

IMIO105.2
IMIO110.2

DDC controllers



Summary

DDC (Direct digital control) controllers IMIO105.2 and IMIO110.2 are free programmable process station with ARM i.MX6UL processor and Linux OS. It contains two Ethernet ports, 4 × AI, 4 × DI, 2 × AO, 6 × DO and RS485 interface. Controllers are suitable for control of larger installations (approximately 400 to 500 physical data points).

IMIO110.2 also contains LCD display and 6 buttons.

Application

- 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 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, IMIOs contain two Ethernet ports. I/Os integrated on the board are 4v AI, 2 × AO, 4 × DI and 6 × DO and RS485 interface.

Controllers have sufficient computing power to control larger installation with external I/O modules and communication channels (for example Modbus TCP server, SSCP client, ...).

The process station contains a web server for remote connection and user intervention. The web pages are created in Merbon IDE which is also used for uploading the exported web definition to the process station. 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.

IMIO110.2 process station can be operated through a 3 × 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 and uploaded to the process station through Merbon IDE (see LCD menu definition in PLC properties)

Modules are 105 mm wide and mounts on a standard DIN rail.

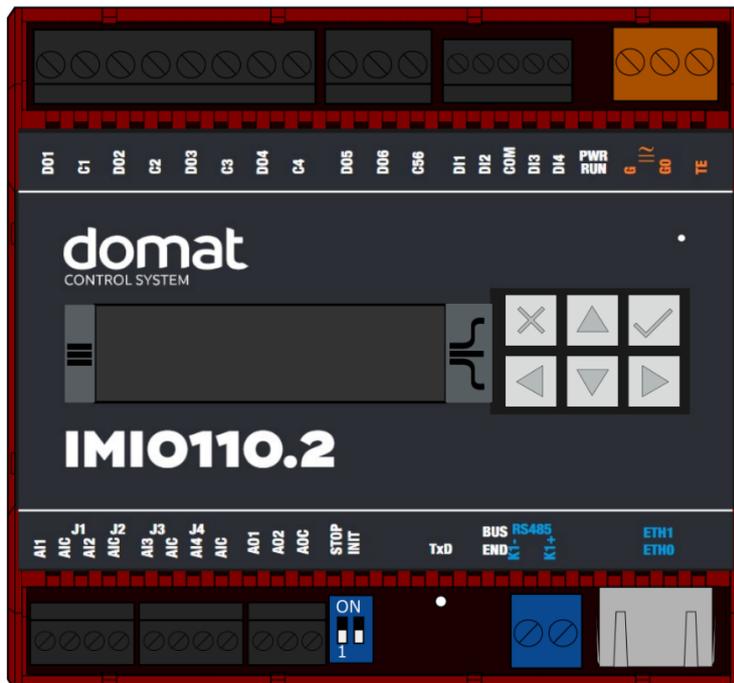
Technical data

Power	24 V AC/DC ± 20 %; max 5 VA
Communication	
Ethernet	2 × Ethernet 10/100BaseT RJ45, 4 × LED (link, data, ETH 1 and 2) integrated in the connector
RS485	COM1 RS485 (K+, K-) galvanically insulated, insulating voltage 1 kV 300...115 200 bit/s, parity and bits are set in software maximal bus length 1200 m maximum number of modules depends on requested response time – up to 255 addresses, for common HVAC applications with IMIOs use about 400 physical data points on the bus
LCD display (IMIO110.2 only)	3 rows × 16 characters, blue backlight adjustable backlight intensity possibility to switch off the backlight through application software
Buttons (IMIO110.2 only)	6 backlit buttons
3 × LED	RUN - yellow, TXD - red, PWR - green
Analogue inputs	
Number	4

Resistance measuring range	0...1600 Ohm, 0...5000 Ohm, Pt100, Pt500, Pt1000, Ni1000-5000, Ni1000-6180... sensors (transformation is performed only at the application level in the PLC), settings see in Terminals -> Jumpers Measuring current in the passive mode (0...1600 Ohm): 200 µA at 100 % of the time.
Voltage measuring range	Only AI3, AI4: 0...10 V DC (settings see in Terminals -> Jumpers)
Current measuring range	Only AI3, AI4: with an external resistor of 125 Ohm as 0...20 mA
Input resistance	10 kOhm
Resolution	16 bit
Galvanic insulation	optically insulated up to 1 kV
Analogue outputs	
Number	2
Voltage range	0...10 V DC
Analogue outputs load	min. 10 kΩ outputs are protected against permanent short-circuit – 20 mA limitation
Resolution	8 bit
Galvanic insulation	optically insulated up to 1 kV
Digital inputs	
Number	4
Voltage	24 V AC/DC – voltage must be applied (no dry contacts), e.g. from G and G0
Input current	4 mA
Logical level	log. 0 - (<5 V) log. 1 - (>18 V)
Maximal voltage	60 V DC, 40 V AC
Max. switching frequency	10 Hz
Galvanic insulation	optically insulated up to 1 kV
Digital outputs	
Number	4 relays, normally open 2 solid state relays
Relay load (DO 1 to 4)	5 A at 250 V AC, 1250 VA 5 A at 30 V DC, 150 W
Solid state relay load	For AC and DC load, 24 V DC/AC, maximum current 0.4 A

(DO 5 and 6)	Recommended thermic actuators are STA71 (Siemens), TWA (the 24 V types, Danfoss).
Galvanic insulation	optically insulated up to 1 kV
CPU	ARM i.MX6UL 528 MHz, 128 MB FLASH, 128 MB SRAM, 128 KB NVRAM
SW	Merbon IDE 2.4.0.19 and newer
Housing	Polycarbonate box (certification UL94V0)
Dimensions	105 × 98 × 64 mm
Protection degree	IP20 (EN 60529 + A2:2019)
Terminals	Power, RS485, DO: screw terminals M3, maximum wire cross-section 2.5 mm ² AO/AI/DI: screw terminals M2, maximum wire cross-section 1.5 mm ²
Ambient conditions	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 61000-6-2 ed.4:2019, EN IEC 61000-6-4 ed.3:2019 EN IEC 62368-1 ed. 2:2020+A11:2020 EN IEC 63000:2019

Terminals



Terminals and connectors

DO1...DO4	relay output 1...4, normally open against C1...C4
C1...C4	relay output 1...4, ground
DO5, DO6	SSR outputs 5 and 6, normally open against C56
C5, C6	SSR output 5 a 6, ground (common)
DI1...4	digital inputs 1...4
G	power
G0	power
TE	optional connection for shielding
AI1...4	analogue input 1...4
AIC	analogue input ground (common) Notice: All analogue inputs AI1 to AI4 have common ground AIC. The inputs are optically separated from the other parts of the I/O module. For three-wire connection (active sensors, e.g. pressure, humidity), the analogue input ground AIC must be connected with the peripheral 24 V AC power ground (or 0 V terminal for DC peripheral). As all I/O types are mutually separated in the module, it is possible to use one common transformer to power both the active peripherals and the IMIO module.
AO1, AO2	analogue outputs 1 and 2
AOC	analogue outputs ground (common) Notice: The ground is optically separated from the other parts of the I/O module. For three-wire connection (active periphery, e.g. valves actuators, frequency changer), the analogue output ground AOC must be connected with the peripheral 24 V AC power ground (or 0 V terminal for DC peripheral). As all I/O types are mutually separated in the module, it is possible to use one common transformer to power both the active peripherals and the IMIO module.
RS485	port COM1 – serial line RS485, terminals K+, K-
Eth0, Eth1	network interface
LED indication	
RUN	yellow LED – system cycle (OK: LED flashes periodically 1 s ON, 1 s OFF; ERROR: LED flashes in other pattern, LED is permanently ON or OFF)
TxD	red LED – transmitting data at COM1 (flashing: receiving 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	
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;

e.g. IP address, user and password, database settings, proxy, ...)

BUS END

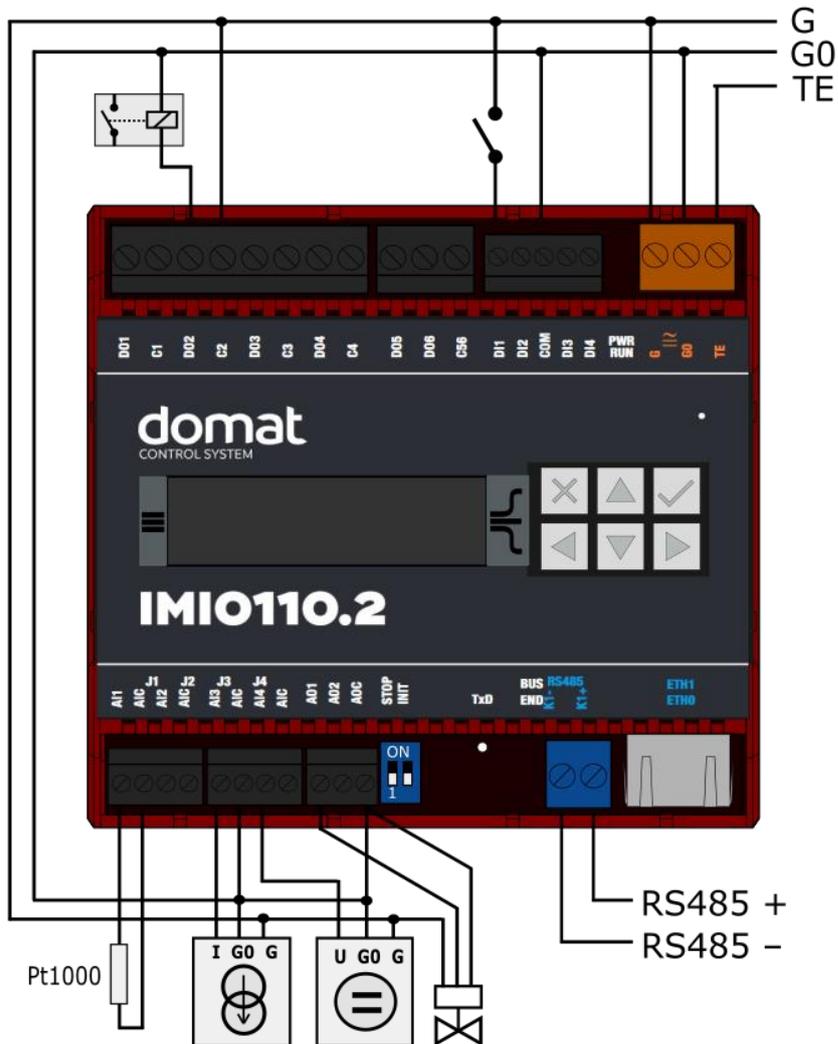
DIP3 and DIP4 both ON = bus end RS485; the first and last devices on bus should have bus end ON

Jumpers

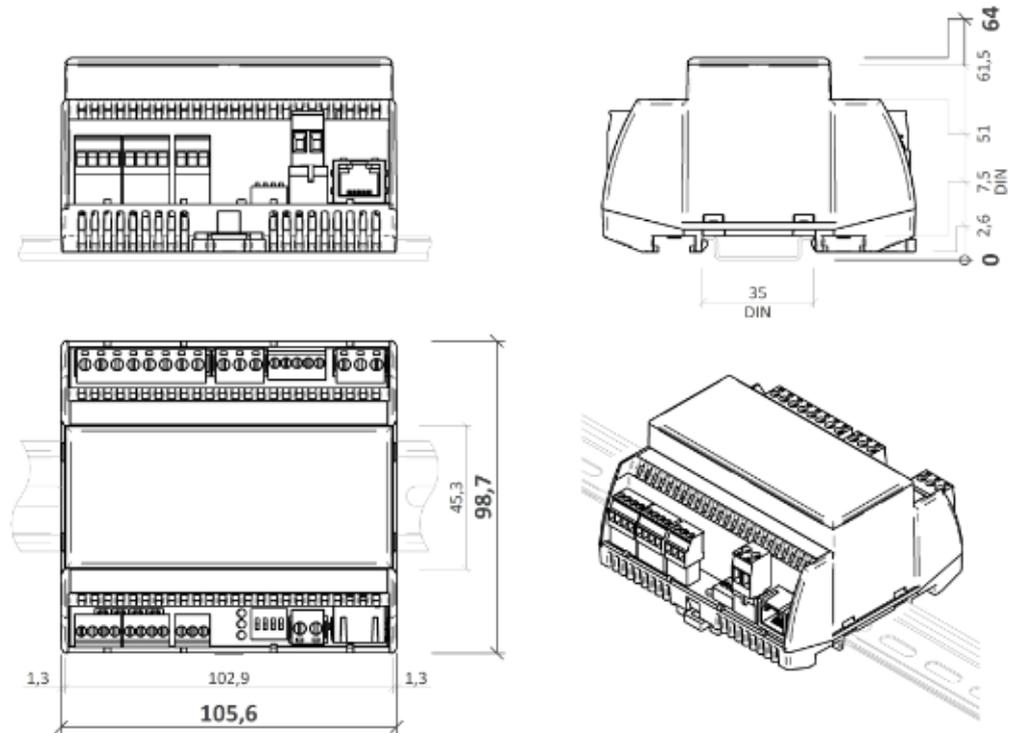
The jumpers are available after the AI terminals are removed. Default setting is resistance (passive temperature) measuring. Change the settings for voltage range (see table below). Take out the jumper and plug in an external resistor of 125 Ohm between terminals AI3-AIC or AI4-AIC for 0...20 mA range. **The setting is valid only for AI3 and AI4, other analogue inputs are for resistance only!** (Jumpers numbered from the left.)

	Resistance (temperature)	Voltage
AI3	J1=OFF, J2=ON	J1=ON, J2=OFF
AI4	J3=OFF, J4=ON	J3=ON, J4=OFF

Connection



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.

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 record 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 which communicates e.g. through Modbus TCP/RTU (server/client), M-Bus, IEC62056-21, SSCP, SoftPLC link and BACnet IP server/client (see 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 etc.) 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**

03/2022 – First datasheet version.

04/2022 – Number of data points specified.