NORDBO ROBOTICS

NAC-S20-15 Active Compensation Unit

User Manual

Manual Version 1.0
For Software Version 1.1

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NORDBO ROBOTICS

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Table of Contents

1. Introduction

1.1. Intended Use

This document serves as a guide for the installation of Nordbo Robotics' Active Compensation unit (NAC) on a manipulator. This guide does not provide any information about risk assessment which must be carried out before initiating any robot movements.

1.2. Prerequisites

This documentation is intended for people who have experience in installation, commissioning, programming, and diagnostics of automation systems. Furthermore, it is expected that the person using this manual understands the risks related to working with industrial robots. It is recommended reader should also have basic knowledge in using a computer and configuration of network settings.

1.3. Safety Warnings

Following instructions must be read thoroughly by anyone intending to use this product.

Warning! This symbol indicates that potentially hazardous, dangerous, or unwanted situations can arise from not following the instructions correctly. If safety instructions are not followed properly it may result in death, personnel injury, or equipment damage.

Before attempting to connect the NAC to a robot, it is important to ensure that the robot cannot move unintentionally. The robot must therefore be powered off before attempting to connect the equipment to the robot.

Robots must always be **powered off** before attempting to connect wires to the robot's controller, or when connecting cables between any of Nordbo Robotics' products. Only switch the supply voltage and pneumatics on when installation is fully complete.

The product may be damaged if dropped on hard surfaces. Be aware that connectors can break if the user pulls or overtightens the cables. Do not perform any repairs on the product(s). In the event of a defect: replace the control unit or/and tool unit.

The product can only be used within the specified range. Using the product outside of its specified range may create unexpected results. Nordbo Robotics is not liable for any damage or injury resulting from the use of the product.

2. Product information

The Nordbo Active Compensation unit (NAC) is a solution for applications with where a constant, specifiable force between tool and workpiece is required. The NAC consist of two parts, a tool unit, and a controller. The force can be specified through the controller using IO or ethernet, and the integrated sensors ensure that high contact forces are prevented during initial part contact.

Figure 1 – Tool Unit

Figure 2 - Controller

Figure 3

2.1. Included in the Package

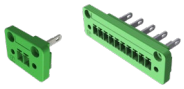
Picture	Code	Description
	NAC-CTRL	*Controller for the NAC-S20-15 controllable by IO or ethernet.*
	NAC-S20-15	*Tool unit with a stroke of 20 mm and a maximum payload capacity of 15 kg.*
	Ethernet cable RJ45	*Ethernet cable for connecting the NAC-CTRL.*
	NAC Cable	*Communication cable to connect the NAC-CTRL and the NAC-S20-15.*
	IO modules	*IO modules that can be used directly with most common robot brands.*

Table 1

2.2. Technical Specifications

General specifications	
Maximum force (push/pull)	150 N / 110 N
Maximum allowed external moment	16 Nm
Stroke length	20 mm
Control Interface	Ethernet TCP/IP Digital IO ports
Parameterization Interface	Web interface
Pneumatic specifications The NAC tool needs to be connected to a supply of compressed air through an air-regulator to regulate push/pull force	
Maximum supply pressure	1.0 MPa
Minimum supply pressure	0.1 MPa[1]
Nominal supply pressure	0.7 MPa
Maximum flow rate	0.6 L/min
Electrical specifications	
Power supply voltage	24VDC ±10%
Power supply current consumption	Typical 0.30A, Up to 2A
Digital IO interface **Switch logic** **IO logic voltage ratings** **Maximum output current**	 NPN 5 to 48V 0.22A
Ambient specifications	
Operating ambient temperature	0° to +50°
Storage ambient temperature	-10° to +75°
Cooling	Passive
Operating humidity (at 25° C)	0% to 85%, No condensation
Degree of protection	NAC-S20-15: IP67 with full pin and fitting allocation NAC-CTRL: IP40 with full pin allocations

Table 2

[1]Maximum possibly actuated force will be reduced when supply pressure is under nominal. At 0.1MPa the maximum actuated force is 25N

2.3. Mechanical Dimensions

Unit	NAC-S20-15	NAC-CTRL
Weight	2.6 Kg	1.2 Kg
Dimensions **Height** **Width** **Depth**	 121-141 mm 110 mm 110 mm	 56.26 mm 106.13 mm 226 mm
Mounting Tool Side **Bolts** **Flange Diameter**	 M5-10 Ø60mm	-
Mounting Fixation Site **Bolts** **Flange Diameter**	 M5-10 Ø60mm	-

Table 3

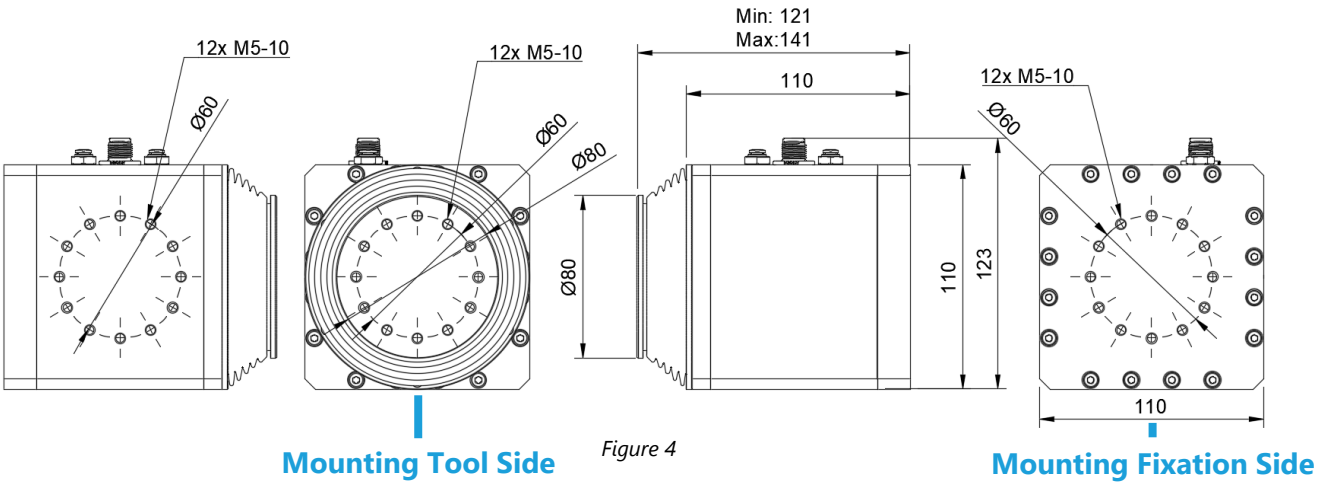


Figure 4

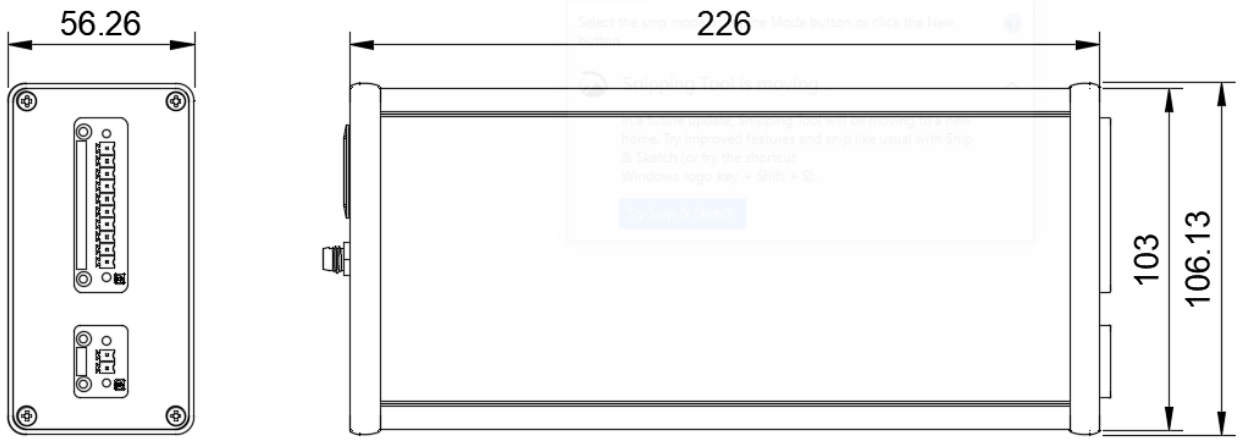


Figure 5

2.4. NAC-S20-15 Overview

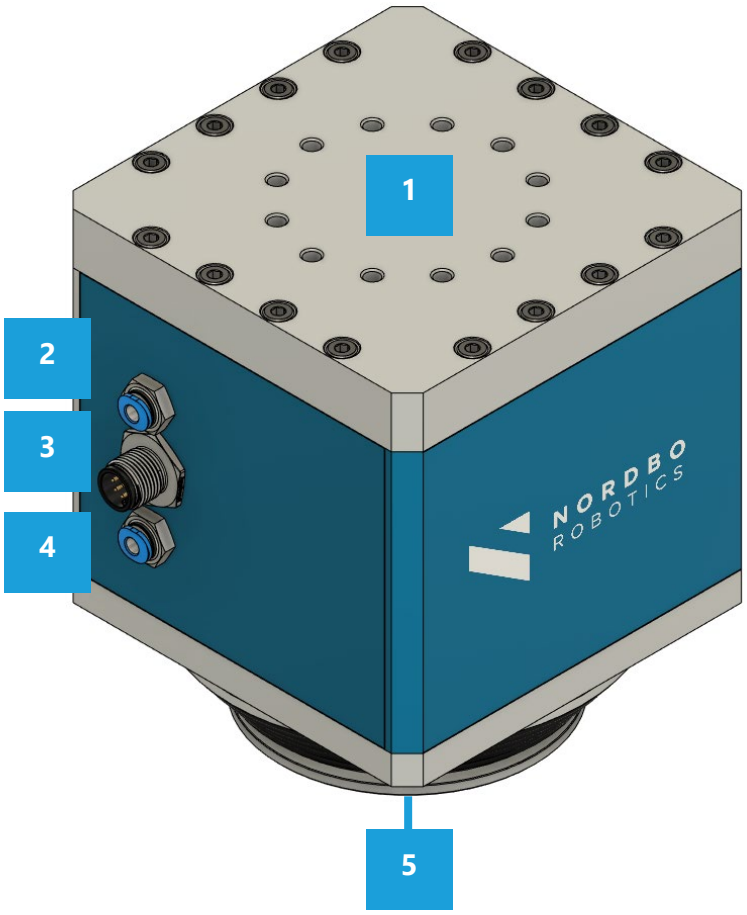


Figure 6

ID	Description	Functionality
1	Mounting hole pattern, fixation site	Used when mounting the tool unit on a stable surface or on a robot flange.
2	Air, in	Connect tube to supply air to the tool unit.
3	Interface for NAC control Unit	Use the supplied cable to connect the tool unit and the controller.
4	Air, out	Connect tube for exhaust air
5	Mounting hole pattern, tool side	Used when mounting a tool on the tool unit.

Table 4

2.5. NAC-CTRL Interfaces

NAC-CTRL Interface, Front

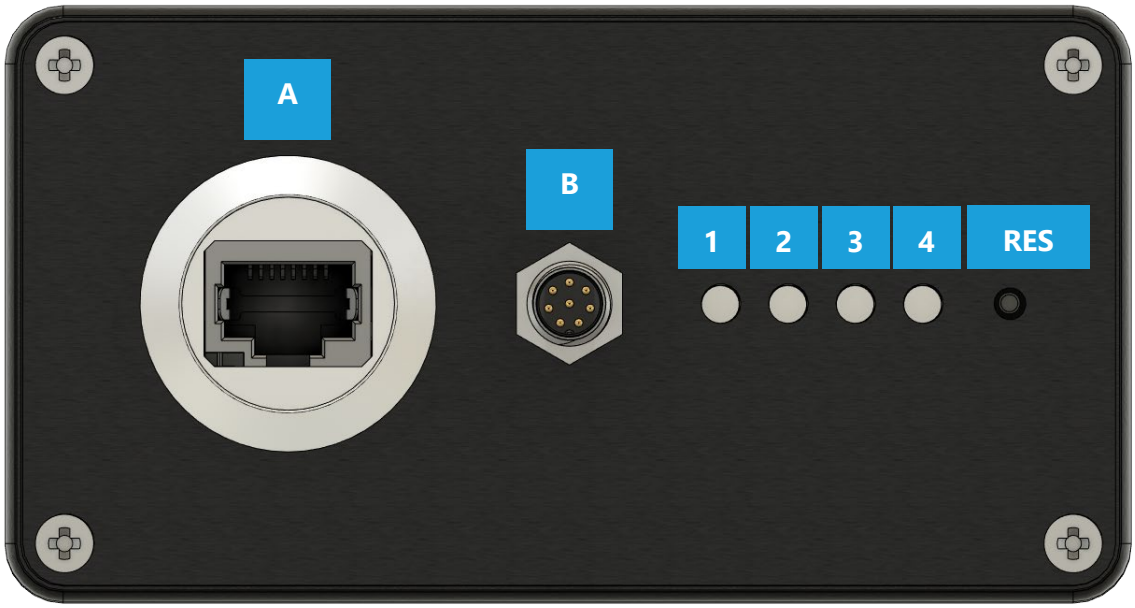


Figure 7

ID	Description	Functionality
A	Ethernet Connection	For connecting the controller to a PC.
B	Interface to NAC tool unit	For connecting the controller to the NAC.
1	LED status indicator	Ready for operation indicator. Is turned "On" when the NAC is ready for operation.
2	LED status indicator	Ethernet session indicator. The LED is only turned "On" when there is a connection using the Ethernet TCP/IP connection.
3	LED status indicator	System state indicator. The LED is "Off" when the system is in idle state, "On" when system is in active force control state. The LED is blinking when an error has occurred, and the device is in error state.
4	LED status indicator	Power indicator. The LED is "On" when the NAC-CTRL is powered on.
RES	Reset button	Hold to reset the controller to the default settings.

Table 5

NAC-CTRL Interface, Back

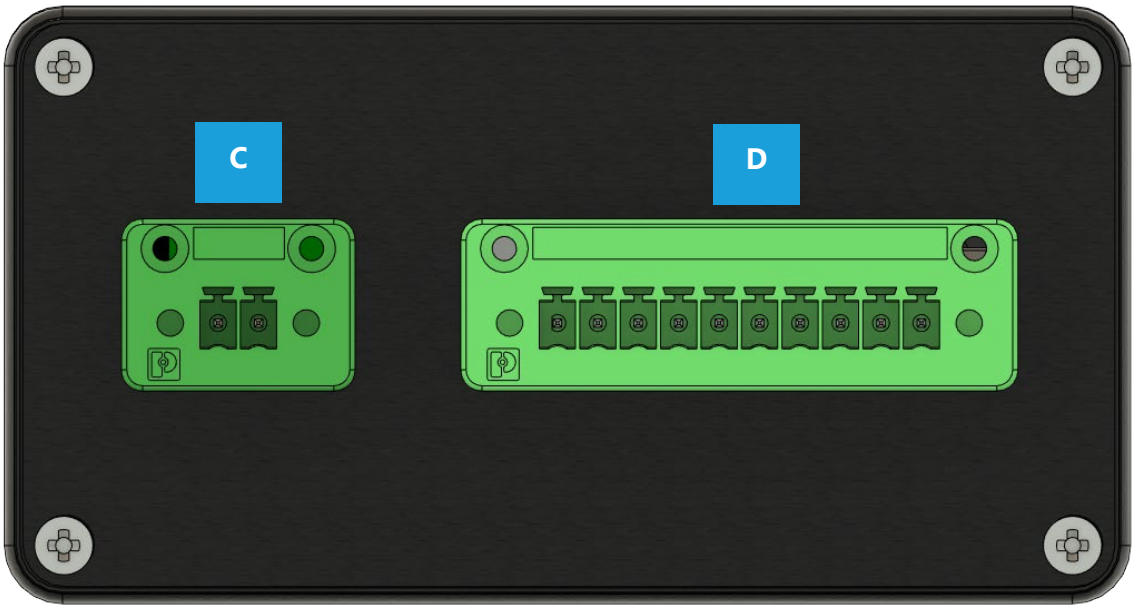


Figure 8

ID	Description	Functionality
C	Power supply input	Use to power the NAC controller.
D	IO interface	Use to connect and control the NAC using inputs/outputs.

Table 6

3. Web Interface & Configuration

The NAC can be reconfigured by accessing its integrated web interface. The web interface is accessible by connecting the NAC-CTRL to a PC via ethernet link. Input the NAC-CTRL's IP address in a web browser e.g., Internet Explorer or Google Chrome to access the settings.

The integrated web interface of the NAC supports:

- Diagnostics of NAC
- Parameterization target forces selectable when using the IO interfaces
- Updating the NAC-CTRL and NAC-S20-15
- Configuring Network settings for the NAC

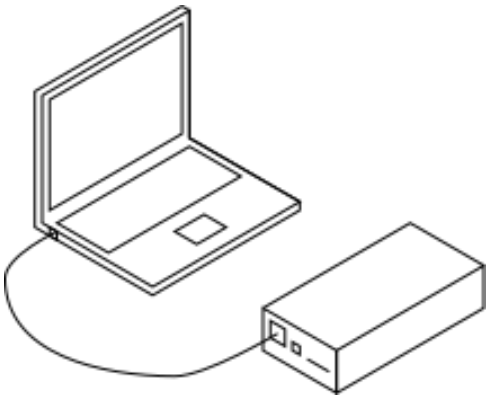


Figure 9

3.1. Overview of Web Interface

The NAC web interface contains the tabs listed in the following table.

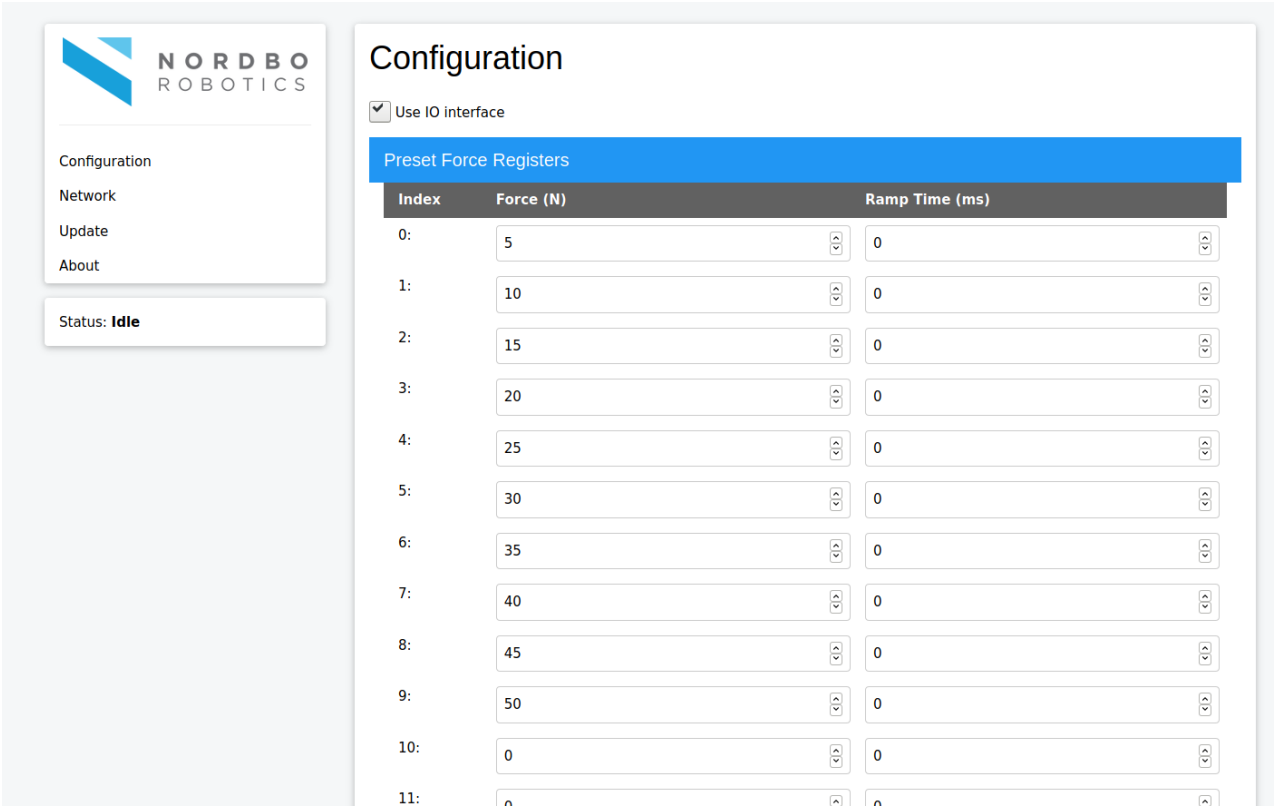


Figure 10 - NAC web interface

Tab	Functions

Configuration	• Configuration IO Interface
	  ○ Enable disable control using IO interface
	  ○ Setting predefined target forces and ramp time for each of the 16 preset registers which can be selected using the 4-bit IO register indexing
	  ○ Is moving parameterization
	  ▪ Timeout of is moving signal. How long the actuator should stand still before it is considered not moving
	  ▪ Distance threshold of how far the actuator should move before it is considered being in motion

Network	• Enable/Disable DHCP. ***Note:*** If enabled the NAC will gain an IP address from the networks DHCP provider • Static address, subnet mask and default gateway if DHCP is disabled
Update	• Update firmware on NAC control unit and Tool unit
About	• Firmware version number • Serial number

Table 7: Website tab functions for NAC web interface

3.2. How to Access the Web Interface

Before the controller can be accessed through an internet browser by typing in the IP address of the controller, the network settings may need to be configured. The following section explains how to connect to the controller using a Windows 10 PC.

Note: *Default settings for the NAC-CTRL is having a static IP address of 192.168.1.100. Adding the device to a network with an existing device having the same IP address can cause network faults. For initial commissioning, connect the control unit directly to a PC via the Ethernet interface.*

Step 1

Connect the controller's power supply and connect to a PC using an ethernet cable.

Step 2

Open Network & Internet settings by right-clicking on the Wi-Fi/LAN icon in the menu.

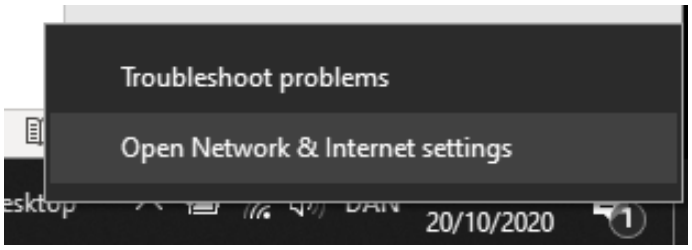


Figure 11

Step 3

Click "Change adapter options".

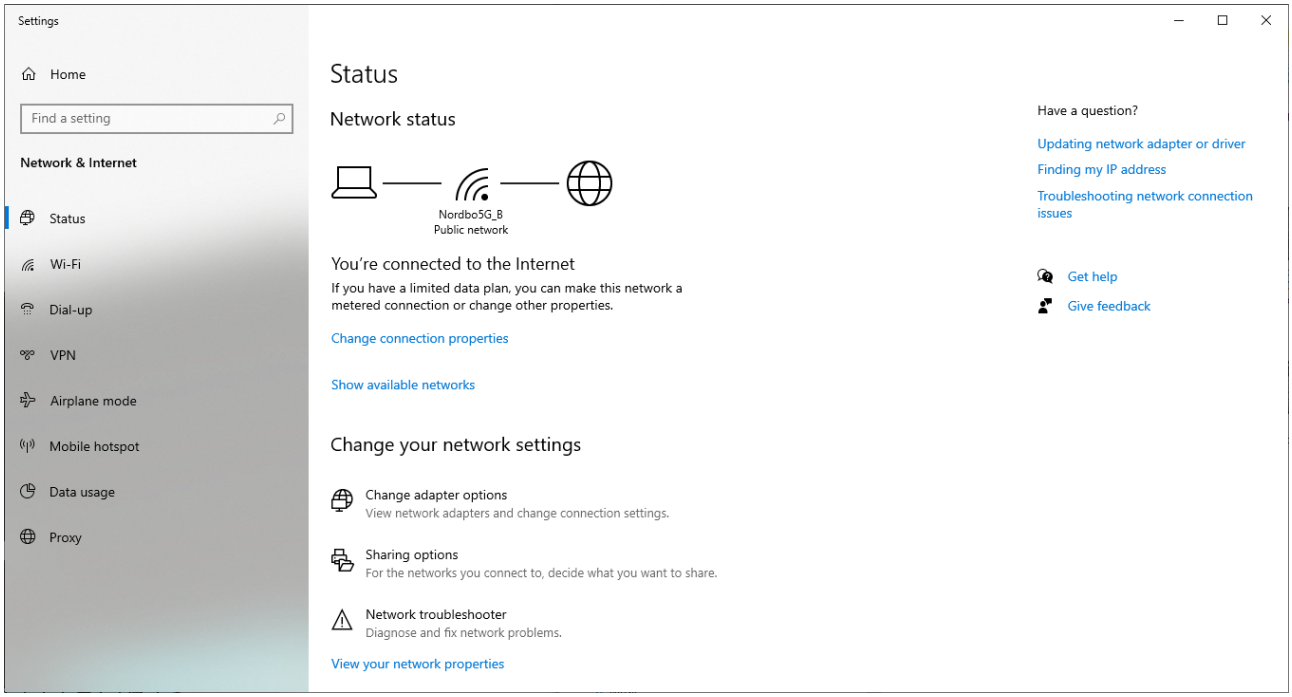


Figure 12

Step 4

Right-click on "Ethernet 3" and select "Properties."

Note: *Ethernet number may vary from system to system*

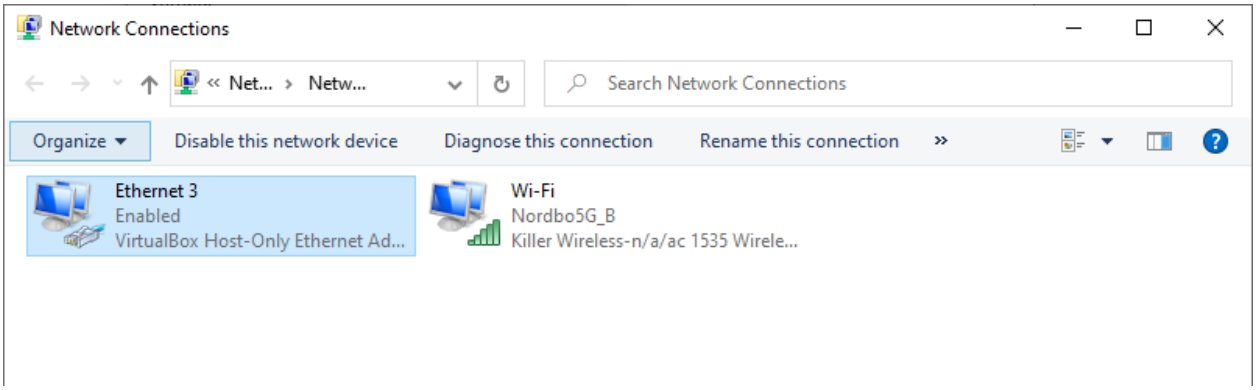


Figure 13

Step 5

Select Internet Protocol Version 4 (TCP/IPv4) and click “Properties”.

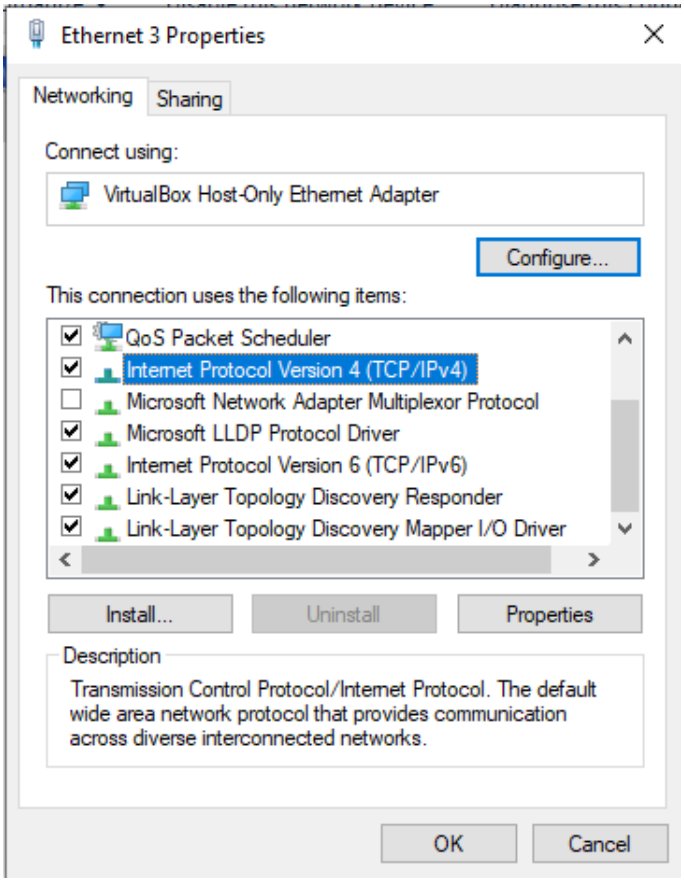


Figure 14

Step 6

Set the IP address to 192.168.1.42

Set the Subnet mask to 255.255.255.0

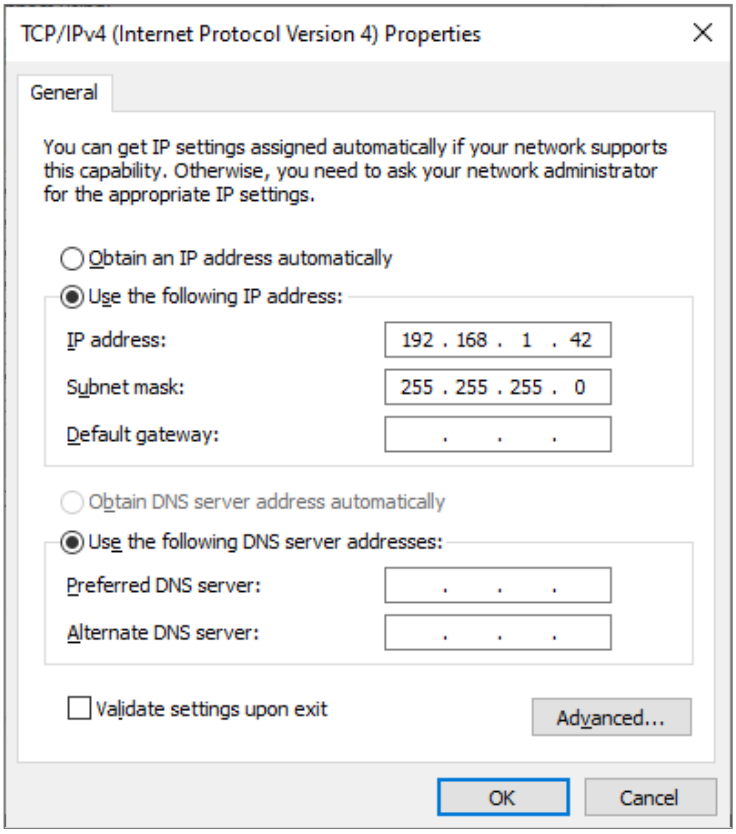


Figure 15

Step 7

Access the real-time view using a browser by typing the IP address 192.168.1.42.

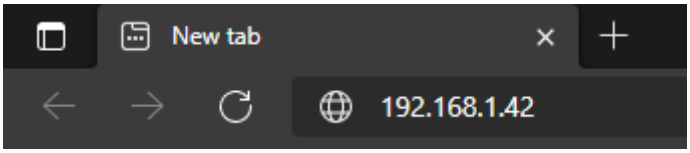


Figure 16

4. Configuring the NAC Using Web Interface

4.1. Enable/Disable Digital IO Interface Control

Step 1

Click the checkbox “Enable IO Interface”

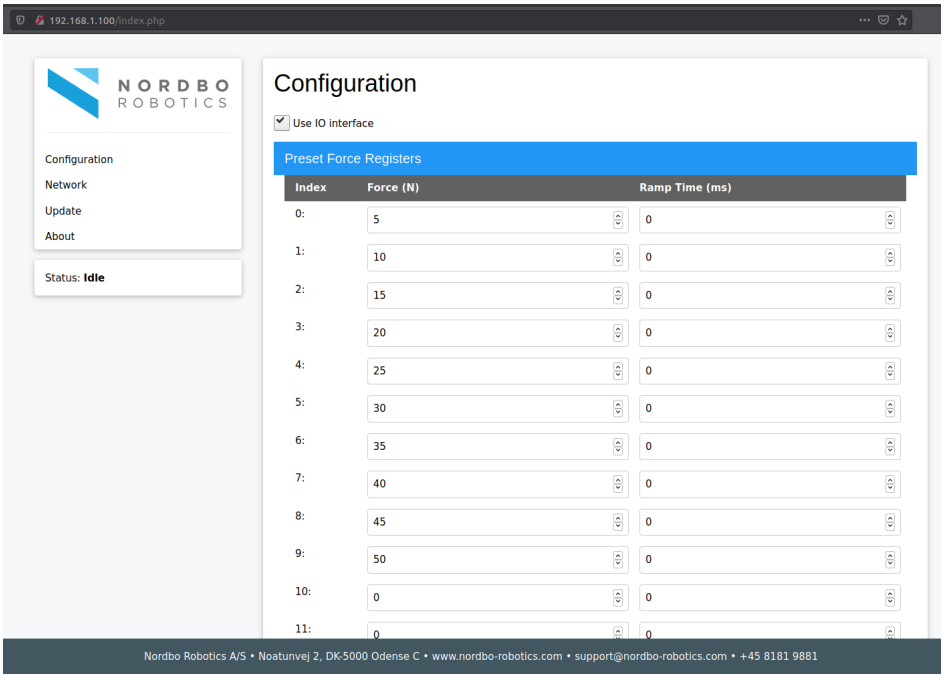


Figure 17

Step 2

Navigate to the bottom of the configuration page and click “Save”.

Step 3

Apply the new settings by rebooting the NAC-CTRL by powering it off and on again.

4.2. Configure Force Registers

Force registers enables the user to control the actuated force the NAC-S20-15 is applying by indexing to one of the 16 registers using the 4-force register selection digital input pins.

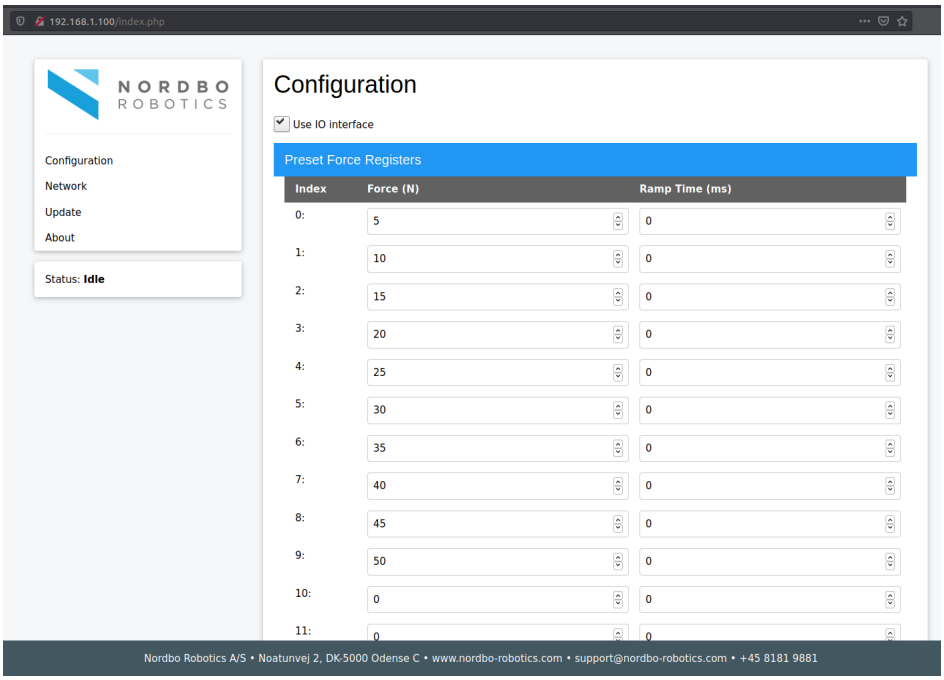


Figure 18

Step 1

Edit each row in the Force register table

- Assign your target force.
    - **Positive values** correspond to a **push force**.
    - **Negative values** correspond to a **pull force**.
- Assign a ramp time.

Step 2

Navigate to the bottom of the configuration page and click “save”.

Step 3

Apply the new settings by rebooting the NAC-CTRL by powering it off and then on again (pull the power supply).

4.3. Configure “Is moving”

Is moving is a state flag that is low when the tool actuator is moving and high when standing still. You can configure a timeout timer and distance threshold to filter the signal.

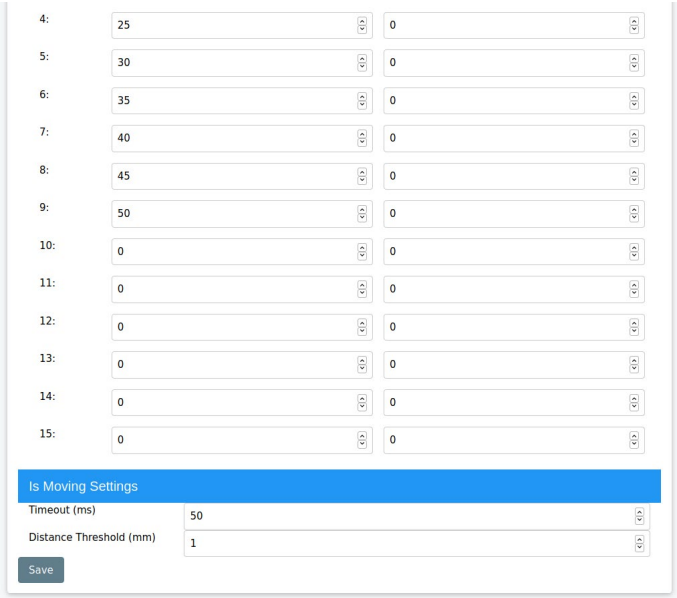


Figure 19

Step 1

Set timeout value.

Note: *The “Timeout” corresponds to the time before the actuator starts moving (the “is moving” signal is set to high).*

Step 2

Set distance threshold. The distance threshold corresponds to how far the actuator needs to move before the is moving signal goes low.

Step 3

Navigate to the bottom of the configuration page and click “Save”.

Step 4

Reboot the NAC-CTRL by powering it off and on again, to apply the new setting.

4.4. Configuring Static IP

Step 1

Navigate to the Network tab.

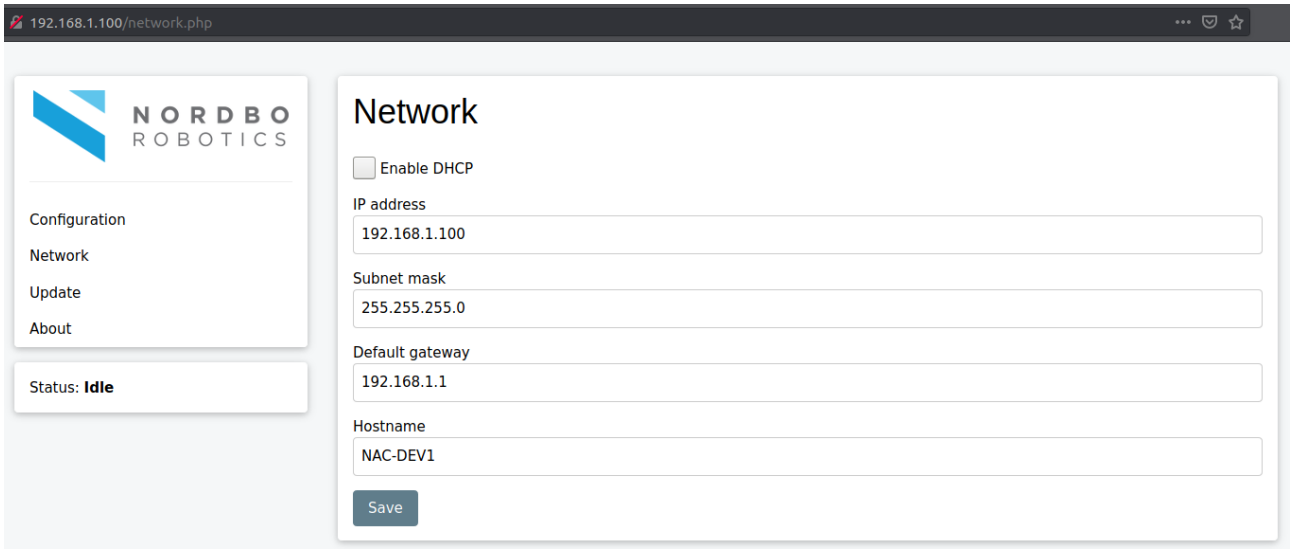


Figure 20

Step 2

Uncheck the box “Enable DHCP” so it is unset.

Step 3

Enter the desired static IP address in the “IP address” field.

Step 4

Enter the desired subnet mask in the “Subnet mask” field.

Step 5

Enter the desired default gateway in the “Default gateway” field.

Step 6

Navigate to the bottom of the configuration page and click “Save”.

4.5. Configure DHCP Client

When the NAC-CTRL is configured as a DHCP client it will obtain its IP address from a DHCP server on the Network if any.

Step 1

Click the checkbox “Enable DHCP” so it is set.

Step 2

Navigate to the bottom of the configuration page and click “Save”.

4.6. Updating the Firmware

Using the update page, it is possible to update the firmware on the NAC-CTRL and NAC-S20-15.

Updating the NAC-CTRL Firmware:

Step 1

Contact your Nordbo Robotics contact for any updates.

Step 2

Download the update file and store it on your PC. The file should have the file extension ".deb".

Step 3

Click the "Browse…" button on the web page to select the downloaded update file.

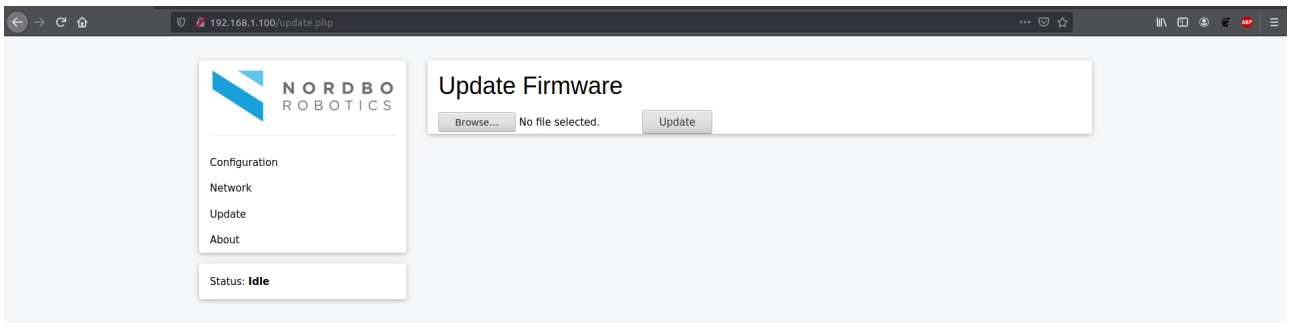


Figure 21

Step 4

Click the "Update" button.

Step 5

Wait for the message "Firmware updated successfully".

Updating the NAC-S20-15 Firmware

OBS! It is very important not to interrupt this process since it could place the NAC-S20-15 in a non-working state. The update process can take up to 5 min.

Note: *Risk of malfunctions and corrupted firmware if the NAC-S20-15 update process is interrupted. Secure power supply against accidental deactivation.*

Step 1

Contact your Nordbo Robotics contact for any updates

Step 2

Download the update file and store it on your PC. The file should have the file extension ".bin"

Step 3

Click the "Browse…" button on the web page to select the downloaded update file

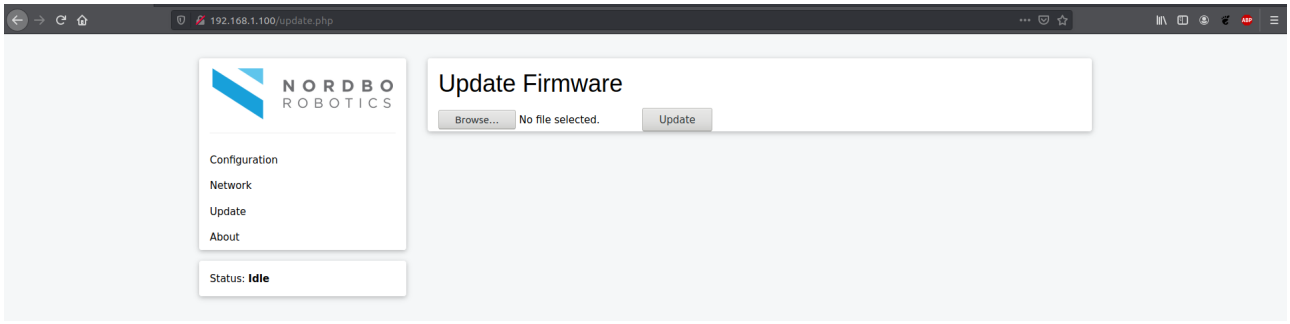


Figure 22

Step 4

Click the "Update" button

Step 5

Wait for the web page to say "Firmware updated successfully"

5. Installing the NAC-S20-15

The following section describes how to install the NAC-S20-15 for a standard operation. The section will elaborate how pneumatic- and electrical installation is performed and the digital IO control interface for PLC control.

Warning! Pneumatic and electric installations can cause unexpected movement of the NAC tool unit. Switch off all pneumatic and power supplies before installing. All electrical and pneumatic connections must comply with the limits specified in section 2.2 Technical Specifications!

The NAC can be controlled by either using the Ethernet TCP/IP protocol or the IO Interface. The difference in possible controls is highlighted below.

TCP/IP	IO
• Setting target force and ramp time • Configuring or calibrating load weight • Retract tool unit • Reset tool unit stroke position count • Read firmware version • Read Tool unit angle • Read Tool unit stroke position • Read is moving signal flag • Read error state flag	• Calibrating load weight • Selecting between 16 different target forces and ramp times • Error state output • Is moving signal output

Table 8: Control interfaces for the NAC and their supported functionality

Warning! Unexpected movement of the NAC tool unit or the robot during mounting and installation. Switch off all power supplies and pneumatic supplies before installation. Secure power supply and pneumatic supply against accidental reactivation

5.1. Connection Scheme, robots

The following schematic illustrates how to connect the NAC in a robotic application.

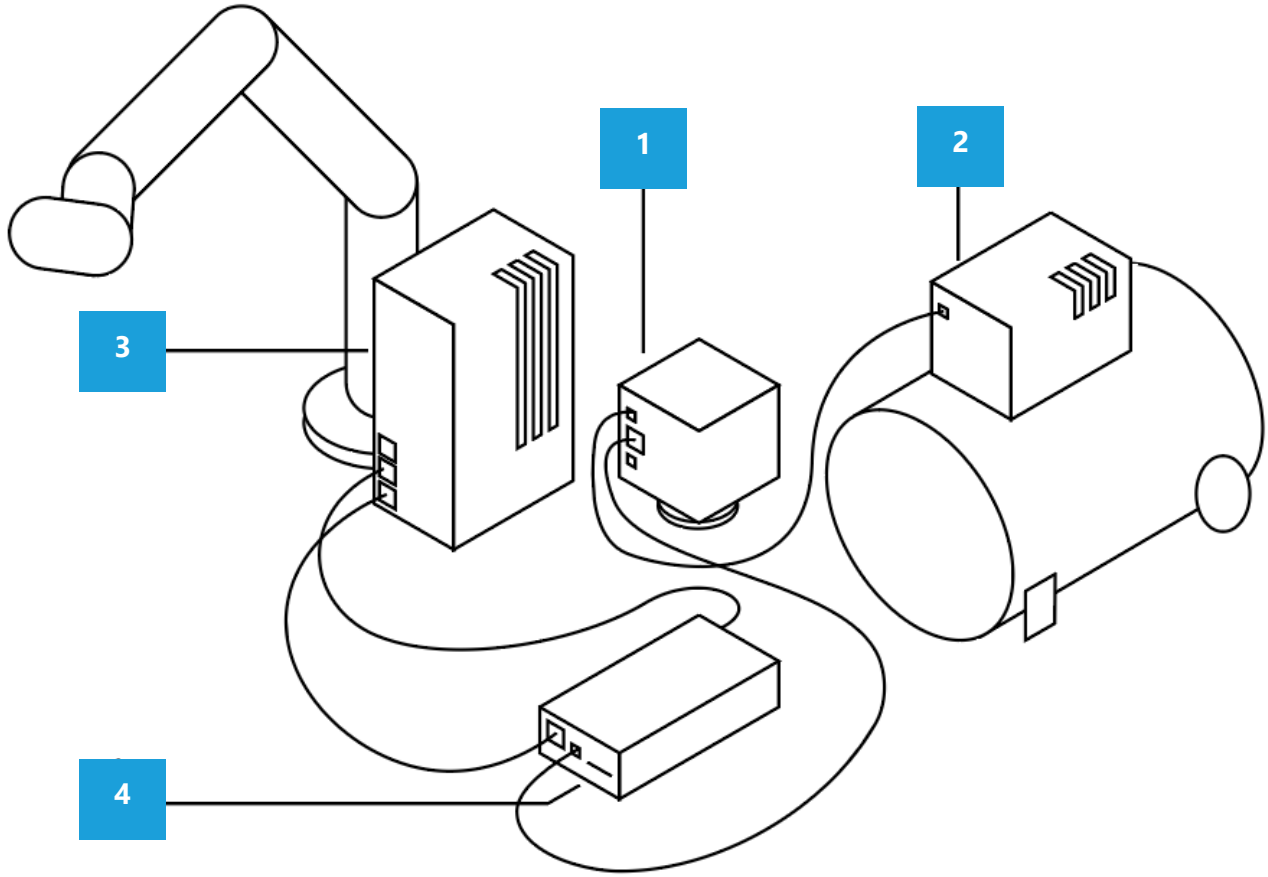


Figure 23

ID	Unit	Description
1	NAC-S20-15	Nordbo Active Compensation unit.
2	Air compressor	Supplies air to the NAC for it to be functional.
3	Robot controller	Supplies the system with power. Controls the force applied using Ethernet.
4	NAC-CTRL	Controls the active compensation unit.

Table 9

5.2. Connection Scheme, PLC/IPC

The following schematic illustrates how to connect the NAC in an application using PLC/IPC.

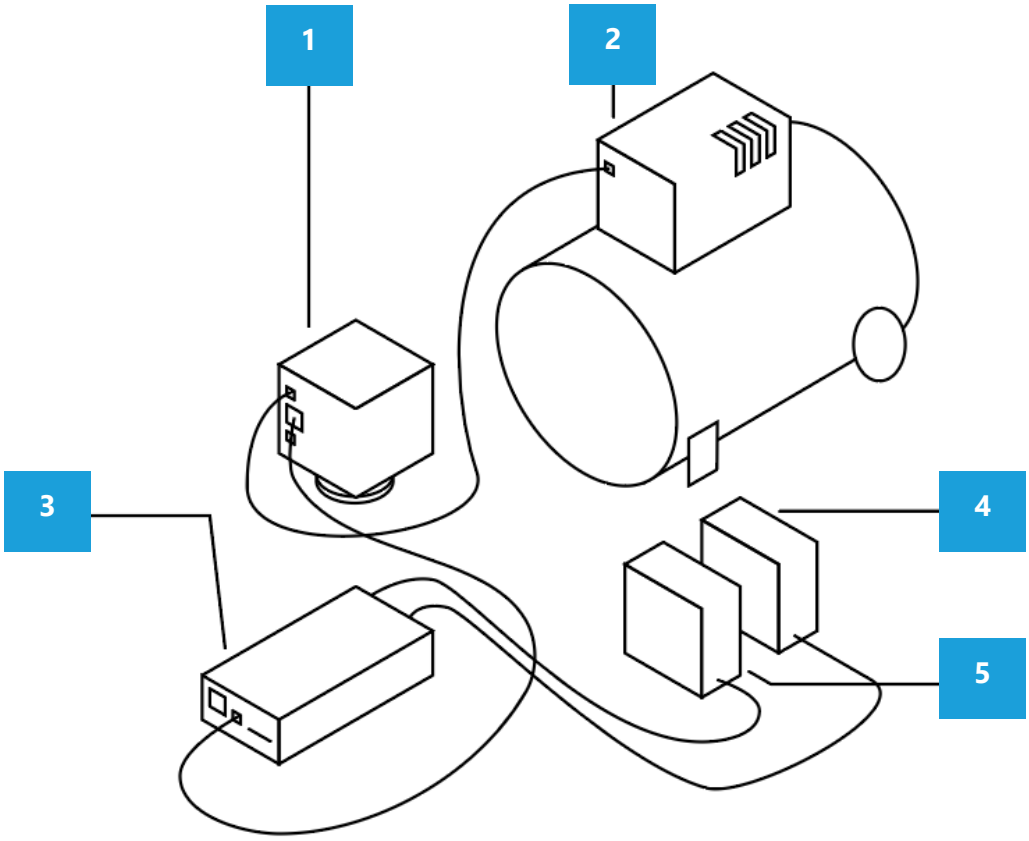


Figure 24

ID	Unit	Description
1	NAC-S20-15	Nordbo Active Compensation unit.
2	Air compressor	Supplies air to the NAC in order for it to function.
3	NAC-CTRL	Controls the active compensation unit.
4	Higher order controller (PLC/IPC) for controlling I/O on NAC control unit	Controls the force applied using IO's according to settings configured in the web interface.
5	Power supply unit 24V.	Supplies the system with power.

Table 10

5.3. Pneumatic Installation

The NAC tool needs to be connected to a supply of compressed air through an air-regulator to regulate push/pull force. The following sections elaborates how the air supply is connected.

OBS! A regulator must have a filter.

Step 1

Connect from the air-regulator to the NAC-S20-15 with a 4mm air hose to the pneumatic push-in fitting at the air intake on the NAC-S20-15.

Step 2

To keep a IP67 rating the exhaust on the NAC-S20-15 must be attached to a 4 mm hose. The loose end of the hose must be placed in an environment protected against dust and liquids.

Note: *If the IP67 rating is not required, a pneumatic exhaust silencer/muffler can be used instead.*

Step 3

Make sure the air-regulator is set so its compliance with the technical limits.

5.4. Electrical Installation

The NAC tool needs to be connected to a power supply and IO or ethernet to function. The following sections elaborates how the NAC is connected.

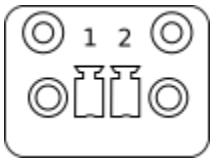
Warning! Unassigned plug connectors can be susceptible to electrostatic discharge and damage may occur to the device or other parts of the system. Seal unassigned plug connectors with caps. Earth system parts prior to installation. Use appropriate ESD equipment e.g., earthing straps!

Power Supply Using I/O

The NAC-CTRL can be powered on by using I/O by completing the following steps.

Step 1

Wire the plug connector, female according to the table below which illustrates the power supply connectors and their pins.

Connectors	
 **Plug connector, Male**	 **Plug connector, Female**

Pin #	Function
1	GND, Reference potential of 0V
2	+24 V DC, Power supply

Table 11: Power supply connection with plug connector

Step 2

Connect the loose end of the wire to the I/O terminal blocks of e.g., the robot controller.

Step 3

Insert the female connector into the male connector on the NAC controller.

Power Supply Using External Power Supply

The NAC-CTRL can be powered by using an external power supply according to the diagram.

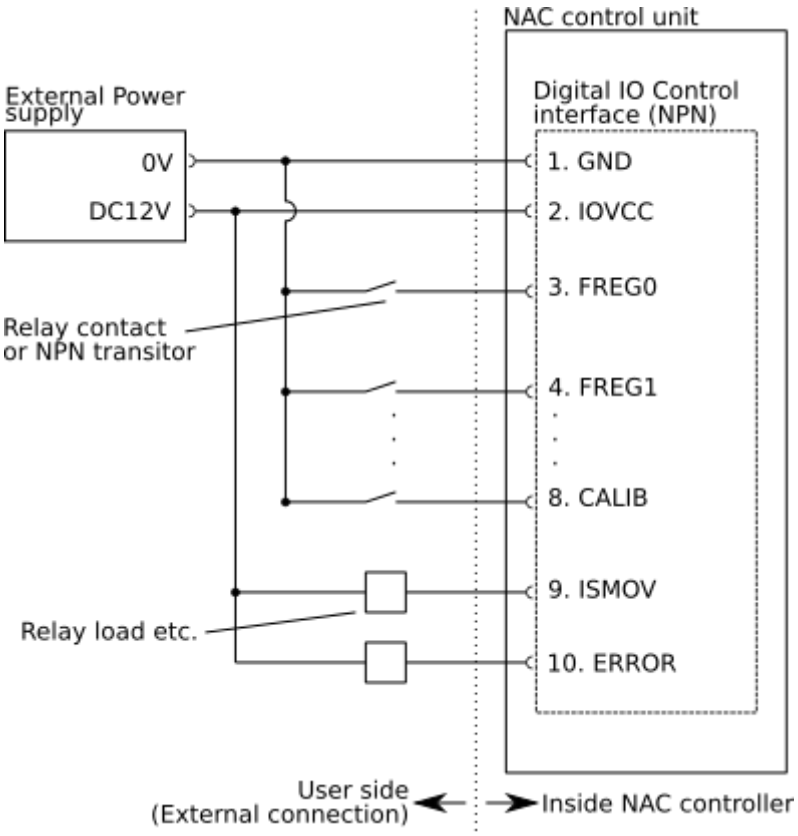


Figure 25: Connection of Digital IO interface with external user circuitry

Digital IO Control Interface

The IO control interface is used for controlling the NAC using a higher order controller e.g., PLC or using manual switches.

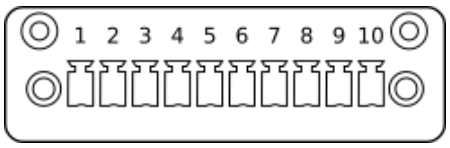
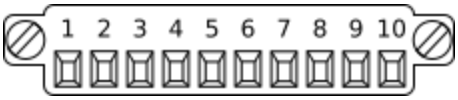
OBS! The IO Interface is configured as NPN. If using the product in EU or NA, a converter may be needed to convert configuration to PNP!

Step 1

Insert and fasten the necessary wires in the female terminal block using the screws.

Step 2

Insert the terminal plug with the wires in the IO of the PLC, robot controller or other desired electrical switch.

Connectors	
 **Terminal block, male**	 **Terminal block, female**

Pin #	Function		
1	GND	IN	0V Reference potential for Input and output signals
2	IOVCC	IN	Logic supply
3	FREG0	IN	Force register selection 1st bit. Least significant bit. [LSB]
4	FREG1	IN	Force register selection 2nd bit
5	FREG2	IN	Force register selection 3rd bit
6	FREG3	IN	Force register selection 4th bit Most significant bit. [MSB]
7	ENABLE	IN	Enable active force control
8	CALIB	IN	Calibrate Load weight
9	ISMOV	OUT	Is moving
10	ERROR	OUT	System error flag

6. Controller Functions

The following NAC has different functionalities that are elaborated in this section. The functionalities elaborated are the following:

- **Idle:** Operation mode where the tool unit is applying no active forces
- **Active Force Control:** Operation mode to apply a target force with the tool unit.
- **Retract:** Operation mode where tool unit is fully retracted to it 0 stroke position
- **Load Calibration:** Performs a calibration to measure the load weight.

Warning! Injury and pinching hazard can occur when performing the following steps if the load is not secured. Perform a risk assessment before carrying out actions based on the following instructions. Prevent unauthorized access and inform operators of potential hazards.

6.1. Idle

In idle the tool unit is consuming no air and applying no active force control. The passive force by the load is not compensated either.

6.2. Active Force Control

When active force control is activated the NAC-S20-15 is regulated to apply the target force profile with a negative or positive force values. It is also possible to ramp linear up to or down to a target force value from a previous target. The parameters for active force control are:

- **Target Force:** Target force the NAC should push/pull with
- **Ramp time:** The time to linear ramping up/down to the target force. If the time is set to 0 it will perform a regular step response
- **Load weigh:** The unit will actively cancel out the load weight

When specifying the IO interface using the web interface, only 16 different force profiles can be selected. Each stating a target force and ramp time.

Note: *It is possible to configure a soft approach using a higher order controller. Start from retract state. Set a low approach force and enable active force control. Monitor the is moving state flag. It will signal the tool is not moving upon impact. Then ramp your force up to desired target force.*

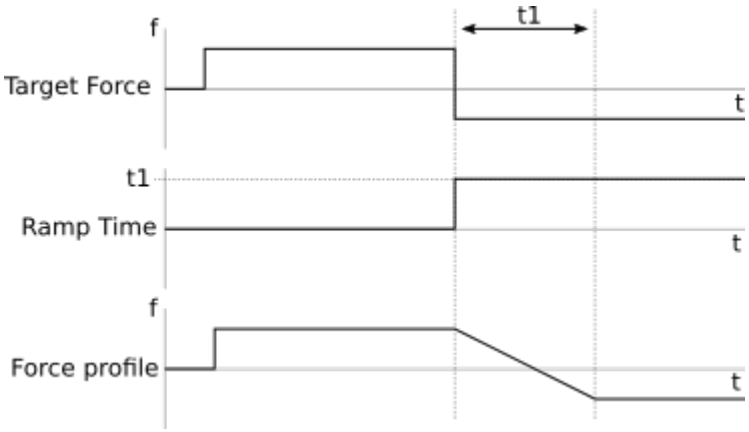


Figure 26: Example of force profile by adjusting target force and ramp time

6.3. Retract

Retract applies a high pull force to the NAC tool so the tool is retracted to its 0-position stroke length. Any active force control is canceled, and position encoder is reset.

6.4. Load Calibration

During load calibration the tool will figure out the load weight. It will try to figure out what force it should applied to cancel out the gravitational force on the load. Load weight is saved and maintained even after power has been switched off. It is important that the Tool unit is positioned so its stroke direction is aligned with the gravitational force.

7. Control via Digital IO Interface

Using the IO interface, it is possible to:

- Control target forces and ramp time by selecting one of 16 different preset forces.
- Initiating a load calibration.
- Monitor if the NAC-S20-15 is in motion
- Monitor if there are any errors.

7.1. Logic Status of Input and Outputs

When using NPN there is a difference between electrical high and low and the logical status 1 and 0.

Logic state	Electrical level (NPN)
1	Low-level (GND: 0V)
0	High-level (IOVCC: 5 to 48V)

Table 12: Logical status of IO Interface

7.2. Determine Unit is Ready

Readying the error signal from the controller is sufficient to decided when the unit is ready after powering on.

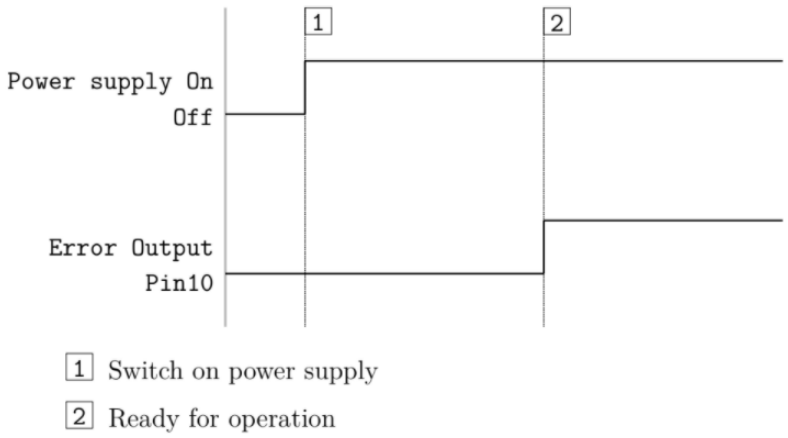


Figure 27: Determine ready status

7.3. Active Force Control

Pins 3-6 are used to set the target force. These pins form a 4-bit word where pin 3 is the least significant bit and pin 6 is the most significant bit. The value represented on these pins determines the force register index to be used e.g., 0101 will select force register index 5. Set pin 7 high to start active force control.

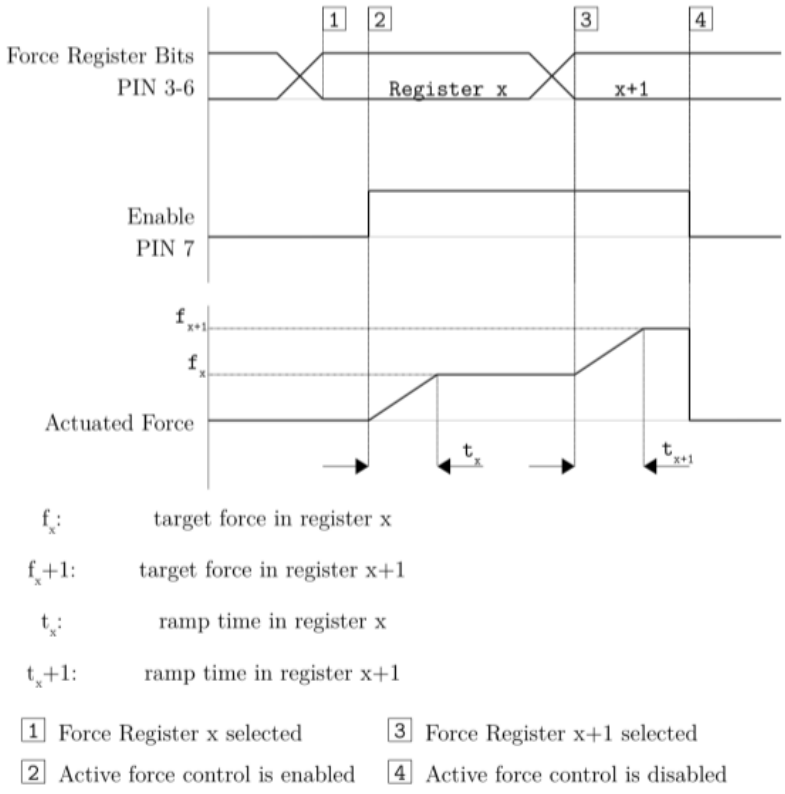


Figure 28: Active force control with switching force targets

7.4. Initiate Calibration

Pin 8 can be used to initiate the calibration routine. See section

Load Calibration for information on the calibration procedure. To initiate the calibration routine a pulse should be applied to the pin, but no longer than 2 seconds.

7.5. Monitor NAC-S20-15 Motion and Error

Pin 9 can be used to monitor if the system NAC-S20-15 is moving. It will be logic high when the NAC-S20-15 is standing still and logic low when NAC-S20-15 is moving. Pin 10 can be used to monitor if the systems is in an error state. It will be logic high if there is no error state and logic low if it is in an error state.

8. Control via Ethernet TCP/IP Interface

Using the Ethernet TCP/IP interface it is possible to:

- Control target force and ramp time
- Initiating load calibration
- Initiate position sensor homing
- Monitor Error flags
- Monitor if the NAC-S20-15 is in motion
- Monitor the stroke distance
- Monitor the NAC-S20-15 angle relative to the gravity vector

The NAC can be controlled through an Ethernet interface using a simple protocol on a standard TCP/IP connection. Data is transmitted using port 2002. The protocol uses only the data types seen in the table below.

Type	Description	Bytes	Value range
UINT8	8-bit unsigned integer	1	0 … 255
INT32	32-bit signed integer	4	-2147483648 … 2147483647
UINT32	32-bit unsigned integer	4	0 … 4294967295
DOUBLE	64-bit IEEE-754 Floating Point	8	-10^{308} … 10^{308}

Table 13: Overview of the Types supported by the Ethernet Interface.

The protocol defines a package format. Each packet consists of two parts: A header which contains the package size and type identifier and the data body which contains any data which may be transferred with a package. For every packet sent by the user an acknowledge is returned. The acknowledge has the same type as the packet initially sent. The body of the packet will hold 0x01 if the request was correctly carried out and 0x00 if it was not. The body of a packet can be empty. An overview of the format can be seen in Table 16 The size field counts the total number of bytes in a package, including the header. If the size field does not reflect the actual packet size the packet will not be read correctly. The Type field can have one of the values shown in Table 15. If the value entered in the type-field cannot be recognized the system will respond with an error.

Byte	Function	Data type	Description
0x00	Size	UINT8	The size of the message in bytes. Size = 2 + Data length
0x01	Type	UINT8	Message type identifier. See Table 15: Message Types for all message types supported
0x03 **…** **0xFF**	Data bytes	Types supported in Table 15	Data values

Table 14: Package format

Two types of transactions exist within the protocol. A control transaction or a stream transaction. A control transaction consists of two packets: A request and a response. The response can contain any requested data or just simply act as an acknowledge. The type of the response will always be identical to the type of the request. The body of the response will contain either a Boolean indicating whether the request has been carried out successfully or the Boolean success indicator followed by the requested data and as such the size will be determined by the requested data. Only one outstanding request can be handled at any given time. A stream transaction is a packet transmitted from the server to the client at a predefined interval. These packets contain either the current position or angle of the tool. A stream is not started before the client submitted a successful request for that specific stream.

#	Direction	Name	Data type	Data value	Description
0x01	TX	Active force control	UINT8	START: 0x01, STOP: 0x00	Indicates whether force control should be active.
0x02	TX	Set target force	UINT8	Force [N] 0 … 150N	Set target actuated force. Ramp time is set to 0. Note the difference in units between sending a UINT8 vs sending a INT32.
			INT32	Force [mN] -110000 … 150000 mN	
0x03	TX	Retract	-	-	Signals the NAC to lift the load weight and tares the position encoder when fully retracted.

0x05	TX	Set target force and ramp	INT32 and UINT32	Force [mN] -110000 … 150000 mN and Ramp time [mS] 0 … 200000 mS	Set target actuated force and ramp time.
0x0B	TX	Set load weight	UINT8	Load weight [N] 0 … 255N	Set weight of the load attached to the NAC-S20-15.
0x0F	TX	Idle	-	-	Signals the NAC to release the pressure. This command should be issued if the setup is going to be idle for an extended time to prolong the lifetime of the NAC-S20-15.
0x15	TX	Stream position	UINT8	START: 0x01 STOP: 0x00	Indicates whether the system should stream the current position of the NAC-S20-15.
0x16	RX	Position data	DOUBLE	Position [m]	The current position of the NAC-S20-15.
0x17	TX	Set position stream data rate	UINT8	Time between data packages [ms]	Data rate for position data stream.
0x18	TX	Set angle stream data rate	UINT8	Time between data packages [ms]	Data rate for angle data stream.
0x21	TX	Stream angle	UINT8	START: 0x01 STOP: 0x00	Indicates whether the system should stream the current angle of the NAC-S20-15.
0x22	RX	Angle data	DOUBLE	Angle [m]	The current angle of the NAC-S20-15 relative to the gravitational vector.

0x28	TX	Calibrate	-	-	Initiates calibration of load weight
0x29	TX/RX	Is moving	UINT8	Moving: 0x00, Not moving: 0x01	Returns the is moving flag. See Section Monitor NAC-S20-15 Motion and Error page 36
0x30	TX/RX	Firmware version	UINT8[4]	UINT8[0] = 1, UINT8[1] = Major, UINT8[2] = Minor, UINT8[3] = Patch	Returns the firmware version of the NAC-CB firmware.

Table 15: Message Types

9. Troubleshooting

The following section provides an overview of common issues and their solutions. The content of this section will be expanded based on customer feedback.

9.1. Unable to Connect to the Controller

Step 1

Check your network adapter settings on your windows PC if they are set to a static IP address.

Static IP address: Should be in the range 192.168.1.1-255 but different from 192.168.1.100

Subnet mask: Should be set to 255.255.255.0

Step 2

Determine IP address of the control unit. Initially it should be 192.168.1.100 but it can have been setup to use another IP address. If this is the case, use the reset button to reset IP address to 192.168.1.100.

Step 3

Try using an IP Scanner software to scan your network to identify the IP of the NAC-CTRL.

9.2. Reset Controller to Factory Defaults

The NAC-CTRL has a reset button on the front plate. Using it is possible to reset to factory defaults

Parameter	Default value	Unit
Enable IO Interface	True	
Force presets	0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75	N
Ramp preset	0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	ms
Is Moving timeout	50	ms
Is Moving threshold	1	mm
Load Weight	3	N

Table 16: Factory default parameters

Parameter	Default value
DHCP client	Off
IP address	192.168.1.100
Subnet mask	255.255.255.0
Default gateway	192.168.1.1
Hostname	nacserver

Table 17: Factory default network settings

Step 1

Click and hold the reset button

Step 2

Release reset button after the 3 white status LED has flashed 3 times

Step 3

Apply the Factory default by rebooting the NAC-CTRL by powering it off and then on again.

9.3. Support Requests

For questions, feature requests, and general support, please visit support.nordbo.io and create a ticket. We highly value feedback on our products and you can help us improve the product by sharing your experience.

10. Technical Appendix

10.1. Connection Specifications

Power supply	
Connection Plug	Phoenix DFK-MC 1,5/ 10-GF-3,81
Load voltage (pin 2) **Nominal voltage** **Nominal current** **Peak current**	 24VDC ±10% 0.35 A 2.0 A
Connection Plug	Phoenix DFK-MC 1,5/ 10-GF-3,81
Switch logic	NPN
Maximum cable length	30 m
IOVCC logic supply **Voltage rating**	Pin 2 5 to 48V DC
Digital input **Scanning rate** **Galvanic isolation**	Pin 3 to 8 50 ms No
Digital output **Maximum current per output** **Overload protection**	Pin 9 & 10 220 mA No
Ethernet interface	
Connection plug	RJ45 8-pin female
Transmission rate	100 Mbps
Bus interface	IEEE 802.3
Supported protocols	TCP/IP
Transmission class	Category Cat 5
IP address	192.168.1.100 (Default)
Subnetwork mask	255.255.255.0
Standard ports **Web server** **Control interface**	 80 2002
Maximum cable length	30 m
Tool unit interface	
Connection plug	M8 8-pin female
Maximum cable length	8 m

Table 18: Connectors and specifications

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