

## System Detail & Design Specification: BioWaste Control System

Document: Biowaste\_FRS\_Short  
 Revision: 0  
 Effective Date: 08/27/07  
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Written By: M. Molloy

### 2.2. Data Decomposition

#### 2.2.1) BioWaste System Data Decomposition

The BioWaste System data will be structured using separate files for handling discrete functions and operations. This structure will aid in understanding and modification of the ladder logic.

##### 2.2.1.1 Data Table Structure

The data table structure is as follows:

Data Table Number	Type	Name	Description	Comment
0	Output	OUTPUT	PLC Outputs	Automatic assigned register
1	Input	INPUT	PLC Inputs	Automatic assigned register
2	Status	STATUS	PLC Status Register	Automatic assigned register
3	Binary	MISC BIN	Misc Binary Data	Automatic assigned register
4	Timer	MISC TIMER	Misc Timer Data	Automatic assigned register
5	Counter	COUNTER	Misc Counters	Automatic assigned register
6	Control	CONTROL	Control Registers (not used)	Automatic assigned register
7	Integer	INTEGER	Misc Integers	Automatic assigned register
8	Floating Point	FLOAT	Misc Floating Point Data	Automatic assigned register
9	Floating Point	CNTRL SETP	Process Control Setpoints	Stores all control setpoints
10	Binary	ALARMS	Alarms	Set when an alarm is present
11	Binary	ALARM ACKN	Alarm Acknowledge	Set when a specific alarm is acknowledged
12	Binary	AL ACK LAT	Alarm Acknowledge Latch	Latched when an alarm is acknowledged
13	Timer	ALARM DEL	Alarm Delay Timers	Time delays for each alarm
14	Floating Point	SCALED PV	Scaled Process Variable	Analog inputs in engineering units
15	Binary	ALRM ACTIV	Alarm Activation	Each alarm has a bit which can turn it on and off
16	Floating Point	ALARM SETP	Alarm Setpoint	Stores all alarm setpoints
17	Floating Point	SCALED CV	Scaled Control Variable	Analog outputs in engineering units & Analog Overrides
18	Integer	CNTRL MODE	Control Mode	Operator Control Mode integer values
19	Binary	ALARM SIL	Alarm Silence	Each alarm has a bit for silence
20	Binary	PV FNC KEY	Panelview Function Keys	Each Panelview screen function key has a bit assigned
21	ASCII	ALM ACT ST	Alarm Activation Status	B15 converted to ASCII strings
22	Binary	ONE SHOTS	One Shots	One Shots used throughout the code
23	Integer	OUT OVRD	Output Override	PLC Output override integers
24	ASCII	OUTPT STAT	Output Override Status	N23 converted to ASCII strings
25	ASCII	ASCII STOR	ASCII Storage	Stored ASCII strings
26	ASCII	A CNTRL MD	ASCII Control Mode	N18 converted to ASCII strings

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Data Table Number	Type	Name	Description	Comment
27	Binary	ALARM PREQ	Alarm Prerequisite interlocks	Interlocks for Alarms
28	Binary	OUT INTRLC	Output Control Interlocks	Interlocks for Output Control
29	Binary	OC_INTRLCK	Operator Control Interlocks	Operator Interlocks for invalid selection
30				
31				
32				
33				
34				
35				
36				
37	Binary	NQ MSK ALM	Non Quality Masked Alarm Bits	PID Control Block
40	Integer	INP INMIN	Analog Input: Input Minimum	Input SCP Instruction: Input Minimum
41	Integer	INP INMAX	Analog Input: Input Maximum	Input SCP Instruction: Input Maximum
42	Floating Point	INP SCMIN	Analog Input: Scaled Minimum	Input SCP Instruction: Scaled Minimum
43	Floating Point	INP SCMAX	Analog Input: Scaled Maximum	Input SCP Instruction: Scaled Maximum
44	Floating Point	OUT INMIN	Analog Output: Input Minimum	Output SCP Instruction: Input Minimum
45	Floating Point	OUT INMAX	Analog Output: Input Maximum	Output SCP Instruction: Input Maximum
46	Integer	OUT SCLMIN	Analog Output: Scaled Minimum	Output SCP Instruction: Scaled Minimum
47	Integer	OUT SCLMAX	Analog Output: Scaled Maximum	Output SCP Instruction: Scaled Maximum
50	Floating Point	CS RNG MIN	Control Setpoint Range Minimum	Range Limit for control setpoint entry
51	Floating Point	CS RNG MAX	Control Setpoint Range Maximum	Range Limit for control setpoint entry
52	Floating Point	AS RNG MIN	Alarm Setpoint Range Minimum	Range Limit for alarm setpoint entry
53	Floating Point	AS RNG MAX	Alarm Setpoint Range Maximum	Range Limit for alarm setpoint entry
54	Timer	OUTPUT_DEL	Output Delay Timers	Time delays for each digital output
63	Integer	PRETIME	Pretreatment Setpoints	Pretreatment setpoint integer values
64	Integer	OUT OVRD 2	Output Override 2	PLC Output override integers 2
65	ASCII	OUT STAT 2	Output Override Status 2	N64 converted to ASCII strings
66	Timer	PT TIME	Pretreatment Timers	Time delays for sequence
100	Integer	I/O CONFIG	PLC Slot 1,2,3 & 4 Setup	Initialization for Slot 1 & Slot 2 1746-NI16I, Slot 3 1746-N8, Slot 4 1746-NO8I

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### 4. Detailed Design

#### 4.1. System Architecture

The BioWaste Control System will consist of (1) Allen Bradley SLC505 PLC and (2) PanelView 1000 Operator Interface Terminals.

The PLC and PanelView will communicate over an Ethernet cable internal to the main BioWaste System cabinet.

##### 4.1.1) OIT Hardware

System	Manufacturer	Model	Firmware	Type	Description
E5061	Allen Bradley	2711-K10C16	4.1	Panelview	1000, Color, RS-232, DF1

##### 4.1.2) OIT Software

System	Manufacturer	Model	Revision
E5061	Allen Bradley	Panelbuilder 32	3.82

##### 4.1.3) PLC Hardware

System	Manufacturer	Model	Slot	Type
E5061	Allen Bradley	1747-L551	0	Processor
E5061	Allen Bradley	1746-NI16I	1	Analog Input
E5061	Allen Bradley	1746-N2	2	Slot Blank
E5061	Allen Bradley	1746-N04I	3	Analog Output
E5061	Allen Bradley	1746-IB16	4	Discrete Input
E5061	Allen Bradley	1746-OB32	5	Discrete Output
E5061	Allen Bradley	1746-OB32	6	Discrete Output
E5061	Allen Bradley	1746-N2	7	Slot Blank
E5061	Allen Bradley	1746-N2	8	Slot Blank
E5061	Allen Bradley	1746-N2	9	Slot Blank
E5061	Allen Bradley	1747-A10	NA	Rack
E5061	Allen Bradley	1746-P4	NA	Power Supply

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### 4.1.4) PLC Software

Manufacturer	Model	Revision	Type
Rockwell Software	RSLogix500	#7.00.00	PLC Programming
Rockwell Software	RSLinx	#2.50.00	Communication

### 4.1.5) Communication Configuration

System	Description	Driver	Speed	Node	Subnet Setting
E5061	1747-L552	DH-485	19.2KB	1	NA
E5061	1747-L552	Ether-Net	10Mb	100.100.100.100	255.255.255.0

## 4.2. Power Loss

In the event of a power loss the system will return to the state prior to power loss. The Panelview will return to the Main screen.

### 4.2.1) Power Up

The Process PLC is operational upon the application of power. The program will execute, based on inputs and operator interface settings, on the application of power.

The PanelView terminals are operational upon the application of power. The main screen is the start up screen.

### 4.2.2) Power Down

The PanelView consoles and PLC processor have battery-backed memory which will maintain the programming when power is removed.

## 4.3. Redundancy

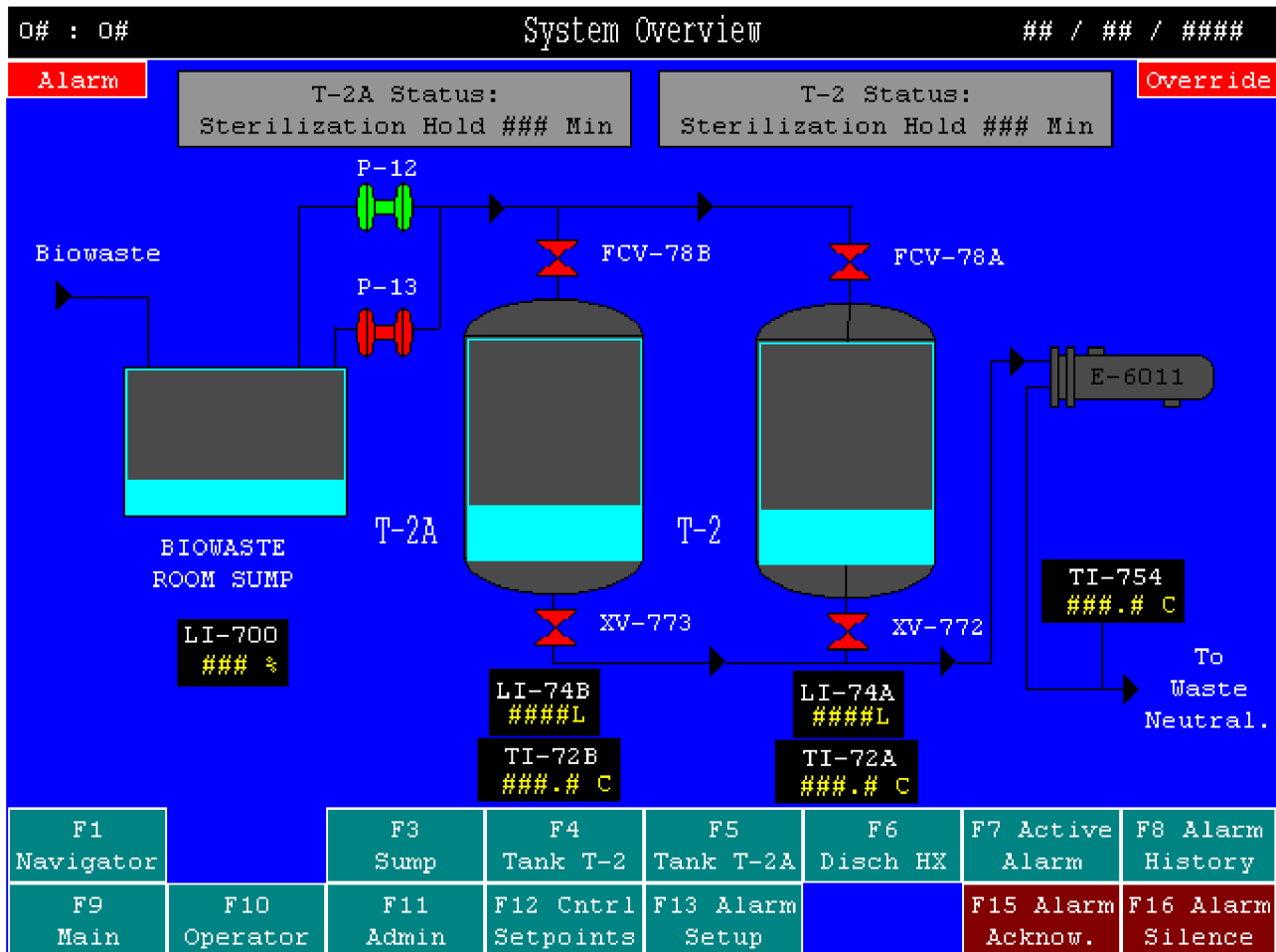
The PLC's processors and OIT's have battery backed RAM which will retain the contents of user memory through extended power outages. Should a hardware failure result in a loss of program software the PLC & Panel View software must be restored from backup into the repaired hardware. There is no hardware redundancy in the PLC control system. A hardware failure may cause the system to become inoperable or may cause unexpected results.

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### 6.2 System Overview Screen



6.2.1 Purpose: This screen shows the BioWaste System Overview Screen. This screen displays general information about the entire system.

6.2.2 Global Indicators: The following discrete states will be displayed on this screen.

6.2.2.1 [ALARM\_ACTIVE] Indicates an alarm condition is present

6.2.2.2 [OVERRIDE] Indicates an output Override in place

6.2.3 Time & Date Indicator: The following time and date will be displayed on this screen.

6.2.3.1 [YEAR] Clock Calendar Year

6.2.3.2 [MONTH] Clock Calendar Month

6.2.3.3 [DAY] Clock Calendar Day

6.2.3.4 [HOUR] Clock Calendar Hours

6.2.3.5 [MINUTE] Clock Calendar Minutes

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- 6.2.4 Status Information Blocks: Two blocks on this screen display Tank T-2 and Tank T-2 status information. Blocks will display the current mode the tanks are in.
- 6.2.5 Screen Navigation Function Keys: The Screen Navigation keys are located at the bottom of the OIT and will have a cyan colored background on the screen. These keys allow navigation to other screens.
- 6.2.5.1 F1 Navigator: Depress to go to the navigator screen.
  - 6.2.5.2 F3 Sump: Depress to go to the sump screen.
  - 6.2.5.3 F4 Tank T-2: Depress to go to the T-2 screen.
  - 6.2.5.4 F5 Tank T-2A: Depress to go to the T-2A screen.
  - 6.2.5.5 F6 Disch HX: Depress to go to the Disch HX screen.
  - 6.2.5.6 F7 Active Alarm: Depress to go to the Active Alarm screen.
  - 6.2.5.7 F8 Alarm History: Depress to go to the Alarm History screen.
  - 6.2.5.8 F9 Main: Depress to go to the Main screen.
  - 6.2.5.9 F10 Operator: Depress to go to the operator screen.
  - 6.2.5.10 F11 Admin: Depress to go to the admin screen.
  - 6.2.5.11 F12 Cntrl Setpoints: Depress to go to the control setpoints screen.
  - 6.2.5.12 F13 Alarm Config: Depress to go to the alarm config screen.
- 6.2.6 Action Function Keys: The Action keys are located at the bottom of the OIT. These keys will perform a specific task or action.
- 6.2.6.1 F15 Alarm Acknow: Depress to acknowledge any current alarm.
  - 6.2.6.2 F16 Alarm Silence: Depress to silence the alarm siren. (this will not acknowledge the alarm).

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### 6.11 PID Loop Tuning Screen

O# : 0#
Control Loop PID Tuning
## / ## / ####

Alarm
Override

Discharge Loop Tuning Parameters

	Gain Kc	Reset Ti	Rate Td	Loop Updat	Min CV	Maxim CV	CV Out	Set Point	Process Value
Discharge Temp.	0###.#	0###.#	0##.##	0#.##	0##	0## %	### %	###.#	###.# C

PID Manual Setpoint: 0##%

PID Auto

Minuum CV must be less than the maximum CV.

F1 Navigator	F2 Overview	F3 Sump	F4 Tank T-2	F5 Tank T-2A	F6 Disch HX	F7 Active Alarm	F8 Alarm History
F9 Main	F10 Operator	F11 Admin	F12 PID Auto	F13 PID Manual	F14 PID Off	F15 Alarm Acknow.	F16 Alarm Silence

- 6.11.1 Purpose: This screen shows the BioWaste System PID Loop Tuning Screen. This screen provides the ability to adjust all system PID setpoints.
- 6.11.2 Global Indicators: The following discrete states will be displayed on this screen.
- 6.11.2.1 [ALARM\_ACTIVE] Indicates an alarm condition is present
  - 6.11.2.2 [OVERRIDE] Indicates an output Override in place
- 6.11.3 Time & Date Indicator: The following time and date will be displayed on this screen.
- 6.11.3.1 [YEAR] Clock Calendar Year
  - 6.11.3.2 [MONTH] Clock Calendar Month
  - 6.11.3.3 [DAY] Clock Calendar Day
  - 6.11.3.4 [HOUR] Clock Calendar Hours
  - 6.11.3.5 [MINUTE] Clock Calendar Minutes

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- 6.11.4 Status Information Block: One block on the screen displays the state of the PID (Manual, Auto or Off).
- 6.11.5 Control Setpoint Entry: When in manual, the PID setpoints can be changed by placing the cursor on the value and entering new values with the key pad.
- 6.11.6 Screen Navigation Function Keys: The Screen Navigation keys are located at the bottom of the OIT and will have a cyan colored background on the screen. These keys allow navigation to other screens.
  - 6.11.6.1 F1 Navigator: Depress to go to the navigator screen.
  - 6.11.6.2 F2 Operator: Depress to go to the operator screen.
  - 6.11.6.3 F3 Sump: Depress to go to the sump screen.
  - 6.11.6.4 F4 Tank T-2: Depress to go to the T-2 screen.
  - 6.11.6.5 F5 Tank T-2A: Depress to go to the T-2A screen.
  - 6.11.6.6 F6 Disch HX: Depress to go to the Disch HX screen.
  - 6.11.6.7 F7 Active Alarm: Depress to go to the Active Alarm screen.
  - 6.11.6.8 F8 Alarm History: Depress to go to the Alarm History screen.
  - 6.11.6.9 F9 Main: Depress to go to the Main screen.
  - 6.11.6.10 F10 Operator: Depress to go to the operator screen.
  - 6.11.6.11 F11 Admin: Depress to go to the admin screen.
- 6.11.7 Action Function Keys: The Action keys are located at the bottom of the OIT. These keys will perform a specific task or action.
  - 6.11.7.1 F12 PID Auto: Depress to place the PID in Auto.
  - 6.11.7.2 F13 PID Manual: Depress to place the PID in Manual. When in manual control setpoints can be adjusted.
  - 6.11.7.3 F14 PID Off: Depress to place the PID in Off.
  - 6.11.7.4 F15 Alarm Acknow: Depress to acknowledge any current alarm.
  - 6.11.7.5 F16 Alarm Silence: Depress to silence the alarm siren. (this will not acknowledge the alarm).