

Description

Switchgear assembly

The invention is in the field of switching arrangements for outputting or distributing electrical energy and relates to a switchgear assembly having at least two modular functional units for functional outgoers, which units are each provided with a field device, which has a connecting line and is capable of communication, for the purpose of communicating with a field bus line.

In particular in the case of readily available switchgear assemblies, each of the functional units needs to be replaceable during continuing operation, without the other functional units or functional outgoers being impaired.

In a generic switchgear assembly, as is known from the document DE 42 10 657 C2, the field devices which are capable of communication and are in the form of communication modules having a simple linear topology are coupled to a field bus line in the form of a bus cable. In order to avoid the field bus line being interrupted when a modular functional unit is replaced, the functional units are coupled to the field bus line via connecting lines in the form of spur lines. The use of these spur lines results in communication faults and failures, however, owing to signal reflections at high data transmission rates.

On the basis of a switchgear assembly according to the precharacterizing clause of patent claim 1 (DE 42 10 657 C2), the invention is based on the object of simplifying the wiring for the switchgear assembly.

This object is achieved according to the invention by virtue of the fact that, in order to couple the field devices, which are capable of communication, of the at least two modular functional units to the field bus line, a common bus module is provided, the bus module having in each case one separate device interface for connecting each of the connecting lines of the individual field devices, which are capable of communication, to the bus module, a field bus interface for connecting the field bus line to the bus module, and in each case one separate coupling channel, which is provided with a repeater circuit and is arranged between the device interface and the field bus interface, for the DC-isolated coupling of each of the device interfaces with the field bus interface.

Spur lines, which are referred to as "active spur lines", are known per se in which a repeater circuit is integrated and which have a transmission rate of up to 12 Mbit/s. Such active spur lines are marketed, for example, under the abbreviation "ASTL" by Indu-Sol GmbH, Germany (<http://www.indu-sol.com/opencms/export/indusol/hp/produkte/infrastrukturkomponenten/>).

Furthermore, interface converters are known per se from computer technology which have an RS-485 input channel and three RS-485 output channels. These known interface converters are neither provided nor suitable for use as a bus module in a switchgear assembly according to the invention, however, owing to their low transmission rate (<http://www.spectra.de>).

A preferred configuration of the novel switchgear assembly provides for the bus module to have more than two separate device interfaces.

In a further preferred configuration, provision is made for a combination of at least two bus modules to be provided for coupling the field devices, which are capable of communication, of more than two modular functional units to the field bus line, each of the at least two bus modules having two or more device interfaces. - Given a corresponding combination, it is possible to connect any desired number of modular functional units in a simple manner.

It is advantageous if the data interchange takes place via the connecting lines and the field bus line in accordance with the transmission standard RS485 - in particular at a transmission rate which is conventional for the known field bus system Profibus-DP of more than 500 kbit/s.

Further advantageous configurations of the novel switchgear assembly provide for the bus module to be arranged in a space outside the functional space of a switchpanel of the switchgear assembly - in particular on a top-hat rail. Here, a person skilled in the art will understand the functional space to be the physical space in a switchgear assembly which serves the purpose of accommodating the modular functional units.

For protection against electric shock and protection against the ingress of foreign bodies and water, in a further preferred configuration provision is made for all of the separate coupling channels, which are provided with a repeater circuit, of a bus module to be arranged in a common housing.

Provision is furthermore made for the device interfaces and the field bus interface of a bus module to be in the form of plug system components which can be removed from the housing in order

to design the bus module such that it is more installation-friendly and easier to wire.

The invention will be explained in more detail below with reference to figures 1 to 5, in which:

figure 1 shows a low-voltage switchgear assembly known from the existing prior art having active spur lines,
figure 2 shows a switchgear assembly according to the invention in the form of a low-voltage switchgear assembly having a bus module,
figure 3 shows the bus module shown in figure 2, and
figures 4 and 5 show preferred configurations of the bus module according to the invention.

As shown in figure 1, in switchgear assemblies 1 which have previously been conventional in the art and in which a plurality of modular functional units 3, which are equipped with field devices 2 which are capable of communication, are arranged in a switch panel 4, the field devices 2 which are capable of communication are provided with connecting lines in the form of spur lines 5. The field devices 2, which are capable of communication, are connected to a field bus line 6, which is designed to have a simple linear topology, via these spur lines 5.

As shown in figure 2, with the switchgear assembly 7 according to the invention in the form of an easily accessible low-voltage switchgear assembly, provision is made for the field devices 8, which are capable of communication, of the modular functional units 9 of a switchpanel 10 to be connected without the use of spur lines. For this purpose, each of the field devices 8 which are capable of communication is coupled to a bus module 12 via in each case one connecting line 11 comprising two sections. In this case, a first section 13 of

PCT/EP2005/056729
2004P21046WOIN

- 4a -

the connecting line 11 extends within the modular functional units 9, and a second section 14 of the connecting lines

11 extends between the modular functional unit 9 and the bus module 12. The first section 13 is prefabricated on one side with a nine-pole D-SUB-plug system component in the form of a plug (not shown in the figures) and a matching resistor. Its length is approximately one meter. The second section 14 is prefabricated on one side with a first RJ45 plug system component 15 in the form of a plug. This second section 14 has a length of approximately 2.5 meters.

As shown in figure 3, the bus module 12 has a plurality of separate device interfaces 16 in the form of second RJ45 plug system components in the form of jacks for the purpose of connecting the individual field devices 8, which are capable of communication, to the bus module 12. Furthermore, the bus module 12 has a separate field bus interface 18 in the form of a nine-pole D-SUB-plug system component in the form of a jack for the purpose of connecting the field bus line 17 to the bus module 12. For the DC-isolated coupling of each of the device interfaces 16 to the field bus interface 18, a separate coupling channel 19 is provided in each case between one of the device interfaces 16 and the field bus interface 18, each of the coupling channels 19 being provided with a repeater circuit 20 known per se.

Since it is conventional in the art to provide the switchpanels 21 of low-voltage switchgear assemblies with a variable, in particular even number of more than two modular functional units to be connected, provision is made in a preferred configuration, as shown in figures 4 and 5, for the bus module 22 or 23 to have four or six separate device interfaces 16. Up to four or up to six modular functional units 9 can therefore be connected to the bus module 22 or 23. With

these two variants of the bus module (4-fold or 6-fold), the coupling of each number, which is conventional in the art, of modular functional units 9 to the field bus line 17 can be implemented by a corresponding combination.

Owing to the fact that it is used within the low-voltage switchgear assembly, the bus module is subject to particular environmental conditions and therefore needs to satisfy particular requirements as regards its heating response, its operational safety and operator safety as well as its response in its electrical environment. It is therefore advantageous that all of the components of the bus module - in particular the separate coupling channels 19 provided with the repeater circuit - are accommodated in a common housing 24. The bus module 12, 22, 23 is mounted within the low-voltage switchpanel in a cable connection space (not illustrated in the figures) or in a wiring space (likewise not illustrated), to be precise outside the functional space of the switchpanels of the switchgear assembly.

Since the device interfaces 16 and the field bus interface 18 are in the form of removable plug system components, the bus module 12, 22, 23 can be mounted and wired easily. In addition, maintenance and replacement of the bus module 12, 22, 23 are assisted by the vertical wiring in the form of connecting lines 11.

The repeater circuits 20 within the coupling channels 19 DC-isolate the field bus line 17 and the connecting lines in a known manner and therefore ensure safe operation without limiting the transmission rate. It is therefore possible to replace modular functional units 9 during continuing operation without impairing other functional

PCT/EP2005/056729
2004P21046WOIN

- 7 -

units. In particular, an external control voltage may be provided as the supply voltage to the individual repeater circuits 20.

Patent claims

1. A switchgear assembly (7) having at least two modular functional units (9), which are each provided with a field device (8), which has a connecting line (11) and is capable of communication, for the purpose of communicating with a field bus line (17), characterized in that, in order to couple the field devices (8), which are capable of communication, of the at least two modular functional units (9) to the field bus line (17), a common bus module (12; 22; 23) is provided, the bus module (12; 22; 23) having in each case one separate device interface (16) for connecting the connecting lines (11) of the individual field devices (8), which are capable of communication, to the bus module (12; 22; 23), a field bus interface (18) for connecting the field bus line (17) to the bus module (12; 22; 23), and in each case one separate coupling channel (19), which is provided with a repeater circuit (20) and is arranged between the device interface (16) and the field bus interface (18), for the DC-isolated coupling of each of the device interfaces (16) with the field bus interface (18).

2. The switchgear assembly as claimed in claim 1, characterized in that the bus module (22; 23) has more than two separate device interfaces (16).

3. The switchgear assembly as claimed in claim 1, characterized in that a combination of at least two bus modules (22, 22; 23, 23; 22, 23) is provided

for coupling the field devices (8), which are capable of communication, of more than two modular functional units (9) to the field bus line (17), each of the at least two bus modules having two or more device interfaces.

4. The switchgear assembly as claimed in one of the preceding claims, characterized in that the transmission rate of the bus module (12; 22; 23) is greater than 500 kbit/s.

5. The switchgear assembly as claimed in one of the preceding claims, characterized in that the data interchange takes place via the connecting lines (11) and the field bus line (17) in accordance with the transmission standard RS485.

6. The switchgear assembly as claimed in one of the preceding claims, characterized in that the bus module (12; 22; 23) is arranged in a space outside the functional space of a switchpanel (21) of the switchgear assembly.

7. The switchgear assembly as claimed in one of the preceding claims, characterized in that the bus module (12; 22; 23) can be mounted on a top-hat rail.

8. The switchgear assembly as claimed in one of the preceding claims, characterized in that all of the separate coupling channels, which are provided with the repeater circuit (20), of a bus module (12; 22; 23) are arranged in a common housing (24).

9. The switchgear assembly as claimed in claim 9, characterized in that the device interfaces (16) and the field bus interface (18) are in the form of plug system components which can be removed from the housing (24).