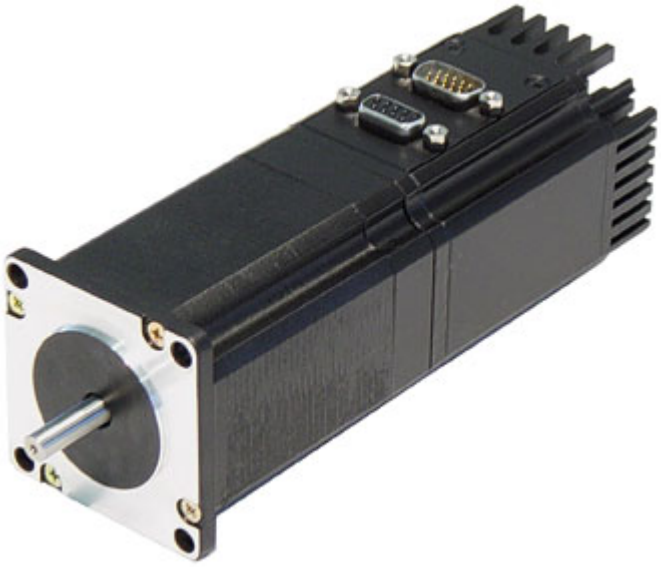
Manual

(Version 2.1)

Plug & Drive Series

PDx-I



Nanotec® Electronic GmbH
Gewerbestr. 11
85652 Landsham / Pliening

Tel.: (089) 900 686-0
Fax: (089) 900 686-50

Internet: www.nanotec.com

This documentation should be carefully read before the installation and commissioning.

In the interests of its customers, Nanotec® reserves the right to make technical alterations and developments to hard- and software to improve the functioning of this product without giving special prior notice.

This manual has been written with the necessary care. It is exclusively intended for the technical description of the product and to give instructions for commissioning. In according with our general terms and conditions, the warranty extends exclusively to repair or replacement of defective devices. Liability for consequential damage and sequence errors is ruled out. The valid standards and regulations are to be observed when installing the device.

For criticism, proposals and suggestions for improvement, please contact the address given above or send an email to:

info@nanotec.de

Contents

1. Product Description 5

1.1 General 5

1.2 Description of Motor- and Machine-related Parameters 5

1.2.1 Motor-related Parameters 6

1.2.2 Machine-related Parameters 7

1.3 Description of the Mode of Operation 7

1.3.1 Position mode 7

1.3.2 Speed mode 9

1.3.3 Flag position mode 11

1.3.4 Clock Direction Mode 12

2. Connections 13

2.1 Pin Assignment 1 (D-Sub 15 pin connector) 13

2.1.1 Operating Voltage 13

2.1.2 Inputs 14

2.1.3 Outputs 14

2.2 Pin Assignment 2 (RS485 interface D-Sub 9 contact strip) 15

3. Function of the Inputs and Outputs in the Position Mode 16

3.1 Assignments of the Inputs and Outputs 16

3.2 Signal Characteristics in the Position Mode 17

4. Functions of the Inputs and Outputs in the Speed Mode 18

4.1 Assignments of the Inputs and Outputs 18

4.2 Signal Characteristics in Speed Mode 19

5. Functions of the Inputs and Outputs in the Flag Position Mode 20

5.1 Assignments of the Inputs and Outputs 20

5.2 Signal Characteristics in the Flag Position Mode 21

6. Function of the Inputs and Outputs in the Clock Direction Mode 22

6.1 Assignments of the Inputs and Outputs 22

6.2 Signal Characteristics in Clock Direction Mode 23

7. Reference Travels and Limit Switch Behaviour 24

7.1 External Reference travel and Limit Switch Behaviour 24

7.2 Internal Reference travel and Limit Switch Behaviour 26

8. Speed Control 28

9. Programming Software NANOPRO-PDx-I 29

9.1 General 29

9.2 Program installation 29

9.3 Program Start 29
9.4 Desktop 30
9.5 Setting of the Motor Address 31
9.6 Selection of Motor 32
9.7 Selection of the Control 33
9.8 Commissioning 33
9.8.1 Setting of the Step Mode ____ **34**
9.8.2 Setting of the Phase Current ____ **35**
9.8.3 Setting of the Current Reduction ____ **35**
9.8.4 Motor Test ____ **36**
9.9 Program and Machine Settings 37
9.10 Setting of the Reference Switches 39
9.11 Description of the Mode of operation 40
9.11.1 General Functions (all modes) ____ **40**
9.11.2 Selection of the Mode of Operation ____ **41**
9.11.3 Mode of operation Position ____ **42**
9.11.4 Mode of operation Speed ____ **46**
9.11.5 Mode of operation Flag position ____ **49**
9.11.6 Clock Direction Mode of Operation ____ **52**
9.11.7 Entry of Reference Travels ____ **56**
9.11.8 Data Menu ____ **57**
9.11.9 Error Messages ____ **58**
9.11.10 **Setting of the COM port** ____ **61**
10. Communication 62
10.1 The Overriding Control 62
10.2 Data Acceptance by the PDx-l 63
10.3 Commands and data 63
10.3.1 Read Commands ____ **63**
10.3.2 Writing Commands ____ **68**
10.3.3 Control Commands ____ **78**
10.3.4 Unknown Commands ____ **80**
11. Technical Data 81
12. Dimensions 82
12.1 PD4-I57 series 82

1. Product Description

1.1 General

The PDx-I (Plug & Drive) motors offer, for the first time, the possibility of configuring the suitable motor according to the requirements. This compact drive unit is the most effective and quickest solution for planners, designers and engineers who need to solve revolution and positioning tasks. Assembly, commissioning and machine settings are possible at low efforts and within the cost budget.
The PDx-I series includes, in addition to the microstep driver a micro processor, a speed control and an RS485 interface for the parametrisation of the different mode of operations.
In total, up to 16 motors can be networked so that with a small SPS synchronous or time-critical multi-axis solutions may be quickly and comfortably realised.
The PDx-I offers four modes of operations: speed, position, flag position or clock direction. Machine-related parameters such as feed in mm/s, frequency in Hz or speed in r.p.m., feed constant in mm/revolution as well as any gear reducers and the reverse clearance can be set using the software *Nanopro PDx-I*. Motor-related parameters such as phase current and step resolution from 1,8° to 0.18° (0.09°) can be set. Three adjustable reference modes (external and internal) allow for automatic machine settings, with external reference switched may be inapplicable with an adjustment up to 360°.
Even if stepper motors do not lose any steps during normal operation, the integrated speed control offers additional safety, e.g. against stalled motors or external sources of errors. The monitoring function recognises a stalled motor after 25 full steps (with 1.8° stepper motors) at the latest. Malfunctions are recognised and necessary corrective measures are shown at the error output.

1.2 Description of Motor- and Machine-related Parameters

In addition to special settings only applying to a specific mode of operation, the PDx-I allows for generally valid motor and machine settings.

1.2.1 Motor-related Parameters

Step mode

The motor can be operated in the following step modes:

Step mode	*Step resolution*	
	1.8°Motor	*0.9°Motor*
Full step	1,8°	0,9°
Half step	0,9°	0,45°
Quarter step	0,45°	0,225°
Fifth step	0,36°	0,18°
Eighth step	0,225°	0,1125°
Tenth step	0,18°	0,09°

Default: Half step

Phase current

The phase current can be set to values between 25% and 125% of the motor nominal current, which can be seen from the type designation of the PDx-I.
Example: Type designation: PD4-I-T5718L**32**04

Nominal current = 3.2 A

The following settings for the phase current are possible:

125% of nominal current
Nominal current
75% of nominal current
50% of nominal current
25% of nominal current

Default: Nominal current

Current reduction

To reduce power loss the automatic power reduction can be activated during downtimes. The following settings for the current reduction are possible:

No current reduction
to 75 % of set phase current
to 50 % of set phase current
to 25 % of set phase current

Default: Current reduction to 50% of set phase current

1.2.2 Machine-related Parameters

Reverse Clearance

In the position mode, the PDx-I enables the compensation of the reverse clearance by changing the direction. With the corresponding applications (e.g. spindle drives), position errors can be compensated during a change in direction. The reverse clearance is automatically added to the nominal position on a change of direction. To avoid an error in position during the first start of a driving profile after switching on, a reference travel is necessary made after reverse clearance and switching on.

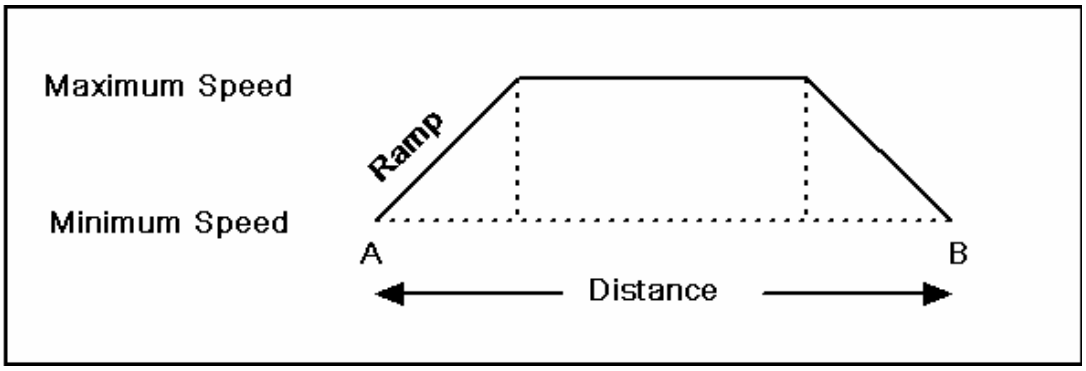
1.3 Description of the Mode of Operation

The PDx-I can be operated in four different modes:

- Position mode (Default, see1.3.1)
- Speed mode (see 1.3.2)
- Flag position mode (see 1.3.3)
- Clock direction mode (see 1.3.4)

1.3.1 Position mode

In the position mode, the motor runs according to a preset travel profile from a Position A to a Position B. The positions can be defined as absolute or reference values. In addition, this mode offers the internal and external reference travel (see Chapter 7). Up to 16 travel profiles including reference travels can be saved in the PDx-I and started via the corresponding inputs and/or by the serial interface.



Profile parameters

The travel profile consists of the following parameters:

a) Types of position
b) Distance
c) Minimum speed
d) Maximum speed
e) Ramp factor
f) Direction
g) Change in direction
h) Operations
i) Break

a) Types of position

There are two different types of position:

⇨ Relative positioning (default setting)
The travel profile is run from the current position.

⇨ Absolute positioning
The travel profile refers to a firmly set nominal position, independent of the actual position.

b) Distance

Number of motor steps

⇨ up to 16.777.215 for relative positioning
⇨ +8.388.607 to -8.388.608 for absolute positioning
⇨ Default: 200 steps

c) Minimum speed

The minimum speed is the starting speed (start/stop frequency) of the PDx-I. To avoid losses in steps it should be chosen outside the self-resonance ranges of the motor. A minimum speed which is too high will also lead to losses in steps.

⇨ selectable range: 100 Hz to 20 kHz in 100 Hz steps
(≙ 30 r.p.m. to 6000 r.p.m. in full step)
⇨ Default: 400 Hz

d) Maximum speed

The maximum speed is the speed of the PDx-I. To avoid losses in steps it should be chosen outside the resonance ranges. A maximum speed which is too high may lead to losses in steps and motor standstill.

⇨ selectable range: 100 Hz to 20 kHz in 100 Hz steps
(≙ 30 r.p.m. to 6000 r.p.m. in full step)
⇨ Default: 1000 Hz

e) Ramp factor
The PDx-I is a ramp (acceleration and braking ramp) with a frequency jump of 100 Hz per millisecond. A linear alteration of this basic ramp is possible through the ramp factor (e.g. ramp = 2 ≙ 100 Hz per 2 ms).

- ⇨ selectable range 1 to 255
- ⇨ Default: 1

f) Direction
Direction of the motor

- ⇨ selectable range 1 or 0 (right or left)
- ⇨ Default: 0
- ⇨ not relevant for the absolute position

g) Change in direction
With activated change in direction, the direction of the PDx-I is automatically changed, when the record is activated successively several times. The change is altered after each activation.

- ⇨ selectable range 1 or 0 (on or off)
- ⇨ Default: 0 = off
- ⇨ not relevant for the absolute position

h) Operations
The Operations parameter shows how often the selected travel profile is to be run automatically successively without a further start command.

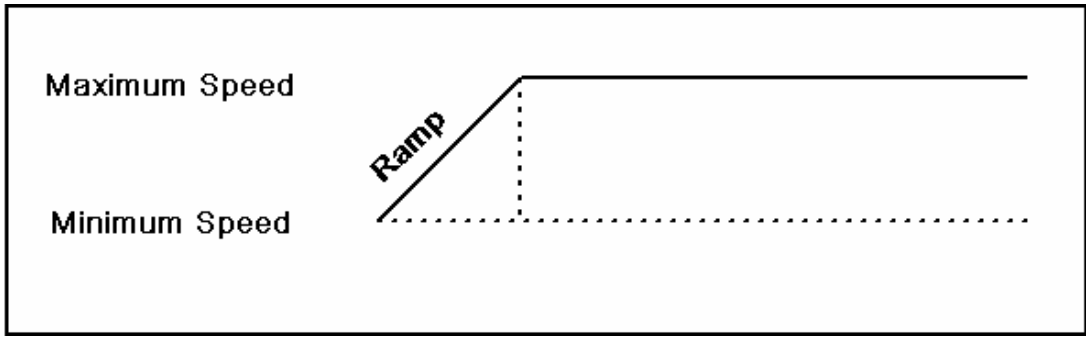
- ⇨ range 1 to 255
- ⇨ Default 1
- ⇨ open entry of 0, the travel profile is permanently used

i) Break
The break is the idle time of the motor, if several operations (see h) are run.

- ⇨ Range 1 to 255 ⇔ 0.1 to 25.5 s
- ⇨ Default 1 s

1.3.2 Speed mode

The speed mode accelerates the motor with the given ramp from the start speed (start frequency) to the set maximum speed (maximum frequency). In the PDx-I 16 different speed profiles can be stored, change in speed through the inputs and/or the interface are possible at any time.



Profile parameters

The speed profile consists of the following parameters:

a) minimum speed
b) maximum speed
c) Ramp factor
d) Direction

a) Minimum speed

The minimum speed is the starting speed (start/stop frequency) of the PDx-I. To avoid losses in steps it should be chosen outside the self-resonance ranges of the motor. A minimum speed which is too high will also lead to losses in steps.

⇨ selectable range: 100 Hz to 20 kHz in 100 Hz steps
(≙ 30 rpm to 6000 rpm in full step (1.9° step angle))
⇨ Default: 400 Hz

b) Maximum speed

The maximum speed is the nominal speed of the PDx-I. To avoid uneven running, the speed should be outside the resonance ranges. A maximum speed which is too high may lead to losses in steps and motor standstill.

⇨ selectable range: 100 Hz to 20 kHz in 100 Hz steps
(≙ 30 rpm to 6000 rpm in full step)
⇨ Default: 1000 Hz

c) Ramp factor

The PDx-I is a ramp (acceleration and braking ramp) with a frequency jump default of 100 Hz per millisecond. A linear alteration of this basic ramp is possible through the ramp factor (e.g. ramp = 2 ≙ 100 Hz per 2 ms).

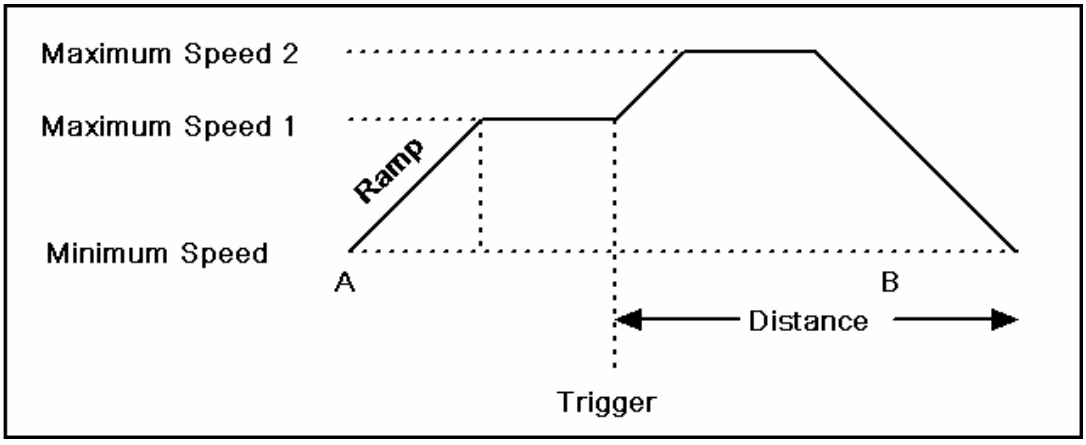
⇨ selectable range 1 to 255
⇨ Default: 1

d) Direction
Direction of the motor

⇨ only relevant when operated via the serial interface, otherwise the direction is selected through an input
⇨ selectable range 1 or 0 (right or left)
⇨ Default: 0

1.3.3 Flag position mode

Flag position mode offers a combination of position and speed mode. The motor is first operated in the speed mode, on reaching a triggering point, the position mode is started and the motor travels to the nominal position (relative to the trigger position). In addition, this mode offers internal and external reference travels (see Chapter 7). Up to 8 travel profiles including reference travels can be saved in the PDx-I and started via the corresponding inputs and/or by the serial interface.



Profile parameters

The travel profile consists of the following parameters:

a) Distance
b) Minimum speed
c) Maximum speed 1
d) Maximum speed 2
e) Ramp factor
f) Direction
g) Change in direction

a) Distance
Number of motor steps

⇨ up to 16.777.215 steps
⇨ Default: 200 steps

b) Minimum speed

The minimum speed is the starting speed (start/stop frequency) of the starting speed of the PDx-I. To avoid losses in steps it should be chosen outside the self-resonance ranges of the motor. A minimum speed which is too high will also lead to losses in steps.

- ⇨ selectable range: 100 Hz to 20 kHz in 100 Hz steps (≙ 30 rpm to 6000 rpm in full step)
- ⇨ Default: 400 Hz

c) and d) Maximum speed 1 / maximum speed 2

The maximum speeds are the nominal speeds of the PDx-I. To avoid losses in steps they should be outside the resonance ranges. Maximum speeds which are too high may lead to losses in steps and motor standstill.

- ⇨ selectable area: 100 Hz to 20 kHz in 100 Hz steps (≙ 30 rpm. to 6000 rpm. in full step)
- ⇨ Default: 1000 Hz (maximum frequency 1)
  2000 Hz (maximum frequency 2)

e) Ramp factor

The PDx-I is a ramp (acceleration and braking ramp) with a frequency jump of 100 Hz per millisecond. The ramp is the same in the speed as well as in the position mode. A linear alteration of this basic ramp is possible through the ramp factor (e.g. ramp = 2 ≙ 100 Hz per 2 ms).

- ⇨ selectable range 1 to 255
- ⇨ Default: 1

f) Direction

Direction of the motor

- ⇨ selectable range 1 or 0 (right or left)
- ⇨ Default: 0

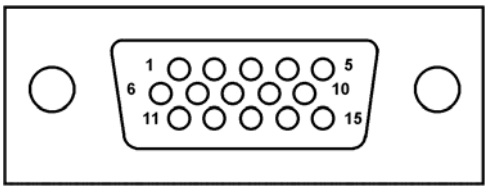
1.3.4 Clock Direction Mode

In the Clock Direction Mode the PDx-I is operated via two inputs by an overriding position control (indexer) with a clock and direction signal. With each clocking impulse, a motor step in the direction stipulated by the direction input is carried out. In addition, the internal and external reference travel (see Chapter 7) and a manual mode are supported.

2. Connections

2.1 Pin Assignment 1 (D-Sub 15 pin connector)

Top view



Pin No	*Name*	*Remarks*
1	Input 5	Input +24 V Optocoupler
2	Input 4	Input +24 V Optocoupler
3	Input 3	Input +24 V Optocoupler
4	Input 2	Input +24 V Optocoupler
5	Input 1	Input +24 V Optocoupler
6	+ 48 V	Operating voltage +24 to +48 V
7	Input 6	Input +24 V Optocoupler
8	Output 3	Output overtemperature open collector
9	Com	Input common (-) for optocoupler
10	GND (0V)	Operating voltage GND (0V)
11	+ 48 V	Operating voltage +24 to +48 V
12	NC	
13	Output 2	Output open collector
14	Output 1	Output open collector
15	GND (0V)	Operating voltage GND (0V)

2.1.1 Operating Voltage

The permitted operating voltage of PDx-I lies in the range from 24 to 48 V DC and must not exceed 50 V and/or fall below 21 V under any circumstances. A charging capacitor of at least 2200 µF must be provided at the supply voltage in order to avoid exceeding the permitted operating voltage (e.g. with braking procedure).

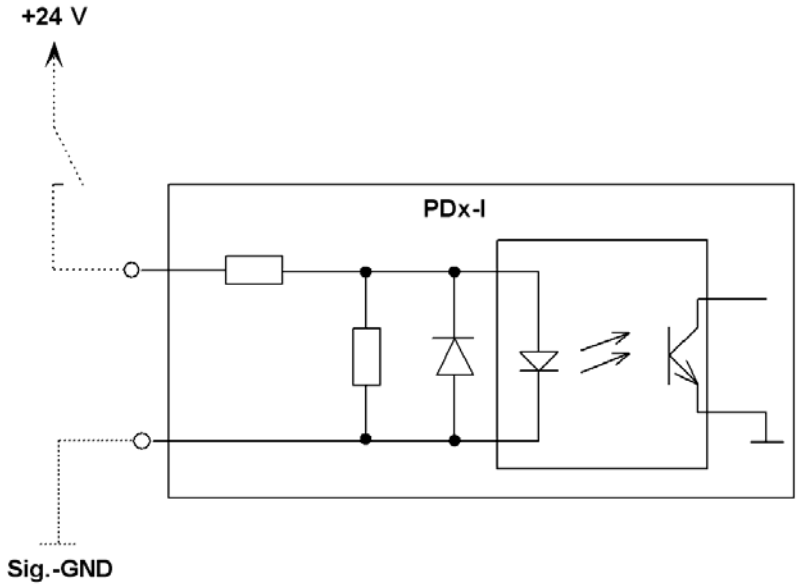
- **Connect a charging capacitor of min 2200µF.**
- **Mixing up the connections can destroy the output stage.**
- **Never disconnect the intermediate circuit if the power supply is on**
- **Do not pull energised plugs!**

Appropriate power packs and charging capacitors are available as accessories.

2.1.2 Inputs

All inputs are galvanically separated from the supply voltage of the PDx-I by optocoupler and designed for 24 V input signals (5 V optionally) with an input current of 10 mA.

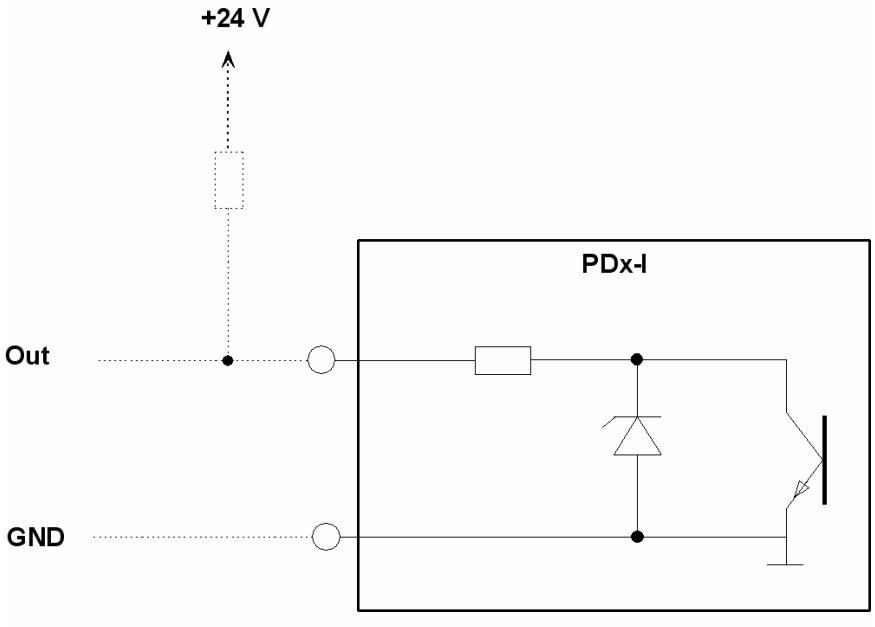
Circuit



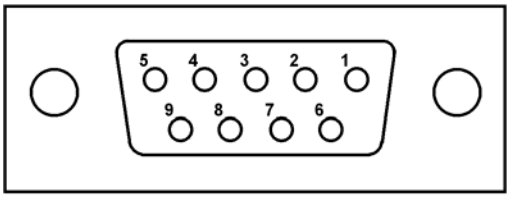
2.1.3 Outputs

The outputs are transistor outputs in open-collector circuit (0 switching, max. 30V / 30 mA).

Circuit

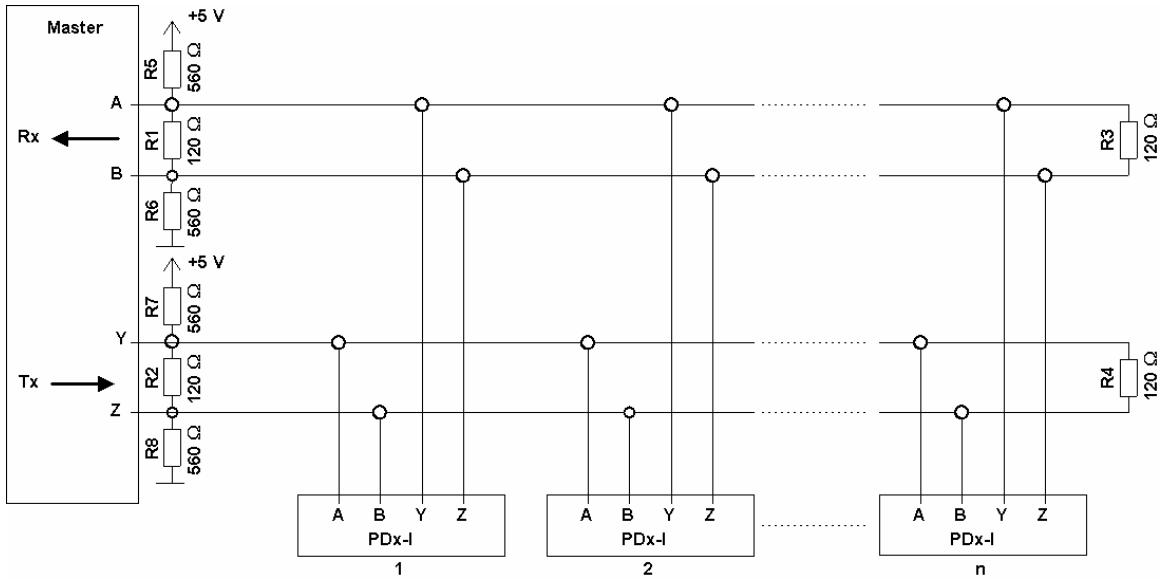


2.2 Pin Assignment 2 (RS485 interface D-Sub 9 contact strip)



Pin No	*Name*	*Remarks*
1	NC	not used
2	A	RS-485 Rx+
3	+5 V	Output +5 V
4	Y	RS-485 Tx+
5	NC	not used
6	NC	not used
7	B	RS-485 Rx-
8	GND	Output GND (0V)
9	Z	RS-485 Tx-

Circuit RS485 network



If the RS485 4-wire bus is used as a pure Master-Slave application, all PDx-Is are connected in parallel to the bus as slaves. The length of the connection lines (stub lines) is as short as possible and should not exceed 5 m under any circumstances. To avoid reflections during data transmission, the bus is to be provided with a 120 Ω finanl resistance (R1 to R4). To guarantee a defined resting level, the resistances R5 to R8 are to be connected to the bus according the above figure.

3. Function of the Inputs and Outputs in the Position Mode

3.1 Assignments of the Inputs and Outputs

Input 1: Start input/ Error reset

The impulse at the input 1 starts the desired travel profile. Through the negative flank at 1, an error (speed control) can be reset.

Inputs 2 to 5: Selection of the travel profile

The inputs 2 to 3 are used to set the profile number of the profile to be triggered. When activating Input 1, the value is read and the corresponding profile is loaded and started.

Selection of profile number:

Profile No	*Input 2*	*Input 3*	*Input 4*	*Input 5*
1	OFF	OFF	OFF	OFF
2	ON	OFF	OFF	OFF
3	OFF	ON	OFF	OFF
4	ON	ON	OFF	OFF
5	OFF	OFF	ON	OFF
6	ON	OFF	ON	OFF
7	OFF	ON	ON	OFF
8	ON	ON	ON	OFF
9	OFF	OFF	OFF	ON
10	ON	OFF	OFF	ON
11	OFF	ON	OFF	ON
12	ON	ON	OFF	ON
13	OFF	OFF	ON	ON
14	ON	OFF	ON	ON
15	OFF	ON	ON	ON
16	ON	ON	ON	ON

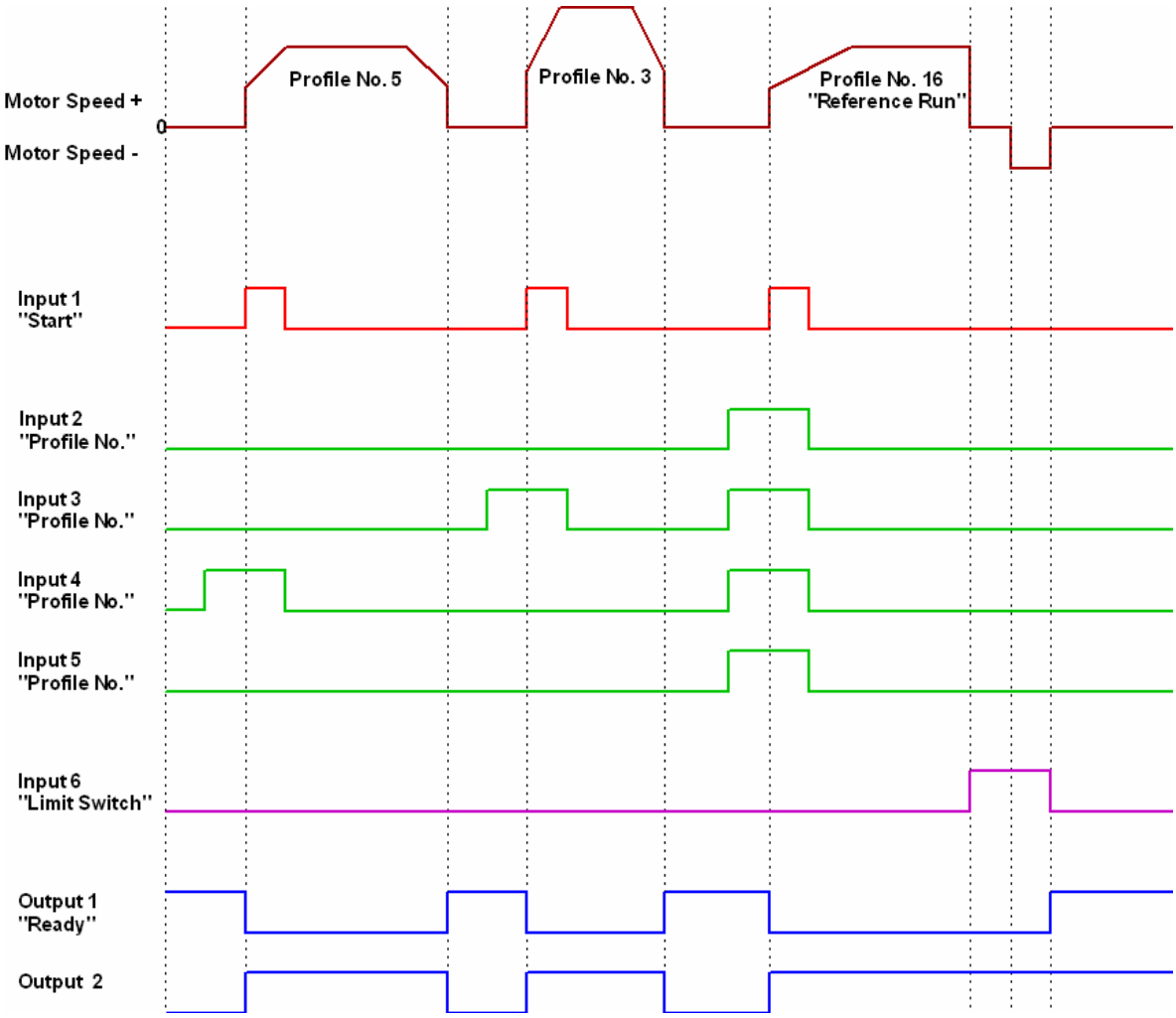
Input 6: External limit switch (see reference travel Chapter 7.1)

Outputs:

Output 1	*Output 2*	*State*
OFF	ON	Control processes latest command
ON	OFF	“Ready”, motor stands and waits for new command
OFF	OFF	Error (speed control) or error switch (normal operation)
ON	ON	Reference point (zero position reached)

3.2 Signal Characteristics in the Position Mode

In the example, profile No. 5, then profile No. 3 and then profile No 16 (as reference run programmed, see Chapter 7) are started.



4. Functions of the Inputs and Outputs in the Speed Mode

4.1 Assignments of the Inputs and Outputs

Input 1: Enable
Input 1 starts and stops the PDX-I.
Through a negative flank at input 1, an error (speed control) can be reset.

Input 6: Direction
Input 6 determines the direction of the PDX-I.

Inputs 2 to 5: Speed
The speed is defined by the inputs 2, 3, 4 and 5. The condition of the inputs is constantly read and output into the corresponding speed parameter. The motor accelerates or brakes to the new nominal speed on changes in the speed using the set ramp

Selection of speed

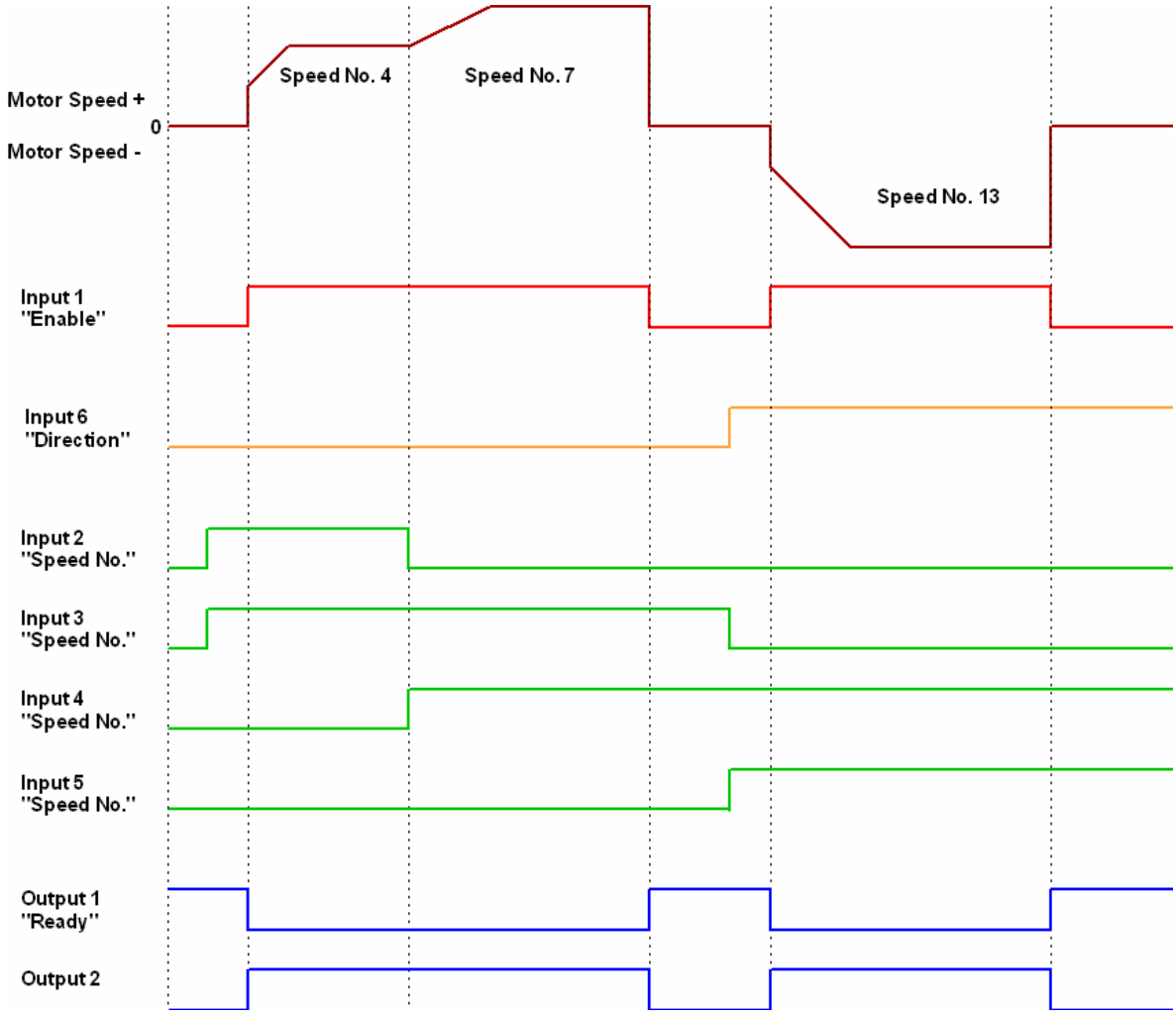
Speed No	*Input 2*	*Input 3*	*Input 4*	*Input 5*
1	OFF	OFF	OFF	OFF
2	ON	OFF	OFF	OFF
3	OFF	ON	OFF	OFF
4	ON	ON	OFF	OFF
5	OFF	OFF	ON	OFF
6	ON	OFF	ON	OFF
7	OFF	ON	ON	OFF
8	ON	ON	ON	OFF
9	OFF	OFF	OFF	ON
10	ON	OFF	OFF	ON
11	OFF	ON	OFF	ON
12	ON	ON	OFF	ON
13	OFF	OFF	ON	ON
14	ON	OFF	ON	ON
15	OFF	ON	ON	ON
16	ON	ON	ON	ON

Outputs:

Output 1	*Output 2*	*State*
OFF	ON	Speed output travels
ON	OFF	“Ready”, motor stands and waits for new command
OFF	OFF	Error (speed control)
ON	ON	Zero position reached

4.2 Signal Characteristics in Speed Mode

In the example, speed no. 4, speed no. 7 and, after a change in direction, speed no. 13 are activated.



5. Functions of the Inputs and Outputs in the Flag Position Mode

5.1 Assignments of the Inputs and Outputs

Input 1: Start

The impulse at the input 1 starts the speed mode.
Through a negative flank at input 1, an error (speed control) can be reset.

Input 5: Trigger

The impulse at the input 5 triggers the position mode.

Inputs 2 to 4: Profile number

The inputs 2 to 4 are used to set the profile number of the profile to be run. When activating Input 1, the value is read and the corresponding profile is loaded and started.

Selection of profile number:

Profile No	*Input 2*	*Input 3*	*Input 4*
1	OFF	OFF	OFF
2	ON	OFF	OFF
3	OFF	ON	OFF
4	ON	ON	OFF
5	OFF	OFF	ON
6	ON	OFF	ON
7	OFF	ON	ON
8	ON	ON	ON

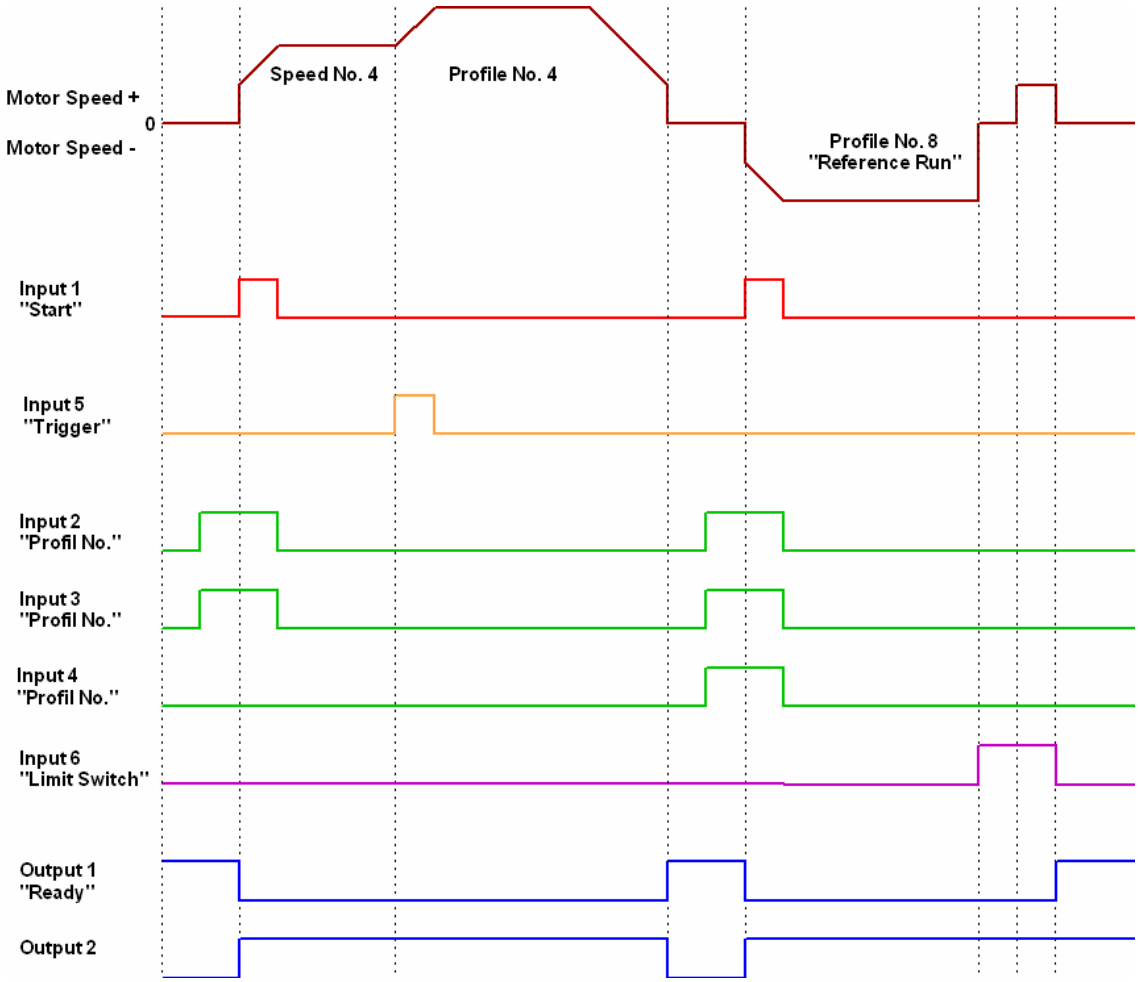
Input 6: External limit switch
(see reference travel Chapter 7.1)

Outputs:

Output 1	*Output 2*	*State*
OFF	ON	Control processes latest command
ON	OFF	“Ready”, motor stands and waits for new command
OFF	OFF	Error (speed control) or error switch (normal operation)
ON	ON	Reference point is reached

5.2 Signal Characteristics in the Flag Position Mode

In the example, profile No 4 is started and then a reference travel (programmed as profile No 8) is made.



6. Function of the Inputs and Outputs in the Clock Direction Mode

6.1 Assignments of the Inputs and Outputs

Input 1: Enable

By activation of input 1, the auto mode selected through the inputs 2 and 3 are started. The reference travels are started by an impulse.
Through a negative flank at input 1, an error (speed control) can be reset.

Inputs 2 and 3: Auto mode

The auto mode (see table) is defined by the inputs 2 and 3. The setting is taken over by the activation of input 1. The direction of the reference travel is determined by the set parameters. In the auto modes 1 and 2 (left and/or right) the motor makes 10 single steps at a frequency of approx. 2 Hz, then it accelerates to the programmed maximum frequency.

Selection of the auto mode:

No	*Auto mode*	*Input 2*	*Input 3*
1	left	OFF	OFF
2	right	ON	OFF
3	internal reference	OFF	ON
4	external reference	ON	ON

Input 4: External limit switch

(see external reference travel …)

Input 5: Direction

The input signal determines the direction of the motor. The signal must no longer be switched at least 150 µs before a clock signal.

Input 6: Clock (external)

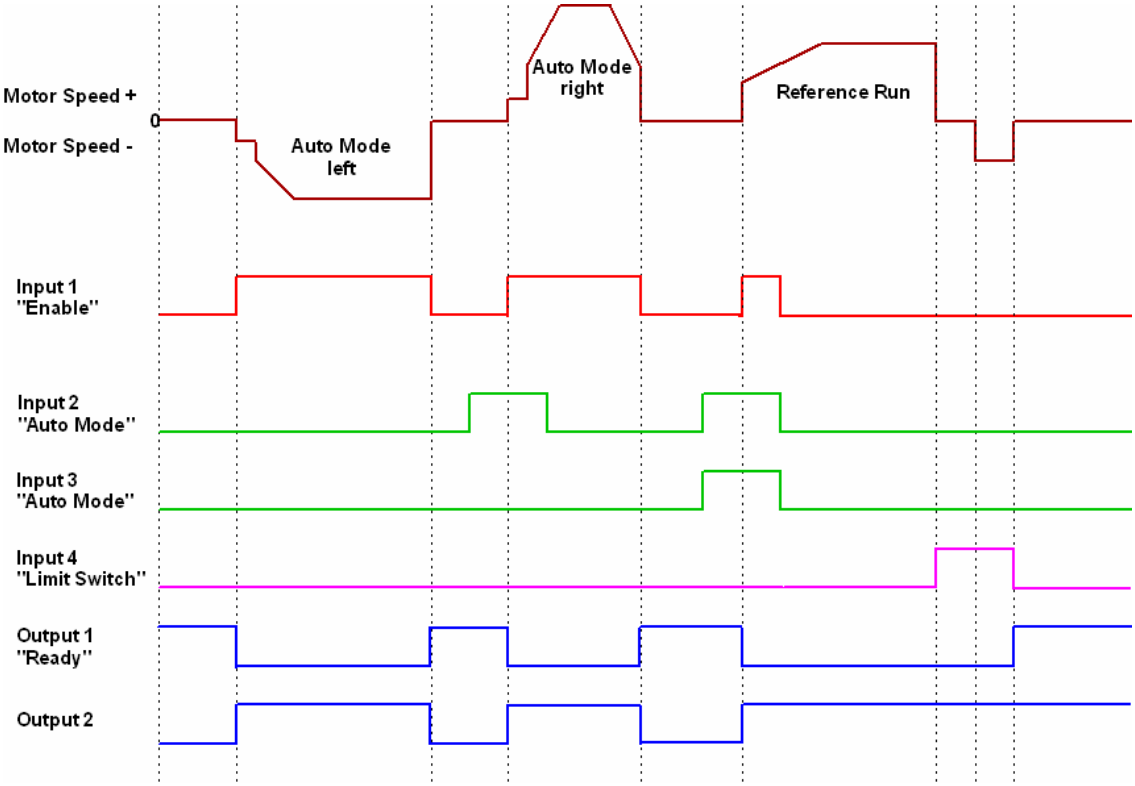
A motor step in the direction stipulated by the direction input is carried out with the negative flank of the input signal

Outputs:

Output 1	*Output 2*	*State*
OFF	ON	Control processes latest command
ON	OFF	Current reduction active
OFF	OFF	Error (speed control)
ON	ON	Reference point is reached

6.2 Signal Characteristics in Clock Direction Mode

In the example, the auto modes on left and right are consecutively started and then the external reference run made.

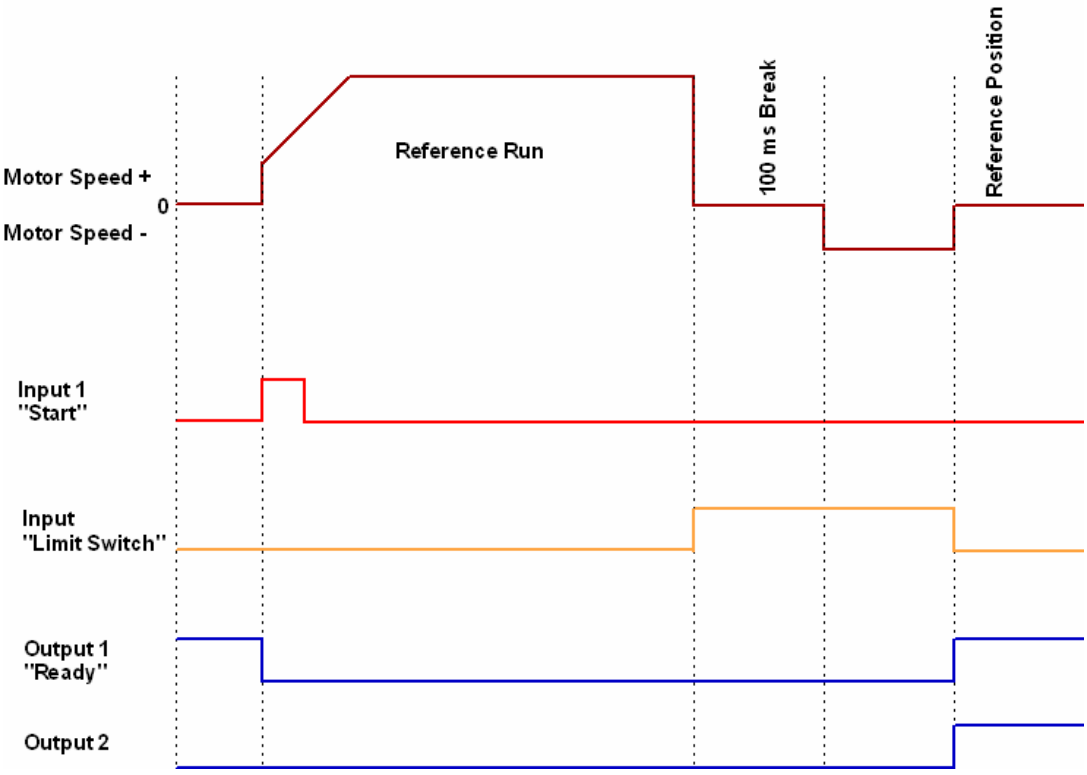


7. Reference Travels and Limit Switch Behaviour

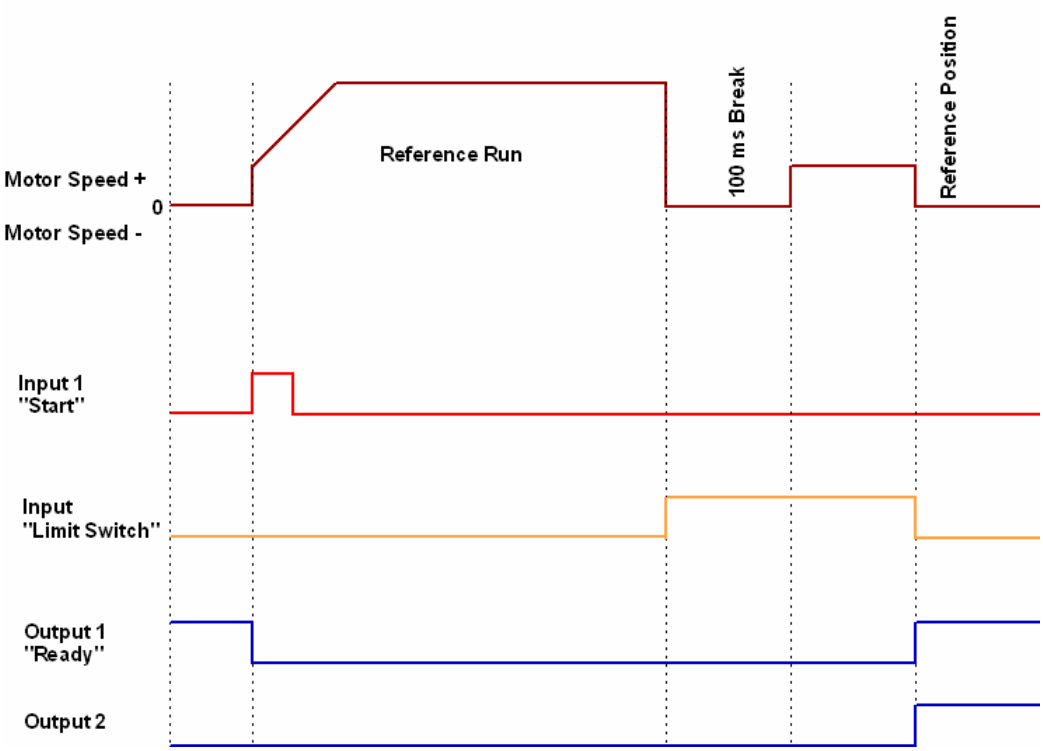
7.1 External Reference travel and Limit Switch Behaviour

During an external reference run, the PDx-I runs to a switch connected to the reference input (Input per mode different, see description of input and output signals of the corresponding mode).
After the start of the external reference travel, the motor accelerates with the set ramp from the minimum to the maximum speed on reaching the reference switch. The reference switch can be a opener or as closer (has to be initilised by the software during programming).
The behaviour of the PDx-I when recognising the reference switch can be separately defined for normal operation (position and flag position mode) and of the reference travel. There are four types of position behaviour at the limit switch:

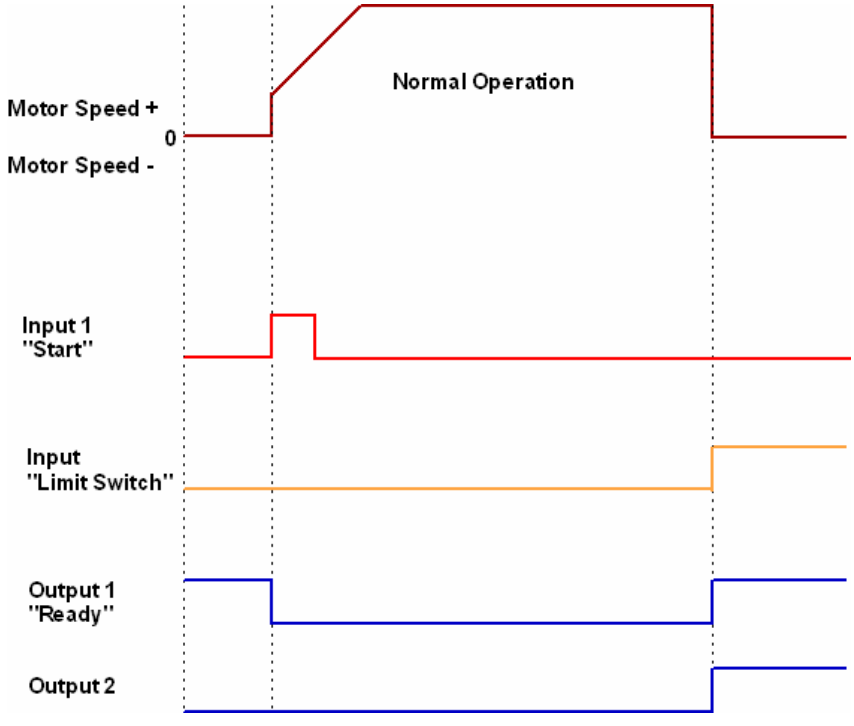
1. „Free travel backwards“ (reference travel and normal operation) The motor changes the direction on recognition of the limit switch and leaves the limit switch.



2. „Free travel forwards“ (reference travel and normal operation)
   The motor continues to run into the same direction on recognition of the limit switch and leaves the limit switch.



3. „Stop“ (only for normal operation)
   The motor stops immediately on recognition of the limit switch. Then, a reference travel has to be carried out, as the motor may have lost steps (overflow).



4. „Disable“ (only for normal operation)
   The limit switch has no function.

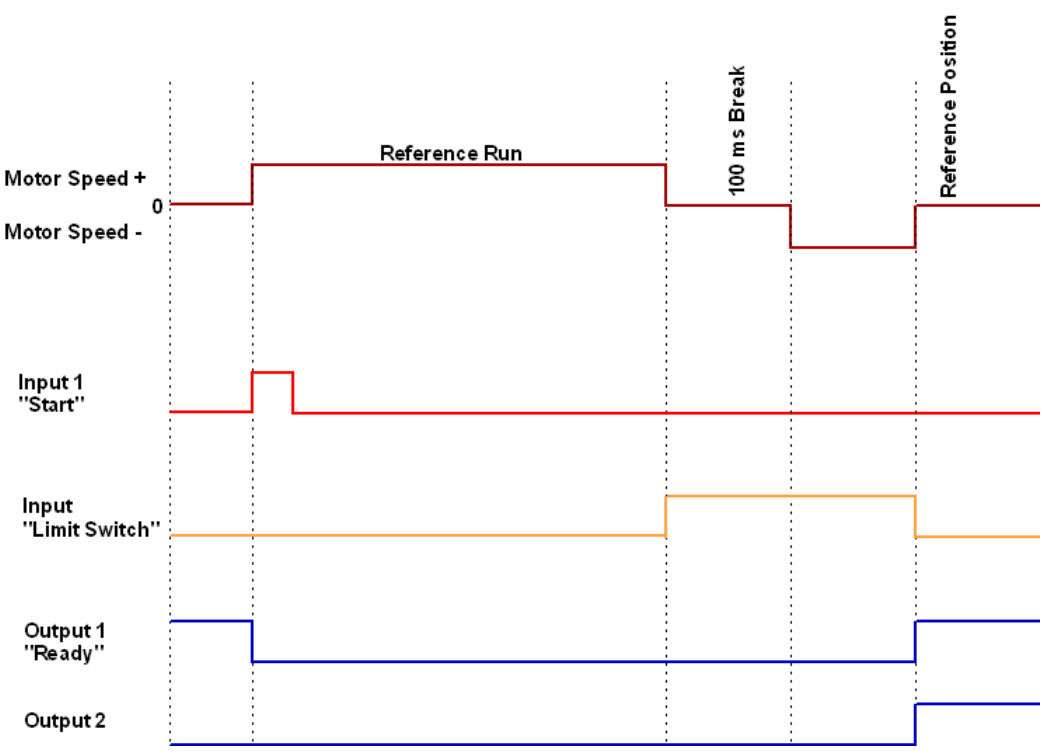
On reaching a reference position, Input 1 and Input 2 are simultaneously switched off during a reference travel as well as in normal operation.

Default settings for limit switch behaviour:
⇨ Limit switch = „opener“
⇨ on reference travel „free travel backwards“.
⇨ in normal operation “disable”

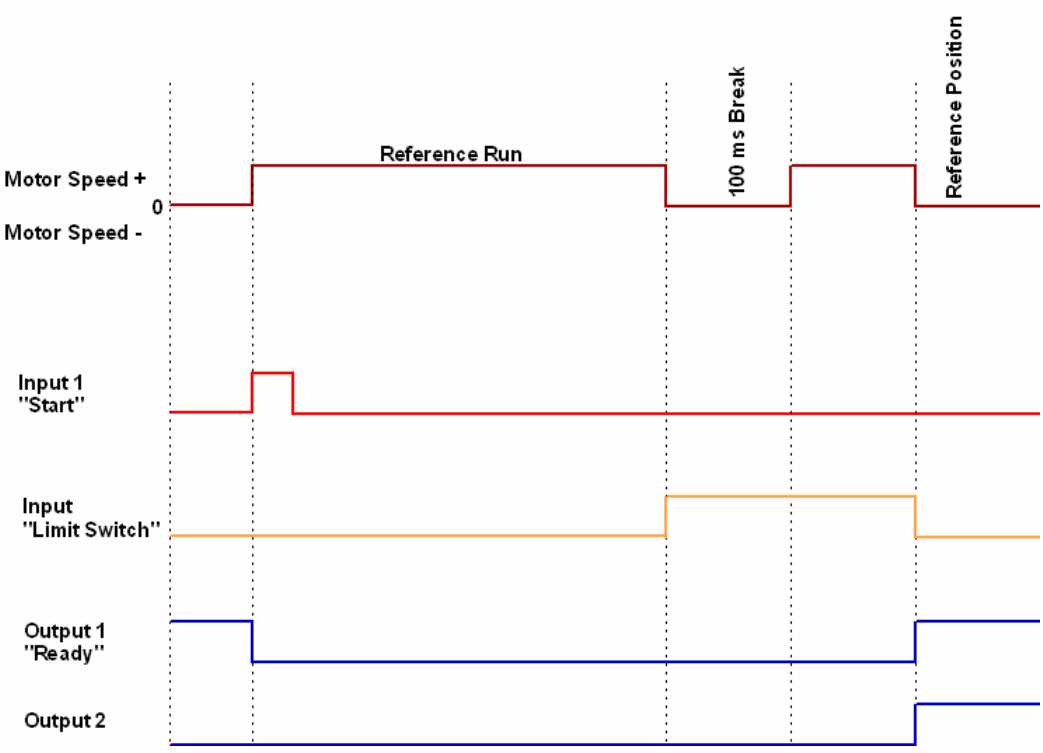
7.2 Internal Reference travel and Limit Switch Behaviour

During an internal reference travel the PDx-I moves to an internal reference point with set minimum speed. This reference point is on the motor shaft and is reached anew on each full turn of the motor. The internal reference travel may only be used to find the actual reference position at a positioning of less than 330°. The behaviour of the PDx-I when recognising the reference point can be defined for normal operation (position and flag position modes) as with an external reference travel. During the internal reference travel, there are four types of positioning behaviour at the reference point (separately initializable for reference travel and normal operation).

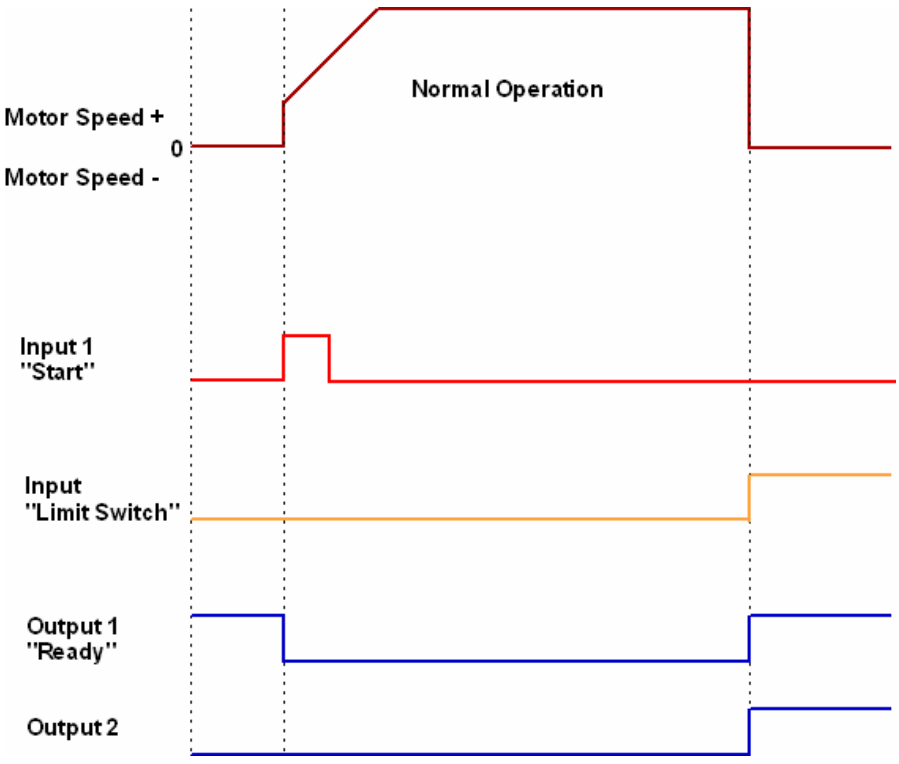
1. „Free Travel Backwards“ (reference travel and normal operation)
   The motor changes the direction on recognition of the internal reference and leaves the reference point.



2. „Free Travel forwards“ (reference travel and normal operation)
The motor continues to run into the same direction on recognition of the internal reference point and leaves the reference point.



3. „Stop“ (only for normal operation)
The motor stops immediately on recognition of the reference point. Then, a reference travel has to be carried out, as the motor stops on the internal reference.



4. „Disable“ (only for normal operation)
   The internal reference has no function.

On reaching a reference position, Input 1 and Input 2 are simultaneously switched off during a reference travel as well as in normal operation.

Default setting for the behaviour of the internal reference:
⇨ on internal reference travel „free travel backwards“.
⇨ in normal operation “disable”

8. Speed Control

The PDx-I has an internal speed control. for monitoring the motor function and messages on losses in steps. If the motor loses more than 25 full steps (50 half steps, 100 quarter steps etc. with a 1.8° stepper motor) within a rotation angle of 9°, Output 2 shows an error. Any travel job will be aborted. Due to the resolution, speed control cannot replace an encoder.

9. Programming Software NANOPRO-PDx-I

9.1 General

The *NANOPRO-PDx-I* software enables configuring and programming of the PDx-I motor series using a standard PC. Well-structured surfaces and simple test functions enable the uncomplicated operation of the PDx-I and facilitate commissioning.
The software is suited for the MS-Windows 98/NT/ME/2000/XP operating systems; for the communication, a free COM-Port for the connection of the RS232/485-Converter is necessary.

System requirements

MSWindows 98/NT/ME/2000/XP
CD-ROM drive for installation CD
Free COM port
Accessory: RS232/485 converter

9.2 Program installation

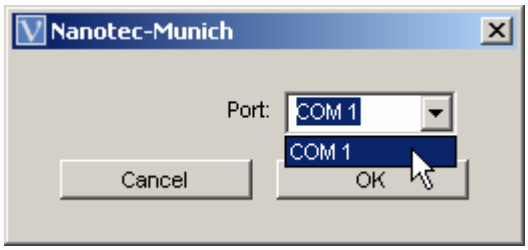
1. Insert the installation CD into the CD drive.
2. Change to the CD drive in Windows Explorer and open the Setup directory.
3. Start the setup program by double clicking on the file *setup.exe*.
4. Follow the installation instructions of the setup program.

9.3 Program Start

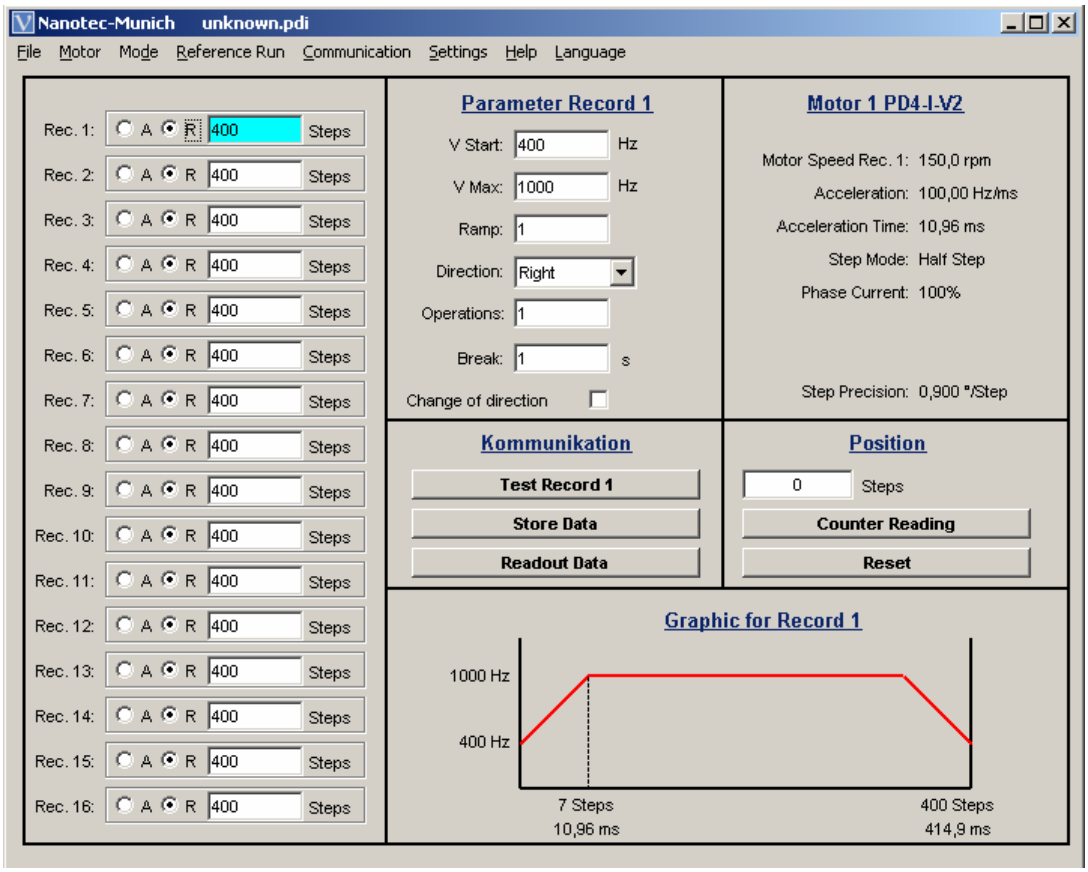
If the program is started for the first time, the desktop for setting the COM port appears.

Select the free COM port in the *Connection* drop down menu of the free COM port at which the PDx-I is connected by the RS232/485 converter.

By clicking onto the *OK* button, the setting for the future program start is enabled.



9.4 Desktop

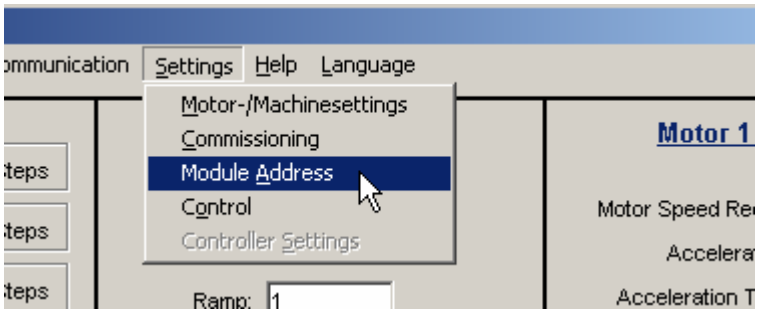


Desktop in the Position Mode

After the program start, the desktop is shown. All further parameters and functions can be set there. All entry fields and buttons can be operated using the tab and the arrow keys on the keyboard in addition to the mouse.

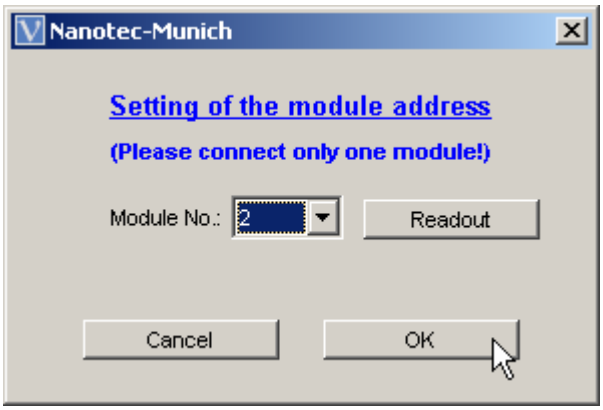
9.5 Setting of the Motor Address

To enable the error-free connection with the PDx-I, the motor address has to be set correctly. All PDx-I are delivered with the preset address „1“. To be able to operate several motors in a RS485 network a unique address has to be allocated to each motor.
To set the motor address, activate the *Motor address* submenu *Setting* menu .



An alarm message appears to confirm that only one motor is connected to the interface.

Then set the motor address on the desktop:



This menu offers the following functions:

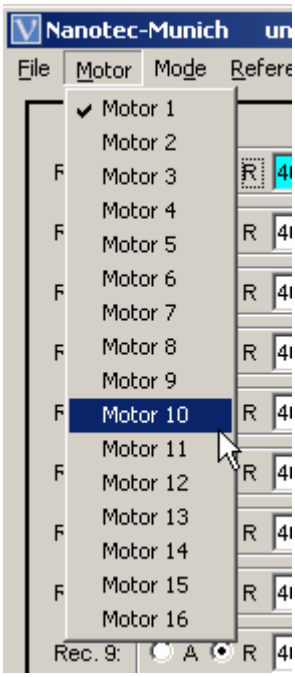
Reading of current motor address:
Activate the *Readout* button to read the current addresses of the connected PDx-I. The *Motor No:* field shows the current motor address.

Allocation of a new motor address:
To allocate a new address to the connected motor, set the corresponding address in the *Motor number* drop down field and confirm with *OK*. The address is taken over by the motor and the program shows the desktop again.

Cancel
By activating the *Cancel* button, the program returns to the desktop without further action.

9.6 Selection of Motor

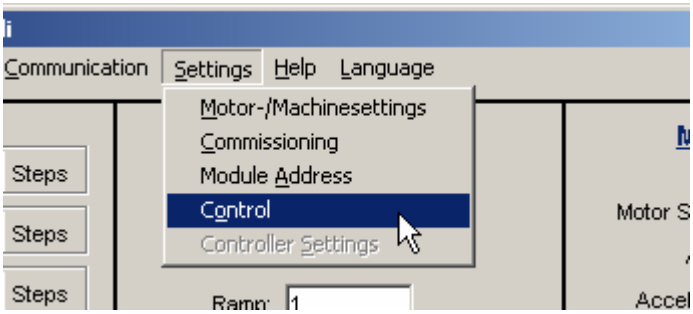
Up to 16 motors can be addressed and parameterised through the program. Confirm the selection of the desired motor by activating the corresponding motor number in the *Motor* menu.



All settings and entries are saved motor-related by the program. When ending the program, these settings are lost if they are not stored in a file (see *Data* menu).

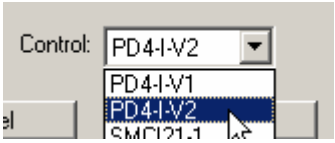
9.7 Selection of the Control

To select the control to use, activate the *Motor Control* submenu *Setting* menu.



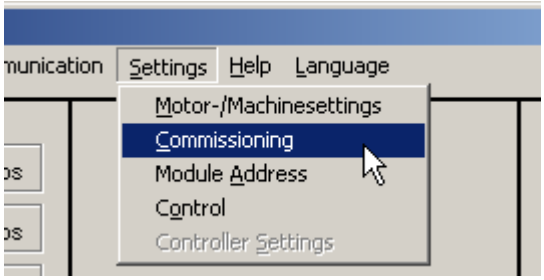
Then the program desktop *Control* is shown.

To select the control used, highlight the corresponding control type in the drop down field Control and confirm it by *OK*.
By confirming the *Readout* button, the control type can be automatically read and shown.

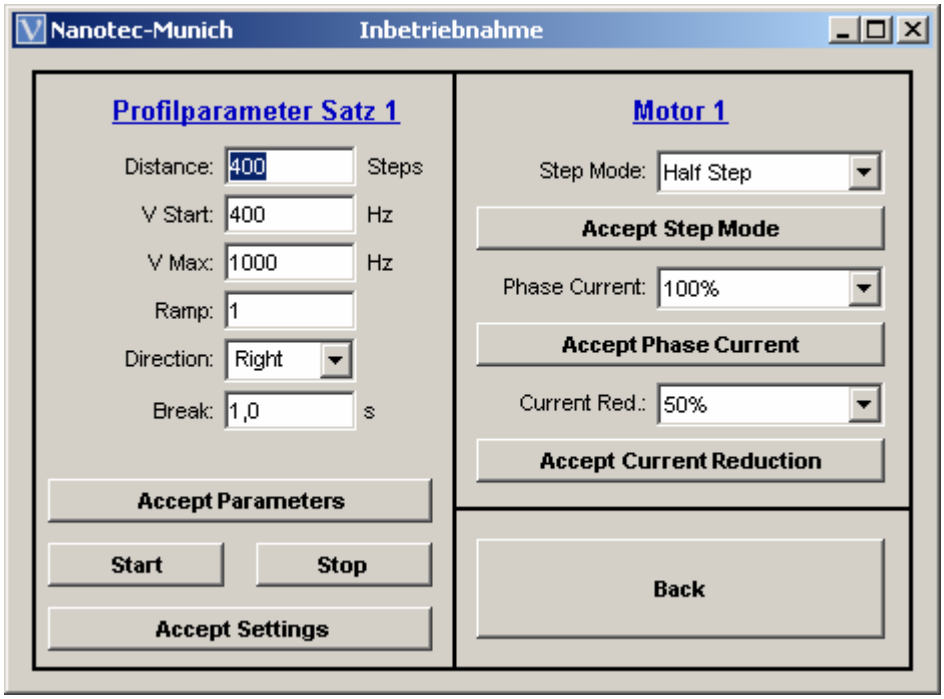


9.8 Commissioning

To set the motor-related parameters, activate the *Commissioning* submenu *Settings* menu.



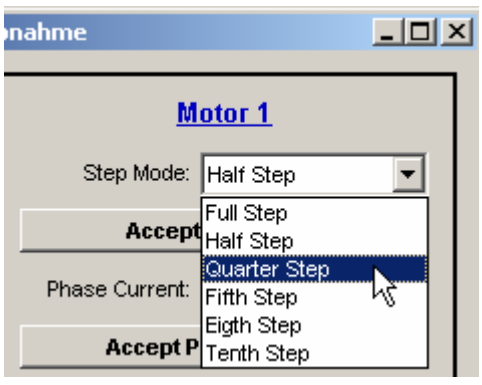
Then the program desktop *Commissioning* is shown.



In the right range of the desktop, the current motor number is displayed, in the left area, the parameters of the current record are shown. By activating the *Return* button, the program returns to the desktop.

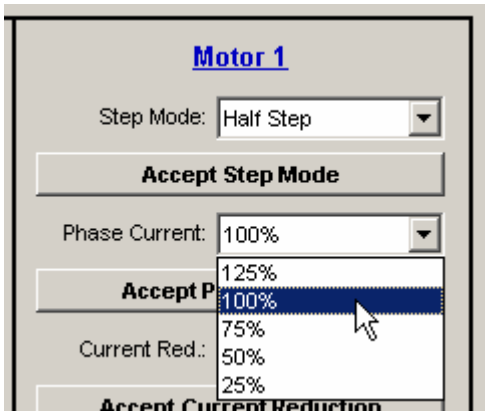
9.8.1 Setting of the Step Mode

For setting the step mode, enter the desired step mode in the *Step mode* drop down field. By pressing the *Step mode* button, the PDx-l is re-initialised with the step mode set.



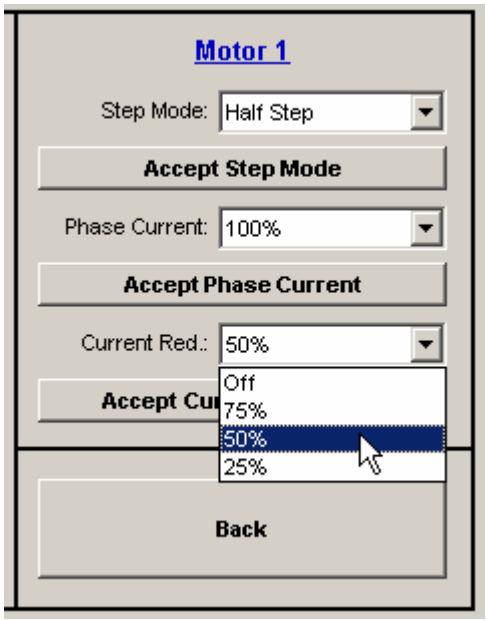
9.8.2 Setting of the Phase Current

The phase current is set in the *Phase current* drop down field, the value relates to the nominal current of the PDx-I. By pressing the *Accept phase current* button, the PDx-I is re-initialised with the preset phase current.



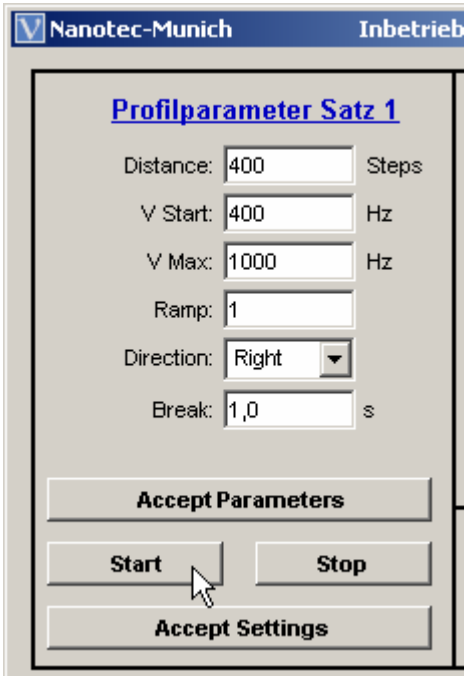
9.8.3 Setting of the Current Reduction

The current reduction is set in the *Reduction* drop down field (75% corresponds to a reduction of 75% of the set phase current). By pressing the *Accept reduction* button, the current reduction of the PDx-I is taken over.



9.8.4 Motor Test

The motor parameters set can be tested in connection with the current record in the position mode mode of operation. For this purpose enter the desired record parameter s into the corresponding fields.



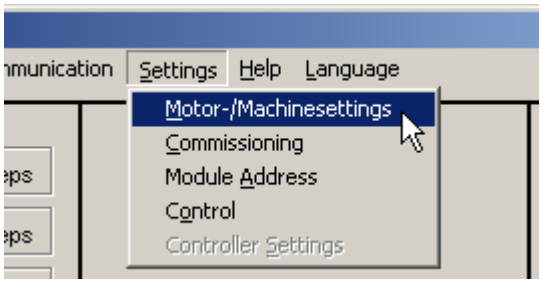
After activating the *Start* button, the motor is started with the preset settings. If the motor reaches the preset position, it stops for the period set in the *Break* field and is then started in the reverse direction. This process is constantly repeated until the *Stop* button is activated. The parameters can be changed at any time and transferred to the PDx-I by activating the *Accept parameter* button. The changed parameters are transferred after the next change in direction.
For the transfer of the parameters tested into the current record, activate the *Accept settings* button. The program shows again the desktop.

If, in the current test program, the speed control responds, the following message appears:

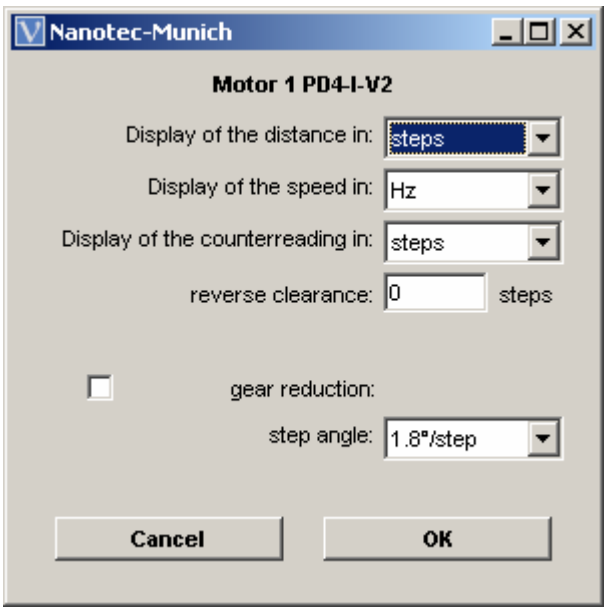
By confirming this message, the speed control is reset and the test program has to be started again.

9.9 Program and Machine Settings

In order to carry out special program and machine settings confirm the *Program machine settings* submenu in the Settings menu.



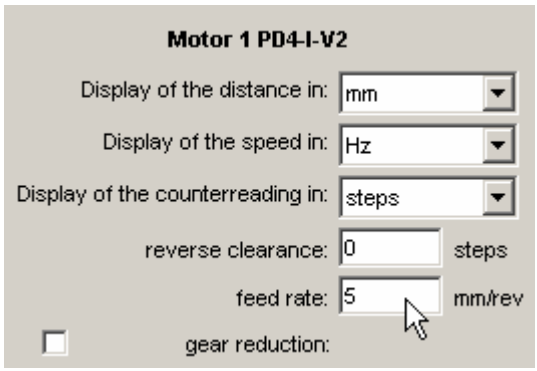
The desktop for setting the program and machine parameters are shown:



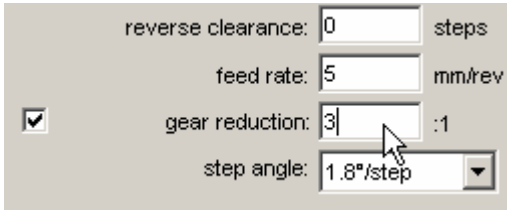
By activating the drop-down fields, the following program settings for the desktop can be made:

Display of the distance in:		steps degree mm
Display of the speed in:	Hz	
		rpm mm/s
Display of the counter reading in:		steps degree mm

The units are automatically converted after activating the *OK* button.
If one of the settings is „mm“ the corresponding feed has to be shown in the *Feed constant* field:



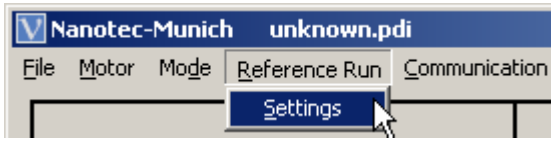
In addition, any reverse clearance to be set off (see 1.2.2) and a gear reduction can be indicated by activation of the corresponding check box.



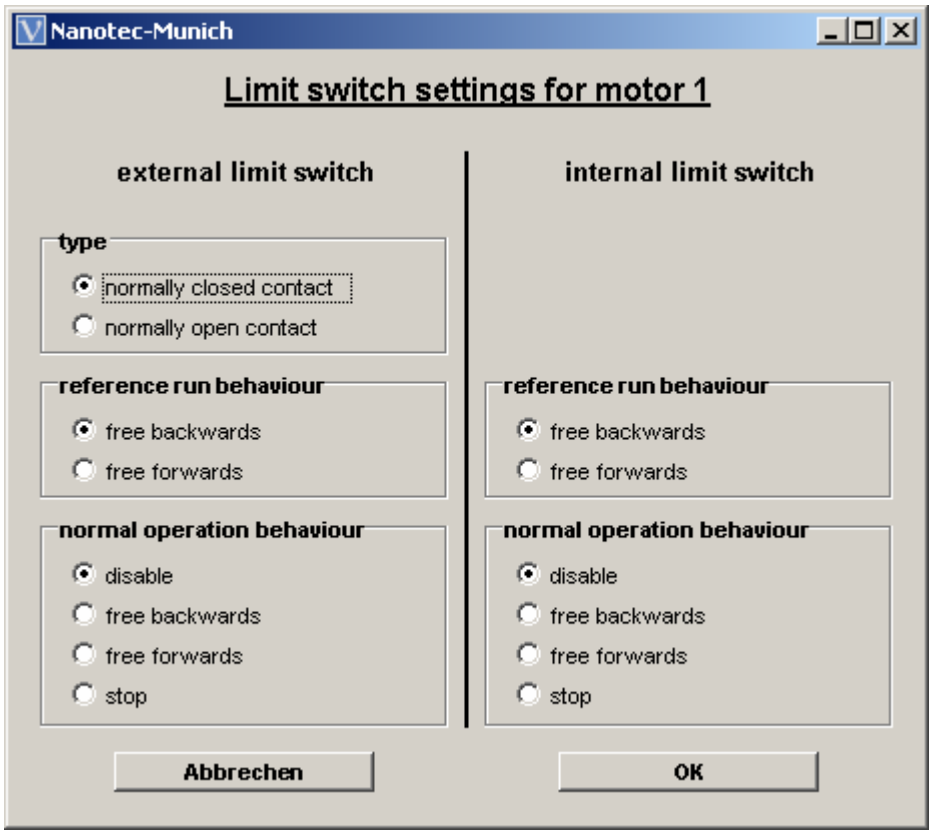
Press the OK button to confirm the settings, the parameters are converted and taken over into the desktop.
By activating the *Escape* button, the program returns to the desktop without taking over the settings.

9.10 Setting of the Reference Switches

The PDx-I offers different possibilities to define the behaviour at the internal and external limit switch (see 7.1 and 7.2). For these settings, activate the *Settings* submenu *Reference travel* menu .



The desktop for setting the reference switch is opened.



The following settings can be made:

Type:

Setting, whether the external limit switch is an opener or closer.

Behaviour during reference travel:

Setting, whether limit switch (external and internal) is to be driven forwards (without change in direction) or backwards (in the opposite direction) to be released.

Behaviour during normal operation:

Setting of behaviour of PDx-I on recognition of the limit switch (external and internal) during normal operation (no reference travel).

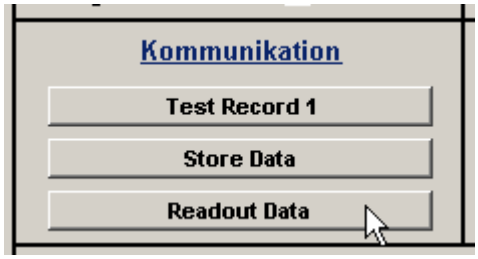
After confirmation with *OK* the settings are taken over by the motor and the program shows the desktop again.
By activating the *Escape* button, the program returns to the desktop without taking over the settings.

9.11 *Description of the Mode of operation*

9.11.1 General Functions (all modes)

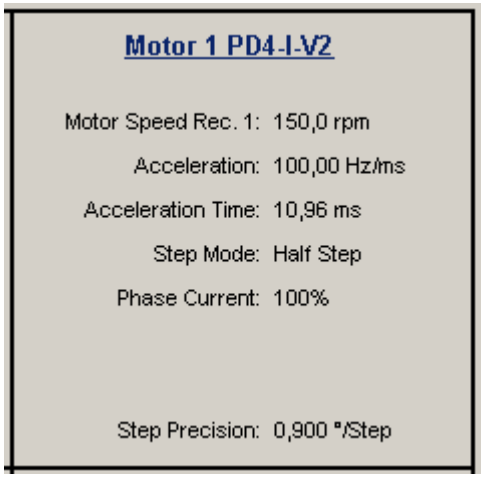
Readout of data

By activating the *Readout data* button, all parameters and profile data of PDx-I are transferred to the program. Then the desktop changes into the corresponding mode of operation.

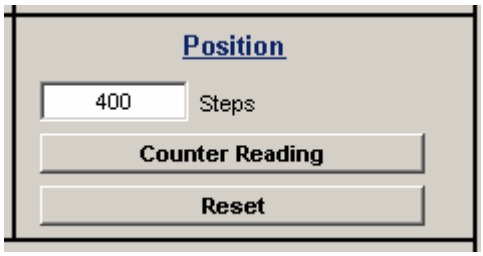


Motor and Machine Settings

In the right range of the desktop, the selected motor and machine settings are indicated. All settings refer to a PDx-I with a step angle of 1.8° at the program start. To adjust the settings to the actual motor, confirm the *Readout data* button (see above).
The times and speed resulting from the profile entered as well as the motor number selected are also indicated in the machine setting area. The data is recalculated when entering new data.



Position:
The current position of the motor can be read out by using the *Counter reading* button, the position is shown absolute to the zero position (see also 9.8, Display of the counter reading).
The counter is deleted and the current position becomes the zero position by activating the *Reset* button.



9.11.2 Selection of the Mode of Operation

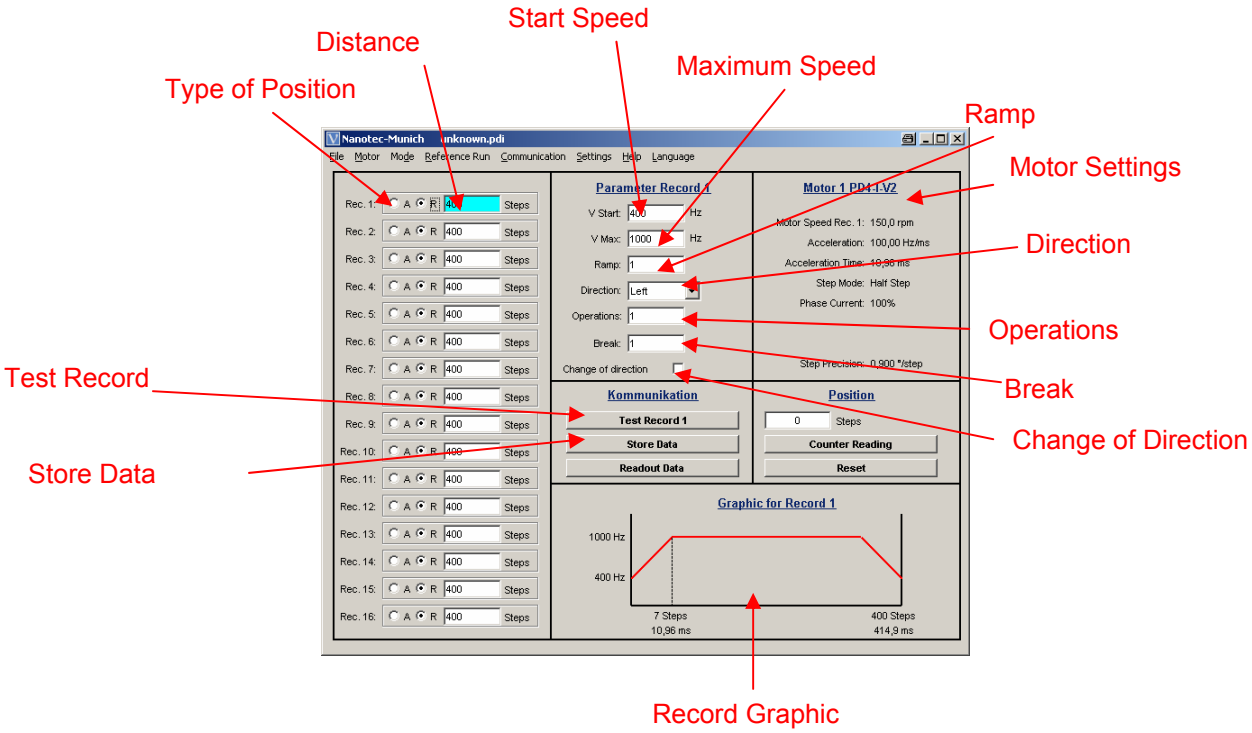
To select an mode of operation , start *Mode* and then the corresponding submenu. The program changes to the desktop correspondingly to the mode.

The current mode is provided with a hook under this menu item.

9.11.3 Mode of operation Position

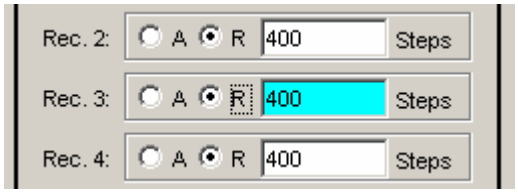
(Position mode, see also 1.3.1 and 3.)

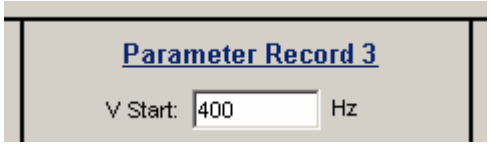
The following desktop is shown in the position mode:



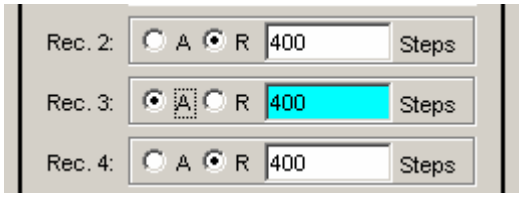
In this mode, up to 16 travel profiles can be defined and programmed.
To enter a travel profile, proceed as follows:

a) Selection of the travel profile
By activation of the option fields for the types of position or the entry field for the distance, the desired travel profile is selected. The entry field for the distance is coloured, in the *Record parameter ..* field, the display of the record number changes.

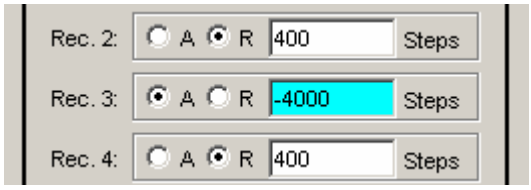




b) Entry of the type of position
Select the option field *R* for the relative position and/or *A* for the absolute position .

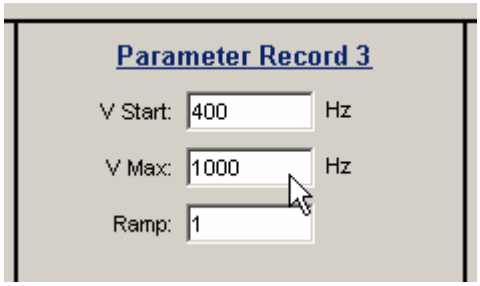


c) Display of the distance in:
Enter the absolute or relative position for the selected travel profile in the Distance field (see also 9.8, Program and Machine Settings ⇨ Display of distance).
Admissible values at absolute position: ± 8.388.607 steps
Admissible values at relative position: 0 up to 16777215 steps



d) Entry of speed and ramp:
Enter the start and maximum speeds of the desired travel profile in the fields *V Start* and *V Max*, and the ramp steepness in the *Ramp* field.

Admissible values for the speeds:	100 up to 20000 Hz (in 100 Hz steps, according to other units)
Admissible values for the ramp:	1 to 255



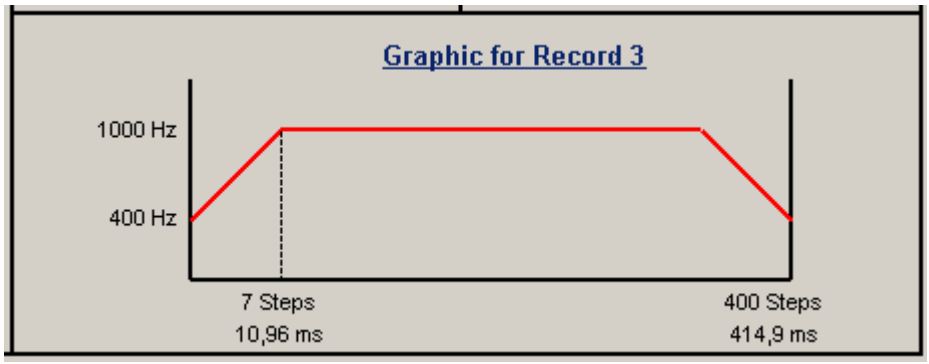
e) Entry of direction (only with relative position):
On relative position, enter the direction of the travel profile in the *Direction* choice field.

f) Entry of the operations:
Enter the number of operations in the *Operations* field (see 1.3.1 h).

g) Entry of the break:
Enter the required break time between the operations in the *Break* field (see 1.3.1 i).

h) Entry of change of direction (only with relative position):
The automatic change of direction can be activated in the *Change of Direction* choice box (see 1.3.1 g).

i) Display of the route graphics(only with relative position):



Ramp time (starting time) and the total actuating time for the travel profile can be seen in the route graphics. The graphics is re-calculated which each relevant input.

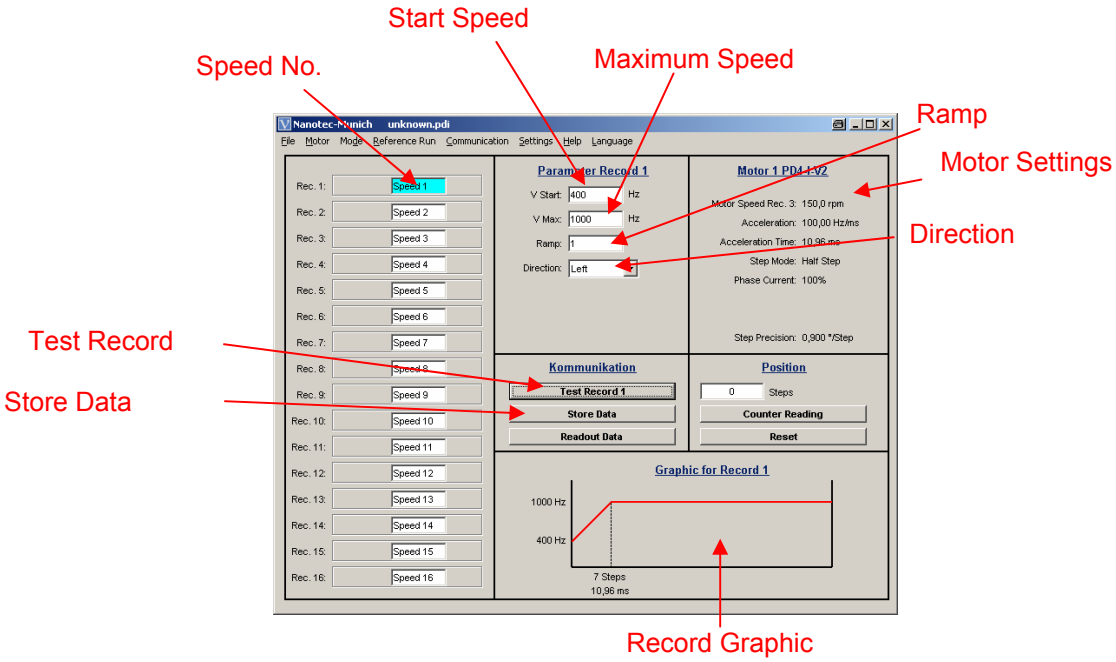
j) Record test:
By activating the *Test Record …* button, the current record is transferred to the PDx-I and started. The parameters are not stored by the control unit.

k) Store data :
To store the set travel profiles permanently in the PDx-I, activate the *Store data* button. The transfer may last some seconds and is optically shown with a bar. Then the travel profiles are selected and started via the inputs of the PDx-I.

9.11.4 Mode of operation Speed

(Speed mode, see also 1.3.2 and 4.)

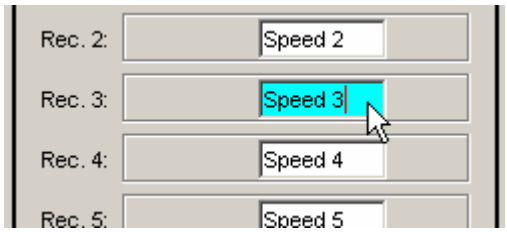
The following desktop is shown in the speed mode:



In this mode, up to 16 different speeds can be defined and programmed.

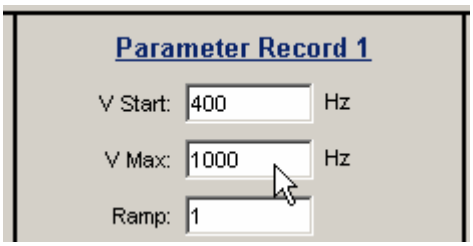
To enter a speed profile proceed as follows:

a) Selection of speed No:
To select a speed, activate the corresponding speed number field which is then highlighted in colour.

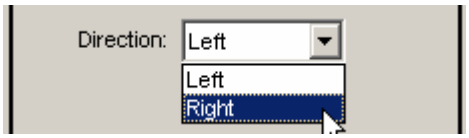


b) Entry of speed and ramp:
Enter the start and maximum speeds of the desired speed profile in the fields *V Start* and *V Max*, and the ramp steepness in the *Ramp* field.

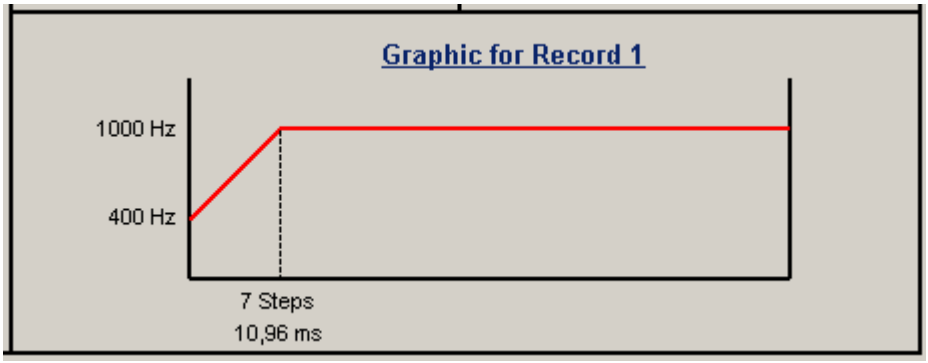
Admissible values for the speeds:	100 up to 20000 Hz (in 100 Hz steps, according to other units)
Admissible values for the ramp:	1 to 255



c) Entry of direction (only with speed test):
For the program-controlled speed test, enter the direction of the speed profile in the *Direction* choice field.

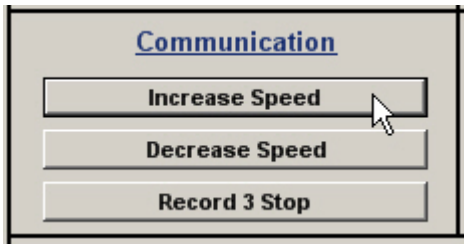


d) Display of the route graphics in:
Ramp time (starting time) for the speed profile selected can be seen in the route graphics. The graphics is re-calculated which each relevant input.



l) Speed test:
By activating the *Test Record …* button, the current speed profile is transferred to the PDx-I and started. The parameters are not stored by the control unit.

After the start, the buttons for the control of the motor are shown. The speed can be increased or decreased by mouse clicks. To end the speed tests, activate the *Record … stop* button.

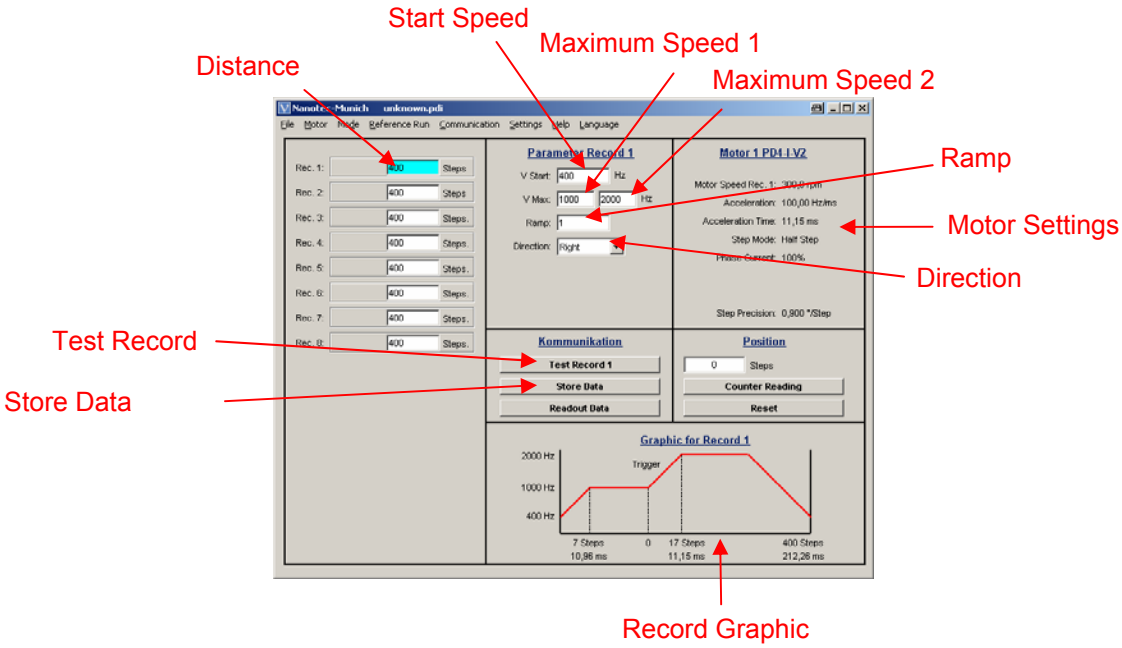


m) Store data
To store the set speed profiles permanently in the PDx-I, activate the *Store data* button. The transfer may last some seconds and is optically shown with a bar. Then the speeds are selected and started via the inputs of the PDx-I.

9.11.5 *Mode of operation Flag position*

(Flag position mode, see also 1.3.2 and 5.)

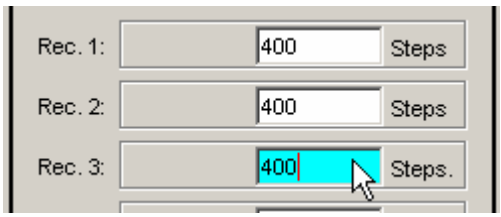
The following desktop is shown in the flag position mode:



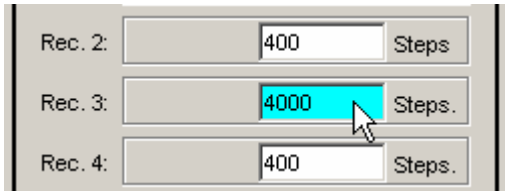
In this mode, up to 8 different flag positions can be defined and programmed.

To enter a travel profile proceed as follows:

a) Selection of the travel profiles:
By activation of the entry field for the distance, the desired travel profile is selected. The entry field is coloured and in the *Record parameter ...* field, the display of the record number changes to the current record.

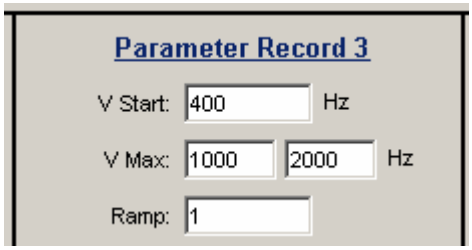


b) Display of the distance in:
Enter the nominal position for the selected travel profile in the Distance field (relative to the trigger point) (see also 9.8, Program and Machine Settings ⇨ Display of distance).
Admissible values for the position: 0 up to 16777215 steps
(for other units the corresponding values are admissible)

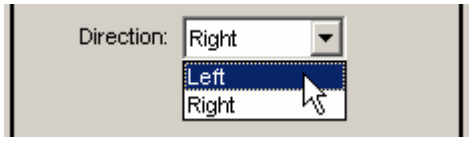


c) Entry of speed and ramp:
Enter the start and maximum speeds (*V1* for speed operation, *V2* for position operation) of the desired speed profile in the fields *V Start* and *V1/V2*, and the ramp steepness in the *Ramp* field (identical for both modes of operation).

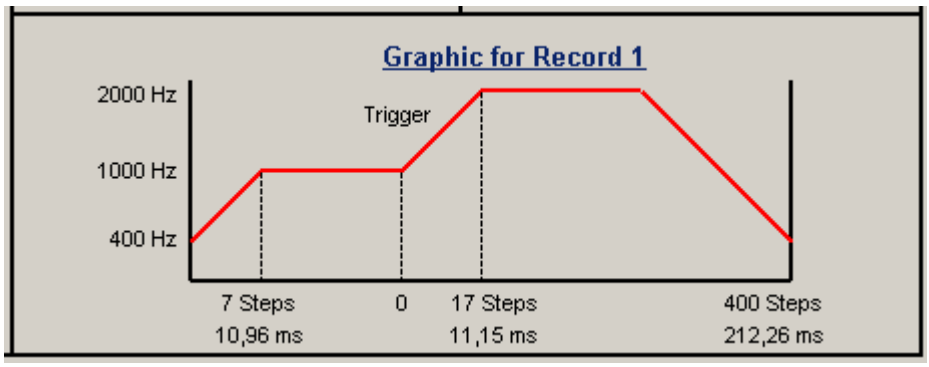
Admissible values for the speeds:	100 up to 20000 Hz (in 100 Hz steps, according to other units)
Admissible values for the ramp:	1 to 255



d) Entry of the direction:
Enter the direction of the selected travel profile in the *Direction* choice field.

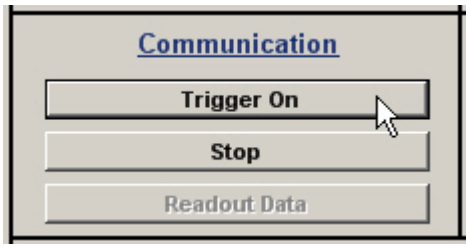


e) Display of the route graphics in:
Ramp time (starting times) for the travel profile selected can be seen in the route graphics. The graphics is re-calculated which each relevant input.



f) Profile test:
By activating the *Test Record ...* button, the current travel profile is transferred to the PDx-I and started. The parameters are not stored by the control unit.

After the start, the buttons for the control of the motor are shown. By activating the *Trigger on* button, the trigger can be set, the motor changes into the position mode and travels to nominal position set. By activating the *Stop* button, the profile test is ended.

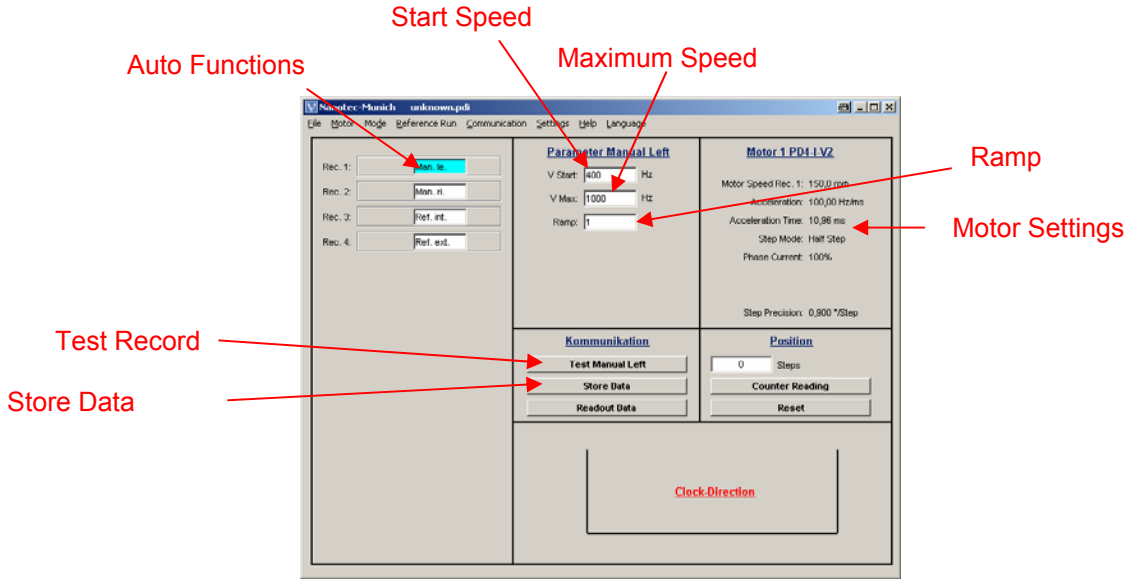


g) Store data
To store the set travel profiles permanently in the PDx-I, activate the *Store data* button. The transfer may last some seconds and is optically shown with a bar. Then the travel profiles are selected and started via the inputs of the PDx-I.

9.11.6 Clock Direction Mode of Operation

Clock direction mode (see also 1.3.4)

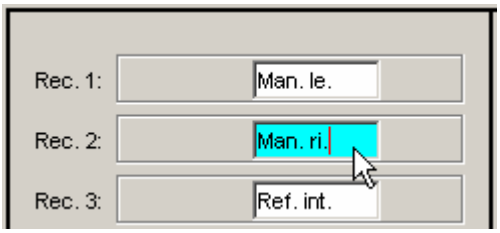
The following desktop is shown in the clock direction mode:



In this mode, up to 4 different functions of the auto mode can be defined and programmed.

To program the functions proceed as follows:

a) Selection of the function:
By activation of the corresponding display field, the auto mode function is selected. The entry field is coloured and in the *Record parameter ...* field, the display of the record number changes to the corresponding function.

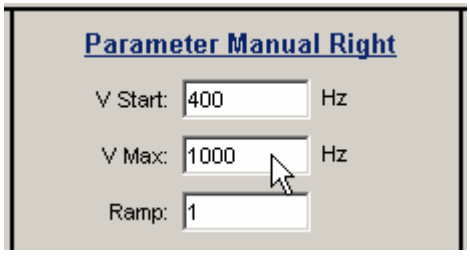


The following auto functions can be selected:

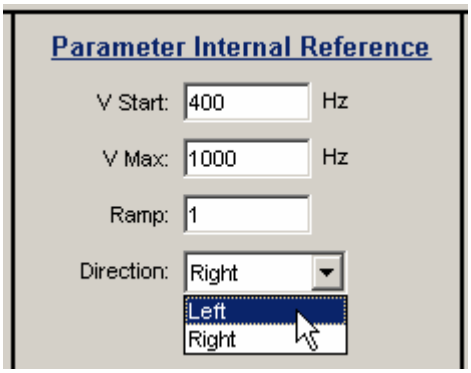
Man. le.	⇨	Settings for the manual travel left
Man. ri.	⇨	Settings for the manual travel right
Ref. int.	⇨	Settings for internal reference travel
Ref. ext.	⇨	Settings for external reference travel

b) Entry of speeds and ramp:
Enter the start and maximum speeds of the desired auto function in the fields *V Start* and *V Max*, and the ramp steepness in the *Ramp* field.

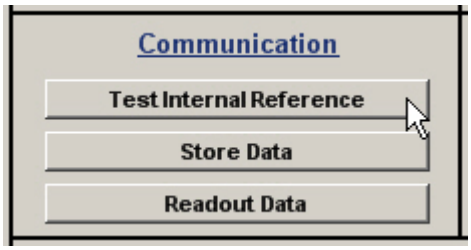
Admissible values for the speeds:	100 up to 20000 Hz (in 100 Hz steps, according to other units)
Admissible values for the ramp:	1 to 255



c) Entry of direction (only with reference travels):
Enter the direction of the selected reference travel in the *Direction* choice field.



d) Function test:
By activating the *Test (Function)* button, the current auto mode is transferred to the PDx-I and started. The parameters are not stored by the control unit.



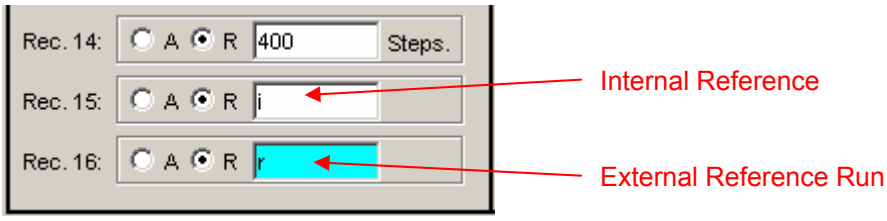
e) End function test
By activating the *Stop* button, the active auto mode is ended.

f) Store data
To store the set parameters of the auto modes permanently in the PDx-I, activate the *Store data* button. The transfer is optically shown with a bar. Then the modes are selected and started via the inputs of the PDx-I.

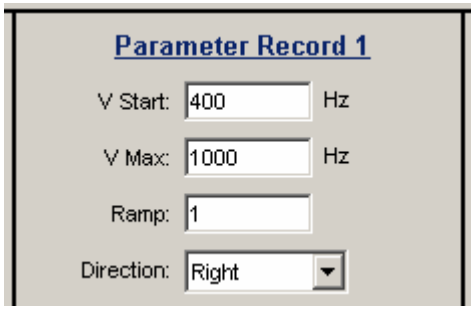
9.11.7 *Entry of Reference Travels*

(Reference travels, see also Chapter 7)

Individual travel profiles can be programmed as reference travel (internal or external) in the position and flag position mode. For the entry of a reference travel, enter an “I” or and “i” for the internal reference travel and/or an “r” order “r” for the external reference travel in the entry field for the distance.



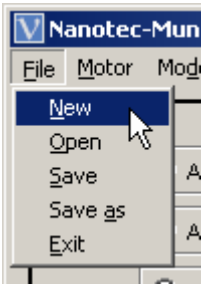
The entry of speeds, ramp and direction is similar to the entry of the travel profiles.



The reference travels can be started by activating the *Test Record …* buttons. The parameters are not stored by the control unit.

By activating the Store data button, in addition to the travel profiles entered, the parameters of the reference travels are transferred to the PDx-I and can be selected and started via the inputs.

9.11.8 Data Menu



In the Data menu the settings can be stored, opened and the program may be ended.

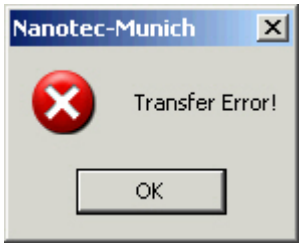
9.11.9 Error Messages

a) Communication error

This message appears when the data transmission to the PDx-l is not possible.
The following causes can be responsible:

- the wrong COM Port is set (see *Settings of the COM-Port* 9.11.10)
- the communication cable is not connected or interrupted.
- a non-existing motor number is set
- power supply of the PDc-l is interrupted

b) Transfer error



This message appears when the data transmission to the PDx-l is disturbed (sender or receiver are disturbed).
The following causes can be responsible:

- wrong laying of the communication cable (to be laid separately in motor and supply lines).
- Cable is not shielded
- Rs-485 wires not twisted in pairs
- the resistances for the resting levels do not exist in the communication line.
- the bus final resistances do not exist

c) The control unit is not prepared

If during the output of a travel profile, inadmissible data are tried to be sent to the control unit, the above shown message appears. By pressing the *Yes* button, the travel profile is stopped and the PDx-I changes into the “Ready” condition. Then the data can be again transferred to the control unit. By activating the *No* button, the travel profile is continued to be output.

d) The control unit is not active

If during the output of the speed profile, a reset of the control unit is made (by switching the operating voltage on and off), a change of the frequency is no longer possible in the speed mode, the message *„Control not active“* is shown. After activation of the *OK* button, the speed mode can be started again.

e) Position error

If the button is activated when the control is in the error mode (position error or limit switch in normal operation), the message "*Position error!*" is shown. The error can be reset by activation of the *Yes* button.

f) Input 1 active

If a button is activated, when a travel profile is already completed and Input 1 is still active, the above error message appears. After deactivation of the input, the desired button can be activated.

g) Motor version

The version test is failed, the version of the control unit entered (motor entered) differs from the currently connected version. The version is changed by confirmation with *Yes*.

9.11.10 Setting of the COM port

To set the COM port, select the *CommPort* menu item in the *Communication* menu.

Select the free COM port in the *Connection* drop down menu of the free COM port at which the PDx-I is connected by the RS232/485 converter.

By clicking onto the *OK* button, the setting is taken over.

10. Communication

The PDx-I is configured as a pure slave, it sends data only on request of an overriding control.

10.1 The Overriding Control

Each data packet of the overriding control consists of the following components:
- Start byte
- Address
- Command
- Data (depending on the command)
- CR

Start byte	Address	Command	Data	CR
#	Address number	1 byte	0 to n bytes	1 byte

Each byte consists of 1 start byte, 8 data bits and 1 stop bit without parity bit. The baud rate is permanently set at 19200 bauds.

a) Start byte and address
Each communication with a PDx-I starts with the start byte „#“ followed by the motor address. The activated address is to be unique when several controls are used in the network to avoid collision when several controls answer. Valid addresses are the values 1 to 249, the address 255 is the general address (all PDx-I are addressed).

b) Command
The command byte includes the action of the PDx-I to be carried out.

c) Data
According to the command, a certain number of data bytes are transferred. The prescribed number of bytes must be adhered to. The control commands are not followed by data bytes.

d) CR (Carriage Return)
Each data packet is concluded with <CR>.

10.2 Data Acceptance by the PDx-I

The data packet sent by the overriding control unit is first read into the receipt buffer. On successful transmission, the data are taken over by the PDx-I and the corresponding command is carried out. If the transmission is incorrect, the data received are rejected. With the exception of the start bytes, all other bytes received are directly returned to the sender after receipt as echo (exception: commands which use the general address). On reading commands, the data bytes are attached to the command byte and concluded with CR.

Dead time: On an interruption of the data packet for a duration of more than 2 seconds, all data already received are rejected.

10.3 Commands and data

Note: For commands which trigger a storage of the data sent, the storing time is to be taken into consideration. After expiry of this period, communication with the control is again enabled.

10.3.1 Read Commands

a) StatusQuery

Command:	Character„$“	ASCII Hex 24	ASCII Dec 36

Example (hex):	23	01	24	0D

<#> <Motor address (1)> <$> <CR>

Answer (hex):	01	24	13	0D

<Motor address (1)> <$> <Status byte> <CR>

Structure of status byte:
Bit 0: 1 = ready / 0 = not ready
Bit 1: 1 = Reference position (internal 0 position) reached
Bit 2: 1 = Position error (speed control or limit switch enabled
Bit 3: 1 = Travel profile ended and start input still active
Bit 4: 1 = Position mode active
Bit 5: 1 = Speed mode active
Bit 6: 1 = Flag position mode active
Bit 7: 1 = Clock direction active (Bit 0 (ready) always set)

b) Query of the Motor Address

Command:	Character„M“	ASCII Hex 4D	ASCII Dec 77

Example (hex):

23	FF	4D	0D

<#> <Global motor address (255)> <M> <CR>

Answer (hex):

FF	4D	30	30	31	0D

<Motor address (255)> <M> <Motor address (001)> <CR>

The motor address is transmitted in 3 data bytes (3-digit address).

Sending the command is only admissible in the “ready” state.

As the global motor address is used with this command, a PDx-I may only be connected to the overriding control!

c) Reading of Stored Data (3 byte Storage Address)

Command:	Character„Z“	ASCII Hex 5A	ASCII Dec 90

Example (hex):

23	01	5A	30	31	30	0D

<#> <Motor address (1)> <Z> <Storage address (010)> <CR>

Antwort (Hex):

01	5A	30	31	30	32	30	30	0D

<Motor address (1)> <Z> <Storage address (010)> <Data (200)> <CR>

Storage address and data:
The following table shows the stored data and the relevant address (decimal) in the EEPROM of the PDx-I. In the answer packet, first the command and the storage address are repeated, then the three data bytes (3-digit address content) are sent.

Add.	Parameter	Add.	Parameter
000	Step mode	019	Steps H byte record 1
001	Motor address	020	Start frequency record 1
002	Mode of operation	021	Max. fr. 1 record 1
003	Phase current	022	Max. fr. 2 record 1
004	Current reduction	023	Ramp factor record 1
005	Limit sw. ext. reference	024	Direction record 1
006	Limit sw. int. reference	025	Direction revers. record 1
007	Limit sw. ext. operation	026	Break record 1
008	Limit sw. int. operation	027	Travel record 1
009	Limit sw. type external	028	
010	Reverse clearance L byte	029	
011	Reverse clearance H byte	030	Position type record 2
012	Motor step angle 1	031	Steps L byte record 2
013	Motor step angle 2	032	Steps M byte record 2
014		033	Steps H byte record 2
015		034	Start frequency record 2
016	Position type record 1	035	Max. fr. 1 record 2
017	Steps L byte record 1	036	Max. fr. 2 record 2
018	Steps M byte record 1	037	Ramp factor record 2

Add.	Parameter	Add.	Parameter
038	Direction record 2	088	Steps M byte record 6
039	Direction revers. record 2	089	Steps H byte record 6
040	Break record 2	090	Start frequency record 6
041	Travels record 2	091	Max. fr. 1 record 6
042		092	Max. fr. 2 record 6
043		093	Ramp factor record 6
044	Position type record 3	094	Direction record 6
045	Steps L byte record 3	095	Direction revers. record 6
046	Steps M byte record 3	096	Break record 6
047	Steps H byte record 3	097	Travels record 6
048	Start frequency record 3	098	
049	Max. fr. 1 record 3	099	
050	Max. fr. 2 record 3	100	Position type record 7
051	Ramp factor record 3	101	Steps L byte record 7
052	Direction record 3	102	Steps M byte record 7
053	Direction revers. record 3	103	Steps H byte record 7
054	Break record 3	104	Start frequency record 7
055	Travels record 3	105	Max. fr. 1 record 7
056		106	Max. fr. 2 record 7
057		107	Ramp factor record 7
058	Position type record 4	108	Direction record 7
059	Steps L byte record 4	109	Direction revers. record 7
060	Steps M byte record 4	110	Break record 7
061	Steps H byte record 4	111	Travels record 7
062	Start frequency record 4	112	
063	Max. fr. 1 record 4	113	
064	Max. fr. 2 record 4	114	Position type record 8
065	Ramp factor record 4	115	Steps L byte record 8
066	Direction record 4	116	Steps M byte record 8
067	Direction revers. record 4	117	Steps H byte record 8
068	Break record 4	118	Start frequency record 8
069	Travels record 4	119	Max. fr. 1 record 8
070		120	Max. fr. 2 record 8
071		121	Ramp factor record 8
072	Position type record 5	122	Direction record 8
073	Steps L byte record 5	123	Direction revers. record 8
074	Steps M byte record 5	124	Break record 8
075	Steps H byte record 5	125	Travels record 8
076	Start frequency record 5	126	
077	Max. fr. 1 record 5	127	
078	Max. fr. 2 record 5	128	Position type record 9
079	Ramp factor record 5	129	Steps L byte record 9
080	Direction record 5	130	Steps M byte record 9
081	Direction revers. record 5	131	Steps H byte record 9
082	Break record 5	132	Start frequency record 9
083	Travels record 5	133	Max. fr. 1 record 9
084		134	Max. fr. 2 record 9
085		135	Ramp factor record 9
086	Position type record 6	136	Direction record 9
087	Steps L byte record 6	137	Direction revers. record 9

Add.	Parameter	Add.	Parameter
138	Break record 9	190	Max. fr. 2 record 13
139	Travels record 9	191	Ramp factor record 13
140		192	Direction record 13
141		193	Direction revers. record 13
142	Position type record 10	194	Break record 13
143	Steps L byte record 10	195	Travels record 13
144	Steps M byte record 10	196	
145	Steps H byte record 10	197	
146	Start frequency record 10	198	Position type record 14
147	Max. fr. 1 record 10	199	Steps L byte record 14
148	Max. fr. 2 record 10	201	Steps M byte record 14
149	Ramp factor record 10	202	Steps H byte record 14
150	Direction record 10	203	Start frequency record 14
151	Direction revers. record 10	204	Max. fr. 1 record 14
152	Break record 10	205	Max. fr. 2 record 14
153	Travels record 10	206	Ramp factor record 14
154		207	Direction record 14
155		208	Direction revers. record 14
156	Position type record 11	209	Break record 14
157	Steps L byte record 11	210	Travels record 14
158	Steps M byte record 11	211	
159	Steps H byte record 11	212	
160	Start frequency record 11	213	Position type record 15
161	Max. fr. 1 record 11	214	Steps L byte record 15
162	Max. fr. 2 record 11	215	Steps M byte record 15
163	Ramp factor record 11	216	Steps H byte record 15
164	Direction record 11	217	Start frequency record 15
165	Direction revers. record 11	218	Max. fr. 1 record 15
166	Break record 11	219	Max. fr. 2 record 15
167	Travels record 11	220	Ramp factor record 15
168		221	Direction record 15
169		222	Direction revers. record 15
170	Position type record 12	223	Break record 15
171	Steps L byte record 12	224	Travels record 15
172	Steps M byte record 12	225	
173	Steps H byte record 12	226	
174	Start frequency record 12	227	Position type record 16
175	Max. fr. 1 record 12	228	Steps L byte record 16
176	Max. fr. 2 record 12	229	Steps M byte record 16
177	Ramp factor record 12	230	Steps H byte record 16
178	Direction record 12	231	Start frequency record 16
179	Direction revers. record 12	232	Max. fr. 1 record 16
180	Break record 12	233	Max. fr. 2 record 16
181	Travels record 12	234	Ramp factor record 16
182		235	Direction record 16
183		236	Direction revers. record 16
184	Position type record 13	237	Break record 16
185	Steps L byte record 13	238	Travels record 16
186	Steps M byte record 13		
187	Steps H byte record13		
188	Start frequency record 13		
189	Max. fr. 1 record 13		

Sending the command is only admissible in the “ready” state.

Note:
The step angle (set on address 12 and 13) has two characters:

Step angle 1,8° ⇨ Address 12 = „1“ (Hex 31)
Address 13 = „8“ (Hex 38)
Step angle 0.9° ⇨ Address 12 = „0“ (Hex 30)
Address 13 = „9“ (Hex 39)

Example: Query of the step mode:

Example (hex):

23	01	5A	30	30	30	0D

<#> <Motor address (1)> <Z> <Storage address (000)> <CR>

Answer (hex):

01	5A	30	30	30	30	30	31	0D

<Motor address (1)> <Z> <Storage address (000)> <Data (001)> <CR>

⇨ Data = 001 ⇔ Step mode „Full step“

d) Reading of Actual Position (9 Byte Position)

Command:

Character„C“	ASCII Hex 43	ASCII Dec 67

Example (hex):

23	01	43	0D

<#> <Motor address (1)> <C> <CR>

Answer (Hex):

01	43	30	30	30	30	30	31	31
34	34	0D						

<Motor address (1)> <C> <Position (000001144)> < CR>

Position:
The position is sent as decimal contents of the storage of the three position bytes.
Example: The position was sent as 000001144 (see above) and converted as follows:

1. Byte * 65536 ⇨ 000 * 65536 = 0
2. Byte * 256 ⇨ 001 * 256 = 256
3. Byte * 1 ⇨ 144 *1 = 144
⇨ Position: = 400

If the calculated position value is larger than 8.388.607, this is a negative position. The calculated value has to be deducted from the possible maximum value 16.777.216.

Sending the command is only admissible in the “ready” state.

10.3.2 Writing Commands

a) Set motor address (1 or 2 bytes motor address)

Command:	Character„m“	ASCII Hex 6D	ASCII Dec 109

Example (hex):	23	FF	6D	31	0D

<#> <Motor address (255)> <m> <Motor address (1)> <CR>

Answer (hex):	FF	6D	31	0D

<Motor address (255)> <m> <Motor address (1)> <CR>

A value between 1 and 249 is admissible for the *Motor address*. The allocated address is taken over by the PDx-l and stored.
As the global motor address is used with this command, a PDx-l may only be connected to the overriding control!

Sending the command is only admissible in the “ready” state.

b) Set step mode (1 or 2 bytes step address)

Command:	Character„g“	ASCII Hex 67	ASCII Dez 103

Example (hex):	23	01	67	31	0D

<#> <Motor address (1)> <g> <Step mode (1)> <CR>

Antwort (Hex):	01	67	31	0D

<Motor address (1)> <g> <Step mode (1)> <CR>

Explanation of step mode:

„1“ (Hex 31):	Full step
„2“ (Hex 32):	Half step
„4“ (Hex 34):	Quarter step
„5“ (Hex 35):	Fifth step
„8“ (Hex 38):	Eighth step
„10“ (Hex 31; 30):	Tenth step

The step mode is stored by PDx-l (duration: approx. 4 ms) and the control is again initialised.

Sending the command is only admissible in the “ready” state.

c) Set phase current (2to 3 bytes phase current)

Command:	Character„i“	ASCII Hex 69	ASCII Dec 105

Example (hex):	23	01	69	31	30	30	0D

<#> <Motor address (1)> <i> <Phase current (100)> <CR>

Answer (hex):	01	69	31	30	30	0D

<Motor address (1)> <i> <Phase current (100)> <CR>

Explanation of phase current:

„25“ (Hex 32; 35): Phase current 25 % of nominal current
„50“ (Hex 35; 30): Phase current 50 % of nominal current
„75“ (Hex 37; 35): Phase current 75 % of nominal current
„100“ (Hex 31; 30; 30): Phase current 100 % of nominal current
„125“ (Hex 31; 32; 35): Phase current 125 % of nominal current

The phase mode is stored by PDx-I (duration: approx. 4 ms) and the control is again initialised.

Sending the command is only admissible in the “ready” state.

d) Set current reduction (2 or 3 bytes current reduction)

Command:	Character„r“	ASCII Hex 72	ASCII Dec 114

Example (hex):	23	01	72	32	35	0D

<#> <Motor address (1)> <r> <Current reduction (25)> <CR>

Answer (hex):	01	72	32	35	0D

<Motor address (1)> <r> <Current reduction (25)> <CR>

Explanation of current reduction:

„25“ (Hex 32; 35): Reduction to 25 % of phase current
„50“ (Hex 35; 30): Reduction to 50 % of phase current
„75“ (Hex 37; 35): Reduction to 75 % of phase current
„100“ (Hex 31; 30; 30): No current reduction

The current reduction is stored by PDx-I (duration: approx. 4 ms).

e) Set mode of operation (1 byte mode of operation)

Command:	Character„!“	ASCII Hex 21	ASCII Dec 33

Example (hex):

23	01	21	31	0D

<#> <Motor address (1)> <!> <Mode of operation (1)> <CR>

Answer (Hex):

01	21	31	0D

<Motor address (1)> <!> <Mode of operation (1)> <CR>

Explanation of mode of operation:
„1“ (Hex 31): Position mode
„2“ (Hex 32): Speed Mode
„3“ (Hex 33): Flag position mode
„4“ (Hex 34): Clock direction

The mode of operation sent is taken over into the main memory and written into the EEPROM after the command *Save record* has been carried out.

Sending the command is only admissible in the “ready” state.

f) Set type of position(1 byte position type)

Command:	Character„p“	ASCII Hex 70	ASCII Dez 112

Example (hex):

23	01	70	31	0D

<#> <Motor address (1)> <p> <Position type (1)> <CR>

Answer (hex):

01	70	31	0D

<Motor addresse (1)> <p> <Position type (1)> <CR>

Explanation of position type:
„1“ (Hex 31): Relative position
„2“ (Hex 32): Absolute position
„3“ (Hex 33): Internal reference travel
„4“ (Hex 34): External reference travel

The type of position sent is taken over into the main memory and written into the EEPROM after the command *Save record* has been carried out.

Sending the command is only admissible in the “ready” state.

g) Set steps (1 to 8 bytes step steps)

Command:	Character„s“	ASCII Hex 73	ASCII Dec 115

Example (hex):	23	01	73	31	30	30	0D
	<#>	<Motor address (1)>	<s>	<Steps (100)>			<CR>

Answer (hex):	01	73	31	30	30	0D
	<Motor address (1)>	<s>	<Steps (100)>			<CR>

Steps
Max. at relative position: 16.777.215
Max. at absolute position: ± 8.388.607

On absolute position, the sign is prefixed to the steps as additional byte.

Character„+“	ASCII Hex 2B
Character„-“	ASCII Hex 2D

The steps sent are taken over into the main memory and written into the EEPROM after the command *Save record* has been carried out.

Sending the command is only admissible in the “ready” state.

h) Set start frequency (3 to 5 bytes start frequency)

Command:	Character„u“	ASCII Hex 75	ASCII Dec 117

Example (hex):	23	01	75	34	30	30	0D
	<#>	<Motor address (1)>	<u>	<Start frequency (400)>			<CR>

Answer (hex):	01	75	34	30	30	0D
	<Motor address (1)>	<u>	<Start frequency (400)>			<CR>

Start frequency
The start frequency is transferred in 3 to 5 data bytes to the PDx-l.
Range: 100 Hz to 20000 kHz in 100 Hz steps

The start frequency sent is taken over into the main memory and written into the EEPROM after the command *Save record* has been carried out.

Sending the command is only admissible in the “ready” state.

i) Set maximum frequency (3 to 5 bytes maximum frequency)

Command:	Character„o“	ASCII Hex 6F	ASCII Dec 111

Example (hex):	23	01	6F	31	30	30	30	0D

<#> <Motor address (1)> <o> <Max frequency (1000)> <CR>

Answer (hex):	01	6F	31	30	30	30	0D

<Motor address (1)> <o> <Max frequency (1000)> <CR>

Maximum frequency
The maximum frequency is transferred in 3 to 5 data bytes to the PDx-I.
Range: 100 Hz to 20000 kHz in 100 Hz steps

The maximum frequency sent is taken over into the main memory and written into the EEPROM after the command *Save record* has been carried out.

Sending the command is only admissible in the “ready” state.

j) Set maximum frequency 2 (3 to 5 bytes maximum frequency 2)

Command:	Character„n“	ASCII Hex 6E	ASCII Dec 110

Example (hex):	23	01	6E	32	30	30	30	0D

<#> <Motor address (1)> <n> <Max frequency2 (2000)> <CR>

Answer (hex):	01	6E	32	30	30	30	0D

<Motor address (1)> <n> <Max frequency 2 (2000)> <CR>

Maximum frequency 2 (only valid in flag position mode)
The maximum frequency 2 is transferred in 3 to 5 data bytes to the PDx-I.
Range: 100 Hz to 20000 kHz in 100 Hz steps

The maximum frequency 2 sent is taken over into the main memory and written into the EEPROM after the command *Save record* has been carried out.

Sending the command is only admissible in the “ready” state.

k) Set ramp (1 to 3 bytes ramp)

Command:	Character„b“	ASCII Hex 62	ASCII Dec 98

Example (hex):

23	01	62	35	0D

<#> <Motor address (1)> <b> <Ramp (5)> <CR>

Answer (hex):

01	62	35	0D

<Motor address (1)> <b> <Ramp (5)> <CR>

Ramp
The ramp is sent in 1 to 3 data bytes.
Range: 1 to 255

The ramp sent is taken over into the main memory and written into the EEPROM after the command *Save record* has been carried out.

Sending the command is only admissible in the “ready” state.

l) Set direction (1 byte direction)

Command:	Character„d“	ASCII Hex 64	ASCII Dec 100

Example (hex):

23	01	64	31	0D

<#> <Motor address (1)> <d> <Direction (1)> <CR>

Answer (hex):

01	64	31	0D

<Motor address (1)> <d> <Direction (1)> <CR>

Direction
The direction is sent as 1 byte.
Range:

Character„0“	ASCII Hex 30	left direction
Character„1“	ASCII Hex 31	right direction

The direction sent is taken over into the main memory and written into the EEPROM after the command *Save record* has been carried out.

Sending the command is only admissible in the “ready” state.

m) Set change of direction (1 byte change of direction)

Command:	Character„t“	ASCII Hex 74	ASCII Dec 116

Example (hex):

23	01	74	31	0D

<#> <Motor address (1)> <t> <Change of direction (1)> <CR>

Answer (hex):

01	74	31	0D

<Motor address (1)> <t> <Change of direction (1)> <CR>

Change of direction
The change of direction is sent as 1 byte.
Range:

Character„0“	ASCII Hex 30	Change of direction off
Character„1“	ASCII Hex 31	Change of direction on

The change of direction sent is taken over into the main memory and written into the EEPROM after the command *Save record* has been carried out.

Sending the command is only admissible in the “ready” state.

n) Set operations (1 to 3 bytes operations)

Command:	Character„W“	ASCII Hex 57	ASCII Dec 87

Example (hex):

23	01	57	32	0D

<#> <Motor address (1)> <W> <Operations (2)> <CR>

Answer (hex):

01	57	32	0D

<Motor address (1)> <W> <Operations (2)> <CR>

Operations
The operations are sent in 1 to 3 data bytes.
Range: 0 to 255

Operations = 0 ⇨ The travel profile is endless.
Operations 1 to 255 ⇨ The travel profile is successive according to the number of operations.

The operations sent are taken over into the main memory and written into the EEPROM after the command *Save record* has been carried out.

Sending the command is only admissible in the “ready” state.

o) Set break (1 to 3 bytes break)

Command:	Character„P“	ASCII Hex 50	ASCII Dec 80

Example (hex):

23	01	50	35	0D

<#> <Motor address (1)> < P > <Break (5)> <CR>

Answer (hex):

01	50	35	0D

<Motor address (1)> <P> <Break (5)> <CR>

Break
The break are sent in 1 to 3 data bytes.
Range: 1 to 255
Calculation of the break time: ⇨ sent value * 0.1 s = break

The break sent is taken over into the main memory and written into the EEPROM after the command *Save record* has been carried out.

Sending the command is only admissible in the “ready” state.

p) Set limit switch behaviour (int. and ext.) (2 or 3 bytes limit switch behaviour)

Command:	Character„l“	ASCII Hex 6C	ASCII Dec 108

Example (hex):

23	01	6C	69	31	0D

<#> <Motor address (1)> <l> <Limit switch behaviour. (i1)> <CR>

Answer (hex):

01	6C	69	31	0D

<Motor address (1)> <l> <Limit switch behaviour (i1)> <CR>

Limit switch behaviour
The limit switch behaviour is stored by PDx-I (duration: approx. 4 ms).

Sending the command is only admissible in the “ready” state.

The following settings for the are possible (DB = data byte):

1. DB	2. DB	3. DB	Limit switch behaviour
„i“	„1“	-	return at int. reference travel
„i“	„2“	-	forwards at int. reference travel
„e“	„1“	-	return at ext. reference travel
„e“	„2“	-	forwards at ext. reference travel
„i“	„b“	„0“	int. limit switch disabled in normal operation
„i“	„b“	„1“	int. limit switch return in normal operation
„i“	„b“	„2“	int. limit switch forwards in normal operation
„i“	„b“	„3“	int. limit switch stop in normal operation
„e“	„b“	„0“	ext. limit switch disabled in normal operation
„e“	„b“	„1“	ext. limit switch return in normal operation
„e“	„b“	„2“	ext. limit switch forwards in normal operation
„e“	„b“	„3“	ext. limit switch stop in normal operation

Sending the command is only admissible in the “ready” state.

q) Set limit switch type (opener or closer) (1 byte limit switch type)

Command:	Character „e“	ASCII Hex 65	ASCII Dec 101

Example (hex):

23	01	65	31	0D

<#> <Motor address (1)> <e> <Limit switch type (1)> <CR>

Answer (hex):

01	65	31	0D

<Motor address (1)> <e> <Limit switch type (1)> <CR>

Limit switch type
The limit switch is stored by PDx-I (duration: approx. 4 ms).
The following settings for the limit switch type are possible:

Character„0“	ASCII Hex 30	Limit switch type „Opener“
Character„1“	ASCII Hex 31	Limit switch type „Closer“

Sending the command is only admissible in the “ready” state.

r) Store record (1 or 2 byte record number)

Command:	Character„>“	ASCII Hex 3E	ASCII Dec 62

Example (hex):

23	01	3E	31	0D

<#> <Motor address (1)> <>> <Record number (1)> <CR>

Answer (hex):

01	3E	31	0D

<Motor address (1)> <>> <Record number (1)> <CR>

Record number
The data of the record currently on the desktop are stored in the EEPROM under the record number stated (duration: approx. 40 ms).
Range: „1“ to „16“ (record number 1 to 16)

Sending the command is only admissible in the “ready” state.

s) Set reverse clearance (1 to 4 bytes reverse clearance)

Command:	Character„z“	ASCII Hex 7A	ASCII Dec 122

Example (hex):

23	01	7A	32	30	0D

<#> <Motor address (1)> <z> <Reverse clearance (20)> <CR>

Answer (hex):

01	7A	32	30	0D

<Motor address (1)> <z> <Reverse clearance (20)> <CR>

Reverse clearance
On each change of direction of the motor in the position mode, the reverse clearance is added to the distance to be run.
Range: 0 (no reverse clearance; default) up to 9999 steps
The reverse clearance is stored by PDx-I (duration: approx. 8 ms).

Sending the command is only admissible in the “ready” state.

t) Reset actual position

Command:	Character„c“	ASCII Hex 63	ASCII Dec 99

Example (hex):

23	01	63	0D

<#> <Motor address (1)> <c> <CR>

Answer (hex):

01	63	0D

<Motor address (1)> <c> <CR>

This command resets the actual position in the PDx-I to 0.

Sending the command is only admissible in the “ready” state.

10.3.3 Control Commands

a) Start of the current travel profile

Command:	Character„A“	ASCII Hex 41	ASCII Dec 65

Example (hex):

23	01	41	0D

<#> <Motor address (1)> <A> <CR>

Answer (hex):

01	41	0D

<Motor address (1)> <A> <CR>

(correspondingly to the mode of operation, the travel profile stored in the main memory is started)

Sending the command is only admissible in the “ready” state.

b) Stop travel profile

Command:	Character„S“	ASCII Hex 53	ASCII Dec 83

Example (hex):

23	01	53	0D

<#> <Motor address (1)> <S> <CR>

Answer (hex):

01	53	0D

<Motor address (1)> <S> <CR>

(The currently activated travel profile is immediately interrupted)

c) Increase maximum frequency (only in speed mode)

Command:	Character„+“	ASCII Hex 2B	ASCII Dec 43

Example (hex):

23	01	2B	0D

<#> <Motor address (1)> <+> <CR>

Answer (hex):

01	2B	0D

<Motor address (1)> <+> <CR>

(The maximum speed is increased by 100 Hz [according to other units])

This command is only possible in the speed mode after the start command according 10.3.3 a).

d) Reduce maximum speed (only in speed mode)

Command:	Character„-“	ASCII Hex 2D	ASCII Dec 45

Example (hex):

23	01	2D	0D

<#> <Motor address (1)> <-> <CR>

Answer (hex):

01	2D	0D

<Motor address (1)> <-> <CR>

(The maximum speed is reduced by 100 Hz [according to other units])

This command is only possible in the speed mode after the start command according 10.3.3 a).

e) Trigger on (only in flag position mode)

Command:	Character„T“	ASCII Hex 54	ASCII Dec 84

Example (hex):

23	01	54	0D

<#> <Motor address (1)> <T> <CR>

Answer (hex):

01	54	0D

<Motor address (1)> <T> <CR>

The command starts the trigger in the flag position mode.

f) Reset position errors

Command:	Character „D“	ASCII Hex 44	ASCII Dec 68

Example (hex):

23	01	44	0D

<#> <Motor address (1)> <D> <CR>

Answer (hex):

01	44	0D

<Motor address (1)> <D> <CR>

The command resets the position errors.

This command is possible on recognition of a position error by the speed control.

10.3.4 Unknown Commands

Undefined commands are answered by the PDx-I with the following character:

Character„?“	ASCII Hex 3F	ASCII Dec 63

Example (hex):

23	01	5E	0D

<#> <Motor address (1)> <unknown command^> <CR>

Answer (hex):

01	5E	3F	0D

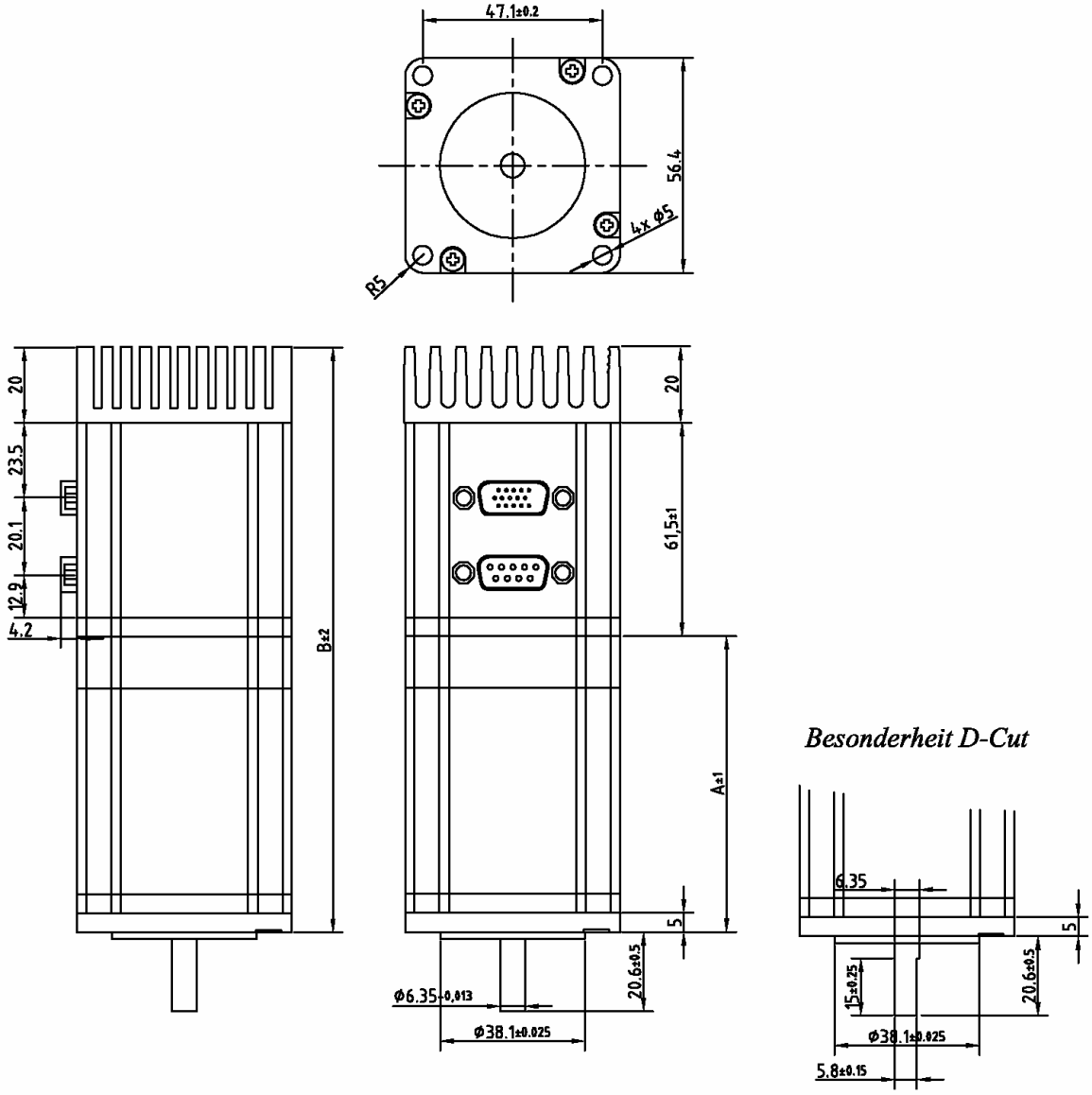
<Motor address (1)> <unknown command^> <?> <CR>

11. Technical Data

Operating voltage U_b	DC 21V to 48V ± 4%
Phase current	adjustable from 25% to 125 % of nominal current
Current reduction	0, 25%, 50%, 75% of phase current
Step resolution	Full step Half step Quarter step Fifth step Eighth step Ten step
Step angle:	PDx-Ixx09… 0,9° PDx-Ixx18… 1,8°
Clock frequency max.	Mode clock direction 30 kHz other modes 20 kHz
Inputs:	Optocoupler 24V ± 10% ≈ 10 mA Signal delay time: Inputs 1 to 5: 120 µs Input 6: 10 µs
Outputs	Open collector max. 30V ≈ 30 mA Signal delay time: Output 1 : Output 2 : ≈ 12 µs (at 10 kΩ pull up at 24 V)
Connection type	V_B and I/O: D-SUB 15 pin connector Interface: D-SUB 9 contact strip
Interface	RS-485 (4 wire) Dead time: 2 seconds 19200 Baud 1 start bit, 8 data bits, 1 stop bit No parity
max. cooling unit temperature	approx 80° C during full operation and depending on operation time, current reduction set and external cooling surfaces, external ventilation might be necessary.
max. ambient temperature	50° C

12. Dimensions

12.1 PD4-I57 series



Type	Step angle	Weight [kg]	Length A [mm]	Length B [mm]	Remarks
PD4-I5709X3208	0,9°	0,76	43,5	120	1st series with D cut
PD4-I5709S3208	0,9°	0,96	52,5	129	
PD4-I5709L3208	0,9°	1,30	77,5	154	1st series with D cut
PD4-I5718X3208	1,8°	0,76	43,5	120	D cut
PD4-I5718S3208	1,8°	0,96	52,5	129	
PD4-I5718L3208	1,8°	1,30	77,5	154	
PD4-I5718D3208	1,8°	2,06	115	191,5	Shaft diameter 10 mm

A

Absolut position 45, 72
Address 64

B

Break 9, 46, 77

C

Change in direction 9
Change of direction 46, 76
Charging capacitor 14
Clock direction mode 7, 54
Clock Direction Mode 12, 24
Clock frequency 83
Command 64, 65
Commissioning 35
Communication error 60
COM-Port 31
Converter 31
Counter 40, 43
Current reduction 6, 37, 71, 83

D

Data 59, 64
Data packet 64
Desktop 32
Direction 9, 11, 12, 46, 49, 52, 56, 75
Distance 8, 11, 40, 45, 52
Driving profile 7

F

Feed 40
Flag position mode 22
Flagposition mode 7, 11, 51
Free Run 26

I

Input 14, 17, 20, 22, 24, 83
Interface 83

L

Limit switch 41, 42, 77, 78

M

Machine parameter 39
Machine Settings 39
Maximum frequency 9
Maximum speed 9
  increase 80
  reduce 81
Mode of operation 43, 72
Motor address 33, 70
Motor Address 66
Motor number 36
Motor parameter 38
Motor standstill 8
Motornumber 34

N

Network 16, 33
Nominal current 6, 37

O

Operating voltage 83
Operations 9, 46, 76
Output 13, 14, 17, 20, 22, 24, 83

P

Phase current 6, 37, 71, 83
Position 43, 69
Position error 62
  reset 81
Position mode 7, 11, 38, 44, 53
Position type 8, 45, 72
Positioniermodus 17
Power loss 6
power pack 14
Profile parameters 8, 10, 11
Program installation 31
Programmino Software 31

R

Ramp 45, 49, 52, 55, 75
Ramp factor 9, 10, 12
Read Commands 65
Reading Commands 80
Record number 78
Record parameter 38
Record test 47
Reference run 7, 11, 12, 41, 58, 77
  external 26, 72
  internal 28, 72
Reference Run 26
Relative position 45, 72
Reverse clearance 7, 40, 79
Route graphics 46, 49, 53
RS485 16
Run profile 44, 51
  start 80
  stop 80
Run profiles 11

S

Speed 8, 10, 12, 40, 45, 49, 52, 55
Speed change 9
Speed control 5, 39
Speed Control 30
Speed mode 7, 9, 11, 48, 61
Speed Mode 21
Speed profile 9
Start byte 64
Start frequency 9, 73
Start speed 9
Status 65
Step angle 42, 69, 83

Step losses 8
Step mode 6, 36, 69, 70
Step resolution 83
Steps 73
Store data 50, 54, 57

T

Temperature 83
Transfer error 60
Trigger 53

W

Writing Commands 70