

# ADAC 4000

## Advanced Deaerator Control



Boiler Book  
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# CONTENTS

## FEATURES AND BENEFITS 3

Standard Features 3

Optional Features 3

## PRODUCT OFFERING 4

Standard Features, Single Tank System 4

Optional Features, Single Tank System 4

Standard Features, Duo Tank or DA-and-Surge System 4

Optional Features, Duo Tank or DA-and-Surge System: 5

## ENGINEERING DATA 5

## SAMPLE SPECIFICATIONS 6

The CB ADAC 4000 Advanced Deaerator Control provides a PLC based control system for a deaerator, surge tank, two tank deaerator-and-surge, or Duo-tank installations. The system is capable of controlling operation of boiler feed and/or transfer pumps, maintaining tank levels, monitoring and responding to system demands, and recording/annunciating alarm conditions.

The ADAC can run as a stand-alone system or connect to a CB-HAWK Master Panel or customer building automation system for monitoring purposes.

## ***FEATURES AND BENEFITS***

### **Standard Features**

- Integration of various deaerator and surge tank devices in a common control system
- Touch screen graphical Human Machine Interface (HMI)
- Deaerator and surge tank water level modulating controls
- Basic Chemical feed pump control
- Boiler feed pump control - up to 6 pumps via variable speed drive, soft starters, combination starters, or contactors
- Surge tank feed pump control (transfer pumps) - up to 3 pumps
- Pump alternating, lead/lag, and automatic rotation
- Ethernet, BAS, web server communications capability
- Control of remote devices (valves, etc.)
- Alarm/fault annunciation and history with audible alarm
- Red/Yellow/Green stack light for visual status indication
- Resettable Cumulative pump run time totals for maintenance purposes

### **Optional Features**

- 10" PanelView Plus in lieu of 7" (10" is standard on two tank systems)
- Alarm bell, horn, or electric sounder
- GEMS Mini Sure Site level indicator with 4-20 mA transmitter, DP Level transmitter or discrete level switches
- Steam or water flow transmitters
- Manual hard wired controls for any 4-20 mA controlled valve
- Siemens motorized make-up valve
- RSLinx OPC compliant remote monitoring software
- Recirculation bypass (tank one only)
- NEMA 4/12 entrance panel
- NEMA 4x electrical panel

## ***PRODUCT OFFERING***

### **STANDARD FEATURES, SINGLE TANK SYSTEM**

- Compact Logix L33ER processor
- 7" color touch screen HMI
- Stack light

#### **Programming and I/O cards for the following:**

- I/O for 1-6 pumps using contactors, soft starters, or combination starters
- Hard wired fixed location level inputs for Hi and Low water alarms
- Low water pump cutoff audible alarm output
- Stack light outputs
- Recirculation bypass output
- Chemical feed relay
- Boiler 1-6 'Feed Water Required' inputs for hard piped one pump per boiler systems using contactors, combination starters or soft starters only.
- Pump proving switch inputs for up to 6 feed pumps
- Analog inputs for tank pressure, temperature, level, and discharge header pressure

### **Optional Features, Single Tank System**

**NOTE: Options must be selected in order; each option requires all of the preceding ones.**

|          |  |
|----------|--|
| Option 1 | Feedwater make up valve analog output      |
| Option 2 | 1-6 pump proving flow switch inputs        |
| Option 3 | Single tank system emergency make up valve |
| Option 4 | 1-3 VFD driven pumps I/O                   |
| Option 5 | 4-6 VFD driven pumps I/O                   |

### **STANDARD FEATURES, DUO TANK OR DA-AND-SURGE SYSTEM**

- Compact Logix L33ER processor
- 10" color touch screen HMI
- Stack light

#### **Programming and I/O cards for the following:**

- I/O for 1-6 boiler feed pumps and 1-3 transfer pumps using contactors, soft starters, or combination starters
- Hard wired fixed location level inputs for HI and LO water alarms, and low water pump cutoff for 2 tanks
- Audible alarm output
- Stack light outputs
- Recirc bypass output

- Chemical feed relay
- Boiler 1-6 'Feed Water Required' inputs for hard piped one pump per boiler systems using contactors, combination starters, or soft starters only
- Pump proving switch inputs for up to 6 feed pumps and 3 transfer pumps
- DA tank pressure analog input
- Tank temperature, level, discharge header pressure inputs for 2 tanks
- 1 customer configured analog input

**Optional Features, Duo Tank or DA-and-Surge System:**

**NOTE: Options must be selected in order; each option requires all of the preceding ones.**

|          |   |
|----------|---|
| Option 1 | Feedwater make up valve analog output Tank 2                    |
| Option 2 | Tank 1 Emergency make up valve analog output for 2 Tank systems |
| Option 3 | Tank 2 Emergency make up valve analog output for 2 Tank systems |
| Option 4 | I/O for 1-3 feed pumps and 1 transfer pump VFD driven           |
| Option 5 | I/O for 4-6 feed pumps and 2-3 transfer pump VFD driven         |

***ENGINEERING DATA***

- Supply voltage: 120 VAC (102 VAC - 132 VAC), 50 or 60 Hz
- Maximum total connected load: 500 VA
- Operating temperature limits: 32 to 130°F
- Humidity: 85% relative humidity continuous, non-condensing
- 0.5G continuous vibration

## *SAMPLE SPECIFICATIONS*

# **CB ADAC 4000 ADVANCED DEAERATOR CONTROL**

### ***PART 1 GENERAL***

#### 1.1 GENERAL

- A. Each ADAC system shall be factory equipped with a pre-configured Programmable Controller and Human Machine Interface.
- B. System shall provide control logic for the following:
  - 1. 1-6 feed pumps and 1-3 transfer pumps
  - 2. Make up water level control for DA tank or DA and Surge
  - 3. Low Water, Hi Water, and Aux Low Water alarms
  - 4. Chemical feed control

### ***PART 2 PRODUCTS***

#### 2.1 STANDARD SYSTEM AND OPTIONS

- A. Hardware Platform - Standard System
  - 1. Compact Logix L33ER Processor
  - 2. Power Supply
  - 3. Discrete Input Module
  - 4. Discrete Output Module
  - 5. Analog Input Module 4 Channel
  - 6. Analog Input Module 8 Channel
  - 7. Analog Output Module 2 Channel
  - 8. Analog Output Module 8 Channel
  - 9. Right Termination End Cap
  - 10. HMI Display, 7" Color - Standard on single tank systems
  - 11. HMI Display, 10" Color Standard on two tank systems, optional on single tank systems
- B. Optional Components
  - 12. Veris Current Switch - sized for pump
  - 13. Electric actuators for pump water recirculation bypass - sized for system
  - 14. PowerFlex 70, 400, or 700 Variable Speed Drive

#### 2.2 SENSORS AND TRANSMITTERS

- A. Tank level indication
  - 1. Standard
    - a. DA tank - GEMS Mini Sure Site with transmitter
    - b. Surge tank - GEMS Mini Sure Site with transmitter
  - 2. Optional
    - a. DA tank - Differential pressure level transmitter
    - b. Surge tank - Differential pressure level transmitter
- B. Tank Pressure and Temperature (see table)

**Tank Pressure/Temperature Transmitters**

|   | Standard | Optional       |
|---|----------|----------------|
| DA tank pressure transmitter                  | E&H      | Rosemount-3051 |
| DA pump discharge pressure transmitter        | E&H      | Rosemount-3051 |
| Surge tank transfer pump pressure transmitter | E&H      | Rosemount-3051 |
| DA tank temperature transmitter               | E&H      | Rosemount-3144 |
| Surge tank temperature transmitter            | E&H      | Rosemount-3144 |

- C. Pump flow proving sensors
  - 1. Pressure switch mounted after each pump or differential pressure switch across pump or Veris current switch on the high voltage pump motor leads.
- D. E&H flow transmitters - sized per application

2.3 VALVES

- A. Make-up water valves - all sized per application
  - 1. DA tank make-up valve - Siemens SK electronic actuator with optional 3 valve bypass and strainer
  - 2. DA tank emergency or raw water make-up valve - Siemens SK electronic actuator with optional 3 valve bypass and strainer
  - 3. Surge tank make-up valve - Siemens SK electronic actuator with optional 3 valve bypass and strainer

2.4 PUMPS

- A. Feed water pumps - Grundfos
- B. Transfer pumps - Grundfos

2.5 SOFTWARE DEVELOPMENT PLATFORM

(software not required - for informational purposes only)

- A. RSLogix 5000 (controller logic programming)
- B. Factory Talk View ME (HMI programming)
- C. Factory Talk View SE (control room display and data acquisition)
- D. RSLinx OEM version (OPC server - Building Automation System)

2.6 MAJOR FUNCTIONS THAT THE ADAC SYSTEM SHALL PROVIDE:

(controller functions based on customer configuration and purchase of options)

- A. Feed water pump control
  - 1. System will be able to support up to 6 pumps, selected using the HMI (no PC or additional software required). Upon selection, graphics and control logic will be activated automatically.
  - 2. Pumps may be part of a common header or may feed individual boilers. If part of a common header pumps may be configured to operate in a lead/lag sequence based on system demand. If one pump per boiler hard piped, NO VFD option is available and no lead lag or alternation.
  - 3. Order of pump alternation can be automatically rotated to share running time and wear equally between pumps.

4. For a common boiler feedwater pump discharge system, PLC monitors 4-20 mA pressure/flow signal from boiler feedwater header to determine when to command pumps to start/stop. In a VFD system the 4-20 mA pressure/flow signal will determine VFD output.
  5. If the pumps are feeding individual boilers, pumps will be turned on/off based on individual discrete 110 VAC signals from each boiler.
  6. PLC/VFDs can only control pumps that are in AUTO mode. Pumps in manual will run continuously. The hard wired Aux Low Water pump cutoff will prevent pumps from running in any mode if water level drops below set point.
- B. Transfer pump control
1. System will be able to support up to 3 pumps for transferring water from the Surge tank to the DA. Pumps are selected using the HMI; no PC or additional software required. Upon selection, graphics and control logic will be activated automatically.
  2. Pumps may be configured to operate in a lead/lag sequence based on system demand. In addition, order of pump alternation can be automatically rotated to share running time and wear equally between pumps.
- C. DA make-up water level control
1. The lead pump runs continuously. If DA tank level falls below set point, make up valve is already fully open, and condensate tank discharge pressure falls below set point, the PLC will command the lag pump to start.
  2. When surge tank discharge pressure falls below set point, the PLC will sound an alarm. Operator must respond to the alarm condition and reset the alarm.
  3. When level control is in manual mode, the make up valve can be opened or closed from the HMI screen, or optionally by a manual potentiometer. Either method will allow the operator to manually adjust the valve between fully open and fully closed to control the incoming flow of make up water.
  4. An optional Surge tank MUV biasing mode is available. A bias may be enabled (user defined) to force the primary MUV feeding the DA tank to close as level falls in the surge tank. The bias factor applied to the primary MUV position increases as the level in the surge tank gets lower. This prevents the surge tank from pumping down to low water cutout so it can continue to run while condensate is returned to it. The secondary valve would in this case be plumbed to the DA from a separate source and add water to the DA to be heated, deaerated and sent to the boilers instead of adding cold water to the surge tank.
- D. Surge tank make up water level control
1. The PLC receives a 4-20 mA signal indicating surge tank water level. Signal is compared to the operator input set point and valve modulates accordingly to control the incoming flow of make-up water.
  2. When the valve is in manual mode the HMI or optional manual potentiometers will allow the operator to manually adjust the valve between fully open and fully closed.
- E. Pump Lead/Lag and Alternating Control
1. Selection of pumps and rotation schedule are configurable from the HMI. PLC will monitor all pumps and determine availability; pumps may be taken out of rotation for maintenance.



2. When system is in auto rotation, if a pump is not available the PLC will alternate to the next available one. If no pumps are available an alarm will sound, requiring manual reset. PLC will maintain equal run time between all pumps.
  3. If Lead/Lag option is selected, pump start/stop set points are set from the HMI. Start point is based on percentage of set point achieved by previous pump in sequence. PLC internal timers will maintain minimum load fluctuations.
  4. If Lead/Lag and VFD options are selected, VFD% to start/stop lag pump is set from the HMI. When lag function is activated, VFDs function in unison modulation until the speed reaches VFD stop point; then lag pump shuts off.
  5. When pump alternation is selected, alternation schedule is configured from the HMI. When current pump run time is met, next pump will start and come up to speed; previous pump will then stop.
- F. Chemical Feed Control
1. One set of dry contacts wired to terminal blocks will be provided to change state when any boiler feed pump is running, enabling customer chemical feed pump.

## 2.7 ADDITIONAL ADAC SYSTEM FUNCTIONS:

- A. A pressure sensor mounted in steam space monitors Deaerator pressure.
- B. A set of contacts on each pump's overload relay provides indication of pump failure. If VFDs or soft starters are used, a fault contact is monitored by the PLC to indicate pump failure.
- C. A set of contacts on each pump starter indicates pump running. If VFDs or soft starters are used, a contact is monitored by the PLC to indicate run status.
- D. A selector switch is mounted at each pump starter to allow Hand-Off-Auto switching. 'Hand' ignores all external signals except Aux Low Water Cutoff, 'Off' ignores all signals and prevents pump from running, 'Auto' allows pump to run based on commands from the PLC.

## 2.8 ALARM FEATURES

- A. DA Tank water level alarms
  1. Low Water — If water level as indicated by the tank level device falls to a pre-set point, the PLC will sound an alarm, display a message on the HMI, log a message to the alarm history file, and turn on the appropriate stack light.
  2. Low Low Water — If water level falls further to the pre-set Low Low Water point, the PLC will sound an alarm, display a message on the HMI, log a message to the alarm history file, and turn on the appropriate stack light.
  3. Hi Water — If water level as indicated by the tank level device rises to a pre-set point, the PLC will sound an alarm, display a message on the HMI, log a message to the alarm history file, and turn on the appropriate stack light.
  4. Aux Low Water — If water level falls to the pre-set Aux Low Water point, the hard wired Aux Low Water device will open, signalling the PLC and shutting down all pumps for that tank. The PLC will sound an alarm, display a message on the HMI, log a message to the alarm history file, and turn on the appropriate stack light.
- B. Surge Tank water level alarms (same as above)

## 2.9 ADAC COMMUNICATION OPTIONS

- A. Ethernet connectivity
  1. PLC features an OPC compliant Ethernet/IP port for connection to a Building/

- Plant Automation System or Local Area Network.
  - 2. Remote monitoring/data logging available using Factory Talk View SE software.
  - 3. Connection to CB HAWK Master Panel (*Note: Existing Master Panels would require a program upgrade and possibly a processor upgrade to use this option*).
  - 4. Compliance with IEEE 802.3 Physical and Data Link, TCP/IP protocol, and Control and Information Protocol (CIP) standards.
- B. Other communication options
- 1. Communication to most major building management system interfaces such as Johnson Controls Metasys, ASHRAE Bacnet, LON, and Siemens will be available via a Cleaver-Brooks Protonode. Check with Cleaver-Brooks for specific information.
  - 2. Data can be transferred by Ethernet through a CB Master Panel to a customer BAS. If a Master Panel is unavailable, the Protonode can be configured to communicate directly between the ADAC and the customer BAS.



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