mark320
mark220

DDC controllers

Summary DDC (Direct digital control) controllers mark320 and mark220 are free programmable process stations with MPC5200 processor and OS Linux. They are suitable for control of large installation (approximately 400 – 500 physical data points). Mark 320 contains 1x Ethernet port, 2x RS485 interface, and 2x RS232 interface for connecting I/O modules. Mark220 contains only 1x Ethernet port and 1x RS485 interface.

Application
- **Free programmable control units for HVAC systems and other applications with local HMI and web access**
- **Data acquisition, processing, and presentation systems with advanced networking features**
- **Controls of power systems, photovoltaic power plants etc.**
- **Protocol converters with web data presentation (must be programmed by user)**

Function The controller hosts an embedded Linux operating system which boots up the Merbon runtime with the application. The board contains real time clock with battery backup, flash memory containing OS, runtime, application, and other data (time programs, setpoints etc.), and a watchdog. It is also possible to use NVRAM to backup parameters in case of unexpected system shutdown.

The application is created and uploaded in the Merbon IDE development environment. The maximum application program size depends on number of physical and software data points, amount of function blocks which require more memory (e.g. time schedulers), degree of code optimisation, and number of connections the PLC has to handle.

For communication with other devices, mark320 contains 1x Ethernet port, 2x a RS485 interface and 2x a RS232 interface. The mark220 contains only 1x Ethernet port and 1x a RS485 interface.

The process station contains a web server for remote connection and user intervention. The web pages are created in Merbon HMI editor, which is included in the package of development programs. The exported web definition is uploaded to the process station through Merbon IDE. From the security point of view, the website is not recommended for use in the public network, it is intended for operation in a local network., Therefore it is necessary to integrate the configured router or other element that ensures network security during the design of the network topology.

The process station can be operated through a 3 x 16 characters backlit LCD display and 6 backlit pushbuttons. Users move in the menu using buttons – the **active row is the middle row**. Objects such as Value setting, Alarm, and Time schedule have predefined functionality, and thus for the configuration it is only necessary to set addresses, assign data points, and complete user texts.

The user menu structure is configured in Merbon HMI editor. The menu is uploaded to the process station through Merbon IDE (see LCD menu definition in PLC properties).

The module is 105 mm wide and mounts on a standard DIN rail. It is provided with markPLC kit for mounting into an aperture in panel door or any suitable box (on demand).

Technical data

Power	10 V ÷ 35 V DC, 14 V ÷ 24 V AC; 5,5 VA
Communication mark320	
Ethernet	1x Ethernet 10/100BaseT
	RJ45, 2 LED (link, data) integrated in the connector
RS232	COM1, COM2
	2x CANNON 9 male; pin 2=TX, 3=RX, 5=GND
	300 ... 115 200 bit/s, parity and bits are set in SW
RS485	COM3, COM4 RS485 (K+, K-)
	2 separated buses galvanically insulated from each other, insulating voltage 1 kV
	300 ... 115 200 bit/s, parity and bits are set in SW
	maximal bus length 1200 m
	maximum number of modules depends on requested response time – up to 255 addresses, for common HVAC applications use about 300...400 physical data points on the bus
Communication mark220	
Ethernet	1x Ethernet 10/100BaseT
	RJ45, 2 LED (link, data) integrated in the connector
RS485	COM4 RS485 (K+, K-)

1 bus; galvanically insulated, insulating voltage 1 kV

300 ... 115 200 bit/s, parity and bits are set in SW

maximal bus length 1200 m

maximum number of modules depends on requested response time – up to 255 addresses, for common HVAC applications use about 300…400 physical data points on the bus

LCD display	3 rows x 16 characters,
	mark220 yellow backlight
	mark320 blue backlight
	adjustable backlight intensity
	possibility to switch off the backlight through application software
Buttons	6 backlit buttons
6x LED – mark320	RUN, PWR, 2x RS485 RxD/TxD
4x LED – mark220	RUN, PWR, RS485 RxD/TxD
HW	MPC5200, 400 MHz, 760 MIPS, 128 MB RAM, 64 MB Flash, 128kB NVRAM FRAM
SW	Merbon IDE
	Merbon HMI
Housing	Polycarbonate box (certification UL94V0)
Dimensions	See below
Aperture dimensions	102(width) x 45 (high) mm; tolerance +1 mm
	(**notice:** the previous type of housing of IPLC201 has different dimensions)
Protection degree	IP20 (EN 60529+A1+A2)
Terminals	Screw terminals M3, maximum wire cross-section 2,5 mm^2
Ambient conditions	5 – 40 °C; 5 – 85 % relative humidity; non-condensing gases and chemically non-aggressive conditions (according EN 60721-3-3 climatic class 3K3)
Accessories	markPLCkit – frame for mounting into an aperture in panel door or any suitable box (**notice:** the previous type of housing of IPLC201 has different dimensions)

Scheme
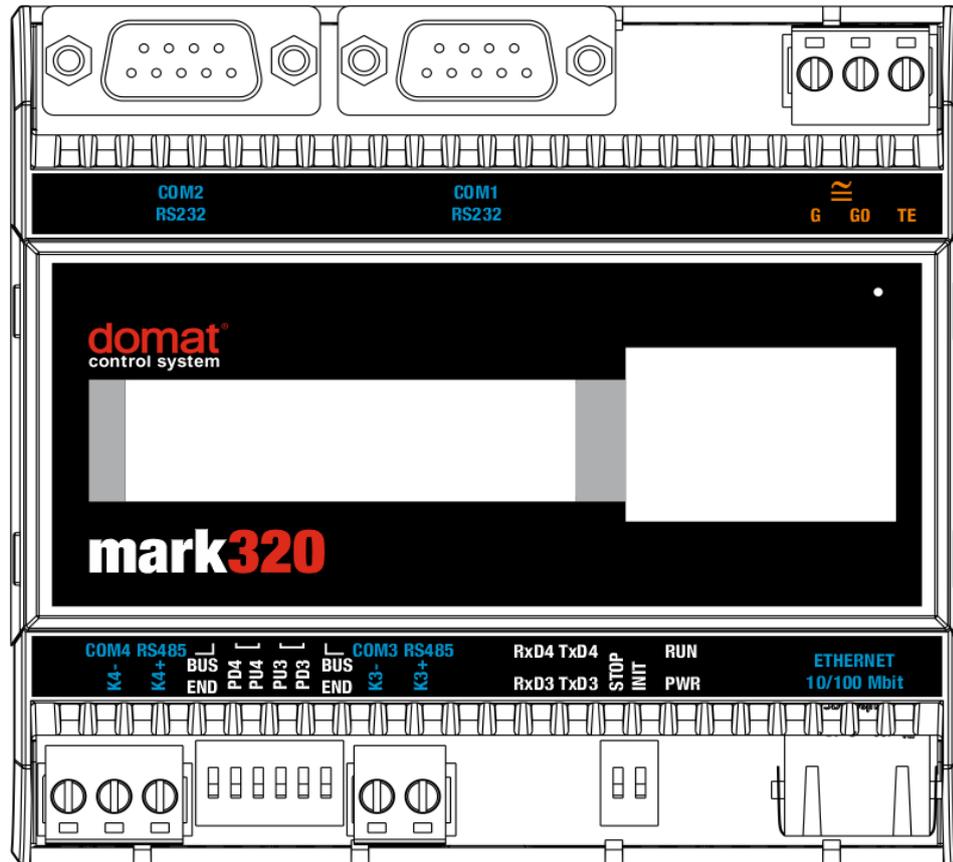
Terminals and connectors:

COM1	port COM1 - serial link RS232; CANNON 9 male (**mark320 only**)
COM2	port COM2 - serial link RS232; CANNON 9 male (**mark320 only**)
COM3	port COM3 - serial link RS485, terminals K+, K- (**mark320 only**)
COM4	port COM4 - serial link RS485, terminals K+, K-
Ethernet	network interface
G	power
G0	power
TE	optional connection for shielding (on the back side in the DIN rail groove there is a metal strip which connects TE to DIN rail after the device is snapped on the rail)

LED indication:

RUN	green LED – system cycle (OK: LED flashes periodically 1 s ON, 1 s OFF; ERROR: LED flashes in other pattern, LED is still ON or OFF)
PWR	green LED – power (ON: power OK; OFF: no power applied, weak or damaged power supply, …)
RxD3	green LED – RS485 receiving data at COM3 (flashing: receiving data; OFF: no data traffic)(**mark320 only**)
TxD3	red LED – RS485 transmitting data at COM3 (flashing: transmitting data; OFF: no data traffic)(**mark320 only**)
RxD4	green LED – RS485 receiving data at COM4 (flashing: receiving data; OFF: no data traffic)

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TxD4	red LED – RS485 transmitting data at COM4 (flashing: transmitting data; OFF: no data traffic)
DIP switches:	
STOP	if ON runtime is running, program execution is stopped
INIT	if ON at power-up, configuration parameters are brought to defaults (see Configuration parameters in Merbon IDE; for example IP address, user and password, database settings, proxy, …)
BUS END	(DIP6 next to COM3 RS485) bus end COM3; the first and last devices on bus should have bus end ON
BUS END	(DIP1 next to COM4 RS485) bus end COM4; the first and last devices on bus should have bus end ON
PU3	pull-up resistor for COM3
PD3	pull-down resistor for COM3
PU4	pull-up resistor for COM4
PD4	pull-down resistor for COM4

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DIP BUS END, PU/PD	Bus End and pull up / pull down switches:
	Three switches on the left belong to COM4, three switches on the right belong to COM3.
	Unlike for the other modules and controllers, the bus is terminated (BUS END) with one switch only (SW1 and SW6).
	The inner switches (2 and 3 for COM4, 4 and 5 for COM3) are pull-up and pull-down switches for K+, and K- wires:
	The K- signal is bound over a resistor to RS485 ground (PD switch), the K+ links over a resistor to +5V power of the bus driver (PU switch).
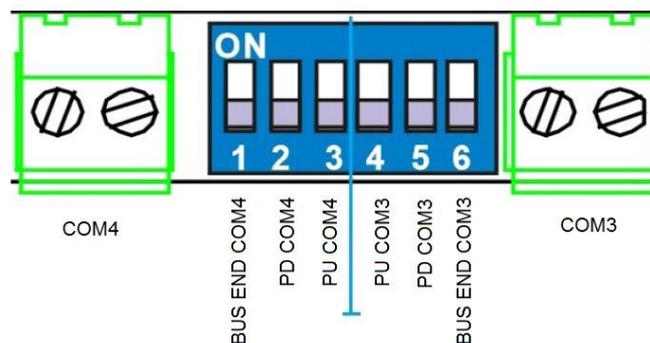
Unlike at the older PLC versions, the RS485 buses are separated from each other. It is possible to activate all PU and PD switches at the same time.

Dimensions
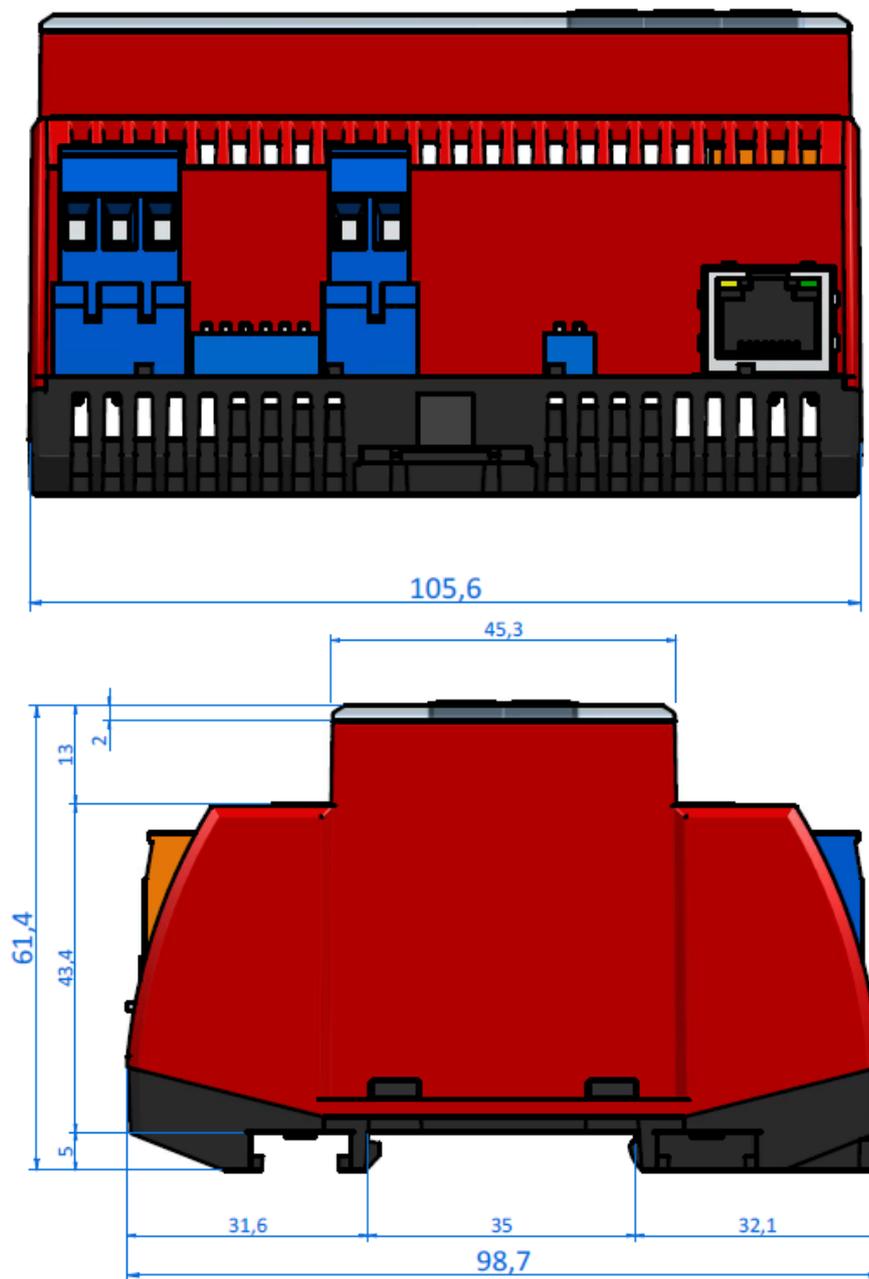
Dimensions are in *mm*.

Programming

Merbon IDE

The main programming tool is the Merbon package which contains I/O editor, graphical editor of the function plan (FBD), structure text editor and compiler (Merbon IDE). The Merbon package contains also LCD menu editor as well as web editor (Merbon HMI).

The application program consists of function blocks which are stored in libraries. Those contain analogue and digital functions, mathematical blocks including goniometric functions, time schedulers, alarm blocks, and HVAC specific blocks (heat recovery, dewpoint calculation, enthalpy, pump switch etc.).

The minimum guaranteed number of records for history on the PLC is 37 000, but the actual number of stored samples may be larger depending on the data types that are stored in the history. The program can be set up also as structure text (ST) or with combination of both types of programming languages.

Communication   Default network settings are:

IP address	192.168.1.10
subnet mask	255.255.255.0
default gateway	192.168.1.1

SSCP user: admin
Password: rw

Notice: Do not forget to note the new network settings after change!

After these values have been changed, it is possible to bring the process station into default settings by the INIT DIP switch: set INIT to ON and restart the station. All values in the PLC configuration are set to defaults. The PLC will respond at the default IP address and it is possible to change the old address through Merbon IDE.

The controllers can share variables over the Ethernet network (outside temperature, heat demands etc.) together with other PLC platforms.

The runtime provides drivers for communication with I/O modules and other subsystems. For example Merbon runtime contains: Modbus TCP / RTU (server/client), M-Bus, IEC62056-21, SSCP, SoftPLC link and BACnet IP server/client (viz PICS). The complete list of drivers can be found in the Channel configuration dialogue in the most recent Merbon release. Please check the required protocol features and functions with the list of implemented features in the Merbon IDE help. It is also possible to program own communication drivers using the I/O library functions in structure text language.

Number of communication channels (on the serial lines and Ethernet) to I/O modules and subsystems is not directly restricted. It depends on available RAM PLC memory.

Number of connections from SSCP clients is max. 20. This includes connections from RcWare Vision, Merbon IDE, HT102/200, mobile application Merbon Menu Reader, connection from other PLCs over SSCP etc.

Number of connections from Modbus TCP clients on Modbus TCP server is max. 5.

Other clients channels (web, …) are not directly restricted.

RoHS notice   The device contains a non-rechargeable battery which backups the real-time clock and part of the memory. After the device is not operable, please return it to the manufacturer or dispose of it in compliance with local regulations.

Safety note   The device is designed for monitoring and control of heating, ventilation, and air conditioning systems. It must not be used for protection of persons against health risks or death, as a safety element, or in applications where its failure could lead to physical or property damage or environmental damage. All risks related to device operation must be considered together with design, installation, and operation of the entire control system which the device is part of.

Changes in versions

08/2015 – First version.

11/2015 – Correction of processor system information. Picture of final housing version.

07/2016 – Added information about new communication drivers and communication limits. Corrected information about function of STOP DIP switch.

03/2017 – Added a new image mark320.

07/2020 – Added information about min. number of records in history, new logo, safety note.

10/2020 — Updated information about web usage, modified description of communication protocols.