GAS BOX DESIGN
ESS NEUTRONS BEAM LOSS MONITOR
VERSION 1.0

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SUMMARY

1 Introduction

The purpose of this document is to explain, in the most detailed way possible, how the nBLM gas box or rack system was designed.
Hardware, connections, faults functions, will be explained in following parts of this document.

2 Gas Rack Architecture

The ESS nBLM gas system control is composed of four main parts:

- A main distribution rack, to supply the three regulation rack
- A first regulation rack for line 1 (MEBT-DTL1), line 2 (DTL2-DTL3) and line 3 (DTL4-DTL5)
- A second regulation rack for lines 4 (SPK1-6), line 5 (SPK7-13) and line 6 (MB-HB-Bend Magnet)
- A spare rack, for maintenance

You can find on the schematic below (Figure 1 : Hardware architecture), previous mentioned parts and how they are connected together.

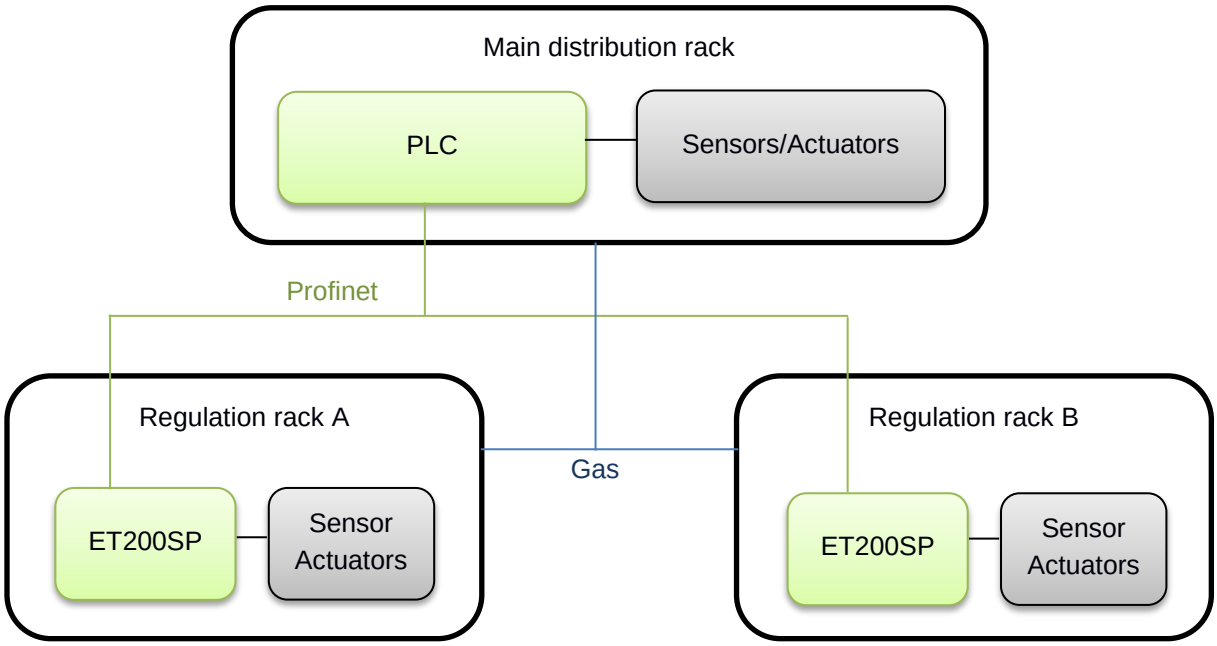


Figure 1 : Hardware architecture

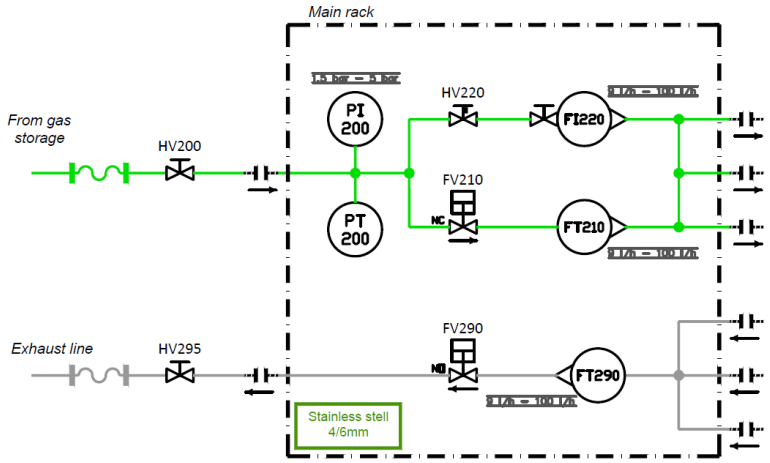
3 Racks functions

3.1 Main distribution rack

The main distribution supply the other three racks in gas. It contains also the PLC which control the three other ET200SP (remote I/Os).
You can find on the drawing above, the different parts of the gas distribution rack:

- Two manual valves to disconnect the rack from IN and OUT lines
- A pressure indicator (manometer) to limit the input pressure manually
- A pressure sensor which is connected to the PLC

- A manual line, with hand valve (and limits switches) and manual flowmeter to supply the distribution racks if the automatic line is out of order.
- An automatic line, with electro-valve (Normally close) and flowmeter
- A return line, with flowmeter and electro-valve (Normally open)



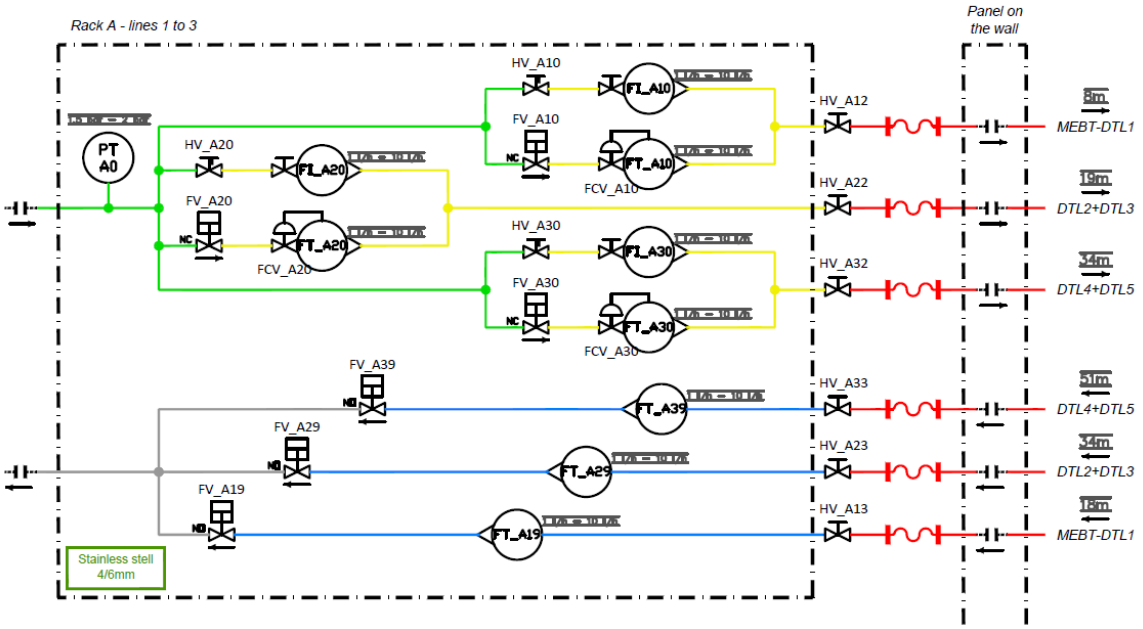
Below, you can find details of gas components:

Device name	Schematic name	Hardware reference	Quantity
Manometer	PI200	WIKA-2333RV	1
Pressure sensor	PT200	KELLER-PAA23SY	1
Hand valve	HV220	HYLOK-B2VAH-6M	1
Flow indicator	FI220	BROOKS-GT1350-I-VD2	1
Electro valves	FV210-FV290	ASCO-E262K185	2
Flowmeter	FT210-FT290	BROOKS-SLA5850S	2
Self-sealing connection		SERTO CO KA/B-SOSC-6EV	8

3.2 Distribution racks

The three distribution racks work in the same way. It allow supplying each lines independently. You can find below the drawing of a rack.

The PLC monitoring pressure at the rack inlet. A distribution line is composed by a manual line and an automatic line. The same material allows controlling the manual line distribution.
A flowmeter with regulation valve regulates input flow. The PLC check also the output flow to provide information (leak for example). Faults are explains in the chapter 4.

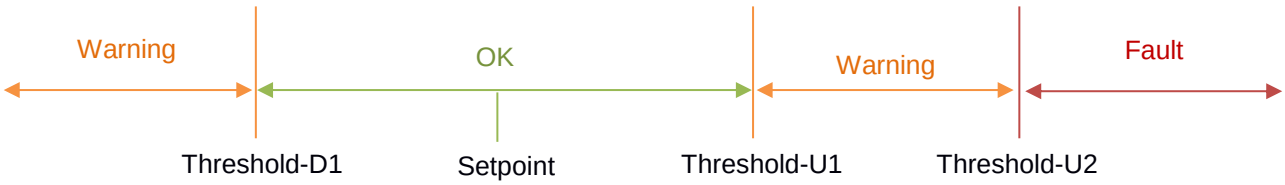


Below, you can find details of gas components (for one rack, multiply per three for the three distribution racks).

Device name	Schematic name	Hardware reference	Quantity
Pressure sensor	PTA0	KELLER-PAA23SY	1
Hand valve with limits switches	HV_A10-HV_A20-HV_A30	HYLOK-B2VAH-6M	3
Flow indicator	FI_A10-FI_A20-FI_A30	BROOKS-GT1350-I-VD2	3
Electro valves	FV_A10-FV_A20-FV_A30-FV_A19-FV_A29-FV_A39	ASCO-E262K185	6
Flowmeter with valves	FCV_A10-FCV_A20-FCV_A30	BROOKS-SLA5850S	3
Flowmeter	FT_A19-FT_A29-FT-A39	BROOKS-SLA5850S	3
Hand valves	HV_A12-HV_A22-HV_A32 HV_A13-HV_A23-HV_A33	HYLOK-B2VAH-6M	3
Self-sealing connection		SERTO CO KA/B-SOSC-6EV	2

4 Faults and security functions

A warning is displayed on the HMI (EPICS). A fault is also displayed on the HMI but it affect the process. Warnings and faults are only accessible in automatic mode. They are coded as follows:



Here is the warnings and faults list:

- General pressure (PT200)
    - < Threshold-D1
    - > Threshold-D1
    - > Threshold-D2
- General flow (FT210)
    - < Threshold-D1
    - > Threshold-D1
    - > Threshold-D2

This threshold are automatically calculated by set point and threshold of actives lines.

- General flow – return (FT290)
    - < Threshold-D1
    - > Threshold-D1
    - > Threshold-D2
- Pressure in rack A and B (PT_A0 / PT_B0)
    - < Threshold-D1
    - > Threshold-D1
    - > Threshold-D2
- Flow in line 1, 2, 3, 4, 5 and 6 (FT_A10 / FT_A20 / FT_A30 / FT_B40 / FT_B50 / FT_B60)
    - < Threshold-D1
    - > Threshold-D1
    - > Threshold-D2
- Flow in line 1 – return (FT_A19 / FT_A29 / FT_A39 / FT_B49 / FT_B59 / FT_B69)
    - < Threshold-D1
    - > Threshold-D1
    - > Threshold-D2

If a flow fault appears, regulation of the line is stopped. A manual acknowledgment and a start command are necessary to restart the regulation.
A pressure fault drive the same procedure, the output electro-valve being normally open.