Fuji Electric

Instruction Manual

FIXED TYPE ULTRASONIC FLOWMETER (FSV-3) COMMUNICATION FUNCTIONS

TYPE: FSV-3

INF-TN5A6216-E Fuji Electric Co., Ltd.

PREFACE

Thank you for purchasing Fuji Electric's ultrasonic flowmeter.
This instruction manual describes the communication specifications, MODBUS protocol, and device address mapping for connecting an ultrasonic flowmeter (FSV) to a PC or programmable controller in order to control and monitor devices through communication.
In addition to this manual, please read the separate instruction manual for the Ultrasonic Flowmeter Transmitter INF-TN3FSV-E.

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NOTICE

1. Exemption items from responsibility
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Issued in Oct., 2024

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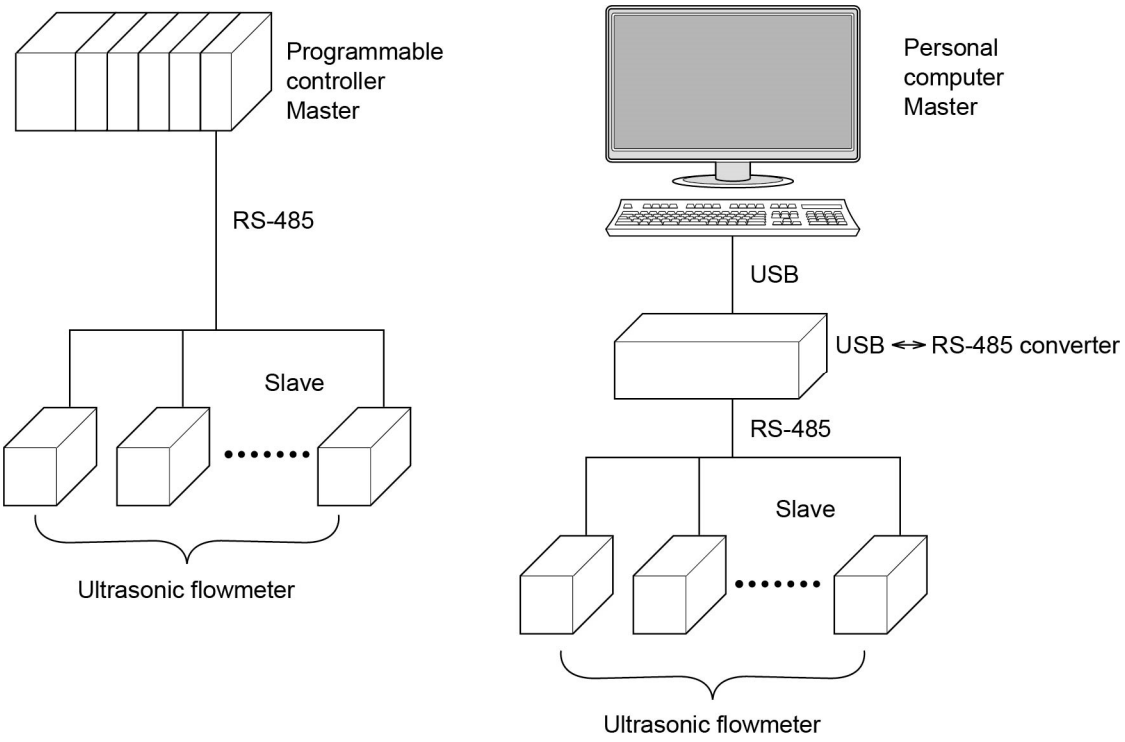
1. COMMUNICATION FUNCTIONS

1.1 General

- This instrument provides a communication function by RS-485 interface, by which it can transmit and receive data to and from host computer, programmable controller, graphic display panel, etc.
- When using the RS-485 interface, the communication system consists of master station and slave stations. Up to 31 slave stations (this instrument) can be connected per master station.
  Note that, because the master station can communicate with only only one slave station at a time, a party to communicate with must be specified by the “Station No.” set at each slave station.
- In order that the master station and slave station can communicate, the format of the transmit/receive data must coincide. With this instrument, communication data format is determined by the MODBUS protocol.
- Please use an USB ↔ RS-485 converter in case of designating a personal computer or other devices which have an USB interface as a master station.

  Communication converter (recommended product)
  USB ↔ RS485 converter: Model No. SI-35USB-2/LINEEYE CO., LTD.

System configuration (when using the RS-485 interface)



Note) When using the USB ↔ RS-485 converter, pay attention to cable connection between the converter and master station. If the cable is not connected correctly, the master station and slave station cannot communicate. In addition, please adjust the communication settings (baud rate, parity, etc.) of your communication converter if your model requires such settings.

2. SPECIFICATIONS

2.1 Communication Specifications

Item	Specification	
Electrical specification	Based on EIA RS-485	
Transmission system	2-wire, semi-duplicate	
Synchronizing system	Start-stop synchronous system	
Connection format	1 : N (RS-485)	
Number connectable units	Up to 31 units (RS-485)	
Transmission distance (total extension)	1,000 m max. (RS-485)	
Transmission speed	9600, 19200, 38400 bps	
Data format	Data length	8 bits
	Stop bit	1 bit, 2 bit
	Parity	none, even, odd (selectable)
Isolation	Functional isolation between transmission circuit and ground (withstand voltage : 500V AC)	

2.1.1 Communication protocol

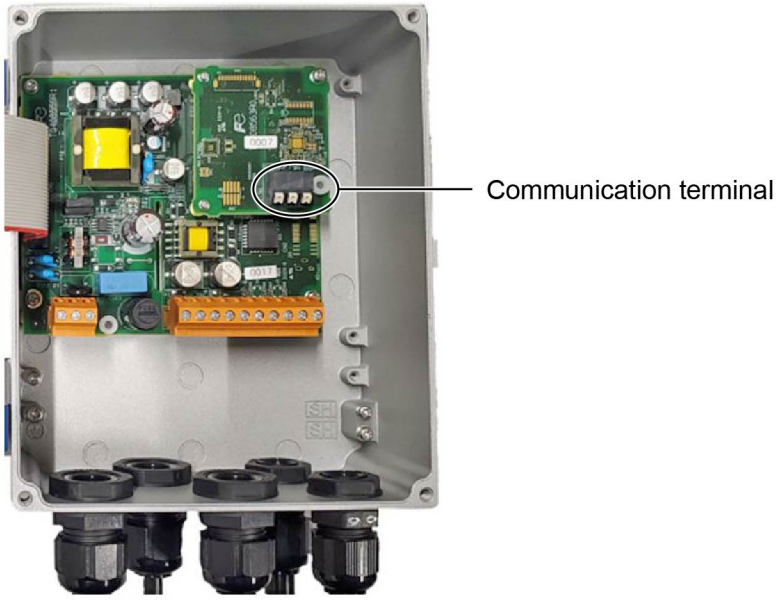
(1) MODBUS protocol

Item	Specification
Transmission code	HEX value (MODBUS RTU mode)
Error detection	CRC-16

3. CONNECTION

> **⚠ WARNING**
>
> For avoiding electric shock and malfunctions, do not turn on the power supply untill all wiring have been completed.

3.1 Communication Terminal Allocation



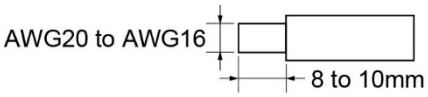
Communication Terminal

1	2	3
+	–	SG

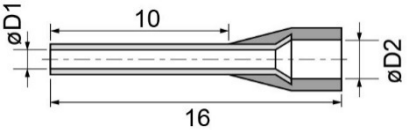
RS-485

■Useable wire material

・Electric wire
Thickness: AWG20 (0.5mm^2) to AWG16 (1.5mm^2)
Strip-off length: 8 to 10mm



・Bar terminal
Weidmüller
www.weidmuller.com
Product name: Wire end ferrule with plastic collar

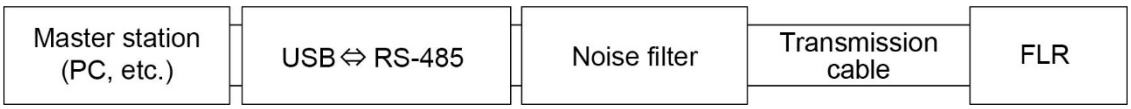


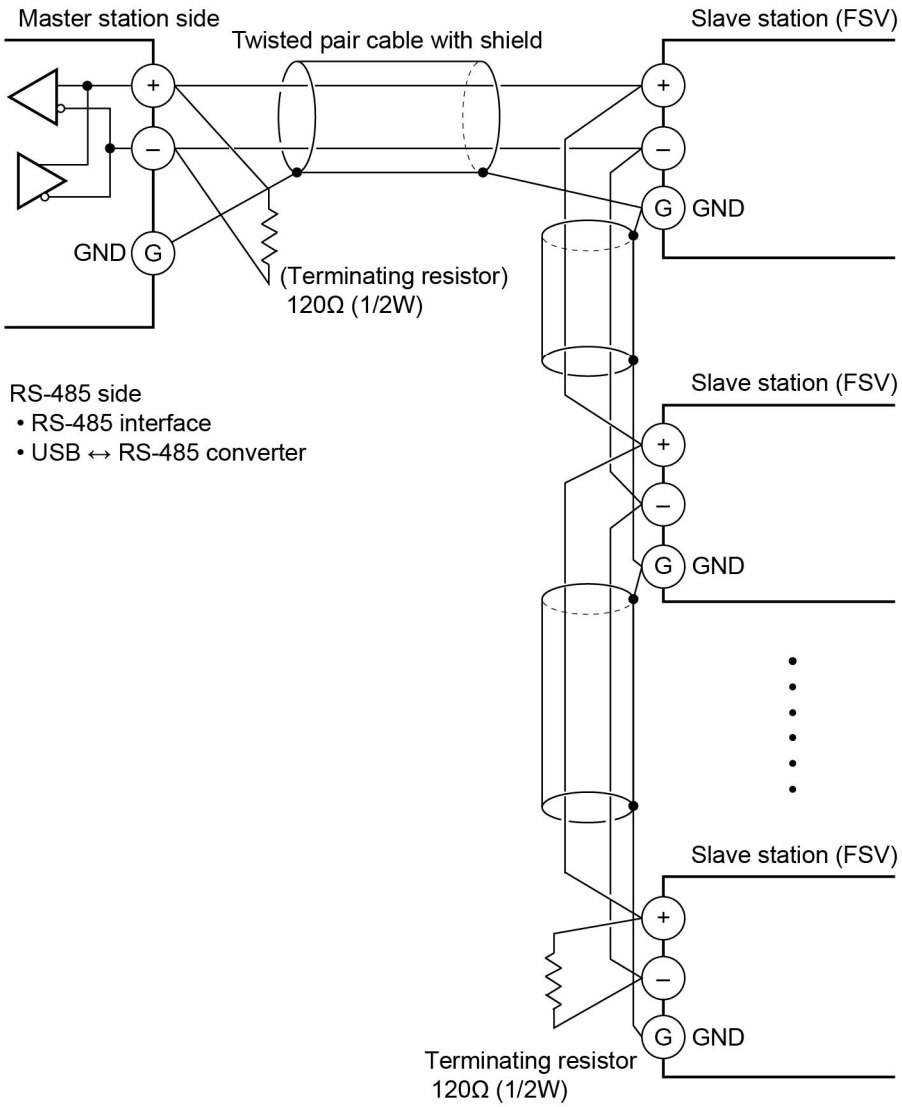
Electric wire thickness (mm^2)	øD1 (mm)	øD2 (mm)	Model
0.5	1	2.6	H0.5/16
0.75	1.2	2.8	H0.75/16
1	1.4	3	H1/16
1.5	1.7	3.5	H1.5/16

3.2 Wiring

3.2.1 RS-485 interface

- Use twisted pair cables with shield.
  Recommended eable: UL2464, UL2448, etc.
- The total extension length of the cable is up to 1000 m. A master station and up to 31 units of this instrument can be connected per line.
- Terminate the both ends of the cable with 120Ω (1/2 W or higher) terminating resistors.
  Note: See the specifications of the master for the terminating resistors of the master station unit.
- The shield wire of the cable should be grounded only at one place on the master station unit side.
- If this instrument is to be installed where the level of noise applied to this instrument may exceed 1000 V, it is recommended to install a noise filter in the master station side as below.





4. SETTING OF COMMUNICATION CONDITION

In order that the master station and instrument (this instrument) can correctly communicate, following settings are required.

- All communication condition settings of the master station are the same as those of instruments (this instrument).
- All instruments (this instrument) connected on a line are set to “Station No.” which are different from each other. Any “Station No.” is not shared by more than one instrument (when using the RS-485 interface).

4.1 Set Items

The parameters to be set are shown in the following table. Set them by operating the front panel keys.

Item	Value at delivery	Setting range	Remarks
Station No.	1	1 to 31 (0:communication function stop)	Set a different value to each station.
Transmission speed	9600 bps	9600 bps, 19200 bps, 38400 bps	Set the same communi-cation condition to the master station and all slave stations.
Parity setting	Odd	None: None parity Odd: Odd parity Even: Even parity	
Data length	8 bits	Fixed (can not be changed)	
Stop bit	1 bit	1 bit, 2 bits	

4.2 Setting operation method

(1) Make communication settings on the maintenance mode screen of the display setting area of the main unit. For operating instructions, refer to the instruction manual for the Ultrasonic Flowmeter Transmitter INF-TN3FSV-E.

5. MODBUS COMMUNICATION PROTOCOL

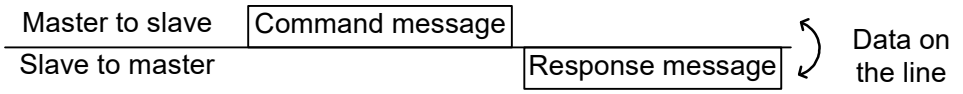
5.1 General

The communication system by the MODBUS protocol is that the communication is always started from the master station and a slave station responds to the received message.

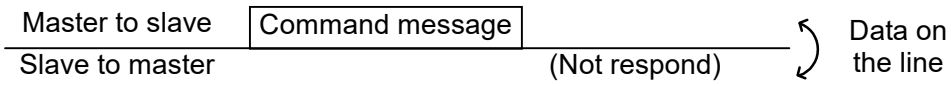
Transmission procedures is as shown below.

1) The master station sends a command message to a slave station.
2) The slave station checks that the station No. in the received message matches with the own station No. or not.
3) If matched, the slave station executes the command and sends back the response message.
4) If mismatched, the slave station leaves the command message and wait for the next command message.

a) In case when the station No. in the received command message matches with the own slave station No.



b) In case when the station No. in the received command message mismatches with the own slave station No.



5) To assure safety, provide a structure where the response message is checked and retry is made three (3) times or more if no response is made or an error occurs.

The master station can individually communicate with any one of slave stations connected on the same line upon setting the station No. in the command message.

5.2 Composition of Message

Compositions of the command message and response message are as shown in Fig. 5-1. ; And these are sent in this order.

Station No. (1 byte)
Function code (1 byte)
Data (2 to 133 bytes)
Error check code (CRC-16) (2 bytes)

Fig. 5-1 Composition of message

In the following, each field is explained.

(1) Station No.

Station No. is the number specifiing a slave station. When RS-485 interface is used, the command message is received and operated only by the slave station (FSV) whose station No. matches with the No. set in "Station No."

For details of setting the parameter "Station No.," refer to Chapter 4.

(2) Function code

This is a code to designate the function executed at a slave station.

For details, refer to Section 5.4.

(3) Data

Data are the data required for executing function codes. The composition of data varies with function codes.

For details, refer to Chapter 6.

A register number is assigned to each data in the flowmeter. For reading/writing the data by communication, designate the register number.

Note that the register number transmitted on message is expressed as its relative address.

The relative address is calculated by the following expression.

$$\boxed{\text{Relative address}} = \left(\text{The lower 4 digits of the } \boxed{\text{register number}} \right) - 1$$

For example, when the resister number designated by a function code is 40003,

Relative address = (lower 4 digits of 40003) – 1

= 0002

is used on the message.

(4) Error check code

This is the code to detect message errors (change in bit) in the signal transmission.

On the MODUBUS protocol (RTU mode), CRC-16 (Cycric Redundancy Check) is applied.

For CRC calculation method, refer to Section 5.5.

5.3 Response of Slave Station

(1) Response for normal command

To a relevant message, the slave station creates and sends back a response message which corresponds to the command message. The composition of message in this case is the same as in Section 5.2.
Contents of the data field depend on the function code. For details, refer to Chapter 6.

(2) Response for abnormal command

If contents of a command message have an abnormality (for example, non-actual function code is designated) other than transmission error, the slave station does not execute that command but creates and sends back a response message at error detection.
The composition of response message at error detection is as shown in Fig. 5-2 The value used for function code field is function code of command message plus 80_H.
Table 5-1 gives error codes.

Station No.
Function code + 80_H
Error code
Error check（CRC-16）

Fig. 5-2 Response message at error detection

Table 5-1 Error Code

Error code	Contents	Description
01H	Illegal function code	Non-actual function code is designated. Check for the function code.
02H	Illegal data address	A relative address of a resister number to which the designated function code can not be used.
03H	Illegal data number	Because the designation of number is too much, the area where resister numbers do not exist is designated.

(3) No response

Under any of the following items, the slave station takes no action of the command message and sends back no response.

- A station number transmitted in the command message differs from the station number specified to the slave station.
- A error check code is not matched, or a transmission error (parity error, etc.) is detected.
- The time interval between the composition data of the message becomes longer than the time corresponding to 24 bits. (Refer to Section 5.6 Transmission Control Procedure)
- Station No. of a slave station is set to 0.
- Setting is made on the main unit with the operation keys.
- The main unit displays a write-in command on a screen other than the measurement screen.

5.4 Function Code

According to MODBUS protocol, register numbers are assigned by function codes.
Each function code acts on specific register number.
This correspondence is shown in Table 5-2, and the message length by function is shown in Table 5-3.

Table 5-2 Correspondence between function codes and objective address

Function code			⟷	Resister No.	
No.	Function	Object		No.	Contents
03_H	Read-out (continuously)	Holding register		4xxxx	Read-out/write-in word data
04_H	Read-out (continuously)	Input register		3xxxx	Read-out word data
06_H	Write-in	Holding register		4xxxx	Read-out/write-in word data
10_H	Write-in (continuously)	Holding register		4xxxx	Read-out/write-in word data

Table 5-3 Function code and message length

[Unit:byte]

Function code	Contents	Number of designatable data	Command message		Response message	
			Minimum	Maximum	Minimum	Maximum
03_H	Read-out of word data	64 words	8	8	7	133
04_H	Read-out of word data (read-out only)	64 words	8	8	7	133
06_H	Write-in of word data	1 word	8	8	7	7
10_H	Write-in of continuous word data	64 words	11	137	8	8

5.5 Calculation of Error Check Code (CRC-16)

CRC-16 is the 2-byte (16-bits) error check code. From the top of the message (station No.) to the end of the data field are calculated.

The slave station calculates the CRC of the received message, and does not respond if the calculated CRC is different from the contents of the received CRC code.

Fig. 5-3 shows the flow of the CRC-16 calculation system.

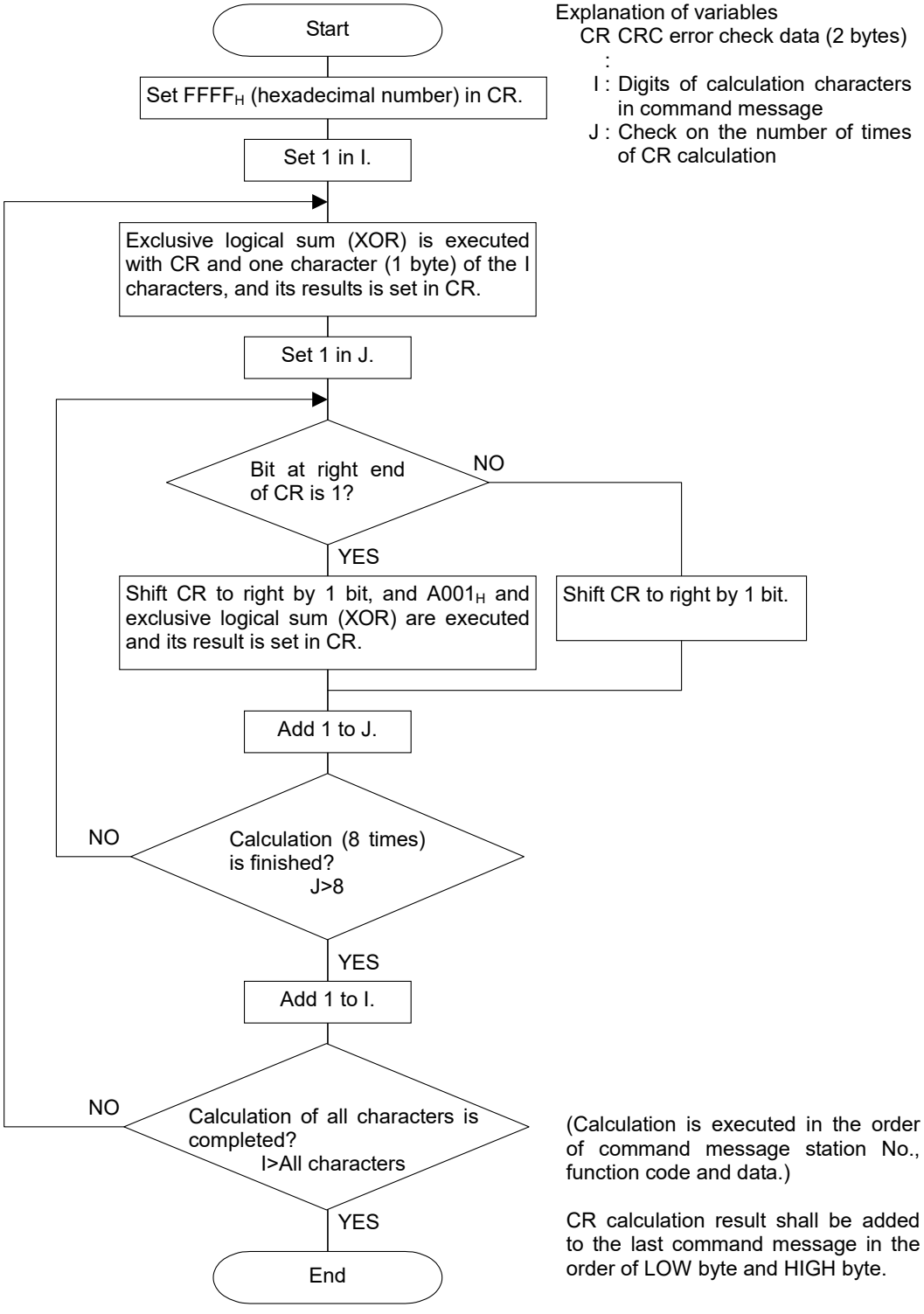


Fig. 5-3 Flow of CRC-16 calculation

5.6 Transmission Control Procedure

(1) Transmission procedure of master station

The master station must proceed to a communication upon conforming to the following items.

(1-1) Before sending a command message, provide 48 bits time or more vacant status.

(1-2) For sending, the interval between bytes of a command message is below 24 bits time.

(1-3) Within 24 bits time after sending a command message, the receiving status is posted.

(1-4) Provide 48 bits time or more vacant status between the end of response message reception and beginning of next command message sending [same as in (1-1)].

(1-5) For ensuring the safety, make a confirmation of the response message and make an arrangement so as to provide 3 or more retries in case of no response, error occurrence, etc.

Note) The above definition is for most unfavorable value. For ensuring the safety, it's recommended the program of the master to work with safety factors of 2 to 3. Concretely, it is advised to arrange the program for 9600 bps with 15 ms or more for vacant status (1-1), and within 1 ms for byte interval (1-2) and changeover from sending to receiving (1-3).

(2) Description

1) Detection of the message frame

This communication system may be 2 statuses on a line below.

(a) Vacant status (no data on line)

(b) Communication status (data is existing)

Instruments connected on the line are initially at a receiving status and monitoring the line. When 24 bits time or more vacant status has appeared on the line, the end of preceding frame is assumed and, within following 24 bits time, a receiving status is posted. When data appears on the line, instruments receive it while 24 bits time or more vacant status is detected again, and the end of that frame is assumed. I.e., data which appeared on the line from the first 24 bits time or more vacant status to the next 24 bits time or more vacant status is fetched as one frame.

Therefore, one frame (command message) must be sent upon confirming the following.

(1-1) 48 bits time or more vacant status precedes the command message sending.

(1-2) Interval between bytes of 1 command message is smaller than 24 bits time.

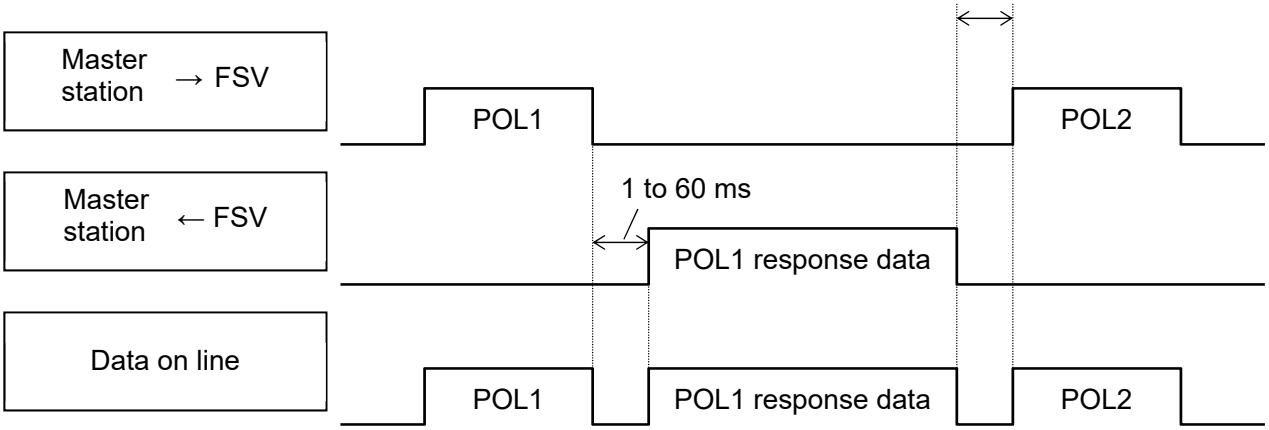
2) Response of this instrument (FSV)

After a frame detection (24 bits time or more vacant status), this instrument carries out processing with that frame as a command message. If the command message is destined to the own station, a response message is returned. Its processing time is 5 to 60 ms (depends on contents of command message).

After sending a command message, therefore, the master station must observe the following

(1-3) Receiving status is posted within 24 bits time after sending a command message.

Space time of longer than 25 ms is needed.



6. DETAILS OF MESSAGE

6.1 Read-out of Word Data [Function code: 03_H]

Function code	Max. word number read-out in one message	Relative data address	Register No.	Kind of data
03_H	64 words	0000_H－0105_H 0140_H－0145_H	40001－40262 40321－40326	Storage enable data
		0154_H－0167_H	40341－40360	Storage disable data

(1) Message composition

Command message composition (byte)

Station No.		
Function code		
Read-out start No. (relative address)	Upper	
	Lower	
Read-out word number	Upper	1 to 64
	Lower	
CRC data	Lower	
	Upper	

Response message composition (byte)

Station No.		
Function code		
Read-out byte number		Read-out word number×2
Contents of the first word data	Upper	
	Lower	
Contents of the next word data	Upper	
	Lower	
～		～
Contents of the last word data	Upper	
	Lower	
CRC data	Lower	
	Upper	

* Arrangement of read-out word data

MSB　　LSB
Upper byte of contents of the first word data
Lower byte of contents of the first word data
Upper byte of contents of the next word data
Lower byte of contents of the next word data
～ ～
Upper byte of contents of the last word data
Lower byte of contents of the last word data

(2) Function explanations

Word data of continuous word numbers from the read-out start No. can be read. Read-out word data are transmitted from the slave station in the order of upper and lower bytes.

(3) Message transmission (example)

Reading “Damping” from No. 2 station is shown below.

Relative address of damping: 0000_H (Register No.40001), Data number: 01_H

Command message composition (byte)

Station No.		02_H
Function code		03_H
Read-out start No. (relative address)	Upper	00_H
	Lower	00_H
Read-out word number	Upper	00_H
	Lower	01_H
CRC data	Lower	84_H
	Upper	39_H

Response message composition (byte)

Station No.		02_H
Function code		03_H
Read-out byte number		02_H
Contents of the first word data	Upper	00_H
	Lower	64_H
CRC data	Lower	FD_H
	Upper	AF_H

* Meaning of data to be read

Damping (contents of the first word data) 00 $64_H = 100$

Where the unit is sec with decimal point position set at 1,

Damping = 10.0 sec

Point For “Point” decimal point, refer to Section 7.1.

6.2 Read-out of Read-out Only Word Data [Function code: 04_H]

Function code	Max. word number read-out in one message	Relative data address	Register No.
04_H	64 words	0000_H－0025_H 0080_H－$00B1_H$	30001－30038 30129－30178

(1) Message composition

Command message composition (byte)

Station No.		
Function code		
Read-out start No. (relative address)	Upper	
	Lower	
Read-out word number	Upper	} 1 to 64
	Lower	
CRC data	Lower	
	Upper	

Response message composition (byte)

Station No.		
Function code		
Read-out byte number		Read-out word number×2
Contents of the first word data	Upper	
	Lower	
Contents of the next word data	Upper	
	Lower	
～	～	
Contents of the last word data	Upper	
	Lower	
CRC data	Lower	
	Upper	

* Arrangement of read-out word data

MSB　　LSB
Upper byte of contents of the first word data
Lower byte of contents of the first word data
Upper byte of contents of the next word data
Lower byte of contents of the next word data
～
Upper byte of contents of the last word data
Lower byte of contents of the last word data

(2) Function explanations

Word data of continuous word numbers from the read-out start No. can be read. Read-out word data are transmitted from the slave station in the order of upper and lower bytes.

(3) Message transmission (example)

The following is an example of reading out the flow rate from station No. 1.

Relative address of the flow rate: 0004_H (Register No. 30005), Number of data to be read out: 02_H

Command message composition (byte)

Station No.		01_H
Function code		04_H
Read-out start No. (relative address)	Upper	00_H
	Lower	04_H
Read-out word number	Upper	00_H
	Lower	02_H
CRC data	Lower	30_H
	Upper	$0A_H$

Response message composition (byte)

Station No.		01_H
Function code		04_H
Read-out byte number		04_H
Contents of the first word data	Upper	43_H
	Lower	40_H
Contents of the next word data	Upper	00_H
	Lower	00_H
CRC data	Lower	EF_H
	Upper	$D4_H$

Meaning of read-out data

Data having the unit m^3/h and floating decimal point

The read-out data is expressed as a 32-bit single-precision floating value.

Connect the read-out 4-byte data, and convert it into an actual value using an appropriate conversion program.

Flow rate, 192.0 m3/h = 1.5x (2 to the 7th power)

= 0100 0011 0100 0000 0000 0000 0000 0000 (binary number)

Refer to Section 7.1 for handling of floating data.

> Point For handling of floating data, refer to Section 7.1.

6.3 Write-in of Word Data [Function code: 06_H]

Function code	Max. word number write-in in one message	Relative data address	Register No.	Kind of data
06_H	1 word	0140_H－0145_H	40321－40326	Storage enable data
		0154_H－0167_H	40341－40360	Storage disable data

(1) Message composition

Command message composition (byte)

Station No.		
Function code		
Write-in designate No. (relative address)	Upper	
	Lower	
Write-in word data	Upper	
	Lower	
CRC data	Lower	
	Upper	

Response message composition (byte)

Station No.		
Function code		
Write-in designate No. (relative address)	Upper	
	Lower	
Write-in word data	Upper	
	Lower	
CRC data	Lower	
	Upper	

(2) Function explanation

Designated word data is written in write-in designate No. Write-in data are transmitted from master station in the order of upper and lower bytes.

The current value is returned when the write-in data does not fall within the effective range.

(3) Message transmission (example)

The following shows an example of transmitting the “Zero adjustment” key command to No.1 station.

Key operation command Relative address: 0140_H

Command message composition (byte)

Station No.		01_H	
Function code		06_H	
Write-in designate No. (relative address)	Upper	01_H	
	Lower	40_H	
Write-in word data	Upper	00_H	“Brightness UP” key command
	Lower	01_H	
CRC data	Lower	48_H	
	Upper	22_H	

Response message composition (byte)

Station No.		01_H
Function code		06_H
Write-in designate No. (relative address)	Upper	01_H
	Lower	40_H
Write-in word data	Upper	00_H
	Lower	01_H
CRC data	Lower	48_H
	Upper	22_H

6.4 Write-in of continuous word data [Function code: 10_H]

Function code	Max. word number write-in in one message	Relative data address	Register No.	Kind of data
10_H	64 word	0000_H－0105_H	40001－40262	Storage enable data

(1) Message composition

Command message composition (byte)

Station No.		
Function code		
Write-in start No. (relative address)	Upper	
	Lower	
Write-in word number	Upper	1 to 64
	Lower	
Write-in byte number		Write-in word number × 2
First write-in word data	Upper	
	Lower	
Next write-in word data	Upper	
	Lower	
～		
Last write-in word data	Upper	
	Lower	
CRC data	Lower	
	Upper	

Response message composition (byte)

Station No.	
Function code	
Write-in start No. (relative address)	Upper
	Lower
Write-in word number	Upper
	Lower
CRC data	Lower
	Upper

* Arrangement of write-in word data

MSB　　LSB
Upper byte of contents of the first word data
Lower byte of contents of the first word data
Upper byte of contents of the next word data
Lower byte of contents of the next word data
～
Upper byte of contents of the last word data
Lower byte of contents of the last word data

(2) Function explanation

Word data of continuous word number is written from write-in start address. Write-in word data are transmitted from master station in the order of upper and lower bytes.

If write-in data does not fall within the effective range, response is made without counting it as write-in word number. If an attempt is made to write data in an unused address, write-in is not performed, and response is made without counting it as write-in word number.

(3) Message transmission (example)

Writing Flow unit = m^3/h, Range type = single range, Full scale 1 = 300.0 m^3/h in No. 1 station is shown below.

Flow unit = 0006_H (= 6_D)

Range type = 0000_H (= 0_D)

Full scale 1 = 4072 C000 0000 0000 (= 300.0_D) (64-bit double precision float type)

Relative address of Flow unit: 0004_H (Register No. 40005), Data number: 06_H

Command message composition (byte)

Station No.		01_H
Function code		10_H
Write-in start No. (relative address)	Upper	00_H
	Lower	04_H
Write-in word number	Upper	00_H
	Lower	06_H
Write-in byte number		$0C_H$
First write-in word data	Upper	00_H
	Lower	06_H
Next write-in word data	Upper	00_H
	Lower	00_H
Next write-in word data	Upper	40_H
	Lower	72_H
Next write-in word data	Upper	$C0_H$
	Lower	00_H
Next write-in word data	Upper	00_H
	Lower	00_H
Last write-in word data	Upper	00_H
	Lower	00_H
CRC data	Lower	51_H
	Upper	AB_H

Response message composition (byte)

Station No.		01_H
Function code		10_H
Write-in start No. (relative address)	Upper	00_H
	Lower	04_H
Write-in word number	Upper	00_H
	Lower	06_H
CRC data	Lower	01_H
	Upper	CA_H

Point For handling of floating data, refer to Section 7.1.
For transmission format of each data, refer to the address map (Chapter 7.)

7. ADDRESS MAP AND DATA FORMAT

7.1 Data Format

7.1.1 Transmission data format

The MODBUS protocol used in this product is RTU (Remote Terminal Unit) mode.
The transmitted data is “numerical value”, but ASCII code data is partly included.

7.1.2 Handling of decimal point

Numerical value data includes integer data, decimal point position fixed data and floating data. Handling of data containing a decimal point is described below.

(1) Data with determined decimal point position (int type, long type)

No decimal point is added in the transmission data. Execute decimal point position alignment processing (elimination of decimal point at the time of transmission, addition of decimal point at the time of reception) on data with decimal point.

Example: Case of damping data

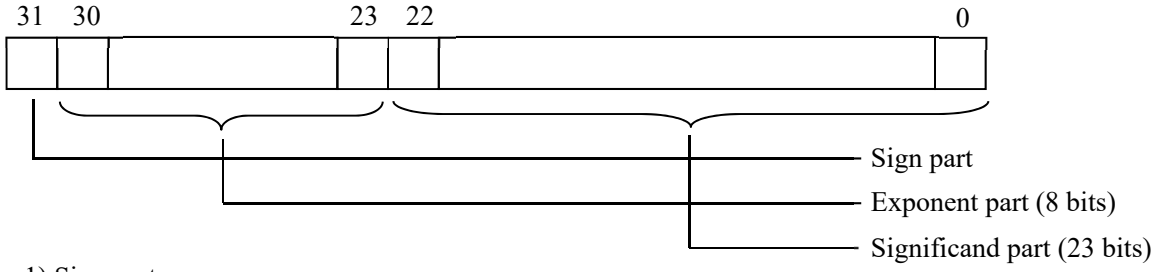
Read-out data: 03 $E8_H$ = 1000

Decimal point position: 1 digit

Value: 100.0sec

(2) 32-bit floating data (float type)

Instantaneous values or the like are expressed by 32-bit single precision float type.
The meaning of each bit is as follows (standard format specified in IEEE).



1) Sign part

Indicates the sign of the floating decimal point. “0” represents “positive”, and “1” represents “negative”.

2) Exponent part

Indicates the exponent of the floating decimal point by a power of 2. The value obtained by subtracting 127 from this value is the actual exponent.

3) Significand part

This is the data that corresponds to the significant figure of the floating decimal point. The actual numerical value is interpreted by adding 1 to the top.

Example: 1 10000000 11000000000000000000000

Sign : Minus

Exponent : $10000000_{(2)} - 127 = 1$

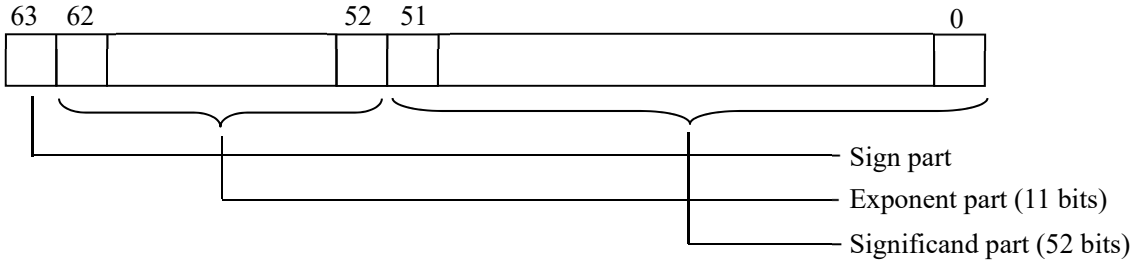
Significand : $1.11_{(2)} = 1 + 1/2 + 1/4 = 1.75$

Value : $-1.75 \times$ (1st power of 2) = –3.5

(3) 64-bit floating data (double type)

Instantaneous values or the like are expressed by 64-bit double precision float type.

The meaning of each bit is as follows (standard format specified in IEEE).



1) Sign part

Indicates the sign of the floating decimal point. "0" represents "positive", and "1" represents "negative".

2) Exponent part

Indicates the exponent of the floating decimal point by a power of 2. The value obtained by subtracting 1023 from this value is the actual exponent.

3) Significand part

This is the data that corresponds to the significant figure of the floating decimal point. The actual numerical value is interpreted by adding 1 to the top.

Example: 0 01111111111 1110000000000000000000000000000000000000000000000000

Sign	:	Plus
Exponent	:	$01111111111_{(2)} - 1023 = 0$
Significand	:	$1.111_{(2)} = 1 + 1/2 + 1/4 + 1/8 = 1.875$
Value	:	1.875 × (0th power of 2) = 1.875

7.1.3 Handling of measured data on occurrence of range over

Even if the measured data (instantaneous value) is in excess of the scale range, the measured data (velocity or flow rate) is transmitted as it is as the instantaneous value Read-out data.

7.1.4 RAS Information

RAS information consists of 16 bits, each of which indicates a specific status (error) and is expressed as 1 (occurred)/ 0 (not occurred). The normal status is "0000_H." The bit assignment is in Table 7-1.

Table 7-1 <RAS information bit assignment>

bit	RAS information	Conditions
15	E1: Device error 1	Backup memory error
14	E1: Device error 2	Measurement circuit error
13	E2: Collection error	Cannot collect ultrasonic reception signals.
12	E2: Window scan	Detecting ultrasonic reception waves
11	E2: No signal	No ultrasonic reception waves received
10	E2: Signal error	Poor ultrasonic reception wave conditions
9	E2: Signal over	Ultrasonic reception waves are not in the proper range
8	E2: Calculate error	Detected measurement data has abnormal values
7	Reserved	–
6	Reserved	–
5	Reserved	–
4	Reserved	–
3	Reserved	–
2	Reserved	–
1	E4: Range over	The analog output and total output exceed the range
0	Reserved	–

7.2 Address Map

For detailed information on the functions and setting ranges of individual parameters, refer to the instruction manual for the Ultrasonic Flowmeter Transmitter INF-TN3FSV-E.

Data type
- unsigned char : Byte data without sign. This data is handled in byte units. One data per address
- int : Word data with sign. This data is handled in word units. One data per two addresses
- unsigned int : Word data without sign. This data is handled in word units. One data per two addresses
- Long : 2-word data with sign. This data is handled in 2-word units. One data per four addresses
- float : Floating data. This data is handled in 2-word units. One data per four addresses
- double : Floating data. This data is handled in 4-word units. One data per eight addresses

7.2.1 Word data [Read-out/Write-in]: Function code [03_H, 10_H]

Relative address	Register No.	Data type	Parameter	Read-out data/Write-in data setting range	Remarks
	4XXXX				
0000	40001	int	Damping	1 place after the decimal point, 0.0 to 100.0sec	
0002	40003	int	Range kind	0: Velocity, 1: Flow rate	
0004	40005	int	Flow rate unit	Metric system : 0:L/s, 1:L/min, 2:L/h, 3:L/d, 4:kL/d, 5:ML/d, 6:m^3/s, 7:m^3/min, 8:m^3/h, 9:m^3/d, 10:km^3/d, 11:Mm^3/d, 12:BBL/s, 13:BBL/min, 14:BBL/h, 15:BBL/d, 16:kBBL/d, 17:MBBL/d English system : 0:gal/s, 1:gal/min, 2:gal/h, 3:gal/d, 4:kgal/d, 5:Mgal/d, 6:ft^3/s, 7:ft^3/min, 8:ft^3/h, 9:ft^3/d, 10:kft^3/d, 11:Mft^3/d, 12:BBL/s, 13:BBL/min, 14:BBL/h, 15:BBL/d, 16:kBBL/d, 17:MBBL/d	
0006	40007	int	Range type	0: Single range, 1: Auto 2 range, 2: Forward-reverse range, 3: Forward-reverse auto 2 range	
0008	40009	double	Full scale 1	Metric system: 64-bit floating data; 0, ±0.3 to ±32m/s as converted to flow rate English system: 64-bit floating data	Unit: Flow rate
0010	40017	double	Full scale 2	Metric system: 64-bit floating data; 0, ±0.3 to ±32m/s as converted to flow rate English system: 64-bit floating data	Unit: Flow rate
0018	40025	int	Range hysteresis	2 places after the decimal point, 0.00 to 20.00%	
001A	40027	int	Burnout	0: Not use, 1: Hold, 2: Upper, 3: Lower, 4: Zero	
001C	40029	int	Burnout timer	Decimal point fixed, 0 to 900sec	
001E	40031	int	Output limit low	Decimal point fixed, –20 to 0%	
0020	40033	int	Output limit high	Decimal point fixed, 100 to 120%	
0022	40035	int	Rate limit timer	Decimal point fixed, 0 to 900sec	
0024	40037	double	Rate limit	Metric system: 64-bit floating data; 0 to 5m/s as converted to flow rate English system: 64-bit floating data	Unit: Flow rate
002C	40045	double	Low flow rate cut	Metric system: 64-bit floating data; 0 to 5m/s as converted to flow rate English system: 64-bit floating data	Unit: Flow rate
0034	40053	double	Calibration zero	Metric system: 64-bit floating data; ±5m/s as converted to flow rate English system: 64-bit floating data	Unit: Flow rate
003C	40061	int	Calibration span	2 places after the decimal point, 0.00 to 200.00%	
003E	40063	int	Operation mode	0: Normal, 1: High speed response mode	
0040	40065	int	Total unit *1	Metric system : 0:mL, 1:L, 2:m^3, 3:km^3, 4:Mm^3, 5:mBBL, 6:BBL, 7:kBBL English system : 0:gal, 1:kgal, 2:ft^3, 3:kft^3, 4:Mft^3, 5:mBBL, 6:BBL, 7:kBBL, 8:ACRf	
0042	40067	int	Total mode	0: Start, 1: Stop, 2: Total reset	
0044	40069	double	Total constant *1	64-bit floating data, 0 to 99999999	Unit: Total
004C	40077	double	Total preset *1	64-bit floating data, 0 to 99999999	Unit: Total
0054	40085	int	Pulse width *1	0: 5.0 msec, 1: 10.0 msec, 2: 50.0 msec, 3: 100.0 msec, 4: 200.0 msec, 5: 500.0 msec, 6: 1000.0 msec	
0056	40087	int	Burnout	0: Hold, 1: Not use	
0058	40089	int	Burnout timer	Decimal point fixed, 0 to 900sec	
005A	40091	int	DO1 out	0: Not use, 1: + Total pulse, 2: – Total pulse, 3: Full scale 2, 4: Alarm, 5: Flow switch, 6: Total switch,7: Ao range over,8: Pulse range over,9: – Flow direction	
005C	40093	int	Alarm	0: All, 1: Equipment error, 2: Process error	
005E	40095	int	Flow rate switch	0: Upper flow rate, 1: Lower flow rate	
0060	40097	double	Upper flow rate	Metric system: 64-bit floating data; 0 to 32m/s as converted to flow rate English system: 64-bit floating data	Unit: Flow rate
0068	40105	double	Lower flow rate	Metric system: 64-bit floating data; 0 to 32m/s as converted to flow rate English system: 64-bit floating data	Unit: Flow rate
0070	40113	double	Total switch *1	64-bit floating data, 0 to 99999999	Unit: Total
0078	40121	int	DO1 contact action	0: Active ON, 1: Active OFF	

Relative address	Register No.	Data type	Parameter	Read-out data/Write-in data setting range	Remarks
007A	40123	int	DO2 out	0: Not use, 1: + Total pulse, 2: – Total pulse, 3: Full scale 2, 4: Alarm, 5: Flow switch, 6: Total switch,7: Ao range over,8: Pulse range over,9: – Flow direction	
007C	40125	int	Alarm	0: All, 1: Equipment error, 2: Process error	
007E	40127	int	Flow rate switch	0: Upper flow rate, 1: Lower flow rate	
0080	40129	double	Upper flow rate	Metric system: 64-bit floating data; 0 to 32m/s as converted to flow rate English system: 64-bit floating data	Unit: Flow rate
0088	40137	double	Lower flow rate	Metric system: 64-bit floating data; 0 to 32m/s as converted to flow rate English system: 64-bit floating data	Unit: Flow rate
0090	40145	double	Total switch *1	64-bit floating data, 0 to 99999999	Unit: Total
0098	40153	int	DO2 contact action	0: Active ON, 1: Active OFF	
009A	40155	int			Not use, writein inhibited
009C	40157	int			Not use, writein inhibited
009E	40159	int			Not use, writein inhibited
00A0	40161	double			Not use, writein inhibited
00A8	40169	double			Not use, writein inhibited
00B0	40177	double			Not use, writein inhibited
00B8	40185	int			Not use, writein inhibited
00BA	40187	int			Not use, writein inhibited
00BC	40189	int			Not use, writein inhibited
00BE	40191	int			Not use, writein inhibited
00C0	40193	int	1st row	0: Velocity, 1: Flow rate, 2: Flow rate (%), 3: + Total (actual), 4: + Total pulse, 5: – Total (actual), 6: – Total pulse	
00C2	40195	int	Decimal point position of 1st row	0: *.******, 1: **.*****, 2: ***.****, 3: ****.***, 4: *****.**, 5: ******.*, 6: ********.	Write-in is not permitted in case the row is “Velocity”, “+ Total pulse” or “– Total pulse”.
00C4	40197	Int	2nd row	0: Velocity, 1: Flow rate, 2: Flow rate (%), 3: + Total (actual), 4: + Total pulse, 5: – Total (actual), 6: – Total pulse	
00C6	40199	int	Decimal point position of 2nd row	0: *.******, 1: **.*****, 2: ***.****, 3: ****.***, 4: *****.**, 5: ******.*, 6: ********.	Write-in is not permitted in case the row is “Velocity”, “+ Total pulse” or “– Total pulse”.
00C8	40201	int	LCD Backlight	0: ON, 1: OFF	
00CA	40203	int	LCD Backlight out time	0 to 99 min	
00CC	40205				Not use, writein inhibited
00CE	40207				Not use, writein inhibited
00D0	40209	int	Sensor type	2: FSSA/FSSG, 3: FLS_12/FLS_22, 4: FSSC, 5: FSG_32, 6: FSG_31/FSG_41, 7: FSSE/FSG_50, 8: FSSF/FSG_51, 9: FSD12, 10: FSSD/FSD22, 11: FSSH/FSD32	
00D2	40211	long	Outside diameter	Metric system: 2 places after decimal point, 6.00 to 6200.00mm English system: 4 places after decimal point, 0.2362 to 244.100inch	

Relative address	Register No.	Data type	Parameter	Read-out data/Write-in data setting range	Remarks
00D6	40215	int	Pipe material	0: Carbon steel, 1: Stainless steel, 2: PVC, 3: Copper, 4: Cast iron, 5: Aluminum, 6: FRP, 7: Ductile iron, 8: PEEK, 9: PVDF, 10: Acrylic, 11: PP, 12: Pipe S.V.	
00D8	40217	int	Pipe S.V.	Metric system: Decimal point fixed, 1000 to 3700m/s English system: Decimal point fixed, 3280 to 12140ft/s	Write-in is permitted in case pipe material is "12: Pipe S.V."
00DA	40219	long	Pipe wall thickness	Metric system: 2 places after decimal point, 0.10 to 100.00mm English system: 4 places after decimal point, 0.0039 to 3.9380inch	
00DE	40223	int	Lining material	0: No lining, 1: Tar epoxy, 2: Mortar, 3: Rubber, 4: Teflon, 5: Pyrex glass, 6: PVC, 7: Lining S.V.	
00E0	40225	int	Lining S.V.	Metric system: Decimal point fixed, 1000 to 3700m/s English system: Decimal point fixed, 3280 to 12140ft/s	Write-in is permitted in case lining material is "7: Lining S.V."
00E2	40227	long	Lining thickness	Metric system: 2 places after decimal point, 0.10 to 100.00mm English system: 4 places after decimal point, 0.0003 to 3.9380inch	
00E6	40231	int	Kind of fluid	0: Water, 1: Seawater, 2: Distilled water, 3: Ammonia, 4: Alcohol, 5: Benzene, 6: Bromide, 7: Ethanol, 8: Glycol, 9: Kerosene, 10: Milk, 11: Methanol, 12: Toluol, 13: Lube oil, 14: Fuel oil, 15: Petrol, 16: Refrigerant R410, 17: Fluid S.V.	
00E8	40233	int	Fluid S.V.	Metric system: Decimal point fixed, 300 to 2500m/s English system: Decimal point fixed, 984 to 8203ft/s	
00EA	40235	double	Viscosity	Metric system: 32-bit floating data; 0.001 to 999.999 E-6m^2/s English system: 32-bit floating data; 0.0107 to 10764 E-6ft^2/s	
00F2	40243	int	Sensor mount	0: V method, 1: Z method	
00F4	40245	int			Not use, writein inhibited
00F6	40247	int			Not use, writein inhibited
00F8	40249	int			Not use, writein inhibited
00FA	40251	int			Not use, writein inhibited
00FC	40253	int			Not use, writein inhibited
00FE	40255	int			Not use, writein inhibited
0100	40257	int	System unit *1	0: Metric, 1: English	
0102	40259	int	System language	0: English, 1: Japanese, 2: German, 3: French, 4: Spanish	
0104	40261	int	ID No. setup	Decimal point fixed, 0 to 9999	

*1) Total set value and system unit may be set only in the state where the total mode is stop. (If write-in is attempted without stopping, response occurs without counting in the write-in byte count.)

*2) Read only in the setting screen. No response is made against write-in. Setting from communication is permitted only in the protected state.

7.2.2 Word data [Read-out/Write-in]: Function code [03_H, 06_H]

Relative address	Register No.	Data type	Parameter	Read-out data/Write-in data setting range	Remarks
0140	40321	int	Zero adjustment	0: Clear, 1: Adjust	
0142	40323	unsigned int	4mA	No decimal point, 200 to 8000	
0144	40325	unsigned int	20mA	No decimal point, 11000 to 22000	

The address data indicated below is not stored in the main unit.

Relative address	Register No.	Data type	Parameter	Read-out data/Write-in data setting range	Remarks
0154	40341	int	Output setting (current check)	Decimal point fixed, –20 to 120%	
0156	40343	int	Total pulse check	Decimal point fixed, 1 to 100PULSE/s	
0158	40345	int	DO check	0: ON, 1: OFF	
015A	40347	int			Not use, write-in inhibited
015C	40349	int	Test mode	0: Not use, 1: Set	
015E	40351	int	Input data	Decimal point fixed, ±120%	
0160	40353	int	Tracking time	Decimal point fixed, 0 to 900sec	
0162	40355	int	LCD & LED check *3	0: Not use, 1: Check	
0164	40357	int			Not use, writein inhibited
0166	40359	int	Test cancel	Read-out data: 0: Termination, 1: Being tested Write-in data : 0: Termination	Cancellation of testing of current, total pulse, DO check and test mode

*3) No response is made if execution is attempted in a screen other than measure screen.

7.2.3 Word data [Read-out only]: Function code [04_H]

Relative address	Register No.	Data type	Parameter	Read-out data/Write-in data setting range	Remarks
	30XXX				
0000	30001	float	Velocity	Metric system: 32-bit floating data, Unit: m/s English system: 32-bit floating data, Unit: ft/s	
0004	30005	float	Flow rate	32-bit floating data	Unit: Flow rate
0008	30009	float	Flow rate %	32-bit floating data, Unit: %	
000C	30013	double	+ Total value	64-bit floating data	Unit: Total
0014	30021	double	– Total value	64-bit floating data	
001C	30029	long	+ Total pulse	No decimal point, Unit: Pulse	
0020	30033	long	– Total pulse	No decimal point, Unit: Pulse	
0024	30037	unsigned int	RAS information	Data of hexadecimal number	
0080	30129	long	Sensor spacing 1	Metric system: 2 places after decimal point, Unit: mm English system: 3 places after decimal point, Unit: inch	
0084	30133	unsigned int	Sensor spacing 2	No decimal point	Cases of FLS_12, FLS_22, FSSA, FSSG, sensors
0086	30135	unsigned char	1st and 2nd characters of version	14 characters of ASCII code	
0088	30137	unsigned char	3rd and 4th characters of version		
008A	30139	unsigned char	5th and 6th characters of version		
008C	30141	unsigned char	7th and 8th characters of version		
008E	30143	unsigned char	9th and 10th characters of version		
0080	30145	unsigned char	11th and 12th characters of version		
0092	30147	unsigned char	13th and 14th characters of version		
0094	30149	unsigned char	1st and 2nd characters of type	16 characters of ASCII code	
0096	30151	unsigned char	3rd and 4th characters of type		
0098	30153	unsigned char	5th and 6th characters of type		
009A	30155	unsigned char	7th and 8th characters of type		
009C	30157	unsigned char	9th and 10th characters of type		
009E	30159	unsigned char	11th and 12th characters of type		
00A0	30161	unsigned char	13th and 14th characters of type		
00A2	30163	unsigned char	15th and 16th characters of type		
00A4	30165	unsigned char	1st and 2nd characters of vendor name	14 characters of ASCII code	
00A6	30167	unsigned char	3rd and 4th characters of vendor name		
00A8	30169	unsigned char	5th and 6th characters of vendor name		
00AA	30171	unsigned char	7th and 8th characters of vendor name		
00AC	30173	unsigned char	9th and 10th characters of vendor name		
00AE	30175	unsigned char	11th and 12th characters of vendor name		
00B0	30177	unsigned char	13th and 14th characters of vendor name		

8. PC LOADER SOFTWARE

8.1 Copyright of This Software

The copyright of this software belongs to Fuji Electric Co., Ltd. No part of this software may be reproduced or transmitted in any form.

8.2 Outline

By using this software, you can set, read, and display relevant graphs of fixed-type ultrasonic flowmeters on your PC with ease. Your data can be easily edited with Microsoft Excel because you can save your data in CSV file format.
Note: Microsoft Excel is the registered Trademark of the Microsoft Corporation in the United States.

8.3 Download PC Loader Software

The latest version of the PC loader software can be downloaded from our website.
Please carefully review the information on the website and the instructions for using the software (license agreement).

8.4 PC to Be Used

8.4.1 Interface

USB port (RS-485 MODBUS communication protocol)

8.4.2 OS

Windows 10 (Enterprise, Pro)/Windows 11 (Pro)
Editions in parentheses ( ) indicate versions for which operation has been verified.
.NET Framework3.5 or higher

Note: Windows is a registered trademark of Microsoft Corporation.
Note: Microsoft .NET Framework is a registered trademark of Microsoft Corporation.

8.5 Installing of Software

(1) Double-click the installer “FLR_FSV_Loader_Ver6000j.msi”.
The version number indicated is just a display example.

Fig. 8-1 <Install file>

(2) Setting wizard will start up. Click the [Next] button. Click the [Cancel] button to cancel the installation.

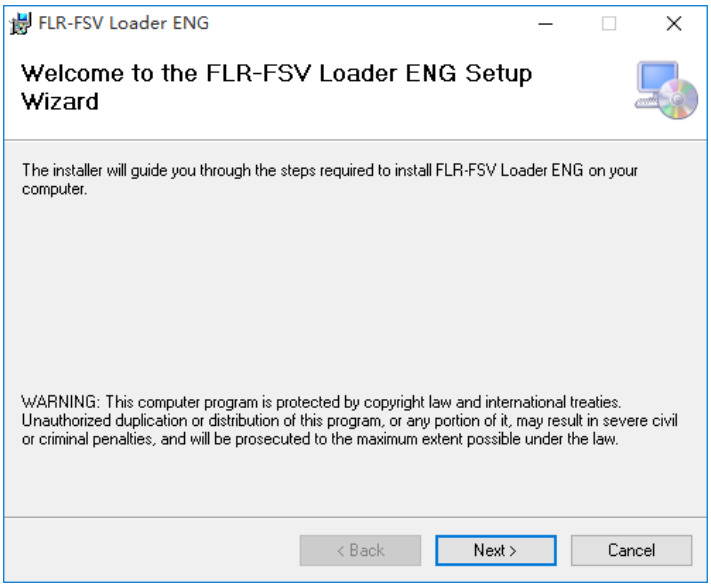


Fig. 8-2 <Setup wizard screen>

(3) There is a query about selection of installation folder. Click the [Next] button to install the software in that folder. To specify a folder click the [Browse] button and select, or enter directly. To return to the previous screen, click the [Previous] button. Click the [Cancel] button to cancel the installation.

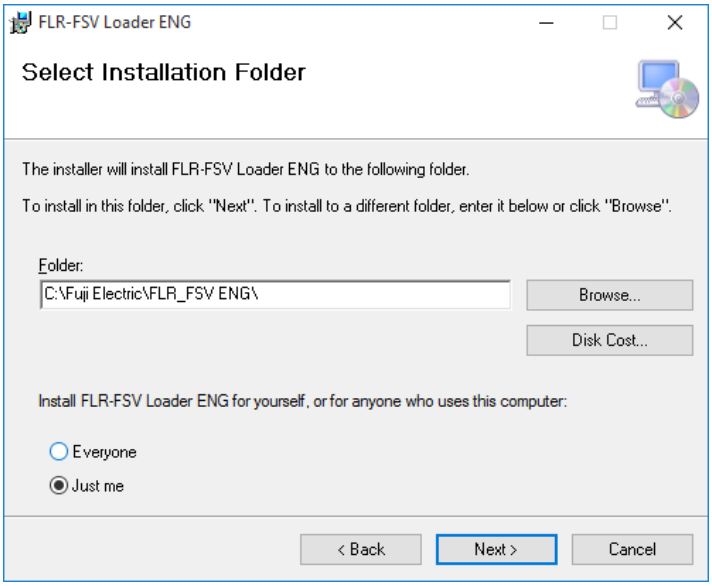


Fig. 8-3 <Select installation folder screen>

(4) Screen is displayed to confirm installation. Click the [Next] button to execute the installation. Click the [Previous] button to return to the previous screen. Click the [Cancel] button to cancel the installation.

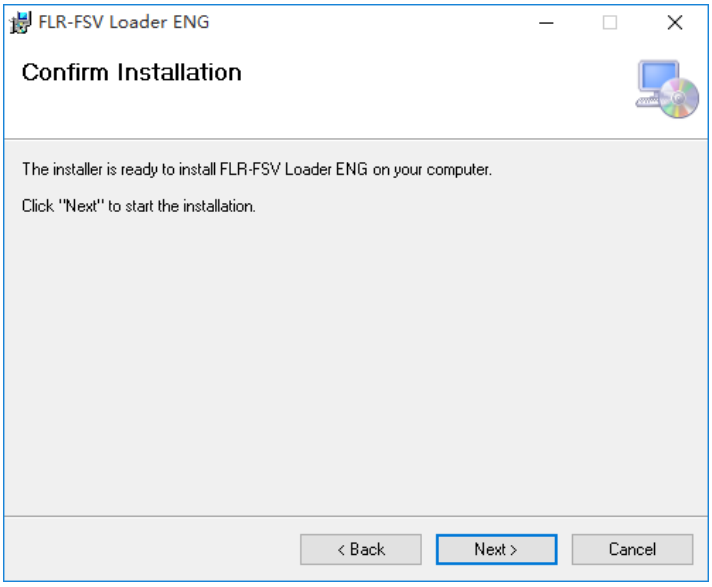


Fig. 8-4 <Installation confirmation screen>

(5) If a “User Account Control” screen is displayed, click the [Yes] button to permit the computer change.

(6) Execution of Installation

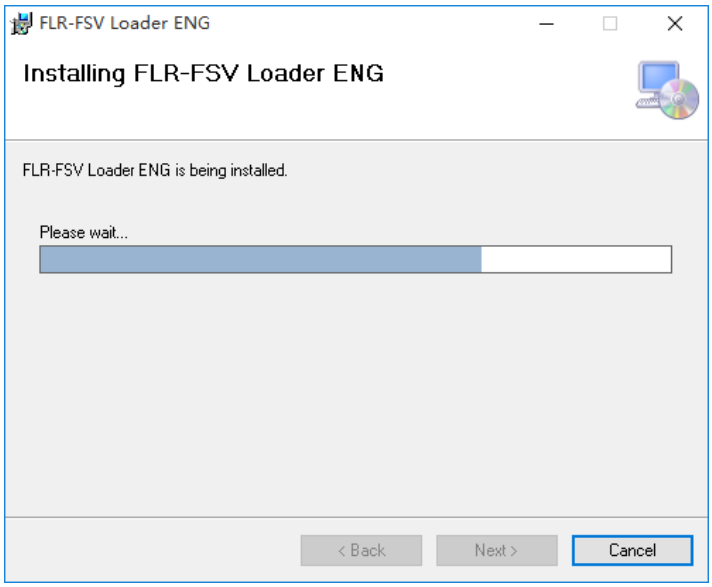


Fig. 8-5 <Installing screen>

(7) The Installation Complete screen is displayed. Click the [Close] button to exit the installation screen.

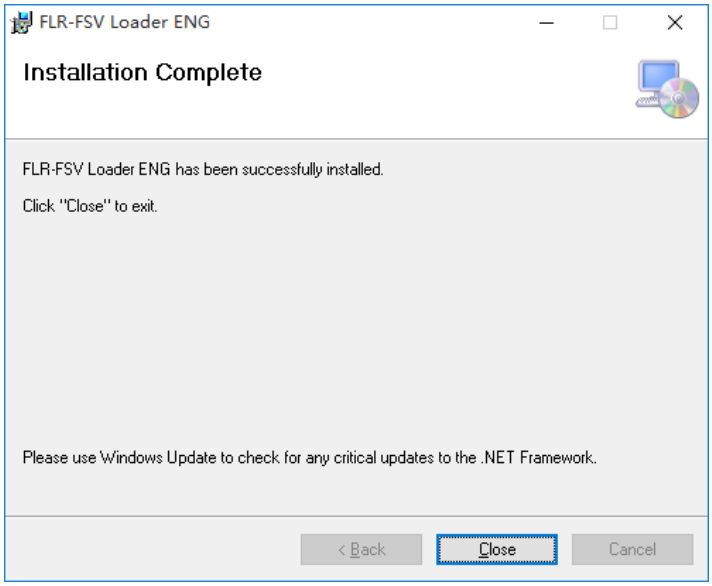


Fig. 8-6 <Installation complete screen>

(8) After installation, the start menu and the application (“FLR-FSV Loader V600J”) that has been installed in the disktop are created.

* The version number indicated is just a display example.

8.6 Startup Method

To start the loader, click on “FLR-FSV Loader V600j” from the Start menu or from the shortcut on the desktop.
* The version number indicated is just a display example.

Fig. 8-7 <Start screen>

The software communicates with the flow transmitter to get the language and unit information.
A message appears if a communication error occurs. Click [OK], and check the “Communication” settings on the menu screen that appear.

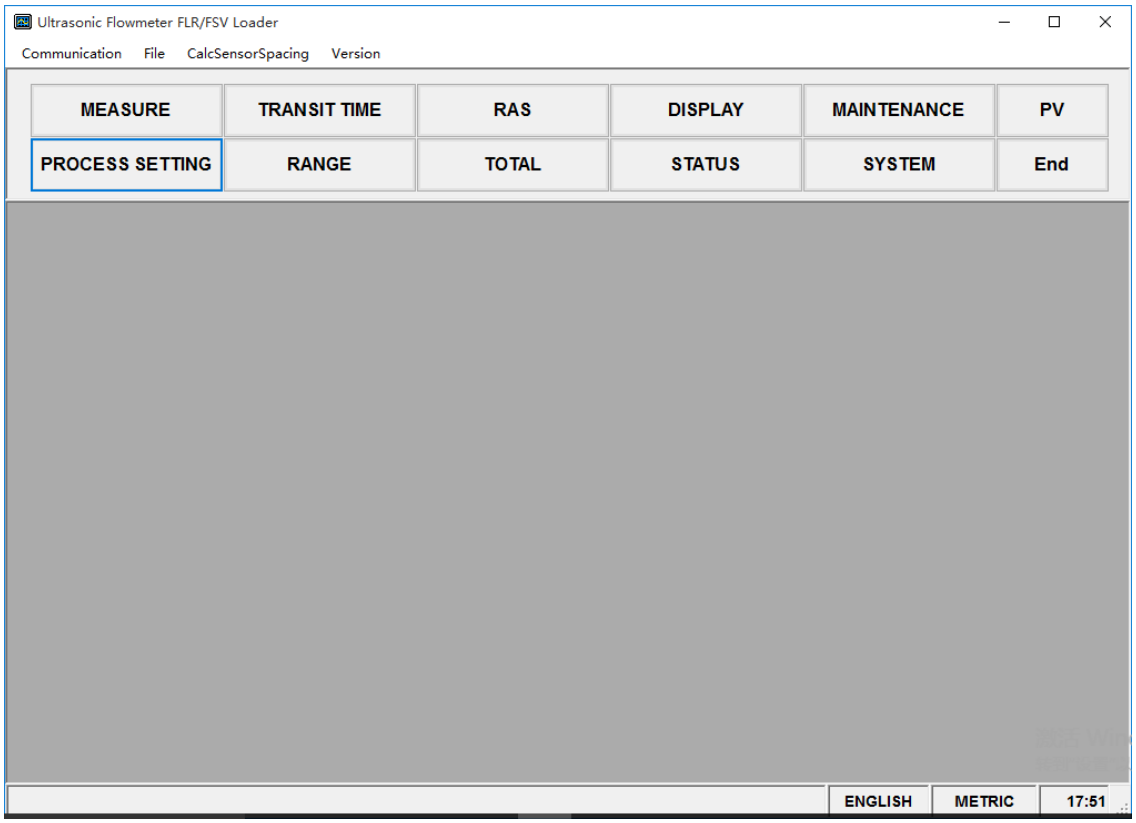


Fig. 8-8 <Menu screen>

Click the menu bar and each function button to execute a desired function.
Note: When communication cables are removed and then reconnected, restart the loader software.

8.6.1 Communications

Click “Communication” on the menu bar on the Menu screen, and the following setup screen appears.

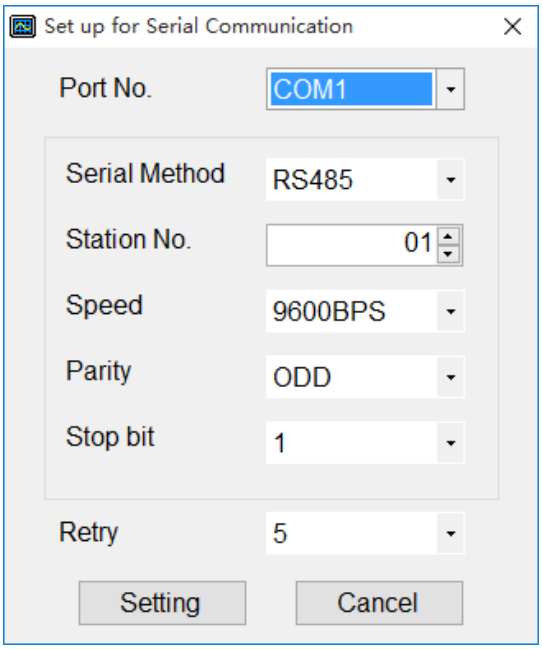


Fig. 8-9 <Serial communication setup screen>

Click the [Setting] button, and setting content is reflected; communications are executed with the flow transmitter and information related to system name, measurement method, language and unit is obtained. Click the [Cancel] button to invalidate the setting.

Table 8-1 <Measurement and Detailed Setting>

Item	Content
Port No.	Select either from COM1 to COM20.
Serial Method	Select RS485.
Station No.	Select one from 01 to 31.
Speed	Select one from 9600BPS, 19200BPS and 38400BPS.
Parity	Select one from NONE, EVEN and ODD.
Stop Bit	Select either 1-bit or 2-bit.
Retry	Specify in the range from 0 to 5.

* The factory default setting of the transmitter is “RS485/ST1/9600BPS/odd/1bit”.

How to check the PC COM port

For Windows 10

• Right-click on the “Start menu” and left-click on “Device Manager”.

• The [Device Manager] will open.

• On the Device Manager screen, right-click “Ports (COM & LPT)”.

• Confirm the available port names and COM numbers listed under “Ports (COM & LPT)”.

8.6.2 Setting

Click “File” on the menu bar on the Menu screen, and either “Save setting” or “Read setting” can be selected.

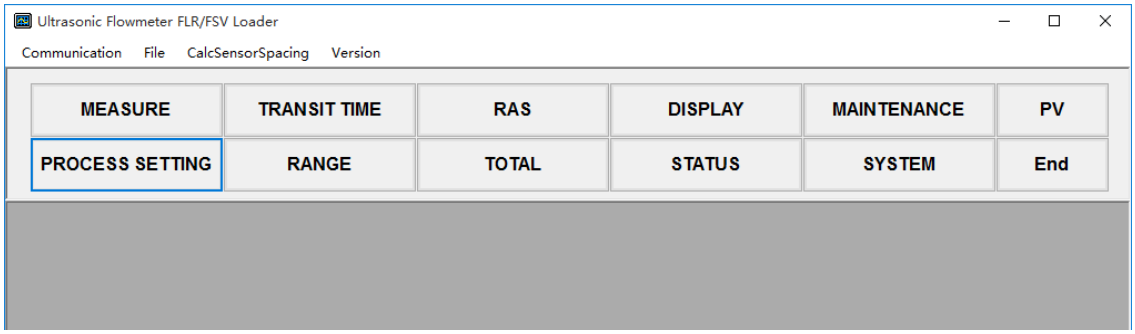


Fig. 8-10 <Upper part of menu screen>

8.6.2.1 Save setting

Click “Save Setting”, and the following screen appears. Specify saving location and file name, and setting content is saved by clicking [Save] button. Click the [Cancel] button not to save the setting. File format is ini file.
The “Save setting” saves the values [READ] on the PROCESS, RANGE, TOTAL, STATUS, DISPLAY, SYSTEM, and TRANSIT TIME setting screens described starting in Section 8.7 “Structure of Function” to the specified file.

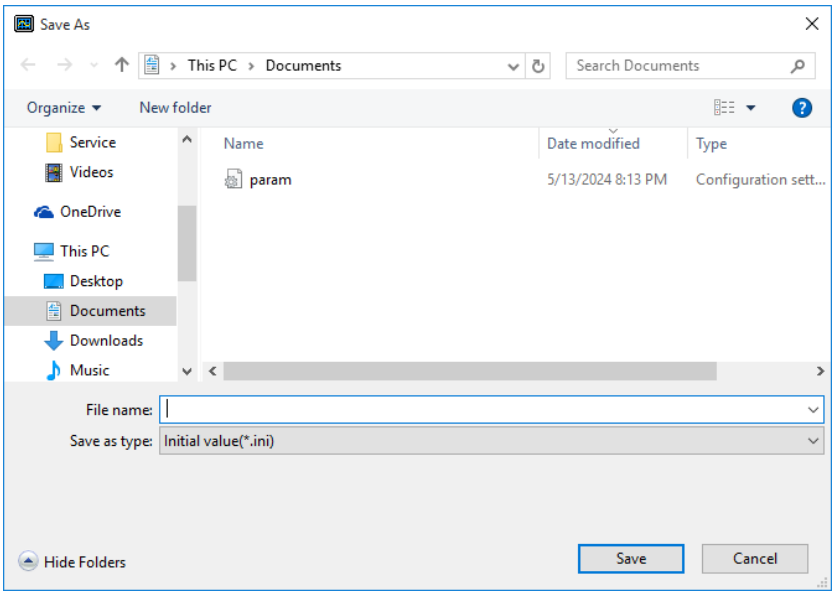


Fig. 8-11 <Save setting: select save file screen>

* Note: Please be careful not to rewrite the initial setting file for loader (USF.ini).

8.6.2.2 Read setting

Click “Read Setting”, and the following screen appears. Specify the location and the name of the file saved previously. Click the [Open] button to read the setting. Click the [Cancel] button not to read the setting. File format is ini file.

The “Read setting” reflects the values from the previously saved file to the cells and list boxes in the PROCESS, RANGE, TOTAL, STATUS, DISPLAY, SYSTEM, and TRANSIT TIME setting screens described starting in Section 8.7 “Structure of Function”.

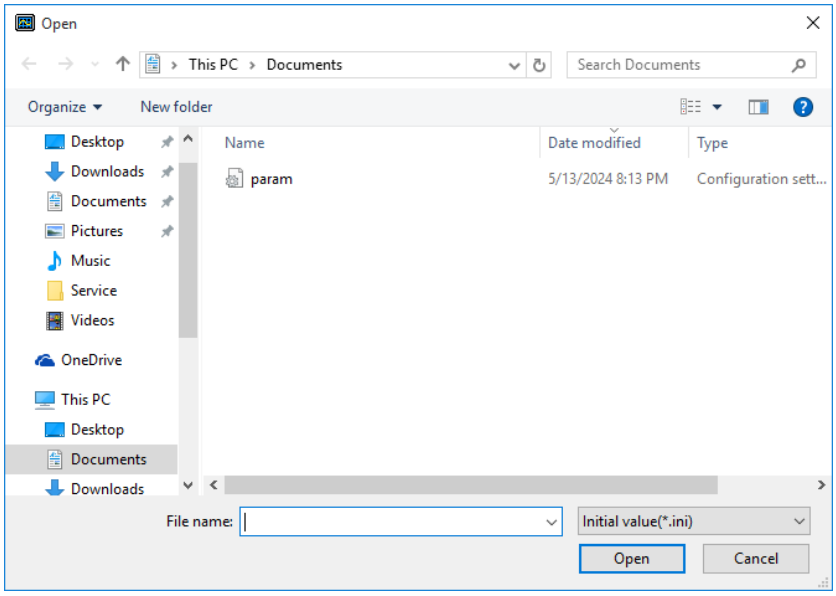


Fig. 8-12 <Read setting: select read file screen>

8.6.3 Calculation Sensor Spacing

On the menu screen, click [Calculation Sensor Spacing] of the menu bar, and the following screen appears. This function can be used even when connection with the main unit is not established for communication.

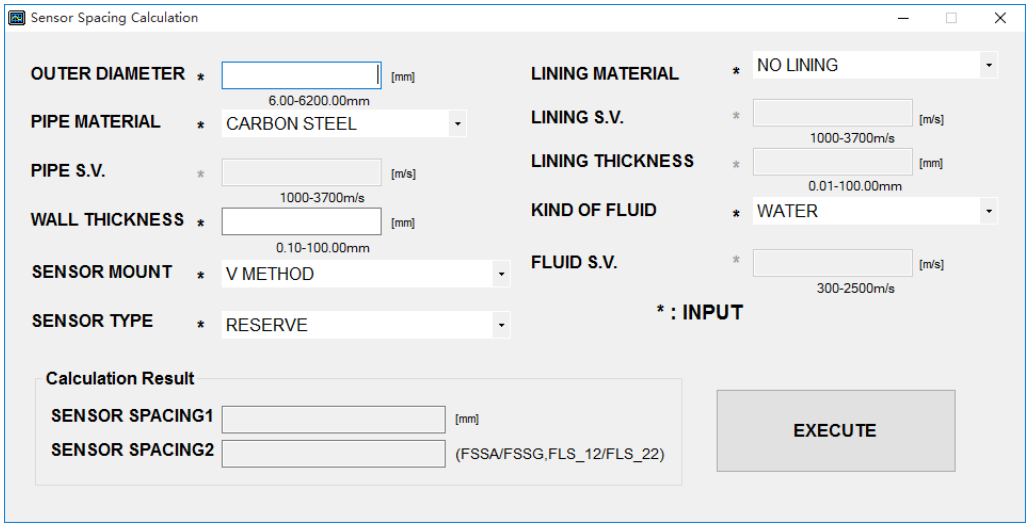


Fig. 8-13 <Calculation sensor spacing>

See Table 8-2 for details of calculation sensor spacing.

[Execute] button .....Calculates and displays sensor spacing 1 and 2 based on the input values.

Note: The values after the decimal point may differ from those of the main unit depending on the accuracy of calculation.

Table 8-2 <What to Enter>

Item	Content
OUTER DIAMETER	Enter in the range from 6.00 to 6200.00 mm (two decimal places) for metric system, and from 0.2362 to 244.1000 inch (four decimal places) for inch system.
PIPE MATERIAL	Select from carbon steel, stainless steel, PVC, copper, cast iron, aluminum, FRP, ductile iron, PEEK, PVDF, acrylic, PP, and pipe S.V.
PIPE SOUND VELOCITY	Enter in the range from 1000 to 3700 m/s (no decimal point) for metric system and from 3280 to 12140 ft/s (no decimal point) for inch system. (If “Pipe S.V.” is selected as piping material.)
WALL THICKNESS	Enter in the range from 0.10 to 100.00 mm (two decimal places) for metric system, and from 0.0039 to 3.9380 inch (four decimal places) for inch system.
LINING MATERIAL	Select from no lining, tar epoxy, mortar, rubber, Teflon, pyrex glass, PVC and lining S.V.
LINING SOUND VELOCITY	Enter in the range from 1000 to 3700 m/s (no decimal point) for metric system, and from 3280 to 12140 ft/s (no decimal point) for inch system. (If “Lining S.V.” is selected as lining material”.)
LINING THICKNESS	Enter in the range from 0.01 to 100.00 mm (two decimal places) for metric system, and 0.0003 to 3.9380 inch (four decimal places) for inch system. (If “No lining” is selected as lining material.)
KIND OF FLUID	Select for water, seawater, dist. water, ammonia, alcohol, benzene, bromide, ethanol, glycol, kerosene, milk, methanol, toluene, lube oil, fuel oil, petrol, coolant R410, and fluid S.V.
FLUID S.V.	Enter in the range from 300 to 2500 m/s (no decimal point) for metric system, and from 984 to 8203 ft/s (no decimal point) for inch system. (If “Fluid S.V.” is selected as fluid type”).
SENSOR MOUNT	Select from V method and Z method.
SENSOR TYPE	Select from FSSA/FSSG, FLS_12/FLS_22, FSSC, FSG_32, FSG_31/FSG_41, FSSE/FSG_50, FSSF/FSG_51, FSD12, FSSD/FSD22, FSSH/FSD32
SENSOR SPACING 1	Displays the calculation result of sensor spacing 1.
SENSOR SPACING 2	Displays the calculation result of sensor spacing 2. (If FLS_12, FLS_22, FSSA or FSSG is selected as sensor type.)

8.6.4 Version

Click “Version” on the menu bar on the Menu screen, and the following screen appears.

* The version number indicated is just a display example.

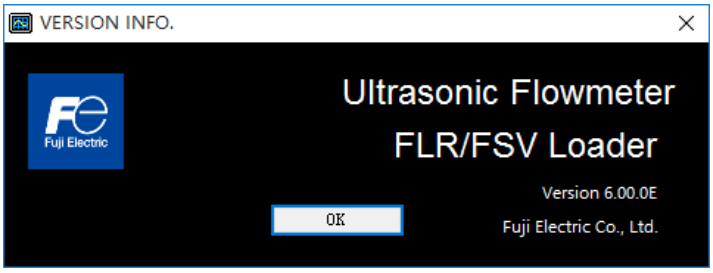


Fig. 8-14 <Version screen>

Click the [OK] button to close the screen.

8.7 Structure of Function

Functions with loader are as follows:

Table 8-3 <Function>

Function	Outline
MEASURE	Displays trend of flow rate, etc.
TRANSIT TIME	Displays graphs on detailed setting of transit time difference, operation information and received waveform, etc.
RAS	Read-in RAS.
MAINTENANCE	Conducts AO adjustment and AO/DO test.
PV	Measures station No. 1 to No. 31. Available only when RS485 communication.
PROCESS	Sets piping specifications, sensor type, etc.
RANGE	Sets range-related matters.
TOTAL	Sets total-related matters.
STATUS	Sets status output-related matters.
DISPLAY	Sets LCD display-related matters.
SYSTEM	Sets system related to language, etc.
End	Exits the application.

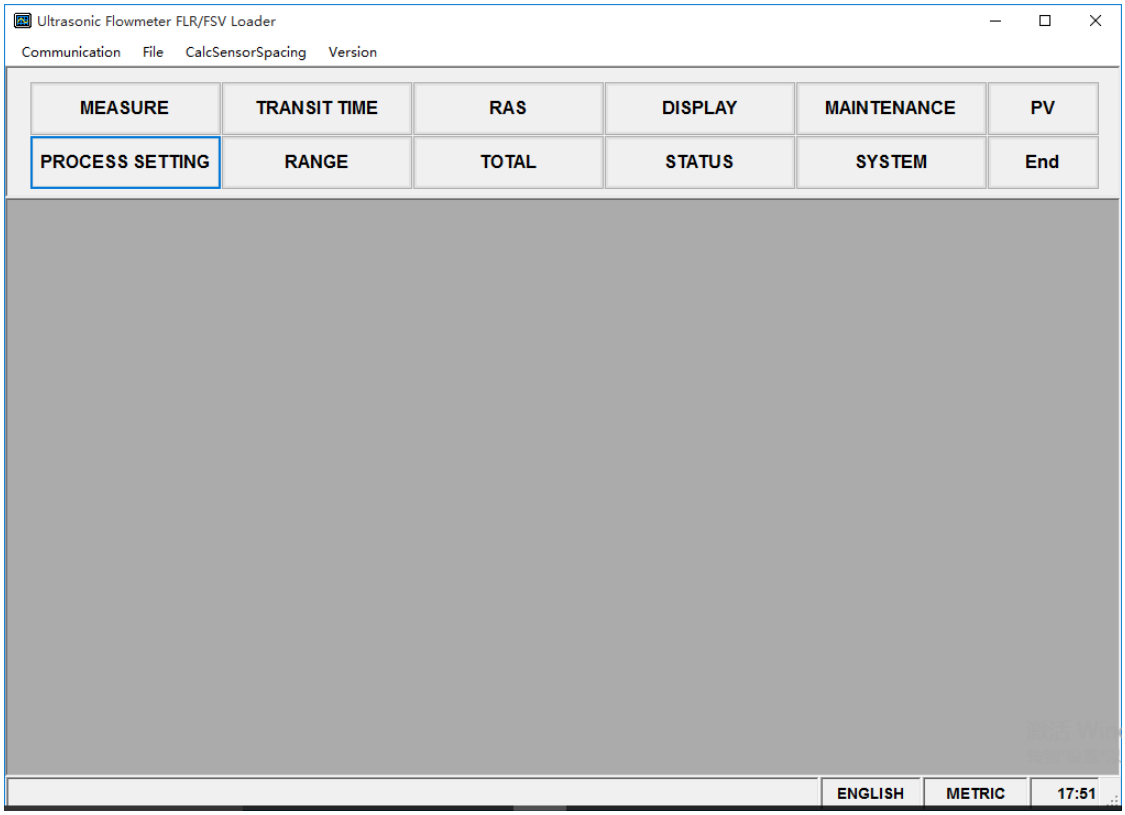


Fig. 8-15 <Menu screen>

8.8 Common Functions on Setting Screen

The [SETTING] button, [READ] button, and [CHECK ON/OFF] check-box button are common functions on the setting screen.

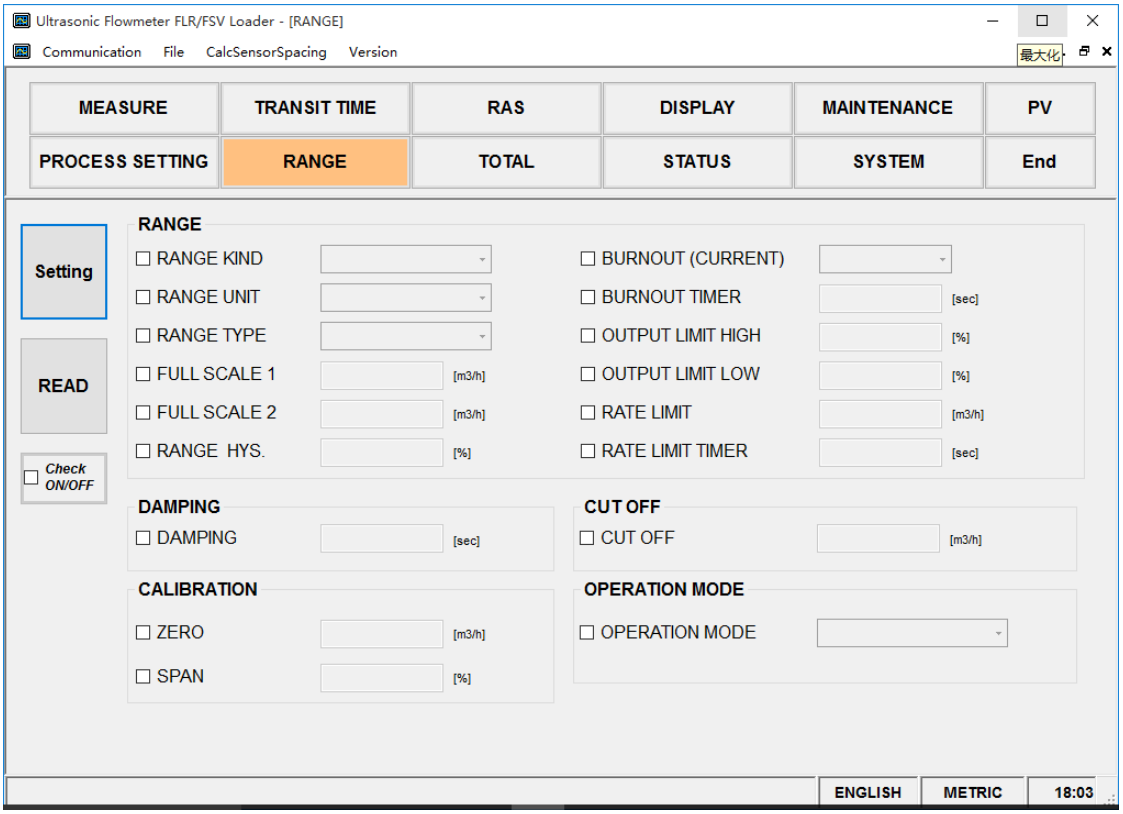


Fig. 8-16 <Example of setting screen>

Select items you want to set and read by checking their check boxes ("☑").
Clear the check-box ("☐") of an item when you do not want to select the item (or you want to unselect it). Version information can only be read-in.

[SETTING] button ..... Sends the setting of the selected item (check box set to ("☑")) to the flowmeter, and reflects the flowmeter response value on the setting. This is always required when the setting is changed.

[READ] button ..... Reads the setting of the selected item (check box set to ("☑")) from the flowmeter, and reflects the flowmeter response value on the setting.

[CHECK ON/OFF] check button ..... By checking the check box ("☑"), all items will be selected (the check box will be checked ("☑") for all items.) Furthermore, by clearing the check box ("☐"), all items will be deselected (the check box will be cleared ("☐") for all items.)

8.9 Process Setting

Click the “PROCESS SETTING” button on the Menu screen, and the following screen appears.

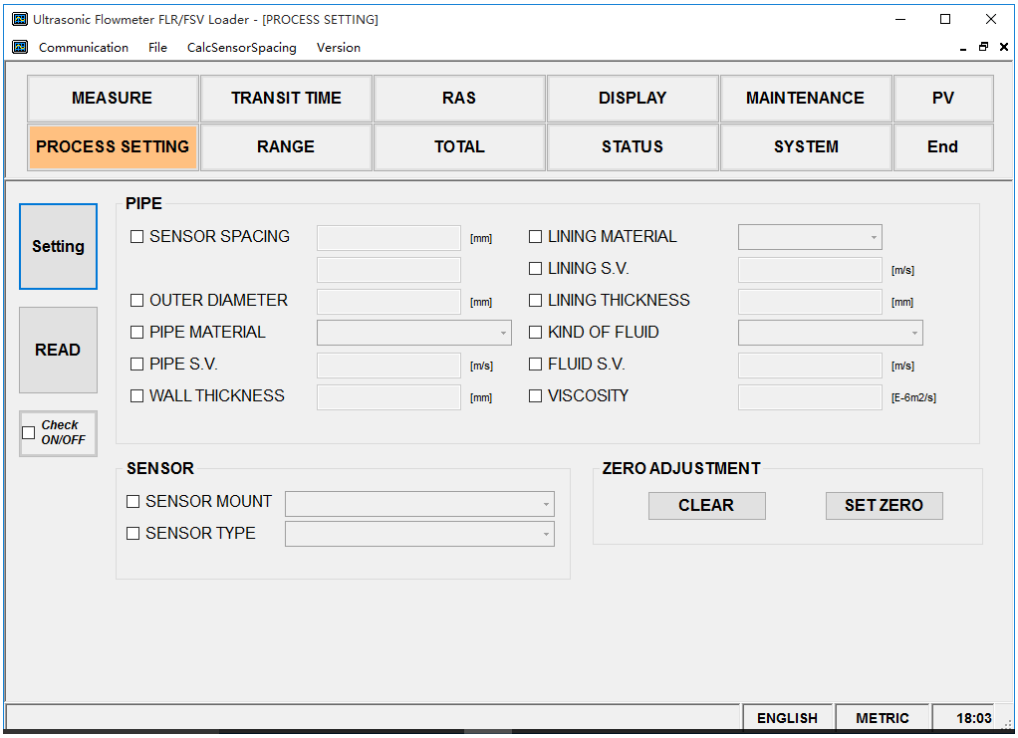


Fig. 8-17 <Process setting screen>

For details of the PROCESS settings, refer to Tables 8-4 and 8-5 on the next page.

- Pipe material: Items other than PIPE S.V.
  Input invalid ..... PIPE S.V.
- Pipe material: PIPE S.V.
  Input valid ..... PIPE S.V.
- Lining material: Without lining
  Input invalid ..... LINING S.V., LINING THICKNESS
- Lining material: Without lining, Items other than LINING S.V.
  Input valid ..... LINING THICKNESS
  Input invalid ..... LINING S.V.
- Lining material: LINING S.V.
  Input valid ..... LINING S.V., LINING THICKNESS
- Kind of fluid: For items other than FLUID S.V.
  Input invalid ..... FLUID S.V
- Kind of fluid: FLUID S.V.
  Input valid ..... FLUID S.V.

Table 8-4 <Piping Specifications>

Item	Content
OUTER DIAMETER	Enter in the range from 6.00 to 6200.00 mm (two decimal places) for metric system, and from 0.2362 to 244.1000 inch (four decimal places) for inch system.
PIPE MATERIAL	Select from carbon steel, stainless steel, PVC, copper, cast iron, aluminum, FRP, ductile iron, PEEK, PVDF, acrylic, PP, and pipe S.V.
PIPE SOUND VELOCITY	Enter in the range from 1000 to 3700 m/s (no decimal point) for metric system and from 3280 to 12140 ft/s (no decimal point) for inch system. (If "Pipe S.V." is selected as piping material.)
WALL THICKNESS	Enter in the range from 0.10 to 100.00 mm (two decimal places) for metric system, and from 0.0039 to 3.9380 inch (four decimal places) for inch system.
LINING MATERIAL	Select from no lining, tar epoxy, mortar, rubber, Teflon, pyrex glass, PVC and lining S.V.
LINING SOUND VELOCITY	Enter in the range from 1000 to 3700 m/s (no decimal point) for metric system, and from 3280 to 12140 ft/s (no decimal point) for inch system. (If "Lining S.V." is selected as lining material".)
LINING THICKNESS	Enter in the range from 0.01 to 100.00 mm (two decimal places) for metric system, and 0.0003 to 3.9380 inch (four decimal places) for inch system. (If "No lining" is selected as lining material.)
KIND OF FLUID	Select for water, seawater, dist. water, ammonia, alcohol, benzene, bromide, ethanol, glycol, kerosene, milk, methanol, toluene, lube oil, fuel oil, petrol, coolant R410, and fluid S.V.
FLUID S.V.	Enter in the range from 300 to 2500 m/s (no decimal point) for metric system, and from 984 to 8203 ft/s (no decimal point) for inch system. (If "Fluid S.V." is selected as fluid type").
VISCOSITY	Enter in the range from 0.001 to 999.999 E·6 m^2/s for metric system, and from 0.0107 to 10764 E·6 ft^2/s for inch system.
SENSOR SPACING	[Read] only is valid.

Table 8-5 <Sensor>

Item	Content
SENSOR MOUNT	Select from Z method and V method.
SENSOR TYPE	Select from FSSA/FSSG, FLS_12/FLS_22, FSSC, FSG_32, FSG_31/FSG_41 Note) If transmitter type is FLR, only the above sensors can be selected. Otherwise, a setting error occurs.

Table 8-6 <Zero calibration>

Button	Description
CLEAR	Clears the adjustment value of zero calibration.
SET ZERO	Executes automatic adjustment of zero calibration. Note) Stop the flow completely before executing zero calibration. Perform measurements under normal conditions. The adjustment could take about 30 seconds to approximately 2 minutes depending on the pipe diameter.

8.10 Range Setting

Click the “RANGE” button on the Menu screen, and the following screen appears.

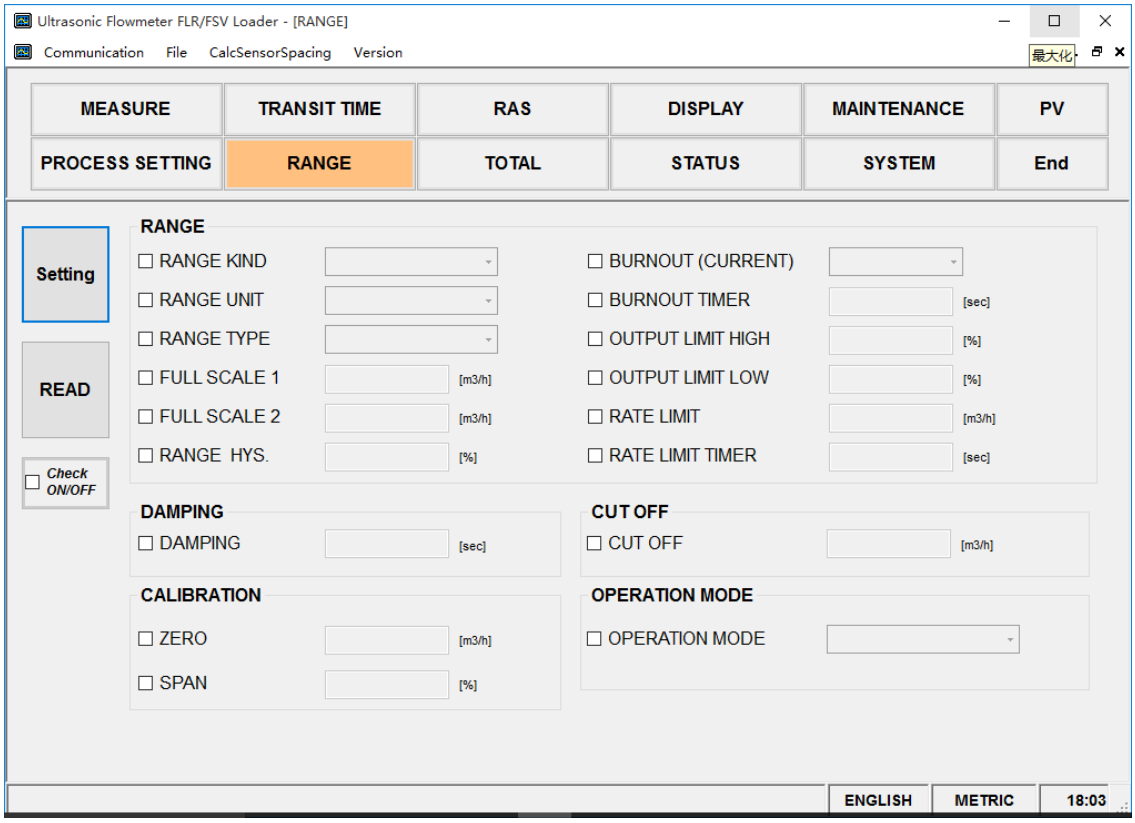


Fig. 8-18 <Range setting screen>

For details on the RANGE settings, refer to Tables 8-7 to 8-11 on the next page.

- Type: in case of single range;
  Input Valid..... Full scale 1
  Input Invalid..... Full scale 2 and histeresis
- Type: in case of automatic 2-range, forward and reverse range, forward and reverse automatic 2-range
  Valid..... Full scale 1, full scale 2 and histeresis

Table 8-7 <Range Setting>

Item	Content
KIND OF RANGE	Velocity, Flow rate
RANGE UNIT	Select from L/s, L/min, L/h, L/d, kL/d, ML/d, m^3/s, m^3/min, m^3/h, m^3/d, k $m^3$3/d, M m^3/d, BBL/s, BBL/min, BBL/h, BBL/d, kBBL/d, MBBL/d [ft^3/s, ft^3/min, ft^3/h, ft^3/d, kft/d, Mft^3/d, gal/s, gal/min, gal/h, gal/d, kgal/d, Mgal/d, BBL/s, BBL/min, BBL/h, BBL/d, kBBL/d, MBBL/d]* Of which [ ]: unit is in case of inch system.
RANGE TYPE	Select from SINGLE, AUTO 2, BI-DIR, BI-DIR AUTO 2.
FULL SCALE 1	Enter 0, ±0.3 to 32 m/s fitting value (comply with range unit).
FULL SCALE 2	Enter 0, ±0.3 to 32 m/s fitting value (comply with range unit).
HYSTERISIS	Enter in the range of 0.00 to 20.00%. (2 places after decimal point)
OUTPUT LIMIT LOW	Enter in the range of -20 to 0%.
OUTPUT LIMIT HIGH	Enter in the range of 100 to 120%.
BURNOUT (CURRENT)	Select from NOT USED, HOLD, UPPER, LOWER, ZERO.
BURNOUT TIMER	Enter in the range of 0 to 900sec.
RATE LIMIT	Enter 0 to 5 m/s fitting value (comply with range unit).
RATE LIMIT TIMER	Enter in the range of 0 to 900 sec.

Table 8-8 <Damping>

Item	Content
DAMPING	Enter in the range of 0.0 to 100.0 sec. (1 place after decimal point)

Table 8-9 <Low Flow Rate Cut>

Item	Content
CUT OFF	Enter 0 to 5 m/s fitting value (comply with range unit).

Table 8-10 <Output Correction>

Item	Content
ZERO	Enter –5 to 5 m/s fitting value (comply with range unit).
SPAN	Enter in the range of ±200.00%. (2 places after decimal point)

Table 8-11 <Operation Mode>

Item	Content
OPERATION MODE	Select from NORMAL, HIGH SPEED.

8.11 Total Setting

Click the “TOTAL” button on the Menu screen, and the following screen appears.

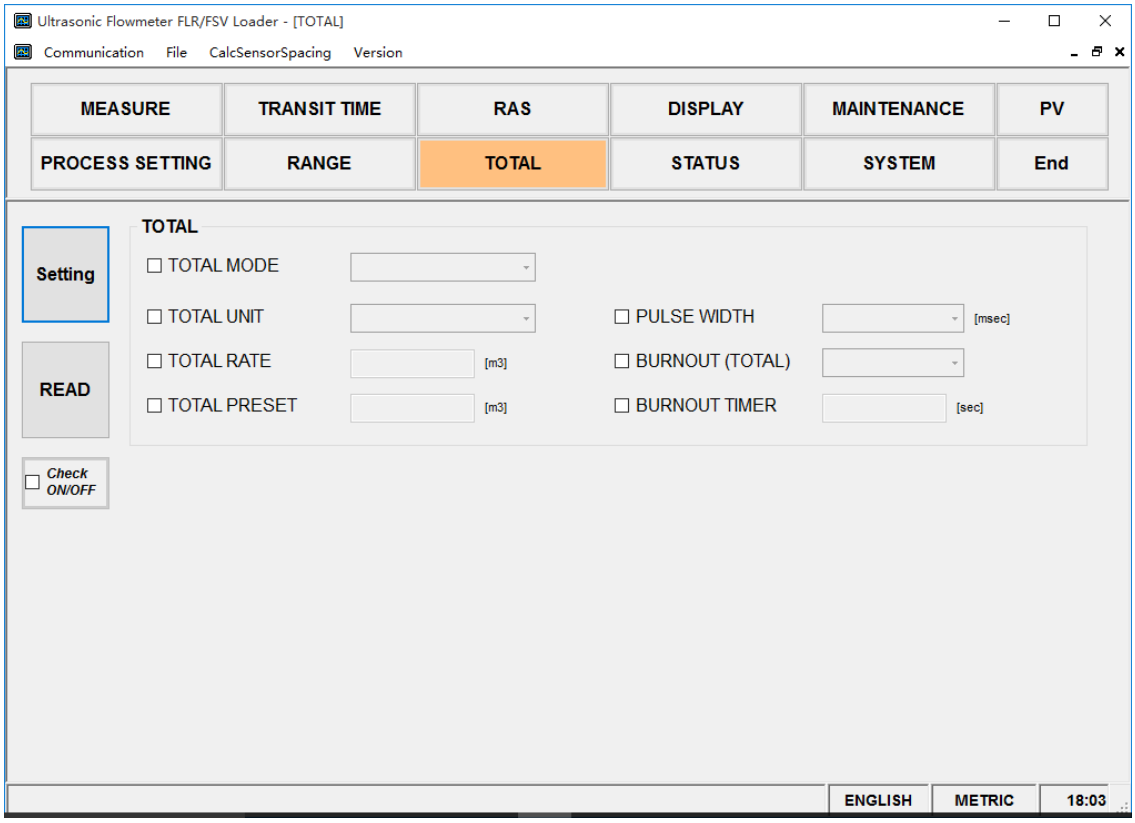


Fig. 8-19 <Total setting screen>

For details on the TOTAL settings, refer to Table 8-12 on the next page.

- Mode: in case of start and reset;
  Display invalid ..... Unit, constant, total preset, pulse width
- Mode: in case of stop;
  Display valid ..... Unit, constant, total preset, pulse width

Table 8-12 <Total Setting>

Item	Content
TOTAL MODE	Select from TOTAL STOP, TOTAL RUN, TOTAL RESET.
TOTAL UNIT	Select from mL, L, m^3, km^3, Mm^3, mBBL, BBL and kBBL, [ft^3, kft^3, Mft^3, kgal, gal, mBBL, BBL, kBBL and ACRf]* Of which [ ]: unit is in case of inch system.
TOTAL RATE	Enter in the range of 0 to 99999999 fitting value. (comply with total unit)
TOTAL PRESET	Enter in the range of 0 to 99999999 fitting value. (comply with total unit)
PLUSE WIDTH	Select from 5.0, 10.0, 50.0, 100.0, 200.0, 500.0, 1000.0 msec
BURNOUT (TOTAL)	Select from NOT USED and HOLD.
BURNOUT TIMER	Enter in the range of 0 to 900 sec.

Note: When unit is changed, each unit indication of constant and total preset is changed if [Read] is executed.

Note: When setting of the unit, constant, total preset, and pulse withe is changed, it should be executed with the mode stop.

8.12 Status Setting

Click the “STATUS” button on the Menu screen, and the following screen appears.

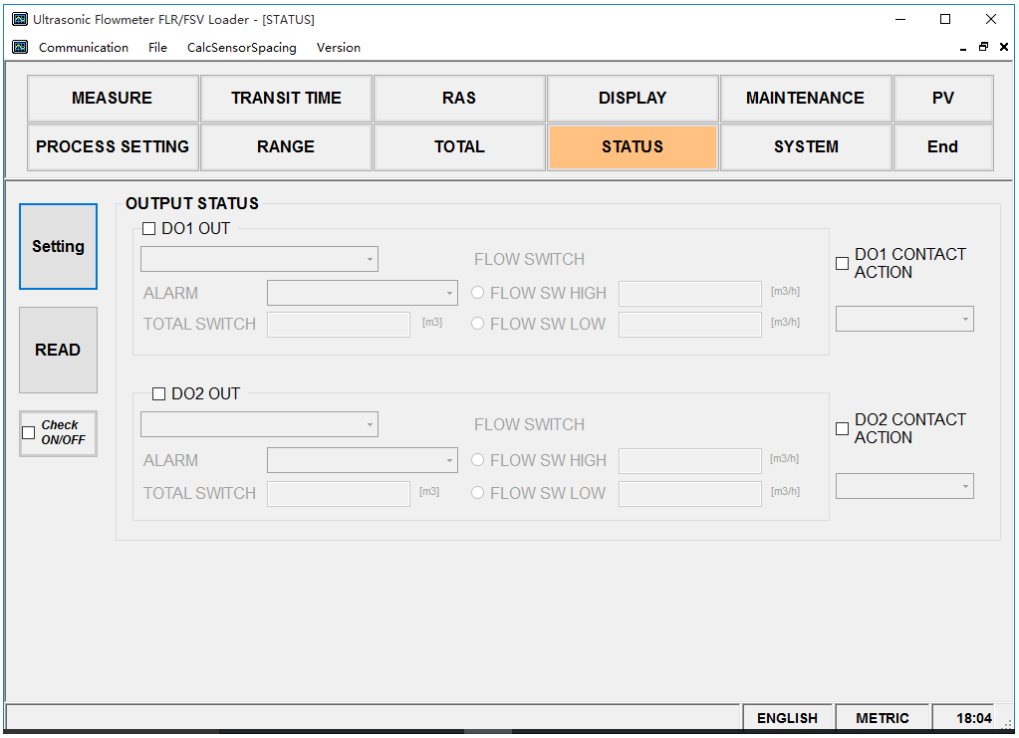


Fig. 8-20 <Status output setting screen>

For details on the STATUS settings, refer to Table 8-13 <Status output setting> on the next page.

- DO1, DO2 output: Items other than alarm, flow rate switch, and total switch
  Input invalid..... Alarm, flow rate switch (Flow switch High/Flow switch Low), total switch
- DO1, DO2 output: Alarm
  Input valid..... Alarm
  Input invalid..... Flow rate switch（Flow switch High/Flow switch Low）, total switch
- DO1, DO2 output: Flow rate switch
  Input valid..... Flow rate switch（Flow switch High/Flow switch Low）
  Input invalid..... Alarm, total switch
- DO1, DO2 output:
  Input valid ..... Flow total switch
  Input invalid ..... Alarm, flow rate switch (Flow switch High/Flow switch Low)

Table 8-13 <Status output setting>

Item		Content
DO1	Output	Select from Not use, + Total pulse, – Total pulse, Full scale 2, Alarm, Flow switch, Total switch, AO range over, Pulse range over, and – Flow direction.
	Alarm	Select from All, Hardware error, and Process error (when alarm is selected for DO1 output).
	Flow rate switch	Select from Upper flow rate limit (Flow switch High) and Lower flow rate limit (Flow switch Low) (when flow rate switch is selected for DO1 output).
	Flow switch High	Enter in the range from 0 to 32 m/s or equivalent. (Use the same unit as the range unit.)
	Flow switch Low	Enter in the range from 0 to 32 m/s or equivalent. (Use the same unit as the range unit.)
	Total switch	Enter in the range from 0 to 99999999. (Use the same unit as the total unit.)
DO2	Output	Select from Not use, + Total pulse, – Total pulse, Full scale 2, Alarm, Flow switch, Total switch, AO range over, Pulse range over, and – Flow direction.
	Alarm	Select from All, Hardware error, and Process error (when alarm is selected for DO1 output).
	Flow rate switch	Select from Upper flow rate limit (Flow switch High) and Lower flow rate limit (Flow switch Low) (when flow rate switch is selected for DO1 output).
	Flow switch High	Enter in the range from 0 to 32 m/s or equivalent. (Use the same unit as the range unit.)
	Flow switch Low	Enter in the range from 0 to 32 m/s or equivalent. (Use the same unit as the range unit.)
	Total switch	Enter in the range from 0 to 99999999. (Use the same unit as the total unit.)
DO1 contact operation		Select ON at operation or OFF at operation.
DO2 contact operation		Ditto

8.13 Display Setting

Click the “DISPLAY” button on the Menu screen, and the following screen appears.

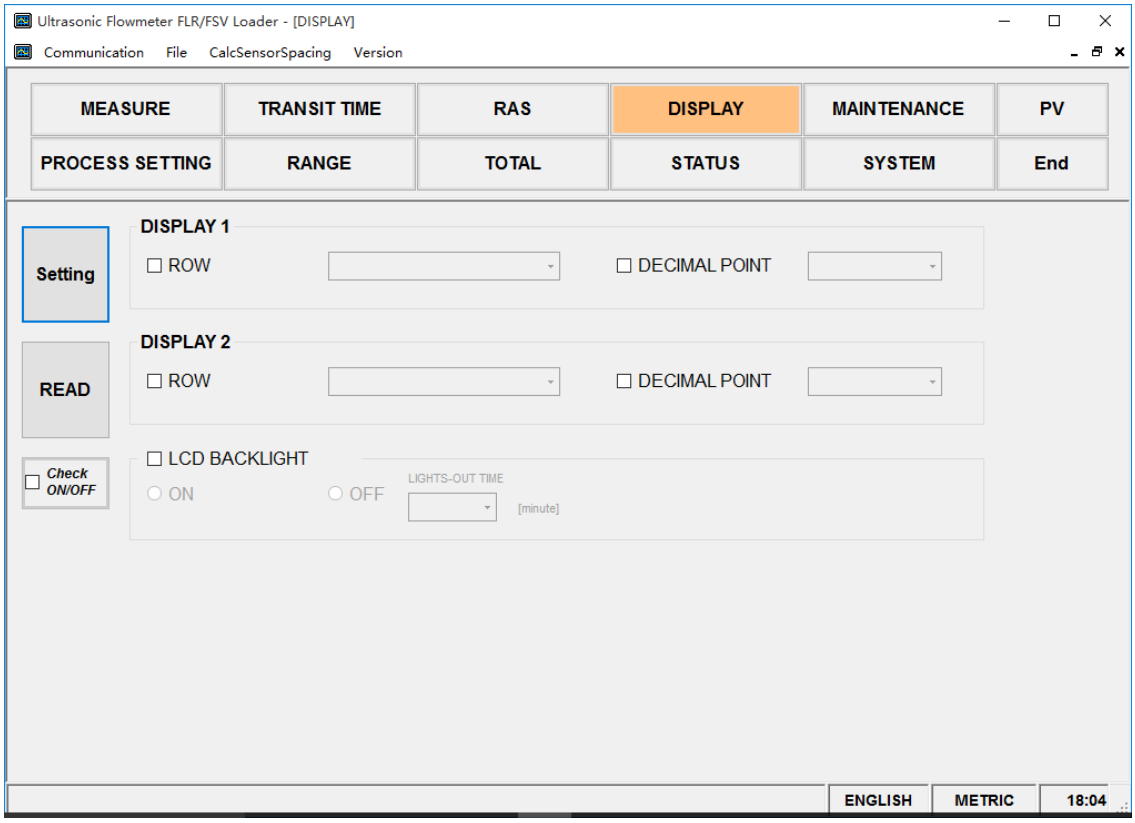


Fig. 8-21 <Display setting screen>

For details of “Display setting,” refer to Table 8-14.

- Display 1, 2 selection: In case of velocity, + total pulse, – total palse
  Display invalid..... Decimal point position

Table 8-14 <Display Setting>

Item		Content
DISPLAY 1	Selection	Select from VELOCITY, FLOW RATE, + TOTAL (ACTUAL), – TOTAL (ACTUAL), + TOTAL PULSE, – TOTAL PULSE.
	Decimal Point Position	Select from *.******, **.*****, ***.****, ****.***, *****.**, ******.*, ********.
DISPLAY 2	Selection	Same as the selection of DISPLAY 1
	Decimal Point Position	Same as the decimal point position of DISPLAY 1
LCD BACKLIGHT	Selection	Select from ON, OFF
	Light off tine	0 to 99 min

8.14 System Setting

Click the “SYSTEM” button on the Menu screen, and the following screen appears.

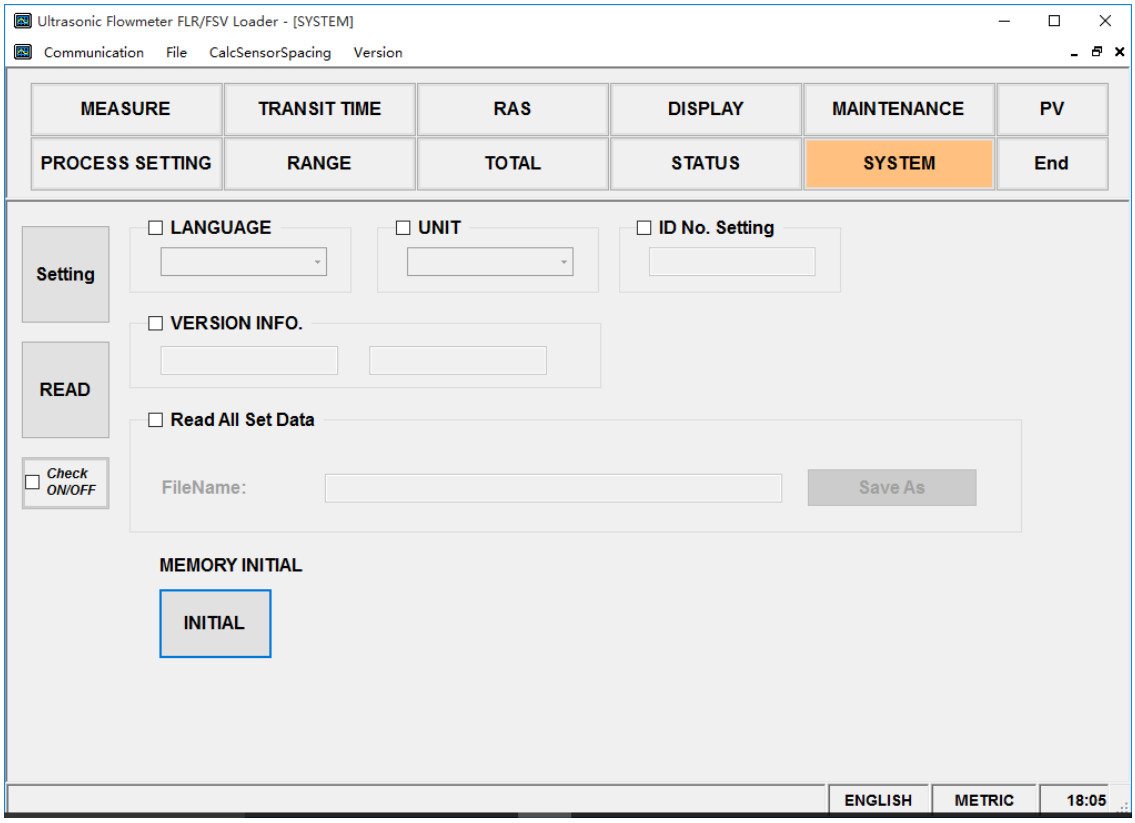


Fig. 8-22 <System setting screen>

Version information can only be read. For details of “System setting,” refer to Table 8-15.

Initialize Memory

[INITIAL] button .....Resets all flowmeter settings to the factory defaults.

Read All Set Data

[Save As] button .....Specify the save location and file name, and click the [READ] button to save the settings in CSV format.

Table 8-15 <System Setting>

Item	Content
LANGUAGE	Language is available in ENGLISH, JAPANESE, GERMAN, FRENCH and SPANISH.
UNIT SYSTEM	Select from METRIC and ENGLISH.
ID No. Setting	Enter in rage of 0000 to 9999.
Version information	Read only
Read All Set Data	Outputs all the settings of the flowmeter to a designated file in CSV format.

8.15 Measurement

Click the “MEASURE” button on the Menu screen, and the following screen appears.

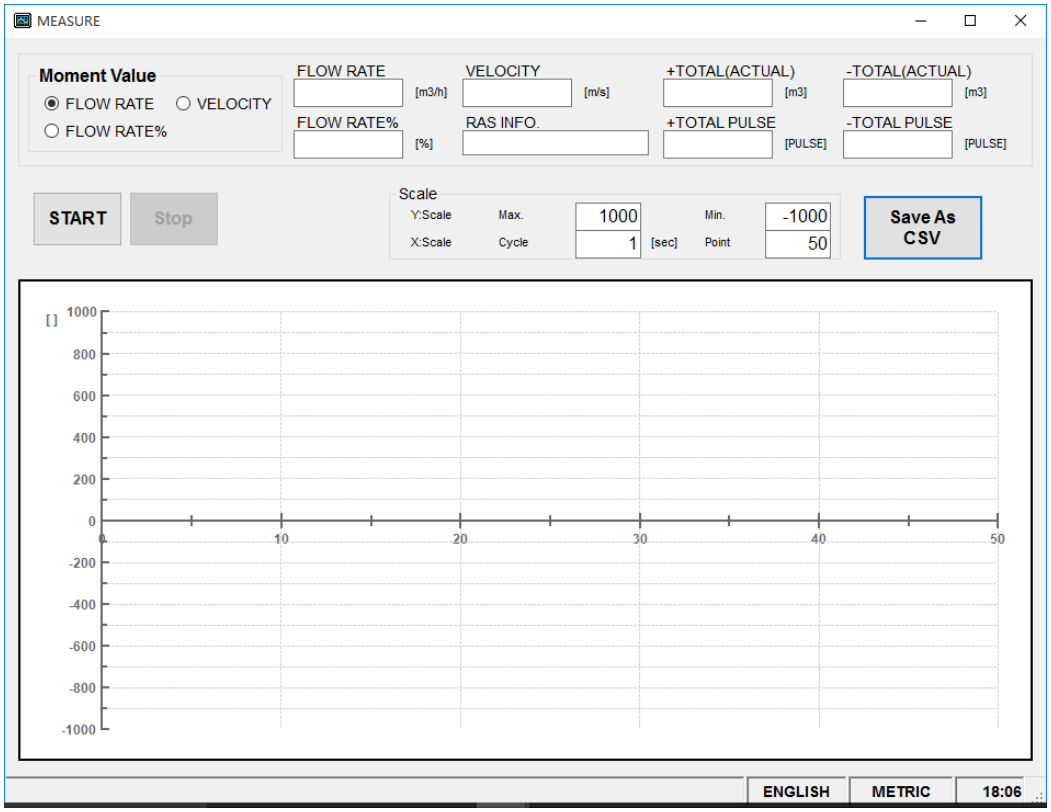


Fig. 8-23 <Measure screen>

Perform steps (1) to (3) before clicking [START] to begin viewing and recording.

(1) Select the measurement values to be displayed on the graph from the instantaneous values.
(2) Set the scale. Y scale [Max.][Min.], X scale [Cycle][Point]
(3) Click the [Save as CSV] button to register the save destination and file name.
(4) Click the [Stop] button to stop viewing and recording.

Note 1) The value displayed in the frame is updated every setting cycle.
Note 2) Select from [FLOW RATE], [FLOW RATE %] and [VELOCITY] for the graph.
Note 3) The following data is recorded every cycle in the CSV FILE: VELOCITY, FLOW RATE, FLOW RATE %, +TOTAL, -TOTAL, +TOTAL PULSE, -TOTAL PULSE, ERROR (RAS).
Note 4) CSV FILE data can be collected simultaneously when there are multiple flowmeters. Refer to 8-17 PV for instructions.

Table 8-16 <Measurement/Detailed Setting>

Item		Content
Instantaneous value		Select from Flow rate, Flow rate %, and Velocity.
Scale	Y scale	Enter the maximum and minimum values.
	X scale	Enter cycles and number of points. Enter cycles in the range from 1 to 3600.

[Save As CSV] button .....When you click this button, “Specify a saving file name” dialog box appears. Select the folder and enter the file name. A CSV file will be created.

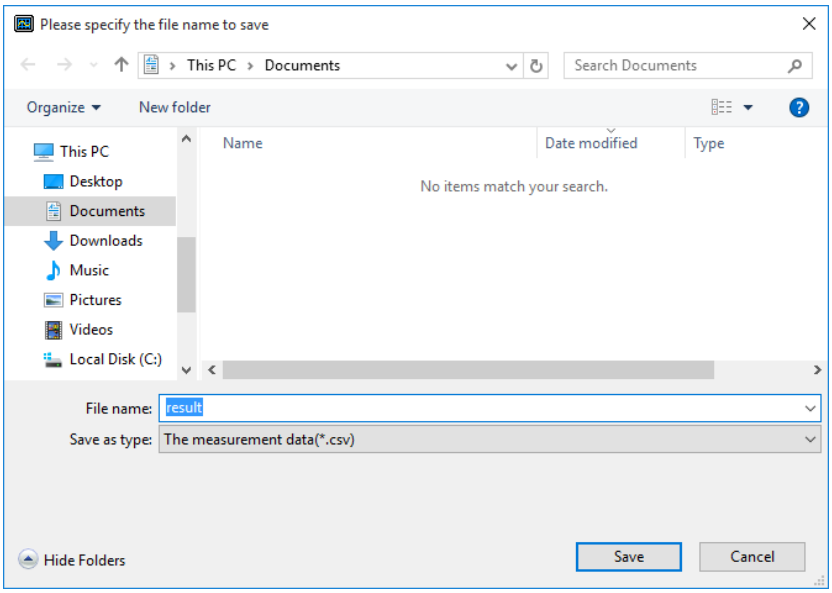


Fig. 8-24 <PC save screen>

Default file name: “result_YYYYMMDDHHMMSS.csv”
The file name can be changed.
If the saved data exceeds 32000 lines, a new file will be automatically created.
The new file will be identified with the date and time added to the end of the file name.
Note) A new file is automatically created when the number of data lines is exceeded.
Ensure that there is sufficient capacity on your computer hard disk.
Example) Settings file name YYYYMMDDHHMMSS
Yr Mon Day Hr Min Sec

8.16 Transit Time Difference Measurement

Click the [TRANSIT TIME] button on the Menu screen, and the following screen appears. Click detailed setting tab, receiving waveform tab and operation information tab when necessary.

8.16.1 Detailed Setting

⚠ CAUTION

- Do not change the setting by yourself. Otherwise measurement may be disabled.
- Make the detailed setting only when a problem should arise in flow rate measurement with factory default settings. The setting need not be made in other cases.

Click “DETAILS”, and the following screen appears.

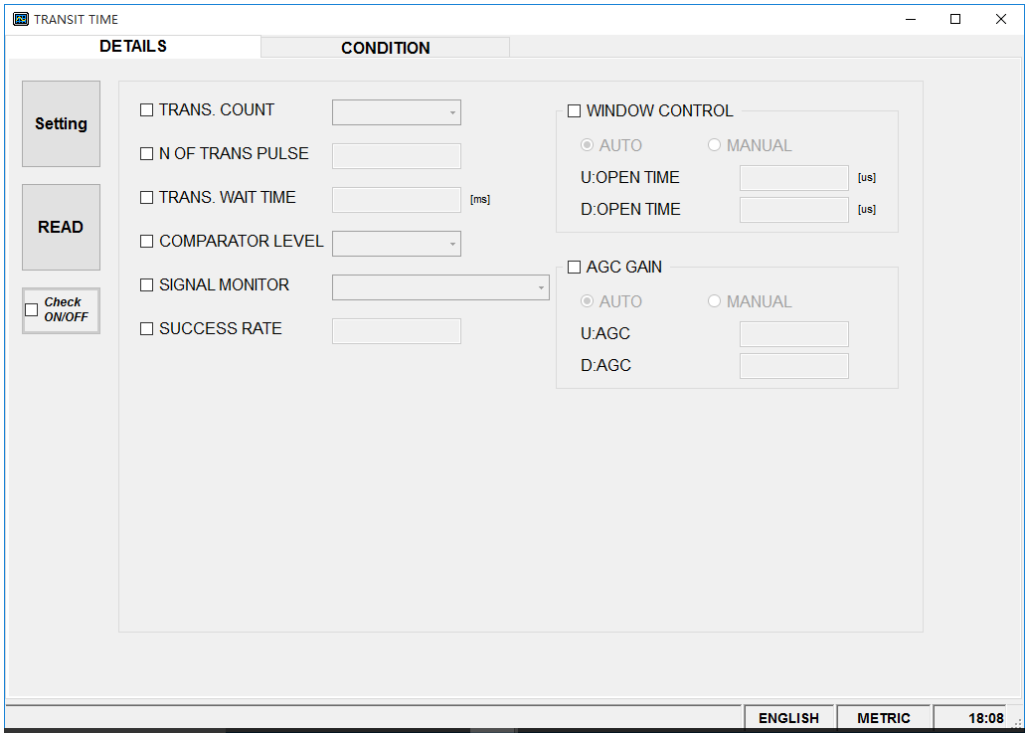


Fig. 8-25 <Detailed information screen>

For detailed settings, refer to Table 8-17 on the next page.

Table 8-17 <Detailed Setting>

Item	Description
TRANSMIT COUNT	Select from 16, 32, 64, and 128. (Factory default: 128)
TRANS. WAVE COUNT	Select from 1 to 31. (Factory default: 3)
TRANS. WAIT TIME	Enter a number between 1 and 30 ms. (Factory default: 5 ms)
COMPARATOR LEVEL	Select from -35 mV, -50 mV, -75 mV, -125 mV, -220 mV, -410 mV, -775 mV, and -1500 mV. (Factory default: -220 mV)
SIGNAL MONITOR	Select from OFF, COMPARATOR LEVEL, P/H ALARM, COMPARATOR LEVEL +P/H ALARM. (Factory-set value: COMPARATOR LEVEL)
SUCCESS RATE	Enter a number between 0 and 100%. (Factory default: 25%)
WINDOW CONTROL	Select AUTO or MANUAL. (Factory default: AUTO) In the case of manual, enter a value in the range of 18 to 16406 μs in the U:OPEN TIME and D:OPEN TIME fields.
AGC GAIN	Select AUTO or MANUAL. (Factory default: AUTO) In the case of manual, enter a value in the range of 1700 to 4000 in the U:AGC and D:AGC fields.

8.16.2 Operation Information

Click “CONDITION”, and the following screen appears.

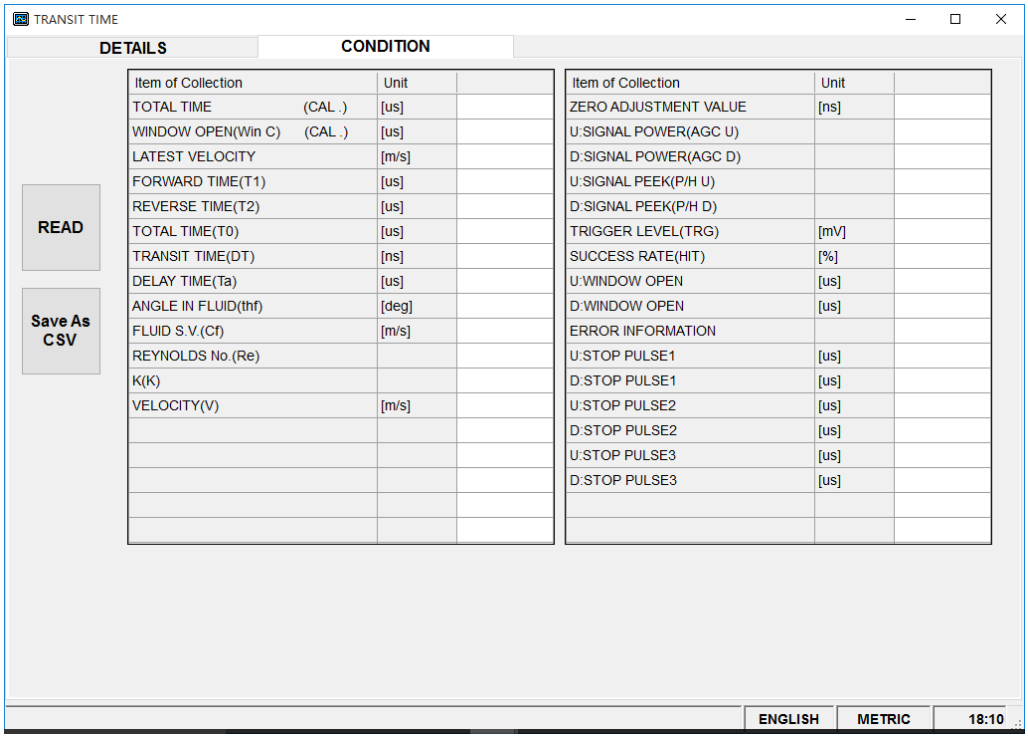


Fig. 8-26 <Operation Information screen>

[Read] button..... Reads operation information in batches and automatically updates it every second.

[Save As CSV] button ..... Saves Operation Information in file with CSV format. Click the button, and you are prompted to enter the name of a file to which the data is to be saved. Specify the destination to save and enter the file name, and a CSV file is created.
Default file name: “value_YYYYMMDDHHMMSS.csv”
The file name can be changed.

Table 8-18 <Operation Information>

Item	Content
TOTAL TIME	μs
WINDOW OPEN (Win C)	μs
FINAL FLOW VELOCITY	m/s [ft/s]
FORWARD TIME (T1)	μs
REVERSE TIME (T2)	μs
TOTAL TIME (T0)	μs
TRANSIT TIME (DT)	ns
DELAY TIME (Ta)	μs
ANGLE IN FLUID (θf)	°
FLUID SOUND VELOCITY (Cf)	m/s [ft/s]
REYNOLDS No. (Re)	
K (K)	
VELOCITY (V)	m/s [ft/s]
ZERO ADJUSTMENT VALUE	[ns]
U: SIGNAL POWER (AGC U)	(Normal range: 45% or higher)
D: SIGNAL POWER (AGC D)	(Normal range: 45% or higher)
U: SIGNAL PEEK (P/H U)	(Normal range: 1410 to 2230)
D: SIGNAL PEEK (P/H D)	(Normal range: 1410 to 2230)
TRIGGER LEVEL (TRG)	mV
SUCCESS RATE (HIT)	%
U: WINDOW OPEN	μs
D: WINDOW OPEN	μs
ERROR CODE	
U:STOP PULSE1	μs
D:STOP PULSE1	μs
U:STOP PULSE2	μs
D:STOP PULSE2	μs
U:STOP PULSE3	μs
D:STOP PULSE3	μs

For operating information, refer to “Displaying data in maintenance mode” in “6. Maintenance and Inspection” of the instruction manual for the Ultrasonic Flowmeter Transmitter INF-TN3FSV-E.

8.17 RAS

Click the [RAS] button on the menu screen to display the RAS screen shown below.

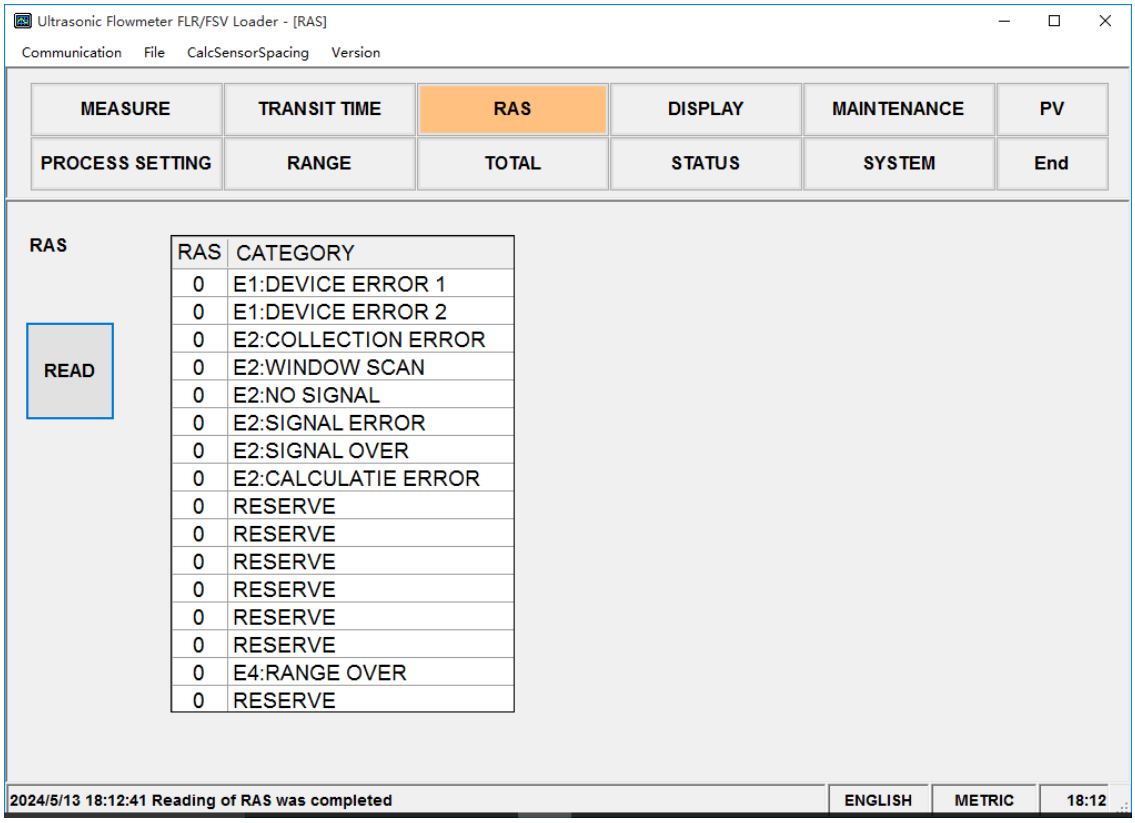


Fig. 8-27 <RAS screen>

[READ] button..... Displays RAS information (0/1 of 16 items).

0: Normal

1: Error

8.18 Maintenance

Click the “MAINTENANCE” button on the Menu screen, and the following screen appears.

Note: If [Setting] and [Read] are executed on this screen, the instrument is in the Maintenance mode for flowmeter. Be sure to reset the Maintenance mode of flowmeter by clicking the [TEST Cancel] button.

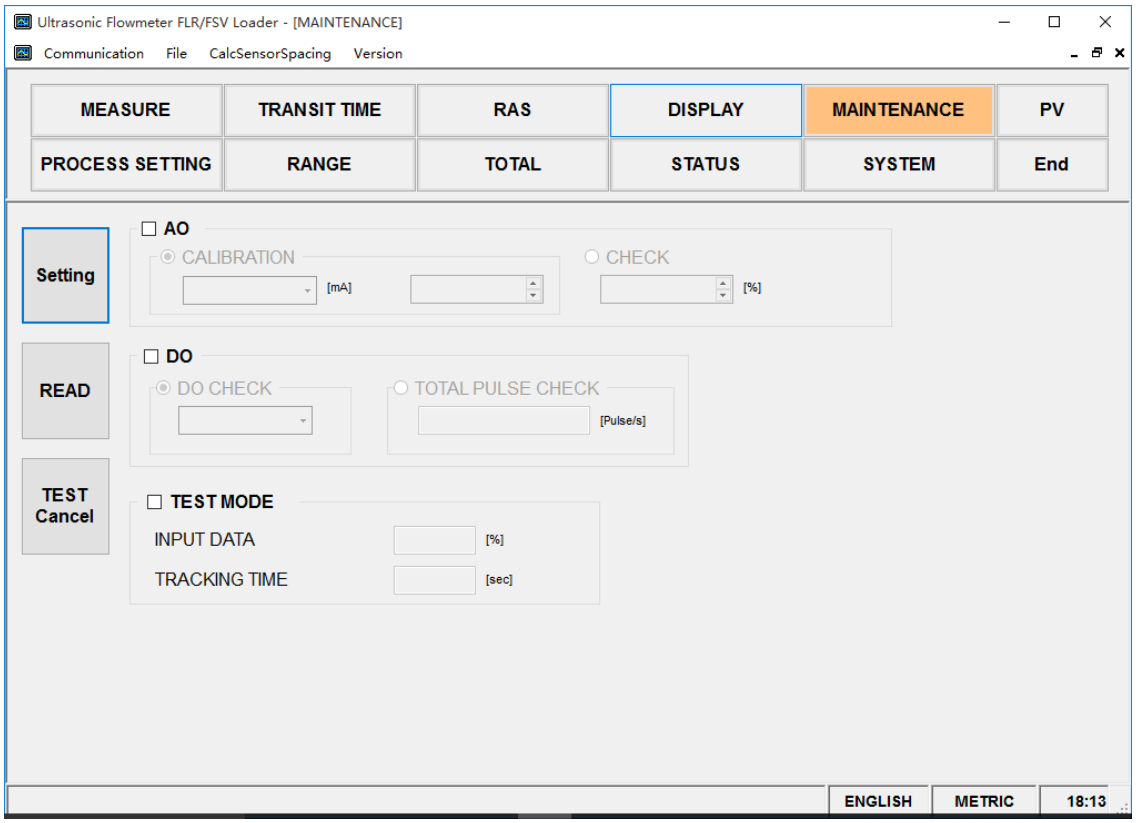


Fig. 8-28 <Maintenance screen>

See Table 8-19 on the next page for details of the maintenance.

[TEST Cancel] button..Cancels the AO/DO/Test mode.

* Be sure to press the [TEST Cancel] button when maintenance is completed.

Table 8-19 <Maintenance/setting>

Item	Content
AO adjustment	When 4 mA is selected, without decimal point, setting range 200 to 8000: Enter a value around 3552. When 20 mA is selected, without decimal point, setting range 11000 to 22000: Enter a value in the range of 18050. * Note: Be sure to click the [READ] button after selecting 4 mA or 20 mA. The setting value is listed in the right pane. Connect an ammeter. Click the [SET] button to change the adjusted value.
AO check	Without decimal point, Enter in the range from -20 to 120%.
DO check	Select ON or OFF.
DO total pulse check	Without decimal point, Enter in the range from 1 to 100 Pulse/s.
Test mode	Check the check box (☑) to enter the test mode. Exit the test mode if either input data or tracking time is entered and the check box is blank (☐).
Input data	Without decimal point, Enter in the ±120% range.
Tracking time	Without decimal point, Enter in the range from 0 to 900 sec.

8.19 PV

Click the [PV] button on the menu screen to display. It is only available on the menu screen when RS-485 is selected as the communication method.

⚠ CAUTION

- The window cannot be moved on the PV screen.
- Do not start or operate other applications while measurement is in progress. Otherwise proper measurement cannot be obtained.

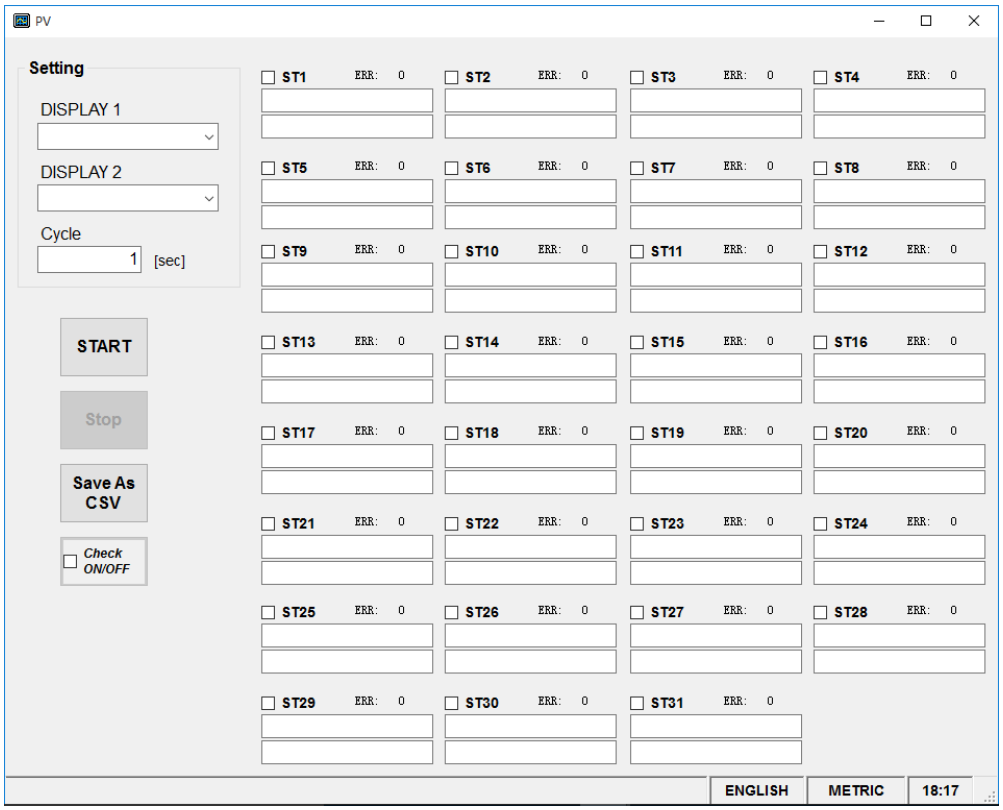


Fig. 8-29 <PV screen>

Select the station No. to be measured by checking the check box of the desired item (☑). Make the check box of the items not to be selected (or to be canceled) blank (☐).

The number of measurable units can be calculated by the following expression:

Number of measurable units = Cycle (sec) / 0.5 sec

See Table 8-20 for details of PV.

[START] button ..... Starts the measurement of the selected device (☑). When setting of saving file is completed with [Save as CSV] button, [Start] button will be enabled to click.

[Stop] button ..... Stops the measurement.

[Save as CSV] button ..Saves the measurement data of each device in a file in CSV format.

On clicking the button, you are asked where to save the data as well as the name of the file. Enter the place to save data and the name of the file, and a file in CSV format is created. When click the [Save as CSV], you are asked the file name where to save and then input the destination and file name to save, and file in CSV format will be created.

Default file name: "pvdata_YYYYMMDDHHMMSS.csv"

The file name can be changed.

When setting of saving file is completed, [Start] button will be enabled to click.

When the number of data in the saving file exceeds 32000 line, new file will be created separately.

Year, month, date, hour, minute, and second part of the file name will be changed when the file are updated automatically.

Note) When amount of the data to be saved on the file exceeds 32000 lines, new file will be created automatically.

Please make sure that PC hard disc has space to save the data.

e.g.) Setting of file name YYYYMMDDHHMMSS
Yr Mon Day Hr Min Sec

[Check ON/OFF] check button ..... Check the check box (☑) to select all the items. (The check boxes for all the items are checked (☑)). Keep the check box blank (☐) to cancel the selection of all the items. (The check boxes for all the items are made blank (☐).

ERR: ..... Displays a count of measurement and communication errors that have occurred since the [START] button was clicked.

Click the [Stop] button and then the [START] button to reset the count to zero.

Table 8-20 <PV Setting>

Item	Content
DISPLAY 1	Select from VELOCITY, FLOW RATE, FLOW RATE %, +TOTAL, +TOTAL PULSE, -TOTAL, -TOTAL PULSE, and RAS.
DISPLAY 2	Same as the selection of DISPLAY 1
CYCLE	Enter in range of 1 to 60 sec.

8.20 End

Click the [End] button on the Menu screen, and the following screen appears.

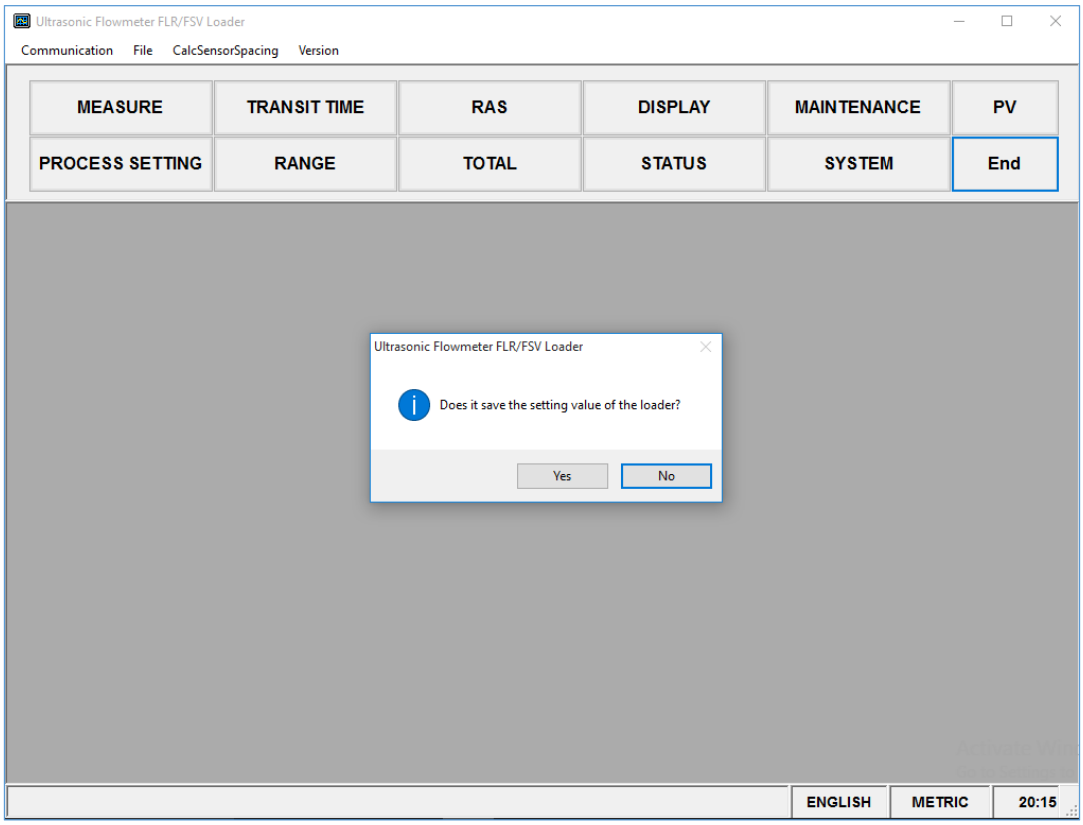


Fig. 8-30 <Menu screen>

Click either the [End] button or the [X] button, and a message asking you whether you want to exit appears. Select “Yes” to exit or “No” to continue.

8.21 Uninstalling of Software

Select “Addition and Deletion of Application” from “Control Panel” of Windows, and click [Change and Deletion] to uninstall the software.

9. TROUBLESHOOTING

If the communication is unavailable, check the following items.

- ☐ Whether all devices related to communication are turned on.
- ☐ Whether connections are correct.
- ☐ Whether the number of connected instruments and connection distance are as specified.
- ☐ Whether communication conditions coincide between the master station (host computer) and slave stations.
  - ☐ Transmission speed: ☐ 9600bps
    ☐ 19200bps
    ☐ 38400bps
  - ☐ Data length: 8 bits
  - ☐ Stop bit: 1 bit
  - ☐ Parity: ☐ odd
    ☐ even
    ☐ none
- ☐ Whether send/receive signal timing conforms to Section 5.6 in this manual.
- ☐ Whether the station No. designated as send destination by the master station coincides with the station No. of the connected FSV.
- ☐ Whether more than one instrument connected on the same transmission line shares the same station No.
- ☐ Whether the station No. of instruments is set at other than 0.
  If it is 0, the communication function does not work.
- ☐ Whether the 5th digit of type cord of this Flow transmitterr is A ?
  (FSV☐A☐☐3)

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