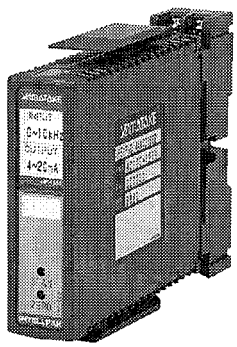
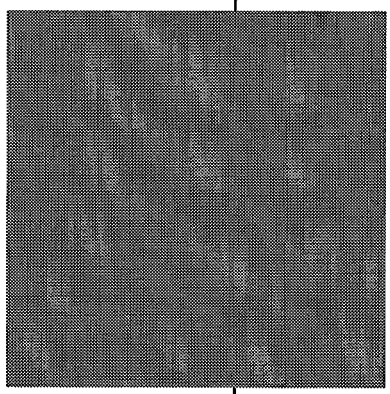
azbil

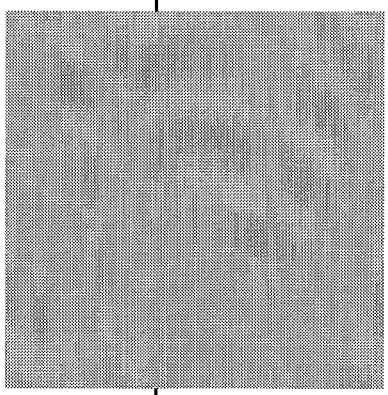
No. CP-UM-1335E

IP51FVD
INTELLPAK
Pulse DC Converter

User's Manual







Yamatake Corporation

RESTRICTIONS ON USE

This product has been designed, developed and manufactured for general-purpose application in machinery and equipment.

Accordingly, when used in applications outlined below, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.

- Safety devices for plant worker protection
- Start/stop control devices for transportation and material handling machines
- Aeronautical/aerospace machines
- Control devices for nuclear reactors

Never use this product in applications where human-safety may be put at risk.

REQUEST

Ensure that this User's Manual is handed over to the user before the product is used.

Copying or duplicating this User's Manual in part or in whole is forbidden. The information and specifications in this User's Manual are subject to change without notice.

Considerable effort has been made to ensure that this User's Manual is free from inaccuracies and omissions.
If you should find any inaccuracies or omissions, please contact Yamatake Corporation.

In no event is Yamatake Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

SAFETY PRECAUTIONS

⚠WARNING Warnings are indicated when mishandling this product might result in death or serious injury.

⚠CAUTION Cautions are indicated when mishandling this product might result in minor injury to the user, or only physical damage to the product.

⚠WARNING

- Before wiring, or removing/mounting the IP51, be sure to turn the power OFF. Failure to do so might cause electric shock.

⚠CAUTION

- Before removing or mounting the IP51, be sure to turn the power OFF. Failure to do so might cause electric shock.
- Use the IP51 within the operating ranges recommended in the specifications (temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc.).
- Do not block ventilation holes. Doing so might cause fire or faulty operation.
- Do not disassemble the IP51. Doing so might cause electric shock or faulty operation.
- Before wiring the IP51, be sure to turn the power OFF. Failure to do so might cause electric shock.
- Do not touch electrically charged parts such as the power terminals. Doing so might cause electric shock.
- Do not allow lead clippings, chips or water to enter the controller case. Doing so might cause fire or faulty operation.
- Firmly tighten the terminal screws at the torque listed in the specifications. Insufficient tightening of terminal screws might cause electric shock or fire.
- Do not use unused terminals on the IP51 as relay terminals. Doing so might cause electric shock, fire, or faulty operation.

CONTENTS

1. Introduction and Specifications

1. INTRODUCTION

The INTELLPAK IP51FVD is a plug-in DC converter system which converts pulse signal inputs into voltage or current analog signals proportional to their frequency.

2. SPECIFICATIONS

<table>
<tr><td rowspan="4">Input part</td><td rowspan="4">Input type</td><td>AC voltage pulse</td><td colspan="3">Peak-to-peak voltage detection model for small-signal input
1: 200mV$_{p-p}$ to 50V$_{p-p}$ 0: 0 to 20mV$_{p-p}$
Input impedance: 100kΩ or greater</td></tr>
<tr><td>DC voltage pulse</td><td colspan="2">Model for proximity or photoelectric sensors with large signal level input
1: 5 to 50V 0: –30 to +1.5V
Input impedance: 20kΩ or greater</td><td rowspan="2">Selected by DIP switch</td></tr>
<tr><td>ON/OFF pulse</td><td colspan="2">Model for non-voltage contact and open collector
OFF position: 5V
ON position: 1mA
(voltage or current applied to contact.)
Input impedance: 20kΩ or greater</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td></td><td>Input frequency</td><td colspan="4">From 0 to 50Hz FS till 0 to 100kHz FS Duty ratio: 25 to 75%</td></tr>
<tr><td>Output part</td><td>Output type</td><td colspan="4">DC voltage and current Refer to Table 1</td></tr>
<tr><td></td><td>Allowable load resistance</td><td colspan="4">Refer to Table 1</td></tr>
<tr><td rowspan="11">General specifi-cations</td><td>Accuracy</td><td colspan="4">±0.1% FS at 23°C</td></tr>
<tr><td rowspan="5">Response time</td><td>Input frequency upper limit value</td><td>Response time (Note 1)</td><td>Dropout frequency (Note 2)</td><td rowspan="5">Note
(1) With 90% response time
(2) When input frequency value is reduced below dropout frequency, output is set to zero (0)</td></tr>
<tr><td>50 to 100Hz·FS</td><td>Approx. 2 s</td><td>Approx. 2.5Hz</td></tr>
<tr><td>101 to 200Hz·FS</td><td>Approx. 1 s</td><td>Approx. 5Hz</td></tr>
<tr><td>201 to 500Hz·FS</td><td>Approx. 0.5 s</td><td>Approx. 10Hz</td></tr>
<tr><td>501Hz·FS to 100kHz·FS</td><td>Approx. 0.2 s</td><td>Approx. 25Hz</td></tr>
<tr><td>Zero and span adjustment</td><td colspan="4">± 10% FS (each zero and span)</td></tr>
<tr><td>Power supply</td><td colspan="2">AC</td><td>DC</td></tr>
<tr><td>Rated power voltage</td><td>100/110/120Vac 50/60Hz</td><td>200/220/240Vac 50/60Hz</td><td>24Vdc</td></tr>
<tr><td>Operating power voltage</td><td>80 to 132Vac 45 to 65Hz</td><td>170 to 264Vac 45 to 65Hz</td><td>24Vdc ± 10%</td></tr>
<tr><td>Power consumption</td><td colspan="2">Approx. 5.5VA</td><td>Approx. 2.7VA</td></tr>
<tr><td>Starting current</td><td colspan="2">—</td><td>0.11A or less</td></tr>
<tr><td>Current peak and width when power ON</td><td colspan="2">10A or less, 1ms</td><td>5A or less, 1ms</td></tr>
<tr><td>Insulation resistance</td><td colspan="4">100MΩ or greater between I/O and power terminals, and between I and O terminals, measured by 500 Vdc megger</td></tr>
<tr><td>Dielectric strength</td><td colspan="4">2000 Vac, 1 minute between I/O and power terminals, and between I and O terminals</td></tr>
<tr><td>Power supply characteristic</td><td colspan="2">± 0.1% FS/80 to 132 Vac or 170 to 264 Vac</td><td>±0.1%FS / 24Vdc ±10%</td></tr>
</table>

General specifi-cations	Temperature characteristic	±0.15% FS/10°C	
	Operating ambient temperature	–5 to +55°C, non-freezing	
	Storage ambient temperature	–20 to +70°C, non-freezing	
	Operating ambient humidity	90% RH or less, no condensation	
	Storage ambient humidity	90% RH or less, no condensation	
	Vibration resistance	4.9m/s² or less, 10 to 60Hz, for 2 hour in X, Y and Z directions when equipped with vibration-absorbing bracket	Not applicable when mounted on DIN rail
	Shock resistance	490m/s² or less, three times in either up or down direction	
	Case material	Heat resistant ABS resin	
	Case color	Gray, Munsell 2.5PB3.5/1	
	Wiring terminal screw	M3.5	
	Terminal screw tightening torque	0.78 to 0.98N•m	
	Installation	Mounted on wall or DIN rail	
	Mass	Approx. 200g including the base socket	

Standard accessory	Base socket Part No. QN719A
Auxiliary part (sold separately)	Vibration-absorbing bracket Part No. QN 718A

2. Model Selection

Model Configuration

I	II	III	IV	V	0	VI

Example: IP51FVD12AA07322

I	II	III	IV	V	VI	Specifications	
Basic model No.	Input	Output	Power voltage	Additional processing	Specified input range		
IP51FVD						Pulse DC converter	
	12					AC voltage pulse, small-signal input, peak-to-peak voltage detection model	
	14					DC voltage pulse, large-signal input, proximity and photoelectric sensors model	Selected by DIP switch
						ON/OFF pulse, non-voltage contact input/ open collector model	
	Selected from Table 1. →					—	
			A			100/110/120Vac 50/60Hz	
			B			200/220/240Vac 50/60Hz	
			D			24Vdc	
				0		None	
				T		Tropicalization	
				D		Test data	
				B		Tropicalization and test data	
				Y		Complying with the traceability certification	
				Selected from Table 2. →		—	

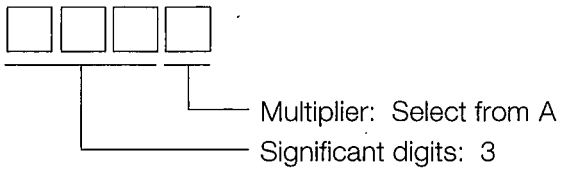
Table 1. Output

Symbol	Output	Allowable load resistance
A	4 – 20mA	750Ω or less
B	1 – 5mA	3kΩ or less
C	2 – 10mA	1.5kΩ or less
D	0 – 1mA	15kΩ or less
E	0 – 10mA	1.5kΩ or less
F	0 – 16mA	937Ω or less
G	0 – 20mA	750Ω or less
H	1 – 5V	2.5kΩ or greater
J	0 – 10mV	10kΩ or greater
K	0 – 100mV	100kΩ or greater
L	0 – 1V	500Ω or greater
N	0 – 5V	2.5kΩ or greater
P	0 – 10V	5kΩ or greater

Table 2. Specified Input Range

A	
Symbol	Multiplier
1	×10
2	×100
3	×1000
4	$\times 10^4$
5	$\times 10^5$
8	×1
9	×0.1

Pulse frequency specification in Hertz (Hz)

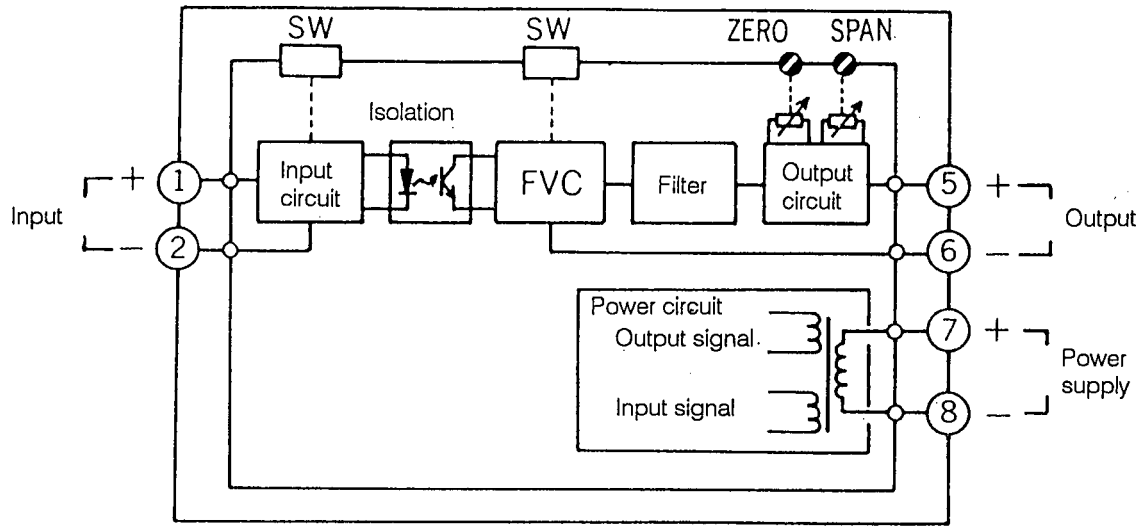


Example

(1) 0Hz to 73.2kHz
0Hz to 73200Hz
0Hz to 732 × 100
7322

(2) 0Hz to 96.3Hz
0Hz to 963 × 0.1
9639

3. Circuit Block Diagram

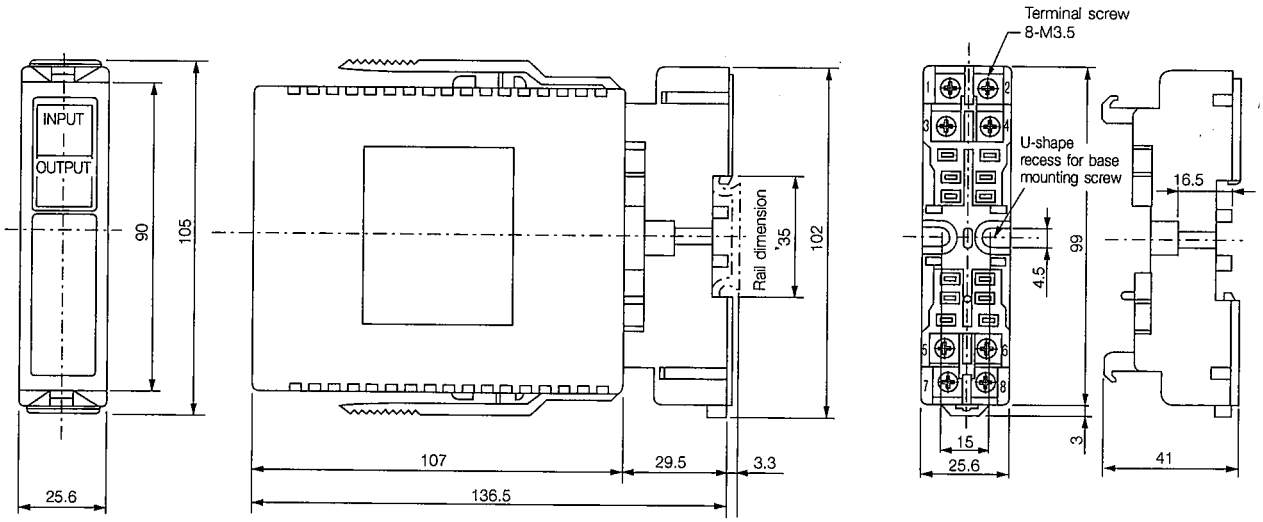


4. External Dimensions

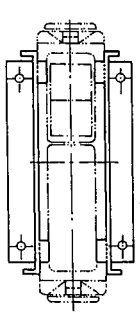
External Dimension Drawing

(Unit: mm)

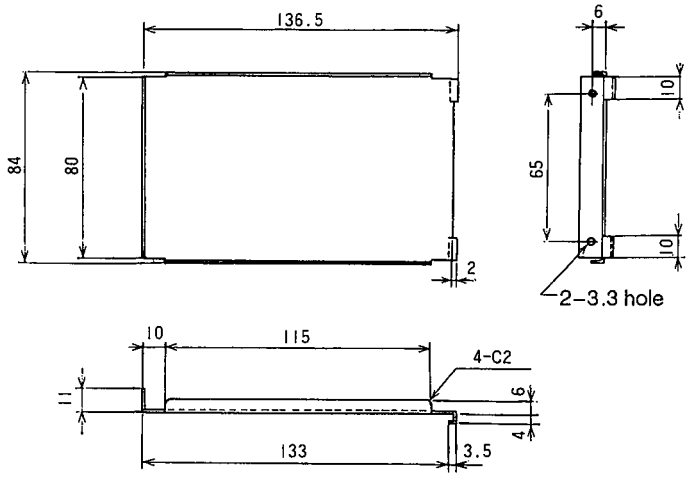
Base socket Part No. QN719A



Vibration-absorbing bracket Part No. QN718A



Equipped with
vibration-absorbing
bracket



Material: Galvanized, cold rolled plate steel
SPCC t1 with chromate processing

5. Installation

1. INSTALLATION PRECAUTIONS

(1) Handling

For personal safety, when removing or mounting the main unit, always turn OFF both power supply and input signal.

(2) Installation

(a) When equipment is installed in a dusty environment, house it in a dust-proof cabinet with heat dissipation capability.

(b) Avoid excessive vibration and shocks.

(3) Wiring

(a) Do not mount power, input signal or output signal lines near either noise generators or relay drive lines.

(b) Avoid clamping lines together or putting them in the same duct.

(c) While the equipment can be operated when power supply is turned ON, 30 minutes are required to fully energize all circuits.

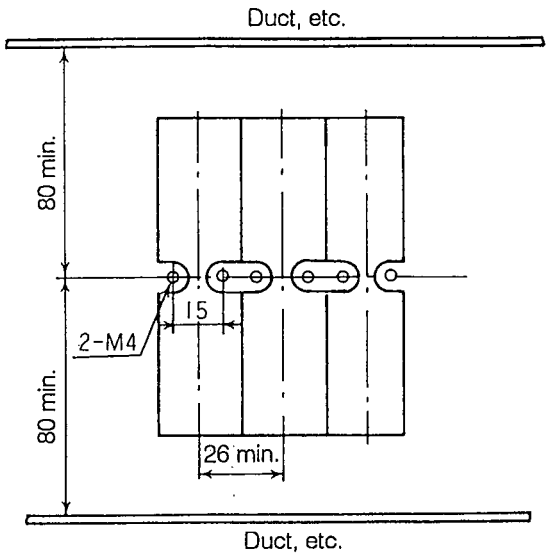
(4) Output terminal short circuit

Avoid shorting output terminals for any length of time.

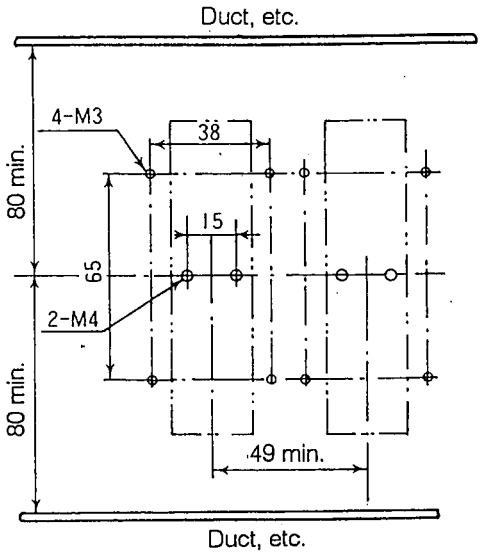
2. INSTALLATION PROCEDURES

(Unit: mm)

Lateral and vertical spacing



Installation on vibration-absorbing bracket with lateral and vertical spacing



Caution:

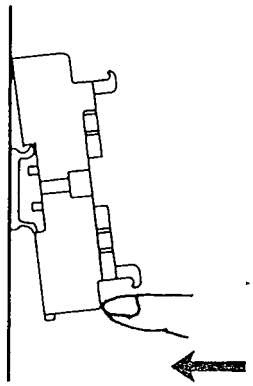
① When installing equipment on a wall with vibration, always use vibration-absorbing bracket (option QN718A). Where vibration is present, the equipment cannot be installed on DIN rail.

② When the main unit output is A/D converted, use the integral A/D converter. When the high speed A/D converter for sequential comparison is used, check the operation in advance by using the combination test.

3. MOUNTING AND REMOVING

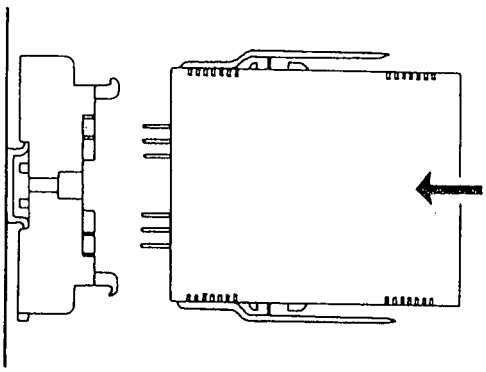
(1) Socket – DIN Rail Attachment

Hook one edge of the socket to the rail as shown in the figure, then push the socket in the direction of the arrow until it clicks in place.



(2) Main Unit – Socket Attachment

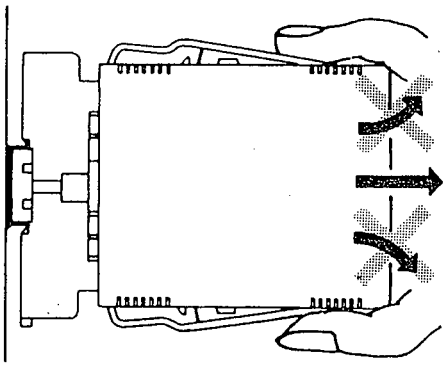
Hold the main unit with labels facing installer and insert unit straight into socket. Insert the unit until the side hooks return to their normal position parallel to the case. The unit should be tightly connected to the socket at this point.



(3) Main unit removal

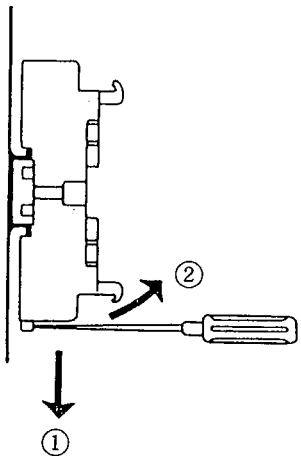
Push the main unit forward the socket while clasping side hooks, then slide unit straight out away from socket.

Note: Socket may be damaged if it is removed without clasping both side hooks equally.

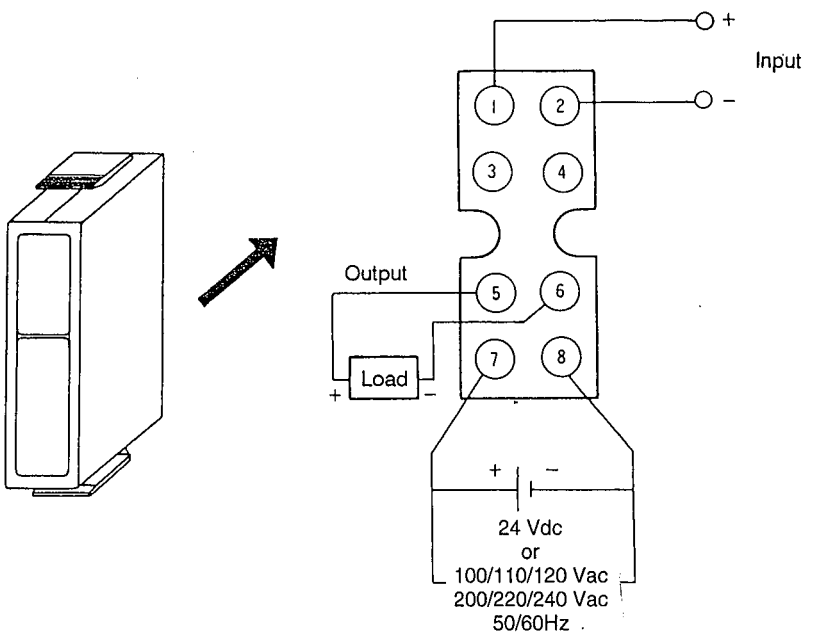


(4) Socket removal

Insert a screwdriver in the slider groove of the socket as shown in the figure. While moving screwdriver in arrow direction ① swing the socket away from rail in arrow direction ② until it is fully removed.



6. Wiring



1. WIRING

1 – 1 Power Supply

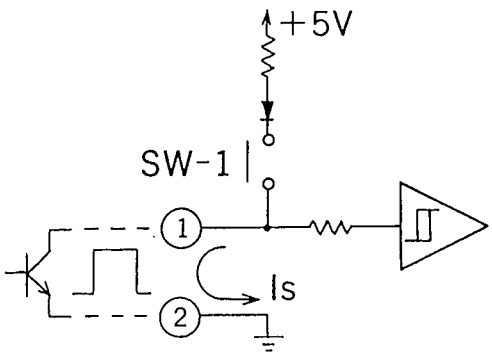
Connect the rated power supply to terminals ⑦ and ⑧. With DC power supply, connect (+) to terminal ⑦ and (−) to terminal ⑧.

1 – 2 Input

Connect (+) input signal indicated on label to terminal ① and (−) to terminal ②. With square wave input, set the duty to 25% to 75%.

Correspondence between open collector and large input signals	Input code 14

SW1 on the left side



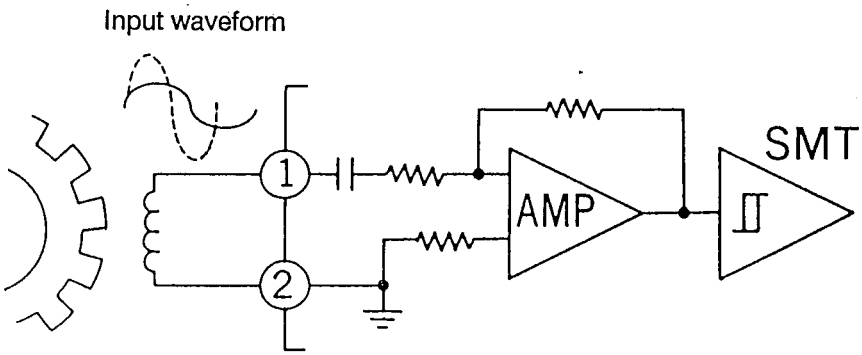
a) Open collector input

Input circuit where sensor output is adaptable to an open collector. When DIP switch SW-1 is turned ON, the closed current (Is) is 1mA. The pull-up voltage when OFF is +5V.

b) Large-lavel input

Suitable for output circuit of +5 to +30V when sensor output is of high level, or −30 to +1.5V when it is of low level. The input impedance is 20kΩ or greater. Turn OFF DIP switch SW-1 for this function.

Correspondence to small input	Input code 12



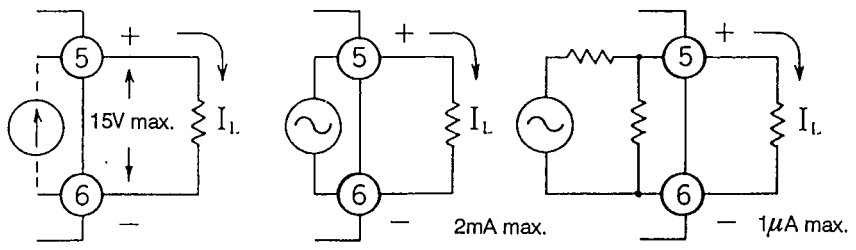
The input circuit suitable for signal source is one that is smaller at low speed mechanical rotation and increases with speed, such as happens with an electromagnetic pickup sensor. The input impedance is 100kΩ or greater with an allowable signal level range from 200mV_{p-p} to 50V_{p-p} using a 0 −V center.

This input is not provided with DIP switch SW-1.

1−3 Output

The DC output specified on the label is output to terminals ⑤ and ⑥, when the rated input frequency is applied. With current output, apply a load that limits the voltage between the output terminals to 15V or less when the rated output is delivered.

With voltage output, use a load current of 1μA or less when the rated voltage is less than 1V; 2mA or less when it is 1V or more.

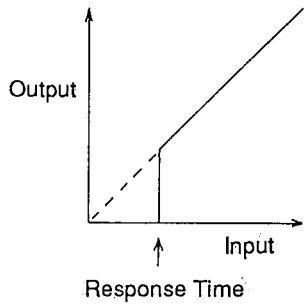


Current output

Voltage output (1V or more)

Voltage output (less than 1V)

2. OUTPUT DROPOUT AND RESPONSE TIME



If input frequency is smaller than input frequency rating, the output ripples are accepted by LPF. To prevent this when the input is less than the rated frequency, output is set to zero or a minimum value. This is called a dropout frequency. The relationship of the input/output and dropout frequencies is shown in Fig. 6.

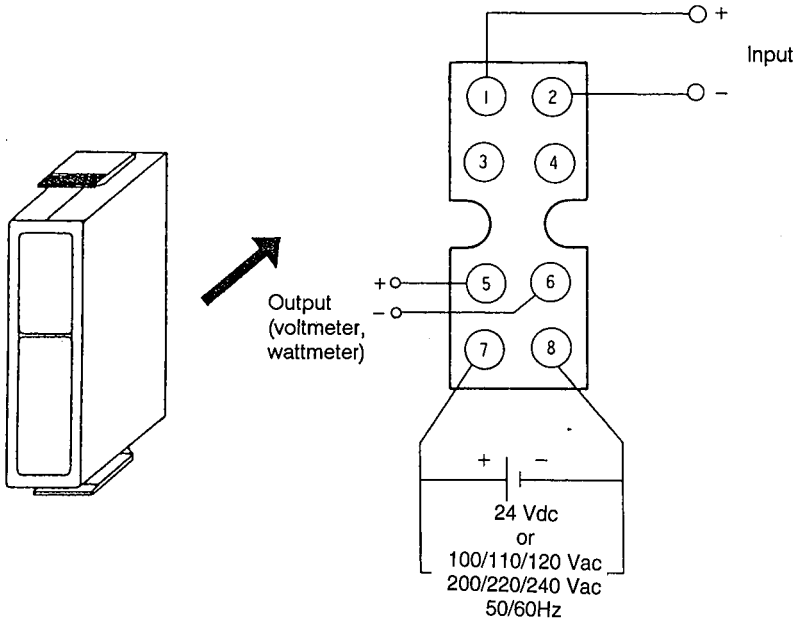
The equipment output response time is the time required for output to reach 90% of the final value when the input frequency changes from zero to the rated value. The following table shows the response time and dropout frequency at each rated input frequency.

Table

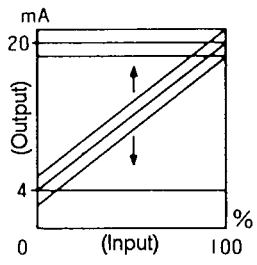
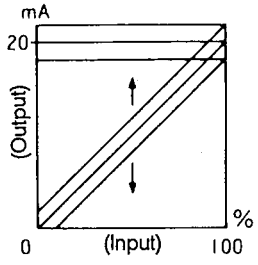
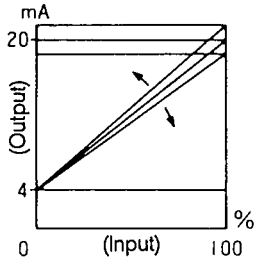
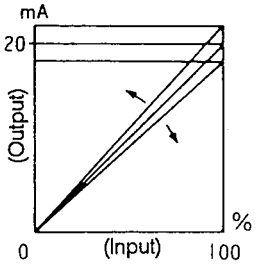
Rated input frequency	Response time	Dropout frequency
50 – 100Hz	2 seconds	2.5Hz
101 – 200Hz	1 second	5Hz
201 – 500Hz	0.5 second	10Hz
501 – 10kHz	0.2 second	25Hz

To eliminate the dropout function, turn DIP switch SW-2 OFF (normally ON).

7. Adjustment



This equipment has been optimally adjusted at the factory. If field calibration or adjustment is required, follow the procedure below. Connect an oscillator, frequency counter, and voltmeter or ammeter as shown in the figure above. Turn the ZERO variable resistor until the output is zero, minimum value when the oscillator output is zero, or less than the dropout frequency. Turn the SPAN variable resistor until the output matches the rated value, at the same time the output of the generator matches the rated input frequency. The adjustable range of both the ZERO and SPAN are ± 10% FS. For zero adjustment when the minimum value of the current output is 0mA, apply a frequency higher than the dropout frequency and adjust output to equal the input frequency/rated input frequency with respect to rated output. The zero adjustment range is 0 to – 2% FS.

		With 4 to 20mA output	With 0 to 20mA output
Zero adjustment	Zero point shifted up. ⓣ ZERO Zero point shifted down.		
Span adjustment	The span widened. ⓣ SPAN The span narrowed		

azbil

Specifications are subject to change without notice.

Yamatake Corporation
Advanced Automation Company

1-12-2 Kawana, Fujisawa
Kanagawa 251-8522 Japan

URL: http://www.azbil.com

Printed on recycled paper. (07)

Printed in Japan.
1st Edition: Issued in Feb. 1991
3rd Edition: Issued in July 2006 (M)