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United States Government **Department of Energy**

memorandum

Office of River Protection

DATE: AUG 27 2007

REPLY TO ATTN OF: WTP:MLR 07-WTP-212

SUBJECT: DESIGN OVERSIGHT REPORT: D-07-DESIGN-043, REVIEW BECHTEL NATIONAL, INC. FIELD CONTROL AND COMMUNICATION EQUIPMENT

TO: FILE

During February 2007 the Waste Treatment and Immobilization Plant (WTP) Engineering Division looked at the field-level control and communication equipment that comprises much of the hardware design for the WTP Integrated Control Network (ICN). As expressed below, this oversight activity was not intended to be a formal assessment, even though after the activity had begun, a mistake in the formal assessment schedule indicated the activity as a scheduled assessment, which would ordinarily require formality consistent with assessment procedures. However, since the Contractor was never informed on the oversight activity nor was there any Findings or Issues identified, the report was not formally transmitted to the Contractor. This memorandum to file is intended to stand as record that a limited design review was performed for information gathering purposes and that a report was written, but that a formal assessment was not executed.

The following disclaimer was added to the cover sheet of the report: Design Oversight Reports typically follow the procedure outlined in ORP DI 220.1, *Conduct of Design Oversight* which outlines the formality required for an oversight assessment. However, the assessment described in this oversight report was neither intended nor originally scheduled to be a formal assessment. Consequently those activities such as assessment planning, contractor notification, document requests, lines of inquiry, entrance and exit meetings, etc. as required by DI 220.1 were not performed. Instead, this review was conducted mainly to obtain a better understanding of the ICN field control and communication equipment in order to extend the general knowledge of the WTP design for personnel within the Office of River Protection, especially in preparation for future assessment activity. Thus, compliance to DI 220.1 in this report is limited only to report format.

Questions regarding this memorandum or the referenced report may be directed to the author of the report, Mark L. Ramsay (509) 376-7924.

Robert W. Griffith, Acting Director
WTP Engineering Division

Attachment

U.S. Department of Energy, Office of River Protection

REVIEW
BECHTEL NATIONAL, INC.
FIELD CONTROL AND COMMUNICATION EQUIPMENT

March 2007

DESIGN OVERSIGHT: D-07-DESIGN-043

Reviewer:

Mark L. Ramsay, SSO Engineer
Waste Treatment and Immobilization Plant Project
Engineering Division

Note: Design Oversight Reports typically follow the procedure outlined in Office of River Protection (ORP) DI 220.1, *Conduct of Design Oversight*, which outlines the formality required for an oversight assessment. However, the assessment described in this oversight report was neither intended nor originally scheduled to be a formal assessment. Consequently, those activities such as assessment planning, contractor notification, document requests, lines of inquiry, entrance and exit meetings, etc. as required by ORP DI 220.1 were not performed. Instead, this review was conducted mainly to obtain a better understanding of the Integrated Control Network (ICN) field control and communication equipment in order to extend the general knowledge of the WTP design for personnel within the ORP, especially in preparation for future assessment activity. Thus, compliance to ORP DI 220.1 in this report is limited only to report format.

Furthermore, figure and appendix callouts in the text are provided in one attachment to this report, and not inserted within the text.

EXECUTIVE SUMMARY

This design oversight activity looked at the field-level control and communication equipment that comprises much of the Waste Treatment and Immobilization Plant (WTP) Integrated Control Network (ICN). The equipment is assembled in dedicated industrial enclosures and includes power supplies, process controllers, and communications devices necessary for controlling plant process systems and equipment. This review was conducted mainly to obtain a better understanding of the ICN field control and communication equipment in order to extend the general knowledge of the WTP design for personnel within the U.S. Department of Energy, Office of River Protection (ORP). Consequently, most of this report is a description of ICN communication equipment components. The knowledge obtained in this review will be useful in a formal assessment to be conducted in the future when more of the plant systems have been designed, and ICN control and communication equipment have been allocated for the main processing facilities. A planned future assessment will be placed in the ORP Consolidated Action Reporting System (CARS) as an Assessment Follow-up Item (AFI), **D-07-DESIGN-043-A01**, "ICN Field Control and Communication Assessment."

Based on evaluation of design documentation and observation of installed equipment, this design review resulted in the following conclusions:

- The design and assembly of the ICN field-level control and communication equipment appears to follow a general pattern of uniformity and consistency in the selection of equipment components and installation.
- The enclosures and contained equipment in the BOF buildings are in various stages of completion mainly with respect to field wiring. In some cases, equipment such as fiber optic patch panels is not yet installed. These conditions are expected because construction remains ongoing.
- The installed equipment, which represents a very small volume compared to the overall plant, provides a reasonable expectation for installations to be accomplished in the large processing facilities sometime in the future.
- Equipment, devices, and wire terminations appear to be compliant with specifications.
- The Contractor employs a standardized datasheet, submitted material listings, and drawings from facility design/construction subcontractors to ensure equipment consistency. However, in the cases observed, the datasheets were not entirely consistent with material listings on drawings or with the installed equipment. This raises questions about the adequacy of the Contractor's as-build configuration process. As-built configuration will be evaluated further in the planned future assessment D-07-DESIGN-043-A01.
- Based on specification requirements and datasheets, a test bed system has been utilized to test field control and communication equipment functionality and to standardize connectivity methods. However, the degree to which test bed system components were checked out and tested was not evaluated in this review. Testing of the control and communication equipment will be assessed in the planned future assessment D-07-DESIGN-043-A01.

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LIST OF TERMS

AFI	Assessment Follow-up Item
BNI	Bechtel National, Inc.
BOF	Balance of Facilities
CARS	Consolidated Action Reporting System
CCH	closet connector housings
CP	connector panel
CPU	central processing units
DCS	distributed control system
DP	Decentralized Periphery
DPM1	DP Master Class 1
DPM2	Master Class 2
FCCE	field control and communication equipment
FF	FOUNDATION Fieldbus
FNI	Facility Network Infrastructure
HMI	human-machine interface
HSE	High Speed Ethernet
I/O	Input/Output
ICN	Integrated Control Network
ITS	important-to-safety
MICE	Modular Industrial Communication Equipment
OPC	Object Linking and Embedding (OLE) for Process Control
PA	Process Automation
PC	personnel computer
PLC	programmable logic controller
PROM	programmable read-only memory
RAM	random access memory
RS	recommended standards
WIC	wall-mountable interconnect center
WTP	Waste Treatment and Immobilization Plant Project

1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

The plant-wide control system for the Waste Treatment and Immobilization Plant (WTP) Project is composed of programmable electronic systems, human-machine interfaces (HMI), and system servers. This equipment functions to assist plant operations personnel in the safe startup, monitoring, control, and planned shutdown of the plant. The equipment is connected and integrated together on a common network referred to as the Integrated Control Network (ICN). The ICN at the field level includes equipment comprised of process controllers, industrial local area network (fieldbus) interface equipment, remote input/output (I/O) equipment, and devices to accommodate electronic and optical communication signals. This equipment provides for the interface between the field process equipment (instruments, motors, valves, etc.) and WTP Control Room equipment (HMIs, servers, etc.) via high-speed (100 Mbit/sec) Ethernet fiber-optic media. The ICN field control and communication equipment (FCCE) is critical to WTP control and operability.

1.2 Background

FCCE is currently being installed in the WTP Balance of Facilities (BOF). Descriptions of this equipment are not readily available within the document database provided to ORP by the Contractor, and therefore it is not clear what the functions are for many of the control and communication devices installed in the BOF enclosures. Since this equipment will be distributed throughout the WTP facilities, it is appropriate that an evaluation of this equipment be performed in preparation for future assessments of the WTP ICN design and installation.

2.0 OBJECTIVES, SCOPE, AND APPROACH

2.1 Objectives

The objectives in this review were to evaluate the design and assembly of the FCCE for functionality, uniformity, consistency, and compliance with specifications, as well as provide a brief report that describes the main control and field communication equipment components and how that equipment is integrated for ICN functionality. A report of this kind is necessary because a description document of the FCCE apparently does not exist in the Contractor's database (DocSearch). Due to the complexity of the equipment and the varied system installations throughout the WTP, the report will be useful in future assessments.

2.2 Scope

The scope of this review was limited to the evaluation of hardware components utilized in the ICN control and communications design. ICN software was not evaluated, nor was the system design basis for selection and quantities of equipment components.

2.3 Approach

This review evaluated design documentation (drawings and specifications); inspected installations of hardware equipment contained in 15 enclosures in BOF, and studied equipment/component information gathered from vendors via the Internet. The review of this information is summarized in this report.

As of the writing of this report, the following WTP facilities have installed FCCE:

- Non Important-to-Safety (ITS) Switchgear Building (Bldg. 87)
- BOF Switchgear Building (Bldg. 91)
- Cooling Tower Facility Support Building (Bldg. 83S)
- Steam Plant Facility (Bldg. 85)
- Non-Dangerous, Non-Radioactive Effluent Facility (Bldg. 54)
- Fuel Oil Facility (Bldg. 81)

The installed FCCE enclosures at these facilities were observed, photographs of the equipment within each enclosure were taken, and listings of equipment were made. This information was used to review the equipment and the assemblies within each enclosure. The reviewer will maintain the photographs and equipment lists for future assessments.
[Editor's Note: This information is called out in the report as figures and appendices. Figure and appendix callouts in the text are provided in one attachment to this report, and not inserted within the text.]

3.0 RESULTS

3.1 Discussion and Observations

The ICN is designed to accommodate five basic types of communication:

- Remote Input/Output (I/O)
- Foundation™ Fieldbus
- Discrete bus
- Serial communications
- Object Linking and Embedding (OLE) for Process Control (OPC)

The first four types and their associated equipment modules were considered in this review. OPC was not considered as this type of communication is generally associated with package systems equipped to communicate directly with the ICN host servers. Remote I/O and discrete bus types of communication are implemented using a fieldbus technology referred to as Profibus DP (Decentralized Periphery). Foundation fieldbus is used for process operations that typically involve the handling of large amounts of field data. In the general context of bus types, both Profibus DP and Foundation Fieldbus technologies are discussed briefly in Figure 1.

The FCCE is assembled in industrial grade enclosures, which are labeled as either main control enclosures or remote enclosures. Several dozens of these enclosures will be distributed throughout the WTP facilities. Figure 2 is a generic configuration of a typical installation showing the equipment enclosures as they interface with the plant process equipment, other control networks, and the host system servers. The ICN communication equipment and process controllers contained in these enclosures are the subject of the following discussion.

The Contractor (Bechtel National, Inc. [BNI]) has selected the IndustrialIT product line supplied by ABB Automation Inc. as the primary control system for the WTP. This system is a hybrid of traditional distributed control system (DCS) and programmable logic controller (PLC) applications. The hardware platform is oriented around the ABB AC800M controller and S800 I/O modules system. Necessarily associated with this equipment are ABB power supplies and network interface communication modules. Equipment from other vendors is also utilized to support system communication.

As evident from DocSearch, BNI uses a standardized datasheet (24590-BOF-JJD-PCJ-000xx) that functions as a material/component list for all the FCCE components and quantities that may be found in any given enclosure depending on the particular implementation. Material lists on design drawings also indicate equipment and quantities used in a given installation. Each implementation is different. Not all systems require redundant controllers; nor do all systems require the same I/O modules or network interface devices. Thus, the datasheets and material lists, while generally comprehensive of all the FCCE, are also specific to each facility or system application. The types of listed equipment include:

- Power supplies
- Controllers
- Field communications interfaces
- S800 I/O modules and termination units
- Fieldbus support devices
- Ethernet switches
- Media converters
- Fiber optic connectivity equipment

The datasheets also indicate other useful information such as system supplier, purchase order, enclosure numbers, and reference drawings showing equipment layout and wiring.

Furthermore, the datasheets indicate that a methodical process is being applied by the WTP Contractor to ensure uniformity and consistency of the FCCE design as implemented throughout the WTP. The datasheets along with material lists can also provide a basis for managing standardization and configuration control.

Appendix A provides an FCCE equipment list as obtained from WTP datasheets and material lists. This list is slightly different from the contractors' standard list in that only the major electronic components are provided. The list does not include cable, plugs, or termination units required for some of the hardware modules. The list was used in evaluating the installed equipment.

3.2 Equipment Descriptions

Of particular interest in this review was the functionality of the main equipment components installed within the enclosures typified in Figure 2. The main control enclosure will usually contain the system process controller(s) and the necessary communication interface modules, as well as power supplies, fieldbus support equipment, media conversion units and devices that provide for fiber optic communication with remote equipment, and the plant host system. For small systems, I/O modules may also be included in main control enclosures. However, in most instances, especially concerning the main WTP processing facilities, separate I/O enclosures are required. Remote enclosures typically contain I/O modules, fieldbus support devices, power supplies and media conversion equipment for communicating with the system controller. Figure 3 depicts the equipment that typically may be found in the main control enclosures and remote enclosures. Each installation is different and how much equipment is incorporated depends on the system design requirements. In addition, most systems will require redundancy while some systems may not.

The following equipment will be described:

- Power supplies
- Process controllers
- Profibus DP communication interface modules
- Foundation fieldbus communication interface modules
- RS-232-C interface modules
- Remote I/O modules (digital and analog units)
- Fieldbus support devices
- Ethernet switches
- Media conversion devices
- Fiber optic connectivity equipment

3.2.1 Power Supplies

The FCCE is powered by 24V DC power supply devices installed within the enclosures. The power supply units are switch-mode power converters that convert either 115V AC or 230V AC (selected at the unit) input mains to a regulated 24V DC output. For the WTP, three versions of ABB power supply units are utilized: a 2.5-amp unit (ABB#SD821), a 5-amp unit (ABB# SD822), and a 10-amp unit (ABB# SD823). Power output ratings are 60, 120, and 240 watts, respectively. The units can be used in both redundant and non-redundant applications. Where redundant units are connected to a common load, a voting device (ABB# SS822) is required to combine the two power unit outputs to a single output via diodes. The voting unit ensures power is always provided from one or the other power supplies.

Based on the equipment observed in the FCCE enclosures, another power unit is also utilized, the Quint-PS 24V DC power supply by Phoenix Contact. This device, as utilized for the WTP, comes in two versions, 2.5 amps and 5.0 amps. However, it is not clear why these power devices are used in some enclosures in addition to the ABB units and not in others. This question will be addressed in the future assessment D-07-DESIGN-043-A01, "ICN Field Control and Communication Assessment."

3.2.2 Process Controllers

WTP distributed process control performed at the field component level and communication with the host plant control system is obtained using ABB AC 800M processor units. This processor (controller) coordinates local system/equipment control occurring over local area networks (fieldbuses) and receives and actuates control commands from the host system. In addition, the AC 800M provides system status and monitoring information utilized by the host system. Based on the design media reviewed, two versions of the AC 800M unit will be used within the WTP ICN. The main features of each version are described in Table 1.

As indicated in Table 1, the AC 800M communicates with field equipment via network interface devices such as Profibus DP, Foundation Fieldbus, and RS-232 C modules. These devices are described in Sections 3.2.3, 3.2.4, and 3.2.5. Plant system control functionality is distributed from host system servers to the AC 800M units. System application programs provided from the host system servers reside within the processor's random access memory (RAM). The AC 800M unit communicates with host system servers via electrical-to-optical media conversion devices and network switches (store and forward type) that accommodate the Ethernet standards for 10 Mbit/sec and 100 Mbit/sec data transmission.

Table 1. Process Controllers

AC 800M Redundant Processor: (contains 2 central processing units (CPU)	PM861AK02	PM864AK02
Microprocessor:	Motorola MPC860	Motorola MPC862
Clock frequency:	48 MHz	96 MHz
Memory (RAM):	16 Mb	32 Mb
RAM available for applications:	8.616 Mb	24.961 Mb
Flash programmable read-only memory (PROM) for firmware storage:	2 Mb	2 Mb
Ethernet channels:	2	2
Ethernet interface:	IEEE 802.3, 10 Mbit/sec	IEEE 802.3, 10 Mbit/sec
Comm. Modules for WTP:	Profibus Foundation Fieldbus RS-232 C	Profibus Foundation Fieldbus RS-232 C
Support Modules on CEX bus:	12	12

3.2.3 Profibus DP Communication Interface Modules

Profibus is an open digital, two-way communication specification that comes in two versions, Profibus PA (Process Automation) and Profibus DP (Decentralized Peripherals). General features of the two types are described in Figure 1. Only Profibus DP is used within the WTP to communicate with intelligent motor control centers, adjustable speed drives, intelligent positioning instruments, remote I/O, etc.

Profibus DP has three versions, DP-V0, DP-V1, and DP-V2. The second version, DP-V1, is used within the WTP. This version, in addition to the basic functions in DP-V0 (cyclic data exchange as well as diagnosis of station, module, and channel communications), contains enhancements geared toward process automation, in particular acyclic data communication for parameter assignment, operation, visualization, and alarm handling of intelligent field devices, parallel to cyclic user data communication. These capabilities permit online access to stations using engineering tools. In addition, DP-V1 defines alarms (i.e., status, update, and manufacturer-specific alarms). Additional technical information regarding Profibus DP is provided in Appendix B.

ABB provides four communication interface modules that may be used in a given Profibus DP network scheme. These four modules, CI830, CI840, CI851, and CI852, are required in order to extend the AC 800M processor control capability to Profibus-compliant field components.

<u>CI830 or CI840 (redundant version of the CI830):</u>

These devices are Profibus-DP I/O adapters for direct interface with S800 I/O modules (described in Section 3.2.6). The CI830 and CI840 units can handle up to 24 I/O modules and function to convey the field I/O electronic (analog and/or discrete) data to and from the controller/processor in compliance with the Profibus DP protocol. These units, when used, will typically be for remote I/O. Profibus uses a multi-drop wiring scheme composed of two wires for power and two wires for data communications.

In the language of the Profibus standard, the CI830 and CI840 are typed as "slave" devices. A slave is a peripheral unit (such as, I/O devices, drives, HMIs, valves, transducers, analysis devices) that reads in process information and/or uses output information to intervene in the process. While some devices process only input information or only output information, the CI830 and CI840 process both input and output information as indicated by the various types of S800 I/O modules that may be utilized. In regard to communication, slaves are passive devices that only respond to direct queries.

Based on WTP facility designs such as the Glass Former Storage Facility (Bldg. 21) and the Water Treatment Facility (Bldg. 86), the CI840 (which is the redundant version of the CI830) is typically used for large I/O handling in association with the CI851 or CI854 units described below.

CI851 and CI854:

These modules extend the processor control functionality to Profibus field devices. The units provide for communication between the process controller and remote I/O and/or fieldbus instruments via the Profibus DP (CI851) and DP-V1 (CI854) communication protocols.

The CI851 unit (based on the Profibus standard) is typed as "DP Master Class 1" (DPM1). This means that the unit, in connection with the AC 800M, is a central controller (similar to a PLC or personnel computer [PC]) that cyclically exchanges information with the distributed stations (slaves) at a specified message cycle. As a DPM1 device, the CI851 has active bus access by which it can read measurement data (inputs) of the field devices and write the setpoint values (outputs) of the actuators at fixed times. This continuously repeating cycle is the basis of the automation function.

The CI854 unit is typed as a "Master Class 2" (DPM2) for DP-V1 services. Master Class 2 means the unit is used for engineering, configuration, or operating devices. It is implemented during commissioning, and for maintenance and diagnosis in order to configure connected devices, evaluate measured values and parameters, and request device status. As a DPM2 device, the CI854 module also has active bus access.

The CI851 and CI854 modules are powered by the processor unit (24V DC) and can accommodate communication speeds ranging from 9.6 to 12,000 Kbit/sec depending on cable length.

There is a wide range of flexibility in how the Profibus interface modules are connected up. Figure 4 shows some of the connectivity options also utilizing the necessary Profibus support equipment. The arrows depict flow of electronic data.

3.2.4 FOUNDATION Fieldbus Communication Interface Modules

FOUNDATION Fieldbus (FF) is a two-way digital communication specification with two versions, H1 and High Speed Ethernet (HSE). H1 was designed as a digital replacement of the

4 to 20 mA standard and operates at a transmission rate of 31.25 Kbit/sec. HSE operates at transmission rates of 100 Mbit/sec. FF operates using only two wires for both power and data communications. As a multi-drop system, several microprocessor-based instruments (smart instruments) or devices may be connected to a common set of two wires making up an H1 segment. An FF network can contain one or many segments. FF H1 is specifically described in Appendix B.

Within the WTP, the FF networks will be used to communicate and coordinate control and monitoring functions associated with FF compliant industrial process control devices such as transmitters (for flow, pressure, temperature, level sensing, etc.) and control devices (valves, dampers, etc.).

The WTP utilizes two FF communication interface modules from ABB, the CI852 and CI860. The CI852 is single-channel (can only accommodate one H1 segment) and is used directly for individual H1 segments. The CI860 is used for HSE communication with several H1 segments typically through an LD800HSE linking device as described in Section 3.2.7. Both units are powered from the processor unit and interface to H1 segments via power conditioners. Power conditioners are also described in Section 3.2.7. Figure 5 provides a general depiction of connectivity options associated with these two FF communication interface modules along with the necessary support equipment.

3.2.5 RS-232-C Communication Interface Modules

The CI853 module provides CPU extension via RS-232 C ports where serial communication is required for some types of field equipment.

RS-232 is an industry standard that does not define bit rates for transmission but merely indicates that the standard is intended for bit rates lower than 20Kbit/sec. However, many devices currently can exceed this speed by ten-fold while still using RS-232 compatible signal levels. Speed is also heavily dependent on cable length; the longer the distance, the slower the modem transmission speed.

The CI853 is powered by the processor unit at 24V DC and can establish two RS-232 C channels through COM1 and COM2 ports.

3.2.6 Remote I/O modules (Digital and Analog Units)

As mentioned earlier, the WTP ICN will utilize the ABB S800 I/O system line of I/O modules. Many types of I/O modules are available in the S800 line; however, only the modules used for the WTP are listed in Table 2 along with their device features.

Table 2. Input/Output Modules use at WTP

I/O Device Type	ABB#	Features (from ABB specifications)
Analog Input Module	AI810	8 channels, single-ended, 0(4)-20mA, 0(2)-10V, 12 bits
Analog Input Module	AI820	Differential Inputs, 4 channels, 0(1)-5V, ±0(2)-10V, ±0(4)-20mA, 12 bits + sign
Digital Input Module	DI810	16 channels, 2 groups of 8 channels, current sink
Analog Output Module	AO810	8 channels, common return, 0(4)-20mA, 14 bits, 859Ω

Table 2. Input/Output Modules use at WTP

		load (short-circuit proof)
Analog Output Module	AO820	Isolated output, 4 channels, separate returns, measuring range: ±0(2)-10V, ±0(4)-20mA, resolution :12 bits + sign, load: ≤500ohms (current) or ≥2kΩ (voltage), short circuit proof
Digital Output Module	DO810	16 channels, 2 groups of 8 channels, 24V, max 0.5A DC, transistor, current source, short-circuit-proof
Digital Output Module	DO820	8 channels, separate returns, 5-250V, max 3A AC/DC, relay (NO)
Incremental Pulse Counter Module	DP820	2 channels, separate returns, 0.25Hz-1.5MHz, signal voltage: 5 or 24V DC

3.2.7 Fieldbus Support Devices

Fieldbus support devices provide power conditioning and network linking capability for FF and Profibus DP devices. The three units used in the WTP configuration are described below.

HSE FF Linking Device (LD800HSE):

The ABB FF Linking Device LD 800HSE is used to connect or link several H1 segments to the high speed Ethernet (100 Mbit/sec) network. This unit serves as a gateway between field devices on the H1 links and supervisory and control system applications via the ABB FF communication interface module.

The LD 800HSE enables users to access the field devices connected to the FF from supervisory and control systems and management consoles. The device is qualified for redundant use, where the corresponding H1-ports of two linking devices are connected to one H1 link. Redundant linking devices are interconnected via a serial RS-232 null modem cable to exchange redundancy control information.

FF Power Conditioner (KLD2-PC-1.1.IEC):

This unit, by Pepperl+Fuchs, provides power conditioning for FF H1 network segments in order to ensure power is not drained off the network by the connected devices (see Figure 5).
The KLD2 provides up to 1 amp of current at standard 24V DC as well as the necessary impedance matching circuitry for IEC 61158-2 based networks (61158-2 is the standard for FF and Profibus PA). Power is provided to the unit by the enclosure power modules discussed previously.

Where groups of four conditioner units are used and for advanced configuration, the KLD2s can be outfitted with a specifically suited motherboard (MB-FB-PC4) that acts as a power hub.
The power hub supports other functions such as communications enhancements, redundancy support, and diagnostics.

Profibus DP Redundancy Link Module (RLM01):

The RLM01 functions to covert one simple non-redundant Profibus line into two reciprocally redundant lines. The module also provides repeater functionality in that it regenerates the signal shape and the amplitude of the received data. Within the WTP, this unit will typically be connected to the CI854 module, the master device line (M), and to slave devices on the network via line A and B connections (see Figure 4). The RLM01 monitors all three lines, M, A, and B, for activity and error states. Detected errors are signaled by lit diodes on the front of the unit and the device can be polled for diagnostics purposes by the process controller.

3.2.8 Ethernet Switches

BNI's FCCE datasheets identify two versions of Hirschmann Modular Industrial Communication Equipment (MICE) Ethernet switches (MS2108-2 and MS3124-4). These units function by storing and then forwarding (switching) information via Ethernet (10 Mbit/sec) and Fast-Ethernet (100 Mbit/sec). The differences between the two switches are mainly in the number of ports available, 8 and 24, respectively.

When the switch receives a packet of information (a frame in Ethernet terms), it reads the destination address from the header information in the packet, establishes a temporary connection between the source and the destination ports, sends the packet on its way, and then terminates the connection.

The Ethernet switches work in conjunction with media modules that accommodate twisted-pair (copper) and single mode or multimode fiber optic connection ports. The media modules are listed in the below along with their device features.

Table 3. Hirschmann Media Modules Typically Used with MICE Switches

Device ID	Media	# of ports	Xmtr. speed
MM2-4FXM3	Fiber	4	100 Mbit/sec
MM2-4TX1	Copper	4	10 or 100 Mbit/sec
MM2-2FXM3/2TX1	Fiber Copper	2 2	100 Mbit/sec 10 or 100 Mbit/sec

Typically, as seen in the FCCE enclosures for the BOF, a MICE switch and two media modules are utilized.

3.2.9 Media Converters

The WTP FCCE incorporates five kinds of devices for converting signal media (copper to fiber optic and vice versa and/or signal speed and type). These devices are described as follows:

<u>RS2-4R 2MM SC:</u>

This unit, by Hirschmann, is a redundant industrial Ethernet rail switch that operates in store and forward mode for Ethernet 10 Mbit/sec and Fast-Ethernet 100 Mbit/sec. It provides two ports for 10/100Base-TX twisted pair cable connections and two ports for 100Base-FX multimode fiber optic cable connections.

<u>OZD Profi 12M G12:</u>

This device is used for Profibus field bus networks to enable electrical Profibus data signals (RS 485 level) to be converted into fiber optic Profibus signals. This unit contains three channels and accommodates multimode fiber optic cable.

The OZD Profi 12M supports all the following transmission speeds, 9.6, 19.2, 45.45, 93.75, 187.5, or 500Kbit/s, as well as 1.5, 3, 6, and 12Mbit/s. The device sets the transmission rate automatically as it receives a frame. If the transmission speed has not been recognized, the outputs of all ports are blocked. If the transmission rate changes during operation, the unit makes adjustments accordingly.

This unit is specifically called out in several of the WTP specifications for field equipment.

LD-63DC:

The LD-63 (DC version) is a line splitter designed for use in multi-drop fiber optic networks. The unit contains two fiber optic channels each with a separate transmitter and receiver; this also allows the conversion between recommended standards (RS), such as RS-422/485, RS-232/V.24, and fiber optic. The standards define mechanical and electrical characteristics for connection of data communications equipment.

485LDRC:

This device is used to optically isolate and convert unbalanced, full or half-duplex RS-232 signals to optically isolated, balanced, full- or half-duplex RS-422 or RS-485 signals at transmission rates up to 115.2 Kbit/sec. The unit also provides surge suppression for the RS-422/485 lines.

Spider 5TX:

This unit is a network switch that provides five ports for auto-negotiation between equipment communicating over 10 Mbit/sec or 100Mbit/sec connections via copper media.

The media conversion devices described above indicate that a high degree of flexibility has been planned into the ICN design in order to accommodate communication with a wide range of field equipment and vendors meeting open communication standards.

3.2.10 Fiber Optic Connectivity

Typically within the ABB equipment enclosures, there will be patch panels where fiber optic cables are connected from the Facility Network Infrastructure (FNI) in order to accommodate ICN communications from the field to the control room. The patch panel represents the physical interface between process control equipment in the field and the FNI that provides the fiber optic connection to host system servers and HMIs.

A fiber optic patch panel is essentially a cabinet referred to as a wall-mountable interconnect center (WIC) that provides housing for connector panel (CP) modules referred to as closet connector housings (CCH). The contractor utilizes two types of WICs, one type can accept two connector panels (WIC-02P) and another type accepts up to four connector panels (WIC-04P). There are also two types of connector panels, one type (CCH-CP16-97) accommodates 16 fibers through 8 MTRJ adapters and the other type (CCH-CP24-97) involves 24 fibers through 12 MTRJ adapters. The MTRJ adapters are designed for connection of two 62.5 micrometer multimode (i.e., more than one light signal group). MTRJ refers to a standard type of fiber optic cable.

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Most of the equipment described above was observed in the WTP installed systems. Figures 6 and 7 are sample photos (with added annotation) of the equipment enclosures within the Steam Plant (Bldg. 85). Of the installed equipment, the Steam Plant is the most complex in terms of system controls. Thus, the photos convey a reasonable expectation for how the larger and more complex arrangements of FCCE will be assembled in future installations.

It is noteworthy that given the varied types of equipment selected for the FCCE and the variability in equipment layout, size, and arrangement of enclosures and wire ducts that a high degree of flexibility has been engineered into the FCCE. Yet the means and process for maintaining consistency and commonality of equipment is evident.

4.0 RECOMMENDATIONS

None

5.0 REFERENCES

The discussion in this report is based on reviews of the documents listed below as well as inspection of installed equipment:

- 24590-WTP-3PS-JD01-T0001, *Plant Wide Control Systems (Integrated Control Network)*, Bechtel National, Inc.
- 24590-WTP-3PS-JQ07-T0001, *Instrumentation for Package Systems*, Bechtel National, Inc.
- (ABB)- *System Guide, Industrial^{IT} Extended Automation System 800xA, System Version 3.1*
- (ABB)- *Product Guide, Control^{IT} AC 800M, Version 2.1, Controller Hardware*
- (ABB)- *Hardware and Operation, Control^{IT} AC 800M, Version 2.1, Controller Hardware*
- Equipment Vendor Datasheets (ABB, Hirschmann, Pepperl+Fuchs, Phoenix Contact, Corning, etc.) – see note below
- Drawings (mainly fieldbus routing maps, control and instrumentation general arrangements, enclosure datasheets, and material lists)

Note: Highly technical information on the equipment described in this report is contained in vendor literature obtained via the Internet and kept on file by this reviewer.

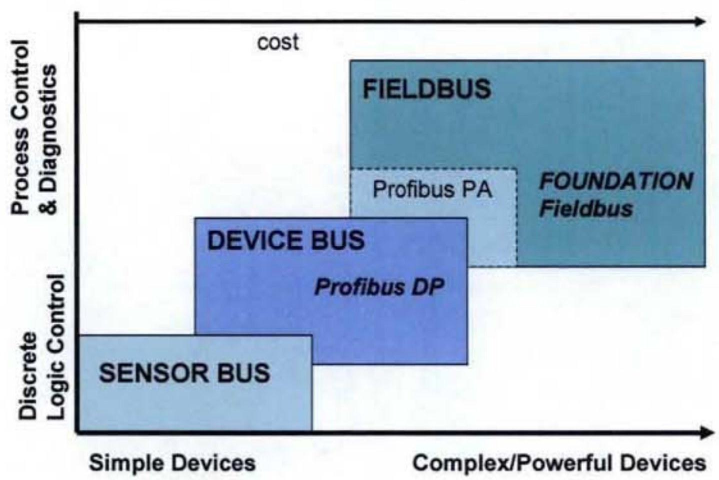
5.1 Other References

ORP DI 220.1, *Conduct of Design Oversight*, Rev. 1, January 26, 2006

ATTACHMENT A. FIGURES AND APPENDICES

Bus Types

Digital field networks or buses typically connect sensors, actuators, and other I/O devices with a multi-drop wiring scheme. Different network technologies have different capabilities.



The WTP utilizes Profibus DP and FOUNDATION Fieldbus in the Integrated Control Network (ICN)

Figure 1

Sensor Bus

For discrete manufacturing, used with proximity switches, pushbuttons, motor starters, etc. Simple bit-level communications such as turning something on or off or indicating on-off state. Minimal cost where only a few bits of information needs to be transmitted.

Device Bus

For more complex or fast-moving operations requiring short, fast communications. Often used with intelligent mechanical handling and electrical equipment such as adjustable speed drives and motor control centers. Message capacities are from several bytes to over 200 bytes depending on the protocol. Handles not only discrete on/off signals but also periodic adjustments and some ancillary analog information. Can communicate at high speed for short distances and slower speeds for longer distances.

Fieldbus

Useful in control and diagnostics associated with process operations. Provides highly reliable two-way communications between "smart" devices and systems in time-critical applications. Optimized for messages containing several floating-point variables sampled at the same time, providing status of each variable. Digital replacement for analog 4-20mA communications in process operations. Since requirements are different for process operations compared to discrete manufacturing, fieldbuses typically have slower transmission rates than device or sensor buses. Supports intrinsic safety and able to run on existing field-instrument wiring. FOUNDATION Fieldbus also includes standard and open function blocks that support distributed control in the field.

Field Network

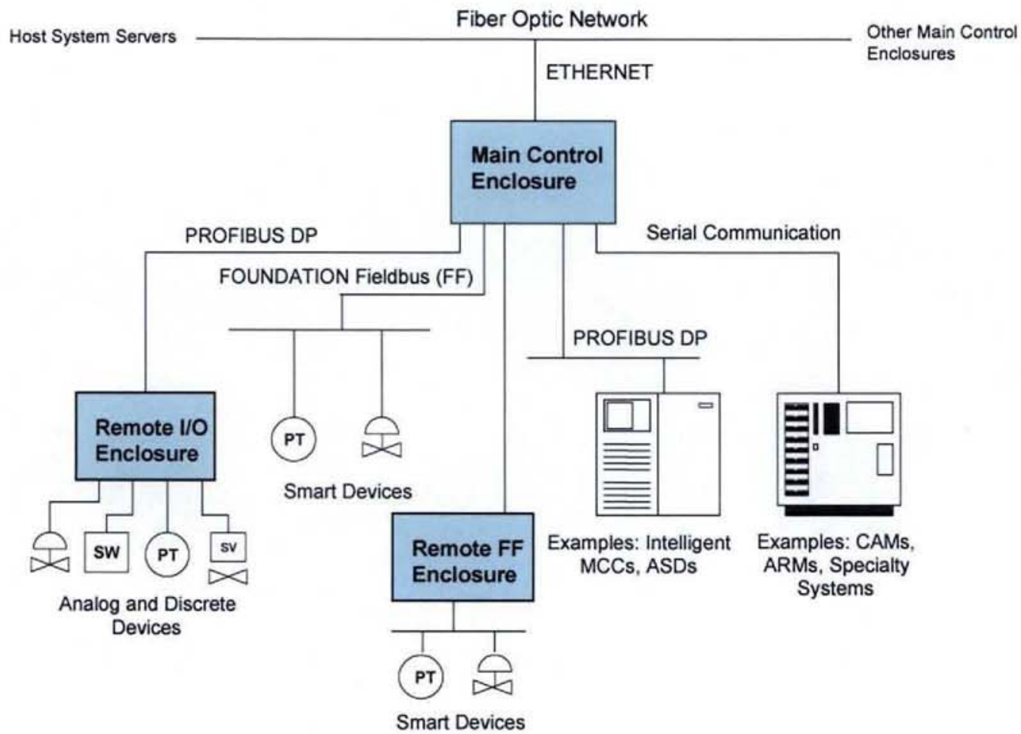


Figure 2

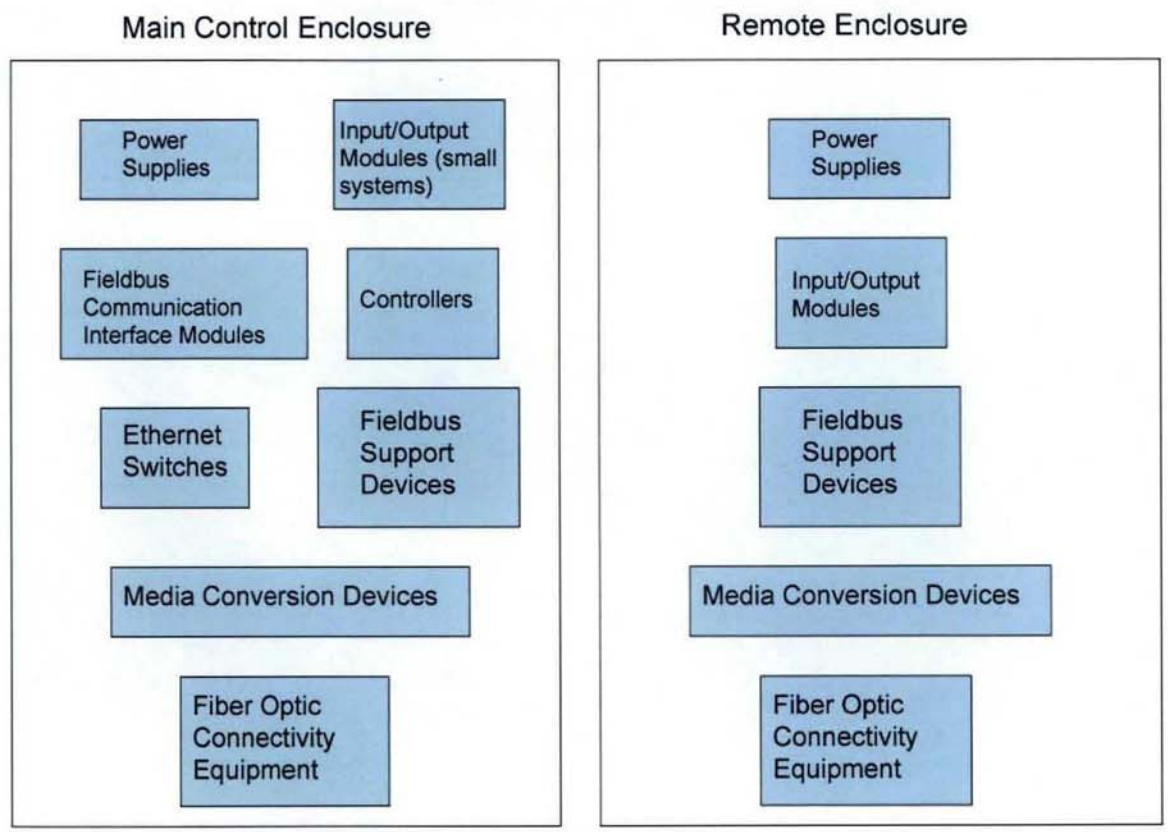

Main Control Enclosure
Power Supplies
Input/Output Modules (small systems)
Fieldbus Communication Interface Modules
Controllers
Ethernet Switches
Fieldbus Support Devices
Media Conversion Devices
Fiber Optic Connectivity Equipment
Remote Enclosure
Power Supplies
Input/Output Modules
Fieldbus Support Devices
Media Conversion Devices
Fiber Optic Connectivity Equipment

Figure 3

Profibus DP Connectivity Options

Note: The connectivity options shown here are intended to convey how in some instances the Profibus equipment will be interconnected. However, because of the flexibility of the equipment, other options may be utilized as well.

Typically when data transmission is required between main control enclosures and remote equipment or I/O enclosures, fiber optic equipment is utilized as shown to the right. The electrical-to-optical converter unit is specifically for Profibus.

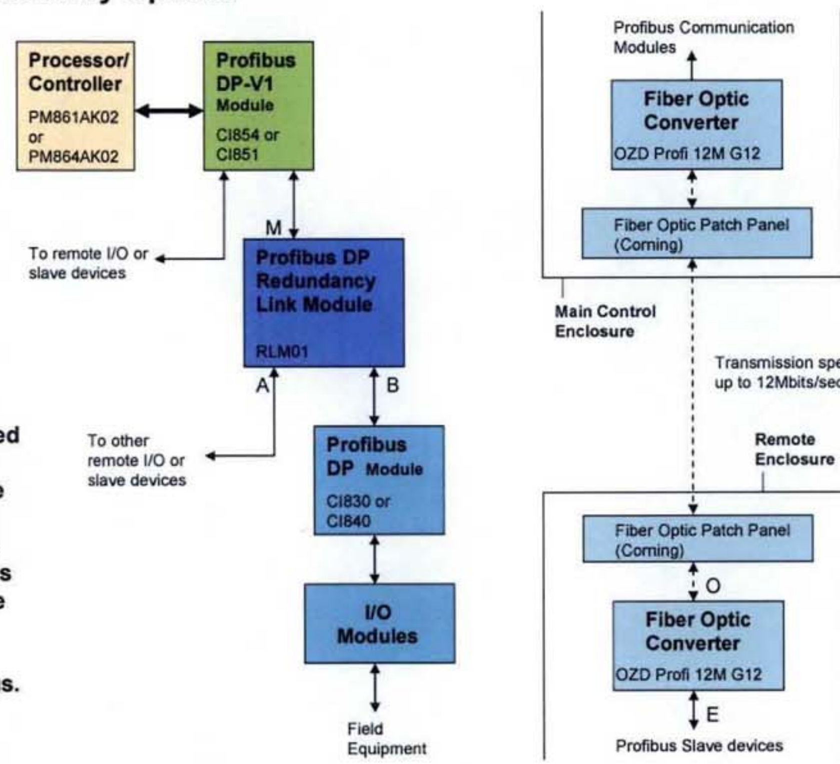


Figure 4

Foundation Fieldbus Connectivity Options

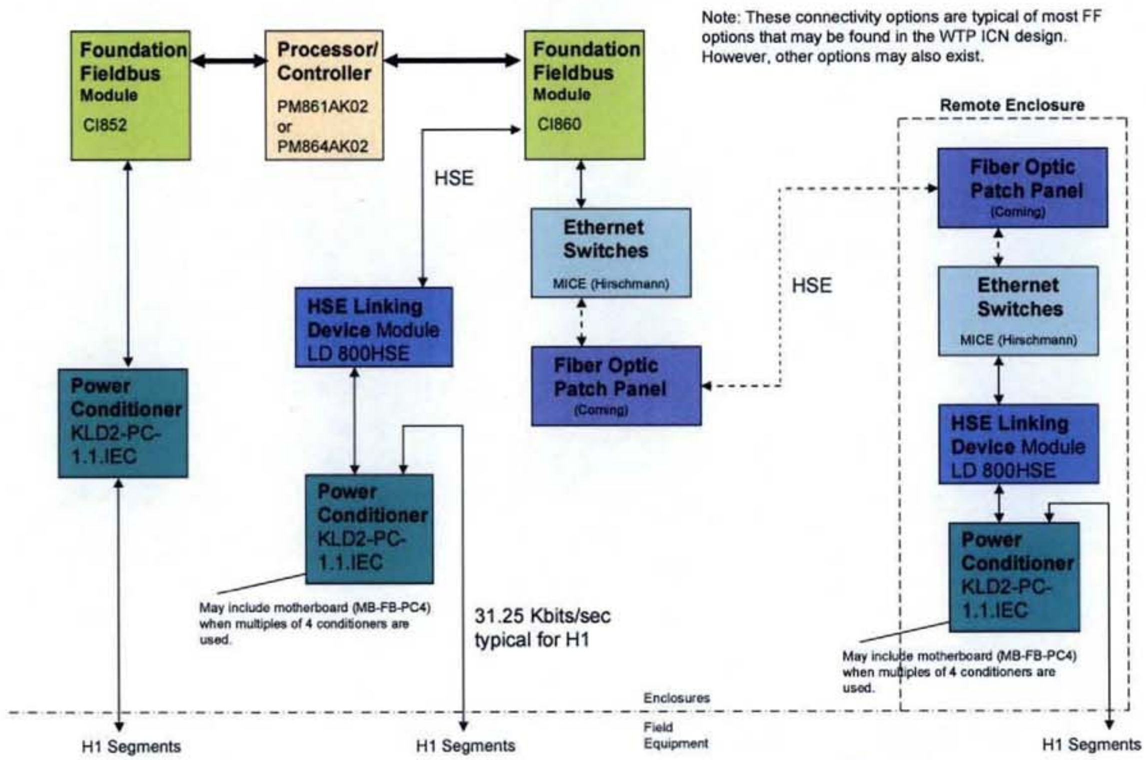
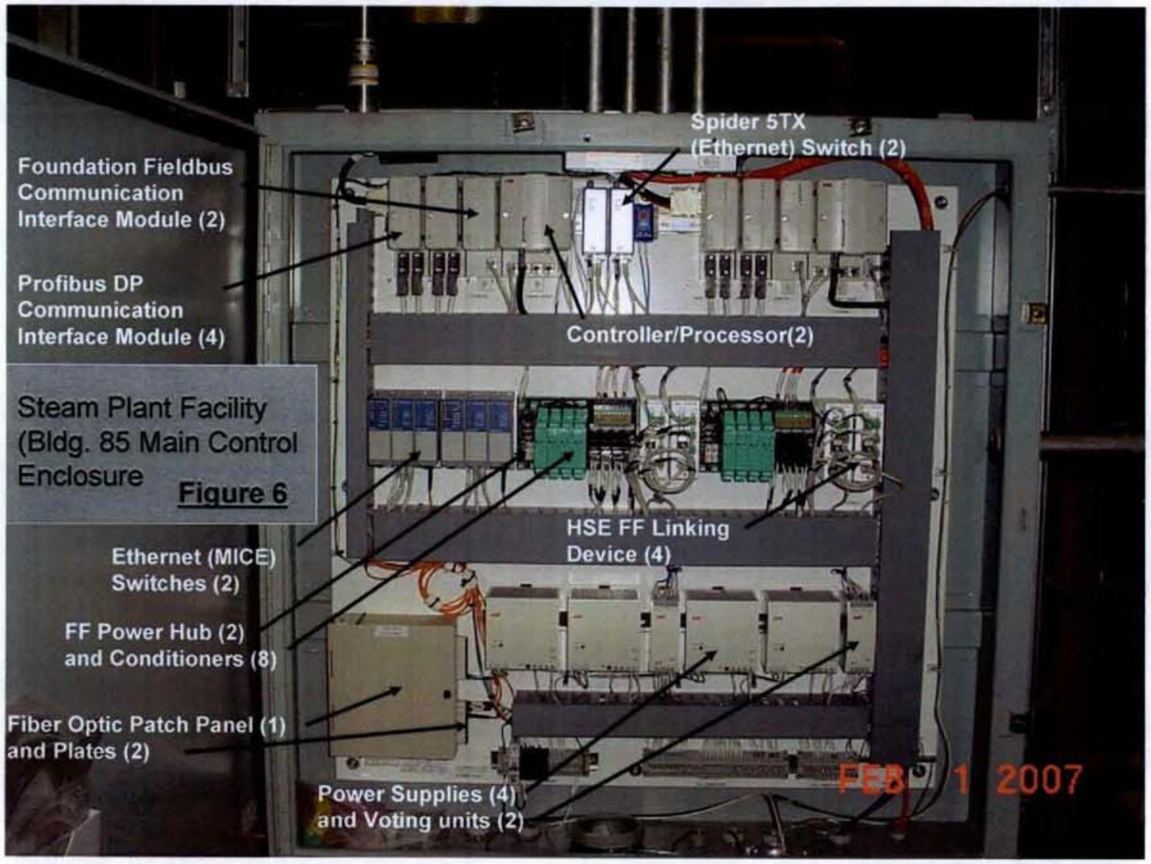
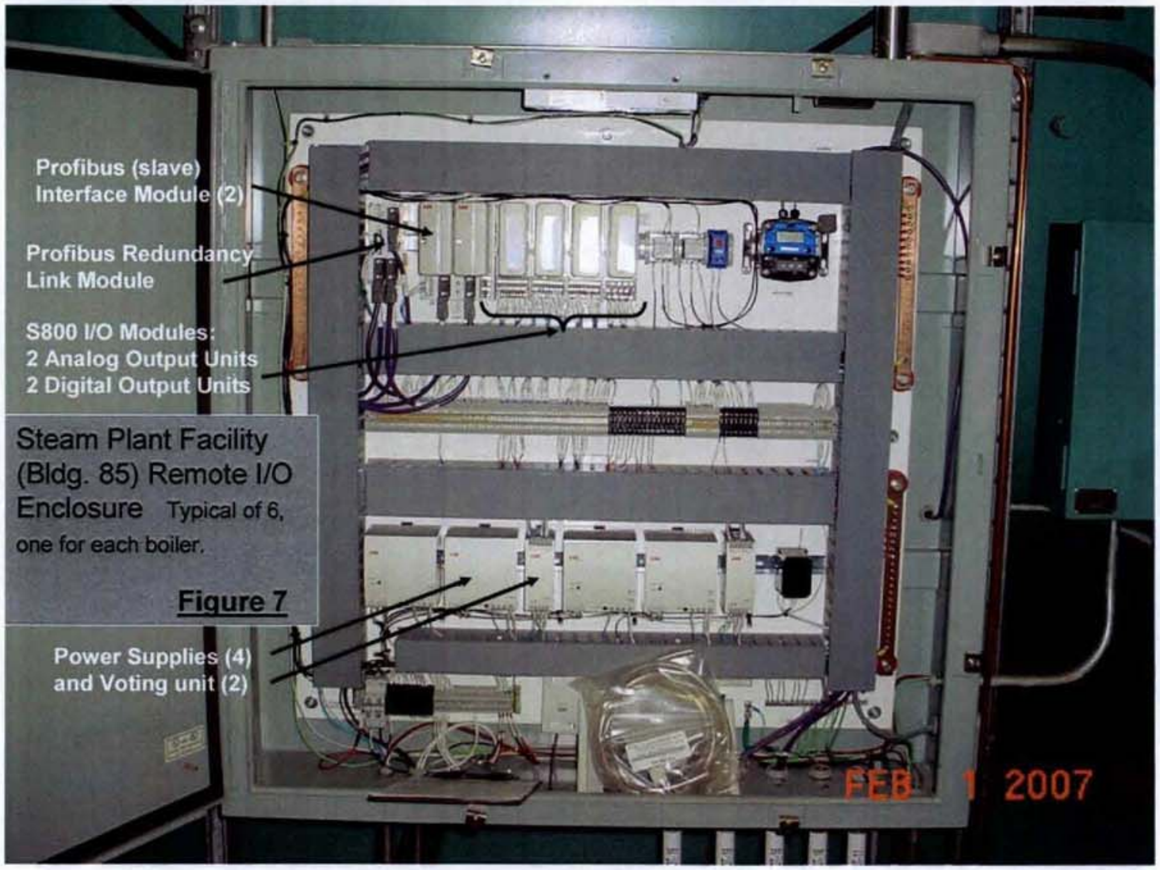


Figure 5


Spider 5TX
(Ethernet) Switch (2)
Foundation Fieldbus
Communication
Interface Module (2)
Profibus DP
Communication
Interface Module (4)
Controller/Processor(2)
Steam Plant Facility
(Bldg. 85 Main Control
Enclosure
Figure 6
HSE FF Linking
Device (4)
Ethernet (MICE)
Switches (2)
FF Power Hub (2)
and Conditioners (8)
Fiber Optic Patch Panel (1)
and Plates (2)
Power Supplies (4)
and Voting units (2)
FEB 1 2007



Steam Plant Facility (Bldg. 85) Remote I/O Enclosure Typical of 6, one for each boiler.

Figure 7

FOUNDATION Fieldbus Overview and Analysis

FOUNDATION Fieldbus H1 level has been designed as a digital replacement of the 4 to 20mA standard in the process industries. FOUNDATION Fieldbus is also a LAN (Local Area Network) for instruments used in both process and manufacturing automation with built-in capability to distribute the control application across the network. The physical wiring is also fully compatible with intrinsic safety (IS) or nonincendive wiring standards and may be used in hazardous, as well as general purpose areas. In hazardous areas standard explosion-proofing or power limited concepts may be used, as well as IS concepts, offering greater cabling design flexibility.

FOUNDATION Fieldbus has a unique user layer that defines the interface by which users can communicate with devices through a set of blocks. These blocks are 1) resource blocks, 2) function blocks and 3) transducer blocks. Resource blocks provide on-line information of name, manufacturer and serial number. Function blocks describe control and I/O behavior. Transducer blocks decouple the function blocks from the functions required to read/write inputs and outputs.

With FOUNDATION Fieldbus, the user is able to interconnect the function blocks and schedule the running of the blocks to create control algorithms. The control may reside in the field devices rather than in the centralized controller depending on the capability of the field device.

FOUNDATION Fieldbus (FF) Benefits

- Reduce field wiring costs.
- Intrinsic safety wiring option available to further reduce costs in hazardous environments.
- Same bus used for analog and discrete devices.
- Control (LAS) for the segment may reside in the field devices freeing up space in central controllers.
- Time stamping of control parameters performed in field devices and coupled to control data to optimize operating performance.
- Provides greater controllability and process information.
- Standardized function blocks, representing control and I/O; speed set up.
- Long bus length of 1900m (6,175 ft) and spurs up to 120m (390 ft) span most process systems.
- Supported by over 80% of the world's process instrumentation suppliers.

FOUNDATION Fieldbus vs Conventional Systems

The FOUNDATION Fieldbus network may consist of 16 instruments connected to a two-wire bus. This translates into significant savings over conventional point-to-point wiring due to less expensive wiring, reduced space, and greater flexibility. In control loops, FOUNDATION Fieldbus offers greater controllability and transfers control to the field for better reliability.

Conventional System

Analog and discrete instruments are wired individually to centralized controllers in a conventional system. Control functions are processed in the centralized controller with passive devices accepting commands and providing feedback. ***See figure 1.*** No on-line diagnostics may be performed and instrument parameters, as well as descriptive device information, is recorded manually.

Critical factors to consider in evaluating a conventional system include:

1. Design layout for I/O racks and conduit runs.
2. Space allocation for cabinets and conduit.
3. Conduit, wiring and fittings cost and installation time.
4. System commissioning and troubleshooting.

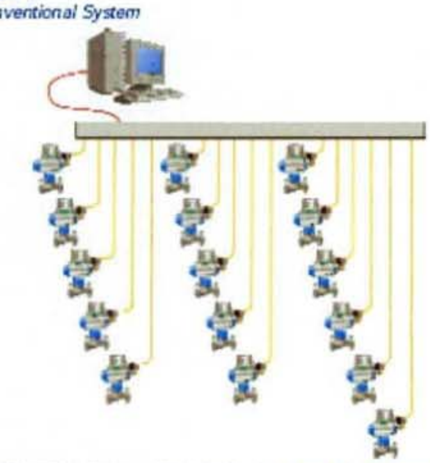
FOUNDATION Fieldbus System

In a FOUNDATION Fieldbus system, typically from 2 to 16 devices may be included on a common network. ***See figure 2.*** One of the devices must be a Link Active Scheduler (LAS) or Link Master, which manages the communication network. There may be multiple Link Masters on the same bus. If the current LAS fails, another Link Master may take over the LAS function and the operation of the fieldbus will continue. Wiring topology may be bus or tree topology with the bus topology illustrated. Since FOUNDATION Fieldbus has limited power delivery capability, two more power wires are used in the example to provide power for solenoid coils. Any FOUNDATION Fieldbus compliant device may be connected into the network.

FOUNDATION Fieldbus Economic Analysis

When using a StoneL VCT module and integrating it into the FOUNDATION Fieldbus (FF) network illustrated, there are significant savings. This system consists of 16 automated valve systems located in a cluster approximately 200 feet from the I/O rack. Each of the automated valves is located 20 feet apart in the cluster. Following is an estimated comparison:

Figure 1
Conventional System



Installation Cost Comparison (per field device)

	Conventional	FF*
Computer I/O: Master/Gateway	$ 70	$ 160
Conduit, Cable Tray, Wiring and Fittings	$ 1,400	$ 290
Valve Monitor/VCT and Pneumatic Valve	$ 315	$1,025
Switched Protected Drop Connector	NA	$ 160
Installation and Commissioning Labor	$ 600	$ 250
Power Supply	$ 50	$ 30
Total Installed Cost	$ 2,435	$1,915

Total Installation Savings

$520 per device

* Foundation Fieldbus is not directly comparable. Analog instruments require minimal adder over conventional 4 to 20mA system making this system cost effective when combining analog and discrete field instruments on the same segment. Functionality for FOUNDATION Fieldbus devices is also significantly greater, offering increased diagnostic and operational capabilities.

Foundation Fieldbus Analog Point Addition to StoneL I/O Modules

The StoneL FOUNDATION Fieldbus I/O modules have an auxiliary 4 to 20mA input and a 4 to 20mA output which is powered from the supplemental 24VDC supply bus. Additional savings may result from connecting the 4 to 20mA device directly to the StoneL I/O instead of running wires back to I/O at the controller. *See figure 3.* The additional analog input would be represented as an AI (Analog Input) function block as part of the StoneL device description. StoneL I/O analog 4 to 20mA point addition is illustrated.

The 4 to 20mA instrument may be conveniently wired directly into the StoneL I/O module. With a conventional system the control would need a 200 foot run back to the controller. Other savings would result from:

- Reduction in design time because of simpler conduit and cabling systems.
- Reduction in conduit and cabinetry space.
- Right first time wiring and easier troubleshooting.
- Faster commissioning.

Analog Installation Cost Comparison:

	Conventional	FF
Conduit and Wiring ($8/ft)	$1,600	$ 160
Analog Input Point	$ 30	$ 650
Total Installed Cost	$1,630	$ 810

Total Installation Savings

$320 per device

FOUNDATION Fieldbus Network Specifications

Topology	Bus/Tree: terminators required
Cabling	Shielded twisted pair
Bus Power	Typically 20mA /device @ 9 to 32 VDC
Number of Devices	2 to 16 typical (Theoretically 32)
Data Delivery	Unlimited
Max. Cable Length	1900m (6,125ft) total of trunk length and all spurs
Spur Length	# of Devices / Max Length: 15 to 16 – 60m (197ft); 13 to 14 – 90m (295ft); 2 to 12 – 120m (394ft)
Transmission Rate	31.25 kbit/second
Cycle Time	Link Active Scheduler determines priority
Communication Method	Publisher/Subscriber; delegated token passing with cyclic and acyclic options.
Link Active Scheduler	Acts as master for bus; schedules communication; maintains live list of segment devices
Data Signal	Manchester Biphase-L with synchronous serial signaling
Error Checking	Frame check sequence comparison
Addressing	May be done off-line or performed on-line automatically by system management
Support Organization	Fieldbus Foundation www.fieldbus.org

FOUNDATION

Figure 2
FOUNDATION Fieldbus Network

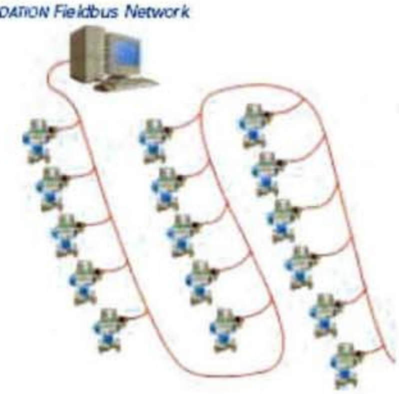
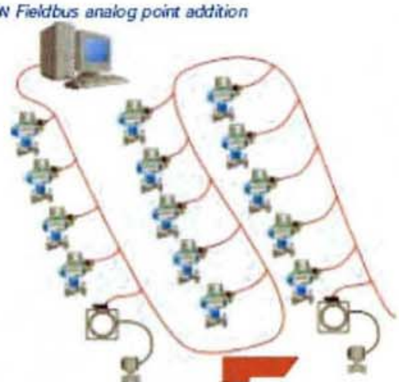


Figure 3
FOUNDATION Fieldbus analog point addition



Fieldbus

StoneL Corporation Telephone 218-739-5774 / Toll free 800-843-7866 www.stonel.com 105

Appendix A – Data Sheet

ICN Field Equipment Enclosure Data Sheet			
Equipment Listing	***Part Number***	***MC***	***RIO***
Power Supplies			

115/230 VAC Power Supply, 24 VDC Output, 2.5A	SD821		
115/230 VAC Power Supply, 24 VDC Output, 5A	SD822		
115/230 VAC Power Supply, 24VDC Output, 10A	SD823		
Power Supply Voting Unit	SS822		
PS (Phoenix Contact) 24VDC 2.5A or 5.0A	QUINT-PS...24DC		
Controllers			
AC 800M Redundant Processor Unit (48MHz)	PM861AK02		
AC 800M Redundant Processor Unit (96MHz)	PB864AK02		
Field Communications Interfaces			
Profibus Communications Interface	CI830		
Profibus Communications Interface (Redundant)	CI840		
Profibus DP Interface	CI851		
Foundation Fieldbus H1 Interface	CI852		
Dual RS-232-C Interface	CI853K01		
Dual Profibus DP/V1 Interface	CI854AK01		
Foundation Fieldbus HSE Interface	CI860K01		
S800 I/O Modules			
Analog Input Module (1x8 ch)	AI810		
Analog Input Module (4x1 ch)	AI820		
Digital Input Module (2x8 ch)	DI810		
Analog Output Module (1x8 ch)	AO810		
Analog Output Module (4x1 ch)	AO820		
Digital Output Module (2x8 ch)	DO810		
Digital Output Module (1x8 ch)	DO820		
Incremental Pulse Counter Module	DP820		

See next page for fieldbus support, Ethernet switches, media converters, and fiber connectivity equipment.

Equipment Listing	*Part Number*	*MC*	*RIO*
Fieldbus Support			
HSE FF Linking Device	LD800HSE		
Interface for 4 FF Segments, Pepperl&Fuchs	MB-FB-PC4		
FF Power Conditioner, Pepperl&Fuchs	KLD2-PC-1.1.IEC		
Profibus DP Redundancy Link Module	RLM01		
Ethernet Switches (Hirschmann)			
MICE, 2000 Basic Switch	MS2108-2		
MICE, 3000 Basic Switch	MS3124-4		
MICE, Media Module, 4 100Base-FX ... ports	MM2-4FXM3		
MICE, Media Module, 4 10/100Base-T(X) ... ports	MM2-4TX1		
MICE, Media Module, 2 10/100Base-T(X) ... ports	MM2-2FXM3/2TX1		
Media Converters			
Rail Switch, Hirschmann	RS2-4R 2MM SC		
Profibus DP Fiber Optic Converter, Hirschmann	OZD Profi 12M G12		
RS-232 or RS-422/485 to fiber optic, Westermo	LD-63 DC		
RS-232 to RS-422/485 Converter, B&B Electronics	485LDRC		
Rail Switch, Hirschman	Spider 5TX		
Fiber Connectivity			
Fiber Optic Patch Panel, Corning Cable Systems	WIC – 02P		
Fiber Optic Patch Panel, Corning Cable Systems	WIC – 04P		
16-Fiber, 8MT-RJ Fiber Optic Patch Plate, (CCS)	CCH-CP16-97		
24-Fiber, 12MT-RJ Fiber Optic Patch Plate, (CCS)	CCH-CP24-97		

Appendix B – Profibus DP

(Ref: WWW.stonel.com "Process Networking Solutions" FieldLink™

Profibus Overview and Analysis

PROFIBUS originated in the European market and has become a worldwide standard because of its performance attributes. PROFIBUS consists of several variations which are designed for use in special applications. The two PROFIBUS versions most commonly used are PROFIBUS-DP (Distributed Peripherals) and PROFIBUS-PA (Process Automation).

PROFIBUS-DP is recognized as a high performance bus network capable of transmitting thousands of I/O point information in less than a few milliseconds. For that reason it has been used extensively for fast response control applications such as turbine servos and variable speed drives.

PROFIBUS-PA was developed to connect directly into PROFIBUS-DP and may be used in intrinsically safe applications. DP uses the RS485 physical layer while PA uses the IEC 61158-2 physical layer designed primarily for process applications.

PROFIBUS-DP Features

- High speed data access capable of handling time critical functions.
- Networks up to 32 devices (up to 126 with repeaters) on a 4-wire network (2-wires for signal and 2-wires for power).
- Trunk network may extend up to 4,000 feet (1220 meters) per segment.
- Dramatically cuts wiring costs and commissioning over conventional applications.
- Interfaces readily into newer control systems.
- Used extensively throughout Europe with support in North America.

PROFIBUS-DP Description

The DP version of Profibus uses the RS485 physical layer with its unique data link layer and a direct data link mapper connecting the data link layer directly to application functions.

PROFIBUS uses a medium access control which includes token-passing for multimaster applications and the master slave interaction. Networks may be multi-master, multi-master with slaves, or single-master with slaves. In a multi-master network the token is passed to each master in a predetermined time frame. The master with the token is active and communicates with other masters or accesses its assigned slaves.

Communication occurs on a peer-to-peer basis for data communication or on a multi-cast basis for control commands. Cyclic polling may also be used for data communication between the master and its designated slaves. DP also offers acyclic communication services for the parameterization, operation, monitoring, and alarm-handling of intelligent field devices. These acyclic services may be handled in parallel to data transfer with the master taking some additional time to carry out this function. Acyclic extended functions are optional.

PROFIBUS-DP handles large amounts of I/O data at very high speeds. DP requires about 1 millisec to handle 1024 I/O points over 32 devices at the 12Mbit/sec rate. This is possible due to the efficient mapping of the data from the data link layer directly to the user layer by means of the SRD service of the data link layer.

For configuration of DP devices a GSD file (Electronic device data sheet) is used which describes the characteristics of a device type in a precisely defined format. Vendors provide specific GSD files to users. The system simply reads the GSD file for each device and automatically configures the bus system using this information.

An EDD (Electronic Data Description) file, which is not vendor specific, is also used to describe each device. These files, also provided by vendors, are read by the engineering tools to simplify the Profibus systems configuration, commissioning, and maintenance.

PROFIBUS-DP Specifications

Physical Layer	RS-485				
Cabling	One shielded twisted pair for signal and one pair for 24 VDC supply				
Topology	Trunk with drops				
Cable Length					
Baud Rate (Kbits/sec)	93.75*	187.5	500	1500	12000
Length (meters)	1200	1000	400	200	100
Number of Devices	32 per segment; Up to 126 with 4 repeaters				
Bus Power	Must have auxiliary 24VDC supply				
Transmission Rate	9.6K to 12M bits/second				
Data Access	Token sharing for multi-masters; peer-to-peer; multicast and cyclic polling for data transfer; acyclic for asset management				
Data Transfer Size	Up to 246 Bytes of Input & 246 Bytes of Output Depending on Device Type				
Device Identity	Specific ID Number for each device				
Error Detection	HD4 CRC (Cyclic Redundancy Check)				
Support Organization	PROFIBUS Users Group (www.profibus.com)				

Task# ORP-WTP-2007-0233

E-STARS[R] Report
Task Detail Report
08/27/2007 0825

TASK INFORMATION			
Task#	ORP-WTP-2007-0233		
Subject	Concurrence: 07-WTP-212 DESIGN OVERSIGHT REPORT: D-07-DESIGN-043, REVIEW BECHTEL NATIONAL, INC. FIELD CONTROL AND COMMUNICATION EQUIPMENT		
Parent Task#		**Status**	CLOSED 08/27/2007
Reference	07-WTP-212	**Due**	
Originator	Perez, Anez (Perez, Anez)	**Priority**	High
Originator Phone	(509) 373-0068	**Category**	None
Origination Date	08/24/2007 0648	**Generic1**	
Remote Task#		**Generic2**	
Deliverable	None	**Generic3**	
Class	None	**View Permissions**	Normal
Instructions	bcc: WTP Off File WTP Rdg File MGR Rdg File J. R. Eschenberg, WTP R. W. Griffith, WTP M. L. Ramsay, WTP		

ROUTING LISTS

1	Route List	Inactive
	• Ramsay, Mark L - Review - Cancelled - 08/27/2007 0825 *Instructions:*	
	• Griffith, Robert W - Approve - Cancelled - 08/27/2007 0825 *Instructions:*	

ATTACHMENTS

No Attachments

COLLABORATION

COMMENTS

No Comments

TASK DUE DATE HISTORY

No Due Date History

SUB TASK HISTORY

No Subtasks

-- end of report --

Task# ORP-WTP-2007-0233

E-STARS[R] Report
Task Detail Report
08/24/2007 0651

TASK INFORMATION			
Task#	ORP-WTP-2007-0233		
Subject	Concurrence: 07-WTP-212 DESIGN OVERSIGHT REPORT: D-07-DESIGN-043, REVIEW BECHTEL NATIONAL, INC. FIELD CONTROL AND COMMUNICATION EQUIPMENT		
Parent Task#		**Status**	Open
Reference	07-WTP-212	**Due**	
Originator	Perez, Anez (Perez, Anez)	**Priority**	High
Originator Phone	(509) 373-0068	**Category**	None
Origination Date	08/24/2007 0648	**Generic1**	
Remote Task#		**Generic2**	
Deliverable	None	**Generic3**	
Class	None	**View Permissions**	Normal
Instructions	bcc: WTP Off File WTP Rdg File MGR Rdg File J. R. Eschenberg, WTP R. W. Griffith, WTP M. L. Ramsay, WTP		

ROUTING LISTS

1	Route List	Active
	• Ramsay, Mark L - Review - Awaiting Response - Due Date *Instructions:*	
	• Griffith, Robert W - Approve - Awaiting Response - Due Date *Instructions:*	

ML Ramsay 8/27/07

ML Ramsay (for) 8/27/07

ATTACHMENTS

No Attachments

COLLABORATION

COMMENTS

No Comments

TASK DUE DATE HISTORY

No Due Date History

SUB TASK HISTORY

No Subtasks

-- end of report --