IP51FVL
INTELLPAK Pulse/DC Converter
User's Manual

Thank you for purchasing the IP51FVL.
This manual contains information for ensuring correct use of the IP51FVL. It also provides necessary information for installation, maintenance, and troubleshooting.
This manual should be read by those who design and maintain devices that use the IP51FVL.
Be sure to keep this manual nearby for handy reference.

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.

NOTICE

Be sure that the user receives this manual 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 manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is free from inaccuracies and omissions. If you should find an error or omission, 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

Safety precautions are for ensuring safe and correct use of this product, and for preventing injury to the operator and other people or damage to property. You must observe these safety precautions. Also, be sure to read and understand the contents of this user's manual.

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

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

⚠ WARNING

- Before wiring, removing, or mounting the IP51FVL, be sure to turn the power OFF. Otherwise, touching electrically charged parts could cause electric shock.

⚠ CAUTION

- Use the IP51FVL within the operating ranges given in the specifications for temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc. Failure to do so could cause malfunction.
- Do not allow lead clippings, chips or water to enter the case. Doing so could cause fire or faulty operation.
- Firmly tighten the terminal screws at the torque listed in the specifications. Insufficient tightening of terminal screws could cause electric shock or fire.
- Do not use unused terminals on the IP51FVL as relay terminals. Doing so could cause electric shock, fire, or faulty operation.
- Do not block ventilation holes. Doing so could cause fire or faulty operation.
- Do not touch electrically charged parts such as the power terminals. Doing so could cause electric shock.
- Do not disassemble the IP51FVL. Doing so could cause electric shock or faulty operation.

Conventions Used in This Manual

The following conventions are used in this manual:

! Handling Precautions:
Handling Precautions indicate items that the user should pay attention to when handling the IP51FVL.

(1), (2), (3): Numbers within parentheses indicate steps in a sequence or parts of an explanation.

1.Outline

The IP51FVL is a thin plug-in type pulse/DC converter designed for extremely slow pulses. It receives a slow input pulse signal, calculates the frequency from the cycle with a built-in microprocessor, and generates an analog output signal with a voltage or current proportional to the calculated frequency.

2.Mounting

■ Mounting locations

Install the IP51FVL so as to avoid the following:

- High and low temperatures and humidity
- Direct sunlight, outdoor locations exposed to wind and rain
- Splashing liquid such as water, oil, or chemicals
- Corrosive or flammable gases
- Dust and soot
- Mechanical vibration and shock
- Strong electric or magnetic fields
- Sources of electrical noise, such as high voltage ignition devices or welding machines

! Handling Precautions:

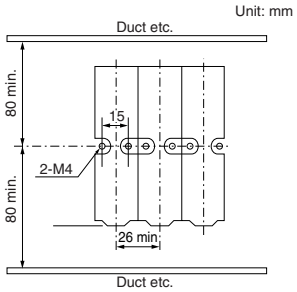
- When installing the IP51FVL in a place subject to mechanical vibration or shock, attach a damping bracket like the QN718A (sold separately). A damping bracket cannot be attached if the IP51FVL is mounted on a DIN rail.
- When installing the IP51FVL in place with much dust or metal powder, mount it in a case designed to be dustproof, and take measures to prevent excessive heat.

■ Installation

The IP51FVL plugs into a socket which can be attached directly to a wall or to a DIN rail.

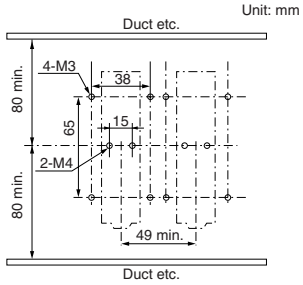
● Lateral installation layout

When installing multiple IP51FVL units side by side, use the layout shown below.



● Installation layout with damping bracket

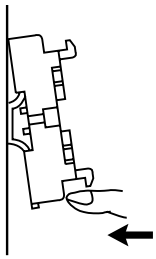
When installing the IP51FVL with the damping bracket, use the layout shown below. (The QN718A damping bracket is sold separately.)



● How to attach the IP51FVL to the DIN rail

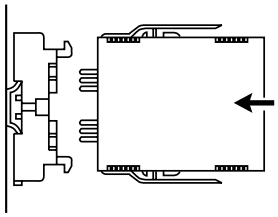
(1) Attach the socket first

With the slider on the base of the socket facing downward, hook the socket onto the DIN rail. Then push in the base of the socket, as shown in the drawing.



(2) Attach the IP51FVL

Push the IP51FVL straight into the socket. The label lettering should be pointing the right way. Be sure to push the unit firmly into the socket.

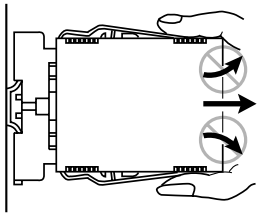


■ Removing

(1) If the damping bracket is attached to the IP51FVL, remove the damping bracket first. Then remove the IP51FVL from the socket.

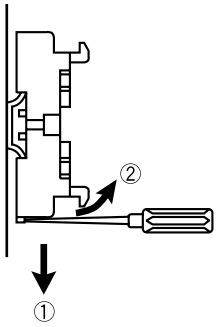
(2) How to remove the IP51FVL from the socket

First make sure that the IP51FVL is fully pushed onto the socket. Fully press both upper and lower levers on the IP51FVL and pull it straight off the socket. Pulling it off when the levers are not sufficiently pressed can damage the socket.



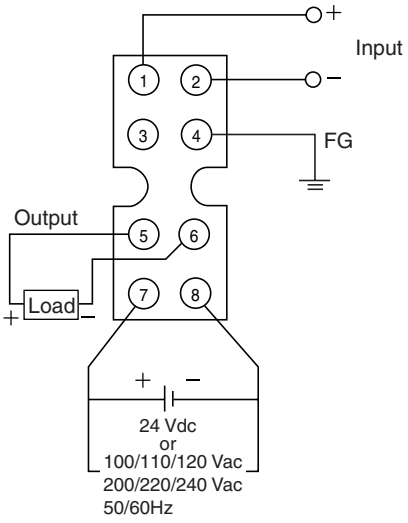
(3) How to remove the socket from the DIN rail

Insert a flat-head screwdriver into the slit of the DIN rail holder, and pull it down. Then lift the socket off the DIN rail in the direction shown by the arrow in the figure right.



3.Wiring

Wire the unit as shown in the figure below. Use M3.5 crimp contacts for wiring.

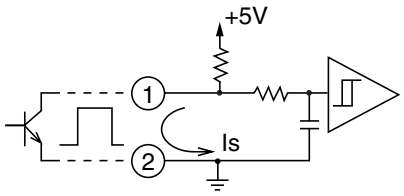


■ Input wiring

Connect the input signals indicated on the label to terminal 1 (+) and terminal 2 (-). The signal duty ratio should be between 25% and 75%.

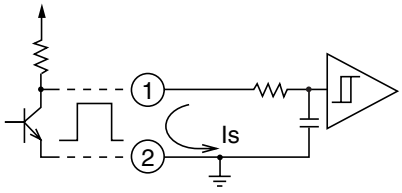
● Input type code 11

This input circuit is for a sensor with open collector output or no-voltage contacts. The applied voltage (V) at OFF is 5V, and the current at ON (Is) is approximately 1mA.



● Input type code 13

This input circuit is for a sensor with voltage output that is either between +5V and +50V (high range), or voltage between –30V and +1.5V (low range). The input impedance is 20k Ω or more.

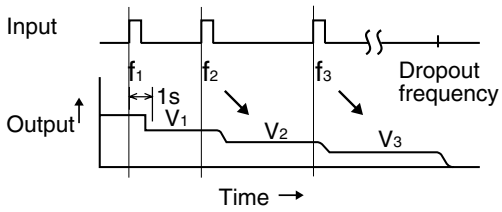


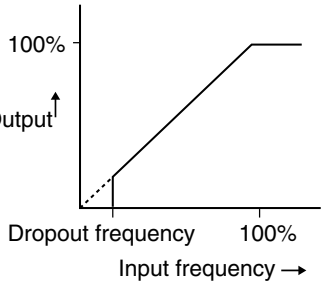
■ Output wiring

Connect the output to terminals 5 and 6.

● Input-output relationship and dropout frequency

The IP51FVL frequency-voltage converter calculates the period of an input pulse train and then converts it to DC output proportional to the pulse frequency. For this reason, if there is no input pulse for longer than a prescribed time, the output automatically changes to zero or the minimum voltage. This frequency is called the dropout frequency and is 1% of the input frequency. The output of this converter is refreshed within 1 second of every pulse input. If the input frequency exceeds the rated value, the output is saturated at the rated voltage.





! Handling Precautions:

- Be sure to use insulated crimp contacts for terminal connections. When installing the IP51FVL in a place with heavy mechanical vibration or shock, use ring terminals so that they do not come loose.
- Make sure that nearby terminal lugs do not touch each other.
- Keep the input/output signal line 50cm or more away from any power lines carrying over 100V. Do not put them in the same conduit or duct.
- Before wiring double-check the model No. and terminal Nos. on the attached label
- Before turning the power on, be sure that all wiring is correct.
- Though the IP51FVL is operational as soon as the power is turned on, wait 30 minutes or more to satisfy the accuracy levels stated in the specifications.
- Do not short circuit output terminals on the voltage output model. Doing so could cause damage.
- Use an integral analog-to-digital converter to convert the analog output into digital output. When using a high-speed analog-to-digital converter such as successive approximation type, make sure to operate by combined test beforehand.

4.Adjustment

■ Zero and span adjustment

The IP51FVL is calibrated before shipping. Generally it is not necessary to adjust the zero or span potentiometers on the front panel. When an adjustment is required in order to coordinate with associated instruments, or for periodic inspection, follow the procedure below.

! Handling Precautions:

- The adjustable range for zero is ±2% FS, and for span the range is ±5% FS.
- The potentiometer knob does not have a stop to limit turning. Do not turn it too much.

● Required equipment

- Signal source (standard voltage/current generator) with at least 10 times the accuracy of the IP51FVL
- Voltmeter/ammeter
- Frequency counter

● Adjustment procedure

(1) Wait 30 minutes or more after turning the power on.

(2) Do not input anything into input terminals.

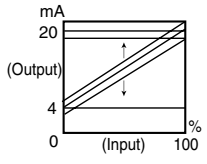
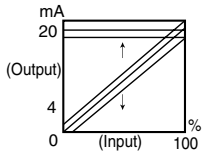
(3) Turn the ZERO potentiometer so that the output signal is at the minimum for the output range.

(4) Use a signal generator to input a signal of the rated input frequency into the input terminals.

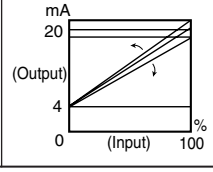
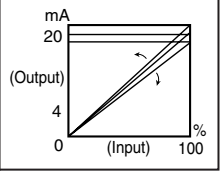
(5) Turn the SPAN potentiometer so that the output signal is at the maximum for the output range.

(6) Repeat steps 2 to 5 two or three times.

• Zero adjustment

Output type / Rotation	4 to 20mA	0 to 20mA
The zero point shifts upward. (① ZERO The zero point shifts downward.		

• Span adjustment

Output type / Rotation	4 to 20mA	0 to 20mA
The span expands. (① SPAN The span narrows.		

! Handling Precautions:

- For current output when the output range minimum value is 0mA, zero adjustment must be done in the following way. Input a signal with a frequency slightly greater than the dropout frequency, and adjust the output voltage so that its ratio to the rated voltage is the same as the ratio of the input frequency to the rated input frequency. In this case, the zero adjustment range is from 0 to +2% FS.

5.Specifications

■ Specifications

Input type	DC voltage pulse	For large signal input from proximity/photoelectric switches 1:5 to 30V, 0: -30 to +1.5V Input impedance: 20kΩ or more	
	ON/OFF pulse	For dry contact and open collector output OFF: 5V ON: 1mA (voltage and current applied to contact) Input impedance: 20kΩ or more	
Input frequency	0.1 to 50Hz FS, pulse width 10ms or more		
Output type	DC voltage and DC current, see table 1.		
Allowable load resistance	See table 1.		
Dropout frequency	If the input frequency is less than 1% of the upper limit of the range, the output is 0%.		
Accuracy	±0.2%FS at a reference temperature of 23ºC		
Response time	sInput pulse interval + 1s max. (0 to 90% response) At power-up, input pulse interval x 2 + 1s max. (0 to 90% response)		
Zero/span adjustment	Zero: ±2% FS, Span: ±5%		
Power type	AC		DC
Rated voltage	100/110/120Vac (50/60Hz)	200/220/240Vac (50/60Hz)	24Vdc
Operating voltage	80 to 132Vac (45 to 65Hz)	170 to 264Vac (45 to 65Hz)	24Vdc±10%
Power consumption	Approx. 6.0VA		Approx. 2.9VA
Starting current	–		0.11A or less
Inrash current at power on	10A or less, 1ms		5A or less, 1ms
Insulation resistance	Between I/O terminal and power terminal, Between I/O terminals (for isolated type) 100MΩ or more by 500Vdc megger		
Dielectric strength	Between I/O terminal and power terminal, Between I/O terminals (for isolated type) 2000Vac 1 minute		
Power characteristics	±0.1% FS/80 to 132Vac or 170 to 264Vac		±0.1% FS/24Vdc±10%
Temperature characteristics	±0.15% FS/10ºC		
Operating ambient temperature	0 to +50ºC		
Storage ambient temperature	-20 to +70ºC		
Operating ambient humidity	90% RH or less (without condensation)		
Storage ambient humidity	90% RH or less (without condensation)		
Vibration resistance*	4.9m/s^2 or less 10 to 60Hz X,Y,Z each direction 2h (with damping bracket)		
Shock resistance*	490m/s^2 or less, upward and downward 3 times		
Case material	Heat resistant ABS resin		
Case color	Gray, Munsell color scale 2.5PB3.5/1		
Terminal screw	M3.5		
Terminal screw tightening torque	0.78 to 0.98N•m		
Mounting	Installed on wall or DIN rail		
Mass	200g (Including the base socket)		
Included accessories	Base socket parts number QN719A		
Optional parts (sold separately)	Damping bracket parts number QN718A		

* If unit is mounted on a DIN rail, these specifications do not apply.

■ Key to model numbers

I	II	III	IV	V	VI

: IP51FVL11AA001669

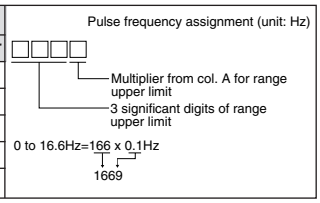
I Basic number	II Input type	III Output type	IV Power voltage	V Additional features	VI Input range	Description
IP51FVL						Pulse/DC converter
	11					ON/OFF pulse, dry contact and open collector
	13					DC voltage pluse, proximity/photoelectric switches
		Select from table 1				–
			A			100/110/120Vac 50/60Hz
			B			200/220/240Vac 50/60Hz
			D			24Vdc
				00		None
				T0		Tropicalization
				D0		With inspection data
				B0		Tropicalization and inspection data
				Y0		With traceability certification
					Select from table 2	–

Table 1. Output type

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

Table 2. How to specify the input range

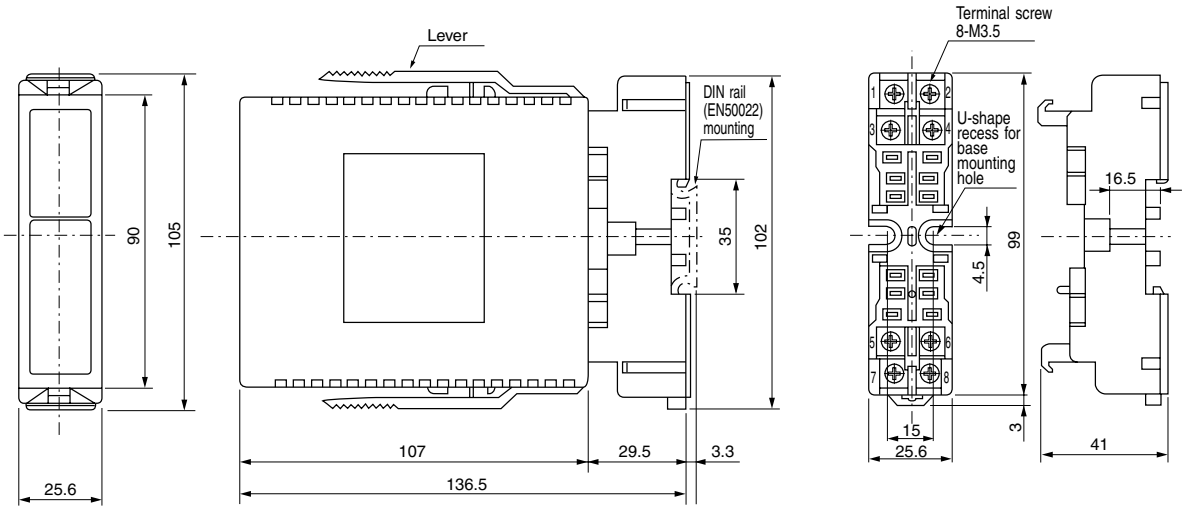
A	
Code	Multiplier
9	x 0.1
G	x 0.01
H	10^{-3}
J	10^{-4}
–	–



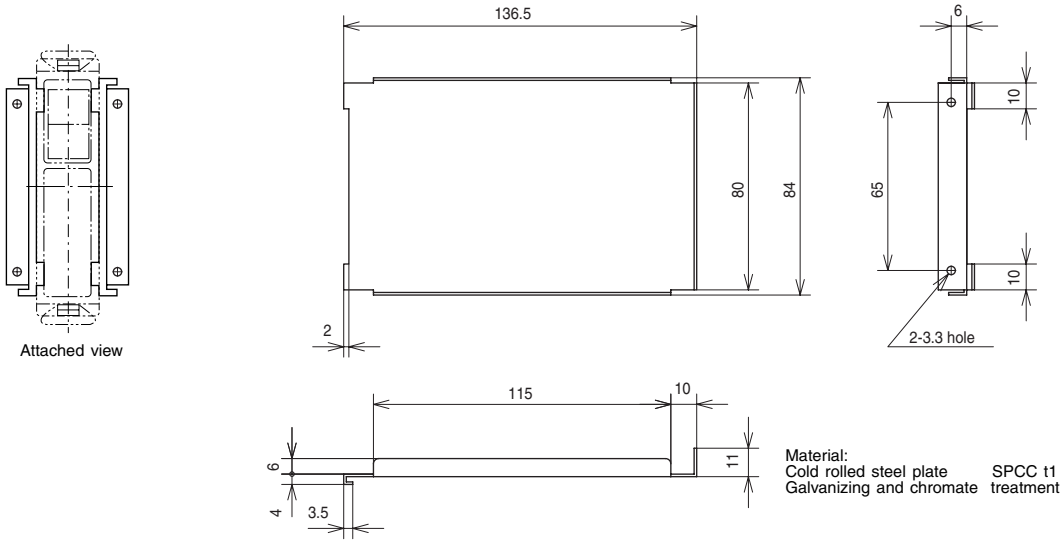
■ External dimensions

Unit: mm

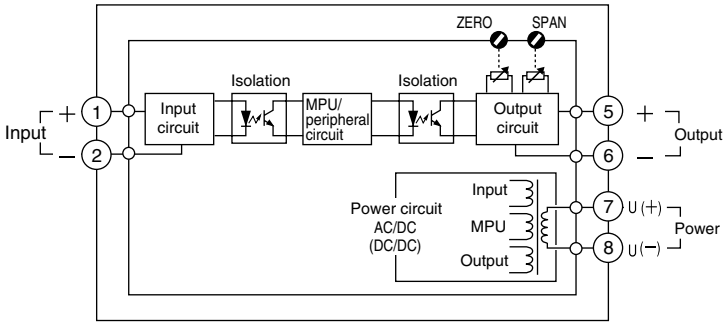
Base socket part number QN719A



Damping bracket part number QN718A



■ Circuit block diagram



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Specifications are subject to change without notice. (08)

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