New Laser Safety Interlock System Design using a PSSuniversal PLC Device

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Introduction

A laser safety interlock system was required for the new stand-alone Research Complex G43 LIFEtime Lab. It was decided that the existing standard interlock system design should be updated to use a single Pilz safety PLC for safety and standard functions instead of the current Schneider Momentum PLC and Pilz 3047 safety PLC.

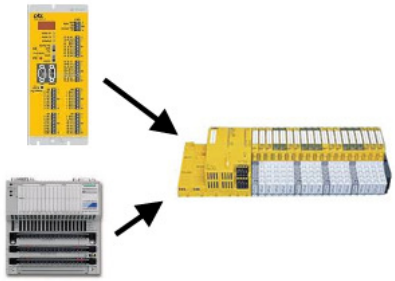

Figure 1 - Pilz PSS4000 Replaces the Pilz 3047 & Schneider Momentum

Reason for redesign

Both, the Schneider Momentum PLC and the Pilz 3047 safety PLC have been replaced by their manufacturers for the M340 and the PSS4000 models respectively. A single PSS4000 safety PLC can perform all of the standard functions of the current Schneider standard PLC and removes the previously problematic Modbus link.

Pilz technology simplifies the process of meeting the Machinery Directive by combining standard and safety control in one plc.

The harmonized standard EN ISO 14119:2013 for interlocking devices associated with guards has been produced and is specific to systems developed by the CLF interlocks department. Having a flexible I/O solution on the Pilz PSS 4000 system makes it easier to comply with the requirements of this new standard.

Pilz PSS4000 PLC Hardware

The PSS4000 PLC allows for decentralization and modularization. Instead of remote junction boxes full of relays, there are remote I/O modules that can be expanded upon as the installation grows in complexity. Safe local networks link the remote hardware and use the SafetyNET p Ethernet-based fieldbus communications protocol in order to safeguard against danger.

Scalability of I/O and the linking of multiple laser areas are now simplified.

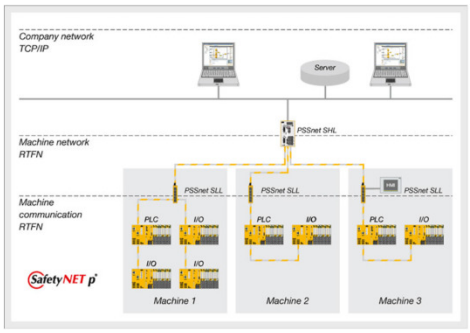

Figure 2 - Laser area/zones are easily connected together

SCADA software will now only need to access one PLC for total system diagnostic information.

PAS4000 Software Platform

The PSS 4000 PLC control systems can be programmed in PAS Multi (block based environment), PAS IL (Instruction List), PAS STL (Structured Text) and PAS LD (Ladder Diagram) in accordance with EN/IEC 61131-3. The graphical interface simplifies development and easily allows reuse of software routines.

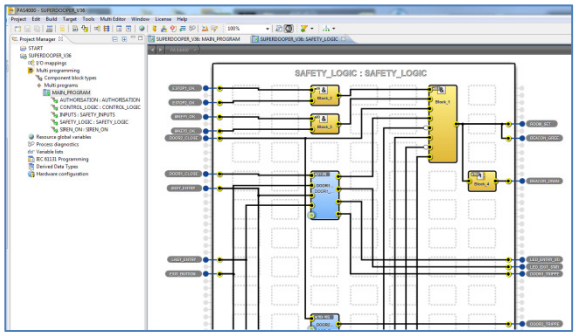

Figure 3 - The Multi editor programming environment is user friendly helping speed up development.

G43 Lab

G43 lab is a stand-alone lab with the potential to integrate into the Ultra labs. There is one entrance and one fire escape door monitored by Pilz PSENmag dual channel magnetic switches.

Figure 4 - HMI Panel for laser control

Figure 5 – Improved and simplified GUI

Four unenclosed lasers and four enclosed lasers are available and controlled from a Schneider HMI panel. Laser access is restricted by the use of Kaba security keys. Two Estops are installed in the lab. Visual warnings consist of Werma stackable beacons, and hazard & information screens located inside and outside of the lab.

Figure 6 – Dual channel PSENmag magnetic switches

Figure 7 – Entrance door override button

The main safety control panel is now simpler with fewer components.

Figure 8 – Panel installation with hazard screens and estop

Figure 9 – Main safety panel containing the new PSS4000

All Cerberus SCADA hardware is now in a single panel. Cerberus is still run on a Windows PC but the dimensions are much more compact.

Figure 10 – Lab entrance hazard/information screens showing no hazards in lab

Figure 11 – Lab entrance hazard/information screens showing single laser hazard present. Door has been overridden to enter lab

Figure 12 – SCADA equipment panel containing PC and VGA distribution units

Figure 13 – PSS4000 Safety PLC

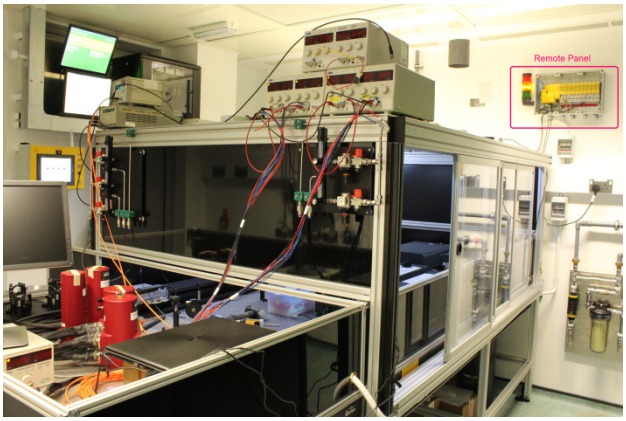

Figure 14 – Modular remote panel enclosure can be expanded to accommodate more laser channels

Proposed Future Developments

Future changes to the standard interlock system include the following:-

- Migrate to Pilz PMI Windows CE panels and use Zenon Operator software
- Move away from the in-house designed Cerberus SCADA and go for Copadata Zenon Supervisor development suite to program a runtime for the Linux platform
- Laser on lamps to change to LED instead of fluorescent lamps and to include monitoring
- Incorporate the Pilz decentralized input module PDP67 to remove the need for switch boxes (SB). This may also mean a change to RFID based switches that can be series connected and still achieve a high performance level.
- Utilize the Pilz PSSnet managed switch and develop a SCADA system to monitor multiple laser areas for diagnostics
- Werma beacons to include monitoring

Conclusions

The transition to a PSS4000 is a success. System drawings are scaled down, maintenance tasks are much simpler. This is an easily expandable system. There is still a need to use the switch boxes containing the PDP20 modules for protection against fault masking.

The CLF developed Cerberus SCADA software has connection issues with the PSS PLC which causes a hazard screen refresh lag of >1s. This is being investigated.

References

1. Pilz Automation Technology, Pilz House, Little Colliers Field, Corby, Northamptonshire, NN18 8TJ