



MIDAM CDALI01

Modbus TCP/DALI multimaster converter



Serial converter which acts as a Modbus TCP server (accepts Modbus TCP commands) and controls a DALI bus with up to 64 DALI enabled devices. This is the second generation multimaster converter harmonized according to EN60929 Edition 4: 2011 Annex E. CDALI01 provides the power supply for the DALI bus, can be powered over the Ethernet and features an integrated web interface for manual intervention of DALI commands or configuration and diagnostic.



Application

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

Function

CDALI01 acts as a DALI bus multimaster harmonized according to EN 60929 ed. 4:2011 Annex E, with static priority 4, setting time 16 ms and retry timeout of 300 ms, and provides the power supply for the bus. The Modbus and web commands are translated into DALI protocol telegrams and sent to the DALI devices. The responses from the light controllers are translated back to Modbus registers and available at the corresponding addresses. It is also possible to use CGI commands, where all web functions can be communicated to the device as CGI requests too.

Design notes

The DALI bus supports up to 64 light controller addresses, up to 16 scenes, and up to 16 groups. Wire length and diameter must always be respected! For the complete overview of the DALI bus specification, refer to <http://www.dali-ag.org/> (DALI manual).

The bus devices are connected over a 2-pole connector, regardless of polarity. The Ethernet is connected over RJ45 connector with PoE (Power over Ethernet) functionality.

Power supply

When specifying the DALI bus load, the amount and types of the DALI components must be considered in order not to exceed the standardized DALI bus power supply current. The DALI bus uses 22.5 V operation voltage. The device is overload sustainable to unlimited bus short-circuit. Using the single master topology, up to 64 control devices may be installed. **It is recommended not to exceed a maximum total current multimaster bus load for all devices (incl. input devices and application controllers) of 240 mA.** In any case, maximum current according to EN 62386-101 is guaranteed up to 250 mA. To learn about different power supply options please refer to the "Power supply alternatives" row in Technical data section further in this document.

Operation environment

If the bus is loaded, please allow proper heat dissipation all around the module, especially when multiple of these are installed in a row on DIN rail. The heat is a consequence of frequent communication with high number of devices. Please do not exceed maximal permitted working temperature of 45 °C, otherwise the proper function can not be guaranteed or may result in device damage.



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Technical data

Power supply	24V ± 20 % DC / AC, or PoE (Power over Ethernet, 802.af class2)
Power supply alternatives	<p>G/G0 terminals vs. PoE:</p> <ol style="list-style-type: none"> If the G/G0 power is applied first, the CDALI01 is powered from this G/G0 external source. At power dropout the power is switched over to PoE with a short dropout (device reset). If the PoE power is applied first, the CDALI01 is powered from the PoE. The switchover to G/G0 follows only if the G/G0 voltage is 27 V DC (19 V AC) and above. If both G/G0 and PoE are applied at the same time, the CDALI01 is powered from G/G0 terminals. The device will not be damaged.
Consumption	1 VA (no DALI load) max. 6 VA (full load, 64 DALI slaves)
Ethernet	1x Ethernet 10/100BaseT; galvanically insulated, insulating voltage 1 kV RJ45, 2x LED (link, data) integrated in the connector
DALI	Standard EN 60929 ed. 4:2011 Annex E, 1200 bps, power supply and multimaster (collision avoidance/detection, priority 4 setting time 16 ms, retry timeout 300 ms) Galvanic insulation of DALI bus up to 1000 V Electronic short circuit protection of DALI power supply with automatic reset, short circuit current I _k = 250 mA
Mechanical and dimensions	99 x 70 x 45 mm (incl. terminal blocks) Polycarbonate box (certification UL94V0); 4, IP20 (EN 60529) 4x LEDs (RUN, PWR, TxD, RxD) 5x DIP switch (WEB, INIT, BC 1/0, RSTPW, D-OFF) 5x screw terminals M3, maximum wire cross section 2,5 mm (DALI, power supply)
Ambient conditions	-5 to +45 °C, 5 % to 95 % rH (EN 60721-3-3 class 3K5)
Conformity standards	EMC EN 61000-6-2 ed.3:2005, EN 61000-6-4 ed.2:2006 + A1:2010 EN 60950-1 ed.2:2006 + A11:2009 + A12:2011 + A1:2010 + A2:2014 + Opr.1:2012 + Z1:2016 EN 50581:2012
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.



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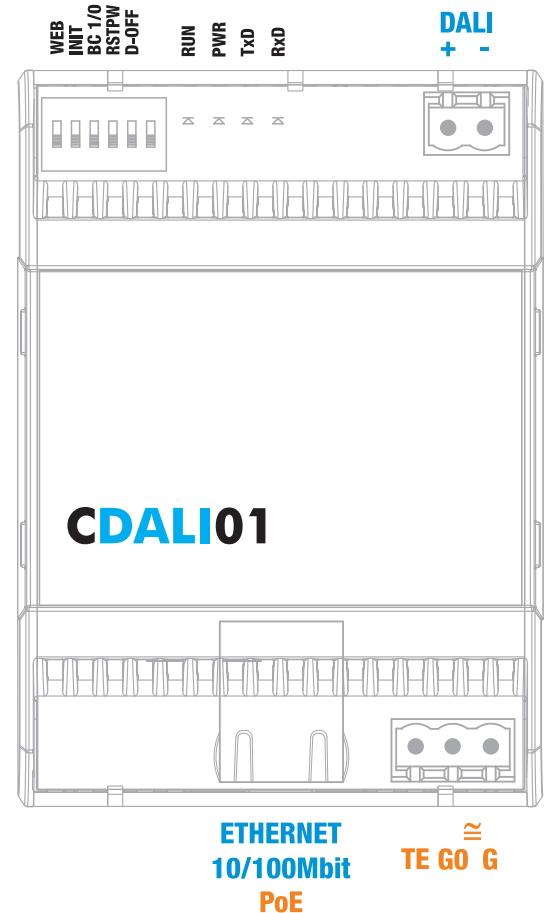


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Terminals, connection and DIP switches

DALI	DALI bus, positive and negative
Ethernet, PoE	Network interface, PoE
G	Power
G0	Power
TE	Optional connection for shielding
RUN	Yellow LED - system cycle (OK: LED flashes periodically 1 s ON, 1 s OFF; ERROR: LED flashes in another pattern, LED is still ON or OFF)
PWR	Green LED - power (ON: power OK; OFF: no power applied, weak or damaged power supply, ...)
RxD	Green LED - receiving data at DALI interface (flashing: receiving data; OFF: no data traffic)
TxD	Red LED - transmitting data at DALI interface (flashing: transmitting data; OFF: no data traffic)
INK/DATA	Ethernet activity
WEB	DIP1 ON at power-up, web access is denied
INIT	DIP2 ON at power-up, configuration parameters are brought to defaults
BC 1/0	OFF → ON to Broadcast to switch all lights ON ON → OFF Broadcast to switch all lights OFF
RSTPW	Dip 4 FREE „no function“
D-OFF	Dip 5 OFF power supply to DALI bus “ON” from this device Dip 5 ON DALI bus not powered from this device
FREE	Dip 6 FREE „no function“



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Settings

The network properties are set over the web interface integrated directly in CDALI01. 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

All settings are stored in EEPROM.

Bringing the device to default settings:

1. Power off the CDALI01.
2. Set the DIP switch 1 (INIT) to ON.
3. Apply power.
4. Locate the device on its default IP address and configure it as necessary.
5. Disconnect the converter from power.
6. Set the INIT switch to OFF.
7. Apply power again.
8. The CDALI01 runs on the default settings.

Installation

Please ensure that, when installed onto a DIN rail, there is at least a 15 mm gap for proper air circulation at both sides, which is necessary for proper cooling of the device.





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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 Support for Midam devices or contact supplier/manufacturer.

1. Open the web page of the CDALI01.
2. Backup modified web by FTP (name / password: root / root99).
3. Go to Administration, and upload the new firmware file (C-DALI-01_fw_x_x_x.bin).
4. Power off / on the CDALI01.
5. Restore backup web by FTP.
6. Power off / on the CDALI01.

Modbus TCP communication

The supported Modbus functions are:

- 01 Read Single Coils - read bits
- 03 Read Holding Registers - read words
- 05 Write Single Coils - write bits
- 15 Write Multiple Registers - write words
- 16 Force Multiple Registers - write words

The memory is divided into sections, and only registers which functionally stick together, like 5 to 182, 500 to 900, etc. are able to be written in a single command. In other words, the F16 command cannot cross borders, like writing to registers 157 to 505 in one command and limit 256 registers.

The address space is accessible word wise (16 bit words).

Modbus TCP command example

There are 8 "blocks" - (0 to 7) - which represent positions for the DALI commands.

To execute a command:

- the block(s) must be filled with the data representing the command(s)
- bit(s) in Register 5 LSB which corresponds to the block to be executed must be set.

After executing of the command, the info bit in register 5 MSB is set so that the Modbus master can read that the execution was OK.

If a command is generating a response, the response is stored in the DO..D2 registers of the particular block.

More blocks may be filled at the same time and executed all together by writing a corresponding bit pattern into register 5 LSB.

Example

Command blocks 0-7 Dali V1, Turn on the light on address 3

- 1) Reg6 = 0x0507 (command:05, address: YAAAAAA1)
- 2) Reg7 = 0x0
- 3) Reg5 = 0x1
- 4) Check command execution in Reg5, bit8

Note: Response to any query command is in Reg7

Command blocks 8-15 Dali V1/V2, Turn on the light on address 3

- 1) Reg516 = 0x0705 (address: YAAAAAA1, command:05) 2) Reg517 = 0x0
- 3) Reg518 = 0x0 (send once, priority 0, 16bit packet)
- 4) Reg511 = 0x1
- 5) Check command execution in Reg512, bit1
- 6) Reg511 = 0x0
- 7) Check response/status of operation in Reg561 - received data
- 8) Check response/status of operation in Reg562 bit1 - operation was successful



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Web interface

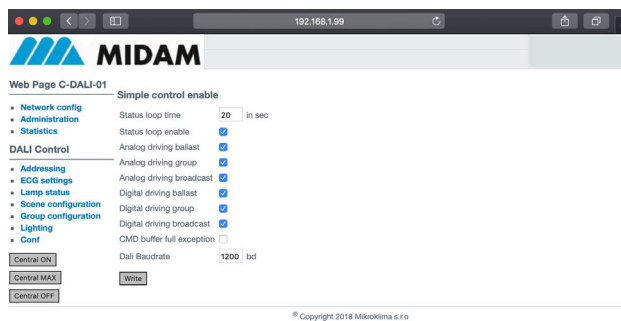
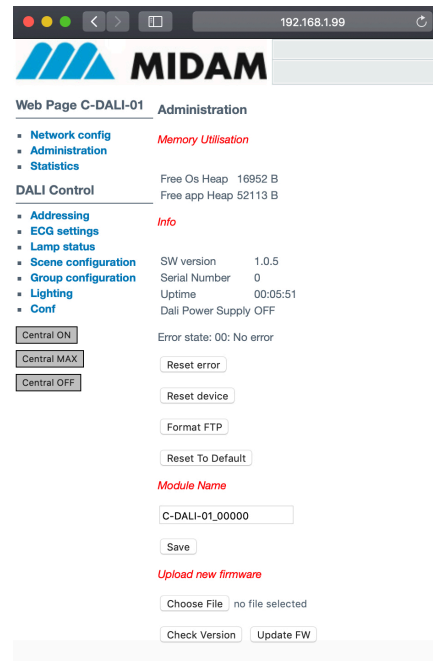
The integrated web interface is possible to use in order to set the CDALI01 up (Network config), upload new firmware if necessary (Administration), and diagnose the interface (Statistics). The DALI Control menu is used to test if the DALI part is operating properly, to address the ballasts (Addressing), set the individual ballast parameters (ECG settings), see the states of the lamps at a glance (Lamp status), configure scenes and groups, issue group commands (Lighting), and enable registers for simple control (Conf).

The files are part of the firmware release package. For upload, use a ftp client with username/password: root/ root99 for customized pages and links.

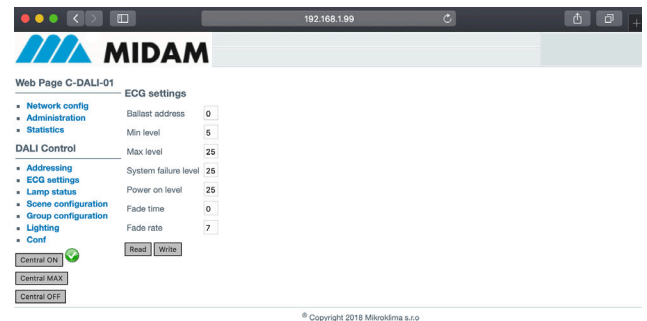
Please note the numbering of the DALI ballasts:

0...63 at the web interface

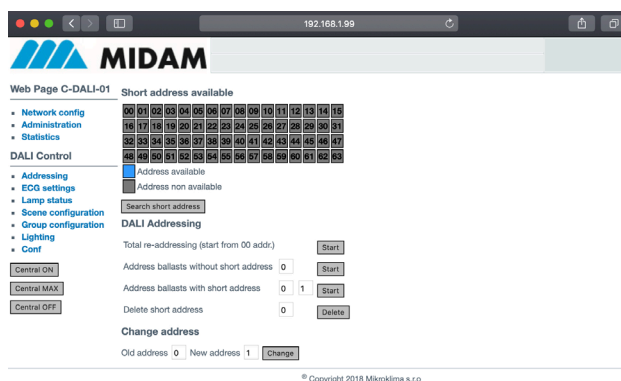
0...63 in the Modbus telegrams



Conf - simple control enable menu



Menu ECG settings



The web interface is useful when commissioning the system. The DALI bus may be checked/maintained separately from the PLC application program. As soon as the groups are configured and there is the possibility to control the DALI ballasts over the web interface, it is time to commission the PLC part.

In the Midam IDE, there are Modbus devices for direct commands through writing to Modbus registers.





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Light level control

It is possible to control the light level using two different ways. DALI recognizes direct and indirect light level control.

Indirect light level control

The command consists of 2 bytes.

Byte 1 DALI address (short address / group address / broadcast)

Byte 2 Standard or Extended DALI command - see tables above.

Direct light level control

The command consists of 2 bytes.

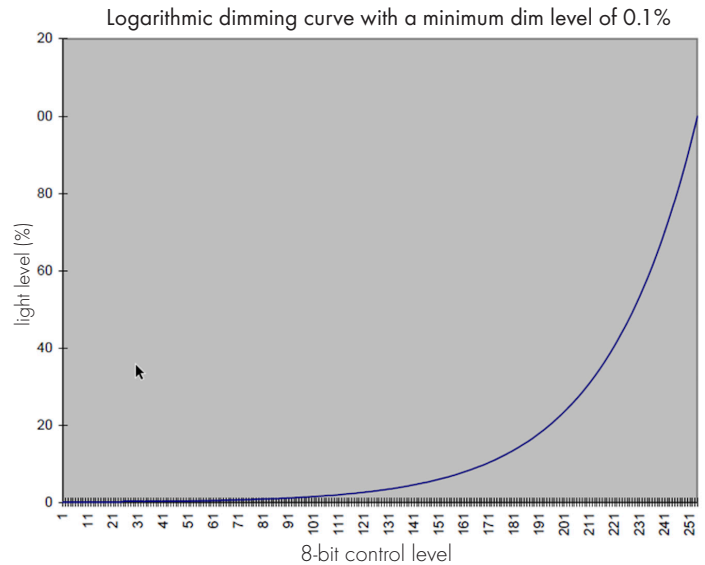
Byte 1 DALI address; this is the DALI ballast short address, with the first bit of 0.

Byte 2 Light level: a number in the range of 0...254.

This is a way, how to control the light level directly without using of groups, scenes etc.

Scene control can use also percentage values. It is calculated using formula:

$$X(n) = 10^{\frac{n-1}{253/3}-1}, \left| \frac{X(n)-X(n+1)}{X(n)} \right| = \text{const.} = 2.8\%$$



Registers for simple control and status monitoring

To make Modbus communication easier, it is possible to read out statuses and control the ballasts also using a simple Modbus read / write commands to dedicated Modbus registers 30 to 182. These commands are converted to DALI commands in the converter, and sent to the DALI bus (unlike the standard commands, where the Modbus client actually has to compile the DALI telegrams and send them over Modbus). The Modbus client then may assign a separate register or bit to each ballast which makes the Modbus client engineering easier.

It is necessary to enable the required functions in Register 30 (see table above) for two reasons:

1. This communication may bring extra load to the DALI bus, it is advisable to set e.g. the status update interval to the longest acceptable time
2. Only enabled command types are sent to the DALI bus - security reason.

If these functions are not used, they should be disabled in register 30.

If more commands to control a single DALI ballast are set over different registers, the last one is active. Make sure that the Modbus client does not send weird commands over different registers which could spoil the DALI functionality.

To use the simple control commands in a proper way, it is necessary to understand the principle of command processing within the CDALI01. There is an internal FIFO queue of 96 commands. The commands are read over the Modbus TCP interface or web pages, and put into the queue. On the queue output, the commands are translated into DALI telegrams, and sent to the DALI interface. There is no feedback between the DALI command execution and the respective Simple command. The Modbus server response to confirm a Simple command receipt only means that the command has been received by the CDALI01, not that the command has been queued or executed at the DALI bus.

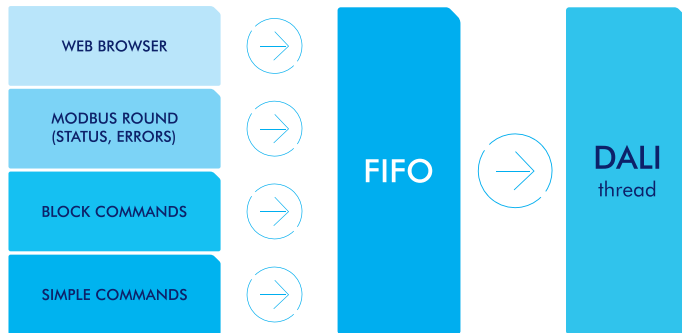
There are neither exceptions, priorities, nor any other internal logics in the queue. As the DALI bus communication speed is 1200 bps, while the Modbus TCP commands run at a speed of Ethernet, in case that the Simple commands are sent in fast sequence, it likely happens that the queue gets full.





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If the queue is full, all incoming Modbus Simple commands are discarded. At the Statistics web page, there is a DALI failure counter item which counts the discarded commands. If this value is increasing steadily, it means that the Simple commands queue is permanently full and the Modbus communication should be less frequent.

Always select only the relevant simple command types at the Conf page. It is advised to disable the types of commands which are not used.

Always select only the relevant simple command types at the Configuration page. It is advised to disable the types of commands which are not in use.

Web Page C-DALI-01 Statistics

Statistics		Number of frames
RX		
<i>Incoming frames</i>		
ARP frames		NA
ICMP frames		NA
UDP frames		NA
TCP frames		0979
DALI Control		
TX		
ARP frames		NA
ICMP frames		NA
UDP frames		NA
TCP frames		0939
Dali		
Tx Packets		1554
Rx Packets		1553
Tx Packets Fails		0000
Rx Packets Fails		0001
Events		0000
Web Packets		0013
Modbus Block Packets		0000
Modbus Packets		0000
Regular Status Packets		1536
Others Packets		0004
Dip Packets		0000

Buttons: Central ON, Central MAX, Central OFF, Reset frame stats



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Changes in versions

02/2019	New datasheet version (v19/01).
04/2019	Housing, dimensions, scheme (v19/02).
01/2021	Power and operation information added. (v21/01).

Subject to technical changes and General Terms and Conditions.

