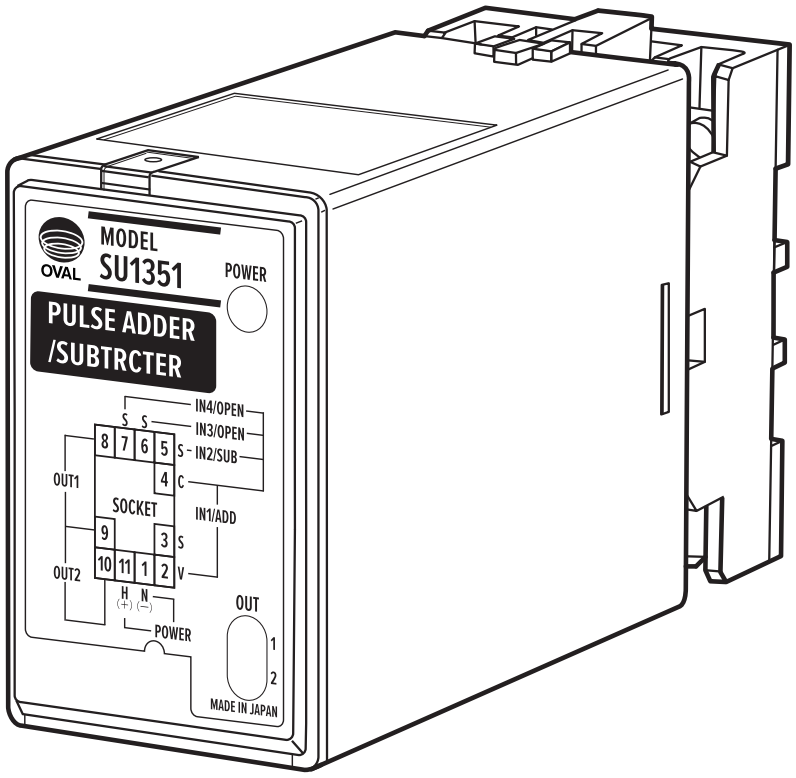
OVAL INSTRUCTIONS

Ins. No. E-742-5-E

PULSE ADDER/SUBTRACTER

MODEL : SU1351



Every Oval product is manufactured and shipped from our factory under strict quality control. In order to assist in maintaining its design performance throughout the life of the product, this manual offers the operator the necessary installation, operation and maintenance information. Be well familiar with these information and instructions before you place the product in service and retain this manual at the field location for ready reference.

Also read the instruction manual of the companion pulse generator (flowmeter) and receiving instrument.

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

Before leaving the factory, every Oval product has been thoroughly inspected and tested and is shipped in first-class operating condition. When received, it should be carefully inspected for any indication of rough handling during transit. In this section, instructions necessary for handling this instrument are described. Make yourself familiar with these instructions. As for other instructions, refer to respective sections. If you have any inquiries, contact the nearest OVAL authorized service station in your district.

⚠ **NOTE : When you make inquiries, include the product name, model number, stock number, ratings and other necessary information.**

1.1 Confirming the Nameplate

This instrument has been assembled and tested according to your particular specifications. Product code and major ratings appear on the nameplate on top of the housing. Make sure that the product you received complies with the specifications in your order.

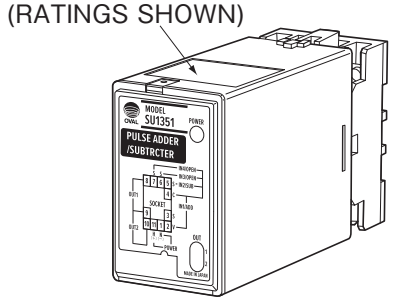


Fig. 1.1 Location of Nameplate

1.2 Transportation Considerations

(1) The OVAL instrument can best be transported to the installation site in the shipping container used for transit from our factory.
(2) Avoid giving impact shocks to the instrument during transportation.

1.3 Storage Considerations

Storing the instrument for long period before installation can result in unexpected and undesirable conditions. When long term storage is anticipated, take the following percautions:
(1) The product can best be stored in the original package used for transit from the factory.
(2) Select a storage location that meets the following requirements:
- ★ Free from rainwater and moisture
- ★ Least vibration and impact shock
- ★ In the room temperature and humidity environment (around 25℃ and 65% R.H.)

⚠ **CAUTION: A sensor which has been idle for extended periods of time may possibly require internal inspection. If such is the case, consult factory.**

(3) If long-term storage is expected, duplicated the conditions of shipment from the factory.
An instrument that has been left out of operation for a long time may require internal inspection. See our service.

2. GENERAL

This instrument serves as a pulse adder or pulse subtracter (selectable with an internal switch). As a pulse adder, it receives a maximum of four pulse trains coming in from multiple flowmeters, and provides a pulse signal that has added up these pulse trains. As a pulse subtracter, on the other hand, it receives a pulse train from the flowmeter at the supply end and at the return end, and provides the difference between two pulse trains, as in an application of boiler fuel consumption measurement.
Since it is a difference pulse, the same pulse unit is used for both supply side and the return side, and the pulse speed of the supply side must be faster than that of the return side.
Both the adder and subtracter can produce at the output "2," a frequency reduction output demultiplied by 1/1, 1/10, or 1/100. (Output "1" is a fixed output in this case.)

2.1 Features

(1) Simple to obtain an add or subtract pulse output.
(2) A 1/1, 1/10, or 1/100 demultiplied pulse output is available.
(3) Contains a power supply to the pulse generator/preamplifier of a variety of flowmeters.
(4) A free AC power source type operates on a power source 85-264V AC. A DC power source type, on the other hand, operates on a 20-30V DC source.
(5) A compact plug-in design for maximum ease of use and maintenance.

2.2 Part Names

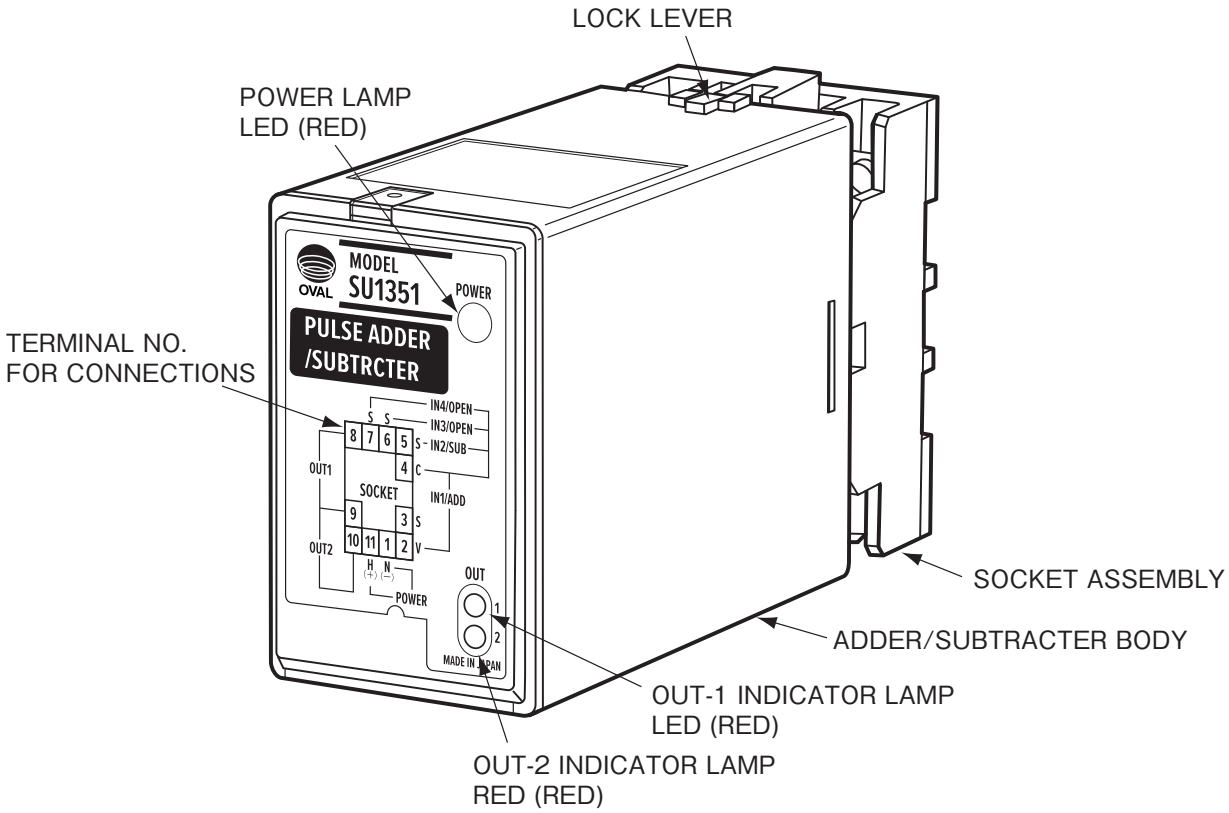


Fig. 2.1 Part Names

2.3 Outline Dimensions

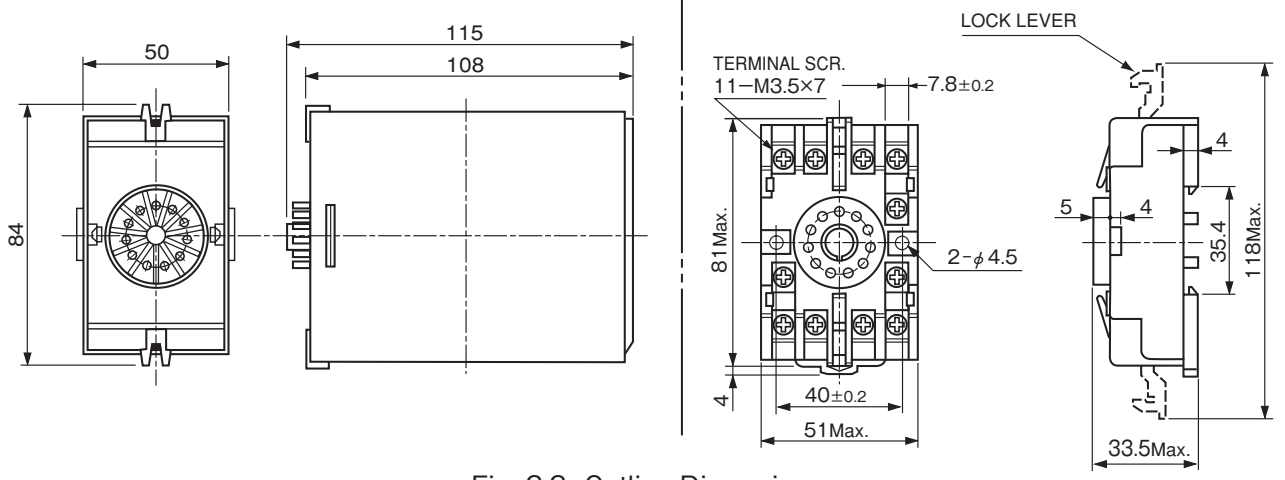


Fig. 2.2 Outline Dimensions

3. OVERALL BLOCK DIAGRAM

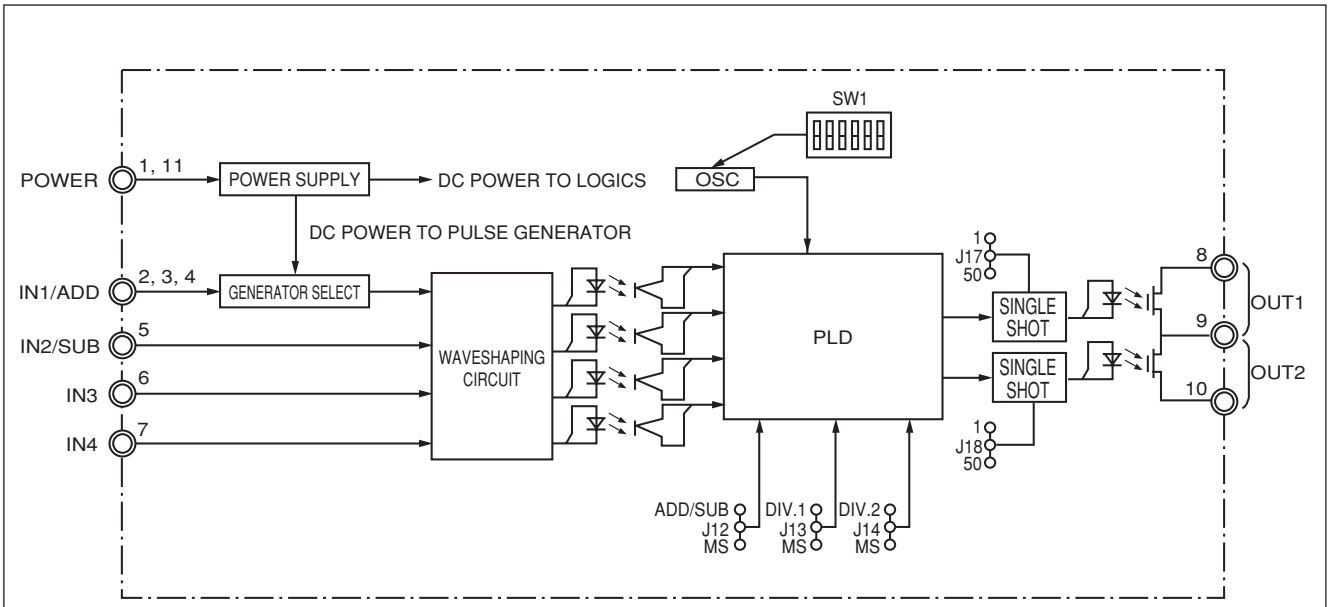


Fig. 3.1 Overall Block Diagram

● Description of Individual Circuits (Blocks)

- Pulse generator selector: Selects pulse generator signal type.
- Power supply: Furnishes power of required internal voltage to individual circuits from the power source.
- Waveshaping circuit: Shapes individual input signals.
- PLD (programmable logic device): With connections of jumpers J12 through J14 selected, adds or subtracts incoming pulses, and demultiplies pulse frequency.
- OSC: Clock signal (SW1 selects the frequency.)
- Single-shot multivibrator: With connections of jumpers J17 and J18 selected, changes output pulse width from 1 ms to 50 ms, or vice versa.

4. INSTALLATION

Installation Location

Select an installation location where

(1) Mechanical vibration, shock and corrosive gases least exist.

(2) Air is dry and temperature at room temperature and stable.

➡NOTE: Although allowable temperature ranges from -10 to +50℃, select an installation site close to room temperature.

(3) Potential sources of inductive interference, such as electromagnetic contactors, are located sufficiently away.

(4) A lightening arrestor is provided if incoming signals are subject to potential influence of lightening.

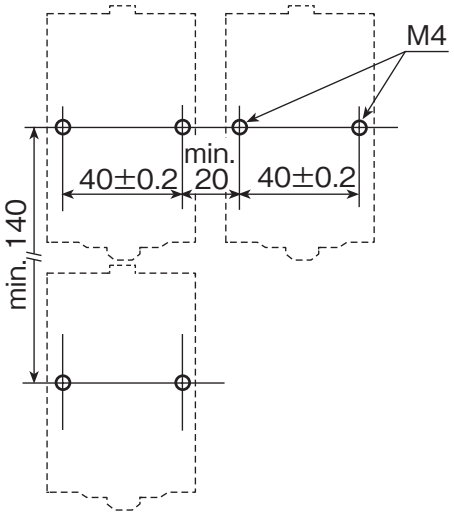


Fig. 4.1 Mounting Centers of Socket Assembly

5) If you wan to install two or more units alongside, sufficient working space is secured behind them to facilitate wiring and maintenance (see Fig. 4.1).

(6) In an environment where the instrument is exposed to a high noise level, we recommend to use a commercially available noise filter or noise isolating transformer.

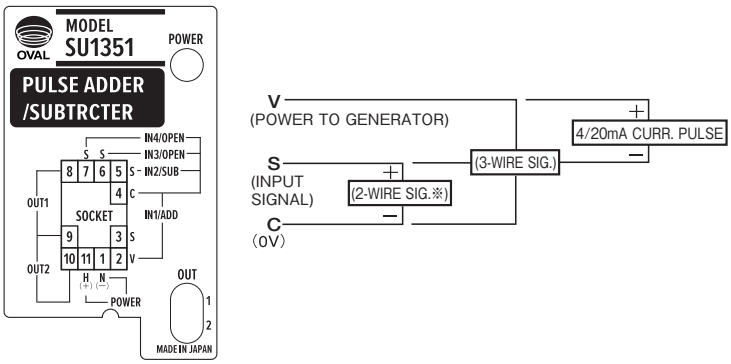
5. WIRING

(1) Separate field wiring from other power lines or power circuits to minimize the possibility of stray current pickup.

(2) Terminal arrangement is shown in Fig. 5.1.

(3) M3.5×11.5 screws are used for terminals. Ensure good electrical connections.

(4) Upon completion of wiring connections, install the adder/subtracter body into the socket. Then engage the locking levers on the socket assembly with the adder/subtracter body.



➡NOTES

All inputs have V (power to pulse generator) and C (0V) in common.

OUT 1 and OUT 2 have terminal "9" in common.

※…Contact-closure, voltage, open collector pulses, etc.

Fig. 5.1 Terminals for Connections

(5) For input signal cable, be sure to use the one recommended for the flowmeter or other equipment to be connected. The maximum transmission length depends on these equipment used. For other signal cables, do not fail to use electrostati-cally-shielded, polyethylene-insulated, vinyl-sheathed control cables (CEVS 1.25-2mm^2, 2- or 3-conductor), or equivalent. With a cable 2mm^2 in conductor area, transmission length is typically one kilometer max.

⚠ **CAUTION: Make electrical connections upon confirmation of validity of flowmeter (pulse generator) and receiving instrument combination by their product No., etc.**

6. PREOPERATIONAL CHECKS AND OPERATION

(1) Ensure that the adder/subtracter and related equipment are correctly installed and wired with no place left unfinished.

⚠ **WARNING: Make sure to see that the power terminals are connected to a power source of the rated voltage. Applying a power source of incorrect voltage could ruin your instrument.**

(2) Supply power to this instrument and make sure to see that the power indicator (red LED) comes on.
(3) Initiate operation by allowing the process fluid to run.

⚠ **CAUTION: Please be careful to avoid inadvertent power interruption during operation. A precaution to remember while using as a subtracter, in particular, is that the variable of SUB (return) pulses will be reset in the internal counter when power is turned off. (No backup feature is incorporated in this instrument.)**

7. TROUBLESHOOTING

● If the trouble is suspected to be internal to the adder/subtracter, seek our service.

Symptom	Check	Possible Causes
Power indicator lamp (LED) fails to come on.	1. Is power source type (AC/DC) in conformity with the power supply specification? 2. Make sure of power source voltage. Is an 85-246V AC (50/60Hz) power or 20-30V DC power impressed across terminals 11 (+) and 1 (−)?	1. Power source type is improper. → Use a power source proper to this instrument. 2. Line voltage is improper. → Use a power source proper to this instrument. ※ If trouble is other than above, a fault is suspected in the internal power supply board.
No pulse output. Or the instrument fails to operate properly.	1. Input signal line correctly wired? 2. Input signal coming in? 3. Are jumper and switch set in the right position? 4. Are LED indicator lamps OUT 1 and OUT 2 blinking?	1. Input wiring is incorrect. → Make the right wiring connections referring to Fig. 5.1 (page 6). 2. Pulse generator itself is at fault. → Refer to the instruction manual for the pulse generator coupled. 3. Jumpers and switch are set in → incorrect positions. Set them in the right positions, referring to Fig.9 (page 11). 4. Some of the internal boards is suspected to be at fault. ※ If trouble is other than above, a fault is suspected in the receiving instrument (eg., counter) couled.

◆ Component Locations

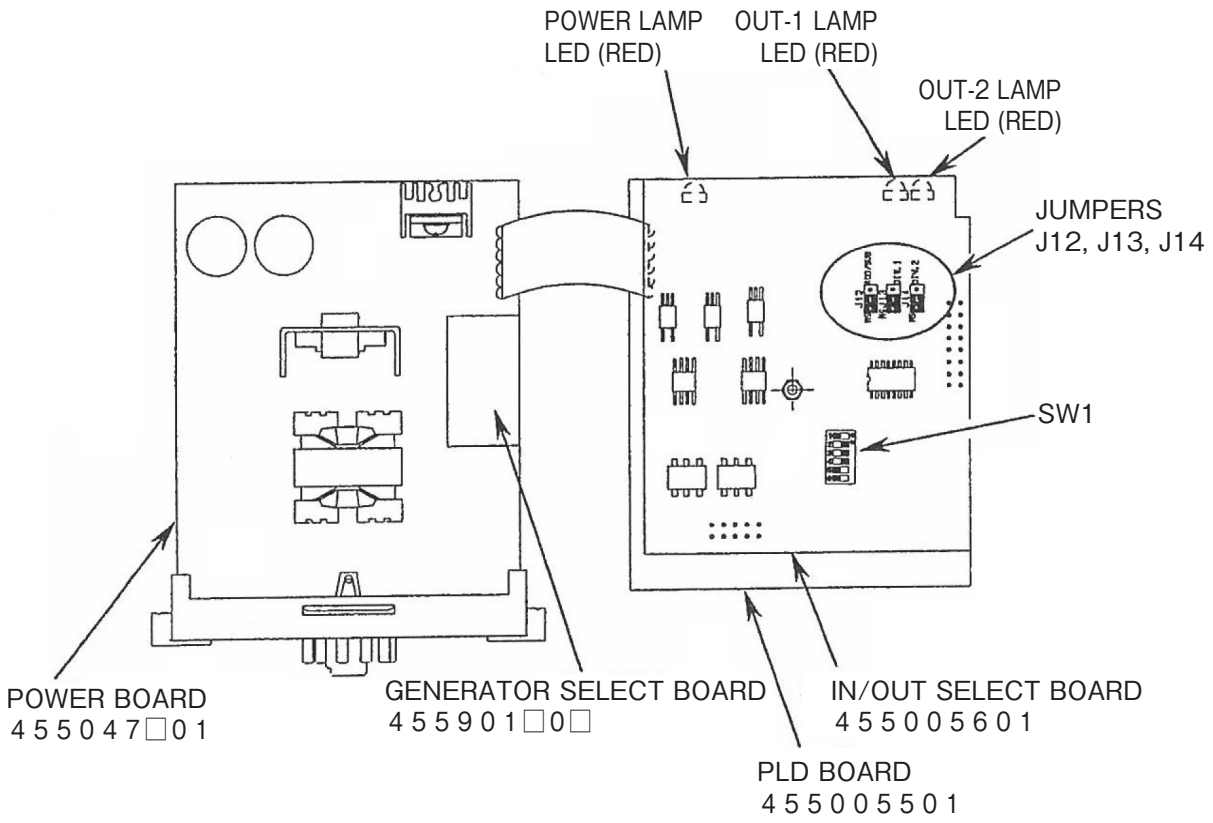


Fig. 7.1 Component Locations

8. DESCRIPTION OF OPERATION

See Sec. 8.1 for use as an adder; Sec. 8.2 for used as a subtracter.

8.1 Operation as an Adder

Pulse trains coming in irregularly from IN-1 through IN-4 are, after waveshaping, fed to the logic circuit (PLD) ("a" in the figure).
In this logic circuit, four different clock pulses are firstly generated and secondly, each incoming pulse is synchronized with each internally generated clock pulse.
The resultant pulses of IN-1 through IN-4 are pulses that are not overlapped with each other in timing ("b" in the figure).
Then the process of adding up these pulses takes place ("c" in the figure) and the resultant output appears at OUT 1.
Output at OUT 2 is a pulse train scaled by 1/1, 1/10, or 1/100 (depending on the customer specification).

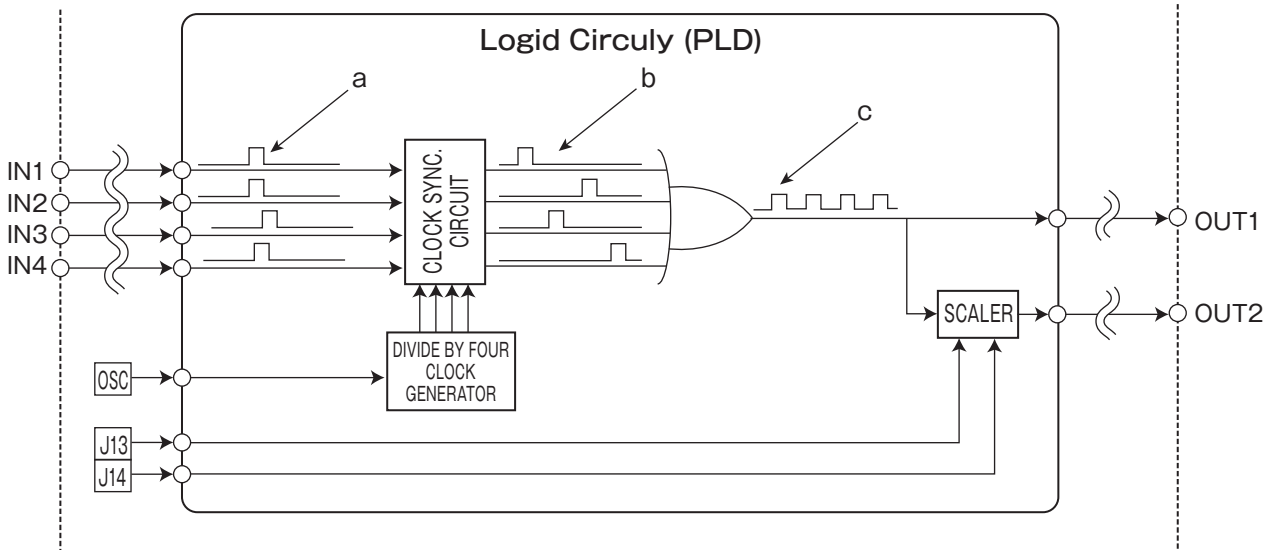


Fig. 8.1

8.2 Operation as a Subtracter

Pulse trains coming in from ADD (supply) and SUB (return) go to the logic circuit (PLD) after waveshaping ("a" in the figure).
In the logic circuit, two different clock pulses are firstly generated and secondly, each incoming pulse is synchronized with each internally generated clock pulse.
The resultant pulses of ADD and SUB are pulses that are not overlapped with each other in timing ("b" in the figure).
They are then fed to the add/subtract counter for the process of subtraction. In this add/subtract counter, incoming ADD pulses are cancelled out by the number of incoming SUB pulses ("c" in the figure).
The resultant pulse output appears at OUT 1. Output at OUT 2 is a pulse train scaled by 1/1, 1/10, or 1/100 (depending on the customer specification).

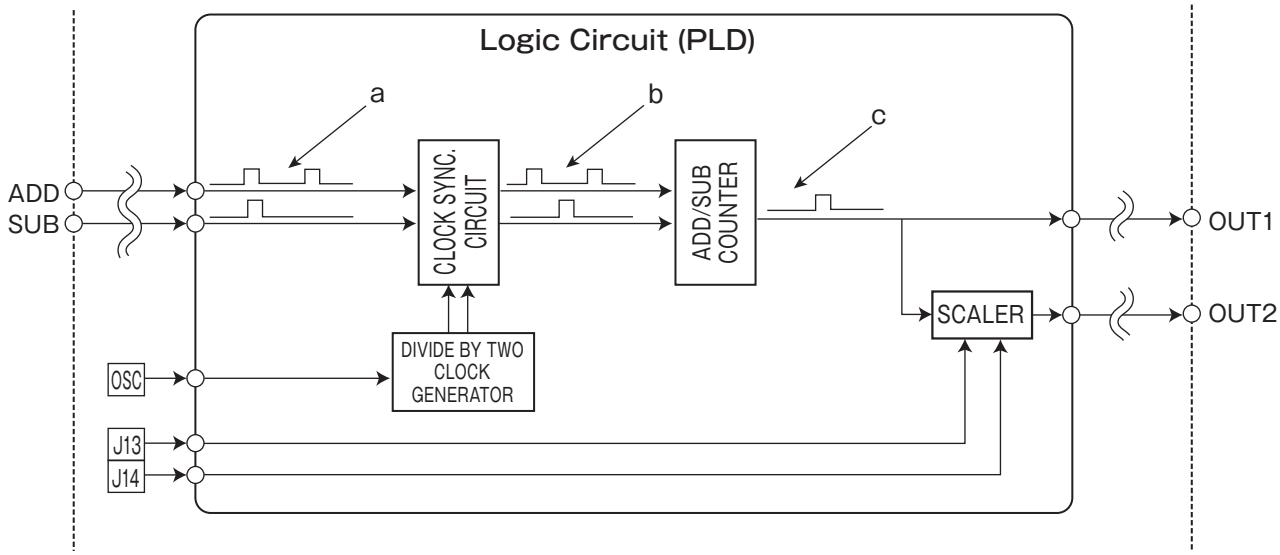


Fig. 8.2

8.3 About Output Pulses

Output pulses (open MOS-FET) from OUT-1 and OUT-2 are 1 ms or 50 ms wide, depending on the setting in the singleshot circuit.
A model configured as an adder has the maximum output frequency five times the input response frequency at OUT-1 (and OUT-2 scaled at 1/1).
See Section 9 for selecting the output pulse width and response frequency.

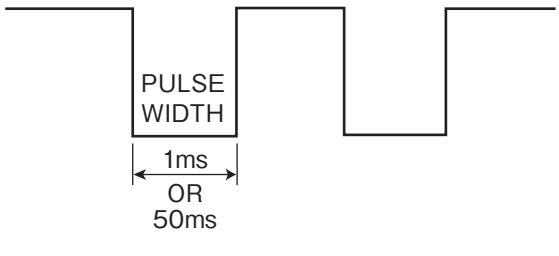


Fig. 8.3 Output Pulse Width

9. INDIVIDUAL JUMPER AND SWITCH SETUP

Jumpers J12, J13, and J14 select the adder or subtracter function, and the factor of frequency reduction at OUT-2 (⇨ see Fig. 7.1 on page 8 for their locations). Be sure to turn off power before changing their settings.

Jumper J12 selects the adder or subtracter function, while J13 and J14 select the frequency reduction at OUT-2.

See the tables for jumper settings.

Shown in the example at right are adder settings at OUT-2 with 1/1 frequency reduction.

(J12, J13, and J14 are all installed in "MS" position).

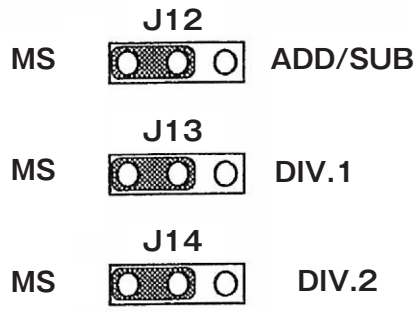


Fig. 9.1 Adder Scaled at 1/1 (example)

●Function select: J12 selects the function to use.

Jumper Setting: J12	Function
"MS"	Pulse adder
"ADD/SUB"	Pulse subtracter

●Scaling select: J13 and J14 select the factor of frequency reduction at OUT2.

Jumper Settings		Output at OUT 2
J13	J14	
"MS"	"MS"	Freq.reduction : 1 ／1
"DIV.1"	"MS"	Freq.reduction : 1 ／10
"DIV.1"	"DIV.2"	Freq.reduction : 1 ／100

●Response frequency select (only in a model configured as the adder)

Switch SW-1 on the PLD board selects the response frequency to the incoming pulses. Shown in the example at right is set at 2 Hz for response frequency.

See the table below for selecting the frequency.

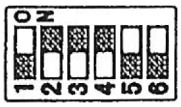


Fig. 9.2 Response Frequency = 2kHz (example)

SW 1 Setting						Response Frequency ※Figures in brackets ( ) show the highest output frequency.
1	2	3	4	5	6	
ON	OFF	OFF	OFF	ON	ON	2 Hz (10 Hz)
OFF	ON	ON	OFF	ON	OFF	30 Hz (150 Hz)
OFF	ON	OFF	ON	ON	OFF	100 Hz (500 Hz)

⚠ **CAUTION : Jumpers and switch have been set according to the customer specification before the instrument leaves the factory and no further adjustment is necessary. The information described in this section is presented only for reconfiguring the instrument. Inadvertent disassembly of the instrument may lead to a damage or trouble to this instrument.**

10. GENERAL SPECIFICATIONS

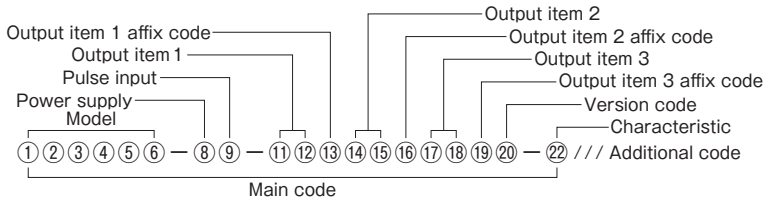
ITEM		DESCRIPTION	
		Adder	Subtracter
Input Signal	Acceptable No. of Inputs	4 inputs (SUP in common)	2 inputs (SUP in common)
	Response Frequency	100Hz／30Hz／2Hz (Max.)	200Hz (Max.)

Label	Companion pulse generator	Power to pulse generator ※	
Contact-closure	PG20	13.5 VDC	Current Carrying Capacity 40mA approx. Shortcircuit protection circuit provided.
2-wire, 12V 3-wire voltage	PG30, NPG60A(F)	13.5 VDC	
24V 2-wire current pulse (4/20mA)	PA14, 15, 25, ULTRA OVAL	24.0 VDC	
Open collector pulse	FLOWPET-NX, NPG60A(E3)	13.5 VDC	
32V 3-wire, open collector pulse	PA11	32 VDC	

Output Signal	Signal	Non-contact relay
	Capacity	230V AC/340V DC 0.2A Resistance at "ON": 16Ω max. Leak current at "OFF": 1μA
	Frequency Reduction	Pulse output "OUT 1": 1/1 fixed Pulse output "OUT 2": 1/1, 1/10, or 1/100 } Terminal "9" in common
	Pulse Duration	1 msec, or 50 msec.
Power Supply		85 - 264V AC 50/60Hz or 20 - 30V DC
Power Consumption		10VA approx.
Ambient Temperature		−10 to +50 ℃
Insulation Resistance		Across power terminals bundied and output terminals bundied: 10MΩ Min. (with 500V DC Megger)
Withstand Voltage		Across power terminals bundied and output terminals bundied: 1500V AC for one minute
Mounting		Plug-in type
Enclosure		Resin molding. black
Mass		0.5kg, approx.
Accessory Furnished		11P surface-mount socket: 1 pc.

➡NOTE:※ Lack of current capacity supplied to the connected transmitter may occur depending on the operating environment and the operation of the transmitter may be stopped. Therefore, the rated current capacity should be 80% or less. If the above condition cannot be met, prepare another power supply.

11. PRODUCT CODE EXPLANATION



•Main code

①	②	③	④	⑤	⑥	Model
S	U	1	3	5	1	Pulse Adder / Subtractor
⑦	—					
⑧	Power supply					
D	20 to 30VDC					
J	85 to 264VAC 50Hz/60Hz					
⑨	Pulse input					
B	Voltage pulse 12VDC 2 wires / 3 wires					
D	Current pulse 24VDC (4/20mADC) ULTRA OVAL, PA25, PA14 etc.					
G	Open collector pulse 12VDC 2 wires / 3 wires					
J	Open collector pulse 32VDC 3 wires					
K	Contact pulse 12VDC 2 wires / 3 wires					
Z	Special					
⑩	—					
⑪	⑫	Output item 1				
Pulse output						
A	D	Pulse adding function				
S	U	Pulse subtracting function				
⑬	Output item 1 affix code					
N	Non					
⑭	⑮	Output item 2				
Input response frequency of pulse inputting function ※1						
H	1	Output pulse width 1ms (input frequency: 100Hz)				
L	5	Output pulse width 50ms (input frequency: 2Hz)				
Z	Z	Special				
⑯	Output item 2 affix code					
X	Frequency division 1/1					
1	Frequency division 1/10					
2	Frequency division 1/100					
⑰	⑱	Output item 3				
N	N	Non				
⑲	Output item 3 affix code					
N	Non					
⑳	Version code					
B	Version B					
㉑	—					
㉒	Characteristic					
0	Standard					
Z	Special					

•Additional code

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 Only Japanese
Witness Test			
V	1	1	Appearance, dimensions, quantity check
V	1	4	Appearance, dimensions, quantity check/performance

※1 : Basically OUT1 and OUT2 are output of an identical pulse width.
When used for pulse adding function, max. output frequency of OUT1 (and OUT2 at dividing frequency 1/1) is 5 (five) times faster than the above response frequency.
As pulse subtractor, since the response frequency is fixed to 200Hz, chose the pulse width from either one of code H1 (1ms), L5 (50ms) and ZZ (special).

《PRODUCT CODE EXPLANATION OF THE OLD PRODUCT CODE》

The new product code has been implemented since April 2017.
Therefore, the product code explanation of the old product code will not be updated after April 2017.
Contact OVAL if you wish to order with the old product code for reasons such as type approval.

Item	Product Code		Supplement. Code						Description
	① ② ③ ④ ⑤ ⑥	—	⑦	⑧	⑨	⑩	⑪	⑫	
Model	S U 1 3 5 1								Pulse Adder/Subtracter
		—							
Power Supply			6						20 - 30 VDC
			7						85 - 264 VDC 50/60 Hz
Flow Input				2					Contact-closure pulse
				3					2-wire, 12V 3-wire voltage pulse
				6					Open collector pulse
				8					32V 3-wire open collector pulse
				A					24V 2-wire current pulse (4/20mA)
				9					Other than above
Function					1				Pulse adder
					2				Pulse subtracter
Output Pulse Width ※ (Response frequency to Incoming pulses in a model configured as the adder)						1			1 ms (100Hz)
						2			50 ms (2Hz)
						3			1 ms (30Hz)
						9			Other than above
Frequency Reduction at OUT 2							1		Frequency division 1/1
							2		Frequency division 1/10
							3		Frequency division 1/100
								0	Always “0”

➡NOTE:※ Pulses that appear at OUT 1 and OUT 2 basically have the same pulse width. In a model configured as the adder, the highest output frequency is five times the response frequency to incoming pulses shown in the table above at OUT 1 (and OUT 2 with 1/1 frequency reduction). In the subtracter, its response frequency is fixed at 200Hz and its pulse width is selectable from pulse width codes 1 (1 ms), 2 (50 ms), or 9 (other than above).

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