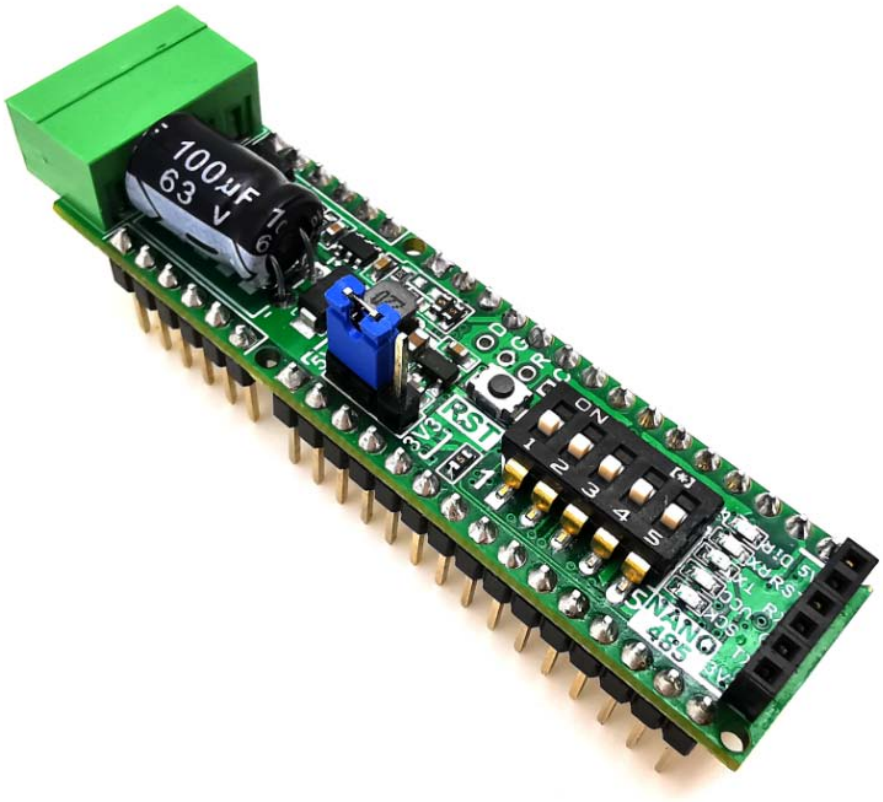
1 Summary

The Massduino Nano485 is a module which combined microcontroller MD-3248P and RS-485 interface, a onboard DC/DC with input DC voltage up to 48V, the module can be supply power by RS-485 bus, and output 5V and 3.3V 500mA to peripheral circuit.



NANO485 inherits the pin assignment of the standard Massduino NANO and expands more IO pins, so the NANO485 is slightly longer than the standard Massduino NANO.

The MD-3248P is highly compatible with the ATMega328P, but with more IO pins, you can use the MD-32848P just like you would with UNO.

To use NANO485 smoothly, please download the Arduino development extension package at the following URL: http://www.inhaos.com/downcount.php?download_id=218

Features:

- **Compact size:**. 64x18mm (Standard Massduino NANO size is 45x18mm)
- **Easy to use:** Programming with Arduino IDE.
- **Stable design:** Industrial level RS-485 protection design.
- **Strong compatibility:** Compatible with existing Arduino Shielding board, realize various functions .
- **Onboard DC/DC:** Onboard DC2CD, input 8~48V, output 5V/3.3V 500mA to peripheral circuit.
- **Onboard address coder:** 5bit onboard address coder, easy networking.
- **Easy to upload firmware:** Device can be upload firmware via Arduino IDE or via RS-485 bus.

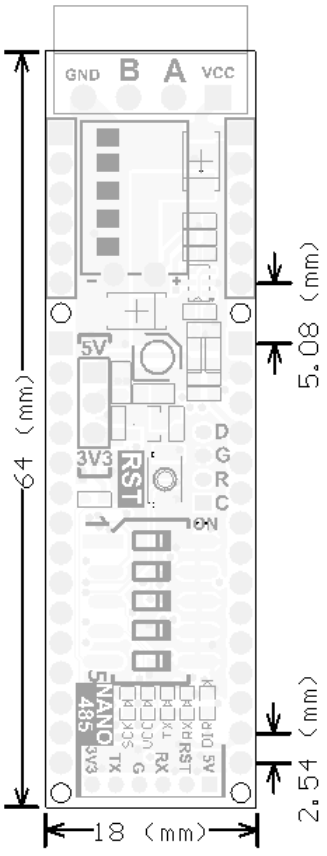
2 Parameters

Microcontroller:	MD-3248P TQFP48
Operation Voltage:	3.3V/5V (VIN 12 to 48V)
Input voltage:	Bus powered 8~48V
Total connector pins:	42Pins
Flash:	32 Kbytes
SRAM:	2 Kbytes
Clock Speed:	16 MHz
Number of PIOs:	22(Compatible with standard Massduino NANO) + 8 (extended)
RS-485 interface:	1 ch
Arduino Support package:	http://www.inhaos.com/downcount.php?download_id=218

3 Pin Description

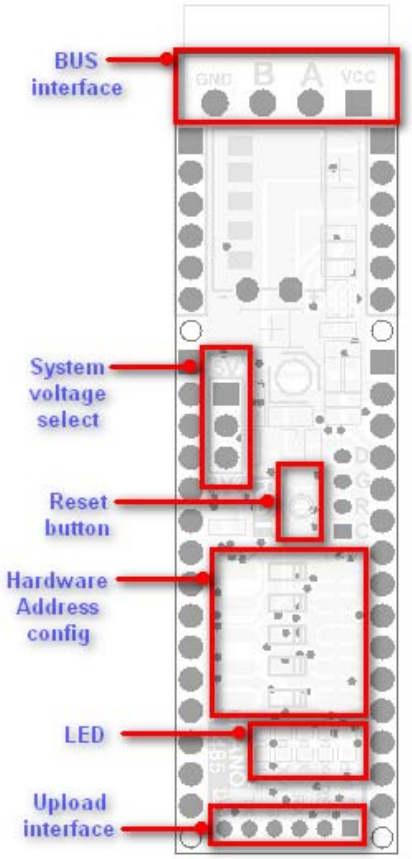
< TOP VIEW >

Fun	No.	Pin	Pin	No.	Fun
485-A		31	42		VIN
485-B		32	41		DGND
OC3A	D33	33	40	D23	A8
OC3B	D34	34	39	D35	
OC1A	D37	35	38	D38	OC2A
OC1B	D36	36	37	D39	OC2B
TX	D1	1	30		VIN
RX	D0	2	29		GND
RESET		3	28		RESET
GND		4	27		+5V
	D2	5	26	D21	A7
	D3	6	25	D20	A6
	D4	7	24	D19	A5
	D5	8	23	D18	A4
	D6	9	22	D17	A3
	D7	10	21	D16	A2
	D8	11	20	D15	A1
	D9	12	19	D14	A0
	D10	13	18		AREF
MOSI	D11	14	17		+3.3V
MISO	D12	15	16	D13	SCK



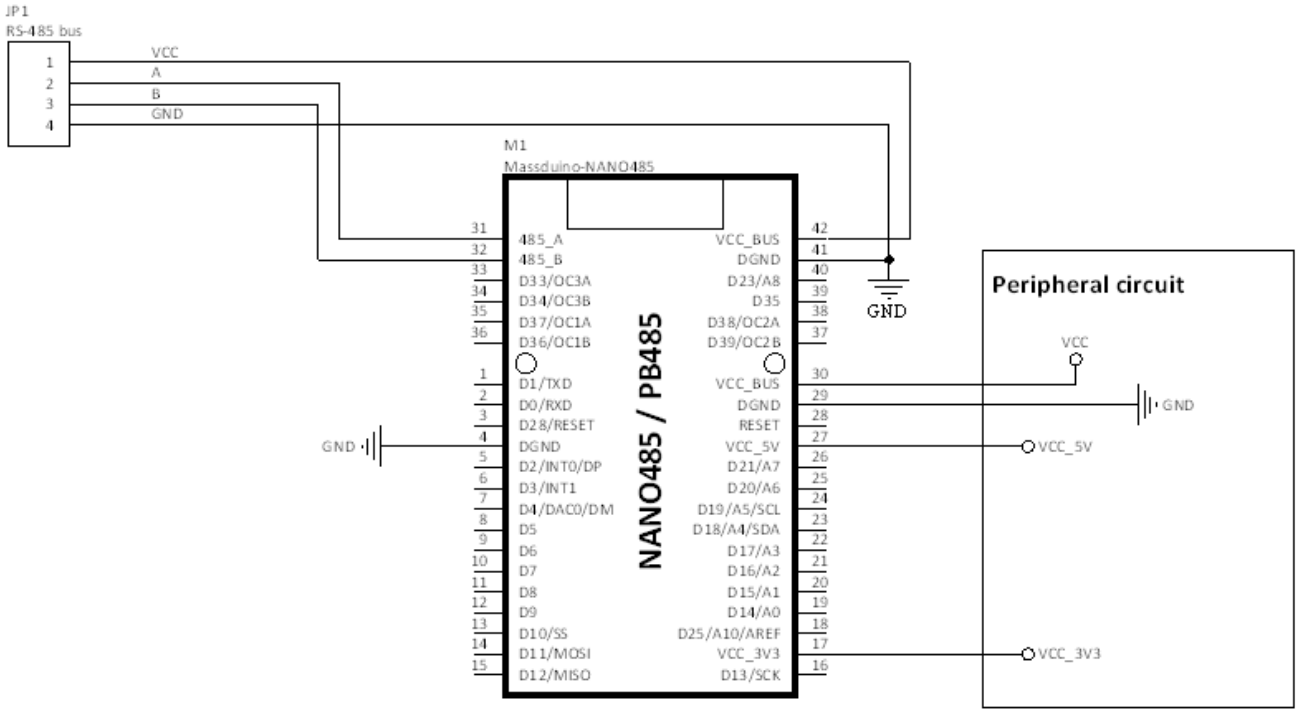
Onboard resource:

- The VIN (Pin 30 and Pin42) and VCC of the bus interface are internal connected.
- The module can be output both 5V and 3.3V, and the total current should be limit to 500mA
- Pin1 to Pin30 is compatible with standard Arduino Nano, the Pin31 to Pin42 is additional parts.
- The module can be work under 5V or 3.3V, the system voltage is selectable by a jumper, the jumper must install on the pin.
- Onboard 5 bits of hardware address coder, for easy to address the device when bus applied.
- Onboard LED: SCK(D13)/VCC/TX/RX/Bus Direct
- **The module can be upgrade firmware by two method:**
  - Upload by UART interface in Arduino IDE
  - Upload by RS-485 bus

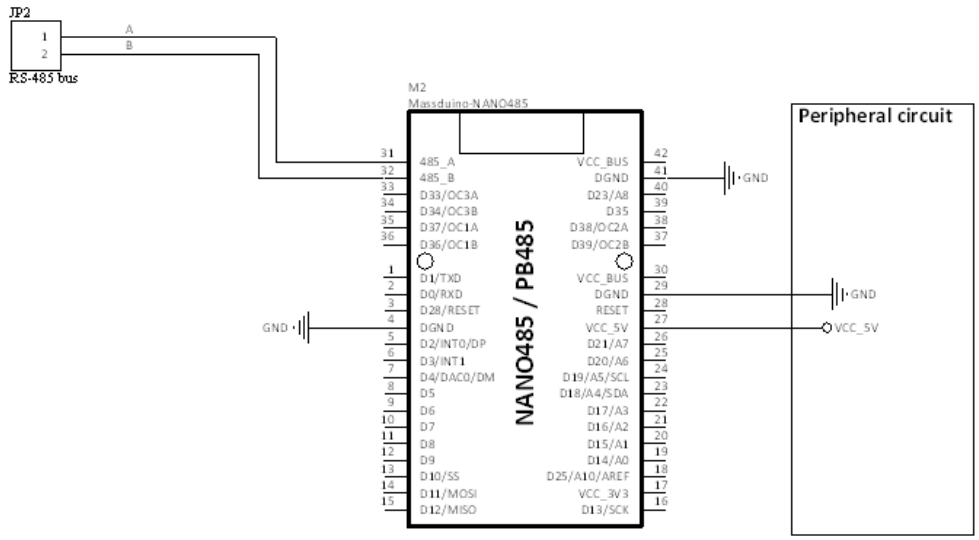


4 Typical application

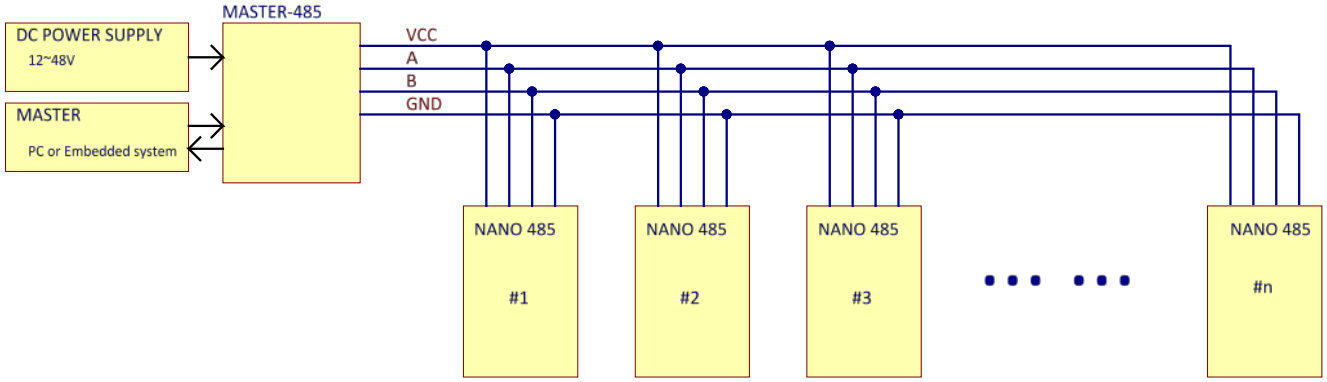
Power Connection 1: Bus Powered Mode:



Power Connection 2: Ext Vcc Mode:



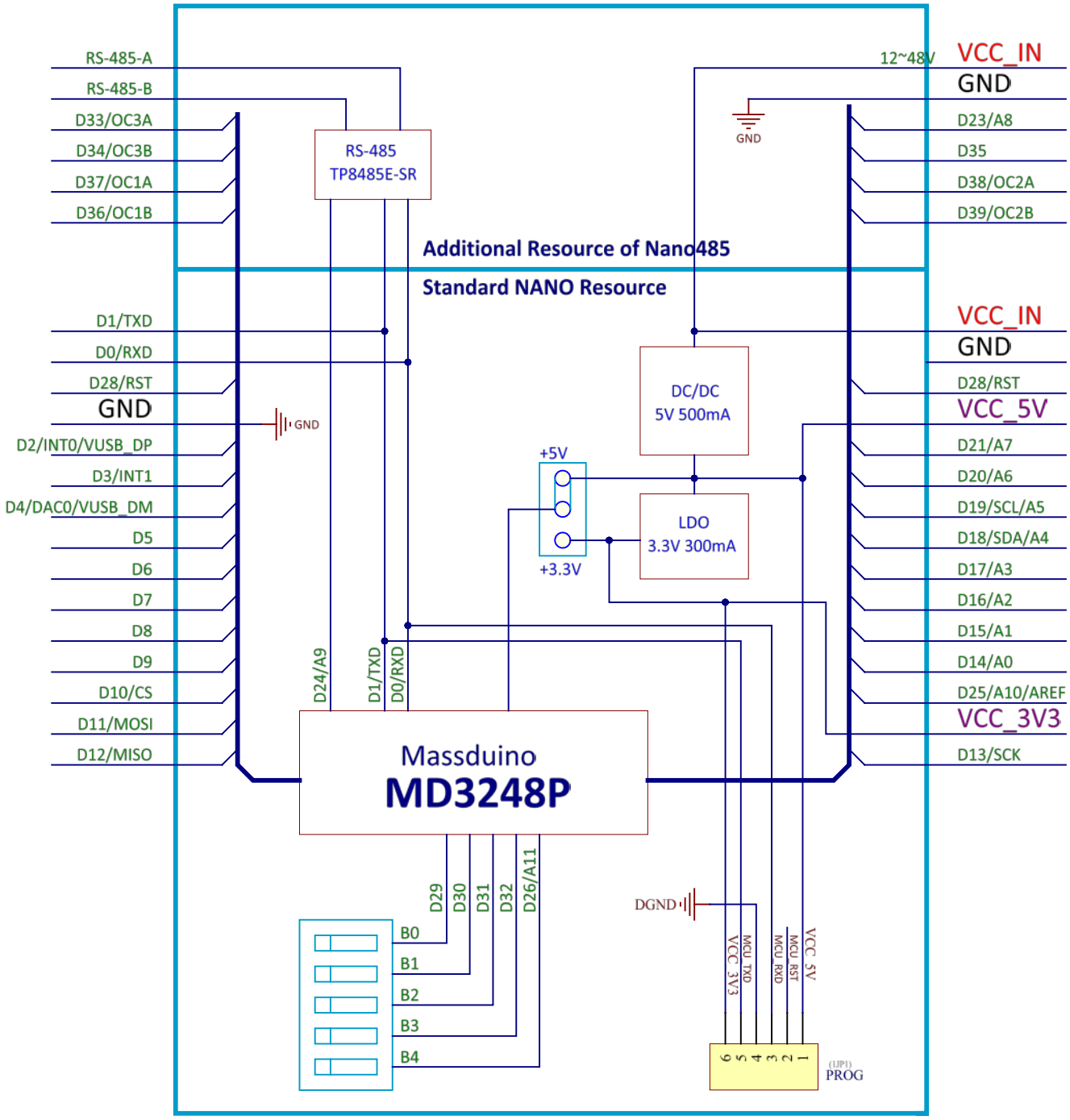
Network:



NOTE:

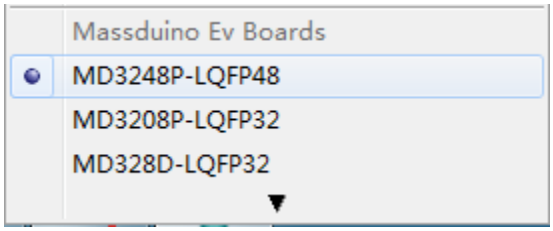
- In bus powered mode, the VCC_Bus OUT is limit to 2A
- The module can be output a 5V and 3.3V to peripheral circuit, the total current must limit in 500mA

5 Hardware block diagram



6 Programming Nano485

When programming NANO485, you need to download Arduino - **MassDuino_Support_Package** by this link: http://www.inhaos.com/downcount.php?download_id=218, then select device: "MD-3248P-LQFP48"



6.1 Feature of Massduino MD-3248P chip

MD-3248P is highly compatible with ATMega328P, and add some feature, to use those feature, please refer this document: UM-MASSDUINO-V4.6r2-EN: http://www.inhaos.com/downcount.php?download_id=245

6.2 Hardware address

Nano485 has onboard 5bit coder, user can use it easy to setup the hardware address, the 5bit can be set max32 address, this should be enough for most application, by the way, the Nano485 support max 128 device in one network.

The coder connection is below:

Coder b0: D29
Coder b1: D30
Coder b2: D31
Coder b3: D32
Coder b4: D26

User need set those IO to input pull up mode and read the pin value to calculate the hardware address.

6.3 EEPROM usage

User can write some information to EEPROM, and this information will show in Massduino NANO485 Loader device list. User must follow below rules:

- There have total 1K bytes (1024bytes) of EEPROM can be use in MD-3248P
- The address range is 0 to 1023
- Address 1016 ~ 1023 is reserved, DO NOT USE IN USER's CODE.
- Address 1000 ~ 1015 is used to save model number, user can be write the device model number to this range (Length limit in 16bytes, must ASCII character)
- Address 0 ~ 999 is used for user's application , total 1000 bytes
- Please notes, the EEPROM have write life limit, do not write the EEPROM too frequently

6.4 RS-485 communication

RS-485 programming is very simple, you can use it like UART but need to add TX/RX control, the TX/RX control pin is D24.

Before sent data, you need to pull high the D24 and then sent data, Please notice there need a little bit delay to wait UART hardware to finish the transmit, use "`Serial.flush()`" to wait data transmit, then pull low the D24 pin.

Please notice the RS-485 communication is half duplex communication, Can only be in either RX or TX status at

any time, in most time, the device should be stay in RX mode.

For network, one master will be communication to multi slave, whatever in a same time only allow one device (Master or Slave) sent data, and all device will be received the data, so here need a hardware address to identify information. To make programming simple, you can adopt polling communication mechanism.

In polling communication mechanism, Master will be scheduling all communication event, we assume here have 5 slave in the network, first master will be ask device 1, and device 1 need to reply to master and other device must keep stillness, then master going to ask device 2, device 3 …, followed by cycle .if one unit have data need send to master, just wait master to ask , and then include the data into the reply packet and sent to the master.

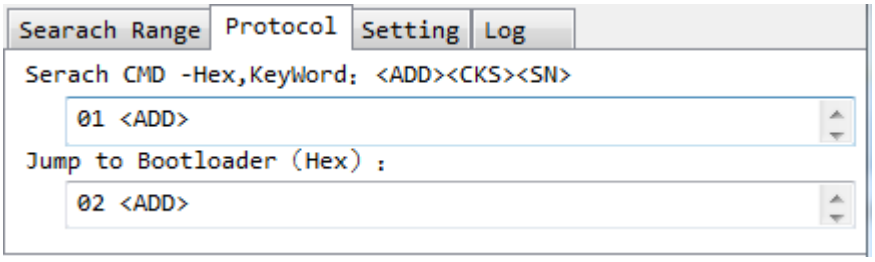
6.5 "Serach" and "Jump" command support

The Nano485 have two data area, bootloader and app area, usually the device run at app area, if user want to upgrade firmware, user can use Massduino Nano485 Loader to do it.

In the first, Nano485 Loader will be sent a "Search" command, this command is defined by user, and it's must include a hardware address byte, once device received the search command, it will return a model number to the loader, the model number will be shown on the device list table.

Loader need some time to search all device, after all device appeared in the device list, user can start download, the loader will sent a "Jump to bootlaoder" command, device received this command, then jump to bootloader, and then Loader will sent hex data to Nano485, Until the bootload succeed.

The "Serach" and "Jump" command is support Hex data format only, and the format is defined by user, here is the keyword which user maybe need:



<ADD> : it's the hardware address which set by 5bit coder, range 0 to 31, Hex range is 0x00 to 0x1F.
<CKS> : it's the check sum of the package.
<SN> : it's a number which will automatic increase by 1 each package.

The CKS function is :

VB Code

```
Private Function CalcCheckSum(ByVal buf() As Byte, ByVal len As UInt16) As Byte
        Dim sum As Int16 = 0
        Dim i As UInt16 = 0
        Dim retByte As Byte

        For i = 0 To len - 1
            sum += buf(i)
            sum = sum And &HFF
```

```
        Next

        retByte = (Not sum) And &HFF

        Return retByte
End Function
```

//C++ code

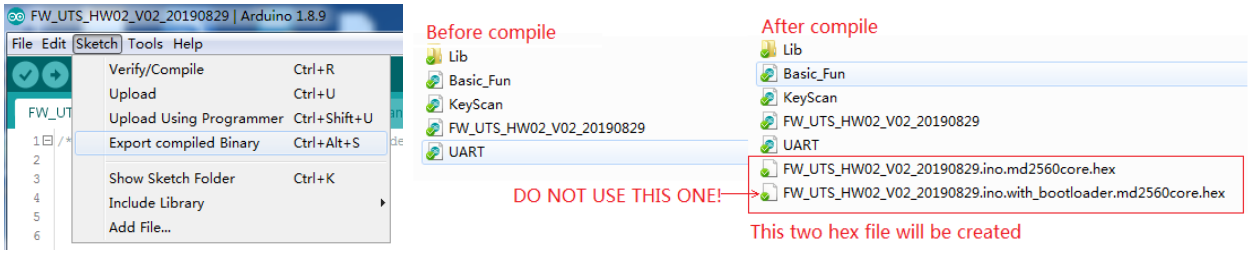
```
u8 Uart_CheckSum(u8 * buffer, u8 len)
{
    if (buffer == NULL)
        return NULL;

    u8 i=0;
    u8 sum = 0;

    while(len--)
    {
        sum += buffer[i];
        i++;
    }
    return (~sum);
}
```

6.6 Export compiled binary file

Usually the arduino IDE will not output a hex file in source code folder, in our application, user must get the hex file for Nano485 Loader. To get the hex file, please click menu “Sketch” – “Export compiled Binary”:



As we can see, there have two hex file are created in user code’s folder, one name is “with_bootloader”, please remember DO NOT USE THIS ONE for Nano485 loader.

6.7 Upload sketch by Arduino IDE

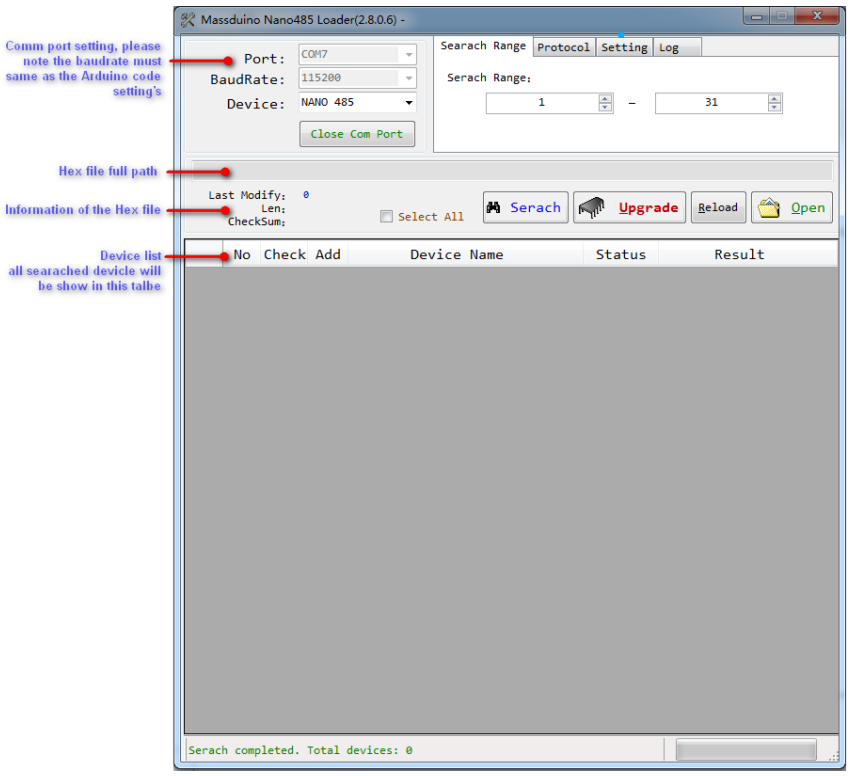
After code finished, you can download the sketch by Arduino as all standard arduino device.

Here you will be beed a USB to serial convertor, please reference below document:

6.8 Massduino Nano485 Loader App

You can download this app in www.inhaos.com.

The running environment is Winodws 7/8/10, with Microsoft .net framework 4.8 or above.



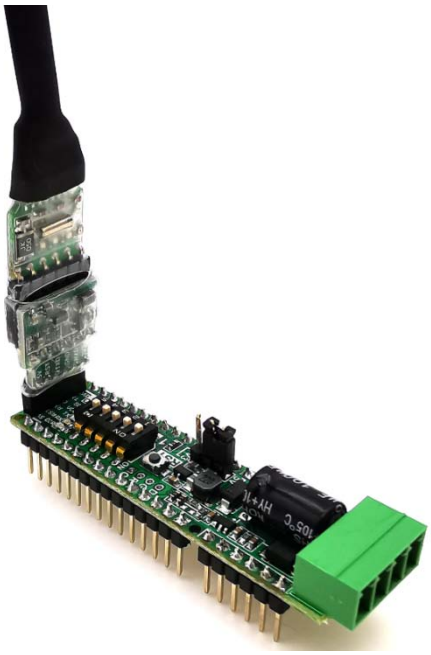
To use Nano485 Loader, follow below steps:

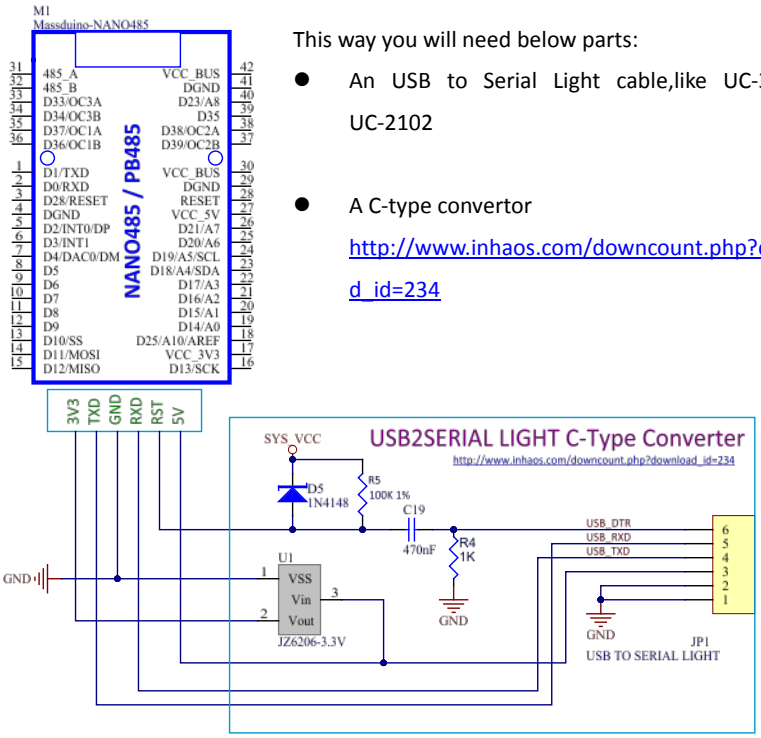
- Set comport number and baudrate, open the comm Port
- Set search range
- Set “Search” and “Jump” command
- open hex file
- Press “Search” button to start the device
- When all device show in the table, check which device you want to upgrade.
- Press “Upgrade” button to start upgrade.
  The device will be upgrade one by one.

7 Uploading Sketch

The Massduino NANO485 can be uploading sketch by two method:

Upload by Arduino IDE: user can use the USB to UART cable to upload sketch via Arduino IDE as every standard arduino board.





This way you will need below parts:

- An USB to Serial Light cable,like UC-340G or UC-2102
- A C-type convertor
  http://www.inhaos.com/downcount.php?download_id=234

Upload by Massduino Nano485 Loader : This is very useful when you need to upgrade firmware when the module used in network mode. In order to use RS-485 loader function, user need to follow some rules in ardino code:

- User's application must enable uart communication
- User's code must parsing below command:
  - Response when master sent "Serach" command
  - Jump to bootloader when master sent "Jump" command
  - Both Serach and Jump command are defined by user
- User can write some information to EEPROM, and this information will show in Massduino NANO485 Loader device list. User must follow below address definition:
  - There have total 1K bytes (1024bytes) of EEPROM can be use in MD-3248P
  - The address range is 0 to 1023
  - Address **1016 ~ 1023** is reserved, DO NOT USE IN USER's CODE.
  - Address **1000 ~ 1015** is used to save **model number**, user can be write the device model number to this range (Length limit in 16bytes, must ASCII character)
  - Address **0 ~ 999** is used for user's application , total 1000 bytes
  - Please notes, the EEPROM have write life limit, do not write the EEPROM too frequently

Massduino Nano485 EEPROM address mapping

1023 1016	8 Bytes	**Reserved, Do not use!**
1015 1000	16 Bytes	Model Number, like: "MD-NANO485"
999 0	1000 Bytes	User's application

- If user's code do not support "Serach" and "Jump" command, once the application is running, it will not upgrade firmware via RS-485 bus anymore, in this case, user only can use uart interface to upload sketch via Arduino IDE.

If you upgraded a firmware which does not support "Serach" and "Jump" command, you have two way to upload firmware in this case:

(1), connected device to PC via USB to UART cable, upload sketch by Arduino IDE.

(2), use Massduino Nano 485 Loader, press "Serach" button, and then power cycle the device, after device power up, it will received the serach command and stay in bootloader, then user can be upload firmware in by Loader.

Please Note: every Nano 485 device must have difference hardware address.

8 Arduino example code (with TEXT MODE)

We provide an example code which implement bootloader protocol, this protocol also can be used for user's application.

For text mode, all communication based on text string, each element are split by ":", and they will end with a newline.

The string format is:

COMMAND:ADD:PARA1:PARA2

Where:

COMMAND: two commands are reserved for Massduino Nano485 Loader used:

Search: used for search all device, when device received this command, return it's device name.

Jump: used for jump to bootloader area, device received this command, jump to bootloader area.

ADD: Nano485 have a 5bit coder, so the valid add range are 1 to 31, add 0 are keep for master use.

PARA1 to PARA4: the optional parameter of the command, for Search and Jump command, there are no parameter.

Notes:

1). All characters are not case sensitive, Jump = JUMP = jump
2). All command must end with newline (hex data 0x0D 0x0A)
3). Parameters are optional
4). The address value is expressed in decimal, valid range are 1 to 31
5). The device can only respond when the address matches
6). Search and Jump command are used for Nano485 Loader, do not used for other usage
7). User can be extend this protocol, to add more element like Parameters
8). Spaces before and after each element string will be ignored, Jump:1 = Jump : 1 = Jump : 1

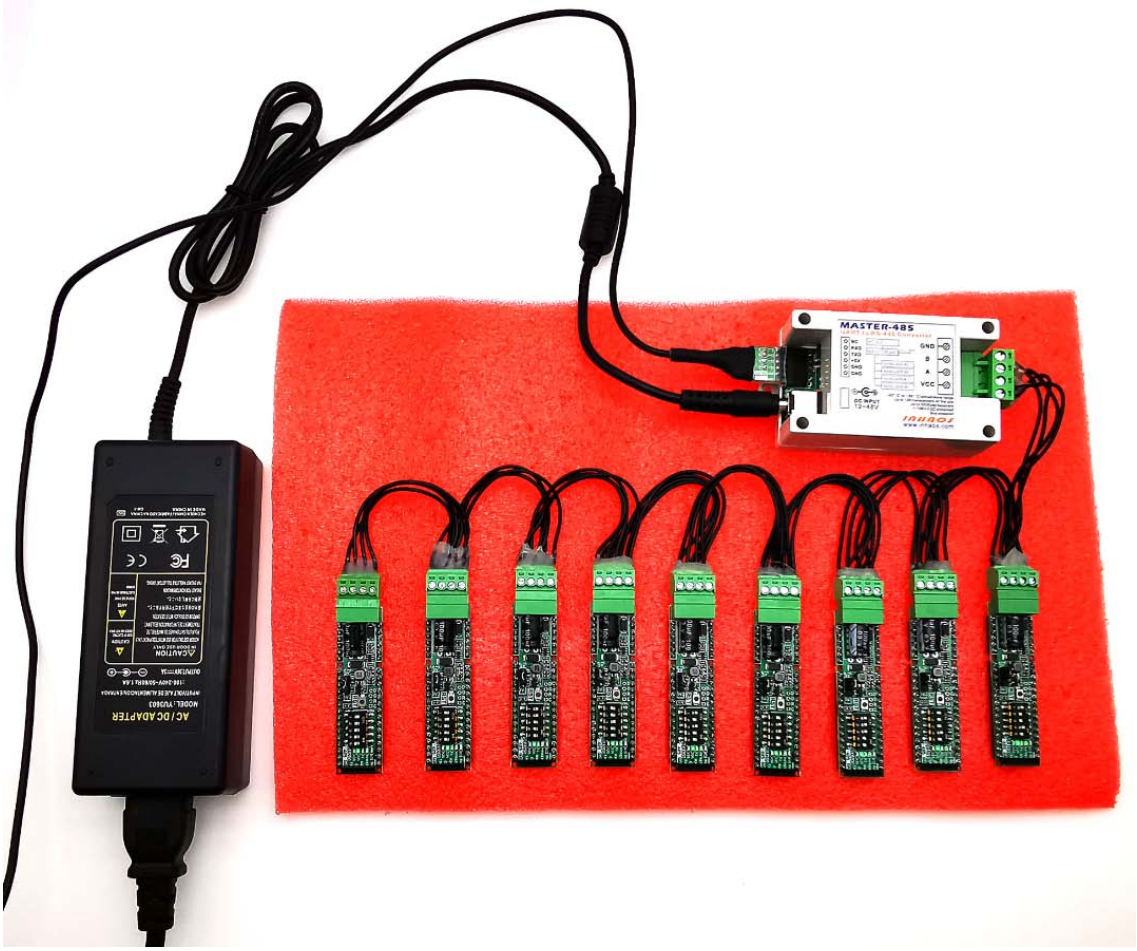
A completed search and jump command like this, those command are no parameters.

Search:1
Jump:1

The code can be download at www.inhaos.com.

9 Related products

- UC-340G USB to UART cable:
  http://www.inhaos.com/product_info.php?products_id=159
- UC-2102 USB to UART cable:
  http://www.inhaos.com/product_info.php?products_id=120
- UC-3100P islation USB to UART convertor:
  http://www.inhaos.com/product_info.php?products_id=124
- Master-485 UART to RS-485 Convertor:
  http://www.inhaos.com/product_info.php?products_id=178



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