Installation Guide Technology Module

ENG

TM01

Important Notice:

Please note that we use machine translation to provide documents in your local language. It is possible that not all texts will be translated correctly. If you have any questions or discrepancies regarding the accuracy of the information in the translated version, please read the original English version (0185-1180-E).

Please visit https://www.linmot.com to check for the latest version of this document!

Content

1 General Information

1.1 Introduction

This manual includes instructions for the assembly, installation, maintenance, transport, and storage of the Technology Module 01 (TM01). The document is intended for electricians, mechanics, service technicians, and warehouse staff.
Read this manual before using the product and always observe the general safety instructions and those in the relevant section.
Keep these operating instructions in an accessible place and make them available to the personnel assigned.

1.2 Explanation of Symbols

Triangular warning signs warn of danger.

Round command symbols tell what to do.

1.3 Qualified Personnel

All work such as installation, commissioning, operation, and service of the product may only be carried out by qualified personnel.
The personnel must have the necessary qualifications for the corresponding activity and be familiar with the installation, commissioning, operation, and service of the product. The manual and in particular the safety instructions must be carefully read, understood, and observed.

1.4 Liability

NTI AG (as manufacturer of LinMot and MagSpring products) excludes all liability for damages and expenses caused by incorrect use of the products. This also applies to false applications, which are caused by NTI AG's own data and notes, for example during sales, support or application activities. It is the responsibility of the user to check the data and information provided by NTI AG for correct applicability in terms of safety.
NTI AG's warranty is limited to repair or replacement as stated in our standard warranty policy as described in our "terms and conditions" previously supplied to the purchaser of our equipment (please request copy of same if not otherwise available). Further reference is made to our general terms and conditions.

1.5 Copyright

2 Safety Instructions

For your personal safety

Disregarding the following safety measures can lead to severe injury to persons and damage to material:

- Only use the product as directed.
- Never commission the product in the event of visible damage.
- Never commission the product before assembly has been completed.
- Do not carry out any technical changes on the product.
- Only use the accessories approved for the product.
- Only use original spare parts from LinMot.
- Observe all regulations for the prevention of accidents, directives and laws applicable on site.
- Transport, installation, commissioning, and maintenance work must only be carried out by qualified personnel.
- Observe IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or DIN VDE 0110 and all national regulations for the prevention of accidents.
- According to the basic safety information, qualified, skilled personnel are persons who are familiar with the assembly, installation, commissioning, and operation of the product and who have the qualifications necessary for their occupation.
- Observe all specifications in this documentation.
- This is the condition for safe and trouble−free operation and the achievement of the specified product features.
- The procedural notes and circuit details described in this documentation are only proposals. It is up to the user to check whether they can be transferred to the applications. NTI AG / LinMot does not accept any liability for the suitability of the procedures and circuit proposals described.
- Non−authorized removal of the required cover, inappropriate use, incorrect installation, or operation create the risk of severe injury to persons or damage to material assets.
- For more information, please see the documentation.

Application as directed

- TM01 are components, which are designed for installation in electrical systems or machines. They are not to be used as domestic appliances, but only for industrial purposes according to EN 61000−3−2.
- When TM01 are installed into machines, commissioning (i.e., starting of the operation as directed) is prohibited until it is proven that the machine complies with the regulations of the EC Directive 2006/42/EG (Machinery Directive); EN 60204 must be observed.
- Commissioning (i.e., starting of the operation as directed) is only allowed when there is compliance with the EMC Directive (2014/30/EU).
- The technical data and supply conditions can be obtained from the nameplate and the documentation. They must be strictly observed.

Transport, storage

- Please observe the notes on transport, storage, and appropriate handling.
- Observe the climatic conditions according to the technical data.

Installation

- The TM01 must be installed and cooled according to the instructions given in the corresponding documentation.
- The ambient air must not exceed degree of pollution 2 according to EN 61800−5−1.
- Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport or handling. Do not touch any electronic components and contacts.
- TM01 contain electrostatic sensitive devices, which can easily be damaged by inappropriate handling. Do not damage or destroy any electrical components since this might endanger your health!

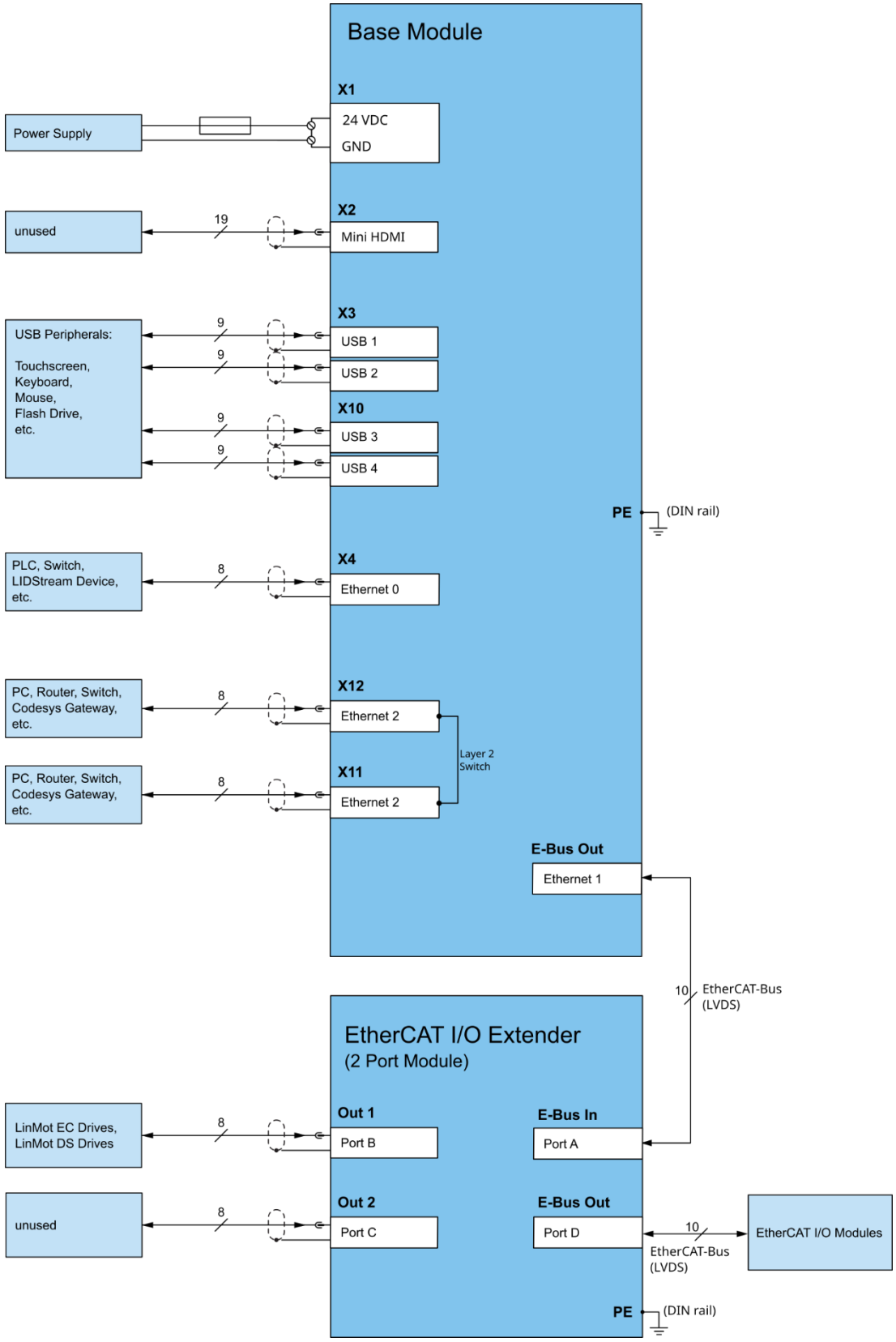
Electrical connection

- When working on live TM01, observe the applicable national regulations for the prevention of accidents.
- The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross−sections, circuit breakers, fuses, PE connection). Additional information can be obtained from the documentation.
- This product can cause high-frequency interferences in non-industrial environments, which can require measures for interference suppression.

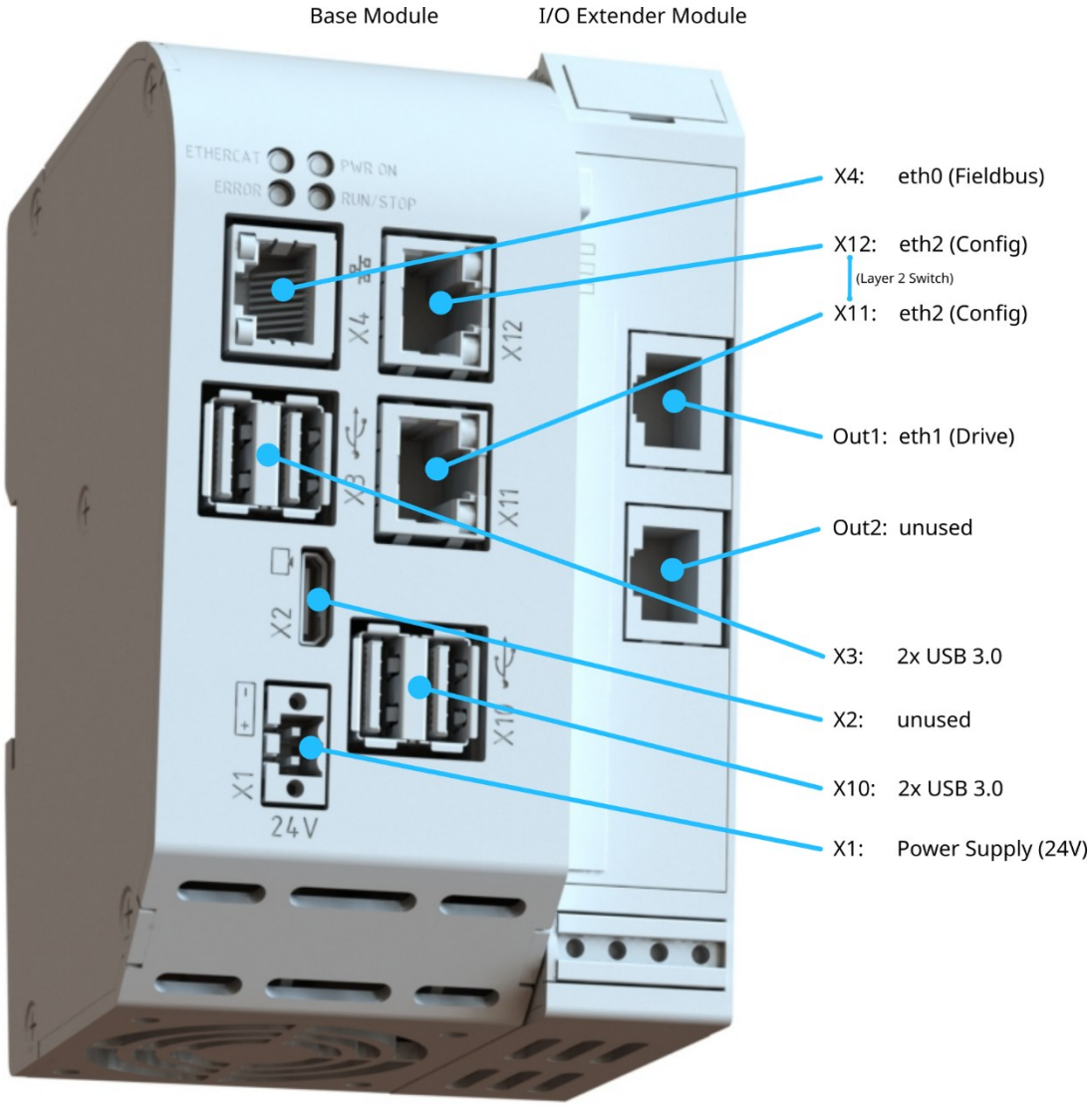
Grounding

All metal parts that are exposed to contact during any user operation or servicing and likely to become energized shall be reliably connected to the means for grounding.

3 System Overview



4 Interfaces



5 Functionality

	TM01-2xxx	TM01-3xxx	TM01-4xxx
Article Number	0150-6552	0150-6553	0150-6491
CODESYS Licenses			
CODESYS Control	●	●	●
CODESYS SoftMotion	●	●	
CODESYS SoftMotion CNC & Robotics		●	
eth0 Interface			
LIDStream	●	●	●
PROFINET Device (Slave)	●	●	●
EtherNet/IP Adapter (Slave)	●	●	●
eth1 Interface			
EtherCAT Master	●	●	●
EtherCAT SoftMotion Master (CiA402)	●	●	●
eth2 Interface			
CODESYS WebVisu	●	●	●
OPC UA Server	●	●	●

6 Software

6.1 TM-Manager

TM-Manager is an application from LinMot that discovers Technology Modules on the local network and performs the device configuration and maintenance tasks (login, network settings, time and date, firmware update, application update, backup/restore, factory reset, reboot) from a single window. It is the tool used to configure a Technology Module. TM-Manager can be downloaded from https://linmot.com.

Connecting and starting

- The simplest setup is a direct connection: connect the computer to port eth2 (X11/X12) of the TM01 with an RJ45 cable. TM-Manager also works in a DHCP environment - when the TM01 and the computer are on the same network through a switch or router, the TM receives an address from the DHCP server and TM-Manager finds it during the scan.
- Start TM-Manager. No installation is required.

Scanning and logging in

- On startup TM-Manager scans the network and lists every TM01 it finds in a table with the columns Hostname, Custom Name, IP Address, MAC-ID, Username and Password. Press "Scan Again" to repeat the scan.
- The username is *admin*. Enter the password (written on the LinMot label) in the Password column. Typing a password automatically selects the device's checkbox. You can also select devices manually. The eye button on the right shows or hides the typed passwords.
- (Optional) Give a device a Custom Name. The name is stored on the computer and reappears on the next scan.
- Press "Login Selected" to log in to all selected devices and open the device page. After a successful login the password is stored encrypted on the computer and pre-filled the next time the device is scanned. A device whose login fails is marked in red, and the page does not switch.

The device page

- The left side lists the logged-in devices; select one to act on it. The right side shows the selected device's information (application name and version, firmware version, IP address, and more under "show more").
- The middle holds the action buttons, grouped as Configuration (Get Device Info, Time and Date, Network Settings), Software (Update Firmware, Update Application, Open Application), System (System Backup, System Restore, Factory Reset) and Power (Reboot, Poweroff). A progress bar at the bottom shows the progress of the running action.
- "<< Back" returns to the scan page without losing the current list.

Network Settings

The configuration port is eth2 (X11/X12). Per default eth2 obtains its address via DHCP, and eth2:1 holds the static IP address printed on the label (netmask 255.255.0.0, gateway 0.0.0.0). eth0 is a "profinet device" (used for Profinet and Ethernet/IP) and eth1 is "ethercat" (used by the EtherCAT Bus Extender); these are not changed by TM-Manager.

1. Select the device on the device page and click "Network Settings". The dialog reads the current configuration of the eth2 (X11/X12) interface.
2. Choose "DHCP" to obtain an address automatically, or "Static" and enter the IP Address, Subnet Mask and (optionally) Gateway.
3. Press "Apply" and confirm. TM-Manager writes the configuration and reboots the device. The recovery address on the label (eth2:1) is always kept, and eth0, eth1 and eth2:1 are left untouched.
4. Because the device may come back on a different IP address, TM-Manager returns to the scan page after the reboot. Press "Scan Again" to find the device at its new address. Please note that a reboot takes about 30 seconds.

Time / Timezone

1. Select the device on the device page and click "Time and Date". The dialog reads the current date, time, timezone and NTP servers from the device.
2. To set the timezone and clock to match your computer, press "Sync to Computer". To set them manually, edit the Date, Time and Timezone fields and press "Apply" (only changed values are sent to the device).
3. For NTP time synchronization, enter one to three NTP servers as IP addresses and press "Apply". TM-Manager enables NTP synchronization automatically, and because the servers are given as IP addresses no DNS server has to be configured. Press "Clear" to switch NTP synchronization off again.

Application Update

1. Select the device on the device page and click "Update Application". Choose the application type, then either select a version from the list (downloaded directly from the LinMot server) or press "Browse..." to pick a *.tgz* file you received from LinMot. If there is no internet connection, previously downloaded versions are listed instead.
2. Press "Download & Install" (or "Install", if the file is already present) and confirm.
3. TM-Manager runs the whole sequence automatically: it verifies the package signature, checks that the device firmware meets the application's minimum requirement, creates a backup, stops the running PLC application, uploads the package and reboots the device. You do not need to stop the PLC application by hand.

Notes:

- If the device firmware is too old for the selected application, TM-Manager blocks the update and tells you to update the firmware first (see Firmware Update).
- If the selected version is not newer than the installed one, you must acknowledge a downgrade warning before continuing.

Firmware Update

Important: Only update the firmware if a new plc application needs its dependency. The name of the plc application indicates the required firmware with the following string: "FWx.x.x".

1. Select the device on the device page and click "Update Firmware". Select a version from the list (downloaded directly from the LinMot server), or use a previously downloaded file when offline.
2. Press "Download & Install" (or "Install") and confirm. If the selected version is not newer than the installed one, you must acknowledge a downgrade warning first.
3. TM-Manager verifies the signature, creates a backup, installs the firmware and reboots the device. Wait until the update is finished and do not remove the power cord.

Network/Password recovery mode

Recovery mode is used when the device can no longer be reached (for example after a wrong network setting or a forgotten admin password). To enter it, press and hold the S1 button on top of the TM01 while plugging in the power cord. Keep the button held until the Run/Stop LED blinks yellow. Connect the computer to eth0 (X4) and set the computer's ethernet adapter to the following fixed address: 169.254.255.200, with subnet mask 255.255.255.0).

In TM-Manager, open the "Manual Login" section, enter the device's default IP address (from the LinMot label) and password, and press "Manual Login". You can then correct the eth2 (X11/X12) address under "Network Settings". When finished, set the computer's ethernet adapter back to "Obtain an IP address automatically".

To reset a forgotten admin password, you have to perform a Factory Reset (see the Factory Reset section) with the correct cabling. The factory reset restores the device to its defaults, including the default password printed on the LinMot label.

Factory Reset

A factory reset erases all data on the device and restores the LinMot default configuration. TM-Manager automatically creates a backup as the first step, then performs the reset.

The reset reconfigures the device network, so a specific cabling and adapter setup is required to keep the device reachable throughout:

1. Connect the computer to one of the X11/X12 ports of the TM01.
2. Connect an additional LAN cable between port X4 and the other X11/X12 port on the TM01. This second path keeps the device reachable while its network is being reset.
3. Set the computer's ethernet adapter to a fixed IP address: 169.254.255.200, with subnet mask 255.255.0.0.
4. Press "Scan Again", enter the password and press "Login Selected".
5. On the device page select the device and press "Factory Reset", then confirm the warning. TM-Manager enables the reset only when it detects the required connections; if it reports that the device is not ready or that no suitable network adapter was found, check steps 1-3 and scan again.
6. When the reset finishes the device reboots with its default network settings (eth2 via DHCP, the label IP on eth2:1). Set the computer's ethernet adapter back to "Obtain an IP address automatically" afterwards.

6.2 WebVisu

The Web Visualization shows the graphical interface of a running PLC Application such as the "LinMot-Pilot".

To call the WebVisu, enter http://<ip-address> in the address bar of a web browser. The default IP address can be located on the LinMot-Label on the TM01. To use the default address, make sure that the computer is directly connected to port X11/X12 (eth2) without a router in between. If a DHCP router is found during bootup the port will automatically receive an address from it.

6.3 License Dongle

Some license keys will already be present on the license dongle (CmStick/B) which is connected to the TM01. The following steps will show how to activate newly purchased licenses on the license dongle.

Download and install the CodeMeter User Runtime from the following page:
https://www.wibu.com/support/user/user-software.html

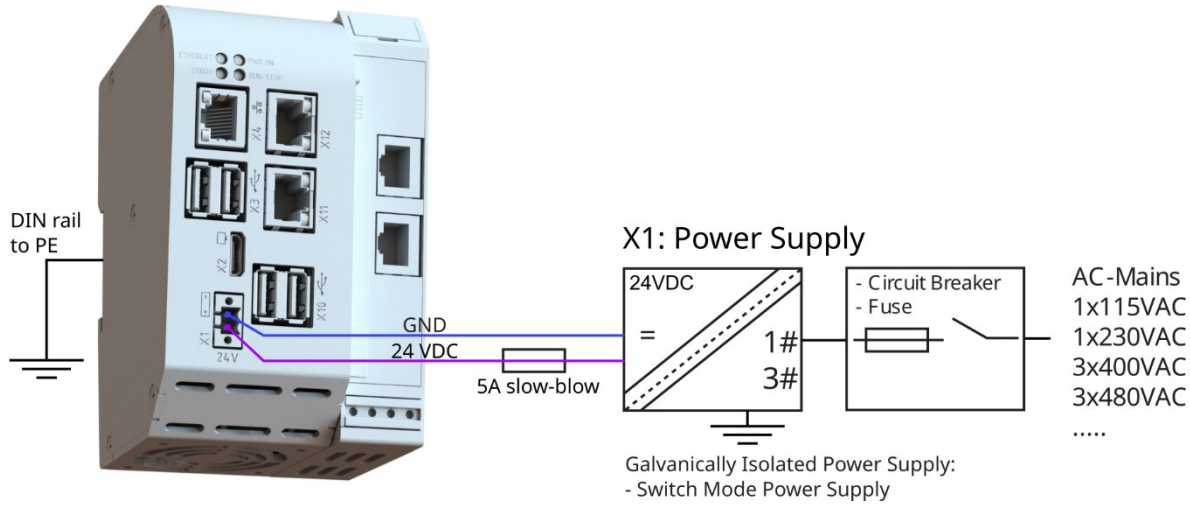
Take note of the serial number of the license dongle
which is located on one side with the following format: x-xxxxxxx.

Plug the license dongle into the computer and open the following webpage: https://lc.codemeter.com/97838/depot/.

Now enter the received license key ticket into the ticket field and press "Next". Now choose the connected license dongle with the correct serial number and activate the license on it.

The license dongle is now ready to be plugged back into the TM01.

7 Power Supply and Grounding

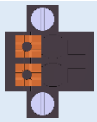


To assure a safe and error free operation, and to avoid severe damage to system components, **all system components must be well grounded to protective earth PE**. This includes both LinMot and all other control system components on the same ground bus.

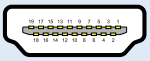
Each system component should be tied directly to the ground bus **(star pattern)**. Daisy chaining from component to component is forbidden.

8 Description of the connectors / Interfaces

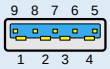
8.1 X1

X1	Power Supply	
	DGND PWR	Power Supply: +24 VDC (-20% / +25%) • Use min. 0.5 mm² (AWG20) **Important notes:** • The 24 VDC power supply must be protected with an external fuse (5 A slow blow)
BLF 3.50/02/180FQV SN BK BX	Connector is included	

8.2 X2

X2	Mini HDMI Port (unused)	
	HDMI	Supported video formats per cable type: • HDMI Standard: max. 1920x1080p/30Hz (Full HD) • HDMI High Speed: max. 3840x2160p/30Hz (4K Ultra HD)
HDMI 1.4b	**Attention:** The use of the HDMI port for visualization is not supported!	

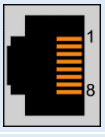
8.3 X3 / X10

X3 / X10	USB Ports	
	USB 1-4	Support of various USB devices
USB 3.2 Gen 1x1		

8.4 X4

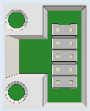
X4	Ethernet Port (Fieldbus)	
	eth0	LIDStream, PROFINET, EtherNet/IP
RJ-45 10/100/1000 Mbit/s	This port is used to control the TM01 from a PLC. This port can also be used to connect LIDStream-capable devices.	

8.5 X11 / X12

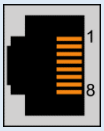
X11/X12 (L2 Switch)	Ethernet Port (Config)	
	eth2	SSH, HTTP, etc.
RJ-45 10/100 Mbit/s	This port is used to program the TM01 from the CODESYS IDE. Furthermore, the Webinterface and WebVisu Services can be reached via this port.	

The Ethernet ports should never be directly accessible from the Internet. Appropriate security measures must be used (Example: Using a gateway with an activated firewall to deny incoming connections).

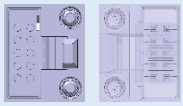
8.6 E-Bus Out

E-Bus Out	EtherCAT Bus (LVDS)	
	eth1	EtherCAT LVDS (Low Voltage Differential Signaling) connector
RJ-45 100 Mbit/s	This port is used to connect expansion modules.	

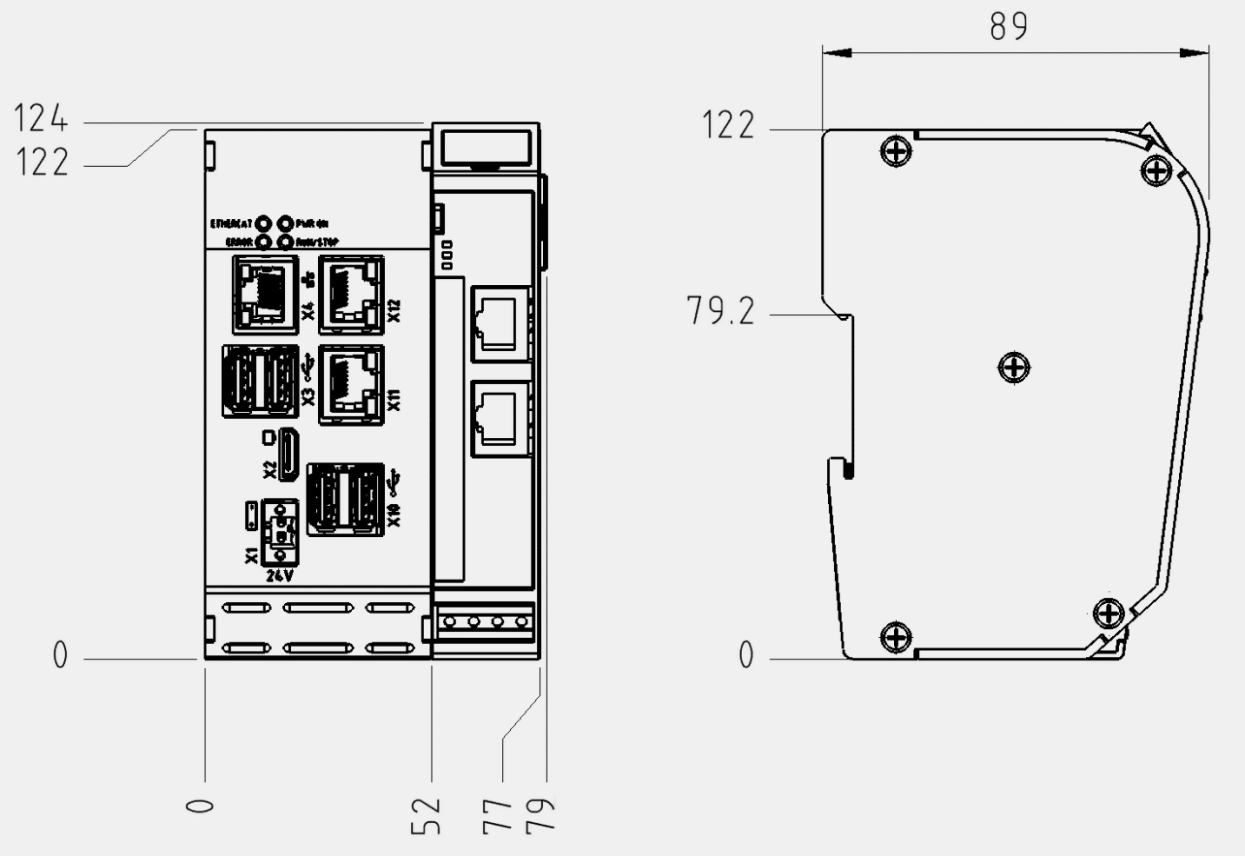
8.7 Out 1/2 (EtherCAT I/O Extender)

Out 1/2	RealTime Ethernet Port (Drive)	
	eth1	EtherCAT, EtherCAT SoftMotion (CiA402) Info: The ports on the extender are handled in the following order: 1. E-Bus In, 2. E-Bus Out, 3. Out 1, 4. Out 2. Therefore, the drives on Out 1/2 are always the last datagrams in the EtherCAT telegram.
RJ-45 100 Mbit/s	These ports are optimized for real-time communication with EtherCAT drives.	

8.8 E-Bus In/Out (EtherCAT I/O Extender)

E-Bus In/Out	EtherCAT Bus (LVDS)	
	Port A / Port D	EtherCAT LVDS (Low Voltage Differential Signaling) connectors on the EtherCAT I/O-Extender module.
RJ-45 100 Mbit/s	These ports are used to connect expansion modules.	

9 Physical Dimension



Technology Module		TM01
Width	mm (in)	79 (3.11)
Height	mm (in)	124 (4.88)
Depth	mm (in)	89 (3.50)
Weight	g (lb)	500 (1.10)
Mounting	NS 35/7,5 EN 50022	35 mm DIN-rail
Case, Degree of Protection	IP	20
Storage / Transport Temperature	°C	-20…70
Operating Temperature (Ambient)	°C	-20…40*
Operating Temperature (CPU)	°C	-20…85
Relative humidity	RH	< 85% (non-condensing)
Mounting place		In the control cabinet
Mounting position		Vertical
Distance between TM01 & Drives	mm (in)	20 (0.8) horizontal / 50 (2) vertical

* The temperature of the TM01 CPU should be checked under full load (the temperature should be stable, which may take an hour or more). This allows to verify that enough margin is there if the cabinet goes to the maximum allowable temperature of 40° C. For example, if the TM01 CPU temperature reaches 68° C and the cabinet temperature is 23° C, this would result in a TM01 CPU temperature of about 85° C at a cabinet temperature of 40° C.

10 Power Supply Requirements

10.1 Power Supply

A regulated power supply of a nominal voltage of 24 VDC SELV is needed.
The voltage must be between 19.2 VDC (-20%) and 30 VDC (+25%).

Current to be provided from the 24 VDC supply:

- min. 0.1 A (standby)
- typ. 0.7 A (running – normal workload)
- max. 2.2 A (running – high workload)

The 24 VDC power supply must be protected with an external fuse (max. 5 A slow blow).

11 Ordering Information

11.1 Technology Modules

Technology Module	Description	Art. No.
TM01 (with Softmotion)	Raspberry Pi based TM01 with CODESYS Softmotion	0150-6552
TM01 (with Softmotion and CNC/Robotic)	Raspberry Pi based TM01 with CODESYS Softmotion and CNC/Robotics -> suitable for the LinMot-Pilot Application (Art. No. 0187-1000)	0150-6553
TM01 (without Softmotion)	Raspberry Pi based TM01 without any CODESYS Softmotion -> suitable for a Stand-alone Process Monitoring Application (Art. No. 0150-6453)	0150-6491

The TM01 comes preinstalled with a certain firmware version. Do not update the firmware unless you have been asked to do so by LinMot. See chapter 6 on how to perform an update.

12 International Certifications

The TM01 consists of a Base Module and an EtherCAT I/O Extender. Both do not have the same certifications.

Base Module (Art No. 0150-6454, 0150-6455, 0150-6456)

Certifications Base Module (B-Nimis MC-Pi Prime S02)	
Europe	See chapter 12.1 EU Declaration of Conformity CE Marking (Base Module)
UK	See chapter 12.2 UK Declaration of Conformity UKCA Marking (Base Module)
USA / Canada	File Number: E242595 Type: Open Type PCD Category: Programmable controller UL Standard: UL 61010-1, 3rd Edition and UL 61010-2-201, 2nd Edition cUL Standard: CAN/CSA C22.2 No. 61010-1, 3rd Edition and CAN/CSA C22.2 No. 61010-2-201:18

EtherCAT I/O Extender (Art No. 0150-6457)

Certifications EtherCAT I/O Extender (B-Nimis MC-I/O Extender 2 Port)	
Europe	See chapter 12.3 EU Declaration of Conformity CE Marking (EtherCAT I/O Extender)
USA / Canada	File Number: E242595 Type: Open Type PCD Category: Programmable controller UL Standard: UL 61010-1, 3rd Edition and UL 61010-2-201, 2nd Edition cUL Standard: CAN/CSA C22.2 No. 61010-1, 3rd Edition and CAN/CSA C22.2 No. 61010-2-201:18

12.1 EU Declaration of Conformity CE Marking (Base Module)

NTI AG / LinMot®
Bodenaeckerstrasse 2
8957 Spreitenbach
Switzerland
Tel.: +41 (0)56 419 91 91
Fax: +41 (0)56 419 91 92

declares under sole responsibility the compliance of the products:

- Base Module of the Technology Module Series TM01-201x, TM01-301x ,TM01-401x

with the following directives:

- EMC Directive 2014/30/EU
- RoHs Directive 2011/65/EU & 2015/863/EU
- RED Directive 2014/53/EU

Applied harmonized standards:

- EN 61000-6-4:2020-09
- IEC EN 61010-1:2010/A1:2019/AC:2019
- EN 61131-2:2007
- IEC EN 62311:2020
- EN 63000:2019-05
- ETSI EN 300 328 V2.2.2:2019
- ETSI EN 301 893 V2.1.1:2017

According to the EMC directive, the listed devices are not independently operable products.

Compliance of the directive requires the correct installation of the product, the observance of specific installation guides and product documentation. This was tested on specific system configurations.

The safety instructions of the manuals are to be considered.

The product must be mounted and used in strict accordance with the installation instructions contained within the installation guide, a copy of which may be obtained from NTI AG.

Company: NTI AG

Spreitenbach, 09.08.2024

Dr. Ronald Rohner / CEO NTI AG

12.2 UK Declaration of Conformity UKCA Marking (Base Module)

NTI AG / LinMot®
Bodenaeckerstrasse 2
8957 Spreitenbach
Switzerland
Tel.: +41 (0)56 419 91 91
Fax: +41 (0)56 419 91 92

declares under sole responsibility the compliance of the products:

- Base Module of the Technology Module Series TM01-201x, TM01-301x ,TM01-401x

with the regulations:

- UK S.I. 2012 No. 3032
- UK S.I. 2016 No. 1091
- UK S.I. 2017 No. 1206

Applied designated standards:

- BS EN IEC 61000-6-4:2019
- BS EN 61010-1:2010+A1:2019
- BS EN 61131-2:2007
- BS EN IEC 62311:2020
- BS EN IEC 63000:2018
- ETSI EN 300 328 V2.2.2:2019
- ETSI EN 301 893 V2.1.1:2017

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Company: NTI AG

Spreitenbach, 09.08.2024

Dr. Ronald Rohner / CEO NTI AG

12.3 EU Declaration of Conformity CE Marking (EtherCAT I/O Extender)

NTI AG / LinMot®
Bodenaeckerstrasse 2
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Fax: +41 (0)56 419 91 92

declares under sole responsibility the compliance of the products:

- EtherCAT I/O Extender of the Technology Module Series TM01-201x, TM01-301x ,TM01-401x

with the following directives:

- EMC Directive 2014/30/EU
- RoHs Directive 2011/65/EU

Applied harmonized standards:

- EN 61131-2:2007
- EN 50581:2012

According to the EMC directive, the listed devices are not independently operable products.

Compliance of the directive requires the correct installation of the product, the observance of specific installation guides and product documentation. This was tested on specific system configurations.

The safety instructions of the manuals are to be considered.

The product must be mounted and used in strict accordance with the installation instructions contained within the installation guide, a copy of which may be obtained from NTI AG.

Company: NTI AG

Spreitenbach, 09.08.2024

Dr. Ronald Rohner / CEO NTI AG

ALL LINEAR MOTION
FROM A SINGLE SOURCE

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