

## CONTROL SYSTEM FOR A PARTITION SYSTEM

### Description

5 The invention relates to a control system for a partition wall system according to the generic part of claim 1, which has individually displaceable partition wall elements, which each have a subordinate control unit and can be disposed to form a closed partition wall, wherein each partition wall  
10 element is displaceable in a guiding rail, and for this purpose, has a drive motor for displacing the partition wall element.

It is known from the publication EP 1 085 159 B1 that  
15 control systems are utilized for automatically displacing partition wall elements. In this case, a central control unit communicates with subordinate control units. In this case, during operation of the partition wall system, data, in particular position data, are transmitted between the  
20 subordinate control units and the central control unit. However, it has proven to be disadvantageous in this case, that in the event of failure of power supply to the control system or to the subordinate control units, data exchange between the subordinate control units and the central  
25 control unit is interrupted, which may result in undefined states of the partition wall system, in particular if individual partition wall elements are manually displaced during power failure, for example in the event of power outage.

Therefore, it is the object of the present invention to further develop a control system for a partition wall system of the mentioned species, which allows for a simple structure and  
5 a high functional safety.

To solve this problem, a control system for a partition wall system is proposed having the features of claim 1, in particular of the characterizing part. Preferred further  
10 developments of the invention are specified in the dependent claims.

According to the invention, it is intended that the subordinate control units be equipped with a position  
15 detection unit, which detects the position of the partition wall elements independently from an operating state, in particular during interruption of energy supply to the control system.

20 It is particularly advantageous if the power supply to the drive motors and/or to the subordinate control units is realized via at least one supply track, wherein the supply track is disposed in the area of the guiding rail. In this case, the supply track may be disposed separately at the guiding  
25 rail, whereby exchange is easier in the event of a defect. In addition it may be conceivable the supply track carries several usable voltages, such that direct voltage and/or alternating voltage can be simultaneously provided. Also

utilizing a three-phase current-supply track is conceivable, in particular via a three-wire or a four-wire track, whereby it is possible to use three-phase current consumers. The guiding rail and/or the supply track may consist in this case  
5 of several individual tracks, which are interconnected by means of a screw connection and/or a plug-in connection. Thereby, transporting the guiding rails and/or the supply tracks to the final place of installation is made easy and a simple assembly is guaranteed. In addition it is conceivable  
10 that the supply track is non-positively affixed to the guiding rail via a plug-in connection and/or a screw connection and/or a bonded connection and/or a welded connection. It is likewise conceivable that the supply track is integral with the guiding rail. Therefore, mounting or inserting additional  
15 lines for supplying electrical energy to the consumers in or at the partition wall elements is not required, whereby the overall structure is simplified. Nevertheless, it is conceivable that an additional cable duct is provided at or in the guiding rail, in which signal lines and/or electrical  
20 energy lines can be run to the individual partition wall elements. This allows for affixing additional electrical consumers having power consumptions above the maximum total power output of the supply track.

25 It may be likewise provided that a bidirectional data exchange is realized between the central control unit and the subordinate control units of the partition wall elements. The central control unit is thus enabled to query the

subordinate control units. Unlike with a unidirectional connection, in this case, the parameters, respectively operating states of the subordinate control units can be transmitted to the central control unit. A pull-method is  
5 likewise conceivable in which the subordinate control units automatically request relevant data from the central control unit. Detectable malfunction of the subordinate control units may likewise be transmitted directly to the central control unit such that the central control unit is informed at any time  
10 about the overall condition of the individual units of the partition wall system and is thus able to control them in a reliable manner.

As an option, it is conceivable that the data exchange  
15 between the subordinate control units and the central control unit is realized via a data channel, which is configured as a data line and/or via modulated data on the supply track and/or a radio communication link. When transmitting the data via a data line, a higher level of  
20 interference immunity can be achieved by utilizing screened lines. In order to achieve a simple overall structure for the partition wall system, modulated data on the supply track can be utilized, which likewise allow for a bidirectional data exchange. Bidirectional data exchange  
25 may be realized likewise via radio communication links, in particular via Bluetooth / GSM / wireless LAN / IrDA / NFC / UMTS / ZigBee / WiMAX / ULP or ultra-sound. In this case,

utilizing a combination of all transmission types is likewise feasible.

It is advantageous in a first basic variant of the invention, if  
5 the position data detection units and/or the subordinate  
control units include at least one energy accumulator, in  
particular a rechargeable energy accumulator, in particular  
an accumulator of the type Pb, NiCd-, NiH<sub>2</sub>-, NiMH-, Li-Ion-  
, LiPo-, LiFe-, Li-Mn-, LiFePO<sub>4</sub>-, LiTi-, RAM-, PTMA-, Ni-Fe-  
10 , Na/NiCl-, SCiB-, Silver-Zinc-, Vanadium-Redox- or Zinc-  
Bromine. It is likewise conceivable to employ a capacitor, in  
particular a double layer capacitor. The particular  
advantage of these energy accumulators is that, even in  
the event of an interrupted power supply, the transmission  
15 of the position data by the position data detection units will  
perfectly function via the supply tracks and/or the supply  
lines, because data, possibly transiently stored in the  
central control unit and/or the subordinate control units, are  
not erased. In addition, it is not required to initialize the  
20 position data detection units after restoring the power  
supply via the supply track and/or the supply line. In this  
variant, a slip-free mechanical connection between the  
drive motor, respectively the partition wall element and the  
guiding rail should be present, unless the position data  
25 detection units detect directly, i.e. without any other  
mechanical means, a relative position change of the  
partition wall element in relation to the guiding rail.

It is likewise conceivable that the partition wall elements are in addition manually displaceable along the guiding rails. It is thereby guaranteed that should the drive motors fail, for example on account of a power outage, the individual  
5 partition wall elements can nevertheless be disposed manually to form a closed partition wall. Also, should the control system fail, the user of the partition wall systems is able to manually dispose the individual partition wall elements to form a closed partition wall.

10

It may be likewise provided that the position data detection units and/or the subordinate control units have sensors, in particular position sensors. Said position sensors may transmit position data to the subordinate control units,  
15 which in turn transmit said data to the central control unit for the purpose of monitoring the whole partition wall system. In this case, it is conceivable to initially store the position data in chronological order in the individual subordinate control units, in order to forward them, if  
20 required and necessary, to the central control unit. It is thereby possible to efficiently avoid redundant data exchange between the subordinate control units and the central control unit. Moreover, it is conceivable the subordinate control units have abutment sensors and/or  
25 proximity sensors, which are able to avoid a collision between the individual partition wall elements. It is likewise conceivable that the data of the abutment sensors and/or proximity sensors are autonomously processed by the

subordinate control units in order to directly control the drive motors. It is thereby possible to avoid collision between the partition wall elements should the central control unit fail. It is furthermore conceivable that sensors  
5 for pressure, light, position, oscillation and/or humidity are affixed in addition to the subordinate control units. It is thereby possible to allow the individual partition wall elements to detect outside influences, such as impacts, direct insolation and/or contact with water, in order to  
10 initiate targeted corrective measures, for example automatically displacing the partition wall elements.

Furthermore, in a second basic variant of the invention, it is conceivable that the guiding rail has a position code and  
15 therefore it is possible to determine an absolute position of the individual partition wall elements. In this case, it is conceivable the position code is realized by an electrical resistance path, which is affixed to the guiding rail. In this case, a sliding contact, which can be affixed to the  
20 subordinate control units, measures the actual resistance value, which, depending on the traveling direction of the partition wall elements, increases or decreases. This is why the actual position of the individual partition wall elements can be absolutely determined at any time, such that an  
25 energy accumulator for detecting a relative change in position, like in the first variant, can be foregone. In this variant, slippage between the mechanical connection of the drive motor, respectively the partition wall element to the

guiding rail may be likewise present, because the respective position of the partition wall element is absolutely detected. It is likewise conceivable that readable codes, in particular optical codes, in the shape of bar codes, are provided at the guiding rail. Said codes may be read via an optical measuring sensor, which can be affixed to the subordinate control units. It is thus again possible to efficiently allow to absolutely determine the position of the individual partition wall elements. In this case, utilizing other position code methods in combination with resistance paths and/or bar codes is conceivable. Also a combination of the first variant and the second basic variant of the invention is conceivable, wherein for example a relative position detection can be realized by means of a step counter, which is affixed to the subordinate control unit, for example at a drive wheel of a carriage which is inserted into the guiding rail, which step counter, when displacing a partition wall element, forwards the impulses or signals to the subordinate unit.

20

It is likewise conceivable that the subordinate control units have at least one unique identification code, which, in terms of control, unambiguously characterizes the partition wall elements. It is thereby possible for the central control unit to address, respectively to control the individual subordinate control units independently from each other. This is why the individual partition wall elements can be displaced within the guiding rail independently from each other. Unlike a

25

wire solution for controlling the individual partition wall elements, the complexity of the control system structure is independent from the number of partition wall elements, because no additional wiring is required. Moreover, it is  
5 conceivable that several available compound parking boxes are provided for the partition wall elements in a simple way and manner within the overall system, in which the partition wall elements are positioned when not in use.

10 It may be likewise provided that the partition wall elements have additional actuators, which are addressable by the subordinate control units via a unique additional identification code. In this case, it is conceivable that the individual partition wall elements have actuators, such as  
15 heating elements, lighting elements, ventilators, display elements, speakers or sun visor elements. Moreover, it is possible to realize the data exchange in packet-mode between the central control unit and the subordinate control units. It is thereby likewise possible to simultaneously  
20 execute several functions of the actuators by means of the subordinate control units.

Furthermore, it is the object of the invention to provide a method of the type mentioned in the introduction, which  
25 increases the functional safety of a generic partition wall system, in particular in the event of electrical malfunctioning. According to the invention, this problem is solved in that, if the power supply is interrupted, the

subordinate control units transmit the respective position data to the central control unit via the position data detection units, once the power supply is restored.

- 5 The inventive method features the advantages already explained in conjunction with the inventive device.

Advantageously, when manually displacing the partition walls during a power interruption, the position data are  
10 continuously metrologically detectable, because the position data detection units have an energy accumulator, in particular a rechargeable energy accumulator (variant I). It is thereby possible to employ systems which metrologically detect the relative position of the individual  
15 partition wall elements, such as done for example by incremental encoders (rotary encoders) affixed to a carriage. Moreover, it is likewise possible to metrologically detect the absolute position of the partition wall elements by means of a position code on the guiding rail, for example  
20 by means of an optical sensor affixed to the carriage (variant II). On account of these possibilities for detecting the position, likewise by combining the two variants I and II essential to the invention, the partition wall elements can be reliably prevented from colliding, when the central control  
25 unit and/or the power supply of the supply tracks is switched on again, because the actual position data of the partition wall elements are transmitted to the central control unit once the power supply is restored, and the central

control unit can therefore perform a collision-free displacement of the partition wall elements. As a consequence, the functional safety of the overall installation is considerably improved by the inventive method.

5

Further advantages, features and details of the invention will result from the following description, in which several embodiments of the invention are described in detail, reference being made to the drawings. In this context, the features mentioned in the claims and in the description, may be individually or randomly combined essential to the invention.

10

In the drawings:

15

Figure 1: shows a block diagram of an inventive control,

Figure 2: shows a diagrammatic view of the inventive partition wall system,

20

Figure 3: shows a diagrammatic frontal view of a guiding rail with a drive motor inserted therein, and

25

Figure 4: shows a simple diagrammatic lateral view of a carriage with a partition wall element affixed thereto.

Figure 1 represents a control system 1 with a central control unit 10 and subordinate control units 11 for the respective partition wall elements 21, which communicate with each other via diagrammatically illustrated data channels 12, which comprise physically wire-less and/or electrical conductive connections. In this case, data are sent from the central control unit to the individual subordinate control units 11 via the already mentioned transmission techniques. The subordinate control units 11 as well can send data to the central control unit 10, such as to allow for a reliable data communication in that the subordinate control units 11 acknowledge data receipt to the central control unit 10 and vice versa.

Figure 2 shows a diagrammatic structure of a partition wall system 2, which has a control system 1, as described in Figure 1. In this case, the individual partition wall elements 21 have subordinate control units 11 and actuators 26, which are disposed in or at the individual partition wall elements 21. The actuators 26 and possibly the drive motor 22 are supplied with power via an electrical connection 27, which electrically connects the subordinate control unit 11 to the actuators 26. In this case, the subordinate control unit 11 is connected to a carriage 42 via an electrical connection 27. Respectively one partition wall element 21 is essentially attached to be suspended from the one or more carriages 42 (two or more). The respective carriages 42 are in turn movably supported in the guiding rail 23.

Current collectors, in particular sliding contacts, affixed in or at the carriage 42, pick off the voltage applied to the supply tracks 24. It is thus possible to supply the actuators 26 with electrical energy via the supply track 24. Respectively one  
5 data channel 12 is provided to exchange data between the subordinate control units 11 and the actuators 26. Moreover, it should be mentioned that in Figure 2 various techniques may be utilized for transmitting data between the subordinate control units 11 and the central control unit  
10 10. However, in practice this will normally not happen, in order to guarantee a homogenous system structure and thus to keep cost of the partition wall system low. Just to mention that the option of having differently configured data channels 12 in a control system 1 is available. Accordingly,  
15 the partition wall elements 21, as described in Figure 2, may exchange data between each other via either a data line 12.1, or via modulated data 12.2 on the supply track 24 or via a radio communication link 12.3. The power supply of both the drive motors 22 and the subordinate control units  
20 11 and the actuators 26 is realized via a supply track 24. In Figure 2, the drive motors 22 are disposed in the guiding rails 23 by means of the carriages 42. It is likewise conceivable that the drive motors 22 are disposed in the partition wall elements 21 and have a gear, which is  
25 mechanically coupled to the carriages 42, respectively to the guiding rail 23. Also affixing an additional guiding rail on the floor is conceivable, which would cooperate with a carriage 42 affixed to the lower end of the partition wall

elements 21. This carriage 42 may likewise be driven by a drive motor 22 via a gear or the like.

Figure 3 illustrates a diagrammatic frontal view of the  
5 guiding rail 23 in which a drive motor 22 is located within a carriage 42. The electric conductive drive wheels 30 are respectively located on a supply track 24, which is affixed to the guiding rail 23 in an electrically insulated manner. This is how among others, electrical energy is supplied to  
10 the actuators 26 and the drive motors 22. The supply track 24 likewise supplies power to the subordinate control units 11 and to the actuators 26 which are located in the individual partition wall elements 21. Moreover, the carriage 42, in particular the drive motor 22 has a position data  
15 detection unit 25 including a sensor 41 affixed to the drive motor 22, which sensor is able to read a bar code affixed to the guiding rail 23. Information on the absolute length can be read from this bar code, such that the central control unit always knows the exact position of the individual partition  
20 wall elements 21, i.e. even after a power failure.

Figure 4 shows the frontal view of a drive motor 22, to which a partition wall element 21 is affixed. A position data detection unit 25, which is affixed to the drive motor 22, has  
25 a sensor 41 and an energy accumulator 40. In this case, the sensor 41 may be an optical measuring sensor, in particular a scanner, which is able to read a bar code affixed to the guiding rail 23 and thus to determine the

position of the individual partition wall elements 21. It is likewise conceivable that a sensor would be placed at this location which allows to detect a resistance value by means of a resistance path affixed to the guiding rail 23. Said  
5 resistance value may be transmitted to the central control unit 10 and/or to the subordinate control unit 11 which is thereby enabled to determine the exact position of the individual partition wall elements 21. Another possibility to detect the position data is to metrologically detect the  
10 movement of the individual partition wall elements 21 via a relative movement by means of a step counter affixed for example to the carriage 42. For this purpose, for example a rotary encoder may be provided at a motor shaft of the drive motor 22. The detected values are likewise  
15 transmitted to the central control unit 10 and/or to the subordinate control unit 11. In this case, the energy accumulators 40, which preferably comprise rechargeable energy accumulators 40, continue to supply power to the position data detection units 25 if the power supply is  
20 interrupted, such that the position data are continuously detected, even when manually displacing the partition wall elements 21. Independently from the operating state of the overall system, in both scenarios, the positions of the partition wall elements 21 can be reliably determined, in  
25 particular after restoring the energy supply. Moreover, it is conceivable that the power supply of the drive motors 22 is realized via sliding contacts 31, which are located at the drive wheels 30 of the drive motor 22 and positively bear

against an energized track affixed to the guiding rail 23. In order to galvanically separate the supply track 24 from the guiding rail 23, prior to installing the supply track 24, an insulating layer may be vapor-deposited on the guiding rail.

- 5 Moreover, affixing the supply track 24 laterally to the guiding rail 23 is conceivable, such that the supply voltage thereof can be picked off by means of carbon brushes which are affixed to the carriages 42.

## List of reference numerals

|    |      |                              |
|----|------|------------------------------|
|    | 1    | control system               |
|    | 2    | partition wall system        |
| 5  | 10   | central control unit         |
|    | 11   | subordinate control unit     |
|    | 12   | data channel                 |
|    | 12.1 | data line                    |
|    | 12.2 | modulated data               |
| 10 | 12.3 | radio communication link     |
|    | 21   | partition wall element       |
|    | 22   | drive motor                  |
|    | 23   | guiding rail                 |
|    | 24   | supply track                 |
| 15 | 25   | position data detection unit |
|    | 26   | actuator                     |
|    | 27   | electrical connection        |
|    | 30   | driving wheel                |
|    | 31   | sliding contact              |
| 20 | 40   | energy accumulator           |
|    | 41   | sensor                       |
|    | 42   | carriage                     |

## Patent claims

1. A control system (1) for a partition wall system (2),  
which includes individually displaceable partition wall  
5 elements (21), which respectively have a subordinate  
control unit (11) and can be disposed to form a  
closed partition wall,  
wherein each partition wall element (21) is  
displaceable in a guiding rail (23), and, for this  
10 purpose, has a drive motor (22) for displacing the  
partition wall element (21),  
**characterized in that**  
the subordinate control units (11) are equipped with a  
position data detection unit (25), which detects the  
15 position of the partition wall elements (21)  
independently from an operating state of the control  
system (1), in particular during interruption of power  
supply to it.
- 20 2. A control system (1) for a partition wall system (2)  
according to claim 1,  
**characterized in that**  
the power supply to the drive motors (22) and/or to  
the subordinate control units (11) is realized via at  
25 least one supply track (24), wherein the supply track  
(24) is disposed in the area of the guiding rail (23).

3. A control system (1) for a partition wall system (2) according to claim 1 or 2,  
**characterized in that**  
a bidirectional data exchange is realized between a  
5 central control unit (10) and the subordinate control units (11) of the partition wall elements (21).
4. A control system (1) for a partition wall system (2) according to claim 1 to 3,  
10 **characterized in that**  
the data exchange is realized via a data channel (12), which is configured as a data line (12.1.) and/or as modulated data on the supply track (24, 12.2) and/or as a radio communication link (12.3).
- 15 5. A control system (1) for a partition wall system (2) according to any of the preceding claims,  
**characterized in that**  
the position data detection units (25) and/or the  
20 subordinate control units have an energy accumulator (40), in particular a rechargeable energy accumulator (40).
- 25 6. A control system (1) for a partition wall system (2) according to any of the preceding claims,  
**characterized in that**  
the partition wall elements (21) are likewise manually displaceable along the guiding rails (23).

7. A control system (1) for a partition wall system (2) according to any of the preceding claims,  
**characterized in that**  
5 the position data detection units (25) and/or the subordinate control units (11) have sensors (41), in particular position sensors (41).
8. A control system (1) for a partition wall system (2) according to any of the preceding claims,  
10 **characterized in that**  
the guiding rail (23) has a position code and thereby allows to absolutely determine the position of the individual partition wall elements (21).
- 15 9. A control system (1) for a partition wall system (2) according to any of the preceding claims.  
**characterized in that**  
the subordinate control units (11) have at least one  
20 unique identification code, which in terms of control unambiguously characterizes the partition wall elements (21).
10. A control system (1) for a partition wall system (2) according to any of the preceding claims,  
25 **characterized in that**  
the partition wall elements (21) have additional actuators (26), which are controllable by the

subordinate control units (11) via a unique additional identification code.

- 5           11. A partition wall system (2) including a control system (1) according to any of the preceding claims.
- 10           12. A method for operating a partition wall system (2), including individually displaceable partition wall elements (21) and a control system (1), which has a central control unit (10) and subordinate control units (11) in the partition wall elements (21), which units bidirectionally exchange also position data with each other, wherein the subordinate control units (11) are equipped with a position data detection unit (25),
- 15           **characterized in that,**
- in that in the event of failing power supply, the subordinate control units (11) transmit the respective position data to the central control unit (10), via the position detection units, once the power supply is
- 20           restored.