SymbiNet

CFW-11

User's Manual
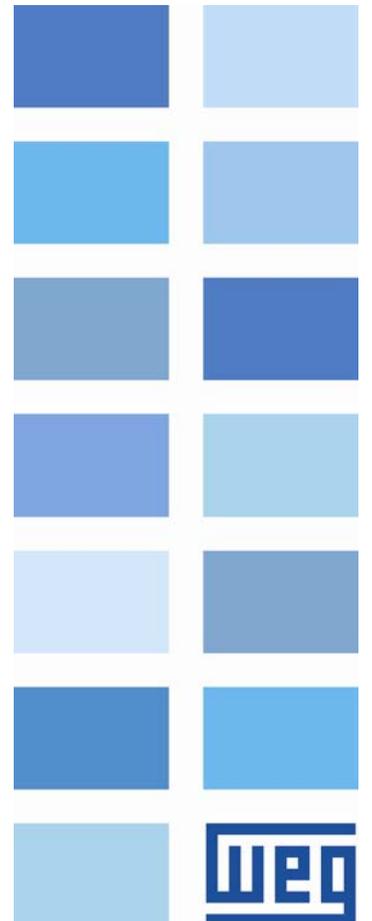
SymbiNet User's Manual

CONTENTS

ABOUT THIS MANUAL

This manual supplies the necessary information for the operation of the CFW-11 frenquency inverter using the SymbiNet protocol. This manual must be used together with the CFW-11 user manual.

ABBREVIATIONS AND DEFINITIONS

ASCII   American Standard Code for Information Interchange

NUMERICAL REPRESENTATION

Decimal numbers are represented by means of digits without suffix. Hexadecimal numbers are represented with the letter 'h' after the number. Binary numbers are represented with the letter 'b' after the number.

1 SYMBINET PROTOCOL

SymbiNet is a communication protocol that enables information exchange directly between devices that support such protocol. SymbiNet communication protocol has the following characteristics:

- All data exchange is done directly between the devices in the network without the need of a master to manage communication
- All the communication programming can be performed using parameters without the need of a configuration tool.
- The programming for exchanging data is performed based on the existing Modbus loggers for the device. One must then know the list of Modbus loggers for the correct data addressing during programming.
- It uses the Publisher / Subscriber mechanism, where each device publishes its data so that one or more subscribers will receive this information. Besides optimizing communication, it allows a decentralized communication control, allowing each device to identify problems and continue communication even if failures occur with one or more members of the network.
- It was designed to operate independently of the communication interface. Depending on the device, it can be used via interfaces such as RS485 or CAN (not simultaneously) in a transparent and similar way to the user.

Details on the implementation of the protocol are not relevant to the user, since the communication is managed directly by the network device. Thus, only information on programming and operation are shown in this document.

1.1 TYPICAL APPLICATION

Among the applications where SymbiNet protocol can be used, we may point out:

- Load division
- Pumping system with multiple pumps
- Speed follower

1.2 LIMITS ON USE OF THE NETWORK

The SymbiNet protocol allows addressing of up to 63 devices in the network. The amount of data that each device can transmit and receive from the other network devices, however, depends on the device.

1.3 THE PUBLISHER/SUBSCRIBER MECHANISM

The Publisher / Subscriber mechanism describes a way of data exchange where each network element declares interest in receiving (or "subscribes") certain data from the other participants in the network, and the elements that have the desired information transmit (or "publish") this information to the whole network.

The SymbiNet protocol uses this mechanism, where the data exchange is performed basically through the following events:

1. **Data Subscription** before starting to exchange data, it is necessary to subscribe to the desired data. Each device in the network must inform the others what data it wants to receive. This is done by sending subscription requests, indicating to the other devices which data each one must transmit. Upon receiving a subscription request, each device saves the requested data in a list.
2. **Data publishing:** once a device has received a subscription request, it must transmit (publish) the requested data to the network periodically. All network devices must receive the published data, filter the data that are of interest and save them locally.

1.4 OPERATION PRINCIPLE

It is critical to understand the principle of operation of the SymbiNet protocol to enable the correct network programming. For this, the following figures illustrate a situation where a device in address # 1 must monitor the states of the device in address # 2, while the device in address # 2 must receive the command information from the address # 1.

Endereço 1   Endereço 2

Interface de Comunicação (CAN, RS485, etc.)

1. Definition of the interface and addresses

In SymbiNet protocol, it is possible to use different physical interfaces, provided that the protocol is available for this interface. Each device in the network is identified by an address, which depends on the type of interface used. It is necessary to know the addresses programmed because they are used as a basis for data exchange.

Endereço 1   Endereço 2

Quero receber dados sobre o estado do endereço 2!

Quero receber dados de comando do endereço 1!

Interface de Comunicação (CAN, RS485, etc.)

2. Data subscription

Once the addresses are defined, it is necessary to program which data each device wants to receive from other network members. This programming is made by indicating which Modbus loggers must be transmitted by other stations, and in which Modbus loggers these data should be saved locally. Once programmed, upon entering the network, each device will automatically indicate via network which data it wishes to receive from other addresses.

Endereço 1   Endereço 2

#1 publica periodicamente os dados solicitados por #2 e vice-versa

Interface de Comunicação (CAN, RS485, etc.)

3. Data publishing

After making the data subscription, each device is responsible for periodically transmitting the data that were requested. The data transmitted by a device are received by the others, which filter the data of interest and save them locally. This way if all devices define what data must be received, the data exchange is performed among all devices in the network according to the desired application.

How to program data exchange, monitor communication states, as well as features of each interface available for communication are described in item 4.

2   SYMBINET COMMUNICATION ACCESSORY

The SymbiNet protocol FOR the CFW-11 frequency inverter is available via CAN or RS485 interfaces. To use these interfaces, it is necessary to use one of the communication accessories available for the product described below. Information about the installation of these modules can be found on the device in the instructions that come with the accessory.

2.1   RS485

The CFW-11 presents two options for using the RS485 interface, described next.

2.1.1   RS485-01 KIT
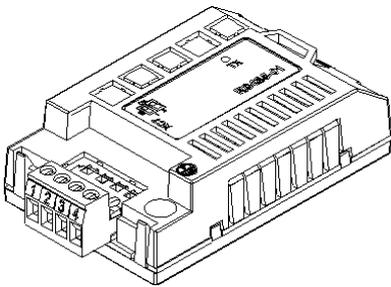
- WEG part number: 10051957.
- Composed by the RS485 communication module (drawing at the left), mounting instructions and fixing screw.
- The interface follows the EIA-485 standard.
- It allows baud rates from 9600 bits/s to 57600 bit/s.
- The interface is electrically isolated and with differential signal, which grants more robustness against electromagnetic interference
- It allows the connection of up to 32 devices to the same segment. More devices can be connected by using repeaters. [1]
- A maximum bus length of 1000 meters.

2.1.2   CAN/RS485-01 KIT
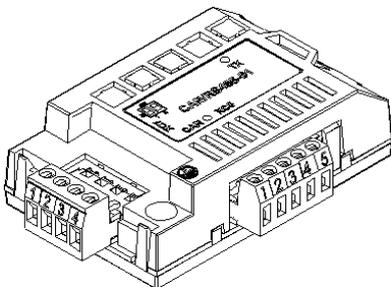
- WEG part number: 10051960.
- Composed by the CAN/RS485 communication module (drawing at the left), mounting instruction and fixing screw.
- It has the same characteristics of the CAN-01 interface, plus an RS485 interface, for applications where the operation with both interfaces is necessary.

> ✓ **NOTE!**
> It is also possible to use a passive Anybus-DC communication module for RS485 interface connected to slot 4 of the CFW-11 frequency inverter. For information about this module, refer to the Anybus-DC communication manual.

2.2   CONNECTOR PINOUT

The RS485 communication module presents a 4-wire plug-in terminal strip (XC7) with the following pinout:

Table 2.1: 4-wire RS485 terminal strip pinout

Terminal	Name	Function
1	A-Line (-)	RxD/TxD negative
2	B-Line (+)	RxD/TxD positive
3	GND	0V isolated from the RS485 circuit
4	Ground	Terra (shield)

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1 The limit number of devices that can be connected to the network depends also on the used protocol. Both interfaces cannot be programmed for SymbiNet protocol simultaneously.

2.2.1 Indications and Switches
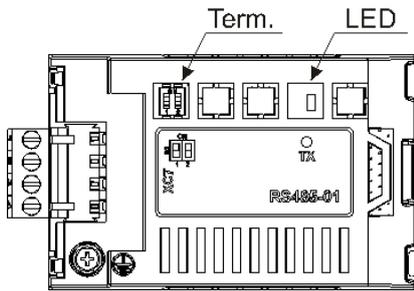
- **TX LED:** LED for the indication of data transmission by the frenquency inverter, in green color.
- **Termination resistor (S1):** switch for enabling the termination resistor, necessary for the RS485 interface. This resistor must be enabled (position ON) only at the devices located at the extremes of the main bus.

2.3 CAN

The CFW-11 has two options to use the CAN interface, which are described below.

2.3.1 CAN-01 KIT
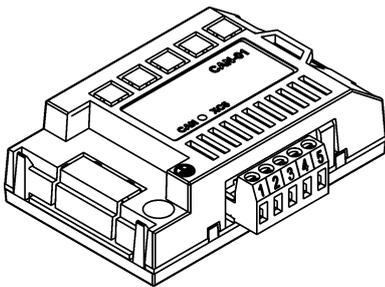
- WEG part number: 10051961.
- Composed by the CAN communication module (drawing at the left), mounting instruction and fixing screw.
- The interface is electrically isolated and with differential signal, which grants more robustness against electromagnetic interference.
- External 24V supply.
- It allows the connection of up to 64 devices to the same segment. More devices can be connected by using repeaters[2].
- A maximum bus length of 1000 meters..

2.3.2 CAN/RS485-01 KIT

It is the same module described in item 2.1.2.

2.3.3 Connector Pinout

The CAN communication module presents a 5-wire plug-in connector (XC5) with the following pinout:
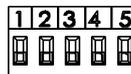
Table 2.2: CAN interface XC5 connector pinout

Pin	Name	Function
1	V-	Power supply negative pole
2	CAN_L	CAN_L communication signal
3	Shield	Cable shield
4	CAN_H	CAN_H communication signal
5	V+	Power supply positive pole

2.3.4 Power Supply

The CAN interface needs an external power supply between the pins 1 and 5 of the network connector. The individual consumption and input voltage data are presented in the next table.

Table 2.3: CAN interface supply characteristics

Supply Voltage (V_{DC})		
Minimum	Maximum	Recommended
11	30	24
Current (mA)		
Typical		Maximum
30		50

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[2] The maximum number of devices that can be connected to the network depends also on the used protocol.

2.3.5 Indications

The CAN interface module have a green LED to indicate that the interface is powered. Further details on the alarms, communications failures and communication states are made through the keypad (HMI) and product parameters.

3 PROGRAMMING

Next, only the CFW-11 frenquency inverter parameters related to the SymbiNet communication will be presented.

3.1 SYMBOLS FOR THE PROPERTIES DESCRIPTION

RO	Read-only parameter
CFG	Parameter that can be changed only with a stopped motor

P0766 – NUMBER OF DATA FOR SENDING

Range:	0 to 36	**Default:** -
Properties:	RO	
Access groups via HMI:	01 PARAMETER GROUPS	
	└ 49 Communication	
	└ 116 SymbiNet	

Description:

Indicates the quantity of Loggers required by the other members of the network, so that the CFW-11 frequency inverter will publish periodically. This publication request is received via network interface and it is automatically requested by the other members of the network depending on the programming performed.

The CFW-11 frequency inverter has a maximum of 36 loggers that can be published. If the other members of the network request a larger quantity of Loggers, the request is ignored. If more than one device requests the same logger, this will be added only once to the list of data for publication.

> ✓ **NOTE!**
> ▪ A list of loggers is not saved in nonvolatile memory, so that this parameter is reset if the device is switched off or reset.
> ▪ Via RS485 interface, if the device is not detecting other stations for a period of time longer than 1 second, this parameter value is reset and a new request for publication must be sent, which is done automatically.
> ▪ Via CAN interface, this parameter value is also reset if the interface is disabled, as when detecting power failure or bus off.

P0767 – STATUS OF THE GROUPS OF LOGGERS

Range:	000000b to 111111b	**Default:** -
Properties:	RO	
Access groups via HMI:	01 PARAMETER GROUPS	
	└ 49 Communication	
	└ 116 SymbiNet	

Description:

The programming of the communication is done based on groups of registers that are transmitted by the other members of the network. In order to identify when the transmitted data are valid, each group of loggers must have an indication, informing if the data are valid or not:

▪ Group of loggers is inactive or in timeout: indicates that the group of loggers is not set locally, or the group of loggers are programmed, but the address in the network responsible for publishing the data had not been publishing them for longer than the timeout set for the data timeout. Another possibility is that the transmission of data has not yet been started, which typically occurs when turning on the device.
▪ Group of loggers is active: indicates that the group of loggers is programmed, and address in the network responsible for publishing the data is sending publications periodically.

This parameter represents a binary field with six bits, where each bit indicates the status of each of the six groups of loggers programmable for the CFW-11 frequency inverter:

Bits	15 to 6	5	4	3	2	1	0
Function	Reserved	Group Status 6	Group Status 5	Group Status 4	Group Status 3	Group Status 2	Group Status 1

Table 3.1: Functions for the bits of parameter P0767

Bits	Values
Bit 0 Group Status 1	0: the group is active and data are updated. 1: the group is inactive or in timeout.
Bit 1 Group Status 2	0: the group is active and data are updated. 1: the group is inactive or in timeout.
Bit 2 Group Status 3	0: the group is active and data are updated. 1: the group is inactive or in timeout.
Bit 3 Group Status 4	0: the group is active and data are updated. 1: the group is inactive or in timeout.
Bit 4 Group Status 5	0: the group is active and data are updated. 1: the group is inactive or in timeout.
Bit 5 Group Status 6	0: the group is active and data are updated. 1: the group is inactive or in timeout.
Bits 6 to 15	Reserved.

Thus, if a machine receives a group of loggers from another address and a communication failure occurs, it is possible to identify this failure through the status of the group, which should go to the timeout status. The time set for the timeout of the data depends on the device and on the communication interface used:

- Interface RS485: the timeout time for data is 200ms, plus some extra time for each of the addresses which may be present in the network - P0796. The value of this additional time depends on the used baud rate:
  - 9600bps   -> 250ms
  - 19200bps   -> 150ms
  - 38400bps   -> 120ms
  - 57600bps   -> 100ms

  For example, for a network communicating at 19200bps, with at most three devices in the network (P0796 = 3), the total time for timeout will be 200ms + 3 x 150ms = 650ms.
- CAN interface: The time for data timeout is fixed at 200ms.

P0768 – GROUP 1: SOURCE ADDRESS

P0772 – GROUP 2: SOURCE ADDRESS

P0776 – GROUP 3: SOURCE ADDRESS

P0780 – GROUP 4: SOURCE ADDRESS

P0784 – GROUP 5: SOURCE ADDRESS

P0788 – GROUP 6: SOURCE ADDRESS

Range:	0 to 63	**Default:** 0

Properties:

Access groups via HMI:
01 PARAMETER GROUPS
└ 49 Communication
└ 116 SymbiNet

Description:
It allows programming, for each group of loggers available for the CFW-11, the source address for publication of the data. The address used by the CFW-11 frequency inverter depends on the interface used for communication:

- RS485: the address of the device in the network is programmed by P0308.

▪ CAN: the address of the device in the network is programmed by P0701.

The value 0 (zero) disables the use of the respective group. For values between 1 and 63, the CFW-11 frequency inverter sends a telegram to the specified address, requesting the publication of the data programmed in the group. This request is made periodically, while the status of the group in P0759 is in the "Inactive" status.

P0769 – GROUP 1: SOURCE INITIAL LOGGER

P0773 – GROUP 2: SOURCE INITIAL LOGGER

P0777 – GROUP 3: SOURCE INITIAL LOGGER

P0781 – GROUP 4: SOURCE INITIAL LOGGER

P0785 – GROUP 5: SOURCE INITIAL LOGGER

P0789 – GROUP 6: SOURCE INITIAL LOGGER

Range:	0 to 65535	**Default:** 0
Properties:		
Access groups via HMI:	01 PARAMETER GROUPS └ 49 Communication └ 116 SymbiNet	

Description:
It allows programming, for each group of loggers available for the CFW-11, the number of Modbus initial logger, whose value sequence must be published by the device defined in the source address. Besides the source initial logger, other loggers will also be published in sequence, as defined in the parameters of quantity of Loggers.

It is necessary to know the list of Modbus loggers of the source device for the correct programming of these parameters. If the number of some invalid or nonexistent logger is programmed, the source device sends the value 0 (zero) to such logger.

P0770 – GROUP 1: DESTINATION INITIAL LOGGER

P0774 – GROUP 2: DESTINATION INITIAL LOGGER

P0778 – GROUP 3: DESTINATION INITIAL LOGGER

P0782 – GROUP 4: DESTINATION INITIAL LOGGER

P0786 – GROUP 5: DESTINATION INITIAL LOGGER

P0790 – GROUP 6: DESTINATION INITIAL LOGGER

Range:	0 to 65535	**Default:** 0
Properties:		
Access groups via HMI:	01 PARAMETER GROUPS └ 49 Communication └ 116 SymbiNet	

Description:
It allows programming, for each group of loggers available for the CFW-11, the number of Modbus initial logger where the value sequence must be published by the device defined in the source address. Besides the source initial logger, other loggers will also be published in sequence, as defined in the parameters of quantity of Loggers.

It is necessary to know the list of Modbus loggers of the source device for the correct programming of these parameters. If the number of some invalid or nonexistent local logger is programmed, the value received will be ignored.

✅ **NOTE!**
For the CFW-11, valid addresses are 0 to 1059 (inverter parameters), and 8000-8199 (SoftPLC WORD markers).

P0771 – GROUP 1: QUANTITY OF LOGGERS

P0775 – GROUP 2: QUANTITY OF LOGGERS

P0779 – GROUP 3: QUANTITY OF LOGGERS

P0783 – GROUP 4: QUANTITY OF LOGGERS

P0787 – GROUP 5: QUANTITY OF LOGGERS

P0791 – GROUP 6: QUANTITY OF LOGGERS

Range:	1 to 6	**Default:** 1
Properties:		

Access groups via HMI:
01 PARAMETER GROUPS
  └ 49 Communication
    └ 116 SymbiNet

Description:
The parameters for programming the source and destination initial loggers indicate the number of the first logger whose value will be published by the remote devices and saved locally. Besides the initial logger, other loggers will also be published and saved in sequence, according to the quantity of Loggers defined in this parameter.

P0796 – LONGEST ADDRESS ALLOWED IN RS485 INTERFACE

Range:	1 to 63	**Default:** 63
Properties:		

Access groups via HMI:
01 PARAMETER GROUPS
  └ 49 Communication
    └ 116 SymbiNet

Description:
Specific parameter of the SymbiNet protocol via RS485 interface; for other interfaces this parameter has no function. It allows programming the longest address used by a device in the SymbiNet network, optimizing the communication. All the network devices must be set with the same value in this parameter.

With the standard value (63) for this parameter, any address set for the device can participate in the communication. However, that will make the devices in the network send requests searching for devices in all the address range, hindering the data exchange cycle and the entrance of new devices in the network. By limiting the longest address accepted, addresses above this value are ignored, preventing the search for unnecessary addresses and optimizing the communications.

It is recommended that the devices in the network be addressed in sequence from address 1 on, and that this parameter be set with the same value as the last address of the network.

P0797 – NUMBER OF TOKENS RECEIVED

Range:	0 to 65535		**Default:** -
Properties:			
Access groups	01 PARAMETER GROUPS		
via HMI:	└ 49 Communication		
	└ 116 SymbiNet		

Description:

Specific parameter of the SymbiNet protocol via RS485 interface; for other interfaces this parameter has no function. It allows observing the quantity of tokens received by the device. It has basically two functions:

- It allows viewing if the device is communicating correctly with other devices on the bus.
- The rate of increment in the quantity of tokens received also indicates the update rate of the data, since each device publishes its data whenever a token is received. With the RS485 interface, this rate is not fixed and depends on the number of devices, quantity of Loggers communicated and baud rate used.

P0798 – NEXT ADDRESS DETECTED IN RS485 INTERFACE

Range:	0 to 63		**Default:** -
Properties:			
Access groups	01 PARAMETER GROUPS		
via HMI:	└ 49 Communication		
	└ 116 SymbiNet		

Description:

Specific parameter of the SymbiNet protocol via RS485 interface; for other interfaces this parameter has no function. In the SymbiNet protocol via RS485, the devices scan the addresses, looking for the next address active for which it must transmit the token telegram. This parameter allows checking what the next detected address of the device in the network is, providing diagnosis if the device sequence was detected properly as scheduled.

> ✓ **NOTE!**
> - If the local address is the same as the last one allowed (P0796), or the device scans but finds no device with address above the current one, it will continue the search from address 1.
> - If this parameter has value 0 (zero), it means that so far it has not found another device in the network.
> - This parameter provides the logical address of the next device, due to the parameterization performed, and not the next physical device, due to the network installation.

3.2 PARAMETERS COMMON WITH OTHER FUNCTIONS AND INTERFACES

Besides the specific parameters of the SymbiNet protocol, described above, other parameters related to other functions of the device must also be programmed for the correct functioning of communication.

A detailed description of these parameters can be obtained from the Serial Communication Manual or CANopen Communication Manual of the CFW-11 frequency inverter.

3.2.1 Parameters for Configuration of the RS485 Interface

- P0312 – Serial Protocol: it must be programmed with the SymbiNet option.
- P0308 –Serial Address
- P0310 – Serial Baud Rate
- P0311 – Configuration of Bytes
- P0314 – Serial Watchdog

3.2.2 Parameters for Configuration of the CAN Interface

- P0700 – CAN Protocol: must be programmed with the SymbiNet option.

- P0701 – CAN Address
- P0702 – CAN Baud Rate
- P0703 –Bus Off Reset

3.2.3   Parameters for Device Control and Monitoring

- P0313 – Action for Communication Error SymbiNet protocol considers communication errors the events of A128 (RS485), besides A133 and A134 (CAN).
- P0680 – Logic Status
- P0681 – Motor Speed in 13 Bits
- P0682 – Command via Serial
- P0683 – Speed Reference via Serial
- P0684 – Command via Serial
- P0685 – Speed Reference via Serial

4 OPERATION IN THE SYMBINET NETWORKOPERATION IN THE SYMBINET NETWORK

Below are the SymbiNet protocol characteristics specific for the CFW-11 frequency inverter.

4.1 PROGRAMMING METHOD

The programming for data exchange is performed through "groups of loggers." A group of loggers is a sequence of Modbus loggers, which must be transmitted by the address that is publishing these data (Publisher), and will be received by all subscribers of these data. The programming of each group is based on the following parameters:

- **Source Address** the address of the remote device that will transmit data must be indicated.
- **Initial Logger of the Source** indicates the number of the first Modbus logger the remote device must transmit.
- **Initial Logger of the Destination** indicates the number of the first local Modbus logger where the data will be saved.
- **Quantity of Loggers:** from the first Modbus logger, it indicates how many loggers should be transmitted in sequence.

The CFW-11 frequency inverter offers 6 logger groups; each group can communicate 1 to 6 loggers, in a total of up to 36 loggers that can be received by the device. These groups are programmed via parameters P0760 to P0783, described in item # REF {Parameterization}.

For example, for data exchange between two CFW-11, in addresses # 1 and # 2, the device in address # 1 has a group with the following programming:

- Source Address   = 2
- Initial Logger of the Source   = 680
- Quantity of Loggers:= 2
- Initial Logger of the Destination   = 1010

This will cause the device in address # 2 to publish 2 loggers, 680 and 681, which correspond to parameters P0680 (Status Word) and P0681 (Motor Speed). The values of these two loggers will be received by address # 1, and saved locally in loggers 1010 and 1011 respectively, which are equivalent to SoftPLC user's parameters P1010 and P1011.
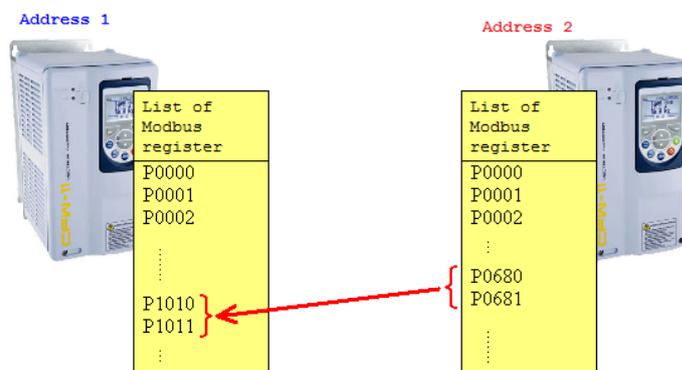
Figure 4.1: *Example of data transfer*

4.2 DATA FOR PUBLICATION

For publication of the data, the devices send messages to other members of the network requesting what data must be transmitted. Each time a request for publication is received, loggers are added to the list of local data for publication. For the CFW-11 frequency inverter, the loggers that can be programmed for communication include:

- Parameters of the CFW-11 frequency inverter, including SoftPLC user's parameters. For these data, the number of the parameter is equivalent to the number of the logger.

- WORD markers also available for operation via SoftPLC. WORD markers are available from the logger 8000 to 8199

If the same logger is requested by more than one device in the local list of data, it is saved only once. Its value is also transmitted only once, and its value is received simultaneously by all requesting device.

There is also a limit of 36 loggers that can be published by a CFW-11. It is necessary that the total quantity of loggers requested by all other network devices for a single CFW-11 does not exceed this limit. Parameter P0758 indicates the quantity of Loggers in the list of data to be published by the device, providing a diagnosis according to the programming made by other network device.

4.3   STATUS OF THE GROUPS

For each group of existing loggers, it is necessary to know if the programmed data was received correctly. Parameter P0759 represents a binary field with 6 bits, where each bit indicates the status of each of the 6 groups available for the CFW-11 frequency inverter:

- Bit value = 1: the respective group is disabled or timeout occurred at the receipt of the data.
- Bit value = 0: the respective group is active and data are updated.

The value of this parameter can be used, for example, for diagnostics during a startup phase, or in a SoftPLC application for identifying communication errors and perform actions due to these errors.

4.4   AVAILABLE INTERFACES

The CFW-11 frequency inverter enables communication using the protocol SymbiNet through two different interfaces[3]:

- RS485: uses one of the accessories connected to the RS485 interface in slot 3 (RS485 or CAN/RS485-01-01)
- CAN: uses one of the accessories for CAN interface connected to slot 3 (CAN-01 or CAN/RS485-01)

In addition to the general characteristics of the protocol common to all interfaces, such as programming of groups and monitoring of status, each interface has some specific features. The description of these features is found below.

4.5   SYMBINET VIA INTERFACE RS485

When used via the RS485 interface, the SymbiNet protocol uses the token pass mechanism to allow all the devices to be able to access the communication bus without conflicts. In this mechanism, each device follows a routine as described below:

- A machine receives a telegram from the token device that is programmed with the previous address.
- After receiving the token, this device can transmit telegrams to perform different activities:
    - Identifying other devices in the network
    - Make subscriptions
    - Publish its data
- After performing these functions, it transmits the token to the next address detected in the network, and waits until the token passes by all other devices and is transmitted to him again. While waiting, it must monitor the bus, for example, to receive data published by the other network devices.

This mechanism operates automatically and has protections to detect communication failures, loss of tokens or input / output of new devices in the network. Thus, the operation of the devices in the network becomes transparent to the user. Some aspects of this communication, however, are important for configuration and diagnosis operations mentioned below.

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[3] Both interfaces cannot be programmed for the SymbiNet protocol simultaneously.

4.5.1   Installation of the RS485 Interface

The installation using the RS485 interface is similar to that described for the other serial protocols available for the device. For further details, you should follow the information described in the Serial Communication Manual for CFW-11.

4.5.2   Network Configuration

- P0312 – Serial Protocol: to enable the SymbiNet protocol, you must set this option through this parameter.
- P0308 –Serial Address: valid address values for SymbiNet protocol are 1 to 63.
- P0311 – Configuration of Bytes: parity and stop bits are defined by this parameter.
- P0310 – Baud Rate.

4.5.3   Configurations and Diagnosis Specific to SymbiNet via RS485

- P0796 – Longest Address Allowed: the longest address acceptable in the SymbiNet network for the application must be set in order to optimize communication.
- P0797 – Number of Tokens Received: indicates how many token telegrams were received by the device, providing diagnosis on the operation of the network and the data update rate.
- P0798 – Next Address Detected: indicates to whom the device will transmit the token when all operating telegrams are sent.

The only mistake existing for the SymbiNet operation via RS485 is timeout in the serial communication - A128/F228. This error is enabled through the P0314, and occurs if the device stops receiving valid telegrams from the network.

4.5.4   Data Update Time via RS485

The time involved in the data update using the RS485 interface depends on a number of factors such as:

- Quantity of devices in the network
- Quantity of loggers published for each device
- Baud Rate used in the network

Typically, for an application containing two devices, each publishing 6 loggers, even with the lowest rate of communication, the data update time is less than 100ms. This time may vary if there are no active devices in the network, groups of loggers in the timeout status or occurrence of communication errors.

The recommended way to identify the update time is using the counter of number of tokens received - P0797. Since for each token received, a data publication telegram is sent, the increment rate of this parameter also represents the data update rate.

4.6   SYMBINET VIA CAN INTERFACE

The CAN interface has mechanisms that enable the transmission of messages by different devices, without causing conflicts, even without the existence of a master in the network. This way, it is not necessary to define one way of managing the bus, like the token pass in the RS485. The functions in the device are basically summarized to:

- Send telegrams subscribing the desired data.
- Publish the data requested by other devices.
- Monitor the data published by the other devices.

4.6.1   Installation of the CAN Interface

The installation using the CAN interface is similar to that described for the other serial protocols available for the device. For further details, refer to the CANopen Communication Manual for CFW-11.

4.6.2   Network Configuration

- P0700 – CAN Protocol: to enable the SymbiNet protocol, you must set this option through this parameter.

- P0701 – CAN Address: valid address values for SymbiNet protocol are 1 to 63.
- P0702 – Baud Rate.

4.6.3   Configurations and Diagnosis Specific to SymbiNet via CAN

There are no specific diagnoses for the SymbiNet protocol operating via CAN interface. The diagnoses of the interface are the same as for other existing CAN-based protocols, such as CANopen and DeviceNet, which include an indication of the status of the CAN interface and the number of telegrams sent and received. Communication errors related to the interface - Bus Off and No Power - are also indicated.

4.6.4   Data Update Time via CAN

The data update time via CAN interface is fixed at 100ms, regardless the baud rate, quantity of published data or number of devices in the network. Every 100ms, each station transmits all data in its data list for publication. Data are transmitted using multiple CAN telegrams, where each telegram can transmit the value of one or two loggers.

5 FAULTS AND ALARMS RELATED TO THE SYMBINET COMMUNICATION

A128/F228 – TIMEOUT FOR SERIAL COMMUNICATION

Description:
It is the only alarm/fault related to the serial communication indicates that the equipment stopped receiving valid serial telegrams for a period longer than the one programmed in P0314.

Operation:
The parameter P0314 allows programming a period of time during which the equipment must receive at least one valid telegram via the RS232 / RS485 serial interface – with address and error-checking field correct – otherwise, it will be considered that there was any problem in the serial communication. The time counting initiates after the reception of the first valid telegram. This function can be used by any serial protocol supported by the equipment.

After the serial communication timeout has been identified, the A128 alarm or F228 fault message will be showed on the HMI, depending on the P0313 programming. For alarms, if the communication is reestablished and new valid telegrams are received, the alarm indication will be removed from the HMI.

Possible Causes/Correction:
- Verify factors that could cause failures in the communication (cables, installation, and grounding).
- Make sure that the master sends telegrams to the equipment in intervals shorter than the programmed in P0314.
- Disable this function at P0314.

A133/F233 – CAN INTERFACE WITHOUT POWER SUPPLY

Description:
It indicates that the CAN interface does not have power supply between the pins 1 and 5 of the connector.

Actuation:
In order that it be possible to send and receive telegrams through the CAN interface, it is necessary to supply external power to the interface circuit.

If the CAN interface is connected to the power supply and the absence of power is detected, the alarm A133 – or the fault F233, depending on the P0313 programming, will be signalized through the HMI. If the circuit power supply is reestablished, the CAN communication will be reinitiated. In case of alarms, the alarm indication will also be removed from the HMI.

Possible Causes/Correction:
- Measure the voltage between the pins 1 and 5 of the CAN interface connector.
- Verify if the power supply cables have not been changed or inverted.
- Make sure there is no contact problem in the cable or in the CAN interface connector.

A134/F234 – BUS OFF

Description:
The *bus off* error in the CAN interface has been detected.

Actuation:
If the number of reception or transmission errors detected by the CAN interface is too high[4], the CAN controller can be taken to the *bus off* state, where it interrupts the communication and disables the CAN interface.

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[4] For more information on the error detection, refer to the CAN specification.

In this case the alarm A134 – or the fault F234, depending on the P0313 programming, will be signalized through the HMI. In order that the communication be reestablished, it will be necessary to cycle the power of the product, or remove the power supply from the CAN interface and apply it again, so that the communication be reinitiated.

Possible Causes/Correction:
- Verify if there is any short-circuit between the CAN circuit transmission cables.
- Verify if the cables have not been changed or inverted.
- Verify if all the network devices use the same baud rate.
- Verify if termination resistors with the correct values were installed only at the extremes of the main bus.
- Verify if the CAN network installation was carried out in proper manner.