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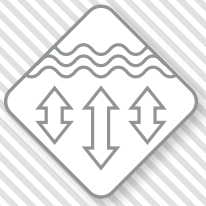

Dynamometric Scale

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Instruments and Systems for Geotechnical and Structural Monitoring

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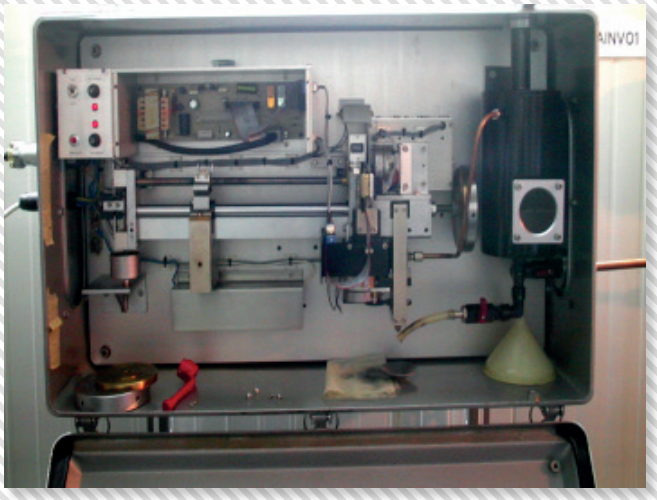
Dynamometric Scale



Description

The dynamometric scale is a precise, reliable and rugged instrument .
The instrument was installed on different dams in Italy and abroad few decades ago and still maintains its technical and functional characteristics with minimum maintenance and few interventions of repair.
The dynamometric scale is a system designed to detect, record and transmit, at a distance, water levels measured in large basins; they function with an elevated accuracy and extended measurement range.

Two versions are available. They differ in their system of application:

A) Hydrostatic version, cfor installation with hydrostatic pressure measurements, where the water level measurer is placed low, at the same height of the minimum level to be measured.

B) Pneumatic version, with the installation of the measurer at the same height as the top of the dam; a pressure measurement is performed at the altitude of the lowest level to be measured.

In both cases, the hydrostatic pressure is measured by a precision scale, with a mobile roman, that takes the measurement with a sensibility of **+/- 1 cm of water column, with a range of 80 metres** (in the standard version).
Our datalogger DAQ3000 allows data restitution at distance.

Applications

The dynamometric scale is used to measure the water level in large dams where it is necessary to have high accuracy on wide ranges. The instrument reaches accuracies of **±1cm** of water column for levels up to 80 meters and of **±2 cm** for levels up to 140 meters.

Features and benefits

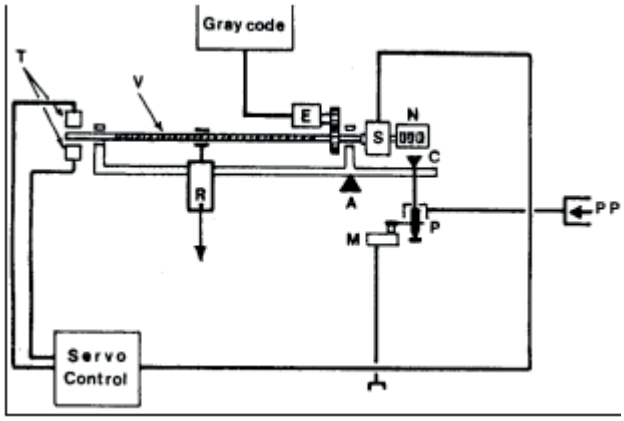
- **High degree of ruggedness**
- **High reliability**
- **Great resistance**
- **Long life**
- **Easy maintenance**
- **Easy Repair**
- **Great accuracy**
- **Certainty of data**
- **Absence of drifts and over time and with temperature**

Measurement principle

The dynamometric scale focuses its measuring principle on a primary lever. The charge of the water to be measured works on one of the arms of the lever, by means of a pressure/force system of transduction.
A mobile roman, directed by a micrometric screw, runs along the lever's arm that is opposite the charge application. The equilibrium position shows the measure of the applied charge, and therefore of the level to be measured.
When the system is at rest, the end of the arm of the lever on which the roman acts is in equilibrium in the action field of two magnetic sensors.
Each movement away from the lever's equilibrium position causes an imbalance in the magnetic circuit; this activates the command motor of the micrometric screw by means of a special electronic circuit, which in turn moves the mobile roman until it regains its electrical and mechanical equilibrium.
A mechanical counter, with the same axial as the micrometric screw, counts the number and the fraction of turns necessary to bring the mobile roman to the new position of equilibrium. The reduction ratio between counter and screw is enough to reestablish the value of the level, a value which is expressed directly in centimetres.

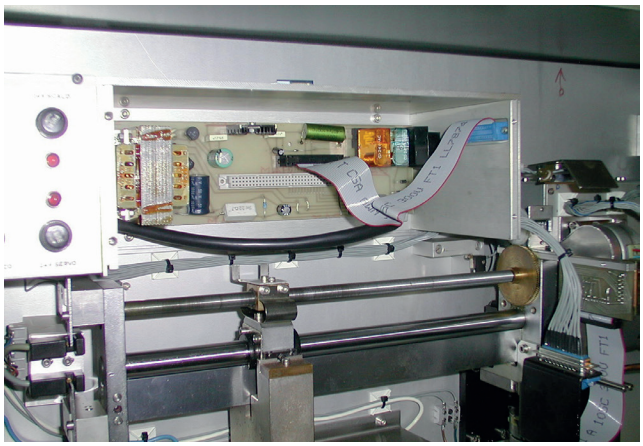
The system is also equipped with an absolute encoder in Gray code, 13 bits, which allows the digitalization of the data for remote reading. The system is designed for a maximum reliability and accuracy. For example, the pressure/force transduction is constructed with a sliding piston with a calibrated diameter, maintained in continuous rotation thanks to an agitating motor.
The piston works in oil and is subjected to the pressure of the water beater to be measured. In this way the system has virtually no inertia or friction.
Knife systems have been used, both for the fulcrum and the junctions of the roman and the piston; we guarantee that there is no phase displacement between the micrometric screw, the mechanical numerator and the absolute encoder.

T Magnetic Sensors
V Micrometric Screws
R Balancing Weight
E Absolute Encoder
A Pivot (Main knife)
C Knife for the load application
N Mechanical Counter for local reading
P Piston/Cylinder (transducer pressure/force)
M Engine for piston rotation
PP Pressure to be measured



Not having any contacts, the system used to locate the position of the arm ensures an elevated reliability in every condition.
As already mentioned, a 13 bit absolute Gray encoder is used for remote reading; this ensures a resolution of 1cm over a range of 81 m. The scale is equipped with magnetic end courses for safety.
The entire group is contained in a hermetically sealed case and maintained at constant temperature by a thermostat-heating element.
The dynamometric scale system allows the measurement of levels both with direct hydrostatic pressure measurements and pneumatic pressure measurements.
The basic instrument is the same for both versions; these only differ in their way of measuring pressure, as can be seen in the illustrative designs.
In the protection container of the mechanical groups, both the "electronic group" to control the sensors and the various components for regulation and protection are present. These are, for example: the "fuse group", the "control thermostat" for the heater, the chart for data serialization (optional).

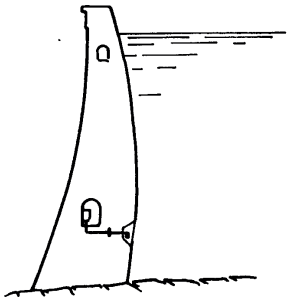
The apparatus is already calibrated; therefore the operations to be performed on installation are limited to those regarding the connection of the connectors for signal and power supply transmission .
The data for the transmission is converted into serial RS232 or RS485.



HYDROSTATIC VERSION

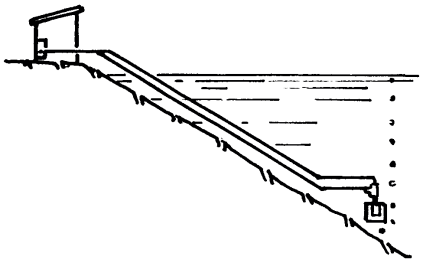
Necessary material:
1. Scale
2. Hydrostatic pressure taking group
3. Restraint flange
4. 2" Tube
5. Hydrostatic pressure measuring group

For the connection between scale 4) and the acquisition unit it is used a multiple screened cable 4c.



PNEUMATIC VERSION

Necessary material:
1. Dynamometric scale
2. Compressed air feeding group
3. Pressure regulation frame
4. Pneumatic taking pressure group
5. Copper tube 10/12 mm
6. Pressure measuring bell



Groups 1,2 and 3 are normally installed at the top of the dam, at a height near that of the maximum level of the reservoir.

The connection between the scale and the acquisition unit is ensured by means of copper tubes, that have a diameter of 10/12mm.

The connectors necessary to join the various groups are included with the respective units.

Groups 1) and 2) are generally placed in alarm situations.

To join scale 4) and the ML81B unit, a multiple screened cable is used (19c for parallel transmission, 4c for serial transmission).

Technical features

Measuring Range	80 m or 140 m
Encoder Resolution	1 cm (range 80m); 2cm (range 140m)
Sensibility	1 cm (range 80m); 2cm (range 140m)
Accuracy	± 1cm on all range; ± 2 cm on all range
Standard output code:	13 bit parallel Gray – disconnected Serial Gray with transmission in current loop 0/20mA
Power supply voltage:	Standard : 24Vca ±10%; 50 Hz; Optional : 110/220 Vca ±10%
Consumption with heaters switched off	50VA
Maximum consumption with heaters switched on	100VA
Tracking rate of the level change	22 cm/min (66cm/min)

Technical assitance

If you have any requests or questions about our instruments or if you have special needs that require different solutions from the standard, please contact us. Our team will provide all the necessary information and will be very happy to work with you to study, develop and customize instruments and solutions suitable for your specific needs.

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The product information may be subject to variations at any time.
Please carefully check the release and contact Pizzi Instruments for further details.

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