

IMIO105 DDC controllers



Summary DDC (Direct digital control) controller IMIO105 is free programmable process station with ARM Cortex M4 processor and OS FreeRTOS. It contains one Ethernet port, 4 AI, 4 DI, 2 AO, 6 DO and also a RS485 interface and 8 MB more RAM. IMIO105 is suitable for control of larger installation (approximately 150 physical data points).

- 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 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, IMIO105 contains an Ethernet port and one RS485 interface for I/O module extension. I/Os integrated on the board are 4 AI, 2 AO, 4 DI and 6 DO.

IMIO105 has 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 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 105 mm wide and mounts on a standard DIN rail.

Technical data

Power	24 V AC/DC \pm 20 %; max 5 VA
Communication	
Ethernet	1x Ethernet 10/100BaseT RJ45, 2 LED (link, data) 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 IMIO105 use about 150 physical data points on the bus
3x LED	RUN, TxD, PWR
Analogue inputs	
Number	4
Resistance measuring range	0...1600 Ohm, 0...5000 Ohm, Pt100, Pt500, Pt1000, Ni1000-5000, Ni1000-6180... sensors (transformation is done in the runtime application), settings see in Terminals -> Jumpers Measuring current in the passive mode (0...1600 Ohm): 200 μ A 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
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 k Ω outputs are protected against permanent short-circuit – 20 mA limitation
Resolution	8 bit
Galvanic insulation	Optically insulated up to 1 kV.

Digital inputs

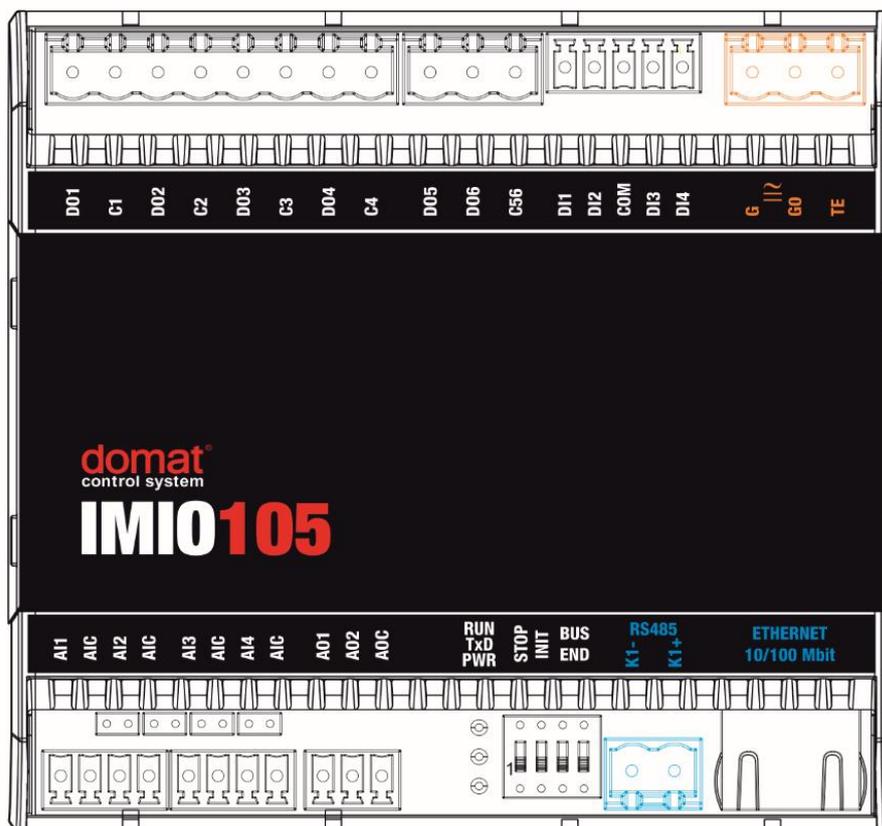
Number	4
Voltage	24 V AC/DC – voltage must be applied (no dry contacts), e.g. from G and G0
Input current	4 mA
Maximal voltage	60 V DC, 40 V AC
Galvanic insulation	Optically insulated up to 1 kV.

Digital outputs

Number	4 relays, normally open 2 solid state relays
Relay load	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 Recommended thermic actuators are STA71 (Siemens), TWA (the 24 V types, Danfoss).
Galvanic insulation	Optically insulated up to 1 kV.
HW	ARM Cortex M4 168 MHz, 10 MB FLASH, 256 KB + 8 MB SRAM, 4 KB + 64 KB NVRAM
SW	Merbon IDE (supported from version ER2 2.2.0.0) Merbon HMI
Housing	Polycarbonate box (certification UL94V0)
Dimensions	See the schema below.
Protection degree	IP21 (EN 60529)
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	5 – 40 °C; 5 – 85 % relative humidity; non-condensing gases and chemically non-aggressive conditions (according to 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

Terminals

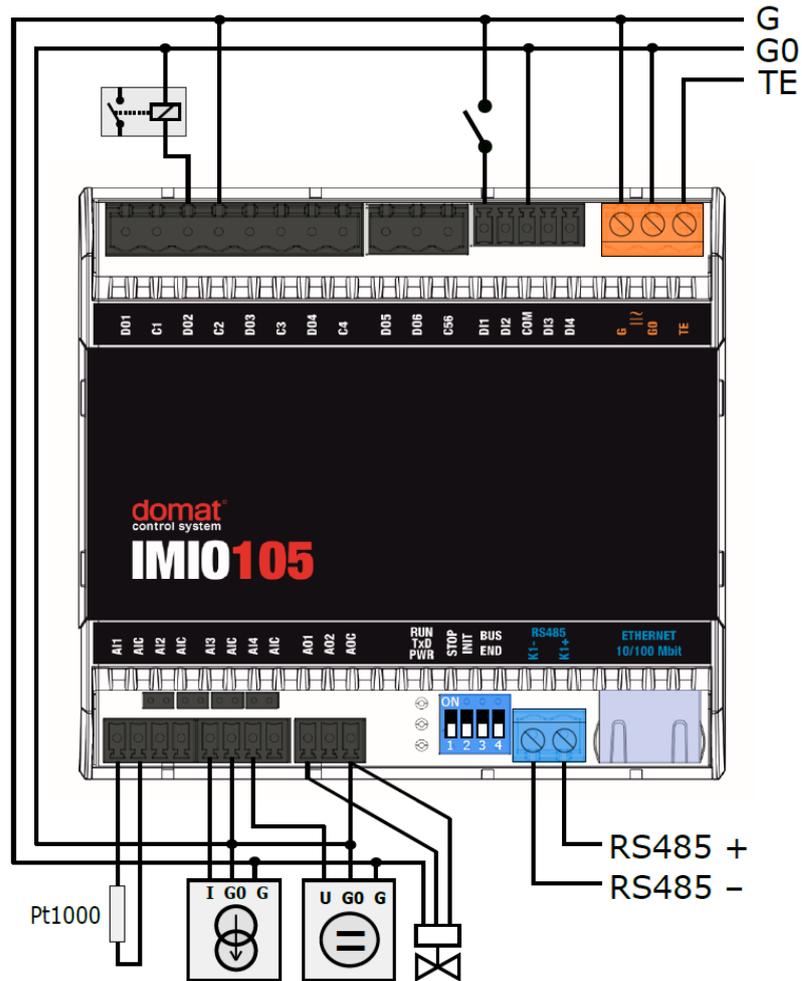


Terminals and connectors:

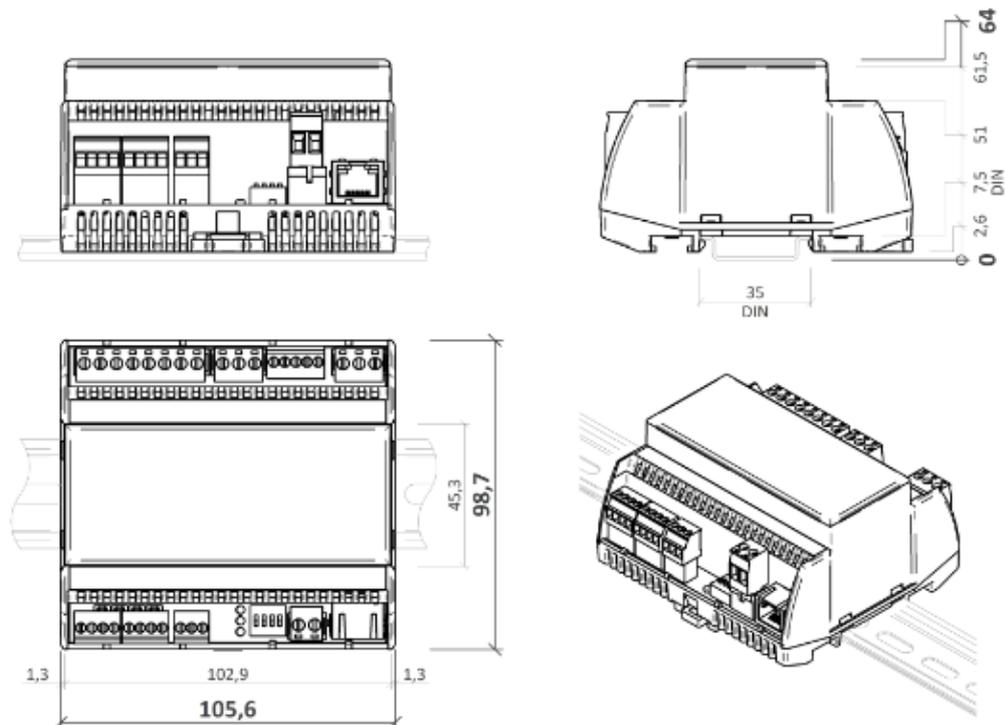
D01 ... D04	relay output 1 ... 4, normally open against C1 ... C4
C1 ... C4	relay output 1 ... 4, ground
D05, D06	SSR outputs 5 and 6, normally open against C56
C5, C6	SSR output 5 a 6, ground (common)
D11 ... 4	digital inputs 1 ... 4
G	power
GO	power
TE	optional connection for shielding
AI1 ... 4	analogue input 1
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. 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. 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-	
Ethernet	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 settings 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

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 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 subsystems. Merbon runtime contains e.g. 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 etc.) 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.

08/2016 – Corrected information about DO5 and DO6. These outputs do not switch at zero.

01/2017 – Jumpers: 0..20 mA range description enhanced.

07/2017 – Added terminals connection scheme.

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

12/2019 – IMIO100 removed.