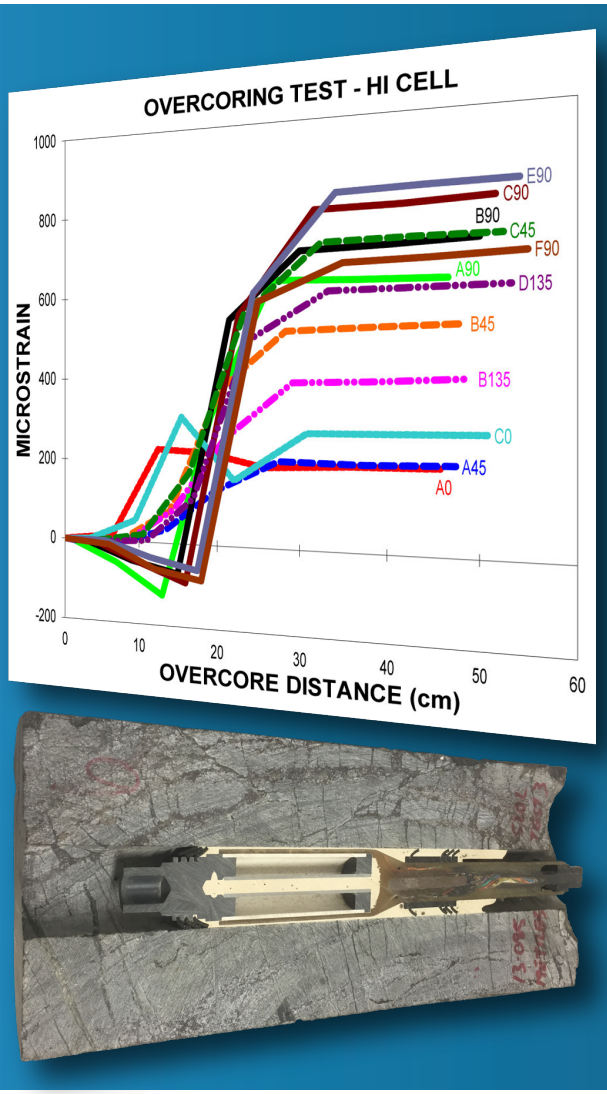
GEOSYSTEMS

Stress 201i

ISOTROPIC ANALYSIS SOFTWARE FOR HI CELL DATA

PRODUCT USER MANUAL



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Introduction

This programme allows the user to determine stresses (Isotropic solution) and rock properties from raw data output from a CSIRO HI cell and plot overcore and biaxial tests. The programme is run from Excel. Once the programme is run for the first time a new tool bar is added to Excel (Stress201i). This toolbar has 8 buttons and these buttons operate like any other Excel toolbar button. Simply select the desired button and click the mouse.

The user should have an understanding of the overcore process for CSIRO HI cells and be experienced in selecting gauges for analysis. The user should have a basic understanding of strain gauges. It is also important to understand the conventions used. The programme is for genuine ESS Earth Sciences manufactured CSIRO HI and HID cells with having preset values for Alpha and Beta angles for the strain gauges. It is assumed that the user is familiar with Excel.

This Excel **add in** allows the user to determine rock properties and stresses (Isotropic solution) from raw data output from a CSIRO HI cell. It converts raw voltage to strain, plots overcoring and biaxial data, imports data from a logger, saves and opens Overcoring and Biaxial test files.

The user should know/have/used:

- Best practices were used installing the HI Cell(s)
- A good understanding of the CSIRO HI cell
- Be experienced in selecting gauges for analysis.
- Understanding of strain gauges limitations and techniques.
- Understand the conventions used.
- Experience using Excel.
- The limitations of this software

Installation Procedure

Minimum System requirements:

- Windows 7 and above operating system
- Excel 2010 and above
- 8Mb Ram
- Internet connection

System setup

Updating from a previous version of stress 201i

All previous versions of Stress 201i ***must be deleted***.

Delete the Stress 201i.xla(m) File

Delete the Stress 201i tool bar

If you have trouble with this, contact your IT specialist.

What's new in this version?

- New Ribbon design with more tabs.
- Better security. The user does not have to have security settings in Excel set to "Allow all macros". A digital signature is provided so security settings can be set to "Disable all macros except digitally signed macros".
- Better error checking of data and stress computations.
- New Import button which allows user to import logger data directly into a worksheet.
- Alerts the user when a new update is available.
- If you desire we offer free checking of your first workbook to make sure the worksheets have been set up correctly.

Before you install this software you should read the SOFTWARE LICENCE AGREEMENT (EULA) on page 16 of this manual.

Download stress201i.zip folder> extract files to a new folder eg Stress Overcoring.

Right Click "Stress 201i.xlam"> properties

If Security is not visible >OK

Else If Security is visible. "This file came from another computer…… "

> unblock >OK

We have provided a digital signature to use with this software. A digital signature is an electronic, encrypted, stamp of authentication on software. A signature confirms that the information originated from the signer and has not been altered.

If you choose to install this digital signature you will have greater security on your computer system and not have the Microsoft security warnings pop up each time you run the software.

If you choose ***not to*** install the digital signature (***not recommended and some organizations will not allow this***). You will need to change your Trust Settings to allow "Enable all macros"

Installing the digital signature (recommended).

We have provided a step by step pictorial guide at the end of this manual, if you have any problems installing the digital signature.

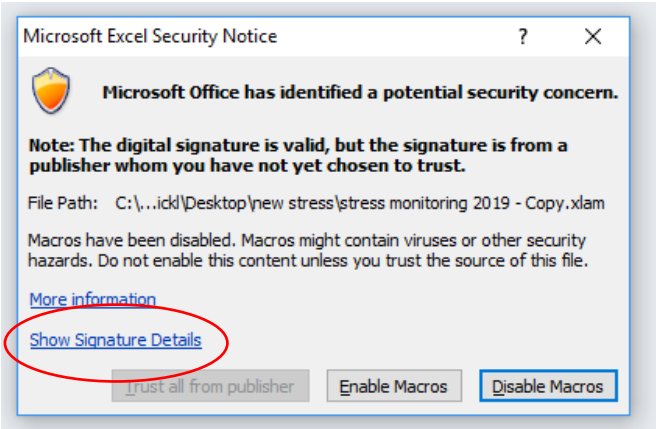
First setup the Macro settings in Excel.

Run Excel> File>Options> Trust Center> Trust Center Settings> Macro Settings > Disable all macros except digitally signed macros> OK> OK> Close Excel.

Click "Stress 201i.xlam" to open

A pop up should appear

Follow the steps below



> Show Signature Details

> View Certificate

> install Certificate

> Current User

> Next

>Place all certificates in the following store

> Browse

>Trusted Root Certification Authorities

> OK > Next > Finish

"You are about to install a certificate"

> YES

Certificate Import Wizard > OK> OK>OK

>Trust all from Publisher

The Stress Icons should now be visible in the Stress tab and the program ready to run. We have provided a sample workbook to open and get familiar with the program.

EARLIER VERSIONS

Go to windows explorer, select C: (local drive), select program files, once in program files generate a new folder and name it "Stress programme" (or preferred name and path).

Save "Stress 201i.xla" and "sample.hio" in this newly created folder. Open Microsoft Excel.

Excel 2003

Updating from a previous version (Deleting Old Toolbar)

Select Tools> customise> tool bars> Stress 20XX toolbar> delete.
It is also recommended that the old stress 20XX.xla programme be deleted.

Macro Security Settings

Select tools > macro > security > medium or low (not recommended as this setting could allow other malicious macros to run). If medium security is selected you will be prompted each time you want to run the programme.

Once saved, double click "Stress 201i.xla" and select Enable macros.

A tool bar will automatically appear. If it doesn't appear select tools> customise> tool bars> select Stress 201i toolbar.

Excel 2007/2010

Updating from a previous version (Deleting Old Toolbar)

Select Add-Ins > right click Stress 20XX toolbar > Delete Custom Toolbar
It is also recommended that the old stress 20XX.xla programme be deleted.

Macro Security Settings

Select Office Button > Excel Options > Trust Center > Trust Center Settings > Macro Settings > Enable all macros

If you cannot select this button contact your IT specialist.

Once saved, double click "Stress 201i.xla". Select and click the Add-ins Tab.

The stress 201i tool bar should be apparent.

Sample File

Click the Open File icon (green folder) located on the Stress 201i tool bar, open the "sample.hio" file which should now be located in c:\program files\stress 201i (or preferred path and name). This file is a sample file of data, plots and analysis. The installation should now be completed and the programme working.

The Stress Icons should now be visible in the Stress tab and the program ready to run. We have provided a sample workbook to open and get familiar with the program.

Stress 201i Toolbar

Button Description and Operation

 *Open*

This button allows you to select then open a saved CSIRO HI Cell file ("hio").

filename(s) > Open.

 *Save*

This button allows you to save a CSIRO HI Cell file ("hio" File.)

filename> Save.

 *New*

This button creates a new CSIRO HI cell workbook.

Seven worksheets are created. oc*data, bidata, info, plt, stress, rock and rawdata*.

 *Import*

This button imports a logger file to the rawdata worksheet. Either a tab delimited text file (txt) or comma delimited file (csv).

 *Strains*

This button converts raw microvolts to microstrain in the ocdata and bidata worksheets.

 *Plot*

This button plots selected rows of data from the oc*data* and bidata worksheets.

 Rock

This button calculates the Rock Modulus and Poisson's Ratio

 *Stress*

This button calculates Principal Stresses and Normal and Shear Stresses.

Stress 201i Toolbar Pre 2018

 The "Open File" button allows the user to open an existing CSIRO HI Cell file (*.hio).

 The "Save File" button allows the user to save a CSIRO HI Cell file (*.hio).

 The "New File" button allows the user to make a new spreadsheet for CSIRO HI Cell data.

 The "Calculate" button converts the raw data to micro strain, temperature and distance.

 The "Plot data" button plots the selected corrected data.

 The "Calculate Rock Properties" button calculates Young's Modulus and Poisson's ratio from the selected data.

 The "Calculate Stress" button calculates the principal stress magnitudes, dips and bearings and also the normal and shear stress components from the selected data.

When creating a New File, six sheets are created: ocdata; bidata; info; plt; stress; and rock

Info Worksheet

Some of this information is necessary to perform calculations. Default values for the CSIRO Thinwall cell are automatically inserted. Enter information in column 2.

In this sheet information for the Hi cell is stored in column 2.

This spreadsheet has 3 text colours

Critical information this information has to **entered.**

This information is needed to convert microvolts to strain and calculate stresses. ***This must be numeric data only ie don't enter 38.1mm enter 38.1.***

Non critical information this data is ***not*** needed for any calculations. This is just for a record of your test information. This is Information such as location, test number etc.

Calculated information this data will be populated when the programme is run, such as maximum temperature change during the overcore test etc.

Row Descriptions

Row 8 Hole Bearing This is the hole bearing for the test, ***Positive clockwise from North.***

Row 9 Hole Dip This is the hole dip for the test, ***Dip from Horizontal Positive Down.*** (Ie 5° up would be entered as -5).

Row 21 Overcore Diameter: This is the Outside diameter of the overcore (in mm).

Row 22 E Hole Diameter: This is the diameter of the pilot hole (in mm).

Row 23 Diameter of Gauges. This is the diameter of the gauges in the CSIRO cell. This information is on the data sheet for the HI cell.

Row 24 Inner Diameter of Cell. This is the inner diameter of the CSIRO cell. . This information is on the data sheet for the HI cell.

Row 25 Young's Modulus of Epoxy. This is the modulus (GPa) of the epoxy used to glue the CSIRO HI cell to the pilothole. This information is on the data sheet for the HI cell.

Row 26 Poisson's Ratio of Epoxy. This is the Poisson's ratio of the epoxy used to glue the CSIRO HI cell to the pilothole. This information is on the data sheet for the HI cell.

Row 31 Cell Gauge Factor. This is the Gauge Factor of the CSIRO HI Cell. This information is on the data sheet for the HI cell.

Row 32 Readout Gauge Factor. This is the gauge Factor for the logger/readout unit. This must be determined by the operator to give a correct conversion from microvolts to microstrain (consult your operating manual).

Row 33 Orientation of B90 Gauge (#6) .This is the angle of the B90 gauge in the borehole.

Row 37 Rock Modulus. This is the modulus of the rock in GPa. This is calculated from the biaxial test or from laboratory rock testing.

Row 38 Rock Poisson's ratio. This is the Poisson's ratio of the rock. This is calculated from the biaxial test or from laboratory rock testing.

Non critical information

Rows 1 – 7, 10 - 20, 34 - 36 and 39. This data is not needed for any calculations. This is just for a record of test information.

Critical information

Rows 8, 9, 21, 22, 23, 24, 25, 26, 31, 32, 33, 37 and 38. This information is needed to convert volts to strain, calculate rock properties and determine stresses. **This must be numeric data only – i.e. don't enter 38.1mm, enter 38.1**

Calculated information

Rows 16, 17, 27, 28, 29, 30 and 39. These are calculated values from the test information.

	1	2	3
1	Location:	Macclesfield Mine	
2	Hole Number:	UDD1	
3	Test Number:	HI 1	
4	Hole Collar - Northing:	10525	
5	- Easting :	20725	
6	- Reduced Level :	-620m	
7	Surface RL:	+100m	
8	Hole Bearing:	45.30	
9	Hole Dip:	-4.30	
10	Mine North:	45° West of True North	
11	Date/Time Installed :	23/05/2011 09:35	
12	Date/Time Overcored :	24/05/2011 11:00	
13	E Collar Depth :	12.145	
14	E Hole Length :	600mm	
15	Strain Gauge Depth :	12.445m	
16	Rock Temperature:	33.23°C	
17	Temperature Offset	-0.1°C	
18	Drill Water Temperature :	25°C	
19	Cell Type :	CSIRO HI Thinwall Cell	
20	Cell Number:	8069	
21	Overcore Diameter:	144.5	
22	E Hole Diameter :	38.1	
23	Diameter of Gauges :	35	
24	Inner Diameter of Cell :	35	
25	Young 's Modulus of Epoxy :	2.60	
26	Poisson 's Ratio of Epoxy :	0.40	
27	K1:	1.1258	
28	K2:	1.2503	
29	K3:	1.081	

30	K4:	0.9505	
31	Cell Gauge Factor :	2.103	
32	Readout Gauge Factor :	2.000	
33	Orientation of B90 Gauge (#6) :	180	
34	Core Length :	550mm	
35	Maximum Biaxial Test Pressure :	15MPa	
36	Rock Type:	Granite	
37	Modulus:	82.53	
38	Poisson's ratio:	0.25	
39	Maximum Temperature Change:	-6.6°C	

Overcore and Biaxial Worksheets

Note: Only numeric data should be placed in the spreadsheet.

Columns 1-12 Enter raw data from the field measurement record for the gauge outputs in **microvolts**.

Column 13 Enter the Thermistor reading in **Ohms**

Column 14 Enter the distance measurement in **cms** (This is the approximate distance of drill advance after taking a set of readings for the 12 gauges) in the overcore sheet, and enter the Pressure (MPa) in the biaxial sheet for each row of data.

Column 15 Enter Time in hours and minutes (**hh:mm**). This is the approximate time after taking a set of readings of the 12 gauges.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A0	A90	A45	B45	B135	B90	C0	C90	C45	D135	E90	F90	Therm	Dist	Time
(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(Ohms)	(cm)	(hrs)
12	26	1	12	11	18	8	512	-19	1016	1012	1019	2110	0	09:00
14	29	6	18	18	24	10	518	-14	1019	1012	1028	2110	0	09:10
16	28	2	18	17	21	14	516	-14	1016	1012	1018	2110	6	09:12
30	-26	4	26	21	-24	66	466	6	1024	974	961	2110	12	09:14
254	-104	41	101	105	-52	333	420	168	1136	947	938	2110	18	09:16
248	353	144	411	288	591	176	1097	565	1534	1644	1639	2120	25	09:18
214	691	222	554	428	756	296	1348	736	1651	1881	1727	2145	35	09:20
221	686	218	560	430	762	297	1351	740	1653	1887	1732	2798	45	09:22
222	684	221	564	436	771	298	1361	741	1656	1891	1741	2120	55	09:24

ocdata sheet

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A0	A90	A45	B45	B135	B90	C0	C90	C45	D135	E90	F90	Therm	Press	Time
(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(Ohms	(MPa)	(hrs)
230	934	345	664	551	992	315	1560	848	1814	2091	1940		0	
284	766	286	596	484	784	366	1331	757	1715	1842	1753		5	
338	581	219	523	413	572	414	1108	667	1655	1616	1567		10	
395	384	149	447	341	344	466	865	569	1589	1370	1373		15	
236	956	352	673	561	1010	314	1572	857	1795	2087	1950		0	

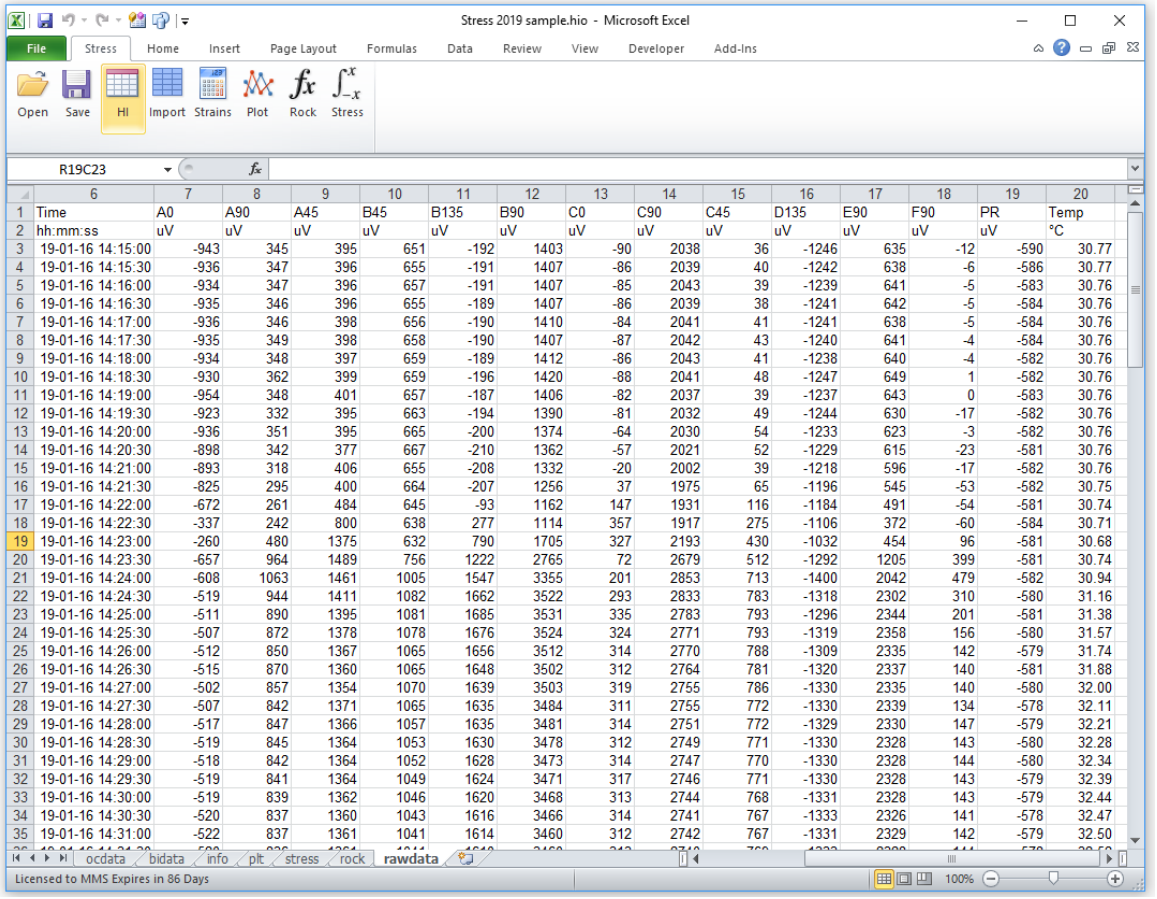
bidata sheet

Note it is not necessary to input time and thermistor readings for the biaxial test

Raw data worksheet

This is the data after using the import button (or you can manually import the data).

This would typically include Date, Time, 12 strain gauge outputs, temperature and other logger variables.



This worksheet is provided to so you can store the output file from the logger.

Either use formulas or cut and paste the data into the ocdata (overcoring) and bidata (biaxial) worksheets.

Columns 1-12 Enter raw data from the strain gauge outputs in **microvolts**.

Column 13 Enter the Thermistor reading in **°C or Ohms**

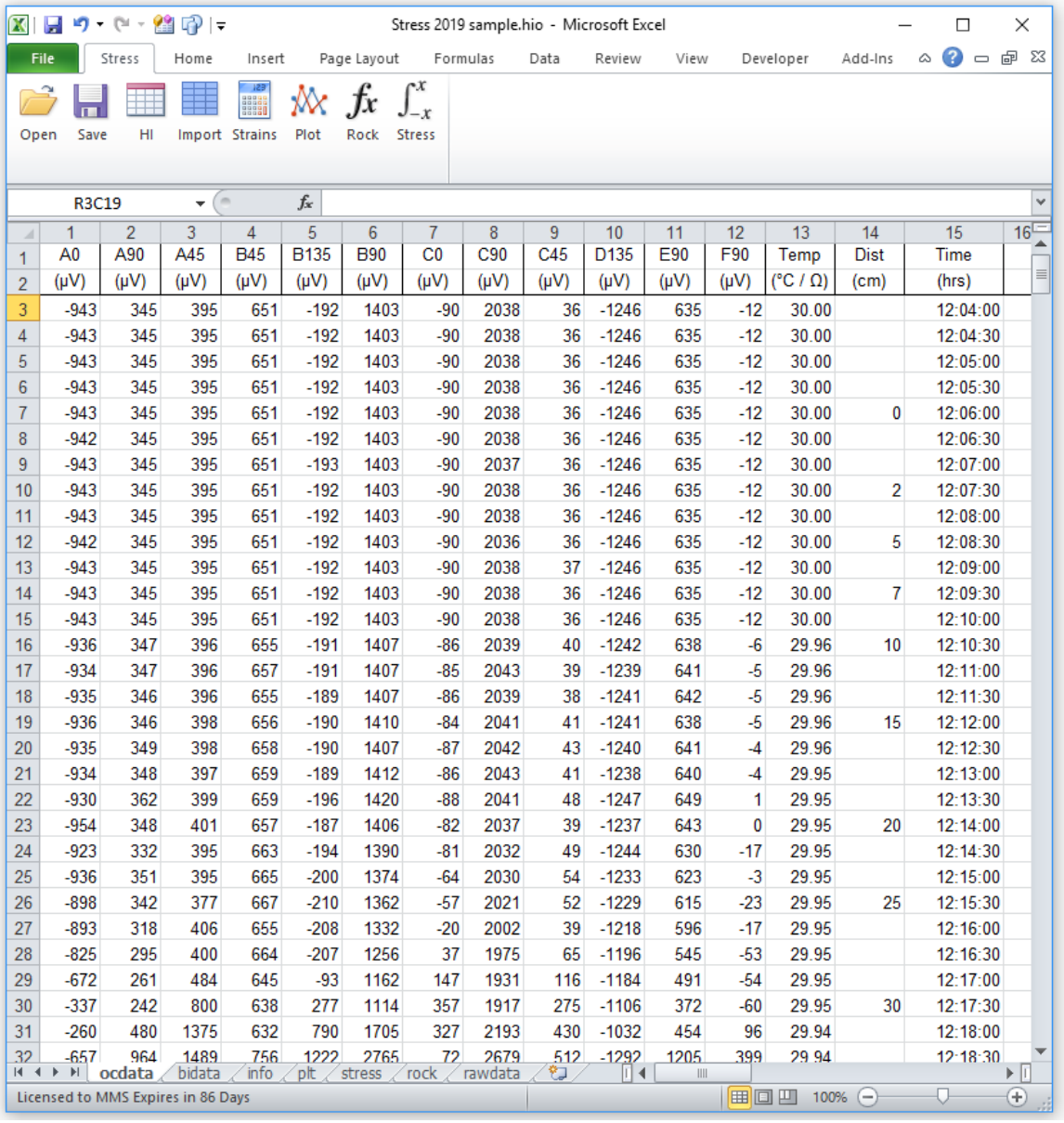
Column 14 Enter the distance measurement in **cms** (drill advance during the overcore test) in the overcore sheet, and the pressure increments in **MPa** in the biaxial sheet.

Column 15 Enter Time in hours and minutes (**hh:mm**). This is the time when taking a set of readings for the 12 gauges.

ocdata worksheet

Fill in column 14 with the distance measurements for the overcore test

Note: A Zero must be placed for your start row. `Calculated strains and time will be relative to the first Zero in column 14.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	A0	A90	A45	B45	B135	B90	C0	C90	C45	D135	E90	F90	Temp	Dist	Time
2	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(°C / Ω)	(cm)	(hrs)
3	-943	345	395	651	-192	1403	-90	2038	36	-1246	635	-12	30.00		12:04:00
4	-943	345	395	651	-192	1403	-90	2038	36	-1246	635	-12	30.00		12:04:30
5	-943	345	395	651	-192	1403	-90	2038	36	-1246	635	-12	30.00		12:05:00
6	-943	345	395	651	-192	1403	-90	2038	36	-1246	635	-12	30.00		12:05:30
7	-943	345	395	651	-192	1403	-90	2038	36	-1246	635	-12	30.00	0	12:06:00
8	-942	345	395	651	-192	1403	-90	2038	36	-1246	635	-12	30.00		12:06:30
9	-943	345	395	651	-193	1403	-90	2037	36	-1246	635	-12	30.00		12:07:00
10	-943	345	395	651	-192	1403	-90	2038	36	-1246	635	-12	30.00	2	12:07:30
11	-943	345	395	651	-192	1403	-90	2038	36	-1246	635	-12	30.00		12:08:00
12	-942	345	395	651	-192	1403	-90	2036	36	-1246	635	-12	30.00	5	12:08:30
13	-943	345	395	651	-192	1403	-90	2038	37	-1246	635	-12	30.00		12:09:00
14	-943	345	395	651	-192	1403	-90	2038	36	-1246	635	-12	30.00	7	12:09:30
15	-943	345	395	651	-192	1403	-90	2038	36	-1246	635	-12	30.00		12:10:00
16	-936	347	396	655	-191	1407	-86	2039	40	-1242	638	-6	29.96	10	12:10:30
17	-934	347	396	657	-191	1407	-85	2043	39	-1239	641	-5	29.96		12:11:00
18	-935	346	396	655	-189	1407	-86	2039	38	-1241	642	-5	29.96		12:11:30
19	-936	346	398	656	-190	1410	-84	2041	41	-1241	638	-5	29.96	15	12:12:00
20	-935	349	398	658	-190	1407	-87	2042	43	-1240	641	-4	29.96		12:12:30
21	-934	348	397	659	-189	1412	-86	2043	41	-1238	640	-4	29.95		12:13:00
22	-930	362	399	659	-196	1420	-88	2041	48	-1247	649	1	29.95		12:13:30
23	-954	348	401	657	-187	1406	-82	2037	39	-1237	643	0	29.95	20	12:14:00
24	-923	332	395	663	-194	1390	-81	2032	49	-1244	630	-17	29.95		12:14:30
25	-936	351	395	665	-200	1374	-64	2030	54	-1233	623	-3	29.95		12:15:00
26	-898	342	377	667	-210	1362	-57	2021	52	-1229	615	-23	29.95	25	12:15:30
27	-893	318	406	655	-208	1332	-20	2002	39	-1218	596	-17	29.95		12:16:00
28	-825	295	400	664	-207	1256	37	1975	65	-1196	545	-53	29.95		12:16:30
29	-672	261	484	645	-93	1162	147	1931	116	-1184	491	-54	29.95		12:17:00
30	-337	242	800	638	277	1114	357	1917	275	-1106	372	-60	29.95	30	12:17:30
31	-260	480	1375	632	790	1705	327	2193	430	-1032	454	96	29.94		12:18:00
32	-657	964	1489	756	1222	2765	72	2679	512	-1292	1205	399	29.94		12:18:30

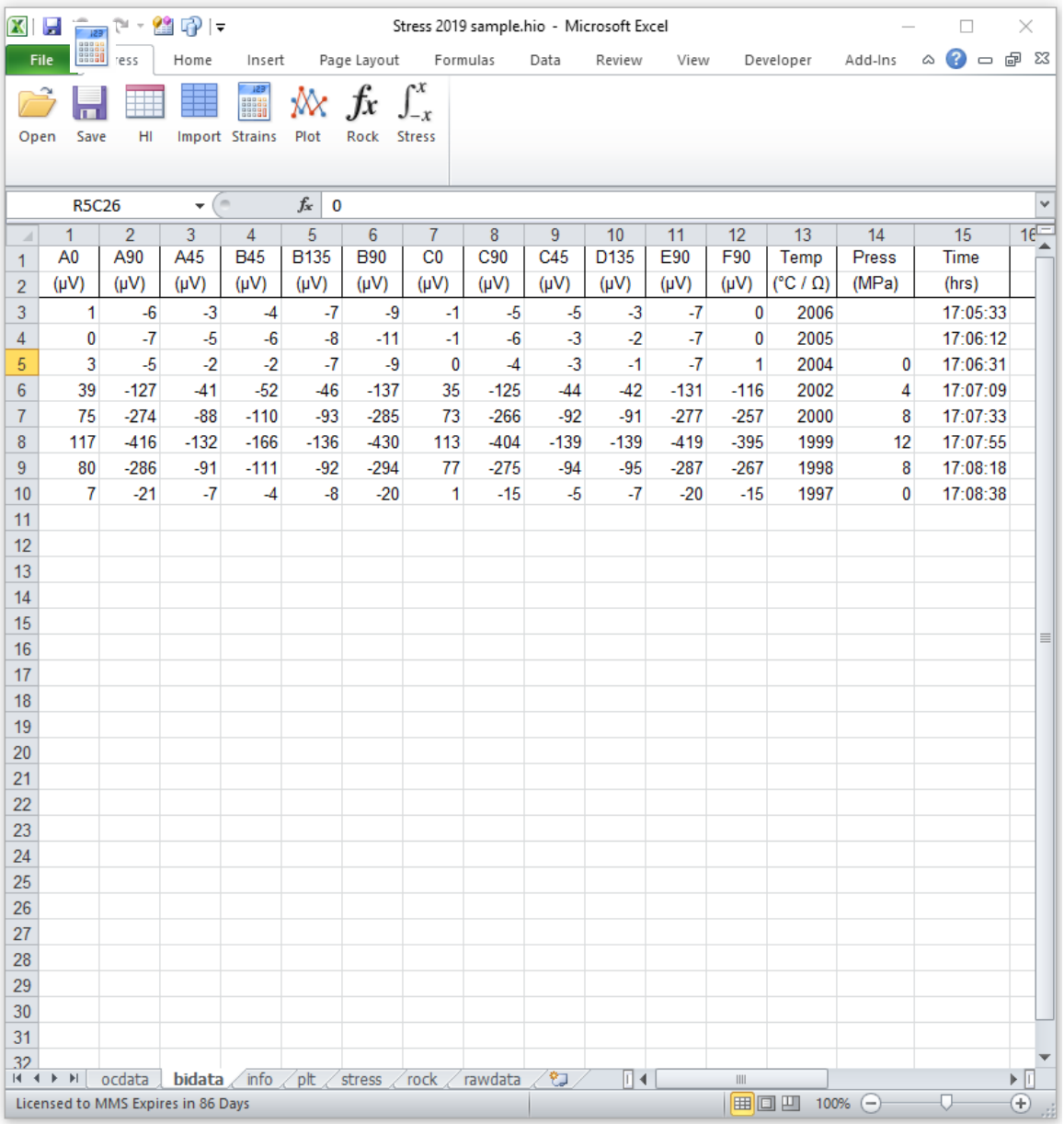
Notes*: Only numeric data will be accepted. If non numeric data is encountered while calculating an error will be displayed.*

If the reading from the thermistor is in Ohms (column 13) the temperature will be calculated in column 30.

bidata worksheet

Fill in column 14 with the Pressure increments (MPa) taken for the biaxial test.

Note: Zero must be placed for your start row. Calculated strains and time will be relative to the first Zero in column 14.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	A0	A90	A45	B45	B135	B90	C0	C90	C45	D135	E90	F90	Temp	Press	Time
2	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(°C / Ω)	(MPa)	(hrs)
3	1	-6	-3	-4	-7	-9	-1	-5	-5	-3	-7	0	2006		17:05:33
4	0	-7	-5	-6	-8	-11	-1	-6	-3	-2	-7	0	2005		17:06:12
5	3	-5	-2	-2	-7	-9	0	-4	-3	-1	-7	1	2004	0	17:06:31
6	39	-127	-41	-52	-46	-137	35	-125	-44	-42	-131	-116	2002	4	17:07:09
7	75	-274	-88	-110	-93	-285	73	-266	-92	-91	-277	-257	2000	8	17:07:33
8	117	-416	-132	-166	-136	-430	113	-404	-139	-139	-419	-395	1999	12	17:07:55
9	80	-286	-91	-111	-92	-294	77	-275	-94	-95	-287	-267	1998	8	17:08:18
10	7	-21	-7	-4	-8	-20	1	-15	-5	-7	-20	-15	1997	0	17:08:38

Notes*: Only numeric data will be accepted. If non numeric data is encountered while calculating an error will be displayed.*

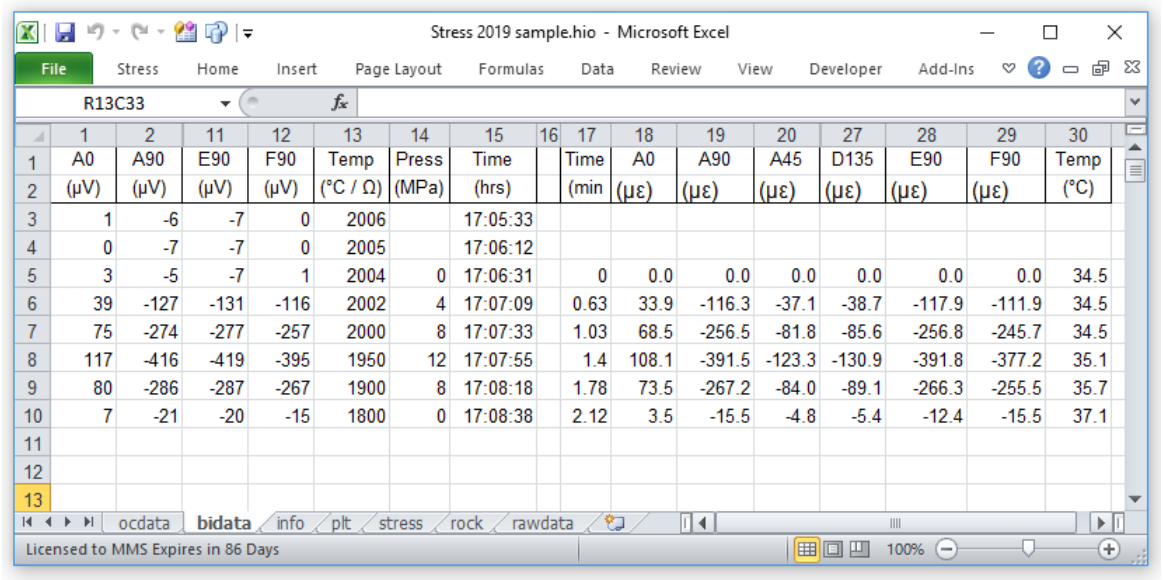
If the reading from the thermistor is in Ohms (column 13) the temperature will be calculated in column 30.

Calculate Strains

This button converts the raw data in microvolts to microstrain for both the biaxial test and the overcore test. It also calculates the relative time difference (column 17), relative strain difference for each gauge (columns 18 - 29), rock temperature (column 30) and incremental distance for each gauge (columns 31 – 42).

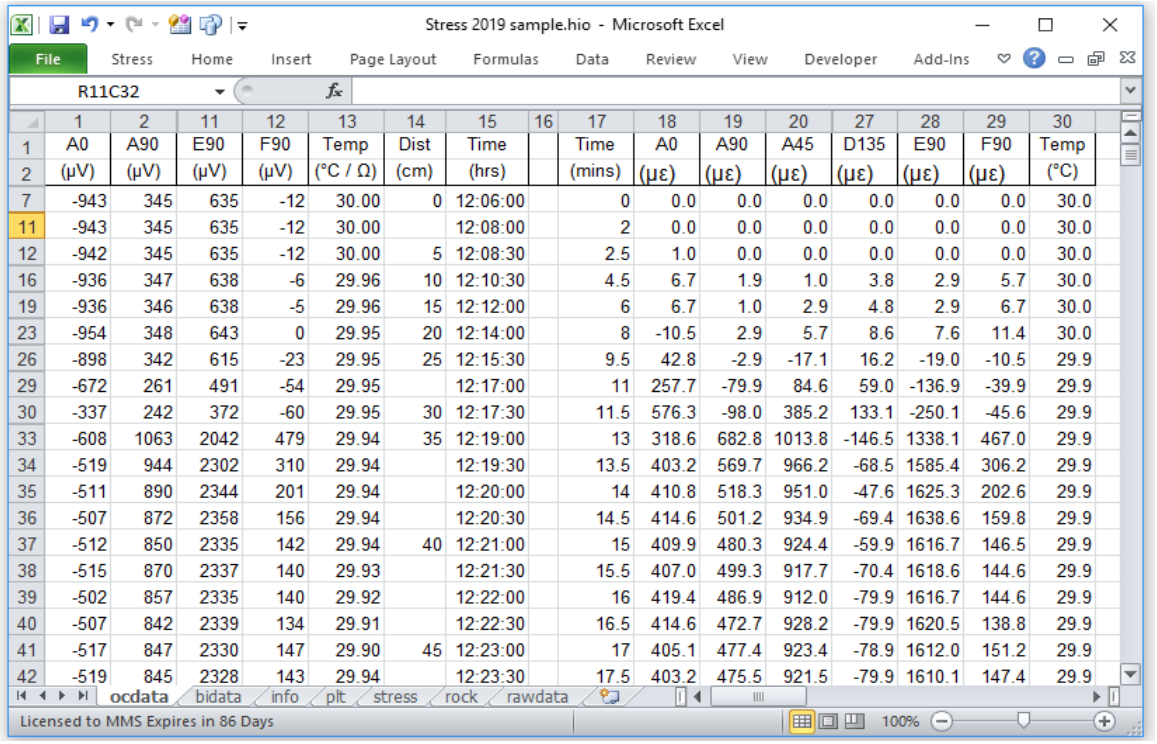
It is important that a zero is placed in the first row in column 14. More than one zero can be placed in this column. The programme calculates relative values from the last zero value at the beginning of this column. The programme will keep calculating values while there is a value in the Distance / Pressure (14) or Time column (15).

Only numeric data will be accepted. If non numeric data is encountered while calculating an error will be displayed (Run time error '1004' or "13").



	1	2	11	12	13	14	15	16	17	18	19	20	27	28	29	30
1	A0	A90	E90	F90	Temp	Press	Time		Time	A0	A90	A45	D135	E90	F90	Temp
2	(μV)	(μV)	(μV)	(μV)	(°C / Ω)	(MPa)	(hrs)		(min	(με)	(με)	(με)	(με)	(με)	(με)	(°C)
3	1	-6	-7	0	2006		17:05:33									
4	0	-7	-7	0	2005		17:06:12									
5	3	-5	-7	1	2004	0	17:06:31		0	0.0	0.0	0.0	0.0	0.0	0.0	34.5
6	39	-127	-131	-116	2002	4	17:07:09		0.63	33.9	-116.3	-37.1	-38.7	-117.9	-111.9	34.5
7	75	-274	-277	-257	2000	8	17:07:33		1.03	68.5	-256.5	-81.8	-85.6	-256.8	-245.7	34.5
8	117	-416	-419	-395	1950	12	17:07:55		1.4	108.1	-391.5	-123.3	-130.9	-391.8	-377.2	35.1
9	80	-286	-287	-267	1900	8	17:08:18		1.78	73.5	-267.2	-84.0	-89.1	-266.3	-255.5	35.7
10	7	-21	-20	-15	1800	0	17:08:38		2.12	3.5	-15.5	-4.8	-5.4	-12.4	-15.5	37.1
11																
12																
13																

Biaxial Worksheet



	1	2	11	12	13	14	15	16	17	18	19	20	27	28	29	30
1	A0	A90	E90	F90	Temp	Dist	Time		Time	A0	A90	A45	D135	E90	F90	Temp
2	(μV)	(μV)	(μV)	(μV)	(°C / Ω)	(cm)	(hrs)		(mins)	(με)	(με)	(με)	(με)	(με)	(με)	(°C)
7	-943	345	635	-12	30.00	0	12:06:00		0	0.0	0.0	0.0	0.0	0.0	0.0	30.0
11	-943	345	635	-12	30.00		12:08:00		2	0.0	0.0	0.0	0.0	0.0	0.0	30.0
12	-942	345	635	-12	30.00	5	12:08:30		2.5	1.0	0.0	0.0	0.0	0.0	0.0	30.0
16	-936	347	638	-6	29.96	10	12:10:30		4.5	6.7	1.9	1.0	3.8	2.9	5.7	30.0
19	-936	346	638	-5	29.96	15	12:12:00		6	6.7	1.0	2.9	4.8	2.9	6.7	30.0
23	-954	348	643	0	29.95	20	12:14:00		8	-10.5	2.9	5.7	8.6	7.6	11.4	30.0
26	-898	342	615	-23	29.95	25	12:15:30		9.5	42.8	-2.9	-17.1	16.2	-19.0	-10.5	29.9
29	-672	261	491	-54	29.95		12:17:00		11	257.7	-79.9	84.6	59.0	-136.9	-39.9	29.9
30	-337	242	372	-60	29.95	30	12:17:30		11.5	576.3	-98.0	385.2	133.1	-250.1	-45.6	29.9
33	-608	1063	2042	479	29.94	35	12:19:00		13	318.6	682.8	1013.8	-146.5	1338.1	467.0	29.9
34	-519	944	2302	310	29.94		12:19:30		13.5	403.2	569.7	966.2	-68.5	1585.4	306.2	29.9
35	-511	890	2344	201	29.94		12:20:00		14	410.8	518.3	951.0	-47.6	1625.3	202.6	29.9
36	-507	872	2358	156	29.94		12:20:30		14.5	414.6	501.2	934.9	-69.4	1638.6	159.8	29.9
37	-512	850	2335	142	29.94	40	12:21:00		15	409.9	480.3	924.4	-59.9	1616.7	146.5	29.9
38	-515	870	2337	140	29.93		12:21:30		15.5	407.0	499.3	917.7	-70.4	1618.6	144.6	29.9
39	-502	857	2335	140	29.92		12:22:00		16	419.4	486.9	912.0	-79.9	1616.7	144.6	29.9
40	-507	842	2339	134	29.91		12:22:30		16.5	414.6	472.7	928.2	-79.9	1620.5	138.8	29.9
41	-517	847	2330	147	29.90	45	12:23:00		17	405.1	477.4	923.4	-78.9	1612.0	151.2	29.9
42	-519	845	2328	143	29.94		12:23:30		17.5	403.2	475.5	921.5	-79.9	1610.1	147.4	29.9

Overcore Worksheet

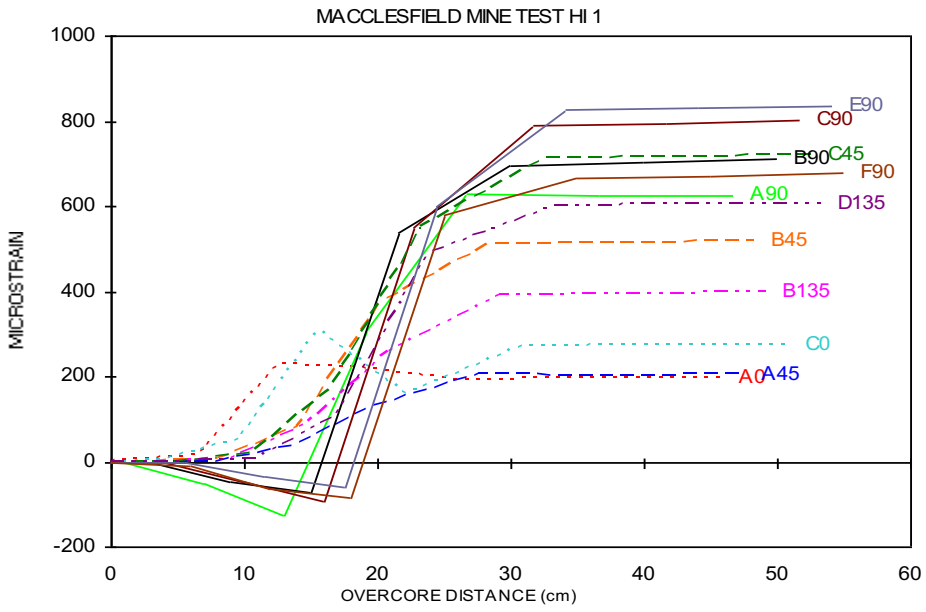
Plot

This button allows plotting of the overcore and biaxial data.

To plot all gauges vs **distance** select any of columns 1-14. Select the start row and highlight to the end row you wish to plot. Click and the graph will be updated in the "plt" sheet. To plot all gauges vs **time** select the column 15 from the start row to the end row.

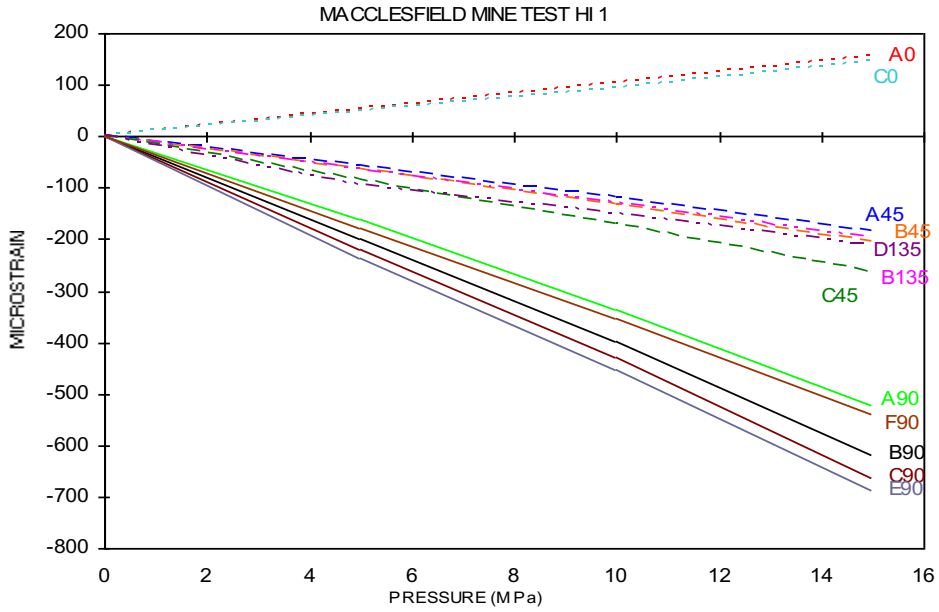
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A0	A90	A45	B45	B135	B90	C0	C90	C45	D135	E90	F90	Therm	Dist	Time
(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(Ohms)	(cm)	(hrs)
12	26	1	12	11	18	8	512	-19	1016	1012	1019	2110	0	09:00
14	29	6	18	18	24	10	518	-14	1019	1012	1028	2110	0	09:10
16	28	2	18	17	21	14	516	-14	1016	1012	1018	2110	6	09:12
30	-26	4	26	21	-24	66	466	6	1024	974	961	2110	12	09:14
254	-104	41	101	105	-52	333	420	168	1136	947	938	2110	18	09:16
248	353	144	411	288	591	176	1097	565	1534	1644	1639	2120	25	09:18
214	691	222	554	428	756	296	1348	736	1651	1881	1727	2145	35	09:20
221	686	218	560	430	762	297	1351	740	1653	1887	1732	2798	45	09:22
222	684	221	564	436	771	298	1361	741	1656	1891	1741	2120	55	09:24

(above) select column – ocdata worksheet. Then click to get pot (below).



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A0	A90	A45	B45	B135	B90	C0	C90	C45	D135	E90	F90	Therm	Press	Time
(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(Ohms	(MPa)	(hrs)
230	934	345	664	551	992	315	1560	848	1814	2091	1940		0	
284	766	286	596	484	784	366	1331	757	1715	1842	1753		5	
338	581	219	523	413	572	414	1108	667	1655	1616	1567		10	
395	384	149	447	341	344	466	865	569	1589	1370	1373		15	
236	956	352	673	561	1010	314	1572	857	1795	2087	1950		0	

(above) select column – bidata worksheet. Then click  *to get pot (below).*

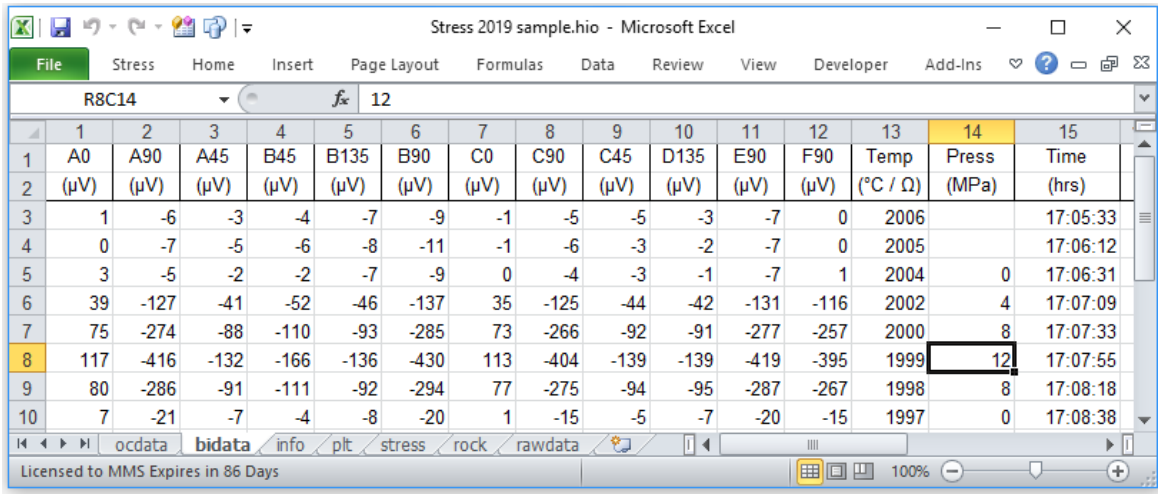


Rock Properties

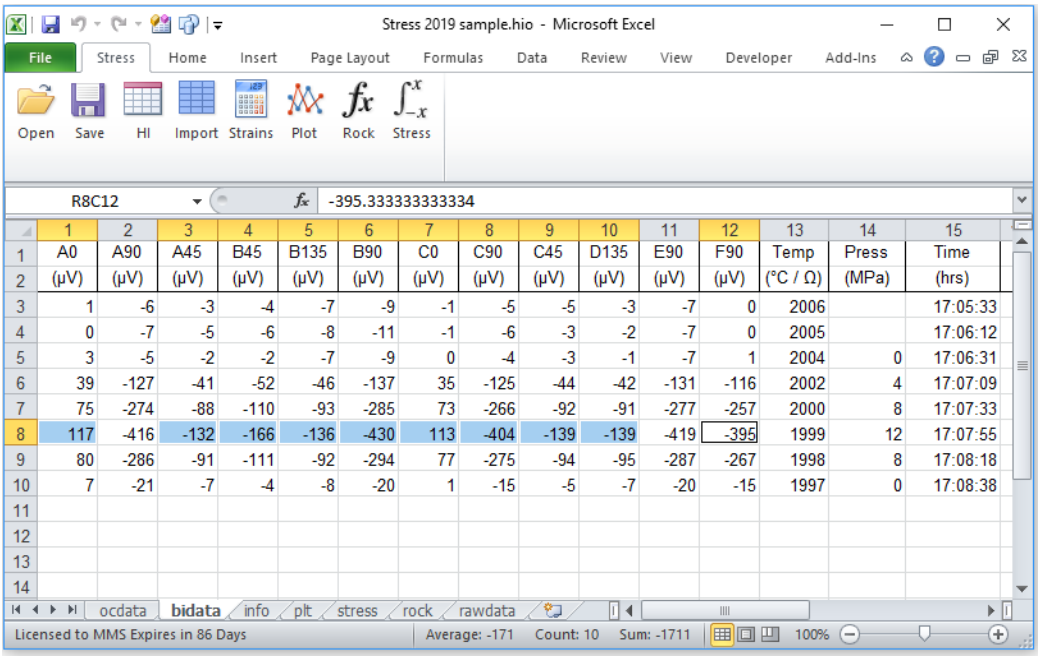
This button allows you to calculate the Young's Modulus and Poisson's ratio and their respective standard errors. Select the row you wish to calculate rock properties from or multi select gauges you wish to include. The calculated Modulus and Poisson's ratio is placed in the info worksheet.

Select the biaxial sheet; click the row you wish to calculate rock properties from or multi select gauges you wish to include. Click

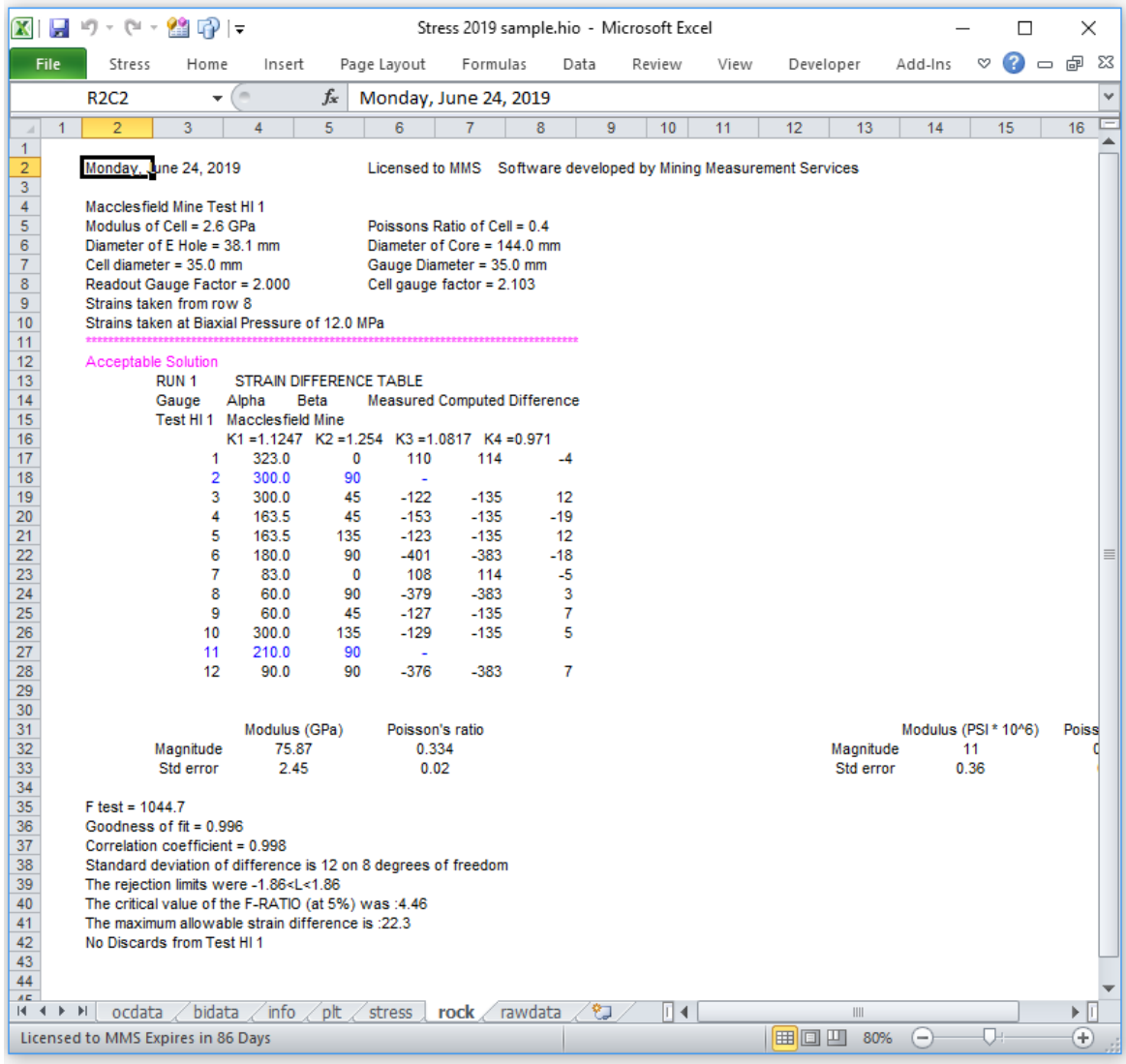
Single select



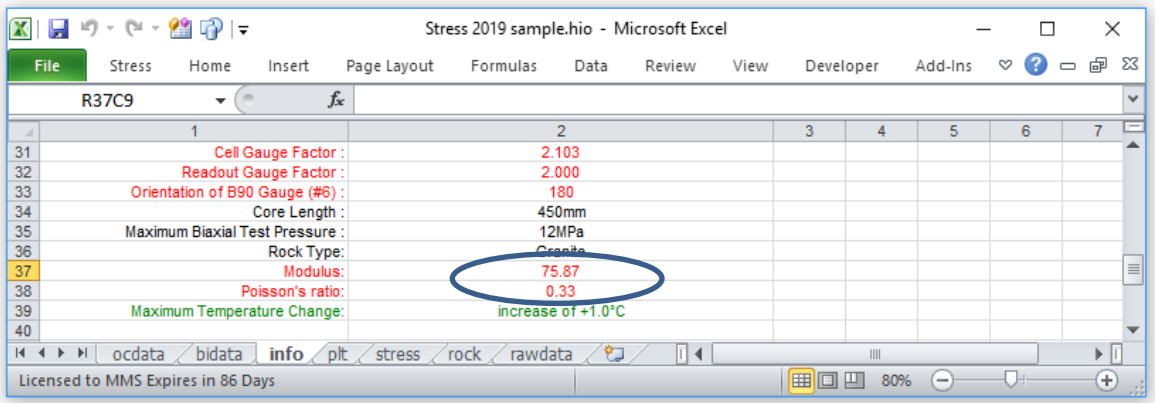
OR multi select cells



The calculated Modulus and Poisson's ratio, statistical and test details are placed in the rock worksheet.



The calculated Modulus and Poisson's ratio are also placed in the info sheet column 2, in rows 37 and 38 respectively.



The file must be saved first to calculate the rock properties. If the file is not saved an error will be displayed "Select Valid Workbook (.hio)".

Select data – bidata worksheet

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A0	A90	A45	B45	B135	B90	C0	C90	C45	D135	E90	F90	Therm	Press	Time
(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(Ohms	(MPa)	(hrs)
230	934	345	664	551	992	315	1560	848	1814	2091	1940		0	
284	766	286	596	484	784	366	1331	757	1715	1842	1753		5	
338	581	219	523	413	572	414	1108	667	1655	1616	1567		10	
395	384	149	447	341	344	466	865	569	1589	1370	1373		15	
236	956	352	673	561	1010	314	1572	857	1795	2087	1950		0	

Single selection – for all gauges (any column)…

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A0	A90	A45	B45	B135	B90	C0	C90	C45	D135	E90	F90	Therm	Press	Time
(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(Ohms	(MPa)	(hrs)
230	934	345	664	551	992	315	1560	848	1814	2091	1940		0	
284	766	286	596	484	784	366	1331	757	1715	1842	1753		5	
338	581	219	523	413	572	414	1108	667	1655	1616	1567		10	
395	384	149	447	341	344	466	865	569	1589	1370	1373		15	
236	956	352	673	561	1010	314	1572	857	1795	2087	1950		0	

…or Multi selection – for selected gauges (from same pressure only)

You may be prompted to accept or reject a certain Run if gauges are not statistically acceptable. Select Yes or No.

Click fx to get the following report:

Friday, 24 June 2011 Licensed to X Software developed by

Macclesfield Mine Test HI 1
Modulus of Cell = 2.6 GPa Poissons Ratio of Cell = 0.4
Diameter of E Hole = 38.1 mm Diameter of Core = 144.5 mm
Cell diameter = 35.0 mm Gauge Diameter = 35.0 mm
Readout Gauge Factor = 2.000 Cell gauge factor = 2.103
Strains taken from row 6
Strains taken at Biaxial Pressure of 15.0 MPa
****

Acceptable Solution

RUN 1 STRAIN DIFFERENCE TABLE

Gauge	Alpha	Beta	Measured	Compute	Difference
Test HI 1	Macclesfield Mine				
	K1 =1.1245 K2 =1.250 K3 =1.0809 K4 =0.961				
1	323.0	0	157	173	-16
2	300.0	90	-523	-618	94
3	300.0	45	-186	-222	36
4	163.5	45	-206	-222	16
5	163.5	135	-200	-222	23
6	180.0	90	-616	-618	1
7	83.0	0	-		
8	60.0	90	-661	-618	-43
9	60.0	45	-265	-222	-43
10	300.0	135	-214		
11	210.0	90	-686	-618	-68
12	90.0	90	-		

	Modulus (GPa)	Poisson's ratio
Magnitude	58.71	0.315
Std error	4.75	0.08

F test = 111.4
Goodness of fit = 0.970
Correlation coefficient = 0.985
Standard deviation of difference is 53 on 7 degrees of freedom
The rejection limits were -1.79<L<1.79
The critical value of the F-RATIO (at 5%) was :4.74
The maximum allowable strain difference is :94.8
No Discards from Test HI 1

The bidata worksheet will be updated showing your selection.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A0	A90	A45	B45	B135	B90	C0	C90	C45	D135	E90	F90	Therm	Press	Time
(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(µV)	(Ohms	(MPa)	(hrs)
230	934	345	664	551	992	315	1560	848	1814	2091	1940		0	
284	766	286	596	484	784	366	1331	757	1715	1842	1753		5	
338	581	219	523	413	572	414	1108	667	1655	1616	1567		10	
395	384	149	447	341	344	466	865	569	1589	1370	1373		15	
236	956	352	673	561	1010	314	1572	857	1795	2087	1950		0	

$\int_{-x}^{x}$ Calculate Stress

This button allows you to calculate Principal stresses, stress components and standard errors. ***Note*** the Modulus and Poisson's ratio of the rock must be first calculated or entered manually in the info worksheet column 2, in rows 37 and 38 respectively.

Conventions used

Preset values for Alpha and Beta angles for the strain gauges are used.

Orientation of The B90 gauge must be known relative to the borehole

Bearing = Clockwise from NORTH Positive

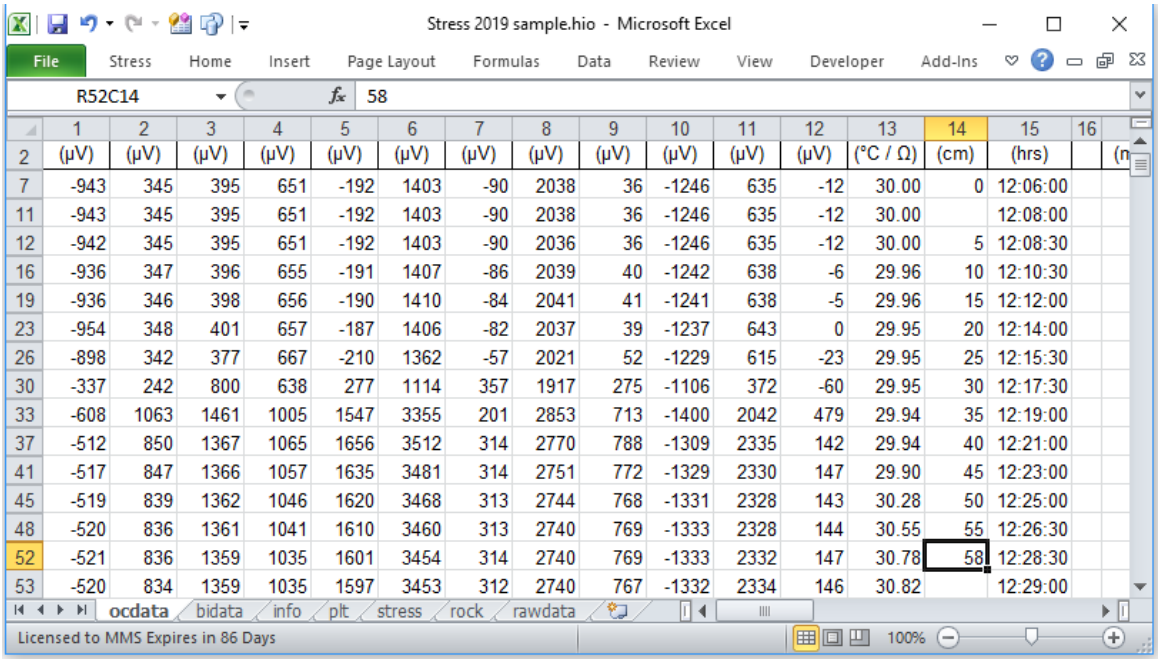
Dip= Dip from Horizontal Positive Down

Right handed co-ordinate system

Positive stresses are compressive

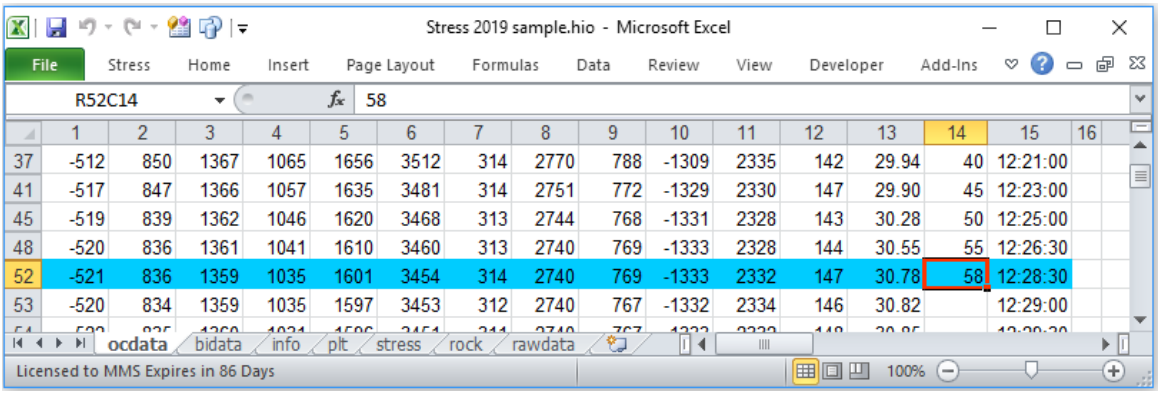
+ve strains imply an expansion of the pilothole.

Select the overcore sheet; click the row you wish to calculate the stresses from or multi select gauges you wish to include. Click $\int_{-x}^{x}$



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(°C / Ω)	(cm)	(hrs)	
7	-943	345	395	651	-192	1403	-90	2038	36	-1246	635	-12	30.00	0	12:06:00	
11	-943	345	395	651	-192	1403	-90	2038	36	-1246	635	-12	30.00		12:08:00	
12	-942	345	395	651	-192	1403	-90	2036	36	-1246	635	-12	30.00	5	12:08:30	
16	-936	347	396	655	-191	1407	-86	2039	40	-1242	638	-6	29.96	10	12:10:30	
19	-936	346	398	656	-190	1410	-84	2041	41	-1241	638	-5	29.96	15	12:12:00	
23	-954	348	401	657	-187	1406	-82	2037	39	-1237	643	0	29.95	20	12:14:00	
26	-898	342	377	667	-210	1362	-57	2021	52	-1229	615	-23	29.95	25	12:15:30	
30	-337	242	800	638	277	1114	357	1917	275	-1106	372	-60	29.95	30	12:17:30	
33	-608	1063	1461	1005	1547	3355	201	2853	713	-1400	2042	479	29.94	35	12:19:00	
37	-512	850	1367	1065	1656	3512	314	2770	788	-1309	2335	142	29.94	40	12:21:00	
41	-517	847	1366	1057	1635	3481	314	2751	772	-1329	2330	147	29.90	45	12:23:00	
45	-519	839	1362	1046	1620	3468	313	2744	768	-1331	2328	143	30.28	50	12:25:00	
48	-520	836	1361	1041	1610	3460	313	2740	769	-1333	2328	144	30.55	55	12:26:30	
52	-521	836	1359	1035	1601	3454	314	2740	769	-1333	2332	147	30.78	58	12:28:30	
53	-520	834	1359	1035	1597	3453	312	2740	767	-1332	2334	146	30.82		12:29:00	

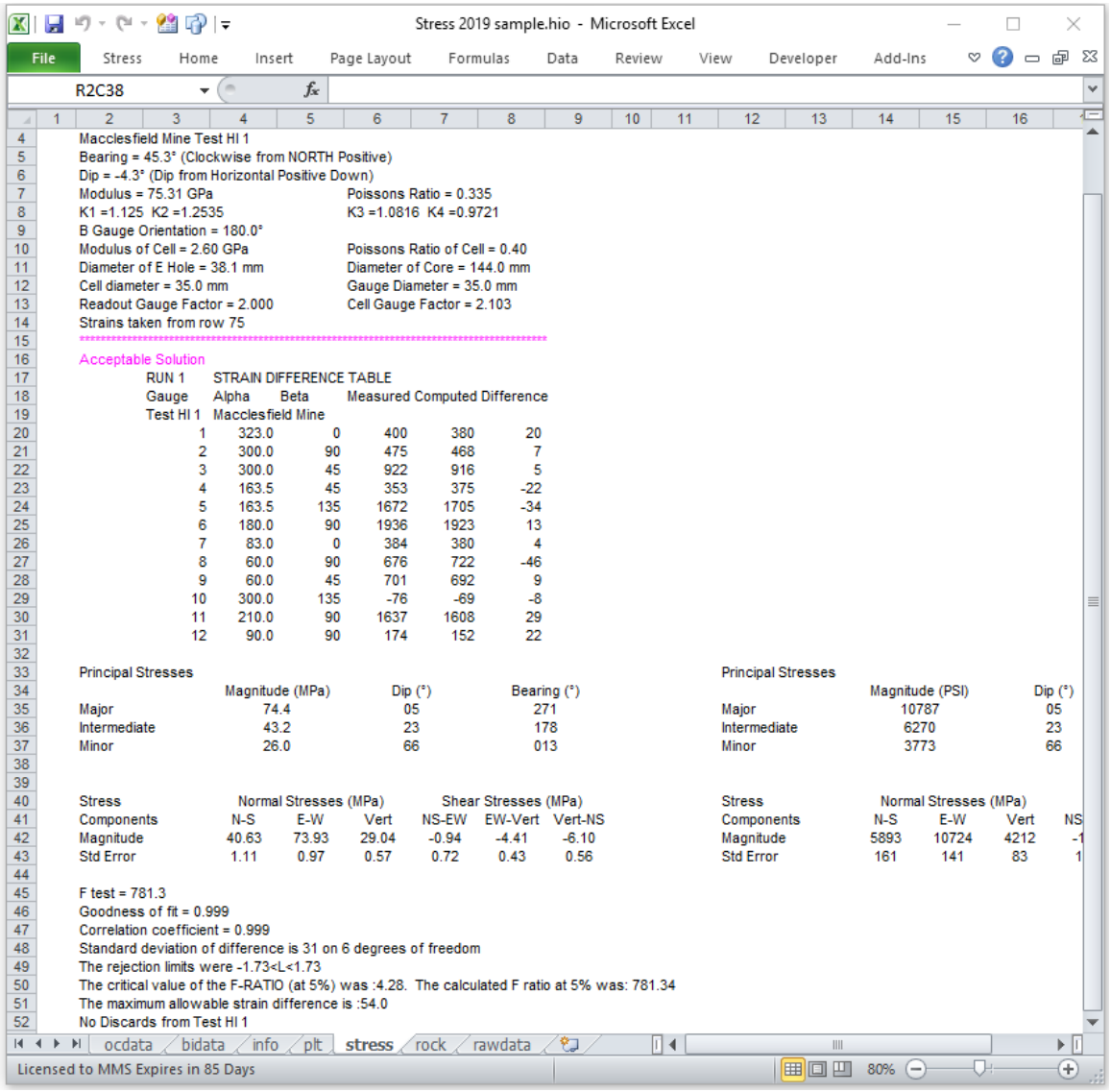
After you click $\int_{-x}^{x}$ the ocdata worksheet will be updated showing your selection



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
37	-512	850	1367	1065	1656	3512	314	2770	788	-1309	2335	142	29.94	40	12:21:00	
41	-517	847	1366	1057	1635	3481	314	2751	772	-1329	2330	147	29.90	45	12:23:00	
45	-519	839	1362	1046	1620	3468	313	2744	768	-1331	2328	143	30.28	50	12:25:00	
48	-520	836	1361	1041	1610	3460	313	2740	769	-1333	2328	144	30.55	55	12:26:30	
52	-521	836	1359	1035	1601	3454	314	2740	769	-1333	2332	147	30.78	58	12:28:30	
53	-520	834	1359	1035	1597	3453	312	2740	767	-1332	2334	146	30.82		12:29:00	

Stress worksheet

The output of the stress calculations is placed in this worksheet.



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A0	A90	A45	B45	B135	B90	C0	C90	C45	D135	E90	F90	Therm	Dist	Time
(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(μV)	(Ohms)	(cm)	(hrs)
12	26	1	12	11	18	8	512	-19	1016	1012	1019	2110	0	09:00
14	29	6	18	18	24	10	518	-14	1019	1012	1028	2110	0	09:10
16	28	2	18	17	21	14	516	-14	1016	1012	1018	2110	6	09:12
30	-26	4	26	21	-24	66	466	6	1024	974	961	2110	12	09:14
254	-104	41	101	105	-52	333	420	168	1136	947	938	2110	18	09:16
248	353	144	411	288	591	176	1097	565	1534	1644	1639	2120	25	09:18

214	691	222	554	428	756	296	1348	736	1651	1881	1727	2145	35	09:20
221	686	218	560	430	762	297	1351	740	1653	1887	1732	2798	45	09:22
222	684	221	564	436	771	298	1361	741	1656	1891	1741	2120	55	09:24

…or multi selection – for selected gauges

You may be prompted to accept or reject a certain Run if gauges are not statistically acceptable. Select Yes or No.

Click $\int_{-x}^{x}$ to get the following report:

Friday, 24 June 2011 Licensed to X Software developed by MMS

Macclesfield Mine Test HI 1

Bearing = 45.3° (Clockwise from NORTH Positive)

Dip = -4.3° (Dip from Horizontal Positive Down)

Modulus = 60.34 GPa Poissons Ratio = 0.297

K1 =1.126 K2 =1.2503 K3 =1.0810 K4 =0.9505

B Gauge Orientation = 180.0°

Modulus of Cell = 2.60 GPa Poissons Ratio of Cell = 0.40

Diameter of E Hole = 38.1 mm Diameter of Core = 144.5 mm

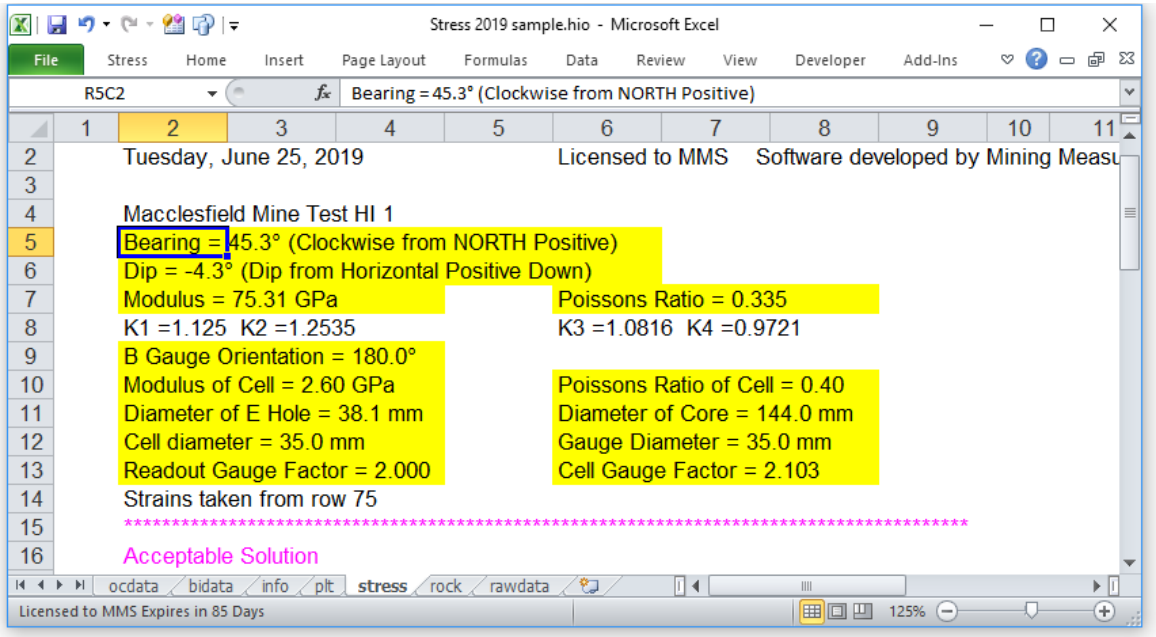
Cell diameter = 35.0 mm Gauge Diameter = 35.0 mm

Readout Gauge Factor = 2.000 Cell Gauge Factor = 2.103

Strains taken from row 11

Checks

After calculating Stresses the values at the beginning of the *stress* worksheet should be checked to make sure they have been entered correctly. These values are taken from the info worksheet.



Warnings and errors

The user will be advised when the program detects problems (not all problems) with the data. Some are critical warnings eg. "Invalid cell diameter" and the program will terminate and others are just warnings

Not all errors are trapped by the program; however, Excel will terminate the program and display an error message if it encounters a un trapped error.

Trouble shooting

If you would like to send us a copy of your first workbook you have made. We will check that the correct variables have been used and there are no errors in the spreadsheets.

This program has been trialled in the English version for over 10 years with satisfactory results.

If there is a problem or unexpected/suspect results occur when the program is run please send the following information:

- Description of the problem
- Workbook
- Any error numbers
- Regional, Date/Time and locale number settings
- Microsoft Office Version number

TROUBLE SHOOTING

This programme has been trialled in the English version for over 20 years with satisfactory results.

If there is a problem with the programme, send the workbook, together with a description of the problem and/or the error number and also the Regional, Date/Time and locale number settings to sales@geosystems.com.au

We welcome any suggestions that you may have to improve the programme.

COPYRIGHT & SUBSCRIPTION

This programme is supplied subject to the following terms and conditions:

- Each copy can only be installed on a maximum of 3 machines at the one time.
- No reverse engineering is allowed.
- The copy is licensed ONLY to the original purchaser for a period of one year from the purchase date
- The program will prompt the user in advance to renew their subscription. A reminder message will be displayed alerting the user of the approaching expiry date.
- Updates will be issued where necessary.

ACKNOWLEDGMENTS

The user understands and acknowledges that the current development of the program is as outlined by the following general disclaimers.

The outcome and tasks provided by this program depend on the quality of output data collected. The CSIRO HI Cell input data is dependant on the quality, ability and experience of installation by the user.

The program provides statistical information of rock stresses with specified standard errors. Accuracy is dependant on the sensors gauges. Any individual gauge may fail for any of a multitude of reasons. Damage or poor contact to pilot wall will produce dubious results. Strain gauge data behaving in a non linear or anisotropic fashion must be disregarded.

ESS Earth Sciences in no way accept responsibility for any misuse of software or misinterpretation of results.

It is assumed that the user is familiar with the Field Manual for the use of HI Cells which are available from ESS Earth Sciences. It is assumed that the user is familiar with the Stress 91 which is also available from ESS Earth Sciences.

The rock stresses are computed using the method proposed by Panek, L.A (1966). The program calculates the best statistical estimate of the stress components in a desired coordinate system, their standard errors and the principal stresses and directions. The program makes use of factors (K-Factors; Worotnicki and Walton, 1976) to correct for the effect of the strain gauges of a HI Cell being located approximately 1.5-2.0mm away from pilot hole wall.

REFERENCES

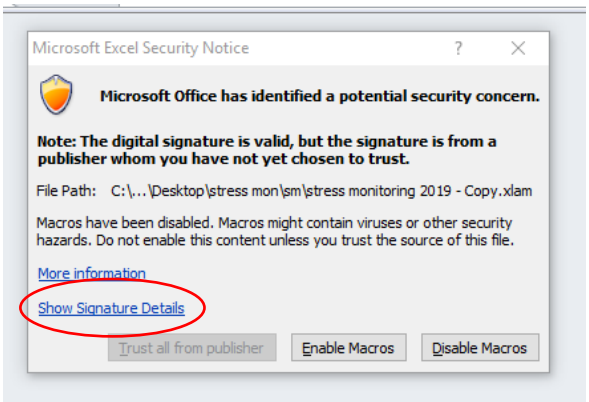
PANEK, L.A. (1966). Calculation of the Average Ground Stress Components from Measurements of Diametrical Deformation of a Drill Hole. Testing Techniques for Rock Mechanics, A.S.T.M. STP No.402, pp 106-132.

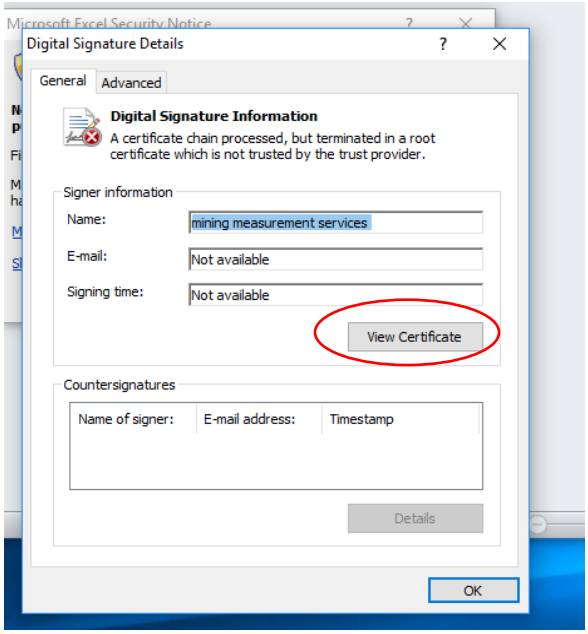
DUNCAN FAMA, M.E. & PENDER, MJ (1980) Analysis of the Hollow Inclusion Technique for measuring in insitu rock stress. Int.J. Rock Mech. Min. Sci V.17, No.3 pp.137-146.

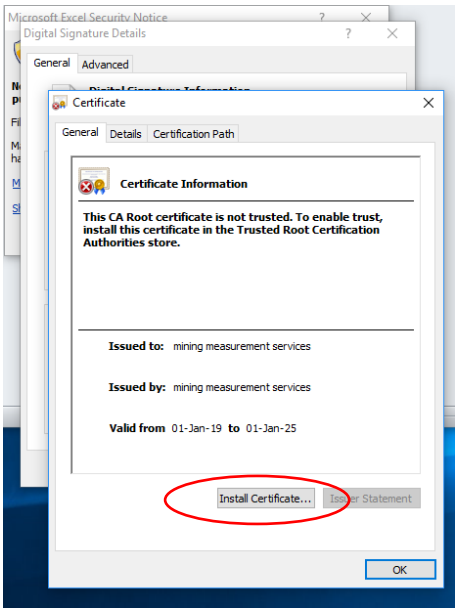
WOROTNICKI, G & WALTON, RJ (1976) Triaxial 'hollow inclusion' gauges fro determination of rock stresses in situ. CSIRO Aust. Division Applied Geomechanics Research Paper 275, reprinted from Proc. ISRM Symp. On investigations of stress in rock – Advances in Stress Measurement, Sydney, Aug., Supplement pp. 1-8

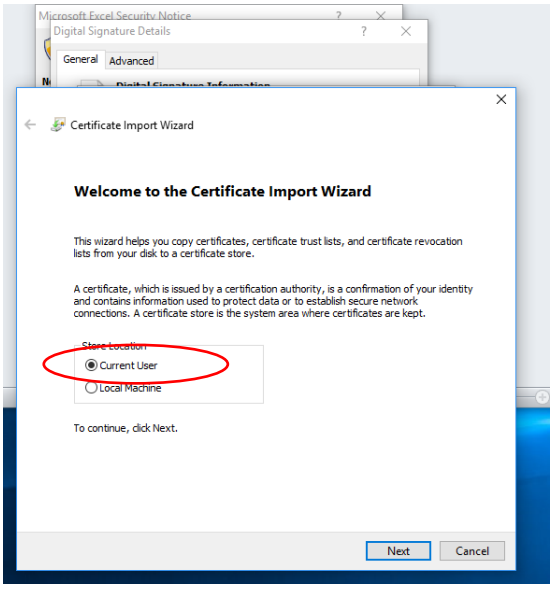
LITTERBACH, Nick (1991) Programming to Determine Insitu Stress, Mining Measurement Services Report.

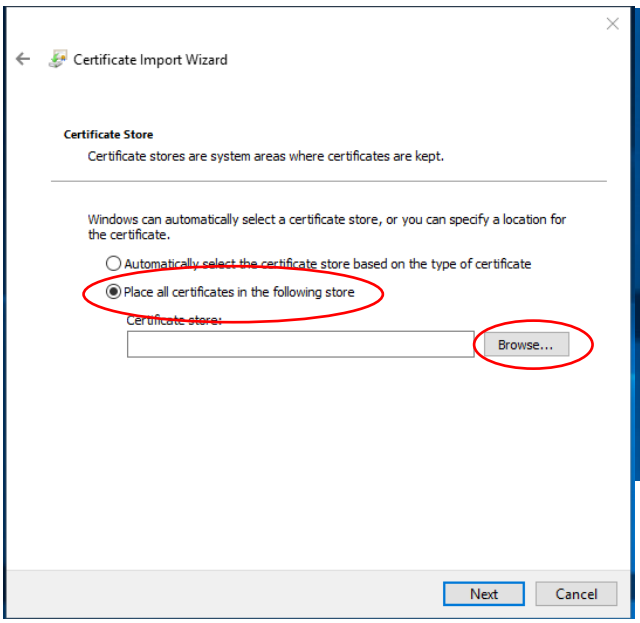
Installing The Digital Signature

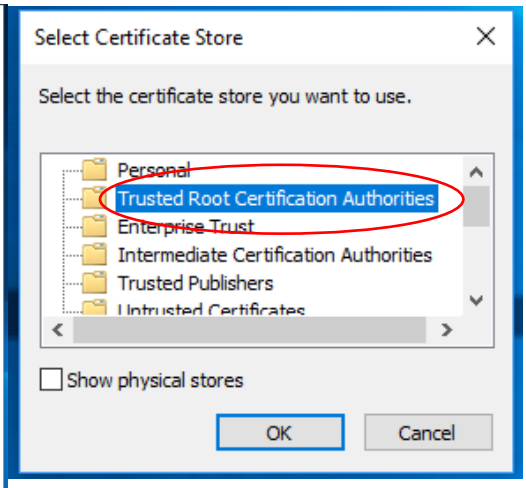


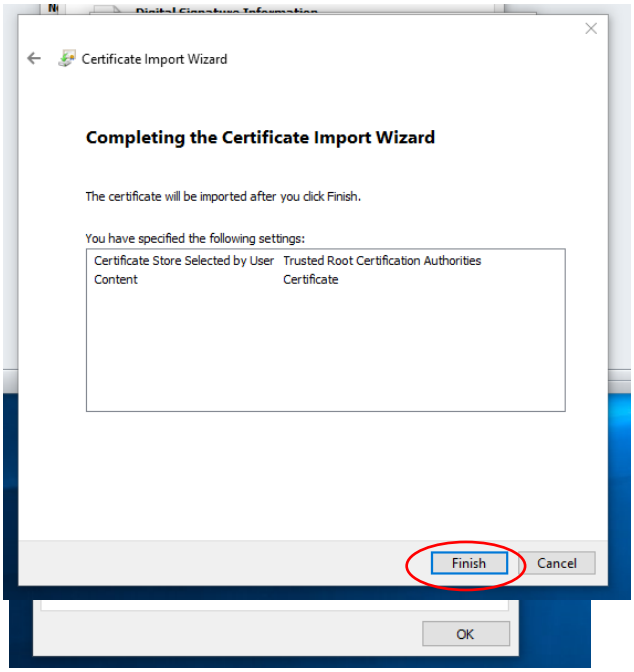


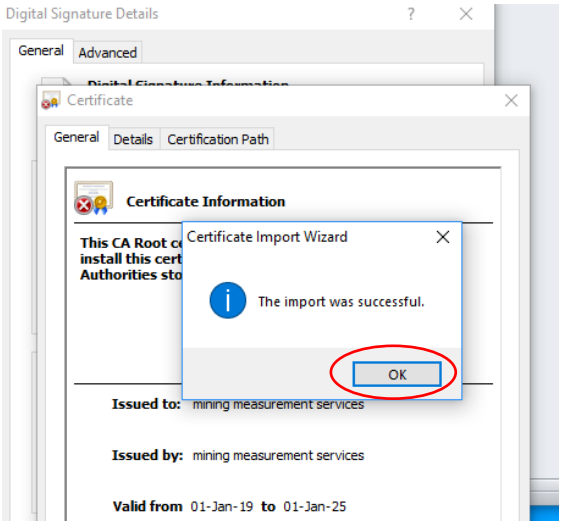

Microsoft Excel Security Notice
Digital Signature Details
General
Advanced
Certificate
General
Details
Certification Path
Certificate Information
This CA Root certificate is not trusted. To enable trust, install this certificate in the Trusted Root Certification Authorities store.
Issued to: mining measurement services
Issued by: mining measurement services
Valid from 01-Jan-19 to 01-Jan-25
Install Certificate...
OK

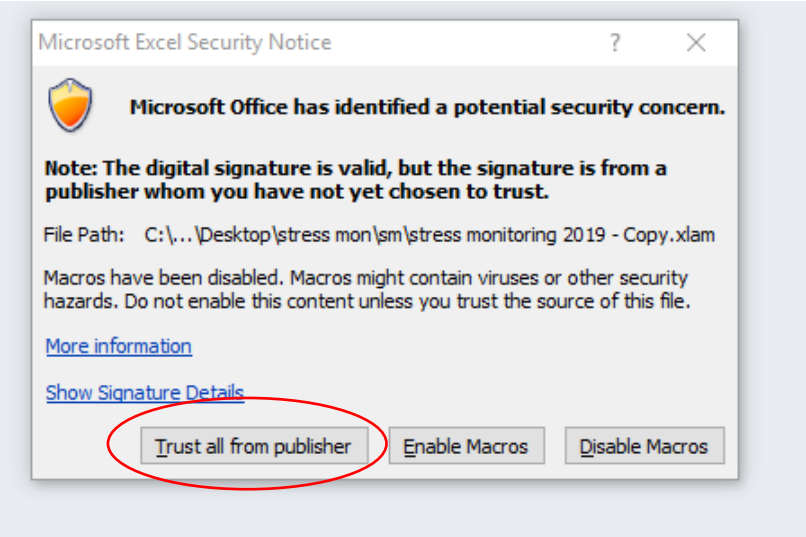

Microsoft Excel Security Notice
Digital Signature Details
General
Advanced
Certificate Import Wizard
Welcome to the Certificate Import Wizard
This wizard helps you copy certificates, certificate trust lists, and certificate revocation lists from your disk to a certificate store.
A certificate, which is issued by a certification authority, is a confirmation of your identity and contains information used to protect data or to establish secure network connections. A certificate store is the system area where certificates are kept.
Store Location
Current User
Local Machine
To continue, click Next.
Next
Cancel


Certificate Import Wizard
Certificate Store
Certificate stores are system areas where certificates are kept.
Windows can automatically select a certificate store, or you can specify a location for the certificate.
Automatically select the certificate store based on the type of certificate
Place all certificates in the following store
Certificate store:
Browse...
Next
Cancel


Select Certificate Store
Select the certificate store you want to use.
Personal
Trusted Root Certification Authorities
Enterprise Trust
Intermediate Certification Authorities
Trusted Publishers
Untrusted Certificates
Show physical stores
OK
Cancel


Certificate Import Wizard
Completing the Certificate Import Wizard
The certificate will be imported after you click Finish.
You have specified the following settings:
Certificate Store Selected by User Trusted Root Certification Authorities
Content Certificate
Finish
Cancel
OK


Digital Signature Details
General
Advanced
Certificate
General
Details
Certification Path
Certificate Information
Certificate Import Wizard
The import was successful.
OK
Issued to: mining measurement services
Issued by: mining measurement services
Valid from 01-Jan-19 to 01-Jan-25


Microsoft Excel Security Notice
Microsoft Office has identified a potential security concern.
Note: The digital signature is valid, but the signature is from a publisher whom you have not yet chosen to trust.
File Path: C:\...\Desktop\stress mon\sm\stress monitoring 2019 - Copy.xlam
Macros have been disabled. Macros might contain viruses or other security hazards. Do not enable this content unless you trust the source of this file.
More information
Show Signature Details
Trust all from publisher
Enable Macros
Disable Macros