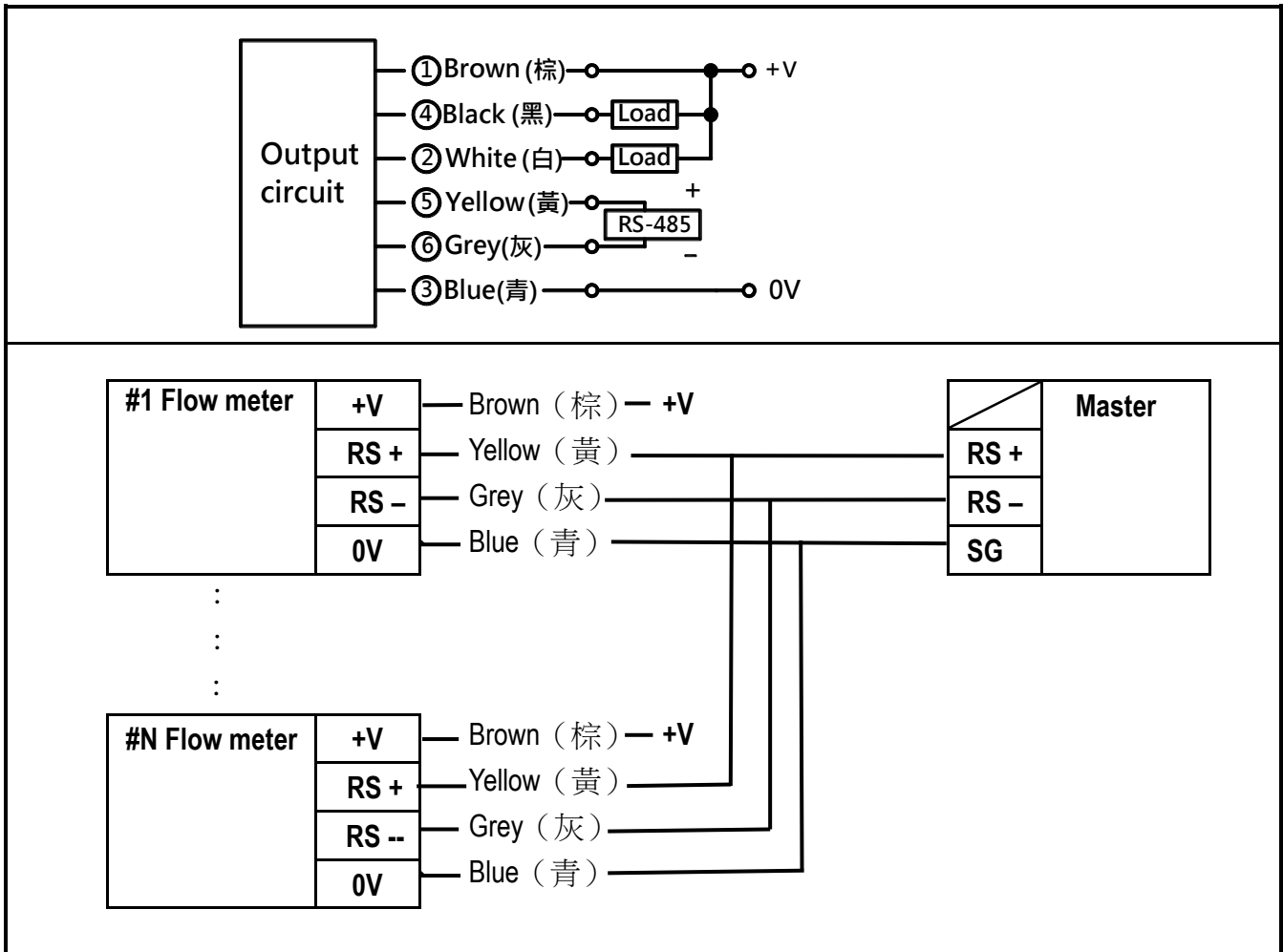


<b>CE</b> <b>RoHS</b>	<b>Instruction Manual / RS-485 通訊使用手冊</b> <b>RS-485 Modbus Protocol -IV</b>	F- <span style="border: 1px solid black; display: inline-block; width: 20px; height: 20px;"></span> <span style="border: 1px solid black; display: inline-block; width: 20px; height: 20px;"></span>
	<b>ATP series    Flow meter / 流量計</b>	

Thank you very much for using FOTEK AT series flow meter  
 Please read this instruction manual before operating it to avoid from the malfunction.  
 非常感謝您採用 FOTEK AT 系列流量計，  
 使用前務必詳讀本使用手冊以防止使用錯誤！

◆ **Connection diagram / 接線圖**



Communication standard	EIA – RS 485	Communication speed	9600 or 19200 or 38400 bps
Communication mode	RS=0 : 「MODBUS- RTU mode」 RS=1 : 「MODBUS-ASCII mode」	Communication station No.	ID No. = 01 ~ 99 ( 01H ~ 63H )
Configuration of communication ( 8N1 )			
<div style="display: flex; align-items: center; justify-content: space-around;"> <div style="text-align: center;">             Start bit ( 起始位元 )             <div style="border: 1px solid black; padding: 2px 10px;">0</div> </div> <div style="text-align: center;"> <div style="border: 1px solid black; padding: 2px 10px;">B0</div> <div style="border: 1px solid black; padding: 2px 10px;">B1</div> <div style="border: 1px solid black; padding: 2px 10px;">B2</div> <div style="border: 1px solid black; padding: 2px 10px;">B3</div> <div style="border: 1px solid black; padding: 2px 10px;">B4</div> <div style="border: 1px solid black; padding: 2px 10px;">B5</div> <div style="border: 1px solid black; padding: 2px 10px;">B6</div> <div style="border: 1px solid black; padding: 2px 10px;">B7</div> </div> <div style="text-align: center;"> <div style="border: 1px solid black; padding: 2px 10px;">N</div> </div> <div style="text-align: center;"> <div style="border: 1px solid black; padding: 2px 10px;">1</div> </div> <div style="margin-top: 10px; text-align: center;">             Stop bit ( 停止位元 )           </div> </div> <div style="margin-top: 10px; text-align: center;">             8 bit           </div> <div style="margin-top: 10px; text-align: center;">             Non parity ( 無同位元 )           </div>			

## ◆ Address of parameter register / 參數儲存位址

Address No.	Parameter	Description	Read Write	Decimal point	Range of Data
00H 01H	Lck	Lock setting (鎖定設定)	R / W	0	0 ~ 9999
00H 02H	U t	Unit selecting (累積流量單位選擇)	R / W	0	0 ~ 3
00H 03H	k	K value setting (K 值設定)	R / W	1	0.1 ~ 999.9
00H 0CH	Con*	Control mode (累積流量輸出控制)	R / W	0	0 ~ 3
00H 0DH	t 1	Reset time (輸出復歸時間設定)	R / W	2	0.1 ~ 99.99
00H 0EH	ALt	Output status (LPM (Op 1) 輸出狀態)	R / W	0	0 ~ 3
00H 0FH	HYS	Hysteresis (LPM 輸出復歸應差)	R / W	1	0.1 ~ 999.9
00H 10H	t 2	Delay time (OP1 送電動作延遲時間)	R / W	0	0 ~ 99
00H 11H	r S*	RS-485 mode (通訊碼選擇)	R / W	0	0 ~ 1
00H 12H	bPS*	Baud rate (傳輸速率選擇)	R / W	0	0 ~ 2
00H 13H	I d	Station No. (通訊站號設定)	R	0	1 ~ 99
00H 14H	SV1 (Lo word)	Flow rate setting (瞬間流量設定值)	R / W	1	0.0 ~ 99999.9
00H 15H	SV1 (Hi word)				
00H 16H	SV2 (Lo word)	Flow volume setting (累積流量設定值)	R / W	0	0 ~ 999999
00H 17H	SV2 (Hi word)				
00H 20H	PV (Lo word)	Flow rate value (瞬間流量)	R	1	0.0 ~ 99999.9
00H 21H	PV (Hi word)				
00H 22H	CV (Lo word)	Flow volume value (累積流量)	R / W	0	0 ~ 999999
00H 23H	CV (Hi word)				
00H 24H	Output status*	Out1 & Out2 output status (輸出狀態)	R	0	0 ~ 3

**Decimal point** : All value of the parameter is processed to integer, Ex. 「123.4」→「1234」

**小數點** : 所有參數的數值都當成整數處理，例如「123.4」→「1234」

「Con\*」:「0」=「n」,「1」=「r」,「2」=「c」,「3」=「E」

「r S\*」:「0」=「Modbus - RTU mode」,「1」=「Modbus - ASCII mode」

「bPS\*」:「0」=「9600」,「1」=「19200」,「2」=「38400」

**Output status\*\*\*\***

Data	Out1	Out2	Data	Out1	Out2
00H 00H	Off	Off	00H 01H	On	Off
Data	Out1	Out2	Data	Out1	Out2
00H 02H	Off	On	00H 03H	On	On

## ◆ Remarks

Symbol	ASCII code	Description	Symbol	ASCII code	Description	Symbol	ASCII code	Description
@	40	Start code	C	43	Hex	4	34	Hex / BCD
R	52	Read	D	44	Hex	5	35	Hex / BCD
W	57	Write	E	45	Hex	6	36	Hex / BCD
CR	0D	Stop code	F	46	Hex	7	37	Hex / BCD
-	2D	Minus	1	31	Hex / BCD	8	38	Hex / BCD
A	41	Hex	2	32	Hex / BCD	9	39	Hex / BCD
B	42	Hex	3	33	Hex / BCD	:	3A	Hex

# ATP Series RS-485 communication / 通訊協定

## ◆ Message format / 資料格式

MODBUS RTU	Read command :	Station No.	Function code	Address	Batches of data	CRC	
	Read response :	Station No.	Function code	Data byte counts	Data	CRC	
MODBUS ASCII	Read command :	Start code	Station No.	Function code	Address	Data	LRC Stop code
	Read response :	Start code	Station No.	Function code	Address	Data	LRC Stop code

### \* Function code

Function code	Function	Description
03H	Read	To read the data on register
06H	Write ( Single word )	To write the preset value on register
10H	Multi-Write ( Double word )	To write the preset value on register
08H	Diagnose	To diagnose the error of message format

**Ex :** 「Read the **CV** value ( flow volume ) of No.01 flow meter ; CV=123456 ( **01E240H** ) ( Liters )」 and  
 「Write the **K** value ( K factor ) of No.01 flow meter ; **K=123.4** ( **04D2H** )」  
 「Write the **SV1** value ( Flow rate setting ) of No.01 flow meter ; **SV1=12345.6** ( **01E240H** )」  
**【Station No= 01H,CV address = 22H/23H,CV = 123456 ( 01E240H ) ,K address = 03H,K=123.4 ( 04D2H)】**  
**【SV1 address = 14H/15H, SV1 = 123456 ( 01E240H)】**  
 讀取 # 1 流量計的「CV」值 (Liters) 時 CV 是「123456」; 改寫 # 1 流量計的「K」值為「123.4」  
 改寫 # 1 流量計的「SV1」值為「12345.6」  
**【站號= 01H , CV 位址 = 22H/23H、CV =123456 ( 01E240H ) , K 值位址= 03H , K=123.4 ( 04D2H)】**  
**【SV1 位址 = 14H/15H、SV1 =12345.6 ( 01E240H)】**

### Communication mode : 「RS = 0 : MODBUS – RTU code」

Read command	Station No.	Function code	Address		Batches of data		CRC	
	<u>01H</u>	<u>03H</u>	<u>00H 22H</u>		<u>00H 02H</u>		<u>64H 01H</u>	
Read response	Station No.	Function code	Data byte counts		Data		CRC	
	<u>01H</u>	<u>03H</u>	<u>04H</u>		<u>E2H 40H 00H 01H</u>		<u>0CH 5FH</u>	
Write command	Station No.	Function code	Address		Data		CRC	
	<u>01H</u>	<u>06H</u>	<u>00H 03H</u>		<u>04H D2H</u>		<u>FBH 57H</u>	
Write response	Station No.	Function code	Address		Data		CRC	
	<u>01H</u>	<u>06H</u>	<u>00H 03H</u>		<u>04H D2H</u>		<u>FBH 57H</u>	
Multi-Write command	Station No.	Function code	Address	Data batches	Data byte counts	Data		CRC
	<u>01H</u>	<u>10H</u>	<u>00H 14H</u>	<u>00H 02H</u>	04H	<u>E2H 40H 00H 01H</u>		<u>05 3C</u>
Multi-Write response	Station No.	Function code	Address	Data batches				CRC
	01H	10H	00H 14H	00H 02H				01 CC

### Communication mode : 「RS = 1 : MODBUS – ASCII code」

Read command	Start code	Station No.	Function code	Address	Batches of data*	LRC	Stop code
	3AH	30H 31H	30H 33H	30H 30H 32H 32H	30H30H 30H 32H	44H 38H	0DH 0AH
Read response	Start code	Station No.	Function code	Data byte counts**	Data	LRC	Stop code
	3AH	30H 31H	30H 33H	30H 34H	*1	33H 43H	0DH 0AH
Write command	Start code	Station No.	Function code	Address	Data	LRC	Stop code
	3AH	30H 31H	30H 36H	30H 30H 30H 33H	*2	39H 43H	0DH 0AH
Write response	Start code	Station No.	Function code	Address	Data	LRC	Stop code
	3AH	30H 31H	30H 36H	30H 30H 30H 33H	*2	39H 43H	0DH 0AH

Data byte counts\*\* : 2 ASCII code byte = 1 data byte

\*1 : 45H 32H 34H 30H 30H 30H 30H 31H ( 4 data bytes ) \*2 : 30H 34H 44H 32H ( 2 data bytes )

## ◆ Calculation of 「FCS」 / 查核碼計算方式

【RS = 0 : MODBUS – RTU code】: FCS = CRC –16 (Cyclic redundancy check)

## Procedure of CRC-16 calculation

- 1> To load FFH FFH to the 16 bit CRC register
- 2> To exclusive OR (∗) the first byte of the message format with the low order byte of the 16 bit CRC register, then put the result in the 16 bit CRC register.
- 3> To shift the CRC register one bit to right (toward the LSB) and fill the MSB with zero.
- 4> To repeat the step 3 If the carry flag is 0 (LSB is 0), Exclusive OR the CRC register with A001H which is the value of polynomial if the carry flag is 1 (LSB is 1), then put the result in the 16 bit CRC register.
- 5> To repeat the step3 and 4 until the 16 bit CRC register is shifted 8 times
- 6> To repeat from step 2 to step 5 for the next byte of the message format until final byte of message is completed. (Except the CRC bytes)
- 7> To get the CRC value by changing the high order and low order byte of the final CRC register.

【RS = 1 : MODBUS – ASCII code】: FCS = LRC

## Procedure of LRC calculation

- 1> To add all bytes in the message format, excluding the start code ( : ) and ending code (0DH 0AH), then put this value in an 8-bit field.
- 2> To get a Two's complement from this 8-bit field. it is named 「Y」 (8-bit field also)
- 3> To get the LRC value by changing the Hex code to ASCII code from the 「Y」.

## ◆ Error response code / 錯誤回應碼

## \* Message format / 資料格式

RS = 0 : MODBUS – RTU code				
Function	Station No.	Function code	Error code	FCS
Read	01H ~ 63H	83H	01H ~ 05H	CRC-16
Write	01H ~ 63H	86H	01H ~ 05H	CRC-16

RS = 1 : MODBUS – ASCII code						
Function	Start code	Station No.	Function code	Error code	FCS	Stop code
Read	3AH	30H 31H ~ 36H 33H	38H 33H	30H 31H ~ 30H 35H	LRC	0DH 0AH
Write	3AH	30H 31H ~ 36H 33H	38H 36H	30H 31H ~ 30H 35H	LRC	0DH 0AH

Error code					
Code		Description (說明)	Code		Description (說明)
MODBUS – RTU	01H	Command error (指令錯誤)	MODBUS – RTU	03H	Data overflow error (資料長度錯誤)
MODBUS – ASCII	03H 31H		MODBUS – ASCII	30H 33H	
MODBUS – RTU	02H	Address overflow error (位址錯誤)	MODBUS – RTU	04H	Data error (資料值錯誤)
MODBUS – ASCII	30H 32H		MODBUS – ASCII	30H 34H	
MODBUS – RTU	05H	CRC or LRC error			
MODBUS – ASCII	30H 35H				