

PULLTEST Version 2.0

YieldPoint Inc.

March 2017

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Units within the warranty period returned for repair, test, and recalibration are serviced at no charge in accordance with the terms of the warranty policy. The Customer pays all transportation and other charges to the factory.

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Please be sure all returns are shipped with the following information included:

- 1. Your company Name with Billing and Shipping Addresses.
- 2.A complete description of your problem, or re-calibration data.
- 3. The contact person at your company, with their telephone and facsimile numbers.
- 4. Non-Warranty returns additionally need your Purchase Order Number.

Please pack your returned instruments in their original shipping cartons, or in equivalent strong protective shipping cartons.



Figure 1. The pull test unit being used at Kidd Mine (courtesy of Jennmar Canada)

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1. INTRODUCTION

1.1.What is PullTest?

PullTest is a turnkey solution system for accurately and efficiently monitoring pull tests on bolts and anchors. A Data Acquisition (DAQ) unit converts analog signals from displacement, load and pressure transducers directly to the USB port of a PC or tablet. The preferred operating system is Windows 10. YieldPoint cannot ensure operation with computers running Windows 7. Real-time monitoring of pull test results enables on-the-fly interactive optimization of the number, type and location of tests.

PullTest has been designed to be low cost and low weight (2.5kg). The user can select to minimize weight and inconvenience further by using a Tablet computer to read and store the data, as opposed to the standard laptop interface

All aspects of PullTest design incorporate redundancy features which include:

- displacement measurement based on two independent sensors(Disp1 and Disp2)
- load can also be calculated based on a measurement of the in-line pressure (Pres). Two pressure cells are provided, and,
- an optional interchangeable backup load-cell is provided (Load).

This design strategy ensures that the system will continue to operate even under the most t scenarios.

Reporting tools enable plots to be prepared easily and efficiently, so that a presentation can be made to a customer or client within minutes of the test program being completed.

1.2 Units Conversions form Metric to Imperial

PullTest works with and stores data in metric units. However options exist to work in imperial units without inconvenience. Should conversion factors be required they are listed below.

Metric To Imperial	Imperial to Metric
1 inch =25.4mm	1mm = 0.03937"
1kN = 0.1004 tons (2240lbs)	1 ton(2240lbs) =9.964 kN
1kN = 0.1124 short tons	1 short Ton = 8.896kN
1 metric tonne =1.102 short tons	1 short ton = 0.9071 short tons
1 MPa = 145psi	1psi=0.006894MPa
1kPa = 0.145psi	1psi = 6.894kPa
1tonne= 2204.62lbf	1lbf= 0.000453tonnes

2. COMPONENTS and CONNECTIONS

2.1. Data Acquisition Units.

PullTest electronic components combine analog sensors to monitor load and displacement and a 4 channel, 12-bit data Acquisition unit. The Data Acquisition unit (DAQ) streams data to a USB port of a PC.

2.2 Displacement Sensors

The two displacement sensors operate using a magnetostrictive principle that measures the relative position of a flexible waveguide and a ring-magnet. This transducer has the advantage that there is no physical connection across the loading jack, so that if the bolt ruptures the sensor will not be damaged. The specification sheet for the displacement sensors is provided in Appendix A1. *PullTest* enables either a single displacement sensor or a pair of displacement sensors(average result plotted) to be used to monitor the pull test.

The two displacement sensors are fully interchangeable and can be plugged into either port 1 or 2 on either DAQ unit. PullTest/PC must be modified depending on which port is used.



Figure 1. The magnetostrictive displacement sensor. The extended red probe is the waveguide.

2.3 In-Line Pressure Cell.

The load applied to the bolt can also be calculated based on the line pressure multiplied by the area of the ram (see section 3 below). The pressure cell is rated for a range 0-69MPa or 0-10000psi. The corresponding force applied to the bolt through a hydraulic cyclinder is:

F= In-Line Pressure * Area

Where the area is the specified area of the cylinder (see Appendix 2 for Enerpac specs).



Figure 2. The In-Line Pressure Cell

2.4 Load Cells (Optional).

Two load cells are provided with the *PullTest* system.

Load cell 1

Load Cell 1 is a rated for 50000lbf with an output of 10mV FS. The sensing element incorporates bonded foil strain gages of the highest quality and is sealed for protection against most industrial environments. To obtain accurate results with the load cell it is imperative that the lower surface be evenly load. Therefore a stainless steel disc with a central hole is provided on which the load cell must sit. It is recommended that a sacrificial washer be used at the upper surface of the load cell to avoid damaging the finish.

The specification and calibration sheets for the load cell is provided in Appendix A2

Load cell 2

Load Cell 2 is a rated for 80000lbf with an output of 10mV FS. This load cell is generally less accurate (2% non-linearity compared with 0.25% for load cell 1) than load cell 1 and is provided as a lightweight backup load cell. For accurate load measurement it is imperative to ensure that load cell 2 is aligned concentrically to the bolt shaft, and that eccentric loading is avoided.

The specification and calibration sheets for the load cell is provided in Appendix A2



a. Load cell 1



b. Load cell 2

Figure 3 The load cells. Load cell 2 is intended as a lightweight backup

2.5 Connections

The transducers must be attached to the DAQ system as indicated in Figure 4. The DAQs is turned on/off by the rocker switch - white dot depressed is on.

Each DAQ has a 9V battery power source. It is recommended that the battery be replaced at the beginning of each day's testing. Turning the system off between tests will conserve battery power.

IMPORTANT: The DAQ should be turned off before connecting or disconnecting sensors.



USB DAQ Unit

Figure 4. Connections to the DAQ Unit

3. PULLTESTWindows Software

PullTest is a PC Windows database application for automated real-time monitoring of pull tests. Data from an external DAQ unit is streamed through the USB port at a rate of approximately 1 readings/second. During a test the application allows the user to observe the detailed pull test response, either as load *versus* displacement, or displacement *versus* time,. All graphs can be saved or printed as JPEGs, and data can be exported to both MS Word and MS Excel. . Real-time reporting allows the user to optimize the number and type of pull tests within a test series, provide the client with immediate results. Time spent preparing a final report is minimized.

The application is laid out in a tabular format which allows rapid access to the information required. When the form loads it will always display the Test Info tab. To move from field to field you can use the Tab key on your keyboard, or click on the field using the mouse.

3 The Test Info Tab.

3.1 Selecting a Virtual Com Port(VCP)

Once the DAQ has been powered with a 9V battery (preferably Litium for longer life), and with the DAQ turned off (LED not flashing/zero depressed on rocker switch), the USB plug should be plugged into the laptop or tablet. Drivers will load once the USB adapter is detected for the first time. If the drivers do not load and the USB is not recognized then:

(i) The files (setup executable is best option) can be downloaded from the webpage: http://www.ftdichip.com/Drivers/VCP.htm

SH4	Comments
-	WHQL Certified. Includes VCP and D2XX. Available as a setup executable Please read the Release Notes and Installation Guides.
	All FTDI devices now supported in Ubuntu 11.10, kernel 3.0.0-19

(ii) Follow the instructions in the PDF guide (FTDI_AN352_Driver_Installation _Guide) that can be downloaded from the YieldPoint website

Once the drivers are properly installed a VCP will be created for the DAQ each time it is plugged into the PC. The designation (COM3, COM\$ etc) will vary from computer to computer. Use the following steps to deduce which COM is associated with the DAQ:

(i) with the DAQ's USB unplugged from the laptop click the green arrows next to the Select COM dropdown. Record the COM ports

(ii) Plug in the DAQ and repeat the process. The addition COM port is associated with the DAQ.

l'est info	Graph (Time)	Graph (Load v Disp)	Report (Time)	Report (Load v Disp)	Configuration
OM Port Status: elect a COM from th	e dropdown list to beg	gin streaming data	Cu	Disp Irrent Values:	Load
Test Series Informa Type a new series	tion name & hit ENTER ke	y or select existing serie	Select COM:		
YP Test series 1			- 3 COM port	(s 82 87	
+	1 of 1	*			
Date of Test Serie	s: No. of Compl	eted Tests: Auto ID	*		
18- Jan - 17	0	1			
Series Information	n:				
Series Information	n:				
Series Information	1:				
Series Information	1:				
Series Information	n:				
Series Information	1:				

Next, select the appropriate COM port and the COM port will be connected. Turn on the DAQ

Test Info	Graph (Time)	Graph (Load v Disp)	Report (Time)	Report (Load v Disp)	Configuration
COM Port Status:				Disp	Load
COM87 CONNECTED			Cu	rrent Values: 128.3	0.06
Test Series Informat Type a new series r	ion name & hit ENTER ke	y or select existing serie	Select COM:	87 🗸 🛃	
YP Test series 1		•	COM87 CON	NECTED	
4	1 of 1	*	TESTBOLT VE :, 1,4988 :, 2,4988	ERSION 2.0 ,4985 , 521 ,3436 ,4985 , 521 ,3436	
Date of Test Series	: No. of Comple	eted Tests: Auto ID#	:, 3,4988	, 4985 , 521 , 3436	
18- Jan - 17 🛛 🖉 🔻	0	1	:, 5,4988	, 4985 , 521 , 3436	
6					
Series information	•				
		-			

Data will begin to stream from the DAQ over the USB to the laptop with an approximately 1/sec interval.

The output string is

;, Reading #, Disp1, Disp2, Pressure, Load CRLF

The Disp1, Disp 2, Pressure are monitored directly in mV. In the figure above 4988 corresponds to 4.988V which is the voltage output of Disp 1 with the actuation magnet absent.

The displacement sensors range from slightly less than 5V (e.g. 4.970-4.990) to slightly greater than 0V (0.010-0.100) and the in-line pressure cell ranges from aprox 0.5V (500mV) to 4.5V (4500mV).

To test the displacement sensor, with the DAQ running run the actuator magnet (additional provided) over the yellow probe of the displacement sensor. As shown below the Disp1 values will cjhnage from aprox 5v with the magnet off to approx. 0V with the magnet fully on.

Test Info	Graph (Time)	Graph (Load v Disp)	Report (Time)	Report (Load v Disp)	Configuration
COM Port Status:				Disp	Load
COM87 CONNECTED			Cu	rrent Values: 128.3	0.05
Test Series Informat	ion		Select COM:	87 🗸 🛃	
Type a new series r	name & hit ENTER ke	y or select existing seri	es:	4095 544 50	
TP Test series 1			• 0 4987	4985 516 90	
			., 9, 4707	. 4985 . 516 . 122	
+ (1 of 1	▶ 🗱	:, 11, 2862	4985, 516, 154	
			:, 12 , 2293	, 4985 , 516 , 186	
			:, 13, 1707	7,4985,516,216	
Date of Test Series	: No. of Comple	eted Tests: Auto ID	# :, 14 , 728	,4985 , 516 , 246	
18- Jan - 17 🛛 🔍 🔻	0	1	:, 15, 10	,4985,516,276	
			:, 16 , 10	, 4985 , 516 , 307	
Series Information	:		:, 17, 349	,4980, 010, 330 / 4095 515 265	
			. 19 2250	4985 516 395	
			:, 20, 3424	4985, 515, 424	E
			:, 21, 4268	, 4985 , 515 , 453	
			:, 22 , 4562	985 , 516 , 482	
			:, 23, 4987	7,4985,515,510	
			:, 24 , 4987	, 4985 , 515 , 539	
			:, 25, 4987	7,4985,515,566	
			:, 26, 4987	,4980, 016, 094	
			.		-

Figure 5: The Test Info tab.

Test Info Graph (Time) Graph (Load v Disp) Report (Time) Report (Load v Disp) Config COM Port Status: COM87 CONNECTED Disp Load Test Series Information Select COM: 87 87 Type a new series name & hit ENTER key or select existing series: 0 0 0 Inco Shell Test Series: No. of Completed Tests: Auto ID# 0 0 Series Information: 2 2 1 1 1				-				eldPoint's PULLTEST ver 5.1.0
COM Port Status: Disp Load COM87 CONNECTED Current Values: 128.3 Type a new series name & hit ENTER key or select existing series: Inco Shell Test Series 1 2 of 2 2 of 2 Common Completed Tests: Auto ID# 2:	iguration	ad v Disp)	Report (Loa	Report (Time)	ad v Disp)	Graph (Loa	Graph (Time)	Test Info
COM87 CONNECTED Current Values: 128.3 0.07 Test Series Information Type a new series name & hit ENTER key or select existing series: Inco Shell Test Series 1 2 of 2 Date of Test Series: No. of Completed Tests: Auto ID# 23-Mar-17 • 0 Series Information:	d	Disp						OM Port Status:
Test Series Information Type a new series name & hit ENTER key or select existing series: Inco Shell Test Series 1 2 of 2 2 of 2 COM87 CONNECTED COM87 CONNECTED Completed Tests: Auto ID# 2 Series Information:	7	128.3	rent Values:	Cu				OM87 CONNECTED
Inco Shell Test Series 1 2 of 2 Date of Test Series: No. of Completed Tests: Auto ID# 2 Series Information:		- 2	87	Select COM:	cisting series	y or select exi	on ame & hit ENTER ke	Test Series Information Type a new series na
Late of Test Series: No. of Completed Tests: Auto ID# 2 Series Information:			ECTED	COM87 CON	•		es 1	Inco Shell Test Serie
Date of Test Series: No. of Completed Tests: Auto ID# 23-Mar-17 • 0 2 Series Information: • •					*		2 of 2	+
23-Mar-17 v 0 2 Series Information:					Auto ID#	eted Tests:	No. of Compl	Date of Test Series:
Series Information:					2		0	23-Mar - 17 🛛 🖉 🔻
								Series Information:
					*			
*					-			

3.2 Series Information:

A test series usually designates a number of identical tests in the same location used to assess variability. To add a new test series type the description in the Test Series drop down field and click "+". The new series will be created The date can be enetered and then other relevant Series information such as Location, rock type, bolt type etc can be entered in the **Series Information** field.

The series information applies to all tests done for that series. Click the "Add a new series button" to create a new test series. The only required information is a series name, which is entered at the prompt. The current date is automatically entered in the Date field but can be changed by typing the preferred date in the field.

Once a series exists in the database, it can be selected by clicking the Series dropdown list. If there are a large number of series in the list, typing the first few letters of the series will bring up the closest match in the list. Simply hit the Enter key on the keyboard to select that series. When the program opens, the series are sorted in descending order on the Date field, so that the most current test series is displayed first.

Each test series can contain a maximum of ten individual tests. The test information can be entered before or after a test is run. Use the Test Number dropdown list to select a particular test, or click on the Previous or Next buttons to navigate through tests.

hoose which valu	es to plot/save*	Load Cell/Pressure Cell	Parameters:
All Metric	•	Default Load Cell:	Load Cell 2 🗸
Port 1	•	Load Cell 1 Cal. Coe	ff: Load Cell 1 Span (lbs):
Pressure Cell	(Port 3) -	2.028	50000
Tressure ceu	(10(13))	Load Cell 2 Cal. Coe	eff: Load Cell 2 Span (lbs):
s): All Incoming		2.0346	80000
aph Maximum Axi	s Values:	Area (sq. inches):	
Load 20	Secs 150	2.75	View Load Cell Specs
PORT 1) DISP2(P	ORT 2)	Displacement Sensor T	ype:
		Magnetostrictive	Potentiometric
. VialdDaint		Range (mm):	Sensitivity (mV/mm/Ve):
Sensing the future		128.3 -	
PullTest USB			Disp1
Sanada Sanada au Canad	0		Disp2
	All Metric Port 1 Pressure Cell I Pressure Cell I All Incoming aph Maximum Axi Load 20 PORT 1) DISP2(P VieldPoint Sensing the forum PullTest USB Pressure Center PullTest USB	All Metric Port 1 Pressure Cell (Port 3) Pre	All Metric Port 1 Port 1 Pressure Cell (Port 3) Fressure Cell (Port 3) All Incoming Fressure Cell (Port 3) Default Load Cell: Load Cell 1 Cal. Coe 2.028 Load Cell 2 Cal. Coe 2.0346 Area (sq. inches): 2.75 Displacement Sensor T Magnetostrictive Range (mm): 128.3

4.0 The Configuration Tab

Data Preferences - choose which values to plot/save* -								
Graphing Units:	All Metric 🔹							
Displacement:	Port 1							
Load/Pressure:	Port 1 Port 2 Average							
Save Interval (secs):	Difference (1-2)							
Use Custom Graph Maximum Axis Values:								
Disp 50 Loa	ad 20 Secs 150							

The Configuration Tab is used to set up the software for the specific types of instruments that are plugged into the DAQ. Options related to the data preferences (Metric versus Imperial), whether to graph using Disp1 or Disp2, or some kind of combination (see above), whether to plot load calculated from the in-line pressure or measured directly from the load cell.

3.4 The Graph (Time) Tab.



Figure 6. The Pull Test tab

The Pull Test tab displays the real time graph for an individual test. On this graph, Load is plotted directly against Displacement. The name of the series is displayed at the top of the graph, and the dropdown list at the top indicates which test number is being run.

Once the correct test is selected and the serial or usb is connected to the PC, click the "Start Test" button to begin. The remaining buttons will now be enabled. Data can be plotted and saved at different intervals, and can be shown in Metric or Imperial units. Both of these settings are found on the Preferences tab.

To "zero out" the Load data or the Displacement data, click the corresponding Zero button in the lower right corner. At any time during or after a test, click the Pull Test(Time) tab to view the current test being simultaneously plotted as Load and Displacement against Time. Click the Pull Test tab to return to the original graph.

To end a test, click the Stop Test button. The data is saved and the incoming data is no longer plotted on the graph. The saved data is now viewable on the Reporting tab, but a copy of the individual pull test graph can be saved as a JPEG by clicking on the Save button in the lower left corner, or printed directly to a printer by clicking the Print button.

To continue with a new test in the same series, simply click the Next Test button and the graph is ready to start a new test. Click <u>here</u> for information on zooming in on graphs

3.5 The Pull Test (Time) Tab



Figure 7. The Pull Test (Time) tab

The Pull Test (Time) tab displays the real time graph for an individual test. On this graph, Load and Displacement are plotted individually against time in Seconds. Load is shown on the left axis in blue, and Displacement is shown on the right axis in red. If a test exceeds 90 seconds, the graph will begin to scroll to the right to show the most current incoming data.

The name of the series is displayed at the top of the graph, and the dropdown list at the top indicates which test number is being run.

Once the correct test is selected and the serial or USB is connected to the PC, click the "Start Test" button to begin. The remaining buttons will now be enabled. Data can be plotted and saved at different intervals, and can be shown in Metric or Imperial units. Both of these settings are found in the Config tab.

To "zero out" either the Load data or the Displacement data, click the corresponding Zero button in the lower right corner. At any time during or after a test, click the Pull Test tab to view the current test being simultaneously plotted as Load *versus* Displacement. Click the Pull Test (Time) tab to return to the original graph.

To end a test, click the Stop Test button. The data is saved and the incoming data is no longer plotted on the graph. The saved data is now viewable on the Reporting tab, and a copy of the individual pull test graph can be saved as a JPEG by clicking on the Save button in the lower left corner, or printed directly to a printer by clicking the Print button.

To continue with a new test in the same series, simply click the Next Test button and the graph is ready to start a new test.



3.6 The Reporting Tab.

Figure 8 The Reporting tab shows the graph of all the completed tests for a series. Data can be plotted in Imperial or Metric units. Series information is shown below the graph. To view individual test information, click on the test data line in the graph.

To remove a test from the plot, uncheck the corresponding test number in the graph legend. To show a hidden test, re-check the corresponding test number.

Both graph axes can be moved by clicking on the axis with the left mouse button and dragging the axis in the desired direction while the mouse button is held down. The axis can also be scrolled using the wheel button if your mouse has one.

Zooming in on graphs: To zoom in on an area in the graph, use the mouse to 'draw' a rectangle around the area to be viewed.

Start with your mouse pointer positioned at the top left of where you would like your selection to begin. Click and drag using the left mouse button and move your mouse diagonally down and to the right. You will see a grey outline of a rectangle to use as your guide. Once you have the desired area selected, release the left mouse button and the graph will zoom in to that area.



To return the graph to its original view, draw the rectangle in reverse. To see a demonstration of this, double-click the short movie clip below. ψ

Figure 9. A video clip indicating how to use the Reporting Tab.

This graph can be saved as a JPEG by clicking the Save button, printed directly to a printer by hitting the Print button, or exported to MS Word by clicking the Export to Word button.

If there is no existing test data for a series, a message box will display when the Reporting tab is clicked.

Raw data:

The raw data can be viewed by clicking the Datasheet button on the lower right corner of then reporting Tab. All data is saved in the database with metric units.

<u></u>	🔺 Test Data - Units are Metric (tonnes and mms)								_ 🗆 🗙						
	Delete Row										Expor data t	t Series to MS Ex	and tes cel —	st	\rightarrow
	ReadingNo1	T1 Disp1	T1 Disp2	T1 Load	T1 Press	ReadingNo2	T2 Disp1	T2 Disp2	T2 Load	T2 Press	ReadingNo3	T3 Disp1	T3 Disp2	T3 Load	T3 Press
	1	0	0	0	0	1	0	0	0	0	1	0		0	0
	2	0	0	1	0	2	0	0	1	0	2	0		0	1
	3	0.127	0	2	0	3	0.254	0	2	0	3	0.2032		0	2
	4	0.3048	0	3	0	4	0.7112	0	3	0	4	0.5588		0	3
	5	0.7366	0	4	U	5	1.0414	0	4	0	5	5.4102		0	4
	7	5.0300	0	6		7	1.3462	0	6	0	7	9.4742		n	6
	8	11.7602	0	7		8	2.5146	0	7	0	8	11.2268		0	7
	9	17.4244	Ő	. 8	i o	9	7.1374	0	. 8	0	9	12.7508		0	8
	10	19	0	9	0	10	7.747	0	9	0	10	13.7414		0	9
	11	23	0	10	0	11	8.6106	0	10	0	11	14.8336		0	10
	1														

Figure 10. The raw data

Delete one row of data at a time by clicking on the desired row at the 'ReadingNo1' column which will highlight the selected row in green. Click the "Delete Row" button to permanently delete that row.

To export all the data to MS Excel, click the Export to Excel button at the top right on the Datasheet form. The series information is exported along with the test data.

3.7 The Config Tab.

Test Info	Pull Test	Pull Test (Time)	Reporting	Preferences	USB Data	YieldPoint
Graphing P Un it	references - choos	e which values to p ric	lot :	Load Cell / Pressure Default Load Cell:	Cell Parameters:	·
Disp	lacement: Disp) 1		Load Cell 1 Cal. Coel 2. 3329	ff: Load Cell 50000	1 Span (lbs):
Load	d/Pressure: Loa	d 🗾		Load Cell 2 Cal. Coel	ff: Load Cell 45000	2 Span (lbs):
Set Tim	er Defaults (in sec	onds):		Area (sq. inches): 2.76		
Plot int Save in	erval: 1 terval: 5	•		Comm Port:	Bac Date	kup Ibase

Figure 11 The Preferences Tab. The graphing preferences determine which port the displacement sensor is plugged into , and whether the load value is based on a pressure cell plugged into port 3 or a load cell plugged into port 4. Although data is streamed drom the DAQ unit at 0.1mm intervals the interval between saved values and plotted values can be varied. Finally the calibration coefficients for the load and pressure cell s are input on the RHS. The should only be changed if the transducers are replaced or the recalibrated.

Graphing Preferences:

The Figure shows a top view of the DAQ/PC with the location of the 4 ports indicated. It is imperative that each transducer be plugged into the appropriate port.

Units dropdown list – select either Metric or Imperial from the list. This preference applies only to the values plotted on the graph. Metric values are always written to the database.

Displacement dropdown list – select Port1, Port 2 depending on which port the displacement sensor is plugged into. Select average to use an arithmetic average from both displacement sensors.

Load/Pressure dropdown list – select either Load cell (Port 4) or Pressure cell(port 3) depending on which transducer the load value is based on.

Set Timer Defaults:

Plotting and saving intervals can be the same value, or set to different values.

Plot Interval – select the frequency in seconds in which the graph will plot a point of data when running a test.

Save Interval – select the frequency in seconds in which the program will save a point of data to the database.

Load Cell/Pressure Cell Parameters:

Default Load Cell – select Load Cell 1(port 4) or Load Cell 2(port 4) from the dropdown list.

The Area of the Ram depends on the capacity of the ram used for testing.

Load Cell Coefficients. and Span values are pre-entered for the Load and Pressure equipment, based on the specification and calibration data provided in Appendices A2 and A3

3.8 The Comms Tab

Test Info	Pull Test	Pull Test (Time)	Reporting	Preferences	USB Data	Yield Point
Test Info	Pull Test	Pull Test (Time)	Reporting	Preferences	USB Data	Test USB / Comm Open Comm Port Close Comm Port Scan for Available Comms

Figure 12. The comms Tab

The Comms tab is primarily used to select a COM port and then ensure that COM port is functional and correct. Click the "Open Comm Port" button to open the default COM. Any error messages are displayed in the main screen. If the COM is correct and the USB is plugged in to the PC, the incoming raw data should be shown in this window as well. Click the "Close Comm Port" to close the port and free up the COM for testing. If you have ensured that the USB is

properly connected, and there is no incoming data being shown, the most likely reason is that the COM port number selected as default is not correct.

Click the "Scan for Available Comms" button to scan the PC for any usable COM ports. Select the port to be used from the dropdown list.

🖏 Communia	ations Port Set	tings					
C	hoose a Comm P	ort:					
	Baud Rate	•					
Data Bits	-Parity	Stop Bits	-Handshaking -				
C 7 Bit	C Even	C 2 Bit	C Xon				
** O Dic	© None	* 2 bit	C RTS C Both				
OK							

Figure 12 The Com Port settings

Click OK to close the form and use the selected port, or click Cancel to abort.

Step 1: The RCH cylinder and stand should be bolted together using the bolts which are supplied (middle).

Step 2: Assemble the Displacement Sensor Clamp The displacement sensor clamp should be assembled as shown below.

Step 3: Clamp the displacement sensor to the cylinder.

Step 4: Add the Displacement actuator.

The actuator contains a ring magnet which interacts with the displacement sensor to measure load. A spare ring magnet was supplied.

APPENDIX 2:

This information can be found at: http://www.enerpac.com/en-us/print/3502

RCH-Series, Hollow Plunger Cylinders



- Enerpac hollow plunger cylinders provide versatility in testing, maintenance and tensioning applications. The hollow plunger design allows for both pull and push forces
- Single-acting spring return
- Cylinders are nickel-plated, floating center tube on models over 20 tons increases product life
- · Baked enamel finish for increased corrosion resistance
- · Collar threads for easy fixturing
- RCH-120 cylinders include AR-630 coupler and has 1/4 NPTF port
- RCH-121 and RCH-1211 cylinders have FZ-1630 reducer and AR-630 coupler, all other models feature CR-400 coupler

Chart (Imperial)		Chart (Metr	ic) Do	wnloads	Application	\$			
Cylinder Capacity	Stroke	Model Number	Cylinder Effective rea	Oil Capacity	Collapsed Height	Extended Height	Outside Diameter	Center Hole Dia.	Weight
tons (max)	(in)		(in ²)	(in ³)	(in)	(in)	(in)	(in)	(lbs)
12 (13.8)	0.31	RCH-120	2.76	0.86	2.19	2.5	2.75	0.77	3.2
	1.63	RCH-121*	2.76	4.49	4.75	6.38	2.75	0.77	6.2
	1.63	RCH-1211	2.76	4.49	4.75	6.38	2.75	0.77	6.2
	3.00	RCH-123	2.76	8.29	7.25	10.25	2.75	0.77	9.8
20 (23.6)	2.00	RCH-202*	4.72	9.46	6.38	8.38	3.88	1.06	17
	6.10	RCH-206	4.72	28.67	12.05	18.11	3.88	1.06	31
30 (36.1)	2.50	RCH-302*	7.22	18.05	7.03	9.53	4.50	1.31	24
	6.13	RCH-306	7.22	44.23	13.00	19.13	4.50	1.31	48
60 (63.6)	3.00	RCH-603*	12.73	38.20	9.75	12.75	6.25	2.12	62
	6.00	RCH-606	12.73	76.41	12.75	18.75	6.25	2.12	78
100 (103.1)	3.00	RCH-1003*	20.63	61.88	10.00	13.00	8.38	3.11	132

Step 4: Add the donut load cell.

It is of paramount importance that the load cell be inserted between the two flat platens. Failure to compress the load cell between two flat surfaces may result in inaccurate readings. Eccentric loading may also result in inaccurate load cell reading. Always compare load cell reading with the pressure in the line multiplied by the area of the cylinder.