Durham Geo-Enterprises, Inc.

E-410
4-CHANNEL DIGITAL TRANSDUCER READOUT

Locate your machine's Model and Serial Number.
Should you ever need to call for service, you will need these numbers. You'll find them on a plate on the front side of your equipment.

Model # _____

Serial # _____

•You will need both of these numbers if you ever need to call for service.

You will also find it convenient to have the following information.

Sold by: _____

Date Purchased: _____

THE OPERATOR SHOULD READ THIS ENTIRE MANUAL CAREFULLY BEFORE ATTEMPTING TO OPERATE THIS MACHINE.

DANGER	Indicates serious injury or death WILL result if instructions are not followed.
WARNING	Indicates a strong possibility that serious personal injury or death may result if instructions are not followed.
CAUTION	Indicates a possibility that minor injury could result if instructions are not followed.
NOTICE	Indicates that equipment or property damage could result if instructions are not followed.
NOTE	Gives helpful information.

WARNING Do not attempt to remove any panels with the unit plugged in. Before examining the interior of this equipment, disconnect power to the machine. Either 110V or 220V are painful and cause serious injury to yourself and the machine.

SAFETY SUMMARY

This instrument is designed to prevent accidental shock to operate when properly used. however, no engineering design can ensure the safety of an instrument used negligently. Therefore, read this manual carefully and completely prior to operating the instrument. Do not remove the instrument or use it for purpose other than that for which it was intended without consulting the factory. Failure to do so could seriously damage the instrument or injure the operator.

UNIT DESCRIPTION

This unit is a microprocessor-based, intelligent digital panel meter, with a 9999 (1) display. it features 3 front panel soft keys that allow the user to select various setup features and to access various software features of the device.

AUTOCALIBRATION

An internal self-calibrating circuit replaces the need for potentiometer adjustments of the A/D section. The unit will self-calibrate once every 4 seconds to compensate for the internal drift that would be expected for the electronics.

SPECIFICATIONS

Power	115V AC (220V AC on request)
Display Rate	2 updates per second nominal
Response Time	750 ms typical for input step change
Environment	0 to 45 C operating temperature
	-40 to +85 C storage temperature
	80% relative humidity, non condensing
Range	100 mV (30.00 mV on request)

INSTALLATION

This unit has been setup and calibrated at the factory. Further adjustments by the user are not necessary and should not be attempted until you have read and understood this manual. Any unauthorized changing of scale factors, offsets, or other internal settings will void all written or implied warranties.

USING THE E-410

Congratulations! You have purchased a Durham Geo-Enterprises Inc. E-410 series Digital Readout. Before using your Readout, please read the following sections carefully. The basic operation of the unit is simple, however by taking a few minutes to familiarize yourself with the unit and its many features, you will be able to use the device to its full capabilities.

SETTING UP

To set up the device, remove it from its packing and place it on a flat, level surface. The handle on the Readout is designed to be used as a stand. To turn the unit on, plug it into a 110V AC outlet. The display will come on. Attach the mating transducing device by plugging it into the input socket on the back panel of the Readout. The unit should now be displaying a stable reading around 0.

> THE READOUT AND TRANSDUCERS HAVE BEEN CALIBRATED AT THE FACTORY AND ARE MATCHED. BE SURE THAT YOU HAVE PLUGGED THE TRANSDUCING DEVICES INTO THE PROPER INPUT SOCKETS. CHECK THE SERIAL NUMBERS OF THE TRANSDUCERS WITH THE CHART IN THE BACK OF THIS MANUAL.

The units displayed by the Readout are standard English engineering units (unless otherwise requested).

To use the unit, simply apply a load, pressure, or displacement to the transducing device. The display will show the load applied.

USING THE SOFT-KEYS

The soft-keys in the front panel are used to access the various functions available with the E-410. The functions include:

1. Peak-Hold
2. Set-up

A brief discussion of the use and function of the Peak Hold keys follows. The set-up function will be discussed in the section on calibration.

Peak Hold Function

The Peak Hold function allows the E-410 to save and display the highest or lowest value input to the device between Peak Hold clears. To view the maximum peak value, depress the **up arrow** key. The Readout will display the peak value as long as you hold the **up arrow** key down. To reset the peak function, depress the **up arrow** key and the "S" key at the same time. The Readout will display -9999. This indicates that a peak reset has occurred. When you see
-9999, release both keys.

To view the minimum peak value, depress the **down arrow** key. The Readout will display the minimum value as long as you hold the key down. To reset the minimum peak value, depress the **down arrow** key and the "S" key simultaneously. The Readout will display +9999 . This indicates that a peak reset has occurred. When you see +9999, release both keys.

There are several other features of the E-410 Digital Readout that you should be aware of. If you are using a Durham Geo-Enterprises Inc. transducing device, you now have enough information to begin using the device. If you have a non-Durham Geo transducer or want to know more about setting up and calibrating the Readout, please continue.

POWER SUPPLY

The E-410 generates 10V DC to energize its mating transducer. All Durham Geo-Enterprises Inc. pressure transducers, load cells, and displacement transducers are compatible with this excitation voltage. The E-410 has the capacity to supply 90mA of current to its mating transducing devices. If the device you are attaching to the E-410 have a total resistance greater than 110 ohms, please check with the factory. Attachment of total resistances greater than 110 ohms may result in damage to the Readout or transducing devices.

If you are using non-Durham Geo products with your unit, please check with the manufacturer to insure that no damage will occur to the Readout or transducer.

INPUT

The E-410 will accept a maximum of 100mV from a transducing device. An output of more than 100mV will result in a display of "OFLO".

WIRING CONFIGURATION

The input socket on the back of the Readout is wired as follows:

Pin 1 -Signal 100mV
Pin 2 +Signal
Pin 3 not attached
Pin 4 -Supply 10V DC
Pin 5 +Supply

The pin position is shown on the data sheet at the back of this manual. To prevent damage to the Readout or transducer, please conform to this wiring specification when using non-Durham Geo transducers.

If you have purchased a Readout with an analog output, the output pins are connected as follows:

Pin 1 +DC Rail
Pin 5 -DC Rail

For further information on wiring and hookups, please call the factory.

MAINTENANCE

The E-410 is designed to be maintenance free. It is an electronic device and should be treated as one. Do not expose the Readout to temperature extremes, high humidity or water. Try to avoid setting objects on top of the Readout, and keep the unit reasonably clean. By using a little common sense when operating the unit, it should give you years of trouble free service.

CALIBRATION AND SET-UP

The E-410 is classified as an intelligent digital display. The unit is controlled by a microprocessor. This allows the user a great deal of flexibility in setting up the readout for specific applications. The microprocessor allows for ease in changing engineering units, configuring options, and permits customization of calibration fits for specific needs.

The E-410 utilizes a single scale calibration fit for four transducers. This feature is unique among digital readouts in this price range. This option allows you to attach up to four transducing devices to the Readout and by means of an interlocking switch, read a desired transducer.

Using the Set-Up Program

The calibration data for the E-410 is contained in the SETUP program which is permanently stored in memory. Access to the SETUP program is protected by the lockout code. The lockout code for this Readout is "28".

To enter the SETUP program, depress the "S" key in the front panel of the Readout. The display will prompt "SETUP" then go to "0". At this point, use the **up arrow** and **down arrow** keys to display the lockout code. Press "S" to enter the code. If you have entered the correct code, the display will flash "INPUT", then display a numeric value. This value is the actual mV output of the attached transducing device.

By depressing the "S" key, you can scroll through the menu of choices available in the SETUP program. These choices are:

DISPLAY	VALUE
Input	See certificate
OFFS0	See certificate
SCAL0	See certificate
OFFS1	See certificate
SCAL1	See certificate
OFFS2	See certificate
SCAL2	See certificate
OFFS3	See certificate
SCAL3	See certificate
dP	varies(decimal point flashes)
run	Active

By using the **up arrow** and the **down arrow** keys, the display value can be changed to the proper values. In the following calibration discussion and example, use of these keys and the "S" key allow movement through the program.

Calibration

To calibrate the E-410 and a transducing device, you will need a few items specific to the task. These include:

1. Some type of variable load application device. For example: a dead weight transfer for pressure, height gauges for displacement, calibration load cells for load.
2. Pencil and paper
3. Calculator

Calibrating the E-410 consists of gathering mV input data at 2 predefined loads and then using this data to calculate scale factors and offsets. In mathematical terms, the scale factor is the slope of a linear approximation of the gathered calibration points. The offset is the deviation of this line through the origin.

Two data points should be taken. Typical behavior of transducing elements suggests that readings should be taken at no load (0) and at full load. For example, on a 150 psi transducer, input m V readings would be taken at 0 PSI and 150 PSI. Set up a chart like the one below to record data.

load (psi)	mV (input)	The mV are recorded by placing the Readout in the "INPUT" mode of the SETUP program. The values displayed in "INPUT" are actual mV coming from the transducer. For example, a display of 1382 is a 13.82mV signal from the transducer.
0	-12	
150	6898	

After recording the input data, the nest step in calibrating is to calculate the scale factors and offsets. The scale factors are calculated by using the following formulas.

$$SCALX = \frac{HI\ (DISPLAY) - LO(DISPLAY)}{HI(mv) - LO(mv)}$$

When putting the values for (DIPLAY) into the equation, ignore the decimal point. For example, a HI(DISPLAY) of 150.0 PSI would be entered into the formula as 1500. For our example:

$$SCALX = \frac{HI\ (DISPLAY) - LO(DISPLAY)}{HI(MV) - LO(MV)} = \frac{1500 - 0}{6898-(-12)6910} = \frac{1500}{} = .2171$$

The offsets are calculated by the following formulas:

OFFSX = LO(DISPLAY) - [(SCALX)*LO(mv)]

The same rule of ignoring decimal points when entering **DISPLAY** values into the formulas applies here. The "**OFFS**" feature will only allow you to enter an integer, so we will round off our final answer to the nearest whole number. For our example:

OFFSX = LO(DISPLAY) - [(SCALX)*LO(mv)] = 0 - [(.2171)* (-12)] = 0-(-2.6)
OFFSX = +3

You will need to repeat the above procedure for each transducer that will be attached to the Readout. Write each scale factor and offset down, and mark the transducer with the number of the socket it is attached to.

With these values calculated, we can now enter them into the SETUP program. By depressing the **"S"** key, scroll through the menu until you see **"OFFS0"**. Using the **"up arrow"** and the **"down arrow"** keys, enter the value you have calculated for **OFFS0** (transducer #1). Press the **"S"** key to enter this value and to scroll to **"SCAL0"**. Enter the calculated value for **"SCAL0"**. Depress the **"S"** key and scroll to **"OFFS1"**. Enter the offset of transducer #2. Depress the **"S"** and enter the scale factor for transducer #2.

Depress the **"S"** key and scroll to **"OFFS2".** Enter the calculated value for **"OFFS2"** (transducer #3). Depress the **"S"** and scroll to **"SCAL2"**. Enter the calculated value for **"SCAL2"**. Depress the **"S"** key and scroll to **"OFFS3".** Enter the offset for transducer #4. Depress the "S" key and enter the scale factor for transducer #4.

Using the **"up arrow"** and **"down arrow"** keys, move the decimal point to the proper place. The decimal point is fixed for all readings. This is not a problem if you have similar devices attached to the readout. However, if you have mixed devices attached, you may want to leave off the decimal or fix it for the most read transducer.

Depress the **"S"** key again and release it at the **"run"** prompt. The unit will go blank, flash **"run"** again, then display numeric data. The E-410 has now memorized the calibration settings and is ready for use. A quick check of the unit should verify that it is displaying the proper readings.

In summary, the following steps should be taken to set the calibration of the unit:

1. Place the E-410 in the "INPUT" mode of the "SETUP" menu.
2. Take two readings of mV input and record them. Suggested readings are at 0 and full load.
3. Calculate OFFSET and SCALE FACTOR
4. Enter the calculated values for the scale and offset into the readout.
5. Set the decimal point.
6. Exit the SETUP mode into the RUN mode and test your calibration.

Hopefully, these instructions have provided you with some insight into the operation of the E-410. If you have any questions about this manual, your Readout or applications, please contact

1-800-837-0864 (domestic-toll free)
1-770-465-7557 (inside GA or international)

WARRANTY STATEMENT

Durham Geo-Enterprises Inc. warrants that equipment shall be free from defects in material and workmanship for a period of **90 days** from the time equipment is put into service. In any event, the warranty period will not exceed **6 months** from the date of shipment.

Durham Geo-Enterprises Inc. liability shall be limited to replacement of components or equipment (at the manufacturer's discretion) that have been determined by the manufacturer to be faulty. No claims in excess of component replacement value will be recognized. Durham Geo-Enterprises Inc.will not be held liable for damages or lost business relating to a warranty claim.

Specifically excluded from this warranty are claims deemed by the manufacturer to have resulted from normal wear and tear, improper use, or abuse of the equipment.

For a complete warranty disclosure, please call 1-800-837-0864 (outside GA) or 770-465-7557 (inside GA) or refer to the printed statement on the back of any Durham Geo-Enterprises Inc. original invoice.