

METHOD, APPARATUS, AND DEVICE FOR STARTING BUS SERVOMOTOR OVER NETWORK, AND STORAGE MEDIUM

[0001] The present application claims the priority to Chinese Patent Application No.
5 202010130057.9, titled "METHOD, APPARATUS, AND DEVICE FOR STARTING BUS
SERVOMOTOR OVER NETWORK, AND STORAGE MEDIUM", filed on February 28,
2020 with the China National Intellectual Property Administration, which is incorporated
herein by reference in its entirety.

10 FIELD

[0002] The present disclosure relates to the technical field of automatic control, and in
particular to a method, an apparatus, and a device for starting a bus servomotor over a
network, and a storage medium.

15 BACKGROUND

[0003] In automation industry, a servo axis generally cooperates with an upper controller,
instead of operating independently. Few servo drives are adapted to a controller in a
traditional pulse control mode. A PROFINET bus is common and quite cost-effective in
factory automation control. Generally, each control system corresponds to a lot of servo
20 axes when a bus is applied. A high-speed bus servo features in a capability of exchanging a
large amount of data with the upper control system via a high-speed bus, and thereby ensuring
a start and normal operation of a network.

[0004] Currently, a bus protocol addresses in-process data interaction. Parameters
prepared before servo operation are not all transmitted, and are manually set during
25 equipment adjustment. It is very time-consuming to input starting parameters into each
servo manually, which seriously reduces production efficiency.

[0005] In summary, it is an urgent issue for those skilled in the art to solve that inputting the
starting parameters of the servomotor manually wastes time and reduces production
efficiency.

SUMMARY

[0006] An object of the present disclosure is to provide a method for starting a bus servomotor over a network, which accelerates an over-network start of the bus servomotor and improves production efficiency. Another object of the present disclosure is to provide an apparatus and a device for starting a bus servomotor over a network, and a computer-readable storage medium.

[0007] In order to address the above issues, following technical solutions are provided according to embodiments of the present disclosure.

[0008] A method for starting a bus servomotor over a network is provided, including:

determining a servo protocol stack as a target servo protocol stack, in a case that a start of the servo protocol stack is detected;

acquiring a target starting parameter corresponding to the target servo protocol stack, where the target starting parameter is for a target bus servomotor;

parsing a preconfigured GSD file, to obtain a target parameter channel corresponding to the target servo protocol stack; and

transmitting the target starting parameter to the target bus servomotor via the target parameter channel, to start the target bus servomotor over the network according to the target starting parameter.

[0009] In an embodiment of the present disclosure, after transmitting the target starting parameter to the target bus servomotor via the target parameter channel, the method further includes:

receiving parameter-response information fed back by the target bus servomotor;

determining, according to the parameter-response information, whether to adjust the target starting parameter; and

adjusting the target starting parameter, in a case that a result of the determining is positive.

[0010] In an embodiment of the present disclosure, after determining the servo protocol stack as the target servo protocol stack and before acquiring the target starting parameter

corresponding to the target servo protocol stack, the method further includes:

determining whether the start of the target servo protocol stack is normal;

acquiring the target starting parameter corresponding to the target servo protocol stack, in a case that the start of the target servo protocol stack is determined to be normal;

5 reporting an error of the start of the servo protocol stack, in a case that the start of the target servo protocol stack is determined to be abnormal.

[0011] In an embodiment of the present disclosure, determining whether the start of the target servo protocol stack is normal includes:

10 determining whether a virtual configuration of the network is consistent with a real configuration of the network, where the target servo protocol stack is located in the network.

[0012] An apparatus for starting a bus servomotor over a network is further provided, including:

a protocol stack determining module, configured to determine a servo protocol stack as a target servo protocol stack, in a case that a start of the servo protocol stack is detected;

15 a starting parameter acquiring module, configured to acquire a target starting parameter corresponding to the target servo protocol stack, where the target starting parameter is for a target bus servomotor;

a parameter channel acquiring module, configured to parse a preconfigured GSD file to obtain a target parameter channel corresponding to the target servo protocol stack; and

20 a network starting module, configured to transmit the target starting parameter to the target bus servomotor via the target parameter channel, to start the target bus servomotor over the network according to the target starting parameter.

[0013] In an embodiment of the present disclosure, the apparatus further includes:

25 a feedback information receiving module, configured to receive parameter-response information fed back by the target bus servomotor, after the target starting parameter is transmitted to the target bus servomotor via the target parameter channel;

a first determining module, configured to determine, according to the parameter-response information, whether to adjust the target starting parameter, and

a parameter adjusting module, configured to adjust the target starting parameter, in a case that the determination of the first determining module is positive.

[0014] In an embodiment of present disclosure, the apparatus further includes:

5 a second determining module, configured to determine whether the start of the target servo protocol stack is normal, after the servo protocol stack is determined as the target servo protocol stack and before the target starting parameter corresponding to the target servo protocol stack is acquired; and

10 an abnormal error reporting module, configured to report an error of the start of the servo protocol stack, in a case that the start of the target servo protocol stack is determined to be abnormal;

wherein the starting parameter acquiring module is configured to acquire the target starting parameter corresponding to the target servo protocol stack, in a case that the start of the target servo protocol stack is determined to be normal.

15 **[0015]** In an embodiment of the present disclosure, the second determining module is configured to determine whether a virtual configuration of the network is consistent with a real configuration of the network, where the target servo protocol stack is located in the network.

[0016] A device for starting a bus servomotor over a network is further provided, including:

20 a memory, configured to store a computer program, and
a processor, configured to implement the aforementioned method for starting the bus servomotor over the network when executing the computer program.

[0017] A computer-readable storage medium is further provided, storing a computer program. The computer program when executed by a processor implements the aforementioned method for starting the bus servomotor over the network.

25 **[0018]** The method is provided according to embodiments of the present disclosure. The servo protocol stack is determined as the target servo protocol stack, in a case that a start of the servo protocol stack is detected. The target starting parameter corresponding to the target servo protocol stack is acquired, where the target starting parameter is for the target bus servomotor. The preconfigured GSD file is parsed to obtain a target parameter channel

corresponding to the target servo protocol stack. The target starting parameter is transmitted to the target bus servomotor via the target parameter channel, to start the target bus servomotor over the network according to the target starting parameter. A GSD file provided with a corresponding relationship between all servo protocol stacks and all parameter channels the starting parameters is configured in advance. Thereby, the starting parameter is directly transmitted to the target bus servomotor via the corresponding target parameter channel, in case of the start of the servo protocol stack. The method accelerates network start of the bus servomotor and improves production efficiency, in comparison with a conventional manner in which network-starting parameters for a bus servomotor are manually inputted.

[0019] The apparatus and the device for starting the bus servomotor over the network, and the computer-readable storage medium, which correspond to the above method, are further provided according to embodiments of the present disclosure. The same technical effects also applies, and are not repeated herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] For clearer illustration of the technical solutions according to embodiments of the present disclosure or conventional techniques, hereinafter briefly described are the drawings to be applied in embodiments of the present disclosure or conventional techniques. Apparently, the drawings in the following descriptions are only some embodiments of the present disclosure, and other drawings may be obtained by those skilled in the art based on the provided drawings without creative efforts.

[0021] Figure 1 is a flow chart of a method for starting a bus servomotor over a network according to an embodiment of the present disclosure;

[0022] Figure 2 is another flow chart of a method for starting a bus servomotor over a network according to an embodiment of the present disclosure;

[0023] Figure 3 is a schematic structural diagram of an apparatus for starting a bus servomotor over a network according to an embodiment of the present disclosure; and

[0024] Figure 4 is a schematic structural diagram of a device for starting a bus servomotor over a network according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF EMBODIMENTS

[0025] In order to help those skilled in the art better understand technical solutions of the present disclosure, hereinafter the present disclosure is further described in conjunction with the drawings and embodiments. Apparently, the described embodiments are only some rather than all of the embodiments of the present disclosure. Any other embodiments obtained based on the embodiments of the present disclosure by those skilled in the art without any creative effort fall within the scope of protection of the present disclosure.

[0026] First embodiment

[0027] Reference is made to Figure 1, which is a flow chart of a method for starting a bus servomotor over a network according to an embodiment of the present disclosure. The method may include following steps S101 to S104.

[0028] In step S101, a servo protocol stack is determined as a target servo protocol stack, in a case that a start of the servo protocol stack is detected.

[0029] A servo protocol stack may be separately set in advance between each bus servomotor and an upper controller. The upper controller may detect in real time whether there is a start of the servo protocol stack. In a case that the start of a servo protocol stack is detected, it indicates that the upper controller needs to control the bus servomotor corresponding to such servo protocol stack. In such case, the servo protocol stack currently started may be determined as the target servo protocol stack.

[0030] In step S102, the target starting parameter corresponding to the target servo protocol stack is acquired, where the target starting parameter is for a target bus servomotor.

[0031] A starting parameter for the bus servomotor corresponding to each servo protocol stack may be stored in advance. A corresponding relationship between all servo protocol stacks and all starting parameters may be further stored in advance. After the target servo protocol stack is determined, the target starting parameter that is for the target bus servomotor and corresponds to the target servo protocol stack may be acquired.

[0032] In step S103, a preconfigured GSD file is parsed to obtain a target parameter channel corresponding to the target servo protocol stack.

[0033] The GSD file (Ground Sampling Distance) is provided with parameter channels for

the upper controller transmitting the starting parameter to each bus servomotor, and a corresponding relationship between all servo protocol stacks and all parameter channels. The GSD file may be configured in advance. In a case that the target servo protocol stack is determined, the preconfigured GSD file is parsed to obtain the target parameter channel
5 corresponding to the target servo protocol stack. Flexible allocation of the parameter channels may be achieved by pre-configuring the starting parameters for each case according to an operation condition, and by fixing the parameter channels in the GSD file. GSD data exploits standardization of the GSD file fully, and expands communications to an operator-control level. Configuration tools based on GSD are capable to integrate equipment
10 produced by different manufacturers into a same bus system, which has advantages of simplicity and user-friendliness.

[0034] In step S104, the target starting parameter is transmitted to the target bus servomotor via the target parameter channel, so as to start the target bus servomotor over the network according to the target starting parameter.

[0035] The target starting parameter may be transmitted to the target bus servomotor via the target parameter channel, after the target starting parameter corresponding to the target servo protocol stack is acquired and the target parameter channel corresponding to the target servo protocol stack is obtained by parsing the preconfigured GSD file. Thereby, the target bus servomotor is started over a network according to the target starting parameter. Through
15 setting the parameter channel between the upper controller and the bus servomotor, it is implemented that the upper controller transmits the starting parameter automatically to the bus servomotor. Starting the bus servomotor over the network is greatly accelerated, production efficiency is improved, and labor costs are reduced. In addition, the bus servomotor responds to the target starting parameter before operation, instead of during
20 operation, and thereby execution efficiency of the upper controller and the bus servomotor are not affected.

[0036] The method is provided according to embodiments of the present disclosure. The servo protocol stack is determined as the target servo protocol stack, in a case that a start of the servo protocol stack is detected. The target starting parameter corresponding to the
30 target servo protocol stack is acquired, where the target starting parameter is for the target bus servomotor. The preconfigured GSD file is parsed to obtain a target parameter channel

corresponding to the target servo protocol stack. The target starting parameter is transmitted to the target bus servomotor via the target parameter channel, to start the target bus servomotor over the network according to the target starting parameter. A GSD file provided with a corresponding relationship between all servo protocol stacks and all parameter channels the starting parameters is configured in advance. Thereby, the starting parameter is directly transmitted to the target bus servomotor via the corresponding target parameter channel, in case of the start of the servo protocol stack. The method accelerates network start of the bus servomotor and improves production efficiency, in comparison with a conventional manner in which network-starting parameters for a bus servomotor are manually inputted.

[0037] Modifications on a basis of the first embodiment are further provided according to embodiments of the present disclosure. Following embodiments may refer to the first embodiment for the same or similar steps and for beneficial effects, and the vice versa. Hereinafter details would not be repeated.

[0038] Second Embodiment

[0039] In step S201, a servo protocol stack is determined as a target servo protocol stack, in a case that a start of the servo protocol stack is detected.

[0040] In step S202, it is determined whether a virtual configuration of a network is consistent with a real configuration of the network. The target servo protocol stack is located in the network. The method goes to step S203 in case of negative determination, and goes to step S204 in case of positive determination.

[0041] After the target servo protocol stack is determined, it may be determined whether the virtual configuration of the network in which the target servo protocol stack is located is consistent with the real configuration of the network. Thereby, it is determined whether the start of the target servo protocol is normal, according to the virtual configuration and the real configuration of the network. That is, in a case that the virtual configuration of the network is consistent with the real configuration of the network, it indicates that the start of the target servo protocol stack is normal, and the process goes to the step S204. In a case that the virtual configuration of the network is not consistent with the real configuration of the network, it indicates that the start of the target servo protocol stack is abnormal, and the process goes to the step S203.

[0042] Besides the consistency between the virtual configuration and the real configuration of the network, a state of the start of the servo protocol stack may be determined according to whether another criterion is met or not, and such criterion is capable of indicating the state of the start of the servo protocol stack. The criterion is not limited in embodiments of the present disclosure.

[0043] In step S203, an error of the start of the servo protocol stack is reported.

[0044] In the case that the virtual configuration of the network is not consistent with the real configuration of the network, it indicates that the start of the target servo protocol stack is abnormal. Accordingly, the error of the start of the servo protocol stack is reported, so as to prompt relevant personnel to perform maintenance in time.

[0045] In step S204, the target starting parameter corresponding to the target servo protocol stack is acquired, where the target starting parameter is for a target bus servomotor.

[0046] In step S205, a preconfigured GSD file is parsed to obtain a target parameter channel corresponding to the target servo protocol stack.

[0047] In step S206, the target starting parameter is transmitted to the target bus servomotor via the target parameter channel.

[0048] In step S207, parameter-response information fed back by the target bus servomotor is received.

[0049] The target bus servomotor identifies the target starting parameter, after the target starting parameter is transmitted to the target bus servomotor via the target parameter channel. For example, the target bus servomotor identifies a length of the parameter, an effectuation manner of the parameter, or correctness of the parameter. The target bus servomotor obtains a result of the identification, generates the parameter-response information according to the result, and feeds the parameter-response information back to the upper controller. The upper controller receives the parameter-response information fed back by the target bus servomotor.

[0050] In step S208, it is determined according to the parameter-response information whether to adjust the target starting parameter. The method goes to step S209 in case of positive determination. No processing is performed in case of negative determination.

[0051] After received, the parameter-response information fed back by the target bus servomotor may be used to determine whether the target starting parameter needs to be

regulated. In case of positive determination, it indicates that the target starting parameter is erroneous, and the process goes to the step S209. In case of negative determination, it indicates that the target starting parameter is normal and needs no processing.

[0052] In step S209, the target starting parameter is adjusted.

5 **[0053]** The target starting parameters is adjusted in case of positive determination in the step S208. For example, adjusted is a length of the parameter, an effectuation manner of the parameter, or the like. Thereby, the starting parameter meets a corresponding starting condition, which ensures correct start of the servomotor.

10 **[0054]** Corresponding to the foregoing method embodiments, an apparatus for starting bus a servomotor over a network is further provided according to embodiments of the present disclosure. Hereinafter description of the apparatus for starting the bus servomotor over the network may refer to that of the foregoing method for starting the bus servomotor over the network, and the vice versa.

15 **[0055]** Reference is made to Figure 3, which is a schematic structural diagram of an apparatus for starting a bus servomotor over a network according to an embodiment of the present disclosure. The apparatus may include a protocol stack determining module 31, a starting parameter acquiring module 32, a parameter channel acquiring module 33, and a network starting module 34.

20 **[0056]** The protocol stack determining module 31 is configured to determine a servo protocol stack as a target servo protocol stack, in a case that a start of the servo protocol stack is detected.

[0057] The starting parameter acquiring module 32 is configured to acquire a target starting parameter corresponding to the target servo protocol stack, where the target starting parameter is for a target bus servomotor.

25 **[0058]** The parameter channel acquiring module 33 is configured to parse a preconfigured GSD file to obtain a target parameter channel corresponding to the target servo protocol stack.

[0059] The network starting module 34 is configured to transmit the target starting parameter to the target bus servomotor via the target parameter channel, so as to start the target bus servomotor over the network according to the target starting parameter.

30 **[0060]** The apparatus is provided according to embodiments of the present disclosure.

The servo protocol stack is determined as the target servo protocol stack, in a case that a start of the servo protocol stack is detected. The target starting parameter corresponding to the target servo protocol stack is acquired, where the target starting parameter is for the target bus servomotor. The preconfigured GSD file is parsed to obtain the target parameter channel
5 corresponding to the target servo protocol stack. The target starting parameter is transmitted to the target bus servomotor via the target parameter channel, to start the target bus servomotor over the network according to the target starting parameter. A GSD file provided with a corresponding relationship between all servo protocol stacks and all parameter channels the starting parameters is configured in advance. Thereby, the starting parameter is
10 directly transmitted to the target bus servomotor via the corresponding target parameter channel, in case of the start of the servo protocol stack. The apparatus accelerates network start of the bus servomotor and improves production efficiency, in comparison with a conventional manner in which network-starting parameters for a bus servomotor are manually inputted.

15 **[0061]** In one embodiment of the present disclosure, the apparatus may include a feedback receiving module, a first determining module, and a parameter adjusting module.

[0062] The feedback receiving module is configured to receive parameter-response information fed back by the target bus servomotor, after the target starting parameter is transmitted to the target bus servomotor via the target parameter channel.

20 **[0063]** The first determining module is configured to determine, according to the parameter-response information, whether to adjust the target starting parameter.

[0064] The parameter adjusting module is configured to adjust the target starting parameter, in a case that the determination of the first determining module is positive.

25 **[0065]** In one embodiment of the present disclosure, the apparatus may include a second determining module and an error reporting module.

[0066] The second determining module is configured to determine whether the start of the target servo protocol stack is normal, after the servo protocol stack is determined as the target servo protocol stack and before the target starting parameter corresponding to the target servo protocol stack is acquired.

30 **[0067]** The starting parameter acquiring module 32 is specifically configured to acquire the

target starting parameter corresponding to the target servo protocol stack, in a case that the start of the target servo protocol stack is determined to be normal.

[0068] The abnormal error reporting module is configured to report an error of the start of the servo protocol stack, in a case that the start of the target servo protocol stack is determined
5 to be abnormal.

[0069] In one embodiment of the present disclosure, the second determining module is configured to determine whether a virtual configuration of the network is consistent with a real configuration of the network. The target servo protocol stack is located in the network.

[0070] Corresponding to the above method embodiments, reference is made to Figure 4,
10 which is a schematic structural diagram of a device for starting bus servomotor over a network according to an embodiment of the present disclosure. The device may include a memory 41 and a processor 42.

[0071] The memory 41 is configured to store a computer program.

[0072] The processor 42 is configured to implement following steps when executing the
15 computer program

[0073] A servo protocol stack is determined as a target servo protocol stack, in a case that a start of the servo protocol stack is detected. A target starting parameter corresponding to the target servo protocol stack is acquired, where the target starting parameter is for a target bus servomotor. A preconfigured GSD file is parsed to obtain a target parameter channel
20 corresponding to the target servo protocol stack. The target starting parameter is transmitted to the target bus servomotor via the target parameter channel, to start the target bus servomotor over the network according to the target starting parameter.

[0074] Illustration of the device provided according to embodiments of the present disclosure may refer to that of the foregoing method embodiments of the method, and would
25 not be repeated herein.

[0075] Corresponding to the above method embodiments, a computer-readable storage medium is further provided according to embodiments of the present disclosure. The computer-readable storage medium stores a computer program. The computer program when executed by a processor implements following steps.

[0076] A servo protocol stack is determined as a target servo protocol stack, in a case that a
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start of the servo protocol stack is detected. A target starting parameter corresponding to the target servo protocol stack is acquired, where the target starting parameter is for a target bus servomotor. A preconfigured GSD file is parsed to obtain a target parameter channel corresponding to the target servo protocol stack. The target starting parameter is transmitted
5 to the target bus servomotor via the target parameter channel, to start the target bus servomotor over the network according to the target starting parameter.

[0077] The computer-readable storage medium may include an USB flash drive, a portable hard drive, a read-only memory (ROM), a random access memory (RAM), a magnetic disk, an optical disk, or another medium that can store program codes.

10 **[0078]** Illustration of the computer-readable storage medium provided according to embodiments of the present disclosure may refer to that of the foregoing method embodiments of the method, and would not be repeated herein.

[0079] The embodiments of the present disclosure are described in a progressive manner, and each embodiment places emphasis on the difference from other embodiments.
15 Therefore, one embodiment can refer to other embodiments for the same or similar parts. Since the apparatus, the device, and the computer-readable storage medium disclosed in the embodiments corresponds to the methods disclosed in the embodiments, the description of the apparatus, the device, and the computer-readable storage medium is simple, and reference may be made to the relevant part of the methods.

20 **[0080]** Specific examples are used herein to describe the principles and embodiments of the present disclosure. The illustration of the above embodiments is only intended to help understand the technical solutions and core concepts of the present disclosure. It should be noted that those skilled in the art can make improvements and modifications to the present disclosure without departing from the principles of the present disclosure, and these
25 improvements and modifications also fall within the protection scope of the claims of the present disclosure.

CLAIMS

1. A method for starting a bus servomotor over a network, comprising:

determining a servo protocol stack as a target servo protocol stack, in a case that a start
5 of the servo protocol stack is detected;

acquiring a target starting parameter corresponding to the target servo protocol stack,
wherein the target starting parameter is for a target bus servomotor;

parsing a preconfigured GSD file, to obtain a target parameter channel corresponding to
the target servo protocol stack; and

10 transmitting the target starting parameter to the target bus servomotor via the target
parameter channel, to start the target bus servomotor over the network according to the target
starting parameter.

2. The method according to claim 1, wherein after transmitting the target starting
15 parameter to the target bus servomotor via the target parameter channel, the method further
comprises:

receiving parameter-response information fed back by the target bus servomotor;

determining, according to the parameter-response information, whether to adjust the
target starting parameter; and

20 adjusting the target starting parameter, in a case that a result of the determining is
positive.

3. The method according to claim 1 or 2, wherein after determining the servo protocol
stack as the target servo protocol stack and before acquiring the target starting parameter
25 corresponding to the target servo protocol stack, the method further comprises:

determining whether the start of the target servo protocol stack is normal;

acquiring the target starting parameter corresponding to the target servo protocol stack,
in a case that the start of the target servo protocol stack is determined to be normal;

reporting an error of the start of the servo protocol stack, in a case that the start of the target servo protocol stack is determined to be abnormal.

4. The method according to claim 3, wherein determining whether the start of the target
5 servo protocol stack is normal comprises:

determining whether a virtual configuration of the network is consistent with a real configuration of the network, wherein the target servo protocol stack is located in the network.

10 5. An apparatus for starting a bus servomotor over a network, comprising:

a protocol stack determining module, configured to determine a servo protocol stack as a target servo protocol stack, in a case that a start of the servo protocol stack is detected;

a starting parameter acquiring module, configured to acquire a target starting parameter corresponding to the target servo protocol stack, where the target starting parameter is for a
15 target bus servomotor;

a parameter channel acquiring module, configured to parse a preconfigured GSD file to obtain a target parameter channel corresponding to the target servo protocol stack; and

a network starting module, configured to transmit the target starting parameter to the target bus servomotor via the target parameter channel, to start the target bus servomotor over
20 the network according to the target starting parameter.

6. The apparatus according to claim 5, further comprising:

a feedback information receiving module, configured to receive parameter-response information fed back by the target bus servomotor, after the target starting parameter is
25 transmitted to the target bus servomotor via the target parameter channel;

a first determining module, configured to determine, according to the parameter-response information, whether to adjust the target starting parameter, and

a parameter adjusting module, configured to adjust the target starting parameter, in a case

that the determination of the first determining module is positive.

7. The apparatus according to claim 5 or 6, further comprising:

5 a second determining module, configured to determine whether the start of the target servo protocol stack is normal, after the servo protocol stack is determined as the target servo protocol stack and before the target starting parameter corresponding to the target servo protocol stack is acquired; and

10 an abnormal error reporting module, configured to report an error of the start of the servo protocol stack, in a case that the start of the target servo protocol stack is determined to be abnormal;

wherein the starting parameter acquiring module is configured to acquire the target starting parameter corresponding to the target servo protocol stack, in a case that the start of the target servo protocol stack is determined to be normal.

15 8. The apparatus according to claim 7, wherein the second determining module is configured to determine whether a virtual configuration of the network is consistent with a real configuration of the network, wherein the target servo protocol stack is located in the network.

20 9. A device for starting a bus servomotor over a network, comprising

a memory, configured to store a computer program, and

a processor, configured to implement the method according to any one of claims 1 to 4 when executing the computer program..

25 10. A computer-readable storage medium, storing a computer program, wherein:

the computer program when executed by a processor implements the method according to any one of claims 1 to 4.