

# DPT

## Smart Pressure/DP Transmitter User Manual



**ABUS TECHNOLOGIES INC.**

## WARNING

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- v This manual should be passed on to the end user.
- v The contents of this manual are subject to change without prior notice.
- v All rights reserved.
- v ABUS gives no warranty of any kind with regard to this manual, including, but not limited to, fitness for a particular purpose.
- v If any question arises or errors are found, or if any information is missing from this manual, please inform your supplier or inform at [info@abusek.com](mailto:info@abusek.com)
- v The specifications mentioned in this manual are limited to those for the standard type under the specified model number break-down and do not necessarily apply for customized instruments.
- v Please note that changes in the specifications, construction, or component parts of the instrument may not immediately be reflected in this manual at the time of change.
- v If the customer or any third party is harmed by the use of this product, ABUS assumes no responsibility for any such harm owing to any defects in the product which were not predictable, or for any indirect damages.
- v The integral modules specifically HART module are not manufactured by ABUS.

Although Warning hazards are related to personal injury, and Caution hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all Warning and Caution notices.

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of Technical Communications Department, ABUS Technologies.

## HEALTH AND SAFETY

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To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given. Any deviation from these instructions will transfer the complete liability to the user.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

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## 1. INTRODUCTION

The ABUS DP Series features high performance with high degree of precision. Differential pressure measurement can be used to measure flow, level, density and viscosity. This versatile primary measurement can provide high accuracy results even in harsh environmental conditions. It is considered on the basis of the proven and reliable sensing technology and extensive digital technology.

16-bit single chip is adopted as its core element, with its powerful function and high-speed processing capacity, ensures the excellent accuracy with stability of the transmitter. The whole design frame focuses on its reliability, stability and high precision, meeting the growing demand of on-site industrial use. To achieve this goal, digital signal processing is used by the software to ensure minimum disturbance effects and zero point stability. Meanwhile, it has the Zero Stability Capacity (ZSC) and Temperature Supplementing Capacity (TSC).

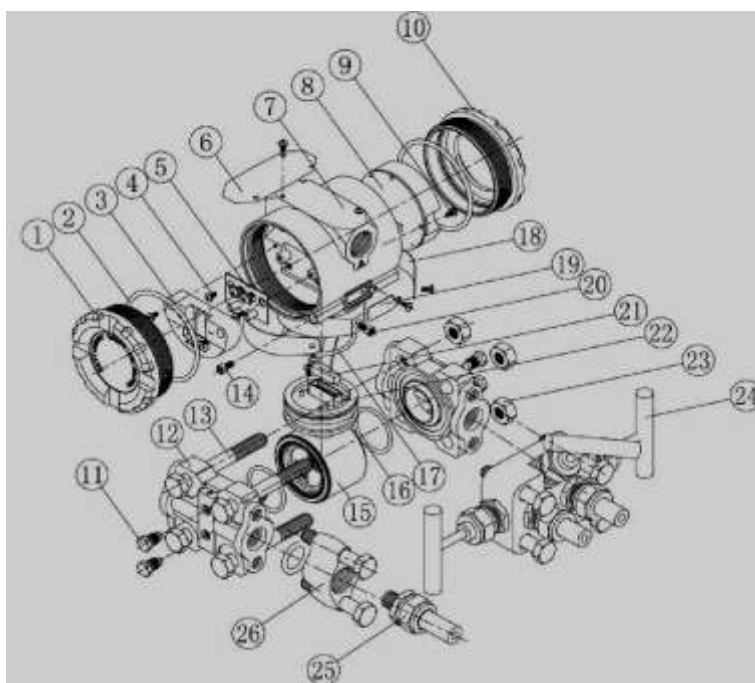
The powerful interface guarantees an excellent interaction rarely needing manual operator. Keypad operation can accomplish the basic settings of zero, range setting, damping setting under the circumstances of no standard pressure, and proving to be very convenient for the on-site adjustments.

By connecting with module RS485, it can realize the remote transmission of digital signal or the building up of RS485 industrial LAN.

Transmitter has an optional HART module. Transmitter added the HART module has HART communication capabilities, with the conventional operations being controlled by the manual operator. Transmitter can be widely used in the sectors such as petroleum, chemical, iron & steel, power supply, light industry and environmental protection, capable of realizing the measurement of various pressures, differential pressures, flows and fluids, can adapt for all kinds of harsh and hazardous environment and corrosive processes.

## 2. PRESENTATION

### 2.1 Structure Overview

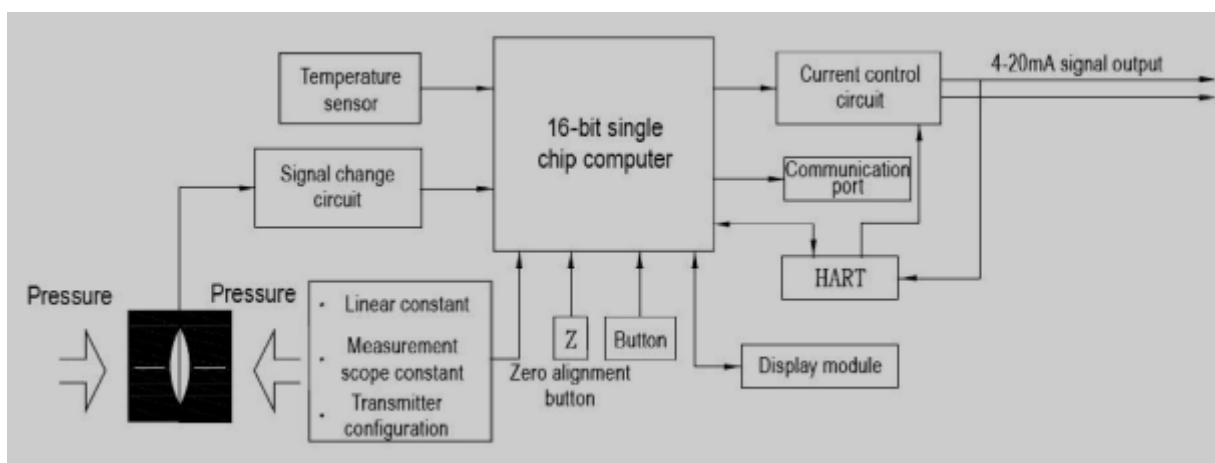


## Description

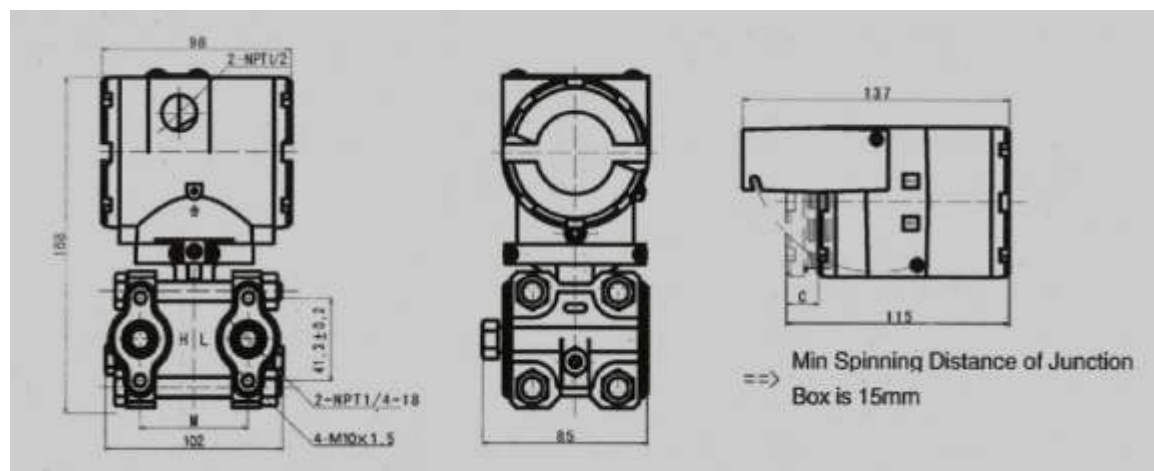
1	Cover	14	Cover lock bolt
2	O-ring	15	Sensor
3	Wiring terminals cover	16	O-ring
4	Mounting bolts of circuit board	17	O-ring
5	Thunder-proof wiring circuit board	18	Position code plate
6	Name plate	19	Zero alignment plate
7	Housing body	20	Housing body lockup bolt
8	Meter head	21	Parallel wires
9	Mounting bolts of meter head	22	Circuit board
10	Meter head cover	23	Nut M10
11	Drain/ vent valve	24	Integrated 3-valve group (optional)
12	Template	25	Welded connector (optional)
13	Bolts M10	26	Flange (optional)

## 2.2 Working Principle

As indicated in the working principle diagram, the outside pressure or differential pressure will cause some change in the sensor capacitance value. Through the digital signal conversion, it will change into the frequency signal, which is sent to the microprocessor. After the calculation by microprocessor, a current control signal will be output to the current control circuit, converted into analogue 4-20mA current output. Meanwhile, the microprocessor is responsible for the interactive and other actions (display and setting). The communication port used for digital communication needs the special port of our company. HART module will realize the transmitter HART communication.



## 2.3 Dimensions



M	Type	1200	1300	1400	1500	1600	1700	1800	1900	1000	2300	
	Size (mm)	54				55.6		57.2	58.4	59.2	54	
	Type	2400	2500	2600	2700	2800	5600	6600	7600	8600	9600	
	Size (mm)	54		55.6		57.2		55.6				
	Type	5700	6700	7700	8700	9700	6800	7800	8800			
	Size (mm)	55.6				57.2						

NOTE: PI refer to product manual for any changes

## 2.4 Technical Parameters

Output Signal:	4 ~ 20mA DC, 2-Wire System with Digital communication,
Reference Accuracy:	±0.075%
Range ability	100 : 1
Overall Performance:	± 0.1 % (for range of 1/10 of max allowed span) including comprehensive inaccuracy of linearity, changing difference and repeatability.
Stability:	0.15% of the span; for Draft Ranges, ±0.25% of the span.
Start-Up time:	Max 2 seconds for minimum damping.
Volume Change:	Less than 0.16cm <sup>3</sup> .
Response Time:	Less that 100 ms
Damping:	Electrical damping is 0 ~ 32 seconds, continually adjustable at an interval of 0.1 second. Sensitive components have 0.2 seconds constant damping time. (Span 3 is 0.4 seconds)
Functions:	PushButton configurable Linear/Square root
Effect of Temperature:	Zero Inaccuracy: Max. ±0.25% of span for each 50F (28°C).
Vibration Effect:	At time of 0 ~ 200Hz for shock frequency on any direction, the error is 0.05%/g of the highest one.
Power Effect:	Less than output range by ±0.005%/V.

Mounting Orientation Effect: Zero drifts no more than 0.24kPa. No effect for movement parallel to diaphragm. The error could be resolved by quick Zero reset pushbutton on the instrument.

Power Voltage: 12V ~ 45V DC  
Intrinsically safe/explosion-proof products with max 30 VDC should be powered by safe Barrier

Parameters for intrinsically safety:  $U_0$  28V DC,  
type outsourcing safe barrier  $I_0$  30mA  
P  $P_0$  0.84W

Physical Parameters:

O Ring of Contacting Medium: Viton / Glass Filled PTFE

Filling liquid: Silicone Oil / Inert Gas

Bolt: Cadmium plated carbon steel.

Outer shell or electronic circuit: Low Cu Al.

O shaped seal ring: Acrylonitrile-butadiene rubber, fluorine rubber polyurethane.

NOTE: Please refer to Ordering Table for Flange connector, Exhaust/Vent valves and Isolation Diaphragm Material options

Pressure Connection Part:  $\frac{1}{4}$  - 18 NPT for joint thread in pressure room,  
 $\frac{1}{2}$  - 14 NPT for joint thread in pressure guiding joint.

Weight: Basic Model, 2.4Kg

Operation Environment under Normal Conditions

Operation Temperature(Ambient): Smart Type:-20°C ~ +85°C.

Storage Temperature: -40°C ~ +104°C

Humidity: 0 ~ 90%

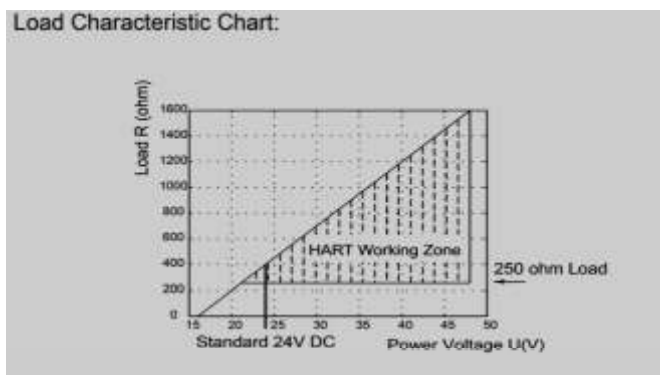
Atmospheric Pressure: 106 kPa ~ 86

Operation Environment Conditions for Explosion-Proof Product

Humidity: -20°C ~ +40°C

Relative Humidity: 5% ~ 95%

Atmospheric Pressure: -106 kPa ~ 86





## 2.4.1 Push Button Functions

### 1. Zero & Span Shift

**Zero Shift :** push key S & Z at the same time (key S on the left while key Z on the right) for 6 seconds, the screen indicates “Hart”, means zero and span adjustment status is activated; push key Z for 5 seconds, “Hart” on the screen disappeared; zero shifts successfully and exits the status of activation.

**Span Shift:** push key S & Z at the same time (key S on the left while key Z on the right) for 6 seconds, the screen indicates “Hart”, means zero and span adjustment status is activated; after confirming the pressure of equipment is span pressure, push key S for 6 seconds; then “Hart” on the screen disappeared; span shifts successfully and exits the status of activation.

**Note:** After entering the status of activation, if you don't want to adjust, push key S & Z together; after losing the key, “Hart” on the screen disappears; it means having exit the status of activation.

### 2. Parameter Setting

**2-1 keys :** Push key S & Z = exit key; exit key comes into force after losing key S & Z; push key Z for 4 seconds to shift

**2-2 Parameters :** After pushing key S for 6 seconds, the screen indicates “PASS”; then push key Z, the screen indicates value and the cursor flickers. The flickering bit is modifier bit; push key Z the value increases 1 but not carry. Push key Z for 4 seconds the cursor shifts. Follow the above mentioned operation to revise the value to be 160, then push key S to enter adjustment procedure of next parameter. Meanings of parameters are as follows:

Parameter Prompt	Value	Meaning
PASS	XXXXX	Password Verification, PW: 160
bdSh	XXXX.X	Process value to 20 mA (full scale value)
bdSL	XXXX.X	Process Value to 4 mA (zero value)
trAn	XXXXX	Transmitting function, “=0” stands for linearity, “=1” stands for evolution
UnIt	XXXXX	Indicating units, 0=KPa, 1=KPa, 2=KPa, 4=KPa, 6=Pi, 7=bar, 8=KPa, 9=KPa, 11=Pa, 12=KPa, 13=KPa, 15=MPa, 16=mA, 17=%, 18=S, 19=m <sup>3</sup> , 20=t/h
dAhP	XXXX.X	Damping time, max limited value is 30 s when program runs
PrEL	XXXXX	Low point trimming. Process value adjusted to input value; after pushing key Z revise low point trimming pressure value; don't push key Z if you don't want to adjust; directly push key S to enter next parameter
PrEh	XXXXX	High point trimming. Process value adjusted to input value; after pushing key Z revise high point trimming pressure value; don't push key Z if you don't want to adjust; directly push key S to enter next parameter
InIt	yes/no	Hart. Three-point linearization and trimming data initialization

**Hotkey:** push key Z for 6 seconds to do zero trimming

**Note:** Please operate carefully for italic part parameters; make sure correct value of pressure forced on equipment





### 3. ELECTRICAL CONNECTIONS

Electrical Port: :NPT 1/2 load resistance of cable sealed connector: (4-20mA)

$$= \frac{14}{0.02}$$

where: U is power voltage,  $R_D$  is cable internal resistance

(Note 1: User can install the distributor or safe barriers per the on-site and design requirements. For details, see the usage of distributor and safe barrier.)

It is recommended to choose the explosion-proof impulse terminal with the cable diameter of  $\phi 8 - 12$ . The connection terminal is set with test terminal, convenient for the online test of the operator.

Signal terminal is situated in a separate housing of the electrical box. Screw up the meter cover for wiring. The upper end is for signal, while the lower end is for test meter. Fig. 2-13 indicated the terminal location. The test terminal is used for connecting any optional indicator

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head or test. The power supply goes to the transmitter through the signal line, with no need of additional wiring.

**Special Attention :**

Do not connect the power signal line to the test terminal; otherwise the diode inside the test terminal would be destroyed

In case of the diode being damaged unfortunately, connecting the test terminal can keep the transmitter working on, except the indicator unable to connect.

No need to shield the signal wire, and litz wire can be used for better effect. Do not lay together the signal wire and other power wires, to get near to the strong electricity equipment.

The wiring orifice on the housing body of transmitter should be sealed or inserted in a plug smeared with seal glue to prevent the humidity being accumulated in the housing. In the case of the wiring not being sealed, the transmitter should be mounted with the wiring orifice upside down to discharge the moisture.

The signal line may ignore the grounding (hanging) or get to ground at any point on the loop line. The transmitter housing can have grounding or not, and the power has no need of being stabilized, even if the power ripples has a peak-to-peak value of 1V. And the output ripples of transmitter can also be ignored.

Since the transmitter gets grounded by way of capacitance coupling, it is not appropriate to use a high-voltage mega-ohm meter to check the insulation resistance. The voltage used for checking the line should be no more than 100 V.

The transmitter circuitry is designed as intrinsic safe circuitry, limiting the output current below 30 mA DC (35 mA DC under the condition of high temperature or high voltage).

### Intrinsically Safety Type Explosion Proof Transmitter System Wiring Diagram

U <sub>i</sub> :	28V DC	U <sub>m</sub>	250V AC/DC
I <sub>i</sub> :	30mA	U <sub>o</sub>	28V DC
P <sub>i</sub> :	0.84W	I <sub>o</sub>	30mA
	0.84W	P <sub>o</sub>	

Note: See GB3836, 4-2000 standard for the definitions of U<sub>m</sub>, U<sub>o</sub>, I<sub>o</sub>, P<sub>o</sub>, U<sub>i</sub>, I<sub>i</sub>, P<sub>i</sub>

The connection wire or cable between safe barrier and transmitter has a largest allowed distribution capacitance of no more than 0.02 $\mu$ F and the largest allowed distribution inductance of not more than 2.0mH.

## 4. ORDERING DETAILS

		TYPE	DESCRIPTION			
Product	M94		Smart Transmitter with HART Communication			
Type		DP	Differential Pressure			
			SPAN	RANGE	STATIC PRESSURE	
Range		33	1.2~7.2kPa	-7.2~7.2kPa	2.5MPa	
		53	1.2~7.2kPa	-7.2~7.2kPa	6.4 MPa	
		54	6~36kPa	-36~36kPa	6.4 MPa	
		55	30~180kPa	-180~180kPa	6.4 MPa	
		64	6~36kPa	-36~36kPa	16 MPa	
		65	30~180kPa	-180~180kPa	16 MPa	
		96	160~1000kPa	-1000~1000kPa	40 MPa	
		97	400~2500kPa	-2500~2500kPa	40 MPa	
		88	1600~10000kPa	-10000~10000kPa	32 MPa	
			FLANGE	DRAIN/VENT	DIAPHRAGM	FILL LIQUID
Structure Material	L22 is the Part of Standard equipment	L12	CS CD-plating	316 L SS	316 L SS	Silicone Oil
		L13	CS CD-plating	Hastelloy C	Hastelloy C	
		L14	CS CD-plating	Monel	Monel	
		L15	CS CD-plating	316 L SS	Tantalum	
		L22*	316 L SS	316 L SS	316 L SS	
		L23	316 L SS	316 L SS	Hastelloy C	
		L24	316 L SS	316 L SS	Monel	
		L25	316 L SS	316 L SS	Tantalum	
		L33	Hastelloy C	Hastelloy C	Hastelloy C	
		L35	Hastelloy C	Hastelloy C	Tantalum	
		L44	Monel	Monel	Monel	
Optional Components	Weather proof is the Standard equipment	D	Digital Backlit LCD Indicator(with programming keys)			
		B1	Bend bracket for pipe mounting (2" pipe)			
		B2	Bend Bracket for plate mounting			
		B3	Flat bracket for pipe mounting (2" pipe)			
		D1	Side exhaust/vent valve of flange on top			
		D2	Side exhaust/vent valve of flange on bottom			
		W*	WeatherProof Type			
E	Explosion Proof Type					
I	Intrinsically Safe Type					

Example: M94 DP 65 L22 D

## 5. ORDERING DETAILS (Micro Differential Transmitter)

		TYPE	DESCRIPTION			
Product	M94		Smart Transmitter with HART Communication			
Type		MD	Differential Pressure			
Range		12	SPAN		RANGE	
		10	0.20~2kPa		-0.2~+2kPa	
			0.06~0.3kPa		-0.3~0.3kPa	
			FLANGE	DRAIN/VENT	DIAPHRAGM	FILL LIQUID
Structure Material	L22 is the Part of Standard equipment	L12	CS CD-plating	316 L SS	316 L SS	
		L13	CS CD-plating	Hastelloy C	Hastelloy C	
		L14	CS CD-plating	Monel	Monel	
		L15	CS CD-plating	316 L SS	Tantalum	
		L22*	316 L SS	316 L SS	316 L SS	
		L23	316 L SS	316 L SS	Hastelloy C	Silicone Oil
		L24	316 L SS	316 L SS	Monel	
		L25	316 L SS	316 L SS	Tantalum	
		L33	Hastelloy C	Hastelloy C	Hastelloy C	
		L35	Hastelloy C	Hastelloy C	Tantalum	
		L44	Monel	Monel	Monel	
Optional Components	Weather proof is the Standard equipment	D	Digital Backlit LCD Indicator(with programming keys)			
		B1	Bend bracket for pipe mounting (2" pipe)			
		B2	Bend Bracket for plate mounting			
		B3	Flat bracket for pipe mounting (2" pipe)			
		D1	Side exhaust/vent valve of flange on top			
		D2	Side exhaust/vent valve of flange on bottom			
		W*	WeatherProof Type			
E	Explosion Proof Type					
I	Intrinsically Safe Type					

Example: M94 MD 12 L22 D

## FLANGED DIAPHRAGM DP TRANSMITTER (LEVEL TRANSMITTER)

### Remote Sealed Diaphragm DP Transmitters

Direct Flanged Diaphragm  
DP Transmitters

C

With Sealing Groove

B

Insert Depth

A

### Static Pressure and Overpressure Limit

150lb flange: 15kg/cm<sup>2</sup> (at 37° filled with silicon oil)

300lb flange: 30kg/cm<sup>2</sup> (at 37° filled with silicon oil)

### Connecting Fitting for Process Pressure

High-pressure side : 3" or 4" 150lb flange or 300lb flange

Low-pressure side : The connecting thread of the flange is 1/4-18NPT (taper-pipe-thread)

The connecting thread of the joint is ½-14NPT (taper-pipe-thread)

Code	Size	FLANGE SIZE (MM)		A	B	C	BOLT HOLE (MM)		
		Specification	Diameter				Amount	Diameter	Distribution Diameter
A	3"	150lb	190.5	30	66	127	4	19	152
B	4"	150lb	228.6	30	89	157	8	19	190
C	3"	300lb	209.6	35	66	127	8	22.2	168
D	4"	300lb	254	38	89	157	8	22.2	200

## 6. ORDERING DETAILS (M94DL)

	TYPE	DESCRIPTION
Product	M94	Smart Transmitter with HART Communication
Type	DL	Flanged Diaphragm (on HP Side) DP Transmitter
		SPAN RANGE
Range	53	1.2~7.2kPa -7.2~7.2kPa
	64	6~36kPa -36~36kPa
	65	30~180kPa -180~180kPa
	96	160~1000kPa -1000~1000kPa
	97	400~2500kPa -2500~2500kPa
Diaphragm Extension	0	None (0 mm)
	1	25 mm
	2	50mm
	3	75mm
Diaphragm Material	1	SS316L
	2	Hastelloy C
	3	Tantalum
	4	Monel
Capillary	00	None
	--	Specify Length in meters
Optional Components		D Digital Backlit LCD Indicator(with programming keys)
		B1 Bend bracket for pipe mounting (2" pipe)
		B2 Bend Bracket for plate mounting
		B3 Flat bracket for pipe mounting (2" pipe)
		D1 Side exhaust/vent valve of flange on top
		D2 Side exhaust/vent valve of flange on bottom
		W WeatherProof Type
		E Explosion Proof Type
	I Intrinsically Safe Type	
		I

Example: M94 DL 64 0 1 00 D



## 7. SAFETY PRECAUTIONS

1. The unit should be powered for 15 minutes before use.
2. Use in ambient temperature of 0-60 C.
3. Avoid vibrations, shock, excessive dust, corrosive chemical materials or gaseous environment.
4. Input wire should not be too long. If measured signal have to be far away from the unit, please use 2-core shielded cable.
5. Use this instrument in the scope of its specifications, otherwise fire or malfunctions may result.
6. Contact of the instrument, with organic solvents or oils should be avoided.
7. Do not turn on the power supply until all of the wiring is completed. Otherwise electrical shock, fire or malfunction may result.
8. Do not disassemble, repair or modify the instrument.
9. All connections should be tightened properly.
10. Power supply should be constant, should not be fluctuating.

## 8. WARRANTY

ABUS provides the original purchaser of this instrument a one (1) year warranty against defects in material and workmanship under the following terms:

- The one year warranty begins on the day of shipment as stated on the sales bill.
- During the warranty period all costs of material and labor will be free of charge provided that the instrument does not show any evidence of misuse.
- For maintenance, return the instrument with a copy of the sales bill to our factory.
- All transportation and insurance costs should be covered by the owner of the equipment.
- Should any sign of electrical or mechanical shock, abuse, bad handling or misuse be evident the warranty voids and maintenance costs will be charged.

Authorised Dealer

	<p style="text-align: center;"><i>NK Instruments Pvt. Ltd.</i></p> <p>B-501/504, 5th floor, Raunak Arcade, Near THC Hospital, Gokhale Road, Naupada, Thane(W) 400602. Maharashtra INDIA      Telefax Nos.: 91-22-25301330 / 31 / 32 E-Mail: sales@nkinstruments.com      Web: http://www.nkinstruments.com Skype: nitinkelkarskype      Gtalk: nkinstruments2006</p>	
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