



MIDAM CDMX01

Modbus TCP/DMX 2 channel converter



Converter that translates Ethernet protocols into Digital Multiplex (DMX) signals to control lighting fixtures. This serial converter acts as a Modbus TCP server, controlling up to 1024 lights or other DMX compatible devices simultaneously. It also acts as a DMX sniffer, reading packets sent by a DMX controller on a DMX bus and returning the data as Modbus TCP server registers.



CONVERTERS

Application

- Direct DMX bus control
- DMX bus maintenance and configuration
- Web based remote DMX bus control
- Wired integration into SCADA systems

Function

CDMX01 converter generate serial signals in a format called DMX512, the lighting controller output is connected to a light fixture. Each DMX capable light fixture has a DMX input/output. It is a master-slave system where the lighting controller acts as the master, and the light fixture acts as a slave to the controller, but as a master to the next light fixture that is attached in a row. The device acts as a DMX master and can control up to 2x 512 DMX slaves. In Modbus communication topology the device acts as a slave (server) device. It receives commands from a Modbus TCP master (client). the typical client is a PLC. The Modbus data are translated to DMX commands for 2 independent DMX channels and sent to the RS485 buses with DMX512-A protocol. The DMX telegram is sent immediately after writing into the Modbus registers, and optionally on a periodical basis according to the Period Modbus register setting. The period time is configurable in the range of 0.1 to 65.5 s. All parameters and functions of the converter are set over its web interface (http protocol) at TCP port 80. The devices web pages are used for configuration,

setup of current and default values of the DMX channels, and for device diagnostics. The web interface and FTP server can be switched off on a HW basis (via USB switch) to ensure extra security of the device. The Ethernet interface switches automatically between 10 and 100 Mbps.

Design notes

The PLC controls the DMX lights according to data written into the CDMX01 Modbus registers.

In a Sniffer mode the device does not send any data to DMX, and only reads telegrams from the DMX controller (master device). The data are written into the Modbus table. A Modbus TCP client (master), can read these data from the converter's Modbus table and process them accordingly. The Sniffer mode makes possible to control 3rd party devices, connected to the PLC, over a DMX controller then. In this mode, the expected DMX telegram length should be set in the Modbus register (Size).

If the packets are shorter than specified in the Size register, the converter learns the end of the telegram according to the start byte of the next telegram, or space between telegrams longer than 1 s.

A DMX channel always works in the specified mode only. There must be only one Master device on a DMX bus. The Master and Sniffer modes can be combined intentionally at both channels (Master - Master, Sniffer - Sniffer, Master - Sniffer, Sniffer - Master).



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Technical data

Power supply	24V ± 15 % AC/DC
Consumption	3W
Ethernet	1x Ethernet 10/100BaseT; galvanically insulated, insulating voltage 1 kV RJ45, 2x LED (link, data) integrated in the connector
DMX	2x DMX512 interface (DMX512-A, ESTA, ANSI E1.11-2008), 250 kbps Galvanic insulation up to 1000 V, short circuit protection, bus termination, max. cable length 300 m, 256 slave max.
Mechanical and dimensions	99 x 70 x 45 mm (incl. terminal blocks) Polycarbonate box (certification UL94V0); 4, IP20 (EN 60529) 4x LEDs (RUN, PWR, TX1, TX2) 4x DIP switch (BUS END, INIT, USR) 9x screw terminals M3, Recommended wire diameter 0.35 to 1.5 mm ²
Ambient conditions	-5 to +45 °C, 5 % to 95 % rH (EN 60721-3-3 class 3K5)
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.

Terminals and connection

GND1	DMX512 - RS485, bus 1, reference (ground)
K1+	DMX512 - RS485, bus 1, positive
K1-	DMX512 - RS485, bus 1, negative
GND2	DMX512 - RS485, bus 2, reference (ground)
K2+	DMX512 - RS485, bus 2, positive
K2-	DMX512 - RS485, bus 2, negative
G	Power
G0	Power
TE	Technical ground
Ethernet	Network interface (RJ45).



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LED indication and DIP switches

BUS END	In ON position; the first and last devices on bus should have bus end ON.
INIT	In ON position at power-up; configuration parameters are brought to defaults. IP address 192.168.1.99 and mask 255.255.255.0
USR	In ON position at power-up; web server and FTP server disabled.
TX1	DMX512, Bus 1 sending data.
TX2	DMX512, Bus 2 sending data.
RUN	RED 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).
PWR	GREEN LED; Power supply indicator (ON: power OK; OFF: no power applied, weak or damaged power supply).

Modbus map operation notes

The Modbus map is divided into segments:

- System part at registers 1 to 17 (DMX bus 1), and 2005 to 2017 (DMX bus 2), which are used to set up the converter and for internal diagnostics.
- Registers 128 to 385, and 2128 to 2185, to write data in Master mode: the DMX channels are in LSB and MSB bytes of each register, so for each 512 DMX channels there is 256 Modbus registers used (the Modbus TX area).
- Registers 512 to 768, and 2512 to 2768, to read data from DMX: this is where the received telegrams from the DMX controller are stored in the Sniffer mode (Modbus RX area).
- Register 1003 which contains (unique) serial number of the converter.
- Registers 1024 to 1280, and 3024 to 3280, with default values to be sent to the DMX bus after power failure (Modbus Default TX area).

Communication settings and RUN LED operation

The network properties are set over the web interface integrated directly in CDMX01. Web access is available over TCP port 80. The default network settings are as follows:

IP address	192.168.1.99
Network mask	255.255.255.0
Default gateway	192.168.1.1

- Connect the converter to the Ethernet network. Power the device (24 V AC/DC, G and G0 terminals, any polarity). Wait about 30 s for the device to boot up.
- Set a fixed IP address in the 192.168.1.x network, e.g. 192.168.1.10
- Enter the device IP address into your browser - the default address is 192.168.1.99

RUN LED operation

flashes with 50:50 duty cycle: correct function,
flashes with another pattern: error code indicated with periodic flashing:

- code 1.1, 1.2, 1.3: memory low
- code 1.5: FW update failed
- code 3.1: processor hard fault
- code 4.x: watchdog expired
- code 5.x: file system corrupted
- code 6.x: file system full,
- permanently on or off: error**

Power-up behaviour

All parameters and functions of the converter are set up over its web interface (http protocol) at TCP port 80. Set the USR switch to ON and restart the device to disable the web interface and FTP server for security reasons. A green LED (PWR) indicates power presence, a flashing red LED (RUN) means processor activity. The Ethernet hosts typical pair of LEDs: Link and Network activity. The Ethernet interface switches automatically between 10 and 100 Mbps.





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RAM/Behaviour after power failure

The device has an internal battery to preserve the RAM contents. After power failure and restoration the device acts depending on the power outage duration. The time limit is set in Modbus register 15 (see Modbus map), maximum configurable time is 1 hour. Power drop below the configured limit (short dropout): After power restoration the device sends to the DMX bus a single telegram with the last values preserved in the backedup RAM. Next telegrams are sent depending on writing into Modbus registers, and on the value of

the Period parameter (configurable in Modbus register 8 and 2008 or over the web). Dropout above the configured limit (long dropout): After power restoration the device sends to the DMX bus default values from Modbus registers 1024 to 1280 and 3024 to 3280 (Modbus Default TX). The default values are saved in EEPROM. (After the device restart, the default EEPROM values are copied to the RAM once. These values are then overwritten by writing into Modbus registers 128 to 385 and 2128 to 2385, Modbus TX.)

User control principles

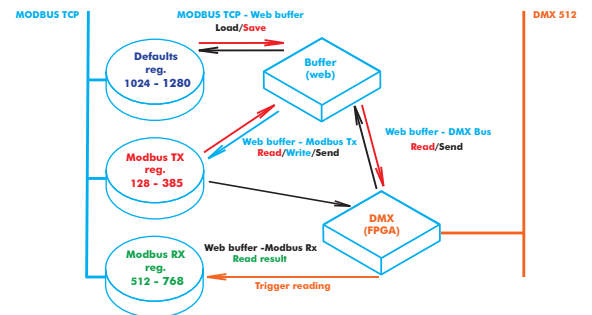
The converter contains, apart from Modbus areas for:

- writing (Modbus TX),
 - reading (Modbus RX), and
 - keeping of default values (Modbus Default TX), also a web buffer.
- This is a memory area where values from the above mentioned areas can be copied and edited. The edited values can be copied back to Modbus TX and Modbus Default TX areas, as well as directly to the memory (FPGA) from which the DMX packet is sent to the DMX bus. The web buffer is not mapped directly to any Modbus registers. The buffer data are stored in RAM only.

The web buffer for each channel can be edited either by manual entering of individual channel values to positions 1 to 512, or by semi-automatic filling of values for colour lights with RGB or RGBW (i.e. RGB + white) channels for a given number of lights. The web interface is used for copying and editing. The description of control elements is given below at the DMX 1 and DMX2 web page description. These functions are useful mainly for system commissioning and testing at times when the control program of the Modbus master device has not been developed yet.

Note:

- some DMX devices may require also writing into other channels (called e.g. Master enable, Dimmer, Shutter) for correct functionality
- some DMX devices may require periodic sending of DMX telegrams. If a DMX packet is not received for a certain time, the lights go off. Therefore, the one-off commands (as sent using Web Buffer – DMX Bus: Send) may not work as expected. Consult your lights fixture supplier if necessary.

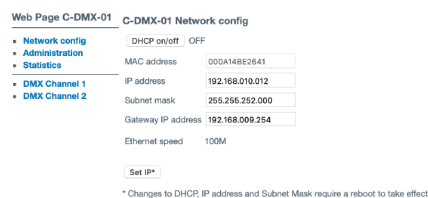


Function principle for DMX bus 1. For DMX bus 2, add a offset of 2000 to all register numbers.)

Web interface

The converter web pages are used for configuration, setup of current and default values of the DMX channels, and for device diagnostics. The web server is not password-protected, it can be disabled using the USR switch.

Network config



- DHCP on/off:** Activation and deactivation of DHCP client. In technological networks, fixed IP addressing (DHCP off) is mainly used.
- MAC address:** Ethernet physical address, bytes are not separated by commas. The MAC address can not be edited.
- IP address:** Set IP address, formatted XXX.XXX.XXX.XXX
- Subnet mask:** IP subnet mask
- Gateway IP address:** Default network gateway address.
- Ethernet speed:** automatically detected bitrate of the Ethernet card
- Set IP:** Button to set IP address, mask, and gateway. Edit the parameters in the fields above, and click the Set IP button to confirm and write. The default parameters (IP address 192.168.1.99, mask 255.255.255.0) are set by setting the INIT switch to ON and device restart.





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Administration

Memory utilisation: Current memory usage for diagnostic purposes. (Free OS heap = operating system free memory, Free app heap = free memory for communication clients and servers).

Info: Firmware version, serial number, time since last reset, last error code.

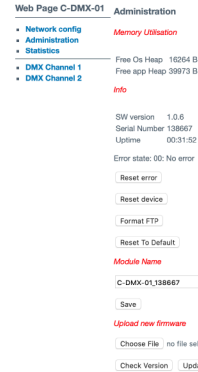
Reset error: Resets the last error code.

Reset device: Restarts the R065.

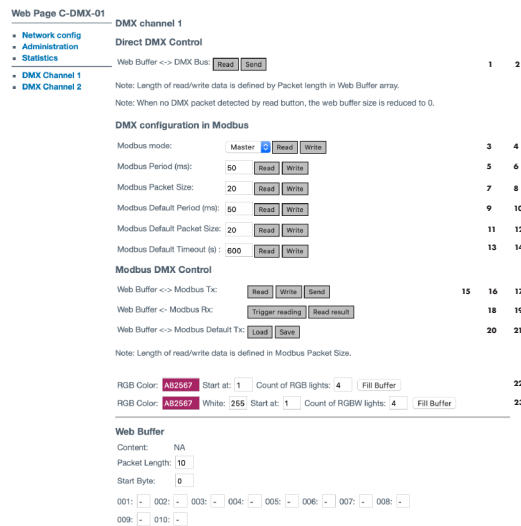
Format FTP: Format of the FTP part of memory where files such as web pages are stored. Use with caution.

Module name: Free definable text (device location, name, etc., max. 20 chars)

Upload new firmware: Select the firmware file and click Update FW. After successful upload the device restarts automatically. Check Version checks the integrity of the firmware file, and returns firmware version of the file. Incompatible binary files cannot be uploaded into the device.



Maintaining DMX channels



- 1: Reads a captured DMX packet and writes it into the web buffer.
- 2: Sends a DMX packet from web buffer to the DMX bus.
- 3,4: Reads and saves the Master/Sniffer mode configuration in the Modbus table. The Write command saves the change permanently.
- 5,6: Reads and saves the period for reading or writing of DMX packet in the Modbus table. The Write command saves the change permanently.
- 7,8: Reads and saves the DMX packet size parameter in the Modbus table. The Write command saves the change permanently.
- 9, 10: Reads and saves the default period size for reading or writing of DMX packet in the Modbus table. The Write command saves the change permanently.
- 11,12: Reads and saves the default DMX packet size parameter in the Modbus table. The Write command saves the change permanently.
- 13,14: Reads and saves the default interval to distinguish between short and long power dropout. The Write command saves the change permanently.
- 15: Reads the DMX packet from Modbus TX registers to web buffer.
- 16: Writes the DMX packet from web buffer to Modbus TX registers.
- 17: Invokes a one-off write of the DMX packet from Modbus TX registers to DMX bus.
- 18: Reads the sniffed DMX packet to Modbus RX registers.
- 19: Reads packet from Modbus RX registers to web buffer.
- 20: Reads packet from Default Modbus TX registers to web buffer.
- 21: Writes packet from web buffer to Default Modbus TX registers. The values are written permanently.
- 22: Fills the web buffer by selected RGB colour for given number of lights.
- 23: Fills the web buffer by selected RGBW colour for given number of lights.

Web buffer

A memory area for manual edit of a DMX packet for commissioning and service purposes. Enter the **Packet length**, DMX telegram length (number of channels) to display the corresponding number of positions for editing of DMX channels (1 to 512). **Start Byte** gives the first channel number, channels with lower numbers will not be displayed here and are not overwritten when copying the web buffer to Modbus registers.

Example of testing two RGB lights which use DMX channels 1,2,3 and 4,5,6 respectively:

1. Set Packet length = 6, Start byte = 1 (in the Web Buffer

section the corresponding positions, or channels, are displayed).

2. In the RGB Color field select the colour you want to set, it will be displayed together with its hex code.
3. Set Start at = 1, Count of RGB lights = 2.
4. Click "Fill Buffer, the Web Buffer channels will be filled in by the required colours (channels can be edited also directly by manual entering of values into fields).
5. Click Web Buffer - DMX bus: Send, the buffer contents will be transferred to FPGA and the DMX telegram is sent to the bus.





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Reading statistics

The page shows the number of received (RX) and sent (TX) telegrams for different Ethernet protocols. The "Reset frame" stats button resets all counters.

DMX Channels show number of sent and received DMX packets for channel 1 and channel 2 separately..

Web Page C-DMX-01 Statistics

- Network config
- Administration
- Statistics
- DMX Channel 1
- DMX Channel 2

	RX	Number of frames
Incoming frames		
ARP frames		6673
ICMP frames		0000
UDP frames		2735
TCP frames		0442
TX		
ARP frames		0005
ICMP frames		0000
UDP frames		0000
TCP frames		0559
DMX Channel 1		
Modbus TX		0000
Regular TX		19481
Web TX		0000
DMX errors		0000
RX Packets		0000
DMX Channel 2		
Modbus TX		0000
Regular TX		19481
Web TX		0000
DMX errors		0000
RX Packets		0000

Device firmware update

The latest firmware version for this device is available for download on a web link: <http://Midam.cz/en/downloads/software> Section Firmware for Midam devices.

1. Open the web page of the device
2. Backup modified web by FTP (name / password: root / root99)
3. Go to Administration, and upload the new firmware file (C-DMX-01_fw_x_x_x.bin)
4. Power off / on the device
5. Restore backup web by FTP
6. Power off / on the device



Changes in versions

01/2020	New datasheet version (v20/01)
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