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## **FOUNDATION™ Fieldbus Competency** **Project Training Recommendations**

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### **Introduction**

The purpose of this paper is to outline a suggested approach for staff training in any new FOUNDATION™ Fieldbus (FF) project – this includes both greenfield and brownfield sites. This recommendation will address both aspects separately.

The expectation at the project start is that most current staff will have little or no familiarity with any type of fieldbus system.

If some staff involved in the project have no understanding of networking (fieldbus) concepts, then this will impose another layer of competency training i.e. basic digital communications. There are many good third party courses available and any personnel rising through the ranks from electrical to instrumentation and now fieldbus should have some exposure to training at this level. See the appendix for more details.

### **1.0 Greenfield Projects**

As a prerequisite to the any of the parties involved in a FF project, some basic knowledge or previous experience should be offered. There are many basic FF training courses available and anyone who has a technical involvement with the job should complete one of these before starting on the project.

It has been reported time and time again that the best lesson learned from the first FF project was to train technical staff at the *earliest* possible stage of the exercise. This early training was also found to be crucial to staff acceptance of the new FF technology.

For the end user client it may also be appropriate to ask for any out-sourced contractors involved in the project to demonstrate some level of basic FF knowledge.

## **2.0 Basic Theory Course**

Any *basic* FF course (7-8 hours) should contain sections on the following :-

- 2.1 History & Background to the FF Technology -  
Although not technical in nature, it helps the user understand the driving force behind the changes that are motivating improvements in the protocol.
- 2.2 Overview of the Technology and basic Networking -  
For those without any background in data communications or networking this is a very important base for further OSI model discussions.
- 2.3 Physical layer Design and Specifications -  
Explanation of the various wiring options (including IS) at the H1 network level complete with details of the segment loading limitations.
- 2.4 Node Addressing and ID Methodology -  
Segment addressing and the manufacturer, model, revision numbering system should be fully covered and understood.
- 2.5 Device Description files (and EDDL) -  
As an extension of item 2.4 above, the importance of the correct DD file to FF unit association needs to be fully explained. Some details of the CFF file requirements and use should be covered.
- 2.6 Foundation Function Blocks -  
Extensive coverage in the use of function blocks (standard and enhanced) and their interoperability fit in the FF control environment is needed.
- 2.7 Practical Demonstration -  
Some sort of display of a working FF segment during the training is also highly desirable to instil confidence in the technology and show a typical topology. This should include a working FF PID loop.

As a further step towards staff upgrading, some form of hands-on FF training should be undertaken. This is best done with a couple of the final host vendors workstations and a trainer from that supplier. Because of timing and delivery issues, in many projects this is not available. The next best solution is a generic workstation training course from one of the third party suppliers as outlined below.

## **3.0 Practical Training**

Any *hands-on* FF course (7-8 hours) should contain sections on the following :-

- 3.1 Segment Wiring -  
This should include users wiring a typical H1 segment along with physical layer condition recording as per the AG-181 commissioning sheet with some possible problem troubleshooting shooting.
- 3.2 Host System setup -  
Familiarity with the setup of both the host hardware package and any ethernet configuration for the student / operator workstation or HSE network component should be addressed. If the staff have no previous experience with 100baseTX setup, then a simple network configuration should also be covered.
- 3.3 Control Strategy Configuration -  
Function block (FB) linking and scheduling should now be done using a basic PID loop as an example. Schedule downloading and FB mode handling needs to be done manually to fully understand the FB concepts.

### 3.4 Segment Analysis / Configuration changes -

If the host software configuration package allows, some analysis of the H1 packets may be done. Changes to a capable field instrument to allow a backup LAS in the field will also enhance the learning.

## **4.0 Brownfield Projects**

With brownfield projects the expectation is that some staff may have had some small exposure to FF as a precursor to the decision to go the fieldbus route. In any event it is important that all staff with any further involvement in the upcoming project have *basic* FF training.

Those with any hands-on responsibility for the project should also take the next level of FF training as well. This should include all design and maintenance staff – both the control system and instrumentation personnel, together with the IT staff if they are actively involved with any HSE component. A brief summary of a practical training course is outlined in the previous section of this document. This hands-on (practical) training is also critical to staff gaining confidence in dealing with fieldbus technology.

As a valuable extension to the hands-on training, some sort of in-house fieldbus laboratory / workstation should be setup to give staff further experience. Many new FF installations have now realised how important this is only after struggling to learn the vendor's software with a live Process Control (PC) system. Experimenting and testing with an offline system host allows staff a much steeper learning curve. These main system isolated “maintenance / development / testing workstations” should be an important part of all new technology installations.

If at the point of purchasing this training / testing system the main PC vendor has not been decided, then a vendor neutral package such the National Instruments (NI) host could be used. The PCMCIA version of this package also has some other beneficial troubleshooting options with its portable “packet monitor” mode. This package can be used as an in-depth maintenance tool during the operational phase of the installation as well.

## **5.0 Conclusion**

The most common reflection from those who have done their first FF project is to train staff thoroughly and train early. “Over training” even considering the extra cost is far more productive for the project as a whole than to “under train” and have to live with the cost and time overruns later.

Some projects have even gone to the extent of cross-training the Information Technology and Control / Instrumentation staff. Managers all confirm that they have not regretted it. Another benefit found here is that either group can be used for an after hours system call-out.

***Fieldbus is not difficult – it's just different.***

## **6.0 References**

AG-181 FF Engineering Guidelines  
FF End User Advisory Council

FF End User Council Australia Inc website :-  
<http://www.fieldbus.org.au/training/EUCtrain.htm>

Fieldbus FOUNDATION website :-  
<http://www.fieldbus.org/ProductsandServices/Training/>

Southern Alberta Institute of Technology website :-  
<http://www.sait.ab.ca>

Tri-State University Technology Center :-  
<http://www.tsutechcenter.org>

Lee College Texas website :-  
<http://www.knowthebus.org>

## **7.0 Appendix - A**

### **Digital Communications**

Depending on the current skill level of the staff involved, some or all of the following subjects may also need to be covered in any preliminary training.

7.1 Digital Concepts & Introduction -

7.2 Binary / Hex numbering systems -

7.3 Analog to Digital conversion -

7.4 Data Serialisation Concepts & Formats -

7.5 Physical Layer types & the OSI Model -

7.6 Details of some Fieldbus forms -

The depth of coverage here will determine if the above training runs one or two days. If practical sessions are included then two days could be the expectation. Should the course focus be constrained to FF requirements then a one day training course should be sufficient.

