SAMARTEM LPC-3.GOT.112 Programmable Controller User Manual

Contents

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Product Usage Instructions

- **Installation**
  - **Block Diagram**
    - Refer to the block diagram in the user manual for a visual representation of the device's components and connections.
  - **Input & Output Connection Interfaces**
    - Connect the input and output devices to the specified interfaces as outlined in the user manual to ensure proper functionality.
  - **Mounting Instructions**
    - Follow the mounting instructions provided to securely install the controller in the designated location.
  - **Grounding Possibilities**
    - Review the grounding options available and select the appropriate method to ensure electrical safety.
- **Programming Guide**
  - **Basic Functionalities**
    - Understand and utilize the basic functionalities of the controller as detailed in the programming

guide section of the manual.

- **WiFi Configuration**
  - Configure the WiFi settings following the instructions provided to enable wireless connectivity.
- **Ethernet Configuration**
  - Set up the Ethernet connection by following the configuration steps outlined in the manual.
- **GUI Design and Programming**
  - Create and customize graphical user interfaces using the programming guidelines specified in the manual.

- **Module Labeling**
  - Refer to the module labeling section for information on how to label and identify different components of the controller.

FAQs

- **Q: Can unauthorized personnel work on the controller connected to a 100-230 V AC network?**
  - **A:** No, only authorized personnel should work on electrical devices operating on 100-230 V AC networks to ensure safety.
- **Q: What should be done with waste electrical and electronic equipment (WEEE)?**
  - **A:** WEEE must be collected separately for proper disposal and recycling to minimize environmental impact.

ABBREVIATIONS

- **SOM** System on the module
- **ARM** Advanced RISC machines
- **OS** Operating system
- **TCP** Transmission control protocol
- **SSL** Secure sockets layer
- **IEC** International Electrotechnical Commission
- **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** Nonvolatile
- **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

DESCRIPTION

- **Smarteh LPC-3.GOT.112** 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.112** has an integrated USB programming and debugging port, connection for Smarteh intelligent peripheral modules, two Ethernet ports, 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.112 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 large set of dynamic controls from buttons to indicators and enables connectivity between the PLC program and the graphical user interface.

FEATURES

Table 1: Features

- Frameless glass screen with 4.3” LCD and capacitive touch screen,
- landscape or portrait orientation
- Real-Time Linux OS ARM-based main module
- The graphical interface is freely designed by the user with GUI editor in Smarteh IDE 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
- Wi-Fi connector for external antenna
- 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
- RTC and 512 kB NV RAM with supercapacitor for needed energy storage
- Built-in buzzer controlled by PLC program
- Display brightness level controlled by PLC program
- White or black glass screen
- Metal back housing
- Status LEDs
- Quality design

INSTALLATION

Block diagram

Figure 2: LPC-3.GOT.112 block diagram

Input & output connection interfaces

Figure 3: Connection scheme

Table 2: PS1 Power supply1

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

Table 3: COM1 RS-4852

- **COM1.1** RS-485 (B) Modbus RTU 0 .. 3.3 V
- **COM1.2** RS-485 (A) Modbus RTU
- **COM1.3** — GND
- **COM1.4** +U Power supply output

1. Wires connected to the module must have cross sectional area at least 0.75 mm2. The minimum temperature rating of wire insulation must be 85 °C.
2. Different protocols like Modbus RTU Master can be selected inside Smarteh IDE. Wires connected to the module must have cross sectional area of at least 0.14 mm2. Use twisted-pair cables of type CAT5+ or better, shielding is recommended.

Mounting instructions

Figure 4: Housing dimensions

Dimensions in millimeters.

- **EXTERNAL SWITCH OR CIRCUIT-BREAKER AND EXTERNAL OVERCURRENT PROTECTION:** The unit is allowed to be connected to installation with over-current protection that has a nominal value of 6 A or less. All connections, PLC attachments, and assembling must be done while
- **LPC-3.GOT.112** is not connected to the main power supply. The module should be positioned on the wall inside of the room. Avoid direct sunlight, positioning near heating/cooling source objects or under high luminance lights for best performance of the onboard sensors. The junction box and tubes in the wall must be sealed to prevent airflow. The displayed temperature is adequate to temperature approx. 10 cm below the module and 1 cm off the wall. The recommended installation height is 1.5 m above floor level. The portrait orientation of the module may produce slight errors in temperature measurements.
- **Wires connected** to the PLC must have cross sectional area of at least 0.75 mm2. The minimum temperature rating of wire insulation must be 85 °C.

Mounting instructions on the enclosure door

1. Switch off the power supply.
2. Make cut-out and mounting holes – see Figure 4.
3. Mount LPC-3.GOT.112 into cut out and fasten it with screws.
4. Connect the power supply and communication wires.
5. Switch on the power supply.

Grounding possibilities

Figure 5: Grounding possibilities

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

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

TECHNICAL SPECIFICATIONS

Table 9: 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 mm2
- **Connection type for** COM1 disconnectable spring type connectors for stranded wire 0.14 to 1.5 mm2
- **Connection type for** COM2 RJ-12 6/4

- **COM1** RS-485 port nonisolated, 2 wire
- **COM2 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** 1 GB DDR3
- **Flash** 4 GB eMMC 8bits (MLC type)
- **NV RAM** 512 kB, capacitor backed up with retention cca. 14 days
- **Display** 4.3″, 480 × 272 resolution
- **LCD viewing angle** (R/L/T/B) 70°/70°/50°/70°
- **Dimensions** (L x W x H) 106 x 160 x 39 mm
- **Display dimensions** (L x W) 54 x 95 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

PROGRAMMING GUIDE

- This chapter is intended to offer the programmer additional information about some of the functionalities and units integrated into this graphical operation terminal.

Basic functionalities

- **RTC unit**
  - For RTC backup 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 a minimum of 14 days from the power down. RTC time provides date and time information.
- **Ethernet**
  - The 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.112 functions as a master device, controlling the communications with other slave devices such as sensors, inverters, other PLCs, etc. LPC-3.GOT.112 sends Modbus TCP/IP commands to and receives Modbus TCP/IP responses from the slave units.

The 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 these commands 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). The highest scan rate is 100 ms.

Modbus RTU master unit
When configured for Modbus RTU Master mode, the the LPC-3.GOT.112 functions as a master device, controlling the communications with other slave devices such as sensors, inverters, other PLCs, etc. LPC-3.GOT.112 sends Modbus RTU commands to and receives Modbus RTU responses from the slave devices.

The 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 these 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 a higher quantity of data is required, LPC-3.GOT.112 can execute up to 32 same or different supported commands simultaneously.

- **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 COM2 is used for communication with LPC-2 slave modules. All communication settings are configured in the SmartehIDE software program.

BACnet IP unit

- When configured for BACnet IP (B-ACS), the 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 the producer.

RUN/STOP Switch

- **Run:** Status RUN status LED “on” indicates that the user graphical application is up and user program is running.
- **Stop:** When the switch is turned to STOP state, the RUN status LED is “off” and the 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.

WiFi configuration

1. Connect the module to the PC via USB connector and switch ON the power supply.
2. In the address bar, type the module's default IP address: 192.168.45.1 followed by the port number: 8009 (e.g., http://192.168.45.1:8009). Refer to Figure 6: Web interface.
3. Click on the "Settings" button on the web interface.
4. The Settings page opens. In the "Network Settings for wlan0 interface (wireless)," section set the parameters of the wireless network to which you want to connect: "Configuration type", "Authentication type", "Network name" and "Password". Refer to Figure 7: Web interface settings.
5. Click the "Set" button at the bottom of the section to apply the changes.

Ethernet configuration

1. Connect the module to the PC via USB connector and switch ON the power supply.
2. Open a web browser on your PC.
3. In the address bar, type the module's default IP address: 192.168.45.1 followed by the port number: 8009 (e.g., http://192.168.45.1:8009). Press Enter. Refer to Figure 7: Web interface settings.
4. Click on the "Settings" button on the web interface.
5. The Settings page will display two sections for configuring network connections (Ethernet and Wi-Fi). The "Network Settings for eth0 interface (wired)" section allows you to set parameters for the module's RJ45 Ethernet port. Enter the desired network parameters for your specific network configuration. Ethernet port and WiFi must use the same Gateway. So if we select the first port on DHCP, we must set the second one to DHCP (address only). Refer to Figure 7: Web interface settings
6. Once you have configured the settings, connect a UTP cable to the desired port.
7. Click the "Set" button at the bottom of the section to apply the changes.

GUI design and programming

The graphical interface is freely designed by the user with a GUI editor in SmartehIDE (Inkscape 0.92).

NOTE: It is recommended that only one Ethernet or Wifi connection to the Smarteh PLC GUI by using an internet browser, is established and used at a time. Exceptionally up to three Ethernet or Wifi connections could be established at the same time.

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

MODULE LABELING

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 a product family,
    - BBB – short product name,
    - CD – 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-YYXXXXXXXXX – serial number.**
    - SSS – short product name,
    - RR – user code (test procedure, e.g. Smarteh person xxx),
    - YY – year,
    - XXXXXXXXX– 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

SPARE PARTS

For ordering spare parts following Part Numbers should be used:

- **LPC-3.GOT.112 Graphical operation terminal**
    - **LPC-3.GOT.112,** black glass screen
    - **P/N:** 226GOT23112B01

CHANGES

The following table describes all the changes to the document.

Date	V.	Description
05.06.24	3	Chapter 6 updated.
19.12.23	2	Revision of the document.
21.09.23	1	The initial version, is issued as *LPC-3.GOT.112 User Manual.*

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References

- User Manual