

## Commissioning and safety manual



# DSL1-35mA-NUC

REV0

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*Csm DSL1-35-NUC rev0 ind1 -17/10/19  
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## 1 Introduction

### 1.1 General information

This manual contains necessary information for product integration to ensure the functional safety of related loops. All the failure modes and the HFT of the module are specified in the FMEA analysis referenced "Nomenclature et AMDEC DSL1-35mA-NUC rev0.xls"

**Other documents :**

- Datasheet DSL1-35mA-NUC rev0
- EU Declaration of conformity DSL1-35mA-NUC rev0
- Nomenclature and AMDEC DSL1-35mA-NUC rev0

The mentioned documents are available on [www.loreme.fr](http://www.loreme.fr)

The assembly, installation, commissioning and maintenance can only be performed by trained personnel qualified and have read and understood the instructions in this manual.

When it is not possible to correct the defects, the equipment must be decommissioned, precaution must be taken to protect against accidental use. Only the manufacturer can bring the product to be repaired.

Failure to follow advice given in this manual can cause a deterioration in security features, and damage to property, environment or people.

### 1.2 Function and intended uses

The DSL1-35mA-NUC provide the threshold detection on a 4-20mA analog input signal. It provide too a loop breaking detection. The information is transmitted on a dry contact.

The devices are designed, manufactured and tested according to security rules. They should be used only for the purposes described and in compliance with environmental conditions contained in the data sheet: [http://www.loreme.fr/fichtech/DSL1-35mA-NUC\\_eng.pdf](http://www.loreme.fr/fichtech/DSL1-35mA-NUC_eng.pdf)

### 1.3 Manufacturer information

LOREME SAS  
12, rue des potiers d'étain 57071 Actipole Metz Borny  
[www.loreme.fr](http://www.loreme.fr)

## 2 Safety function and safety state

### 2.1 Safety function

The safety function of the device is completed, as long as the threshold function stay in a range of +/-2% of initial adjustment and the loop breaking detection is not altered.  
The good working range of input signal is 0mA to 25mA.

### 2.2 Safety fallback position

The safety fallback position is defined by the opening of output contacts. The application should always be configured to detect the contacts opening and considered them as 'faulty'.  
Thus, in the FMEA study, this condition may be considered as "**not dangerous**".  
The reaction time for all safety functions is < 20ms.

## 3 Safety Recommendation

### 3.1 Interfaces

The device has the following interfaces:

- safety interfaces : analog input, relay output
- not safety or auxiliary interface : none

### 3.2 Configuration / calibration / setting

No configuration or re-calibration is needed. Only the trip threshold setting can be made.  
No changes should be made to the device.

### 3.3 Useful lifetime

Although a constant failure rate is assumed by the probabilistic estimation, that it applies only to the useful lifetime of components.  
Beyond this lifetime, the probability of failure is increasing significantly with time.  
The useful lifetime is very dependent to components themselves and operating conditions such as temperature particularly (Electrolytic capacitors are very sensitive to temperature).

This assumption of a constant failure rate is based on the bathtub curve, which shows the typical behavior of electronic components. Therefore, the validity of this calculation is limited to the useful life of each component.

It is assumed that early failures are detected for a very high percentage during the burn in and the installation period, assuming a constant failure rate during the useful life remains valid.

The useful lifetime based on the feedback, must be considered.

Experience has shown that the useful lifetime is between 15 and 20 years, and may be higher if there are no components with reduced lifetime in security function. (Such as electrolytic capacitors, relays, flash memory, opto coupler) and if the ambient temperature is well below 60 °C.

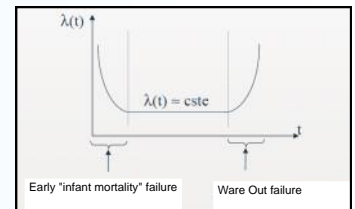
#### **Note :**

The useful lifetime corresponds to constant random failure rate of the device.

The effective lifetime may be higher.

User must ensure that the device is no longer necessary for the security before its disposal.

Evolution of failure rate



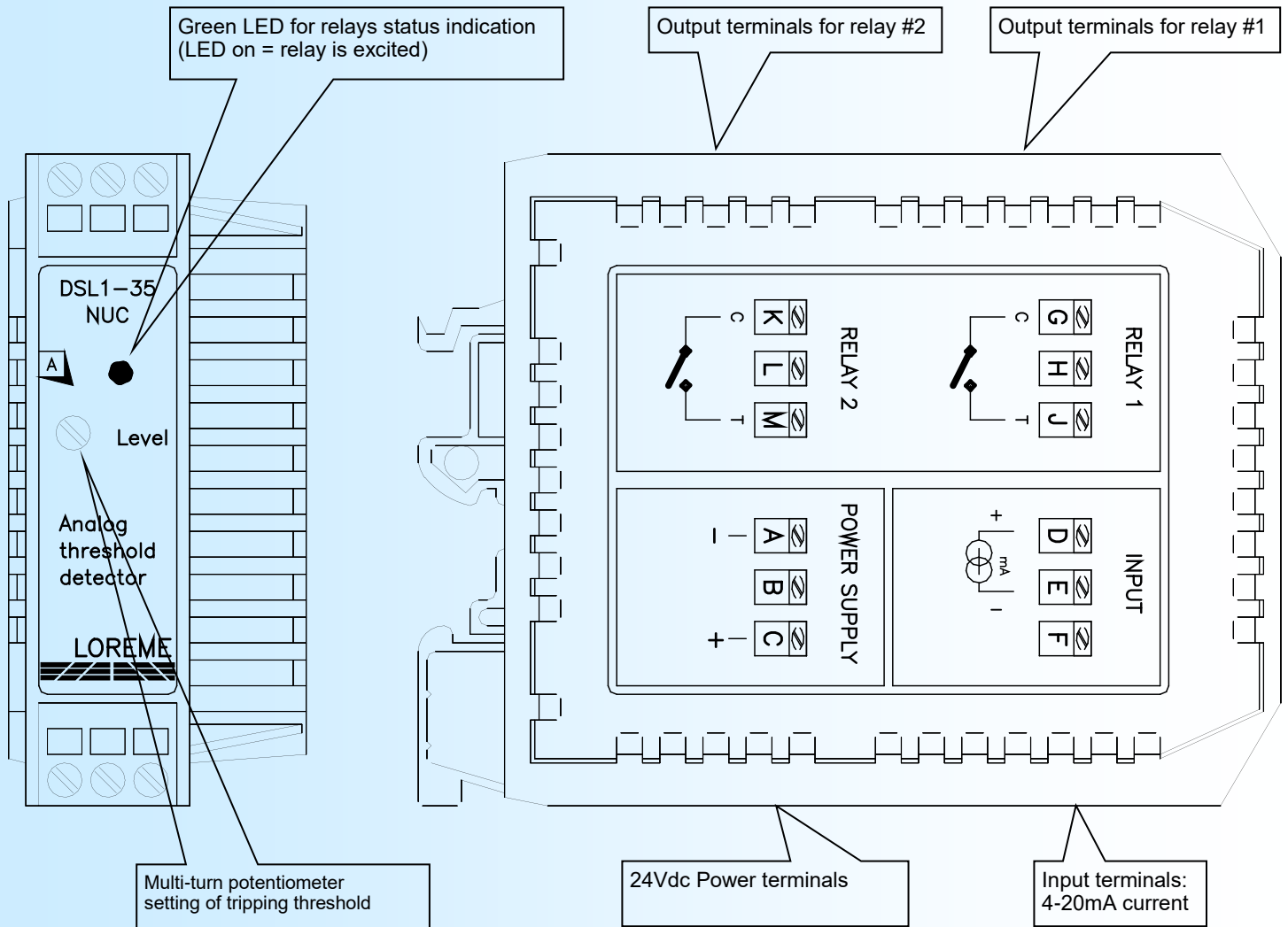
**4 Installation, commissioning and replacement**

Operating capacity and current error reporting should be checked during commissioning (validation) see section: "commissioning and periodic proof" and at appropriate intervals recommended in paragraph: "proof interval". Any device that does not satisfy the commissioning control must be replaced.

**WARNING!**

No user maintenance should be conducted, a defective device must be replaced by a new device of the same type. For a repair return or recalibration, it is very important that all types of equipment failures are reported to allow the company to take corrective action to prevent systematic errors.

**4.1 Description**



**4.2 Operating**

The 2 output relays are activated (NO contact is closed) when the input current measure (4-20mA signal) is lower than the threshold setting via the front face of device.

The relays are released when the measure is higher than the threshold or when the input signal is loss (current loop breaking detection).

A fixed hysteresis of 0.2mA suppress the possibility of beat phenomenon near the threshold.

### 4.3 Electrical wiring

Power supply connection : 24Vdc nominal between terminals **C(+)** and **A(-)**.

The device is protected against the reverse polarity.

*Do not exceed the specification writing on the datasheet. Respect the auxiliary supply voltage range.*

Input current connection : between terminals **D(+)** and **E(-)** , respecting the polarity.

*Warning, the input current should not exceed the value of 25mA. This can damage the input measure.*

Check the loop current calculation (load supported by the current emitter) to avoid a saturation of input signal.

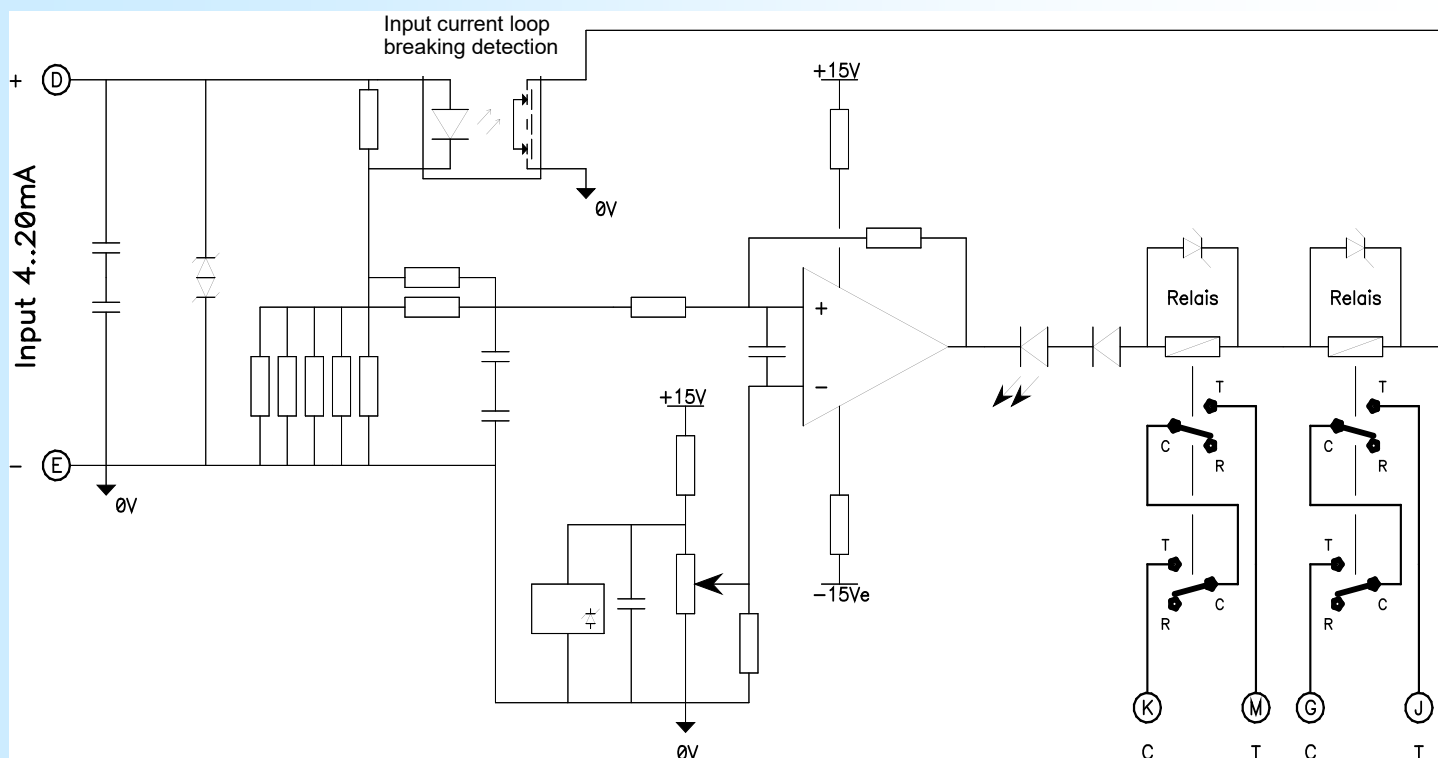
*Warning, a load overtake in the 4-20mA current loop may prevent the current from reaching the maximum value or the security fallback value. It can saturate in the measuring range, and put the system in a dangerous state.*

Output relays connection : between the terminals **G** and **J** for relay #1 and for relay #2 between terminals **K** and **M**.

*Warning! do not exceed the switching capacity of contact relay. This can damage the contact materials.*

*The contact should be used in such a way that the system is safe from loss of power to the device.*

### 4.4 Internal synoptic



## 5 Commissioning and periodic proof

The periodic test procedure is defined by LOREME and must be followed by the end user to ensure and guarantee the operating over time.

Periodic testing should be performed following the procedure defined below and at the intervals defined under paragraph "**proof interval** "

### 5.1 Control steps

Periodic proof allows detection of possible product internal failure and loop calibration. environmental conditions and a minimum heating time of 5 minutes must be respected.

Full testing of threshold detector and the signal processing chain ( *the system is unavailable during the test*)

1. If necessary, bypass the security system and / or take appropriate provision to ensure safety during the test.
2. Inspect the device, no visible damage or contamination (oxidation)
3. Disconnect the output relays and connect an ohmmeter\* on this terminals, The input still connected.  
( the relays are activated, the green LED is on, "out of alarm condition")
4. Disconnect the input sensor who provide the input signal  
(The relays should be deactivated and the led off. Current breaking condition)
5. Connect a current simulator\* on the input terminals.
6. Set the input current at the trip threshold wishes value.
  - a) if the device has never setting, adjust the potentiometer to find the trip point.  
(The threshold value increase when the potentiometer is clockwise turn)
  - b) Once the device is set, check the tipping point by varying the current value around the set point.  
( The hysteresis found must be 0.2mA)
  - c) At a periodic check, for a device already set previously, a gap on the tipping point greater than 2% (0.4mA) should alert on hidden internal fault, it is strongly recommended to replace the device.
7. Disconnect the current simulator and connect the input signal  
(Check that the relays are activated, the green led is lit on, "out of alarm condition")
8. Reconnect the relay outputs and ensure there is no faults on the safety system.
9. After the tests, the results must be documented and archived.

Any devices not satisfying the control need to be replaced

*note\**: *The current generator and the ohmmeter must be regularly calibrated for this test (according to the state of the art and practice)*

### 5.2 Proof interval

The experience feedback shows that a periodicity of one year inspections is sufficient and does not show any difference in the setting of tripping threshold.

## FMEA summary

### Context

This document describe the Failure Mode and Effect Analysis (FMEA) for the component DSL1-35mA-NUC from manufacturer LOREME.

In addition to characterizing the information needed for functional safety ( especially for the calculation of availability and storage of spare parts ), this study identifies and quantifies the component's dangerous failures thus allowing interaction to occur on the system design to avoid or reduce these risks.

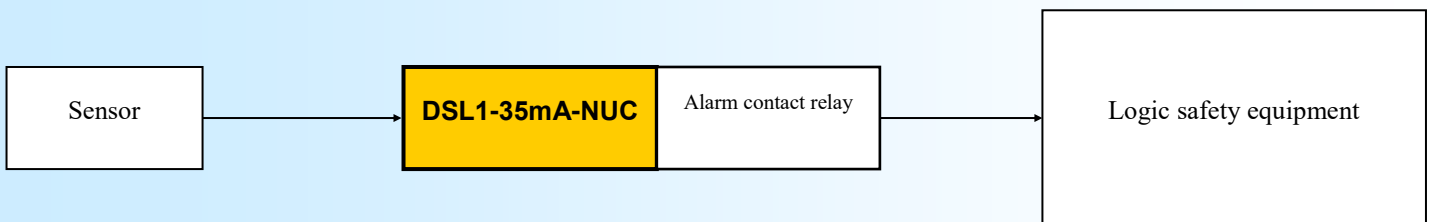
### Purpose of analysis

This study was conducted to verify the ability of DSL1-35mA-NUC threshold detector to be used in functional safety applications.

### Scope of analysis

The device include a whole of electronic components acquiring the analog input signal (4-20mA) by comparing it to an internal setpoint to provide an alarm.

Generally, a threshold detector is insert between a sensor and a protective equipment designated "Logic safety equipment"



### Component characterization

The DSL1-35mA-NUC detector is a sub-system including analog type components.

The failure modes of components needed for the safety function are well defined. Behaviour in anomalous conditions is fully determined and benefits from experience feedback in many security applications.

### Safe failures:

Failure that do not have de ability to put the safety related system in a dangerous state or in the inability to perform its required function.

A safe failure is a not a dangerous failure.

**SFF** : (Safe Failure Fraction) is the fraction of safe failures ( $\lambda_S$ ) and detected dangerous failures ( $\lambda_{DD}$ ) related to the total failure rate (sum of safe failures ( $\lambda_S$ ) and dangerous failure ( $\lambda_D$ )). Failures are considered as non-hazardous if they cannot put the system in a dangerous mode.

$$SFF = \frac{\lambda_S + \lambda_{DD}}{\lambda_S + \lambda_D}$$

### Dangerous failures :

Failure that has the ability to put the safety related system in a dangerous state or unable to perform its required function. We also designed it by unsafe failure.



### **Functional analysis**

The device consist of :  
an isolated power stage  
an input stage for current to voltage conversion  
a comparator (alarm processing)  
an output stage for relay (and isolation)

### **Dreaded event definition**

For the DSL1-35mA-NUC detector, the dreaded event ( i.e the dangerous failure as defined in the previous section) is the inability to provide an alarm, is an erroneous threshold of more than 2% compared to the process demand.

### **Security fallback definition**

The security fallback state is defined by the contact opening on the relay outputs.  
The application in the "Logic safety equipment" shall be configured for detect the contact opening and considere them as "invalidate".  
Thereby, in the FMEA analysis, this state is considered as a not dangerous state.

### **Study hypotheses**

The failure rate of components are considered constant for the all system lifetime.  
The evaluation of the safety features of a module involves a number of assumptions:  
Only the material aspect is treated.  
Only the catalectic failures are taken in account : straight, sudden, or unpredictable failures.  
Are not considered the failure that could be due to:  
- design errors  
- batch defect in production  
- environment (electrical interference, temperature cycles, vibrations)  
- human errors in operation or maintenance  
Precautions are taken to avoid them: management of a L.O.F.C (List of manufacturing operation and control)  
Only simple fault are handled. Welding defect, which are usually due to a lack of quality detectable at the end of production by a specific burn-in, are not taken into account.  
All aspects of power-on specific features are not treated.

### **Failure rate**

The simple failure rate for the components of the DSL1-35mA-NUC threshold detector are classified on the document: **Nomenclature et AMDEC DSL1-35mA-NUC rev0** available on request.

Created with "ALD MTBF calculator" : <http://www.aldservice.com/> according to the standard : CEI 62380 2004-08

**EU DECLARATION OF CONFORMITY**

REV9  
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With requirements of directive EMC 2004/108/CE "Electromagnetic Compatibility"  
and requirements of directive BT 2006/95/CE "Low Voltage"

We declare under our sole responsibility, that the following product:

Designation: **Analog threshold detector**

Type: **DSL1-35mA-NUC**

Revision : 0

date : 18/01/2016



complies with the following harmonized generic or specific standards :

Test Réalisé tested	Normes Standards	Description			
	Directive « basse tension » 2006/95/CE	<a href="#">Low Voltage Directive 2006/95/EC.</a>			
X	IEC EN 61010-1	Règle de sécurité pour les appareils électriques de mesurage, de régulation et de laboratoire	<a href="#">Safety requirements for electrical equipment for measurement, control, and laboratory use</a>		
	EN 61000-6-4 Compatibilité électromagnétique (CEM) Norme sur l'émission pour les environnements industriels	<a href="#">Emission standard for industrial environments</a>	<b>Limites Test level</b>		
X	IEC EN 55011	Emission rayonnée <a href="#">Radiated emission</a>	30-230 MHz: 30 dBµV/m (à 30m) 230-1000 MHz: 37 dBµV/m (à 30m)	Groupe1 Classe A	Ok
X	IEC EN 55011	émission conduite sur l'alimentation <a href="#">power supply induced emission</a>	0.15-0.5 MHz : 79 dBµV / 66 dBµV 0.5-30 MHz : 73 dBµV / 60 dBµV	Groupe1 Classe A	Ok
	EN 61000-6-2 Compatibilité électromagnétique (CEM) Immunité pour les environnements industriels	<a href="#">Immunity standard for industrial environments</a>	<b>Niveau de test Test level</b>	Influence constatée Critère d'aptitude requis	
X	IEC EN 61000-4-2 ESD	Immunité aux décharges électrostatiques <a href="#">Electrostatic discharge immunity test</a>	4 KV au contact 8 KV dans l'air	Sans influence <a href="#">No influence</a>	B
X	IEC EN 61000-4-3	Immunité aux champs électromagnétiques rayonnés aux fréquences radioélectriques <a href="#">Radiated Immunity</a>	80 à 1000 MHz 10 V/m (eff) 80% AM (1KHz)	Sans influence <a href="#">No influence</a>	A
X	IEC EN 61000-4-4 EFT	Immunité aux transitoires électriques rapides en salves <a href="#">Electrical fast transient /burst immunity test</a>	2 KV crête 5 / 50 ns 5 KHz	Sans influence <a href="#">No influence</a>	B
X	IEC EN 61000-4-5 CWG	Immunité aux ondes de chocs 1,2/50 µs. <a href="#">Surge immunity test</a>	1.2/50 (5/20) µs 2 kV	Sans influence <a href="#">No influence</a>	B
X	IEC EN 61000-4-6	Immunité aux perturbations conduites, induites par les champs radioélectriques <a href="#">Conducted Immunity</a>	0.15 à 80 MHz 10 V 80% AM (1 KHz) 150 Ohms	Sans influence <a href="#">No influence</a>	A
X	IEC EN 61000-4-8 AC MF	Immunité au champ magnétique à la fréquence du réseau <a href="#">Power frequency magnetic field immunity test</a>	50 Hz 30 A/m (eff)	Sans influence <a href="#">No influence</a>	A
X	IEC EN 61000-4-9 impulse MF	Immunité au champ magnétique impulsionnel <a href="#">Pulse magnetic field immunity test.</a>	1000A/m peak 6.4/16µs pulse	Sans influence <a href="#">No influence</a>	B
na	IEC EN 61000-4-11 AC dips	Immunité aux creux de tension, coupures brèves et variations de tension en AC <a href="#">Voltage dips, short interruptions and voltage variations immunity tests.</a>	-30 % 10 ms -60 % 100 ms -95 % 5000 ms	Sans influence <a href="#">No influence</a>	B -> 10ms C -> 100ms
X	IEC EN 61000-4-12 Ring wave	Immunité aux ondes oscillatoires <a href="#">Oscillatory waves immunity test</a>	2.5Kv common mode 1kV differential mode @ 1MHz	Sans influence <a href="#">No influence</a>	B
X	IEC EN 61000-4-29 Dc dips	Immunité aux creux de tension, coupures brèves et variations de tension en DC <a href="#">Voltage dips, short interruptions and voltage variations on DC input power port immunity tests.</a>	-30 % 10 ms -60 % 100 ms -95 % 5000 ms	Sans influence <a href="#">No influence</a>	B -> 10ms C -> 100ms

Metz, le : 18/01/16

Signé au nom de LOREME ; M. Dominique Curulla

Signed on behalf of LOREME

Année d'apposition du marquage CE : 2016

CE marking year

**Annexe 1 : EMC CONSIDERATIONS**

**1) Introduction:**

In order to satisfy its policy as regards EMC, based on the Community directive 2004/108/CE, the LOREME company takes into account the standards relative to this directive from the very start of the conception of each product.

As the devices are devised to work in industrial environments, the various tests are carried out in the sight of the EN 61000-6-4 and EN 61000-6-2 standards, in order to make out a statement of conformity.

As the devices lie in certain typical configurations during the tests, it is not possible to secure the outcomes in any possible configuration. To ensure the best functioning of each device, it would be judicious to comply with several recommendations of use.

**2) Recommendation of uses:**

**2.1) General remarks:**

Comply with the recommendations of assembly (direction of assembly, spacing between the devices, ...) specified in technical sheet.

Comply with the recommendations of use indicated in the technical sheet (temperature range, protection index).

Avoid dust and excessive humidity, corrosive gas, considerable sources of heat.

Avoid disturbed environments and disruptive phenomena or elements.

If possible, group together the instrumentation devices in a zone separated from the power and relay circuits.

Avoid the direct proximity with considerable power distance switches, contactors, relays, thyristor power groups, ...

Do not get closer within fifty centimeters of a device with a transmitter (walkie-talkie) of a power of 5 W, because the latter can create a field with an intensity higher than 10 V/M for a distance fewer than 50 cm.

**2.2) Power supply:**

Comply with the features indicated in the datasheet (power supply voltage, frequency, tolerance on values, stability, variations, ...).

It is better to use a power supply for instrumentation element and that the power supply line be the most direct possible from the section switch. Avoid using this power supply for the control of relays, of contactors, of electrogates, ...

If the switching of thyristor statical groups, of engines, of speed variator, ... causes strong interferences on the power supply circuit, it would be necessary to put an insulation transformer especially intended for instrumentation linking the screen to earth.

If the installation is near high frequency generators or installations of arc welding, it is better to put suitable section filters.

**2.3) Inputs / Outputs:**

In a harsh environment, it is advisable to use sheathed and twisted cables whose ground pair will be linked to the earth at a single point.

It is advisable to separate the input / output line from the power supply line in order to avoid the coupling phenomena.

It is also advisable to limit the lengths of data cable as much as possible.