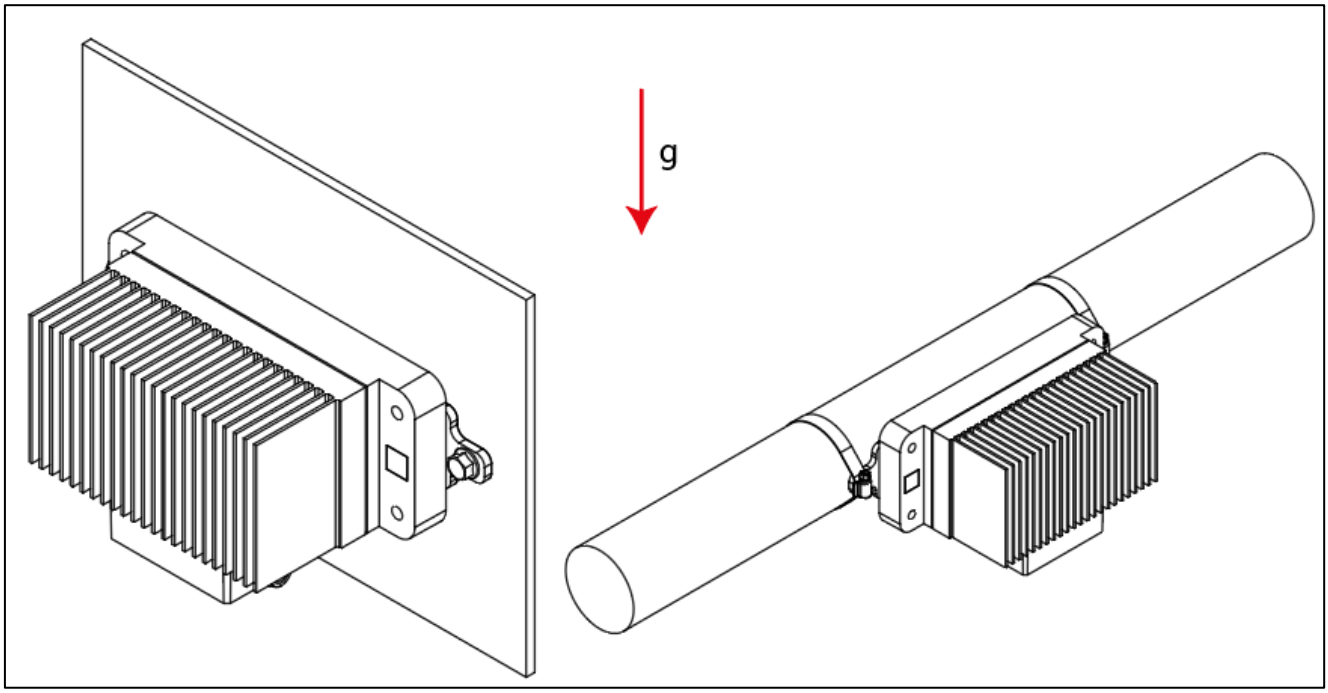


Figure 4.- InduEye® TG Duo module mounting options with vertically positioned heat sink fins

3.1.1 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 3 only in 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 5.

! NOTES	• The screwing mounting requires holes to be drilled on the flat surface. • The screwing mounting only it is recommended to install in flat surfaces. • When installing the InduEye® TG Duo, 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 3).

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 5.5mm and a minimum length of 22 mm. Therefore, select the type of screw that best suits the characteristics of the surface to be installed.
3. Insert the screws, with washers, and tighten them without deforming the plastic base of the InduEye® TG Duo module.

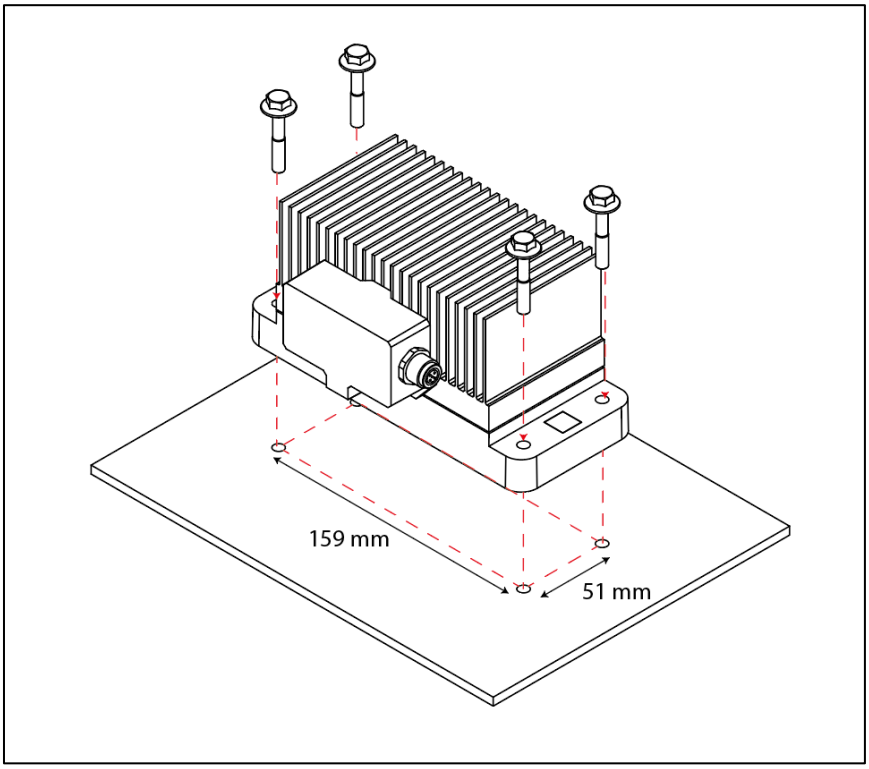


Figure 5.- InduEye® TG Duo module optimal mounting procedure

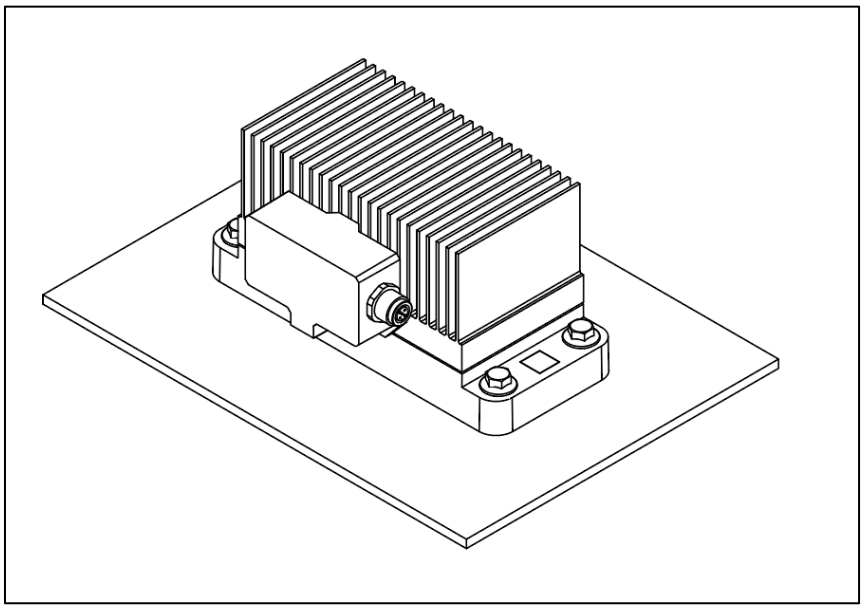


Figure 6.- InduEye® TG Duo module optimal mounting option

3.1.2 Flat or cylindrical surface mounting

The use of this accessory is recommended when it is not possible to apply the optimal mounting, need and aluminium material and a faster assembly is desired.

Parts included in the mounting kit:

- Fixing plate MEP-0004 (Aluminium) – 1 unit (Figure 7). See accessories catalogue MUSPAI for more information.
- Countersunk screw DIN7991 M5x12 – 2 units.

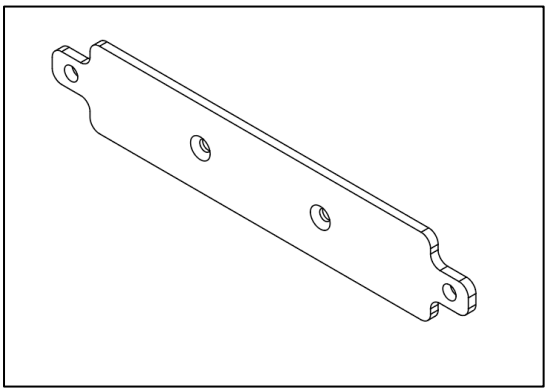


Figure 7.- Mounting kit accessory – fixing plate MEP-0004 – Optional accessory

! NOTES	• Mounting in flat surfaces requires holes to be drilled on the surface. • When installing the InduEye® TG Duo with the mounting accessory (Figure 7), 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 8.
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 6mm maximum diameter through the accessory as shown in Figure 9.
4. Insert the screws or metal clamps on the top and lower tabs, as shown on Figure 8 and Figure 9, and tighten them until the module is properly fixed.

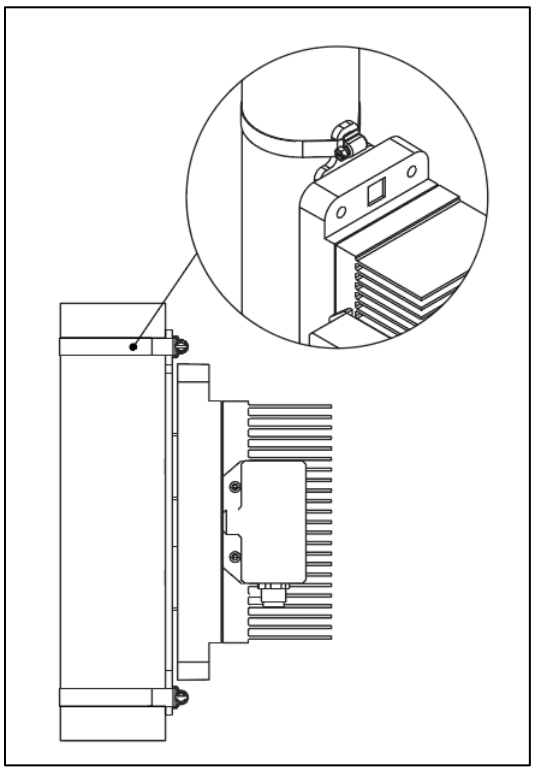


Figure 8.- InduEye® TG Duo module - Cylindrical mounting option with a metal clamp

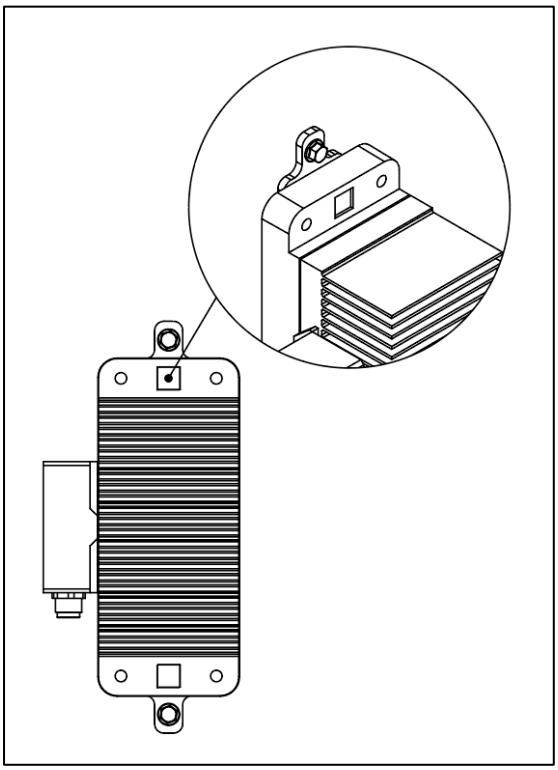


Figure 9.- InduEye® TG Duo module - Flat mounting option with a screw

3.1.3 Weldable flat surface

If it is not possible to mount the module as described in section 3.1.1 to obtain a higher thermal and electrical efficiency, use the optional accessory shown in Figure 10 , 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 MEP-0008 (AISI304) – 2 units (Figure 10). (See accessories catalogue MUSPAI)
- Washer DIN125 M5 AISI304 – 4 units.
- Self-locking nut DIN 985 M5 AISI304 – 4 units.

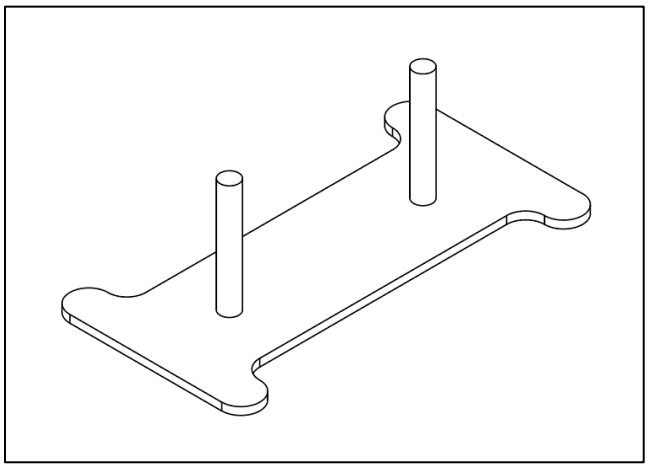


Figure 10.- Weldable mounting kit accessory fixing plate MEP-0008 – Optional accessory

! NOTES	• Mounting in flat surfaces with this accessory requires arc welding on the surface. Check compatibility between materials. • When installing the InduEye® TG Duo with the mounting accessory (Figure 10), 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 3).

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 InduEye® TG Duo module. 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 12.
4. Once the mounting accessories have been welded, install the InduEye® TG Duo. On each rod, the installation shall consist of washer and self-locking nut. Once these components have been mounted on the 4 rods, tight them homogeneously so that the equipment does not have more pressure on one side than on the other.

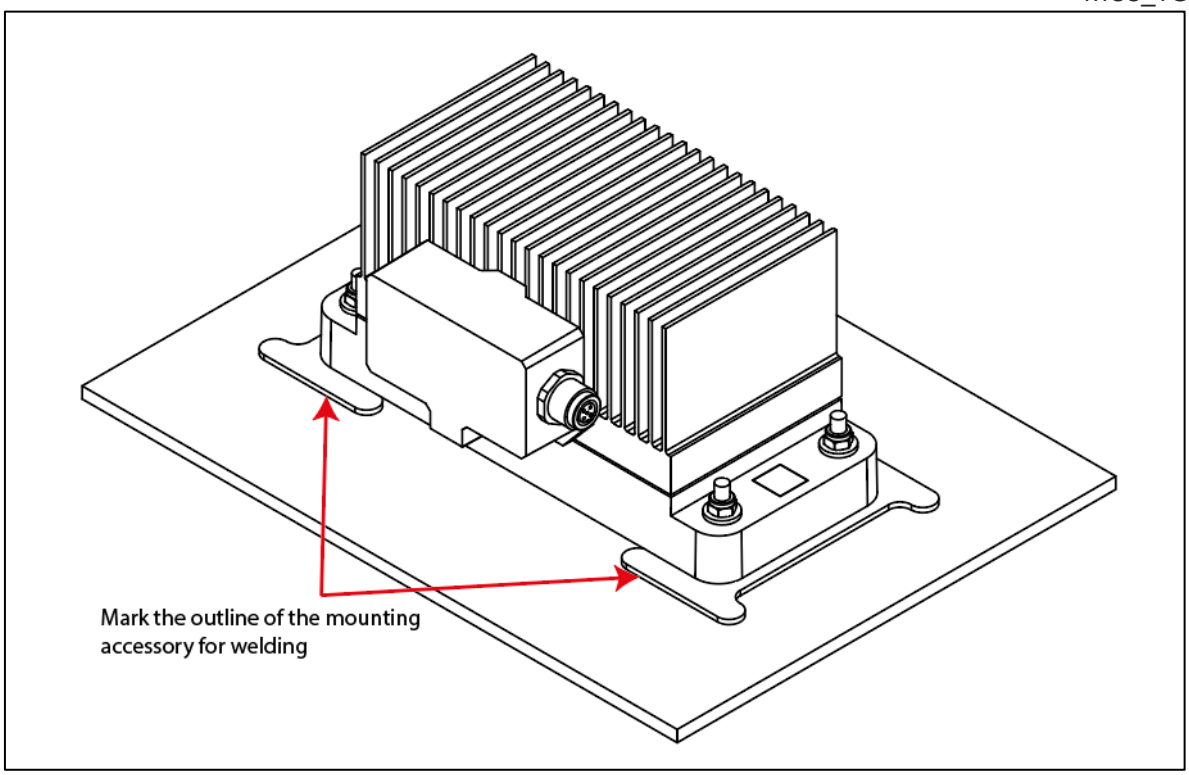


Figure 11.- Weldable mounting accessory used to mark the outline.

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

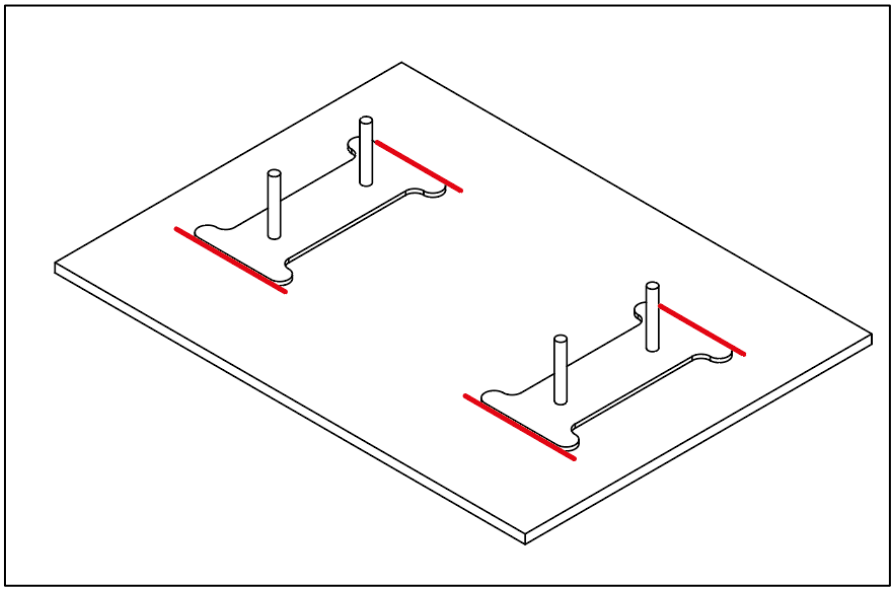


Figure 12.- Welding mounting accessories process

3.2 Output power connections

3.2.1 Preparing the connection

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

NOTES	• Refer to the chapter "Technical data" to know 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 module once it has been properly anchored.

3.2.2 Physical connectivity

The InduEye® TG Duo module 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, verify the orientation to ensure the terminal is not harmed and proceed to introduce it effortlessly.

The InduEye® TG Duo module power supply connector is an M12x1 female plug, A-Code 4P circular connector, as seen in Figure 13.

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

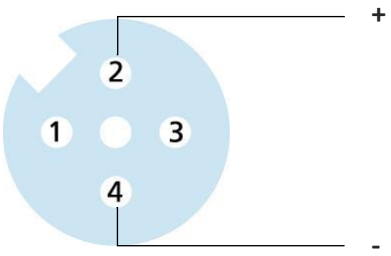


Figure 13.- InduEye® TG Duo module output power supply connector M12x1, A-Code 4P – Pin configuration

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 InduEye® TG Duo to the IIoT Wireless module, the connection must be done via the power supply cable (CAB-0001) 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 deterioration.
- Insert and screw the cable connection male to the InduEye® TG Duo output power supply connector, as can be shown in Figure 14.
- Wait until the IIoT Wireless module is charged and the Gateway starts receiving data.
- On the other side, from the power generation module, in this case InduEye® TG Duo, make sure the connection between modules is properly done (Figure 15).
- Orient the InduEye® TG Duo unit to suit wireless module position (Figure 16).
- Secure the cable to the machine 120-150mm away from the mounting location using an appropriately sized cable clamp. Do not coil the cable with a bending radius of less than 100mm (Figure 17).

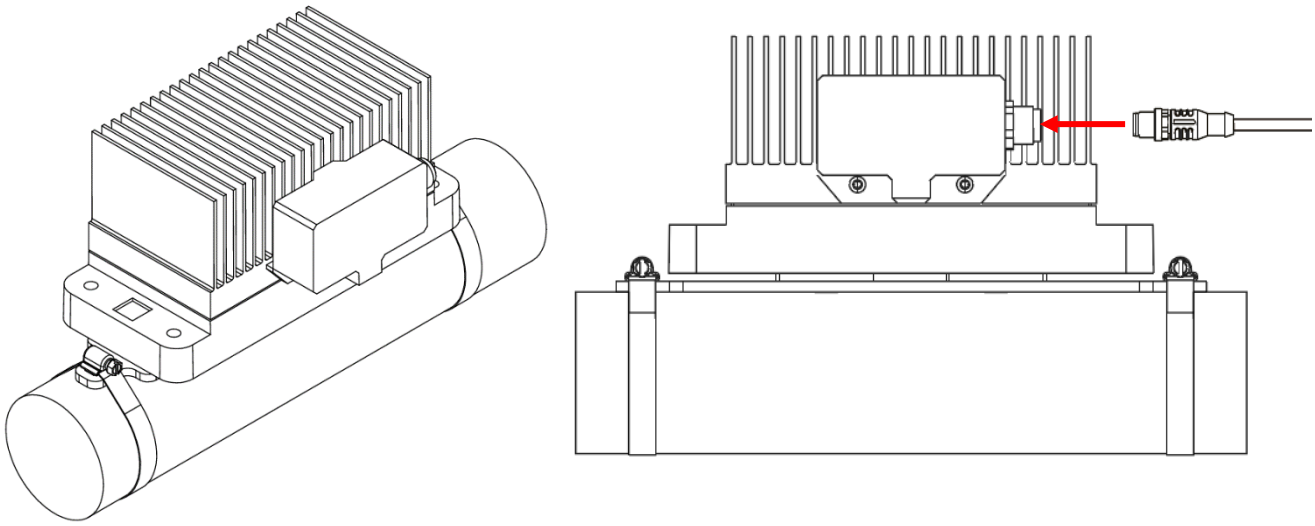


Figure 14.- Power supply (InduEye® TG Duo module– Tube mounting) connection

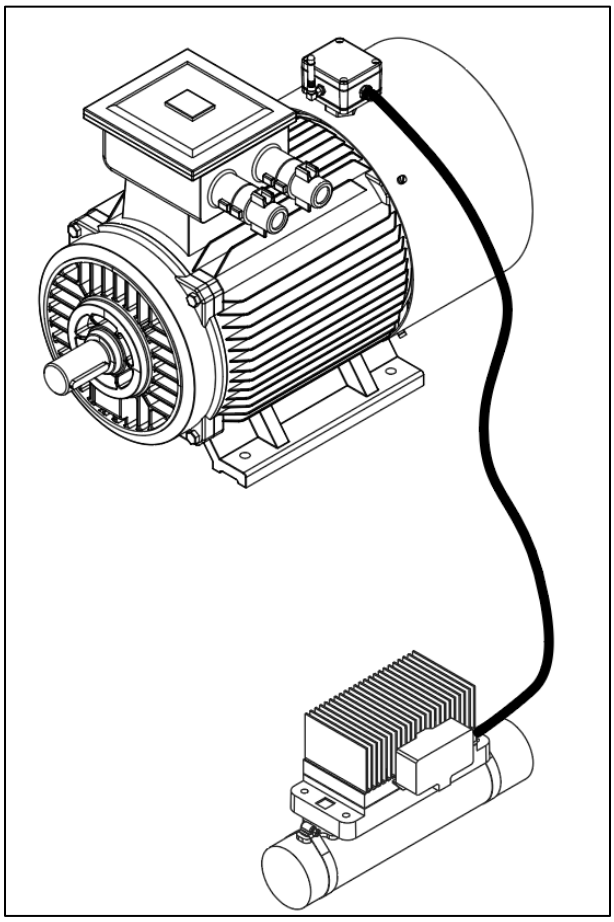


Figure 15.- Connection between the IIoT Wireless module and the Generator module (InduEye® TG Duo module)

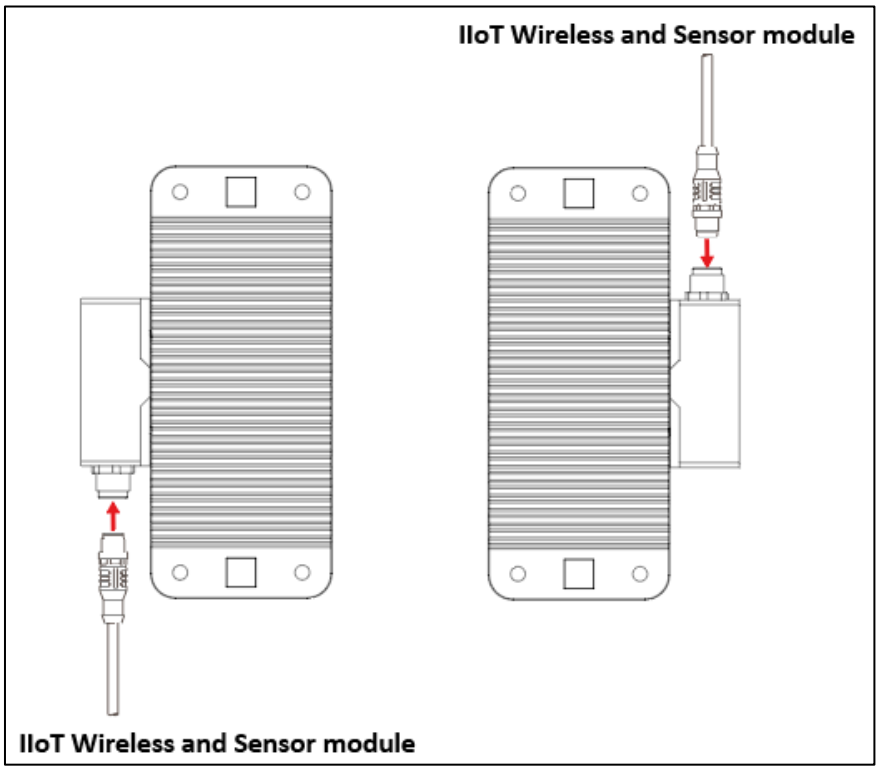


Figure 16.- Correct InduEye® TG Duo orientation between modules

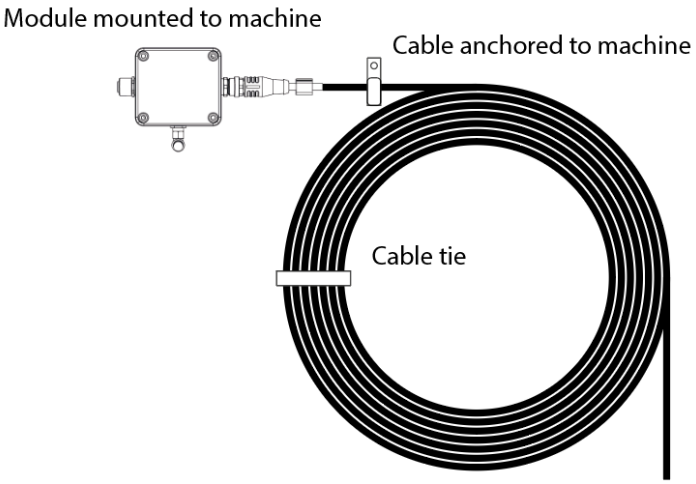


Figure 17.- Cable securing process

4 InduEye® TG Duo module start-up

We use the InduEye® TG Duo to power the IIoT Wireless module, developed by AEInnova to monitor parameters from the process in which it is installed.

Once the modules have been properly installed, the commissioning may start. The process unfolds as follows:

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

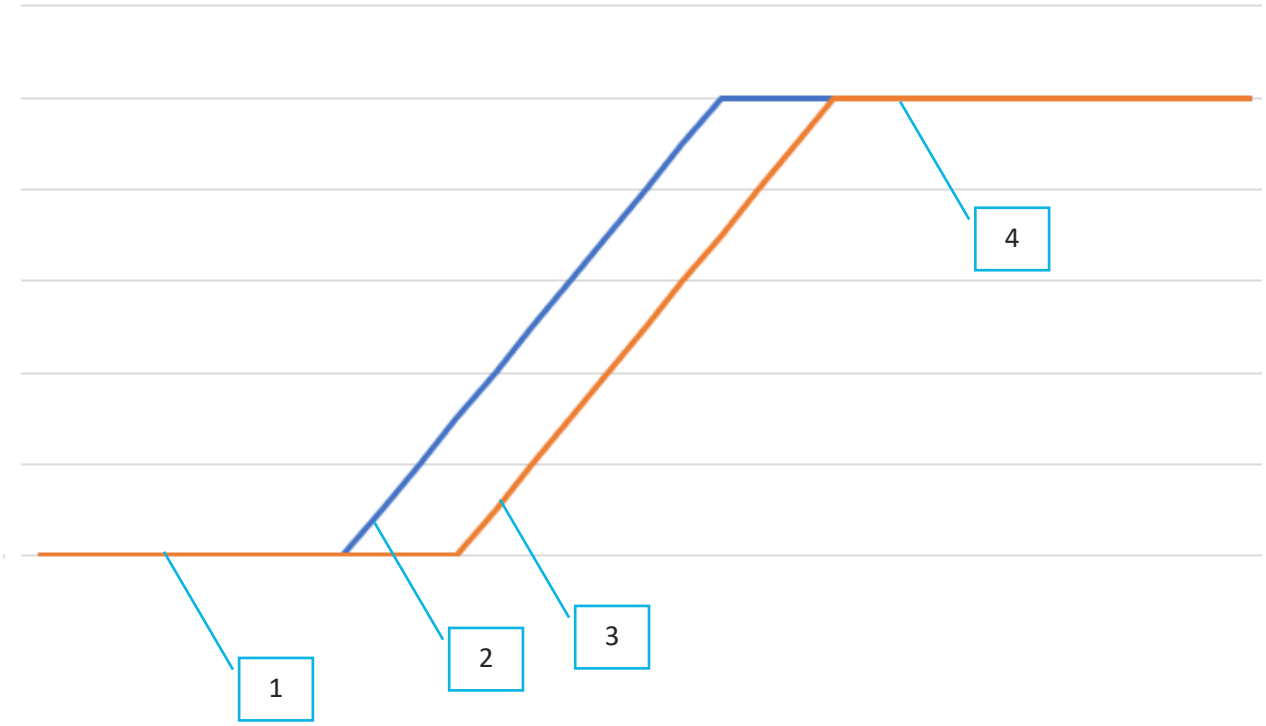


Figure 18.- Commissioning diagram (Temperature variation of the hot Surface- blue line; Equipment charging process-orange line).

5 Servicing, diagnostics, and maintenance

5.1 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 modules' installation and stain condition. If any module becomes dirty or dusty, wipe with a soft cloth moistened with water or mild soap.

5.2 Troubleshooting

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

The InduEye® system provides great reliability. However, problems may develop during operation. These can be induced 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

6 Warranty

- The warranty shall cover the period noted on 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 is 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 InduEye® TG Duo 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.
- Reason of 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 3.

7 Technical data

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

7.1 Functional features

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

7.2 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 3.1.1). Flat or cylindrical surface mounting (Standard – For more information see section 3.1.2). Weldable flat surface (Optional – For more information see section 3.1.3).
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).

7.3 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 200 °C (see operation temperatures Table 2).

Table 2.- InduEye® TG Duo module hot surface temperature range (°C) vs ambient temperature (°C)

T_{amb} \ T_{sur}	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
50																
40																
30																
20																
10																
0																
-10																
-20																

7.4 Electrical Features

Output voltage supply	5 V
Output current supply	0.5 A

7.5 Dimensions

7.5.1 InduEye® TG Duo module dimensions

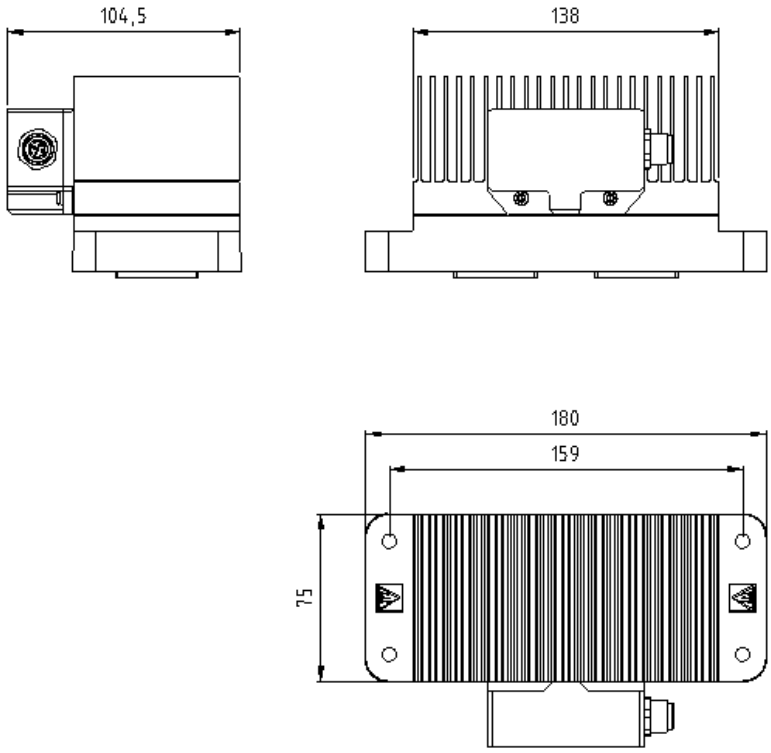


Figure 19.- InduEye® TG Duo module - Dimensions in mm

7.5.2 Standard Mounting accessory

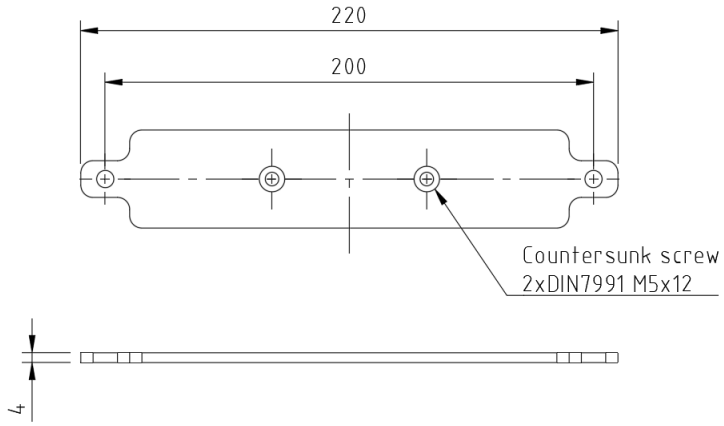


Figure 20.- InduEye® TG Duo module standard mounting accessory - Dimensions in mm

8 Regulatory compliance statements and marking

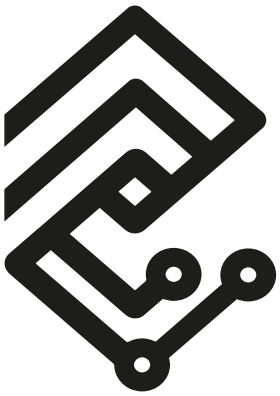
The equipment has been tested and complies with all relevant directives required for CE marking:

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

Additionally, the InduEye® TG Duo Ex modules comply with the following:

- Directive 2014/34/EU (ATEX) on equipment and protective systems intended for use in potentially explosive atmospheres.

The corresponding declaration of conformity is supplied with the product.



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