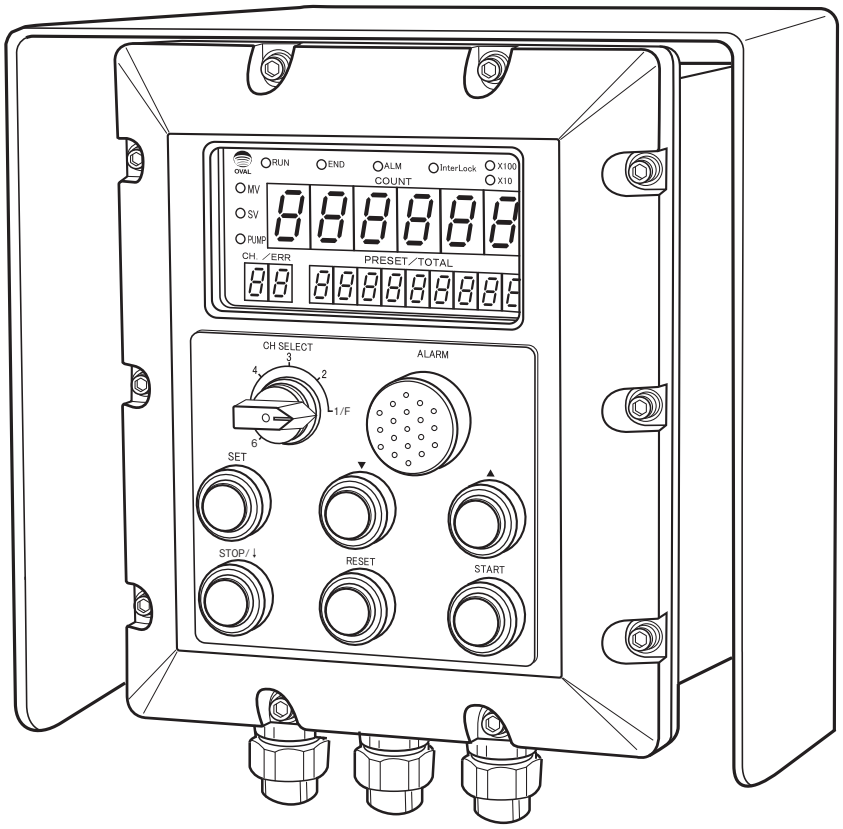
OVAL INSTRUCTIONS

Ins. No. E-235-6-E

Explosionproof Batch Counter

MODEL : EL7320



＜Wall-mount type＞

Thank you for choosing OVAL's Explosionproof Batch Counter EL7320.
Every OVAL product is fabricated and shipped from our factory under strict quality control. This manual is designed to assist the user to obtain the best performance of this product throughout its service life. In order to sufficiently install, operate, and execute maintenance, please read the instructions carefully before the use and keep this manual handy for quick reference.

Also, refer to the instruction manuals of other instruments used in combination with this batch controller such as a flowmeter, valve, etc.

CONTENTS

The indications **NOTE**, **CAUTION**, and **WARNING** shown throughout this manual are to draw your attention to specific items:

➡ NOTE

Notes are separated from the general text to bring user's attention to important information.

⚠ **CAUTION**

Caution statements call attention to user about hazards or unsafe practices that could result in minor personal injury or property damage.

⚠ **WARNING**

Warning statements call attention to user about hazards or unsafe practices that could result in serious personal injury or death.

1. BEFORE YOU BEGIN

Every OVAL batch controller is thoroughly tested before its shipment from the factory. Once you receive the product, it must be thoroughly inspected for any signs of damage by rough handling during transit. Please read this section carefully first, since it contains necessary considerations in handling this product. For more detailed instructions, find the corresponding sections from "CONTENTS".

If you have any inquiries, please contact the nearest OVAL sales/service office in your district.

This product is an electrical instrument with explosionproof configuration. Before installation, make sure to read "Instruction Manual for Explosionproof Equipment" along with this section, and handle the product properly.

1.1 Confirming the Nameplate

The OVAL Batch Counter EL7320 is assembled and adjusted according to individual customer specifications.
A nameplate (product tag) is placed on the side of the product.
Make sure that the specifications you ordered and those written on the nameplate match.

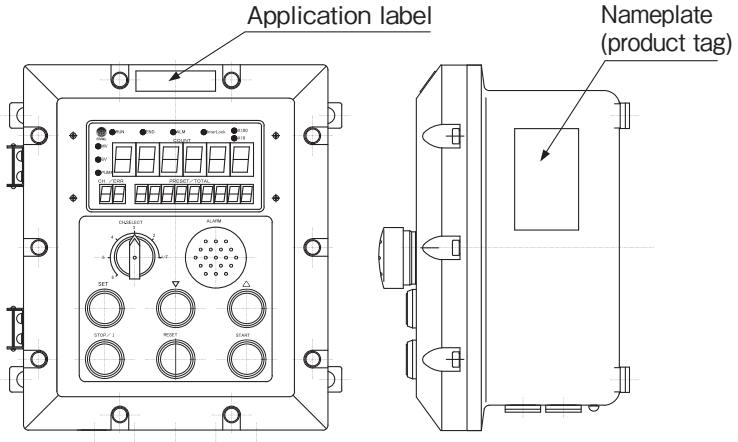


Fig. 1.1 Nameplate Location

◆When you inquire, please specify the product name, model/type no., ratings, and other pertinent information.◆

1.2 Transportation Considerations

(1) The Batch Counter can best be transported to the installation site in the original shipping package used during transit from our factory if circumstances permit.
(2) Exercise care not to give strong impact shocks to the product during transportation.

1.3 Storage Considerations

If the Batch Counter is stored for a long period of time before installation, unexpected circumstances may arise. If long-term storage is inevitable, please take the following precautions:

(1) Keep the product in the original shipping package used during transportation from the factory.
(2) Select a place for storage that meets the following requirements:
- Free from rain and water
- Free from vibration and impact shocks
- Temperature and relative humidity at around 25℃ and 65%

1.4 Install Location Guidelines

The allowable ambient temperature for this batch controller ranges from -10 to +50℃. If the controller is expected to be exposed to direct sunlight, reflected heat, or rainwater at the installation location, make sure to provide a sunshade or other protection to keep the equipment within allowable temperature range.

1.5 Structural Considerations

(1) The Batch Controller EL7320/EL7321 is explosionproof/waterproof rated for outdoor applications. When you close the front cover after parameter setting or wiring installation, make sure that no cable is lodged between the front cover and the body.
(2) Make sure to use appropriate pressure-tight packing cable glands according to the Instruction Manual for Explosionproof Equipment.
(3) Make sure to tighten the union joint of pressure-tight packings upon completion of wiring.

1.6 Explosionproof Considerations

To maintain the validity of the explosionproof rating, the following requirements must be met:

(1) Use this product within the specified ratings.
(2) Do not modify or replace internal wirings or parts.

Additionally, please refer to "Instruction Manual for Explosionproof Equipment" and strictly follow its instructions.

2. GENERAL

Combined with a flowmeter and valve, the batch counter measures a predetermined amount of process fluid in batching operations. It saves time and effort in various processes, such as blending materials, dosing with additives, transferring fluid from one tank to another, or shipping process, mainly in chemical, food, and paint industries.

2.1 Features and Functions

(1) Flameproof rated

This equipment is flameproof rated (Ex d IIB T4) and can be implemented in hazardous locations Zone1 and Zone2.

(2) Easy to operate

① Parameter settings, start, stop, and reset can be done by pressing large pushbuttons on the front panel.

② Improved visibility for outdoor and/or remote applications with large LED display (7-segment, 25.4mm).

③ With operation functions (start, stop, and reset) and parameter setting functions assigned separately to different buttons, erroneous setting will be prevented.

(3) Erroneous setting protection

Accidental erroneous settings can be prevented by selecting predefined batch settings with the cam switch. Up to five batch settings are available.

(4) Accurate batching control

① The valve can be programmed to open and close in two stages for precise batch control.

② Setting an anticipated overshoot enables the batch controller to correct overshoot caused by response lag from the valve.

(5) Feasible system construction

With the ability to operate by remote commands (start, stop, and reset) and batch-end output function, interlocking with other process control systems can be easily done.

(6) Increased process safety

① The batch controller controls a valve in two stages (two-stage open, two-stage close). This prevents static inside pipes or tanks at the start of operation, and hydraulic shock at valve closure.

② An alarm signal can be generated when there is no pulse input or the batch controller receives a pulse exceeding the batch setting for any reason.

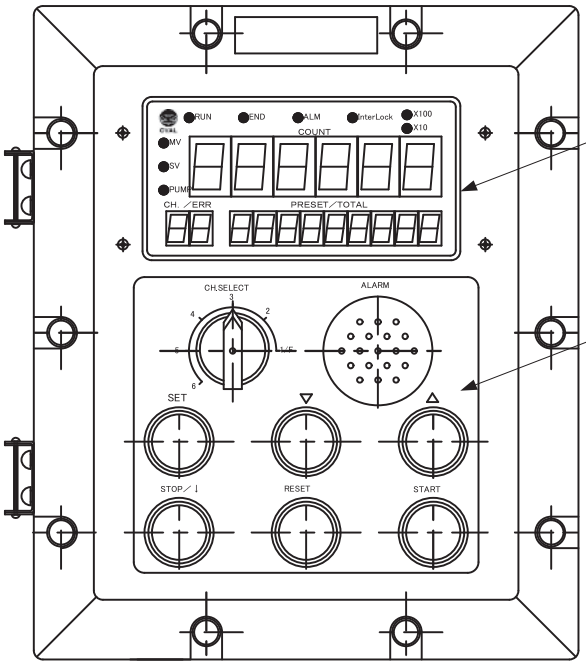
(7) Reliable and easy to maintain

① This equipment is highly reliable and easily serviced since internal electronics are assembled as units.

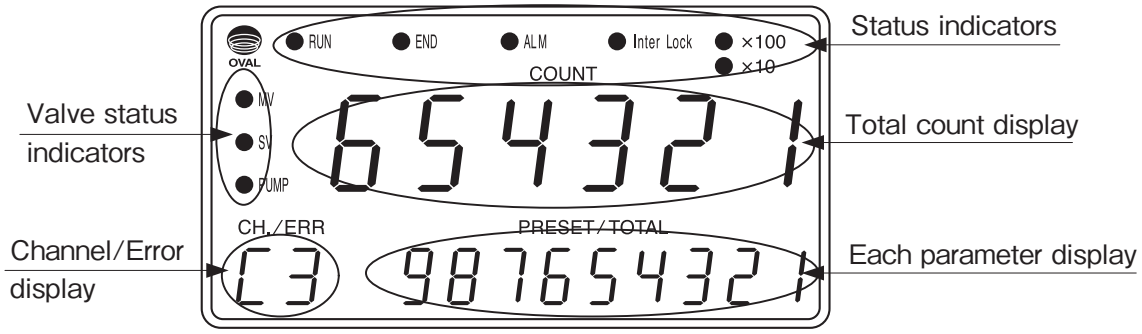
② Every input/output system is isolated by photocouplers and/or relays.

③ Total count and parameters are retained in storage.

3. COMPONENT NAMES



■ Display panel



■ Control panel

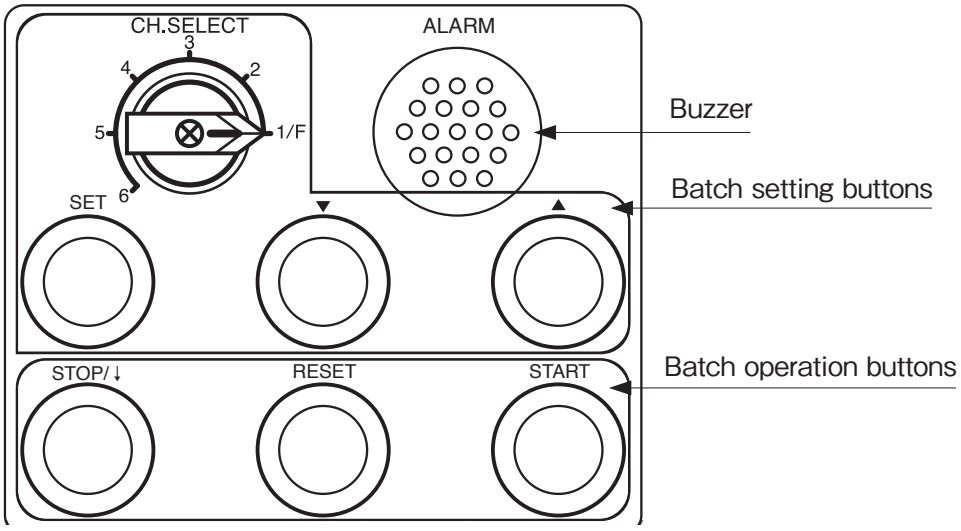


Fig. 3.1 Component Names

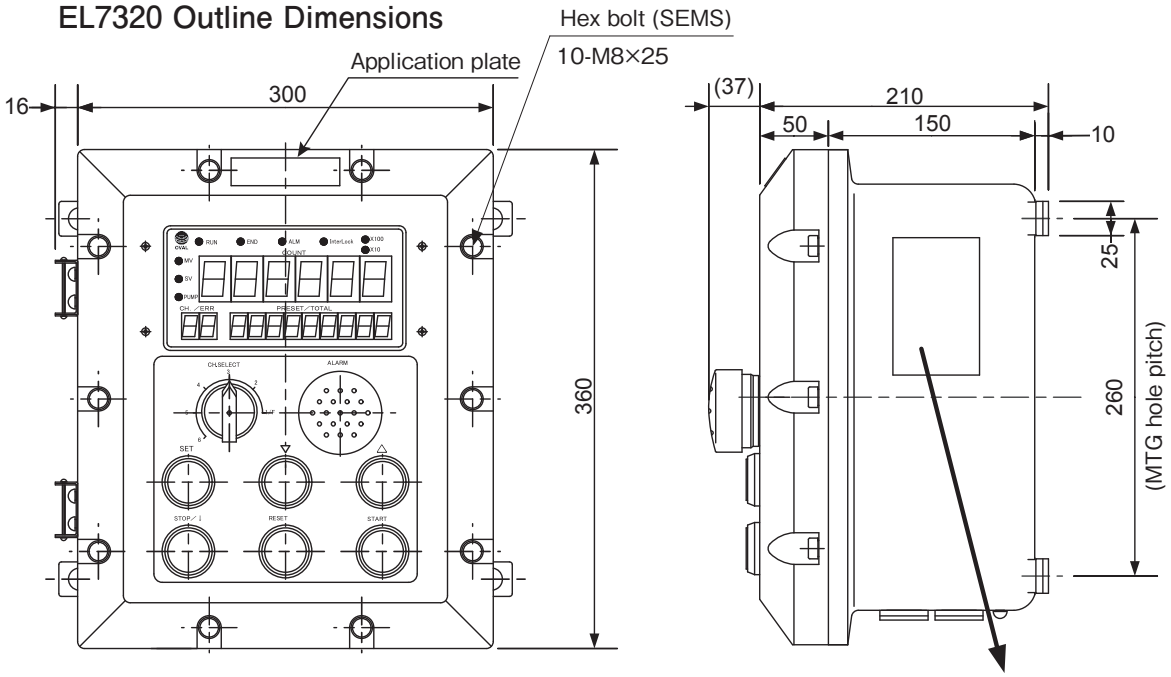
4. INSTALLATION

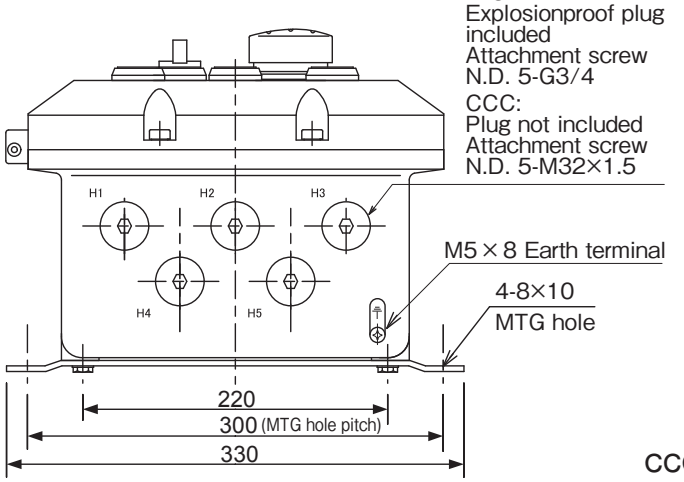
4.1 Outline Dimensions

● Wall-mount type

Unit: mm

EL7320 Outline Dimensions





TIIS ⇨

BATCH COUNTER

TYPE	EL7320–
SERIAL NO.	
FLOW INPUT	
DATE	

防爆関連表示事項

製造者名称	株式会社オーバル 横浜事業所
型式の名称	EL7320
防爆構造に関する記号	ExdⅡBT4
定　格	□AC220V 50／60Hz 1136mA □AC200V 50／60Hz 1149mA □AC110V 50／60Hz 1272mA □AC100V 50／60Hz 1292mA 周囲温度 −20℃〜+50℃

警 告
1. 爆発性ガス雰囲気の存在する恐れがある時は容器の蓋を開けないで下さい。
2. 蓋締付ボルト下降伏点450N／mm²

OVAL Corporation

952200481

Product specifications

Certification label

Explosionproof-related items

CCC ⇨

防爆批量控制器

型　式	
序列号　No.	
流量輸入	
日　期	

认证编号

Ex db ⅡB T4 Gb　-20℃ ≤Tamb≤+50℃
额定功率　AC100V to 220V　23VA
50/60Hz

⚠ 注意
1. 有关安装和接线的详细信息，请参阅使用说明书
2. 當存在爆炸性氣體環境或通電時請勿打開

〒236-8645 日本 神奈川縣橫濱市金澤區福浦1-9-5

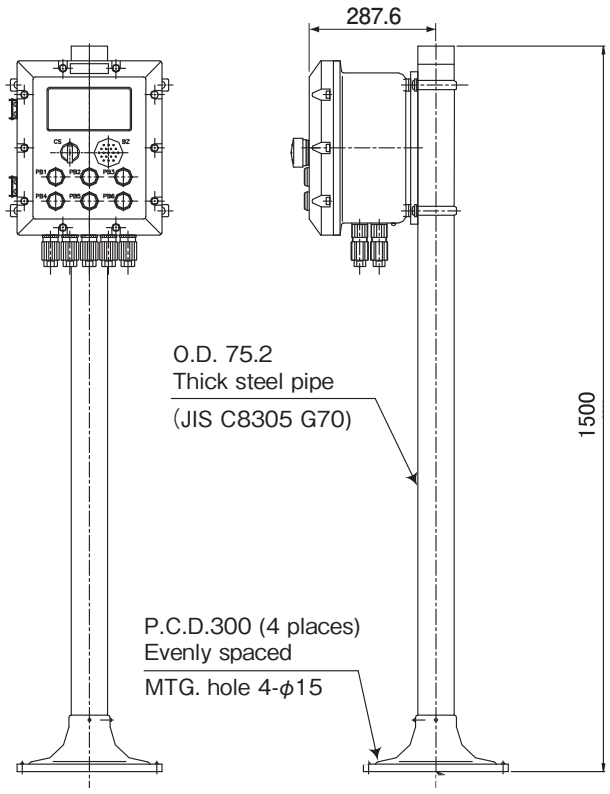
OVAL Corporation

MADE IN JAPAN

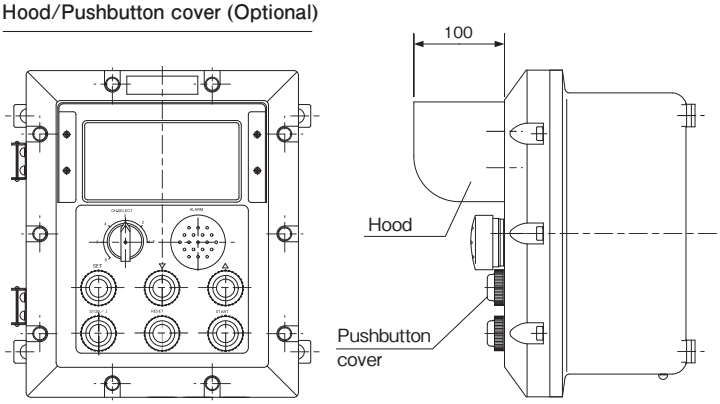
Fig. 4.1

● Stanchion type

Unit: mm



Hood/Pushbutton cover (Optional)



Sunshade (Optional)

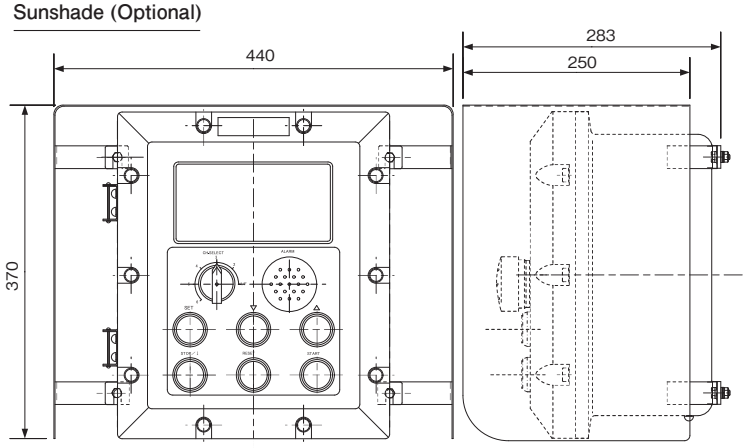


Fig. 4.2

4.2 Installation

4.2.1 Location Considerations

(1) Although this batch counter is weatherproof, avoid installing in places where the controller is exposed to the direct sunlight. If this is difficult, attach the hood.

(2) The controller must be installed where there is the least amount of mechanical vibration and corrosive gases.

4.2.2 Installation Procedures

● Wall-mount type

Secure the controller with four bolts from behind the bracket. Mounting holes are at the back of the controller.

➡ NOTE: Weighs approx. 20kg.

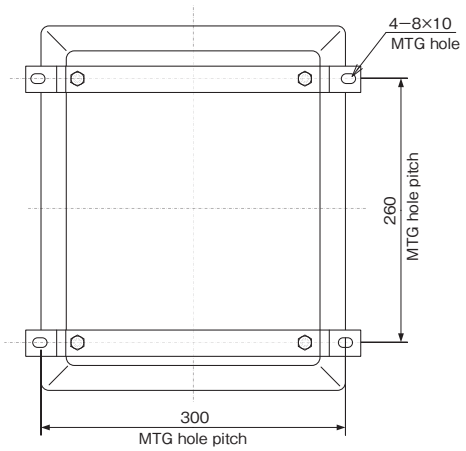


Fig. 4.3 Install Dimension

● Stanchion-mount type

Secure the stanchion base according to Fig.4.5 by "base concrete placing" and "anchor bolt mounting".

Follow steps 1 through 3 instructed below.

To prevent the batch controller from falling, make sure that it is securely fixed.

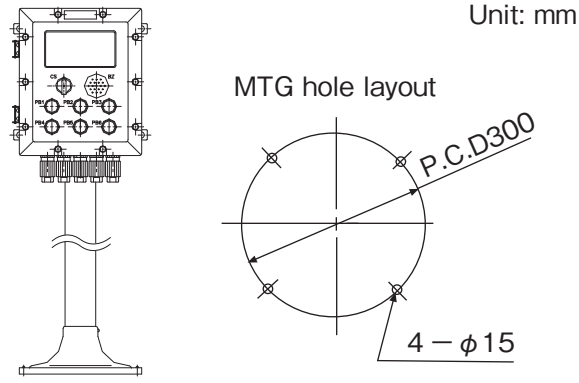


Fig. 4.4 Install Dimension

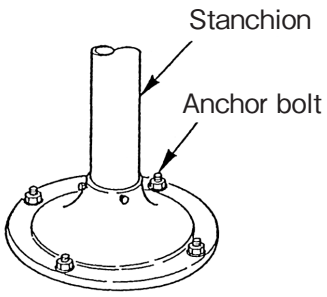


Fig. 4.5

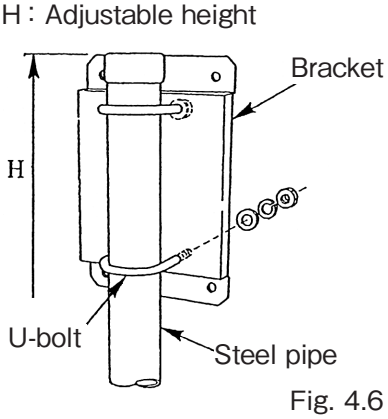


Fig. 4.6

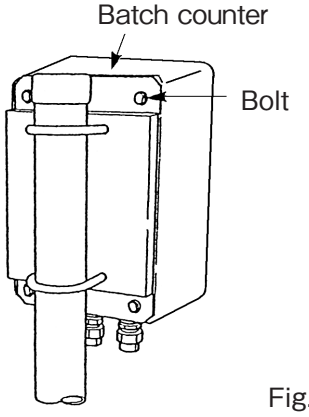


Fig. 4.7

① Secure the stanchion base with anchor bolts.

② Attach the bracket to the pipe by using two U-bolts.

③ Secure the batch counter to the bracket with four bolts.

● Sunshade (optional)

Align the bracket of the batch counter with the sunshade, then fix them together with included screws.

Unit: mm

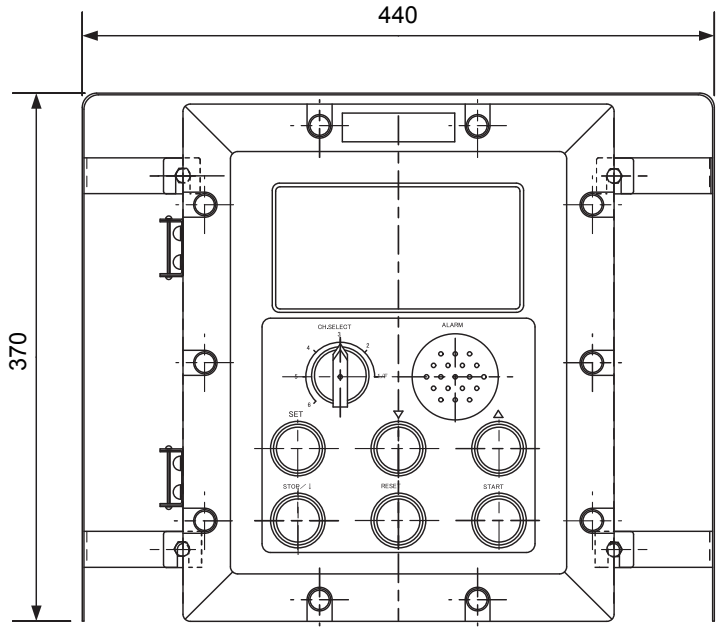


Fig. 4.8

● Hood (optional)

Remove four screws from the batch counter body and attach the hood with included screws.

Unit: mm

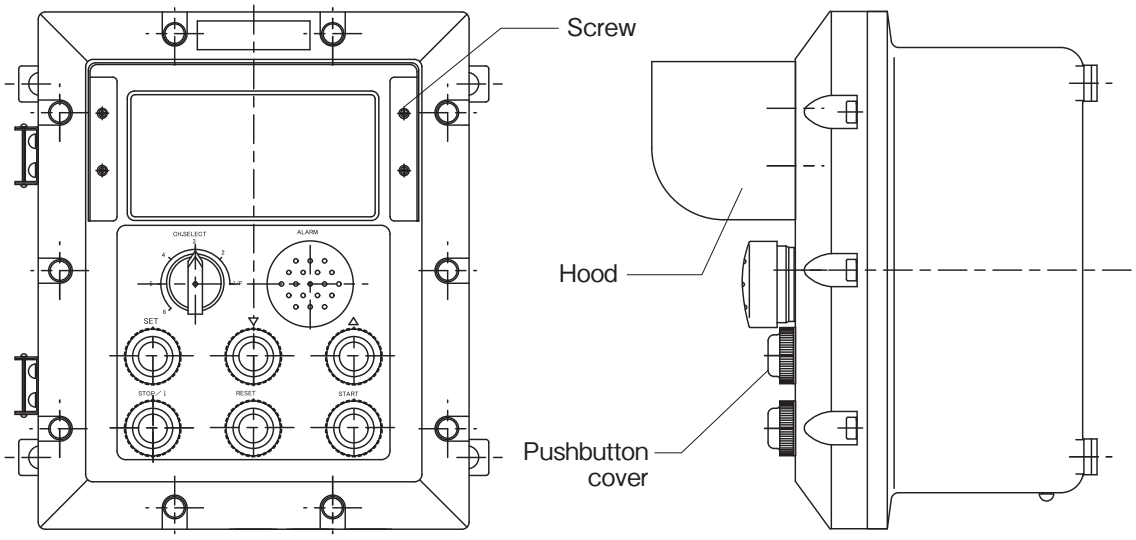


Fig. 4.9

5. WIRING

➡NOTE: Also, refer to the wiring section of the transmitter (flowmeter) instruction manual.

5.1 Cable Specifications

(1) Connect shielded wire to the terminal block. In this case, do not process the terminals on the sensor side of shielded wire.

(2) The ground terminal is connected inside of the casing. If installation surface is insulant, make sure to ground the earth terminal located outside (back side) of the controller body.

5.2 Wiring Considerations

(1) Conduit work is recommended for field wiring.

➡NOTE: In conduit work, route power cables and signal cables in separate conduits, or inductive interference may occur.

(2) Keep field wiring away from other power lines or circuits to reduce the possibility of inductive interference.

(3) Use crimp terminals for connections and ensure electrial contact. Connection terminals are located inside the batch controller.

(4) If you intend to operate inductive loads such as valves and pumps, make sure to install a surge suppressor.

5.3 Terminal Block

There are a total of 60 terminals (20 terminals in 3 rows) for signaling inside the batch controller.

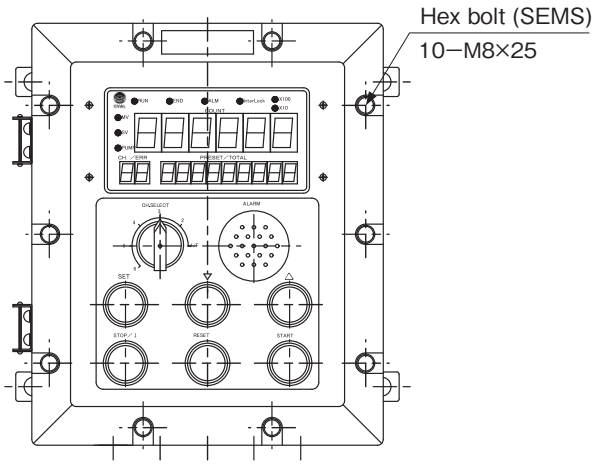


Fig. 5.1

Using a hex key, unscrew 10 hex bolts and open the front cover.

⚠ **CAUTION: Before making wiring connections, check the model numbers, tags, and other labelings on the flowmeter (pulse generator) and those of the receiving instrument used together to verify the compatibility.**

5.4 External Connection Terminals

■ Terminal Block

1	2	3	4	5	6	7	8	9	10
SUP	SIG	COM1		E	LOCK	COM2	E	TC +	TC −
21	22	23	24	25	26	27	28	29	30
START	RESET	STOP	SEL0	SEL1	SEL2	SET	COM2	E	RXD +
41	42	43	44	45	46	47	48	49	50
FV +	FV −	TEMP +	TEMP −	E	PRESS +	PRESS −	E	Pt100 A	Pt100 B

11	12	13	14	15	16	17	18	19	20
E	END +	END −	E	ALARM N.O.	ALARM C	ALARM N.C.	PUMP N.O.	PUMP C	PUMP N.C.
31	32	33	34	35	36	37	38	39	40
RXD −	TXD +	TXD −	COM3	E			SV	C	MV
51	52	53	54	55	56	57	58	59	60
Pt100 b	E	PID +	PID −	E			E	L	N

Signal		No.	Description
Flow Signal Input	SUP.	01	Contact-closure pulse / Open collector pulse; 2-wire voltage pulse (4/20mA); 2-wire voltage pulse (PG30S); 3-wire voltage pulse (PG30); 3-wire open collector pulse
	SIG.	02	
	COM.1	03	
		04	
	E	05	Shield Earth Ground
InterLock	LOCK	06	Short-circuit InterLock when not in use
	COM2	07	
	E	08	Shield Earth Ground
Pulse Output	+	09	Open Collector Output
	−	10	
	E	11	Shield Earth Ground
Batch-end Output	END+	12	Non-contact relay: Form "a" contact
	END-	13	
	E	14	Shield Earth Ground
Alarm Output	N.O.	15	Alarm Output: Relay output "c" contact
	C.	16	
	N.C.	17	
Pump Output	N.O.	18	Pump Control Output: Relay output "c" contact
	C.	19	
	N.C.	20	
Remote Control Input	START	21	Short-circuit STOP when not in use Combination of each SEL terminal and CH.
	RESET	22	
	STOP	23	
	SEL 0	24	
	SEL 1	25	
	SEL 2	26	
	SET(Unused)	27	
	COM.2	28	
	E	29	Shield Earth Ground
Communication	Rx+	30	RS-485 communication • Both full-duplex and half-duplex communication is possible. • If half-duplex communication is used, short-circuit the terminals 30 and 32, and 31 and 33. • With no built-in terminating resistors.
	Rx-	31	
	Tx+	32	
	Tx-	33	
	COM 3	34	
	E	35	Shield Earth Ground

	CH.1	CH.2	CH.3	CH.4	CH.5	CH.6
SEL0	ON	OFF	ON	OFF	ON	OFF
SEL1	OFF	ON	ON	OFF	OFF	ON
SEL2	OFF	OFF	OFF	ON	ON	ON

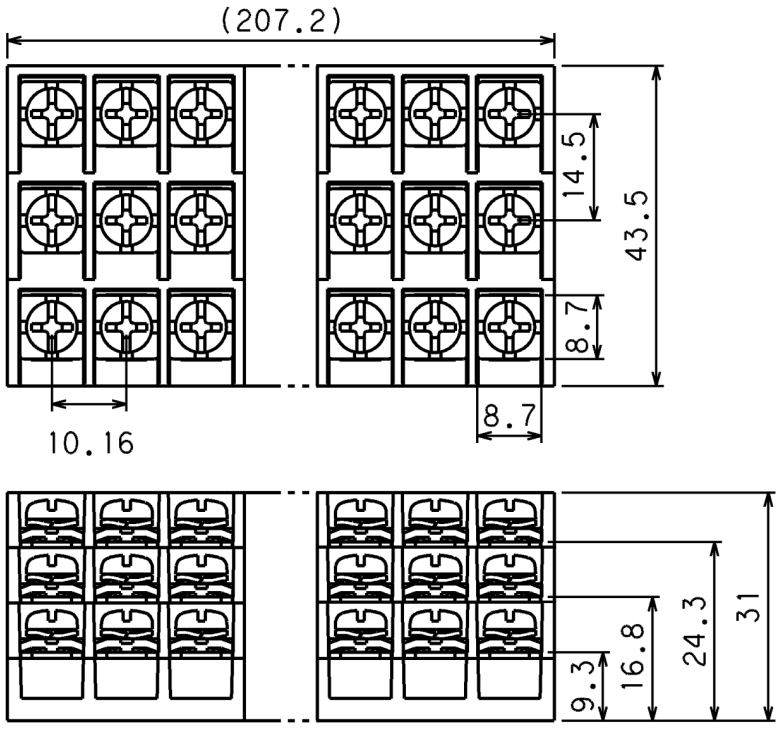
Signal		No.	Description	
		36		
		37		
Valve Operation Output	SV (L)	38	Partial flow control: One-stage open Upper limit flow control: Fully open	Same voltage as power supply or relay contact, form "a" contact
	C. (N)	39		
	MV (L)	40		
24V Power	+24V	41	+24VDC (max 30mA)	Disabled when model codes (10) and (21) are N. (Electrical connection between E terminals)
	0V	42		
Temp Input	+	43	4 to 20mADC/ 1 to 5VDC	
	−	44		
	E	45	Shield Earth Ground	
Special specification terminal		46	Special specification terminal Normally, do not connect wires.	
		47		
		48		
Pt100Ω	A	49	Pt100Ω 3-wirePartial	
	B	50		
	b	51		
	E	52	Shield Earth Ground	
PID Output	+	53	4 to 20mADC PID Output	
	−	54		
	E	55		
		56		
		57		
POWER IN	E	58	Ground Terminal	
	L	59	100/110VAC	
	N	60	200/220VAC	

Terminal screw: M4 x 8

Maximum tightening torque: 1.2 N·m

(Tighten unconnected terminals with a torque of 0.2 to 0.3 N·m.)

Unit: mm



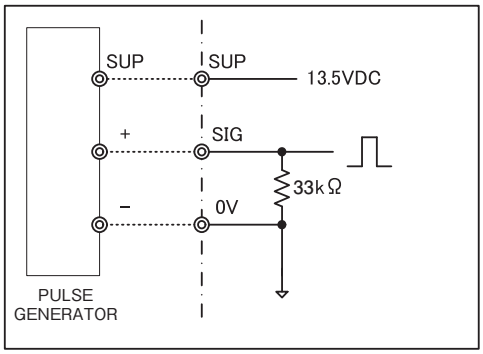
5.5 Flow Input and Terminal Connections

Signal Type		Contact-closure pulse, 2-wire voltage pulse, open collector pulse, 12V DC 2-wire current pulse	24V DC 2-wire current pulse	3-wire open collector pulse, 3-wire voltage pulse
Pulse Generator		PG20, Coriolis Flowmeters PG30S	PA14, 15, 25 NPG60A	PG30, NPG60A FLOWPET
Terminals	1	——	○ +	○ SUP.
	2	○ +	○ –	○ SIG.
	3	○ –	——	○ COM.

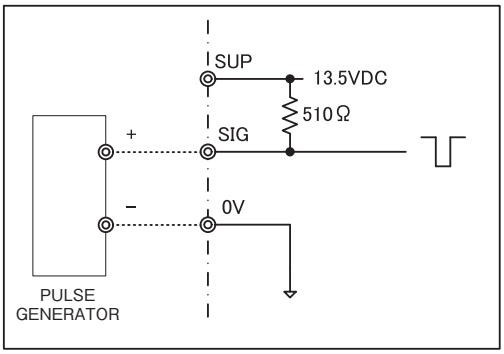
○ : Terminals in use

5.6 Flowmeter Signal Wiring Diagrams

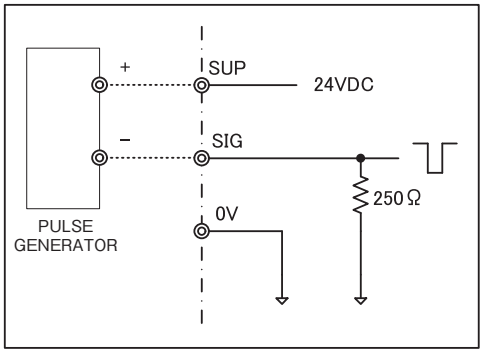
12VDC 3-wire voltage pulse (PG30)



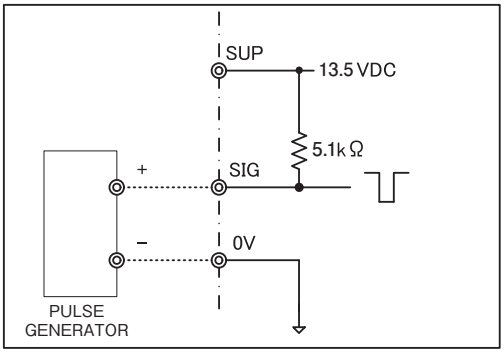
12VDC 2-wire current pulse (PG30S)



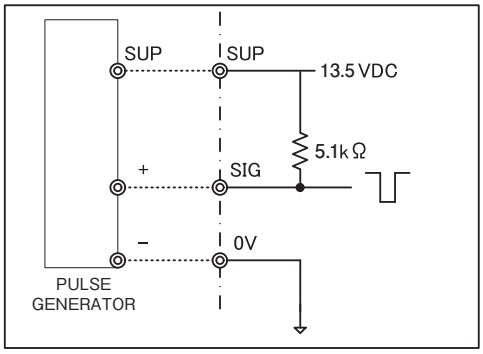
24VDC 2-wire current pulse (4/20mA)



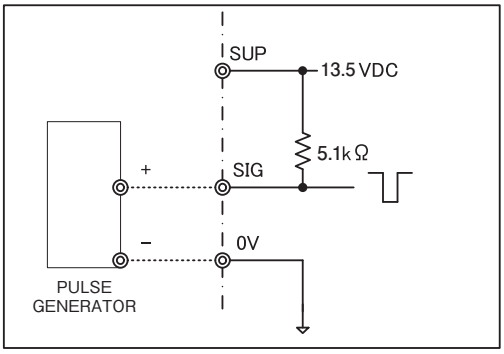
Open collector pulse



3-wire open collector pulse



Contact-closure pulse



⚠ **CAUTION: Before making wiring connections, check the model numbers, tags, and other labelings on the flowmeter (pulse generator) and those of the receiving instrument used together to verify the compatibility.**

6. DISPLAY PANEL AND CONTROLS

6.1 Display Panel Functions

LEDs on the top row indicate status such as RUN and END. Displays in the middle to bottom show total count, batch setting, grand total, and channel number/error code.
LEDs on the left column indicate the state of valve/pump operation.

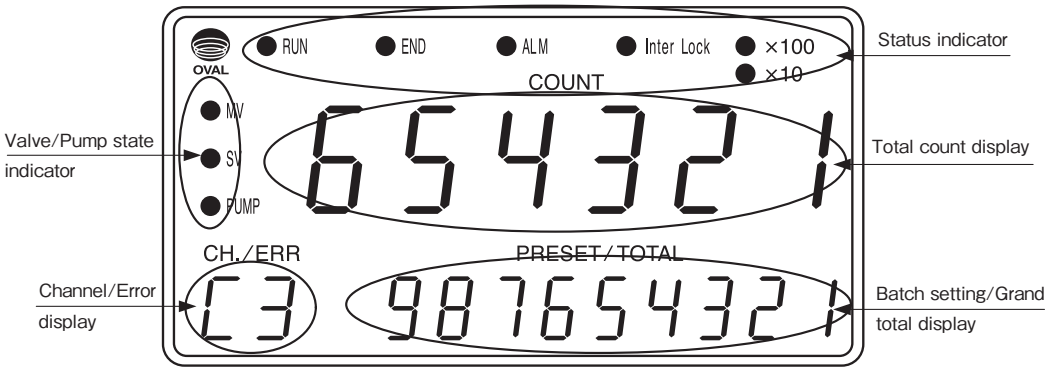


Fig. 6.1

	Name	Function
LED Yellow	RUN	Displays batch operation status. Turns on while filling. Blinks while pausing.
LED Green	END	Turns on at batch-end.
LED Red	ALARM	Turns on when an alarms is set off.
LED Blue	Inter Lock	Turns on when InterLock signal is ON. Batching enabled when ON.
LED Red	×10	Indicates that measurement unit is 10 times display. ※ 1
LED Red	×100	Indicates that measurement unit is 100 times display. ※ 1
LED Red	MV	Turns on when upper limit flow signal is ON. Turns off when OFF.
LED Red	SV	Turns on when partial flow signal is ON. Turns off when OFF.
LED Red	PUMP	Turns on when PUMP signal is ON. Turns off when OFF.
6-digit Red 7-segment LED	COUNT	Displays batch total count.
6-digit Red 7-segment LED	PRESET	Displays batch setting.
9-digit Red 7-segment LED	TOTAL	During standby: Displays each parameter with the ▼ and ▲ buttons. During batch operation: Displays cumulative total value by turning ON the ▼ button. ※ 2 Displays instantaneous flowrate by turning ON the ▲ button.
2-digit Red 7-segment LED	CH. No.	Displays the selected channel number. ※ 3
2-digit Red 7-segment LED	ERR. CODE	Displays the error code when an alarm is set off. ※ 4

➡NOTES: ※1：When both turned on, measurement unit is 1000 times display.
※2：Time display set for the parameter.
※3：Channel Display
C1：Channel 1 (Free setting channel)
C2 to 6：Channel 2 to 6
※4：Error Display

E0：Internal Communication Error	E5：Temperature Upper Limit	EA : Instantaneous flowrate Upper Limit Error
E1：Missing Pulse Alarm	E6：Temperature Lower Limit	
E2：Overfill Alarm	E7：Internal Assembly Abnormality	EP : Parameter Error
E3：Leak Alarm	E8：Internal Assembly Abnormality	EF : FRAM Error
E4：InterLock Alarm	E9：Loading Error	

※ At start-up, software version is displayed:
Top row: Display board, Bottom row: Batch board, analog board

6.2 Pushbutton Functions

On the front panel, there are three pushbuttons for batch operation (STOP, RESET, and START), another three pushbuttons for settings (SET, ▲, and▼), and a cam switch.

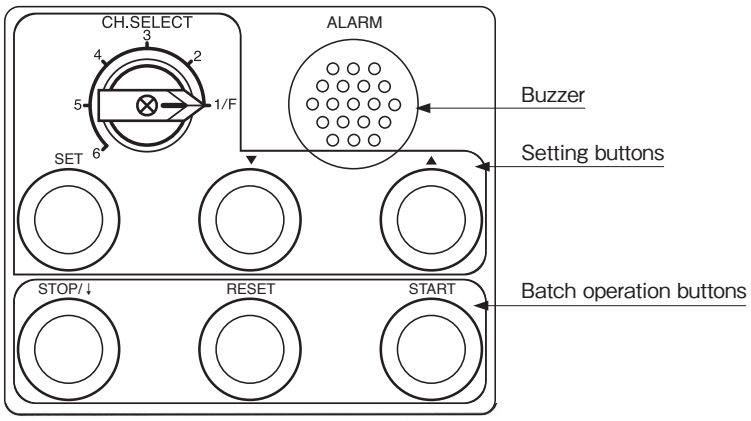


Fig. 6.2

	Label	Function
Setting buttons	CH, SELECT	Channel selection (digit selection during parameter setting changes)
	SET	When changing channels, input batch setting value confirmation (Button color: Black) When one channel is specified, press and hold it to move to the batch quantity setting mode
	▼	During standby: Switches parameters displayed When setting parameter: Increase the numerical value by 1 During batch operation: Displays cumulative total value ※1 (Button color: Black)
	▲	During standby: Changes parameters displayed When setting parameter: Increase the numerical value by 1 During batch operation: Displays instantaneous flowrate ※1 (Button color: Black)
Batch operation buttons	STOP/↓	Temporarily stops batch operation When alarm is issued: Stops buzzer Moving from parameter setting screen to standby screen (Button color: Red)
	RESET	Resets batch-end status or cancels alarm (Button color: yellow)
	START	Start batching (When operation is on hold, restart batching) (Button color: green)
Buzzer	ALARM	Buzzer sound when alarm is on

➡NOTES: ※1：Display stays on during depression of ▼button. Display duration can be configured by parameter setting.

STOP+RESET ：Cancel batch operation

SET+▼ ：
SET+ Power-on ： } Transition to parameter set mode (disabled during batch operation)

6.3 Parameter Display Function During Standby

Each parameter can be checked in a standby state before starting batch operation.

Press the ▼ or ▲ button to change the contents displayed on the lower LED display (channel/error display section, and batch setting/grand total display section).

➡ NOTE: Batch operation cannot be started while P1 to P6 are displayed.

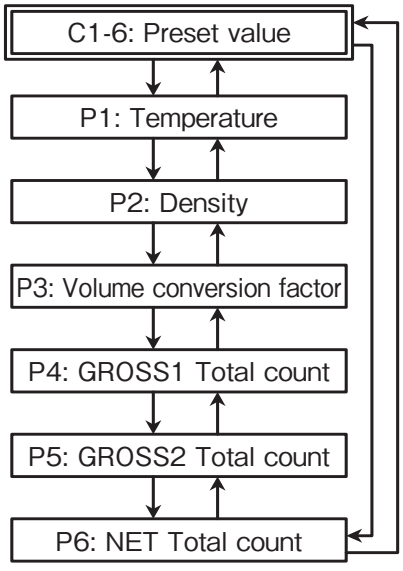


Fig. 6.3

7. OPERATION

7.1 Preparation

(1) Inspect the batch controller and related instruments for any parts that are improper or incomplete, such as installation, piping, and wiring.

> **⚠ WARNING**
> **Ensure that the power terminals are connected to a source of the rated voltage. Applying an incorrect supply voltage may ruin the controller.**

(2) Make sure that installation and wiring of the continuous flow valve are complete and in place. Refer to the instruction manual of the valve for details.

7.2 Function Check before Operation

After stopping the flow of the measured fluid, confirm the valve function by following the steps below. (Conduct this function check on a daily basis.)

(1) Supply power to the batch controller.
(2) Configure batch settings at preferred values.
(3) See if the continuous valve opens by pressing the START button.
(4) See if the continuous valve closes by pressing the STOP button.
(5) Repeat (3) and (4) a few more times and make sure that the continuous valve works properly.
(6) If remote control is planned to be used, test the function by conducting steps (3) through (5).

7.3 Operation Procedures (local mode)

(1) Turn the power on.
(2) Configure batch settings referring to "7.4 Batch Setting Configuration".
(3) Press the RESET button to reset total count.
(4) Initiate batching operation by pressing the START button.
(5) If you wish to reuse the previous batch setting, you can do so by resetting the total count and pressing the START button.
➡ NOTE: You are required to set batch setting whenever a different batch setting needs to be used.
(6) By pressing the STOP button, batching operation will pause and the continuous flow valve will be completely closed.
Pressing the START button will resume the batching operation from the point where it is paused.
If you wish to abort the operation, press the STOP and RESET buttons after pausing.

> **⚠ CAUTION**
> **The batch controller will not start the operation if it receives any pulse before pressing the START button after pressing the RESET button.**

7.4 Batch Setting Configuration

There are 2 methods to configure batch setting.

(1) Select saved batch setting with the cam switch.

CH. No. 2 to 6 fixed batch settings

(2) Set preferred batch setting with front panel buttons.

CH. No. 1 Free batch setting

Fixed batch settings need to be programed beforehand in parameter setting.

Conditions under which batch setting amount cannot be changed:
If the following conditions are satisfied, setting cannot be performed.
(1) When an alarm is generated
→ Take measures appropriate for each alarm to cancel the alarm (See 7.6 Alarm Operation).
(2) When batch completion is output
→ Press the RESET button to cancel batch completion.
(3) During batch operation
→ Wait until the batch in progress is completed, or cancel the batch.
(See 7.5 (8) Batch Cancel Operation)

● How to set fixed batch setting

(1) Turn the cam switch to point to channel 2 to 6.

(2) Selected channel number on the CH. No. display starts blinking.

(3) Press the SET button.

(4) Batch setting is set and the channel number on the display stops blinking.

(5) Press the START button.

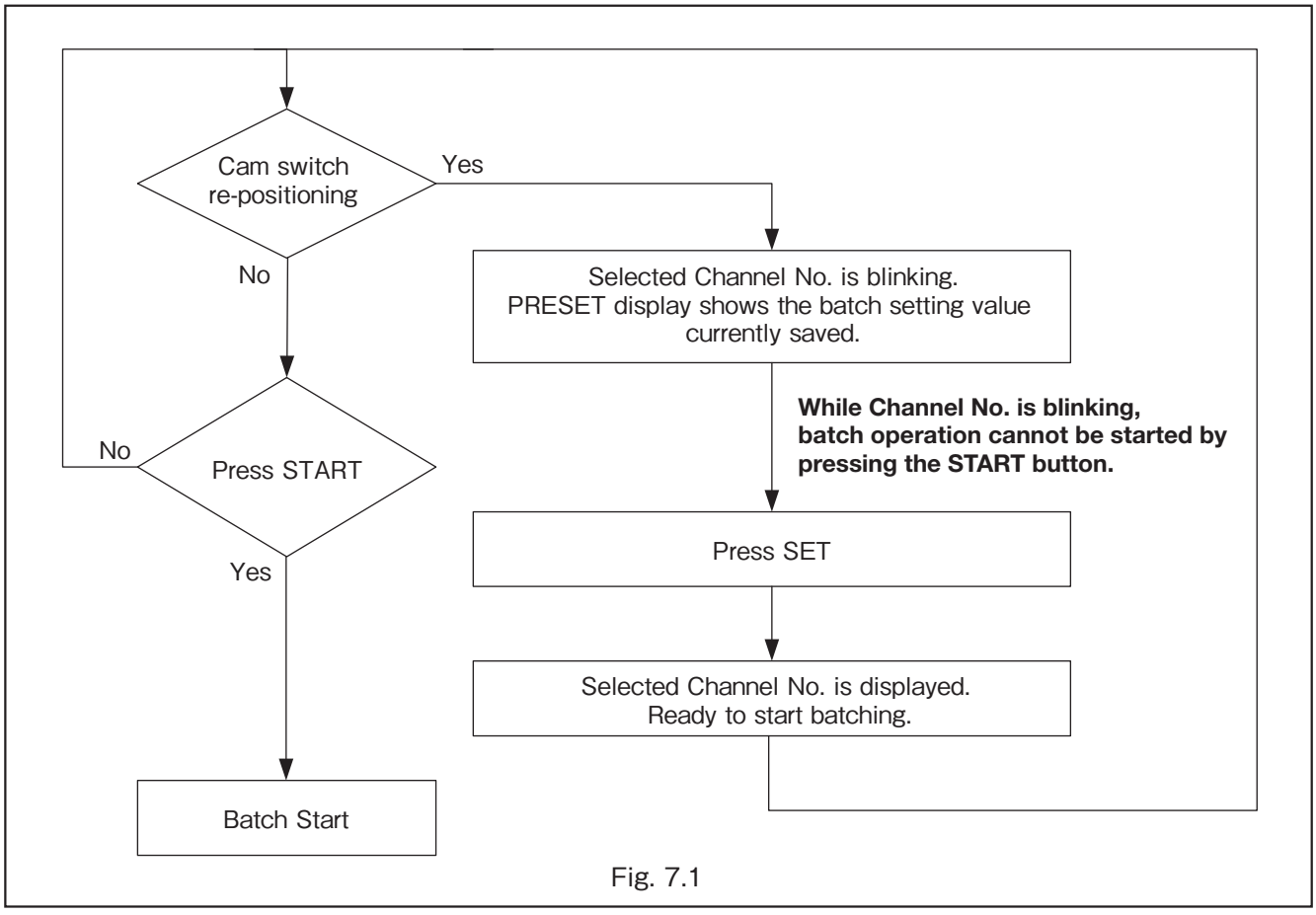


Fig. 7.1

● How to configure CH. No.1 Free batch setting

Follow the chart below.

Point the cam switch to "1/F" and hold down the SET button for 3 seconds.

↓

The count display (7-segment LED) will start blinking. Batch setting is enabled.

↓

Adjust the value with buttons ▼, ▲, and cam switch.
Digit selection : Turn the cam switch
Value setting : ▼button -1, ▲button +1

↓

- ● Turn the cam switch back to "1/F" after entering preferred batch setting.
- ● Press the SET button to set the entered batch setting to Channel 1. The Channel display starts blinking (transition to channel selection state). The buzzer sounds (1 sec).
  (Pressing the SET button will not set the batch setting unless the cam switch is turned to "1/F". In such cases, the buzzer will sound briefly.)
  If the STOP button is pressed in stead of the SET button, the entered value is discarded and the channel display starts blinking (Cancel).
- ● Press the SET button again to return to the standby state. (Channel confirmed)

Each switch or button corresponds to the display as shown below.

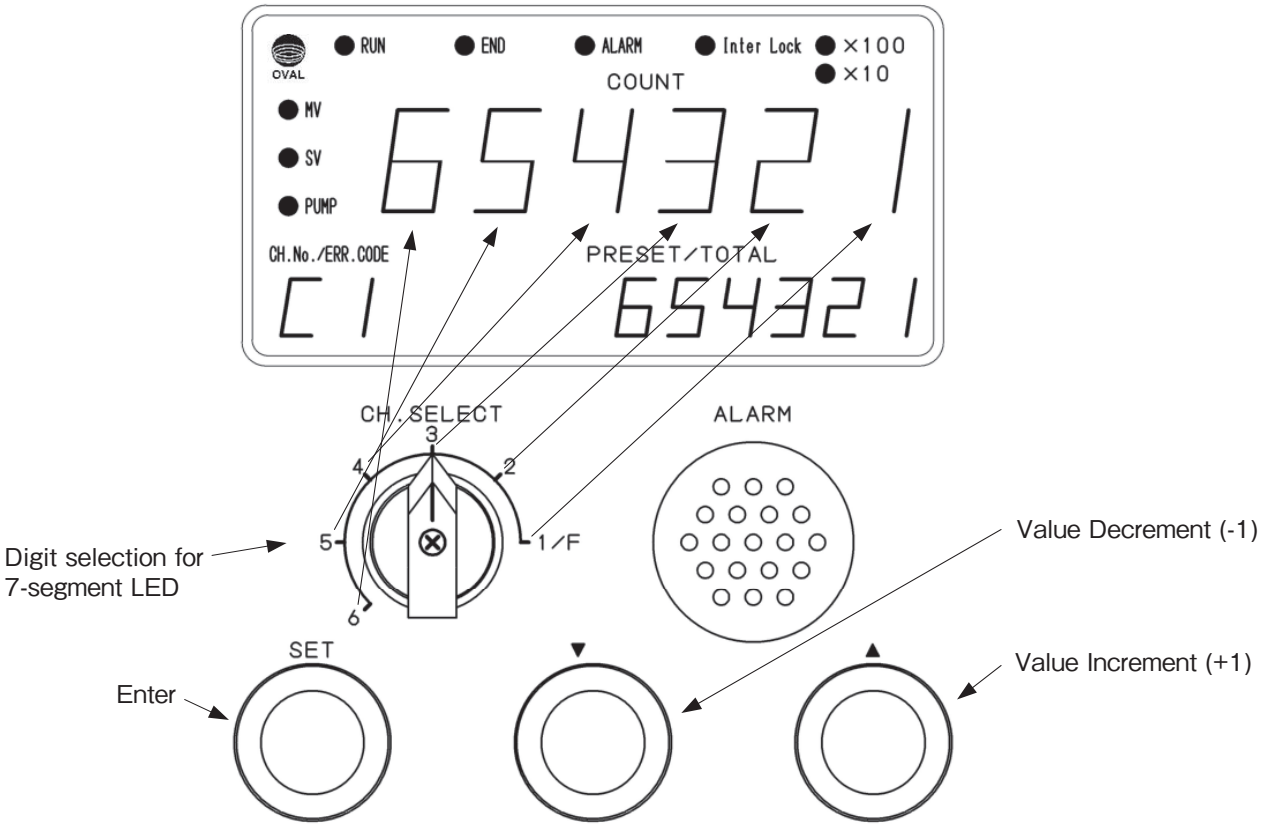


Fig. 7.2

7.5 Batching Functions

(1) Normal Operation

As you press the START button, the valve opens at a predefined position.
The valve fully opens when flow of the fluid reaches a certain amount (Initial setting = from Point A to Point B).
As it reaches Point C, the valve automatically closes to a predefined position.
At Point D, a signal will be generated to shut the valve, but because of valve operation delay, the valve fully closes at Point E.
If overshoot exceeds a certain amount, an alarm will be set off.
Note that the position of the valve (for Point A→B and C→D) needs to be defined beforehand.

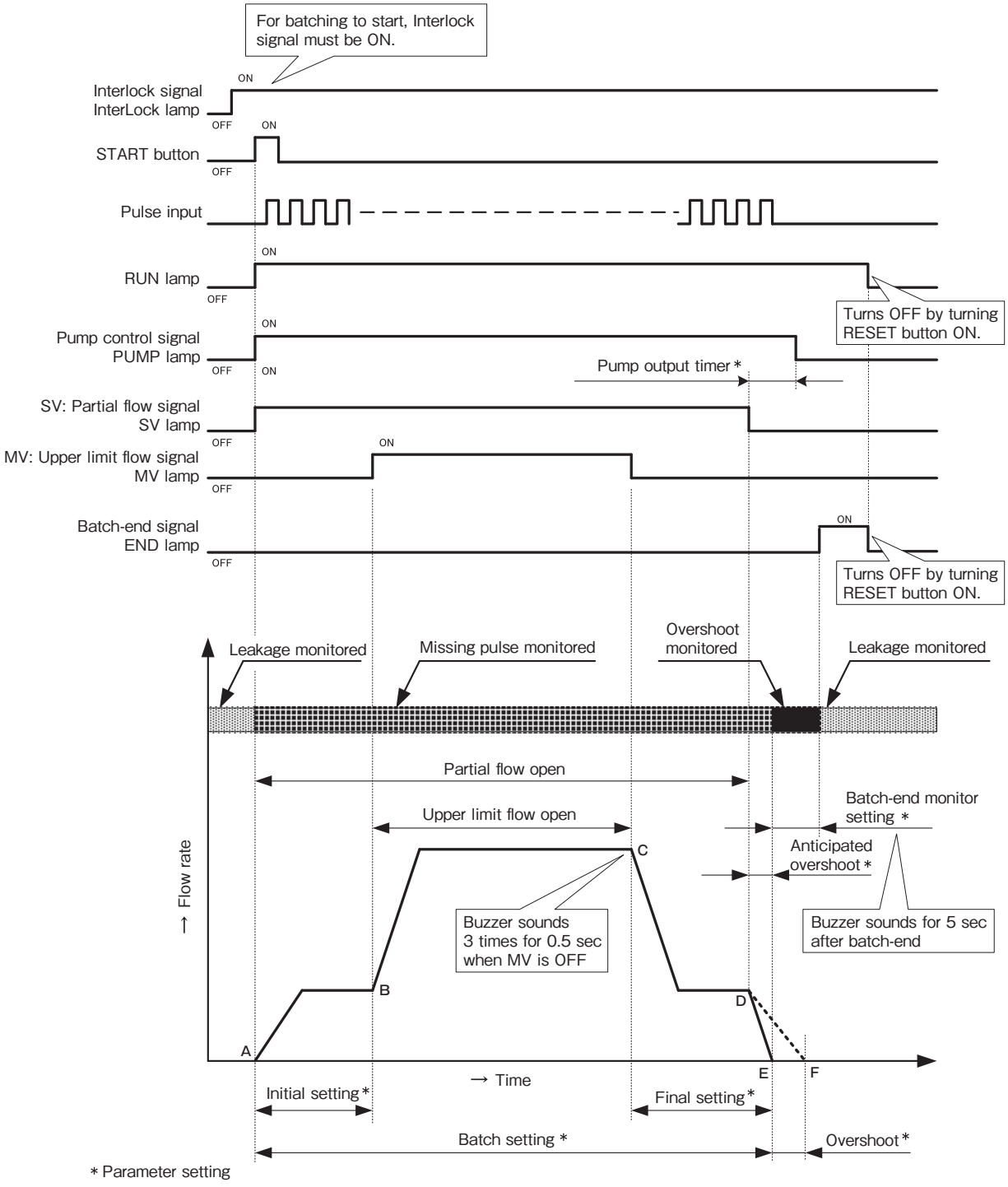


Fig. 7.3

(2) Pausing Operation

By pressing the STOP button, SV/MV output turns OFF and operation will be paused.
PUMP output will turn OFF after pump output timer expires.
Operation will resume when the START button is pressed.

If the operation is paused during upper limit flow rate, the operation differs depending on the setting of the valve control specifications at the time of restart. When the setting is MV, both SV and MV turn on at upper limit flow rate. When the setting is SV, only SV turns on at partial flow rate. When the value is added from the count value at the time of stop and reaches the initial setting, MV turns on at upper limit flow rate.
When the operation is paused at partial flow rate, only SV turns on by restarting, therefore operating at partial flow rate.

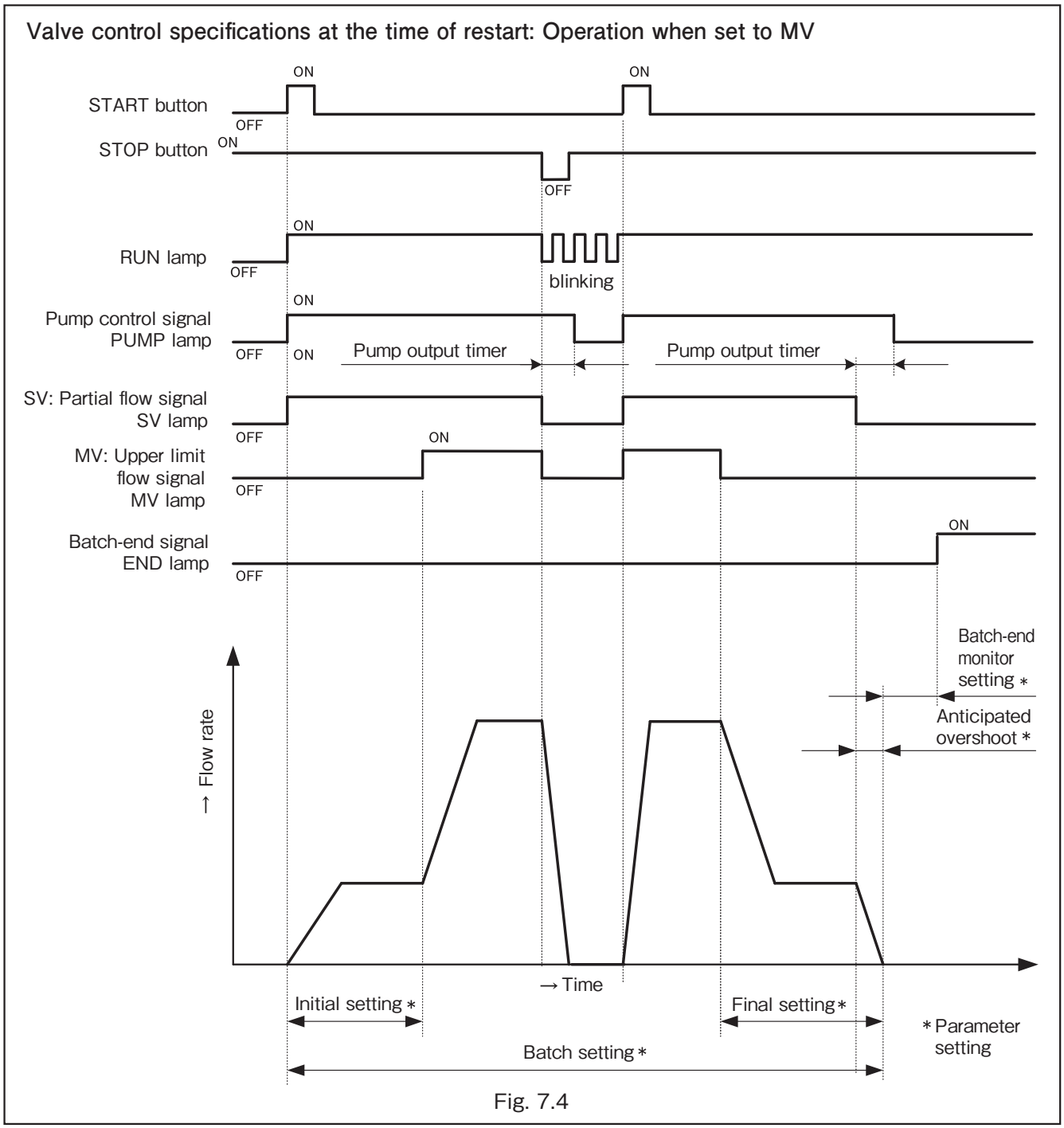


Fig. 7.4

Valve control specifications at the time of restart: Operation when set to SV

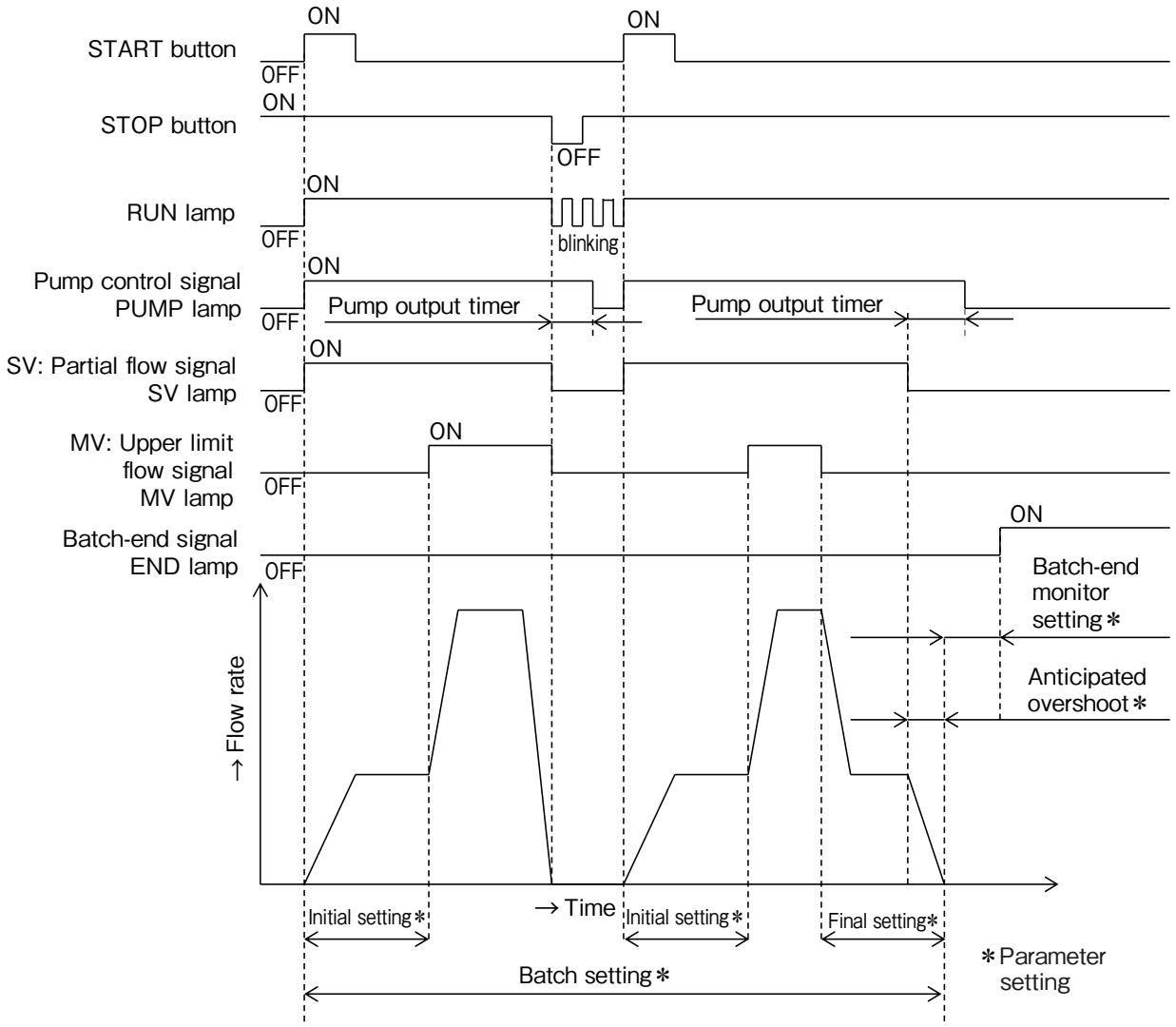


Fig. 7.5

(3) Batch Operation Setting

This controller is capable of five patterns of batch measurement operations using four parameters listed below:

- Initial Setting
- Final Setting
- Batch setting
- Anticipated Overshoot

Each pattern is explained as follows:

1) 2-stage open, 2-stage close

When the following conditions are satisfied:

Initial setting ≠ 0	and	Final setting > Anticipated overshoot

Operation

(1) SV output begins when the START button is pressed.
(2) MV output starts once "Total count" reaches "Initial setting".
(3) MV output stops when "Total count" reaches "Batch setting - Final setting".
(4) SV output stops when "Total count" reaches "Batch setting - Anticipated overshoot".

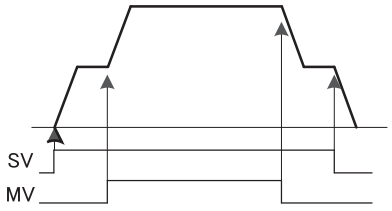


Fig. 7.6

2) 2-stage open, 1-stage close

When the following conditions are satisfied:

Initial setting ≠ 0	and	Final setting ≦ Anticipated overshoot

Operation

(1) SV output begins when the START button is pressed.
(2) MV output starts once "Total count" reaches "Initial setting".
(3) Both MV output and SV output will stop when "Total count" reaches "Batch setting - Anticipated overshoot".

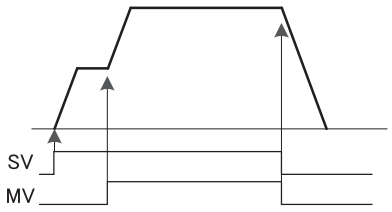


Fig. 7.7

3) 1-stage open, 2-stage close

When the following conditions are satisfied:

Initial setting = 0 and Final setting > Anticipated overshoot

Operation

(1) Both MV output and SV output will turn ON when the START button is pressed.
(2) MV output stops once "Total count" reaches "Batch setting - Final Setting".
(3) SV output will stop when "Total count" reaches "Batch setting - Anticipated overshoot".

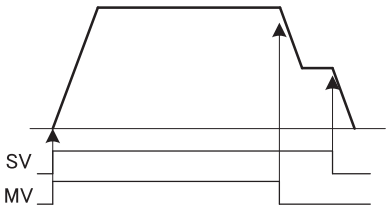


Fig. 7.8

4) 1-stage open, 1-stage close

When the following conditions are satisfied:

Initial setting = 0 and Final setting ≦ Anticipated overshoot

Operation

(1) Both MV output and SV output will turn ON when the START button is pressed.
(2) Both MV output and SV output turn OFF once "Total count" reaches "Batch setting - Anticipated overshoot".

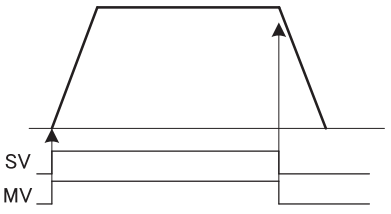


Fig. 7.9

5) 1-stage open, 1-stage close (SV only)

When the following conditions are satisfied:

Batch setting ≦ Initial setting + Final setting or Batch setting ≦ Initial setting + Anticipated overshoot

Operation

(1) SV output will turn ON when the START button is pressed.
(2) SV output turns OFF once "Total count" reaches "Batch setting - Anticipated overshoot".

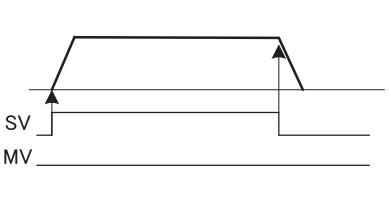


Fig. 7.10

(4) Batch Start Restraining Conditions

When the following conditions are present, batching operation will not start by pressing the START button.

Condition	Countermeasure
Total count is not "0"	Set total count to "0" by pressing the RESET button
END lamp is ON	Set total count to "0" by pressing the RESET button
ALARM lamp is ON	Cancel the alarm by pressing the RESET button
InterLock lamp is OFF	Turn the InterLock signal ON
Remote "STOP input" is OFF	Turn remote STOP input ON.
CH. No. display is blinking	Confirm batch setting then press the SET button. CH. No. display will stay turned on.
Total count is blinking	Exit batch setting configuration mode
Total count is blinking	Exit parameter setting mode
Batch setting is "0"	Configure batch setting
Batch setting ≦ Anticipated overshoot	Set batch setting higher than anticipated overshoot
Buzzer is ON	Stop buzzer by pressing the STOP button, and cancel alarm
Batch setting > Upper limit	Adjust batch setting bellow the upper limit
Every SELECT CH. bit is OFF	Turn ON any SELECT CH. bit. (If remote operation is enabled by parameter.)
Temperature input value exceeds set range	Enter the temperature input value within the range
Parameter Display is shown (P1 to P6)	Switch to CH. No. Display (Switch with ▲ / ▼ button)

(5) Operation During Electrical Outage

If there is an electrical outage during batch operation, the batch controller will operate as follows:

Electrical Outage →

Batch operation → Paused
Total count up to electrical outage is restored on the memory.

Pump operation → Without pump output timer, pump output turns OFF at the same time as electrical outage.

Electricity Restored →

Batch operation → Paused

Pump operation → Stopped

- Pressing the START button will resume the operation.
  Press the STOP and RESET buttons to cancel.

(6) Batch Setting Upper Limit

- By setting an upper limit, values exceeding the upper limit cannot be set as a batch setting.
- Values exceeding the upper limit cannot be set during parameter setting for C1 to C6.
- Batching will not begin if values exceeding the upper limit are already configured to channels C1 to C6.

(7) Remote Setting Mode

When the parameter setting item [0 d] (see 8.1 Parameter List) is set to 1, channel selection and batch operation can be performed externally.
In this case, the CH./ERR display will show a dot between two digits (e.g. C.1).

Mode	Function	Pushbutton	Remote setting	Example of front CH display
Remote setting mode	START/STOP RESET	○	○	C. 1
	CH. SELECT	×	○	
Front panel setting mode	START/STOP RESET	○	○	C 1
	CH. SELECT	○	×	

Combination of each SEL terminal and CH

	CH.1	CH.2	CH.3	CH.4	CH.5	CH.6
SEL 0	ON	OFF	ON	OFF	ON	OFF
SEL 1	OFF	ON	ON	OFF	OFF	ON
SEL 2	OFF	OFF	OFF	ON	ON	ON

If all bits of the external SEL terminal are OFF or ON, C.0 is displayed on the display and the operation cannot be started. If CHs are switched during batch operation, the CH at the time of start is retained, but if the CH is C.0, the operation stops temporarily.
If CHs are switched in the temporarily stopped condition, the operation can be performed with the batch amount set for the CH to be switched, but if the current count exceeds the batch amount, the operation finishes or H2: Overfilling Alarm is generated.

(8) Batch Cancellation

To cancel batching operation while in progress, pause the operation first, then press the STOP and RESET buttons. Total count will be reset to "0".
If you press the STOP and RESET buttons while pump is operating, batching will pause regardless of pump output timer setting.

(9) Reset-start Function

Normally, batching cannot start without resetting after prior batching operation is complete. However, once the reset-start function is activated on parameter setting, starting a new batch without resetting will be possible. However, while the buzzer is sounding or the alarm is being generated, batch operation does not start unless the buzzer or the alarm is cancelled.

(10) InterLock Function

Batch operation cannot start while remote interlock signal is turned OFF.
InterLock alarm will be generated if interlock signal turned OFF during batch operation, pausing the batch operation at the same time.
If you do not intend to use the interlock function, a jumper must be placed for corresponding terminals on the terminal block.

(11) Correction Function

Implement correction processing with the software of the CPU. The correction flow is as shown in Fig. 7.11. For both counters for batch count and total count, fractions after decimal point will be cleared at every batch.

※ Set the parameters so that the total of all conversion factors will be 1.99999 or less.

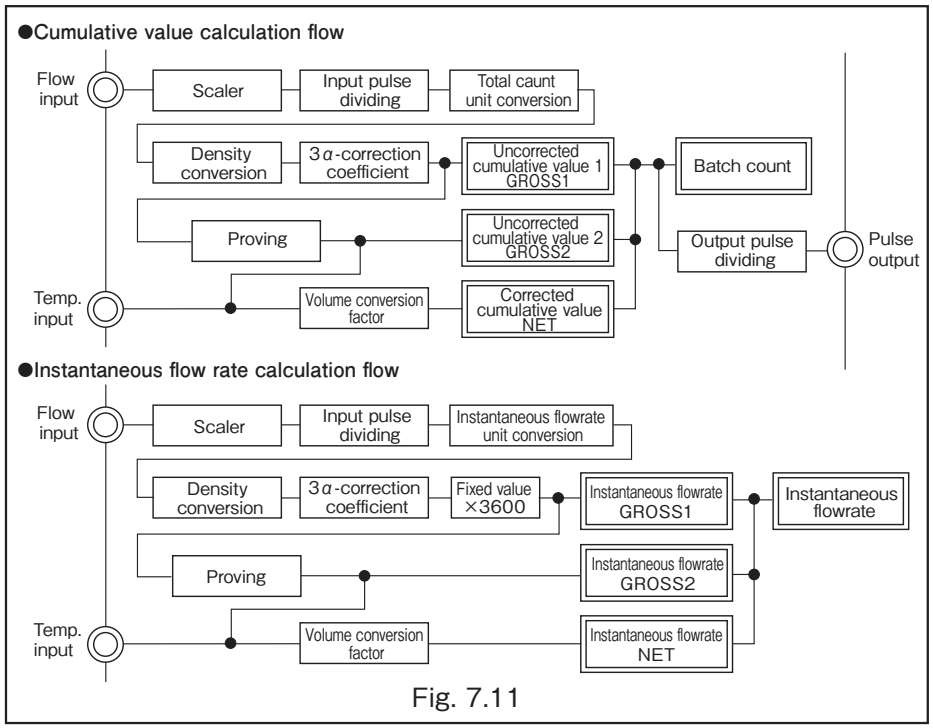


Fig. 7.11

- Scaler: When the batch controller receives unscaled pulse signals, it will round the signals to an integered industrial unit by multiplying a constant that is specific to the flowmeter.
- Pulse division function: Input pulse dividing divides input pulse to one tenth, one hundredth, one thousandth or one ten-thousandth. When "tenth" is selected, the counter will count every 10 pulses. Output pulse dividing divides output pulse to one tenth or one hundredth.
- Cumulative value unit conversion: Performs unit conversion by multiplying the cumulative value by a factor.
- Instantaneous flow rate unit conversion: Performs unit conversion by multiplying the instantaneous flow rate by a factor.
- Density conversion: Performs mass conversion by multiplying the reference density.
- Proving: Corrects the eigenvalue of prover by multiplying the proving factor.

The following corrections are available only for the high-performance type (with temperature input).

- 3 α -correction: Uses a coefficient of cubical expansion for the material of the measuring instrument to correct volume increase due to fluid temperature.
- Temperature correction: Performs correction operation based on temperature.

※ For details of 3 α -correction and temperature correction, refer to p.46.

7.6 Alarm Functions

There are 13 types of alarms as listed below:

E0 Internal Communication Error	E5 Temperature Upper Limit	EA Instantaneous Flow Rate Upper Limit Error
E1 Missing Pulse Alarm	E6 Temperature Lower Limit	EP Parameter Error
E2 Overfill Alarm	E7 Internal Assembly Abnormality 1	EF FRAM Error
E3 Leak Alarm	E8 Internal Assembly Abnormality 2	
E4 InterLock Alarm	E9 Loading Error	

A buzzer will sound either for a predefined time or until the STOP button is pressed from the moment an alarm is generated. The buzzer can sound continuously until alarm cancelation if it is configured so on parameter setting. Batching operation cannot start while the overshoot alarm or leak alarm is present.
Even if multiple alarms occur at the same time, the alarm functions will operate according to each of the following alarm functions.
Moreover, the alarm functions will not stop until all the conditions that generated the alarms are cleared.

E0: Internal Communication Error

An internal communication error will be generated when communication between CPUs is abnormal.
If powering ON/OFF does not stop the alarm, the circuit board can be failing. Please contact OVAL.

Signal Output	Cancel
Buzzer: ON	STOP button
ALARM lamp : ON ALARM output : ON SV – MV output : OFF	Power ON/OFF RESET+STOP button

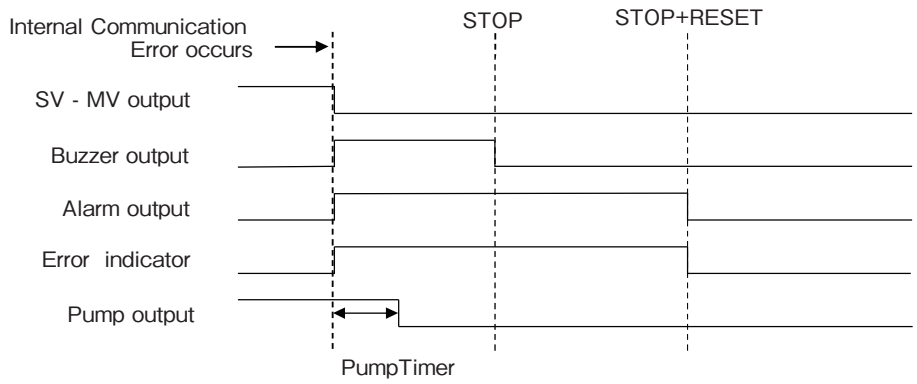


Fig. 7.12

E1: Missing Pulse Alarm

A missing pulse alarm will be generated when the batch controller does not receive setting time (missing pulse time) pulse by the time total count reaches batch setting after batch start.
Pulse monitoring will not start until 5 seconds after batch is started.
Alarm will not be monitored when it is set at "0".

Signal Output	Cancel
Buzzer: ON	STOP button
ALARM lamp : ON ALARM output : ON	STOP after buzzer OFF
SV – MV output : OFF Pump output : OFF after pump output timer	

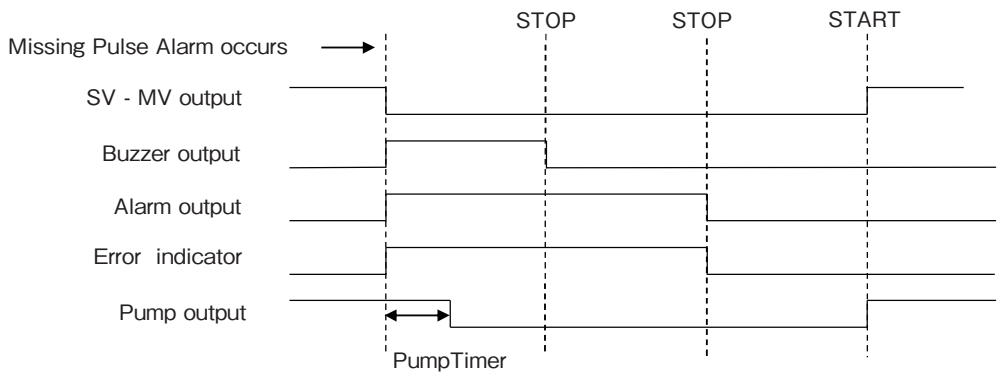


Fig. 7.13

E2: Overfill Alarm

An overshoot alarm is generated when total count exceeds "Batch setting + Overshoot".
Presence of this alarm will be monitored from the point, "Total count = Batch setting" through batch-end.
When batch setting is "0", alarm will not be monitored.

Signal Output	Cancel
Buzzer: ON	STOP button
ALARM lamp : ON ALARM output : ON	RESET button after buzzer is OFF. Total count resets as alarm is canceled.
Batch operation is complete (END) Pump output : OFF after pump output timer	

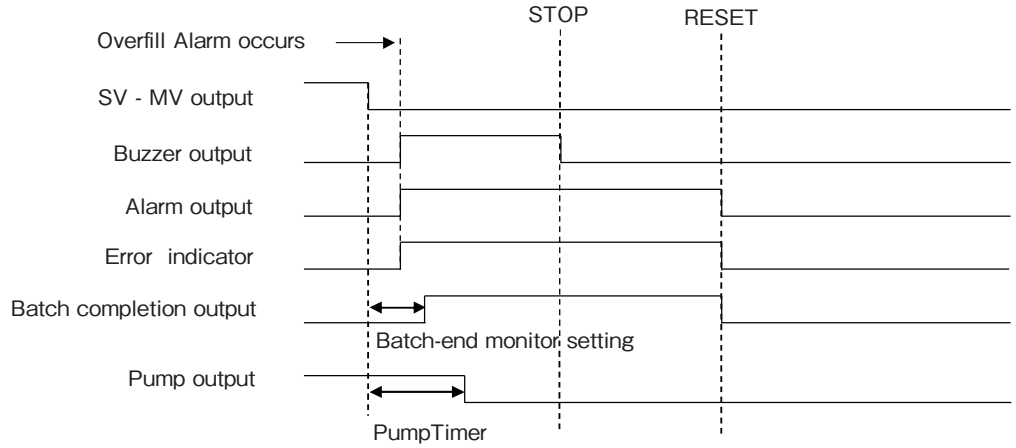


Fig. 7.14

E3: Leak Alarm

This alarm is generated when a pulse greater than the set amount (set value for leakage abnormality) is input between the completion of a batch (END) and the start of the next batch.
When leak error setting is "0", alarm will not be monitored.

Signal Output	Cancel
Buzzer: ON	STOP button
ALARM lamp : ON ALARM output : ON	Turn interlock signal ON and press the STOP button after buzzer is OFF.

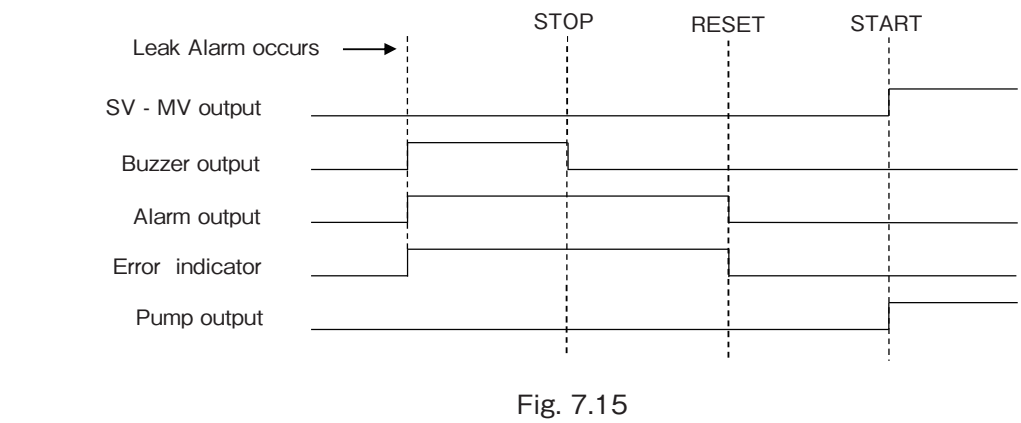


Fig. 7.15

E4: Interlock Alarm

An interlock alarm will be generated when interlock signal becomes OFF between the beginning of batch and batch-end.
When the interlock signal becomes OFF, the interlock LED on the front display panel turns off. (Refer to Fig. 6.1.)

Signal Output	Cancel
Buzzer: ON	STOP button
ALARM lamp : ON ALARM output : ON	Turn interlock signal ON and press the STOP button after buzzer is OFF.
SV – MV output : OFF Pump output : OFF after pump output timer	

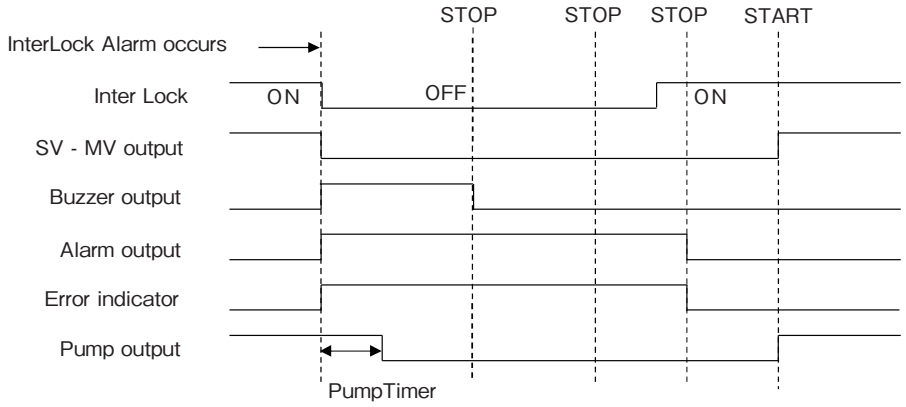


Fig. 7.16

E5: Temperature Upper Limit

A temperature upper limit alarm is generated when the measured temperature equals to or exceeds the value set as the temperature upper limit alarm value.

Signal Output	Cancel
Buzzer: ON	STOP button
ALARM lamp : ON ALARM output : ON	STOP after buzzer OFF
SV – MV output : OFF Pump output : OFF after pump output timer	

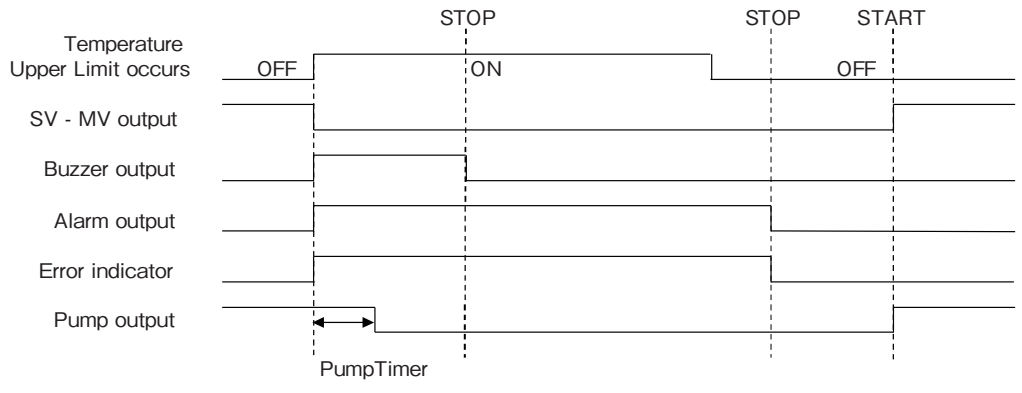


Fig. 7.17

E6: Temperature Lower Limit

A temperature lower limit alarm is generated when the measured temperature equals to or falls below the value set as the temperature lower limit alarm value.

Signal Output	Cancel
Buzzer: ON	STOP button
ALARM lamp : ON ALARM output : ON	STOP after buzzer OFF
SV – MV output : OFF Pump output : OFF after pump output timer	

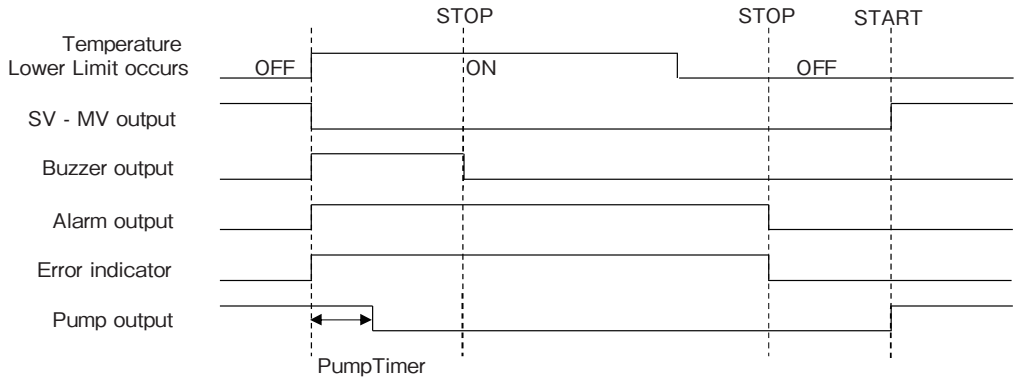


Fig. 7.18

E7: Internal Assembly Abnormality 1

An abnormality is occurring in the internal assembly. Please consult OVAL sales office or nearest representative.

E8: Internal Assembly Abnormality 2

An abnormality is occurring in the internal assembly. Please consult OVAL sales office or nearest representative.

E9 : Loading Error

A loading error is generated when the loading status (Parameter number: B3) becomes [1]→[0] while the batch operation mode is set to "Remote."

Signal Output	Cancel
Buzzer: ON	STOP button
ALARM lamp : ON ALARM output : ON	RESET after buzzer OFF
SV – MV output : OFF Pump output : OFF after pump output timer	

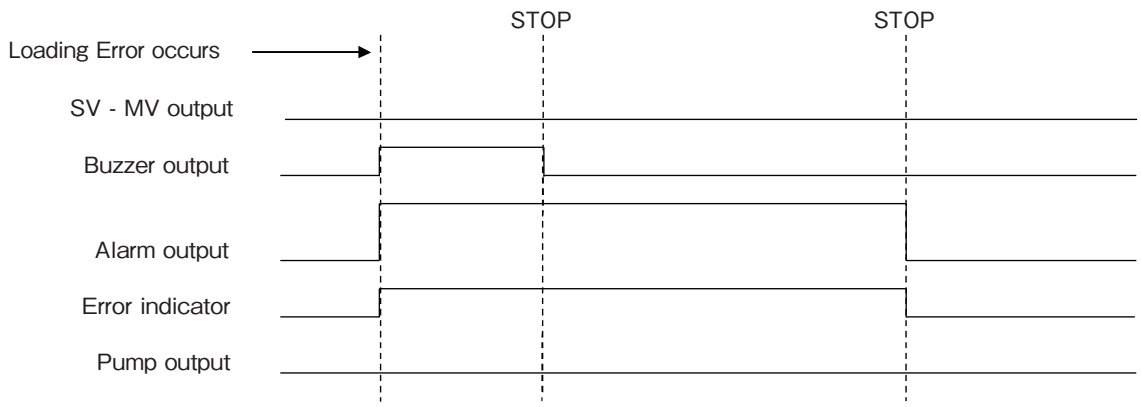


Fig. 7.19

EA: Instantaneous Flow Rate Upper Limit Error

An instantaneous flow rate upper limit error is generated when the instantaneous flow rate exceeds the instantaneous flow rate upper limit alarm value.
Alarm will not be monitored when the set value is "0."

Signal Output	Cancel
Buzzer: ON	STOP button
ALARM lamp : ON ALARM output : ON	STOP after buzzer OFF
SV – MV output : OFF Pump output : OFF after pump output timer	

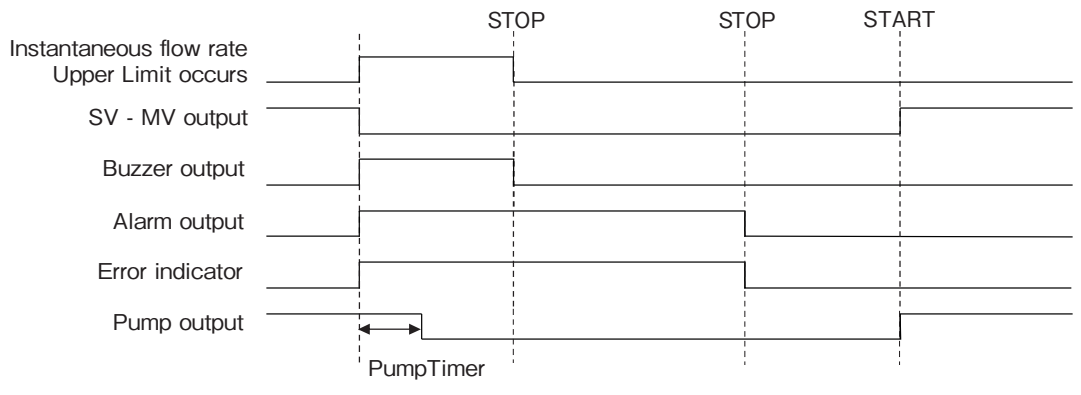


Fig. 7.20

EP: Parameter Error

Parameter errors occur when there is an abnormality in memory access or setting data.
Conditions for occurrence

① When access to memory fails at the time of parameter change
② When the parameter save data is damaged when the power is turned on

How to deal with it

① If an error occurs at the time of parameter change, parameters may have not been changed due to some factor (e.g., transient noise). Clear the error, and then change the parameters again. If the error occurs repeatedly, the memory may be faulty. In such a case, please contact our service department.
② If an error occurs when the power is turned on, it is necessary to initialize the parameters and then to reset them. Please contact our service department.

Signal Output	Cancel
Buzzer: ON	STOP button
ALARM lamp : ON ALARM output : ON SV – MV output : OFF Pump output : OFF after pump output timer	

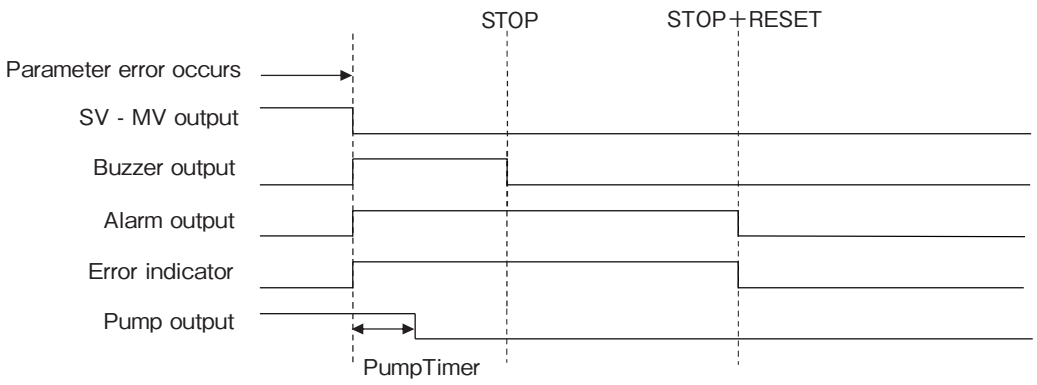


Fig. 7.21

EF: STATUS Error

A status error is generated when data of the operation mode or the total count are broken. If powering ON/OFF does not stop the alarm, the circuit board can be failing. Please consult OVAL sales office or nearest representative.

Signal Output	Cancel
Buzzer: ON	STOP button
ALARM lamp : ON ALARM output : ON SV – MV output : OFF Pump output : OFF after pump output timer	

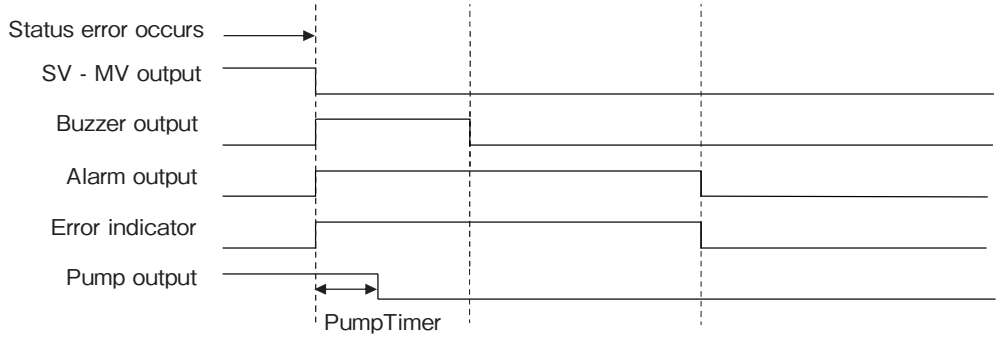


Fig. 7.22

8. PARAMETER SETTINGS

8.1 Parameter List

Table 8.1 Parameter List (1/5)

Address	No.	Parameter name	Initial value	Setting range	Unit	Description	Data type		Items displayed on screen	
									Standard type	High-performance type
7,001	C1	Channel1 Preset Value	0	0 to 999,999		Volume of batch operation for Channel 1	32 intgr	R/W	○	○
7,002										
7,003	C2	Channel2 Preset Value	0	0 to 999,999		Volume of batch operation for Channel 2	32 intgr	R/W	○	○
7,004										
7,005	C3	Channel3 Preset Value	0	0 to 999,999		Volume of batch operation for Channel 3	32 intgr	R/W	○	○
7,006										
7,007	C4	Channel4 Preset Value	0	0 to 999,999		Volume of batch operation for Channel 4	32 intgr	R/W	○	○
7,008										
7,009	C5	Channel5 Preset Value	0	0 to 999,999		Volume of batch operation for Channel 5	32 intgr	R/W	○	○
7,010										
7,011	C6	Channel6 Preset Value	0	0 to 999,999		Volume of batch operation for Channel 6	32 intgr	R/W	○	○
7,012										
7,013	01	Initial Setup Value	80	0 to 9999		Set the flow rate until MV opens	16 intgr	R/W	○	○
7,014	02	Final Setup Value	80	0 to 9999		Set the flow rate until MV closes.	16 intgr	R/W	○	○
7,015	03	Anticipated Overshoot Setting	2	0 to 99		Set the anticipated overshoot.	16 intgr	R/W	○	○
7,016	04	Overshoot Setting	2	0 to 99		Setting of the amount for overfill alarm.	16 intgr	R/W	○	○
7,017	05	Leak Pulse Setting	10	0 to 99		Set the leak error setting value. When set to "0," alarm will not be monitored.	16 intgr	R/W	○	○
7,018	06	Missing Pulse	5	0 to 999	sec	Set the missing pulse interval. When set to "0," alarm will not be monitored.	16 intgr	R/W	○	○
7,019	07	Batch-end Monitor Setting	5	0 to 99	sec	Set the time of batch-end monitoring.	16 intgr	R/W	○	○
7,020	08	Pump Timer	30	0 to 9,999	sec	Set the pump output timer.	16 intgr	R/W	○	○
7,021	09	Buzzer Duration Timer	0	0 to 999	sec	Set the time duration during which an alarm buzzer is turned ON. Set value 0: Continuous, 1-999: ON for the set period of time	16 intgr	R/W	○	○
7,022	0A	Preset Setting Upper Limit	999999	0 to 999999		Set the upper limit of batch setting.	32 intgr	R/W	○	○
7,023										
7,024	0B	Reset+Start	0	0: Disable, 1: Enable		Enable or disable RESET+START function.	16 intgr	R/W	○	○
7,025	0C	Grand Total Display	0	0 to 9		Set the value to be displayed when ▼ button is depressed. 0: Cumulative volume is displayed while ▼ button is depressed. 1-9: Automatically return to display the preset value after the set time has elapsed.	16 intgr	R/W	○	○
7,026	0d	Operation Switch	0	0: Front switch, 1: External switch		Choose the method of selecting a channel.	16 intgr	R/W	○	○
7,027	0E	Reference Cumulative Value Selection	1	0: GROSS2 1: NET 2: GROSS1		Choose the reference cumulative value for batch operation.	16 intgr	R/W	○	○
7,028	0F	Valve Control Specification at Restart	0	0:MV 1:SV		Choose the operation after returning from a pause.	16 intgr	R/W	○	○
7,029	11	Scale Factor	1.00000	0.00010 to 1.99999		Set the value of the factor that is used to determine cumulative volume.	32 float	R/W	○	○
7,030										
7,031	12	Proving Factor	1.00000	0.00010 to 1.99999		Set the value of the factor that is used to determine cumulative volume.	32 float	R/W	○	○
7,032										
7,033	13	Input Pulse Dividing	0	0:1/1 1:1/10 2:1/100 3:1/1000 4:1/10000		Set a dividing value of input pulses.	16 intgr	R/W	○	○
7,034	14	Cumulative Value Unit Coefficient	1.00000	0 to +9.9999		Set the coefficient part of the unit conversion coefficient for the cumulative value.	32 float	R/W	○	○
7,035										
7,036	15	Cumulative Value Unit Coefficient_Exponent	0	−5 to +5		Set the exponent part of the unit conversion coefficient for the cumulative value.	16 intgr	R/W	○	○
7,037	16	Unit of Coefficient	3	0:×1,000 1:×100 2:×10 3:×1 4:×0.1 5:×0.01 6:×0.001		Choose and set a multiple number of the unit.	16 intgr	R/W	○	○

Table 8.1 Parameter List (2/5)

Address	No.	Parameter name	Initial value	Setting range	Unit	Description	Data type		Items displayed on screen: Standard type	Items displayed on screen: High-performance type
7,038	17	Output Pulse Dividing	0	0:1/1 1:1/10 2:1/100		Set the dividing value of output pulses.	16 intgr	R/W	○	○
7,039	18	Output Pulse Signal Width	1	0 to 99	msec	Set the width of output pulse. When set to 0, the pulse width will be 150 μsec.	16 intgr	R/W	○	○
7,040 7,041	21	Density at Reference Temperature	1.0000	0.5000 to 1.9999	g/cm^3	Set the reference density.	32 float	R/W	○	○
7,042	22	Density Correction Selection	0	0: None, 1: Cumulative value + Instantaneous flow rate, 2: Cumulative value only, 3: Instantaneous flow rate only		Choose absence or presence of density correction calculation.	16 intgr	R/W	○	○
7,043 7,044	31	nstantaneous Flow Rate Unit Coefficient	1.0000	0 to 9.9999		Set the coefficient part of the unit conversion coefficient for the instantaneous flow rate.	32 float	R/W	○	○
7,045	32	Instantaneous Flow Rate Unit Coefficient_Exponent	0	–5 to +5		Set the exponent part of the unit conversion coefficient for the instantaneous flow rate.	16 intgr	R/W	○	○
7,046 7,047	33	Instantaneous Flow Rate Upper Limit Alarm	999999	0 to 999999		Set an instantaneous flow rate upper limit alarm value.	32 intgr	R/W	○	○
7,048	34	Average Time When Stable	1	1 to 20		Set the average number of times of movement of instantaneous flow rate in PID output.	16 intgr	R/W		○
7,049	41	Analog Mode	0	Analog board 0: Present, 1: Absent		Enable or disable the analog function. ON only in the case of high-performance specifications.	16 intgr	R/W		
7,050	42	Instantaneous Flow Rate Correction	1	0: With correction, 1: Without correction		Selection of temperature correction for instantaneous flow rate.	16 intgr	R/W		
7,051	51	emperature Correction Arithmetic Table Selection	2	0: None, 1: Crude oil, 2: Fuel oil, 3: Lubrication oil, 4: Unused, 5: Unused, 6: Other chemical fluid		Choose an arithmetic table for temperature correction.	16 intgr	R/W		
7,052 7,053	52	Reference Temperature of Fluid	15	–20.0 to 160.0		Set the reference temperature value.	32 float	R/W		
7,054 7,055	53	Parameter for special response	50			This is for special response, and not normally used. Do not change this.	32 float	R/W		
7,056 7,057	54	A1 Coefficient Part when [7051: 6]	0	–9.9999 to +9.9999		Set the coefficient part of Coefficient A1 used when [7051] is set to “6: Other chemical fluid.”	32 float	R/W		
7,058	55	A1 Exponent Part when [7051: 6]	0	–9 to +0		Set the exponent part of Coefficient A1 used when [7051] is set to "6: Other chemical fluid."	16 intgr	R/W		
7,059 7,060	56	A2 Coefficient Part when [7051:6]	0	–9.9999 to +9.9999		Set the coefficient part of Coefficient A2 used when [7051] is set to “6: Other chemical fluid.”	32 float	R/W		
7,061	57	A2 Exponent Part when [7051: 6]	0	–9 to +0		Set the exponent part of Coefficient A2 used when [7051] is set to “6: Other chemical fluid.”	16 intgr	R/W		
7,062 7,063	58	B Coefficient Part when [7051:6]	1	–9.9999 to +9.9999		Set the coefficient part of Coefficient B used when [7051] is set to “6: Other chemical fluid.”	32 float	R/W		
7,064	59	B Exponent Part when [7051: 6]	0	–5 to +5		Set the exponent part of Coefficient B used when [7051] is set to "6: Other chemical fluid."	16 intgr	R/W		
7,065	5A	Temperature Input Method	0	0: Fixed, 1: Pt, 2: JPt, 3: 4-20mA		Choose a temperature input method.	16 intgr	R/W		
7,066 7,067	5b	Measured Temperature when [7065: 0]	15	–20.0 to 160.0		Temperature setting when [7065] is set to “0: Fixed.”	32 float	R/W		
7,068 7,069	5C	Temperature when Temperature Port is 4mA	-20	–20.0 to 160.0		Set the temperature value at 4mA (1V) in external temperature input (4-20mADC or 1-5VDC).	32 float	R/W		
7,070 7,071	5d	Temperature when Temperature Port is 20mA	160	–20.0 to 160.0		Set the temperature value at 20mA (5V) in external temperature input (4-20mADC or 1-5VDC).	32 float	R/W		
7,072 7,073	5E	Upper Temperature Limit Alarm Value	160	–20.0 to 160.0		Set the temperature value at which the upper temperature limit alarm is generated.	32 float	R/W		○

Table 8.1 Parameter List (3/5)

Address	No.	Parameter name	Initial value	Setting range	Unit	Description	Data type		Items displayed on screen	
									Standard type	High-performance type
7,074 7,075	5F	Lower Temperature Limit Alarm Value	-20	-20.0 to 160.0		Set the temperature value at which the lower temperature limit alarm is generated.	32 float	R/W		○
7,076	61	Selection of 3α-correction	0	0: Without correction, 1: With correction		Choose presence or absence of 3α-correction.	16 intgr	R/W		
7,077 7,078	62	Linear Expansion Coefficient for 3α-correction	0.000016	0.0000000 to 0.0000600		Set the linear expansion coefficient used for 3α-correction.	32 float	R/W		
7,079	71	Parameters for Special Response	0			These parameters are for special response, and are not used normally. Do not change them.	16 intgr	R/W		
7,080 7,081	72		0				32 float	R/W		
7,082 7,083	73		1				32 float	R/W		
7,084	74		0				16 intgr	R/W		
7,085 7,086	75		1				32 float	R/W		
7,087 7,088	76		0				32 float	R/W		
7,089 7,090	77		9.8066				32 float	R/W		
7,091 7,092	78		9.8066				32 float	R/W		
7,093 7,094	79		0				32 float	R/W		
7,095	81	Analog Output Selection	0	0: None, 1: PID, 2: Special specification		[Selection of analog output function]	16 intgr	R/W		
7,096 7,097	82	Instantaneous Flow Rate at 4mA	0	0 to 999999		Set the instantaneous flow rate when PID output and instantaneous analog output are 4mA.	32 float	R/W		○
7,098 7,099	83	nstantaneous Flow Rate at 20mA	720000	0 to 999999		Set the instantaneous flow rate when PID output and instantaneous analog output are 20mA.	32 float	R/W		○
7,100 7,101	84	PID Initial Instantaneous Flow Rate	360000	0 to 999999		Set the initial instantaneous flow rate in PID output.	32 float	R/W		○
7,102 7,103	85	PID Upper Limit Instantaneous Flow Rate	680000	0 to 999999		Set the upper limit instantaneous flow rate in PID output.	32 float	R/W		○
7,104 7,105	86	PID Final Instantaneous Flow Rate	360000	0 to 999999		Set the final instantaneous flow rate in PID output.	32 intgr	R/W		○
7,106 7,107	87	PID_Kp value	0.25	0.0 to 2.00		Set the proportional gain.	32 float	R/W		○
7,108 7,109	88	PID_Ki value	0.05	0.0 to 2.00		Set the integral gain.	32 float	R/W		○
7,110 7,111	89	PID_Kd value	0.4	0.0 to 2.00		Set the derivative gain.	32 float	R/W		○
7,112	8A	Increase Time	5	5 to 999		Set the time it takes to increase from the stopped state to the initial instantaneous flow rate and from the initial instantaneous flow rate to the upper limit instantaneous flow rate in PID output.	16 intgr	R/W		○

Table 8.1 Parameter List (4/5)

Address	No.	Parameter name	Initial value	Setting range	Unit	Description	Data type		Items displayed on screen	
									Standard type	High-performance type
7,113	8B	Decrease Time	5	5 to 999		et the time it takes to decrease from the upper limit instantaneous flow rate to the final instantaneous flow rate and from the final instantaneous flow rate to the stopped state in PID output.	16 intgr	R/W		○
7,114	8C	For Special Specifications	0			Used only for special specifications.	16 intgr	R/W		
7,115 7,116	91	Pt Temperature Adjustment Value (Offset)	13000	0 to 65535		Adjustment value for Pt100 input (offset). Adjusted at the time of factory shipment. Normally, do not change it.	32 float	R/W		
7,117 7,118	92	Pt Temperature Adjustment Value (Span)	22000	0 to 65535		Adjustment value for Pt100 input (span). Adjusted at the time of factory shipment. Normally, do not change it.	32 float	R/W		
7,119 7,120	93	Temperature Port Adjustment Value (4mA)	9000	0 to 65535		Adjustment value for temperature input (4mA). Adjusted at the time of factory shipment. Normally, do not change it.	32 float	R/W		
7,121 7,122	94	Temperature Port Adjustment Value (20mA)	45000	0 to 65535		djustment value for temperature input (20mA). Adjusted at the time of factory shipment. Normally, do not change it.	32 float	R/W		
7,123 7,124	95	Parameters for Maintenance	9000			These parameters are for maintenance purposes and are not normally used. Do not change them.	32 float	R/W		
7,125 7,126	96		45000				32 float	R/W		
7,127	97	Analog Output Adjustment Value (4mA)	680	400 to 1000		Adjustment value for analog output (4mA). Adjusted at the time of factory shipment. Normally, do not change it.	16 intgr	R/W		
7,128	98	Analog Output Adjustment Value (20mA)	3400	3000 to 4095		Adjustment value for analog output (20mA). Adjusted at the time of factory shipment. Normally, do not change it.	16 intgr	R/W		
7,129	A1	Device Address	1	1 to 247		Set the slave address of MODBUS communication.	16 intgr	R/W	○	○
7,130	A2	Communication Baud Rate	3	0:1200bps 1:2400bps 2:4800bps 3:9600bps 4:19200bps 5:38400bps		Set the communication format (baud rate) of RS-485.	16 intgr	R/W	○	○
7,131	A3	Stop Bit	0	0:1bit 1:2bit		Set the communication format (stop bit) of RS-485.	16 intgr	R/W	○	○
7,132	A4	Parity Bit	0	0:None 1:Odd 2:Even		Set the communication format (parity bit) of RS-485.	16 intgr	R/W	○	○
7,133	B1	Batch Operation Mode	1	1:Local 2:Remote		Choose the batch operation mode.	16 intgr	R/W	○	○
7,134 7,135	B2	Vehicle Number	0	0 to 999999		Enter the vehicle number.	32 intgr	R/W		
7,136	B3	Loading Status	0	0: State of vehicle number entry 1: Vehicle number determination waiting state 2: Vehicle number determined state		arameters which define status of batch operation.	16 intgr	R/W		
7,137	d1	GROSS1 Value Clear	0	1: Clear (Return to 0)		Clear the cumulative total value of GROSS1.	16 intgr	R/W	○	○
7,138	d2	GROSS2 Value Clear	0	1: Clear (Return to 0)		Clear the cumulative value of GROSS2.	16 intgr	R/W	○	○
7,139	d3	NET Value Clear	0	1: Clear (Return to 0)		Clear the cumulative value of NET.	16 intgr	R/W	○	○
7,140 7,141	H1	Cumulative Value	0			Display the cumulative value of batch volume.	32 intgr	R	○	○

Table 8.1 Parameter List (5/5)

Address	No.	Parameter name	Initial value	Setting range	Unit	Description	Data type		Items displayed on screen	
									Standard type	High-performance type
7,142 7,143	H2	GROSS1 Cumulative Value	0			Display the cumulative value of GROSS1.	32 intgr	R	○	○
7,144 7,145	H3	GROSS2 Cumulative Value	0			Display the cumulative value of GROSS2.	32 intgr	R	○	○
7,146 7,147	H4	NET Cumulative Value	0			Display the cumulative value of NET.	32 intgr	R	○	○
7,148 7,149	H5	Instantaneous Flow Rate Value	0			Display the instantaneous flow rate value.	32 intgr	R	○	○
7,150 7,151	H6	Temperature	0			Display the measured temperature.	32 float	R		○
7,152 7,153	H7	For Special Specifications	0			Used only for special specifications.	32 float	R		
7,154 7,155	H8	Volume conversion factor (temperature)	0			Displays volume conversion factor for temperature correction.	32 float	R		○
7,156 7,157	H9	For Special Specifications	0			Used only for special specifications.	32 float	R		
7,158 7,159	HA	Reference Density	0			Display the density.	32 float	R	○	○
7,160	Hb	Input/output Status	0			Read out the input/output status. Indicates each input/output state is ON when the bit is 1 in binary 16-bit notation. bit0: Batch operation state (RUN lamp on or flashing); bit1: Temporary stop state (RUN lamp flashing); bit 2: END; bit3: ILOCK; bit4: SV; bit5: MV; bit6: PUMP; bits7 to 12: Not used; bits13 to 15: Maintenance functions Example: 0000000000001011 indicates a temporary stop state.	16 intgr	R		
7,161	HC	Alarm Status	0			Read out the alarm status. Indicates that an alarm is generated when the bit is 1 in binary 16-bit notation. bit0: Pulse not arrived alarm (E1); bit1: Overfill alarm (E2); bit2: Leak alarm (E3); bit3: Interlock alarm (E4); bit4: Temperature upper limit alarm (E5); bit5: Temperature lower limit alarm (E6); bit6: Internal assembly abnormality 1 (E7); bit7: Internal assembly abnormality 2 (E8); bit8: Shipping error (E9); bit9: Instantaneous flowrate upper limit error (EA); bit14: Status error (EF); bit15: Parameter error (EP); bits10 to 13: Not used Example: 0000000000000100 indicates that “bit2: Leak alarm” has occurred.	16 intgr	R		
7,162 7,163	Hd	ROM Version				Read out the ROM version information.	32 float	R	○	○
7,164		Start, Stop, Reset	0	0: None, 1: Reset, 2: Start, 3: Stop, 4: Stop+Reset		Perform switch operation. ※Please operate with the switch of the product during normal operation.	16 intgr	W		

8.2 How to set parameters

Turn the power on while pressing the SET button or press SET and ▼ buttons to start setting mode.

↓

Parameter setting menu is enabled.
"C1" is displayed on CH./ERR. display LED regardless of cam switch position.
7-segment LED on CH./ERR display will blink.

↓

Every time the ▼ or ▲ button is pressed, the selection will move to the next one.(selected item code will be displayed on CH. No./ERR. LED display)
When switching between items, the buzzer will briefly sound.
Press the SET button at the parameter you want to set.

↓

When the SET button is pressed, the numerical digit of the cam switch of 7-segment LED on the COUNT display will blink. Use the cam switch, ▼ and ▲ buttons to change the setting. Press the SET button to register the changed parameter. At this time, a buzzer will sound. Saved data will be displayed on PRESET/TOTAL 7-segment LED.

↓

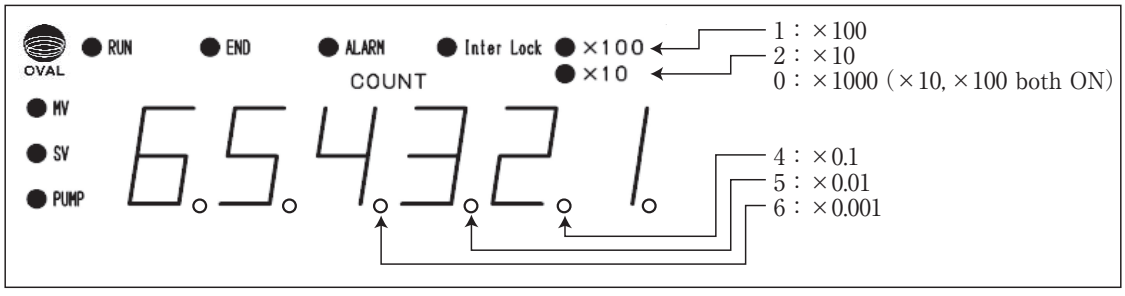
Upon completion of parameter setting, press the STOP button.
The batch controller moves to its standby state from parameter setting menu. ※ 1

➡ NOTE: ※1: When the batch controller is ready to batch, the channel is selected as per cam switch position indication. Erroneous batching protection flow will prevent erroneous batching.

- Items loop around parameters C1 and Hd.
- At the following status, transition to setting mode cannot be executed:
  - ・Batching is in progress (RUN lamp ON/Blinking)
  - ・Pump is operating (PUMP lamp ON)
  - ・Batch is complete (END lamp ON)

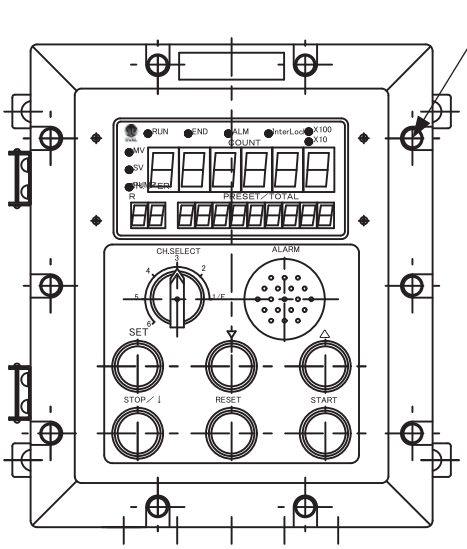
※ : Decimal point selects display method only, and does not affect internal computation.

0 : Status indicator ×10 and ×100 ON
1 : Status indicator ×100 ON
2 : Status indicator ×10 ON
3 : No LED display of decimal point
4 : Decimal point 1 place from the right on total count and batch setting
5 : Decimal point 2 places from the right on total count and batch setting
6 : Decimal point 3 places from the right on total count and batch setting



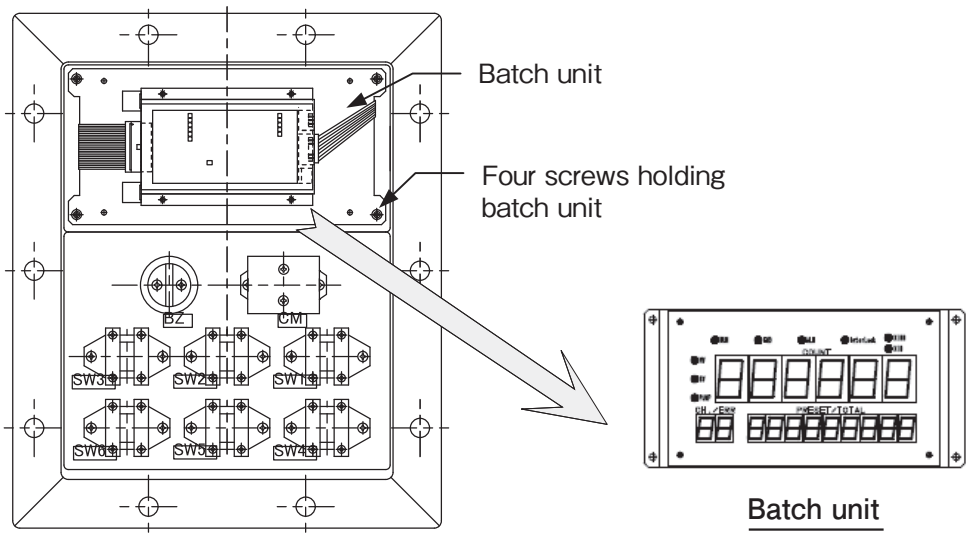
8.3 Retrieving Internal Assembly

⚠ CAUTION: Make sure to turn the power off before executing this procedure.



Remove the front cover by unscrewing the 10 hex bolts with a hex wrench.

Detaching batch unit



① Detach the connectors between the power supply unit/switch and batch unit.
② Remove the four screws.
③ Take off the batch unit.

Fig. 8.1

8.4 Setting Changes on Batch Board

Jumpers on the batch board are located as shown in Fig.9.5.

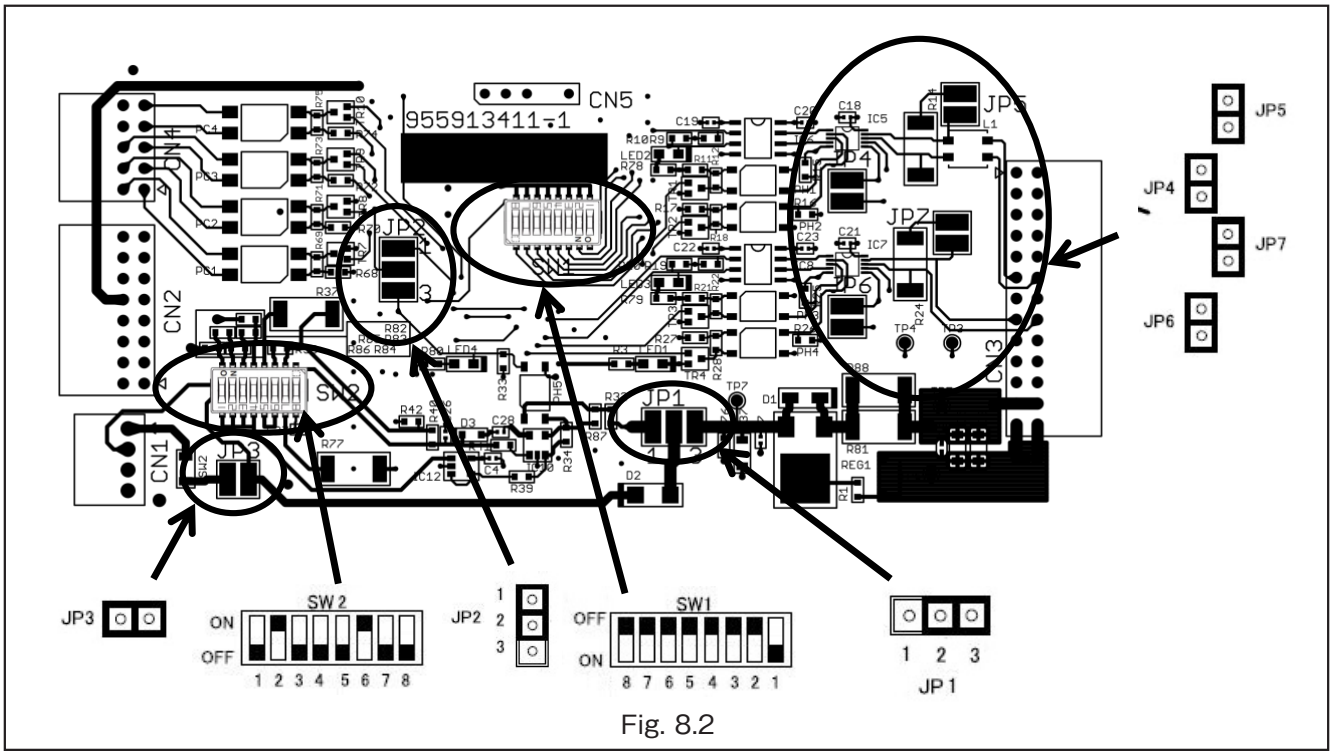


Fig. 8.2

The table below shows the switch and jumper descriptions and default settings.

No.	Signal Description	Default
JP2	Pulse output selection 1-2 short-circuit: Synchronize with displayed cumulative value 2-3 short-circuit: Synchronize with input pulse	1-2
JP4	These are for maintenance purposes only and are not normally used. Do not change them.	Short-circuit
JP5		Short-circuit
JP6		Short-circuit
JP7		Short-circuit
SW1:1 to 8		Only 1 is ON

With the following switch and jumper settings, pulse input from a flowmeter can be changed to different types.

The default pulse input type is set according to the specified model code at the time of purchase.

Model code	Output forms	JP1	JP3	SW2							
				1	2	3	4	5	6	7	8
B	2-wire/12V DC 3-wire voltage pulse PG30	2–3	●	●							
C	12V DC 2-wire current pulse PG30S	2–3			●			●			
D	24V DC 2-wire current pulse Ultra	1–2	●	●						●	
G	2-wire/12V DC 3-wire O.C. pulse	2–3	●		●				●		
K	2-wire/12V DC 3-wire contact-closure pulse PG20	2–3	●		●				●		●

⚠ CAUTION: When changing the settings, be sure to turn off the power of this product. Do not change switch and jumper settings for factory adjustment. It may cause malfunctions.

8.5 Setting Changes on Display Board

Jumpers on the display board are located at the positions shown below.

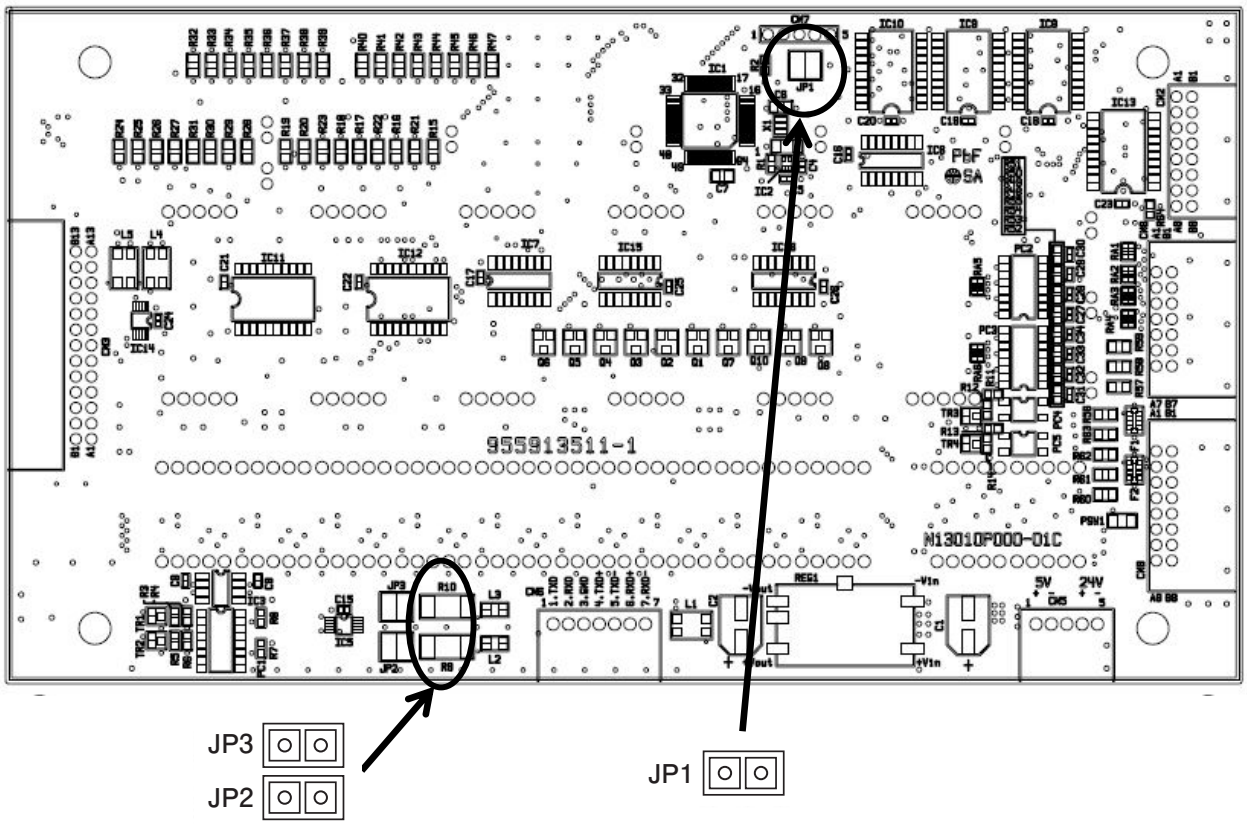


Fig. 8.3

No.	Description	Default
JP1	These are for maintenance purposes only and are not normally used. Do not change them.	OPEN
JP2		OPEN
JP3		OPEN

⚠ **CAUTION: Do not change the jumper settings on the display board. It may cause malfunctions.**

8.6 Setting Changes on Analog Board

Jumpers on the analog board are located at the positions shown below.

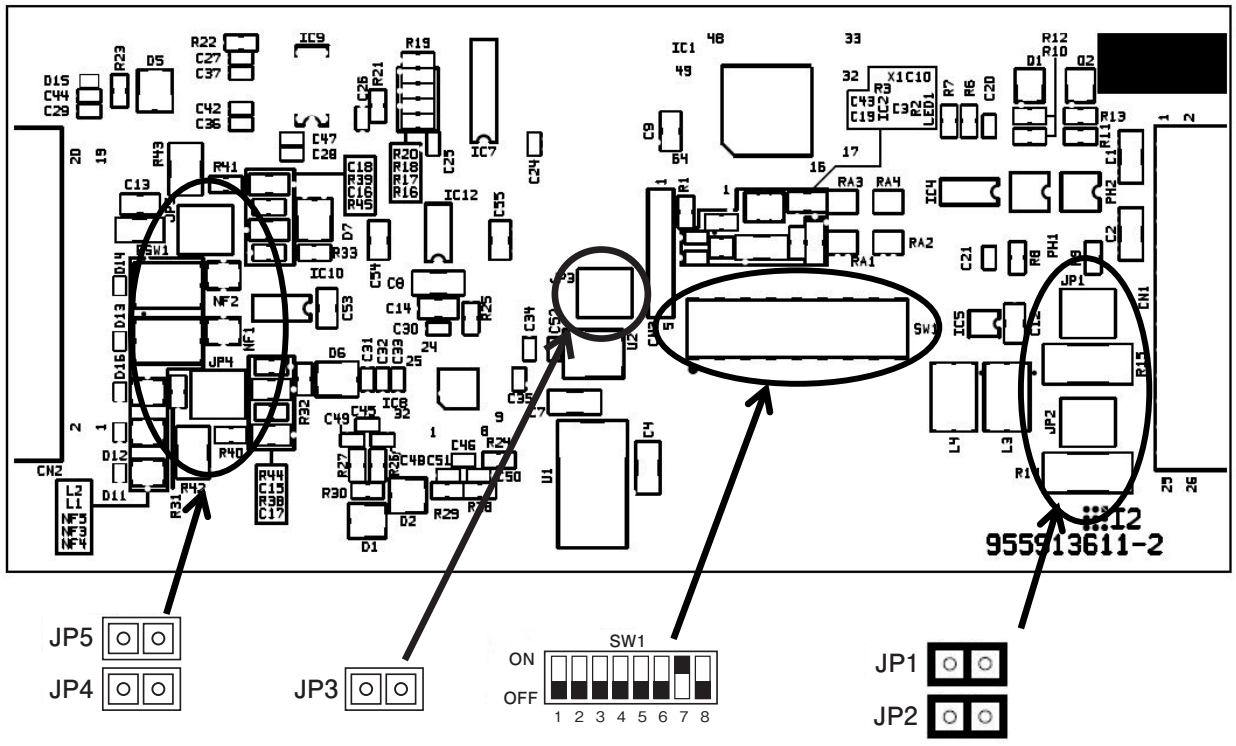


Fig. 8.4

No.	Description	Default
JP4	Temperature input switching Short-circuit: 4-20mA, Open: 1-5V	Short-circuit
JP1	These are for maintenance purposes only and are not normally used. Do not change them.	Short-circuit
JP2		Short-circuit
JP3		OPEN
JP5		OPEN
SW1		Only 7 is ON

⚠ CAUTION: Do not change switch and jumper settings on the analog board except for JP4. It may cause malfunctions.

9. TEMPERATURE CORRECTION FACTOR (volume conversion factor)

○ Temperature correction factor (3α)

If [61] 3α correction selection is "Corrected," 3α correction will be performed.

The arithmetic expression is as follows:

$K_{3\alpha} = 1 + 3\alpha(t - t_0)$

α	α Expansion Coeff. (Linear expansion coefficient of the flowmeter body) (Parameter No. 62)
t	Depends on measured temperature or fixed value (Parameter No. 5b)
t_0	Reference Temp. (Reference temperature) (Parameter No. 52)

○ Temperature correction factor (Volume conversion factor)

An appropriate correction formula for a liquid type can be selected by [51] Temperature Correction Arithmetic Table Selection (crude oil, fuel oil, lubrication oil, etc.).

When Parameter [0]: No Temperature Correction is selected, the correction factor Kt =1. For volume conversion factor, the formula varies depending on the setting of [51] Temperature Correction Arithmetic Table Selection.

selected	correction formula
0	Kt = 1
1	JIS K 2249-2011 (ASTM D 1250 table 54B): Crude oil
2	JIS K 2249-2011 (ASTM D 1250 table 54B): Fuel oil
3	JIS K 2249-2011 (ASTM D 1250 table 54B): Lubrication oil
5	ASTM D1250 Table 6B

●JIS K 2249-2011 "Crude Oil and Petroleum Products"

Correction factor Kt is determined by the use of [51] Temperature Correction Arithmetic Table Selection Fluid: [1], [2] or [3], reference density, and temperature measured.

The formula is as follows:

$Kt = EXP[- \alpha T \times \{t - t_0\} \times \{1 + 0.8 \times \alpha T \times (t - t_0)\}]$

$\alpha T = \{ K_0 / (\rho r \times 1000)^2 \} + (K_1 / \rho r \times 1000)$ ※ρr [kg/m^3]

or $\alpha T = A + (B / (\rho r \times 1000)^2)$

αT Coefficient of thermal expansion at 15℃

ρr [21] Reference Density [g/cm^3 = g/mL] (Density at 15°C)

t which depends on temperature measured or fixed value [5b]

t_0 [52] Reference Temperature

[51] Temperature Correction Arithmetic Table Selection Fluid	Density range [g/cm^3]	constant			
		K_0	K_1	A	B
[1] Crude oil	—	613.9723	0.0	—	—
[2] Fuel oil	Density < 0.7705	346.4228	0.4388	—	—
	0.7705 ≦ Density < 0.7880	—	—	-0.00336312	2680.3206
	0.7880 ≦ Density < 0.8390	594.5418	0.0	—	—
	0.8390 ≦ Density	186.9696	0.4862	—	—
[3] Lubricating oil	—	0.0	0.6278	—	—

●Other chemical fluid

When [7,051] Fluid is set to [6] Other chemical fluid, the formula is as follows:

$Kt = B\ coefficient \times 10^{B\ exponent} + (A1\ coefficient \times 10^{A1\ exponent}) \times (t - t_0) + (A2\ coefficient \times 10^{A2\ exponent}) \times (t - t_0)^2$

A1 coefficient: [7,054] A1 Coefficient Part
A1 exponent: [7,055] A1 Exponent Part
A2 coefficient: [7,056] A2 Coefficient Part
A2 exponent: [7,057] A2 Exponent Part
B coefficient: [7,058] B Coefficient Part
B exponent: [7,059] B Exponent Part
t: which depends on temperature measured or fixed value [7,066]
t_0: [7,052] Reference Temperature

9.1 PID Flow Rate Control

Operation description

As with the valve operation signal, PID flow rate control is also capable of five patterns of control from ① to ⑤ by setting of the initial setting, final setting, batch setting and anticipated overshoot (the setting method is also the same).

Furthermore, when the PID flow rate control is enabled, the valve operation signal is also output simultaneously.

① 2-stage open, 2-stage close

1. SV is ON
   Adjust the PID output so that the instantaneous flow rate becomes "PID Initial Instantaneous Flow Rate (Parameter No. 84)."
2. MV is ON
   Adjust the PID output so that the instantaneous flow rate becomes "PID Upper Limit Instantaneous Flow Rate (Parameter No. 85)."
3. MV is OFF
   Adjust the PID output so that the instantaneous flow rate becomes "PID Final Instantaneous Flow Rate (Parameter No. 86)."
4. SV is OFF, and adjust the PID output to 4mA.

② 2-stage open, 1-stage close

1. SV is ON
   Adjust the PID output so that the instantaneous flow rate becomes "PID Initial Instantaneous Flow Rate (Parameter No. 84)."
2. MV is ON
   Adjust the PID output so that the instantaneous flow rate becomes "PID Upper Limit Instantaneous Flow Rate (Parameter No. 85)."
3. SV an MV are OFF, and adjust the PID output to 4mA.

③ 1-stage open, 2-stage close

1. SV and MV are ON
   Adjust the PID output so that the instantaneous flow rate becomes "PID Upper Limit Instantaneous Flow Rate (Parameter No. 85)."
2. MV is OFF
   Adjust the PID output so that the instantaneous flow rate becomes "PID Final Instantaneous Flow Rate (Parameter No. 86)."
3. SV is OFF, and adjust the PID output to 4mA.

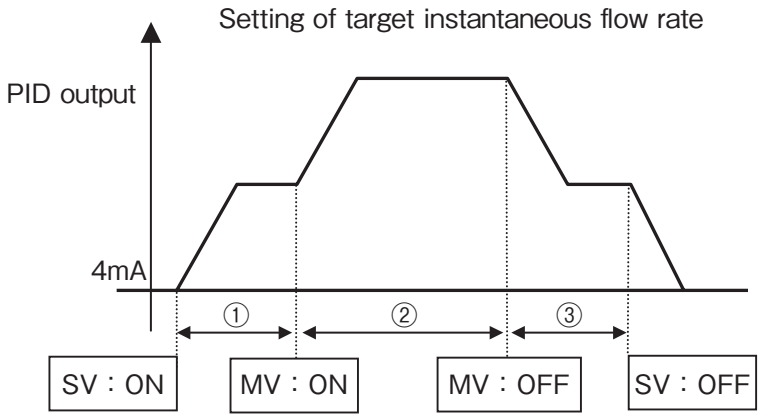
④ 1-stage open, 1-stage close

1. SV and MV are ON
   Adjust the PID output so that the instantaneous flow rate becomes "PID Upper Limit Instantaneous Flow Rate (Parameter No. 85)."
2. SV and MV are OFF, and adjust the PID output to 4mA.

⑤ 1-stage open, 1-stage close (SV only)

1. SV is ON
   Adjust the PID output so that the instantaneous flow rate becomes "PID Initial Instantaneous Flow Rate (Parameter No. 84)."
2. SV is OFF, and adjust the PID output to 4mA.

Parameter No.	Parameter name	Description
34	Average Time When Stable	Set the average movements number of the instantaneous flow rate of PID output
81	Analog Output Function	0: No function, 1: PID output function, 2: Instantaneous flow rate analog output function
82	Instantaneous Flow Rate at 4mA	Instantaneous flow rate when PID output is 4mA
83	Instantaneous Flow Rate at 20mA	Instantaneous flow rate when PID output is 20mA
84	PID Initial Instantaneous Flow Rate	Target instantaneous flow rate during the period ① (in the figure below)
85	PID Final Instantaneous Flow Rate	Target instantaneous flow rate during the period ③ (in the figure below)
86	PID Upper Limit Instantaneous Flow Rate	Target instantaneous flow rate during the period ② (in the figure below)
87	P Setting Value	Proportional band (%)
88	I Setting Value	Integral time
89	D Setting Value	Derivative time
8A	Increase Time	Time it takes to increase from the stopped state and the initial instantaneous flow rate to the target instantaneous flow rate.
8B	Decrease Time	Time it takes to decrease from the initial instantaneous flow rate and the upper limit instantaneous flow rate to the target instantaneous flow rate



10. ENTRY OF VEHICLE NUMBER

This device performs batch operation in the following two operation modes:

• "Remote mode" interlocking through communications with an upper controller; This device is connected with the upper controller via RS-485, and the communication is based on Modbus standard.

• "Local mode" by itself (as a stand-alone device).

■ Remote mode

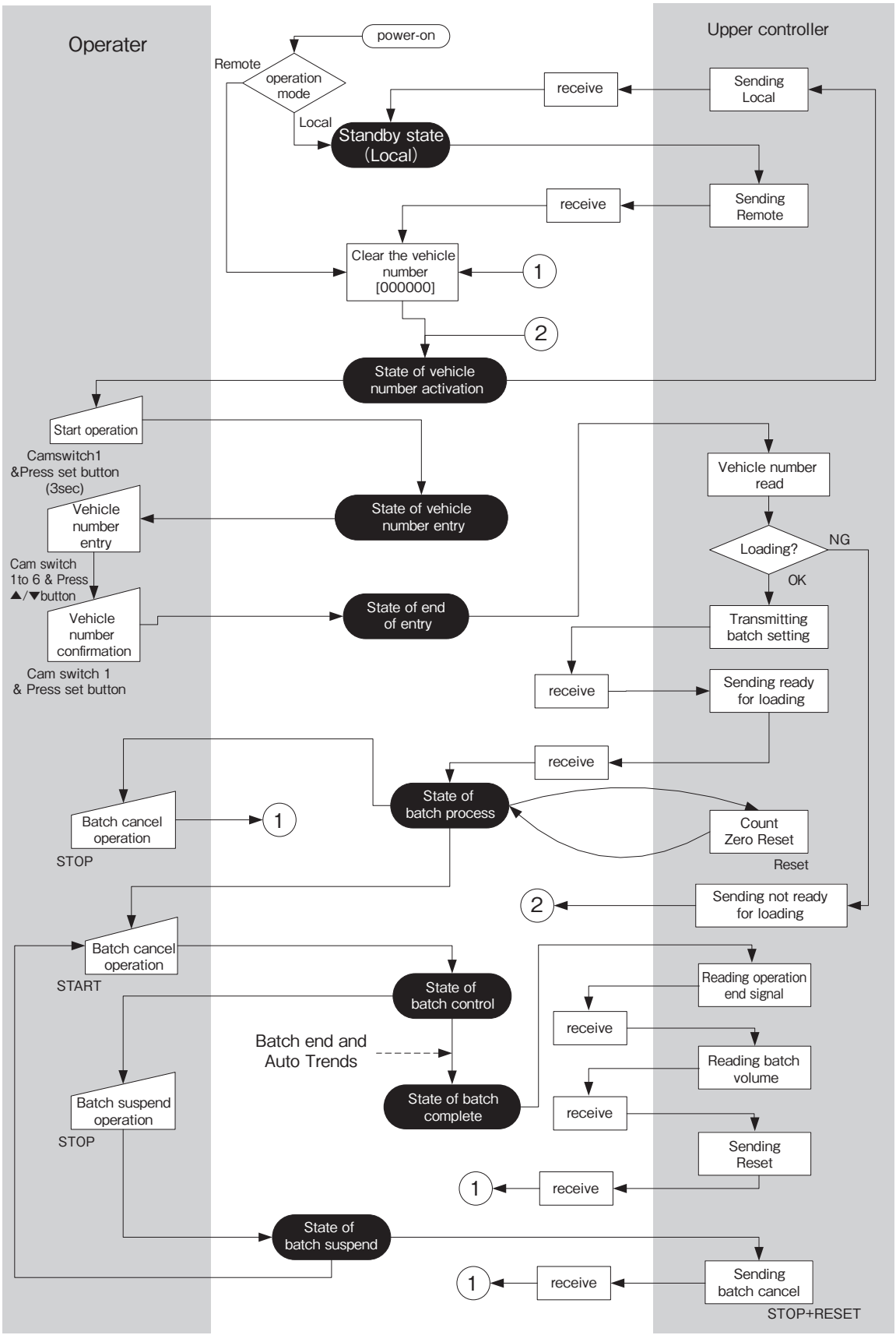
This device is interlocked with the upper controller in the following sequence:

1. Enter a vehicle number with appropriate switch and button on the front panel.
2. The upper controller collates the vehicle number. Then, the batch setting information is sent to the device to allow batch operation.
3. Start a batch operation with the START button on the front panel, and the batch operation will start according to the information received.
4. The upper controller will monitor the status of this device, and, upon completion of the batch, will load the batch volume, recording the log.
5. In "Remote mode," the RESET button on the front panel is disabled.
6. Switching between "Remote" and "Local" modes can be done with either the upper controller or the parameter setting mode on the front panel. Switching can be done with the Parameter Number B1: Batch Operation Mode.

■ Local mode

To carry out batch operation, enter various batch operation setting information with appropriate switches and buttons on the front panel.

■ Local mode


Operater
Upper controller
power-on
Remote
operation mode
Local
receive
Sending Local
Standby state (Local)
receive
Sending Remote
Clear the vehicle number [000000]
1
2
State of vehicle number activation
Start operation
Camswitch1 &Press set button (3sec)
Vehicle number entry
State of vehicle number entry
Vehicle number read
Loading?
NG
OK
Cam switch 1to 6 & Press ▲/▼button
Vehicle number confirmation
State of end of entry
Transmitting batch setting
Cam switch 1 & Press set button
receive
Sending ready for loading
receive
Batch cancel operation
STOP
1
State of batch process
Count Zero Reset
Reset
2
Sending not ready for loading
Batch cancel operation
START
State of batch control
Reading operation end signal
receive
Batch end and Auto Trends
Reading batch volume
Batch suspend operation
STOP
State of batch complete
receive
Sending Reset
1
receive
State of batch suspend
1
receive
Sending batch cancel
STOP+RESET

[Detailed Function]

■ To switch to Remote mode,

During standby state, receive “Remote” from the upper controller, or Upon power-on, validate “Remote” in parameter setting mode.

■ To switch to “Local”,

Under vehicle number activation, receive “Load” from the upper controller, or Upon power-on, validate “Local” with appropriate controls (i.e. switch and button) on the front panel.
In Local mode, manipulation of the controls on the front panel will enable batch operation.

■ State monitoring by the upper controller

The upper controller will monitor the following states of this device at a fixed-cycle and transmit parameter setting corresponding to the status monitored. Parameter writing during batch operation is not allowed.

■ State of vehicle number activation

”no.” blinks on the channel indicator.
Count value is displayed on the COUNT indicator.
”000000” is displayed on the PRESET / TOTAL indicator.

Depressing the front cam switch together with SET button for more than three seconds will move the state to “vehicle number entry”.

■ State of vehicle number entry

”no.” blinks on the channel indicator.
Vehicle number being set is displayed on the COUNT indicator.
Six-digit previous vehicle number is displayed on the COUNT indicator.
Choose the number of digits with the cam switch (1 – 6) on the front panel, and set a number from 0 through 9 using the ▲/▼ button. The digits just set blinks.

Depressing the front cam switch together with SET button will move the state to “end of entry”

■ State of end of entry

”no.” blinks on the channel indicator.
Nothing is displayed on the COUNT indicator.
Vehicle number blinks on the RESET / TOTAL indicator.

The upper controller will send “Loading OK” after sending “batch volume” and “other parameters”. On receipt of “Loading OK”, EL7321 will become “batch operation in process”. If “Loading NG” is received from the upper controller, the state will move to “vehicle number entry”, notifying loading error E9.

■ State of batch process

”C1.” is displayed on the channel indicator.
Batch volume is displayed on the RESET / TOTAL indicator.

After making sure of the above display switching, an operator depresses the START button to move the state to “batch control”.
To cancel the vehicle number just entered, press the STOP button on the front panel, clear the vehicle number, and move to the state of “vehicle number activation”.

Since the operation will not start if the count value is not zero due to leakage, the upper controller sends a “reset” signal to clear the count value.

■ State of batch control

Batch control is performed according to the parameter which was set from the upper controller.
For details, see “7. OPERATION”.

■ State of batch complete

When this device finishes the batch operation, the state becomes "batch complete."

Making sure that the END parameter is valid, the upper controller reads the batch volume, logs the actual data, and sends RESET signal.

■ State of batch suspend

By depressing STOP button on the front panel during batch operation, batch operation can be suspended halfway.
There may be the case that the operation is suspended due to an alarm occurrence. For details See “7.6 Alarm Functions”.
To start batch operation, awake the cause of alarm and press START button.
For the way of awaking, see “7.6 Alarm Functions”.

■ State of batch cancellation

The upper controller reads the batch volume, logs the actual data, and sends STOP+RESET signals. The upper controller also adjusts the loading information of whether or not the volume difference can be loaded.

◆ Send / receive data of the upper controller

■ Local transmission

[1] is sent to Batch Operation Mode [Register: 7133].

■ Remote transmission

[2] is sent to Batch Operation Mode [Register: 7133].

■ Vehicle number read

Reads Batch Operation Mode [Register: 7,133], and, if it is [1], then reads Vehicle Number [Register: 7,134].

■ Transmitting batch setting

Writes Channel 1 Preset Value [Register: 7,001].

■ Sending ready for loading

Writes [2] to Loading Status [Register: 7,136].

■ Sending not ready for loading

Write [0] to Loading Status [Register: 7,136].

■ Transmitting Reset

Writes [1] to Start, Stop, Reset [Register: 7,164].

■ Reading operation end signal

Reads Input/output Status [Register: 7,160], making sure that bit2 is set to [1].

■ Reading batch volume

Reads Cumulative Value [Register: 7,140].

■ Sending batch cancel signal

Writes [4] to Start, Stop, Reset [Register: 7,164].

11. COMMUNICATION FUNCTION

In this device, various parameters can be configured through RS-485 interface.
In addition, Modbus communication protocol is used for communication and, thus, multiple devices can be connected to a single host.

11.1 Connection Configuration

Higher-level devices (personal computers, sequencers, etc.) and lower-level devices (batch counter) are connected as shown in the figure below.

※ It is recommended to use shielded twisted pair cable between the batch counter and the RS-485 adapter.

※ A terminating resistor is required to terminate the device. When making a multi-drop connection, connect a terminating resistor to the terminating device. Do not attach a terminating resistor to intermediate devices. This unit does not have a built-in terminating resistor, so connect a terminating resistor of about 100-200Ω in the vicinity of the terminal as necessary.

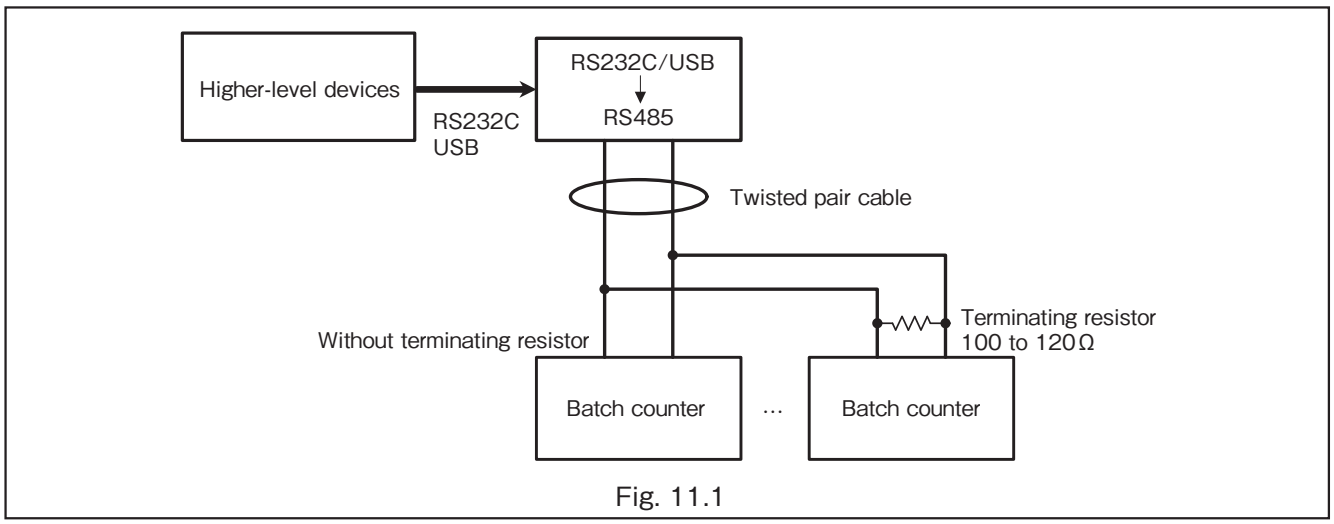


Fig. 11.1

11.2 Communication Format

Specifications for communication format are as follows, and they can be set.
For how to change the settings, refer to "8.1 Parameter List."

Baud Rate : 1,200, 2,400, 4,800, 9,600, 19,200, 38,400 bps
Data Bit : 8 Bit
Stop Bit : 1 Bit, 2 Bit
Parity : None, Odd, Even
(Note) Underlined values are default values.

(1) Display format for floating point data

The floating point handled by the microcomputer inside the batch counter follows the standard format of IEEE.

(2) Communication format

・Message frame configuration

Silent interval	Slave address	Function code	Data	CRC	Silent interval
3.5 characters	1 Byte	1 Byte	n Byte	2 Byte	3.5 characters

・Communication timing

After receiving a query from the host, this device responds after the following time has elapsed depending on the number of specified registers.

Function 3 : About 50 to 200ms
Function 16 : About 50 to 250ms

(3) Address setting

Address can be set between 1 and 247. However, "0" cannot be set because it is used for Broadcast.

(4) Supported function codes:

①Read Holding Registers: 03 (Broadcast: Unsupported)

Reads values from a holding register by specifying the target address, register and number of registers. The holding register consists of 16 bits in length.

As an example, queries and responses to read values of the holding register 7007 (1B5Fh) are shown below. The start register is 7006 (1B5Eh), which is 7007 minus 1.

● Queries

	Example (HEX)
Address	01
Function code	03
Start register (higher-level)	1B
Start register (lower-level)	5E
Number of registers (higher-level)	00
Number of registers (lower-level)	02
CRC	A3 3D

● Responses

	Example (HEX)
Address	01
Function code	03
Number of data bytes	04
Data 1 (higher-level)	00
Data 1 (lower-level)	00
Data 2 (higher-level)	03
Data 2 (lower-level)	E8
CRC	FA 8D

②Preset Multiple Registers: 16 (Broadcast: Supported)

Writes arbitrary data to multiple consecutive holding registers of the target address. The holding register consists of 16 bits in length. As an example, queries and responses to write 20.0 (41A00000h in IEEE format) to the holding register 7052 (1B8Ch) are shown below. The start register is 7051 (1B8Bh), which is 7052 minus 1.

● Queries

	Example (HEX)
Address	01
Function code	10
Start register (higher-level)	1B
Start register (lower-level)	8B
Number of registers (higher-level)	00
Number of registers (lower-level)	02
Number of data bytes	04
Data 1 (higher-level)	41
Data 1 (lower-level)	A0
Data 2 (higher-level)	00
Data 2 (lower-level)	00
CRC	10 92

● Responses

	Example (HEX)
Address	01
Function code	10
Start register (higher-level)	1B
Start register (lower-level)	8B
Number of registers (higher-level)	00
Number of registers (lower-level)	02
CRC	37 06

(5) Exception code

Exception code supports the following four points:

01: ILLEGAL FUNCTION (invalid function)
02: ILLEGAL DATA ADDRESS (invalid data address)
03: ILLEGAL DATA VALUE (invalid data value)
04: SLAVE DEVICE BUSY (busy state)

As an example, queries to write 80 to the holding register 7013 (1B65h) and responses when this device is in a busy state are shown below.

● **Queries**

	Example (HEX)
Address	01
Function code	10
Start register (higher-level)	1B
Start register (lower-level)	64
Number of registers (higher-level)	00
Number of registers (lower-level)	01
Number of data bytes	02
Data 1 (higher-level)	00
Data 1 (lower-level)	50
CRC	05 49

● **Responses**

	Example (HEX)
Address	01
Function code	90
Exception code	06
CRC	CC 02

➡ NOTE: The function code for the response sets MSB to 1 for the function code of the query. (10h: 00010000→90h: 10010000)

12. QUICK TROUBLE SHOOTING

12.1 Inspection Items

➡ NOTE: If the trouble is suspected to be occurring internally, identify the problem according to the table below and consult OVAL sales office or nearest representative.

Problem	Inspect	Countermeasure / Possible Cause
No display	1. Is the circuit protector of power supply unit ON? 2. Is the power-supply voltage correct? Power supply specification: AC110V/ AC220V	1. Turn the circuit protector ON. 2. The power-supply voltage is incorrect. 3. Internal problem
Unable to operate even though the START button is pressed	1. Is the InterLock LED on? 2. Are terminal blocks 23 and 28 (remote operation input is at STOP/form "b" contact input) short-circuited? 3. Was the batching procedure reset? 4. Check for the items listed in "7.5 (4) Batch Start Restraining Conditions". 5. Does "RUN" LED turn on by pressing the START button? 6. Are valve operation signals SV and MV generated properly? 7. Are wiring for valve operation signal and applied pressure correct? 8. Is the pressure used for valve operation and/or for valve control correct?	1. Short-circuit terminals 06 and 07 (InterLock) 2. Since form "b" contact is used for STOP operation, make sure to complete the circuit so that the circuit turns off only when pausing is necessary. 3. Reset the batching procedure. 4. Follow the steps instructed in "7.5 (4) Batch Start Restraining Conditions". 5. If "RUN" LED does not turn on, there might be an internal problem. 6. Failure on valve operation signal output relay. 7. Improper wiring for valve operation signal or disconnected wires. 8. Improper pressure for valve operation and/or for valve control.
Unable to totalize even though the valve is operating	1. Is the batch controller receiving a flow signal input from the flowmeter? 2. Is the flow signal input within the responsive frequency range?	1. Improper wiring, disconnected wires, problem with flowmeter, or with transmitter. 2. Flow signal input is out of specified range. Contact-closure pulse : Max. 50Hz Other : Max. 2kHz
Unable to operate constantly at the values set	1. Are valve operate signals SV and MV generated properly when total count reaches batch setting? 2. Does the following happen when total count reaches batch setting? (SV: OFF, END: ON)	1. Failure on valve operate signal output relay. 2. Internal problem
Unable to operate remotely	1. Can batch setting be selected by using the cam switch? 2. Is the wiring for remote control input done properly?	1. If you are able to set parameters with the cam switch, remote operation is not enabled yet. Change the operation switch selection to remote cam switch on parameter settings. 2. Incorrect wiring for remote input, disconnected wires, or failure inside the batch controller.

12.2 FAQ at Standby

Question	Answer
1. What happens when the controller receives a pulse while in standby?	・Totalization will continue as well as measurement of the grand total. ・Valve operation signals (SV and MV) do not work. (remain off) ・A leak error will be generated as the pulse exceeds the batch setting if leak error is set.
2. What happens when the total count reaches the batch setting without starting?	・Totalization will continue. ・Batch-end signal will not be generated.
3. Is it possible to start when totalization is already in progress?	・It is NOT possible to start if totalization is already in progress. If even one pulse is counted at the initial state, batching operation cannot proceed. Make sure to reset the total count to "0" by pressing the RESET button once, then start.

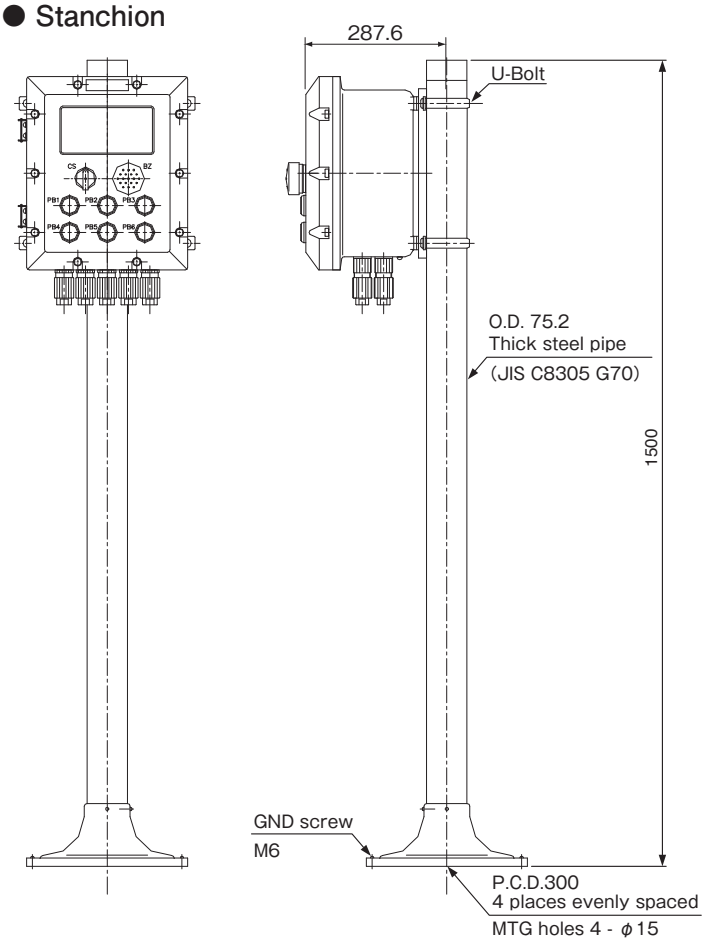
12.3 Other FAQs

Question	Answer
1. Channel display is showing "C.0" and cannot start.	・During the remote setting mode (Parameter No.0d = 1), "C.0" will be displayed if no channel is set. ・Set a channel with the remote select terminals. (Refer to P. 13 and P. 27)
2. How do I cancel a batch process in mid-course?	・Pause the process first by pressing the STOP button, then press STOP and RESET buttons to cancel the batch process. (Count reset)

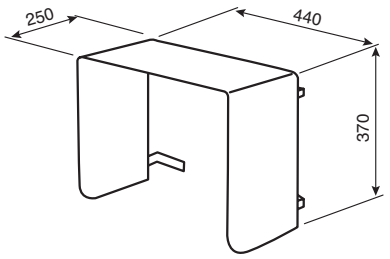
13. OPTIONS

Unit: mm

● Stanchion

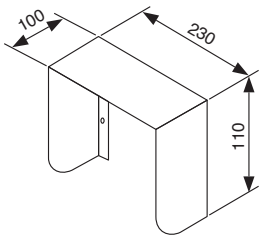


● Sunshade



Protects the batch counter from direct sunlight and rain.
Material: SUS unfinished

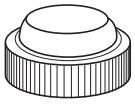
● Hood



Covers over the display for better visibility.

Material: SUS
Finish : N1.5 matte

● Rubber Cover for Pushbuttons



Ensures better waterproof performance by covering the pushbuttons.

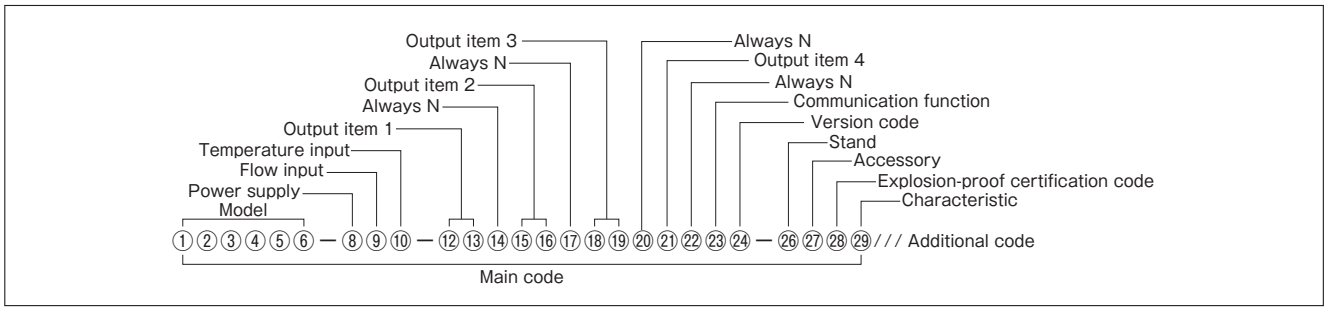
Fig. 13.1

14. GENERAL SPECIFICATIONS

Item			Description				
Type of operation			Pulse addition				
Display	Display		Total count: 6-digit, 7-segment, 25.4mm, Red LED				
			Batch setting: 6-digit, 7-segment, 14.24mm, Red LED (displays each measurement parameter by operating ▼ and ▲ buttons)				
			Channel number: 2-digit, 7-segment, 14mm, Red LED (displays error code when alarm is set off.)				
	Operation status indicator		LEDs: RUN (YEL)/ END (GRN)/ ALARM (RED)/ InterLock(BLU)/ ×10 (ORG)/ ×100 (ORG)/ MV (RED)/ SV (RED)/ PUMP (RED)				
Buttons	Channel select		Explosionproof cam switch with 6 notches				
	Pushbutton		ϕ 30 explosionproof pushbuttons: SET(BLK)/ ▼ (BLK)/ ▲ (BLK)/ STOP (RED)/ RESET (YEL)/ START (GRN)				
Buzzer			explosionproof buzzer for alarm				
Input Signal	Pulse Input	Pulse type	Example Transmitters	Power to Transmitter		Signal Level	Freq. Response
		2-wire/12V DC 3-wire contact-closure pulse	PG20	13.5VDC	Current capacity: 55mA (with short-circuit protection)	12VDC ON/OFF (Input load resistance: 10kΩ)	Max 50Hz
		2-wire/12V DC 3-wire open collector pulse	Coriolis flowmeter/NPG60A (E3) FLOWPET-5G	13.5VDC			Max.2kHz (※1)
		2-wire/12V DC 3-wire voltage pulse	PG30 NPG60A (F)	13.5VDC		"1": more than 5VDC "0": less than 1.5VDC	
		12V DC 2-wire current pulse	PG30S	13.5VDC		"1": 20mADC "0": 4mADC Input load resistance: 510Ω	
		24V DC 2-wire current pulse	PA14/15/25 ULTRA OVAL NPG60A (E)	24VDC		"1": 20mADC "0": 4mADC Input load resistance: 250Ω	
	Remote Input	Start	Form "a" contact	Contact signal/Open collector signal Contact current: 24V DC Max. 20mA Instant signal "ON" width: 200msec Instant signal "OFF" width: 200msec			
		Reset	Form "a" contact				
		Stop	Form "b" contact				
		Channel select	BCD combination of 1 /2 /4				
		InterLock	Form "a" contact normally short-circuited				
	Temperature input		3-wire Pt100Ω (Pt or jPt) or 4 to 20mA or 1 to 5VDC Transmitter Power Supply: 24VDC Current capacity: 30mA				
Compensation	Temperature Compensation		JIS K 2249-2011 "Crude Oil and Petroleum Products" Other fluid (second-order approximation correction formula)				
	Accuracy of temperature compensation		±0.075%±0.004%/℃ (Reference: 20℃) Excluding other fluids				
Parameter Setting	Meter factor setting		0.00010 to 1.99999 (Default: 1.00000)				
	Proving factor		0.00010 to 1.99999 (Default: 1.00000)				
	Input pulse freq.		Software-defined frequency: 1/1, 1/10, 1/100 (Default: 1/1)				
	Output pulse freq.		Software-defined frequency: 1/1, 1/10, 1/100 (Default: 1/1)				
	Batch	Batch setting	6 channels: 0 to 999999 counts (Only Ch.1 can be changed on the front panel.)				
		Initial setting	0 to 9999 counts (Default: 80)				
		Final setting	0 to 9999 counts (Default: 80)				
		Anticipated overshoot	0 to 99 counts (Default: 2)				
		Batch-end monitor setting	0 to 99 sec (Default: 5)				
	Pump output timer		0 to 9999 sec (Default: 30)				
	Alarm	Missing pulse interval	0 to 999 sec (Default: 5)				
		Overshoot	0 to 99 counts (Default: 2)				
		Leak	0 to 99 counts (Default: 10)				
Output Signal	Upper limit flow signal		Full-open signal MV	Same as power-supply voltage (Max 0.5A) or relay contact (Max 250V AC 0.5A) Refer to the operation chart for ON/OFF of form "a" contact.			
	Partial flow signal		1-stage open signal SV				
	Pump control signal		Relay contact (Max 250V AC 0.5A) form "c" contact				
	Batch-end signal		Non-contact relay (Max 250V AC 0.1A) form "a" contact				
	Alarm signal		Relay contact (Max 250V AC 0.5A) form "a" contact				
	Pulse signal		Open collector NPN transistor output (35V DC 100mA) Total count synchronizing output: Pulse width 150μ sec, 1 to 99ms (Maximum 50Hz) or Input synchronizing output Maximunm 2000Hz				
	PID output		4 to 20mA (Maximum load resistance: 750Ω)				
Communication	Interface		RS-485				
	Protocol		Modbus RTU				
	Baud rate		1200, 2400, 4800, 9600, 19200, 38400bps				
	Function		Parameter reading/writing, Car number input mode (optional)				
Power failure backup			Saves data to FeRAM at power-off				
Power source			100/110VAC or 200/220VAC 50/60Hz (Allowable voltage: within ±10% of rated voltage)				
Power consumption			42VA (Power consumed by the batch counter only, excluding power supply for MV/SV.)				
Ambient temperature			–20 to +50℃				
Explosionproof configuration			Flameproof enclosure Exd Ⅱ B T4				
Installation			Wall-mount or Stanchion				
Finish			Munsell 2.5PB 5/8, glossy (standard)				
Housing material			Aluminum casting (Stanchion: steel)				
Outline dimensions			300 (W) ×360 (H) ×247 (D) (batch controller body only)				
Weight			Approx. 20kg (batch controller body only)				
Noise resistance			EMC EN55011 EN61326-1				
Others			NET loading/GROSS loading switching function				
			Unit conversion function (fixed conversion)				
			Parameter rewrite prohibiting function				

※1 Depends on the cable specifications and the transmission distance. Reference: 100 m with CVVS1.25sq cable in the case of open collector specification

15. PRODUCT CODE EXPLANATION



●Main code

①	②	③	④	⑤	⑥	Model
E	L	7	3	2	0	Explosionproof batch counter

⑦	—

⑧	Power supply
E	100VAC 50/60Hz
F	110VAC 50/60Hz
G	200VAC 50/60Hz
H	220VAC 50/60Hz

⑨	Flow input
B	Voltage pulse 12VDC 2 wires / 3 wires
C	Current pulse 12VDC for PG30S Exclusive Use
D	Current pulse 24VDC (4/20mA) for ULTRA OVAL, PA25, PA14, etc.
G	Open collector pulse 12VDC 2 wires / 3 wires
K	Contact pulse 12VDC 2 wires / 3 wires
Z	Special

⑩	Temperature input
B	1 to 5V
E	4 to 20mA
F	Pt100
G	JPt100
N	Non（no temp.compensation）

⑪	—

⑫	⑬	Output item 1
Pulse Output		
B	1	Pulse width 1ms
B	5	Pulse width 50ms
B	9	Pulse width other above
S	Y	Synchronized to the pulse input
Z	Z	Special

⑭	Always N
N	Always N

⑮	⑯	Output item 2
Pump Output		
C	C	C contact
Z	Z	Special

⑰	Always N
N	Always N

※ Refer to Instruction Manual E-235EX-1-C.

⑱	⑲	Output item 3
Valve operation signal		
1	V	Same as supply power
2	C	Contact output
Z	Z	Special

⑳	Always N
N	Always N

㉑	Output Item 4
Analog Output	
N	Non-output
P	Flow controlling PID output 4 to 20mA
Z	Special

㉒	Always N
N	Always N

㉓	Communication function
R	RS-485
Z	Special

㉔	Version code
B	Version B

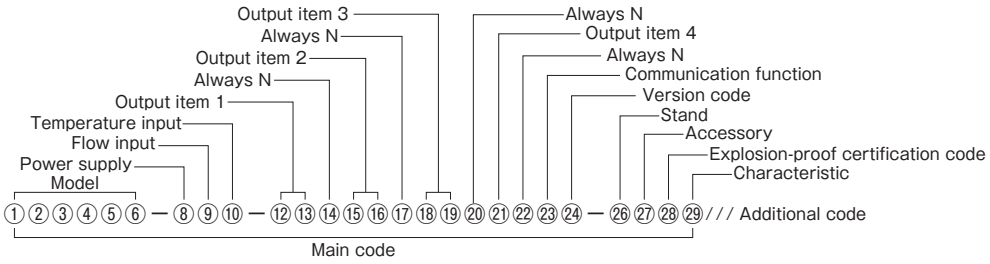
㉕	—

㉖	Stand
N	Unnecessary
1	Necessary

㉗	Accessory
N	Unnecessary
1	Cover
2	Hood
3	Push button rubber cover
4	Cover + hood
5	Cover + push button rubber cover
6	Hood + push button rubber cover
7	Cover + hood + push button rubber cover

㉘	Explosion-proof certification code
0	Non-explosionproof
J	TIIS explosionproof
C	CCC explosionproof ※ For the CCC explosionproof product, the Model specific code of the code number ㉙ is “Z.”

㉙	Characteristic
0	Standard
Z	Special



● Additional code

Pressure-tight packing			
J	F	0	Pressure tight packing　Unnecessary
J	F	1	Pressure tight packing　Necessary
Special test			
A	1	0	Taxed custody transfer
A	2	0	By certified measurer
A	3	0	Liquor tax
A	4	0	MITI alcohol
Designated special paint on transmitter			
S	F	0	Corrosion proof　Special treatment
S	D	0	Salinity tolerance　Special treatment
S	E	0	Acid tolerance　Special treatment
S	X	0	Customer designated paint　Special treatment
Document			
D	S	J	SPEC. & DWG (Approval Drawing) (Japanese)
D	S	E	SPEC. & DWG (Approval Drawing) (English)
D	R	0	Re-submission of SPEC. & DWG
D	C	J	Final DWG (Japanese)
D	C	E	Final DWG (English)
D	W	J	Wiring diagram (Japanese)
D	W	E	Wiring diagram (English)
S	D	J	Inspection report of electronics (Japanese)
S	D	E	Inspection report of electronics (English)
D	T	J	Inspection procedure (Japanese)
D	T	E	Inspection procedure (English)
C	B	J	Traceability certificate: B set
Witness Test			
V	1	1	Appearance, dimension, total number
V	1	4	Appearance, dimension, total number/performance (Output confirmation, etc.)

● Pressure-tight packing cable glands
(Arranged separately from the main unit. If they are used for TIIS explosionproof purposes, be sure to arrange them.)

Classification	Type			Description
Model	H P N 2 1	—		Cable gland
Applicable cable diameter			R 8 — C	Over 6mm and up to 8mm
			R10 — C	Over 8mm and up to 10mm
			R12 — C	Over 10mm and up to 12mm

Classification	Type			Description
Model	H P N 2 2	—		Cable gland
Applicable cable diameter			R14 — C	Over 12mm and up to 14mm
			R16 — C	Over 14mm and up to 16mm

※ When using this product for CCC explosionproof purpose , please separately prepare CCC certified cable glands and close up plugs.

Instruction Manual for Explosionproof Equipment

Flameproof Enclosure
Batch Counter
EL7320

This is an instruction manual for the flameproof enclosure type batch counter EL7320.
Explosionproof electronics are designed to be used in explosive environments. Read this manual thoroughly before installation and make sure to operate carefully and properly.
This manual is addressed to the personnel who intend to install, operate, and/or inspect this equipment who shall also have proper knowledge and understanding in the fields of electronics and explosionproof equipment.

Safety Messages

Please read this manual and other referential documents carefully to learn about the equipment, and understand safety information before installation, operation, maintenance, and inspection. Make sure to keep this manual handy for quick reference.

This manual signals safety messages with two classifications; "CAUTION" and "WARNING".
This document describes TIIS explosionproof configuration.
For CCC explosionproof configuration, please refer to Attachment E 235EX 1 C.

⚠WARNING

Failing to follow warning statements may result in severe personal injury or death.

⚠CAUTION

Failing to follow caution statements may result in minor personal injury or property damage. Bear in mind that even not following caution statements could cause serious damage depending on the situation. Therefore make sure to follow every safety message.

⚠WARNING

〈General〉

· Make sure to use the explosionproof electrical equipment that is suitable for a hazardous location (where concentrations of flammable gases or vapors occur).

· This equipment can only be installed in hazardous locations classified as Zone 1 and Zone 2. Implementation in Zone 0 is prohibited.

· Make sure that the power is off before mounting, dismounting, wiring, or performing maintenance and inspection. Failure to do so may cause electrical shock, fire, or explosion.

· Only personnel with knowledge and skills in explosionproof configuration, electrical construction, and related regulations should handle transportation, implementation, piping, operation, inspection, troubleshooting, and disassembling. Otherwise, explosion, fire, electrical shock, and/or personal injury may occur.

· Modification of this equipment is strictly prohibited since it could result in malfunction of equipment and/or serious injury.

〈Piping/Wiring〉

· Connect the external cables according to the delivery specification. Failure to do so may cause electrical shock, fire and/or explosion.

· Refer to the instruction manual, electrical technical standards, indoor wiring regulations, and explosionproof guidelines when installing cable lead-in. Otherwise, explosion, fire, electrical shock, and/or personal injury may occur.

〈Installation/Adjustment〉

· Ensure that the earth cable is properly grounded. Failure to do so may result in electrical shock, fire, and/or explosion.

· Never step on or hang from the explosionproof equipment, as it may cause damage to property, injury, or a critical accident.

· Make sure to install the equipment on a robust surface. Mounting the equipment on soft ground or a movable trestle could cause a fall of equipment, electrical shock, and/or personal injury.

· Do not cover the equipment with flammable materials such as fabric or paper. Also, refrain from putting foreign objects into gaps of the equipment. Otherwise, explosion and/or fire may occur.

〈Operation〉

· Do not open the cover while applying current, or electrical shock, fire and/or explosion may occur.

〈Maintenance/Inspection〉

· Before you measure the insulation resistance, ensure that there is no explosive atmosphere around the site.

· Make sure that the power is turned off and that there is no explosive atmosphere present before performing maintenance and inspection.

⚠CAUTION

〈General〉

- Do not use this product outside of specified ratings, or electrical shock, injury, and/or damage to property may occur.
- Do not use explosionproof electrical equipment that is damaged. Otherwise, injury and/or fire may occur.
- Do not place obstacles in front of the nameplate.
- Do not remove the nameplate.
- To prevent malfunction, do not use or store this product in places with vibration and impact shocks.
- Should the product be installed in a special environment including high/low temperature, high humidity, strong wind, strong vibration, salt damage, corrosive gases, or considerable amount of dust, additional proper measures will be required additionally.
- Do not let foreign objects (dirt, dust, metal powder, etc.) enter inside of the equipment during maintenance and inspection. Failure to do so may cause loose connection and/or insulation failure.

〈Transportation〉

- Pay due attention during transportation to prevent a fall or turnover of the equipment.

〈Unpackaging〉

- To prevent injury, make sure that the right side is facing up before unpackaging.
- Make sure that the received product satisfies the specifications on your order.
  Personal injury and property damage may occur if the wrong product is installed.

〈Piping/Wiring〉

- For outside conductors, use the cable with circular cross-section and less gap inside.
- Do not touch the connectors when you measure the insulation resistance, or electrical shock may occur.

〈Operation〉

- In cases of errors, stop the operation immediately, or electrical shock, injury, and/or fire may occur.
- Make sure to operate this equipment within the power-supply voltage specified on the nameplate. Failure to do so may cause property damage, fire, and/or electrical shock.

〈Maintenance/Inspection〉

- Do not touch the connectors when you measure the insulation resistance, or electrical shock may occur.
- To prevent burns from high temperature of the equipment surface, do not touch the explosionproof electrical equipment with bare hands during maintenance and inspection.

〈Disposal〉

- At the time of disposal, make sure to follow the related laws and regulations.

1 PRODUCT SPECIFICATION

Main Specification

- Product Name　Batch Counter
- Model　EL7320
- Construction　Flameproof Enclosure
- Classification　Ex d IIB T4
- Explosionproof Areas　Zone 1, Zone 2
- Rating　AC 220V, 50/60Hz, 1136mA
- Ambient Temperature　-20 to +50℃
- Mount　Wall-mount
- Manufacturer　OVAL Corporation

2 BEFORE YOU BEGIN

2.1 Install Location

(1) This equipment can only be installed in hazardous locations classified as Zone 1 and Zone 2 for products in "Group IIA or IIB", and "Temperature classes T1 to T4".
Do not install this equipment in Zone 0 hazardous locations.

(2) Operate this equipment within the rated operation temperature range.
If the surface temperature is expected to exceed the temperature range, take necessary measures.

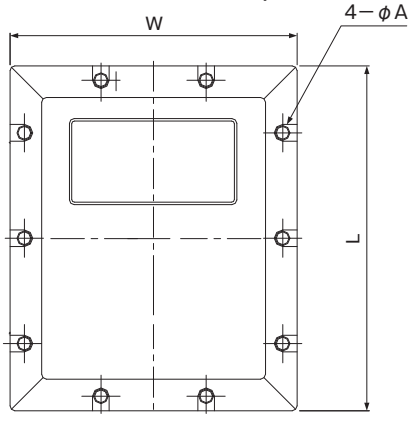
(3) For classification of hazardous locations and explosionproof electrical equipment, please refer to "USERS' GUIDELINES for Installations for Explosive Atmospheres in General Industry (JNIOSH-TR-No.44'2012')", and "Guidelines for Industrial Electrical Installations for Explosionproof (Gas/Steam Explosionproof 2006)".

2.2 Installation

(1) For mounting of the casing, make sure to fix it tightly with four bolts.

(2) Use plain washer and spring washer for installation.

(3) Refer to information below for mounting hole diameter and pitch.
Recommended torque: 5 to 6.9 N・m



W	L	ϕ A	Recommended Diameter
270	260	Long hole of 8×10	M6

Mounting hole pitch and hole diameter

2.3 Wiring

(1) Remove ten bolts (M8) using the hex key shipped with the batch counter.
※ Make sure not to lose the removed bolts.
※ Make sure that there is no explosive atmosphere surrounding the site.

(2) Slowly open the lid holding the un-hinged side of the lid.
Do not exert too much pressure on the hinges during this procedure.

(3) Lead the power cable inside through pressure-tight packing cable gland.
※ Please refer to section 4." External Cable Lead-in" for handling pressure-tight packing cable gland.

(4) Install wiring to the terminal block.
※ Make sure to cut off the excessive cable.
※ Make sure to use round crimping terminals that are insulated with insulating tube or marker tube, or those with insulating coating.
※ Make sure to wire so that there is no external force directly acting on the terminals.
※ Connecting more than two wires on one terminal is not acceptable.

(5) Carefully close the lid after checking following items:
a) There is no foreign matter stuck on the joining surface.
b) Water-proof packing is securely placed in the slit.
c) Joining surface is thoroughly greased.
d) No wire is lodged between the front cover and batch counter body.

Then tighten the bolts you removed in procedure (1).

The bolts used for tightening the cover are stainless-steel hex bolts with plain washer and spring washer.
Specifications of cover-tightening bolts:

Bolt size : M8 × 25
Recommended torque : 11 to 14.7 N・m
Lower yield point : 450N/mm^2
Make sure to use the bolts specified as above.
For repurchasing and/or replacing of the bolts, please contact OVAL.

3 EARTH GROUND

(1) Ground terminal can be found inside of the batch counter. Install the ground terminal so that grounding resistance does not exceed 100Ω.
For cable wiring, use one of the cable cores as the grounding wire.
(2) Use inside ground terminal as much as possible. If it is not possible to use the inside ground terminal, use the outside ground terminal.
(3) Grounding wire must have an insulation capacity of 600V plastic insulant wire or better, and the diameter large enough to safely carry the maximum electrical earth anticipated.
Also, make sure to protect the grounding wire from external damage by using protective tube or equivalent.
(4) The size of ground terminal (both inside and outside) is M5.

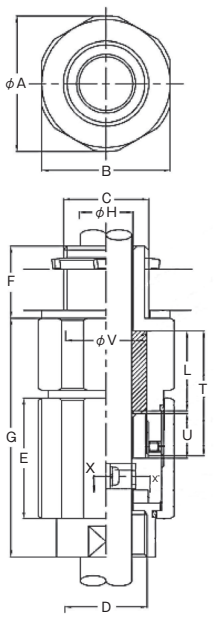
4 EXTERNAL CABLE LEAD-IN

- Consider maximum operating temperature of insulant and sheath as well as chemical resistance when choosing the cable. Gaps inside the cable must be as little as possible so that explosive gases will not circulate easily. The surface of the cable must be smooth, and the cross-section has to be round.
Also, take into consideration the temperature increase of the cable when you determine the size and insulant material of the cable.
- Cable should be protected from anticipated exogenous forces with metal tube to ensure sufficient strength.

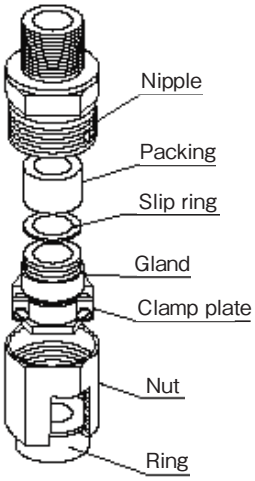
4.1 Pressure-tight packing cable gland

The pressure-tight packing cable gland constitutes a part of the explosionproof configuration. Please use the following pressure-tight packings specified by OVAL and do not use those other than specified.

Model			HPN21–			HPN22–	
			R8 - C	R10 - C	R12 - C	R14 - C	R16 - C
Applicable cable O.D.			6 - 8	8 - 10	10 - 12	12 - 14	14 - 16
Packing		O.D.	21			25	
		I.D.	8	10	12	14	16
		Thickness	6.5	5.5	4.5	5.5	4.5
		Length before compression (L)	34			34	
		Length after compression (L)	Min. 25.5			Min. 25.5	
		Effective compressibility	10% approx.			10% approx.	
	Box	I.D. (V)	21.5			25.5	
		I.D. (T)	44			44	
		Depth (U)	17.5			17.5	
A			38			42	
B			36			40	
C		N.D.	G 3/4			G 3/4	
		Pitch	1.8143			1.8143	
		Grade	B			B	
D			G 1/2			G 3/4	
E			41.5			41.5	
F			25			25	
G			(78)			(78)	
H			13			17	
J			R14			R12	
K			9	11	13	15	17
M			21			25	
N			13			17	
O			5			5	
P (min.)			4.5	5.5	6.5	11	12
Q			8			8	
R			28			32	
S			21			25	



4.2 Part Names

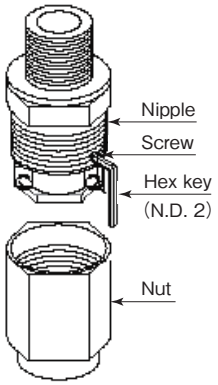


4.3 Cable lead-in procedures

Follow the steps below for leading cable into HPN pressure-tight packing cable gland.

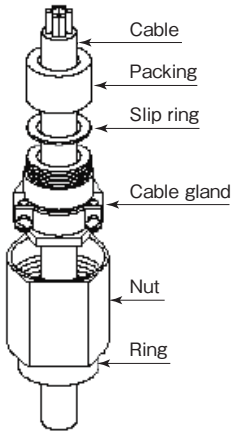
① Confirm that the applicable cable diameter for HPN pressure-tight packing cable gland and O.D. of the cable match. If they do not match, change the cable to applicable size or replace the cable gland to one that matches the O.D. of the cable.

② Unscrew the nut (ring) from the nipple.
Loosen the cable gland locking screw with the attached hex key (N.D. 2), then disassemble the cable gland, slip ring, and packing from the nipple. (Fig. 1)



(Fig. 1)

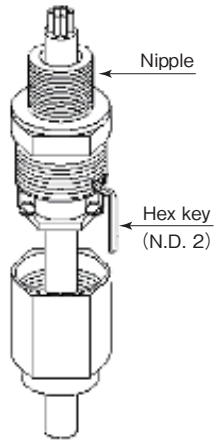
③ Run the cable through the parts in the following order; nut, ring, cable gland, slip ring, then packing. (Fig. 2)



(Fig. 2)

④ Compress the packing by screwing the cable gland into the nipple.
As a general rule of thumb, screw the cable gland an additional 360° from the point where inside diameter of packing matches the outside diameter of the cable.

If the position of clamp plate is undesirable, adjust the cable gland within a range of ±120°, then screw the cable gland locking screw. (Fig. 3)



(Fig. 3)

⑤ Fix the cable by tightening two screws on the clamp plate, then screw the nut into the nipple.

5 MAINTENANCE/INSPECTION

5.1 Attention during Maintenance and Inspection

(1) Do not open the front cover while circuits are alive.
(2) Use maintenance/inspection tools that will not generate frictional sparks.
(3) If you intend to use an electric measuring instrument, make sure it is explosionproof.
(4) Please contact OVAL if disassembling and/or reassembling is required for service or repair.
(5) Confirm the following after maintenance and inspection:
- There is no damage on the joint surface.
- Sufficient depth and clearance are ensured on the joint surface.
- There is no damage or crack on the batch counter body.
- Locking screws are tightened evenly and sufficiently.
- Rust-proof measures are properly applied.

5.2 Requirements for Person in Charge of Maintenance

Those who conduct maintenance/inspection must be trained and experienced in the field of electrical equipment installation, related regulations, and general principle of hazardous location classifications.
[Excerpt from "USERS' GUIDELINES for Installations for Explosive Atmospheres in General Industry (Gas explosionproof 1994)"]

5.3 Contents of Maintenance and Inspection

Regarding soundness of the counter body, clearance of joint surface, and temparature increase of counter surface, conduct proper inspection daily and periodically referring to Table1.

(1) In addition to inspection conducted at non-hazardous location, electrical wiring must be inspected daily and periodically to maintain explosionproof performance.
(2) Electrical wiring can easily be affected by exogenous forces. Daily visual inspection is highly recommended.

5.4 Other

For further infomation regarding maintenance and inspection, please refer to "Guidelines for Industrial Electrical Installations for Explosionproof (Gas/Steam Explosionproof 2006)" and "USERS' GUIDELINES for Installations for Explosive Atmospheres in General Industry (JNIOSH-TR-No.44'2012')".

Table1. Items for inspection and maintenance

Item	Method	Description	Treatment
Internal assembly	Visual	No rust No damage	Cleaning Rust-proofing
Tightening bolts	Visual Touch	No backlash No rust	Retorquing Cleaning
Packing	Visual	No cracks No significant deformation	Replacing
Lead-in	Visual	No damage or degradation	Replacing
Joints	Visual Touch	No backlash on joints No stain on insulation	Retorquing Cleaning
Temperature increase	Thermometer Touch	Under the limit	Further investigation
Joint surface	Visual	No damage or rust Anti-rust grease is applied	Cleaning Foreign matter removal Greasing

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