

mark150
mark150/485 **DDC controllers**



Summary DDC (Direct digital control) controller mark150 and mark150/485 are free programmable process stations with ARM Cortex M4 processor and OS FreeRTOS. They are suitable for data readout from utility meters or control of small installations (up to about 30 physical data points). They contain 1x Ethernet port, 1x M-Bus interface (maximum 10 meters), 4 AI, 4 DI, 4 DO, and 3 pulse inputs. Mark150/485 contains also 1x RS485 interface. These DDC controllers are successors of the previous types M007, IPLC150, IPLC150/485, mark150s and mark150/485s.

- Application**
- Water, heat, gas, and electrical energy meter readout for meters with M-Bus communication or pulse output
 - Free programmable control units for HVAC systems and other applications with web access
 - Data acquisition, processing, and presentation systems with advanced networking features
 - Protocol converters with web data presentation (must be programmed by user)

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, mark150 contains 1x Ethernet port and 1x M-Bus interface (10 meters). I/Os integrated on the board are 4 AI, 4 DI, 4 DO and 3 pulse inputs. The mark150/485 contains 1x Ethernet port, 1x M-Bus interface (10 meters) and 1x RS485 interface for I/O module extension, with the same onboard I/O mix as the mark150.

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 (see Web definition in PLC properties).

The module is 158 mm wide and mounts on a standard DIN rail.

Technical data

Power 24 V AC/DC \pm 20 %; max. 10 VA

Communication - mark150

Ethernet 1x Ethernet 10/100BaseT
RJ45, 2 LED (link, data) integrated in the connector

M-Bus COM1
according to EN 1434-3, EN 13757-2
optically separated from the other parts of the module up to 1 kV DC; resistant to permanent short-circuit; electronic fuse with indication and auto-recovery
300 ... 9600 bit/s
maximal bus length 1200 m
maximum number of meters 10

Communication - mark150/485

Ethernet 1x Ethernet 10/100BaseT
RJ45, 2 LED (link, data) integrated in the connector

M-Bus COM1
according to EN 1434-3, EN 13757-2
optically separated from the other parts of the module up to 1 kV DC; resistant to permanent short-circuit; electronic fuse with indication and auto-recovery
300 ... 9600 bit/s
maximal bus length 1200 m
maximum number of meters 10

RS485 COM2 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

4x LED RUN, TxD, PWR, 1x M-Bus RxD/TxD

Analogue inputs

Number 4, galvanically separated from other parts of the module up to 1 kV DC

Voltage measuring range 0...10 V DC (setting see in Terminals->Jumpers)

Resistance measuring range 0..1600 Ohm, 0...5000 Ohm, Pt100, Pt500, Pt1000, Ni1000-5000, Ni1000-6180... sensors (transformation is done in the runtime application)(setting see in Terminals->Jumpers)

Passive sensors are connected between AIx and AIC terminals.

Current measuring range with an external resistor of 125 Ohm as 0..20 mA

Resolution 16 bit

Measuring frequency 1 / s

Input impedance > 10 MOhm

Digital outputs

Number 4 relays in 2 pairs with common terminal

Relay type normally open

Relay load 3 A at 250 V AC, 3 A at 24 V DC

Category AC-1 (common use, non-inductive load) according EN 60947-4-1 ed. 3

Max. voltage at the contacts 277 V AC, 30 V DC

Max. current 5 A

Number of cycles min. 5*10⁵

Digital inputs

Number 4 inputs for potential-free contacts

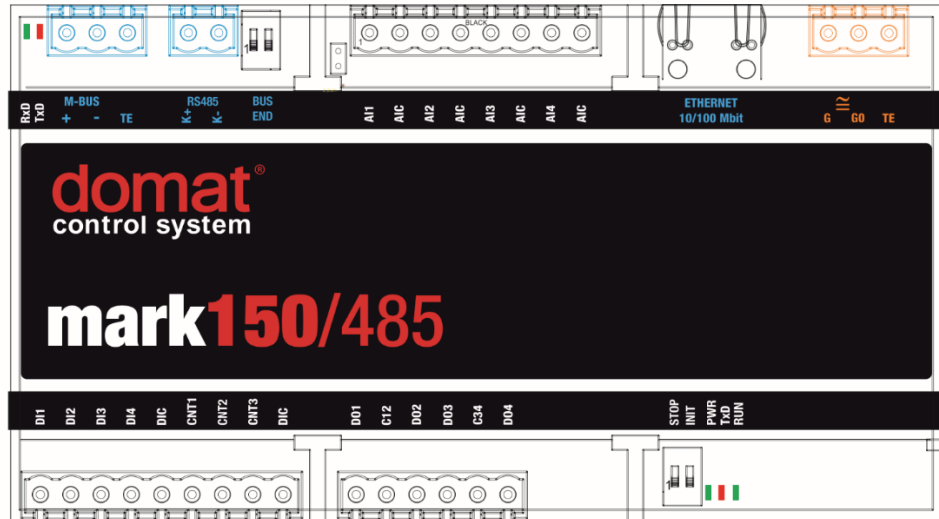
Voltage 12 V DC

Current 5 mA

Counting inputs

Number	3
Input type	for potential-free contacts, with common terminal (-)
Max. input frequency	200 Hz
Min. pulse length	1 ms
Max. distance between input and meter	10 m
HW	ARM M4 STM427 168 MHz, 256 kB RAM, 3 MB Flash, 4 kB NVRAM
SW	Merbon IDE (supported from version ER2 2.2.0.0) Merbon HMI
Housing	Polyphenylene oxid box; gray
Dimensions	158 (l) x 90 (w) x 58 (h) mm
Protection degree	IP10 (EN 60529)
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)
Standards regarding conformity	EMC EN 61000-6-2 ed.3:2005, EN 55022 ed.3:2010 EN 60950-1 ed.2:2006 + A11:2009 + A12:2011 + A1:2010 + A2:2014 EN 50581:2012
EU legislation	Council Directive 2006/95/EC, health and low voltage equipment safety Council Directive 2004/108/EC, electromagnetic compatibility Council Directive 2011/65/EC, certain hazardous substances in electrical and electronic equipment

Terminals



Terminals and connectors:

M-Bus

port COM1 - meter bus for communicative M-Bus meters, terminals +, -, TE (technical earth M-Bus, it is not connected with main TE terminal; usually it is not wired; it connects all metal parts in galvanically separated M-Bus part)

RS485

port COM2 – serial link RS485, terminals K+, K- (**mark150/485 only**)

AI1

analogue input 1

AIC

analogue input ground (common)

AI2

analogue input 2

AIC

analogue input ground (common)

AI3

analogue input 3

AIC

analogue input ground (common)

AI4

analogue input 4

AIC

analogue input ground (common)

Ethernet

network interface

G

power

G0

power

TE

optional connection for shielding

DI1

digital input 1 (for dry contact, to be shortcircuited to DIC)

DI2

digital input 2 (for dry contact, to be shortcircuited to DIC)

DI3

digital input 3 (for dry contact, to be shortcircuited to DIC)

DI4

digital input 4 (for dry contact, to be shortcircuited to DIC)

DIC

common terminal for digital inputs

CNT1

counting input 1 (for dry contact, to be shortcircuited to DIC)

CNT2

counting input 2 (for dry contact, to be shortcircuited to DIC)

CNT3

counting input 3 (for dry contact, to be shortcircuited to DIC)

DIC

common terminal for pulse outputs

DO1

relay output 1, normally open against C12

C12

relay output 1 and 2, common terminal

DO2

relay output 2, normally open against C12

DO3	relay output 3, normally open against C34
C34	relay output 3 and 4, common terminal
DO4	relay output 4, normally open against C34
LED indication:	
RxD	green LED – M-Bus receiving data at COM1 (flashing: receiving data; still ON: shortcircuited or overload bus)
TxD	red LED – M-bus transmitting data at COM1 (flashing: transmitting data; still ON: shortcircuited or overload bus)
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)
TxD	red LED –RS485 transmitting data at COM2 (flashing: transmitting data; still ON: shortcircuited or overload bus)
PWR	green LED – power (ON: power OK; OFF: no power applied, weak or damaged power supply, ...)
DIP switches:	
BUS END	DIP1 and DIP2 bouth ON = bus end RS485; the first and last devices on bus should have bus end ON (mark150/485 only)
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, ...)
STOP	if ON runtime is running, program execution is stopped
Jumpers:	The jumpers are available after the AI terminals are removed. Default setting is resistance (passive temperature) measuring. Change the settings for voltage range (see table below). Take out the jumper and plug in an external resistor of 125 Ohm for current range. (Jumpers numbered from the left.)
	Resistance (temperature) Voltage
AI1	J1=OFF, J2=ON J1=ON, J2=OFF
AI2	J3=OFF, J4=ON J3=ON, J4=OFF
AI3	J5=OFF, J6=ON J5=ON, J6=OFF
AI4	J7=OFF, J8=ON J7=ON, J8=OFF

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 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 subsystems. For example Merbon runtime contains: Modbus TCP / RTU (server/client), M-Bus, IEC62056-21, SSCP, and SoftPLC link. 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. 5. 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

05/2016 – First 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 mark150/485.

11/2017 – Added safety note, passive sensor connection information and power tolerance.