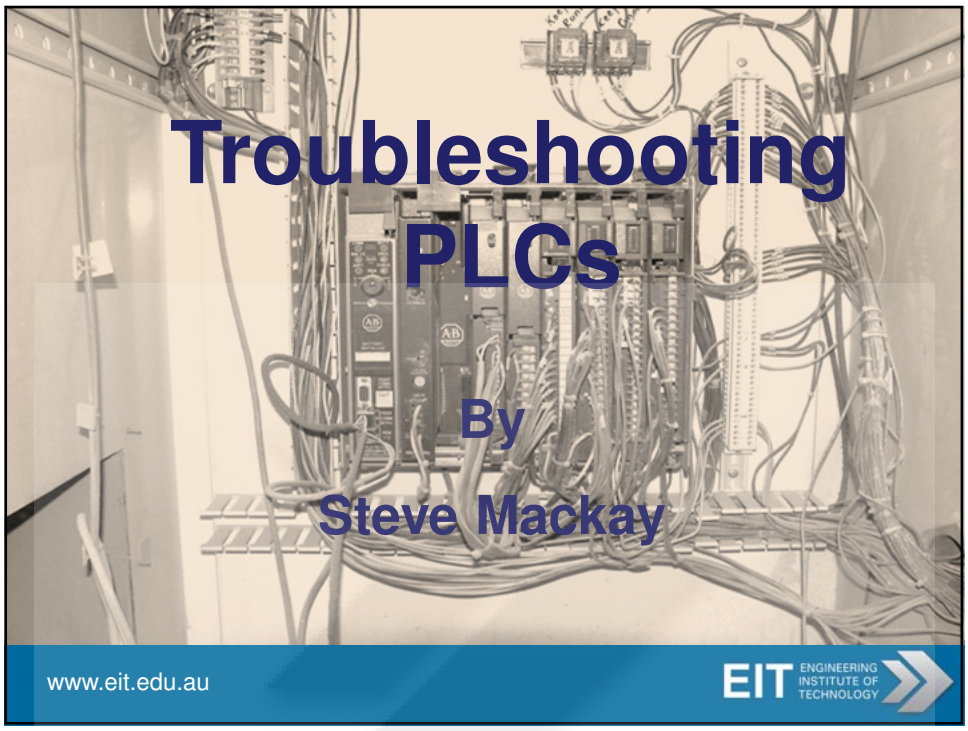
Troubleshooting
PLCs
By
Steve Mackay
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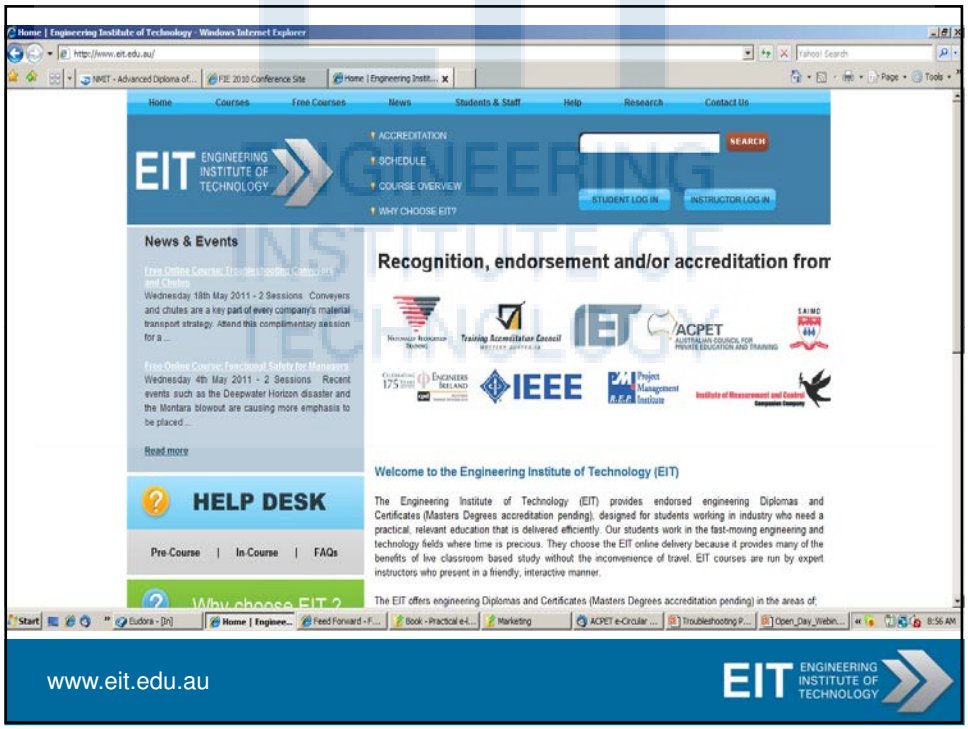
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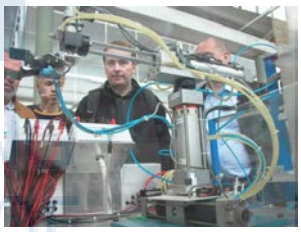
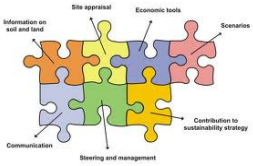
Objectives

- Quickly interpret, isolate and fix common hardware problems related to PLC input/outputs
- Troubleshoot PLC software
- Identify data communications problems

Topics



- Introduction to PLC
- Internal or External Problem
- Internal Problems
- External Problems - I/O and Comms
- Applications
- Conclusion



Industrial Automation Skills

"Today's Industrial Automation engineer and technician should be able to troubleshoot, identify, prevent and fix common PLC and SCADA problems.

If you have worked in industry, you are probably familiar with PLCs and SCADA systems and understand their basic operation.

You want to be able to quickly diagnose problems using your PLC software; know how to connect to the right PLC processor online, make minor changes to get the machine running and have the know-how to test new ideas and hardware components. In addition, you want to be able to do troubleshooting and problem solving of your associated SCADA system".

Introduction to the PLC

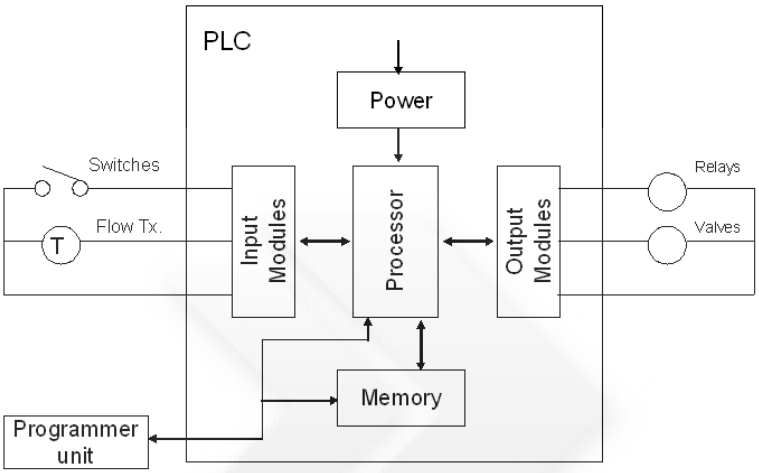
Introduction to the PLC

- "PLC" means "Programmable Logic Controller". The word "Programmable" differentiates it from the conventional hard-wired relay logic
- The PLC as a unit consists of a processor to execute the control action on the field data provided by input and output modules
- In a programming device, the PLC control logic is first developed and then transferred to the PLC
- PAC or Programmable Automation Controller

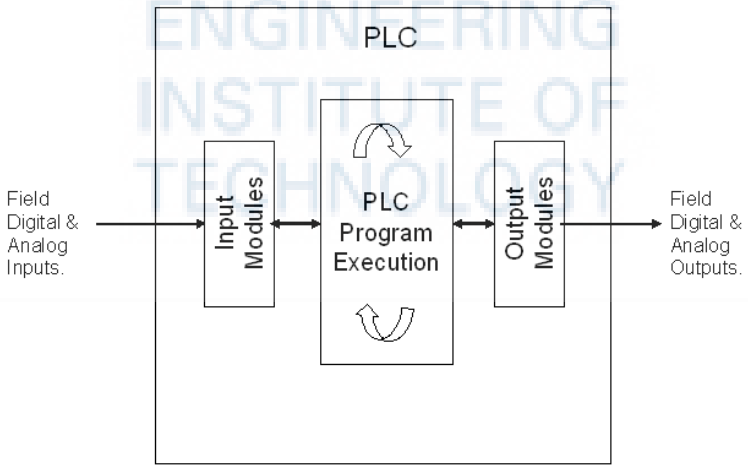
What can a PLC do?

- It can perform relay-switching tasks.
- It can conduct counting, calculation and comparison of analog process values.
- It offers flexibility to modify the control logic, whenever required, in the shortest time.
- It responds to the changes in process parameters within fraction of seconds.
- It improves the overall control system reliability.
- It is cost effective for controlling complex systems.
- Trouble-shooting becomes simpler and faster.
- An operator can easily interact with the process with the help of the HMI (Human-Machine Interface) computer.

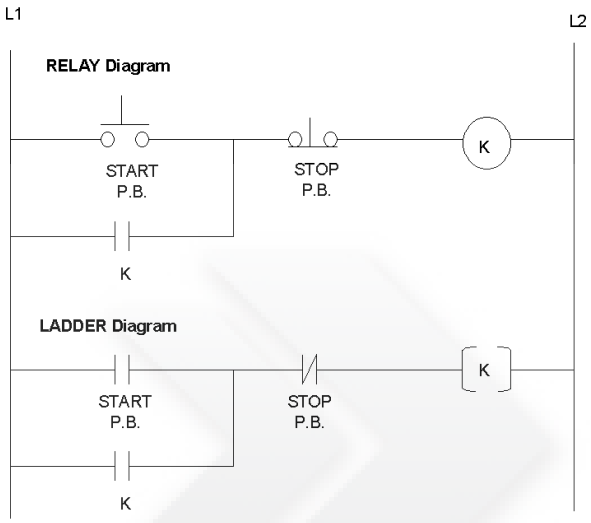
Basic block diagram of the PLC



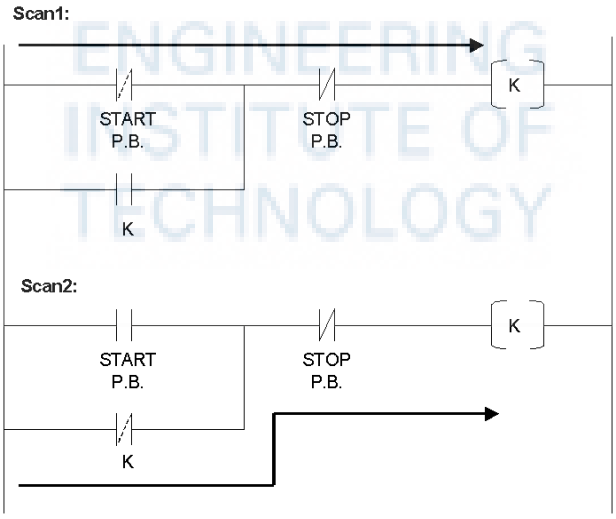
Working of a PLC CPU



Ladder diagram



Ladder program execution



Internal or External Problem?

- Over 80% of malfunctions are with I/O modules and field equipment
- Problems related to specific I/O module or I/O device are external problems
- Large groups of failures – internals of PLC

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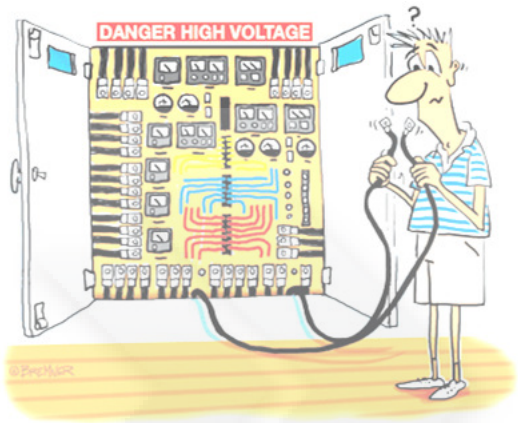
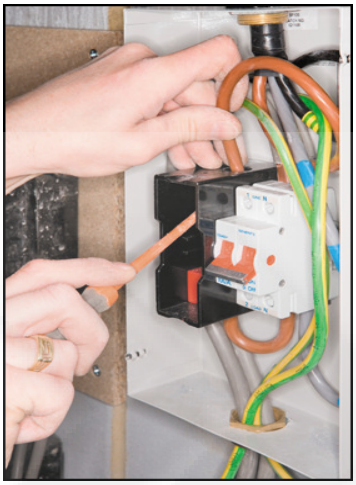
Internal Problems



Internal Problems

- Check earthing/grounding is correct
- Check power supply to PLC is within correct range and ac ripple on dc supplies is not excessive
- Batteries on PLC are OK
- PLC program hasn't been corrupted
- Examine internal diagnostics for a crash of PLC program

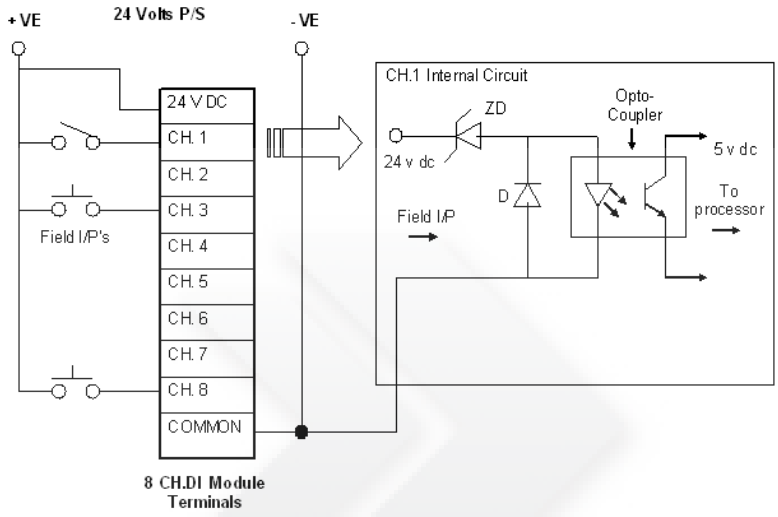
External Problems



External Problems: Digital Inputs

- Check Power supply to module
- Look for where power to digital Input comes from
- Check fuses/breakers
- Adequate changes of voltage to Input
- Digital input fine ===> PLC program problem

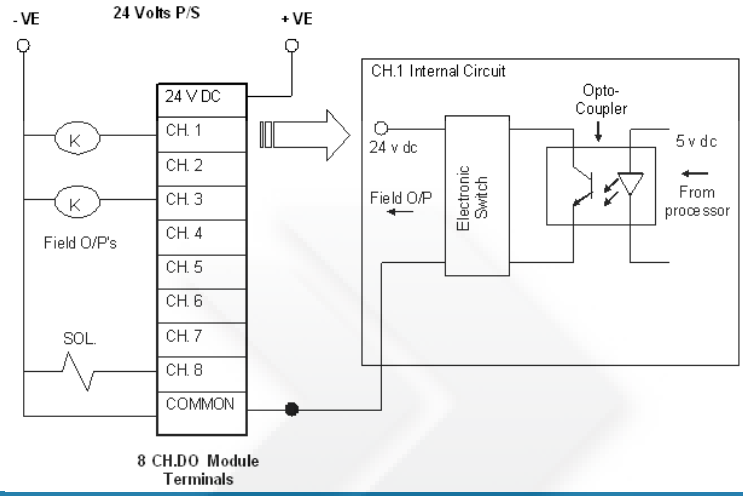
Discrete DC Input Module



External Problems – digital outputs

- Check Power supply to module
- Check power output from PLC
- Check fuses
- Force digital outputs on and off
- Use test load rather than open circuit – why ?

Discrete DC output module

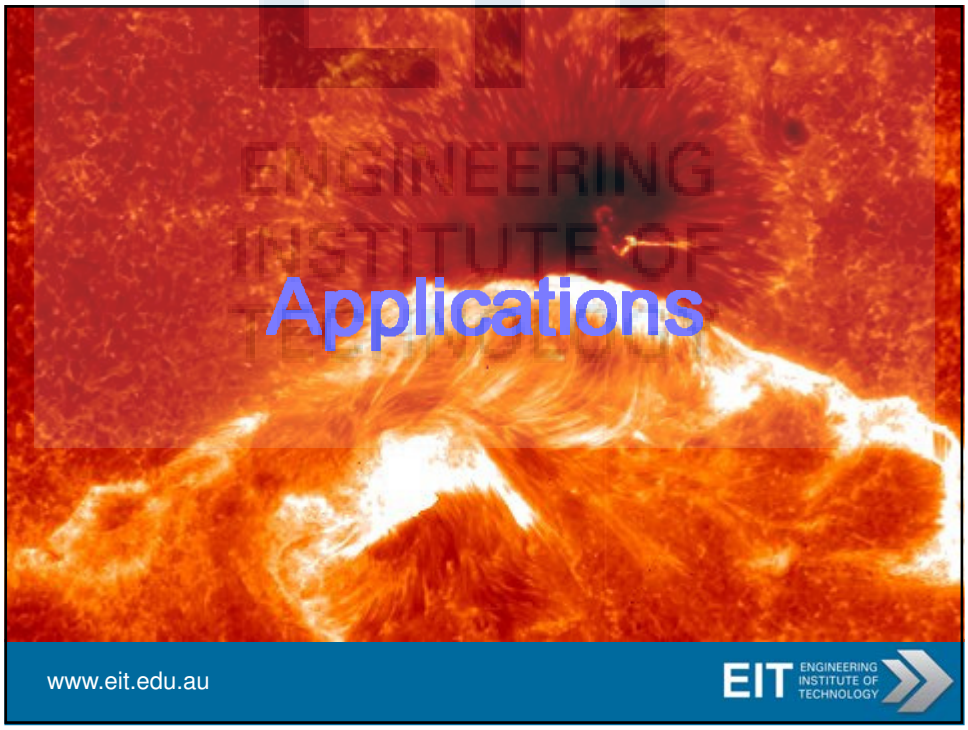


External Problems: Analog Inputs

- Move field device through full range of current – 4-20mA
- Hook up signal transmitter if you need to be absolutely sure.

External Problems: Analog Outputs

- Force output to specific value and observe
- Check external wiring



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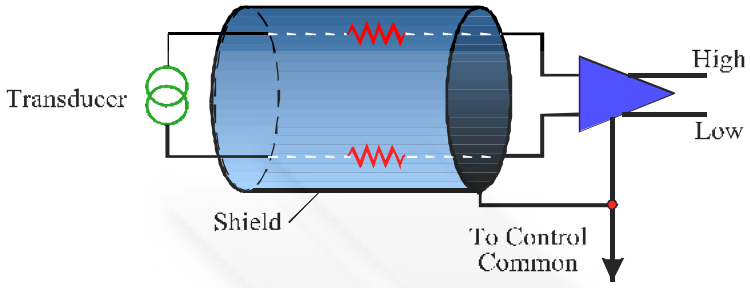
Remote troubleshooting

- Be careful with remote troubleshooting about industrial network security
- Hackers are about 24x7

Thorny transients

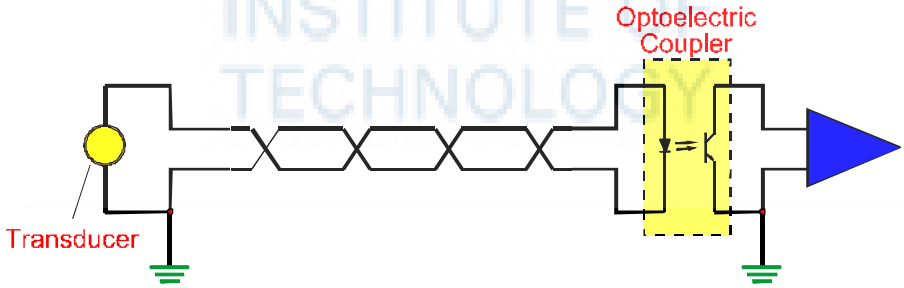
- Fiber Optics where possible
- Good earthing/grounding for data comms

A typical shield



The purpose of the shield is to reduce the magnitude of the noise coupled into the low-level signal circuits by electrostatic or magnetic coupling. This has brushed up the above-mentioned concepts up to some extent

Opto-electric coupler circuit



When in doubt -disconnect

- Test with dummy equipment not 1MW ball mills

Conclusion

Thank You For Your Interest

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