



REHAU INTELLIGENT CONTROLS MKIII

Technical Information

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More information on the REHAU Intelligent control system and all documentation is available for download at

www.rehau.uk/controls

1 INFORMATION AND SAFETY INSTRUCTIONS

1.1 Notes on this technical information

Validity

This technical information is valid for the United Kingdom and Ireland.

Other applicable technical information

Intelligent controls commissioning and operating instructions.

Navigation

At the beginning of this technical information, you will find a detailed table of contents with the hierarchical headings and the corresponding page numbers.

Pictograms and logos



Electrical voltage! Danger to life! Warnings are indicated with the adjacent symbol.



Note

Most current technical information

For your own safety and in order to ensure correct use of our products, please regularly check whether an updated version of this technical information is available.

The date of issue of this technical information is always printed on the back cover.

The latest version of the technical information is available from your REHAU sales office, specialist wholesaler and it can be downloaded via the Internet at www.rehau.uk.

Safety instructions and operating manuals

- For your own safety and that of others, please read this technical information and the installation and operating manuals carefully and completely before commencing installation.
- Keep the operating manuals and ensure that they are always available.
- If you do not understand the safety instructions or the individual installation regulations or if there is any uncertainty with regard to their content, please contact your local REHAU sales office.
- Ignoring the safety instructions may cause injury or property damage.



This technical information presents an overview of the features, the functions and the basic requirements for correct operation of the system. In addition to this information, the installation and operating manuals for the products and additional documents are available from www.rehau.uk/controls and must be followed in the planning and installation phase.

1.2 Intended use

The Intelligent control system must be configured, installed and operated only as described in this technical information and in the other installation manuals for the system. Any other use is deemed to be inappropriate and is therefore impermissible.

Observe the applicable national and international routing, installation, accident prevention and safety regulations and the instructions in this technical information when installing piping systems and electrical components and equipment.

Our applications engineering department must be consulted for areas of application which deviate from those described in this technical information (special applications).

Contact your REHAU sales office.

Requirements for personnel



- Only authorised, trained and competent persons are permitted to install our systems.
- Work on electrical equipment or wiring may only be performed by authorised and qualified electricians.

General precautionary measures

- Keep your workplace clean and free of objects which could get in your way.
- Ensure that your workplace is adequately lit.
- Keep children, pets and unauthorised persons away from tools and the installation locations. This is particularly important when carrying out renovation work in occupied areas.

2 INTELLIGENT CONTROLS

2.1 System overview

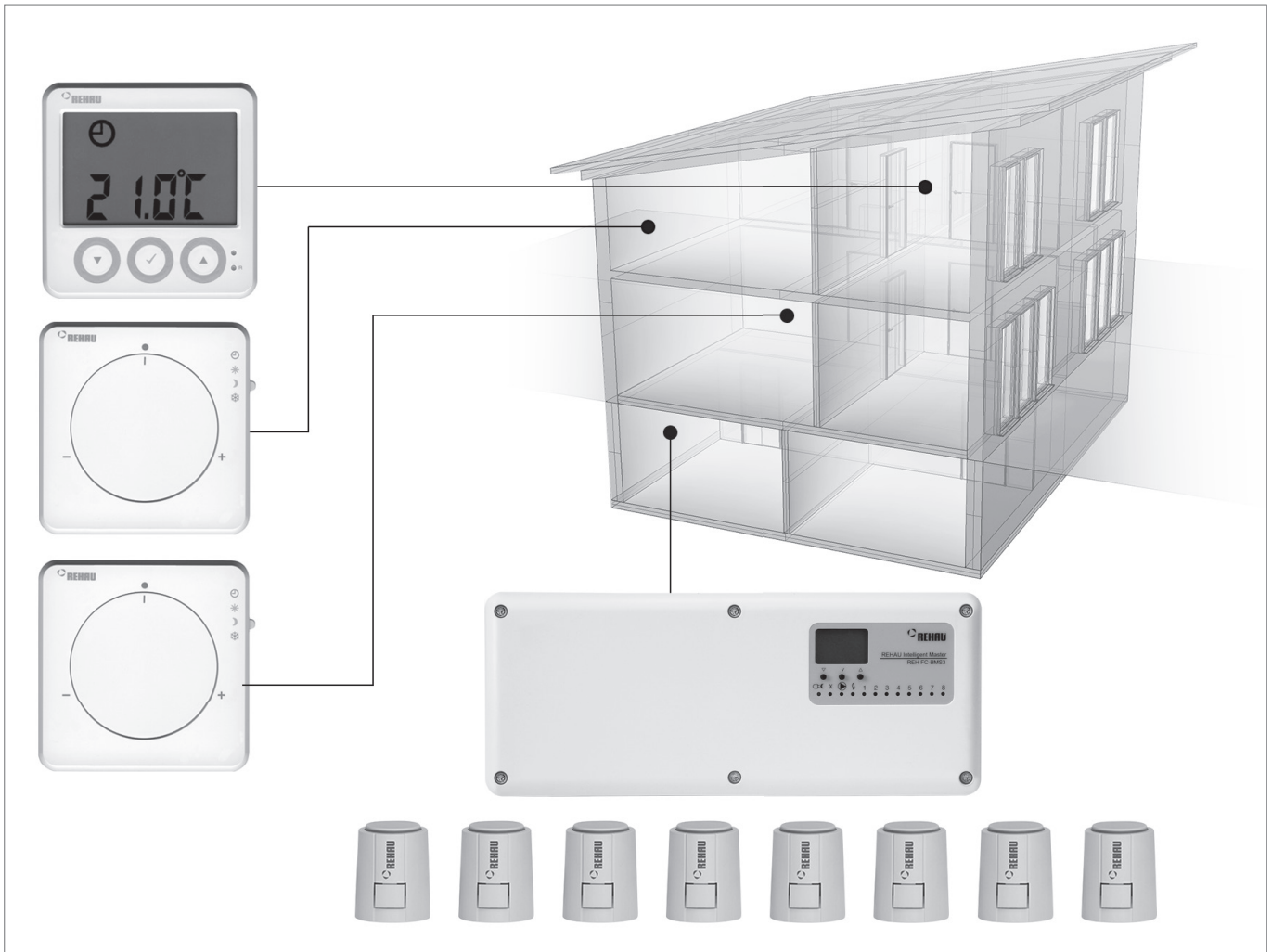


Fig. 1 Intelligent control system

REHAU's Intelligent controls sets the standard in smart floor heating and cooling solutions. They have been developed to deliver industry-leading intelligence to maximise system efficiency, maintenance and control, whilst providing an easy to install thermostat that improves home climate control.

REHAU Intelligent masters, room controllers and room sensors have been designed to create control systems which function effortlessly for heating and cooling. This helps build a smarter and more flexible heating solution for applications of any size. Additional features such as domestic hot water heating, valve and radiator control, system checking and networking possibilities, creates a system that works not just efficiently, but intelligently. REHAU Intelligent controls delivers industry-leading, value-adding solutions.

Key features

The REHAU masters ensure intelligent operation of building temperature and system control, offering a standard Modbus interface for Building Management Systems (BMS).

- Centralised access for maintenance of building controls
- Masters that can be easily set, limited and activated for individual rooms and floors
- System balance ensuring multiple systems work together
- Status read-outs
- Override functions to support testing
- Communication with all masters in a REHAU Intelligent controls' network through a single connection point.

Easy configuration

A centralised **REH FC-BMS3 master** can control multiple areas in large buildings by communicating and relaying information easily and effectively among other masters.

- A **“Network Master”** controls, mixes and supplies water
- **“Secondary Masters”** can then be added to the network to create additional zones
- **“Secondary Masters”** control local pumps and mixing valves and are connected as network strings representing the different stocks in a building.
- Up to 15 strings, each containing up to 9 masters, can be connected to form a network supporting very large installations.

Area of application



Components of the REHAU Intelligent controls are designed to provide room temperature control in combination with radiant surface heating and/or cooling systems in small to large buildings.

2.2 Components & system structure

Components

- REHAU Intelligent masters (REH BA3, REH FC-BMS3)
- REHAU Intelligent room controllers (REH CT3)
- REHAU Intelligent room sensors (REH TA3, REH TM3, REH DT3, REH TP3)
- REHAU Intelligent room sensor with floor sensor (REH TD3)
- UNI 24V actuator

REHAU Intelligent room sensors and controllers are easily linked to the communications port of the Intelligent master with a 2-wire cable. The wiring layout can be selected from a daisy-chain or star configuration as desired. Existing wiring can generally be used (see planning information). The room controller and some of the room sensors have the option to be fitted with a remote sensor to monitor the minimum or maximum floor temperature. The thermal actuators are connected to the Intelligent master.

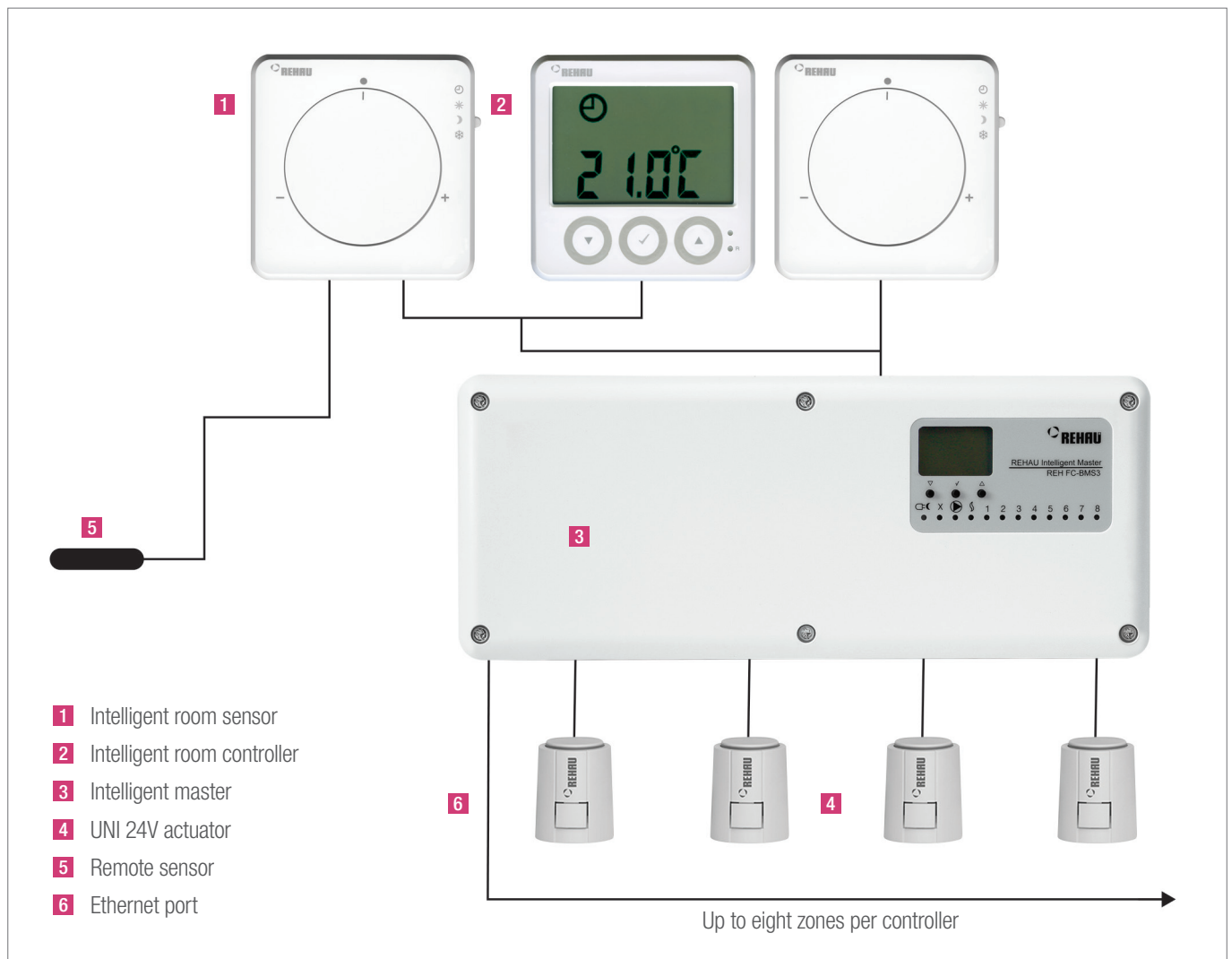


Fig. 2 REHAU Intelligent controls system structure

2.3. Description of components

2.3.1 Room controller & sensors

- 3.2 backlit display (REH CT3 & REH DT3)
- PI controlled room temperatures
- Safe 5 volt connection to all hard wired room sensors/controllers
- Energy saving comfort with adaptive function (early start) - ensuring comfort at the "right" time
- Frost protection

Intelligent room controller



Fig. 3 REH CT3

The 24/7 clock combined with the 4-event timer, enables the end user to customise their heating/cooling system according to their requirements. The REH CT3 has a temperature adjustment range from +5°C to +35°C. The room controller is able to program the set point temperature for multiple other room sensors (except for another room controller).

Intelligent room sensor with display



Fig. 4 REH DT3

This room sensor offers local temperature adjustment of $\pm 4^{\circ}\text{C}$ from the current set point (set through master or room controller). This can be manually switched by the end user into one of 4 modes: Auto, Day, Night and Frost Protection.

The REH DT3 also allows the connection of a floor limit sensor to prevent the floor surface temperature to drop below a pre-set minimum temperature or rise above a pre-set maximum temperature.

Intelligent room sensor - tamper proof



Fig. 5 REH TP3

This room sensor is the ideal solution for public areas where unauthorised adjustments are to be prevented.

Intelligent room sensor REH TA3

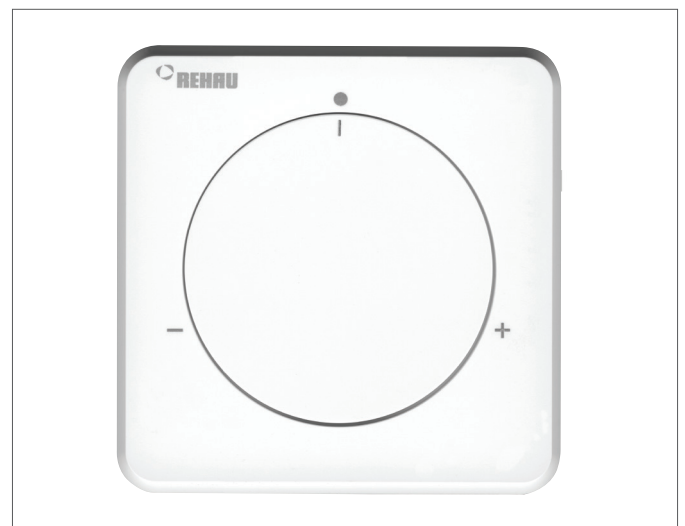


Fig. 6 REH TA3

This room sensor offers local temperature adjustment of $\pm 4^{\circ}\text{C}$ from the current set point (set through master or room controller).

Intelligent room sensor REH TM3

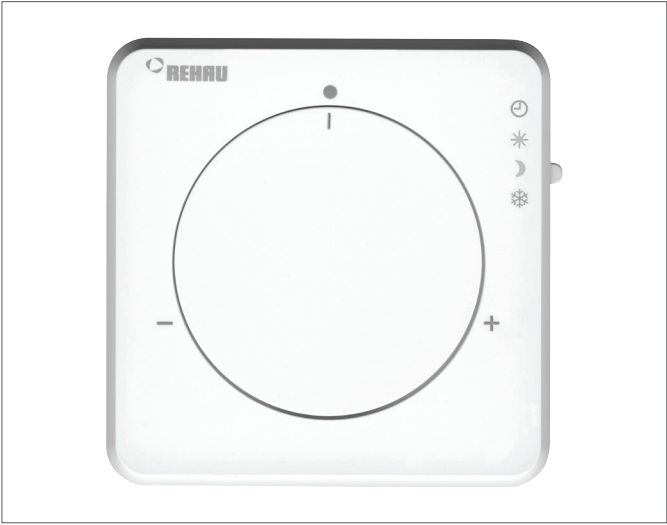


Fig. 7 REH TM3

This room sensor offers local temperature adjustment of $\pm 4^{\circ}\text{C}$ from the current set point (set through master or room controller). In addition it has a slide switch to enable the end user to manually switch the zone into one of 4 modes: Auto, Day, Night and Frost Protection.

Intelligent room sensor REH TD3

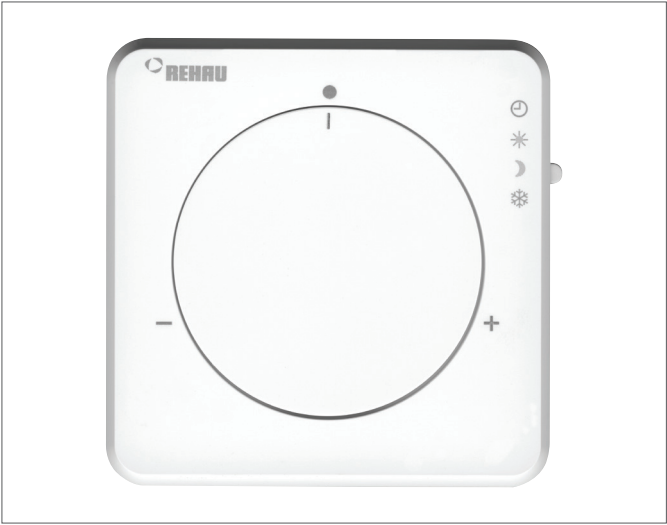


Fig. 8 REH TD3

This room sensor has identical features to the REH DT3 sensor but without the display.

Technical Data	
Dimensions	(H x W x D) 86 x 86 x 25.5mm
Mounting method	For mounting direct on wall or in wall socket
Connection type	2-wire, 5v, communication BUS
Cable type	Standard installation cable $\geq 0.25\text{mm}^2$
Max cabling distance	100 metres between units, 300m in total
Control type	PI (4°C P-Band – PWM) or ON/OFF
Floor limit sensor	Max 50m (type ETF)
Enclosure	IP 21
Ambient temperature range	0 to 40°C

Tab. 1 Technical data – room controllers and sensors

2.3.2 Intelligent masters

Intelligent master REH BA3



Fig. 9

- Heating & cooling control available on the same or separate manifolds (e.g. divide ceiling and floor control).
- High power relay outputs for boiler and pump.
- Safe 5 volt connection to hard wired room controllers/sensors.
- Network communication for large applications, e.g. support for more than 1800 zones.
- Modbus communication interface for Building Management Systems (BMS) and remote access.

The REH BA3 master is suitable for connecting up to 8 zones of multiple room sensors and/or controllers, with up to 14 x actuators (24v). In addition, it provides outputs for a secondary and primary pump and a demand signal for the energy source.

Intelligent master REH FC-BMS3



Fig.10

Same as the REH BA3 plus:

- Optional dew point calculation on cooling systems to prevent condensation on floors.
- Optional outdoor temperature compensation with output for mixing valve.

The REH FC-BMS3 master is suitable for connecting up to 8 zones of multiple room sensors and/or controllers, with up to 14 x actuators (24v). The master provides outputs for a secondary and primary pump, a demand signal for the energy source and power and control outputs for a mixing valve and actuator (24v / 0-10v). It comes supplied with the flow temperature sensor.

	Intelligent master REH BA3	Intelligent master REH FC-BMS3
Power supply	230V AC +10/-15%, 50 Hz	
Max load pumps, boiler & thermal actuators	10A	
Boiler & main pump (X-output) relay	Volt free signal. Max 4A (Boiler 10A)	
Secondary pump output	230V AC, 50Hz Max. 10	
Output for thermal actuators	Max. 10VA per output. Max. 35VA in total	
Timer input for night setback	Open for NSB / closed for day operation	
Communication bus to room sensors & controllers	5vDC 2-wi	

Tab 2 Technical data – Intelligent master

Communication bus on RJ14 connection	24Vdc - standard RS485	
	Intelligent master REH BA3	Intelligent master REH FC-BMS3
Max cabling distance (CAT5)	max 300 metres between masters and 600 metres in total	
Supply water sensor type	Not applicable	NTC ETF-522 for water temp.
Control signal for mixing valve actuator	Not applicable	0-10V DC
Power supply for mixing valve actuator	Not applicable	24V AC – Max 6VA
BMS and smart access protocol	Not applicable	Standard RTU Modbus

Tab 3 Communication bus data for Intelligent masters

2.4 Planning



The Intelligent masters can either be fitted directly to the wall or via DIN rail.

The REHAU Intelligent system only requires a 2-wire cable for communication between the room units and masters. The cable layout can be selected as desired (daisy-chain star, or any mix).



Please ensure the polarity is observed when connecting the bus network, as cross connections will produce error signals.

The cable termination length at the sensor position should be long enough to allow for connection to the sensor i.e. 150mm. Any surplus cable should be coiled and positioned within an electrical back box. The sensors supplied are suitable for both flush and surface electrical black box mounting. It is very important that the cables terminating at the control unit should have a minimum length of 600mm and ensure that they are clearly identified so at the second fix stage it is clear what the cable does.

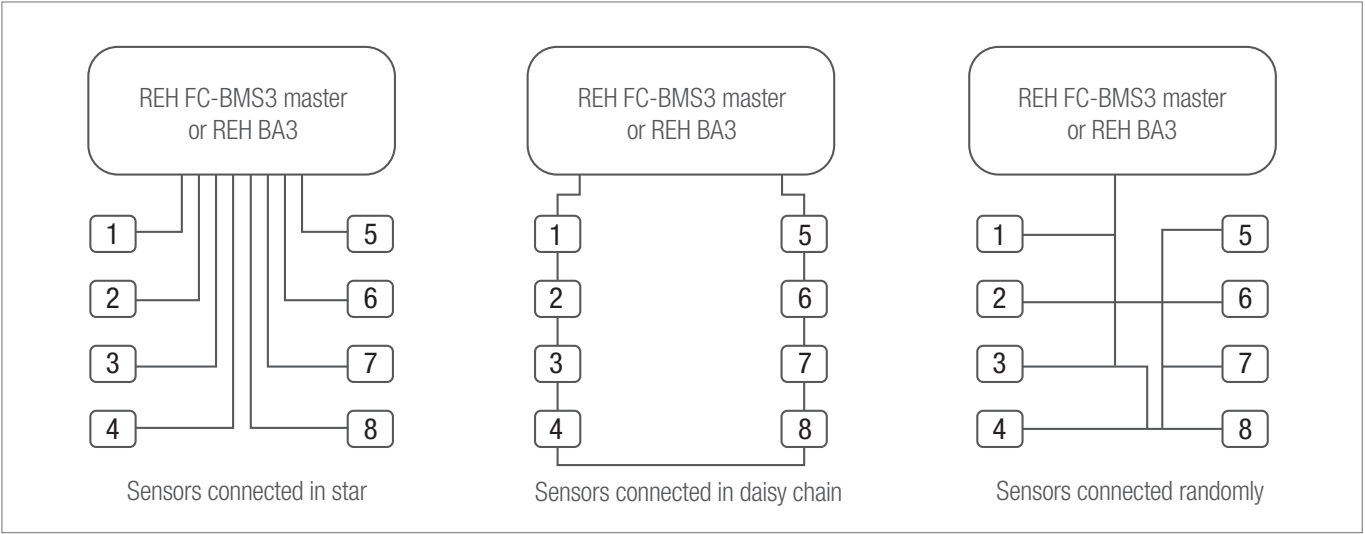


Fig 11 Star & series layouts

2.4.1 Cable layouts

The following maximum cable distances apply to the REHAU Intelligent controls system.

Cable layouts	
Maximum cable length from controller to actuator	40m
The maximum system cable length using the series layout is	300m
The maximum cable length between room sensors/controllers and master controllers	100m
The maximum cable length from a sensor to the REHAU master in star configuration is	100m
Maximum cable length from master to master	100m
Maximum cable length of flow temperature sensor to master	50m
Maximum number of actuators that can be connected to master	14
Maximum number of actuators on each individual output on master	4

Tab 4 Cabling distances

Use of existing wiring (retrofit)



If the existing wiring of previously installed 24V or 230V room thermostats is used, it is very important to ensure that the existing lines are totally disconnected from the mains power.

2.5 Networking master & BMS connectivity

The system is typically a modular system, you may increase the size of the network or it may be extended as the project develops.

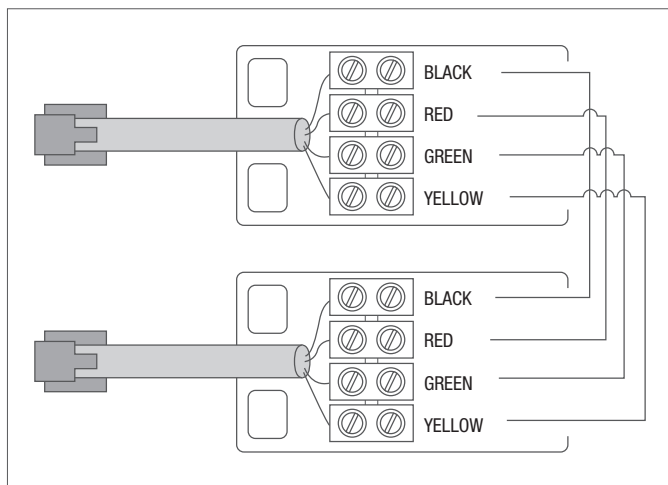


Fig 12 Net extension kit



REHAU recommend the use of net extension kits.
Details of connections are shown in Fig 12.

2.5.1 Overview of communication connections & control coding

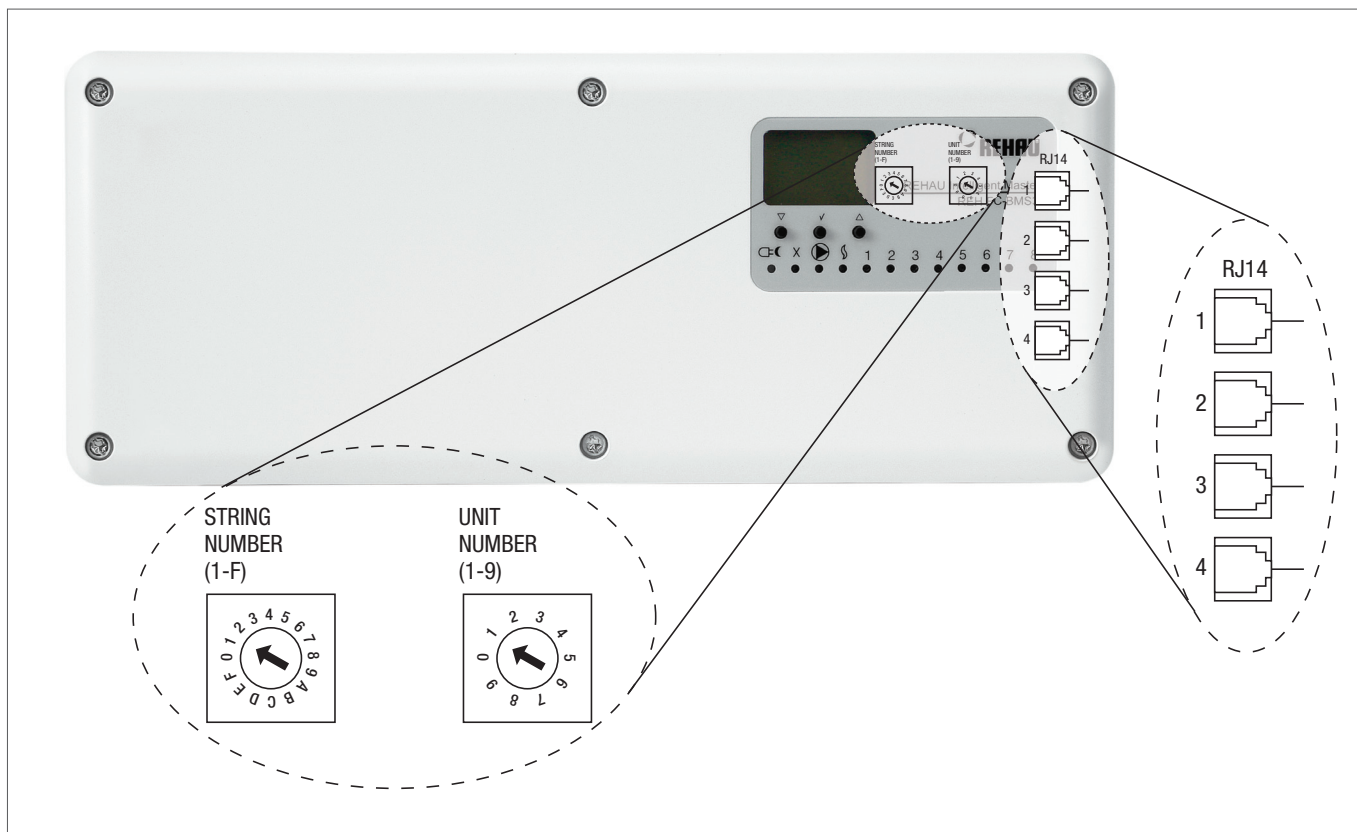


Fig 13 Placement of rotary encoders and RJ14 connection slots inside the REH FC-BMS3

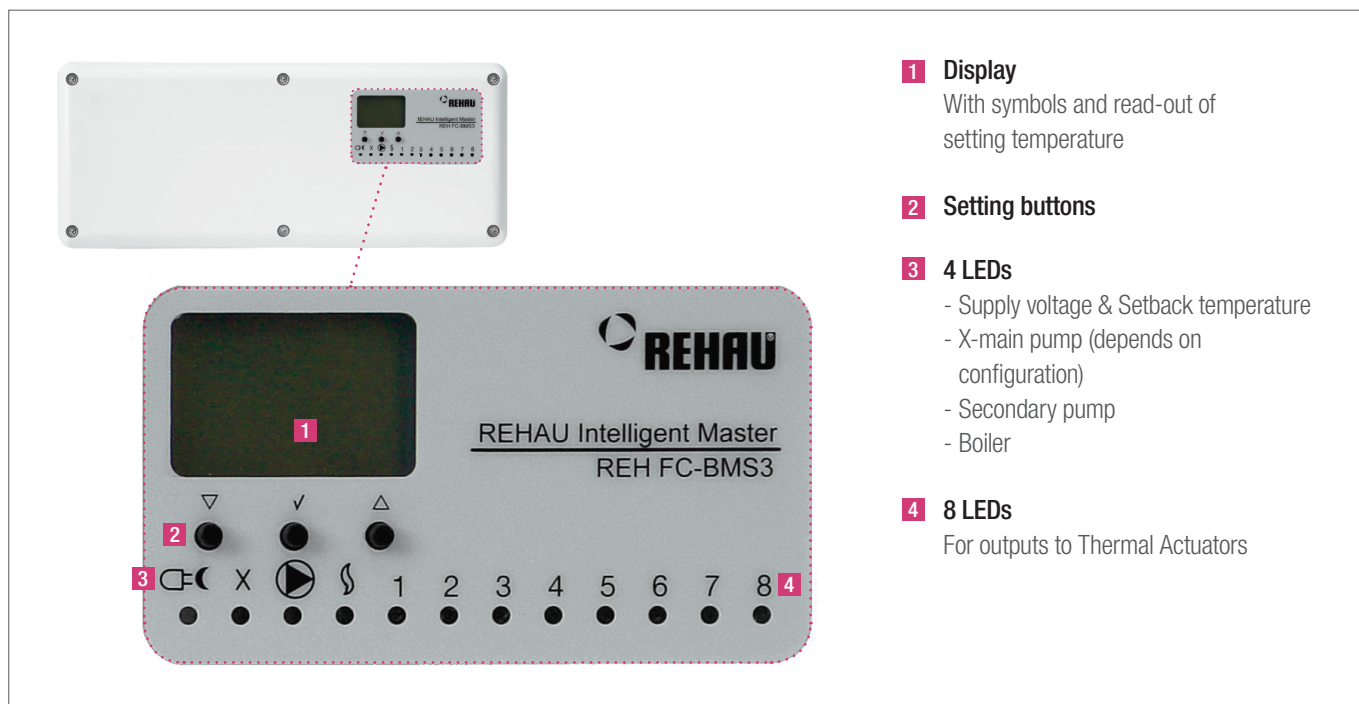


Fig 14 REHAU FC-BMS3 Screen

The REHAU Intelligent control system can grow with your building design. A simple system using the Intelligent master REH BA3, with up to eight zones and sensor match, may be selected to suit the situation as shown below (fig 15). Although it has no screen on the controller it can be networked to other controllers or connected to the Intelligent master REH FC-BMS3. Any time zone or temperature control can be simply adjusted with the inclusion of a REH CT3 room controller, this unit is also a temperature sensor if required.

Simple system with single timer/room controller REH CT3

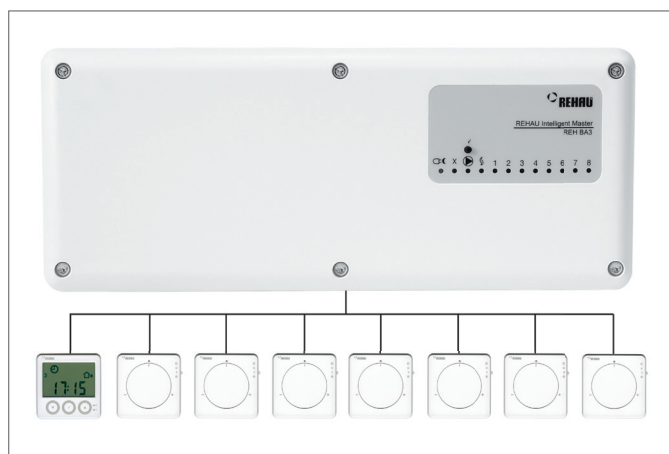


Fig 15 REH BA3

The next control level in the range is the basic system communication utilising a REH FC-BMS3. This has the same basic functions as the REH BA3, but with enhanced capability. It allows controlling of the network (modulation valve control capability when used with a system pump) and is also suitable for cooling. The main function of the screen is for network checking and parameter settings.

Advanced system with single timer/room controller REH CT3 & network capability

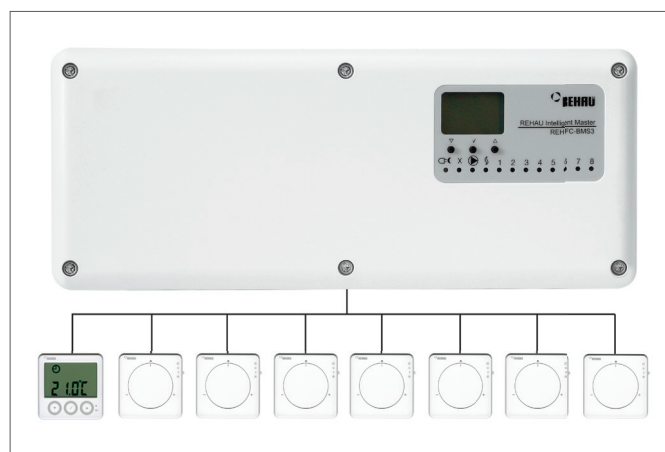


Fig 16 REH FC-BMS3

If there is a need to extend the UFH / Cooling system beyond eight zones, and allow communication via Modbus, it would be necessary to use the Intelligent master REH FC-BMS3.

The Intelligent master REH FC-BMS3 ensures intelligent operation of building temperature and system control whilst offering a standard Modbus interface for Building Management Systems (BMS). In addition the system provides a user interface for local and remote monitoring of floor heating and cooling including a gateway for remote smartphone access. Please contact the Sales Office for more information.

The Modbus interface allows data transfer from the Intelligent master REH FC-BMS3 to the majority of all commercially available BMS systems. This data transfer is normally via an interface unit that translates the Modbus data into the appropriate BMS protocol to allow data transfer to such systems.

Centralised access offers the following benefits for maintenance of building controls:

- Masters that can be easily set, limited and activated for individual rooms and floors.
- System balance ensuring multiple systems work together
- Status read-outs.
- Override functions to support testing.
- Communication with all masters in a network through a single connection point - the REHAU Intelligent master REH FC-BMS3.

Any commercial available interface unit creates a management user interface for the REH FC-BMS3 master. Whether for homes or commercial buildings, the interface can be fully integrated into your BMS systems such as Trend® Building Energy Management System for complete and direct control.

- Built in Modbus tables for 'Plug and Play' installation
- Controlled from any PC and laptop computer via an IP connection
- Ethernet, web and LAN connectivity.

Building management – computer communicating

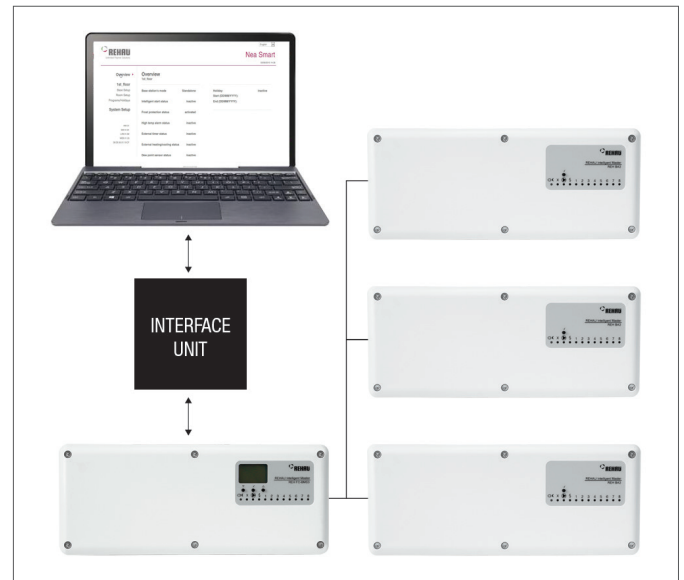


Fig 17 Building management communications network

2.5.2 Networking

By networking the masters the connection of up to 15 strings, each containing up to 9 masters, can be connected to form a network supporting a system of 1890 heating or cooling zones.

When mapping or reading the Modbus system please note the following information:

	Input registers	Holding registers	Coil status bits	Input status bits
Description	These provide readable information from controller.	These provide readable/writable information from controller i.e day temp, setback temp, channel 'n' BMS override temp.	Allows for values to be overridden. In order to change these values they have to be enabled for being overridden. Once enabled some of the values can be overridden in Holding registers. Up to 30 minutes.	This provides the status of relays on the controller i.e pump boiler, X-relay, channel output relay etc.
Type of values	Room temp, room support.	Room temp, BMS override, day temp, night temp, frost protection.	Boiler, pump and X-ray, outside temp, override etc.	Boiler output, pump output, X-output etc.
Read	✓	✓	—	✓
Write	—	✓	✓	—
Modbus address for register	30001	40001	1	10001
Example	For reading channel 1 room temperature, it has to be $n \times 10 + 12$ i.e. $1 \times 10 + 12 = 22$. This makes the Modbus to be $30001 + 22$ i.e. 30023 to read the room temperature of channel 1.	For adjusting room temperature on channel 1 it has to be $n \times 10 + 10$ i.e. $n \times 10 + 10 = 20$. The Modbus register to entered would be $40001 + 20$ i.e. 40021 to change the room temperature for channel 1. The entered value to be between 500 and 40000 (i.e. 5°C to 40°C with a 0.01 resolution).		

Tab 5 Modbus RTU – Guidelines for REH FC-BM3

2.6 Installation



The electrical installation must comply with the applicable national regulations and the requirements of the local power provider. The installation must only be carried out by persons who are certified as electricians or electronic technicians or comparable trades as defined by specific national legislation. (It is important that the control system should have a dedicated separate fused spur, normally unswitched to avoid unplanned isolations).

Position

To ensure correct operation and to prevent interference and efficient control, the room unit should be installed in an area without drafts at a height of 130cm from the floor.

- Do not install the room units close to a heat source, behind curtains, places exposed to direct sunlight, areas of drafts or areas of high humidity.
- Do not install the room units on an exterior wall.
- A suitable empty conduit is required for connecting the limit floor sensor. The sensor probe must be installed in such a way to ensure a good temperature transfer to the floor.

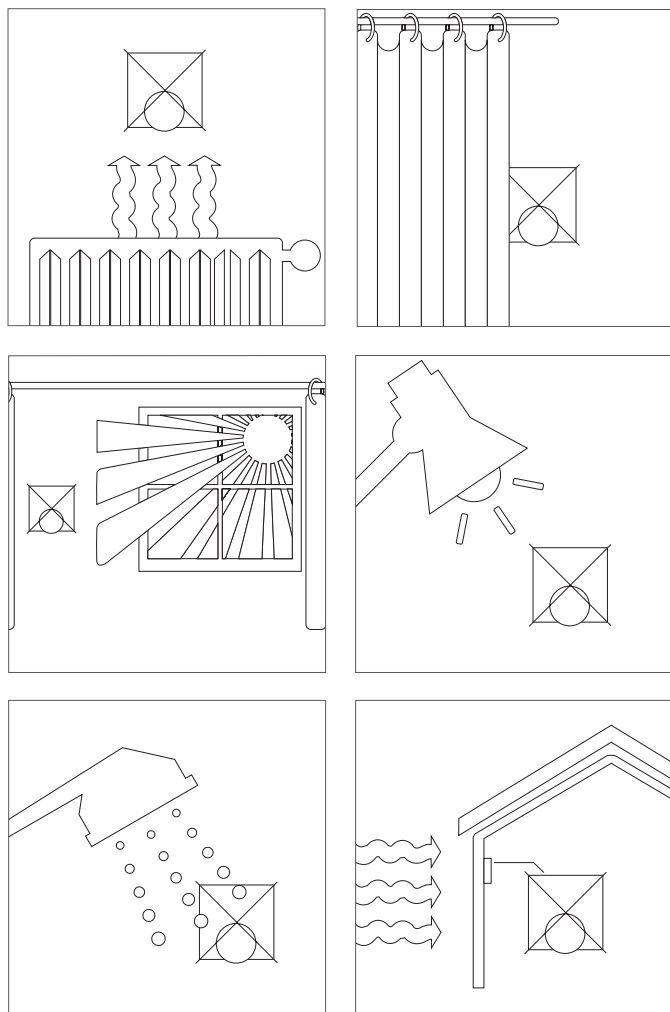


Fig 18 Incorrect positioning of room controllers/sensors

2.7 System set-up & commissioning

Commissioning can be divided into the following steps:

1. Prior to power up the system should be coded.
2. Each master should be assigned a unique string code.
3. It is recommended that you install a net extension kit on each network connection to ensure correct operation and polarity.
4. Each room sensor should be coded as per the room and output desired. Setting up which room sensor is paired with which thermal actuator.
5. Each room sensor can be set to operate a specific output which in turn controls a thermal actuator on the manifold. A selector can be accessed under the front cover of the unit where the number of its output (i.e. its channel number) can be set with a screwdriver.
6. Carry out a wiring check to ensure all connections are as per manufacturer's instructions.
7. Ensure that the polarity is correct on each sensor.
8. BMS networks should only be connected once there is an established network shown on the REHAU Intelligent Master REH FC-BMS3.



To unlock the first-open function of the REHAU UNI actuators, all actuator outputs of the Intelligent master must be activated for at least 10min.

After commission a System check can be carried out: Correct operation of the system can be checked using a special "Install Mode". This enables the installer to individually test and verify each output.

Testing the system:

1. Switch on DIP-3 to activate learning mode: - the power LED will flash quickly.
2. Each red channel LED on the master should now be lit if a sensor/controller is present on that channel.
3. Switch off DIP-3 to deactivate learning mode – the power LED will stop flashing.
4. Set the setpoint on all adjustable room sensors/controllers to minimum.
5. Switch on DIP-1 on the master to activate install mode. Install mode will remain active for 2 hours. Pumps, boiler, mixing valve and actuators should now be OFF.
6. Set the knob on the adjustable room sensor/controller in room 1 to maximum. The red channel 1 LED should light up and the actuator on output 1 should activate, opening after a 1-3 minute delay depending on the type of actuator. The boiler will not operate during test mode unless DIP-2 is activated, see step 9 below.
7. Check that the UFH pump is running and that the mixing valve (REH FC-BMS3 master only) opens.
8. Check step 2 for all rooms.

9. Boiler test function: Switch on DIP-2. This closes the boiler start relay contacts for 1 minute.

10. To end system testing:

1. Switch off DIP-1 to deactivate install mode.
2. Switch off DIP-2 to deactivate the boiler test.
3. Set all temperature knobs to default positions.

Room sensors REH TA3, REH TD3 and REH TM3 to zero (centre position).

Room controllers REH CT3 and REH DT3 to 21°C (recommended). Set all override switches on REH TM3 and REH TD3 room sensors to automatic position (clock symbol).

2.7.1 Testing a network

If a network of masters has been set up, communication between them must be tested.

When the masters acting as network slaves are in install mode (DIP-1 is ON), their power LED will flash briefly whenever communication is detected (approx. every 3 sec). The REHAU network master features a menu option that allows the number of network slaves present on the system, and whether there are any errors, to be checked. (Please refer to the User Guide for information on this menu option). The system is now operating automatically.

The definition of commissioning, according to CIBSE (Chartered Institution of Building Services Engineers) is the advancement of an installation from static completion to working order to specified requirements. The commissioning of a system is essential to obtain the design operating parameters of the FH system as set out by the system designer. Co-operation between all parties involved with the design and installation of the FH and control system is essential. Sufficient time and resources has to be allowed for the full commissioning process of the installation to be completed.

Pre-commissioning requirements:

- Balance the flow rate through the circuit valves on the manifold.
- Confirm with the installer that the boiler commissioning has been carried out as instructed in the boiler manufacturer's installation and servicing instructions.
- Confirm with the installer that the chiller unit commissioning has been carried out as instructed and in accordance with the chiller manufacturer's installation and servicing instructions.
- Confirm correct operation of the system controls including the sequencing of the pumps, valves, boiler and chiller.

Automatic initial heating system warm up:

REH FS-BMS3 has a special "automatic heat up sequence", which allows the temperature of the supply water to be controlled via the mixing valve to allow correct compliance with BS EN 1264 Initial Heat Up.

To start initial heat up sequence:

1. Set DIP-4 to "on".
2. This will set the supply water temperature at 23°C for three days and will fully open the entire manifold actuators.
3. Then for a further four days the water will be supplied at the maximum supply water temperature, as set in the REHAU master during this period the manifold actuators will remain fully open.
4. When the REHAU master is operating in the commissioning function, this is indicated by the output LED's flashing in rotation and with the word "commissioning" flashing in the display.
5. The commissioning function time periods are paused if the power supply is interrupted.
6. Should you need to restart the commissioning from the beginning, switch DIP-4 to "OFF" and back to "ON".
7. To de-activate the function switch DIP-4 to "OFF".

2.7.2 Initial system start up for cooling systems

It is important that the initial heating system start up procedure is carried out prior to the operation of the cooling system. Even if the cooling system is to be commissioned in the summer months. Confirm that the system operating input parameters listed below have been set into the BMS master sub menu (see separate operating manual).

- (B) Offset to day temperature
- (C) Night setback temperature (NSB)
- (G) System operating mode selection
- (H) Rooms where cooling is to be allowed
- (L) Minimum allowed system water temperature
- (M) Delay time between heating & cooling

The commissioning team normally consists of:

- FH installer
- FH control system installer / electrician
- Boiler, chiller and main system controls installer / electrician
- M & E contractor
- Commissioning engineer

The REHAU portfolio.
Systems for installation professionals:

Underfloor heating and cooling
Heating and plumbing
Ground source energy
Ground-air heat exchanger
Sewer pipes
Cable trunking

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