User Manual PNDS3

For Plug & Drive Studio 3 Version 3.1.9

User Manual Version: 1.3.2

Contents

1 Document aim and conventions

Beside technical data, this document explains product use and function. For possible combination with other Nanotec products, please ask your Nanotec sales partner. Before using the product, please note document font styles and conventions.

Underlined text marks a cross reference or hyperlink.

Example 1: Observe our safety notes.

Example 2: Download needed code templates from our website for EMEA / APAC or AMERICA.

Gray bold italics call out **menu paths, buttons, tab** and **file names**.

Example 1: Select **Home > Connect controller > CANopen**.

Example 2: In the **NanoJ** tab, select **NanoJ project** and open **Analog Input.cpp**.

Plain italics mark *Freehand entries* and *foreign-language* expressions. They also emphasize words of critical weight. Alternatively, bracketed exclaim marks(!) give critical weight.

Example 1: Enter *Plug & Drive Studio*. In addition to users (= *Nutzer; usuario; utente; utilisateur; utente* etc.), this document also addresses:

- Third-party users (= *Drittnutzer; tercero usuario; terceiro utente; tiers utilisateur; terzo utente* etc.).

- End users (= *Endnutzer; usuario final; utente final; utilisateur final; utente finale* etc.).

Example 2: Protect yourself, others and your equipment. Follow our *general* safety notes that are generally applicable to *all* Nanotec products. Also follow the *specific* safety notes that apply to *this* specific product.

`Courier` marks `code blocks` or `programming commands`.

Example 1: Via Bash, call `sudo make install` to copy shared objects; then call `ldconfig`.

Example 2: Use the following NanoLibAccessor function to change the logging level in NanoLib:

```
//
        ***** C++ variant *****
 void setLoggingLevel(LogLevel level);
```

The verb *to co-click*

Co-clicking means a mouse click by secondary key to open context menus etc.

Example 1: Co-click the file, select **Rename**, and rename the file.

Example 2: Co-click the file to check and select **Properties**.

Numerical values

Numbers appear in decimal. Hexadecimal notation ends in subscript *h.* Objects in the object dictionary notate in hexadecimal as `<Index>:<Subindex>`, non-notated subindices as `00`$_h$. Example: `1003`$_h$`:05`$_h$ is subindex 5 in object 1003$_h$. And `6040`$_h$ is subindex 00 in object 6040$_h$.

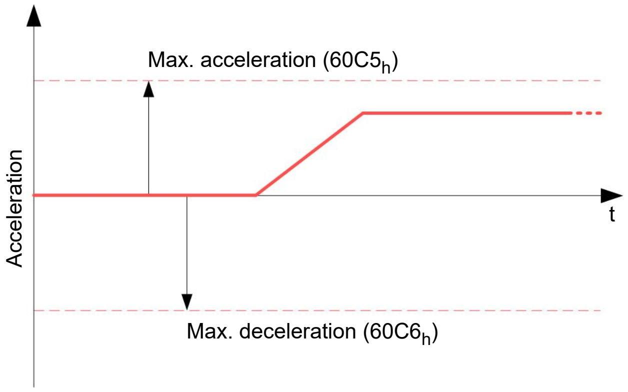
Bits

Each object bit counts up from LSB (bit number 0), such as data type *UNSIGNED8*:

	MSB							LSB	
Bit Nummer	7	6	5	4	3	2	1	0	
Bits	0	1	0	1	0	1	0	1	≙ 55$_{hex}$ ≙ 85$_{dec}$

Count direction (arrows)

Illustrations always count arrow-wards; both example objects 60C5$_h$ and 60C6$_h$ are thus positive.



2 For your safety

Before product use, please ensure that all users read, understand and follow the instructions in this document fully.

2.1 Warn and risk levels

Please note: our hazard warnings, alert symbols and signal words mark different risk levels.

CAUTION!

CAUTION warns of *possible physical danger!*

Minor / moderate injury possible.

► Instruction against **unhealthy** user errors.

NOTICE

A NOTICE warns of wrong operation.

Material or ecological damage possible (not strictly injury).

► Instruction against **destructive** user errors (= mere material risks).

Note: Explains or simplifies a process by additional information.

3 Before you start

Before product use, you need to prepare the PC and verify product intent / limits. Via online help, you can learn how to install and set up projects and how PNDS3 runs. Observe the safety notes in the manual (www.nanotec.com).

3.1 System and hardware requirements

Plug & Drive Studio 3 (PNDS3) needs 64-bit operating systems. Nanotec recommends controller firmware *FIR-v2213* or newer. PNDS3 offers a special control for firmware update.

PNDS3

v3.1.7

64-bit OS requirements

- Windows 10
- .NET Framework 4.8
- Display resolution 1920x1080

Fieldbus adapters / cables

- **CANopen:**
  - IXXAT USB-to-CAN V2
  - Nanotec ZK-USB-CAN-1
- **Modbus RTU:**
  - Nanotec ZK-USB-RS485-1 or equivalent USB-RS485 adapter
  - USB cable via virtual comport (VCP)
- **Modbus TCP:**
  - suitable ethernet cable
- **Ethernet (REST) , EtherCAT, Profinet:**
  - suitable ethernet cable
  - WinPcap 4.1.3, or Npcap installation, see Installation and adapter

3.2 Intended use and audience

NOTICE

Damage: from unskilled staff!

▶ Use the product only for the purpose described in this document.

▶ Restrict use to expert staff only.

▶ Follow valid OEM and system prescriptions for all equipment involved.

Plug & Drive Studio 3 (PNDS3) is a free software for easy Nanotec drive commissioning. The underlying operating system / hardware (PC) is **not** real-time capable. **Never** use PNDS3 for time-critical or synchronous multi-axis motion **nor** integrate it as a safety component in a product or system.

Add proper warnings and instructions for safe use / operation to each end user product with a Nanotec-produced component. Submit any Nanotec warning directly to end users. The product addresses skilled experts in industry use cases alone. Expert means:

- Training / experience in motor and controller handling
- Understanding this document plus Nanotec drive manuals
- Knowledge of valid regulations

3.3 Delivery scope and warranty

PNDS3 comes as a **.zip* folder from our download website for either EMEA / APAC or AMERICA. Duly store and unzip your download before setup. The product package contains:

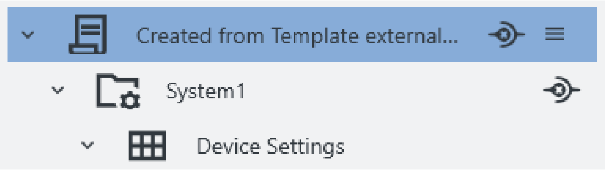
- Software as an executable file
- Project templates
- Current firmware release
- Online help file

For scope of warranty, please observe our terms and conditions for either EMEA / APAC or AMERICA. **Note:** Nanotec is not liable for wrong quality, handling, installation, operation, use, and maintenance of third-party equipment! Follow valid OEM instructions.

4 Your product

With PNDS3, you parametrize and commission Nanotec drives. Using templates for various Nanotec drives, you can add your own projects, systems and modules to the modular user interface. The software comes with a default folder structure (*Project, System, Module Group, Module,* etc.).

Project



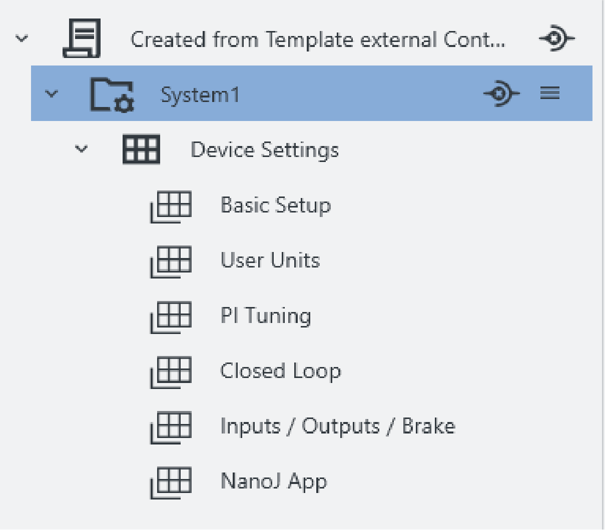
Created from Template external...

System1

Device Settings

You manage all settings and device parameters in projects, save these as a file and im- / export them, say, as a template. Such a reusable **Project** can have multiple systems, say, the axes of a machine.

System



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System1

Device Settings

Basic Setup

User Units

PI Tuning

Closed Loop

Inputs / Outputs / Brake

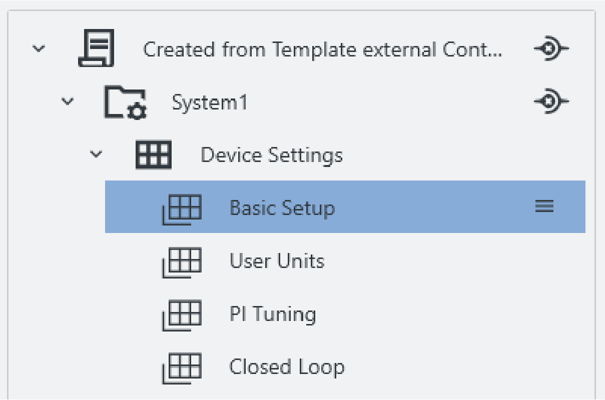
NanoJ App

In a project (here: external controller), you create and store drive systems (here: X-axis). Each is im- / exportable as template.

You can extend such a reusable **System**, of at least motor and controller, by modules or module groups for encoder, gearbox, brake, settings, parameters, etc.

By parameters, sortable / poolable into several modules or module groups, you quickly control all system elements.

Module (Group)



Created from Template external Cont...

System1

Device Settings

Basic Setup

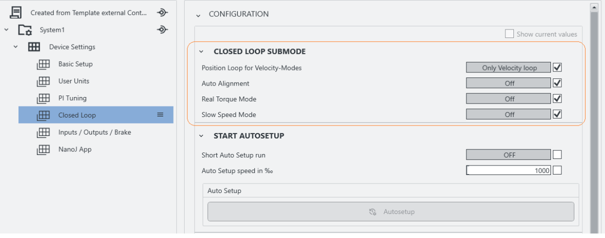
User Units

PI Tuning

Closed Loop

A module (group) contains parameters or controls (groups) and is im- / exportable, single or grouped, as template.

Controls Group



CLOSED LOOP SUBMODE

Position Loop for Velocity-Modes: Only Velocity loop ☑

Auto Alignment: Off ☑

Real Torque Mode: Off ☑

Slow Speed Mode: Off ☑

START AUTOSETUP

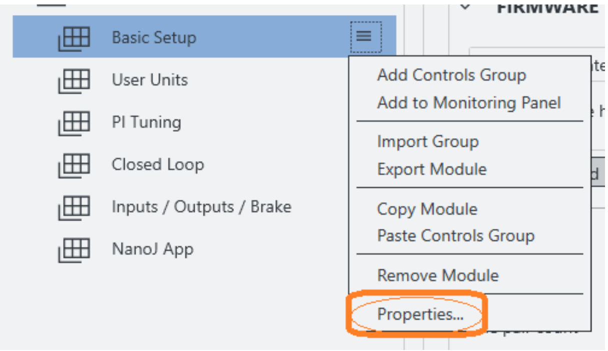
Short Auto Setup run: OFF □

Auto Setup speed in ‰: 1000 □

A **Controls group** pools single device parameters (objects from the dictionary in the controller) and / or **Special controls**.

You im- / export such a control group together with set values, say, as template.

Property editing



Simply co-click an element, select **Properties**, insert a visible name, version number, and description: This way you create your individual user interface.

5 Installation and adapter

Install the software, set up the adapter – and PNDS3 is ready to go. You find PNDS3 software online as a zip download.

1. Open the website **Nanotec > Products > Software > Plug & Drive Studio 3**.
2. Download and extract the product zip file.
3. Run the executable file **PNDS3.exe**.
4. Only with PNDS3 installed: Prepare your fieldbus adapter (see below).

CANopen

1. Decide: **Ixxat USB-to-CAN**? Or **Nanotec ZK-USB-CAN-1**?
2. For **Ixxat USB-to-CAN:** Download the driver (www.ixxat.com/); install it by hand.
3. Connect the adapter to the computer. For **Nanotec ZK-USB-CAN-1:** Wait for self-installation.
4. Via correct cable (see product manual): Connect the installed adapter to the controller.

USB: Nanotec Virtual COM-Port (VCP)

1. Connect the voltage supply to the controller and switch it on.
2. Via correct USB cable: Connect the PC to the controller (= "mass storage device").
3. In Explorer > Controller directory: Select `cfg.txt` (= `pd4ccfg.txt`for a PD4C).
4. Open the file via text editor (Notepad etc.).
5. Add the lines `2102|=0x100000` and `4015:01=0`. Save the file.
6. Restart the controller and check if its COM port appears in the device manager.

Modbus RTU

1. For **Nanotec ZK-USB-RS485-1**: Connect the adapter to the computer and wait for self-installation.
2. For **other equivalent adapters**: Follow valid OEM instructions to install the driver.

Modbus TCP

Configure the IP address of the drive and the ethernet adapter accordingly, as described in the drive manual.

EtherCAT

Install WinPcap 4.1.3 or Npcap and make sure the corresponding driver is activated for the designated ethernet adapter.

Profinet

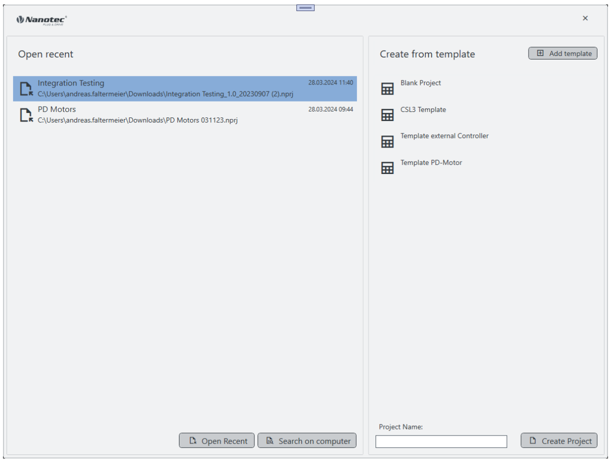
1. Install Win10cap or Npcap and make sure the corresponding driver is activated for the designated ethernet adapter.
2. Configure the IP address of the drive and the ethernet adapter accordingly, as described in the drive manual.

Ethernet (REST)

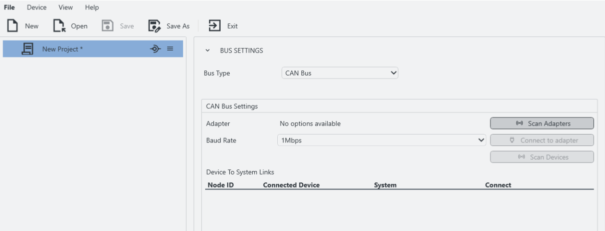
1. Install Npcap and make sure the corresponding driver is activated for the designated ethernet adapter.
2. Configure the IP address of the drive and the ethernet adapter accordingly, as described in the drive manual.

6 User interface (UI)

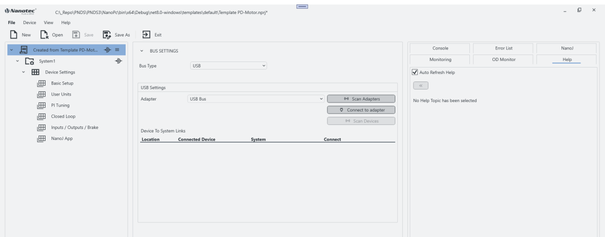
Thanks to flexible areas and windows, fitted into the main window or usable stand-alone, you can master a wide range of tasks. Before product use, please understand the UI structure.


Open recent
Integration Testing 28.03.2024 11:40
C:\Users\andreas.faltermeier\Downloads\Integration Testing_1.0_20230907 (2).nprj
PD Motors 28.03.2024 09:44
C:\Users\andreas.faltermeier\Downloads\PD Motors 031123.nprj
Open Recent
Search on computer
Create from template
Add template
Blank Project
CSL3 Template
Template external Controller
Template PD-Motor
Project Name:
Create Project

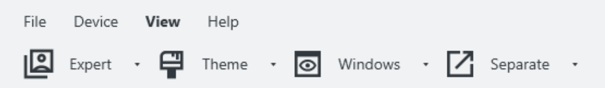
When PNDS3 starts for the first time, you are asked to create a new project: either a blank one or one based on a template.



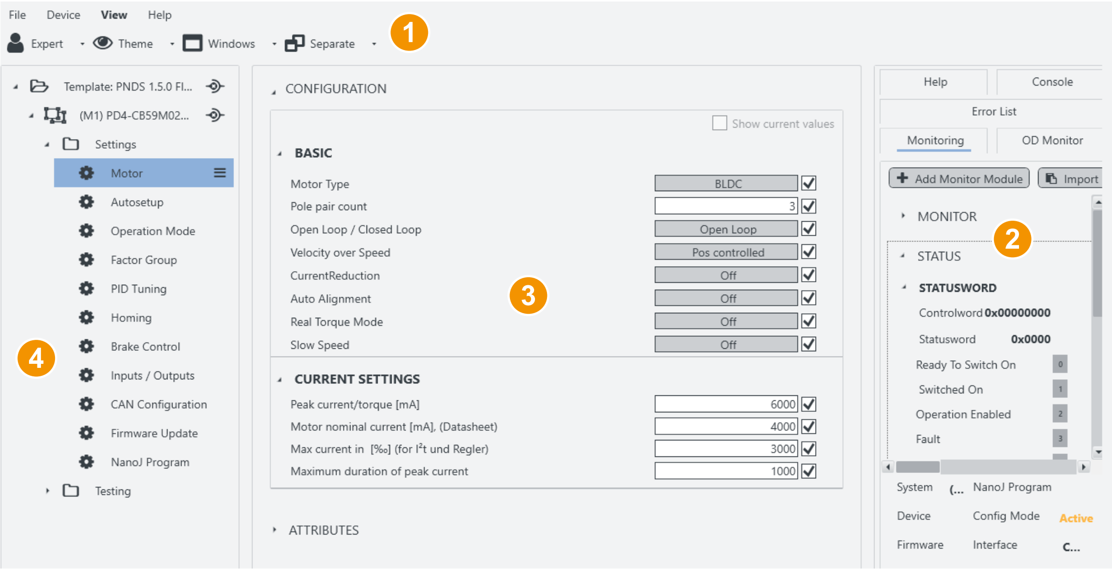
If you create a blank project, the project tree is empty at first.



If you create a new project or load a template, the interface fills up according to your needs. This way, you design your own UI.



Using the **View** options in the main menu you can further customize the UI by changing the theme, showing/hiding features or opening them in separate windows.



BASIC

Motor Type BLDC ☑
Pole pair count 3 ☑
Open Loop / Closed Loop Open Loop ☑
Velocity over Speed Pos controlled ☑
CurrentReduction Off ☑
Auto Alignment Off ☑
Real Torque Mode Off ☑
Slow Speed Off ☑

CURRENT SETTINGS

Peak current/torque [mA] 6000 ☑
Motor nominal current [mA], (Datasheet) 4000 ☑
Max current in [‰] (for I²t und Regler) 3000 ☑
Maximum duration of peak current 1000 ☑

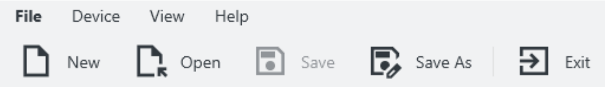
Controlword 0x00000000
Statusword 0x0000

- Header for main menu (1).
- Display wall (2) for monitoring, object directory, help etc.
- Work desk (3) for user controls etc.
- Project (or side) bar (4) for systems etc.

6.1 Header (1)

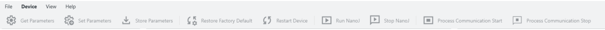
As a prominent layout bracket on top in the user interface, the UI header contains all basic functions and commands relevant to projects, devices and the UI view.

File



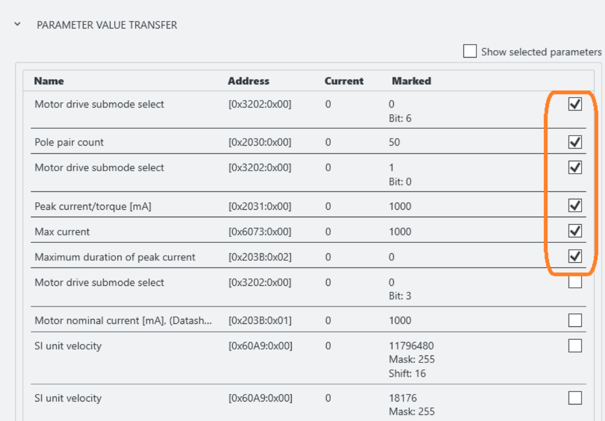
Leftmost above the header, you find the main menu for project files. You can load new – and save, reopen, edit existing projects.

Device



Read, write, and save device parameters. Govern NanoJ programs and fieldbus network (with CANopen).

Set Parameters: Transmits *the selected* parameter values to system-connected controllers.



PARAMETER VALUE TRANSFER

□ Show selected parameters

Name	Address	Current	Marked	
Motor drive submode select	[0x3202:0x00]	0	0 Bit: 6	☑
Pole pair count	[0x2030:0x00]	0	50	☑
Motor drive submode select	[0x3202:0x00]	0	1 Bit: 0	☑
Peak current/torque [mA]	[0x2031:0x00]	0	1000	☑
Max current	[0x6073:0x00]	0	1000	☑
Maximum duration of peak current	[0x203B:0x02]	0	0	☑
Motor drive submode select	[0x3202:0x00]	0	0 Bit: 3	□
Motor nominal current [mA], (Datash...	[0x203B:0x01]	0	1000	□
SI unit velocity	[0x60A9:0x00]	0	11796480 Mask: 255 Shift: 16	□
SI unit velocity	[0x60A9:0x00]	0	18176 Mask: 255	□

Note: You can select parameters to be set by ticking them. You can find a list of all used parameters under **Parameter Value Transfer** if you click the respective system.

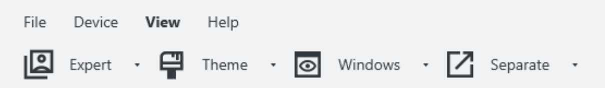
Get Parameters: *Reads* the values of system-connected controllers.

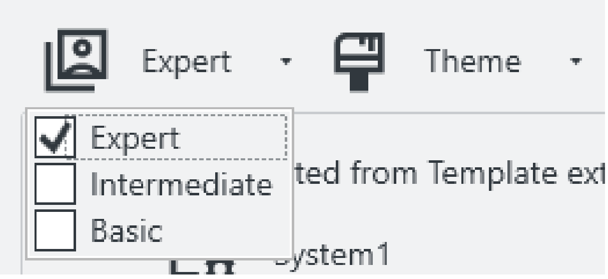
Store Parameters: *Stores* **Set**-transmitted values of system-connected controllers.

Restore Factory Default: The stored objects are discarded, with the exception of the category *Tuning* and the fieldbus-specific category. You can find further details in the chapter *Discarding the saved data* in the manual of your controller.

The change does not take effect until after the controller is restarted (**Restart Device**).

View



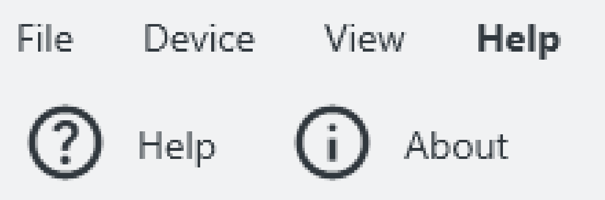


Here you can customize the UI by changing the theme, showing/hiding features or opening them in separate windows.

You can also set the **User level**, to govern user rights for the following roles:

- **Expert**: Project owner with all rights. May create and edit projects, rights, visibilities, etc. Governs via **Properties**, for each single parameter up to a complete **Controls group**, *who* may see and edit exactly *what*.
- **Intermediate**: May change device parameters, but can't edit a project.
- **Basic**: Similar to **Intermediate**, but often gets fewer editing rights from **Expert**.

Help

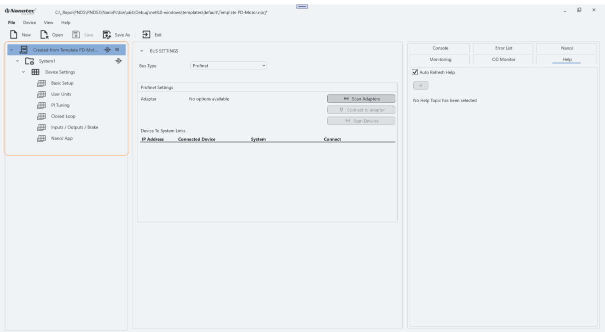


Open the online help or PNDS3 version info.

6.2 Project bar (4)

This side bar diplays your loaded project as a tree list by which you create the user interface. **Note:** Depending on assembly, you can check connections and attributes of all tree list items in the work desk (3).

Tree list



Bus Type: Profinet

Profinet Settings

Adapter: No options available

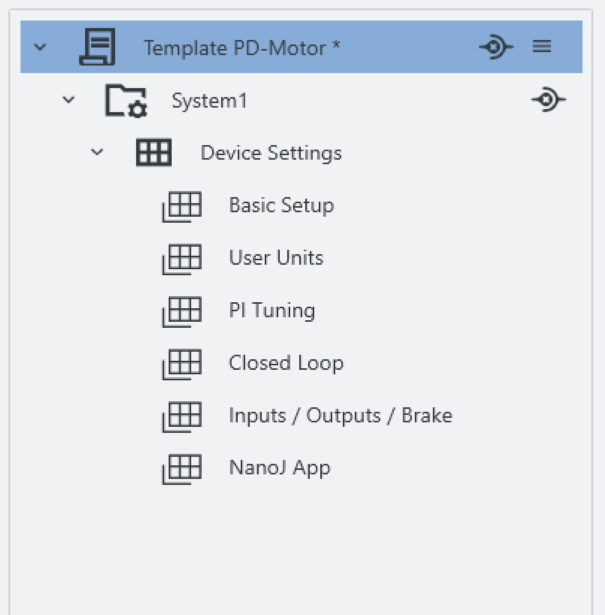
Device To System Links

IP Address	Connected Device	System	Connect

☑ Auto Refresh Help

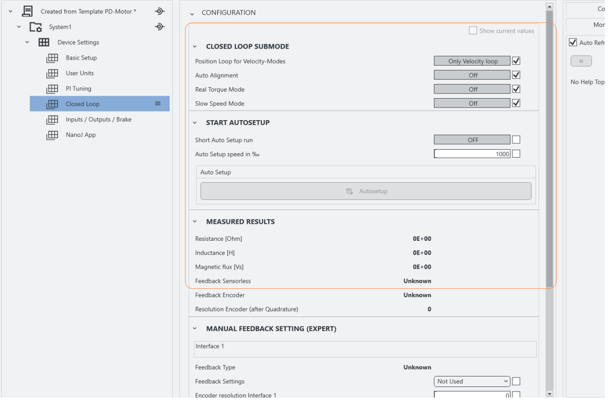
No Help Topic has been selected

You find the project bar in the very left of the user screen.



A project (here: for a *PD motor*) tree-lists all systems and the items therein (see also Project setup). *One* project and *one* system are minimum; further items are optional and later on define the entire UI layout.

System 1 contains the module groups *Quick Start* with modules for the basic settings and *Application Settings* with further controls and parameter groups.



□ Show current values

CLOSED LOOP SUBMODE

Position Loop for Velocity-Modes: Only Velocity loop ☑
Auto Alignment: Off ☑
Real Torque Mode: Off ☑
Slow Speed Mode: Off ☑

START AUTOSETUP

Short Auto Setup run: OFF □
Auto Setup speed in ‰: 1000 □

Auto Setup

MEASURED RESULTS

Resistance [Ohm]: 0E+00
Inductance [H]: 0E+00
Magnetic flux [Vs]: 0E+00
Feedback Sensorless: Unknown
Feedback Encoder: Unknown
Resolution Encoder (after Quadrature): 0

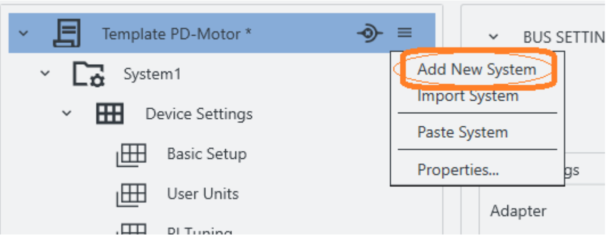
MANUAL FEEDBACK SETTING (EXPERT)

Interface 1

Feedback Type: Unknown
Feedback Settings: Not Used □
Encoder resolution Interface 1: 0 □

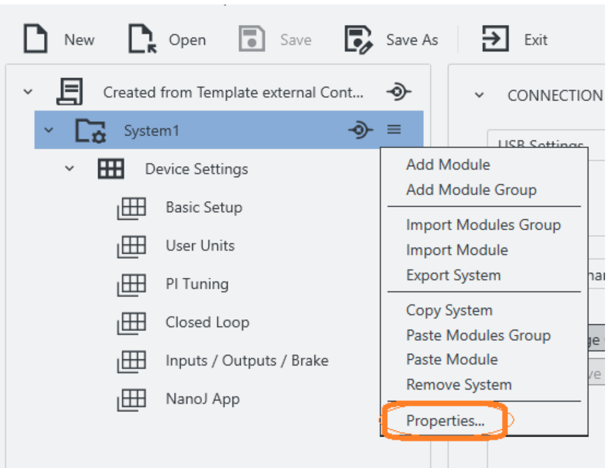
For each module, you may add one or more controls groups to the work desk (3) further to the right.

Project > System

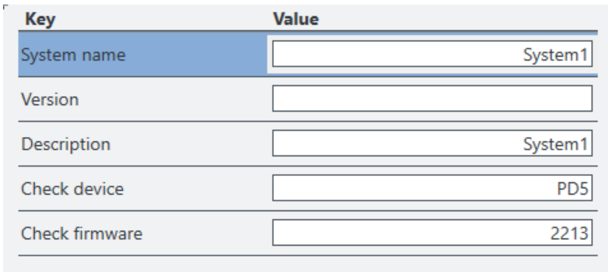


A system represents a motor with controller, that is, one per motor in a multi-axis application.

1. To set up a system: Co-click the project.
2. In the context menu: Either create a new system via **Add New System**.
3. Or fetch an existing one via **Import System**.



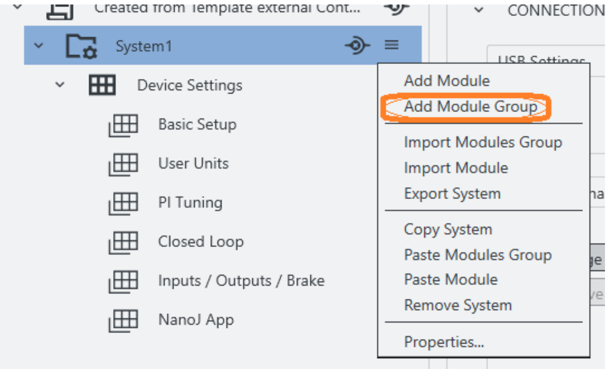
4. A new node (= blue) appears in the tree list.
5. To name it: Co-click the node, select **Properties**. **Note:** You can edit *any* object via **Properties**.



Key	Value
System name	System1
Version	
Description	System1
Check device	PD5
Check firmware	2213

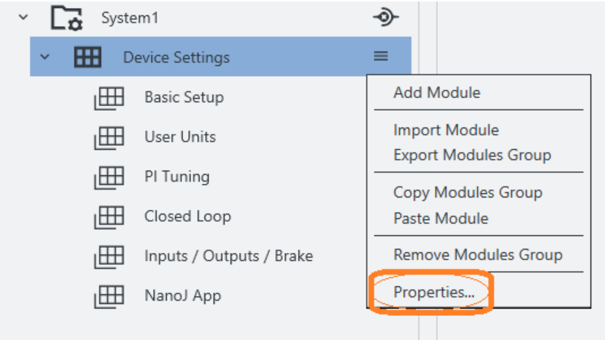
6. In the **Properties** window: Name the system as needed.
7. If needed: Versionize and describe the system. You can add a string for the device name and firmware version, which should be checked after connecting to a device.
8. After last entry: Set a tab stop (so that all is stored).
9. Assemble the system with module groups (see below).

Project > System > Module group

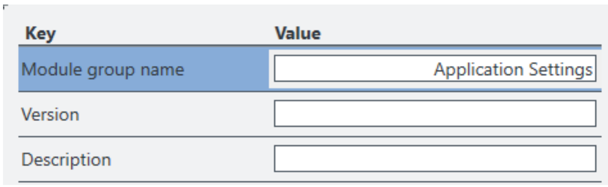


A module group bundles *several* motor functions (= modules). Depending on assembly, you can check its connections and attributes in the work desk (3).

1. To set up a module group: Co-click the system.
2. In the context menu: Either create a new module group via **Add module group**.
3. Or fetch an existing one via **Import module group**.



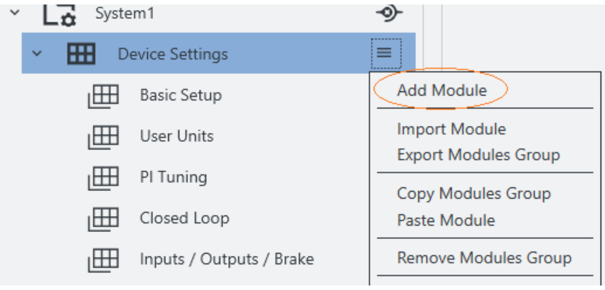
4. A new node appears in the tree list.
5. To name it: Co-click the node, select **Properties**.
   Note: You can edit *any* object via **Properties**.



Key	Value
Module group name	Application Settings
Version	
Description	

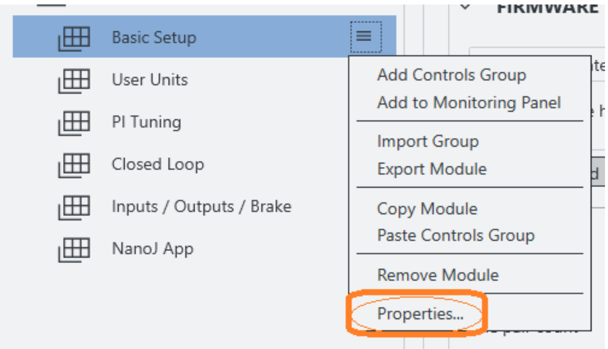
6. In the **Properties** window: Name the module group as needed (here: *Controller template*).
7. If needed: Versionize and describe the module group.
8. After last entry: Set a tab stop (so that all is stored).
9. Assemble the module group with modules (see below).

Project > System > Module group > Module

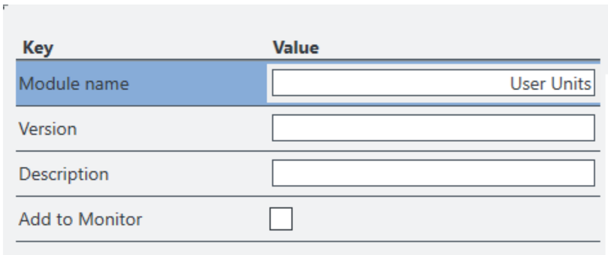


A module allows you to add a *single* motor function (= parameter set etc.). Depending on assembly, you can check its connections and attributes in the work desk (3).

1. To set up a module: Co-click the module group (here: *Controller template*).
2. In the context menu: Either create a new module via **Add Module**.
3. Or fetch an existing one via **Import Module**.



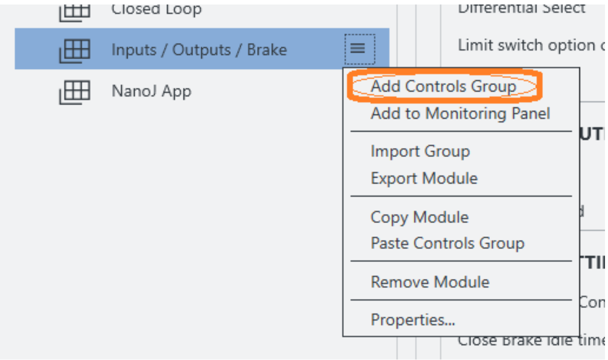
4. A new node appears in the tree list.
5. To name it: Co-click the node, select **Properties**.
   Note: You can edit *any* object via **Properties**.



Key	Value
Module name	User Units
Version	
Description	
Add to Monitor	□

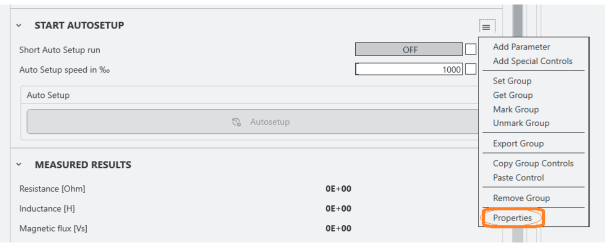
6. In the **Properties** window: Name the module as needed (here: *Communication settings*).
7. If needed: Versionize and describe the module, add it to a Monitor
8. After last entry: Set a tab stop (so that all is stored).

Project > System > Module group > Module > Controls group



A controls group bundles individual operating elements or parameter sets.

1. To set up a controls group: Co-click the module.
2. In the context menu: Either create a new controls group via **Add Controls Group**.
3. Or fetch an existing one via **Import Group**.



Short Auto Setup run: OFF

Auto Setup speed in ‰: 1000

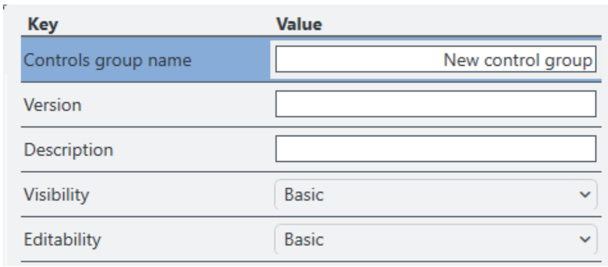
Auto Setup

Resistance [Ohm]: 0E+00

Inductance [H]: 0E+00

Magnetic flux [Vs]: 0E+00

4. In any case, the controls group appears in the work desk (3).
5. Right there: Co-click the group and its **Properties**.
   Note: You can edit *any* object via **Properties**.



Key	Value
Controls group name	New control group
Version	
Description	
Visibility	Basic
Editability	Basic

6. In the **Properties** window: Name the controls group as needed.
7. If needed: Versionize and describe the group.
   Note the pull-downs for granted viewing and editing rights (here: both *Basic*).
8. After last entry: Set a tab stop (so that all is stored).

6.3 Work desk (3)

At the work desk, in the user screen's half-left, you edit the properties / contents / controls of your project and systems. Depending on assembly, different tabs are above the worktable:

An **Attributes** area accompanies all items (also module groups); **Bus settings**, by contrast, only the project itself. The **Connection settings** tab, finally, is for systems only; and **Configuration** is only for modules. Each tab opens different aspects:

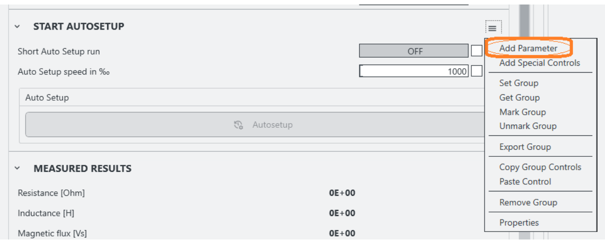
Controls groups Operator clusters

Parameters Operator values

Special controls Feature operators

Complex controls Multi-level operators

Controls group > Parameter



Short Auto Setup run: OFF

Auto Setup speed in ‰: 1000

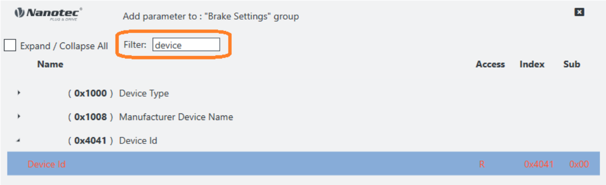
Auto Setup

Resistance [Ohm]: 0E+00

Inductance [H]: 0E+00

Magnetic flux [Vs]: 0E+00

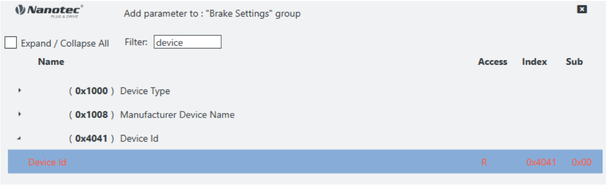
1. To add a parameter: Co-click the controls group and click **Add Parameter**.


Add parameter to : "Brake Settings" group

□ Expand / Collapse All   Filter: device

Name	Access	Index	Sub
(0x1000) Device Type			
(0x1008) Manufacturer Device Name			
(0x4041) Device Id			
Device Id	R	0x4041	0x00

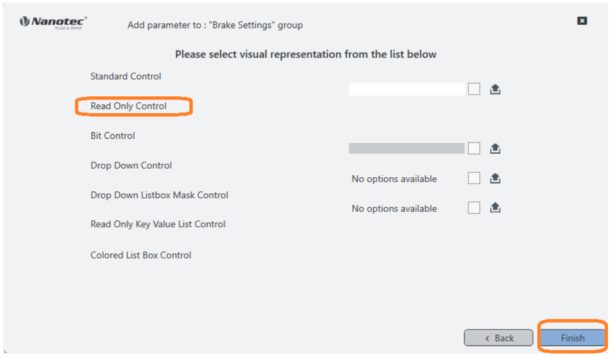
2. In the pop-up: Enter *device* or *0x4041* to filter for the **Device Id** object.


Add parameter to : "Brake Settings" group

□ Expand / Collapse All   Filter: device

Name	Access	Index	Sub
(0x1000) Device Type			
(0x1008) Manufacturer Device Name			
(0x4041) Device Id			
Device Id	R	0x4041	0x00

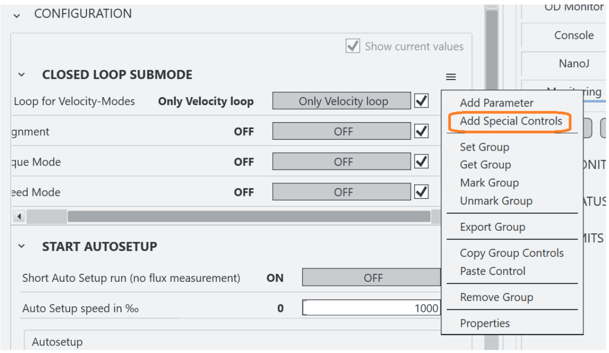
3. You may expand objects by mouse (or tick at **Expand all**).
4. Click **Device Id** and **Next** (if wrong: step **Back**).


Add parameter to : "Brake Settings" group

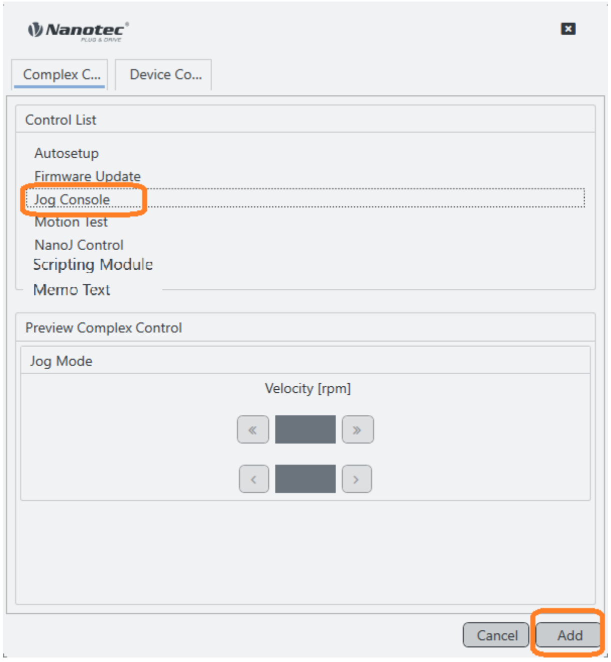
Please select visual representation from the list below

5. In the next pop-up: Select the visual reprentation and click **Finish**.

Controls group > Special controls



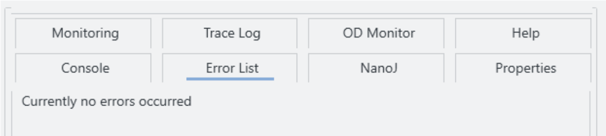
1. Co-klick a controls goup to open its context menu.
2. Select **Add Special Controls** to open the **Complex controls** list.



3. In the pop-up: Select the needed item.
4. To confirm: Click **Add**.

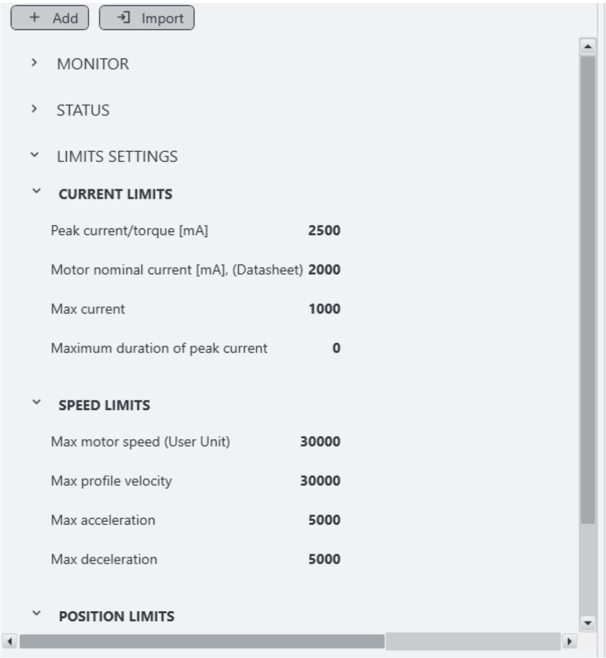
6.4 Display wall (2)

The display wall contains the monitors, error list, current OD values, properties, help and console.



Currently no errors occurred

Several tabs facilitate navigation in the display wall, in the user screen's upper right.



CURRENT LIMITS

Peak current/torque [mA]	2500
Motor nominal current [mA], (Datasheet)	2000
Max current	1000
Maximum duration of peak current	0

SPEED LIMITS

Max motor speed (User Unit)	30000
Max profile velocity	30000
Max acceleration	5000
Max deceleration	5000

POSITION LIMITS

In the **Monitoring** tab, you combine either single or grouped monitors to track individual system behavior in real time.

1. To set up a monitor: Co-click the tab **Monitoring**.
2. In the context menu: Either create a new monitor via **Add Monitor Module**.
3. Or fetch an existent one via **Import Module**.

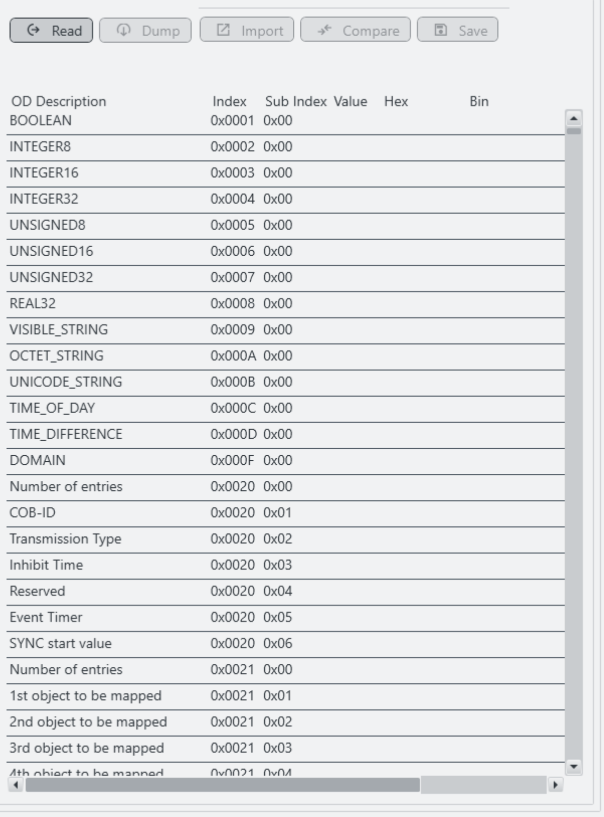
The bottom part of the monitor display contains always the system monitor which shows the current device and connection status information.

In the tab **Trace Log** you see live the messages that are transferred via the filedbus.

OD Monitor: Lists all objects from the controller's dictionary, together with their current values. For updates: Click **Read**.

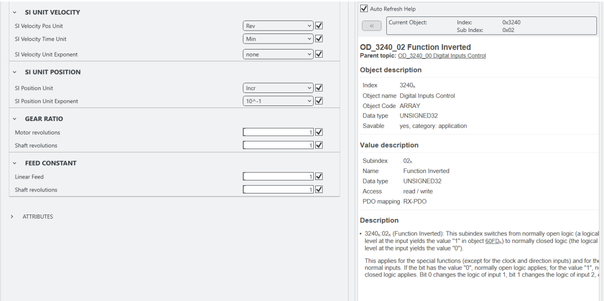
To save the list as a text file on the hard drive: Click **Dump**. Keep the text file with current values ready in case of support enquiries.

Ypu can import an already saved dump file, compare it with the current OD and save it on another controller.



OD Description	Index	Sub Index	Value	Hex	Bin
BOOLEAN	0x0001	0x00			
INTEGER8	0x0002	0x00			
INTEGER16	0x0003	0x00			
INTEGER32	0x0004	0x00			
UNSIGNED8	0x0005	0x00			
UNSIGNED16	0x0006	0x00			
UNSIGNED32	0x0007	0x00			
REAL32	0x0008	0x00			
VISIBLE_STRING	0x0009	0x00			
OCTET_STRING	0x000A	0x00			
UNICODE_STRING	0x000B	0x00			
TIME_OF_DAY	0x000C	0x00			
TIME_DIFFERENCE	0x000D	0x00			
DOMAIN	0x000F	0x00			
Number of entries	0x0020	0x00			
COB-ID	0x0020	0x01			
Transmission Type	0x0020	0x02			
Inhibit Time	0x0020	0x03			
Reserved	0x0020	0x04			
Event Timer	0x0020	0x05			
SYNC start value	0x0020	0x06			
Number of entries	0x0021	0x00			
1st object to be mapped	0x0021	0x01			
2nd object to be mapped	0x0021	0x02			
3rd object to be mapped	0x0021	0x03			
4th object to be mapped	0x0021	0x04			

Help: Displays the description of the currently chosen element (OD object).



SI UNIT VELOCITY
- SI Velocity Pos Unit: Rev ☑
- SI Velocity Time Unit: Min ☑
- SI Velocity Unit Exponent: none ☑

SI UNIT POSITION
- SI Position Unit: Incr ☑
- SI Position Unit Exponent: 10^-1 ☑

GEAR RATIO
- Motor revolutions: 1 ☑
- Shaft revolutions: 1 ☑

FEED CONSTANT
- Linear Feed: 1 ☑
- Shaft revolutions: 1 ☑

ATTRIBUTES

☑ Auto Refresh Help

Current Object: Index: 0x3240 Sub Index: 0x02

OD_3240_02 Function Inverted
Parent topic: OD_3240_00 Digital Inputs Control

Object description

Index	3240_h
Object name	Digital Inputs Control
Object Code	ARRAY
Data type	UNSIGNED32
Savable	yes, category: application

Value description

Subindex	02_h
Name	Function Inverted
Data type	UNSIGNED32
Access	read / write
PDO mapping	RX-PDO

Description

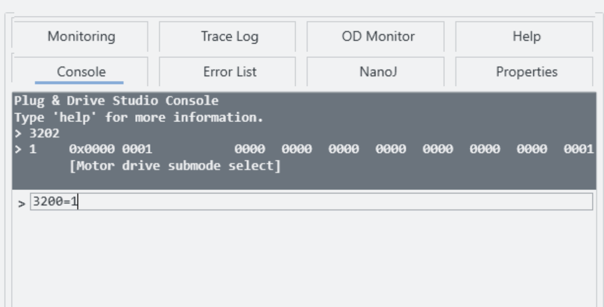
- 3240_h:02_h (Function Inverted): This subindex switches from normally open logic (a logical level at the input yields the value "1" in object $60FD_h$) to normally closed logic (the logical level at the input yields the value "0").

  This applies for the special functions (except for the clock and direction inputs) and for the normal inputs. If the bit has the value "0", normally open logic applies; for the value "1", n closed logic applies. Bit 0 changes the logic of input 1, bit 1 changes the logic of input 2,

Console: Use this to quickly read/write.from/to the device's object dictionary.

Type <od index>:<od subindex> for read.

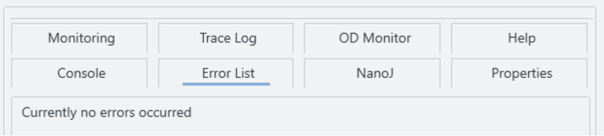
Type <od index>:<od subindex>=<value> for write.



```
Plug & Drive Studio Console
Type 'help' for more information.
> 3202
> 1     0x0000 0001          0000  0000  0000  0000  0000  0000  0000  0001
        [Motor drive submode select]
```

```
> 3200=1
```

Error List: Here you can read the actual errors.

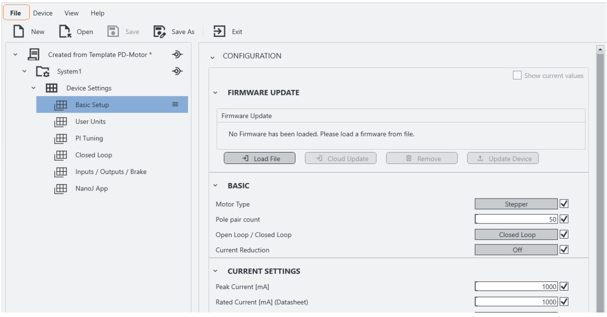


Currently no errors occurred

7 Project setup

In a project, you manage your devices, settings, connections, etc. **Note:** Ex works, in the software's templates folder, there is a sample project each for an external andan integrated controller. Nanotec recommends using these templates.

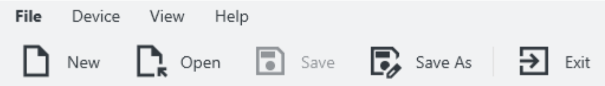
Load / Create a project



No Firmware has been loaded. Please load a firmware from file.

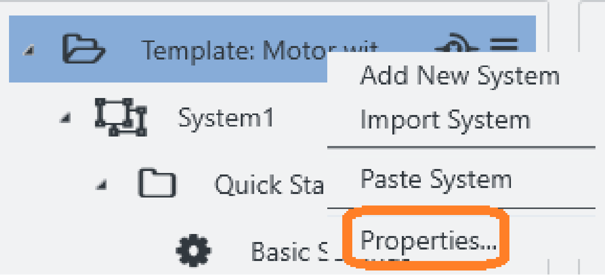
Motor Type	Stepper	☑
Pole pair count	50	☑
Open Loop / Closed Loop	Closed Loop	☑
Current Reduction	Off	☑
Peak Current [mA]	1000	☑
Rated Current [mA] (Datasheet)	1000	☑

1. In the user screen: Visit the file menu (1)

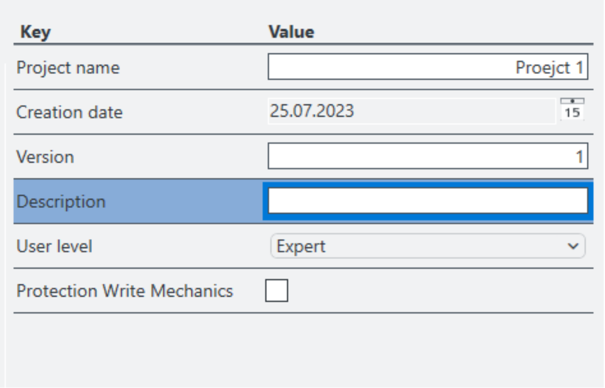


2. Preferably use **Project > Open** to select an existent sample project for template.
3. Or, for a new one instead: Select **Project > New**.
4. If a pop-up wants to store the current project: Click **Yes**.
   - **No** will close the project unstored and without backup.
   - **Cancel** will just close the pop-up.
5. The newly loaded selection appears in the project bar (4)

If needed: Name the project



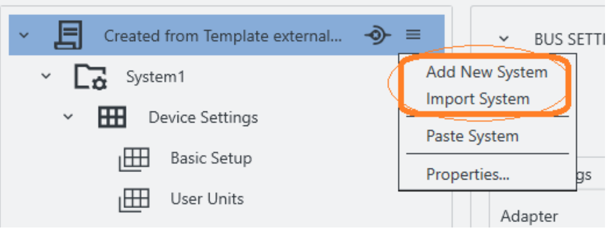
1. Go to the Project bar (4).
2. Co-click the current project and **Properties**.



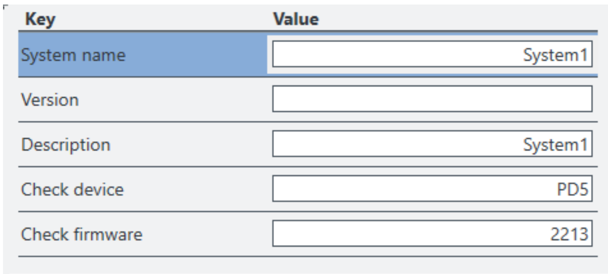
Key	Value
Project name	Proejct 1
Creation date	25.07.2023
Version	1
Description	
User level	Expert
Protection Write Mechanics	□

3. In the **Properties** window: Name, versionize, and describe the project. **Note** the pull-down for granted user rights (here: *Expert*).
4. After last entry: Set a tab stop (so that all is stored).

Load / Create a system



1. In the project: Preferably use **Import System** to select an existent sample system for template.
2. Or, for a new one instead: Select **Add new system**.

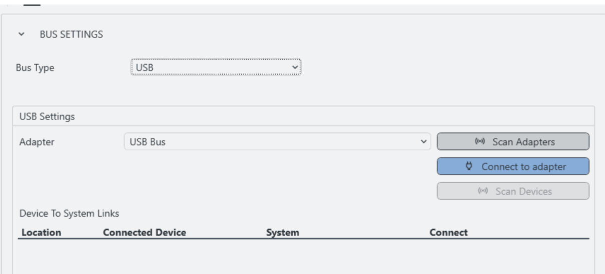


Key	Value
System name	System1
Version	
Description	System1
Check device	PD5
Check firmware	2213

3. In the **Properties** window: Name, versionize, describe the system as needed.
4. After last entry: Set a tab stop (so that all is stored).
5. Repeat for each additional system.

Connect to adapter

1. In the project bar (4): Select your project.



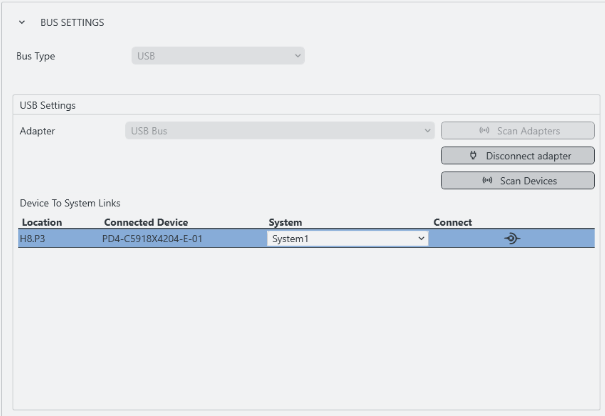
Bus Type: USB

Adapter: USB Bus

Location	Connected Device	System	Connect

2. In the work desk (3): Open the **Bus settings** tab.
3. In the **Bus settings** tab: Select the **Bus type**.
4. Check setup by **Scan adapters**. If no result: Set up an adapter and check again.
5. Select the needed adapter.

Connect to device

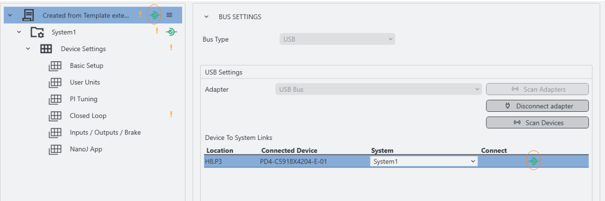


Bus Type: USB

Adapter: USB Bus

Location	Connected Device	System	Connect
H8.P3	PD4-C5918X4204-E-01	System1	

1. In the **Bus settings** tab: With the adapter linked, you can see all available devices.
2. Click **Scan devices**. Check **Connected device**.
3. By Pulldown: Select a **system** to link your device to.



Bus Type: USB

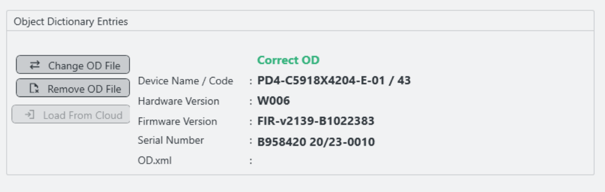
Adapter: USB Bus

Location	Connected Device	System	Connect
H8.P3	PD4-C5918X4204-E-01	System1	

4. You can link / unlink the device via **Connect** icon (here: green).

Select the OD file

PNDS3 shows objects that match the controller firmware with correct OD file only (object dictionary). If the system is linked, a **Object Dictionary Entries** tab shows if the correct OD file is loaded. Otherwise, the generic file *Common OD* loads, by which you reach available objects of all Nanotec products.



Correct OD
Device Name / Code : PD4-C5918X4204-E-01 / 43
Hardware Version : W006
Firmware Version : FIR-v2139-B1022383
Serial Number : B958420 20/23-0010
OD.xml :

1. Select the system.
2. Open the **Object Dictionary Entries** tab.

- *Common OD*: Reloadable via **Remove OD File**
- OD file of choice: Loadable via **Change OD File**
- Firmware-correct OD files for all Nanotec controllers: In the **Firmware** package on the PNDS3 website or via **Load From Cloud** (internet access necessary).

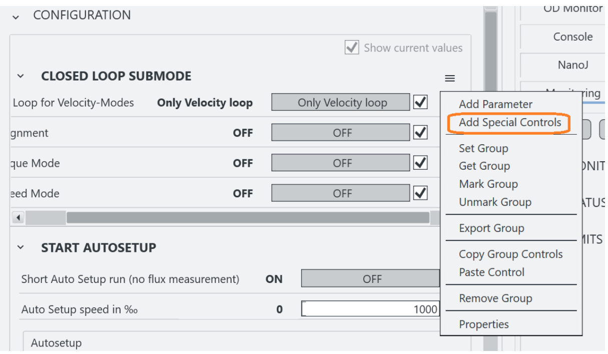
Wrong OD files report an error (= red).

8 Special controls

Via **Special controls**, you add **Complex controls** and **Device communication settings** to the user interface. Both help you to use advanced controller functions.

Basic principle

Special controls define and monitor (as macro collections) the system behavior. Depending on assembly, you can check their connections and attributes in the work desk.



CONFIGURATION

☑ Show current values

CLOSED LOOP SUBMODE

Loop for Velocity-Modes Only Velocity loop Only Velocity loop ☑

gnment OFF OFF ☑

que Mode OFF OFF ☑

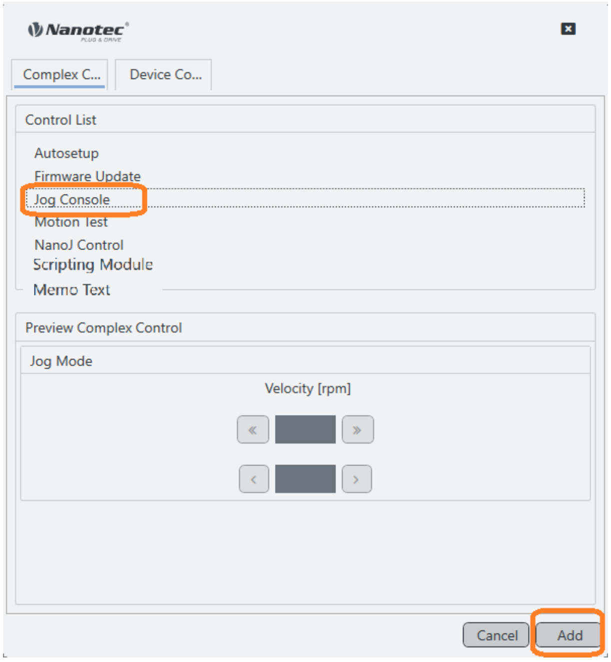
eed Mode OFF OFF ☑

START AUTOSETUP

Short Auto Setup run (no flux measurement) ON OFF

Auto Setup speed in ‰ 0 1000

1. To set up complex controls or device communication: Co-click the controls group.
2. In the context menu: Select **Add Special Controls**.



3. **Complex controls**? **Device communication settings**? Open the tab of choice.
4. Select the needed item and **Add**.

→ The control / setting of choice appears in the work desk.

8.1 Complex controls

With the **Complex controls** macro collection, you create your own controller functions. Next to **Autosetup** and **Firmware update**, these include **Jog Console, Motion Test, NanoJ Control, Scripting module** and **Memo Text.**

Autosetup

Autosetup detects the motor type and connected sensors (encoder / Hall sensors).

CAUTION!

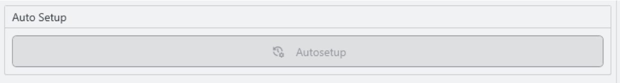
Injury: from abrupt motor travel after auto-setup (= parameter loss)!

- ▶ For motors with integrated controllers: Avert auto-setup (since it comes factory-run already).
- ▶ Otherwise: Restart the motor after auto-setup (homing alone won't suffice).
- ▶ Stay clear of moving motor parts.
- ▶ Touch the motor at standstill only.

NOTICE

Motor malfunction: from auto-setup user error!

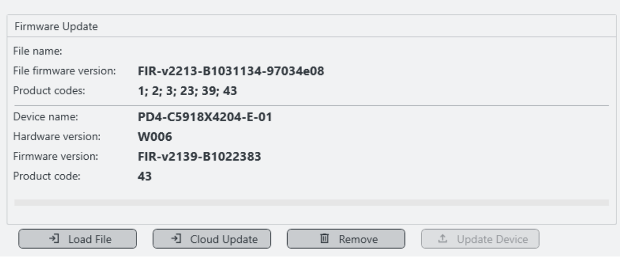
- ▶ Close possible NanoJ programs (object 2300_h:00_h Bit 0 = "0"; cf. 2300h NanoJ Control).
- ▶ Keep the motor load-free, and freely rotable in any direction.
- ▶ **Don't** touch the motor.



As long as the motor on the controller or the feed-back sensors (encoder / Hall) remain the same: Run **Autosetup** only once, on initial commissioning.

Firmware update

Nanotec recommends controller firmware *FIR-v2213* or newer. Please find the current version in the **Firmware** folder on the PNDS3-website or via **Load From Cloud** (see Select the OD file internet access necessary).



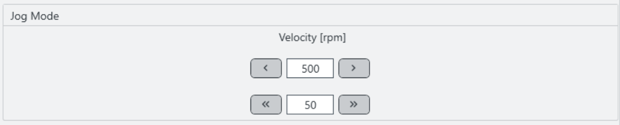
File name:
File firmware version: FIR-v2213-B1031134-97034e08
Product codes: 1; 2; 3; 23; 39; 43

Device name: PD4-C5918X4204-E-01
Hardware version: W006
Firmware version: FIR-v2139-B1022383
Product code: 43

1. Open or add theFirmware update control.
2. Click **Load from file**.
3. Select a firmware file and click **Open**.
4. PNDS3 checks via product code if the chosen file fits to the product.
5. Click **Update device**.
6. Firmware updates itself.

Note: The chosen firmware file will be stored as part of the project the next time the latter is stored. If you don't want this to happen, click **Remove from project** before.

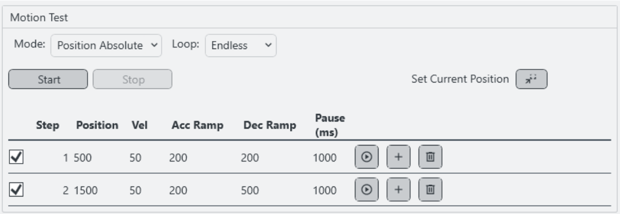
Jog Console



Via **Jog Console**, you test the motor in velocity mode. You can select two target speeds. The motor runs as long as you use the mouse to press the button for left / right rotation.

Note: The console may be deactivated, in case the controller is currently also connected to an external PLC.

Motion Test



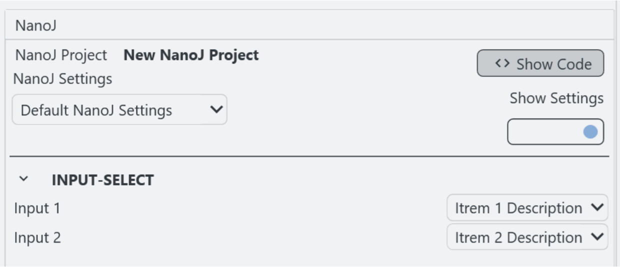
Motion Test

Mode: Position Absolute   Loop: Endless

	Step	Position	Vel	Acc Ramp	Dec Ramp	Pause (ms)
☑	1	500	50	200	200	1000
☑	2	1500	50	200	500	1000

In **Motion Test**, you test the motor in position / velocity / torque mode. Your options include target values, acceleration / deceleration ramps, repetition cycles, test run duration etc.

NanoJ Control



NanoJ

NanoJ Project **New NanoJ Project**

NanoJ Settings: Default NanoJ Settings

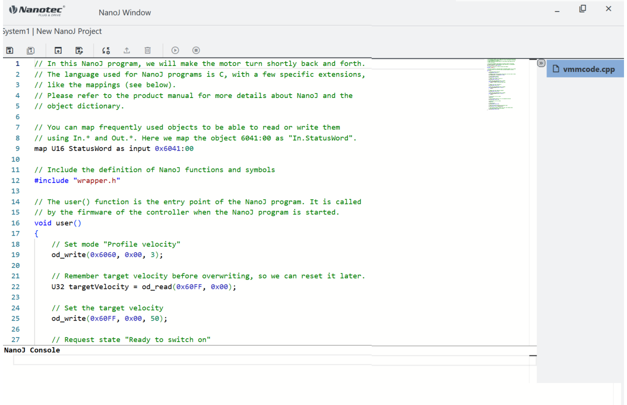
INPUT-SELECT

Input 1: Itrem 1 Description

Input 2: Itrem 2 Description

By adding a **NanoJ control**, you create a new Nano project which at first inludes some example code and has no settings / variables declared. You can then **Import** an existing project or **Export** your project after editing the code and defining some custom settings.

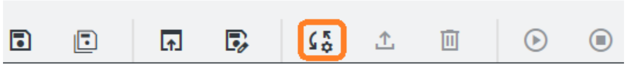
Click **Show Settings** to display the current settings (if any) in the section below. You can delete or rename the current settings, create new settings, or load the default settings. For more details, see chapter NanoJ App.



```
// In this NanoJ program, we will make the motor turn shortly back and forth.
// The language used for NanoJ programs is C, with a few specific extensions,
// like the mappings (see below).
// Please refer to the product manual for more details about NanoJ and the
// object dictionary.

// You can map frequently used objects to be able to read or write them
// using In.* and Out.*. Here we map the object 6041:00 as "In.StatusWord".
map U16 StatusWord as input 0x6041:00

// Include the definition of NanoJ functions and symbols
#include "wrapper.h"

// The user() function is the entry point of the NanoJ program. It is called
// by the firmware of the controller when the NanoJ program is started.
void user()
{
    // Set mode "Profile velocity"
    od_write(0x6060, 0x00, 3);

    // Remember target velocity before overwriting, so we can reset it later.
    U32 targetVelocity = od_read(0x60FF, 0x00);

    // Set the target velocity
    od_write(0x60FF, 0x00, 50);

    // Request state "Ready to switch on"
```

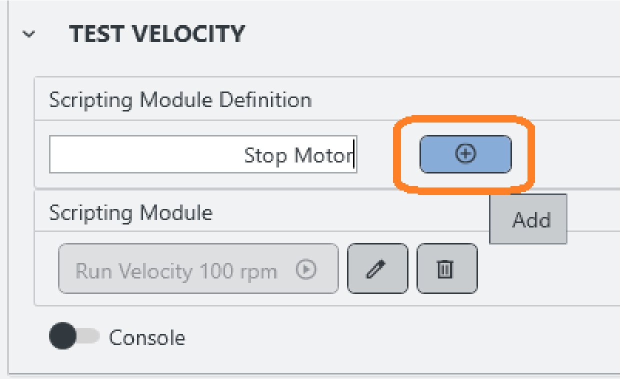
NanoJ Console

Click **Show Code** to open the editor. You can open it in a separate window for more convenience: **Main Menu > View > Separate > NanoJ.**

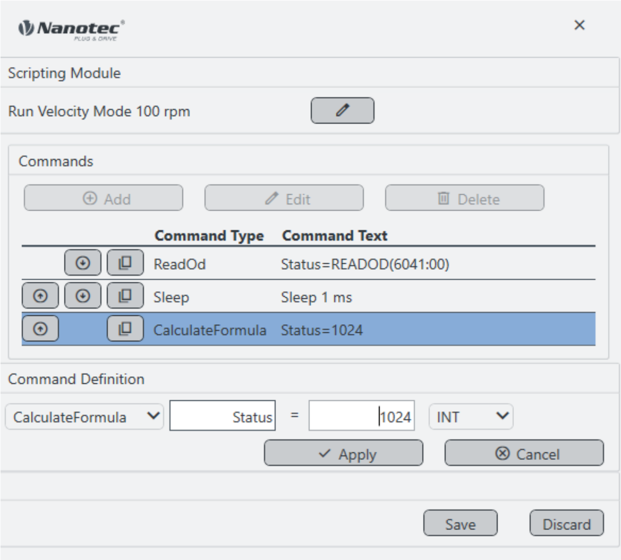


Build the project to compile and be able to transfer to the controller and run the *NanoJ program*.

Scripting Module



In the **Scripting Module** (only available for expert) you create scripts consisting of **Buttons** which execute one or more commands each.



Scripting Module

Run Velocity Mode 100 rpm

Commands

Command Type	Command Text
ReadOd	Status=READOD(6041:00)
Sleep	Sleep 1 ms
CalculateFormula	Status=1024

Command Definition

CalculateFormula | Status = 1024 | INT

You can link following commands to each **Button**:

- **ReadOd**: Reads the value from an object and writes it into a variable.
- **WriteOd**: Writes a value into an object.
- **CalculateFormula**: For operations with previosuly assigned variables. E.g.: z = 5.67*x+y*3.98-x*y
- **Sleep**: The script waits at this position for the set time (in milliseonds).
- **Sleep**: The script waits at this position until the set condition is fulfilled (value of an object is compared to a given value).

Memo Text

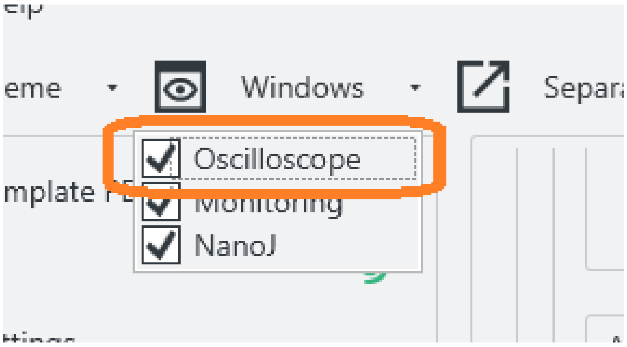
Adds a freely editable text box.

8.2 Device communication

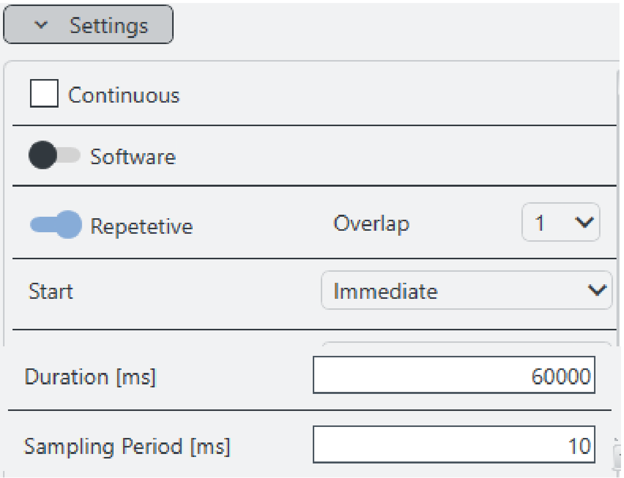
With these controls, you parametrize the device communication. **Note:** Coding switches for setting the communication parameters overwrite the software settings on some devices. For details: Follow valid OEM instructions.

9 Oscilloscope

Via **Oscilloscope**, you monitor and control in real time the current value of device parameters from the object dictionary, say, for recording.



To open the oscillosope, go to the **Main Menu > View > Windows** and select it.



□ Continuous

Software

Repetetive — Overlap: 1

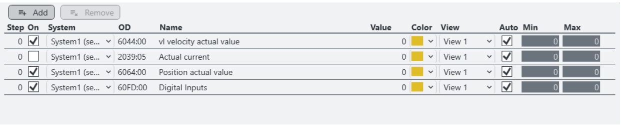
Start: Immediate

Duration [ms]: 60000

Sampling Period [ms]: 10

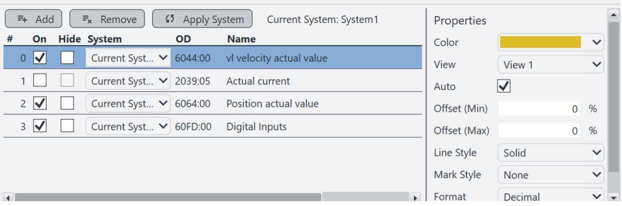
Under **Settings** you can configure the following:

- **Continuous:** If chosen, the oscilloscope starts imeediately and runs continuously, until the buffer is full (if **On-Device**) or after the set **Duration** expires (if **Software** is selected). If not selected you can further define the conditions for start/stop.
- **Start: Immediate**, **Condition** (**On-Device**, as soon as a parameter of choice changes), or **Motion test** (**Software**, Motion test triggers the scope).
- **Stop: Duration** (of recording) or manual.



Step	On	System	OD	Name	Value	Color	View	Auto	Min	Max
0	☑	System1 (se...	6044:00	vl velocity actual value	0	🟨	View 1	☑	0	0
0	□	System1 (se...	2039:05	Actual current	0	🟨	View 1	☑	0	0
0	☑	System1 (se...	6064:00	Position actual value	0	🟨	View 1	☑	0	0
0	☑	System1 (se...	60FD:00	Digital Inputs	0	🟨	View 1	☑	0	0

In the right bottom corner you can add channels by selecting from the object dictionary or remove them.



Current System: System1

#	On	Hide	System	OD	Name
0	☑	□	Current Syst...	6044:00	vl velocity actual value
1	□	□	Current Syst...	2039:05	Actual current
2	☑	□	Current Syst...	6064:00	Position actual value
3	☑	□	Current Syst...	60FD:00	Digital Inputs

Properties

Color: 🟨

View: View 1

Auto: ☑

Offset (Min): 0 %

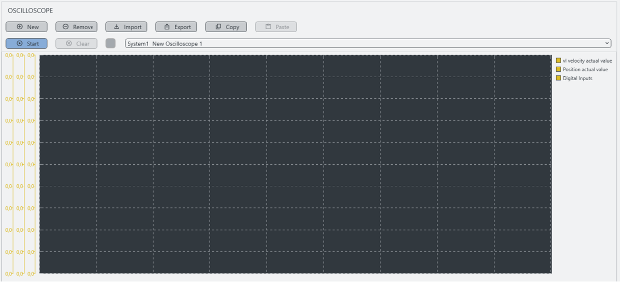
Offset (Max): 0 %

Line Style: Solid

Mark Style: None

Format: Decimal

For each channel you can define under **Properties** in which view and how it is shown.



System1 New Oscilloscope 1

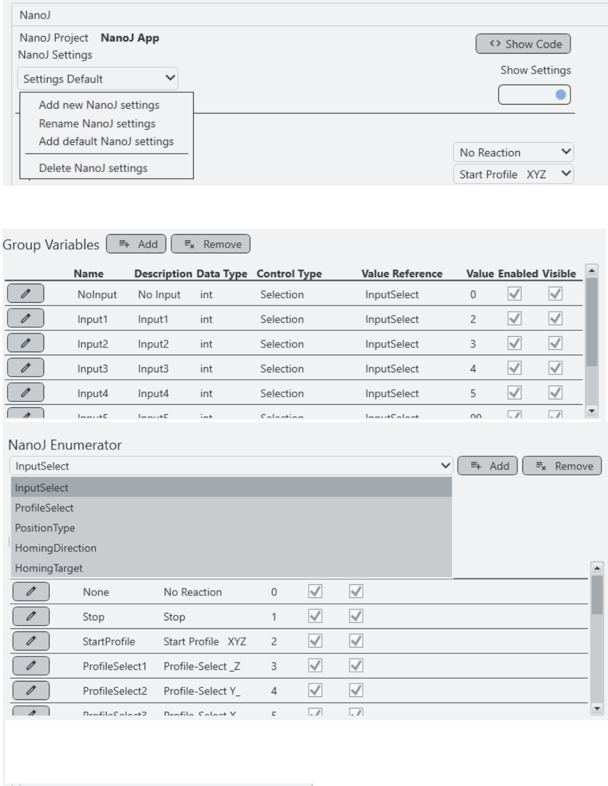
For recording, you open a new (or import an existing) oscilloscope in the tab above the settings and click **Start.**

10 NanoJ App

With the **NanoJ App** you create a *NanoJ program* based on the *NanoJ Library*by editing the **Default Settings** or creating new settings.

TIP

Further information on *NanoJ Library* and programming with *NanoJ* can be found in the *Know-How* section of the Nanotec website and in the respective product manual.



	Name	Description	Data Type	Control Type	Value Reference	Value	Enabled	Visible
✎	NoInput	No Input	int	Selection	InputSelect	0	☑	☑
✎	Input1	Input1	int	Selection	InputSelect	2	☑	☑
✎	Input2	Input2	int	Selection	InputSelect	3	☑	☑
✎	Input3	Input3	int	Selection	InputSelect	4	☑	☑
✎	Input4	Input4	int	Selection	InputSelect	5	☑	☑
✎	Input5	Input5	int	Selection	InputSelect	99	☑	☑

✎	None	No Reaction	0	☑	☑
✎	Stop	Stop	1	☑	☑
✎	StartProfile	Start Profile XYZ	2	☑	☑
✎	ProfileSelect1	Profile-Select _Z	3	☑	☑
✎	ProfileSelect2	Profile-Select Y_	4	☑	☑
✎	ProfileSelect3	Profile-Select Y	5	☑	☑

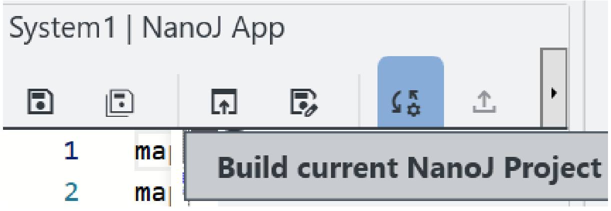
Click **Show Settings** to display the current settings in the section below. You can delete or rename the current settings, create new settings, or reload the default settings.

Click **Show Code** to display the NanoJ code that corresponds to the current settings.

Under **Properties** you can edit the variables of the current settings or create new variables.

With the **Default Settings** of the **NanoJ app**, you can:

- Assign a function to each digital input of your controller.
  - Enable (release) the output stage.
  - Select preset driving profile and start/ stop it.
  - Home switch
- Assign a mode/driving set to each driving profile.
- Adjust each driving set (set points, ramps etc..).



After editing or creating the settings, click **Show Code** and save/export the *NanoJ program* or have it compiled and transferred to the controller and run.

11 Imprint, versions

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Document	Changes	PNDS3
1.0.0 (06/2022)	Edition	V1.3.0
1.0.1 (11/2022)	New software version V1.4.0, new firmware FIR-v2213	V1.4.0
1.1.0 (11/2023)	New software version V1.5.2	V1.5.2
1.2.0 (04/2024)	New software version V1.6.0	V1.6.0
1.3.0 (10/2024)	New software version V3.1.7 (1.7.0 according to the old versioning). Modbus TCP support added. Firmware and OD file can now be directly downloaded from cloud, see Select the OD file.	V3.1.7
1.3.1 (04/2025)	New software version V3.1.8	V3.1.8
1.3.2 (11/2025)	New software version V3.1.9. New chapters Scripting Module and NanoJ App.	V3.1.9