



Operation Manual

PRODUCT NAME

Precision Regulator

MODEL/ Series

IR2000
IR2010
IR2020

SMC Corporation

Contents

Safety Instructions	2~3
1. Specifications	4~5
2. Construction and operation principle	6
3. How to order	7
4. Marking on product	7
5. Precautions for handling	8~11
6. Warranty	12
7. Troubleshooting	13
8. Assembly drawing	14



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 10218-1992: Manipulating industrial robots -Safety.

etc.



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

1. 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 catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

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.

3. 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.

4. 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, combustion 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 specifications described in the product catalog.

3. An application which could have negative effects on people, property, or animals requiring special safety analysis.

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.



Safety Instructions

⚠ Caution

1. 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.

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.*2)

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 catalog for the particular products.

*2) 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.

2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulation 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.

Foreword

The IR2000 precision regulator (hereinafter referred to as the "product") has excellent relief characteristics, and is constructed to always keep a constant pressure even if used with a reverse flow. The product has the following features.

- (1) A sensitivity of 0.2%F.S. at max is achieved by the nozzle and flapper design.
(IR2000: F.S. ≈ 0.2MPa, IR2010: F.S. ≈ 0.4MPa, IR2020: F.S. ≈ 0.8MPa)
Note) "F.S." is the abbreviation of full span.
- (2) Various characteristics such as flow rate, pressure characteristics and repeatability are improved compared to general regulators.
- (3) Relief characteristics are improved.
- (4) The adjustment range is as wide as general regulators, which is 0.01~0.8MPa.
(IR2000 is 0.005MPa~)

1. Specifications

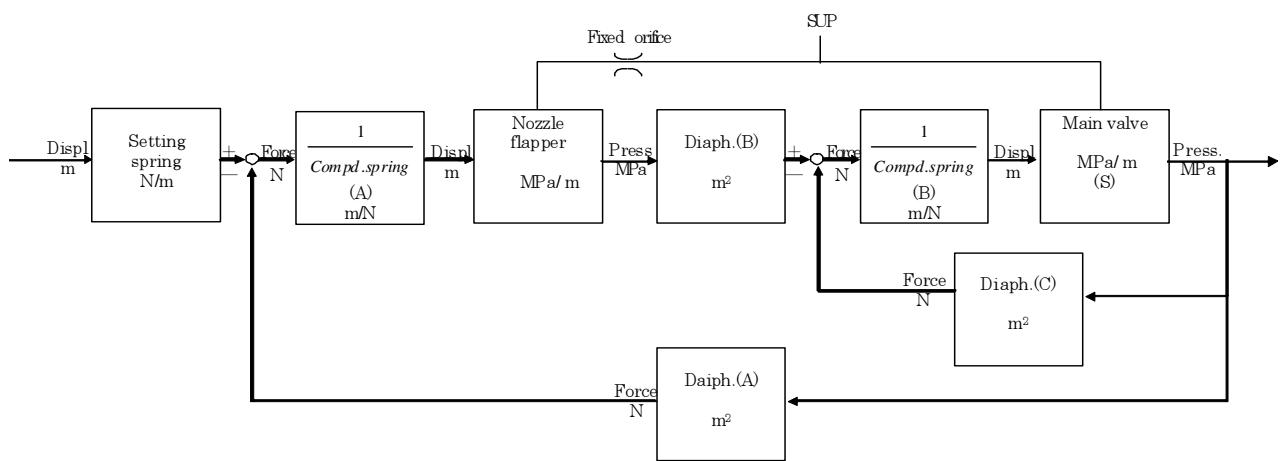
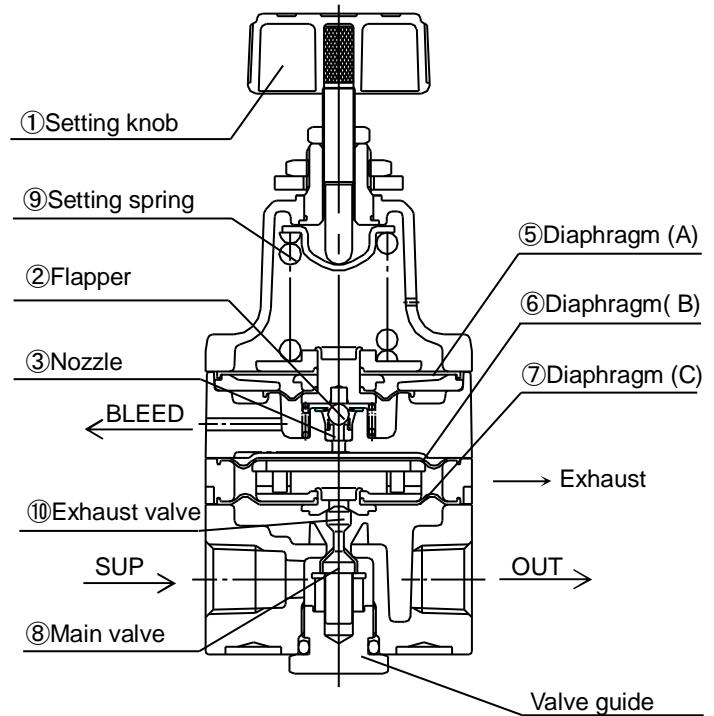
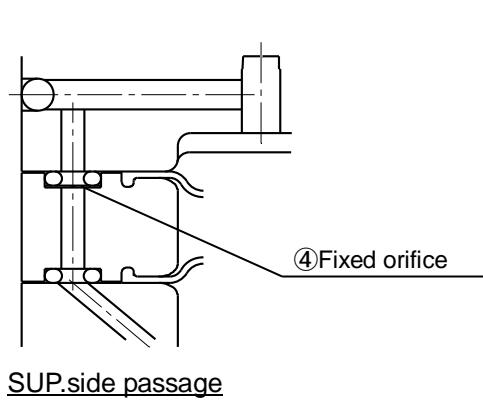
The following specifications are for a single unit of precision regulator. They do not meet the specifications of the actual system.

Model	IR2000	IR2010	IR2020
Fluid	Compressed air (dry air)		
Max. supply pressure	MAX. 1.0MPa		
Min. supply pressure ^(Note 1)	Setting pressure + 0.05MPa		
Setting pressure ^(Note 2)	0.005~0.2MPa	0.01~0.4MPa	0.01~0.8MPa
Setting sensitivity ^(Note 3)	Within 0.2% F.S. ^(Note 4)		
Repeatability ^(Note 5)	Within ±0.5% F.S. ^(Note 4)		
Air consumption ^(Note 6)	4.4L/min(ANR) or less (at supply pressure of 1.0MPa)		
Ambient and fluid temperature	-5 to 60°C (No freezing)		
Port size	Rc1/4		
Port size of pressure gauge	Rc1/8 [2 places]		
Weight	0.30kg		

- (Note1) Minimum supply pressure: At a downstream side flow rate of zero. Be sure to keep the minimum supply pressure. (setting pressure+0.05MPa)
- (Note2) Setting pressure: At a downstream side flow rate of zero.
- (Note3) Setting sensitivity: This is the minimum pressure range that the downstream pressure is adjustable by conducting fine adjustment of the setting knob on the downstream side of the precision regulator.
- (Note 4)The F.S. means the condition at the maximum setting pressure of the product. (F.S. ≈0.2MPa, IR2000)
- (Note 5) Repeatability: This is the reproducibility of the downstream pressure at every operation (ON/OFF) on the downstream side. The repeatability does not consider the influence of pressure variation due to aging deterioration, temperature change or oscillation of the regulator. The aging deterioration means that the downstream pressure varies gradually affected by change or distortion due to aging of the internal components of the precision regulator.
- (Note 6) Air consumption: This is the combined flow to atmosphere of the bleed and exhaust ports; when the supply pressure is 1.0 MPa and the downstream setting pressure is 0.8MPa (maximum setting pressure). It does not include any flow for the relief of downstream pressure increases due to back pressure or downstream pressure decreases due to the adjustment of the setting knob.

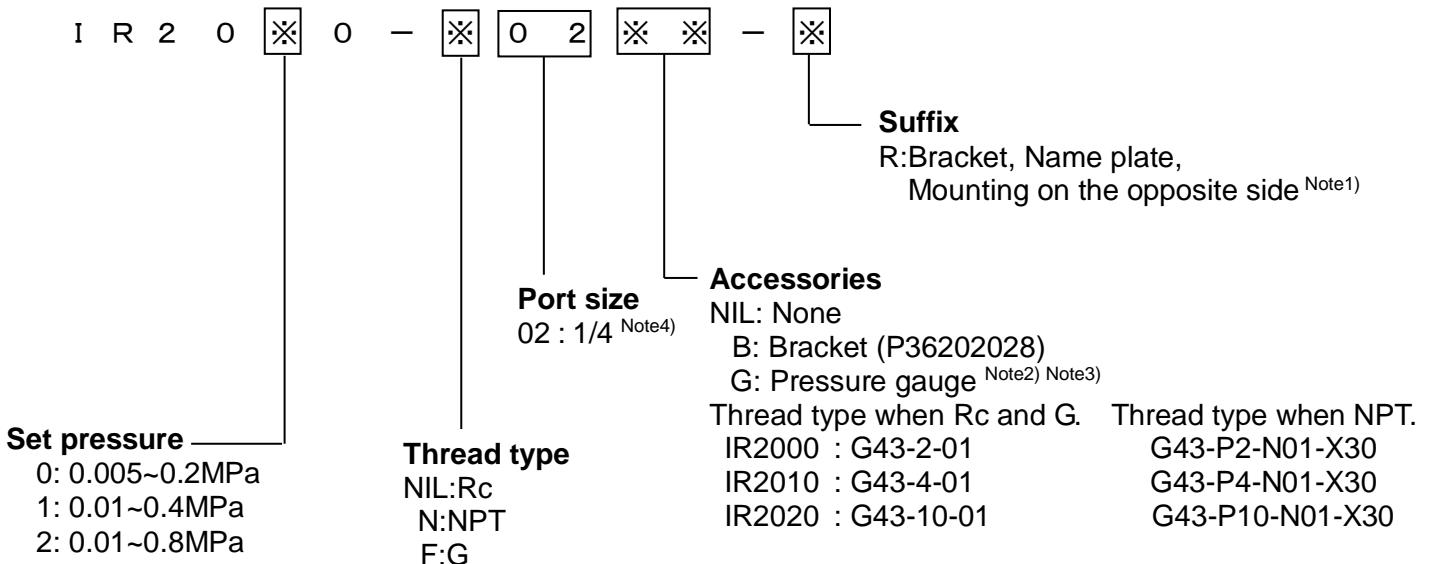
2. Construction and operation principle

When the ①setting knob is turned, the ③nozzle is closed by the ②flapper, allowing the supply air that flows in from the upstream side to pass through the ④fixed orifice. It then acts on ⑥diaphragm(B) as nozzle back pressure, the ⑧main valve is pushed down by the generated force and the supply pressure flows out to the downstream side. The air pressure that flows in acts on ⑦diaphragm(C) and while opposing the force generated by ⑥diaphragm(B), it also acts on ⑤diaphragm(A) opposing the compression force of the ⑨setting spring and becomes the set pressure. When the output pressure raises above the setting pressure, ⑤diaphragm(A) is pushed up which makes the interval between the ②flapper and the ③nozzle widens, the nozzle back pressure drops, the pressure balance of ⑥diaphragm(B) and ⑦diaphragm(C) is broken. Then as the ⑧main valve closes, the ⑩exhaust valve opens at the same time and the excess pressure from the downstream side is discharged to the atmosphere. In this way fine pressure variations are detected by the nozzle/flapper type pilot mechanism, and precise pressure adjustment is performed.



Block diagram

3. How to order



(Note 1) In the standard mounting position, the product name plate is attached to the front and the bracket is mounted to the back when viewed with the SUP side on the left and OUT side on the right.

(Note 2) Accuracy: $\pm 3\%$ F.S.(full span)

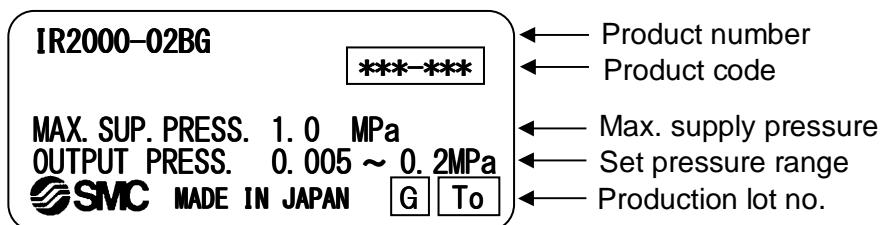
Accuracy guarantee temperature range : $23 \pm 5^\circ\text{C}$

(Note 3) The pressure gauge is not attached and becomes bundled shipment.

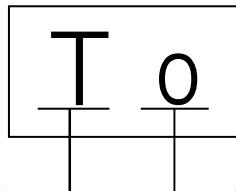
(Note 4) One type only.

4. Marking on product

- Product name plate



Production lot no.



Year

T : 2015
U : 2016
V : 2017
W: 2018
X : 2019

Month

o: January
P: February
Q: March
R: April
⋮
Z: December

5. Precautions for handling



Warning

Fluid

- (1) The operating fluids must be compressed air. Contact SMC when using the product with other fluids.
- (2) Do not use compressed air which contains chemicals, synthetic oils containing organic solvents, salts or corrosive gases, etc., as this can cause damage or malfunction.
- (3) If condensate in the drain bowl is not emptied on a regular basis (air filter and mist separator), the bowl will overflow and this may cause the malfunction of pneumatic equipment. If the drain bowl is difficult to check and remove, installation of a drain bowl with an auto drain option is recommended.
- (4) Condensate and dust in the piping can clog the fixed orifice, which may lead to operation failure. Make sure to install a mist separator (SMC AFM series / Filtration of 0.3 µm) as well as an air filter (SMC AF series), and exhaust the condensate or replace the element regularly. To maintain good air condition, refer to "Air Preparation Equipment Model Selection Guide" in Best Pneumatics No. 5 and select the C or higher (D, E, F, G or H) level.
- (5) When a lubricator is used on the supply (upstream) side of the product, it can clog the fixed orifice, which may lead to operation failure. Never use a lubricator on the supply (upstream) side of the product. If lubrication is required for terminal devices, connect a lubricator on the output side of the regulator.

* If the fixed orifice is clogged or almost clogged, the following conditions may occur.

- No output
- Reduction of the set pressure
- Unstable set pressure
- Delay in increase of the downstream pressure



Warning

Operating environment

- (1) Do not use in an environment where corrosive gases, chemicals, sea water, water or steam are present.
- (2) Do not operate in a location subject to vibration or impact. It may cause malfunction.
- (3) The product should not be exposed to prolonged sunlight. If used in direct sunlight, install a protective cover.
- (4) Do not use in a place where there are heat sources around the product and it can receive radiant heat.
- (5) Employ suitable protective measures in locations where there is contact with water drop-lets, oil or welding spatter, etc.

! Warning

Maintenance

- (1) When the Spring Holder is to be removed (see construction on page 6), reduce the set pressure to 0 and shut off the supply pressure completely beforehand.
- (2) If a pressure gauge is to be added, reduce the set pressure to 0 before removing the plug.
- (3) Rubber parts such as diaphragm, o-rings and seals are consumption, and should be replaced every three years. If the fixed orifice is exposed to contamination from extended use of the precision regulator, the product may not operate within specification. It is recommended checked every year, and replacing the part every three years.
- (4) Ensure to exhaust the condensate of the filters installed on the supply (upstream) side, wash the element and pipings, and perform replacement regularly. Although it depends on the operating conditions, the guideline is every month or every three months.
- (5) When removing the equipment for maintenance, contamination may enter the pipe and the precision regulator. Please flush the pipe and fittings thoroughly with air before reconnecting them to remove the foreign matter or contamination from the piping materials.

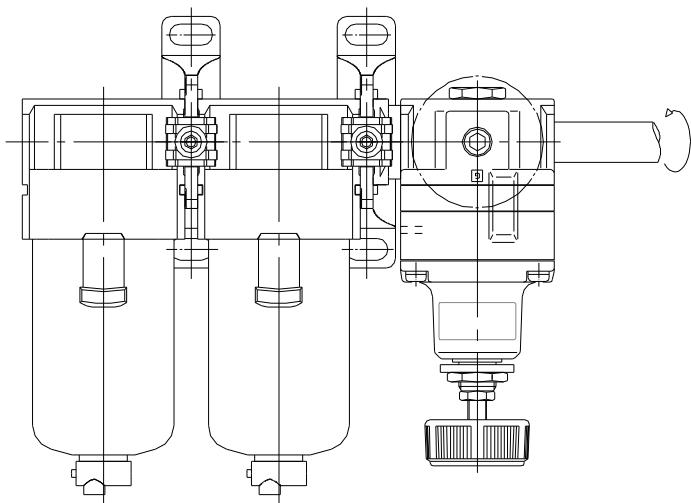
! Warning

Piping

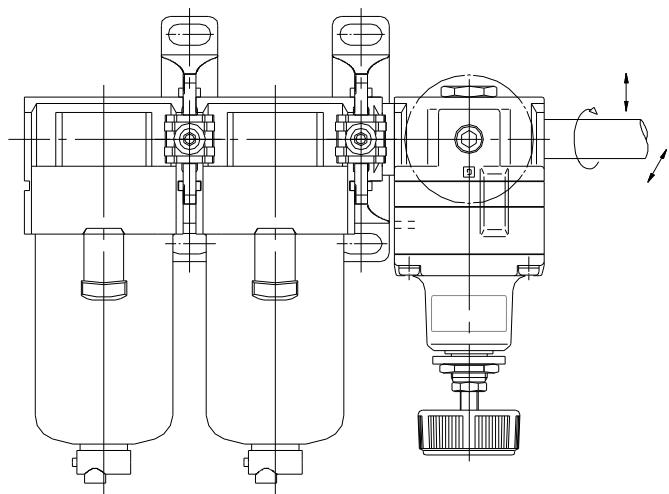
- (1) Connect piping/fittings using the recommended torque while holding the product tightly. Loose or faulty sealing can occur if tightening torque is insufficient, while damage to the thread can occur if over tightened. If the product is not held while tightening, excessive force will be applied to the product bracket, causing breakage.

Recommended tightening torque (N · m)

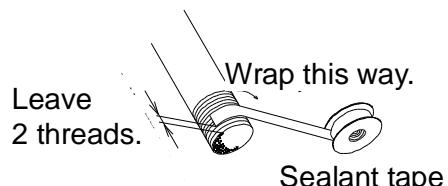
Thread size	1/4
Torque	12 to 14



- (2) Do not apply torsion or bending moment other than the weight of the product itself. The external piping should be supported separately because it may cause breakage.



- (3) Non-flexible piping such as steel piping will be subject to excessive moment load and vibration from the piping side, so use a flexible tube for intermediate connection.
(4) If the failure of the product will cause danger in the system, install a safety circuit and configure the system so that danger can be avoided.
(5) Be sure to confirm the port indication when connecting the product.
(6) Before piping, perform air blow (flushing) or cleaning to remove any cutting chips, cutting oil, dust, etc. from the piping.
(7) When installing piping or fitting into a port, prevent cutting chips and sealant material from getting inside the piping. If a sealant tape is used, leave 1.5 to 2 threads exposed.



Caution

Handling

- (1) Do not apply force when transferring, mounting and dropping the regulator with a pressure gauge.
This may cause misalignment of the pressure gauge pointer.



Warning

Operation

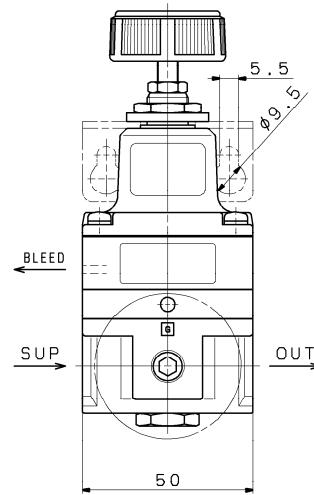
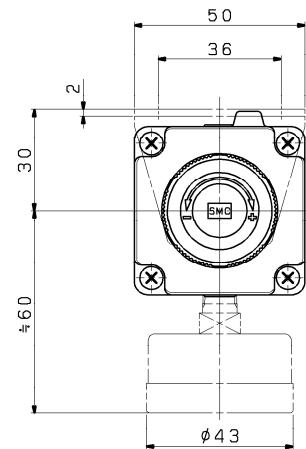
- (1) Do not use a precision regulator outside the range of its specifications as this can cause failure.(Refer to the specifications.)
- (2) Screw a panel nut with the recommended proper torque $21\text{N}\cdot\text{m}$ when mounting onto a panel. Looseness or faulty sealing will occur if tightening torque is insufficient, while thread damage will result if the torque is excessive.
- (3) If a directional switching valve (solenoid valve, mechanical valve, etc.) is mounted on the supply side of the regulator and repeatedly switched ON and OFF, wear of the nozzle/flapper section will be accelerated and a discrepancy in the setting value may occur. Therefore, avoid using a directional switching valve on the supply side. In the event a directional switching valve will be used, install it on the output side of the regulator.
- (4) The accessory pressure gauge is supplied with the regulator in the unassembled status. Before using the regulator, be sure to install the pressure gauge at the gauge port of the regulator. At this time, the recommended tightening torque of the pressure gauge is 7 to $9\text{N}\cdot\text{m}$.
- (5) Air is normally released from the bleed hole (the two hole on the side of the body's mid-section). This is a necessary consumption of air based on the construction of the precision regulator, and is not an abnormality.
- (6) Make sure to tighten the lock nut after pressure adjustment.
- (7) There may be oscillation of the set pressure 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.
- (8) After supplying pressure from the upstream side or adjusting the set pressure, the set pressure may vary gradually over time due to changes in the internal components. If the variation in the set pressure becomes large, adjust the set pressure again by adjusting the setting knob.
- (9) Changes in the ambient temperature or fluid temperature may result in changing the set pressure. If this occurs, stabilize the ambient temperature and fluid temperature properly.

6. Warranty

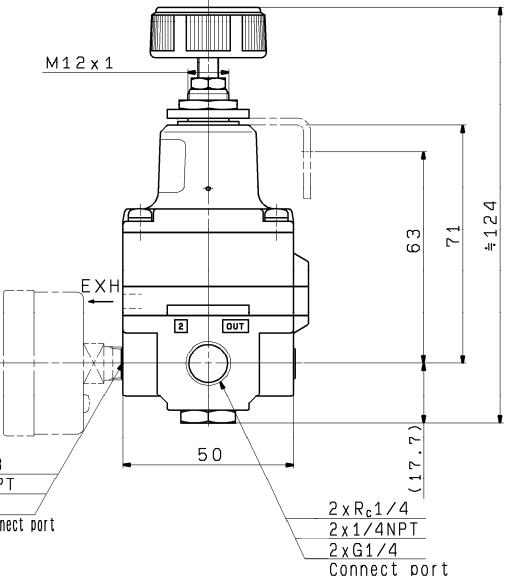
- (1) Period: The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.
- (2) Scope: For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided. This limited warranty applies only to SMC product independently, and not to any other damage incurred due to the failure of the product.
- (3) Content:
 - a. We guarantee that the product will operate normally if it is installed under maintenance and control in accordance with the Operation Manual, and operated under the conditions specified in the catalog or contracted separately.
 - b. We guarantee that the product does not have any defects in components, materials or assembly. -8-
 - c. We guarantee that the product complies with the outline dimensions provided.
 - d. The following situations are out of scope of this warranty.
 - (1) The product was incorrectly installed or connected with other equipment.
 - (2) The product was under insufficient maintenance and control or incorrectly handled.
 - (3) The product was operated outside of the specifications.
 - (4) The product was modified or altered in construction.
 - (5) The failure was a secondary failure of the product caused by the failure of equipment connected to the product.
 - (6) The failure was caused by a natural disaster such as an earthquake, typhoon, or flood, or by an accident or fire.
- (4) Agreement: If there is any doubt about anything specified in "Scope" and "Content", it shall be resolved by agreement between the customer and SMC.

7. Troubleshooting

No.	Trouble	Possible cause	Countermeasures
1	The set pressure is decreasing.	Fluctuation of flow rate at the downstream side	Reset the pressure. Return the flow rate at the downstream side to the initial rate.
		Clogging of fixed orifice due to moisture, condensation or foreign matter	Install a filter and mist separator and use clean air.
		Leakage due to deterioration of rubber parts	Ozone Replace with an ozone resistant product (80- series).
			Copper Change the material of piping, etc. from copper.
			Temperature Avoid using at high temperature or low temperature.
			Petroleum type oil Prevent the oil from entering the ambient environment and fluid.
		Frequent switch of on and off at the downstream side	Reset the pressure again.
2	The set pressure is increased or decreased over time.	The decrease of pressure in the bonnet	Set the pressure in the bonnet, which is a standard pressure, to atmospheric pressure.
		Change of the product over time	Reset the pressure again.
3	Response is slow.	Clogging of fixed orifice due to moisture, condensation or foreign matter	Install a filter and mist separator and use a clean air.
		Increased consumed flow rate at the downstream side (due to leakage, etc.)	Eliminate leakage in the piping.
4	The leakage at the EXH port has increased.	Leakage due to deterioration of rubber parts	Ozone Replace with an ozone resistant product (80- series).
			Copper Change the material of piping, etc. from copper.
			Temperature Avoid using at high temperature or low temperature.
			Petroleum type oil Prevent the oil from entering the ambient environment and fluid.
		Foreign matter stuck to the seating part	Install a filter and mist separator and use clean air.
			Perform flushing by releasing the downstream side to atmosphere, etc.
5	The set pressure changes periodically.	Fluctuation of supply pressure	Install the regulator in front to reduce the fluctuation.
		Change of ambient and fluid temperature	Prevent the effect of temperature change.
6	Pressure does not increase.	Insufficient supply pressure	Increase the supply pressure.
		Clogging of fixed orifice due to moisture, condensation or foreign matter	Install a filter and mist separator and use clean air.
7	Repeatability is poor.	Same as trouble 1.	Refer to problem 1.
		Same as trouble 2.	Refer to problem 2.
8	The product is chattering.	Leakage at the downstream side	Eliminate leakage in the piping.
		Problem with the piping at the downstream side	Chattering occurs depending on the operating conditions. Consult SMC.
9	There is leakage at the places other than the bleed hole and EXH port.	Leakage due to deterioration of rubber parts	Consult SMC.



2xRc1/8
2x1/8NPT
2xG1/8
Pressure gauge connect port



2xRc1/4
2x1/4NPT
2xG1/4
Connect port

SPECIFICATIONS

SUPPLY PRESSURE	MAX. 1.0MPa
SETTING PRSSURE	MODEL IR2000: 0.005~0.2MPa
	MODEL IR2010: 0.01~0.4MPa
	MODEL IR2020: 0.01~0.8MPa
MINIMUM SUPPLY PRESSURE	(SETTING PRESSURE)+0.05MPa
SENSITIVITY	Less than 0.2%F.S.
REPEATABILITY	Less than $\pm 0.5\%$ F.S. ^(Note)
AIR CONSUMPTION	Less than 4.4l/min(ANR) [at SUP=1.0MPa]
OPERATING TEMPERATURE	-5~60 °C
WEIGHT	0.30kg (WITHOUT ACCESSORY)

(Note) indicates the set pressure fluctuation of the secondary side for every ON-OFF (excluding the change over time and the temperature)

Model identification numbering

I R 2 0 0 -

0 2

0

0

0

0

0

0

0

0

0

Accessories
Nil:No accessories
B:With bracket
G:With pressure gauge

Port size
02:1/4

Thread type
Nil:Rc
N:NPT
F:G

Setting pressure
0:0.005~0.2MPa
1:0.01~0.4MPa
2:0.01~0.8MPa

REV/DIV	DESCRIPTION	DATE PREPARED	REV. NO.	FINISH	PAINT	PACKING	MODEL	QTY
TOLERANCES JIS B 4405	GRADE C	DRAWN BY K.Sugita	SCALE FREE	MATERIAL			THIRD ANGLE	
RANGE (mm)	0.05 0.1 0.2	DATE 2012-04-20	DESIGNED BY T.Shirane	MATERIAL SIZE				
0.5D6	0.05 0.1 0.2	DATE 2012-04-20	CHECKED BY					
3xD6	0.05 0.1 0.3	DATE 2012-04-20	APPROVED BY T.Uehara					
6xD6	0.1 0.2 0.5	DATE 2012-04-23	DATE APPROVED BY T.Uehara					
30xD420	0.15 0.3 0.6	DATE 2012-04-23	DATE APPROVED BY T.Uehara					
120xD6400	0.2 0.5 1.2	DATE 2012-04-23	DATE APPROVED BY T.Uehara					
496xD61000	0.3 0.8 2	DATE 2012-04-23	DATE APPROVED BY T.Uehara					
1000xD62000	0.5 1.2 3	DATE 2012-04-23	DATE APPROVED BY T.Uehara					

PRECISION REGULATOR
DWG NO: IR20*0-*02**
DWG ID: SMC Corporation

Revision history

- A creation
- B Thread type (NPT,G) addition
- C Format change and content review
- D Sectional view filter deletion of P.5
- E Name plate layout change
- F Content review

SMC Corporation

4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021 JAPAN

Tel: + 81 3 5207 8249 Fax: +81 3 5298 5362

URL <http://www.smcworld.com>

Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.
© 2009 SMC Corporation All Rights Reserved