

## **Creating a monster file**

One of the most powerful aspects of ChassisSim is using race data to reverse engineer many of the aspects of the vehicle model, and to reverse engineer track properties. The primary way of doing this is what we call a monster file. This is an ascii tab or space delimited file that contains the information that ChassisSim needs for many of its toolboxes.

The purpose of this document is to guide you how to create this monster file and things you need to be aware of.

### **Step – 1 Data basics**

There is an old saying in computing called GIGO (Garbage in, Garbage out) and the foundation of a good monster file is good reliable data from a single flying lap.

The first step in creating a monster file is zeroing the dampers and if you have them load sensors at the appropriate point. Even though ChassisSim is capable of working from zeros in the air, it is preferred zeroing is done from the ground. This is for the following reasons. this is why in my experience you should be zeroing on the ground,

- Getting a consistent reading in the air will always be difficult. There is always going to be differing compliances, asymmetric preloads as you're playing with platform heights.
- It also greatly simplifies any hand calcs you have to do. This is particular apparent with the aero.

The question is though how do we grab a good zero point. In my experience a really good place to zero is as the car is trundling down the pitlane on the speed limiter. To illustrate this consider Fig-1,

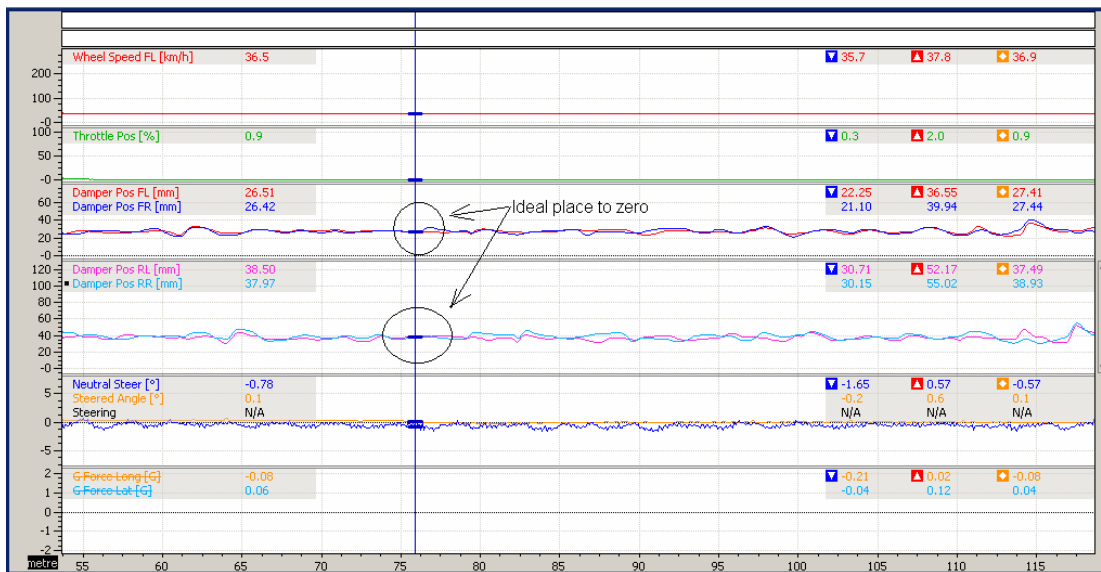


Fig-1 – Places where you should be zeroing

You know when you have it right; particular on a symmetric car is that when you are going down the straight the damper displacements will be close to identical. The reason I have chosen this as a place to 0 is that on paper we really should be zeroing as the car comes off the jacks. However in my experience as you are going down the straight you know for sure you are definitely logging and getting a good signal.

The other thing to be aware of is to ensure that when you export the steering data, that it is calibrated at the tyre and not at the steering wheel. A tell tale sign that you have it calibrated at the steering wheel is that the magnitudes are in the order of +/- 15 deg. Anything more than this double check your rack ratio or where the sensor was taken from.

Also ensure all sensors are calibrated correctly and are good quality. Very noisy signals will lead to inaccurate results. Before creating the file have a quick global view of the results. This will be your best check of what you are looking at. Also take the fastest lap to base the data off.

The other key thing when generating the monster file is to ensure the dampers are positive in bump. This is necessary to ensure the toolboxes work as advertised. Another thing is to ensure as we have discussed is you zero them at ride height. Even though ChassisSim can deal with zeroes in the air this gives the most consistent results.

## Step – 2 Monster Import File format

The format of the file is an ASCII tab delimited file of the data with no headers and footers. The data that is required is,

lap distance (m)

rpm

ay (g)

ax (g)

damp front left (mm)

damp front right (mm)

damper rear left (mm)

damper rear right (mm)

steering (deg) – This is the angle of the tyre as opposed to the steering wheel.

throttle pos (%)

Vehicle speed (km/h)

If you have strains,

Strain Front Left (kgf)

Strain Front Right (kgf)

Strain Rear Left (kgf)

Strain Rear Right (kgf)

These are added at the end of the other listed parameters. What it would look like in a file is shown below,

Without loads,

0	7392.94	-0.03	0.1	4.65	4.87	5.51	5.57	0	100	207.92
1.174	7395.56	-0.03	0.11	5.01	4.58	5.16	4.72	0.03	100	207.99
2.346	7398.33	-0.02	0.11	5.08	4.85	5.98	6.57	0.06	100	208.07
3.52	7401.26	-0.02	0.12	4.83	4.81	10.52	11.16	0.08	100	208.15
4.693	7404.28	-0.02	0.12	3.93	3.96	13.22	13.3	0.09	100	208.24
5.867	7407.27	-0.02	0.12	4.07	3.72	12.74	12.42	0.1	100	208.32
7.042	7410.23	-0.02	0.12	6.22	5.88	13.07	12.63	0.06	100	208.4
8.217	7413.14	-0.03	0.12	5.77	5.69	11.26	11.23	0.02	100	208.49
9.392	7416.04	-0.03	0.12	5.52	5.44	10.26	10.61	-0.01	100	208.57
10.568	7418.92	-0.03	0.11	7.27	6.85	11.73	11.65	-0.03	100	208.65
11.744	7421.78	-0.04	0.11	7.36	6.88	12.43	11.88	-0.03	100	208.73
12.921	7424.61	-0.05	0.11	5.72	5.62	10.39	10.2	-0.01	100	208.81
14.098	7427.42	-0.05	0.11	5	5.05	8.36	8.39	0.01	100	208.89
15.276	7430.27	-0.05	0.11	6.46	6.37	8.75	8.48	0.03	100	208.97
5865.339	7392.94	-0.03	0.1	4.65	4.87	5.51	5.57	0	100	207.92

With loads the file looks like

0	7392.94	-0.03	0.1	4.65	4.87	5.51	5.57	0	100	207.92	166.98	157.86	216.53
	202.85												
1.22	7392.94	-0.03	0.1	4.65	4.87	5.51	5.57	0	100	207.92	166.98	157.86	216.53
	202.85												
4.55	7392.94	-0.03	0.1	4.65	4.87	5.51	5.57	0	100	207.92	166.98	157.86	216.53
	202.85												

Please note the distance vector needs to have at least 2 decimal places. This is very important.

Also for monoshock users for the FL and FR Damper columns copy the front damper movement. So for a monoshock the format will be,

lap distance (m)

rpm

ay (g)

ax (g)

Front damper (mm)

Front damper (mm)

damper rear left (mm)

damper rear right (mm)

steering (deg) – This is the angle of the tyre as opposed to the steering wheel.

throttle pos (%)

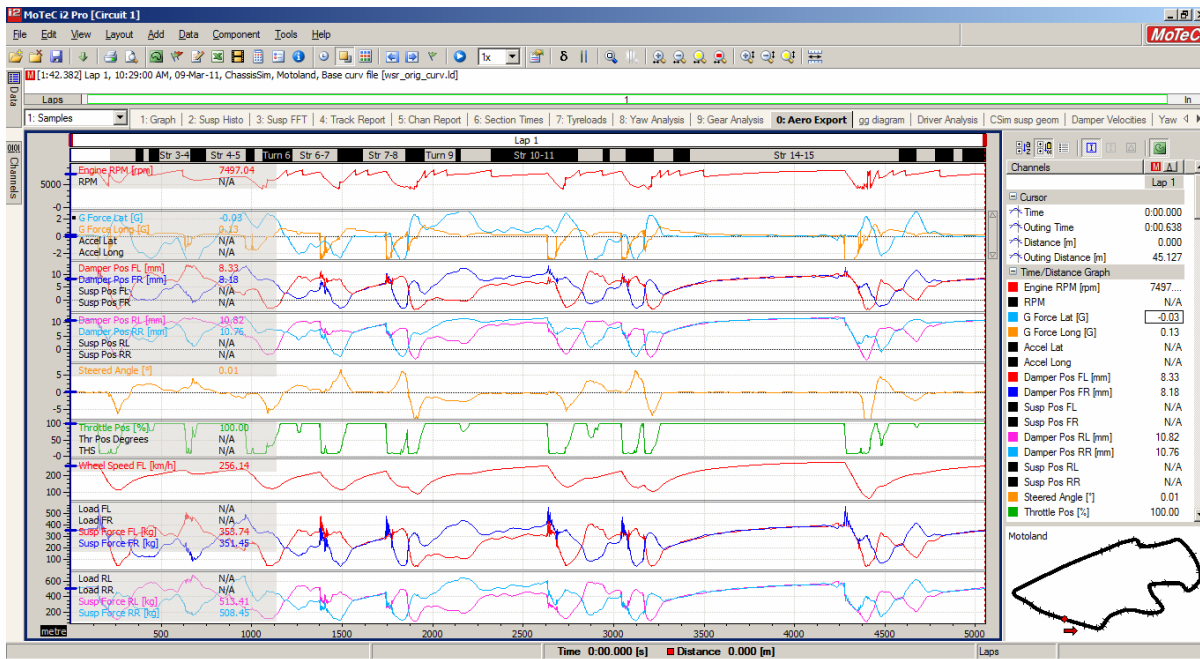
Vehicle speed (km/h)

Also please note dampers are positive in bump!

## **Step – 3 Examples of monster file generation.**

### **Example – 1 – Motec i2**

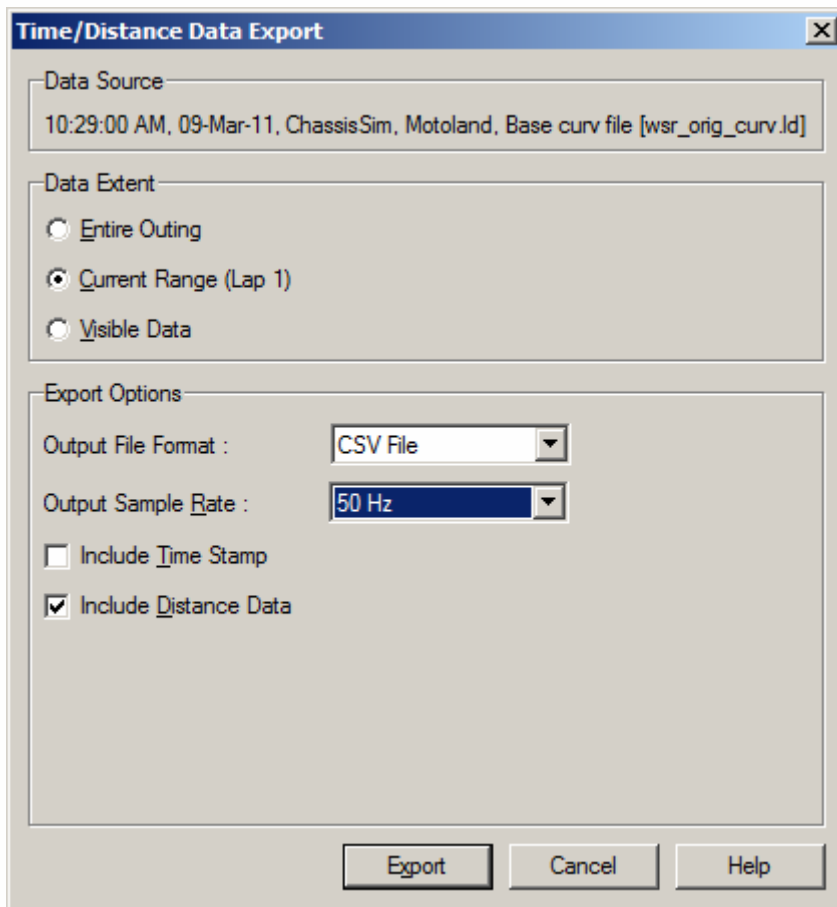
You would setup a Motec Worksheet with all of the available channels. The only channel you don't include is distance. Also ensure that distance is calibrated in m. A screen grab of the Worksheet will look something like this,



As we can see all the data that is required is present in the correct order. The next step is to right mouse click on the data. Select Export Data. The export dialog is illustrated overleaf. The key things to select in this dialog are,

- Export Distance.
- Set export frequency to 50 Hz.
- Choose a CSV file

It will then prompt you for the location of the file. Select it in a directory of your choosing and press OK.



The last step in the process is to open the csv file in excel. You simply select the header and press delete. Save this as an ASCII Tab delimited file. This process is illustrated overleaf.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Format	Motec CSV File		Workboob Samples													
2	Venue	Motoland		Workshee Graph													
3	Vehicle	WSR		Vehicle Desc													
4	Driver	ChassisSim		Engine ID													
5	Device	ADL															
6	Comment	Mofaz Data		Session													
7	Log Date	#####		Origin Tin	0.96 s												
8	Log Time	#####		Start Time	0.96 s												
9	Sample Ri	50 Hz		End Time	105.02 s												
10	Duration	104.06 s		Start Dist	68.275 m												
11	Range	Lap 1		End Distar	5364.88 m												
12																	
13	Distance	Wheel Sp	Throttle P	Damper P	Damper P	Damper P	Damper P	Steered A	G Force	La Curvature	Rear Roll						
14	m	km/h	%	mm	mm	mm	mm	deg	G		mm						
15																	
16																	
17																	
18		0	261.25	100	7.78	7.78	9.58	9.26	0.07	-0.27	0.000502	0.16					
19		1.453	261.58	99.9	7.52	7.52	9.46	9.18	0	-0.28	0.00052	0.14					
20		2.772	262.02	100	7.42	7.42	9.4	9.08	0	-0.2	0.00037	0.16					
21		4.158	261.69	100	7.27	7.27	9.31	8.92	0.07	-0.18	0.00034	0.2					
22		5.543	261.58	100	7.12	7.12	9.31	8.87	0	-0.28	0.00052	0.22					
23		6.928	261.69	99.9	7.08	7.08	9.34	8.89	0	-0.31	0.000575	0.22					
24		8.316	262.24	99.9	7.23	7.23	9.43	8.95	0	-0.26	0.00048	0.24					
25		9.707	262.68	99.9	7.5	7.5	9.51	9.06	0	-0.19	0.00035	0.22					
26		11.101	263.34	99.9	7.79	7.79	9.62	9.27	-0.07	-0.25	0.000458	0.18					

As illustrated above delete the text just above the numbers. Congratulations you have just created your first monster file!

### Example – 2 Pi Toolbox.

The monster file creation in toolbox is very similar to i2. There is just one important difference. You need to export Lap Distance separately and then combine it in Excel with the rest of the data. A Work around for this is to integrate the speed sensor to obtain distance. The math channel for this will look like,

$$\text{Distance} = \text{integral}(\text{speed})/3.6.$$

This presumes speed is in km/h

### Example – 3 Bosch WinDarab.

In WinDarab as in Pi and Motec, you create a template with all of your channels. This time include a distance channel. However the trick here is that you select the x axis as time. You then go to export and set the sampling period to 50Hz. Open the file in Excel and edit out the headers and non numbers.

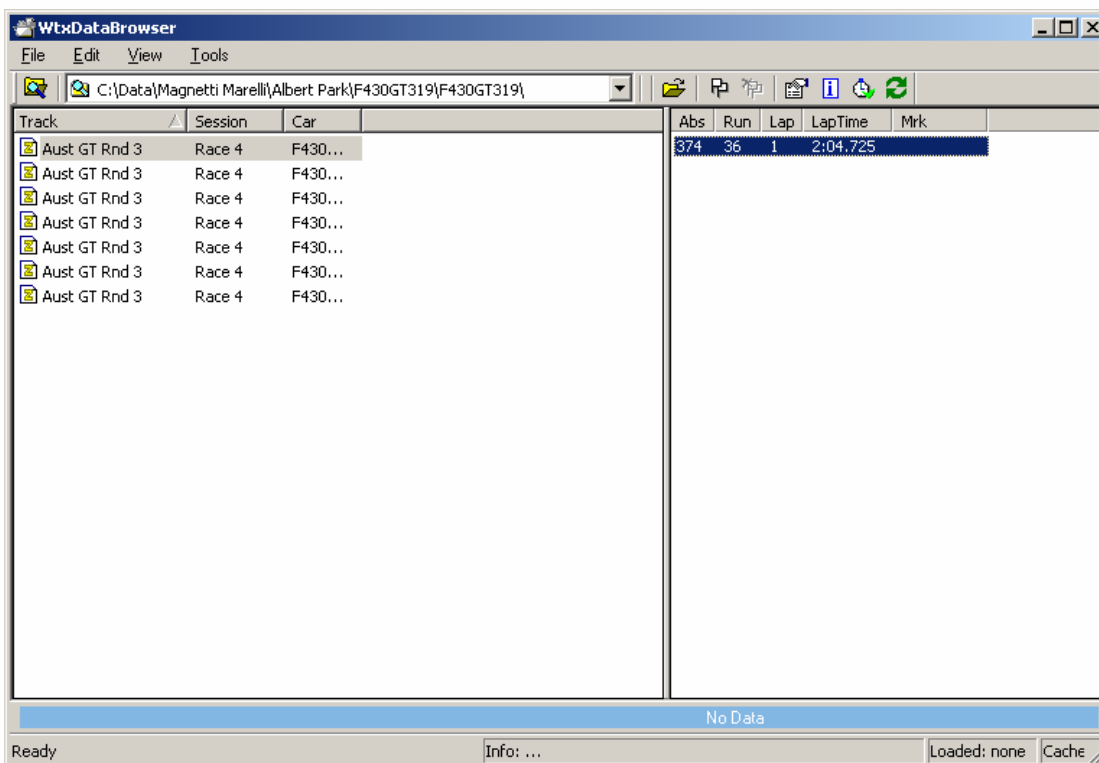
## Example – 4 – WinTax

To create a monster file using WinTax you need to establish a distance channel. For convenience we will repeat it again,

Distance = integral(speed)/3.6.

This presumes speed is in km/h

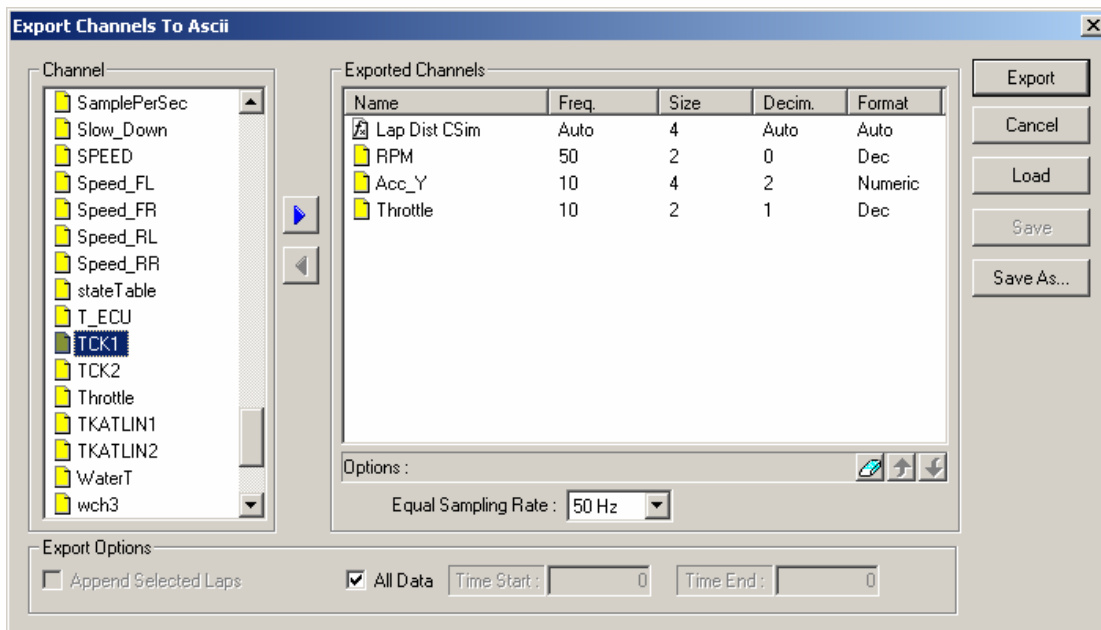
Open up the Data browser. Your screen should look like this,



As Illustrated select your desired session and then click on the lap.

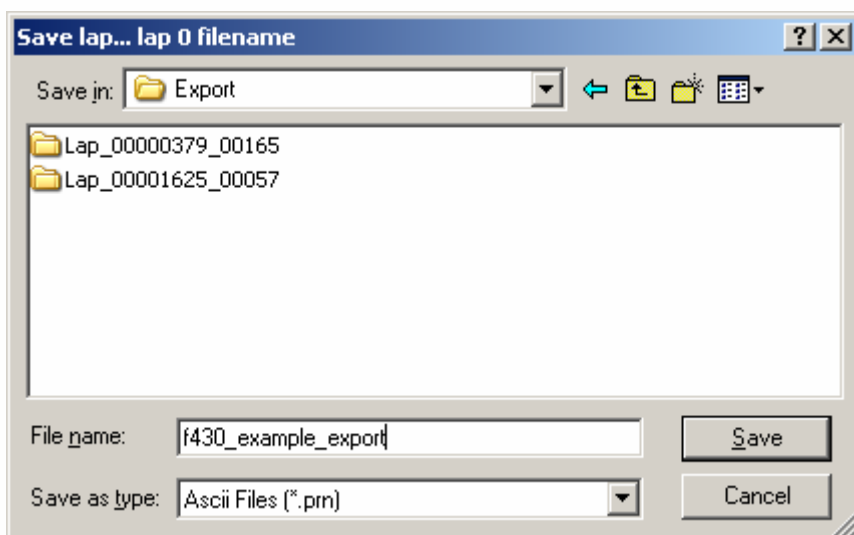
Then go to the Tools menu and select Export->Export to Ascii. The following dialog should appear,



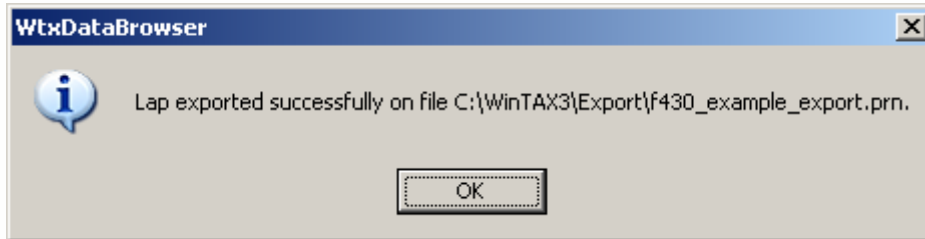


The export Procedure is quite simple. On the left hand side is the available channels. Click on the desired channels. You will see a right hand arrow button become illuminated. Click on this and this exports this channel into the list you see on the right hand side. As illustrated set the Equal sampling rate to 50Hz. In this particular example we haven't selected all of the ChassisSim monster file channels. However in this case of the monster file creation, the list above would be identical to what we outlined in Step 2 when we discussed the format of the monster file.

When you are done click on Export. This will bring up the following dialog,



Navigate to a directory of your choosing. Type in the file name and choose the file extension \*.prn. Don't worry this is an ascii file that can be opened in excel, notepad etc. Click on save. You are done. When the export is completed it should look like this,



The file itself will look something like this,

Time	Lap	Dist	CSim	RPM	Acc_Y	Throttle
0:000			NoRx	125	-0.11	2.3
0:020			NoRx	135	-0.11	2.3
0:040			NoRx	131	-0.11	2.3
0:060			NoRx	123	-0.11	2.3
0:080			NoRx	109	-0.11	2.3
0:100			NoRx	99	-0.11	2.3
0:120			NoRx	111	-0.11	2.3
0:140			NoRx	139	-0.08	3.1

You then open this file up in Excel, delete the time channel and first row and you are done.

## Conclusion

As can be seen creation of the monster file is a very simple process. Once you are use to it, this process will take you minutes. In summary the steps are,

- Select and export your fastest lap and check the data is sound.
- Set up your templates in the data logger.
- Repeat the necessary steps in your data logger.
- Finalise the formatting in Excel.

If you do all these steps correctly this will be the bedrock of successful simulations.