Electromagnetic Flowmeter

MODBUS RTU Protocol

V1.8.0

Version: 2014

Table of Contents

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1. Introduction

This communication protocol is used for the real-time acquisition of instantaneous flow rate, flow velocity, flow percentage, fluid resistance, total forward and reverse flow, alarm status. The converter parameters can also be read and written through this protocol.

2. The protocol

2.1 Electrical Interface: RS485 or RS232

2.2 Data Transfer Mode: RTU mode

2.3 Data Format:

- 1 start bit
- 8 bits data, the least significant bit first
- Non parity check
- 1 stop bit

2.4 Error Check: CRC checksum

2.5 MODBUS function code:

0X03: data read

0X04: parameter read

0X06: parameter write

2.6 Flow Data Register Address：(0X03 function code)

Register Address		Data Description	Data Format	Register Length
Dec	Hex			
4112	1010	Flow rate	float	2
4114	1012	Forward total(integer part)	long	2
4116	1014	Forward total(fractional part)	float	2
4118	1016	Flow velocity(m/s)	float	2
4120	1018	Flow percentage(%)	float	2
4122	101A	Fluid resistance(KΩ)	float	2
4124	101C	Reverse total(integer part)	long	2
4126	101E	Reverse total(fractional part)	float	2
4128	1020	Flow rate unit	uchar	1
4129	1021	Total unit	uchar	1
4130	1022	Alarm status	uchar	1

Float format: IEEE754 Float Inverse

2.7 Parameter Register Address:（Read:0X04 function code, Write: 0X06 function code）

Register Address		Parameter	format	字节	寄存器首址		参数定义	格式	字节
Dec	Hex				Dec	Hex			
32	20	language	uchar	01	55	37	EmpPipe Alm (KΩ)	uint	01

33	21	Pipe size(mm)	uchar	01	56	38	Input control	uchar	01
34	22	Flow range	float	02	57	39	1# Output	uchar	01
36	24	Flow unit	uchar	01	58	3A	Hi Alm Limit (%)	uint	01
37	25	Flow range auto change	uchar	01	59	3B	2# Output	uchar	01
38	26	Damping	uchar	01	60	3C	Lo Alm Limit (%)	uint	01
39	27	Flow direction	uchar	01	61	3D	Clr Tot. Key	uint	01
40	28	Flow zero sign(+/-)	uchar	01	62	3E	Sensor S/N	char[]	06
41	29	Flow zero	uint	01	68	44	Sensor Factor	uint	01
42	2A	Low flow cutoff (%)	uint	01	69	45	Field Mode	uchar	01
43	2B	Cutoff enable	uchar	01	70	46	Flow density(t/m³)	uint	01
44	2C	Rate-Of-Chng (%)	uchar	01	71	47	Multiplying	uint	01
45	2D	Limit Time (s)	uchar	01	72	48	Current Zero	uint	01
46	2E	Total Unit	uchar	01	73	49	Current Max	uint	01
47	2F	Flow decimal point	uchar	01	74	4A	Meter Factor	uint	01
48	30	Pulse type	uchar	01	75	4B	Converter S/N	char[]	05
49	31	Pulse factor	uchar	01	80	50	F. Total Set	char[]	05
50	32	Pulse width	uchar	01	85	55	R.Total Set	char[]	05
51	33	Frequency max	uint	01	90	5A	Date	char[]	03
52	34	Comm address	uchar	01	93	5D	Time	char[]	03
53	35	Baud rate	uchar	01	96	60	RevMeas.Enbl	uchar	01
54	36	EmpPipe Det.	uchar	01	97	61	Remote resetting total	uint	01

3. Communication Instruction Format and Examples

3.1 Flow Data Read Instructions and Examples

Master computer sends:

Slave address	0X03	Register high byte	Register low byte	Register length high byte	Register length low byte	CRC checksum low byte	CRC checksum high byte

Slave flowmeter responds:

Slave address	0X03	Data length N	Data 01	……	Data N	CRC checksum low byte	CRC checksum high byte

Take slave addres 0X01 flowmeter as an example:

Flow rate

Read data: 01 03 10 10 00 02 C1 0E

Flowmeter responses: 01 03 04 **2C 52 1A 46** D9 E0

2C 52 1A 46 is as IEEE754 float inverse format, which is 9876.54

Example:
```
UCHAR charTempi[0X04];
*(FLOAT*)charTempi =fTempi;
float fTempi=*((float*)charTempi);
```

forward total

read data: 01 03 10 12 00 04 E0 CC

flwometer responses: 01 03 08 **B1 68 DE 3A 80 D6 FC 3D** 34 FB

B1 68 DE 3A is as longformat: 987654321

80 D6 FC 3D is as float format: 0.123456

Forward total: 987654321.123456

Flow velocity(m/s)

Read data: 01 03 10 16 00 02 21 0F

responses: 01 03 04 **F6 28 B1 42** BD D2

F6 28 B1 42 = 88.58

Flow percentage (%)

Read data: 01 03 10 18 00 02 40 CC

responses: 01 03 04 **00 00 A4 41** 40 C3

00 00 A4 41 = 20.50

Fluid resistance (KΩ)

Read data: 01 03 10 1A 00 02 E1 0C

responses: 01 03 04 **00 00 C8 42** 2D C2

00 00 C8 42 = 100.00

Reverse total

Read data: 01 03 10 1C 00 04 81 0F

responses: 01 03 08 **B1 68 DE 3A 80 D6 FC 3D** 34 FB

B1 68 DE 3A = 987654321

80 D6 FC 3D = 0.123456

Reverse total =987654321.123456

Flow rate unit

Read data: 01 03 10 20 00 01 81 00

responses: 01 03 02 **00 02** 39 85

Definition:

00	01	**02**	03	04	05	06	07
m^3/s	m^3/min	**m^3/h**	L/s	L/min	L/h	USg/m	USg/h
08	09	0A	0B	0C	0D	0E	0F
ig/m	ig/h	t/s	t/m	t/h	kg/s	kg/min	kg/h

Total unit

Read data: 01 03 10 21 00 01 D0 C0

responses: 01 03 02 **00 07** F9 86

definition:

00	01	02	03	04	05
L	m^3	USgal	igal	kg	t

Alarm status

Read data: 01 03 10 22 00 01 20 C0

responses: 01 03 02 **00 00** B8 44

definition:

02	04	08	10	20
Excitation alarm	Electrode alarm	Empty pipe alarm	High alarm	Low alarm

Read all flow data

Read data: 01 03 10 10 00 13 01 02

response: 01 03 26 2C 52 1A 46 F6 28 B1 42 00 00 A4 41 00 00 C8 42 B1 68 DE 3A 80 D6 FC 3D B1 68 DE 3A 80 D6 FC 3D 00 02 00 07 00 00 87 2B

3.2 Read/Write Parameter Instructions and Examples

3.2.1 Read instructions:

Slave address	0X04	Register high byte	Register low byte	Register length high byte	Register length low byte	CRC checksum low byte	CRC checksum high byte

Slave flowmeter responds:

Slave address	0X04	Data byte number	D0	……	Dn	CRC checksum low byte	CRC checksum high byte

3.2.2 Write instructions:

Slave address	0X06	Register high byte	Register low byte	D0	……	Dn	CRC checksum low byte	CRC checksum high byte

Slave flowmeter responds:

Slave addres	0X06	Register high byte	Register low byte	D0	……	Dn	CRC checksum low byte	CRC checksum high byte

The response data is consistent with the write instruction if written successfully.

Take slave address 0X01flowmeter as an example for parameter read and write:

Language 0X20

Read 01 04 00 20 00 01 30 00 return 01 04 02 **00 00** B9 30

Write 01 06 00 20 00 00 88 00 (simplified Chinese) 01 06 00 20 00 01 49 C0 (English)

Parameter value

00	01
simplified Chinese	English

Pipe Size(mm) 0X21

Read 01 04 00 21 00 01 61 C0 return 01 04 02 **00 0C** B9 35

Write 01 06 00 21 00 0C D9 C5 (100) 01 06 00 21 00 0F 99 C4 (200)

Parameter value

00	3	0D	125	1A	1000
01	6	0E	150	1B	1100
02	8	0F	200	1C	1200
03	10	10	250	1D	1300
04	15	11	300	1E	1400
05	20	12	350	1F	1600
06	25	13	400	20	1800
07	32	14	450	21	2000
08	40	15	500	22	2200
09	50	16	600	23	2400
0A	65	17	700	24	2600
0B	80	18	800	25	2800
0C	**100**	19	900	26	3000

Flow range 0X22

Read 01 04 00 22 00 02 D1 C1 return 01 04 04 **43 8D 5E B8** 46 39

write 01 06 00 22 00 0C D9 C5 (282.74)

43 8D 5E B8 = 282.74

Flow unit 0X24

Read 01 04 00 24 00 01 71 C1 return 01 04 02 **00 02** 38 F1

write 01 06 00 24 00 02 48 00 (m^3/h) 01 06 00 24 00 09 09 C7 (ig/h)

Parameter value

00	01	**02**	03	04	05	06	07
m^3/s	m^3/min	**m^3/h**	L/s	L/min	L/h	USg/m	USg/h
08	09	0A	0B	0C	0D	0E	0F
ig/m	ig/h	t/s	t/m	t/h	kg/s	kg/min	kg/h

Flow range auto change 0X25

Read 01 04 00 25 00 01 20 01 return 01 04 02 00 00 B9 30

Write 01 06 00 25 00 00 98 01

Parameter value

00	01	02	03
disabled	1:2	1:4	1:8

Damping 0X26

Read 01 04 00 26 00 01 71 C1 return 01 04 02 **00 08** B8 F6

Write 01 06 00 26 00 08 69 C7 (6.0s) 01 06 00 26 00 05 A8 02 (3.0s)

Parameter value

00	01	02	03	04	05	06	07
0.2s	0.5s	0.8s	1.0s	2.0s	3.0s	4.0s	5.0s
08	09	0A	0B	0C	0D	0E	
6.0s	8.0s	10.0s	20.0s	30.0s	50.0s	100.0s	

Flow direction 0X27

Read 01 04 00 27 00 01 81 C1 return 01 04 02 **00 00** B9 30

Write 01 06 00 27 00 00 39 C1 (forward) 01 06 00 27 00 01 F8 01 (reverse)

Parameter value

00	01
forward	reverse

Flow zero sign(+/-) 0X28

Read 01 04 00 28 00 01 B1 C2 return 01 04 02 **00 00** B9 30

Write 01 06 00 28 00 00 09 C2 (+) 01 06 00 28 00 01 C8 02 (-)

Parameter value

00	01
+	-

Flow zero 0X29

Read 01 04 00 29 00 01 E0 02 return 01 04 02 **04 56** 3B CE

Write 01 06 00 29 00 00 58 02 01 06 00 29 04 56 DA FC

04 56 = 1110, divided by 1000, then flow zero = 1.110

Low flow cutoff (%) 0X2A

Read 01 04 00 2A 00 01 10 02 return 01 04 02 **00 05** 79 33

write 01 06 00 2A 00 00 A8 02 (0.0) 01 06 00 2A 00 05 68 01 (0.5)

00 05 = 5, divided by 10, then low flow cutoff = 0.5%

Cutoff enable 0X2B

Read 01 04 00 2B 00 01 41 C2 return 01 04 02 **00 01** 78 F0

Write 01 06 00 2B 00 00 F9 C2 (enable) 01 06 00 2B 00 01 38 02 (disable)

Parameter value

00	**01**
enable	**disable**

Rate-Of-Change (%) 0X2C

Read 01 04 00 2C 00 01 F0 03 return 01 04 02 **00 00** B9 30

Write 01 06 00 2C 00 00 48 03 (00%) 01 06 00 2C 00 05 88 00 (05%)

00 00 = 0, range: 0～99%，rate-of-change = 00%

Limit time (s) 0X2D

Read 01 04 00 2D 00 01 A1 C3 return 01 04 02 **00 00** B9 30

Write 01 06 00 2D 00 00 48 03 (00s) 01 06 00 2D 00 05 88 00 (05s)

00 00 = 0, range:0～99s，limit time = 00s

Total unit 0X2E

Read 01 04 00 2E 00 01 51 C3 return 01 04 02 **00 07** F8 F2

Write 01 06 00 2E 00 07 A8 01 (1m³) 01 06 00 2E 00 04 E8 00 (0.001m³)

Parameter value

00	01	02	03	04	05	06	**07**
0.001L	0.01L	0.1L	1L	0.001m³	0.01m³	0.1m³	**1m³**
08	09	0A	0B	0C	0D	0E	0F
0.001USgal	0.01USgal	0.1USgal	1USgal	0.001igal	0.01igal	0.1igal	1igal
10	11	12	13	14	15	16	17
0.001kg	0.01kg	0.1kg	1kg	0.001t	0.01t	0.1t	1t

Flow decimal point 0X2F

Read 01 04 00 2F 00 01 00 03 return 01 04 02 **00 02** 38 F1

Write 01 06 00 2F 00 02 39 C2 (2) 01 06 00 2F 00 01 79 C3 (1)

Parameter value

00	01	**02**	03
0	1	**2**	3

Pulse type 0X30

Read 01 04 00 30 00 01 31 C5 return 01 04 02 **00 00** B9 30

Write 01 06 00 30 00 00 89 C5 (frequency) 01 06 00 30 00 01 48 05 (pulse)

Parameter value

00	01
frequency	pulse

Pulse factor 0X31

Read 01 04 00 31 00 01 60 05 return 01 04 02 **00 04** B8 F3

Write 01 06 00 31 00 04 D9 C6 (1.0L/P) 01 06 00 31 00 01 19 C5 (0.001L/P)

Parameter value

00	01	02	03	**04**	05	06	07	08	09	0A	0B	0C
0.0001L/P	0.001L/P	0.01L/P	0.1L/P	**1.0L/P**	2.0L/P	5.0L/P	10.0L/P	100.0L/P	1.0m³/P	10.0m³/P	100.0m³/P	1000.0m³/P

Pulse width 0X32

Read 01 04 00 32 00 01 90 05 return 01 04 02 **00 00** B9 30

write 01 06 00 32 00 00 28 05 (自动) 01 06 00 32 00 01 E9 C5 (100ms)

Parameter value

00	01	02	03	04	05	06	07	08	09	0A
auto	10ms	20ms	50ms	100ms	150ms	200ms	250ms	300ms	350ms	400ms

Frequency max 0X33

Read 01 04 00 33 00 01 C1 C5 return 01 04 02 **07 D0** BA 9C

Write 01 06 00 33 07 D0 7A 69 (2000)

07 D0 = 2000, range = 1～5999Hz，frequency max = 2000Hz

Comm address 0X34

Read 01 04 00 34 00 01 70 04 return 01 04 02 **00 01** 78 f0

Write 01 06 00 34 00 01 09 C4 (01)

00 01 = 01, range 1～255, comm address = 01

Baud rate 0X35

Read 01 04 00 35 00 01 21 C4 return 01 04 02 **00 03** F9 31

Write 01 06 00 35 00 07 D8 06 (38400) 01 06 00 35 00 03 D9 C5 (9600)

Parameter value

value	00	01	02	**03**	04	05	06	07
Dec	1200	2400	4800	**9600**	14400	19200	28800	38400
Hex	0X4B0	0X960	0X12C0	**0X2580**	0X3840	0X4B00	0X7080	0X9600

Empty pipe detection 0X36

Read 01 04 00 36 00 01 D1 C4 return 01 04 02 **00 01** 78 F0

Write 01 06 00 36 00 00 69 C4 (enable) 01 06 00 36 00 01 A8 04 (disable)

Parameter value

00	**01**
enable	**Disable**

EmpPipe Alarm (KΩ) 0X37

Read 01 04 00 37 00 01 80 04 return 01 04 02 **05 DC** BB F9

Write 01 06 00 37 05 DC 3A CD (150.0)

05 DC= 1500, divided by 10, EmpPipe Alarm=150.0KΩ, range 0～999.9KΩ

Input Control 0X38

Read 01 04 00 38 00 01 B0 07 return 01 04 02 **00 00** B9 30

Write 01 06 00 38 00 00 08 07 (disable) 01 06 00 38 00 01 C9 C7 (stopping totalizing)

Parameter value

00	01	02
disable	Stopping totalizing	Resetting totalizing

1# Output 0X39

Read 01 04 00 39 00 01 E1 C7 return 01 04 02 **00 01** 78 F0

Write 01 06 00 39 00 01 98 07 (High alarm) 01 06 00 39 00 00 59 C7 (output disable)

Parameter value

00	**01**	02	03	04	05
Output disable	**High alarm**	Low alarm	Empty pipe alarm	Flow direction alarm	Pulse alarm

Hi Alm Limit (%) 0X3A

Read 01 04 00 3A 00 01 11 C7 return 01 04 02 **03 20** B8 18

Write 01 06 00 3A 03 20 A8 EF (80.0%)

03 20=800, divided by 10, Hi Alm Limit=80.0%, range 0～199.9%

2# output 0X3B

Read 01 04 00 3B 00 01 40 07 return 01 04 02 **00 01** 78 F0

Write 01 06 00 3B 00 00 F8 07 (output disable) 01 06 00 3B 00 01 39 C7 (**Low alarm**)

Parameter value

00	**01**	02
Output disable	**Low alarm**	Range auto change

Lo Alm Limit (%) 0X3C

Read 01 04 00 3C 00 01 F1 C6 return 01 04 02 **00 96** 39 5E

Write 01 06 00 3C 00 96 C9 A8 (15.0%)

00 96=150, divided by 10, Lo Alm Limit=15.0%, range 0～199.9%

Clr Tot. Key 0X3D

Read 01 04 00 3D 00 01 A0 06 return 01 04 02 **8F 3A** 5D 13

Write 01 06 00 3D 8F 3A FC 25 (36666)

8F 3A=36666, range 00000～59999

Sensor S/N 0X3E (BCD code)

Read 01 04 00 3E 00 06 11 C4

return 01 04 0C **01 04 00 03 00 00 00 00 00 00 00 00** 69 B4

Write 01 06 00 3E 01 04 00 03 00 00 00 00 00 00 00 00 52 1F

Sensor S/N 140300000000, range 000000000000～999999999999

Sensor factor 0X44

Read 01 04 00 44 00 01 71 DF return 01 04 02 **27 10** A3 0C

Write 01 06 00 44 27 10 A8 EF (1.0000)

27 10=10000，divided by 10000, sensor factor=1.0000, range 0.0000～3.9999

Field mode 0X45

Read 01 04 00 45 00 01 20 1F return 01 04 02 **00 00** B9 30

Write 01 06 00 45 00 00 98 1F (Mode 1) 01 06 00 45 00 01 59 DF (Mode 2)

Parameter value

00	01	02
Mode 1	Mode 2	Mode 3

Flow density (t/m³) 0X46

Read 01 04 00 46 00 01 D0 1F return 01 04 02 **03 E8** B9 8E

Write 01 06 00 46 03 E8 68 A1 (1.000 t/m³)

03 E8=1000, divided by 1000, flow density=1.000 t/m³, range 0.000～9.999 t/ m³

Multiplying 0X47

Read 01 04 00 47 00 01 81 DF return 01 04 02 **27 10** A3 0C

Write 01 06 00 47 27 10 23 E3 (1.0000)

27 10=10000, divided by 10000, multiplying=1.0000, range 0.0000～3.9999

Current zero 0X48

Read 01 04 00 48 00 01 B1 DC return 01 04 02 **0C 83** FD 91

Write 01 06 00 48 0C 83 4D 7D (0.3203)

0C 83=3203, divided by 10000, current zero=0.3203, range 0.0000～1.9999

Current max 0X49

Read 01 04 00 49 00 01 E0 1C return 01 04 02 **3E 89** 68 F6

Write 01 06 00 49 3E 89 89 DA (1.6009)

3E 89=16009，divided by 10000, current max=1.6009, range 0.0000～4.9999

Meter factor 0X4A

Read 01 04 00 4A 00 01 10 1C return 01 04 02 **27 10** A3 0C

Write 01 06 00 4A 27 10 B2 20 (1.0000)

27 10=10000，divided by 10000, meter factor=1.0000, range 0.0000～3.9999

Converter S/N 0X4B (BCD code)

Read 01 04 00 4B 00 05 40 1F

Return 01 04 0A **01 04 00 03 00 00 00 00 00 00** 81 78

Write 01 06 00 4B 01 04 00 03 00 00 00 00 00 00 82 E6

Converter S//N 1403000000，range 0000000000～9999999999

F. Total Set 0X50 (BCD code)

Read 01 04 00 50 00 05 30 18

Return 01 04 0A **00 00 00 00 00 00 00 00 00 00** D1 7D

Write 01 06 00 50 00 00 00 00 00 00 00 00 00 00 A3 07

F.Total Set 000000000, range 0000000000～2000000000

R. Total Set 0X55 (BCD code)

Read 01 04 00 55 00 05 20 19

Return 01 04 0A **00 00 00 00 00 00 00 00 00 00** D1 7D

Write 01 06 00 55 00 00 00 00 00 00 00 00 00 00 B2 CB

R.Total Set 000000000, range 0000000000～2000000000

Date 0X5A (BCD code)

Read 01 04 00 5A 00 03 90 18

Return 01 04 06 **07 00 00 01 00 01** F1 24

Write 01 06 00 5A 07 00 00 01 00 01 61 D0

Date 70-01-01, range 00/01/01~99/12/31

Time 0X5D (BCD code)

Read 01 04 00 5D 00 03 21 D9

Return 01 04 06 **00 00 00 00 00 00** 60 93

Write 01 06 00 5D 00 00 00 00 00 00 86 A7

Time 00:00:00, range 00/00/00~23/59/59

RevMeas.Enbl 0X60

Read 01 04 00 60 00 01 31 D4 return 01 04 02 00 00 B9 30

Write 01 06 00 60 00 00 89 D4 (enable) 01 06 00 60 00 01 48 14 (disable)

Parameter value

00	**01**	02
enable	**disable**	Single direction

Remote resetting total 0X61

Write 01 06 00 61 8F 3A 3C 37

4. Wiring

4.1 Compact-type

- RS485: T+（terminal） — A（external）
  T-（terminal） — B（external）
- RS232: T+（terminal） — RXD（external）
  T-（terminal） — TXD（external）
  IN-（terminal） — GND（external）

4.2 Remote-type

- RS485: A2（terminal） — A（external）
  B2（terminal） — B（external）
- RS232: A2（terminal） — TXD（external）
  B2（terminal） — RXD（external）
  GND（terminal） — GND（external）

4.3 Wiring

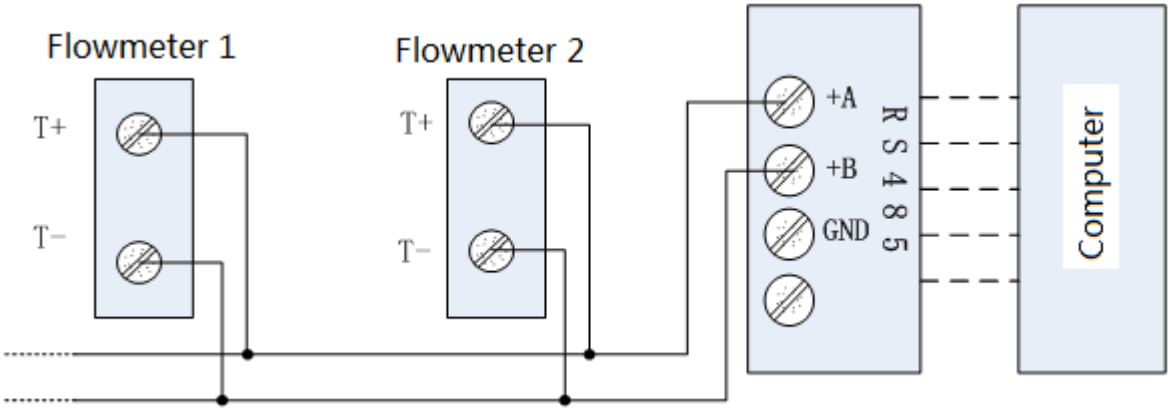

Fig. 1 Wiring for compact-type

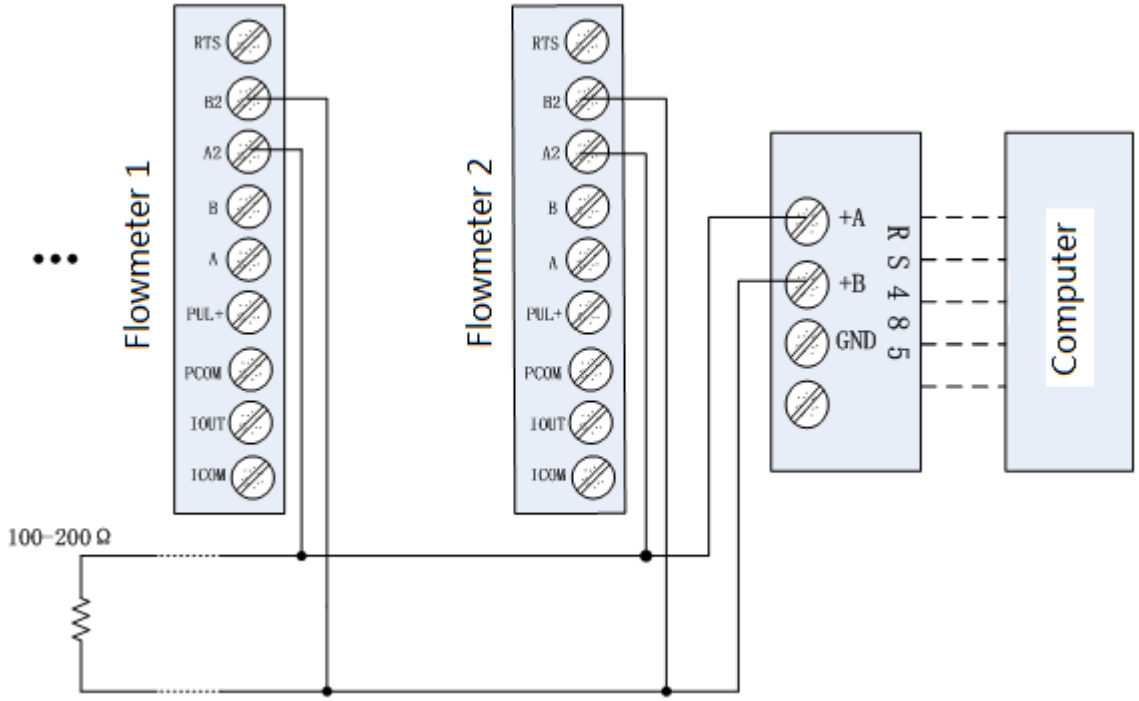

Fig. 2 Wiring for remote-type