



USER'S MANUAL

MasterBus CANopen Interface

Interface between MasterBus and CANopen



MASTERVOLT
Snijdersbergweg 93,
1105 AN Amsterdam
The Netherlands
Tel.: +31-20-3422100
Fax.: +31-20-6971006
www.Mastervolt.com

ENGLISH: PAGE 1

Copyright © 2016 Mastervolt
1000011510/04

1 General information

1.1 USE OF THIS MANUAL

Copyright © 2016 Mastervolt. All rights reserved.
 Reproduction, transfer, distribution or storage of part or all of the contents in this document in any form without the prior written permission of Mastervolt is prohibited.

This manual serves as a guideline for the safe and effective operation of the MasterBus – CANopen Interface, to be called *CANopen Interface* further in this manual.

Keep this manual at a secure place!

1.2 GUARANTEE SPECIFICATIONS

Mastervolt guarantees that this product was built according to the legally applicable standards and stipulations. If you fail to act in accordance with the regulations, instructions and stipulations in this user's manual, damage can occur and/or the product will not fulfil the specifications. This may mean that the guarantee will become null and void.

1.3 LIABILITY

Mastervolt can accept no liability for:

- consequential damage due to use of the CANopen Interface;
- possible errors in the manuals and the results thereof;
- Use that is inconsistent with the purpose of the product.

2 How it works

2.1 COMMUNICATION

You can connect Mastervolt products with MasterBus in a CANopen network with this CANopen interface. MasterBus products can share information and can be controlled by CANopen products.

Information is transferred between MasterBus and CANopen via data fields. Up to 100 data fields can be used. (Chapter 4)

MasterBus events can also be received by the Interface and the information shared on the CANopen network. (Chapter 5)

MasterBus products can also be controlled via Events from the CANopen network. The Interface



CAUTION!
 Never remove the identification label.

1.4 CORRECT DISPOSAL OF THIS PRODUCT (Waste Electrical & Electronic Equipment)



This product is designed and manufactured with high quality materials and components, which can be recycled and reused. When this crossed-out wheeled bin symbol is attached to a product, it means the product is covered by the European Directive 2012/19/EU.

Please be informed about the local separate collection system for electrical and electronic products.

Please act according to your local rules and do not dispose of your old products with your normal household waste. The correct disposal of your old product will help prevent potential negative consequences to the environment and human health.

generates the MasterBus Events when a specific CANopen message is received. (Chapter 6)

Chapter 3 is a basic introduction of CANopen and the NMT protocol used by many CANopen products. This interface uses the NMT protocol as well.



To get yourself familiar with CANopen read The wikipedia page on:

<https://www.wikipedia.org/wiki/CANopen>

and the CAN knowledge base of the international user' and manufacturer' group:

<http://www.can-cia.org/can-knowledge/canopen/canopen/>

3 CANopen communication

This interface is designed to be part of a CANopen network. It follows the minimum boot-up process as defined by CANopen in the NMT protocol. The state diagram is shown in figure 1. The interface will show the current State on the monitoring Page on MasterBus.

Notes: You have to log in as Installer to be able to change the configuration. If you are not familiar with this process contact your Mastervolt representative. We assume you use MasterAdjust software to do the configuration of the CANopen interface. A basic understanding of CANopen is required for the configuration process.

Match the CANopen interface Baud rate to your CANopen network. You can choose between 125kB/s and 250kB/s for the CANopen interface.

You can set the Node-ID of your interface. The interface will transmit a “Heartbeat message” every second at 0x700+Node-ID whenever the interface is powered. For example, if you set the Node-ID to 0x05, the Heartbeat message will have an COB-ID of 0x0705. The Node-ID is also used for NMT control messages.

NOTE: Literals in this manual that start with ‘0x’ are hexadecimal numbers(base 16). This format is standard in CANopen.

All standard CANopen products will wait in the Pre-operational state for a NMT Module Control message. When a “Start Remote Node” Control message is received the state will change to Operational.

This interface has an ‘Auto start’ option. With this option selected the Interface will proceed from Pre-Operational to Operational automatically. The Interface will start operation without the need for any input from other CANopen devices.

This option can be turned off to follow the standard CANopen behaviour. The interface listens to Control messages with its specific Node-ID and broadcasts to all devices (Node-ID=0).



If you are new to CANopen we recommend to leave the ‘Auto start’ turned on. The CANopen interface will be operational without Control messages.

Table 1 State transactions of Figure 1

State transactions / NMT Service command (NMT command specifier)	
1	Device initialisation finished
2	Automatic in Auto start or upon receiving Start remote Node / <i>Start_Remote_Node</i> (0x01)
3	Stop remote frame received / <i>Stop_Remote_Node</i> (0x02)
4	Enter Pre-operational State frame received / <i>Pre-Operational_Remote_Node</i> (0x80)
5	Reset node Frame received / <i>Reset_Remote_Node</i> (0x82)

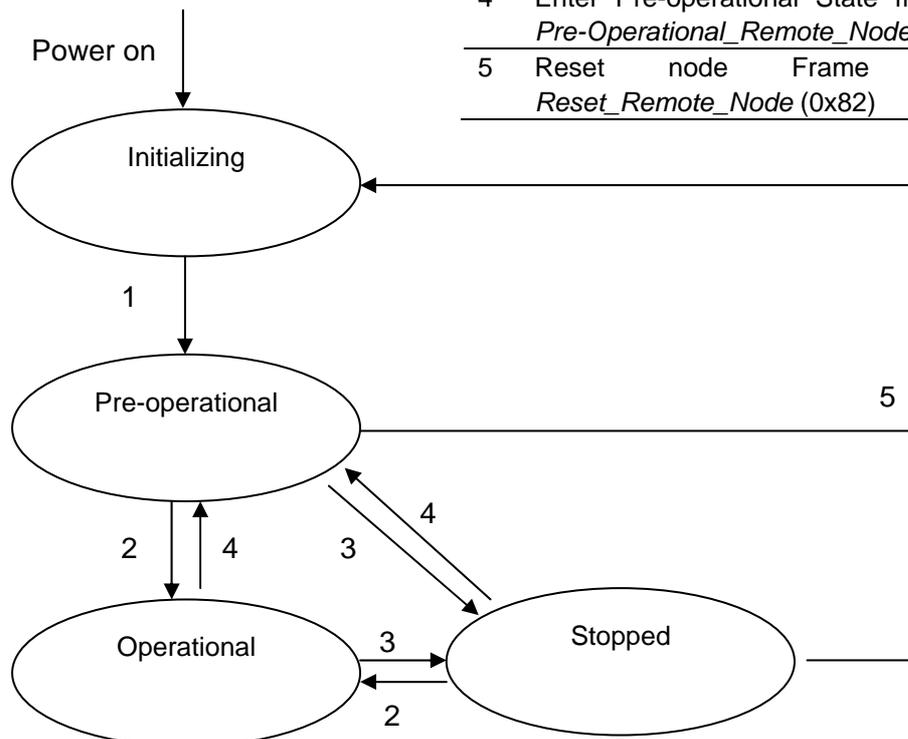


Figure 1: State diagram CANopen devices with NMT protocol

4 Transfer data between MasterBus and CANopen

The CANopen interface can transfer 100 data fields (values) between MasterBus and CANopen. This chapter describes how to configure these fields and shows some examples.

The CANopen interface uses PDO messages to receive data from; and transmit data to the CANopen network. A PDO message is a CANopen message containing data.

4.1 CONFIGURE THE NUMBER OF DATA FIELDS

Start by selecting the number of data fields you want to transfer. This can be configured on the configuration page at “Nr of fields”.

4.2 CONFIGURE THE DEVICE NUMBERS

Select the number of devices on the MasterBus you want to communicate with. This can be configured on the configuration page at “Nr of devices”. Select the individual devices in the ‘Device numbers’ group.

For example, if you want to connect to your Mass Combi Ultra and your MLI battery, you select Nr of devices = 2 and select in the Device numbers group the Mass Combi and the MLI battery.

Now you can use these devices in the next steps of configuration.

4.3 DATA FIELD CONFIGURATION (STANDARD)

To configure one of your data fields select the field number in the ‘Field config’ group. This loads the configuration for this field. Changes to the field configuration will take effect after you press the ‘Save data field’ button. The following parameters can be changed in this group:

- **COB-ID**

The PDO on CANopen uses this COB-ID. This COB-ID is independent from the configured Node-ID. Minimum value is 0x181(hexadecimal), and the maximum value is 0x57F(hexadecimal) as defined by CANopen.

By setting the same COB-ID multiple fields can be combined into one PDO.

- **Byte**

Byte location of your data in the CANopen message. The PDO messages of the CANopen interface always contain 8 data bytes. The data bytes which do not contain data are set to 0xFF’.

The ‘Byte’ setting allows you to place the information next to each other in the 8 data bytes.

For example if you want to combine 2 floats in one message. Select ‘Byte’ 0 for the first data field and 4 for the second data field (Floats require 4 bytes). If you want to combine 4 Signed integers select ‘Byte’ 0, 2, 4 and 6 for the four data fields(16 bit Integers require 2 bytes). Floats and Signed integers can be combined in one PDO as well.

- **Device**

Select any MasterBus device which has the information you want to connect to from the CANopen network. If you select for example “1” the device at “Device 1” in the ‘Device Indices’ group will be used for this data field.

- **Page**

Select the page of the MasterBus device which has the information you want to connect to. Select Monitoring, Configuration, Alarm or the History page.

- **Index**

Select the Index of the information you want to connect to. The Index can be found by hovering your mouse pointer over an item in MasterAdjust software.

Figure 2 shows an example on how to find the index of a specific data field.

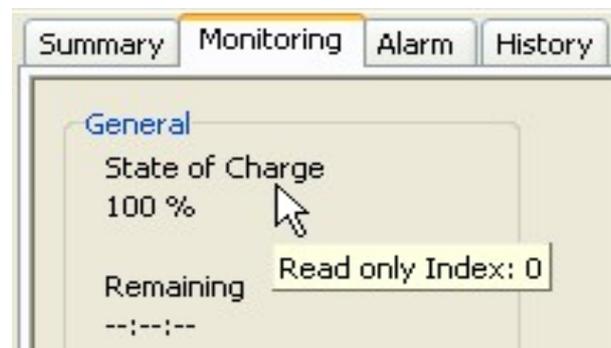


Figure 2:
Monitoring page of the MasterShunt, State of Charge has an Index of 0

- **Data type**

Data on CANopen can be represented as a float or as a 16 bit Integer.

Floats store float-point values, that is, values that have potential decimal places.

Integers use 2 bytes and only store integral values, that is whole numbers.

Which type you chose depends on the capabilities of the receiving CANopen product.

- **Scaling**

When using Integer values on CANopen you might want to use scaling. This allows values like the battery voltage to be transmitted without losing accuracy. Select Scaling 'x100' to transmit a value 1325 instead of 13,25.

When receiving a CANopen PDO the input value will be divided by the scaling value.

Select 'x1' if you don't need scaling.

4.4 DATA FIELD CONFIGURATION (ADVANCED)

It is also possible to update the data field configurations directly by changing the strings in 'Data fields A' group and 'Data Fields B' group.

The complete configuration of each data field is shown as a string (sequence of characters).

These strings look like Figure 3 and consist of five parts: the CANopen configuration, the data direction, the MasterBus configuration, a comma separator and the data representation.

285b0<1m0,s0

Figure 3. Example of configuration string

NOTE: you will notice the same configuration parameters as in the configuration via the standard method but now combined into one string.

Meaning:

285

This is the hexadecimal COB-ID of the CANopen message. Range: 0x181 –0x57F.

b0

Byte followed by the location of the data within the PDO. Minimum value is 0, maximum value is 6.

<

Direction indicator. "<" indicated data direction from MasterBus to CANopen. ">" indicates data direction from CANopen to MasterBus

1

Device Number. The device in the Device numbers group with this number will be used to connect to. Minimum number 1, maximum number 20.

m

Indicates data on the monitoring page is used. Other options include a(Alarm page), c(Configuration page) and h (History page)

0

Index on page. Decimal value ranging from 0 to 1000.

,

Comma separator

s

Indicates data on CANopen is represented as 2 byte signed int. Other option is f (Float) for a 4 byte float representation.

0

Indicates data scaling on CANopen. Use 0 for no scaling(x1).

1 for 'x10 scaling, 2 for x100 scaling and 3 for x1000 scaling on CANopen.

4.5 CONFIG ERROR

Your CANopen interface status will show 'Config Error' if:

1. Two or more data fields are 'CANopen<MB' and have the same COB-ID and the data is overlapping.
2. One or more data fields are CANopen>MB and do not fit in the 8 data bytes.

When there is a 'Config error' no CANopen PDO's will be transmitted or received by the CANopen interface.

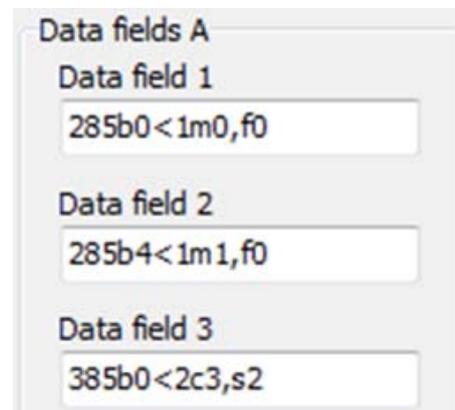


Figure 4: Example of stings in advanced data field configuration

4.6 EXAMPLE MASTERBUS TO CANOPEN

What we want to achieve

Imagine we want to use the state of charge(charge level) of a MasterShunt monitored battery in a CANopen network.

How we configure it

Connect the CANopen receiving product to the CANopen connection of the CANopen interface. Follow CANBus installation guidelines, install terminating resistors etc.

Connect the MasterShunt, which needs to share information, to the MasterBus port on the CANopen interface. Again follow Mastervolt guidelines for installing a MasterBus network. (install terminators etc.)

Configure the MasterShunt according to the manual of the MasterShunt to monitor your battery correctly.

Configure the CANopen interface to transfer 1 data field via the 'Nr of fields' setting.

In the Device numbers group select as 'Device 1' the MasterShunt. In the data field configuration we can now refer to 'Device 1' being the MasterShunt.

In the 'Field config' group select data field 1. We leave all settings as default. COB-ID(hex) = 285; Byte: 0; Direction: MB>CANopen; Device: 1; Page: Monitoring; Index: 0; Data type: Int 16bit signed.

In this specific case the index of the 'State of charge' is 0 on the monitoring page. Therefore we do not need to update the index.

Press the 'Save data field' button to save the configuration of data field 1.'

Make sure the option 'Auto start' is still turned on.

The result

The CANopen interface will start transmitting two CANopen messages: the Heart beat and one PDO. The Heartbeat is transmitted every second and has 1 data byte. The data byte will be 0x05 indicating the interface is in Operational mode.

The PDO will have 8 data bytes. Starting on byte 0 there will be 2 bytes(16 bits) of data indicating the State of charge of the MasterShunt.

The monitoring page of the CANopen interface shows the last value which has been transmitted to CANopen for each data field. This value includes scaling.

The screenshot shows a configuration window with the following sections and values:

- Device numbers:** Device 1 dropdown menu set to 'MSH Mastershunt'.
- Field config:**
 - Datafield select: 1
 - COB-ID (hex): 285
 - Byte: 0
 - Direction: CANopen < MB
 - Device number: 1
 - MB Tab page: Monitoring
 - MB Index: 0
 - Data type: Int 16bit signed
 - Scaling: x 1
- Buttons:** A 'Save data field' button is visible at the bottom of the configuration section.
- Data fields A:** A summary box for 'Data field 1' showing the value '285b0 < 1m0,s0'.

Figure 5: Configuration example MasterBus to CANopen

4.7 EXAMPLE CANOPEN TO MASTERBUS

What we want to achieve

Image we want to control the 'Mains fuse' setting of the Mass Combi Ultra via the CANopen interface via CANopen.

How we configure it

Connect the CANopen interface following the same procedure as in the previous example.

Again configure just 1 data field for this example.

Now select the Mass Combi Ultra in the 'Device indices' group as device 1.

In the 'Field config' group select data field 1. We leave most settings as default. COB-ID(hex) = 285; Byte: 0; Device: 1; Page: Monitoring; Data type: Int 16bit signed.

For 'Direction' we select 'CANopen>MB'. This is because we want to control the Mass Combi Ultra on the MasterBus from the CANopen.

Change the Index value to be 19 because the 'Mains fuse' has this index on the monitoring page of the Mass Combi Ultra.

Press the 'Save data field' button to save the configuration of data field 1.'

Make sure the option 'Auto start' is still turned on.

The result

The CANopen interface transmits out the heartbeat message every second. No other messages are transmitted by the CANopen interface on the CANopen network.

To set the 'Mains fuse' from the CANopen network, make sure a PDO is received by the CANopen interface with a COB-ID of 0x285 with a data length of 8 data bytes. Make sure the new Mains fuse setting is present in the first two data bytes as 16 bit signed Integer.

The monitoring page of the CANopen interface shows the last value which is received for each data field. This value is already divided by the scaling factor.



To easily understand the required format of the control message, set the direction to 'CANopen<MB'. The CANopen interface will now transmit the correct message.

NOTE: You can set two or more data fields to have the same COB-ID and Byte if they are CANopen>MB. This way you can control for example the state of three Mass Combi Ultras by just one CANopen PDO.

5 MasterBus Event data to CANopen network

Your CANopen devices can react on Events in the MasterBus network. The CANopen interface will broadcast this data on the CANopen network. An event PDO is transmitted containing all the 8 Event states, each as a single data byte. Any MasterBus product with Events can be configured to transmit an Event to the CANopen interface. The CANopen interface has 8 event targets; named Event target 1 to 8.

- **Transmit Event PDO**

Once the “Send Event PDO” option is checked the Interface will transmit a dedicated PDO with the data of 8 events. This PDO will be transmitted periodically and upon changes of the events.

- **COB-ID**

Select the COB-ID for the Event PDO.

Example:

If you want a CANopen product to react on an empty battery event of your MasterShunt battery monitor. Select the following configuration:

- ✓ In the MasterShunt configure one event.
- ✓ Event source: Battery low
- ✓ Event target: CANopen Interface
- ✓ Event command: Event target 1
- ✓ Event data: Copy
- ✓ In the CANopen interface check the “Send Event PDO” option and set the COB-ID for the broadcast message.

Make sure your CANopen device listens to this broadcast. An event PDO will be transmitted periodically and when new events are received from MasterBus.

The Event PDO consists of 8 bytes each representing an Event state. 0x00 indicates OFF, 0x01 indicated ON, 0x02 indicates Alarm and 0xFF indicates Not Applicable / Not initialized.

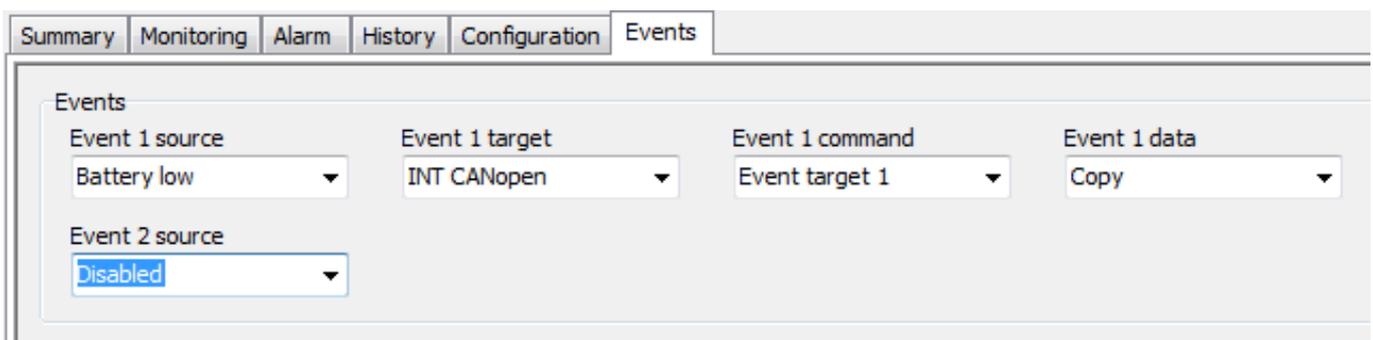


Figure 6:
 Configuration of Chapter 5 example
 MasterShunt event configuration to send event data to CANopen

6 CANopen to initiate MasterBus events

Your MasterBus devices can be controlled from your CANopen network. The Interface will listen to PDO messages with a specific COB-ID. Once this message is received, the 8 data bytes will be interpreted as the source for 8 Events. Named Event source 1 to 8.

Each data byte for one event source. Value 0x00 is interpreted as OFF, 0x01 as ON, 0x02 as Alarm and 0xFF and all other values are ignored.

Configure which product you want to control on the events page of the CANopen interface. Events will be transmitted immediately after the PDO is received.

- **Receive Event PDO**

Once the “Receive Event PDO” option is checked the Interface will listen to a dedicated PDO with the data of 8 events.

- **COB-ID**

The interface will listen to PDO messages with this COB-ID.

Example:

To control the backlight of the MasterView Easy from your CANopen network select the following configuration:

- ✓ In the CANopen interface configure one event.
- ✓ Event source; Event source 1
- ✓ Event target: MasterView Easy
- ✓ Event command: Backlight
- ✓ Event data: Copy
- ✓ In the CANopen interface check the “Receive Event PDO” option and set the COB-ID which needs to be interpreted.
- ✓ Transmit a PDO with data length of 8 with the configured COB-ID to the Interface.

If the first byte(Input 1) equals 0x00 the backlight will turn off, when 0x01 is transmit, the backlight will turn on.

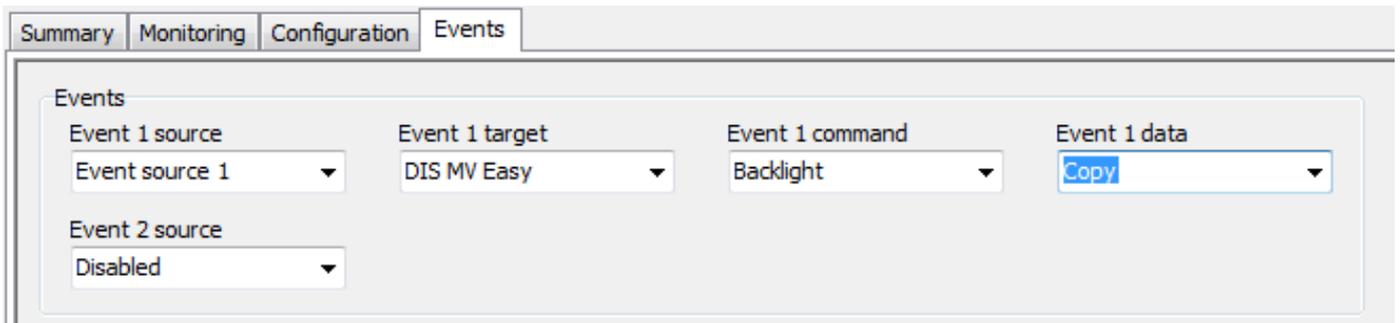


Figure 7:
 Configuration for chapter 6 example
 CANopen event configuration to send event data to MasterView Easy

7 INSTALLATION

See figure 8 for the CANopen Interface connections.

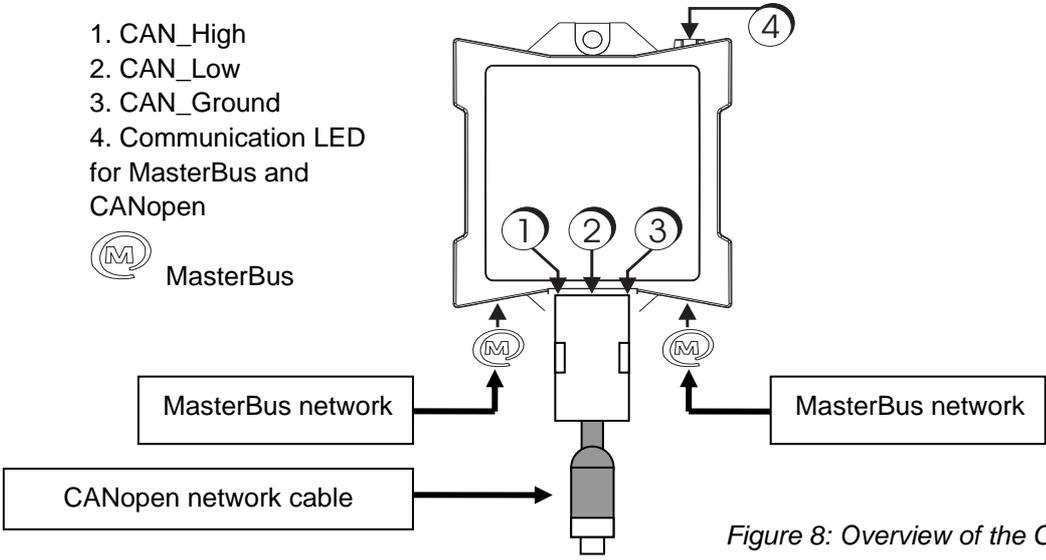


Figure 8: Overview of the CANopen Interface

8 SPECIFICATIONS

Model:	MasterBus – CANopen interface
Article number:	77032600
Delivery also includes:	CANopen cable (length: 100mm), MasterBus Terminating device, MasterBus cable (1 meter) User's manual
Function of instrument:	Interface between MasterBus and CANopen
Language:	English
Current consumption:	<40 mA
MasterBus Powering:	No
Din rail mounting:	Yes, Din rail 30 mm [1.2 inch]
Protection degree:	IP 21
Dimensions:	66 x 78 x 32 mm [2.6 x 3.1 x 1.3 inch]; see Figure 9
Weight:	Approx. 70 gr [0.15 lb] excluding cables
Event Sources	8
Events to be configured	63
Event targets	8
CANopen Baud rate	125kB/s, 250kB/s
CANopen support	NMT protocol(NMT Module control), Heartbeat protocol, Transmit PDO's and Receive PDO's

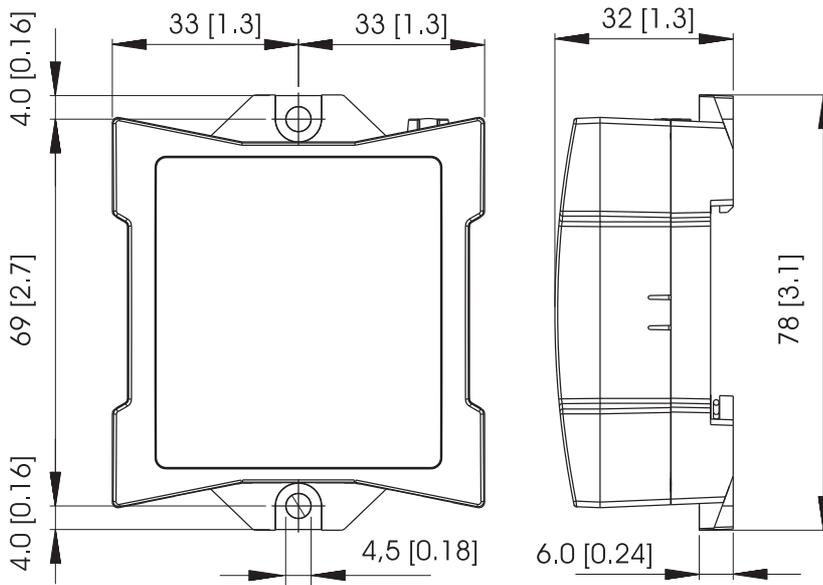


Figure 9: Dimensions in mm [inch]

MASTERVOLT

Snijdersbergweg 93, 1105 AN Amsterdam, The Netherlands

Tel : + 31-20-3422100

Fax : + 31-20-6971006

Email : info@mastervolt.com