

# MPPT PRO Duo Controller Communication Instruction

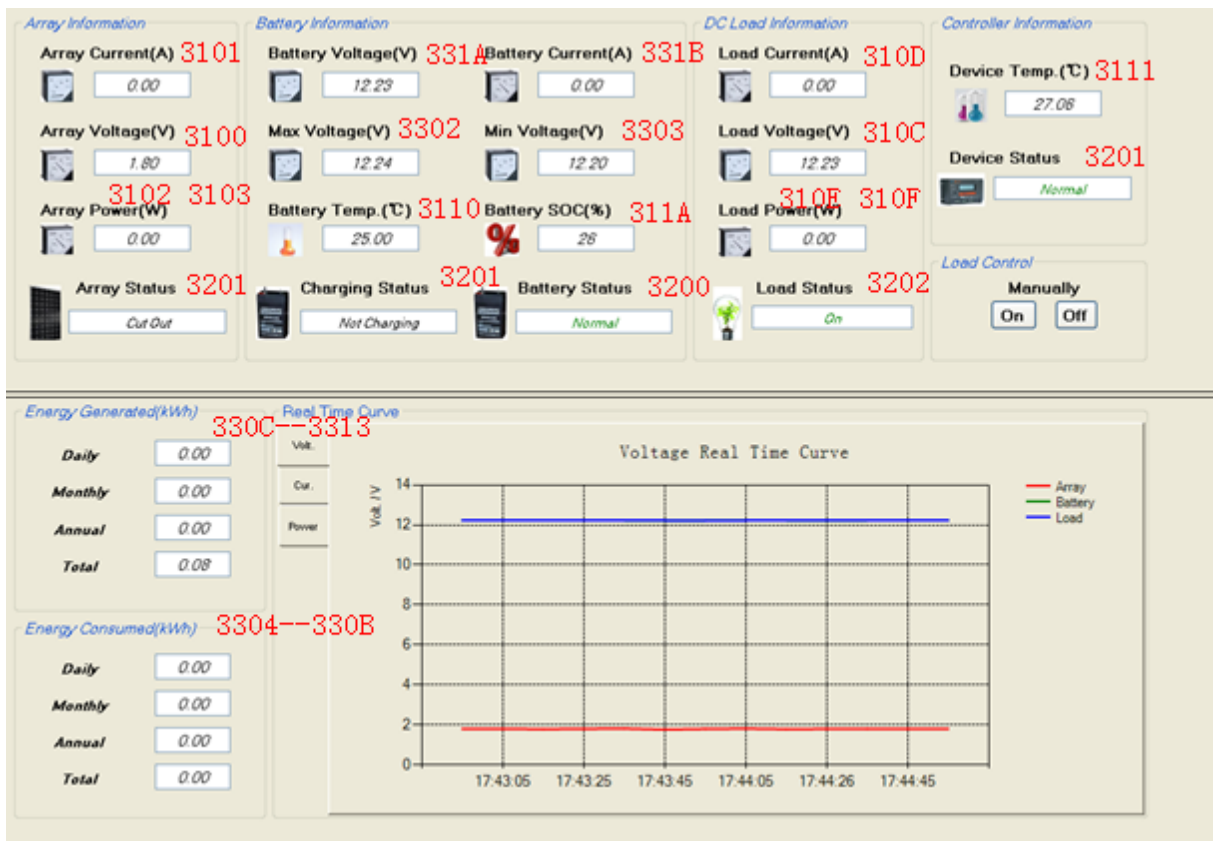
Modbus is an application layer packet transmission protocol and it lies in 7 layer of OSI model. It provides client / server communication between the different network equipment. Modbus is also a request / response protocol, and provides the services of function code.

As a master / slave protocol, at the same time, there is only one master and one or more (Max 247) slave on the bus. Modbus communication is always initiated by the master, and if no request is received from the master to the slave, no data will be sent. The slaves can not communicate with each other, at the same time the master can only initiate one Modbus transaction.

Our product communication protocol has the following characteristics :

1. Communication protocol is standard Modbus-RTU protocol.
2. The default controller ID number is "1", we can modify the ID via PC common software (Tips: when modify ID, please make sure the bus only connects a controller. After modifying the ID, please recharge the controller.)
3. Serial communication parameters: baud rate 115200, data bits 8, stop bits 1, no data flow control.
4. Register address uses hexadecimal format, the base address offset is 0x00.
5. All 32-bit-length data uses two 16-bit registers to represent (L and H register, respectively), for example, the value of the array rated power is 3000, data multiple is 100, the data of L register (address 0x3002) is 0x93E0 and the data of H register(address 0x3003) is 0x0004.

**Real Time Data:** all system's real time data , real time status and the history statistics of energy generated and energy consumed.



Number	Variable name	Address	Function code	Description	Unit	Times
A1	Over temperature inside the device	2000	02 (read)	1-The temperature inside the controller is higher than the over-temperature protection point. 0-Normal		
A2	AES status	2002	02 (read)	1-Run, 0-Stop		
A3	Day/Night	200C	02 (read)	1-Night, 0-Day		
A4	PV array input voltage	3100	04 (read)	Solar charge controller--PV array voltage	V	100
A5	PV array input current	3101	04 (read)	Solar charge controller--PV array current	A	100
A6	PV array input power L	3102	04 (read)	Solar charge controller--PV array power	W	100
A7	PV array input power H	3103	04 (read)	Solar charge controller--PV array power	W	100

A8	Load voltage	310C	04 (read)	Load voltage	V	100
A9	Load current	310D	04 (read)	Load current	A	100
A10	Load power L	310E	04 (read)	Load power	W	100
A11	Load power H	310F	04 (read)	Load power	W	100
A12	Battery temperature	3110	04 (read)	Battery temperature	°C	100
A13	Device temperature	3111	04 (read)	Device temperature	°C	100
A14	Battery 1 SOC	311A	04 (read)	The percentage of battery1's remaining capacity	%	1
A15	Battery2 voltage	311C	04 (read)	Bat2's real rated voltage		
A16	Battery's real rated voltage	311D	04 (read)	Current system rated voltage. 1200, 2400, 3600, 4800 represent 12V, 24V, 36V, 48V	V	100
A17	Battery 2 voltage	3130	04 (read)	Battery 2 voltage	V	100
A18	Battery 2 current	3131	04 (read)	Battery 2 current	A	100
A18	Battery 2 charging power L	3132	04 (read)	Battery 2 charging power L	W	100
A19	Battery 2 charging power H	3133	04 (read)	Battery 2 charging power H	W	100
A20	Battery 2 SOC	3134	04 (read)	The percentage of battery2's remaining capacity		
A21	Battery 1 status	3200	04 (read)	D15: 1-Wrong identification for rated voltage D8: Battery inner resistance abnormal 1, normal 0 D7-D4: 00H Normal, 01H Over Temp.(Higher than the warning settings), 02H Low Temp.(Lower than the warning settings), D3-D0: 00H Normal ,01H Over Voltage. , 02H Under Voltage, 03H Over discharge, 04H Fault		
A22	Charging equipment status	3201	04 (read)	D15-D14: Input voltage status. 00H normal, 01H No input power connected, 02H Higher input voltage , 03H Input voltage error. D13: Charging MOSFET is short		

				<p>circuit.</p> <p>D12: Charging or Anti-reverse MOSFET is open circuit.</p> <p>D11: Anti-reverse MOSFET is short circuit.</p> <p>D10: Input is over current.</p> <p>D9: The load is over current.</p> <p>D8: The load is short circuit.</p> <p>D7: Load MOSFET is short circuit.</p> <p>D6 : Disequilibrium in three circuits.</p> <p>D4: PV input is short circuit.</p> <p>D3-D2: Charging status. 00H No charging,01H Float,02H Boost, 03H Equalization.</p> <p>D1: 0 Normal, 1 Fault.</p> <p>D0: 1 Running, 0 Standby.</p>		
A23	Maximum battery 1 voltage today	3302	04 (read)	00: 00 Refresh every day	V	100
A24	Minimum battery 1 voltage today	3303	04 (read)	00: 00 Refresh every day	V	100
A25	Battery connection status	3205	04 (read)	<p>D15-D8 (Battery 1 ) : 00H: No battery connected, others values: connect.</p> <p>D15-D8 Battery 1 ): 00H: No battery connected, others values: connect.</p>		
A28	Generated energy today L	330C	04 (read)	00: 00 Clear every day.	KW H	100
A29	Generated energy today H	330D	04 (read)		KW H	100
A30	Generated energy this month L	330E	04 (read)	00: 00 Clear on the first day of month.	KW H	100
A31	Generated energy this month H	330F	04 (read)		KW H	100
A32	Generated energy this year L	3310	04 (read)	00: 00 Clear on 1, Jan.	KW H	100
A33	Generated energy this year H	3311	04 (read)		KW H	100
A34	Total generated energy L	3312	04 (read)		KW H	100
A35	Total generated energy H	3313	04 (read)		KW H	100
A36	Battery1 voltage	331A	04 (read)	Battery1 voltage	V	100
A37	Battery1 current L	331B	04 (read)	Battery1 current	A	100
A38	Battery1 current	331C	04 (read)	Battery1 current	A	100

	H					
A39	Maximum battery 2 voltage today	3320	04 (read)	00: 00 Refresh every day	V	100
A40	Minimum battery 2 voltage today	3321	04 (read)	00: 00 Refresh every day	V	100

## Status analysis

Array status: address 3201 bits D15-D10

Charging status: address 3201 bits D3-D2

Battery status: address 3200 bits D7-D0

Load status: address 3201 bits D9-D7, address 3202 bits D13-D8,D6-D4

Device status: address 3200 bit D15 address 3201 bits D6 address 2000

## For example

### Read real-time battery voltage

**Send command:** 01 04 33 1A 00 01 1F 49

**Analysis :**

01                    **device ID**  
04                    **function code**  
33 1A                **the start bit of the address**  
00 01                **the number of the address**  
1F 49                **CRC**

**Receive command :** 01 04 02 04 CE 3A 64

**Analysis :**

01                    **device ID**  
04                    **function code**  
02                    **two bytes**  
04 CE                **data (0x04CE (Hex) = 1230 (Dec), 1230/100=12.3V)**  
3A 64                **CRC**

**Battery 1 Parameter: After choosing the battery type , set the corresponding parameter, and mainly set the reasonable parameter to the special voltage.**

Station Name  Device ID

Rated Voltage (V)  Rated Load Current (A)  Rated Charging Current (A)

	Default	Current		Default	Current
9000 Battery Type	Sealed	User	9067 Rated Voltage Level	12V	12V
9070 Charging Mode	Volt. Comp.	Volt. Com	906C Boost Duration (m)	120	120
9001 Battery Capacity (Ah)	200	200	906B Equilibrium Duration (m)	120	120
9002 Temp. Compensation Coefficient (mV/°C/2V)	-3	-2			
9003 Over Volt. Disconnect Volt. (V)	16.00	15.40	9004 Charging Limit Voltage (V)	15.00	14.60
9005 Over Volt. Reconnect Volt. (V)	15.00	14.60	900E Discharging Limit Volt. (V)	10.60	9.50
9006 Equilibrium Charging Volt. (V)	14.60	14.60	900D Low Volt. Disconnect Volt. (V)	11.10	10.10
9007 Boost Charging Volt. (V)	14.40	14.60	900A Low Volt. Reconnect Volt. (V)	12.60	11.10
9008 Float Charging Volt. (V)	13.80	14.50	900C Under Volt. Warning Volt. (V)	12.00	11.00
9009 Boost Recon. Charg. Volt. (V)	13.20	13.50	900B Under Volt. Warn. Reco. Volt. (V)	12.20	11.20

Num ber	Variable name	Addr ess	Function code	Description	Unit	Times
B1	Rated charging current	3005	04(read)	Rated current to battery	A	100
B3	Battery's real rated voltage	311D	04(read)	Current system rated voltage. 1200, 2400, 3600, 4800 represent 12V, 24V, 36V, 48V	V	100
B4	Battery1 type	9000	03 ( read ) 10 ( write )	0000H User defined, 0001H Sealed , 0002H GEL, 0003H Flooded, 0004H Lithium-ion battery		
B5	Battery capacity	9001	03 ( read ) 10 ( write )	Rated capacity of the battery	AH	1
B6	Temperature compensation coefficient	9002	03 ( read ) 10 ( write )	Range 0-9	mV/ °C/2 V	100
B7	Over voltage disconnect voltage	9003	03 ( read ) 10 ( write )		V	100
B8	Charging limit voltage	9004	03 ( read ) 10 ( write )		V	100

B9	Over voltage reconnect voltage	9005	03 (read) 10 (write)		V	100
B10	Equalize charging voltage	9006	03 (read) 10 (write)		V	100
B11	Boost charging voltage	9007	03 (read) 10 (write)		V	100
B12	Float charging voltage	9008	03 (read) 10 (write)		V	100
B13	Boost reconnect charging voltage	9009	03 (read) 10 (write)		V	100
B14	Low voltage reconnect voltage	900A	03 (read) 10 (write)		V	100
B15	Under voltage warning recover voltage	900B	03 (read) 10 (write)		V	100
B16	Under voltage warning voltage	900C	03 (read) 10 (write)		V	100
B17	Low voltage disconnect voltage	900D	03 (read) 10 (write)		V	100
B18	Discharging limit voltage	900E	03 (read) 10 (write)		V	100
B19	Battery1 rated voltage level	9067	03 (read) 10 (write)	0, auto recognize. 1-12V, 2-24V, 3-36V, 4-48V, 5-60V, 6-110V, 7-120V, 8-220V, 9-240V,		
B20	Default load On/Off in manual mode	906A	03 (read) 10 (write)	0-off, 1-on		
B21	Equalize duration	906B	03 (read) 10 (write)	Usually 60-120 minutes	Min	
B22	Boost duration	906C	03 (read) 10 (write)	Usually 60-120 minutes	Min	
B23	Battery discharge	906D	03 (read) 10 (write)	Usually 20%-80%. The percentage of battery's remaining capacity when stop charging	%	100
B24	Battery charge	906E	03 (read) 10 (write)	Depth of charge, 20%-100%	%	100

B25	Charging mode	9070	03 (read) 10 (write)	Management modes of battery charge and discharge, voltage compensation : 0 and SOC : 1		
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### Voltage parameters limit condition for lead acid battery:

- 1 Over voltage disconnect voltage>Charge limit voltage>Equalize charging voltage>Boost charging voltage>Float charging voltage>Boost reconnect charging voltage
- 2 Under voltage warning recover voltage>Under voltage warning voltage>Low voltage disconnect voltage>Discharging limit voltage
- 3 Over voltage disconnect voltage>Over voltage reconnect voltage
- 4 Low voltage reconnect voltage>Low voltage disconnect voltage

### Voltage parameters limit condition for lithium-ion battery:

- A. Over Voltage Disconnect Voltage>Over charging protection voltage(Protection Circuit Modules(BMS))+0.2V※;
- B. Over Voltage Disconnect Voltage>Over Voltage Reconnect Voltage=Charging Limit Voltage ≥ Equalize Charging Voltage=Boost Charging Voltage ≥ Float Charging Voltage>Boost Reconnect Charging Voltage;
- C. Low Voltage Reconnect Voltage>Low Voltage Disconnect Voltage ≥ Discharging Limit Voltage;
- D. Under Voltage Warning Reconnect Voltage>Under Voltage Warning Voltage≥ Discharging Limit Voltage;
- E. Boost Reconnect Charging voltage> Low Voltage Reconnect Voltage;
- F. Low Voltage Disconnect Voltage ≥ Over discharging protection voltage (BMS)+0.2V※.



WARNING: The voltage parameters of lithium battery can be set, but you must refer to the voltage parameters of lithium battery BMS.



WARNING: The required accuracy of BMS shall be at least 0.2V. If the deviation is higher than 0.2V, the manufacturer will assume no liability for any system malfunction caused by this.



#### Warning

- 1 When the battery type is Sealed、 Gel or Flooded, the customer only can set Charging mode、 battery capacity、 temperature compensation coefficient、 equalize duration、 boost duration (you cannot set the Equalize duration when the battery type is Gel) . Only when the battery type is User, the customer can set the other parameters (9003~900E the parameters need to be set at the same time)
- 2 Battery discharge and battery charge can be set when the charging mode is SOC
- 3 The battery type and battery rated voltage level cannot be User and Self-recognition at the same time

For example:

**Read battery parameter (battery type: user rated voltage level: 12V)**

**Send command: 01 03 90 00 00 0F 28 CE**

**Analysis :**

01

**device ID**



03                    **function code**  
90 00                **the start bit of the address**  
00 0F                **the number of the address**  
28 CE                **CRC**

**Receive command: 01 03 1E 00 00 00 C8 01 2C 06 40 05 DC 05 DC 05 B4 05 A0 05 64 05 28 04 EC  
04 C4 04 B0 04 56 04 24 72 A5**

**Analysis: :**

01                    **device ID**  
03                    **function code**  
1E                    **the number of the sending data**  
00 00 00 C8 01 2C 06 40 05 DC 05 DC 05 B4 05 A0 05 64 05 28 04 EC 04 C4 04 B0 04 56 04 24

**the sending data (00 00 battery type(User) 00 C8**

**battery capacity(200) 01 2C temperature compensation  
coefficient(3) 06 40 Over voltage disconnect  
voltage(16V) 05 DC Charge limit voltage(15V)  
05 DC Over voltage reconnect voltage(15V) 05 B4  
Equalize charging voltage(14.6V) 05 A0 Boost  
charging voltage(14.4V) 05 64 Float charging  
voltage(13.8V) 05 28 Boost reconnect charging  
voltage(13.2V) 04 EC Low voltage reconnect  
voltage(12.6V) 04 C4 Under voltage warning recover  
voltage(12.2V) 04 B0 Under voltage warning  
voltage(12V) 04 56 Low voltage disconnect  
voltage(11.1V) 04 24 Discharging limit voltage(10.6V)  
CRC**

3C C4

**Send command : 01 03 90 67 00 01 18 D5**

**Analysis :**

01                    **device ID**  
03                    **function code**  
90 67                **the start bit of the address**  
00 01                **the number of the address**  
18 D5                **CRC**

**Receive command : 01 03 02 00 01 79 84**

**Analysis :**

01                    **device ID**  
03                    **function code**  
02                    **the number of the sending data**  
00 01                **the sending data (12V system)**  
79 84                **CRC**

**Send command : 01 03 90 6B 00 02 98 D7**

**Analysis :**

01                    **device ID**  
03                    **function code**  
90 6B                **the start bit of the address**  
00 02                **the number of the address**

98 D7

CRC

Receive command : 01 03 04 00 78 00 78 7A 08

Analysis:

01	device ID
03	function code
04	the number of the sending data
00 78 00 78	the sending data (00 78 equalize duration(120Min) 00 78 boost duration (120Min)
7A 08	CRC

**Battery2 Parameter:** After choosing the battery type , set the corresponding parameter, and mainly set the reasonable parameter to the special voltage.

Number	Variable name	Address	Function code	Description	Unit	Times
C1	Battery 2 rated voltage level	908C	03 (read) 10 (write)	0, auto recognize. 1-12V, 2-24V ,3-36V, 4-48V, 5-60V, 6-110V, 7-120V, 8-220V, 9-240V,		
C2	Full charging voltage	908D	03 (read) 10 (write)		V	100
C3	Charging return voltage	908E	03 (read) 10 (write)		V	100
C4	AES signal closed delay	908F	03 (read) 10 (write)	Range:0~999	min	1

# Real Time Clock

Station Name  Device ID

Local Time

Device Time  9013--9015

Number	Variable name	Address	Function code	Description	Unit	Times
D1	Real time clock	9013	03 (read) 10 (write)	D7-0 Sec, D15-8Min. (Year, Month, Day, Hour,Min, Sec. should be written simultaneously)		
D2	Real time clock	9014	03 (read) 10 (write)	D7-0 Hour, D15-8 Day		
D3	Real time clock	9015	03 (read) 10 (write)	D7-0 Month, D15-8 Year		

For example:

**Read the address 0x9013-9015**

**Send command : 01 03 90 13 00 03 D9 0E**

**Analysis :**

01                    **device ID**  
 03                    **function code**  
 90 13                **the start bit of the address**  
 00 03                **the number of the address**  
 D9 0E                **CRC**

**Receive command : 01 03 06 1A 1B 18 0B 10 02 BC 2E**

**Analysis :**

01                    **device ID**  
 03                    **function code**  
 06                    **six bytes**  
 1A 1B 18 0B 10 02 **the receiving data (1A 26(minute), 1B 27(second), 18 24(day), 0B 11(hour), 10 16 (year) , 02 02(month))**  
 B7 24                **CRC**

## Device parameter settings

Device Parameter Settings

Station Name  Device ID

Standard Battery Parameter

Backlight Control **9063** (0 ~ 999s)

Device Over Temperature **9019** (40 ~ 100°C)

Device Recovery Temperature **901A** (30 ~ 80°C)

Battery Upper Temperature Limit **9017** (50 ~ 80°C)

Battery Lower Temperature Limit **9018** (0 ~ -40°C)

LiBattery Parameter

Lower Temperature Charging Limit **9010** (+10 ~ -40°C)

Lower Temperature Discharging Limit **9011** (+10 ~ -40°C)

Number	Variable name	Address	Function code	Description	Unit	Times
E1	Lower Temperature Charging Limit	9010	03 (read) 10 (write)	Range: -40+10	°C	100
E2	Lower Temperature Discharging Limit	9011	03 (read) 10 (write)	Range: -40+10	°C	100
E3	Battery upper temperature limit	9017	03 (read) 10 (write)		°C	100
E4	Battery lower temperature limit	9018	03 (read) 10 (write)		°C	100
E5	Device over temperature	9019	03 (read) 10 (write)		°C	100
E6	Device recovery temperature	901A	03 (read) 10 (write)		°C	100
E7	Backlight time	9063	03 (read) 10 (write)	Close after LCD backlight light setting the number of seconds	S	

For example

Send the data of 0x9017-0x901A

Send command : 01 10 90 17 00 04 08 19 64 F0 60 21 34 1D 4C 70 10

Analysis :

01	device ID
10	function
90 17	the start bit of the address
00 04	the number of the address



17 70    **the receiving data (0x1770 (Dec), 6000, 6000/100=60V)**  
 B7 24    **CRC**

## The other switching values

Number	Variable name	Address	Function code	Description	Unit	Times
G1	Charging device on/off	0	05 (write)	1 Charging device on 0 Charging device off		
G2	Battery 2 connection status	1	01 (read)	1 BATT2 connected 0 BATT2 not connect		
G3	Battery 2 charging full status	2	05 (write)	1 Charged full 0 Not charged full		
G5	Battery 2 charging status	5	05 (write)	1 In charging 0 No charging		
G6	Force the load on/off	6	05 (write)	1 Turn on 0 Turn off (used for temporary test of the load)		
G7	Restore system defaults	13	05 (write)	1 yes 0 no		
G8	Clear generating electricity statistics	14	05 (write)	1 clear.    Root privileges to perform		

For example:

**Send restore system defaults command:**

**Send command : 01 05 00 13 FF 00 7D FF**

**Analysis :**

01            **device ID**  
 05            **function code**  
 00 13        **the address of the sending data**  
 FF 00        **the sending data (enable restore system defaults)**  
 7D FF        **CRC**

**Receive command : 01 05 00 13 FF 00 7D FF**

**Analysis :**

01            **device ID**  
 05            **function code**  
 00 13        **the address of the receiving data**  
 FF 00        **the receiving data**  
 7D FF        **CRC**

## Device ID settings

For example:

### 1. Read the device ID

Send command : F8 45 00 01 01 F8 89 BE

Analysis :

F8 45	function code
00 01	the reading data length
01	the reading bytes
F8	read the device ID
89 BE	CRC

Receive command : F8 45 03 82 A0

Analysis :

F8 45	function code
03	the receiving ID
82 A0	CRC

### 2. Set the device ID

Send command : F8 45 00 01 01 02 09 FD

Analysis :

F8 45	function code
00 01	the reading data length
01	the reading bytes
02	the sending data
09 FD	CRC

Receive command : F8 45 02 43 60

Analysis :

F8 45	function code
02	the receiving data
43 60	CRC

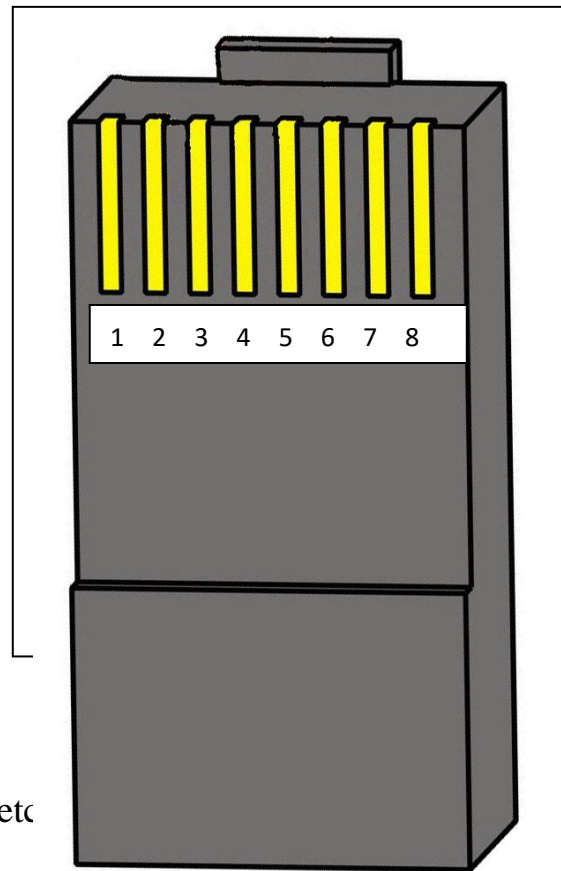
## Pin Definition

1. The RJ45 interface pin define for RS485 port of LS-B、VS-B、Tracer-B 、

Tracer-A series controllers is shown below:

Pins define:

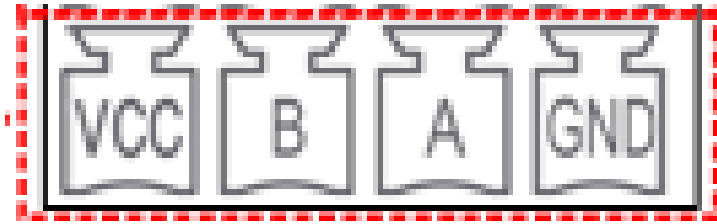
Pins	Define
1	Power supply output +5V
2	Power supply output +5V
3	RS-485-B
4	RS-485-B
5	RS-485-A
6	RS-485-A
7	Ground
8	Ground



RJ45 plug pins are sorted by number, the sketc



2. The interface pin definition for RS485 port of DuoRacer series controllers is shown below:



Note:

(1)To improve the communication quality, the Ground pins(connected with the negative terminal of the battery) could be used if necessary. However, the user must care the common ground problem of the connected devices.

(2)Do not use the Vcc pins (+5v), or the controller may be damaged permanently.