

Differential pressure transmitter

Model: SMT2001-B

Spec. sheet no. SD02-02

Service intended

The differential pressure transmitter SMT2001-B is suitable to measure liquid, gas, and steam flow as well as liquid level, density and pressure.

SMT2001-B outputs a 4~20 mA DC signal corresponding to the measured differential pressure.

Its highly accurate and stable sensor can also measure the static pressure which can be shown on the integral indicator or remotely monitored via HART communications. Other key features include quick response, remote set-up using communications, self-diagnostics and optional status output for pressure high/low alarm.



Standard features

Base accuracy

±0.075 % of calibrated span.

Range limits

0 ~ 100 MPa to 0 ~ 3 MPa

Turn down

Adjustable up to 100:1 range ability

Temperature compensation

High sensitivity temperature sensor packaged in the sensor

Isolating diaphragm

Stainless steel 316L / Hastelloy C / Tantalum

Stainless steel 316L with gold plated

Stainless steel 316L with FEP plated

Measurement medium

Gas, steam and liquid

Stability

10 years stability

0.15 % of URL

Output

4 ~ 20 mA with HART protocol

Principle of operation

The differential pressure transmitter includes two functional units:

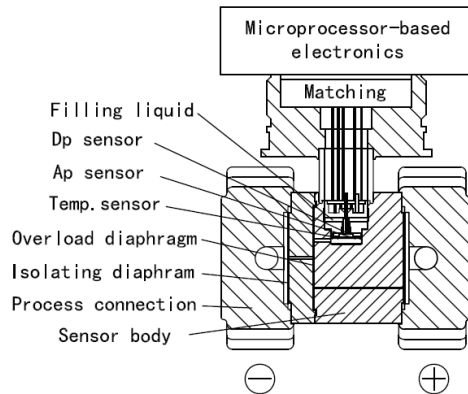
- Main unit
- Auxiliary unit

The main unit includes a sensor and process connection.

The completely welded sensor module is a twin-chamber system with an integral overload diaphragm, an absolute pressure sensor, a temperature sensor and the silicon differential pressure sensor.

The absolute pressure sensor, which is only exposed to the pressure at the high pressure side, acts as a reference value to compensate for the static pressure.

The temperature sensor as a temperature compensated reference value to compensate for the temperature drift.



Main specification

- The differential pressure transmitter utilize the world's leading high stability silicon sensor, the highest Reference Accuracy is $\pm 0.075\%$
- Micro-differential pressure transmitter utilize the world's leading dual overload diaphragm patented technology, the highest Reference Accuracy is $\pm 0.075\%$
- The differential pressure transmitter working pressure are 16 MPa, 25 MPa and 40 MPa, the one-way overload pressure up to 40 MPa
- Micro-pressure / absolute pressure transmitter utilize the no pressure transmission loss overload diaphragm patented technology, the one-way overload pressure up to 7 MPa
- The absolute pressure sensor packaged in the differential pressure transmitter, can be used for static pressure measurement, display and the static pressure compensation. The minimum of the static error is $\leq \pm 0.075\% / 10\text{ MPa}$
- High sensitivity temperature sensor packaged in the sensor. The minimum of the temperature error is $\leq \pm 0.04\% / 10\text{ K}$
- Stainless steel 316L and silicone oil filling welded seal structure
- Long stability is $\leq \pm 0.1\% / 3\text{ years}$, 10 years of maintenance-free
- Extremely wide measuring range 100 Pa ~ 60 MPa
- Adjustable up to 100:1 range ability
- The remote seal transmitter utilize ultra-high temperature(400 °C) patented technology.

Standard Specifications

Performance Specifications

Reference Accuracy of Calibrated Span (includes terminal-based linearity, hysteresis, and repeatability) $\pm 0.075\%$
 If $TD > 10$ ($TD = URL / SPAN$), $\pm(0.075 \times TD)\%$

The square root accuracy is 1.5 times of reference accuracy of calibrated span.

Ambient Temperature Effects

$-20 \sim 65\text{ }^\circ\text{C} : \pm(0.2 \times TD + 0.05)\% \times \text{Span}$

Every $10\text{ }^\circ\text{C}$ is $\pm 0.08\% \times \text{Span}$ ($TD=1$)

$-40 \sim -20\text{ }^\circ\text{C}$ and $65 \sim 85\text{ }^\circ\text{C} : \pm(0.3 \times TD + 0.1)\% \times \text{Span}$

Static Pressure Effects

$\pm(0.05\% \text{ URL} + 0.075\% \text{ Span}) / 10 \text{ MPa}$

Overpressure Effects

$\pm 0.1\% \times \text{Span} / 10 \text{ MPa}$

Stability

$\pm 0.1\% \times \text{Span} / 3 \text{ years}$

Power Supply Effects

$\pm 0.001\% / 10 \text{ V}$ ($12 \sim 42 \text{ V DC}$)

Reference Accuracy of Calibrated Span

(Includes terminal-based linearity, hysteresis, and repeatability)

Measurement span		C
Reference accuracy	$X \leq \text{Span}$	$\pm 0.05\%$ of span
	$X \geq \text{Span}$	$\pm (0.0075 + \frac{\text{URL}}{\text{Span}})\%$ of span
X		4 kPa
URL (Upper range limit)		40 kPa
Measurement span		D
Reference accuracy	$X \leq \text{Span}$	$\pm 0.05\%$ of span
	$X \geq \text{Span}$	$\pm (0.0075 + \frac{\text{URL}}{\text{Span}})\%$ of span
X		25 kPa
URL (Upper range limit)		250 kPa
Measurement span		E
Reference accuracy	$X \leq \text{Span}$	$\pm 0.05\%$ of span
	$X \geq \text{Span}$	$\pm (0.0075 + \frac{\text{URL}}{\text{Span}})\%$ of span
X		0.2 MPa
URL (Upper range limit)		2 MPa

Maximum total performance

For temperature change of $28\text{ }^\circ\text{C}$, static pressure change of 5.1 Mpa, for model SMT2001-B.

Sensor	Span	Maximum total performance
A	0~100 Pa to 0~1 kPa	$\leq \pm 0.188\%$ of calibrated span
B	0~200 Pa to 0~6 kPa	
C	0~400 Pa to 0~40 kPa	
D	0~2.5 kPa to 0~250 kPa	
E	0~20 kPa to 0~2 MPa	

Standard Specifications

$$E_{Mperf} = \sqrt{(E_{\Delta TZ} + E_{\Delta TS})^2 E_{\Delta PS}^2 + E_{lin}^2}$$

E_{Mperf} = Maximum total performance

$E_{\Delta TZ}$ = Effect of the ambient temperature on zero

$E_{\Delta TS}$ = Effect of the ambient temperature on span

$E_{\Delta PS}$ = Effect of the static pressure on span

E_{lin} = Accuracy rating (for terminal – based linearity 0.05%)

Total performance

Similar to DIN 16086

Temperature change in the range from -10 to 60 °C, static pressure change. (SMT2001-B) 10 Mpa

$$E_{perf} = \sqrt{(E_{\Delta TZ} + E_{\Delta TS})^2 E_{\Delta PS}^2 + E_{lin}^2}$$

E_{perf} = Total performance

$E_{\Delta TZ}$ = Effect of the ambient temperature on zero

$E_{\Delta TS}$ = Effect of the ambient temperature on span

$E_{\Delta PS}$ = Effect of the static pressure on span

E_{lin} = Accuracy rating (for terminal – based linearity 0.075 % as per model and sensor accuracy)

Maximum total performance and Total performance includes the measuring errors of

- Non-linearity including hysteresis and non-reproducibility,
- Thermal change of the ambient temperature as regards the zero signal and the calibrated span,
- Effect of static pressure change on the calibrated span, with transmitter re-zeroed at line pressure

Functional Specifications

Span and Range Limits

Span / Range Limits		kPa	mbar
A	Span	0.1 ~ 1	1 ~ 10
	Range Limits	-1 ~ 1	-10 ~ 10
B	Span	0.2 ~ 6	2 ~ 60
	Range Limits	-6 ~ 6	-60 ~ 60
C	Span	0.4 ~ 40	4 ~ 400
	Range Limits	-40 ~ 40	-400 ~ 400
D	Span	2.5 ~ 250	25 ~ 2500
	Range Limits	-250 ~ 250	-2500 ~ 2500
E	Span	20 ~ 2000	0.2 ~ 20 bar
	Range Limits	-500 ~ 2000	-5 ~ 20 bar

Zero Adjustment Limits

Zero can be fully elevated or suppressed, within the lower and upper range limits of the capsule.

Standard Specifications

External Zero Adjustment

External zero is continuously adjustable with 0.01 % incremental resolution of span. Re-range can be done locally using the range setting switch.

Mounting Position Effects

Rotation in diaphragm plane has no effect. Tilting up to 90° will cause zero shift up to 0.4 kPa which can be corrected by the zero adjustment.

Output

Two wire 4~20 mADC output with digital communications, linear or square root programmable. HART FSK protocol are superimposed on the 4~20 mADC signal.
Output range: 3.9 mA to 20.5 mA.

Failure Alarm (The mode can be selected)

Low Mode (Min): 3.7 mA
High Mode (Max): 21 mA
No Mode (Hold): Keep the effective value before the fault.

* Note: The standard setting of failure alarm is High Mode.

Response Time

The amplifier damping constant is 0.1 sec. ;
The sensor damping constant is 0.1~1.6 sec, it depends on the range and range compression ratio.
Amplifier damping time constant is adjustable from 0.1 to 60 sec by software and added to response time.

UpTime

< 15s

Ambient Temperature Limits

-40 to 85 °C
-20 to 65 °C with LCD display or fluorine rubber sealing

Storage and Transportation Temperature Limits

-50 to 85 °C
-40 to 85 °C with LCD display

Working Pressure Limits (Silicone oil)

Maximum working pressure : 16, 25 and 40 MPa

Static Pressure Limits

3.5 kPa absolute to maximum working pressure.

One-way Overload Pressure Limit

The maximum one-way overload pressure is maximum working pressure.

Standard Specifications

HART digital communication and 4 to 20 mA output Power Supply

The transmitter operates from 12 to 36 V DC with no load and is protected against reverse polarity connection
Minimum operating voltage increase to 12 V DC with surge protector

Ripple

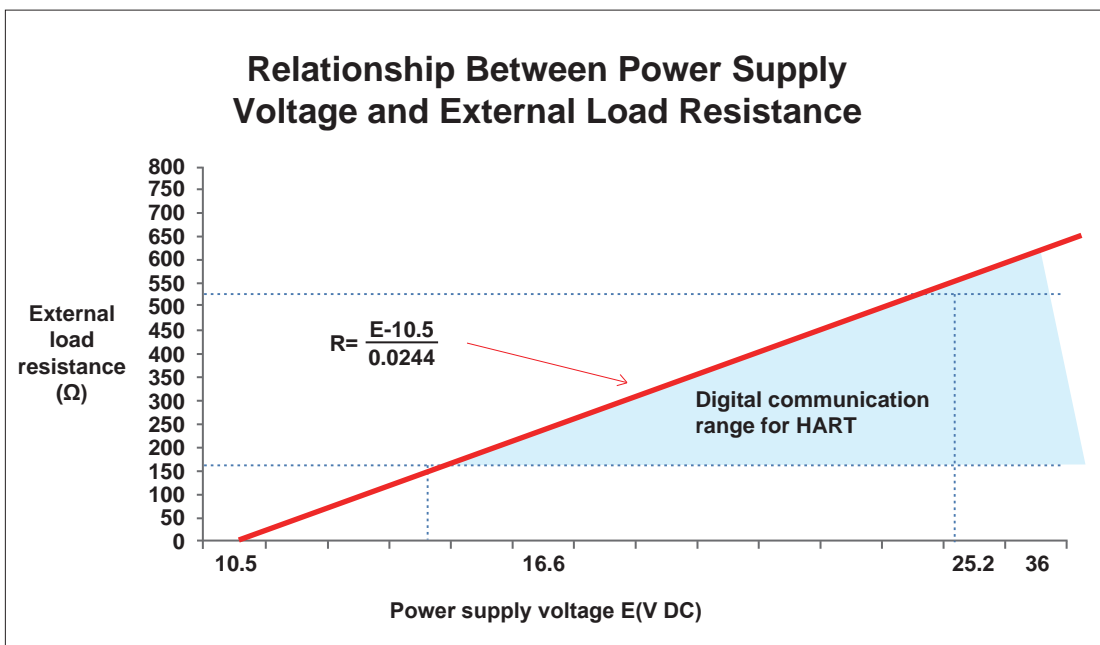
20 mV max on a 250 Ω load as per HART specifications.

Load limitations

4 to 20 mA and HART total loop resistance :

$$R \text{ (k}\Omega\text{)} = \frac{\text{Supply voltage} - \text{min. operating voltage (V DC)}}{22 \text{ mA}}$$

A minimum of 250 Ω is required for HART communication.



Supply and Load Requirements

24 VDC supply, $R \leq (U_s - 12 \text{ V}) / I_{\text{max}}$ kΩ, $I_{\text{max}} = 23 \text{ mA}$.

Maximum voltage limited: 42 VDC, Minimum voltage limited: 12 VDC, 15 VDC (with LCD display)

230Ω to 600Ω for digital communication

Electrical Connection

The electrical connection is made via cable entry M20x1.5.

The screw terminals are suitable for wire cross-sections up to 2.5 mm².

Standard Specifications

Process Connection

Flange with fixing thread 7/16-20 UNF and 1/4-18 NPT female thread on both sides.

Electromagnetic field

Meets all the requirements of EN 61326 and NAMUR NE-21.

Load

Within load/voltage specified limits the total effect is negligible.

Install

The transmitter housing can be rotated about 360 degrees relative to the transmitter module without affecting the performance and internal wiring.

Transmitter can be operated Through the PC machine or notebook computer via HART modem.

HART modem can be connected in parallel to the signal circuit at arbitrary point.

The HART modem communicates with the transmitter through an AC signal superimposed on the 4~20 mA output signals. This modulation does not change in the mean values, so does not affect the measurement signal.

Physical Specifications

Wetted Parts Materials

Sensor Body

Stainless steel 316L

Process Connector Gasket

Perbunan (NBR) / Viton (FKM) / Teflon (PTFE)

Isolating Diaphragm

Stainless steel 316L / Hastelloy C /
Gold plated on 316L / FEP Plated on 316L /
Tantalum

Amplifier Housing

Aluminium with epoxy resin coat

Cover Flange

Stainless steel 316

Housing Gasket

Perbunan (NBR)

Nuts and Bolts

Stainless steel 304

Name plate and tag

Stainless steel 304

Process Connector

Stainless steel 316

Weight

3.3 kg

Fill fluid

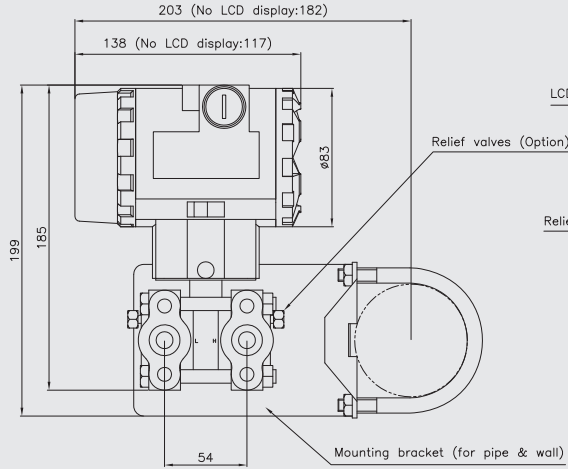
Silicone oil / Fluorinated oil

Degrees of Protection

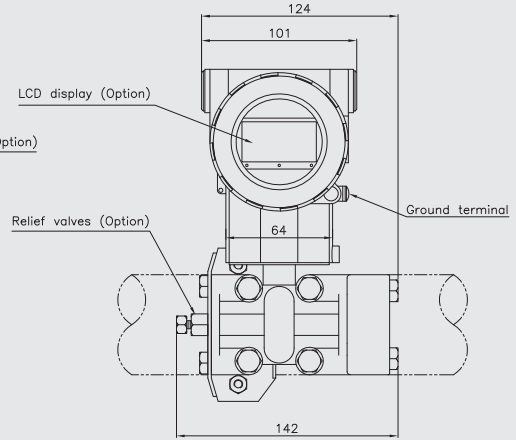
IP67

Unit : mm

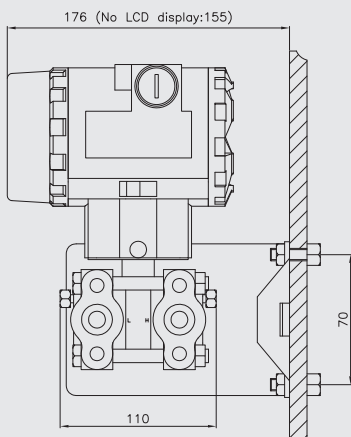
**Horizontal Impulse Piping Type
(Side face)**



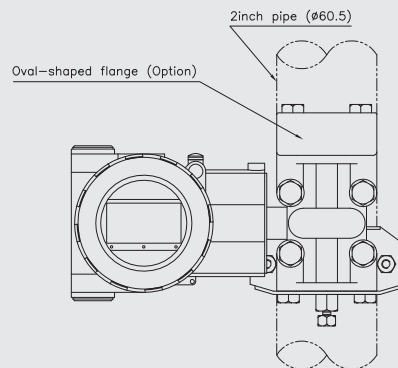
**Horizontal Impulse Piping Type
(Front side)**



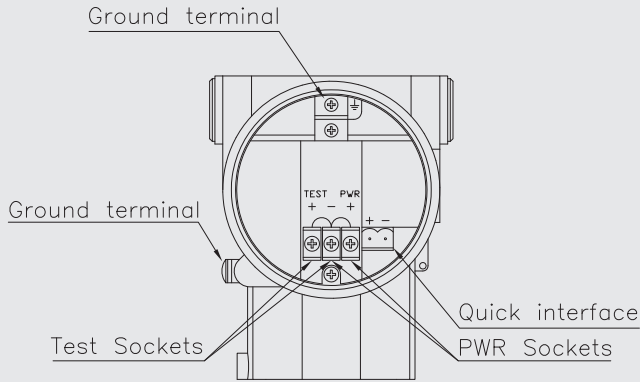
Horizontal Impulse Wall Mounting Type



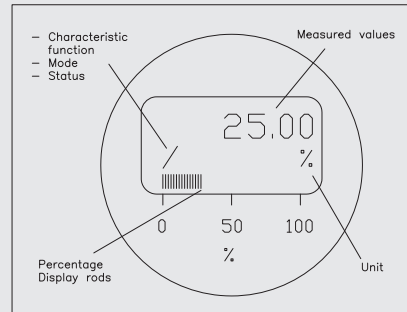
Vertical Impulse Piping Type



Terminal Configuration

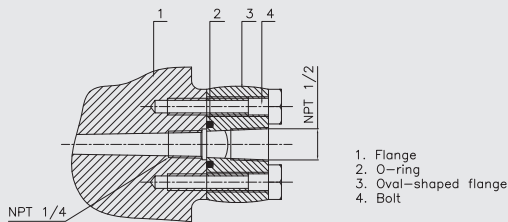


LCD Display

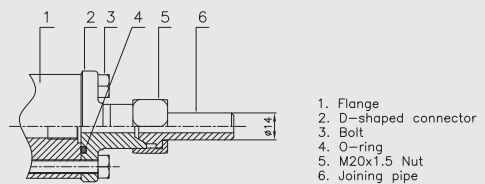


Process Connection Description

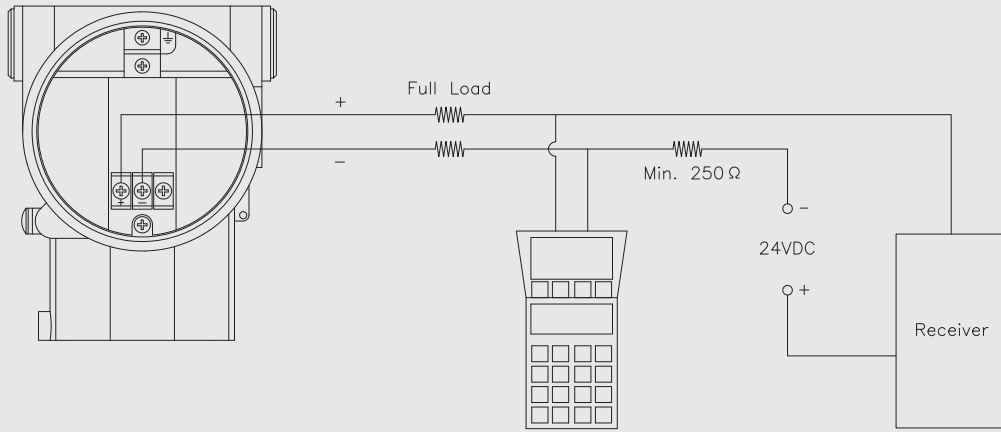
Oval-shaped flange with 1/4-18 NPT female thread (Code 1)



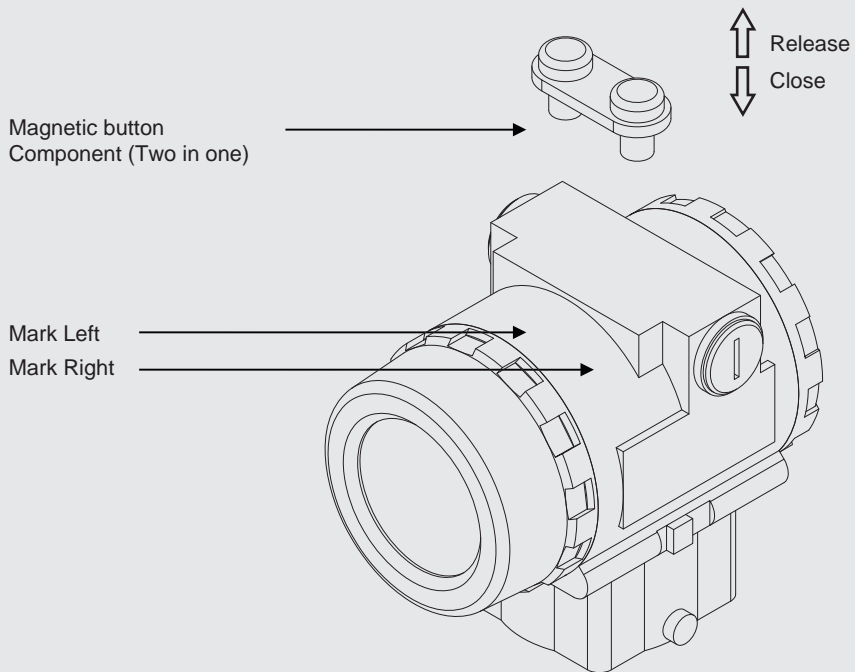
D-shaped connector with M20X1.5 male thread (Code 2)



Electrical Connection Diagram



Control Button



1. Base model**SMT2001-B** Differential Pressure Transmitter**2. Accuracy**

- S** 0.075 %
A 0.1 %

3. Span (kPa / bar)

- A** 0.1 ~ 1 / 0.01 ~ 0.1 (Only available with A grade accuracy)
B 0.2 ~ 6 / 0.02 ~ 0.6
C 0.4 ~ 40 / 0.04 ~ 4
D 2.5 ~ 250 / 0.25 ~ 25
E 20 ~ 2000 / 0.2 ~ 20

4. Diaphragm fill fluid

- A** Stainless steel 316L / Silicone oil
C Hastelloy-C / Silicone oil

5. Maximum working pressure (MPa)

- 1** 16
2 25
3 40

6. Process connections

- N** 7/16-20 UNF and 1/4-18 NPT female thread,
No relief valve
B 7/16-20 UNF and 1/4-18 NPT female thread,
Relief valves at end of flanges
U 7/16-20 UNF and 1/4-18 NPT female thread,
Relief valves at the upper part of the flange side
D 7/16-20 UNF and 1/4-18 NPT female thread,
Relief valve at the lower part of the flange side

7. Process connector gasket

- N** NBR
F Viton
P PTFE

8. Special Function

- N** None
F Square root output
O Degrease cleansing treatment (Oxygen
measurement must be with fluorinated oil filled
capsule, Viton (FKM) gasket, < 6 MPa ,< 60°C)

9. Mounting bracket

- N** None
1 Stainless steel 304
2 Carbon steel galvanized

10. Process connector accessory

- N** None
1 Stainless steel oval-shaped flange with ½ NPT female thread
2 Stainless steel D-shaped connector with M20X1.5 male thread

11. Explosion-proof option

- N** None
I Intrinsic safety Ex ia
D Isolated explosion Ex d

1	2	3	4	5	6	7	8	9	10	11	Sample ordering code
SMT2001-B	A	C	A	2	N	N	F	N	1	N	

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