FOR BOARD ACTION

Agenda Item # 7. **Meeting Date:** 12/13/07

SUBJECT:

SLP Control Room Consolidation-2008

PREPARED BY:

Matt Mueller
Power Production Engineer

ITEM DESCRIPTION:

In 2001 the RPU Utility Board approved the selection of Novaspect Inc. as the supplier of the Emerson Delta V Digital Control System to control operations and protective activities on the SLP boilers and auxiliary equipment which set a direction and standard for how we would control and integrate future processes at the facility. The direction was confirmed and strengthened when Novaspect supplied the same professional services for controls for the steam line and the water treatment plant. In addition, Novaspect Inc. has provided system performance services related to preventative and corrective maintenance, software and hardware upgrades, engineering and technical support as well as access to critical parts inventory for the control equipment. With the addition of the emissions reduction equipment it is important to realign and maximize manpower efficiency to help meet the needs of the new equipment.

The control room consolidation project includes relocating the existing control systems for the gas turbines, automating and relocating the load controls for the Silver Lake turbines into the fire room, and adding synchronizing relays for the Silver Lake generators.

By consolidating control rooms a modest amount of automation can be achieved with the generation controls and it provides the benefit of the operators and firemen being able to communicate in one control room. The control room consolidation must integrate the new automation with the existing operator interfaces and graphics which require an intimate knowledge of and expertise in the existing control logic.

Under the attached agreement Novaspect Inc. would provide professional services for the software development, logic development, documentation, start-up and hardware supply as documented in the attached proposal.

This item is an approved budgeted item in the 2008 capital budget.

UTILITY BOARD ACTION REQUESTED:

Staff recommends that the Utility Board approve a contract agreement with Novaspect, Inc. for professional services in the amount of $496,000 contingent on the approval of the RPU General Manager and the City Attorney.

Larry Koshire — General Manager

10/11/07 — Date

ROCHESTER PUBLIC UTILITIES

Project Performance Summary
At the completion of this project the identified functionality from the Operator Room will be available in the Fire Room. In addition the first level of generator automation and monitoring will be incorporated into the Fire room. The following paragraphs detail the existing and new functionality that will be in the Fire Room. It will also describe the performance criteria for this functionality.

1. Relocation of Existing Operators Room Functionality

The existing operations control room is the center for load control and RPU system monitoring. The operator has access to the Silver Lake steam generators, the cascade creek gas combustion turbines, and the scada system for RPU load control. Listed below is a summary of the operations control room functionality per system area.

Silver Lake Steam Turbines

- Unit 3, & 4 MW Raise / Lower
- Unit 3 & 4 AGC
- Unit 3, & 4 Voltage Raise / Lower
- Unit 3 & 4 Generator Temperatures
- Unit 3, & 4 Net MW - new
- Annunciator Alarms

Note that the control and monitoring for units 1 & 2 is on the generator panels and is not in the existing operators control room. This also includes any additional monitoring or control functions for Unit 3 & 4 that are not listed above.

Cascade Creek Combustion Turbines

- GT 1 – Westinghouse Workstation, allows monitor and control
- GT 2 – Pratt Whitney Workstation, allows monitor and control

System Operations

- SCADA System Operations Workstation
- Phones and Intercoms, RPU system Hotline, Transmission Radio, Office phone, Intercom.

This project will move all of the above functionality to the Fire Room.

2. Relocation of Existing and New Generator Panel Functionality

The existing operations control room is close to the generator panels for all four of the steam turbine generators. This project will bring key monitor and control points from these panels in addition to new generator automation functionality to the Fire Room. This includes the following.

Silver Lake Steam Turbines

- Unit 1, 2 MW Raise / Lower
- Unit 1, 2 Voltage Raise / Lower
- Unit 3, & 4 Net MW – new
- Unit 1 & 2 Voltage Control
- Unit 1, 2, & 3 Generator Sync Check Relay - new
- Unit 1 & 2 Generator Auto Synchronization - new

3. Operational Functionality

At the completion of the Control Room Consolidation project the operator will be able to follow the list below of task for startup and control of the turbine generators for the Silver Lake Plant.

The two sections below summarize the tasks performed by the Operator including the task's location after this project is complete:

Unit 1 & 2

1. Operator brings Boiler up to Design Pressure and Temperature
2. Operator follows current Operating Procedures to Roll-up the Turbine until it is on Governor Control
3. Sync Select Switch in Auto (Field)
4. Operator can complete Turbine Ramp-up from DeltaV
5. Close the Field Breaker from DeltaV
6. Voltage Regulator will Automatically Match Generator Output to Buss Voltage in DeltaV
7. Operator can select "Auto Sync" from DeltaV
8. Auto Synchronizer will Sync the Generator Output to Buss Frequency and Close Generator Breaker
9. Operator take the Unit to a Minimum Load from DeltaV
10. Operator can Ramp Unit to Load and VAR Requirement from DeltaV
11. Operator can enter a Setpoint and select Voltage or VAR control of the Voltage Regulator from DeltaV

Unit 3 & 4

1. Operator brings Boiler up to Design Pressure and Temperature
2. Operator follows current Operating Procedures to Startup Turbine Generator, Synchronize Generator Output to Buss Voltage, and close Generator Breaker

3. Operator manually places the existing Voltage Regulator Switch at the Switchboard to "Auto"
4. Operator bring Unit to minimum load from Switchboard
5. Operator returns to Control Room
6. DeltaV will maintain balance between the output of the manual and auto Voltage Regulators
7. Operator can enter a Setpoint and select Voltage or VAR control of the Voltage Regulator from DeltaV
8. Operator can initiate AGC control from DeltaV to either SMMPA or RPU SCADA from DeltaV

4. System Performance Summary

At the project completion the system performance will include the relocation of the existing functionality from the operator control room, additional functionality from the generator control panels, and new functionality that will enhance the operator's ability to control load at the Silver Lake Plant. The existing control and monitoring of Cascade Creek and Systems Operators will remain the same but will be included within the console bay structure of the boiler control system.

The following sections summarize the new performance functionality that will be available to the operator.

Megawatt Control

The existing generator panel mounted raise and lower switches will still be available to the operators. At the DeltaV system they can initiate a raise or lower pulse to manually control megawatts. In addition they will be able to set a megawatt setpoint and ramp rate and the system will automatically raise or lower the generator output. Note that this automatic functionality only controls the generator output and is not directly tied to the boiler controls and the operator may need to bring in or take out boiler equipment to allow the load setpoint to be reached.

During Automatic Generation Control, the megawatt control will be through the remote telemetry unit. The operator will be able to monitor the load changes and switch back to load control during a disruption.

Voltage Control

All four units will have generator voltage control functionality at the DeltaV workstation. The operator will have the ability to set a Voltage or VAR setpoint and when the unit is on-line the controls will automatically adjust to the voltage or VAR setpoint. The ability to control voltage at the generator panel will also be available.

Generator Control and Automation

Additional functionality for all four units will be available in the DeltaV system to allow better monitoring of the system and minimize the operators time at the generator panels. The Megawatt and VAR metering will be upgraded to provide greater accuracy of Net MegaWatts. This will allow the operators to control closer to the load setpoint and realize potential savings from under or over generating.

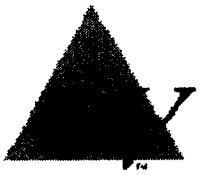
The operator will have control of the generator and field breaker on units 1 & 2, and be able to monitor the status of the breakers with units 3 & 4.

Additional key generator points will be monitored as detailed in our proposal I/O list.

Turbine Speed

The monitoring of turbine speed is available on all four units. Unit 1 & 2 will have the additional ability to roll the turbine up once it is on governor control from the Fire Room.

EMERSON.
Process Management



Proposal For

Rochester Public Utilities
Rochester, MN
Control Room Consolidation

Rev.	Date	Description	By	Reviewed By / Date
5-a	12/06/07	Modified Transducers to Serial Communication	SDL	LAL /12-06-07
4-a	11/30/07	Modified from Preliminary Engineering	SDL	JP / 12-03-07
3-a	09/04/07	Revision for Temperature Inputs	MSK	SDL / 09-06-07
2-a	08/14/07	Revised Training and Updated Document	KAS	SDL / 08-14-07
1-a	08/09/07	Revised Scope Added Auto Sync	KAS	JCO / 08-09-07
0-c	07/11/07	Original	KAS	JCO / 7-11-07

Note: Number in Rev. identifies version sent to customer. Lower case letter in Rev. identifies internal version.

Prepared By:

NOVAspect
PROCESS MANAGEMENT SOLUTIONS
An Emerson Process Management Local Business Partner

Novaspect, Inc.
An Emerson Process Management
Local Business Partner
7565 Corporate Way
Eden Prairie, MN 55344

TABLE OF CONTENTS

1. Project Overview

This proposal is for consolidating the functions from the 'Operator Control Room' into the 'Fire Room'. In the process of consolidating the functions, a level of automation will be implemented to allow better long term control and monitoring. In summary the following functions will be relocated to the Fire Room.

- Unit 1, 2, 3, & 4 MW Raise / Lower
- Unit 3 & 4 AGC
- Unit 1, 2, 3, & 4 Voltage Raise / Lower
- Unit 3 & 4 Generator Temperatures (Units 1 & 2 Generator Temps – Presented as an Option)
- Unit 1, 2 , 3, & 4 Net MW - new
- Annunciator Alarms
- GT 1 – Westinghouse Workstation
- GT 2 – Pratt Whitney Workstation
- System Operations Workstation
- Phones and Intercoms, RPU system Hotline, Transmission Radio, Office phone, Intercom.

The following functions which are currently not in the Operations Control Room will be implemented.

- Unit 1, 2, 3, & 4 MW Raise / Lower
- Unit 1, 2, 3, & 4 Voltage Raise / Lower
- Unit 1, 2, & 3 Generator Sync Check Relay - new
- Unit 1 & 2 Generator Auto Synchronization - new

Having these functions in the Operations Control Room will provide the functional specification described in Appendix D. The interface to the turbine generator control functions listed above will be through the DeltaV control system. The existing system will be expanded to accommodate the new areas. The expansion of the unit 3 & 4 areas will be setup to allow the future automation of the turbine controls.

The new DeltaV equipment will be mounted on new sub-panel that will be installed in existing cabinets in the Operations Control Room. The temperature transmitters (848Ts) will be mounted near the temperature element source to eliminate any questionable RTD/TC wiring. RPU will provide a Rosemount 3144 Fieldbus Temperature Transmitter for the River Temperature and the Outside Air Temperature RTDs.

The console bays from the Operator Control Room along with some of the existing bays in the Fire Room will be combined to form one continuous workstation area. Preliminary layouts have shown the use of two existing bays on the right side of the Operator Control Room furniture combined with two more bays from the Fire Room allowing for double stacking of certain stations.

2. Preliminary Engineering

This proposal is based on our current understanding of the stated project requirements as well as our preliminary engineering. The "Proposal Development Checklist" documents how the data for the preliminary engineering was gathered. The results of the preliminary engineering are documented in Appendix A, "Engineering Data Sheet". Disagreement with any of this data or the stated assumptions should be immediately brought to Novaspect's attention.

Continuous Control Field I/O Counts (Hardwired)	X			
Continuous Control Field I/O Counts (Serial)	X			
Continuous Control Field I/O Counts (Bus Based)	X			
Discrete Control Field I/O Counts (Hardwired)	X			
Discrete Control Field I/O Counts (Serial)	X			
Discrete Control Field I/O Counts (Bus Based)				X
External Interface Data Flow	X			
Hardware I/O Requirements	X			
Continuous Control Strategies Types and Count	X			
Discrete Control Strategies Types and Count	X			
Batch and Recipe Control Types and Count				X
Controller Requirements	X			
Graphic Interfaces Types and Count	X			
Console Types and Count	X			
Other Control System Hardware Requirements	X			
Documentation Types and Count	X			
Subcontractor Requirements or Options	X			

2.1. Customer Supplied Drawings

Drawing #	Description	Tiff#	Dwg#
E172	Wiring Diagram Panel A-F	4802	E-172
E173	Wiring Diagram Panel A-R	4803	E-173
E174	Wiring Diagram Panel B-F	4804	E-174
E175	Wiring Diagram Panel B-R	4805	E-175
SL3-E-131	Wiring Diagram Panel C-F		
E178	Wiring Diagram Panel C-R	4806	E-178
E307	Wiring Diagram Panel D-F	4807	E-307
E308	Wiring Diagram Panel D-R	4808	E-308
E309	Wiring Diagram Panel E-F	4809	
E310	Wiring Diagram Panel E-R	4810	E-310
E311	Wiring Diagram Panel F-F	4811	

E312	Wiring Diagram Panel F-R	4812	
E375	Wiring Diagram Panel G-F	4290	E-375
E376	Wiring Diagram Panel G-R	4291	E-376
E377	Wiring Diagram Panel H-F	4292	E-377
E378	Wiring Diagram Panel H-R	4293	E-378
E379	Wiring Diagram Panel J-F	38970	E-379
E380	Wiring Diagram Panel J-R	4295	E-380
E101	Single Line Sync Diagram	38394	E-101
E102	3 Line Unit 1 13.8kv Cubicle 1,2,3	3804	E-102
E104	3 Line Unit 2 13.8kv Cubicle 7,8,9	3806	E-104
E108	G1 Panel 1 & 1R	3810	
E108A		38397	E-108A
E108B		38398	E-108B
E108C		38399	E-108C
E108D		38400	E-108D
E109	RA3 Panel 2 & 2R	3811	
E110	SA-1 Panel 3 & 3R	3812	
E111	103 Panel 4 & 4R	3814	
E112	BT1-2 Panel 5 & 5R	3815	
E113	SA2 Panel 6 & 6R	3816	
E114	207 Panel 7 & 7R	3817	
E115	G2 Panel 8 & 8R	3818	
E115A		38401	E-115A
E115B		38402	E-115B
E115C		38403	E-115C
E115D		38404	E-115D
E116	209,219 Panel 9 & 9R	3819	
E118	Generator Field Switch Cubicles	3821	
E120	Phasing Diagrams	3823	
E133	Relaying and Metering Diagram Unit 1& 2 Part 1	3831	
E134	Schematic Control Diagram Generator Field & Aux Transformer Breaker	3832	
	3832 SUPERCEEDED BY:	38405	E-134A
	3832 SUPERCEEDED BY:	38406	E-134B
E136	Relaying and Metering Diagram Unit 1& 2, Part 2	3834	
E137	Relaying and Metering Diagram Unit 3	3835	
E144	Wiring Diagram Panels 10,12 & 13	3837	
E145	Wiring Diagram Panels 10R,12R & 13R	3838	
E146	Wiring Diagram Panels 11 & 11R	3839	
	3839 SUPERCEEDED BY:	38409	E-146A
	3839 SUPERCEEDED BY:	38410	E-146B
E161	Single Line 13.8kv Outdoor Switchyard		
E161	Control Schematic 13.8kv Outdoor Switchyard		
6016-E-40	Single Line & Syncronizing	4014	
6016-E-41	Elevation Main Switchboard	4015	
6016-E-45	13.8kv Switchgear & Generator Interconnection	4019	

	Diagram		
6016-E-48	Main Control Board Panels	4022	
???	Governor Motor Control		
E96	Duplex Switchboard C-F & C-R		
E396	115 & 13.8kv Circuit Numbering	4306	
E397	Supervisory Room Annunciator	4307	E-397
E420	GSU Transformer External Connection Diagram	4329	E-420
E303	Control for G3 & No.6 & Bus Tie	4042	
E304	3 Line Diagram & Metering G3 & Bus 3	4043	
E306	Outdoor Switchgear 13.8kv Bus No. 3	4045	
GE Drawings			
66G54-E-?	Phasing Diagram	4200	
66C54-E75	Plant Xfmrs & TG Excitation Cubicle - Hydrogen Cab. - Turbine Start-up Panel	4256	
44D209847 SH.1-4	Static Exciter Sht 1	9632	
	Sht 2	32180	
	Sht 3	32183	
	Sht 4	32184	
Westinghouse Drawings			
138D99	Voltage Regulator Equipment for Static Exciter		
588C361	Trinistat Voltage Regulator Equipment		
589C560	Type PRX Voltage Regulator		
784A142	Motor Operated Potentiometer		
E366	G4 86G4 Relay Schematic	4283	E-366
E366A		4284	E-366A
E366B	G4 86GT4 Relay Schematic	4285	E-366B
E369	G4 AC Schematic	4287	E-369
E369	????	28969	E-369
E370	G4 Voltage Regulator & Governor Control	4288	E-370
E381	Generator Control Panel #1	4296	E-381
E382	Generator Control Panel #2	4297	E-382
7011	Generator 1	4489	7011
7012	Generator 2	4490	7012
In Sub.	G4T3 Generator Breaker Schematic	5808	
In Sub.	G4T3 Generator Breaker Wiring Diagram	5809	
In Sub.	G4T4 Generator Breaker Schematic	5810	
In Sub.	G4T4 Generator Breaker Wiring Diagram	SL5E009	

2.2. Assumptions

2.2.1. A serial connection to a Basler DESC-200N voltage regulator has been included as part of this proposal. Set-up and tuning of the voltage regulator will be completed on-site as part of the time and expenses start-up services. A Basler service engineer will be scheduled by Novaspect to complete these efforts.

2.2.2. Unit 2's bridge will continue to be powered from Unit 1's Aux buss.

2.2.3. RPU is responsible for relocating and testing intercom, phone, and hotline wiring for the Fire Room.

2.2.4. RPU is responsible for patching the fiber signals from the Operator Control Room to the DeltaV Cabinet Room.

2.2.5. Novaspect will provide metal plates to patch existing holes on the Unit 3 & 4 existing DeltaV Cabinet and accommodate the Unit 1 & 2 Auto Synchronizer in the Switchboard.

2.2.6. Novaspect will provide and install LCD Articulating Arms for 2 DeltaV Quad Workstations.

2.2.7. RPU to provide an RPU representative to assist in loop checking the Annunciator Panel for Units 3 & 4.

2.2.8. RPU to provide a RPU Relay Technician to shoot the PTs and CTs on Unit 1, 2, 3, & 4 during loop checkout.

2.2.9. The proposal is based on the project being completed using a combination of existing configuration standards and Novaspect proven configuration standards.

2.2.10. The continuous and discrete I/O types and counts included in this proposal have been determined by Novaspect based on similar projects and an understanding of Rochester Public Utilities goals for the project.

2.2.11. This project will be completed using DeltaV version 8.4.1.

2.2.12. This proposal assumes a minimum of 4 calendar months (Award of PO to completion of customer acceptance testing) to complete the project.

2.2.13. This proposal expires on 1/31/2007.

3. Proposed Services

Described within this section are the services that are required to complete the project in an effective manner. This section will also document the tasks that Novaspect will be providing under this proposal. The proposed services are based on the results of the section 2.0 "Preliminary Engineering" as well as on your responses documented on the following "Project Performance Checklist". Please review this Checklist for those performance areas that are currently marked as "Customer Responsibility" and plan accordingly.

Note: Any services not explicitly defined as being "Included" in the following table are assumed NOT to be included in the lump sum price.

3.1. Project Performance Checklist

Project Management	X			
Kickoff Meeting	X			
Design Review Meetings	X			
Additional On-Site Project Meetings				X
I/O Database and Associated Engineering Parameters	X			
Specification of Field Instrumentation	X			
Process Graphics	X			
Motor and Other Discrete Control Logic	X			
External Interfaces	X			
Continuous Control Strategies	X			
Advanced Control Strategies				X
Production Reports				X
Historical Data Requirements	X			
Display Directory	X			
System Security				X
Control System Hardware	X			
Electrical Design	X			
Foundation Fieldbus Segment Design	X			
DeviceNet, AS-Interface, Profibus Segment Design				X
Subcontractor Specifications	X			
Detailed Design Documentation (See Appendix A)	X			
P&ID's			X	
Control System Architecture	X			
Control System Network	X			
Control System Cabinet	X			
Control System Power and Grounding	X			
Field Device Termination	X			
External Interface	X			
SAMA				X
Process Instrumentation	X			
Control System Hardware	X			
Control Room Furniture	X			
Additional User Software Programs/Packages				X
I/O Database and Associated Engineering Parameters	X			
Process Graphics	X			
Motor and Other Discrete Control Logic	X			
External Interfaces	X			

Continuous Control Strategies	X			
Advanced Control Strategies				X
Production Reports				X
Historical Data Point Entries	X			
Display Directory	X			
System Security	X			
Internal Testing	X			
Customer Acceptance Testing	X			
Site Assessment – Power and Grounding	X			
Control System and/or Control System Enclosures	X			
Electrical	X			
Foundation Fieldbus Segments	X			
DeviceNet, AS-Interface, Profibus Segments				X
Installation Supervision	X			
Certification of Electrical Contractor	X			
System Communications Testing (Included in T&E Estimate)	X			
Loop Check-out (Included in T&E Estimate)	X			
Process Control Tuning (Included in T&E Estimate)	X			
Operation Verification Testing (Included in T&E Estimate)	X			
Simulator System Development (Operator Training Tool)				X
Operators	X			
Engineers				X
Maintenance Personnel				X
System Engineering Manual	X			
Operator Manual				X

3.2. Project Management

A Project Manager will be assigned to every Project Team. The remainder of the project team will consist of Lead Engineers, Consultants, Application Engineers and Designers as required. Customer communications will be primarily through the Project Manager. All communications and meetings minutes will be documented, distributed and preserved via email. There will be one project meeting, the design review meeting for 1 day at the plant facility.

Standard change order control will be used by the Novaspect Project Manager. Depending on when a change order is received and the type of change, the affect to the project schedule and budget will be communicated to the customer.

3.3. Detailed Design

The following describes the detailed design services needed to complete a successful project. Refer to the "Project Performance Checklist" in section 3.1 for the definition of responsible parties. Refer to the "Engineering Data Sheet" in Appendix A for the details of types and quantities.

I/O Database and Associated Engineering Parameters
Development of a software database that documents the field inputs and outputs to/from the Control System. This database contains appropriate parameters including tag names, engineering units, range and alarm points.

Specification of Field Instrumentation
Development of field device specifications in sufficient detail to procure or to request supplier bids. These specifications are based on process parameters, control system needs and purchasing guidelines provided by the customer.

Process Graphics
Development of the operator interface graphics, including the Index, Overview, Area and Process graphics. These graphics will be utilized by the operator to interface with and control plant/production area operations as well as special graphics that represent other unique control functions. The development of these graphics can be completed directly on the control console or via hand sketches. Novaspect will provide two-dimensional graphic templates (dynamos) that will serve as the basis for graphic development. They will be based on the existing RPU standards. Enhancements to the dynamo templates can be completed via a change order. Alarm Management Philosophies are also defined in this area of detailed design services.

Motor and other Discrete Control Logic
Development of the discrete logic requirements of the control system including all interlock, start/stop, and on/off functions to be displayed, controlled or acted upon by the control system and/or the operator.

External Interfaces
Development of control strategies and data/information flow between the Process Automation System and other specified electronic control, display, monitoring and/or data acquisition systems. Design of the changes required to the external device is not included in this proposal.

Continuous Control Strategies
Development of all closed and open loop continuous control elements including type of control, available modes of operation, setpoint options, and other related controller parameters.

Advanced Control Strategies
Development of control strategies that utilize advanced technologies such as Neural Nets, Fuzzy Logic and Model Predictive Control.

Production Reports
Develop layout and content of shift, daily, or other production reports.

Historical Data Requirements
Develop the list of points and associated parameters whose history has been indicated by the user as beneficial in the analysis of process efficiency, quality or other attribute. Make list ready and available for implementation into the Historian Software.

Display Directory
Develop the list of process graphics to be accessed from the display directory.

System Security
Determine plant security philosophy, the levels of security required and the authority granted to each level.

Control System Hardware
Based on the results of the preliminary engineering and section 3.3 "Detailed Design" services, specify the Control System components and architectural layout required to implement. Refer to the "Bill of Materials" in Appendix for further detail.

Electrical Design
Design the electrical layout and the terminations of the equipment that will be installed. Develop a bid package for the electrical contractor.

Foundation Fieldbus Segment Design
Determine Fieldbus device assignments to segments based on process requirements, required execution rates, loading, and physical length limitations.

DeviceNet, AS-Interface, Profibus Segment Design
Determine device assignments to segments based on process requirements, segment loading, and physical length limitations.

Subcontractor Specifications
Provide schedule requirements, design criteria and the operational and physical attributes necessary for a subcontractor to quote and/or provide the equipment and/or services requested.

Detailed Design Documentation
Diagrams and Drawings developed during Detailed Design will be provided to the customer as delineated in the "Documentation" section of the "Engineering Data Sheet" in Appendix A.

Following the completion of Detailed Design phase of the project, the results are documented in the "Detailed Design Document". The Detail Design Document will be the document that is used as the basis for implementation and testing by Novaspect. The Detail Design Document is distributed to the customer for review and approval. Upon receipt of customer approval, the design services will

be considered complete and project implementation can begin. Changes to the Detail Design Document after the implementation has begun will be considered as a change of scope and may require a change order to complete.

3.4. Drawings

The following describes the drawing services needed to complete a successful project. Refer to the "Project Performance Checklist" in section 3.1 for the definition of responsible parties. Refer to the "Engineering Data Sheet" in Appendix A for the details of types and quantities. Please reference Appendix B for example drawings.

P&IDs Piping and Instrument Diagrams
Drawings that convey process, instrument, and control equipment information.

Control System Architecture ***(Appendix B drawing – Sample01)***
Drawings depicting the location and general connections of the control system cabinets, PCs, UPS units, switches, and other control system hardware.

Control System Network ***(Appendix B drawings – Sample02 & Sample03)***
Ethernet drawings depicting nodes and the location of nodes on the Ethernet Network. Includes a drawing for Ethernet pin-out and shielding specifications.

Control System Cabinet ***(Appendix B drawing – Sample04)***
Drawings required to locate and label control system hardware on the cabinet panel.

Control System Power and Grounding ***(Appendix B drawings – Sample05, Sample05_2)***
Drawings depicting the wiring of incoming AC power, DC power supplies, and specific grounding rules for the control system.

Field Device Termination ***(Appendix B drawings – Sample06)***
Control System I/O drawings, which depict the field device to be terminated at the control system I/O. These drawings consist of I/O cards, interposing relays/terminals, and field devices. These drawings do not typically include marshalling or junction box drawings located in the field unless specifically addressed in this proposal.

External Interface ***(Appendix B drawings – Sample07 & Sample08)***
Control System drawings which depict the wiring and physical architecture of the control system interface to an external system or device.

SAMA
Functional control diagrams using symbols developed by the Scientific Apparatus Maker Association (SAMA).

3.5. Procurement

Procurement of the items indicated as "Included" on the "Project Performance Checklist" and delineated in "Bill of Materials" Appendix. Procurement includes placing the order,

monitoring order status, handling supplier problems, product inspection and testing when applicable and overall assurance of proper order fulfillment.

3.6. Software Configuration

Implement, via application software provided within the Control System, those elements designed during the "Detailed Design" phase of the project (section 3.3).

3.7. Pre-Installation Testing

The Novaspect project team will perform internal testing at the Novaspect's testing facility to ensure that all aspects of the implemented Control System configuration meet the customer approved "Detailed Design Document".

Upon successful completion of internal testing, the Customer Acceptance Test will be performed in the same manner and location with guidance and support from the Novaspect project team. Successful completion of the Customer Acceptance Test will release all system software components for shipment to the customer's site. This proposal includes 2 day for Customer Acceptance Testing at the Novaspect facility in Eden Prairie, MN. Additional time may be added as a change order if required.

Novaspect will use simulation software to perform these tests. The simulation will be low fidelity, including I/O manipulation and generic tie-backs only.

3.8. Installation

All required physical installation of the control system, associated field instrumentation, as well as the connection of all field wiring to the system, are included in this proposal. Demolition has been included only to the extent required for the successful installation of new equipment and interfaces. Installation services do not include the handling of any existing hazardous materials.

3.9. Startup and System Operational Verification

Startup and system operational verification is not included in the fixed price portion of this proposal and is therefore the customer's responsibility. In order to ensure a smooth and efficient startup, we offer and recommend the optional services below.

Optional Startup Services

On a "Time and Expense" basis, Novaspect will support the loop checkout, provide initial tuning of control loops and provide operations with guidance and support during the startup period. The time allotted and the sequence of tests to be performed to verify proper Control System functionality will be defined and mutually agreed upon by Novaspect and the customer. Successful completion will be documented via customer's signature on Novaspect's "Final Customer Acceptance Form". Time and expense rates are delineated in the "Rate Schedule" contained in the Appendix.

Estimated start-up Services

There has been an estimate for start-up services and expenses included in section 4 of this proposal. This estimate is based on Novaspect providing start-up engineering services for the DeltaV and physical installation. Start-up support services for the voltage regulators will be sub-contracted to the manufacturer. Please be aware that these estimates assume that no other major maintenance activities will be done in conjunction with this project, and have not been factored into the start-up.

Due to Novaspect's close working relationship and many years of experience with the Novaspect/Emerson product lines, we have found that overall startup duration is reduced when all of the field devices are provided by Novaspect/Emerson.

3.10. Training

Operator training has been included in the fixed price portion of this proposal. To ensure maximum operation, engineering and maintenance personnel knowledge and efficiency, we recommend you consider the available Emerson Process Management standard training classes and Novaspect custom training programs.

Process simulation can be used as an initial training and on-going operator training tool. Novaspect has the ability to provide process simulation as basic as I/O manipulation with generic tie-backs (low fidelity) to mass balance simulation with failure scenarios operator response reports (medium fidelity).

Operator Training Services

On-site operator training has been included as an option in this proposal. The training included would provide 4-hours of training for each operator. The class will be repeated up to 4 times. Each training group will consist of up to 6 people. This class will be conducted using six rental stations for a two week duration. The following outlines the training schedule. The training will be conducted over four days. If deviation from this schedule is required the cost proposed will be adjusted to reflect the impact of the schedule changes.

Group1 Project Specific	Group 2 Project Specific	Group3 Project Specific	Group 4 Project Specific

The Project Specific session will cover the following topics.

- Operator Interface
- Process specific Plant Graphics Displays
- Process specific Plant DeltaV Configuration Modules
- Alarming

- Trending/Event History
- Diagnostics & Troubleshooting

Notes: Process simulation will be used during this class if available.
These courses can be amended per your needs.

3.11. Manuals

The System Engineering Manual is an updated copy of the Detailed Design Document with as-built information from the Customer Acceptance Test.

4. Financial Summary

Fixed Price Services	
Control System Project Management and Meetings	165,490.00
Preliminary Engineering	
Control System Detailed Design	
Control Configuration	
Graphic Implementation	
Pre-installation Testing and Customer Acceptance	
DeltaV Panel Design	
DeltaV Installation Drawing (see appendix)	
Installation Supervision	
Instrumentation Engineering	
Project expenses	
Supplied Equipment	
DeltaV Bill of Materials presented in Appendix C	73,865.00
Cabinet Sub-panel for Units 3, 4, & Common	4,725.00
Metal Cover Plating for DeltaV Cabinet & Unit 1&2 Auto Sync	837.00
Fieldbus Temperature Transmitters	6,120.00
Sync Check Relays Basler BE1-25 for Units 1, 2, & 3	5,594.00
Auto Synchronizers Basler BE1-25A for Units 1 & 2	12,804.00
Voltage Regulators Basler DESC-200N for Units 1 & 2	31,766.00
Power Transmitter for Units 1, 2, 3, & 4	
Watt Gross, Watt Net, VARs, Phase Amps, Phase-Phase Volts (Refer to Appendix C)	15,987.00
Control Room Evans Furniture Modification by Evans	9,725.00
Turbine Speed Signal Conditioner and Manual Field Switches	2,833.00
Installation Services	
Electrical Installation (Hunt Electric)	
DeltaV I/O, Basler Hardware , & Power Transmitters	90,660.00
Electrical Installation (All Systems) – Ethernet	3,273.00
Training Services	
Operator Training Class (see section 3.10)	$11,827.00
On-Site Startup Services	
Time and Expense Services, Refer to Appendix for Rates - *Estimate*	*32,500.00*
Loop Checkout – 2 Days Unit 1 & 2, 2 Days Unit 3, 2 Days Unit 4	
Startup – 2 Days Unit 1 & 2, 1 Day Unit 3, 1 Day Unit 4	
Loop Tuning – 1 Day Unit 1 & 2, 1 Day Unit 3, 1 Day Unit 4	
Voltage Regulator Startup – 3 Days	
Voltage Regulators & Auto Sync Setup/Tuning by Basler – *Estimate*	*16,000.00*
2 Trips – 3 Days for Unit 1 & 2, 3 Days for Unit 3 & 4	
Total Equipment and Services:	**$484,006.00**
Taxes:	**$11,930.55**
Total Equipment, Services, and Taxes:	**$495,936.55**

Options

Convert Existing DeltaV Workstation to Quad Monitor (Includes Qty 2. Dell 20" Monitors)	6,641.00
Add Turbine 1 & 2 Generator Winding Temps	8,080.00

Note:
The above project pricing is contingent upon client agreement with the attached Novaspect Terms and Conditions. Requested modifications to these Terms and Conditions will require a pricing adjustment.

Payment Schedule

On Receipt of Order	15%
Design Review	15%
Software Acceptance	30%
Shipment of Hardware and Software	30%
Successful Completion of Site Acceptance. *Note that the definition of site acceptance will be mutually agreed upon during the project design meeting.*	10%
Time and Expenses Services	Monthly

Proposal Presented by:

Scott D. Larson — 12/07/2007

Scott D. Larson — Date
Engineering Group Manager

Notes:

1. Terms and Conditions are listed in the Appendix.
2. All freight charges will be pre-paid and billed at cost.
3. Change orders will be handled via defined change request procedures. All change orders will be priced individually and agreed upon prior to commencement of the work.

Please request information from and send purchase order to:

Novaspect, Inc.
7565 Corporate Way
Eden Prairie, MN 55344
Attn: Ray Kisner
Phone 952-934-5100
FAX 952-934-1279

APPENDIX A – Engineering Data Sheet

7	6	11	15	0	39
0	0	0	0	0	0
0	0	8	16	0	24
10	10	15	15	58	108
7	7	10	10	0	34
24	23	44	56	58	205
40	40	0	0	0	80
3	3	0	0	0	6
6	6	0	0	0	12
3	3	0	0	0	6
52	52	0	0	0	104
7	6	16	28	0	57
1	1	6	6	0	14
0	0	0	0	0	0
8	7	22	34	0	71
46	46	11	11	58	172
3	3	4	4	0	14
4	4	0	0	0	8
3	3	6	6	0	18
56	56	21	21	58	212

-	-	-	-	-	-
1	1	1	1	1	5
-	-	-	-	-	-
-	-	-	-	1	1
-	-	-	-	-	-
1	1	1	1	2	6
-	-	-	-	-	-
-	-	-	-	1	1
-	-	-	-	-	-
-	-	1	1	-	2
-	-	1	1	-	2
3	3	7	7	2	22
1	1	-	-	-	2
4	4	9	9	3	29
1	1	1	1	-	4
1	1	1	1	2	6
3	3	3	3	-	12
1	1	1	1	-	4
1	1	1	1	-	4
-	-	-	-	1	1
1	1	1	-	-	3
1	1	-	-	-	2
1	1	-	-	-	2
10	10	8	7	3	38

I/O List

Description	Type		DI - 120VAC	DO - 120VAC	DI - 24VDC	DO - 24VDC
TG1 Phase A Current	AI	Serial				
TG1 Phase B Current	AI	Serial				
TG1 Phase C Current	AI	Serial				
TG1 MW Gross	AI	Serial				
TG1 Manual Speed Raise	DI	Classical	1			
TG1 Manual Speed Lower	DI	Classical	1			
TG1 86G Lock-out Tripped	DI	Classical	1			

TG1 Auto Sync Disabled (from Panel)	DI	Classical	1				
TG1 Auto Sync Lock-out	DI	Classical	1				
TG1 Field Breaker Closed	DI	Classical	1				
TG1 Field Breaker Open	DI	Classical	1				
TG1 Field Breaker Close	DO	Classical		1			
TG1 Field Breaker Open	DO	Classical		1			
TG1 Generator Breaker Closed	DI	Classical	1				
TG1 Generator Breaker Open	DI	Classical	1				
TG1 Generator Breaker Open	DO	Classical		1			
TG1 Voltage Regulator Watch Dog	DI	Classical	1				
TG1 Mvar	AI	Serial					
TG1 Phase A-B Voltage	AI	Serial					
TG1 Phase B-C Voltage	AI	Serial					
TG1 Phase C-A Voltage	AI	Serial					
TG1 Voltage SP	AO	Serial					
TG1 Field Voltage	AI	Serial					
TG1 Field Current	AI	Serial					
TG1 Voltage Matching Status	DI	Serial					
TG1 Protection Status Bit Flags - Set1	DI	Serial					
TG1 Annunciation Status Bit Flags	DI	Serial					
TG1 Protection Status Bit Flags - Set2	DI	Serial					
TG1 Unit Mode - with readback	DO	Serial					
TG1 Control Mode - with readback	DO	Serial					
TG1 Operating Mode - with readback	DO	Serial					
TG1 Unit Mode	DI	Serial					
TG1 Control Mode	DI	Serial					
TG1 Operating Mode	DI	Serial					
TG1 AVR Mode (Generator Voltage) - with readback	AO	Serial					
TG1 Var Mode (Setpoint) - with readback	AO	Serial					
Aux XFMR No. 1 Watts	AI	Classical					
Res, Aux. XFMR Watts	AI	Classical					
TG1 Speed	AI	Classical					
TG1 Auto Sync enable	DO	Classical		1			
TG1 Speed Lower	DO	Classical		1			
TG1 Speed Raise	DO	Classical		1			
TG1 Voltage Regulator Alarm Reset	DO	Classical		1			
TG1 Generator Winding Temp 1	AI	Classical					
TG1 Generator Winding Temp 2	AI	Classical					
TG1 Generator Winding Temp 3	AI	Classical					
TG1 Generator Winding Temp 4	AI	Classical					
TG1 Generator Winding Temp 5	AI	Classical					
TG1 Generator Winding Temp 6	AI	Classical					
Total TG1:			10	7	0	0	0
TG2 Phase A Current	AI	Serial					
TG2 Phase B Current	AI	Serial					

TG2 Phase C Current	AI	Serial					
TG2 MW Gross	AI	Serial					
TG2 Manual Speed Raise	DI	Classical	1				
TG2 Manual Speed Lower	DI	Classical	1				
TG2 86G Tripped	DI	Classical	1				
TG2 Auto Sync Disabled (from Panel)	DI	Classical	1				
TG2 Auto Sync Lock Out	DI	Classical	1				
TG2 Field Breaker Closed	DI	Classical	1				
TG2 Field Breaker Open	DI	Classical	1				
TG2 Field Breaker Close	DO	Classical		1			
TG2 Field Breaker Open	DO	Classical		1			
TG2 Generator Breaker Closed	DI	Classical	1				
TG2 Generator Breaker Open	DI	Classical	1				
TG2 Generator Breaker Open	DO	Classical		1			
TG2 Voltage Regulator Watch Dog	DI	Classical	1				
TG2 Mvar	AI	Serial					
TG2 Phase A-B Voltage	AI	Serial					
TG2 Phase B-C Voltage	AI	Serial					
TG2 Phase C-A Voltage	AI	Serial					
TG2 Voltage SP	AO	Serial					
TG2 Field Voltage	AI	Serial					
TG2 Field Current	AI	Serial					
TG2 Voltage Matching Status	DI	Serial					
TG2 Protection Status Bit Flags - Set1	DI	Serial					
TG2 Annunciation Status Bit Flags	DI	Serial					
TG2 Protection Status Bit Flags - Set2	DI	Serial					
TG2 Unit Mode - with readback	DO	Serial					
TG2 Control Mode - with readback	DO	Serial					
TG2 Operating Mode - with readback	DO	Serial					
TG2 Unit Mode	DI	Serial					
TG2 Control Mode	DI	Serial					
TG2 Operating Mode	DI	Serial					
TG2 AVR Mode (Generator Voltage) - with readback	AO	Serial					
TG2 Var Mode (Setpoint) - with readback	AO	Serial					
Aux XFMR No. 2 Watts	AI	Classical					
TG2 Speed	AI	Classical					
TG2 Auto Sync enable	DO	Classical		1			
TG2 Speed Lower	DO	Classical		1			
TG2 Speed Raise	DO	Classical		1			
TG2 Voltage Regulator Alarm Reset	DO	Classical		1			
TG2 Generator Winding Temp 1	AI	Fieldbus					
TG2 Generator Winding Temp 2	AI	Fieldbus					
TG2 Generator Winding Temp 3	AI	Fieldbus					
TG2 Generator Winding Temp 4	AI	Fieldbus					
TG2 Generator Winding Temp 5	AI	Fieldbus					

TG2 Generator Winding Temp 6	AI	Fieldbus				
TG2 Generator Winding Temp 7	AI	Fieldbus				
TG2 Generator Winding Temp 8	AI	Fieldbus				
Total TG2:			10	7	0	0
TG3 Generator Winding Temp 1	AI	Fieldbus				
TG3 Generator Winding Temp 2	AI	Fieldbus				
TG3 Generator Winding Temp 3	AI	Fieldbus				
TG3 Generator Winding Temp 4	AI	Fieldbus				
TG3 Generator Winding Temp 5	AI	Fieldbus				
TG3 Generator Winding Temp 6	AI	Fieldbus				
TG3 Generator Winding Temp 7	AI	Fieldbus				
TG3 Generator Winding Temp 8	AI	Fieldbus				
TG3 Mvars	AI	Classical				
TG3 MW Aux	AI	Serial				
TG3 MW Gross	AI	Classical				
TG3 Phase A Current	AI	Serial				
TG3 Phase A-B Voltage	AI	Serial				
TG3 Phase B Current	AI	Serial				
TG3 Phase B-C Voltage	AI	Serial				
TG3 Phase C Current	AI	Serial				
TG3 Phase C-A Voltage	AI	Serial				
TG3 Voltage Reg Balance	AI	Classical				
TG3 Speed	AI	Classical				
TG3 SMMPA Raise	DI	Classical	1			
TG3 SMMPA Lower	DI	Classical	1			
TG3 SCADA Raise	DI	Classical	1			
TG3 SCADA Lower	DI	Classical	1			
TG3 Field Breaker Closed	DI	Classical	1			
TG3 Field Breaker Open	DI	Classical	1			
TG3 Generator Breaker Closed	DI	Classical	1			
TG3 Generator Breaker Open	DI	Classical	1			
TG3 MO Rheo Green Light	DI	Classical	1			
TG3 MO Rheo Red Light	DI	Classical	1			
TG3 MO Rheo White Light	DI	Classical	1			
TG3 Manual Voltage Raise	DI	Classical	1			
TG3 Manual Voltage Lower	DI	Classical	1			
TG3 Manual Speed Raise	DI	Classical	1			
TG3 Manual Speed Lower	DI	Classical	1			
TG3 AGC Raise command to SCADA (Feedback)	DO	Classical		1		
TG3 AGC lower command to SCADA (Feedback)	DO	Classical		1		
TG3 in AGC to SCADA	DO	Classical		1		
TG3 in AGC to SMMPA	DO	Classical		1		
TG3 MO Rheo Lower	DO	Classical		1		
TG3 MO Rheo Raise	DO	Classical		1		
TG3 Speed Lower	DO	Classical		1		
TG3 Speed Raise	DO	Classical		1		

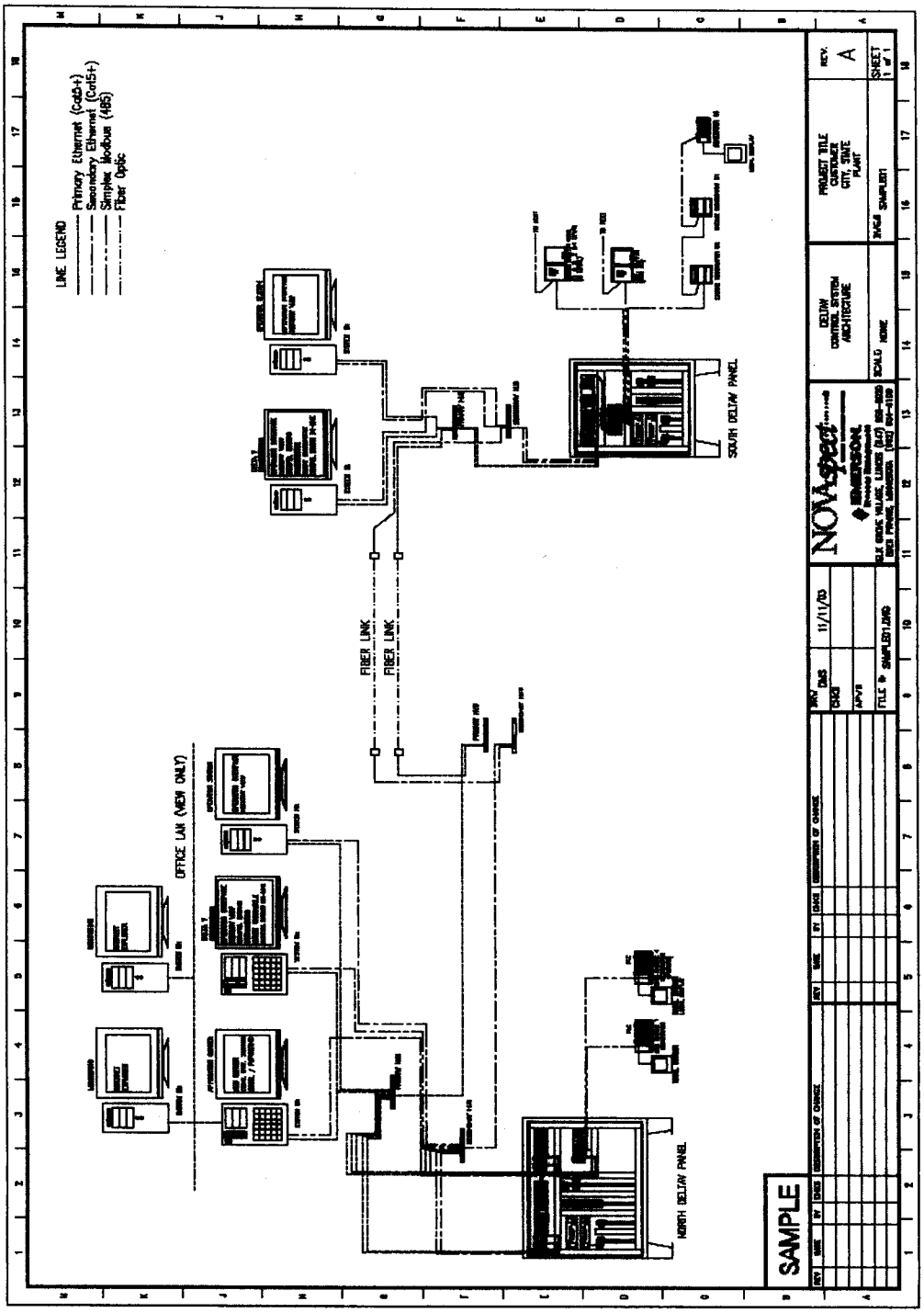
TG3 Voltage Lower	DO	Classical		1		
TG3 Voltage Raise	DO	Classical		1		
Total TG3:			15	10	0	0
TG4 Cold Gas NW	AI	Fieldbus				
TG4 Cold Gas NE	AI	Fieldbus				
TG4 Hot Gas NW (RTD 3)	AI	Fieldbus				
TG4 Cold Gas SW (RTD 13)	AI	Fieldbus				
TG4 Cold Gas SE	AI	Fieldbus				
TG4 Hot Gas SW (RTD 11)	AI	Fieldbus				
TG4 Phase 1 Winding (RTD 5)	AI	Fieldbus				
TG4 Phase 2 Winding (RTD 6)	AI	Fieldbus				
TG4 Phase 3 Winding (RTD 7)	AI	Fieldbus				
TG4 Phase 1 Winding (RTD 8)	AI	Fieldbus				
TG4 Phase 2 Winding (RTD 9)	AI	Fieldbus				
TG4 Phase 3 Winding (RTD 10)	AI	Fieldbus				
River Out Inst. Deg. C	AI	Fieldbus				
Outside Air Temp Inst. Deg. C	AI	Fieldbus				
#3 Exciter Air Out	AI	Fieldbus				
#3 Exciter Air In	AI	Fieldbus				
TG4 Mvars	AI	Classical				
TG4 MW Aux	AI	Serial				
TG4 MW Gross	AI	Classical				
TG4 Phase A Current	AI	Serial				
TG4 Phase A-B Voltage	AI	Serial				
TG4 Phase B Current	AI	Serial				
TG4 Phase B-C Voltage	AI	Serial				
TG4 Phase C Current	AI	Serial				
TG4 Phase C-A Voltage	AI	Serial				
TG4 Voltage Reg Balance	AI	Classical				
TG4 Speed	AI	Classical				
TG4 Vibration 1	AI	Classical				
TG4 Vibration 2	AI	Classical				
TG4 Vibration 3	AI	Classical				
TG4 Vibration 4	AI	Classical				
TG4 SMMPA Raise	DI	Classical	1			
TG4 SMMPA Lower	DI	Classical	1			
TG4 SCADA Raise	DI	Classical	1			
TG4 SCADA Lower	DI	Classical	1			
TG4 Field Breaker Closed	DI	Classical	1			
TG4 Field Breaker Open	DI	Classical	1			
TG4 Generator Breaker Closed	DI	Classical	1			
TG4 Generator Breaker Open	DI	Classical	1			
TG4 MO Rheo Green Light	DI	Classical	1			
TG4 MO Rheo Red Light	DI	Classical	1			
TG4 MO Rheo White Light (Exess Transfer Voltage)	DI	Classical	1			

TG4 Manual Voltage Raise	DI	Classical	1			
TG4 Manual Voltage Lower	DI	Classical	1			
TG4 Manual Speed Raise	DI	Classical	1			
TG4 Manual Speed Lower	DI	Classical	1			
TG4 AGC Raise command to SCADA (Feedback)	DO	Classical		1		
TG4 AGC lower command to SCADA (Feedback)	DO	Classical		1		
TG4 in AGC to SCADA	DO	Classical		1		
TG4 in AGC to SMMPA	DO	Classical		1		
TG4 MO Rheo Lower	DO	Classical		1		
TG4 MO Rheo Raise	DO	Classical		1		
TG4 Speed Lower	DO	Classical		1		
TG4 Speed Raise	DO	Classical		1		
TG4 Voltage Lower	DO	Classical		1		
TG4 Voltage Raise	DO	Classical		1		
Total TG4:			15	10	0	0
1-2 Bus	DI	Classical			1	
3-4 bus	DI	Classical			1	
Gen. # Shaft Voltage Monitor	DI	Classical			1	
#3 2.4 KV Station PWR XFMR Temp. High	DI	Classical			1	
#3 480 V Station PWR XFMR Temp. High	DI	Classical			1	
#4 field Ground	DI	Classical			1	
#4 PT Dead	DI	Classical			1	
#4 Gen. Exc. Rectifier Temp. High	DI	Classical			1	
#4 Gen. Exc. Transfer to Manual	DI	Classical			1	
#4 Gen. EXC. Excess Transfer Voltage	DI	Classical			1	
#4 Gen. SCT Fan Off	DI	Classical			1	
Low Plant Air Press. CEMS Enclosure	DI	Classical			1	
Low Span Cal. Gas Press. High Rack Temp.	DI	Classical			1	
CEMS HVAC Malfunction	DI	Classical			1	
#4 Main Sta. Serv. Transfer Gas Press. Low	DI	Classical			1	
#4 Main Sta. Serv. Transfer CTRL PWR Failure	DI	Classical			1	
#4 Main Sta. Serv. Transfer Oil LVL Low or Press. Relief	DI	Classical			1	
#4 Main Sta. Serv. Transfer Gas Press. Low	DI	Classical			1	
#4 Res. Sta. Serv. Transfer Top Oil Temp. High	DI	Classical			1	
#4 Res. Sta. Serv. Transfer CTRL PWR Failure	DI	Classical			1	
#4 Res. Sta. Serv. Transfer Oil LVL Low or Press. Relief	DI	Classical			1	
#4 Res. Sta. Serv. Transfer Gas Press. Low	DI	Classical			1	
U4 DC System Ground	DI	Classical			1	
U4 Battery Low Voltage	DI	Classical			1	
U4 Inverter Failure	DI	Classical			1	
U1,2,3 Battery Low Voltage	DI	Classical			1	
Fire Alarm Coal Garage Warehouse 73-74	DI	Classical			1	
DC Ground U1,2,3	DI	Classical			1	
Master Lift Station	DI	Classical			1	

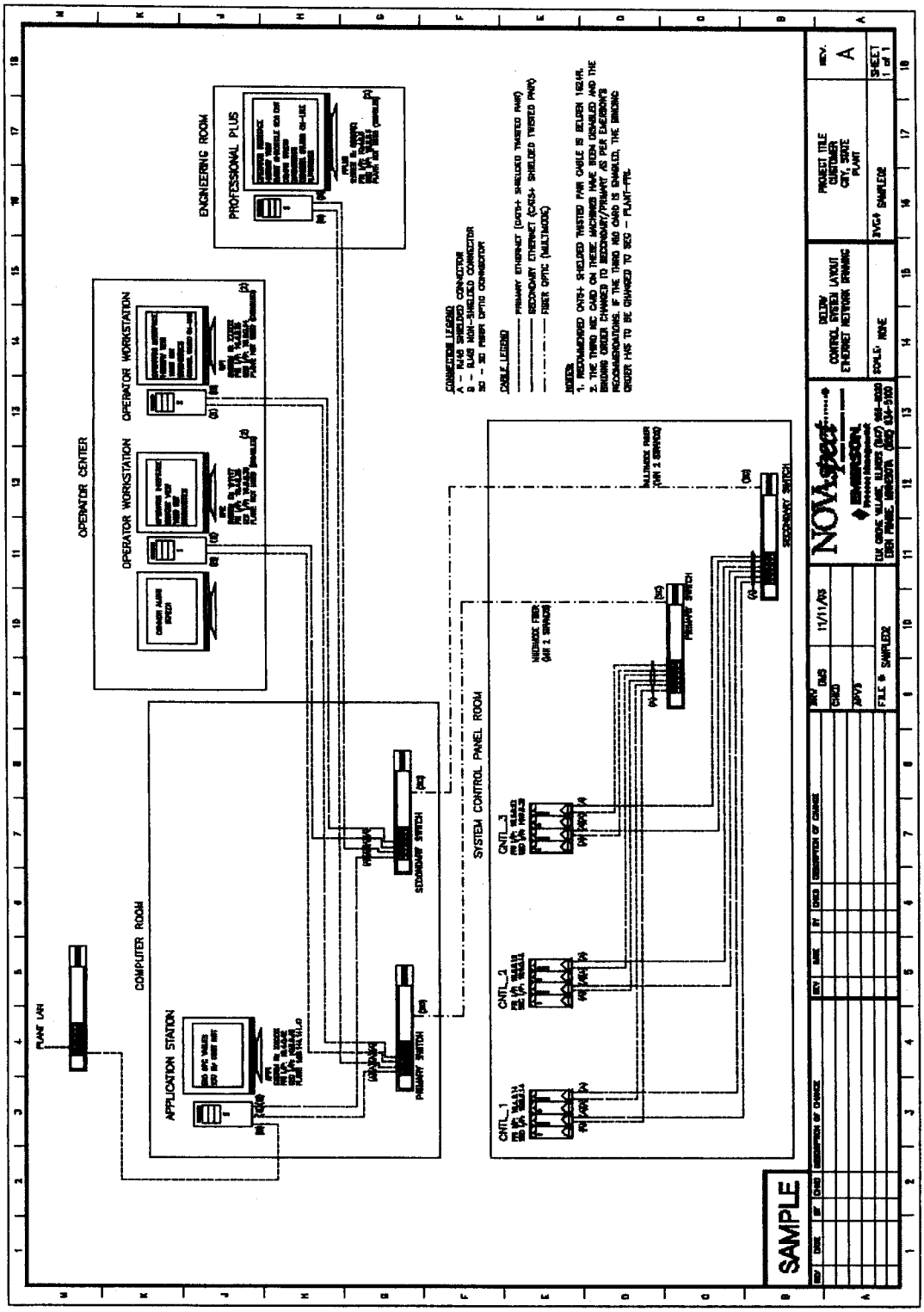
Gen. #4 Shaft Monitor	DI	Classical			1	
Gen. #4 E.T.D. Failure	DI	Classical			1	
CEMs Calibration Malfunction	DI	Classical			1	
Cooling Tower Fire Protection Air Low	DI	Classical			1	
Under Freq. Trip	DI	Classical			1	
CEMS UPS Malfunction	DI	Classical			1	
Radio Loss of AC	DI	Classical			1	
Deluge House Low Temp.	DI	Classical			1	
System Metering Load Control AC Power Failure	DI	Classical			1	
#4 Fire Protection Valves Not Open	DI	Classical			1	
#4 Fire Protection Valves Header Press. Low	DI	Classical			1	
#4 Transformers Fire Protechtion Fire	DI	Classical			1	
Plant Tie Trans.Main Header Valve Not Open	DI	Classical			1	
Stack Elevator Trouble	DI	Classical			1	
CEMS Fire Protection	DI	Classical			1	
#4 Cooling Tower Fire	DI	Classical			1	
#3 Cooling Tower Fire or Building Sprinkler	DI	Classical			1	
Low Air #3 or #4 Cooling Tower Fire Protection	DI	Classical			1	
Loss A.C. Cooling Tower Fire Protection	DI	Classical			1	
Fire Shop Ventilation	DI	Classical			1	
Low Air Shop Fire Protection	DI	Classical			1	
Bailey Room Fire Detected	DI	Classical			1	
Bailey Room Fire Protection Trouble	DI	Classical			1	
Gen. 3 Fire Protection	DI	Classical			1	
Battery Room North Smoke Alarm	DI	Classical			1	
Battery Room South Smoke Alarm	DI	Classical			1	
Gen. 4 Fire Protection	DI	Classical			1	
#3 Gen. Exc. Excess Transfer Voltage	DI	Classical			1	
#3 Gen. Exc. Transfer to Manual	DI	Classical			1	
	DI	Classical				
Total Common:			0	0	58	0
Unit 1, 2, 3, & 4 Total:			50	34	58	0
			DI - 120VAC	DO - 120VAC	DI - 24VDC	DO - 24VDC

APPENDIX B – Example Drawings

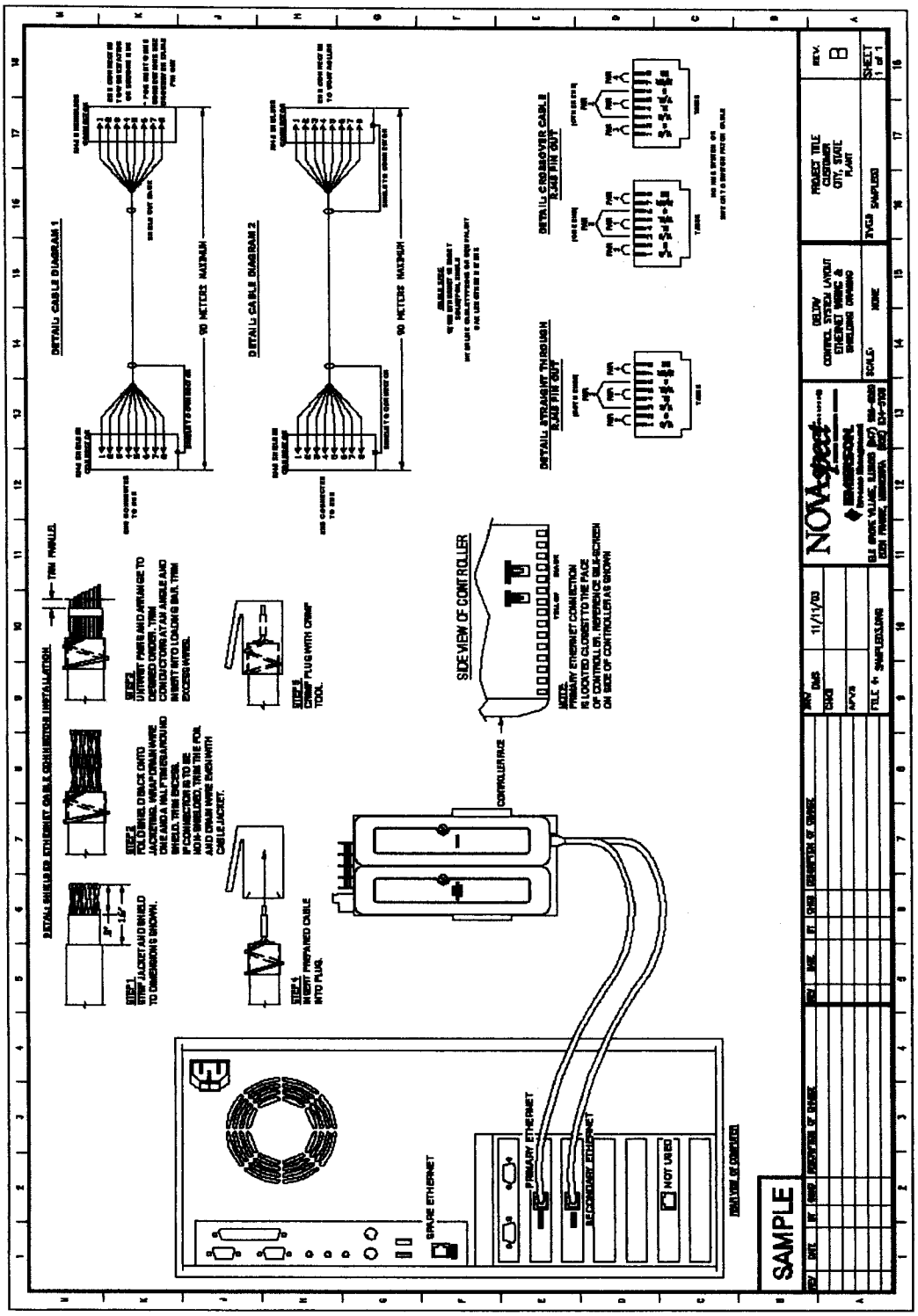
Sample01 – DeltaV Control System Architecture



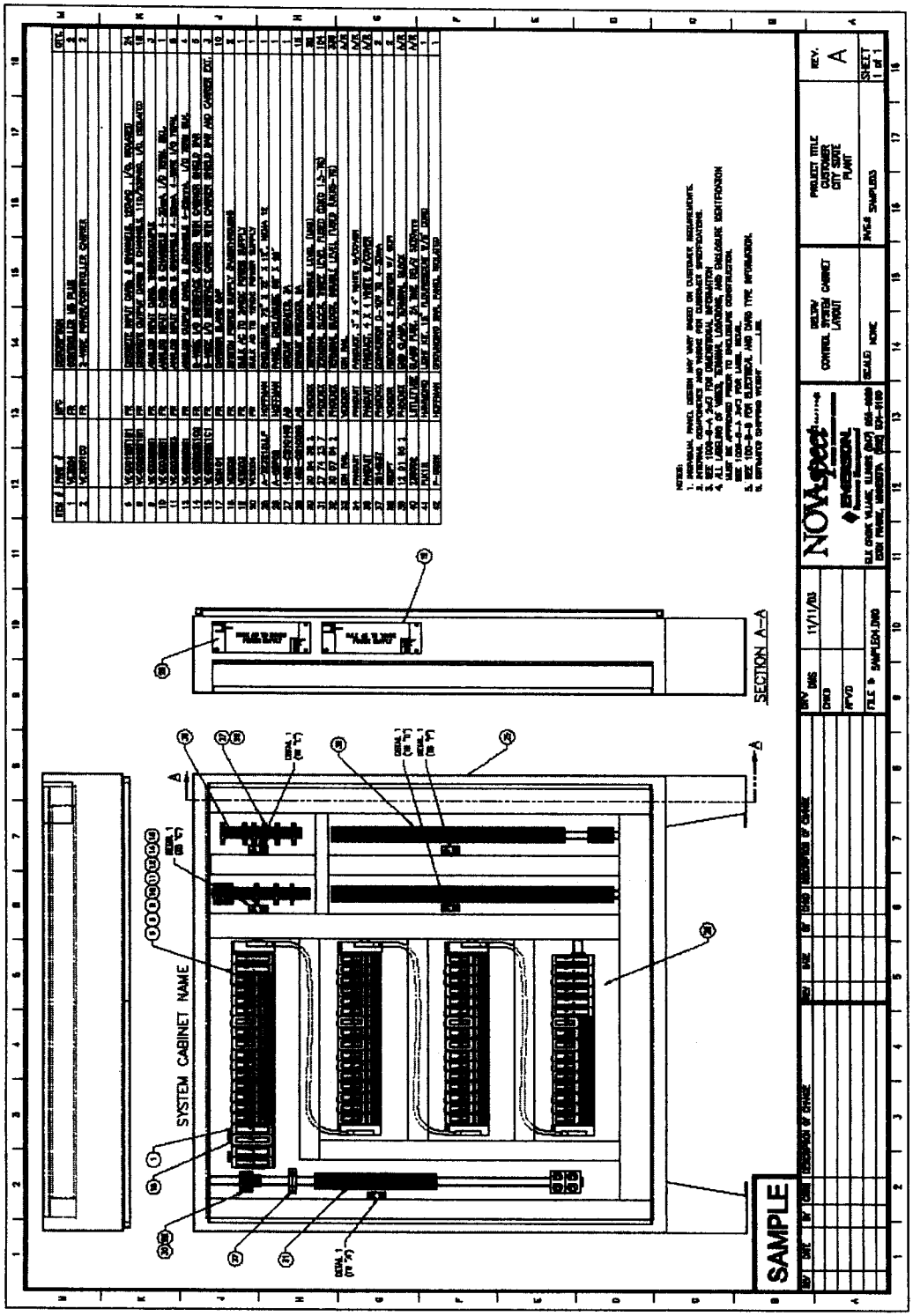
Sample02 – DeltaV Control System Network Drawing



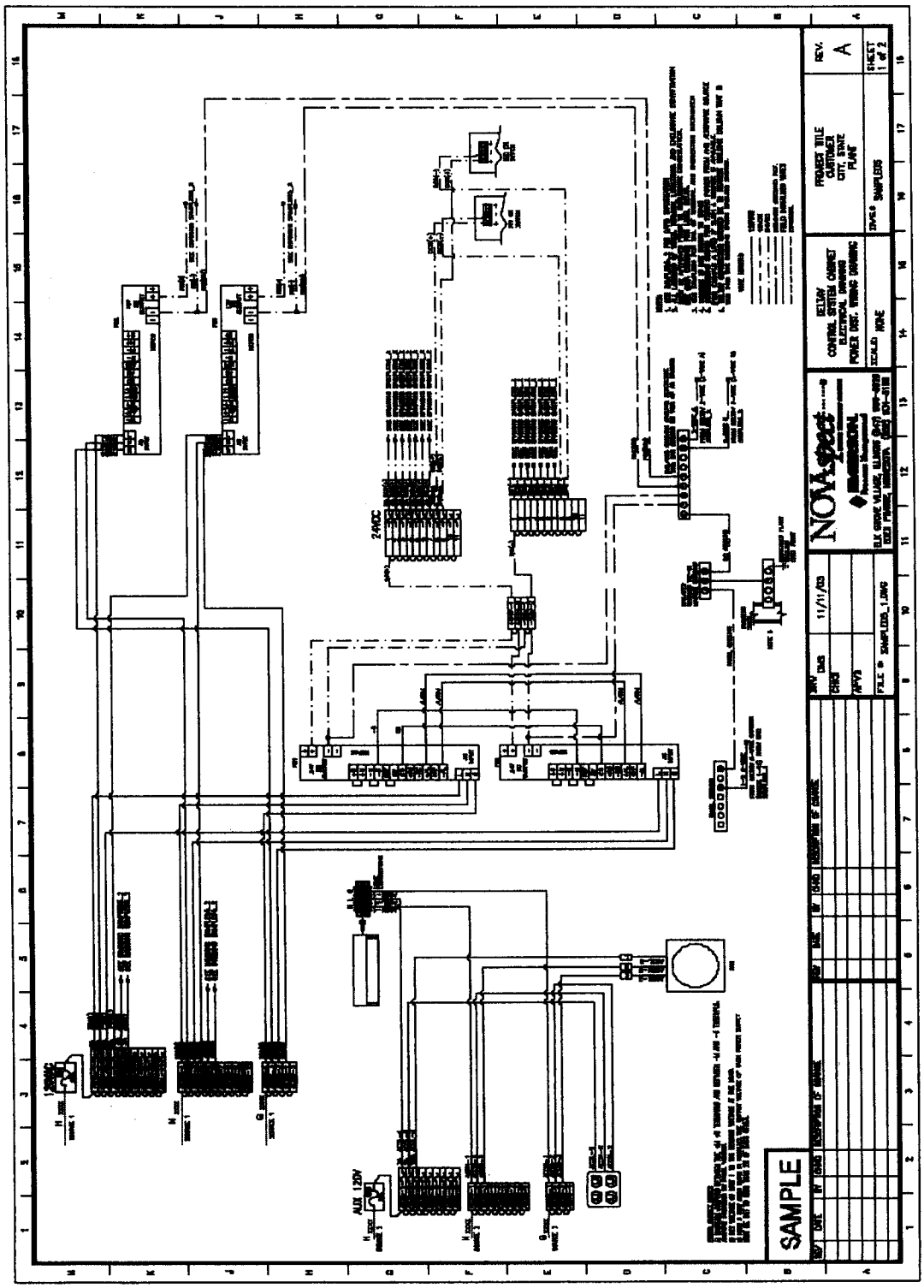
Sample03 – DeltaV Control System Network Drawing



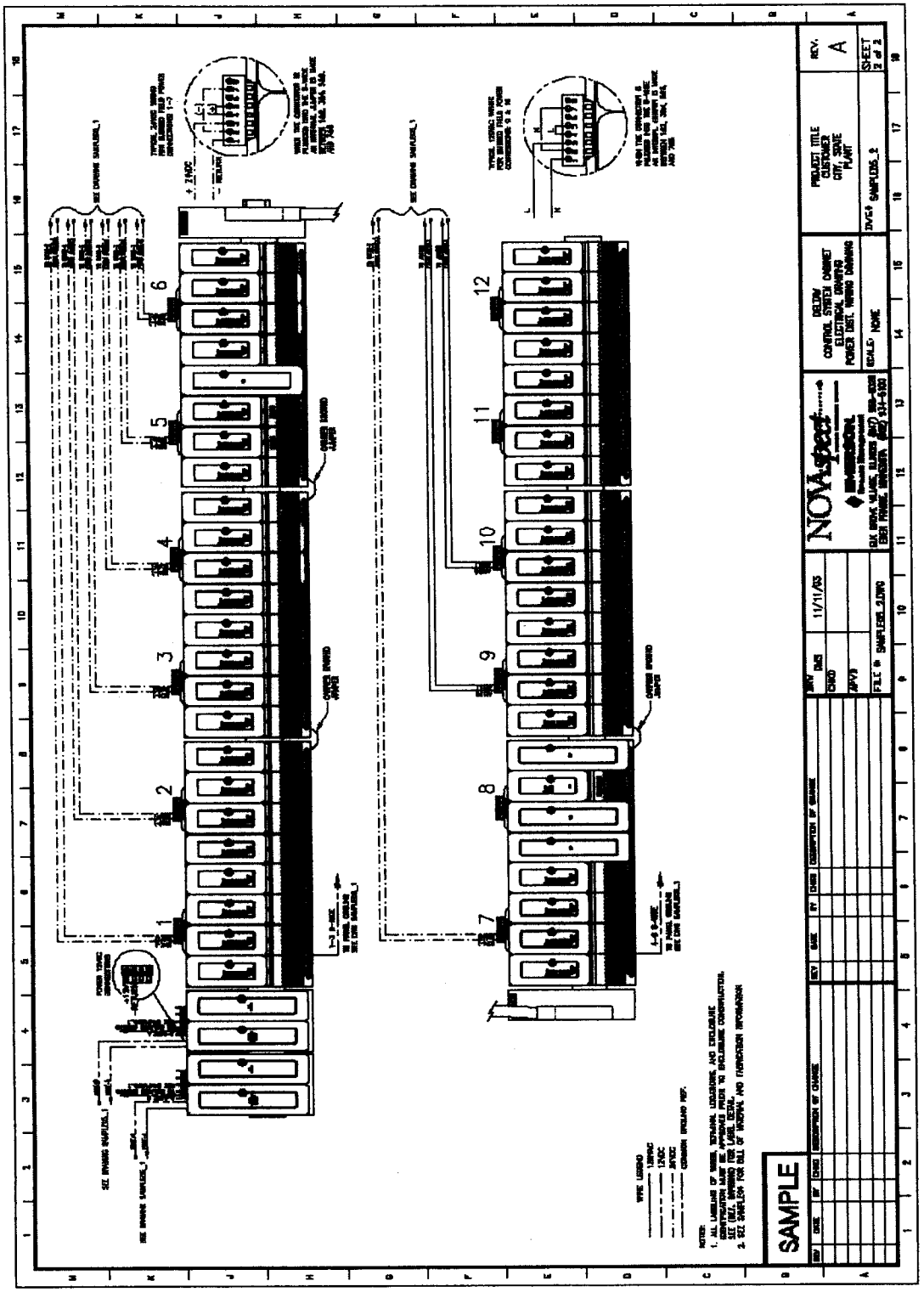
Sample04 – DeltaV Control System Cabinet Layout



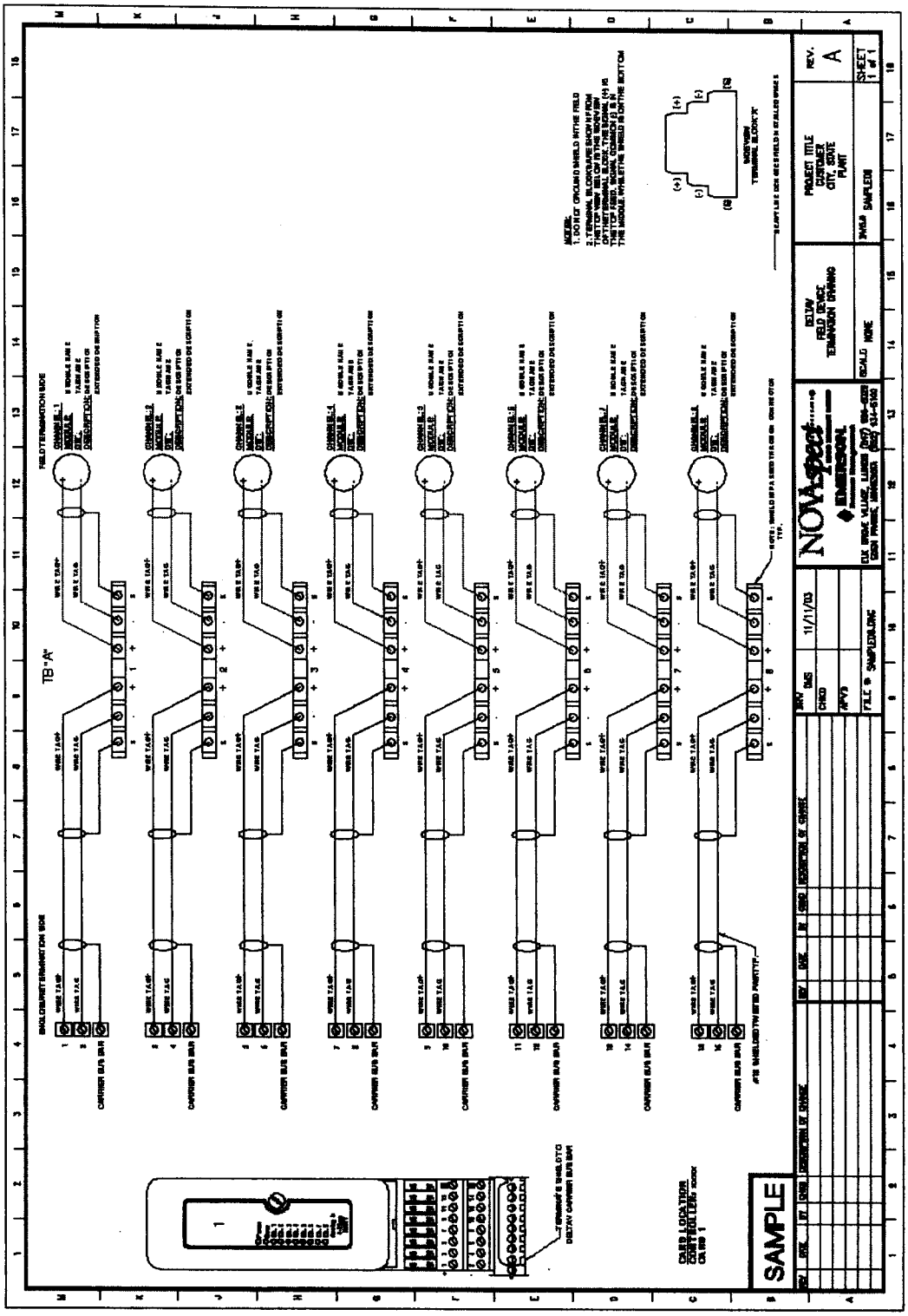
Sample05 – DeltaV Control System Power and Grounding Drawing



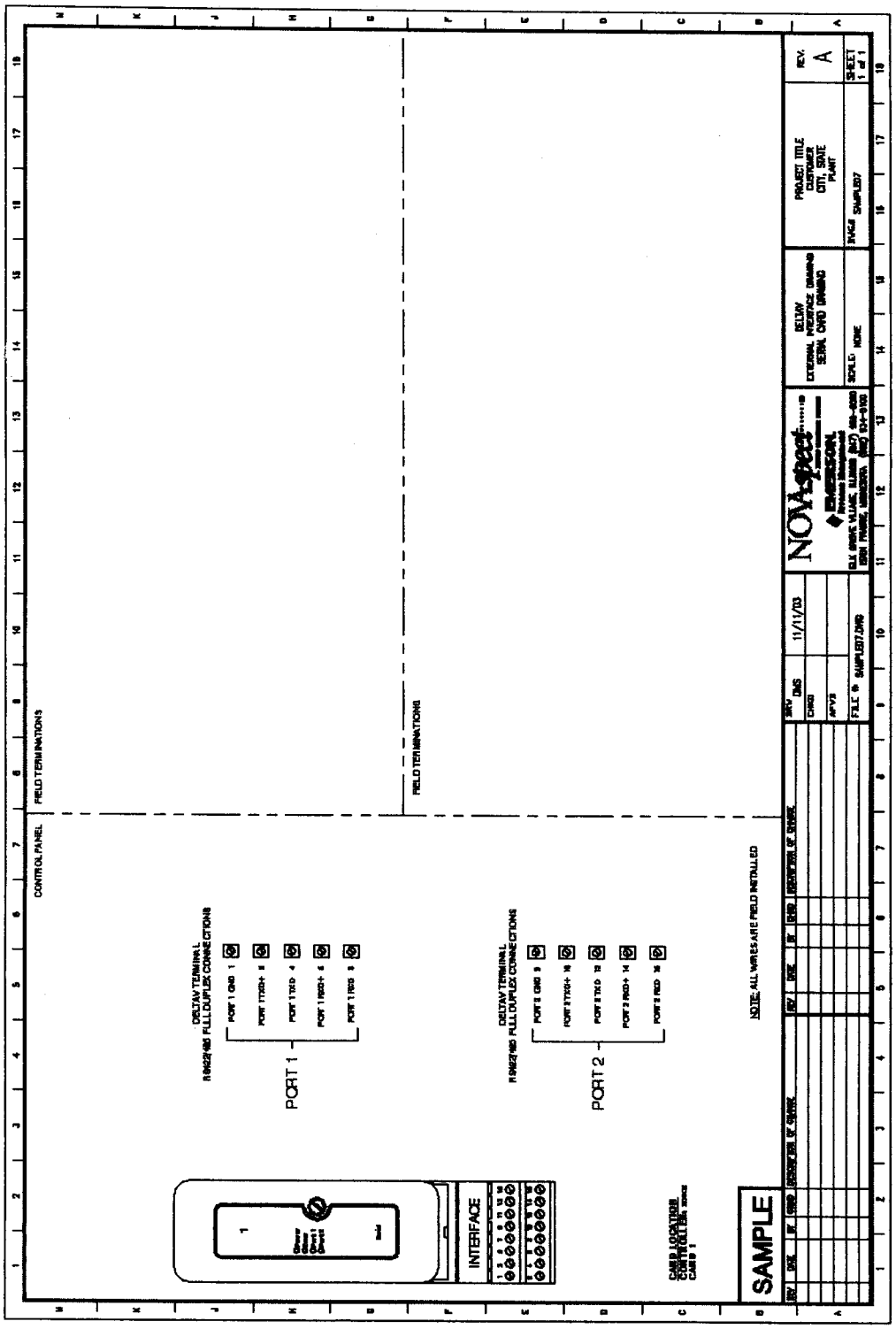
Sample05_2 – DeltaV Control System Power and Grounding Drawing



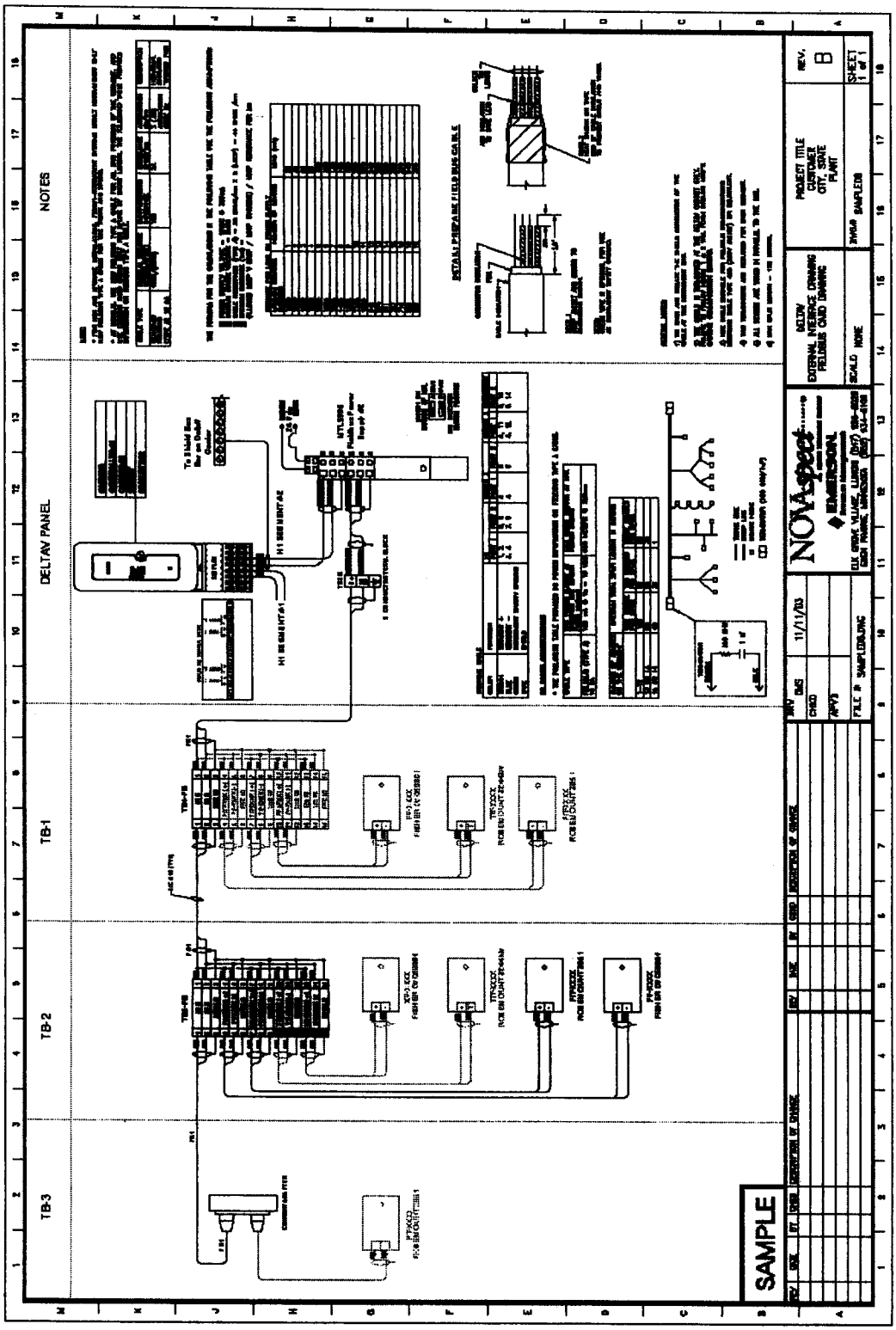
Sample06 – DeltaV Field Device Termination Drawing



Sample07 – DeltaV External Interface Drawing (Serial Card Drawing)



Sample08 - DeltaV External Interface Drawing (Fieldbus Card Drawing)



APPENDIX C – Bill of Materials

DeltaV Hardware

Item	Qty	Description
1	2	**VE3051C0**
		2-Wide Power/Controller Carrier
2	2	**VE3006**
		MD Plus Controller
3	1	**VE31RED**
		Controller Redundancy
4	2	**VE5008**
		24/12 Vdc System Power Supply
5	2	**VE5011**
		DIN-rail Mounted Bulk AC-to-24 Vdc Power Supply
6	1	**29 38 96 3**
		Power Redundancy Module
7	2	**VE6019**
		1-Port Fiber, 4-Port Copper Switch
8	3	**VE4050S2K1C0**
		8-Wide I/O Interface Carrier with Carrier Shield Bar
		Boiler 1 I/O Hardware (Installed in Existing CCS Cabinet)
9	2	**VE4001S3T1B1**
		Discrete Input Card: 8 Channels 120 Vac; Isolated; I/O Termination Block
10	1	**VE4003S2B3**
		Analog Input Card: 8 Channels 4-20 mA; HART 4-wire I/O Termination Block
11	1	**VE4006P2**
		Serial Interface with 2-Ports and Termination Block
12	2	**VE4102**
		Serial Interface Port License
		Boiler 2 I/O Hardware (Installed in Exsisting CCS CAbinet)
13	2	**VE4001S3T1B1**
		Discrete Input Card: 8 Channels 120 Vac; Isolated; I/O Termination Block
14	1	**VE4003S2B3**
		Analog Input Card: 8 Channels 4-20 mA; HART 4-wire I/O Termination Block
15	1	**VE4006P2**
		Serial Interface with 2-Ports and Termination Block
16	2	**VE4102**
		Serial Interface Port License
		Boiler 3 I/O Hardware
17	2	**VE4001S3T1B1**
		Discrete Input Card: 8 Channels 120 Vac; Isolated; I/O Termination Block

18	2	**VE4002S2T1B2**
		Discrete Output Card: 8 Channels 115/230 Vac; Isolated; Fused I/O Termination Block
19	1	**VE4003S2B3**
		Analog Input Card: 8 Channels 4-20 mA; HART 4-wire I/O Termination Block
20	1	**VE4017P0**
		Simplex H1 Fieldbus I/O Interface (Series 2) with Termination Block
21	1	**KLD2-FBPS-1.25.360**
		Fieldbus Power Supply
		Boiler 4 I/O Hardware
22	2	**VE4001S3T1B1**
		Discrete Input Card: 8 Channels 120 Vac; Isolated; I/O Termination Block
23	2	**VE4002S2T1B2**
		Discrete Output Card: 8 Channels 115/230 Vac; Isolated; Fused I/O Termination Block
24	1	**VE4003S2B3**
		Analog Input Card: 8 Channels 4-20 mA; HART 4-wire I/O Termination Block
25	1	**VE4003S2B2**
		Analog Input Card: 8 Channels 4-20 mA; HART; Fused I/O Termination Block
26	1	**KLD2-FBPS-1.25.360**
		Fieldbus Power Supply
		Common I/O Hardware
27	1	**VE4006P2**
		Serial Interface with 2-Ports and Termination Block
28	2	**VE4102**
		Serial Interface Port License
29	2	**VE4001S2T2B5**
		Discrete Input Card: 32 Channels 24 Vdc; Dry Contact; 40-pin Mass Termination Block
30	8	**2304115**
		Adapter, V8L-INPUT, Relay to Mass Termination Block
31	4	**2298438**
		Cable, 2M one 20 Pos and Two 14 Pos Connectors
32	64	**2966171**
		Relay, 24VDC Coil, 6 Amp Contacts
		Licensing
34	1	**VE31UPS062**
		Discrete Monitor Input Scaleup 100 DST
35	1	**VE31UPS061**
		Discrete Monitor Input Scaleup 25 DST
36	2	**VE31UPS071**
		Discrete Control Output Scaleup 25 DST
37	2	**VE31UPS081**
		Analog Monitor Input Scaleup 25 DST
38	2	**VE21UPS036**

		ProfessionalPLUS Station 100 DST Scaleup
39	12	**VE21UPS010**
		Operator Workstation Software Scaleup 100 DST
40	1	**VE2523M99L01 (Optional)**
		4-Monitor Workstation without Monitors; Precision WS390 Minitower; English Win XP Pro; E6300 1.86GHz (min) Dual-Core CPU; Ext. Spkrs; 73G (min) SAS Drive; 2G RAM; 48/32 (min) DVD-CDRW; Redund Control Network Ports; 3rd E-net Port
40A	1	**VE2523M44L01 (Alternate)**
		4-Monitor Workstation with 4 Non-Touch Dell Monitors; Precision WS390 Minitower; English Win XP Pro; E6300 1.86GHz (min) Dual-Core CPU; Ext. Spkrs; 73G (min) SAS Drive; 2G RAM; 48/32 (min) DVD-CDRW; Redund Control Network Ports; 3rd E-net Port
41	1	**VE2104K01 (Optional)**
		Quad-Monitor Workstation License
42	2	**Dell 20" LCD Monitor (Optional)**

Additional Hardware and Services

Item	Qty	Description
		Common Equipment & Services
1	1	**Control Room Furniture**
		Modify Evans Furniture - Remove 2 - 24" Bays from Foreman's Control Room Furniture and incorporate into the Fire Room Furniture
2	4	**EVO Series 5507 LCD Articulating Arm**
		Intuitive Movement (No Buttons or Levers), Extends to 18", Collapses to 3", Vertical Range 13.5", Cable Management
3	1	**Ethernet Cable Installation - All Systems**
		Qty. 2 Shielded Cat 5e Cables from Foreman's Office to Bailey Room Cabinet; Qty. 2 Shielded Cat 5e Cables in Foreman's Office from DeltaV Panel to Work Station new location; Qty. 4 Unshielded Cat 5e Cable and Qty. 1 Profibus Cable (Provied by Novaspect) pulled from Bailey Room Cabinet to the Fire Room for Westinghouse, Pratt Whitney PC, Pratt Whitney Printer, SCADA, and RPU Net PC
4	1	**Electrical Installation - Hunt Electric**
5	1	**Metal Plating for DeltaV Cabinet and Installation of Unit 1 & 2 Auto Syncronizers - Control Center**
6	1	**Unit 3 & 4 DeltaV Subplate**
		Unit 1 Hardware
7	1	**Turbine Speed Electro-Sensor Model SA420**
		P/N 800-084000; 115VAC; Din Rail Mountable; 4-20 mA Field Powered
8	1	**Auto/Off/Manual Sync Switch - ElectroSwitch**
9	1	**Volt Raise/Lower Switch - ElectroSwitch**

10	1	**Turbine Voltage Regulator - Basler**
		P/N DECS-200N-C-1 Power Bridge-20 Ampere Capacity, and negative forcing Voltage Regulation 0.25%, true RMS sensing Generator voltage softstar tGenerator to bus voltage matching Underfrequency limiting Under excitation limiting Over excitation limiting (on-line and off-line) Stator Current Limiter Field Current Regulator (includes softstart also) Var and Power Factor Controller Metering, real time at local LCD or at personal computer Preposition setpoints (maintain or release) Setpoint position indication Communication, RS-232 Port, RS-485 port (ModBus™) Protection Generator over/undervoltage Field overvoltageField overcurrent Rotating Diode Fault Detector (ripple detector) Failure to build voltage Loss of voltage sensing to internal FCR Mode (Manual) Control Provisions for external hardwired contacts and switches Oscillography Sequence of Events
11	1	**Turbine Sync Check Relay - Basler**
		P/N BE1-25-M1E-A6P-N5N0F Verifies Proper Phase Angle and Voltage Direct Reading Thumbwheel Switches for Setting Angle and Delay Respond as quick as 1 cycle of 50/60 Hz Accuracy < 1 Degree
12	1	**Turbine Auto Syncronizer - Basler**
		P/N BE1-25A-A1F5V0D0 Anticipatory Close Signal provides smooth synch with min system impact Patented real-time adaptive proportional speed control algorithm Highly Flexible Design Configured for Optimum Performance Standard 19 inch Rack-Mounted Case
		Transducers
13	1	MegaWatt Range: 0-10 MW
14		MegaVar Range: -8-8 MV
15		Phase A Amps Range: 0-500 Amps
16		Phase B Amps Range: 0-500 Amps
17		Phase C Amps Range: 0-500 Amps
18	1	Aux KW Range: 0-1200KW
19	1	Reserve Aux Range: KW 0-1200KW
		Unit 2 Hardware
20	1	**Turbine Speed Electro-Sensor Model SA420**
		P/N 800-084000; 115VAC; Din Rail Mountable; 4-20 mA Field Powered
21	1	**Auto/Off/Manual Sync Switch - ElectroSwitch**
22	1	**Volt Raise/Lower Switch - ElectroSwitch**

23	1	**Turbine Voltage Regulator - Basler**
		P/N DECS-200N-C-1 Power Bridge-20 Ampere Capacity, and negative forcing Voltage Regulation 0.25%, true RMS sensing Generator voltage softstart Generator to bus voltage matching Underfrequency limiting Under excitation limiting Over excitation limiting (on-line and off-line) Stator Current Limiter Field Current Regulator (includes softstart also) Var and Power Factor Controller Metering, real time at local LCD or at personal computer Preposition setpoints (maintain or release) Setpoint position indication Communication, RS-232 Port, RS-485 port (ModBus™) <u>Protection</u> Generator over/undervoltage Field overvoltage Field overcurrent Rotating Diode Fault Detector (ripple detector) Failure to build voltage Loss of voltage sensing to internal FCR Mode (Manual) <u>Control</u> Provisions for external hardwired contacts and switches Oscillography Sequence of Events
24	1	**Turbine Sync Check Relay - Basler**
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		Transducers
26	1	MegaWatt Range: 0-15 MW
27		MegaVar Range: -8-8 MV
28		Phase A Amps Range: 0-500 Amps
29		Phase B Amps Range: 0-500 Amps
30		Phase C Amps Range: 0-500 Amps
31	1	Aux KW Range: 0-1200KW
		Unit 3 Hardware
32	1	**Turbine Speed Electro-Sensor Model SA420**
		P/N 800-084000; 115VAC; Din Rail Mountable; 4-20 mA Field Powered

33	1	**Turbine Sync Check Relay - Basler**
		P/N BE1-25-M1E-A6P-N5N0F Verifies Proper Phase Angle and Voltage Direct Reading Thumbwheel Switches for Setting Angle and Delay Respond as quick as 1 cycle of 50/60 Hz Accuracy < 1 Degree
34	1	**Rosemount 848TFNAS001**
		Transducers
35	1	MegaWatt Range: 0-30 MW
36		MegaVar Range: -20-20 MV
37		Phase A Amps Range: 0-1500 Amps
38		Phase B Amps Range: 0-1500 Amps
39		Phase C Amps Range: 0-1500 Amps
40		Phase A-B Volts Range: 0-20 KV
41		Phase B-C Volts Range: 0-20 KV
42		Phase C-A Volts Range: 0-20 KV
43	1	Aux KW Range: 0-2500 KW
44	1	Exciter Balance Range: -50-50 VDC
		Unit 4 Hardware
45	1	**Turbine Speed Electro-Sensor Model SA420**
		P/N 800-084000; 115VAC; Din Rail Mountable; 4-20 mA Field Powered
46	2	**Rosemount 848TFNAS001**
		Transducers
47	1	MegaWatt Range: 0-70 MW
48		MegaVar Range: -40-40 MV
49		Phase A Amps Range: 0-3000 Amps
50		Phase B Amps Range: 0-3000 Amps
51		Phase C Amps Range: 0-3000 Amps
52		Phase A-B Volts Range: 0-20 KV
53		Phase B-C Volts Range: 0-20 KV
54		Phase C-A Volts Range: 0-20 KV
55	1	Aux KW Range: 0-6000 KW
56	1	Exciter Balance Range: -50-50 VDC

APPENDIX D – Operational Functional Specification

The two sections below summarize the tasks performed by the Operator including the task's location after this project is complete:

Unit 1 & 2

1. Operator brings Boiler up to Design Pressure and Temperature
2. Operator follows current Operating Procedures to Roll-up the Turbine until it is on Governor Control
3. Sync Select Switch in Auto (Field)
4. Operator can complete Turbine Ramp-up from DeltaV
5. Close the Field Breaker from DeltaV
6. Voltage Regulator will Automatically Match Generator Output to Buss Voltage in DeltaV
7. Operator can select "Auto Sync" from DeltaV
8. Auto Synchronizer will Sync the Generator Output to Buss Frequency and Close Generator Breaker
9. Operator take the Unit to a Minimum Load from DeltaV
10. Operator can Ramp Unit to Load and Var Requirement from DeltaV
11. Operator can enter a Setpoint and select Voltage or Var control of the Voltage Regulator from DeltaV

Unit 3 & 4

1. Operator brings Boiler up to Design Pressure and Temperature
2. Operator follows current Operating Procedures to Startup Turbine Generator, Synchronize Generator Output to Buss Voltage, and close Generator Breaker
3. Operator manually places the existing Voltage Regulator Switch at the Switchboard to "Auto"
4. Operator bring Unit to minimum load from Switchboard
5. Operator returns to Control Room
6. DeltaV will maintain balance between the output of the manual and auto Voltage Regulators
7. Operator can enter a Setpoint and select Voltage or Var control of the Voltage Regulator from DeltaV
8. Operator can initiate AGC control from DeltaV to either SMMPA or RPU SCADA

APPENDIX E – Rate Schedule

Any rates specified in an existing and current Service Contract will supersede the corresponding rate below.

SERVICE DESCRIPTION	Scheduled Hourly Rate	Demand Hourly Rate
Drawing Services / Project Support Services	$83.00	
Control System Designer	$110.00	$125.00
Instrumentation Engineering	$135.00	$150.00
Valve Asset Manager / Valve Diagnostic Engineer	$135.00	$150.00
Control System Engineering (See * Note 4)	$160.00	$210.00
Control System Field Service Engineer (See * Note 4)	$175.00	$225.00
Project Manager / Lead Project Engineer	$175.00	
Custom Training Courses	$185.00	
Control Loop Performance Consulting	$200.00	
Process Consulting (Steam Generation, Refining, Batch)	$225.00	

Primetime – Hourly Rate times 1 (Straight time)
Monday - Friday, 7:00 AM to 6:00 PM (8 hour maximum)

Overtime - Hourly Rate times 1.5 (Time and one-half)
Monday - Friday hours exceeding 8 hours but less than 12 hours
Saturday, 7:00 AM to 6:00 PM (8 hour maximum)

Premium Overtime - Hourly Rate times 2 (Double time)
Monday - Friday hours exceeding 12 hours
Saturday hours exceeding 8 hours
Sundays and Novaspect scheduled holidays

* Note 1 - A four (4) hour minimum charge (including travel time) applies to demand services.
* Note 2 - A four (4) hour minimum charge will be applied for calls canceled or re-scheduled with less than 24 hours prior notification.
* Note 3 – The appropriate multiplier applies to all minimum charges.
* Note 4 – Rates are subject to discount for large projects and Service Agreements based upon project size or services committed under a Service Agreement.
* Note 5 – For time and material engagements, Novaspect will invoice one hour for project management time for every 20 hours of engineering services provided.

Phone technical support is available at the defined rate for the service type required. A two (2) hour minimum will be charged for Primetime hours and a four (4) hour minimum will be charged for non-Primetime hours.

TRAVEL AND EXPENSE CHARGES

- Travel time is calculated portal to portal at prevailing rates.
- All travel and living expenses will be invoiced at cost plus 10% as incurred by Novaspect.
- Auto mileage will be invoiced at the IRS rates per mile (currently $0.485/mile).

EQUIPMENT RENTAL CHARGES

- Control system equipment is available for rental. Pricing upon request.
- Control system test equipment is available for rental (i.e. Combustion Gas Analyzer)

APPENDIX F – Terms and Conditions

The Professional Services Agreement No. 11262007 dated November 27, 2007, negotiated between Novaspect at 7565 Corporate Way, Eden Prairie, MN 55344 and the City of Rochester, Minnesota will be used for the Rochester Public Utilities, Silver Lake Power Plant at 425 West Silver Lake Drive NE, Rochester, MN 55906-3675, Control Room Consolidation Project.

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RESOLUTION

BE IT RESOLVED by the Public Utility Board of the City of Rochester, Minnesota, to approve a contract agreement with Novaspect, Inc. and request the Mayor and the City Clerk to execute the agreement for

Professional Services for Software Development, Logic Development, Documentation, Start-up and Hardware Supply for the Silver Lake Plant Control Room Consolidation.

The amount of the contract agreement to be FOUR HUNDRED NINETY SIX THOUSAND AND 00/100 DOLLARS ($496,000.00) contingent upon the approval of the RPU General Manager and the City Attorney.

Passed by the Public Utility Board of the City of Rochester, Minnesota, this 13th day of December, 2007.

President_____

Secretary_____