USER MANUAL

Longo programmable controller
LPC-2.MC9
Main module

Version 8

Written by SMARTEH d.o.o.
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User Manual

Document Version: 8
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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 .. 240 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-2 – 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-2 complies to the following standards:
- EMC: EN 61000-6-3:2007 + A1:2011, EN 61000-6-1:2007, EN 61000-3-2:2006 + A1:2009 + A2: 2009, EN 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.

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Longo programmable controller LPC-2.MC9

1 ABBREVIATIONS

SOM   System on module

ARM   Advanced RISC machines

TCP   Transmission control protocol

IEC   International electrotechnical commission

CAN   Controller area network

COM   Communication

LED   Light emmiting diode

RAM   Random access memory

NV   Non volatile

PS   Power supply

2 DESCRIPTION

LPC-2.MC9 Smarteh flagship main module modular PLC offers improved performance, scalability and a wide range of new features within a single compact SOM based package. Simple and innovative concept, where most competitors require multiple products to deliver similar functionality. Main module based on ARM architecture processor running Linux based operating system (OS) adds more computing power, more control and additional interface connection offering capability for future core SOM module upgrade without hardware changes.

In addition, LPC-2.MC9 is designed to connect additional input, output modules on the right (connector K2) and communication modules on left (connector K1).

LPC-2.MC9 has integrated USB programming and debugging port, connection for intelligent peripheral modules, Ethernet connection that can be used as a Modbus TCP/IP Master and/or Slave device, BACnet IP (B-ASC) and RS-485 port for Modbus RTU Master or Slave. It can be used as a stand-alone PLC or connected to remote input/output devices via the CANopen interface. This interface also allows you to communicate with other PLCs.

Hardware configuration is done using Smarteh IDE programming software, used to design user configuration selecting from a wide range of module (up to 7[1]) in a single configuration.

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 <,=, >

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

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1 Some modules are subject to power consumption and number limitation, this limitations are handled directly in the Smarteh IDE not allowing users to add more modules.
For proper system configuration and data allocation please refer to Smarteh IDE software help menu.
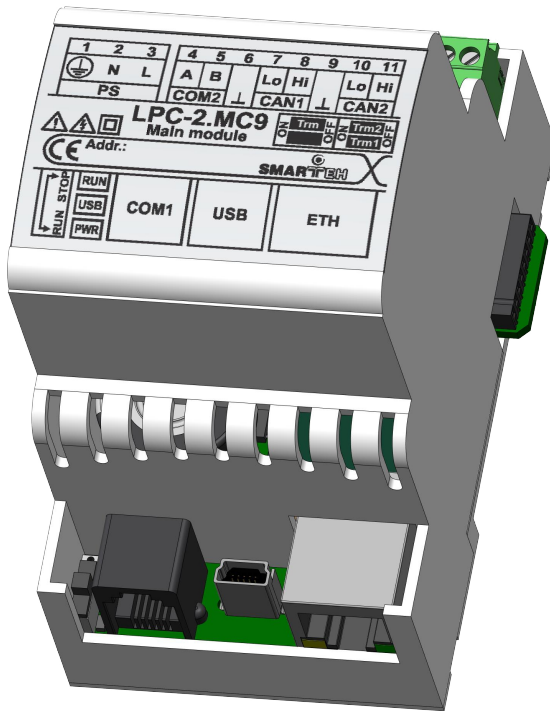
3 FEATURES

Figure 1: LPC-2.MC9 module

Table 1: Features
Real Time Linux OS ARM based main module
Ethernet connectivity with Modbus TCP/IP Slave (server) and/or Master (client) functionality, BACnet IP (B-ASC), web server and SSL
Modbus RTU Master or Slave
USB port for Debugging and application transfer
Two CAN ports - one for master, one for slave
Smarteh bus for Smarteh intelligent peripheral modules (thermostat, RFID, IR, operator terminal,..)
RTC and 512 kB non-volatile memory with super capacitor for needed energy storage
3 status LEDs

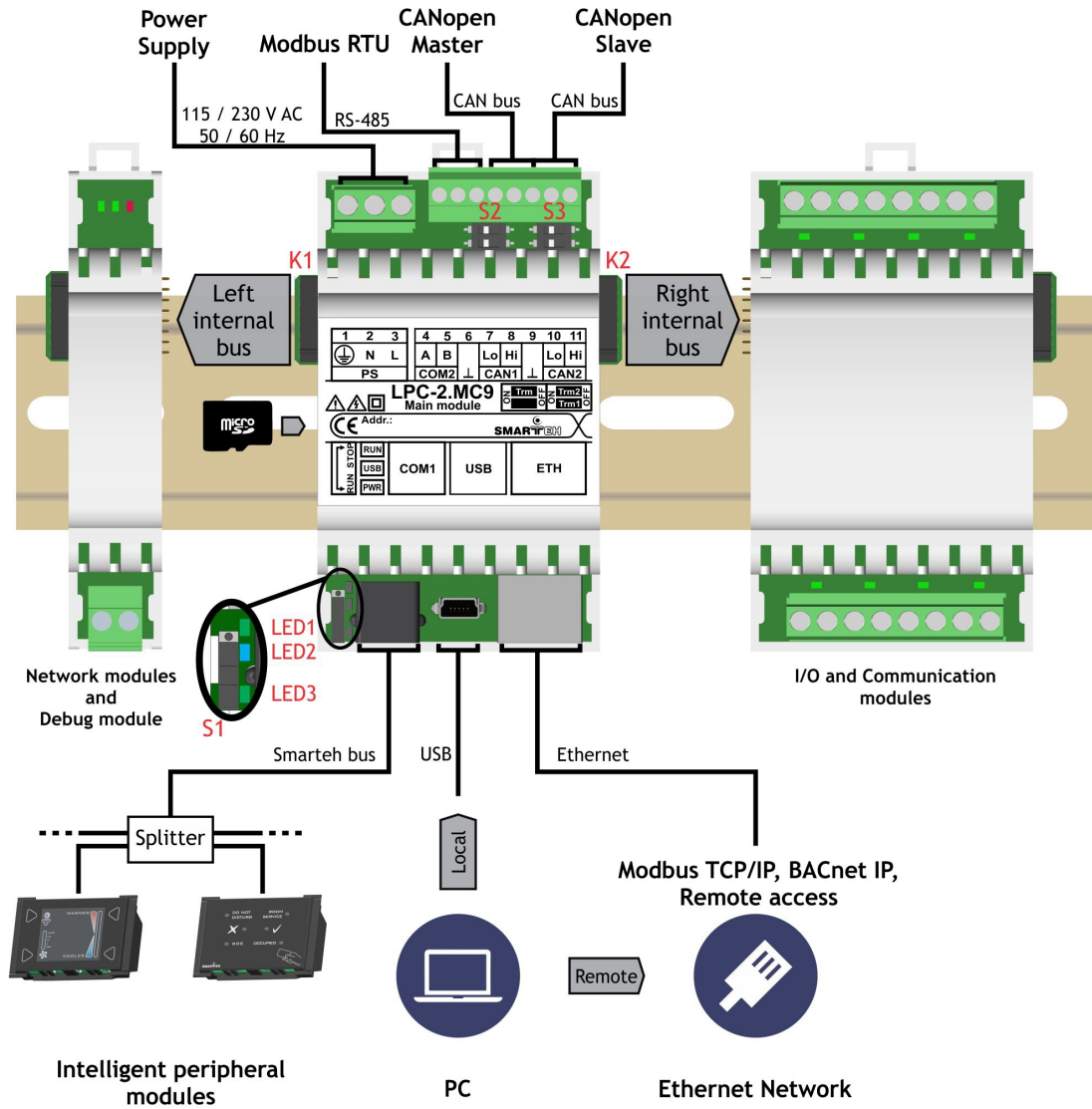# 4 INSTALLATION

4.1 Connection scheme

Figure 2: Connection scheme

Table 2: CAN1 & CAN2[2]

CAN1.7	CAN1 Low (Lo) (Master)	0 .. 5 V
CAN1.8	CAN1 High (Hi) (Master)	
⊥.9	⊥	GND
CAN2.10	CAN2 Low (Lo) (Slave)	0 .. 5 V
CAN2.11	CAN2 High (Hi) (Slave)	

Table 3: COM2 RS-485[3]

COM2.4	RS-485 (A)	0 .. 5 V
COM2.5	RS-485 (B)	
⊥.6	⊥	GND

Table 4: Switches

S3	CAN1 & CAN2 bus termination (Trm1 & Trm2)	ON: CAN channels are internally terminated with 120 Ω OFF: no internal termination present. Trm1 terminates CAN2 and Trm2 terminates CAN1
S2	COM2 RS-485 termination (Trm)	ON: RS-485 channel is internally terminated with 120 Ω OFF: no internal termination present. Trm terminates COM2
S1	Operation mode (RUN/STOP)	RUN: PLC normal operational mode STOP: application not running

Table 5: LEDs

|		
LED1: green	Application running (RUN)	ON: application is running OFF: application is stopped or PLC in boot mode
LED2: blue	Additional LED	Not used
LED3: green	Power (PWR)	ON: PLC is powered on OFF: PLC has no power supply

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2 **Wires** connected to the module must have cross sectional area at least 0.14 mm^2. Use twisted-pair cables of type CAT5+ or better, shielding is recommended. Minimum temperature rating of wire insulation must be 85 ˚C.

3 **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 mm^2. Use twisted-pair cables of type CAT5+ or better, shielding is recommended. Minimum temperature rating of wire insulation must be 85 ˚C.

4.2 Mounting instructions

Figure 3: Housing dimensions
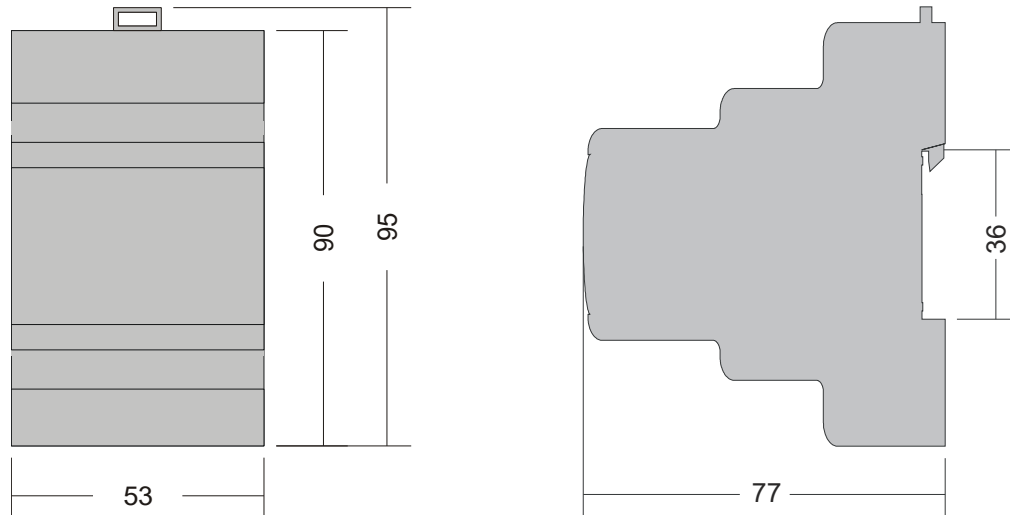
Dimensions in milimeters.

RECOMMENDATION ON SWITCH OR CIRCUIT-BREAKER PROTECTION: There should be two poles main switch in the installation in order to switch off the module. The switch must meet the requirements of standard IEC60947-1 and have a nominal value at least 6 A. The switch or circuit-breaker should be within easy reach of the operator. It must be used as the disconnected device for the equipment.

RATING AND CHARACTERISTICS OF FUSES: LPC-2.MC9 main module must be connected with 4 A circuit breaker in Live and Neutral conductor. It is class I unit and must be permannetly connected to Protective Earth. The units are permanently connected to the Mains.

All connections, module attachments and assembling must be done while module is not connected to the main power supply. Wires connected to the module must have cross sectional area at least 0.75 mm^2. Minimum temperature rating of wire insulation must be 85 °C.

The modules must be installed in enclosure with no openings. Enclosure must provide electrical and fire protection which shall withstand dynamic test with 500 g steel sphere from distance is 1.3 m and also static test 30 N. When installed in enclosure, only authorized person can have a key to open it.

Mounting instructions:

1. Switch OFF main power supply.
2. Mount module to the provided place inside an electrical panel (DIN EN50022-35 rail mounting).
3. Mount other IO modules (if required). Mount each module to the DIN rail first, then attach modules together through K1, K2 connectors.
4. Connect needed input, output and communication wires.
5. Switch ON main power supply.
6. Dismount in reverse order. For mounting/dismounting modules to/from DIN rail a free space of at least one module must be left on the DIN rail.
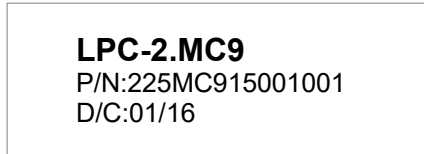
Figure 4: Minimum clearances

60 mm or more
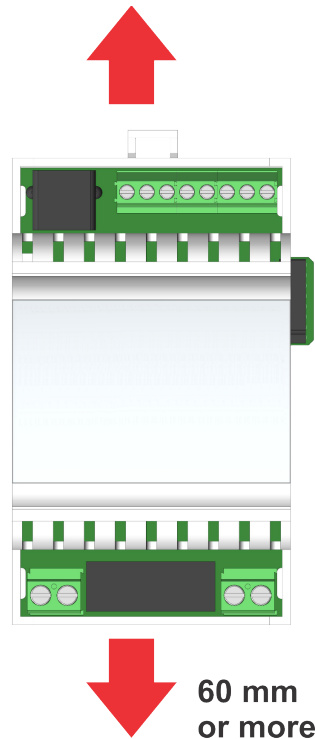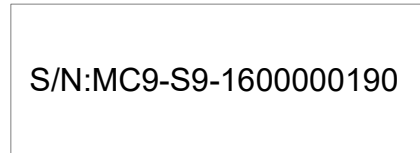
The clearances above must be considered before module mounting.

4.3 Module labeling

Figure 5: Labels

Label 1 (sample):

| **LPC-2.MC9**
P/N:225MC915001001
D/C:01/16 |

Label 2 (sample):

| S/N:MC9-S9-1600000190 |

Label 3 (sample):

| MAC: 20-41-5A-1A-00-00 |
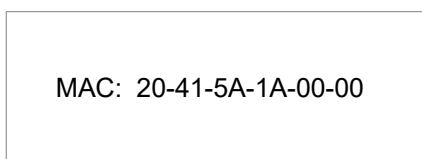
Label 1 description:

1. **LPC-2.MC9** is the full product name.
2. **P/N: 225MC915001001** is the part number.

    - **225**– general code for product family,

    - **MC9** – short product name,

    - **15001** – sequence code,

        - 15 – year of code opening,

        - 001 – derivation code,

    - **001** – version code (reserved for future HW and/or SW firmware upgrades).

3. **D/C:01/16** is the date code.

    - **01** – week and

    - **16** – year of production.

Label 2 description:

1. **S/N: MC9-S9-1100000190** is the serial number.

    - **MC9** – short product name,

    - **S9** – user code (test procedure, e.g. Smarteh person 009),

    - **1600000190** – year and current stack code,

        - 16 – year (last two cyphers),

        - 00000190 – current stack number; previous module would have the stack number 00000189 and the next one 00000191.

Label 3 description:

    - MAC: 20-41-5A-1A-00-00 is the MAC address.

5 PROGRAMMING GUIDE

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

5.1 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.

Modbus TCP/IP master unit
When configured for Modbus TCP/IP Master / Client mode, the LPC-2.MC9 functions as a master device, controlling the communications with other slave devices such as sensors, inverters, other PLCs, etc. LPC-2.MC9 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 LPC-2.MC9 functions as a master device, controlling the communications with other slave devices such as sensors, inverters, other PLCs, etc. LPC-2.MC9 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-2.MC9 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 1024 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.

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 6: CAN Master and Slave wiring diagram example
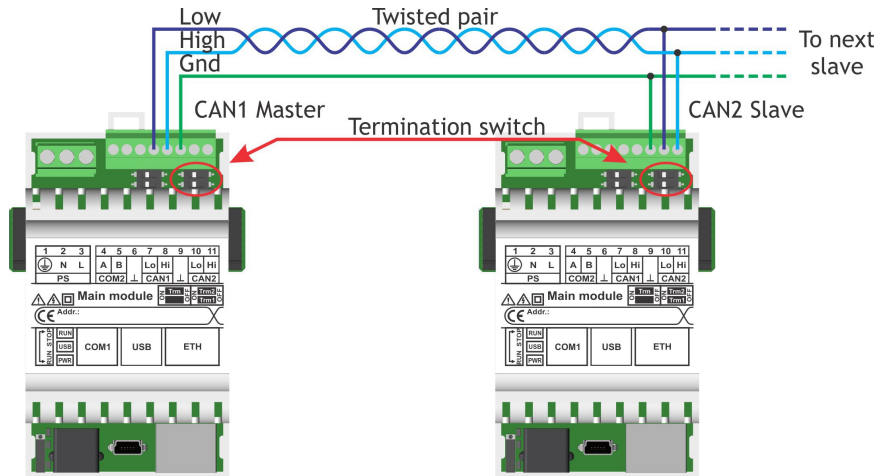
RUN/STOP Switch

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.

6 TECHNICAL SPECIFICATIONS

Table 6: Technical specifications	
Rated power supply PS	115/230 V AC, 50/60 Hz
Operational power supply PS	90 .. 264 V AC
Power consumption	up to 24 W depending on additional modules connected to main module
Connection type for PS	screw type connector for stranded wire 0.75 to 2.5 mm^2
Connection type for CAN1, CAN2, COM2	disconnectable screw type connector for stranded wire 0.14 to 1.5 mm^2
USB	mini B type, device mode or host mode (USB On-The-Go), high-speed/full-speed
RTC	capacitor backed up with retention cca. 14 days
Operating system	Linux
CPU	SOC ARM9 454 MHz
RAM	256 MB DDR2
Flash	512 MB SLC NAND
NV RAM	512 kB, capacitor backed up with retention cca. 14 days
Dimensions (L x W x H)	90 x 53 x 77 mm
Weight	180 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
Fuse	integrated 2 A (T-slow), 250 V
Pollution degree	2
Over-voltage category	II
Electrical equipment	class II (double insulation)
Protection class	IP 30

7 SPARE PARTS

For ordering spare parts following Part Numbers should be used:

LPC-2.MC9 Main module	
LPC-2.MC9	P/N: 225MC915001001

8 CHANGES

The following table describes all the changes to the document.

Date	V.	Description
09.03.20	8	Modbus chapter update.
24.10.19	7	BACnet description added.
15.01.18	6	Technical data update.
30.09.17	5	Added technical data.
15/04/17	4	RTU update.
15/01/17	3	Added technical data.
16/11/16	2	Added technical data.
30.09.16	1	The initial version, issued as *LPC-2.MC9 User Manual*.

9 NOTES