# ULTRASONIC FLOWMETER FOR STEAM
# COMMUNICATION FUNCTIONS

**TYPE: FSJ (Flow Transmiter)**
**FSX (Detector)**
**FLY (Signal cable)**

Note: MODBUS® is the trade mark or registered trade mark of AEG Schneider Automation International.

# CONTENTS

# 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 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 RS-232C ⇔ RS-485 converter in case of designating a personal computer or other devices which have an RS-232C interface as a master station.

[RS-232C ⇔ RS-485 converter] (recommended article)
    Type: K3SC-10 (isolated type)/OMRON Corporation

System configuration (when using the RS-485 interface)
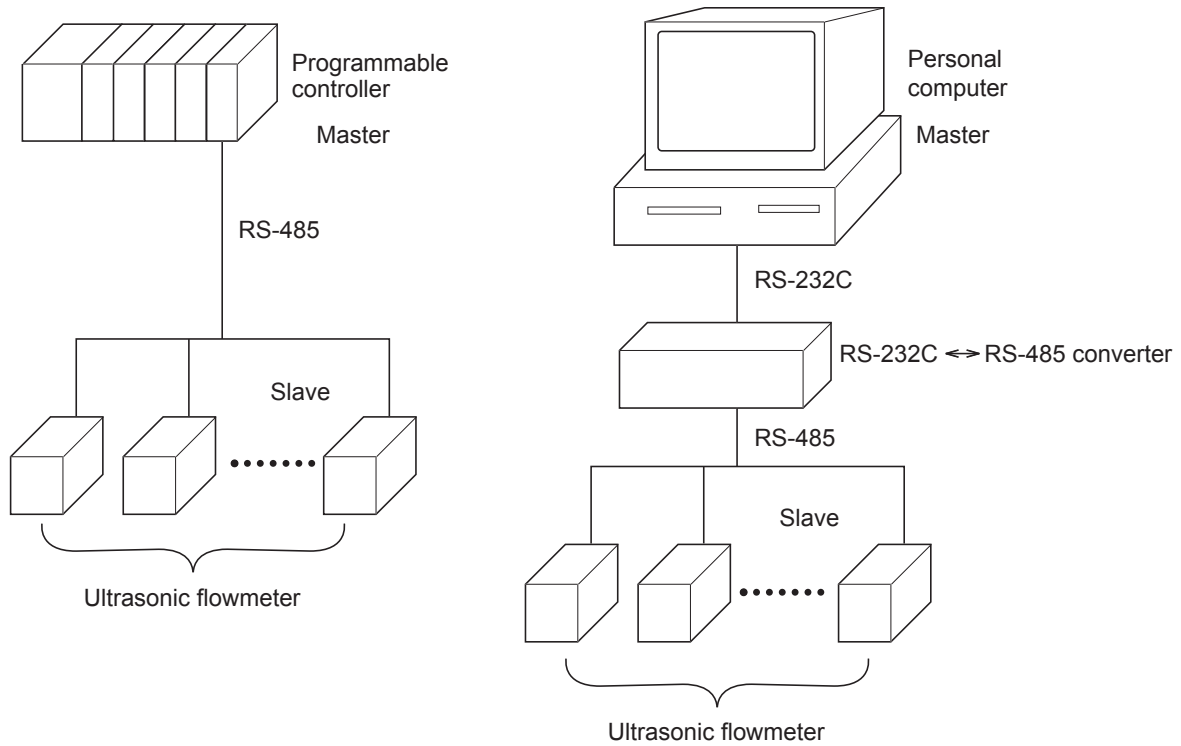


[Note]

    When using the RS-232C ⇔ 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, be careful about communication settings such as baud rate and parity set for the converter.

# 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 bits |
| | 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

| 41 | 42 | 43 |
|----|----|----|
| SG | A– | B+ |

RS-485
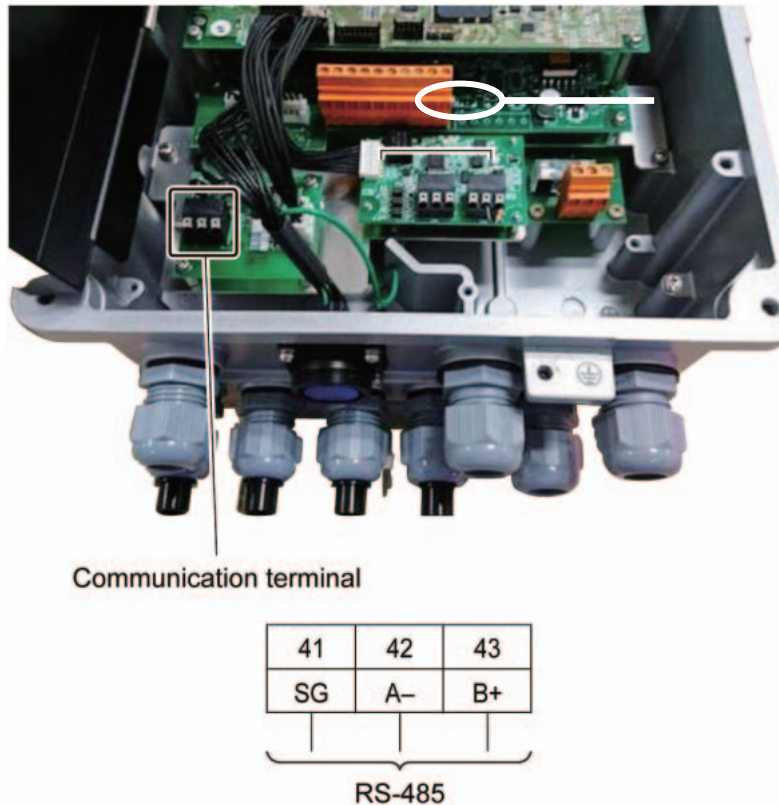
■Useable wire material

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

・ Bar terminal
Weidmüller
www.weidmüller.com
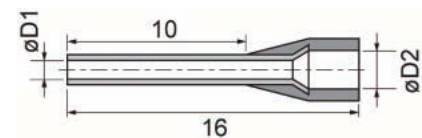


| Electric wire thickness (mm$^2$) | øD1 (mm) | øD2 (mm) | Model |
|---|---|---|---|
| 0.5 | 1 | 2.6 | H0.5/16 |
| 0.75 | 1.2 | 2.8 | H0.75/16 |
| 1 | 1.4 | 3 | H1/16 |
| 1.5 | 1.7 | 3.5 | H1.5/16 |

## 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 120 Ω (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 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.
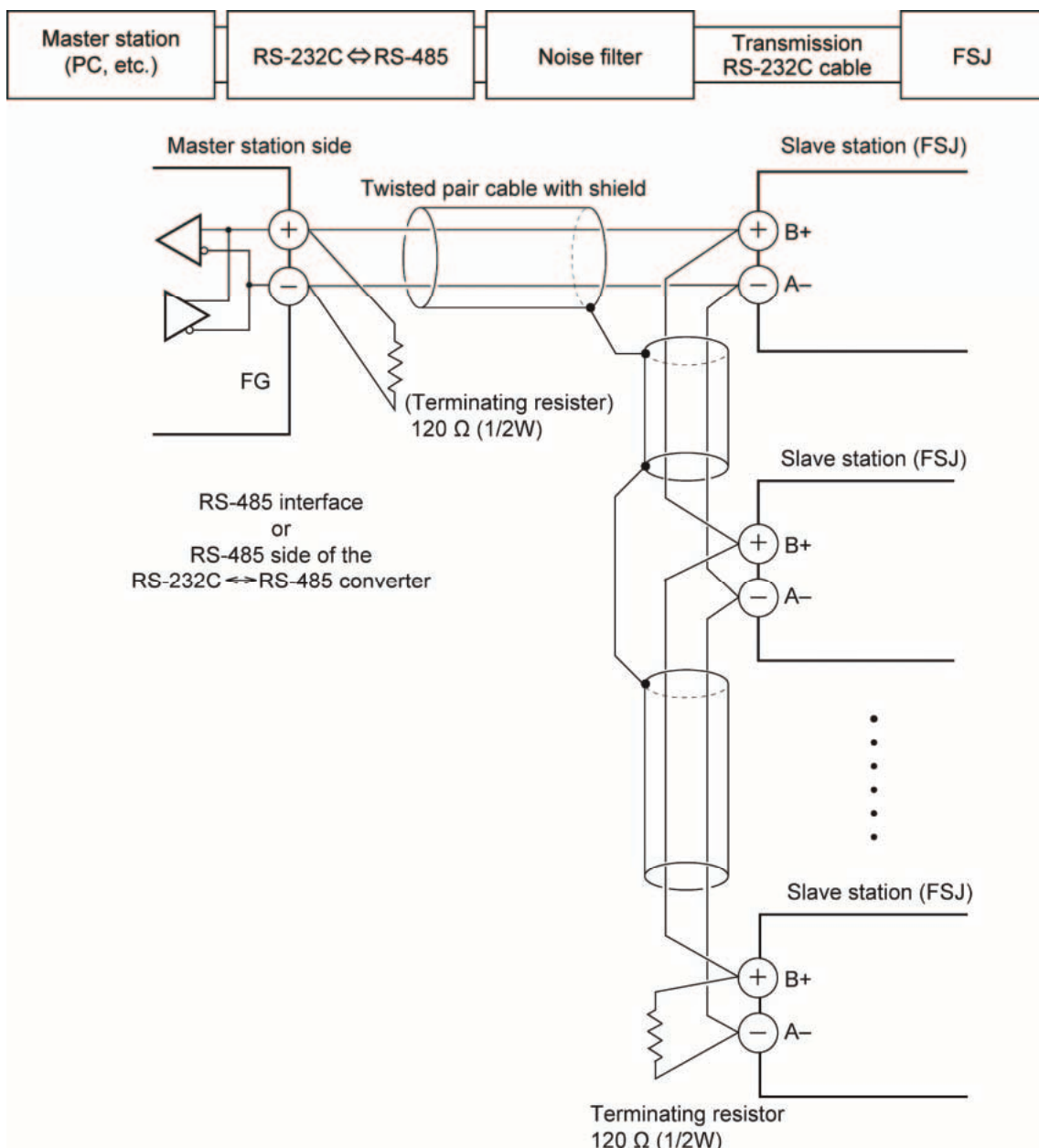
# 4. SETTING OF COMMUNICATION CONDITION

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 | 38400 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<br>Odd: Odd parity<br>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. Refer to the separate instruction manual for "ULTRASONIC FLOWMETER FOR STEAM", INF-TNFSJ-E, for the operation method.

# 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.

| Master to slave | Command message | |
|---|---|---|
| Slave to master | | Response message |

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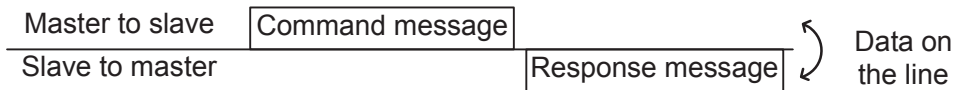
    b) In case when the station No. in the received command message mismatches with the own slave station No.

| Master to slave | Command message | |
|---|---|---|
| Slave to master | | (Not respond) |

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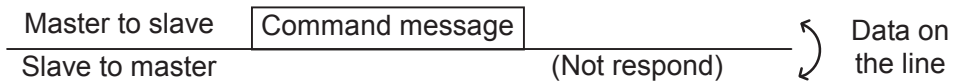
5) To assure safety, provide a structure where the response message is checked and retry is made three (3) times or more if no response is made or an error occurs.

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 (FSJ) 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.

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

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.

```
                    ┌──────────────┐
                    │    Start     │
                    └──────────────┘
                           │
        ┌──────────────────────────────────────┐
        │ Set FFFF_H (hexadecimal number) in CR.│
        └──────────────────────────────────────┘
                           │
                    ┌──────────────┐
                    │  Set 1 in I. │
                    └──────────────┘
```

Explanation of variables

CR CRC error check data (2 bytes)

I : Digits of calculation characters in command message

J : Check on the number of times of CR calculation

Exclusive logical sum (XOR) is executed with CR and one character (1 byte) of the I characters, and its results is set in CR.

Set 1 in J.

Bit at right end of CR is 1?   NO

YES

Shift CR to right by 1 bit, and A001_H and exclusive logical sum (XOR) are executed and its result is set in CR.

Shift CR to right by 1 bit.

Add 1 to J.

NO   Calculation (8 times) is finished?   J>8

YES

Add 1 to I.

NO   Calculation of all characters is completed?   I>All characters

YES

End

(Calculation is executed in the order of command message station No., function code and data.)

CR calculation result shall be added to the last command message in the order of LOW byte and HIGH byte.
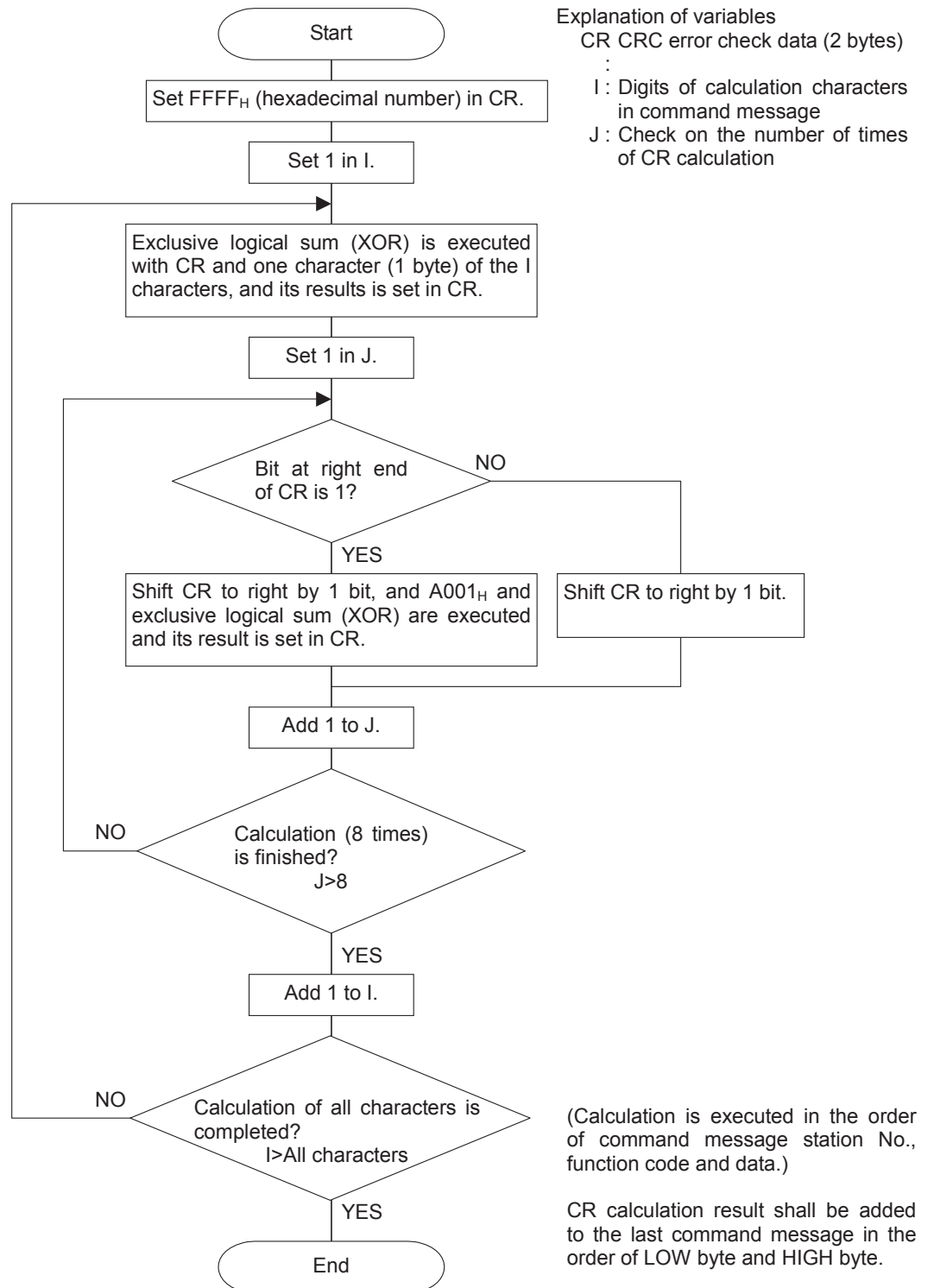
Fig. 5-3 Flow of CRC-16 calculation

# 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 23 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.

| Master station → FSJ | | POL1 | | | | | POL2 | |

| Master station ← FSJ | | | 5 to 60 ms | POL1 response data | | | | |

| Data on line | | POL1 | | POL1 response data | | | POL2 | |
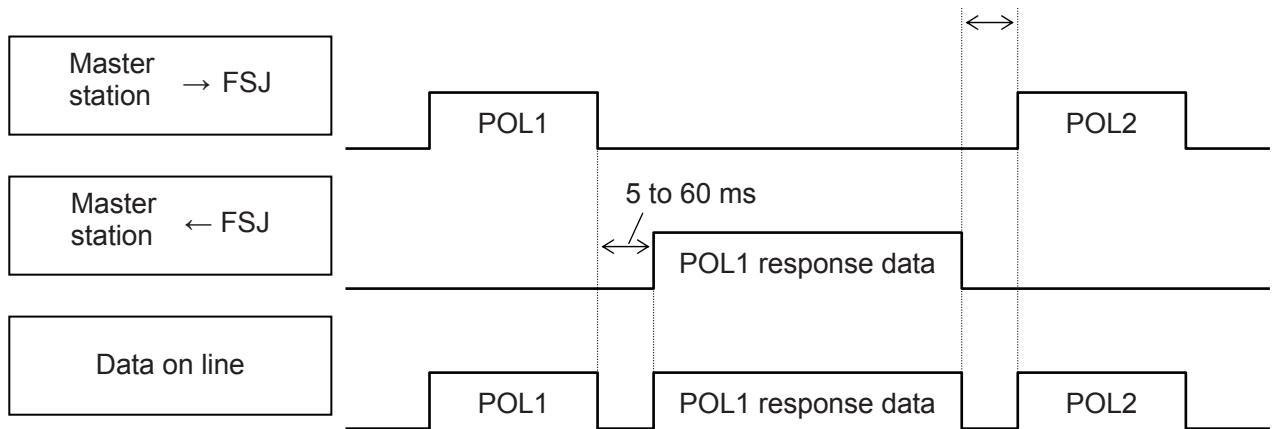
# 6.  DETAILS OF MESSAGE

## 6.1  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$_H$ – 00BF$_H$ | 30001 – 30192 |

### (1)  Message composition

Command message composition (byte)

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

} 1 to 64

Response message composition (byte)

| Station No. | |
|---|---|
| Function code | |
| Read-out byte number | |
| 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 |

Read-out word number × 2

*   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 $m^3/h$ = 1.5x (2 to the 7th power)

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

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

# 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:   100.0 sec

（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).
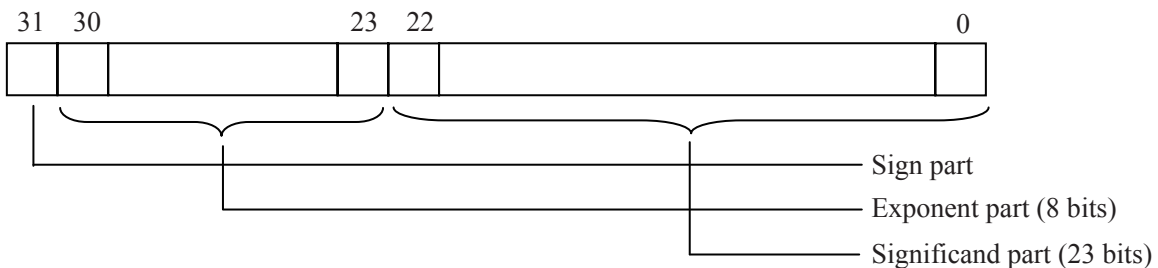


1) Sign part

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　　　　:　$-1.75 \times (\text{1st power of } 2) = -3.5$

（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 : $1.875 \times (0\text{th power of } 2) = 1.875$

## 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.

# 7.2　Address Map

See the instruction manual attached to the main unit for details of functions and setting ranges of individual parameters.

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 only]: Function code [04$_H$]

| Relative address | Register No. | Data type | Parameter | Read-out data | Remarks |
|---|---|---|---|---|---|
| | 3XXXX | | | | |
| 0000 | 30001 | float | Flow velocity | Metric system: 32-bit floating data, unit: m/s<br>Inch system: 32-bit floating data, unit: ft/s | |
| 0004 | 30005 | float | Volume flow rate | 32-bit floating data | Unit: Volume flow unit |
| 0008 | 30009 | float | Volume flow rate (%) | 32-bit floating data | Unit (%) |
| 000C | 30013 | double | +Volume total | 64-bit floating data | Unit: Volume flow total unit |
| 0014 | 30021 | double | -Volume total | 64-bit floating data | Unit: Volume flow total unit |
| 001C | 30029 | long | +Volume total pulse | No decimal point | Unit: Pulse |
| 0020 | 30033 | long | -Volume total pulse | No decimal point | Unit: Pulse |
| 0024 | 30037 | unsigned int | RAS information | Hexadecimal data | |
| 0026 | 30039 | float | Mass flow rate | | Unit: Mass flow unit |
| 002A | 30043 | float | Mass flow rate (%) | | % |
| 002E | 30047 | double | +Mass total | 64-bit floating data | Unit: Mass flow total unit |
| 0036 | 30055 | double | -Mass total | 64-bit floating data | Unit: Mass flow total unit |
| 003E | 30063 | long | +Mass total pulse | No decimal point | Unit: Pulse |
| 0042 | 30067 | long | -Mass total pulse | No decimal point | Unit: Pulse |
| 0046 | 30071 | float | AI input | | Unit: mA |
| 004A | 30075 | float | Density | Metric system: 32-bit floating data, unit: kg/m$^3$<br>Inch system: 32-bit floating data, unit: lb/ft$^3$ | |
| 004E | 30079 | float | Pressure | | Unit: Pressure unit |
| 0052 | 30083 | float | Temperature | | Unit: Temperature unit |
| 0056 | 30087 | float | Pt temperature | | Unit: Temperature unit |
| 005A | 30091 | int | U: SNR | 2 places after decimal point | Unit: dB |
| 005C | 30093 | int | D: SNR | 2 places after decimal point | Unit: dB |
| 005E | 30095 | int | U: Signal power (AGC U) | 2 places after decimal point, 0.00 to 100.00% | |
| 0060 | 30097 | int | D: Signal power (AGC D) | 2 places after decimal point, 0.00 to 100.00% | |
| 0062 | 30099 | unsigned int | Measurement error information | Hexadecimal data | |
| 0064 | 30101 | int | Reserved | | write-in inhibit |
| ∼ | ∼ | | Reserved | | write-in inhibit |
| 007E | 30127 | int | Reserved | | write-in inhibit |
| 0080 | 30129 | long | Sensor spacing 1 | Metric system: 2 places after decimal point, unit: mm<br>Inch system: 3 places after decimal point, unit: inch | |
| 0084 | 30133 | unsigned int | Sensor spacing 2 | No decimal point | Unused |
| 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 | | |
| 0090 | 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 | int | Reserved | | write-in inhibit |
| ∼ | ∼ | | Reserved | | write-in inhibit |
| 00BE | 30191 | int | Reserved | | write-in inhibit |

# 8.   PC LOADER SOFTWARE IN CD SUPPLIED WITH THE MAIN UNIT

## 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

Using this software, you can set, read and display relevant graphs of this instrument 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   PC to Be Used

### 8.3.1   Computer

AT compatible-type with CPU Pentium IV 1 GHz/Celeron 1 GHz or more installed, display resolution of 1024 × 768, and use of small font recommended.

### 8.3.2   Memory capacity

128 MB or more (256 MB or more recommended) [52 MB memory or more for free space required]

### 8.3.3   Interface

RS232C port or RS485 port, MODBUS communication protocol

### 8.3.4   OS

Microsoft Windows 7 (Professional) / Windows 8.1 (Professional) / Windows 10 (Enterprise)
The editions in parentheses are those for which operation has been verified.
.NET Framework 3.5, .NET Framework 4/4.5/4.6

# 8.4 Installing of Software

(1) Insert the setup disk into the drive, and double-click "FSJ_Loader_a_V1000E.msi"
  * The version number indicated is a display example.



FSJ_Loader_Ver10
00E.msi

Fig. 8-1 <Install file>

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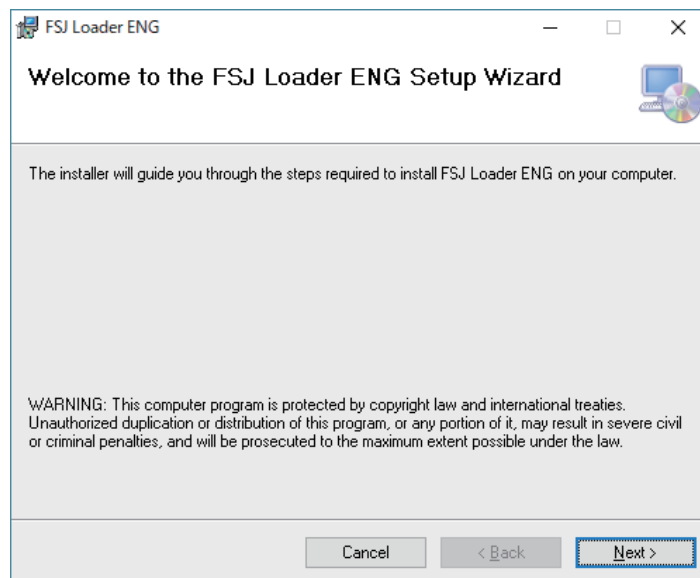


Fig. 8-2 < Setup wizard screen >

(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.
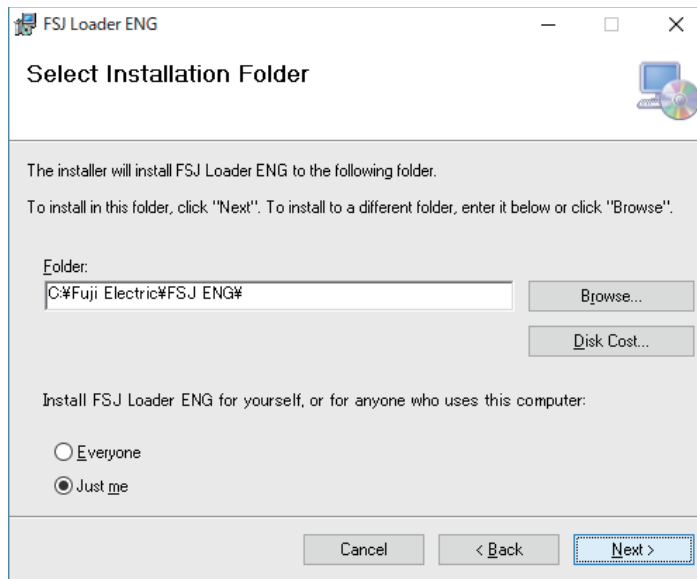


Fig. 8-3 < Select installation folder screen >

(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.
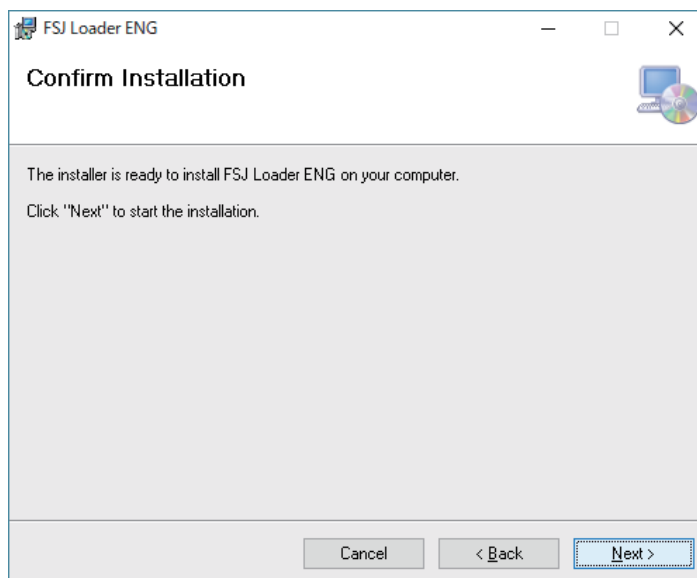


Fig. 8-4 < Installation confirmation screen >

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


(6) Execution of Installation

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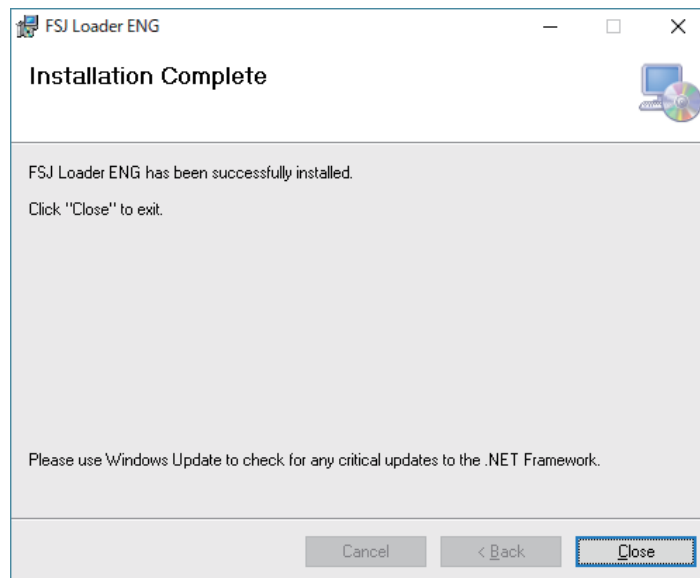


Fig. 8-5 < Installation complete screen >

(8) After installation, the start menu and the application ("FSJ Loader V1000E") that has been installed in the disktop are created.
  * The version number indicated is a display example.

# 8.5 Startup Method

Start "FSJ Loader V1000J" from the start menu or the shortcut menu to start up the loader.

\* The version number indicated is a display example.
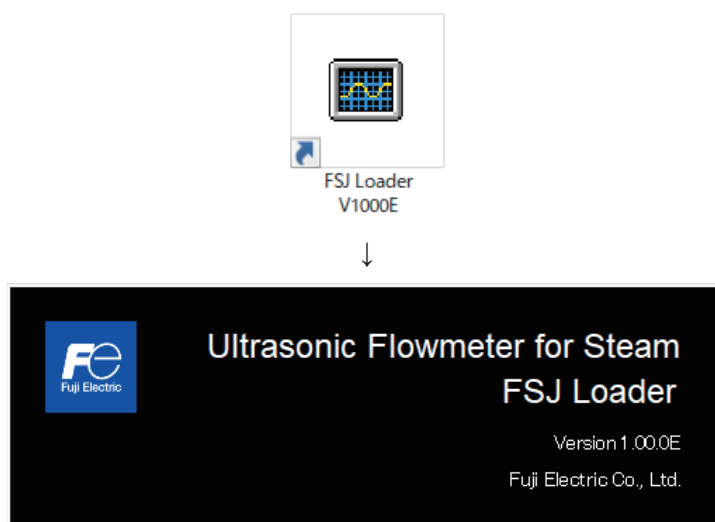


Fig. 8-6 < Start screen >

Information related to system name, measuring method, language and unit can be obtained by communicating with the flow transmitter.

A message appears if a communication error occurs. Click [OK], and check the "Communication" settings at the menu screen that appears.
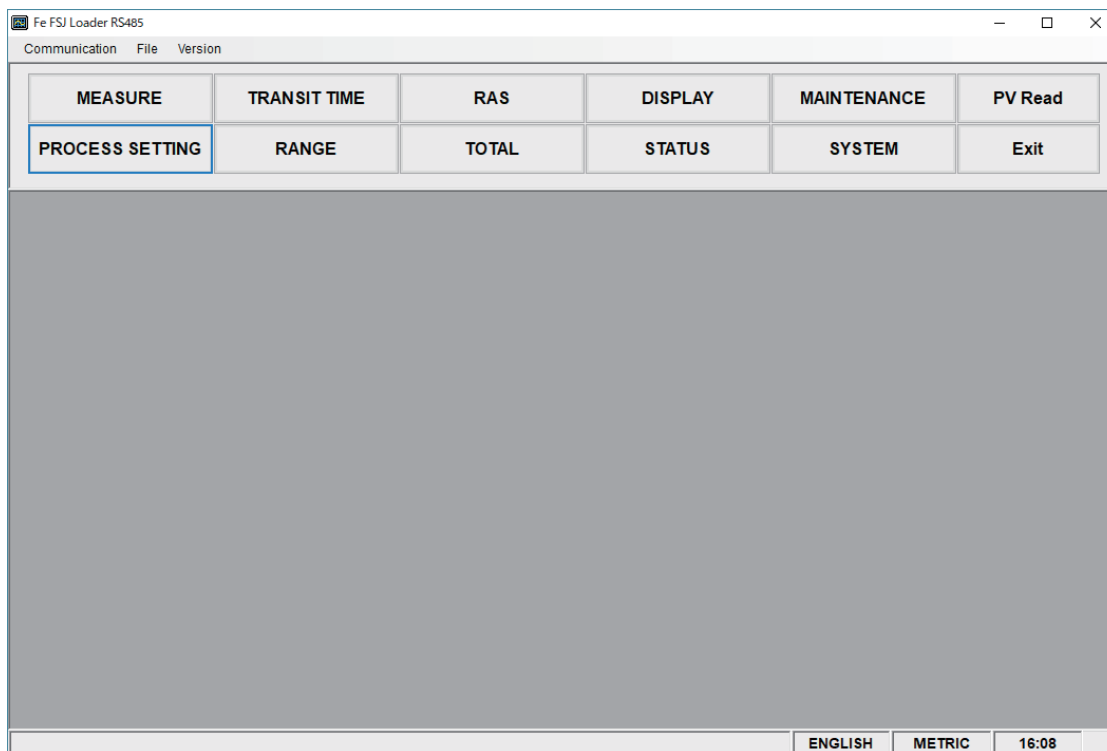


Fig. 8-7 < Menu screen >

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.

## 8.5.1　Communications

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



Fig. 8-8 < 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, COM2, COM3, COM4, COM5, COM6, COM7, COM8, COM9 and COM10. |
| Serial Method | Select RS485. |
| Station No. | Select one from 01 to 31.　If communication method is RS232C, no selection is allowed (fixed with 00). |
| Speed | Select one from 9600 bps, 19200 bps and 38400 bps. |
| Parity | Select one from NONE, EVEN and ODD. |
| Stop Bit | Select either 1-bit or 2-bits. |
| Retry | Specify in the range from 0 to 5. |

＊ Data transmitted from the transmission port for maintenance is formatted "RS485/38400 bps/None/1 bit."

## 8.5.2 Setting

Click "File" on the menu bar on the Menu screen, and either "Downlode" or "Uplode" can be selected.

### 8.5.2.1 Download

This function is used to read the parameters set in the flow transmitter all at once to the computer side, and then save the read parameters to a specified location in CSV format.

By clicking [Download], the following screen is displayed. Specify the location to which the parameters are to be saved and the file name, and click the [Save] button to download. By clicking the [Save] button, the parameters set in the flow transmitter are read to the computer side, and a CSV file is saved to the specified location. Furthermore, the read parameter values are updated to the cells and list boxes of each PC Loader setting screen (settings screens from item "8.6 Structure of Function" onward).

By clicking the [Cancel] button, parameters are not downloaded.

Default file name: "param_MMDDYYHHMMSS.csv"

The file name can be changed.



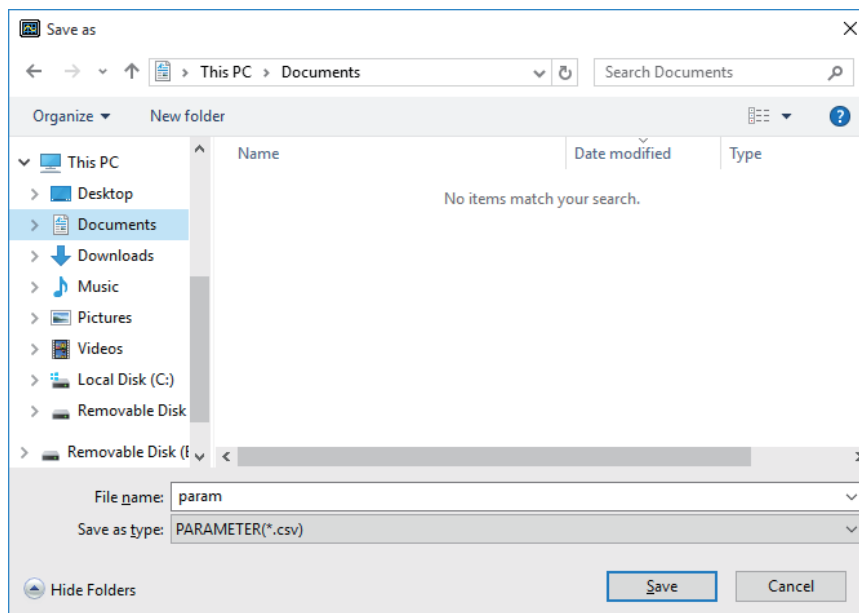Fig. 8-9 < Save: Save file selection screen >

## 8.5.2.2　Upload

This function reads the values contained in the CSV file saved to the computer when downloading to the cells and list boxes of each PC Loader setting screen (settings screens from item "8.6 Structure of Function" onward). By clicking [Upload], the following screen is displayed. Specify the location and file name of the previously saved file, and click the [Open] button to read the file. The file format is ".csv". Values are then read to the cells and list boxes of each PC Loader setting screen (settings screens from item "8.6 Structure of Function" onward). At this point, parameters have not been written to the flow transmitter. To write parameters to the flow transmitter, click the [Setting] button at each setting screen, and then click the [Save] button to write the parameters. By clicking [Cancel], parameters are not read.
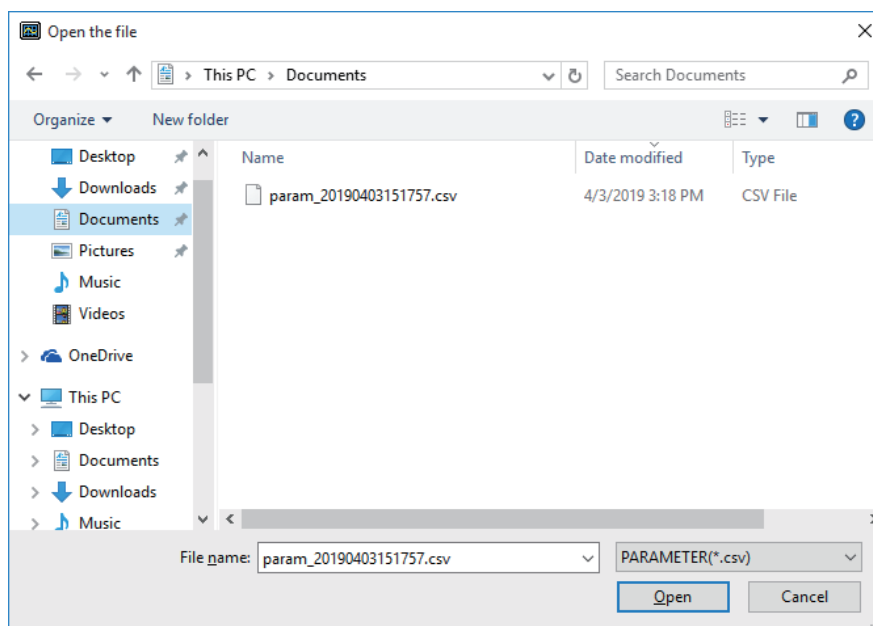


Fig. 8-10 < Open: Read file selection screen >

## 8.5.3 Version

By clicking [Version] on the menu bar at the menu screen, the following screen is displayed.
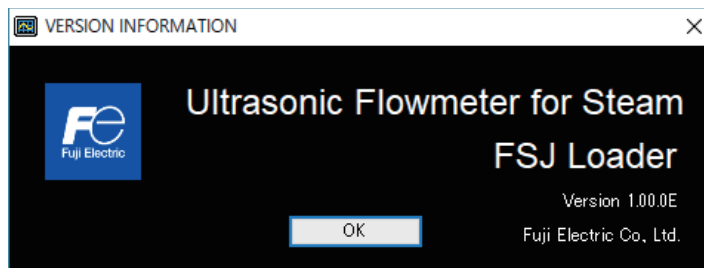* The version number at left is a display example.



Fig. 8-11 < Version screen >

Click the [OK] button to close the screen.

# 8.6   Structure of Function

Functions with loader are as follows:

Table 8-2 < Function>

| Function | Outline |
|---|---|
| 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. |
| 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/AI adjustment and AO/DO test. |
| PV Read | Measures station No. 1 to No. 31. Available only when RS485 communication. |



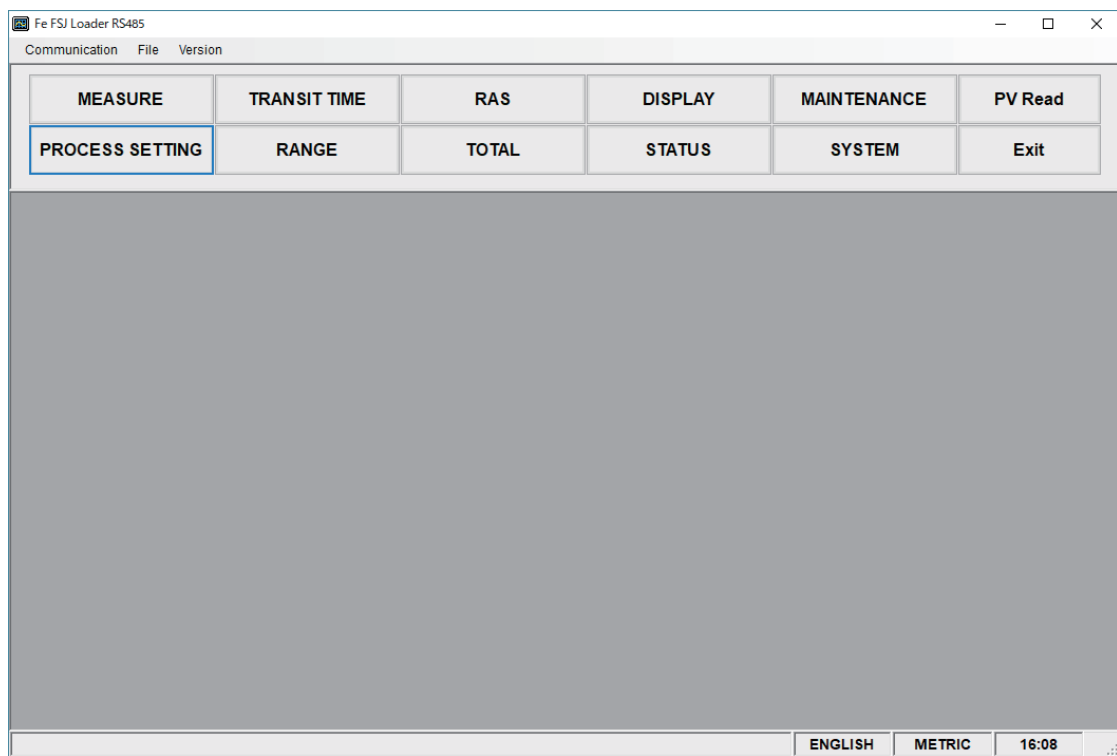Fig. 8-12 < Menu screen >

# 8.7 System Setting

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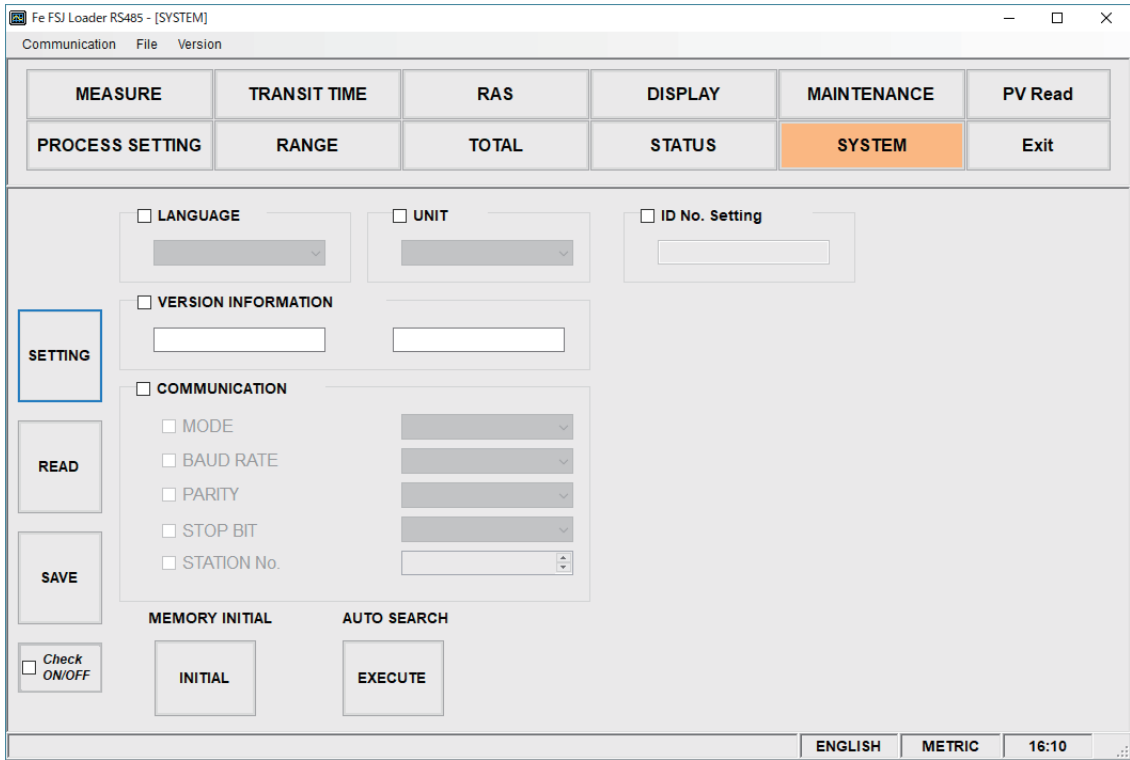


Fig. 8-13 < System setting screen >

To select an item to be set or read, set the relevant check box to ON (☑).   Not to select (or to reset the selection), set the relevant check box to OFF (☐).   However, system name and version information can only be read.   For details of "System setting," refer to Table 8-3.

[Setting]........................Sends the setting of the selected item (check box set to ON (☑)), reflecting the response value on the setting.

[READ].......................Reads the setting of the selected item (check box set to ON (☑)), reflecting the response value on the setting.

[Save] .........................Reflects the setting sent by pressing the [Setting] button on the flow transmitter.   <u>Be sure to press the [Save] button if the setting is changed.</u>

[Check ON/OFF].........Set the check box to ON (☑) to select all the items (to set all the check boxes to ON (☑)). Set the check box to OFF (☐) to release the selection of all the items (to set all the check boxes to OFF (☐)).

[INITIAL] button ........Returns all the settings of the flowmeter to the initial state. Note) Measurement will not be possible if initialization is performed.

[RUN] button ..............Detects receipt signals automatically.

Table 8-3 < 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 |
| COMMUNICATION | | It is possible to set USB communication only. Reading only is possible with RS-485 communication. |
| | MODE | Select from RS-485 (factory default). |
| | BAUD RATE | Select from 9600 bps, 19200 bps, or 38400 bps (factory default). |
| | PARITY | Select from NONE, ODD (factory default), or EVEN. |
| | STOP BIT | Select from 1 bit (factory default) or 2 bits. |
| | STATION No. | Enter in the 1 to 31 range. (Factory default: 1) |

# 8.8 Process Setting

Displayed when you press the [Process setting] button on the "Menu" screen.
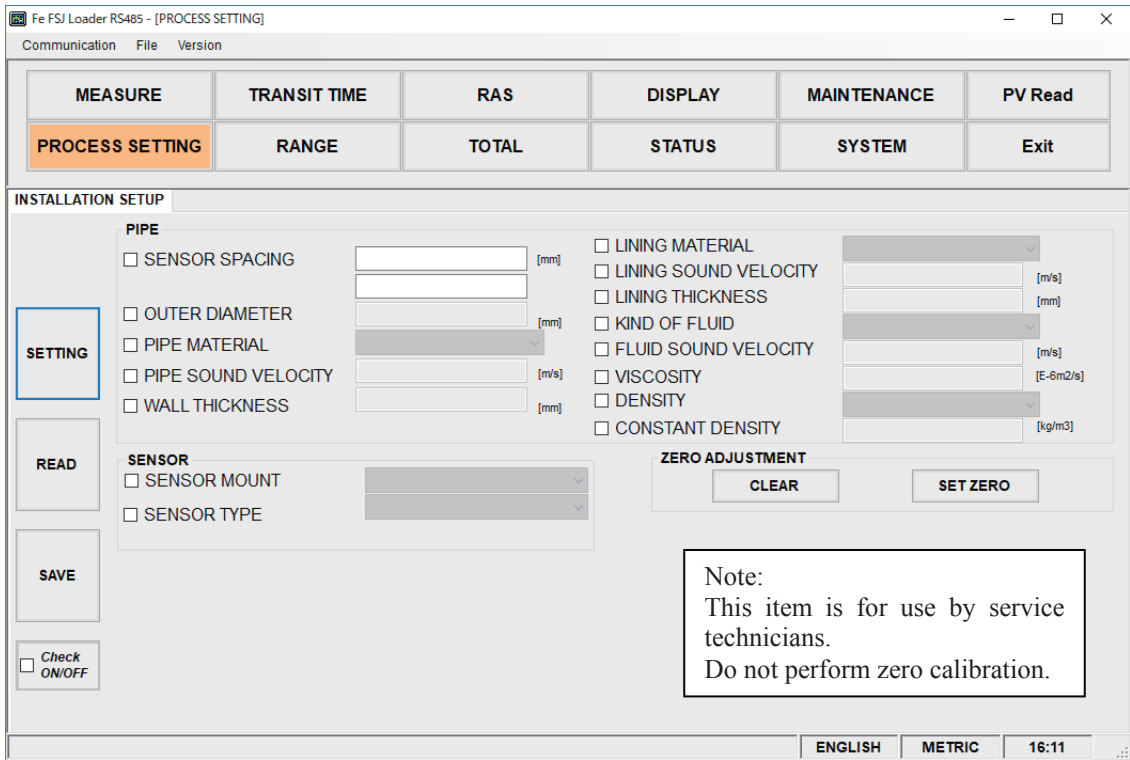


Fig. 8-14 < Process setting screen >

To select an item to be set or read, set the relevant check box to ON (☑).   Not to select (or to reset the selection), set the relevant check box to OFF (☐).

For details of "Piping Specifications" refer to Table 8-4 and Table 8-5 on the next page.

- Pipe material: Items other than PIPE SOUND VELOCITY
  Display invalid................... PIPE SOUND VELOCITY
- Pipe material: PIPE SOUND VELOCITY
  Display valid...................... PIPE SOUND VELOCITY
- Lining material: Without lining
  Display invalid................... LINING SOUND VELOCITY, LINING THICKNESS
- Lining material: Without lining, Items other than LINING SOUND VELOCITY
  Display valid...................... LINING THICKNESS
  Display invalid................... LINING SOUND VELOCITY
- Lining material: LINING SOUND VELOCITY
  Display valid...................... LINING SOUND VELOCITY, LINING THICKNESS
- Kind of fluid: For items other than FLUID SOUND VELOCITY
  Display invalid................... FLUID SOUND VELOCITY
- Kind of fluid: FLUID SOUND VELOCITY
  Display valid...................... FLUID SOUND VELOCITY
- If other than "Density: Fixed density
  Display disable................... Fixed density value
- If "Density: Fixed density
  Display enabled ................. Fixed density value

[Setting] .......................Sends the setting of the selected item (check box set to ON (☑)), reflecting the response value on the setting.

[READ] .......................Reads the setting of the selected item (check box set to ON (☑)), reflecting the response value on the setting.

[Save] .........................Reflects the setting sent by pressing the [Setting] button on the flow transmitter.  <u>Be sure to press the [Save] button if the setting is changed.</u>

[Zero adjustment] ........Note: This item is for use by service technicians. Do not perform zero calibration.

[CLEAR] .....................Clears zero calibration.

[SET ZERO]................Executes zero calibration adjustment.

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, and PIPE SOUND VELOCITY |
| 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 SOUND VELOCITY" 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 SOUND VELOCITY" 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 from AIR, STEAM (factory default), NITROGEN, or FLUID SOUND VELOCITY. |
| FLUID SOUND VELOCITY | 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 SOUND VELOCITY" is selected as fluid type".) |
| DENSITY | Select from AI CURRENT, Pt TEMPERATURE, or FIXED DENSITY VALUE. |
| CONSTANT DENSITY | Enter in either of the following ranges: <br> Metric system: 0.000000 to 999.9999 kg/m$^3$ (factory default 2.667378 kg/m$^3$) <br> Inch system: 0.000000 to 62.42796 lb/ft$^3$ <br> (If density is set to "Fixed density value") |
| 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.  (factory default: 7.000 E-6m$^2$/s) |
| SENSOR SPACING | [Read] only is valid. |

Table 8-5 < System >

| Item | Content |
|---|---|
| SENSOR MOUNT | Select from V METHOD, Z METHOD, N METHOD (factory default), NN METHOD, or NNN METHOD. |
| SENSOR TYPE | Select from FSX5 (factory default). |

# 8.9　Range Setting

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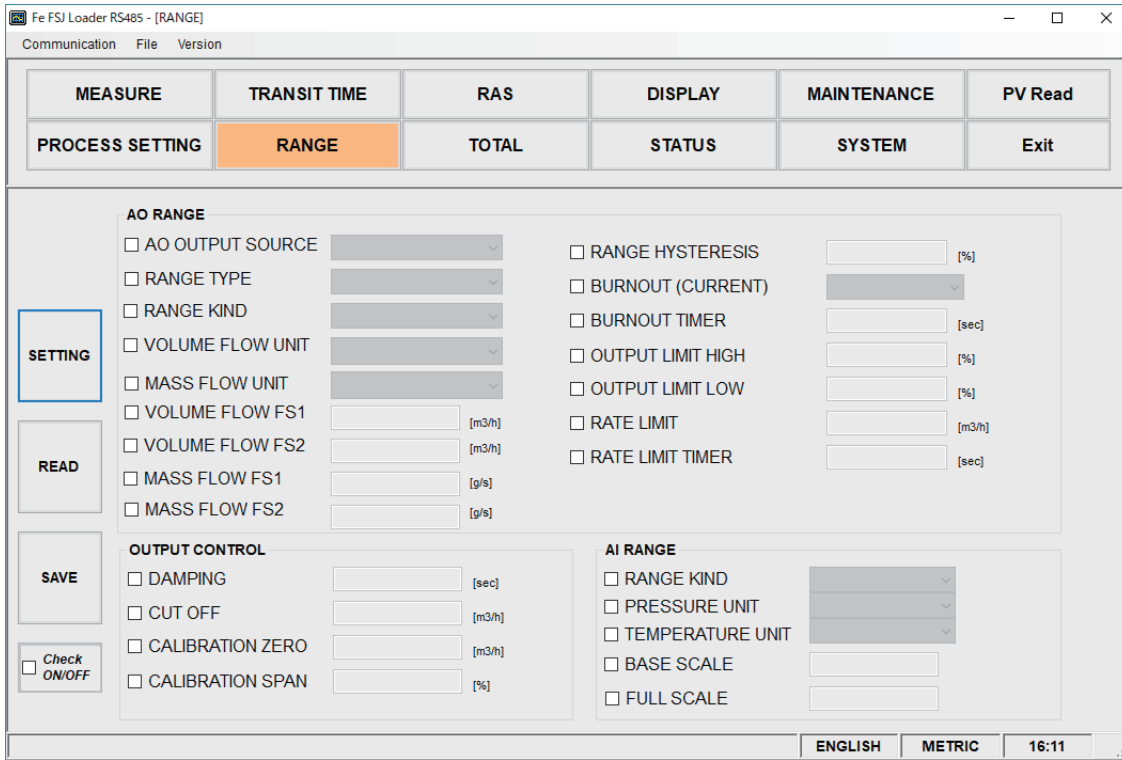


Fig. 8-15 < Range setting screen >

To select an item to be set or read, set the relevant check box to ON (☑).　Not to select (or to reset the selection), set the relevant check box to OFF (☐).　For details of "Range setting," refer to Table 8-6 to Table 8-7 on the next page.

- Type: in the case of single range;
  Display Valid ...................... Full scale 1
  Display Invalid................... Full scale 2 and histeresis
- Type: in the case of automatic 2-range, Bi-directional range, Bi-directional automatic 2-range
  Display Valid ...................... Full scale 1, full scale 2 and histeresis
  Display Invalid................... None

[Setting].......................Sends the setting of the selected item (check box set to ON (☑)), reflecting the response value on the setting.

[READ].......................Reads the setting of the selected item (check box set to ON (☑)), reflecting the response value on the setting.

[Save] ..........................Reflects the setting sent by pressing the [Setting] button on the flow transmitter.　<u>Be sure to press the [Save] button if the setting is changed.</u>

[Check ON/OFF] check box .... By selecting the check box (☑), all items will be selected (the check box will be selected (☑) for all items.) Furthermore, by clearing the check box (☐), all items will be deselected (the check box will be cleared (☐) for all items.)

Table 8-6 < AO range setting >

| Item | Content |
|---|---|
| AO OUTPUT SOURCE | Select from VOLUME FLOW RATE (incl. FLOW VELOCITY) or MASS FLOW RATE. |
| RANGE TYPE | Select from SINGLE (factory default), AUOMATIC 2-RANGE, BI-DIRECTIONAL RANGE, or BI-DIRECTIONAL RANGE AUOMATIC 2-RANGE. |
| RANGE KIND | Select from FLOW VELOCITY or FLOW RATE (factory default). |
| VOLUME FLOW UNIT | Select from L/s, L/min, L/h, L/d, kL/d, ML/d, $m^3$/s, $m^3$/min, $m^3$/h (factory default ), $m^3$/d, $km^3$/d, $Mm^3$/d, BBL/s, BBL/min, BBL/h, BBL/d, kBBL/d, or MBBL/d, [gal/s, gal/min, gal/h, gal/d, kgal/d, Mgal/d, $ft^3$/s, $ft^3$/min, $ft^3$/h, $ft^3$/d, $kft^3$/d, $Mft^3$/d, BBL/s, BBL/min, BBL/h, BBL/d, kBBL/d, MBBL/d]. <br> * The units in [ ] apply when the inch system is selected. |
| MASS FLOW UNIT | Select from g/s, g/min, g/h, g/d, kg/s, kg/min, kg/h (factory default ), kg/d, t/s, t/min, t/h, or t/d [oz/s, oz/min, oz/h, oz/d, lb/s, lb/min, lb/h, lb/d, ton/s, ton/min, ton/h, ton/d] <br> * The units in [ ] apply when the inch system is selected. |
| VOLUME FLOW FS1 | Enter in the 0, ±0.3 to ±50 m/s (factory default: 80 $m^3$/h) range for flow velocity conversion. (Based on volume flow unit) |
| VOLUME FLOW FS2 | Enter in the 0, ±0.3 to ±50 m/s (factory default: 0 $m^3$/h) range for flow velocity conversion. (Based on volume flow unit) |
| MASS FLOW FS1 | Enter in the ±999.9999 (factory default: 0 kg/h) range. (Based on mass flow unit) |
| MASS FLOW FS2 | Enter in the ±999.9999 (factory default: 0 kg/h) range. (Based on mass flow unit) |
| RANGE HYSTERESIS | Enter in the 0.00 to 20.00% (factory default: 10%) range up to 2 places after the decimal point. |
| OUTPUT LIMIT HIGH | Enter in the 100 to 120% (factory default: 120%) range. |
| OUTPUT LIMIT LOW | Enter in the -20 to 0% (factory default: -20%) range. |
| BURNOUT (CURRENT) | Select from NOT USED, HOLD (factory default), UPPER LIMIT, LOWER LIMIT, or ZERO. |
| BURNOUT TIMER | Enter in the 0 to 900 sec (factory default: 10 sec) range. |
| RATE LIMIT | Enter in the 0 to 50 m/s (factory default: 40 $m^3$/h) range for flow velocity conversion. (Based on volume flow unit) |
| RATE LIMIT TIMER | Enter in the 0 to 900 sec (factory default: 10 sec) range. |

Table 8-7 < OUTPUT CONTROL >

| Item | Content |
|---|---|
| DAMPING | Enter in the 0.0 to 100.0 sec (factory default: 5 sec) range up to 1 place after the decimal point. |
| CUT OFF | Enter in the 0 to 5 m/s (factory default: 2.4 $m^3$/h) range for flow velocity conversion. (Based on volume flow unit) |
| CALIBRATION ZERO | Enter in the ±5 m/s (factory default: 0 $m^3$/h) range for flow velocity conversion. (Based on volume flow unit) |
| CALIBRATION SPAN | Enter in the ±200.00% (factory default: 100%) range up to 2 places after the decimal point. |

Table 8-8 < AI range setting >

| Item | Content |
|---|---|
| RANGE KIND | Select from NOT USED (factory default), PRESSURE, or TEMPERATURE. |
| PRESSURE UNIT | MPa (G) (factory default), bar (G) (G: gauge pressure) |
| | Select from [psi (G) or bar (G)]. |
| | * The units in [ ] apply when the inch system is selected. |
| TEMPERATURE UNIT | Select from °C (factory default), K, or °F. |
| BASE SCALE | Enter in the ±999.9999 (factory default: 0) range. |
| | The type unit selected at RANGE TYPE is displayed. If "NOT USED" is selected, the unit is not displayed. |
| FULL SCALE | Enter in the ±999.9999 (factory default: 0) range. |
| | The type unit selected at RANGE TYPE is displayed. If "NOT USED" is selected, the unit is not displayed. |

# 8.10 Total Setting

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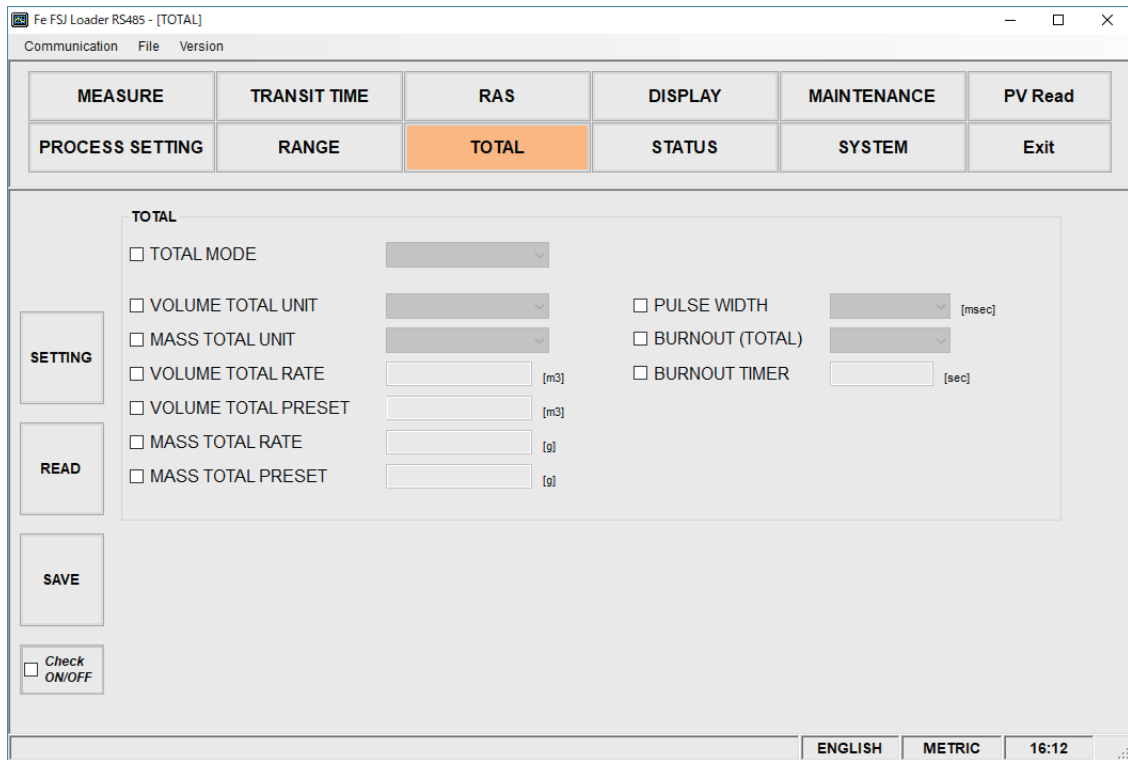


Fig. 8-16 < Total setting screen >

To select an item to be set or read, set the relevant check box to ON (☑).   Not to select (or to reset the selection), set the relevant check box to OFF (☐).   For details of "Total setting," refer to Table 8-9 on the next page.

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

[Setting] ....................... Sends the setting of the selected item (check box set to ON (☑)), reflecting the response value on the setting.   Note that only when "STOP" mode is selected, the setting of unit, constant, total preset, pulse width is reflected.

[READ] ...................... Reads the setting of the selected item (check box set to ON (☑)), reflecting the response value together with the unit on the setting.

[Save] ......................... Reflects the setting sent by pressing the [Setting] button on the flowmeter flow transmitter. Be sure to press the [Save] button if the setting is changed.

[Check ON/OFF] ......... Set the check box to ON (☑) to select all the items (to set all the check boxes to ON (☑)). Set the check box to OFF (☐) to release the selection of all the items (to set all the check boxes to OFF (☐)).

Table 8-9 < Total Setting >

| Item | Content |
|---|---|
| TOTAL MODE | Select from TOTAL STOP, TOTAL RUN, TOTAL RESET. |
| VOLUME TOTAL UNIT | Select from mL, L, m3, km3, Mm3, mBBL, BBL and kBBL, [ft3, kft3, Mft3, kgal, gal, mBBL, BBL, kBBL and ACRf] * Of which [ ]: unit is in case of inch system. |
| MASS TOTAL UNIT | Select from g, kg, t [oz, lb, ton] * Of which [ ]: unit is in case of inch system. |
| VOLUME TOTAL RATE | Enter in the range of 0 to 99999999 fitting value. (Comply with volume total unit) |
| VOLUME TOTAL PRESET | Enter in the range of 0 to 99999999 fitting value. (Comply with volume total unit) |
| MASS TOTAL RATE | Enter in the range of 0 to 99999999 fitting value. (Comply with mass total unit) |
| MASS TOTAL PRESET | Enter in the range of 0 to 99999999 fitting value. (Comply with mass 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 total rate and total preset is changed if [Read] is executed.

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

# 8.11 Status Output Setting

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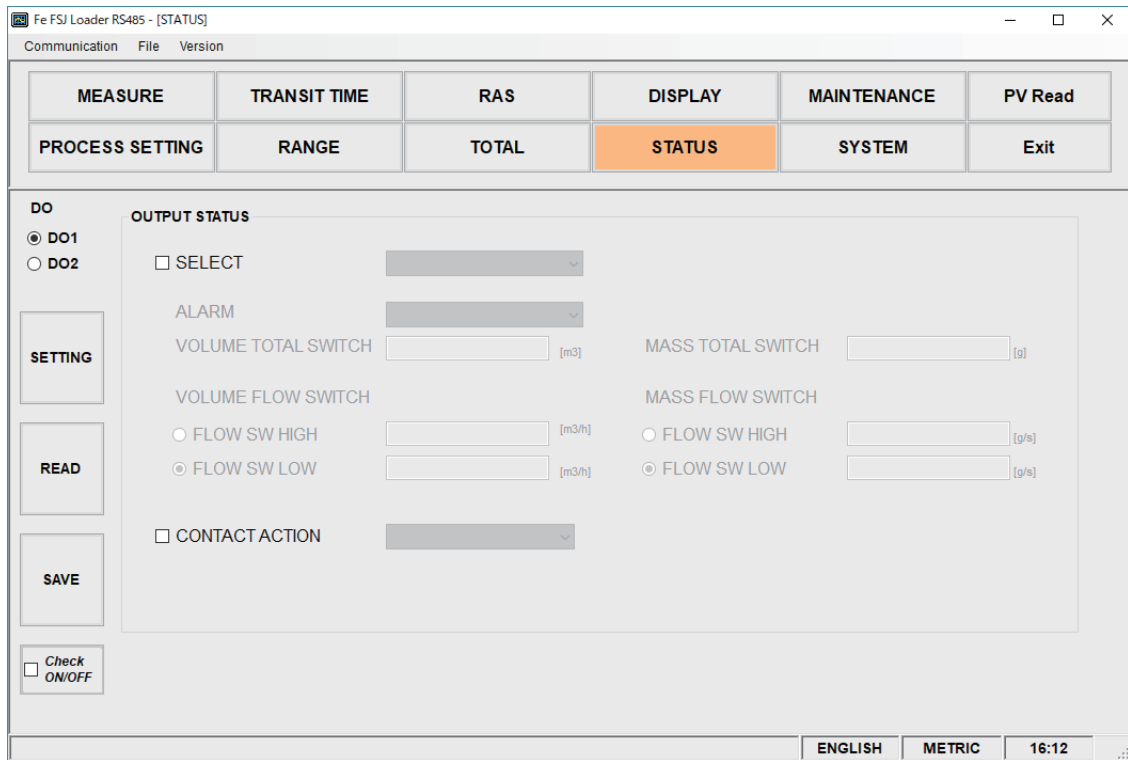


Fig. 8-17 < Status output setting screen >

To select an item to be set or read, set the relevant check box to ON (☑).　Not to select (or to reset the selection), set the relevant check box to OFF (☐).　For details of "Status output setting," refer to Table 8-10 on the next page.

• Status output: output excluding Alarm, Volume flow switch, Volume total switch, Mass flow switch, and Mass total switch

Display disabled ..........Alarm, Volume flow switch (Flow SW high and Flow SW low), Volume total switch, Mass flow switch (Flow SW high and Flow SW low), Mass total switch

• Status output: output of Alarm

Display enabled ...........Alarm

Display disabled ..........Volume flow switch (Flow SW high and Flow SW low), Volume total switch, Mass flow switch (Flow SW high and Flow SW low), Mass total switch

• Status output: In the case of Volume flow switch

Display enabled ..........Volume flow switch (Flow SW high and Flow SW low)

Display disabled ..........Alarm, Volume total switch, Mass flow switch (Flow SW high and Flow SW low), Mass total switch

• Status output: In the case of Volume total switch

Display enabled ..........Volume total switch

Display disabled ..........Alarm, Volume flow switch (Flow SW high and Flow SW low), Mass flow switch (Flow SW high and Flow SW low), Mass total switch

• Status output: In the case of Mass flow switch

Display enabled ...........Mass flow switch (Flow SW high and Flow SW low)

Display disabled ..........Alarm, Volume flow switch (Flow SW high and Flow SW low), Volume total switch, Mass total switch

• Status output: In the case of Mass total switch

Display enabled ........... Mass total switch

Display disabled .......... Alarm, Volume total switch (Volume flow switch high and Volume total switch low), Volume flow switch, Mass flow switch (Flow SW high and Flow SW low)

DO Select .................... Sets or reads status output of the selected DO number.

[Setting] ....................... Sends the setting of the selected item (check box set to ON (☑)), reflecting the response value on the setting.

[READ] ....................... Reads the setting of the selected item (check box set to ON (☑)), reflecting the response value on the setting.

[Save] ......................... Reflects the setting sent by pressing the [Setting] button on the flow transmitter.   <u>Be sure to press the [Save] button if the setting is changed.</u>

[Check ON/OFF] ......... Set the check box to ON to select all the items (to set all the check boxes to ON (☑)).   Set the check box to OFF (☐) to release the selection of all the items (to set all the check boxes to OFF (☐)).

Table 8-10 < Status output setting >

| Item | | Content | |
|------|--|---------|--|
| DO1 | Select from a group of Not use, +Volume total pulse, -Volume total pulse, +Mass total pulse, -Mass total pulse, Full scale 2, Alarm, Volume flow switch, Mass flow switch, Volume total switch, Mass total switch, Ao range-over, Pulse range-over, -Flow direction, Input alarm. | | |
| | ALARM | Select from All, Hardware error, and Process error (when alarm is selected for DO1 output). | |
| | VOLUME FIOW 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 (Use the same unit as the range unit.) |
| | | Flow switch Low | Enter in (Use the same unit as the range unit.) |
| | VOLUME TOTAL SWITCH | Enter in the range from 0 to 99999999. (Use the same unit as the total unit.) | |
| | MASS FIOW SWITCH | Select "Flow SW light" or "Flow SW low" (When the DO1 output is "Mass flow switch") | |
| | | Flow SW light | Enter in. (conforming to the heat unit) |
| | | Flow SW low | Enter in. (conforming to the heat unit) |
| | MASS TOTAL SWITCH | Enter in the range of 0 to 99999999 fitting value. (conforming to the integration unit) (When the DO1 output is "Mass total switch") | |
| DO2 | Same as DO1 selection | | |
| DO1 CONTACT ACTION | | Select ACTIVE ON at operation or ACTIVE OFF at operation. | |
| DO2 CONTACT ACTION | | Ditto | |

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# 8.12 Display Setting

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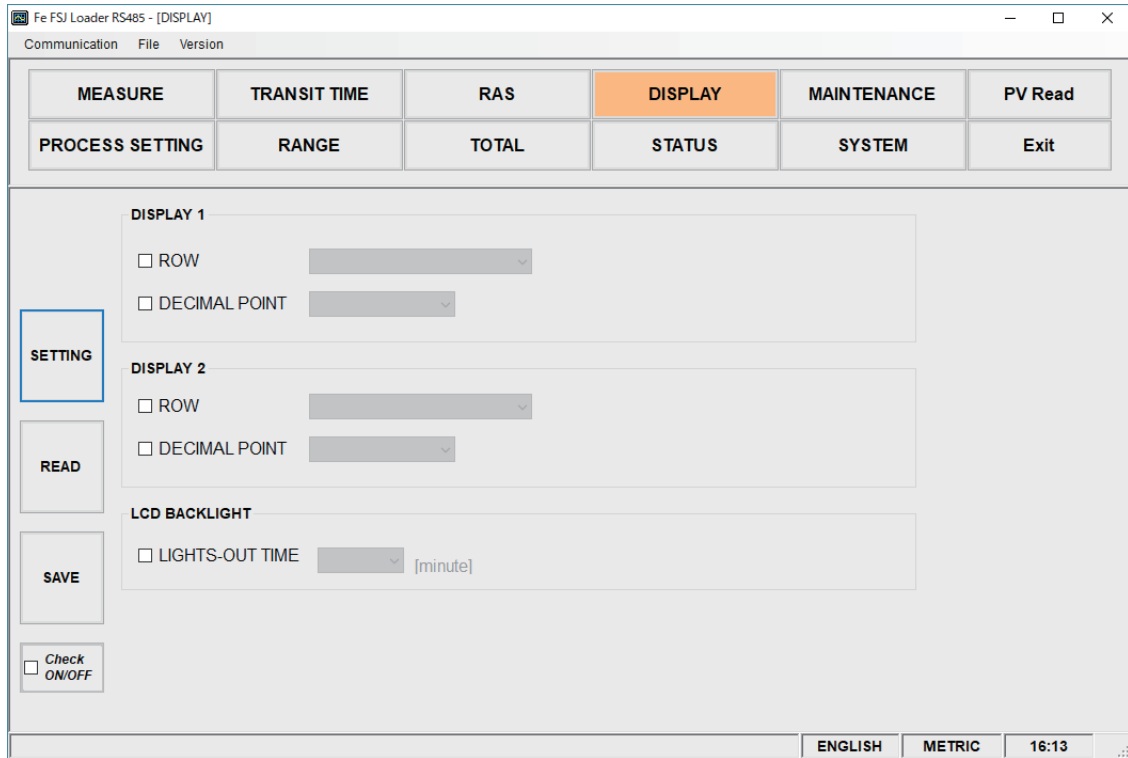


Fig. 8-18 < Display setting screen >

To select an item to be set or read, set the relevant check box to ON (☑).　Not to select (or to reset the selection), set the relevant check box to OFF (☐).　For details of "Display setting," refer to Table 8-11.

● Display 1, 2 selection: In the case of flow velocity, +Volume total pulse, -Volume total pulse, +Mass total pulse, -Mass total pulse, temperature, Pt temperature, SNR, AGC
　Display invalid....................Decimal point

[Setting]........................Sends the setting of the selected item (check box set to ON (☑)), reflecting the response value on the setting.

[READ] ........................Reads the setting of the selected item (check box set to ON (☑)), reflecting the response value on the setting.

[Save] ..........................Reflects the setting sent by pressing the [Setting] button on the flowmeter flow transmitter. Be sure to press the [Save] button if the setting is changed.

[Check ON/OFF].........Set the check box to ON to select all the items (to set all the check boxes to ON (☑)).　Set the check box to OFF (☐) to release the selection of all the items (to set all the check boxes to OFF (☐)).

Table 8-11 < Display Setting >

| Item | | Content |
|---|---|---|
| DISPLAY 1 | Selection | Select from FLOW VELOCITY, VOLUME FLOW RATE (factory default), VOLUME FLOW RATE (%), MASS FLOW RATE, MASS FLOW RATE (%), +VOLUME TOTAL, +VOLUME TOTAL PULSE, -VOLUME TOTAL, -VOLUME TOTAL PULSE, +MASS TOTAL, +MASS TOTAL PULSE, -MASS TOTAL, -MASS TOTAL PULSE, PRESSURE, TEMPERATURE, Pt TEMPERATURE, SNR, or AGC. |
| | Decimal Point Position | 0: *.******, 1: **.*****, 2: ***.****, 3: ****.***, 4: *****.**, 5: ******.*, 6: ******** |
| DISPLAY 2 | Selection | Select from FLOW VELOCITY, VOLUME FLOW RATE (factory default), VOLUME FLOW RATE (%), MASS FLOW RATE, MASS FLOW RATE (%), +VOLUME TOTAL, +VOLUME TOTAL PULSE, -VOLUME TOTAL, -VOLUME TOTAL PULSE, +MASS TOTAL, +MASS TOTAL PULSE, -MASS TOTAL, -MASS TOTAL PULSE, PRESSURE, TEMPERATURE, Pt TEMPERATURE, SNR, or AGC. |
| | Decimal Point Position | 0: *.******, 1: **.*****, 2: ***.****, 3: ****.***, 4: *****.**, 5: ******.*, 6: ******** |
| LCD BACKLIGHT | Lights-out time | 0 to 99 min |

# 8.13　Measurement

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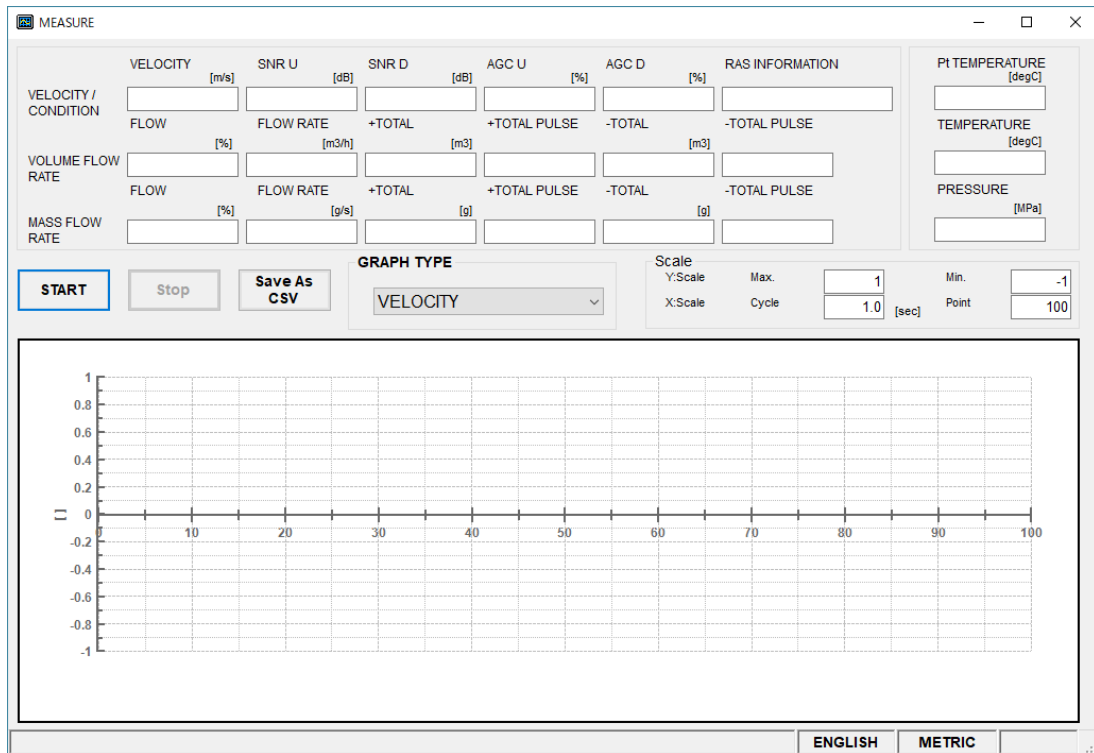


Fig. 8-19 < Measure screen >

First, select the instantaneous value (channel, type) for which the trend is to be displayed.

Next, click the [Save as CSV] button to register the name of the file being saved.

By clicking the [START] button, the system reads at the preset cycle and updates the Velocity, SNR U, SNR D, AGC U, AGC D, RAS Information, Volume flow (%), Volume flow rate, +Volume Total, +Volume Total pulse, - Volume Total,　-Volume Total pulse, Mass flow (%), Mass flow rate, +Mass Total, +Mass Total pulse, -Mass Total, -Mass Total pulse, Pt temperature, Temperature, and pressure.

You can also check the measurement result in a trend chart, with the measured time on X-axis and the user-defined scale on Y-axis.

Refer to Table 8-12 for details on measurement.

[Start]...........................Starts measuring.　When setting of saving file is completed with [Save as CSV] button, [Start] button will be enabled to click.

[Stop]...........................Stops measuring.

[Save as CSV] .............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.

Default file name: "result_MMDDYYHHMMSS.csv"

The file name can be changed.

If the saved data exceeds 259202 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.

e.g.)　Setting of file name　YYYYMMDDHHMMSS

Year, Month, Day, Hour, Minute, Second

Table 8-12 < Measurement/Detailed Setting >

| Item | | Content |
|---|---|---|
| Moment value | KIND | Select from VELOCITY, VOLUME FLOW RATE, VOLUME FLOW RATE %, MASS FLOW RATE, or MASS FLOW RATE (%). |
| 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. |

# 8.14 Transit Time Difference Measurement

By clicking the [TRANSIT TIME] button on the menu screen, the following screen is displayed. If necessary, click the [RECEIVED WAVEFORM] or [DETAILS] tab.

## 8.14.1 Received Waveform

By clicking the [RECEIVED WAVEFORM] tab, the following screen is displayed.
* The received waveform in Fig. 8-20 is a filter waveform display example.

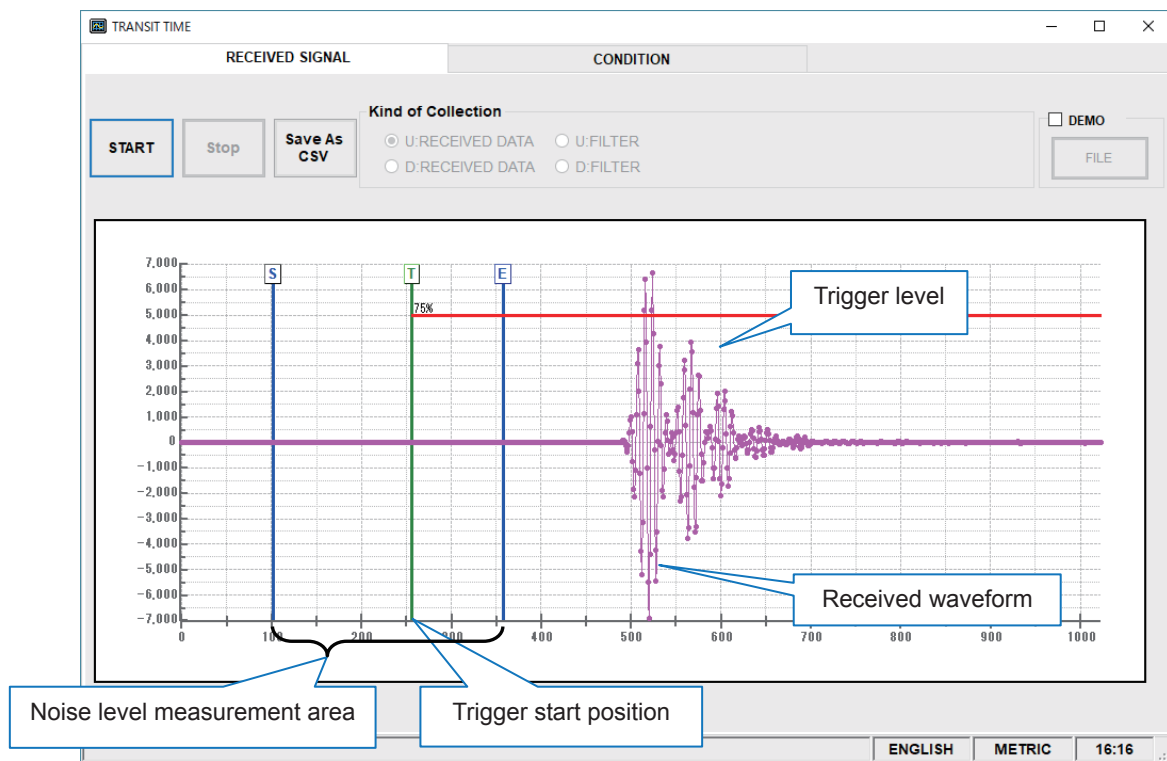

Fig. 8-20 < Detailed information screen >

Select U:RECEIVED DATA, D: RECEIVED DATA, U:FILTER, or D:FILTER.

With forward direction filter and reverse direction filter waveforms, the SNR measurement noise evaluation start position, noise evaluation finish position, and trigger level start position are displayed.

By left-clicking the mouse while holding down the SHIFT key and specifying the screen range, the display can be enlarged. Press the R key to return to the normal display.

[START] button ........... Starts reading.
[Stop] button ................ Stops reading.
[Save as CSV] button .. Saves read data to a file in CSV format.

By clicking this button, a dialog box appears asking where to save the CSV file to. By specifying a folder and entering a file name, a CSV file containing data separated with commas is created.

Default file name: "signal_MMDDYYHHMMSS.csv"

The file name can be changed.

If the saved file exceeds 86402 lines of data, 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.

Secure enough space in your hard disc because the new files are created automatically.

Demo function

[FILE] button .............. By selecting the check box (☑), a dialog box appears asking for the name of a saved CSV file. Select a CSV file, and then open the file. The [FILE] button changes to a [CANCEL] button, and a demo of the saved waveform is displayed. To end the demo, click [CANCEL]. By clearing the check box (☐), the demo function is canceled.

> Point >

1. Startup is within 3 to 6 waves.
2. There should be no peak (amplitude) fluctuations.
   Rising and falling peak fluctuations indicate contamination such as splashes.
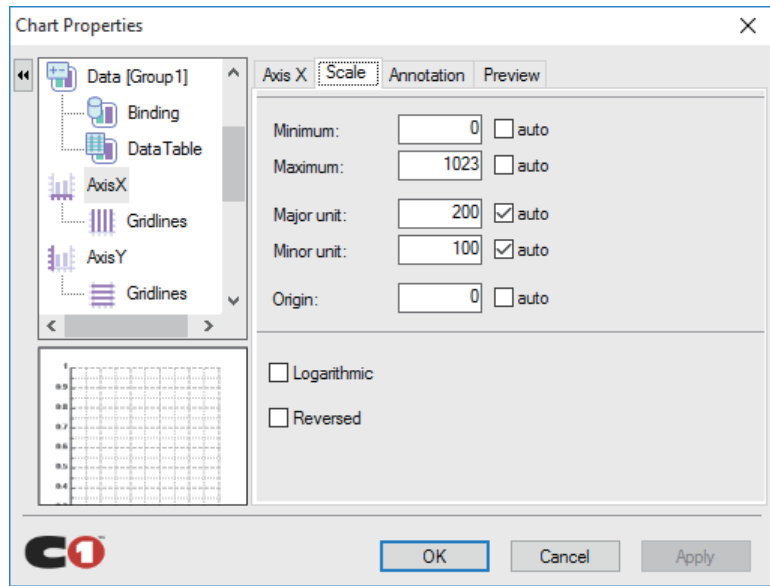


\* By right-clicking the mouse on the [MEASURMENT] or [RECEIVED WAVEFORM] screen, the scale can be adjusted.

## 8.14.2    Operation Information

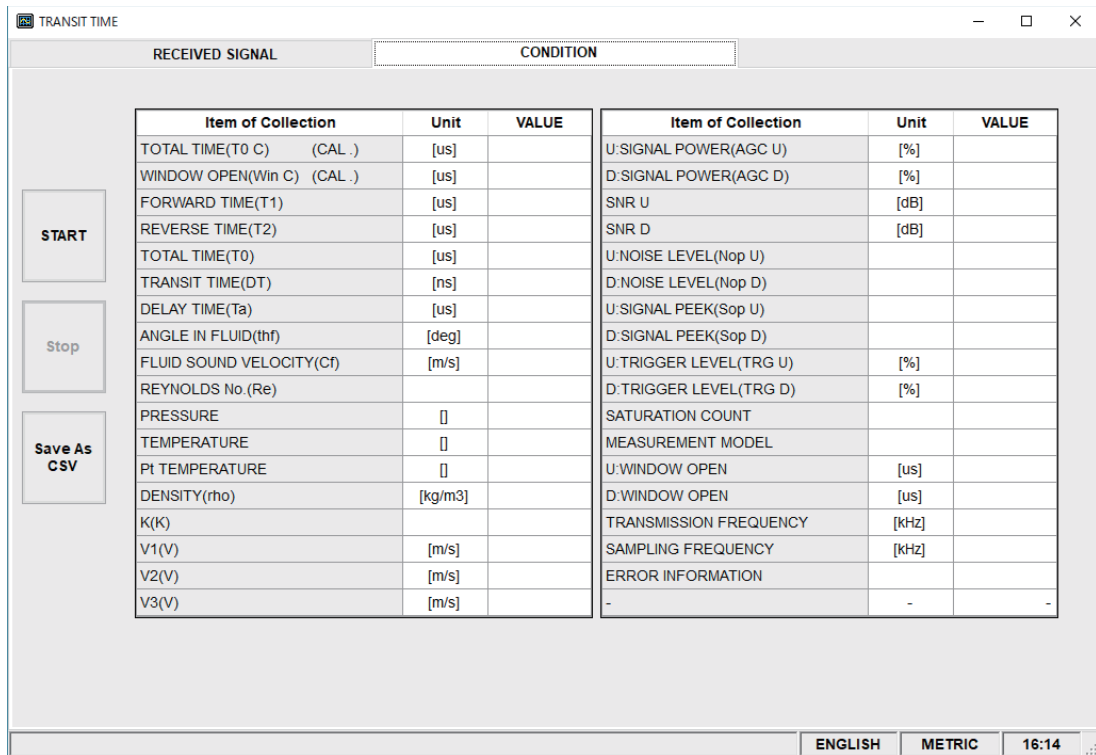Click "CONDITION", and the following screen appears.



Fig. 8-21 < Operation Information screen >

[Start]...........................Starts reading.

[Stop]............................Stops reading.

[Save As CSV].............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_MMDDYYHHMMSS.csv"

The file name can be changed.

If the saved file exceeds 259223 lines of data, 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.

Secure enough space in your hard disc because the new files are created automatically.

Table 8-13 < Operation Information >

| Item | Content |
|------|---------|
| TOTAL TIME (T0 C) | μs |
| WINDOW OPEN (Win C) | μs |
| FORWARD TIME (T1) | μs |
| REVERSE TIME (T2) | μs |
| TOTAL TIME (T0) | μs |
| TRANSIT TIME (DT) | ns |
| DELAY TIME (Ta) | μs |
| ANGLE IN FLUID (thf) | ° |
| FLUID SOUND VELOCITY (Cf) | m/s[ft/s] |
| REYNOLDS No. (Re) | |
| PRESSURE | MPa(G),bar(G)[psi(G),bar(G)] |
| TEMPERATURE | °C, K, °F |
| Pt TEMPERATURE | °C, K, °F |
| DENSITY (rho) | kg/m3[lb/ft3] |
| K (K) | |
| V1 | m/s[ft/s] |
| V2 | m/s[ft/s] |
| V3 | m/s[ft/s] |
| U: SIGNAL POWER (AGC U) | %           * This will be 43% or higher when measurement is successful. |
| D: SIGNAL POWER (AGC D) | %           * This will be 43% or higher when measurement is successful. |
| SNR U | dB           * 15 dB or higher is necessary for stable measurement. |
| SNR D | dB           * 15 dB or higher is necessary for stable measurement. |
| U: NOISE LEVEL (Nop U) | |
| D: NOISE LEVEL (Nop D) | |
| U: SIGNAL PEEK (Sop U) | |
| D: SIGNAL PEEK (Sop D) | |
| U: TRIGGER LEVEL (TRG U) | % |
| D: TRIGGER LEVEL (TRG D) | % |
| SATURATION COUNT | |
| MEASUREMENT MODEL | |
| WINDOW OPEN U | μs |
| WINDOW OPEN D | μs |
| TRANSMISSION FREQUENCY | kHz |
| SAMPLING FREQUENCY | kHz |
| ERROR INFORMATION | |

Refer to "Displaying Maintenance Mode Data" in chapter "6. Maintenance and Inspection" of the product "ULTRASONIC FLOWMETER FOR STEAM" instruction manual (INF-TN1FSJ-E) for details on operation information.

# 8.15 RAS

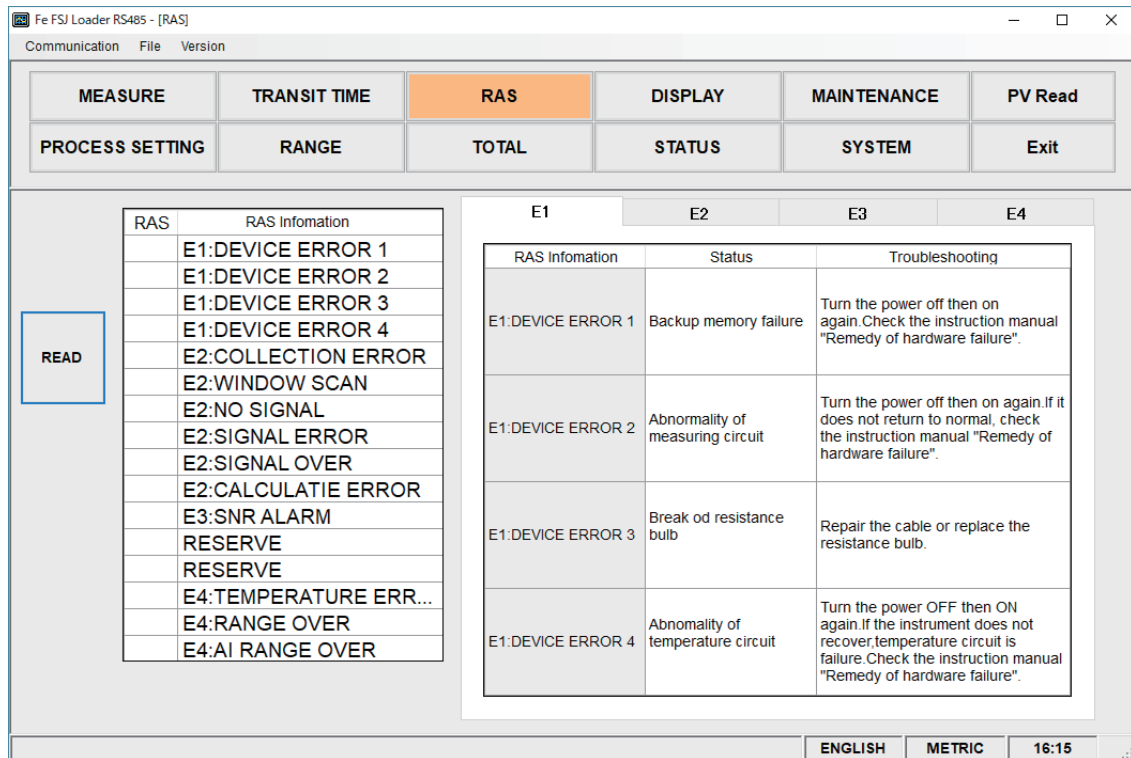Click the [RAS] button on the menu screen to display the RAS screen shown below.



Fig. 8-22 < RAS screen >

[READ] button ............Displays RAS information (16 items from 0/1 to 0/16).
[E1] tab ........................Displays the category "E1" error status and error handling method.
[E2] tab ........................Displays the category "E2" error status and error handling method.
[E3] tab ........................Displays the category "E3" error status and error handling method.
[E4] tab ........................Displays the category "E4" error status and error handling method.

# 8.16 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 [Release] button.



Fig. 8-23 < Maintenance screen >

Select the items to be set or read-in by checking the check box of the desired items (☑). Make the check box of the items not to be selected (or to be canceled) blank (☐).

See Table 8-14 on the next page for details of the maintenance.

[Setting] button............Sends the setting of the selected items (☑) and reflects the response value to the setting.

[READ] button............Read-ins the setting of the selected items (☑) and reflects the response value to the setting.

[Save] button...............Reflects the setting sent by pressing the [Setting] button to the flow transmitter. Note that However, you cannot save AO check, DO check, integration pulse check, test mode, input data, tracking time, and, AI check, Pt temperature input data.. Be sure to click the [Save] button if AO or AI is adjusted.

[TEST Cancel] button .Cancels the AO/DO/Test mode/AI.
　　　　　　　　　　　　* Be sure to press the [TEST Cancel] button when maintenance is completed.

Table 8-14 < Maintenance/setting >

| Item | Content |
|---|---|
| AO1 CALIBRATION | When 4mA is selected, without decimal point, Enter in the range from 9320. When 20mA is selected, without decimal point, Enter in the range from 47028. Select "4mA" or "20mA" and then click [READ]. The adjusted value is listed in the right pane. Connect an ammeter and use it for adjustment. Click the [SET] button to change the adjusted value. |
| AO1 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. |
| AI CALIBRATION | Connect a current generator and perform calibration. The current generator outputs 4 mA. Wait until output stabilizes. Click the [4 mA CALIBRATION] button. The current generator then outputs 20 mA. Wait until output stabilizes. Click the [20 mA CALIBRATION] button to complete calibration. |
| AI CHECK | Connect a current generator, and ensure that the current input is between 4 and 20 mA. |
| Pt TEMPERATURE | Click the [READ] button. The temperature input value is displayed. The value at the TS side is the temperature input from the resistance temperature detector. |

# 8.17 PV

Click the [PV Read] button on the menu screen to display the PV screen (when RS-485 communication system is selected only).

```
  ┌─────────────────────────────────────────────────────────────────┐
  │ ⚠ CAUTION                                                         │
  ├─────────────────────────────────────────────────────────────────┤
  │ • Do not start or operate the other application while the         │
  │   measurement is in progress. The measurement may not be          │
  │   successful.                                                     │
  └─────────────────────────────────────────────────────────────────┘
```
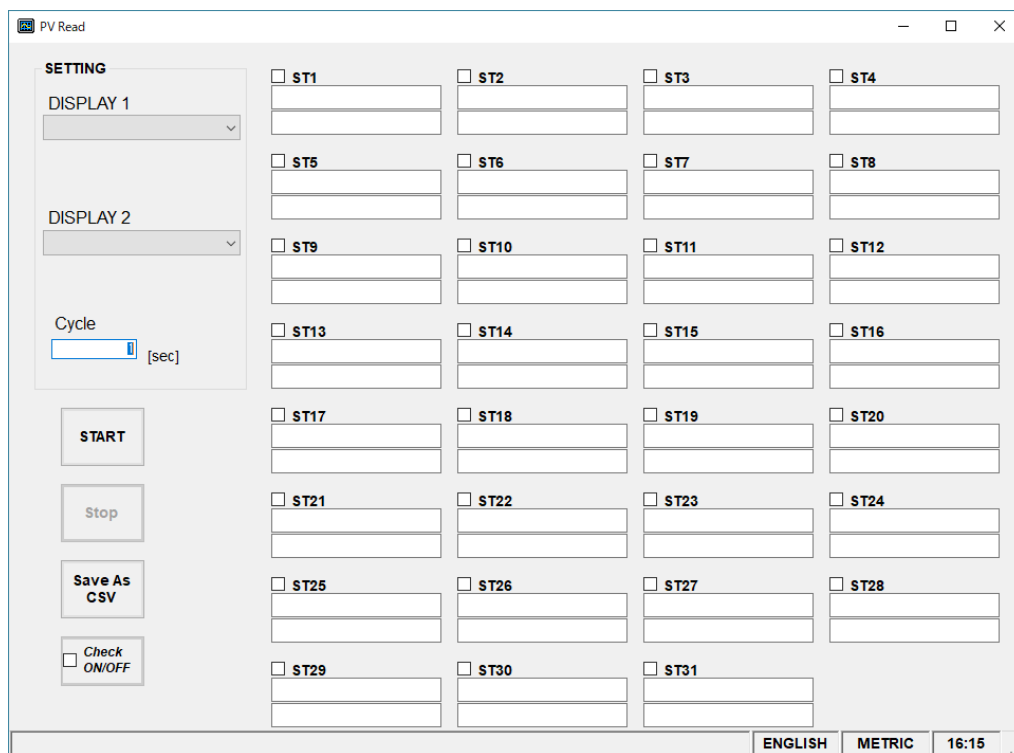


Fig. 8-24 < PV screen >

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 8-15 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 ................................ Stop communication

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

By clicking this button, a dialog box appears asking where to save the CSV file to. By specifying a folder and entering a file name, a CSV file containing data separated with commas is created.

Default file name: "pvdata_MMDDYYHHMMSS.csv"

The file name can be changed.

If the saved file exceeds 259205 lines of data, 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. Secure enough space in your hard disc because the new files are created 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

└──── Year, Month, Day, Hour, Minute, Second
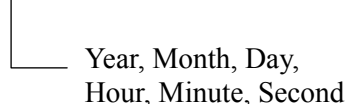
[Check ON/OFF] check button ..... Check the check box (☑) to select all the items. (The check boxes for all the items are checked (☑)). Keep the check box blank (☐) to cancel the selection of all the items. (The check boxes for all the items are made blank (☐).

Table 8-15 < PV Setting >

| Item | | Content |
|---|---|---|
| DISPLAY 1 | Type | Select from VELOCITY, VOLUME FLOW RATE, VOLUME FLOW RATE (%), +VOLUME TOTAL, +VOLUME TOTAL PULSE, -VOLUME TOTAL, -VOLUME TOTAL PULSE, MASS FLOW RATE, MASS FLOW RATE (%), +MASS TOTAL, +MASS TOTAL PULSE, -MASS TOTAL, -MASS TOTAL PULSE, PRESSURE, TEMPERATURE, Pt TEMPERATURE, SNR U, SNR D, AGC U, AGC D, or RAS. |
| DISPLAY 2 | | Same as the selection of DISPLAY 1 |
| CYCLE | | Enter in range of 1 to 60 sec. |

## 8.18 End

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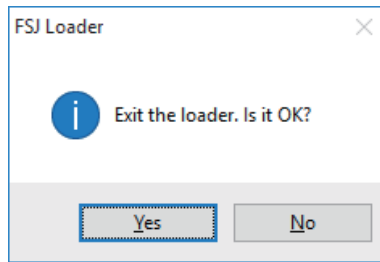


Fig. 8-25 < Menu screen >

By clicking the [End] button or [⊠] button, a message appears asking whether to exit PC Loader. To exit, click [Yes]. To cancel, click [No].

## 8.19 Uninstalling of Software

Uninstall the software using the standard Windows OS program uninstall procedure.

To uninstall the software, select [Programs and Features] from the Windows Control Panel, and then click the [Uninstall] button.

The software will no longer appear in the Start menu, and the desktop shortcut will also be deleted.

# 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
                       ☐ 2 bits

    ☐　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 FSJ.

☐　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.

☐　Is the 9th digit of the equipment type (FSJ☐☐☐☐1-■) D or F?
    Communication is not supported if the 9th digit is Y or E

**Fe** Fuji Electric Co., Ltd.