mark130 DDC controllers

Summary

DDC (Direct digital control) controller mark130 is free programmable process station with ARM Cortex M4 processor and OS FreeRTOS. It is suitable for control of small installation or use like control panel for other mark process station with Merbon runtime. Mark130 contains 1 × Ethernet port, 1 × RS485 interface, 1 × RS232 interface and external 8 MB RAM.

Application

- **Control panel incl. mark process station with Merbon runtime for HVAC systems or other technologies**
- **Free programmable control units for small HVAC systems and other applications**

Function

The controller hosts an embedded FreeRTOS 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, mark130 contains 1 × Ethernet port, 1 × a RS485 interface and 1 × a RS232 interface.

The process station contains a web server for remote connection and user intervention. The web pages and LDC menu are created and 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 4 × 20 characters backlit LCD display and 6 pushbuttons. Users move in the menu using buttons – the **active row is the second row** from the top, which is enhanced by the red line on the printed cover. 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 and uploaded to the process station through Merbon IDE (see LCD menu definition in PLC properties).
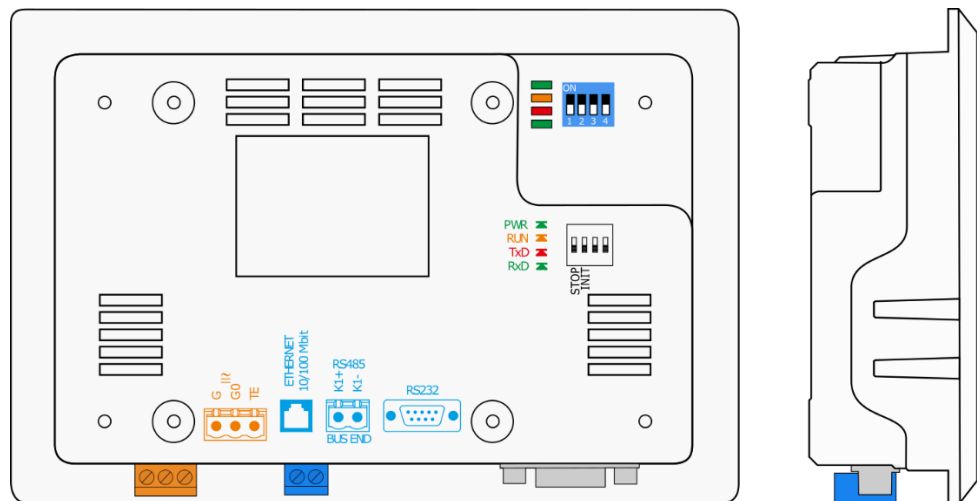
The device is installed using three plastic clamps into an aperture in panel door or any suitable box. The aperture dimensions are 153 × 100 mm, with tolerance 2 mm.

Technical data		
Power	24 V AC/DC ± 20%; max. 5 W	
Communication		
Ethernet	1 × Ethernet 10/100BaseT	
	RJ45, 2 LED (link, data) integrated in the connector	
RS232	COM2	
	1 × CANNON 9 male; pin 2=TX, 3=RX, 5=GND	
	galvanically insulated, insulating voltage 1 kV	
	300…115 200 bit/s, parity and bits are set in SW	
RS485	COM1 RS485 (K+, K-)	
	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	4 rows × 20 characters, blue backlight	
	possibility to switch off the backlight through application software	
Buttons	6 buttons on a membrane keyboard, water and dirt resistant	
4x LED	PWR, RUN, RS485 TxD/RxD	
HW	ARM Cortex M4 168 MHz, 10 MB FLASH, 256 KB SRAM, 4 KB + 64 KB NVRAM, 8 MB external SDRAM	
SW	Merbon IDE	

Housing	polycarbonate (PC) box (UL94V-2); front panel polyester membrane keypad
Front panel dimensions	171.8 × 116.5 × 39.3 mm; see scheme below
Aperture dimensions	153 × 100 mm (deviation +2 mm)
Front protection degree	IP65 (EN 60529 + A2:2019)
Terminals	screw terminals M3, recommended wire diameter 0.35…1.5 mm^2
Ambient temperature	from -20…50 °C; 5…85% relative humidity; non-condensing gases, chemically non-aggressive conditions, fog, ice, and frost (according EN IEC 60721-3-3 ed. 2:2019 climatic class 3K22, 1K21, 3M11)
	for installation at high altitude, it is necessary to consider the reduction of dielectric strength and a limited cooling air (EN IEC 60664-1 ed.3: 2020)
Standards of conformity	EMC EN IEC 61000-6-2 ed. 4:2019, EN IEC 61000-6-4 ed. 3:2019 (industrial environment)
	Electrical safety EN IEC 62368-1 ed. 2:2020+A11:2020
	Hazardous substances reduction EN IEC 63000:2019

Terminals
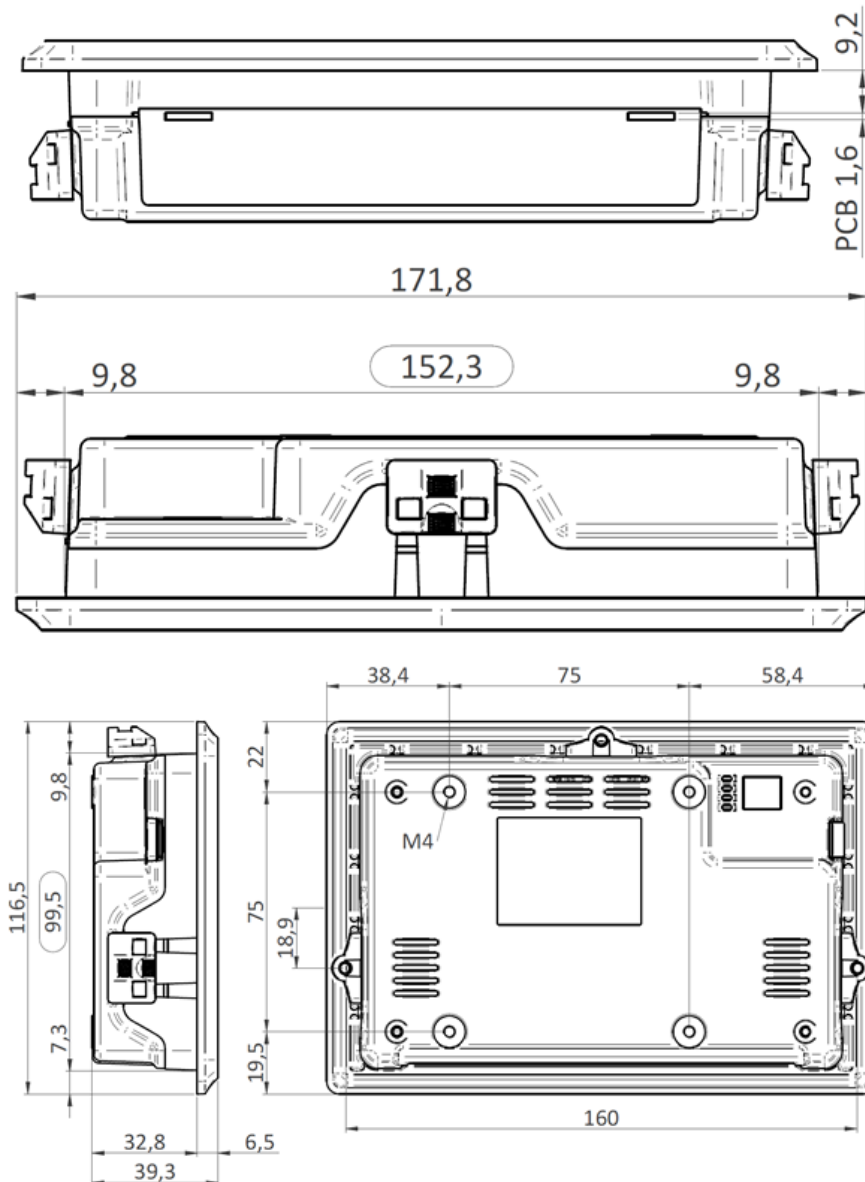

Terminals and connectors

G	power
G0	power
TE	optional connection for shielding
Ethernet	network interface
RS232	port COM2 - serial link RS232; CANNON 9 male
RS485	port COM1 - serial link RS485, terminals K+, K-

LED indication

PWR	green LED – power (ON: power OK; OFF: no power applied, weak or damaged power supply, …)

RUN	orange 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)
TxD	red LED – RS485 transmitting data at COM1 (flashing: transmitting data; OFF: no data traffic)
RxD	green LED – RS485 receiving data at COM1 (flashing: receiving data; OFF: no data traffic)

DIP switches

STOP	DIP1 if ON runtime is running, program execution is stopped
INIT	DIP2 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	If ON = bus end COM1; the first and last devices on bus should have bus end ON; switch is under the RS485 terminals

Dimensions

Dimensions are in *mm*.

Programming   **Merbon IDE**

Programming tool Merbon IDE contains I/O editor, graphical editor of the function plan (FBD), structure text editor, web page editor and LCD menu editor (HMI) for PLC and compiler.

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.). In addition to function blocks, the application program can also be compiled from structured text, or a combination of both languages can be used.

The minimum guaranteed number of records for history on the PLC is 79 000, 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 Merbon IDE, Merbon SCADA, HT104/200, mobile application Merbon Visual, connection from other PLCs over SSCP etc.

Uploading a project from the Merbon IDE reserves two SSCP TCP connections.

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

In case of implementation of your own ST driver, there is limitation of max. 10 clients connected simultaneously.

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

WEEE 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	02/2021 – First version of datasheet. 03/2021 – Correction of DIP switch description, change of the logo. 07/2021 – Specification edit. 12/2021 – Logo change, stylistic modifications, added information about limiting the number of connected clients. 03/2022 - Modified paragraph on the number of simultaneously connected clients using the SSCP protocol.