OPERATING MANUAL

Data Readout

HM-418/418F • HM-419/419F

HM-418 Two Channel Data Readout

HM-419 Four-Channel Data Readout

Rev: 08/2021

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CHANGES AND NEW FEATURES

New Sensor Capabilities 6/20/2018

The readout can now supply constant current excitation (1 mA) in addition to +5 and +10 Volts DC.

Windows Software Update Beta version released 12/09/2016

New data acquisition program, GETDATA Version 5 for Windows 7,8 10. Also compatible with legacy Windows Xp systems. The program can also be used to replace all older Windows versions of GETDATA without changes to the readout.

The password for accessing the readout calibration factors from GETDATA is eliminated.

RS232 Data Output Discontinued 12/16/2016

Units now use a built in USB adapter. Serial communications drivers are provided to create a virtual COM port for use with GETDATA

Firmware Version 2.01K Released 1/20/2011

The readout now supports two complete and independent calibrations stored in nonvolatile memory. This allows different units systems for the same sensor calibration factors or calibrations for two different sets of sensors. The selection is made through the MENU options key on the readout.

The front panel calibration routine now allows changes to ALL parameters including channel name and unit labels. Complete calibrations can be performed without the need for the GETDATA program or a PC. Calibrations can also be performed through GETDATA Version 4.30, which is now required for compatibility.

Firmware Version 2.01H Released 11/17/2009

Serial Communications handshake was eliminated to improve communications with the PC. This requires GETDATA version 4.12A.

PRECAUTIONS AND WARNINGS

RISK OF INJURY OR DEATH FROM SHOCK OR ELECTROCUTION!

The readout power requirements are shown on the back of the device. **CONNECT THE UNIT TO THE PROPER ELECTRIC SUPPLY VOLTAGE**

The readout is often used in locations where exposure to moisture is possible.

DO NOT DEFEAT THE SAFETY OF THE EARTH GROUND BY REMOVING THE GROUND PIN FROM THE POWER CORD OR BY USING AN UNGROUNDED CORD

If you are unsure of the condition of the building electrical system grounding, contact a licensed professional electrician to perform an inspection.

THE UNIT MUST BE CONNECTED TO A PROPERLY GROUNDED ELECTRIC SUPPLY

Calibrating the readout may require removing the cover to access internal jumpers or switches.

ALWAYS SWITCH OFF THE UNIT AND REMOVE THE POWER CORD FROM THE WALL SOCKET AND THE BACK OF THE READOUT BEFORE REMOVING THE COVER.

DO NOT RECONNECT THE POWER CORD UNTIL THE COVER HAS BEEN REINSTALLED.

RISK OF FIRE OR OTHER DAMAGE!

REPLACE THE INTERNAL POWER FUSE WITH A FUSE OF THE SAME TYPE AND RATING AS SUPPLIED.

REPLACE THE POWER CORD IF IT BECOMES WORN OR FRAYED OR THERE IS ANY DAMAGE TO THE COVERING OR CONNECTORS

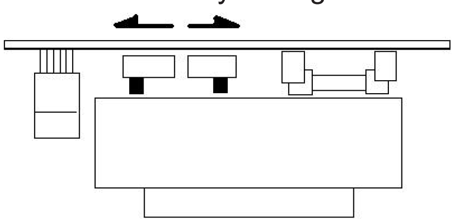
DO NOT DEFEAT THE SAFETY OF THE EARTH GROUND BY REMOVING THE GROUND PIN FROM THE POWER CORD OR BY USING AN UNGROUNDED CORD, WALL OUTLET OR POWER SOURCE

AC POWER REQUIREMENTS AND AVOIDING ELECTRICAL INTERFERENCE

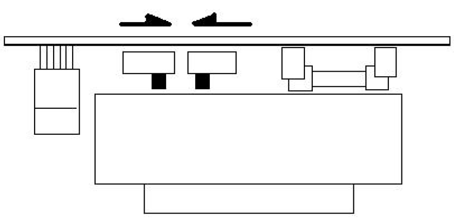
Before connecting this unit to the AC power determine the AC voltage supplied by the building. In the USA this is normally 120 Volts but can be 230 VAC under certain circumstances. In other countries the voltage must be determined (120 or 230 VAC). The setting of the readout will be shown on the rear of the unit next to the power inlet. If this is not correct follow these instructions.

To set the correct voltage **DISCONNECT THE POWER CORD FROM THE UNIT.** Open the unit by using a flat screwdriver to PUSH IN the locking tab on each side of the unit and twist GENTLY. Examine the switch settings on the top of the power supply as indicated below:

Slide both switches away from each other for 120 VAC. This is the factory setting.



120 volts AC
Slide both switches OUT
in the direction of the arrows



230 Volts AC
Slide both switches IN
according to the arrows

Slide both switches toward each other for 230 VAC.

Do not slide both switches in the same direction. **Mark the back of the readout with the corrected voltage setting.**

If the test equipment does not provide a designated power outlet for the readout, connect the readout to the same power outlet as the PC that will be used to record data. This should be surge-protected. The PC and readout should share the same ground point to prevent interference from the load-frame or other test equipment.

If power is supplied from a generator The voltage MUST be a noise free, stable sine-wave output. Filtering and noise suppression MUST be employed to avoid interference with and damage to the unit.

Accessing the Calibration Factors from the Readout Front Panel

The following information should only be given to persons qualified and authorized to perform calibrations or modifications to the readout.

The key sequence to access the front panel calibration is:

1. Press and hold the TARE key.

2. Press and release the CLEAR key.

3. Release the TARE key.

4. At the prompt “Calibration?”, repeat steps 1-3.

The meanings and settings of each factor are explained further on in this manual.

The external calibration no longer requires entering a password to access the calibration factors when using GETDATA version 5. Please read the instructions in the GETDATA documentation.

FRONT PANEL CONTROLS

Power Switch: See ‘Specifications’ for AC power requirements. Be sure the readout is connected to a properly grounded source at the proper supply voltage.

Keys: NOTE: There may be one or more ‘spare’ keys depending on the number of channels or installed features. Some of these may be active only during certain ‘menu’ or other functions. Their function will be listed on the display, over the corresponding key.

MENU: Allows access to user selectable options. The Menu key may temporarily change the function of the other keys as described below.

TARE: Subtracts displayed value from subsequent readings. Used to remove initial offsets from data and display a value of zero. Each channel can be zeroed individually.

PEAK: Displays the maximum measured value of the selected channel and values of all other channels when that value occurred.

CLEAR: Used to reset or clear a desired function such as the peak reading or the tare on a selected channel.

REAR PANEL CONNECTIONS

Refer to figure 1 for the two channel readout or figure 2 for the four channel. There will be two or four input connections plus the AC power and data connector. The channels are numbered from left to right starting with 1.

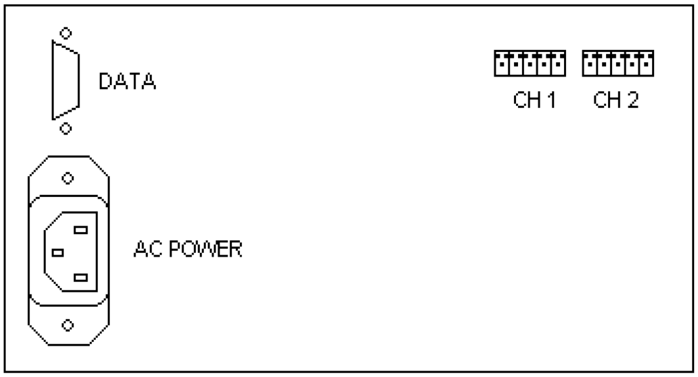


Figure 1 Two Channel - Rear Connections

The data connector serves as the I/O port for the data acquisition and calibration program. The USB port will be seen by the PC as a virtual COM port. Refer to the GETDATA instructions.

The power connector accepts a standard IEC 60320 cord. Be sure that the AC supply is the correct voltage for the readout. The required input voltage can be changed on the internal power supply. THE UNIT MUST BE PROPERLY GROUNDED FOR SAFETY and to prevent electrical interference from corrupting data.

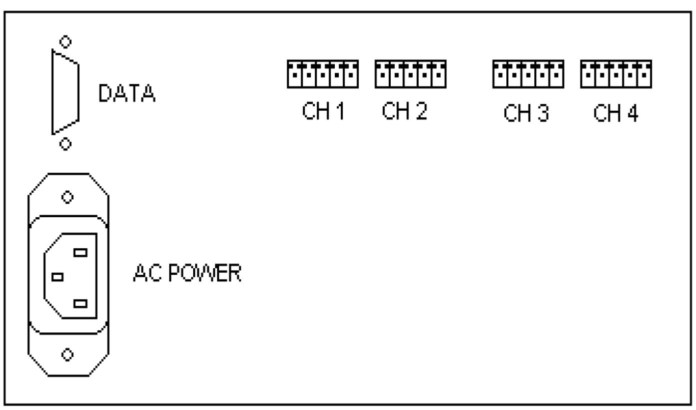


Figure 2 Four Channel - Rear Connections

Additional rear panel connectors will be present if the relay alarm option is installed.

SETUP AND OPERATION

The readout is usually supplied with transducers and a complete calibration. Calibration factors are stored in non-volatile memory. Calibration factors for converter "counts" and scaling to engineering units can be accessed from the front panel or through the serial port using the setup program running on a PC. Loading calibration factors from or to a file and other options can be set by the user only through the external program. Refer to the instructions provided elsewhere for details. If you are connecting your own sensors to the readout, read the section on interfacing transducers to the readout for proper signal connections and internal jumper settings. If data is to be sent to a PC, the data cable must be connected to the back panel connector. The PC should share the same AC ground as the readout.

Ensure that the unit is connected to a properly grounded AC outlet using the correct power cord. The sensors must also be connected to the correct inputs on the back panel. Alarm relays should also be connected if supplied.

After switching on the power, the unit will display the data from each channel unless the relay option is installed. In this case, the following message will appear:

POWER LOST

CLEAR ALARMS?

Press **CLEAR** to continue **IF YOU ARE SURE THAT CLEARING THE ALARMS WILL NOT CREATE A DANGEROUS SITUATION.** Refer to the supplemental instructions for details.

Data is not stored in the unit. Data is accessed through the data port. Some type of software program must be running on the PC in order to send commands to or read data from the readout. Refer to the section regarding the serial port commands for more information. A Windows based program named 'GETDATA' is provided with the readout to allow viewing the data as collected and recording to a computer. This program also includes a calibration function that can be used in place of the front panel calibration routine. Refer to the instructions provided with the program.

FRONT PANEL KEY FUNCTIONS

MENU: The MENU key selects user options such as the Peak reference channel, automatic tare settings, alarm limits and alternate calibration factors. Each time MENU is pressed the next option will be displayed. To change a desired option press MENU to step through the available options until the desired selection is displayed. To skip an option press MENU. After all options have been shown the readout will return to normal operation. When the readout is in ‘menu’ mode data acquisition and serial communications are suspended.

TARE: To subtract the displayed offset and “zero” a channel press TARE. The display shows:

TARE CHANNEL?

The bottom line of the display will show the channel names over the keys. Press the key corresponding to the desired channel. The display will return to normal with the selected channel reading zero. Repeat these steps to tare a new channel or the same channel again.

The TARE function allows a channel to be set to zero by subtracting any initial offset from all subsequent readings. Each channel is treated individually.

Tares may be cleared individually or simultaneously. Press CLEAR. The display will prompt ‘CLEAR?’. The lowest line of the display will show ‘TARE PEAK’. Press the key below TARE. Press the key for the desired channel to clear or press MENU to clear all tares. The setup/calibration program allows the tare function to be disabled for any channel. Attempting to tare such a channel will cause the readout to momentarily display the message ‘TARE LOCKED’ and then return to normal display mode.

PEAK: To view the current peak data press PEAK.

The label (channel name) of the chosen trigger channel will change to ‘PEAK’ to show which channel is the reference for the data.

The Peak function allows the display of data relevant to the occurrence of a maximum value on any desired channel. When a peak is detected the readings of all channels are saved and can be viewed by pressing the PEAK key. While the peak is being displayed, data is continuously read and the peak values of all channels are updated. This will show on the display if a new (higher) peak reading is detected. To return to normal data display press PEAK again. The peak data is saved until a new peak occurs or the peak is cleared.

CLEAR: The CLEAR key is used to reset the tare and peak data. If the optional alarm relay board is installed, the relays can be reset after an alarm condition is cleared.

To clear the current data, press the CLEAR key. The display will show

CLEAR?

and prompt you to select the TARE, PEAK, and optionally ALM (alarm). To exit the clear function without changes press MENU at this time.

Press PEAK to clear the current peak reading. The display will show

CLEAR PEAK?

YES NO

Press the desired key: YES to clear the peak reading or NO if the function was selected by mistake.

Press TARE to clear the tare settings. Channels to be cleared will be listed on the bottom line of the display, over the keys. Press the key corresponding to the desired channel. All tares may be cleared at once by pressing MENU. If a channel name does not appear in the list, the tare has been disabled for that channel. Refer to the calibration instructions for details.

If the OPTIONAL Alarm Relays are installed:

Press ALM (Alarm) to reset all alarm relays and re-energize the equipment connected to the relays.

DO NOT ATTEMPT TO CLEAR THE ALARM UNTIL IT HAS BEEN DETERMINED THAT IT SAFE TO DO SO. If the alarm condition (such as an overload) has passed and the equipment is safe, press ALM. The relay will return to its normal state. If the alarm condition is still present, the relay will not release.

DESCRIPTION OF MENU KEY FUNCTIONS

When the readout is in normal operating mode pressing MENU will allow changing various settings. To skip over an item press MENU again. Currently the MENU options available are:

Select an alternate calibration from internal memory

Select the PEAK reference channel

Set the ‘seating level’ for the auto-tare function (optional, two channel only) Set alarm trip levels (optional)

ALTERNATE CALIBRATION

This feature allows the selection of an alternate calibration stored in memory. This can be the same sensor calibration scaled to a different units system or a completely different calibration for an alternate set of sensors. The display will prompt

ALT CALIBRATION?

CAL1 CAL2

Press the key below the desired calibration. In a typical unit, CAL1 is English units (lbs, in, psi) and CAL2 is metric units (kN, mm, kPa). The readout will prompt for a new peak reference channel (described below) by displaying the channel names of the new calibration. If the calibration is not the desired one, press MENU until the display again prompts for an alternate calibration and select the other.

PEAK REFERENCE

This menu item allows the user to select the desired channel for capturing a peak or maximum event and retaining data occurring with that event (at the same time) on all other channels. The display shows

PEAK REFERENCE

and the bottom line of the display will show the names of each channel over one of the remaining keys. Press the key corresponding to the desired channel. Continue to press the MENU key, ignoring other menu options until the display returns to the normal data display.

When the AC power is switched off the setting of the peak channel is lost and will be reset to the default peak channel (set during setup/calibration) when power is restored.

SEAT Load (optional on two channel versions only)

The automatic tare (seating) function monitors the input to channel 1 (typically Load) and performs a tare (to zero) on channel two when a preset SEAT value is read. This is typically a very small load or force used to tare a displacement transducer when the loading element first comes in contact with the sample and is intended to simplify repeated tests such as Marshall Stability.

As an example, in a typical application the readout is fitted with a load cell on channel one and a displacement transducer on channel two. These are installed on a load frame. A sample is placed in the frame and force is applied. When the seating load (perhaps a pound or so) is reached, a tare is automatically performed on channel 2 to zero the displacement. When the peak load is reached the displayed displacement is measured from the point of the seating load. Be sure to set the value as low as possible.

1. To set the seating value press MENU until the display shows

SEAT <channel name> <channel units>

Below this will be a number with a blinking cursor at the far left. This is the value at which the tare will be triggered.

2. Press TARE to advance the blinking cursor to the desired digit to change. Press PEAK to increment the digit. The digit will increase from 0 through 9 and back to 0.

3. To change the sign of the value place the cursor at the left most position by pressing TARE until the cursor warps around to the first position. Press PEAK to toggle the sign between positive (blank) and negative (-).

4. To move the decimal point press TARE until the cursor is over the decimal point. Press PEAK to move the decimal point to the right. At the end of the number the decimal point will wrap around to the first digit position.

5. To disable the auto-tare function simply set the seating value to a high level that is not likely to be encountered during the test, such as full scale. This is the default setting from the factory.

6. To exit the setting function press MENU to display the alarm setting functions or repeat until the display returns to normal operation. The value displayed will be written to permanent memory and will be available for all subsequent tests.

After the test is complete **and the output of the load channel is below the seating value**, press CLEAR, then TARE, and then the desired key indicated on the display to clear the tared channel. Remember that at any time channel one output reaches the seating value, channel two will be set to zero. The output of channel 1 must be below the seating value before the tare on channel 2 can be removed.

LOW ALARM and HIGH ALARM (optional)

The readout can be provided with up to four alarm relays that can be used to signal that a preset value has been reached. This signal is in the form of standard 'form C' relay contacts that can be used to stop a motor or release a pressure valve, for example. On a 2 channel device, two relays are available for each channel. The alarm values are designated LOW and HIGH but this is somewhat arbitrary. On a 4 channel device only one relay is available for each channel, designated as the HIGH alarm value. The alarm settings can be anywhere within the valid signal input range of the connected sensor. All alarms are 'latched', meaning the relays remain in the alarm state until they are manually reset by the operator.

1. To set an alarm press MENU until the desired channel and alarm level (LOW or HIGH) is displayed. The display will show

<channel name> LOW ALARM or <channel name> HIGH ALARM

Use the same procedure described above for setting the numeric seating value to set the desired alarm value.

2. Press MENU to store the displayed value and advance to the next alarm or menu item. Alarm values are stored in non-volatile memory and are used for subsequent tests.

To disable the alarm function for a desired channel, set the alarm value to a level that will not be achieved during a normal test. As a default, the alarms are set to -10% of the channel's full scale calibration point for the LOW alarm and +110% of full scale calibration point for the high alarm. The full scale calibration point is that value stored in memory and NOT the full scale range of the transducer.

PRECAUTIONS FOR THE ALARM FUNCTION

The alarm levels set in the menu function are scaled magnitudes and assume a value of zero as a starting point. Thus if a tare is performed on a channel that is already indicating a large initial value and the alarm level is, for example, full scale; the alarm level may not be reached and an alarm cannot be tripped before damage is done to the transducer or other equipment.

THERE IS ALSO A RISK OF INJURY TO THE OPERATOR OR OTHERS.

Be sure that the transducers have sufficient measuring range to accommodate the desired measurement AFTER any tare. The alarm levels must be set within the remaining available range.

ALARM CONDITIONS AND POWER FAILURE

During normal operation in the non-alarm condition, each relay is energized and the contact conditions Normally Closed (NC) and Normally Open (NO) are as indicated on the connector panel of the readout. The contacts change state to signal an alarm. They also change state if power to the readout is interrupted. All relays are in the alarm condition upon application of power to the readout. When power to the readout is restored the power-fail alarm condition cannot be reset until the alarm condition is cleared manually. In addition, all tares in the readout will be cleared. This can cause the controlled equipment to restart in an unknown state. The operator MUST ensure that the equipment will re-energize in a safe manner before clearing an alarm.

EXTERNAL FAIL-SAFE CIRCUITS OR CONTROLS SHOULD BE EMPLOYED TO PREVENT RESTARTING AN APPARATUS UNDER UNSAFE CONDITIONS.

Clearing an alarm is described under the CLEAR key description.

CONNECTING SENSORS AND CALIBRATING THE UNIT

The readout is usually fitted with sensors and calibrated at the factory to customer requirements. It is ready to go out of the box. If it is necessary to install new sensors follow the procedure below. If you are only replacing an existing sensor or adding one of the same type and configuration, skip to the section entitled **"Calibrating the Unit from the Front Panel".**

Before connecting a transducer or signal source to the readout, internal jumpers on the signal conditioning card must be set to select the proper input range and excitation voltage.

Refer to figure 3 for the jumper locations and figure 4 for typical sensor wiring connections.

Each channel has jumper blocks for setting the excitation voltage or current (E, F, and G) for the sensor, a group of two jumpers (A & B) for selecting the input range, and two jumper positions (C or D) for selecting unipolar or bipolar input function. Refer to figure 3 below.

When setting up the readout for two different calibrations and different sensors are required, the required jumper settings may be different. If so the jumper settings must be changed before selecting an alternate calibration.

After a calibration is complete record all settings for future reference. Use the calibration function in GET-DATA to read the calibration from the readout and write it to a file as a backup.

RISK OF INJURY OR DEATH FROM SHOCK OR ELECTROCUTION!

Calibrating the readout may require removing the cover to access internal jumpers or switches.

ALWAYS SWITCH OFF THE UNIT AND REMOVE THE POWER CORD FROM THE WALL SOCKET AND THE BACK OF THE READOUT BEFORE REMOVING THE COVER.

DO NOT RECONNECT THE POWER CORD UNTIL THE COVER HAS BEEN REINSTALLED.

SIGNAL CONDITIONING CARD SETTINGS AND CONNECTIONS

JUMPER SETTINGS FOR EACH CHANNEL

OUTPUT FROM SENSOR

	JUMPER A	B	C	D
0-5 V			X	
0-200 mV	X		X	
0-100 mV		X	X	
0-66 mV	X	X	X	
+/- 2.5 V				X
+/- 100 mV	X			X
+/- 50 mV		X		X
+/- 33 mV	X	X		X

NOTE: JUMPERS C AND D
MUST NOT BE INSTALLED AT THE SAME TIME

EXCITATION

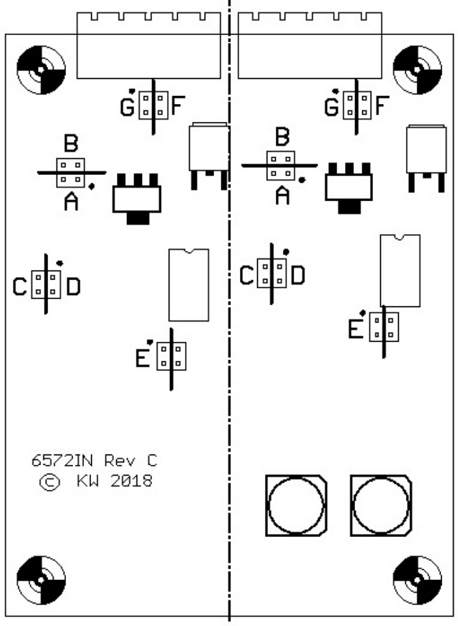
JUMPER	E	F	G
5.00 V	X	X	
10.00 V		X	
1.00 mA	*		X

* DON'T CARE

NOTE: JUMPERS F AND G
MUST NOT BE INSTALLED AT THE SAME TIME

X = JUMPER INSTALLED
REMOVE ANY JUMPERS FROM UNMARKED POSITIONS

INPUT CONNECTOR, CH2 OR CH4 | INPUT CONNECTOR, CH1 OR CH3



INPUT CONNECTOR PIN IDENTIFICATION
VIEWED FROM REAR OF READOUT

• • • • •
1 2 3 4 5

1 E+, EXCITATION POSITIVE
2 E-, EXCITATION RETURN
3 S-, SIGNAL NEGATIVE
4 S+, SIGNAL POSITIVE
5 SHIELD, FRAME GROUND

Figure 3

SETTING THE JUMPERS

First, determine the following information for each sensor:

1. Required DC excitation. The readout can provide 5.00 or 10.00 volts DC or 1.00 milliamps DC.

2. The voltage output from the sensor at the maximum expected input to the sensor.

Usually this is the output voltage at the full-scale rating of the device and is provided on the calibration data sheet. If the output is specified as sensitivity in mV/V, the full-scale output is equal to the sensitivity multiplied by the excitation voltage.

3. The sense (direction) of the output. In most sensors the output is unipolar, meaning that the output increases from the zero-input value. In some cases, such as a load cell in a universal tester, the load cell can be stressed in compression OR tension. This results in an output that can change from zero volts to PLUS or MINUS full-scale voltage. This is an example of a bipolar output.

4.Determine the required jumper settings for each channel on the input card from the tables in figure 3.

Jumpers A & B set the input range according to the full-scale output of the sensor.

Jumpers C & D determine unipolar or bipolar input. NOTE: Do not install both jumper C and jumper D at the same time. There must, however, be a jumper at position C or D at ALL times.

Jumper E determines the voltage excitation level (+5 or +10 VDC). Jumper E has no function if current (milliamp) excitation is selected.

Jumpers F & G determine voltage or current excitation. Do not install both jumpers at the same time. There must be a jumper at position F or position G at ALL times.

Unused jumpers may be installed on a single pin for storage.

5. Determine the required electrical connections for the sensor. Refer to the sensor manufacturer's data and figure 4 below.

SIGNAL CONDITIONING CARD SETTINGS AND CONNECTIONS

JUMPER SETTINGS FOR EACH CHANNEL

OUTPUT FROM SENSOR / JUMPER

	A	B	C	D
0-5 V			X	
0-200 mV	X		X	
0-100 mV		X	X	
0-66 mV	X	X	X	
+/- 2.5 V				X
+/- 100 mV	X			X
+/- 50 mV		X		X
+/- 33 mV	X	X		X

NOTE: JUMPERS C AND D MUST NOT BE INSTALLED AT THE SAME TIME

EXCITATION

JUMPER	E	F	G
5.00 V	X	X	
10.00 V		X	
1.00 mA	*		X

* DON'T CARE

X = JUMPER INSTALLED
REMOVE ANY JUMPERS FROM UNMARKED POSITIONS

NOTE: JUMPERS F AND G MUST NOT BE INSTALLED AT THE SAME TIME

INPUT CONNECTOR, CH2 OR CH4 | INPUT CONNECTOR, CH1 OR CH3

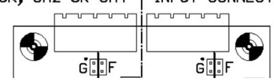


Figure 4 Typical Input Connections

TRANSDUCER CONNECTION EXAMPLES

Bridge type transducer, load cell, or pressure transducer with unipolar output

The specifications for a typical bridge type transducer are 3 mV/V sensitivity and 10.0 V excitation.

The excitation is DC volts. Install jumper F.

The excitation is set to 10 Volts by removing jumper E. The jumper can be left hanging on a single pin for storage.

Install jumper C for unipolar output.

The output at full scale will be 3 mV/V x 10 V = 30 mV. Select the combination of jumpers A and B to provide the closest full-scale input range that is greater than this (66 mV for unipolar input). Install jumpers A and B.

The sensor connections are shown in figure 4-A

Bridge type transducer, bipolar output application

A load cell is designed for loading in compression or tension and will be used in a universal testing frame. As above the excitation is 10 Volts and the full-scale sensitivity is 3 mV/V. This is the default configuration for factory calibrated load cells.

The full-scale output is 30 mV. The input direction is bipolar.

Install jumper F for voltage excitation. Remove jumper E for 10 V excitation.

Install jumper D for bipolar input. There should NOT be a jumper at position C. Install jumpers A and B for 33 mV input span.

The sensor connections are shown in figure 4-A

Potentiometer / Linear Displacement Transducer. Also refer to Appendix A

The output voltage from a potentiometer is directly proportional to the excitation voltage and will usually reach the excitation voltage at the limit of travel. The sensitivity is therefor, 1V/V.

The direction of the sensor output is unipolar. Install jumper C Install jumper F for voltage excitation.

The excitation must be set to 5V. Install jumper E.

Install jumper C for unipolar input. Do not leave a jumper installed at position D The required input range is 0-5V. Remove jumpers A and B.

The input connections are shown in figure 4-B

Pressure transducer, bridge configuration with constant current excitation

The direction of the output is unipolar. Install jumper C. Do not install a jumper at D.

The transducer requires milliamp excitation. Install jumper G. Do not install a jumper at F. The output of the sensor is ratiometric to the supply current and is rated at 100 millivolts output for a 1.5 mA excitation. Since the excitation current is fixed at 1 mA the sensor output will be 1/1.5 x 100 mV = 66 mv. Install jumpers A and B.The sensor connections are shown in figure 4-A.

Setting the internal jumpers

Follow the steps below to open the case and access the signal conditioning cards.

WARNING! FAILURE TO CAREFULLY FOLLOW THE STEPS BELOW COULD RESULT IN EQUIPMENT DAMAGE, FIRE, INJURY, OR DEATH FIRST:

1. SWITCH OFF THE AC POWER AT THE FRONT PANEL. THEN:

2. DISCONNECT THE AC POWER AT THE SOURCE (OUTLET). THEN:

3. UNPLUG THE AC POWER CORD FROM THE BACK OF THE READOUT.

4. Insert a flat blade screw driver into the slot on one side of the readout. **DO NOT USE A SHARP OBJECT SUCH AS AN ICE PICK OR KNIFE BLADE.** Push in slightly while GENTLY twisting the driver until the latch releases and the top and bottom of the case begin to separate. Repeat this on the other side. Lift off the top of the case.

WARNING! DO NOT APPLY POWER TO THE UNIT WHILE THE COVER IS NOT COMPLETELY AND SECURELY INSTALLED.

5. If desired, carefully slide the back panel out of the bottom of the case and gently fold it down to allow better access to the jumpers. Do not stretch or kink the wiring. Refer to figure 3. There is one circuit board for each pair of channels. The channels are numbered from RIGHT to LEFT when viewed with the sensor input connectors at the top as shown in figure 3.

After setting the jumpers as required, reposition the rear panel, if moved. Replace the cover on the readout. Slide the cover into place and press down on the sides until the latches lock into place. You should hear a ‘click’ as the cover is latched.

For convenience and record keeping, a blank chart of jumper settings and sensor connections has been provided. Use this to record the exact jumper settings, sensor connections by both name and wire color, as well as the type, serial number and capacity of the connected sensor for each channel. This sheet will serve as a guide to restore the readout settings and locate the correct input connector for each sensor should they become detached. Fill out the chart by marking the position of each installed jumper. After connecting the sensors as described below, record the sensor information, connections, and color code. Keep copies in a safe place.

CONNECTING SENSORS TO THE READOUT

Refer to figure 4 for the proper input connections from the sensor. The pin functions are:

SH Shield - The cable shield, if any, should be connected here. This point is connected to the frame (AC power) ground. The shield should be connected at only one end. If it is connected to the body of the sensor and hence to a different AC ground point, DO NOT connect it to the readout. Check for continuity between the shield wire and sensor body if in doubt. If continuity is indicated leave the shield unconnected.

E+ Plus Excitation Voltage - Positive DC drive voltage for the transducer.

E- Minus Excitation - Excitation return. This point is also the signal ground reference. DO NOT connect the shield to this point.

S- Minus Signal Input

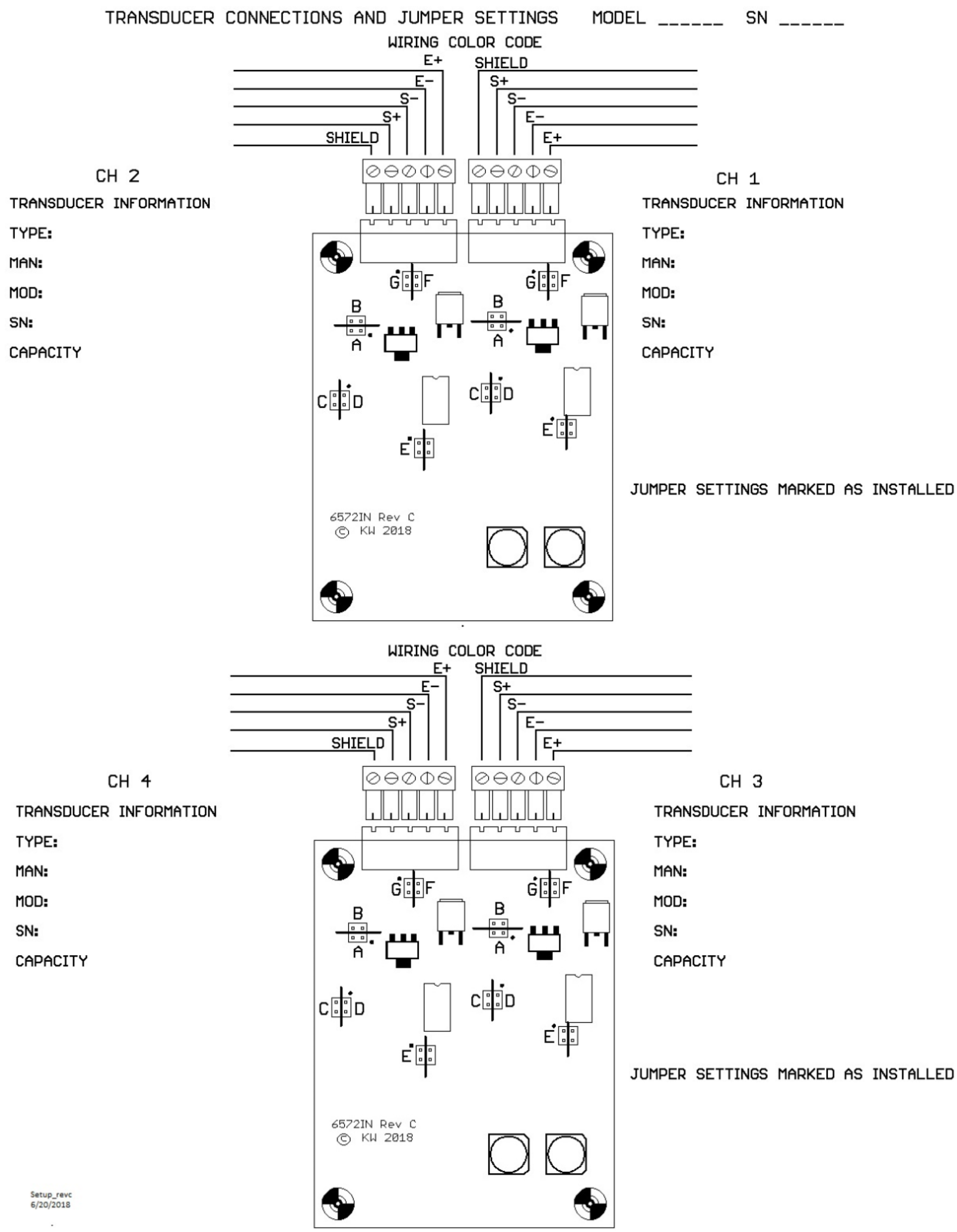
S+ Plus Signal Input

The S- and S+ inputs are fully differential. If the sensor reads “backwards”, such as when a load cell is used in compression when the output is positive in tension, the S- and S+ connections can be reversed. For a potentiometer, if the output reads backward, reverse ONLY the E+ and E- connections. The wiper (output) must always be connected to S+ ONLY.

The wires from the sensor are connected via screw terminals to a detachable plug. There is one plug for each channel. If a channel will not be used and there is no sensor connected to it, connect short wire jumpers from S+ and S- to E-. This will prevent electrical noise from interfering with other channels or damaging the readout. **DO NOT CONNECT A JUMPER TO E+.** See figure 4-D.

Small wire clamps are located next to the connectors. After plugging in the transducer, fit the clamps around the cable jacket and tighten the screw. This will act as a strain relief.

Use this diagram to record transducer information and connections



CALIBRATING THE UNIT FROM THE FRONT PANEL

The readout can be calibrated from the front panel or through the GETDATA program.

Either of two independent calibrations can be selected. Changing one does not affect the other.

Short instructions

1. Enter the access key sequence to begin the front panel calibration routine. See page 5.

2. SELECT the desired calibration, CAL1 or CAL2.

3. Chose the desired channel.

4. Edit the NAME label. Examples are Load, CH_2, etc. Four characters maximum and do not start the name with a number (0-9).

5. Press MENU.

6. Edit the UNITS label. Examples are lbs, kPa, etc. Three characters maximum.

7. Press MENU.

8. Apply a low (normally zero) input to the transducer and press NEW (the CLEAR key) to read the conversion counts (LOW READ). Make note of the input to the transducer (engineering units) to use as the low scale below.

Alternately, enter a new calculated low ‘count’. Use the tare key to shift the cursor and the Peak key to increment the number at that position.

9. Press MENU.

10. Apply a high (full scale) input and press NEW (the CLEAR key) to read the HIGH READ. Make note of the input to the transducer (engineering units) to use as the high scale below. Alternately, enter a new calculated high ‘count’.

11. Press MENU.

12. Select the decimal point location.

13. Press MENU.

14. Enter the LOW SCALE in engineering units noted in step 8 or determined from the manufacturer’s data..

15. Press MENU

16. Enter the HIGH SCALE in engineering units noted in step 10 or determined from the manufactures data.

17. Press MENU

18. Enter an OFFSET in engineering units. Usually this is zero.

19. Press MENU

20. Select a new channel and repeat steps 3-19 or Press MENU to exit.

21. Press YES to write the calibration to permanent memory or NO to use the calibration until power to the unit is removed.

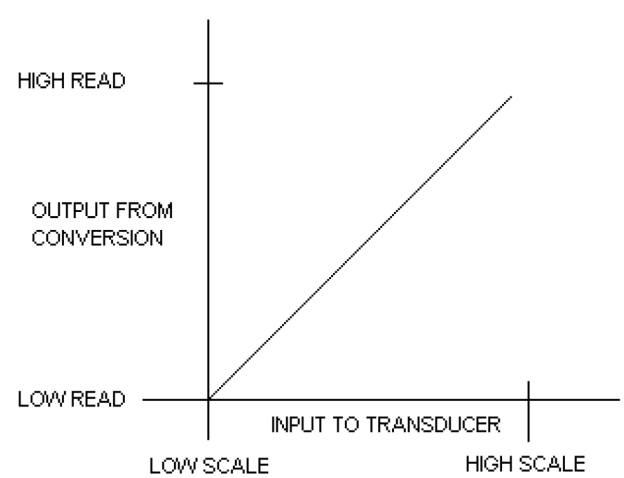
22. If an alternate calibration is desired select it now and repeat steps 3-19.

23. Press MENU to exit the calibration function.

24. After returning the readout to normal operation, observe the value of the calibrated channel with no input applied to the transducer. If the display shows a large non-zero value, the OFFSET parameter may be adjusted to provide a zero reading. This will usually be required only when calculated calibration factors are used.

Front panel calibration detailed instructions

The readout is calibrated by taking the coordinates of two points along the line of the input versus output characteristic for the desired channel/transducer combination. The input is the applied stimulus (load, pressure, etc.) and the ‘output’ in this case is the numerical result of the analog-to-digital conversion (the low or high ‘read’). This output is scaled using the low and high input values to define the coordinates. This is shown graphically here.



1. The key sequence to begin the front panel calibration is provided elsewhere for security.

The proper key sequence must be used or access will be denied.

2. The display will show (on the four channel): SELECT

MENU = DONE

CAL1 CAL2

or for the two channel: SELECT

OUT CAL1 CAL2

3. This is the entry and exit point from the calibration function. Pressing MENU here will exit the calibration and prompt you to save or ignore the calibration as discussed below. Press TARE or PEAK to select the desired calibration.

4. The readout will prompt

CHANNEL?

The channels are listed by name on the bottom line of the display; one over each key under the display. Press the key below the desired channel or press MENU to exit.

5. After selecting the channel the display prompts

XXXX NAME

where xxxx is the current channel name label. The label is repeated at the bottom of the display with a flashing cursor. Use the TARE key to advance the cursor to the right. It will wrap around to the beginning if stepped off the end. Use the PEAK key to increment the character at the cursor position or press the CLEAR key to decrement the character. Use TARE to move the position and PEAK or CLEAR to change the characters. The characters available are 0-9, a-z, A-Z, - , % , / , * , ^, space, and _ (underscore). Blank spaces are allowed at the beginning or end of a label but should be avoided within the label (GETDATA will ignore the part of the label before the space). Instead of the space character use the underscore (CH_1 is better than CH 1) Note also that the software forbids digits 0-9 as the first character in a label.

6. Press MENU to accept the changes. Pressing MENU will advance to the next function. If any change is not required, pressing MENU will skip the function and leave the setting unchanged.

7. The display will show XXXX UNITS where xxxx is the new channel name label.

At the bottom of the display is the current units label with a flashing cursor. Use the same procedure as changing the name label to set the desired units label.

8. Press MENU to accept the label.

9. The display will show XXXX LOW READ where xxxx is the channel name.

The last line of the display will show a 7 digit number with a flashing cursor. This is the stored value of the converter output (the 'counts'). On the far right, over the last key is the word NEW. The sensor should have low or zero input applied. Press NEW to read the new low calibration factor. The number displayed will be updated. NEW may pressed repeatedly. Note the exact input applied as this will be entered as the new LOW SCALE. Usually this value is zero.

To manually enter a count, press the TARE key to move the cursor. Press the PEAK key to Increment the number. If the cursor is on the leading (blank) position pressing the PEAK key will change the sign. THE LOW AND HIGH COUNTS MUST BE POSITIVE ALWAYS. Manually entering a reading is used if you are changing sensors and wish to use a previous calibration or you are entering a calibration factor that was calculated from published sensitivity data.

10. Pressing MENU will advance to the next function. The display will show

XXXX HIGH READ

and the high 'counts' at the lower left of the display.

11. Apply a high or full load to the sensor and press NEW to read the counts. Note the exact applied input for scaling the reading. This value will be entered as the HIGH SCALE.

To Manually enter a count, press the TARE key to move the cursor. Press the PEAK key to Increment the number. If the cursor is on the leading (blank) position pressing the PEAK key will change the sign. THE LOW AND HIGH COUNTS MUST BE POSITIVE ALWAYS.

12. Press MENU. The Display will show

XXXX DECIMAL PLC

At the bottom is a row of X's as place holders (XXXXX . X) with the blinking cursor on the decimal point. Use the PEAK key to move the decimal point. It will wrap around to the front automatically. Position the decimal point for the desired number of decimal places for the displayed data. Up to five decimal places can be shown. To display data as a whole number (no decimal point), position the decimal point at the rightmost end of the row. For example; to display linear displacement to 0.0001 inches, position the decimal place as shown : XX . XXXX

13. Press MENU. The display will show

XXXX LOW SCALE

and a number at the lower left. Enter the scaling value noted when the LOW reading

was taken. Use the TARE and PEAK keys as above. When the cursor is on the decimal point, pressing PEAK will move the decimal point. This will allow adding decimal places for entering the correct scaling value. For example, if the low input is 0.00012, this is the value that should be entered here. Data will be displayed according to the decimal place selection made in step 12.

14. Press MENU. The display will show

XXXX HIGH SCALE

and the high scaling number at the lower left. Enter the scaling value noted when the HIGH reading was taken. Use the TARE and PEAK keys as above. When the cursor is on the decimal point, pressing PEAK will move the decimal point. This will allow adding decimal places for entering the correct scaling value. For example, if the full scale input is 5.00082, this is the number that should be entered here. Data will be displayed according to the decimal place selection made in step 12.

15. Press MENU. The display will show

XXXX OFFSET

Enter an offset in engineering units. Usually this will be zero. The offset is used to correct for zero errors in the transducer if calculated calibration factors were entered, or to allow setting the zero on a channel where the tare is disabled. It is best to leave (or set) this value at zero and complete the calibration. Observe the displayed offset for the channel under zero input conditions while the readout is operating normally. Re-enter the calibration function and advance to the OFFSET display. Enter the offset value that was displayed, with the sign of the offset entry opposite that which is shown on the display. This will zero the channel.

16. Press MENU.

The readout will prompt

CHANNEL?

And the list of channels. Select another channel or MENU to exit.

17. The display should show 'WRITE TO MEMORY?'. The memory referred to is permanent memory. The calibration is already active in temporary memory and will be in effect until power is lost or removed. Press YES to save the new calibration permanently or NO to keep the calibration in temporary memory (until power off).

18. The display will show (on the four channel): SELECT

MENU = DONE

CAL1 CAL2

or for the two channel: SELECT

OUT CAL1 CAL2

19. Select the other calibration or press MENU to exit and return to normal operation.

20. The calibration factors entered from the front panel can be saved to a file using the external calibration function in GETDATA . Refer to those instruction for details.

ACCESSING THE READOUT THROUGH THE USB PORT

The 'GETDATA' program is normally used to acquire and record data during a test. If this program is not available or more custom control is desired, data collection and control of the readout can be accomplished through the USB serial port by way of simple alpha-numeric commands. This allows external data acquisition software running on a host PC to monitor and log the data and control certain functions in the readout. Commands are sent from the PC and a response (if any) is sent by the readout before another command is sent. The commands consist of a number (0-9) followed by a single letter and a carriage return, sent as an ASCII string. The number can represent a channel number or it simply signals that a command is being sent, in the case of commands that affect all channels. Commands that affect all channels start with 9 (nine). The lower case 'x' in the descriptions below should be replaced by the desired channel number. CHANNELS ARE NUMBERED STARTING AT ZERO. The response if any from the readout is in ASCII form and is terminated by a carriage return. Each command is described below. Note that some commands are upper case and some are lower. Commands are case sensitive. Each command sent MUST be terminated with a carriage return only.

COMMAND SENT ACTION READOUT RESPONSE

9B Test bi-directional data communications port
OK CR

9C Update Conversion buffer
CR

Loads the most recent data from each channel into a buffer for retrieval by the 'Send' command. The command is used to 'latch' data at a desired time interval and allow retrieval in between sampling intervals. This command MUST be sent each time new data is required from the readout or a new interval has elapsed. Once sent, any desired channel data can be called for in any order. Undesired channels can be ignored.

9D Send Number of channels in readout to PC.
Data CR

9F Fast data streaming to PC
Data CR

Causes data to be sent continuously to the PC at fastest rate, about 7 conversions per second. Data is sent for all channels, in order, with a comma to delimit each channel. The string of data is terminated by a carriage return.

9f Cancel data streaming
Data CR

Stops data streaming. A carriage return is sent to signal the end of the data

xS Send desired channel 'x' data to the PC.
Data CR

X is a number from 0 to the number of channels in the readout minus one (0-3 for a four channel device)

xT Tare (zero) a desired channel
CR

The channel will tare only if it is not restricted, such as an absolute pressure sensor. Refer to the calibration instructions.

xt Clear the tare and restore the channel offset.
CR

9P Send the current PEAK readings to the PC.
Data CR

The readout will send the most recent peak data for all channels, referenced to the peak trigger channel, in order, comma delimited, with a carriage return to terminate the string. After the peak data is sent the buffer in the readout is cleared.

9p Display/clear the peak DISPLAY on the readout.
CR

If the readout is currently in normal display mode, this command will cause the most recent peak data to be displayed as if the PEAK button on the readout had been pressed. If the readout is already in peak display mode, normal data display will resume.

xM Send channel 'Magnitude' to PC.
Channel Full Scale Value CR

The full scale value of each channel is sent. This is the value entered as 'Full Scale' during the calibration procedure, and may not be the full range of the channel output.

xN Send desired channel name to the PC.
Channel Name CR

This for aiding in identifying the data on graphs and in files.

xU Send desired channel units to the PC.
Channel Units CR

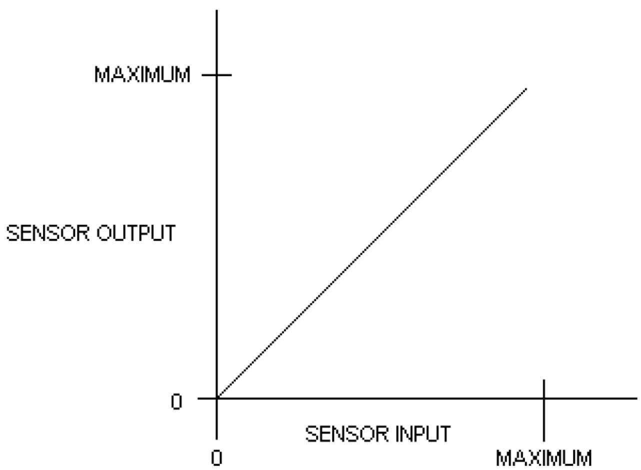
This for aiding in identifying the data on graphs and in files.

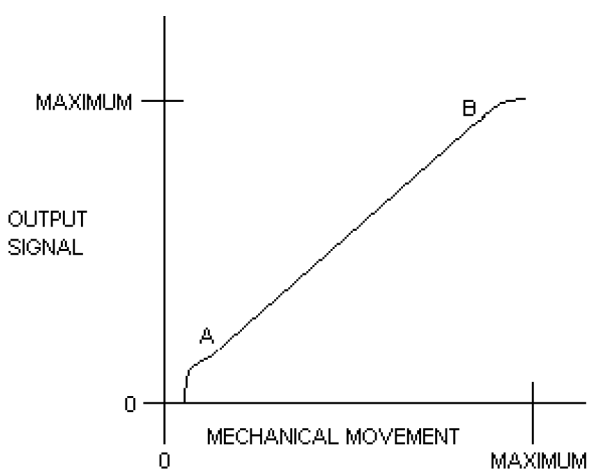
The action of the above commands can be observed with any terminal emulator program such as Windows 'Terminal'.

APPENDIX A

Calibrating Potentiometers and Linear Displacement Transducers

Potentiometers and linear displacement transducers require special attention when calibrating them to the readout. This is due to the non-linear output of the devices at the extreme limits of their mechanical movement. Examine the two plots below. The left represents the response of a typical sensor such as a load cell that has good linear response (a nice straight line) from zero to full scale input. The right plot shows a typical curve of a linear potentiometer. While exaggerated, it shows that at each end of the devices' mechanical travel the electrical output does not follow. At the low end (A) there is some movement before the output begins to respond. Near the maximum travel (B) the device has stopped responding. These transducers are typically specified by their mechanical travel, so a 2 inch device is really only linear over about 1.8" (+0.1" to 1.9").





To eliminate the error when calibrating linear displacement sensors set the device in it's calibration fixture or in the machine where it will be used.

If the device reads increasing displacement as the rod is pushed into the device, position the rod so that the tip of the rod is pushed into the device about 3-4mm (0.075 to 0.1 in). This corresponds to point A of the plot above. Record the LOW READ at this point and set the LOW SCALE to 0.0. Place a gauge block between the fixture and the rod to move the rod a precise distance BUT NOT TO THE MACHANICAL LIMIT. Choose a block that allows some head-room at the end of the travel (typically 3 to 4 mm in most cases). This corresponds to point B of the plot. Record the HIGH READ at this point. Set the HIGH SCALE to the dimension of the gauge block used.

If the device reads increasing displacement as the rod extends out of the device, Position the device so that the rod is pushed in 3-4mm and the output of the sensor is still increasing. Now, position a gauge block so that the rod is pushed in almost all the way but leave 3-4 mm of travel. Record the LOW READ at this position and set the LOW SCALE to 0.0. Remove the gauge block and record the HIGH READ. Set the HIGH SCALE to the dimension of the gauge block used.

Specifications

Power Requirements	115 or 230 Volts AC, 50-60 Hz,100 W Supplied ONLY from a properly connected and grounded three wire receptacle. Voltage is selected by switches on the internal power supply.
Fuse	0.5 Amp, 250 Volts. Located inside the unit
Data output	USB 2.0 format USB mini B female connector. The driver sets up the connection as a virtual COM port. Settings are: 19200 Baud, 8 data bits, 1 stop bit, no parity. No Handshake.

Sensor excitation	5.0 or 10.0 Volts DC or 1.0 mA DC
Minimum sensor input resistance	300 Ohms
Sensor output range	+/- 33 mV to +/- 2.5 V or 0-5V
Maximum display resolution	5 Digits (1 part in 100 000)*
Data converter resolution	20 bits (1 part in 1 000 000)
Data conversion rate	7.5 conversions per second @ 60 Hz line frequency rejection 6.25 conversions per second @ 50 Hz line frequency rejection
Data conversion time, each reading	133.3 ms @ 60 Hz 160 ms @ 50 Hz
Maximum conversion latency	+/- 2.6 ms @ 60 Hz** +/- 3.2 ms @ 50 Hz

* The resolution will depend on various factors such as noise in the sensor output, gain settings in the readout, and number of readings averaged (if any). It is limited by input referred noise sources.

** This refers to the maximum time window for completion of conversion of all channels. In this acquisition system each channel is digitized using a separate analog to digital (A/D) converter instead of a single converter with an input multiplexor. The start of each conversion is synchronized across all channels. Each converter completes the digitization process within the specified conversion time plus or minus the error (latency) due to variations in the individual converter clocks. Therefor, the latency specification is the worst-case time error between readings. For practical purposes the results of the conversions can be considered simultaneous readings.

Due to continuous sampling during the relatively long conversion time, the values obtained for each channel may reflect changes presented at the input during the conversion.

Keep input changes and noise to a minimum.

Alarm Relay Specifications (optional)

Configuration	Form C (SPDT)
Contact rating,	5 Amp maximum @ 30 VDC Resistive load 5 Amp maximum @ 250 VAC Resistive load Reduce load current ratings for inductive or capacitive loads
Operate Time*	5 ms Typical
Release Time*	2 ms Typical

DO NOT EXCEED 250 VAC applied to the contacts.

*From manufactures published specifications