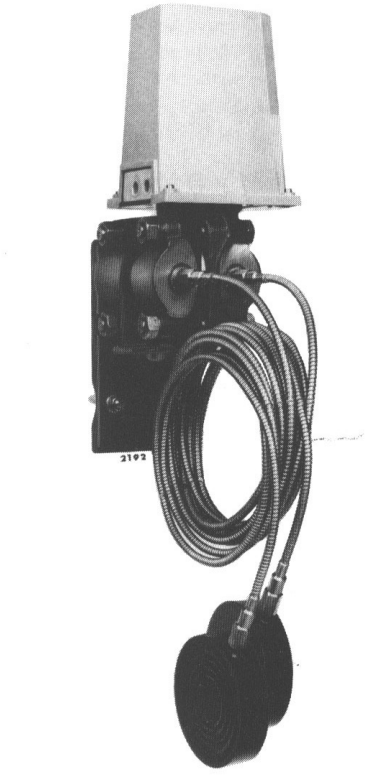
Operating Instruction OI/NAE-EN Rev. A

Models NAE
Pneumatic differential pressure transmitters with remote diaphragm seals

Deltapi N Series
A complete range of pneumatic pressure transmitters



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INTRODUCTION

The differential-pressure pneumatic transmitter mod. N-AE is commonly employed for the measurement of pressure,flow and level of fluids with crystallizing, polymerizing or corrosive characteristics,which require the physical separation between the measuring element and the instrument.

The diaphragm seals are always of the 3 in. or DN80 size.

The range is continuously adjustable by means of the proper setting, obtained tightening or slackening the screw (6). To this screw it is fixed a pointer, which indicates, approximately, the range setting of the instrument on a suitable scale, fitted on the output shaft.

For any technical characteristic and data, see the relevant data sheet DS/NAE-EN.

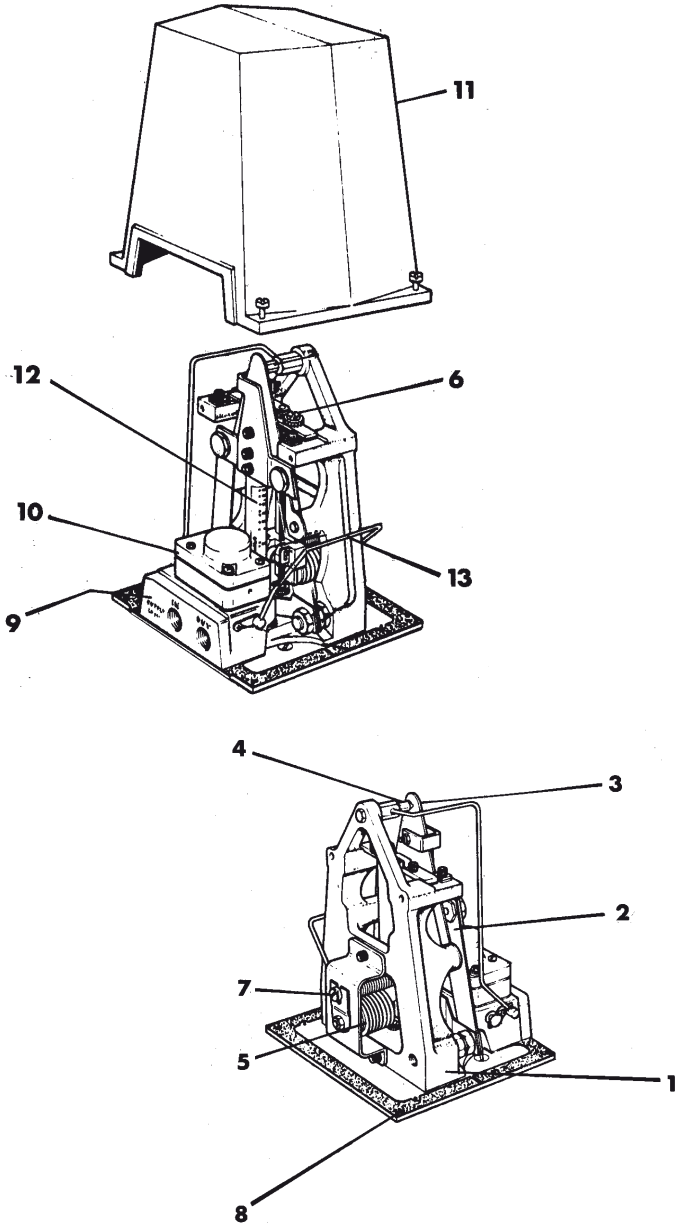

Fig. 1 - Transmitter section

INSTRUMENT FEATURES

The transmitter mod. N-AE,as all Deltapi N series instruments, consists of two main sections:

a) The measuring section,which detects any pressure variation of the process fluid.

b) The transmission section,which changes the displacement of the measuring element into a pneumatic signal,with range 3 to15 psi, 0.2 to1 kg/cm^2 or 20 to 100 kPa/0.2 to 1 bar.

The measuring section is subdivided into two main elements:

- THE PRIMARY MEASURING ELEMENT (see fig. 2) formed by the diaphragm (1).which is housed and blocked between the two sides (3) and (4)

The half-body (3) together with the upper surface of the diaphragm forms the negative side of the instrument.

The half-body (4), instead,together with the lower surface of the same diaphragm forms the positive side.

The assebly of the diaphragm with the two sides is guaranteed by the four screws (5), while the gaskets (2) give a perfect sealing.

The item (6) is a compensation element, which,during the calibration of the instrument at the factory, allows the reaching of a perfect volume equilibrium between the two sides.

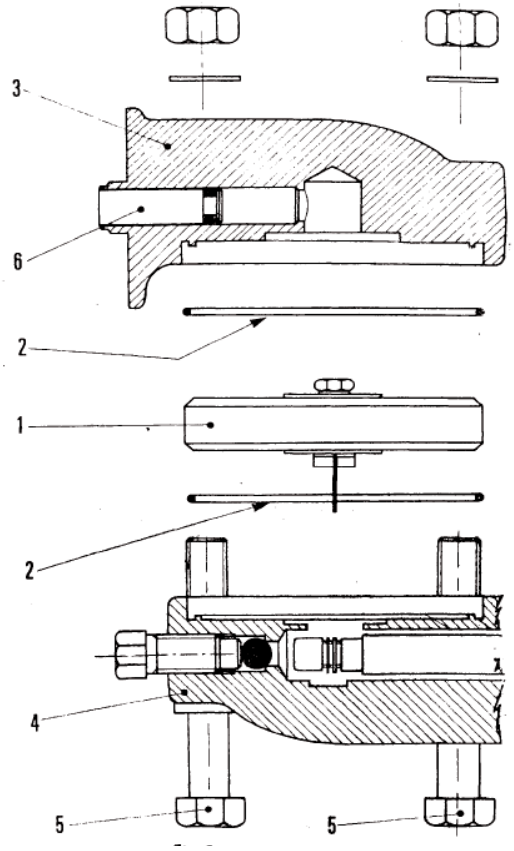

Fig. 2 - Primary measuring element

- THE SECONDARY MEASURING ELEMENT (see fig. 3) consists of two diaphragm seals (3) fitted respectively to the positive and negative sides; the seals are connected by two capillary tubes (1), made of AISI 316 ss and protected by the relevant sheath (2).
The seals are then fitted directly to the process line with a flange/counterflange group and using proper gaskets (4).

The system comprising seals/capillary tubes/positive-negative sides is filled with a low viscosity fluid,which acts as a transmission means between the primary and secondary measuring elements.
The seals filling fluids and the material in contact with the process fluid is available in different variants, in order to satisfy the stringent process requirements.

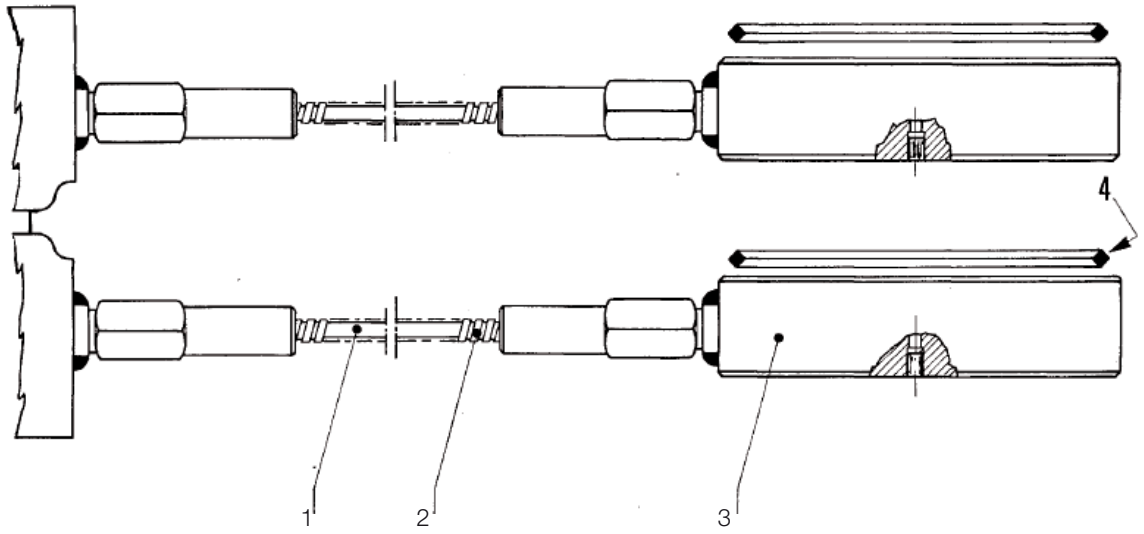

Fig. 3 - Secondary measuring element

THE TRANSMISSION SECTION (fig. 1)
This unit comprises the following items:
A mounting frame (1) attached directly to the measuring unit body and to which is attached an “A” flexure (2), flapper (3), nozzle (4), feedback bellows (5), span adjustment (6), and zero adjustment mechanisms (7).
A base plate (8) mounted directly to the measuring unit and supports the air connection block (9), the air relay (10) for amplifying the signal coming from the flapper-nozzle set and the transmission unit cover (11).
Beneath the base plate is fixed the transmitter data plate.
The force bar (12) is attached at its lower end to the transmission bar (measuring unit) and at its upper end to the ‘A’ flexure.
At the upper end of the force bar, there is the ‘T’ strap which actuates the flapper; the flapper adjustment screw is also on this strap.

ZERO ELEVATION AND RANGE SUPPRESSION (fig. 4)
The pneumatic transmitter mod. N-AE can be completed,on request, with a zero elevation or range suppression device.
Both these devices consist basically of a spring (1), mounted on the support (3) and its control screw (2).
The support 3) is fixed to the support of the transmission section, so that the spring l) works on the output shaft.
For the zero elevation mechanism, the spring is made to expand itself, while for the range suppression, it is compressed.

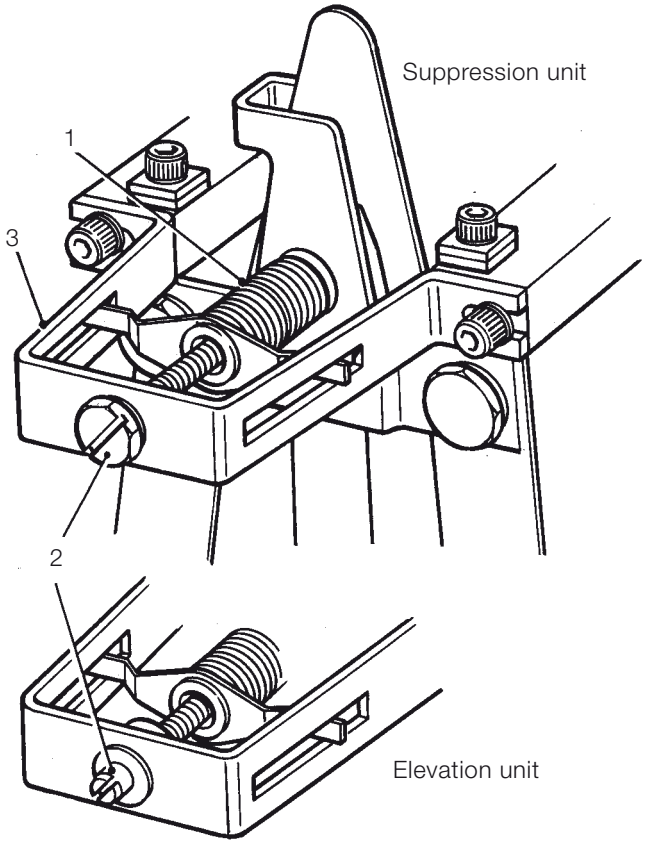

Fig. 4 - Suppression and elevation devices

INSTALLATION

Before installing the instrument, make sure that the ambient temperature does not exceed the -40 and +120 °C limits.
This condition applies to the transmission section only, since the diaphragm seals can withstand even higher temperatures, as long as the filling fluid and the seals material are selected of the suitable type.
With reference to the dimensions of the instrument, published in the data sheet, be sure that the assembly and the disassembly of the protective cover is easy.
As far as the mounting position is concerned, it is advisable to be vertical on a 2 in. pipe.
The capillary tubes must be sufficientely laid out in length and protected by any danger, such as flattening and vibrations, and they should lay on the same horizontal axis, in order to avoid any interference on the zero setting.

PNEUMATIC CONNECTIONS

For the best performance of the instrument and to grant the lowest maintenance level, it is necessary that the supply air is properly filtered, dried and oil-free.
All the pipework and every connection for both the supply and the transmission lines must be clean and leak-proof: eventually test them with soaped water, at the maximum output value (this can be obtained just supplying the instrument with air and blocking the nozzle output by pressing the flapper lightly on it).
The instrument supply must be with air at 20 psi,controlled usually by a filter-reducer mounted nearby.
The pneumatic connections must be of either copper or plastic pipes, with dimension 4x6 mm. The supply (IN) and output (OUT) connections will be 1/4 in NPT.
If the distance between the Deltapi N transmitter and the receiving instrument is very short (eg. less than 4 mt.),there might occurr oscillations on the transmitted signal: in order to avoid this effect, it is advisable to connect to the line a 500 cc capacitor.
If instead the distance between the transmitter and the receiver is quite long (more than 200 mt.), a 1:1 flow-amplifying relay has to be connected in the line.

PUTTING INTO SERVICE

Before putting it into service,this transmitter has to be installed and its connections to be made as previously detailed; add also a pressure gauge on both the supply and output lines.
Then take off all the plastic plugs,fitted to the air vents in order to avoid that dirt and any other impurity can enter inside the air conduits.
Connect the supply and output lines and supply the instrument with air at 20 psi.

Zero adjustment

Before fitting the seals to the process, check that the output pressure gauge indicates 3 psi. (or 0.2 kg/cm^2 or 0.2 bar, according to the range).
If the indication is different move on one side the small plate on the instrument cover and you will be able to adjust properly the indication,by means of the suitable zero adjustment.
Using a screwdriver, rotate accordingly the zero control screw until a satisfactory condition is obtained.
Disconnect then the pressure gauges and connect the instrument to the process: block the seals between flanges according to their standards.
The transmitter is now ready to start operation.

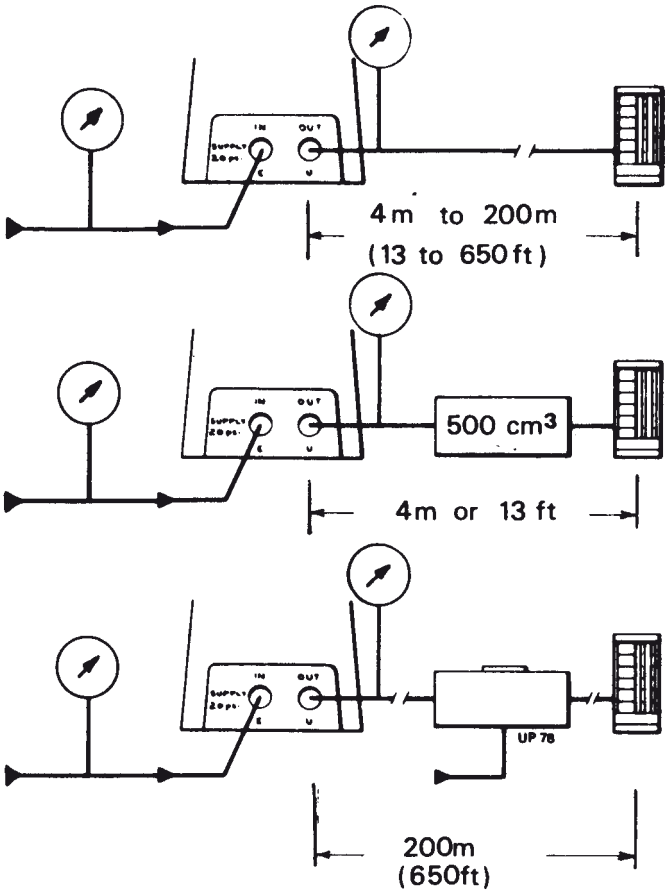

Fig. 5 - Pneumatic connections

MAINTENANCE

During normal operation, any Deltapi N instrument requires minimum maintenance. To mantain efficiency, it is recommended to drain periodically the filter reducer unit in order to avoid excessive deposits of condensate.

Check periodically the sealing of both the pneumatic and process connection: repair immediately any leaks.

A zero shifting effect can be noticed mainly if the transmitter is installed in dusty enviroments or if the supply air is not perfectly filtered.

This may be caused by deposits of dirt on the flapper/ nozzle, inside the capillary or the amplifier relay.

For the cleaning of these components proceed as follows:

Flapper-nozzle assembly (fig. 1)

a) Stop supplying the instrument and remove it out of the process.

b) Take off the protective cover 12). *

c) Disconnect the connection tube to the nozzle 13) from the connection block in the following way:
Holding firmly the nozzle support with a 10 mm spanner, slacken the nut that locks it, with an 8 mm spanner.
Disconnect thus the tube from the block.

d) Clean gently and accurately the flapper with cotton wetted with alcohol. Be careful not to bend it.

e) Clean then the nozzle with a copper or brass wire (not steel wire) of 1 mm max. diameter. Then dip it in a solvent and then dry it with clean air.

f) Grease (or in case replace) the O-ring of the nozzle supply tube.

Restriction orifice (Fig. 6)

a) Remove the restrictor by loosening the locking plate screw in the relay block and rotating the plate to one side. The restrictor may now be pulled straight out from the relay block. Remove the 'O' rings.

b) Clean by probing with a non-ferrous wire of less than 0.15 mm (0.005 inch) diameter and wash in solvent. Examine the 'O' rings and if necessary replace with new one.

c) Replace the 'O' rings on the restrictor and smear then with silicone grease.

d) Reposition the restrictor and lock with the plate and screw.

e) Check zero and adjust as necessary.

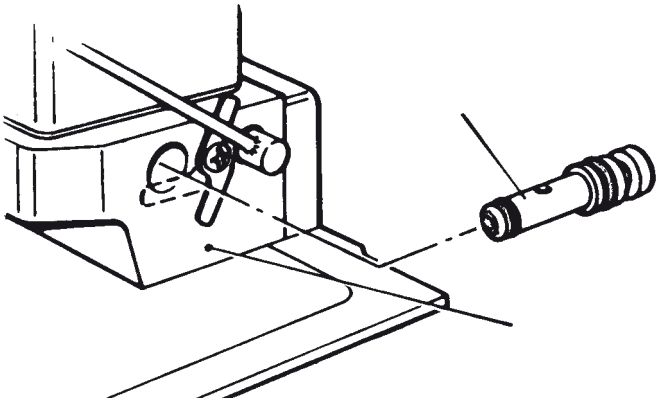

Fig. 6 - Restriction orifice

Relay (fig. 7)

a) Detach the relay to connection block (3), by removing the two mounting screws (1) and (2) taking care not to damage the gasket (4).

b) Remove the two screws (5) and (6) and separate both halves of the relay taking care not to damage sphere (7) and spacer tube (8) within relay body (9).

c) With solvent such as carbon tetrachloride clean the interior of the relay and dry throughly.

d) Examine: the gaskets (10-11), the diaphragm (12) and the metal foil (13). Replace with new ones if damaged.

e) Reassembled the relay ensuring that both halves are correctly oriented with regards to each other and that the gasket (4) is correctly placed.

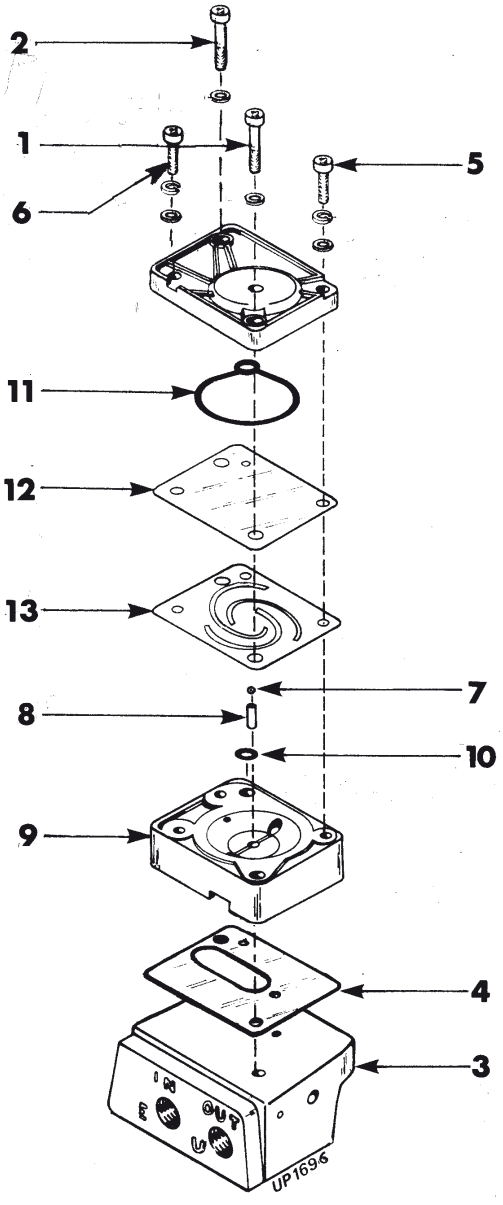

Fig. 7 - Relay

CALIBRATION

A calibration of this transmitter mod. N-AE is required to be carried out every time the instrument is submitted to a replacement ofparts or when the range has to be changed.

Mechanical alignement (to be carried out before filling).

Unlock the diaphragm group using a 6 mm Allen key.

Adjust the parallellism condition between the feedback bar and the output shaft,using the zero adjusting device.

Pneumatic alignment (to be carried out before filling).

Supply the instrument with air at 20 psi

Leaving the slider set on the max. range value, adjust the flapper, using the suitable control screw, in order that the output signal is 3 psi. If any little error occurs, reset it adjusting the zero screw.

Acting then on the ferrule, lock the capsule (diaphragm group) to the output shaft, being careful to keep the parallel position of the feedback bar with respect to the output shaft.

The output variation must not deviate from its value for more than ±0.2 psi (1.7%). If this condition is not satisfied, repeat the “locking” procedure.

Acting then on the flapper control screw, adjust the output signal of the instrument to 3.4+3.5 psi. Then zero it again with the suitable screw. This will give the output shaft the initial force necessary to overcome possible hysteresis effects of the diaphragm.

Set now the slider to the minimum range value and check that the variation falls within 2.5 to 4 psi limits.

If this condition is not satisfied, set the slider again to the max. range value, unlock the capsule and zero the output again as follows:

a) OUTPUT GREATER THAN 4 psi:

Pull the zero spring (screwing up) in order to increase the output signal by an amount proportional to the error found at the min. range setting. Set the signal back to 3 psi, using the flapper control screw.

Lock the cansule again and repeat the test.

b) OUTPUT LOWER THAN 2.5 psi:

Follow the same procedure as under a), but pressing (unscrewing) the zero spring.

Linearity test (fig.8)

Leaving the seal connected to the negative side exposed to the atmosphere pressure, set the output signal to 3 psi, by means of the screw (7) (fig. 1).

Apply to the positive side a pressure equal to the test range and check that the output signal is 15 ± 0.5 psi.

If the output is not accurate enough, proceed as follows:

- Rotate the gear wheel (2) (fig. 1) clockwise for an output lower than 15 psi.

Rotate it anti-clockwise for the opposite condition.

- Without pressure applied set output signal zero to 3 psi.
- Feed again pressure to the positive side and check the output.

If the results are not accurate yet,repeat these three operations until satisfactory results are finally obtained.

Chech also the output signal is 9 ±0.5 psi. for an input value of 50%.

Range calibration (fig. 8)

If it is required to change the working range of the instrument, proceed as follows:

- Move the slider as close as possible to the new full range value.
- Set the output to 3 psi,using the zero screw.

Apply on the. positive side a pressure equal to the full range to be checked. If the output, at this point, is not 15 psi, adjust properly the slider: lift it for an output greater than 15 psi, and lower it in the opposite condition.

Without pressure applied set to 3 psi.

Apply the pressure again, checking that the output is 15 psi +0.5% for 3 in diaphragm and 15 psi ±1% for 2 in diaphragm.

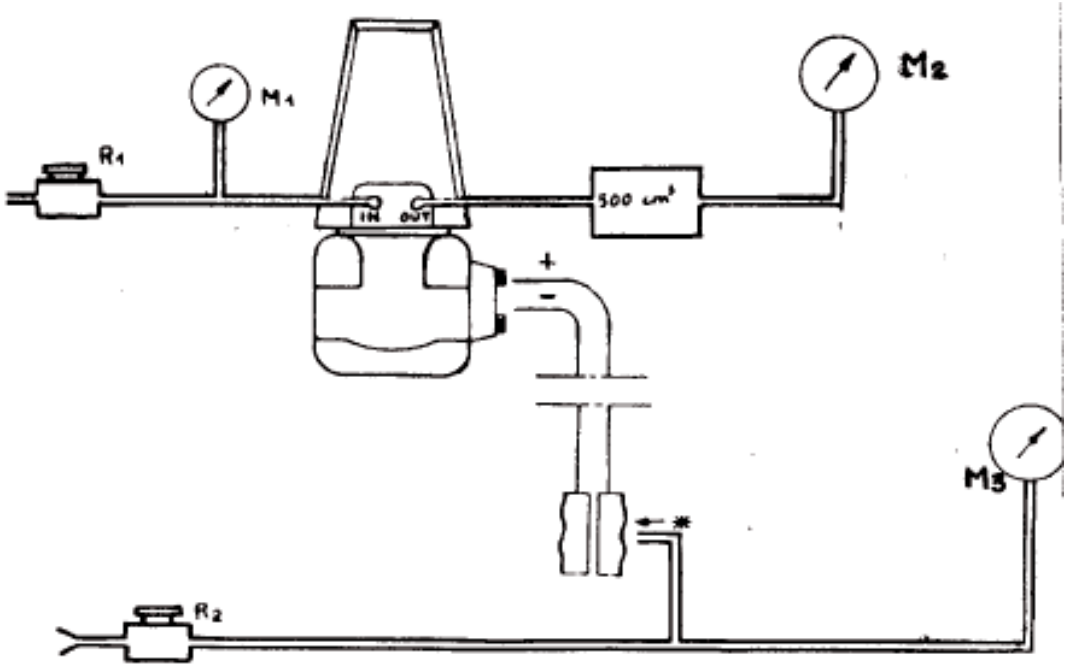

Fig. 8

CALIBRATION OF THE ZERO ELEVATION
OR RANGE SUPPRESSION DEVICES
Zero elevation (fig. 8)
After having completed the standard calibration of the transmitter and having fitted the zero elevator on, act as follows:
- Supply the instrument with air at 20 psi indicated on M1 adjusting R1.
- Zero the output, indicated on M2, to 3 psi using the screw (2) (fig. 4).
- Apply on the positive side (+) a pressure equal to the value to be elevated, using the pressure reducer R2 and reading the indication on M3,.
- The output signal, indicated on M2, will certainly change: pull the spring (1) with the screw (2) until the indication of the output (on M2) is again 3 psi.
- By adjusting now R2 and reading on the pressure gauge M3, feed the positive side (inside which there is already a pressure equal to the value to be elevated) with a pneumatic signal equal to the full range value: the output,indicated on M2 should now be,natu
rally, 15 psi.
- Adjust then R2 at 50% of the differential calibration pressure, checking that the output is 9 lb/sq.in.

Range suppression (fig. 9)
After having completed the standard calibration of the transmit ter and having fitted the range suppressor, act as follows for a test of this device:
- Supply the instrument with air at 20 psi, indicated on MI, adjusting R1.
- Zero the output indicated on M2 to 3 psi, using the screw (2) (fig.4).
- Apply on the negative side (-) a pressure equal to the value to be suppressed, using the pressure reducer R3 and reading the indication on M4,.
- The output signal will certainly change: press the spring (1) with the screw (2) until the indication of the output on M2 is again 3 psi.
- By adjusting now R2 and reading on the pressure gauge M3, feed the positive side with a pneumatic signal equal to the full range value, checking that the output is now 15 psi.
- Adjust then R2 at 50% of the differential calibration pressure, checking that the output is 9 lb/sq.in.
N.B. The accuracy is the same as that for the full calibration of the transmitter.

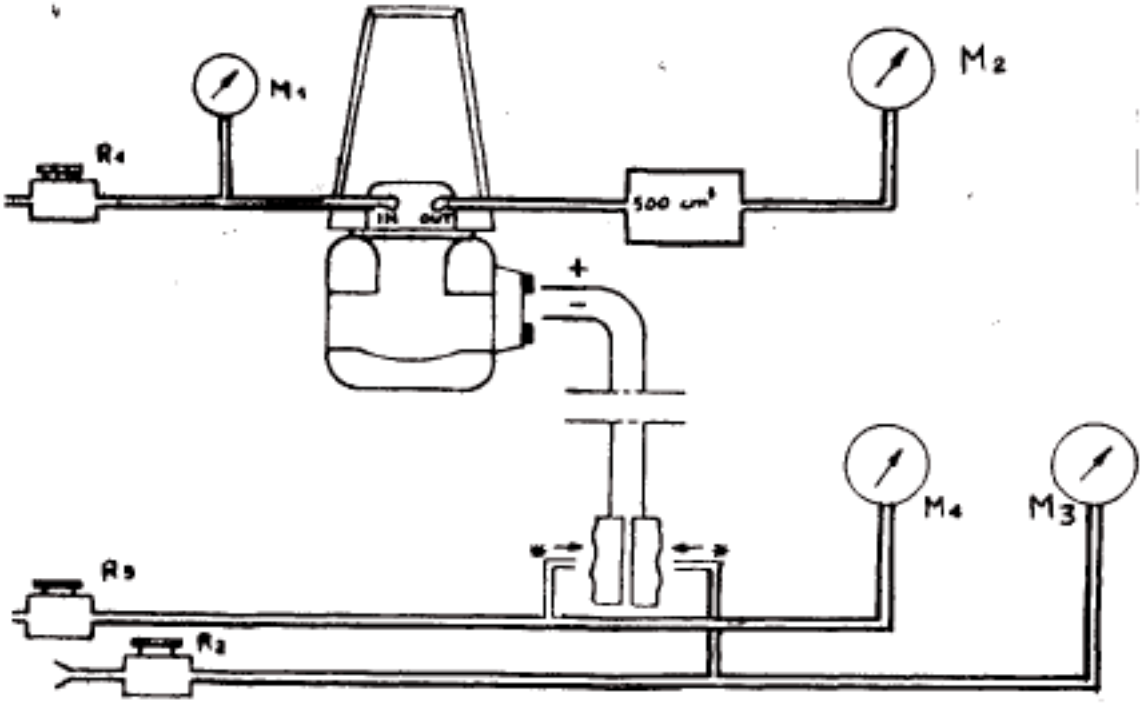

Fig. 9

NOTE
The accuracy is the same as for the full calibration of the transmitter. NOTE: the tests just illustrated and detailed are only to be cariied out with a suitable test equipment and performed by skilled people.
It is recommended that the instrument is sent back to our laboratories for any repair or replacement of the measuring section.

NOTE
The asterisks refer to connections to be made after zero setting.
R1 : 20 lb/3q.in. pressure reducer.
R2-R3 : 17,000 mm H20 (25 lb/sq.in.) pressure reducers.
M1 : 0-20 lb/sq.in. pressure gauge. Accuracy: 1%.
M2 : 0-20 lb/sq.in. pressure gauge. Accuracy: 0.25%.
M3-M4 : pressure gauges to be chosen according to the differential pressure range at which the transmitter is calibra ted. Minimum accuracy: 0.25
For low ranges,it is advisable to use a water column.

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