



CONTROL SYSTEMS WITH A DIFFERENCE I



CASE STUDY 2

Modern solution for legacy Human Machine Interface

A challenge in reverse engineering, data traffic analysis, building of specialised hardware and software tools.

Client: ZF Boge in Dingley, Melbourne

Project Title: Human Machine Interface Development

Background information

A manufacturing plant in Melbourne makes rubber components for motor vehicles. Its rubber extrusion machine operates with **Siemens PLC**. It incorporates antiquated HMI and PC. We were asked to create a modernised version of the HMI.

Technical objective

At PBA we can re-create an undocumented existing Human Machine Interface (HMI) system in new technology.

- Currently, extremely antiquated HMI is operating on out of date computer and operating system.
- There was no documentation of requirements or how the system works. However, the client required the operation to be replicated in modern technology whilst interfacing with existing technology (PLC).

“ Our hypothesis is that we can re-create an undocumented existing Human Machine Interface (HMI) system in new technology. ”

- We had to research how to reverse engineer what the machine controls actually perform. This required detailed recording and analysis of the HMI Screens, data traffic and the data protocol.
- We identified that the HMI requirements were not standard and current HMI does not operate in the manner required for the new HMI.
- This meant we had to develop HMI functionality in modern technology that works in the same manner as old technology. This is challenging. It had to invoke triggers to transfer the required messages inside the Program Logic Controllers. Achieving the objectives was further complicated since the data protocols and their application are PLC manufacturer's proprietary knowledge that is not available to parties other than the PLC manufacturer.



New Knowledge

How to make modern HMI operate similar to outdated HMI. This is useful technology as HMI facilities have to often interface with antiquated machinery.

Protocol instruction strings as utilised by the PLC programming tools; this is proprietary information that is not released by the PLC manufacturer. This information is nevertheless required for the analysis of the data traffic between the PLC and existing HMI.

Methods and mainly software tools to analyse data traffic between HMI and PLC.

Investigation of Existing System

Reverse engineering of what the machine controls actually perform. This required working out ways to make detailed analysis of the data traffic so that we could interpret and document how the existing HMI operates.

Design

We purchased a new off the shelf operating panel and designed HMI configuration so that it can replicate the old system. The existing PLC software was reverse engineered and re-configured to provide functions previously performed by the old HMI since these functions cannot be performed by the new HMI. The new HMI combined with the modified PLC functionality operate in the same manner as the outdated technology.



Factory Testing and Modifications

We developed the new technology and tested and modified it in our factory.

Many changes and additions were made to the originally intended design as more detailed information about the workings of the outdated system was uncovered.

The new HMI panel was installed in January 2013 to the complete satisfaction of the client.