

*phy***MOTION**<sup>™</sup>

## **1 Axis Stepper Motor Drive**

**I1AM02.1 / I1AM0b.1**

**Firmware Version:**

<b>V1.1.0 (Loader)</b>	<b>V1.1.0 (Loader)</b>
<b>V1.1.02 (System)</b>	<b>V1.1.02 (System)</b>

**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: 1 Axis Stepper Motor Drive I1AM02 and its variants.

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.

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### 3 Module Overview - I1AM02

I1AM02 stands for “1 Axis Indexer with Integrated Power Stage (amplifier)”. This module is a full stepper motor drive up to 5 A<sub>PEAK</sub> max. It can be connected directly next to a MCM01 (main controller module). The module includes a mid-performance indexer and a slot for a high performance power stage.

Two limit switches and a third switch, which can be wired as limit switch evaluation are included as standard.

In addition, sub modules can be optionally selected for encoder evaluation (ECAS01, ECES01, ECMS01) as well as motor temperature evaluation (PTS01 and KTS01).

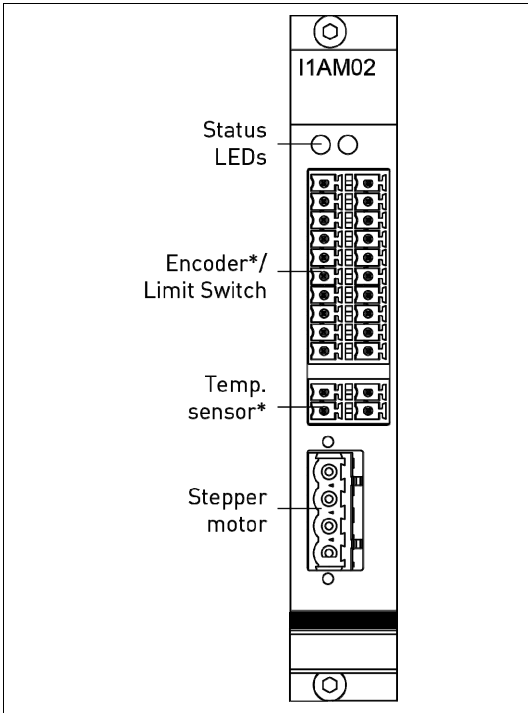


Fig.1 I1AM02 Vorderansicht der Frontplatte

Ordering code of the 1 axis stepper motor drive module (I1AM02):

Ordering code (example): **I1AM02-APS01-ECAS01-PTS01**  
1 axis stepper motor drive module (APS power stage) with  
integrated encoder and PT sensor

Ordering Code

Type

Power stage

Encoder evaluation

Temperature evaluation

I1AM02 - APS01 - ECAS01 - PTS01

Options		
Power stage	APS01	Int. power stage 5A/70V
Encoder evaluation	ECES01 ECAS01 ECMS01	Integr. ENDAT encoder SSI/QUADR. encoder Resolver no encoder module
Temperature evaluation	PTS01 KTS01	Pt sensor K type no temperature module

Mating connectors are included in delivery.



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-0672-4  
CE 7034 Rev. 2  
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Genossenschaftsbank – Kto. 96610 – BLZ 70169444  
IBAN DE4770169440000096610 – BIC GENODEF330  
Sparkasse Fürstentfeldbruck – Kto. 1801245 – BLZ 70059070  
Oberbank München – Kto. 1041021021 – BLZ 70120700  
Volksbank Fürstentfeldbruck – Kto. 712531 – BLZ 70163370  
Postbank München – Kto. 0286001800 – BLZ 70010080

- 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

AP QS-0672-4  
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## 4.2 Mechanical Data

<b>Dimensions</b>	100 x 100 mm (without front panel)
<b>Weight</b>	90 g / 112 g (without / with font panel)
<b>Mounting</b>	Plug-in module into the modular stepper motor controller <i>phyMOTION</i> <sup>TM</sup>
<b>Mounting position</b>	Vertical

### 4.3 Features

Performance Characteristics	
<b>Stepper motor</b>	Suitable for bipolar control of 2 phase stepper motors with 4, (6) or 8 lead wiring
<b>Superior controller</b>	Modular <i>phyMOTION</i> <sup>TM</sup> controller
<b>Supply voltage</b>	24...70 V <sub>DC</sub> Nominal voltage: 70 V <sub>DC</sub> 5 V <sub>DC</sub> internal
<b>Phase current</b>	0.1 to 5 A <sub>PEAK</sub> (0...3.5 A <sub>r.m.s.</sub> )
<b>Current adjustment</b>	10 mA steps
<b>Step resolutions</b>	Full step, half step, 1/2.5, 1/4, 1/5, 1/8, 1/10, 1/16, 1/20, 1/32, 1/64, 1/128, 1/256 micro step
<b>Maximum step frequency</b>	40.000 steps/sec
<b>Physical resolution</b>	Approx. 102 400 positions per revolution (0,0035° /step). The optional encoder modules should be considered for very fine positioning.
<b>Current consumption (max.)</b>	3.6 A <sub>DC</sub> at 5 A <sub>PEAK</sub> 250 mA (5 V <sub>DC</sub> internal) 10 mA (24 V <sub>DC</sub> I/O) 30 mA (EnDat Encoder 5 V <sub>DC</sub> internal) 20 mA + Encoder (24 V <sub>DC</sub> I/O) 30 mA (temperature module) Axis supply: 24-70 V
<b>Mechanical output power</b>	Up to the 250 W range
<b>Nominal power of the motor voltage supply</b>	250 W
<b>Cable length – motor</b>	Shielded: max. 50 m

Performance Characteristics	
<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 on the front panel
<b>Support of linear and rotary axes</b>	Yes
<b>Hardware error detection</b>	Over current, short circuit > 10 A spike at the power stage
<b>Refresh rate</b>	2 ms

Interfaces	
<b>Analogue outputs</b>	A, B, C, D for a 2 phase stepper motor
<b>Analogue inputs</b>	Option: Motor temperature evaluation <ul style="list-style-type: none"> <li>- K thermal element (needs sub module: KTS01)</li> <li>- PT100 sensor (needs sub module: PTS01)</li> </ul>
<b>Digital inputs</b>	3 Limit switches: PNP- NOC/NCC Option: Encoder evaluation <ul style="list-style-type: none"> <li>- SSI/Quadrature (needs sub module: ECAS01)</li> <li>- EnDat (needs sub module: ECES01)</li> <li>- Resolver or LVDT/RVDT (needs ECMS01)</li> </ul>
<b>Communication via backplane bus</b>	Proprietary phytron bus
Kommunikation und Programmierung	
<b>Programming</b>	Via phytron's programming environment <i>phyLOGIC™</i> ToolBox
<b>Communication</b>	Master-slave communication. The I1AM02 is slave and communicates with the MCM01 main controller module.

### 4.4 Functions

---

#### Integrated stepper motor indexer for standard functions

- Relative and absolute positioning
- Reference movements/ speed mode
- Step frequency up to 40,000 steps/sec.

#### Integrated 5 A<sub>PEAK</sub> power stage

- Integrated 5 A<sub>PEAK</sub> / 24 to 70 V<sub>DC</sub> stepper motor power stage
- Selectable step resolution up to 1/256 micro step
- Online power stage parameterisation and diagnostics

#### 3 Limit/reference switches

- Evaluation of up to three limit/reference switches (PNP NCC/NOC)

#### Option: Encoder evaluation

- The evaluation of a SSI / quadrature encoder (with ECAS01 sub module) or EnDat (with ECES01 sub module) or resolver/LVDT/RVDT (with ECMS01 sub module) is possible depending on the selected sub module.

#### Option: Motor temperature evaluation

- The evaluation of PT100 temperature sensors (with PTS01 sub module) or K types (with KTS01 sub module) is possible depending on the selected sub module.

## 5 Installation

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

In case you receive an individually packed I1AM02 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.



#### CAUTION – Possible damage!

*The I1AM02 module is designed for a maximum supply voltage of 70V<sub>DC</sub>. If it is supplied with >70 V<sub>DC</sub> the card might be damaged.*

- Make sure that a power module (POWM01, POWM02) is supplied on the left with less than 48 V<sub>DC</sub> to avoid damage.

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*<sup>TM</sup> 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 I1AM02 referring to your order and documentation. The I1AM02 needs at least a preceding power module (POWM01, POWM02) and the main controller module (MCM01).

Push the module carefully into the guide rail until the rear contacts the housing frame of the *phyMOTION*<sup>TM</sup>.

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

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

Connector	Number of pins	Connector on the module (Phoenix)	Mating connector (Phoenix)	Mating connector ID number
Motor	1x4	IC 2,5/4-G-5,08	IC 2,5/4-ST-5,08	10005390
Limit switches	1x10	MCDN1,5/10-G1-3,5P26	FMC1,5/10-ST-3,5	10013217
Encoder	1x10	MCDN1,5/10-G1-3,5P26	FMC1,5/10-ST-3,5	10013217
Temperature evaluation	2x2	MCDN1,5/2-G1-3,5P26	FMC1,5/2-ST-3,5	10007077

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 10-pin connector for limit switches with the 10-pin connector for the encoder evaluation.

5.2.2 Pin Assignment

In the following the pin assignment:

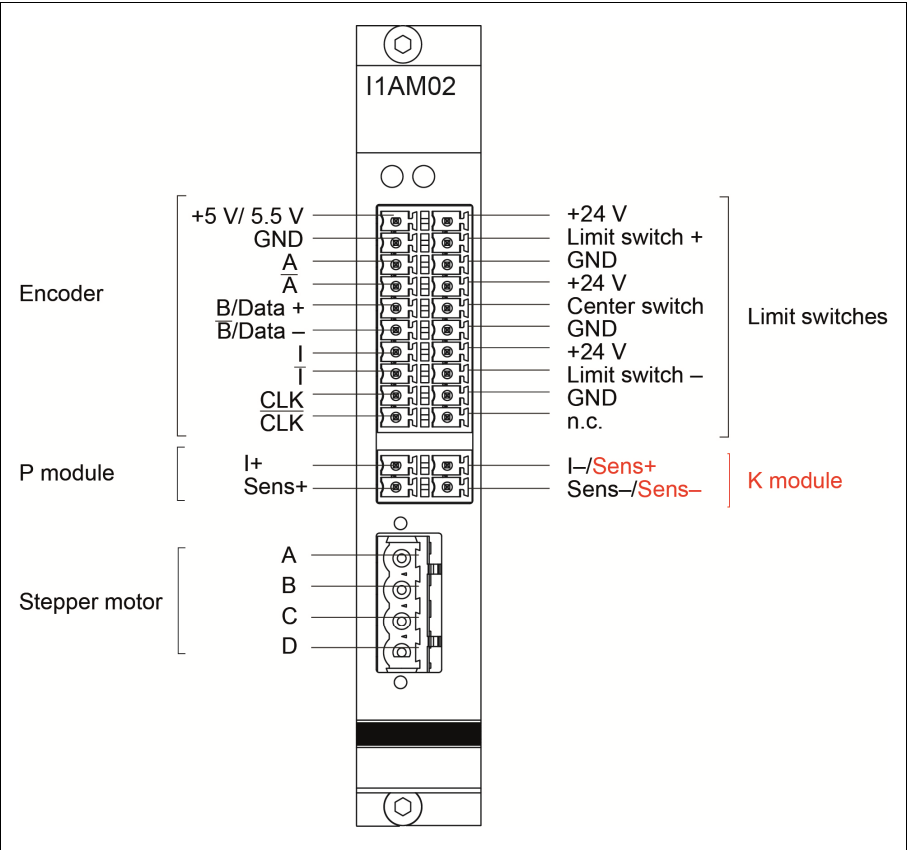


Fig.2 Pin assignment

Use the specified mating connectors for wiring.

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

- Do not exchange the 10-pin connector for limit switches with the 10-pin connector for the encoder evaluation.

### 5.2.3 Stepper Motor Connection

In the next chapter the connection of a 2 phase stepper motor with 4, (6), or 8 lead wiring is described.

Stepper motors with 0.1 to 5 A<sub>PEAK</sub> can be controlled at maximum 70 V<sub>DC</sub> by the I1AM02.

#### Wiring schemes

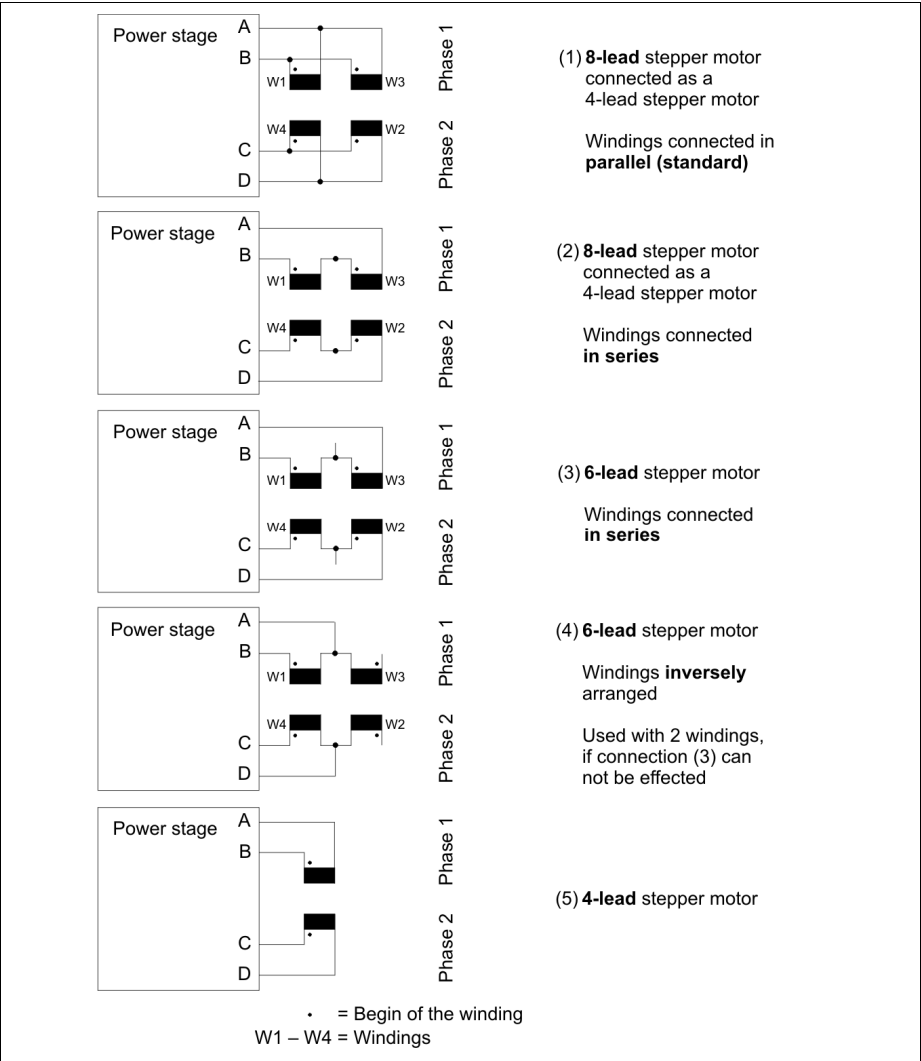


Fig.3 Connection diagrams for 4,(6) and 8 lead stepper motors

Stepper motors with 8 leads can be connected with the windings wired in parallel (1) or series (2).

For 6 lead stepper motors, wiring scheme (3) with series windings is recommended.

If wiring scheme (3) cannot be used because of the motor construction, the motor may be operated with only two of the four windings energized according to wiring scheme (4).



### CAUTION – Possible damage!

*Destruction of the power stage by connecting a 5 phase stepper motor.*

- Do not connect any 5 phase stepper motors to avoid damage.

### Motor time constant $\tau$ :

$\tau = \frac{L}{R}$  applies to the electrical motor time constant  $\tau$ .

The total inductance  $L_{\text{total}}$  is equal to the winding inductance in a parallel circuit, because of interlinked inductances.

$L_{\text{total}} = 4 \times L$  applies to a series circuit.

The result is an equal motor time constant  $\tau$  for a serial and a parallel circuit:

Circuit	series	parallel
Resistance $R_{\text{total}}$	$2 \times R$	$\frac{R}{2}$
Inductance $L_{\text{total}}$	$4 \times L$	$L$
Motor time constant $\tau$	$\tau_{\text{series}} = \frac{4 \times L}{2 \times R} = \frac{2 \times L}{R}$	$\tau_{\text{parallel}} = \frac{L}{R/2} = \frac{2 \times L}{R}$

## 5.2.4 Limit Switch Connection

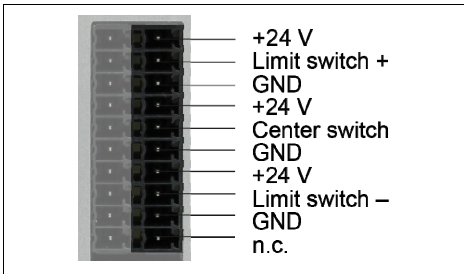


Fig.4 Pin assignment of the limit switches

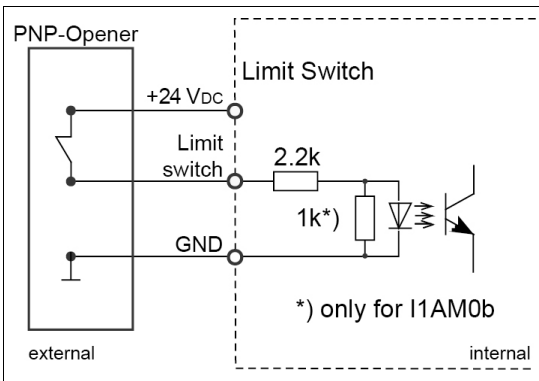


Fig.5 Input wiring

The controller is designed for connection of up to three limit switches type PNP-NOC/NCC. A limit switch is determined for monitoring the movement in the + direction (limit switch +), the second in the – direction (limit switch –). The third switch (centre switch) for example can be used as a reference switch. The switch type PNP NCC has the advantage that cable breaks can be detected. Mechanical limit switches (NCC) can also be used.

### CAUTION – Possible damage!

**i**

*Damage of the module by wrong connection.*

- Do not exchange the 10 pin connector for limit switches with the 10 pin connector for the encoder evaluation.

### 5.2.5 Option: Encoder Connection

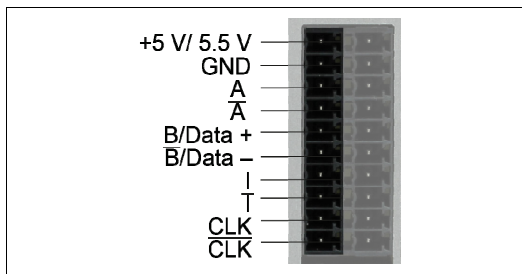


Fig.6 Pin assignment of the encoder

- Suitable encoder types depend on the selected evaluation module (ECES01/ECAS01):
  - differential incremental encoder with quadrature signals (ECAS01/ECES01)
  - Absolute encoder according to the SSI standard (ECAS01/ECES01)
  - EnDat encoder (ECES01)
- The incremental encoder supply voltage, 5 or 5.5 V<sub>DC</sub> / 200 mA max., is generated by the controller.
- Use shielded cables, twisted pair, for encoder connection. The transmission mode includes no protection against faulty transmission values.
- Wiring diagrams for the encoder types: see next page.

#### **CAUTION – Possible damage!**

**i**

*Damage of the module by wrong connection..*

- Do not exchange the 10 pin connector for limit switches with the 10 pin connector for the encoder evaluation.
- Also ensure that the encoder is configured correctly in its programming. The connection of an incremental encoder and parameterising for SSI can cause damage.

**Wiring of the encoder**

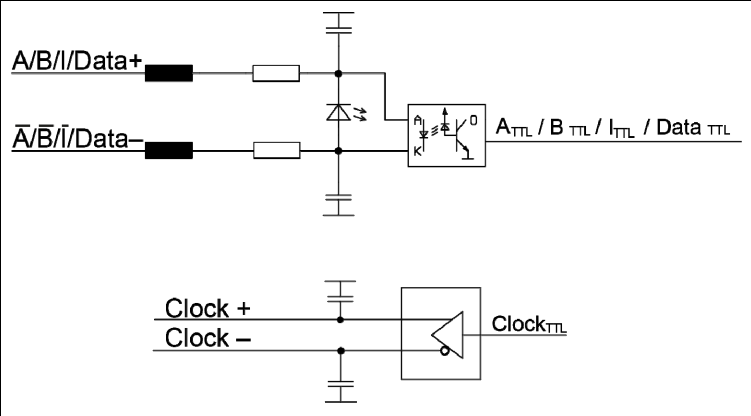


Fig.7 Wiring: SSI/Quadrature

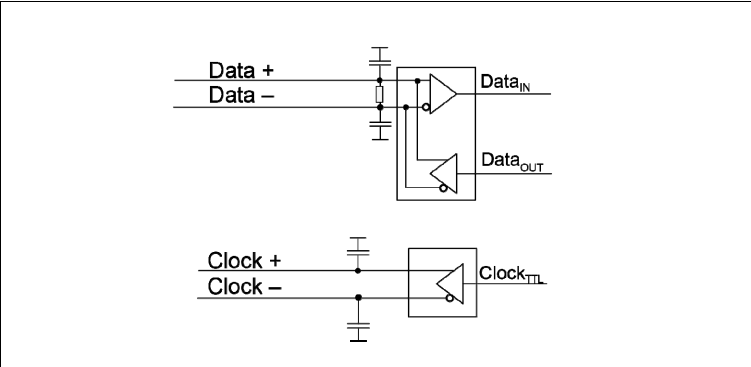


Fig.8 Wiring: EnDat encoder

**Optional accessories: adapter cable for EnDat encoder**

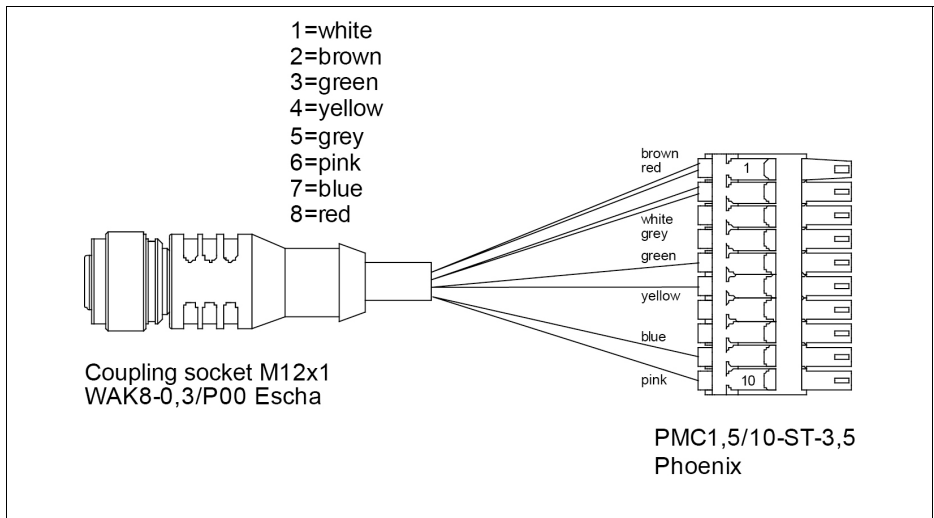


Fig.9 Adapter cable (ID no 10014905)



5.2.6 Option: Resolver, LVDT or RVDT Connection X1

Characteristics

- Excitation amplitude: 5 to 10 V<sub>r.m.s</sub>
- Excitation frequency: 10 kHz
- Excitation current: up to 150 mA
- Resolution: up to 8 arcmin (8/4096 increments/rev.)

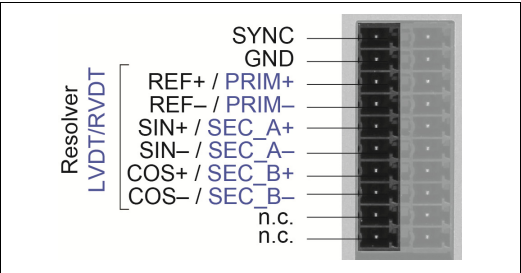



Fig. 1: Pin assignment of the encoder connector

Setable parameters

- Primary sinusoidal voltage from 5 to 10 V<sub>r.m.s</sub>. in 1 V steps.
- Ratio from 1/8 to 2 (1/8, 1/4, 1/2, 1 and 2) only in the resolver or 5/6-wire-LVDT mode
- Operating modes: Resolver, 4-wire-LVDT and 5/6-wire-LVDT

The supply voltage for the ECSM module is provided by the controller.



Use shielded cables, twisted pair, for encoder connection. The transmission mode includes no protection against faulty transmission values

Default values

Operating mode: Resolver  
Excitation amplitude: 5 V<sub>r.m.s</sub>  
Ratio: 1/2  
SYNC-Slave: deactivated

**Operating modes of the encoders**

**Resolver**

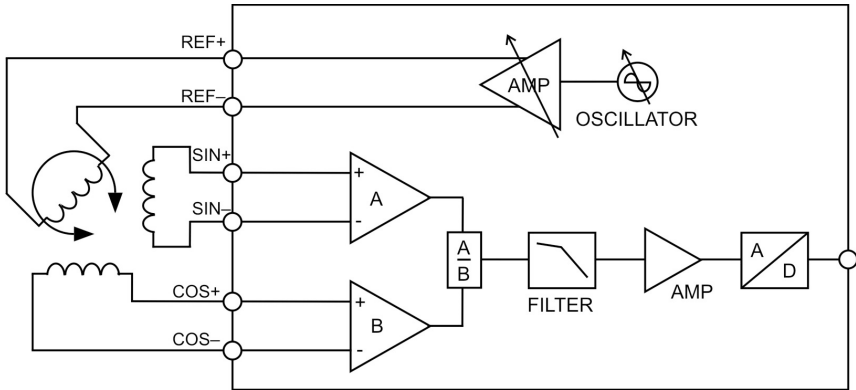


Fig. 2: Resolver wiring

**4-wire-LVDT**

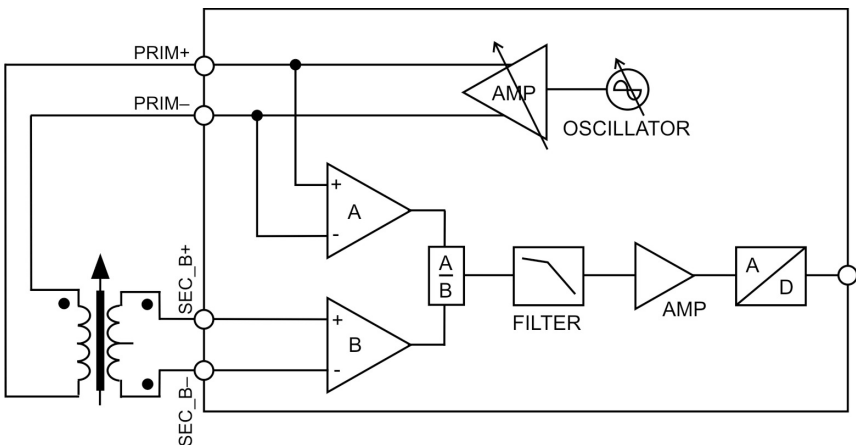


Fig. 3: 4-wire-LVDT/RVDT wiring (full bridge)

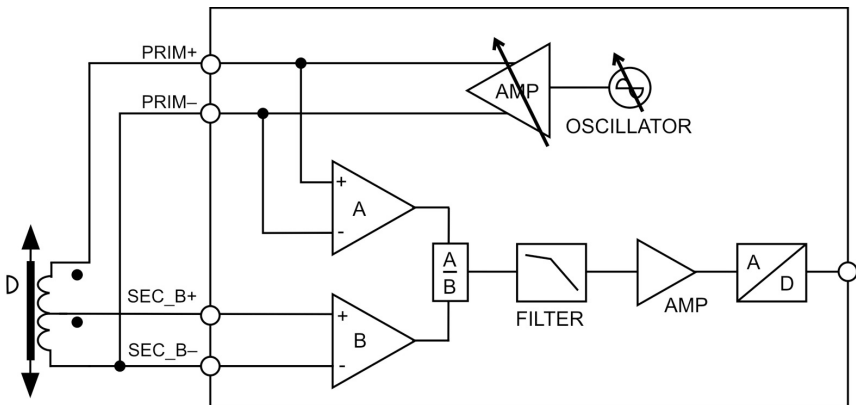


Fig. 4: 4-wire-LVDT/RVDT-wiring (half bridge)

5/6-wire-LVDT

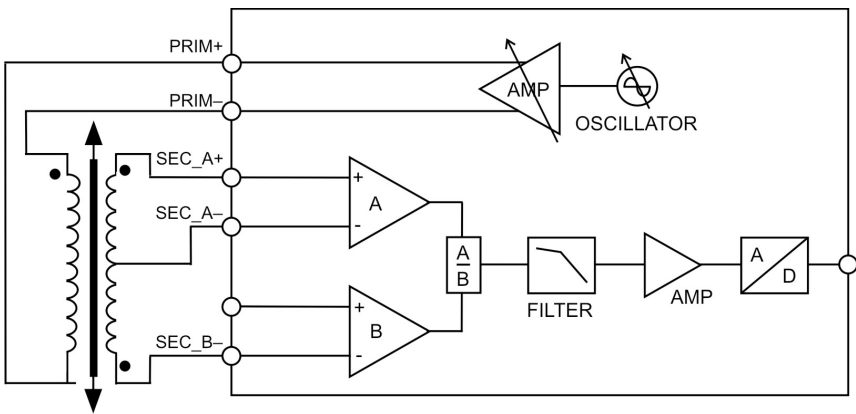


Fig. 5: 5-wire-LVDT/RVDT-wiring

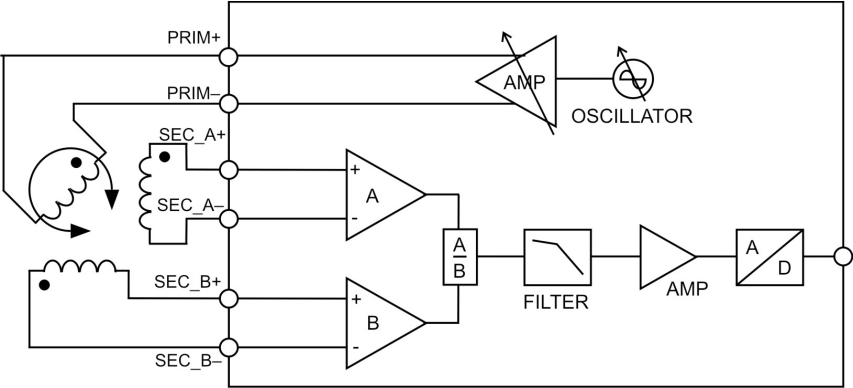


Fig. 6: 6-wire-LVDT/RVDT-wiring

**Synchronisation**

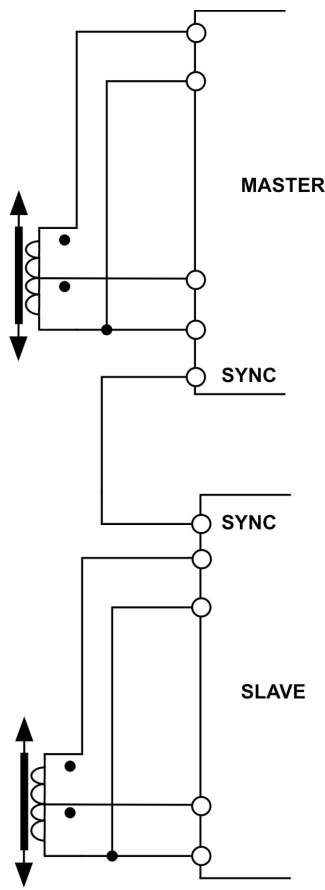


Fig. 7: Synchronisation wiring

### 5.2.7 Option: Motor Temperature Sensor Connection

The temperature evaluation module is used for monitoring the stepper motor temperature. Depending on the selected evaluation module (KTS01 or PTS01) thermal elements type K or platinum sensors PT100 can be used.

The insulated temperature sensor in phytron motors is integrated in the motor windings. The response time is very short, compared to temperature sensors mounted outside the motor housing. The temperature is measured all the time, even if only one motor phase is powered at any one time.

#### Thermal element type K

With the Type K (NiCr-Ni) in-vacuum and cryo stepper motors, thermal elements in the temperature range from  $-270$  to  $+1370$  °C, accuracy class 1, are used.

The Type K is a metal thermal element with nickel-based alloy conductors. Temperature ranges, accuracy and characteristics of thermal elements for industrial use are defined in the IEC 584 standard (temperature measuring with thermal elements).

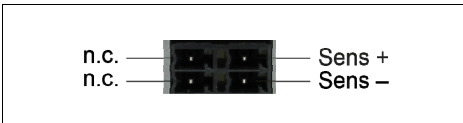


Fig.10 K element connection

#### Principle of the stepper motor temperature measurement by element type K:

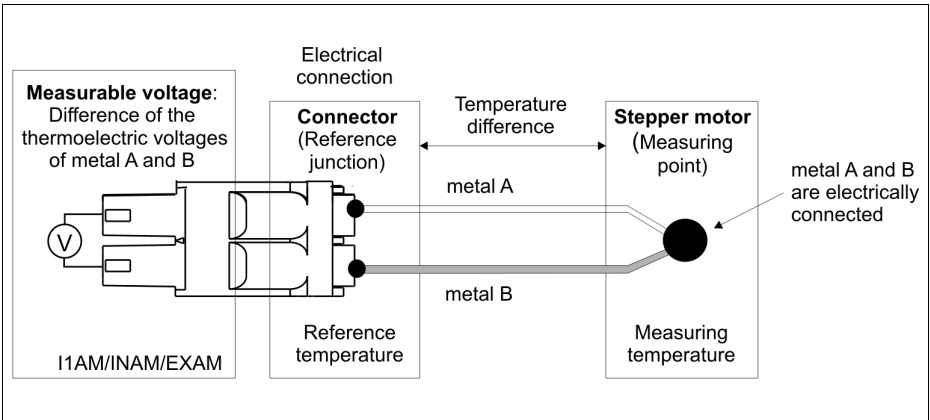


Fig.11 Sample form

An accurate temperature can only be measured when the temperature at the reference junction (connector) is exactly known. This is not possible by the connection construction and und can cause indeterminate deviations of the temperature values.

Software evaluation of the measuring values from -180 °C to +260 °C.

**i**

**CAUTION – Possible damage!**

*Damage of the module by wrong connection or wire break.*

- Check the integrity of the element type K and the correct *phyMOTION*™ connection before motor temperature measurement. An improperly connected or broken wire can result a wrong temperature evaluation and thus a damage of the motor or other system components by overheating.

## Pt100 Resistor Sensor

Pt100 resistor sensors are used with in-vacuum and cryo stepper motors in the temperature range –200 to +300 °C.

These precise sensors are used in extreme industrial and laboratory conditions. They consist of a wound resistance wire that is mounted and unsupported inside a cylindrical ceramic case.



Fig.12 Pt100 connection

## Principle of the stepper motor temperature measurement by Pt100 resistor sensors:

The PTS generates a constant current between I+ and I-. This current generates a voltage drop at the Pt100 which is measured at Sens+ and Sens-. The Pt100 sensors are connected with 4 leads in order to enable measuring independent of the wire resistance.

Software evaluation of the measuring values from -220 °C to +390 °C.

### 6 Commissioning

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Please read the manual for basic commissioning information of the I1AM02 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 I1AM02 module by colours and blinking:

Status of the I1AM	LED	
	left	right
ready and power stage is activated	green	green
ready and power stage is NOT activated	green	off
motor is running	orange	green
module is not addressed	green	blinking red slowly (about 2 Hz)
no power supply available on the 5 V bus	off	off
Initiator or SFI error	green	blinking red fast (about 5 Hz)

### 6.2 Parameterising the Modules

---

When using encoders, the corresponding *phyLOGIC*<sup>TM</sup> parameters **P34** to **P39** should be checked and set.

For the power stage settings use the parameters **P43** to **P45**.

For a general overview of the parameters:



#### **Further manual**

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

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



### **CAUTION – Possible damage!**

*Changes of the frequency- and target positions during the motor running in the I1AM02 is not possible.*

- Please change the frequency or target positions only when the motor stands still.

You'll find information about positioning in:



### **Further manual**

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

"Principles of Positioning of the Stepper Motor Controllers"

### 8 Heating Curve of the I1AM02 Module

**i** The adjusting module temperature depends on the motor type, the motor cable length, phase current, supply voltage and the tolerance of the components.

In practice it can differ from the diagrams below.

#### Measuring conditions or operation:

- Module vertical arranged
- 60 V<sub>DC</sub> supply voltage
- Motortype: ZSH 57.200.4,2
- Temperatures are normalised, i.e. relatively without reference point

The power stage temperature (measured on the board or heat sink) should not exceed 85 °C. The temperature for the internal emergency shutdown is set by software to prevent the destruction of the hardware.

#### Normalised power stage temperature, maximum current (3.5 Ar.m.s.), 100% duty cycle

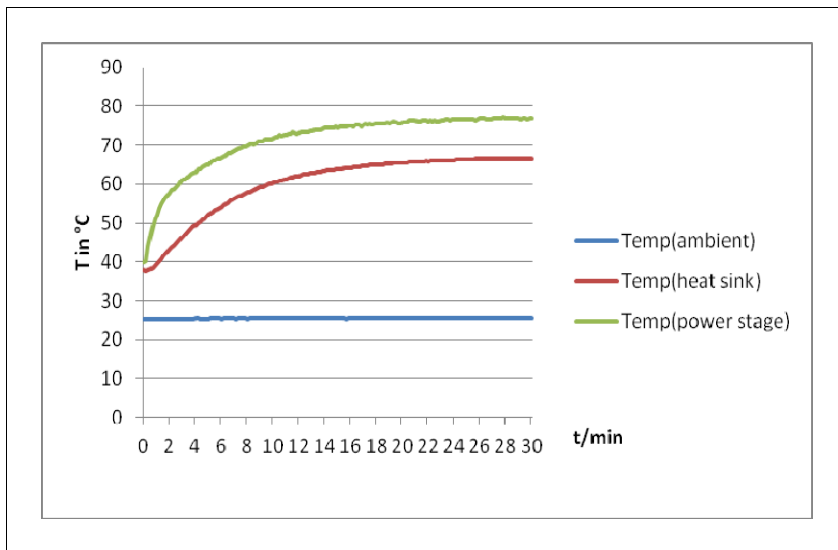


Fig.13 Heating curve of the power stage

## 9 Service

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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*™'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 screw on top and the screw on the bottom of the module's front plate
- Pull the card carefully by the handle.
- If you want to use the *phyMOTION*™ 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.

## 10 Warranty, Disclaimer and Registered Trademarks

### 10.1 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.

### 10.2 Warranty

---

The *phy***MOTION**<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.

### 10.3 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:

- *phy***MOTION**<sup>TM</sup> is a trademark of Phytron GmbH.
- *phy***LOGIC**<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.
- DuPont<sup>TM</sup> is a registered trade mark and Kapton<sup>®</sup> is a trade mark of E. I. du Pont de Nemours and Company or its affiliates.

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