Fermilab

LARIAT Experimental Hall ODH System Equipment, Hardware, Software, and behavior Description

Location: FermiLab\MESON\MC-7\LARIAT Experimental Hall

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ENGINEERING NOTE

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PPD/MD/PROCESS CONTROLS ENGINEERING

I. Introduction

This document describes the Equipment, Hardware, Software, and behavior of the ODH system as designed and installed at the LARIAT experimental hall at FermiLab.

The ODH system equipment components are all UL Listed commercially available products. The ODH system has been designed and built following all the required rules and standards such as the NEC. All premises wiring was installed by Fermi Electrical contractors and licensed electricians.

II. Field Devices and Components

a. Oxygen Sensors

i. Description

The LARIAT ODH system has four MSA (Mine Safety Appliances Company) O2 sensor heads. The four O2 sensor heads are distributed among the cryogenic equipment in the enclosure. The O2 Sensors are MSA model A-UltimaX-PL-A-14-03D2-0000-100 and have a span of 0-25% ambient O2 in air. Each O2 sensor is wired to an MSA electronic controller which provides an analog output signal wired to the S7 PLC. This MSA electronic unit also provides relays which have three O2 level alarms thresholds, 19.5%, 19%, and 18.5%. The relay output that is set at 19.5% is wired directly to the ODH system hardware which controls the warning horns and strobe lamps located in the LARIAT hall, as well as the FIRUS ODH alarm message. The MSA electronic unit also provides a trouble relay output which is also wired to the PLC and FIRUS. The trouble output is wired in a failsafe manner, such that loss of power or blown fuse to the ODH controls will generate a trouble alarm.

b. EF-1 Exhaust Fan

i. Description

The Exhaust fan installed at MC7 is a Greenheck SWB-215-30-CCW-UB-X. EF-1 is a 3000 CFM fan that pulls air from the hall ceiling and exhausts it outdoors. Full Speed is 1765 RPM @ 60 Hz. Either the ODH system or the PLC can turn the fan ON or OFF and call for emergency ventilation which runs the fan motor at 60Hz which is full speed or 3000 CFM.

c. EF-1 Damper

i. Description

The EF-1 damper is in the exhaust duct of the EF-1 air inlet. Damper Model # WD-340 from Greenheck. This is a backdraft damper which allows airflow in one direction and prevents airflow in the opposite direction.

d. Air Velocity Switch

There is one air velocity switch to allow air flow in the ventilation system. The switch is manufactured by ifm Efector, Inc. Air Velocity Switch model # SL5101 SLG23CEEAKOG.

The switch is in the EF-1 air exhaust duct. The switch is configured to energize the relay when air flow is present. The probe outputs will be input into the Siemens PLC, where the plc system will contain logic that compares air flow to expected air flow rates for diagnostic reasons. The air flow switch is configured at certain threshold to monitor the air flow when fan is running.

III. ODH System Behavior

a. Description

The ODH system is hardwired such that if any ODH sensor dips below

19.5%, Horns and Strobes will activate, EF-1 will turn on at full speed, the damper will open, and FIRUS will be notified of an ODH event.

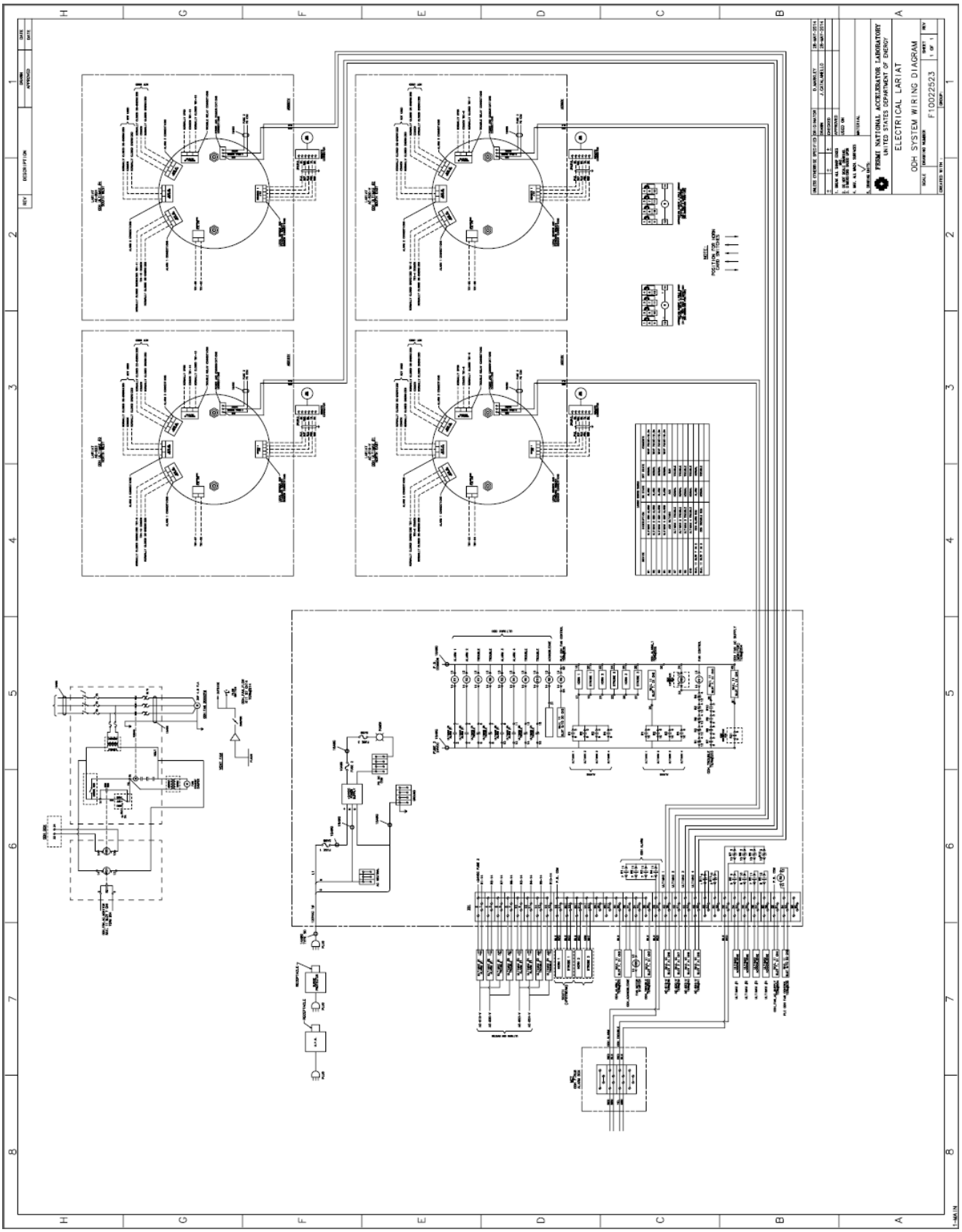
The PLC will contain logic that monitors the analog values of the four MSA O2 sensors and will be programmed such that if any ODH sensor dips below 19.5%, EF-1 will turn on at full speed, the damper will open, auto-dialer and computer alarms will be generated.

The PLC will also contain logic that monitors EF-1 fan performance using the air velocity switch. The PLC will also contain logic that performs daily ventilation testing for EF-1.

LARIAT at MC7 System----Control Logic Flow Diagram

Rev Date Jan 27, 2015 *ODH and MISC SECTION LOGIC*

PLC SOFTWARE		HARDWARE	ACTION
Operator Command			ODH_FAN_CONTROL
ON when AE-819 is below19.5%		AE-819 < 19.5%	FIRUS Alarm
ON when AE-820 is below 19.5%		AE-820 < 19.5%	Horn/Strobe
ON when AE-823 is below 19.5%		AE-823 < 19.5%	
ON when AE-824 is below 19.5%		AE-824 < 19.5%	
Daily Test	EN/DIS		



ODH System Wiring Diagram