



Te Rapa Wholemilk Drier 5

DeviceNet Installation

An Anchor Products - ODVA Presentation



Anchor Products Corporate Overview

Anchor Products is the manufacturing division of New Zealand's largest dairy manufacturer, the New Zealand Dairy Group.

The Anchor Te Rapa site is one of 10 Anchor Products manufacturing sites producing export dairy products, making a major contribution to the New Zealand economy. The Te Rapa site now processes 8 million litres of milk a day into milk powder through its driers.

Anchor Products Automation philosophy is based on the use of real-time production data to optimise plant performance and profitability. DeviceNet is the most suitable technology for achieving this.



ODVA User Group

The ODVA user group in New Zealand was formed in 1997 when users and developers of DeviceNet technology saw the need for a common organisation to ensure full benefits were gained in New Zealand.

The ODVA New Zealand Australia User Group was incorporated as a non profit organisation. A neutral facilitator was appointed to maximise the benefits for companies with a common interest in the "Open" technology and automation research in the region.

The ODVA has become active in the development of DeviceNet and ControlNet technology, and the standardisation process to ensure that New Zealand benefits from the efforts of companies manufacturing and using DeviceNet technology.

Anchor Products is a Founding member of the ODVA New Zealand Australia User Group Inc.

Project Overview

Anchor Te Rapa Wholemilk Powder Drier 5

The recent US\$85 million expansion project at the Te Rapa site included the construction of the world's largest whole milk powder plant with a capacity of 5 million litres a day at an output rate of 23 tonnes per hour of milk powder.



The 55 metre tall glass clad building houses the drier structure and some of the processing equipment. A large portion of the storage and wet processing equipment is external to the building. All processes are connected to the automation architecture with DeviceNet.

The plant was commissioned in August 1999 after a 15 month construction period, and many new and innovative technology features were included in the project.

Several of these features were in the Automation Specification chosen by Anchor as part of their ongoing automation philosophy.



Wholemilk Powder Drier



The wet process includes the tanker unloading, milk storage, separation, standardisation and evaporation.

All of these process areas utilise hygienic process valves and pumps in a fully automated process and cleaned in place with no manual intervention from operators.

All process valves and Motor drives are connected using DeviceNet. The ability to change process selections and clean the plant without stopping milk flow is critical to feed a drier of this size.



The ability to service process valves, interrogate statistical information, and reconfigure equipment without shutting down networks is an important reason why DeviceNet was chosen for this project.



The drier is so large that it has several tonnes of powder in the air at any time, and so the consistency of feed to the drier and its ability to handle the dried product is critical.

The drier fluid beds and dust handling systems are a critical design consideration on a plant this size where it is not possible to stop and start the process without enduring a long period of down time and cleaning.

The giant Stork Drier includes 3 x 600 kW variable speed MVR fans controlled and monitored using DeviceNet.



Powder Handling

The ability to convey the whole milk powder to the packaging lines on a 24 hour basis is a technology that is as important as the drying process itself.

This area utilises many pneumatic valves and solenoids all controlled using DeviceNet with all of the motor starters connected to individual DeviceNet interfaces.



Refrigeration

Refrigeration of product while it is waiting to be processed is necessary to ensure that only the highest quality whole milk powder is produced.

The motors and controls in this area are critical plant items and are monitored using DeviceNet.

Water Treatment

Most valves in the water treatment system are similar to the types used in the wet process area and are all connected via DeviceNet

Wastewater

The control of the motors in the water treatment system has been included on DeviceNet to allow for optimisation of the plant and provide more information on the status of the process.

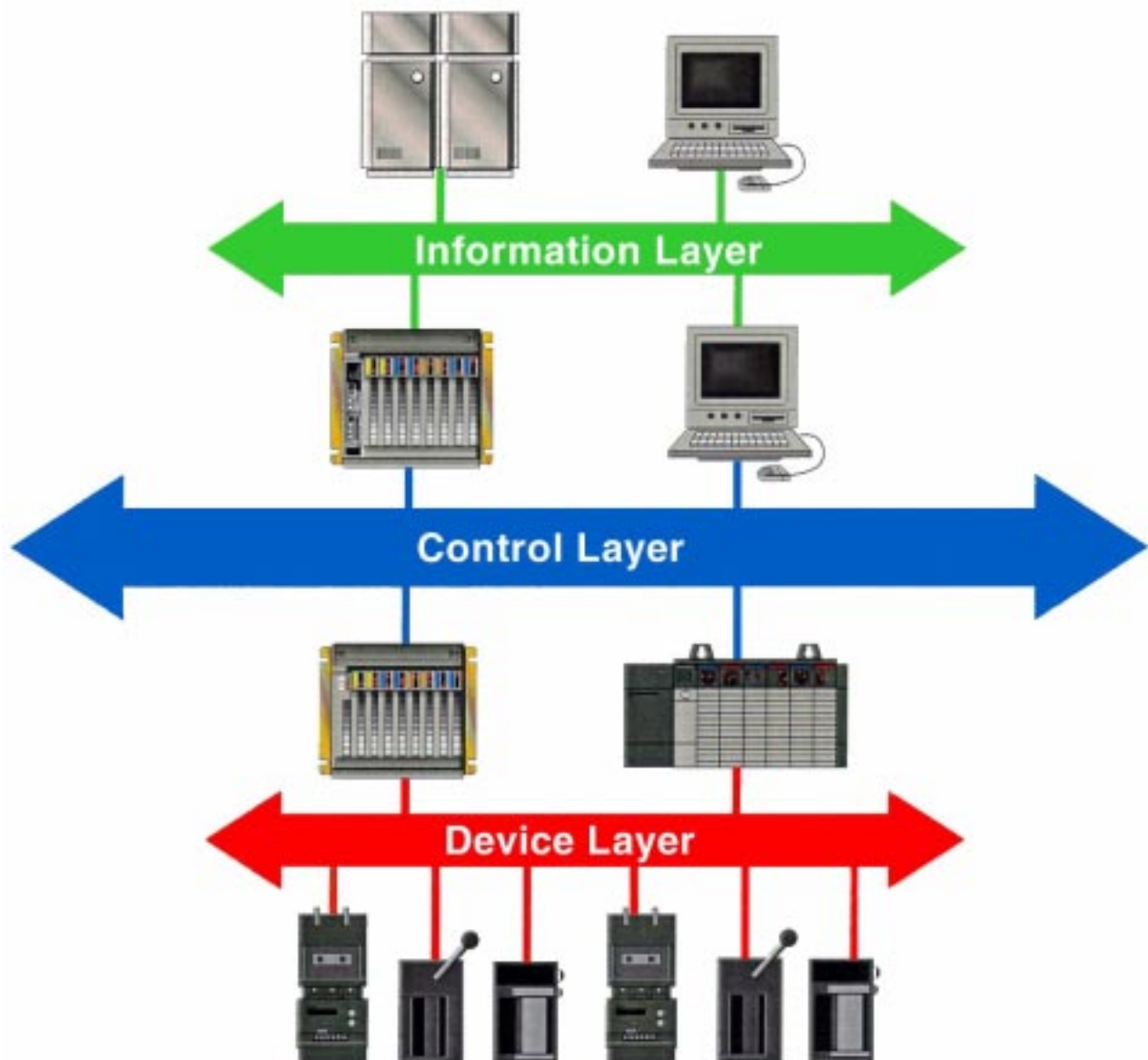


Automation Philosophy

“Access to real-time production data is an essential element in achieving optimal plant performance and profitability. A rich data base of historical plant data provides the basis for predictive neural-based control models.

The use of a widely distributed control system using the Ethernet ControlNet DeviceNet data communications topology is an ideal fit with this neural model for its processes and this is applied across the complete installation.”

(Ian Steele - Anchor Products, Engineering Services Manager.)



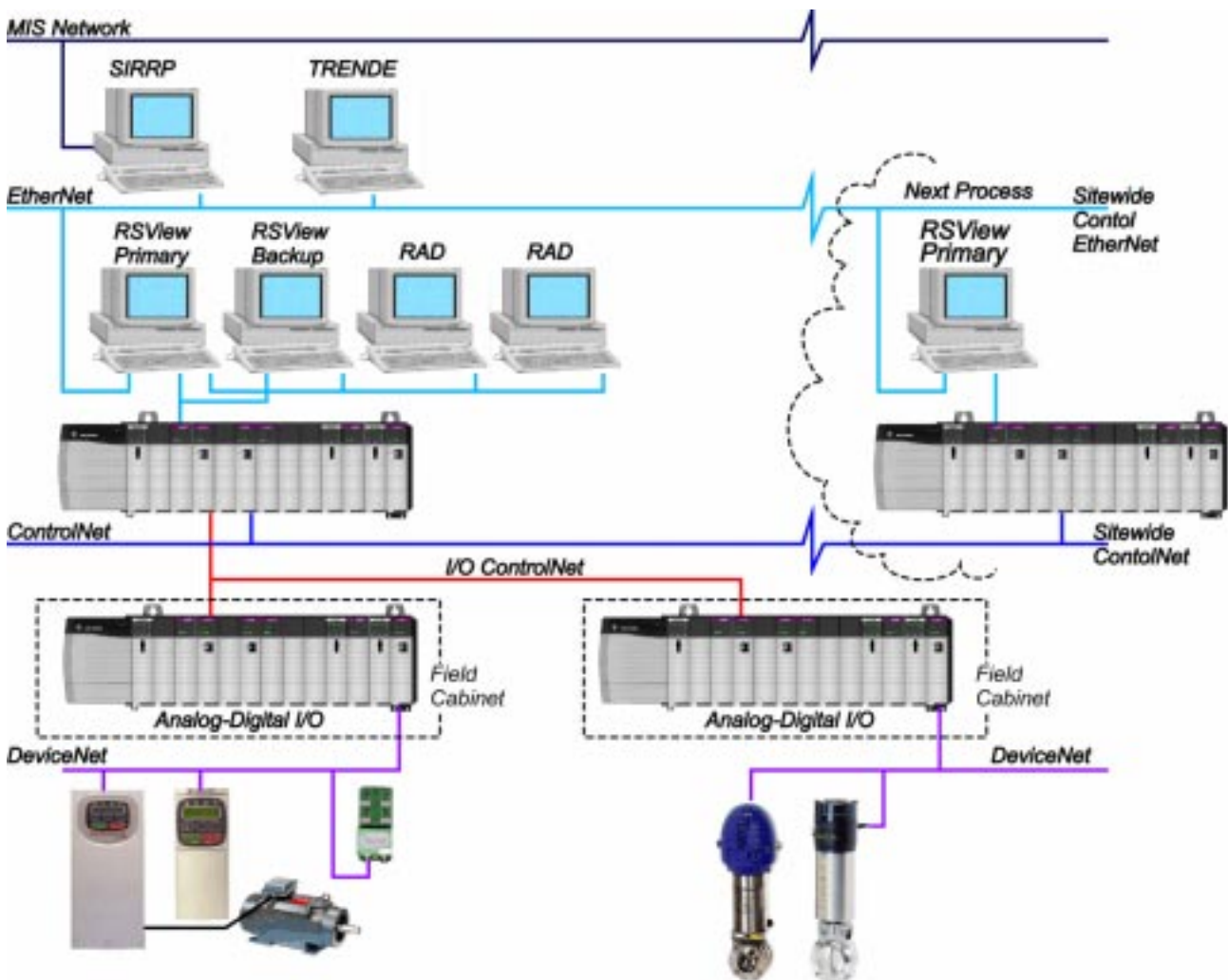
Automation Architecture

“The use of “Open” systems is a key part of Anchor’s automation philosophy as this ensures availability of equipment from multiple vendors and technology that is being advanced by the world’s leading automation providers”.

“The "Open" technologies of DeviceNet and ControlNet are a key factor to the success of this project and we are encouraging all of our technology equipment providers to develop interfaces to these technologies, as it gives both parties the security of compliance to a common open specification”.

“The use of technology that specifies standards for both the protocol and the physical media makes it easier for all to apply new technology”.

(Ian Steele-Anchor Products.)



PLC's

Supplier : Rockwell Automation



“This installation of 12 Allen Bradley ControlLogix controllers is one of the largest in the Southern Hemisphere, and their advanced features have provided some concepts not possible with legacy PLC platforms.

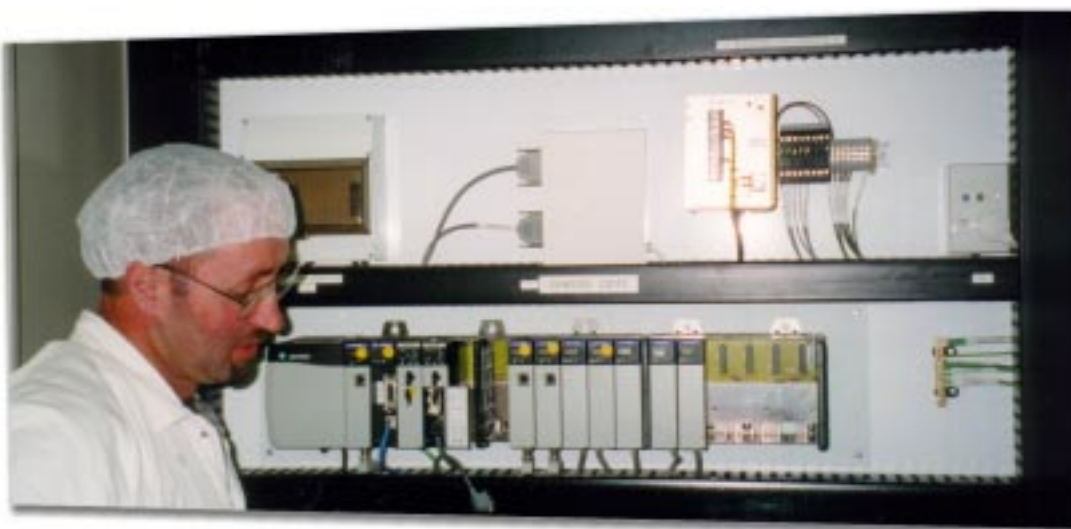
The ability to have user-defined data types, tag-based addressing and dynamic memory allocation have been major leaps forward in controller technology, which have assisted in making this such a successful project.

The flexible nature of the ControlLogix architecture is a benefit that has allowed process improvements to be handled easily by engineers at the request of production management.

Several of the processes are now configured differently from that originally designed and much of this is achieved by the ability to share I/O and databases across different controllers located in different chassis. The use of multiple controllers sited in a single chassis also has benefits in configuring the hardware layout.

The ability to position DeviceNet scanners in the field gave the opportunity for the contractors to reduce the number of power supplies and have more flexibility in their design”.

(Steve Hayward- Anchor Products.)



Software

Supplier : CSE NZ Ltd

The selection of RSNetWorx for DeviceNet and ControlNet networks offered a lot of flexibility not previously possible.

The ability to configure, diagnose and display any network with products from multiple vendors saves time at commissioning as well as during operation.

The use of Electronic Data Sheets simplifies the configuration process for some of the more complex products.

Being able to store node configuration data in a central location and download it when changing or installing new equipment saves a lot of time.



In the future, the use of some of the software intelligence in the valves to replace the software in the PLC's for alarm and indications will give more benefits of distributed control and further cost savings.



Storage of written records of software systems and connection information are now almost obsolete with the new software tools.

DeviceNet Cable System

Suppliers : Connector Systems, Rockwell Automation, Electrical Importing Company



With 60 networks the design of the DeviceNet cabling system was one of the critical components of the project as over half of the nodes are external to the building. This has called for the need to consider UV resistance and IP ratings carefully.

Many of the internal networks are exposed to corrosive chemicals and water so this also required special attention.

The site wide adoption of the use of micro style connections was chosen to ensure the compatibility of node connections.

The selection of specialist corrosion and water-resistant equipment and design of the installation cabling systems is one of the new skills required to be learned by this industry.



The enclosureless concept has been designed in such a manner that the networks are protected in wet process environments by mounting equipment at a safe height and using suitable IP rated equipment for the environment.

The saving in installation time and enclosures was one of the main considerations in using DeviceNet.

Motor Control Centres

The diagnostic information available via DeviceNet from motor starters connected to DeviceNet is a key benefit.

To be able to monitor the motors thermal model and current gives a better picture of what is happening in the process.

Where remote reset or other information is required this is a simple software configuration with no additional hardware required when using intelligent overloads.



The flexibility of using a network to connect to MCC's also reduces the amount of control wiring and on site connections required.

The Motor Control Centres were configured to provide a separate node for each drive so we can use intelligent overloads wherever more information is required in the future.

Variable Frequency Drives

Suppliers : PDL Electronics

“The wealth of diagnostic information available from the variable speed drives with DeviceNet interfaces is absolutely brilliant”.

“It is possible to obtain the thermal model of the drive, frequency, current, acceleration rates..... anything you want to know about the drive.

All of the Variable Frequency Drives, including the 3 x 600 kW MVR fans, are controlled and monitored with DeviceNet”.



“The imbedded DeviceNet technology in the drive gives up to 62 parameters for control or diagnosis, which is critical information in a process like this”.

“The ability to store drive configuration information in a central location and download it when installing a new drive is a very useful feature”.

(Steve Hayward Anchor Products).



Softstarters

The use of DeviceNet interfaces to soft starters ensures that all control functions are carried out on the DeviceNet networks for motor control making the most of installation flexibility and available information.

Process Valves

Suppliers : Keystone Tyco

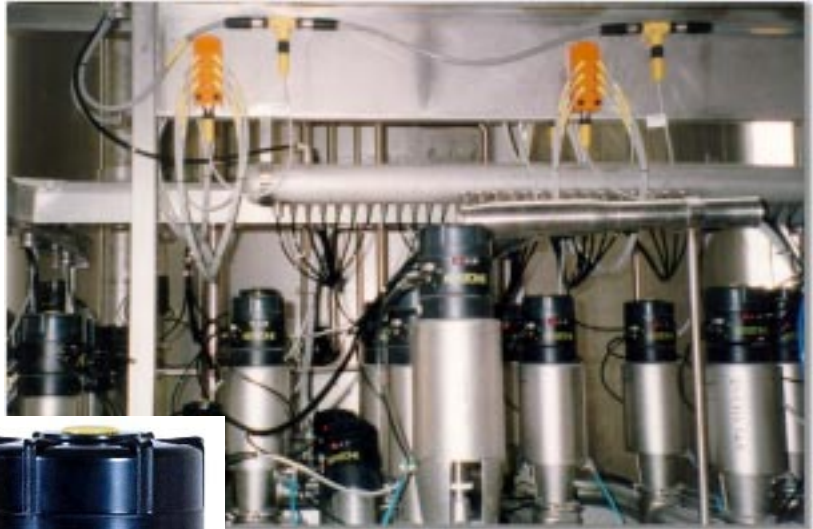
The selection of DeviceNet interfaces for process valves allows the many features developed into the control head of the valves to be used for process control or maintenance purposes in the dairy manufacturing environment.

Features such as “last time to open” and “last time to close”, when monitored over a dairy season can pre-warn of valve failures or obstructions.

The inclusion of operations counters in the valve head itself ensures that valuable information is not lost during software changes or backup procedures.

The design of the valves has been carried out to assist the operators of the plant for the life of the valve and the ability to store parts lists on board and display fault finding information are all part of the philosophy of increasing plant availability.

Several of these features will be used on future projects to reduce software costs and reduce unnecessary maintenance.

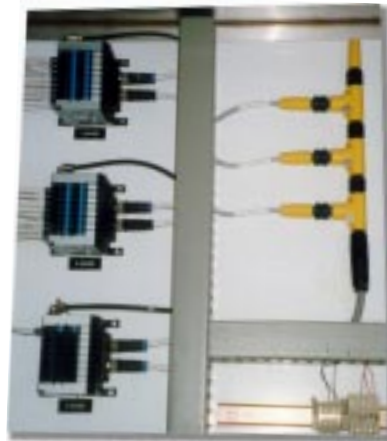


Pneumatics

The change to DeviceNet technology has had a dramatic effect on the layout and concepts for pneumatics in the processing environment.

The reduced space requirements and the elimination of marshalling terminals has simplified the installation of pneumatics in the processing areas.

The layout of pneumatics equipment for this project ensures that solenoid valves can be located close to the application and the reduced documentation requirements simplify the job for installer and service staff alike.



The advanced diagnostics features of pneumatic equipment to monitor voltage and air pressure will assist in reducing processing downtime and also assist with fault finding.



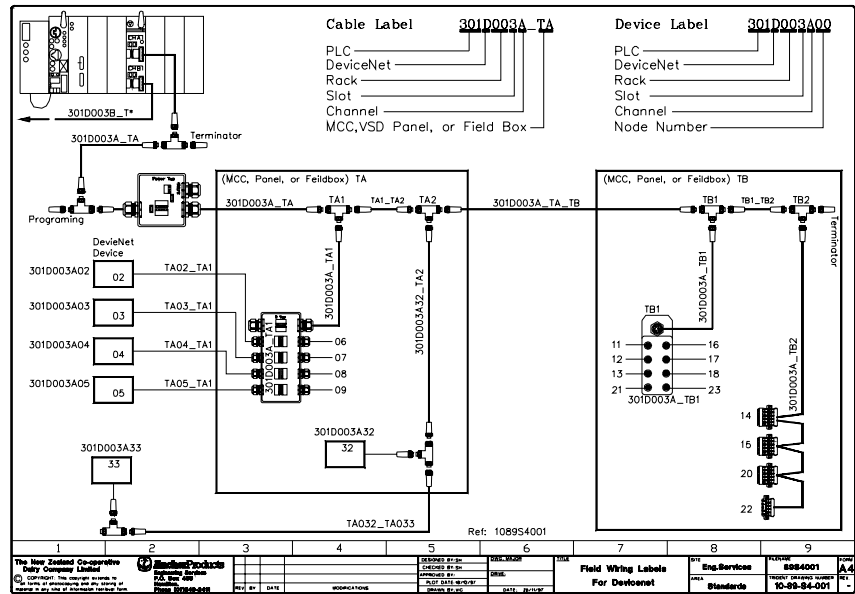
Documentation

The reduction in documentation requirements is a key benefit of DeviceNet technology.

The traditional requirement for wiring schedules and wiring diagrams is reduced to the need for one layout diagram for each network.

If this diagram is prepared correctly it can display all of the necessary information for both network designers and service personnel.

The ability of the DeviceNet software system to store Electronic Data Sheet information for each device as well as the set-up and configuration data for the device to operate on the network gives increased flexibility.



In many cases there is only one wiring label required on a node replacing up to 10 labels on each individual conductor of a field device as each input used to be wired from PLC I/O, marshalling terminals and junction boxes. These nodes often have what would have been several I/O in one node and so this can equate to a 10 to 100 fold reduction in conductor labelling requirements, along with hardware savings.

In the past several colour-coded conductors were required along with specialist equipment for labelling individual cores.

Specialist Interfaces

Suppliers : Tait Control Systems

The ability to configure DeviceNet to interface to specialist field devices is an important reason why DeviceNet was chosen for this industry.

The dairy industry has several proprietary items of equipment, which can be fitted with interfaces for DeviceNet and accessed on a DeviceNet network along with other standard devices.

This reduces the need for specialist PLC I/O and cabling systems as well as the requirement for specialist skills.

The interfaces can be as simple as a 2 input device or, as on this project, a proprietary in-line milk analyser. This unit has 18 individual real time analogue signals, representing the milk's percentage of fat, protein, lactose and other parameters.

DeviceNet was also used to allow the unit to be automated to have functions for line purge and analyser mode change.



In several cases the need to interface equipment to traditional protocols like RS232 and RS422 can easily be done using local companies and readily available hardware.



Training

Suppliers : Waikato Polytechnic

The commitment to the requirement for all contractors to have attended an ODVA approved training courses was seen as essential to ensure a successful project.

The training courses ensured that the technology of DeviceNet was well understood as well as a good working knowledge of equipment available to maximise the use of the technology.

Training was provided on equipment from several vendors and delivered by the local polytechnic, ensuring that the cost was reasonable.

Each course attendee was required to sit an examination and was presented with a certificate.

Two training courses were offered.

1 day DeviceNet cabling installation course that was a minimum requirement.

2 day DeviceNet software configuration course.

The training has proven a major success for the project and, in the few situations, where non-trained staff were used on parts of the project their lack of training was very noticeable.

