

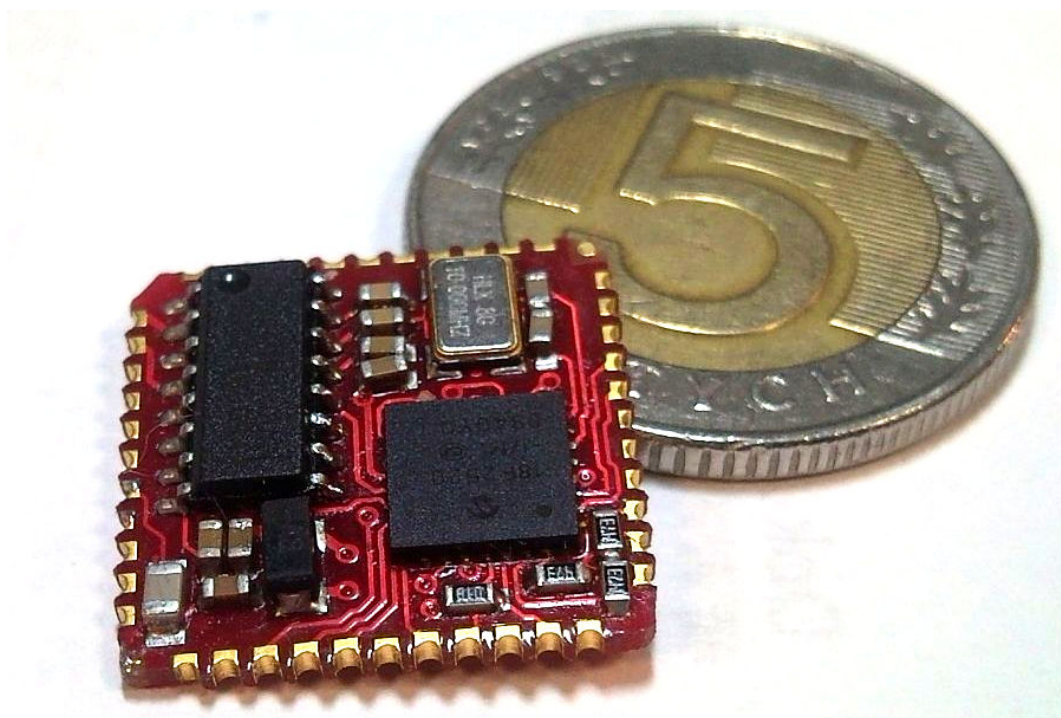


Technical Data Sheet

RFID reader

NANO-UP NANO-US

NANO-U-man-eng-v6
For firmware version V10 or higher



NANO-US

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1 . Introduction

NANO-U device 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,
- RS232 (TTL) interface with RS485 bus transmitter/receiver control output,
- Addressability on bus in RS-485 mode,
- I²C interface,
- SPI interface,
- 1WIRE (Dallas DS1990) interface,
- Interface WIEGAND,
- Signal terminal for reset to factory defaults,
- Anticollision output for multiple readers operating in proximity,
- Low current consumption,
- standby mode,
- 5 configurable inputs/outputs,
- 2-state output control,
- Read-out of 2-state inputs,
- Data password protected,
- Small dimensions 17,5 x 17,5 x 3mm,
- Software update via RS-232 interface using *NEFIR* program.

Reader is available in two versions depending on assembly method:

- NANO-US – version for surface mounting (SMD)
- NANO-UP – version for through-hole mounting (THT)

2 . Specifications

Transponder operate frequency	120 to 130 kHz
Supported transponder type	Unique, Q5, HID, Hitag-1, Hitag-S
Approximate maximal communication range with transponders (using ø 50 mm antenna)	Unique, Q5 – 12 cm HID – 8.5 cm Hitag – 13 cm
Module supply voltage	5 V ±10%
Operating temperature	-20°C to +70°C
Current consumption: - in „autoreader” mode - during field switch-off - during field switch-on - in standby mode	35 mA 12 mA up to 100 mA – depending on antenna used 1 µA
Supported two-way interfaces:	- TTL RS232 version with terminal controlling RS485 driver - SPI - I ² C
Supported one-way interfaces:	- 1WIRE (DS1990 pill emulation) - WIEGAND
Common purpose inputs/outputs	5 configurable inputs/outputs
Dimensions	17.5 x 17.5 x 3 mm

Supported functionality depending o transponder / card type:

Transponder type	ID number read-out	Full write/read of memory blocs	Write/read using encryption
Unique	YES	-	-
Q5	YES	YES	-
HID	YES	-	-
HITAG	YES	YES	NO

3. Terminal description

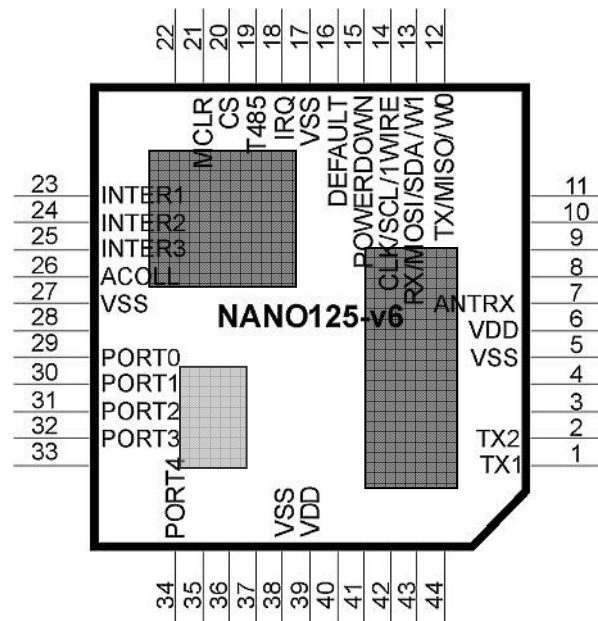


Fig. 1

No.	Label	Description
1	TX1	Antenna 1 output
2	TX2	Antenna 2 output
5	VSS	Ground of module supply
6	VDD	Plus of supply voltage of the module
7	ANTRX	Return signal from antenna
12	TX/MISO/W0	TX(data out) for RS232, MISO(data out) for SPI, '0' for Wiegand
13	RX/MOSI/SDA/W1	RX(data in) for RS232, MOSI(data in) for SPI, '1' for Wiegand
14	CLK/SCL/1WIRE	CLK signal for SPI bus, SCL signal for I ² C bus, 1WIRE pin
15	/POWERDOWN	Applying logical zero makes the module go to standby mode. If module enters stand-by mode by means C_Sleep command, positive slope wakes the module up.
16	/DEFAULT	Applying logical zero for time 2 sec. or longer makes NANO module return to default settings
17	VSS	Ground of module supply
18	/IRQ	Interrupt output – currently not used
19	T485	Transmit/receive switching output for RS485 interface transceiver
20	/CS	Chip select input for SPI bus
21	/MLCR	Input of hardware reset of NANO module – currently not used
23	INTER1	Communication interface select, see diagrams below
24	INTER2	
25	INTER3	
26	/ACOLL	Field switch on synchronization input for multiple readers operating in proximity
27	VSS	Ground of module supply
29	PORT0	Input/output port of common purpose
30	PORT1	Input/output port of common purpose
31	PORT2	Input/output port of common purpose
32	PORT3	Input/output port of common purpose
34	PORT4	Input/output port of common purpose
38	VSS	Ground of module supply
39	VDD	Plus of supply voltage of the module

4 . Interface selection, hardware configuration

4 . 1 . Configuring inputs of interface select

INTER1	INTER2	INTER3	Interface type	Default settings of interface
1	1	1	RS232	9600 bps, 8, N, 1
1	1	0	I ² C	Address 0xC0, fclk: 400 kHz
0	1	0	I ² C	Address 0xC2, fclk: 400 kHz
1	0	1	SPI	Fclk: 400kHz
0	1	1	DALLAS	Address: 0x01, family code: 0x01
0	0	1	WIEGAND	37 bits

‘1’ – logic ‘1’ - connected to +5 V

„0” – connected to GND

4 . 2 . Selecting external elements of antenna

It is recommended that transmit/receive antenna inductance to be 0.5 mH to 1 mH. Inductance L with capacitor C used should form resonance circuit for 125 kHz frequency. Resistance R sets the antenna quality which should be 10 to 15. Be sure to use a capacitor with properly high voltage higher than 100 V.

For instance, for antenna of 1 mH inductance, a capacitance of C should be approximately 1,62 nF (1.5 nF 2% + 120 pF). Resistance R should be ca. 68 Ω. The capacitance of C can be found by applying the formula:

$$C_{RES} = \frac{1}{(2\pi f_0)^2 L_A}$$

4.3. Application diagrams

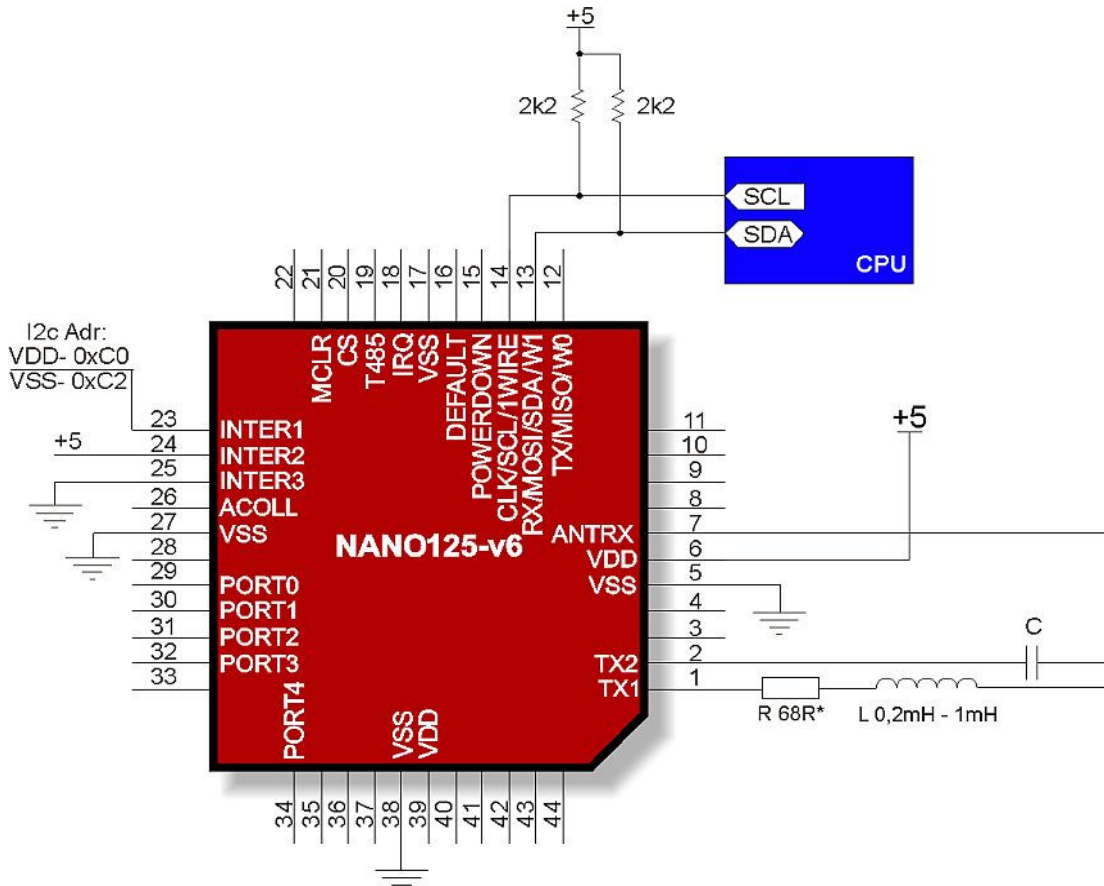


Fig. 2 Minimal configuration for I²C interface

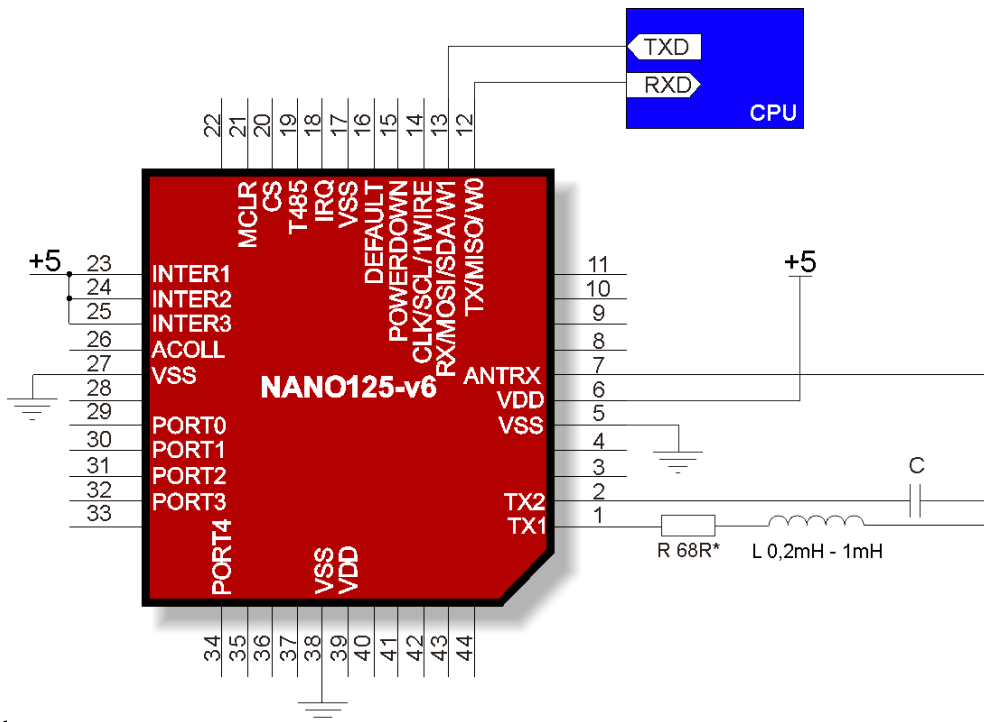


Fig. 3 Minimal configuration for RS232 interface

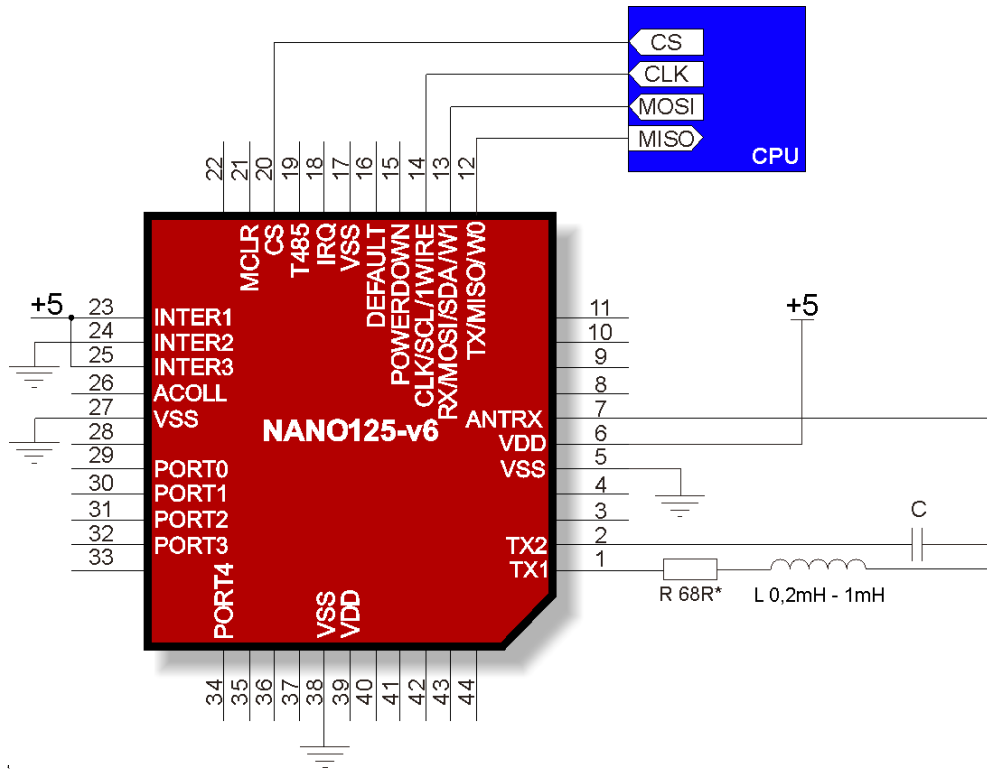


Fig. 4 Minimal configuration for SPI interface

5. Transmission protocols

5.1. RS232 transmission protocol

In this data sheet RS-232 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”.

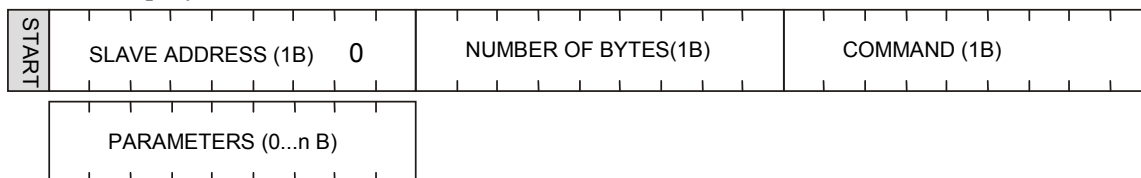
5.2. Protocol for I²C transmission

5.2.1. Data exchange algorithm

A module configured depending on diagram showed on Fig. 2 operates in I²C interface mode in following sequences:

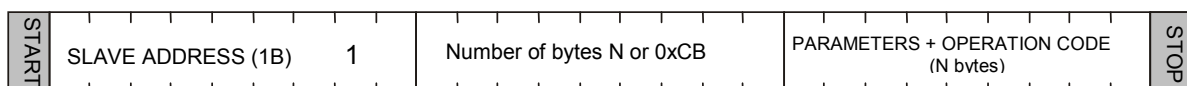
1. Master (external device) writes command with parameters if nessesery into slave device (NANO module)
2. The command is performed (immediatly after receiving byte sent quantity declared in frame)
3. Master device reads response, its parameters and operation code. In case of receiving busy byte 0xCB, 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).

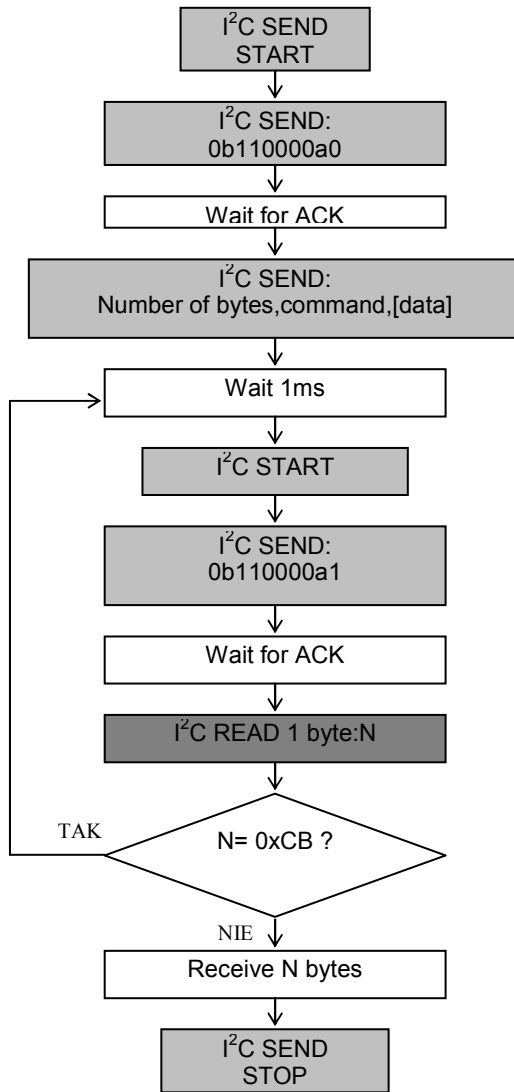
We write inquiry-command to NANO module:



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

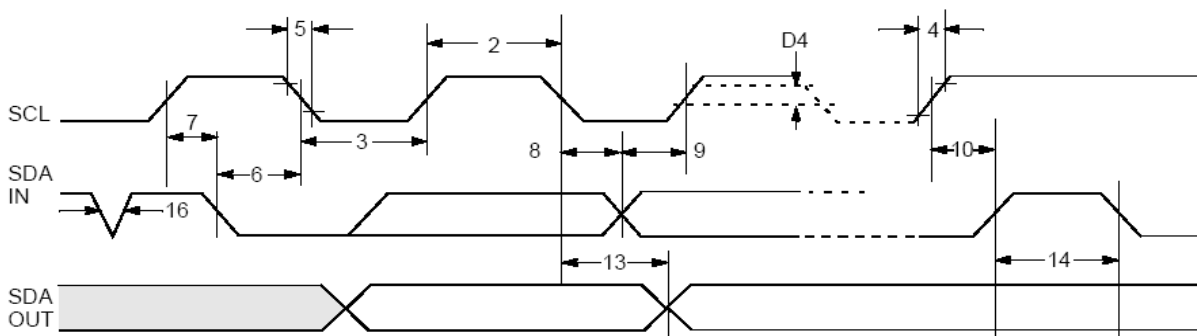
We have then:





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 V_{IH} Minimum to V_{IL} 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.

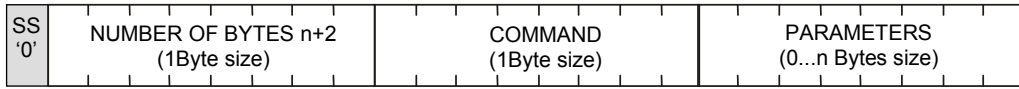
5.3. SPI transmission protocol

5.3.1. Data exchange algorithm

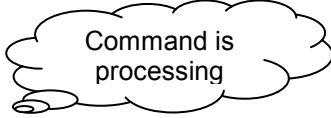
A module configured depending on diagram showed on Fig. 4 operates in SPI interface mode in following sequences:

1. SS pin goes low.
2. Master device sends a command with parameters to slave (NANO) device.
3. Commands is executing
4. NANO module is ready to response, when MISO line is on LOW level. MISO level test should be perform at least after 200us from end of command sending.
5. Master reads data and operation code from NANO,
6. SS pin goes high.

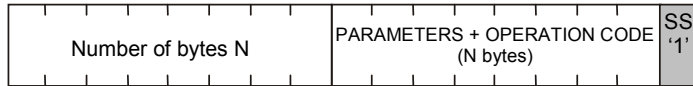
master->slave direction



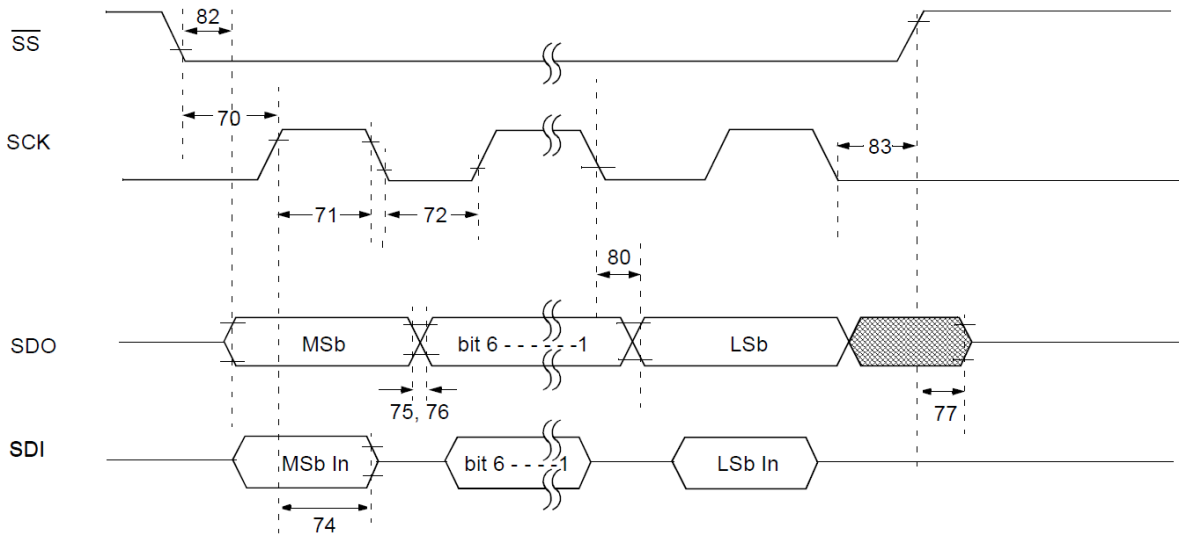
1. Wait 200µs
2. Wait for MISO 'low'



Slave->master



5.3.2. SPI Timings



Param No.	Symbol	Characteristic	Min	Max	Units	
70	TssL2scH, TssL2scL	\overline{SS} ↓ to SCK ↓ or SCK ↑ Input	Tcy	—	ns	
71 71A	TscH	SCK Input High Time (Slave mode)	Continuous Single Byte	1.25 Tcy + 30 40	— —	ns ns
72 72A	TscL	SCK Input Low Time (Slave mode)	Continuous Single Byte	1.25 Tcy + 30 40	— —	ns ns
73A	Tb2b	Last Clock Edge of Byte 1 to the First Clock Edge of Byte 2	1.5 Tcy + 40	—	ns	
74	Tsch2diL, TscL2diL	Hold Time of SDI Data Input to SCK Edge	100	—	ns	
75	TdoR	SDO Data Output Rise Time	XXXX	—	25	ns
76	TdoF	SDO Data Output Fall Time	—	25	ns	
77	TssH2doZ	\overline{SS} ↑ to SDO Output High-Impedance	10	50	ns	
78	TscR	SCK Output Rise Time (Master mode)	XXXX	—	25	ns
79	TscF	SCK Output Fall Time (Master mode)	—	25	ns	
80	Tsch2doV, TscL2doV	SDO Data Output Valid after SCK Edge	XXXX	—	50	ns
82	TssL2doV	SDO Data Output Valid after \overline{SS} ↓ Edge	XXXX	—	50	ns
83	Tsch2ssH, TscL2ssH	\overline{SS} ↑ after SCK Edge	1.5 Tcy + 40	—	ns	

Tcy = 150ns

5.4. 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

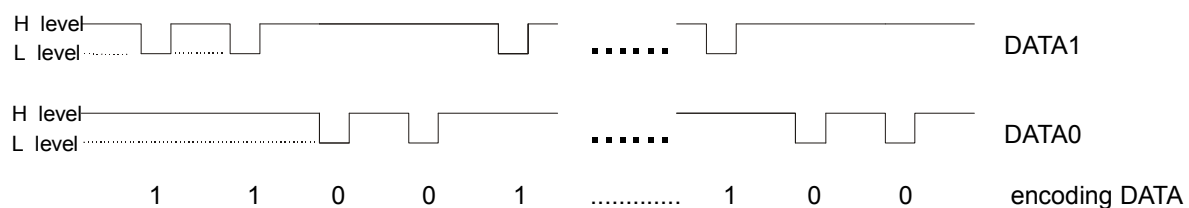
```
unsigned char CalcCRCDallas(unsigned char *SourceAdr)
{
  unsigned char i,k,In,CRC=0;
  for(i=0;i<7;i++)
  {
    In=*SourceAdr;
    for(k=0;k<8;k++)
    {
      if((In^CRC)&1) CRC=((CRC^0x18)>>1)|0x80;
      else CRC=CRC>>1;
      In>>=1;
    }
    SourceAdr++;
  }
  return(CRC);
}
```

where *SourceAdr is beginning flag of data buffer

5.5. 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.



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		OperationCode
-------------------------	--	---------------

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		OperationCode	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	OperationCode
-------------	--------------------------	---------------

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		OperationCode
------------------	--	---------------

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 read is 4-byte password protected	0x00-0xff

Response frame:

C_ReadBlock +1		OperationCode
----------------	--	---------------

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		OperationCode
-----------------	--	---------------

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		OperationCode
----------------	--	---------------

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		OperationCode
-----------------	--	---------------

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	0x0..0x4
State	Requested output state	0x00 or 0x01

Response frame:

C_WriteOutputs +1		OperationCode
-------------------	--	---------------

6.4.2. Reading the input state

Command frame:

C_ReadInputs	IONo
--------------	------

Where:

Parameter name	Parameter description	Value range
C_ReadInputs	Input state read-out	0x72
IONo	I/O port number. Should be configured as an input.	0x0..0x4

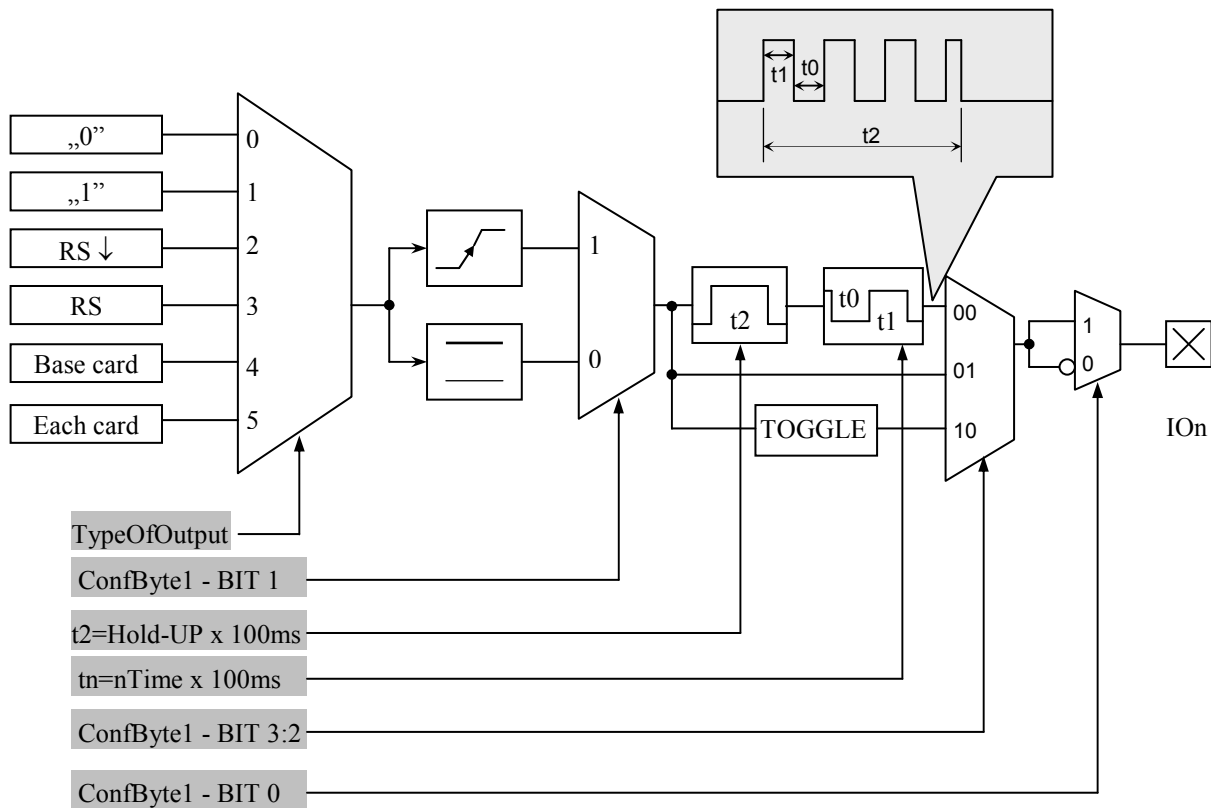
Response frame:

C_ReadInputs +1	State,[COUNTER]	OperationCode
-----------------	-----------------	---------------

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).	ConfByte1 Bit 0 0-Normally closed 1-Normally open ConfByte1 Bit 1 0-level sensitive 1-slope sensitive

BIT3:2 determines operation method of output referring to trigger signal state.		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 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, which 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 an 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.	0x00-0x04
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...0x04

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.	

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
--------	-----------------	---------------	-----

6.5.4. Writing the “automatic read” configuration

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

Because of high security level provided by Milfare transponders, there is no possibility of operation of UID reading automatic device and communication with transponders via RS-485 simultaneously.

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, RFU,AMulti	CRC
--------	-----------------------	---	-----

Where:

Parameter name	Parameter description	Value range
C_SetAutoReaderConfig	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 RS485 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 RS485 bus $T = AofflineTime * [100ms]$ Lack of transmission can concern to any commands (Atrig=2), or commands for communication with transponder (Atrig=3). Commands for communication with transponder: C_TurnOnAntennaPower C_Select	0x00...0xff
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 R CR M E I A	R Reserved, always 0
		CR=1 Number which is ended with line end mark CR+LF
		M=1 Number which begins with "M" sign
		E=1 information extended with cards number in filed and card type (UW-M4x readers only)
		I=1 Number in reversed order
		A=1 Number sent in ASCII format
		A=0 Number sent in Nertonix format
RFU	reserved	0
AMulti	Transponder(s) selection MSB LSB R R R HID Ht U x x	R HID=1 Ht=1 U=1 X
		Reserved, always 0 HID Transponder HITAG-1/S Transponder Uniqe/Q5 Transponder always 0

Response frame:

Header	C_SetAutoReaderConfig+1	OperationCode	CRC
--------	-------------------------	---------------	-----

6.5.5. 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_GetAutoReaderConfig+1	ATrig, AOfflineTime, ASerial, ABuzz	OperationCode	CRC
--------	-------------------------	-------------------------------------	---------------	-----

Where:

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

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
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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
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Where:

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

6.7.3. 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
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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
--------	-------------	---------------	-----

6.7.4. 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	
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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		
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Where:

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

Odpowiedź:

	C_GetInterfaceConfig +1	Mode, Adr, Baudrate	OperationCode	
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Where:

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

6.9. Other commands

6.9.1. Remote reset of reader

Command frame:

Header	C_Reset		CRC
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Where:

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

Response frame:

Header	C_Reset +1	KodOperacji	CRC

6.9.2. Sleep mode

This commands set a module into sleep mode. Depending on communication interface used, there are various methods of awaking, and then:

- For RS232 interface, awaking will occur, after positive slope is applied to /POWERDOWN terminal
- For I²C interface, awaking will occur, after sending the byte with proper number of SLAVE device. After this byte, awaking process begins which lasts 2 ms. Sending the subsequent data to NANO module should occur after this time elapses. Applying positive slope to /POWERDOWN terminal also causes a device to leave sleep mode.
- For SPI interface, awaking will occur, after receiving of one complete byte. After that, next data sending is allowed, after awaking process is completed, i.e. after 2 ms.

Command frame:

C_Sleep	
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Where:

Parameter name	Parameter description	Value range
C_Sleep	Entering sleep mode	0xda

Response frame:

C_Sleep +1		OperationCode
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6.9.3. 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	KodOperacji	CRC

Where:

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

6.10. 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“. To use this feature, access control module must be turned on.

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.

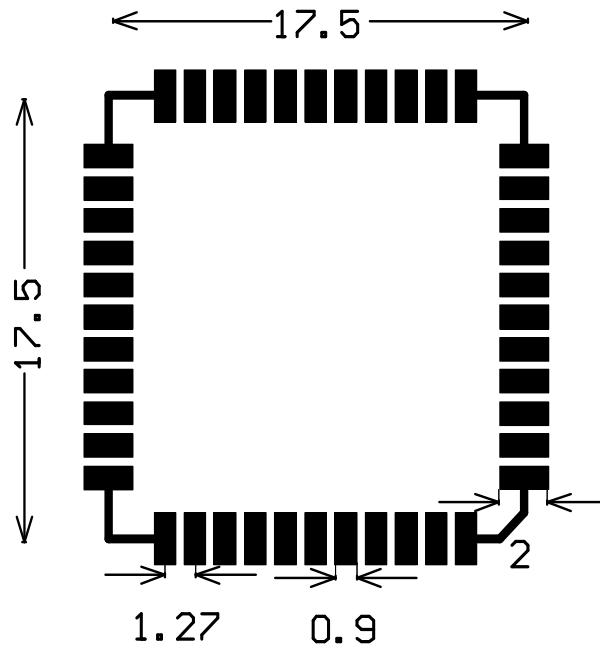
After applying to a reader the “user card“, the reader enables electric output, which has been programmed as a controlled by internal access control mechanism.

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	Common purpose input
Port 3	Output indicating card detect
Port 4	Common purpose input
Gain of RFID receive circuit	1
“Autoreader” configuration	0x2,0x14,0x1,0x1,0xff
Transponder type	Unique

9 . Footprint proposed for NANO module.



Footprint dimensions recommended for SMD NANO-US version of the module

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