SAFETY MANUAL

vibro-meter®

GSI127
galvanic separation unit
– IEC 61508 SIL 2

SIL Safety

This document contains important information about products that are intended for use in safety-related applications.

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PREFACE

About this manual

This manual provides reference information on using the GSI127 galvanic separation unit, from Parker Meggitt's vibro-meter® product line, in safety-related applications (functional-safety contexts).

It is applicable to GSI127 galvanic separation units with diagnostics (PNR 244-127-000-021) that are used in SIL measurement chains, typically by using a IPC707 signal conditioner with diagnostics or a IQS9xx signal conditioner with diagnostics.

Such SIL measurement chains include but are not limited to vibration measurement chains using a CAxxx piezoelectric accelerometer and a IPC707 signal conditioner, pressure measurement chains using a CPxxx dynamic pressure sensor and a IPC707 signal conditioner, and proximity measurement chains using a TQ9xx proximity sensor and a IQS9xx signal conditioner.

These SIL measurement chains are typically used for critical functions in machinery protection system (MPS) and/or condition monitoring system (CMS) applications.

About Parker Meggitt and vibro-meter®

Parker Hannifin Corporation – usually referred to as just Parker – is a global leader in motion and control technologies, providing precision-engineered solutions for a wide variety of mobile, industrial and aerospace markets. For more than a century the company has been enabling engineering breakthroughs that lead to a better tomorrow.

Parker Meggitt joined the Parker Aerospace Group in September 2022 following the successful acquisition of Meggitt PLC, a world leader in aerospace, defense and energy. This included the Meggitt facility in Fribourg, Switzerland, operating as the legal entity Meggitt SA (formerly Vibro-Meter SA). Accordingly, the vibro-meter® product line is now owned by Parker.

Working closely with its customers, Parker Meggitt delivers technologically differentiated systems and products for the most demanding environments with high certification requirements for applications across its core end markets: aerospace, energy and industrial.

For the energy market (power generation, oil & gas and other industrial markets), vibro-meter® products and solutions include a wide range of vibration, dynamic pressure, proximity, air-gap and other sensors / measurement chains capable of operation in extreme environments, machinery protection and condition monitoring systems, and innovative software.

To learn more about Parker Meggitt (Meggitt SA), our proud tradition of innovation and excellence, and our solutions for energy markets and applications, visit our website at www.meggittsensing.com/energy

Who should use this manual?

This manual is written for personnel such as designers and operators of machinery protection and/or monitoring systems in safety-related applications that use a sensor / measurement chain including a GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021) as an input (sensor) to an external monitoring and/or protection system (safety instrumented system (SIS)) that performs a safety function.

The system designers and operators are assumed to have the necessary technical training in safety, reliability, electronics and/or mechanical engineering (professional certificate/diploma or equivalent) to enable them to design, install, configure, use and maintain such safety instrumented systems.

Structure of the manual

This section gives an overview of the structure of the manual and the information contained within it. Some information has been deliberately repeated in different sections of the document to minimize cross-referencing and to facilitate understanding through reiteration.

The chapters are presented in a logical order. You should read those that are most relevant to your safety-related application and then keep the document at hand for future reference.

The structure of the document is as follows:

Chapter 1	Introduction Explains the purpose and scope of this safety manual. Introduces the GSI127 galvanic separation unit with diagnostics and applicable measurement chains.
Chapter 2	System description Explains the operation of the GSI127 galvanic separation unit. Specifies the requirements for a valid measurement chain such as sensor / signal conditioner, galvanic separation unit and cabling, and measurement chain and power supply considerations.
Chapter 3	How to use the system for safety Explains how a a sensor / measurement chain including a GSI127 galvanic separation unit is used in safety-related applications in terms of the various safety properties. And provides safety parameters and highlights safety considerations relevant to the design, installation, configuration, use and maintenance of these systems.
Chapter 4	Configuration Provides configuration information for sensors / measurement chains including a GSI127 galvanic separation unit.
Chapter 5	Installation and commissioning Provides installation and commissioning information for sensors / measurement chains including a GSI127 galvanic separation unit.
Chapter 6	Operation and maintenance Provides proof test and other operation and maintenance information for sensors / measurement chains including a GSI127 galvanic separation unit.
Chapter 7	Safety issues Provides safety parameters and highlights safety considerations relevant to the design, installation, configuration, use and maintenance of sensors / measurement chains including a GSI127 galvanic separation unit in safety-related applications.
Chapter 8	Service and support Provides contact information for technical support. Includes information regarding important SIL safety product information and the procedure to follow in order to opt in and receive such SIL product communications. Includes information regarding product returns and the procedure to follow in order to report problems and return Parker Meggitt (Meggitt SA) energy products for repair.

Related publications and documentation

See 1.7 Related documentation and 1.8 Applicable functional safety standards.

Abbreviations

The following table defines some abbreviations useful to this safety manual and related documentation.

Abbreviation	Meaning
1oo1	one out of one
AC	alternating current
APFxxx	24 V_{DC} power supplies, from vibro-meter®
BIST	built-in self-test
CAxxx	piezoelectric accelerometers, used with a IPCxxx signal conditioner (for example, CAxxx and IPC707), from vibro-meter®
CExxx	piezoelectric accelerometers, from vibro-meter®
CE6xx	general-purpose vibration sensors (piezoelectric accelerometers), from vibro-meter®
CPxxx	dynamic pressure sensors, used with a IPCxxx signal conditioner (for example, CPxxx and IPC707), from vibro-meter®
CCF	common cause failure
CMS	condition monitoring system
COM	common
DC	diagnostic coverage
DC	direct current
DCS	distributed control system
ESD	emergency shutdown system
Exida	A product certification and knowledge company specialising in system safety
FMEDA	failure modes, effects and diagnostic analysis
HFT	hardware fault tolerance
IEC 61508	IEC standard “Functional safety of electrical/electronic/programmable electronic safety-related systems”
IEPE	integrated electronics piezo electric
IPCxxx	signal conditioner, used with CAxxx and CPxxx sensors (for example, CAxxx or CPxxx and IPC707), from vibro-meter®

Abbreviation	Meaning
IQSxxx	signal conditioner, used with TQxxx sensors (for example, TQ9xx and IQS900), from vibro-meter®
MPS	machinery protection system
MRT	mean repair time Note: See also MTTR.
MTTFd	mean time to dangerous failure
MTTR	mean time to restoration Note: MTTR = MRT, where mean time to restoration (hour) = mean repair time (hour) as per IEC 61508-6 © IEC:2010 Table B.1
N/A	not applicable, not available
PFD	probability of failure on demand (low-demand system)
PFDavg	average probability of failure on demand
PFH	probability of failure per hour (high-demand system)
PL	performance level
PLC	programmable logic controller
PNR	part number
PST	process safety time
PSU	power supply unit
PTC	proof test coverage
PTI	proof test interval
PV6xx	general-purpose vibration sensors (piezoelectric velocity sensors), from vibro-meter®
SFF	safe failure fraction
SIF	safety instrumented function
SIL	safety integrity level
SIS	safety instrumented system
SNR	serial number
SRS	safety-related system
TQxxx	proximity sensor, used with a IQSxxx signal conditioner (for example, TQ9xx and IQS900), from vibro-meter®
VE210	velocity sensor, from vibro-meter®
vibro-meter®	Parker Meggitt product line
VibroSmart®	VibroSmart® distributed monitoring system (DMS) based machinery monitoring and protection systems, from vibro-meter®
VM600^{Mk2}/VM600	VM600^{Mk2}/VM600 rack-based machinery monitoring and protection systems, from vibro-meter®
WEEE	waste electrical and electronic equipment

SAFETY

Symbols and styles used in this manual

The following symbols are used in this manual where appropriate:

The WARNING safety symbol

THIS INTRODUCES DIRECTIVES, PROCEDURES OR PRECAUTIONARY MEASURES WHICH MUST BE EXECUTED OR FOLLOWED. FAILURE TO OBEY A WARNING MIGHT RESULT IN INJURY TO THE OPERATOR AND/OR THIRD PARTIES, AND/OR RESULT IN DAMAGE TO EQUIPMENT.

The CAUTION safety symbol

This draws the operator's attention to information, directives or procedures which must be executed or followed. Failure to obey a caution can result in damage to equipment.

NOTE: The NOTE symbol. This draws the operator's attention to complementary information or advice relating to the subject being treated.

Important remarks on safety-related applications

USE OF A GSI127 GALVANIC SEPARATION UNIT WITH DIAGNOSTICS (PNR 244-127-000-021) IN SAFETY-RELATED APPLICATIONS (FUNCTIONAL-SAFETY CONTEXTS) ASSUMES THAT THE INSTRUCTIONS AND RECOMMENDATIONS IN THIS SAFETY MANUAL ARE IMPLEMENTED AS APPROPRIATE BY THE END-USER.

FAILURE TO FOLLOW THE INSTRUCTIONS AND IMPLEMENT THE RECOMMENDATIONS IN THIS SAFETY MANUAL MIGHT RESULT IN INJURY TO THE OPERATOR AND/OR THIRD PARTIES, AND/OR RESULT IN DAMAGE TO EQUIPMENT AND WILL INVALIDATE ANY WARRANTY.

Important remarks on safety

Read this manual carefully and observe the safety instructions before installing and using the equipment described.

By doing this, you will be aware of the potential hazards and be able to work safely, ensuring your own protection and also that of the equipment.

Every effort has been made to include specific safety-related procedures in this manual using the symbols described above. However, operating personnel are expected to follow all generally accepted safety procedures.

All personnel who are liable to operate the equipment described in this manual should be trained in the correct safety procedures.

Parker Meggitt does not accept any liability for injury or material damage caused by failure to obey any safety-related instructions or due to any modification, transformation or repair carried out on the equipment without written permission from Parker Meggitt (Meggitt SA). Any modification, transformation or repair carried out on the equipment without written permission from Parker Meggitt will invalidate any warranty.

Electrical safety and installation

WHEN INSTALLING A GSI127 GALVANIC SEPARATION UNIT, OBSERVE ALL SAFETY (WARNING AND CAUTION) STATEMENTS IN THIS MANUAL AND IN THE RELEVANT SENSOR / MEASUREMENT CHAIN INSTALLATION MANUAL, AND FOLLOW ALL NATIONAL AND LOCAL ELECTRICAL CODES. SEE 1.7 RELATED DOCUMENTATION FOR A LIST OF INSTALLATION MANUALS.

ONLY TRAINED AND QUALIFIED PERSONNEL (SUCH AS A QUALIFIED/LICENSED ELECTRICIAN) SHOULD BE ALLOWED TO INSTALL OR REPLACE THIS EQUIPMENT. CHECKS TO ENSURE ELECTRICAL SAFETY SHOULD BE CARRIED OUT BY A COMPETENT PERSON.

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN DEATH, SERIOUS INJURY, AND/OR EQUIPMENT DAMAGE.

Replacement parts and accessories

Use only approved replacement parts and accessories.

Do not connect with incompatible products or accessories.

Only use replacement parts and accessories intended for use with a GSI127 galvanic separation unit that have been approved by Parker Meggitt (Meggitt SA).

Using incompatible replacement parts and accessories could be dangerous and may damage the equipment or result in injury.

For information on replacement parts and accessories:

- Visit the Parker Meggitt website at www.meggittsensing.com/energy
- Contact your local Parker Meggitt representative.

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1 INTRODUCTION

1.1 Purpose

This safety manual provides the specific information required to use a GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021) in safety-related applications (functional-safety contexts), in accordance with the IEC 61508 safety standard.

It is applicable to sensors / measurement chains that include a GSI127 galvanic separation unit with diagnostics as part of a SIL measurement chain, typically by using a IPC707 signal conditioner with diagnostics or a IQS9xx signal conditioner with diagnostics. For IPC707 and IQS9xx signal conditioners with optional diagnostics (that is, built-in self-test (BIST)), the quasi-static (DC) component of the output signal provides diagnostic information about the state of the sensor / measurement chain.

In such SIL measurement chains, the GSI127 galvanic separation unit acts as an interface between the sensor / signal conditioner and the external machinery monitoring system, such as a VM600^{Mk2}/VM600, VibroSmart® or third-party system. Accordingly, the main functions of the GSI127 are:

- Galvanic isolation between the sensor-side (sensor / signal conditioner) and the monitor-side (machinery monitoring system).
- Provision of a safe, isolated power supply to the measurement chain (sensor / signal conditioner).
- Conversion of current or voltage input signal coming from the measurement chain (sensor / signal conditioner) to an appropriate voltage output signal.
- Integrated diagnostic health checks in order to indicate the integrity of the unit.

NOTE: The GSI127 galvanic separation unit's output is an analog voltage signal consisting of two components: a dynamic (AC) signal sitting on a quasi-static (DC) signal.
The dynamic (AC) component corresponds to the dynamic measurement value. For example, vibration for a CAxxx/IPC707, pressure for a CPxxx/IPC707 and displacement for a TQ9xx/IQS900.
For a a GSI127 with diagnostics (PNR 244-127-000-021), the quasi-static (DC) component corresponds to either:
- A diagnostic value (that is, a voltage outside of the normal operating range) used to indicate that the GSI127 has detected a problem.
- A non-diagnostic value (that is, a voltage inside of the normal operating range) that corresponds to the DC output signal from the signal conditioner, For example, a mid-range bias signal for a CAxxx/IPC707 or CPxxx/IPC707, and an initial-gap measurement value for a TQ9xx/IQS900.

For more general information on the GSI127 galvanic separation unit and or the information required to use a GSI127 in standard (non-safety related) applications, refer to the relevant sensor / measurement chain installation manual. See 1.7 Related documentation for a list of installation manuals.

1.2 GSI127 diagnostic capability

A GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021) contains integrated diagnostics (that is, built-in self-test (BIST)) that can detect and indicate the following internal problems:

- Power supply diagnostics
  This diagnostic checks the input power supply (to GSI127) and internal power supplies.
- Input signal diagnostics
  This diagnostic checks that the sensor / signal conditioner is well connected at the input (to GSI127).
- DC standby diagnostics
  This diagnostic checks the health of the electronic components in the signal processing chain.

Upon detection of a problem, the GSI127 galvanic separation unit will drive/saturate the quasi-static (DC) component of its output signal to a voltage value outside of its normal operating range in order to indicate that there is a problem.

In a safety-related application (functional-safety context), the output signal from a GSI127 galvanic separation unit can be used an input to an external machinery monitoring system that performs a safety function by taking this input, together with other safety-related signals and performing a system-level safety function, such as initiating the shutdown (trip) of a machine.

For reference, during “normal operation”, when the diagnostics of a GSI127 galvanic separation unit does not detect any problems, the GSI127 provides an output signal where the dynamic (AC) component corresponds to the dynamic measurement value and the quasi-static (DC) component corresponds to a mid-range bias signal or an initial-gap measurement value (depending on the sensor / signal conditioner).

1.3 SIL measurement chains with a GSI127

To use a GSI127 galvanic separation unit with diagnostics as part of a SIL measurement chain in a safety-related application typically requires a measurement chain consisting of the following components:

- Sensor and signal conditioner with diagnostics.
  For example:
  - CAxxx piezoelectric accelerometer and IPC707 signal conditioner with diagnostics, and cabling.
  - CPxxx dynamic pressure sensor and IPC707 signal conditioner with diagnostics, and cabling.
  - TQxxx proximity sensor and IQS9xx signal conditioner with diagnostics, and cabling.
- Transmission cable (to GSI127).
- GSI127 galvanic separation unit.
- Transmission cable (from GSI127).
- External machinery monitoring system, such as a VM600^{Mk2}/VM600, VibroSmart® or third-party system.
- External power supply.

The GSI127 galvanic separation unit can also be used with sensors that have integrated signal conditioning electronics (that is, no external signal conditioner is required) such as CExxx piezoelectric accelerometers, and with sensors / signal conditioners without diagnostics.

Figure 1-1 shows the components of a SIL measurement chain including a GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021).

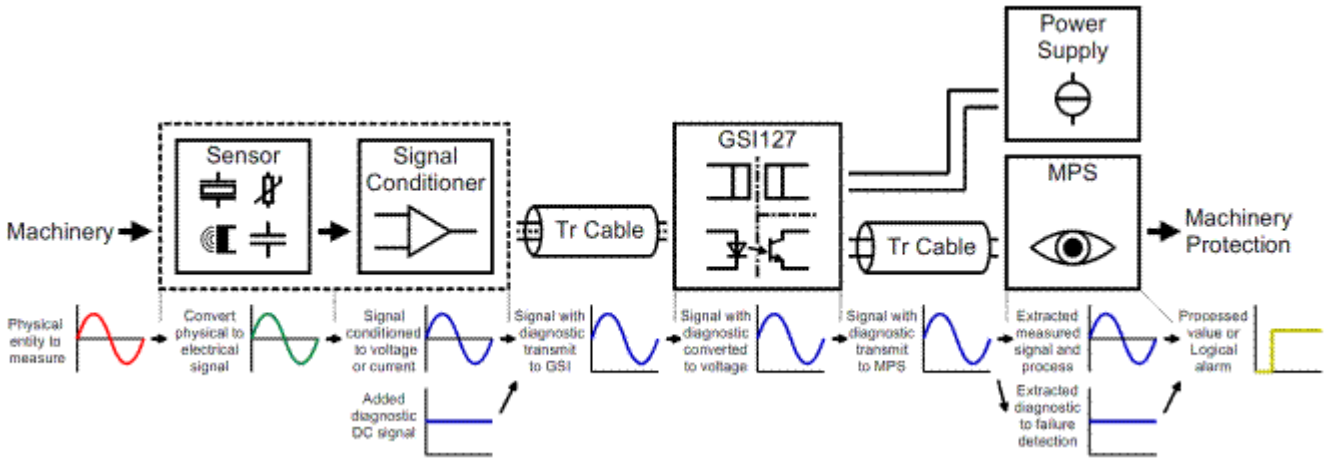

Figure 1-1: SIL measurement chain including a GSI127 galvanic separation unit

1.4 GSI127 galvanic separation unit

The GSI127 galvanic separation unit (PNR 244-127-000-021) is a versatile and configurable device that supports diagnostics that runs health checks on the internals of the GSI127 itself and updates its output signal (quasi-static (DC) signal) to indicate the integrity of the unit.

The diagnostics running on a GSI127 galvanic separation unit is in addition to any diagnostic functionality provided earlier in the SIL measurement chain, for example, by a IPC707 signal conditioner with diagnostics or a IQS9xx signal conditioner with diagnostics.

Details of the diagnostics / health checks are specified in 1.2 GSI127 diagnostic capability.

IN SAFETY-RELATED APPLICATIONS (FUNCTIONAL-SAFETY CONTEXTS), ANY REQUIRED SAFE STATE BEHAVIOUR, INCLUDING THE LATCHING OF ALARMS OR RELAYS, MUST BE IMPLEMENTED BY AN EXTERNAL MONITORING AND/OR PROTECTION SYSTEM AT THE SAFETY-SYSTEM LEVEL.

A SIL measurement chain can be used as an input (sensor) to an external monitoring and/or protection system (safety instrumented system (SIS)) configured to perform a safety function (safety instrumented function (SIF)), as shown in Figure 1-1.

In certain industries and applications, the monitoring and/or protection systems used are known by other names. For example, the terms “machinery protection system (MPS)” and “condition monitoring system (CMS)” are commonly used in the energy and oil & gas industries.

1.4.1 Reference part numbers

One version of the GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021), developed in accordance with the IEC 61508 safety standard, is available.

Table 1-1 lists the reference part number (PNR) for the GSI127 galvanic separation unit.

Table 1-1: Reference part number (PNR) for the GSI127 galvanic separation unit

Product	Part number (PNR)
GSI127 galvanic separation unit	244-127-000-021

As shown in Table 1-1, only one version of the GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021) is available. That is, diagnostics is always supported (it is not optional).

For reference, earlier versions of the GSI127 galvanic separation unit (PNR 244-127-000-01*x*) did not support diagnostics.

Different variants of the GSI127, specified by different ordering option codes (A*x* and B*xx*), are available for use with different measurement chain (see 1.5 GSI127 compatible measurement chains and 1.4.2 Configurations).

NOTE: Refer to the *GSI127 galvanic separation unit data sheet* for further information.

1.4.2 Configurations

The GSI127 galvanic separation unit is a configurable product. When ordering a GSI127, the part number (PNR) and ordering option codes are used to specify the complete configuration of the different variants of the device.

NOTE: GSI127 galvanic separation units are configured in the factory as part of the manufacturing process. The configuration is fixed and cannot be changed later.

For example, a complete GSI127 ordering number, including part number (PNR) and ordering option codes, is: 244-127-000-021-A*x*-B*xx*.

The different ordering option codes (A*x* and B*xx*) are used to specify different variants of the GSI127, suitable for use with different measurement chains (see 1.5 GSI127 compatible measurement chains).

NOTE: Only a GSI127 galvanic separation unit with diagnostics (244-127-000-021) should be used in safety-related applications (functional-safety contexts).

The diagnostics / health checks are specified in 1.2 GSI127 diagnostic capability.

NOTE: Refer to the *GSI127 galvanic separation unit data sheet* for further information.

1.4.3 Identifying

As shown in Figure 1-2, the product label on the side of a GSI127 galvanic separation unit shows the complete ordering number – part number (PNR) and ordering option codes.

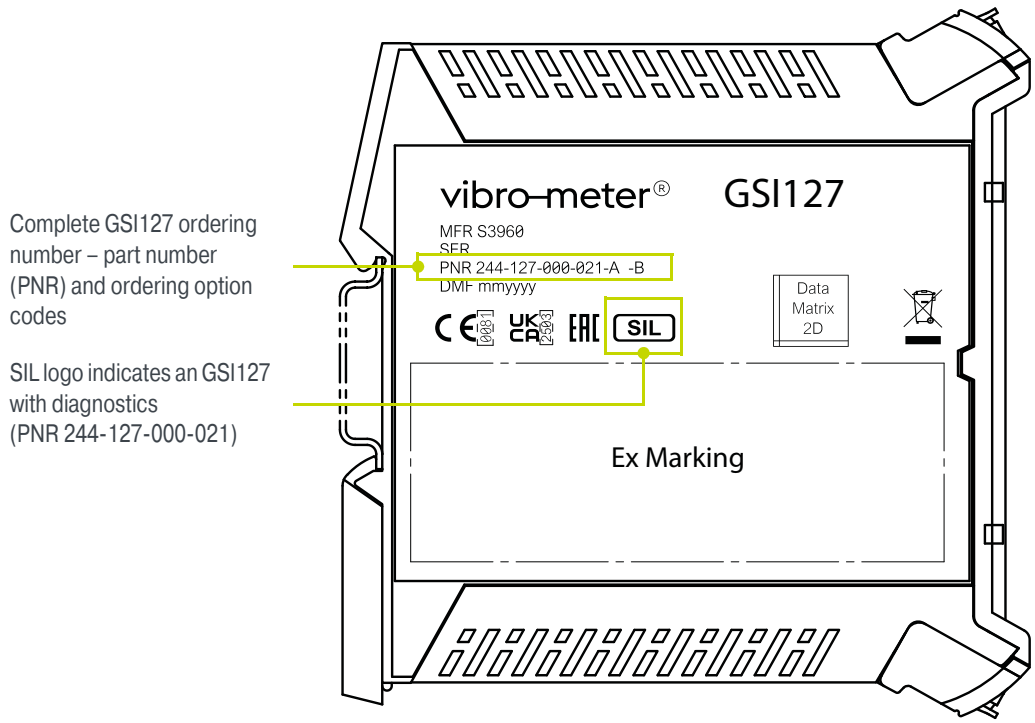

Figure 1-2: Top view of a GSI127 galvanic separation unit with a typical product label showing the complete ordering number

NOTE: A GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021) suitable for use in safety-related applications is identified by a SIL logo.

1.5 GSI127 compatible measurement chains

The GSI127 galvanic separation unit is compatible with different types of measurement chain. More specifically, different variants of the GSI127 are available for use with different families of sensors and signal conditioners.

Table 1-2 shows the different variants of the GSI127 galvanic separation unit and the different types of measurement chain that they are compatible with.

Table 1-2: GSI127 compatible measurement chains

GSI127 variant			Type of measurement chain		
Ordering option code	**Sensitivity**	**Offset**	**Sensor**	**Signal conditioner**	**Measurement**
B01	1 V / mA	2 V	CExxx piezoelectric accelerometers	None	Vibration (absolute)
B02	1 V / mA	−5 V	CAxxx piezoelectric accelerometers	IPC707 with a current output	Vibration (absolute)
			CPxxx dynamic pressure sensors	IPC707 with a current output	Pressure (dynamic)
			VE210 velocity sensor with a current output	None	Vibration (velocity)
B03	3.2 V / mA	−48 V	TQxxx proximity sensors	IQS90x with a current output	Vibration (relative) and/or displacement
B04	1 V / V	0 V	CAxxx piezoelectric accelerometers	IPC707 with a voltage output	Vibration (absolute)
			CPxxx dynamic pressure sensors	IPC707 with a voltage output	Pressure (dynamic)
B05	−1 V / V	0 V	TQxxx proximity sensors	IQS90x with a voltage output	Vibration (relative) and/or displacement
			VE210 velocity sensor with a voltage output	None	Vibration (velocity)
B11	0.5 V / mA	0 V	TQxxx proximity sensors	IQS91x with a 4-20 mA current-loop signal	Position or vibration (“peak-meter”)
			CE6xx and PV6xx vibration sensors with a 4-20 mA current-loop signal. Note: Also other industry-standard 4-20 mA sensors/transmitters.	None	Vibration (absolute and velocity)
B21	1 V / V	0 V	CE6xx and PV6xx vibration sensors with a voltage output. Note: Also other industry-standard IEPE sensors.	None	Vibration (absolute and velocity)

1.6 Use in safety-related applications

It is the end-user's responsibility to ensure that only a GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021) is used in a safety-related application (functional-safety context), and that the recommendations in this safety manual are implemented as appropriate by the end-user.

FAILURE TO FOLLOW THE INSTRUCTIONS AND IMPLEMENT THE RECOMMENDATIONS IN THIS SAFETY MANUAL MIGHT RESULT IN INJURY TO THE OPERATOR AND/OR THIRD PARTIES, AND/OR RESULT IN DAMAGE TO EQUIPMENT.

Always check the product label to ensure that the complete GSI127 ordering number – part number (PNR) and ordering option codes – is correct before installing or replacing a GSI127 galvanic separation unit (see 1.4.2 Configurations and 1.4.3 Identifying).

1.7 Related documentation

This safety manual is limited to the information and actions that are required to ensure compliance with the relevant safety certifications and standards.

Table 1-3 lists other documentation, such as data sheets and manuals, that must be referred to for information outside the scope of this safety manual.

Table 1-3: Related documentation

Document name	Document reference
GSI127 galvanic separation unit data sheet	262-870
Vibration measurement chains using CAxxx piezoelectric accelerometers installation manual	MACA/E
Vibration measurement chains using CExxx piezoelectric accelerometers and PVxxx piezoelectric velocity sensors installation manual	MACE/E
Vibration measurement chains using CVxxx velocity sensors and VExxx velocity sensors installation manual	MACV/E
Pressure measurement chains using CPxxx piezoelectric pressure sensors installation manual	MACP/E
Proximity measurement chains using TQ9xx proximity sensors installation manual	MAPROX900/E
IPC707 signal conditioner safety manual	MAIPC707-FS/E
TQxxx proximity measurement chains using an IQS900 signal conditioner safety manual	MAIQS900-FS/E

NOTE: Ensure that the latest version of related documentation is being used by obtaining the documents from the Parker Meggitt website at www.meggittsensing.com/energy or by contacting your local Parker Meggitt representative.

1.8 Applicable functional safety standards

Table 1-4: Applicable functional safety standards

Document name	Document reference
IEC 61508: Functional safety of electrical/electronic/programmable electronic safety-related systems	Ed. 2 (2010)

2 SYSTEM DESCRIPTION

2.1 Operation of a GSI127

As shown in Figure 2-1, the output from a GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021) is an analog voltage signal consisting of two components: a dynamic (AC) signal sitting on a quasi-static (DC) signal.

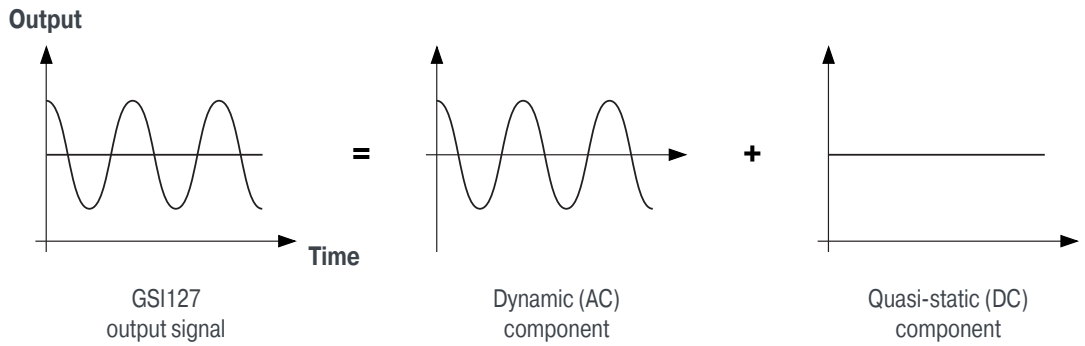

Figure 2-1: Output signal from a GSI127 galvanic separation unit

For the output signal from a GSI127 galvanic separation unit:

- The dynamic (AC) component corresponds to the dynamic measurement value from the sensor / signal conditioner in the measurement chain. For example, vibration, pressure, proximity and so on.
- The quasi-static (DC) component can be either:
  - A GSI127 non-diagnostic value that corresponds to the DC output signal from the sensor / signal conditioner in the measurement chain.

NOTE: A GSI127 non-diagnostic value is a voltage inside of the GSI127's normal operating range.

  - A GSI127 diagnostic value used to indicate that the GSI127 has detected a problem (see 1.2 GSI127 diagnostic capability).

NOTE: A GSI127 diagnostic value is a voltage outside of the GSI127's normal operating range.

Further, when a GSI127 galvanic separation unit is used with a SIL measurement chain containing a IPC707 signal conditioner with diagnostics or a IQS9xx signal conditioner with diagnostics and the GSI127's output has a quasi-static (DC) component that is a GSI127 non-diagnostic value, the value can correspond to either:

- A measurement value – such as a mid-range bias signal for a CAxxx/IPC707 (vibration) or CPxxx/IPC707 (pressure), or an initial-gap measurement value for a TQ9xx/IQS900 (proximity).
- A diagnostic value – used to indicate that the IPC707 or IQS9xx has detected a problem earlier in the measurement chain (sensor, cabling and/or signal conditioner itself).

2.2 GSI127 normal operating values

For the output signal from a GSI127 galvanic separation unit, the normal operating values depend on the particular variant of the GSI127 and are different for the different types of measurement chain.

Table 2-1 lists the permitted values for the quasi-static (DC) component of the output signal from a GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021).

NOTE: For an GSI127 galvanic separation unit, any quasi-static (DC) component value inside of the GSI127's normal operating range corresponds to normal operation. All other values indicate a problem with the GSI127 (see Table 2-1).

For any particular variant of a GSI127 galvanic separation unit, it is the quasi-static (DC) component values given in Table 2-1 that should be used as the limit/reference values when configuring an external machinery monitoring system to perform a system-level safety function (see 3.1 Safety function).

Table 2-1: Permitted values for the quasi-static (DC) component of the output signal from a GSI127 galvanic separation unit

GSI127 variant	Quasi-static (DC) component – permitted values	Measurement chain OK?	Description
B01	3.5 to 14.5 V_{DC}	Yes	Normal operation. Output signal (AC and DC) from GSI127 can be trusted.
	<3.5 or >14.5 V_{DC}	No	Problem with the GSI127
B02	0.8 to 13.7 V_{DC}	Yes	Normal operation. Output signal (AC and DC) from GSI127 can be trusted.
	<0.8 or >13.7 V_{DC}	No	Problem with the GSI127
B03	1.1 to 18.9 V_{DC}	Yes	Normal operation. Output signal (AC and DC) from GSI127 can be trusted.
	<1.1 or >18.9 V_{DC}	No	Problem with the GSI127
B04	0.8 to 19.5 V_{DC}	Yes	Normal operation. Output signal (AC and DC) from GSI127 can be trusted.
	<0.8 or >19.5 V_{DC}	No	Problem with the GSI127
B05	0.8 to 19.5 V_{DC}	Yes	Normal operation. Output signal (AC and DC) from GSI127 can be trusted.
	<0.8 or >19.5 V_{DC}	No	Problem with the GSI127
B11	1.6 to 10.4 V_{DC}	Yes	Normal operation. Output signal (AC and DC) from GSI127 can be trusted.
	<1.6 or >10.4 V_{DC}	No	Problem with the GSI127
B21	0.8 to 20.8 V_{DC}	Yes	Normal operation. Output signal (AC and DC) from GSI127 can be trusted.
	<0.8 or >20.8 V_{DC}	No	Problem with the GSI127

Table 2-2 lists the output ranges for the dynamic (AC) component of the output signal from a GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021).

Table 2-2: Output ranges for the dynamic (AC) component of the output signal from a GSI127 galvanic separation unit

GSI127 variant (ordering option code)	Dynamic (AC) component – output range	Description
B01	2 V_{PEAK}	Normal operation
B02	5 V_{PEAK}	Normal operation
B03	8 V_{PEAK}	Normal operation
B04	5 V_{PEAK}	Normal operation
B05	8 V_{PEAK}	Normal operation
B11	4 V_{PEAK}	Normal operation
B21	8 V_{PEAK}	Normal operation

NOTE: Refer to the *GSI127 galvanic separation unit data sheet* and the relevant sensor / measurement chain installation manual for further information. See 1.7 Related documentation for a list of installation manuals.

2.3 SIL measurement chains with a GSI127 in safety-related applications

To use a GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021) as part of a SIL measurement chain in a safety-related application (functional-safety context), certain conditions/restrictions apply.

AS AN INPUT (SENSOR) TO AN EXTERNAL SAFETY INSTRUMENTED SYSTEM (SIS) PERFORMING A SAFETY INSTRUMENTED FUNCTION (SIF), THE SIL MEASUREMENT CHAIN MUST CONSIST OF A "VALID" MEASUREMENT CHAIN (SENSOR / SIGNAL CONDITIONER) AND A GSI127 GALVANIC SEPARATION UNIT WITH DIAGNOSTICS (PNR 244-127-000-021).

REFER TO THE RELEVANT SENSOR / MEASUREMENT CHAIN SAFETY MANUAL FOR INFORMATION ON "VALID" MEASUREMENT CHAINS. SEE 1.7 RELATED DOCUMENTATION FOR A LIST OF INSTALLATION MANUALS.

2.4 Power supply requirements

Table 2-3 shows the power supply specifications for a GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021).

Table 2-3: GSI127 galvanic separation unit power supply specifications

Parameter	Value
Input voltage range	24 V_{DC} nominal (20 to 28 V_{DC})
Power consumption	< 3.1 W
Current consumption (with 24 V_{DC} power supply)	< 130 mA
Overvoltage protection (diode)	Protection starts between ±31.4 and ±34.7 V_{DC} at an ambient temperature of 23°C ±5°C (73°F ±9°F)
Power-up time	< 30 s

A GSI127 galvanic separation unit should be powered (energised) using a limited-power, low-voltage power supply such as a APFxxx 24 V_{DC} power supply or other suitable power supply unit.

In safety-related applications, a GSI127 with diagnostics (PNR 244-127-000-021) must be powered using a limited-power, low-voltage power supply with a safe limitation of 60 V_{DC} (nominal), even in the event of a single fault with the power supply.

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3 HOW TO USE THE SYSTEM FOR SAFETY

3.1 Safety function

A GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021) provides an analog voltage output signal that corresponds to a measured parameter, within the safety accuracy, according to the configuration of the components of the measurement chain.

The SIL measurement chain that the GSI127 galvanic separation unit is used with dictates the machine parameter that is measured, such as vibration, pressure, proximity and so on (see 1.5 GSI127 compatible measurement chains). The SIL measurement chain (sensor / signal conditioner) also dictates the variant of the GSI127 required.

For the GSI127 galvanic separation unit with diagnostics, the quasi-static (DC) component of its analog voltage output signal is also used to indicate the diagnostic status of the GSI127 itself.

In a safety-related application (functional-safety context), the output signal from a GSI127 galvanic separation unit with diagnostics used as part of a SIL measurement chain is used as an input (sensor) to an external monitoring and/or protection system (safety instrumented system (SIS)) that performs a safety function by taking this input together with other safety-related signals and performing a system-level safety function, such as initiating the shutdown (trip) of a machine.

NOTE: For the external monitoring and/or protection system performing a safety function:
- Any alarms corresponding to a safety function must be configured as latching.
- Any relays corresponding to a safety function must be configured as latching and normally energised (de-energised to trip).
- An analysis must be carried out at the safety-system level to ensure that no alarm can be missed or to identify all possible impacts and acceptability of residual risks in case of a missed alarm.

Figure 3-1 shows the relationship between a GSI127 galvanic separation unit with diagnostics and an external machinery monitoring system.

With reference to Figure 3-1, when the GSI127's analog voltage output signal (blue line, top, "DC standby value") does outside of its normal operating range (green area, top, "MPS valid range") to indicate that there is a problem, the machinery monitoring system (green line, bottom, "MPS sensor OK")) must detect this as a problem and take appropriate action such as a system-level safety function.

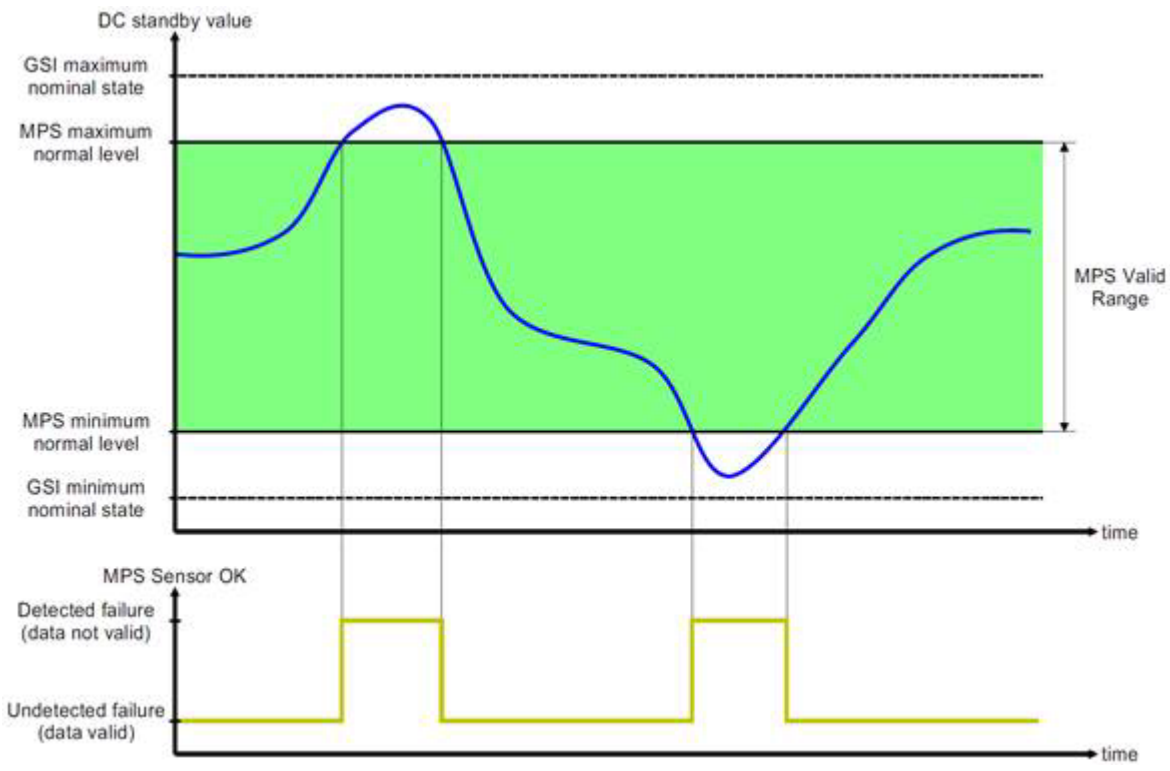

Figure 3-1: Safety function – relationship between GSI127 safety output (top) and external machinery monitoring system (bottom)

Table 3-1 lists the safety accuracy and other important safety properties for a GSI127 galvanic separation unit with diagnostics used as part of a SIL measurement chain.

3.2 Safety output(s)

A GSI127 galvanic separation unit with diagnostics has one safety-critical output – an analog voltage signal consisting of two components: a dynamic (AC) signal sitting on a quasi-static (DC) signal, as described in 2.1 Operation of a GSI127.

In typical safety-related applications:

- During normal operation of the SIL measurement chain with a GSI127 galvanic separation unit, the GSI127's output (dynamic (AC) component and the quasi-static (DC) component) are used to indicate whether the machinery being monitored is operating correctly or not.
- When there is a problem with the SIL measurement chain with a GSI127 galvanic separation unit, the quasi-static (DC) component of the GSI127's output indicates that the measurement chain is not operating correctly, that is, there is a problem with the GSI127 itself (see 1.2 GSI127 diagnostic capability).

It is important to note that for a SIL measurement chain using a GSI127 galvanic separation unit with diagnostics, there is no safe state. Instead, dangerous-detected failures (λ_{DD}) in the GSI127 are indicated by driving/saturating the quasi-static (DC) component of the GSI127's output signal to a voltage value outside of the normal operating range. Accordingly, any required safe state

behaviour, including the latching of alarms or relays, must be implemented by an external monitoring and/or protection system at the safety-system level.

A GSI127 GALVANIC SEPARATION UNIT WITH DIAGNOSTICS AS PART OF A SIL MEASUREMENT CHAIN PROVIDES A SAFETY-CRITICAL OUTPUT BUT DOES NOT PROVIDE A SAFE STATE. ANY REQUIRED SAFE STATE BEHAVIOUR, INCLUDING THE LATCHING OF ALARMS OR RELAYS, MUST BE IMPLEMENTED BY AN EXTERNAL MONITORING AND/OR PROTECTION SYSTEM.

THE EXTERNAL MONITORING AND/OR PROTECTION SYSTEM MUST BE ABLE TO MEASURE THE SAFETY-CRITICAL OUTPUT WITH AN ACCURACY OF AT LEAST $\pm 0.1\ V_{DC}$.

See also 7.7 Configuring the external monitoring and/or protection system.

3.3 Safety properties(s)

Table 3-1 lists the important safety properties for the GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021).

Table 3-1: important safety properties for the GSI127 galvanic separation unit with diagnostics

Safety property	Description / Value
SIL level (IEC 61508)	SIL 2
Systematic capability (IEC 61508)	2
Modes of operations	Low-demand mode or High-demand (continuous) mode
Type of subsystem	Type A
Hardware fault tolerance (HFT)	0
Dangerous-detected failures (λ_{DD})	See Table 3-2 (below).
Dangerous-undetected failures (λ_{DU})	
Safe-detected failures (λ_{SD}) and safe-undetected failures (λ_{SU})	
Process safety time (PST)	< 5 ms in Low-demand mode. < 500 ms in High-demand (continuous) mode. Note: This is the time required for a GSI127 galvanic separation unit to update the nominal value of the measurement/diagnostic component (DC) of its output signal.
Safety accuracy	DC output error: ±0.5 V_{DC} (DC transfer sensitivity + DC output offset). AC transfer sensitivity: ±10%. Low-pass (LP) filter cutoff frequency: < 12 kHz. Noise: 1% of FSD. Refer to the *GSI127 galvanic separation unit data sheet* for typical sensitivity values.
Notes Failure rate calculations and analysis were performed with a long-term ambient temperature of 40°C (104°F). For the different variants of the GSI127 galvanic separation unit with diagnostics, the permitted output values are defined in Table 2-1.	

Table 3-2: Failure rates for the GSI127 galvanic separation unit with diagnostics

GSI127 variant		Failure rate (FIT)			
Ordering option code A*x*	**Ordering option code B*xx***	**Dangerous-detected failures (λ_{DD})**	**Dangerous-undetected failures (λ_{DU})**	**Safe-detected failures (λ_{SD})**	**Safe-undetected failures (λ_{SU})**
A1 (Standard)	B0*x* to B1*x*	279	208	0	7
	B2*x*	248	195		
A2 (Ex)	B0*x* to B1*x*	296	223		
	B2*x*	271	211		

Notes

Dangerous-detected (λ_{DD}) and dangerous-undetected (λ_{DU}) failures depend on the particular variant of the GSI127 galvanic separation unit. See 1.4.1 Reference part numbers and 1.4.2 Configurations.

For dangerous-detected failures (λ_{DD}), the output from a GSI127 galvanic separation unit is defined, that is, the quasi-static (DC) component of the GSI127's output is driven to a voltage outside of its normal operating range (see Table 2-1). For dangerous-undetected failures (λ_{DU}), the GSI127's output has "other" voltage values.
A GSI127 galvanic separation unit has no safe-detected (λ_{SD}) failures, that is, there is no latched safe state.

In safety-related applications (functional-safety contexts), any required safe state behaviour is implemented by an external monitoring and/or protection system that is configured to detect when the GSI127's output is driven/saturated to a positive or negative at a positive or negative output limit (outside of its normal operating range). See Table 2-1 and 7.7.1 Defining the alarm levels.

Failure rate calculations and analysis were performed with a long-term ambient temperature of 40°C (104°F).

For the different variants of the GSI127 galvanic separation unit with diagnostics, the permitted output values are defined in Table 2-1.

Additional failure modes, effects and diagnostic analysis (FMEDA) calculations, details and results can be made available on request. Contact your local Parker Meggitt representative for further information.

3.4 Design verification

The safety integrity level (SIL) of an entire safety instrumented function (SIF) must be verified via a calculation of probability of failure per hour (PFH) / average probability of failure on demand (PFDavg) for the specific application – with due consideration of proof test interval (PTI), proof test effectiveness, any automatic diagnostics, average repair time, redundant architectures and the specific failure rates of all products included in the SIF.

Further, each element must be checked to assure compliance with minimum hardware fault tolerance (HFT) requirements.

3.5 Environmental and application limits

NOTE: Refer to the *GSI127 galvanic separation unit data sheet* for further information on environmental and application limits such as temperature, humidity, IP protection rating, vibration and shock.

3.6 Safety certificate(s)

The GSI127 galvanic separation unit described in this safety manual is certified by Exida (Exida LLC, USA):

- SIL 2 in accordance with IEC 61508-1:2010 and IEC 61508-2:2010.

Accordingly, the Exida safety certificate and functional safety assessment report can be obtained:

- From the Parker Meggitt website at www.meggittsensing.com/energy
- From the safety/security automation equipment List (SAEL) pages of the Exida website at www.exida.com/SAEL-safety
- By contacting your local Parker Meggitt representative or Meggitt SA.

In addition, an Exida failure modes, effects and diagnostic analysis (FMEDA) report can be made available on request. Contact your local Parker Meggitt representative or Meggitt SA for further information.

4 CONFIGURATION

4.1 Configuration

During manufacture, a GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021) is configured in accordance with the complete GSI127 ordering number – part number (PNR) and ordering option codes – defined by the customer at the time of ordering (see 1.4.2 Configurations).

NOTE: Refer to the *GSI127 galvanic separation unit data sheet* for further information on part number (PNR) and ordering option codes.

After manufacture, the configuration of a GSI127 galvanic separation unit cannot be changed.

4.2 Transfer function

The transfer function of the GSI127 galvanic separation unit with diagnostics is:

$$Output\ value = (Input\ value \times Sensitivity) + Offset$$

Where:

Output value is the value of the analog voltage output signal from the GSI127.

Input value is the value of the analog input signal (current or voltage) to the GSI127.

Sensitivity is the transfer sensitivity for a particular variant of the GSI127.

Offset is the output offset for a particular variant of the GSI127

Table 1-2 includes the sensitivity and offset for the different variants of the GSI127.

Table 4-1 provides the input and output range values for the different variants of the GSI127.

Table 4-1: Input range and output range values for the GSI127 galvanic separation unit with diagnostics

GSI127 variant	Input range		Output range	
	DC	AC	DC	AC
B01	2.0 to 12.0 mA	2.0 mA_{PEAK}	4.0 to 14.0 V	2.0 V_{PEAK}
B02	6.3 to 18.2 mA	5.0 mA_{PEAK}	1.3 to 13.2 V	5.0 V_{PEAK}
B03	15.5 to 20.75 mA	2.5 mA_{PEAK}	1.6 to 18.4 V	8.0 V_{PEAK}
B04	1.3 to 19.0 V	5.0 V_{PEAK}	1.3 to 19.0 V	5.0 V_{PEAK}

Table 4-1: Input range and output range values for the GSI127 galvanic separation unit with diagnostics

GSI127 variant	Input range		Output range	
	DC	**AC**	**DC**	**AC**
B05	−1.3 to −19.0 V	$-8.0\ V_{PEAK}$	1.3 to 19.0 V	$8.0\ V_{PEAK}$
B11	4.0 to 20.0 mA	$8\ mA_{PEAK}$	2 to 10.0 V	$4.0\ V_{PEAK}$
B21	1.3 to 20.3 V	$8.0\ V_{PEAK}$	1.3 to 20.3 V	$8.0\ V_{PEAK}$

5 INSTALLATION AND COMMISSIONING

5.1 Installation

For general information on the installation of a GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021) as part of a SIL measurement chain, refer to the relevant sensor / measurement chain installation manual. See 1.7 Related documentation for a list of installation manuals.

5.2 Commissioning

USE OF A GSI127 GALVANIC SEPARATION UNIT WITH DIAGNOSTICS AS PART OF A SIL MEASUREMENT CHAIN IN A SAFETY-RELATED APPLICATION (FUNCTIONAL-SAFETY CONTEXT) REQUIRES THAT THE MEASUREMENT CHAIN IS COMMISSIONED AS AN INTEGRAL PART OF THE OVERALL SAFETY-RELATED SYSTEM COMMISSIONING.

NOTE: Installation and commissioning should only be performed by competent and authorised personnel following the plant specific guidelines in force at the installation.

For the commissioning of a GSI127 galvanic separation unit with diagnostics as part of a SIL measurement chain in a safety-related application (functional-safety context), it is important to ensure that the correct components are used and that they are connected together correctly:

- A GSI127 with diagnostics with diagnostics (PNR 244-127-000-021) must be used (see 1.4 GSI127 galvanic separation unit and 1.4.1 Reference part numbers).
- The sensor / measurement chain must be compatible with the GSI127 (see 1.5 GSI127 compatible measurement chains) and “valid” (see 2.3 SIL measurement chains with a GSI127 in safety-related applications).
- The external power supply used to power the GSI127 must meet the requirements specified in 2.4 Power supply requirements.
- Correct wiring must be verified.

See also 7.8 Commissioning.

NOTE: It is important to note that a GSI127 galvanic separation unit with diagnostics as part of a SIL measurement chain is used as an input (sensor) to an external monitoring and/or protection system (safety instrumented system (SIS)) that performs a safety function, so it is the external system that provides the “intelligence” in the safety system.
Accordingly, any required safe state behaviour, including the latching of alarms or relays, must be implemented by an external monitoring and/or protection system at the safety-system level.

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6 OPERATION AND MAINTENANCE

6.1 Proof test

When a GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021) is used as part of a SIL measurement chain in safety-related applications (functional-safety contexts), the following proof test is required in order to detect failures/faults (dangerous-undetected failures (λ_{DU})) which remain undetected by the integrated diagnostics of the GSI127 (that is, built-in self-test (BIST)).

NOTE: The proof test should be performed in accordance with overall safety-system requirements.

The following proof test provides a proof test coverage (PTC) of 79%.

Equipment required

- Small screwdriver
- Multimeter such as a digital multimeter (DMM).

Procedure

1- For the measurement channel of the external monitoring and/or protection system using the SIL measurement chain that includes the GSI127 galvanic separation unit as an input, bypass the safety function and take appropriate action to ensure that a shutdown (“trip”) of the machinery is not accidentally initiated by the proof test.

2- Measure and record the value of the analog voltage signal on the GSI127 galvanic separation unit’s output.

For example, a multimeter (DMM) could be used to measure the signal via the GSI127’s output screw-terminal connector (as shown on the right of the image in Figure 1-2). Alternatively, the external monitoring system could be used to measure the signal.

NOTE: To measure the analog voltage output signal on the GSI127 galvanic separation unit with a multimeter (DMM), use the “0 V” and “O/P” terminals at the output of the GSI127.
These terminals/signals are available on the monitor-side (machinery monitoring system) of the GSI127, that is, the screw-terminal connector on the bottom of the unit, marked “MONITOR”.

When measuring the analog voltage output signal on the GSI127 galvanic separation unit, be sure to record both the dynamic (AC) component and the quasi-static (DC) component of the signal (see Figure 2-1).

3- Disconnect the sensor / signal conditioner from the input of the GSI127 galvanic separation unit and check that the quasi-static (DC) component of the output signal from the GSI127 indicates that there is a problem with the measurement chain.

To disconnect the sensor / signal conditioner from the input of the GSI127, unplug the screw-terminal on the top of the unit, marked “SENSOR”.

NOTE: The GSI127 galvanic separation unit features removal screw-terminal connectors that can unplugged from the main body of the housing.

To remove a screw-terminal connector from the main body of a GSI127 unit:
(1) Push the raised tab on the front of the screw-terminal connector (which acts as a lever) away from the main body of the unit to overcome the retaining force and separate the screw-terminal connector and the unit. Use enough force to separate the connector from the body of the unit by approximately 5 mm.

(2) Pull the screw-terminal connector to remove it from the main body of the unit.

For a GSI127 with diagnostics, the quasi-static (DC) component values that indicate normal operation or a problem on the variant of the GSI127 and are different for the different types of measurement chain. See 2.2 GSI127 normal operating values and Table 2-1.

4- Reconnect the sensor / signal conditioner to the input of the GSI127 galvanic separation unit and check that the value of the analog voltage signal on the GSI127's output is equal to the AC and DC values recorded before the disconnection (see step 2).

To reconnect the sensor / signal conditioner to the input of the GSI127, re-plug the screw-terminal on the top of the unit, marked "SENSOR".

NOTE: The GSI127 galvanic separation unit features removal screw-terminal connectors that can unplugged from the main body of the housing.

To reinsert a screw-terminal connector into the main body of a GSI127 unit:
(1) Ensure that the raised tab on the front of the screw-terminal connector is pushed down flat so that the rear of the connector is not obstructed.
(2) Align the screw-terminal connector with the main body of the unit, ensuring that the guide-rails of both parts are aligned, and push the connector into the main body of the unit.
(3) When the screw-terminal connector is approximately 1-2 mm from the main body of the unit, more force is required to overcome the mechanical locking mechanism and the friction of the connectors. There should be an audible click when the connector is properly inserted.

5- Inspect the GSI127 galvanic separation unit for any visible damage or contamination.

6- For the measurement channel of the external monitoring and/or protection system using the SIL measurement chain that includes the GSI127 galvanic separation unit as an input, remove the bypass on the safety function and restore the system to normal operation.

6.2 Maintenance and end-of-life product disposal

For general maintenance and end-of-life product disposal information, refer to the relevant sensor / measurement chain installation manual. See 1.7 Related documentation for a list of installation manuals.

See also 7.10 Maintenance.

7 SAFETY ISSUES

7.1 Safety function

In practice, the output signal from a GSI127 galvanic separation unit with diagnostics (PNR 244-127-000-021) as part of a SIL measurement chain is used an input (sensor) to an external monitoring and/or protection system (safety instrumented system (SIS)) that performs a safety function by taking this input together with other safety-related signals and performing a system-level safety function, such as initiating the shutdown (trip) of a machine.

Accordingly, any required safe state behaviour, including the latching of alarms or relays, must be implemented by an external monitoring and/or protection system at the safety-system level.

See also 3.1 Safety function.

7.2 Safety output(s)

See Table 2-1.

7.3 Safety time

See process safety time (PST) in Table 3-1.

7.4 Power supply

See 2.4 Power supply requirements.

7.5 Installation

Installation must be performed following the guidelines in the relevant sensor / measurement chain installation manual.

Environmental restrictions and applications limits such as temperature, humidity, protection rating, vibration and shock are given in the *GSI127 galvanic separation unit data sheet*.

NOTE: Refer to the *GSI127 galvanic separation unit data sheet* and the relevant sensor / measurement chain installation manual for further information. See 1.7 Related documentation for a list of installation manuals.

7.6 Configuring a SIL measurement chain with a GSI127

The GSI127 galvanic separation unit is a configurable product with ordering option codes that are used to specify the complete configuration of the different variants of the device at the time of ordering (see 1.4.2 Configurations).

7.7 Configuring the external monitoring and/or protection system

FOR THE EXTERNAL MONITORING AND/OR PROTECTION SYSTEM USED WITH A GSI127 GALVANIC SEPARATION UNIT WITH DIAGNOSTICS AS PART OF A SIL MEASUREMENT CHAIN, SUCH AS A VM600^{Mk2}/VM600 OR VIBROSMART® PROTECTION SYSTEM, IT IS IMPORTANT THAT THE ALARM LEVELS/LIMITS (ALERT AND/OR DANGER) CONFIGURED FOR THE MEASUREMENTS (VIBRATION, PRESSURE, PROXIMITY AND SO ON) ARE APPROPRIATE FOR THE MACHINERY/SYSTEM UNDER PROTECTION.

NOTE: Refer to the monitoring and/or protection system documentation for further information, for example, VM600^{Mk2}/VM600 or VibroSmart®.

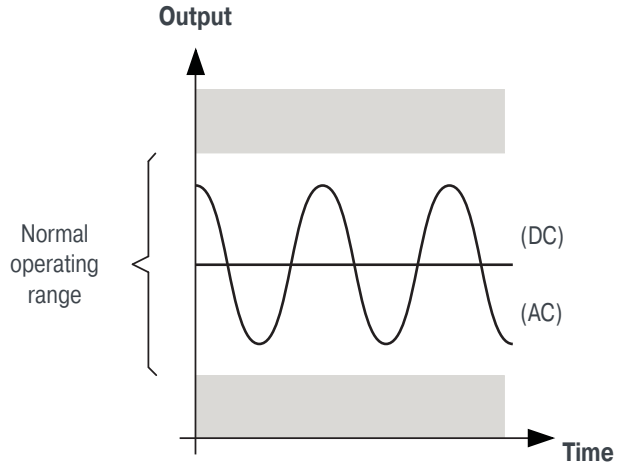
A GSI127 with diagnostics (PNR 244-127-000-021) continuously:

- Updates the dynamic (AC) component of the GSI127's output signal to correspond to the dynamic measurement value and the quasi-static (DC) component of the output signal to correspond to a mid-range bias signal or an initial-gap measurement value (depending on the sensor / signal conditioner).
- Runs health health checks on the internals of the GSI127 itself and drives/saturates the quasi-static (DC) component of the output signal of the GSI127's output signal outside of its normal operating range to indicate a problem with the unit (see 1.2 GSI127 diagnostic capability).

In safety-related applications, the external monitoring and/or protection system used with a GSI127 galvanic separation unit as part of a SIL measurement chain must monitor the quasi-static (DC) component of the GSI127 galvanic separation unit's output signal for the values described in Table 2-1.

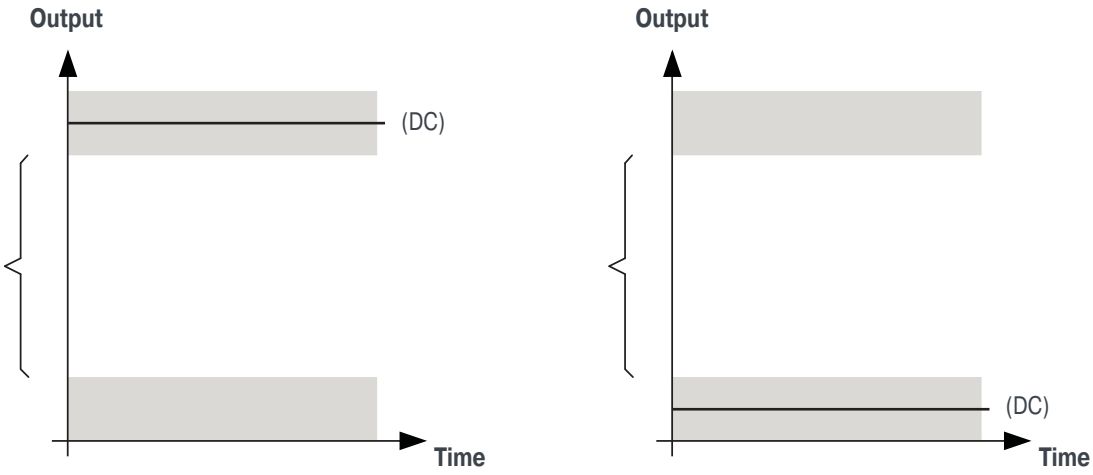
A GSI127 GALVANIC SEPARATION UNIT WITH DIAGNOSTICS AS PART OF A SIL MEASUREMENT CHAIN PROVIDES A SAFETY-CRITICAL OUTPUT BUT DOES NOT PROVIDE A SAFE STATE. ANY REQUIRED SAFE STATE BEHAVIOUR, INCLUDING THE LATCHING OF ALARMS OR RELAYS, MUST BE IMPLEMENTED BY AN EXTERNAL MONITORING AND/OR PROTECTION SYSTEM.

THE EXTERNAL MONITORING AND/OR PROTECTION SYSTEM MUST BE ABLE TO MEASURE THE SAFETY-CRITICAL OUTPUT WITH AN ACCURACY OF AT LEAST $\pm 0.1\ V_{DC}$.



(a) Quasi-static (DC) component value = inside of the GSI127's normal operating range.

A quasi-static (DC) component value inside of the GSI127's normal operating range is a non-diagnostic value, so the measurement chain is OK and both measurement components (AC and DC) of the output signal can be trusted and used.



(b) Quasi-static (DC) component value = outside of the GSI127's normal operating range.

A quasi-static (DC) component value outside of the GSI127's normal operating range is a diagnostic value, used to indicate that the GSI127 has detected a problem and that the measurement chain is not OK!

Note: In the (a) and (b) drawings above, the grey areas correspond to the recommended alarm levels/ranges to be configured for the external monitoring and/or protection system (safety instrumented system (SIS)).

These levels/ranges are different for the different variants of the GSI127 galvanic separation unit, as given in Table 2-1.

Figure 7-1: Output signal from a GSI127 with diagnostics (PNR 244-127-000-021)

7.7.1 Defining the alarm levels

As shown in Figure 7-1 (a), during normal operation, a GSI127 galvanic separation unit with diagnostics will update its output signal as follows:

- Quasi-static (DC) component inside of the normal operating range for the particular variant of the GSI127 (see Table 2-1) that corresponds to a mid-range bias signal or an initial-gap measurement value (depending on the sensor / signal conditioner).
- Dynamic (AC) component inside of the normal operating range for the particular variant of the GSI127 (see Table 2-1) that corresponds to the dynamic measurement value. example, vibration, pressure, proximity and so on.

NOTE: The measured physical quantity depends on the SIL measurement chain that a GSI127 galvanic separation unit is used with.

As shown in Figure 7-1 (b), after the detection of a an internal problem (that is, with the GSI127 itself), a GSI127 with diagnostics will update its output signal as follows:

- Quasi-static (DC) component outside of the normal operating range for the particular variant of the GSI127 (see Table 2-1), that is, driven/saturated to a positive or negative at a positive or negative output limit.

See also 2.1 Operation of a GSI127, including Table 2-1 and 3.3 Safety properties(s).

Accordingly, in a safety-related application, the external monitoring and/or protection system using a GSI127 galvanic separation unit as part of a SIL measurement chain is an input must be capable of detecting and reporting the diagnostic status of the measurement chain as communicated by the quasi-static (DC) component of the GSI127 galvanic separation units output signal. More specifically, the corresponding sensor/measurement chain OK check/levels must be suitable (see Figure 7-1 and Table 2-1).

It is also important that the measurement channel / machinery monitoring system using a GSI127 galvanic separation unit as part of a SIL measurement chain as an input is configured to detect and report any problems with the measurement chain as quickly as possible, that is, corresponding delay times should be configured as zero (0).

For the quasi-static (DC) component of the output signal from a GSI127, the configuration of the safety function in the external monitoring and/or protection system must be made in consultation with the safety system engineer (or a similar authority).

For the dynamic (AC) component, and any measurement component/value of the quasi-static (DC) component (for example, gap measurement), of the output signal from an GSI127, the configuration of the alarm levels/limits in the external monitoring and/or protection system must be made in consultation with the site manager. It is the end user's responsibility to ensure that the alarm levels/limits are appropriate for the machinery/system under protection.

NOTE: Refer to the monitoring and/or protection system documentation for further information.

7.8 Commissioning

Installation and commissioning of a GSI127 galvanic separation unit as part of a SIL measurement chain should only be performed by competent and authorised personnel following the plant specific guidelines in force at the installation.

Further, a GSI127 galvanic separation unit as part of a SIL measurement chain must be commissioned as an integral part of the overall safety-related system commissioning.

USE OF A GSI127 GALVANIC SEPARATION UNIT AS PART OF A SIL MEASUREMENT CHAIN IN A SAFETY-RELATED APPLICATION (FUNCTIONAL-SAFETY CONTEXT) REQUIRES THAT THE MEASUREMENT CHAIN IS COMMISSIONED AS AN INTEGRAL PART OF THE OVERALL SAFETY-RELATED SYSTEM COMMISSIONING.

See also 5 Installation and commissioning.

7.8.1 Guidelines for commissioning

NOTE: Refer to the monitoring and/or protection system documentation for further information.

7.9 Product lifetime

In safety-related applications, a GSI127 galvanic separation unit has a product lifetime of 10 years after entry into service.

7.10Maintenance

Proof testing of a GSI127 galvanic separation unit as part of a SIL measurement chain should be performed in accordance with the overall maintenance plan for the external monitoring and/or protection system (safety instrumented system (SIS)). See 6 Operation and maintenance for the proof test procedure.

General maintenance should be performed following the guidelines in the relevant sensor / measurement chain installation manual. See 1.7 Related documentation for a list of installation manuals.

See 8.1 Contacting us for the contact details relevant to repairing defective hardware.

IF A GSI127 GALVANIC SEPARATION UNIT IS UNDER MAINTENANCE OR REPAIR, THEN THE ATTACHED SYSTEM AND EQUIPMENT MAY NO LONGER BE PROTECTED. THEREFORE, SUCH PROCEDURES SHOULD ONLY BE UNDERTAKEN BY AUTHORISED PERSONNEL RESPECTING THE OVERALL PLANT OPERATION PROCEDURES.

7.11Mean time to repair

The mean time to repair/restoration (MTTR = MRT) for a GSI127 galvanic separation unit is considered to be 8 hours.

7.12Assumptions

When a GSI127 galvanic separation unit as part of a SIL measurement chain is used in safety-related applications (functional-safety contexts), certain characteristics of connected equipment such as a VM600^{Mk2}/VM600 or VibroSmart® monitoring and/or protection system and associated transmission cabling are assumed as follows:

#1

The power supply to a GSI127 galvanic separation unit is able to provide the supply current of $< 130\ mA_{DC}$.

#2

The power supply to a GSI127 galvanic separation unit is able to ensure a supply voltage of $24\ V_{DC}$ nominal (20 to $28\ V_{DC}$) for the maximum current consumption of $< 130\ mA_{DC}$, at the input to the GSI127 on the + screw-terminal connector.

#3

For the GSI127 galvanic separation unit, the minimum input impedance for connected equipment is 3 kΩ.

NOTE: This is in order to have a GSI127 output signal loss of 1% max.

#4

The external monitoring and/or protection system connected to the output of a GSI127 galvanic separation unit is capable of reading the quasi-static (DC) component of the GSI127's output signal with an accuracy of at least $\pm 0.1\ V_{DC}$.

NOTE: This is in order to be able to detect and identify the diagnostic status of a GSI127 galvanic separation unit, that is, to distinguish between normal operation and a dangerous-detected failure.

8 SERVICE AND SUPPORT

8.1 Contacting us

Parker Meggitt's worldwide customer support network offers a range of support, including 8.3 Technical support and 8.4 Sales and repairs support. For customer support, contact your local Parker Meggitt representative. Alternatively, contact our Swiss (Meggitt SA) office:

Customer support department
Meggitt SA
Route de Moncor 4
Case postale
1701 Fribourg
Switzerland

Telephone: +41 26 407 11 11
Email: energysupport@ch.meggitt.com
Website: www.meggittsensing.com/energy

8.2 SIL safety product information

For SIL products used in safety-related applications, Parker Meggitt (Meggitt SA) strongly recommends that you opt in and receive SIL product communications as this could include important future information concerning the safety of a product such as safety bulletins and/or product update/replacement information.

If you do not opt in to receive SIL product communications, you might not receive important future information concerning the safety of a product.

For products used in safety-related applications, it is important that:

- Parker Meggitt's technical support team is able to provide you and/or the end-user with product-related safety information such as service bulletins and/or product recalls.

  NOTE: Accordingly, the Energy SIL safety product communications procedure described on page 8-3 should be used in order to opt in and receive such SIL product communications.

- You and/or the end-user provide Parker Meggitt's technical support team with product-related applications information such as operating issues and/or failures.

  NOTE: Accordingly, the Energy product return procedure described on page 8-5 should be used in order to report problems and return Parker Meggitt energy products for repair.

8.3 Technical support

Parker Meggitt's technical support team provide both pre-sales and post-sales technical support, including:

- General advice
- Technical advice
- Troubleshooting
- Site visits.

NOTE: For further information, contact your local Parker Meggitt representative (see 8.1 Contacting us).

8.4 Sales and repairs support

Parker Meggitt's sales team provide both pre-sales and post-sales support, including advice on:

- New products
- Spare parts
- Repairs.

NOTE: If a product has to be returned for repairs, then this should be done in accordance with the Energy product return procedure described on page 8-5.

8.5 Customer feedback

As part of our continuing commitment to improving customer service, we welcome your comments. To provide feedback, complete the Energy customer feedback form on page 8-10 and return it to our Swiss (Meggitt SA) office (see 8.1 Contacting us).

SIL SAFETY PRODUCT INFORMATION

For SIL products used in safety-related applications, Parker Meggitt (Meggitt SA) strongly recommends that you opt in and receive SIL product communications as this could include important future information concerning the safety of a product such as safety bulletins and/or product update/replacement information.

If you do not opt in to receive SIL product communications, you might not receive important future information concerning the safety of a product.

Energy SIL safety product communications procedure

In order for important future information concerning the use of a Parker Meggitt (Meggit SA) energy SIL safety product to be communicated to users, it is important that we have contact and product information for the users of SIL products.

Accordingly, in order to opt in and receive SIL safety product communications, please use the online SIL safety product communications procedure on the Parker Meggitt website at:
www.meggittsensing.com/energy/service-and-support/silproductcommunications

As described on the website, the SIL safety product communications procedure is as follows:

1- Complete and submit online the Energy SIL safety product communications form that is available on the website (note: * indicates a required field).

   For each type of energy SIL safety product, a separate energy SIL safety product communications form must be completed and submitted online.

2- An acknowledgement email will be sent by return to confirm that the form was received and that your contact and product information has been added to the energy SIL safety product database managed by our Customer support department.

   Accordingly, any important future information concerning the use of an energy SIL safety product will be communicated to you, should this become necessary.

NOTE: The Energy SIL safety product communications form reproduced below is included to support the gathering of information required for completion and submission online.

Energy SIL safety product communications form

Customer contact information

First name:*

Last name:*

Job title:

Company:*

Address:*

Country:*

Email:*

Telephone:*

Fax:

SIL safety product information

Product type:*

Part number (PNR):*

Serial number (SER):

Note: Enter “Unknown” if the serial number (SER) is not known.

Meggitt SA purchase order number:

Date of purchase (dd.mm.yyyy):

Site where installed:

End-user:

SIL safety product communications

Do you want to opt in and receive important communications information concerning your SIL safety product?:*

☐ Yes

☐ No

Note: For SIL safety products used in safety-related applications, Meggitt SA strongly recommends that you opt in to receive SIL product communications as this could include important future information concerning the safety of a product such as safety bulletins and/or product update/replacement information.

REPAIRS AND RETURNS

Energy product return procedure

If a Parker Meggitt (Meggit SA) energy product needs to be returned to our Swiss (Meggitt SA) office, please use the online product return procedure on the Parker Meggitt website at www.meggittsensing.com/energy/service-and-support/repair

As described on the website, all requests for product repair/return should be sent to Parker Meggitt (Meggitt SA), as follows:

1- Please complete and submit online the Energy product return form that is available on the website.

When the form has been processed by Meggitt, a return merchandise authorization (RMA) document and an end-user certificate (EUC) will be emailed by return, which typically takes a few days.

2- It is optional to issue a PO to Parker Meggitt (Meggitt SA) for every product (may include multiple items / serial numbers).

3- Return the product, together with the signed RMA and EUC, to the address indicated on the RMA.

NOTE: Do NOT send goods back to Parker Meggitt (Meggitt SA) without an RMA form! All goods returned must be accompanied by a fully completed and signed RMA form.

Notes:

- An asterisk (*) in the form below indicates a required field. JavaScript must be enabled (in your web browser) for the form to be displayed and completed correctly.
- For every product to be returned:
  - A separate form must be submitted online. Although multiple items of the same product (one part number, different serial numbers) can be covered by a single form.
  - An associated single-use EUC must be included, unless an annual EUC is in place for your company. Although multiple items of the same product can be covered by a single RMA and EUC.
- When a product is returned, all information is sent to our repair center in our Swiss (Meggitt SA) office. For any queries about product returns, please send an email to energysupport@ch.meggitt.com.
- The RMA document contains a unique reference number that should be used in all communications regarding a product return.

NOTE: The Energy product return form reproduced below is included to support the gathering of information required for completion and submission online.

Energy product return form

Contact information

First name:*

Last name:*

Job title:

Company:*

Address:*

Country:*

Email:*

Telephone:*

Fax:

Product information

Product type:*

Part number (PNR):*

Serial number (SER):

Note: Enter “Unknown” if the serial number (SER) is not known.

Ex product:

☐ Yes

☐ No

SIL product:*

☐ Yes

☐ No

Meggitt SA purchase order number:

Date of purchase (dd.mm.yyyy):

Product under warranty:

☐ Yes

☐ No

☐ Don’t know

Site where installed:

End-user:

Return information

Reason for return:*

☐ Repair

☐ Calibration / recertification

☐ Out-of-box problem

☐ Return

If the reason for return is “Repair”, please answer the following questions:*

Type of problem:

☐ Continuous

☐ Intermittent

☐ Temperature dependent

How long was the operating time before the problem?

Description of problem:

Note: Please provide a detailed description in order to help with problem diagnosis.

If the reason for return is “Out-of-box problem”, please answer the following questions:*

Type of out-of-box problem:

☐ Product damaged

☐ Incorrect product configuration

☐ Incorrect product delivered

☐ Problem with documentation / labelling

☐ Product dead-on-arrival

Additional information:

Note: Please provide as much information as possible in order to help with problem diagnosis.

Ex product information – additional information required for Ex products only

Is the product installed in a hazardous area (potentially explosive atmosphere)?:

☐ Yes

☐ No

If the product is installed in a hazardous area, please answer the following questions:

How long was the operating time before the problem?:

Additional information:

SIL product information – additional information required for SIL products only*

Note: For SIL products used in functional-safety contexts/systems, this SIL product information section must be completed.

When was it installed and first operated (dd.mm.yyyy)?:

When was a proof test last executed (dd.mm.yyyy)?:

Is the product installed in a safety-related system?:*

☐ Yes

☐ No

If the product is installed in a safety-related system, please answer the following questions:*

Did the system fail** in a safe mode?:* (That is, the safety relay operated but the trip was spurious.)

☐ Yes

☐ No

☐ Not applicable

Did the system fail** in a dangerous state?:* (That is, the failure did not result in the safe state.)

☐ Yes

☐ No

☐ Not applicable

How long was the operating time before the failure (in hours)?:*

Additional information:

** A faulty indicator LED is considered as a cosmetic failure.

FEEDBACK

Energy customer feedback form

Manual information

Title of manual:

GSI127 galvanic separation unit safety manual

Reference:	MAGSI127-FS/E	Version:	Edition 1
Date of issue:	March 2024		

Customer contact information

First name:*

Last name:*

Job title:

Company:*

Address:*

Country:*

Email:*

Telephone:*

Fax:

Feedback – general

Please answer the following questions:

Is the document well organised?	☐ Yes	☐ No
Is the information technically accurate?	☐ Yes	☐ No
Is more technical detail required?	☐ Yes	☐ No
Are the instructions clear and complete?	☐ Yes	☐ No
Are the descriptions easy to understand?	☐ Yes	☐ No
Are the examples and diagrams/photos helpful?	☐ Yes	☐ No
Are there enough examples and diagrams/photos?	☐ Yes	☐ No
Is the style/wording easy to read?	☐ Yes	☐ No
Is any information not included?	☐ Yes	☐ No

Note: Please include any additional information in the “Feedback – additional” section below.

Feedback – additional

Additional information:

Note: Please provide as much feedback as possible in order to help us improve our product documentation.
Continue on a separate sheet if necessary …

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