



phyMOTION™

Modular multi-axes controller for stepper motors

The **phyMOTION™** combines PLC and motion control functions into a flexible and convenient automation station for multi axis stepper motor applications. Well-trying standard modules form the technology's basis with the option to add application-specific supplements.

The free software **phyLOGIC™** Toolbox, the LabVIEW interface, the Android-based touch interface (internal/external) and the open pro-

tolocol for controller drive and parameterising create additional scope for development. The integrated, high resolution power stages up to 5 A_{Peak} at 70 V_{DC} simplify the wiring significantly.

Online parameterising and -diagnostics are also standard feature as integrated limit switch/reference switch inputs per axis. Each axis can be expanded with encoder (Endat, SSI- /Quadrature) and temperature

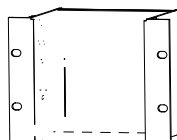
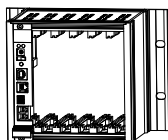
evaluation. Besides standard PLC functions such as analogue and digital I/Os, a variety of interfaces (Ethernet, Profibus, Profinet, RS232/485, USB, Bluetooth) the **phyMOTION™** also provides linear and circular interpolation.

The **phyMOTION™** can be operated below existing PLC systems as a slave system, as distributed intelligence or as a stand-alone motion control solution.

In 4 steps to your stepper motor controller

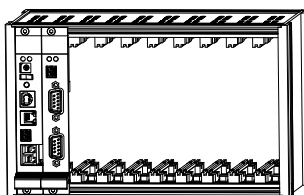
Choose housing

Type of mounting
Width/Depth
Main supply

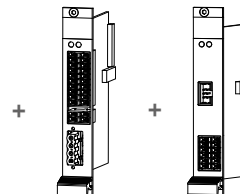
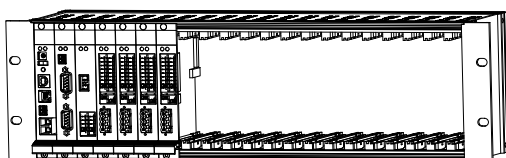


Define host interface

CAN, Ethernet
Profibus, Profinet
RS 232/RS 485
Bluetooth



Fill the module slots



Order and receive the fully assembled **phyMOTION™**

Any questions? Please contact us.

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Control

Module selection for your phyMOTION™

To make the module selection as comfortable as possible, we coded the modules by main and auxiliary functions.

CPU This main function is included in the respective module.

CPU The main function is not available in the respective module.

I/O D Auxiliary functions are shown only if the module supports them.

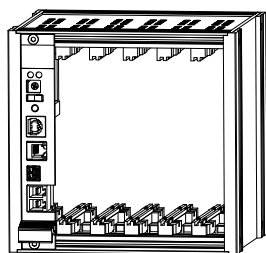
*** POWER STAGE** * means the main or auxiliary function is selectable as option.

ENC *

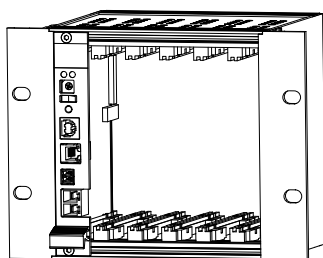
Main functions	POWER SUPPLY	The POWER SUPPLY function is marked when there is a power supply in the module (power supply unit).	
	CPU	Modules with CPU contain intelligent processors and can execute the total sequential programs and enable the phyMOTION™ to drive in stand-alone mode.	
	INDEX	The INDEXER represents the functionality to generate signals from commands of a programming language, which the power stage can amplify. Normally, the signal is control pulses/direction or SIN/COS.	
	POWER STAGE	POWER STAGE represents a stepper motor amplifier. Incoming control pulses/direction or SIN/COS signals are amplified and output to the motor..	
Auxiliary functions	ENC	Encoder evaluation	POW IN Power distribution
	TEMP	Motor temperature evaluation	COM Host interface
	I/O D	Digital inputs and/or outputs	
	I/O A	Analogue inputs and/or outputs	
	...		

1 Housing and Supply

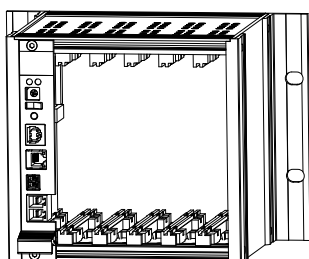
Housing Types of the phyMOTION™:



Bench or rail mounting



Rack mounting



Wall mounting

Type of mounting:

- Bench or rail
- Rack
- Wall

Number of slots defines the housing width:

- 6 Slots (24 U)
- 8 Slots (32 U)
- 10 Slots (40 U)
- 21 Slots (84 U or 19" sub rack)
- Special sizes on request

1 Slot = 4 U
1 U = 5.08 mm

Housing depth:

- s (small): 121 mm
All currently available modules are suitable for this depth.
- m (medium): 180 mm
This depth is intended for future modules.

Dimensions for Bench (W x H x D) [mm]:

- 6 Slots: 137 x 132.5 x 121
- 8 Slots: 177.6 x 132.5 x 121
- 10 Slots: 218.3 x 132.5 x 121
- 21 Slots: 441.8 x 132.5 x 121
- general:
(24 bis 84 TE) x 3 HE x 121 mm
- Mounting brackets for Rack or Wall:
+ 40.2 mm

Ordering Code

Type	Number of slots	Mounting	Housing depth	customised
phyMOTION -	6SL	MR	s	X

Options

Number of slots	6SL 8SL 10SL 21SL	6 Slots 8 Slots 10 Slots 21 Slots (=19")
Mounting	W MR R D	Wall mouting Rail 19" sub rack Bench
Housing depth	s m	small medium
customised	X	customer demand

POWER
SUPPLY

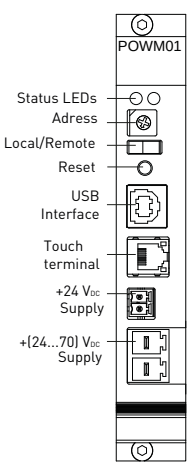
CPU

INDEX

POWER
STAGE

POW IN
COM

Main Supply (POWM01)



The beginning of each *phyMOTION*™

- Main supply:
 - 24 to 70 V_{DC} supply voltage (for motors and generates internally the logic voltages) – max. 20 A
 - Electrically isolated 24 V_{DC} for inputs/outputs, limit and reference switches
- Configuration
 - USB interface for programming and diagnostics
 - Device address switch
 - Reset key
 - Connection of an external phytron touch panel
- The external supply must be designed for the required current (e.g. by the PS5-48 power supply unit).

Ordering Code

Type
POWM01

Mating connectors are included in delivery.

POWER
SUPPLY

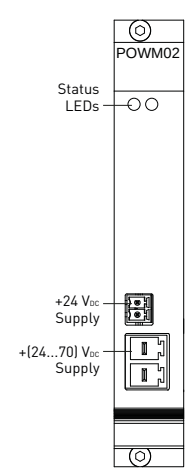
CPU

INDEX

POWER
STAGE

POW IN

Intermediate Supply (POWM02)



Maximum 20 A per supply

- 24 to 70 V_{DC} supply voltage (for motors and generates internally the logic voltages) – max. 20 A
- Electrically isolated 24 V_{DC} for inputs and outputs, limit and reference switches
- The external supply must be designed for the required current (e.g. by the PS5-48 power supply unit).

Ordering Code

Type
POWM02

Mating connectors are included in delivery.

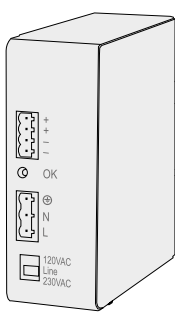
POWER
SUPPLY

CPU

INDEX

POWER
STAGE

External Power Supply Unit (SPH)



Compatible Power Supply Unit (5 to 20 A)

- Mains supply voltage 115 / 230 V_{AC}
- Internally fused mains input
- Output voltage
 - 24 V_{DC} (10 A / 20 A), 48 V_{DC} (5 A / 10 A / 20 A), 72 V_{DC} (6.7 A / 13.5 A)
- Permanently short circuit-proof output
- Overvoltage protection primary and secondary side
- Overtemperature protection
- Integrated fan
- Dimensions (WxHxD)
 - SPH240: 45 x 125 x 121
 - SPH500: 82 x 125 x 121,
 - SPH1013: 66 x 230 x 183
- DIN rail or wall

Ordering Code

Type
Output power
Output
Mounting
SPH1013-4821 - W

Options		
Output power - Output	240-2410	24 V _{DC} / 10 A
	240-4805	48 V _{DC} / 5 A
	500-2420	24 V _{DC} / 20 A
	500-4810	48 V _{DC} / 10 A
	500-7207	72 V _{DC} / 6.7 A
	1013-4821	48 V _{DC} / 20 A ^{*)}
	1013-7214	72 V _{DC} / 13.5 A ^{*)}
Mounting	H	Rear DIN rail
	W	Rear wall

*) wall mounting only

Mating connectors are included in delivery.

Control

2 Host Interface

POWER SUPPLY

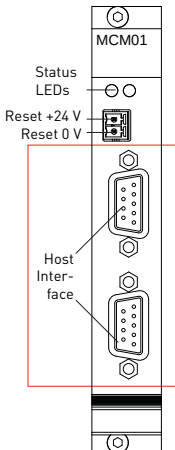
CPU

INDEX

POWER STAGE

COM

Main Controller (MCM01)



Intelligent CPU and bus:

- Main CPU:
 - Controls and administers up to 64 modules
 - Program and register memory up to 4 MB
 - Internal memory expandable with future memory modules
 - Script program administration
 - Firmware administration
 - Elegant programming with *phyLOGIC*™ and G-Code
- Selectable communication interface:
 - CAN
 - Ethernet
 - ProfiBus/ProfiNet
 - RS 485, RS 232, RS 422
 - Bluetooth (I/2014)

Ordering Code

Type	Host communication
MCM01	RSS01

Options

Host communication	CANS01	CAN-Bus
	ETHS01	Ethernet
	PBS01	ProfiBus
	PNS01	ProfiNet
	RSS01	RS 232 or RS 485/422
	BTS01	Bluetooth (I/2014)
	NNS01	no interface

Mating connectors are included in delivery.

POWER SUPPLY

CPU

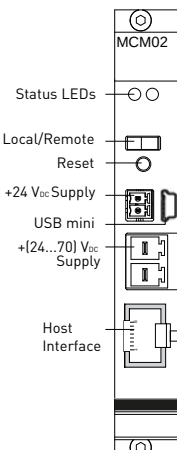
INDEX

POWER STAGE

COM

POW IN

Main Controller (MCM02)



Intelligent CPU, bus and supply:

- Main CPU:
 - Controls and administers up to 64 modules
 - 24 to 70 V_{DC} supply voltage
 - Mini USB interface
 - Program and register memory up to 4 MB
 - Internal memory expandable with future memory modules
 - Script program administration
 - Firmware administration
 - Elegant programming with *phyLOGIC*™
- Selectable communication interface:
 - Ethernet
 - ProfiBus/ProfiNet
 - Bluetooth (I/2014)

Ordering Code

Type	Host communication
MCM02	PBS01

Options

Host communication	ETHS01	Ethernet
	PBS01	ProfiBus
	PNS01	ProfiNet
	BTS01	Bluetooth (I/2014)
	NNS01	no interface

Mating connectors are included in delivery.

3 Power Stages, Indexer, I/Os (analog/digital) & HMI

POWER SUPPLY

CPU

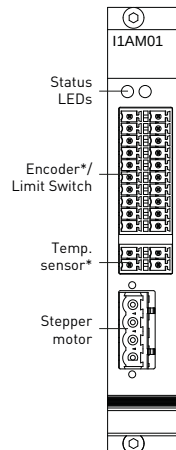
INDEX

POWER STAGE

ENC *

TEMP *

1 Axis Stepper Motor Drive (I1AM01)



Indexer with integrated 3.5 A power stage

- Integrated indexer for standard functions:
 - Relative and absolute positioning
 - Reference movements/speed mode
 - Step frequency to 40,000 steps/second
- Integrated 3.5 A power stage
 - 3.5 A_{PEAK} at 24 to 48 V_{DC} (derating dep. on application)
 - Selectable step resolution up to 1/256 step
 - Online power stage parameterisation and diagnostics
- 3 limit/reference switches
- Optional encoder evaluation
 - SSI/ Quadratic Incremental (ECAS01) or Endat (ECES01); in I/2014: Resolver (ECMS01)
- Optional motor temperature evaluation
 - for Pt100 sensors (PTS01) or K types (KTS01)

Ordering Code

Type	Encoder evaluation	Motor temperature evaluation
I1AM01	ECES01	PTS01

Options

Encoder evaluation	ECES01 ECAS01 ECMS01	ENDAT encoder SSI/QUADR. encoder Resolver (II/2014) no encoder module
Temperature evaluation	PTS01 KTS01	Pt sensor K type no temperature module

Mating connectors are included in delivery.

POWER SUPPLY

CPU

INDEX

* POWER STAGE

ENC *

TEMP *

1 Axis Stepper Motor Drive (I1AM02)

Indexer with selectable APS power stage

- Integrated indexer for standard functions:
 - Relative and absolute positioning
 - Reference movements/speed mode
 - Step frequency to 40,000 steps/second
 - Up to 5 A_{PEAK} at 24 to 70 V_{DC} (derating dep. on application)
 - Selectable step resolution up to 1/256 step
 - Online power stage parameterisation and diagnostics
- 3 limit/reference switches
- Optional encoder evaluation
 - SSI/ Quadratic Incremental (ECAS01) or Endat (ECES01); in II/2014: Resolver (ECMS01)
- Optional motor temperature evaluation
 - for Pt100 sensors (PTS01) or K types (KTS01)

Ordering Code

Options		
Power stage	APS01	Int. power stage 5A/70V
Encoder evaluation	ECES01 ECAS01 ECMS01	Integr. ENDAT encoder SSI/QUADR. encoder Resolver (II/2014) no encoder module
Temperature evaluation	PTS01 KTS01	Pt sensor K type no temperature module

Mating connectors are included in delivery.

POWER SUPPLY

CPU

INDEX

POWER STAGE

4 Axes High End Indexer (I4XM01)

Indexer module

- 1, 2, 3 and 4 axes stepper motor indexer
- Circular interpolation for 2 any axes
- Linear interpolation for 4 axes (also for reduction gears axes)
- Additional Control Pulses/Direction input and output for "electronic wave"
- Expanded indexer functions:
 - Velocity/end position during the movement changeable
 - Variable, short ramps; high velocities
 - Interpolation also for gear axes
 - High speed: up to 500,000 steps/second
 - ...

Ordering Code

Mating connectors are included in delivery.

POWER SUPPLY

CPU

INDEX

* POWER STAGE

ENC *

TEMP *

1 Axis Carrier Module for APS Power Stage (INAM01)

APS, encoder and temperature

- Requires an upstream installed indexer for interpolation (i.e. I4XM01)
- Currently the high end power stage APS01 can be selected
 - Up to 5 A_{peak} for 24 to 70 V_{DC} (derating dep. on application)
 - Precision up to 1/512 step resolution
 - Online parameterisation and diagnostics
- 3 limit/reference switches
- Optional encoder evaluation
 - SSI/ Quadratic Incremental (ECAS01); Endat (ECES01); in II/2014: Resolver (ECMS01)
- Optional motor temperature evaluation
 - For Pt100 sensors (PTS01)
 - K types (KTS01)

Ordering Code

Options		
Power stage	APS01	Int. power stage 5A/70V
Encoder evaluation	ECES01 ECAS01 ECMS01	ENDAT encoder SSI/QUADR. encoder Resolver (II/2014) no encoder module
Temperature evaluation	PTS01 KTS01	Pt sensor K type no temperature module

Mating connectors are included in delivery.

Control

POWER SUPPLY

CPU

INDEX

POWER STAGE

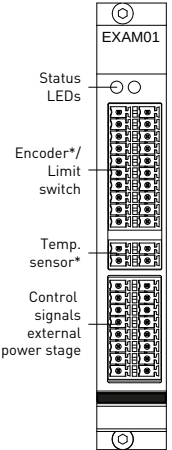
ENC *

TEMP *

Indexer Interface (EXAM01) for External Power Stage

Interface between indexer and external power stages

- Requires an upstream installed indexer (i.e. I4XM01)
- Outputs Control pulses/Direction/Boost and Enable to an external power stage
- External power stages with ServiceBus can be parameterised online by the interface on the indexer module (i.e. I4XM01) and be diagnosed.
- 3 limit/reference switches
- Optional encoder evaluation
 - SSI/ Quadratic Incremental (ECAS01) or Endat (ECES01); in II/2014: Resolver (ECMS01)
- Optional motor temperature evaluation
 - for Pt100 sensors (PTS01) or K types (KTS01)



Ordering Code

Type

Encoder evaluation

Temperature evaluation

EXAM01

- ECES01 -

PTS01

Options		
Encoder evaluation	ECES01 ECAS01 ECMS01	ENDAT encoder SSI/QUADR. encoder Resolver (II/2014) no encoder module
Temperature evaluation	PTS01 KTS01	Pt sensor K type no temperature module

Mating connectors are included in delivery.

POWER SUPPLY

CPU

INDEX

POWER STAGE

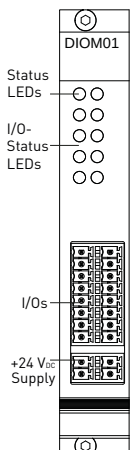
I/O D

POW IN

Digital I/Os (DIOM01)

Digital I/O module

- 8 digital inputs 24 V_{DC}
- 8 digital outputs 24 V_{DC}, max. 1 A
- 24 V supply of the inputs and outputs is centrally delivered either by the power modules or directly at the DIOM01.
- DIOM01 can also be used as a single channel counter module.



Ordering Code

Type

DIOM01

Mating connectors are included in delivery.

POWER SUPPLY

CPU

INDEX

POWER STAGE

I/O A

AIM01

Status LEDs

I/O-Status LEDs

Inputs

int. Supply

Analogue input module

4 analogue inputs: $\pm 10\text{ V}$ bipolar, $0\ldots 10\text{ V}$, $0\ldots 20\text{ mA}$

Resolution: 14 Bit

Sample rate: 416 Hz

Electrically isolated

Ordering Code

Type

AIM01

Mating connectors are included in delivery.

POWER SUPPLY

CPU

INDEX

POWER STAGE

I/O A

AOM01

Status LEDs

I/O-Status LEDs

Outputs

int. Supply

Analogue output module

4 analogue outputs

Max. output current: 16 mA

Electrically isolated

Resolution: 16 Bit

Short-circuit proof

Thermal overload protection

Ordering Code

Type

AOM01

Mating connectors are included in delivery.

POWER SUPPLY

CPU

INDEX

POWER STAGE

I/O A

AIOM01

Status LEDs

I/O-Status LEDs

Inputs

Outputs

int. Supply

Analogue input and output module

4 analogue inputs and outputs included

Inputs: $\pm 10\text{ V}$ bipolar, $0\ldots 10\text{ V}$, $0\ldots 20\text{ mA}$

Resolution: 14 Bit

Outputs: Max. output current: 16 mA

Resolution: 16 Bit

Short-circuit proof

Thermal overload protection

Electrically isolated

Ordering Code

Type

AIOM01

Mating connectors are included in delivery.

Control

Customised Modules

The diagram illustrates a customised module stack. On the left, a vertical list of modules is shown in grey boxes: POWER SUPPLY, CPU, INDEX, POWER STAGE, I/O A, I/O D, TEMP, and ENC. To the right, a tall, narrow white rectangle represents the physical stack of modules. At the top of this stack is a circle with a dot inside, representing the POWER SUPPLY module. Below this is a large empty space, representing the CUSTOMISED MODULES section. At the bottom of this space are two small circles, representing the I/O D and I/O A modules. Below the customised modules section is a thick black horizontal bar, representing the TEMP module. Below that is a thin white horizontal bar, representing the ENC module. At the very bottom of the stack is another circle with a dot inside, representing the CPU module.

On demand

Customised modules can be realised on demand.

Customised modules can be realised on demand.

HMI-Interfaces & Software

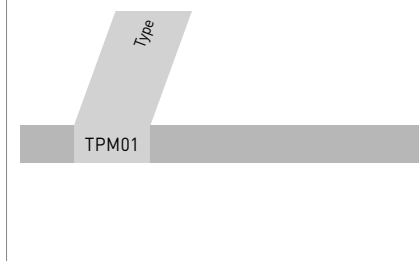
Android-based integrated Touch Panel (TPM01)



Integrated human-machine interface

- 800 x 480 px – TFT display
- Integrated in the *phyMOTION*™ housing
- Touch functionality
- As user interface i.e. for parameter selection
- For support, parameterisation and diagnostics

Ordering Code



Control via Android-based Tablets (from version V 4.0)



External human-machine interface

- from 480 x 800 px (recommended: 7"-display) – TFT display
- For connection to the POWM01 main power module (Ethernet or WLAN) or to the MCM01/MCM02 module (Bluetooth)
- Touch functionality
- As user interface i.e. for parameter selection
- For support, parameterisation and diagnostics

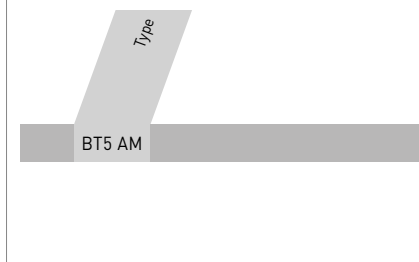
Control with Operator Panel BT5 AM



External human-machine interface

- For connection to the POWM01 main power module (terminal interface)
- For support, parameterisation and diagnostics
- Status display, operating mode
- Parameter reading
- Function keys
- Remote or Local mode

Ordering Code



Control

phyLOGIC™ ToolBox



Free of charge development environment

- Operating software and development environment for the phyMOTION™ phytron controller
- Easy to program: Drawing and converting of 2D contours in phyLOGIC™ commands (Motion Creator)
- Parameterising, programming, editing, debugging
- Support in the commissioning phase i.e. by test functions
- Display of status and graphical presentation of a current XY position
- Archiving of parameter sets and programs

phyCONTROL



Free of charge App for tablets

- Operating software for tablets connected to the phyMOTION™ phytron controller
- Direct mode, operating mode, I/O monitor, configuration of the controller
- Status display and parameter reading

LabVIEW®-VI



VIs for phyMOTION™

- Simulation software with a graphical style
- Use the VIs (Virtual Instruments) generated by Phytron and integrate them in your LabVIEW® project. So you can easily control the phytron controller phyMOTION™ from your usual programming environment.

EPICS Motor Module



Software environment for large-scale experiments

- Software environment to develop and realise distributed control systems for large-scale experiments such as telescopes and accelerators. EPICS provides the SCADA support.
- Phytron delivers the source code to integrate the phytron controller *phyMOTION™* into the EPICS environment.
- Also in multi-axis operation: positioning, limit switches, encoder evaluation

Equipment

Motor Shield Clamp



Shielding for motor connection

- Easy to go
- Plug-in connection for motor shielding of the following modules of the phytron controller *phyMOTION™*: INAM-, EXAM-, I1AM01- or I1AM02-module
- On delivery: shielded clamp with cableties and screws
- The motor connectors are included in the package of your *phyMOTION™* controller.

Mating connector set

included in
delivery

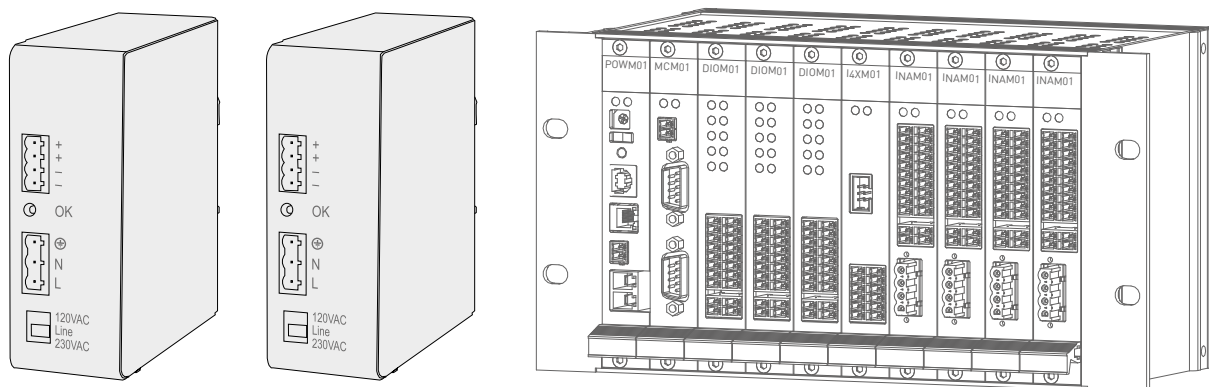
- Motor connector
- Power supply
- I/O digital or analog
- Quality Phoenix connectors

Control

4 Order and Receive the Fully Assembled phyMOTION™

Configuration Example

10-Slot housing for rack mounting: 4 axes with indexer and I/Os



Ordering Code Example:

	Ordering Code	Description
Housing	phyMOTION-10SL-R-s	Rack mounting housing with 10 slots and depth 120 mm

Module	Ordering Code	Description
Slot 1	POWM01	Main power supply
Slot 2	MCM01-RSS01	Main controller with RS 485 interface
Slot 3	DIOM01	Digital I/O module
Slot 4	DIOM01	Digital I/O module
Slot 5	DIOM01	Digital I/O module
Slot 6	I4XM01	4 axes indexer module
Slot 7	INAM01-APS01-ECAS01	Internal 5 A power stage with Quadratic encoder evaluation
Slot 8	INAM01-APS01-ECES01	Internal 5 A power stage with ENDAT encoder evaluation
Slot 9	INAM01-APS01-ECAS01-PTS	Internal 5 A power stage with Quadratic encoder- and motor temperature evaluation with PT sensor
Slot 10	INAM01-APS01-ECES01-KTS	Internal 5 A power stage with ENDAT encoder- and motor temperature evaluation with K types

Power supply	SPH240-2410-W	External power supply unit with 240 W, 24 V _{DC} output voltage and 10 A for rear wall
Power supply	SPH240-4805-W	External power supply unit with 240 W, 48 V _{DC} output voltage and 5 A for rear wall

Any questions? Please contact us.