‘Level-3’ Safety Alarms and Alarm Systems

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Annex
Request for the disabling of a system generating a level-3 alarm (IS37)
1 Purpose

The purpose of this Safety Instruction is to:

- define ‘level-3’ alarms;
- lay down the rules for the installation, commissioning, disabling, maintenance, and periodic inspection of level-3 alarm systems and assess the availability of the systems concerned up to the SCR;
- lay down the rules for ensuring the traceability of work done on these systems.

2 Rules for the installation of an alarm system

2.1 General

Prior to installation, all possible measures must be taken to reduce the risk to an acceptable level.

Nevertheless, for the personnel, the environment, or if it proves necessary to protect installations or equipment, and each time the risk exceeds acceptable levels, the buildings concerned must be equipped with a level-3 alarm system.

The group technically in charge must inform the TIS Division and the SCR of the installation of new level-3 alarm systems and of any significant change to existing systems and their controls.

The TIS Division has full authority to request the installation of a new level-3 alarm system.

Before a level-3 alarm system is commissioned, the Fire and Rescue Service of the TIS Division, in collaboration with the persons responsible for safety in the divisions (TSO, DSO) or experiments concerned (GLIMOS), draws up the instructions and procedures to be followed by the teams that respond to any level 3 alarm generated.

Level-3 alarm systems are designed in such a way as to facilitate access for authorized maintenance personnel and intervention teams’ personnel. However, access must be forbidden for unauthorized personnel.

Level-3 alarm signals may also be used to activate other technical or safety equipment (automatic controls).
2.2 Level-3 alarms

Level-3 alarms are those arising from the following hazards:

- a general emergency stop (danger: presence of potentially hazardous electrical power),
- detection of fire and/or smoke (fire hazard),
- an emergency call system (information about various hazards via, for example, a red telephone),
- a call from a lift (risk of trapped occupants), see ‘Specific details’ below,
- activation of evacuation signals (risk to personnel),
- detection of flammable or toxic gases (risk of explosion or poisoning),
- detection of oxygen deficiency (risk of suffocation),
- a water-level detector (risk of flooding),
- a dead-man device (risk of sudden medical problem affecting operator).

The TIS Division may classify other alarms as level-3 alarms.

Under specific circumstances, the TIS Division may classify the simultaneous occurrence of several level-2 alarms as a level-3 alarm, which will be transmitted as such to the SCR.

The downgrading of a level-3 alarm detector to transmit a lower level alarm must be authorized by the TIS Division.

Except in the cases provided for in this Safety Instruction, it is forbidden to render inoperative all or part of a level-3 alarm system.

Specific details

- Lifts
  In accordance with a European Directive\(^1\), all lifts must be fitted with a two-way means of communication with a built-in self-test feature ensuring a permanent link with the SCR; however, this equipment is not considered as a level-3 alarm system.
  Nevertheless, certain lifts located in high-risk areas, such as underground areas, must have a level-3 alarm system as defined in this Safety Instruction. Assessing the degree of risk is the responsibility of the TIS Division.

- Red telephones
  The red telephones installed in high-risk areas constitute a CERN-specific level-3 alarm system. Users are put directly in touch with the SCR by simply picking up the receiver.

\(^1\) EC/95/16.
2.3 Classification of alarms and related actions

The following table defines the different alarm levels, their meaning, the actions necessary, and the corresponding display colours to be indicated on the SCR and TCR displays.

<table>
<thead>
<tr>
<th>Alarm level</th>
<th>Meaning</th>
<th>Action to be taken</th>
<th>Display colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 3</td>
<td>Presence of a potential danger to human life, property or the environment</td>
<td>Immediate intervention by the Fire and Rescue Service (SCR)(^1)</td>
<td>Red</td>
</tr>
<tr>
<td>Level 2</td>
<td>Malfunction of an item of equipment or an abnormality which could result in a level-3 alarm</td>
<td>Immediate intervention by the competent technical service (TCR or group technically in charge)</td>
<td>Yellow</td>
</tr>
<tr>
<td>Level 1</td>
<td>Fault in a piece of equipment or an installation which cannot immediately result in a level-3 alarm</td>
<td>Intervention by the competent technical service (TCR or group technically in charge)</td>
<td>Blue</td>
</tr>
<tr>
<td>Level 0</td>
<td>Normal state</td>
<td>No action to be taken</td>
<td>White</td>
</tr>
</tbody>
</table>

\(^1\) If the Fire and Rescue Service receives an alarm they must attend the incident regardless of whether the alarm is considered ‘real’ or ‘false’.

2.4 Technical requirements for the design of level-3 alarm systems

Level-3 alarm systems are grouped into alarm zones (with local displays).

The transmission system must comprise a minimum of two redundant and independent fail-safe systems to ensure the required reliability and availability.

Identical reception and display systems are located in the SCR and the TCR so that one serves as a back-up for the other.

The states of a level-3 alarm system must be displayed; the location and classification of the alarm detectors must be clearly identified.

In the event of conflicting requirements, the preservation of human life must always take priority over any other consideration that could compromise the quality of service or reliability of equipment.
The following table defines the colours that must be used for the various level-3 alarm system states and displayed in the various control rooms.

<table>
<thead>
<tr>
<th>Alarm system state</th>
<th>Display colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm</td>
<td>Red</td>
</tr>
<tr>
<td>Fault</td>
<td>Yellow</td>
</tr>
<tr>
<td>Test</td>
<td>Blue</td>
</tr>
<tr>
<td>Out of service</td>
<td>White</td>
</tr>
<tr>
<td>Normal</td>
<td>Green</td>
</tr>
</tbody>
</table>

2.5 Testing a level-3 alarm system

2.5.1 Commissioning

The group technically in charge of a level-3 alarm detection system is responsible for the full commissioning of the system (detection, transmission, programmed automatic actions, display) and, in particular, for the acceptance test before commissioning. The group runs a full test of the level-3 alarm system’s effectiveness in its actual environment, with the participation of the TSO or GLIMOS and the TIS Division. The latter, which must be given at least two weeks’ advance notice, shall supervise the test and draw up a report, copies of which must be given to the participants, the TCR, and the SCR. The system may not be regarded as commissioned until the TIS Division has given its formal approval.

2.5.2 Significant changes to the environment

The TSO/GLIMOS is responsible for monitoring the risks in the area of which he is in charge.

If any significant change in the environment of an area protected by a level-3 alarm system is noticed, the TSO/GLIMOS must organize with the group technically in charge and the TIS Division a full test of the effectiveness of the system in its new environment, according to the procedures described in Section 2.5.1 above. Where appropriate, he must inform the TSO/GLIMOS responsible for a neighbouring level-3 alarm system.

2.5.3 Tests following a technical intervention

After any changes or repairs following a fault in a level-3 alarm system, the components concerned must be tested and the tests must be documented by the group technically in charge.

\footnote{Flammable Gas Safety Manual G, Section 7.4.}
2.5.4 Maintenance

The group technically in charge must ensure that the alarm systems are regularly maintained and, at least once a year, checked and calibrated in accordance with procedures to be established with the TIS Division. Each test must be documented by the group technically in charge to ensure the traceability of maintenance work.

2.6 Functional safety of level-3 alarm systems

2.6.1 General

The industrial standards requirements relating to functional safety must be applied throughout a level-3 alarm system’s life cycle. This means that the group technically in charge must constantly assess functional safety in collaboration with the TIS Division (functional safety requirements during operation, maintenance and repair, and subsequent to modifications).

2.6.2 Requirements

For each new level-3 alarm system, the requirements (for example, the safety integrity level) must be defined in agreement with the TIS Division.

If these requirements are not immediately met, transitional measures must be taken to remedy the situation.

2.7 Traceability and handling of anomalies

The group technically in charge shall be responsible for the traceability of the status of faults in a level-3 alarm system, for which an anomaly record sheet must be used to follow the history of any incident from the moment of its discovery until the system is brought back to normal. This record may be made electronically (e.g. in a computer-assisted maintenance management – CAMM – file) or on paper. It must be archived and easily accessible.

3 Procedure for the disabling and recommissioning of alarms

3.1 General

3.1.1 Disabling procedure

It is necessary to disable a level-3 alarm detection system in the following cases:

- scheduled work (e.g. maintenance, torch welding) which could trigger or affect the system and trigger a false alarm; disabling may be temporary or definitive;
- breakdown of the alarm system, i.e. an unscheduled disabling.
3.1.2 Responsibility

Scheduled disabling and subsequent recommissioning are carried out under the responsibility of the user of the level-3 alarm system, namely the TSO/GLIMOS.

The actions must be coordinated with those of any other TSO/GLIMOS concerned.

The person in charge of unscheduled disabling is the TSO/GLIMOS or, in his absence, the emergency response service concerned.

3.1.3 Tasks of the various people concerned

The issuer requesting the disabling of a level-3 alarm detection system is responsible for implementing compensatory measures.

The TSO/GLIMOS evaluates the risk, makes sure that compensatory measures have been implemented, approves requests for disabling, keeps himself informed of how the risks develop, and checks that the systems are recommissioned.

The person technically responsible for the detection system disables and recommissions the system, either personally or via a contractor working under his supervision.

The concerned services of TIS, e.g. the Fire and Rescue Service, give advice about compensatory measures and, where necessary, provide human surveillance (see Section 3.2).

The TCR operator transmits requests between the various people concerned, reminds them of what they are required to do, and documents the progress of operations.

3.1.4 Procedure


The paper form (see Annex) must be used only if the EDH system is unavailable. The TSO/GLIMOS must ensure that the form is distributed and check that it has been received.

3.2 Compensatory measures

Before any compensatory measures are put in place, all necessary steps must be taken to minimize the risks associated with disabling alarm systems.

In the case of temporary or unscheduled disabling, the issuer or the TSO/GLIMOS must make provision for adequate compensatory measures; make sure they are approved by the relevant TIS services, for example the SRC; and ensure that they are implemented.
– If there is work to be done requiring short-term disabling (less than four hours), the issuer must make provision for human surveillance (the usual occupants of the premises), even outside normal working hours.

– In the case of long-term disabling (more than four hours), suitably qualified human surveillance (CERN firemen, contractors, etc.) must be provided unless, at the issuer’s request and where this is possible, the group technically in charge takes adequate technical compensatory measures (e.g. installation of mobile detectors).

3.3 Scheduled disabling

3.3.1 Applicability

Scheduled disabling corresponds to temporary or periodic work or to the permanent dismantling of a level-3 alarm detection system.

3.3.2 Procedure

3.3.2.1 Requests

Requests for disabling must be made via EDH with sufficient notice (at least three days) to allow time for the necessary preparations, including the implementation of compensatory measures.

– The issuer requests disabling, specifying the circumstances (date, place and reason), and proposes compensatory measures.

– The TSO/GLIMOS checks, completes and approves the request for disabling as quickly as possible.

– The following services and people must be informed of the approval of a disabling request: the issuer, the person technically responsible for the level-3 alarm detection system, the TCR, the SCR, and the TIS-GS group.

3.3.2.2 Disabling

On the day of disabling, having implemented the compensatory measures (see Section 3.2), the issuer or a person appointed by them requests the person technically responsible to have the alarm system disabled. If necessary, such requests may be made via the TCR.

The person technically responsible then disables the system (or has it disabled) and reports this to the TCR and the issuer.

On receipt of confirmation of disabling, the TCR records the date and time and the name and details of the operator. The TCR informs the SCR if there is no ‘out of service’ display (in the case of old systems).
3.4 Unscheduled disabling (emergency procedure)

3.4.1 Applicability

The unscheduled disabling procedure applies to alarm system breakdowns that cannot be repaired within four hours.

If the breakdown can be repaired within a period of four hours, only the first four points of the emergency procedure are applied.

3.4.2 Emergency procedure

The TCR, SCR and, where applicable, the person technically responsible:

1) agree on the disabling of a system, and if necessary ensure the area is evacuated,
2) take compensatory measures (see Section 3.2),
3) disable the system where applicable,
4) inform the TSO/GLIMOS as soon as possible,
5) complete form IS37 (via EDH).

The TSO/GLIMOS, after being informed of the situation, visits the area and, after consulting the person technically responsible, proposes a date for recommissioning.

Recommissioning then proceeds as follows.

3.5 Recommissioning

3.5.1 On the date indicated in form IS37

The person technically responsible recommissions the system or has it recommissioned, checks that it is operating correctly, and reports this to the TCR.

After confirmation by the person technically responsible that the system has been recommissioned, the TCR records the date and time and the name and details of the operator.

Having been informed by the TCR that the system has been recommissioned, the TSO/GLIMOS checks that this is the case and records the fact on form IS37, thus concluding the procedure.

3.5.2 Recommissioning before the scheduled date

If the system can be recommissioned before the date shown in form IS37, the issuer contacts the TCR to request that this be done. The TCR forwards the issuer’s new request to the person technically responsible, who then recommissions the system as specified in Section 3.5.1 above.
3.5.3  Recommissioning after the scheduled date

If the system has to be recommissioned after the date shown in form IS37, the issuer draws up a new form IS37 in which the word ‘extension’ and the number of the old request is indicated in the ‘reasons’ section. The new request must follow the procedure specified in Section 3.5.1.

4  Legal basis

This Safety Instruction is published by the TIS Division in accordance with the procedure set out in the CERN Safety Policy document SAPOCO/42, pursuant to the CERN Staff Rules and Regulations and by virtue of the Organization’s regulatory powers on its territory.

It shall enter into force on the date of publication.

5  Definitions

Alarm sensor

Device designed to put the system in the alarm state when an abnormal event indicating the presence of danger is detected.

Different alarm system states

An alarm system has five different states\(^3\) defining its physical state of operation, namely:

- **Normal**: all the system’s equipment is fully operational.
- **Alarm**: an alarm signal has been triggered.
- **Fault**: operation is impossible in the conditions foreseen by the appropriate standards or operating range.
- **Test**: the normal functions are deliberately modified for test purposes.
- **Disabled**: all or part of a system is deliberately rendered inoperative.

Fail-safe

Automatic protection mechanism designed to ensure safety even when the failure of a piece of software or hardware is detected in the system.

\(^3\) The alarm systems already installed at CERN may comprise fewer states.
**False alarm**

An alarm triggered accidentally in the absence of any danger. It may be classed as follows, according to its origin:

- Originating within the detection system itself. This is a false alarm (for example, a fault in one of its components).
- Origin not connected with the detection system. This type of alarm is activated by:
  - A phenomenon to which, in principle, it should not respond. This is a false alarm (for example, electrical noise picked up from adjacent apparatus).
  - A phenomenon to which it should respond in principle but which is caused by something other than the monitored object. This is a justified alarm (for example, an aerosol that activates a smoke detector).

**Functional safety**

Functional safety constitutes a guide for the development of safety systems. Industrial systems need to operate with an increasingly high degree of **Reliability**, **Availability**, **Maintainability**, and **Safety**. This is the subject of IEC standard 61508, whose aim is to ensure functional safety, i.e. reduce risk to an acceptable level. This standard has already been taken into account in the petrochemical field and very similar standards have been applied in the nuclear and aeronautical fields.

**Group technically in charge** (may be one or more groups)

Group that carries out the installation, maintenance, disabling, and recommissioning of a level-3 alarm system. If more than one group is involved, they must define which of them is responsible within the meaning of the provisions of this Safety Instruction.

**Independence**

Two systems are said to be independent when they have the same objectives but different functions and means.

**Issuer**

The person who requests a level-3 alarm detection system to be disabled and who must be a CERN staff member.

**Level-3 alarm**

 Warns of the presence of a potential danger to human life, to property, or to the environment.
Level-3 alarm system

Technical installation designed to detect and to inform principally the SCR of a potentially dangerous abnormality. It consists of a detector (or detection system), a transmitter (or transmission system), and a receiver (or reception system).

Person technically responsible

Member of the group technically in charge, who is responsible for all or part of a level-3 alarm system (installation, maintenance, operation). This person is responsible for disabling and recommissioning the system, either personally or via a contractor working under his supervision.

Redundancy

Two systems are said to be redundant if they perform the same tasks and provide the same functions.

Safety Integrity Level SIL (Safety Integrity Level)

Discrete level (SIL 1, 2, 3 or 4) categorizing the safety integrity of E/E/PE systems, with technology based on electric, electronic and/or programmable electronic methods, SIL4 denoting the highest level of integrity.

Safety integrity (RAMS) of a system (Reliability, Availability, Maintainability, and Safety)

The safety integrity (RAMS) of a system is the probability of a safety-related system operating satisfactorily under a defined set of conditions for a defined period of time.

6  Glossary

Alarm level (see Section 2.3)

Determined according to the dangers and hazards to which people, property, or the environment in the vicinity are exposed.

Alarm system user

The TSO or, in the case of an experiment, the GLIMOS. This person is referred by the abbreviation TSO/GLIMOS.

DSO

Divisional Safety Officer.

Fire and Rescue Service

Also responsible for the SCR (Safety Control Room).
GLIMOS

Group Leader in Matters of Safety.

GMAO

Computer-assisted maintenance management (Gestion de la Maintenance Assistée par Ordinateur).

SCR

Safety Control Room on the Meyrin site run by the TIS Division’s Fire and Rescue Service.

SIL

Safety Integrity Level.

TCR

Technical Control Room run by ST Division.

TIS-GS (General Safety)

One of this group’s tasks is to check that the procedures laid down in this Safety Instruction are enforced.

TSO

Territorial Safety Officer.

7 References used

As the provisions applicable at CERN are those laid down in this Safety Instruction, the following references are given for information only:

– International standard IEC 839 ‘Alarm systems’.
– European standard EN 50136 ‘Alarm transmission systems and equipment’.
– European directive EC 95/16 on the safety of lifts.
– Plenary meeting of the Association of Insurance Companies (APSAD), Rule No. 37: Automatic fire detection, rules for use.
### Annex

**Request for the disabling of a system generating a level-3 alarm (IS37)**

<table>
<thead>
<tr>
<th>Issuer</th>
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<tbody>
<tr>
<td>Family name</td>
<td>First name</td>
<td></td>
</tr>
<tr>
<td>Division - Group</td>
<td>Telephone and fax nos.</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Signature</td>
<td></td>
</tr>
</tbody>
</table>

| Scheduled period |   |   |
| Start Date | Time: hh:mm h |
| Duration |   |   |
| ☑ Permanent disabling |   |   |
| ☑ Temporary disabling; indicate the scheduled end (periodic) |   |   |
| Date: | Time: hh:mm h |

<table>
<thead>
<tr>
<th>Place concerned</th>
<th>Place</th>
<th>Additional details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building - Floor - Office</td>
<td>And/or experiment</td>
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</table>

<table>
<thead>
<tr>
<th>Reason for disabling</th>
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<table>
<thead>
<tr>
<th>Compensatory measures</th>
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<table>
<thead>
<tr>
<th>TSO/GLIMOS</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Family name</td>
<td>First name</td>
</tr>
<tr>
<td>Division - Group</td>
<td>Telephone and fax nos.</td>
</tr>
<tr>
<td>Date</td>
<td>Signature</td>
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</table>

<table>
<thead>
<tr>
<th>Type of alarm concerned</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☑ smoke detector</td>
<td>☑ flood detector</td>
</tr>
<tr>
<td>☑ gas detector</td>
<td>☑ triggering of an alarm signal</td>
</tr>
<tr>
<td>☑ red telephone</td>
<td>☑ blocked lift</td>
</tr>
<tr>
<td>☑ general emergency stop</td>
<td>☑ dead-man device</td>
</tr>
</tbody>
</table>
| ☑ oxygen concentration detector | ☑ other (specify): ...............................................
|   |   |

<table>
<thead>
<tr>
<th>Person technically responsible for the alarm system</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Family name</td>
<td>First name</td>
</tr>
<tr>
<td>Division - Group</td>
<td>Telephone and fax nos.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Copies of the form to be sent to:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. the TSO/GLIMOS</td>
<td>4. the TIS/GS group leader (Tel: 74860, Fax: 79465)</td>
</tr>
<tr>
<td>2. the issuer</td>
<td>5. the person technically responsible for the alarm system</td>
</tr>
<tr>
<td>3. the SCR (Tel: 74848, Fax: 78342)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disabled by:</th>
<th>Recommissioned by:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<table>
<thead>
<tr>
<th>Date and time</th>
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<table>
<thead>
<tr>
<th>Comments</th>
<th>Operator’s name</th>
<th>Date and signature</th>
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<tbody>
<tr>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Recommissioning/permanent disabling checked and archived</th>
<th>Date</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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