



Installation & Maintenance Manual

Digital Flow Switch (Sensor Part)

For Air

Series **PF2A 510/550**

PF2A 511/521/551

For Water

Series **PF2W 504/520/540**

PF2W 511

For Water (High Temperature Fluid Type)

Series **PF2W 504T/520T/540T**



Safety Instructions

The Digital Flow Switch and this manual contain essential information for the protection of users and others from possible injury and property damage and to ensure correct handling. Please confirm that you fully understand the definition of the following messages (signs) before going on to read the text, and always follow the instructions.

Please read and understand the operation manuals of related apparatus before operating the flow switch.

IMPORTANT MESSAGES

Read this manual and follow its instructions. Signal words such as WARNING, CAUTION and NOTE, will be followed by important safety information that must be carefully reviewed.

⚠ WARNING	Indicates a potentially hazardous situation which could result in death or serious injury if you do not follow instructions.
⚠ CAUTION	Indicates a potentially hazardous situation which if not avoided, may result in minor injury or moderate injury.
NOTE	Gives you helpful information.

⚠ WARNING

Do not disassemble, modify (including change of printed circuit board) or repair.

An injury or failure can result.

Do not operate outside of the specification.

Fire, malfunction or switch damage can result.

Please use it after confirming the specification.

Do not operate in an environment of inflammable, explosive or corrosive gas.

Fire or an explosion can result.

This flow switch is not an explosion proof type.

Safety Instructions (continue)

⚠ WARNING

Prepare a double interlock using another system (Mechanical interlock, etc.), and check it is operating correctly, when using this product in an interlock circuit.

An accident by a malfunction may potentially result.

Do not use with an inflammable, an explosive or a combustible fluid.

Otherwise, a fire or an explosion or damage may potentially result. (The detector of the flow switch for air is heated to 150°C)

⚠ CAUTION

Check for fluid leakage after installing the flow switch.

Neglecting fluid leakage may cause a burn or damage to the machines and equipment. A burn may occur when using a high temperature model for water.

Do not touch the pipe joining parts. (High temperature applications for water)

Otherwise, a burn may occur. Touch after confirming the product has sufficiently cooled.

NOTE

Follow the instructions given below when handling the flow switch. Otherwise, the switch may be damaged or may fail, thereby resulting in malfunction.

- Do not drop, bring into collision with other objects or apply excessive shock to the unit (490m/s² or more).
- Do not pull the lead wire with force or lift the main unit by holding the lead wire. (Pulling strength less than 49N)
- Connect wires and cables correctly.

- Do not perform wiring while power is on.
- Although the flow switch complies with the CE Marking, it does not have lightning surge protection, therefore please apply the necessary protection to the equipment.
- Although the flow switch complies with the CE Marking, it should be protected against any sources of surge (electro-magnetic lifter, high frequency induction furnace, motors etc.) around the flow switch.
- Do not use with power cable or high-voltage cable in the same wire route.
- Do not use in a place in which oil or chemical splashes may occur.
- Turn on the power supply of a flow switch for Air, when the flow is zero. Some initial drift occurs during ten minutes after turning the power on.
- For 3 seconds after power is turned ON the measurement output will be OFF. This includes after momentary disconnection of the power, by reset etc.) Please program the equipment to correspond to this.
- Install a filter on the primary side (inlet side) if foreign matter is feared to mix in the fluid.
- Use the flow switch within the specified operating pressure range. Design the piping and switch setting (for water) so that the flow switch is not subjected to pressures outside the specified range by a water hammer, etc.
- Do not attach the flow switch (for air) with the underneath of the body facing upwards.

Model Indication Method

PF2 5 1 1 1 1 1 1 1 1 1 1

Fluid

A: Air

W: Water

e-con connector

No Symbol: No connector

C: e-con connector 1 pc.
(supplied not assembled)

Output Specification

- No Symbol: Sensor output (for Display unit only)
- 1: Sensor output + Analog output (1 to 5V)
 - 2: Sensor output + Analog output (4 to 20mA)

Lead Wire Specification

- No Symbol: M12 Lead wire with connector (3m)
- N: No Lead wire with connector

Pipe Port Size (Refer to table below)

- 01: Port Size 1/8 02: Port Size 1/4
03: Port Size 3/8 04: Port Size 1/2
06: Port Size 3/4 10: Port Size 1

Port Thread Type

- No Symbol: Rc N: NPT F: G

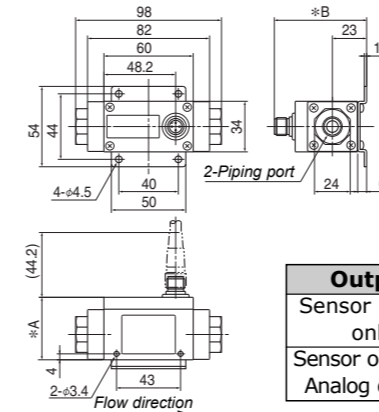
Temperature Range

- No Symbol: Standard temperature range
T: 0 to 90°C (available with PF2W for water only)

Type	Flow Rate	Pipe Port Size
PF2A 5	10: 1 to 10L/min	01, 02
	50: 5 to 50L/min	01, 02
	11: 10 to 100L/min	03
	21: 20 to 200L/min	03
	51: 50 to 500L/min	04
PF2W 5	04: 0.5 to 4L/min	03
	20: 2 to 16L/min	03, 04
	40: 5 to 40L/min	04, 06
	11: 10 to 100L/min	06, 10

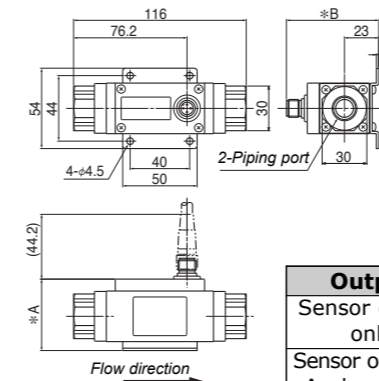
Outline with Dimensions (in mm)

PF2A 510 / 550



Output	*A	*B
Sensor output only	42mm	62mm
Sensor output & Analog output	52mm	72mm

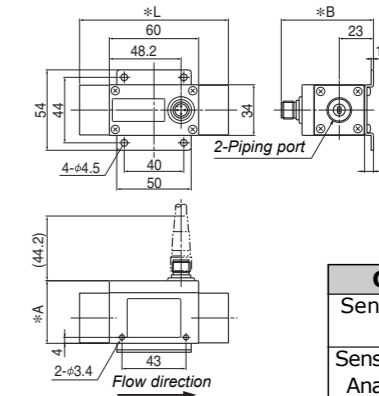
PF2A 511 / 521 / 551



Output	*A	*B
Sensor output only	48mm	62mm
Sensor output & Analog output	58mm	72mm

Outline with Dimensions (in mm)(continue)

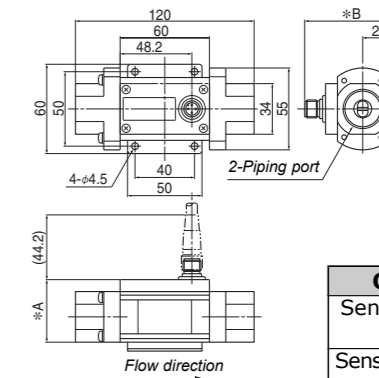
PF2W 504 / 520



Type	*L
PF2W 504	100mm
PF2W 520	106mm

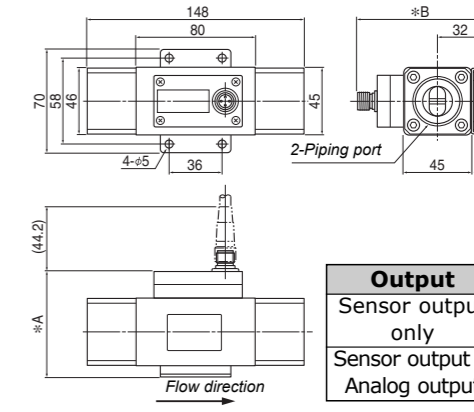
Output	*A	*B
Sensor output only	42mm	62mm
Sensor output & Analog output	52mm	72mm

PF2W 540



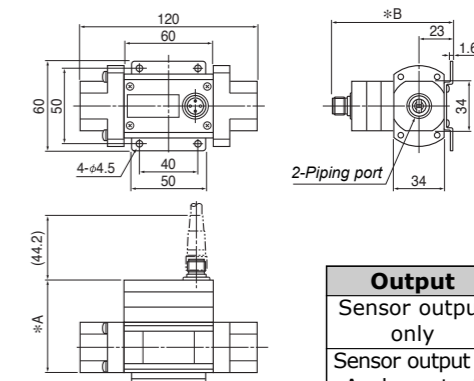
Output	*A	*B
Sensor output only	42mm	62mm
Sensor output & Analog output	52mm	72mm

PF2W 511



Output	*A	*B
Sensor output only	63mm	77mm
Sensor output & Analog output	73mm	87mm

PF2W 504T / 520T / 540T



Output	*A	*B
Sensor output only	52mm	72mm
Sensor output & Analog output	62mm	82mm

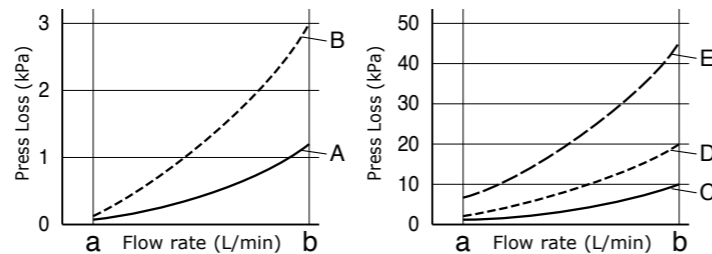
Specification

For Air

Model	PF2A 510	PF2A 550	PF2A 511	PF2A 521	PF2A 551
Rated Flow Range	1 to 10L/min	5 to 50L/min	10 to 100L/min	20 to 200L/min	50 to 500L/min
Operating Pressure Range	-50kPa to 0.5MPa		-50kPa to 0.75MPa		
Linearity (*1)	±5%F.S. or less				
Repeatability (*1)	±1%F.S. or less				
Temperature Characteristic	±2%F.S. or less (15 to 35°C, 25°C standard) ±3%F.S. or less (0 to 50°C, 25°C standard)				
Current Consumption (No load)	100mA or less				110mA or less
Mass (Weight) (*2)	200g		240g		
Piping Specification	1/8, 1/4		3/8		1/2
Material of Wet Part	Attachment: ADC Packing: NBR Mesh: SUS Internal Body: PBT Sensor-housing: PBT Sensor: Lead-glass/ PtIr/ FeNi/ OFC		Attachment: ADC Packing: NBR Spacer: PBT Mesh: SUS Internal Body: PBT Sensor-housing: PBT Sensor: Lead-glass/ PtIr/ FeNi/ OFC		

Flow rate characteristic (Pressure Loss)

PF2A 5**



Type	Graph	a (L/min)	b (L/min)
PF2A 510	A	1	10
PF2A 550	B	5	50
PF2A 511	C	10	100
PF2A 521	D	20	200
PF2A 551	E	50	500

For Water

Common Specification	
Detecting Method	Karman Vortex Method
Operating Pressure Range	0 to 1MPa
Withstand Pressure	1.5MPa
Ambient Temperature Range	Operation: 0 to 50°C, Storage: -25 to 85°C (No condensation or Freezing)
Output Specification (*3)	Sensor Output Nch Open Drain Output for Display Part PF2W3*0/3*1 (Reference : Maximum load current 10mA, maximum applied voltage 30V)
	Analog Output Voltage Output 1 to 5V (Within rated flow rate range) Linearity: ±5%F.S. or less, permissible load impedance: 100kΩ or more Current Output 4 to 20mA (Within rated flow rate range) Linearity: ±5%F.S. or less, Permissible load impedance: 300Ω or less (@12VDC), 600Ω or less (@24VDC)
Power Supply Voltage	12 to 24V DC, ripple ±10% or less
Current Consumption	20mA or less (No load)
Withstand Voltage	1000VAC 1 minute. Between group of external terminals and case
Insulation Resistance	50MΩ or more (@ 500VDC M). Between group of external terminals and case
Resistance to Noise	1000Vp-p pulse width 1μs, rise 1ns
Vibration Proof	10 to 500Hz and amplitude 1.5mm or acceleration 98m/s ² whichever is smaller
Impact Proof	490m/s ² , (3 times each directions of X, Y and Z respectively)
Enclosure	IP65 (IEC60529)

*1: This is an overall accuracy combined with PF2W3**.

*2: Lead wire not included.

(The unit with analog output (either voltage or current output) is 20g heavier.)

*3: Select the output option by the Model indication Method.

*4: The flow switch conforms entirely to the CE standard.

Names and Functions of Individual Parts

Body

Flow switch sensor body

The arrow on the side of the body indicates the direction of flow.

Piping port

This port connects with pipeline.

Use a pipe fitting to connect with external pipeline.

Accessories

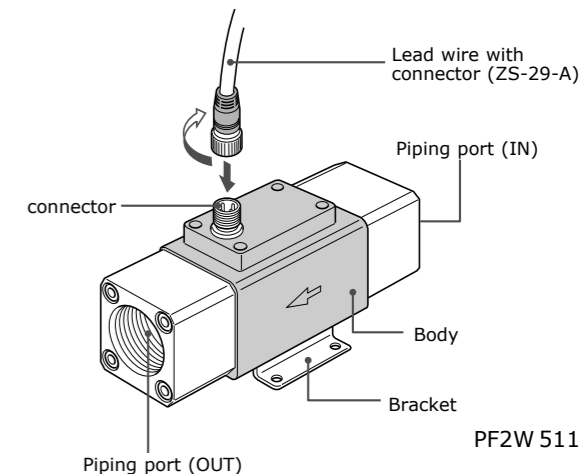
(When specified for optional wiring in the model type specification).

Lead wire with connector on one end (3m in length).

E-con connector supplied not assembled (ZS-28-CA-4), for

connecting other end with the PF2*3*0 / 3*1 series display unit

supplied by SMC.



For Air

Common Specification	
Fluid to be Measured	Air, Nitrogen
Detecting Method	Calorimetry
Withstand Pressure	1.0MPa
Operating Fluid Temperature	0 to 50°C
Ambient Temperature Range	Operation: 0 to 50°C, Storage: -25 to 85°C (No condensation or Freezing)
Output Specification (*3)	Sensor Output Output impedance 1kΩ, (for Display Part PF2A 3**)
	Analog Output Voltage Output 1 to 5V (Within rated flow rate range) Linearity: ±5%F.S. or less, Permissible load impedance: 100kΩ or more Current Output 4 to 20mA (Within rated flow rate range) Linearity: ±5%F.S. or less, Permissible load impedance: 300Ω or less (@12VDC), 600Ω or less (@24VDC)
Power Supply Voltage	12 to 24VDC, ripple ±10% or less
Withstand Voltage	1000VAC 1 minute. Between group of external terminals and case
Insulation Resistance	50MΩ or more (@ 500VDC M). Between group of external terminals and case
Resistance to Noise	1000Vp-p pulse width 1μs, rise 1ns
Vibration Proof	10 to 500Hz and amplitude 1.5mm or acceleration 98m/s ² whichever is smaller
Impact Proof	490m/s ² , (3 times each directions of X, Y and Z respectively)
Enclosure	IP65 (IEC 60529)

*1: This is an overall accuracy combined with PF2A 3**.

*2: Lead wire not included.

(The unit with analog output (either voltage or current output) is 20g heavier.)

*3: Select the output option by the Model indication Method.

*4: The flow unit is based on a Normal condition of 0°C/ 101.3kPa.

*5: The flow switch conforms entirely to the CE standard.

For Water

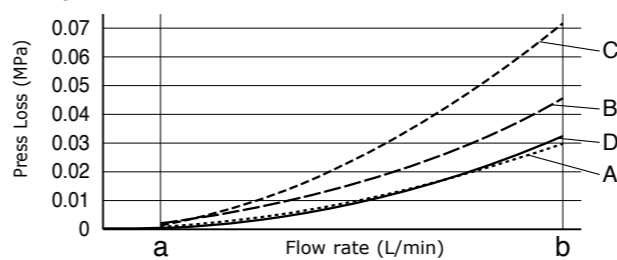
Model	PF2W 504	PF2W 520	PF2W 540	PF2W 511
Fluid to be Measured	Water			
Rated Flow Range	0.5 to 4L/min	2 to 16L/min	5 to 40L/min	10 to 100L/min
Operating Fluid Temperature	0 to 50°C			
Linearity (*1)	±5%F.S. or less		±3%F.S. or less	
Repeatability	±2%F.S. or less		±1%F.S. or less	
Temperature Characteristic	±2%F.S. or less (15 to 35°C, 25°C standard) ±3%F.S. or less (0 to 50°C, 25°C standard)			
Mass (Weight) (*2)	410g	470g	650g	1,100g
Vibration Proof	10 to 500Hz and amplitude 1.5mm or acceleration 98m/s ² whichever is smaller			4.9m/s ²
Piping Specification	3/8	3/8, 1/2	1/2, 3/4	3/4, 1
Material of Wet Part	Attachment: SUS, Packing: NBR, Internal Body: PPS, Sensor: PPS			

For High Temperature fluid

Model	PF2W 504T	PF2W 520T	PF2W 540T
Fluid to be Measured	Water, mixture of 50% water and 50% ethylene glycol		
Rated Flow Range	0.5 to 4L/min	2 to 16L/min	5 to 40L/min
Operating Fluid Temperature	0 to 90°C (No cavitation)		
Linearity (*1)	±5%F.S. or less		
Repeatability	±2%F.S. or less		
Temperature Characteristic	±5%F.S. or less (0 to 90°C, 25°C standard)		
Mass (Weight) (*2)	660g		
Vibration Proof	10 to 500Hz and amplitude 1.5mm or acceleration 98m/s ² whichever is smaller		
Piping Specification	3/8	3/8, 1/2	1/2, 3/4
Material of Wet Part	Attachment: SUS, Packing: FKM, Internal Body: PPS, Sensor: PPS		

Flow rate characteristic (Pressure Loss)

PF2W 5**



Type	Graph	a (L/min)	b (L/min)
PF2W 504/504T	A	0.5	4
PF2W 520/520T	B	2	16
PF2W 540/540T	C	5	40
PF2W 511	D	10	100

Installation

Pipe Connection

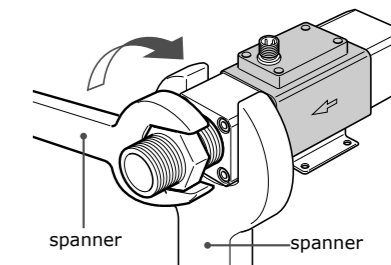
• Use a suitable pipe fitting to connect pipeline with the flow switch.

• Observe the specified tightening torque when connecting pipes.

Refer to the following table for the appropriate torque values.

Nominal size of thread	Tightening torque N·m
Rc 1/8	7 to 9
Rc 1/4	12 to 14
Rc 3/8	22 to 24
Rc 1/2	28 to 30
Rc 3/4	28 to 30
Rc 1	36 to 38

• When connecting the pipeline to the flow switch, apply a spanner to the metal part of the flow switch body.



PF2W 511

• Make sure that sealing tapes do not enter inside the pipe when connecting pipes.

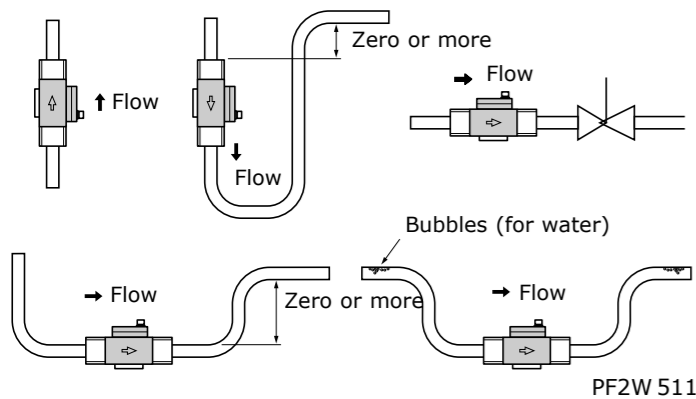
• Connect pipes securely so that fluid will not leak from loose connections.

Installation(continue)

Before mounting the flow switch, read "Safety Instructions" and "Installation" described in this manual carefully to ensure safe and correct measurement.

Mounting

- Use this flow switch within the specified operating pressure range and operating temperature range.
 - Withstand pressure are 1.0MPa for air and 1.5MPa for water.
 - Do not install a flow switch at a foothold position.
 - Cavitation (bubbles) may be generated depending on the piping design.
- Refer to an example of a recommended piping system. (for water)



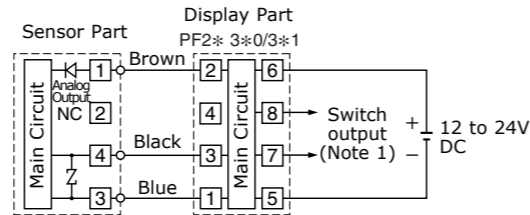
- Install the flow switch so that the flow direction agrees with the arrow direction on the side of the body.
- Provide a straight pipe length of more than eight times the pipe diameter to the primary side (inlet side) of the flow switch.
- To start designing the piping system, check the pressure loss at the operating flow rate using the flow rate characteristic (pressure loss) curve.

Internal Circuit and Wiring

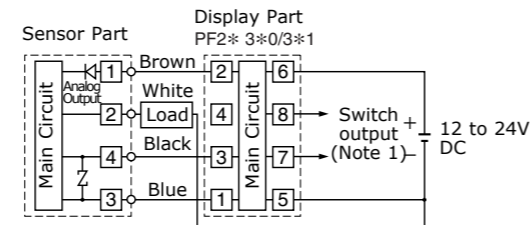
The sensor output is output for flow rate display.
Be sure to combine the flow switch with the PF2*3*0/3*1 series display manufactured by SMC.
When the Lead wire with connector provided by SMC corporation is used the color of wire(Brown, White, Black, Blue) shown on circuit diagram will be applied.

Output Specification

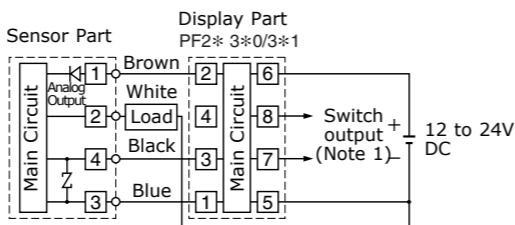
No Symbol
Sensor Output
Nch Open Drain Output 1 Output (For PF2*3*0/3*1 Series)



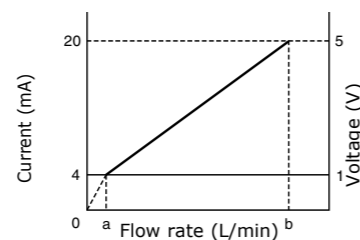
-1
Sensor Output
Nch Open Drain Output 1 Output (For PF2*3*0/3*1 Series)
Analog Output: 1 to 5V Load Impedance: 100kΩ or more



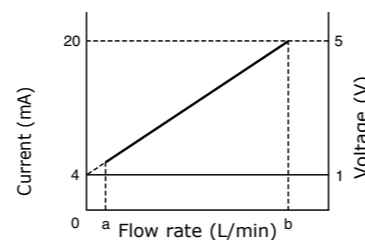
-2
Sensor Output
Nch Open Drain Output 1 Output (For PF2*3*0/3*1 Series)
Analog Output: 4 to 20mA Load Impedance: 300Ω or less (@12VDC), 600Ω or less (@24VDC)



(Note 1) See the operation manual of PF2*3*0/3*1 series for complete information.



Type	a	b
PF2A 510	1	10
PF2A 550	5	50
PF2A 511	10	100
PF2A 521	20	200
PF2A 551	50	500

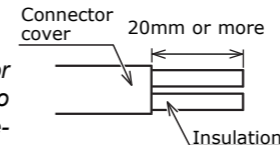


Type	a	b
PF2W 504	0.5	4
PF2W 520	2	16
PF2W 540	5	40
PF2W 511	10	100
PF2W 502T	0.5	4
PF2W 520T	2	16
PF2W 540T	5	40

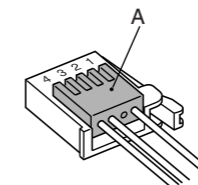
Internal Circuit and Wiring (continue)

Attaching connector to sensor lead wire

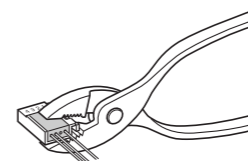
- Strip the sensor wire as shown in the right figure.
- The core of the corresponding color shown in the following table is put into the pin of the number printed on the e-con connector, and pushed to the back.



Pin No.	Color of Insulation
1	Brown (DC (+))
2	N.C.
3	Blue (DC (-))
4	Black (IN:1 to 5VDC)



- Check that the above-mentioned preparation work has been performed correctly, then part A shown in the figure is pushed in by hand to make temporary connection.
- Part A center is pressed straight in using a tool, such as pliers.
- Re-use cannot be performed once the e-con connector has been completely crimped.
- In case connection failure such as incorrect order of wires or incomplete insertion, please use the new e-con connector.



Contact

AUSTRIA	(43) 2262 62280	NETHERLANDS	(31) 20 531 8888
BELGIUM	(32) 3 355 1464	NORWAY	(47) 67 12 90 20
CZECH REP.	(420) 541 424 611	POLAND	(48) 22 211 9600
DENMARK	(45) 7025 2900	PORTUGAL	(351) 21 471 1880
FINLAND	(358) 207 513513	SLOVAKIA	(421) 2 444 56725
FRANCE	(33) 1 6476 1000	SLOVENIA	(386) 73 885 412
GERMANY	(49) 6103 4020	SPAIN	(34) 945 184 100
GREECE	(30) 210 271 7265	SWEDEN	(46) 8 603 1200
HUNGARY	(36) 23 511 390	SWITZERLAND	(41) 52 396 3131
IRELAND	(353) 1 403 9000	UNITED KINGDOM	(44) 1908 563888
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SMC Corporation

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