Hydronic floor heating
Easy, proven and profitable

Easy selection saves time and increases your turnover.

heating.danfoss.com
Our advanced knowledge of **hydronic control** means that you get the best products on the market.

Our knowledge of hydronic control and balancing provides you with:
- Comfort in terms of accurate temperature control
- Comfort and energy savings due to easy and accurate balancing of the heating system

**WE PROVIDE CONTROL EXPERTISE**

6 product areas where hydronic control engineering results in comfort and energy saving products.

**+80 years**

of experience with innovating heating control technology.

**TEAM UP WITH THE INVENTOR**

Being the first to introduce **wireless floor heating control** is only one part of our long life within comfort control.

Danfoss has been pioneering heating control systems for more than 80 years and we have 20 years of experience in advanced wireless solutions. Throughout the years, it has been our goal to simplify both installation and operation to ensure maximum end user value and energy savings.

**Contents**

4 | WHY CHOOSE DANFOSS?
6 | ROOM CONTROLS
22 | MANIFOLDS AND MIXING SHUNTS
34 | FLOOR HEATING PANELS
38 | QUALITY PIPES
42 | CASE STORIES

**Hydronic Balancing Controls**

**District Heating Controls**

**Hydronic Floor Heating Controls**

**Room Controls**

**Radiator Controls**

**Cooling Controls**
The most advanced test center

In Vejle, Denmark we are testing floor heating in combination with other heat emitters and heat sources while simulating outdoor temperatures.

Thermal mass
(Cell 1, 2 and 4)
Houses around the world are constructed differently. Each room in the Test Center is therefore constructed with different materials and different thermal mass. The amount of thermal mass determines the heat absorbing ability of the room and thereby how fast the floor heating can heat up the room.

Outdoor temperature simulation
(Cell 6)
The test rooms are surrounded by a cooling zone. This enables the engineers to simulate different outdoor temperatures and test how floor heating reacts under different conditions.

Floor heating reaction time
(Cell 1, 2 and 4)
Floor heating reacts slower than radiators. Temperature sensors are embedded in the concrete at multiple levels and vertically in the cell from floor surface to ceiling for every 0.5 m. This enables the engineers to register the reaction time of the floor heating system.

Impact on the entire system
(Cell 5)
The floor heating can be connected to different heat sources such as gas boilers and district energy stations. Also, multiple heat emitters (floor heating and radiator) in the same room can be tested. This enables the engineers to assess the impact of any change on the entire system and not just on the floor heating.

Thermal radiation
(Cell 1, 2 and 4)
A special sensor not only measures the air temperature but also the thermal radiation from e.g. windows when it is cold outside. Thermal radiation affects comfort, which means that an air temperature of 21 °C may not feel like 21 °C.

Multiple rooms for testing
(Cell 1, 2 and 4)
Most test facilities use only one room. The Danfoss test facility has three rooms. This enables the engineers to test in a multi-room-system approach that is similar to a normal house.

Before...
- Danfoss can provide all necessary components for balancing the entire system and can advise you on the optimum solution
- Danfoss offers radiator, hydronic and electrical floor heating control and can advise you about the ideal heat emitter
- Danfoss can provide written system specifications to help you with the tendering process
- Danfoss offer specialist training to ensure optimum installation results

...during...
- If applications change during the project, we can advise on any necessary changes
- Danfoss can help you with your first installation, thereby minimizing the risk of mistakes
- Danfoss offer full technical support. Simply call us

...after installation...
- With over 80 years of experience, you can rely on our ongoing support
- Danfoss offer cost-free help with balancing the floor heating system correctly
- During handover, we provide all relevant material, e.g. operating instructions. This minimizes call-backs

All products from one supplier ensures better systems and makes your life easier.
Product highlight:
**Danfoss Link™**

**Danfoss Link™ Central Controller – intuitive touch screen and access point:**
- Remote access with Danfoss Link™ App
- Makes temperature scheduling easy
- Save 5% energy for every degree the room temperature can be lowered
- Adaptive learning ensures the right temperature at the right time
- Put entire heating system in ‘At Home’, ‘Away/Asleep’, ‘Pause’ or ‘Vacation’ mode from a single central point
- Wireless for easy installation
- Very accurate control with e.g. PID-controlled living connect® for more comfort

**TIP!** Ask your customers if they are interested in a smart home solution.

---

**Easy wireless temperature control from one access point – all around the house:**

1. Danfoss Connect™
   Electronic radiator thermostat
2. Danfoss Icon™ Wireless Room sensor for radiator and and floor heating control.
3. Danfoss Link™ HC
   Hydronic controller for floor heating
4. Danfoss Link™ App
   Easy temperature control from your smartphone

---

**A simple smart home solution**
Why balance?
Water chooses the easiest path with the least resistance. In floor heating systems, the consequence is an uneven heat distribution where the shortest loop will get the most water, resulting in a faster warming of smaller rooms at the expense of the larger rooms. To achieve harmonic room temperatures, the floor heating system should be hydronically balanced as it provides maximum comfort with minimum energy costs.

How automatic balancing works
Based on the ability to meet the setpoint in each room, the Danfoss Icon™ system will know the approximate size of each output (pipe length). With Danfoss Icon™ automatic balancing, the system will reduce the “ON time” for the shorter pipes / small rooms and prioritize the longer pipes / large rooms. Thereby all rooms will get their fair ratio of the available flow when heat demand increases.

Why outdoor temperature compensation is not always optimal:
The supply temperature is often controlled via outdoor temperature compensation. However, outdoor temperature compensation requires wiring to an outdoor sensor and heat curve settings. Furthermore, the outdoor temperature does not necessarily reflect the actual heat demand inside of the house.

Product highlight:
Danfoss Icon™ Automatic balancing

Product highlight:
Danfoss Icon™ Demand based supply temperature

How demand based supply temperature works
Danfoss Icon™ 3V/4 and wireless systems detect actual and required temperatures in each room. Based on the information, an actuator on the mixing shunt will constantly adapt the supply temperature to the actual heat demand. In effect, comfort will increase and the return temperature will decrease for improved energy efficiency.
WIRELESS INSTALLATION IS SIMPLE

Installing Danfoss Icon™

1. When all actuators are connected, connect the 24V/wireless Master Controller to the main supply.
2. Make sure the Master Controller is in installation mode (Master Controller display must show "InS")
3. Swipe the room thermostat display within a distance of 1.5 meter from the radio module / Master Controller
4. All outputs will flash. Press the output(s) you would like to add to the room thermostat
5. Repeat steps 3-4 for each room thermostat you wish to add.

Installing Danfoss Link™ CC Central Controller

1. When all actuators are connected, connect the Danfoss Link™ HC Hydronic Controller to the main supply.
2. Add the master controller to Danfoss Link™ CC Central Controller.
3. Add the room thermostat to Danfoss Link™ CC Central Controller.
4. Pair the room thermostat with the output via Danfoss Link™ CC Central Controller.
5. Install the Danfoss Link™ CC Central Controller in its final position.
6. Perform a network test via Danfoss Link™ CC Central Controller.
Selling system controls is good for your business and provides comfort and savings for your customers.

Danfoss control solutions makes it easier for you to boost your business. The example below is for a home where six room controls are needed.

In both cases, the manifold is a FHF and pipes are PE-RT. Room controls are CF2 wireless system with room thermostat CF-RS.

TIP! Inform your customers about the comfort and energy saving benefits from using room controls.

Typical installation without controls

Turnover INDEX ~40

Typical installation with controls

Turnover INDEX ~100

Double your turnover and provide comfort and energy savings for your customers.
### Room Controls

#### What to Consider

<table>
<thead>
<tr>
<th>1. Building Size</th>
<th>Is the house or individual apartment larger than 300 m²? (Wireless range)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO</strong></td>
<td></td>
</tr>
<tr>
<td><strong>YES</strong></td>
<td><strong>CHOOSE HARDWIRED</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Flexibility</th>
<th>Are short installation time flexibility of placing thermostat important?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO</strong></td>
<td></td>
</tr>
<tr>
<td><strong>YES</strong></td>
<td><strong>CHOOSE WIRELESS</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Cooling</th>
<th>Will floor heating system be used for floor cooling?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO</strong></td>
<td></td>
</tr>
<tr>
<td><strong>YES</strong></td>
<td><strong>CHOOSE Danfoss Icon™</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Batteries</th>
<th>Is it ok that batteries need to be changed every 2 years?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO</strong></td>
<td></td>
</tr>
<tr>
<td><strong>YES</strong></td>
<td><strong>CHOOSE WIRELESS</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. Features</th>
<th>Is automatic balancing, demand based supply temperature and App required?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO</strong></td>
<td></td>
</tr>
<tr>
<td><strong>YES</strong></td>
<td><strong>CHOOSE Danfoss Icon™ 24V</strong></td>
</tr>
</tbody>
</table>

### Wireless Solutions

- **Danfoss Link™**
  - The full “Smart house” solution. Can be paired with Alexa - Amazon’s voice-control system. Use the both intuitive touch screen and mobile application to control both radiators and floor heating. NB: no cooling option is available, though connecting Danfoss Icon™ Wireless infrared thermostat makes possible to use infrared floor sensor.

- **Danfoss Icon™ Wireless**
  - Designer room thermostats with automatic balancing, demand based supply temperature, App and much more.

- **Danfoss Icon™ 230 V/24V**
  - Designer room thermostats with multiple features.

- **BasicPlus® WT-x 230 V**
  - Basic 230 V room thermostats.

- **FH-Wx 24 V**
  - No electrician needed (low voltage).

### Hardwired Solutions

- **Danfoss Icon™ 230 V/24V**
  - No electrician needed (low voltage).

- **BasicPlus® WT-x 230 V**
  - Basic 230 V room thermostats.

- **FH-Wx 24 V**
  - No electrician needed (low voltage).
Danfoss Icon™
230V, 24V AND WIRELESS ROOM SYSTEMS

**Room thermostats**

<table>
<thead>
<tr>
<th>Code no.</th>
<th>230V</th>
<th>24V</th>
<th>Wireless</th>
</tr>
</thead>
<tbody>
<tr>
<td>088U1000</td>
<td>Dial, In-wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088U1010</td>
<td>Display, In-wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088U1020</td>
<td>Programmable, In-wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088U1005</td>
<td>Dial, On-wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088U1015</td>
<td>Display, On-wall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088U1025</td>
<td>Programmable, On-wall</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Master controllers**

<table>
<thead>
<tr>
<th>Code no.</th>
<th>230V</th>
<th>24V</th>
<th>Wireless</th>
</tr>
</thead>
<tbody>
<tr>
<td>088U1030</td>
<td>8 ch., Basic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088U1031</td>
<td>8 ch., Featured</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088U1071</td>
<td>10 ch.</td>
<td>8 ch.</td>
<td></td>
</tr>
<tr>
<td>088U1072</td>
<td>15 ch.</td>
<td>8 ch.</td>
<td></td>
</tr>
</tbody>
</table>

**Main accessories**

<table>
<thead>
<tr>
<th>Code no.</th>
<th>230V</th>
<th>24V</th>
<th>Wireless</th>
</tr>
</thead>
<tbody>
<tr>
<td>088U1110</td>
<td>Floor Sensor for 24V and 230V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088U1010</td>
<td>App Module</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088U1000</td>
<td>Expansion Module</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088U1020</td>
<td>Repeater</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088U1030</td>
<td>Radio Module</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088U1025</td>
<td>Dry Point Sensor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088U1165</td>
<td>Surface temperature sensor, ESM-11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>193B2148</td>
<td>Actuator ABN-F24NC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Description**

- **For setting min., max. or fixed floor temperature.**
- **To enable smart phone / app access.**
- **To enable global away input, manual cooling input, dry point sensor, automatic cooling change-over and supply temperature control.**
- **To extend wireless signal range.**
- **To transform 24 V system into wireless system or as spare part for wireless system.**
- **To prevent condensation in cooling application. Mounted on manifold. Powered by Expansion Module 088U1100.**
- **For automatic change over between cooling and heating and for controlling supply temperature.**
- **For "upside down" installation on mixing shunt in demand based supply temperature applications (requires high IP class). Remember adapter 193B2005 for RA connection.**
- **RA manifold connection. NO = Normally Open, NC = Normally Closed.**
- **RA manifold connection. NO = Normally Open, NC = Normally Closed.**
- **M30 manifold connection. NO = Normally Open, NC = Normally Closed.**

**Features**

- **15 channels**
- **Programmable, 2-way**
- **Display 24 V**
- **Display 230 V**
- **Display Wireless**
- **Display Wireless Infrared**
- **Display Wireless Infrared**

**Applications**

- **For setting min., max. or fixed floor temperature.**
- **M30 manifold connection. NO = Normally Open, NC = Normally Closed.**
- **For automatic change over between cooling and heating and for controlling supply temperature.**
# Room Controls

## Master Controllers

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Features</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>014G0103</td>
<td>Pump relay, input relay for external signal</td>
<td></td>
</tr>
<tr>
<td>014G0100</td>
<td>Boiler relay, adaptive learning</td>
<td></td>
</tr>
</tbody>
</table>

## Room Thermostats

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Features</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>088U1081</td>
<td>Display, On-wall</td>
<td></td>
</tr>
<tr>
<td>088U1082</td>
<td>Infrared, On-wall</td>
<td></td>
</tr>
</tbody>
</table>

## Accessories

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>014G0287 / 014G0289</td>
<td>Controller with user friendly screen. With NSU (wall mounted). Required.</td>
<td></td>
</tr>
<tr>
<td>014G0286 / 014G0288</td>
<td>Controller with user friendly screen. With PSU (flush-mounted). Required.</td>
<td></td>
</tr>
<tr>
<td>088U0230</td>
<td>Repeater Unit, CF-RU</td>
<td></td>
</tr>
<tr>
<td>088U0250</td>
<td>External Antenna, CF-EA</td>
<td></td>
</tr>
<tr>
<td>088U0255</td>
<td>Extension cable, 5 meters.</td>
<td></td>
</tr>
<tr>
<td>088H3110</td>
<td>RA manifold connection. Connect wire to hydronic controller.</td>
<td></td>
</tr>
<tr>
<td>088H3111</td>
<td>RA manifold connection. Connect wire to hydronic controller.</td>
<td></td>
</tr>
<tr>
<td>088H3140</td>
<td>M30x1.5 manifold connection. Connect wire to hydronic controller.</td>
<td></td>
</tr>
<tr>
<td>088H3141</td>
<td>M30x1.5 manifold connection. Connect wire to hydronic controller.</td>
<td></td>
</tr>
</tbody>
</table>

## Other Products

### That Can Be Controlled by Danfoss Link™ Central Controller

- Danfoss Link™ Floor Thermostat
- Radiator thermostat, living connect
- Radiator thermostat, living connect

### That Can Be Controlled by Danfoss Link™ Central Controller

- Danfoss Link™ Floor Thermostat
- Radiator thermostat, living connect
- Radiator thermostat, living connect

---

*Note: All products require Danfoss Link™ Central Controller.

**Features**

- Pump relay
- Input relay for external signal
- Boiler relay
- Adaptive learning
- Week schedule (via Danfoss Link™ Central Controller)

**Room Thermostats**

- Display, On-wall
- Infrared, On-wall

**Accessories**

- Repeater Unit, CF-RU
- External Antenna, CF-EA
- Extension cable, 5 meters.
### OTHER HARDWIRED

**Master Controller:**

**FH-WC 24 V – 10 outputs**

**Code no.:** 088H0017

---

**Thermal Actuator**

- **FH-WF**
- **Floor sensor**
  - 088H3110
  - 088H3113
  - 088H3140
  - 088H3143

---

**Connecting Boxes**

- **Wired**
  - **230 V BasicPlus**
    - BasicPlus® dial (WT-T)
      - Code no.: 088U0620
    - BasicPlus® display (WT-D)
      - Code no.: 088U0622
    - BasicPlus® display w/ relay (WT-DR)
      - Code no.: 088U0624
    - BasicPlus® programmable (WT-P)
      - Code no.: 088U0625
    - BasicPlus® programmable w/ relay (WT-PR)
      - Code no.: 088U0626

- **24 V FH-Wx**
  - FH-WT dial
    - Code no.: 088H0022
  - FH-WP dial (tamperproof)
    - Code no.: 088H0023
  - FH-WS dial (featured)
    - Code no.: 088H0024

---

**Room Controls**

- **Wired**
  - **230 V BasicPlus**
  - **24 V FH-Wx**

---

**Accessories – for hardwired solutions**

- **Thermal actuators for 24 V**
  - Code no.: 088H3110 (NC) + 088H3111 (NO)
  - Code no.: 088H3140 (NC) + 088H3143 (NO)

- **Floor sensor, for FH-Wx – 24 V**
  - Code no.: 088H0025

- **Floor sensor, for FH-CWx and WT-x**
  - Code no.: 088U0010

- **Danfoss Icon™ floor sensor**
  - Code no.: 088U1110

---

**Code no.:** 088H0017

**Features**

- **Pump relay**
- **Cooling relay**
- **Standby relay**
- **Boiler relay**

**Description**

- Required for all 24 V room controls.

---

**Features**

- **For system**
  - **230 V**
  - **24 V**

- **RA manifold connection.**
  - Connected via connection box 088H0017.
  - Connected directly with 230 V room thermostats or conn. box 088H0016.
  - Connected via connection box 088H0017.
  - Connected directly with 230 V room thermostats or conn. box 088H0016.

- **For setting either minimum or maximum floor temperature.**
- **For setting min., max. or fixed floor temperature.**
- **For setting min., max. or fixed floor temperature.**

---

**Note:** If a Normally Open (NO) actuator is connected, the pump or boiler relay cannot be used as the relay function is inverted.
MANIFOLDS, MIXING SHUNTS AND CABINETS

MEET THE FAMILY
MANIFOLDS AND MIXING SHUNTS

Mounting the mixing shunt is extremely easy, as it is very compact from only 110 mm in installation dimension. The mixing shunt is mounted directly on the manifold on either the left or right-hand side, it can also be angle mounted with angle fittings as accessories.

**FHF**
With pre-setting but without flow meter. FHF with flow meter (FHF-F) is shown on the above picture.

**FH-ME (BasicPlus)**
No flow meter and no pre-setting.

**SSM-F**
With pre-setting and flow meter.

**SSM**
With pre-setting and without flow meter.

**Mixing shunt**

**Product highlights:**
- Prefabricated for quick and easy mounting
- Very compact - fits into cabinets

No flow meter and no pre-setting.
Pressure test
In a pressure test, the manifolds, fittings and pipes are assembled and placed under pressure. In this way, the manifold, fittings and pipes can be tested to withstand even unrealistic pressures.

Temperature test
In a temperature test, the floor heating system is exposed to different heat levels. These variations make the components expand and contract, allowing us to test the sustainability of the different components.

Capacity test
In a capacity test, the flow through the valves is tested, enabling us to find the kvs-value. This allows us to calculate how much energy each circuit can provide to the room.

We have minimized failure rates so you can maximize your business.
During production and development, all components are subjected to various tests to maximize their efficiency and working life.

TESTED TO LAST FOR DECADES

We have minimized failure rates so you can maximize your business.
During production and development, all components are subjected to various tests to maximize their efficiency and working life.

High quality brass
The purity and quality of the brass used in Danfoss manifolds minimizes the risk of corrosion and leakages.
FHF and FHF-F manifolds are all produced according to the CW617N standard, which ensures a very high brass quality.
A study with 537 plumbers from seven countries shows that installers are called back to approx. 20% of installations. The saving potential for leaving behind a well-functioning system is enormous.

**TIP!** Make sure to explain the importance of perfect hydronic balancing to your customers.

**Manifolds with pre-setting**

**Reduce call-backs and provide comfort and savings for your customers**

Typical installation with pre-setting

With hydronic balancing, the right amount of water will be distributed to the right rooms. Hydronic balancing can be achieved via manifold pre-setting or by using the automatic balancing feature available with some Danfoss Icon™ room controls.

Typical installation without pre-setting

Without hydronic balancing valves, you risk the scenario of very uneven heat distribution which decreases comfort.

**More than just pre-setting**

**We give you the best solutions on the market**

A Danfoss manifold with pre-setting offers better distribution of water and energy, which ensures the right temperatures in different rooms.

**Comparison**

- **Danfoss throttle pre-setting**
  - No tools required. Can be done quickly and easily
  - Precise pre-setting scale visible on valve
  - Easy to use pre-setting guide
  - Pre-setting can be checked after installation (visible setting)
  - Spindle and valve seat produced as 1 piece – provides extreme accuracy

- **Typical non-Danfoss pre-setting**
  - Tools required. Time consuming
  - Normally not visible on valve
  - More complex pre-setting
  - Pre-setting cannot be checked without a visible scale
  - Spindle uses manifold as seat. Difficult to set accurately
Accurate pre-setting example

How to pre-set the valves on a Danfoss manifold:

Step 1: Identify the column that describes the longest pipe in the system (in the below example 100 meters)

Step 2: Identify the row that describes the second longest pipe in the system (in the below example 85 meters)

Step 3: The column and row intersect in a cell with a value (in the below example the value "5.5"). This is the pre-setting value of the valve connected to the pipe in question

Step 4: Repeat step 2 and 3 for the next pipes
**MANIFOLDS**

**WHAT TO CONSIDER**

1. **BALANCED SYSTEM**
   - Is balancing via pre-setting or flow meters required?
   - **YES**
   - **NO**

2. **FLOW METER**
   - Are flow meters required?
   - **YES**
   - **NO**

3. **CHOOSE**
   - FHF-F or SSM-F with both pre-setting and flow meter

**MANIFOLD OVERVIEW**

### Manifolds

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Number of outputs</th>
<th>Flow meter</th>
<th>Pre-setting</th>
<th>Control valves for actuators</th>
<th>Solution</th>
<th>Material</th>
<th>Working Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>FHF-F</td>
<td>088U0522-32</td>
<td>✓</td>
<td>✓</td>
<td>(TWA-A)</td>
<td>Only manifold</td>
<td>Brass</td>
<td>6 bar</td>
</tr>
<tr>
<td>FHF</td>
<td>088U0502-12</td>
<td>✓</td>
<td>✓</td>
<td>(TWA-A)</td>
<td>Only manifold</td>
<td>Brass</td>
<td>10 bar</td>
</tr>
<tr>
<td>FH-ME (BasicPlus)</td>
<td>088U0512-18</td>
<td>✓</td>
<td>✓</td>
<td>(TWA-A)</td>
<td>Only manifold</td>
<td>Brass</td>
<td>10 bar</td>
</tr>
<tr>
<td>FH-B with shut-off</td>
<td>088U0542-32</td>
<td>✓</td>
<td>✓</td>
<td>(TWA-A)</td>
<td>Only manifold</td>
<td>Brass</td>
<td>10 bar</td>
</tr>
<tr>
<td>SSM-F</td>
<td>088U0752-62</td>
<td>✓</td>
<td>✓</td>
<td>(TWA-A)</td>
<td>Assembled</td>
<td>Stainless steel</td>
<td>6 bar</td>
</tr>
<tr>
<td>SSM</td>
<td>088U0802-12</td>
<td>✓</td>
<td>✓</td>
<td>(TWA-A)</td>
<td>Assembled</td>
<td>Stainless steel</td>
<td>10 bar</td>
</tr>
</tbody>
</table>

* You will need to order end-piece (1 pcs. 088U0582 or 2 pcs. end section 088U0786 or 088U0785), mounting brackets (088U0584) and ball valves (088U0822).

### Accessories

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>088U0582</td>
<td>Used where air vents are not used.</td>
</tr>
<tr>
<td>088U0785</td>
<td>Includes automatic air vent and drain valve.</td>
</tr>
<tr>
<td>088U0786</td>
<td>Includes manual air vent and drain valve.</td>
</tr>
<tr>
<td>088U0584</td>
<td>Enables connection between ¾&quot; pipe and 1&quot; manifold.</td>
</tr>
<tr>
<td>088U0583</td>
<td>Used to mount manifold.</td>
</tr>
<tr>
<td>088U0822</td>
<td>To shut off water to entire manifold.</td>
</tr>
<tr>
<td>088U0588</td>
<td>For combining two or more manifolds.</td>
</tr>
</tbody>
</table>

### Cabinets

<table>
<thead>
<tr>
<th>Code no.</th>
<th>On-wall</th>
<th>In-wall</th>
<th>Width [mm]</th>
<th>Depth [mm]</th>
<th>Height [mm]</th>
<th>Max. FHF-F outputs A</th>
<th>Max. FHF-F outputs B</th>
<th>Max. FHF-F outputs C</th>
<th>Max. FHF-F outputs D</th>
</tr>
</thead>
<tbody>
<tr>
<td>FHF-FCA</td>
<td>088X0900</td>
<td>✓</td>
<td>395</td>
<td>110-170</td>
<td>650</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>FHF-FCE</td>
<td>088X0903</td>
<td>✓</td>
<td>995</td>
<td>110-170</td>
<td>650</td>
<td>16</td>
<td>12</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>FHF-FCD</td>
<td>088X0909</td>
<td>✓</td>
<td>1195</td>
<td>110-170</td>
<td>650</td>
<td>18</td>
<td>14</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>FHF-FCB</td>
<td>088X0901</td>
<td>✓</td>
<td>595</td>
<td>110-170</td>
<td>650</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>FHF-FCF</td>
<td>088X0902</td>
<td>✓</td>
<td>795</td>
<td>110-170</td>
<td>650</td>
<td>10</td>
<td>9</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>FHF-FCA</td>
<td>088X0900</td>
<td>✓</td>
<td>450</td>
<td>119</td>
<td>650</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>FHF-SCB</td>
<td>088X0906</td>
<td>✓</td>
<td>700</td>
<td>119</td>
<td>650</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>FHF-SCC</td>
<td>088X0907</td>
<td>✓</td>
<td>850</td>
<td>119</td>
<td>650</td>
<td>13</td>
<td>10</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>FHF-SCD</td>
<td>088X0908</td>
<td>✓</td>
<td>1000</td>
<td>119</td>
<td>650</td>
<td>16</td>
<td>12</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>FHF-SCF</td>
<td>088X0909</td>
<td>✓</td>
<td>1300</td>
<td>119</td>
<td>650</td>
<td>18</td>
<td>14</td>
<td>13</td>
<td>12</td>
</tr>
</tbody>
</table>

* The cabinets are adjustable in depth from 110 mm to 170 mm.

### Minimum delivery time:

- 6 weeks.
MIXING SHUNT OVERVIEW

Mixing shunt | Code no. | Features |
---|---|---|
FHM-C1 | 088U0094 | Pump type: UPM3 Auto L 15-70, Pump speed: Variable, Additional accessories included: - |
FHM-C2 (without FH-TC) | 088U0092 | Pump type: UPM3 Auto L 15-70, Pump speed: Variable, Additional accessories included: - |
FHM-C5 | 088U0093 | Pump type: UPS 15-40, Additional accessories included: Fixed, non-adaptive, Pump energy class: - |
FHM-C6 | 088U0096 | Pump type: UPS 15-60, Additional accessories included: Fixed, non-adaptive, Pump energy class: - |

FHM-C1 (088U0094)
- Speed-controlled UPM3 Auto L 15-70 pump
- Internal non-return valve
- FHD-T thermometer
- FH-TC self-acting thermo-static controller

FHM-C2 (088U0092)
- Speed-controlled UPM3 Auto L 15-70 pump
- Internal non-return valve
- FHD-T thermometer

FHM-C5 (088U0093)
- 3-speed UPS 15-60 pump
- Internal non-return valve
- FHD-T thermometer
- FH-TC self-acting thermo-static controller

FHM-C6 (088U0096)
- 3-speed UPS 15-60 pump
- Internal non-return valve
- FHD-T thermometer
- FH-TC self-acting thermo-static controller

MIDI SHUNT OVERVIEW

Midi shunt - for small floor heating systems | Code no. | Measurement (H x W x D) | Pre-mounted components |
---|---|---|---|
Midishunt with 1 circuit | 088U0851 | 420 x 290 x 100 | Pump type: UPM3 Auto L 15-70, Controls: - |

Midi Shunt (088U0851)
- with 1 circuit, up to 20 m²

Accessories for mixing shunt | Code no. | Description |
---|---|---|
Safety thermostat | 088U0301 | Stops pump if supply temperature is above 55° C |
Measurement set | 088U0304 | Output for measuring flow |
Angle fittings | 088U0305 | For mounting mixing shunt at a different angle |
Insulation capsule for UPM3 pump | 088U0075 | Insulation capsule for UPM3 pump |
Basic™ screed systems

Using tools and laying pipes at the same time is difficult. No tools are required for BasicRail™ and BasicGrip™. This means that one person can lay the pipes alone when using BasicRail™ and BasicGrip™.

For BasicRail™ the rails need to be installed first. The BasicGrip™ panel, on the other hand, contains both insulation and knobs that hold the pipes in place. That means fewer work processes with BasicGrip™.

1. Is 1-person installation important?
   - **YES**
   - **NO**
   - **CHOOSE BasicClip™**

2. Is few work processes important?
   - **YES**
   - **NO**
   - **CHOOSE BasicRail™**
   - **NO**
   - **CHOOSE BasicGrip™**
## FLOOR HEATING PANEL

### OVERVIEW

<table>
<thead>
<tr>
<th>System overview</th>
<th>Installation time (min./m² at c/c 300 mm)</th>
<th>Available insulation thickness (mm)</th>
<th>Installation tools needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>BasicGrip™</td>
<td>7,5</td>
<td>0, 11, 35</td>
<td>None</td>
</tr>
<tr>
<td>BasicClip™</td>
<td>8</td>
<td>0, 20, 35 (panels) / 30 (10 m² rolls)</td>
<td>BasicClip Tool</td>
</tr>
<tr>
<td>BasicRail™</td>
<td>6,5</td>
<td>0, 20, 35</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BasicRail™</th>
<th>Code no.</th>
<th>Consumption (m²/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FH-BRA – Rails, 2 meters for 16x2 pipe</td>
<td>088X0040</td>
<td>1,2</td>
</tr>
<tr>
<td>FH-BRC – Rails, 3 meter, for 20x2,25 pipe</td>
<td>088X0042</td>
<td>1,2</td>
</tr>
<tr>
<td>FH-BRD – Clips for BasicRail™, 500 pcs</td>
<td>088X0043</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BasicClip™</th>
<th>Code no.</th>
<th>Consumption, pcs./m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>FH-BCB – Clips for BasicClip™, 300 pcs</td>
<td>088X0062</td>
<td>7</td>
</tr>
<tr>
<td>FH-BCC – Clips for foil, 200 pcs</td>
<td>088X0060</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BasicGrip™ panels and rolls</th>
<th>Code no.</th>
<th>Form</th>
<th>Insulation thickness (mm)</th>
<th>Size (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FH-BGA – Standard panel</td>
<td>088X0050</td>
<td>Panel</td>
<td>35</td>
<td>1</td>
</tr>
<tr>
<td>FH-BGB – Standard panel</td>
<td>088X0051</td>
<td>Panel</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>FH-BGC – Standard panel</td>
<td>088X0052</td>
<td>Panel</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>FH-BGD – Connection panel</td>
<td>088X0053</td>
<td>Panel</td>
<td>0</td>
<td>0,1</td>
</tr>
<tr>
<td>Manifold/multi-panel</td>
<td>088X0054</td>
<td>Panel</td>
<td>35</td>
<td>0,5</td>
</tr>
<tr>
<td>Manifold/multi-panel</td>
<td>088X0055</td>
<td>Panel</td>
<td>11</td>
<td>0,3</td>
</tr>
<tr>
<td>Manifold/multi-panel</td>
<td>088X0056</td>
<td>Panel</td>
<td>0</td>
<td>0,5</td>
</tr>
<tr>
<td>Basic Panel Standard</td>
<td>088X1051</td>
<td>Panel</td>
<td>18</td>
<td>0,62</td>
</tr>
<tr>
<td>Basic Panel Ultra</td>
<td>088X1052</td>
<td>Panel</td>
<td>18</td>
<td>0,62</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BasicClip™ and BasicRail™ rolls</th>
<th>Code no.</th>
<th>Form</th>
<th>Insulation thickness (mm)</th>
<th>Size (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic insulation roll</td>
<td>088X0072</td>
<td>Roll</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Basic insulation roll</td>
<td>088X0073</td>
<td>Roll</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other accessories</th>
<th>Code no.</th>
<th>For which system</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>FH-BGI – Conduit elbow</td>
<td>088X0058</td>
<td>BasicGrip™</td>
<td>✓</td>
</tr>
<tr>
<td>FH-BK – Perimeter insulation</td>
<td>088X0065</td>
<td>BasicClip™</td>
<td>✓</td>
</tr>
<tr>
<td>FH-ACA – Basic movement gap strip</td>
<td>088X0066</td>
<td>BasicRail™</td>
<td>✓</td>
</tr>
<tr>
<td>FH-ACB – Basic pipe sleeve</td>
<td>088X0067</td>
<td>BasicGrip™</td>
<td>✓</td>
</tr>
</tbody>
</table>
Pipes

What to consider

1. LOW TEMPERATURE
   - Is the pipe installed in temperatures below -10 °C?
   - NO
   - Yes USE COMPOSITE PIPE WITH ALUMINIUM

2. PIPE EXPANSION
   - Is it important that the pipe does not expand?
   - NO
   - YES USE PEXa OR COMPOSITE PIPE WITH ALUMINIUM

3. PRESSURE AND TEMPERATURE
   - Is pressure higher than 6 bars or does temperature exceed 60 °C?
   - NO
   - YES USE COMPOSITE PIPE WITH ALUMINIUM

QUALITY PIPES

No matter which Danfoss pipe you choose it always has five layers. Having the oxygen barrier protected by a pipe wall and adhesive layer will ensure that minimal oxygen will be able to enter your installation and help ensure that the installation will remain corrosion free over time.

Our PEXa pipes are produced according to the ISO 15875 standard and has a cross linking degree of min. 70 %. The heat transfer coefficient of the pipe is 0.41 W/m K which will ensure that energy is transferred in the fastest possible way from water to the floor.

COMPOSITE PIPE WITH ALUMINIUM
PE-RT outer pipe, stabilized for high temperatures
Adhesive layer
Homogeneous, longitudinally, butt-welded and totally circular aluminium pipe
Adhesive layer
Polymer outer pipe stabilized for high temperatures. Grey and UV stabilized

PEX PIPE
PEXa pipe wall
Adhesive layer
Oxygen (O2) diffusion barrier layer
Adhesive layer
Protective PE layer

FIVE LAYERS OF QUALITY

CROSS LINKED FOR MAXIMUM OUTPUT

CHOOSE ANOTHER PIPE
TESTING OUR PIPES TO THE MAX

All pipes are thoroughly tested to meet the highest quality standards.

Danfoss pipes are subjected to a range of different tests to ensure optimum product quality and working life. During production, the pipes undergo real life simulation tests and quality inspections to meet our precise tolerances.

Layer and wall thickness
The thickness of each layer is measured. Thickness needs to be kept within narrow tolerances to ensure that the fittings precisely match the pipes, enabling them to withstand high pressures.

Outer diameter test
During production, random tests are carried out on the outer diameter of our pipes to ensure that tolerances are met.

Long-term pressure test
The pipes undergo a thermal cycle test. The test simulates the conditions that pipes are exposed to during their lifetime. The test is based on the ISO 22391 standard.

Adhesion test
The pipes consist of several layers that are “glued” together. In the lab, their durability is thoroughly tested to prevent the layers from dissolving over time.

Bending relaxation test
The extent to which the pipe changes shape when bent is important for the resistance in the pipe. An oval pipe will increase resistance, which may affect pump requirements.

PIPED OVERVIEW

**Most popular pipes**

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Dimension</th>
<th>Material type</th>
<th>Coi length</th>
<th>Oxygen barrier</th>
<th>Max. temper- ature</th>
<th>Max. pro- sure</th>
<th>Life ex- pectancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>088X0001</td>
<td>16 x 2.0 mm</td>
<td>PE-RT/Alu/PE-HD</td>
<td>200 m</td>
<td>alu</td>
<td>95 °C</td>
<td>10 bar</td>
<td>50 years</td>
</tr>
<tr>
<td>088X0003</td>
<td>16 x 2.0 mm</td>
<td>PE-RT/Alu/PE-HD</td>
<td>500 m</td>
<td>alu</td>
<td>95 °C</td>
<td>10 bar</td>
<td>50 years</td>
</tr>
<tr>
<td>088X0910</td>
<td>14 x 2.0 mm</td>
<td>PEXa</td>
<td>240 m</td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 Bar</td>
<td>50 years</td>
</tr>
<tr>
<td>088X0951</td>
<td>16 x 2.0 mm</td>
<td>PEXa</td>
<td>120 m</td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 Bar</td>
<td>50 years</td>
</tr>
<tr>
<td>088X0952</td>
<td>16 x 2.0 mm</td>
<td>PEXa</td>
<td>240 m</td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 Bar</td>
<td>50 years</td>
</tr>
<tr>
<td>088X0968</td>
<td>16 x 2.0 mm</td>
<td>PEXa</td>
<td>310 m</td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 Bar</td>
<td>50 years</td>
</tr>
<tr>
<td>088X0969</td>
<td>16 x 2.0 mm</td>
<td>PEXa</td>
<td>400 m</td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 Bar</td>
<td>50 years</td>
</tr>
<tr>
<td>088X0953</td>
<td>16 x 2.0 mm</td>
<td>PEXa</td>
<td>600 m</td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 Bar</td>
<td>50 years</td>
</tr>
<tr>
<td>088X0954</td>
<td>16 x 2.2 mm</td>
<td>PEXa</td>
<td>240 m</td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 Bar</td>
<td>50 years</td>
</tr>
<tr>
<td>088X0957</td>
<td>18 x 2.0 mm</td>
<td>PEXa</td>
<td>240 m</td>
<td>EVOH</td>
<td>95 °C</td>
<td>10 bar</td>
<td>50 years</td>
</tr>
<tr>
<td>088X0958</td>
<td>18 x 2.0 mm</td>
<td>PEXa</td>
<td>600 m</td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 Bar</td>
<td>50 years</td>
</tr>
<tr>
<td>088X0959</td>
<td>20 x 2.0 mm</td>
<td>PEXa</td>
<td>240 m</td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 Bar</td>
<td>50 years</td>
</tr>
<tr>
<td>088X0961</td>
<td>20 x 2.0 mm</td>
<td>PEXa</td>
<td>400 m</td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 Bar</td>
<td>50 years</td>
</tr>
<tr>
<td>088X0963</td>
<td>25 x 2.3 mm</td>
<td>PEXa</td>
<td>200 m</td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 Bar</td>
<td>50 years</td>
</tr>
</tbody>
</table>

**Accessories for pipes**

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Composite pipe</th>
<th>PEXa pipe</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>013G4154 X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>013G4156 X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>013G4186 X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>013G4163 X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>013G4158 X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>013G4160 X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>013G4093 X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088X0200</td>
<td>Connection fitting for joining two pipes e.g. for repairs (press tool required).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088X0201</td>
<td>Connection fitting for joining two pipes e.g. for repairs (press tool required).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088X0205</td>
<td>Connection fitting for joining two pipes e.g. for repairs (fittings incl. insulator ring).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>088X0206</td>
<td>Connection fitting for joining two pipes e.g. for repairs (fittings incl. insulator ring).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Renovating a private house
A stone’s throw from Frankfurt-am-Main, Germany, the house was built in 1984 and boasted what was then state-of-the-art insulation. When the current owners took over the house, in addition to inadequate roof insulation by today’s standards, the underfloor heating was not sufficiently controllable and drove up energy consumption.

Meeting the challenge
The existing underfloor heating system was slow to heat up, virtually unregulated and worked continuously at too high a flow rate. This meant excessive room temperatures and a high level of energy waste. In addition, the manifold’s control valves were extremely calcified by old leaks and the actuators were completely disconnected and disabled.

Comprehensive renovation
Looking for suitable products, the contractor identified the Danfoss CF2+ system. This wireless solution offers individual room control and excellent regulation and management features. For the twin heating circuits, two CF-MC Master Controllers were installed along with an external CF-EA antenna to ensure good wireless contact. Once the old system had been fully overhauled, the valve flow settings were defined to ensure correct hydronic balance.

Room-by-room heating control
A CF-RF thermostat with infrared floor sensor was fitted in the reception room to ensure an adequate base temperature. This device also regulates floor temperature when secondary heat sources are in use, such as a fireplace. Other rooms were equipped with CF-RD thermostats. A CF-RC remote control was fitted to look after timing and the old manifold was replaced for a FHF-F equipped with new TWA-A actuators.

Increased comfort and energy savings
The biggest advantage over the old solution was the achievement of genuine heating comfort. Temperature can now be individually set and regulated in each room, which offers excellent cost savings in a household with children and working adults.

D. Braun,
Braun Haustechnik

Energy makeover generates efficient and controllable heating

Country: Germany
Building type: I-family house
Renovation year: 2013
Size: 220 m²
Heat emitter: Floor Heating
Control type: CF2+, FHF-F and TWA-A
Heat source: Gas, with water-based floor heating
Company name: Braun Haustechnik, Dreieich
Company industry: Plumbing
Private consumer name: Klaus Gerlach, Wehrheim

The wireless CF2+ system removes the need for expensive cable laying and almost all the restoration work was carried out in the control cabinet. The work caused no mess and both installation and commissioning were very straightforward.

D. Braun,
Braun Haustechnik
Underfloor heating and cooling

For year round comfort

A sustainable solution
In the Dutch city of Rotterdam, an office building from the 60’s was completely stripped to its core and rebuilt. The project involved creating new offices and adding a further nine floors of luxury apartments on top. The developer wanted a highly sustainable climate system with both heating and comfort cooling. Heat is supplied to the building via the city’s district heating system. To achieve the desired cooling effect, a customized solution was developed that involved drawing water from the river Maas, which flows right alongside the building. The water is then fed into heat exchangers to provide the cooling.

Floor heating and cooling
To ensure that residents in the apartments could enjoy the most comfortable possible living experience, the decision was taken to use floor heating. During the warm months of the year, this system is also able to contribute to cooling the apartments. A manual switch to change from heating to cooling operation ensures that heating and cooling cannot work simultaneously and avoids wasting energy.

Flexibility required
Throughout the apartments, non-structural stud walls were used to give future owners the flexibility to arrange the room layout to suit their personal preferences. This design choice meant that the temperature controls in each of the rooms needed to be easy to relocate.

Wireless controls
A Danfoss solution using the CF2 wireless control system was chosen to accommodate the demands of the innovative design concept. This allowed temperatures to be set individually in each room. In addition, the wireless CF-R thermostats provided the necessary flexibility for possible future changes to the room layout in the apartments. Thanks to 2-way communication between room thermostats and the central master controller on a frequency of 868.42 MHz, the wireless system is extremely reliable.

Well-balanced floor heating comfort in 17 high-rise apartment buildings

Ensuring comfortable heating
The “Taiyang Gongyuan” project in Beijing, China, includes 17 residential buildings with a total of 2,154 apartments. All buildings are heated via district heating. Due to the large size of the buildings, each with up to 29 floors, establishing proper hydronic balancing was a priority. This would eliminate complaints from residents about uneven heating while providing the desired high level of indoor comfort. To meet both requirements, Danfoss proposed a thoughtfully configured system that included automatic balancing valves, floor heating and individual room temperature control.

Hydronic balancing
To establish the necessary hydronic balance, Danfoss ASV automatic balancing valves were installed for each apartment. These valves prevent pressure fluctuations and ensure even heat distribution throughout the entire building.

Different temperatures in each room
In the larger apartments, room temperature can be individually controlled via Danfoss CWD thermostats. The temperature can be separately set for each room, ensuring superb levels of indoor comfort while also saving energy by not heating rooms unnecessarily.

In the smaller apartments, temperature is controlled via one central CWD thermostat. A total of 6,090 thermostats were installed to provide the 2,154 apartments with optimum temperature and comfort control.

Underfloor heating and cooling

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With the Danfoss CF2 system we are able to control the underfloor heating and cooling, and can also ensure future flexibility for repositioning of the thermostats at the same time.

Bax Lissen
Underfloor heating constructor

The apartment cabinet
Heating and cooling supplies enter the apartment and are connected to the manifold. A manual switch allows the apartment occupants to determine between heating or cooling control. CF2 contains several features to optimize control in floor cooling applications and the CF-MC Master Controller automatically opens or closes the electric actuators. Each is controlled by one of the CF-R room thermostats.

Danfoss manifold with RA-G valve and TWA-A actuators. Each combination was installed in the smaller apartments to provide central temperature control via a CWD thermostat in the main living room. Individual room controls were installed in the larger apartments.

Danfoss ASV balancing valves and energy meters were installed in the technical room for each group of four apartments.

We wanted to avoid typical complaints related to poor hydronic balancing while also offering residents optimal comfort. With the help of Danfoss, we fully achieved both these goals.

Mr. Shengguo Zhu
Xinyuan real estate

Country: The Netherlands
Building type: Apartments
Building year: 2012
Size: 36 m x 210 m²
Heat emitter: Underfloor heating
Cool emitter: Underfloor cooling
Control type: CF2
(CF-MC, CF-RD, CF-RS, CF-EA)
Heat source: District heating
Cooling source: River water
Company name: Jupiter Vloerverwarming
Benelux BV
Company industry: Underfloor heating construction
Private consumer name: Mr. and Mrs. Schoneveld

Country: China
Building type: 17 multi family houses
Building year: 2010
Size: 500,000 m²
Heat emitter: Floor heating and hydronic balancing
Floor heating control type: Danfoss CWD and FHF-F manifolds
Heat source: District heating
Company name: Xinyuan
Company industry: Real estate company
Private consumer name: Ms. Chen
The advantage of working with a single solution provider

Optimal indoor climate
The task was to build 18 houses in Denmark with the best possible indoor climate and zero energy consumption. A tough challenge, but very achievable.

Designing a total solution
The contractor and the manager of the building project put their heads together to work out a solution. A photovoltaic system was chosen as the primary energy source, transforming the sun’s rays into electric power. The electric power is then used to operate a heat pump and a heat recovery and ventilation unit. The heat pump provides warm water for the floor heating in the houses.

Floor heating helps to eliminate heating costs
Energy consumption for heating and ventilating the houses is estimated to be less than 4,000 kWh per year per house, while the photovoltaic system produces around 6,000 kWh. This means that more energy is produced than is required to operate the heat pump and ventilation unit. Using floor heating in combination with the heat pump is very energy efficient. This is because floor heating requires a lower supply temperature than radiators. For every 1 degree centigrade that the supply temperature can be lowered, heat pump efficiency (COP) improves by 2%.

Individual room temperature controls save energy

Optimizing living space
What do you do when you want to offer apartment owners maximum living space, valuable energy savings and high heating comfort at the same time? The architects and engineers working on the ‘Vadistanbul’ project in Istanbul, Turkey, agreed that they could meet all these requirements by using Danfoss floor heating. Floor heating would save precious space in the development’s many small apartments while increasing comfort and reducing energy consumption at the same time.

A prestigious project
The ‘Vadistanbul’ project is one of Turkey’s most prestigious projects. An entire new district will be added to the Istanbul metropolis in three stages. In the first phase, called ‘Vadistanbul Teras’, 1,111 apartments are being constructed in eight buildings. Subsequent phases will see the construction of a shopping mall, restaurants, a 5-star hotel and a further 1,200 apartments.

A complete floor heating portfolio
Danfoss provided all necessary floor heating products. In addition, the innovative Danfoss floor panels make the installation of FH PE-RT pipes a simple job.

Hydronic balancing
To maximize both energy savings and living comfort, the floor heating system is hydronically balanced. Each group in the floor heating system is pre-set to allow only the required flow to pass through.

Individual temperature control
The key to long-term energy savings is the provision of individual temperature control for each room. Heating is provided only when and where it is needed. In addition, floor heating provides such a high level of comfort that the desired temperature can be set 1 or 2 degrees centigrade lower than a comparable radiator heating system. 5% energy is saved for every degree the room temperature is lowered.

Individual room temperature controls will provide future occupants energy savings and a high comfort level.

McKem Akınkö Mechanical engineer
Pioneering heating controls for decades

Danfoss has been designing and developing heating control systems for more than 80 years. Throughout that time, it has been our goal to continuously innovate, perfect and refine cutting-edge heating and cooling solutions.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1943</td>
<td>Mads Clausen designs the world’s first radiator thermostat</td>
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<tr>
<td>1982</td>
<td>World’s first wireless room control for floor heating introduced</td>
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<td>1996</td>
<td>Danfoss acquires PentaCom floor heating and launches its own TWA</td>
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<tr>
<td>1998</td>
<td>Danfoss acquires Jupiter floor heating</td>
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<td>2002</td>
<td>Launch of Danfoss Icon™ Floor Heating Controls</td>
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<tr>
<td>2005</td>
<td>Launch of Danfoss Link™ floor heating and radiator thermostat</td>
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<tr>
<td>2007</td>
<td>CF2 wireless room controls introduced with infrared sensor</td>
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<tr>
<td>2009</td>
<td>First manifold with Danfoss built-in valves</td>
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<tr>
<td>2011</td>
<td>First sales of built-in valves (used in floor heating manifolds)</td>
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