Hydronic floor heating
Easy, proven and profitable

Easy selection saves time and increases your turnover.
WE PROVIDE CONTROL EXPERTISE

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.
**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 temperature conditions 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.

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**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

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**From specification to after-sales service**

*We have you covered*

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**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 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.

ON time  OFF time  Forced OFF time

System without automatic balancing when heat demand suddenly increases:

- Short pipe
- Medium pipe
- Long pipe

System with automatic balancing when heat demand suddenly increases:

- Short pipe
- Medium pipe
- Long pipe

Large rooms with long pipes experience pressure losses. When heat demand suddenly increases, the long pipes need to be prioritized at the expense of short pipes. Or else it will take too long to heat the room.

Small rooms with short pipes experience limited pressure losses. When heat demand suddenly increases, the short pipe will "steal" most of the energy / water at the expense of the long pipes and will be heated quickly.

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.

How demand based supply temperature works
Danfoss Icon™ 24V 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")
   1. Press OK

3. Swipe the room thermostat display within a distance of 1.5 meter from the radio module / Master Controller
   1. When successfully connected, the room thermostat display will show a tick mark

4. All outputs will flash. Press the output(s) you would like to add to the room thermostat
   1. Press OK

5. Repeat steps 3-4 for each room thermostat you wish to add.

6. Place the room thermostats in the rooms
   1. Perform network, application and flow test via the master controller

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

![Typical installation without controls](image1)

Turnover **INDEX ~40**

Typical installation **with** controls

![Typical installation with controls](image2)

Turnover **INDEX ~100**

**Double your turnover** and provide comfort and energy savings for your customers.
ROOM CONTROLS

WHAT TO CONSIDER

1. BUILDING SIZE
   Is the house an individual apartment larger than 300 m²? (Wireless range)
   - NO
   - YES
   - CHOOSE HARDWIRED

2. FLEXIBILITY
   Are short installation time flexibility of placing thermostat important?
   - NO
   - YES
   - CHOOSE WIRELESS

3. COOLING
   Will floor heating system be used for floor cooling?
   - NO
   - YES
   - CHOOSE Danfoss Icon™ Wireless

4. BATTERIES
   Is it ok that batteries need to be changed every 2 years?
   - NO
   - YES
   - CHOOSE WIRELESS

5. FEATURES
   Is automatic balancing, demand based supply temperature and App required?
   - NO
   - YES
   - CHOOSE Danfoss Icon™ 24V

WIRELESS SOLUTIONS

- Danfoss Link™
  The full “Smart house” solution. Can be paired with Alexa - Amazon’s voice-control system. Use the 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™ Wireless
  Designer room thermostats with multiple features.

- Basic Plus 230 V
  Basic 230 V room thermostats.

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

HARDWIRED SOLUTIONS

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

**230V, 24V AND WIRELESS ROOM SYSTEMS**

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### Room thermostats

<table>
<thead>
<tr>
<th></th>
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<td>✓</td>
<td>✓</td>
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<td></td>
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### Master controllers

<table>
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<tr>
<th></th>
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<tbody>
<tr>
<td>08BU1030</td>
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<td></td>
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<td>08BU1031</td>
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<td>08BU1071</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>08BU1072</td>
<td>✓</td>
<td>✓</td>
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<td></td>
</tr>
</tbody>
</table>

---

### Main accessories

- **Floor Sensor for 24V and 230V**
  - Code no.: 08BU1110
  - Description: For setting min., max. or fixed floor temperature.
- **App Module**
  - Code no.: 08BU1001
  - Description: To enable smartphone / app access.
- **Expansion Module**
  - Code no.: 08BU1100
  - Description: To enable global area input, manual cooling input, dew point sensor, automatic cooling change-over and supply temperature control.
- **Repeater**
  - Code no.: 08BU1002
  - Description: To extend wireless signal range.
- **Radio Module**
  - Code no.: 08BU1031
  - Description: To prevent condensation in cooling application. Mounted on manifold. Powered by Expansion Module 08BU1100.
- **Dew point sensor**
  - Code no.: 08BU251
  - Description: To transform 24 V system into wireless system or as spare part for wireless system.
- **Surface temperature sensor, ESM-11**
  - Code no.: 08BU87116
  - Description: For automatic change over between cooling and heating and for controlling supply temperature.
- **Actuator ABN-F24NC**
  - Code no.: 193B2148 + 193B2005
  - Description: For "upside down" installation on mixing shunt in demand based supply temperature applications (requires high IP class). Remember adapter 193B2005 for RA connection.
- **Thermal actuators for 24V**
  - Code no.: 08BU93110 (NC) + 08BU93110 (NO)
  - Description: RA manifold connection. NO = Normally Open. NC = Normally Closed.
- **Thermal actuators for 230V**
  - Code no.: 08BU93112 (NC) + 08BU93113 (NO)
  - Description: RA manifold connection. NO = Normally Open. NC = Normally Closed.
- **Thermal actuators for 24V**
  - Code no.: 08BU93140 (NC) + 08BU93141 (NO)
  - Description: M30 manifold connection. NO = Normally Open. NC = Normally Closed.
- **Thermal actuators for 230V**
  - Code no.: 08BU93142 (NC) + 08BU93143 (NO)
  - Description: M30 manifold connection. NO = Normally Open. NC = Normally Closed.
### Master controllers

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Features</th>
</tr>
</thead>
</table>

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

### Room thermostats

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Features</th>
</tr>
</thead>
</table>

### Accessories

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>014G0287 / 014G0289</td>
<td>Danfoss Icon™ Wireless display / infrared thermostats</td>
</tr>
<tr>
<td>088U0230</td>
<td>Repeater unit</td>
</tr>
<tr>
<td>088U0250</td>
<td>External Antenna</td>
</tr>
<tr>
<td>088U0255</td>
<td>Extension cable</td>
</tr>
<tr>
<td>088H3110</td>
<td>Thermal Actuator, TWA-A, NC 24 V</td>
</tr>
<tr>
<td>088H3111</td>
<td>Thermal Actuator, TWA-A, NO 24 V</td>
</tr>
<tr>
<td>088H3140</td>
<td>Thermal Actuator, TWA-K, NC 24 V</td>
</tr>
<tr>
<td>088H3141</td>
<td>Thermal Actuator, TWA-K, NO 24 V</td>
</tr>
</tbody>
</table>

### Other products...

**...that can be controlled by Danfoss Link™ Central Controller**

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>088U1905</td>
<td>Danfoss Link™ Floor Thermostat</td>
</tr>
</tbody>
</table>

**Note:** The Danfoss Link™ Central Controller is a required component for all products to function.
### Wired

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>088U0620</td>
<td>BasicPlus® dial (WT-T)</td>
</tr>
<tr>
<td>088U0622</td>
<td>BasicPlus® display (WT-D)</td>
</tr>
<tr>
<td>088U0624</td>
<td>BasicPlus® display w/ relay (WT-DR)</td>
</tr>
<tr>
<td>088U0625</td>
<td>BasicPlus® programmable (WT-P)</td>
</tr>
<tr>
<td>088U0626</td>
<td>BasicPlus® programmable w/ relay (WT-PR)</td>
</tr>
</tbody>
</table>

#### Accessory specifications

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>088H0020</td>
<td>230 V BasicPlus®</td>
</tr>
<tr>
<td>088H3110</td>
<td>088H3111 (NC)</td>
</tr>
<tr>
<td>088H3112</td>
<td>088H3113 (NO)</td>
</tr>
<tr>
<td>088H3140</td>
<td>088H3141 (NO)</td>
</tr>
<tr>
<td>088H3142</td>
<td>088H3143 (NO)</td>
</tr>
<tr>
<td>088H0022</td>
<td>24 V FH-Wx</td>
</tr>
<tr>
<td>088H0023</td>
<td>FH-WP dial (tamperproof)</td>
</tr>
<tr>
<td>088H0024</td>
<td>FH-WS dial (featured)</td>
</tr>
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</table>

### Connection Boxes

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>088H0017</td>
<td>Master Controller, FH-WC 24 V – 10 outputs</td>
</tr>
</tbody>
</table>

- **Pump relay**: Required for all 24 V room controls.
- **Cooling relay**: Algorithms optimized for controlling actuator on radiator.
- **Standby relay**: If a Normally Open (NO) actuator is connected, the pump or boiler relay cannot be used as the relay function is inverted.
- **Boiler relay**: Tamperproof.

### Accessories – for hardwired solutions

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>088H0017</td>
<td>RA manifold connection. Connected via connection box 088H0017.</td>
</tr>
<tr>
<td>088H0025</td>
<td>RA manifold connection. Connected directly with 230 V room thermostats or conn. box 088H0016.</td>
</tr>
<tr>
<td>088H0025</td>
<td>M30 manifold connection. Connected via connection box 088H0017.</td>
</tr>
<tr>
<td>088H0025</td>
<td>M30 manifold connection. Connected directly with 230 V room thermostats or conn. box 088H0016.</td>
</tr>
<tr>
<td>088H0025</td>
<td>For setting either minimum or maximum floor temperature.</td>
</tr>
<tr>
<td>088H0025</td>
<td>For setting min., max. or fixed floor temperature.</td>
</tr>
<tr>
<td>088H0025</td>
<td>For setting min., max. or fixed floor temperature.</td>
</tr>
</tbody>
</table>
MANIFOLDS, MIXING SHUNTS AND CABINETS

MEET THE FAMILY
MANIFOLDS AND MIXING SHUNTS

No flow meter and no pre-setting.

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.

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

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.

Mixing shunt

SSM
With pre-setting and without flow meter.
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.

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.

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**

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

**More than just pre-setting**

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

**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.

**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

Danfoss

heating.danfoss.com
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.

1. TEMPERATURE
   IS THERE A HIGH TEMPERATURE HEAT SOURCE? (e.g. boiler or district energy)

   YES

   NO

   USE A MIXING SHUNT

   Should it be with a variable speed pump for extra energy saving?

   YES

   NO

2. VARIABLE SPEED

   CHOOSE VARIABLE SPEED

   FHM-C1 × 15-70
   FHM-C2 × 15-70

   MIDI-SHUNT
   Solution with 1 circuit, up to 20 m²

   CHOOSE FIXED SPEED

   FHM-C5 × 15-40
   FHM-C6 × 15-60

hydronic floor heating by Danfoss

heating.danfoss.com
### MANIFOLDS

**WHAT TO CONSIDER**

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

2. **FLOW METER**
   - Are flow meters required?
   - **YES** if yes, **NO** if 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>
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<tbody>
<tr>
<td>FHF-F</td>
<td>088U0522-32</td>
<td>From 2 + 2 (088U0522) – To 12 + 12 (088U0512)</td>
<td>✓</td>
<td>✓ (TWA-A)</td>
<td>Only manifold 1</td>
<td>Brass</td>
<td>6 bar</td>
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<td>FHF</td>
<td>088U0502-12</td>
<td>From 2 + 2 (088U0502) – To 12 + 12 (088U0512)</td>
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<td>✓ (TWA-A)</td>
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<td>10 bar</td>
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<td>FH-ME (BasicPlus)</td>
<td>088U0612-18</td>
<td>From 2 + 2 (088U0612) – To 8 + 8 (088U0618)</td>
<td>✓</td>
<td>✓ (TWA-A)</td>
<td>Only manifold 1</td>
<td>Brass</td>
<td>10 bar</td>
</tr>
<tr>
<td>FHF-B with shut-off</td>
<td>088U0542-52</td>
<td>From 2 + 2 (088U0542) – To 12 + 12 (088U0512)</td>
<td>✓</td>
<td>✓ (TWA-A)</td>
<td>Only manifold 1</td>
<td>Brass</td>
<td>10 bar</td>
</tr>
<tr>
<td>SSM-F</td>
<td>088U0752-62</td>
<td>From 2 + 2 (088U0752) – To 12 + 12 (088U0762)</td>
<td>✓</td>
<td>✓ (TWA-A)</td>
<td>Assembled 2</td>
<td>Stainless steel</td>
<td>6 bar</td>
</tr>
<tr>
<td>SSM</td>
<td>088U0802-12</td>
<td>From 2 + 2 (088U0802) – To 12 + 12 (088U0812)</td>
<td>✓</td>
<td>✓ (TWA-A)</td>
<td>Assembled 2</td>
<td>Stainless steel</td>
<td>10 bar</td>
</tr>
</tbody>
</table>

---

#### Accessories

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>088U0582</td>
<td>End caps (2 pieces)</td>
</tr>
<tr>
<td>088U0785</td>
<td>End section – automatic air vent</td>
</tr>
<tr>
<td>088U0786</td>
<td>End section – manual air vent</td>
</tr>
<tr>
<td>088U0585</td>
<td>Mounting brackets (2 pieces)</td>
</tr>
<tr>
<td>088U0822</td>
<td>Ball valves (2 pieces)</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>✓</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-FCB</td>
<td>✓</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-FCC</td>
<td>✓</td>
<td></td>
<td>795</td>
<td>110-170</td>
<td>650</td>
<td>10</td>
<td>10</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>FHF-FCD</td>
<td>✓</td>
<td></td>
<td>995</td>
<td>110-170</td>
<td>650</td>
<td>12</td>
<td>12</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>FHF-FCE</td>
<td>✓</td>
<td></td>
<td>1195</td>
<td>110-170</td>
<td>650</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>FH-SCA</td>
<td>✓</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>FH-SCB</td>
<td>✓</td>
<td></td>
<td>700</td>
<td>119</td>
<td>650</td>
<td>6</td>
<td>6</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>FH-SCC</td>
<td>✓</td>
<td></td>
<td>850</td>
<td>119</td>
<td>650</td>
<td>10</td>
<td>10</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>FH-SCD</td>
<td>✓</td>
<td></td>
<td>1000</td>
<td>119</td>
<td>650</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>FH-SCE</td>
<td>✓</td>
<td></td>
<td>1300</td>
<td>119</td>
<td>650</td>
<td>14</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>

1) You will need to order end-piece (1 pcs. 088U0582 or 2 pcs. end section 088U0786 or 088U0785), mounting brackets (088U0585) and ball valves (088U0822).
2) You will only need to order mounting brackets (088U0585).

---

#### Minimum delivery time:
- 6 weeks.

---

1) In-wall mounted cabinets need a build-in hole, which is about 5 mm larger than the width mentioned in the table and 650 mm above floor surface.
2) The cabinets are adjustable in depth from 110 mm to 170 mm.
3) Maximum order quantity: 11 pcs.
4) Medium delivery time: 6 weeks.
**MIDI SHUNT OVERVIEW**

<table>
<thead>
<tr>
<th>Midi shunt - for small floor heating systems</th>
<th>Code no.</th>
<th>Measurement mm (H x W x D)</th>
<th>Pre-mounted components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midi shunt (088U0851) 088U0851</td>
<td>420 x 290 x 100</td>
<td>UPM3 Auto L 15-70 088U1005</td>
<td>Up to 20 m² ✔</td>
</tr>
</tbody>
</table>

**ACCESSORIES FOR MIDI SHUNT**

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>088U0301</td>
<td>Safety thermostat (stops pump if supply temperature is above 55° C)</td>
</tr>
<tr>
<td>088U0304</td>
<td>Measurement set (output for measuring flow)</td>
</tr>
<tr>
<td>088U0305</td>
<td>Angle fittings (for mounting mixing shunt at a different angle)</td>
</tr>
<tr>
<td>088U0075</td>
<td>Insulation capsule for UPM3 pump</td>
</tr>
</tbody>
</table>

**ACCESSORIES FOR MIXING SHUNT**

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>088U0301</td>
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</tbody>
</table>

**MIXING SHUNT OVERVIEW**

<table>
<thead>
<tr>
<th>Mixing shunt</th>
<th>Code no.</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>FHM-C1 (088U0094)</td>
<td>088U0094</td>
<td>Speed-controlled UPM3 Auto L 15-70 pump, Internal non-return valve, FHD-T thermometer, FH-TC self-acting thermostat</td>
</tr>
<tr>
<td>FHM-C2 (088U0092)</td>
<td>088U0092</td>
<td>Speed-controlled UPM3 Auto L 15-70 pump, Internal non-return valve, FHD-T thermometer</td>
</tr>
<tr>
<td>FHM-C5</td>
<td>088U0093</td>
<td>UPS 15-40 Fixed, non-adaptive</td>
</tr>
<tr>
<td>FHM-C6 (088U0096)</td>
<td>088U0096</td>
<td>UPS 15-60 Fixed, non-adaptive</td>
</tr>
</tbody>
</table>

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</tr>
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</tr>
</tbody>
</table>
FLOOR HEATING PANELS

MEET THE FAMILY

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™.

Panels
What to consider

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

2. WORK PROCES
   Is few work processes important?
   - YES
   - NO
   CHOOSE
   - BasicRail™
   - BasicGrip™

heating.danfoss.com | 35
# FLOOR HEATING PANEL

## OVERVIEW

### System overview

| BasicGrip™ | 7,5 | 0, 11, 35 | None |
| BasicClip™ | 8 | 0, 20, 35 (panels) / 30 (10 m² rolls) | BasicClip Tool |
| BasicRail™ | 6,5 | 0, 20, 35 | None |

### BasicRail™

| Code no. | Consumption
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>088X0040</td>
<td>1,2</td>
</tr>
<tr>
<td>088X0042</td>
<td>1,2</td>
</tr>
</tbody>
</table>

### BasicClip™

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Consumption pcs./m² with c/c 300 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>088X0060</td>
<td>7</td>
</tr>
<tr>
<td>088X0062</td>
<td>8</td>
</tr>
</tbody>
</table>

### BasicGrip™ panels and rolls

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Form</th>
<th>Insulation thickness (mm)</th>
<th>Size (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>088X0050</td>
<td>Panel</td>
<td>35</td>
<td>1</td>
</tr>
<tr>
<td>088X0051</td>
<td>Panel</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>088X0052</td>
<td>Panel</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>088X0053</td>
<td>Panel</td>
<td>0</td>
<td>0,1</td>
</tr>
<tr>
<td>088X0054</td>
<td>Panel</td>
<td>35</td>
<td>0,5</td>
</tr>
<tr>
<td>088X0055</td>
<td>Panel</td>
<td>11</td>
<td>0,5</td>
</tr>
<tr>
<td>088X0056</td>
<td>Panel</td>
<td>0</td>
<td>0,5</td>
</tr>
<tr>
<td>088X1051</td>
<td>Panel</td>
<td>18</td>
<td>0,62</td>
</tr>
<tr>
<td>088X1052</td>
<td>Panel</td>
<td>18</td>
<td>0,62</td>
</tr>
</tbody>
</table>

### Other accessories

<table>
<thead>
<tr>
<th>Code no.</th>
<th>BasicGrip™</th>
<th>BasicClip™</th>
<th>BasicRail™</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>088X0058</td>
<td>✓</td>
<td></td>
<td></td>
<td>For 16-20 mm pipe.</td>
</tr>
<tr>
<td>088X0065</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>2 meters.</td>
</tr>
<tr>
<td>088X0066</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>For 16 mm pipe and pipe length 40 cm.</td>
</tr>
<tr>
<td>088X0067</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
Pipes

What to consider

1. **LOW TEMPERATURE**
   - Is the pipe installed in temperatures below -10 °C?
   - **NO**
   - **YES**

2. **PIPE EXPANSION**
   - Is it important that the pipe does not expand?
   - **NO**
   - **YES**

3. **PRESSURE AND TEMPERATURE**
   - Is pressure higher than 6 bars or does temperature exceed 60 °C?
   - **NO**
   - **YES**

**COMPOSITE PIPE WITH ALUMINIUM**
- PE-RT inner 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**

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.

**CROSS LINKED FOR MAXIMUM OUTPUT**

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.

**QUALITY PIPES**

[Image of PEX pipe and composite pipe]

[Image of decision tree for choosing the right 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.

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.

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

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.

### PIPE OVERVIEW

**Most popular pipes**

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Dimension</th>
<th>Material type</th>
<th>Coil length</th>
<th>Oxygen barrier</th>
<th>Max. temperature</th>
<th>Max. pressure</th>
<th>Life expectancy</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></td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 bar</td>
</tr>
<tr>
<td>088X0951</td>
<td>16 x 2,0 mm</td>
<td>PEXa</td>
<td>240 m</td>
<td></td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 bar</td>
</tr>
<tr>
<td>088X0952</td>
<td>16 x 2,0 mm</td>
<td>PEXa</td>
<td>240 m</td>
<td></td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 bar</td>
</tr>
<tr>
<td>088X0968</td>
<td>16 x 2,0 mm</td>
<td>PEXa</td>
<td>350 m</td>
<td></td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 bar</td>
</tr>
<tr>
<td>088X0969</td>
<td>16 x 2,0 mm</td>
<td>PEXa</td>
<td>400 m</td>
<td></td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 bar</td>
</tr>
<tr>
<td>088X0953</td>
<td>16 x 2,0 mm</td>
<td>PEXa</td>
<td>600 m</td>
<td></td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 bar</td>
</tr>
<tr>
<td>088X0954</td>
<td>16 x 2,2 mm</td>
<td>PEXa</td>
<td>240 m</td>
<td></td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 bar</td>
</tr>
<tr>
<td>088X0957</td>
<td>18 x 2,0 mm</td>
<td>PEXa</td>
<td>240 m</td>
<td></td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 bar</td>
</tr>
<tr>
<td>088X0958</td>
<td>18 x 2,0 mm</td>
<td>PEXa</td>
<td>600 m</td>
<td></td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 bar</td>
</tr>
<tr>
<td>088X0959</td>
<td>20 x 2,0 mm</td>
<td>PEXa</td>
<td>120 m</td>
<td></td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 bar</td>
</tr>
<tr>
<td>088X0961</td>
<td>20 x 2,0 mm</td>
<td>PEXa</td>
<td>400 m</td>
<td></td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 bar</td>
</tr>
<tr>
<td>088X0963</td>
<td>25 x 2,3 mm</td>
<td>PEXa</td>
<td>200 m</td>
<td></td>
<td>EVOH</td>
<td>95 °C</td>
<td>6 bar</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</td>
<td>X</td>
<td>X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
</tr>
<tr>
<td>013G4156</td>
<td>X</td>
<td>X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
</tr>
<tr>
<td>013G4186</td>
<td>X</td>
<td>X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
</tr>
<tr>
<td>013G4163</td>
<td>X</td>
<td>X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
</tr>
<tr>
<td>013G4158</td>
<td>X</td>
<td>X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
</tr>
<tr>
<td>013G4160</td>
<td>X</td>
<td>X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
</tr>
<tr>
<td>013G4093</td>
<td>X</td>
<td>X</td>
<td>Fitting for connecting pipes to manifolds or valves with ¾&quot; thread.</td>
</tr>
<tr>
<td>088X0200</td>
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<td>Connection fitting for joining two pipes e.g. for repairs (press tool needed).</td>
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<td>Connection fitting for joining two pipes e.g. for repairs (fittings incl. insulator ring).</td>
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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.

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

Energy makeover generates efficient and controllable heating

Country: Germany
Building type: 1-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
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 re-built. 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.

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.

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.
Bas Linssen
Underfloor heating constructor

Ensure 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.
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%.

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.

Individual room temperature controls save energy
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.

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.

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.

Floor heating with low-energy optimizer
The CF2+ floor heating system uses a technique called “low energy optimizer” for heat pumps. The technique optimizes floor heating duty cycles so that the heat pump runs more efficiently.

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

Danfoss heat pump, DHP-AQ
Heat source: Danfoss heat pump, DHP-AQ
Company name: Salling Enterprise
Company industry: Constructor
Private consumer name: Dorthe Pedersen

Country: Denmark
Building type: 18 family houses
Building year: 2013-2014
Size: 104-125 m²
Heat emitter: Floor heating
Floor heating type: CF2+
Heat source: Danfoss heat pump, DHP-AQ
Company name: Salling Enterprise
Company industry: Constructor
Private consumer name: Dorthe Pedersen

Country: Turkey
Building type: 8 apartment buildings
Building year: 2014
Size: 1+1 rooms (70 m²) up to 5+1 rooms (400 m²)
Heat emitter: Floor heating
Floor heating type: Basic Plus for 600 km of PE-RT pipe
Floor heating controls: 6,342 FH-WC connection boxes + 1,179 FH-WC connection boxes control 8,226 TWA-A actuators on FHF-F manifolds
Heat source: Central heating with a sub-station per apartment
Company name: Artas-Aydinli-Kelesoglu construction consortium
Company industry: Construction

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

**Pioneering heating controls for decades**

- **1943**: Mads Clausen designs the world’s first radiator thermostat
- **1982**: World’s first wireless room control for floor heating introduced
- **1998**: Danfoss acquires PentaCom floor heating and launches its own TWA
- **2002**: Danfoss acquires Jupiter floor heating
- **2005**: Launch of Danfoss Link™ floor heating and radiator thermostat
- **2007**: Danfoss acquires Jupiter floor heating
- **2011**: Launch of Danfoss Icon™ Floor Heating Controls