172-65206M-00 (VFM-T3) 21 August 2001

ISO 9001/ ISO 14001

Manufacturer

TLV CO., LTD.

Kakogawa, Japan

is approved by LRQA LTD. to ISO 9001/14001

Instruction Manual

Flow Computer

VFM-T3

Contents

Introduction

Thank you for purchasing the TLV flow computer.

This product has been thoroughly inspected before being shipped from the factory. When the product is delivered, before doing anything else, check the specifications and external appearance to make sure nothing is out of the ordinary. Also be sure to read this manual carefully before use and follow the instructions to be sure of using the product properly.

The flow meter incorporates steam equations for both saturated steam and superheated steam. It computes the mass flow rate and enthalpy by using standard equations to determine the specific weight and the specific enthalpy of steam. It receives a pulse input signal from the VFM flowmeter transmitter, which is then scaled to display the mass flow rate and enthalpy.

If detailed instructions for special order specifications or options not contained in this manual are required, please contact TLV for full details.

This instruction manual is intended for use with the model(s) listed on the front cover. It is necessary not only for installation, but for subsequent maintenance, disassembly/reassembly and troubleshooting. Please keep it in a safe place for future reference.

Safety Considerations

- Read this section carefully before use and be sure to follow the instructions.
- Installation, inspection, maintenance, repairs, disassembly, adjustment and valve opening/closing should be carried out only by trained maintenance personnel.
- The precautions listed in this manual are designed to ensure safety and prevent equipment damage and personal injury. For situations that may occur as a result of erroneous handling, three different types of cautionary items are used to indicate the degree of urgency and the scale of potential damage and danger: DANGER, WARNING and CAUTION.
- The three types of cautionary items above are very important for safety: be sure to observe all of them as they relate to installation, use, maintenance and repair. Furthermore, TLV accepts no responsibility for any accidents or damage occurring as a result of failure to observe these precautions.

Symbols

	**Indicates a DANGER, WARNING or CAUTION item.**
	Indicates an urgent situation which poses a threat of death or serious injury
	Indicates that there is a potential threat of death or serious injury
	Indicates that there is a possibility of injury or equipment / product damage

	**Do not touch the terminals during transmission.** Failure to observe this precaution could result in such hazards as damage to the product, malfunctions, electric shock or fire.
	Make sure the power supply is OFF before carrying out work on the wiring or inspections involving disassembly. If such work is carried out with the power on, there is a danger that equipment may malfunction or electric shock may occur, leading to injury or other accidents.
	Make sure that wiring work requiring a special license is carried out only by qualified personnel. If carried out by unqualified personnel, overheating or short circuits leading to injury, fires, damage or other accidents may occur.

Specifications

<General>

Display	Alphanumeric LCD display with backlighting and 2 lines x 20 characters/line, each character is 5.5 mm high
Keyboard	Sealed membrane keyboard with four keys
Input Voltage for Transducer (Sensor)	8 – 24V DC, 50mA maximum
Line Voltage	95 – 135V AC or 190 – 260V AC
Ambient Temperature	0 – 55°C
Ambient Humidity	20 – 80%
Panel	IP65 or NEMA 3S
Dimensions	144 (width) x 72 (height) x 188 mm (depth)

<Frequency Input>

Frequency Range	0.25Hz – 10kHz
K-Factor Range	0.1000 – 999,999

<Temperature Input>

Temperature Measurement Range	0 – 300°C
Accuracy	0.1°C
Sensor Type	Resistance Temperature Detector (RTD) PT100
Non-linearity Compensation	The non-linearity of the RTD is internally compensated for

<Pressure Input>

Type	Absolute or gauge pressure
Span	4mA to 20mA programmable

<Pulse Output>

Pulse Width	10mSec
Pulse Rate	Maximum of 49 pulses per second
Output Method	Open collector
Sink Current	Maximum 100mA

<Transmission>

Standard (not included when optional analog output has been selected)

<Analog Output>

Optional (not included unless this option is selected)

Operation

The VFM-T3 uses a low power C-MOS microprocessor to perform a variety of measurement and control functions. The instrument is fully programmable, with all operating parameters and calculation constants user programmable.

Front Panel Operation

The alphanumeric display provides an indication of parameters and engineering units. During calibration, the value that is to be normally displayed is set as the DEFAULT display.

Steam Measurement

The VFM-T3 incorporates the equations to handle both saturated and superheated steam over the following range:

Pressure: 1kPa (abs) – 100,000kPa (abs)
Temperature: 100°C – 450°C

When measuring saturated steam, it is possible to use only one of the pressure or temperature sensors, as all temperatures above the saturation curve have the same pressure. For superheated steam, however, both the pressure and steam sensors must be used.

Both the mass flow (kg/h or lb/h) and the heat content (enthalpy) are calculated internally in accordance with 1967 IFC Formulation (ASME) equations.

These equations use the pressure and temperature readings to determine the following data:

v: the specific volume of steam (dm^3/kg)
h: the specific enthalpy of steam (kJ/kg)

Mass Flow:

SI Units: $Q_{M(SI)} = 1000 \cdot N / (Kf \cdot v)$

US Units: $Q_{M(US)} = 62.435 \cdot N / (Kf \cdot v)$

N: frequency (Hz)

Kf: K-factor (pulse/m^3, pulse/ft^3)

Energy Flow:

SI Units: $Q_{E(SI)} = Q_{M(SI)} \cdot h / 1000$

US Units: $Q_{E(US)} = 0.42992 \cdot Q_{M(US)} \cdot h / 1000$

Fixed Variable Setting (Parameter Setting)

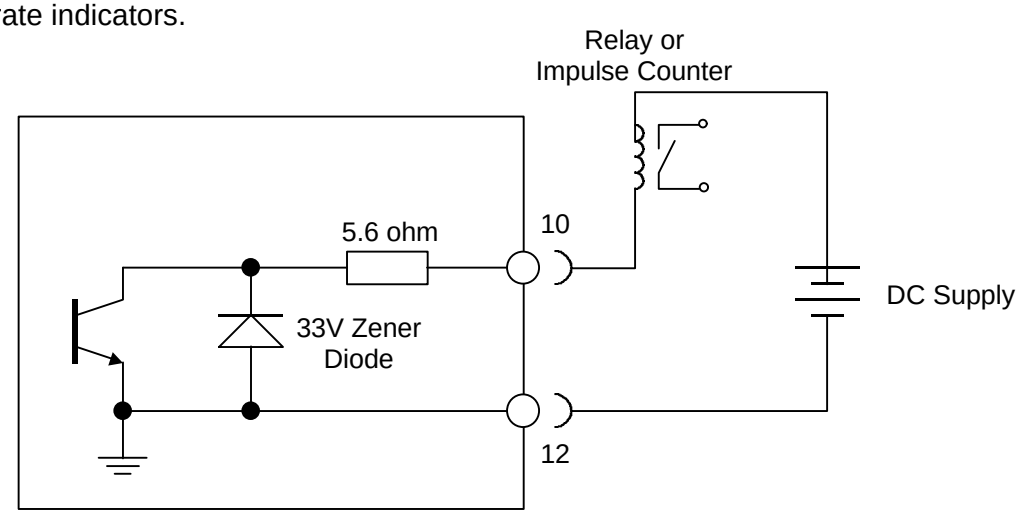
Set the K-factor to the value of: the reciprocal of the meter factor used for the flowmeter transmitter × 1000.

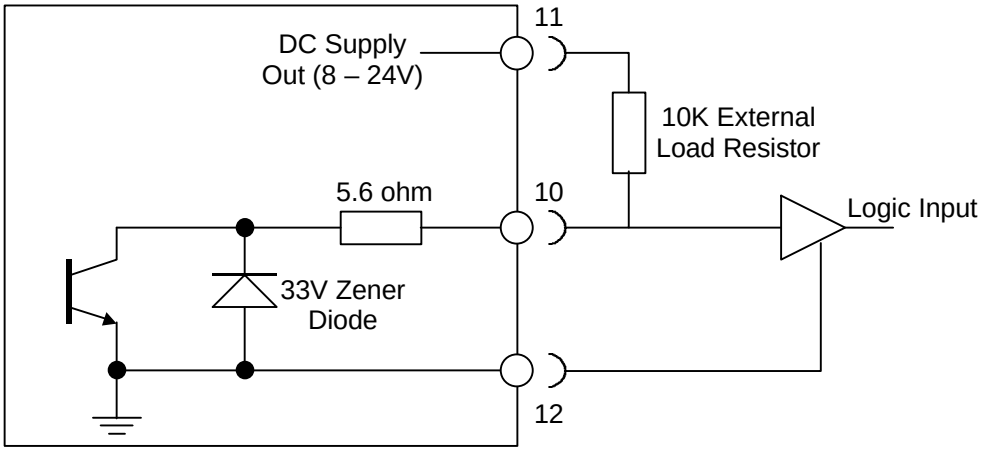
The Output Pulse

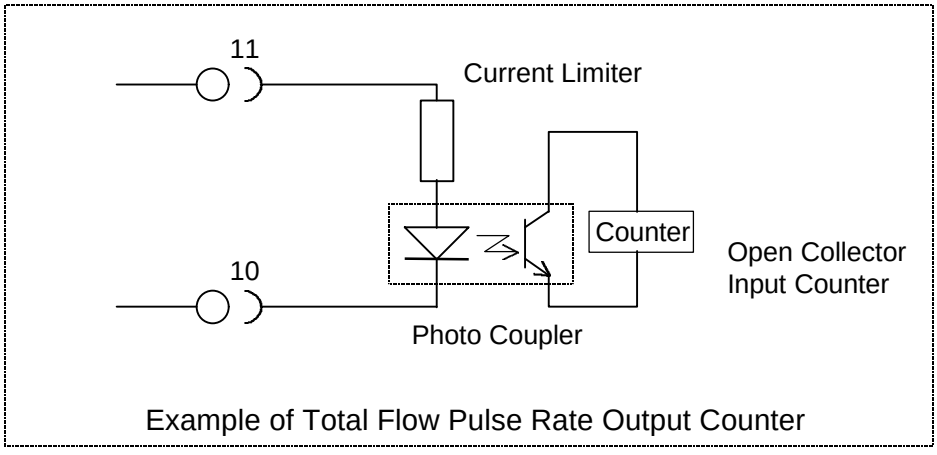
Each time the total value displayed increments by one digit, a pulse is produced. For example, if the total has a resolution of 0.1 kg, a pulse is produced each 0.1 kilograms.

The pulse is a current sinking pulse of approximately 10mSec produced by an open collector transistor and is capable of sinking up to 100mA. The maximum pulse rate is limited to 49 pulses per second and the resolution on the accumulated total must be set so that it increments at less than 49 counts per second.

Note: due to the uneven pulse output spacing, the pulse output cannot be used to drive rate indicators.







Example of Total Flow Pulse Rate Output Counter

Calibration

The calibration routine can be entered in either of the two following ways:
(It is not necessary to use both.)

(1) By pressing and holding the [TOTAL] and [DISPLAY] keys simultaneously for 6 seconds. NOTE: In order to use this second method, “ENABLE” in “FRONT ACCESS” must be activated during calibration.
(2) By connecting a wire link to the rear terminal strip across terminals 1 and 2.

The key switch actions for the calibration routine are as follows:

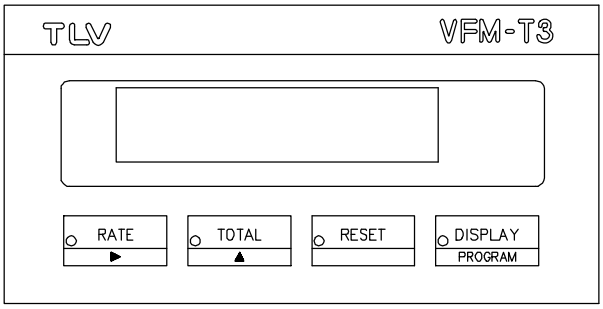
[RATE, ▸]: used to change a flashing digit or a setting option
[TOTAL, ▲]: used to increment a flashing digit or change a parameter selection
[RESET]: used to reset a flashing digit to zero
[DISPLAY, PROGRAM]: used to step through program sequences

There are six main menu items:

1. GENERAL SETUP
2. GAS PARAMETERS
3. FLOW PARAMETRS
4. OPTIONS
5. SYSTEM TEST
6. EXIT

The user can toggle between these menus using the [▸] key. The [PROGRAM] key is used to enter each menu. In the following flowcharts, the options that can be selected using the [▸] or [▲] keys are shown in brackets ( ), and the values to be entered are shown as xxxx’s. The flowcharts show the program flow during the calibration, and a list of term definitions is given along with each step.

To exit calibration, select the “EXIT” menu and press the [PROGRAM] key.
(Ensure that the calibration connecting wire link is removed from the terminals in the rear panel.)



Programming Chart

SELECT (GENERAL SETUP)

⇓

DISPLAY CONTRAST ADJUST

- It is possible to adjust the contrast of the display using the [▲] key to give optimum clarity.

⇓

FLOW UNITS (SI UNITS, US UNITS)

- Select the type of units to be used.

⇓

TOTAL UNITS (UNITS × 1000, UNITS × 1)

- If "UNITS × 1000" is selected, "k" will appear at the end of the total value.

⇓

FLOW TIMEBASE (DAYS, HOURS, MINUTES, SECONDS)

- Select the flow display units (time).

⇓

FRONT ACCESS (ENABLE, DISABLE)

- If enabled, access to the calibration routine is possible via the front panel.

⇓

FRONT RESET (ENABLE, DISABLE)

- If disabled, reset is not possible via the front panel.

⇓

RESET TOTAL NOW? (PRESS RESET)

- This resets the current total value.

⇓

SELECT (EXIT)

- This is used to exit the calibration routine.

SELECT (GAS PARAMETERS)

⇓

GAS EQUATION (STEAM, IDEAL GAS, GENERAL GAS, NATURAL GAS)

- Select "STEAM".

⇓

STEAM TYPE SATURATED, SUPERHEATED)

- Saturated steam ⇒ SATURATED
  Superheated steam ⇒ SUPERHEATED

⇓

SAT STEAM INPUT (PRESSURE, TEMPERATURE)

- Select the sensor input for saturated steam (pressure or temperature).

⇓

DEFAULT DISPLAY (MASS, ENERGY)

- Mass flow ⇒ MASS
  Energy flow ⇒ ENERGY

⇓

BASE TEMP + XXX.XX

- It is not necessary to set this.

⇓

BASE PRESSURE XXXXX

- It is not necessary to set this.

⇓

SELECT (EXIT)

- This is used to exit the calibration mode.

SELECT
(FLOW PARAMETERS)

⇓

FLOW INPUT TYPE
(FREQUENCY, ANALOG)
- Select “FREQUENCY”.

⇓

FLOW SIGNAL TYPE
(LINEAR, NON-LINEAR)
- Select “LINEAR”.

⇓

K-FACTOR
XXXXX.XXX
- Enter the value of the reciprocal of the meter factor × 1000.

⇓

FILTER FACTOR
XX
- It is not necessary to set this.

⇓

FLOWRATE DECIMAL
XXX.XX
- The number of decimal points with which the instantaneous flow rate is displayed.

⇓

TOTAL DECIMAL
XXX.XX
- The number of decimal points with which the total value is displayed.

⇓

TEMP OFFSET
± X.XX
- Enter the offset for the temperature sensor.

⇓

PRESSURE INPUT
(ABSOLUTE GAUGE)
- Select either absolute or gauge pressure for the pressure sensor input.

⇓ ⇓

⇓ ATMOSPHERIC PRESSURE
XXXXX
- As a general rule, it is not necessary to modify this.

⇓ ⇓

PRESSURE at 4mA
XXXXX
- Enter the pressure when the output current is 4mA (minimum).

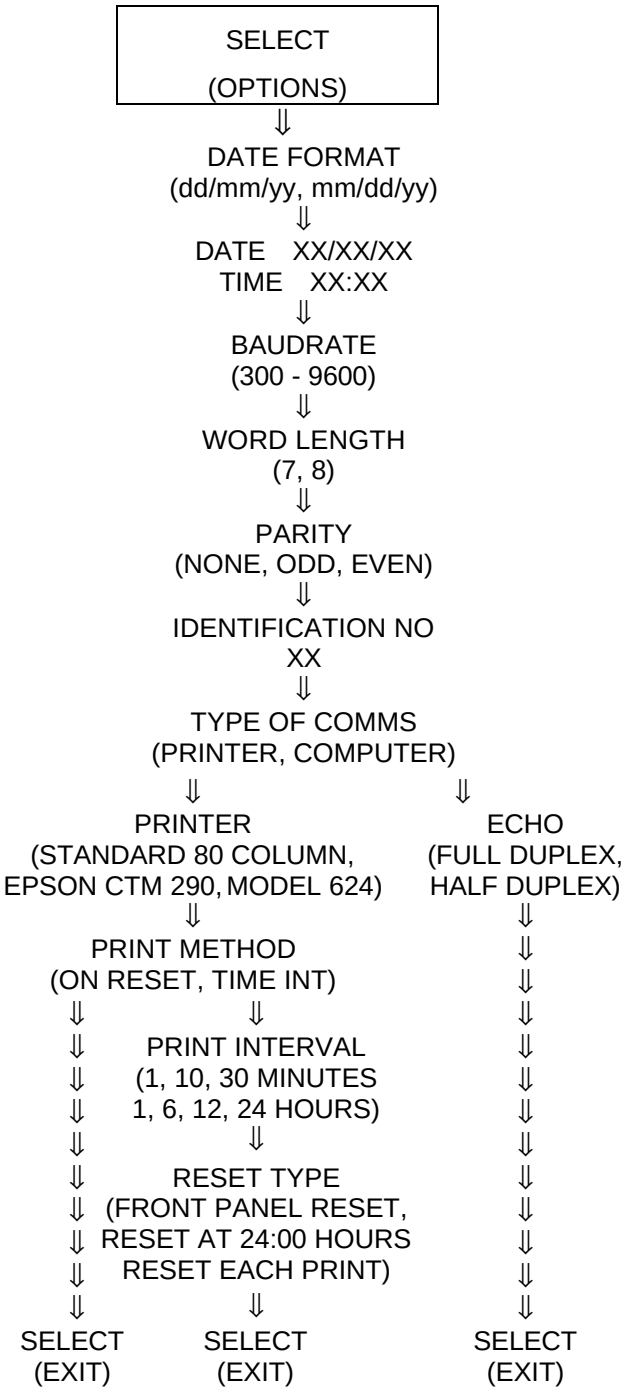
⇓

PRESSURE at 20mA
XXXXX
- Enter the pressure when the output current is 20mA (maximum).

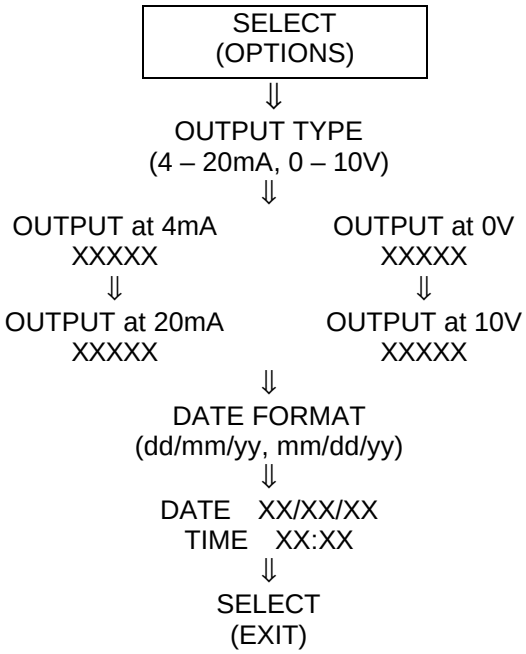
⇓

SELECT
(EXIT)
- This is used to exit the calibration mode.

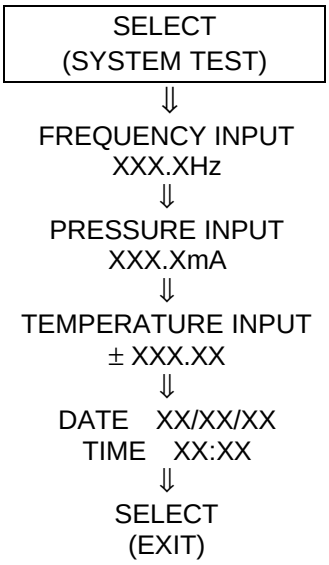
<With Communications Feature>



<With Analog Output Option>



- Select either current or voltage.
- Enter the flow rate at either 4mA or 0V (minimum). This is typically “0”.
- Enter the flow rate at either 20mA or 10V (maximum).
- Select the method in which to display the date.
- Enter the current date and time.
- This is used to exit the calibration routine.



- This displays the entered frequency.
- This displays the pressure sensor input current.
- This displays the temperature sensor input value.
- Enter the current date and time.
- This is used to exit the calibration routine.

Input Circuits

CAUTION **Make sure the power supply is OFF before carrying out work on the wiring or inspections involving disassembly. If such work is carried out with the power on, there is a danger that equipment may malfunction or electric shock may occur, leading to injury or other accidents.**

CAUTION **Make sure that wiring work requiring a special license is carried out only by qualified personnel. If carried out by unqualified personnel, overheating or short circuits leading to injury, fires, damage or other accidents may occur.**

CAUTION **Do not touch the terminals during transmission. Failure to observe this precaution could result in such hazards as damage to the product, malfunctions, electric shock or fire.**

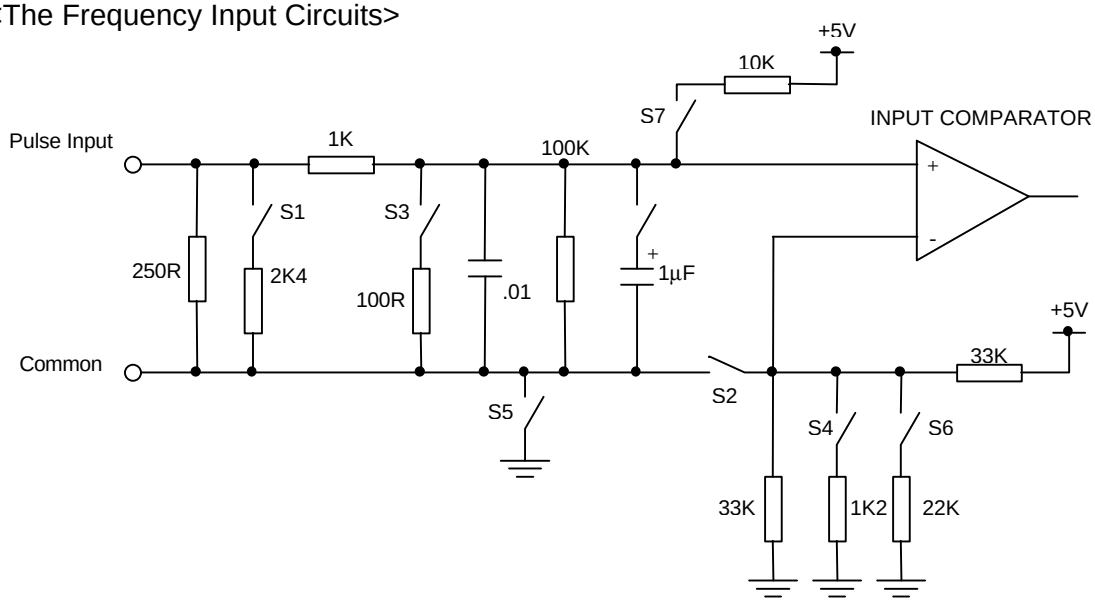
The VFM-T3 has a regulated output that can be used to power sensors. A trimpot on the rear of the instrument allows the voltage to be adjusted in the range of 8V – 24V, and the output can supply a maximum of 50mA.

Connecting the VFM Transmitter

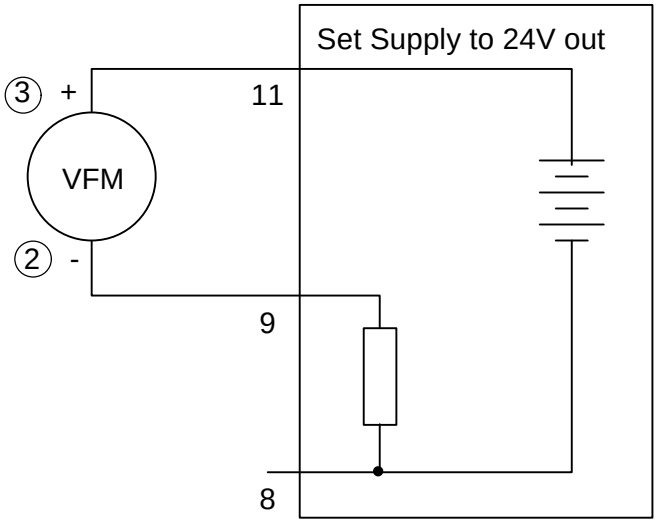
The 8 point switches on the rear panel are set as follows:

1	2	3	4	5	6	7	8
OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF

<The Frequency Input Circuits>



Either the internal DC output power on the VFM-T3 body or an external power source may be used to power the VFM transmitter.

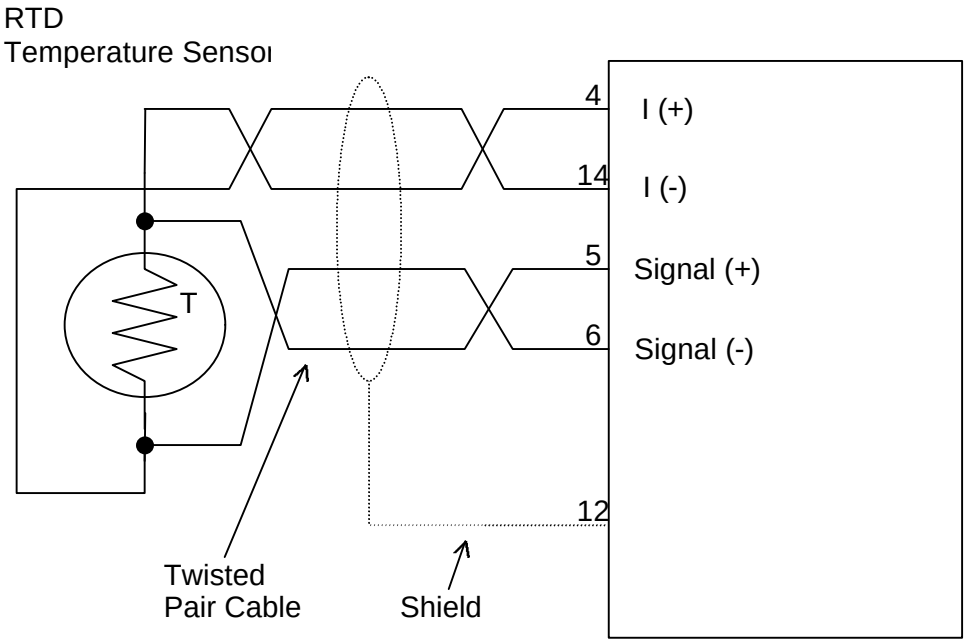


Connecting the Temperature Sensor

Use a Pt100Ω temperature sensor.

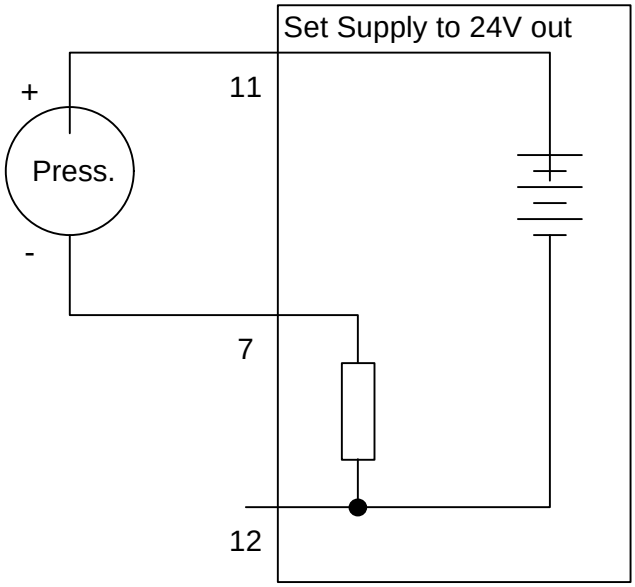
Four wire measurement is the most accurate, though two or three wire types can be used in place of four wire types. However, when types other than four wire types are used, four wires must be taken from the VFM-T3 body to the sensor and the signal and current wires connected as close to the temperature sensor as possible.

The program automatically corrects for the non-linearity in the temperature sensor.



Connecting the Pressure Sensor

Use a 4 – 20mA output type pressure sensor.
Either the internal DC output power on the VFM-T3 body or an external power source may be used to power the pressure sensor.



Installation

CAUTION **Make sure the power supply is OFF before carrying out work on the wiring or inspections involving disassembly. If such work is carried out with the power on, there is a danger that equipment may malfunction or electric shock may occur, leading to injury or other accidents.**

CAUTION **Make sure that wiring work requiring a special license is carried out only by qualified personnel. If carried out by unqualified personnel, overheating or short circuits leading to injury, fires, damage or other accidents may occur.**

CAUTION **Do not touch the terminals during transmission. Failure to observe this precaution could result in such hazards as damage to the product, malfunctions, electric shock or fire.**

General

The cutout hole in the panel should be 140 mm wide and 68 mm high. Two side clips are supplied to secure the instrument into the panel.

A case ground point is provided via a connection on the side of the case. Note that this ground point is for the case only and that there is complete electrical isolation between this point and all electronic circuits.

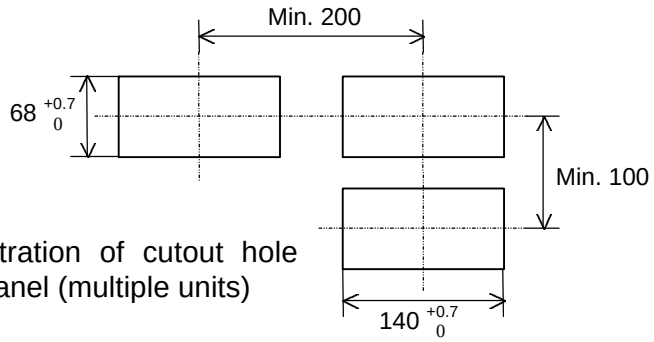


Illustration of cutout hole in panel (multiple units)

Terminal Block Particulars

No.	Description
1	Calibration
2	Calibration
3	Not to be used
4	Pt100 (A)
5	Pt100 (A)
6	Pt100 (B)
7	Pressure Sensor Input
8	Flow Rate Pulse Input (–)
9	Flow Rate Pulse Input (+)
10	Flow Rate Pulse Output
11	DC Output
12	DC Ground
13	Not to be used
14	Pt100 (B)

Standard (RS232/422)

No.	Description
20	RS232 Signal Ground
21	RS232 Data In
22	RS232 Data Out
23	RS422 - Data Out
24	RS422 + Data Out
25	RS422 - Data In
26	RS422 + Data In
27	RS232 CTS

Option (Analog Output)

No.	Description
20	Not to be used
21	0V
22	0 –10V Out
23	-12V
24	I(-)
25	I(+)
26	+15V
27	Not to be used

Analog Output (Optional)

CAUTION Make sure the power supply is OFF before carrying out work on the wiring or inspections involving disassembly. If such work is carried out with the power on, there is a danger that equipment may malfunction or electric shock may occur, leading to injury or other accidents.

CAUTION Make sure that wiring work requiring a special license is carried out only by qualified personnel. If carried out by unqualified personnel, overheating or short circuits leading to injury, fires, damage or other accidents may occur.

CAUTION Do not touch the terminals during transmission. Failure to observe this precaution could result in such hazards as damage to the product, malfunctions, electric shock or fire.

The optional analog output provides the instantaneous flow rate as either a 4 – 20mA current or a 0 – 10V (voltage) level.
Either 2 wire current transmission is available with the loop powered internally, or 3 wire transmission from an external loop supply.
It should be noted that the output will be updated every 0.5 seconds and that in between updates, the output value is constant.
A block diagram of the output is shown below, as well as a method of interconnection.

Load Specification (Maximum load)

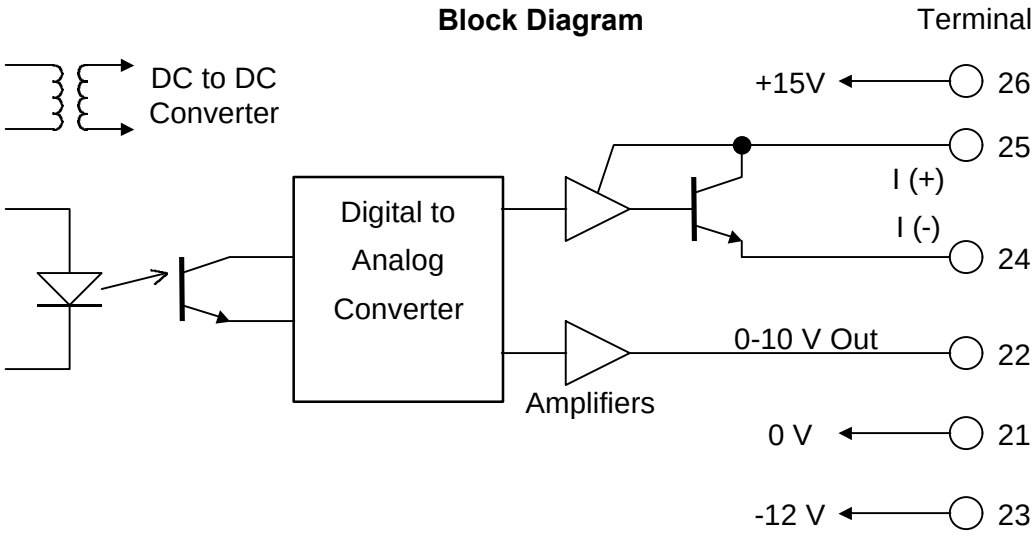
Internally powered loop: 500Ω
Externally powered loop: R = (V - 5) / 0.02 (V: external loop voltage, R = maximum load resistance)
Output voltage impedance: 100Ω

Parameters relating to this option are programmed when calibrating the instrument and provide for:

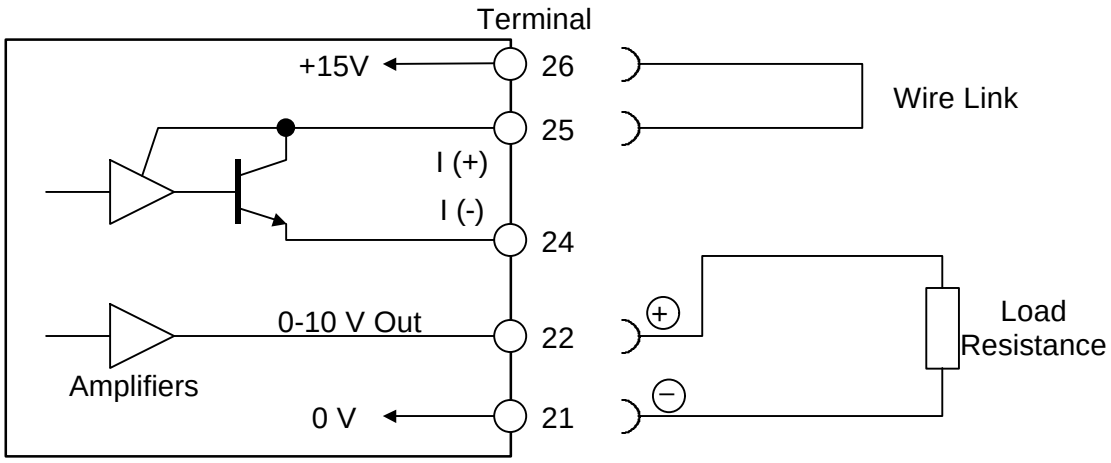
* Defining the rate that is equivalent to 4mA or 0 volts
* Defining the rate that is equivalent to 20mA or 10 volts
* Selecting the output range as 4 – 20mA or as 0 – 10 volts

NOTE: If the optional analog output is selected, the RS323/422 interface is not supplied.

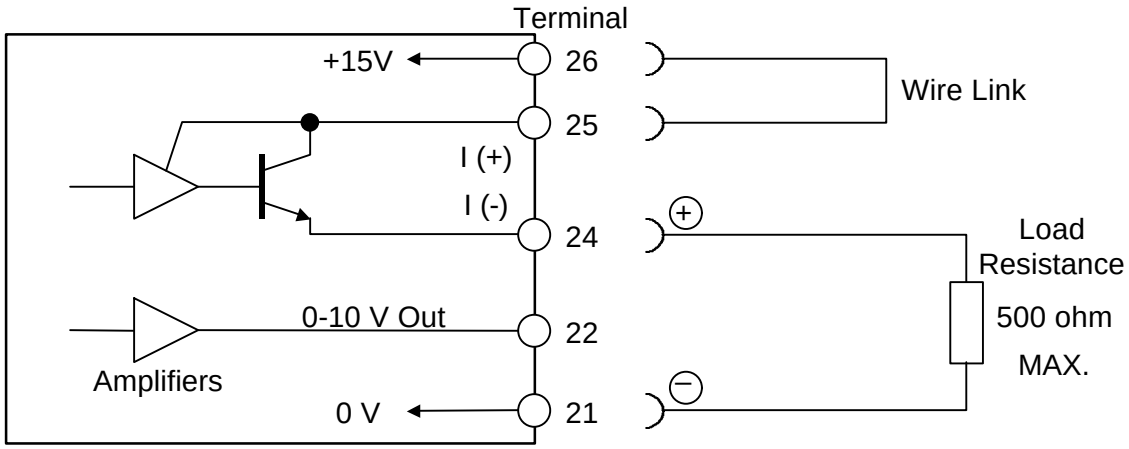
Block Diagram



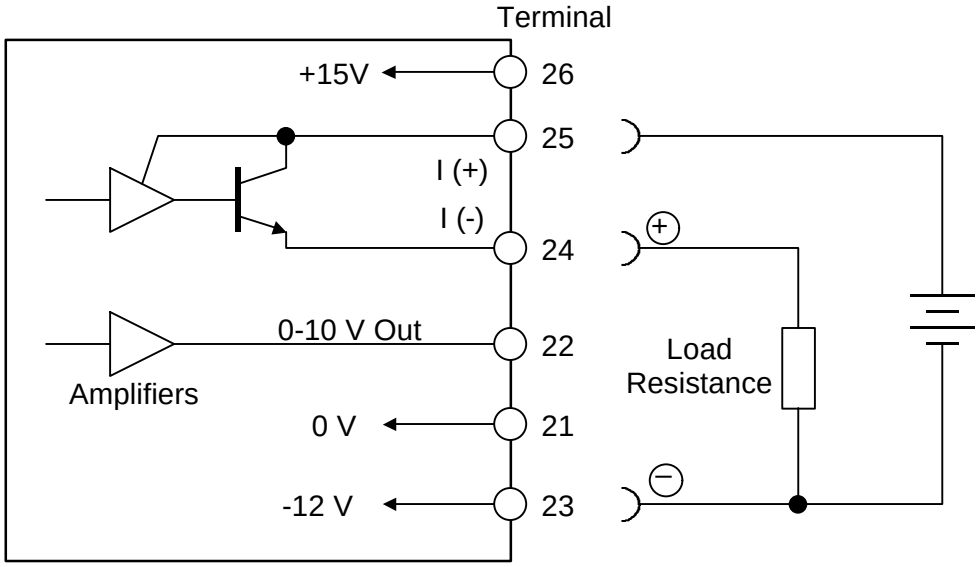
Example of Voltage Output Connection



Example of Current Output (Internal Power Source) Connection



Example of Current Output (External Power Source) Connection



Troubleshooting

CAUTION Make sure the power supply is OFF before carrying out work on the wiring or inspections involving disassembly. If such work is carried out with the power on, there is a danger that equipment may malfunction or electric shock may occur, leading to injury or other accidents.

CAUTION Make sure that wiring work requiring a special license is carried out only by qualified personnel. If carried out by unqualified personnel, overheating or short circuits leading to injury, fires, damage or other accidents may occur.

CAUTION Do not touch the terminals during transmission. Failure to observe this precaution could result in such hazards as damage to the product, malfunctions, electric shock or fire.

Phenomenon	Treatment
No flow rate is displayed	Check the wiring connections, referring to “Input Circuits” (p. 11).
The displayed value differs greatly from the actual flow rate	Check the input values for the “K-FACTOR” in “FLOW PARAMETER” and “PRESSURE at 20mA”
The number displayed for the total flow rate is too large to be read easily	Select “× 1000” for the “TOTAL UNITS” in the “GENERAL SETUP”. The display units change to tones.

Product Warranty

1. Warranty Period
   One year following product delivery.
2. Warranty Coverage
   TLV CO., LTD. warrants this product to the original purchaser to be free from defective materials and workmanship. Under this warranty, the product will be repaired or replaced at our option, without charge for parts or labor.
3. This product warranty will not apply to cosmetic defects, nor to any product whose exterior has been damaged or defaced; nor does it apply in the following cases:
   - Malfunctions due to improper installation, use, handling, etc., by other than TLV CO., LTD. authorized service representatives.
   - Malfunctions due to dirt, scale, rust, etc.
   - Malfunctions due to improper disassembly and reassembly, or inadequate inspection and maintenance by other TLV CO., LTD. authorized service representatives.
   - Malfunctions due to disasters or forces of nature.
   - Accidents or malfunctions due to any other cause beyond the control of TLV CO., LTD.

Under no circumstances will TLV CO., LTD. be liable for consequential economic loss damage or consequential damage to property.

* * * * * * *

For Service or Technical Assistance:
Contact your TLV representative or your regional TLV office.

Manufacturer

TLV CO., LTD.
881 Nagasuna, Noguchi
Kakogawa, Hyogo 675-8511 JAPAN
Tel: 81–(0)794–27–1800

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ISO 9001/ ISO 14001

Manufacturer

TLV. CO., LTD.

Kakogawa, Japan

is approved by LRQA LTD. to ISO 9001/14001

VFM-T3 Quick Start Guide

This Quick Start Guide contains an explanation of only the basic system calibration of the VFM-T3, and must be used in conjunction with the “VFM-T3 Instruction Manual.”

Contents

Introduction

This “Quick Start Guide” provides an easy-to-understand explanation of only the most basic instructions to display flow rate.

For detailed settings or operation, see the “Instruction Manual”.

The VFM-T3 is an outstanding steam flow computer that accurately measures the flow rates of steam in various conditions.

If offers an extremely varied number of display options, including mass flow rate, corrected volume, energy flow (rate and total), temperature, pressure, specific weight and enthalpy.

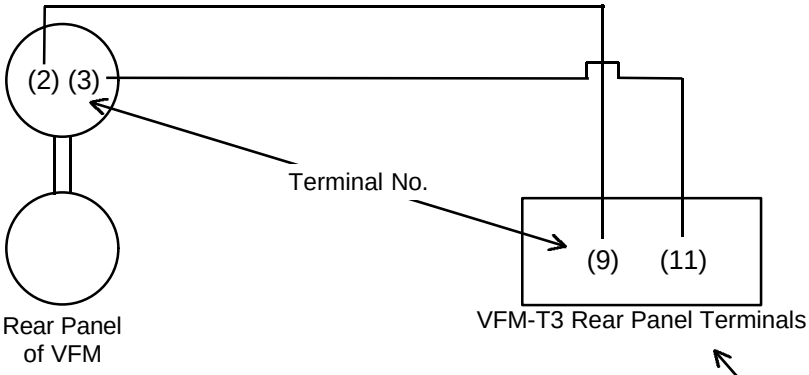
This guide contains information on wiring connections, calibration and operation.

Be sure to calibrate the unit before use.

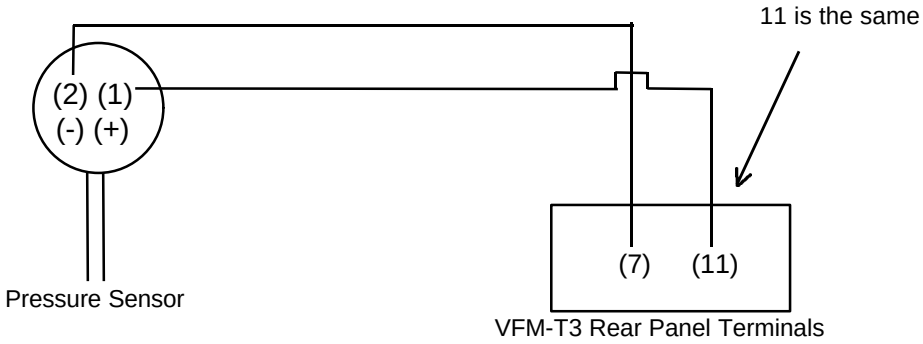
Wiring Connections

Use shielded cable for the VFM to VFM-T3 wiring connections. Connect the shielded cable to the T3 ground terminal, and do not connect it to the VFM.

Connection with the VFM



Connection with the Pressure Sensor



NOTE: Check the voltage and wiring connections.
If used incorrectly, accurate flow rates cannot be indicated and there is danger of damage to equipment.

For details on the T3 terminal block, refer to the “Installation” and “Terminal Block Particulars” sections of the separate “Instruction Manual”.

Calibration

If the VFM-T3 is not properly calibrated, accurate flow rate measurement cannot be achieved. The flow rate indicated will not be correct.

Be sure to correctly calibrate the unit before use.

The calibration routine can be entered in either of the following 2 ways:

1. By connecting a wire link to the rear terminal strip across terminals (1) and (2).
2. By pressing and holding down the [TOTAL] and [DISPLAY] keys for 6 seconds.

The key switch actions during calibration are as follows:

[RATE, ▸]: used to change a selected (flashing) digit or a setting option
[TOTAL, ▴]: used to increment the selected digit or change a parameter selection
[RESET]: used to reset the selected digit to zero
[DISPLAY, PROGRAM]: used to step through program sequences

In calibration, there are six main menu items as follows:

1. GENERAL SETUP
2. GAS PARAMETERS
3. FLOW PARAMETERS
4. OPTIONS
5. SYSTEM TEST
6. EXIT

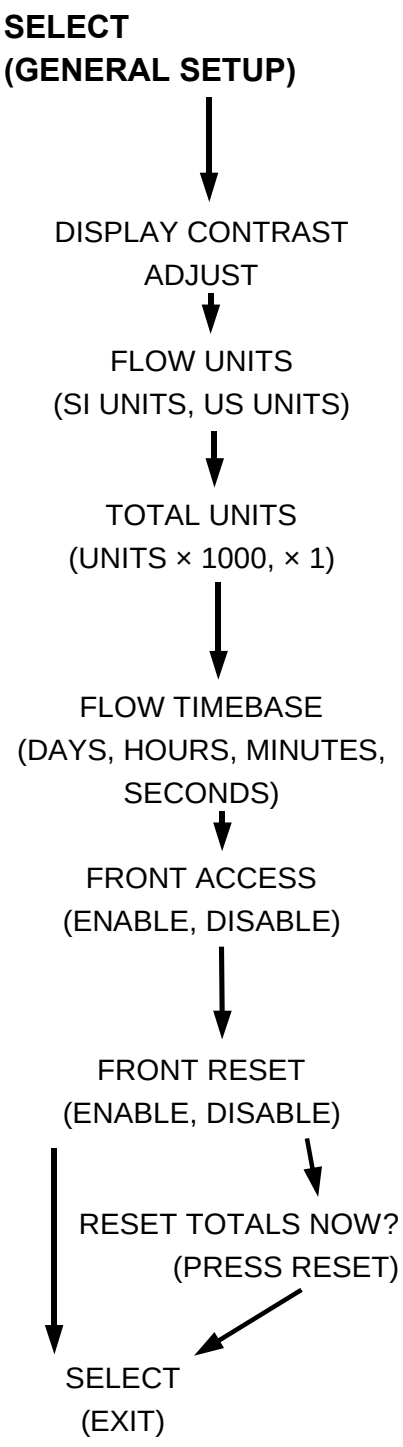
To change the option displayed, press the [RATE] key. When the option to be modified appears, press [DISPLAY] to enter the routine below corresponding to the selected option.

NOTE: This **"Quick Start Guide"** explains only the 3 options that must be set without fail: "GENERAL SETUP", "GAS PARAMETERS" and "FLOW PARAMETERS".

Refer to the "Instruction Manual" for details concerning other options.

Perform the calibration slowly and carefully.

General Setup



Press the [DISPLAY] key once to move to the next step.

Adjust the contrast of the display using the [TOTAL] key.

Select the type of units to be used with the [TOTAL] key.
(Typically, “SI UNITS” (kPa) are selected.)

Select the units to be used in total flow rate display with the [TOTAL] key.
If “× 1000” is selected, “k” appears at the end of the value.

Select the displayed units (time) with the [TOTAL] key.
(Typically, “HOURS” is selected.)

If disabled, access to the calibration routine is not possible via the front panel.
This is a type of “key lock”.
(Typically, “ENABLE” is selected.)

If disabled, total flow rate reset is not possible via the front panel.
(Typically, “ENABLE” is selected.)

This is displayed only when “DISABLE” was selected in the above step. Press to reset the total flow rate.

Press [DISPLAY] to exit the calibration routine.
To continue the calibration routine, press “RATE” to select the next option.

Gas Parameters

SELECT (GAS PARAMETERS)	
↓	Press the [DISPLAY] key once to move to the next step.
GAS EQUATION (STEAM, IDEAL GAS GENERAL GAS, NATURAL GAS)	Select “STEAM” and press the [TOTAL] key.
↓	
STEAM TYPE (SATURATED, SUPERHEATED)	Typically, “SATURATED” is selected. When using a temperature sensor and measuring superheated steam, “SUPERHEAT” is selected.
↓	
SAT STEAM INPUT (PRESSURE, TEMPERATURE)	To enable pressure compensation by the pressure sensor, select “PRESSURE”. For temperature compensation, select “TEMPERATURE”.
↓	
DEFAULT DISPLAY (MASS, ENERGY)	Select “MASS”.
↓	
BASE TEMPERATURE + XXX.XX	It is not necessary to set this.
↓	
BASE PRESSURE XXXXX	It is not necessary to set this.
↓	
SELECT (EXIT)	Press [DISPLAY] to exit the calibration routine. To continue the calibration routine, press [RATE] to select the next option.

This is the MOST CRITICAL option!

Flow Parameters

SELECT
(FLOW PARAMETERS)

Press the [DISPLAY] key once to move to the next step.

FLOW INPUT TYPE
(FREQUENCY, ANALOG)

Select “FREQUENCY”.

FLOW SIGNAL TYPE
(LINEAR, NON-LINEAR)

Select “LINEAR”.

K-FACTOR
XXXXXX.X

K-factor is: the reciprocal of the meter factor (found on the VFM nameplate) × 1000.
For example, if the METER FACTOR = 0.01627 l/P:
K-factor = (1/0.01627) × 1000 = 61462.8
Enter 61462.8.
Move the curser using the [RATE] key and change the numbers using the [TOTAL] key.

FILTER FACTOR
XX

It is not necessary to set this.

FLOW DECIMAL
XXX.XX

Select the number of decimal points with which the instantaneous flow rate is to be displayed for the [TOTAL] key.

TOTAL DECIMAL
XXXX.XX

In the same manner, select the number of decimal points with which the total flow rate is to be displayed.

PRESSURE INPUT
(ABSOLUTE, GAUGE)

Select “GAUGE”.

ATMOSPHERIC PRESSURE
XXXXXX

It is not necessary to set this.

PRESSURE at 4mA
XXXXX

Though typically this is “0”, check the specifications of the pressure sensor being used.

PRESSURE at 20mA
XXXXX

Enter the pressure at which the pressure sensor produces 20mA (maximum value). Check the pressure sensor specifications. Note: if SI units were selected, the units used here will be in Pascal (kPa).

SELECT
(EXIT)

Press [DISPLAY] to exit the calibration routine.
To continue the calibration routine, press [RATE] to select the next option.

Pascal Conversion

The flow units chosen during the general setup could be either SI units or US units. If SI units were selected, the units to used must be in Pascal (kPa). If using a different system of units, convert them to kPa before entering.

NOTE: If the pressure sensor specifications are in Pascal, enter them without conversion.

A pressure of 1 kg/cm^2 is converted to 98.06 kPa.
A pressure of 1 bar is converted to 100 kPa.

This completes calibration. For information on detailed settings and functions, see the separate “Instruction Manual”.

Front Panel Operation

After calibrating the unit, test the operation by supplying steam flow and checking the flow rate.

To display the instantaneous mass flow, press the “RATE” key; to display the total flow rate, press the [TOTAL] key.

Press the [DISPLAY] key to sequence through the display of mass flow rate, corrected volume, energy flow (rate and total), temperature, pressure, specific weight and enthalpy. (These are only displayed for 5 seconds.)

Troubleshooting

No flow rate is displayed	→	Check the wiring connections, referring to “Wiring Connections”.
The displayed value differs greatly from the actual flow rate	→	Check the input values for the “K-FACTOR” in “FLOW PARAMETER” and “PRESSURE at 20mA”
The number displayed for the total flow rate is too large to be read easily	→	Select “× 1000” for the “TOTAL UNITS” in the “GENERAL SETUP”. The display units change to tones.

This “Quick Start Guide” provides an easy-to-understand explanation of only the most basic instructions to display flow rate.

For detailed settings or operation, see the “Instruction Manual”.