Description of Operation

For VES Control Panel Equipment

Project Reference:
PRA Number:
AHU Ref:
SO Number:
Date:
Revision:
Date Last Revised:

Contents

1. Supply Fan

1.1. *Functionality Overview*

The supply fan is an EC type motor which is controlled by the Siemens PLC device. The Siemens controller will output signals directly to the EC fan motor where it has functionality for on/off control manually by the HMI or via a timer schedule and has speed control functionality. There is also an input to the Siemens PLC device to read a trip/alarm signal from the supply fan.

1.2. *On/Off Control*

The supply fan has start/stop functionality which can be controlled via the 'System Switch' located on the HMI. There are options for manual 'On' and 'Off' control or start/stop via a timer schedule with a maximum on/off schedule up to 6 times per day. The start/stop function enables/disables an onboard relay in the Siemens PLC device giving the EC fan motor its run signal

1.3. *Speed Control*

The supply fan speed is controlled automatically via the air quality sensor. This can be set up to control on CO2 or VOC on the HMI. Set points for CO2 [user adjustable 0…2000ppm] and VOC [user adjustable 0…100%] can be set on the HMI. A 0-10v signal is supplied by the Siemens PLC device and is used as a reference voltage by the EC fan motor to produce a proportional output voltage to the supply fan motor.

1.4. *Trips/Alarms Control*

The supply fan will automatically ramp down to a stop if the EC fan motor trips. The EC fan will provide a fault signal to the Siemens PLC device which will produce an alarm signal on the HMI. The alarm will be present in the HMI alarm menu and will be displayed as 'Supply Fan Trip'. If requested a 'Common V/F Trip Indication' will be enabled and can be read via an external source.

A volt-free common trip output from the control panel will be provided for remote fault monitoring.

2. Extract Fan

2.1. *Functionality Overview*

The extract fan is an EC type motor which is controlled by the Siemens PLC device. The Siemens controller will output signals directly to the EC fan motor where it has functionality for on/off control manually by the HMI or via a timer schedule and has speed control functionality. There is also an input to the Siemens PLC device to read a trip/alarm signal from the the extract fan. The run and standby extract fan has the option to enable and disable an 8 hour change over timer [user adjustable on HMI]. If disable is selected the run and standby fan will change over when the on/off state is changed and the Siemens PLC device will select the fan with the least running hours.

2.2. *On/Off Control*

The extract fan has start/stop functionality which can be controlled via the 'System Switch' located on the HMI. There are options for manual 'On' and 'Off' control or start/stop via a timer schedule with a maximum on/off schedule up to 6 times per day. The start/stop function enables/disables an onboard relay in the Siemens PLC device giving the EC fan motor its run signal

2.3. *Speed Control*

The extract fan speed is controlled automatically via the air quality sensor. This can be set up to control on CO2 or VOC on the HMI. Set points for CO2 [user adjustable 0…2000ppm] and VOC [user adjustable 0…100%] can be set on the HMI. A 0-10v signal is supplied by the Siemens PLC device and is used as a

reference voltage by the EC fan motor to produce a proportional output voltage to the extract fan motor.

2.4. *Trips/Alarms Control*

The supply fan will automatically ramp down to a stop if the EC fan motor trips. The EC fan will provide a fault signal to the Siemens PLC device which will produce an alarm signal on the HMI. The alarm will be present in the HMI alarm menu and will be displayed as 'Supply Fan Trip'. If requested a 'Common V/F Trip Indication' will be enabled and can be read via an external source.

A volt-free common trip output from the control panel will be provided for remote fault monitoring.

3. Supply and Extract Filter

3.1. *Functionality Overview*

The supply and extract filter/s are monitored by a differential pressure switch. The differential pressure switch is set to the filter dirty resistance [Pa].

3.2. *Filter Dirty Indication*

The supply and extract filter/s pressure is measured by a differential pressure switch monitored by the Siemens PLC device. When the filter dirty resistance is higher than the setpoint on the pressure switch [user adjustable Pa] this will enable a switch, which is read by the Siemens PLC device as an alarm.

3.3. *Trips/Alarm Control*

The supply and extract filter/s will alarm if the switch is activated by a higher differential pressure than the setpoint on the switch [user adjustable Pa]. This will display on the HMI as 'Supply Filter Dirty or Extract Filter Dirty', investigation of the supply and extract filter/s is required and to be replaced if necessary. Once resolved the alarm needs to be 'Acknowledged' to reset the function.

A volt-free common trip output from the control panel will be provided for remote fault monitoring.

4. Supply and Extract Airflow Pressure Switch

4.1. *Functionality Overview*

This is a differential pressure switch that is activated if there is no airflow towards the inlet spigot; it is programmed to automatically shut down the system.

4.2. *APS Trips/Alarm Control*

A differential pressure switch is used to monitor the differential pressure across the supply and extract fan bulkhead. If the expected airflow does not meet the requirements of the airflow pressure switch a trip signal will be fed back to the Siemens PLC device. The alarm will be present in the HMI alarm menu and will be displayed as 'Supply Fan Trip or Extract Fan Trip'.

5. Inlet / Outlet Damper Control

5.1. *Functionality Overview*

The fresh and supply air dampers are used to block off either the fresh or supply air inlet / outlet spigots when the unit is not operational.

5.2. *Damper Control*

When the unit is in the 'Off' state the fresh air and/or supply air dampers will be closed. When the unit is in the 'On' state the fresh air and/or supply air dampers will modulate open, the supply fan will have a delay on timer [user adjustable 0…10000s],[Default value 180s] where the Siemens PLC device will hold the fan start signal for this user set period of time to ensure the dampers are fully open before the operation of the ventilated air begins.

6. Temperature Control

6.1. *Functionality Overview*

The temperature can be controlled on Supply air. The unit will maintain set point by supplying tempered air [DegC] to the required set point whilst monitoring the supply air temperature sensor. A dead band can be set for closer control to ensure the set point does not over shoot [user adjustable 0...100°C]. The default dead band value is 2°C.

The temperature can be controlled on Return cascade air. The unit will maintain set point by supplying tempered air [DegC] to the required set point whilst monitoring the Room air or Return air temperature sensor. A dead band can be set for closer control to ensure the set point does not over shoot [user adjustable 0...100°C]. The default dead band value is 2°C.

7. Heat Recovery Control

7.1. *Functionality Overview*

The variable speed heat wheel heat recovery device is used to provide a free source of ventilated heating and cooling for the occupied building space or area for which a process is being conducted. Heat recovery is considered as the first stage of heating or cooling. Heat recovery is used to achieve temperature set point until no more free heating or cooling can be achieved. Main heating and main cooling will thereafter provide the sufficient heating or cooling demand.

7.2. *Temperature Control*

The variable speed heat wheel heat recovery device is controlled by the Siemens PLC device through an onboard inverter. A 0-10v output signal from the Siemens PLC device is used a reference voltage by the heat recovery inverter to produce a proportional level of free heating or cooling. The Siemens PLC device also monitors the inverter alarm relay to feed back any fault signals produced by the heat recovery device. The heat recovery device will recuperate upon the following conditions;

a. If heating is required and the return air temperature is higher than the fresh air temperature.
b. If cooling is required and the return air temperature is lower than the fresh air temperature.

8. Main Heating Control

8.1. *Functionality overview*

The LPHW main heater is used to provide tempered air to the occupied building space or area for which a process is being conducted.

8.2. *Temperature Control*

The LPHW main heater is controlled via a 0-10v output from the Siemens PLC device. The 0-10v signal is produced by the controller and is used as a reference voltage to alter the position of the LPHW valve. The set point required is [user adjustable -50°C...150°C] and the valve will modulate accordingly to

closely control the temperature set point required. The temperature strategy is adjustable on the HMI where you can select Cascade or Supply temperature control. The LPHW main heater also has a coil temperature sensor which monitors the coil temperature for frost conditions. The default value for the frost alarm is 5°C [user adjustable 0...10000°C]

The LPHW heater will alarm if in a frost condition. The alarm will be present on the HMI as 'Heating frost alarm'. Frost alarm will be present if the coil temperature falls below setpoint [user adjustable 0…10000°C], default value 5°C. In this condition the Siemens PLC device will output a 10v signal to the pre-heating LPHW valve to prevent the coil from freezing, the alarm will clear itself when the coil temperature reaches >5°C [user adjustable 0...150°C]. Once the alarm has been rectified the HMI alarm will be need to be 'Acknowledged' to reset the function. When in a frost condition the unit will shut down the supply and extract fans to avoid cold air to be passed across the coil, this function can be enabled...disabled on the HMI.

9. Fire Alarm Control

9.1. *Functionality Overview*

This function is used to shut down the operating AHU during a fire alarm situation.

9.2. *Operation*

The external fire alarm system is to provide 24VDC and 0VDC to the terminals during a fire situation. The 24VDC signal will provide power to the Relay, which in turn disables the AHU run signal. On receiving the fire alarm signal, the fan will naturally ramp down based on run-on-timer settings and the LPHW valve closes. All other components of the AHU will be completely disabled at this point in time. Once the fire alarm signal is removed, the AHU will automatically return to its original running condition.

10. Control Panel Interface and HMI

10.1. *Functionality Overview*

The HMI controller is used to provide a user-friendly interface, which can be customised according to customer requirements. The HMI provides the ability to read information from the AHU (sensor temperatures, devices running, demand signals, alarms), set control parameters (set points, PID loop controls) and program timers for automatic AHU control.

10.2. *HMI*

1. It is pin-protected access to commissioning level.
2. HMI is programmed to support time clock and stand-alone functionality.
3. HMI is programmed such that all individual and common faults will be displayed and can be scrolled through review at the LCD.
4. HMI is programmed such that all status is displayed.

Various device changes can be made via the HMI including:

1. The temperatures set point.
2. Fans speed control adjustment.
3. Fan hold off settings.
4. Panel power control including On, Off, Auto setting.
5. User level settings defined by password.

6. Filter dirty switch settings.
7. Required control loop adjustments.
8. Timer and alarm settings.