Outbound
Technologies

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Sequence of Operation

Lytle Tunnel Fan Controls

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Revision 2.0

Table of Contents

SECTION 1
OVERVIEW

1.0 INTRODUCTION

This SCADA/PLC control system will monitor, control and collect data for the tunnel ventilation system. This includes carbon monoxide monitoring, linear heat detection and tunnel fire alarms. The control system will also control the operation of the tunnel and fan dampers as well as the ventilation fans.

1.1 SCADA OIT

The operator will interface with the controls from a SCADA OIT located in the Central Control Cabinet in the Tunnel Ventilation Facility, or from a SCADA OIT located at The City of Cincinnati Dispatch Center, or from a SCADA OIT located at the District 8 Office in Lebanon, Ohio. In order to allow automatic onsite or remote offsite operation requires that the Local-Remote selector switch be placed in the "Remote" position.

Local onsite manual operation will require the user to change the Local-Remote selector switch to the "Local" position to bypass the automatic PLC and SCADA OIT control of the tunnel ventilation system.

Automatic fan alternation can be enabled/disabled from any of the HMIs but at least two fans must be available.

Ventilation fan sequencing set points may be entered and selected on the HMIs. These set points will be used for sequencing on and off fans for changing CO levels. When set point values are changed, they will be checked for errors to make sure that the values are in the proper range and that no two fans share the same duty position.

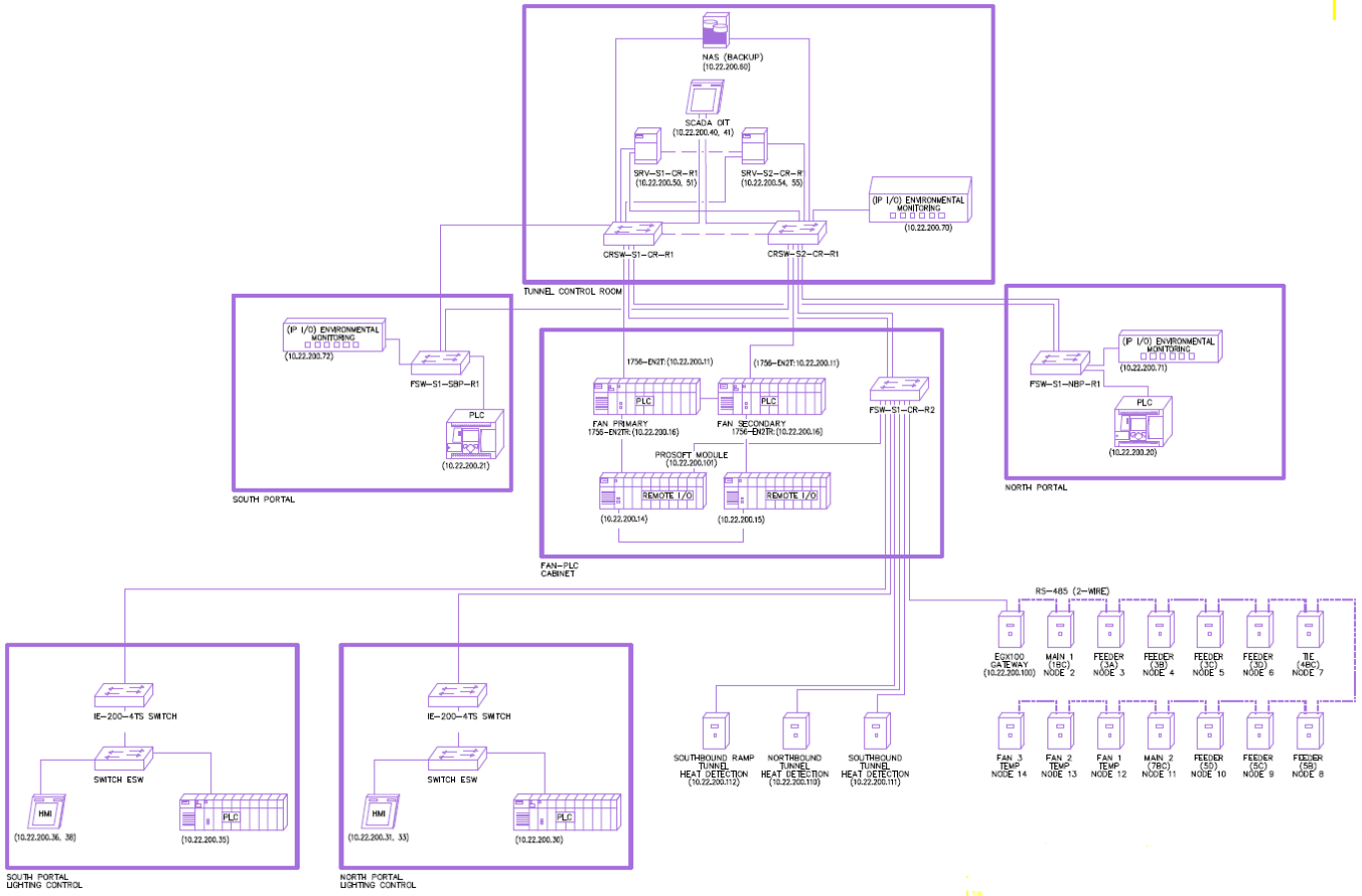
1.2 SEQUENCE OF OPERATION

Under normal conditions, three sets of tunnel isolation dampers (Northbound Tunnel, Southbound Tunnel, and Southbound Ramp Tunnel) will be in the closed position. The three sets of fan isolation dampers will also be in a closed position, and the ventilation fans will be stopped.

The ventilation fans and dampers will be controlled based on the state of the following critical inputs:

- CO Level in Southbound Tunnel
- CO Level in Southbound Ramp Tunnel
- CO Level in Northbound Tunnel
- Fire Alarm Status in Southbound Tunnel
- Fire Alarm Status in Southbound Ramp Tunnel
- Fire Alarm Status in Northbound Tunnel
- Emergency Mode Buttons

1.3 Network Topology



SECTION 2
SEQUENCE

2.0 Tunnel Ventilation Control Based on CO Level

The PLC will receive a continuous 4-20mA input signal from each carbon monoxide detector, which represents the highest current level measured for each tunnel. When the carbon monoxide level is in excess of the system "ON" threshold, the PLC will sequence the following devices:

1. An actuator "open" signal will be sent to the appropriate tunnel isolation damper for the tunnel that is experiencing the high CO level.
2. An actuator "open" signal will be sent to the appropriate fan isolation damper actuators. The selected dampers will be based on the current duty cycle status of the three ventilation fans. There will be a Duty 1 fan, Duty 2 fan, and a Duty 3 fan that is based on duty cycle alternation that is explained later in this document.
3. A short time delay will start after the tunnel dampers receive their open command and are positioned off of the closed limit switch, the PLC will start the appropriate fan based on the table in section 2.0.1 below. The fans will run in the direction required to supply air to or exhaust air from the affected tunnel. The direction is based upon the zone that receives the high CO level.

The fan motor will start based on the scenarios described in section 2.01 below. The PLC will continue to operate the fan while continuously monitoring the CO detectors. If the CO level begins to lower, the motor speed will remain constant until the the level has dropped below the minimum threshold for at least fifteen minutes. If the CO level remains constant or continues to rise, additional fans will start as explained in more detail in section 2.01 below. Fans will continue to run until a reduction in carbon monoxide is detected. The reduction must result in a level that is below one of the minimum thresholds before a reduction in fan operation is realized. If a fan is operating at low speed, and the carbon monoxide level rises to the point where a second fan is needed, the second fan will also run at low speed.

In the case of an extremely high CO level, all three fans will be run at high speed, and the appropriate portal PLC will trigger a tunnel closure. For example, if an extremely high CO level is detected in the Northbound tunnel, the South Portal will trigger a tunnel closure procedure. The North Portal will trigger a closure for the Southbound Tunnel. In order to run all three fans at high speed, they must first all be shut off. Once all three fans are shut off, the Duty 1 (lead) fan will be started at low speed for a short time. The Duty 1 fan is then shut off for a short time delay, and while it is still spinning, it is commanded to run at high speed. After a longer time delay that allows the Duty 1 fan to get to operating speed, Duty 2 fan will start at low speed. After the fan runs at low speed for a few seconds, it is shut off and then quickly transitons to high speed. The same procedure is used to start the Duty 3 fan. In order to run the necessary number of fans, the Hand-Off-Auto switches for the fan and tunnel dampers should be left in the "Auto" position, and the fans must be available for "Remote" control. Fan and Tunnel Dampers should also be set for automatic (remote) control.

2.0.1 Fan Operation Based on CO Level (Normal Operation)

In normal fan operation based on CO level, all fans will be run in the reverse direction to supply air to the tunnel or in the forward direction to exhaust air from the tunnel based on the zone where the high CO level occurs.

1. If CO detection alarms between 25-49 ppm, turn one fan on at low speed with air supplied to the affected roadway.
2. If CO detection alarms between 50-74 ppm, turn a second fan on at low speed with air supplied to the affected roadway.
3. If CO detection alarms between 75-99 ppm, turn a third fan on at low speed with air supplied to the roadway.
4. If CO detection alarms between 100-119 ppm, high speed fan sequencing is required. In the operation mode table for high speed, this mode is referred to as #105. For high speed fan operation, the duty cycle alternation does not apply. Fans must be started at high speed in the order of Fan 1, Fan 2, and then Fan 3. This needs to be done to allow fans to start without drawing too much current. If Fan 1 is not available, it would be possible to start Fan 2 and then Fan 3. However, only two fans would be able to run at high speed.

   A warning message is displayed on the SCADA HMI to indicate that high speed CO operation is being requested. It has been determined by others that three fans running at low speed should provide enough air flow to mitigate any CO levels in all three roadways simultaneously. It is believed that if CO levels climb over 100 ppm, there is likely a problem in the system that needs to be addressed. After a two-minute delay, the high-speed fan sequencing will begin.

   Fan 1 is checked to make sure it is available and to see if it is currently running or spinning down from previously running at low speed. If Fan 1 is currently available, and it is fully stopped, it will be started at low speed in the direction required and then run for twenty seconds. Once the time delay has expired, Fan 1 will be commanded off. After a short time delay, the fan will be started at high speed while it is spinning down. This is done to prevent starting the fan at high speed from a complete stop.

   When Fan 1 is first checked and found to be available, but spinning down from a previous low speed operation, the direction of rotation is checked. If it is determined that the fan is spinning down from the same direction required for high speed operation, the fan will be started at high speed. If Fan 1 is spinning down from the opposite direction required for high speed, it will be necessary to wait until the fan reaches a safe switch speed. Then Fan 1 must be started at low speed and run as described above from a complete stop.

   Once Fan 1 has been started at high speed, Fan 2 will be checked in the same way that Fan 1 was checked for availability, running state, and direction of rotation. There will be a minimum delay time from when Fan 1 is started at high speed and when Fan 2 is started at high speed.

   Once Fan 2 has been started at high speed, Fan 3 will be checked in the same way that Fans 1 and 2 were checked for availability, running state, and direction of rotation. There will be a minimum delay time from when Fan 2 is started at high speed and when Fan 3 is started at high speed.

5. If the CO detection level continues to rise, and goes above 120 ppm, all fans will continue to run at high speed, but a road closure will be initiated. If fans are not running prior to the level reaching 120 ppm or higher in a zone, all of the fan availability, speed and direction of rotation checks will be made before sequencing on any fans at high speed.
6. If multiple roadways have detected a high level of CO, the fan operation is based on the highest alarm detected. The fan speed does not change based on the number of alarms, only the CO level of the highest alarm detected. If by the very small chance that multiple roadways have the same level of CO, the tunnels are based off a programmed priority of southbound tunnel, southbound ramp Tunnel, northbound Tunnel. The appropriate tunnel isolation dampers will be opened in the event of multiple CO alarms.

TUNNEL VENTILATION NORMAL OPERATION MODES (LOW SPEED)									
MODE	ROADWAY	ZONE	CO ALARM (PPM)	NO. FANS	VENTILATION MODE	DUTY 1 FAN SPEED	DUTY 2 FAN SPEED	DUTY 3 FAN SPEED	TRAFFIC MANAGEMENT
101	SOUTHBOUND TUNNEL	1_01	0-24	0	OFF	OFF	OFF	OFF	NO CLOSURE
101	SOUTHBOUND TUNNEL	1_02	0-24	0	OFF	OFF	OFF	OFF	NO CLOSURE
101	NORTHBOUND TUNNEL	3_01	0-24	0	OFF	OFF	OFF	OFF	NO CLOSURE
101	NORTHBOUND TUNNEL	3_02	0-24	0	OFF	OFF	OFF	OFF	NO CLOSURE
101	SOUTHBOUND RAMP TUNNEL	2_01	0-24	0	OFF	OFF	OFF	OFF	NO CLOSURE
101	SOUTHBOUND RAMP TUNNEL	2_02	0-24	0	OFF	OFF	OFF	OFF	NO CLOSURE
102	SOUTHBOUND TUNNEL	1_01	25-49	1	SUPPLY	LOW	OFF	OFF	NO CLOSURE
102	SOUTHBOUND TUNNEL	1_02	25-49	1	EXHAUST	LOW	OFF	OFF	NO CLOSURE
102	NORTHBOUND TUNNEL	3_01	25-49	1	EXHAUST	LOW	OFF	OFF	NO CLOSURE
102	NORTHBOUND TUNNEL	3_02	25-49	1	SUPPLY	LOW	OFF	OFF	NO CLOSURE
102	SOUTHBOUND RAMP TUNNEL	2_01	25-49	1	SUPPLY	LOW	OFF	OFF	NO CLOSURE
102	SOUTHBOUND RAMP TUNNEL	2_02	25-49	1	EXHAUST	LOW	OFF	OFF	NO CLOSURE
103	SOUTHBOUND TUNNEL	1_01	50-74	2	SUPPLY	LOW	LOW	OFF	NO CLOSURE
103	SOUTHBOUND TUNNEL	1_02	50-74	2	EXHAUST	LOW	LOW	OFF	NO CLOSURE
103	NORTHBOUND TUNNEL	3_01	50-74	2	EXHAUST	LOW	LOW	OFF	NO CLOSURE
103	NORTHBOUND TUNNEL	3_02	50-74	2	SUPPLY	LOW	LOW	OFF	NO CLOSURE
103	SOUTHBOUND RAMP TUNNEL	2_01	50-74	2	SUPPLY	LOW	LOW	OFF	NO CLOSURE
103	SOUTHBOUND RAMP TUNNEL	2_02	50-74	2	EXHAUST	LOW	LOW	OFF	NO CLOSURE
104	SOUTHBOUND TUNNEL	1_01	75-99	3	SUPPLY	LOW	LOW	LOW	NO CLOSURE
104	SOUTHBOUND TUNNEL	1_02	75-99	3	EXHAUST	LOW	LOW	LOW	NO CLOSURE
104	NORTHBOUND TUNNEL	3_01	75-99	3	EXHAUST	LOW	LOW	LOW	NO CLOSURE
104	NORTHBOUND TUNNEL	3_02	75-99	3	SUPPLY	LOW	LOW	LOW	NO CLOSURE
104	SOUTHBOUND RAMP TUNNEL	2_01	75-99	3	SUPPLY	LOW	LOW	LOW	NO CLOSURE
104	SOUTHBOUND RAMP TUNNEL	2_02	75-99	3	EXHAUST	LOW	LOW	LOW	NO CLOSURE

TUNNEL VENTILATION NORMAL OPERATION MODES (HIGH SPEED)									
MODE	ROADWAY	ZONE	CO ALARM (PPM)	NO. FANS	VENTILATION MODE	TV-F1 FAN SPEED	TV-F2 FAN SPEED	TV-F3 FAN SPEED	TRAFFIC MANAGEMENT
105	SOUTHBOUND TUNNEL	1_01	100-119	3	SUPPLY	HIGH	HIGH	HIGH	NO CLOSURE
105	SOUTHBOUND TUNNEL	1_02	100-119	3	EXHAUST	HIGH	HIGH	HIGH	NO CLOSURE
105	NORTHBOUND TUNNEL	3_01	100-119	3	EXHAUST	HIGH	HIGH	HIGH	NO CLOSURE
105	NORTHBOUND TUNNEL	3_02	100-119	2	SUPPLY	HIGH	HIGH	OFF	NO CLOSURE
105	SOUTHBOUND RAMP TUNNEL	2_01	100-119	2	SUPPLY	HIGH	HIGH	OFF	NO CLOSURE
105	SOUTHBOUND RAMP TUNNEL	2_02	100-119	2	EXHAUST	HIGH	HIGH	OFF	NO CLOSURE
105	SOUTHBOUND TUNNEL	1_01	> = 120	3	SUPPLY	HIGH	HIGH	HIGH	ROAD CLOSURE
105	SOUTHBOUND TUNNEL	1_02	> = 120	3	EXHAUST	HIGH	HIGH	HIGH	ROAD CLOSURE
105	NORTHBOUND TUNNEL	3_01	> = 120	3	EXHAUST	HIGH	HIGH	HIGH	ROAD CLOSURE
105	NORTHBOUND TUNNEL	3_02	> = 120	3	SUPPLY	HIGH	HIGH	HIGH	ROAD CLOSURE
105	SOUTHBOUND RAMP TUNNEL	2_01	> = 120	2	SUPPLY	HIGH	HIGH	OFF	ROAD CLOSURE
105	SOUTHBOUND RAMP TUNNEL	2_02	> = 120	2	EXHAUST	HIGH	HIGH	OFF	ROAD CLOSURE

2.1 Fan Operation (Emergency Operation)

Emergency operations must be initiated from one of the SCADA OIT systems. There are six emergency operations modes. These modes must be selected from one of the SCADA OITs. This operation is not based upon CO level or fire alarm status, but is its own unique mode. The PLC will open dampers and start the fans based on the mode selected, but will not automatically turn off any fans or close dampers. These actions must be initiated from one of the SCADA OITs while in the appropriate emergency mode. The emergency mode button may be pressed a second time, which will shut down the fans and close the dampers. When one of the emergency modes is started, the PLC will do the following:

1. The system is checked to verify that it is starting from a “homed” state which is all fans off and all dampers closed. This will allow the system to start from a safe system state. If the system is not “homed” then a homing will be sequence to put the system in a safe state.
2. An actuator “open” signal will be sent to the appropriate tunnel isolation damper per the emergency mode selected.

3. An actuator “open” signal will be sent to all available fan isolation damper actuators. If all three fans have their Hand-Off-Auto selector switch in the “Auto” position, then all three fans and associated dampers will be selected to run per the emergency sequence selected.

4. If the fans are all currently stopped, fans will first need to be started up at low speed. Fan 1 would be started at low speed in the direction required to supply or exhaust air for the zone that the emergency is associated with. Once Fan 1 is running at low speed for a time delay, it will then be commanded off. After a short time delay, Fan 1 will be commanded on at high speed in the appropriate direction. After a short time delay, Fan 2 will be sequenced on at low speed and then to high speed in a similar manner. Finally, Fan 3 will be sequence on in the same way. The Southbound Exit Ramp Tunnel is the shortest roadway, and it only requires two fans to be run at high speed. In the table that follows for the Emergency Modes, only two fans are required to supply or exhaust air to the roadway depending on the zone.

5. The appropriate portal PLCs (North and South) will trigger the tunnel closure procedure based upon the emergency mode selected. (See Table below).

6. The fans will not be stopped automatically, and no dampers will be closed automatically. Tunnel Traffic will also not be automatically resumed via the PLC. These actions must be performed by either the SCADA OIT or locally from the MCC in the electrical room.

TUNNEL VENTILATION EMERGENCY OPERATION MODES							
	OPERATION MODE	INCIDENT LOCATION	EVACUATION DIRECTION	VENTILATION MODE	TV-F1	TV-F2	TV-F3
	NORTHBOUND TUNNEL EXHAUST	ZONE 3_01	SOUTH	EXHAUST	EXHAUST	EXHAUST	EXHAUST
	NORTHBOUND TUNNEL SUPPLY	ZONE 3_02	SOUTH	SUPPLY	SUPPLY	SUPPLY	SUPPLY
	SOUTHBOUND RAMP TUNNEL SUPPLY	ZONE 2_01	NORTH	SUPPLY	SUPPLY	SUPPLY	OFF
	SOUTHBOUND RAMP TUNNEL EXHAUST	ZONE 2_02	NORTH	EXHAUST	EXHAUST	EXHAUST	OFF
	SOUTHBOUND TUNNEL SUPPLY	ZONE 1_01	NORTH	SUPPLY	SUPPLY	SUPPLY	SUPPLY
	SOUTHBOUND TUNNEL EXHAUST	ZONE 1_02	NORTH	EXHAUST	EXHAUST	EXHAUST	EXHAUST

For example, the Northbound Tunnel Emergency Exhaust mode will be initiated from one of the SCADA OITs for an incident that occurs in Zone 3_01 within the Northbound Tunnel. Fan 1 is checked to make sure that it is available and whether it is running, is completely stopped, or spinning down from a previous operation. Assuming that the fan is available and completely stopped, the Northbound Tunnel dampers are first commanded to open. As soon as the tunnel damper closed contacts start to open, a short timer is started. After this time delay, Fan 1 will be started at low speed. At the same time the fan is started at low speed, the fan 1 isolation dampers will be commanded to open. Once fan 1 is running at low speed for a short time and the tunnel dampers and the fan 1 isolation dampers are fully open, Fan 1 will be commanded to turn off. After a time delay, Fan 1 will then be commanded to run at high speed. Once Fan 1 is running at high speed for a time delay, Fan 2's isolation dampers will be commanded to open. Once the fan dampers start to open and a short time delay is reached, Fan 2 will be commanded to run at low speed. After a time delay, Fan 2 will then be commanded to run at high speed. Once Fan 2 is running at high speed for a time delay, Fan 3's isolation dampers will be commanded to open. The same sequence will apply for transitioning Fan 3 to high speed.

2.2 Fan Operation Based on Fire Alarm Status

The PLC will receive signals for the status of all six fire alarm zones in the tunnels. These signals will come from three linear heat detectors located in each of the tunnels. Once the PLC has received a signal indicating a fire alarm in one of the tunnels, the PLC shall send output signals to the following devices:

1. The system is checked to verify that it is starting from a "homed" state which is all fans off and all dampers closed. This will allow the system to start from a safe state. If the system is not "homed" then a homing will be sequence to put the system in a safe state.
2. An actuator open signal will be sent to open all of the tunnel isolation dampers in the tunnel where the alarm has occurred.
3. Fan 1 is checked to make sure it is available, and it is currently stopped, or spinning down in the desired direction. If the fan is spinning down from the opposite direction needed, the fan will need to wind down to a speed that is safe to switch direction. If Fan 1 is available, not stopped or spinning down in the correct direction, the sequence will wait for the fan to come to a safe enough slow speed to allow for re-starting. As soon as the tunnel damper closed contacts open, a short time delay is started. After this time delay, Fan 1 will be started at low speed in the direction determined by the zone where the fire alarm has occurred. The directions are determined by the table that follows.
4. Once Fan 1 is running at low speed, Fan 1 will then be started at high speed after a short delay.

5. Once Fan 1 is running at high speed, Fan 2 is checked to see if it is available and either stopped or spinning down in the same direction required for the alarmed zone. An actuator open signal is sent to the Fan 2 isolation dampers. As soon as the tunnel damper closed contacts open, a short time delay is started. After this time delay, Fan 2 will be started at low speed in the direction determined by the zone where the fire alarm has occurred.

6. Once Fan 2 is running at low speed, Fan 2 will be transitioned to high speed after a short delay.

7. Once Fan 2 is running at high speed, Fan 3 is checked to see if it is available and either stopped or spinning down in the same direction required for the alarmed zone. An actuator open signal is sent to the Fan 3 isolation dampers. As soon as the tunnel damper closed contacts open, a short time delay is started. After this time delay, Fan 3 will be started at low speed in the direction determined by the zone where the fire alarm has occurred.

2.3 Fan Duty Cycle Alternation

When the system is in auto alternation mode (selectable on the SCADA OITs), the fans are automatically alternated on a cycle-by-cycle basis. This is done to equalize fan usage. The Fan PLC monitors the state of the fan Remote-Local selector switch, fan running status, and fan fault status. Fans 1, 2, and 3 will be assigned as Duty 1, Duty 2, or Duty 3. Duty 1 is the fan that will be the first to start. The Duty 2 fan will be the second fan to start in an automatic sequence. The Duty 3 fan will be the third fan to start in an automatic sequence. Fan 1 is the default Duty 1 fan. When all fans are stopped, the next time a fan is needed, Fan 2 will become the Duty 1 fan. Each available fan will take turns as the Duty 1 fan. The Duty 2 and 3 fans will be assigned to the next available fan. If a fan is faulted or not available, the next available fan will be assigned an order in the duty cycle.

If additional fans are needed and are not available because a user has left the Remote-Local selector switch in the “Local” position for a fan, an alarm will be generated.

The ventilation fan level and speed set points are listed below:

DESCRIPTION	SETPOINT RANGE	DEFAULT VALUE
Duty 1 Start Low Speed	25-100 (CO PPM)	25
Duty 2 Start Low Speed	25-100 (CO PPM)	50
Duty 3 Start Low Speed	25-100 (CO PPM)	75
Duty 1 Stop Low Speed	25-100 (CO PPM)	< 25 for 15 minutes
Duty 2 Stop Low Speed	25-100 (CO PPM)	25
Duty 3 Stop Low Speed	25-100 (CO PPM)	50
HIGH CO CONCENTRATION SETPOINTS		
Fan 1 Start High Speed	100-120 (CO PPM)	100
Fan 2 Start High Speed	100-120 (CO PPM)	100 (with time delay after Fan 1)
Fan 3 Start High Speed	100-120 (CO PPM)	100 (with time delay after Duty 2)
Fan 1 Stop High Speed	25-100 (CO PPM)	TBD
Fan 2 Stop High Speed	25-100 (CO PPM)	TBD
Fan 3 Stop High Speed	25-100 (CO PPM)	TBD

SECTION 3
Monitoring from PLC and SCADA

3.0 Lighting Control Panel (Northbound Tunnel Lighting PLC)

The Fan PLC and SCADA will monitor (not control) the status of several signals from the Northbound Tunnel Lighting Control PLC (supplied by others). These signals will be monitored over an Ethernet connection between the SCADA system and the Lighting Controls PLCs. The following signals will be monitored by the SCADA system:

DESCRIPTION	I/O TYPE	TAG IN LIGHTING PLC	DATA TO BE LOGGED BY SCADA?
NE C1 H-O-A selector switch status	DI	R01002	
NE C2 H-O-A selector switch status	DI	R01003	
NW C3 H-O-A selector switch status	DI	R01004	
NW C4 H-O-A selector switch status	DI	R01005	
NE C1 Contactor Output	DI	R01022	Yes
NE C2 Contactor Output	DI	R01023	Yes
NW C1 Contactor Output	DI	R01024	Yes
NW C2 Contactor Output	DI	R01025	Yes

DESCRIPTION	I/O TYPE	TAG IN LIGHTING PLC	DATA TO BE LOGGED BY SCADA?
NE C1 Contactor Status	DI	R01042	
NE C2 Contactor Status	DI	R01043	
NW C3 Contactor Status	DI	R01044	
NW C4 Contactor Status	DI	R01045	
Level 1 Lighting Control Output	DI	R01062	Yes
Level 2 Lighting Control Output	DI	R01063	Yes
Level 3 Lighting Control Output	DI	R01064	Yes
Level 4 Lighting Control Output	DI	R01065	Yes
Level 5 Lighting Control Output	DI	R01066	Yes
Level 6 Lighting Control Output	DI	R01067	Yes
Level 1 Dimming Status	AI	R01082	Yes
Level 2 Dimming Status	AI	R01083	Yes
Level 3 Dimming Status	AI	R01084	Yes
Level 4 Dimming Status	AI	R01085	Yes

DESCRIPTION	I/O TYPE	TAG IN LIGHTING PLC	DATA TO BE LOGGED BY SCADA?
Level 5 Dimming Status	AI	R01086	
Level 6 Dimming Status	AI	R01087	
Luminance Sensor Status	DI	R01091	
Luminance Sensor Reading	AI	R01092	Yes
System Mode	DI	R01093	

3.1 Lighting Control Panel (Southbound Tunnel Lighting PLC)

The Fan PLC will monitor (not control) the status of several signals from the Southbound Tunnel Lighting Control PLC (supplied by others). These signals will be monitored over an Ethernet connection between the SCADA system and the Lighting Controls PLCs. The following signals will be monitored by the SCADA system:

DESCRIPTION	I/O TYPE	TAG IN LIGHTING PLC	DATA TO BE LOGGED BY SCADA?
SE C1 H-O-A selector switch status	DI	R01002	
SE C2 H-O-A selector switch status	DI	R01003	
SW C1 H-O-A selector switch status	DI	R01004	
SW C2 H-O-A selector switch status	DI	R01005	
RE C1 H-O-A selector switch status	DI	R01006	
RE C2 H-O-A selector switch status	DI	R01007	
RW C1 H-O-A selector switch status	DI	R01008	
RW C2 H-O-A selector switch status	DI	R01009	
SE C1 Contactor Output	DI	R01022	Yes
SE C2 Contactor Output	DI	R01023	Yes
SW C1 Contactor Output	DI	R01024	Yes
SW C2 Contactor Output	DI	R01025	Yes
RE C1 Contactor Output	DI	R01026	Yes
RE C2 Contactor Output	DI	R01027	Yes
RW C1 Contactor Output	DI	R01028	Yes
RW C2 Contactor Output	DI	R01029	Yes
SE C1 Contactor Status	DI	R01042	
SE C2 Contactor Status	DI	R01043	

DESCRIPTION	I/O TYPE	TAG IN LIGHTING PLC	DATA TO BE LOGGED BY SCADA?
SW C1 Contactor Status	DI	R01044	
SW C2 Contactor Status	DI	R01045	
RE C1 Contactor Status	DI	R01046	
RE C2 Contactor Status	DI	R01047	
RW C1 Contactor Status	DI	R01048	
RW C2 Contactor Status	DI	R01049	
Level 1 Lighting Control Output	DI	R01062	Yes
Level 2 Lighting Control Output	DI	R01063	Yes
Level 3 Lighting Control Output	DI	R01064	Yes
Level 4 Lighting Control Output	DI	R01065	Yes
Level 5 Lighting Control Output	DI	R01066	Yes
Level 6 Lighting Control Output	DI	R01067	Yes
Level 1 Dimming Status	AI	R01082	Yes
Level 2 Dimming Status	AI	R01083	Yes
Level 3 Dimming Status	AI	R01084	Yes
Level 4 Dimming Status	AI	R01085	Yes
Level 5 Dimming Status	AI	R01086	Yes
Level 6 Dimming Status	AI	R01087	Yes
Luminance Sensor Status	DI	R01091	

DESCRIPTION	I/O TYPE	TAG IN LIGHTING PLC	DATA TO BE LOGGED BY SCADA?
Luminance Sensor Reading	AI	R01092	Yes
System Mode	DI	R01092	

3.2 Southbound Ramp Tunnel Heat Detection Monitoring

The Fan PLC will monitor (not control) the status of the Zone 2-01 and 2-02 fire alarm signals in the Southbound Ramp Tunnel. These signals will be monitored over Modbus TCP/IP from a Protectowire 4-channel controller model PTS-8401. The Fan PLC is equipped with a ProSoft MVI56E-MNETCR, which requests the data from the fire alarm controller.

DESCRIPTION	I/O TYPE	MODBUS ADDRESS	PROTECTOWIRE CONTROLLER IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Southbound Ramp Tunnel Zone 2-01 Fire Alarm	DI	601, 1201	10.22.200.112	Yes
Southbound Ramp Tunnel Zone 2-02 Fire Alarm	DI	602, 1202		Yes

3.3 Southbound Tunnel Heat Detection Monitoring

The Fan PLC will monitor (not control) the status of the Zone 1-01 and 1-02 fire alarm signals in the Southbound Tunnel. These signals will be monitored over Modbus TCP/IP from a Protectowire 4-channel controller model PTS-8401. The Fan PLC is equipped with a ProSoft MVI56E-MNETCR, which requests the data from the fire alarm controller.

DESCRIPTION	I/O TYPE	MODBUS ADDRESS	PROTECTOWIRE CONTROLLER IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Southbound Tunnel Zone 1-01 Fire Alarm	DI	601, 1201	10.22.200.111	Yes
Southbound Tunnel Zone 1-02 Fire Alarm	DI	602, 1202		Yes

3.4 Northbound Tunnel Heat Detection Monitoring

The Fan PLC will monitor (not control) the status of the Zone 3-01 and 3-02 fire alarm signals in the Northbound Tunnel. These signals will be monitored over Modbus TCP/IP from a Protectowire 4-channel controller model PTS-8401. The Fan PLC is equipped with a ProSoft MVI56E-MNETCR, which requests the data from the fire alarm controller.

DESCRIPTION	I/O TYPE	MODBUS ADDRESS	PROTECTOWIRE CONTROLLER IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Northbound Tunnel Zone 3-01 Fire Alarm	DI	601, 1201	10.22.200.110	Yes
Northbound Tunnel Zone 3-02 Fire Alarm	DI	602, 1202		Yes

3.5 Southbound Portal Network Cabinet Monitoring

The SCADA server will monitor (not control) the status of the cabinet environment signals in the Southbound Portal Network Cabinet. These signals will be monitored over Ethernet.

DESCRIPTION	I/O TYPE	NETBOTZ CONTROLLER IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Cabinet Door Open	DI	10.22.200.72	Yes
Cabinet Temperature	AI		Yes
Cabinet Humidity	AI		Yes

3.6 Northbound Portal Network Cabinet Monitoring

The SCADA server will monitor (not control) the status of the cabinet environment signals in the Northbound Portal Network Cabinet. These signals will be monitored over Ethernet.

DESCRIPTION	I/O TYPE	NETBOTZ CONTROLLER IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Cabinet Door Open	DI	10.22.200.71	Yes
Cabinet Temperature	AI		Yes
Cabinet Humidity	AI		Yes

3.7 Control Room Network Cabinet Monitoring

The SCADA server will monitor (not control) the status of the cabinet environment signals in the Control Room Network Cabinet. These signals will be monitored over Ethernet.

DESCRIPTION	I/O TYPE	NETBOTZ CONTROLLER IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Cabinet Door Open	DI	10.22.200.70	Yes
Cabinet Temperature	AI		Yes
Cabinet Humidity	AI		Yes

3.8 Fan 1 Motor Monitoring

The Fan PLC will monitor the status of the Tunnel Ventilation Fan #1 Motor. These signals will be monitored over Modbus TCP/IP from a controller supplied by others. The Fan PLC is equipped with a ProSoft MVI56E-MNETCR, which requests the data from the monitoring device that provides these signals.

DESCRIPTION	I/O TYPE	MODBUS NODE (RS-485)	MODBUS ADDRESS (RS-485)	DATA TO BE LOGGED BY SCADA?
Motor 1 Winding 1 Temperature	Analog RTD	12	299	Yes
Motor 1 Winding 2 Temperature	Analog RTD		300	Yes
Motor 1 Winding 3 Temperature	Analog RTD		301	Yes
Motor 1 Bearing 1 Temperature	Analog RTD		305	Yes
Motor 1 Bearing 2 Temperature	Analog RTD		306	Yes

3.9 Fan 2 Motor Monitoring

The Fan PLC will monitor the status of the Tunnel Ventilation Fan #2 Motor. These signals will be monitored over Modbus TCP/IP from a controller supplied by others. The Fan PLC is equipped with a ProSoft MVI56E-MNETCR, which requests the data from the monitoring device that provides these signals.

DESCRIPTION	I/O TYPE	MODBUS NODE (RS-485)	MODBUS ADDRESS (RS-485)	DATA TO BE LOGGED BY SCADA?
Motor 2 Winding 1 Temperature	Analog RTD	13	299	Yes
Motor 2 Winding 2 Temperature	Analog RTD		300	Yes
Motor 2 Winding 3 Temperature	Analog RTD		301	Yes
Motor 2 Bearing 1 Temperature	Analog RTD		305	Yes
Motor 2 Bearing 2 Temperature	Analog RTD		306	Yes

3.10 Fan 3 Motor Monitoring

The Fan PLC will monitor the status of the Tunnel Ventilation Fan #3 Motor. These signals will be monitored over Modbus TCP/IP from a controller supplied by others. The Fan PLC is equipped with a ProSoft MVI56E-MNETCR, which requests the data from the monitoring device that provides these signals.

DESCRIPTION	I/O TYPE	MODBUS NODE (RS-485)	MODBUS ADDRESS (RS-485)	DATA TO BE LOGGED BY SCADA?
Motor 3 Winding 1 Temperature	Analog RTD	14	299	Yes
Motor 3 Winding 2 Temperature	Analog RTD		300	Yes
Motor 3 Winding 3 Temperature	Analog RTD		301	Yes
Motor 3 Bearing 1 Temperature	Analog RTD		305	Yes
Motor 3 Bearing 2 Temperature	Analog RTD		306	Yes

3.11 Utility Main Breaker 1 Monitoring

The Fan PLC will monitor the status of the Utility Main Breaker 1. These signals will be monitored over Modbus TCP/IP from a controller supplied by others. The Fan PLC is equipped with a ProSoft MVI56E-MNETCR, which requests the data from the monitoring device that provides these signals.

DESCRIPTION	I/O TYPE	MODBUS NODE (RS-485)	MODBUS ADDRESS	DATA TO BE LOGGED BY SCADA?
Voltage (V)	AI	2	1006	Yes
Current (A)	AI		1020	Yes
Power (W)	AI		1037	Yes
Power (VAR)	AI		1041	Yes
Power Factor	AI		1049	Yes

3.12 Utility Main Breaker 2 Monitoring

The Fan PLC will monitor the status of the Utility Main Breaker 2. These signals will be monitored over Modbus TCP/IP from a controller supplied by others. The Fan PLC is equipped with a ProSoft MVI56E-MNETCR, which requests the data from the monitoring device that provides these signals.

DESCRIPTION	I/O TYPE	MODBUS NODE (RS-485)	MODBUS ADDRESS	DATA TO BE LOGGED BY SCADA?
Voltage (V)	AI	11	1006	Yes
Current (A)	AI		1020	Yes
Power (W)	AI		1037	Yes
Power (VAR)	AI		1041	Yes
Power Factor	AI		1049	Yes

3.13 South Portal Network Cabinet PDU Monitoring

The SCADA system will monitor the status of the eight outlets on PDU-A and PDU-B. The SCADA HMI will display the status of the outlets (ON/OFF)

3.14 North Portal Network Cabinet PDU Monitoring

The SCADA system will monitor the status of the eight outlets on PDU-A and PDU-B. The SCADA HMI will display the status of the outlets (ON/OFF)

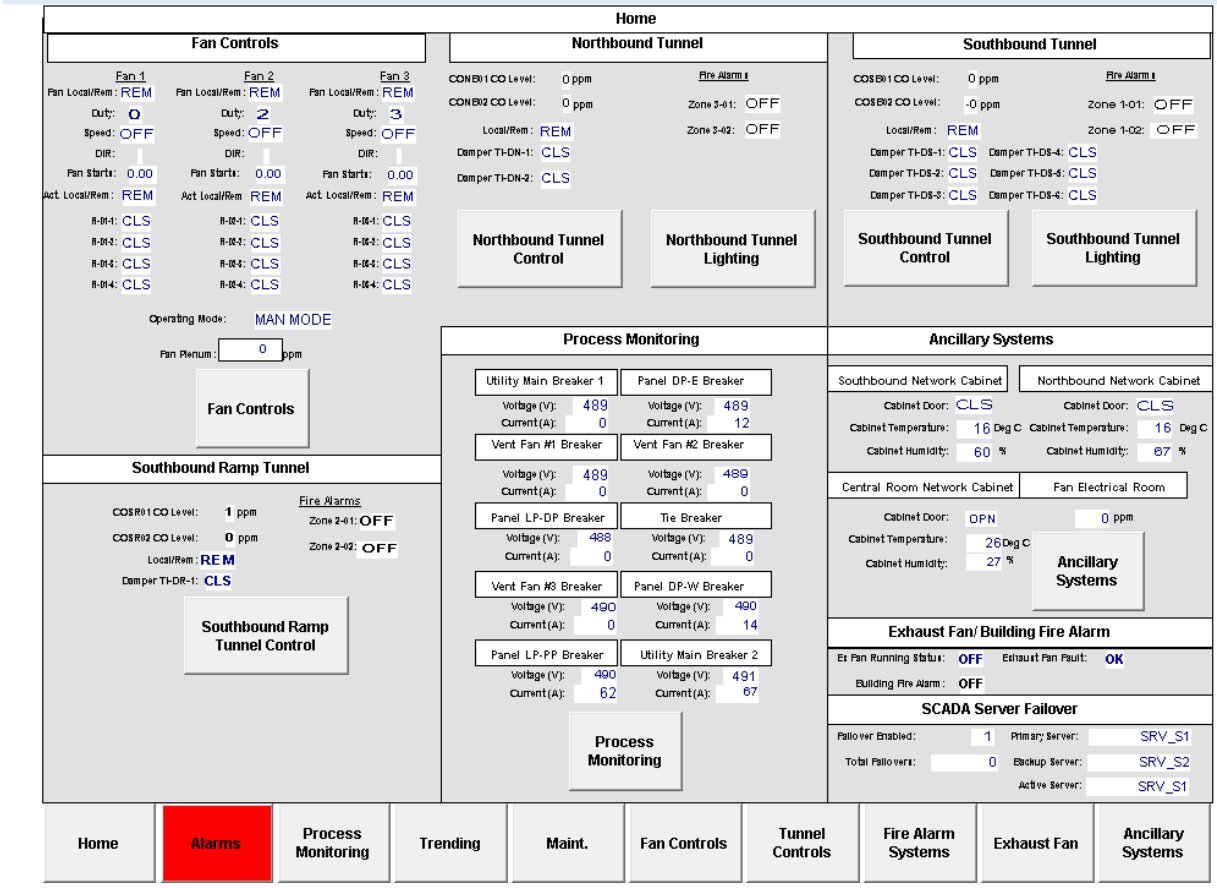
3.15 Central Network Cabinet PDU Monitoring

The SCADA system will monitor the status of the eight outlets on PDU-A and PDU-B. The SCADA HMI will display the status of the outlets (ON/OFF)

SECTION 4
HMI SCREENS

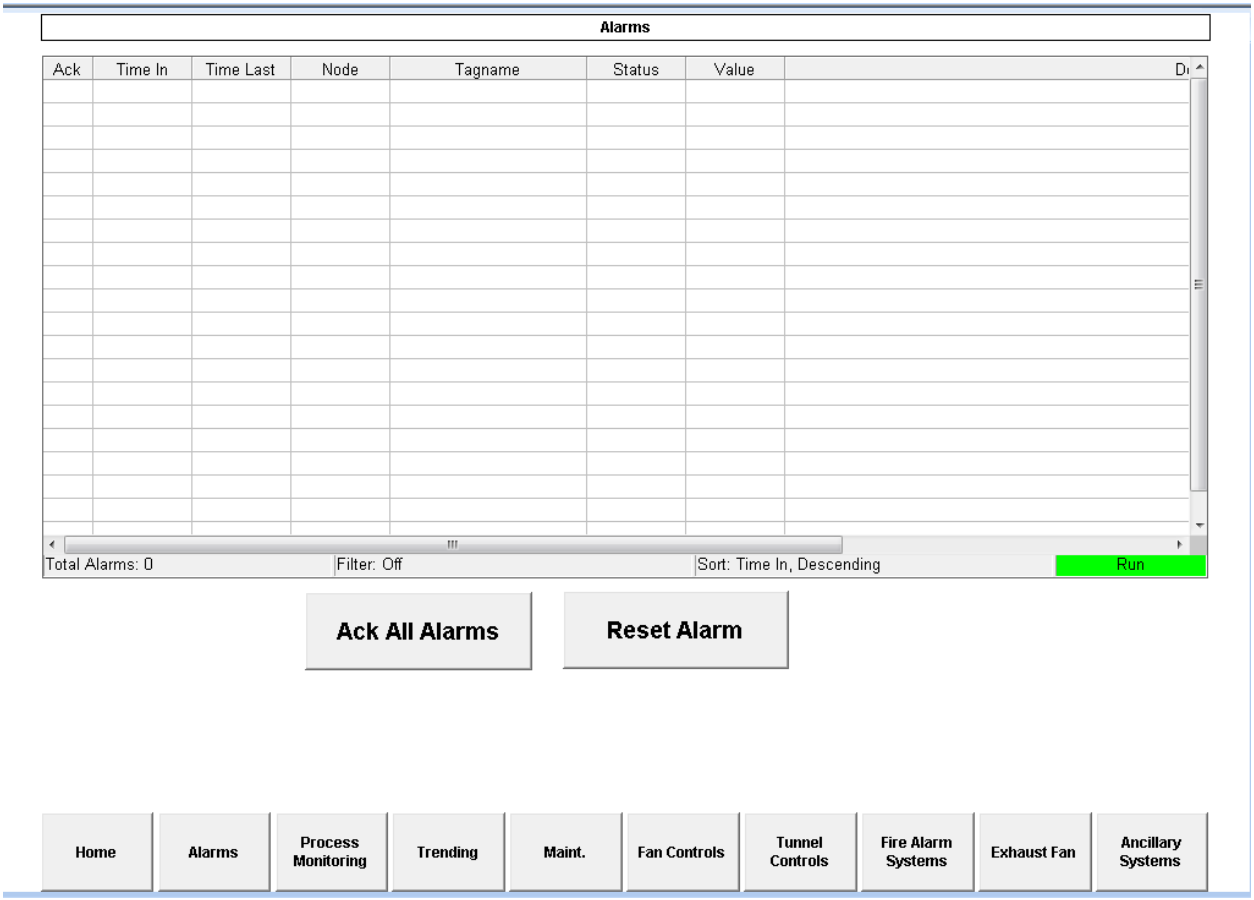
4.1 Home Screen (Main Screen)

The Home Screen shows the status of the ventilation fans, tunnel roadways, and other areas of the system. Navigation buttons across the bottom of the screen allows the user to navigate to other screens.



4.2 Alarm Summary Screen

The Alarm Summary Screen shows the status of current alarms. The Acknowledge All button allows all of the active alarms to be acknowledged at once. This screen can be viewed whenever the Alarms navigation button is pressed from another screen. The Reset Alarm button is pressed to reset an acknowledged alarm.

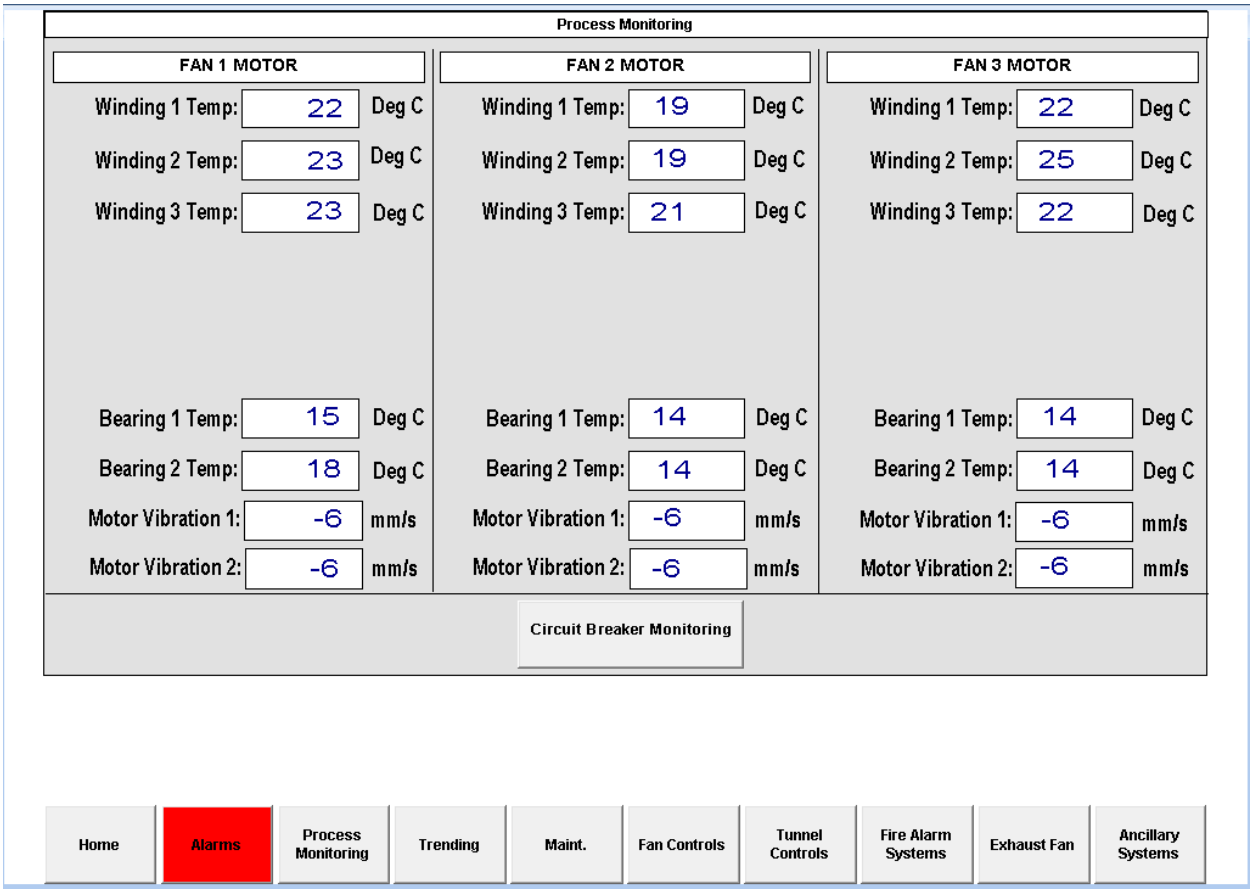


4.3 Alarm Notification from Other Screens

The navigation buttons at the bottom of each screen will have a button named “Alarms” that is the second from the left. When an alarm is active, the text of this button will turn red to notify the operator. If the Alarms button is then pressed, the Alarm Summary screen will be displayed where the active alarms can be viewed and acknwledged.

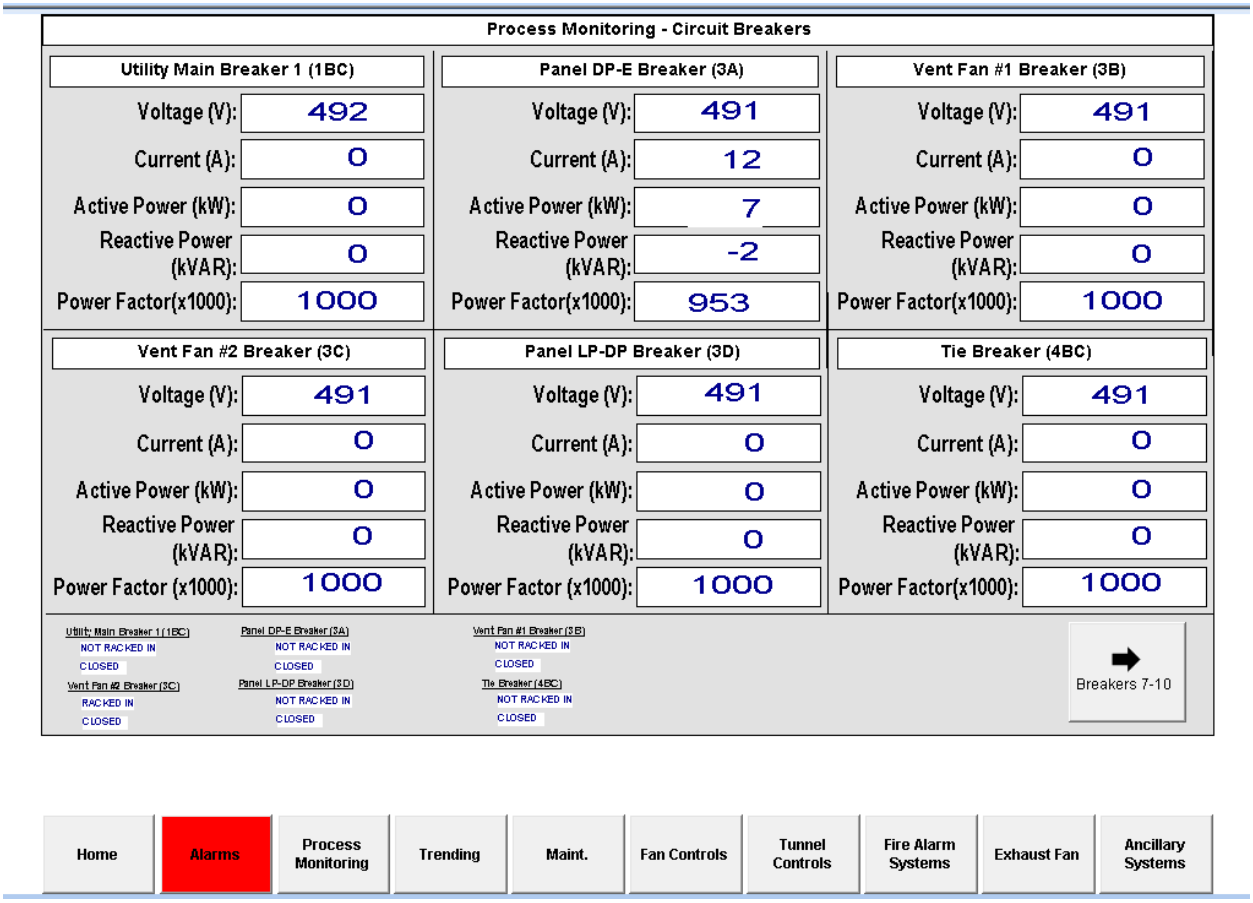
4.4 Process Monitoring Screen – Fan Motors

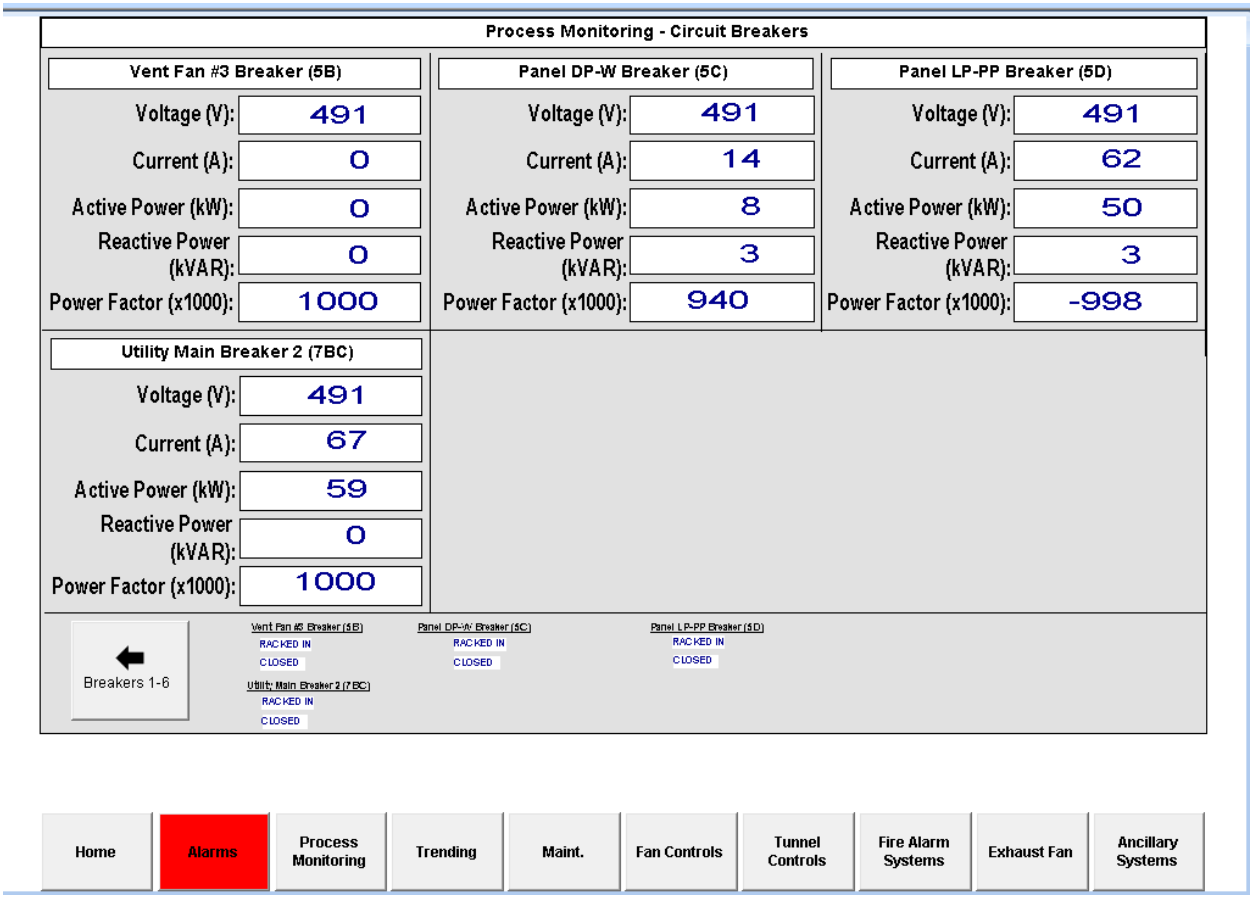
The Process Monitoring Screen shows the status of the fan motor temperatures and vibration. The large circuit breaker monitoring button allow for navigation to more monitoring screens where information on the circuit breakers can be viewed.



4.5 Process Monitoring Screen – Circuit Breakers

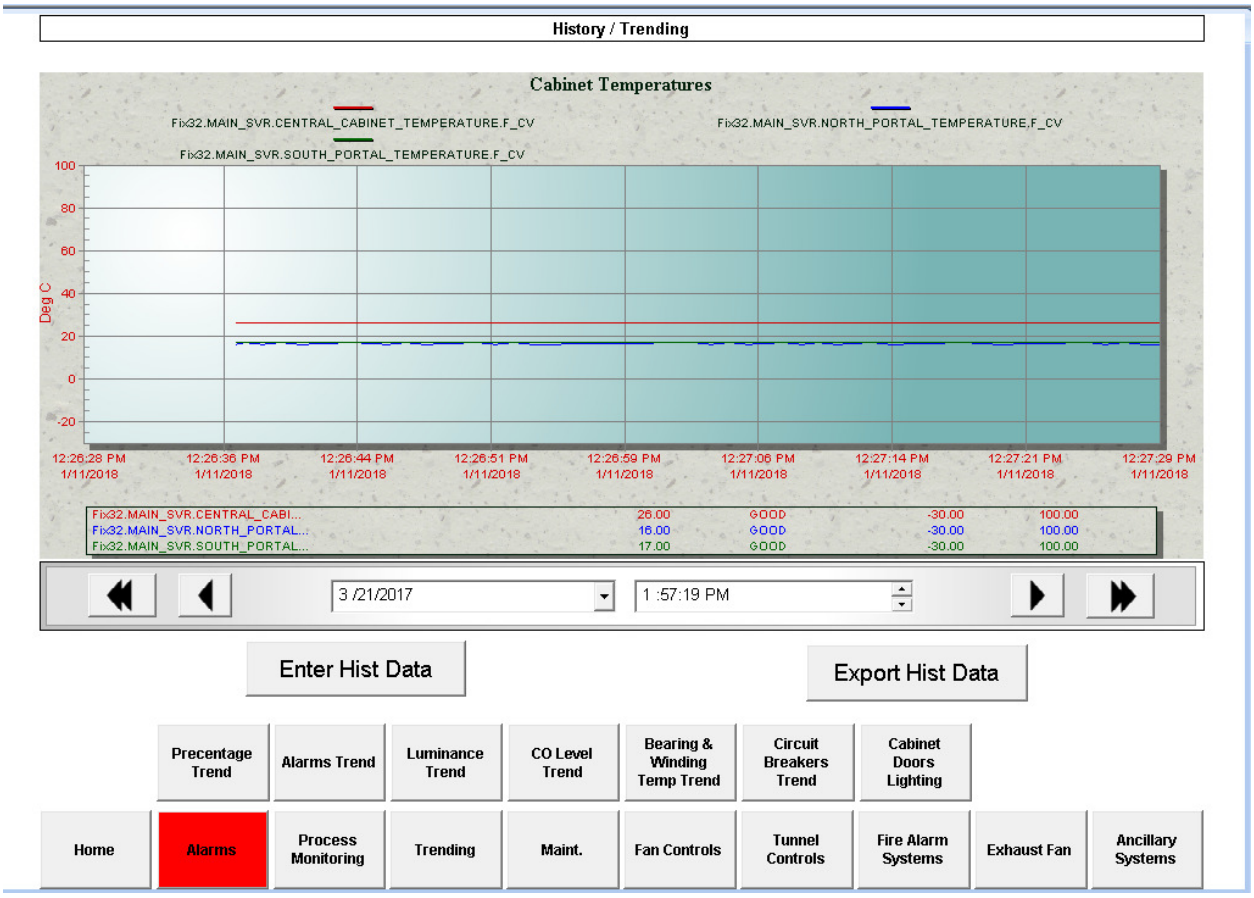
There are two Process Monitoring Screen shows the status of the system circuit breakers. The “Breakers 7-10” button navigates to a second circuit breaker monitoring screen where information on the additional circuit breakers can be viewed.




Process Monitoring - Circuit Breakers
Vent Fan #3 Breaker (5B)
Voltage (V): 491
Current (A): 0
Active Power (kW): 0
Reactive Power (kVAR): 0
Power Factor (x1000): 1000
Panel DP-W Breaker (5C)
Voltage (V): 491
Current (A): 14
Active Power (kW): 8
Reactive Power (kVAR): 3
Power Factor (x1000): 940
Panel LP-PP Breaker (5D)
Voltage (V): 491
Current (A): 62
Active Power (kW): 50
Reactive Power (kVAR): 3
Power Factor (x1000): -998
Utility Main Breaker 2 (7BC)
Voltage (V): 491
Current (A): 67
Active Power (kW): 59
Reactive Power (kVAR): 0
Power Factor (x1000): 1000
Breakers 1-6
Vent Fan #3 Breaker (5B)
RACKED IN
CLOSED
Panel DP-W Breaker (5C)
RACKED IN
CLOSED
Panel LP-PP Breaker (5D)
RACKED IN
CLOSED
Utility Main Breaker 2 (7BC)
RACKED IN
CLOSED
Home
Alarms
Process Monitoring
Trending
Maint.
Fan Controls
Tunnel Controls
Fire Alarm Systems
Exhaust Fan
Ancillary Systems

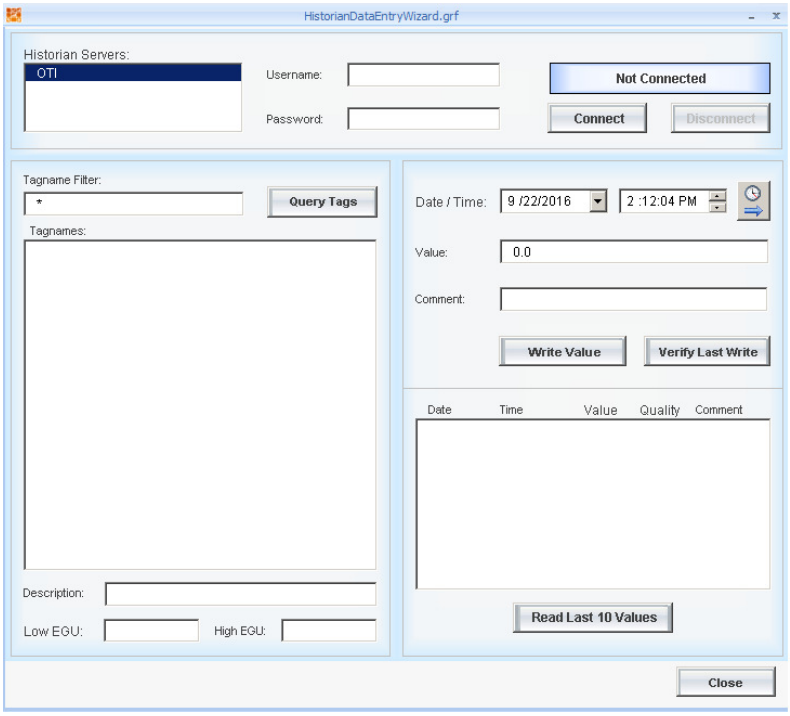
4.6 Trending Screens

The trending screens allows for viewing various tags and their historical values in a line trend. The “Enter Hist Data” button displays a pop-up screen where the data server and tags to view can be selected and data can be entered. The Export Historical data allows historical tag data to be exported to a text file that can be viewed in a text editor or in Microsoft Excel.



4.7 Historian Data Entry Wizard Screen

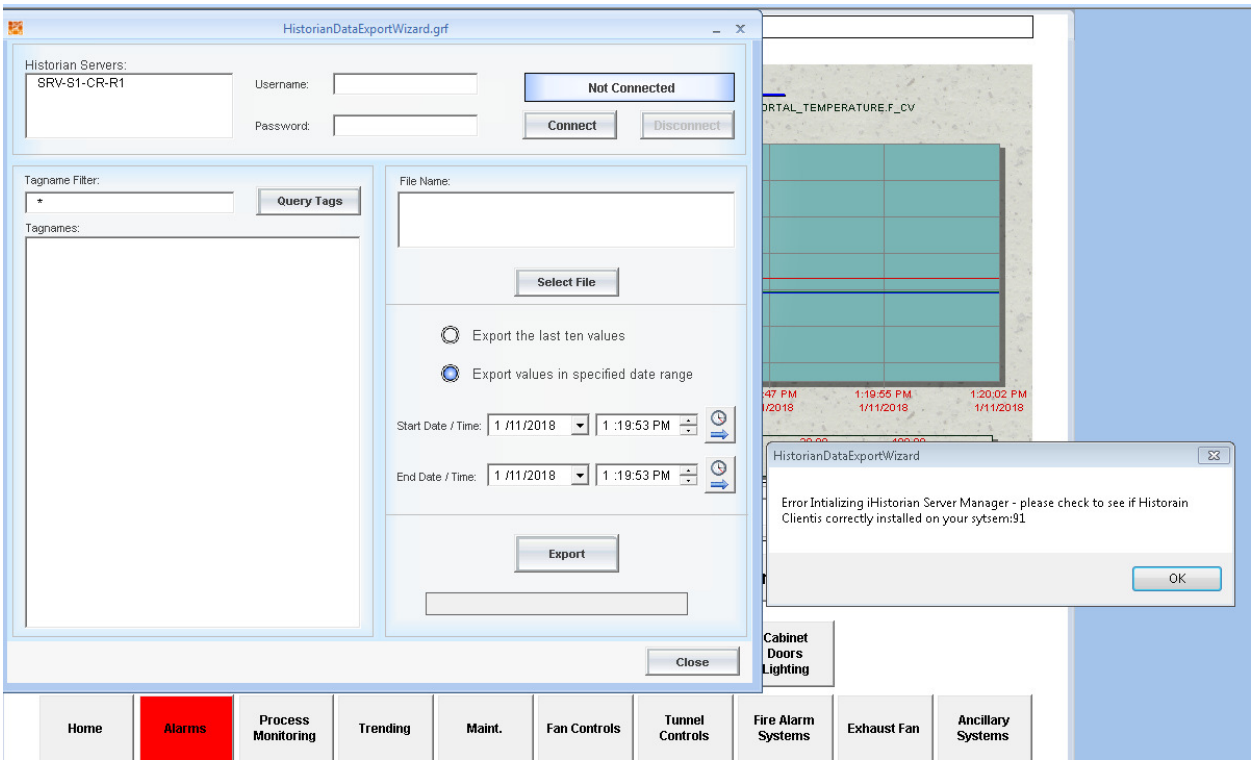
The data server and tags to view and edit can be selected.



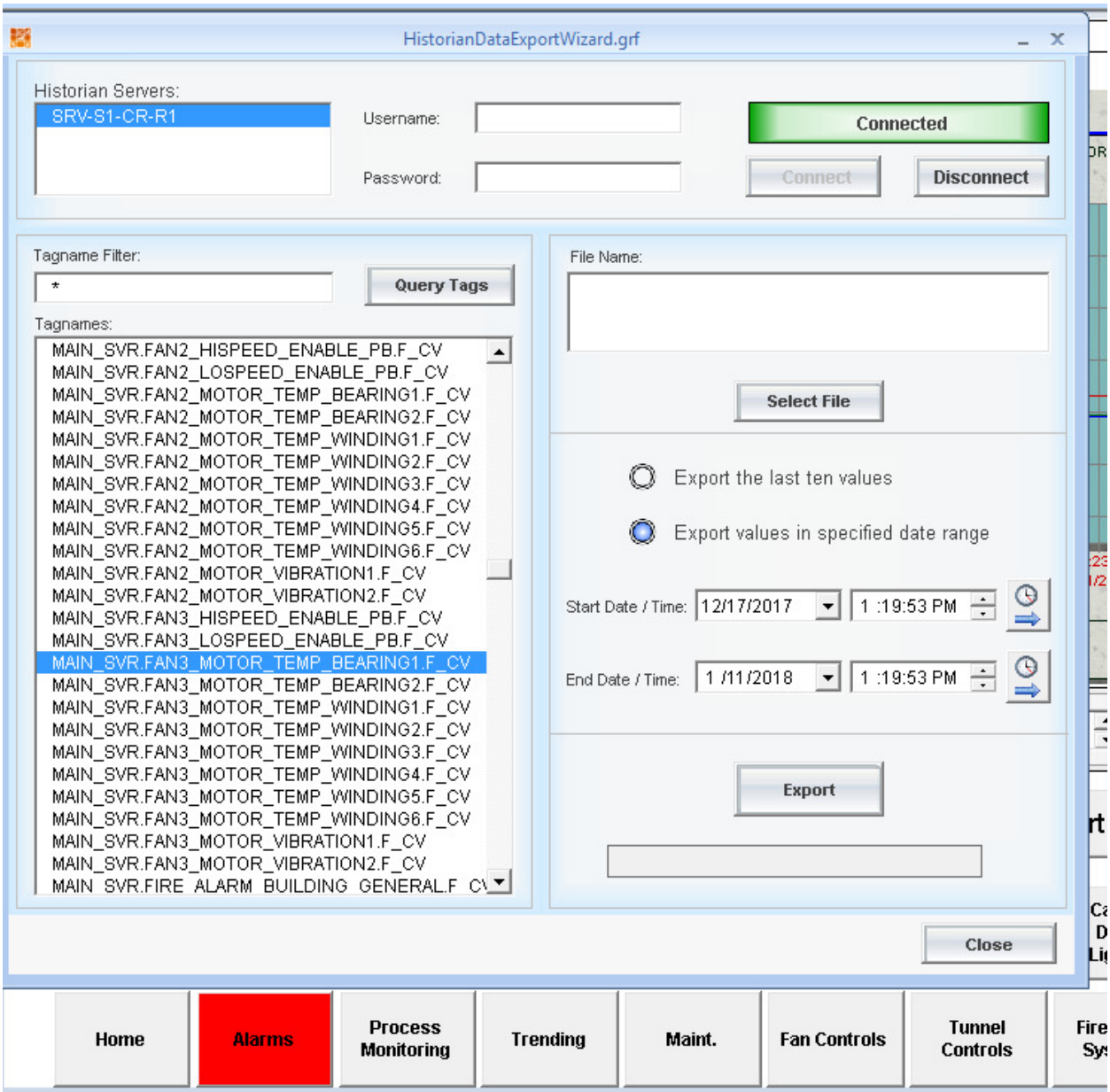
4.8 Historian Data Export Wizard

The historian tag data can be exported to a text file from this screen.

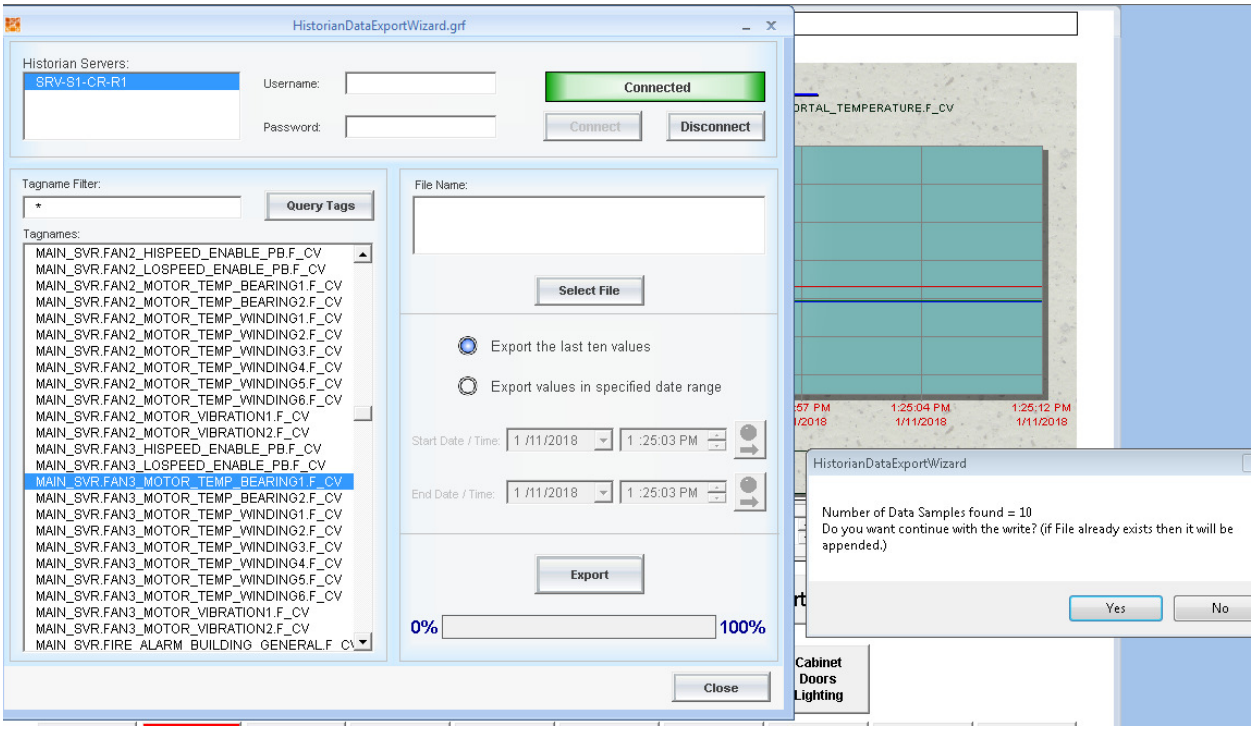
The first step is to connect to the historian server. In the screenshot below, the historian server on Server 1 is SRV-S1-CR-R1. Select this server and then click on the Connect button.



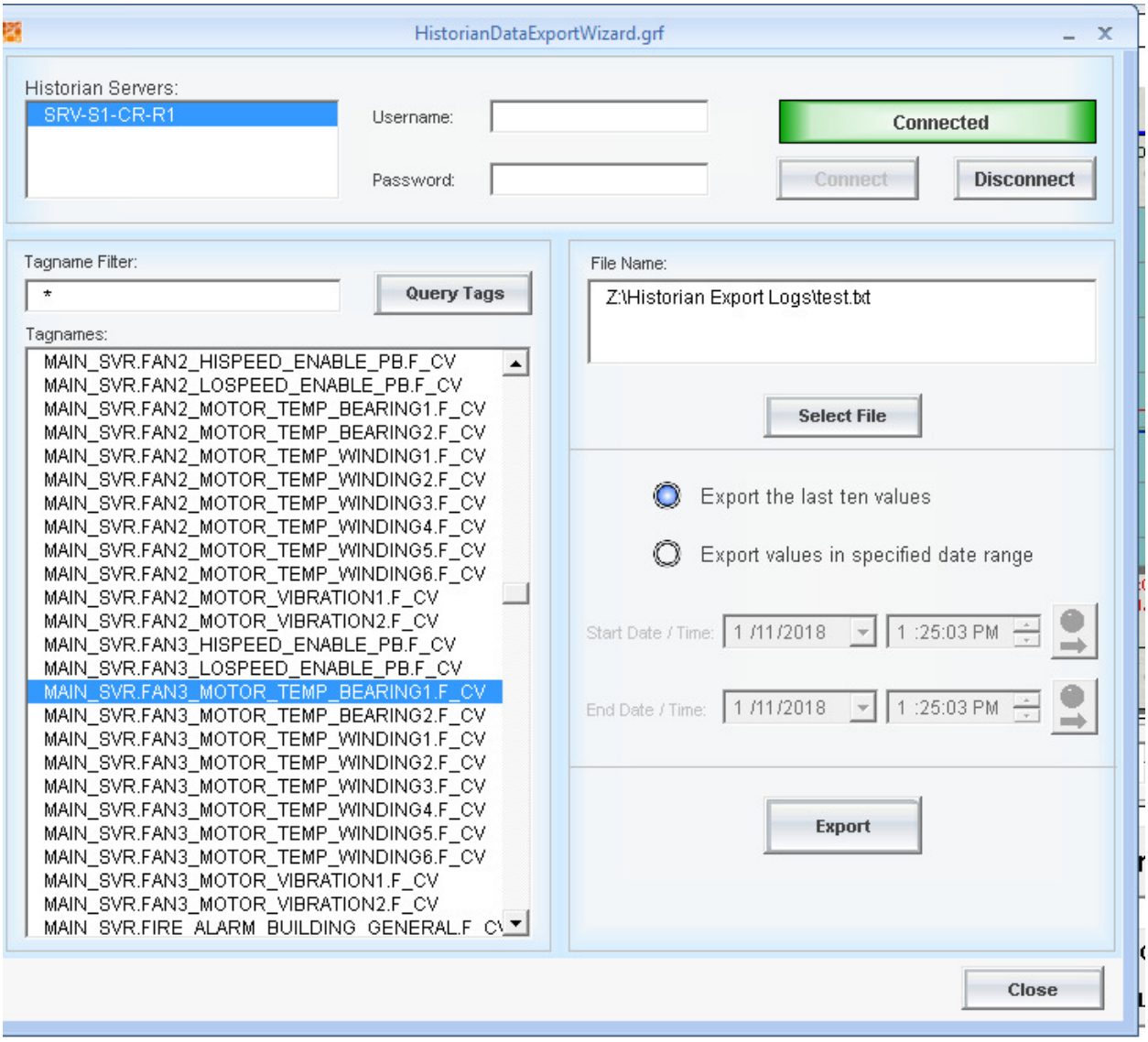
Once the server is connected, the connection indicator will turn green and indicate “Connected”. There is a tagname filter that allows for tags to be filtered by name.



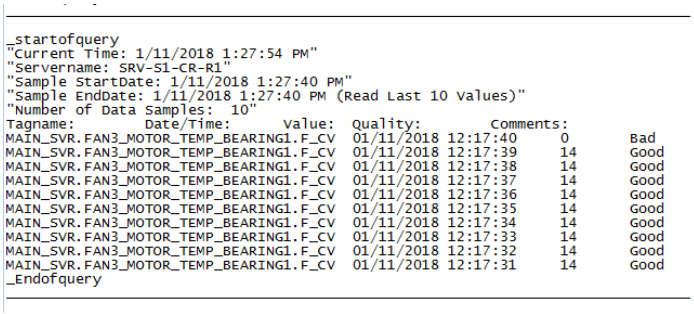
In the example below, the motor bearing 1 temperature is seelected for Fan 3. It is possible to export the historian tag values over a date range, or just the last 10 values.



It is necessary to select or create a new text file for the historian data to be exported to. In the example below, the Z: drive is mapped to the NAS system in the server cabinet. A file named test.txt has been seelcted to receive the last ten values.



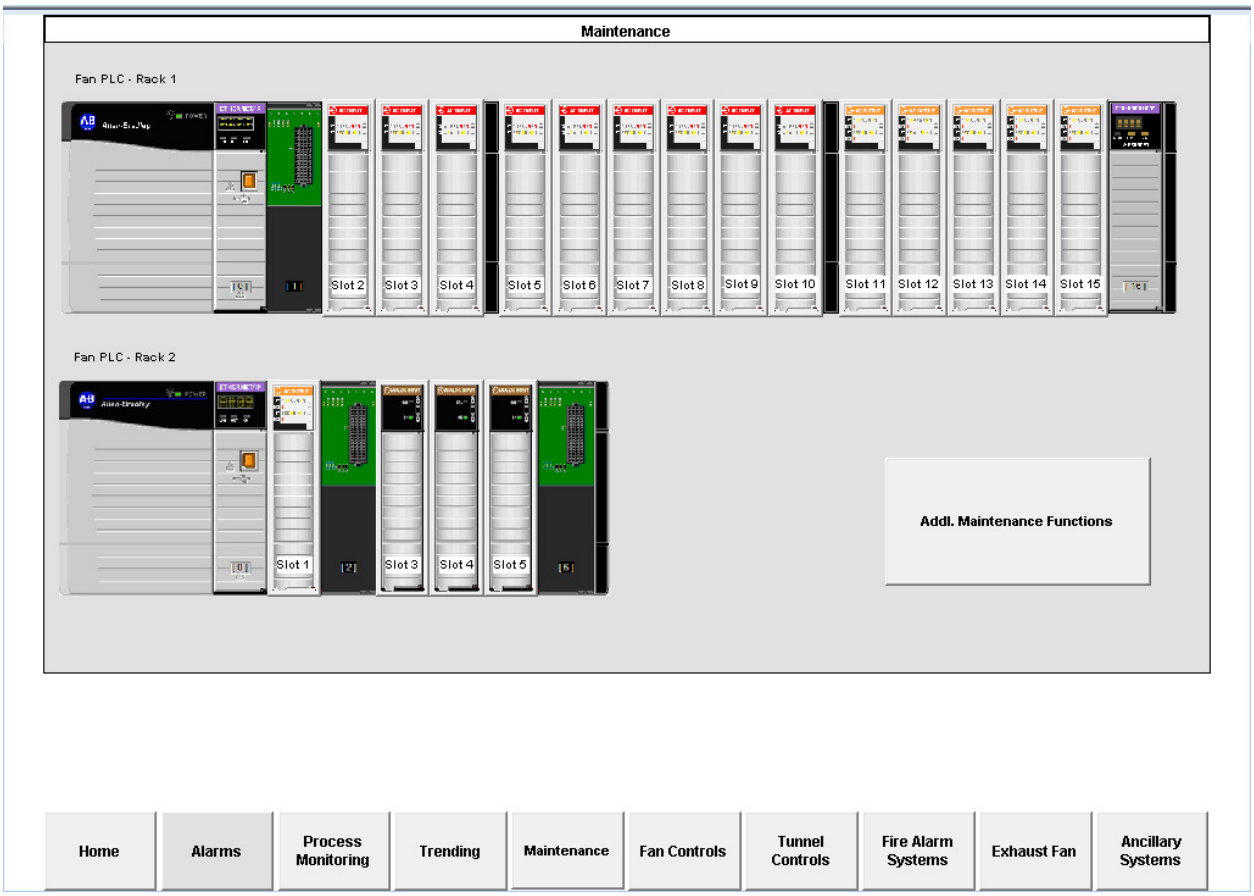
The screenshot below is of the text file showing the last ten values for the Fan 3 bearing 1 temperature. The Proficy Historian is logging values often, so the last ten values are logged over a 9-10 second range. The data shows that the temperature has remained at 14 Deg C. The quality of the data point at 12:17:40 is shown as Bad, which means the data was not collected successfully at that one point. Depending on how the data is to be interpreted, it is possible to modify the collection intervals and interpolate the results based on data quality.



```
_startofquery
"Current Time: 1/11/2018 1:27:54 PM"
"Servername: SRV-S1-CR-R1"
"Sample StartDate: 1/11/2018 1:27:40 PM"
"Sample EndDate: 1/11/2018 1:27:40 PM (Read Last 10 Values)"
"Number of Data Samples:  10"
Tagname:        Date/Time:      Value:  Quality:        Comments:
MAIN_SVR.FAN3_MOTOR_TEMP_BEARING1.F_CV  01/11/2018 12:17:40     0       Bad
MAIN_SVR.FAN3_MOTOR_TEMP_BEARING1.F_CV  01/11/2018 12:17:39     14      Good
MAIN_SVR.FAN3_MOTOR_TEMP_BEARING1.F_CV  01/11/2018 12:17:38     14      Good
MAIN_SVR.FAN3_MOTOR_TEMP_BEARING1.F_CV  01/11/2018 12:17:37     14      Good
MAIN_SVR.FAN3_MOTOR_TEMP_BEARING1.F_CV  01/11/2018 12:17:36     14      Good
MAIN_SVR.FAN3_MOTOR_TEMP_BEARING1.F_CV  01/11/2018 12:17:35     14      Good
MAIN_SVR.FAN3_MOTOR_TEMP_BEARING1.F_CV  01/11/2018 12:17:34     14      Good
MAIN_SVR.FAN3_MOTOR_TEMP_BEARING1.F_CV  01/11/2018 12:17:33     14      Good
MAIN_SVR.FAN3_MOTOR_TEMP_BEARING1.F_CV  01/11/2018 12:17:32     14      Good
MAIN_SVR.FAN3_MOTOR_TEMP_BEARING1.F_CV  01/11/2018 12:17:31     14      Good
_Endofquery
```

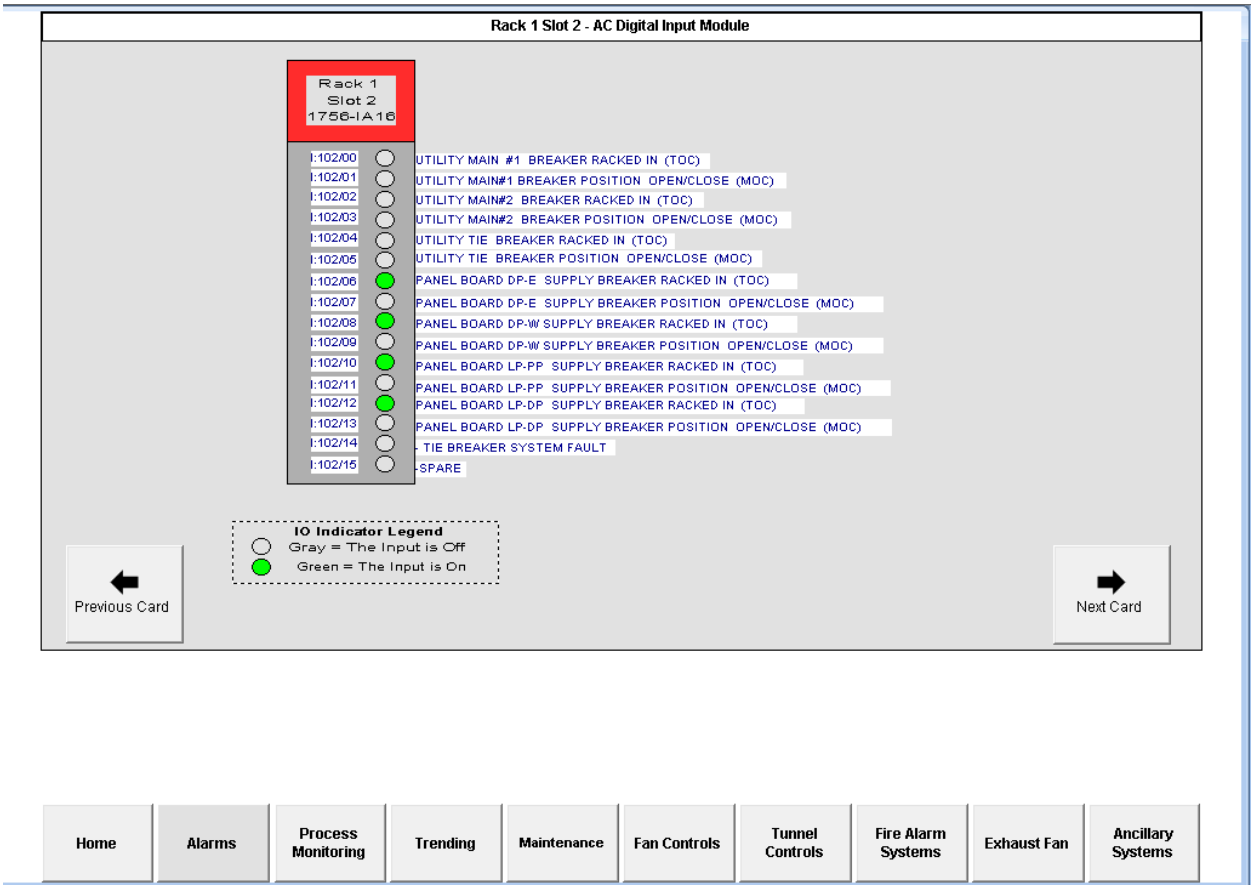
4.9 Maintenance Screen

The Maintenance Screen allows for the monitoring of the digital inputs and outputs as well as the analog inputs of the Fan PLC. The user can select the slot of the card to monitor by pressing on the slot on the touchscreen. An Additional Maintenance Functions button offers additional maintenance features.



4.10 Maintenance – AC Digital Input Screen

The example below is an example of one of the monitoring screens for digital inputs for the Fan PLC.



If the Additional Maintenance Functions button is selected, the following screen is displayed. If the system is in manual mode, it is possible to test the tunnel flashers in the North and South portals. Indicatos below each button show whether or not the portal flashers are on or off.

Fan runtime counts can also be reset from this screen. A runtime total is kept for each fan to show how much time each has run. If the times are reset to zero, the Last Reset time will be updated to show the last time the runtime was reset.

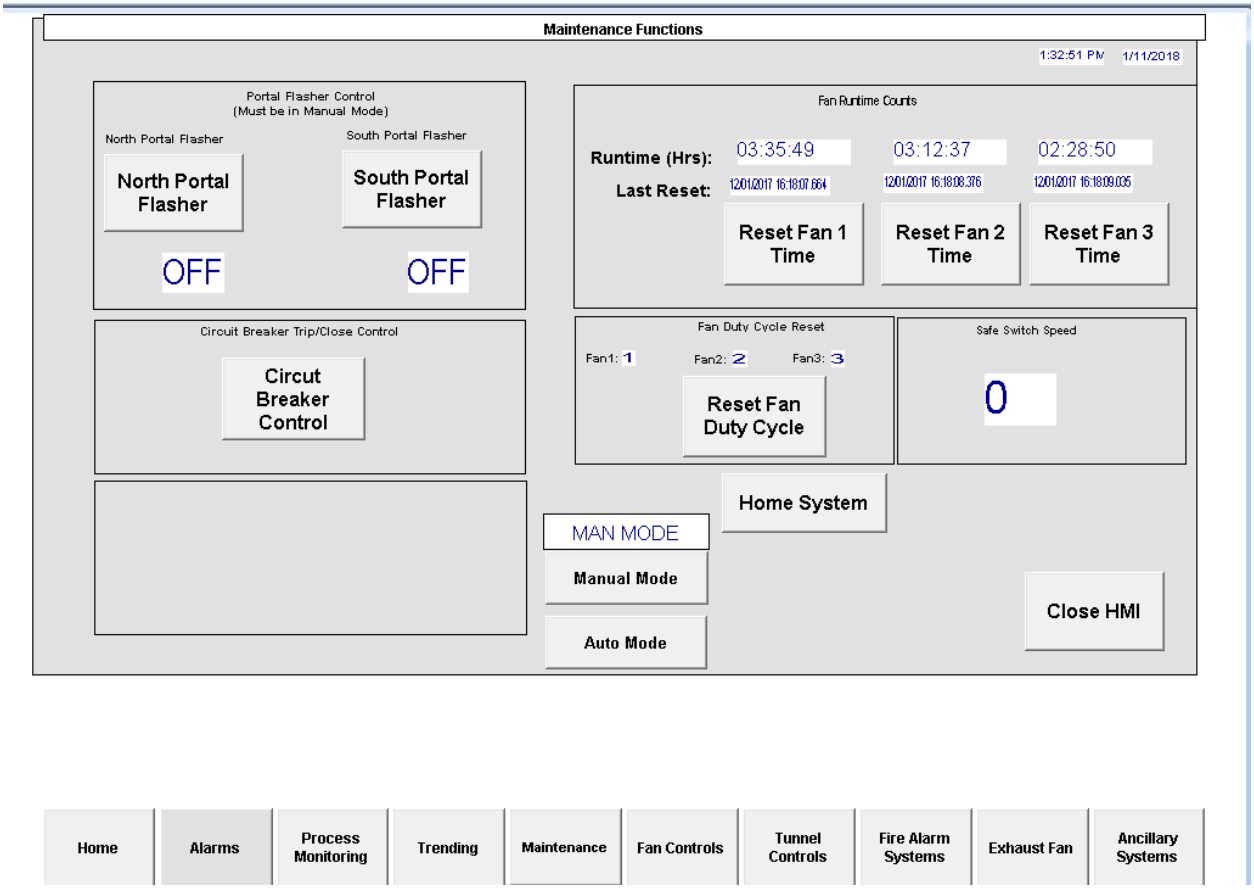
A Reset Fan Duty Cycle button is provided where it is possible to rese the fan duty cycle to where Fan 1 is the Duty 1 fan, Fan 2 is the Duty 2 fan, and Fan 3 is the Duty 3 fan.

The Safe Switch Speed numeric entry allows the range to be set for the “zero speed” function. If a value of 50 is entered, the safe zero speed range will be set to -50 RPM to +50 RPM. This range is used to allow a fan to be started in the opposite direction if the current speed falls within this range.

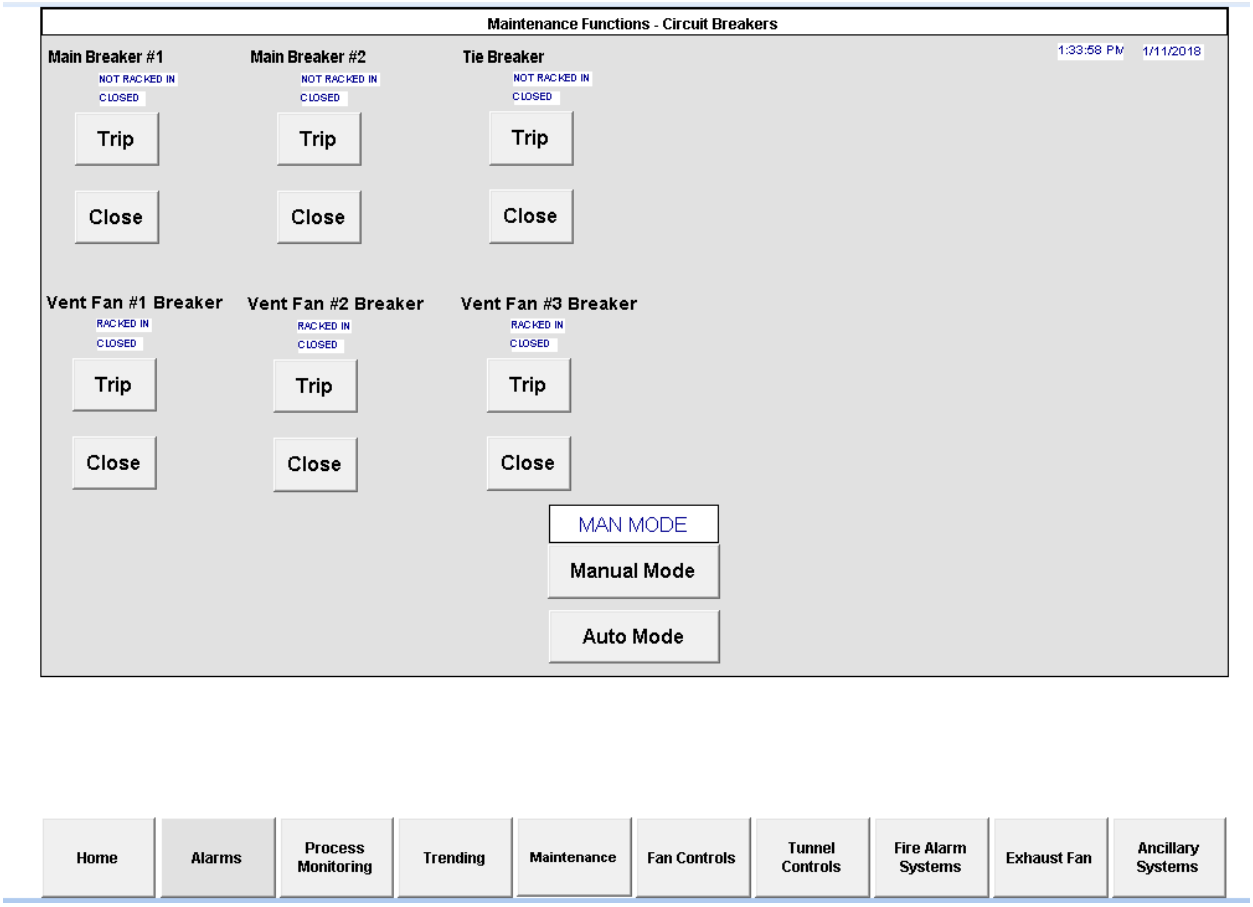
The Home System button allows the system to be homed if the system is in Manual Mode. This button does not work in No Mode or Auto Mode. Homing allows fans to be shut off and all dampers to be put in the closed state. Once the system is homed, it can be started in automatic.

The Close HMI button can be used to shutdown iFix and exit to Windows.

The Circuit Breaker Control button allows remote control of the various circuit breakers in the system.



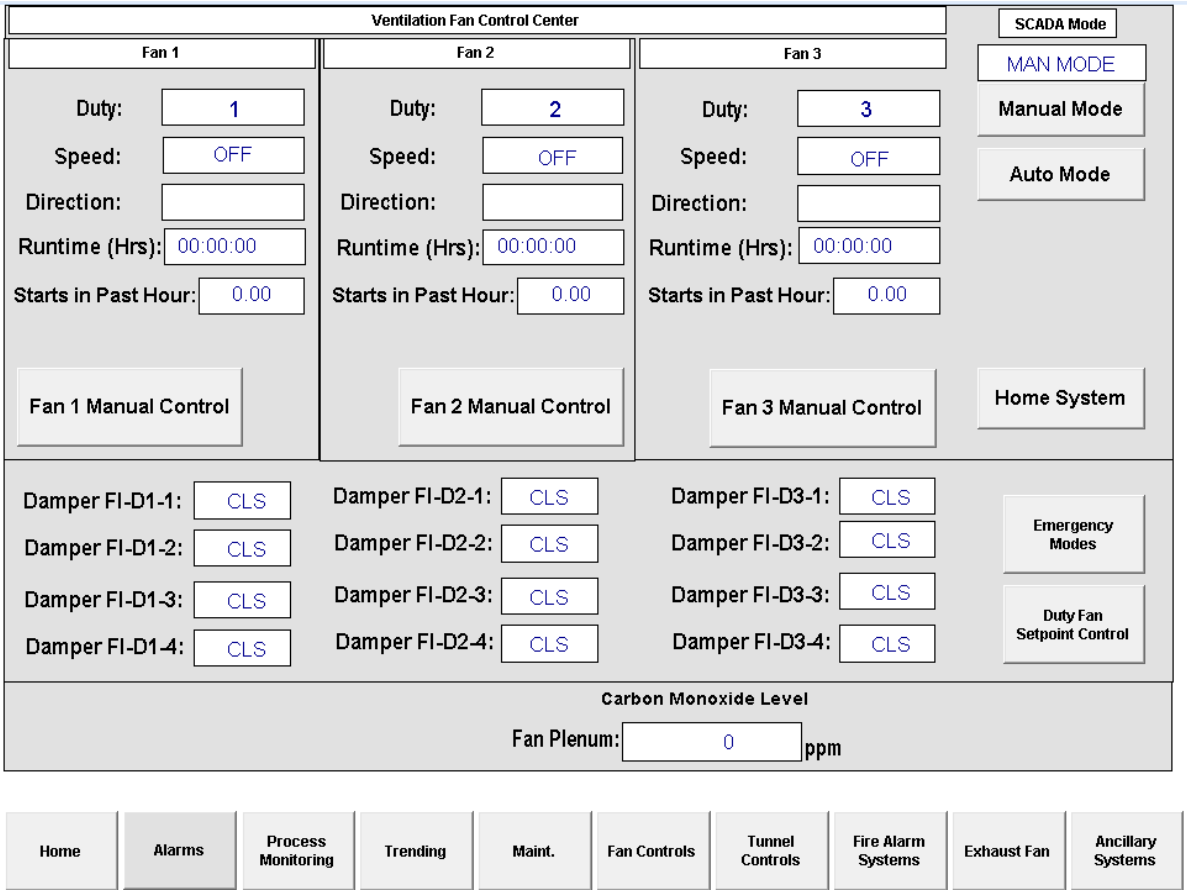
The Circuit Breaker Maintenance screen shows the racked and closed status of each breaker. A trip and closed button can be used to remotely trip a breaker or remotely close a breaker.



4.11 Ventilation Fan Control Screen

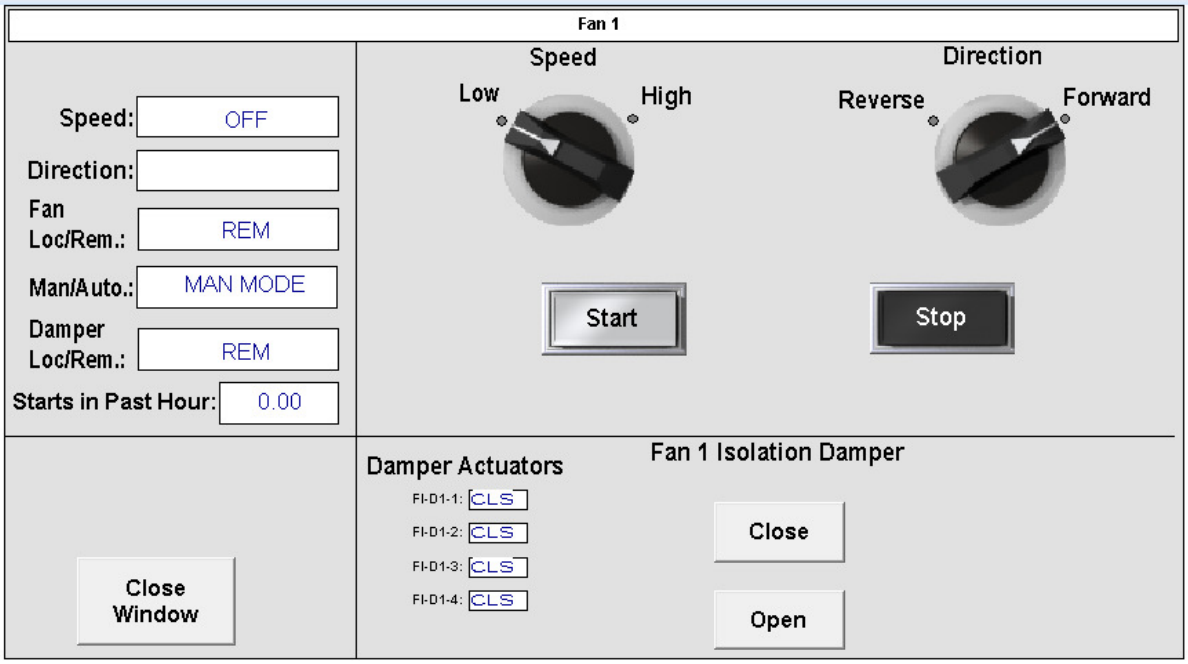
This screen monitors key information regarding the status of the three ventilation fans and isolation dampers, and allows for navigation to setpoint and manual control screens. There is also a button to navigate to the Emergency Modes screen, where ventilation control can be overridden from the normal CO monitoring control. The system can also be homed from this screen, and the system mode can be changed between manual and auto operation. The Duty Fan Setpoint Control button navigates to a screen where the various CO setpoints can be modified. An indicator also shows the CO level in the Fan Plenum area which is near the three ventilation fans. If the system is running in automatic cycle, and if the CO level rises to a high enough level, a fan will turn on and dampers will be opened to the exit ramp roadway to clear out the CO.

The Fan 1, 2 and 3 Manual Control buttons allow for navigation to manual control screens where the fan speeds and directions can be controlled along with the fan isolation dampers.



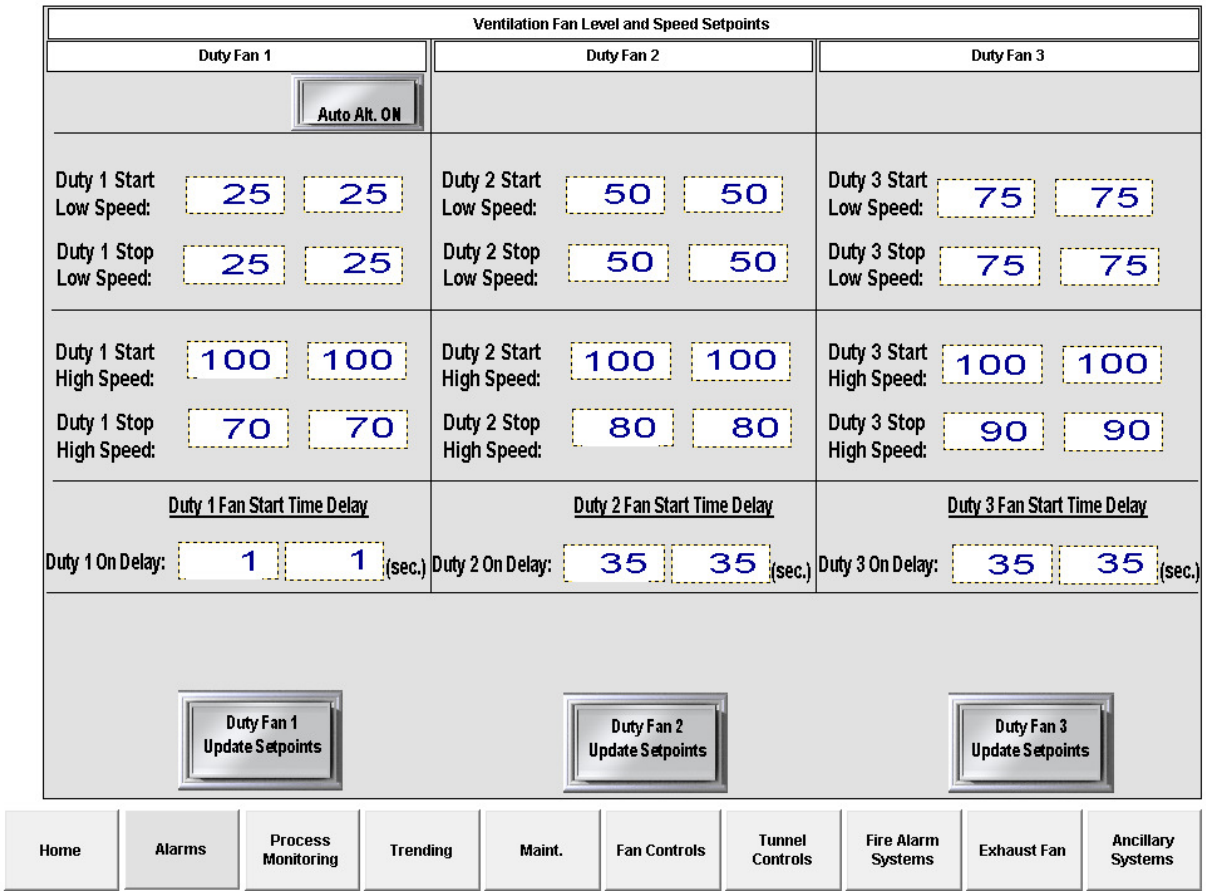
4.12 Fan Manual Control Screen

This screen monitors key information regarding the status of the selected fan, and allows the speed and direction of the fan to be changed. A start and stop button controls whether the fan is running or not. The fan selector switch on the motor control center must be in Remote, and the SCADA mode must be set to manual in order to control the fan using these manual controls on the screen. In addition, the fan isolation damper selector switch must be in the Auto or Remote position. These selector switches are located near the fans. The fan isolation dampers can be opened and closed.



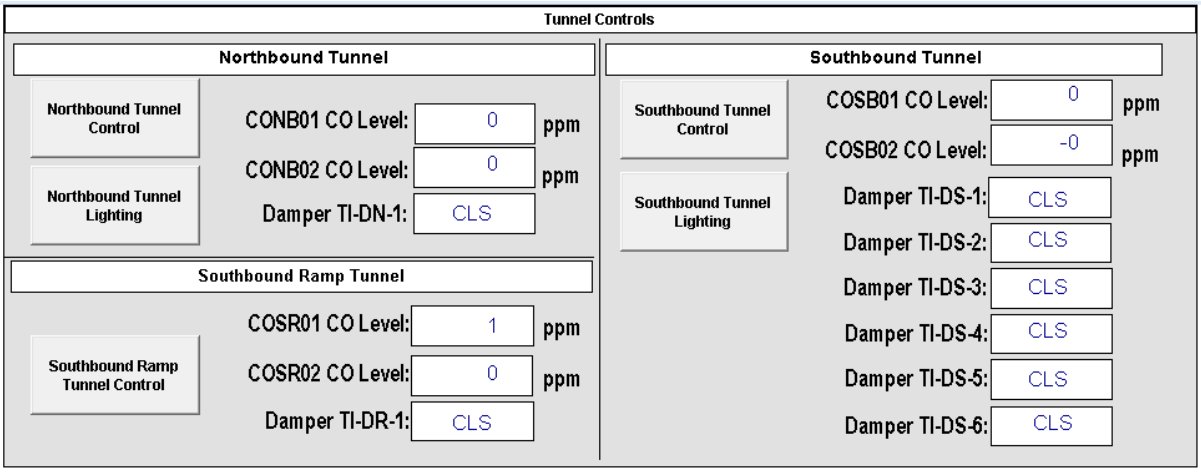
4.13 Ventilation Fan Setpoints Screen

This screen allows the setpoints to be modified that bring on the standby (duty 2 and duty 3) fans based on CO levels. Automatic fan alternation can be turned on and off from this screen as well. It is recommended that automatic fan alternation be left on to allow even run times on all of the fans. The duty fan start time delays allow delays between the automatic starting of each fan. These delays are used to allow fans to get to speed and also to allow for time for the current drawn by each running fan to reduce from the initial starting inrush.



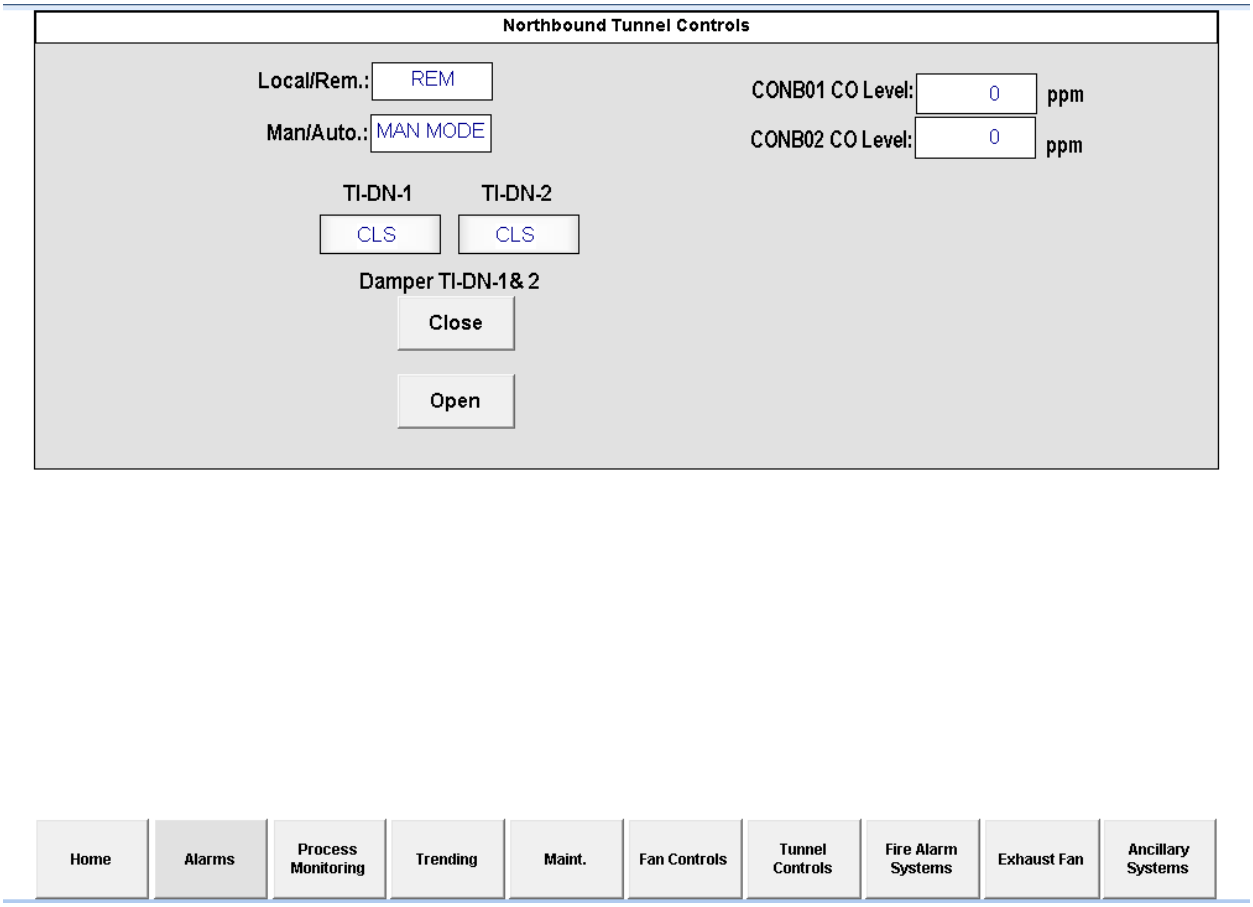
4.14 Tunnel Controls Screen

This screen shows the current CO levels and the state of the tunnel dampers. Additional navigation buttons allow the status of the tunnel lighting to be viewed, and also allows for manual control over the tunnel dampers.



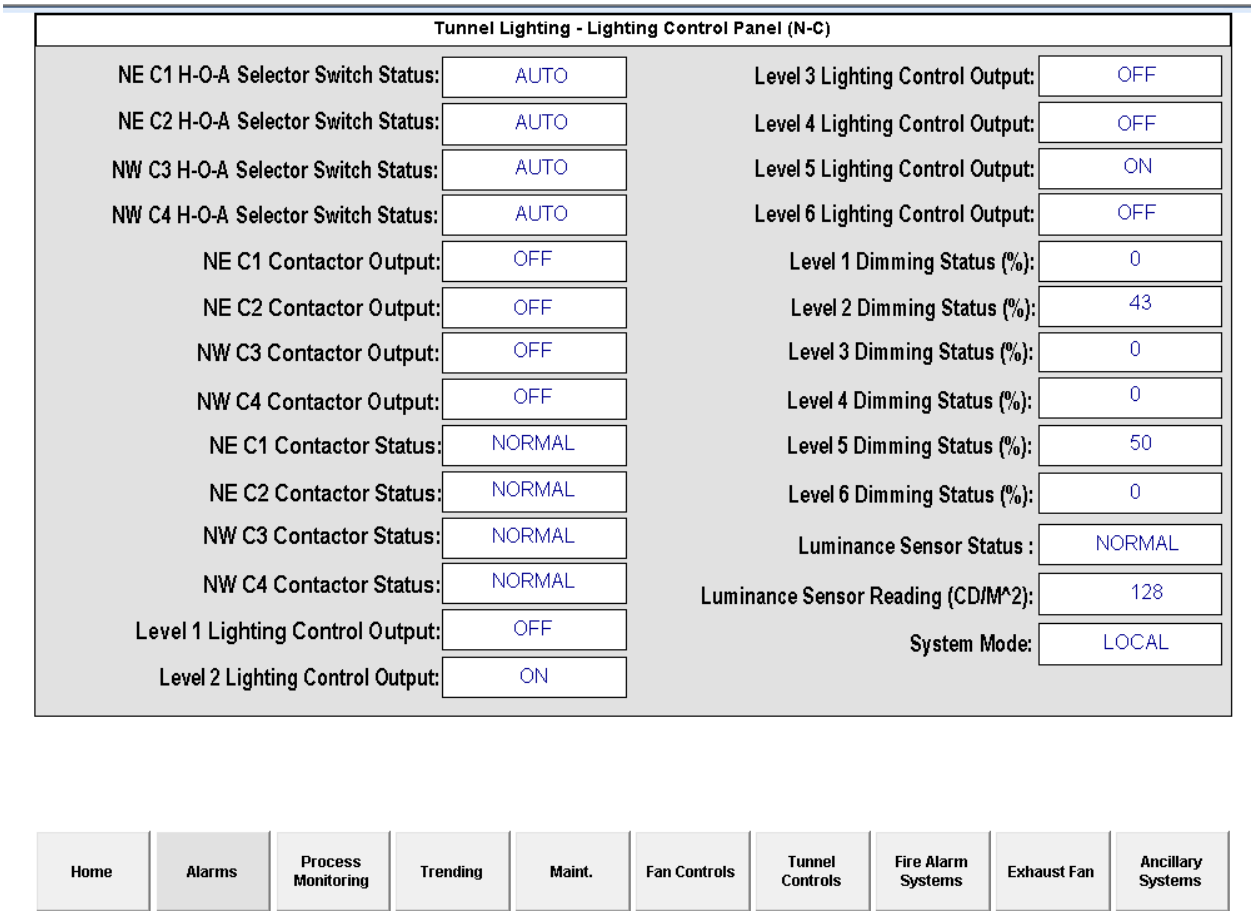
4.15 Northbound Tunnel Control Screen

This screen shows the current CO levels and the state of the tunnel damper. The tunnel damper can also be opened or closed if the SCADA manual mode has been selected and the damper is selected in remote.



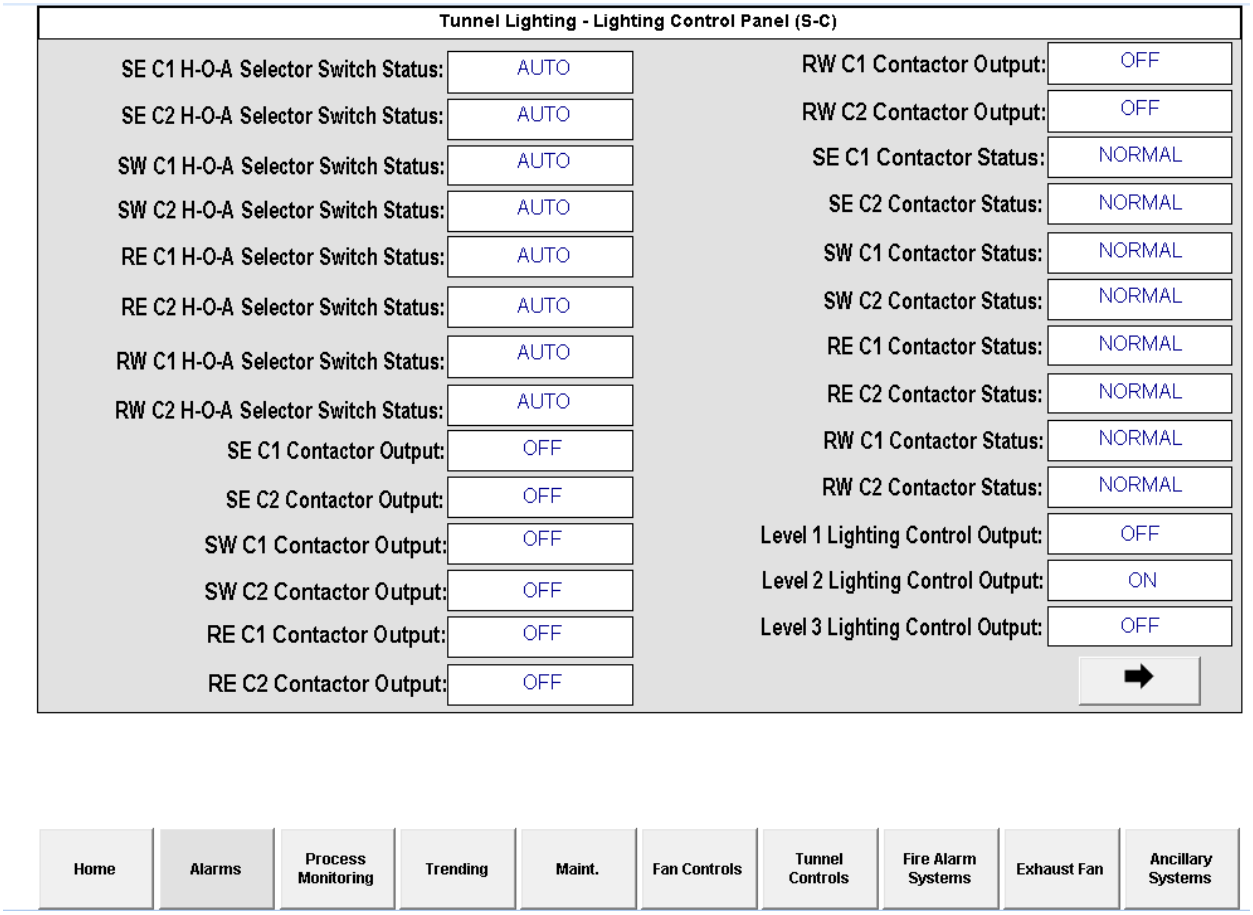
4.16 Northbound Tunnel Lighting Screen

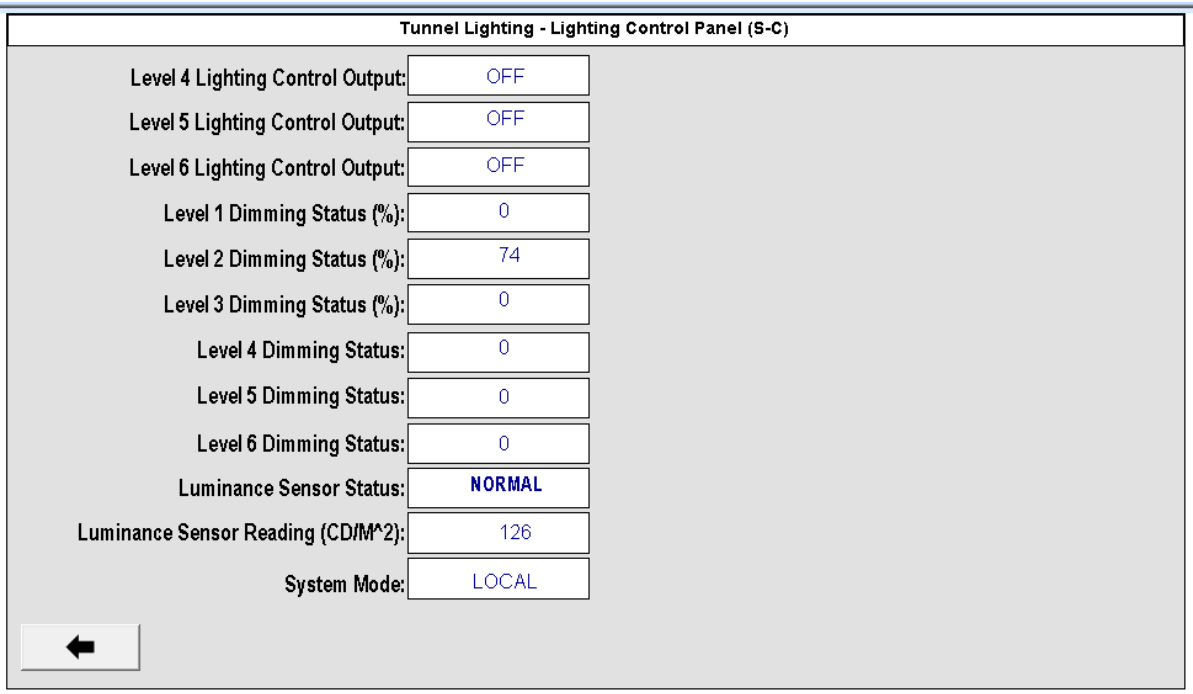
This screen shows the status of the North Lighting Control System.



4.17 Southbound Tunnel Lighting Screens

These two screens show the status of the South Lighting Control System. The status of both the Southbound Tunnel Lighting Controls and the South Exit Ramp Lighting is displayed on these two screens.

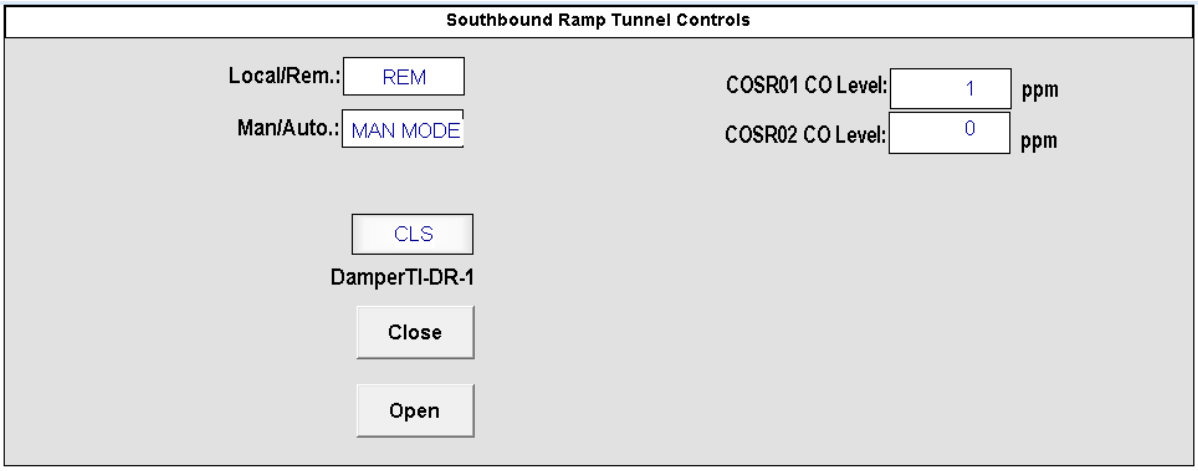



Tunnel Lighting - Lighting Control Panel (S-C)
Level 4 Lighting Control Output:
OFF
Level 5 Lighting Control Output:
OFF
Level 6 Lighting Control Output:
OFF
Level 1 Dimming Status (%):
0
Level 2 Dimming Status (%):
74
Level 3 Dimming Status (%):
0
Level 4 Dimming Status:
0
Level 5 Dimming Status:
0
Level 6 Dimming Status:
0
Luminance Sensor Status:
NORMAL
Luminance Sensor Reading (CD/M^2):
126
System Mode:
LOCAL


Home
Alarms
Process Monitoring
Trending
Maint.
Fan Controls
Tunnel Controls
Fire Alarm Systems
Exhaust Fan
Ancillary Systems

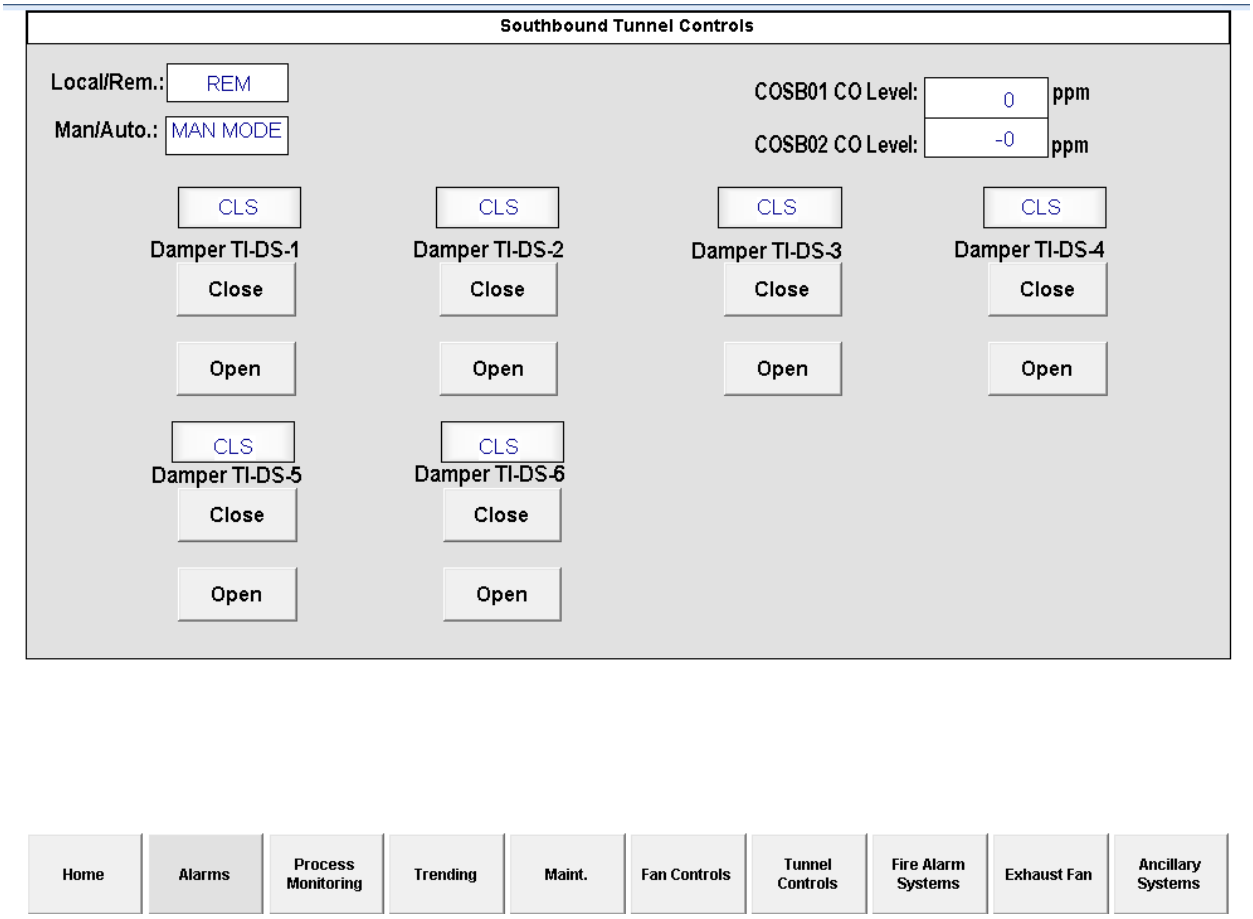
4.18 Southbound Ramp Tunnel Control Screen

This screen shows the current CO levels and the state of the tunnel damper. The tunnel damper can also be opened or closed if the SCADA manual mode has been selected and the damper is selected in remote.



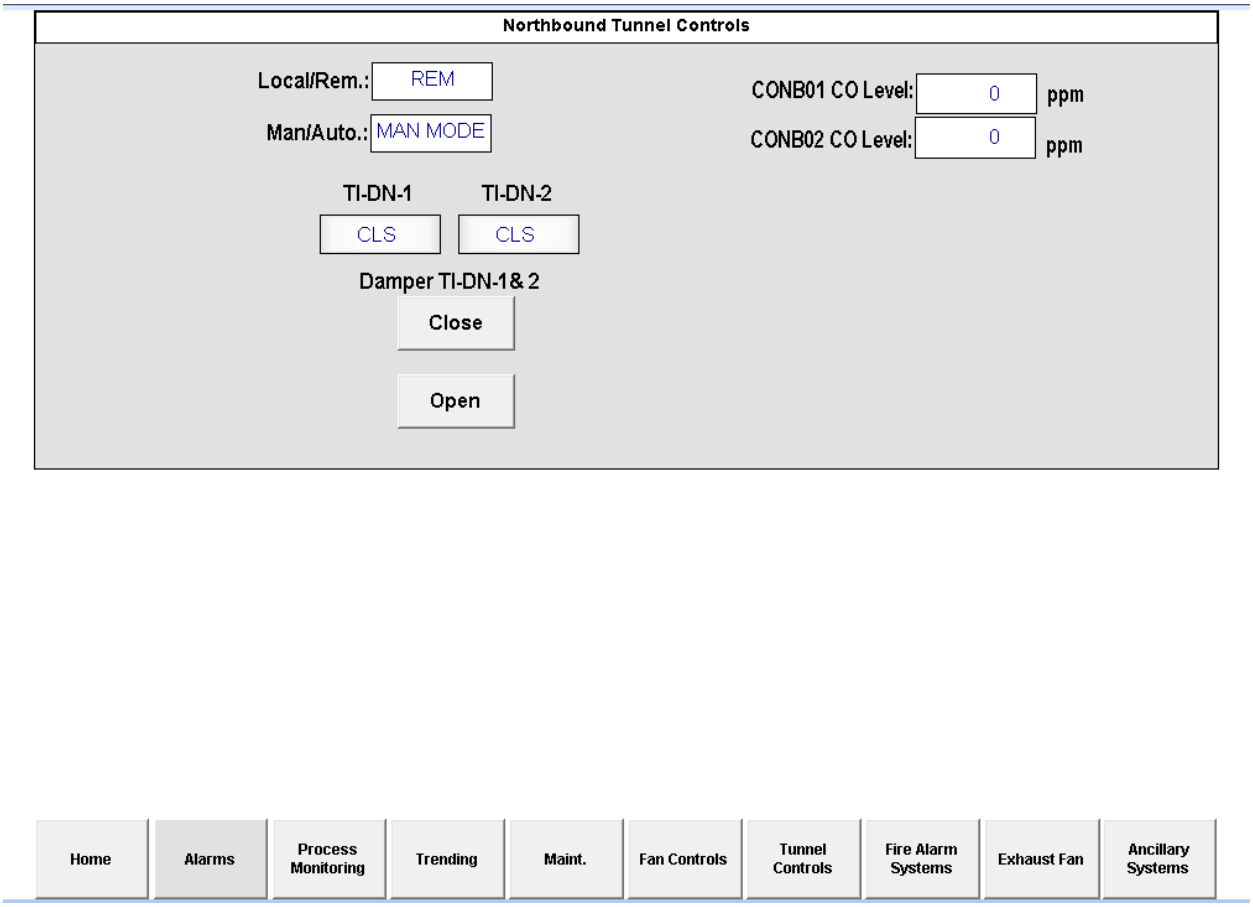
4.19 Southbound Tunnel Control Screen

This screen shows the current CO levels and the state of the tunnel damper. The tunnel damper can also be opened or closed if the SCADA manual mode has been selected and the damper is selected in remote.



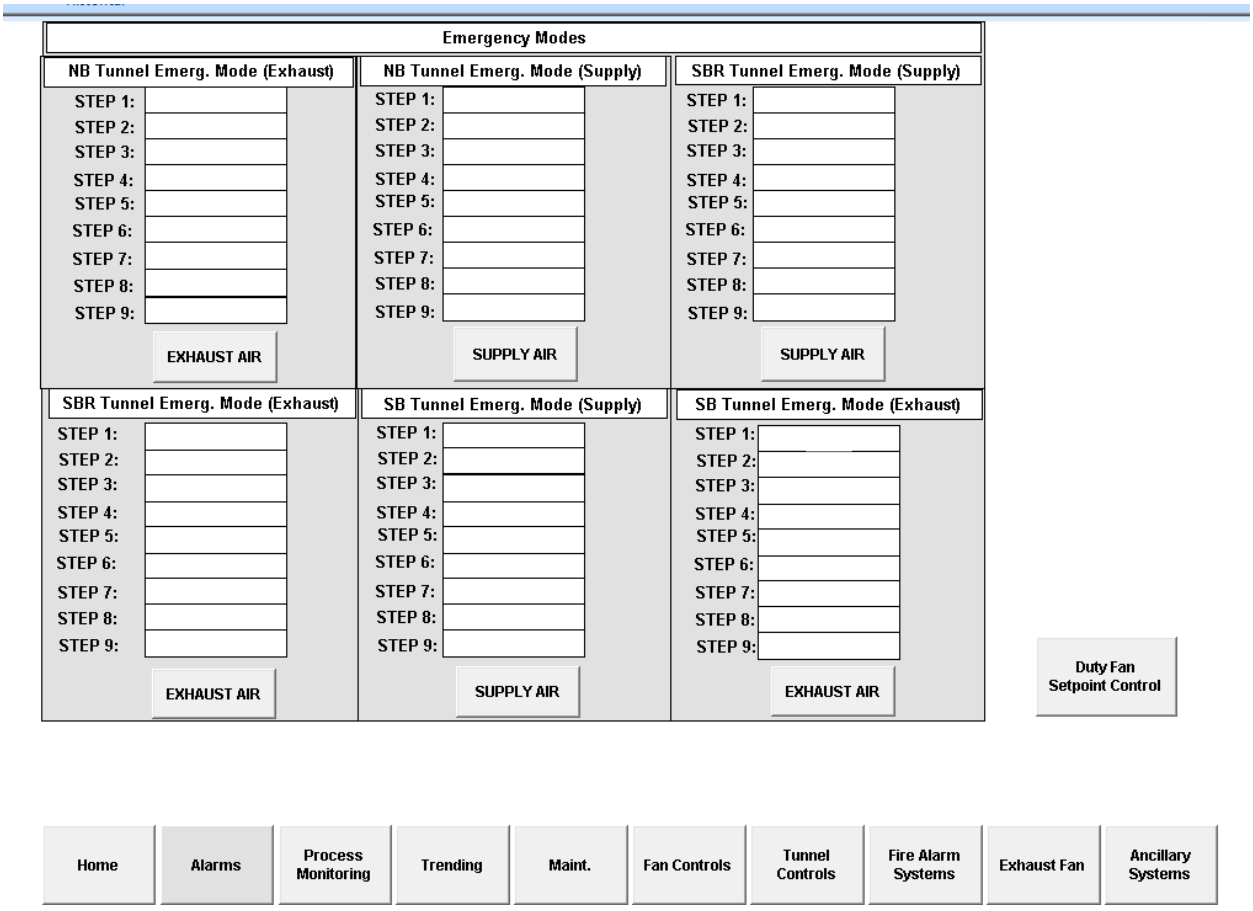
4.20 Northbound Tunnel Control Screen

This screen shows the current CO levels and the state of the tunnel damper. The tunnel damper can also be opened or closed if the SCADA manual mode has been selected and the damper is selected in remote.



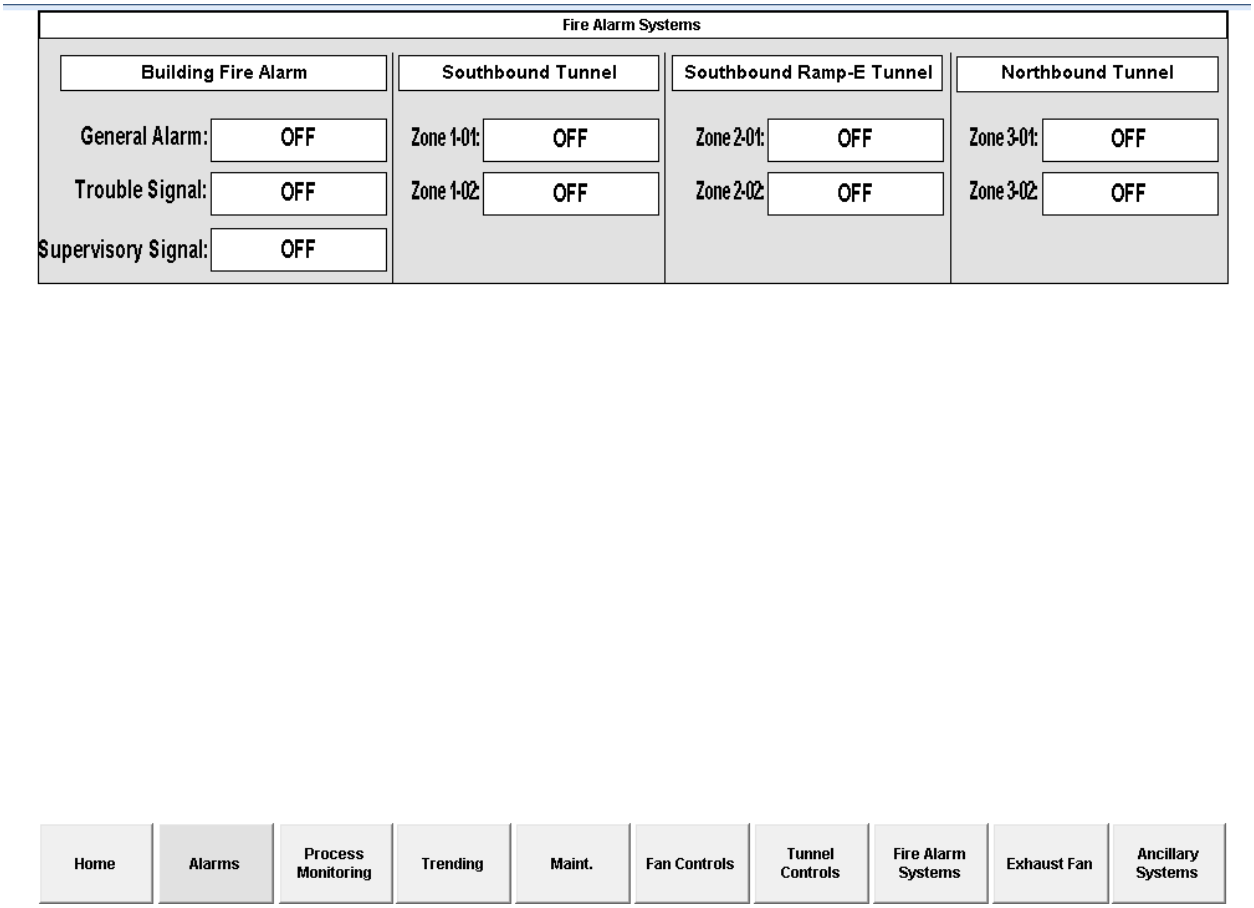
4.21 Emergency Modes Screen

This screen shows the status of any of the emergency modes. Emergency modes can also be initiated from this screen.



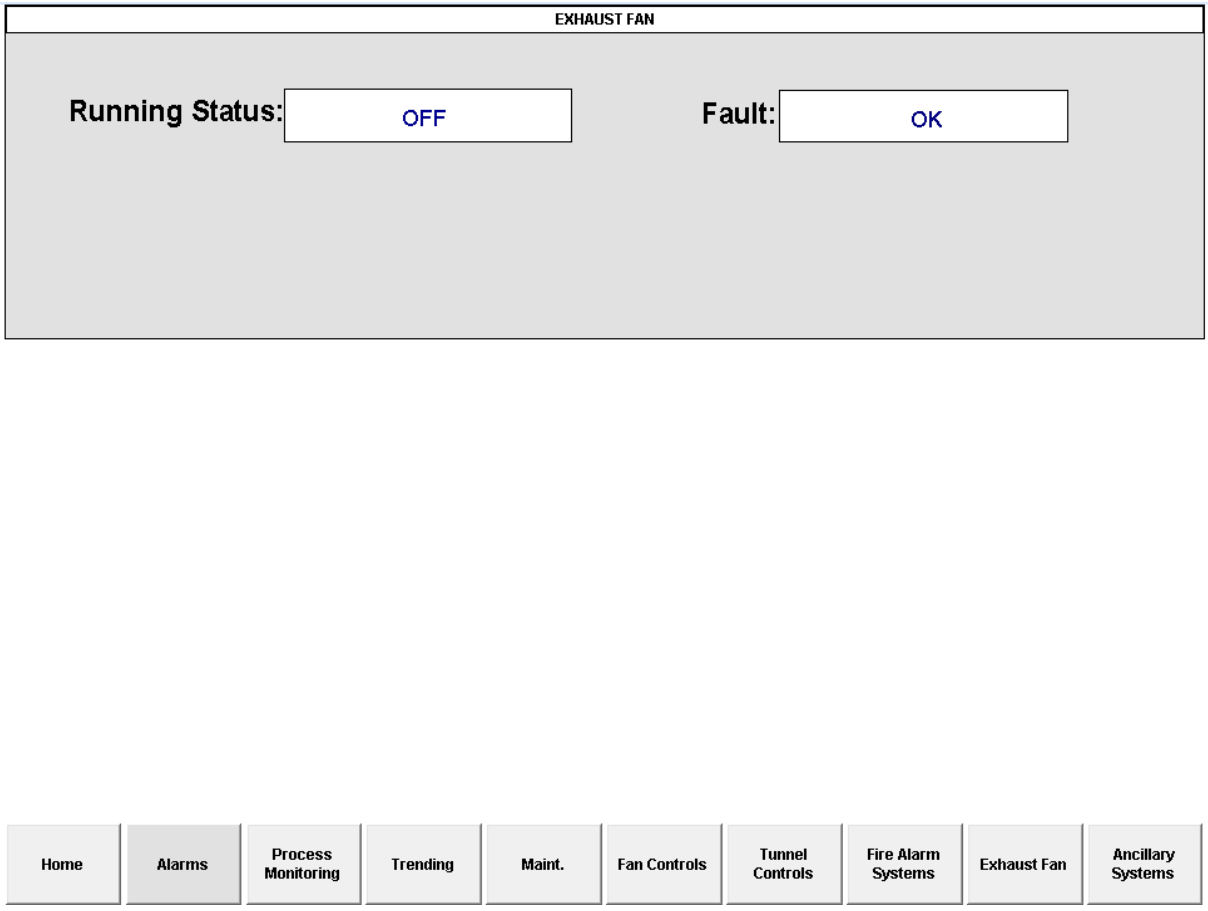
4.22 Fire Alarms Screen

This screen shows the status of the building fire alarms and the tunnel fire alarms.



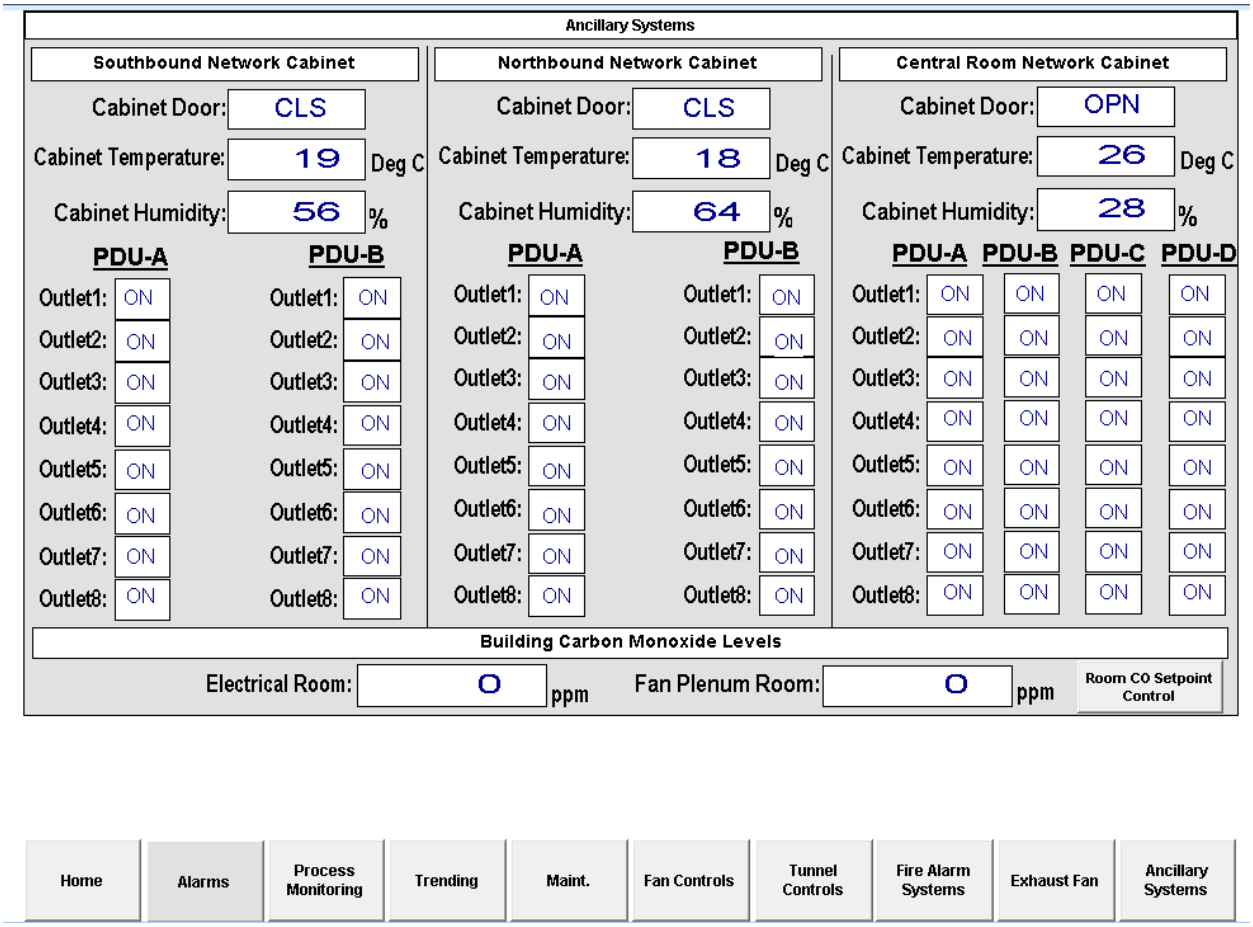
4.23 Exhaust Fan Screen

This screen shows the status of the Exhaust Fan in the Fan Electrical Room.



4.24 Ancillary Systems Screen

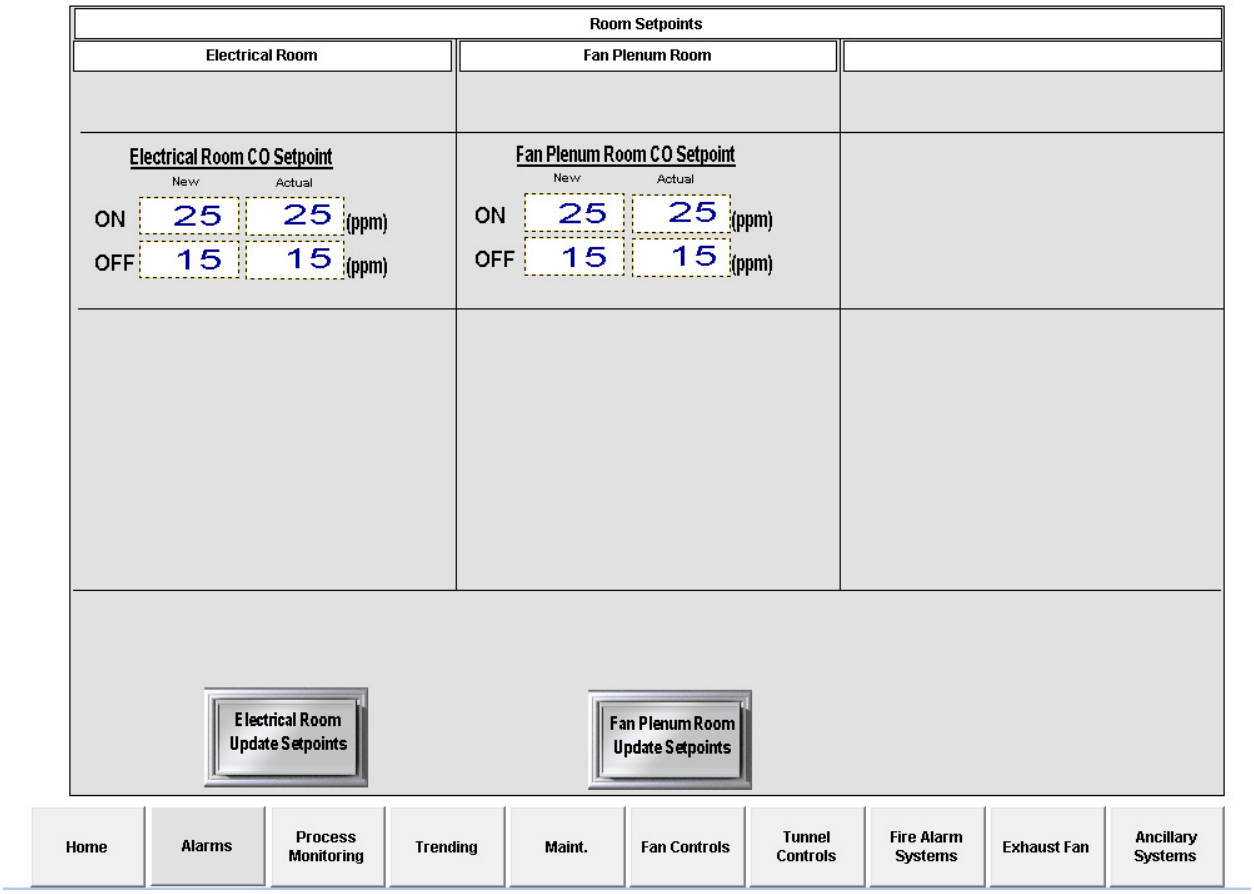
This screen shows the status of the environmental monitoring of the network cabinets as well as the status of the APC PDUs. The carbon monoxide levels measured in the Electrical Room and Fan Plenum Room are also reported on this screen.



4.25 Room Setpoints Screen

The Room Setpoints screen allows the CO setpoints to be entered for the CO control for the Fan Electrical Room and for the Fan Plenum Room. If the CO goes above the setpoint in the Fan Electrical Room, there is an exhaust fan that will run until the CO level goes below the OFF setpoint. In the example below, when the CO rises above 25ppp, the exhaust fan will turn on. When the CO level later goes below 15ppp, the exhaust fan will turn off.

For the Fan Plenum room, the Southbound Exit Ramp dampers will be opened, and one of the ventilation fans will run to clear the area of CO.



SECTION 5
ALARMS

Southbound Tunnel CO Sensor Zone 1_01 High Level - Road Closure
Southbound Tunnel CO Sensor Zone 1_02 High Level - Road Closure
Southbound Tunnel CO Sensor Zone 1_01 Loss of Signal
Southbound Tunnel CO Sensor Zone 1_02 Loss of Signal
Southbound Ramp Tunnel CO Sensor Zone 2_01 High Level - Road Closure
Southbound Ramp Tunnel CO Sensor Zone 2_02 High Level - Road Closure
Southbound Ramp Tunnel CO Sensor Zone 2_01 Loss of Signal
Southbound Ramp Tunnel CO Sensor Zone 2_02 Loss of Signal
Northbound Tunnel CO Sensor Zone 3_01 High Level - Road Closure
Northbound Tunnel CO Sensor Zone 3_02 High Level - Road Closure
Northbound Tunnel CO Sensor Zone 3_01 Loss of Signal
Northbound Tunnel CO Sensor Zone 3_02 Loss of Signal
Duty 2 Fan Requested - Not Available
Duty 3 Fan Requested - Not Available
Fan 1 Failed to Start Lo Speed Fwd
Fan 1 Failed to Start Lo Speed Rev
Fan 1 Failed to Start Hi Speed Fwd
Fan 1 Failed to Start Hi Speed Rev
Fan 2 Failed to Start Lo Speed Fwd
Fan 2 Failed to Start Lo Speed Rev
Fan 2 Failed to Start Hi Speed Fwd
Fan 2 Failed to Start Hi Speed Rev
Fan 3 Failed to Start Lo Speed Fwd
Fan 3 Failed to Start Lo Speed Rev
Fan 3 Failed to Start Hi Speed Fwd
Fan 3 Failed to Start Hi Speed Rev
Fan Motor 1 Winding/Bearing Overtemp
Fan Motor 1 HS Soft Starter fault
Fan Motor 1 High Speed Trip
Fan Motor 1 Low Speed Trip
Fan Motor 1 LS Soft Starter Fault
Fan 1 Isolation Damper Actuator FI-D1-1 failed to open

Fan 1 Isolation Damper Actuator FI-D1-1 failed to close
Fan 1 Isolation Damper Actuator FI-D1-2 failed to open
Fan 1 Isolation Damper Actuator FI-D1-2 failed to close
Fan 1 Isolation Damper Actuator FI-D1-3 failed to open
Fan 1 Isolation Damper Actuator FI-D1-3 failed to close
Fan 1 Isolation Damper Actuator FI-D1-4 failed to open
Fan 1 Isolation Damper Actuator FI-D1-4 failed to close
Fan 1 Breaker is racked but open
Fan running but not commanded by PLC
Fan 1 Motor Restart Limit Reached
Fan Motor 2 Winding/Bearing Overtemp
Fan Motor 2 HS Soft Starter fault
Fan Motor 2 High Speed Trip
Fan Motor 2 Low Speed Trip
Fan Motor 2 LS Soft Starter Fault
Fan 2 Isolation Damper Actuator FI-D2-1 failed to open
Fan 2 Isolation Damper Actuator FI-D2-1 failed to close
Fan 2 Isolation Damper Actuator FI-D2-2 failed to open
Fan 2 Isolation Damper Actuator FI-D2-2 failed to close
Fan 2 Isolation Damper Actuator FI-D2-3 failed to open
Fan 2 Isolation Damper Actuator FI-D2-3 failed to close
Fan 2 Isolation Damper Actuator FI-D2-4 failed to open
Fan 2 Isolation Damper Actuator FI-D2-4 failed to close
Fan 2 Breaker is racked but open
Fan running but not commanded by PLC
Fan 2 Motor Restart Limit Reached
Fan Motor 3 Winding/Bearing Overtemp
Fan Motor 3 HS Soft Starter fault
Fan Motor 3 High Speed Trip
Fan Motor 3 Low Speed Trip
Fan Motor 3 LS Soft Starter Fault
Fan 3 Isolation Damper Actuator FI-D3-1 failed to open
Fan 3 Isolation Damper Actuator FI-D3-1 failed to close
Fan 3 Isolation Damper Actuator FI-D3-2 failed to open
Fan 3 Isolation Damper Actuator FI-D3-2 failed to close
Fan 3 Isolation Damper Actuator FI-D3-3 failed to open
Fan 3 Isolation Damper Actuator FI-D3-3 failed to close
Fan 3 Isolation Damper Actuator FI-D3-4 failed to open
Fan 3 Isolation Damper Actuator FI-D3-4 failed to close
Fan 3 Breaker is racked but open
Fan 3 Motor Restart Limit Reached
Fan running but not commanded by PLC
Southbound Tunnel Damper Actuator TI-DS-1 failed to open
Southbound Tunnel Damper Actuator TI-DS-1 failed to close
Southbound Tunnel Damper Actuator TI-DS-2 failed to open
Southbound Tunnel Damper Actuator TI-DS-2 failed to close
Southbound Tunnel Damper Actuator TI-DS-3 failed to open

Southbound Tunnel Damper Actuator TI-DS-3 failed to close
Southbound Tunnel Damper Actuator TI-DS-4 failed to open
Southbound Tunnel Damper Actuator TI-DS-4 failed to close
Southbound Tunnel Damper Actuator TI-DS-5 failed to open
Southbound Tunnel Damper Actuator TI-DS-5 failed to close
Southbound Tunnel Damper Actuator TI-DS-6 failed to open
Southbound Tunnel Damper Actuator TI-DS-6 failed to close
SB Exit Ramp Tunnel Actuator TI-DR failed to open
SB Exit Ramp Tunnel Actuator TI-DR failed to close
Northbound Tunnel Actuator TI-DN-1 failed to open
Northbound Tunnel Actuator TI-DN-1 failed to close
Northbound Tunnel Actuator TI-DN-2 failed to open
Northbound Tunnel Actuator TI-DN-2 failed to close
Building Fire Alarm General Alarm
Building Fire Alarm Trouble
HVAC Fault
Fan 1 Motor Vibration 1
Fan 1 Motor Vibration 2
Fan 2 Motor Vibration 1
Fan 2 Motor Vibration 2
Fan 3 Motor Vibration 1
Fan 3 Motor Vibration 2
Fan Plenum Room CO High Level
Fan Plenum room CO loss of signal
Electrical Room CO High Level
Electrical room CO loss of signal
Northbound Portal Communications Timeout
Southbound Portal Communications Timeout
SB Ramp Emerg Supply - Road Closure
SB Ramp Emerg Exhaust - Road Closure
SB Emerg Supply - Road Closure
SB Emerg Exhaust - Road Closure
NB Emerg Supply - Road Closure
NB Emerg Exhaust - Road Closure
Main Breaker 1 Racked but Open
Main Breaker 2 Racked but Open
Tie Breaker Racked & Open
Tie Breaker System Fault
Panel DP-E Breaker Racked & Open
Panel DP-W Breaker Racked & Open
Panel LP-PP Breaker Racked & Open
Modbus TCP/IP Communications Alarm
Server S.M.A.R.T. status alarm

SECTION 6
PLC I/O

6.0 DIGITAL INPUTS

TAG	DESCRIPTION
I102.0	Utility Main #1 Breaker racked in (toc) MBRER1-000-RACKD
I102.1	Utility Main #1 Breaker position open/close (moc) MBRER1-000-OPNED
I102.2	Utility Main #2 Breaker racked in (toc) MBRER2-000-OPNED
I102.3	Utility Main #2 Breaker position open/close (moc) MBRER2-000-OPNED
I102.4	Utility tie Breaker racked in (toc) UBRER1-000-RACKD
I102.5	Utility tie Breaker position open/close (moc) UBRER1-000-OPNED
I102.6	Panel Board dp-e Supply Breaker racked in (toc) PBHER1-000-RACKD
I102.7	Panel Board dp-e Supply Breaker position open/close (moc) PBHER1-000-OPNED
I102.8	Panel Board dp-w Supply Breaker racked in (toc) PBHER2-000-RACKD
I102.9	Panel Board dp-w Supply Breaker position open/close (moc) PBHER2-000-OPNED
I102.10	Panel Board lp-pp Supply Breaker racked in (toc) PBERLP-000-RACKD
I102.11	Panel Board lp-pp Supply Breaker position open/close (moc) PBERLP-000-OPNED
I102.12	Panel Board lp-dp Supply Breaker racked in (toc) PBHRLP-000-RACKD
I102.13	Panel Board lp-dp Supply Breaker position open/close (moc) PBHERLP-000-OPNED
I102.14	Tie Breaker System Fault
I102.15	Spare

TAG	DESCRIPTION
I103.0	Fan Motor#1 Motor winding/bearing over temperature block start TV-F1-WBR-OVRTM
I103.1	Fan Motor#1 HS Soft Starter fault TV-F1-SSH-FAULT
I103.2	Fan Motor#1 HS Soft Starter started/bypassed TV-F1-SSH-BYPAS
I103.3	Fan Motor#1 High-Speed forward running TV-F1-HSP-FDRNG
I103.4	Fan Motor#1 High-Speed reverse running TV-F1-HSP-RVRNG
I103.5	Fan Motor#1 Low-Speed forward running TV-F1-LSP-FDRNG
I103.6	Fan Motor#1 Low-Speed reverse running TV-F1-LSP-RVRNG
I103.7	Fan Motor#1 High-Speed trip TV-F1-HSP-TRIP
I103.8	Fan Motor#1 Low-Speed trip TV-F1-LSP-TRIP
I103.9	Fan Motor#1 Local/Remote TV-F1-CTR-REMOT
I103.10	Fan Motor#1 ls Soft Starter fault TV-F1-SSL-FAULT
I103.11	Fan Motor#1 ls Soft Starter started/bypassed TV-F1-SSL-BYPAS
I103.12	Spare
I103.13	Spare
I103.14	Spare
I103.15	Spare

TAG	DESCRIPTION
I104.0	Fan #1 Iso. Damper Actr.s local/remote FI-D1-D00-REMOT
I104.1	Fan #1 Iso. Damper Actr. fi-d1-1 position (ext. limit switch) opened FI-D1-D01-OPNED
I104.2	Fan #1 Iso. Damper Actr. fi-d1-1 position (ext. limit switch) closed FI-D1-D01-CLOSD
I104.3	Fan #1 Iso. Damper Actr. fi-d1-2 position (ext. limit switch) opened FI-D1-D02-OPNED
I104.4	Fan #1 Iso. Damper Actr. fi-d1-2 position (ext. limit switch) closed FI-D1-D02-CLOSD
I104.5	Fan #1 Iso. Damper Actr. fi-d1-3 position (ext. limit switch) opened FI-D1-D03-OPNED
I104.6	Fan #1 Iso. Damper Actr. fi-d1-3 position (ext. limit switch) closed FI-D1-D03-CLOSD
I104.7	Fan #1 Iso. Damper Actr. fi-d1-4 position (ext. limit switch) opened FI-D1-D04-OPNED
I104.8	Fan #1 Iso. Damper Actr. fi-d1-4 position (ext. limit switch) closed FI-D1-D04-CLOSD
I104.9	Soft Starter #1 Utility Supply Breaker racked in SS1FR1-SBR-RACKD
I104.10	Soft Starter #1 Utility Supply Breaker open/close SS1FR1-SBR-OPNED
I104.11	Spare
I104.12	Spare
I104.13	Spare
I104.14	Spare
I104.15	Spare

TAG	DESCRIPTION
I105.0	Fan Motor#2 Motor winding/bearing over temperature block start TV-F2-WBR-OVRTM
I105.1	Fan Motor#2 HS Soft Starter fault TV-F2-SSH-FAULT
I105.2	Fan Motor#2 HS Soft Starter started/bypassed TV-F2-SSH-BYPAS
I105.3	Fan Motor#2 High-Speed Forward running TV-F2-HSP-FDRNG
I105.4	Fan Motor#2 High-Speed Reverse running TV-F2-HSP-RVRNG
I105.5	Fan Motor#2 Low-Speed Forward running TV-F2-LSP-FDRNG
I105.6	Fan Motor#2 Low-Speed Reverse running TV-F2-LSP-RVRNG
I105.7	Fan Motor#2 High-Speed trip TV-F2-HSP-TRIP
I105.8	Fan Motor#2 Low-Speed trip TV-F2-LSP-TRIP
I105.9	Fan Motor#2 local/remote TV-F2-CTR-REMOT
I105.10	Fan Motor#2 LS Soft Starter fault TV-F2-SSL-FAULT
I105.11	Fan Motor#2 LS Soft Starter started/bypassed TV-F2-SSL-BYPAS
I105.12	Spare
I105.13	Spare
I105.14	Spare
I105.15	Spare

TAG	DESCRIPTION
I106.0	Fan #2 Iso. Damper Actr.s local/remote FI-D2-D00-REMOT
I106.1	Fan #2 Iso. Damper Actr fi-d2-1 position (ext. limit switch) opened FI-D2-D01-OPNED
I106.2	Fan #2 Iso. Damper Actr fi-d2-1 position (ext. limit switch) closed FI-D2-D01-CLOSD
I106.3	Fan #2 Iso. Damper Actr fi-d2-2 position (ext. limit switch) opened FI-D2-D02-OPNED
I106.4	Fan #2 Iso. Damper Actr fi-d2-2 position (ext. limit switch) closed FI-D2-D02-CLOSD
I106.5	Fan #2 Iso. Damper Actr. fi-d2-3 position (ext. limit switch) opened FI-D2-D03-OPNED
I106.6	Fan #2 Iso. Damper Actr. fi-d2-3 position (ext. limit switch) closed FI-D2-D03-CLOSD
I106.7	Fan #2 Iso. Damper Actr. fi-d2-4 position (ext. limit switch) opened FI-D2-D04-OPNED
I106.8	Fan #2 Iso. Damper Actr. fi-d2-4 position (ext. limit switch) closed FI-D2-D04-CLOSD
I106.9	Soft Starter #2 Utility Supply Breaker racked in SS2FR2-SBR-RACKD
I106.10	Soft Starter #2 Utility Supply Breaker open/close SS2FR2-SBR-OPNED
I106.11	Spare
I106.12	Spare
I106.13	Spare
I106.14	Spare
I106.15	Spare

TAG	DESCRIPTION
I107.0	Fan Motor #3 motor winding/bearing over temperature block start TV-F3-WBR-OVRTM
I107.1	Fan Motor #3 HS Soft Starter fault TV-F3-SSH-FAULT
I107.2	Fan Motor #3 HS Soft Starter started/bypassed TV-F3-SSH-BYPAS
I107.3	Fan Motor #3 High-Speed forward running TV-F3-HSP-FDRNG
I107.4	Fan Motor #3 High-Speed reverse running TV-F3-HSP-RVRNG
I107.5	Fan Motor #3 Low-Speed forward running TV-F3-LSP-FDRNG
I107.6	Fan Motor #3 Low-Speed reverse running TV-F3-LSP-RVRNG
I107.7	Fan Motor #3 High-Speed trip TV-F3-HSP-TRIP
I107.8	Fan Motor #3 Low-Speed trip TV-F3-LSP-TRIP
I107.9	Fan Motor #3 local/remote TV-F3-CTR-REMOT
I107.10	Fan Motor #3 LS Soft Starter fault TV-F3-SSL-FAULT
I107.11	Fan Motor #3 LS Soft Starter started/bypassed TV-F3-SSL-BYPAS
I107.12	Spare
I107.13	Spare
I107.14	Spare
I107.15	Spare

TAG	DESCRIPTION
I108.0	Fan #3 Iso. Damper Actr.s local/remote FI-D3-D00-REMOT
I108.1	Fan #3 Iso. Damper Actr. fi-d3-1 position (ext. limit switch) opened FI-D3-D01-OPNED
I108.2	Fan #3 Iso. Damper Actr fi-d3-1 position (ext. limit switch) closed FI-D3-D01-CLOSD
I108.3	Fan #3 Iso. Damper Actr fi-d3-2 position (ext. limit switch) opened FI-D3-D02-OPNED
I108.4	Fan #3 Iso. Damper Actr fi-d3-2 position (ext. limit switch) closed FI-D3-D02-CLOSD
I108.5	Fan #3 Iso. Damper Actr. fi-d3-3 position (ext. limit switch) opened FI-D3-D03-OPNED
I108.6	Fan #3 Iso. Damper Actr. fi-d3-3 position (ext. limit switch) closed FI-D3-D03-CLOSD
I108.7	Fan #3 Iso. Damper Actr. fi-d3-4 position (ext. limit switch) opened FI-D3-D04-OPNED
I108.8	Fan #3 Iso. Damper Actr. fi-d3-4 position (ext. limit switch) closed FI-D3-D04-CLOSD
I108.9	Soft Starter #3 Utility Supply Breaker racked in SS3FR3-SBR-RACKD
I108.10	Soft Starter #3 Utility Supply Breaker open/close SS3FR3-SBR-OPNED
I108.11	Spare
I108.12	Spare
I108.13	Spare
I108.14	Spare
I108.15	Spare

TAG	DESCRIPTION
I109.0	Southbound Tunnel Damper Actr.s local/remote TI-DS00-000-REMOTE
I109.1	Southbound Tunnel Damper Actr. t1-ds-1 position opened TI-DS01-000-OPNED
I109.2	Southbound Tunnel Damper Actr. t1-ds-1 position closed TI-DS01-000-CLOSD
I109.3	Southbound Tunnel Damper Actr. t1-ds-2 position opened TI-DS02-000-OPNED
I109.4	Southbound Tunnel Damper Actr. t1-ds-2 position closed TI-DS02-000-CLOSD
I109.5	Southbound Tunnel Damper Actr. t1-ds-3 position opened TI-DS03-000-OPNED
I109.6	Southbound Tunnel Damper Actr. t1-ds-3 position closed TI-DS03-000-CLOSD
I109.7	Southbound Tunnel Damper Actr. t1-ds-4 position opened TI-DS04-000-OPNED
I109.8	Southbound Tunnel Damper Actr. t1-ds-4 position closed TI-DS04-000-CLOSD
I109.9	Southbound Tunnel Damper Actr. t1-ds-5 position opened TI-DS05-000-OPNED
I109.10	Southbound Tunnel Damper Actr. t1-ds-5 position closed TI-DS05-000-CLOSD
I109.11	Southbound Tunnel Damper Actr. t1-ds-6 position opened TI-DS06-000-OPNED
I109.12	Southbound Tunnel Damper Actr. t1-ds-6 position closed TI-DS06-000-CLOSD
I109.13	Spare
I109.14	Spare
I109.15	Spare

TAG	DESCRIPTION
I110.0	Exit Ramp Tunnel Damper Actr.s local/remote TI-DR00-000-REMOTE
I110.1	Exit Ramp Tunnel Damper Actr. ti-dr position opened TI-DR01-000-OPNED
I110.2	Exit Ramp Tunnel Damper Actr. ti-dr position closed TI-DR01-000-CLOSED
I110.3	Northbound Tunnel Actr.s local/remote TI-DN00-000-REMOT
I110.4	Northbound Tunnel Actr. ti-dn-1 position opened TI-DN01-000-OPNED
I110.5	Northbound Tunnel Actr. ti-dn-1 position closed TI-DN01-000-CLOSD
I110.6	Northbound Tunnel Actr. ti-dn-2 position opened TI-DN02-000-OPNED
I110.7	Northbound Tunnel Actr. ti-dn-2 position closed TI-DN02-000-CLOSD
I110.8	Fire Alarm General Alarm Signal FIRALM-GNL-SIGNL
I110.9	Fire Alarm Trouble Signal FIRALM-TRB-SIGNL
I110.10	Fire Alarm Supervisory Signal FIRALM-SUP-SIGNL
I110.11	ELECTRICAL ROOM EXHAUST FAN RUNNING
I110.12	ELECTRICAL ROOM EXHAUST FAN FAULT
I110.13	Spare
I110.14	Spare
I110.15	Spare

6.1 ANALOG INPUTS

TAG	DESCRIPTION
I203_Ch0	Fan #1 Motor Vibration #1 TV-F1-VR1-STAAI
I203_Ch1	Fan #1 Motor vibration #2 TV-F1-VR2-STAAI
I203_Ch2	Fan #1 Motor speed TV-F1-000-SPEED
I203_Ch3	Carbon Monoxide Level - Southbound Tunnel COSB01-000-STAAI
I203_Ch4	Carbon Monoxide Level - Southbound Ramp Tunnel COSR01-000-STAAI
I203_Ch5	Carbon Monoxide Level - Northbound Tunnel CONB01-000-STAAI
I203_Ch6	Carbon Monoxide Level - Electrical Room COER01-000-STAAI
I203_Ch7	Spare

TAG	DESCRIPTION
I204_Ch0	Fan #2 Motor Vibration #1 TV-F2-VR1-STAAI
I204_Ch1	Fan #2 Motor Vibration #2 TV-F2-VR2-STAAI
I204_Ch2	Fan #2 Motor Speed TV-F2-000-SPEED
I204_Ch3	Carbon Monoxide Level - Southbound Tunnel COSB02-000-STAAI
I204_Ch4	Carbon Monoxide Level - Southbound Ramp Tunnel COSR02-000-STAAI
I204_Ch5	Carbon Monoxide Level - Northbound Tunnel CONB02-000-STAAI
I204_Ch6	Carbon Monoxide Level - Fan Plenum Room COFP01-000-STAAI
I204_Ch7	Spare

TAG	DESCRIPTION
I205_Ch0	Fan #3 Motor Vibration #1 TV-F3-VR1-STAAI
I205_Ch1	Fan #3 Motor Vibration #2 TV-F3-VR2-STAAI
I205_Ch2	Fan #3 Motor Speed TV-F3-000-SPEED
I205_Ch3	Spare
I205_Ch4	Spare
I205_Ch5	Spare
I205_Ch6	Spare
I205_Ch7	Spare

6.2 DIGITAL OUTPUTS

TAG	DESCRIPTION
O111.0	Fan #1 Iso. Damper Actr. "fi-d1-1" open command (1200) FI-D1-D01-OPCMD
O111.1	Fan #1 Iso. Damper Actr. "fi-d1-1" close command (1202) FI-D1-D01-CLCMD
O111.2	Fan #2 Iso. Damper Actr. "fi-d1-2" open command (1204) FI-D2-D02-OPCMD
O111.3	Fan #2 Iso. Damper Actr. "fi-d1-2" close command (1206) FI-D2-D02-CLCMD
O111.4	Fan #3 Iso. Damper Actr. "fi-d1-3" open command (1208) FI-D3-D03-OPCMD
O111.5	Fan #3 Iso. Damper Actr. "fi-d1-3" close command (1210) FI-D3-D03-CLCMD
O111.6	Spare
O111.7	Spare
O111.8	Fan Motor #1 Soft Starter enable (1212) TV-F1-SS-ENBLE
O111.9	Fan Motor #1 High-Speed forward run (1214) TV-F1-HSP-FDRUN
O111.10	Fan Motor #1 High-Speed reverse run (1216) TV-F1-HSP-RVRUN
O111.11	Fan Motor #1 Low-Speed forward run (1218) TV-F1-LSP-FDRUN
O111.12	Fan Motor #1 Low-Speed reverse run (1220) TV-F1-LSP-RVRUN
O111.13	Soft Starter #1 Utility Breaker remote trip (1222) SS1-TV-F1-SBR-RTRIP
O111.14	Soft Starter #1 Utility Breaker close (1224) SS1-TV-F1-SBR-CLOSE
O111.15	Spare

TAG	DESCRIPTION
O112.0	Spare
O112.1	Spare
O112.2	Spare
O112.3	Spare
O112.4	Spare
O112.5	Spare
O112.6	Spare
O112.7	Spare
O112.8	Fan Motor #2 soft starter enable (1300) TV-F2-SS-ENBLE
O112.9	Fan Motor #2 High-Speed forward run (1302) TV-F2-HSP-FDRUN
O112.10	Fan Motor #2 High-Speed reverse run (1304) TV-F2-HSP-RVRUN
O112.11	Fan Motor #2 Low-Speed forward run (1306) TV-F2-LSP-FDRUN
O112.12	Fan Motor #2 Low-Speed reverse run (1308) TV-F2-LSP-RVRUN
O112.13	Soft Starter #2 Utility Breaker remote trip (1310) SS2FR2-SBR-RTRIP
O112.14	Soft Starter #2 Utility Breaker close (1312) SS2FR2-SBR-CLOSE
O112.15	Spare

TAG	DESCRIPTION
O113.0	Spare
O113.1	Spare
O113.2	Spare
O113.3	Spare
O113.4	Spare
O113.5	Spare
O113.6	Spare
O113.7	Spare
O113.8	Fan Motor #3 Soft Starter enable (1400) TV-F3-SS-ENBLE
O113.9	Fan Motor #3 High-Speed forward run (1402) TV-F3-HSP-FDRUN
O113.10	Fan Motor #3 High-Speed reverse run (1404) TV-F3-HSP-RVRUN
O113.11	Fan Motor #3 Low-Speed forward run (1406) TV-F3-LSP-FDRUN
O113.12	Fan Motor #3 Low-Speed reverse run (1408) TV-F3-LSP-RVRUN
O113.13	Soft Starter #3 Utility Breaker remote trip (1410) SS3FR3-SBR-RTRIP
O113.14	Soft Starter #3 Utility Breaker close (1412) SS3FR3-SBR-CLOSE
O113.15	Spare

TAG	DESCRIPTION
O114.0	Utility Main #1 Remote trip (1500) MBRER2-000-RTRIP
O114.1	Utility Main #1 Remote close (interlocked with tie breaker) (1502) MBRER2-000-CLOSE
O114.2	Utility Main #2 Remote trip (1504) MBRER2-000-RTRIP
O114.3	Utility Main #2 Remote close (interlocked with tie breaker) (1506) MBRER2-000-CLOSE
O114.4	Utility Tie Breaker Remote trip (1508) UBRER1-000-RTRIP
O114.5	Utility Tie Breaker Remote close (interlocked with main #1 & #2) (1510) UBRER1-000-CLOSE
O114.6	Spare
O114.7	Fan Motor #1 Motor Speed Switch Signal
O114.8	Fan Motor #2 Motor Speed Switch Signal
O114.9	Spare
O114.10	Spare
O114.11	Spare
O114.12	Spare
O114.13	Spare
O114.14	Spare
O114.15	Spare

TAG	DESCRIPTION
O115.0	Southbound Tunnel Damper Actr. "ti-ds-1" open command (1600) TI-DS01-000-OPCMD
O115.1	Southbound Tunnel Damper Actr. "ti-ds-1" close command (1602) TI-DS01-000-CLCMD
O115.2	Southbound Tunnel Damper Actr. "ti-ds-2" open command (1604) TI-DS02-000-OPCMD
O115.3	Southbound Tunnel Damper Actr. "ti-ds-2" close command (1606) TI-DS02-000-CLCMD
O115.4	Southbound Tunnel Damper Actr. "ti-ds-3" open command (1608) TI-DS03-000-OPCMD
O115.5	Southbound Tunnel Damper Actr. "ti-ds-3" close command (1610) TI-DS03-000-CLCMD
O115.6	Southbound Tunnel Damper Actr. "ti-ds-4" open command (1612) TI-DS04-000-OPCMD
O115.7	Southbound Tunnel Damper Actr. "ti-ds-4" close command (1614) TI-DS04-000-CLCMD
O115.8	Southbound Tunnel Damper Actr. "ti-ds-5" open command (1616) TI-DS05-000-OPCMD
O115.9	Southbound Tunnel Damper Actr. "ti-ds-5" close command (1618) TI-DS05-000-CLCMD
O115.10	Southbound Tunnel Damper Actr. "ti-ds-6" open command (1620) TI-DS06-000-OPCMD
O115.11	Southbound Tunnel Damper Actr. "ti-ds-6" close command (1622) TI-DS06-000-CLCMD
O115.12	Fan Motor #3 Motor Speed Switch Signal
O115.13	Spare
O115.14	Spare
O115.15	Spare

TAG	DESCRIPTION
O201.0	Exit Ramp Tunnel Damper Actr. "ti-dr" open command (1700) T1DR01-000-OPCMD
O201.1	Exit Ramp Tunnel Damper Actr. "ti-dr" close command (1700) T1DR01-000-CLCMD
O201.2	Northbound Tunnel Actr. "ti-dn-1" open command (1704) T1DN01-000-OPCMD
O201.3	Northbound Tunnel Actr. "ti-dn-1" close command (1704) T1DN01-000-CLCMD
O201.4	Spare
O201.5	Spare
O201.6	Spare
O201.7	Spare
O201.8	Electrical Room Exhaust Fan Run Command
O201.9	Spare
O201.10	Spare
O201.11	Spare
O201.12	Spare
O201.13	Spare
O201.14	Spare
O201.15	Spare

6.3 LIGHTING CONTROL PANEL (N-C) VIRTUAL I/O SCHEDULE

DESCRIPTION	I/O TYPE	TAG IN LIGHTING PLC	DATA TO BE LOGGED BY SCADA?
NE C1 H-O-A selector switch status	DI	R01002	
NE C2 H-O-A selector switch status	DI	R01003	
NW C3 H-O-A selector switch status	DI	R01004	
NW C4 H-O-A selector switch status	DI	R01005	
NE C1 Contactor Output	DI	R01022	Yes
NE C2 Contactor Output	DI	R01023	Yes
NW C1 Contactor Output	DI	R01024	Yes
NW C2 Contactor Output	DI	R01025	Yes

DESCRIPTION	I/O TYPE	TAG IN LIGHTING PLC	DATA TO BE LOGGED BY SCADA?
NE C1 Contactor Status	DI	R01042	
NE C2 Contactor Status	DI	R01043	
NW C3 Contactor Status	DI	R01044	
NW C4 Contactor Status	DI	R01045	
Level 1 Lighting Control Output	DI	R01062	Yes
Level 2 Lighting Control Output	DI	R01063	Yes
Level 3 Lighting Control Output	DI	R01064	Yes
Level 4 Lighting Control Output	DI	R01065	Yes
Level 5 Lighting Control Output	DI	R01066	Yes
Level 6 Lighting Control Output	DI	R01067	Yes
Level 1 Dimming Status	AI	R01082	Yes
Level 2 Dimming Status	AI	R01083	Yes
Level 3 Dimming Status	AI	R01084	Yes
Level 4 Dimming Status	AI	R01085	Yes

DESCRIPTION	I/O TYPE	TAG IN LIGHTING PLC	DATA TO BE LOGGED BY SCADA?
Level 5 Dimming Status	AI	R01086	
Level 6 Dimming Status	AI	R01087	
Luminance Sensor Status	DI	R01091	
Luminance Sensor Reading	AI	R01092	Yes
System Mode	DI	R01093	

6.4 LIGHTING CONTROL PANEL (S-C) VIRTUAL I/O SCHEDULE

DESCRIPTION	I/O TYPE	TAG IN LIGHTING PLC	DATA TO BE LOGGED BY SCADA?
SE C1 H-O-A selector switch status	DI	R01002	
SE C2 H-O-A selector switch status	DI	R01003	
SW C1 H-O-A selector switch status	DI	R01004	
SW C2 H-O-A selector switch status	DI	R01005	
RE C1 H-O-A selector switch status	DI	R01006	
RE C2 H-O-A selector switch status	DI	R01007	
RW C1 H-O-A selector switch status	DI	R01008	
RW C2 H-O-A selector switch status	DI	R01009	
SE C1 Contactor Output	DI	R01022	Yes
SE C2 Contactor Output	DI	R01023	Yes
SW C1 Contactor Output	DI	R01024	Yes
SW C2 Contactor Output	DI	R01025	Yes
RE C1 Contactor Output	DI	R01026	Yes
RE C2 Contactor Output	DI	R01027	Yes
RW C1 Contactor Output	DI	R01028	Yes
RW C2 Contactor Output	DI	R01029	Yes
SE C1 Contactor Status	DI	R01042	
SE C2 Contactor Status	DI	R01043	

DESCRIPTION	I/O TYPE	TAG IN LIGHTING PLC	DATA TO BE LOGGED BY SCADA?
SW C1 Contactor Status	DI	R01044	
SW C2 Contactor Status	DI	R01045	
RE C1 Contactor Status	DI	R01046	
RE C2 Contactor Status	DI	R01047	
RW C1 Contactor Status	DI	R01048	
RW C2 Contactor Status	DI	R01049	
Level 1 Lighting Control Output	DI	R01062	Yes
Level 2 Lighting Control Output	DI	R01063	Yes
Level 3 Lighting Control Output	DI	R01064	Yes
Level 4 Lighting Control Output	DI	R01065	Yes
Level 5 Lighting Control Output	DI	R01066	Yes
Level 6 Lighting Control Output	DI	R01067	Yes
Level 1 Dimming Status	AI	R01082	Yes
Level 2 Dimming Status	AI	R01083	Yes
Level 3 Dimming Status	AI	R01084	Yes
Level 4 Dimming Status	AI	R01085	Yes
Level 5 Dimming Status	AI	R01086	Yes
Level 6 Dimming Status	AI	R01087	Yes
Luminance Sensor Status	DI	R01091	

DESCRIPTION	I/O TYPE	TAG IN LIGHTING PLC	DATA TO BE LOGGED BY SCADA?
Luminance Sensor Reading	AI	R01092	Yes
System Mode	DI	R01092	

6.5 SOUTHBOUND TUNNEL HEAT DETECTION VIRTUAL I/O SCHEDULE

DESCRIPTION	I/O TYPE	MODBUS ADDRESS	PROTECTOWIRE CONTROLLER IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Southbound Tunnel Zone 1-01 Fire Alarm	DI	601, 1201	10.22.200.111	Yes
Southbound Tunnel Zone 1-02 Fire Alarm	DI	602, 1202		Yes

6.6 NORTHBOUND TUNNEL HEAT DETECTION VIRTUAL I/O SCHEDULE

DESCRIPTION	I/O TYPE	MODBUS ADDRESS	PROTECTOWIRE CONTROLLER IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Northbound Tunnel Zone 3-01 Fire Alarm	DI	601, 1201	10.22.200.110	Yes
Northbound Tunnel Zone 3-02 Fire Alarm	DI	602, 1202		Yes

6.7 SOUTHBOUND RAMP TUNNEL HEAT DETECTION VIRTUAL I/O SCHEDULE

DESCRIPTION	I/O TYPE	MODBUS ADDRESS	PROTECTOWIRE CONTROLLER IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Southbound Ramp Tunnel Zone 2-01 Fire Alarm	DI	601, 1201	10.22.200.112	Yes
Southbound Ramp Tunnel Zone 2-02 Fire Alarm	DI	602, 1202		Yes

6.8 FAN 1 MOTOR MONITORING VIRTUAL I/O SCHEDULE

DESCRIPTION	I/O TYPE	MODBUS NODE (RS-485)	MODBUS ADDRESS (RS-485)	DATA TO BE LOGGED BY SCADA?
Motor 1 Winding 1 Temperature	Analog RTD	12	299	Yes
Motor 1 Winding 2 Temperature	Analog RTD		300	Yes
Motor 1 Winding 3 Temperature	Analog RTD		301	Yes
Motor 1 Bearing 1 Temperature	Analog RTD		305	Yes
Motor 1 Bearing 2 Temperature	Analog RTD		306	Yes

6.9 FAN 2 MOTOR MONITORING VIRTUAL I/O SCHEDULE

DESCRIPTION	I/O TYPE	MODBUS NODE (RS-485)	MODBUS ADDRESS (RS-485)	DATA TO BE LOGGED BY SCADA?
Motor 2 Winding 1 Temperature	Analog RTD	13	299	Yes
Motor 2 Winding 2 Temperature	Analog RTD		300	Yes
Motor 2 Winding 3 Temperature	Analog RTD		301	Yes
Motor 2 Bearing 1 Temperature	Analog RTD		305	Yes
Motor 2 Bearing 2 Temperature	Analog RTD		306	Yes

6.10 FAN 3 MOTOR MONITORING VIRTUAL I/O SCHEDULE

DESCRIPTION	I/O TYPE	MODBUS NODE (RS-485)	MODBUS ADDRESS (RS-485)	DATA TO BE LOGGED BY SCADA?
Motor 3 Winding 1 Temperature	Analog RTD	14	299	Yes
Motor 3 Winding 2 Temperature	Analog RTD		300	Yes
Motor 3 Winding 3 Temperature	Analog RTD		301	Yes
Motor 3 Bearing 1 Temperature	Analog RTD		305	Yes
Motor 3 Bearing 2 Temperature	Analog RTD		306	Yes

6.11 UTILITY MAIN BREAKER 1 VIRTUAL I/O SCHEDULE

DESCRIPTION	I/O TYPE	MODBUS NODE (RS-485)	MODBUS ADDRESS	DATA TO BE LOGGED BY SCADA?
Voltage (V)	AI	2	1006	Yes
Current (A)	AI		1020	Yes
Power (W)	AI		1037	Yes
Power (VAR)	AI		1041	Yes
Power Factor	AI		1049	Yes

6.12 UTILITY MAIN BREAKER 2 VIRTUAL I/O SCHEDULE

DESCRIPTION	I/O TYPE	MODBUS NODE (RS-485)	MODBUS ADDRESS	DATA TO BE LOGGED BY SCADA?
Voltage (V)	AI	11	1006	Yes
Current (A)	AI		1020	Yes
Power (W)	AI		1037	Yes
Power (VAR)	AI		1041	Yes
Power Factor	AI		1049	Yes

6.13 SOUTHBOUND PORTAL NETWORK CABINET VIRTUAL I/O SCHEDULE

DESCRIPTION	I/O TYPE	NETBOTZ CONTROLLER IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Cabinet Door Open	DI	10.22.200.72	Yes
Cabinet Temperature	AI		Yes
Cabinet Humidity	AI		Yes

DESCRIPTION	I/O TYPE	PDU-A IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Outlet 1 On/Off Status	DI	10.22.200.86	
Outlet 2 On/Off Status	DI		
Outlet 3 On/Off Status	DI		
Outlet 4 On/Off Status	DI		
Outlet 5 On/Off Status	DI		
Outlet 6 On/Off Status	DI		
Outlet 7 On/Off Status	DI		
Outlet 8 On/Off Status	DI		

DESCRIPTION	I/O TYPE	PDU-B IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Outlet 1 On/Off Status	DI	10.22.200.87	
Outlet 2 On/Off Status	DI		
Outlet 3 On/Off Status	DI		
Outlet 4 On/Off Status	DI		
Outlet 5 On/Off Status	DI		
Outlet 6 On/Off Status	DI		
Outlet 7 On/Off Status	DI		
Outlet 8 On/Off Status	DI		

6.14 NORTHBOUND PORTAL NETWORK CABINET VIRTUAL I/O SCHEDULE

DESCRIPTION	I/O TYPE	NETBOTZ CONTROLLER IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Cabinet Door Open	DI	10.22.200.71	Yes
Cabinet Temperature	AI		Yes
Cabinet Humidity	AI		Yes

DESCRIPTION	I/O TYPE	PDU-A IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Outlet 1 On/Off Status	DI	10.22.200.84	
Outlet 2 On/Off Status	DI		
Outlet 3 On/Off Status	DI		
Outlet 4 On/Off Status	DI		
Outlet 5 On/Off Status	DI		
Outlet 6 On/Off Status	DI		
Outlet 7 On/Off Status	DI		
Outlet 8 On/Off Status	DI		

DESCRIPTION	I/O TYPE	PDU-B IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Outlet 1 On/Off Status	DI	10.22.200.85	
Outlet 2 On/Off Status	DI		
Outlet 3 On/Off Status	DI		
Outlet 4 On/Off Status	DI		
Outlet 5 On/Off Status	DI		
Outlet 6 On/Off Status	DI		
Outlet 7 On/Off Status	DI		
Outlet 8 On/Off Status	DI		

6.15 CONTROL ROOM NETWORK CABINET VIRTUAL I/O SCHEDULE

DESCRIPTION	I/O TYPE	NETBOTZ CONTROLLER IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Cabinet Door Open	DI	10.22.200.70	Yes
Cabinet Temperature	AI		Yes
Cabinet Humidity	AI		Yes

DESCRIPTION	I/O TYPE	PDU-A IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Outlet 1 On/Off Status	DI	10.22.200.80	
Outlet 2 On/Off Status	DI		
Outlet 3 On/Off Status	DI		
Outlet 4 On/Off Status	DI		
Outlet 5 On/Off Status	DI		
Outlet 6 On/Off Status	DI		
Outlet 7 On/Off Status	DI		
Outlet 8 On/Off Status	DI		

DESCRIPTION	I/O TYPE	PDU-B IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Outlet 1 On/Off Status	DI	10.22.200.81	
Outlet 2 On/Off Status	DI		
Outlet 3 On/Off Status	DI		
Outlet 4 On/Off Status	DI		
Outlet 5 On/Off Status	DI		
Outlet 6 On/Off Status	DI		
Outlet 7 On/Off Status	DI		
Outlet 8 On/Off Status	DI		

DESCRIPTION	I/O TYPE	PDU-C IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Outlet 1 On/Off Status	DI	10.22.200.82	
Outlet 2 On/Off Status	DI		
Outlet 3 On/Off Status	DI		
Outlet 4 On/Off Status	DI		
Outlet 5 On/Off Status	DI		
Outlet 6 On/Off Status	DI		
Outlet 7 On/Off Status	DI		
Outlet 8 On/Off Status	DI		

DESCRIPTION	I/O TYPE	PDU-D IP ADDRESS	DATA TO BE LOGGED BY SCADA?
Outlet 1 On/Off Status	DI	10.22.200.83	
Outlet 2 On/Off Status	DI		
Outlet 3 On/Off Status	DI		
Outlet 4 On/Off Status	DI		
Outlet 5 On/Off Status	DI		
Outlet 6 On/Off Status	DI		
Outlet 7 On/Off Status	DI		
Outlet 8 On/Off Status	DI		