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Absolute Angle Encoder

“GMI-ANGLE” Series

based on the

Giant Magneto Impedance principle

User Manual

2022-04 / rev. 00

www.flux.gmbh

Original instructions.

This Instruction Manual is provided to users of the GMI ANGLE ENCODERS for the training of maintenance technicians and operators. Instructions, drawings, tables and anything else contained in this manual are of a reserved nature and may not be reproduced and/or published, neither completely nor in part, without specific written permission by the company FLUX GmbH.

Technicians, maintenance personnel and operators are explicitly forbidden to spread the news contained herein and to use this manual for purposes other than those strictly related to the good preservation of the GMI ANGLE ENCODERS, its use and maintenance.

The company FLUX GmbH cannot be held responsible or liable for any injury caused by incorrect use of this documentation. To avoid incorrect maneuvers which could cause hazards to persons it is important that you read and understand all the documentation supplied with the GMI ANGLE ENCODERS.

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1. General information

1.1. Introduction

This instruction manual is an integral part of the GMI ANGLE ENCODERS (identified in this document, with the term encoder) realized by the company FLUX GmbH. For this reason, it must follow the encoder itself if it is transferred to a new user or owner.

This manual has been drawn to provide operators and technicians involved in the maintenance of the encoder information and essential instructions to operate properly and safely.

While showing all the attention and the instructions for the correct use of the encoder by the operators or to allow maintenance personnel to intervene correctly, this manual assumes that the use and maintenance personnel has a degree of education that allows them to interpret the information reported.

1.2 Ownership of the information provided

This instruction manual contains proprietary information.

The manufacturer declares that the information contained in this manual are congruent with the technical specifications and safety devices of the encoder the manual refers to. Drawings, diagrams and technical data are updated to the date of publication of this document and are valid only for the encoder to which they were attached.

The Manufacturer reserves the right to make changes or improvements to this documentary material without notice.

The Manufacturer assumes no liability for direct or indirect injury to people, things or animals arising from the use of this document or of the encoder in conditions different than those laid down.

1.3 Conventions and Definitions

1.3.1 Introduction

The instruction manual of the encoder was divided into chapters that allow, for each major phase of the life of the encoder (transport, installation, use, setup, maintenance and disposal), to facilitate the procurement of necessary information to the user of the encoder itself.

1.3.2 Terminological conventions

ENCODER: it is the term used in this instruction manual to indicate the GMI ANGLE ENCODERS.

PPE: it refers to Personal Protective Equipment.

1.3.3 Definitions

***U**SER*

Any person (entrepreneur/business) who uses the *ENCODER* or who entrusts the use or related operations to prepared people.

***O**PERATOR*

Personnel, generally without specific expertise, performing the operations necessary for the use of the encoder and the cleaning of the encoder itself and the place where it is installed; if necessary they can make simple adjustments or measures to restore the encoder operation.

***M**AINTAINER*

Qualified Technician that can intervene on any mechanical part to make the adjustments, repairs and maintenance operations required.

The maintenance technician must have sufficient experience in the mechanical, electrical and control engineering fields; typically is not enabled to carry out work on electrical systems in the presence of voltage.

***M**ANUFACTURER'S TECHNICIAN*

Specialized technician expert provided by the manufacturer of the *ENCODER* to perform complex nature operations in particular situations or when agreed with the user.

1.3.4 Personal Protective Equipment and rules of conduct

For each of the operations described in this manual, are indicated the *PPE* to use (possibly in addition to those that the personnel is required to wear in the place of installation of the encoder) and the rules of conduct that allow to safeguard the operators themselves.

1.3.5 Typographic conventions

The graphic setting of this instruction manual is such as to allow easy recognition of its content; in this context, for example, the instructions are associated to lists, as follows:

- This symbol identifies a generic bulleted list or a bulleted list consisting of simple actions (the order in which the actions are presented is not binding but recommended);

1. This identifies a numbered list explaining a complex procedure (the order in which the actions are presented is binding to safely and correctly perform the operation under consideration).

The **bold text** is used to highlight words, phrases or parts of the procedure.

In addition, to ensure a more in-depth knowledge of the *ENCODER* and of the instructions for its correct and safe use, the text of this instruction manual is accompanied by indications that complete it, by providing additional information, attention needed or particularly significant hazards to consider. At this proposal, the following notation is used:

NOTE: *indicates notes, warnings, hints and other points on which the attention of the reader is drawn or completes the explanation with more information.*

WARNING: *it indicates situations or tasks in which there is a possibility of damage to the ENCODER, to the related equipment or to the environment.*

DANGER: ***it indicates situations or tasks that must be performed or information to which particular attention must be paid to avoid injury.***

In this paragraph shall be shown the graphical symbols used in this manual to indicate the need to wear particular *PPE*.

It indicates the need to use appropriate head protection to perform the operation described.

It indicates the need to use suitable protective gloves to perform the operation described (possibly dielectrics gloves to perform electrical operations).

It indicates the need to use suitable protective shoes to perform the operation described.

Below are the graphic symbols used in this manual to indicate residual hazards and risks for the described operation.

Indicates the risk related to the presence of suspended loads

Indicates the risk associated with the presence of forklifts and other means of transporting goods

Indicates the risk related to the possible crushing of lower and upper limbs

Indicates the risk related to the presence of possible unevenness / obstacles on the ground

Indicates the risk related to the presence of high temperature surfaces (> 45 ° C)

Indicates the risk related to the presence of live parts

Indicates the risk related to the presence of electromagnetic fields

Indicates the risk related to the presence of moving parts that can cause mechanical injuries

Indicates the possible fire risk

1.4 Warranty

1.4.1 General conditions

The manufacturer, the company FLUX GmbH, provides the *ENCODER* and equipment produced by the same Manufacturer free from defects in materials and workmanship for a period of two years unless it is otherwise writtenly agreed in a separate contract.

During the warranty period, the manufacturer undertakes to remove in the time it takes the noticeable faults and defects in materials or workmanship in the event of a malfunction or breakage; this provided that the *ENCODER* has been installed with the assistance of technicians of the manufacturer and it has been used correctly in accordance with the rules of conduct and maintenance described in this manual.

Defective parts under warranty will be repaired or replaced free of charge by the manufacturer, if it is proven their defect at the origin.

Freight or shipping costs unless otherwise specified in the contract of sale, as well as travel expenses relating to the intervention of technicians of the manufacturer at the headquarters of the user are regulated in the contract of sale.

For the construction of the *ENCODER*, the manufacturer uses materials, organs and mechanisms of the type, condition and quality, deemed at its sole discretion, appropriate to the functions that the *ENCODER* needs to perform; in pursuing a policy of constant development and updating of the product, the manufacturer reserves the right to modify both the functional and aesthetic characteristics, to make any changes in the design of any functional organ or accessory, or to suspend the manufacture and supply, without commitment to inform and without incurring in any obligation.

In addition, the company FLUX GmbH reserves the right to make any structural or functional changes, in addition to changing the supply of spare parts and accessories without having to notify anyone and for any reason whatsoever.

1.4.2 Parts excluded from the warranty

The warranty does not cover wear parts and all utensils and any consumables supplied by the manufacturer together with the *ENCODER*.

1.4.3 Operations involving the invalidation of the warranty

Any attempt to disassemble, modify or tamper any component of the *ENCODER* by the user or by unauthorized personnel will result in invalidation of the warranty and will hold the manufacturer harmless from any liability for damages to persons or property caused by such tampering.

The manufacturer is not responsible and the warranty is void in the following cases:

- improper uses of the *ENCODER*;
- use that does not comply with the requirements of the regulations in force in the country of use;
- *ENCODER* installation in conditions other than those specified in this document;
- connections which do not comply with the specifications outlined in this document;
- total or partial non-compliance with the instructions in this manual;
- incorrect or missing maintenance;
- use of non-original spare parts or not specified by the manufacturer.

1.5 Technical support

With regard to the maximum exploitation of the performance provided by the *ENCODER* and extraordinary maintenance operations, this manual does not replace the experience of trained and qualified installers, users and maintenance personnel.

In this case, the Company's Technical Support Service provides:

- telephone support regarding the characteristics and the simplest interventions that can be performed on the *ENCODER*;
- sending of specific technical documentation;
- training interventions of the user's personnel assigned to the *ENCODER*;
- interventions to modify the *ENCODER* (on request only).

***WARNING**:* *In case of doubts about the correct interpretation of the instructions contained in this Instruction manual, contact the Technical Support Service to obtain the NECESSARY clarifications.*

1.5.1 Request for support interventions

To contact the Technical Support Service, contact:

FLUX GmbH

Hans Steininger Gasse 16,
5280 Braunau am Inn, Austria
Tel: +43 7722 20764
office@flux.gmbh
www.flux.gmbh

2. Description and proper use

2.1 Description of the *ENCODER*

The “GMI ANGLE” series of axial, absolute, frameless, angle encoders from FLUX GmbH offers motor feedback solutions for a wide range of applications, fitting optimally in designs that require precise positioning with exacting velocity and torque control.

The “GMI ANGLE” series of axial encoders incorporates the FLUX patented GMI (Giant Magneto Impedance) position sensor to deliver high performance feedback as part of a closed loop motion control system. .

The GMI position sensor technology and encoder architecture, developed and manufactured by FLUX, are the result of 40+ years experience in encoder development and manufacturing. It addresses in a purposeful and compact manner motion control feedback design requirements calling for:

High Accuracy:

- Better than ± 7 arc sec guaranteed accuracy
- Accuracy achievable even with as much as ± 0.15mm (±0.006”) mechanical eccentricity of the rotating Ring Scale (Rotor)
- Accuracy achievable even with as much as ± 0.15mm (±0.006”) mechanical non-concentricity of the rotating Ring Scale relative to the fixed Encoder Head (Stator)

Ease of Installation:

- Air gap between Ring Scale (Rotor) and Encoder Head (Stator): 0.3 ± 0.3mm (0.012 ±0.012”)
- Ring Scale) would be installed directly onto the Rotary Table Mounting Hub with screws. No special heating, cooling or press-fitting required.
- There are two fitting holes in each device, rotor and stator, for quick and easy centering and mounting. Alternatively, the fit of the inner or outer diameter can be used. The air gap between stator and rotor can be adjusted by using a 0.3 mm spacer foil.
- Status LED light informs installer of GOOD/BETTER/BEST alignment
- No special electronics required to verify proper Encoder installation.
- Does not require any signal- or accuracy calibration. High Accuracy and High Performance achieved via 360° sensing of the Ring Scale grating and dynamic signal compensation.

Simple Field Service:

- Ring Scale and Encoder Head do not need to be matched as a set. Replacement of one does not require replacement of both.

- In-field service can be done as simply as described above without any special electronic tools

More details on this, dimensions and tolerances are shown in the dedicated technical data sheet attached to this document or on the website www.flux.gmbh.

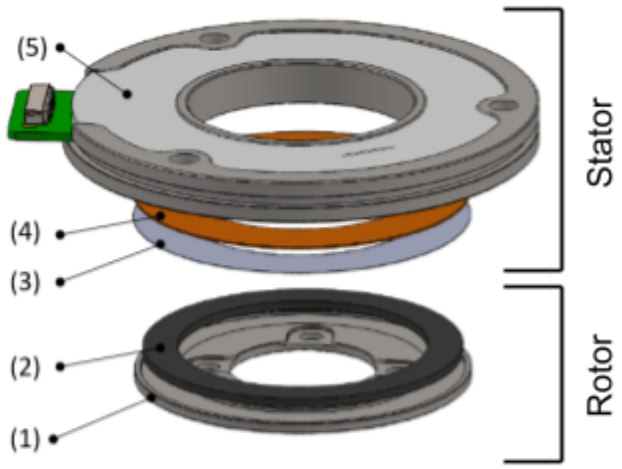
**GMI-ANGLE-160 (size 160mm)*

MODEL	Encoder Stator		Encoder Rotor		Thickness	Resolution	Accuracy	IP
	OD	ID	min OD	max ID				
GIM-ANG-096	96 mm	50 mm	80 mm	35 mm	10.8 mm	23 bit/r.	±14”	IP67
GIM-ANG-160	160 mm	110 mm	160 mm	110 mm	10.8 mm	24 bit/r.	± 7”	IP67
GIM-ANG-180	180 mm	130 mm	160 mm	110 mm	10.8 mm	24 bit/r.	± 7”	IP67
GIM-ANG-250	250 mm	200 mm	230 mm	180 mm	10.8 mm	25 bit/r.	± 4”	IP67

GMI-ANG size (OD)	**96 mm**	**160 mm**	**180 mm**	**250 mm**
System data				
Type	Axial, frameless, true absolute **Giant Magneto Impedance encoder GMI Technology** - FLUX GmbH proprietary			
Standard resolution	23 bits	24 bits	24 bits	24 bits
Standard accuracy *(no calibration required)*	± 14”	± 7”	± 7”	± 4”
	± 70 µrad	± 35 µrad	± 35 µrad	± 20 µrad
Hysteresis	none			
Repeatability	1 resolution count			
Position update rate and signal latency	Real-time			
Standard maximum speed	2’000 rpm (higher on request)			

Electrical data	
Supply voltage *(at encoder connector)*	**Option 5V:** typ. 5 Vdc Min. 4.35 Vdc. Max. 6 Vdc
Reverse polarity protection	Yes
Current Consumption *(w/o output terminations)*	max. 150 mA @ 5 Vdc (**Option 5V**)

2.2 How the Giant Magneto Impedance Principle works



Encoder rotor
(1) Metal carrier
(2) Absolute magnetic ring

Encoder stator
(3) GMI layer
(4) Absolute GMI sensor
(5) Metal housing and evaluation electronic

The magnetic field of the grating ring (2) generates in the thin metal foil (3) areas with variable electrical a.c. impedance. The variation of the generated a.c. impedance is converted to an electrical signal by the GMI sensor (4). The GMI sensor (4) is connected to the evaluation electronic (5) which converts the electrical signal in digital position.

2.3 Declaration of Conformity

Each *ENCODER* is followed by the dedicated Declaration of conformity to the applicable Community Directives, that are:

- 2014/30/EU Directive - Electromagnetic Compatibility Directive (EMC)
- 2011/65/EU Directive - RoHS Directive, as amended by the Commission Delegated Directive (EU) 2015/863.

Every Declaration of Conformity is available on the website www.flux.gmbh.

Each specific *ENCODER* shows, engraved on it, the relevant Type and Serial Number, so that it can be easily reconnected to the Declaration of Conformity.

2.4 Proper use

The intended use of every GMI ANGLE ENCODER from FLUX GmbH is the measurement of rotation and position of a mechanical system equipped with a rotating part (in general of a rotating shaft), in an industrial type application that guarantees at all times and modalities the compliance with the technical specifications shown on the dedicated technical data sheets attached to this document, according to the specific encoder type, in particular respecting the electrical data and the maximum mechanical speed.

Every GMI ANGLE ENCODER has been designed and built to be installed and to work indoors and protected from atmospheric agents.

Every GMI ANGLE ENCODER is designed and built to work in environments where there is not a potentially explosive atmosphere, and the GMI ANGLE ENCODER itself cannot generate a potentially explosive atmosphere if properly used.

Because the product must be integrated into a complex system, the safety of people must be ensured by solutions concerning the system itself. Before using the product, it is necessary to carry out a risk assessment with regard to the actual conditions of use. Based on the outcome of the assessment, the necessary safety measures must be implemented.

The use of the GMI ANGLE ENCODER for operations in contravention to those listed above could result in personal injury or damage to GMI ANGLE ENCODER and are therefore considered improper uses for which FLUX GmbH is not responsible.

The use of the single GMI ANGLE ENCODER in contravention to those listed above can be carried out only after having consulted in writing the manufacturer FLUX GmbH and upon authorization.

2.4.1 Improper use

The GMI ANGLE ENCODERS should not be used improperly. In particular are considered improper uses:

- use the *ENCODER* in deviation from what is indicated in this manual;
- use the *ENCODER* in deviation from the technical specifications shown on the dedicated technical data sheets attached to this document, according to the specific encoder type;
- use the *ENCODER* in deviation from the electrical data, according to the specific encoder type;
- use the *ENCODER* in deviation from the maximum mechanical speed, according to the specific encoder type;
- use the *ENCODER* as a life support device;
- install and use the *ENCODER* in a potentially explosive atmosphere.

WARNING: *in case of different intended use it is essential to consult in advance FLUX GmbH.*

3. Safety

3.1 Warnings about residual risks

In order to avoid any dangerous conditions for persons or damage to the encoder caused by residual risks, that are those risks that remain despite all the measures taken, or potential not evident risks, the manufacturer recommends to operators, maintainers and all personnel involved in *ENCODER* operations to follow the instructions indicated in the following pages.

WARNING: *always respect the signs and indications on the plates applied to the ENCODER and operate exclusively according to the instructions provided in this manual.*

3.1.1 Lifting and transport

Residual risks during lifting and transport

During lifting and transport there are risks related to:

- operations on the *ENCODER* by unqualified, untrained, uninformed, or improperly equipped personnel;
- incorrect selection or incorrect use of the means of transport and handling of the encoder;
- crushing of handling personnel;
- impact or fall of *ENCODER* components, damaging the *ENCODER* itself and its protections;
- unhealthy postures or excessive effort for operators involved in the transport and handling of *ENCODER* components .

PPE required

Attention to follow during lifting and transport

During lifting and transport, it is necessary to follow the precautions described in this paragraph.

- Designate for these operations only personnel qualified and trained on handling procedures and able to choose and use safely the means of lifting and transporting, more suited to the condition.
- Do not lift, for any reason, the various parts of the *ENCODER* by grasping them by non-structural elements (for example, cables or sheaths);
- Make sure that there are no persons in the vicinity of the area where the lifting, moving operations are in course, and always keep a safe distance.

3.1.2 Installation and connection

Residual risks during installation and connection

During installation and connection there are risks related to:

- operations on the *ENCODER* by unqualified, untrained, uninformed, or improperly equipped personnel;
- contact with live elements;
- possible electric shocks, fire, general explosions due to the ignition of the electric arc;
- impact, crushing or dragging and trapping during the handling of the *ENCODER* on the installation site;
- impact, crushing, shearing, entrapment due to the motion of the axes controlled by the *ENCODER*, even when stopped or due to gravity;
- tripping or falling due to wiring;

- the *ENCODER* can locally generate electric and magnetic fields, which can lead to anomalies in sensitive devices;
- damage to the *ENCODER* during installation and connection.

PPE required

Attention to follow during installation and connection

During installation and connection, it is necessary to follow the precautions described in this paragraph.

- Follow the safety instructions given in Paragraph 3.1.1 - Lifting and Transport during the necessary handling operations of the *ENCODER* components.
- Use auxiliary equipment and, in any case, any other machinery, tool or utensil only after having understood the indications given in the relevant Use and Maintenance Manuals or after having followed specific and formalized training.
- Choose an installation site which:
    - provide enough space for normal use as well as for maintenance of the *ENCODER*, including space for any peripheral equipment;
    - allows you to correctly make the connections necessary for the operation of the *ENCODER*;
    - has the characteristics described in Paragraph 4.1 Environmental conditions of the Installation Site.
- With regard to electricity, connect the grounding system **before any other connection** to the power distribution line.
- The manufacturer of the final system in which the *ENCODER* will be incorporated must comply with all current regulations regarding the grounding of the system and verify the correct execution at the end of the installation.
- Make sure that no injuries or material damage can occur due to the rotating elements.
- Follow the installation procedure reported on the dedicated technical data sheets attached to this document, according to the specific *ENCODER* configuration.
- Install the *ENCODER* in applications that ensure compliance with the technical specifications shown on the dedicated technical data sheet attached to this document, according to the specific *ENCODER* configuration.

- Install the *ENCODER* in applications that ensure compliance with the mounting tolerances, according to the specific *ENCODER* configuration.
- Install the *ENCODER* in applications that ensure compliance with the electrical data, according to the specific *ENCODER* configuration.
- Install the *ENCODER* in applications that ensure compliance with the maximum mechanical speed, according to the specific *ENCODER* configuration.
- Do not use the conduits as protective conductors, but a protective conductor inside the conduit.
- The cross-section of the protective conductor must comply with the standards in force.

Do not consider cable shields to be equivalent to a protective conductor.

- Prevent foreign bodies from getting inside the product.
- Check that the gaskets and cable glands are correctly seated in order to prevent pollution due, for example, to sedimentation and humidity.
- Do not touch unprotected components or live parts.
- Carry out the assembly (using screws with adequate tightening torque) so that the *ENCODER* does not come off even in the event of strong acceleration or repeated shocks.
- Each system in which the *ENCODER* is used must be subjected to a risk assessment and an accurate functional check before operation.
- Do not use the *ENCODER* as a load-bearing element.
- Protect the pipes of the connections to the energy sources by means of rigid sheaths or suitable cable ducts.
- Do not place the *ENCODER* in the immediate vicinity of very hot surfaces, flammable or heat sensitive components.
- Perform the required interventions using standard work tools and paying the utmost attention to elements that could lead to stumbling or causing cuts and bruises.
- The *ENCODER* cannot be used until the *ENCODER* itself is tested: the presence of any assembly or installation error could lead, in fact, to serious accidents for the operators.

Before proceeding with the testing and initial start-up of the *ENCODER*, check that the parts do not show physical damage due to impacts, tears or abrasions and that all the connections have been made correctly and without the possibility of disconnection.

3.1.3 Use

Residual risks during use

During use there are risks related to:

- use of the *ENCODER* by unqualified, untrained, uninformed, or improperly equipped personnel;
- contact with rotating parts, which can cause injury and capture edges of clothing and hair;
- contact with hot or overheated parts during and at the end of processing:
    - of the *ENCODER* itself, even in the event of malfunctions;
    - of moving parts, even in the event of malfunctions;
- the *ENCODER* can locally generate electric and magnetic fields, which can lead to anomalies in sensitive devices;
- contact with live parts in case of incorrect maintenance;
- possible electric shocks, fire, general explosions due to the ignition of the electric arc;
- projection of material in case of:
    - breakage of the working elements, with projection of part of them;
    - incorrect positioning of the *ENCODER*;
    - presence of materials / foreign bodies on the working parts or on the *ENCODER*.

PPE required

Attention to follow during use

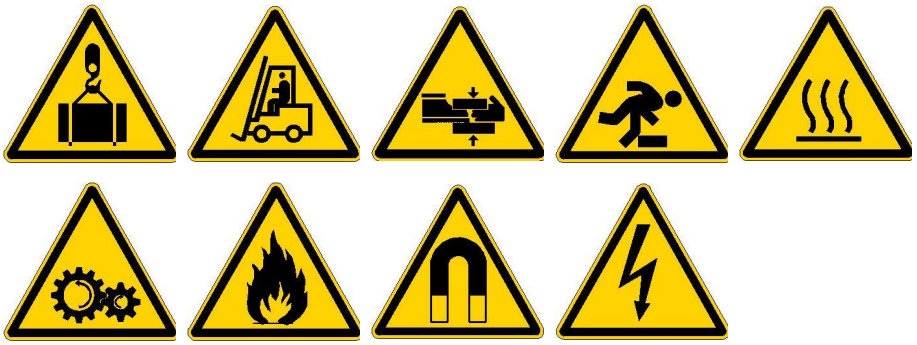
During use, it is necessary to follow the precautions described in this paragraph.

- Do not try to reach drives, even if in stop condition.

- Operate the *ENCODER* only if all the protection and safety devices are intact.
- Observe all safety and danger warnings.
- Wear all the necessary *PPE*, regularly checking its integrity (immediately reporting the *PPE* is no longer able to perform the specific task).
- Do not use the *ENCODER* in conditions other than those indicated in the Intended Use paragraph.
- Use the *ENCODER* ensuring compliance with the technical specifications shown on the dedicated technical data sheets attached to this document, according to the specific *ENCODER* configuration.
- Use the *ENCODER* ensuring compliance with the mounting tolerances, according to the specific *ENCODER* configuration.
- Use the *ENCODER* ensuring compliance with the electrical data, according to the specific *ENCODER* configuration.
- Use the *ENCODER* ensuring compliance with the maximum mechanical speed, according to the specific *ENCODER* configuration.
- Always wait for any overheated parts to cool before intervening on the *ENCODER*.
- Keep people wearing devices such as heart pacemakers away from the *ENCODER*.
- Do not try to reach any moving parts. Do not try to reach drives, even if in stop condition.
- Do not intervene on the *ENCODER* without having read this manual completely and carefully.
- Use auxiliary equipment and, in any case, any other machinery, tool or utensil only after having understood the indications given in the relevant Use and Maintenance Manuals or after having followed specific and formalized training.
- Immediately report abnormal operating situations.
- Do not perform any intervention (including cleaning) with the *ENCODER* in action or electrically powered or near hot surfaces.
- Do not try to make the *ENCODER* perform unauthorized operations (refer to the Proper use paragraph).
- Do not install or place equipment / pipes / channels on the *ENCODER*.

3.1.4 Maintenance and demolition

Residual risks during maintenance and demolition



During maintenance and demolition there are risks related to:

- all the risks previously indicated;
- operations on the *ENCODER* by unqualified, untrained, uninformed, or improperly equipped personnel;
- contact with live parts of the electrical system or parts under voltage;
- forgetting of objects on the *ENCODER* at the end of maintenance or adjustment operations;
- contact with hot elements of the *ENCODER*.

PPE required

Attention to follow during maintenance and demolition

During maintenance and demolition, it is necessary to follow the precautions described in this paragraph.

- Perform required operations using standard tools and always wearing the *PPE* required.
- The execution of maintenance and demolition operations must be carried out by qualified and specially trained personnel.
- Before perform maintenance operations it's always mandatory to:
    - check that all power supplies to the *ENCODER* have been suitably removed (including any external control power supplies and including any power

supplies concerning the mechanical system controlled by the *ENCODER*) and that no one can inadvertently reactivate them (use of padlocks, appropriate signs and consolidated work procedures);

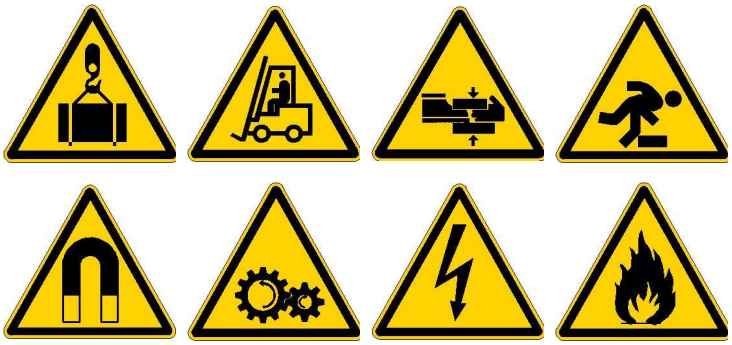
- check that any residual energies have been discharged before carrying out the interventions, including residual energies concerning the mechanical system controlled by the *ENCODER*;
- wait for all surfaces to cool down.

- Use auxiliary tools (manual, electric, hydraulic or pneumatic) only if the operators are skilled and formally trained to use it. Always read and follow the tool manufacturer's instructions before use.
- Do not use, for any reason, petrol, solvents or inflammable fluids for cleaning, but use commercial and approved cleaners non-combustible and non-toxic.
- Do not make changes, transformations or applications to the *ENCODER* that could affect its safety, without first obtaining written authorization from the Manufacturer.
- Do not hit the *ENCODER* with equipment or anything else.
- Do not tamper the *ENCODER* components.

4. Installation and commissioning

To perform this task, the following Individual Protection Devices are required:

During this task there are the following residual risks, as described in full in Chapter 3:



DANGER: ***FLUX GmbH declines all responsibility for damages to things and/or people resulting from improper interventions carried out by unqualified, untrained, or unauthorized personnel.***

4.1 Environmental conditions of the installation site

The operating environmental conditions necessary for the proper functioning of the *ENCODER* are indicated below.

Environmental data	
Temperature range - Standard (*no additional option in order code***)**	
Operating	-20°C .. +85°C
Storage	-20°C .. +85°C
Temperature range - Extended (*contact FLUX for more details***)**	
Operating	-40°C .. +105°C
Storage	-55°C .. +125°C
Ingress Protection	IP67
EMC immunity	complies with EN IEC 61000-6-2
EMC emission	complies with EN IEC 61000-6-4

In the installation room there must be no presence of corrosive or harmful gasses or acids, harmful to both operators and the *ENCODER* itself.

They must not be present in the work area:

- strong oxidizing agents (acids in general, oxidizing mineral acids, amines compounds, magnesium salts, aluminum and zinc), corrosive both to the paint and to the other rubber and plastic parts;
- scouring powder;
- potentially explosive atmospheres.

All previous operating and environmental conditions are always valid if it is not otherwise explicitly specified.

4.2 Installation

4.2.1 Checks before installation

The measures indicated below are used to minimize the occurrence of breakdowns or accidents on the *ENCODER*.

- Check the conformity of type and type of the product ordered with the product code shown on the *ENCODER* itself.
- Carry out a visual check to assess the absence of any damage.
- Prevent foreign bodies (such as shavings, screws or pieces of wire) from entering the product.

DANGER: ***do not use damaged products. Contact the manufacturer.***

- Check that the *ENCODER* is clean and not corroded, otherwise clean it.
- Make sure the mounting surface is stable, clean, free of burrs, paint or lubricants.
- Verify that the mounting surface complies with all the dimensions and mechanical tolerances required for coupling with the *ENCODER*, indicated in the mechanical dimensional drawing, shown on the dedicated technical data sheets attached to this document, according to the specific *ENCODER* configuration.

4.2.2 Mounting

The measures indicated below are used to minimize the occurrence of breakdowns or accidents on the *ENCODER*.

- Install the *ENCODER* in applications that ensure compliance with the technical specifications shown on the dedicated technical data sheets attached to this document, according to the specific *ENCODER* configuration.
- Install the *ENCODER* in applications that ensure compliance with the mounting tolerances, according to the specific *ENCODER* configuration.
- Install the *ENCODER* in applications that ensure compliance with the electrical data, according to the specific *ENCODER* configuration.
- Install the *ENCODER* in applications that ensure compliance with the maximum mechanical speed, according to the specific *ENCODER* configuration.
- Check that the bending radius made by the cable meets the cable specifications.
- Protect the *ENCODER* from shocks or bumps.

- During the assembly of the *ENCODER* on the mounting surface, it is necessary to check that the *ENCODER* is oriented correctly in an axial and radial direction and that it is uniformly in contact with the surface.
- For its correct positioning and centering with respect to the rotating part to be measured, it is necessary to use a centering or alignment tool that must be provided by the User and must be adapted to the *ENCODER* configuration and to the user's application.
- Tighten the fixing screws with the tightening torque suitable for the single *ENCODER*. When tightening the fastening screws, uneven mechanical stresses must not be produced.
- Use screws of the same size as indicated in the dedicated technical data sheets attached to this document, according to the specific *ENCODER* configuration. Tighten the screws using a torque wrench: an example of typical tightening torques depending on the size of the fastening system is shown in the following table.

Table 1 – Typical values of the tightening torques as a function of the size of the fastening

Dimension	Tightening torque [Nm]
M 2,5	0,8
M 3	1,2
M 4	2,8

4.3 Connection and commissioning

The measures indicated below are used to minimize the occurrence of breakdowns or accidents on the *ENCODER*.

DANGER: ***this activity must be performed by a qualified technician.***

DANGER: ***BEFORE CONNECTING THE ELECTRICAL parts, check that the power supply to the ENCODER and to the axes is disconnected.***

- The power supply (also in terms of voltage and frequency) provided by the User must be adequate to properly power the *ENCODER* and ensure compliance with the electrical characteristics shown on the dedicated technical data sheets attached to this document, according to the specific *ENCODER* configuration.

DANGER: ***connecting the ENCODER with unauthorized electrical characteristics causes damage to the ENCODER and can cause a fire.***

- Make all the required connections, as reported in the dedicated technical data sheets attached to this document, according to the specific *ENCODER* configuration.
- Use a motion controller that uses an *ENCODER* reading software with a standard compatible with it. In this regard, see the dedicated technical data sheets attached to this document, where some examples of interface systems are also shown.
- Always use cables with sections suitable for voltages and currents.
- Before inserting or removing a connector, ensure that the voltage supply on all connections has been removed.
- Once the installation is complete, check the electrical continuity of the external parts of the *ENCODER* towards the equipotential protection conductor.
- Once installation is complete, verify compliance with the mechanical tolerances shown in the dedicated technical data sheets attached to this document, according to the specific *ENCODER* configuration.
- Before energizing, check that the connectors are correctly inserted and completely and firmly locked or that the cables are correctly, firmly and securely connected. Always avoid twisting the connection cable.
- Check that the *ENCODER* rotates evenly.
- At the end of the installation, the *ENCODER* does not require calibration.

DANGER: ***the Manufacturer declines all responsibility for any damage to property and / or persons deriving from improper interventions carried out by unqualified, untrained or unauthorized personnel.***

4.4 Storage of the *ENCODER*

These subsequent indications refer to storage to be carried out with the *ENCODER* positioned in the original packaging.

If it is necessary to store the *ENCODER* for a period before installing it (or following an uninstallation), it is recommended to protect it adequately and store it in a suitable environment, having the following characteristics:

- protected against bad weather;
- protected against access by unauthorized persons;
- with the following environmental conditions:
    - good ventilation;
    - ambient temperature between -20 °C and +50 °C;
    - relative air humidity between 30% and 80%;
    - possibly in a dry and dust-free atmosphere.

5. Maintenance and Demolition

5.1 General maintenance instructions

To ensure maximum reliability of the *ENCODER* and avoid dangerous conditions, carefully follow instructions and warnings given on the following pages.

Evaluate all the risks, dangers and the precautions, contained in the relevant paragraph of Chapter 3 of this document.

DANGER: ***only operators who are properly trained and informed about the risks can intervene in correspondence with the ENCODER and only after having read this instruction manual. The Manufacturer declines all responsibility for any damage to property and / or persons deriving from improper interventions carried out by unqualified, untrained or unauthorized personnel.***

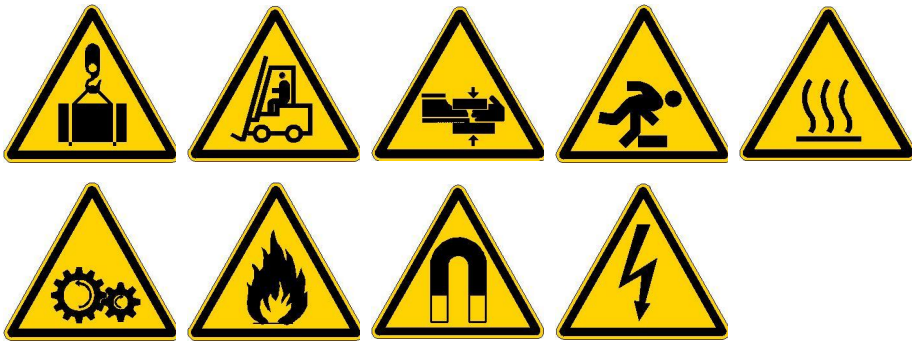
DANGER: ***for safety reasons, all maintenance operations described in this chapter must only be carried out by qualified and specifically trained technicians. The technicians in charge must also have all the tools and PPE necessary to operate safely.***

WARNING*: to always guarantee the operators the full efficiency and safety of the ENCODER and prevent problems related to the deterioration of the safety measures, it is necessary to*

implement effective preventive maintenance, planning interventions at scheduled intervals, to check the general condition of the mechanical and electrical components of the ENCODER, thus providing information on any extraordinary operations that may be necessary.

To perform this task, the following Individual Protection Devices are required:

During this task there are the following residual risks, as described in full in Chapter 3:



Before carrying out any maintenance or cleaning operations described in this chapter, **it is mandatory to:**

- check that **all power supplies to the *ENCODER* have been suitably removed** (including any external **control power supplies** and including any power supplies concerning the **mechanical system controlled by the *ENCODER***) and that no one can inadvertently reactivate them (use of padlocks, appropriate signs and consolidated work procedures);
- check that any **residual energies** have been discharged before carrying out the interventions, including **residual energies** concerning the **mechanical system controlled by the *ENCODER***;
- wait for all surfaces to cool down.

5.2 Debugging

All the GMI ANGLE ENCODERS are equipped with a status LED, except for high temperature applications (in this case contact FLUX GmbH for more information).

Table 2 – Debugging

LED Color	Status	Recommended actions
No color	System is not (correctly) Powered-Up.	Check wiring connection to the motion controller
Red Color		
Continuous	System configuration error	Please contact FLUX
Fast blinking(2)	Encoder in error mode	Check encoder mounting
Slow blinking(3)	Out of operating range	Check encoder air-gap
Yellow		
Continuous	Normal operation, but error was detected	Check encoder shielding connection Check encoder mounting
Green		
Continuous	Optimal performance	
Fast blinking(2)	Normal operation, not optimal performance	Check encoder runout
Slow blinking(3)	Normal operation, not optimal performance	Check encoder air gap

(1) Except for high temperature applications. Please contact FLUX for more information.
(2) Fast blinking ~ 0.4 sec.
(3) Slow blinking ~ 1.6 sec

5.3 Ordinary maintenance of the *ENCODER*

The *ENCODER* does not contain any components whose maintenance can be performed by the User, unless indicated in the following paragraphs. Replace the entire *ENCODER* or contact FLUX GmbH directly in case of faults.

Have repairs carried out exclusively by the service of FLUX GmbH.

Repair without prior disassembly is not allowed.

DANGER: ***only operators who are properly trained and informed about the risks can intervene in correspondence of the ENCODER and only after having read this instruction manual.***

DANGER: ***it is absolutely forbidden to use compressed air to clean the surface areas of the ENCODER.***

- Periodically check the correct connection of the wiring and the connections condition.
- Periodically check all connection cables and connectors for damage. Replace damaged cables immediately.
- Check compliance with the mechanical tolerances, according to the specific configuration of the *ENCODER*, reported in the dedicated technical data sheets attached to this document.
- Check the tightness of all mechanical and electrical screw connections based on the tightening torque given in Paragraph 4.2.
- Periodically remove dust and dirt from the product.
- Before using a detergent, check the compatibility of the detergent and the components involved and, unless otherwise specified, do not use in general:
    - alkaline cleaners;
    - chlorine-based cleaners;
    - sulfuric acid based detergents.

5.4 Extraordinary maintenance interventions

DANGER: ***the Manufacturer declines all responsibility for any damage to property and / or persons deriving from incorrect or incomplete maintenance.***

If extraordinary maintenance is required, only experienced and qualified personnel directly from the Manufacturer FLUX GmbH can intervene on the *ENCODER*.

***WARNING**:* *changes made to the ENCODER not previously agreed with the manufacturer, will void any liability of the manufacturer himself, from any damage caused to things or people, resulting from the use of the ENCODER.*

5.5 Decommissioning, disassembly and demolition

5.5.1 Decommissioning of the *ENCODER*

To put the *ENCODER* out of service for a long time, perform the following operations:

- check that **all power supplies to the *ENCODER* have been suitably removed** (including any external **control power supplies** and including any power supplies concerning the **mechanical system controlled by the *ENCODER***) and that no one can inadvertently reactivate them (use of padlocks, appropriate signs and consolidated work procedures);
- check that any **residual energies** have been discharged before carrying out the interventions, including **residual energies** concerning the **mechanical system controlled by the *ENCODER*;**
- wait for all surfaces to cool down.

5.5.2 Disassembly

In the event that it is necessary to disassemble the *ENCODER*, perform the procedure indicated below.

1. Remove the power supply to the *ENCODER*.
2. Referring to Chapter 4, uninstall the *ENCODER*; furthermore, contact the Manufacturer's Technical Offices to obtain the necessary assistance during this intervention.

DANGER: ***the Manufacturer declines all responsibility for any damage to property and / or persons deriving from improper interventions carried out by unqualified, untrained, inadequately equipped or unauthorized personnel.***

5.5.3 Demolition

When the *ENCODER* has completed its life cycle, proceed with the final dismantling, minimizing the environmental impact related to the disposal of the *ENCODER* components, as required by local regulations on waste disposal.

***WARNING**:* *upon demolition of the ENCODER, make the identification information of the ENCODER itself and the related technical documentation unusable. The User has the right to return these elements to the Manufacturer's Technical Office which will arrange for their destruction. The simple storage of the aforementioned elements in an inaccessible place is not allowed.*

6. Annexes

1. GMI Angle Encoder “GIM-ANG” Series – Technical Datasheet
2. AXIAL - HOLLOW SHAFT - ABSOLUTE ENCODERS – Product overview
3. Declaration of Conformity - CE

7. Revision history

Date	Version	Comments
april 2022	00	First built

All technical data is subject to change without notice.

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