An instruction manual

CCY15 Differential Pressure Transmitter

Typical applications

▲ construction machinery
▲ Energy industry
▲ Water treatment, etc.

1. Overview

1.1 Safety guidance

This operational manual contains important information on how to use the transmitter correctly. The installation personnel of the transmitter should read this manual carefully before operation. In case of further explanation or special questions, which cannot be addressed in this manual, please contact our company for assistance on necessary information.

Please pay attention to the warning signs on the manual! Do not use crystallized or solidified measure medium, to avoid damaging of the sensor.

The operator must strictly follow the safety instructions and user's manual during operation. Furthermore, the operator should comply with the occupational safety rules, the accident prevention guidelines, the national standards and engineering specifications as well.

Please keep this manual in a safe place near the transmitter for easy access.

- The right to modify the technical parameters is retained -

1.2 Icon description

⚠ Danger! - Hazard that may result in death or serious injury.

⚠ Warning!- Potential hazard that may result in death orserious injury.

⚠ Cautious!-Potential hazard that may cause minor injury.

! Reminder!-Potential hazard that may result in personal injury.

☞ Tips!-Tips and information for smooth operation of the equipment.

1.3 Manual user

Warning! This manual is suitable for technicians.

1.4 Limit of liability

⚠ The company will not be held responsible nor provide any warranty service, in case of transmitter damages caused by failure to follow the instruction manual, inappropriate use, self-modification or destruction.

1.5 Instructions for use

Differential Pressure Transmitter CCY15 Series Suitable for Differential Use in Liquid or Gas and Process Industries Pressure measurement. Operators are responsible for checking whether the equipment is suitable for application. If you have any questions, please contact our sales department to ensure the transmitter Correct application. Our company will not bear the influence caused by improper selection.Any liability.

The purchased model is suitable for certain gas or liquid medium as described in the measurement samples. The user must ensure the compatibility of contact media and transmitter.

⚠ Warning!
Inappropriate use may lead to danger!

2. Product overview

CCY15 series differential pressure transmitter adopts compact structure, high static pressure value, stability and reliability. The temperature compensation of zero point and sensitivity in wide temperature range is carried out by laser resistance adjustment technology after computer automatic test. It has strong anti-interference, overload and impact resistance, small temperature drift, high stability and high measurement accuracy. Therefore, the product can be applied to various occasions for differential pressure measurement, including harsh corrosive medium environment. It is an ideal differential pressure measuring instrument in the field of industrial automation.

3. Working principle

The pressure sensors diffuses a wheatstone electric bridge on mono-crystalline silicon, and stressed by the measuring media (liquid or gas)to cause change of the bridge wall resistance value(piezoresistive effect). In result, a differential voltage signal will be generated, which converts the signal corresponding to the range into standard analog signal(as shown in Figure 3-1)or digital signal.

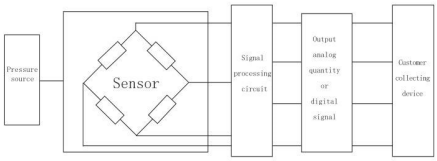

Figure 3-1

4. Product Features

a) Using diaphragm isolation technology

b) integrated chip, wide range of supplied voltage

c)Static pressure upper limit - unilateral - high up to 25 times differential pressure range

d) Frequency Interception Design, Strong Anti-jamming Ability and Lightning Protection

e) Current Limiting, Voltage Limiting and Reverse Connection Protection (Current Limiting Output)

f) High accuracy, good stability, fast response and shock resistance

5. Technical parameters

Measuring media : Liquid or gas(compatible with contact media)
Overall material: Diaphragm 316L stainless(contacted)
Process connection 304 stainless(contacted)
Casing 304 stainless
Seal component Nitrile rubber(contacted)
Display case ABS engineering plastic(digital tube display)
Hessman connector ABS engineering plastic

Range range :

Rated range (MPa)	0.035	0.1	0.25	1	2.5
Differential pressure range (MPa)	0~0.01 to 0~0.035	0~0.02 to 0~0.1	0~0.05 to 0~0.25	0~0.2 to 0~1	0~0.5 to 0~2.5
Unilateral maximum static overpressure (MPa)	0.175	0.5	0.75	3	5

Pressure mode: differential pressure
Output signal: 4~20mA、RS485 (Standard Modbus-RTU Protocol)
(0~10VDC、0~5VDC、1~5VDC)
Supply voltage: 12~36VDC routine
15~36VDC routine(with display or output 0-10VDC)
Accuracy class : 0.25% FS (ratio of differential pressure range to rated range ≤ 1:2.5)
0.5% FS (ratio of differential pressure range to rated range > 1:2.5)
Table Head Display Accuracy 0.5% FS, Digital Tube (LED) Display
Working conditions: contact media temperature -40~85℃
Ambient temperature -40~85℃
Ambient humidity 0%~95%RH (no condensation,no condensing)
Temperature compensation: -10~70℃
Seismic performance : 10g(20...2000Hz)
Response frequency : Analog signal output≤500Hz、
Digital signal output≤5Hz
Stability : ±0.1%FS/year
temperature drift: ±0.01%FS/℃ (Temperature Compensation Range)
Overall weight : No display≈420g display≈500g
Protection level: IP65 (No display) IP54 (display)
Note: The above protection level refers to the levelachieved after the electrical connection is complete.
Power range: Current type≤0.02Us(W)
Voltage type≤0.008Us (W)
Digital type≤0.015Us(W)
Note: Us = supply voltage
Load characteristics : Current-mode load≤{ (Us-7.5) ÷0.02 (Us=Power supply voltage) }Ω Voltage type load≥100kΩ

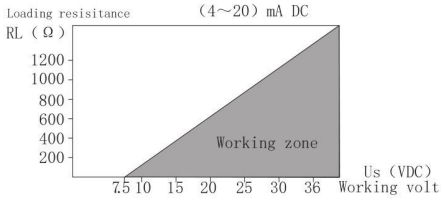

Figure5-1

6. Outline size

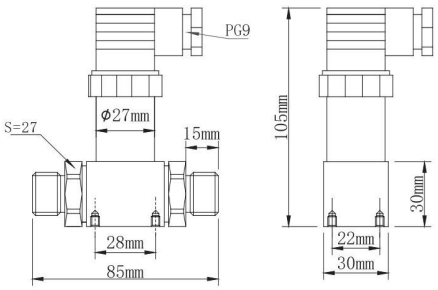

Figure 6-1 no display
Note: Total length of 485 signal output plus 33mm

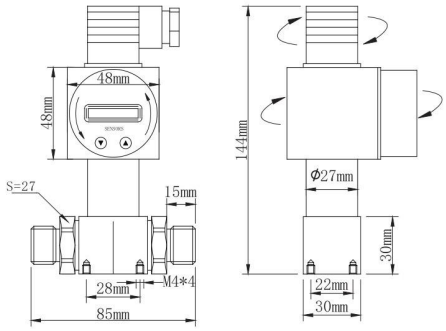

Figure 6-2 display
Note: Total length of 485 signal output plus 33mm
Note: ↻ 360° rotation is available where marked

7. Installation and precautions

⚠ Warning!
a) Installed without pressure nor power supply.

⚠ Warning!
b) Transmitter should be installed by technician who read and understood this operational manual.

⚠ Danger!
c) The transmitter uses diffused silicon oil-filled core, which may cause explosions if in-properly handled. Do not measure oxygen for sake of he safety.

⚠ Danger!
d) This product is not explosion-proof, using in explosive area may cause serious injury and significant loss.

⚠ Warning!
e) It is prohibited to measure media that is not compatible with the transmitter.

☞ f) Please check if the package is in good order when receiving the product, confirm the transmitter model and specifications.

! g) No modification or change can be made to the device.

! h) Handle with care, do not throw, do not force during installation of transmitter.

☞ i) In order to ensure the safe and reliable operation of the transmitter, it is recommended to install a three-valve group between the measured point and the transmitter to ensure that the measured medium is slowly and uniformly applied to the positive and negative pressure chambers of the differential pressure transmitter.

☞ j) When installing, it is recommended to keep the pressure interface at both ends horizontal so as to reduce the influence of the installation position on the transmitter. If the size of the interface does not match the size of the field interface, the self-made conversion joint can be connected.

☞ k) It is recommended to install at minor temperature gradient variations zone.

☞ l) It is recommended to adopt lightning protection and over voltage protection facility between power distribution box or power supply and the transmitter, for the fact that there will be danger if the transmitter is installed in a harsh area.

☞ m) While measuring steam or other high temperature media, please ensure the media temperature is not higher than the maximum work temperature of transmitter. If necessary, it is required to install a cooling device.

☞ n) Install a pressure cutoff valve between the transmitter and media, to inspect and avoid interference with measurement accuracy caused by pressure port clogging.

! o) This product is a light current device, it must be laid separately from high current cables during wiring, and comply with relevant national wiring standard (GB/T50312-2016).

☞ p) Ensure that the power supply voltage meets the requirement of the transmitter. And make sure the maximum voltage of the pressure source is within the range of the transmitter.

☞ q) Increase pressure and reduce pressure very slowly during the pressure measurement, to avoid instantaneous high voltage or low voltage.

⚠ Warning!
r) Make sure the pressure source and power are disconnected before disassembling the transmitter, to avoid accidents in result of media ejection.

☞ s) Do not disassemble during usage, and do not touch the diaphragm, to avoid damage of the product.

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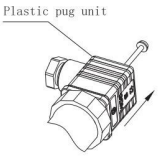
8. wiring installation

8.1 Wiring

Pull out the terminal block which is inside the casing of plug to connect the wire, wiring steps areas shown in the following figure.

a) Unscrew the star type M3 screw

Figure8-1



b) Remove plastic plug units indicated in the figure above.

Figure8-2

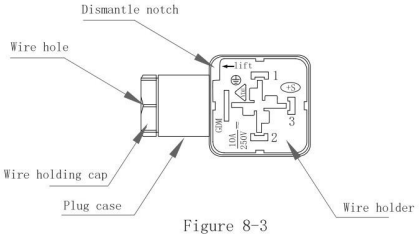


Figure 8-3

c) Remove wire holder from dismantle notch with flat screw driver.

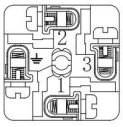
d) Lay shielded cable through the wire hole as figure8-3 after removing, connect wire at the terminal behind the wire holder as instructed in the figure, restore and screw the wire holding cap tightly.

☞ After wiring is completed, the wire outgoing direction can be changed by the direction of wire holder

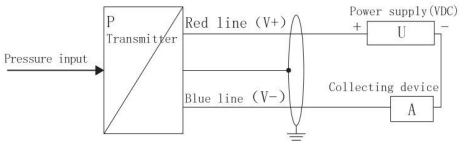
☞ It is required to ensure the outer diameter of the cable used is within the allowable range of the guard staple. And the cable must be fitted in the guard staple firmly and without clearance. The diameter of wire holding cap is 4～6 mm.

☞ The plug must be correctly and properly installed to ensure the protection level.

8.2 Wiring diagram

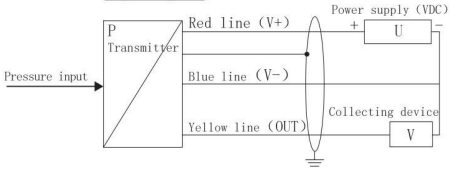


1、Positive power supply (V+)
2、Negative power supply (V-)
⏚ Earthing



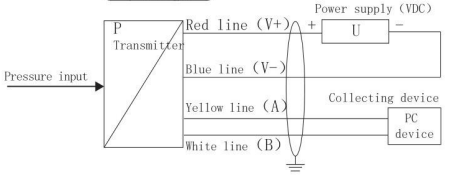
Current output wiring diagram 8-4 (two-wire system)

1、Positive power supply (V+)
2、Positive output (OUT)
3、Negative power supply (V-)
⏚ Earthing



Voltage output wiring figure 8-5 (three-wire system)

1、Positive power supply (V+)
2、RS485A (A)
3、Negative power supply (V-)
⏚ RS485B (B)



RS485 (digital signal) 8-6 output wiring diagram (four-wire system)

☞ ⏚ Representing the shielded wire, all marked grounding points must be effectively grounded.

☞ The transmitter casing defaults to be ground, all field devices are required to be effectively grounded.

☞ Only the current output has reverse connection protection (no damage but does not work), current limiting and voltage limiting protection. Reversed connection of all other output signals can cause damage to the transmitter.

9. Specification Selection

CCY15 Differential pressure transmitter selection table

CCY	Differential pressure transmitter											
	Code	Transmitter type										
	15	Differential pressure type (default connectionless)										
		Code	Is there any display									
		P	Without display									
		X	Display									
			Code	Range range	额定量程							
					35kPa (Code A)	100kPa (Code B)	250kPa (Code C)	1MPa (Code D)	2.5MPa (Code E)			
			04	0～10kPa	A							
			05	0～20kPa	A	B						
			06	0～50kPa		B	C					
			07	0～100kPa		B	C					
			08	0～200kPa			C	D				
			10	0～0.5MPa				D	E			
			11	0～0.6MPa				D	E			
			12	0～1MPa				D	E			
			13	0～1.6MPa					E			
			14	0～2.5MPa					E			
			67	Custom								
				Code	Signal output							
				A1	4-20mA Two-wire systme							
				RS	RS485 communication interface(standard M odbus-RTU protocol) four-wire system							
				DZ	Custom							
					Code	Connection type						
					14	M20*1.5 External thread (standard)						
					17	G1/4 External thread (common)						
					19	G1/2 External thread (common)						
					44	Custom						
						Code	Accuracy level					
						B	0.25% FS (ratio of differential pressure range to rated range ≥ 1:2.5)					
						C	0.5% FS (ratio of differential pressure range to rated range ≥ 1:2.5)					
							Code	Supply voltage				
							G	12-36VDC Regular				
							G2	15-36VDC Regular (with display or output 0~10VDC)				
							DZ	Custom				
								Code	Custom			
								D	Other custom requirements			
								No	Regular			
CCY	15	P	12D	A1	14	B	G	Example of selection				

For example: CCY15-P-12D-A1-14-B-G (CCY15 differential pressure transmitter, no display, differential pressure range 0-1 MPa rated range 1 MPa, output 4-20 mA, connection M20*1.5, accuracy 0.25, power supply 12-36 VDC)

10. Protocol Description

(limited to RS485 signal output 485 all product addresses default to 01)

10.1. Basic technical parameters of the transmitter

(This protocol complies with the Modbus communication protocol, and uses a subset of the Modbus protocol which is RTU mode. RS485 half-duplex working mode)

a) Output signal: RS485 (Maximum distance can be up to 1000 meters. Maximum connection 32 channels)
b) Standard Modbus-RTU protocol
(03 function reads data, 06 function inputs setting data)
c) Data format: 9600, N, 8, 1 (9600bps, no parity, 8 data bits, 1 stop)
d) Measurement range: 0-X (MPa, kPa....)
e) Resolution: 0.05%
f) Output data: 0...2000 (other range customize)
g) Response frequency: ≤ 5Hz
h) Response speed: ≥10ms

10.2. Modbus-RTU Read Data 03 Command Description (Data is hexadecimal)

Protocol format description					
	Device address	Function code	Data address	Number of read data	16CRC code(low before high after)
Host command	Address	03	00 00	CN	CRC0 CRC1
	Device address	Function code	Data byte	Sensor data	16CRC code(low before high after)
Return from machine	Address	03	02*CN	S_HN ,S_LN	CRC0 CRC1

Communication example (reading a sensor signal):

The sensor communication device address of 0-1.6 MPa is set to 01, ie [Address]=01 (Address range 01-254);

And, CRC0=84, CRC1=0a. Then send and return data should be as follows:

Send: 01 03 00 00 00 01 84 0A
Back: 01 03 02 02 AC B9 59

02AC is hexadecimal, converted to decimal 684;

Data output: 0-2000 corresponds to 0-1.6 MPa, so the current pressure is P=1.6*684/2000=0.5472MPa

Calculation formula: (range upper limit - range lower limit) ÷ 2000 * current data + range lower limit = current pressure value

Query example (read the current device address, only to be completed independently by a single sensor)

Send:FF 03 00 0F 00 01 A1 D7
Back:FF 03 02 00 01 50 50
Then: the address of this device is 01 (hexadecimal)

10.3. Modbus-RTU input 06 command detailed description (data is hexadecimal)

Protocol format description					
	Device address	Function code	Data address	New address	16CRC code (low before high after)
Host command	Address	06	00 0F	H L	CRC0 CRC1
	Device address	Function code	Data address	New address	16CRC code (low before high after)
Return from machine	Address	06	00 0F	H L	CRC0 CRC1

Example of modification

For example, change 01 address to 09 address:

Send 01 06 00 0F 00 09 79 CF

Retun 01 06 00 0F 00 09 79 CF

Then the original address 01 is modified to 09 successfully, and the modification of address can be done offline or online. It can work directly without re-powering at completion.

10.4. Precautions for use

☞ a) Single RS485 bus must adopt a "hand-to-hand" bus structure. Do not use a star connection or a fork connection. The address code is set from near to far, that is, the management computer is connected to the No. 1 controller, No. 2 is connected to No. 1, No. 3 is connected to No. 2, and so on...

⚠ Warning!

b) The AC power supply and the case of the equipment must be grounded properly and well. There are many places where there are triangular sockets which in fact, have no grounding at all. Be alerted. When the grounded properly, the equipment to release the energy by combining with the lightning protection design when struck by the lightning surge and the static electricity, to protect the RS485 bus equipment and related chips from damage. Do not use the RS485 bus if there is no grounding or not properly grounded, to avoid equipment burnout and casualties.

☞ c) Wire must use multi-strand shielded twisted pair cable with diameter of more than 0.3 mm2 (multiple strands are for spare). Use PVC pipe separately to avoid lining with strong current to avoid interference from strong current.

☞ d) 485 (A) and 485 (B) must be twisted together, because 485 communication uses differential mode communication principle, and twisted pair anti-interference performance is good. It is wrong not to use twisted pairs, and other types of cables.

☞ e) Connect the RS485 converter and the reference ground GND (power supply negative) of all access controllers, and use the remaining one or all of the multiple twisted pair cables for the series GND; if the reference ground is not connected, it will also affect the communication time. Nowhere, high frequency radiation, mainly from distributed capacitance and inductance, produces a common mode effect.

☞ f) The shield of the network communication line is grounded. It is required for grounding, otherwise the potentially danger of the bus is unknown.

☞ g) If multiple machines or cables are too long for communication, add 120 ohm matching resistors between 485 (A) and 485 (B) at the head and end of the 485 bus, to improve the communication performance quality. (Must be pair twisted)

☞ h) The transmission rate, number of load nodes and transmission distance should be reasonably arranged, to achieve remote low-node for low-speed, short distance multi-node for high-speed principle.

i) The data communication shall be verified to protect the transmission accuracy. Generally, the Modbus-RTU is verified by the crc-16 verification mode, and the error rate is less than 1/1billion.

j) If necessary, choose the company's isolated type model 485, the price is generally higher.

10.5. 16CRC verify

The 16CRC verification is a standard error check method used by the Modbus protocol. Generally, it has detailed descriptions and procedures, which is not explained here.

11. Initial start

⚠ Warning!

a) Before starting, it is a must to check if the transmitter is installed correctly, and if there is any obvious damage.

⚠ Warning!

b) The transmitter must be operated by professional technicians who read and understood this operating manual.

⚠ Warning!

c) The transmitter is only suitable for working conditions that meet the technical requirements!

12. After sales service

a) The company is responsible for all the maintenance costs during the warranty period, after inspected by the technician of the company and confirmed there is quality failure.

⚠ Warning!

b) Please clean the residual media before returning, especially substances that is harmful to human health, such as corrosive, toxic, carcinogenic or radioactive substances;

c) Please keep the warranty card and certificate in a safe place, and return with the product when there is need of repairing;

d) If there is any faulty with the transmitter, please contact our after-sales service. If you need to send the transmitter back to the company for repair after confirming the problem. Please attach the following information:
Description of the site environment;
Fault phenomenon;
Delivery address and contact information;

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12.1Common fault analysis and elimination

Fault phenomenon	Cause analysis	Elimination method
• The transmitter has no output signal.	• The transmitter is not powered. • Fault connection.	• Supply power to transmitter correctly according to the wiring diagram.
• Output irregular jumps whenthepressure isconstant	• The transmitteris not grounded • Strong RF interference on site • No shielded cable applied	• Use shielded cable and ground the shield • The transmitter is properly connected to the earth
• The corresponding output value is incorrect when transmitter is not connected to pressure media	• The transmitter is not operating in required environment	• Move the transmitter to the specified environment or take action to ensure that the environment meets the requirements
• The transmitter output does not match with the measured pressure	• The supply voltage is incorrect •The external load is too large	• Whether it is within the power supply range • Adjust the external load

If the fault phenomenon does not fall within the above range, please contact our after-sales.

12.2 Calibration

Zero and full-scale drift may occur during the use of the transmitter. If the above phenomenon occurs after long time use,it is recommended to send the transmitter back to us for calibration to ensure high accuracy.

13. Transportation and storage

The transmitter should be kept in a sturdy cardboard box (large device requires a wooden box), free move in the box is not allowed,be careful when handling, do not handle with roughly. Store area . should meet the following conditions:

☞a) Protect from rain and moisture.

☞b) Free from mechanical shock or shock.

☞c) Temperature range -20 ~ 55 ° C.

☞d) The relative humidity is not more than 80%.

☞e) No corrosive gas in the environment.

14.Unpacking precautions

☞ a) After unpacking, check the packing list to confirm if the documents and accessories are complete.
The packed documents are:

A copy of the instruction manual.

A product certificate.

A warranty card.

☞ b) Observe if there is any damage caused during transportation, for proper following up.

c) We hope that the user can safely keep the “warranty card”, please don’t misplace it, otherwise you can’t return to the factory for free repair!

15.Instructions for ordering

⚠ Warning!

When purchasing the pressure transmitter, the user should select the appropriate model to make sure it meets specifications of the contact media ,such as the pressure , temperature , protection level and environmental conditions