



RISING

indoor localization and building maintenance using
radio frequency Identification and inertial
Navigation



RISING

Maintenance policies and update procedures of the Rising installations

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Foreword

The RISING project investigates the feasibility of using RFID technology to improve the activities of first responders during emergency missions in indoor/deep indoor environments. This document defines the maintenance policies and update procedures needed to guarantee an adequate level of confidence on the information stored into RFID tags. The reason for this is that the reliability of the RISING system depends on the accuracy of the stored information.



1 Scope

This document describes the process to set the information of a new RISING installation, defining the types of maintenance to be performed. Furthermore, the procedures that need to be performed in order to maintain and update the information on an existing RISING installation are also explained. This document is structured in three sections that explain these procedures but previously, a section with Terms and definitions is provided.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply (alphabetical order).

2.1 Person in charge of the maintenance (PCM)

The person responsible for the maintenance of a RISING installation. This person is the main user of the RAI.

2.2 Points Of Interest (POI)

A POI refers to resources and hazards available on the RISING installation. The tags will store information related to these POIs.

2.3 REFIRE codification

The codification defined in the REFIRE project to store information in passive tags. This information is available in the document “GS1 Standards and encoding proposals”.

2.4 RISING application information (RAI)

The system information to manage all the information of a RISING installation

2.5 RISING installation

A building, several buildings, a complete floor, a set of floors or only a section of a floor that is managed as an independent system for the purpose indoor localization and building maintenance using radio frequency identification and inertial navigation (RISING).

2.6 Site

A RISING installation managed in the RISING application information (RAI).

2.7 Tag

A RFID tag used to store information about localization and Points Of Interest (POIs) in a RISING installation.

3 Creating a new RISING installation

This section describes the process to create a new RISING installation.

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3.1 Physical installation

The first step is to install all the tags in their final position. A usual place for this installation is on the emergency lamps of the building.

Each tag must be tested to verify that it can be read with a RFID reader. The result of this process is the list of tags on the installation.

3.2 Application information

The process to create a new RISING installation requires that the information of the installation will be stored on the RISING Application Information (RAI).

The main purpose of the RAI is to store all the information related to the RISING installation. The tags will be written and verified with the information on the RAI.

The information of a RISING installation, includes the information of the site (3.2.1), the tags of the RISING installation (3.2.2) and the information of the Points Of Interest (POIs) of the RISING installation (3.2.3).

The first step is to create the site on the RAI

3.2.1 Creation of the site

The RAI may contain information of different RAI installations. Each one of these RAI installations is registered on the RAI as a “site”.

To create a new site, select “Create New Site” on the RAI.

The user must enter the following fields:

- **Name:** name describing the site.
- **Geographical coordinates:** information of latitude and longitude to define where the site is located.
- Optionally, a file including the plan of the floor or building of the site can be introduced.

The RAI will store this information and will add the following fields:

- **Site id:** it is the ID (identification) of the building, floor or installation.
- **Creation date:** the date of the site record creation.
- **Creation user:** user id to identify who has created the record of the site.

3.2.2 Register the tags

To store the information about the tags, the user must select a site of the RAI and include the following information for each tag:

- **EPC URI:** the Pure Identity “Electronic Product Code Uniform Resource Identifier” of the tag. Example: urn:epc:id:sgtin:0614141.112345.400. This information is used to code the 14 bits defined in the REFIRE codification.

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- **Geographic coordinates:** absolute geographical position of the tag with latitude, longitude and altitude. This information is used to code the 91 bits defined in the REFIRE codification.
- **Lamp classification:** includes the floor, indication of mezzanine, room and lamp. This information is used to code the 22 bits defined in the REFIRE codification.
- **Tag classification:** to indicate the type of the RFID tag (passive, active or semi-passive). This information is used to code the 2 bits defined in the REFIRE codification.
- **Accuracy:** power and direction of the electromagnetic field. This information is used to code the 8 bits defined in the REFIRE codification.
- **Tag Identification bits:** the id provided by the tag manufacturer (12 bits).

The RAI will store the previous information and will add the following fields:

- **Site id:** it is the ID of the building, floor or installation.
- **Tag ID:** numeric id to identify the tag on the RAI.
- **Creation date:** the date of the tag record creation.
- **Creation user:** user id to identify who has created the record of the tag.

3.2.3 Register the Elements (POIs)

The information of a RISING installation includes for each RFID tag installed, the information of the POIs stored in this specific tag.

To store the information about the POIs, the user must select a tag of the site of the RAI and include the following information for POI:

- **Category:** the main classification of the element, it's the kind of POI. Examples of categories are: emergency exits, fire hoses, extinguishers, fire axes, biological hazards, toxic gases and flammable gases. This information is used to code 6 bits that will be stored on the RFID tag. It allows 64 different categories.
- **Geographic coordinates:** absolute geographical position of element with latitude, longitude and altitude. This information is not stored on the RFID tag, it is stored to calculate the relative location and for maintenance purposes.
- **Relative location:** The relative location will show if the element is close (less than 3 meters) or far (3-7 meters) with respect to the tag. Additionally, the relative position of the item will also be defined: behind, down, left and right. Thus, the item position will be coded in the following way: Here, Left close, Left far, Right close, Right Far, Front close, Front far, Back close, Back far. This information is used to code the 4 bits that will be stored on the RFID tag enabling 16 different categories.
- **Type of element:** a category may consist of different types of elements. For example, the flammable gases category includes different elements such as acetylene, ammonia, hydrogen, propane, propylene and methane. This information is used to code the 6 bits that will be stored on the RFID tag. It allows 64 different types.
- **Subtype of the presence of the element:** for a category of an element (example flammable gases), the element can be present in different ways, for example for flammable gases it



can be a pipeline or a deposit. This information is used to code the 2 bits that will be stored on the RFID tag. It allows 4 different forms.

- **Numeric value:** this number provides information of the subtype of the element. For a pipe it refers to the diameter of the pipe, while for a deposit it is the volume of the deposit. As the information is going to be stored on the RFID tag, the value stored is a code for an approximate value of the real value. For example, for pipelines, the possible values from 0 to 7 correspond to the diameters: ½ inch, 1 inch, 2, 4, 8, 16, 32, and 64. This information is used to code the 4 bits that will be stored on the RFID tag. It allows 16 different values.
- **Comments:** any extra comment about the characteristics of the element.

The RAI will store this information and will add the following fields:

- Tag id.: numeric id to identify the tag on the RAI.
- POI ID: numeric id to identify the POI element.
- Creation date: the date of the POI record creation.
- Creation user: user id to identify who has created the record of the POI.

4 Definition of a type of maintenance of a RISING installation

This section describes the process to define a type of maintenance of a RISING installation.

A RISING installation has different types of maintenances and each one of them must be registered on the RAI.

To store the information about a type of maintenance, the user must select a site of the RAI and select “Create New Type of Maintenance”.

The user must enter the following fields:

- **System maintenance:** this field is a Boolean value. If its value is true means that the maintenance operation is compulsory for the good working order of the Rising system. On the other hand, if the value is false, the type of maintenance will not be compulsory for the Rising system operation.
- **Description:** a description of the type of maintenance to be performed, for example “legal required maintenance”, “six-monthly verification”, etc.;
- **Period of recurrence:** it defines the unit of time (days, weeks, months or years) to carry out the maintenances activities;
- **Number of periods between maintenance:** the number of times that a maintenance task needs to carry out over one year. It depends on the period of recurrence;
- **Last maintenance:** date when the last maintenance activity has been carried out, usually this field will be left void at this moment;
- **Next maintenance:** date when the next maintenance activity is expected according to the recurrence period;

The RAI will store this information and will add the following fields:

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- Site id.
- Maintenance type ID: numeric id to identify the maintenance type on the RAI.
- Creation date: the date of the type of maintenance creation.
- Creation user: user id to identify who has created the record of the tag.

Additionally, the user must enter the list of tags and POIs to be included in this type of maintenance.

4.1 Register the tags of the type of maintenance

To define the tags that need to be reviewed/included during the selected maintenance procedure, the user will select the tags of the site to be included in this maintenance.

The RAI will store the information of the tag IDs selected and the following fields:

- Maintenance type tag ID: numeric id to identify the record.
- Maintenance type ID: numeric id to identify the maintenance type on the RAI.
- Creation date: the date of the tag selection.
- Creation user: user id to identify who has created the record of selection of the tag.

4.2 Register the POIs of the type of maintenance

To define the POIs that need to be reviewed/included during the selected maintenance procedure, the user will select the tags of the site to be included in this maintenance and will include the information about the action to be performed. So the user will select:

- **Element ID:** numeric id to identify the type of element;
- **Action to be performed:** examples of these actions are: verify, refuelling, etc.

The RAI will store this information and will add the following fields:

- Maintenance type POI ID: numeric id to identify the record.
- Maintenance type ID: numeric id to identify the maintenance type on the RAI.
- Creation date: the date of the tag selection.
- Creation user: user id to identify who has created the record of selection of the tag.

5 Performing maintenance

This section describes the process to carry out maintenance activities of a RISING installation.

The RIA provides information about the next maintenances to be done. Based on this information the person in charge of the maintenance (PCM) can be aware of the maintenance procedures to be carried out in the system.

The process starts selecting the type of maintenance from the list of next maintenances presented by the RIA.

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The PCM needs to use a device that allows reading and writing the information of the tags. The device can be connected to the network or it can download the information from the RIA.

With this device, the PCM needs to go to the position where every tag included in the maintenance type is located. For each tag the following actions need to be performed:

- Reading the tag information with the device and verifying that the information is correct. If it is not correct, the PCM must update the information on the tag.
- For each POI element associated to this tag and included in the maintenance procedure, the PCM verifies the information of the POI and performs the action described in the maintenance type definition. The PCM registers if the action has been completed or not. If the PCM needs to write comments, the PCM writes them into the device. If the device is connected to the RIA, this is done directly on the RIA, otherwise, the information is stored in the device and uploaded at the end of the maintenance process to the RIA.
- After finalising all the POI elements of the tag, the PCM updates the information on the tag with the device.

The RAI will store the previous information in addition to the following one:

- Maintenance type ID: numeric id to identify the maintenance type on the RAI.
- Date: the date of the maintenance activity.
- User: user ID who has performed the maintenance.
- Verification date and user who has updated the tag registers.
- Verification date and user in who has updated the POI registers.

The RAI also updates the dates and persons for the next maintenance action on the records of the tags and POIs of this type based on the information of the period fields of the maintenance type.