Roger Access Control System

MCX4D I/O expander

Operating Manual

Product version: 1.0 Firmware version: 1.1.14.189 Document version: Rev. D



rcdr284

Design and application

MCX4D is I/O expander dedicated to control four doors with MCT readers (RS485) in RACS 5 system. Additionally the expander operates as distributor of 12VDC power supply and RS485 bus. For each door the MCX4D offers two inputs, two outputs, RS485 interface, 1.0A main power supply and 0.2A auxiliary power supply. All outputs of the expander are protected against overload. The MCX4D is supplied from the same 13.8VDC PSU as access controller, readers and other door related devices and it offers 1.2A current per door. The expander operates with backup battery which depending on particular requirements can be charged with 0.3A, 0.6A or 0.9A current. The expander is equipped with removable terminal blocks which facilitate electrical connections during installation and maintenance. MCX4D can be also used with PRT and Wiegand readers and then such readers must be connected to the controller directly or through dedicated expanders (e.g. MCX402DR, MCX102DR, MCX16-NT). Inputs and outputs of the expander can be configured to any functions and used for purposes not related to door control. MCX4D is offered individually as electronic module or as a component of MC16-PAC-3-KIT and MC16-PAC-4-KIT.

Characteristics

- Power supply distribution for 4 doors
- RS485 communication bus distribution for 4 doors
- 8 inputs NO/NC EOL/2EOL/3EOL/DW
- 8 transistor outputs 12V/1.0A
- 4 power outputs 12V/1.0A
- 4 power outputs 12V/0.2A
- RS485 interface for communication with controller and readers
- Protection against full battery discharge
- Reporting of power supply status to access controllers
- Battery charging with 0.3A, 0.6A or 0.9A current
- 13.8VDC power supply



Fig. 1 General concept of MCX4D application



Fig. 2 MCX4D application in 2-door access control system

Power supply

PS4D (Roger) power supply unit is recommended to provide 13.8VDC supply to MCX4D expander. However it is possible to use other type of PSU if it offers adequate voltage and current parameters. Due to relatively high current between expander and PSU, all connections should be made using possibly short cables with adequate cross sections. PSxD series PSUs (Roger) are offered with two 30cm/1mm² cables dedicated to supply the expander. Multiple MCX4D expanders can be supplied from the same PSU and in such case each connection must be made with individual pair of cables. When expander's supply voltage is too low the battery cannot be fully charged and when the voltage is too high the battery can be damaged. MCX4D which is supplied from PSU equipped with backup (e.g. battery, UPS) cannot be equipped with own backup battery.

Note: If the expander is expected to operate with full power in regard of power outputs and battery charging (0.9A) then it must be supplied with 6.0A or greater rated current (e.g. PS8D).



Fig. 3 Two MCX4D expanders supplied from the same PSU

Backup battery

MCX4D enables battery charging with 0.3A, 0.6A or 0.9A current up to the level of voltage supplied to the expander (nominal 13.8VDC). The current is selected with jumpers. When battery voltage drops to approximately 10V then it is disconnected from expander. The battery is reconnected when the 13.8V supply to expander is restored. In order to ensure battery charging up to 80% level within 24h (according to EN 60839 standard) following current settings must be applied:

- 0.3A for 7Ah battery
- 0.6A for 17Ah battery
- 0.9A for 24Ah battery

RS485 communication bus distribution

MCX4D is an addressable device connected to RS485 communication bus of the controller. The bus is distributed to each controlled door. Prior to connection, the expander must be addressed. The same applies to readers, taking into account that addresses of all devices on RS485 bus must be unique in range of 100..115. Addressing is done within low level configuration by means of RogerVDM software.



Fig. 4 Distribution of RS485 bus to MCT readers

LCK and BELL outputs

LCK and BELL are transistor (open collector) outputs which can control 15V/1.0A load. In standard scenario of door control, LCK output is dedicated to control door lock while BELL output is dedicated to control alarm signalling device and door bell but they can be used for any other functions which are configured using VISO management software.

Output polarity can be configured as normal or reversed. Output with normal polarity represents high impedance in normal state and is shorted to ground when triggered. Output with reversed polarity operates with inverted logic. It is shorted to ground in normal state and represents high impedance when triggered. The configuration of output polarity is done within low level configuration using RogerVDM software. By default, outputs are configured with normal polarity.

DC and DR inputs

DC and DR are parametric inputs which can be configured as NO, NC, EOL, 2EOL, 3EOL or DW (Double Wiring) types. It is also possible to configure input response time which defines minimal pulse which can trigger the input. The configuration of input electrical parameters is done within low level configuration by means of RogerVDM software.

Each input can be assigned with function. In standard scenario of door control, DC input is dedicated to connection of door contact while DR input is dedicated to connection of exit button. Inputs are assigned with functions using VISO management software. Default factory settings for both inputs are as follows:

- DC input: NC/50ms
- DR input: NO/50ms

VDR power output

VDR power supply output is dedicated to supply door lock, alarm signalling device and other door related devices. The terminal VDR+ is protected with 1.0A electronic fuse. The terminal VDR- is internally shorted to ground (GND). Green LED indicator is located at the VDR+ terminal to signal voltage at the output.

TML power outputs

TML power supply output is dedicated to supply readers at doors. The terminal TML+ is protected with 0.2A electronic fuse . The terminal TML- is internally shorted to ground. Green LED indicator is located at the TML+ terminal to signal voltage at the output.



VOUT power output

VOUT power supply output is dedicated to supply additional electronic modules and it can be also used to supply connected access controller. The terminal VOUT+ is protected with 0.2A electronic fuse . The terminal VOUT- is internally shorted to ground. Green LED indicator is located at the VOUT+ terminal to signal voltage at the output.

Note: If access controller is supplied from the expander then it cannot be at the same time supplied by transformer and it cannot operate with own backup battery.

AUX power output

AUX power supply output is dedicated to supply additional electronic modules. The terminal AUX+ is protected with 0.2A electronic fuse. The terminal AUX- is internally shorted to ground. Green LED indicator is located at the AUX+ terminal to signal voltage at the output.

Door control

The expander enables distribution of power and RS485 communication bus to four doors. For each door the MCX4D offers 1.0A power supply output (VDR+ and VDR- terminals), 0.2A power supply output (TML+ and TML- terminals), communication bus (RS485 A and B terminals), two programmable inputs (DC and DR) and two programmable outputs (LCK and BELL). The 1.0A output is dedicated to supply door lock and door related devices (e.g. alarm signalling device). The 0.2A output is dedicated to supply readers. Short circuit at any power supply output or RS485 bus does not affect other outputs. In the figure below a typical read-in/read-out door control scenario with MCX4D expander is presented. The door system is supplied from the expander and it includes:

- 2 x MCTxx readers (RS485)
- 12VDC door lock
- 12VDC alarm signalling device
- Door contact
- Exit button



Fig. 5 Typical scenario of operation for read-in/read-out door with MCT readers

Connection of expander to controller

MC16 access controller can be supplied from transformer and be equipped with backup battery or as presented in figure below it can be supplied from VOUT output of the expander. In the figure below not only

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controller but also doors are supplied from the expander. If the controller is supplied from transformer and is equipped with own battery then controller's ground (AUX- terminal) must be connected with expander's ground (VOUT- terminal) using any wire.



Fig. 6 Connection diagram for expander and MC16 controller

Connection of multiple expanders to controller

In the figure below an example of system including multidoor MC16 access controller and three MCX4D expanders is presented. In general perspective the maximal number of expanders connected to the controller equals the number of unoccupied addresses on RS485 bus. Each MCX4D can be equipped with own battery and be supplied from its own PSU. It is also possible to use single 13.8 VDC PSU to supply two or more expanders. In the example below the controller is supplied from one of expanders.



Fig. 7 Connection diagram for three MCX4D expanders and MC16 controller

Configuration parameters

In the table below the configuration parameters of MCX4D expander are presented. All settings are programmed with RogerVDM software within low level configuration of the expander.

Note: Expander address can be also programmed manually within memory reset procedure.

Configuration parameters			
Code	Name	Function	
Comn	Communication settings		
101	RS485 address	Parameter defines device address on RS485 bus. Range: 100- 115	
106	Communication lost signalisation delay [s]	Parameter defines delay before indicating communication lost with controller. Range: 0-64s. When set to 0 the parameter is disabled.	
Input	Input types		
210	DC1	Parameter defines input type. Range: 1 – NO; 2 – NC; 3 – EOL/NO; 4 – EOL/NC; 5 – 2EOL/NO; 6 – 2EOL/NC; 7 – 3EOL/NO; 8 – 3EOL/NC; 9 – 3EOL/DW/NO; 10 – 3EOL/DW/NC; 11 – VOLTAGE	
211	DR1	as above	
212	DC2	as above	
213	DR2	as above	

214	DC3	as above	
215	DR3	as above	
216	DC4	as above	
217	DR4	as above	
Paran	netric input resistance		
200	Tamper resistor	Parameter defines the resistance [Ohms]. Range: 1k; 1,2k; 1,5k; 1,8k; 2,2k; 2,7k; 3,3k; 3,9k; 4,7k; 5,6k; 6,8k; 8,2k; 10k; 12k	
201	Alarm A resistor	as above	
202	Alarm B resistor	as above	
Input	response time		
251	DC1	Parameter defines minimal duration of pulse [ms] which is required to trigger the input.	
252	DR1	as above	
253	DC2	as above	
254	DR2	as above	
2535	DC3	as above	
256	DR3	as above	
257	DC4	as above	
258	DR4	as above	
Outpu	Output polarity		
150	LCK1	Parameter defines output polarity. Output with normal polarity represents high impedance in normal state and is shorted to ground when triggered. Output with reversed polarity is shorted to ground in normal state and represents high impedance when triggered. Range: 0 – Normal polarity (default); 1 – Reversed polarity.	
151	BELL1	as above	
152	LCK2	as above	
153	BELL2	as above	
154	LCK3	as above	
155	BELL3	as above	
156	LCK4	as above	
157	BELL4	as above	
Comr	Comments		
500	Device name or comment	Any text to be displayed in VISO management software in order to facilitate device identification.	
501	Object PWR comment	as above	
Input	comments		
601	Object DC1 comment	as above	
602	Object DR1 comment	as above	
603	Object DC2 comment	as above	

604	Object DR2 comment	as above
605	Object DC3 comment	as above
606	Object DR3 comment	as above
607	Object DC4 comment	as above
608	Object DR4 comment	as above
Output comments		
651	Object LCK1 comment	as above
652	Object BELL1 comment	as above
653	Object LCK2 comment	as above
654	Object BELL2 comment	as above
655	Object LCK3 comment	as above
656	Object BELL3 comment	as above
657	Object LCK4 comment	as above
658	Object BELL4 comment	as above

Device configuration

The expander is configured within low level configuration by means of RogerVDM software. The address of expander can also be programmed manually within memory reset procedure



Fig. 8 Connection of expander to RUD-1 (configuration)

Memory reset:

- Turn power supply off
- Place jumper on MEM pins
- Connect LCK1 and DC1 terminals
- Turn power supply on
- When device is supplied then LED AC shall pulsate quickly
- Disconnect LCK1 and DC1 terminals
- Count the number of LED AC pulses and press RES button when the number corresponds to required address
- Remove jumper from MEM pins

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٠	Press RES button and device shall revert from Service mode to Normal mode with default
	settings and new address

Manual addressing	
Number of LED AC pulses	RS485 address
1	101
2	102
3	103
4	104
5	105
6	106
7	107
8	108
9	109
10	110
11	111
12	112
13	113
14	114
15	115
16	100

Note: In order to program the address "100" wait for 16 LED AC pulses. When LED AC and LED RUN are on, remove jumper from MEM pins and press RES button. The device shall revert from *Service mode* to *Normal mode* with default settings and new address.

Low level configuration with RogerVDM software:

- Connect the device to RUD-1 interface according to fig. 8
- Place jumper on MEM pins
- Press RES button, the device shall enter Service mode and LED RUN shall pulsate
- Start RogerVDM software
- From the top menu select *Device->New*, select your device model and version, then click *Connect* button.
- When the connection is established then the software shall download and display current settings of the device
- Configure settings as needed
- Click Send to Device to upload settings
- Click Send to File to backup settings
- From the top menu select *Device->Disconnect*
- Remove jumper from MEM pins
- Press RES button and device shall revert from Service mode to Normal mode with new settings

When low level configuration is finished then the expander can be connected to access controller in order to make functional configuration with VISO management software.

Firmware update

Device firmware can be updated using RogerVDM software and RUD-1 communication interface. The latest firmware file is available at www.roger.pl

Firmware update procedure:

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- Connect the device to RUD-1 interface according to fig. 9
- Place jumper on FDM pins
- Press RES button
- Start RogerVDM software
- In the top menu select *Tools->Update firmware*
- Select device type and communication port with RUD-1 device as well as indicate firmware file
 (*.hex)
- Click Update and proceed according to displayed messages
- After firmware upload, remove jumper from FDM pins and press RES button

Note: When firmware is updated then it is necessary to configure the device with RogerVDM software or start memory reset procedure and manually define the address of device.



Fig. 9 Connection of expander to RUD-1 (firmware update)

Installation

Enclosure with DIN rail is recommended for installation of MCX4D expander. All electric connections must be done without voltage on wires/terminals and with power supply disconnected. Optionally, DIN rail mounting clips can be removed and the expander can be installed on flat surface. It is recommended to install the expander in the same enclosure as PSU. The cross section of power supply wires must be adequate as to avoid voltage drop greater than 200mV for rated load. It is recommended to use cables with minimal 1mm² cross section and maximal 30 cm length. Such cables are offered with PSxD series power supply units. Prior to expander connection to the controller specify RS485 address and configure other electric parameters if necessary. The expander is configured within low level configuration by means of RogerVDM. Default address of factory new device is ID=100.



Fig. 10 MCX4D board

Battery charging settings		
300mA 600mA 900mA	300 mA current recommended for 12V/7Ah battery	
 300mA 600mA 900mA 	600 mA current recommended for 12V/17Ah battery	
300mA 600mA 900mA	900 mA current recommended for 12V/24Ah battery	

LED signalling		
ACL RUN C RU	In <i>Normal mode</i> the LED signals lack of external power supply. In case of <i>Memory</i> reset the LED is used for manual addressing.	
	Single pulse every 4 sec. : <i>Normal mode</i> Quick pulsing: <i>Service mode</i> Slow pulsing (0.5s/0.5s): No communication with controller Very slow pulsing (1s/1s): Configuration memory error	
ACL C RUN C TXD C RXD C	Data transmission to controller	
ACL	Data receiving from controller	

MCX4D terminals	
Terminal	Function
BAT+	Battery positive pole
BAT-	Battery negative pole
VOUT+	13.8VDC/0.2A output power positive pole

VOUT-	13.8VDC/0.2A output power negative pole	
AUX+	13.8VDC/0.2A output power positive pole	
AUX-	13.8VDC/0.2A output power negative pole	
VIN+	13.8VDC input power positive pole	
VIN-	13.8VDC input power negative pole	
A	RS485 input communication bus, line A	
В	RS485 input communication bus, line B	
Note: Following terminals are replicated four times on the expander. The letter "x" in terminal name indicates door number (1-4).		
VDRx+	13.8VDC/1.0A output power positive pole	
VDRx-	13.8VDC/1.0A output power negative pole	
TMLx+	13.8VDC/0.2A output power positive pole	
TMLx-	13.8VDC/0.2A output power negative pole	
Ax	RS485 output communication bus, line A	
Bx	RS485 output communication bus, Line B	
LCKx	Transistor (open collector) output	
BELLx	Transistor (open collector) output	
DCx	Parametric input	
DRx	Parametric input	

Specification

Parameter	Value
Power supply voltage	13.8VDC +/- 100mV (with backup battery connected)
	10-15VDC (no backup battery)
Power supply current	Expander: 50mA
	Expander with maximal load at power outputs and maximal 0.9 battery charging current: 6.0A
VOUT general purpose output power	13.8VDC/0.2A; overload protection
AUX general purpose output power	13.8VDC/0.2A; overload protection
VDR1-4 power outputs for doors	13.8VDC/1.0A; overload protection
TML1-4 power outputs for readers	13.8VDC/0.2A; overload protection
Battery charging current	Configurable: 0.3A; 0.6A; 0.9A
Battery cut-off voltage	Approx. 10.0V
Distance from controller	Max. 1200m
Distance from reader	Max. 150m
Environmental class	Class I, indoor general conditions, temperature: +5°C to +40°C, relative humidity: 10 to 95% (no condensation)
Dimensions	115 x 80 mm
Weight	85 g
Certificates	CE

Ordering information

Product	Description
MCX4D	I/O expander

Product history

Version	Date	Description
MCX4D v1.0	10/2017	The first commercial version of the product



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> Contact: Roger sp. z o.o. sp.k. 82-400 Sztum Gościszewo 59 Tel.: +48 55 272 0132 Fax: +48 55 272 0133 Tech. support: +48 55 267 0126 E-mail: <u>biuro@roger.pl</u> Web: <u>www.roger.pl</u>

