NETRONIX

Technical Data Sheet

RFID reader

CTU-D series

CTU-Dxx-man-eng-v3.pdf

Fig. 1 CTU-D2R

1. Introduction

CTU-D device series is OEM miniature RFID card reader operating at frequency of 125 kHz.
Main features:

- Support of Unique, Q5, Hitag-1, Hitag-S or HID transponders,
- built-in antenna
- card memory with build-in lock driver,
- lots of communication interfaces type, depend on version (see table below)
- Built-in relay and buzzer
- Built-in push-button for reset to default settings
- 2 configurable inputs/outputs
- Two-state outputs control
- Read-out of two-state input
- changeable format of sending ID
- Data password protected
- Software update via RS-232 interface using *NEFIR* program

CTU-D reader series													
Module type	GPIO	Card memory	Event memory	Relay	Power supply	INTERFACES							
						RS-232	RS-485	RS-232TTL	SPI	I2C	WIEGAND	1WIRE
CTU-D2R*	②	**40**	×	✓	**7-16**	✓						
CTU-D4R	②	40	×	✓	7-16		✓					
CTU-D5N*	②	**40**	×	×	**5**			✓	✓	✓	✓	✓
CTU-D5R	②	40	×	✓	5			✓	✓	✓	✓	✓
CTU-D2RM	②	1000	4000	✓	7-16	✓						

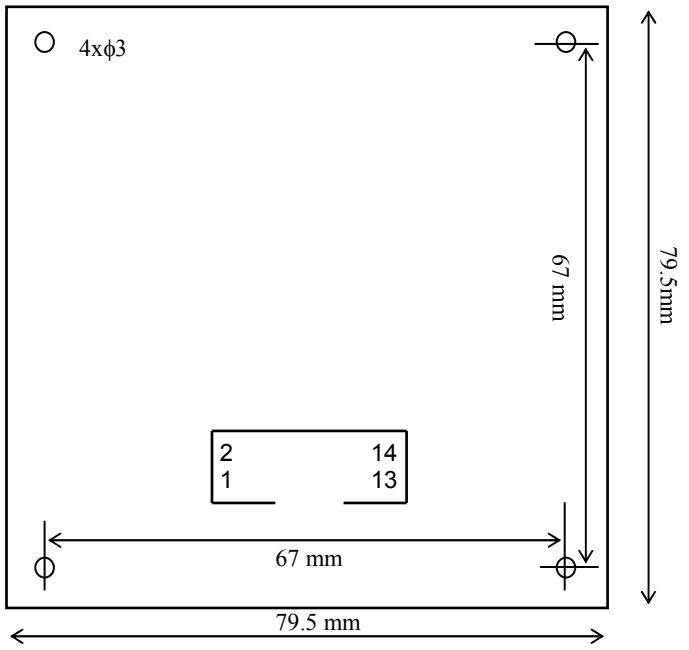
*** - standard version, rest of version for special order**

2. General specification

Supported functionality depending on transponder / card type:			
Transponder type	**ID number read-out**	**Full write and read-out of memory blocks**	**Supported by internal lock driver**
Unique	YES	-	-
Q5	YES	YES	-
HID	YES	-	-
HITAG	YES	YES	NO

CTU-Dxx module parameters	
Supply voltage (D2R i D4R model)	7-16 V
Supply voltage (D5R model)	4,5 - 5,5 V
Max. supply current	120 mA
Rated operation radio frequency of module	125kHz
Working temperature	-20°c - +65°c
Max. relay current	2A
Appr. read distance for Unique	11 cm
Appr. read distance for Hitag	12 cm
Appr. read distance for HID	7 cm
Max. output current for GPIO	20mA
Transmission parameters for RS232/RS485/RSTTL	2400, 4800, 9600, 19200, 38400, 57600, 115200 bps, 8 data bits, 1 stop bit, no parity compliant with „Netronix Protocol”
Address on I^2C bus	0xC0
1WIRE family code,address (configurable)	0x01,0x01
WIEGAND number of bits	37

3. Dimension, terminal description



Rys.2 top side view

Pin no.	Description
1	RS232RX, RS485B, RSTTL_RX, 1WIRE, MOSI, SDA
2	RS232TX, RS485A, RSTTL_TX, MISO
3	SCK, SCL
4	CS
5	MCLR
6	GND
7	VCC
8	GPIO 1
9	GPIO 2
10	GND
11	NC
12	NC
13	RELAY 1
14	RELAY 2

4. Module settings by on-board switch

Two function of build-in switch:

- configure to factory settings – press button for 8 seconds
- change interface and RFID transponder type – press button in schematic:

STEP	Number of press	1	2	3	4	5	6
1	MENU1-transponder selection	-	Unique	Q5	Hitag	HID	MULTI
2	Double beep						
3	MENU2 – interface selection*	-	RS232/485	SPI	WIEGAND	1WIRE	I2C
4	Triple beep						

* - type of interface depends on CTU-D model

5. Transmission protocols

5.1. RS-232/485 transmission protocol

In this data sheet RS-232/485 protocol has been confined to descriptions of commands, responses and their parameters. Header and CRC control sum exist always and are compliant with full “Netronix Protocol” document.

Command frame:

Header	C_CommandName	Response_parameters1…n	CRC

Response frame:

Header	C_CommandName+1	Response_parametrers…m	OperationCode	CRC

RS protocol operation can be tested by means of development tools including free of charge “FRAMER” software”.

5.2. Protocol for I²C transmission

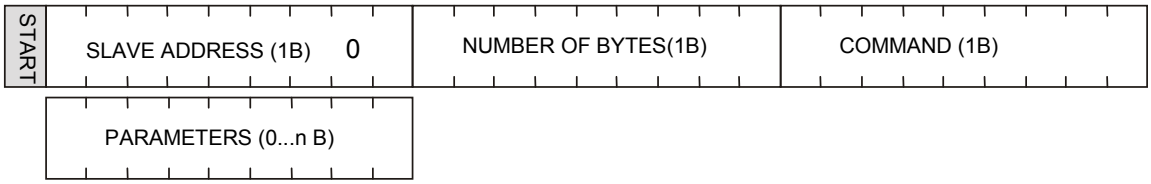
5.2.1. Data exchange algorithm

A module configured depending on table showed on point 4. operates in I²C interface mode in following sequences:

1. Master (external device) writes command with parameters if necessary into slave device (CTU module)
2 The command is performed (immediately after receiving byte sent quantity declared in frame)

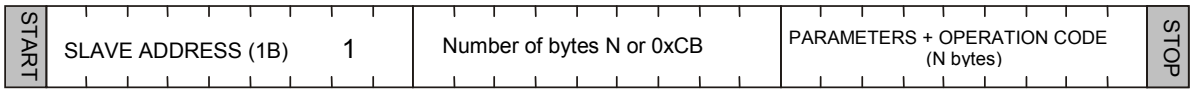
3. Master device reads response, its parameters and operation code. In case of receiving busy byte 0xCB, repeat attempt to read the response after ca. 1 ms (commands connected with write to/and read from transponders can last up to 100 ms).

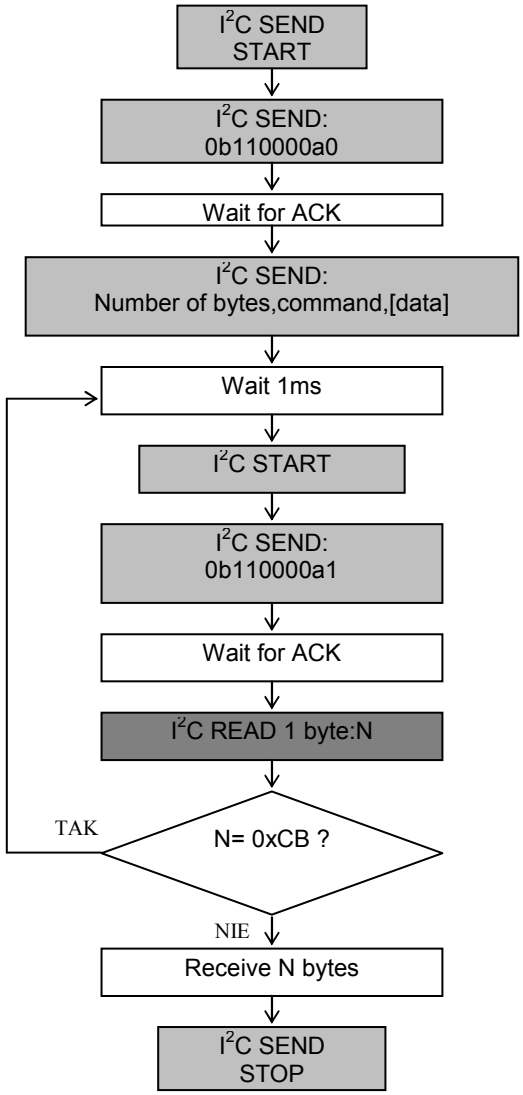
We write inquiry-command to CTU module:



The „number of bytes" field must contain information on byte quantity sent directly "command" fields and "parameters".

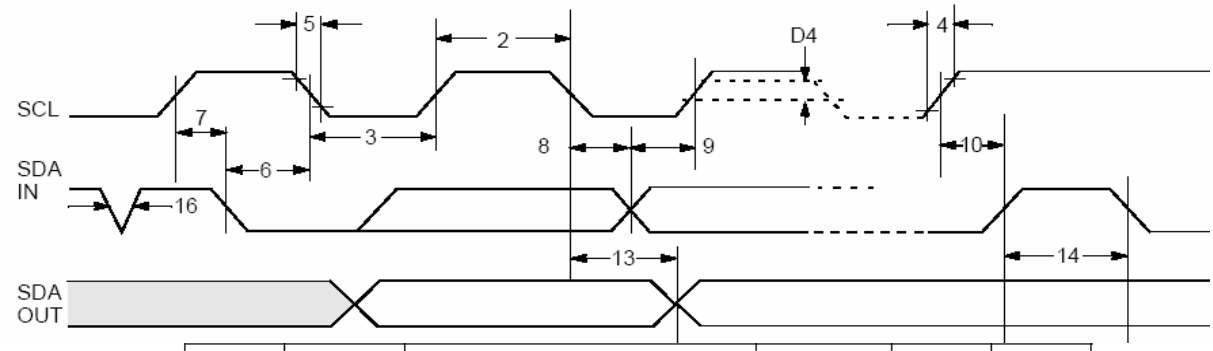
We have then:





5.2.2. Timings

Module sends and receives data at 400 kHz clock frequency considering timings showed below.



Param. No.	Sym.	Characteristic	Min.	Max.	Units
1	FCLK	Clock Frequency	— —	400 100	kHz
2	THIGH	Clock High Time	600 4000	— —	ns
3	TLOW	Clock Low Time	1300 4700	— —	ns
4	TR	SDA and SCL Rise Time **(Note 1)**	— —	300 1000	ns
5	TF	SDA and SCL Fall Time	—	300	ns
6	THD:STA	Start Condition Hold Time	600 4000	— —	ns
7	TSU:STA	Start Condition Setup Time	600 4700	— —	ns
8	THD:DAT	Data Input Hold Time	0	—	ns
9	TSU:DAT	Data Input Setup Time	100 250	— —	ns
10	TSU:STO	Stop Condition Setup Time	600 4000	— —	ns
11	TSU:WP	WP Setup Time	600 4000	— —	ns
12	THD:WP	WP Hold Time	1300 4700	— —	ns
13	TAA	Output Valid from Clock **(Note 2)**	— —	900 3500	ns
14	TBUF	Bus free time: Time the bus must be free before a new transmission can start	1300 4700	— —	ns
15	TOF	Output Fall Time from VIH Minimum to VIL Maximum	20+0.1CB —	250 250	ns

Note 2: Reader keeps in low state first clock pulse of each byte sent until proper state is placed on SDA line.

5.3. Protocol for 1WIRE (Dallas) bus.

Family code	ID1…ID5	Address	CRC
1 byte	5 bytes	1 byte	1 bytet

ID1...5 – unique ID number of transponder
CRC_DAL- check sum of data send

The format conforms 1-WIRE Dallas (e.g.. DS1990A). It means, that described module could be used as a replacement of DS1990A drop.
During operation, a module tries to read-out transponder periodically. If it fails (no successful read-out), module does not response for pulses sent from 1-WIRE master unit. Bus does not "see" the module, which corresponds with lack of reader applying, it means applying the DS1990A drop to drop reader. If module reads out the transponder, the module starts to send data via 1-WIRE bus.

Calculate the CRC value

According to DS1990A specification C value is calculated from equation x^8+x^5+x^4+1 with initial value equal to 0x00. The CRC is calculated on basis of all frame bytes excluding the last one.

An example of CRC value calculation procedure written in C language

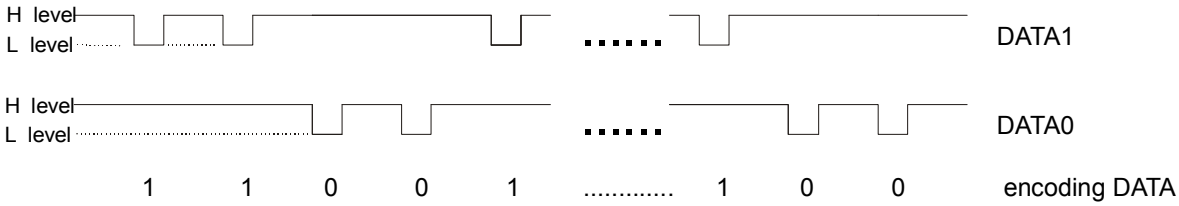
```
unsigned char CalcCRCDallas(unsigned char *SourceAdr)
{
unsigned char i,k,In,CRC=0;
        for(i=0;i<7;i++)
        {
                In=*SourceAdr;
                for(k=0;k<8;k++)
                {
                        if((In^CRC)&1) CRC=((CRC^0x18)>>1)|0x80;
                        else CRC=CRC>>1;
                        In>>=1;
                }
                SourceAdr++;
        }
        return(CRC);
}
```

where *SourceAdr is beginning flag of data buffer

5.4. Wiegand protocol

The format conforms WIEGAND protocol specification for N bits. During operation, a module tries to read-out transponder periodically. If it fails (no successful read-out), module does not send data (bus does not "see" the module). If module reads out the transponder, the module starts to send data via Wiegand bus.

Pulse sequence from left to right.



Total number of pulses (level L) is equal to N. The first being bit sent complements up to parity the bits from first half of total bits. The last bit N complements up to non-parity the bits from second half of bits being sent.
It means, that two bits out of N bits assure the transmission correctness. Information is being sent is written by means bits 2 to N-1, it gives N information bits.

Check sums for bit sequence:

for even N:

EXXXXXXXXXXXXYYYYYYYYYYYYO

or for odd N:

EXXXXXXXXXXXXXXXXXX.....
.....YYYYYYYYYYYYYYYYYYO

Where:
E = bit complementing up to parity
O = bit complementing up to non-parity

X = mask for parity calculation
Y = mask for non-parity calculation

6. Communication protocol commands

6.1. Commands for communication with transponders

6.1.1. Selecting the transponder type

Command frame:

C_SetTransponderType	TransponderType, GAIN

Where:

Parameter name	Parameter description	Value range
C_SetTransponderType	Command of transponder type changing	0x02
TransponderType	Transponder type we want exchange data with	0x01 – Unique 0x02 – Q5 0x03 – HITAG 0x04 – HID
GAIN	Gain of RFID receive circuit *(recommended values 0x1 or 0x2)*	0x0-0x3

Response frame:

C_SetTransponderType +1		Operation Code

6.1.2. On/off switching of reader field

Command frame:

Header	C_TurnOnAntennaPower	State	CRC

Where:

Parameter name	Parameter description	Value range
C_TurnOnAntennaPower	On/off switching of reader field	0x10
State	On state	0x00 – switching the field off 0x01 – switching the field on

Response frame:

Header	C_TurnOnAntennaPower +1		Operation Code	CRC

6.1.3. Reading the ID card unique number

Command frame:

C_Select	

Where:

Parameter name	Parameter description	Value range
C_Select	Odczyt ID	0x12

Response frame:

C_Select +1	Coll, TType, ID1…….IDn	Operation Code

Where:

Parameter name	Parameter description	Meaning
Coll	Information on collision (HITAG transponders only)	0 – no collision 1 – collision of two or more transponders
TType	Information on transponder type, to whom the red ID number concerns	1 - Unique,Q5 3 - HITAG 4 - HID
ID1…IDn	Unique number of transponder	ID1 – LSB, IDn – MSB

6.2. Commands for communication with Q5 transponders

After selecting the type Q5 transponder with C_SetTransponderType command, we have new commands at disposal, which will be used for two-way communication.

6.2.1. Writing the ID-Unique number to Q5 transponder

Command frame:

C_UniqueWrite	Unique1..5, lock

Where:

Parameter name	Parameter description	Value range
C_UniqueWrite	Command of id-unique write	0x08
Unique1..5	5 bytes of ID number	0x00-0xff
lock	ID programming with rewrite lock	0 – without lock 1- with lock

Response frame:

C_UniqueWrite +1		Operation Code

Note: The Q5 type transponders do not have verification function of correct ID number write. Getting proper code of operation does not guarantee correct assign of ID number. Make sure, that ID number has been assigned correctly reading the number with C_Select command.

6.2.2. Reading the sector of Q5 transponder

Command frame:

C_ReadBlock	SectorNo,[Password1..4]

Where:

Parameter name	Parameter description	Value range
C_ReadBlock	Sector read command	0x1E
SectorNo	Read sector number	0x00-0x07
Password	Option –if sector which is being red is 4-byte password protected	0x00-0xff

Response frame:

C_ReadBlock +1		Operation Code

6.2.3. Writing the sector of Q5 transponder

Command frame:

C_WriteBlock	SectorNo, Data1...4, Lock,[Password1..4]

Where:

Parameter name	Parameter description	Value range
C_WriteBlock	Sector write command	0x1C
SectorNo	Write sector number	0x00-0xff
Data1..4	4 bytes of data	0x00-0x07
lock	Programming the sector with rewrite lock	0 – without lock 1- with lock
Password1..4	Option – if we want to protect a sector with 4-byte password	0x00-0xff

Response frame:

C_WriteBlock +1		Operation Code

Note: The Q5 type transponders do not have verification function of correct data write into sectors. Getting proper code of operation does not guarantee correct write. Make sure, that data has been written correctly reading it with C_ReadBlock command.

6.3. Commands for communication with HITAG transponders

6.3.1. Reading the page of HITAG transponder

Command frame:

C_ReadBlock	PageNo

Where:

Parameter name	Parameter description	Value range
C_ReadBlock	Page read command	0x1E
PageNo	Read page number	0x00-0x3f

Response frame:

C_ReadBlock +1		Operation Code

6.3.2. Writing the page to HITAG transponder

Command frame:

C_WriteBlock	PageNo, Data1...4

Where:

Parameter name	Parameter description	Value range
C_WriteBlock	Sector read command	0x1C
PageNo	Read page number	0x00-0x3f
Data1..4	4 bytes of data which is being red	0x00-0xff

Response frame:

C_WriteBlock +1		Operation Code

6.4. Reader inputs and outputs

Reader has inputs and outputs which are configurable. Inputs are controlled directly from microcontroller outputs. Output load current is up to 20 mA.

6.4.1. Writing the output state

Command frame:

C_WriteOutputs	IONo, State

Where:

Parameter name	Parameter description	Value range
C_WriteOutputs	Output state write	0x70
IONo	I/O port number. The port should be configured as an output	0x1..0x7 for UW-U4R 0x1..0xC for UW-U4G
State	Requested output state	0x00 or 0x01

Response frame:

C_WriteOutputs +1		Operation Code

6.4.2. Reading the input state

Command frame:

C_ReadInputs	IONo

Where:

Parameter name	Parameter description	Value range
C_ReadInputs	Input state reed-out	0x72
IONo	I/O port number. Should be configured as an input.	0x0..0x7 dla UW-U4R 0x0..0xC dla UW-U4G

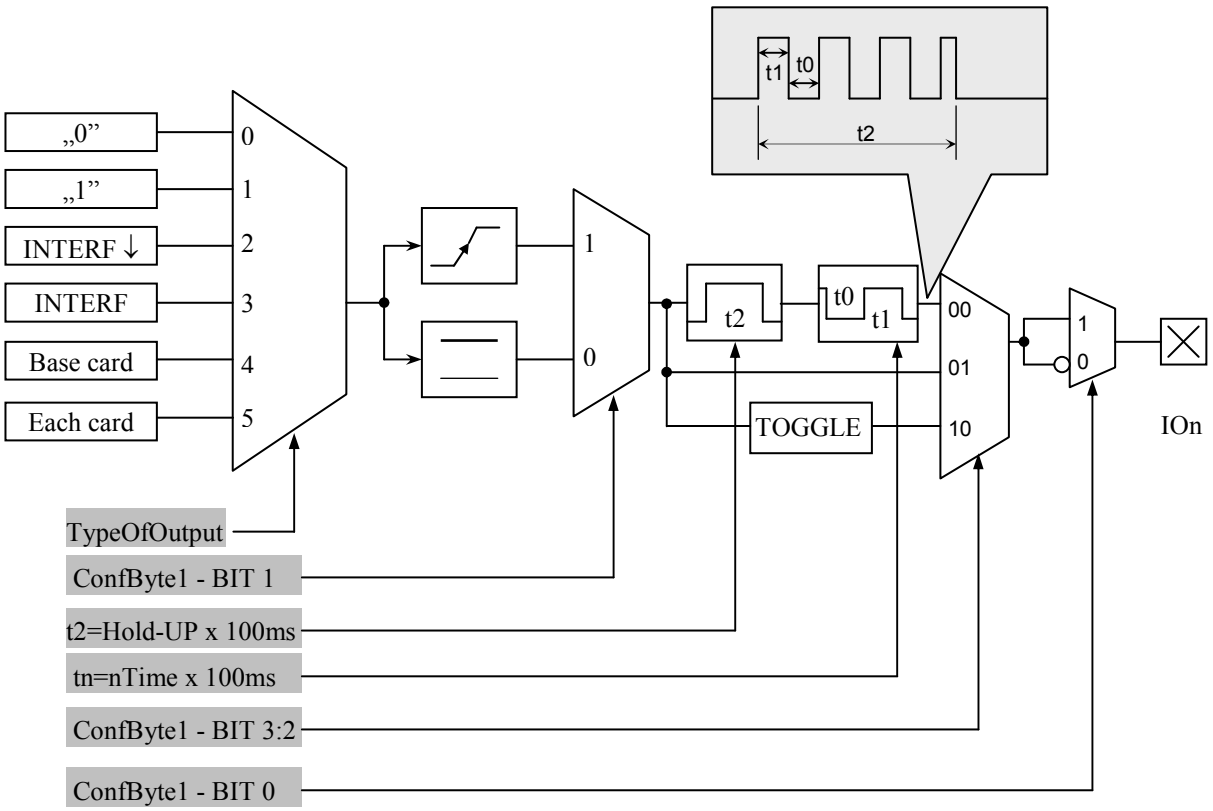
Response frame:

C_ReadInputs +1	State,[COUNTER]	Operation Code

Where:

Parameter name	Parameter description	Value range
State	Input state which has been red	
Counter	Counter state for counter type input.	

6.4.3. Writing the settings to any port



Command frame:

Header	C_SetIOConfig	IONo, IOConfigData1…n	CRC

If we set a port as output, IOConfigData1…n parameters are as below:

Dir, ConfByte1, TypeOfOutput, Hold-up, 0Time, 1Time

Where:

Parameter name	Parameter description	Value range
C_SetIOConfig	Writing the configuration of every port	0x50
IONo	I/O port number, which is to be configured	0x0..0x4
Dir	Port direction	0x00 – output
ConfByte1	One byte in which: BIT0 assigns output type as normally open or normally closed. BIT 1 determines reaction method of each output as sensitive for simulation changing (slope sensitive) or as sensitive for simulation state (state sensitive). BIT3:2 determines operation method of output referring to trigger signal state.	**ConfByte1 Bit 0** 0-Normally closed 1-Normally open **ConfByte1 Bit 1** 0-level sensitive 1-slope sensitive **ConfByte1 Bit 3:2** 00 – rectangular wave generator 01- directly 10 – output state change
TypeOfOutput	Source of driving signal	0x00 – permanently off 0x01 – permanently on 0x02 – driven via serial interface 0x03 – driven via serial with automatic reset(edge emulation) 0x04 – driven by internal access control mechanism ACM. This output is driven in case of applying the card to reader, which is written into internal card base. 0x05 – set in case of applying freely selected card to reader.
Hold-up	Time of maintaining the on state after actuation stopped. This time is specified as: Hold-up x 100 ms During “hold-up” time, it is possible to configure the output, whish is able to generate rectangular wave. By means of following parameters are configured “Logic 1” time and “Logic 0” time:	
0Time	Logic 0 time	
1Time	Logic 1 time	

If we set a port as a input, IOConfigData1…n parameters would be as below:
Dir, Triger, TypeOfInput, Delay,

Where:

Parameter name	Parameter description	Value range
C_SetIOConfig	Writing the configuration of freely selected port.	0x50
IONo	I/O port number, which is to be configured.	0x00,0x01,0x07
Dir	Port direction	0x01 – input
TypeOfInput	Input type	0x03
Delay	Delay	0x00

6.4.4. Reading-out the configuration of freely selected port

Command frame:

Header	C_GetIOConfig	IONo	CRC

Where:

Parameter name	Parameter description	Value range
C_GetIOConfig	Reading-out the configuration of freely selected port.	0x52
IONo	I/O port number, which configuration is to be red-out.	0x00…0x05

Response frame:

Header	C_GetIOConfig +1	IOConfigData1…n	OperationCode	CRC

Where:

Parameter name	Parameter description	Value range
IOConfigData1…n	This is the same, as in case of configuration write.	

Some I/O of CTU-D reader has no possibility to toggle port direction.
To accomplish proper configuration, input proper direction option to given port.

LIST OF EXISTING PORTS, WHICH CAN BE DRIVEN IN UW-M4R		
Port number	Direction	Description
0	input/output	GPIO1
1	input/output	GPIO 2
2	output	RELAY
3	output	BUZZER

Response frame:

Header	C_SetIOConfig +1		OperationCode	CRC

6.5. Access password

6.5.1. Logging to reader

Command frame:

Header	C_LoginUser	Data1…n, 0x0	CRC

Where:

Parameter name	Parameter description	Value range
C_LoginUser	Logging to reader	0xb2
Data1…n	This is any byte string	Any from range: 0x01…0xff. String length, which can be 0 to 8 bytes
0x00	Logic Zero, which terminates a string.	0x00

Response frame:

Header	C_LoginUser+1		OperationCode	CRC

6.5.2. Changing the password

Command frame:

Header	C_ChangeLoginUser	Data1…n, 0x0	CRC

Where:

Parameter name	Parameter description	Value range
C_ChangeLoginUser	Password change	0xb4
Data1…n	This is any byte string, which will form valid access password.	Any from range: 0x01…0xff. String length, which can be 0 to 8 bytes
0x00	Logic Zero, which terminates a string.	0x00

If =0x00, a reader will not be protected by password. At any moment, there is possible to set new password later on, to protect the reader by it.

Response frame:

Header	C_ChangeLoginUser+1		OperationCode	CRC

6.5.3. Logging out of the reader

This command sets latest password as an invalid.

Command frame:

Header	C_LogoutUser		CRC

Parameter name	Parameter description	Value range
C_LogoutUser	Logging out of the reader.	0xd6

Response frame:

Header	C_LogoutUser +1		OperationCode	CRC

6.6. Operating the transponder internal memory

6.6.1. Reading-out the transponder number from memory

Command frame:

Header	C_CardMemoryRead	AdrL, AdrH	CRC

Where:

Parameter name	Parameter description	Value range
C_CardMemoryRead	Read-out of transponder number from memory.	0x20
AdrL, AdrH	Younger and older byte respectively.	0x0000…0x01fd

Response frame:

Header	C_CardMemoryRead+1	ID1(L)….ID5(H), Right	OperationCode	CRC

Where:

Parameter name	Parameter description	Value range
ID1(L)….ID5(H)	Five bytes of transponder number	
Right	Access rights to given transponder	0x01

6.6.2. Writing the transponder name to memory

Command frame:

Header	C_CardMemoryWrite	AdrL, AdrH, ID1(L)….ID5(H), Right	CRC

Where:

Parameter name	Parameter description	Value range
C_CardMemoryWrite	Write of transponder number into memory.	0x22
AdrL, AdrH	Younger and older byte respectively	0x00…0x01fd
ID1(L)….ID5(H)	Five bytes of transponder number	Any of five bytes
Right	Access rights or function performed by transponder.	0x01

Response frame:

Header	C_CardMemoryWrite+1		OperationCode	CRC

Where:

6.7. Operating the built-in access control

6.7.1. Writing the configuration of access control

Command frame:

Header	C_AccesControlConfigWrite	Mode	CRC

Where:

Parameter name	Parameter description	Value range
C_AccesControlConfigWrite	Write of access control configuration.	0x74
Mode	Operation mode of control access module.	0x00 – module disabled 0x01 – module enabled

Response frame:

Header	C_AccesControlConfigWrite+1		OperationCode	CRC

6.7.2. Reading-out the configuration of access control

Command frame:

Header	C_AccesControlConfigRead		CRC

Where:

Parameter name	Parameter description	Value range
C_ AccesControlConfigRead	Read-out of access control configuration.	0x76

Response frame:

Header	C_AccesControlConfigRead+1	Mode	OperationCode	CRC

Where:

Parameter name	Parameter description	Value range
Mode	Operation mode of access control module.	0x00 – module disabled 0x01 – module enabled

6.7.3. Writing the "automatic read" configuration

This command sets operation method of automatic device, reading the unique transponder number UID.

The reader described below makes possible to hold-on operation of automatic device for a while, in case of suitable transmission via serial interface.

If the reader will operate in mixed mode i.e.:
- automatic reading device UID is enabled and:
- master device (computer, controller) communicates with reader or with transponders via reader,
it is required, to configure the reader correctly, so in case of communication with a reader or transponder, automatic reading device would hold-on its operation.

Command frame:

Header	C_SetAutoReaderConfig	ATrig, AMode, AOfflineTime, ASerial, Abuzz,Amulti	CRC

Where:

Parameter name	Parameter description	Value range
C_SetAutoReader Config	Writing the automatic device configuration.	0x58
ATrig	Defines, when automatic reading device UID will operate.	0-automatic device disabled permanently 1-automatic device enabled permanently 2=enabled automatically in case of transmission lack on interface for a time longer than AOfflineTime 3=enabled automatically, in case of no recall of communication commands with transponder for a time longer than AOfflineTime
AOfflineTime	Lack of transmission time on interface bus T= AofflineTime * [100ms] Lack of transmission can concern to any commands (Atrig=2), or commands for communication with transponder (Atrig=3).	0x00…0xff

	Commands for communication with transponder: C_TurnOnAntennaPower C_Select		
ASerial	Automatic sending the UID transponder number, after reading it automatically from transponder.	0-never 1-for the first applying the transponder only 2-sends all	
AMode	Selection the format of sending number 8 bits: MSB LSB R R H CR R E I A	R	Reserved, always 0
		CR=1	Number which is ended with line end mark CR+LF
		E=1	information extended with cards umber in filed and card type
		I=1	Number in reversed order
		A=1 H=0	Number sent in ASCII format
		A=0 H=0	Number sent in Nertonix format
		A=0 H=1	Number sent in binary format
ABuzz	Automatic indication of reading by means of buzzer, after automatic UID read-out from transponder.	0-never 1-for the first applying the transponder only 2-indicates all	
AMulti	Multi type of transponders read mode	0 – read a only selected by CSetTransponderType command trnasponder type 0xff – read all known transponder types	

Response frame:

Header	C_ SetAutoReaderConfig +1		OperationCode	CRC

6.7.4. Reading-out the configuration of automatic device

Command frame:

Header	C_ GetAutoReaderConfig		CRC

Where:

Parameter name	Parameter description	Value range
C_GetAutoReaderConfig	Read-out of automatic device configuration.	0x5a

Response frame:

Header	C_ GetAutoReader Config +1	ATrig, AOfflineTime, ASerial, Abuzz,Amulti	OperationCode	CRC

Where:
The meaning of response parameters is the same as described before.

6.7.5. Setting the date and time

Following setting has no influence for reader operation today.

Command frame:

Header	C_SetRtc	Year, Month, Day, Hour, Minute, Second	CRC

Where:

Parameter name	Parameter description	Value range
C_SetRtc	Date and time set-up	0xb8
Year	year	0…99
Month	month	1…12
Day	day	1…31
Hour	hour	0…23
Minute	minute	0…59
Second	second	0…59

Response frame:

Header	C_SetRtc +1		OperationCode	CRC

6.7.6. Reading-out the date and time

Command frame:

Header	C_GetRtc		CRC

Where:

Parameter name	Parameter description	Value range
C_GetRtc	Read-out of date and time	0xb6

Response frame:

Header	C_GetRtc+1	Year, Month, Day, Hour, Minute, Second	OperationCode	CRC

Where:
The meaning of response parameters is the same as described before.

6.8. Configuring the UART serial interface

6.8.1. Writing the configuration of serial port

Command:

	C_SetInterfaceConfig	Mode, Adr, Baudrate	

Where:

Parameter name	Parameter description	Value range
C_SetInterfaceConfig	Serial interface configuration write	0x54
Mode		0x01
Adr	Address on RS-485 bus	0x01…0xfe
Baudrate	Data baud rate on RS-485 bus	0x01=2400 bps 0x02=4800 bps 0x03=9600 bps 0x04=19200 bps 0x05=38400 bps 0x06=57600 bps 0x07=115200 bps

Response:

	C_SetInterfaceConfig +1		OperationCode	

6.8.2. Reading the configuration of serial interface

Command:

	C_ GetInterfaceConfig		

Where:

Parameter name	Parameter description	Value range
C_GetInterfaceConfig	Serial interface configuration read-out	0x56

Odpowiedź:

	C_ GetInterfaceConfig +1	Mode, Adr, Baudrate	OperationCode	

Where:

The meaning of response parameters is the same as described before.

6.9. Managing the events

The CTU-DxxM series readers has equipped with event memory of capacity 4400 records. Reason of event can be operation related to card or state changing on reader outputs. The readers does not have RTC clock with battery back-up. After supply failure, clock is reset to defaults: date: 1 January 2000, time: 00:00:00. Event counter is not reset.

6.9.1. Setting the event recorder

Command frame:

Header	C_SetEventTrig	CardTrig, IO1Trig	CRC

Wherein:

Parameter name	Parameter description	Value range
C_SetEventTrig **0x7C**	Setting the event masking	0x7C
CardTrig	Masking the events related to card (see below)	0x00 - 0xFF
In1Trig-In4Trig	Masking the events related to inputs (see below)	0x00-0xFF

Response frame:

Header	C_SetEventTrig+1		OperationCode	CRC

Masking byte of events related to card

Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
Reserve	Out of memory	Card removal	Card adding	Reserve	Master card	Outside base card	Inside base card

E.g. byte 0x25(00100101) means that events will be written in case of:

- *inside base card has been red-out,*
- *card written as master has been written,*
- *inside base card has been removed*

Masking bytes related to inputs state change

Byte	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
IO1Trig	IO[3]F	IO[3]R	IO[2]F	IO[2]R	IO[1]F	IO[1]R	IO[0]F	IO[0]R

Bits IO[n]R denote reaction to the input **n** positive slope,
Bits IO[n]F denote reaction to the input **n** negative slope

E.g. In4Trig-In1Trig configuration byte sequence: ***0x00,0x31,0x40,0x08****, causes, that events will be written in case of:*

- *Any state change of input with index 10 occurs*
- *Positive slope appears on input with index 8*
- *Positive slope appears on input with index 7*
- *Negative slope appears on input with index 1*

During configuring the event triggers, decide which port is configured as an input. Do not configure events for those I/O's, which are outputs.

To guarantee correctness of event write process, time between two subsequent triggers must be longer than 20 ms.

6.9.2. Reading the event recorder

Command frame:

Header	C_GetEventTrig		CRC

Wherein:

Parameter name	Parameter description	Value range
C_GetEventTrig **0x7E**	Reading the configuration of event recorder	0x7E

Response frame:

Header	C_GetEventTrig+1	CardTrig, In1Trig	OperationCode	CRC

6.9.3. Reading the counters related to event memory.

Command frame:

Header	C_GetEventParam		CRC

Wherein:

Parameter name	Parameter description	Value range
C_GetEventParam **0x78**	Reading the configuration of event recorder	0x78

Response frame:

Header	C_GetEvent Param+1	CapL, CapH, PointerL, PointerH,TotB3,TotB2,TotB1,TotB0	OperationCode	CRC

CapH:CapL – two-byte value, which defines event memory capacity.
PointerH:PointerL – two-byte value, which marks from first free event.
TotB3:TotB2:TotB1:TotB0 – four-byte value, which defines number of events recorded from the moment of counter reset.
Events are recorded in sequence from index 0 up to Cap-1. In the moment memory gets full, the counter is being "overturned", and older inputs are overwritten.

Example:
If using C_GetEventParam command, we have red that event memory capacity is 4400 inputs; the total value of input events is 5678. For instance, if we want to read the event with no. 5600, event index event of interest will be 5678-4400=1278.
If we want to read the last event, we can use Pointer value. The last event index will be Pointer-1.

6.9.4. Reading the events

Command frame:

Header	C_GetEvent	EvNoL, EvNoH	CRC

Wherein:

Parameter name	Parameter description	Value range
C_GetEvent **0x7a**	Reading the event	0x7a
EvNoL,EvNoH	LSB and MSB of event index	

Response frame:

Header	C_GetEvent+1	YY,MM,DD,hh,mm,ss,type, B1,B2,B3,B4,B5	OperationCode	CRC

YY,MM,DD – year, month, day of event occurrence
hh,mm,ss - hour, minute, second of event occurrence
type - event type

Depending on value “type” the 8-th bit of byte, there are distinguished two assignments:

Bit8	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1
0 – card	Out of memory	Removed	Added	reserved	Master	Outside base	Inside base
1 -inputs	reserved	reserved	reserved	N4	N2	N1	N0

N4:N0 –number of input, on which event trigger signal appeared.

- If given event was related to card, the B1-B5 bytes comprise card ID number.

B1	B2	B3	B4	B5
UID1	UID2	UID3	UID4	UID5 (Unique)

- If event is related to input change, B1-B5 bytes comprise information regarding input state, and have format:

B1				B2	B3	B4	B5
IO0	IO1	IO2	IO3	Reserved	Reserved	Reserved	Reserved

6.10. Other commands

6.10.1. Remote reset of reader

Command frame:

Header	C_Reset		CRC

Where:

Parameter name	Parameter description	Value range
C_Reset	Remote reader reset	0xd0

Response frame:

Header	C_Reset +1		OperationCode	CRC

6.10.2. Reading-out the reader software

Command frame:

Header	C_FirmwareVersion		CRC

Where:

Parameter name	Parameter description	Value range
C_FirmwareVersion	Read-out of reader software version	0xfe

Response frame:

Header	C_FirmwareVersion+1	Data1…..n	OperationCode	CRC

Where:
Data1…n is sequence of dots, which are written as an ASCII codes.

6.10.3. Change buzzer volume

Use this command to set and store setting in EEPROM memory.

Command frame:

Header	C_BuzzerConfig	volume	CRC

Gdzie:

Parameter name	Parameter description	Value range
C_BuzzerConfig		0xD8
volume	Buzzer volume value	0x00-0x0a

Response frame:

Header	C_BuzzerConfig+1		OperationCode	CRC

6.11. Code meanings in response frames

Operation code name	Description	Value
OC_Error	Error	0x00
OC_ParityError	Parity error	0x01
OC_RangeError	Parameter range error	0x02
OC_LengthError	Data quantity error	0x03
OC_ParameterError	Parameter error	0x04
OC_Busy	Internal modules are busy at the moment.	0x05
OC_NoACKFromSlave	No internal communication	0x22
OC_CommandUnknown	Unknown command	0x07
OC_WrongPassword	Wrong password or last password terminated i.e. automatic LogOut occurred.	0x09
OC_NoCard	No transponder	0x0a
OC_BadFormat	Wrong data format.	0x18
OC_FrameError	Transmission error. Noise occurrence possible.	0x19
OC_NoAnswer	No response from transponder.	0x1E
OC_TimeOut	Operation time out. No transponder in reader field possible.	0x16
OC_Successful	Operation completed successfully.	0xff

7. Mechanism of Master ID

Master ID mechanism is based on principle the quick adding/removing of user card to/out of reader memory by means of „master card".

If you want to register a card as a „master card", it is required to clear card memory first by means of reset function to factory defaults.
After clearing the memory, apply selected card to module, whenever you like. This moment, the card becomes "master card". It is impossible to remove or add the master card by means of other card.

If you want to register a card as a "user card", apply "master card" to reader first, and next during five seconds, apply registered card.

If you want to remove "user card" from memory, apply "master card" to reader first, and next during five seconds apply card which is being removed.

After applying to a reader the "user card", the reader enables electric output, which has been programmed as a controlled by internal access control mechanism.

8. Reset to default settings

To restore default settings, connect reset terminal with ground for 2 s or longer. During restoring the defaults following reader parameters are fixed:

Parameter name or functionality	Value or setting
Address on serial bus	0x01
Baud rate on serial bus	9600 bps
Access password	0x0 - no password
Port 0	Common purpose input
Port 1	Common purpose input
Port 2	lock “on” indication
Port 3	lock “on” indication
Gain of RFID receive circuit	1
“Autoreader” configuration	0x2,0x14,0x1,0x1,0x01,0xff
Transponder type	Unique
Whole internal memory of transponders with Master card	0xff 0xff 0xff 0xff 0xff means “memory cleared”

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