

**From:** [REDACTED]  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** RE: July 23 meeting regarding NFSS concerns from LOOW RAB radiological and chemical committees  
**Date:** Tuesday, July 20, 2010 11:30:11 AM  
**Attachments:** [REDACTED]

---

Hi [REDACTED],  
Attached is the third letter you requested from [REDACTED] to [REDACTED] regarding the Waste Containment Performance Monitoring Device.  
Sincerely,  
[REDACTED]

-----Original Message-----

**From:** [REDACTED]  
**Sent:** Tuesday, July 20, 2010 11:26 AM  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** RE: July 23 meeting regarding NFSS concerns from LOOW RAB radiological and chemical committees

Hi [REDACTED],  
Attached is the second letter you requested from [REDACTED] to [REDACTED] regarding the NFSS Waste Containment Performance Monitoring system.  
Sincerely,  
[REDACTED]

-----Original Message-----

**From:** [REDACTED]  
**Sent:** Tuesday, July 20, 2010 11:23 AM  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** FW: July 23 meeting regarding NFSS concerns from LOOW RAB radiological and chemical committees

Hello [REDACTED],  
Attached is a letter with attachments that we provided to [REDACTED] regarding her concerns. Please bring [REDACTED] number with you. We can call [REDACTED] from the speakerphone in the conference room at 10 a.m. our time.

I forwarded your email with additional agenda items to the team.

The letter from [REDACTED] to [REDACTED] regarding the Waste Containment Performance Monitoring System is attached. The other two documents you requested will be forwarded in separate emails due to size limitations. I am copying [REDACTED] so that your request can be logged in through FOIA.  
Sincerely,  
[REDACTED]

-----Original Message-----

**From:** [REDACTED]  
**Sent:** Monday, July 19, 2010 5:26 PM  
**To:** [REDACTED]  
**Subject:** [REDACTED] tel con participation for Friday

Hello [REDACTED]:

I hope I did not neglect to email you about requesting tel con participation for [REDACTED] on Friday. Is that possible? Did I send that request?

[REDACTED]

-----Original Message-----

From: [REDACTED]

Sent: Friday, July 09, 2010 9:31 AM

To: [REDACTED]

Cc: [REDACTED]

Subject: Re: July 23 meeting regarding NFSS concerns from LOOW RAB radiological and chemical committees

Dear [REDACTED]

Given the recent work from [REDACTED] identifying data related to concerns about leaking at the NFSS, it seems prudent to add that report to the agenda and request that she be conferenced in to explain her concerns.

I propose that we set aside a specific time for that in the meeting, perhaps after the first hour, but request that [REDACTED] be added to the meeting via conference call. Is that feasible at the District office?

Thanks

[REDACTED] wrote:

> Dear [REDACTED]

>

> I would be thrilled to get the discussion going now, so yes for me. I

> don't want to wait until September. I would like this discussion fast

> tracked and concluded (with a facilitator identified) by the end of

> the summer.

>

> [REDACTED]

>

> On 7/2/2010 3:56 PM, [REDACTED] wrote:

>> Hello,

>> If it is okay with all of you, we would like to suggest adding a

>> discussion about hiring a technical facilitator to this agenda.

>> Please let us know if this is okay and what additional items you

>> would like on the agenda for this meeting. Thank you and have a nice 4th of July!

>> Sincerely,

>>

>> [REDACTED]

>> US Army Corps of Engineers, Buffalo District

>> 1776 Niagara Street

>> Buffalo, NY 14207

>>

>> [REDACTED]

>>

>> -----Original Message-----

>> From: [REDACTED]

>> Sent: Friday, June 11, 2010 3:07 PM

>> To: [REDACTED]

>>

>> Subject: July 23 meeting regarding NFSS concerns from LOOW RAB

>> radiological and chemical committees

>>

>> Hello,

>> Our meeting is confirmed for July 23 at 9 a.m. in Conference Room A  
>> here at the Buffalo District. I have scheduled an hour and a half for the meeting.  
>> [REDACTED], Special Projects Branch Chief; [REDACTED],  
>> Environmental Project Management Team Leader; [REDACTED], Niagara  
>> Falls Storage Site (NFSS) and Lake Ontario Ordnance Works Site  
>> Program Manager; [REDACTED], Regional Technical Specialist; [REDACTED]  
>> [REDACTED], NFSS Project Engineer; [REDACTED] Risk Assessor; and [REDACTED], Health Physicist will  
be  
>> participating from the Corps.

>>  
>> Please identify and provide us with your top ten comments on the NFSS  
>> Remedial Investigation Report for discussion or any additional items  
>> you wish to discuss. Additionally, please provide any data analyses  
>> supporting your conclusions/concerns/comments regarding the Interim  
>> Waste Containment Structure.

>>  
>> We look forward to meeting with all of you.  
>> Sincerely,

>> [REDACTED]  
[REDACTED]  
>> US Army Corps of Engineers, Buffalo District  
>> 1776 Niagara Street  
>> Buffalo, NY 14207

>> [REDACTED]  
>> [REDACTED]  
>>  
>>  
>>  
>>

>> -----Original Message-----

>> From: [REDACTED]

>> Sent: Thursday, June 10, 2010 2:19 PM

>> To: [REDACTED]

>> Cc: [REDACTED];

>> [REDACTED]

>> Subject: Re: availability for meeting with USACE regarding NFSS

>> concerns from LOOW RAB radiological and chemical committees

>>  
>> [REDACTED]:  
>> We would like to confirm the July 23rd 9am meeting slot.  
>> Thank you.  
>> Please send info to all four of us; [REDACTED] and myself.

>>  
>> [REDACTED]  
[REDACTED] wrote:

>>  
>>> I have a doctor's appointment on the afternoon of the 27th. I could  
>>> make a  
>>>  
>> meeting at 9 AM on the 23rd.

>>  
>>> [REDACTED]  
>>>  
>>> On Jun 10, 2010, at 7:53 AM Jun 10, 2010, [REDACTED] wrote:

>>>  
>>>  
>>>

>>>> Dear RAB members:

>>>>

>>>> [REDACTED] has offered dates below for a followup meeting regarding our  
>>>> concerns and data analysis on the potential leakage at the NFSS.

>>>>

>>>> I suggest that a meeting with [REDACTED], myself, [REDACTED] and  
>>>> [REDACTED] be arranged as we discussed at our last RAB meeting.

>>>>

>>>> Would [REDACTED], and [REDACTED] let me know of your  
>>>> availability in July on the 23rd or 27th at the times listed by  
>>>> [REDACTED] below?

>>>>

>>>> [REDACTED]

>>>>

>>

CCN NO. 28159  
COM. TYPE 21P12

ADVANCED TECHNOLOGY DIVISION  
COMMUNICATION DISTRIBUTION  
FUSRAP PROJECT

COM. REF. NO. \_\_\_\_\_  
COM. DATE 1-13 PROCESS DATE 1-13-85  
FROM Coxon TO Keller  
SUBJECT Waste Containment Performance Monitoring Device  
FILE NO. 197 WBS 115-4 AFF. DOC. NO. 000-4

DISTRIBUTION

	PD	DP	PM	PE	FE	RS	ES	TR	PC	PO	FC	W/A
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DEPUTY PROJECT DIRECTOR												
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PROJECT MANAGER P. Craigwell												
PROJECT ENGINEER												
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ENVIRONMENTAL												
TECHNICAL REPORTS												
PLANNING & CONTROL												
PROCUREMENT												
FIELD CONSTRUCTION												

PLEASE RETURN TO PDCC  
FOR CORRECTIONS

cc: R. B. Barber  
M. N. Kacurak  
V. B. Bauer  
J. A. Blanks  
M. G. Jones

28159  
Bechtel National, Inc.  
Engineers - Constructors

Jackson Plaza Tower  
800 Oak Ridge Turnpike  
Oak Ridge, Tennessee  
Main Address: P.O. Box 250, Oak Ridge, TN 37831-0250  
Fax: 3786013

JUN 13 1985

U.S. Department of Energy  
Oak Ridge Operations  
Post Office Box E  
Oak Ridge, Tennessee 37830

Attention: E. L. Keller, Director  
Technical Services Division

Subject: Bechtel Job No. 14501, FUSRAP Project  
DOE Contract No. DE-AC05-81OR20722  
Waste Containment Performance Monitoring Device  
WBS No. 115/202

Dear Mr. Keller:

A report presenting recommendations for the proposed surface and subsurface monitoring systems, planned for implementation at the Niagara Falls Storage Site (NFSS), is in preparation. This letter summarizes the recommendations included in that report for a subsurface waste containment cell instrumentation system.

I am recommending installation of instrumentation to monitor only one parameter inside the waste containment cell. We believe that the most critical parameter that can be readily detected is the change in potentiometric head inside the stored wastes. Measurement of this parameter can be performed by placing instrumentation inside the containment cell at the base of the wastes. The instruments would be monitored through readout cables, passing over the containing dike, but below the containment cap, to a single automatic data recording station. This information can also be automatically transmitted via telephone interface to any other location.

The instruments recommended for installation at NFSS are Vibrating Wire Pressure Transducers (VWPT). Additionally, at four locations within the containment cell, Pneumatic Pressure Transducers (PPT) would be installed adjacent to the VWPT's to

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Mr. Keller  
Page Two

allow verification of calibration. Product literature from three manufacturers of these devices is attached. These two types of instruments comprise the total internal monitoring system recommended for installation in the NFSS waste containment cell.

The estimated installation cost of this monitoring system is \$110,000 including all subcontractor costs, automatic data recording station, cable, trenches, and transducers. The yearly service and interpretation costs are estimated at \$27,000 per year for the first five years after site closure.

Your concurrence on the installation of the described VVPT system is requested by June 18, 1985. This will allow time for preparation of the subcontract and procurement to install the monitoring system prior to cap (clay) construction later this summer.

Very truly yours,

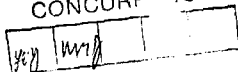
*JCB Barker*  
for Gary D. Coxon  
Project Manager - NFSS

MGJ/djm

Attachments: As Stated - Product Literature

cc: L. Campbell  
J. Nemec

CONCURRENCE



9904A

**PETUR**

U.S.A.

28159

# INSTRUMENTS

PETUR ELECTRONIC PRESSURE TRANSDUCER - ED-100

The Petur Electronic Pressure Transducer offers a reliable yet inexpensive device for monitoring pressure. It can be used to monitor fluid levels such as ground water, wells, reservoirs, storage tanks, etc. Its fast response makes it especially well suited for dynamic monitoring such as drawdown tests.

Each transducer is sealed against the intrusion of water and comes completely ready for submersion or direct burial. Protection is provided against overvoltage surges from external sources.

The Petur Electronic Pressure Transducer utilizes a differential silicon chip pressure gage which incorporates four strain gages into the diaphragm to form a fully active Wheatstone Bridge. One side of the diaphragm is exposed to atmospheric pressure via an open tube to the surface. The other side is exposed to the pressure to be measured. Thus, the registered pressure is gauge pressure.

The Petur Electronic Pressure Transducer is available in three different grades to allow the user to determine just the right combination of economy and accuracy for his needs.

Various readout units are available for the Petur Electronic Pressure Transducer. The simplest and most economical is the ED-200 hand held readout. This battery operated unit is small enough to hold in one hand and allows the user to monitor the pressure via an LCD display. Petur Instruments also offers the inexpensive ED-210 Automatic Pressure Monitor. This battery operated device is designed to be installed at each pressure transducer location. It can be set to automatically record pressure readings at intervals from 1 minute to 24 hours. The data is stored in a 4K internal memory for retrieval later by the ED-220 Automatic Data Retrieval and Readout Unit. The ED-220 retrieves data from the ED-210 or can also be used as an automatic data monitor as well. It can be programmed to take readings at time intervals as small as 1 second. Alternatively, the ED-220 can be programmed to automatically take readings at preset pressure intervals as small as 5 mm of water head (0.01 psi). The ED-220 comes with 36K of usable memory and has an RS-232 serial output for connection with an optional printer or computer.

In addition to the above readout units, the Petur Electronic Pressure Transducer may be read with the standard C-200 readout box. This box offers the flexibility to read not only electronic transducers but also pneumatic pressure transducers. This added flexibility allows users who have both pneumatic and electronic instrumentation to economically monitor all their sensors with the same unit.

Address:  
1401 30th Ave West  
Lynnwood, Washington 98036  
USA

Telephone:  
(206) 774-9191

Telex No.  
152921

PS-100 Electronic Pressure Transducer

Size: 1/2 inch x 1.75 inch  
 Range: 5, 15, 25, 100, and psi  
 Overrange: 1.5 times full scale  
 Resolution: Infinite  
 Operating temperature: -40 to 120 °C  
 Excitation: 10 to 30 volts, 100 mA current  
 Zero drift:  $\pm 0.25$  %/month  
 Output span: 0-100 mV  $\pm 2$  mV  
 Zero offset:  $\pm 1$  mV  
 Note: Accurate settings of zero and span are available for applications where intercomparability is important.

Line	Linearity	Hysteresis	Thermal Coefficient
PS-100-L	0.25	0.15	0.007/°C
PS-100-B	0.25	0.10	0.007/°C
PS-100-A	0.12	0.05	0.007/°C

• SENSOR SPECIFICATIONS •

PS-200 Handheld Recorder

Size: 4.17" x 3.5" x 1.1"  
 Power: Battery operated - internal 12 volt rechargeable battery.  
 Temperature range: 0°C to 70°C  
 Display: 3 1/2 digit LCD  
 Readout units: psi  
 Input: 100mV (full scale)

PS-210 Out-Data Distance Monitor

Power: Battery operated - internal 12 volt rechargeable or 12 volt external battery.  
 Memory: 4K RAM (for expanded memory, contact factory)  
 Display: None  
 Recording interval: User selected time interval (1 minute to 24 hours)  
 Temperature range: 0°C to 70°C (wider temperature ranges are available)  
 Input: 100 mV (full scale)

PS-220 Automatic Data Retrieval and Readout

Power: Battery operated - internal 12 volt rechargeable or 12 volt external battery.  
 Memory: 10K RAM  
 Display: 4 digit LCD  
 Recording interval: User selected; time interval - 1 second minimum  
 pressure interval - 5 or water load (0.61 psi)  
 Temperature range: 0°C to 70°C (wider temperature ranges available)  
 Input: 100mV (full scale)  
 Interface: RS-232 serial output

PS-230 Combination Pneumatic and Electronic Readout

Power: Battery operated - internal 12 volt rechargeable battery.  
 Display: 4 digit LCD  
 Temperature range: 0°C to 70°C (wider temperature ranges available)  
 Sensors: Electronic or Inmanatic  
 Readout units: user selected; psi, kg/cm<sup>2</sup>, or H<sub>2</sub>O (1.01, 1.01, 1.01, 1.01)

• OPTIONS •

- PS-100-L Standard Electronic Pressure Transducer
- PS-100-B High Accuracy Piezoelectric Pressure Transducer
- PS-100-A Scientific Grade Electronic Pressure Transducer
- PS-200 Handheld Recorder
- PS-210 Automatic Pressure Monitor
- PS-220 Automatic Data Retrieval and Readout
- PS-230 Combination Pneumatic & Electronic Readout
- PS-100 Printer

# PETUR PRESSURE TRANSMITTERS PIEZOMETERS



All Petur piezometer designs use the basic Petur Pneumatic Piezometer Sensor. This Patent-Pending design is based on more than 10 years of development and refinement and we believe is the finest, most reliable pneumatic sensor available anywhere. It is non-metallic and is corrosion free, both internally and externally, and has no moving mechanical valve assemblies that will stick, jam or corrode. See specifications on back page.



PETUR INSTRUMENT COMPANY, INC.  
11300 25th Ave. N.E., Seattle, WA. 98125  
Telephone (206) 352-1001

For rejuvenation of plugged standpipes or when standpipe or porous tip piezometers are specified on earthfill projects, consider the advantages and cost savings available by using Petur pneumatic standpipe replacement piezometers.

- Surface unit located out of construction area. No "targets" to dodge or damage.
- Installation can be performed by contractor using own crew and equipment.
- Once installed, system is maintenance free — no added riser pipes to keep pace with changing elevation and no hand tamping.
- Lower unit cost — high reliability data system.
- No filter tip plugging — no data time lag.

For repair or rejuvenation of existing standpipes.

The Petur Epoxy Packer Piezometer is used for repair of existing standpipes which have become plugged or marginal in operation. It is also eliminated the data time lag inherent with all standpipe designs. Pore pressure readings can be obtained immediately after installation.

Permanent Pressure Seal

This new design features an inflatable packer assembly or expanding gland that seals off and isolates the pneumatic sensor tip. Unlike coil or pneumatic sealers, expansion of the gland and a continuous permanent pressure seal are both accomplished simultaneously by a one time automatic filling process which injects a premixed volume of hard setting liquid epoxy into the gland assembly.

Small size — fits all standpipes

Total installation time is less than one hour. Once installed it does not require any further pressure sealing apparatus or maintenance. The diameter of the packer assembly is 0.9 inches and it may be used in all standpipes. It is supplied complete and ready to install.

## PETUR MODEL P-107 EPOXY PACKER PIEZOMETER

PNEUMATIC TUBING  
CONNECTS SENSOR  
TO SURFACE READOUT

EXPANDING GLAND  
PERMANENTLY CONTINUOUS  
LENGTH (30") O-RING  
SEAL AGAINST  
STANDPIPE WALLS TO  
ISOLATE AND SEAL  
PIEZOMETER

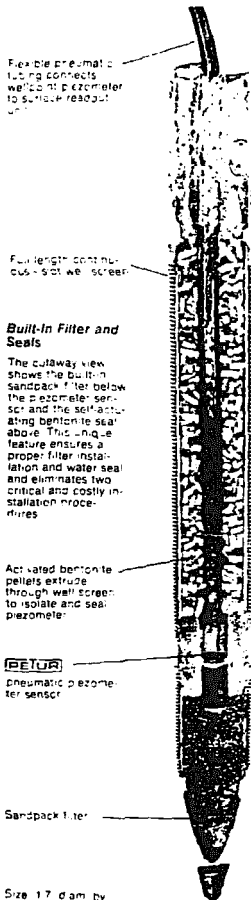
HARD SETTING EPOXY  
EXPANDS PACKER GLAND  
FOR POSITIVE PERMANENT  
PRESSURE SEAL

PNEUMATIC  
PIEZOMETER SENSOR

SPECIAL MULTIPLE  
IN-HOLE PACKERS  
AVAILABLE ON REQUEST



# **PETUR MODEL P-102-1 WELLPACK PIEZOMETER WITH INTEGRAL SANDPACK FILTER AND BENTONITE SEALS.**



## **No Drilling Required**

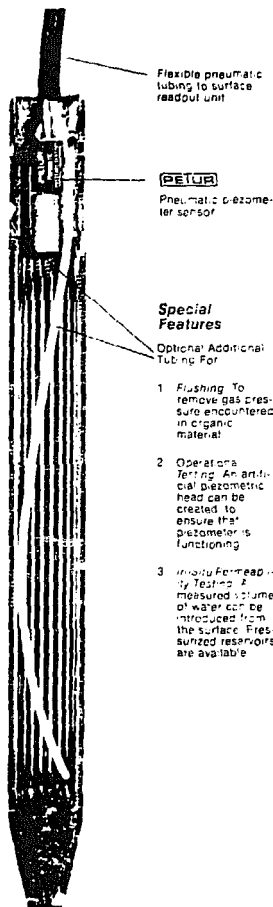
Foundation or Embankment Piezometers are customarily installed in a drilled borehole which usually requires expensive subcontractor services. However, in many soil conditions, costly drilling can be eliminated by the use of a driven wellpoint piezometer.

## **Installation by Contractor**

The Petur Wellpack Piezometer may be installed by the contractor using his own equipment and personnel. In soft graded soils of shallow to moderate depth, the wellpoint piezometer may be easily pushed or driven to the design depth using a standard drop hammer or portable air hammer.



# **PETUR MODEL P-102 WELLPPOINT PIEZOMETER**

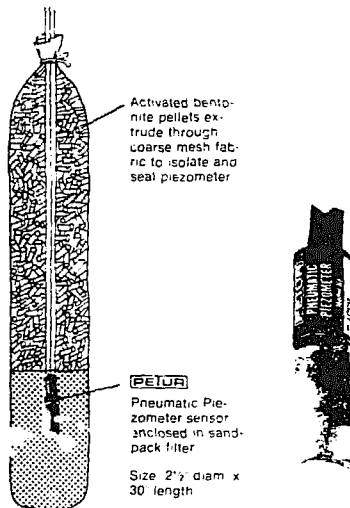


# **PETUR MODEL P-106 CANVASPACK PIEZOMETER**

Where wellpoint installation is not practical and drilling is required, the Petur Canvaspack Piezometer can be installed directly by the contractor. It also features a built-in sandpack filter for the pneumatic piezometer tip and a self-activating bentonite seal.

## **Simplified installation with built-in filter and seals.**

Installation is simply lowering the factory repackaged canvaspack piezometer into the borehole and backfilling. The entire procedure can be performed by the contractor without specialized equipment or highly trained personnel and at his own time schedule.



Size 2 1/2" diam x 30" length

Conventional standpipe piezometers are placed within foundation boreholes or embankment material to provide data on soil conditions during and after construction. By design necessity, they must be placed within the center of the work area where their surface extension interferes with surcharging and can be easily damaged by earthmoving equipment. After the tip is installed, their height must be periodically extended to keep pace with the rising surcharge elevations and the surrounding area must be hand tamped. These limitations are unnecessarily costly to the contractor.

The widespread use of standpipes is based primarily on historical precedent and apparent lower first cost; however, the cost factor is no longer valid. The relatively recent introduction of modern design pneumatic piezometers now offers the contractor project cost savings opportunities that usually exceed the total instrumentation system cost.

Aside from cost considerations, the pneumatic piezometer is acknowledged to be technically superior since it eliminates the dual problems of filter tip plugging and data time lag. These interdependent problems, inherent with all standpipes, result from the large volumetric change and the time required for groundwater to permeate through the soil and fill the pipe to the piezometric head. In low permeability soils the time lag can become so excessive that it is impossible to obtain any meaningful pore pressure data with a standpipe piezometer. In sharp contrast, the Petur Pneumatic Piezometer, which has a negligible volumetric change (.001 CC), provides high accuracy data immediately after installation and as no volumetric change is required, the instrument data time lag problem is completely eliminated.

Pneumatic piezometers are connected to the surface via flexible, direct burial tubing. Unlike the standpipe, which requires the readout station to be located directly above the piezometer, the readout station is typically located at the toe of the embankment, with the tubing buried in a backhoe-cut ditch extending horizontally from the piezometer to top of piezometer borehole, to the readout station.

This complete elimination of vertically extended riser tubes or pipes allows the contractor to place fill material without interfering targets to dodge and eliminates the necessity of hand tamping, and vertically extending the riser tubes to keep pace with the rising surcharge elevation.

## **SPECIFICATIONS FOR GENERAL PURPOSE PIEZOMETER — MODEL P-100**

MAXIMUM OPERATING PRESSURE	DIMENSIONS	MATERIALS BODY	DIAPHRAGM	FILTER	LINEAR RANGE	SENSITIVITY	ACCURACY	DIAPHRAGM DISPLACEMENT	MAX TUBING LENGTH
2000 psi 135 bars	0.625" O.D. x 2.48" 1.59 cm O.D. x 1.99 cm	Glass filled Nylon-12	Nitrile rubber (Buna-N)	Porous (50 $\mu$ ) 316 Stainless	0-2000 psi 0-135 bars	$\pm 0.1\%$ all constant flow rate 0.016 SCFM 28 SCFM	Equal to readout gauge	0.001 cc	5000 ft 1500 m

The repeatability and sensitivity of the pneumatic piezometers is extremely high and will always exceed the readout gauge accuracy.

Petur Instruments offers a complete line of Geotechnical instrumentation including Piezometers, Readout Instruments, Total Pressure Cells, Remote Settlement Indicators, Water and Stream Samplers and Inclinator Systems. In addition, we

build specialized instruments for unique customer applications and offer engineering services, including all phases of design, installation, supervision and training. Catalog and price list available upon request.

**Please contact factory for further information or applications assistance.**

**PETUR INSTRUMENT COMPANY, INC.**

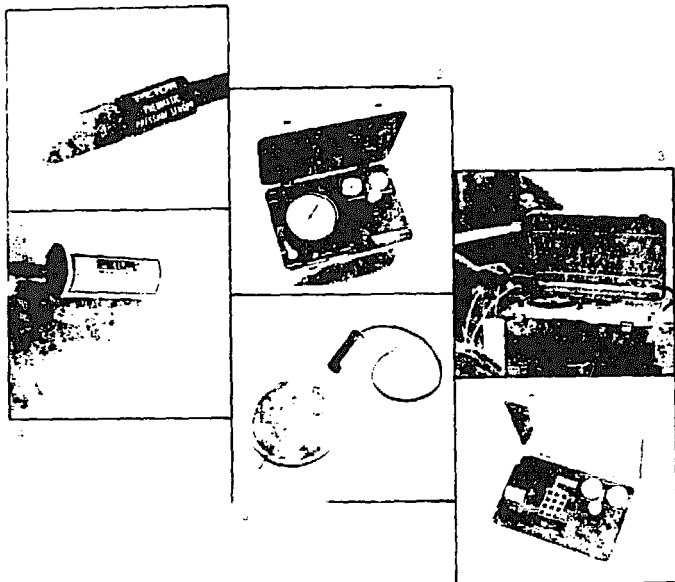
11300 25th Ave. N.E., Seattle, WA. 98125

Telephone (206) 362-1081

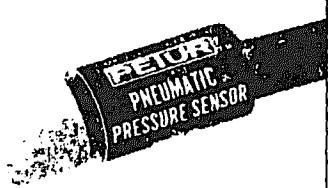
# PETUR<sup>®</sup>

## INSTRUMENTS

28159



1. P-100 Pneumatic Piezometer
2. C-102 Pneumatic Readout Instrument
3. LS-1000P Liquid Sampler with Depth Indicator
4. SP-105 Seepage Sensor
5. TP-101 Total Pressure Cell
6. C-300 Ground Water Monitoring Instrument
7. C-100 Remote Automatic Data Acquisition System



### MODEL P-100 GENERAL PURPOSE PIEZOMETER

The patented P-100 is an accurate and reliable pressure transducer. The small size (0.625 in. dia. x 2.5 in. length), rugged construction (glass filled body, no body with Buna N diaphragm) and simple design (no mechanical moving parts) make the P-100 ideal for most piezometric applications.

The P-100 has an operational range of 3-2000 psi. Sensitivity and repeatability exceed currently available readout instrumentation. The P-100 needs negligible volumetric change ( $< 0.002cc$ ) to register a pressure, which gives it a rapid response time even in very low permeabilities.

The P-100 requires a gas flow rate of less than 35 cc/min for operation. This low flow rate eliminates errors in readings due to flow turbulence and long tube lengths.



### MODEL P-103 PNEUMATIC PIEZOMETER

The P-103 transducer with a fixed offset pressure. The offset can vary between 0-0.25 psi from one transducer to the next. Once fixed, the offset remains constant.

The transducer is mounted in a 1 1/2 in. x 6 in. drilled hole. The tubing diaphragm is very sensitive to small pressure changes to 10 psi, which makes the P-103 particularly suitable for monitoring low head changes. It is specifically recommended for applications where pressures range between 10 ft. of water and 1.0 atmosphere.

### PIEZOMETER APPLICATIONS

- Monitor Ground Water Levels
- Measure Excess Pore Pressure Conditions
- Safety Monitoring of Tailings and Earth Fill Dams
- Measure High Pressures on Concrete Dams
- Measure Hydraulic Pressures

Flexible pneumatic tubing to surface

### MODEL P-102 WELLPOINT PIEZOMETER

Pneumatic pressure sensor

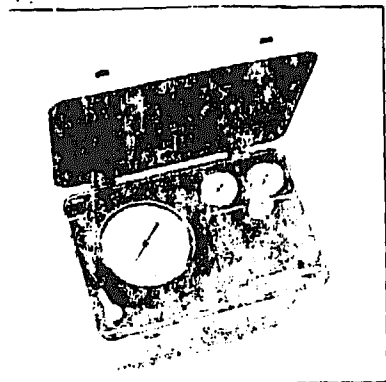
#### Special Features

Optional Additional Tubing For:

1. **Flushing:** Gas pressure encountered in organic material can be removed.
2. **Observation Testing:** An artificial piezometric head can be created to ensure that the piezometer is functioning.
3. **In Situ Permeability Testing:** A measured volume of water can be introduced from the surface. Permeability measurements are available.

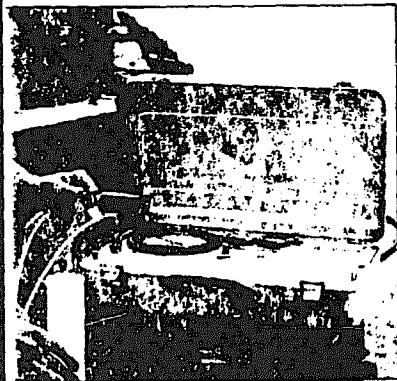
See P-101 for details



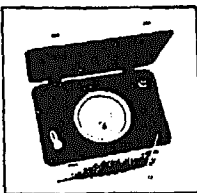


**FC-102 CONTROL UNIT** is the standard instrument used for reading Petrol pneumatic piezometers. The FC-102 comes with automatic flow control provided by a patented **FC-103 FLOW CONTROLLER**. Readout provided by a 6 in. diameter Bourdon tube gauge in full-scale accuracy of 0.55%. Full-scale accuracy 0.1% is also available.

The C-102 is available in pressure ranges from 0-15 to 0-2000 psi. Other units of measurement are also available in the same pressure ranges. The FC-102 contains an internal 2 liter rechargeable gas supply. A filter hose is supplied with the unit. The unit operates on  $N_2$  or  $CO_2$ .



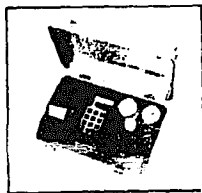
**SC-100 CONTROL UNIT** incorporates a pressure quality double rotation 6 in. diameter gauge with a scale length of 30 in. The readout has an accuracy of 0.1% of full scale. The SC-100 is contained in series with a C-102, or similar readout unit, and is used to obtain highly accurate readings. The unit is primarily used for sediment seals in dredging or very precise piezometer readings.



**C-200 CONTROL UNIT** is an electro pneumatic digital readout instrument. The readout consists of digital readout displays in English or Metric units (pneumatic  $mmH_2O$ ,  $NH_2O$ , kPa, and cmHg). The C-200 is used for very accurate measurements of pneumatic and electronic sensors. The C-200 contains a rechargeable 1.2 amp hour Ni-Cad battery pack and a rechargeable internal gas supply.



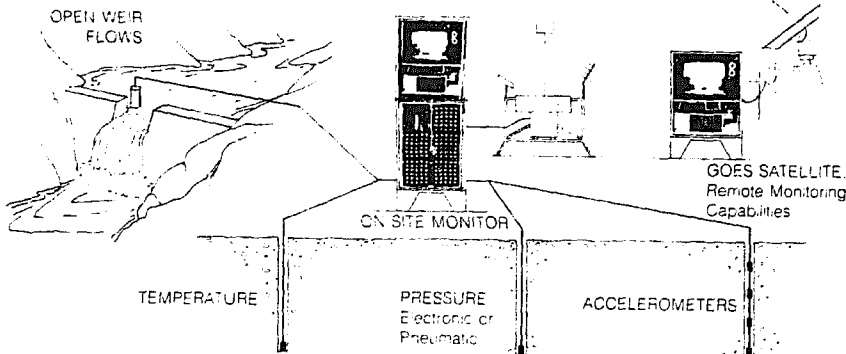
**C-300 CONTROL UNIT** is a pre-programmed data acquisition and memory storage system. The C-300 is designed for use as a monitoring system for drawdown pump tests. Coupled with a multiplexer, the C-300 can monitor up to 10 pneumatic channels at a selectable scanning rate. The C-300 automatically takes a new reading whenever any channel exceeds a user-determined, selectable change in pressure. Readout is an LCD display with selectable English or Metric units. An optional printer is available. The C-300 includes a rechargeable Ni-Cad battery pack, an internal gas supply and an RS-232C serial data port.



**LIQUID SAMPLER with DEPTH INDICATOR** collects a sample of liquid while it reads the depth at which the sample is obtained. The readout gauge records the depth directly in feet in water. The sampler operates in all types of liquids and environmental conditions. Unique construction and operation of the sampler provide large or small samples either at a specific depth or at selected depths, and all samples at all depths are obtained without returning the sampler to the surface. The sampler is available in diameters of 0.6 in. to 3 in.

4096 CHANNEL  
PRESSURE / PNEUMATIC  
PRESSURE / HYDRAULIC  
PRESSURE / ELECTRONIC  
PRESSURE ACCURACY 1%  
FLOW / PNEUMATIC / ELECTRONIC

TEMPERATURE  
FULLY AUTOMATED  
D.C. and A.C. AMP INPUTS  
E-Z OF SOFTWARE  
E-Z SET UP  
OFF SHELF COMPONENTS



## Specifications

Texas Instruments Model TI-99/4A Computer with full typewriter keyboard. TI Basic programming language. Memory for standard to 64K. Also includes as a standard feature the Main Memory Command Module with 4K of RAM and 4K of ROM.

Tape Deck: For storage of user programs. Uses standard cassette tapes.  
T Monitor: 19 inch (diagonal) color, standard. General Expansion System: For addition of optional electronic circuits or expansion of memory or accessory cards.  
232 Board

**PETUR**®

**INSTRUMENT COMPANY, INC.**

13025 36th Avenue W. Lynnwood, WA 98175 U.S.A.

BULK RATE  
U.S. POSTAGE

**PAID**

SEATTLE, WA  
PERMIT #11620

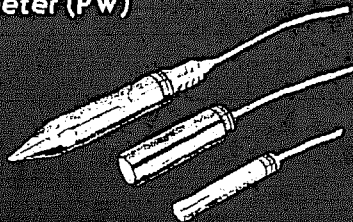
PETUR C-300  
DATA ACQUISITION SYSTEM  
SPECIFICATION SHEET

Designed for Pneumatic and Electronic Data Acquisition.

- Pre-programmed, automatic sequential readout of selected channels.
- Up to 99 channels available with multiplexer additions. C-300 comes with 2 channels.
- Programmable for English or Metric units.
- Programmable scan rate.
- Reads pressures from pneumatic (piezometer or bubbler) or electronic transducers.
- Automatic switching between high range (0-100 psi) and low range (0-10 psi).
- Accuracy is  $\pm 0.06\%$  of full scale.
- Sensitivity in high or low range is  $\pm 0.01\%$  of full scale.
- Standard pneumatic pressure range - 0 to 100 psi (231 feet of  $H_2O$ ).
- Multiplexer channels can be pneumatic pressure, strain gauge or LVDT readouts.
- 32K internal memory.
- RS 232 serial data port.
- Optional strip chart printer.
- LCD data display.
- Power supply is rechargeable Ni-Cad battery and/or external 12V DC source such as a vehicle battery.

IRAD GAGE  
Geotechnical Instrumentation

## Vibrating Wire Piezometer (PW)



- Rugged construction.
- Small size.
- Long-term stability with high reliability.
- Remote readout capability.
- Very sensitive.

IRAD GAGE piezometers have been designed incorporating the latest vibrating wire technology to provide remote, initial readouts of water pressure in fully saturated natural soils, in rolled earth fills and on the surface of retaining structures. The superiority of vibrating wire diaphragm type piezometers for these kinds of measurements is well established (i.e. they exhibit [1] very small time lags, [2] an ability to measure negative pressures, [3] high sensitivity and reliability, and [4] transmission of signals as a frequency over long lead-wire lengths). The IRAD GAGE Piezometer can be buried in fill during construction, sealed in boreholes after construction, and even driven directly into loose ground from the surface (providing the appropriate head design is used). Another application to demonstrate the wide range of uses is to upgrade standpipe installations by lowering the piezometer to a fixed point and measuring head pressure directly from a remote readout station.

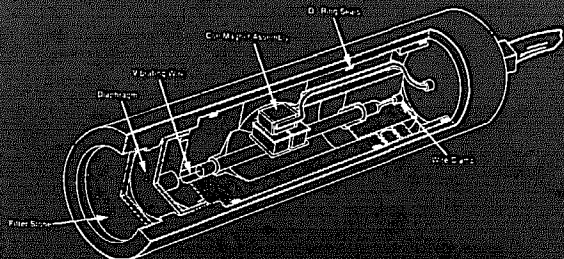
In use, water that enters the gage through a filter stone exerts a pressure against the face of a diaphragm. The resulting deflection changes the resonant frequency of a tensioned steel wire clamped between the diaphragm and the main body of the gage. The wire is vibrated using a coil/magnet assembly built into the gage and connected by cable to the IRAD GAGE Model MB-6 or MB-6L portable Digital

Readout Box. The readout box supplies the electrical pulse to vibrate the wire and also measures the period of the resonant frequencies of these vibrations. A display of the period automatically appears on a digital readout.

Calibration data are provided with each instrument to permit the calculation of water pressures. The readings can be recorded automatically on paper tape indicating time and date using the IRAD GAGE Datalogger (see data sheet).

As the signals to and from the piezometer are based on frequency rather than current or voltage there is no effect on the readings due to contact resistance, lead lengths or ground leakage. Temperature effects on the pressure readings are negligible. However, temperature measurements can be made by the inclusion of a thermometer in the gage body (an optional extra).

The basic piezometer has been designed to be versatile for many different applications. A variety of filter permeabilities can be provided to meet individual customer requirements on request. The Model PWP is designed to be pushed or driven directly into the ground on the end of an E size drill rod or a one-inch water pipe. The small diameter PWP is ideally suited for upgrading existing standpipe installations, and for use in small diameter boreholes.



## Specifications:

Model No. Ranges*	PSI	PW	PWP	PWS
	25, 50, 100, 500, 1000	25, 50, 100	25, 50, 100	50, 100, 500
	KPA 172, 345, 690, 3450, 6900	172, 345, 690	345, 690, 3450	
Average Sensitivity	0.1% Full Scale	0.1% Full Scale	0.1% Full Scale	
Length	inches (mm.) 4.9 (125)	10.0 (254)	4.6 (117)	
Diameter	inches (mm.) 1.32 (33)	1.32 (33)	0.72 (18)	
Filter**	30 micron	30 micron	30 micron	

3 CONDUCTOR SHIELDED

- \* Other ranges available on request  
 \*\* Other filters available on request

## Ordering Information:

Specify: 1. Model Number.  
2. Range.

3. Cable Length.  
 4. Size of drive pipe and required thread connections if piezometers are to be driven into the ground.  
 5. Add thermistor option if temperature measurements are required.  
 6. Contact factory for high entry value filters.

## Required Accessories:

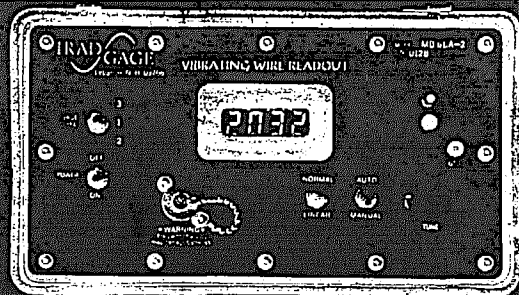
MB-6 or MB-6L Readout Box.

## Available Options:

Thermistors  
 Model MT-1 Thermistor Readout  
 E size drill rod couplers and adaptors.

for further information write: IRAD GAGE, INC. Elna Road

Lebanon, New Hampshire 03766, USA  
 Telephone: (603) 448-4445



## Specifications:

Model No.: MB-6  
 Size: 6 x 6 x 10 inches (15 x 15 x 25 cm.)  
 Weight: 5 1/2 lbs. (2 1/2 kg.)  
 Response: 100,000 microsecond (5.5 kHz-500 Hz)

Resolution: 0.05 microsecond  
 (typically 1 part in 2000)

Pulse Voltage: 10V

Batteries: Rechargeable

Connector: Pomona 2244

Temperature Range: Operating 20° to 110°F

Storage - 20° to 130°F

Display: Liquid crystal 4 digits

## Ordering Information:

- Specify: 1. Model MB-6 or MB-6L  
 2. Intrinsic Safety Approval  
 3. Charger converter (220VAC)  
 and foreign plug adaptors  
 4. Audio option: internal speaker for  
 audible check of gage operation  
 5. Interface for MA-5SM Datalogger

## Accessories:

Shoulder Strap  
 Charger (110 VAC)  
 Clip lead for gage connection

for further information write: IRAD GAGE, INC. Elna Road

Lebanon, New Hampshire 03766, USA  
 Telephone: (603) 448-4445



# PORE-PRESSURE TRANSDUCER

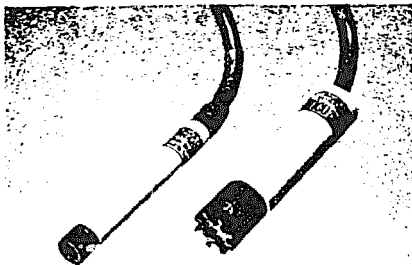
## 514177 & 514178

Patent Applied For

The Models 514177 and 514178 are our most economical pore-pressure transducers for determining pore-water or gas pressure within embankments, foundations, and slide areas. The system features inherent, truly superior repeatability and low diaphragm leakage. Two sizes of transducer are available: Model 514177 has a 5/8-inch O.D. and Model 514178 has a 1-inch O.D.

The transducer converts fluid pressure into pneumatic pressure which can be related to a remote reading station. The basic principle of operation is a pneumatic balance of forces across a flexible diaphragm.

A variety of terminal stations, both portable and wall-mounted indicators provide flexibility to meet various requirements. These are coupled to the pore-pressure transducer by means of polyethylene or nylon tubing in a water-proof polyethylene jacket. This tubing is designed for directional and will withstand rough handling in the field. The two transducer models can both be operated with either a 2-tube or a 3-tube configuration. Accuracy is increased for longer tube lengths with a 3-tube system.



Model 514177      Model 514178

### DESCRIPTION AND SPECIFICATIONS

Pore-water pressure acts upon a flexible diaphragm having negligible spring force. The force of the diaphragm due to water pressure causes a valve to close. To take a reading, when using the 3-tube arrangement, gas pressure is applied through the input tube allowing flow into the chamber and into the output tube which is connected to a high precision pressure gauge in the readout indicator. Pressure in the chamber and two tubes increases until it balances against the pore-water pressure. Excess pressure is vented to atmosphere through the opened transducer valve and third tube. The measurement may be repeated by reducing input pressure to a level just below the output pressure gauge reading at which point it will begin to decrease. The input pressure is increased again and the reading is repeated.

For the 2-tube configuration there is no output tube. Instead the high precision pressure gauge in the indicator measures the input pressure to the transducer. The difference between the pore pressure and the input pressure increases with longer tube lengths and higher operating pressures. However, as long as repeatable reading procedures are maintained and pore pressure changes are not extreme, high precision can be achieved.

For many applications, the flow rate may be limited by visual observation to avoid reading error. For the extremely accurate and sensitive readout pressure gauges, the flow condition is monitored with a floating ball flowmeter. By maintaining constant flow for each reading, the small error due to flow rate and possible operator error is eliminated. Tubing lengths for the 3-tube system may be adjusted to suit conditions with no effect to the calibration of the transducer.

Another means of operation, which also gives excellent results, is the over pressure method. Results are obtained by rapidly injecting gas into the input tube until gas escapes through the vent tube. When gas is detected flowing from the vent tube, the input gas is interrupted and the excess gas is slowly vented until the diaphragm valve is closed. The system pressure can then be measured in either the input tube or the gauge tube. The over pressure method is commonly used with two-tubes, providing a more economical means of measuring pore-pressure.

This transducer does not require in-place calibration and has negligible zero shifts or changes in gauge factor. It provides a non-ambiguous measurement which is a result of the unique pneumatic-hydraulic null-balance condition. The application of this technique to measurement of pore-water pressure results in an economical, stable and sensitive transducer giving long-term repeatability for periodic measurement of fluctuating pressures. Normally, it is not necessary to refer to calibration curves at any time since the gauge factor is essentially 1.

Stainless steel disc filter is standard. Three additional types of filters are available. The Horton Casagrande type and the polyethylene type filters have large pore size and low air-entry pressure. The Coors filter has high air-entry pressure and permits the measurement of water pressure whenever pore-gas pressure is also present.

Fluid-pressure measurements may be continuously monitored and recorded on moving chart or digital data-logging equipment. Output signals may be compared to preset threshold values and utilized to trigger external alarms.

### APPLICATION AND INSTALLATION

The transducer will operate in any position. It can be installed in boreholes or pressed into the soil. Well-points attached to the pipes can be pushed into the soil and do not require drilled holes. The 5/8-inch O.D. size transducer (Model 514177) can be used in



slope indicator company

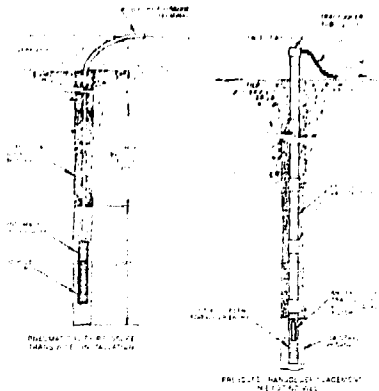
existing standpipes or placed in small size drive type well-points.

In most applications, the 1" O.D. transducer with a Norton tube filter is embedded in an open borehole and is sealed off from other water-bearing areas with Bentonite Pullouts or cement grout. The tubing may be embedded directly in trenches using sand backfill to prevent rocks or other sharp objects from damaging the tubing. In cases where large lateral or vertical deformations may develop, the tubing can be protected by an outer armored conduit.

In many construction projects, it is essential to monitor pore-water pressure in both soil and rock. The transducer will provide in-situ pore-pressure data economically and reliably in support of the following objectives:

- Monitoring water-pressure changes in regard to stability of slopes
- Control during construction of embankments and dams
- Soil stabilization to determine seepage patterns in soil and rock
- Surcharging of compressible foundations
- Gauging of water table and hydrostatic pressures
- Pumping tests to determine permeability and transmissibility coefficients
- Measuring of pore-pressure subjected to static and dynamic transient loadings in, for example, evaluating liquefaction potential associated with earthquake accelerations
- Stability of tailings dams and solid disposal areas

Slope Indicator Company will be pleased to assist users with detailed installation planning.



Since this is a scientific instrument, measurements should be taken, recorded and interpreted by qualified personnel. SINCO is not responsible for errors or omissions of such personnel.

#### TRANSDUCER SPECIFICATIONS:

Pressure Range: 0.5-1000 psig (3.44-6894.8 kPa)

Repeatability:  $\pm .05$  psi

#### Accuracy:

Calib. Zero Offset: 30 psi  $\pm$  .05 psi (2.0 kPa  $\pm$  .35 kPa)

Sensitivity Output/Input: 1.007  $\pm$  0.0005

Diaphragm Displacement: 0.01 cc

#### Diaphragm Material:

Standard Buna-N Rubber

Optional Viton Rubber, Silicone Rubber

#### Body:

Model 514177: Nominal  $\frac{1}{2}$ " O.D. Actual O.D.  $\frac{1}{2}$ " (16 mm) O.D. ABS

Model 514178: Nominal 1" O.D. Actual 1.062" (27 mm) O.D. ABS

#### Filters:

Standard S.S. Disc — 50 micron, pore size sintered stainless steel

Optional Norton Tube — 60 micron, pore size 1.5" (38.1 mm) O.D. x 4" (102 mm) length, .25" (6.35 mm) wall

Polyethylene — 60 micron, pore size 1.5" (38.1 mm) O.D. x 4" (102 mm) length, .25" (6.35 mm) wall

Coors Tube — 1.5 to 2.2 micron, pore size Air Entry Pressure

18 to 28 psi (1.27 to 1.97 kg/cm<sup>2</sup>)

1.5" (38.1 mm) O.D. x 6" (152 mm) length .25" (6.35 mm) wall

Printed in U.S.A. 12-87



**SINCO**

**Slope Indicator Company**

3668 Albion Place No., P.O. Box C 30316, Seattle, WA, 98103 U.S.A.

TWX: 910-444-2205 (SINCO SEA) cable: SINCO SEA phone: (206) 833-3073

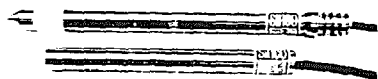
# Vibrating Wire Pressure Transducer Model 52630

- Vibrating Wire Frequency Signal
- Long leads do not affect reading
- Lightning protected—standard
- Temperature measurement—standard
- In-place sensitivity check—standard

The Model 52630 pressure transducer is a reliable and accurate device for measuring liquid or gas pressures in pipe, pressure within embankments, foundations, slide, near wells, tanks, pipelines and reservoirs.

The transducer elements have means to produce three frequency signals which may be transmitted to a remote recording device. Readings can be displayed at a remote location or an automatic data logging system.

Materials, construction and design of the transducer make it corrosion resistant, immersion-proof and electrically stable for long-term operation. It is designed for burial in soil or rock, foundations, embankments, and at the earth interface with tunnels and retaining structures. It can also be attached to pipelines and tanks or immersed in wells or reservoirs.



Top: Drive-Point Piezometer with cylinder filter and EW-Rod Threads. Bottom: Borehole Piezometer with Disc Filter.

## Definition and Specifications

The sensing element is a small diameter steel wire, restrained at both ends, which vibrates at a natural frequency determined by the tension in the wire. One end of the wire is fixed to the transducer body. The other end is fastened to a thin flexible-steel diaphragm in contact with the fluid media. Flexure of the diaphragm due to changes in fluid pressure induces a change in the natural frequency. Fundamentally, the frequency is a function of the square root of the tension stress in the wire multiplied by a constant. This frequency is a very sensitive and repeatable signal corresponding to the fluid media pressure on the diaphragm.

The integral electrical circuit drives the wire in constant oscillation at the natural frequency of the wire by means of an exciter coil and pick-up coil in close proximity to the wire. The

square-wave timing networks in the portable indicator or a marker, such as the oscilloscope at a constant amplitude and a square-wave frequency for a digital display of the reading, which is proportional to the strain in the vibrating wire. The conversion to pressure units is done by subtracting the initial readings from the current reading and dividing by the sensitivity of the transducer.

The electrical cable consists of two-conductor, shielded with a water-proof jacket. The electrical cable is bundled together with two hydraulic tubes within an outer polyethylene jacket. The two tubes extend into the transducer housing cavity behind the diaphragm which contains the sensing wire and the oscillator coils. The two tubes permit circulation of dry nitrogen gas in the cavity. This tube arrangement allows cracking in-place sensitivity and purging moisture which may have entered the cavity. Also, when the transducer cavity is vented to the atmosphere, barometric pressure corrections of the data are eliminated. A high precision indicator, such as the Model 51411-A Pneumatic Indicator, is used to check sensitivity.

The Vibrating Wire Pressure Transducer can measure negative gage pressure (sub-atmospheric) and pressures near atmospheric with a sensitivity equal to that of the positive range.

Although temperature effects are negligible, a temperature sensor is included in the transducer's circuitry. Switching the indicator to TEMP. mode will display temperature changes to permit compensation in data computations when desired. This is a standard feature in all units.

When used as a piezometer, optional filtering, such as porous disc or cylinders is provided. Filters are available with different porosities. The larger pore sizes are most commonly used for saturated ground conditions. The smallest pore size for high-air-entry gas pressures is sometimes used in partially saturated soils. Also, as an option a drive-point, open-hole piezometer is available with a cylindrical filter and square threads, or with the couple with EW-Rod drive rod.

## Monitoring Instruments

Readings of Vibrating Wire Pressure Transducer outputs may be made manually by means of a portable battery operated indicator, Model 52600. This indicator can read a single transducer or be connected to a multi-point terminal station by means of a jumper cable. The battery powered Model 52630 Recorder-Reader can be set up for a battery powered operation providing data print-out. Automatic data logging equipment may be interfaced to give the capability of digital print-out of all data through comparison, curve tracing and also transmission of data via telephone line to office print-out equipment.

slope

indicator

some

Since

## SPECIFICATIONS

Accuracy:  $\pm 1\%$  Range: 0 to 1000 psi (0 to 68.9 MPa)

Resolution: 0.1 psi (0.0069 MPa)

Pressure Range: 0 to 1000 psi (0 to 68.9 MPa)  
0 to 1000 psi (0 to 68.9 MPa)Sensitivity: 1000 mV/psi (14.3 MPa/psi)  
1000 mV/psi (14.3 MPa/psi)

Temperature Coefficient: 0.01% per °F (0.01% per °C)

Operating Temperature: -20 to 150 °F (-30 to 65 °C)

Over Pressure: 100% Range  
100% Range

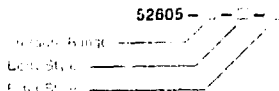
Diaphragm Displacement: 0.01 in. Range

## Materials exposed to fluid media:

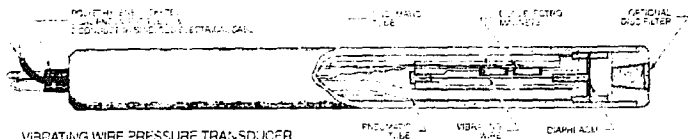
Body/Frame	Stainless Steel
Filter	Stainless Steel
g-Rods	Buna-N

## ORDERING INFORMATION

Specify by part Number as Shown Below:



Since this is a scientific instrument and measurements should be taken accordingly, and interpreted by qualified personnel, SINCOCO is not responsible for errors or omissions by such personnel.



VIBRATING WIRE PRESSURE TRANSDUCER

Body Style	Dash No.	Dimensions	Weight	Attachment Adapter
Epoxied in Placemeter with Disc Filter	1-1	1.0" OD x 10.8" long (25 x 274mm)	1.3 lb (60kg)	None
Borehole Piezometer with cylinder filter	1-2	1.0" OD x 13.0" long (25 x 330mm)	1.8 lb (74kg)	None
Drive-Point Piezometer with cylinder filter	1-3	1.0" OD x 15.3" long (25 x 393mm)	2.0 lb (91kg)	Square Threads 3 inch for EW-Rod 1.25" OD 1" male pipe thread
Transducer with disc filter	1-4	1.0" OD x 10.8" long (25 x 274mm)	1.3 lb (60kg)	1" female pipe thread
Transducer with no filter	1-6	1.0" OD x 10.8" long (25 x 274mm)	1.3 lb (60kg)	1" female pipe thread

Filter Style	Dash No.	Material	Dimensions	Air Entry Pressure	Pore Size
Cylinder	1-1	Norton A-undum	1.0" OD x 2.0" ID x 0.5" x 50mm	0	60 micron
	1-2	Polyethylene	1.0" OD x 0.5" ID x 2.0" ID x 50mm	0	60 micron
	1-3	Cooling Alumina	1.0" OD x 0.5" ID x 2.0" ID x 50mm	16 to 28 psi (1.1 to 1.92 x Pa)	15 micron
Disc	1-4	Sintered Stainless Steel	0.4" OD x 0.050" Thick (10 x 1.3mm)	0	50 micron

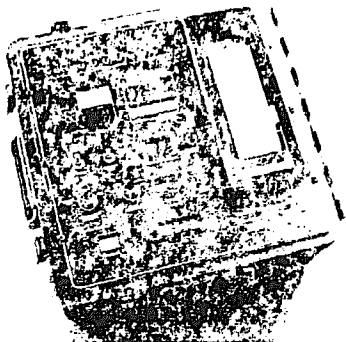


SINCOCO

SINCOCO, Inc. 1000 Albany Road, Albany, New York 12211  
 Tel: (518) 435-2100 SINCOCO, Inc. 1000 Albany Road, Albany, New York 12211

Printed in U.S.A.

# VIBRATING WIRE SCANNER/RECORDER model 52630



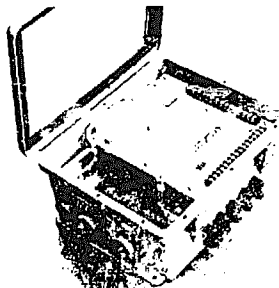
Model 52630 Vibrating Wire Scanner/Recorder

The Vibrating Wire Scanner/Recorder is a multi-channel data acquisition system that can automatically record strain data from one to ten Vibrating Wire Transducers, or up to one hundred transducers when Expansion/Junction Boxes are used. The system provides quick, accurate data for those projects requiring automatic and/or remote recording; sensitive, low drift measurements; rapid response; and very long leads between the transducer and readout point. It is a portable system that can provide telemetering from a remote location and continuous recording. It has rechargeable batteries or can be operated from either an external 12V DC source or AC line power. The recorder has a built-in electrosensitive printer or can be interfaced to any data terminal equipment satisfying EIA Standard RS-232C specifications for interface between data terminal equipment and data communication equipment. The system operates in a powered-down mode and can be programmed to record data at pre-set time intervals for periods up to a week or more from internal batteries, or even longer with external batteries.

The Model 52630 Vibrating Wire Scanner/Recorder is a portable instrument containing rechargeable batteries. It features a crystal controlled calendar and clock that can be monitored on the instrument panel, a built-in electrosensitive printer with automatic paper take-up, and a water-proof case for unattended operation even in adverse weather conditions. The Vibrating Wire Scanner/Recorder will turn on and record the date, time and output from all active channels at selected scan intervals or by remote command. It can also continuously scan and record all active channels at the maximum rate, or alternately monitor a single channel without recording. The data is displayed and recorded directly in units of microstrain and is indicated on a digital readout along with the channel number.

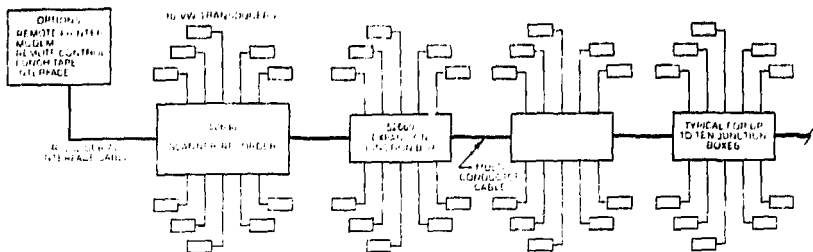
The Scanner/Recorder has a built-in capability for handling up to ten channels. Additional channels up to a maximum of one hundred can be recorded on the system. The Model 52660 Vibrating Wire Expansion/Junction Box can be connected to the system to provide additional channels. Each expander box provides ten additional channels.

Since this is a scientific instrument, measurements should be taken, recorded and interpreted by qualified personnel. SINCO is not responsible for errors or omissions of such personnel.



Model 52660 Vibrating Wire Expansion/Junction Box

slope indicator company **SINCO**



Vibrating Wire Scanner/Recorder System

## SPECIFICATIONS

### Model 52630 Vibrating Wire Scanner/Recorder

Channels:	10; can be expanded in multiples of 10, by using Model 52660, up to a maximum of 100
Resolution:	1 Microstrain/Digit
Temperature Coefficient:	$\pm (.008\% \text{ Reading} + .3 \text{ Digits})/^{\circ}\text{F}$ $\pm (.015\% \text{ Reading} + .5 \text{ Digits})/^{\circ}\text{C}$
Scan Cycle:	Continuous, minutes, hours, manual, remote
Interval:	1-99 minutes or hours
Printing Rate:	2 lines per second maximum
Scanning Rate:	30 Active Channels/Minute Minimum
Data Output:	8 bit even parity ASCII code with start/stop bits; serial by bit, serial by character
Data Interface:	EIA RS-232C Standard, others optional
Data Rate:	110, 150, 300, 1200 Baud (Bits per Second)
Oper. Time:	7 days* with fully charged internal battery *(Clock D 10 minute interval 10 active channels)
Power Requirements:	
Internal Battery:	12 volt rechargeable, 13.5 A.H.
External Power:	115/230 VAC, 50-400 Hz 11-14.7 VDC, 2 amp
Operating Temperature Range:	0°F - 120°F (-18°C to 49°C)
Dimensions:	15 in. x 15 in. x 10.5 inches (38.1 cm x 38.1 cm x 26.7 cm)
Weight:	50 pounds (22.7 kg.)

SOLO INDICATOR CO.

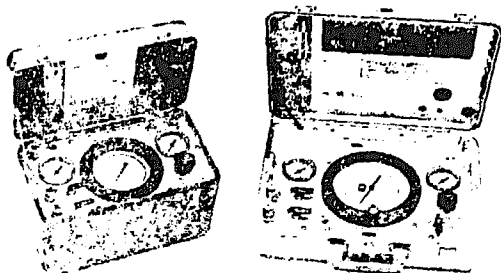
2066 North Ridge Rd., P.O. Box 6, Scottsdale, Arizona 85260

TEL: 602-944-2105 (TOLL FREE) 1-800-451-7773

TELEX: 150000 SOLO INDICATOR CO. U.S.A.

SOLE INDICATOR CO. U.S.A.

# Portable Pneumatic Indicators



Model 51421-A and 51431-A Indicators

The Slope Indicator Company's portable pneumatic indicators are quality built pressure measuring systems for operating pneumatic transducers to determine pore water, gas, or total pressure within embankments, foundations, slides, and other geotechnical study areas.

Enclosed in protective carrying cases for easy handling and operations, these indicators incorporate precision gauges, regulating valves, and a high pressure supply tank for maximum reliability and performance in field or laboratory use.

## DESCRIPTION

All indicators and their components are of the highest quality. The integral tank is high grade steel, commercially inspected to meet safety standards. Industrial quality compression type tube fittings and stacking hydraulic style panel connectors are standard to assure integrity. The indicator's panel is heavy-gauge anodized aluminum, with the internal tubing being stainless steel and nylon. The primary, or output pressure gauge is laboratory quality. A bourdon tube type design with mirror dial for increased reading repeatability and accuracy is used. Secondary gauges for supply, and tank pressure are industrial quality and are of the same bourdon tube type design, but made for continuous service and rugged application.

The indicator's controls and major components are labeled for easy identification and convenient

operations. The supply tank is filled through a panel connector so that the removal of the tank is not necessary. Secondary reference gauges monitor the actual internal and external tank and input supply pressures. Visual inspection of the gas flow through use of a flowmeter mounted in the lid of the case, aids the operator in maintaining a repeatable reference that is necessary in the operating procedures of most pneumatic transducers.

The indicators are designed to operate any of Slope Indicator Company's pneumatic transducers. Operational procedure of the indicator depends upon the type of transducer. A unique transferring circuitry within the portable indicator enables the operation of different types and styles of transducers by either connecting the primary/output pressure gauge in line with the input gas supply, or by isolating the output return. This circuitry also enables system analysis should problems occur due to damage or mishandling.

All portable pneumatic indicators, when selected with the proper primary/output pressure gauge for overall accuracy and range, meet the requirements to give dependable and reliable information for most geotechnical investigative studies.

Since this is a scientific instrument, measurements should be taken, recorded, and interpreted by qualified personnel. SINCO is not responsible for errors or omissions of such personnel.

slope indicator company



## SPECIFICATIONS

MODEL	51411-A	51411-A-AFC	51421-A	51421-A-AFC
Case Dimension	18 x 13 x 7 in (457 x 330 x 178 mm)		14 x 8 x 7 in (356 x 203 x 178 mm)	
Weight	28 lb (13 kg)		23 lb (10 kg)	
Gas Source	Indirect Tank			
Gas Tank Volume	84 cu in (1.38 liters)			
Gas Type	Dry Nitrogen — Standard Grade 99.99%, Pure Grade 99.999%			
Maximum Source Pressure	2000 psi (13,600 kPa)			
Maximum Operating Pressure	500 psi (3,400 kPa)	330 psi (2,200 kPa)	500 psi (3,400 kPa)	150 psi (1,050 kPa)
Flow Meter	0.1 to 10 SCFH			
Flow Controller	Manual	Manual/Automatic	Manual	Manual/Automatic
Output Pressure Gauge				
Scale Length	32 in (813 mm)		9 in (229 mm)	
Accuracy	0.1% Full Range		0.25% Full Range	
Sensitivity	0.01% Full		0.05% Full	
Temperature Compensation	-25° to 125° F Automatic, -25° to 50° C Automatic			
Zero Adjustment	Manual			
Parallax Compensation	Mirror			
Pressure Ranges				
psi	Standard	0-30, 0-60, 0-100, 0-150 psi	0-30, 0-60, 0-100, 0-160 psi	
	High Pressure	0-300, 0-500 psi	0-300 psi	0-360 psi
kg/cm <sup>2</sup>	Standard	0-2, 0-5, 0-7.5, 0-10 kg/cm <sup>2</sup>	0-4, 0-7, 0-11 kg/cm <sup>2</sup>	
	High Pressure	0-20, 0-40 kg/cm <sup>2</sup>	0-20 kg/cm <sup>2</sup>	0-20 kg/cm <sup>2</sup>
bara	Standard	0-200, 0-5	0-400, 0-700, 0-1100	
	High Pressure	0-2000, 0-4000 kPa	0-2000 kPa	0-2900 kPa
SINCO Transducers Operated by Indicators	514177, 514178, 514180, 51482, 514124		514177, 514178, 514180, 51482, 514124	

Also 514163, 51483

Also 514163, 51483

NOTE: All indicators are shipped with nitrogen supply tank empty. Indicator tank must be empty for air travel, unless packaging and labeling complies with Air Transport Restricted Articles Tariff No. 6-D CAB No. 82.

SINCO 7001424-0385 Printed in USA

**Slope Indicator Co.** 3668 Albion Place N., P.O. Box C-30316, Seattle, WA 98103 U.S.A.  
 TWX: 910-444-2205 (SINCO SEA) cable: SINCO SEA phone: (206) 633-3073

Colorado Sales Office: Slope Indicator Company 511 Orchard St., Suite 107 Golden, Colorado 80401 U.S.A. phone: (303) 279-7813

**SINCO**

Slope Indicator Canada Limited

A subsidiary of The Slope Indicator Company

Unit #5-11303 River Road, Richmond, B.C. Canada V6X 1Z5 telex 64-352948 VCR phone: (604) 278-2545