

HLS35 Underfloor Heating/Cooling Controller

The HLS35 is specifically designed for underfloor heating / cooling applications where the same pipework is used to supply in winter warm water and in the summer cold water. The controllers have built-in RS-485 channel for Modbus communication. The controllers can be connected to any supervisory software/system that supports Modbus RTU such as WebBiter Embedded Web-Server.

The HLS35 has built-in display and unique touch sensitive buttons for adjusting the user parameters and to configure the controller.

The controller supports 0..10V, 3-point controlled, thermic PMW and on/off actuators.

The controller has facility to use return water temperature sensor to limit the minimum return water temperature allowing the floor surface to maintain comfortable levels even in cooling applications and to reduce the amount of condensation. The controller can also use the return water temperature sensor to limit the maximum floor temperatures.

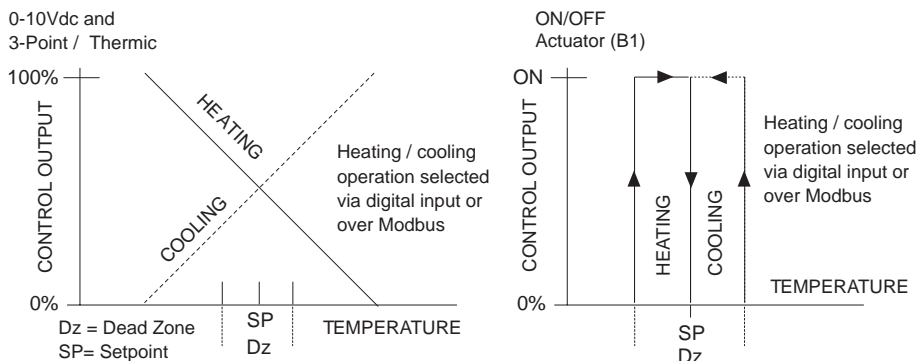


Model Types	Model	Description
	HLS35	HLS35 Underfloor Heating / Cooling Controller
Technical Data	Power supply	24Vac/dc (20...26V), <1VA Note: 3-point and thermic actuators require AC power supply
	Inputs	Built-in Temperature Sensor for Room Temperature Measurement 1 x NTC10 for Return Water Temperature 1 x Digital Input for Summer / Winter Operation
	Outputs	1 x 0..10Vdc (Heating/Cooling Actuator) 2 x 24Vac Triacs, 1A maximum (3-Point Actuator / Thermic Actuator) 1 x 24Vac Triac, 1A maximum (On/Off Actuator) 1 x 24Vac Triac, 1A maximum (Plant eEable)
	Communications	RS-485 Modbus RTU, 9600/19200/38400 bps, 8 data bits, Parity None, 1 Stop Bit (Up to 128 devices per segment)
	Display	LCD Display
	Buttons	3 MagicTouch™ Buttons for the User Functions and Programming
	Wiring Terminals	1.5 mm ²
	Housing	ABS Plastics (White)
	Operating Temp	0..50 deg C
	Operating Humidity	0..95% rH non-condensing
	Protection Class	IP20
	Agency Approvals	2004/108/EY EMC Directive EN61000-6-3: 2001 Emissions EN61000-6-2: 2001 Immunity
	Overall size	87W x 86H x 32D mm

OPERATION

HLS35 has been designed for controlling underfloor heating/cooling systems. The controller is used in applications where the underfloor pipework is in the winter supplied with hot water and in the summer with cold water i.e the same pipework is used for both heating and cooling. The controller operation mode between heating and cooling is operated either via a digital input or via Modbus network.

HLS35 has two operation modes: DAY and NIGHT. The unit can be switched between day and night modes via Modbus network. In the night mode the control outputs are off. When in DAY mode the controller operates the valve outputs according to the below diagram.



DAY MODE

In the DAY mode the controller measures the room temperature controls the valve output based on the PI control logic. If a floor temperature sensor is fitted, the control output is limited based on the floor temperature and the floor setpoint.

In the DAY mode the controller day setpoint (SP) is calculated as follows:-

CurrentSP = $SP_{network} \pm SP_{local}$, where $SP_{network}$ is setpoint set via Modbus network and SP_{local} is the setpoint set by the user by pressing "+" and "-" buttons. SPlocal range is limited at the commissioning stage (default +/-3°C)

When the controller returns to the DAY MODE from NIGHT, the controller DAY setpoint can return to the DAY setpoint programmed previous day, or the DAY SP can be reset to the $SP_{network}$ Modbus Network Setpoint. This is a configurable option (configuration parameter SP_ND). If no network setpoint is available 21°C is used as default.

ON/OFF OUTPUT B1

If the B1 is in automatic control (Modbus register - set to 2), the triac out B1 is controlled based on the current setpoint and the controller mode i.e cooling or heating mode.

In the Cooling Mode:

Room temperature > setpoint + DZ/2 --> B1 is switched ON.

Room temperature < setpoint --> B1 is switched OFF.

In the Heating Mode:

Room temperature < setpoint + DZ/2 --> B1 is switched ON.

Room temperature > setpoint --> B1 is switched OFF.

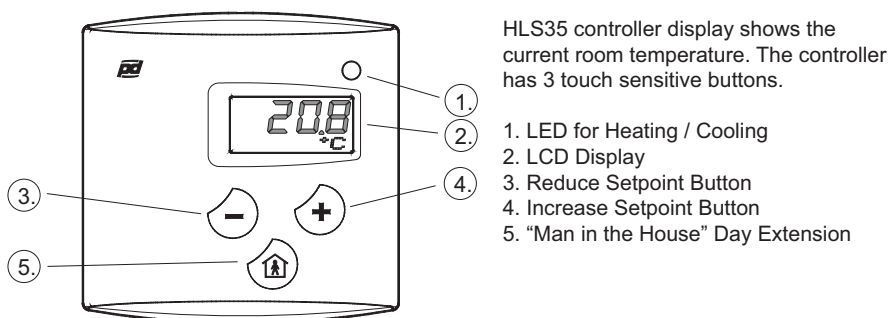
NIGHT MODE

In the NIGHT mode the controller outputs are switched off.

MINIMUM FLOOR TEMPERATURE LIMIT

The controller has minimum floor temperature protection feature typically used in wet rooms to reduce the amount of condensation. If the floor temperature drops below the FLOOR SETPOINT, the room temperature setpoint is reset to compensate the condensation danger. To disable this feature set the FLOOR TEMPERATURE RESET RATIO to zero (0).

CONTROLLER USER INTERFACE



DAY EXTENSION

The controller can be overridden to DAY operation by pressing the "MAN IN THE HOUSE" occupancy button. When pressed the controller is overridden to DAY mode for the period of two hours. The extension time is adjustable between 1..480 minutes via Modbus network.

ADJUSTING DAY SETPOINT

Press + and - buttons to adjust the DAY setpoint. The maximum and minimum setpoint values are set in the configuration mode by the SETPOINT LIMITS parameter.

ADJUSTING FLOOR SETPOINT

The floor setpoint is set by pressing the MAN IN THE HOUSE button. First the current floor temperature is displayed after which the current Floor Setpoint is shown (SET-FL). Adjust the floor setpoint to the required value by pressing + and - buttons.

LED INDICATION

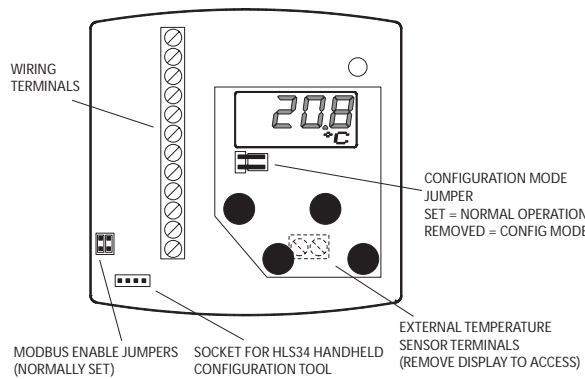
The LED on the top right corner of the controller indicates the current operation mode:-

- Amber: Heating valve is opening
- Green: Cooling valve is opening
- No light: Controller temperature in the dead-zone
- Flashing Amber: Error condition e.g. display disconnected

CONTROLLER CONFIGURATION

The controller is parameterised locally via a configuration mode. To configure the controller locally, first remove the top cover. A CONFIGURATION MODE JUMPER is located below the LCD display. When the jumper is set the controller is in normal operation. By removing the jumper the controller enters to the configuration mode.

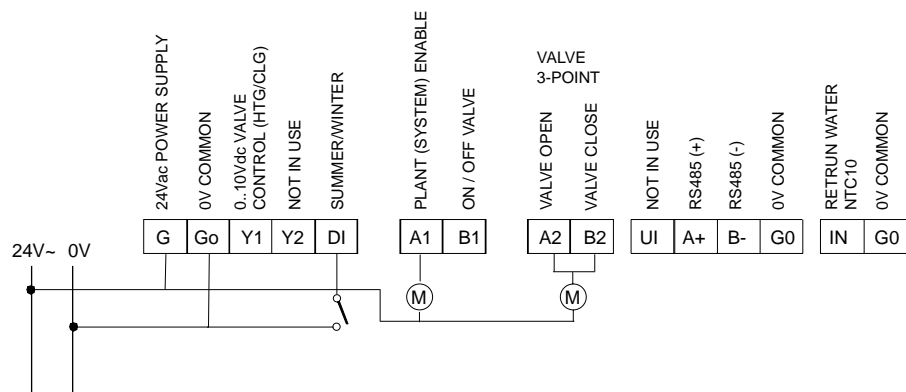
Once the configuration has been completed, by setting the jumper the controller returns to the normal operation.



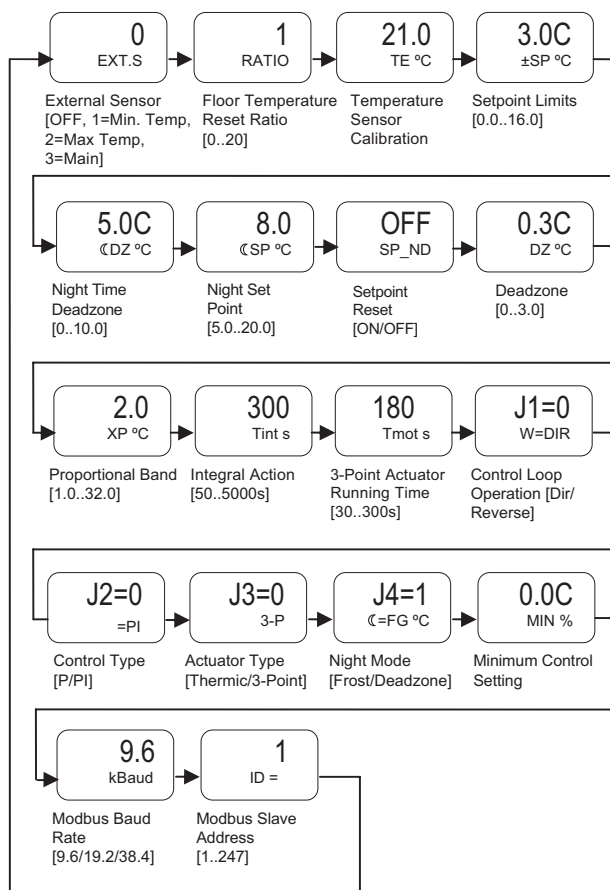
NOTE: The controller is supplied with the configuration jumper unset i.e. in the configuration mode

CONNECTION DIAGRAM

WARNING: The electrical installation, device connection and commissioning can only be carried out by qualified professionals and according to the local wiring regulations!



**CONTROLLER
PARAMETERS**



EXTERNAL SENSOR

External temperature sensor can be used for

- a) minimum temperature control
- b) maximum temperature control
- c) as the main control sensor (the external sensor is used as the control sensor, minimum or maximum temperature control features are disabled)

MINIMUM TEMPERATURE CONTROL

By setting the external sensor to setting 1, the minimum temperature control is enabled. With this function the floor temperature is maintained at minimum level e.g. in summer time providing comfortable temperature in the bathroom installations and preventing condensation. In this mode when the floor temperature drops below the floor setpoint (configured at user mode), the room temperature setpoint is automatically compensated upwards.

MAXIMUM TEMPERATURE CONTROL

By setting the external sensor setting to 2, the maximum temperature control is enabled. This feature prevents the floor temperature exceeding the maximum allowed protecting floor surfaces such as wood. When the floor temperature exceeds the floor temperature setpoint the room temperature setpoint is automatically compensated downwards.

FLOOR TEMPERATURE RESET RATIO

This parameter is used as the reset ratio to offset the the Calculated Setpoint based on the floor setpoint and the floor temperature in the minimum or maximum temperature control modes. By setting the reset ratio to 0, this function is disabled.

SETPOINT LIMITS

Setpoint limits are the +/- maximum limits that the user can adjust the room setpoint. The midpoint of the adjustment is the network setpoint. For example if the network setpoint is 21°C and the maximum limits have been set to +/-3°C the user can adjust the setpoint from 18°C to 24°C.

NIGHT TIME DEADZONE

If the controller has been configured to operate in Relaxed Setpoint mode night time, then this parameter is used to set the relaxed dead-zone.

NIGHT SETPOINT

If the controller has been configured to operate in the Night Off mode, then this parameter is used to set the night time heating setpoint (for frost protection).

TRANSITION FROM NIGHT TO DAY MODE VIA MODBUS

When the controller operating mode is changed via Modbus from Night to Day mode, the controller DAY setpoint is decided based on the configuration setting SP_ND.

- 1) If SP_ND is set to "OFF", then the controller will use the last setpoint defined by the user. E.g. if the user sets the setpoint to 23.3°C on the previous day, the controller returns to control to this setpoint.

2) If SP_ND is set to "ON", then the controller returns to the network setpoint. E.g. if the network setpoint has been set to 21°C and the user adjusted the setpoint to 23.3°C during the previous day, the controller will return to control to 21°C on the transition. This is a very useful energy saving feature for installations such as hotels.

DEADZONE

Deadzone for the Day mode.

NIGHT MODE

Night Mode parameter is used to set the control strategy between Night Relaxed operation mode or Night Off mode. Set to Frost to activate Night Off mode and select Deadzone to activate Relaxed Deadzone mode.

In the Relaxed Deadzone mode the output is active in both heating and cooling mode by providing night time cooling in summer and night time heating in winter.

SOUNDER DISABLE

The HLS35 uses touch sensitive magnetic buttons. For user feedback, for every press of a button feedback sound is transmitted (quiet beep). In some situations it may be desirable to disable the sound. Disabling / enabling the sound is carried out by pressing the "MAN IN THE HOUSE" button continuously for over 5 seconds.

FIRMWARE VERSION

The controller displays the firmware version when the unit is powered up. It is possible to display the firmware version number during normal operation by pressing the "-" and "+" buttons simultaneously for over 5 seconds.

NETWORK DIAGRAMS

Up to 128 HLS35 controllers can be connected to a single network segment. The diagrams below illustrate the typical installation options.

It possible to connect the controllers to an existing BMS (e.g. to TREND BMS) via a Modbus gateway. Please contact SyxthSense for more information.

Alternatively the room controllers are connected on the floor level to the WebBiter embedded web-server that provides BMS front-end capability and access via a standard web-browser. Each WebBiter holds a time schedule for the floor to switch the controller between day and night operation modes.

**MODBUS REGISTERS
(Ver 1.1)**

The controller supports the following Modbus registers and function codes. The default communication speed is 9600 bps, 8 data bits, Parity None and 1 Stop Bit.

Please note that Modbus register space is specified from the Modbus master perspective as in the Modbus Application Protocol specification. The Modbus registers for Function Codes 02, 03, 06 and 16 have presentation for both Modbus "address blocks" and for actual Modbus register offsets. For example, the room temperature is read from Modbus register 13 using Function Code 04. Some Modbus masters will require Function Code 04, register 13 to be entered, whereas the others will require register 30013 and Function Code 04. The actual message string will always be sent as a stripped register value of 13 but the data entered to the Modbus master depends on the implementation of the master.

Register	Parameter Description	Data Type	Raw Value	Range
FUNCTION CODE 01 - READ COILS				
2	Overdrive Mode (controller outputs overdriven)	Bit 0	On - Off	On - Off
3	Night Mode	Bit 1	On - Off	On - Off
4	Summer (Cooling) Mode	Bit 2	On - Off	On - Off
5	Service Alarm	Bit 3	On - Off	On - Off
FUNCTION CODE 02 - READ DISCRETE INPUTS				
10002	Summer Active	Bit 0	On - Off	On - Off
10003	Occupied via Local Keypad by using "Man In The House" Button (NIGHT mode to DAY-mode)	Bit 1	On - Off	On - Off
10004	Day Extension (NIGHT mode to DAY mode)	Bit 2	On - Off	On - Off
FUNCTION CODE 03 - READ HOLDING REGISTERS				
40003	Coils 16 -01	16 bit		
40004	Output (Overdrive Set by Network)	Signed 16	0..1000	0..100.0%
40005	Set Point (Set by Network)	Signed 16	50..370	5.0..37.0°C
40006	Floor Setpoint (Set by Network)	Signed 16	0..500	0.0..50.0°C
40007	Floor Reset Ratio (0= Disabled)	Signed 16	0..20	0..20
40008	Proportional Band XP	Signed 16	10..320	1.0..32.0°C
40009	Integral Action Time (Tint)	Signed 16	50..5000	50..5000 s

Register	Parameter Description	Data Type	Raw Value	Range
40010	Day Extension Period	Signed 16	1..480	1..480 (min)
40011	Thermostat Override (B1 set by Network)	Signed 16	0-1-2	0-1-2 (2=AUTO)
40012	System ON Override (A1 set by Network)	Signed 16	0-1-2	0-1-2 (2=AUTO)

FUNCTION CODE 04 - READ INPUT REGISTERS

30002	Discrete Inputs 16 - 01	16 bit		
30003	Coils 16-01	16 bit		
30004	Output (Overdrive Set by Network)	Signed 16	0..1000	0..100.0%
30005	Set Point (Day SP Set by Network)	Signed 16	50..370	5.0..37.0°C
30006	Floor Setpoint (Set by Network)	Signed 16	0..500	0.0..50.0°C
30007	Floor Reset Ratio (0= Disabled)	Signed 16	0..20	0..20
30008	Proportional Band XP	Signed 16	10..320	1.0..32.0°C
30009	Integral Action Time (Tint)	Signed 16	50..5000	50..5000 s
30010	Day Extension Period	Signed 16	1..480	1..480 (min)
30011	Thermostat Override (B1 set by Network)	Signed 16	0-1-2	0-1-2 (2=AUTO)
30012	System ON (A1 set by Network)	Signed 16	0-1-2	0-1-2 (2=AUTO)
30013	Room Temperature	Signed 16	-600..+600	-60.0..60.0°C
30014	Floor Temperature (Return Water Temperature)	Signed 16	-600..+600	-60.0..60.0°C
30015	Calculated Setpoint	Signed 16	50..370	5.0..37.0°C
30016	Current Control Output	Signed 16	0..1000	0.0..100%

FUNCTION CODE 05 - WRITE SINGLE COIL

2	Overdrive Mode (controller outputs overdriven)	Bit 0	On - Off	On - Off
3	Night Mode	Bit 1	On - Off	On - Off
4	Summer Mode	Bit 2	On - Off	On - Off
5	Service Alarm	Bit 4	On - Off	On - Off

FUNCTION CODE 06 - WRITE SINGLE REGISTER

40003	Coils 16-01	16 bit		
40004	Output (Overdrive Mode = "ON")	Signed 16	0..1000	0..100.0%
40005	Day Set Point (Day SP Set by Network)	Signed 16	50..370	5.0..37.0°C
40006	Floor Setpoint (Set by Network)	Signed 16	0..500	0.0..50.0°C
40007	Floor Reset Ratio (0= Disabled)	Signed 16	0..20	0..20
40008	Proportional Band XP	Signed 16	10..320	1.0..32.0°C
40009	Integral Action Time (Tint)	Signed 16	50..5000	50..5000 s
40010	Day Extension Period	Signed 16	1..480	1..480 (min)
40011	Thermostat Override (B1 set by Network)	Signed 16	0-1-2	0-1-2 (2=AUTO)
40012	System ON Override (A1 set by Network)	Signed 16	0-1-2	0-1-2 (2=AUTO)

FUNCTION CODE 15 - WRITE MULTIPLE COILS

2	Overdrive Mode (controller outputs overdriven)	Bit 0	On - Off	On - Off
3	Night Mode	Bit 1	On - Off	On - Off
4	Summer Mode	Bit 2	On - Off	On - Off
5	Service Alarm	Bit 3	On - Off	On - Off

FUNCTION CODE 16 - WRITE MULTIPLE REGISTER

40003	Coils 16-01	16-bit		
40004	Output (Overdrive Mode = "ON")	Signed 16	0..1000	0..100.0%
40005	Day Set Point (Set by Network)	Signed 16	50..370	5.0..37.0°C
40006	Floor Setpoint (Set by Network)	Signed 16	0..500	0.0..50.0°C
40007	Floor Reset Ratio (0= Disabled)	Signed 16	0..20	0..20
40008	Proportional Band XP	Signed 16	10..320	1.0..32.0°C
40009	Integral Action Time (Tint)	Signed 16	50..5000	50..5000 s
40010	Day Extension Period	Signed 16	1..480	1..480 (min)

Register	Parameter Description	Data Type	Raw Value	Range
40011	Thermostat Override (B1 set by Network)	Signed 16	0-1-2	0-1-2 (2=AUTO)
40012	System ON Override (A1 set by Network)	Signed 16	0-1-2	0-1-2 (2=AUTO)

FUNCTION CODE 22 - MASK WRITE REGISTER

40002	Coils 16 - 01	16 bit		AND 0... 0xFFFF OR 0..0xFFFF
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THERMOSTAT OUTPUT B1 NETWORK OVERRIDE

Function Code 6 - write single register - can be used to write register 40011 values 0, 1 or 2. This will override the output B1 conditions.

- 0 - Output B1 Overridden OFF
- 1 - Output B1 Overridden ON
- 2 - Output B1 Under Automatic Control

PLANT/SYSTEM ENABLE A1 NETWORK OVERRIDE

Function Code 6 - write single register - can be used to write register 40012 values 0, 1 or 2. This will override the output B1 conditions.

- 0 - Output A1 Overridden OFF
- 1 - Output A1 Overridden ON
- 2 - Output A1 Under Automatic Control