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TECHNICAL DATASHEET

MX-master485

Master module for moduleX™ I/O cluster

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Summary

TECHNICAL FEATURES

Dimensions	63 x 72 x 40 mm
Weight	33 g
IP protection grade	IP20
Operating temperature	0 to +50°
Operating humidity	Max 95%, no condensation
Power supply	24 VDC +/- 10% 0.5A max. Galvanically isolated.
Internal protocol	Xbus: up to 16 devices[1], 10mSec refresh rate
Communication protocol	Modbus-RTU up to 115200bps, configurable address (1-16). IN-OUT port. 8 data bytes, no parity, 1 stop bit (8N1). Galvanically isolated.
Connection	Pluggable push-in terminal block with screw lock. AWG(mm2): 24-16(0.2-1.5)
Configuration	Through DIP switch: Modbus ID, baud rate, register mode[2], end-line resistor
Boot up time	5 seconds

Note:
1. MX-4AI limited to 5 devices, MX-4AOV limited to 5 devices.
2. Register mode available only for MX-8DO modules.

Components overview

1. Power supply connector
2. Configuration DIP
3. End-line resistor switch
4. RS485 IN connector
5. RS485 OUT connector
6. Power led: notify power status.
7. Run led: check "Run led table"
8. RS485 led: blinks on valid Modbus request.
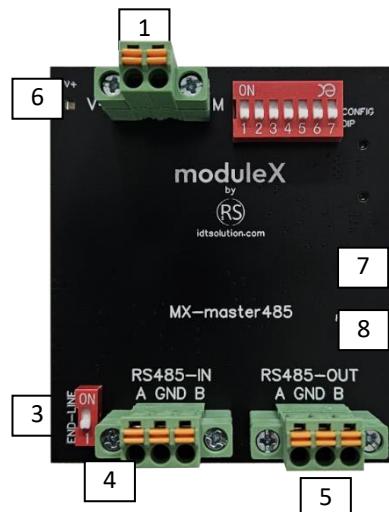
MOUNTING

The device is designed for mounting in a DIN rail enclosure with a height of 72mm. Different installations are not allowed. The module is typically delivered as part of an I/O cluster, already housed in a DIN enclosure.

POWER SUPPLY

It is recommended [4] power the device at 24 VDC +/- 10%, the maximum consumption is 0.5 amps that depends on connected modules. The device is protected against reverse polarity. The power led indicates the presence of power.
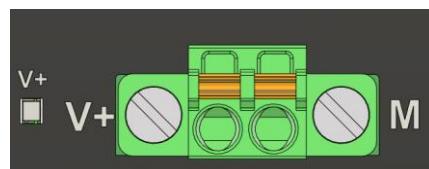
FUNCTIONALITY OVERVIEW

The MX-master485 device serves as the core of the moduleX solution, facilitating the exchange of information between the field (PLC, automated systems, etc.) and the I/O modules that constitute the cluster.

Upon startup, the board executes a scanning procedure to recognize connected modules and self-configure. There are no layout restrictions: module models can be alternated within the cluster, up to a maximum of 16 modules. An exception is made for MX-4AI and MX-4AOV modules, which are limited to a maximum of 5 each.

Upon completion of the scanning phase, the system transitions to the run phase. The main device updates data between Modbus tables and modules every 10 milliseconds.

I/O cluster example

moduleX network example
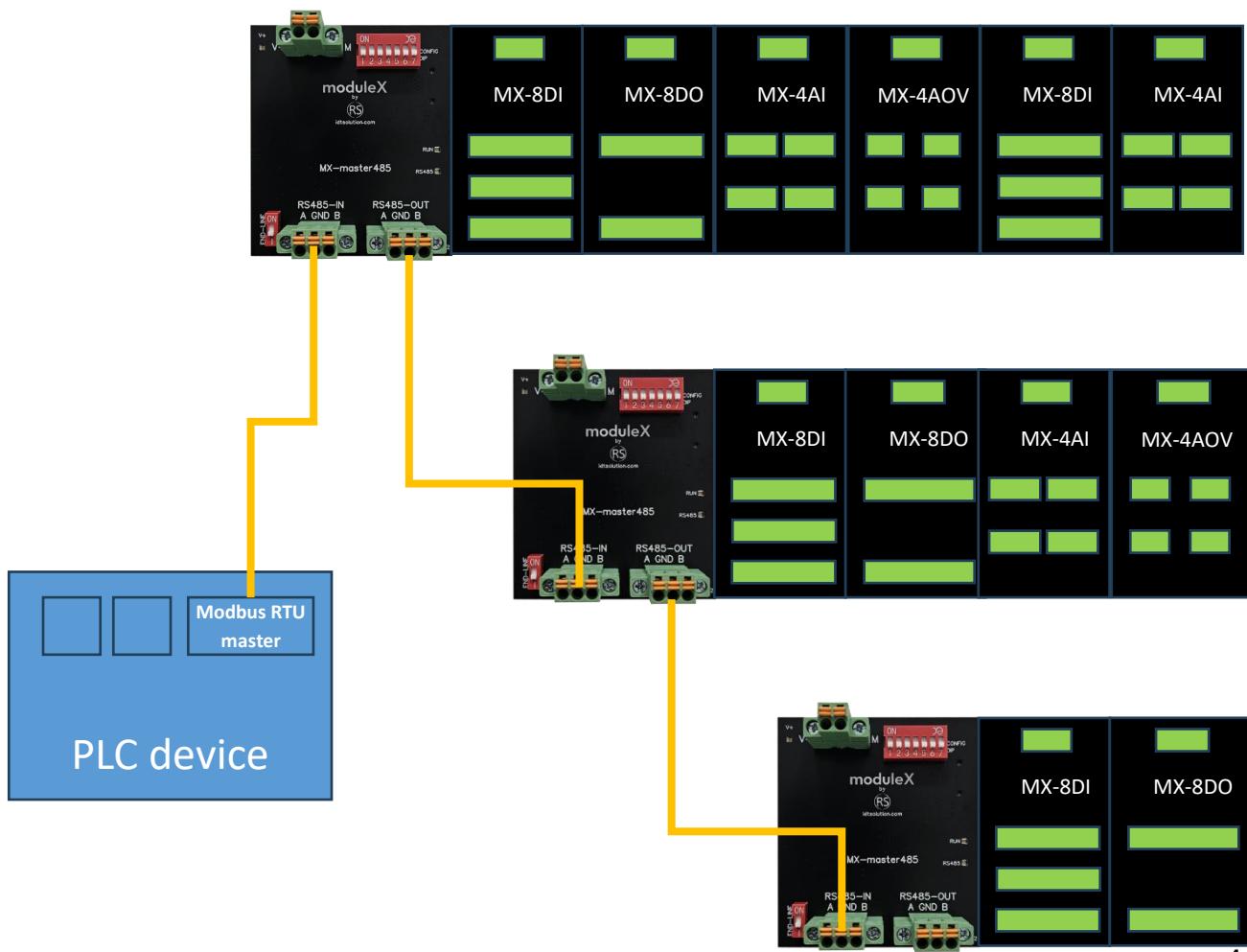
SETUP

After connecting the power and the RS485 cable, the user can configure the following parameters using the dip switches:
1. Device ID Modbus RTU
2. Baud rate
3. Register mode (only for MX-8DO modules)
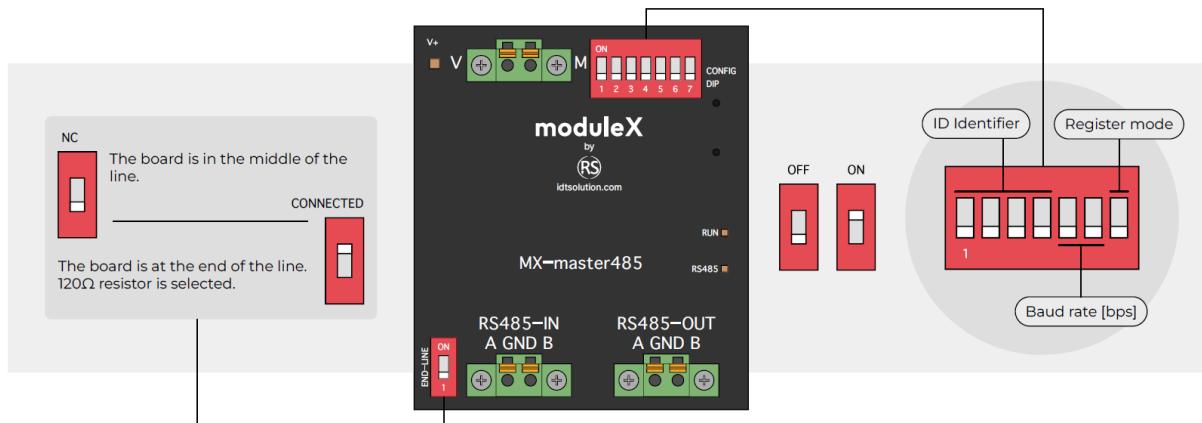
Device ID – Modbus RTU

In a Modbus RTU network each device has a unique device ID that can be configured through dip switch configuration. The following table illustrates the dip switch configuration:

ID	Dip 1	Dip 2	Dip 3	Dip 4
1	Off	Off	Off	Off
1	On	Off	Off	Off
2	Off	On	Off	Off
3	On	On	Off	Off
4	Off	Off	On	Off
5	On	Off	On	Off
6	Off	On	On	Off
7	On	On	On	Off
8	Off	Off	Off	On
9	On	Off	Off	On
10	Off	On	Off	On
11	On	On	Off	On
12	Off	Off	On	On
13	On	Off	On	On
14	Off	On	On	On
15	On	On	On	On

Baud rate

Dip switch configuration RS485 baud rate.

Baud rate [bps]	Dip 5	Dip 6
115200	Off	Off
57600	On	Off
38400	Off	On
19200	On	On

Other serial parameters are fixed: 8 data bytes, no parity, 1 stop bit (8N1)

Register mode

Digital outputs of MX-8DO modules can be written changing values of:
- Holding registers: **Dip 7 = Off**
- Coils: **Dip 7 = On**

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MODBUS REGISTERS

The board can communicate using the Modbus-RTU protocol. Depending on the modules present in the I/O cluster, data exchange occurs through the read/write operations of specific registers. Due to the internal buffer limitation, requests for **multiple registers** must be restricted to a **maximum of 15 registers**.

Note: The order of modules within the cluster is arbitrary and does not impact the read and write data memory zones.

MX-8DO

The **digital outputs** are linked to **holding registers** (configuration Dip 7 Off), where each register corresponds to a pair of modules. Starting from register #0, the LSBit corresponds to output n.1 of module 1, while the MSBit corresponds to output n.8 of module 2, and so on. With configuration Dip 7 On, digital outputs are individually linked to **coils**.

With a maximum of 16 supported MX-8DO modules, the last relevant holding register is register #7.

Register #0: 0000 0000 0000 0000 (binary)
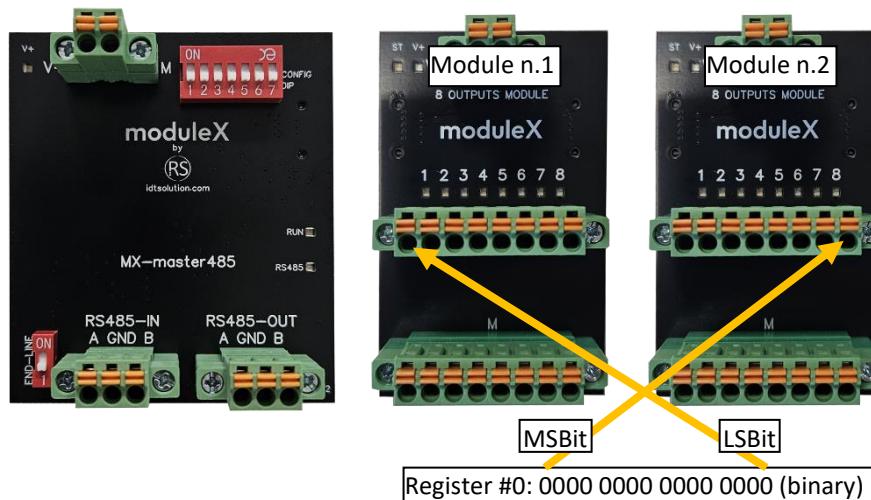
Holding register map:

With configuration **Dip 7 Off** outputs values are assigned from **holding registers**, coils registers are ignored.

Digital outputs - Holding registers				
Register	**Output**	**Module type**	**Module index**	**Range(dec)**
#0	1(LSB)--16(MSB)	MX-8DO	1--2	0-65535
#1	17(LSB)--32(MSB)	MX-8DO	3--4	0-65535
#2	33(LSB)--48(MSB)	MX-8DO	5--6	0-65535
#3	49(LSB)--64(MSB)	MX-8DO	7--8	0-65535
#4	65(LSB)--80(MSB)	MX-8DO	9--10	0-65535
#5	81(LSB)--96(MSB)	MX-8DO	11--12	0-65535
#6	97(LSB)--112(MSB)	MX-8DO	13--14	0-65535
#7	113(LSB)--128(MSB)	MX-8DO	15--16	0-65535

Coils map:

With configuration **Dip 7 On** outputs values are assigned from **coils**, holding registers are ignored.

Digital outputs – coils (only for MX-8DO modules)				
Coil	**Output**	**Module type**	**Module index**	**Range**
#0	1	MX-8DO	1	0-1
#1	2	MX-8DO	1	0-1
..	..	MX-8DO	..	..
#8	1	MX-8DO	2	0-1
#9	2	MX-8DO	2	0-1
..	..	MX-8DO	..	..
#125	6	MX-8DO	16	0-1
#126	7	MX-8DO	16	0-1
#127	8	MX-8DO	16	0-1

MX-8DI

The **digital inputs** are associated with both **input registers** and **discrete coils**. Like digital outputs, each register corresponds to a pair of modules and single input corresponds to a single coil. Starting from register #0, the LSB corresponds to input n.1 of module 1, while the MSB corresponds to input n.8 of module 2, and so on.

With a maximum of 16 supported MX-8DI modules, the last relevant input register is register #7.

Input register map:

Digital inputs - Input registers				
Register	**Input**	**Module type**	**Module index**	**Range(dec)**
#0	1(LSB)--16(MSB)	MX-8DI	1--2	0 - 65535
#1	17(LSB)--32(MSB)	MX-8DI	3--4	0 - 65535
#2	33(LSB)--48(MSB)	MX-8DI	5--6	0 - 65535
#3	49(LSB)--64(MSB)	MX-8DI	7--8	0 - 65535
#4	65(LSB)--80(MSB)	MX-8DI	9--10	0 - 65535
#5	81(LSB)--96(MSB)	MX-8DI	11--12	0 - 65535
#6	97(LSB)--112(MSB)	MX-8DI	13--14	0 - 65535
#7	113(LSB)--128(MSB)	MX-8DI	15--16	0 - 65535

Discrete coils map:

Digital inputs – discrete coils (only for MX-8DI modules)				
Coil	**Input**	**Module type**	**Module index**	**Range**
#0	1	MX-8DI	1	0-1
#1	2	MX-8DI	1	0-1
..	..	MX-8DI	..	..
#8	1	MX-8DI	2	0-1
#9	2	MX-8DI	2	0-1
..	..	MX-8DI	..	..
#125	6	MX-8DI	16	0-1
#126	7	MX-8DI	16	0-1
#127	8	MX-8DI	16	0-1

MX-4AI

The analog inputs are associated to input registers, each analog channel correspond to a single register.

Starting from register #10, each module occupies 4 registers. Due to buffer limitations, the last available register is #29, thus allowing a maximum of 5 analog modules in the same cluster.

The MX-4AI is equipped with a 15 bit ADC so the data range is 0 - 32767

Input register map:

Analog inputs - Input registers				
Register	**Input**	**Module type**	**Module index**	**Range(dec)**
#10	Analog In 1	MX-4AI	1	0 - 32767
#11	Analog In 2	MX-4AI	1	0 - 32767
#12	Analog In 3	MX-4AI	1	0 - 32767
#13	Analog In 4	MX-4AI	1	0 - 32767
#14	Analog In 1	MX-4AI	2	0 - 32767
#15	Analog In 2	MX-4AI	2	0 - 32767
#16	Analog In 3	MX-4AI	2	0 - 32767
#17	Analog In 4	MX-4AI	2	0 - 32767
..	..	..	..	..
#26	Analog In 1	MX-4AI	5	0 - 32767
#27	Analog In 2	MX-4AI	5	0 - 32767
#28	Analog In 3	MX-4AI	5	0 - 32767
#29	Analog In 4	MX-4AI	5	0 - 32767

MX-4AOV

The analog output are associated to holding registers, each analog channel correspond to a single register.
Starting from register #10, each module occupies 4 registers. Due to buffer limitations, the last available register is #29, thus allowing a maximum of 5 analog modules in the same cluster.
The MX-4AOV is equipped with a 12 bit DAC so the data range is 0 - 4096

Holding register map:

Analog outputs - Holding registers				
Register	Output	Module type	Module index	Range(dec)
#10	Analog Out 1	MX-4AOV	1	0 - 4096
#11	Analog Out 2	MX-4AOV	1	0 - 4096
#12	Analog Out 3	MX-4AOV	1	0 - 4096
#13	Analog Out 4	MX-4AOV	1	0 - 4096
#14	Analog Out 1	MX-4AOV	2	0 - 4096
#15	Analog Out 2	MX-4AOV	2	0 - 4096
#16	Analog Out 3	MX-4AOV	2	0 - 4096
#17	Analog Out 4	MX-4AOV	2	0 - 4096
..	..	..	..	..
#26	Analog Out 1	MX-4AOV	5	0 - 4096
#27	Analog Out 2	MX-4AOV	5	0 - 4096
#28	Analog Out 3	MX-4AOV	5	0 - 4096
#29	Analog Out 4	MX-4AOV	5	0 - 4096

BOARD INFORMATION

It is possible to obtain information about the board through dedicated registers.

Register	Description	Example	Range(dec)
#30	Firmware version, divide by 100 to obtain mayor and minor version. 1.40 = 140	140	0 - 999
#11	Baud rate (0= 115200, 1=57600, 2=38400, 3=19200)	0	0 - 3
#12	Digital output register mode (0=Holding reg. 1=coil)	1	0 - 1

LED CODES

The status leds "Run" and "RS485" are used to indicate the board's operational status, there fourth types of communications:

- Firmware version
- Run status
- Modbus operations
- Error codes

Firmware codes

When the board is powered on, the "RS485" status led and the "RUN" led flash sequentially to indicate the firmware version. The number of flashes of the "RS485" led indicates the major version, while those of the "RUN" led indicate the minor version. During this procedure, the RUN LED flashes yellow.
Here is an example of decoding the firmware version:

Decoded version: v.1.3

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Run status

When the board is in operation state the "Run" led blinks with 2 Hz frequency with 2 colors type:

- Green: There are modules connected to xbus connector and the communication is stable
- Red: There are no modules connected to xbus connector

Modbus act

When a Modbus RTU request is valid, the "RS485" led flashes blue, indicating that the board has successfully processed and sent the response. If the led does not flash, there may be issues with the connections or configuration (baud rate, slave ID).

Error codes

In case of malfunction, the board reports the error code by flashing the "RUN" LED in red. The LED flashes at a frequency of 5 Hz, and the number of flashes corresponds to an error. The signaling sequence is repeated twice to allow the user for proper detection. Below is the error table.

Error ID	Description	Module type	
1	Devices scan timeout	Scan request timeout elapsed	Check connection between modules
2	Invalid data received	Data received by modules has invalid data	Check integrity of modules
3	CRC mismatch	Control redundancy check value mismatch	Check integrity of modules
4	Run data timeout	Data timeout, one or more modules in the cluster did not respond	Check connection between modules

REVISION

REVISION		
N.	**Description**	**Date**
0	First release	08/02/2024

This document serves as a technical datasheet; please refer to the comprehensive moduleX™ solution manual for additional details and information.