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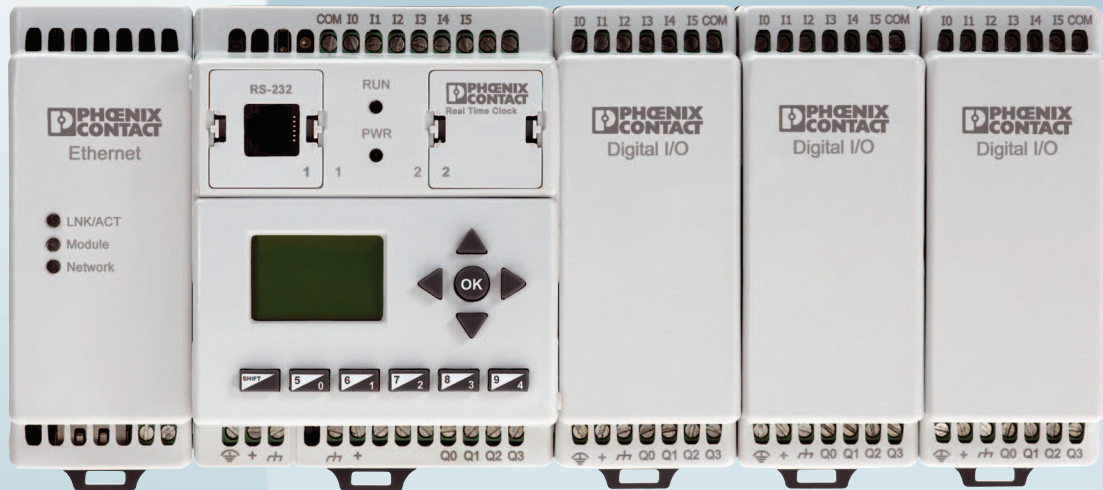
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# Installing and using Nanoline controllers

User manual  
UM EN NLC

# User manual

## Installing and using Nanoline controllers

2015-07-15

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Designation: UM EN NLC

Revision: O

This user manual is valid for:

Designation	Version	Order No.
Nanoline		

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# 1 Overview

The Nanoline family is a cost-effective programmable logic controller (PLC) that allows purchase of only the components and capabilities required for a specific application. This flexibility is achieved by using a modular approach to build a control system using a base unit and adding various expansion and option modules.

## 1.1 Components

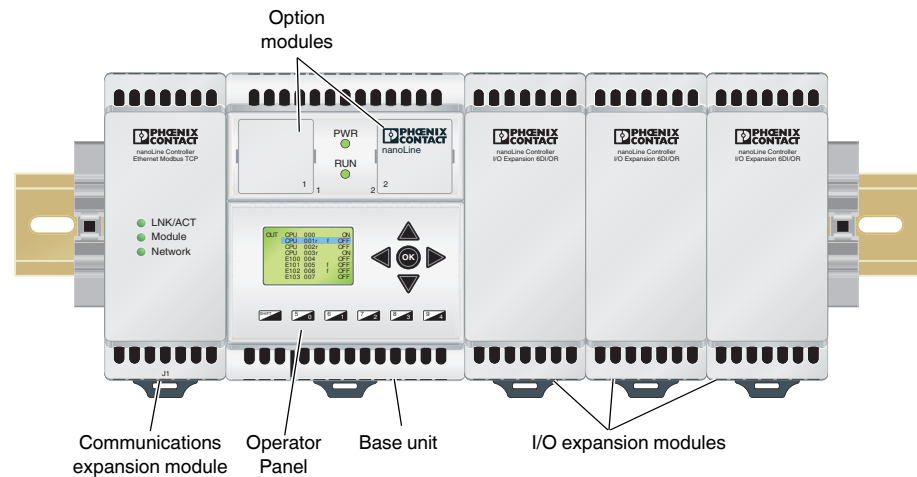


Figure 1-1 Typical system module layout

Starting with a base unit (NLC-05x-...), various expansion modules are connected to create the desired control system. The items that can be connected to the base unit are:

- I/O expansion modules
- Communication expansion modules
- Operator Panel
- Option modules

The base unit, communication expansion modules and I/O expansion modules attach to standard NS 35 mounting rail.

The type code on each base unit indicates how the base unit is equipped. See Figure 1-2 for an explanation of the type codes.

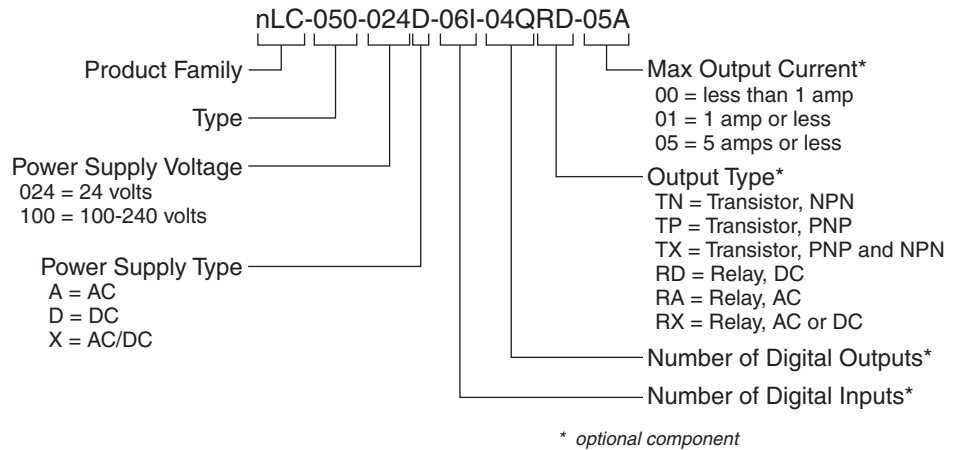


Figure 1-2 Nanoline base unit type codes

### 1.1.1 Nanoline base unit

The base unit contains the processing capability of the Nanoline system. One base unit is required for each Nanoline control system. Power connections are made to the base unit and distributed to the various modules from the base unit. The base unit also contains connection points (terminals) for the input and output devices that are controlled or monitored.

#### NLC-05...

A maximum of three I/O expansion modules can be attached to a base unit.

Two option slots are available on the base unit to install base unit option modules. D-SUB 9 connectors are located on each side of the unit. The left-side connector is for communication expansion modules, and the right-side connector is for I/O expansion modules. Both connectors are female to prevent improper module connection.

The power requirements and input/output (I/O) mix determine the model of base unit used.

#### NLC-03...

The NLC-03... base unit has an integrated RJ12 connector as a connection point for programming, RS-232 or RS-485 2-wire communication. D-SUB 9 connectors are located on each side of the base unit. The left-side connector is for communication modules and the right-side connector allows connection of one NLC-IOX... expansion module.

### 1.1.2 I/O expansion modules

In addition to the I/O points located on the base unit, I/O expansion modules (NLC-IO-...) can be connected to the base unit to provide additional connection points. Different I/O modules provide different combinations and types of I/O.

I/O expansion modules are always connected on the right side of the base unit. For example, a PNP or analog I/O expansion module can be added to an NPN base unit. A female D-SUB 9 connector located on the left side of the module connects to a male D-SUB 9 connector on the right side of the base unit or previously installed I/O expansion module. A maximum of three NLC-IO-... modules can be connected.

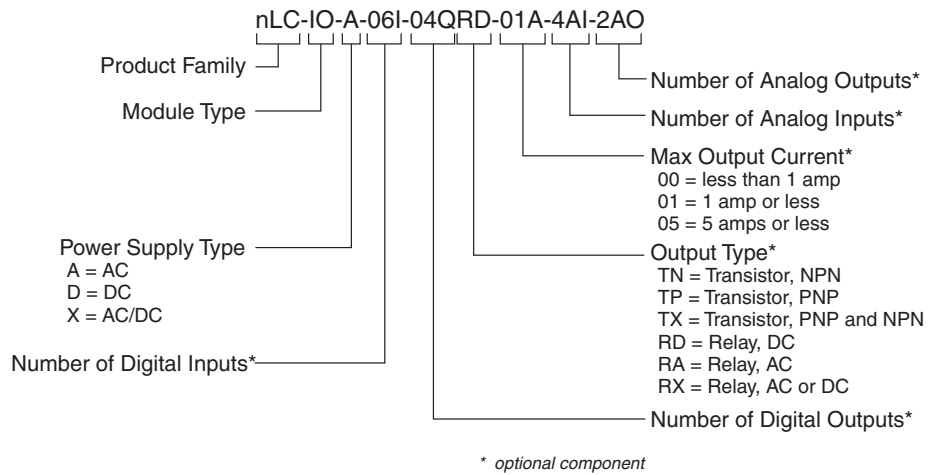


Figure 1-3 NLC-IO... expansion module type codes

### 1.1.3 Communication expansion modules

Communication expansion modules (NLC-COM-*ttt*) are used to place a control system on a network. Appropriate connectors for the type of communication are included on the NLC-COM-.... For instance, an Ethernet-capable module uses an RJ45 connector.

Different expansion modules are required for different network types but only one communication expansion module can be connected to the base unit at a time (a second network can be connected through the RS-232 or RS-485 base unit option module).

Communication expansion modules are always connected on the left side of the base unit. A female D-SUB 9 connector located on the right side of the module connects to a male D-SUB 9 connector on the left side of the base unit.

### 1.1.4 Option module

Base unit option modules (NLC-MOD-...) are placed in the appropriate slot on the base unit. A variety of option modules are available to accomplish specific purposes.

The slots for NLC-MOD-... modules are located on the face of the base module. The slots are numbered 1 or 2, so the proper option module can be placed in the proper slot.



**NOTE:**

Option modules are not keyed to prevent entry into an incorrect slot. However, option modules are not interchangeable between slots. Option modules intended for Slot 1 must only be inserted in Slot 1, and option modules intended for Slot 2 must only be inserted in Slot 2. Each slot is labeled on the face of the base unit, and each option module includes a numeric indicator to indicate which slot is acceptable.

Blanks are used to fill the slot when a module is not used. If a base unit option module is removed, place the blank in the slot to prevent ingress of dirt and dust.

## 1.2 Operator Panel

To provide an interface to the control system, an Operator Panel (NLC-OP...) can be installed in, or attached to, the base unit. Two different sizes of Operating Panel are available:

### 1.2.1 NLC-OP1-LCD-032-4X20

The NLC-OP1-LCD-032-4X20 can be mounted directly on the base unit or remotely, such as in an enclosure door panel. When mounting remotely, a Receptor Panel is placed in the slot on the base unit, and a 1 m (3 ft.) cable connects the Receptor Panel and the remotely mounted Operator Panel. In this way, a single NLC-OP-... can be shared between multiple base units. The Operator Panel is hot-swappable and doesn't require rebooting the controller.

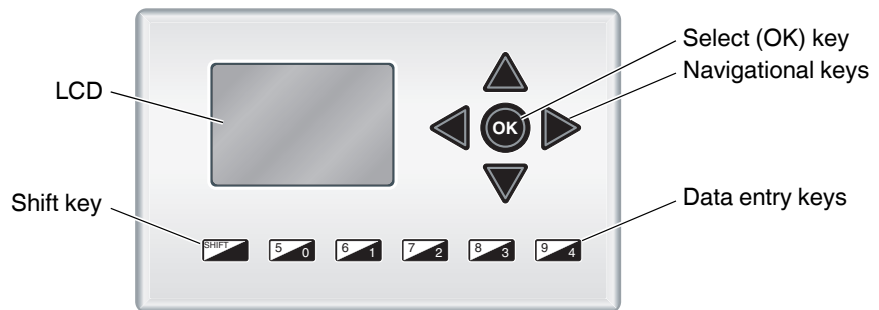


Figure 1-4 Nanoline Operator Panel (NLC-OP1-LCD-032-4X20)

The Nanoline Operator Panel includes an 8-line, 21-character Liquid Crystal Display (LCD), four navigation keys, an <OK> or select key, a <shift> key and five data entry keys.



User-programmed screens are limited to 4 lines with 20 characters (normal text), 2 lines with 10 characters (large text) or a combination of normal and large text.

When a user interface is created within nanoNavigator, the navigational keys allow selection of the various screens and fields within the screens.

- Navigational keys: These allow selection of various screens and fields, or lines, on the LCD.
- Select <OK> key: This selects an option within the screen, allowing selection of another level of screen navigation. This is also used to enter the "edit" mode of a field for data entry.
- Data entry key: These five keys allow entry of numeric values (0 through 4) into a field. The data entry keys can be programmed as digital inputs to allow selection within the software.
- Shift key: This works in conjunction with the data entry keys to obtain values 5 through 9. Press and hold the Shift key while pressing a 0 to 4 key enters the comparable 5 to 9 value.

## 1.2.2 NLC-OP2-LCD-076-4X20

The NLC-OP2-LCD-076-4X20 Operator Panel is mounted remotely and attaches to the Receptor Panel placed in the slot on the base unit. An RS-232 cable connects the Receptor Panel to the remotely mounted Operator Panel up to 15 m away.

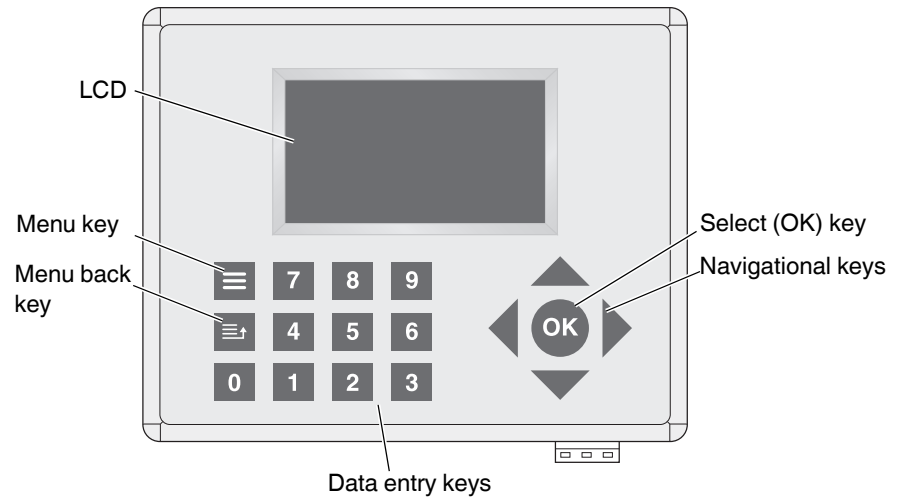


Figure 1-5 Nanoline Operator Panel (NLC-OP2-LCD-076-4X20)

The Operator Panel is hot-swappable and doesn't require rebooting the controller. The NLC-OP2-LCD-076-4X20 is not powered from the NLC... and requires a separate, 12 or 24 V DC power source.

Additional information on the Operator Panels is provided in Section 5, "Operator Panel usage".

### 1.3 nanoNavigator programming software

Programming is accomplished using nanoNavigator programming software. To provide a simple-to-understand controller, nanoNavigator provides:

- control logic development using either flow chart or ladder chart programming
- easy-to-use human machine interface (HMI) development
- complete I/O interface definition
- ability to monitor running Nanoline controllers
- simulation of a project before loading it onto a controller

To program the Nanoline control system, simply select the desired flow chart blocks and populate them with input and output data. Connect the blocks, download the program to the controller, and it's operational.

Using nanoNavigator, the programmer can create screens for display on the Operator Panel. The screens not only display the desired data but can prompt for input from the operator.

nanoNavigator software runs on a PC using a Windows® 2000 or newer, 32- or 64-bit operating system. nanoNavigator software is available for download at [phoenixcontact.com](http://phoenixcontact.com).



For more information on using the nanoNavigator software, refer to the nanoNavigator User Manual.



## 2 Installation and connection of Nanoline components

As modular devices, the Nanoline system components are simple to connect and configure for specific applications. In addition to selecting the correct base unit, additional I/O modules (with the desired I/O mix), communication modules and an Operator Panel can be selected for the specific application.

### 2.1 Base and expansion module installation

The base unit and expansion modules install on NS 35 mounting rail (EN 60715). A release latch is located on the bottom side of each module. Up to three I/O expansion modules can be attached to the right side of the base unit, and one communication expansion module can be attached to the left side of the base unit.

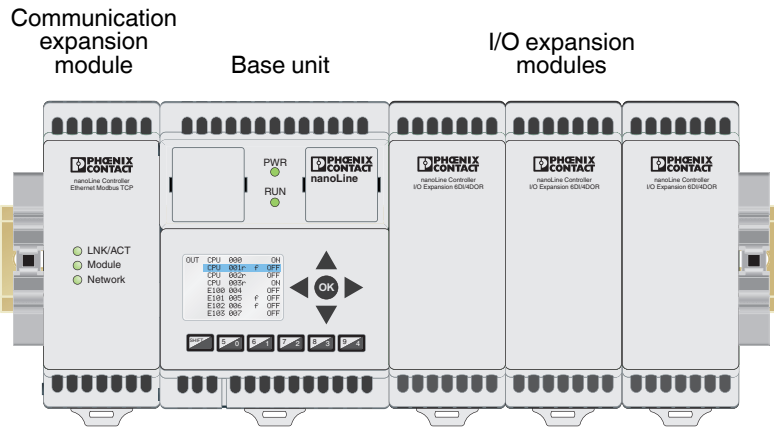


Figure 2-1 Module locations

#### 2.1.1 Installing modules on the mounting rail



**NOTE:**

The Nanoline is intended for vertical mounting (DIN rail attached to a vertical wall). This aids in cooling by allowing air flow through the base unit and any installed modules. Install the Operator Panel and any option modules in the base unit before mounting the unit.

1. Use a small screwdriver to remove the plastic over the D-SUB 9 connector on the appropriate side of the base module before mounting the module on the rail.



**NOTE:**

Do not remove the plastic cover when not installing an expansion module.

- Remove the left-side plastic to connect a communication expansion module.
- Remove the right-side plastic to connect I/O expansion modules.

2. Pull the release latch out before positioning the base unit on the mounting rail.

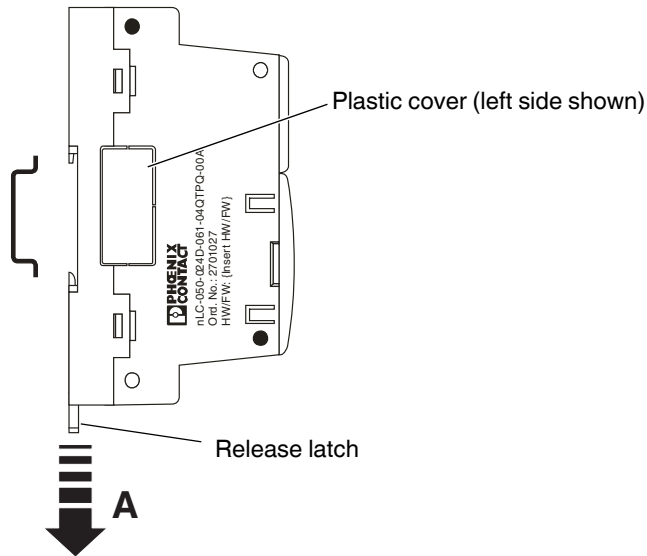


Figure 2-2 Base unit release latch

3. Hook the unit onto the mounting rail.
4. Swivel the module fully onto the rail and push the release latch in to secure it to the rail.

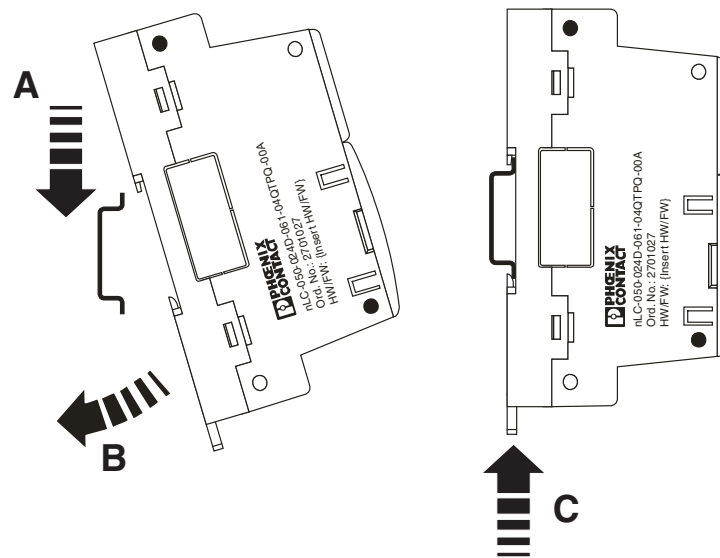


Figure 2-3 Rail placement

5. If multiple I/O expansion modules are to be installed, remove the right-side plastic cover on all but the last module. For example, if two I/O expansion modules will be installed, remove the cover on the first module but not the second.

**NOTE:**

The right-most module must always have the plastic cover over the D-SUB 9 connector installed.

6. Repeat steps 2.- 4. for all expansion modules, placing the communication expansion module (maximum of one) on the left side of the base unit and I/O expansion modules (maximum of three) on the right side of the base unit.
7. Slide the communication expansion module to the right against the base unit. A slight resistance will be felt as the D-SUB 9 connectors mate.
8. Slide any I/O expansion modules to the left against the base unit. A slight resistance will be felt as the D-SUB 9 connectors mate.
9. Repeat step 8. for any additional I/O expansion modules. A maximum of three modules can be attached to a base unit.

### 2.1.2 Removing modules from the mounting rail

To remove a Nanoline base unit or module from the mounting rail:

**CAUTION:**

Always disconnect power to the system at the power source before removing any components from the mounting rail. Do not remove power wires from the connector without disconnecting power at the source.

1. Disconnect power to the base unit at the power source. If input/output wiring is to be disconnected, disable any separate power supplies attached to affected I/O devices.
2. Disconnect the power supply wires to the base unit.
3. If expansion modules are to be removed, disconnect any input/output wiring to I/O expansion modules or network connections to the communication expansion module.



If only the base unit is to be removed, it may be possible to slide the expansion modules to the side, if sufficient wire length and mounting rail space are available, without disconnecting I/O wires.

4. If expansion modules are installed, slide them away, one at a time, from the base unit. Slide communication expansion modules to the left and I/O expansion modules to the right.

**NOTE:**

Do not slide multiple I/O expansion modules as a group as damage to the interfacing connectors may occur.

- If the base unit is to be removed, disconnect any input/output wiring.

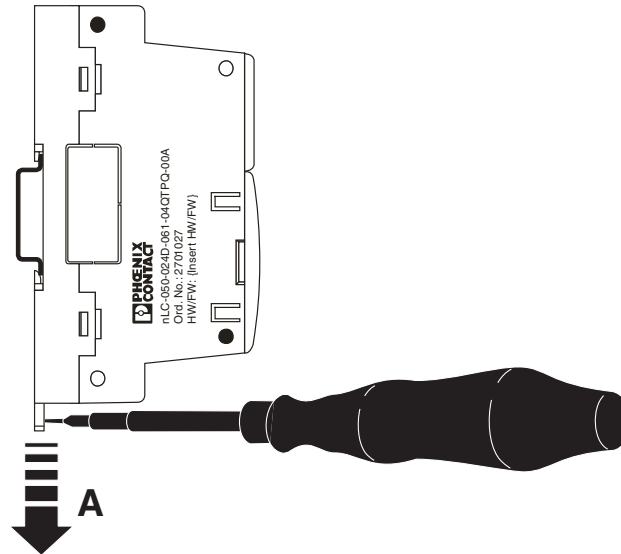


Figure 2-4 Latch release for module removal

- With all wires to the module disconnected, use a small screwdriver to pull down on the release latch and lift the module off the mounting rail.

## 2.2 Option modules

Base unit option modules are installed in slots on the face of the base unit. Option modules are specific to a slot and must not be installed in an incorrect location.



**NOTE:**

Placing an option module in the incorrect slot, or placing it in the slot in the incorrect orientation (rotated), may cause damage to either the option module or base unit or both. Do not force option modules into a slot. They will slide easily when properly aligned. Install the Operator Panel and any option modules in the base unit before mounting the unit.

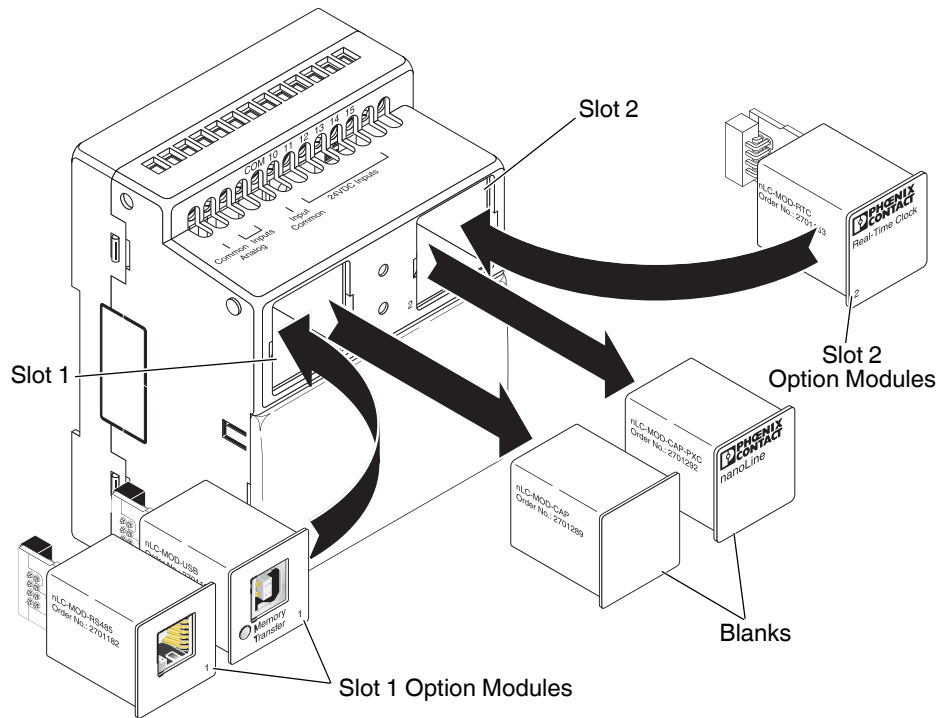


Figure 2-5 Base unit slots

Slot 1 is located on the left side and is typically used for communication and memory modules. Slot 2 is located on the right side and is typically used for the RTC module. A small 1 or 2 is located on the face of the option module to indicate the slot the module may be placed in.

To prevent ingress of dirt and dust, the option module slots are normally covered with a blank. To remove a blank or module, squeeze the two tabs together and pull the blank or module from the base unit. After inserting a module or blank, ensure it is latched in place by pressing the two tabs outward.



**NOTE:**

Never operate the Nanoline base unit without either a blank or option module installed in the slots.

When the blank is removed, the option module may be inserted into the slot. When installing modules ensure that:

- the module is being placed in the correct slot – Slot 1 only accepts modules with 1 on the lower right corner, and Slot 2 only accepts modules with 2 on the lower left corner.
- the module is oriented properly – text must be oriented the same as other text on the face of the base unit.
- the tabs are properly seated to secure the module in the base unit.

### 2.2.1 RS-232 connections

To connect the Nanoline to an RS-232 device, the NLC-MOD-RS232 option module (Order No. 2701179) and cable (Order No. 2701234) are required. The cable is a 1 m cable with an RJ11 connector end to plug into the option module and a D-SUB 9 female end to attach to the RS-232 device.

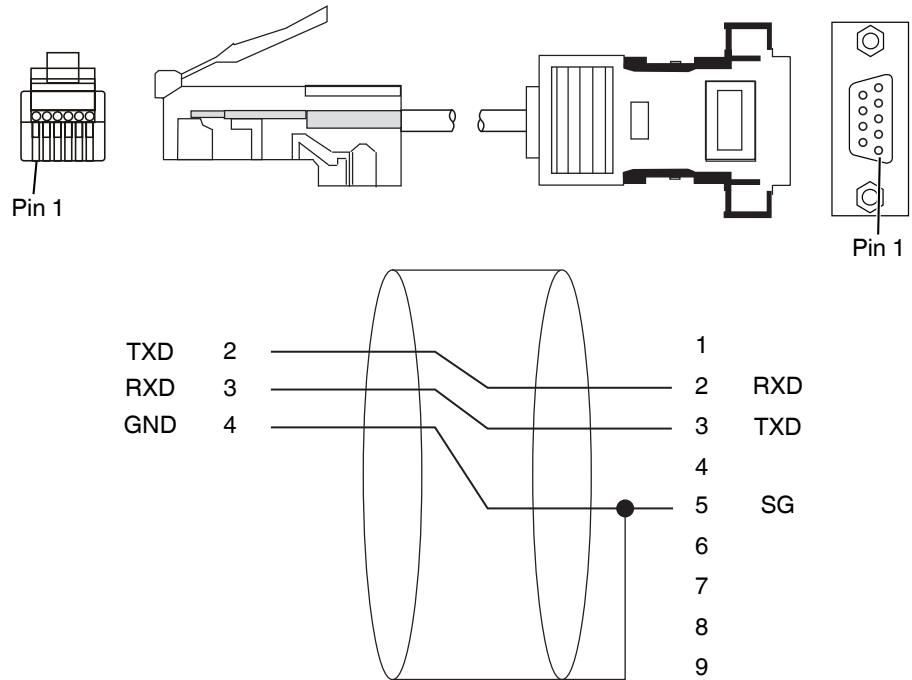


Figure 2-6 RJ11 to D-SUB 9 cable for serial port connection

### 2.2.2 RS-485 connections

To connect the Nanoline to an RS-485 device, the NLC-MOD-RS485 option module (Order No. 2701182) and cable (Order No. 2701073) are required. The option module is a four-wire RS-485 module capable of Modbus<sup>®</sup> communication. The cable is a 5 m cable with an RJ11 connector end to connect to the option module. The other end is open for connection to whatever type of connector is required. Trim the cable to the desired length before connecting.



The NLC-MOD-RS485 option module supports connection of up to 16 nodes before a repeater is required.

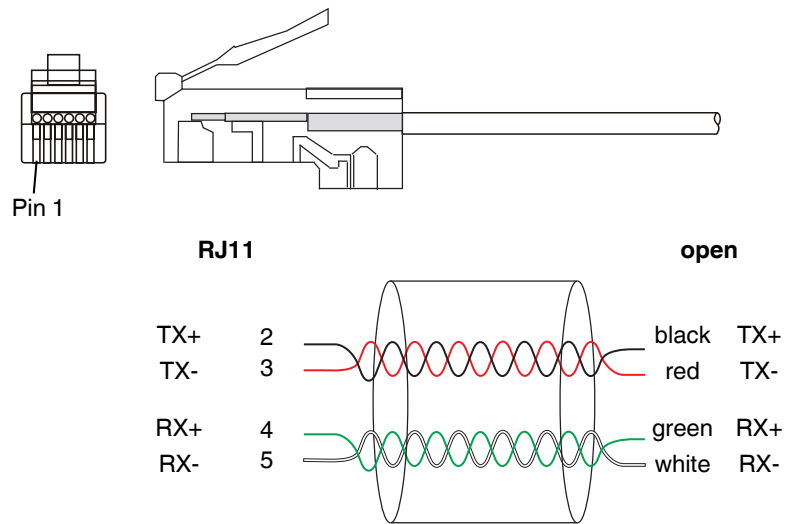


Figure 2-7 RJ11 to open end for 4-wire RS-485 connections



For 2-wire RS-485 communications, jumper TX+ and RX+ together and TX- and RX- together. 2-wire communications limits the Nanoline to performing Modbus commands only. 4-wire communication allows all Nanoline communications (connection, upload and download of projects, Modbus communication, monitoring) except firmware updates.

### 2.2.3 Modbus network connection (NLC-03... only)

The NLC-035... is capable of two-wire RS-485 connection for Modbus communication. A six-pin RJ12 connector attaches to the bottom of the controller, opposite the power connections.

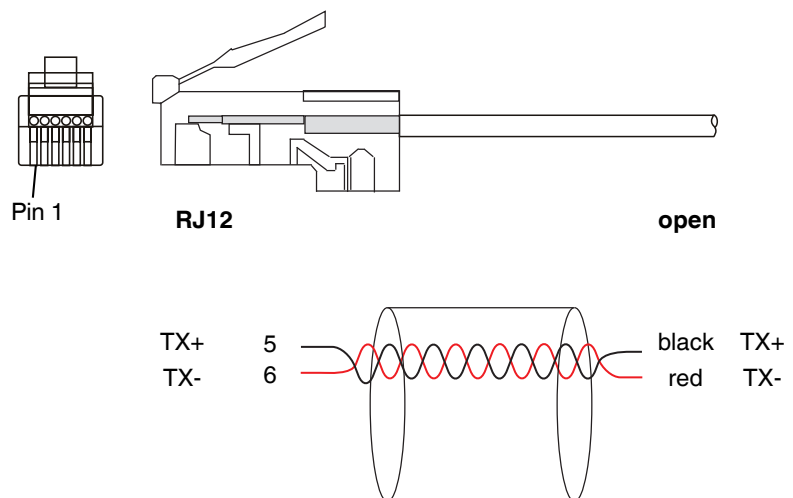


Figure 2-8 RJ-12 to open end for 2-wire RS-485 connection



### 2.2.4 USB connections

To connect the Nanoline controller to a PC for data transfer, a USB port is often used. To connect to a USB device, the NLC-MOD-USB option module (Order No. 2701195) and cable (Order No. 2701247) are required. The cable is a 2 m cable with a Type A connector to attach to the option module and a Type B connector to attach to the device.

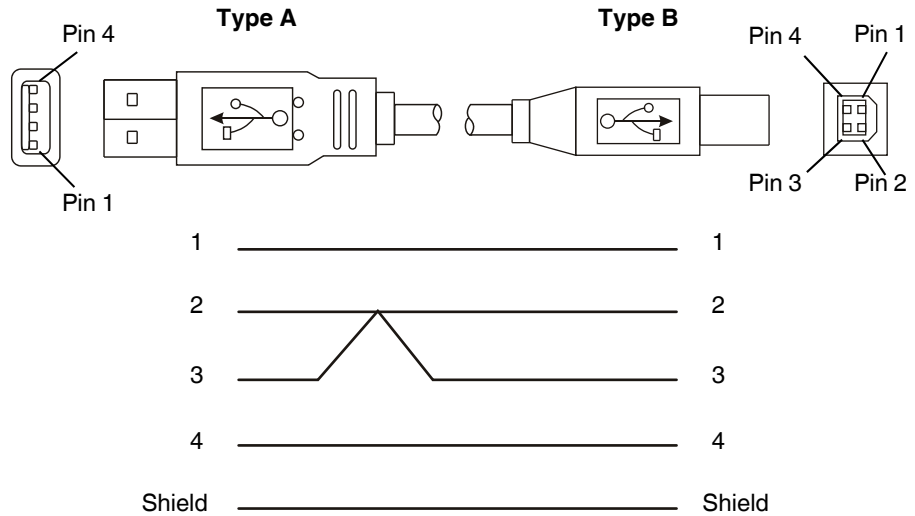


Figure 2-9 USB Type A to USB Type B cable for serial port connection

### 2.3 Operator Panel

The Nanoline system functions with or without an Operator Panel but often includes the Operator Panel to provide an interface for the user.

The base unit is shipped with a blank in the Operator Panel location. To remove the blank, use a screwdriver and pry the blank out of the base unit. When not using an Operator Panel, the blank must be installed to prevent dirt and dust entry.



**NOTE:**

Never operate the Nanoline base unit without either a blank, Receptor Panel or Operator Panel installed in the base unit.

Do not force option modules into a slot. They will slide easily when properly aligned.

Install the Operator Panel and any option modules in the base unit before mounting the unit.

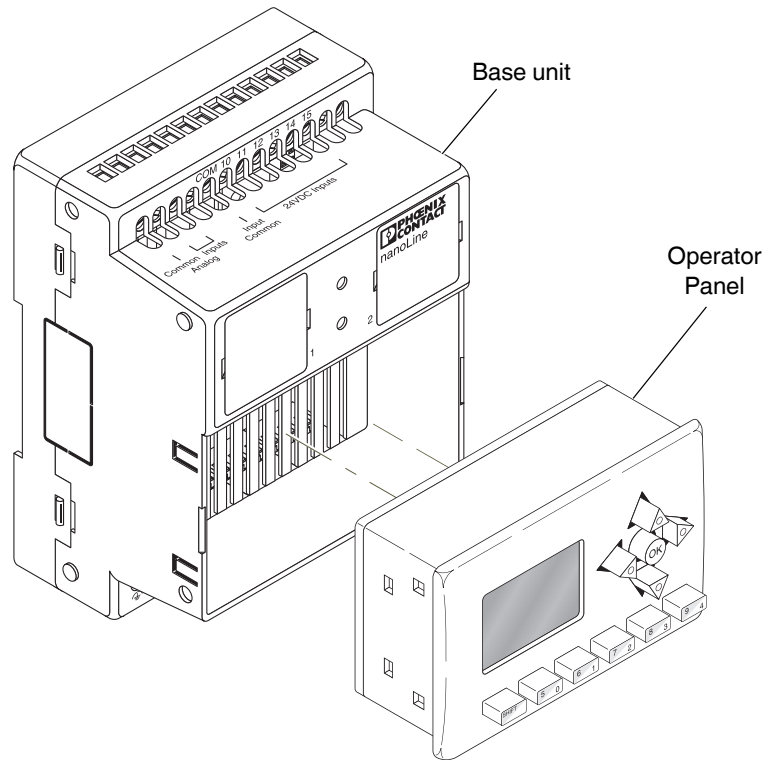


Figure 2-10 Operator Panel location on the base unit

### 2.3.1 Local installation

To install an Operator Panel directly on the base unit, simply replace the blank with the Operator Panel. The Operator Panel snaps into the base unit housing and is powered through the connector in the base unit.

### 2.3.2 Remote installation

To use the Operator Panel remotely, a Receptor Panel and display cable are required. This allows the Operator Panel to be used as a hand-held device and shared between Nanoline controllers, or the Operator Panel can be fixed to an enclosure.

The Receptor Panel with RJ45 connector installs in the base unit where the Operator Panel would normally install. The display cable connects the Receptor Panel and Operator Panel, which is either hand-held and used as a service tool, or remotely mounted in an enclosure.

To install the Receptor Panel in the base unit, simply replace the blank with the Receptor Panel. The Receptor Panel snaps into the base unit housing and is powered through the connector in the base unit just like the Operator Panel.



**NOTE:**

Orient the Receptor Panel so the connector on the back mates with the connector in the base unit slot.

The remote Operator Panel can be mounted in enclosures with a thickness of 1.6 - 2.0 mm. When mounted remotely, the Operator Panel must be within 0.6 m of the base unit for proper communication.



**NOTE:**

To ensure proper power supply and communication with the Operator Panel, only use a display cable supplied by Phoenix Contact.

**NLC-OP1-LCD-032-4X20**

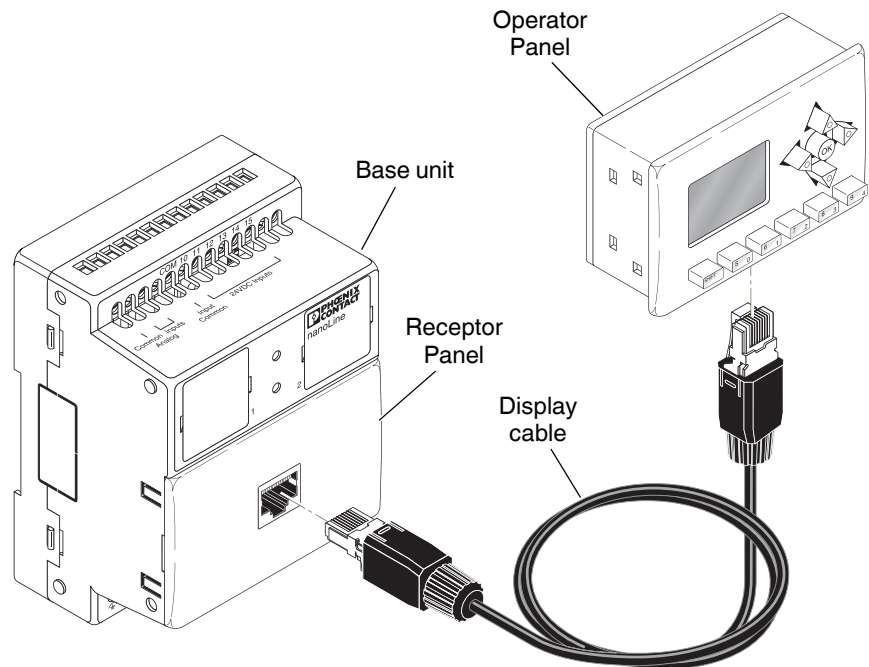


Figure 2-11 Receptor Panel, display cable and remote Operator Panel

To mount the Operator Panel in an enclosure or cabinet:

1. Clear any components around the desired mounting location on the enclosure.

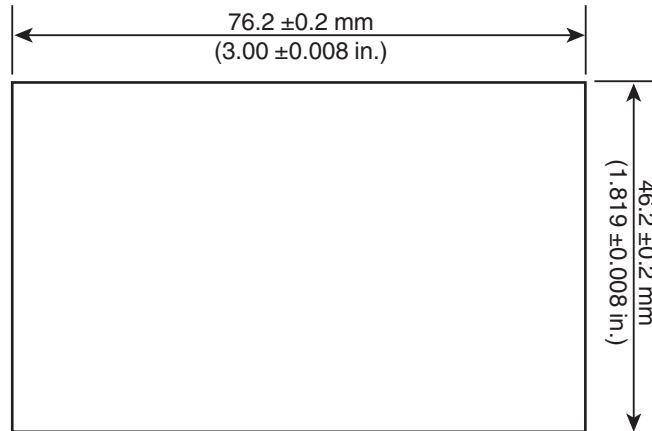


Figure 2-12 Cutout dimensions for panel mounting

2. Using an appropriate tool for the enclosure material, cut a  $46.2 \times 76.2 \pm 0.2$  mm hole in the enclosure (see Figure 2-12). Remove any burrs or sharp edges using a file or appropriate tool.



**NOTE:**

Do not make the hole in the enclosure too large or the Operator Panel will pass through. Do not drill holes for the mounting screws; they do not pass through the enclosure wall.

3. Insert the Operator Panel into the hole from the front.

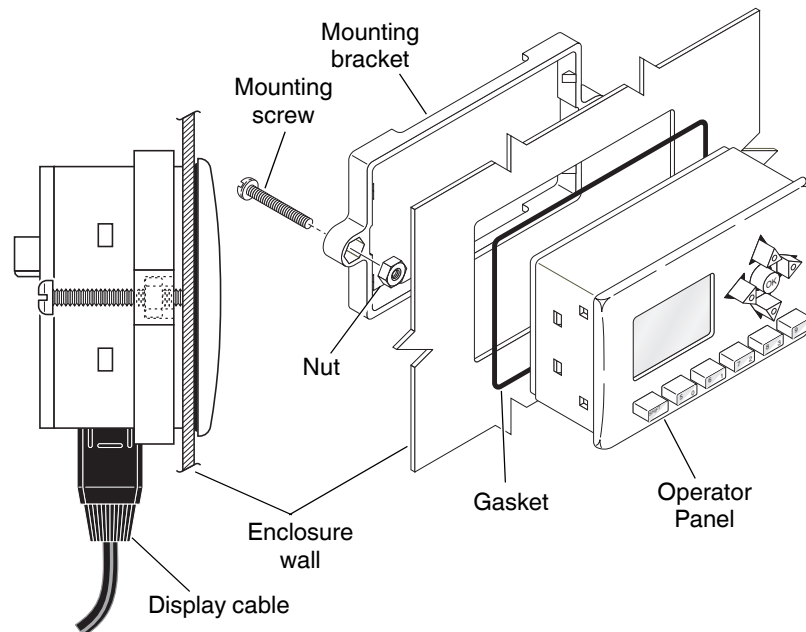


Figure 2-13 Remote Operator Panel installation