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**EUROPEAN LABORATORY FOR PARTICLE PHYSICS
CERN - ST DIVISION**

DRAFT

CERN ST/AA/888//DG-01-36

888 Gas detection monitoring

USER REQUIREMENTS DOCUMENT

888/NA58/URD/WORD/ISSUE 2/REVISION 0

Abstract:

This document defines the user requirements for the CGAZ-00128 Gas detection monitoring systems for building 888. This system aims at extending the monitoring capabilities of the current gas detection & monitoring system, based on a Labview program, to a the NA58 experimental area.

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GENEVA, SWITZERLAND - April, 01

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1. INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This document defines the user requirements for the NA58 Gas detection & monitoring system.

This document defines the User Requirements from a functional point of view, and not from a technical point of view.

The main objective of this document is to define clear and testable functions that can be validated upon completion of the project.

All users shall certify this document as being a faithful representation of their requirements at the time of discussion.

This document will be used by the ST-AA-AS section for the definition of the system requirements and for the production of subsequent price inquiries to its contractors for the supply and installation of gas detection equipment.

1.2 SCOPE OF THE WORK

The objectives of this work package is to extend the flammable, oxygen deficiency & monitoring capabilities of the current gas detection & monitoring system (based on a Labview program), to the NA58 experimental area.

The scope of the work includes the introduction of a new gas distribution and test zone situated in the experimental hall 888 including modifications to the existing Labview applications by accessing data from installed PLC (a4dg888). New gas detection infrastructure to include an air sampling system and oxygen deficiency will be installed.

The work will be based on the specifications of the existing gas detection and Labview program developed by GTD / Spie Trindel.

1.3 DEFINITIONS, ACRONYMS AND ABBREVIATIONS

1.3.1 Acronyms - Abbreviated Coded Rendition of Name Yielding Meaning ☺

AL3	Alarm-of-Level-3
CIE	Control & Indication Equipment
GLIMOS	Group Leader in Matters of Safety
HCI	Human Computer Interface
PCR	Prevessin Control Room
SCR	Safety Control Room
SLIMOS	Shift Leader in Matters of Safety
TCR	Technical Control Room
TIM	Technical Infrastructure Monitoring
TIS	Technical Inspection and Safety commission
TOC	Table Of Contents
URD	User Requirements Document
XCR	Experiment Control Room

1.4 REFERENCES

Two classes of references are detailed in this document:

- Applicable documents are considered to govern or form a part of this URD.
- Reference documents have a bearing on the content of the URD, but they do not govern or form a part of it.

1.4.1 Applicable documents

- [A1] Software Engineering Standards, ESA Board for Software Standardisation and Control, 1994.
- [A2] SL - ST - Software Repository. User Documentation. Tool reference, Versions, Threads, and Issues.
- [A3] GTD documentation for the Gas control system.
- [A4] Spie-Trindel documentation for the CIE CGAZ-00128 (control & Indication Equipment).

1.4.2 Reference documents

- [R1] ESA PSS-05-02 Issue 1, Guide to the User Requirements Definition Phase, October 1991.

1.5 OVERVIEW OF THE DOCUMENT

The document is structured as follows:

Chapter 2 describes the general factors that affect the system and its requirements. It does not state specific requirements; it only makes those requirements easier to understand.

Chapter 3 describes & suggests further recommendations to follow for some of the system requirements.

Appendix **A** Spreadsheet actions for a given alarm of level 2 & 3 for gas distribution building 908.

Appendix **B** Spreadsheet actions for a given alarm of level 2 & 3 for the gas mixing area building 888

Appendix **C** Spreadsheet actions for a given alarm of level 2 for the Experimental zone building 888

Appendix **D** Spreadsheet actions for a given alarm of level 3 for the Experimental zone building 888

Appendix **E** Spreadsheet actions for a given alarm of level 2 & 3 for the RICH test zone building 888

Appendix **F** proposition "initial planning and responsibility chart".

Appendix **G** Architecture of the proposed system.

Appendix **H** E719/MD-04 Access to gas application EHN2.

2. GENERAL DESCRIPTION

2.1 PRODUCT PERSPECTIVE

2.1.1 Motivation

There is a need to modify the existing gas detection & monitoring system CGAZ-00128 installed in building 888 due to the expansion of the experiments flammable and neutral gas needs.

2.1.2 Project Objectives

The project has the following objectives:

- Modify the remote gas monitoring system for the NA58 experimental area.
- Modify & install further hardware components for the existing gas detection system CGAZ-00128 for the NA58 experimental area.
- Execute the off-line testing of the software for functional and performance validation
- Execute on-line testing for provisional acceptance

2.2 GENERAL CAPABILITES, FUNCTION AND PURPOSE

The main functions of the gas detection & monitoring system CGAZ-00128 are to include:

- Surveillance of the flammable gas distribution building 908 (via six catalytic flammable gas sensors)
- Surveillance of the flammable and neutral gas mixing zone situated within the experimental hall 888 (via four catalytic flammable gas sensors)
- Surveillance of the experimental area (to include the Micro drift chambers, MW2 and the RICH experimental tent to incorporate oxygen deficiency) located within the experimental hall 888 (via a mixture of catalytic, air sampling and O₂ deficiency).
- Surveillance of the RICH chamber test area located within the experimental hall 888.
- Acquisition of the data from the CIE (PLC included in the GAS installation package) for alarm processing and transmission of these alarms to the TCR & SCR respectively.
- Display of the data on the HMI similar to the existing Labview program developed by GTD.

The system shall be an extension of the existing Gas monitoring system developed by Spie-Trindel / GTD shown in the schematic diagram below.

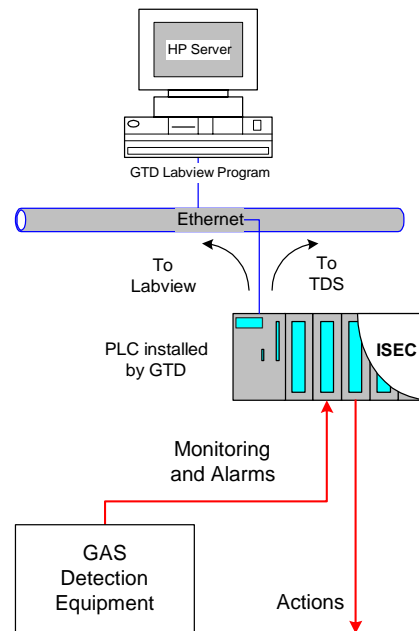


Figure 1 – Monitoring Architecture

2.3 GENERAL DISCRIPTION & CONSTRAINTS OF THE WORK TO BE UNDERTAKEN

The main constraints for the development and implementation of such modifications can be considered as:

- For the purpose of experimental interlocks and slow control, the addition of a communications cable between the CIE and the NA58 experimental control room is desired. *(These signals are generated in the form of a dry contact (positive security = opens when actioned)).*
- RICH detectors require a constant supply of clean gas to protect the CsI coated cathode(s), for this purpose changes to the emergency shut down of the flammable & neutral gas supplies are required.
- Modifications to the relay logic for the isolation of electrical supplies to individual experiments and flammable gas zones when an alarm of level 3 is generated.
- The installation & integration of four additional catalytic heads to be placed inside the ventilation hoods located in the gas mixing zone. These heads will also be interlocked and action the 2 speed ventilation system to be installed by ST-CV. The new infrastructure will be integrated into the existing Labview application by accessing the data from the PLC a4dg888 and included in the GAS installation package.
- The installation & integration of one additional catalytic head and additional hardware for the RICH chamber testing area. The new infrastructure will be integrated into the existing Labview application by accessing the data from the PLC a4dg888 and included in the GAS installation package.
- The installation & integration of a flammable gas air sampling system and an oxygen deficiency sensor to survey the interior of the RICH tent. The new infrastructure will be integrated into the existing Labview application by accessing the data from the PLC a4dg888 and included in the GAS installation package.
- Interaction with the ventilation system for a fault or alarm of level 3

- The data should be read from a PLC datablock structure agreed and documented with the GAS detection contractor Spie-Trindel / GTD.

2.4 FURTHER RECOMMENDATIONS

The special Freon gases, which are supplied from gas building 908, are automatically cut along with the flammable gases when an alarm of level 3 is generated. Special care should be incorporated for the use of halogenated gases such as SF6 & R134a in the presence of flammable gas catalytic sensors. Halogenates are poisonous to these sensors reducing their life expectancy and effectiveness. It is recommended that the existing sensors are replaced by anti poison reinforced catalytic sensors and preventative maintenance is performed every 6 months.

The overall effectiveness of the four flammable gas point detection sensors placed inside the ventilation hood may be slightly reduced if placed within an environment of permanent ventilation. ICARE recommend that the gas detection sensors action the ventilation system to maximum speed and capacity only for a given alarm of level three.

2.5 ASSUMPTIONS AND DEPENDENCIES

We do not consider that sabotage is a likely event. No elaborate measures to prevent tampering with the monitoring system will be taken. However, mechanisms of user authentication and password protection shall be implemented to prevent manipulation by untrained or unauthorised users.

The main assumption is that the modifications to the CGAZ-00128 Gas detection & monitoring can be added to the current gas monitoring application for the SPS experimental zones.

BAT 888 RICH Chamber Test Area AI-2	New Head	Comments
Pre-alarm TCR (Hardwired)	X	
Pre-alarm TCR (ISEC)	X	
Alarm SCR (Hardwired)		
Alarm SCR (ISEC)		
Luminous Warning Panel	X	
Klaxon	X	
Close electrovalves (Flammable 908)		
Close electrovalves (Neutral 908)		
Cut Power Test Area		
Signal (Contact) NA58 Control Room	X	Subject to Modif
Extraction / Ventilation (Hall)		
Klaxon Aquit Button	X	
Alarm Aquit Key 10001		
Close electrovalves (Test/Flammable Gas Mix)		
Close electrovalves (Test/Neutral Gas Mix)		

BAT 888 RICH Chamber Test Area AI-3	New Head	Comments
Pre-alarm TCR (Hardwired)		
Pre-alarm TCR (ISEC)		
Alarm SCR (Hardwired)	X	
Alarm SCR (ISEC)	X	
Luminous Warning Panel	X	All Zones
Klaxon	X	All Zones
Close electrovalves (Flammable 908)	X	See Note *
Close electrovalves (Neutral 908)		
Cut Power Test Area	X	Subject to Modif
Signal (Contact) NA58 Control Room	X	Subject to Modif
Extraction / Ventilation (Hall)	X	
Klaxon Aquit Button		
Alarm Aquit Key 10001	X	
Close electrovalves (Test/Flammable Gas Mix)	X	Subject to Modif
Close electrovalves (Test/Neutral Gas Mix)		Subject to Modif
* Only flammable gas racks Numbers 75, 76, 77		

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BAT 908 Gas Distribution Building AI-2	01-00729	02-00720	03-00731	04-00732	05-00733	06-00734	Comments
Pre-alarm TCR (Hardwired)	X	X	X	X	X	X	
Pre-alarm TCR (ISEC)	X	X	X	X	X	X	
Alarm TCR (Hardwired)							
Alarm TCR (ISEC)							
Luminous Warning Panel	X	X	X	X	X	X	
Klaxon	X	X	X	X	X	X	
Close electrovalves (Flammable 908)							
Close electrovalves (Neutral 908)							
Signal (Contact) NA58 Control Room	X	X	X	X	X	X	Subject to Modif
Cut Power Experiment							
Extraction / Ventilation (High Speed)							
Klaxon Aquit Button	X	X	X	X	X	X	
Alarm Aquit Key 10001							
Close electrovalves (Flammable Gas Mix)							
Close electrovalves (Neutral Gas Mix)							

BAT 908 Gas Distribution Building AI-3	01-00729	02-00720	03-00731	04-00732	05-00733	06-00734	Comments
Pre-alarm TCR (Hardwired)							
Pre-alarm TCR (ISEC)							
Alarm SCR (Hardwired)	X	X	X	X	X	X	
Alarm SCR (ISEC)	X	X	X	X	X	X	
Luminous Warning Panel	X	X	X	X	X	X	All Zones
Klaxon	X	X	X	X	X	X	
Close electrovalves (Flammable 908)	X	X	X	X	X	X	See Note *
Close electrovalves (Neutral 908)							
Cut Power Experiment							
Signal (Contact) NA58 Control Room	X	X	X	X	X	X	Subject to Modif
Extraction / Ventilation (High Speed)	X	X	X	X	X	X	
Klaxon Aquit Button							
Alarm Aquit Key 10001	X	X	X	X	X	X	
Close electrovalves (Flammable Gas Mix)							
Close electrovalves (Neutral Gas Mix)							
* Only flammable gas racks Numbers 75, 76, 77							

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BAT 888 Gas Mixing Zone AI-2	09-00735	10-00736	11-00737	12-00738	New Head 1	New Head 2	New Head 3	New Head 4	Fault Extrac
Pre-alarm TCR (Hardwired)	X	X	X	X	X	X	X	X	
Pre-alarm TCR (ISEC)	X	X	X	X	X	X	X	X	
Alarm TCR (Hardwired)									X
Alarm TCR (ISEC)									X
Luminous Warning Panel	X	X	X	X	X	X	X	X	X
Klaxon	X	X	X	X	X	X	X	X	X
Close electrovalves (Flammable 908)									X
Close electrovalves (Neutral 908)									
Cut Power Experiment									
Signal (Contact) NA58 Control Room	X	X	X	X	X	X	X	X	X
Extraction / Ventilation Hall									
Extraction / Ventilation (High Speed)									
Klaxon Aquit Button	X	X	X	X	X	X	X	X	X
Alarm Aquit Key 10001									
Close electrovalves (Flammable Gas Mix)									X
Close electrovalves (Neutral Gas Mix)									
* Only flammable gas racks Numbers 75, 76, 77									

BAT 888 Gas Mixing Zone AI-3	09-00735	10-00736	11-00737	12-00738	New Head 1	New Head 2	New Head 3	New Head 4	Comments
Pre-alarm TCR (Hardwired)									
Pre-alarm TCR (ISEC)									
Alarm SCR (Hardwired)	X	X	X	X	X	X	X	X	
Alarm SCR (ISEC)	X	X	X	X	X	X	X	X	
Luminous Warning Panel	X	X	X	X	X	X	X	X	All Zones
Klaxon	X	X	X	X	X	X	X	X	All Zones
Close electrovalves (Flammable 908)	X	X	X	X	X	X	X	X	See Note *
Close electrovalves (Neutral 908)									
Cut Power Gas Mixing	X	X	X	X	X	X	X	X	Subject to Modif
Signal (Contact) NA58 Control Room	X	X	X	X	X	X	X	X	Subject to Modif
Cut Power Experiment (Totally)									
Extraction / Ventilation (High Speed)	X	X	X	X	X	X	X	X	Subject to Modif
Extraction / Ventilation Hall	X	X	X	X	X	X	X	X	Contact Exists
Klaxon Aquit Button									
Alarm Aquit Key 10001	X	X	X	X	X	X	X	X	
Close electrovalves (Flammable Gas Mix)	X	X	X	X	X	X	X	X	Subject to Modif
Close electrovalves (Neutral Gas Mix)									Subject to Modif
* Only flammable gas racks Numbers 75, 76, 77									

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	Micro / Drift Chambers		MW2		RICH/Tent Air Sam + 02 deficiency		
BAT 888 Experimental Zone AI-2	15-00739	16-00740	17-00741	18-00742	2 Points Det	1 Point Det (02)	Comments
Pre-alarm TCR (Hardwired)	X	X	X	X	X	X	
Pre-alarm TCR (ISEC)	X	X	X	X	X	X	
Alarm SCR (Hardwired)							
Alarm SCR (ISEC)							
Luminous Warning Panel	X	X	X	X	X	X	Specific to 02 Locally
Klaxon	X	X	X	X	X	X	
Close electrovalves (Flammable 908)							
Close electrovalves (Neutral 908)							
Cut Power Experiment (Total)							
Cut Power Experiment Drift Chambers							
Cut Power Experiment MW2							
Cut Power RICH Tent							
Signal (Contact) NA58 Control Room	X	X	X	X	X	X	Subject to Modif
Extraction / Ventilation Hall							
Extraction / Ventilation (High Speed)							
Klaxon Aquit Button	X	X	X	X	X	X	
Alarm Aquit Key 10001							
Close electrovalves (Flammable Gas Mix)							
Close electrovalves (Neutral Gas Mix)							

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BAT 888 Experimental Zone AI-3	15-00739	16-00740	17-00741	18-00742	2 Points Det	1 Point Det (02)	Comments
Pre-alarm TCR (Hardwired)							
Pre-alarm TCR (ISEC)							
Alarm SCR (Hardwired)	X	X	X	X	X	X	
Alarm SCR (ISEC)	X	X	X	X	X	X	
Luminous Warning Panel	X	X	X	X	X	X	Specific to 02
Klaxon	X	X	X	X	X	X	All Zones
Close electrovalves (Flammable 908)	X	X	X	X	X		See Note*
Close electrovalves (Neutral 908)						X	C4F10
Cut Power experiment (Total)							
Cut Power Experiment Drift Chambers							
Cut Power Experiment MW2							
Cut Power RICH Tent							
Signal (Contact) NA58 Control Room							
Extraction / Ventilation (High Speed)							Gas Mixing
Extraction / Ventilation Hall	X	X	X	X	X	X	Bg 888
Klaxon Aquit Button							
Alarm Aquit Key 10001	X	X	X	X	X	X	
Close electrovalves (Flammable Gas Mix)	X	X	X	X	X		Subject to Modif
Close electrovalves (Neutral Gas Mix)						X	Subject to Modif