

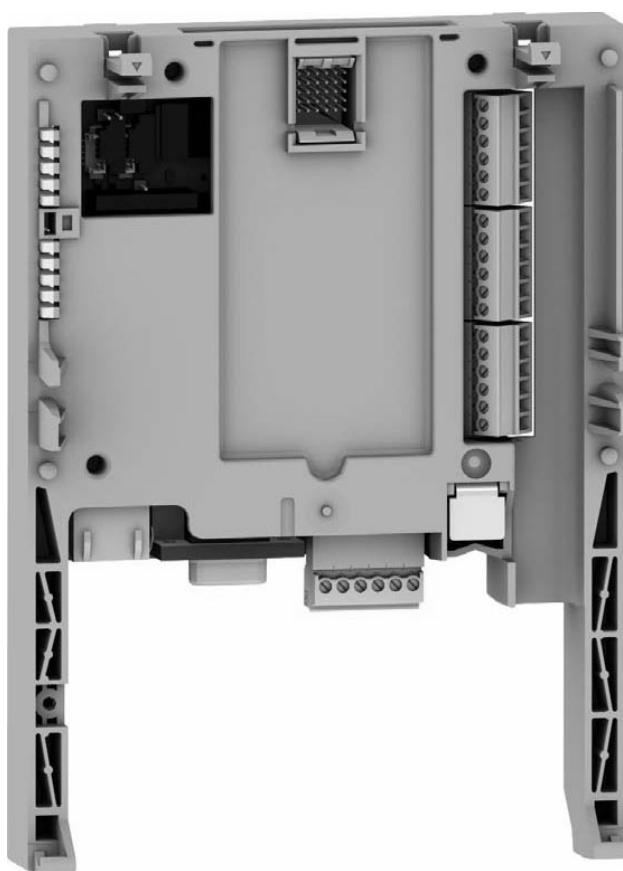
# Altivar AFE

Active Front End

Option for Altivar 61 & Altivar 71

## Operating instructions "Communication Bridge"

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# General remarks

The following symbols should assist you in handling the instructions:



Advice, tip !



General information, note exactly !

The requirements for successful commissioning are correct selection of the device, proper planning and installation. If you have any further questions, please contact the supplier of the device.

## Capacitor discharge !

Before performing any work on or in the device, disconnect it from the mains and wait at least 15 minutes until the capacitors have been fully discharged to ensure that there is no voltage on the device.

## Automatic restart !

With certain parameter settings it may happen that the Active Front End restarts automatically when the mains supply returns after a power failure. Make sure that in this case neither persons nor equipment is in danger.

## Commissioning and service !

Work on or in the device must be done only by duly qualified staff and in full compliance with the appropriate instructions and pertinent regulations. In case of a fault contacts which are normally potential-free and/or PCBs may carry dangerous voltages. To avoid any risk to humans, obey the regulations concerning "Work on Live Equipment" explicitly.

## Terms of delivery

The latest edition "General Terms of Delivery of the Austrian Electrical and Electronics Industry Association" form the basis of our deliveries and services.

## Specifications in this document

We are always anxious to improve our products and adapt them to the latest state of the art. Therefore, we reserve the right to modify the specifications given in this document at any time, particular those referring to weights and dimensions. All planning recommendations and connection examples are non-binding suggestions for which we cannot assume liability, particularly because the regulations to be complied depend on the type and place of installation and on the use of the devices.

All foreign-language translations result from the German or English version. Please consider those in case of unclarity.

## Basis of contract

The specifications in text and drawings of this document are no subject of contract in the legal sense without explicit confirmation.

## Regulations

The user is responsible to ensure that the device and its components are used in compliance with the applicable regulations. It is not permitted to use these devices in residential environments without special measures to suppress radio frequency interferences.

## Trademark rights

Please note that we do not guarantee that the connections, devices and processes described herein are free from patent or trademark rights of third parties.

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# Communication Bridge

## *Altivar AFE*

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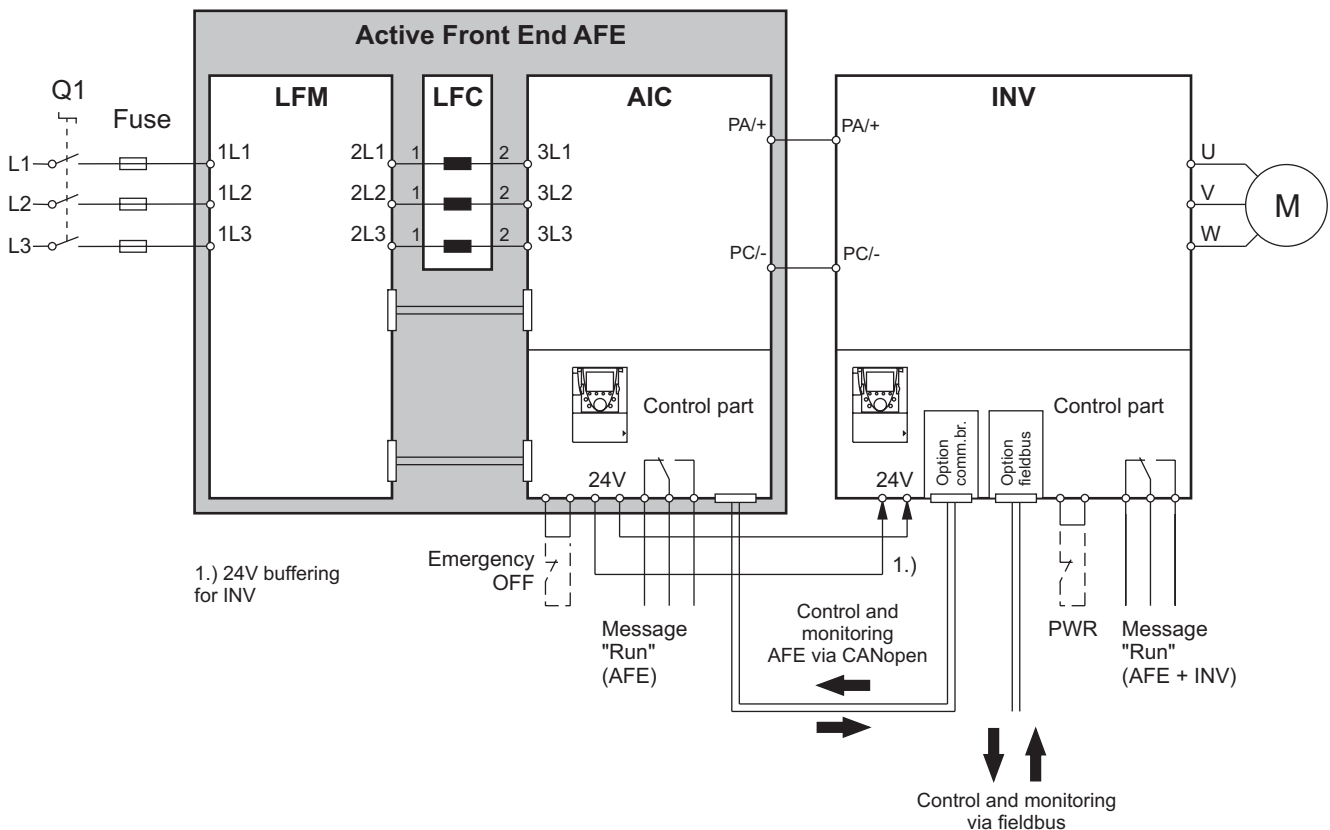
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# Communication Bridge

## Option card "Communication bridge"

### Functional principle

In combination with a fieldbus card the "Communication bridge" card acts as compiler (bridge) between a fieldbus and a CANopen bus. Thus it is possible to communicate with the Active Front End unit(s) via fieldbus. Up to 4 Active Front End units can be connected at the CANopen bus.

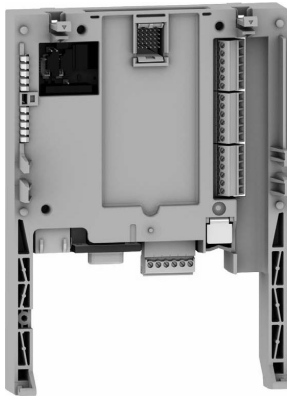


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The "Communication bridge" card is installed in combination with a fieldbus card in the inverter. Via the fieldbus it is possible to address the inverter as well as the Active Front End units.

- ☞ The CANopen bus, which is provided by the "Communication bridge" card, only serves for control of the Active Front End units. It cannot be used for further devices.
  - ☞ When a CANopen or Modbus is used as fieldbus system, we recommend direct control without using the "Communication bridge" card.
  - ☞ When an Ethernet card is used as fieldbus, the IO scanner of the card has to be configured external. This can be read in the description of the Ethernet card.
- For all other fieldbus cards no additional settings have to be carried out.

## Description

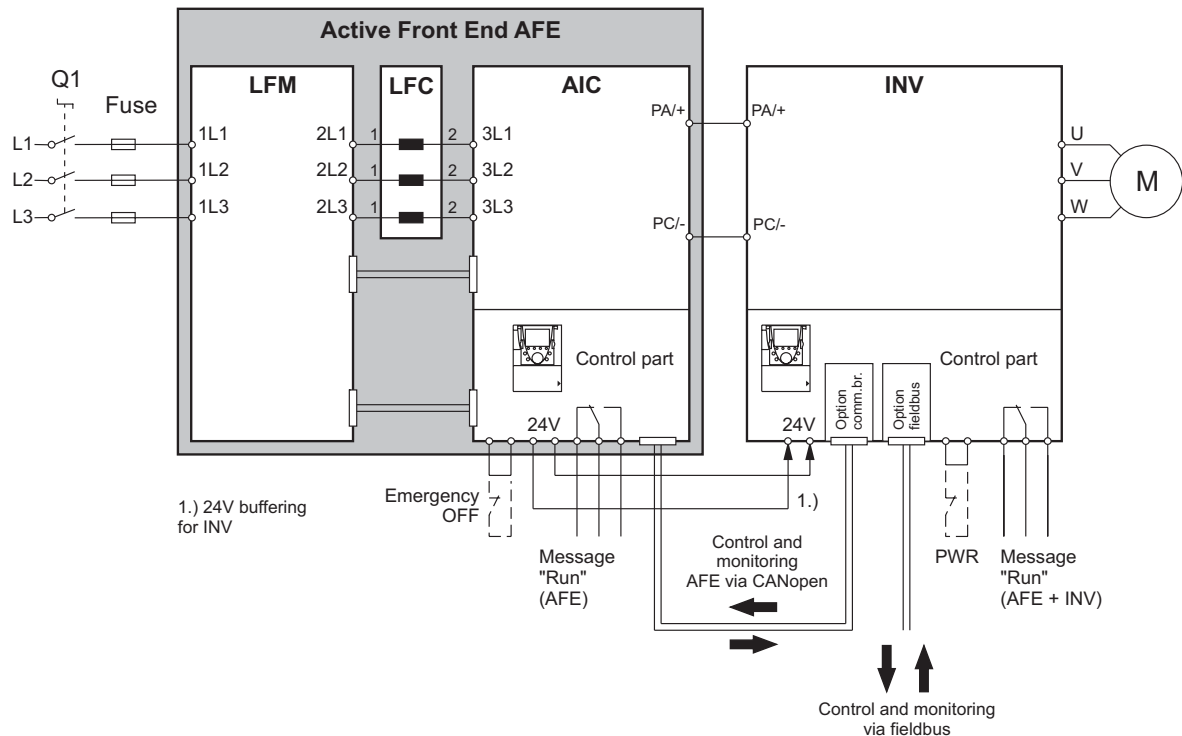


The option card "Communication bridge" enables indirect connection of the Active Front End AFE to further fieldbus systems.

This option card serves as compiler between two fieldbus systems. It is installed together with a fieldbus card in an inverter INV. By means of this combination it is possible to address the inverter as well as up to 4 Active Front End units AFE.

The communication between the option card "Communication bridge" and the Active Front End unit(s) takes place via CANopen.

## Application



The control and status word of the inverter is used for control and monitoring of the Active Front End unit(s).

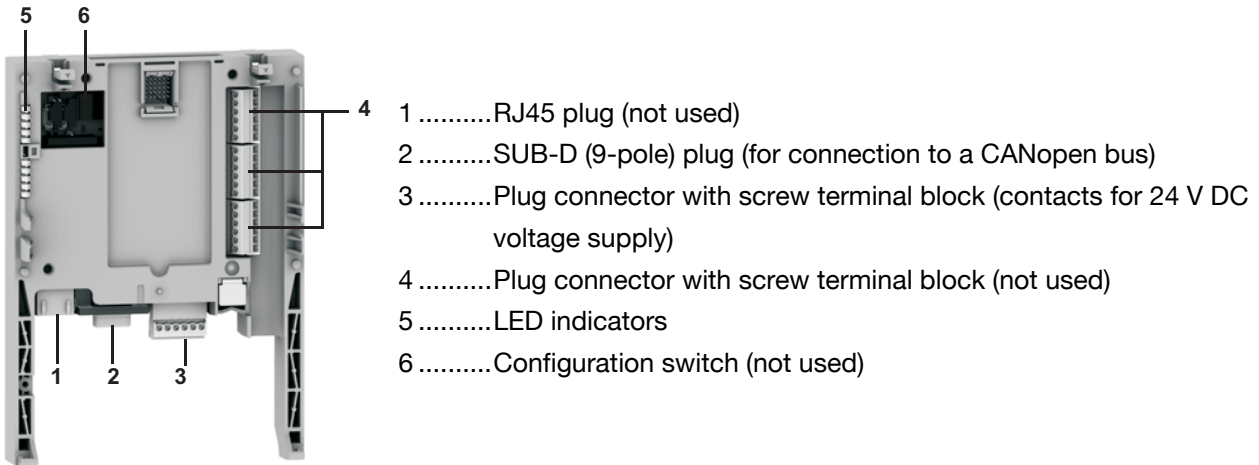
The management of the control and status words has to be realised in the control system (PLC, ...).



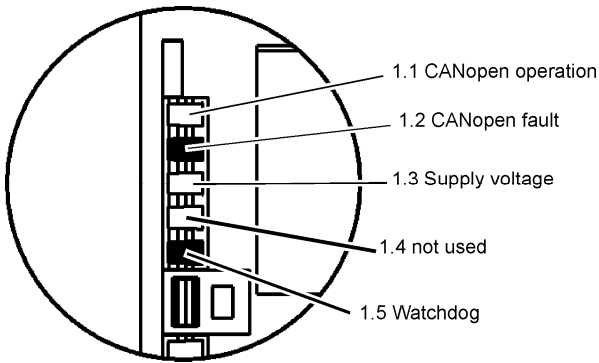
As the option card "Communication bridge" can be only used together with an option card "Fieldbus", there are no further card slots available at the inverter.

## Design

The option card "Communication bridge" is a preprogrammed "Controller inside card".



## LED indicators



The "Communication bridge" card is equipped with 5 LEDs which are visible through the semitransparent windows at the front of the Altivar 61/71.

| LED                   | Color | State                  | Description  |
|-----------------------|-------|------------------------|--|
| 1.1 CANopen operation | green | Off                    | CANopen master in STOP state   |
|                       |       | Flashing               | CANopen master in READY state  |
|                       |       | On                     | CANopen master is in operation (RUN)   |
| 1.2 CANopen fault     | red   | Off                    | No fault at the CANopen bus  |
|                       |       | 1x per second flashing | The fault memory of the CANopen master is full                                       |
|                       |       | 2x per second flashing | Monitoring fault: fault at a bus subscriber (CANopen slave) or Heartbeat             |
|                       |       | On                     | CANopen master is switched off   |
| 1.3 Supply voltage    | green | Off                    | "Communication bridge" card is not supplied  |
|                       |       | On                     | "Communication bridge" card is supplied (with 24 V DC)                               |
| 1.4 not used          |       |                        | Is not used  |
| 1.5 Watchdog          | red   | On                     | Watchdog fault: The program of the "Communication bridge" card has generated a fault |

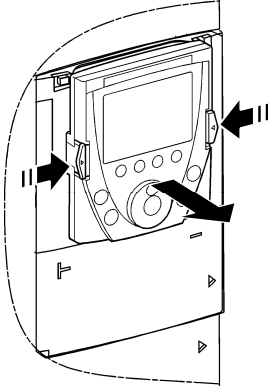
## Installation of the option card "Communication bridge"

Installing of the option card is finished after a few steps.



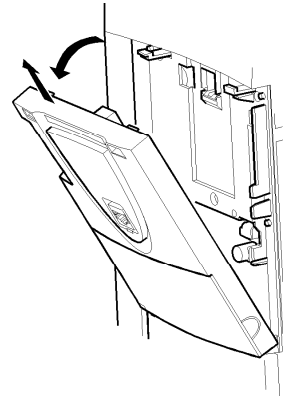
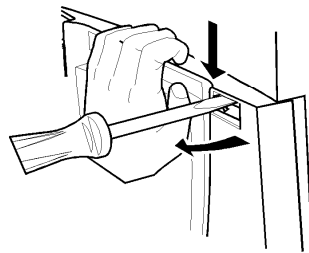
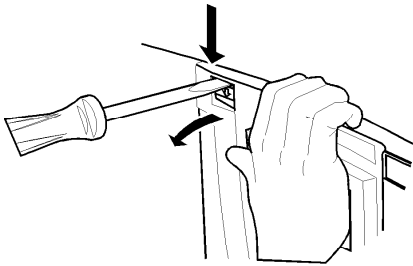
Only install the option card when there is no voltage present.

1. Remove the operating panel from the front side of the device.



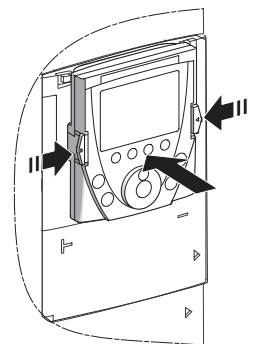
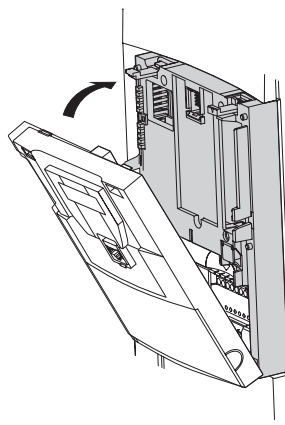
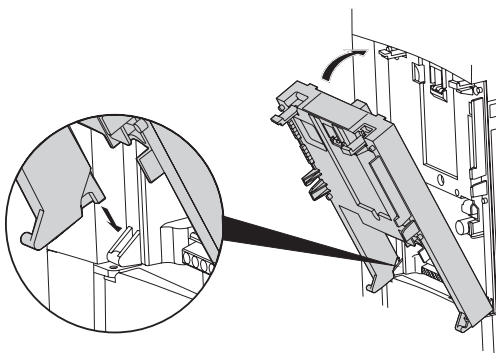
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2. Remove the front cover of the device by releasing both mechanical interlocks.



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3. Mount the option card.



# Fieldbus communication

## Specification

In order to address the inverter via the fieldbus system, only the control word and the two reference values have to be transmitted. The inverter responds with a status word.




| Index | Control words            | Status words           |
|-------|--------------------------|------------------------|
| 0     | Control word inverter    | Status word inverter   |
| 1     | Reference value inverter | Actual value inverter  |
| 2     | Reference value inverter | Actual value inverter  |
| 3     | <b>Control word AFE</b>  | <b>Status word AFE</b> |
| 4     | Not used                 | Actual value AFE       |
| 5     | Not used                 | Actual value AFE       |
| 6     | Not used                 | Actual value AFE       |
| 7     | Not used                 | Actual value AFE       |

In order to address an Active Front End unit at the CANopen bus, its control word and its reference values have to be transmitted to the inverter. For this purpose the control word with index 3 has to be encoded from the control system with the data for the AFE. This control word is filtered from the "Communication bridge" card and is transmitted to the CANopen bus. Any transmitted reference values in the control words 4 to 7 are canceled. The addressed Active Front End unit responds the status word and the actual values. These are written from the communication bridge into the status words of the inverter (index 3 to 7). The inverter transmits its status words via the respective fieldbus to the control system (PLC, etc.). Thus the status and the address of the addressed Active Front End unit are mapped in the status word with index 3 in the inverter. The actual values of the Active Front End unit are in the status words with index 4 to 7.

The inverter can be controlled via the control words 0 to 2 and can be monitored via the status words 0 to 2.

Control has to be realised by the customer. During communication with the Active Front End unit via the "Communication bridge" card it has to encode the control word of the Active Front End unit into the control words of the inverter. Furthermore, the control has to read the status words of the respective Active Front End unit.

With the "Communication bridge" only a cyclic query of the status word and the actual values is possible. As the "Communication bridge" card enables a connection with up to 4 AFEs, it has to be observed that the cycle time at the CANopen is different to the cycle time at the fieldbus.

-  The CANopen bus provided by the "Communication bridge" is only designed for the communication with one or several (maximum 4) Active Front End units. If other subscribers are connected to the CANopen bus and the Active Front End unit is still in operation, we exclude any guarantee or liability in case of breakdown.
-  The control of the Active Front End units and the evaluation of the transmitted data have to be carried out by the control system (e.g. PLC, ...).
-  The structure of the control words and the status words of the inverter are described in the respective instruction of the fieldbus of the fieldbus card.



## Control word

The control word with index 3 of the inverter, which can be used for reference assignment, is used for control of an Active Front End unit at the CANopen bus.

In order to control an Active Front End unit, the control word with index 3 of the inverter has to be structured as follows:

| Structure of control word 3 (control word for the AFE) |  |                         |
|--|--|-------------------------|
| Bit 15   |  |                         |
| Bit 14   | CANopen bus address of the AFE           |                         |
| Bit 13   |  |                         |
| Bit 12   | Trip request - Fault at the superior bus |                         |
| Bit 11   |  |                         |
| Bit 10   | Control O.K.                             | No control              |
| Bit 9  | -  | -                       |
| Bit 8  | -  | -                       |
| Bit 7  | Reset                                    | -                       |
| Bit 6  | -  | -                       |
| Bit 5  | -  | -                       |
| Bit 4  | -  | -                       |
| Bit 3  | Operation released                       | Lock operation          |
| Bit 2  | Operating condition                      | Off 3 (Fast stop)       |
| Bit 1  | Operating condition                      | Off 2 (Impulse inhibit) |
| Bit 0  | On                                       | Off 1                   |
|  | High = 1                                 | Low = 0                 |

Bits 13 to 15 include the CANopen bus address of the respective Active Front End unit to be addressed.



The CANopen bus addresses of the AFEs are not arbitrary.

The Active Front End unit has to be parameterised to an address between 2 and 5.

Encoding of the CANopen bus address has to be realised in the control word as follows:

| AFE CAN-address | Bit 15 | Bit 14 | Bit 13 | AFE no. |
|-----------------|--------|--------|--------|---------|
| 2               | 0      | 0      | 1      | 1       |
| 3               | 0      | 1      | 0      | 2       |
| 4               | 0      | 1      | 1      | 3       |
| 5               | 1      | 0      | 0      | 4       |

This assignment is defined by the "Communication bridge" card. Furthermore it is necessary to adjust the CANopen bus address correctly at the Active Front End unit(s) in order to guarantee flawless operation. CAN address 1 is used from the "Communication bridge" card and is the master address at the CAN bus.

As the Active Front End unit does not require reference values, they are not used and ignored. Any transmitted data are canceled.

In order to return an actual value via the CANopen bus and the communication bridge to the fieldbus network, it has to be set by the operating panel. When a control word is transmitted to the Active Front End unit, automatically a status word is returned.

## Status word

The status word of the Active Front End units is structured as follows:

| Structure of the status word |                                     |                                |
|------------------------------|-------------------------------------|--------------------------------|
| Bit 15                       |                                     |                                |
| Bit 14                       | CANopen bus address of the AFE      |                                |
| Bit 13                       |                                     |                                |
| Bit 12                       | Not ready to run                    | Ready to run                   |
| Bit 11                       | Was in operation but the bus failed | Run                            |
| Bit 10                       | -                                   | -                              |
| Bit 9                        | Control requested                   | No control authority requested |
| Bit 8                        | -                                   | -                              |
| Bit 7                        | Alarm                               | No alarm                       |
| Bit 6                        | Lock switching-on                   | No lock switching-on           |
| Bit 5                        | -                                   | -                              |
| Bit 4                        | -                                   | -                              |
| Bit 3                        | Fault                               | Failure-free                   |
| Bit 2                        | Operation released                  | Operation locked               |
| Bit 1                        | Ready to run                        | Not ready to run               |
| Bit 0                        | Ready to switch on                  | Not ready to switch on         |
|                              | High = 1                            | Low = 0                        |

Bits 13...15 include the encoded CANopen bus address of the Active Front End unit.

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# Parameter settings

## Inverter

Following parameters have to be set at the inverter in order to ensure a communication with the installed "Communication bridge" card:

- In menu [1.6 COMMAND] (*CLL-*) set parameter [Ref. 1 channel] (*F r1*) to [Comm. card] (*nEL*) and parameter [Profile] (*CLCF*) to [Separated] (*SEP*).
- In menu [1.8 FAULT MANAGEMENT] (*FLT-*) parameter [COM. FAULT MANAGEMENT] (*CLL*) must not be set to [Ignore] (*n0*).
- In menu [1.9 COMMUNIKATION] (*COM-*) and submenu [COM. SCANNER INPUT] parameter [Scan.IN1 address] (*nMR1*) and [Scan.IN4 address] (*nMR4*) to [Scan.IN8 address] (*nMR8*) must not be changed. Also in submenu [COM. SCANNER OUTPUT] parameters [Scan.Out1 address] (*nCR1*) and [Scan.Out4 address] (*nCR4*) to [Scan.Out8 address] (*nCR8*) must not be changed.



Parameters for setting the fieldbus card can be found in the respective instructions.

## Active Front End AFE

In menu [2.2 Control commands] parameter [2.2.1 Control source] has to be set to "4 Fieldbus control".

In the AFE the bus parameters, as described in the operating instructions CANopen, have to be adjusted to the existing mains conditions.

The bus addresses of the AFEs must be set as follows.

AFE 1 ... CAN-address 2

AFE 2 ... CAN-address 3

AFE 3 ... CAN-address 4

AFE 4 ... CAN-address 5

Depending on the number of AFEs connected in parallel, all or only a part of the addresses are used.



It is not possible to operate more than 4 AFEs in parallel.

The configuration of the fieldbus reference and actual values of the AFE CAN-bus and the communication bridge is set to 1 control word and 4 reference values and to 1 status word and 4 actual values.

## Technical data

| Option card "Communication bridge" |                                       |
|------------------------------------|---------------------------------------|
| Voltage                            | 24 V DC (min. 19 V, max. 30 V)        |
| Current                            | 2 A (maximum)<br>80 mA (without load) |
| Lithium battery                    | Approx. 8 years life cycle            |

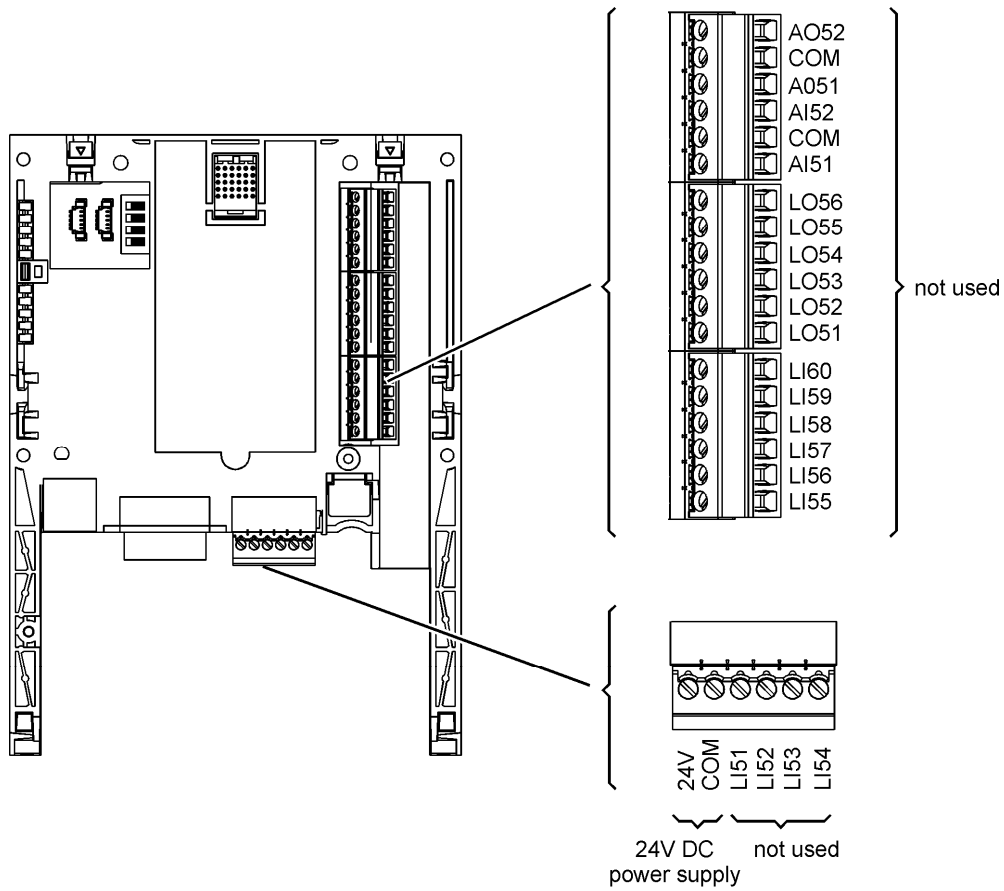
| Characteristics of CANopen-interface |   |
|--------------------------------------|---|
| Structure                            |   |
| Connection                           | One 9-pole male SUB-D plug                                    |
| Network management                   | Master  |
| Transfer rate                        | Configurable  |
| Address management                   | Maximum 4 AFEs as slaves                                      |
| Services                             |   |
| CANopen application level            | DS 301 V4,02  |
| Channel configuration                | DSP 405   |
| Process data object                  | 5 receiving and transmitting PDOs                             |
| Service data object                  | None  |
| Diagnostics                          |   |
| Via LEDs                             | 2 LEDs: "RUN" and "ERROR", according to CIA DR303 version 1.0 |

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# Wiring diagram

## Description of terminals



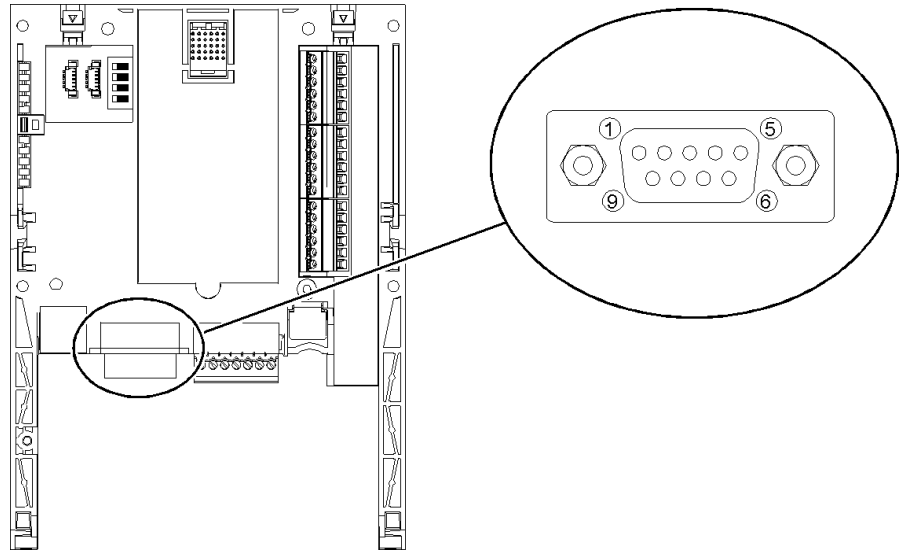
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| Terminal   | Function  |
|--|---|
| 24V  | Voltage supply for the "Communication bridge" card.<br><br>The "Communication bridge" card can be supplied via the 24 V supply in the inverter.<br><br>When using an external voltage supply the "Communication bridge" card should be supplied with voltage in favour before switching on the inverter. Anyway, it should not be supplied later than 2 s after the inverter. When this period is exceeded, a trip message occurs which can be only reset by switching on the inverter again. |
| COM  | Ground and electrical 0 V for the voltage supply of the "Communication bridge" card.  |
| LI51...LI60<br>LO51...LO56<br>AI51 and AI52<br>AO41 and AO52 | The inputs and outputs of the "Communication bridge" card are not used.   |

## Pin assignment

| Pin | Description   |
|-----|---------------|
| 1   | not connected |
| 2   | CAN_L         |
| 3   | CAN_GND       |
| 4   | not connected |
| 5   | not connected |
| 6   | CAN_GND       |
| 7   | CAN_H         |
| 8   | not connected |
| 9   | not connected |



Use a straight plug (catalog number TSX CAN KCDF 180T) in order to connect the "Communication bridge" card with the CANopen bus. This plug includes a shiftable terminating resistor which must be switched on when the "Communication bridge" card is operated at an end of the CANopen bus.

Due to the location of the terminals on the right side of the SUB-D plug it is not possible to use an angled plug.

The 9-pole SUB-D plug at the "Communication bridge" card is connected with the ground of the card and the inverter. The screen of the cable must be connected with the ground of the plug.

## Speeds and lengths at the CANopen bus

It is necessary for a flawless operation to ensure that there is the same transfer rate set at all subscribers connected at the CANopen bus.

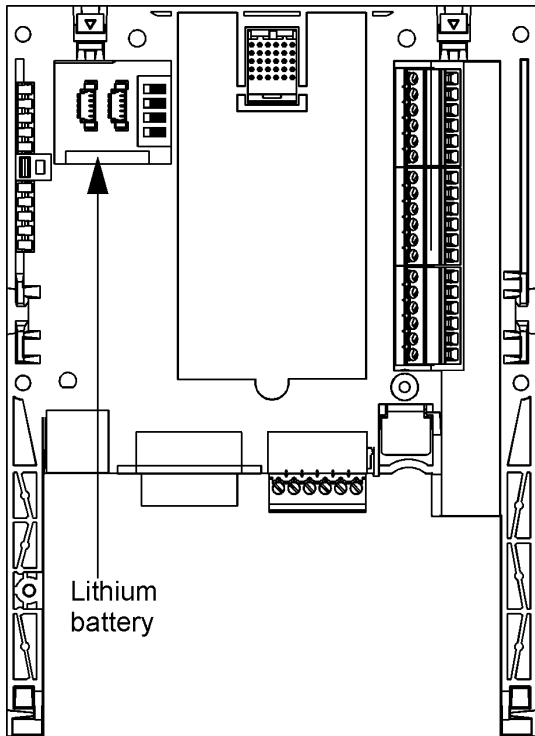
The maximum length of the CANopen bus depends on the transfer speed at the bus.

The following table shows the maximum lengths depending on the transfer rate.

| Transfer rate             | 50 kbps | 125 kbps | 250 kbps | 500 kbps | 1 Mbps |
|---------------------------|---------|----------|----------|----------|--------|
| Maximum length of the bus | 1000 m  | 500 m    | 200 m    | 100 m    | 5 m    |

## Backup battery

The "Communication bridge" card is equipped with an unsteady memory RAM (NVRAM) which is used to store variables. A lithium battery is built-in in order to do not loosen the data in voltage-free state.



When installing the "Communication bridge" card in the inverter, ensure that the battery is existing and built-in.

The life cycle of the battery is about 8 years when there is no additional voltage supply.

Exchange the battery only when the inverter and the "Communication bridge" card are switched off and not supplied with voltage.

Due to the exchange all data stored in the NVRAM are lost.

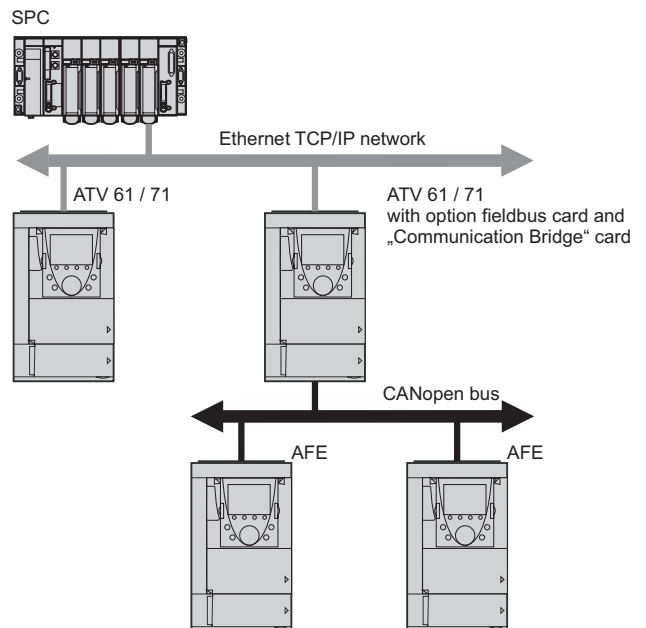
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Because of the storage time the battery is not available as spare part. Thus you have to re-order it by your own. The battery type is: TIMEKEEPER SNAPHAT M4T28-BR12SH1 (48 mAh).

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## Example for the structure of the network



The "Communication bridge" card is installed in combination with the option fieldbus card in the inverter. Thereby the PLC can address via its network the inverter and thus the AFEs at the CANopen bus.

# Diagnosis of faults

## Card fault

The fault message [Int Comm.] (*ILF*) appears when:

- a hardware problem occurred in the "Communication bridge"
- the communication between frequency inverter and "Communication bridge" failed.



When this fault takes place, the frequency inverter cannot be configured and changes to trip state and the drive runs in free wheel without current. This fault cannot be reset!

Two diagnostic parameters can be checked only by the graphical operating panel under [1.10 DIAGNOSTIC] (*DGT-*), [MORE FAULT INFO] (*RFI-*) in order to get more information about the cause of the [internal com. link] (*ILF*) fault:

- [Internal link fault 1] (*ILF1*) when the fault occurs in the first option card (directly installed at the frequency inverter)
- [Internal link fault 2] (*ILF2*) when the fault occurs in the second option card (directly installed at the frequency inverter)

The "Communication bridge" card can be installed in first position as well as in second position.

| Value | Description of the values of parameter [Internal link fault 1] ( <i>ILF1</i> ) and [Internal link fault 2] ( <i>ILF2</i> ) |
|-------|--|
| 0     | No fault   |
| 1     | Loss of communication with the frequency inverter  |
| 2     | Hardware fault detected  |
| 3     | Failure in the EEPROM checksum   |
| 4     | Faulty EEPROM  |
| 5     | Faulty Flash memory  |
| 6     | Faulty RAM memory  |
| 7     | Faulty NVRAM memory  |
| 8     | Faulty analog input  |
| 9     | Faulty analog output   |
| 10    | Faulty logic input   |
| 11    | Faulty logic output  |
| 101   | Unknown card   |
| 102   | Problem at the internal bus of the frequency inverter  |
| 103   | Time out at the internal bus (500 ms) of the frequency inverter  |



## Bus trip

If the bus connection of an AFE is interrupted, it changes into trip state (when parameterised accordingly). When the bus connection is not interrupted to all AFEs at the bus, the fault cannot be always recognised by the superior control (PLC). Only after reconnection of the bus the trip can be passed to the superior system. This means that, when there is a fault management realised in the superior system, it can be handled delayed only.

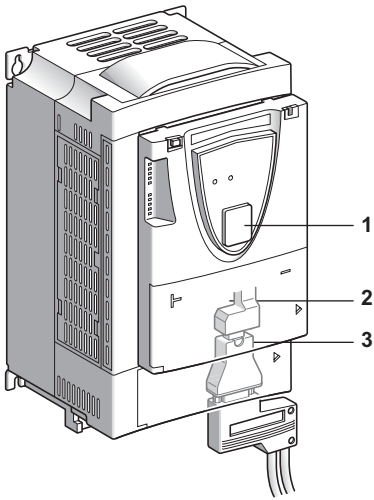
## Exchanging or removing the option card "Communication bridge"

When an option card is removed or replaced by another one, the frequency inverter locks at the next boot up to fault mode with the display [Incorrect config] ( $\overline{CFF}$ ). When exchanging or removing is intended, the fault can be canceled by pressing the ENT key two times. That causes a reset to factory setting of the card-specific parameter groups. Following cases are possible:

- Exchanging a card by the same card type:  
[1.14 Menu prog. card] ( $\overline{PLC-}$ )
- Removing a card (or replacement by another type of card):  
[Config inverter] ( $\overline{dFM}$ ) and [1.14 Menu prog. card] ( $\overline{PLC-}$ )

# Options

## Fieldbus adapter ADAP-CAN for CANopen



All Active Infeed Converters AIC support the fieldbus system CANopen as standard. For the integration of the CANopen-typical Sub-D fieldbus connection, an optional CANopen adapter must be installed at the RJ45 interface next to the terminals of the Active Infeed Converter.

In the CANopen network the Active Infeed Converter AIC is operated as a slave.

1. A RJ45 plug for the Modbus connection is at the front side of the AIC. It is used for the removable operating panel.
2. A RJ45 plug for the Modbus connection is at the control terminals of the Active Infeed Converter AIC. It is provided for control via a PLC or another control system. It is also possible to connect a terminal or diagnosis tool.
3. The Sub-D fieldbus connection can be connected to the modbus interface using a CANopen adapter.

### Technical data:

- Max. 32...126 subscribers (according to the CAN controller used)
- Bus cable: screened, twisted two-wire line
- Bus terminating resistor:  $R = 120 \Omega$  (108...132  $\Omega$ )
- SUB-D port according to ISO 11898
- CAN interface according to CiA DS 102
- No galvanic isolation

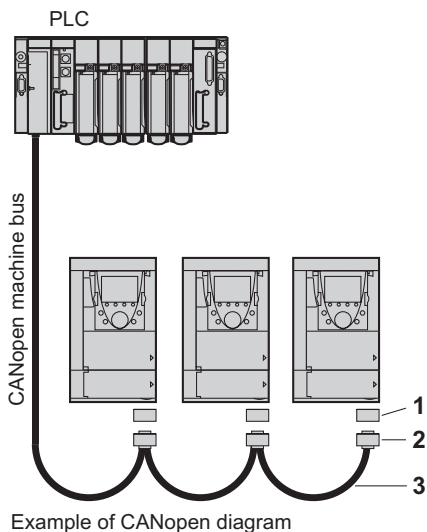


The ADAP-CAN option cannot be used at the same time as the Modbus interface!



More information on the CANopen network and a precise description of the CANopen parameters can be found in the CANopen operating instructions.

### Example for a CANopen network:



**Accessories for CANopen connection**

| No. | Designation                                | Brief description  | Order number      | Weight [kg] |
|-----|--|--|-------------------|-------------|
| 1   | CANopen adapter                            | RJ45/Sub-D adapter for connecting the Active Front End to a CANopen fieldbus system.   | VW3 CAN A71       | –           |
| 2   | Plug connector                             | Connecting plug for CANopen fieldbus system  | VW3 CAN KCDF 180T | –           |
| 3   | Standard connecting cable                  | Pre-assembled standard connecting cable 50 m minimal smoke emission, non-halogen self-extinguishing (IEC 60332-1)  | TSX CAN CA 50     | 4.930       |
|     |  | Pre-assembled standard connecting cable 100 m minimal smoke emission, non-halogen self-extinguishing (IEC 60332-1)   | TSX CAN CA 100    | 8.800       |
|     |  | Pre-assembled standard connecting cable 300 m minimal smoke emission, non-halogen self-extinguishing (IEC 60332-1)   | TSX CAN CA 300    | 24.560      |
| 3   | UL connecting cable                        | Pre-assembled UL connecting cable 50 m self-extinguishing (IEC 60332-2)  | TSX CAN CB 50     | 3.580       |
|     |  | Pre-assembled UL connecting cable 100 m self-extinguishing (IEC 60332-2)   | TSX CAN CB 100    | 7.840       |
|     |  | Pre-assembled UL connecting cable 300 m self-extinguishing (IEC 60332-2)   | TSX CAN CB 300    | 21.870      |
| 3   | Connecting cable for difficult environment | Pre-assembled connecting cable 50 m for difficult ambient conditions or mobile installation. Minimal smoke emission, non-halogen self-extinguishing (IEC 60332-1)  | TSX CAN CD 50     | 3.510       |
|     |  | Pre-assembled connecting cable 100 m for difficult ambient conditions or mobile installation. Minimal smoke emission, non-halogen self-extinguishing (IEC 60332-1) | TSX CAN CD 100    | 7.770       |
|     |  | Pre-assembled connecting cable 300 m for difficult ambient conditions or mobile installation. Minimal smoke emission, non-halogen self-extinguishing (IEC 60332-1) | TSX CAN CD 300    | 21.700      |

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**Schneider Electric Power Drives GmbH**

Ruthnergasse 1  
A-1210 Vienna  
Phone: +43 (0) 1 29191 0  
Fax: +43 (0) 1 29191 15

Due to evolution of standards and equipment, the characteristics indicated in texts and images of this document do not constitute a commitment on our part without confirmation.  
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