XTG P Vented Piezometer

Operating instruction





# Instructions for use of vibration string gauge

# 1 Use

The Vented Piezometer is suitable for long-term buried in hydraulic structures or other concrete structures and land, measuring the permeability (pore) water pressure inside the structure or soil, and can synchronously measure the temperature of the buried point.

The Vented Piezometer can be installed with supporting accessories can be used in the pressure measuring pipeline, foundation drilling, the pressure gauge is all stainless steel structure, 24125mm dexterous volume, can be easily placed in the small part to be measured. The vibrating string type seepage pressure meter has the intelligent recognition function.

specifications and models		XTG	XTG P-0.2	XTG P-0.35	XTG	XTG	
		P-0.175			P-0.7	P-1.0	
Dimensions	Maximum						
parameters	outer	24	24	24	24	24	
	diameter of	24	24	24	24	24	
	D / mm						
	length L/mm	125					
performance parameter	measuring	0~175	0~200	0~350	0~700	0~1000	
	range KPa	0 - 175	0 200	0 - 350	0 - 700	0 1000	
	resolution	≪0. 025%F. S					
	ratio						
	Fitting	≈0. 1%F. S/0. 5%F. S					
	accuracy						
	Temperature	-40~+80°C					
	measurement						
	range						
	sensitivity	±0.1°C					
	temperature	±0.5°C					
	measurement						
	accuracy						
	coefficient	≈0.10KPa/°C					
	of						
	correction						
	b						
	Water	Measured ra	nge of 1.2 x				
	pressure						

# 2 specifications and main technical parameters



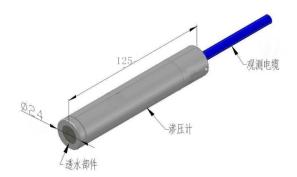
resistance	
insulation	$\geq 50M \Omega$
resistance	

Note: Frequency modulus  $F=Hz^2$   $10^{-3}$ 

# 3. Structure and working principle

# .13 Structure

The chord type seepage pressure gauge is composed of permeable parts, induction film plate, observation cable, chord and shock array electromagnetic coil.



# .23 Working principle

When the measured water load is applied to the seepage pressure gauge, it will cause the deformation of the induced membrane plate, and its deformation drives the chord transformation into the stress of the chord, thus changing the vibration frequency of the chord. The electromagnetic coil shock string and measures its vibration frequency. The frequency signal is transmitted to the reading device by the cable to measure the pressure value of the water load. The temperature value of the buried point is measured synchronously.

# 4 Computational method

a) When the external temperature is constant and the seepage pressure meter is only subjected to the permeable (pore) water pressure, the pressure value P is as linear to the output frequency modulus F as follows:

 $P = k \times \Delta F$ 



 $\triangle F = F 0 - F$ 

Where: measured value of P-seepage pressure meter in KPa;

Measurement sensitivity of k-pressure ometer in KPa / F;

 $\triangle$  F-The base value of the pressure meter is equivalent to the change of real-time measured value, in F;

Real-time measurement of F-pressure ometer in F;

F O-The base value of the seepage pressure meter, in F.

b) When the permeability (pore) water pressure acting on the meter is constant and the temperature increases  $\triangle$  T, the meter has an output  $\triangle$  F', which is caused by the temperature change, and should be deducted in calculation. The experiment shows that the  $\triangle$  F' and  $\triangle$  T have the following linear relationship:

P' =
$$k \times \triangle F$$
' + $b \times \triangle T=0$   
 $K \times \triangle F$ ' =- $b \times \triangle T$   
 $\triangle T=T-T0$ 

Where: the temperature correction coefficient of b-seepage pressure meter, unit in KPa /  $^{\circ}\mathrm{C}$  ;

 $\bigtriangleup$  T-temperature real-time measurement value relative to the base value change in  $\complement$  :

Real-time measurement of T-temperature in  $^{\circ}C$ ;

TO-temperature in  $^{\circ}C$ .

C) When the press is subjected to the dual action of permeable (pore) water pressure and temperature, if the atmospheric pressure changes, it should be corrected. The general calculation formula of the press is as follows:

 $Pm = k \times \triangle F + b \times \triangle T + \triangle Q = k \times (F0-F) + b \times (T - T0) + (Q0-Q)$ 

Where: Pm-measured permeability (pore) water pressure value in KPa;

QO-atmospheric pressure measurement in KPa;

Q-real-time measurement of atmospheric pressure in KPa;





D) The elevation of the pressure meter is:

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Hm = ((k \times (F_{0}-F) + b \times (T-T_{0}))/9.81) + H
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H-The pressure meter is installed at the elevation m.

## 5 is buried in the installation

The seepage meter is used to measure the pore water pressure in the soil, the permeable water pressure in the rock mass and concrete. The buried measuring point should be laid according to the design requirements, and the corresponding buried method should be adopted according to the structural characteristics of the measured structure.

## 5.1 Preparation before installation

Before installation, the seepage pressure meter should be tested first, and can be installed after being qualified.

The saturation of the permeable board: the permeable board of the meter has a certain density, and the pressure water should act on the induction film through the permeable board. If the storage chamber between the permeable board and the induction film is not filled with water (containing blisters), it will cause a serious lag in the measurement value of the permeable meter.

Before buried meter permeable plate and water cavity must remove the air, with operation method, the permeable board parts from the meter body first, and then the permeable board parts in the water soak for more than 2 hours, eliminate the water in the permeable stone, make it fully saturated, and then the seepage meter and permeable board parts immersed in water to assemble.

#### 5.2 buried ment in concrete (Figure 1)

When the concrete pouring layer reaches the requirements of the design of the seepage meter, a pit of 30cm deep and 20cm diameter shall be dug at the foundation surface of the buried position. The fine sand is filled in the pit, the prepared pressure imeter is placed in the fine sand in the hole, and then fill with the fine





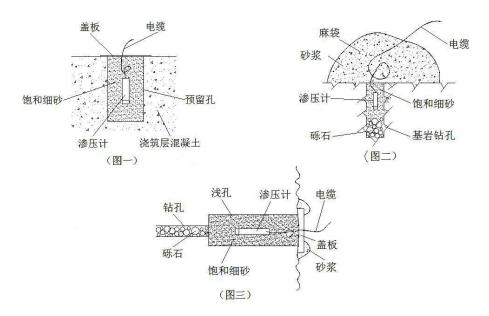
sand, observe the cable according to the design direction, and the concrete is poured.

# 5.3 Burment in bedrock (Figure 2)

drill a catchment hole with a depth of 100cm and 5cm in the bedrock to be buried. After the drilling hole passes the penetration water test, fill the fine sand in the hole, put the prepared seepage pressure meter in the fine sand in the hole, and then fill with the fine sand, observe the cable according to the design direction, and pour the concrete.

# 5.4 Tunnel and slope buried (Figure 3)

The part of the buried perimeter will be drilled with a depth of 20cm ~30cm. If there is no water permeable fissure in the hole, a small hole can be drilled at the bottom of the hole to facilitate water collection. After passing the water seepage test, fill the fine stone in the hole, fill the fine sand in the hole, put the pressure meter in the fine sand, and fill the hole with the fine sand. The long observation cable connected to the immeter is drawn according to the designed snake, and can be blocked with cement mortar.



# 5.5 Buried under the concrete dam foundation

Under the concrete bottom plate of the dam foundation, drill the hole first,



measure the hole depth, and clean the borehole. Before installation and burial, first put the perimeter into a permeable sandbag, filled with fine sand, or wrapped with permeable geotextile.

Pour the fine sand into the lower part of the meter, and adjust the sandbag equipped with the meter into the hole. If the hole is too deep, the weight of the sandbag and cable exceeds the strength of the cable, the steel wire should be used to hang the tail cross hole of the pressure gauge, and tie the cable to the steel wire for lifting, so as to avoid cable damage.

After the pressure meter is installed in place, it should be measured in time to confirm whether the pressure meter is intact, bury the fine sand into the hole, and pour water into the hole to make the hole saturated, and pour concrete on the upper part of the side hole.

If it is necessary to observe the seepage water pressure in layers, multiple pressure meters can be buried in one hole. The embedding method is to repeat the above process step by step, and pay attention to the closed partition between the adjacent pressure meters.

#### 5.6 Burment of earth-rock dam during construction period (Figure 5)

.3.4 The buried seepage pressure meter can be used in the earth-rock dam. When the filling elevation of the dam surface exceeds the buried elevation of the measuring point of about 0 meters, the pit is dug about 0 meters at the measuring point, and the seepage pressure meter can be put into the pit with permeable cloth and sand. Backfill the original soil, carefully compacted, buried with the seepage pressure meter on its rolling safety coverage thickness should be greater than 1 meter.

The observation cable of the seepage meter shall be laid along the dam surface. When crossing the seepage control body, the water stop ring shall be added. When laid in the rockfill dam, the protection pipe should be added. The observation cables must be laid with margin, snake-like direction, and do not cross each other.

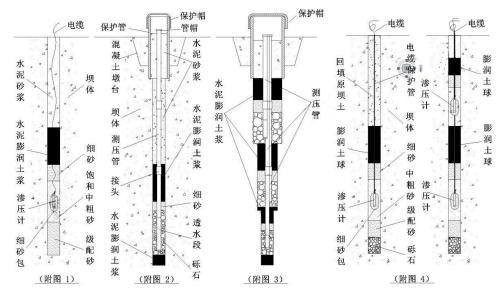


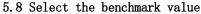


## 5.7 Burment of earth-rock dam

The pressure meter should be buried in the built works, and the hole diameter is determined on the number of pressure meter buried in the hole, the more the aperture, the larger the single hole can use the aperture of  $\not \subset 80^{\circ}100$ mm. The depth of the drilling hole should be more than 40cm higher than the design of the pressure meter. After forming the hole, coarse sand should be poured into the bottom of the hole, wrap the pressure meter with permeable water and sand cloth and lay the fine sand on the hole, as shown in the figure below.

After the burger is buried, the test should be tested in time. Once the abnormal phenomenon is found, it should be treated and buried again in time.





The observed value of the seepage pressure monitor is the change of the real-time



measured value relative to the base value, so the accuracy of the base value selection will directly affect the accuracy of the measured value.

The external load change is not large to choose the same time, stable temperature 3 times similar reading, after the average base value, the pressure meter installed in concrete should choose the hydration heat measurement value. After the base value is selected, it should be recorded as the calculated base value.

In order to make the base value more accurate, the above operation can be repeated twice, if the two values are basically the same (error 0.5%F. S), proves that the base value is correct.

When the measurement value of the pressure ometer deviates, the above method can be used to reccalibrate the base value.

#### 6 Measurements

The hand-held vibration string reader connects the one end of the measuring line to the reader, and the colorful clips at the other end of the measuring line are connected to the output cable of the upper pressure pressure reader, with black and red frequency and white and green temperature measurement. The pressure meter is attached with an intelligent identification chip, which contains the number, calibration coefficient K and temperature correction coefficient b of the pressure meter. When the reader is measured, the identification information will be automatically read, stored in the reader in order, and communicated to the computer, which is convenient for rapid statistical calculation and query, so that the measurement work can realize the paperless operation of artificial intelligence.

Multiple ocometer cables on the project site are accidentally broken, and the number and identity information of each meter can be automatically identified only by measuring the meter.

#### 7 Inge fault check

When the pressure meter is faulty, check the resistance value between the cable core wire. In normal condition, the resistance value of red and black core wires is





usually about  $450^{\circ}900 \ \Omega$ ; the resistance value of green and white core wires should be about 3k  $\Omega$  when the temperature is  $25^{\circ}$ C; the insulation resistance value between red and black lines against green and white lines or shielding wire (bare wire) should be> 50m  $\Omega$  (100V DC Mego can be used when measuring the insulation resistance, and the insulation resistance of multimeter using M  $\Omega$ , so it should be infinite).

## 8 Cable fault inspection

The seepage pressure meter cable length connection model is YSPT-4 hydraulic special observation cable, so that the cable resistance value is about 45  $\Omega$  / km.

8.1 Measure the resistance value of the cable (red and black core wire) with a multimeter: the normal condition is about  $450^{\circ}900 \ \Omega$ , plus the resistance value of the cable.

A) If the resistance value is normal, the pressure gauge may be damaged or water;

BB) If the resistance is very large or infinite, the cable or wiring is disconnected;

C) If the resistance value is very small, the cable or connector is short circuit.

It is manifested that the reader can not measure the frequency value.

8.2 Measure the resistance value of (green and white core wire) with a multimeter: under normal circumstances, about 3 k $\Omega$  when the temperature is 25°C, plus the cable resistance value.

A) If the resistance value is normal, check the reader and its measuring connection line

BB) If the resistance is very large or infinite, the cable or wiring is disconnected;

C) If the resistance value is very small, the cable or connector is short circuit.

Its performance is that the reader can not measure the temperature value.

8.3 Measure the resistance value of the cable core (the red and black line to grounding, the white and green line to the bottom line, the red and black line to



the white and green line). If the measured value is very small  $\langle 5M \ \Omega$ , the cable joint may have water short circuit.

It shows that the reader measurement is normal, and the measurement frequency value of the automatic measurement module may cause the measurement value instability, and the measured temperature value will be  $10^{20}$  C lower than the normal value.

## 9 The measured value of the meter is unstable

A) Connect the shielding line to the black line clip of the reading line;

B) Maybe get water at the cable joint, cut it off and reconnect it;

C) Determine the frequency range of the galvanometer, and correctly select the incentive type;

D) Determine the temperature resistance base value of the seepage pressure meter, and correctly select the resistance base value;

E) Check nearby for interference sources, such as motor, generator, antenna or AC power cable, away from the above interference sources.

#### 10 Precautions

The water inlet buried in the pressure meter (long cable) should be toward the water pressure and set along the cable to prevent high pressure water penetration along the cable. The cable should be buried and fixed according to the design direction.

After the monitor is in place, the base value of the pressure monitor should be measured in time. The water pressure value measured and calculated by the monitor is a change of the base value relative to the base value, so the accuracy of the base value will directly affect the accuracy of the measured value.

After the embedding of the pressure meter, under the end of the concrete hydration heat, the test of the base value should be under the state of no pressure and constant temperature, such as the measured value is relatively stable in the morning. Record the measurement value (frequency and temperature) more than three times on different days, if the measurement value is basically the same (error 0.5%F.



# S), the secondary test value can be used as the reference value.

After embedding the pressure gauge, it shall be recorded and archived according to the pressure gauge number and design number, and the lead cables shall be strictly protected.

# 11 Acceptance and storage

First, the user should first check whether the quantity of the seepage meter (including accessories) and the factory inspection certificate are consistent with the packing list. After opening the box, each seepage pressure meter shall use 100V megohm meter to measure the insulation resistance between the circuit and the sealing housing, and the measured value shall meet the requirements of the insulation resistance. During acceptance, each meter shall be measured by a reader to check whether the meter is normal. The pressure meter shall be kept in a dry, ventilated room.

