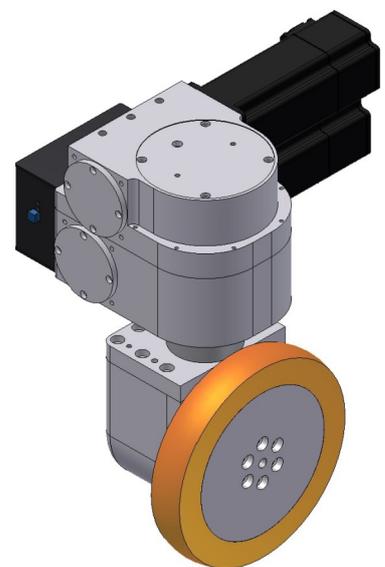


Omni-Drive-Module

Assembly Instructions



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1 Introduction

1.1 General information

The Neobotix Omni-Drive-Modules have been designed to allow engineers and designers to easily create their own, customised mobile robot platform. Different from other solutions, the kinematics of the ODM enables the mobile robot to move omnidirectionally even on a floor that is not perfectly flat.

These modules are intended for research and experiments and need to be modified and completed by the customer. Several important issues must be considered when working with them:

- The Omni-Drive-Module is a partly completed machine and not ready for immediate operation.
- The drive amplifiers have been configured with general purpose settings. Some of these settings might need to be adjusted according to the individual application in order to achieve the best performance.
- Being only partly completed machines, the Omni-Drive-Modules are not conform with all EC Directives applicable for turnkey machinery.
- To achieve the level of safety required by the applicable directives the customer must integrate the ODM into another machine. Additional measures might be necessary to ensure the safe operation of the completed machine.
- An independent assessment of risks has to be performed by the customer to verify conformity with all applicable directives.
- Only the customer can be held responsible for the safe operation of the Omni-Drive-Module.

1.2 About this document

This document describes the mechanical and electrical installation as well as the configuration of the Neobotix Omni-Drive-Module. It is meant as a guideline when installing and assembling the necessary hardware. Basic operation and handling instructions are included as well.

No drivers or software modules are part of this product. Communication with and control of the modules has to be implemented by the customer.

The following icons are used in this document to highlight important paragraphs:



The warning triangle marks paragraphs that concern the danger of injuries, damages or both. Please read these paragraphs very carefully!



The prohibition sign marks actions or applications the module is not intended for and which might result in damages, reduced life expectancy and loss of warranty.



The light bulb marks paragraphs that mention common problems, misunderstandings or errors and is meant to be a help in troubleshooting.

2 Safety

Please read this chapter carefully and mind the instructions given when working with the Omni-Drive-Module. Doing so will help to ensure a safe operation of the module and of the machine it is integrated into.

2.1 Intended usage

Fields of application

The Omni-Drive-Module is intended to be used as part of the drive system of a mobile robot. It has been designed for use in fields like robotics, autonomous vehicles and intralogistics. Vehicles based on the Neobotix Omni-Drive-Module may be used in laboratories and similar controlled indoor environments without public access.

Environmental conditions

The Omni-Drive-Module must only be used indoors. Outdoor use may significantly reduce the system's life expectancy and may result in damages to the module.

Due to the unsealed drive amplifiers at the side of the Omni-Drive-Module it has to be protected against collisions, dirt, metal objects (e.g. screws or washers) and moisture.

Under normal operating conditions the massive aluminium body of the drive module serves as a sufficient heat sink for the amplifiers, the motors and the gears. In case the module is to be covered completely, appropriate ventilation or other means of cooling might become necessary.

The drive module must be kept clean at all times. Exposure to excessive dirt or moisture may lead to damage of the synchronous belt and or the ball bearings. Neobotix cannot be held responsible for damages caused by dirt or moisture.

2.2 Improper usage



The Neobotix Omni-Drive-Modules must be kept dry at all times. Exposing the modules to rain, mist or splash-water may cause severe damage to the electronic components.



Using a vehicle based on the Omni-Drive-Modules for any kind of passenger transportation is strictly prohibited. Climbing onto any vehicle that is based on the Neobotix Omni-Drive-Modules is also prohibited.



The control software for aligning and moving two or more ODMs must be tested with special care. Using an untested or faulty control software may damage the modules or even the complete vehicle.



It is prohibited to operate a vehicle based on the Omni-Drive-Module in public areas without supervision by a qualified trained person.

2.3 Qualified personnel

This product must only be modified, commissioned, operated and serviced by qualified personnel. Qualified personnel are defined as persons who

- due to their specialist training and experience have adequate knowledge for the work at hand

and

- who have been instructed by the responsible robot operator in the operation of the robot or its parts and the currently valid safety guidelines

and

- are sufficiently familiar with the applicable official health and safety regulations, directives and generally recognised engineering practice (e.g. DIN standards, VDE stipulations, engineering regulations from other EC member states) that they can assess the work safety aspects of the robot

and

- who have access to this manual and who have read it.

The following groups of persons are generally not considered qualified:

- Employees, interns or other academic staff not familiar with the robot,
- visitors and guests,
- all members of other departments of the company or institution in which the robot is operated.

This list is not intended to be exhaustive.

2.4 Safety measures and precautions

In order to ensure a safe and successful operation of the Omni-Drive-Module, please mind the following:

- Always take care to protect the drive amplifiers at the side of the module against collisions and moisture.
- Always lift the wheels off the ground while working on the control software.
- Always test any new or changed control software thoroughly with the wheels lifted off the ground. Make sure that the alignment of all wheels is correct at all times and under all conditions.
- The wire diameter of the power supply to the Omni-Drive-Modules as well as any relays must be chosen according to the maximum expected current. **If three or more modules are used, very high sum currents might occur.**



3 Product description

The Neobotix Omni-Drive-Module is a two-axes drive unit for use in a mobile robot or a similar application.

The module contains two high-performance servomotors with an industrial grade servo amplifier each ("Whistle 10/60" from Elmo Motion Control), mounted to a common printed circuit board. One of the motors drives the module's driving wheel while the other motor rotates the wheel around its vertical axis. Both motors can rotate infinitely without mechanical boundaries, thus allowing an omnidirectional robot to move continuously and without the need to re-align the wheels due to any limits. The orientation drive features an inductive position switch which can be used for homing.

Due to the high transmission ratio of both worm gearings, no brake is required. This significantly reduces the module's power consumption and heating. Fail-safe brakes can be integrated for additional safety.

3.1 Components

The Omni-Drive-Module is made up from the following components:

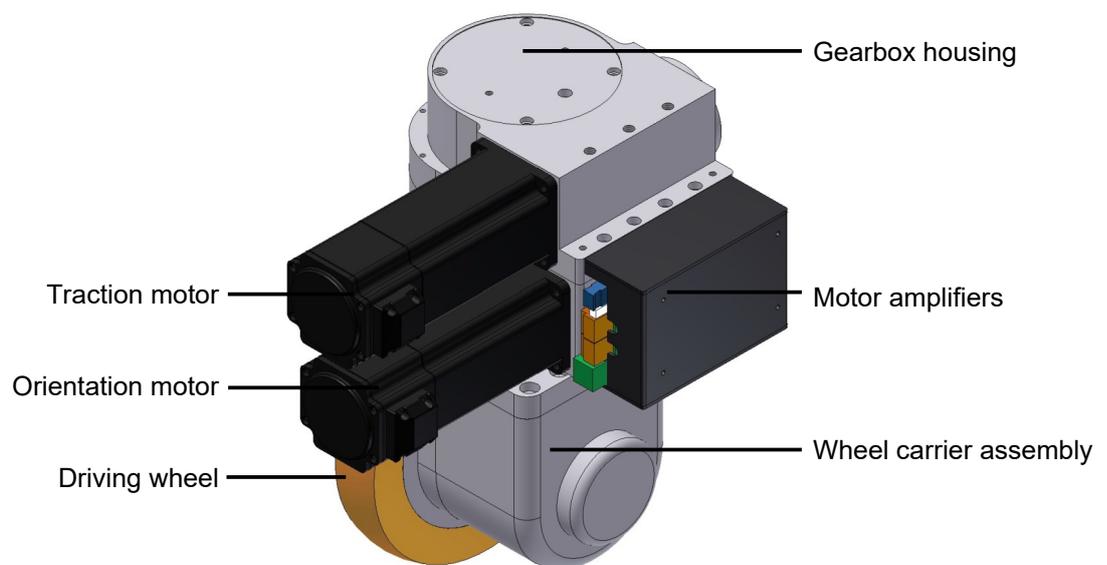
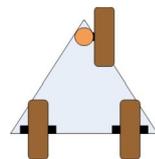


Figure 1: Components of the Omni-Drive-Module

3.2 Possible drive kinematics

The Omni-Drive-Modules can be used to build several different drive kinematics according to the application's requirements. Each configuration has its own advantages and disadvantages. The most commonly used configurations are the following:

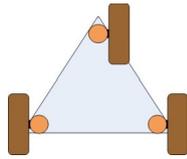
1 Omni-Drive-Module with 2 fixed rollers



This configuration is the cheapest and easiest to control. Although possible, it is very rare that the Omni-Drive-Module is moved in a way that will make the fixed wheels jam.

In this configuration, true omnidirectional motion is not possible since the vehicle will always follow the drive unit.

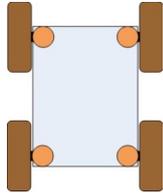
3 Omni-Drive-Modules



This configuration ensures high stability for smaller robots, avoids static indeterminacy and allows fully omnidirectional movement.

All three wheels must be aligned correctly at all times to avoid jamming or slippage. Please mind that the angle between the wheels must change according to the movement's centre of rotation.

4 Omni-Drive-Modules



This configuration is most commonly used for service robots. It guarantees highest stability even for big and heavy robots. Although it is statically indeterminate this will not cause problems in most applications because all wheels are aligned actively.

All four wheels must be aligned correctly at all times to avoid jamming or slippage. Please mind that the angle between the wheels must change according to the movement's centre of rotation.

3.3 Special features

Logic power supply

The drive amplifiers of the Omni-Drive-Module feature a separate power supply pin for the internal logic unit. In case of an emergency stop the main power line can be cut without affecting the internal microcontroller or the motors' feedback devices.

This means that during emergency stop all important functions of the drives (CAN-communication, position detection, etc.) are maintained even if the possibly dangerous power is switched off and motions are stopped.

Position switch

An internal inductive position sensor is connected to the amplifier of the orientation drive and can be used for homing.

Due to variances in the assembly process the homing position may slightly differ from module to module. Therefore the control software must implement an adjustable offset for each orientation drive.



Proper functioning of the overall drive system can only be achieved by aligning all wheels correctly at all times.

Digital and analogue I/O

Each drive amplifier provides six digital inputs, two digital outputs and one analogue input. Three digital inputs and one digital output can be accessed via the PCB's connectors. Please refer to chapter "Electrical installation – Digital I/O" for details. One of the inputs is used for the position switch of the orientation drive. Further information about the I/Os can be found on the Elmo Motion Control homepage at www.elmomc.com.

Programming

Each drive amplifier contains an integrated logic capable of running simple user programs. This feature can be used to shift some basic functions from the main control software to the drive amplifiers. Possible functions are:

- Automatic homing after power on
- Automatic realignment of the drives after emergency stop
- Automatic motor off after a predefined time of inactivity

Details on the programming feature can be found on the Elmo Motion Control homepage.

4 Mounting

4.1 Integrating the module into a platform

Six threaded holes in the bottom side of the Omni-Drive-Module can be used to mount the module onto a carrier plate.

The Omni-Drive-Module is not designed to be mounted under a vehicle but into it. The base plate of your vehicle must be in between the wheel carrier assembly and the gearbox housing.

A U-shaped cut-out of 60mm to 70mm width is recommended for the vertical axle of the wheel carrier assembly.

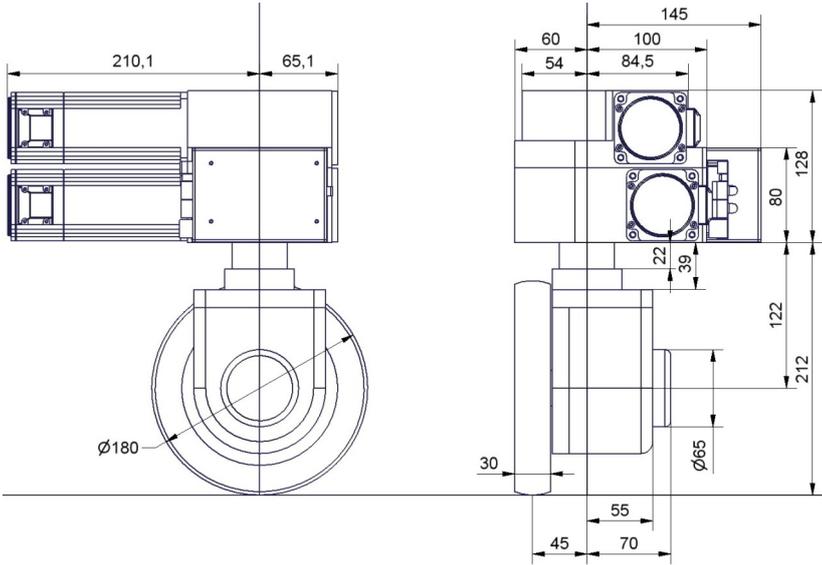


Figure 2: Dimensions of the Omni-Drive-Module

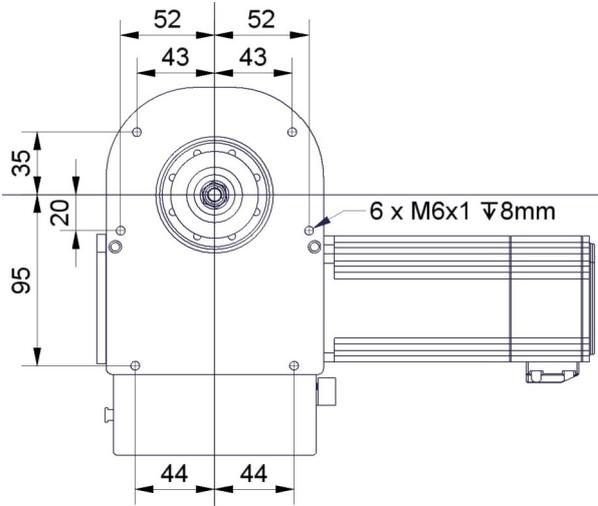


Figure 3: Bottom view of the Omni-Drive-Module

4.2 Mounting components onto the module

If all Omni-Drive-Modules are mounted to a common base plate, additional components may be placed on top of the modules. The step above the drive amplifiers can be used for mounting an auxiliary plate. This might be used to carry smaller components, for example electronic devices.

Using a single plate on top of and screwed to all modules will significantly improve the structure of the overall drive system. It will also optimise the distribution of forces thus allowing a high payload.

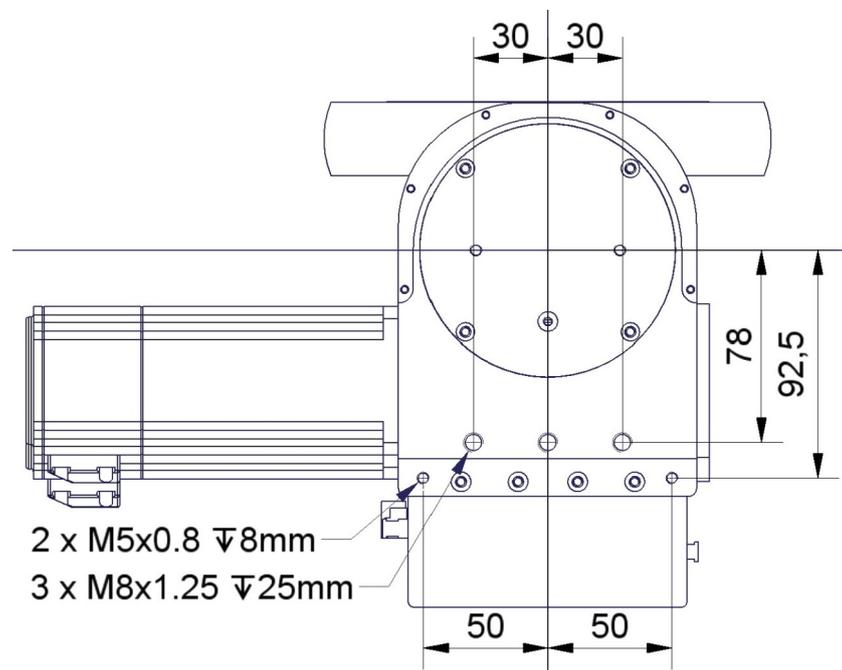


Figure 4: Top view of the Omni-Drive-Module

5 Electrical installation

5.1 Power supply

Main power

Both drive amplifiers are connected to common supply lines. Use the following components for the power supply:

Plug:	Würth Elektronik, Series 351 WR-TBL, 691 351 500 003
Plug (alternative):	Phoenix Contact, MSTB 2,5 HC/ 3-ST, 1911868
Power cable:	H07V-K or better, 2,5mm ² or bigger
Logic supply cable:	H05V-K or better, 0,5mm ² or bigger

The internal logic unit of the drive amplifiers can be powered independently from the main power supply. In case of an emergency stop the amplifiers will still be running, keeping track of the motor position and communicating on the CAN-bus.

By default the Omni-Drive-Module is configured for 24V logic supply voltage. Please contact Neobotix if you want to use other supply voltages

The pin assignment is as follows:



Pin	Function	Voltage / VDC	Description
1	Common ground	0	Common return line
2	Motor power supply	20 – 59	Main power supply, may be switched off
3	24V logic supply	11 – 30	Auxiliary supply, not to be switched at stop
	(Wide range log. su.)	(11 – 95)	

Table 1: Pin assignment of the main power connector

Position switch

If 24VDC are used as logic supply voltage, the inductive position switch of the orientation drive is powered directly from the amplifiers' PCB. If different voltages are used, they must be connected to a common ground.



The ground line of the digital input is by default connected to the common ground of the amplifier power supply. In case independent supply voltages are required, please contact Neobotix.

Use the following components for the power supply of the switch in case you are not supplying 24V for the amplifiers' logic:

Housing:	Molex, Mini-Fit Jr. receptacle dual row 2 circuits, 0039012020
Contacts:	Molex, Mini-Fit Jr. crimp terminal female 18-24 AWG, 0039000039

The pin assignment is as follows:

Pin	Function	Voltage / VDC	Description
1	Supply	24	Position switch power supply
2	Ground	0	Return line

Table 2: Pin assignment of the position switch connector

Brakes

The servomotors can optionally be equipped with fail-safe brakes that need to be released while the motor rotates. A 24VDC supply capable of providing 0,75A is required for the brake.

Use the following components for the power supply of the brakes:

Housing: Molex, series KK receptacle 2 circuits, 22-01-2021

Contacts: Molex, series KK crimp terminal 22-30 AWG, 08-50-0032

The pin assignment is as follows:

Pin	Function	Voltage / VDC	Description
1	Ground	0	Return line
2	Supply	24	Brake power supply

Table 3: Pin assignment of the brake supply connector

5.2 Communication interfaces

CAN

Both drive amplifiers are connected to the PCB's CAN-bus connector. Please use the following components for the CAN-bus connection:

Housing: TE Connectivity, HE14 receptacle double row 8 circuits, 281839-4

Contacts: TE Connectivity, HE14 crimp terminal female 28-24 AWG, 182734-2

The pin assignment is as follows:



Pin	Function	Pin	Function	Pin	Function	Pin	Function
1, 5	GND	2, 6	CANL	3, 7	CANH	4, 8	Shield

Table 4: Pin assignment of the CAN bus connector



If the CAN bus ends at one of the Omni-Drive-Modules a terminating resistor of 120 Ω has to be activated. Please move switch S1 beside the LEDs to position ON.

RS-232

Each drive amplifier has a separate RS-232-interface which can be used for configuration and for communication with the control software.



Pin	Function	Description
1	GND (Orientation)	Reference ground line (orientation drive)
2	TxD (Orientation)	Transmit line (orientation drive)
3	RxD (Orientation)	Receive line (orientation drive)
4	GND (Traction)	Reference ground line (traction drive)
5	TxD (Traction)	Transmit line (traction drive)
6	RxD (Traction)	Receive line (traction drive)

Table 5: Pin assignment of the RS232 connector

5.3 Digital I/Os

The drive amplifiers each feature 6 digital inputs, 2 digital outputs and 1 analogue input which may be used for special functions if required. They can be assigned to predefined functions (torque off, hard stop, etc.) or be accessed by the user program running on the amplifier. Their current state can also be read by the control software via the CAN-bus or the serial interface.

The connectors X2 and X5 of the PCB provide easy access to three of the digital inputs and one digital output. These inputs can be equipped with a limiting resistor if the signal voltage is higher than 5V. The positions for these are marked "Rin1", "Rin2" and "Rin3" and are located right beside the connectors.

Please keep in mind that the limiting resistor has to be bridged if the default signal level of 5V is used.

The digital input 1 of the orientation drive amplifier is connected to the output of the position switch and cannot be used for customised functions.



The ground line of the digital inputs of the orientation drive amplifier is by default tied to the common ground of the amplifier power supply. In case independent voltage levels are required, please contact Neobotix.

The return line of the digital inputs of the traction drive amplifier can also be tied to the common ground by bridging the solder jumper marked "G←I".

The motors' encoder signals are also available at the IO connectors. They can for example be used for motion monitoring by an external safety device.

Furthermore the IO connectors provide power supply for additional low power sensors. The module's logic supply voltage is available at pins "VL" (supply) and "G" (ground).

Further information can be found in the documentation of the drive amplifier "Whistle" on the homepage of Elmo Motion Control at www.elmomc.com.

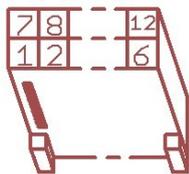
Use the following components for the I/O connection:

Housing: TE Connectivity, HE14 receptacle double row 12 circuits, 281839-6

Contacts: TE Connectivity, HE14 crimp terminal female 28-24 AWG, 182734-2

Pin assignment X2 and X5

The pin assignment of the full connectors is as follows. Depending on the ordered version of the Omni-Drive-Module, not all signals may actually be available.



Pin	Function	Description
1	A+	Channel A of the TTL motor encoder, for motion monitoring
2	B+	Channel A of the TTL motor encoder, for motion monitoring
3	O-	Emitter contact of the optocoupler of digital output 1
4	G	Main ground
5	I-	Common ground of the digital inputs
6	I2	Digital input 2 (mind the limiting resistor)
7	A-	Channel A (inverted) of the TTL motor encoder, for motion monitoring
8	B-	Channel B (inverted) of the TTL motor encoder, for motion monitoring
9	O1	Collector contact of the optocoupler of digital output 1
10	VL	Logic supply (output)

11	I1	Digital input 1 (mind the limiting resistor)
12	I3	Digital input 3 (mind the limiting resistor)

Table 6: Full pin assignment of connectors X2 and X5

Motion monitoring

On request the connectors can be prepared to provide direct access to the encoder signals of the traction and / or orientation motor from outside.

This option will change the pin assignment as follows.



Pin	Function	Description
1	O-	Emitter contact of the optocoupler of digital output 1
2	B+	Channel A of the TTL motor encoder, for motion monitoring
3	A+	Channel A of the TTL motor encoder, for motion monitoring
4	O1	Collector contact of the optocoupler of digital output 1
5	B-	Channel B (inverted) of the TTL motor encoder, for motion monitoring
6	A-	Channel A (inverted) of the TTL motor encoder, for motion monitoring

Table 7: Pin assignment for motion monitoring option

This option requires different connector housings:

TE Connectivity, HE14 receptacle double row 6 circuits, 281839-3

5.4 Enable lines

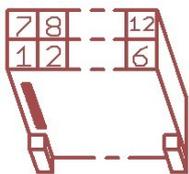
On request the drive amplifiers can be configured to have two 24V enable lines. The signals can be integrated into the CAN bus cable and then be conveniently patched through to all Omni-Drive-Modules.

This option uses digital inputs 2 and 3 which then are no longer available for other functions.



Please note that this feature is not safety approved.

The pin assignment of the CAN bus connector changes as follows:



Pin	Function	Pin	Function	Pin	Function
1, 7	GND	2, 8	CANL	3, 9	CANH
4, 10	Shield	5, 11	Enable 1	6, 12	Enable 2

Table 8: Pin assignment of the CAN bus connector

This option requires the same connector housings as the digital I/Os.

6 Configuration

The best way to configure and optimise the drive amplifiers is by using the interface software *Composer* which is provided for free download from the homepage of the manufacturer Elmo Motion Control. The latest version can be found at:

<http://www.elmomc.com/support/downloads-software-tools-main.htm>

It is recommended to connect the computer that runs the *Composer* to the amplifier by a standard RS-232 serial connection (COM port). The appropriate configuration cable is included in delivery.

The drive amplifiers are configured with general purpose settings and ready for operation. Before the Omni-Drive-Module can be used in a mobile robot, the communication parameters have to be adjusted according to the features of the control system.

If extraordinary kinematics are to be realised or if the modules are to be used under extreme conditions (very heavy vehicle or payload, uneven or soft floor, asymmetric centre of gravity, ...) it might be necessary to adjust the control loop parameters of some or all amplifiers. Please contact Neobotix in such cases.

6.1 Connecting to the amplifiers

After installing and starting the *Composer* the start dialogue will appear. Connect the computer to the amplifier by using the configuration cable and turn on the power supply of the amplifier.

Please be careful to actually connect to the amplifier which you currently want to access.



Figure 5: Start dialogue of the Composer

Choose *Open Communication Directly* to open the communication settings dialogue. After selecting *RS 232* as interface and clicking *Properties* you can select the COM port that you are using. Please select a baud rate of *57600 Bit Per Second* and click *Connect*. The dialogue should close and the configuration toolbox, called *Smart Terminal*, should appear.

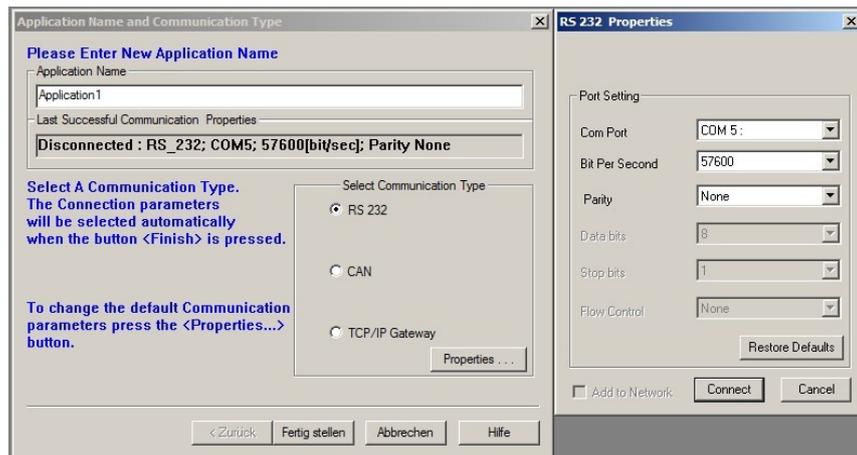


Figure 6: The communication dialogues

In case you cannot connect to the amplifier, please check the following:

- **Amplifier power:** Is the amplifier connected to a sufficient power supply and is the power supply turned on? In case the module is connected to a laboratory power supply: Is the current limit high enough to provide the inrush current and a sufficiently fast rise of the logic supply voltage?
- **Cable:** Is the computer actually connected to the correct amplifier? When handling several drives in a row it sometimes happens that only the power supply is connected to the next module while the configuration cable is still plugged to the previous module.
- **Baud rate:** The baud rate of the serial connections has been changed to 57.6 kBaud to make working with the modules more convenient. The default baud rate of the *Composer* is only 19.2 kBaud.
- **COM port:** Try other COM port numbers. If a USB-to-serial converter or a similar device is used, please check which number has currently been assigned to the interface. Close the *Composer*, re-connect the converter and restart the *Composer*.

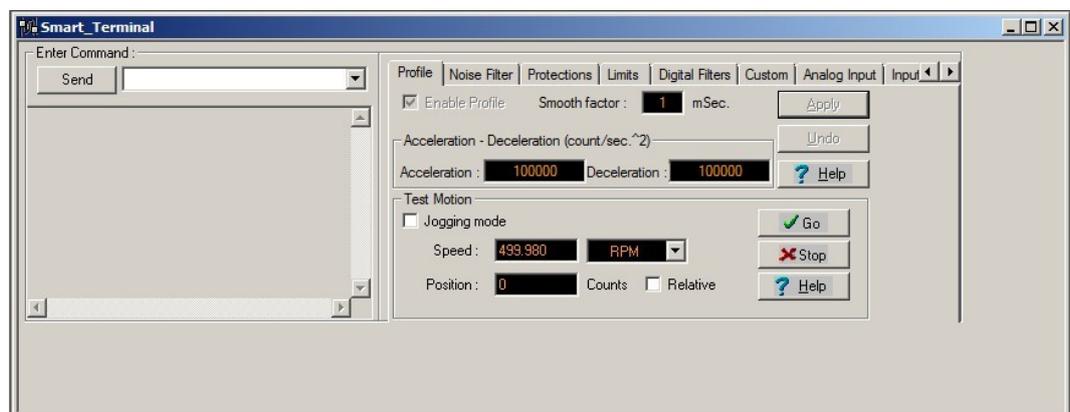


Figure 7: Initial view of the Smart Terminal after connecting to the amplifier

Use the button *Disconnect* on the right end of the main toolbar to close the connection to the amplifier.



Figure 8: Disconnect button

6.2 Handling different configurations

There are basically three ways of handling different configurations.



Figure 9: Main buttons: Create New Application, Open Existing Application, Save Application (f.l.t.r.)

Saving the current configuration

After connecting to an amplifier the current configuration is automatically uploaded to the *Composer* and can be saved in a file by clicking the button *Save Application* in the top left corner of the main window. The *Composer* will always ask whether the current configuration should also be written to the amplifier's non-volatile memory or if it should only be written to a file on the computer.



A Save-As-dialogue will always appear. If the configuration has been saved before (in the current session), the last used file name will be selected automatically but will also automatically have an extension indicating the currently used interface. To avoid having duplicate files please select the appropriate file manually before clicking *Save*.

Any changes to the configuration on the amplifier can also be written to the non-volatile memory without creating a file on the computer. Simply type "sv" into the command line of the *Smart Terminal* and hit *Enter* or click on *Send*.



Figure 10: SV-command and reply

Using an existing file

To use a backup file simply click the button *Open Existing Application*, select the file and click *Download* in the open dialogue. In case the current interface differs from the settings stored in the file, you will need to open the properties dialogue by clicking *Change* in the *Communication Info* area of the file open dialogue.

After the connection has been established successfully, the configuration is downloaded to the volatile memory of the amplifier. To save the configuration permanently, please refer to the previous section.



The motor specific commutation parameters are also stored in the configuration file. This means that any known motor can be run by any amplifier after downloading the correct file to the amplifier. It also means that after connecting a new motor to any amplifier, the unique commutation parameters of the new motor have to be determined even if all other settings that are already saved in the amplifier may remain unchanged. Please contact Neobotix if you intend to replace the motor.

Creating a new configuration

All motor parameters can be defined anew by using an integrated wizard. Since the Omni-Drive-Modules are not meant to be run with different motors, it is not recommended to modify any settings with this feature.

In case you intend to modify the drives or need any further assistance please contact Neobotix.

6.3 Basic settings

The *Smart Terminal* of the *Composer* shows all the basic settings that can easily be changed. In case you need to modify any other settings or need in-depths information, please refer to the documentation on the Elmo MC homepage or contact Elmo MC or Neobotix directly.

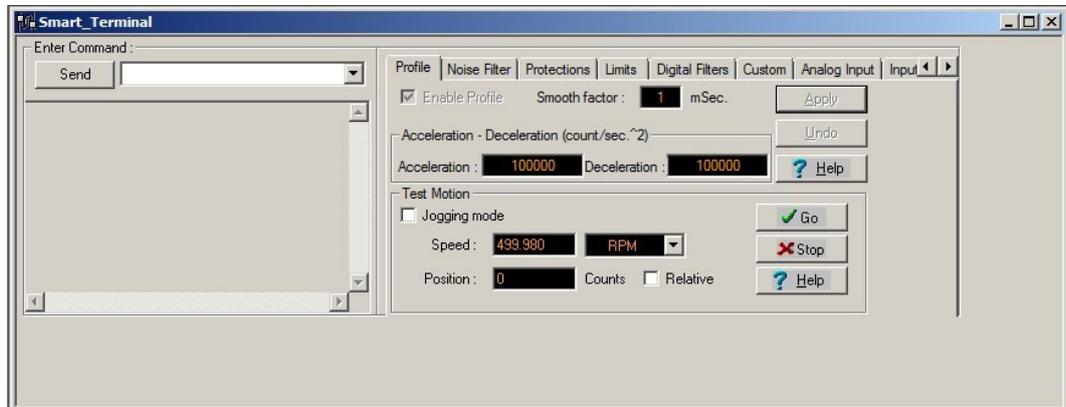


Figure 11: The Smart Terminal

The communication settings can be changed by entering the command “PP” plus an index number in square brackets in the command line at the top left of the *Smart Terminal*. Enter the command and either hit enter or click the *Send* button to read the current value. Add the equals sign and the new value right after the command to change a setting.

The following commands may be necessary:

Command	Description	Common values
PP[2]	RS-232 baud rate	4: 57,600 Baud (Default)
		3: 38,400 Baud
		2: 19,200 Baud
PP[13]	CAN ID	1 – 127
PP[14]	CAN baud rate	0: 1,000,000 Baud (Default)
		1: 500,000 Baud
		2: 250,000 Baud
PP[15]	CAN group ID	1 – 128 (Default: 30)

Table 9: Commands regarding the communication settings

To change the CAN-ID of an amplifier to, for example, 42, send “PP[13]=42”.

Send the command “SV” to write your changes to the non-volatile memory. The new settings will be activated at the next restart of the amplifier.

6.4 Advanced Settings

The motor must be deactivated for some settings to be applied. Use the button *Stop & Motor Off* to deactivate the motor.



Figure 12: Buttons “Motor On” and “Stop & Motor Off” in the main toolbar

Acceleration and deceleration

The maximum permitted acceleration and deceleration can be set by editing the two according fields in the tab *Profile* of the *Smart Terminal* and clicking *Apply*. These values are the limiting values and will be used by the internal control loop of the amplifier. The actual acceleration and deceleration in normal operation is mainly determined by your motion control software and will be (and should be) significantly lower.

Speed limits and stop deceleration

Several speed limits can be set on the tab *Limits*, sub tab *Velocity*. The *Command* limits define the velocity range that will be accepted by the amplifier. Motion commands with velocities exceeding this range will be rejected.

The *Feedback* velocities define the range in which the motor is allowed to operate without raising an error. Therefore the Feedback limits should be set wider than the command limits.

The *Stop deceleration* is the deceleration that is used when a stop command is sent to the amplifier. This deceleration can be much higher than the values defined as normal acceleration and deceleration. It is meant to provide the fastest yet safest stopping of the axis in case of an emergency.

Control loop parameters

The internal parameters of the velocity and position control loop can be changed in the *Digital Filters* tab.

The values of the current control loop should not be changed manually.



In the unlikely case that the behaviour of the Omni-Drive-Module does not meet the application's requirements the internal parameters may be changed carefully. Please consult your local Elmo Motion Control department before modifying these values.

6.5 Testing and debugging

The *Test Motion* area in the *Profile* tab can be used to move the motor under manual control for testing purposes. Activate *Jogging mode* to make the motor rotate continuously with the given *Speed*, or deactivate the check-box to move the motor to the given *Position*. Simply click the *Go* button to start the motion and *Stop* to set the velocity back to zero.

The Composer also offers a function to record high definition measurements of the motor's movements and to plot these data graphically. Please contact Neobotix or Elmo Motion Control if you need further information on this topic.

7 Maintenance

The Neobotix Omni-Drive-Module does not require excessive maintenance. Please check the following details approximately every month to ensure the best function and a long life expectancy.

Cleaning

The gearbox housing of the Omni-Drive-Module is completely sealed and will not be affected by dirt. Nevertheless it is recommended to regularly remove dust and dirt in order to optimise heat dissipation, especially if the module is integrated into a closed hull and has only limited convection cooling.

Please keep the PCB and the amplifiers as clean as possible. This will not only prevent bad smell caused by heated dust but will also prevent short circuiting and damage to the electronics.

Depending on the environment the module is used in, some amount of hairs and dust will accumulate on the wheel's axle near the bearing. Please clean this area regularly to avoid damage to the seals of the ball bearing and to minimise friction.

Traction wheel

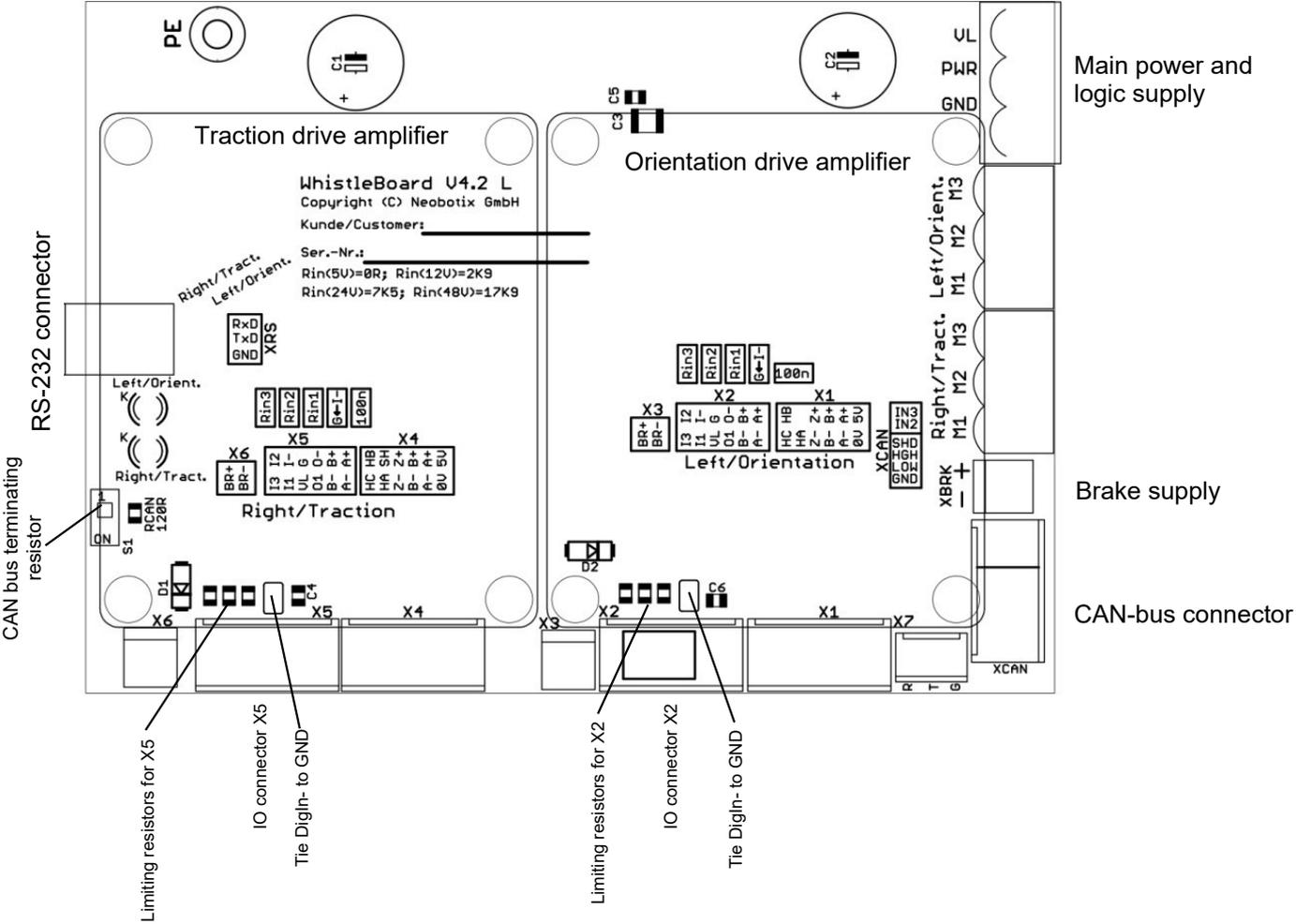
The traction wheel is very hard-wearing and not expected to show any signs of damage or wear within the expected lifetime of the module. In case you find any signs of wear, please contact Neobotix.

8 Technical data

8.1 Dimensions

Dimensional drawings of the Omni-Drive-Module can be found on pages 8 and 9.

8.2 Pin-layout



8.3 Properties

Description	Unit	Value
Weight	kg	18
Amplifier supply voltage (minimum / recommended)	VDC	24 / 48
Position sensor supply voltage	VDC	24
Rated wheel torque @ 48V	Nm	34
Rated wheel speed @ 48V	rpm	100
Traction drive gear ratio (first stage)	1	15:1
Traction drive gear ratio (second stage)	1	2:1
Orientation drive gear ratio	1	19:1
Motor encoder resolution	Inc. / Rev.	10000
Maximum payload per module	kg	150
Expected working time	a	10

Table 10: Technical properties of the Omni-Drive-Module

9 Taking out of service

9.1 Disassembly

Once the Omni-Drive-Module has reached the end of its lifetime it should be disassembled and its components should be recycled.

Disassembly should be done by technicians only, preferably someone who has already worked on the module in the past and knows its technical details. This will ensure:

- Fast and trouble-free disassembly
- Reduced risk of injuries or damages
- Reduced risk of damages to components that are to be reused
- Proper sorting of parts according to materials and way of recycling

9.2 Recycling

Reusable components

Some components of the Omni-Drive-Module (e. g. the servo motors and the amplifiers) have a very long life expectancy and will most probably still be usable when the overall system has reached the end of its lifetime.

Please check carefully which components can be reused immediately or in later projects and make sure that they are removed with care.



Reusing components does not only help the environment by reducing resource consumption but will also save a significant amount of money.

Mechanical components

The mechanical part of the Omni-Drive-Module is made up from different metals which should be separated and recycled accordingly. The most parts of the module are made from aluminium. The remaining parts are mostly made from plain steel or stainless steel and only the worm gears are made from brass alloy.

When separated properly, all these parts can be recycled easily by selling them to companies specialised in metal recycling.

Electrical components

Electronic scrap is both a source of valuable resources as well as a threat to the environment and must not be treated like consumer waste.

All electrical wires and components must therefore be collected and sold to or deposited at the appropriate recycling facilities.

10 Legal notes

Version information

This document has been translated and is not the original. Please refer to the German version in case of uncertainties or questions.

Liability

Every care has been taken in the preparation of this manual which represents the state of technology at the time of its composing. However, inaccuracies or omissions might occur. Please inform Neobotix in case you notice any.

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The product described herein is a partly completed machine which might not yet comply with all applicable safety requirements. It is prohibited to put this product into service until the machine has been completed or was integrated into another machine. Furthermore an assessment of risks has to be performed and the completed machine must be declared in conformity with the applicable EC Directives.

Only the customer respectively the system integrator can be held responsible for the safe use of the completed machine.



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This product complies to the RoHS directives of the European Union. For further information please contact Neobotix.

Downloads and further information

Additional information, data sheets and documentations, also for the other products of Neobotix, can be found on our homepage www.neobotix-roboter.de.

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