

*phy***MOTION**<sup>™</sup>

## **Indexer Module**

**I4XM01.1**

**Firmware Version:**

**V1.1.2 (Loader)**

**V1.2.08 (System)**

**TRANSLATION OF THE GERMAN ORIGINAL MANUAL**

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In this manual you will find the descriptions of the features and specifications of the **phyMOTION™** module: 4 Axes High End Indexer Module I4XM01 (<http://www.phytron.de/phyMOTION>).

This manual is supplementary to the “**phyMOTION™** Modular Multi-axis Controller for Stepper Motors” manual.

Every possible care has been taken to ensure the accuracy of this technical manual. All information contained in this manual is correct to the best of our knowledge and belief but cannot be guaranteed. Furthermore we reserve the right to make improvements and enhancements to the manual and / or the devices described herein without prior notification.

We appreciate suggestions and criticisms for further improvement.

Email address: [doku@phytron.de](mailto:doku@phytron.de)

Questions about the use of the product described in the manual that you cannot find answered here, please contact your representative of Phytron (<http://www.phytron.de/>) in your local agencies.

## 1 Legal Information



### This manual:

*Read this manual very carefully before mounting, installing and operating the device and if necessary further manuals related to this product.*

- Please pay special attention to instructions that are marked as follows:

	<b>DANGER – Serious injury!</b>	<i>Indicates a high risk of serious injury or death!</i>
	<b>DANGER – Serious injury from electric shock!</b>	<i>Indicates a high risk of serious injury or death from electric shock!</i>
	<b>WARNING – Serious injury possible!</b>	<i>Indicates a possible risk of serious injury or death!</i>
	<b>WARNING – Serious injury from electric shock!</b>	<i>Indicates a possible risk of serious injury or death from electric shock!</i>
	<b>CAUTION – Possible injury!</b>	<i>Indicates a possible risk of personal injury.</i>
	<b>CAUTION – Possible damage!</b>	<i>Indicates a possible risk of damage to equipment.</i>
	<b>CAUTION – Possible damage due to ESD!</b>	<i>Refers to a possible risk of equipment damage from electrostatic discharge.</i>
	<b>“Any heading”</b>	<i>Refers to an important paragraph in the manual.</i>

Observe the following safety instructions!

### Qualified personnel



#### **WARNING – Serious injury possible!**

*Serious personal injury or serious damage to the machine and drives could be caused by insufficiently trained personnel!*

Without proper training and qualifications damage to devices and injury might result!

- Design, installation and operation of systems may only be performed by qualified and trained personnel.
- These persons should be able to recognize and handle risks emerging from electrical, mechanical or electronic system parts.
- The qualified personnel must know the content of this manual and be able to understand all documents belonging to the product. Safety instructions are to be provided.
- The trained personnel must know all valid standards, regulations and rules for the prevention of accidents, which are necessary for working with the product.

### Safety Instructions



#### **Further Manual**

*This manual is addition to the following main manual:*

*“phyMOTION™ Modular Multi-axis Controller for Stepper Motors”*

- First, read the main manual and then continue with this manual.

#### **Intended use:**



*The phyMOTION™ is designed for operating in a drive system.*

- An installation is allowed only if the requirements of the EC Machinery and EMC Directives are conformed with.

#### **Part of a machine:**



*This product is used as a part of a complete system, therefore risk evaluations concerning the specific application must be made before using the product.*

- Safety measures have to be taken according to the results and be verified.
- Personnel safety must be ensured by the concept of this overall system (e.g. machine concept).



**WARNING – Serious injury from electric shock!**

*If the phyMOTION™ is not operated with SELV/PELV voltages, the risk of dangerous voltages may be on the device. Touching these components carrying high voltages can cause serious injury or death from electric shock:*

- Always observe the safety concept SELV / PELV to ensure safe isolation and separation of low voltage supplies from the mains.



**WARNING – Serious injury from electric shock!**

*During electrical installation cables, connectors, etc. can be live.*

- Before starting wiring, make sure that none of the power supplies are connected to the primary side of the mains supply. Isolate the power supplies from the mains or remove the appropriate fuses.
- All modules must be inserted and screwed into the phyMOTION™ housing before powering up. If necessary, unoccupied module slots must be covered with the supplied blank front plates. Never operate the equipment when open.
- Do not plug or unplug the modules while powered.
- Do not plug or unplug the connectors while powered.
- If the equipment was energised, wait 3 minutes after power off to allow the capacitors to discharge and ensure that there are no residual charges on cables, connectors and boards.

**2 Contents**

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**1 Legal Information ..... 3**

**2 Contents ..... 6**

**3 I4XM01 Module Overview ..... 7**

**4 Technical Data ..... 8**

    4.1 Declaration of Conformity ..... 8

    4.2 Mechanical Data ..... 10

    4.3 Features ..... 11

    4.4 Functions ..... 13

    4.5 Configuration Example ..... 13

**5 Installation ..... 14**

    5.1 Mechanical Installation ..... 14

    5.2 Electrical Installation ..... 16

        5.2.1 Connectors - Overview ..... 16

        5.2.2 Pin Assignment ..... 17

        5.2.3 ServiceBus Connector X1 ..... 18

        5.2.4 Connection Electronic Wave X2/X3 ..... 18

**6 Commissioning ..... 20**

    6.1 Diagnostics by the LEDs ..... 21

    6.2 Parameterising the Module ..... 22

**7 Principles of Positioning ..... 23**

**8 Service ..... 23**

**9 Warranty, Disclaimer and Registered Trademarks ..... 24**

    9.1 Disclaimer ..... 24

    9.2 Warranty ..... 24

    9.3 Registered Trademarks ..... 24

**10 Index ..... 25**

### 3 I4XM01 Module Overview

I4XM01 stands for “indexer module for up to 4 axes“. This module is used as an interface to the internal and external power stage modules (e.g. INAM01 or EXAM01).

It can interpolate any two axes circular and up to 4 axes linear and sends Control pulses/ Direction/Boost signals to an external power stage.

Via the ServiceBus interface external power stages can be parameterised online.

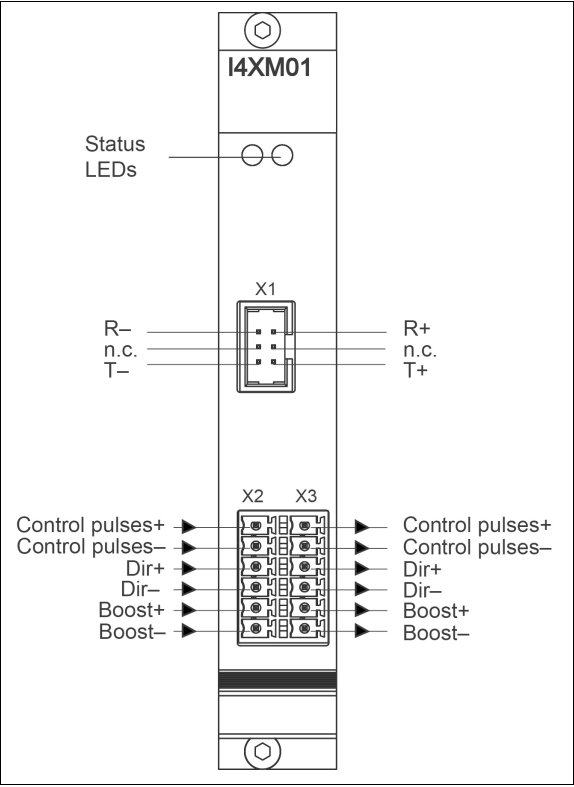


Fig. 1: I4XM01

4 Technical Data

4.1 Declaration of Conformity



Declaration of Conformity  
according to EC directive 2004/108/EC (EMC-Directive)

Name and address of the manufacturer:  
Phytron GmbH,  
Industriestr. 12  
82194 Gröbenzell

We declare that the following product is in conformity with the EC Directives 2004/108/EC relating to EMC.

Product denomination

Part-Name	Description
AIM01.1	Analog Input-Module
AIOM01.1	Analog I/O Module
AOM01.1	Analog Output-Module
APS01.1	High-End Stepper Motor Power Stage
CANS01.1	CAN Communication Sub Module
DIOM01.1	Digital I/O Module
DIOM0a.1	Digital I/O Module (customer-specific version)
ECAS01.1	SSI/ Quadratic Encoder Sensing Sub Module
ECES01.1	EnDat Encoder Sensing Sub Module
EXAM01.1	Indexer Interface Module
I1AM01.1	1-Axis Stepper Motor Drive
I1AM02.1	Indexer and Carrier Module for APS Power Stage
I1AM0a.1	1-Axis Stepper Motor Drive (customer-specific version)
I4XM01.1	4 Axes HighEnd Indexer
INAM01.1	Carrier Module for APS Power Stage
MCM01.1	Main Controller Module
PBS01.1	Profibus Communication Sub Module
PNS01.1	ProfiNet Communication Sub Module
POWM01.1	Main Power Input Module
POWM02.1	Intermediate Power Input Module
RSS01.1	RS485/RS232 Communication Sub Module

From serial number 1402xxxxx

Applied harmonized standards

- EN 61000-6-1: 2007-01 Electromagnetic Compatibility (EMC) - Immunity for residential, commercial and light-industrial environmental

AP QS-0072-4  
CE 7034 Rev. 2

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- EN 61000-6-2: 2005-08 Electromagnetic compatibility (EMC) - Immunity for industrial environments
- EN 61000-6-3: 2007-01 Electromagnetic compatibility (EMC) - Emission standard for residential, commercial and light-industrial environments
- EN 61000-6-4: 2007-01 Electromagnetic compatibility (EMC) - Emission standard for industrial environments

**Comment:**

This declaration of conformity is valid only if the device is built in a suitable casing e.g. phyMOTION-6SL-MR-s.

Gröbenzell, 2014-02-27



Johannes Schmid  
Technical Director

4.2 Mechanical Data

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Dimensions	100 x 100 mm without front panel
Weight	67 g / 91 g (without / with front panel)
Mounting	Plug-in module into the modular stepper motor controller <i>phyMOTION</i> <sup>TM</sup>
Mounting position	Vertical

### 4.3 Features

Performance Characteristics	
<b>Indexer</b>	1, 2, 3 and 4 axes stepper motor indexer
<b>Superior controller</b>	Modular <i>phyMOTION</i> ™ controller
<b>Supply voltage</b>	24 V <sub>DC</sub> I/O supply voltage 5 V <sub>DC</sub> internal
<b>Current consumption (max.)</b>	250 mA (5 V <sub>DC</sub> internal) 10 mA (24 V <sub>DC</sub> I/O)
<b>Cable length – digital inputs</b>	30 m; if longer (100 m max.) use shielded cable and contact shield close to the controller.
<b>Diagnostics</b>	2 status LEDs at the front panel for diagnostics
<b>Support of linear and rotary axes</b>	Yes
<b>Refresh rate</b>	2 ms

Interfaces	
<b>Electronic wave</b>	Control pulses/Direction/Boost - inputs and outputs for synchronisation with external sources or power stages required driver current: 10 mA max. at 3 V, 30 mA max. at 5.5 V
<b>ServiceBus</b>	For the parameterisation of external power stages with ServiceBus to EXAM modules
<b>Bus connection rear side</b>	Proprietary phytron Bus and interface to the INAM01, EXAM01
Communication and Programming	
<b>Programming</b>	Via phytron's programming environment <i>phyLOGIC</i> ™ ToolBox
<b>Communication</b>	Master-slave communication. The I4XM01 module is the slave and communicates with the main controller module MCM01.



## 4.4 Functions

### Interface to the internal (INAM01) or external power stage (EXAM01)

- 1, 2, 3 and 4 axes stepper motor indexer
- Circular interpolation for any two selectable axes
- Linear interpolation for up to 4 selectable axes
- Additional Control pulses/Direction input and output for “electronic wave”
- Extended indexer functions
  - Variable, short ramps
  - High velocity: up to 500,000 steps/second
  - Interpolation also for gear axes

## 4.5 Configuration Example

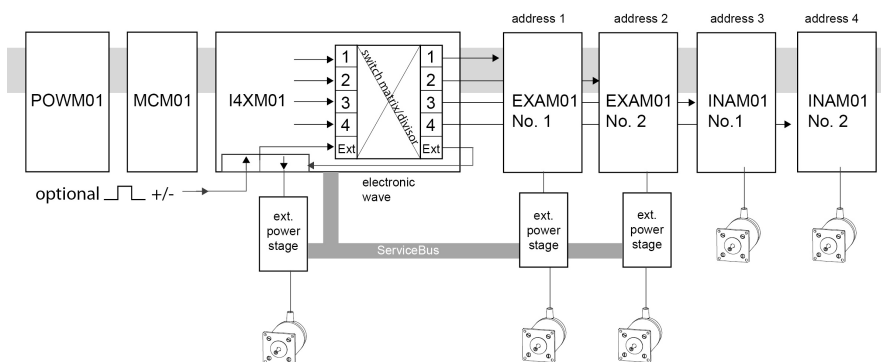


Fig. 2: Example

### 5 Installation

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phytron always delivers the **phyMOTION™** completely assembled in order to make sure you can start with the installation and the wiring right away.



#### Further manual

*Detailed information on this subject is in a supporting manual:*

**“phyMOTION™ Modular Multi-axis Controller for Stepper Motors”**

### 5.1 Mechanical Installation

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In case you receive an individually packed I4XM01 as an expansion module or after repair or service unpack the module in ESD protected area only.



#### **CAUTION – Possible damage by ESD!**

*The modules of the phyMOTION™ consist of sensitive electronic components that can be destroyed by electrostatic discharge voltages.*

- Always store and transport single modules in ESD protective packaging.
- Always handle the components in compliance with the ESD protection measures.
- No liability is accepted for any consequences resulting from improper handling or non-ESD-friendly packaging.

Before integrating or switching modules always make sure that the **phyMOTION™** is shut down and the power supplies are disconnected.



**WARNING – Serious injury from electric shock!**

*During electrical installation cables, connectors, etc. can be live.*

- Before starting wiring, make sure that none of the power supplies are connected to the primary side of the mains supply. Isolate the power supplies from the mains or remove the appropriate fuses.
- All modules must be inserted and screwed into the **phyMOTION™** housing before powering up. If necessary, unoccupied module slots must be covered with the supplied blank front plates. Never operate the equipment when open.
- Do not plug or unplug the modules while powered.
- Do not plug or unplug the connectors while powered.
- If the equipment was energised, wait 3 minutes after power off to allow the capacitors to discharge and ensure that there are no residual charges on cables, connectors and boards.

Make sure not to leave free slots in between modules so the module addressing sequence can work correctly.

Identify the correct slot position for your I4XM01 referring to your order and documentation. The I4XM01 module needs up to 4 INAM01 or EXAM01 modules, one POWM01 or POWM02 and the main controller module (MCM01).

The I4XM01 module is always built as a sandwich with its subsequent INAM01 and / or module cards EXAM01.

Connect the I4XM01 module with the connector (2x13 poles, ribbon cable) to the appropriate INAM01 and/or EXAM01 modules from the rear side.

Push the sandwich module carefully into the guide rail until the rear contacts the housing frame of the **phyMOTION™**

In the last few millimetres the module's plug has to match with the backplane's socket. You should be able to push in the module with light pressure. In case you experience problems move the module's front plate slightly to the left and to the right while pushing in the module, so that the plug's pins can slide into the backplane's socket.

As soon as the module's front plate contacts the housing's frame the module is integrated properly and can be fixed with two electro-conductive bolts.

Now you can start with the electrical installation.

### 5.2 Electrical Installation

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Ensure sufficient bending radius of the cables during installation. Do not lay the cables in tension or bend them.

We recommend labelling the mating connectors to prevent interchanging the connectors.

If all the connections are made, the last step is to plug in the power supply to the mains.

#### 5.2.1 Connectors - Overview

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Connector	Number of pins	Connector on the module (Phoenix)	Mating connector	Mating connector ID number
ServiceBus X1	1x6	Tyco Electronics 2-1761605-1/609-0607	Harting female connector 6 pin (09185066803)	10009897
Electronic wave X2/X3	2x6	MCDN1,5/6-G1-3,5P26	FMC1,5/6-ST-3,5 Phoenix	10013216

The mating connector is included in delivery of the module and is usually plugged into the module at the factory.

**i** **CAUTION – Possible damage!**  
*Damage of the module by wrong connection.*

- Do not exchange the 6 pin signal connector (input/output)!



5.2.2 Pin Assignment

In the following the pin assignment:

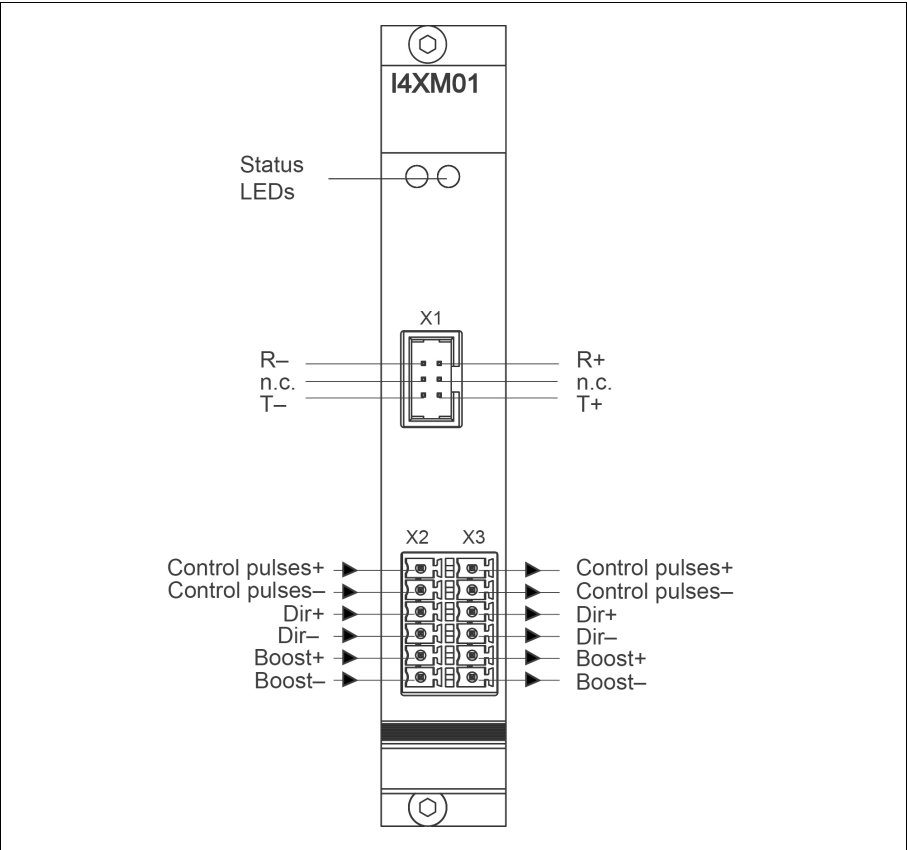


Fig. 3: Pin assignment

Use the specified mating connectors for wiring.

5.2.3 ServiceBus Connector X1

Connect the external power stage (e.g. ZMX<sup>+</sup>) to the 6 pin connector X1 in the ServiceBus mode with the appropriate cable.

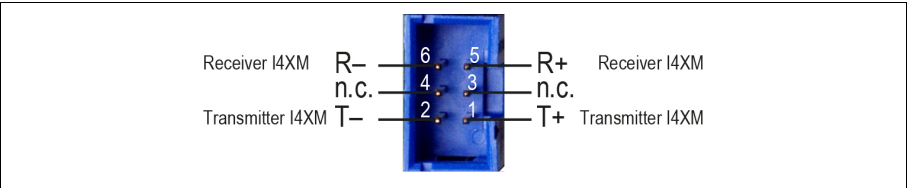


Fig. 4: ServiceBus connector X1, Harting male connector 6 pin (09 18 106 9622)

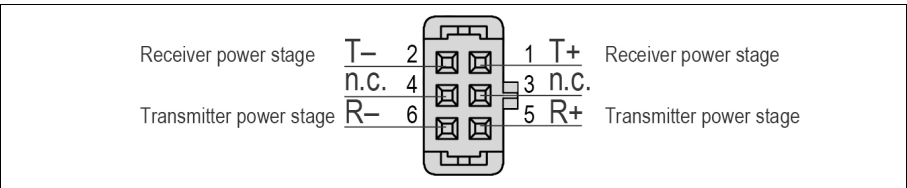


Fig. 5: ServiceBus mating connector, Harting female connector 6 pin (09 18 506 6 803)

5.2.4 Connection Electronic Wave X2/X3

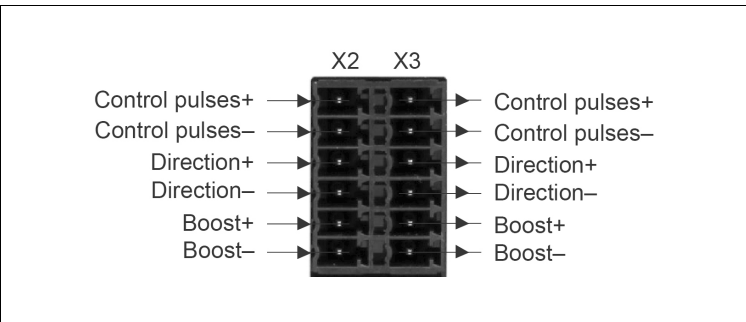


Fig. 6: Signal input and output

It is possible, with the help of Control pulses output and Control pulses input to realise an "electronic wave" so that x number of axes run exactly with the same Control pulses:

A controller initialises itself and its axis (axes), then it is connected as the master. The Control pulses output is connected with the Control pulses input "external Control pulses" of the second controller. The second controller initialises first itself and its axis (axes), then it is connected as a slave. Now it accepts external control pulses and transfers them to the power stage(s).

External Control pulses and Direction signals (RS 422) can be applied to X2.

Signal level: 5 V

Necessary driver current 10 mA max. at 3 V, 30 mA max. at 5.5 V.

The external Control pulses are assigned to the axes by software (parameter P44). Internally it will be switched to all available Control pulses sources.

The **Control pulses signals** must fulfil the specification of the connected power stage:

The following applies to the Direction signals:

If the input optocoupler of the power stage is energised, the motor rotates opposite to the preferred direction of rotation. It is not allowed to change the direction signal at least 1  $\mu$ s before the rising edge and after the falling edge of the Control pulse signals.

Preferably, the Control pulses and Direction inputs are energised with push-pull drivers. This circuit offers high noise immunity.

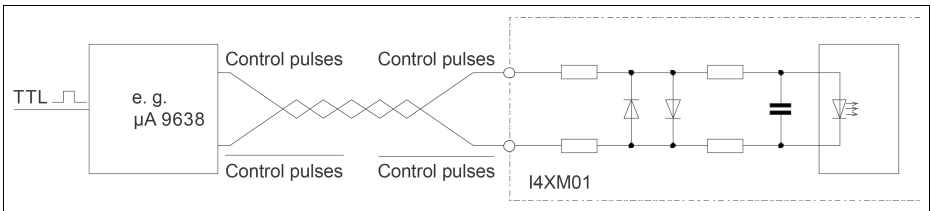


Fig. 7: Push-pull control

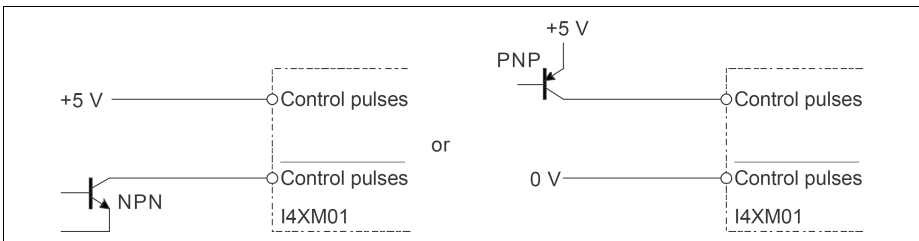


Fig. 8: Open collector control

### 6 Commissioning

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Please read the manual for basic commissioning information of the INAM01 module:



#### Further manual

*Detailed information on this subject is in a supporting manual:*

“**phyMOTION™** Modular Multi-axis Controller for Stepper Motors”

The programming environment **phyLOGIC™** ToolBox is explained in the following manual:



#### Further manual

*Detailed information on this subject is in a supporting manual:*

“**phyLOGIC™** ToolBox – Communication Software for the **phyMOTION™** Stepper Motor Controller”

For programming the sequential program please read:



#### Further manual

*Detailed information on this subject is in a supporting manual:*

“**phyLOGIC™** Command Reference for the **phyMOTION™** Controller”

Information about positioning you'll find in:



#### Further manual

*Detailed information on this subject is in a supporting manual:*

“Principles of Positioning of the Stepper Motor Controllers”



#### CAUTION – Possible damage!

*Some modules are set to a default value on delivery. So e.g., the motor current must be set to the corresponding value (see the motor data from the motor manufacturer). Connected components like motors can be damaged by incorrectly set values.*

- Please check if the parameters are correct before starting.

## 6.1 Diagnostics by the LEDs

The LEDs indicate the status and error of the I4XM01 module by colours and blinking:

LEDs	left	right
<b>off</b>	no power available	
<b>green</b>	ready	ok
<b>orange</b>	Motor runs	–
<b>red</b>	–	Blinks slow (approx. 2 Hz): module is not addressed Blinks fast (approx. 5 Hz): error

### 6.2 Parameterising the Module

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When using encoders, the corresponding *phyLOGIC*<sup>™</sup> parameters **P04** to **P16** should be checked and set.

For the power stage settings use the parameters **P44**, **P50** to **P52**.

For a general overview of the parameters:



#### Further manual

*Detailed information on this subject is in a supporting manual:*

*“*phyLOGIC*<sup>™</sup> Command Reference for the *phyMOTION*<sup>™</sup> Controller”*

Information about positioning you'll find in:



#### Further manual

*Detailed information on this subject is in a supporting manual:*

*“Principles of Positioning of the Stepper Motor Controllers”*

## 7 Principles of Positioning

Information about positioning, see:



### Further manual

*Detailed information on this subject is in a supporting manual:*

"Principles of Positioning of the Stepper Motor Controllers"

## 8 Service

In the case of a service order, please proceed as follows:

First try to identify the technical problem. Feel free to ask our support team for help. We are pleased to assist you.

### Removal of a module:

- Switch off the *phyMOTION*<sup>TM</sup>'s supply voltage
- Disconnect the supply voltage
- Cut the red seal tape and the black label tape carefully on the left and right edge of the module/front panel which you want to remove. Don't slide the blade between the front panels by no means. When backfitting by our service the red seal tape is renewed.
- Loosen the front screws to remove the common INAM01, EXAM01 and I4XM01 modules from the housing. They are connected with ribbon cables.
- Disconnect the connector (ribbon cable) that connects I4XM01 with INAM01 or EXAM01.
- Exchange the I4XM01 module and reassemble it together with the INAM01 or EXAM01 module.
- If you want to use the *phyMOTION*<sup>TM</sup> after removing a module, the gap has to be sealed with a blanking plate before power supply is reconnected and switched on.
- To send a module to phytron use ESD packaging only.

## 9 Warranty, Disclaimer and Registered Trademarks

### 9.1 Disclaimer

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Phytron GmbH has verified the contents of the manual to match with the hardware and software. However, errors and omissions are exempt and Phytron GmbH assumes no responsibility for complete compliance. The information contained in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

### 9.2 Warranty

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The *phyMOTION*<sup>TM</sup> modules are subject to **legal warranty**. phytron will repair or exchange devices which show a failure due to defects in material or caused by the production process. This warranty does not include damage caused by the customer, for example, not intended use, unauthorized modifications, incorrect handling or wiring.

### 9.3 Registered Trademarks

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In this manual several trademarks are used which are no longer explicitly marked as trademarks within the text. The lack of these signs may not be used to draw the conclusion that these products are free from third parties' rights. For example, some product names used herein are:

- *phyMOTION*<sup>TM</sup> is a trademark of Phytron GmbH.
- *phyLOGIC*<sup>TM</sup> is a trademark of Phytron GmbH.
- Microsoft is a registered trade mark and WINDOWS<sup>®</sup> is a trade mark of the Microsoft Corporation in the USA and other countries.



## 10 Index

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### C

Control pulses input 18  
Control pulses output 18  
Copyright 2

### E

External Control pulses 18

### H

Harting connector 17

### I

Installation 13, 15

### L

LED 20

### M

Mating connector 15

### N

Nominal voltage 11

### O

Open collector control 18

### P

Parameterisation 11

### S

seal tape 22  
ServiceBus-connector 17  
Stepper motor 11

### W

Warranty 23