

*phy***MOTION™**

**Modular**

**Multi-axis Controller for Stepper Motors**  
**with INTernal / EXTernal Power Supply**

**TRANSLATION OF THE GERMAN ORIGINAL MANUAL**

<b>Version</b>	<b>Modification</b>
10	SLFM01 module
9	new modules, housing size, accessories
8	with integrated switching power supply, new modules

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In this manual *phyMOTION™ Modular Multi-axis Controller for Stepper Motors* (<http://www.phytron.eu/phyMOTION>) are the descriptions of the features and specifications for the *phyMOTION™* stepper motor controller.

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.eu/>) 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



### 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.



### 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 is 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.



### CAUTION – Possible injury!

*The phyMOTION™ may weigh up to 30 kg, depending on the expansion stage. Foot injuries can occur from dropping the unit.*

- Make sure that the phyMOTION™ is securely held at all times.
- Wear safety shoes during transport and handling.

## 2 Available phyMOTION™ Manuals

The following manuals are available for phyMOTION™ controller, which are referred to in this manual by the following remark:



### Further manual

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

phyMOTION™ – Multi-axis Controller for Stepper Motors	MA 1259-A00x EN
POWM01/POW02/POWM03/POWM04 – Power Supply Modules	MA 1273-A00x EN
MCM01 – CPU and Bus Module	MA 1261-A00x EN
MCM02/MCM03 – CPU, Bus Module and Power Supply	MA 1294-A00x EN
I1AM01 – 1 Axis Stepper Motor Drive 3.5 A power supply	MA 1269-A00x EN
I1AM02 – 1 Axis Stepper Motor Drive 5 A power supply	MA 1269-A00x EN
I1EM02 – Indexer with external power stage	MA 1309-A00x EN
DIOM01 – Digital I/O Module	MA 1271-A00x EN
AIOM01 – Analogue I/O Module	MA 1288-A00x EN
PIDM01 – PID Regulation module	MA 1311-A00x EN
INAM01/INAM02/INAM03 – Power Stage Carrier Module	MA 1275-A00x EN
INSM01 – Power Stage Carrier Module with safety shutdown	MA 1307-A00x EN
EXAM01 – Interface Module for an External Power Stage	MA 1277-A00x EN
I4XM01 – Indexer Module	MA 1279-A00x EN
T4KM01 – Temperature measuring module	MA 1315-A00x EN
phyLOGIC™ Command Reference for the phyMOTION™ Controller	MA 1265-A00x EN
phyLOGIC™ ToolBox – Communication Software for the Stepper Motor Controllers phyMOTION™, MCC and OMC/TMC	MA 1285-A00x EN
Principles of Positioning for Stepper Motor Controllers	MA 1267-A00x EN
ProfiNet/ProfiBus Interfaces	MA 1263-A00x EN
phyLOGIC™ Control – User Software for the operator panel/tablet operation of the stepper motor controller phyMOTION™	MA 1299-A00x EN
More manuals are in progress.	

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## 4 *phy*MOTION™ Overview

### 4.1 Housing

With our *phy*MOTION™ you have chosen a high quality stepper motor controller concept “made in Germany”. Our *phy*MOTION™ is designed to merge the worlds of PLC and CNC by combining high-performance components with cost efficient basic functionality – adjustable to your individual requirements. Contrary to PLC systems our *phy*MOTION™ opens up the world of co-operative product and module development: as a mid-size family-owned company your feedback is the basis for our future – whenever off the shelf PLCs fall short the *phy*MOTION™ grows with your requirements:

The *phy*MOTION™ is a stepper motor controller with modular design and offers the option for later expansion. It controls, depending on the configuration, multi-axes synchronisation and interpolation and offers integrated power stages (up to 15 A<sub>PEAK</sub>, 120 V<sub>DC</sub>) and allows connection of more powerful external power stages.

Whatever its housing (bench, 19” sub rack, rail), with or without touch panel, motor temperature evaluation, limit switches, encoders or I/O - the *phy*MOTION™ adapts to the requirements with up to 21 modules per device.

*phy*LOGIC™ programs are edited, transmitted to the controller and stored by the free development environment *phy*LOGIC™ ToolBox.

Of course, the *phy*MOTION™ can be controlled and programmed, if required, via host interface (ProfiBus, ProfiNet, Ethernet, CAN, RS 485, RS 232, Bluetooth...).

**INT** *phy*MOTION™ with internal power supply (mains 230 / 115 V<sub>AC</sub>)

**EXT** *phy*MOTION™ with external power supply (e.g. SPH mains adaptor)

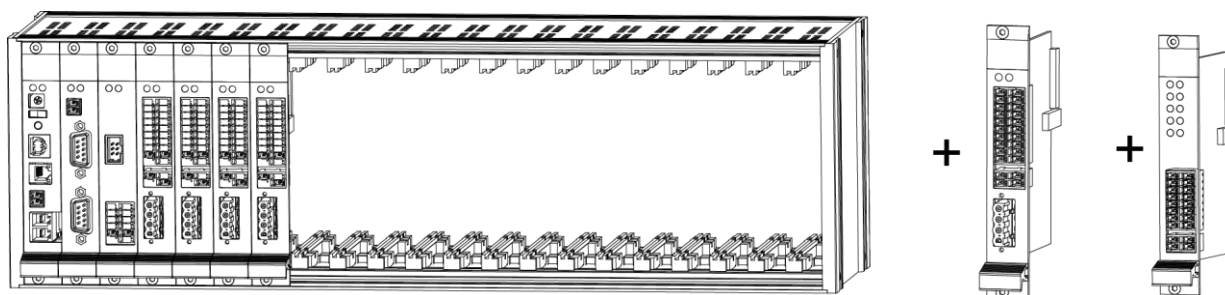


Fig.1 Example 19“ sub rack with module equipment (**EXT** or **INT**)

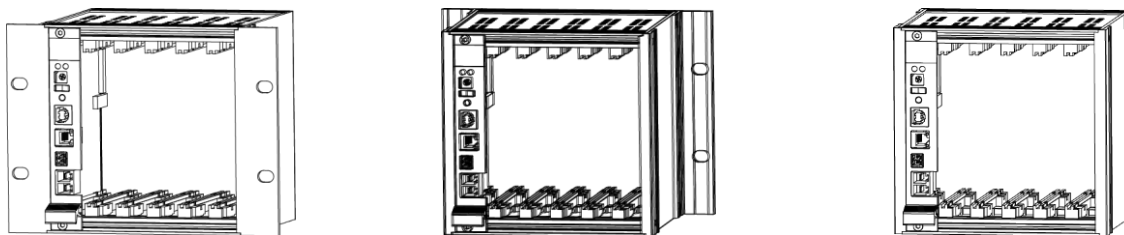


Fig.2 Housing types: sub rack(=standard),  
options: wall or rail mounting, bench

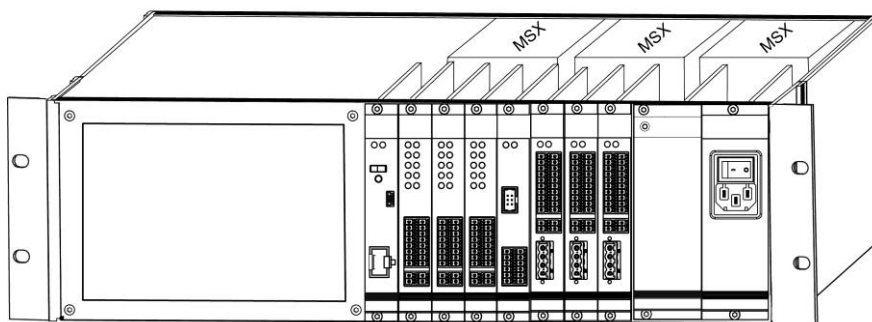
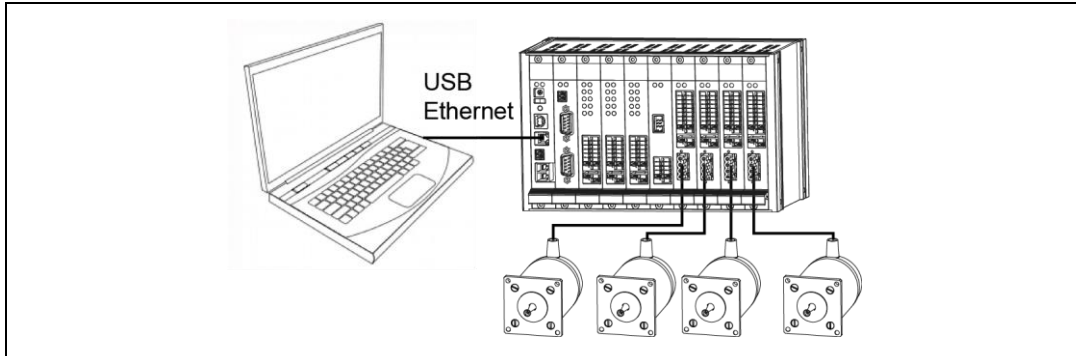


Fig.3 Example 19" sub rack with integrated power stages and touch panel (INT)

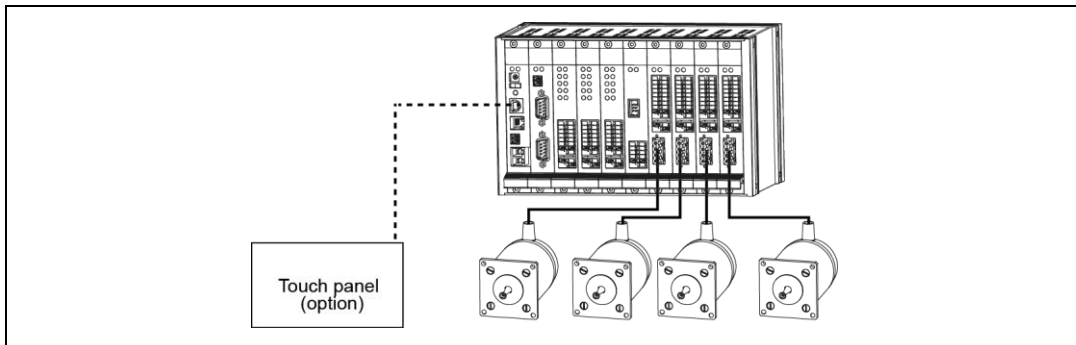
## 4.2 Application Scenarios and Embedding in Existing Systems

There can be many different ways to operate and integrate the *phyMOTION*<sup>TM</sup> into your system architecture:

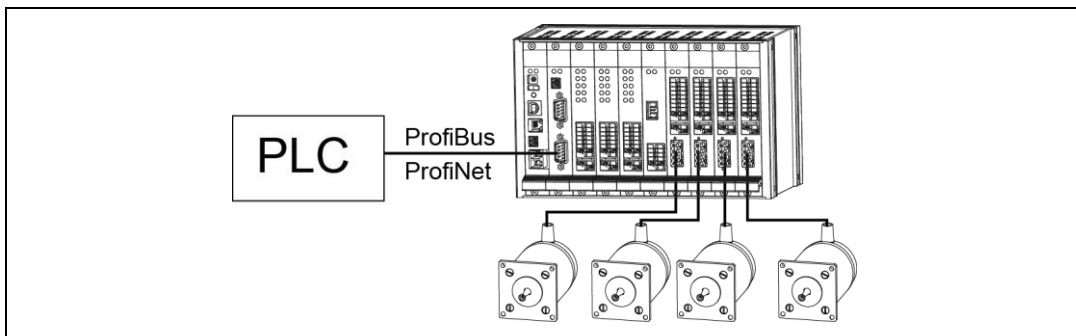
### Via PC:



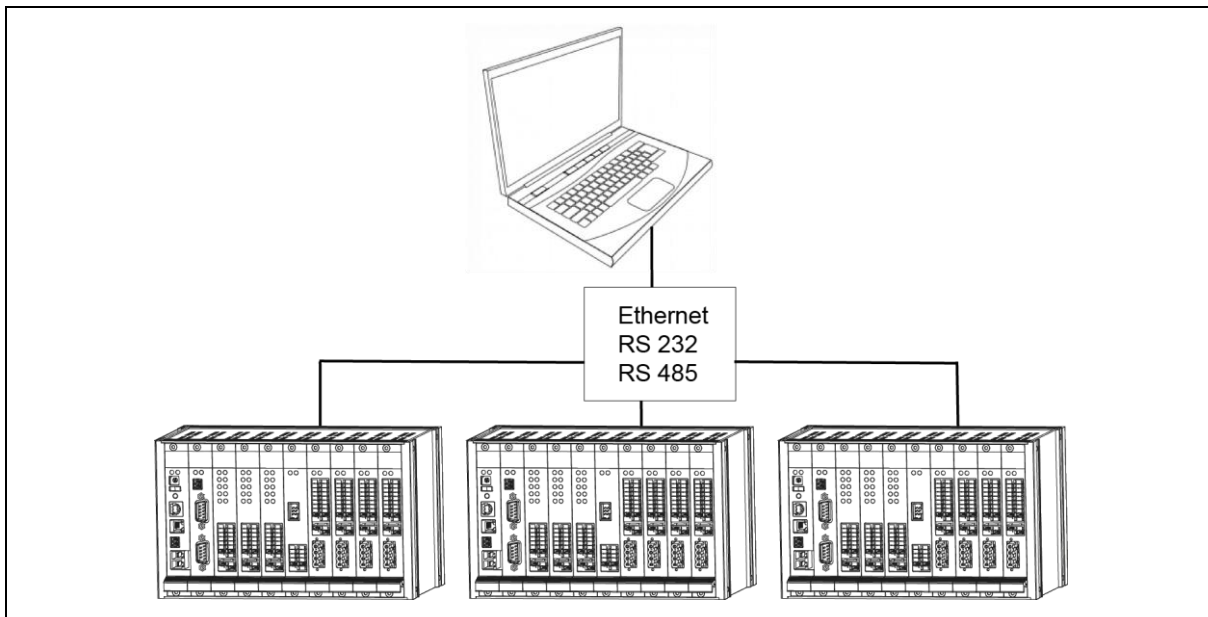
### As stand-alone unit:



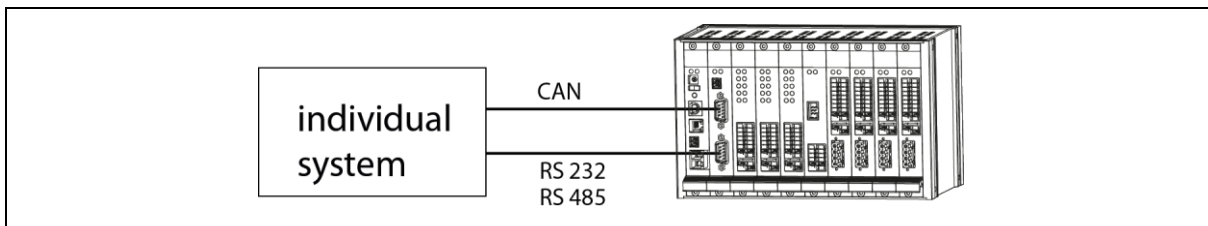
### As distributed or intelligent I/O (PLC):



### In a network:



### Embedded in a customer's system:



### In combination with higher-powered amplifiers:

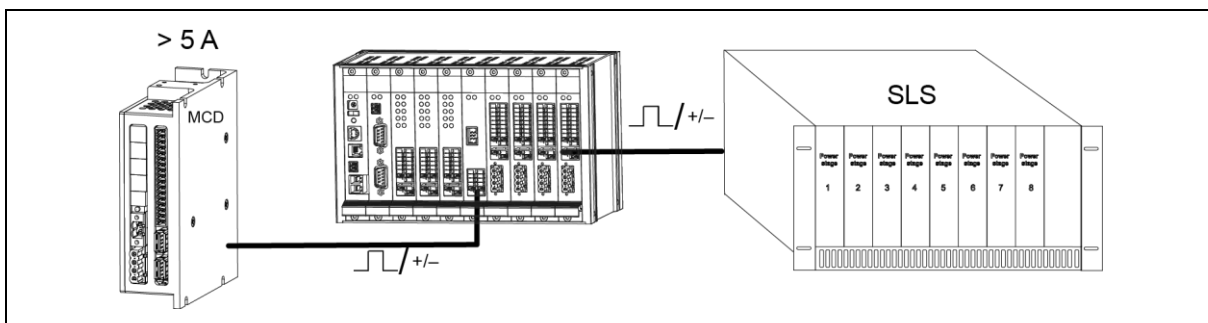


Fig.4 phyMOTION™ for external power stages as in this case, for example, with Phytron's MCD+ or a Phytron's SLS sub rack with 8 ZMX+ or 4 MSX+ power stages

Power adaptor and power stages are integrated: **INT** housing p

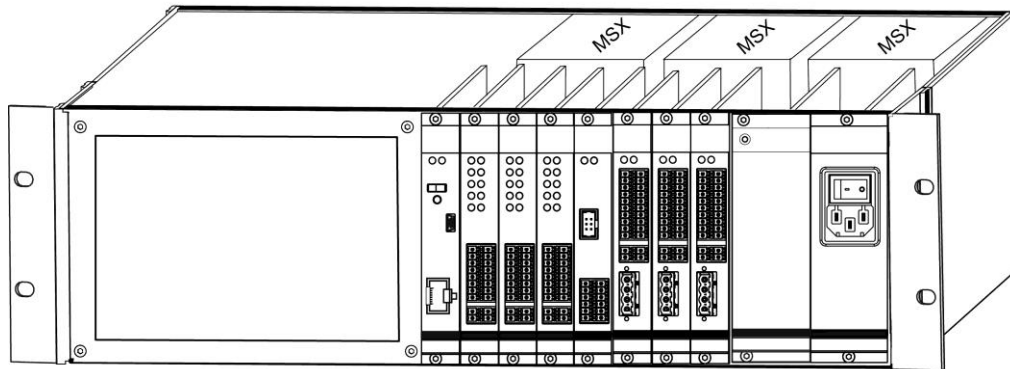


Fig.5 *phyMOTION™* with power adaptor, touch panel and MSX+ power stages

Mains and single axis control are integrated: **INT** housing s

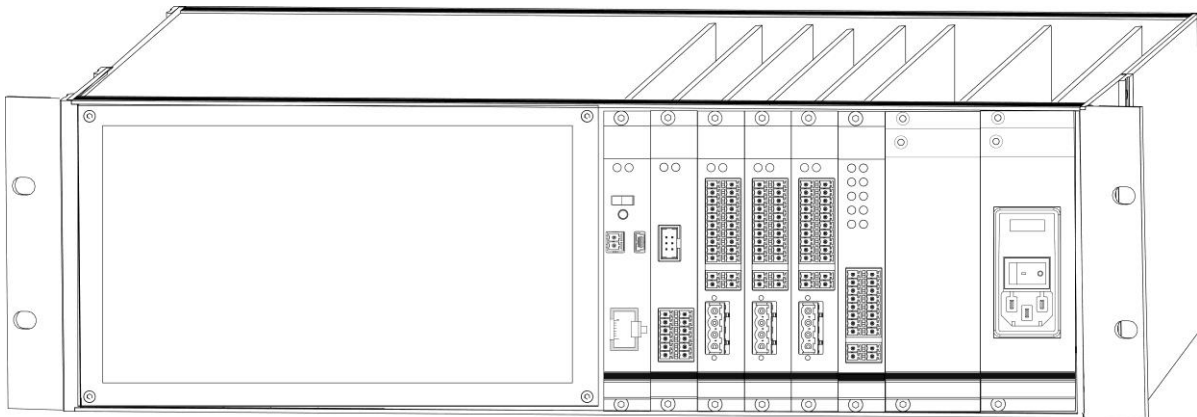


Fig.6 *phyMOTION™* with mains and three axes

## 4.3 The Basic Functions and Modules at a Glance

The modules of the *phyMOTION*™ can be split up into the following functions:

Main functions	POWER SUPPLY	There is a power supply in the module (power supply unit).
	CPU	Modules with a CPU contain intelligent processors to execute all of the sequential programs and enable the <i>phyMOTION</i> ™ to drive in stand-alone mode.
	INDEX	The INDEXER represents the functionality to generate signals from the commands of a programming language, which the power stage amplifies. Normally, the signals are control/direction pulses.
	POWER STAGE	The POWER STAGE represents a stepper motor amplifier. The incoming control/direction pulses are converted into control patterns for the stepper motor.

Auxiliary functions	ENC	Encoder evaluation
	TEMP	Motor temperature evaluation
	I/O D	Digital inputs and/or outputs
	I/O A	Analogue inputs and/or outputs
	POW IN	Power distribution
	COM	Host interface

The *phyMOTION*<sup>™</sup> is tailored to your requirements with the following modules:

	Type	Description	Current consumption [mA]	Weight [g] (without/with front panel)
<b>Power supply from the mains (230 V<sub>AC</sub> / 115 V<sub>AC</sub>)</b>	NETM03	230 V <sub>AC</sub> / 115 V <sub>AC</sub> supply, 24 V I/O is internally generated		—
<b>Supply with external supply voltage</b>	POWM01:	Mains supply and field bus interface		<b>68 / 90</b>
	POWM02:	Intermediate supply		<b>53 / 86</b>
<b>with internal supply voltage</b>	POWM03:	Mains supply and field bus interface		<b>66 / 88</b>
	POWM04:	Intermediate supply		<b>51 / 84</b>
<b>Intermediate circuit voltage</b>	SUPMx:	intermediate circuit voltage as motor voltage and I/O logic voltage		—
<b>Mains filter</b>	SLFM01	Interference suppression of the motor voltage supply		
<b>CPU and Host interface</b>	MCM01:	Intelligent CPU with selectable host interface	<b>180</b> <b>70</b> (RS interface) <b>120</b> (ProfiNet)	<b>61 / 82</b>
	MCM02:	Intelligent CPU with selectable host interface with integrated supply for external power	<b>180</b> <b>70</b> (RS interface) <b>120</b> (ProfiNet)	<b>65 / 85</b>

	Type	Description	Current consumption [mA]	Weight [g] (without/with front panel)
	MCM03:	Intelligent CPU with selectable host interface with integrated supply for external power	<b>180</b> <b>70</b> (RS interface) <b>120</b> (ProfiNet)	<b>65 / 85</b>
<b>Axes</b>	I1AM01:	Indexer with integrated 3.5 A/48 V power stage; encoder and temperature evaluation (option)	<b>170</b> (5 V) <b>30</b> (EnDat encoder 5 V) <b>10</b> (24 V) <b>20 + encoder</b> (24 V) <b>30</b> (temp-module) <b>1 A</b> (limit switch) axis load (24-48 V)	<b>102 / 116</b>
	I1AM02:	Indexer with integrated 5 A or 9 A power stage; encoder and temperature evaluation (option)	<b>170</b> (5 V) <b>30</b> (EnDat encoder 5 V) <b>10</b> (24 V) <b>20 + encoder</b> (24 V) <b>30</b> (temp-module) <b>1 A</b> (limit switch) Axis load (24-70V)	<b>90 / 112</b>



	Type	Description	Current consumption [mA]	Weight [g] (without/with front panel)
	I1EM02:	Indexer with external power stage; encoder and temperature evaluation (option)	<b>30</b> (EnDat Encoder 5 V) <b>20 + Encoder</b> (24 V) <b>30</b> (temp-module) <b>1 A</b> (limit switch) axial load (24-48V)	<b>51 / 67</b>
	I4XM01:	High end stepper motor indexer for 1 to 4 axes		<b>52 / 73</b>
	INAM01:	Carrier module for APS power stage; encoder and temperature evaluation (option)	<b>80</b> (power stage) <b>30</b> (EnDat encoder 5 V) <b>20 + encoder</b> (24 V) <b>30</b> (temp-module) <b>1 A</b> (limit switch) axial load (24-48 V)	<b>71 / 93</b>

	Type	Description	Current consumption [mA]	Weight [g] (without/with front panel)
	INAM02/ INAM03:	1-Axis module for MSX <sup>+</sup> or ZMX <sup>+</sup> power stage with internal supply voltage; encoder and temperature evaluation (option)	<b>10 A</b> (MSX <sup>+</sup> power stage) <b>30</b> (EnDat encoder 5 V) <b>20 + encoder</b> (24 V) <b>30</b> (temp-module) <b>1 A</b> (limit switch) axial load (up to 120 V)	<b>71 / 93</b>
	INSM01:	Power stage carrier module with Safe Torque Off	<b>3.6 A</b> at 5 A <sub>PEAK</sub> <b>250</b> (5 V <sub>DC</sub> internal) <b>10</b> (24 V <sub>DC</sub> I/O) <b>30</b> (EnDat encoder 5 V <sub>DC</sub> internal) <b>20 + encoder</b> (24 V <sub>DC</sub> I/O) <b>1 A</b> (limit switch)	<b>134 / 157</b>
	PEM01 (option):	Grounding module for motors with motor voltage >70 V	—	—

	Type	Description	Current consumption [mA]	Weight [g] (without/with front panel)
	EXAM01:	Interface between indexer and an external power stage; encoder and temperature evaluation (option)	<b>30</b> (EnDat encoder 5 V) <b>20 + encoder</b> (24 V) <b>30</b> (temp-module) <b>1 A</b> (limit switch) axial load (24-48 V)	<b>51 / 67</b>
<b>Expansions</b>	DIOM01:	Digital input and output module	<b>75</b> (5 V) <b>load + 5</b> (24 V)	<b>56 / 79</b>
	AIOM01:	Analogue input and output module	<b>75</b> (5 V) <b>5</b> (24 V)	<b>66 / 87</b>
	PIDM01:	PID Regulator module	<b>75</b> (5 V) <b>load+ 5</b> (24 V)	<b>56 / 79</b>
	T4KM01:	Precision temperature measurement module for up to 4 motors	<b>30</b>	
	TPM02:	Android-based integrated touch panel; mountable on connection side or plain side	—	—
	TPE02:	External touch panel	—	—

## 4.4 Equipment Rules

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The following equipment rules are useful for the configuration of your *phyMOTION*™:

Our personnel will be pleased to advise you on your desired configuration:

phone: 0049-8142-503205

### **POWM01 / POWM02 / POWM03 / POWM04 supply modules**

Every configuration starts

for **external** supply voltage (**EXT**):

- with the POWM01 power input and configuration module followed by the CPU module MCM01, which holds the selectable host interface sub module or
- with the MCM02 module, the combined supply, configuration module and CPU module
- when using a SLFM01 module with the SLFM01 module followed by POWM01 module or MCM02 module

for **internal** supply voltage (**INT**):

- with the POWM03 power input and configuration module followed by the CPU module MCM01, which holds the selectable host interface sub module or
- with the MCM03 module, the combined supply, configuration module and CPU module

Each power input module:

- is designed to supply up to 10 more modules with an internal logic voltage (**5 V**)
- can draw 20 A maximum at **24-70 V** from the external power supply to the power stage modules, which is the limitation on the number of cards per power input module.
- can draw 5 A maximum from the **24 V** I/O supply for outputs (analogue or digital) or to power limit switches.

If more current is needed an additional POWM02/POWM04 module should be considered.

An intermediate power input module can also be used to divide the backplane into different motor voltage sections. That way several different motor voltages can be used within one unit.

The SLFM01 (Supply Line Filter) module is used in the housing s with external supply voltage to suppress the supply voltages.

### **Main Controller Module MCM01 / MCM02 / MCM03**

Each main controller module:

- controls up to 18 modules
- administers script program
- selectable communication interfaces (e.g. Ethernet, ProfiBus, ProfiNet,...)

## Indexer modules

The indexing functionality can be found integrated with the power stage functionality within one module or can be combined by including sub modules. Power stages that use external indexer functionality have to be placed directly after the indexing module.

## Power stage modules

Several power stage modules already contain some power stage functionality; others need additional power stage modules. In both cases encoder and temperature evaluation are additional modular options (for INAM01, INAM02, INAM03, I1AM01, I1AM02, INSM01...).

External power stages can be addressed with control/direction signals via the EXAM01 or I1EM02 module.

## Mains power module NETM03 for internal supply voltage (INT)

The NETM03 power module is always placed at the right end of the connection side and provides the input for the mains voltage (115 to 230 V<sub>AC</sub>).

If the motor voltage >70 V<sub>DC</sub>, it applies (option): the PEM01 grounding module, which is placed right next to the last axis module, is used for grounding of up to six motors.

The **SUPMx intermediate circuit voltage module** generates the internal supply of the *phyMOTION*<sup>™</sup> with motor and logic voltage from the mains voltage.

## Backplane, expandability

Expandability options (for additional power input modules) have to be specified during the ordering process. The backplane separation is permanent and has to be considered when your *phyMOTION*<sup>™</sup> is configured.

## Empty slots

The slots must be filled from left to right without gaps in between. Empty slots at the housing's end must be covered with blanking plates.

## Sub modularity

The following modules can be expanded with sub modules: MCM01, MCM02, MCM03, INAM01, INAM02, INAM03, EXAM01, I1AM01, I1AM02, INSM01, I1EM02,

## Android-based touch panel (option)

The touch panel can be integrated either on the connection side or on the plain side (TPM) or outside of the housing configuration as an external touch panel (TPE).

## Alternative configurations

By integrating independent backplanes, several autonomous main units with their own host interface each can be built into one housing. This way several *phyMOTION*<sup>™</sup> controllers can be combined using a minimum of space.

## Options for internal power supply (mains 230 V<sub>AC</sub> / 115 V<sub>AC</sub>) (INT)

### Housing p

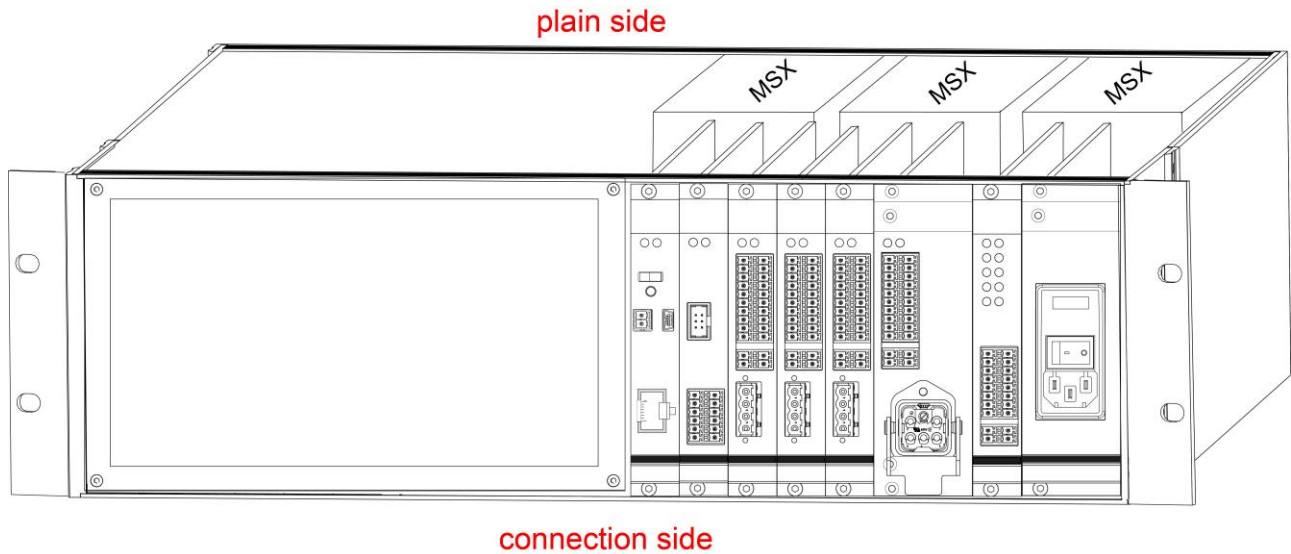


Fig.7 Connection side and plain side

phyMOTION™	Option	CONNECTION SIDE Number of phyMOTION™ modules	PLAIN SIDE Number of power stages
with <b>integrated touch panel (TPM02)</b>	Option 1: TPM02 on the connection side	up to 8	1 to 4 MSX <sup>+</sup> or 1 to 8 ZMX <sup>+</sup>
	Option 2: TPM02 on the connection side	up to 17	1 to 4 MSX <sup>+</sup> or 1 to 8 ZMX <sup>+</sup>
with <b>external touch panel</b>	Option 3	up to 17	1 to 4 MSX <sup>+</sup> or 1 to 8 ZMX <sup>+</sup>
without <b>operator panel</b>	Option 4	up to 17	1 to 4 MSX <sup>+</sup> or 1 to 8 ZMX <sup>+</sup>
<b>Combination with SLS</b> for up to 4 MSX <sup>+</sup> or 8 ZMX <sup>+</sup> power stages	Option 5	up to 17	1 to 4 MSX <sup>+</sup> or 1 to 8 ZMX <sup>+</sup>

### Maximum power consumption: 2100 W

The **Mains power** 230 V<sub>AC</sub> or 115 V<sub>AC</sub> is supplied via NETM03 and generates internally the **24 V** I/O-supply.

The SUPMx modules generates internally the motor voltage **48** and/or **70** and/or **120 V** and the **24 V** I/O supply or logic supply.

### Power stage fans

For reducing the device's internal temperature and protect the components.

### Options for internal power supply (mains 230 V<sub>AC</sub> / 115 V<sub>AC</sub>) (INT)

#### Housing s

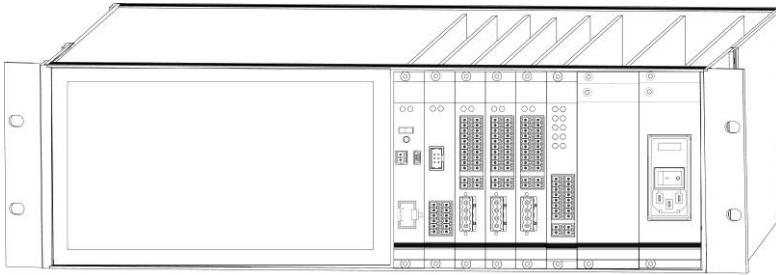


Fig.8 Connection side or plain side

<i>phy</i> MOTION™	Option	Number of <i>phy</i> MOTION™ modules
with <b>integrated touch panel (TPM02)</b>	option 1	up to 8
with <b>external touch panel (TPE02)</b>	option 2	up to 17
without <b>operator panel</b>	option 3	up to 17
<b>Combination with SLS</b> for up to 4 MSX <sup>+</sup> or 8 ZMX <sup>+</sup> power stages	option 4	up to 17

### Maximum power consumption: 1000 W

The **Mains power** 230 V<sub>AC</sub> or 115 V<sub>AC</sub> is supplied via NETM03 and supplies up to 17 *phy*MOTION™ modules.

The SUPMx module generates internally the motor voltage **48 V and/or 70 V** and the **24 V** I/O supply or logic supply.

## 5 General Technical Data

### 5.1 Directives and Standards

<b>CE Mark</b>	With the declaration of conformity and the CE Mark on the product, the manufacturer certifies that the product complies with the requirements of the relevant EC directives. The unit, described here, can be used anywhere in the world.
<b>Machinery Directive</b>	The drive system, described here, is not a machine in the sense of the Machinery Directive (2006/42/EC), but a component of a machine for installation. They have no functional moving parts, but they can be part of a machine or equipment. The conformity of the complete system in accordance with the machine guideline is to be certified by the manufacturer with the CE marking.
<b>EC EMC Directive</b>	<p>The EC Directives on electromagnetic compatibility (2004/108/EC) applies to products that can cause electromagnetic interference or whose operation can be impaired by such interference.</p> <p>The drive system's compliance with the EMC Directive cannot be assessed until it has been installed into a machine or installation. The instructions provided in "Installation" must be complied with to guarantee that the drive system is EMC compliant when fitted in the machine or installation and before use of the device is permitted.</p>
<b>Standards for safe operation</b>	<p>EN 60204-1:2006/AC:2010 Electrical equipment of machines, degree of pollution 2 must be observed</p> <p>EN 60529: IP Degree of protection</p>
<b>Standards for observing the EMC limit values</b>	<p>EN 61000-3-2:2006 / EN 61000-3-2:2006/A2:2009: EMC Limits for harmonic current emissions</p> <p>EN 61000-6-2:2005 / EN 61000-6-2:2005/AC:2005: Generic standards – Immunity for industrial environments</p> <p>EN 61000-6-4:2007: Generic standards – Emission standard for industrial environments</p>



## 5.2 Declaration of Incorporation: Modules gen. with External Power Supply **EXT**



### Declaration of Incorporation according to EC directive 2006/42/EC on machinery (Annex II B) for partly completed machinery

**Name and address of the manufacturer:**

Phytron GmbH,  
Industriestr. 12  
82194 Gröbenzell

**Representative in EU, authorized to compile the relevant technical documentation:**

Rainer Gareis  
Phytron GmbH,  
Industriestr. 12  
82194 Gröbenzell

**Description of the partly completed machinery:**

phyMOTION™, assembled with several of the following modules

Part-Name	Description
AIOM01	Analog I/O Module
APS01	Stepper Motor Power Stage -Submodule 5A 24 to 70V
CANS01	CAN Communication Sub Module
DIOM01	Digital I/O Module
DIOM0a	Digital I/O Module (customer-specific version)
ECAS01	SSI/ Quadratic Encoder Sensing Sub Module
ECBS01	Encoder Biss Evaluation Submodule
ECES01	EnDat Encoder Sensing Sub Module
ECMS01	Resolver Evaluation Submodule
ETHS01	Ethernet Communication Sub Module
EXAM01	Indexer Interface Module
I1AM01	1-Axis Stepper Motor Drive
I1AM02	Indexer & Power Stage Carrier
I1AM0a	1-Axis Stepper Motor Drive (customer-specific version)
I1AM0b	Indexer & Power Stage Carrier (cust)
I4XM01	4 Axes HighEnd Indexer
INAM01	Carrier Module for APS or LPS Power Stage
KTS01	Temperature Evaluation K-Element
LPS01	Stepper Motor Power Stage -Submodule 9A 24 to 70V
MCM01	Main Controller Module
MCM02	Main Controller & ext. Power Input
PBS01	Profibus Communication Sub Module
PNS01	ProfiNet Communication Sub Module

AP QM-0670-14  
CE 7029 Rev. 10

**Phytron GmbH**

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USt.-Ident.-Nr. DE290476265  
Steuernummer 117/116/60501

Deutsche Bank:  
Volksbank FFB:  
Sparkasse FFB:  
Postbank München:

IBAN: DE56 7007 0010 0161 8305 00 - BIC: DEUTDE33XXX  
IBAN: DE87 7016 3370 0000 7125 31 - BIC: GENODEF3333  
IBAN: DE25 7005 3070 0001 8012 65 - BIC: BYLADE33HAN  
IBAN: DE96 7001 0080 0286 0018 00 - BIC: PBNKDE33HAN

Part-Name	Description
POWM01	Main Power Input Module
POWM02	Intermediate Power Input Module
PTS01	Temperature Evaluation Pt-Element
RSS01	RS485/RS232 Communication Sub Module

From serial number 1905xxxxx

**We declare that the product complies with the following essential requirements of the Machinery Directive 2006/42/EC:**

1.2.; 1.5.; 1.3.; 1.3.4.; 1.5.; 1.5.2.; 1.5.4.; 1.5.5.; 1.5.6.; 1.56.; 1.6.3.; 1.6.4.; 1.7.2.; 1.7.3.; 1.7.4.

**In addition the partly completed machinery is in conformity with the following EC Directives:**

EC Directives 2014/30/EU relating to electromagnetic compatibility.

**We declare that the relevant technical documentation is compiled in accordance with part B of Annex VII.**

We commit to transmit, in response to a reasoned request by the market surveillance authorities, relevant documents on the partly completed machinery.

**Important note! The partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of Directive 2006/42/EC on Machinery, where appropriate, and until the EC Declaration of Conformity according to Annex II A is issued.**

Gröbenzell, 2019-05-14



Rainer Adams  
Technical Director

## 5.3 Declaration of Conformity: Modules with Internal Power Supply **INT**



### Declaration of Conformity According to EC directive 2014/30/EU (EMC-Directive) and EC directive 2014/35/EU (electrical equipment)

**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 2014/30/EU relating to EMC and 2014/35/EU relating to electrical equipment.

#### Product denomination

Part-Name	Description
INAM02	High Performance Power Stage Carrier
INAM03	High Performance Power Stage Carrier
MCM03	Main Controller & internal Supply
MSXS01	Power Stage; 15A
NETM01	Power Supply Input 230V
NETM02	Mains input 230V / 115V
NETM03	Mains input 230V / 115V w. int. 24V
PEM01	Protective Earth Module
POWM03	Main Power Input; int. Supply
POWM04	Secondary Power Input; int. Supply

valid from serial number 1905xxxxx.

#### Applied harmonized standards (EMC directive)

<b>EN 61000-6-1: 2007</b>	Electromagnetic Compatibility (EMC) - Immunity for residential, commercial and light-industrial environmental
<b>EN 61000-6-2: 2006 Ber.1:2011</b>	Electromagnetic compatibility (EMC) - Immunity for industrial environments
<b>EN 61000-6-3: 2011 AC:2012</b>	Electromagnetic compatibility (EMC) - Emission standard for residential, commercial and light-industrial environments
<b>EN 61000-6-4: 2011</b>	Electromagnetic compatibility (EMC) - Emission standard for industrial environments

AP QM-0671-13  
CE 7049 Rev. 3

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IBAN: DE25 7005 3070 0001 8012 65 - BIC: BYLADEM1FFB  
IBAN: DE96 7001 0080 0286 0018 00 - BIC: PBNKDEFFXXX

**Applied harmonized standards (electrical equipment)**

<b>EN 60204-1:2007</b> <b>A1:2009 + Ber.1:2010</b>	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
<b>EN 60034-1:2011</b>	Rotating electrical machines - Part 1: Rating and performance
<b>EN 60664-1:2008</b>	Insulation coordination for equipment within low-voltage systems -Part 1: Principles, requirements and tests
<b>EN 50178:1998</b>	Electronic equipment for use in power installations

Gröbenzell, May 14, 2019



Rainer Adams  
Technical Director

AP QM-0671-13  
CE 7049 Rev. 3

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IBAN: DE96 7001 0080 0286 0018 00 - BIC: PBNKDEFFXXX

## 5.4 Transport and Storage Information

Acceptable transport and storage conditions:

<b>Storage and transport temperatures</b>	-40 to +70 °C
<b>Relative humidity</b>	95 % max. without condensation and ice
<b>Package:</b>	Module: only in ESD packaging Housing: only in the original packaging designed for transporting



### CAUTION – Possible injury!

*The phyMOTION™ may weigh up to 30 kg, depending on the expansion stage. Foot injuries can occur from dropping the unit.*

- Make sure that the phyMOTION™ is securely held at all times.
- Wear safety shoes during transport and handling.



### 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 by collisions!

*The phyMOTION™ partly consists of sensitive electronic and mechanical components.*

- Avoid sudden shocks and excessive force during installation.

## 6 Project Planning

Please consider the following information for project planning, before the actual installation.

### 6.1 Information for a Suitable Installation Location

Permissible conditions for the right installation location:

<b>Degree of protection:</b>	IP20
<b>Level of pollution:</b>	2
<b>Ambient temperature:</b>	0 to +40 °C
<b>Relative humidity:</b>	95 % max., without condensation and ice
<b>Installation altitude</b>	2000 m max. above sea level



#### **CAUTION – Possible injury!**

*The phyMOTION™ may weigh up to 30 kg, depending on the expansion stage. Foot injuries can occur from dropping the unit.*

- Make sure that the phyMOTION™ is securely held at all times.
- Take extra care when wall mounting the phyMOTION™.
- Wear safety shoes during transport and handling.



#### **Stray light**

*The phyMOTION™ initialises the installed modules by light transmission.*

- To ensure proper module addressing, avoid intense light sources above or below the phyMOTION™ device.



#### **Air ventilation**

*The phyMOTION™ includes power electronic components, which may become hot depending on the load.*

- Place the phyMOTION™ horizontally and with sufficient distance to devices above or below to allow adequate air circulation.
- With active cooling, filtering measures are necessary.

## 6.2 Safety Concept

First, define the overall safety concept concerning the actual application.

**i** **Intended use:**  
*The phyMOTION™ is designed for operating in a drive system.  
 An installation is allowed only if the requirement of the EC Machine Directive and EMC are conformed with.*

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

**i** **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).

## 6.2.1 External Power Supply (EXT)

The phyMOTION™ is designed for operation in a SELV/PELV system up to 70 V<sub>DC</sub> maximum power supply. The insulation of the phyMOTION™ fulfils the requirements of a basic isolation for non-mains circuits. Thus, power supplies must be used to separate the mains circuit safely from the phyMOTION™ supply.

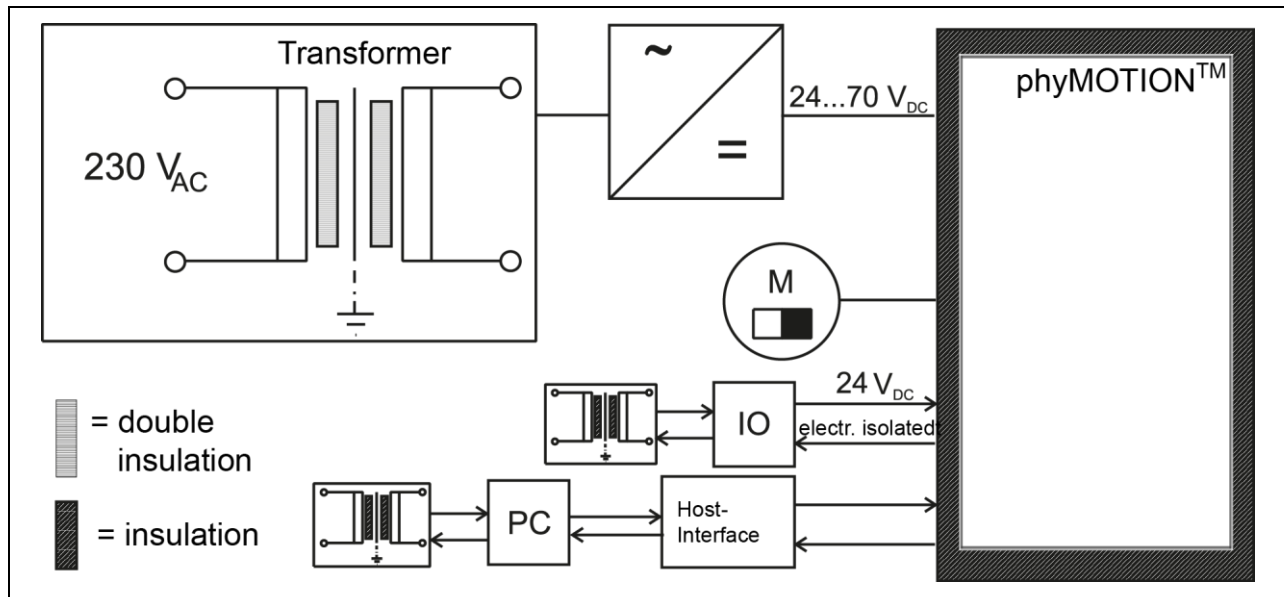


Fig.9 phyMOTION™ isolation overview with external power supply



### 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!

*Also, devices which are connected to the phyMOTION™ for controlling or communication (e.g. PCs, etc.) must have a safe isolation from the mains:*

- Make sure that the devices used to control the phyMOTION™ fulfil the safety concept SELV / PELV, and ensure safe separation from the mains.



## 6.2.2 Internal Power Supply (INT)



### WARNING – Serious injury from electric shock!

*The secondary motor circuits (motor current circuit, I/O and logic circuit) are not insulated by means of a protective separation as defined by the EN 60664:*

- Therefore, the connecting cables to all secondary circuits (I/O cables, logic control cables and motor cables) should have a basic insulation appropriate to the maximum voltage that might be met during normal operation.

Depending on the special requirements of the application and the insulation concept for the complete machine, it might be necessary to apply a reinforced or double insulation for this voltage. In some cases, it could be necessary to mount a protective earth connection at adjoining metal parts that might be accessible for persons.

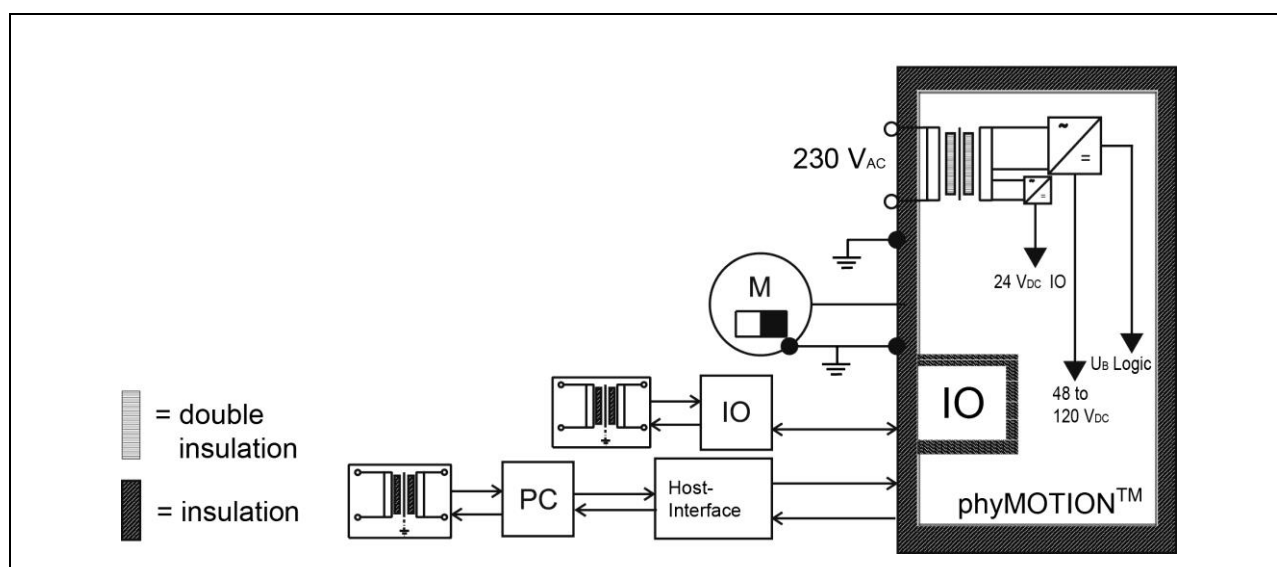


Fig.10 phyMOTION™ isolation overview with internal power supply

The I/O signals are safely electrically isolated by optocoupler.

All host interface signals are electrically isolated from the motor voltage (withstand voltage 800 V<sub>DC</sub>).

In the following section, you will find more information for your safety concept:



### WARNING – Serious injury possible!

*To avoid personal injury please consider the following items in your safety concept:*

- Ensure that no person has access to the area of the plant where there are moving parts.
- Install an emergency stop system in keeping with current technical standards (e.g. European standards EN 60204, EN 418, etc.).



**WARNING – Serious injury possible!**

*The phyMOTION™ is not designed for safety operating modes. Thus, safety-operating modes such as SafeTorqueOff (STO) from IEC61508-2 cannot be implemented directly!*

- In case your risk analysis identifies possible risks for personnel generating the need for safety operating modes you have to implement these security functions at a superior system level.



**CAUTION – Possible damage!**

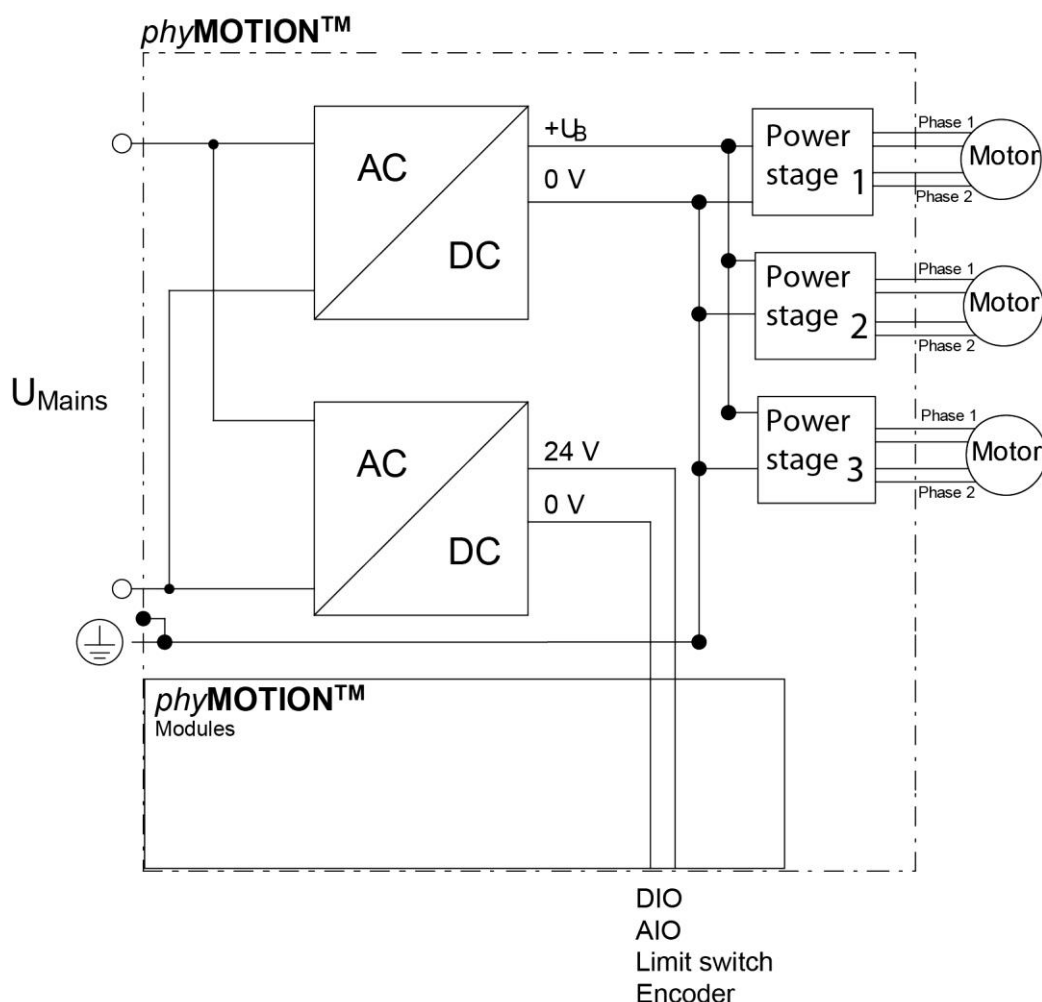
*To avoid damage please consider the following items in your safety concept:*

- Install, for example, hardware limit switches for the end positions of the axes that switch off the power control system directly.
- Install devices and take steps to protect motors and power electronics.

### 6.2.3 phyMOTION™ with Power Stages up to 70 V<sub>DC</sub>

phyMOTION™ with power stages up to 70 V<sub>DC</sub> must be operated by the protective measure PELV acc. to VDE 0100. The phyMOTION™ has to be grounded and the '0 V' is grounded in the phyMOTION™.

The protective measure PELV is fulfilled, as follows:



#### **CAUTION – Possible damage!**

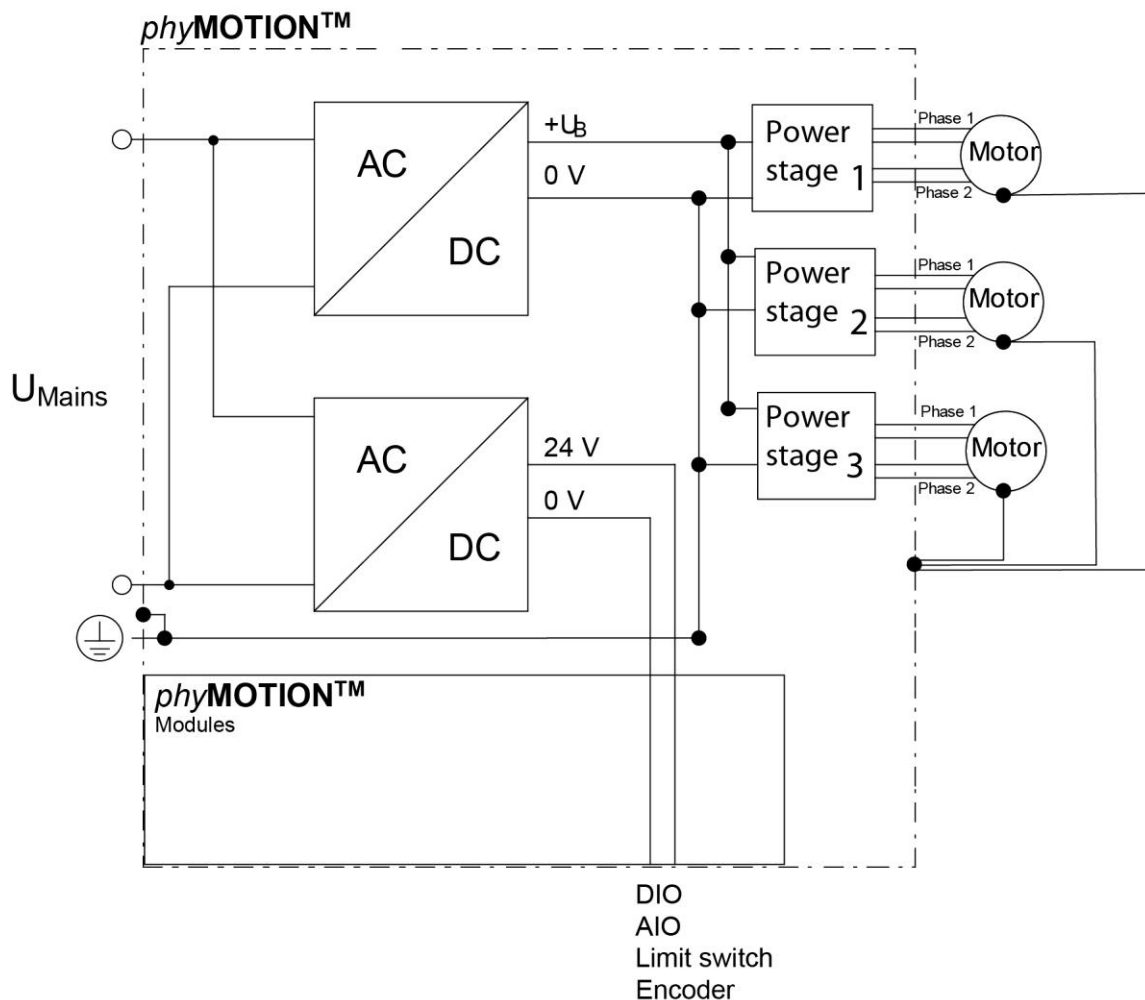
**i**

To avoid damage please consider the following items in your safety concept:

- Protective measure PELV for application of the  $+U_B$  should not exceed 70 V<sub>DC</sub> or 50 V<sub>AC</sub> at dry environment (environmental conditions 3 acc. to IEC 61201).
- The supply transformer must be constructed with reinforced or double insulation between supply and secondary winding (acc. to EN 61558).
- Only use motors that are checked acc. to EN 60034-1 (500 V<sub>AC</sub>/1 minute).

## 6.2.4 phyMOTION™ with Power Stages up to 120 V<sub>DC</sub>

phyMOTION™ with power stages over 70 V<sub>DC</sub> must be operated according to VDE 0100 part 200 with protection by automatic disconnection. Therefore, the motor, power stage, 0 V and each equipment have to be grounded:



### **CAUTION – Possible damage!**



*To avoid damage please consider the following items in your safety concept.*

- When protection by automatic disconnection (EN 61140, VDE 0100, part 410) is used for power stages with definite voltage  $> 50 V_{AC}$  or  $+U_B > 70 V_{DC}$ :
- Only use motors, which are checked according to EN 60034-1 (500 V<sub>AC</sub> + twice-determined voltage).
- The motors must have a protective conductor clamp (EN 60034).

## 6.3 Basic Wiring of the *phy*MOTION™

### 6.3.1 with External Supply (EXT)

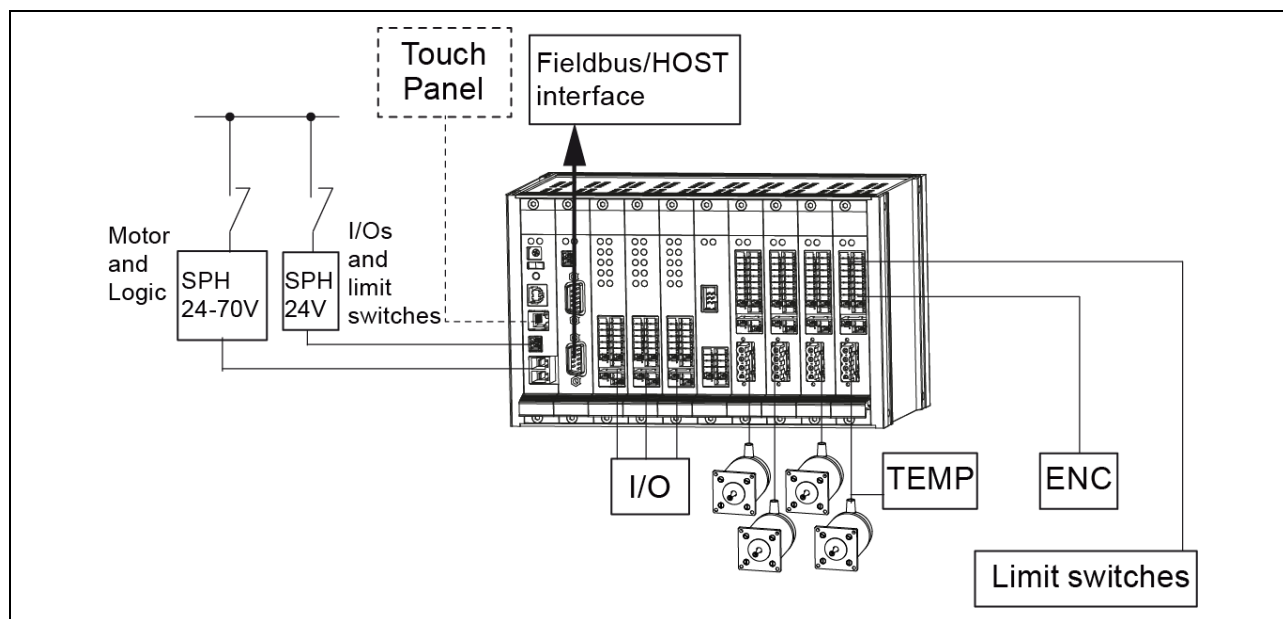


Fig.11 Example of wiring the *phy*MOTION™ – schematically

#### Power supply of the *phy*MOTION™:

Power input modules like the POWM01 and the POWM02 offer two different inputs for power supply:

##### 24–70 V<sub>DC</sub> Supply input for motor supply:

The 24 – 70V<sub>DC</sub> supply input does not only supply the motors. The power input is designed for 20 A maximum. If the integrated power stages need more than 20 A totals, there is need for an additional power feed (POWM02 and POWM04).

After 10 modules, an additional power input module is needed in any case.

Intermediate power input modules cut up the supply voltage on the backplane. This offers the option to drive motors with different voltages separated by an additional power input module (POWM02 and POWM04). The backplane separation is permanent and has to be considered when your *phy*MOTION™ is configured.

##### 24 V I/O Supply input:

The internally required logic voltage is generated from the 24 V I/O supply input. Limit switches, inputs or outputs (digital / analogue) are supplied by the additional supply input at 24 V<sub>DC</sub>. The 24 V can supply 5 A per power input module.



#### Further manual

Detailed information on this subject is in a supporting manual:

“phyMOTION™ Power Modules POWM01/02/03/04”

### 6.3.2 with Internal Supply (INT) in Housing p

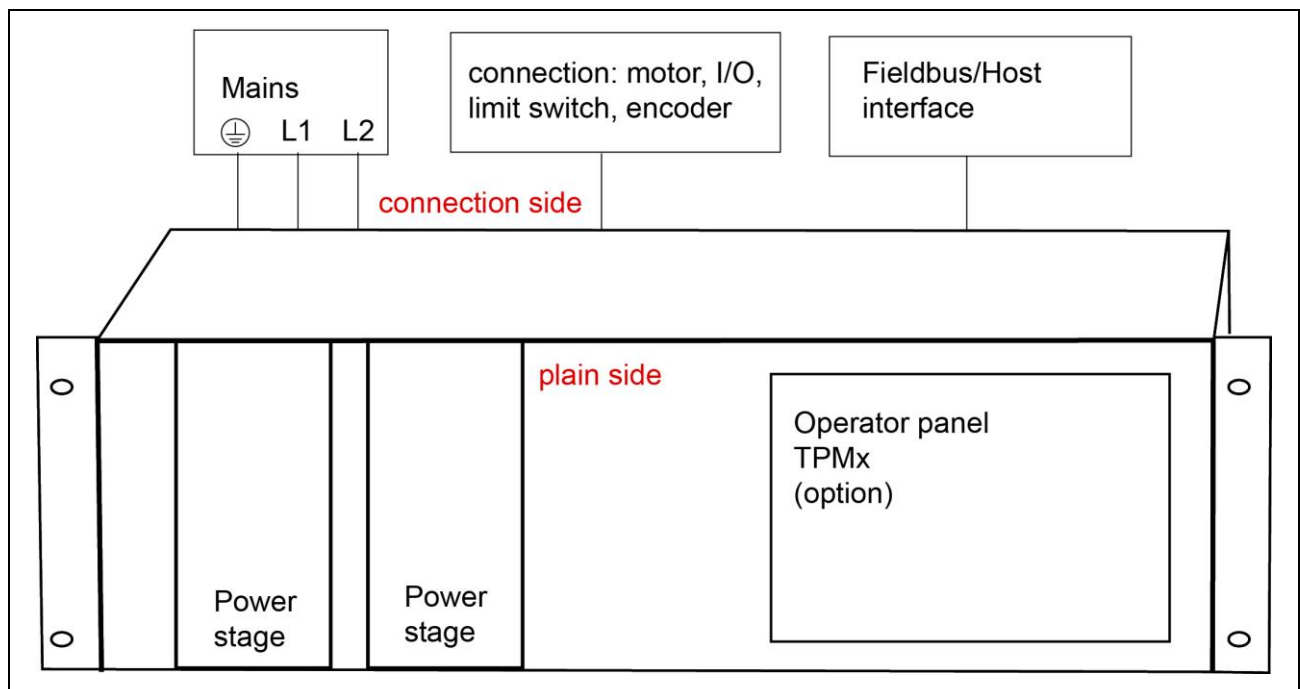


Fig.12 phyMOTION™ wiring with internal power supply (example)

#### Power supply of the phyMOTION™:

From the 230 V<sub>AC</sub> or 115 V<sub>AC</sub> mains voltage:

- the phyMOTION™ modules are supplied.
- the motor voltage **48 V and/or 70 V and/or 120 V** and
- the **24 V** I/O supply are internally generated.

The supply modules like POWM03 and POWM04 have no power connection for the supply and conduct the power supply internally.

#### 24 V I/O Supply input:

The internally required logic voltage is generated from the 24 V I/O supply input.

Limit switches, inputs or outputs (digital / analogue) are supplied by the additional supply input at 24 V<sub>DC</sub>, too. The 24 V can supply 5 A per power input module.



#### Further Manual

Detailed information on this subject is in a supporting manual:

„phyMOTION™ Power Modules POWM01/02/03/04 “

### 6.3.3 with Internal Supply (INT) in housing s

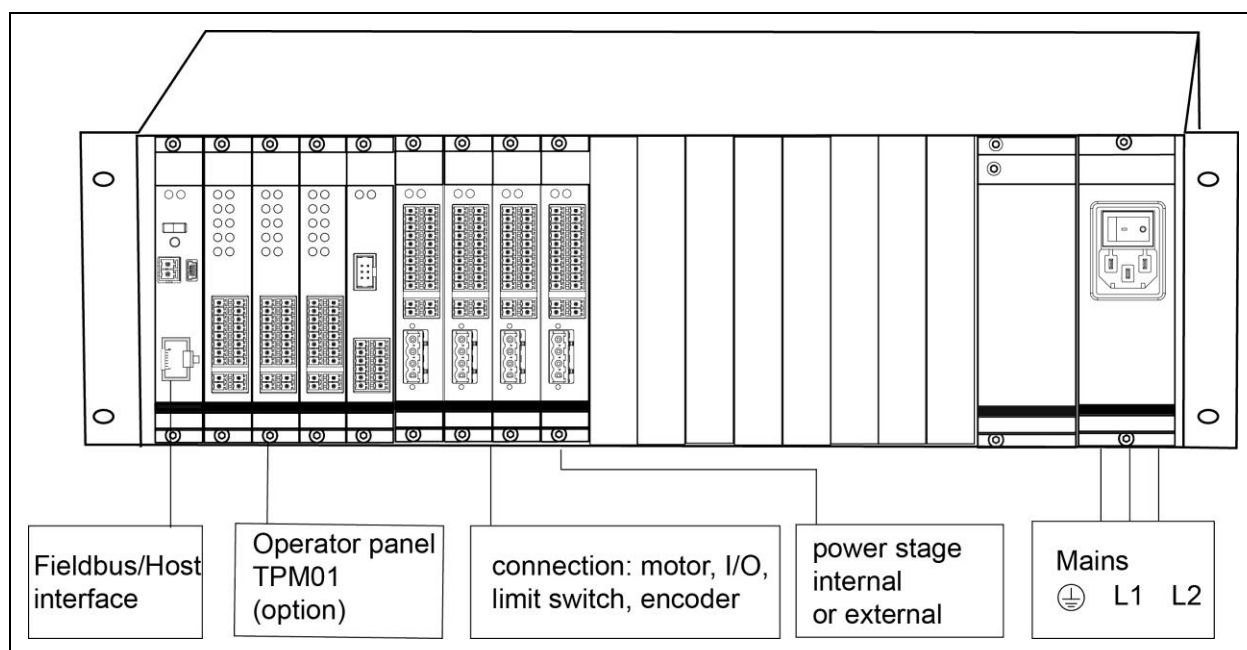


Fig.13 *phyMOTION™* wiring with internal power supply (housing s)

#### Power supply of the *phyMOTION™*:

Eight *phyMOTION™* modules are supplied from the 230 V<sub>AC</sub> or 115 V<sub>AC</sub> mains voltage.

The SUPMx module internally generates the motor voltage **48 V and/or 70 V** and the **24 V** I/O- or logic supply.

The supply modules like POWM03 and POWM04 have no power connection for the supply and conduct the power supply internally.

#### 24 V I/O Supply input:

In case you want to connect limit switches, inputs or outputs (digital / analogue) to the *phyMOTION™*, you need the additional supply input at 24 V<sub>DC</sub>. The 24 V can supply 5 A per power input module.



#### Further Manual

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

„*phyMOTION™* Power Modules POWM01/02/03/04 “

### 6.3.4 Further Modules

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#### HOST interface:

Within each system, there is at least the POWM01 main feeding module and the MCM01 CPU and host interface module or the MCM02 or the MCM03 module. If you only want to operate the system via USB, you have no need for an additional sub module for the MCM. Your PC can be connected directly via the USB interface of the POWM01 (or POWM03).

If you need an additional host interface, select the corresponding sub module for the MCM01/MCM02/MCM03.



#### Further manual

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

„phyMOTION™ CPU and Bus Module MCM01“

„phyMOTION™ CPU and Bus Module and Power Supply MCM02/MCM03“

#### Power stage modules:

The stepper motors themselves are connected directly to the power stage modules. These modules can be expanded by additional sub modules for different encoder and motor temperature evaluation. Evaluations and up to 3 limit or reference switches are directly connected to the axis module.



#### Further manuals

*Detailed information on this subject are in the supporting manuals:*

“phyMOTION™ 1 Axis Stepper Motor Drive I1AM01“

„phyMOTION™ 1 Axis Stepper Motor Drive I1AM02“

“phyMOTION™ 4 Axis High End Indexer I4XM01“

“phyMOTION™ Carrier Module for APS Power Stages  
INAM01/INAM02/INAM03“

“phyMOTION™ Indexer Interface EXAM01“

„phyMOTION™ Indexer for external Power Stage I1EM02“

„phyMOTION™ Power Stage with Safe Torque Off INSM01“



## Inputs and outputs:

Inputs and outputs have to be connected to the corresponding I/O modules supplied by the separated 24 V<sub>DC</sub> supply. There are 5 A available per power feeding module. Then an additional power-feeding module has to be integrated.



## Further Manual

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

„phyMOTION™ Digital I/O Module DIOM01“

„phyMOTION™ Analogue I/O Modules AIOM01 “

„phyMOTION™ PID Regulation Module PIDM01“

„phyMOTION™ T4KM01 Temperature Measuring Module“

## HMI – Human-Machine-Interface:

There is a Human-Machine-Interface like the phytron touch panel that can be connected to your phyMOTION™.

## 6.4 Power Supply Sizing for phyMOTION™ with external Supply (EXT)

### 6.4.1 For the Motor Supply

---

The voltage of the supply unit (24 V<sub>DC</sub> to 70 V<sub>DC</sub>) depends on the motor speed during operation. For low velocity (about < 300 rev/min) but high torque or if only low torque is necessary at higher velocity (> 300 rev/min), a 24 V<sub>DC</sub> supply voltage is often sufficient. Refer to the technical data of the stepper motor manufacturer for information about the required performance with 24 V. These usually indicate torque characteristics dependent on the supply voltage.

If higher numbers of revolutions must be achieved, we recommend supplying the POWM01 or POWM02 module with 70 V<sub>DC</sub> if your selected motors can be driven with these voltages.

#### **i** Number of modules to be supplied:

*The inputs for the motor supply of the power input modules are designed for max. 20 A. If the input is higher, it may cause damage to the device.*

- Make sure that the total power consumption of all modules that delivers one power supply module is less than 20 A with maximum load.

Generally, the required power of the supply voltage is calculated by rules of thumb:

$$P_{\text{SUPPLY}} = 2 \times \Sigma P_{\text{MECHANICAL}} \text{ (for speeds } < 300 \text{ rev/min)}$$

$$P_{\text{SUPPLY}} = 3 \times \Sigma P_{\text{MECHANICAL}} \text{ (for speeds } > 300 \text{ rev/min)}$$

„ $\Sigma P$ “ is the sum of all power of all connected motors to be supplied by one power supply.

#### **i** Remote power supply units:

*If the power supply unit is situated far away from the phyMOTION™ because of installation reasons, ferrites may be needed to suppress line interference.*

#### **i** Rule of thumb for calculating the required supply current

*If the mechanical power is not known, the rule of thumb "Required supply current  $\geq$  sum of all effective motor currents x 0.6" can be used.*

## 6.4.2 For Input/Output Supply

Limit and reference switches on the power stage modules, also analogue or digital inputs and outputs on the corresponding I/O modules are fed by a separate supply voltage.

### **i** Number of I/Os to be supplied:

*The inputs for the 24 V I/O supply of the power input modules are designed for 5 A maximum. If the input is higher, it may cause damage to the device.*

- Make sure that the total power consumption of all I/Os that use one power supply module is less than 5 A.

### **i** Separate power supply:

*The power supply for motor and for the limit/reference switches and I/Os are electrically isolated from one another to reduce interferences.*

- To reduce interference always use two separate power supplies for the 24 V supply and the motor supply. Even if the motor is only driven with 24 V.

## 6.5 Mains Connection phyMOTION™ with Internal Supply (INT)

The phyMOTION™ is supplied via NETM03 module with the 115 to 230 V<sub>AC</sub> mains voltage.

Additional grounding is possible with the shielding module PEM01 (up to 6 motors) for motor voltages >70 V (see chapter 6.8.).

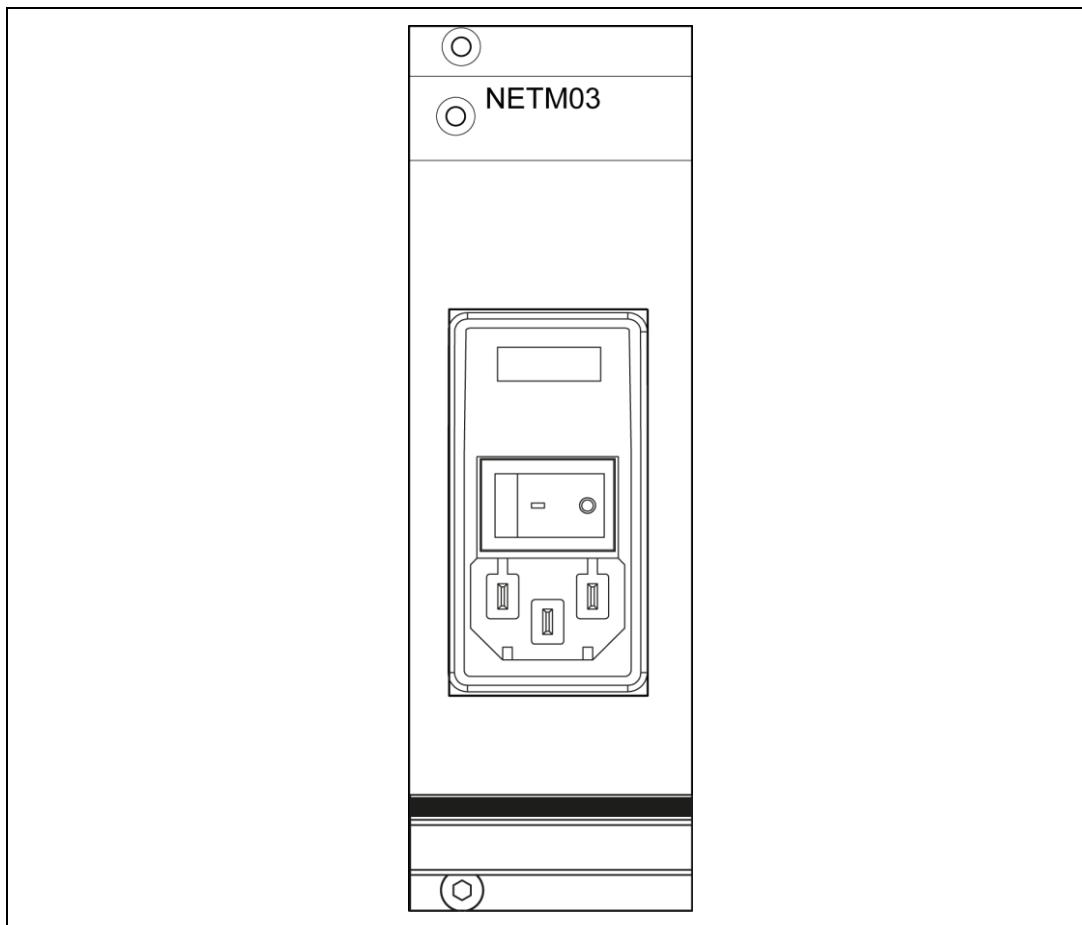


Fig.14 Power entry module with non-heating socket (3 x 0.75 mm<sup>2</sup>) and 2-pole mains switch, nominal current up to 10A, acc. to EC 950



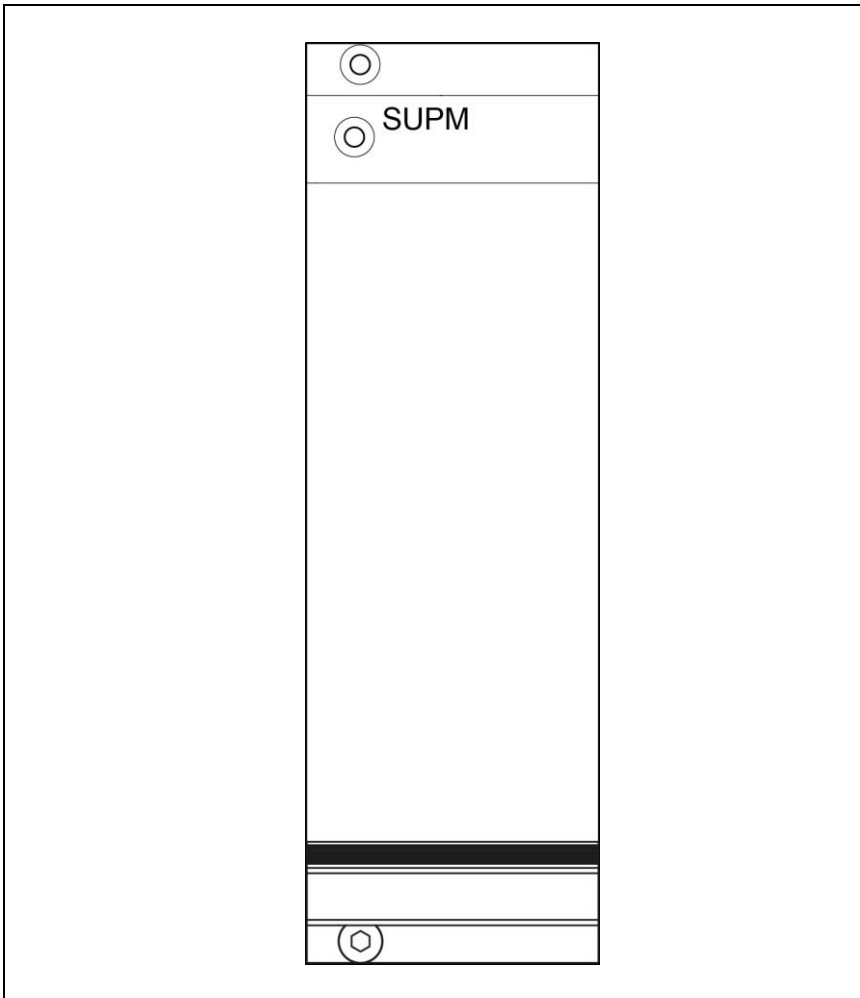
### **WARNING – Serious injury possible!**

*To avoid personal injury please consider the following items:*

- The operating voltage indicated on the type plate should match the local supply voltage.
- Connect the cable only to the socket with a protective earth contact.
- Any interruption of the protective ground contact inside or outside of the device is forbidden.
- Arrange the mains cable so that it cannot be tripped over.

## 6.6 SUPMx Power supply module for internal supply (INT)

The SUPM01,02,03,04,06,07,12 generates the internal supply of the *phyMOTION*<sup>TM</sup> with motor and logic voltage from the mains voltage



The options are defined by power and housing depth:

SUPMx	Power	Housing depth
SUPM01	24 V / 550 W	s
SUPM03	48 V / 550 W	
SUPM06	70 V / 330 W	
SUPM02	24 V / 700 W	p
SUPM04	48 V / 700 W	
SUPM07	70 V / 700 W	
SUPM12	120 V / 580 W	

## 6.7 EMC Measures

For EMC compliant installation, consider the following measures:

	EMC Measures	Effect
<b>Power supply</b>	Use filter groups (e.g. SLFM01 module) (see chapter 6.9).	Reduction of emitted interference and interference coupling
	Protective circuit to mitigate over voltage or lightning strikes.	Protection of damage by over voltage.
<b>Wall/rack/rail mounting, bench</b>	Closed metal housing – bolted and securely seated front and rear panels.	Good conductivity due to planar contacts.
	Fit switching devices such as contactors, relays or solenoids with interference or spark suppressors (e.g. diodes, varistors and RC elements).	Reduction of mutual interference.
	Mount power and control components separately.	Reduction of mutual interference.
<b>Cabling</b>	Keep cables as short as possible. No “safety loops”.	Avoidance of capacitive and inductive interference
	Connect the shielding of all shielded cables to the phyMOTION™ housing to a large area on the front panels.	Reduction of EMC emissions.
	Lay the fieldbus and signal cables spatially separated from each other.	Avoidance of mutual interference.

## 6.8 Shielding

To avoid interference affecting the wires and instruments installed close to the drive system, we recommend the use of shielded cables.

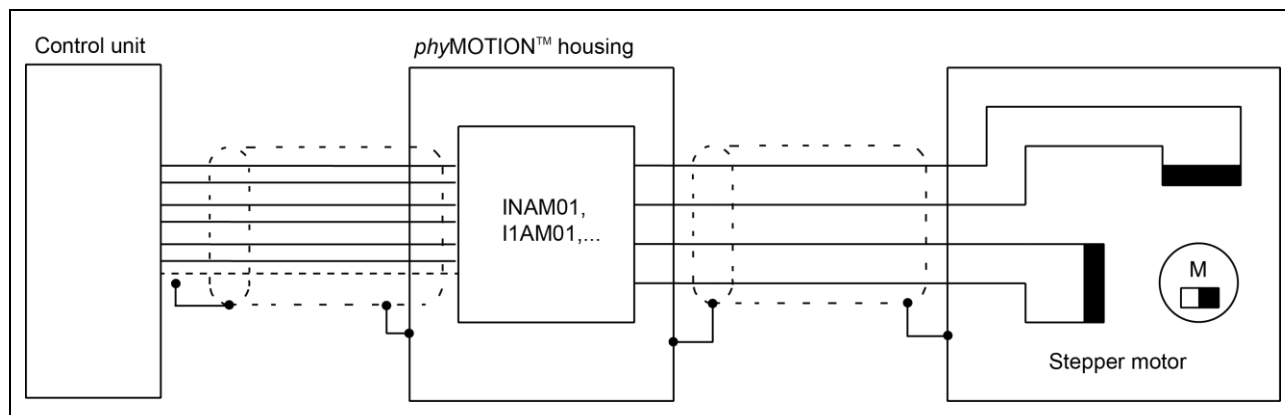


Fig.15 Motor cable shielding

### Motor cables

The motor cable is a source of interference and must be positioned with care.

Use the cables recommended by phytron. They are tested for EMC safety and are suitable for movement.

The motor cable must directly be connected to the motor either with a low resistance or to a large surface area.

- Connect the motor cables without interruption (do not use switches) from the motor to the device. If a cable must be interrupted, use shielded connections and metal housings to reduce interference.
- Lay the motor cable at a distance of at least 20 cm from the signal cables. If they are laid closer together, motor cable and signal wiring must be shielded and grounded.

## 6.9 Option: SLFM01 EMC Module for interference suppression of the motor voltage supply (EXT)

The SLFM01 module is used to suppress the supply voltages when *phyMOTION*™ is operated with an external power supply.

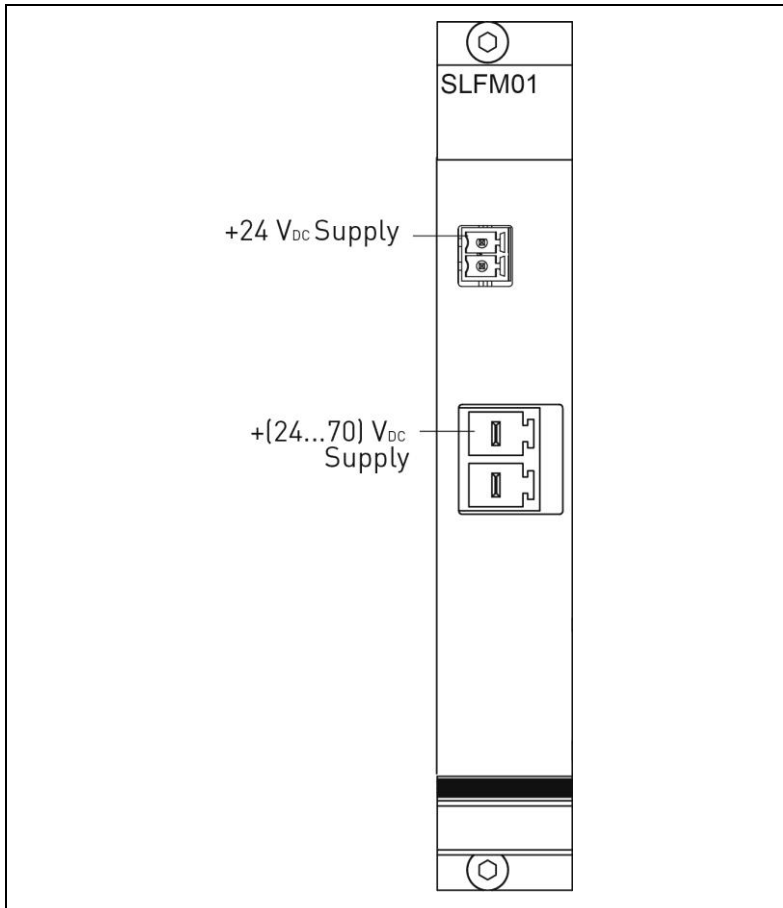


Fig.16 SLFM01, EMC module

Phytron recommends the use of the SLFM01 module,

- if high power stage utilisation (>50 %) is planned.
- if the DC supply line is longer than 3 m.
- if the own DC voltage source does not generate sufficient filter effect to comply with the standard "CISPR 14:2020 Electromagnetic compatibility - Requirements for power tools".

**i**

The SLFM01 module is mounted in the first position on the left in a *phyMOTION*™ rack.

One SLFM01 (EMC module) is required for each intermediate feed in the *phyMOTION*™.



## 6.10 Option: Grounding for Motor Voltage > 70V (INT)

The grounding module PEM01 is used for motor voltage >70 V to ground the PE wire (up to six motors).

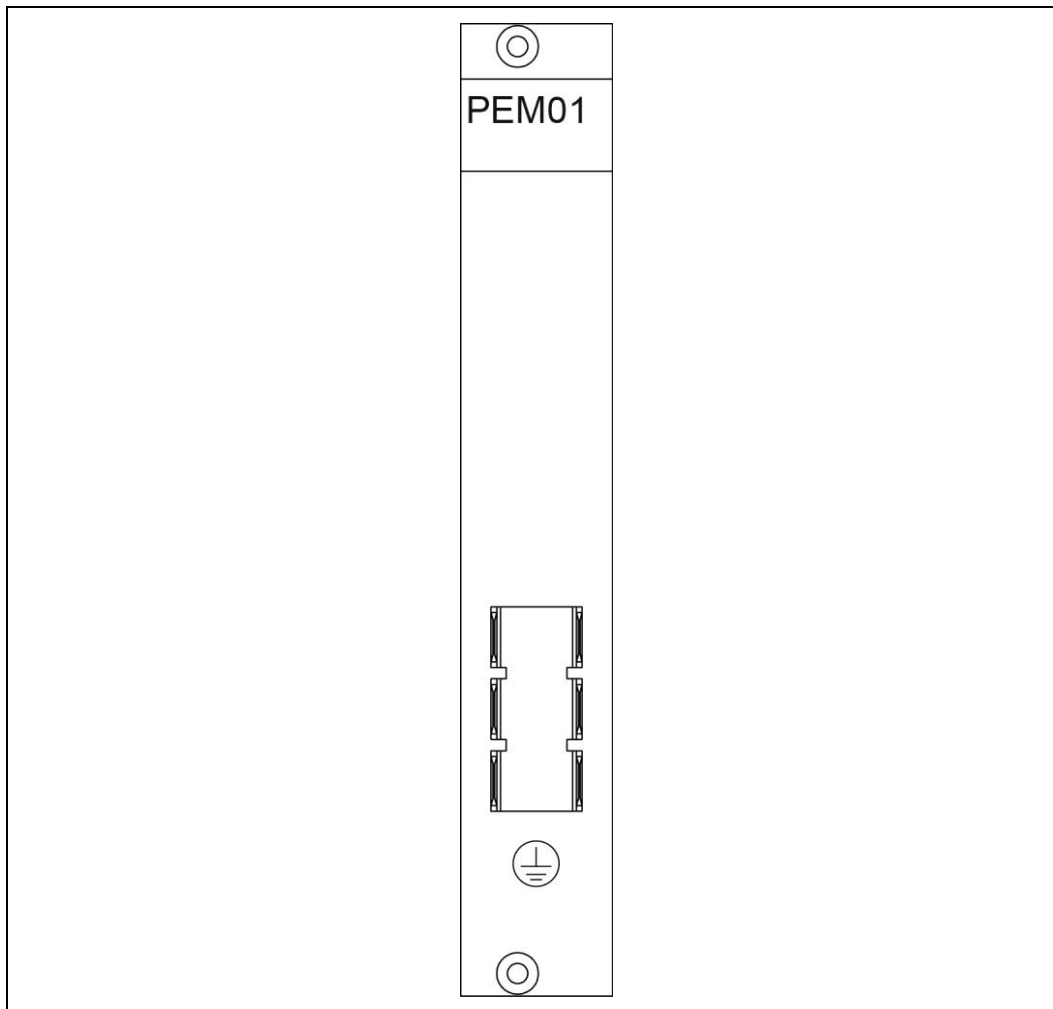


Fig.17 Grounding module for motors with motor voltage >70 V



The PEM01 module is only used in connection with the INAM02/INAM03 module.

## 7 Installation

### 7.1 Mechanical Installation

---

Phytron always delivers the *phyMOTION™* devices fully configured and assembled.

The following modules/components are necessary for the mechanical installation:

- *phyMOTION™* device
- Power supply unit(s) for 24-70 V<sub>DC</sub> motor voltage supply (one per supply module)  
e.g. SPH 240-4805 for 48 V<sub>DC</sub>
- Power supply unit(s) for 24 V<sub>DC</sub> I/O supply (one per supply module)  
e.g. SPH 240-2410
- Mating connectors (included in delivery)
- The necessary wiring materials



#### **CAUTION – Possible injury!**

*The **phyMOTION™** may weigh up to 30 kg, depending on the expansion stage. Foot injuries can occur from dropping the unit.*

- Make sure that the *phyMOTION™* is securely held at all times.
- Wear safety shoes during transport and handling.



#### **CAUTION – Possible damage from collisions!**

*The **phyMOTION™** partly consists of sensitive electronic and mechanical components.*

- Avoid sudden shocks and excessive force during installation.

If you have ordered individual modules, or received them as replacements or expansions, we will send these modules in ESD compliant packaging. Keep the modules in their packaging until you start installing, subject to compliance with the ESD safety measures.

Before the replacement or installation of the module, read the corresponding manual.



#### **Further Manual**

*Read the corresponding module manual for installation of a single module into your **phyMOTION™**.*



### 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 the single modules in ESD protective packaging
- Always handle the components in compliance with the ESD protection measures.
- For any consequences resulting from improper handling or non-ESD-friendly packaging, no responsibility can be accepted.

## 7.2 Housing Types and Dimensions



The **phyMOTION™** housing s or p is always supplied in a rack housing. The following housing variants are possible through in-house conversion (option):

- Wall mounting or rack inverse
- Rail mounting
- Bench (also with housing base)

<b>Dimensions</b>	Width: dependent on the number of slots Height: 3 HU Depth: s / external or internal: 121 mm p / internal: 420 mm
<b>Material/Surface</b>	Aluminium, transparently chromated

	Number of slots		A	B	C	D	E	F
<b>EXT</b>	6 <sup>*)</sup>	[mm]	121 / 135 (with handle)	160	132.5	177.0	137.0	137.0
	8			200.6		217.7	177.6	177.6
	10			241.3		258.3	218.3	218.3
<b>INT</b>	21			465.6		482.6	442.4	442.4
			Dimensions: ±5% tolerance					
			*) only valid for housing s <b>EXT</b>					

Number of free configured slots		A	B	C	D	E	F
10 (with TPM02 connection side)	[mm]	355 / 370 (with handle)	465.6	132.5	482.6	442.4	442.4
21 (with TPM02 plain side)							
21 (touch panel external)							

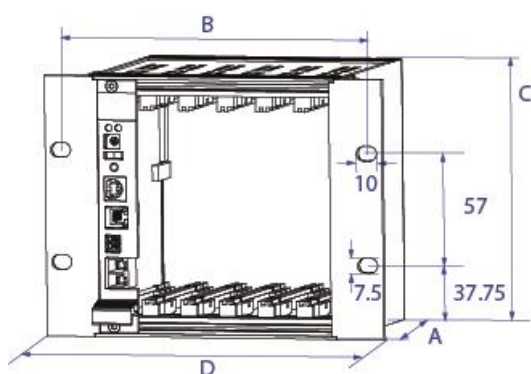


Fig.18 Sub rack dimensions  
(=standard)

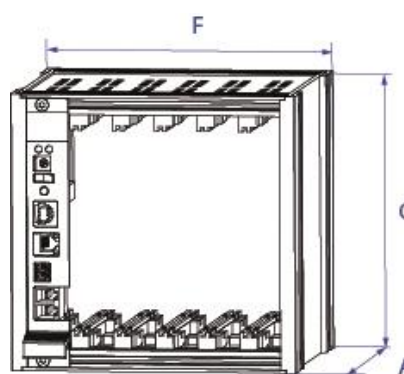


Fig.19 Bench dimensions (=option)

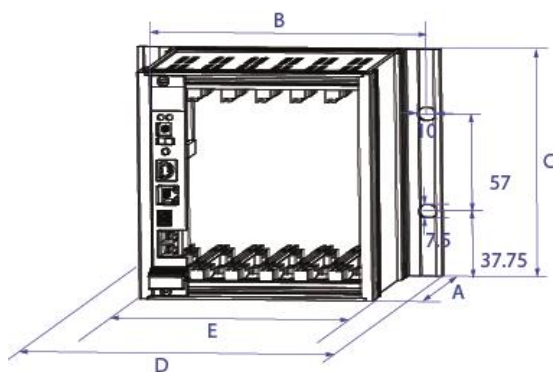
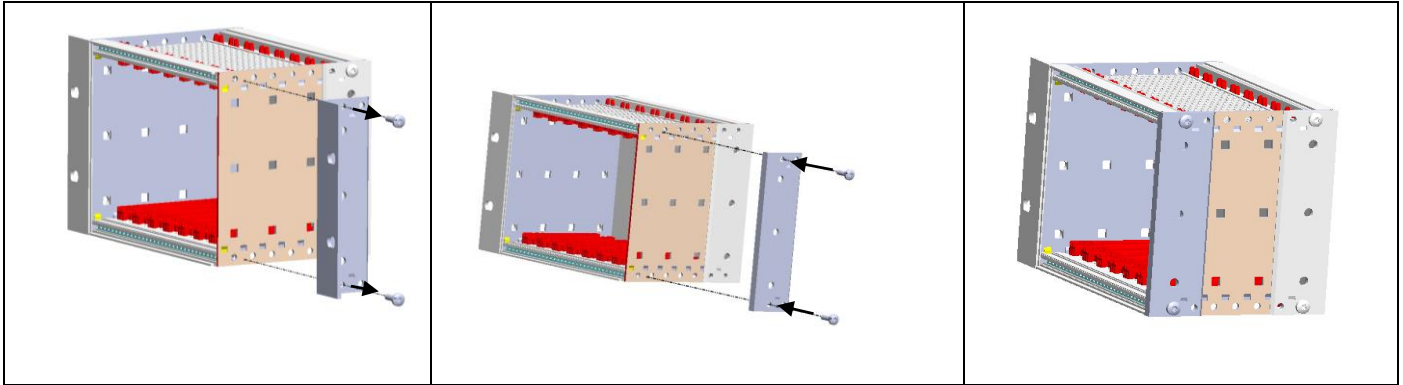


Fig.20 Wall dimensions/rack inverse (=option)

## 7.2.1 Bench

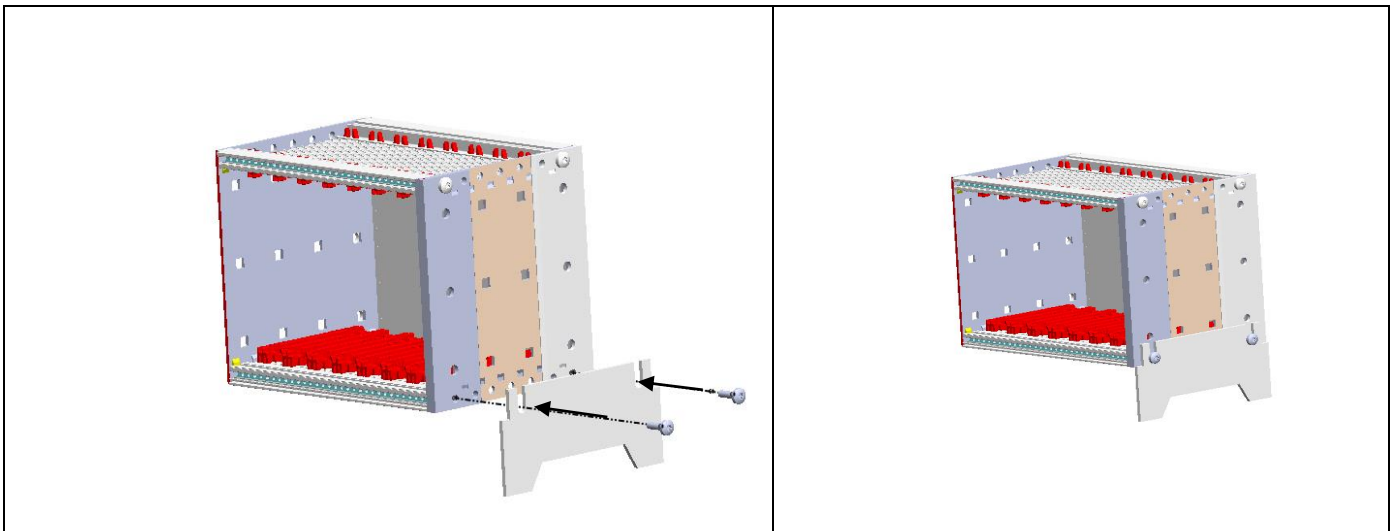
- Make sure that the set-up location is level and that the device has at least 30 mm distance to neighbouring devices
- Do not cover the air vents on the device's top to make sure that emerging heat can escape the housing at any time.

### Conversion to Bench Housing



Dismantle the 19" bracket by loosening the two Torx screws, place the corner profile and screw it tight.

### Fitting the housing base for housing s

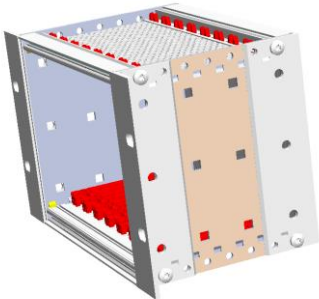
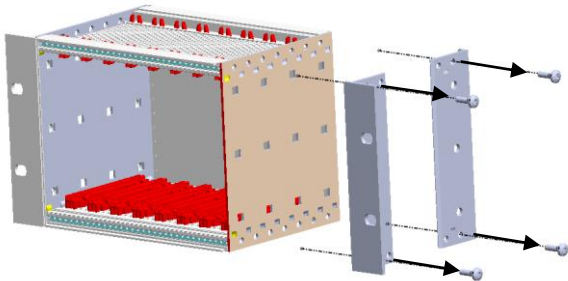
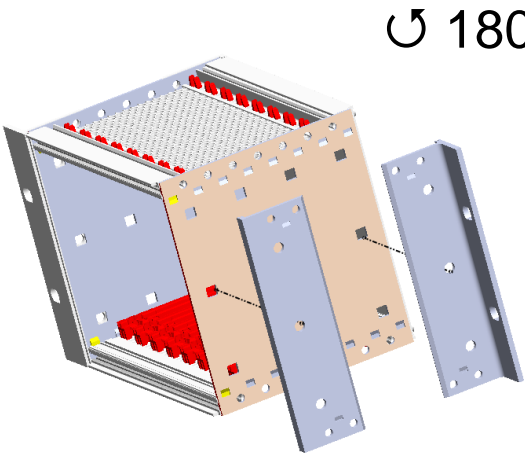
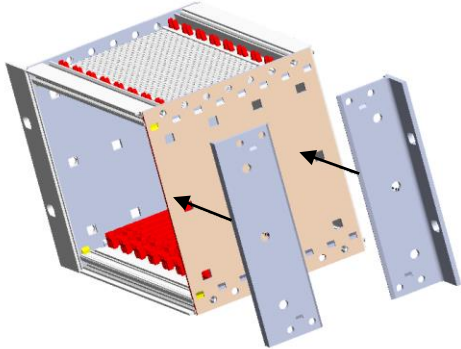


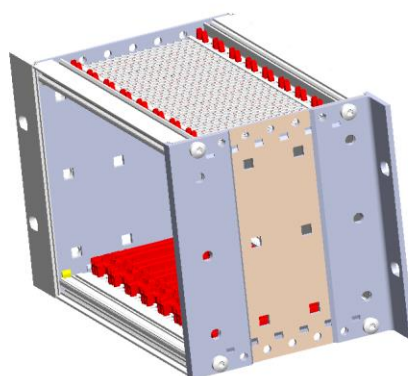
Loosen the two lower Torx screws, put on the foot section and screw it tight.

## 7.2.2 Wall/Rail Mounting for *phyMOTION™* with External Supply **EXT**

- The device needs at least 30mm distance to neighbouring devices. The *phyMOTION™*'s interfaces are placed at the bottom on the front side. Therefore, we recommend leaving at least 100mm of free space below the device in order to ensure the cables can be installed without any kinks.
- Make sure that the device is installed level, so that heated air can escape the housing.
- The installation on a mounting rail has to be designed to hold the weights of the *phyMOTION™* unit.

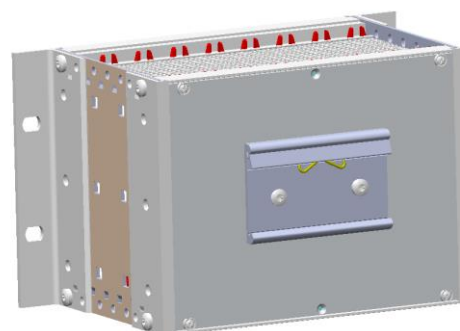
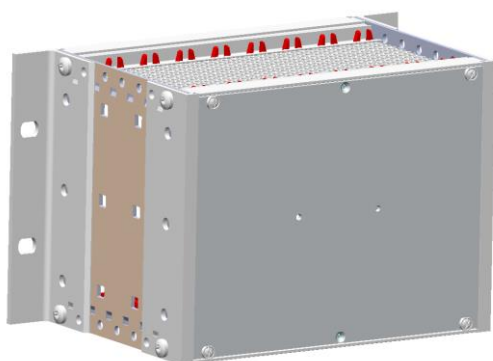
### Conversion from rack housing to wall or rack-inverse housing

	
<p>1. Loosen 2 Torx screws each of the corner bracket and the side bracket.</p>	
	
<p>2. Turn both sheet metal parts by 180°, exchange them and screw them back on.</p>	



### 3. Wall or rack-inverse housing

#### Rail clip mounting



Screw the rail clip to the rear wall of the housing with the two 2 Torx screws.

## 7.2.3 Sub Rack Mounting

- When the *phyMOTION*™ is installed within a rack, you have to take into account the rack manufacturer's guidelines.
- Rails must be installed for the 19" subrack.
- Push the *phyMOTION*™ carefully into the rack's sub rack slot from the front. Secure the unit by connecting it with bolts through the unit's oblong holes into the rack. Fasten the bolts securely.
- The rack's air circulation system has to make sure that the heat produced by the integrated units can escape the rack.
- The *phyMOTION*™ with internal supply can be mounted as follows:

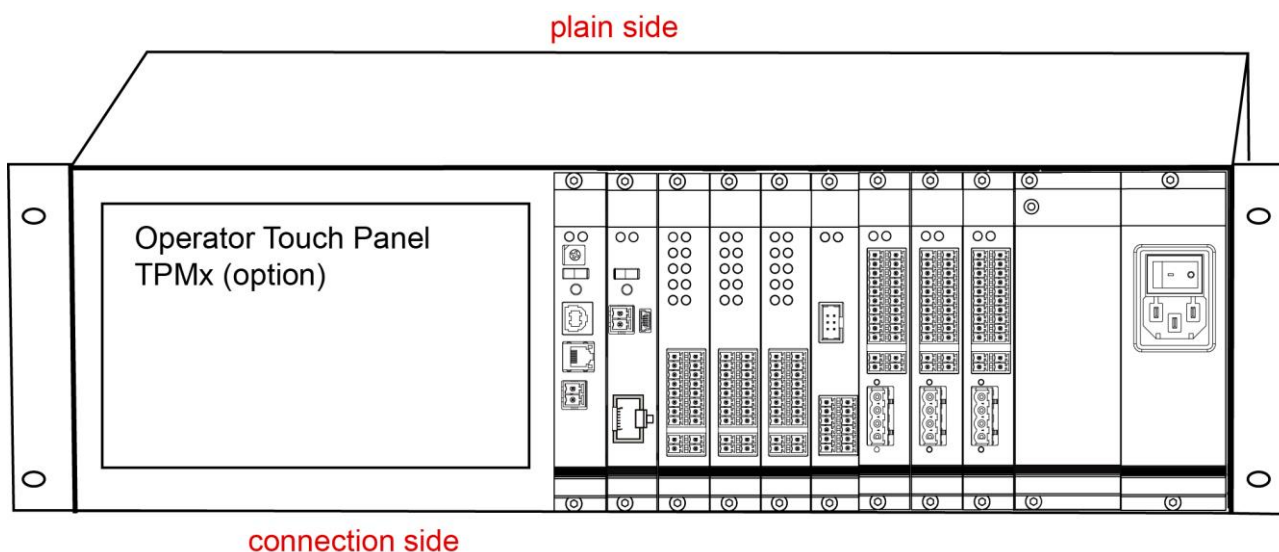


Fig.21 Connection side front (p or s housing)



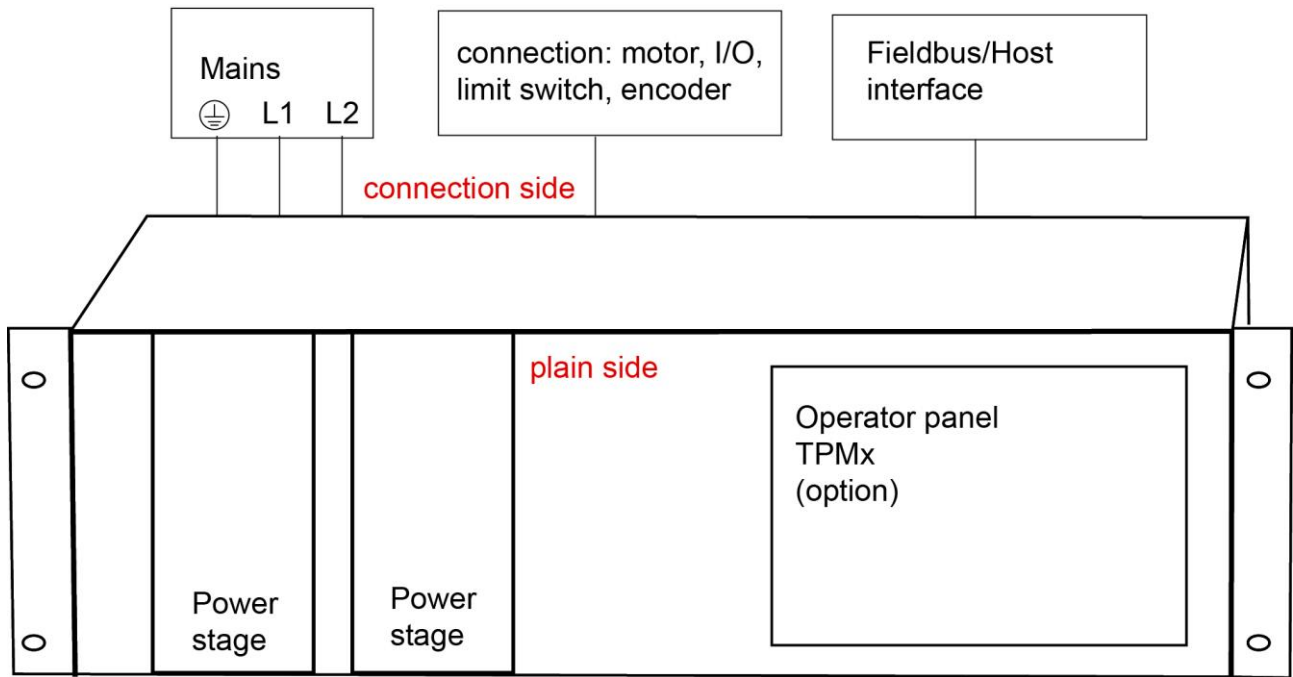
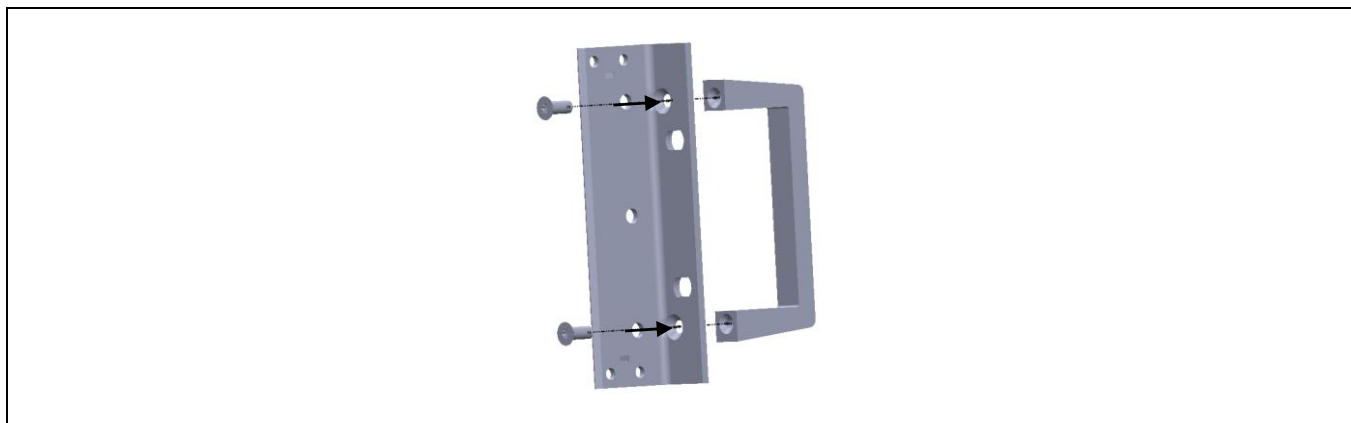
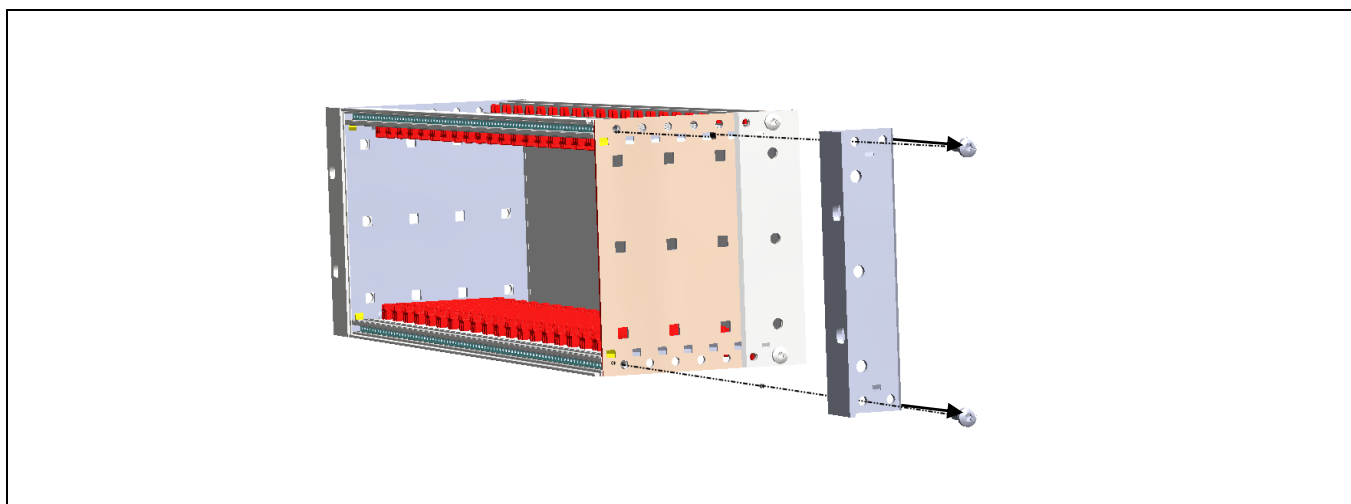


Fig.22 Plain side front (p housing)

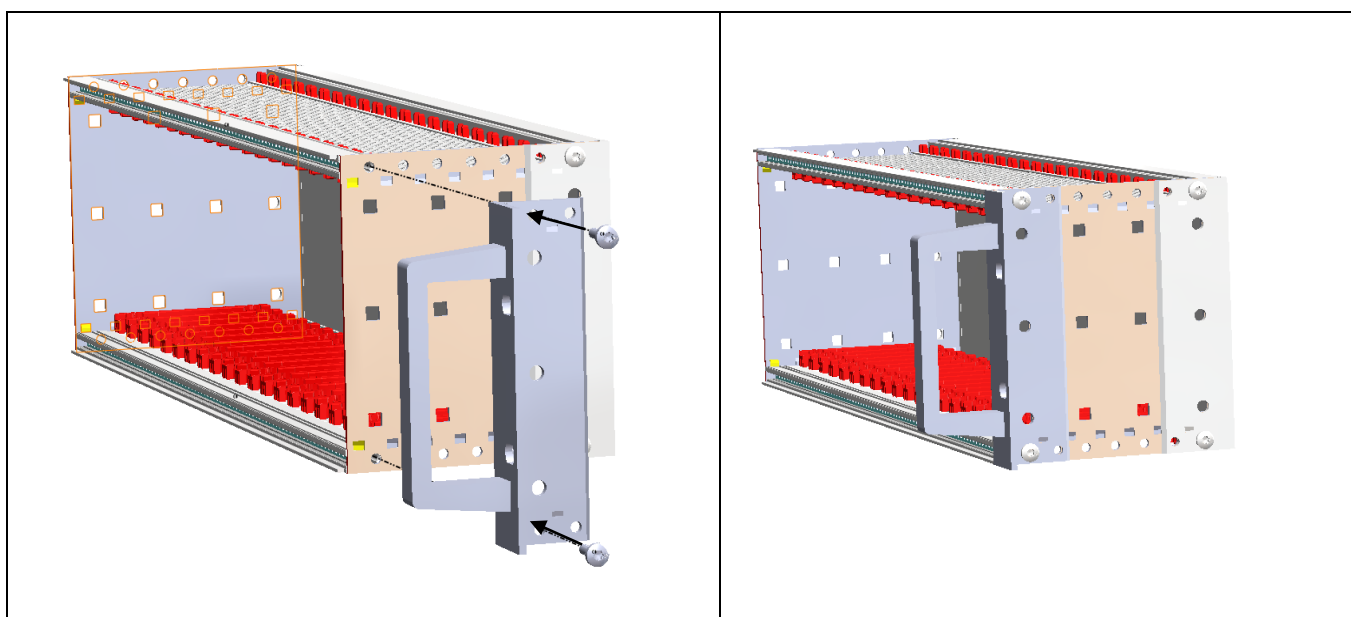
## Front Handle Mounting



1. Screw the handle to the corner bracket using the two countersunk screws.



2. Unscrew the corner bracket from the sidewall by loosening the Torx screws.



3. Screw the front handle to the sidewall with the two 2 Torx screws.

## 7.3 Electrical Installation



### **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 is 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.



### **Further Manual**

*Read the corresponding module manual for installation of the single modules.*

Ensure sufficient bending radius of the cables during installation. Do not lay the cables in tension or distort them. The cable shields are not for strain-relief – for this purpose use the optional shield contact element(s).

We recommend labelling the mating connectors to prevent interchanging them.

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

## 8 Commissioning

### 8.1 Condition

The condition is a fully mechanically and electrically installed **phyMOTION™** and a full installation of the delivered programming software **phyLOGIC™** ToolBox.



#### **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.

### 8.2 Testing of the Communication MCM Module – PC



#### **CAUTION – Possible damage!**

*For the MCM01 module with the POWM01 module and for the MCM02/MCM03 module the communication test is possible with the following interfaces: USB, Ethernet or RS232 / RS485.*

- Please check the interfaces of the MCM module before starting.
- You'll find the description of the communication test with Ethernet or RS232 or RS485 interface in the manual **phyLOGIC™** ToolBox – Communication software for the stepper motor controller **phyMOTION™**.

Description of the communication with the USB interface		
	MCM01 module	MCM02/MCM03 module
1.	Connect the PC to the POWM01 module via USB cable (A-B).	Connect the PC to the MCM02/MCM03 module via USB cable (A-B).
2.	Switch the Remote/Local switch on the POWM01 module to REMOTE.	Switch the Remote/Local switch on the MCM02/MCM03 module to REMOTE.
3.	Power on the supply voltages ('+24...70 V') and ('+24 V') on the POWM01 module.	Power on the supply voltages ('+24...70 V') and ('+24 V') on the MCM02 module.

4. First, the LEDs of the modules blink „red“ while addressing and are a steady red, when the **phyMOTION™** is ready.

**Note:** If you cannot go through addressing fully, check that no intense light sources are placed near the **phyMOTION™** – too bright light can affect the addressing

5. Start **phyLOGIC™** ToolBox.
6. Select the controller type and the interface. Save the interface parameters.



### Further Manual

*Parameterising and programming of the **phyMOTION™** is described in the programming manual **phyLOGIC™**.*

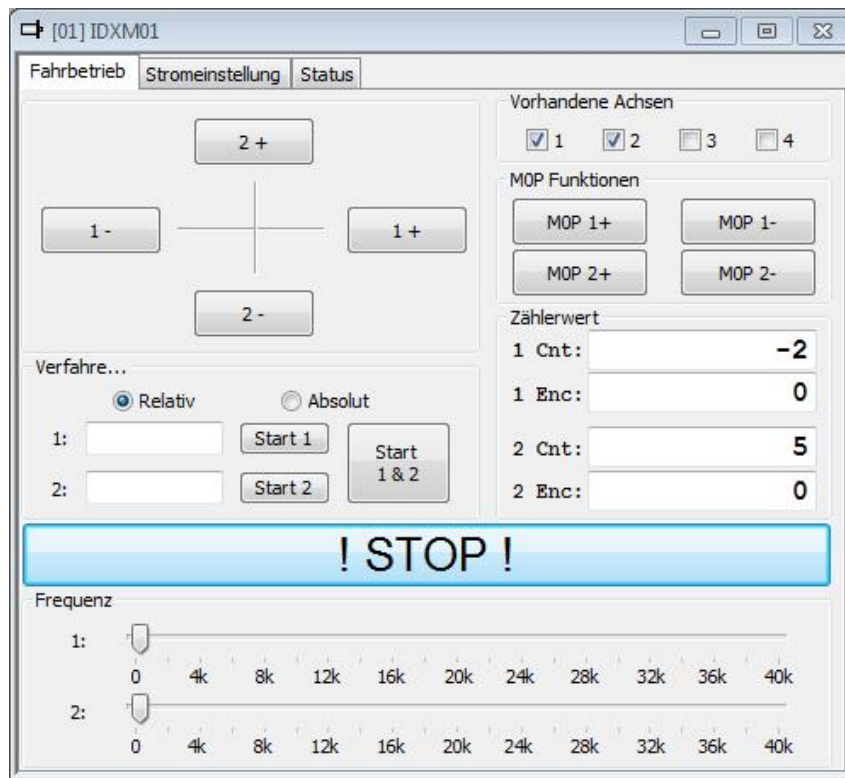
7. After the motor currents have been set to suitable values you can test the modules by selecting the menu items *Transmission/Direct Mode* or *Transmission /Operation*.
8. Menu item *Transmission/Direct Mode*  
Many customers are already familiar with **phyLOGIC™** program instructions. They can enter all types of **phyLOGIC™** instructions into a dialog box. The instruction is executed at once.

Example: Enter *1.1+200*

The motor axis 1 drives 200 steps in direction +.

The corresponding instruction for a second a motor would be: *1.2+200*.

9. An icon in the menu bar *Transmission/Operation* opens the following dialog box that enables you to drive the motor per mouse click.



10. Simply click on one of the buttons e.g. . Direction + means clockwise, as seen looking on the motor shaft.  
If the motor should move in the wrong direction, exchange the connecting leads of one motor phase, e.g. A and B.
11. You can enter drive instructions for two axes into the window „Drive relative ...  
The symbol + or – before the entered number of steps defines the direction.  
When you click on the button the instruction will be executed. Now the button has the marking in order to cancel the movement if required.
12. You can change the drive frequencies of two motors with two slider controls at the bottom of the window ‘Frequency’.
13. You can initialise each axis by clicking on one of the buttons . After starting, the button has the marking to cancel initialising if required.
14. In the module window (e.g. DIOM01) you can test the inputs and outputs.

**i** **CAUTION – Possible damage!**  
*Malfunctions are possible while programming the instruction codes – e.g. sudden running of a connected motor, braking etc.*

- Please test the program flow systematically.

**i** **CAUTION – Possible damage!**  
*For each application, the functional reliability of software products by external factors such as voltage differences or hardware failure, etc. is affected.*

- To prevent damage due to system error, the user should take appropriate safety measures. These include back-up and shutdown mechanisms.

**i** **CAUTION – Possible damage!**  
*Each end user system is customised and differs from the testing platform. Therefore, the user or application designer is responsible for verifying and validating the suitability of the application.*

- The suitability of the device's use must be tested and validated.

**i** **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 before starting, if the parameters are correct.

## 9 Service and Modular Expansion

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In case of a service contract, please proceed as follows:

First, try to identify the technical problem and document the fault. Feel free to ask our support team for help. We are pleased to assist you: tel. 0049-8142-503252 (local rate).



### **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 is 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.



### **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.



## 9.1 Service for *phyMOTION*<sup>TM</sup> with External Supply **EXT**

### 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 that you want to remove. Do not slide the blade between the front panels by no means. When back fitting 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*<sup>TM</sup> after removing a module, the gap has to be covered with a blanking plate before power supply is reconnected and switched on.
- To send a module to phytron use ESD packaging only.

## 9.2 Service for *phyMOTION*<sup>TM</sup> with Internal Supply **INT**

Please note that only the following modules are interchangeable due to the complex design:

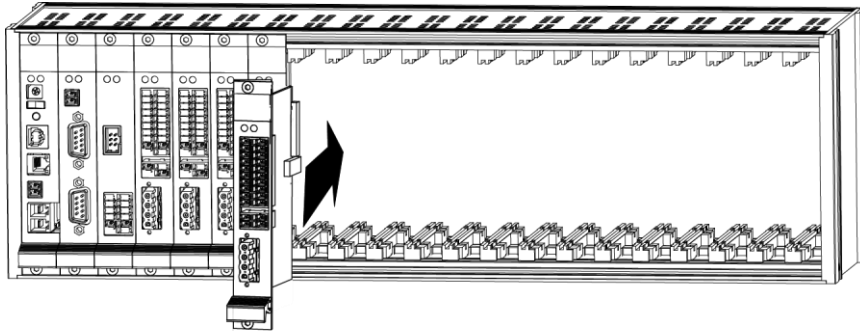
- the power stages MSX<sup>+</sup>
- all *phyMOTION*<sup>TM</sup> modules on the connection side – except NETM03 and TPM02

When removing the module please observe chap. 9.1.

### 9.3 Expansion for phyMOTION™ with External Supply **EXT**

For modular expansion the housing has to be opened. These steps may be taken by qualified personnel only.

Before integrating additional modules read chapter 4.5 *Equipment rules* first.



- 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 that you want to remove. Do not slide the blade between the front panels by no means. When back fitting by our service the red seal tape is renewed.
- Loosen the screws of the first blanking plate (directly to the right of the last built installed module). Do not leave a gap between existing integrated modules and the expansion.
- If the module you want to add is a power feeding module (POWM01 / POWM02), make sure the backplane slot is prepared for power feeding.
- Push the module carefully into the guide rail until the rear contacts the housing's frame. In case there is a problem pushing the module in the last half centimetre, move the modules front plate slightly to the left and to the right while gently pushing in the module, so that the plug's pins slide into the backplane's socket.
- Connect all necessary plugs to the corresponding modules (read the corresponding manual for each module)
- Connect the supply voltage to your phyMOTION™'s power feeding modules ('+24 – 70V') and ('+24 V')
- Power up the phyMOTION™

## 9.4 Accessories

Phytron offers the following accessories to expand the **phyMOTION™**:

### 9.4.1 Assembly at factory

#### Fan Carrier and Fan Controller Module LRM01 for **phyMOTION™** s

Phytron recommends the use of a fan carrier incl. fan controller module when the power consumption of power supply exceeds 50 % and for power stages whose output current exceeds 50 % of the maximum current for a longer period of time.

The fan carrier consists of one or two fans, which is mounted on the underside of the **phyMOTION™** s. The fans are wired to the fan controller module LRM01.



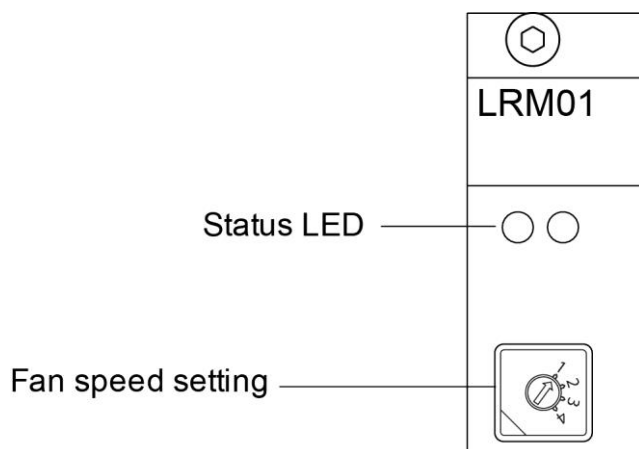
Example: fan carrier with two fans

Fan NMB 2410ML-05W-B10

24 V; 60 mA; 1.44 W

2950 rpm; 0.39 m³/min; 23 dB

The LRM01 controls the speed of up to five fans, which all have the same speed. The fan speed can be adjusted in four steps using the coding switch:



Coding switch position	Function	LED left	LED right
1	Fan is on	It lights up green, as soon as the module is supplied with voltage (= ready for use)	off
2	Fan speed 50 %		orange
3	Fan speed 75 %		
4	Fan speed 100 %		

## i

### CAUTION – Possible damage!

*If the power stages are operated at more than 50 % of the maximum current or if the power consumption of the switching power supply unit exceeds 50 %, overheating can cause damage to the module or the phyMOTION™.*

- Phytron accepts no liability for damage caused by overheating or insufficient ventilation/cooling.
- Phytron recommends the use of fan carrier incl. fan controller module

## i

### Mounting

By mounting the fan carrier to the underside of the phyMOTION™ s the following must be observed:

- *Approx. 40 mm more space (height) is required in a control cabinet.*
- *For the operation of a phyMOTION™ s bench housing, Phytron's housing base is necessary to maintain the distance to the table surface.*

## 9.4.2 Assembly by customer on site

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- fan units for phyMOTION™ p
- Front handles for phyMOTION™ s/p in rack housing
- housing base for bench housing phyMOTION™ s
- strain relief rails phyMOTION™ s/p
- rail mounting

## 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

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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, unauthorised 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 of rights of third parties. Some product names used herein are for instance.

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