



SMARTEH[®]
LIVING SYSTEMS

USER MANUAL

- ▶ Longo programmable controller
LPC-3.GOT.012
Graphical Operation Terminal

Version 2

Written by SMARTEH d.o.o.
Copyright © 2023, SMARTEH d.o.o.

User Manual

Document Version: 2
December, 2023



STANDARDS AND PROVISIONS: Standards, recommendations, regulations and provisions of the country in which the devices will operate, must be considered while planning and setting up electrical devices. Work on 100 .. 230 V AC network is allowed for authorized personnel only.

DANGER WARNINGS: Devices or modules must be protected from moisture, dirt and damage during transport, storing and operation.

WARRANTY CONDITIONS: For all modules LONGO LPC-3 - if no modifications are performed upon and are correctly connected by authorized personnel - in consideration of maximum allowed connecting power, warranty of 24 months is valid from the date of sale to the end buyer, but not more than 36 months after delivery from Smarteh. In case of claims within warranty time, which are based on material malfunctions the producer offers free replacement. The method of return of malfunctioned module, together with description, can be arranged with our authorized representative. Warranty does not include damage due to transport or because of unconsidered corresponding regulations of the country, where the module is installed.

This device must be connected properly by the provided connection scheme in this manual. Misconnections may result in device damage, fire or personal injury.

Hazardous voltage in the device can cause electric shock and may result in personal injury or death.

NEVER SERVICE THIS PRODUCT YOURSELF!

This device must not be installed in the systems critical for life (e.g. medical devices, aircrafts, etc.).

If the device is used in a manner not specified by the manufacturer, the degree of protection provided by the equipment may be impaired.

Waste electrical and electronic equipment (WEEE) must be collected separately!

LONGO LPC-3 complies to the following standards:

- EMC: EN 55032:2012, EN 55035:2017, EN 61000-3-2:2014, 61000-3-3:2013
- LVD: IEC 61010-1:2010 (3rd Ed.), IEC 61010-2-201:2013 (1st Ed.)

Smarteh d.o.o. operates a policy of continuous development. Therefore we reserve the right to make changes and improvements to any of the products described in this manual without any prior notice.

MANUFACTURER:

SMARTEH d.o.o.
Poljubinj 114
5220 Tolmin
Slovenia



Index

Longo programmable controller LPC-3.GOT.012

- 1 ABBREVIATIONS.....1
- 2 DESCRIPTION.....2
- 3 FEATURES.....3
- 4 INSTALLATION.....4
 - 4.1 Block diagram.....4
 - 4.2 Input & output connection interfaces.....5
 - 4.3 Mounting instructions.....7
- 5 TECHNICAL SPECIFICATIONS.....14
- 6 CONNECTION & CONFIGURATION GUIDE.....15
 - 6.1 Main connection scheme & configuration.....15
- 7 PROGRAMMING GUIDE.....17
 - 7.1 Basic functionalities.....17
 - 7.2 WiFi configuration.....20
 - 7.3 GUI design and programming.....22
- 8 MODULE LABELING.....23
- 9 SPARE PARTS.....24
- 10 CHANGES25
- 11 NOTES.....26



1 ABBREVIATIONS

SOM	System on module
ARM	Advanced RISC machines
OS	Operating system
TCP	Transmission control protocol
SSL	Secure sockets layer
IEC	International electrotechnical commission
CAN	Controller area network
COM	Communication
USB	Universal serial bus
USB OTG	Universal serial bus On the go
PLC	Programmable logic controller
LED	Light emitting diode
RAM	Random access memory
NV	Non volatile
PS	Power supply
GUI	Graphical user interface
RTU	Remote terminal unit
RTC	Real time clock
IDE	Integrated development environment
FBD	Function block diagram
LD	Ladder diagram
SFC	Sequential function chart
ST	Structured text
IL	Instruction list



2 DESCRIPTION

SmarteH LPC-3.GOT.012 PLC based graphical operation terminal offers improved performance and a wide range of new features within a single compact SOM based package. The graphical operation terminal based on an ARM architecture processor running a Linux based OS adds more computing power, more control, and additional interface connection offering capability for future core SOM module upgrades without hardware changes.

LPC-3.GOT.012 has an integrated USB programming and debugging port, connection for SmarteH intelligent peripheral modules, Ethernet port and WiFi connectivity that can be used as a programming and debugging port, as a Modbus TCP/IP Master and/or Slave device, and as BACnet IP (B-ASC). LPC-3.GOT.012 is also equipped with an RS-485 port for Modbus RTU Master or Slave communication with other Modbus RTU equipment.

Hardware configuration is done using SmarteH IDE programming software, used to select the required graphical operation terminal.

This software provides you with a simple entry in the IEC programming languages such as:

- Instruction List (IL)
- Function Block Diagram (FBD)
- Ladder Diagram (LD)
- Structured Text (ST)
- Sequential Function Chart (SFC)

This provides a large number of operators such as:

- Logic operators such as AND, OR, ...
- Arithmetic operators such as ADD, MUL, ...
- Comparison operators such as <, =, >
- Other ...

Programming software is used to create, debug, test and document a project. Functions for analog processing, closed-loop control and function blocks such as timers and counters simplify programming.

SmarteH IDE programming software also provides you with a simple entry in the GUI design tool supports a large set of dynamic controls from buttons to indicators and enables connectivity between the PLC program and the graphical user interface.



3 FEATURES



Figure 1: LPC-3.GOT.012

Table 1: Features

Frameless glass screen with 7” LCD display and capacitive touch screen, landscape or portrait orientation

Real Time Linux OS ARM based main module

Graphical interface is freely designed by the user with GUI editor in SmartehIDE software

Ethernet & WiFi connectivity for debugging and application transfer, Modbus TCP/IP Slave (server) and/or Master (client) functionality, BACnet IP (B-ASC), web server and SSL certificate

USB port for debugging and application transfer, USB OTG

Modbus RTU Master or Slave

Smarteh bus for connection with LPC-2 Smarteh intelligent peripheral modules

Remote access and application transfer

2 galvanic isolated (2500 V DC) CAN port - one for master, one for slave

RTC and 512 kB NV RAM with super capacitor for needed energy storage

Micro SD Card slot

Built-in buzzer controlled from PLC program

Display brightness level controlled from PLC program

Disconnectable spring type connectors

Status LEDs

Flush mount

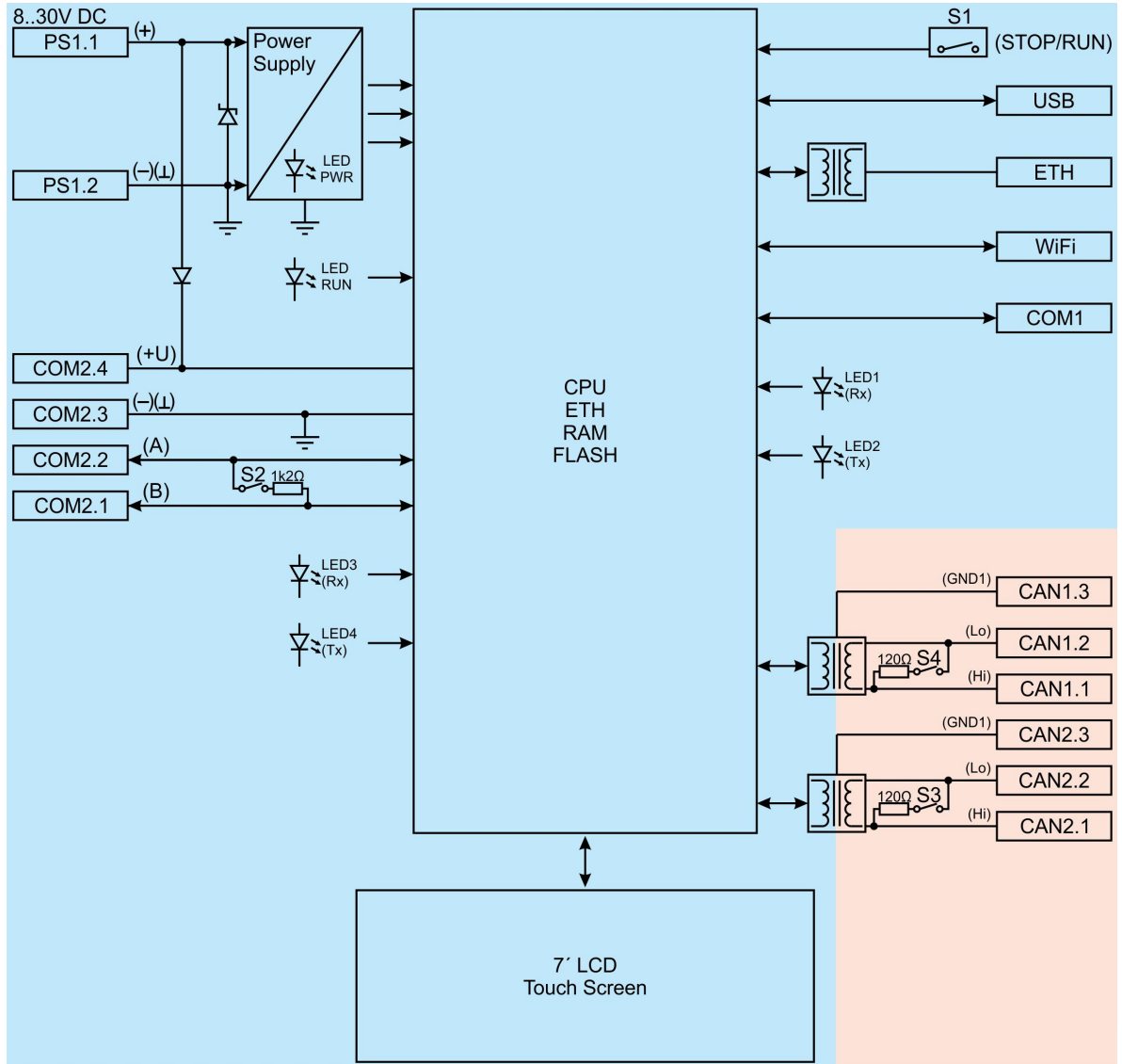
Quality design



4 INSTALLATION

4.1 Block diagram

Figure 2: LPC-3.GOT block diagram¹



¹ Coloured areas represents different voltage domains - galvanic isolated areas. Please refer to General technical specifications in TECHNICAL SPECIFICATION for details.



4.2 Input & output connection interfaces

Table 2: Power supply²

PS1.1 (+)	Power supply input	8 .. 30 V DC, 2 A
PS1.2 (-)	– (⊥)	GND

Table 3: CAN1 & CAN2³

CAN1.1	CAN1 High (Hi) (Master)	0 .. 5 V
CAN1.2	CAN1 Low (Lo) (Master)	
CAN1.3	CAN1 reference point (GND1)	0 V to CAN1
CAN2.1	CAN2 High (Hi) (Slave)	0 .. 5 V
CAN2.2	CAN2 Low (Lo) (Slave)	
CAN2.3	CAN2 reference point (GND1)	0 V to CAN2

Table 4: COM2 RS-485⁴

COM2.1	RS-485 (A) Modbus RTU	0 .. 3.3 V
COM2.2	RS-485 (B) Modbus RTU	
COM2.3	– (⊥)	GND
COM2.4	+U	Power supply output (from PS1.1)

Table 5: COM1 Smarteh bus

COM1.1	N.C.	
COM1.2	(-)(⊥)	GND
COM1.3	+U	Power supply output (from PS1.1)
COM1.4	RS-485 (A) Smarteh bus	0 .. 3.3 V
COM1.5	RS-485 (B) Smarteh bus	
COM1.6	N.C.	

Table 6: WiFi

WiFi	WiFi antenna connector	SMA
------	------------------------	-----

- 2 **Wires** connected to the module must have cross sectional area at least 0.75 mm². Minimum temperature rating of wire insulation must be 85 °C.
- 3 **Wires** connected to the module must have cross sectional area at least 0.14 mm². Use twisted-pair cables of type CAT5+ or better, shielding is recommended. Minimum temperature rating of wire insulation must be 85 °C. **Galvanic isolation** of 2500 V DC between CAN1, CAN2 and rest of the PLC circuit is provided.
- 4 **Different protocols** like Modbus RTU Master can be selected inside Smarteh IDE. **Wires** connected to the module must have cross sectional area at least 0.14 mm². Use twisted-pair cables of type CAT5+ or better, shielding is recommended.



Table 7: USB and Ethernet

USB	USB	mini B type, device mode or host mode, USB On-The-Go
ETH	Ethernet	RJ-45 shielded

Table 8: Switches

S1	Operation mode (RUN/STOP)	RUN: PLC normal operational mode STOP: application not running
S2	COM2 RS-485 termination (Trm1)	ON: corresponding channel is internally terminated with 1k2 Ω OFF: no internal termination present
S3	CAN2 bus termination (Trm2)	ON: corresponding channel is internally terminated with 120 Ω OFF: no internal termination present
S4	CAN1 bus termination (Trm3)	ON: corresponding channel is internally terminated with 120 Ω OFF: no internal termination present

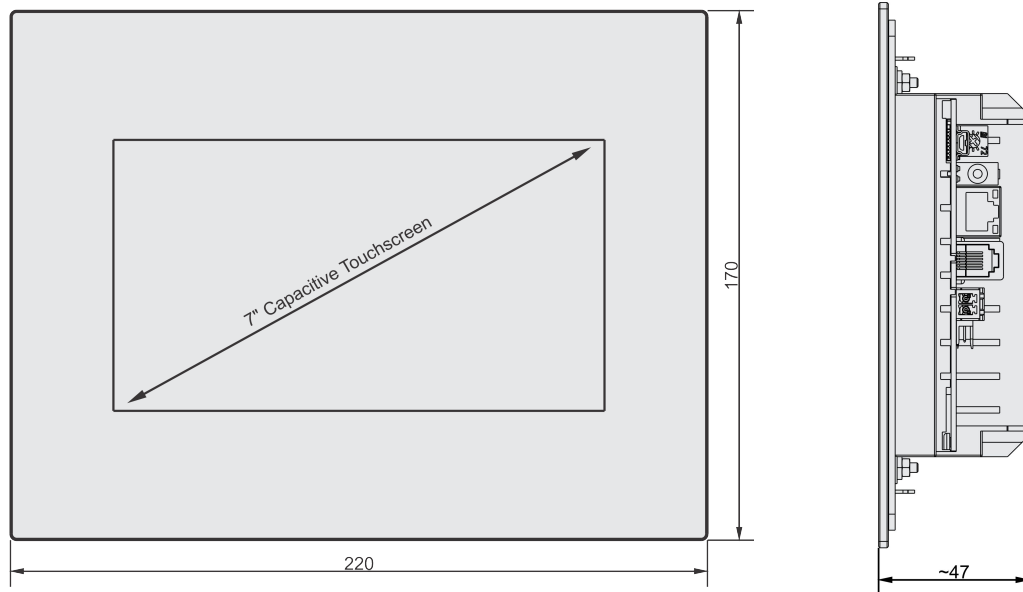
Table 9: LEDs

LED RUN	Application running (green)	ON: Application is running OFF: Application is stopped or PLC in boot mode
LED PWR	Power (green)	ON: PLC is powered on OFF: PLC has no power supply
LED1 (Rx)	COM1 Rx status (red)	OFF: No receiving packets Blink: Receiving packets ON: A and/or B line in the shortcut
LED2 (Tx)	COM1 Tx status (green)	OFF: Not transmitting packets Blink: Transmitting packets ON: A and/or B line in the shortcut
LED3 (Rx)	COM2 Rx status (red)	OFF: No receiving packets Blink: Receiving packets ON: A and/or B line in the shortcut
LED4 (Tx)	COM2 Tx status (green)	OFF: Not transmitting packets Blink: Transmitting packets ON: A and/or B line in the shortcut



4.3 Mounting instructions

Figure 3: Housing dimensions



Dimensions in millimetres.



EXTERNAL SWITCH OR CIRCUIT-BREAKER AND EXTERNAL OVERCURRENT PROTECTION: The unit is allowed to be connected to installation with over current protection that has nominal value of 6 A or less.

All connections, PLC attachments and assembling must be done while LPC-3.GOT.012 is not connected to the main power supply.
Wires connected to the PLC must have cross sectional area at least 0.75 mm².
Minimum temperature rating of wire insulation must be 85 °C.



Mounting instructions for wall mounting:

1. Switch off power supply.
2. Fasten holders⁵ with screws⁵ into Gewiss 48006 flush mounting box⁶ - see Figure 4.
3. Connect input, output and communication wires.
4. Mount LPC-3.GOT.012 into flush mounting box, using provided springs.
5. Switch on power supply.

Figure 4: Mounting instructions for wall mounting



5 Holders, screws and springs are provided in package with LPC-3.GOT.012.

6 Gewiss 48006 flush mounting box must be ordered separately. See chapter spare parts.



Figure 5: Gewiss 48006 flush mounting box dimensions

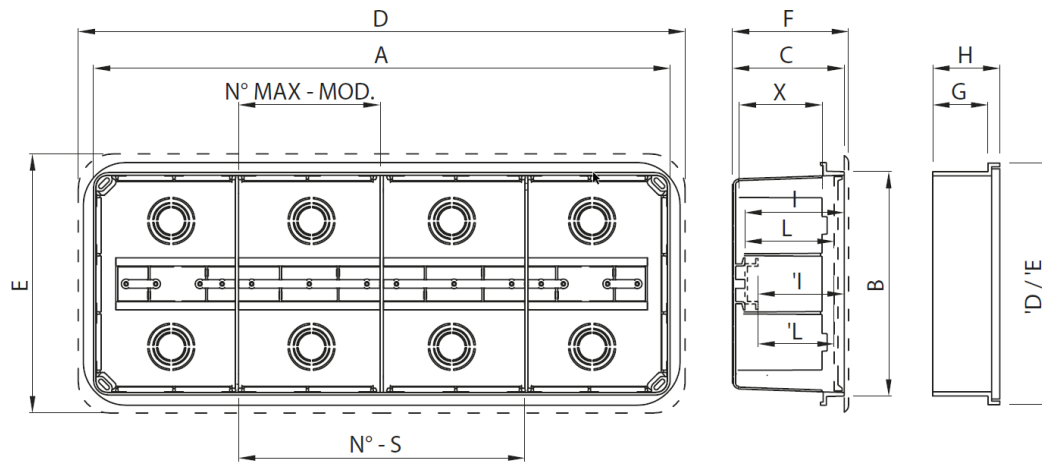


Table 10: Gewiss 48006 flush mounting box dimensions (in millimetres)

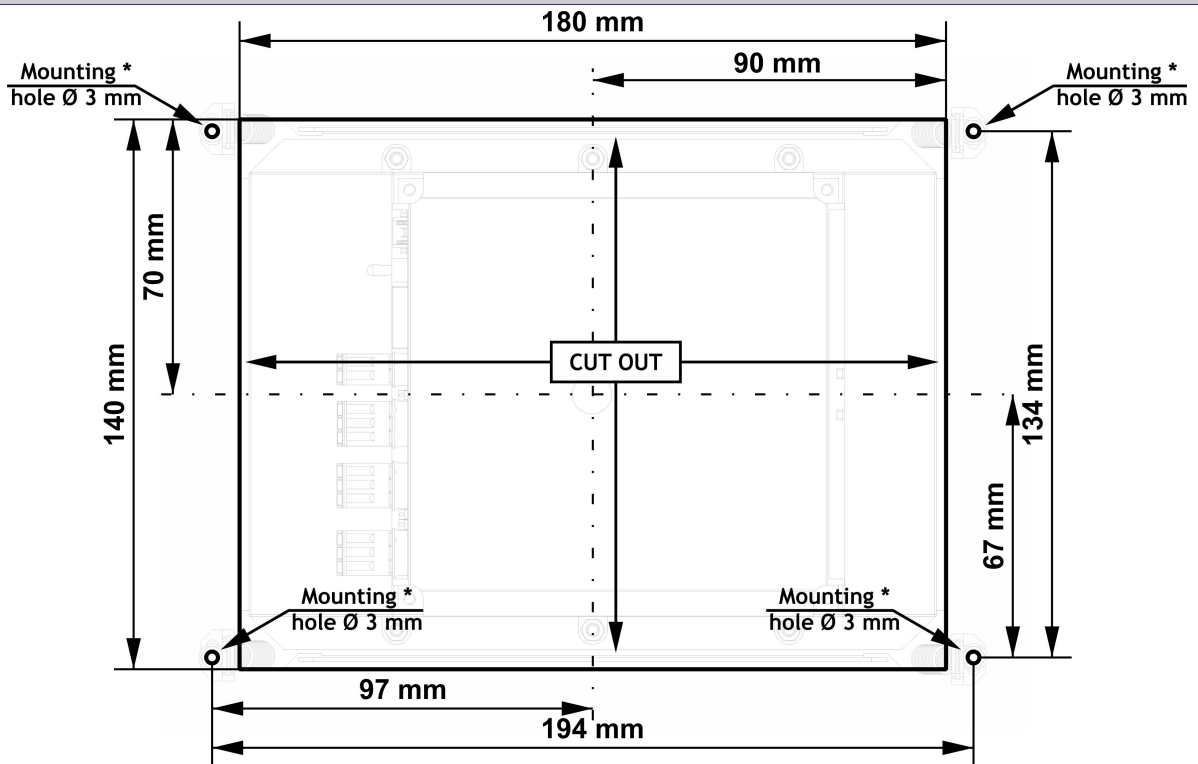
Modular boxes						Cover				Deep lid						
A	B	C	X	N° -S	No. modules N° -M	I	L	'I	'L	D	E	F	'D	'E	G	H
196	152	75	57	2	4.5	69	61	62	53.3	222	178	79	214	170	49	56



Mounting instructions for enclosure door with springs

1. Switch off power supply.
2. Make cut out and mounting holes - see Figure 6.
3. Fasten holders with screws⁷ on enclosure door - see Figure 7.
4. Mount LPC-3.GOT.012 into cut out, using provided springs.
5. Connect input, output and communication wires.
6. Switch on power supply.

Figure 6: Dimensions for cut out and mounting holes for spring holders

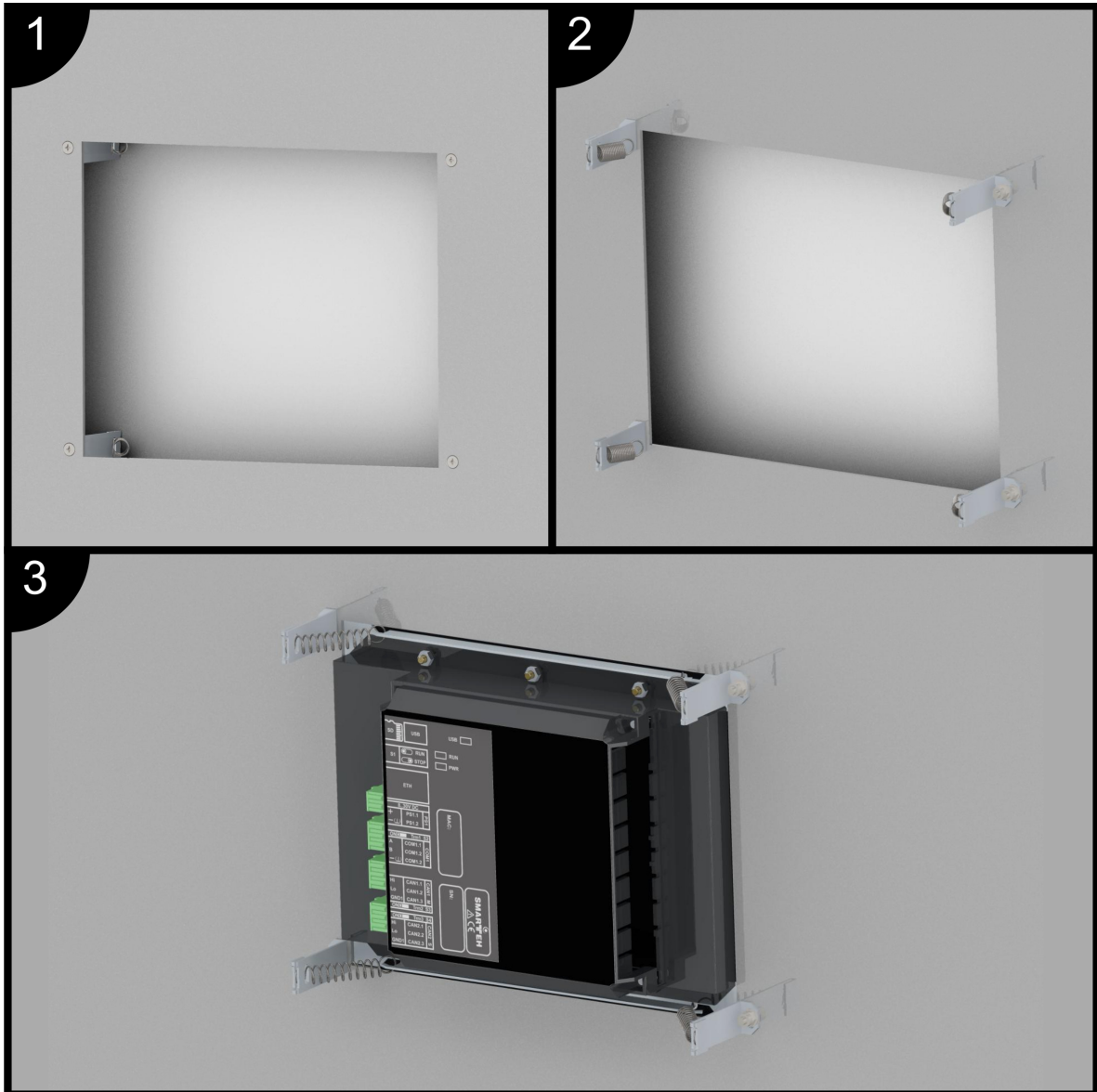


*Mounting hole for screw with countersunk head

⁷ Screw with countersunk head M3 x 15 mm, nut M3 and washer.



Figure 7: Mounting example on enclosure door with springs



Mounting instructions for enclosure door with metal holders

1. Switch off power supply.
2. Make cut out - see Figure 8.
3. Mount LPC-3.GOT.012 into cut out, using metal holders - see Figure 9..
4. Connect input, output and communication wires.
5. Switch on power supply.

Figure 8: Dimensions for cut out for mounting with holders

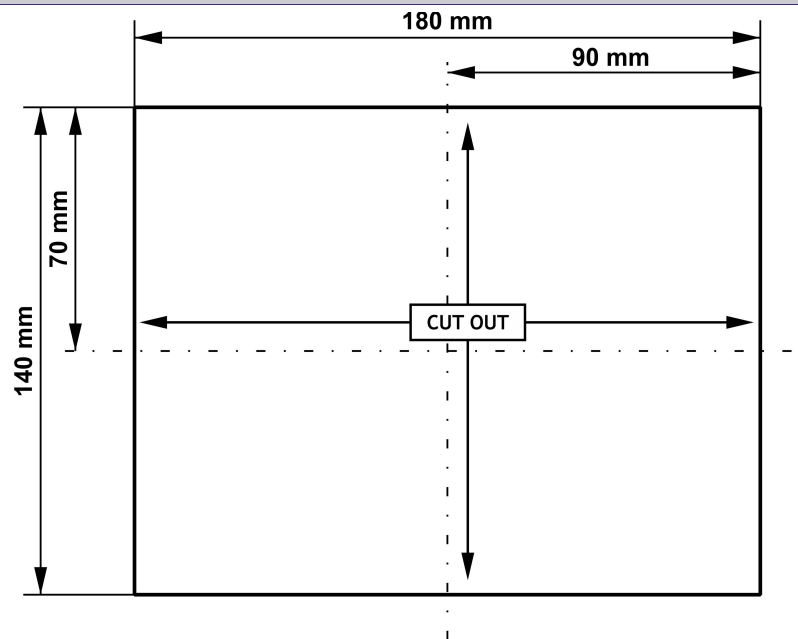


Figure 9: Mounting example on enclosure door with holders

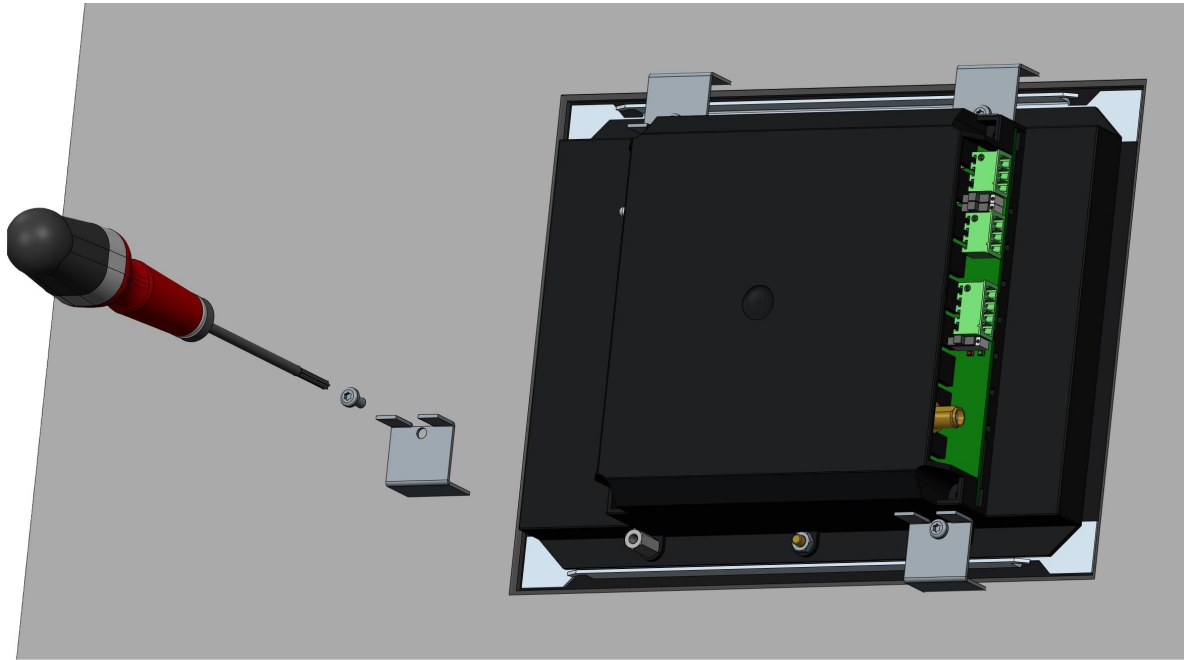
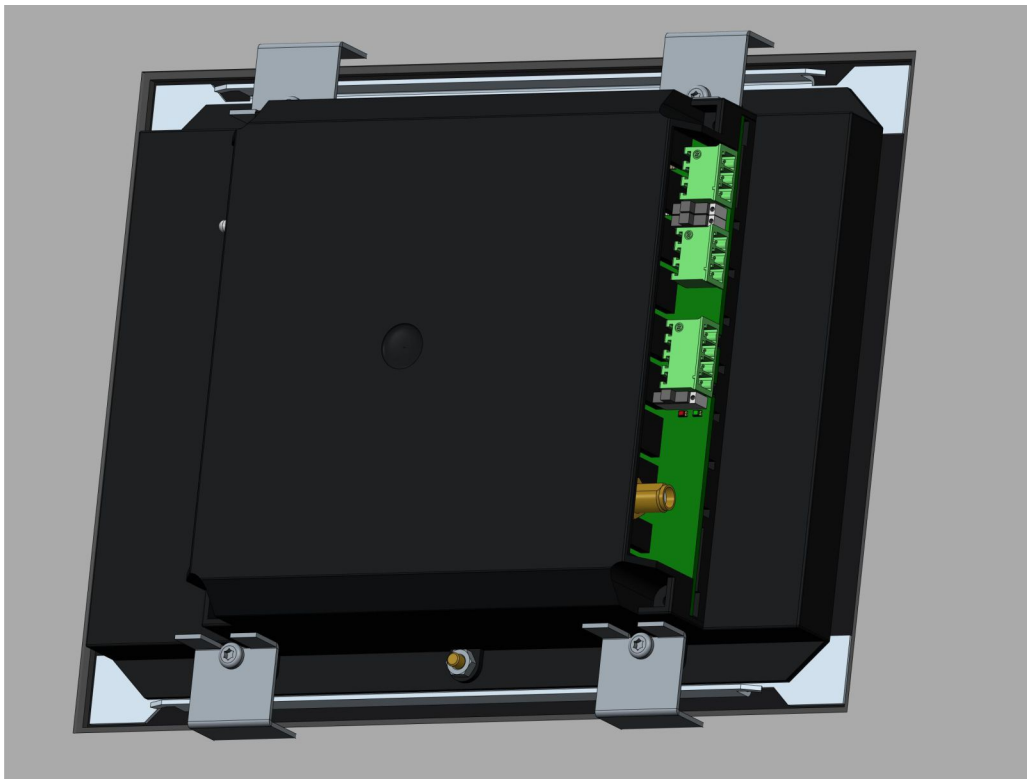


Figure 10: Mounting example on enclosure door with holders



5 TECHNICAL SPECIFICATIONS

Table 11: Technical specifications

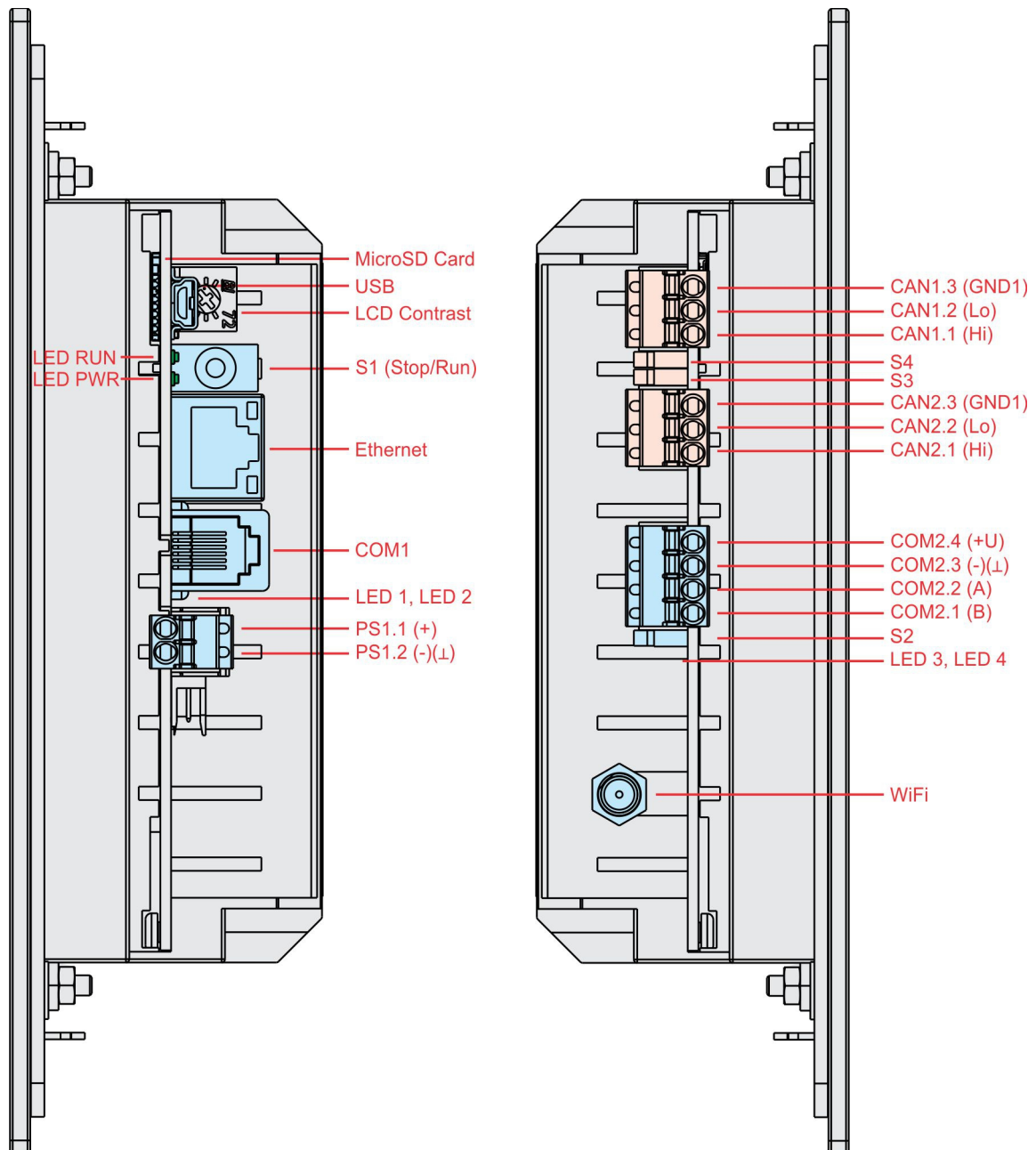
Rated power supply PS1	24 V DC, 2A
Operational power supply PS1	8 .. 30 V DC
Power consumption PS1	max. 5 W
Connection type for PS1	disconnectable spring type connectors for stranded wire 0.75 to 1.5 mm ²
Connection type for CAN1, CAN2, COM2	disconnectable spring type connectors for stranded wire 0.14 to 1.5 mm ²
Connection type for COM1	RJ-12 6/4
CAN1, CAN2 isolation voltage to PS1	2500 V DC
COM2 RS-485 port	non isolated, 2 wire
COM1 Smarteh bus	non isolated
Ethernet	RJ-45, 10/100/1000T IEEE 802.3
WiFi	IEEE 802.11 b/g/n, SMA female connector
USB	mini B type, device mode or host mode (USB On-The-Go), high-speed/full-speed
RTC	capacitor backed up with retention of cca. 14 days
Operating system	Linux
CPU	i.MX6 Single (ARM® Cortex™-A9) @ 1GHz
RAM	1GB DDR3
Flash	4 GB eMMC 8bits (MLC type)
NV RAM	512 kB, capacitor backed up with retention cca. 14 days
Display	7", 800 × 480 resolution, 24 bit colour depth
Dimensions (L x W x H)	170 x 220 x 47 mm
Display dimensions (L x W)	85.5 x 154 mm
Weight	650 g
Ambient temperature	0 to 50 °C
Ambient humidity	max. 95 %, no condensation
Maximum altitude	2000 m
Mounting position	vertical
Transport and storage temperature	-20 to 60 °C
Pollution degree	2
Over-voltage category	II
Electrical equipment	class II (double insulation)
Protection class front side	IP 65
Protection class back side	IP 30



6 CONNECTION & CONFIGURATION GUIDE

6.1 Main connection scheme & configuration

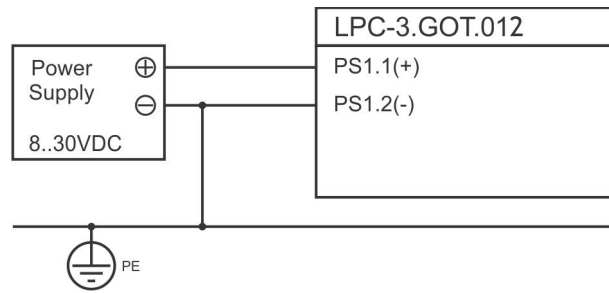
Figure 11: Main connection scheme⁸



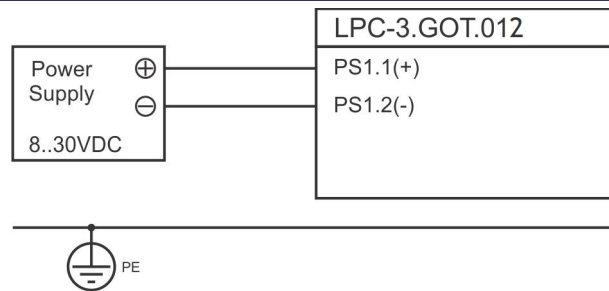
⁸ Coloured areas represents galvanic isolated areas. Please refer to General technical specifications for details.



Figure 12: Grounding possibilities



LPC-3.GOT negative power supply pole connected to the Protective Earth (PE) (⊕) functional earthing.



LPC-3.GOT negative power supply poles not connected to the Protective Earth (PE) (⊕) functional earthing.



7 PROGRAMMING GUIDE

This chapter is intended to offer the programmer additional informations about some of the functionalities and units integrated in this module.

7.1 Basic functionalities

RTC unit

For RTC back-up and for Retain variables there is Super Capacitor instead of battery integrated inside PLC. This way, replacement of the discharged battery is avoided. The Retention time is minimum 14 days from the power down. RTC time provides date and time information.

Ethernet

Ethernet port can be used as a programming and debugging port, as a Modbus TCP/IP Master and/or Slave device and as BACnet IP (B-ASC).

WiFi

WiFi port can be used as a programming and debugging port, as a Modbus TCP/IP Master and/or Slave device and as BACnet IP (B-ASC).

Modbus TCP/IP master unit

When configured for Modbus TCP/IP Master / Client mode, the LPC-3.GOT.012 functions as a master device, controlling the communications with other slave devices such as sensors, inverters, other PLCs, etc. LPC-3.GOT.012 sends Modbus TCP/IP commands to and receives Modbus TCP/IP responses from the slave units.

Following commands are supported:

- 01 - Read Coil Status
- 02 - Read Input Status
- 03 - Read Holding Registers
- 04 - Read Input Registers
- 05 - Write Single Coil
- 06 - Write Single Register
- 15 - Write Multiple Coils
- 16 - Write Multiple Registers

Note: each of this command can read/write up to 10000 addresses.

Modbus TCP/IP slave unit

Modbus TCP slave has 10000 addresses in each memory section:

Coils:	00000 to 09999
Discrete inputs:	10000 to 19999
Input register:	30000 to 39999
Holding registers:	40000 to 49999

Supports up to 5 connections to the slave units (defined with MaxRemoteTCPClient parameter).
Highest scan rate is 100 ms.

Modbus RTU master unit

When configured for Modbus RTU Master mode, the the LPC-3.GOT.012 functions as a master device,



controlling the communications with other slave devices such as sensors, inverters, other PLCs, etc. LPC-3.GOT.012 sends Modbus RTU commands to and receives Modbus RTU responses from the slave devices.

Following commands are supported:

- 01 - Read Coil Status
- 02 - Read Input Status
- 03 - Read Holding Registers
- 04 - Read Input Registers
- 05 - Write Single Coil
- 06 - Write Single Register
- 15 - Write Multiple Coils
- 16 - Write Multiple Registers

Note: each of this commands can read/write up to 246 bytes of data. For analog (Input and Holding registers) this means 123 values, while for digital (Statuses and Coils) this means 1968 values. When higher quantity of data is required, LPC-3.GOT.012 can execute up to 32 same or different supported commands simultaneous.

Physical layer: RS-485

Supported baud rates: 9600, 19200, 38400, 57600 and 115200bps

Parity: None, Odd, Even.

Stop bit: 1

Modbus RTU slave unit

Modbus TCP slave has 1023 addresses in each memory section:

Coils:	00000 to 01023
Discrete inputs:	10000 to 11023
Input register:	30000 to 31023
Holding registers:	40000 to 41023

Highest scan rate is 100 ms.

SmarteH RS485 bus for connectivity with LPC-2 system

Port COM1 is used for communication with LPC-2 slave modules. All communication settings are configured in SmarteHIDE software program.

BACnet IP unit

When configured for BACnet IP (B-ACS), following commands are supported:

Data Sharing

- ReadProperty-B (DS-RP-B)
- WriteProperty-B (DS-WP-B)

Device and Network Management

- Dynamic Device Binding-B (DM-DDB-B)
- Dynamic Object Binding-B (DM-DOB-B)
- Device Communication Control-B (DM-DCC-B)
- Time Synchronization-B (DM-TS-B)
- UTCTimeSynchronization-B (DM-UTC-B)

For more information, please contact producer.



CANopen unit

CANopen unit consists of Master and Slave communication ports. They are independent, thus can be connected to two different CAN network at the same time.

The ports can operate at baud rates 50 kbps, 125 kbps or 250 kbps.

It follows the internationally standardized (EN 50325-4) CAN-based higher-layer protocol for embedded control systems. Advised rules and concepts by this standard must be followed to fulfil the conditions and so achieving normal operation and results.

The structure of the network as cable type and lengths, baud rates, number of the nodes and termination must be taken into account within the recommendations and requirements, when designing the network.

The bus network can consist of at least one Master and at list one Slave node by the standard, but it is advised that with increased number of nodes, the Master node fastest interval is extended. Below are two examples:

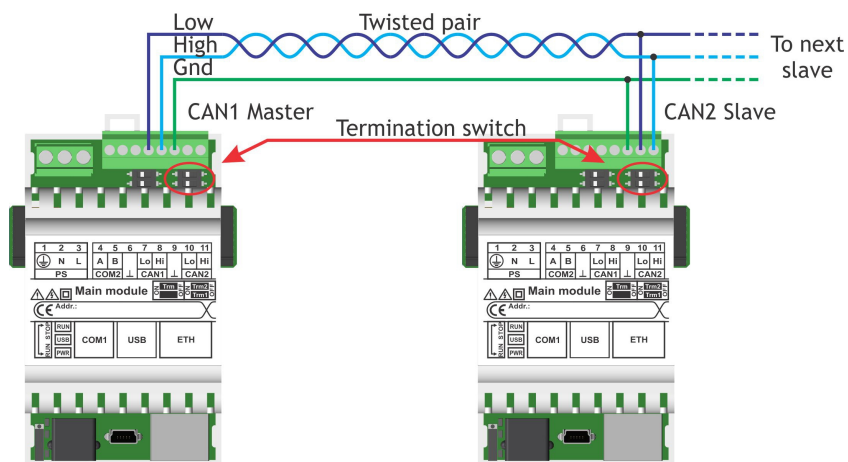
Example 1: network with 1 master and 9 slaves, every slave have defined 32 (4x8) byte of data and baud rate 125 Kbps. Fastest Cycle time for this configuration is 50 ms.

Example 2: network with 1 master and 4 slaves, every slave have defined 4 byte of data and baud rate 250 Kbps. Fastest Cycle time for this configuration is 5 ms.

5 ms is the fastest recommended cycle time.

It is recommended to power-up all the nodes on the same network at the same time, if some or all nodes had been reprogrammed (to reinitialize the communication properly).

Figure 13: CAN Master and Slave wiring diagram example



RUN/STOP Switch

Run: Status RUN status LED “on” indicate that the user graphical application is up and user program is running.

Stop: When the switch is turn to STOP state, the RUN status LED is “off” and application is stopped.

PLC task cycle time

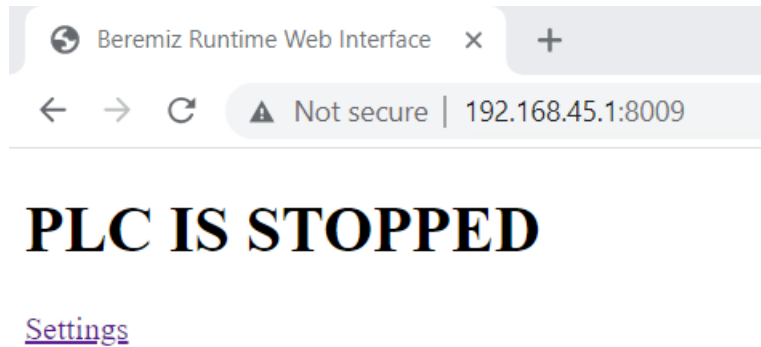
Main PLC task interval (under Project tab -> Resource → Tasks → Interval) time is not recommended to be set lower than 50 ms.



7.2 WiFi configuration

1. Connect terminal to the PC via USB connector and switch ON power supply.
2. Using web browser, type default IP address 192.168.45.1 and port 8009.
3. Click on “Settings”.

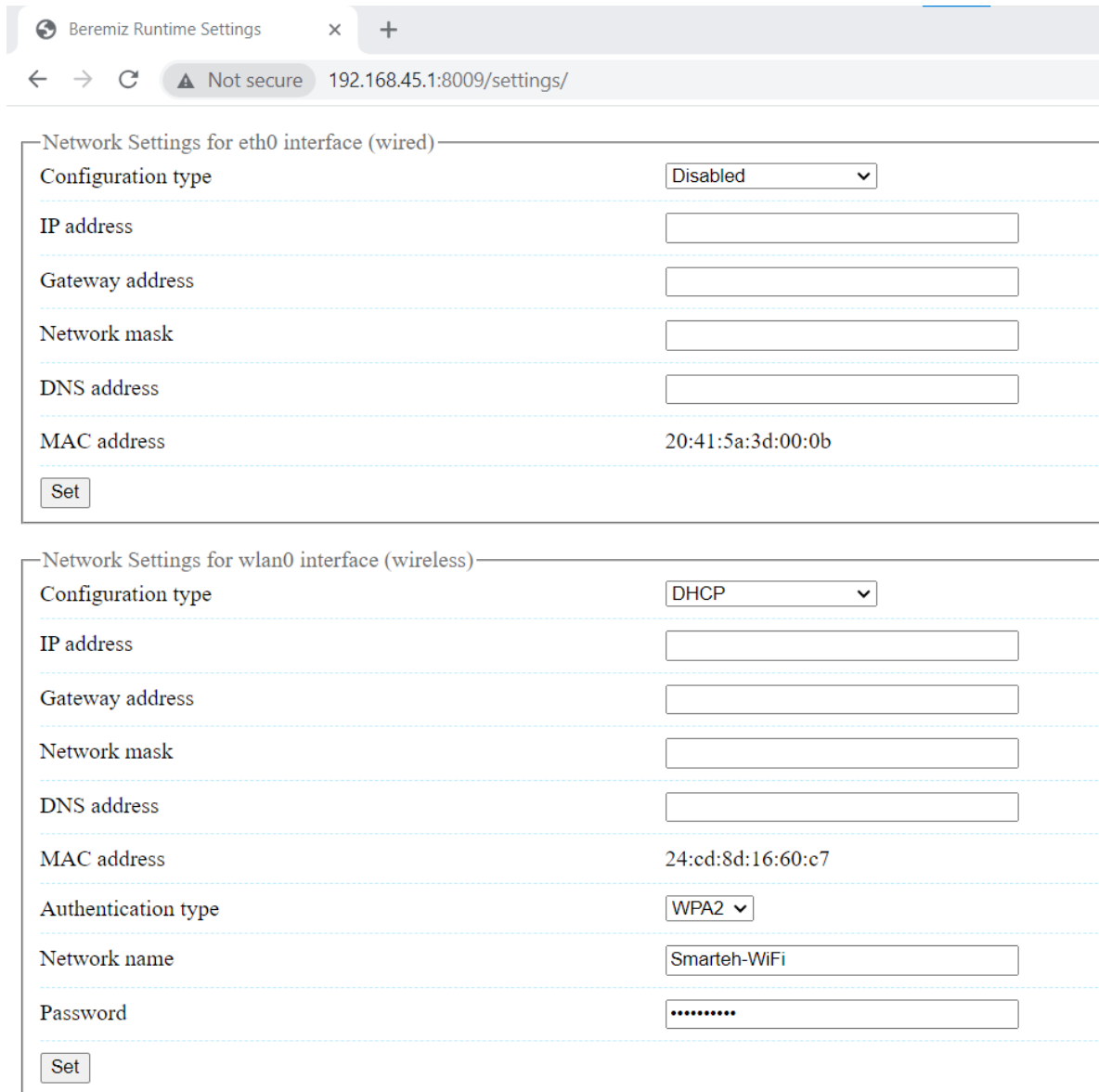
Figure 14: Web interface



4. The Settings page opens. In the “Network Settings for eth() interface (wired)” section select “Disabled”, from the “Configuration type” drop-down menu.
5. Click on “Set” at the bottom of that section.
6. Then in the “Network Settings for wlan() interface (wireless)” section set the parameters of the wireless network to which you want to connect: “Configuration type”, “Authentication type”, “Network name” and “Password”.
7. Click on “Set” at the bottom of that section.



Figure 15: Web interface settings



The screenshot shows a web browser window with the address bar displaying "192.168.45.1:8009/settings/". The page content is divided into two sections for network configuration.

Network Settings for eth0 interface (wired)

Configuration type	Disabled
IP address	
Gateway address	
Network mask	
DNS address	
MAC address	20:41:5a:3d:00:0b

Set

Network Settings for wlan0 interface (wireless)

Configuration type	DHCP
IP address	
Gateway address	
Network mask	
DNS address	
MAC address	24:cd:8d:16:60:c7
Authentication type	WPA2
Network name	SmarteH-WiFi
Password

Set



7.3 GUI design and programming

Figure 16: SmartehIDE software tool⁹

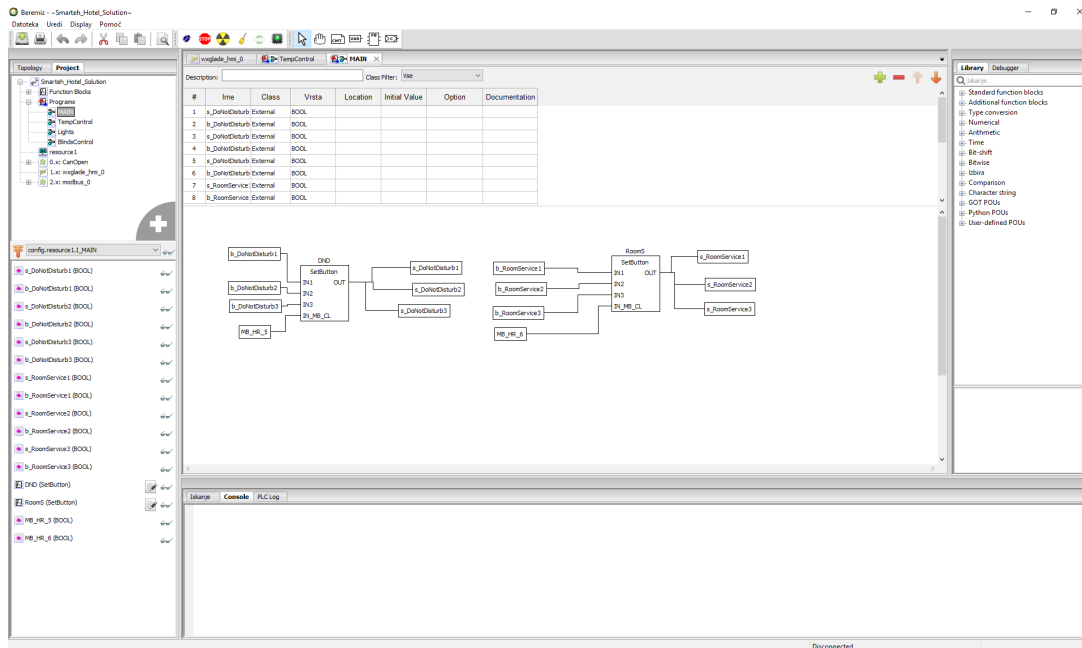
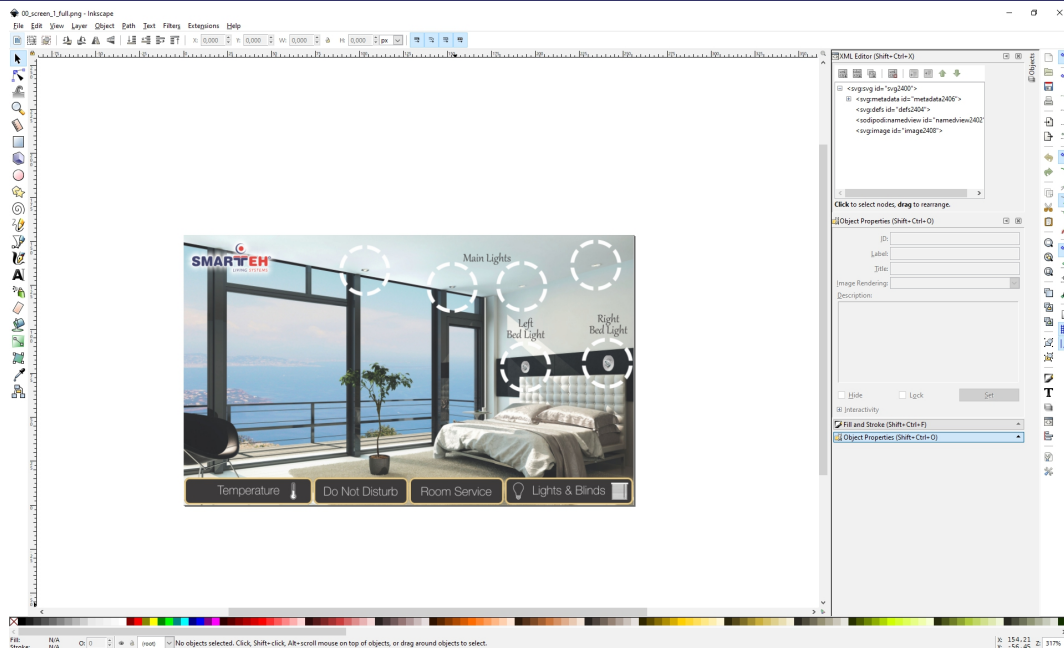


Figure 17: Inkscape open source tool¹⁰



NOTE: Recommended minimum size of the touch object is 10 x 10 mm.

⁹ Configuration of the PLC is done using Smarteh IDE software tool. Please refer to SmartehIDE and LPC Manager user manual for details.

¹⁰ Configuration of the PLC is done using Inkscape open source tool.



8 MODULE LABELING

Figure 18: Label

Label (sample):

XXX-N.ZZZ
 P/N: AAABBBCCDDDEEE
 S/N: SSS-RR-YYXXXXXXXXXX
 D/C: WW/YY

Label description:

1. **XXX-N.ZZZ** - full product name.
 - XXX-N - Product family
 - ZZZ - product
2. **P/N: AAABBBCCDDDEEE** - part number.
 - AAA - general code for product family,
 - BBB - short product name,
 - CCDDDD - sequence code,
 - CC - year of code opening,
 - DDD - derivation code,
 - EEE - version code (reserved for future HW and/or SW firmware upgrades).
3. **S/N: SSS-RR-YYXXXXXXXXXX** - serial number.
 - SSS - short product name,
 - RR - user code (test procedure, e.g. Smarteh person xxx),
 - YY - year,
 - XXXXXXXXXXXX- current stack number.
4. **D/C: WW/YY** - date code.
 - WW - week and
 - YY - year of production.

Optional

1. **MAC**
2. **Symbols**
3. **WAMP**
4. **QR code**
5. **Other**





9 SPARE PARTS

For ordering spare parts following Part Numbers should be used:

LPC-3.GOT.012 Graphical operation terminal	
LPC-3.GOT.012	P/N: 226GOT17012001

Flush mounting box	
Flush mounting box Gewiss 48006	P/N: 206FMB10001001





10 CHANGES

The following table describes all the changes to the document.

Date	V.	Description
19.12.2023	2	Revision of the document.
19.11.2020	1	The initial version, issued as <i>LPC-3.GOT.012 User Manual</i> .



11 NOTES

