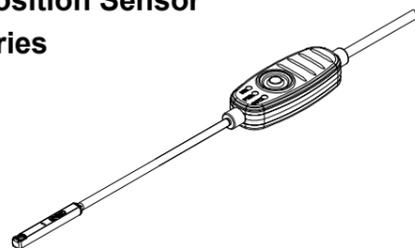




ORIGINAL INSTRUCTIONS

Instruction Manual Compact Position Sensor D-MPG# series



The intended use of the compact position sensor is to detect and control the position of an actuator using magnetic detection.

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/IEC¹⁾, and other safety regulations.

¹⁾ISO 4414: Pneumatic fluid power - General rules and safety requirements for systems and their components.

ISO 4413: Hydraulic fluid power - General rules and safety requirements for systems and their components.

IEC 60204-1: Safety of machinery - Electrical equipment of machines. Part 1: General requirements.

ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots.

- Refer to the product catalogue, Operation Manual and Handling Precautions for SMC Products for additional information.
- Keep this manual in a safe place for future reference.

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

Warning

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

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

- This product is class A equipment intended for use in an industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted or radiated disturbances.

- Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for more Safety Instructions.

- Special products (-X) might have specifications which are different to those shown in the specifications section. Contact SMC for specific drawings.

2 Specifications

2.1 Position sensor specifications

Model	D-MPG*	
Measuring range *1	25 mm (default)	
Power supply voltage	15 to 30 VDC, 10% ripple (p-p) max.	
Current consumption	38 mA or less (no load applied)	
Circuit protection	Power supply polarity protection	
Repeatability *2	0.1 mm (ambient temperature: 25 °C)	
Resolution	0.01 mm	
Linearity *2	±0.6 mm (ambient temperature: 25 °C), Measuring range: 25 mm.	
	±1.5 mm (ambient temperature: 25 °C), Measuring range: 35 mm.	
Switch output	Switch type	NPN or PNP 1 output (push-pull)
	Max. load current	40 mA
	Internal voltage drop	1 V or less
	Leakage current	0.1 mA or less
	Short circuit protection	Yes
Analogue current output *3	Output current	4 to 20 mA (default)
	Max. load resistance	400 Ω
Analogue voltage output *3	Output voltage	0 to 10 V, 1 to 5 V
	Min. load resistance	2 kΩ
Indicator light	MR (Orange), PWR (Green), OUT1 (Orange), CURRENT (Blue), VOLTAGE (Green)	
Lead wire	PUR 4 core, Sensor cable: φ2.2, Teach cable: φ2.6	
Standards	CE/UKCA marking, UL(CSA)	
Impact resistance	300 m/s ²	
Insulation resistance	50 MΩ or more with 500 VDC Ohmmeter	
Withstand voltage	1000 VAC 1 minute	
Ambient temperature	-10 to 60 °C (When using analogue current: -10 to 50 °C)	
Enclosure	IP67 (IEC60529)	

*1: Can be changed up to 35 mm maximum, but will be more susceptible to disturbances, etc.

*2: This is the repeatability due to the movement of the magnet from one direction.

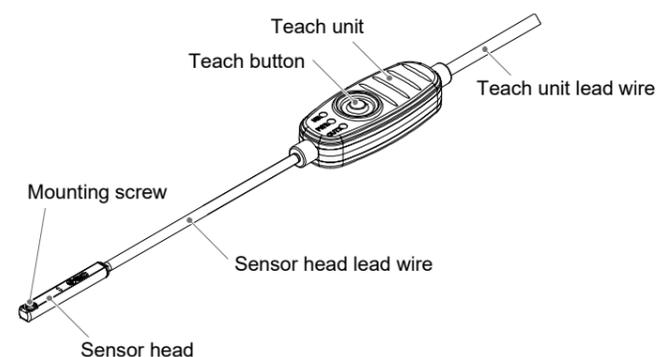
*3: Analogue current (4-20 mA) / Analogue voltage (0-10 V) / Analogue voltage (1-5 V) / selectable.

2.2 IO-Link specifications

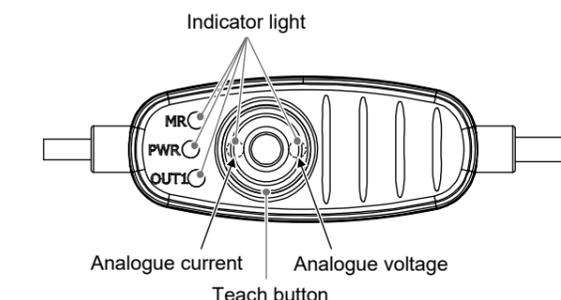
Model	D-MPG*
Version	V1.1
Communication speed	COM3 (230.4 kbps)
Process data size	Input: 4 bytes, Output: 0 byte
Minimum cycle time	1 ms
Vendor ID	83 (hex)
Device ID	243 (hex)

3 Name and function of parts

3.1 Position sensor



3.2 Teach unit operation display



4 Installation

4.1 Installation

Warning

- Do not install the product unless the safety instructions have been read and understood.
- Confirm the specifications.
Read the specifications carefully and use the product correctly.
- When using two or more cylinders or actuators with built-in magnet in close proximity to each other, maintain a minimum separation distance of at least 40 mm. (If the separation distance is specified for the actuator series, then use that value).
The product may malfunction due to magnetic field interference.
- Reserve a space for maintenance.
When designing an application, be sure to allow sufficient clearance for maintenance.
- Never mount the cylinder/actuator in a location that will be used as a footrest. If personnel step on the actuator accidentally, an excessive load will be applied to the actuator, causing the actuator to be damaged.
- Design the application to prevent reverse current when the circuit is open or when the product is forced to operate for operational checks.
Reverse current can cause product damage or malfunction.
- Limitations of the detection position
There will be mounting positions or surfaces where the product cannot be mounted due to physical interference (e.g. rear side of the foot bracket), depending on the mounting conditions of the actuator.
Select the product after confirming that the product mounting position does not interfere with the mounting bracket (e.g. trunnion, reinforcement ring).
The position sensor might protrude outside of the cylinder and it may not be possible to mount depending on the cylinder bore size or stroke.
When the position is to be measured over the cylinder full stroke, use a cylinder with a stroke 5 mm shorter than the sensor range.

4 Installation (continued)

Use a stroke reading cylinder when the full stroke cannot be detected by the position sensor.

- The wiring length should be kept to 20 m or less.
For long wire lengths we recommend a ferrite core should be attached to both ends of the cable, to reduce noise interference.
- Do not use a load which generates a surge voltage.
When a load which generates a surge voltage is to be directly driven, such as a relay or solenoid, use a position sensor with built-in surge protection.

- The output operation of the position sensor will be unstable for 150 ms after power is supplied.

During the time after supplying power, the input device (e.g. PLC, relay) may consider the ON position as OFF output or the OFF position as ON output.

Set up the application to consider the signals will be invalid within 150 ms after power is supplied.

- Install a rotation prevention device to the actuator piston rod.
Use a guide or select an SMC product with a rotation prevention function. The accuracy may decrease without an anti-rotation device.
With some cylinders, the magnet may rotate even when the piston rod does not rotate. Contact SMC for details.

- If power is turned on while the magnet (target of detection) is outside of the measurement range, the analogue output indicates the lower limit value and the switch output indicates logic level low (Analogue current is 4 [mA], analogue voltage is 0 [V], switch output is ON for NPN output, OFF for PNP output).

The Analogue output and switch output will operate correctly by operating the cylinder at full stroke more than once.

- The position sensor accuracy may decrease under the following operating conditions:

When the warm up time is inadequate (10 to 15 minutes), play due to a mechanical reason or a floating joint exists, or a magnetic effect such as disturbance or magnetic substance (iron, screws) is present in the operating environment. It is recommended to use non-magnetic materials for surrounding parts.

4.2 Environment

Warning

- Do not use in a location where magnetic fields are generated.
The Position sensor will malfunction, or the accuracy will be decreased. If a strong magnetic field (approx. 18 mT or more) is applied, the device will not operate correctly and will require calibration.
- Do not use in an environment where the position sensor will be continually exposed to water or condensation.
Although the product satisfies the IP67 (IEC 60529) specifications, do not use in applications continually exposed to water splashing or spray. Otherwise, insulation failure or malfunction may result.
- Do not use in an environment where oil or chemical splashes occur.
If the products are used in an environment with coolants, cleaning solvents, oils or chemicals for even a short time, they may be adversely affected by insulation failure, malfunction due to swelling of the potting resin, or hardening of the lead wires.
- Do not use in an environment where there are cyclic temperature changes.
Heat cycles other than ordinary changes in temperature can adversely affect the position sensor.
- Avoid accumulation of iron filing debris or close contact with magnetic substances.
When a large amount of iron waste such as machining chips or spatter has accumulated, or a magnetic substance (something attracted by a magnet) is brought into close proximity with the cylinder/actuator with built in magnet, it may cause the position sensor to malfunction due to a weakening of the magnetic force inside the actuator.
- Do not use in an area where electrical surges are generated.
When there are units (solenoid lifter, high frequency induction furnace, motor, etc.) which generate a large amount of surges in the area around the cylinder/actuator with position sensor, this may cause damage to the position sensor internal circuit.
- Do not use in direct sunlight.
- Do not mount the position sensor in locations where it is exposed to radiant heat.

4 Installation (continued)

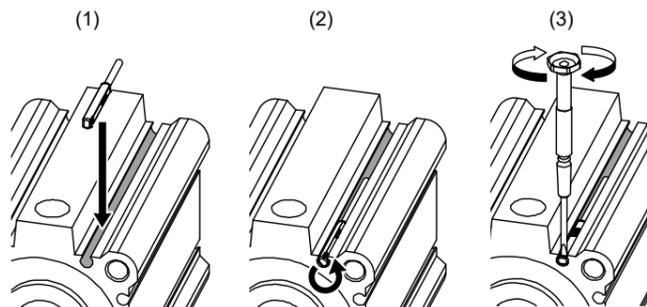
- The product is CE marked, but not immune to lightning strikes. Take measures against lightning strikes in the system.
- Do not use the product in a welding environment. The Position sensor will malfunction, or the accuracy will be decreased.
- Do not use in environments subject to radiation stress. Because radiation resistance is not incorporated, a malfunction of the product or a damage to the circuit elements inside the product may be caused.

4.3 Mounting precautions

- Do not drop or apply an impact to the position sensor. Applying an excessive impact (more than 300 m/s²) may damage the product and cause malfunction.
- Observe the recommended tightening torque for mounting. If the screws are tightened in excessive of the specified torque range (0.05 to 0.1 N.m), it may damage the cylinder/actuator, mounting screws, mounting brackets, and sensor etc. Tightening below the specified tightening torque will allow the position sensor to move out of position.
- Do not carry an actuator by the position sensor lead wire. This may cause broken lead wires or damage to the position sensor internal elements.
- Use only the screws installed in the position sensor for mounting the position sensor. If other screws are used, the position sensor may be damaged.
- Check and adjust the product operation during installation. The position sensor may not operate in the correct actuator mounting position due to the installation environment. If the position sensor does not operate correctly, it may be remedied by turning the power off and on, stroking the piston several times, or restoring the unit to its factory default conditions.

4.4 Mounting

- When mounting a position sensor, use a mounting bracket appropriate for the cylinder/actuator. The mounting method differs according to the type of actuator and the inner diameter of the actuator tube. When mounting a position sensor for the first time, check that the cylinder/actuator has a built-in magnet and use an appropriate bracket for the cylinder/actuator. There are also some cases when a bracket is not needed.
- Recommended tightening torque. Use a small screwdriver whose grip diameter is 5 to 6 mm when tightening the mounting screw. The recommended mounting torque should be 0.05 to 0.1 N.m. Over-tightening can damage the cylinder/actuator and sensor. Loose screws can cause misalignment or a reduction in accuracy during operation.
- To mount the sensor into the actuator mounting groove, secure it using the following procedure:
 - Insert the sensor into the groove in the actuator.
 - Rotate the sensor in the groove.
 - Tighten the mounting screws.



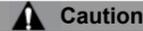
4 Installation (continued)

4.5 Adjustment

- Do not press the teach button with a sharp pointed object. This may cause damage to the teach button.
- After turning on the power, stroke the piston approximately 10-20 times before use. The position sensor will then be optimized and repeatability and linearity will be within the specification range. If the stroke is too short to operate correctly, such as with an air chuck, move the sensor back and forth several times with the printed side of the sensor facing up into the actuator groove before use.

5 Wiring

5.1 Wiring

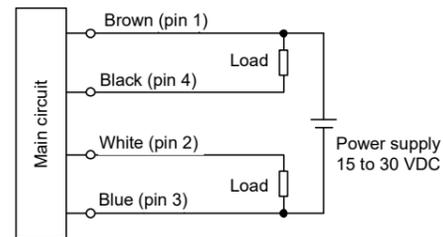


- Do not perform wiring while the power is ON.** Electric shock, malfunction or damage to the position sensor can result.
- Check the insulation of the wiring. Check that there is no faulty wiring insulation (short circuits, faulty ground connections, improper insulation between terminals, etc.), as this may damage the position sensor due to over current.
- Do not route the position sensor wiring in the same place as power cables or high voltage cables. Otherwise position sensor malfunction may result due to noise and inrush current.
- Avoid repeatedly bending or stressing the lead wires. Broken lead wires will result if bending stresses or tensile forces are applied to the lead wires. Stress and tensile forces applied to the connection between the lead wire and the product increases the possibility of disconnection. Secure the lead wire to reduce any movement in the area where the lead wire connects with the position sensor.
- Do not allow short-circuit of loads. There is a risk of damage to the position sensor.
- Wire the position sensor correctly. Incorrect wiring may cause malfunction or damage to the position

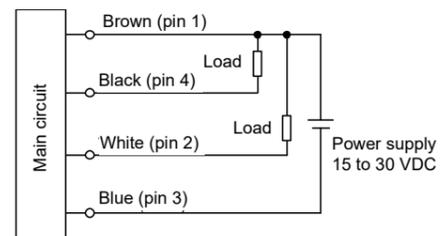
- Do not disconnect the lead wire between the sensor head and the teach unit. Even if the sensor head and teach unit are reconnected, contact resistance may occur and the position sensor may not operate correctly.

5.2 Position sensor Internal circuit and Wiring

• NPN output + Analogue output

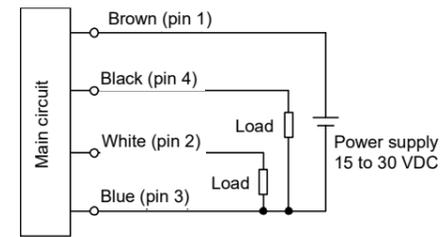


• NPN 2 output + Analogue output

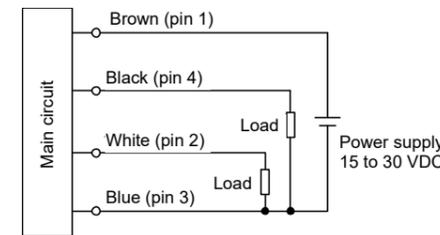


5 Wiring (continued)

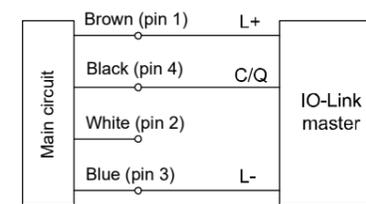
• PNP output + Analogue output



• PNP 2 output



• IO-Link specification



Analogue output (white) is disabled when IO-Link mode is selected.

Wiring		Description
Connector pin number	Wire colour	
1	Brown	Power supply DC(+)
2	White	Analogue current output / Analogue voltage output *
3	Blue	Power supply DC(-)
4	Black	Switch output / IO-Link

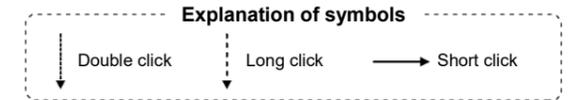
* When used as a switch output, wire in the same manner as the black wire. Switch outputs can only be configured for IO-Link.

5.3 Pre-wired connector pin assignment

D-MPGB	D-MPGC
M8 4-pin connector	M12 4-pin A-coded connector

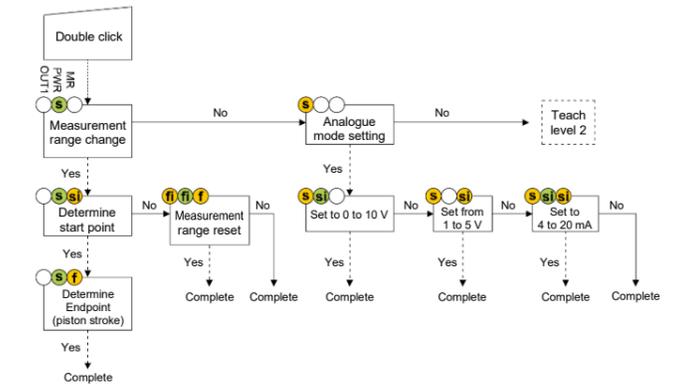
6 Settings

- Initial settings of the position sensor are as follows:
Switch output: Low (NPN = ON, PNP = OFF).
Analogue output: current output.
Measuring range: 25 mm.
- Teach button setting procedure:
Check the following in advance of making any settings.
 - After attaching the position sensor to the actuator and turning on the power, fully stroke the actuator approximately 10 to 20 times. The Linearity and measurement range will be optimized.
 - When changing the measuring range, keep the piston position within the position sensor operating range.
- Double click the teach button to enter the setting mode and the PWR indicator light (green) will flash.



Indication meaning

- LED OFF
- LED ON
- Ⓢ LED flashing
- Ⓢi Inversion flashing
- Ⓢf Fast flashing
- Ⓢfi Fast inversion flashing
- Ⓢx Refer to *1



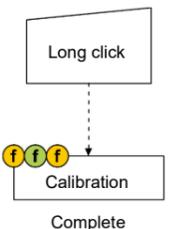
For further details regarding Teach level 2, the switch output and analogue output settings, and the selection of the operating range please refer to the operation manual available on the SMC website (<https://www.smcworld.com>).

6.1 Calibration

- Calibration is necessary when the device stops working correctly, such as when it is subjected to a strong magnetic field.
- Do not perform this operation when the actuator is operating normally.
- If this is carried out when installed in the actuator, it will not operate correctly.

Calibration procedure

- Remove the sensor from the actuator and set it in a magnetic field-free environment.
- Press the teach button for 30 seconds and all indicator lights will turn ON.
- Release the teach button within 3 seconds.
- If the teach button is pressed and held for more than 33 seconds, calibration will not be performed.



7 IO-Link Settings

- Communication
This product can check the position measurement value, diagnostic information and switch output status using cyclic data communication via the IO-Link system.

- Data storage function
The data storage function stores the IO-Link device parameter settings to the IO-Link master.
With the IO-Link data storage function, the IO-link device can be replaced easily without re-setting the equipment construction or setting parameters.

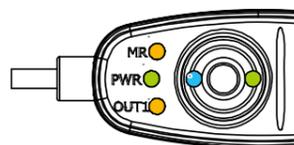
- IODD file
The IODD (I/O Device Description) is a definition file which provides all properties and parameters required for establishing functions and communication of the device.
The IODD includes the main IODD file and a set of image files such as the vendor logo, device picture and device icon.

	Product No.	IODD file *
1	D-MPGA / B / C	SMC-D-MPG-yyyymmdd-IODD1.1

*: "yyyymmdd" indicates the file preparation date. yyyy is the year, mm is the month and dd is the date.

The IODD file can be downloaded from the SMC website (<https://www.smcworld.com>).

8 Error display



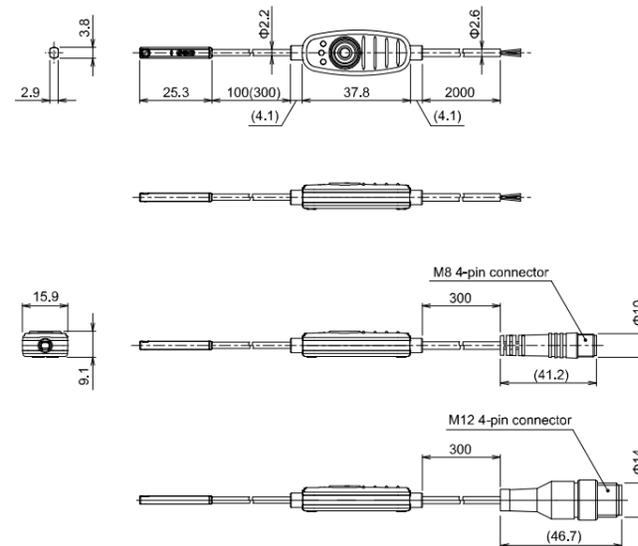
	Mode	Indicator light					Description
		MR	PWR	OUT1	Analogue current	Analogue voltage	
System status	IO-Link		●				IO-Link connection active.
	SIO power supply ON		●				Power ON.
	SIO power supply OFF		○				Power OFF.
	Analogue voltage					●	Analogue voltage output active
	Analogue current				●		Analogue current output active
Switch output	High			●			PNP: ON NPN: OFF
	Low			○			PNP: OFF NPN: ON
Magnetic field	Inside measuring range	●					Magnetic field registered in measuring range.
	Outside measuring range	○					Magnetic field is not registered in measurement range.

● = LED ON, ● (with lines) = LED flashing, ○ = LED OFF

9 How to Order

Refer to the operation manual or catalogue on the SMC website (URL: <https://www.smcworld.com>) for the How to Order information.

10 Outline dimensions



11 Maintenance

11.1 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.

11.2 Periodical maintenance

- Perform the following maintenance periodically to prevent possible danger due to unexpected position sensor malfunction.
 - 1) Securely tighten the position sensor mounting screws. If screws have become loose or the mounting position is moved, retighten them after readjusting the mounting position.
 - 2) Check that there is no damage to lead wires. If damage to the lead wire is found, replace the position sensor, or repair the lead wire, to avoid faulty insulation.
- Do not use solvents such as benzene, thinners etc. to clean the product. These can damage the surface of the body and erase the markings on the body. For heavy stains, use a cloth lightly dampened with diluted neutral detergent, then wipe up any residue with a dry cloth.

11 Maintenance (continued)

- WEEE Directive
This product is classified as waste electrical or electronic equipment according to the WEEE Directive 2012/19/EU and in order to reduce the adverse effects on human health and the environment, should not be disposed of as municipal waste.

How to reset the product after a power loss or when the power has been unexpectedly removed

Regarding set up, contents of the program may be maintained by the customer's application systems.
Be sure to confirm safety when returning operation of the cylinder and actuator because it could have been stopped in an unstable condition.

12 Limitations of Use

Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

13 Product disposal

This product should not be disposed of as municipal waste. Check your local regulations and guidelines to dispose of this product correctly, in order to reduce the impact on human health and the environment.

14 Contacts

Refer to www.smcworld.com or www.smc.eu for your local distributor / importer.

SMC Corporation

URL: <https://www.smcworld.com> (Global) <https://www.smc.eu> (Europe)
SMC Corporation, 1-5-5, Kyobashi, Chuo-ku, Tokyo 104-0031, JAPAN
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