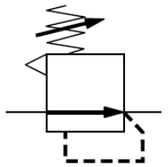
ORIGINAL INSTRUCTIONS

Instruction Manual

Precision Regulator

Series IR1000-A / IR2000-A / IR3000-A





Basic type (Knob)

The intended use of this product is to regulate pressure precisely.

Validated according to ISO 13849, see section 2.

1 Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “Caution”, “Warning” or “Danger”. They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC) [*1)], and other safety regulations.

[*1)] ISO 4414: Pneumatic fluid power - - General rules relating to systems.
ISO 4413: Hydraulic fluid power - - General rules relating to systems.
IEC 60204-1: Safety of machinery - -Electrical equipment of machines. (Part 1: General requirements)
ISO 10218-1: Manipulating industrial robots -Safety.etc.

This manual contains essential information for the protection of users and others from possible injury and/or equipment damage.

- Read this manual before using the product, to ensure correct handling, and read the manuals of related apparatus before use.
- Keep this manual in a safe place for future reference.
- To ensure safety of personnel and equipment the safety instructions in this manual must be observed, along with other relevant safety practices.

⚠ **Caution**	Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
⚠ **Warning**	Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
⚠ **Danger**	Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

⚠ Warning

- **The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.**
- Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalogue information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.
- **Only personnel with appropriate training should operate machinery and equipment.**

1 Safety Instructions - continued

The product specified here may become unsafe if handled incorrectly.

The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

- **Do not service or attempt to remove product and machinery/equipment until safety is confirmed.**

1) The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.

2) When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

3) Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

- **Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.**

1) Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2) Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustions and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specification described in the product catalogue.

3) An application which could have negative effects on people, property, or animals requiring special safety analysis [outside the scope of ISO 13849 described in this document].

4) Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

- **Always ensure compliance with relevant safety laws and standards.**

All electrical work must be carried out in a safe manner by a qualified person in compliance with applicable national regulations.

⚠ Caution

- **The product is provided for use in manufacturing industries.**

The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

2 Specifications

2.1 Standard Specifications

Model	Basic type (Knob)		
	IR10□0-A	IR20□0-A	IR30□0-A
Fluid	Air		
Proof pressure	1.5 MPa		
Max. supply pressure	1.0 MPa		
Min. supply pressure Note 1)	Set pressure + 0.05 MPa		Set pressure + 0.1 MPa
Set pressure range [MPa]	IR1000-A: 0.005 to 0.2	IR2000-A: 0.005 to 0.2	IR3000-A: 0.01 to 0.2
	IR1010-A: 0.01 to 0.4	IR2010-A: 0.01 to 0.4	IR3010-A: 0.01 to 0.4
	IR1020-A: 0.01 to 0.8	IR2020-A: 0.01 to 0.8	IR3020-A: 0.01 to 0.8
Sensitivity	Within 0.2% of full span		
Repeatability Note 2)	Within ±0.5% of full span		
Air consumption Note 3)	1 L/min (ANR) or less		
Port size	1/8	1/4	1/4, 3/8, 1/2
Pressure gauge port	1/8 (2 locations)		
Ambient and fluid temperature Note 4)	-5 to +60 °C (No freezing)		
Weight Note 5)	0.13 kg	0.23 kg	0.47 kg

2 Specifications – continued

Flow	See 2.2
Minimum frequency	1 cycle / 30 days
Lubrication	Not required
Filtration	5 µm filtration or smaller
Standards	Complies with the basic and well-tried safety principles of EN ISO 13849-2:2012
B_{10} Note 6	7.9 million cycles
B_{10D} Note 6	15.8 million cycles

Table 1

Notes:

Note 1) When there is no flow rate on the outlet.
Note 2) Other characteristics such as aging deterioration and temperature characteristics are not included.
Note 3) Measuring conditions: supply pressure 1.0 MPa, set pressure 0.2 MPa.
Note 4) -5 to +50 °C for the products with the digital pressure switch.
Note 5) Without accessories.
Note 6) Under SMC test conditions. The B10 figure is estimated from SMC life tests. The B10D figure is derived from B10 using the assumption in EN ISO 13849-1:2015 Annex C. Contact SMC for details

2.2 Flow-rate Characteristics

IR1020-01-A Supply pressure: 0.7 MPa

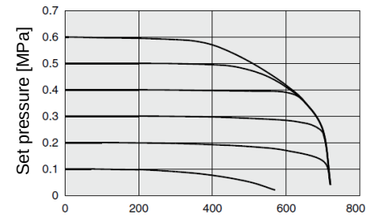


Figure 1

IR2020-02-A Supply pressure: 0.7 MPa

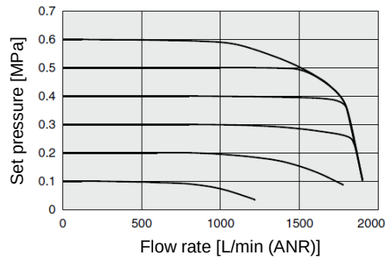


Figure 2

IR3020-04-A Supply pressure: 0.7 MPa

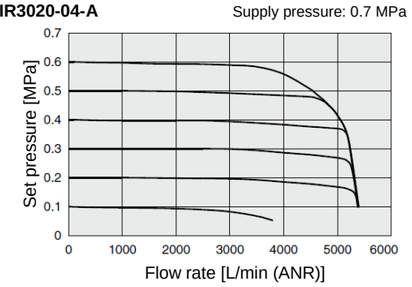


Figure 3

2 Specifications – continued

2.3 Relief Characteristics

IR1020-01-A Back pressure: 0.7 MPa

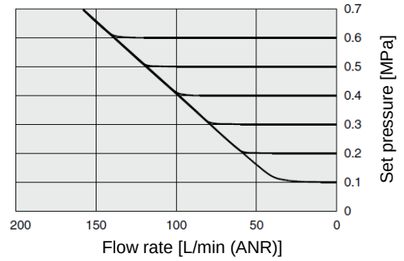


Figure 4

IR2020-02-A Back pressure: 0.7 MPa

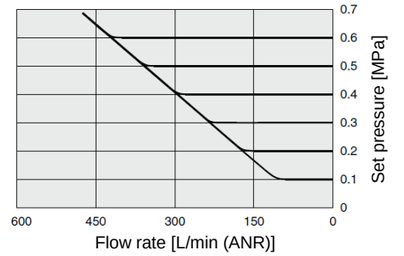


Figure 5

IR3020-04-A Back pressure: 0.7 MPa

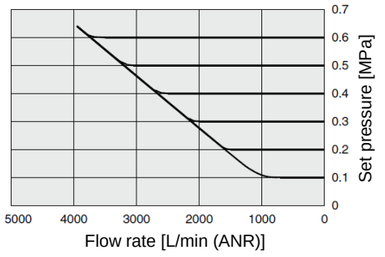


Figure 6

2.4 Pressure Characteristics

- Supply pressure: 0.3 to 1.0 MPa
- Set pressure: 0.2 MPa
- Flow rate: 0 L/min (ANR)

IR1000-A

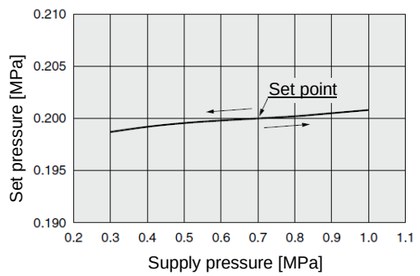


Figure 7

2 Specification – continued

IR1010-A

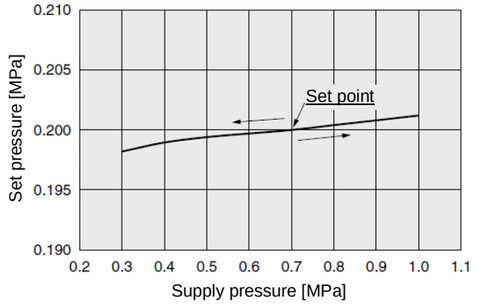


Figure 8

IR1020-A

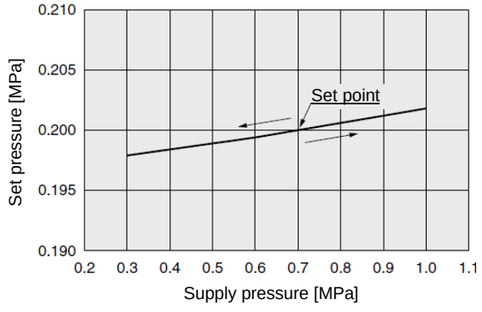


Figure 9

IR2000-A

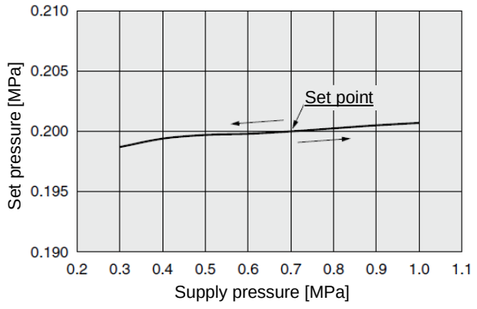


Figure 10

IR2010-A

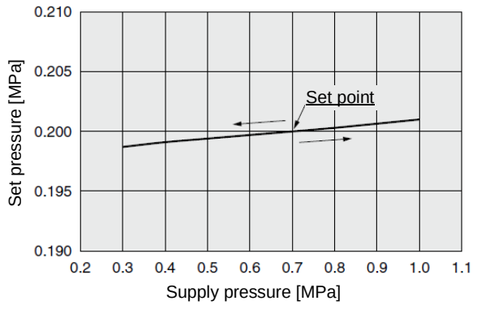


Figure 11

2 Specification – continued

IR2020-A

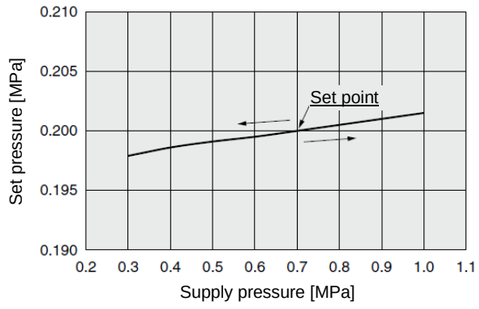


Figure 12

IR3000-A

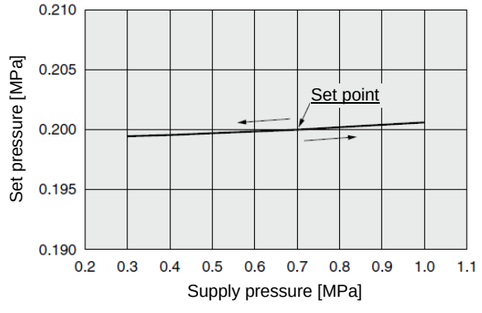


Figure 13

IR3010-A

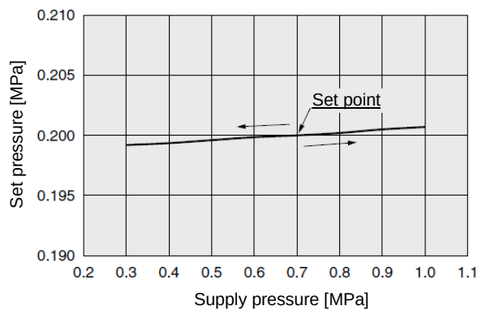


Figure 14

IR3020-A

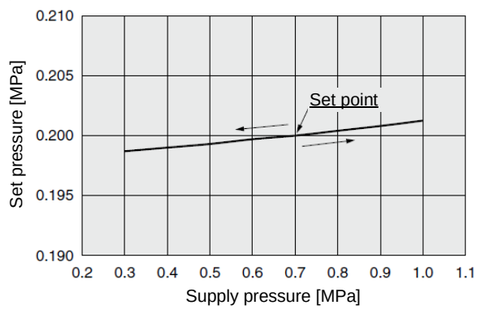
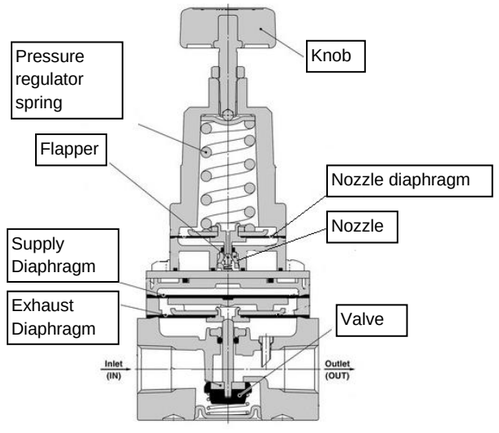


Figure 15

2 Specification – continued

2.5 Working principle



When the knob is rotated, the flapper is pushed through the spring and a gap is generated between the nozzle and flapper. The supply pressure flows to the inlet passes through the path between the nozzle and flapper and acts on the supply diaphragm as nozzle back pressure. The force generated by the diaphragm pushes down the valve and the supply pressure flows to the outlet. The discharged air pressure acts on the exhaust diaphragm and counteracts against the force generated by the supply diaphragm.
The air pressure acts on the nozzle diaphragm at the same time and counteracts against the compression force of the spring to adjust the set pressure. When the set pressure increases too much, the nozzle diaphragm is pushed up and a gap is generated between the flapper and the nozzle diaphragm after the flapper is closed. The balance of the supply diaphragm and exhaust diaphragm is lost when the nozzle back pressure flows into the atmosphere. The exhaust valve is open after the valve is closed and excess pressure on the outlet is released to the air. Due to this pilot mechanism, fine pressure variations are detected and precise pressure adjustment is possible.

Caution

Special products might have specifications different from those shown in this section. Contact SMC for specific drawings. These drawings will give the appropriate specification details and compliance with the safety principles of ISO 13849, if applicable.

3 Installation

3.1 Installation

Warning

- Do not install the product unless the safety instructions have been read and understood.

3.2 Environment

Warning

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact.
- Do not mount in a location exposed to radiant heat.
- In locations where there is contact with spatter from water, oil or solder, etc., implement suitable protective measures.

3 Installation – continued

3.3 Piping

Caution

- Before piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material does not enter inside the port. When using seal tape, leave 1.5 to 2 threads exposed on the end of the pipe/fitting.
- Tighten fittings to the specified tightening torque.

Warning

- **Screw piping together with the recommended proper torque while holding the side with the female threads.**
  Looseness or faulty sealing will occur if tightening torque is insufficient, while thread damage will result if the torque is excessive. Furthermore, if the side with the female threads is not held while tightening, excessive force will be applied directly to piping brackets and may cause damage or other problems.

Recommended Proper Torque

Connection thread	1/8	1/4	3/8	1/2 Note)
Torque [N·m]	7 to 9	12 to 14	22 to 24	28 to 30

Table 2

Note: Tightening force for connecting to the EXH port of IR30□$\frac{1}{2}$-A is 8 to 10 N·m.

- **Do not allow twisting or bending moment to be applied other than the weight of the equipment.**
  Provide separate support for external piping, as damage may otherwise occur.
- **Piping materials without flexibility such as steel tube piping are prone to be effected by excess moment load and vibration from the piping side. Use flexible tubing in between to avoid such an effect.**

3.4 Air Supply

Warning

- **Please consult with SMC when using the product in applications other than compressed air.**
- **Do not use compressed air which includes chemicals, synthetic oils containing organic solvents, salt or corrosive gases, etc., as this can cause damage or malfunction.**
- **If condensate in the drain bowl is not emptied on a regular basis, the bowl will overflow and allow the condensate to enter the outlet side. This will cause a malfunction of pneumatic equipment.**
  When removing drain is difficult, use of a filter with an auto drain is recommended.

Caution

- **Condensate or dust, etc. in the supply pressure line can cause malfunctions. In addition to an air filter (SMC Series AF, etc.) please use a mist separator (SMC series AM, AFM) depending on the conditions.**
  Refer to “Air Preparation Equipment Model Selection Guide” (Best Pneumatics No. 5) for air quality.
- **When a lubricator is used at the supply side of the product, it can cause malfunctions. Do not use a lubricator at the supply side of the product.**
  If lubrication is required for terminal devices, connect a lubricator on the output side of the regulator.

3.5 Handling

Caution

- **When the precision regulator with pressure gauge is used, do not apply impact to the product by dropping it, etc. during transportation or installation.**
  This may cause misalignment of the pressure gauge pointer.

3 Installation – continued

3.6 Operation

Caution

- **Do not use a precision regulator outside the range of its specifications as this can cause failure. (Refer to section 2)**
- **When mounting is performed, make connections while confirming port indications.**
- **When mounting the bracket or tightening the hexagon panel nut on the panel, tighten them to the recommended proper torque.**
  Looseness of faulty sealing will occur if tightening torque is insufficient, while thread damage will result if the torque is excessive.

  Recommended Proper Torque [N·m]

  Set nut (for bracket)

IR10□0-A	IR20□0-A	IR30□□-A
2.0 ±0.2		

Table 3

  Hexagon panel nut (for knob type only)

IR10□0-A	IR20□0-A	IR30□□-A
3.5 ±0.5		

Table 4

- **After pressure adjustment, be sure to tighten the lock nut. When tightening the nut, tighten so that the knob does not move due to friction caused by tightening.**
- **When pressure is applied to the inlet of a regulator, make sure that the output is connected to the circuit. Air blow occurs from the outlet and it depends on the operating conditions.**
- **The set pressure may vary depending on the elapsed time and change in ambient temperature after pressure setting. If the setting value varies, adjust with the knob.**
- **If the directional control valve (solenoid valve, mechanical valve, etc.) is mounted and ON-OFF is repeated for a long time, the set pressure may vary. If the setting value varies, adjust with the knob.**
- **There may be pulsation or noise depending on the pressure conditions, piping conditions and ambient environment. In this case, it is possible to improve the problem by changing the pressure conditions and piping conditions.**
  If the problem is not improved, contact your SMC sales representative.
- **The capacity of the output side is large, and when used for the purpose of a relief function, the exhaust sound will be loud when being relieved. Therefore, operate with a silencer (SMC Series AN, etc.) mounted on the exhaust port (EXH port).**
  When using the IR1000-A and 2000-A series, contact your SMC sales representative.
- **When installing a pressure gauge to the product, do not apply pressure more than the maximum display pressure. This will cause a malfunction.**

4 How to Order

IR 1 0 0 0 – □ 01 BG – □ – A

(1) (2) (3) (4) (5) (6) (7)

		Symbol	Description	❶ Body size 1	2	3
❷	Set pressure range	**0**	0.005 to 0.2 MPa	●	●	–
			0.01 to 0.2 MPa	–	–	●
		1	0.01 to 0.4 MPa	●	●	●
		2	0.01 to 0.8 MPa	●	●	●
❸	Exhaust direction	**0**	Bottom exhaust	●	●	●
		1	Front exhaust	–	–	●
		2	Rear exhaust	–	–	●
❹	Pipe thread type	**Nil**	Rc	●	●	●
		N	NPT	●	●	●
		F	G	●	●	●
❺	Port size	**01**	1/8	●	–	–
		02	1/4	–	●	●
		03	3/8	–	–	●
		04	1/2	–	–	●
❻ Option Note 1)	a Mounting	**Nil**	Without mounting option	●	●	●
		B Note 2)	With bracket	●	●	●
		H	With hexagon panel nut (for panel mount)	●	●	●
	b With digital pressure switch	**Nil**	Without pressure gauge	●	●	●
	Pressure gauge	**G**	Round type pressure gauge	●	●	
	With digital pressure switch	**EA**	NPN open collector 1 output	●	●	●
		EB	PNP open collector 1 output	●	●	●
		EC	NPN open collector 1 output + Analog voltage output	●	●	●
		ED	NPN open collector 1 output + Analog current output	●	●	●
❼ Semi-standard	c Flow direction	**Nil**	Flow direction: Left to right	●	●	●
		R	Flow direction: Right to left	●	●	●
	d Knob	**Nil**	Upward	●	●	●
		V	Downward	●	●	●
	e Pressure unit Note 3)	**Nil**	Name plate and pressure gauge in imperial units: MPa	●	●	●
		Z	Name plate and pressure gauge in imperial units: psi	●	●	●
		ZA	Digital pressure switch: With unit conversation function	●	●	●

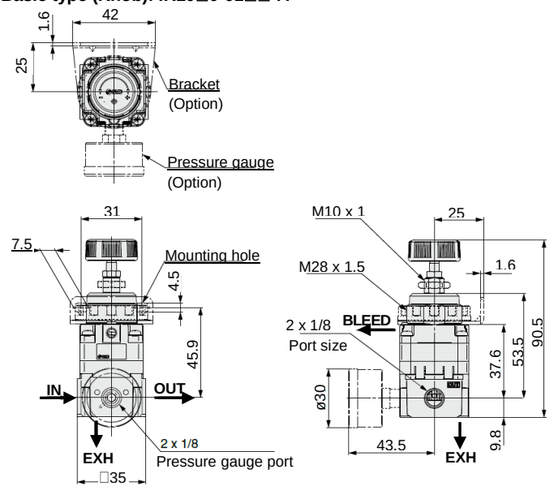
- Option/Semi-standard: Select one each for **a** to **e**.
- Option/Semi-standard symbol: When more than one specification is required, indicate in alphanumeric order.

Note 1) Options are shipped together with the product, but not assembled. B and H cannot be selected at the same time. The current bracket cannot be used for this product.
Note 2) Assembly of a bracket and set nuts.
Note 3) See pressure unit table below.
Note 4) For pipe thread type: NPT
Note 5) For options: EA, EB, EC, ED
Note 6) According to the new Measurement Law, only the SI unit type is provided for use in Japan.

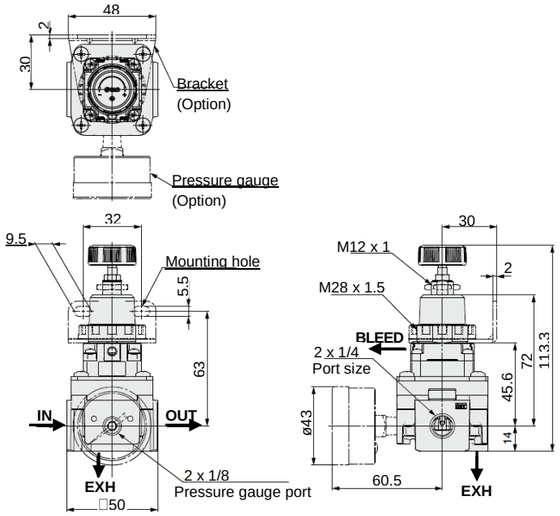
	Pipe thread type	Name plate in imperial units	Pressure gauge in imperial units: G	Pressure gauge in imperial units: EA, EB, EC, ED	Sales Note 6)
Nil	Rc	MPa	MPa	Fixed SI unit	Japan, Overseas
	NPT				
	G				
Z Note 4)	Rc	–	–	–	Only Overseas
	NPT	psi	psi	With unit conversion function (initial value psi)	
	G	–	–	–	
ZA Note 5)	Rc	MPa	–	With unit conversion function	Only Overseas
	NPT				
	G				

5 Outline Dimensions (mm)

Basic type (Knob): IR10□0-01□□-A

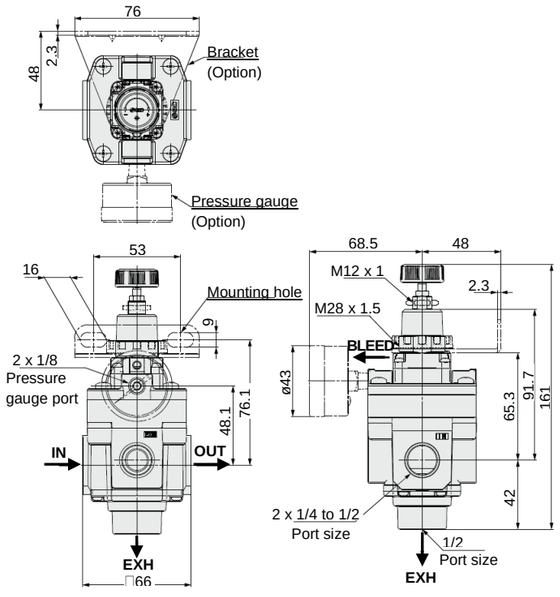


Basic type (Knob): IR20□0-02□□-A

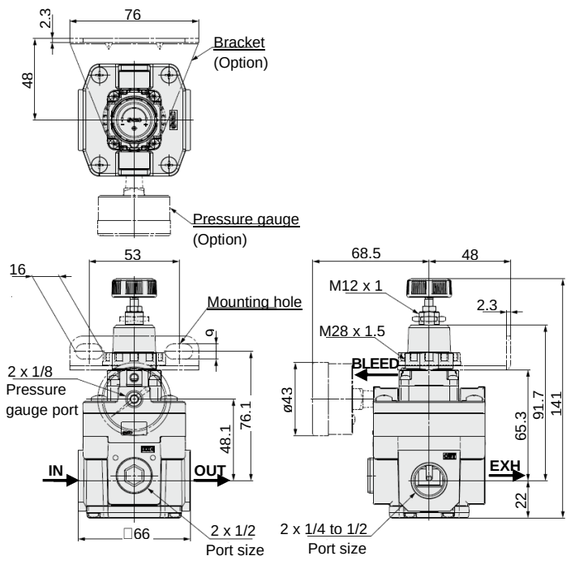


5 Outline Dimensions (mm) – continued

Basic type (Knob): IR30□0-0□□-A



Basic type (Knob): IR30□$\frac{1}{2}$-0□□-A



6 Maintenance

6.1 General Maintenance

Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
- If handled improperly, compressed air can be dangerous. Maintenance of pneumatic systems should be performed only by qualified personnel.
- Before performing maintenance, turn off the power supply and be sure to cut off the supply pressure. Confirm that the air is released to atmosphere.
- After installation and maintenance, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly.
- If any electrical connections are disturbed during maintenance, ensure they are reconnected correctly and safety checks are carried out as required to ensure continued compliance with applicable national regulations.
- Do not make any modification to the product.
- Do not disassemble the product, unless required by installation or maintenance instructions.

Warning

- **When the product is removed for maintenance, reduce the set pressure to "0" and shut off the supply pressure completely beforehand.**
- **When a pressure gauge is to be mounted, remove the plug after reducing the set pressure to "0".**
- **When using the regulator between a solenoid valve and an actuator, check the pressure gauge periodically. Sudden pressure fluctuations may shorten the durability of the pressure gauge.**
  A digital pressure gauge is recommended for such situation or as deemed necessary.

7 Limitations of Use

7.1 Limited warranty and Disclaimer/Compliance Requirements

- **The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements". Read and accept them before using the product**.

- **Limited warranty and Disclaimer**

  1) The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first[(1)]. Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

  2) For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.

  This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

  3) Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalogue for the particular products.

  [(1)] Vacuum pads are excluded from this 1 year warranty.

  A vacuum pad is a consumable part, so it is warranted for a year after it is delivered. Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

- **Compliance Requirements**

  1) The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.

7 Limitations of Use – continued

2) The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

Caution

- **SMC products are not intended for use as instruments for legal metrology.**
  Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.
  Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

Warning

Any use in an ISO 13849 system must be within the specified limits and application conditions. The user is responsible for the specification, design, implementation, validation and maintenance of the safety system SRP/CS).

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