

DMU10 Evaluation Kit User Manual

DMU10-00-0100-910





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Document number: DMU10-00-0100-910

Entitled: DMU10 Evaluation Kit User Manual

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GLOSSARY

CD	Compact Disk
CD-ROM	CD-Read Only Memory
COM	Serial port interface
CSV	Comma Separated Variables
DMU	Dynamic Measurement Unit
FP	Floating Point
GND	Ground
IMU	Inertial Measurement Unit
kbit/s	kilobits per second
LPT	Parallel port interface
MB	Mega Bytes
ms	milliseconds
OEM	Original Equipment Manufacturer
PC	Personal Computer
PCB	Printed Circuit Board
RAM	Random Access Memory
Rx	Receive
SP	Service Pack
Tx	Transmit
USB	Universal Serial Bus
Vel	Velocity



1 Introduction

The DMU10 is the latest six degree of freedom Dynamic Measurement Unit from Silicon Sensing Systems Ltd. The DMU10 has been designed to provide exceptional performance where size and cost are of the upmost priority.

The DMU10 Evaluation Kit, see Figure 1, enables the output data from the DMU10 to be viewed and logged for testing and evaluating purposes.



This kit is primarily for use with the DMU10 build standard.

Figure 1: DMU10 Evaluation Kit

2 System Requirements

The DMU10 Evaluation Kit requires a PC with a USB port. The requirements for the PC are as follows:

- Microsoft[®] Windows[®] XP (SP3 or greater), Vista[®] or Window 7 and Windows 8 Operating Systems. The software has not been tested on any other operating systems and therefore correct functionality cannot be guaranteed.
- Minimum of 500 Mb of RAM.
- 500 Mb of free hard drive space plus space for logged data (typical data rate ≈ 50 kbit/s).
- High power or self-powered USB 2.0 Port.



3 Potential Restrictions and Issues

The USB interface on the PC can result in errors in the USB Message Stream introduced by interruptions by the operating system, resulting in possible loss of partial or complete messages. Such errors, if they occur, can be minimised by:

- a) Minimising the number of other applications and software running on the PC.
- b) Disconnecting the PC from a network or wireless connection.
- c) Using very high speed PCs.
- d) Disabling scheduled virus scans and Operating System updates.
- e) Disabling all PC power saving options.

Any disruption to the message stream can be observed in the logged files using the message counter, checking for lost data.

4 Evaluation Kit Contents

The DMU10 evaluation kit (part number DMU10-21-0500) contains the following:

- DMU10 IMU (Part Number DMU10-21-0100)
- MEV RS485i to USB Converter, (Part Number 630486-0910)
- CD containing the MEV drivers
- USB memory stick (Part Number 630486-0920) containing the data logging software
- Interface Cables

4.1 DMU10

Figure 2 shows the Dynamic Measurement Unit used with the evaluation kit.



Figure 2: DMU10



4.2 MEV RS485i to USB Converter and CD

The RS485i to USB Converter is manufactured by MEV. The standard MEV converter has been modified to route the 5 V USB Supply Voltage through to the DMU10, which allows the DMU10 and the Evaluation Kit to be powered from the USB.



Figure 3: MEV RS485i to USB Converter

The drivers and user manual for the MEV are included on the MEV CD.

4.3 USB Memory Stick

The USB Memory Stick contains the following:

- Data Logging Software 1-10670-020-430 Rev 6
- This User Manual
- DMU10 Brochure

4.4 Interface Cables

Three cables are included in the kit:

- 1. DMU10 to MEV Cable (Part Number 630486-0940)
- 2. MEV to PC USB 2.0 Cable.
- 3. DMU10 Mating Connector kit with unterminated leads

The DMU10 Mating Connector kit enables the user to connect the DMU10 to alternative logging equipment and power supply.



5 Getting Started

5.1 Installation Overview

The software installation program uses the 'ClickOnce' installation format and can therefore be installed onto a PC without administrator rights. However, administrator rights are required whenever the application connects to an individual MEV device for the first time. This is because the application needs to change the MEV default driver settings, which are stored in the HKEY_LOCAL_MACHINE area of the Windows registry. For subsequent connections to that MEV device, the application will not require administrator rights. The recommended installation sequence is therefore:

- 1. Obtain administrator rights on the PC.
- 2. Install the MEV driver, see section 5.2.
- 3. Install the software, see section 5.3.
- 4. The installation procedure automatically runs the application once the installation has completed and at this point you should connect to the installed MEV device using the **Connect** button.

5.2 Installing the MEV RS485i USB Serial Converter Device Driver

5.2.1 Installation Procedure

The MEV RS485i includes an installation CD containing a USB driver file. To install the driver, proceed as follows:

- 1. Ensure that you have administrator rights on the PC.
- Run <CD ROM Drive letter>:\Drivers\Win XP, Vista, 7, 8, 2003-2012\CDM20828_Setup.exe. This will install the required drivers into the Windows System folder.
- 3. Plug the MEV RS485i device into a USB port and when the dialog below appears, be ready to click it or, if it disappears, click the animated icon that it is attached to. Note that in Windows 7, this icon can disappear into the hidden icon box when the dialog disappears.





4. When the dialog shown below appears, click **Skip obtaining driver software from Windows Update**.

If the PC has an internet connection, you can wait for the latest driver to be found via Windows Update. In which case you can skip to step 7 of this procedure. Note however that if a newer driver version is loaded, the software may not have been tested with this driver version.

Driver Software Installation	<u>×</u>
Installing device driver s	oftware
USB Serial Port	Searching Windows Update
Obtaining device driver software Skip obtaining driver software fr	e from Windows Update might take a while. om Windows Update
	Close

5. Click **Yes** when the following dialog appears:



6. The following dialog should then appear and you must wait (do not click **Close** because the installation program has not completed yet):





7. The installation program should then locate the previously installed drivers and you should eventually see the following dialog:

Driver Software Installation		×
USB Serial Port (COM5) installe	d	
USB Serial Port (COM5)	🖌 Ready to use	
		Close

8. Click **Close** on the above dialog.

5.2.2 MEV Installation Troubleshooting

Correctly installed MEV devices should appear in the Windows Device Manager as USB virtual COM ports. These devices will disappear when the USB cable is removed but should re-appear when it is re-inserted. These same COM ports will appear in the DMU10 Utility serial port drop down list, enabling the application to connect to different MEV devices.



Note that each MEV device appears as a separate COM port and you will need to repeat steps 3 to 8 of the installation procedure for each MEV device plugged into the PC. If a MEV device appears under the **Other devices** heading of **Device Manager** instead of the **Ports (COM & LPT)** heading, then the device is in the process of being installed and you should not unplug it (look for the **Installing Driver** icon in the lower icon bar and follow steps 3 to 8 of the installation procedure).

A Device Manager	x
<u>File Action View H</u> elp	
🗢 🔿 🖬 🛛 🎫	
Mice and other pointing devices	*
Monitors Monitors Metwork adapters	
Other devices	
USB RS485 Serial Converter Rev4	
Communications Port (COM1)	=
Processors	
Sound, video and game controllers	-
N IN System devices	



If you encounter problems connecting to a MEV device using the application's **Connect** button, it is possible that the installation failed. You can repeat an installation by right clicking on the device under the **Ports (COM & LPT)** heading and selecting the **Uninstall** option. When the dialog below appears, click **OK**. You must then unplug the USB cable and then plug it back in to restart the installation procedure (steps 3 to 8) again.

Confirm Device Uninstall
USB Serial Port (COM6)
Warning: You are about to uninstall this device from your system.
Delete the driver software for this device
OK Cancel

If the MEV is not detected when the USB cable is plugged into the PC, refer to the MEV USB232/485 Instruction Manual included on the CD within the DMU10 Evaluation Kit. Additional information may be also available on the MEV website at http://www.mev.co.uk

5.3 Installing the Data Logging Software

The data logging software is included on the USB Memory Stick within the DMU10 Evaluation Kit.

This software should work on all supported versions of Windows including XP.

5.3.1 Installation Procedure

To install the software, proceed as follows:

 If a previous version of the Utility has been installed on the PC, you should un-install it first to prevent two different versions appearing. To do this select Control Panel | Programs | Uninstall a program to open the Uninstall or change a program dialog. Left click on the DMU10 program and select Uninstall/Change.





2. Click **OK** to remove the application from the PC.

DMU10 Main DMU10 Choose	e the type of maintenance you need.
<i>*</i>	Restore the application to its previous state.
	Remove the application from this computer. <u>QK</u> <u>Cancel</u> <u>More Information</u>

- 3. If you have not already installed the MEV device driver, you should do this now (see section 5.2), and then ensure that the MEV device is plugged into a USB port on the PC.
- 4. Insert the USB Memory Stick into a USB Port on your PC. Once the memory stick is detected, you should see the following files:

Name	Date modified	Туре	Size
👸 setup.exe	20/03/2014 14:28	Application	419 KB
Application Files	20/03/2014 14:28	File folder	
autorun.inf	20/03/2014 14:28	Setup Information	1 KB
DMU10.application	20/03/2014 14:28	ClickOnce Applica	6 KB
Documentation	21/03/2014 10:14	File folder	

5. Run the Setup.exe program.

Depending on how administrator rights are managed on some installations, you may need to select Setup.exe in its folder (it must be highlighted) and then right click and select the **Run as administrator** option in order to ensure that the installation is run with administrator rights.

You may see the following message displayed because the software is proprietary to Silicon Sensing Systems Ltd and has not been registered with Microsoft.

Application Install - Security Warning		×
Publisher cannot be verified.		2
Are you sure you want to install this application?		S)
Name:		
DMU10		
From (Hover over the string below to see the full d	omain):	
E:\publish		
Publisher:		
Unknown Publisher		
	Install	Don't Install
While applications can be useful, they can potenti source, do not install this software. <u>More Informati</u>	ally harm your computer. If yo on	u do not trust the

6. Click **Install** to install the data logging software.



7. The installation should then proceed with the following dialog:



Note that this dialog may may be missed because it only appears very briefly on fast PCs. The software will install at the following location:

Start | All Programs | Silicon Sensing

8. When the installation has completed, the application will be started by the install program. You should then ensure that a USB Serial Port is selected and then click the **Connect** button. This will write the required MEV driver settings to the Windows Registry. If you intend to use other MEV devices and do not normally have administrator rights on the PC, you should plug all the MEV devices into the PC now and repeat the connection process to ensure that each device has the correct settings written to the Windows Registry file.

The software installation process is now complete.

5.3.2 Installation Troubleshooting

If the installation program was run without administrator rights, the application will be unable to write the required settings to the registry when the **Connect** button is pressed and the dialog below will appear. If this occurs, you should first attempt to uninstall the application and then re-install it (with administrator rights). If you are unable, for any reason, to install the application with administrator rights, then the settings must be changed manually by following the procedure in section 5.4.6. Note however that changing these settings will also require administrator rights.





5.4 Using the Software

5.4.1 Starting the Application

Go to **Start** | **All Programs** | **Silicon Sensing** and select **DMU10** to launch the application. Note: In Windows 8, the installation will create a DMU10 icon in the **Start** menu.

5.4.2 Main Window

The application's main window is shown in Figure 4.

Common Menu Controls	Mair	n Tab C	option	s	Exa Pa	ample ge	of Mair	n Tab		Us but full	e 'maximiz ton to run screen
DMU10 Utility - Part No. 1-10670-	-020-430 R	ev 6 Rele	ease Ve	ersion 1	.0.0.33						
Disconnect USB Serial Port (CON	V/ZI	- Lost	t messa	ages 🛛)]					
Display Logging Settings								/			SENSING
No. to log 2000 Stop 26/0	03/14 10:50	:16	9	967	Msgs	48	%		_		
Les te manari Les te disk			-								
Log to memory Log to disk	_		_							_	
Available drive space (Mb) 3566:	1 L	og File 🛛	C:\Use	ers\alex.	chester	AppDa	ta\Roam	ning\Sil	icon Se	ensing	\DI Open
Message Count	12650		1					1			
	and the second se		and the second s								
Axix X Rats ("/x)	-000.27				T			ί.Τ.	ПÌ		
Axix X Rate ("/x) Axis X Acceleration (g)	-000.27										
Axis X Rate ("/x) Axis X Acceleration (g) Axis Y Rate ("/x)	-000.27 -00.19 000.00										
Axis X Rate ("/x) Axis X Acceleration (g) Axis Y Rate ("/x) Axis Y Acceleration (g)	-000.27 -00.19 000.00 -00.10										
Axis X Rate ("/x) Axis X Accoloration (g) Axis Y Rate ("/x) Axis Y Accoloration (g) Axis Y Accoloration (g) Axis Z Rate ("/x)	-000.27 -00.19 000.00 -00.10										
Axis X Rate (*/x) Axis X Acceleration (g) Axis Y Rate (*/x) Axis Y Acceleration (g) Axis Z Rate (*/x) Axis Z Acceleration (g)	-000.27 -00.19 000.00 -00.10 -000.00										
Axis X Rate (*/x) Axis X Acceleration (g) Axis Y Rate (*/x) Axis Y Acceleration (g) Axis Z Rate (*/x) Axis Z Rate (*/x) Axis Z Rate (*/x) Axis Z Rate (*/x)	-000.27 -00.19 000.00 -00.10 -000.00 -00.98 037.94										
Axis X Rate (*/x) Axis X Acceleration (g) Axis Y Rate (*/x) Axis Y Acceleration (g) Axis Z Rate (*/x)	-000.27 -00.19 000.00 -00.10 -00.00 -00.90 037.94										
Axis X Rate (*/x) Axis X Acceleration (g) Axis Y Rate (*/x) Axis Y Rate (*/x) Axis Z Rate (*/x) Axis Z Rate (*/x) Axis Z Acceleration (g) Axis Z Acceleration (g) Axis Z Acceleration (g) Axis Z Rate (*/x) Axis X Delta Theta (*)	-000.27 -00.19 000.00 -00.00 -00.00 -00.98 037.94 037.43										
Axis X Rate (*/x) Axis X Acceleration (g) Axis Y Rate (*/x) Axis Y Rate (*/x) Axis Z Rate (*/x) Axis Z Acceleration (g) Axis Z Acceleration (g) Average Sensor Temperature (*C) Average IMU Temperature (*C) Axis X Delia Theta (*) Axis X Delia Theta (*)	-000.27 -00.19 000.00 -00.00 -00.00 -00.98 037.94 037.43 -000.00										
Axis X Rate (*/x) Axis X Acceleration (g) Axis Y Rate (*/x) Axis Y Rate (*/x) Axis Y Acceleration (g) Axis Z Rate (*/x) Axis Z Acceleration (g) Axis Z Acceleration (g) Axis Z Acceleration (g) Axis X Delta Theta (*) Axis X Delta Theta (*) Axis X Delta Theta (*)	-000.27 -0.19 000.00 -0.10 -00.00 -0.98 037.94 037.41 -000.00 -00.00 -00.00										
Axis X Rate (*/x) Axis X Acceleration (g) Axis Y Rate (*/x) Axis Y Rate (*/x) Axis Y Acceleration (g) Axis Z Rate (*/x) Axis Z Acceleration (g) Axis Z Acceleration (g) Axis Z Acceleration (g) Axis Z Bella Theta (*) Axis X Bella Theta (*) Axis X Delta Theta (*) Axis Y Delta Theta (*) Axis Y Delta Theta (*)	-000.27 -00.19 000.00 -00.00 -00.00 -00.98 037.94 037.43 -000.00 -000.00 -000.00 -000.00 -000.00										
Axis X Rate (*/s) Axis X Acceleration (g) Axis Y Rate (*/s) Axis Y Rate (*/s) Axis Y Coloration (g) Axis Z Rate (*/s) Axis Z Data Vol (m/s) Axis Y Data Theta (*) Axis Z Data Vol (m/s) Axis Z Data Theta (*)	-000.27 -00.19 000.00 -00.10 -00.00 -00.98 037.94 037.43 -000.00 -000.00 -000.00 -000.00 -000.00 -000.00										
Axis X Rate (*/s) Axis X Acceleration (g) Axis Y Rate (*/s) Axis Y Rate (*/s) Axis Y Acceleration (g) Axis Z Rate (*/s) Axis Z Rate (*/s) Axis Z Acceleration (g) Axis Z Delia Theta (*) Axis X Delia Theta (*) Axis Z Delia Theta (*)	-000.27 -0.19 000.00 -0.10 -0.00 -0.98 037.94 037.43 -000.00 -000.00 -000.00 -000.00 -000.00 -000.00 -000.00										
Axis X Rate (*/x) Axis X Acceleration (g) Axis Y Rate (*/x) Axis Y Rate (*/x) Axis Y Acceleration (g) Axis Z Rate (*/x) Axis Z Rate (*/x) Axis Z Rate (*/x) Axis Z Acceleration (g) Axis Z Delta Theta (*) Axis Z Delta Vel (m/s) Axis Z Delta Theta (*) Axis Z Delta Theta (*) Axis Z Delta Vel (m/s) Axis Z Delta Vel (m/s)	-000.27 -0.19 000.00 -0.10 -0.00 -0.98 037.94 037.94 037.43 -000.00 -000.0										
Axis X Rate (*/x) Axis X Acceleration (g) Axis Y Rate (*/x) Axis Y Rate (*/x) Axis Y Rate (*/x) Axis Y Rate (*/x) Axis Y Acceleration (g) Axis Z Rate (*/x) Axis Z Acceleration (g) Axis Z Acceleration (g) Average Sensor Temperature (*C) Average IMU Temperature (*C) Axis X Delta Theta (*) Axis Y Delta Theta (*) Axis Z Delta Vel (m/s) Axis X BIT Date Axis Y BIT Data	-000.27 -0.19 000.00 -00.10 -00.00 -00.98 037.94 037.41 -000.00 -0										

Figure 4: Software Application Main Window



5.4.2.1 Common Controls



Figure 5: Main Controls

Common controls always remain visible and are used by all Tab pages. These controls have tool tips (help text will appear when you hover the mouse cursor over an enabled control).

5.4.2.2 Main Tab Options

There are three main tab options:

- Display
- Logging
- Settings



Figure 6: Main Tab Options

The following sections describe each tab in detail.

5.4.3 Display Tab

The **Display** tab shows the DMU10 output data in real-time using level meters.

DMU10 Utility - Part No. 1-10670-020-430	Rev 6 Release Version 1.0.0.33	
Display Logging Settings		SILICON* SENSING.
level		
Message Count	14682	
Axis X Rate (°/s)	-003.78	
Axis X Acceleration (g)	00.65	Displays DMU10 output
Axis Y Rate (°/s)	-014.18	data in real-time using
Axis Y Acceleration (g)	00.12	Red = +ve
Axis Z Rate (°/s)	-007.50	Blue = -ve"
Axis Z Acceleration (g)	-00.65	
Average Sensor Temperature (°	C) 034.17	
Average IMU Temperature (°C)	036.95	
Axis_X_Delta_Theta (°)	-000.02	
Axis_X_Delta_Vel (m/s)	000.03	
Axis_Y_Deita_Theta (°)	-000.07	
Axis_Y_Delta_Vel (m/s)	000.01	
Axis_Z_Delta_Theta (°)	-000.03	
Axis_Z_Delta_Vel (m/s)	-000.03	
Axis X BIT Data	00000	
Axis Y BIT Data	00000	
Axis Z BIT Data	00000	

Figure 7: Real-time Display Page

5.4.4 Logging Tab

The **Logging** tab enables the DMU10 data output to be logged for evaluation purposes.

For data logging, you must first connect the application to a MEV USB Serial Port as described in section 5.4.2.1.

The Logging tab contains two tabs:

- Log to memory
- Log to disk

SILICON^C SENSING.



Figure 8: Logging Tab Overview



5.4.4.1 Log File Format

The data is logged in a CSV format. This can be imported into an Excel spreadsheet or read using MATLAB[®] or other similar analysis tools. Table 1 shows the contents of the message stream sent from the DMU10 Evaluation Kit to the PC. When the File is imported into MS Excel, the Worksheet is formatted with in Columns in accordance with Table 3. The message rate is 200 Hz, therefore the time between each message is 5 ms.

Col	Data Item	Value / Units
А	Message	Message Number.
В	Time Stamp	Date and Time.
С	Header	0x55AA
D	Message Count	16 Bit, 0 to 65535 decimal, overflowing.
Е	Axis X Rate	32 Bit Single Precision FP, (°/s).
F	Axis X Acceleration	32 Bit Single Precision FP, (g).
G	Axis Y Rate	32 Bit Single Precision FP, (°/s).
Н	Axis Y Acceleration	32 Bit Single Precision FP, (g).
I	Axis Z Rate	32 Bit Single Precision FP, (°/s).
J	Axis Z Acceleration	32 Bit Single Precision FP, (g).
К	Aux Input Voltage	32 Bit Single Precision FP, (volts).
L	Average IMU Temperature	32 Bit Single Precision FP, (°C).
М	Axis X Delta Theta	32 Bit Single Precision FP, (°).
Ν	Axis X Delta Vel	32 Bit Single Precision FP, (m/s).
0	Axis Y Delta Theta	32 Bit Single Precision FP, (°).
Р	Axis Y Delta Vel	32 Bit Single Precision FP, (m/s).
Q	Axis Z Delta Theta	32 Bit Single Precision FP, (°).
R	Axis Z Delta Vel	32 Bit Single Precision FP, (m/s).
S	Axis X BIT Data	0 to 65535 decimal.
Т	Axis Y BIT Data	0 to 65535 decimal.
U	Axis Z BIT Data	0 to 65535 decimal.
V	Checksum	16 Bit 2's Complement of the 16 Bit Sum of the Previous 0-18 data items.

Table 1: Operational Message Data Output Descriptions

5.4.4.2 Log to memory

This option should be used for short logging sessions where it is useful to view the data onscreen. Logged data can also be saved to disk in CSV format.

The **LoggingMinAvailableMemorySpaceBytes** setting (see Table 2) enables the user to control the remaining memory space limit.



ndicates the available, remaining memory space. When this value falls below the value set for the LoggingMinAvailableMemorySpaceBytes" setting, logging will stop.					ace. he	Clears the current logg session from memory.	ing າ	Displays cap output data. Data column sorted by cli column hear	otured DMU10 ns can be cking the der.
DMU10 U	tility - Part	No. 1-10670-020-430	Rev 6 Re	lease Version 1.0.0	0.33	- K X M - 7	- m - m - 1		
Disconnect		vial Pert (COM2)	- 10	st massagas	_/				
JISCONNECL	038 36	enal Port (COMS)	- 10	scillessages [0					SILICON ³
Jisplay L	ogging S	ettings							JEINDING.
No. to log	2000	Stop 26/03/14 15:4	8:06	1570	Msgs 78 %				
Log to				/					
Log to m	emory L	og to disk	V						
Available	e memory (Mb) 1523 Clear	memory	Save C:\Us	ers\alex.chester\A	ppData\Roaming\Silicon	Sensing\DMU10\	Logfiles\ <u>2</u> 014_03_26_14	_32_37 csv Open
Messar	eNumber	TimeStamp	Header	MessageCount	AvisX Rate (°/s)	AvisX Acceleration (a)	AvisV Rate (°/s)	AxisV Acceleration (a)	Avis7 (ate (%s)
1	ic <u>iti</u> annoci	26/03/14 15:48:06:020	21030	10057	-1 51335	-0.02652502	-0.8809855	-0.1465337	0.07355417
2		26/03/14 15:48:06:025	21930	10958	-1.394871	0.02434772	-0.9056702	-0.1463896	0.3952369
3		26/03/14 15:48:06:020	21930	10959	-1.42435	-0.02436128	-0.9464331	-0.1459044	0.2688166
4		26/03/14 15:48:06:035	21930	10960	-1.511813	-0.02609018	-0.9057178	-0.1466564	0.3939623
5		26/03/14 15:48:06:040	21930	10961	-1.443791	-0.02700216	-0.9971146	-0.1458924	0.1328173
6	0	26/03/14 15:48:06:045	21930	10962	-1.28956	-0.02171199	-0.7203028	-0.1454546	0.4059 096
7	Sa	ves the 20/03/14 15:48:06:050	21930	10963	-1.84 Display	/s.the	-0.8696988	Opens window	VS 0.1822655
8	cur	rent logging 55	21930	10964	-148 path ai	nd file ₇₉₅₂	-0.6242486	Explorer, with	0.3066472
9	ses	sion data as 💿	21930	10965	-1.818name	of the last	-0.7414145	the last saved	0.289207
10	a C	SV3file.5:48:06:065	21930	10966	-1. saved	log file.7	-0.860518	log file selecte	d.1431468
11	-	26/03/14 15:48:06:070	21930	10967	-1.412226	-0.02373262	-1.230324	-0.1459149	0.1916845
12		26/03/14 15:48:06:075	21930	10968	-1.502247	-0.02294374	-0.9667522	-0.1454635	0.2193722
13		26/03/14 15:48:06:080	21930	10969	-1.219262	-0.02294303	-0.9343349	-0.1435821	0.435986
14		26/03/14 15:48:06:086	21930	10970	-1.385649	-0.01769476	-0.8868729	-0.146695	0.3468726
15		26/03/14 15:48:06:090	21930	10971	-1.592738	-0.02266005	-0.6848789	-0.1452764	0.1501785
16		26/03/14 15:48:06:095	21930	10972	-1.639897	-0.02345714	-0.8304454	-0.1466592	0.1982226
17		26/03/14 15:48:06:101	21930	10973	-1.203052	-0.02265599	-0.704464	-0.1480993	0.1447688
18		26/03/14 15:48:06:108	21930	10974	-1.591627	-0.02325147	-0.7412475	-0.1464039	0.3054282
19		26/03/14 15:48:06:110	21930	10975	-1.39572	-0.02514351	-0.8583106	-0.1484025	0.2981679
20		26/03/14 15:48:06:115	21930	10976	-1.462307	-0.02451498	-1.043688	-0.148726	0.2877741
21		26/03/14 15:48:06:121	21930	10977	-1.453273	-0.02436174	-0.8245493	-0.1466858	0.6174741
22		26/03/14 15:48:06:125	21930	10978	-1.718336	-0.02157076	-0.8723904	-0.1479455	-0.006273418
23		26/03/14 15:48:06:133	21930	10979	-1.560361	-0.02327111	-0.9651546	-0.1448165	0.3255304
24		26/03/14 15:48:06:135	21930	10980	-1.461255	-0.02360152	-1.089978	-0.1444772	0.4627824
				A 10	1 1 40E0E7				

Figure 9: Log to memory Tab



5.4.4.3 Log to Disk

This option should be used for logging large amounts of data.

Log files are created automatically, using a sort friendly date-time file name format.

Year, month, day, hour, minute, second, millisecond

Eg: _2014_03_25_16_40_29.csv

The location that log files are stored in can be set by clicking the log file location display box or by editing the **LoggingLogFileDirectory** setting (section 5.4.5). If the **LoggingLogFileDirectory** setting is left empty, a default location will be used.

The size that a log file is allowed to grow to is set by the **LoggingRecordsPerLogFile** setting (section 5.4.5). When this size is reached, a new log file is created.

The **LoggingMinAvailableDriveSpaceBytes** setting (section 5.4.5) allows the user to control the remaining drive space limit.

Indicates the available, remaining When this value falls below the LoggingMinAvailableDriveSpa logging will stop.	ng drive space. value set for the aceBytes setting,	Displays DMU10 output data in real-time using level meters. Red = +ve Blue = -ve"	
DMU10 Utility - Part No. 1-10670-020-430 Rev 6	Release Version 1.0.0.33		
Disconnect USB Serial Port (COM3)	Lost messages 0		SILICON ^S SENSING
No. to log 2000 Stop 26/03/14 17:57:41	1606 Msgs 80 %		
Available drive space (Mb) 35629 Log I	ile C:\Users\alex.chester\AppData\Roar	ming\Silicon Sensing\DMU10\Logfiles\ <u>2</u> 014_08_26_17	7_57_41.csv Open
Message Count	55680		
Axis X Rate (°/s)	-001 48		
Axis X Acceleration (g)	-09.02		
Axis Y Rate (Displays the path Axis Y Accel of the current log Axis Z Rate (Displays the path Log file size is de Axis Z Accel setting. When this	and file name file. 15 file. 15 termined by the PerLogFile size has been	Opens Windows Explorer, with the current log file dire selected.	ectory
Average Sen reached, a new lo Average IM Axis_X_Det file directory selectory Axis_X_Deta_Vel (m/s)	ng file is		
Axis_Y_Delta_Theta (°)	-000.00		
Axis_Y_Delta_Vel (m/s)	-000.01		
Axis_Z_Delta_Theta (°)	000.00		
Axis_Z_Delta_Vel (m/s)	-000.05		
Axis X BIT Data	00000		
Axis Y BIT Data	00000		
Axis Z BIT Data	00000		

Figure 10: Log to disk Tab

	ning	Silicon Sensing A DMIIIO	Logfiler	- to Search Leafiler		
Organize Inclu	de in li	ibrary Share with	New folder	Jeanen Logines		
☆ Favorites	^	Name	Date modified	Туре	Size	
🧮 Desktop	=	2014_03_31_14_01_43	31/03/2014 14:02	Microsoft Excel Comma Separat	2,433 K	В
\rm Downloads		A _2014_03_31_14_02_43	31/03/2014 14:03	Microsoft Excel Comma Separat	2,443 K	В
📃 Recent Places		🐴 _2014_03_31_14_03_43	31/03/2014 14:04	Microsoft Excel Comma Separat	2,445 K	В
		🖳 _2014_03_31_14_04_43	31/03/2014 14:05	Microsoft Excel Comma Separat	2,445 K	В
🥽 Libraries		🐴 _2014_03_31_14_05_44	31/03/2014 14:06	Microsoft Excel Comma Separat	2,437 K	В
Documents	-					
5 items						

Figure 11: Log files in the default log file directory

5.4.5 Settings Tab

The **Settings** tab displays application user settings for editing. If you require a setting to become permanent (i.e. persist between DMU10 Utility re-starts) click **Save settings**.

DMU10 Utility - Part No. 1-10670-020-430 Rev 6 Release Version 1.0.0.33					
Connect NONE -	Baud 460800 V Lost messages 0 Mode NOT CONNECTED				
Firmware 0 SN 0					
Display Logging Settings					
▲ Misc					
FlashLoaderExeArguments	-cpn 5br 115200db 8sb 1to 1000 -i "STM32F303_256K" -eall -dfn "FileName.hex"v				
FlashLoaderUploadDefaultDirectory	Unused				
LoggingLogFileDirectory					
LoggingMinAvailableDriveSpaceBytes	10000000				
LoggingMinAvailableMemorySpaceBytes	30000000				
LoggingRecordsPerLogFile	60000				
Unlock	CUSTOMER_EVAL				
VCP_Device_ID_ATTI_PL303_P	New PL DC Power Supply				
VCP_Device_ID_DLP_1014	12345678A				
VCP_Device_ID_MEV	+MV				
LoggingRecordsPerLogFile					
	Save settings				

Figure 12: Settings Page



5.4.5.1 Default Settings

The following default application settings are used.

Setting name and description	Default value
FlashLoaderUploadDefaultDirectory	
This setting should be left empty	
LoggingLogFileDirectory	
Overrides the default location for storing log files. This can be edited here or set from the "Log to Disk" page using a selection dialog. Leave this setting empty if you want the default location to be used.	
LoggingMinAvailableDriveSpaceBytes	10000000
When logging data to disk, logging will stop when the remaining drive space (in bytes) drops to this limit.	
LoggingMinAvailableMemorySpaceBytes	30000000
When logging data to memory, logging will stop when the remaining memory space (in bytes) drops to this limit.	
LoggingRecordsPerLogFile	60000
When the number of records in a log file reaches this limit, a new log file is created. The DMU10 outputs data at 200Hz so the default setting of 60000 will result in a new file every 5 minutes that is approximately 12.5 Mb in size.	
Unlock	Empty
This setting should be left empty.	

Table 2: Default Settings

Please do not attempt to change any parameters not listed in Table 2. Changes may result in non-functioning software.

5.4.6 Changing the MEV 485i Driver Settings

To perform correctly the DMU10 utility software requires non-default MEV 485i driver settings.

The software will attempt to change them if it detects that they are incorrect.

If the software cannot change these settings, it will inform the user by displaying a message.



Error writing to Windows registry: Error writing ConfigData key. Requested registry access is not allowed. Error writing LatencyTimer key. Requested registry access is not allowed. Virtual COM Port driver settings could not be written. Please refer to the User Manual for instruction on how to change these settings.
ОК

If a message like this appears, follow the procedure below to change the settings:

- Open Windows Device Manager. Instructions for doing this vary between operating systems. In Windows 7, this can be accessed using Start / Control Panel / Hardware and Sound / Device Manager.
- 2. Open Ports (COM & LPT)



3. Double click the port that requires changing (the COM port that the DMU10 Utility will connect to)

USB Serial Port (COM5) Properties				
General	Port Settings Dr	iver Details		
1	USB Serial Port (COM5)		
	Device type:	Ports (COM & LPT)		
	Manufacturer:	FTDI		
	Location:	on USB Serial Converter		
Device status This device is working properly.				
		ОК	Cancel	



4. Select the **Port Settings** tab.

USB Serial Port (COM5) Properties
General Port Settings Driver Details
<u>B</u> its per second: 9600
<u>S</u> top bits: 1 ▼
Flow control: None
Advanced Restore Defaults
OK Cancel

5. Click **Advanced**. If this results in a message informing you that you do not have write privilages for the registry then you must obtain Administrator rights before continuing with this procedure. Otherwise, change the **Receive (Bytes)** value to 2240 and the **Latency Timer (msec)** value to 1 (as shown below).

COM Port Number:		•	OK
			UK
USB Transfer Sizes			Cancel
Select lower settings to correct performa	ance problems at lo	w baud rates.	
Select higher settings for faster perform	ance.		Defaults
Receive (Bytes):	2240 -		
Transmit (Bytes):	4096 🔻		
BM Options		Miscellaneous Options	
Select lower settings to correct response	e problems.	Serial Enumerator	
		Serial Printer	
Latency Timer (msec):	1 -	Cancel If Power Off	
		Event On Surprise Removal	
Timeouts		Set RTS On Close	
Minimum Read Timeout (msec):	0 -	Disable Modem Ctrl At Startup	
Minimum Write Timeout (msec):			

6. Click **OK** to save these settings.



6 Using the DMU10 without the Evaluation Kit

The information in this section is provided to enable the user to use the DMU10 with alternative logging equipment.

3.1V 3.2 to 5.25 **Expansion Port** PL1_2 Orion X 3.1V 3.1V regulator Temperature sensor GND PL1_1 3.1V 3.1V 3.1V RX Lo PL1_3 RX RX_Hi PL1_4 RS422 Orion Y I/F ORION SPI I/F TX_Lo PL1_9 тх тх_ні PL1_10 TX_TRISTATE RS422_TERMINATION Microcontroller 3.1V Factory Use PL1_12 SPARE PL1_11 FREE RUN PL1_6 AUX Orion Z PL1_7 SYNC PL1_8 RESET PL1_5 Т

Figure 13 shows the internal architecture for DMU10.

Figure 13: DMU10 Architecture

Table 3 shows the connector pin out for DMU10. Note: Pin 1 is the left pin when looking into the connector.

Pin	Signal Name	Signal	In / Out
1	GND	Power Supply Ground (0V)	I
2	5V	+5 V DC power supply	I
3	Rx_Lo-	Serial digital data input - RS-422	I
4	Rx_Hi+	Serial digital data input - RS-422	I
5	RESET	Processor reset (active low)	I
6	Enable/Disable	Serial Stream control	I
7	Spare	Do not connect to	N/A
8	Sync Pulse	Pulse at set sampling point (active high)	0
9	Tx_Lo-	Serial digital data output - RS-422	0
10	Tx_Hi+	Serial digital data output - RS-422	0
11	Spare	Do not connect to	N/A
12	Boot0	Programming control pin	I

Table 3: Connector Pin C	Out
--------------------------	-----



A typical connection to a host system is shown in Figure 14. Note that some connections are not essential for correct operation.



Figure 14: Connection to a Host System

ltem	Word	Data Item	Value / Units
0	0	Header	16 Bit, 0x55AA
1	1	Message Count	16 Bit, 0 to 65535 decimal.
2	2-3	Axis X Rate	32 Bit Single Precision FP, (°/s).
3	4-5	Axis X Acceleration	32 Bit Single Precision FP, (g).
4	6-7	Axis Y Rate	32 Bit Single Precision FP, (°/s).
5	8-9	Axis Y Acceleration	32 Bit Single Precision FP, (g).
6	10-11	Axis Z Rate	32 Bit Single Precision FP, (°/s).
7	12-13	Axis Z Acceleration	32 Bit Single Precision FP, (g).
8	14-15	Aux Input Voltage	32 Bit Single Precision FP, (volts).
9	16-17	Average IMU Temperature	32 Bit Single Precision FP, (°C).
10	18-19	Axis X Delta Theta	32 Bit Single Precision FP, (°).
11	20-21	Axis X Delta Vel	32 Bit Single Precision FP, (m/s).
12	22-23	Axis Y Delta Theta	32 Bit Single Precision FP, (°).
13	24-25	Axis Y Delta Vel	32 Bit Single Precision FP, (m/s).
14	26-27	Axis Z Delta Theta	32 Bit Single Precision FP, (°).
15	28-29	Axis Z Delta Vel	32 Bit Single Precision FP, (m/s).
16	30	Axis X BIT Data	16 Bit, 0 to 65535 decimal.
17	31	Axis Y BIT Data	16 Bit, 0 to 65535 decimal.
18	32	Axis Z BIT Data	16 Bit, 0 to 65535 decimal.
19	33	Checksum	16 Bit 2's Complement of the 16 Bit Sum of the Previous 0-18 data items.

Table 4 describes the format of the data output message for DMU10.

Table 4: Operational Message Data Output Descriptions



6.1 Sensor Sampling and Synchronisation

When the DMU10 Evaluation Kit is not used, it is possible to make use of the 'Sync Pulse' output from the DMU10.

The Inertial Sensors within DMU10 are all sampled at 1000 Hz. The 'Sync Pulse' on the connector is set HIGH at the start of the sampling and returned to LOW when the last Inertial Sensor is sampled. Pulses are therefore seen on the connector at 1000 Hz.

The Inertial Sensors measurements are then be filtered with a 2nd order low pass filter, also running at 1000 Hz. The factory default setting for this filter is to have a corner frequency of 100 Hz.

The DMU10 message is output at 200 Hz, of every 5th sampling cycle. The sequence is:

- Cycle 1: Sample Sensors, 2nd order Filter.
- Cycle 2: Sample Sensors, 2nd order Filter, Calculate Sensor Compensation.
- Cycle 3: Sample Sensors, 2nd order Filter, Apply Sensor Compensation.
- Cycle 4: Sample Sensors, 2nd order Filter,
- Cycle 5: Sample Sensors, 2nd order Filter, Transmit Message.

The message is transmitted after the 'Sync Pulse' associated with Cycle 5 has returned LOW. The Inertial data included in the message is when the 'Sync Pulse' associated with Cycle 3 was HIGH. This enables the external equipment to synchronise with the time when the Inertial Data was valid.

The Output Message is output on the RS422 Serial output at 460,800 baud using a nonreturn to zero protocol. Each message contains a start bit (logic 0), 8 data bits and 2 stop bits (logic 1).



7 DMU10 Electrical Connections

The interface cable shown in Figure 15 enables the DMU10 to be connected directly to the MEV interface allowing the application to be used immediately.



Figure 15: Interface Cable 630486-0940

If the user has a dedicated communication protocol system they wish to use, the blank connector shown in Figure 16 can be used.



Figure 16: Blank Connector for Customer Use

The blank connector has all the connections pre-crimped to the mating half of the PCB connector, so it can be easily worked into an existing system if required. Figure 17 highlights pin numbering of the blank cable connector.



Figure 17: Pin numbering of the blank cable connector



8 Installation

The installation drawing for DMU10 is shown in Figure 18.

The (unpackaged) DMU10 is an OEM product supplied as a PCB. It is recommended that it is mounted on spacers or pillars using the four mounting holes provided. These holes are 2.3 mm diameter holes, designed as clearance holes for 2 mm screws.



Figure 18: DMU10 Installation

During calibration of the DMU10, alignment is achieved using external reference dowels on two edges of the PCB. These two faces therefore form the Datum for alignment purposes.

9 Software Updates

If there has been an update to the software supporting the DMU10 Evaluation Kit, it can be downloaded from the 'Software' section of the download library at:

http://www.siliconsensing.com/information-centre/downloads-library/

10 Contact Details

If you require any additional information about the DMU10 Evaluation Kit or any other products please contact Silicon Sensing via:

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