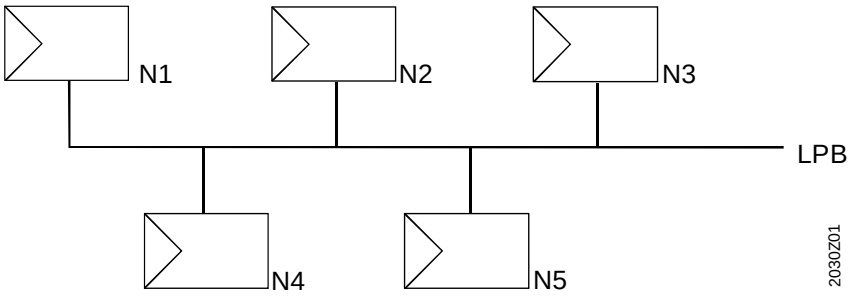
Local Process Bus LPB

Basic System Data

This documentation contains basic data on the Local Process Bus (LPB) and on the process units (controllers) that can be connected to it. Also, the field of application and the system philosophy are described. You will find all relevant data and information about engineering, correct operation and diagnosis of heating systems that use the LPB.

System overview

By interconnecting controllers with LPB capability, it is possible to set up LPB systems for heating plants with communication, covering a very wide field of application.
LPB controllers can be used either autonomously or in interconnected systems. Communication is accomplished via the LPB.



Controllers N1...N5 connected to the LPB

Use

- Zone control with central heat generation
- Remote control of heating plants
- Use of a common outside detector for several autonomous controllers
- Heating plants with a separate controller for d.h.w. heating
- Control of several pieces of heat generating equipment

Functions

Since the functions in an interconnected system are very much dependent on the type of controllers used, it must be checked which system functions the individual controllers support. For details, refer to the relevant data sheet.
Following are some typical functions supported by most of the controllers with LPB capability:

– Passing on the outside temperature signal (zoning)
– Use of common detector data (e.g. common flow temperature detector)
– Heat demand signals from one or several zone controllers that are connected to the heat generating equipment
– D.h.w. priority (e.g. during d.h.w. heating)
– Time synchronization (time master)
– Error signal indication from other LPB devices

Documentation

Title	Data sheet number
Local Process Bus (Basic System Data)	2030E
Local Process Bus (Basic Engineering Data)	2032E
Heating controller RVL470	2522E
BATIGYR Power Supply	8943E

The range of controllers with LPB capability will gradually be extended.

Basic instructions for engineering

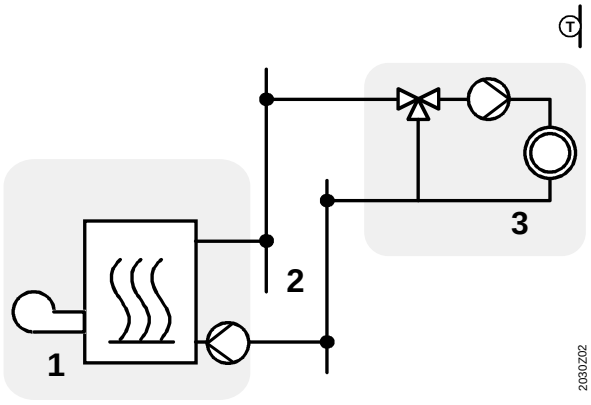
Cable lengths, net topology

For calculation of the cable lengths and the net topologies that can be used, please refer to data sheet 2032. It is important to note that in the case of larger plants, a separate bus power supply is required.

Fundamentals, terminology

In general, heating plants are comprised of one or several pieces of heat generating equipment and one or several loads. The hydraulic connection between heat generation and loads is termed flow / return rail in the following text (or simply "rail").

Example with one distribution level

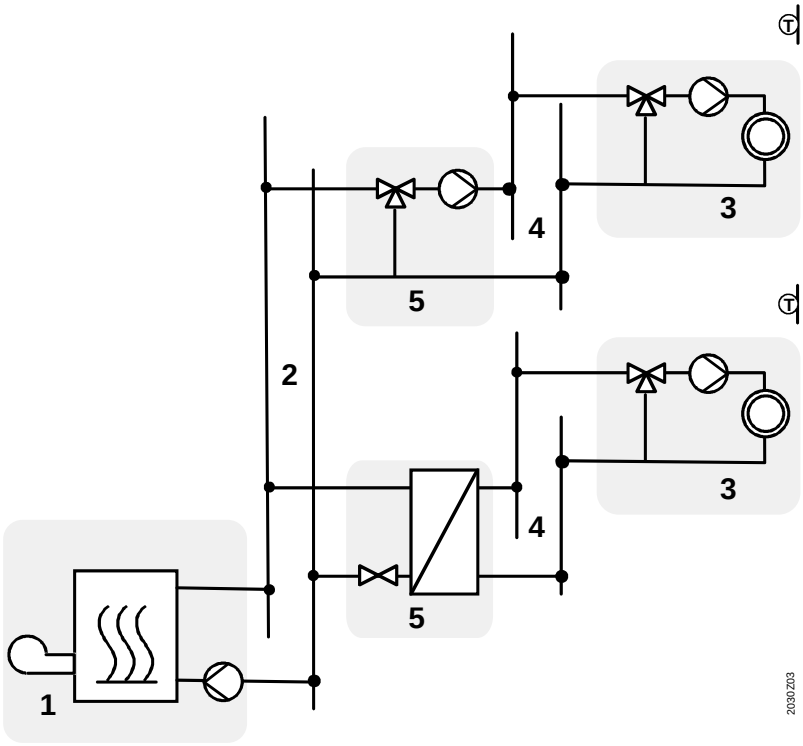


Heating plant with one distribution level

1 Heat generation
2 Primary flow / return rail
3 Load

In larger plants, there may be a heat exchanger between heat generation and the loads. In that case, there is a primary rail between heat generation and the heat exchanger and a secondary rail between heat exchanger and the loads.

Example with two distribution levels



Heating plant with two distribution levels

1 Heat generation
2 Primary flow / return rail
3 Loads
4 Secondary flow / return rail
5 Heat exchangers

In an LPB system, it is possible to have heating systems with a maximum of two distribution levels (that is, with one primary and several secondary rails), as shown above.

From the point of view of application engineering, the basic components used in such plants are heat generating equipment, heat exchangers and loads.

Heat generating equipment

- Oil-fired boilers
- Gas-fired wall-mounted appliances
- Wood-fired boilers
- Heat pumps
- District heat transfer stations

Heat exchangers

- Plate heat exchangers
- Community heat transfer stations

Loads

- D.h.w. storage tanks with or without circulating pump
- D.h.w. exchangers
- Heating circuits with pumps
- Heating circuits with mixing valves
- Air heating coils

A large number of the controllers with LPB capability can be used for control of heat generation, the load or the heat exchanger by making appropriate parameter settings.

LPB addresses

To enable the various devices in a heating plant to exchange information via the bus, addresses must be assigned to them.
The address of an LPB device is comprised of two parts, the segment number and the device number. In the following text, this address is given as LPB address xx / yy, where xx is the segment number and yy the device number. This can be compared with a postal address consisting of street name and house number.

Basic rules

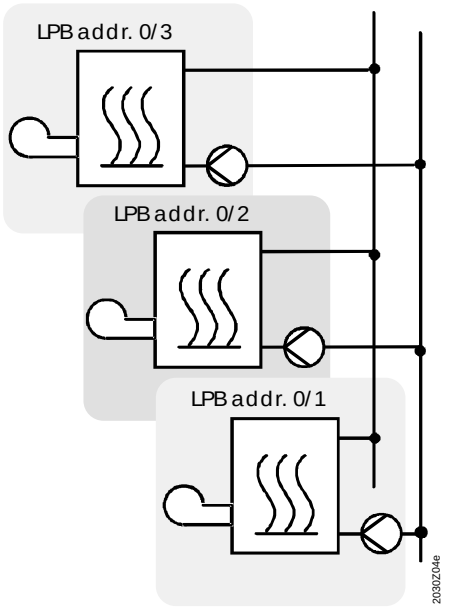
The addresses should be assigned at an early stage in the course of the engineering phase. Even in the case of complex plants, address assignment is very straightforward if the following basic rules are observed:

- Each LPB address may be assigned only once. Very often, it is sufficient to use consecutive numbers. In an LPB system, plant sections connected to the same flow / return rail are generally grouped together. This is accomplished through segmentation, that is, all devices of a segment are given the same segment number.
  There are the segments 1 to 14 and the central segment 0. Segments 1 to 14 are of equal value.
- Segment 0 is of particular importance. If a plant uses central heat generation, the devices associated with heat generation are assigned addresses in segment 0, but this segment can also be used for other applications.
  Heat exchangers and loads in segments 1 to 14 automatically pass on their heat requisition to the central segment 0.
  If a heating plant has several pieces of heat generating equipment which, functionally, are independent (no sequencing of heat generation), none of the various pieces of heat generating equipment may be assigned an address belonging to segment 0, since there is no central heat generation. This is the case, for instance, where the LPB is used for central supervision of several independent heating plants.
- A maximum of 16 devices per segment can be addressed (1 to 16). Device number 0 (zero) means that the device does not communicate. In that case, it operates autonomously.
- Heat demand on the load side is coordinated by a load master, heat generation on the heat generation side by a generation master.
- Devices carrying device number 1 have in their segment the respective master functionalities or, in other words: by addressing a device that has device number 1, the master functionality will be activated. In each segment used, there must always be a device carrying device number 1.
- When assigning addresses, it is also necessary to observe the following rules:
  – Assign addresses in the direction of heat flow
  – Assign addresses while giving consideration to the outside detector (please refer to the following examples)

Address assignment in the direction of heat flow

The controller used for the heat generating equipment is assigned device number 1, usually in segment 0 (LPB address 0 / 1).
If there are several (e.g. n) pieces of heat generating equipment that form a cascade, the respective devices must be assigned device numbers 1…n in ascending order, usually in segment 0 also (LPB addresses 0 / 1 … 0 / n).

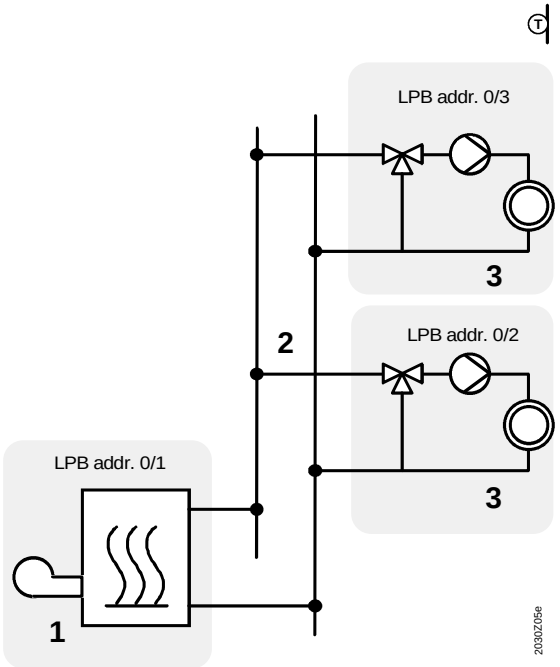
Example of heat generation



Address assignment for heat generation (n=3)

Then, after heat generation, the controllers (e.g. m) for the heating zones (loads) must also be addressed in ascending order, in the same segment.
Device numbers n+1 ... n+m

Example of heating zones

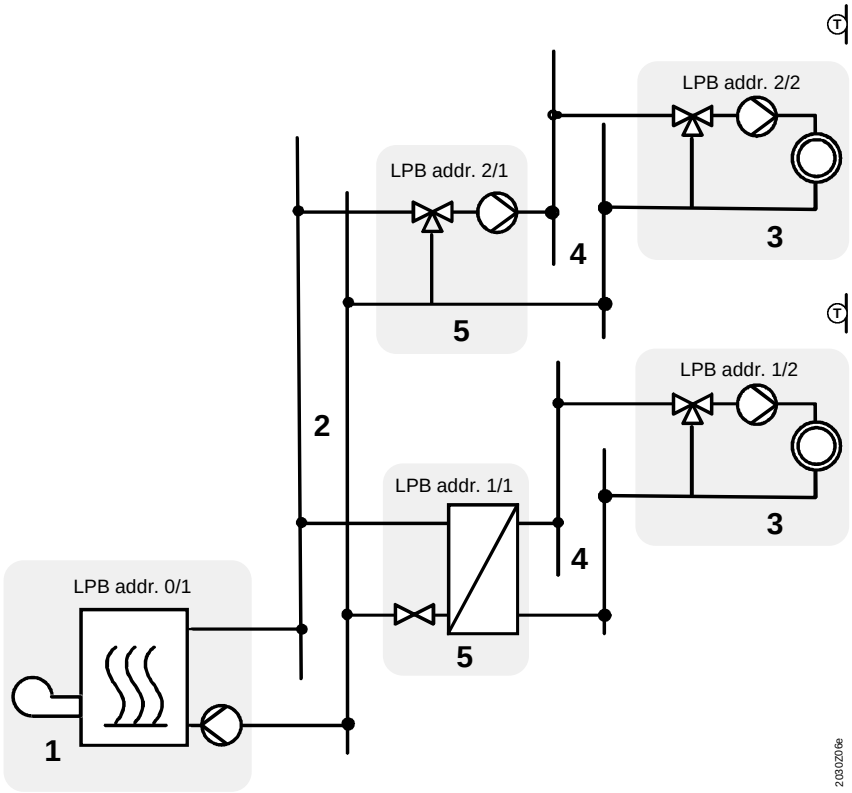


Address assignment for heating zones (n=1, m=2)

1 Heat generation
2 Primary flow / return rail
3 Loads

If there are heat exchangers (e.g. u) that subdivide the system into a primary and a secondary side, they must be assigned to the load side, in segments 1…u with the device numbers 1 (LPB address x / 1).
In that case, the pieces of heat generating equipment must be in segment 0 (mandatory).
The associated zone controllers (e.g. v) which, hydraulically, belong to one heat exchanger are given the device numbers 2…v+1 with the same segment number as the respective heat exchanger (LPB addresses x / 2...x / v+1).

Example with two distribution levels



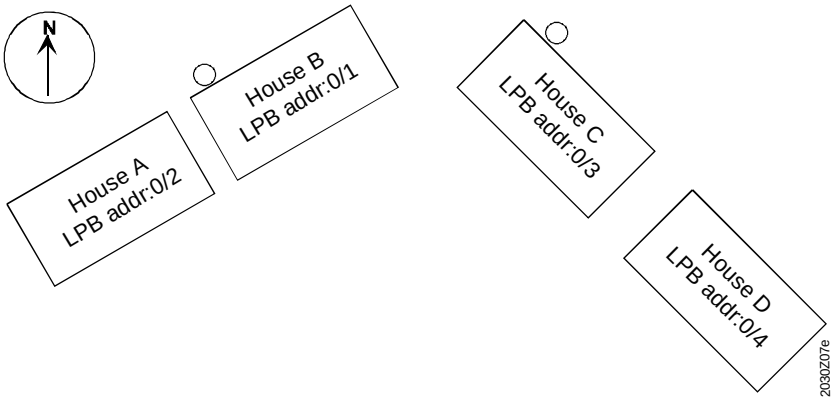
Address assignment with two distribution levels (n=1, u=2, m=1)

1 Heat generation
2 Primary flow / return rail
3 Loads
4 Secondary flow / return rail
5 Heat exchangers

Address assignment while giving consideration to the outside detector

If a device has an outside detector, it makes its detector value available on the bus. A device without its own detector adopts the value from the device with the next lower LPB address that delivers a detector value.
In terms of LPB address order, first the segment number is considered and then the device number. The ascending LPB address order is used : 0/1; 0/2; 0/3; 1/1; 1/2; 2/1; etc.
If the devices with the LPB addresses 0/1…0/n do not have their own outside detector, which means that there is no device with the "next lower LPB address" that would deliver a detector value, they take on the value of the device with the highest LPB address.

Example of an address assignment



Since the orientation of houses A and B is very different from that of houses C and D, each group of houses will be assigned an outside detector. House A will adopt the detector value of house B, and house D that of house C. Heat generation is located in house B.

While observing the basic rules given above, the device in house B is assigned LPB address 0/1. The devices in houses B, C and D are given addresses 0/2 to 0/4, whereby the device numbers are assigned such that the houses without own outside detectors follow the LPB addresses that provide an outside temperature signal.

House	*LPB address*	*Outside temperature value*
A	0/2	From house B
B	0/1	From own outside detector
C	0/3	From own outside detector
D	0/4	From house C

If, for some reason, the outside temperature detector must be fitted to house A instead of house B, the addresses would have to be assigned as follows:

House	*LPB address*	*Outside temperature value*
House A	0/4	From own outside detector
House B	0/1	From house A
House C	0/2	From own outside detector
House D	0/3	From house C

Providing a detector value for other devices

If appropriately configured, certain LPB controllers are capable of making a detector value (e.g. the flow temperature of the primary rail) available on the bus. This detector value can then be used by all devices in the same segment.

Note

With the exception of the outside detectors, only one LPB controller per segment may provide the same type of detector signal on the bus.

Time synchronization

Most of the LPB controllers are capable of delivering the time of day as a time master or to synchronize their clock according to a time master.

Note

In each LPB system, only one device may be assigned the function of time master. This can be set on an operating line of the respective device. The devices are supplied with "no time master function" set. When engineering the plant, the decision must be made whether this function is required and, in the affirmative case, which of the devices the "time master" function shall be assigned to.

Error messages

Most of the LPB devices are capable of displaying error messages of other LPB devices. Information on whether the individual devices display error messages of other devices, and with what restrictions (e.g. only error messages from the same segment), is given in the documentation of the respective devices.

Commissioning

Wiring

Prior to connecting the controllers, the wiring must be checked. False wiring is much more difficult to detect when several devices have already been connected. Since the LPB is a two-wire bus whose wires are non-interchangeable, attention must be paid to the polarity (MD and DB) when connecting the devices.
The voltage of DB against MB must be DC 15…18 V. This voltage may vary since the level drops during communication.
In the case of extensive cabling, it is recommended to keep a record of the measured line resistances.

Configuring the controllers

For the configuration of the controllers, refer to the documentation covering the individual units. It is important that the configuration of the units is made in agreement with their use (loads, heat exchangers, etc.).
The configurations covering the system (time master, etc.) must be made on the respective controllers in agreement with the planning documentation.

LPB address

The devices are supplied with the LPB address set to 0/0. To enable communication on the LPB, the respective LPB address must be set (refer to “Engineering”). It must be made certain that no address number will be assigned twice. An address number that is used twice will not automatically be identified by the system.

Documentation

Wiring and the assigned LPB addresses must be documented to make certain no problems will occur if faults need to be traced (wiring, branches, conduit boxes, and labelling of cables).
In the case of extensive systems, it is recommended to keep a record of the measured line resistances prior to connecting the controllers.
The documentation should also include the assignment of the functions to the various units with the relevant PPB addresses.
E.g. device no. 1 with LPB addr. 1/1 delivers the outside temperature EAST, is time master and provides the flow temperature detector value.

Diagnosis

General

Controllers with LPB capability either have an LED for the bus status, an LCD segment (BUS), or an operating line which displays the status of the LPB.
These LED or displays allow a first diagnosis to be made, indicating whether the LPB bus is correctly connected. For details, please refer to data sheet 2032E.
To make certain the LPB addresses have been correctly assigned and the required functionality will be attained, a few simple checks can be made, if considered necessary.

Passing on the outside temperature signal

It must be checked whether the devices receive the correct outside temperature value. The temperature should be adopted after no more than 10 minutes and can be called up on an operating line.

Adopting common detector values

If a device receives a detector value from some other device, it should be possible to call it up on the respective operating line after no more than two minutes.

Time synchronization

If the time of day is changed on the time master, the other devices should adopt the change within one minutes. If the time is not adopted after 10 minutes, the settings (time master, time synchronization) and the communication need to be checked.

Error messages

By triggering an error signal on purpose (e.g. removing a detector), it is possible to check whether an error is signalled and indicated on the respective devices (exercise caution when triggering an error signal while plant is in operation).