



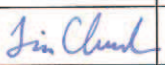

	FUNCTIONAL REQUIREMENTS SPECIFICATION - DCS	Document Code: 112577-0116-48ER-0002
		Revision 00
Client: City of Winnipeg	Project: SEWPCC Ventilation Upgrades	Package / Area: DCS Modifications

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1.0 OVERVIEW

This document is intended to provide a description of the DCS functionality modifications for the SEWPCC Ventilation Upgrades. It is written from a technical perspective, and is intended to be read along with the associated Process & Instrument Diagram (P&ID) drawings and the Instrument Loop Drawings.

The new ventilation systems within the scope of this project are controlled by local PLCs and a local touchscreen HMI. The primary facility DCS will be integrated with the PLC systems via a Modbus TCP interface, however only general alarms and basic status information will be transmitted to the DCS. The DCS will not have any control capability for these ventilation systems.

1.1 Associated Documents

The Process and Instrument Diagrams that are associated with the included work, are listed below. Additional P&ID drawings may be referenced in this document.

Drawing Number	Description
1-0102B-A0024	Miscellaneous
1-0102G-A0026	Electrical Room and Boiler Room Cooling Units, G682-AHU
1-0102G-A0093	Wet Well Ventilation
1-0102G-A0094	Wet Well Upper Level HVAC, G601-SF
1-0102G-A0095	Wet Well Supply and Exhaust Fans G602-SF, G686-EF & G687-EF
1-0102G-A0096	Electrical Room Exhaust Fan, G692-EF

Note: The P&ID drawings for the facility were originally issued in the following numbering format:

1-0102x-G-Ayyyy

The drawing number format has been subsequently modified to remove the document type identifier. All drawings referenced in this document utilize the new drawing number format, as shown below:


1-0102x-Ayyyy

The PLC/Touchscreen HMI functional requirements are identified in a separate document, identified as 112577-0116-48ER-0001.

1.2 Description of Work

1.2.1 Wet Well Ventilation

The existing G686-EF and G687-EF exhaust fans are being replaced with new PLC-controlled fans, where G687-EF is powered by a VFD for speed control. In addition, new supply fans G601-SF and G602-SF, both powered from a VFD, are utilized to supply air into the wet well. The control system for the wet well ventilation is described on the P&IDs and in the Functional Requirement Specification for the Ventilation Upgrades. The DCS will simply monitor the significant data points. No control from the DCS will be required.

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1.2.2 Grit Electrical and Blower Room Ventilation

The existing G682-AHU is being retrofit with PLC based controls. In addition, a new heating coil is being installed to allow for more outdoor air to be provided to the space in cold weather operating conditions. The existing DCS and pneumatic controls will be removed, and replaced with PC-based controls. The DCS will simply monitor and significant data points. No control from the DCS will be required.

1.2.3 Boiler Room Sump

A new sump is being installed in the Boiler Room, which is a localized low area of the plant. The purpose of the sump is to provide sump pump redundancy, as well as flood pumping capability in the event of a Boiler Room flood. The pump will be powered by the local MCC-2B, however it will be controlled by the Grit PCU. Control is not from the local Boiler Room PCU, or nearby Primary Clarifier PCU, as they are at a similar elevation to the sump, and would be susceptible to damage in the event of a flood. Monitoring and control are provided by the DCS.

1.3 DCS –PLC Communications

Modbus TCP communications for the ventilation PLCs will connect into existing Ethernet networks within the plant. The PLCs will provide a contiguous register map for use by the DCS. Map addresses are to be provided by the Subcontractor performing the PLC programming.


The HPG800 incorporates functionality to detect Modbus communication failures between it and each slave device. DCS control logic will need to be created that produces DCS alarms in the event of a communication failure to any slave device.

1.4 Alarm Groups and Priorities

Alarms are configured with a group and priority to facilitate filtering alarms by area and severity.

Group	Area
1	M
2	G
3	P
4	R
5	S and Z
6	B
7	Callout to NEWPCC


Priority	Severity
0	Default
1	Major
2	Minor

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2.0 REMOVALS

Remove all I/O, logic, and graphics associated with the following I/O points:

Tag	Type	Cab.	Row	TB	Pt	Description
SAG682MM	DI	16	4A1	N/A	1B	G682-AHU RUNNING
SAG682QF	DI	16	4A1	N/A	2B	G682-AHU FAULT
SAG682TC	AO	15	9C	3	5-6	G682-AHU SETPOINT OVERRIDE
SAG686MM	DI	16	3A1	N/A	5B	G686-AHU RUNNING
SAG686QF	DI	16	3A1	N/A	4B	G686-AHU FAULT
SAG687MM	DI	16	4A1	N/A	6B	G687-AHU RUNNING
SAG687QF	DI	16	4A1	N/A	5B	G687-AHU FAULT

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3.0 WET WELL VENITLATION UPGRADES

Add the following to the new Wet Well Ventilation graphic. Utilize the existing DCS graphic standards.

3.1 Wet Well Ventilation State Controller G6001-FC

P&ID Drawing: N/A

PLC: PLC-G10

3.1.1 MODBUS Read Map

Analog:


Tag	Slave Node	Slave Register	Description	Range
G6001_FC_State	1		Wet Well Ventilation State	0 - 3

States:

- 0 – Off
- 1– Low
- 2– High
- 3– Emergency

3.1.2 Alarms

- None

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3.2 Wet Well Upper Level Supply G601-SF

P&ID Drawing: 1-0102G-A0094 PLC: PLC-G10

3.2.1 MODBUS Read Map

Discrete:


Tag	Slave Node	Slave Register	Description	0 State	1 State
G601-MM	1		G601-SF Running	Stopped	Running
G601-SF_Alm	1		G601-SF Wet Well Supply Fan Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G601-SI	1		G601-SF Speed	0 – 100%

3.2.2 Alarms

Logic	Description	Group	Pri	Reset
G601-SF_Alm	G601-SF Wet Well Supply Fan Alarm	2	0	Auto

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3.3 Flow Transmitter G601-FT

P&ID Drawing: 1-0102G-A0094 PLC: PLC-G10

3.3.1 MODBUS Read Map

Discrete:

Tag	Slave Node	Slave Register	Description	0 State	1 State
G601-FT_Alm	1		G601-SF Flow Transmitter Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G601-FI	1		G601-SF Airflow (ACH)	0-14.98 ACH

3.3.2 Alarms

Logic	Description	Group	Pri	Reset
G601-FT_Alm	G601-SF Flow Transmitter Alarm	2	0	Auto

3.4 Glycol Pump G603-GP

P&ID Drawing: 1-0102G-A0094 PLC: PLC-G10


3.4.1 MODBUS Read Map

Discrete:

Tag	Slave Node	Slave Register	Description	0 State	1 State
G603-MM	1		G603-GP Running	Stopped	Running
G603-GP_Alm	1		G603-GP Glycol Pump Alarm	Normal	Alarm

3.4.2 Alarms

Logic	Description	Group	Pri	Reset
G603-GP_Alm	G603-GP Glycol Pump Alarm	2	0	Auto

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3.5 Flushing Water Control Valve G603-TV

P&ID Drawing: 1-0102G-A0094 PLC: PLC-G10

3.5.1 MODBUS Read Map

Discrete:

Tag	Slave Node	Slave Register	Description	0 State	1 State
G603-TV_Alm	1		G603-TV Flushing Water Control Valve Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G603-TC	1		G603-TV Position Output	0 – 100%

3.5.2 Alarms

Logic	Description	Group	Pri	Reset
G603-TV_Alm	G603-TV Flushing Water Control Valve Alarm	2	0	Auto

3.6 Glycol Pump G605-GP

P&ID Drawing: 1-0102G-A0094 PLC: PLC-G10


3.6.1 MODBUS Read Map

Discrete:

Tag	Slave Node	Slave Register	Description	0 State	1 State
G605-MM	1		G605-GP Running	Stopped	Running
G605-GP_Alm	1		G605-GP Alarm	Normal	Alarm

3.6.2 Alarms

Logic	Description	Group	Pri	Reset
G605-GP_Alm	G605-GP Alarm	2	0	Auto

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3.7 Hot Water Control Valve G605-TV

P&ID Drawing: 1-0102G-A0094 PLC: PLC-G10

3.7.1 MODBUS Read Map

Discrete:

Tag	Slave Node	Slave Register	Description	0 State	1 State
G605-TV_Alm	1		G605-TV Hot Water Control Valve Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G605-TC	1		G605-TV Position Output	0 – 100%

3.7.2 Alarms

Logic	Description	Group	Pri	Reset
G605-TV_Alm	G605-TV Hot Water Control Valve Alarm	2	0	Auto

3.8 Wet Well Exhaust Fan G687-EF

P&ID Drawing: 1-0102G-A0095 PLC: PLC-G10

3.8.1 MODBUS Read Map

Discrete:


Tag	Slave Node	Slave Register	Description	0 State	1 State
G687-MM	1		G687-EF Running	Stopped	Running
G687-EF_Alm	1		G687-EF Wet Well Exhaust Fan Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G687-SI	1		G687-EF Speed	0 – 100%

3.8.2 Alarms

Logic	Description	Group	Pri	Reset
G687-EF_Alm	G687-EF Wet Well Exhaust Fan Alarm	2	0	Auto

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3.9 Wet Well Pressure Controller G608-PC

P&ID Drawing: 1-0102G-A0093 PLC: PLC-G10

3.9.1 MODBUS Read Map

Discrete:


Tag	Slave Node	Slave Register	Description	0 State	1 State
G608-PC_Alm	1		G608-PC Wet Well Differential Pressure Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G608-PDT	1		Wet Well Differential Pressure	-250 – 250 Pa

3.9.2 Alarms

Logic	Description	Group	Pri	Reset
G608-PC_Alm	G608-PC Wet Well Differential Pressure Alarm	2	0	Auto

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3.10 Wet Well Lower Level Supply G602-SF

P&ID Drawing: 1-0102G-A0095 PLC: PLC-G10

3.10.1 MODBUS Read Map

Discrete:


Tag	Slave Node	Slave Register	Description	0 State	1 State
G602-MM	1		G602-SF Running	Stopped	Running
G602-SF_Alm	1		G602-SF Wet Well Supply Fan Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G602-SI	1		G602-SF Wet Well Supply Fan Speed	0 – 100%

3.10.2 Alarms

Logic	Description	Group	Pri	Reset
G602-SF_Alm	G602-SF Wet Well Supply Fan Alarm	2	0	Auto

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3.11 Flow Transmitter G602-FT

P&ID Drawing: 1-0102G-A0095 PLC: PLC-G10

3.11.1 MODBUS Read Map

Discrete:

Tag	Slave Node	Slave Register	Description	0 State	1 State
G602-FT_Alm	1		G602-SF Flow Transmitter Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G602-FI	1		G602-SF Airflow (ACH)	0-15.93 ACH

3.11.2 Alarms

Logic	Description	Group	Pri	Reset
G602-FT_Alm	G602-SF Flow Transmitter Alarm	2	0	Auto

3.12 Wet Well Exhaust Fan G686-EF

P&ID Drawing: 1-0102G-A0095 PLC: PLC-G10


3.12.1 MODBUS Read Map

Discrete:

Tag	Slave Node	Slave Register	Description	0 State	1 State
G686-MM	1		G686-EF Running	Stopped	Running
G686-EF_Alm	1		G686-EF Wet Well Exhaust Fan Alarm	Normal	Alarm

3.12.2 Alarms

Logic	Description	Group	Pri	Reset
G686-EF_Alm	G686-EF Wet Well Exhaust Fan Alarm	2	0	Auto

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3.13 Miscellaneous

P&ID Drawing: 1-0102G-A0093 PLC: PLC-G10


3.13.1 MODBUS Read Map

Discrete:

Tag	Slave Node	Slave Register	Description	0 State	1 State
G606-KQA	1		Wet Well Occupied for > 8 hours	Normal	Alarm

3.13.2 Alarms

Logic	Description	Group	Pri	Reset
G686-KQA	Wet Well Occupied for > 8 hours	2	0	Auto

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3.14 LCP-G1 Monitoring

P&ID Drawing: N/A PLC: PLC-G10

3.14.1 MODBUS Read Map

Discrete:


Tag	Slave Node	Slave Register	Description	0 State	1 State
G901_EA_1	1		LCP-G1 PS01 Power Supply Fail	Normal	Alarm
G901_EA_2	1		LCP-G1 PS02 Power Supply Fail	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G901_Heartbeat	1		PLC-G10 Heartbeat	0 - 32767

3.14.2 Alarms

Logic	Description	Group	Pri	Reset
G901_EA_1	LCP-G1 PS01 Power Supply Fail	2	0	Auto
G901_EA_2	LCP-G1 PS02 Power Supply Fail	2	0	Auto
G901_HeartbeatFail = G901_Heartbeat does not change for 30 seconds	PLC-G10 Heartbeat Fail	7	1	Auto

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4.0 ELECTRICAL ROOM AND BLOWER ROOM

P&ID Drawing: 1-0102G-A0026 PLC: PLC-G11

Add the following to the new Electrical and Blower Room Ventilation graphic. Utilize the existing DCS graphic standards.

4.1 Electrical Room AHU, G682-AHU

4.1.1 MODBUS Read Map

Discrete:

Tag	Slave Node	Slave Register	Description	0 State	1 State
G682-MM	1		G682-AHU Running	Stopped	Running
G682-AHU_Alm	1		G682-AHU Electrical Room AHU Alarm	Normal	Alarm

4.1.2 Alarms

Logic	Description	Group	Pri	Reset
G682-AHU_Alm	G682-AHU Electrical Room AHU Alarm	2	0	Auto

4.2 G682-AHU Return Air Temperature Controller G682-TC-3

4.2.1 MODBUS Read Map

Discrete:


Tag	Slave Node	Slave Register	Description	0 State	1 State
G682-TT-3_Alm	1		G682-AHU Return Air Temperature Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G682-TT-3	1		G682-AHU Return Air Temperature	0 - 50 °C

4.2.2 Alarms

Logic	Description	Group	Pri	Reset
G682-TT-3_Alm	G682-TT-3 Return Air Temperature Alarm	2	0	Auto

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4.3 G682-AHU Discharge Air Temperature Controller G682-TC-2

4.3.1 MODBUS Read Map

Discrete:

Tag	Slave Node	Slave Register	Description	0 State	1 State
G682-TT-2_Alm	1		G682-AHU Supply Air Temperature Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G682-TT-2	1		G682-AHU Supply Air Temperature	-40 - 40 °C

4.3.2 Alarms


Logic	Description	Group	Pri	Reset
G682-TT-2_Alm	G682-TT-2 Supply Air Temperature Alarm	2	0	Auto

4.4 G682-AHU Heating Valve G682-TV-1

No requirements

4.5 G682-AHU Cooling Valve G682-TV-2

No requirements

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4.6 Mixed Air Dampers – G682-FV-1, G682-FV-2

4.6.1 MODBUS Read Map

Discrete:


Tag	Slave Node	Slave Register	Description	0 State	1 State
G682-FV-1_Alm	1		G682-AHU Intake Damper Alarm	Normal	Alarm
G682-FV-2_Alm	1		G682-AHU Return Air Damper Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G682-ZT-1	1		G682-AHU Intake Air Damper Position Feedback	0 – 100%
G682-ZT-2	1		G682-AHU Return Air Damper Position Feedback	0 – 100%

4.6.2 Alarms

Logic	Description	Group	Pri	Reset
G682-FV-1_Alm	G682-AHU Intake Damper Alarm	2	0	Auto
G682-FV-2_Alm	G682-AHU Return Air Damper Alarm	2	0	Auto

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4.7 Pressure Controller G682-PC

4.7.1 MODBUS Read Map

Discrete:

Tag	Slave Node	Slave Register	Description	0 State	1 State
G682-PC_Alm	1		Grit Electrical Room Pressure Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G682-PDT	1		Grit Electrical Room Differential Pressure	-100 – 100 Pa

4.7.2 Alarms

Logic	Description	Group	Pri	Reset
G682-PC_Alm	Grit Electrical Room Pressure Alarm	2	0	Auto

4.8 Relief Air Damper G682-PV-3

4.8.1 MODBUS Read Map

Discrete:


Tag	Slave Node	Slave Register	Description	0 State	1 State
G682-PV-3_Alm	1		G682-AHU Relief Air Damper Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G682-ZT-3	1		G682-AHU Relief Air Damper Position Feedback	0 – 100% Open

4.8.2 Alarms

Logic	Description	Group	Pri	Reset
G682-PV-3_Alm	G682-AHU Relief Air Damper Alarm	2	0	Auto

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4.9 Grit Electrical Room Temperature, G692-TT

PID Drawing: 1-0102G-A0096

PLC: PLC-G11

4.9.1 MODBUS Read Map

Discrete:


Tag	Slave Node	Slave Register	Description	0 State	1 State
G692-TT_Alm	1		Grit Electrical Room Temperature Alarm	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G692-TT	1		Grit Electrical Room Temperature – VFD Area	0 – 50 °C

4.9.2 Alarms

Logic	Description	Group	Pri	Reset
G692-TT_Alm	Grit Electrical Room Temperature Alarm	2	0	Auto

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4.10 Grit Electrical Room Exhaust Fan, G692-EF

PID Drawing: 1-0102G-A0096

PLC: PLC-G11


4.10.1 MODBUS Read Map

Discrete:

Tag	Slave Node	Slave Register	Description	0 State	1 State
G692-MM	1		G692-EF Running	Stopped	Running
G692-EF_Alm	1		G692-EF Grit Electrical Room Exhaust Fan Alarm	Normal	Alarm

4.10.2 Alarms

Logic	Description	Group	Pri	Reset
G692-EF_Alm	G692-EF Grit Electrical Room Exhaust Fan Alarm	2	0	Auto

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4.11 LCP-G2 Monitoring

P&ID Drawing: N/A PLC: PLC-G10

4.11.1 MODBUS Read Map

Discrete:


Tag	Slave Node	Slave Register	Description	0 State	1 State
G902_EA_1	1		LCP-G2 PS01 Power Supply Fail	Normal	Alarm
G902_EA_2	1		LCP-G2 PS02 Power Supply Fail	Normal	Alarm

Analog:

Tag	Slave Node	Slave Register	Description	Range
G902_Heartbeat	1		PLC-G11 Heartbeat	0 - 32767

4.11.2 Alarms

Logic	Description	Group	Pri	Reset
G902_EA_1	LCP-G2 PS01 Power Supply Fail	2	0	Auto
G902_EA_2	LCP-G2 PS02 Power Supply Fail	2	0	Auto
G902_HeartbeatFail = G902_Heartbeat does not change for 30 seconds	PLC-G11 Heartbeat Fail	7	1	Auto

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5.0 BOILER ROOM

Implementation: DCS

5.1 Boiler Room Flood Pump, B580-SMP

B580-SMP is a flood pump which protects against a Boiler Room flood.

P&ID Drawings: 1-0102B-A0024

Loop Drawing: 1-0102B-A0030

5.1.1 New DCS I/O

Discrete:

Tag	Type	Cab.	Row	Pt	Description	0 State	1 State
SAB580YS	DI	16	1B1	1A	B580-SMP Auto Mode	Not Auto	Auto
SAB580MM	DI	16	1B1	2A	B580-SMP Running	Stopped	Running
SAB580UL	DI	16	1B1	3A	B580-SMP Ready	Not Ready	Ready
SAB580MN	DO	16	2C	5B	B580-SMP Run Command	Stop	Run

Analog:

Tag	Type	Cab.	Row	TB	Pt	Description	Range
SAB580LT	AI	16	9D	3	5,6	Boiler Room Flood Level	0-2 m

Control Narrative


Coordinate X1 start and X2 stop setpoints with Mechanical Subtrade. Ensure pump setpoints prevent unnecessary pump cycling, and prevent the pump from running dry. It is proposed at this time that the X1 setpoint is 0.775 m.

When B580-SMP is in auto-mode, the pump will start based on the data received from the level transmitter B580-LT. Once the water level in the boiler room flood sump goes above X1 m for > 0.5 sec, the pump will run. Conversely, once the water level goes below X2 m, the pump will stop.

```
IF (B580-YS == 1) // Auto Mode
  IF ( B580-LT > X1 m for 0.5 sec)
    Set B580-MN =1
  IF (B580-LT < X2 m)
    Set B580-MN=0
```

Else // Manual Mode, DCS no longer controls the pump

```
Set B580-MN=0
```


 SNC-LAVALIN	FUNCTIONAL REQUIREMENTS SPECIFICATION - DCS		Document Code: 112577-0116-48ER-0002
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5.1.2 HMI Modifications

Create a new graphic for B580-SMP. Include animation for SAB579LA

5.1.3 Alarms

Tag	Description	Logic	Group	Pri	Reset
SAB580UA	B580-SMP Not Ready	B580-UL == 0	6	2	Auto
SAB580MA	B580-SMP Run Fault	B580-YS AND ((B580-MM = 0 AND B580-MN = 1) for > 1 sec OR (B580-MN=0 AND B580 MM=1) for > 1 sec)	6	0	Auto
SAB580LH	Boiler Room Sump High Level	B580-LT > 0.875 m	7	1	Auto
SAB580LHH	Boiler Room Flood	B580-LT > 0.975 m	7	1	Auto