Heating Substation

Example Implementation with Lonix Technologies

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INDEX

1 Introduction

This document presents an implementation example for a heating substation using Lonix technologies. The controls are done using Lonix Modules, and system design and configuration utilizes the Lonix Project Creation Tool (PCT).

2 Heating substation example

This chapter introduces the control diagram and the functional description of a typical heating substation.

2.1 CONTROL DIAGRAM

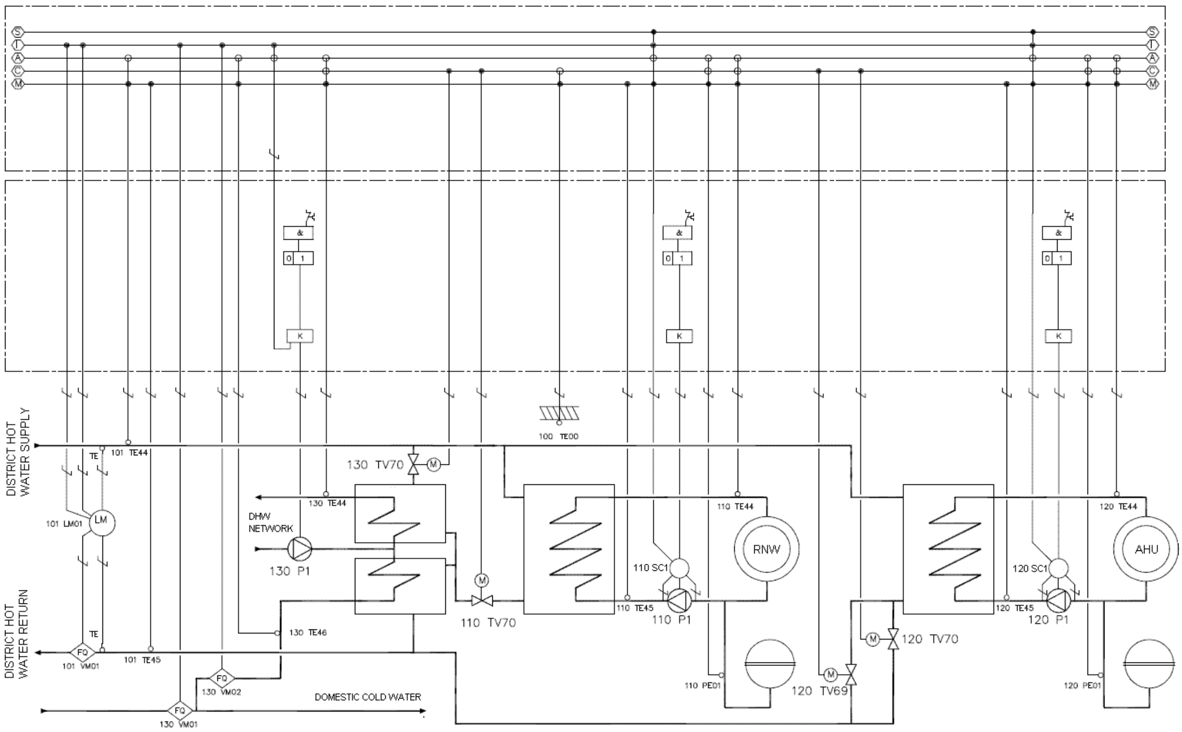

Figure 1. Control diagram of a typical heating substation

A typical heating substation can be considered to consist of three separate subsystems. The first one is responsible for domestic hot water supply, the second keeps the radiator network (floor heating etc.) at the right temperature, and the third one is responsible for the hot water supply for the air handling unit.

2.2 FUNCTIONAL DESCRIPTION

Domestic hot water is kept at a constant temperature with a PID-controller and a valve drive that adjust the flow of district heating water through the heat exchanger. A pump that is always on ensures the circulation of domestic hot water even when no hot water is used.

The radiator network (e.g. radiant floor heating) works in a very similar way. The hot water in the network is heated with hot water of district heating network. The flow of the district heating water is adjusted with a PID-controller and a valve drive. Contrary to the PID-controller in the domestic hot water network, the PID-controller's setpoint should now follow a predefined curve and the effective setpoint depends on the outdoor temperature (see Figure 2). The pump should be always on to ensure the circulation of hot water through the network, but its running speed is adjusted with a variable frequency drive according to a pressure measurement.

The hot water supply for the air handling unit works in exactly the same way except that the flow of district heating water is adjusted with two valve drives. This is because if only one valve was used, even a very small change would cause too great an effect in the AHU supply water temperature. Usually the two valves are of different size and in terms of control the smaller valve is considered to be the primary valve.

In addition, consumption metering is available through three counters: energy (district heat consumption), hot water, and total domestic water consumption (includes both cold and hot domestic water).

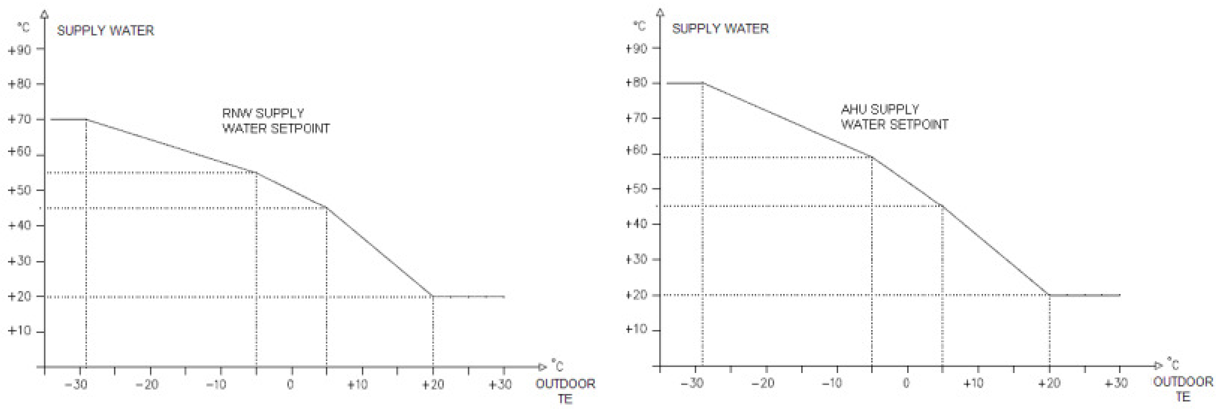

Figure 2. Predefined curves for RNW and AHU supply water controllers

3 Solution with Lonix technologies

This chapter shows an example implementation using Lonix Modules and Lonix PCT. The following figures are screenshots produced from Lonix PCT.

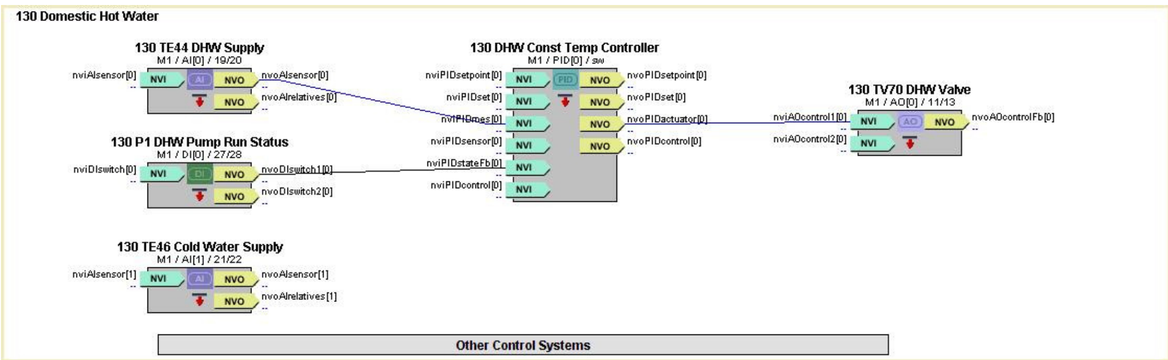

Figure 3. Domestic hot water temperature control

Domestic hot water is kept at a constant 55 degrees centigrade. An alarm is generated if the supply hot water temperature (TE44) drops below 45 or rises over 65 degrees Celsius. Instead of fixed alarm limits it is better to use the sliding alarm functionality of the constant PID-controller, which automatically changes the alarm limits according to the setpoint. As the pump should be always on its run status signal is bound to the PID-controllers nviPIDstateFB-variable. If the pump P1 is turned off it generates an alarm and stops the controller. Cold supply water temperature (TE45) measurement is mostly used only for monitoring purposes, but in this case it will also generate an alarm if the temperature rises over 20 degrees centigrade or is about to get frozen.

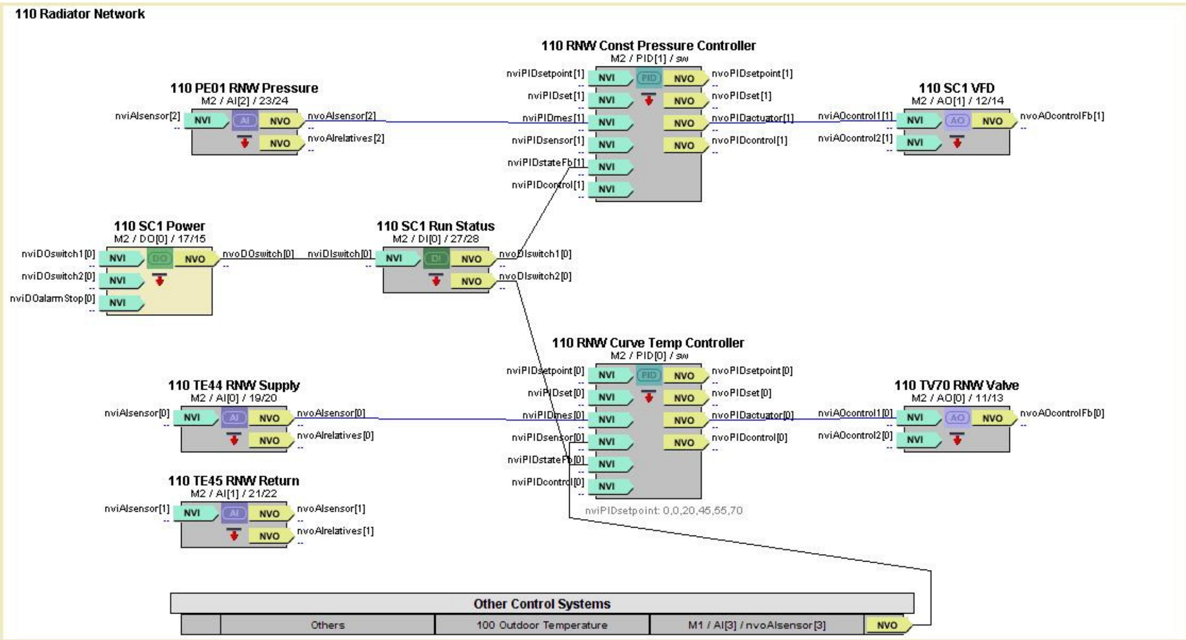

Figure 4. Radiator network temperature and pressure control

The temperature control of the radiator network follows a predefined curve which can be seen in Figure 2. If the supply water temperature TE44 deviates more than 5 degrees from the effective setpoint, an alarm is generated (implemented with the sliding alarm function of the controller).

The pressure in the network (PE01) is kept constant with a variable frequency drive (SC1). Again, if the pressure deviates too much from the setpoint, an alarm is generated. An alarm is generated also if the run status signal is in conflict with the run permission of the VFD (SC1 Power).

Return water temperature measurement of the radiator network (TE45) is only for monitoring purposes.

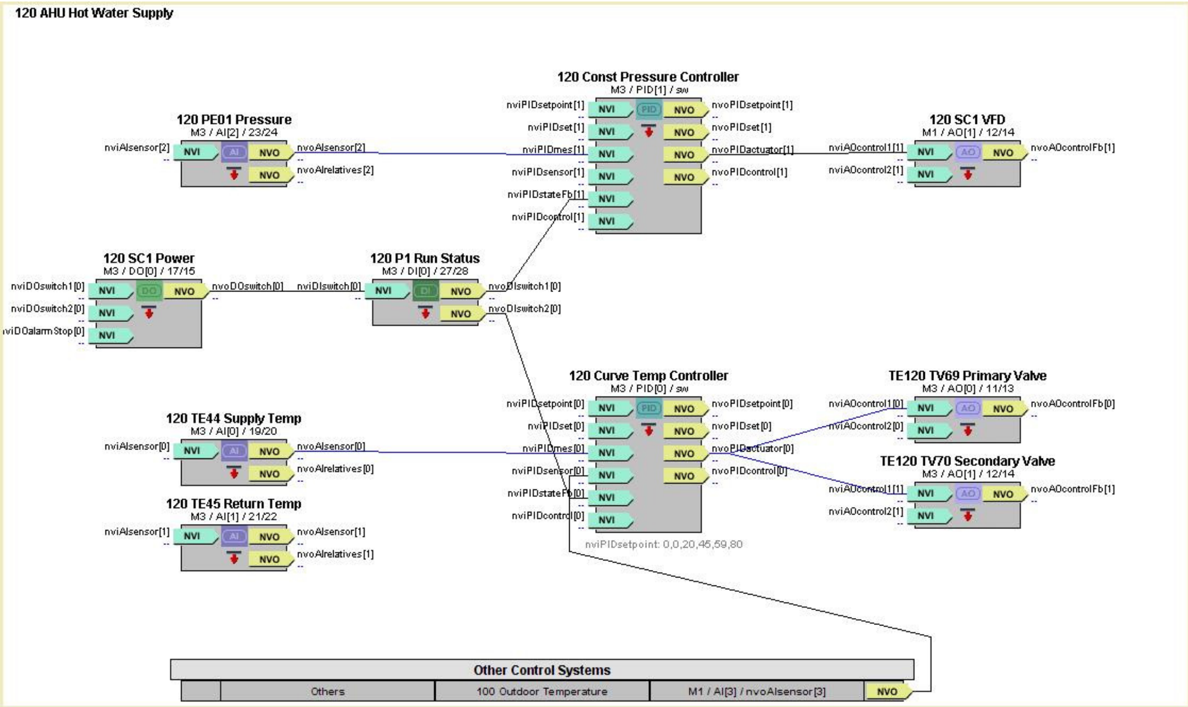

Figure 5. Hot water supply for an air handling unit

The only difference to the radiator network is the use of two valves for the adjustment of the flow of the district hot water through the heat exchanger. The smaller of the valves (TV69) is used primarily to allow for accurate control of the system. Even though the valves are of different size their control ranges are equal (the primary valve from 0 to 50%, the secondary valve TV70 from 50% to 100%).

4 Required devices

This chapter lists the required devices for the example implementation.

Table 1. I/O objects

I/O type	Amount
DI	3
DO	2
AI	11
AO	6
PID	5
DIC (counter object)	3

As you can see in the above table, you will need three (3) Lonix Multimodules 2242P and one (1) Lonix Counter Module 1000C.

Table 2. Lonix Modules

Module Type	Description	Units
Lonix Multimodule 2242P	2 DI, 2 DO, 4 AI, 2 AO, 2 PID	3
Lonix Counter Module 1000C	10 DIC	1

The following table lists the different sensors, transducers and actuators needed in the example implementation.

Table 3. Sensors and actuators

Device	Details	Model
100 TE00	-50..50 °C	LX-TE-O
101 TE44, 101 TE45	-20...+80 °C	LX-TE-W100 + LX-TW100
110 TE44, 110 TE45	-20...+80 °C	LX-TE-W100 + LX-TW100
110 PE01	0..6 bar	LX-PG-W-30
110 TV70		Valve + actuator
110 SC1		e.g. Mitsubishi S500
120 TE45, 120 TE44	-20...+80 °C	LX-TE-W100 + LX-TW100
120 PE01	0..6 bar	LX-PG-W-30
120 TV70		Valve + actuator
120 TV69		Valve + actuator
120 SC1		e.g. Mitsubishi S500
130 TE44, 130 TE46	-20...+80 °C	LX-TE-W100 + LX-TW100
130 TV70		Valve + actuator

Details of the suggested products are available at www.lonix.com.