1. General

The system for recording temperature and humidity data in the transmitter and the transmission by radio to the top hat rail receiver features flexible star-shaped point-to-multipoint forms of connection, with data output of up to 4 distinct analogue signals as 0..10V output signals via an RS485 or RS232 interface to supervisory control systems. In this manner radio networks with up to 16 subscribers can be constructed. A radio receiver (known as a coordinator) coordinates the data traffic. This receiver has a PAN-ID by means of which the appropriate network is identified. Each receiver has another PAN-ID in order to avoid interactive malfunctions between the networks. **All** radio transmitters must sign on to the receiver. This also applies to units that operate via an amplifier at a later date. The network relationships remain even after elements have been switched off. In the event of interruption of the radio traffic the one with the fewest faults is sought out from 16 channels by means of a particular search method. As a result the system is flexible and robust. All the transmitters that we provide can communicate with each coordinator. To increase the range a radio amplifier can be introduced into the circuit. Figure 1 shows a possible structure for a network.

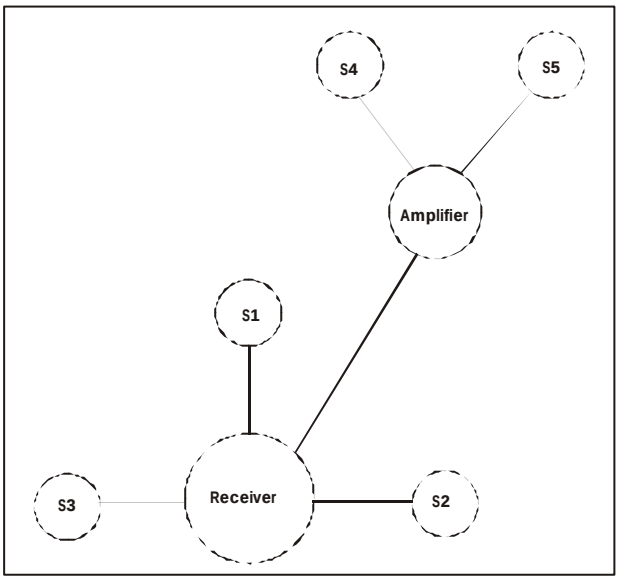

Figure 1: Basic structure for a radio network

2. Installation:

Most units are intended for wall mounting. Care must be taken that all units are mounted in as unrestricted a position as possible, and are not covered by large metal masses (e.g. cabinets, shelves). Furthermore the units should not be mounted on metal surfaces. This would severely attenuate the signal. The range in buildings is strongly dependent on the structure and material of the building. In particular in buildings with reinforced steel and metal walls the range can be severely restricted. Then the introduction of a radio amplifier is recommended. If transmitters and receivers are installed in the same room, they should be on different walls, or if on the same wall at the same height as far as possible. Since the radio waves propagate radially the signal transmission reliability is greatest in such cases. Further problems for signal transmission can be presented by W-LAN and cordless phones. The units are programmed such that at start-up they automatically seek out the transmission channel with the fewest faults. However if the faults are only sporadic problems can occur later in the operation.

3. Construction of a radio network

3.1 Prepare receiver (Figure 1)
The smallest radio network consists in the extreme case of just one transmitter and one receiver. The largest consists of a network with 15 transmitters, one receiver and a radio amplifier. The construction of a network is the same in all cases. Firstly it must be ensured that all other radio networks within range are switched off, otherwise false registrations could be received.
Firstly a reset on the receiver is triggered, as a result of which the power supply is interrupted for at least 10 seconds. During this reset period buttons 1 and 2 (Figures 2, 5) must be depressed. The buttons can only be released when LED2 flashes 5 times. This means that any stored network data that may still be present is deleted.
If only button 1 is held down during the reset period, then the last transmitter that has signed on is deleted. Thus in the event of an incorrect signing on it is not necessary to delete the whole network. If button 2 is pressed during the reset period then the next transmitter to sign on is registered as a radio amplifier.

3.2 Sign on transmitter via reset (Figures 2 and 3)

Now the transmitters must be signed on. For this purpose the transmitter must be separated from the operating voltage for at least 10 seconds. Then buttons 1 and 2 are depressed and jumper 1 (operating voltage) is inserted. LED 1 lights up. The transmitter searches for the most powerful receiver in the network. When it has found this it acknowledges the fact with a 2-times slow flashing of LED1. **Only then can the buttons be released.** If it does not find a receiver then LED1 flashes 10 times. The transmitter enters a sleep mode and repeatedly attempts to sign on in the measurement periods until it has found a receiver. In series with their signing on the transmitters also allocate the 2 or 4 analogue outputs. These outputs are freely configurable via a serial interface (see program description for CoordDecoder).
To ease the commissioning process, jumper 2 can be inserted on the transmitter. This has the effect of accelerating the measurement rate to approx 2 seconds. As a result one does not have to wait so long for the units' reactions. **After commissioning is complete it is essential to remove jumper 2, since otherwise the battery life reduces to less than one month.**

3.3 Introduce amplifier into the network

A radio amplifier can be introduced into each network, which can double the range of the transmitters. For this purpose the amplifier must know the PAN ID of the receiver. This has already been permanently programmed in by the manufacturer. If there is a need to alter the ID it can be done via the serial interface (see program description for CoordDecoder).

4. Commissioning

4.1 Radio receiver (Figure 1)

After switching on LED1 lights up (green). The receiver performs an initialisation procedure. LED2 (red) then flashes 2 times. As soon as a receiver signs on that has already been signed on to this network LED1 (red) lights up continuously. LED3 flashes briefly for each transmission event.

4.2 Radio transmitter (Figures 2 and 3)

A check must first be made as to whether the battery is installed. Jumper 1 is then inserted. LED1 flashes 3 times and attempts to make a connection with its receiver. If this is unsuccessful it flashes 10 times briefly and moves into an idle state. If the module has still made no connection after 3 periods, then all radio channels are scanned every second. If this still fails to make a connection, 3 measurement periods are again transmitted on the stored channel, etc.
If the transmitter was not previously signed on and has found a receiver and signs on, LED2 flashes 2 times slowly.
A radio transmitter that has already been signed on does not sign on again on another receiver, if the previous signing on has not been deleted.

4.3 Radio amplifier (Figure 4)

Firstly **all** transmitters are directly signed on to the receiver (Section 3.2). This is necessary so that the latter can manage the network. Now the transmitters and the amplifier are brought into position. Next preparations are made for the signing on of the radio amplifier, in that the receiver is started with button 1 depressed (see Section 3.1). The receiver now anticipates that the next event will be the signing on of an amplifier. The amplifier is started up by switching on the power supply. The amplifier now attempts to sign on to the receiver. If this succeeds LED3 (red) flashes 2 times. If the registration is unsuccessful, LED3 (red) flashes 10 times briefly. As soon as a receiver signs on to the amplifier that already belongs to this network, LED2 (red) lights up continuously. LED3 flashes briefly for each transmission event. The signing on procedure can last for several minutes, since the transmitters that no longer have contact with the receiver search in each case by turns for the receiver and/or amplifier for 3 measurement periods. The amplifier is already preset to a receiver. This assignment can be modified via the serial interface. (see description for the CoordDecoder program)

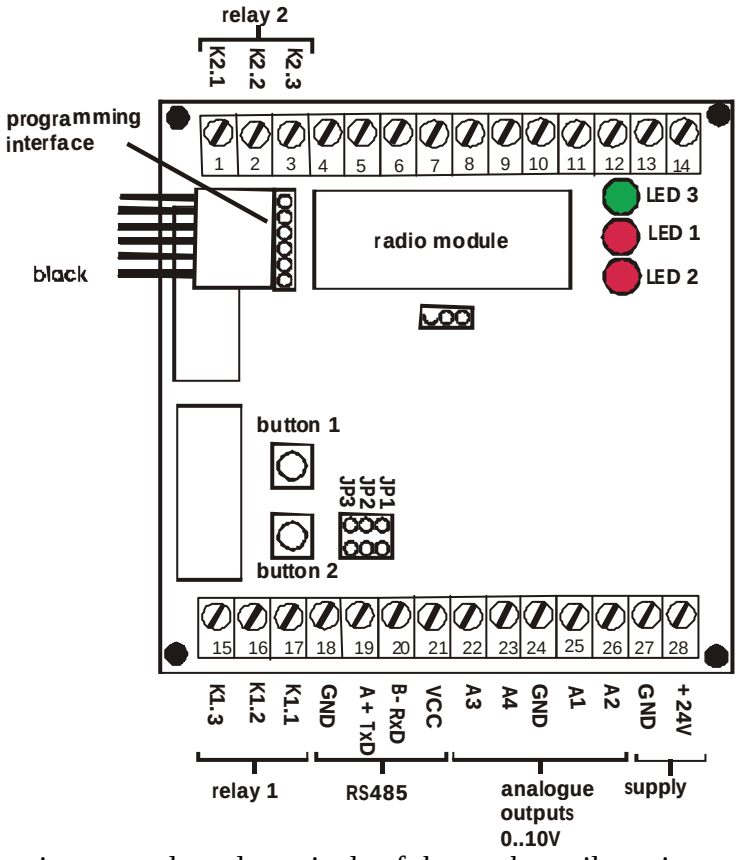

Figure 1: Operating controls and terminals of the top hat rail receiver

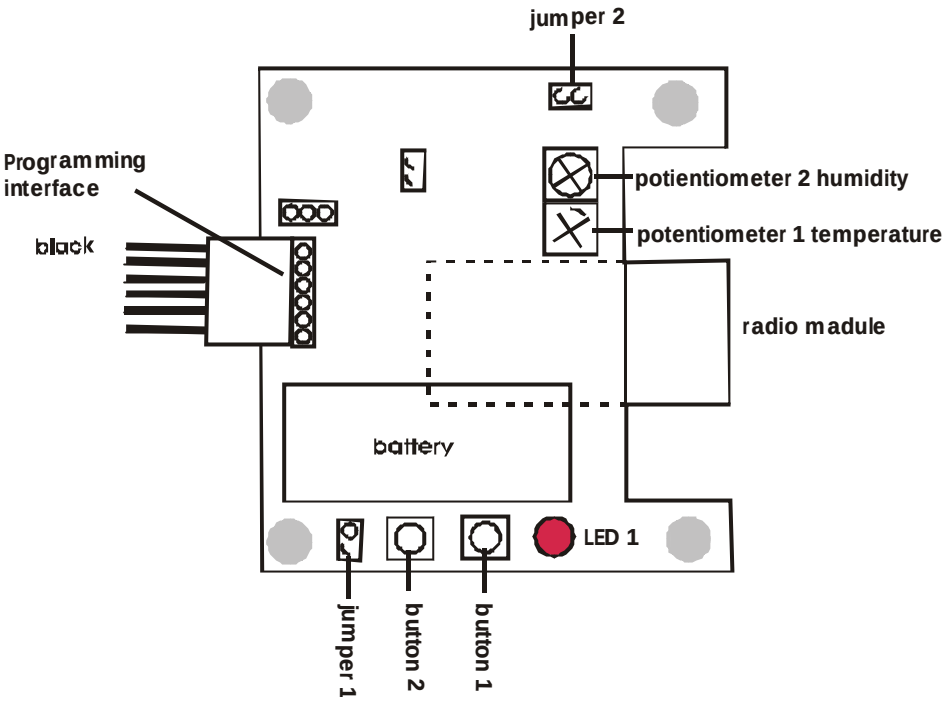

Figure 2: Operating controls of the external temperature – radio/humidity sensor

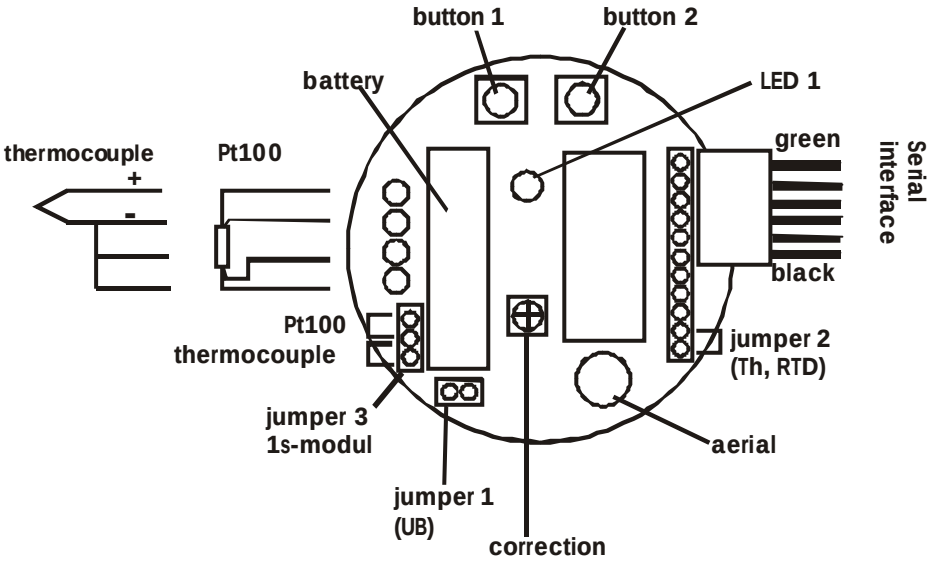

Figure 3: Operating controls and terminals of the radio transmitter

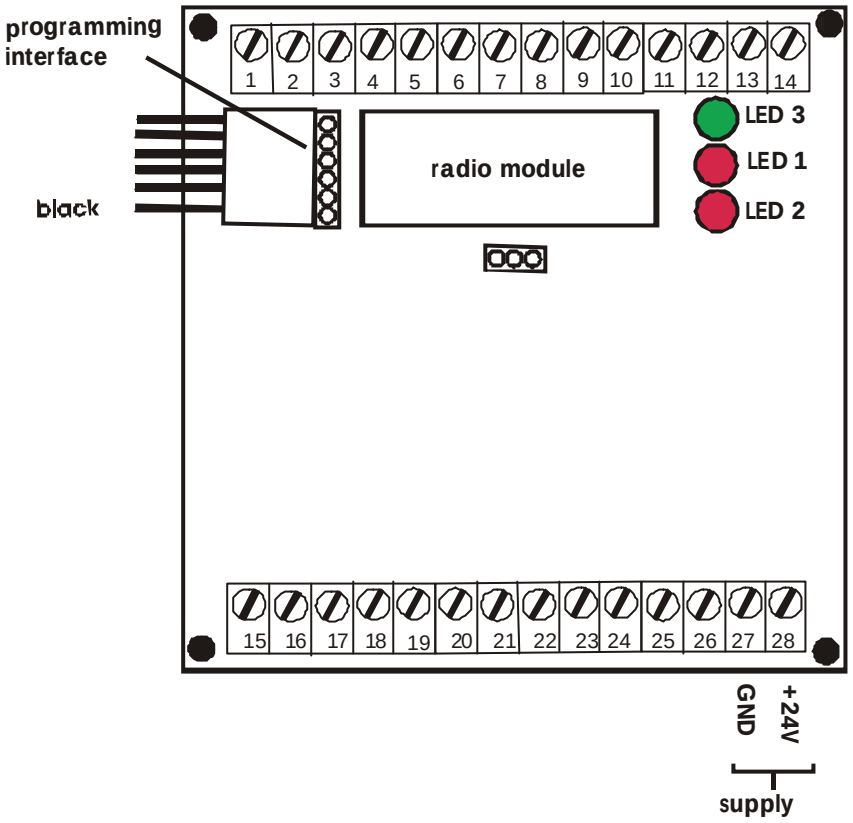

Figure 4: Operating controls and terminals of the top hat rail amplifier

Overview of radio flashing signals

Transmitter (LED1)

Number	Flash frequency	Meaning
2	Slow	Successfully signed on to the network
10	Slow	No network found / no signing on to the network
3	Fast	Network data deleted
2	Fast	Watchdog triggered, system restarts
3	Slow	Restart of an ED already signed on

Receiver (LED2)

Number	Flash frequency	Meaning
3	Fast	Feedback signal received from amplifier
1	Fast	Data received from an end unit
2	Slow	Network scan completed, network initiated
5	Fast	All signed on receivers / repeaters deleted from list
2	Fast	Last signed on ED deleted from list

Status: 11/08