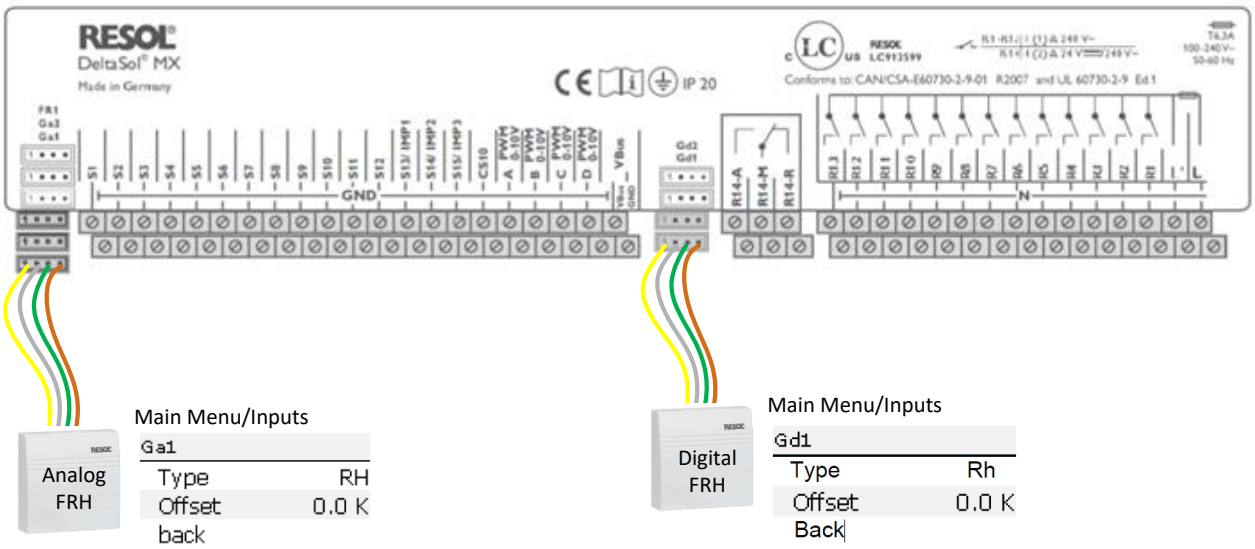
RESOL Room Temperature and Humidity Combination Sensors

RESOL FRH (analog) and FRHd (digital) room sensors measure air temperature and relative humidity in the rooms. With fast response and high measurement accuracy these sensors transmit signal to Resol MX /Resol HC MAX controllers.



FRH/FRHd sensors provide data of the room temperature (dry bulb) and % Relative Humidity when connected and assigned to controller's Ga/Gd inputs. With enabled cooling option for hydronic circuit (HC), the controller uses this data to calculate a dew-point and modulates the chilled water supply temperature to the radiant surface by maintaining it above the point of condensation.

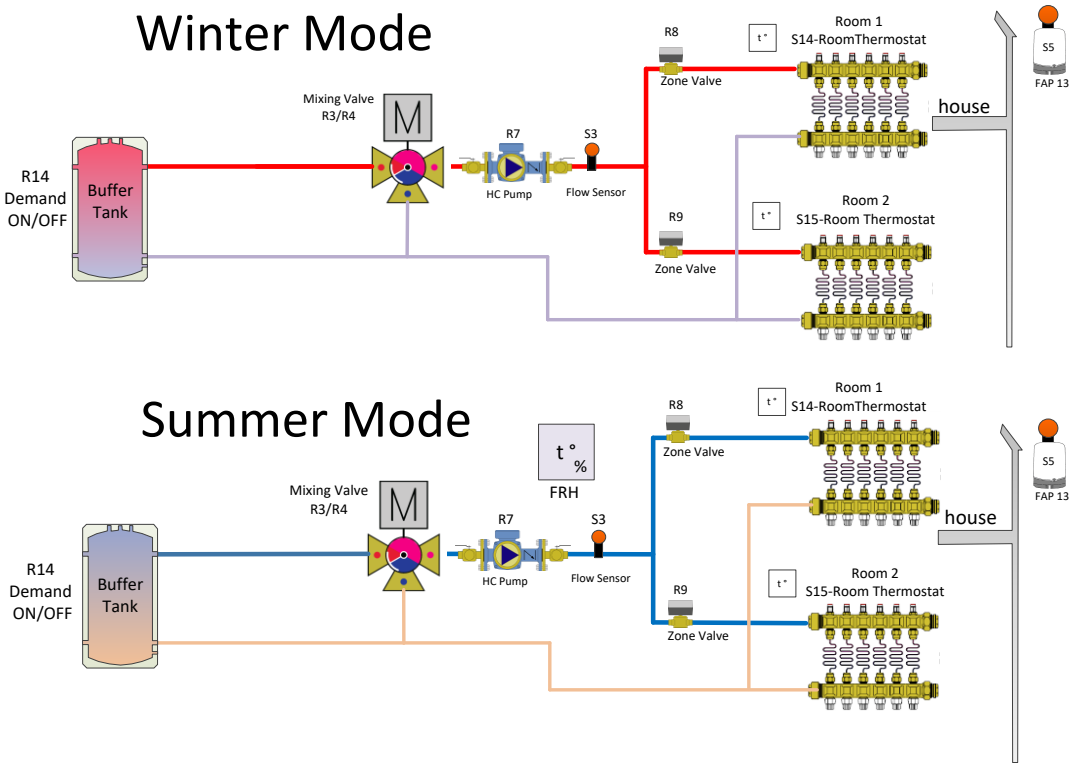


Fig. 1: Radiant Heating and Cooling circuit in 2-pipe system

The cooling can be enabled by following modes and conditions:

a) **OUTDOOR** temperature; when it reaches pre-set ***TDay off*** temperature (default 20°C), the controller automatically switches its operating mode from Winter to Summer.
b) **External switch** (a dry contact switch assigned to a free sensor input).
c) Combination of **both**, which means summer mode is recogized by the controller based on outdoot temperature reaching the ***TDay off*** and a closure of an external switch.

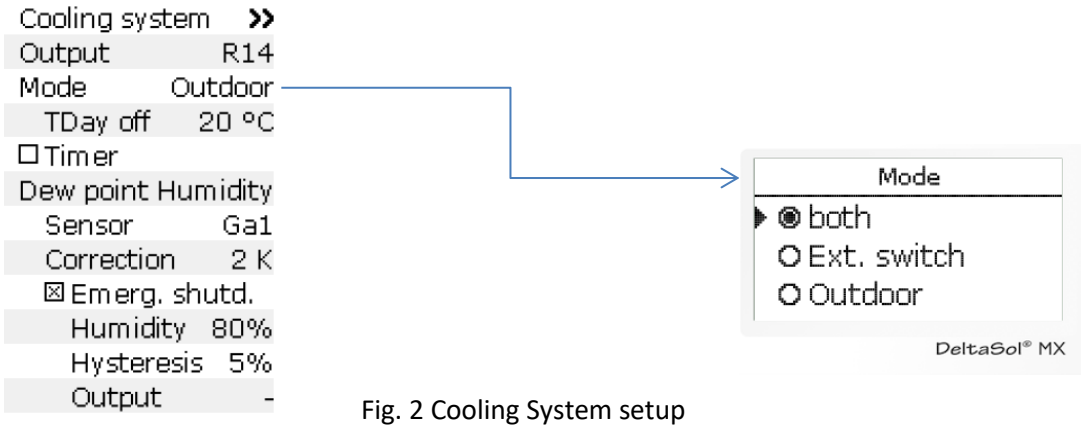


Fig. 2 Cooling System setup

When conditions of Summer Mode are fullfilled, relay R14 is activatted, see Fig.1. Relay R14 can control heating/cooling switchover mode of the heat pump. Please note: more specific wiring and/or additional control options can be required for project specific equipment. The R14A-R14M is normally open dry contact relay terminals in Resol MX /Resol HC MAX controllers.
The user-defined **heating curve** (Supply Water Temp vs. Outdoor Temperature) determines the supply temperature to the radiant surface in **Winter (heating)** operating mode. The controller calculates required flow temperature ***Tflow.*** When measured supply temperature (sensor S3) is below calculated ***Tflow*****,** relay R3-***Mixer open*** is activated and relay R4 ***Mixer close*** activates when supply temperature at S3 goes above calculated ***Tflow***.

In the S**ummer (cooling)** operating mode, a cooling curve is defined as a linear function based on 4 temperature points, see Fig.3. Please note that the curve's slop could be different for diverse geographical locations and climates.

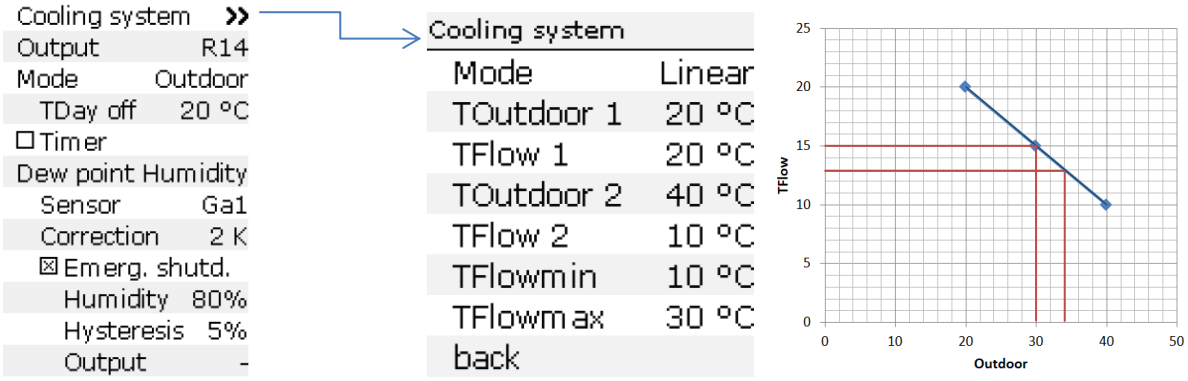


Fig. 3 Cooling System, mode setup

The cooling curve represents required supply ***Tflow*** temperature in relation to outdoor temperature ***without considering dew point***. For example:

- if Outdoor temperature is 30 °C, ***Tflow*** should be 15 °C**;**
- if Outdoor temperature reaches 34 °C, ***Tflow*** should decrease to 13 °C.

Please reivew simulation below made **without** activation of Dew Point control function - Resol MX controller doesn't consider a dew point:

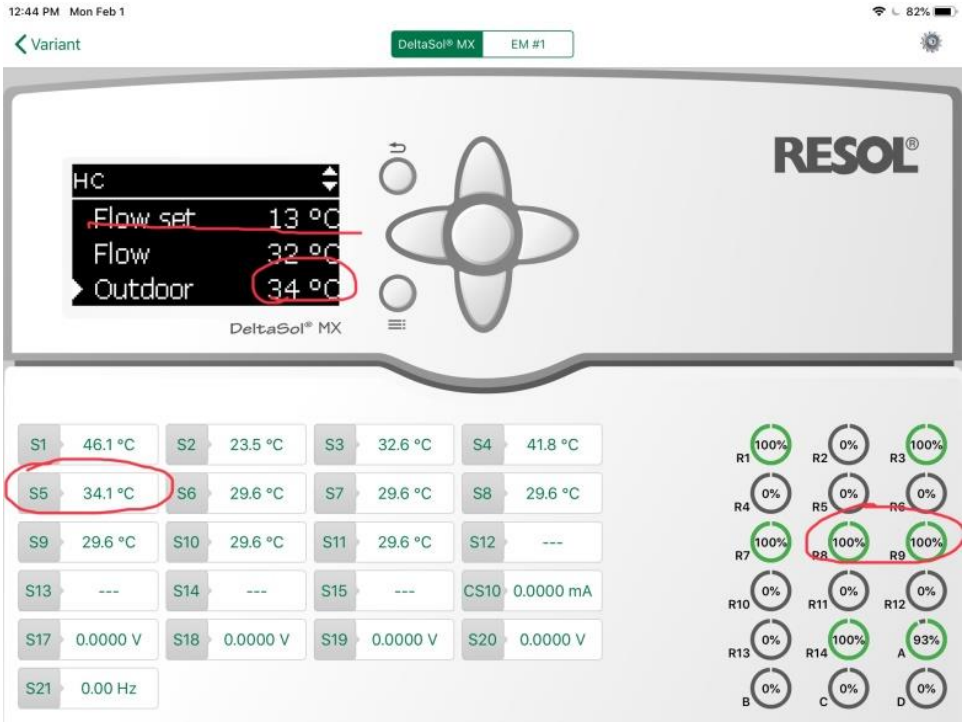


Fig. 4 No Dew Point control test

When any or all of zoness call for cooling , HC pump (R7) is activated. (see Fig. 1) The outdoor tempreature in the simulator is 34 ^{o}C, ***Tflow*** is 13 ^{o}C; so ***Mixer open*** relay R3 is activated and runs 4 seconds as per preset interval of 4 seconds. The supply temperature decreases until it matches predefined by linear courve operating point of 13 ^{o}C.
The ***mixer open/close*** interval is defined in the heating circuit setup section (Fig.5) , it is applicable to both Heating Circuit (HC) operating modes: heating and cooling.

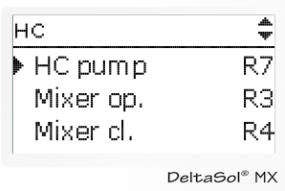


Fig. 5 Heating circuit setup

In the simulation below, the FRH humidity sensor has been registered under Ga1 Input and Dew point humidity control function in the HC is activated.

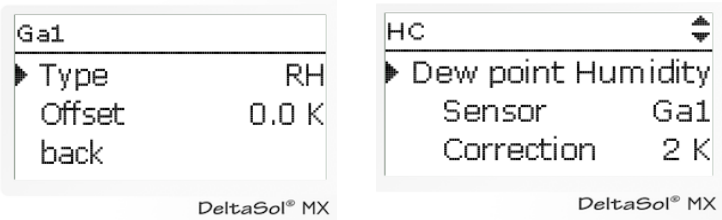


Fig. 6 Dew Point control function setup

Resol FRH sensor measures room temperature and room relative humidity. The controller calculates the dew point based on pshychometric chart built in its algorithm:

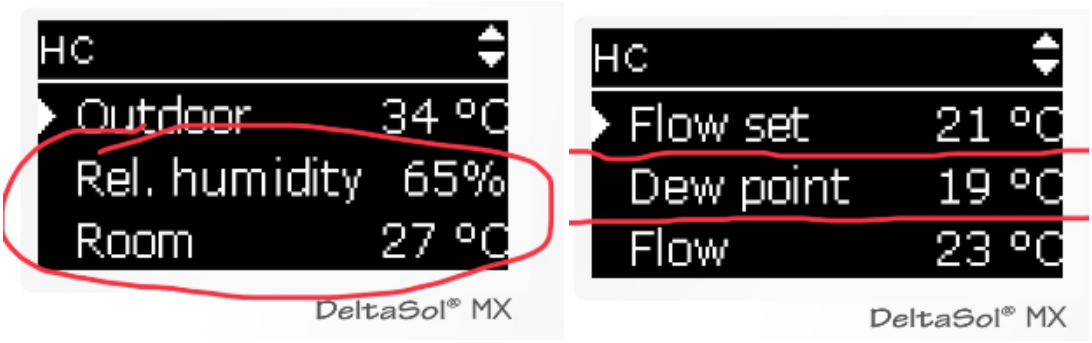


Fig. 7 Measured temperatures and Relative Humidity with calculated supply temp and Dew point temp.

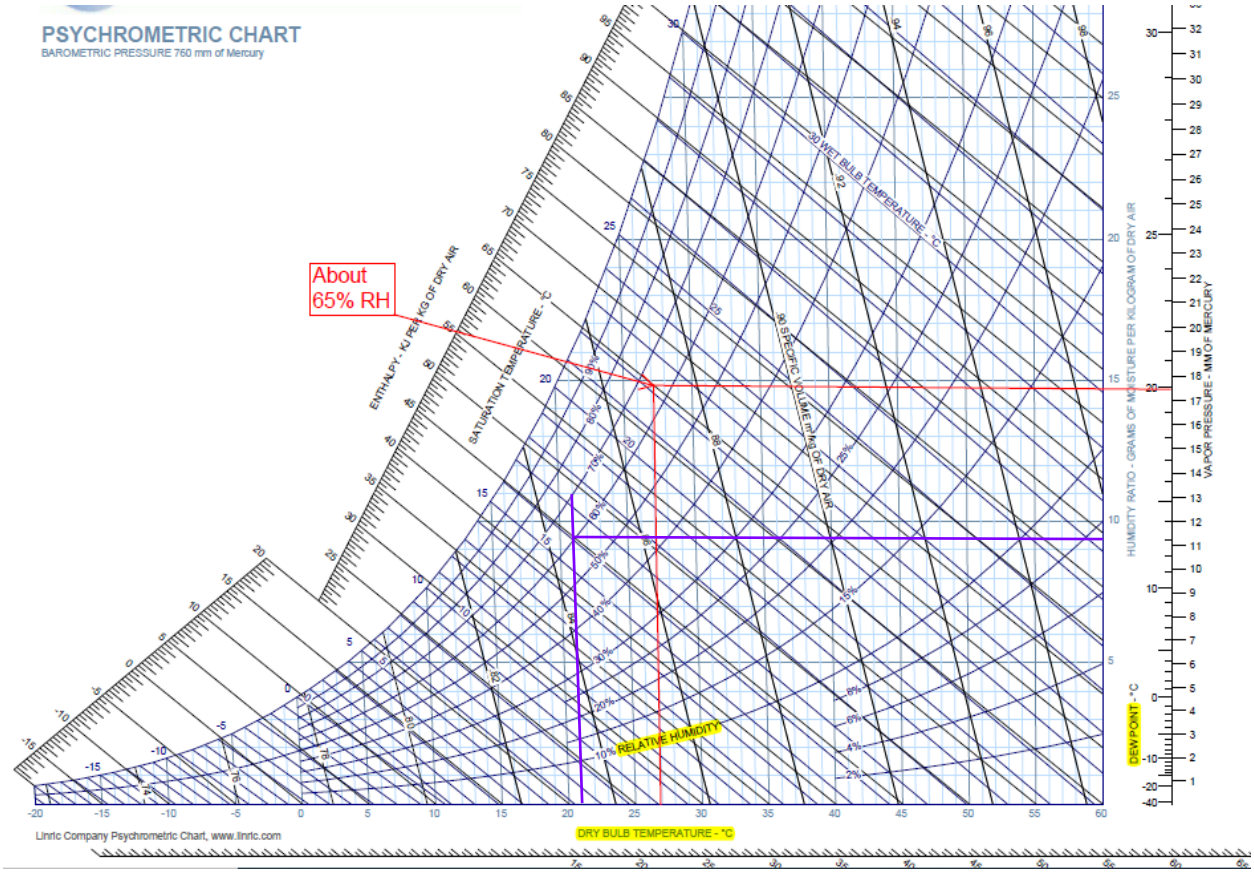


Fig. 8 Pshychometric chart

Based on simulated conditions, by outdoor temperature at 34 ^{o}C and same linear cooling curve, the calculated supply temperature ***Tflow*** has been changed to 22 ^{o}C. The Resol MX controller calculates the dew point to be 20 ^{o}C by room temperature at 27 ^{o}C (dry bulb temperature) and 65% room relative humidity. Obvisouly, by supply temperature equal or less than 20 ^{o}C, condensation on the coling surfaces will occur. Resol MX or HCMAX controllers always keep target supply ***Tflow*** temperature to be 2 ^{o}K above the calculated for given condition Dew Point temperature to prevent condensation.

Beside the floating dew point control, the controller provides Emergency Shutdown function:

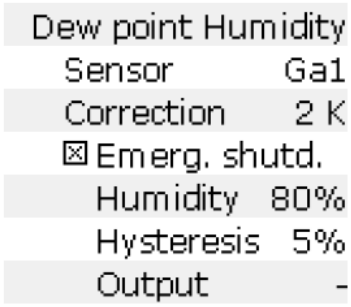


Fig. 9 Dew Point control Emergency Shutdown setup

As as soon as the FRH or FRHd sensor detects Maximum Relative Humidity value (80% pre-set in our simulation), the entire cooling activity will stop, disregard if there are any zones that still calling for cooling. In our simulation, when measured relative humidity reaches 80% and Zone 1 (S14) and Zone 2 (S15) are calling for cooling (R8 and R9 are activated), HC pump (R7) is deactivated – see Fig.10. There is no flow of cold water to zones. A free relay, e.g R13 could be assigned under Emerg.Shutd – Output (Fig.9). This relay will be activated whenever Emergency Shutdown conditions are met. This relay can control a HRV blower(s) or dehumiditifier:

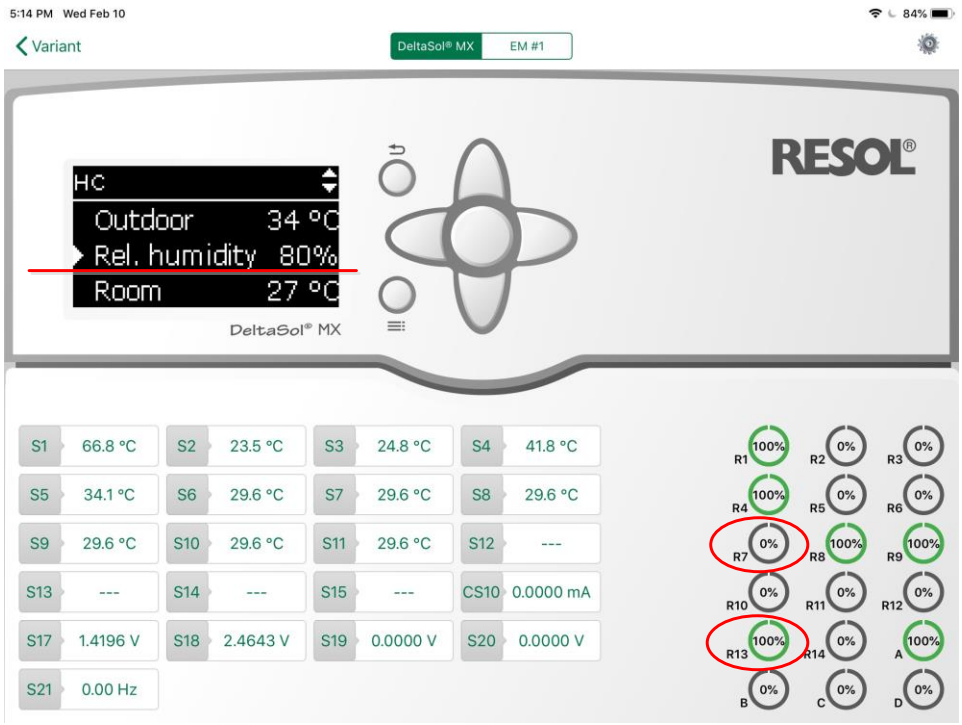


Fig. 10 Emergency Shutdown at maximum % Relative Humidity

By decreased relative humidity in 5% (hysteresis) below Max %rH, the cooling activity is restored as long as cooling demand is present (Fig. 11):

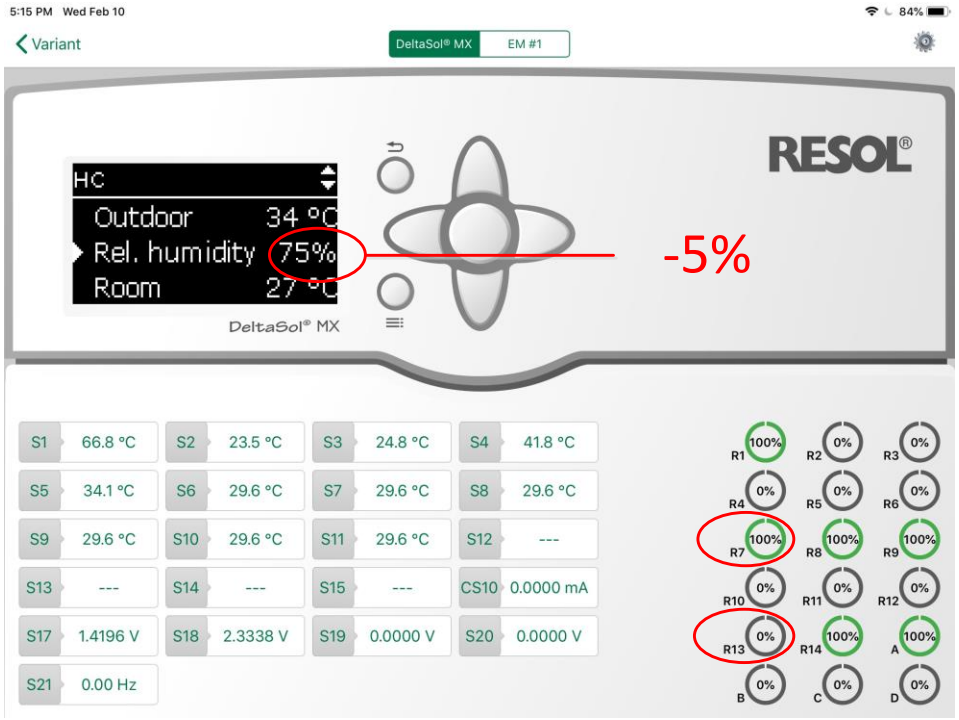


Fig. 11 Maximum % Relative Humidity hysteresis