CONTROLLED TECHNICAL DOCUMENT User Guide	DOC No: BG: 700137	
TITLE: Survey Quick User Manual	**ENGINEER** **Richard Payne**	**ISSUE:** **030** (19-Feb-17)

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1   Release History

Date	Release	Description of Revision
04/03/2016	010	Initial
25/09/2016	020	Major update release. Include Battery and tool spec.
19/02/2017	030	Revision and Include CVS Calibration File feature.

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2   Introduction

2.1   Scope

This document is an operator or user manual intended to setup project for survey tool and operate them in context of field trails purpose.

2.2   Revision Note

The document is valid based on installed

> Software **UDT54** release (Window 8/10)

> Firmware **LPC1549_DIR_BG_5B** (19/02/17) for field trails purpose.

NB: UDT54 was tested on Window 8/10. It unknown of this work on Window 7.

NB: It is essential for both Firmware and Software to have same revision, otherwise certain feature will not work and may lead to hanged operation.

2.3   Legal Note and Definition

The firmware and software are restricted for field trails purpose and internal use. It is not final product for 3rd party or intended to be sale or given to 3rd party use.

Definition:

> SOFTWARE = Universal Debug Terminal (UDT)

> FIRMWARE = Assembly code that reside within tool.

NB: The above items is exclusively owned and copyright under Total Vision Bulgaria EOOD, Varna Richard Payne.

DO NOT COPY/CLONE/TRANSFER SOFTWARE/FIRMWARE

TO 3RD PARTY WITHOUT WRITTEN PERMISSION OR APPROVAL

BY RICHARD PAYNE.

NB: You may send picture of the UDT, resultant survey files/charts and data file to 3rd party.

NB: Due to insecurity of the email, they do not constitute any kind of approval.

Any query: Refer to Richard Payne: Rpayne@totalvision.pro or Riscy00 on Skype or Viper: 359878265080. NB: I am Deaf.

2.4   Introduction

Universal Debugger Terminal (UDT) is a C# written software under WinForm style window offering feature-rich, multi-purpose user interface aligned for board level testing, diagnostic and devices testing and evaluation. It provide simple pathway to develop application code that can be tested in the field and later propagated into application solution. It written for Window 8/10 but window 7 is no longer supported or test.
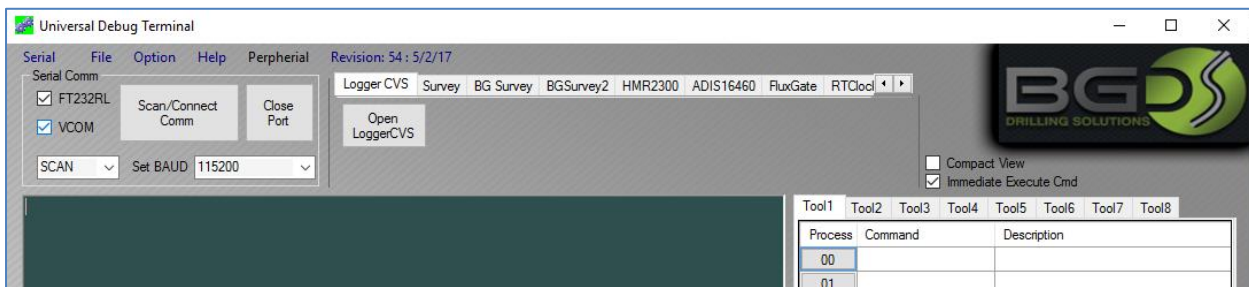
UDT contains multi-purpose instruments to handle data transfer between various devices with UART or USB interface (as well as various kind of serial interface such as I2C, SPI). It has powerful 6 channel USB interface with context friendly commands for quick operation and tools debug and assessments. It provides capability to collects survey data under Logger Window as well as test bed for calibration and directional data. It incorporated FFT analysis and various post data collection tools.

After a completion of field trails and testing, the UDT will be stripped down with many function removed and formed into an application suitable for application project, including possible migration from Window into Android based Tablet, PDA device.

Important: UDT copyright under Total Vision Bulgaria EOOD, author by Richard Payne.

This document is an user manual for test engineer and field trails engineer.

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3   Survey Project Overview

Survey Project is a job process being conducted in the field, it require setup/preparation before tools is ready for survey operation.

This is critical aspect of the job procedure, it is recommended to follow them.

3.1   Setup Survey Project / Tool and Start Survey

Below is an overview of the step you expected to take.

The new feature just added is the <EXPORT CAL CVS FILE>, which allow you to save calibration file into special memory within the tools. The size of this memory is very limited to 2K or 2048 Byte.

The <SETUP TOOL & JOB> create a project folder with details about the job, performs self-test, reset battery capacity (if replaced). It also configure for meter or feet option.

The <FLASH/RTCC RESET> clear the old data in logger memory.

The <EXPORT CAL CSV FILE> save the calibration data into special memory so it can be recovered later.

The <START SURVEY> imitate the Survey operation along with timestamp sync.
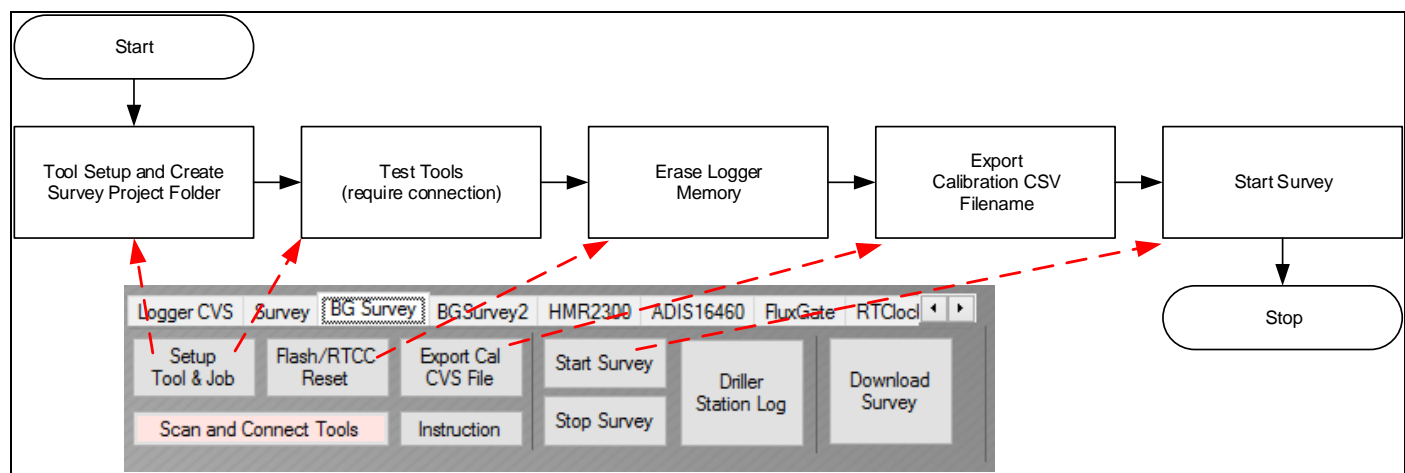
Once <START SURVEY> is successfully initiated, the tool can be disconnected from LEMO connector. The tool now run on battery and put into practical downhole application.

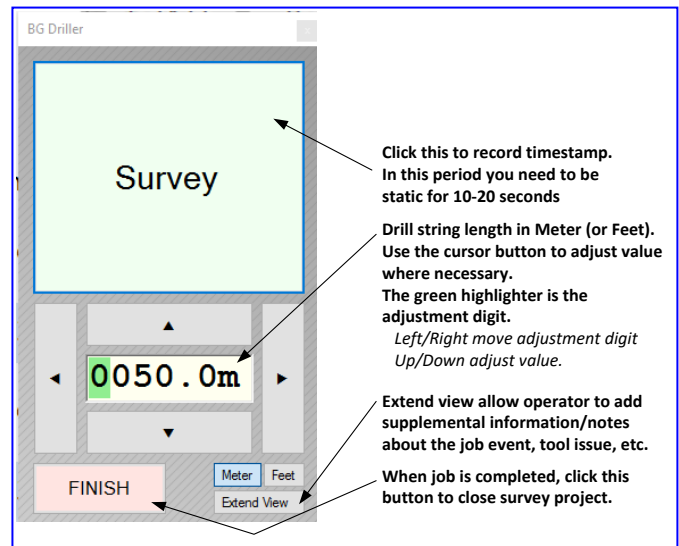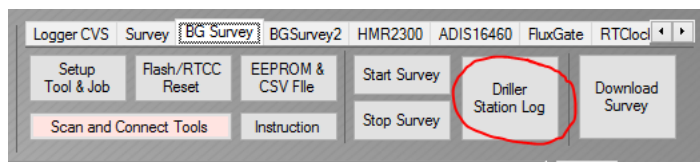The structures of the folder are discussed in Appendix section.

3.2 During Drilling/Survey operation

The reference timestamp (clock, date down to mSec resolution) come from Laptop or PDA which is passed to the tool as part of tool configuration (part if setup procedure). The timestamp is based on Unit Time Clock (www.unixtimestamp.com)

This timestamp is used to sync sampled data within the tool and the Survey snapshot at the surface.

The <Drill Station Log> is open by clicking the button as shown below.

Click this to record timestamp. In this period you need to be static for 10-20 seconds

Drill string length in Meter (or Feet). Use the cursor button to adjust value where necessary.
The green highlighter is the adjustment digit.
Left/Right move adjustment digit
Up/Down adjust value.

Extend view allow operator to add supplemental information/notes about the job event, tool issue, etc.

When job is completed, click this button to close survey project.

The Driller inserts the tool string to certain length interval and then clock large green button (Survey). This button change to red colour along with 20 second timer counter flashes. This is where driller and associated equipment must remain static to give sensor time to finish data capture. This captured data is then stored within EEPROM along with timestamp from internal clock.

> **WARNING: ANY MOVEMENT ON TOOL STRING INCLUDING VIBRATION WILL REDUCE SENSOR ACCUARCY.**
>
> **It good practice to turn off MOTOR and associated machine that induce vibration on ground.**

When the timer expired, the survey timestamp is then appended to project folder and Driller can now continue working with the tool string until next length interval.

In case of shorter or longer interval, the Driller can modify the internal length by clicking

- ➤ Left or Right button move highlighted green cursor
- ➤ Up and Down button change number up and down within green cursor.

On conclusion of the survey, click <FINISH> button.

NB: This paper refers **Driller** as a person responsible doing the Survey operation. It would be called as Surveyor. It does not necessary imply doing actual drilling operation of the tool.

3.3 Stop Survey and Data Collection

When the tool is recovered (NB: the sensor survey continue to remains active) from the tool string and placed next to same laptop/tablet/PDA where timestamp was originally synchronised, the Driller insert the USB cable and plug in the Lemo connector. The UDT (under BG Survey Tab) will automatically make connection and cease the tool sensor survey activity. The Driller now clicks the <Download Survey> button as shown below.
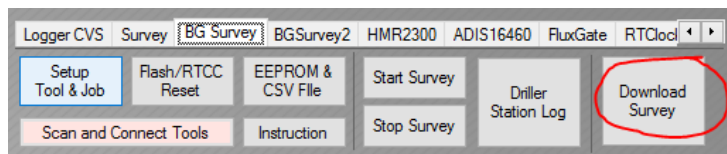

This opens the <Download Survey Manager> window. The Driller now checks the project folder and if necessary resync to correct folder that project previously configured. Once this is done, the Driller can now clock <DOWNLOAD NOW & SAVE> button which become busy transferring the sensor data along with calibration CVS file, saved into project folder.
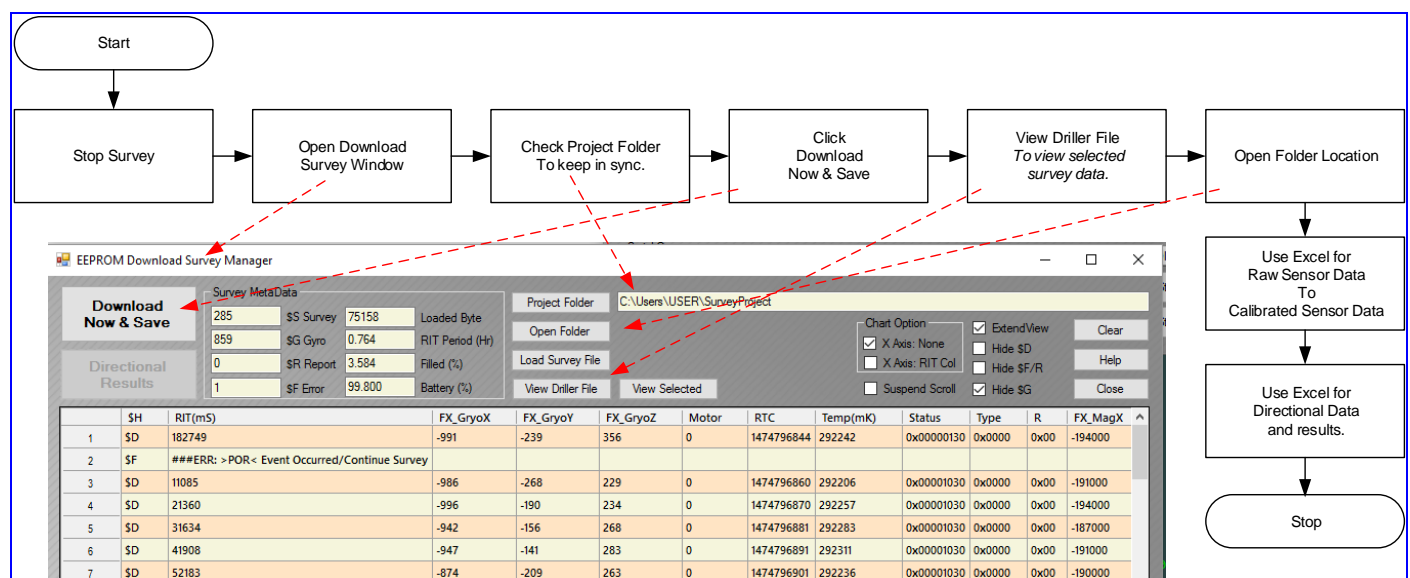
The Driller has option to explore the survey data in-situ as shown above or otherwise close the project. You will fine several files within the project which is covered by this paper. The project folder can be zipped and passed to survey manager for further processing and provide report to customer and concluded the job. The survey includes serial number and firmware revision.

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3.4 Filename with Project Folder (After resultant data transfer)
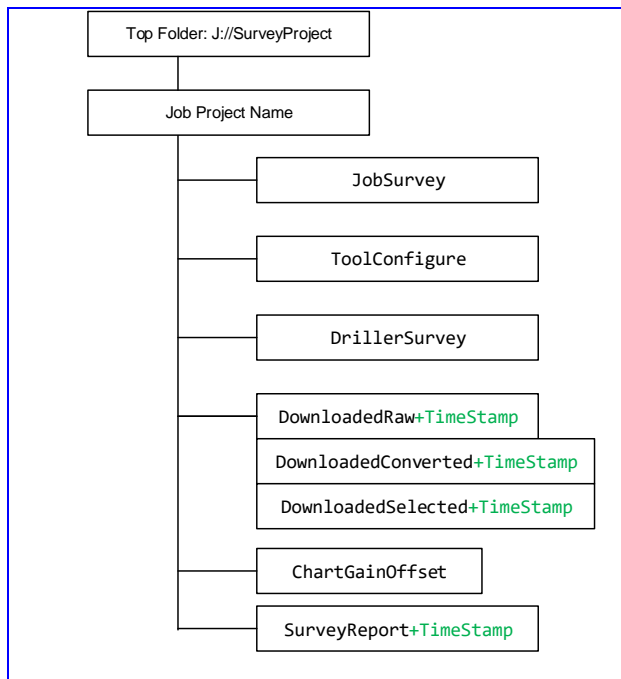
It is critically important to keep all data together into folder.

NB: The above include CalibrationFile.CSV (not shown).

Refer to appendix for more details about the folder name and type.

Below is the example filename structure within the project folder BGtest19Feb17.

| Name	Date modified	Type	Size
DownloadedConverted_19_02_2017_11_27_22.csv	19-Feb-17 11:27 AM	Microsoft Excel C...	2 KB
DownloadedRaw_19_02_2017_11_27_22.csv	19-Feb-17 11:27 AM	Microsoft Excel C...	2 KB
DrillerSurvey.xml	19-Feb-17 11:24 AM	XML File	2 KB
ImportedCalibrationFile_19_02_2017_11_27_23.csv	19-Feb-17 11:27 AM	Microsoft Excel C...	1 KB
JobSurvey.xml	19-Feb-17 11:17 AM	XML File	1 KB
SurveyReport_19_02_2017_11_27_23.csv	19-Feb-17 11:27 AM	Microsoft Excel C...	2 KB

4   Quick Procedure

4.1   STEP-1: Setting up USB connection to UDT Application software

Refer to Appendix section for installation procedure of UDT application and configuration.

Once UDT is up and running, plug in the Lemo to the tool but ***do not connect the cable to Laptop's USB yet.***

Do the following Step as picture shown below
  (1) Select to <BG Survey> Tab (see below), this is important step before plugging in.
  (2) Plug USB connector to the laptop (or tablet/PDA in next revision).
  (3) The UDT automatically make connection. Below is the expected response.
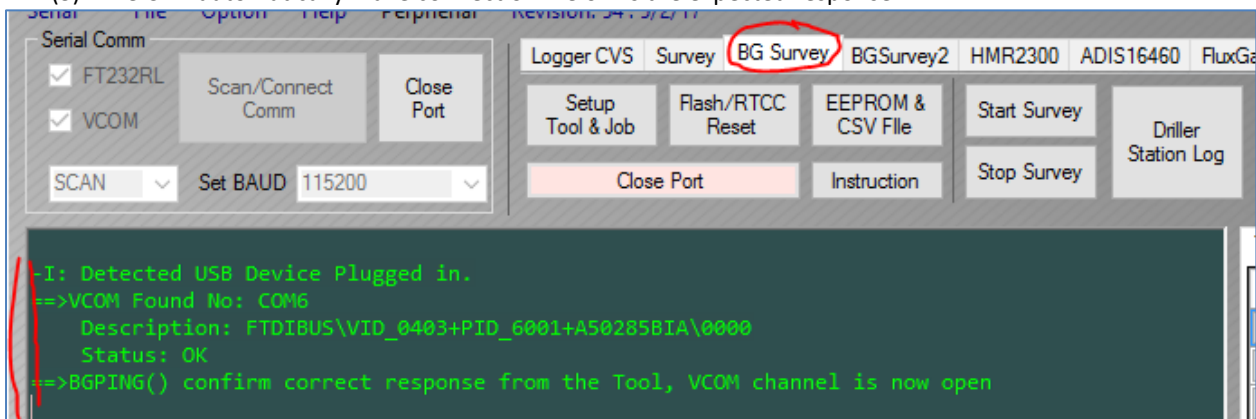
  (4) In case of connection failure, disconnect USB cable and wait 10-20 second and try again.

NB: the USB cable is custom made for this tool, do not use other USB cable.

In case the tool is running on SURVEY mode, the UDT will issue command to cease survey mode automatically.

You can test the response by typing "==" which provide generate welcome message, which include tool part number, serial number, battery type, sensor assembly type and firmware revision. This information would only be useful for tool diagnostic and repairs when requested by support team.

4.2   Step 3: Setup New Project and Validate Battery Capacity

(1)   Select <BG Survey> Tab of the UDT window
(2)   Click <Setup Tool & Job> which pop up Window: <BG Tool Setup>
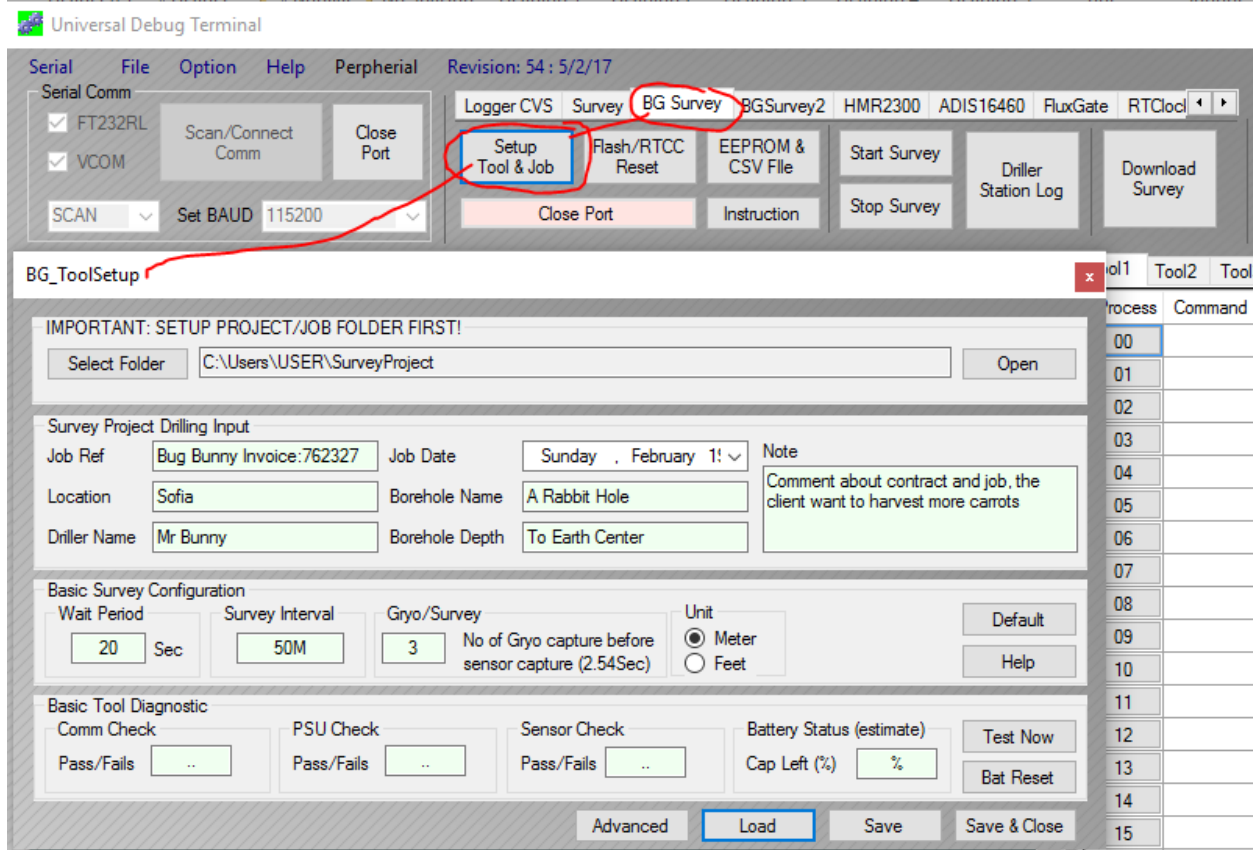
(3)   Click <TEST NOW> and check battery capacity, decide if battery needs replacing.

Continue next step when COMM, PSU and SENSOR indicated PASS results from tool diagnostic.
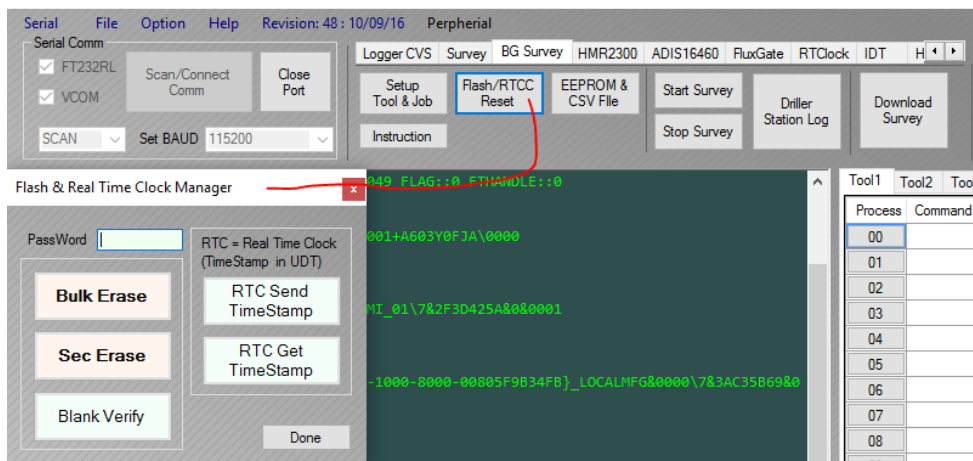
(4)   At the top, create new project folder unique name to contract number or location.
   a.   Important: Make sure the folder location do not have Window's Security Restriction location, otherwise it will not create folder/file without admin on UDT.
   b.   Recommend to retains "SurveyProject" folder as top level folder for all project folder.

(5)   Next: Fill in the Survey Project Drilling Input as desired.
(6)   Modify the Basic Survey Configuration as desired.
   a.   Wait Period: Leave 20 Sec as minimum. (NB: This may be removed later)
   b.   Survey Interval: Next distance of the tool string before next Capture Survey Process.
   c.   Gyro/Survey: Please leave 3 as is.
   d.   Unit: Meter or Feet.

(7)   Click <SAVE AND CLOSE> button to conclude this.

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4.3   Step 4: Erase Tool Logger Memory and check Real Time Clock

WARNING: THIS WILL ERASE ALL SURVEY DATA!!!

(1)   Click <Flash/RTCC Reset> which pop up window.

(2)   Type Password "EEPROM"

(3)   Click <Bulk Erase> to start process, this take 10-20 second.

(4)   Click <Done>

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4.4   STEP-5: Start Survey

The tool is now ready to start survey

(1) Click <Start Survey>

(2) The UDT will automatically performs the following
   (a) Issue command to tool to validate logger memory is empty, if not, it pop up error message and quit Survey mode.
   (b) Issue command to tool to update time and date and validate, if not working, it pop up error message and quit Survey mode.
   (c) If there no error, UDT issue final command to start survey mode.

(3) The UDT pop up window to instruct operator to disconnect LEMO cable or wait bit longer to see ":" pattern which indicate the tool is in Survey mode (This is a confidence check knowing the tool is in right condition to perform the job).
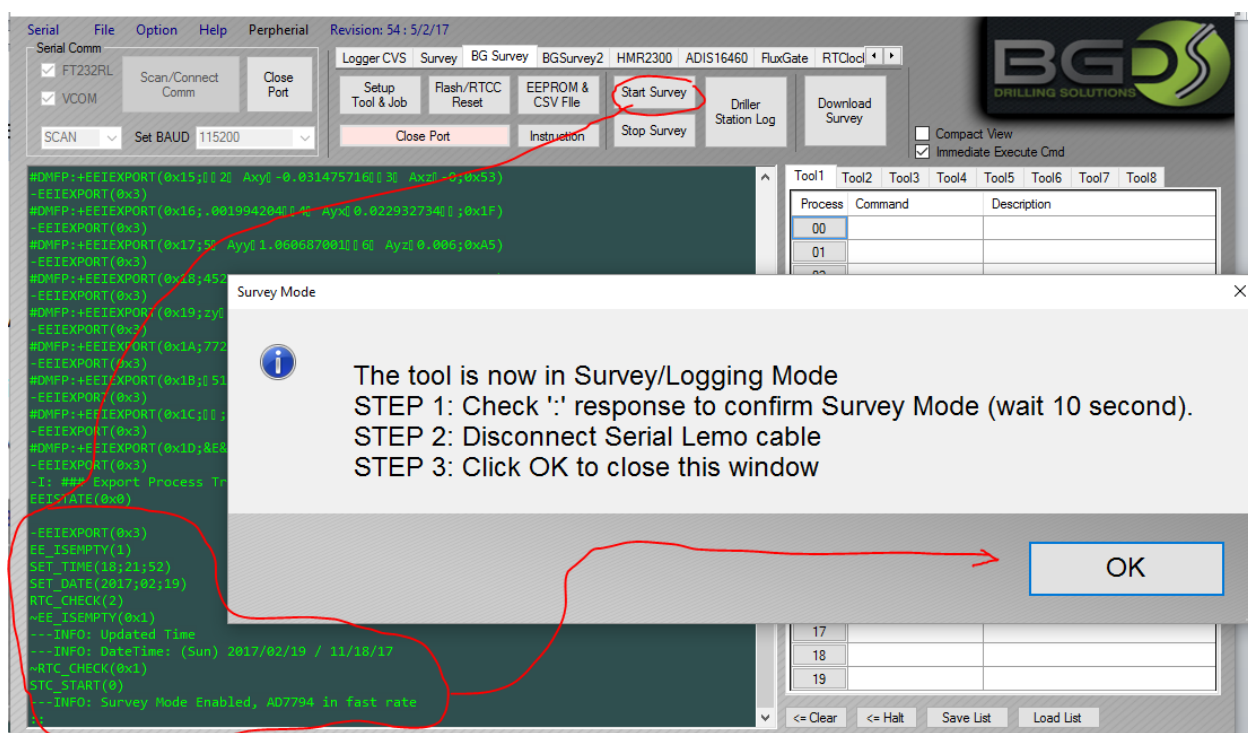
4.5   STEP-5: Driller Station Log

Refer to section 3.2

5 Stop Survey Mode and Uploading Survey Data

5.1 STEP-1: Ceasing the Survey Mode

(1) Before plugging tool to the laptop, make sure the tab is <BG_Survey>

(2) Plug in the tool, you should get this response.

NB: Note that the ':' is still emitted which mean it still in survey mode.

```
---INFO: Survey Mode Enabled, AD7794 in fast rate
::::::::::::::::::::::
-I: Detected USB Device Removed.
-I: Closing USB/UART Port, please wait few seconds until finally closed

-I: Detected USB Device Plugged in.
==>VCOM Found No: COM6
    Description: FTDIBUS\VID_0403+PID_6001+A50285BIA\0000
    Status: OK
==>BGPING() confirm correct response from the Tool, VCOM channel is now open
:
```

(3) Click <Stop Survey> button as indicated, which pop up the message as shown below,
(4) Click <OK>
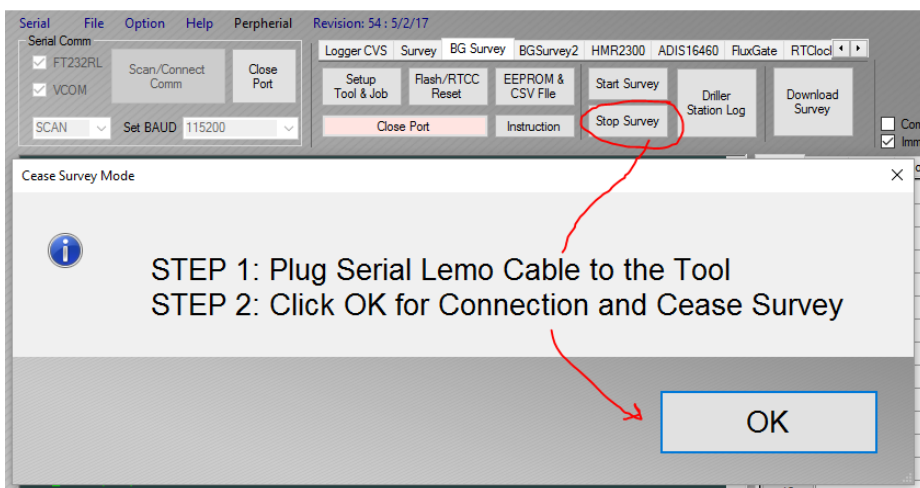
(5) It then reply acknowledge message as indicated. The Tool has successfully entered into Normal Mode.

```
:
:$F2---INFO: Ceasing Survey Operation, FXAS FIFO loop Stopped
```
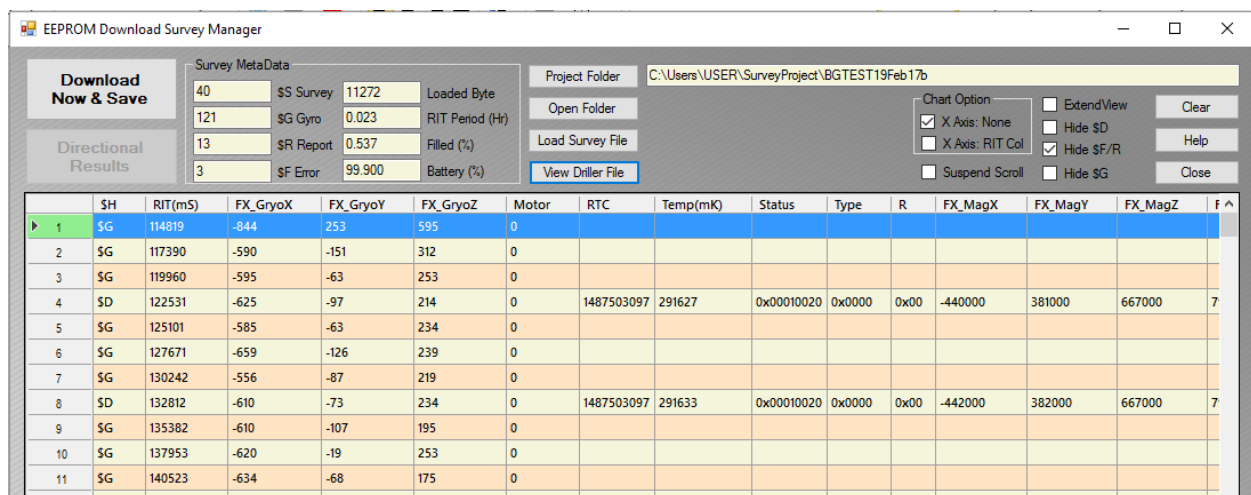
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5.2   STEP-2: Download Survey Data

(1)   Click <Download Survey Window> which pop up the window as shown below

(2)   Double check the Project Folder, has this been changed, if so click <Project Folder> and correct location
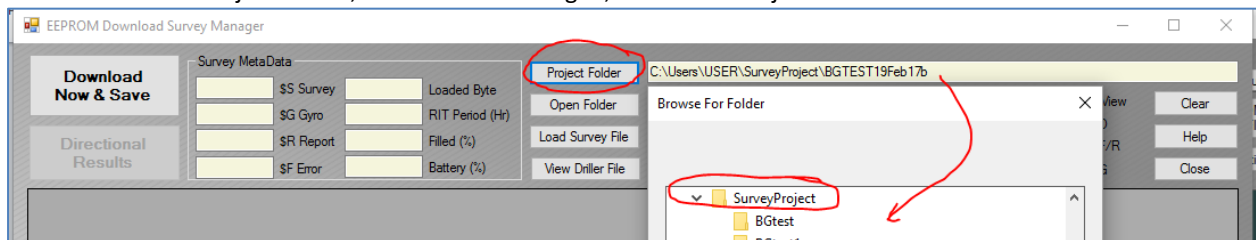
(3)   Now click <DOWNLOAD NOW & SAVE>
- o   Allow few minutes to process data transfer, depending on active job period. Short job period transfer data faster.
- o   This includes Calibration File CSV transfer.

(4)   Note the Survey Meta Data which tell you
- a.   Amount of Gyro and Survey sensor survey collection.
- b.   Remaining battery capacity left.
- c.   Job Period (RIT) in hour.
- d.   Size of uploaded data in Bytes.

(5)   Once the data transfer is concluded, it save in the following filename
- a.   **DownloadRaw + Timestamp in csv format.**   **This is unprocessed data for reference.**
- b.   **DownloadedConverted + Timestamp in csv format.**   **This is converted data for reference**
- c.   **SurveyReport+Timestamp in csv format.**   **This is Driller Report**
- d.   **ImportedCalibrationFile + TimeStamp in csv format**   **This is calibrated data.**

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(6) This SurveyReport file (highlighted yellow) is a conclusion of the survey, below is the snapshot

The file structure as shown below

(7) Surveyor/Driller can view the Driller Survey by clicking <View Driller File> which Driller can edit, modify details. It does not provide sensor readout. (This is XML type file, so it easier to view this by this app than excel).

(8) Surveyor/Driller can scroll down the Sensor data until it highlight the row which represent the captured driller point.

Feature Note about Download Survey Window:

➢ After data transfer with listed data, it has full support of select one or many data rows and CNTR+C to copy and paste data to document and excel.

➢ Right click on sensor column, select ChannelCH0, CH1, CH2, CH3 which display on chart window.

➢ $G is a Gyro data, $D is a Survey data. You can remove this from the table by checking or unchecking the boxes (see RHS)

➢ You can extend view of the table by check box <Extend View>

➢ You can inspect Report and Error Report by checking Hide $D and Hide $G and leave unchecked Hide $F/R as shown RHS.

5.3   Supplemental Information about Download Survey Window

5.3.1   OVERVIEW

Download Survey Window contains many powerful features that manage the data for various viewing option, charting and so on. It can be transferred from tools or directly loaded from the filename either DownloadRaw or Downloadconverted.

It has the following features

Within the Survey MetaData
> Remaining Battery Gauge in %
> Number of Survey frame and type report
> Number of byte uploaded from the tool (or filename) and fill capacity in %.

Various available control
> Operation period (NB: RIT (a special type of timer) which get reset if WDT or power disconnection event occurred)
> Open folder for convenience
> Load Survey file for quick viewing and data analysis
> View SurveyReport via <View Driller File>.
> View selected survey data based on SurveyReport via <View Selected>
> Select column for charts with flexible cursor measurement and adjustment.
> Hide specific survey data, ie $G, $D, $F, $R

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5.3.2 DATA COLLECTION AND METADATA

The Download Survey provides indication of battery capacity and Logger Memory fills. Number of report and error occurrence. For ½ hour operation it accumulated 44KB of data and filled 2% (out of 2MB Logger Memory). Note that there is no $R and $F report which mean the tool operated without issue.

5.3.3 BATTERY CAPACITY
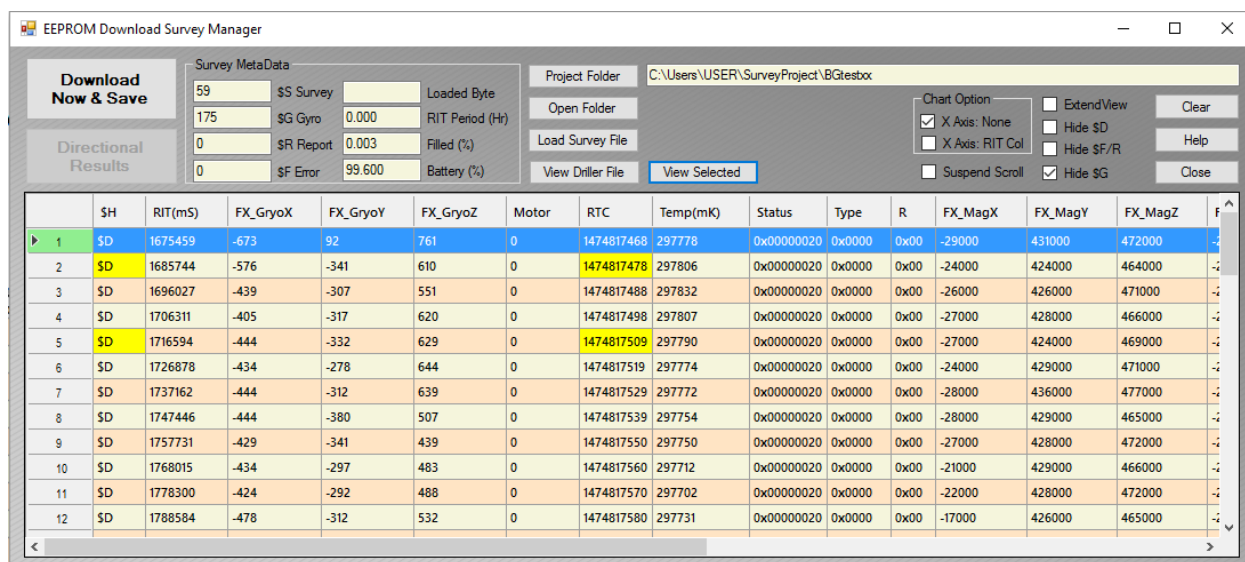
The battery capacity indicated 10% which mean it time to replace it. Generally, it depends on duration of the job task. 10% may mean estimate of 20-40 hour left capacity. 25% may mean 80-100 Hr left. 100% mean 400Hr left capacity based on SAFT LS17500 battery.

The battery capacity is calculated based on Gyro frame and Data frame event during survey which deducts remaining capacity. However it does not factor power consumption under normal Normal Mode. This is why we recommend disconnecting battery while in Normal Mode and not in use, there no off switch. The firmware does not measure battery voltage and make report at present release.

5.3.4 DATA COLLECTION

After loading the data from the tool or filename, it appear as shown below, all data are integer (no float support), the format is

- ➢ nT for Magnetometer
- ➢ uG for Accel
- ➢ Deg/uSec for Gyro

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Other data are

- RIT(mSec) is a special timer which sustain ticking even while MCU is in sleep mode. This is relevant for Gyro measurement since the 2.54 second capture varies between batches.
- Motor is related for Motor calibration and should be ignored.
- RTC is a real time clock in Unix Time format (UTC)
- Status is an operation/error flag in status word which include tools certain flag (stored in internal EEPROM within MCU). This flag indicate WDT and PSU failure event which stay set until end of survey.
- Temp (mK) is the temperature readout of the tool.
- Type and R is future application and should be ignored.

5.3.5 DATA COLLECTION AND REPORTSURVEY

After data transfer from tool or filename download, the UDT automatically load the DrillerSurvey file and make match between timestamp of the DrillerSurvey and Tool's RTC from the downloaded data/file, when match is found or close match, it highlight yellow as indicated below.

	$H	RIT(mS)	FX_GryoX	FX_GryoY	FX_GryoZ	Motor	RTC	Temp(mK)	Status	Type	R	FX_MagX	FX_MagY	FX_MagZ
427	$G	1088287	-1123	-9092	-47086	0								
428	$D	1090834	-1387	-8786	-46961	0	1457095772	291956	0x00000010	0x00000000	0x00	350000	479000	-211000
429	$G	1093381	-1227	-8898	-46972	0								
430	$G	1095928	-1072	-8721	-47089	0								
431	$G	1098475	-1382	-8927	-47129	0								
432	$D	1101022	-1249	-8719	-47349	0	1457095782	291966	0x00000010	0x00000000	0x00	335000	475000	-212000
433	$G	1103569	-1020	-8821	-46920	0								
434	$G	1106116	-1359	-8876	-47270	0								
435	$G	1108663	-1305	-8785	-46876	0								
436	$D	1111211	-1156	-8851	-47286	0	1457095792	291933	0x00000010	0x00000000	0x00	334000	476000	-207000
437	$G	1113758	1477	8548	47042	0								

When the button "ViewSelected" is clicked, all data that is not part of DrillerSurvey are removed.

5.3.6 REPORT SURVEY

The generated report survey initially appears as below.

$H	RIT(mS)	FX_GryoX	FX_GryoY	FX_GryoZ	Motor	RTC	Temp(mK)	Status	Type	R	FX_MagX	FX_MagY	FX_MagZ	FX_AccelX	FX_AccelY	FX_AccelZ	KX_AccelX	KX_AccelY	KX_AccelZ	K2_AccelX	K2_AccelY	K2_AccelZ
$D	1685744	-576	-341	610	0	1.47E+09	297806	0x0000002	0x0000	0x00	-24000	424000	464000	-25390	1018063	41015	-26201	1024031	-17608	18133	1021857	1524
$D	1716594	-444	-332	629	0	1.47E+09	297790	0x0000002	0x0000	0x00	-27000	424000	469000	-25390	1018063	41503	-24459	1023226	-13736	7373	1023232	1593
$D	1932564	-458	-288	405	0	1.47E+09	297727	0x0000002	0x0000	0x00	-23000	435000	473000	-25390	1018063	41503	-24272	1023939	-18197	16540	1019490	-144
$D	1953131	-424	-307	541	0	1.47E+09	297702	0x0000002	0x0000	0x00	-21000	431000	474000	-24902	1017575	41992	-23075	1026921	-15041	18537	1022040	3412
$D	1994264	-415	-253	478	0	1.47E+09	297712	0x0000002	0x0000	0x00	-26000	435000	474000	-23437	1018063	42480	-23429	1022447	-16016	16826	1022642	1681
$D	2148519	-444	-273	429	0	1.47E+09	297688	0x0000002	0x0000	0x00	-23000	432000	479000	-24414	1018063	42968	-25394	1023488	-16428	16346	1022233	2048
$D	2271940	-478	-263	444	0	1.47E+09	297626	0x0000002	0x0000	0x00	-23000	438000	468000	-24414	1018063	42968	-25440	1028253	-15197	14094	1019778	2990

The report survey will be upgraded to include Tool serial and firmware number, Job Survey entry details. Time and Date will be added as well.

5.3.7 VIEW DRILLER FILE

This provide the list of operator survey event which is stored in DrillerSurvey, because it is xml format, this feature provide operator to view them which also display comments.
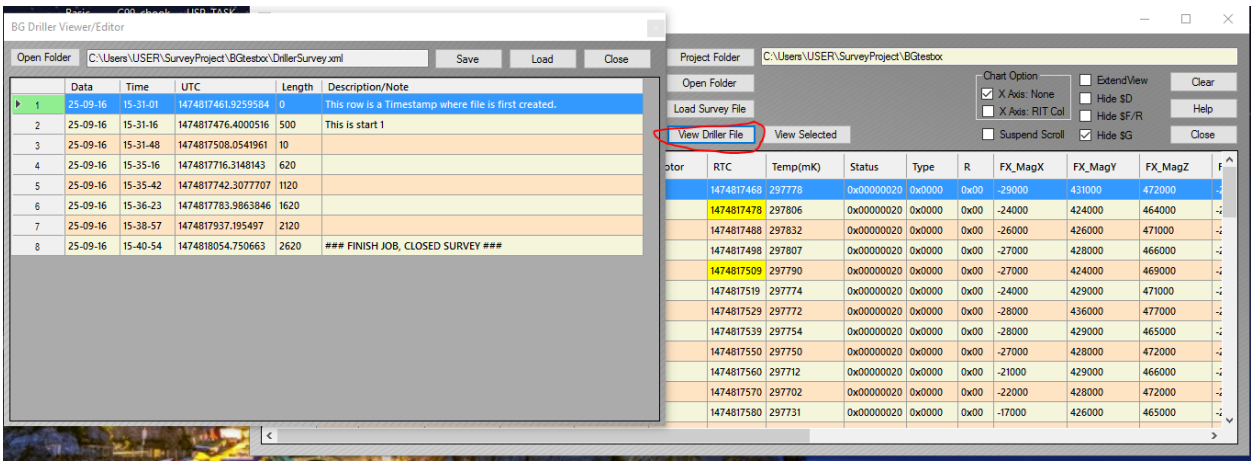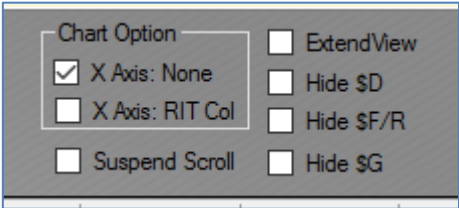

5.3.8 FILTER REPORT AND FRAME TYPE ($D, $F, $R, $F)

The frame type at the start of data frame (between $ and \n)

- $D is a Data frame which contains captured sensor data and gyro data. Raw Data.
- $G is a Gyro frame only (Raw Data).
- $R is a report frame which is information type.
- $F is an Error frame which note operation event that deemed error or issue in tool. There three kind, low battery, WDT event and power disconnection (POR event).

The Hide option hide the row that contain specific type of data. This make data viewing easier, for example the Hide $F/$R hide the report that not related to data evaluation purpose.

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5.3.9   DATAGRID VIEWER AND COPY/PHASE

The data row and column are referred as DataGridViewer. It has many powerful features with mouse control.

The top row ($H) is the **header** row which provide information about the column

Single selected row or many rows can be selected and saved to clipboard (for excel) or filename. Note the timestamp information (UTC decoded to Time and Date). The header names ($H at the top row) are automatically added to them.

Select the row and right click the mouse will pop up the context box as shown below

5.3.10 DATAGRID VIEWER AND CHARTING

The other powerful feature is ability to directly channel data into chart window

Place the mouse on header sensor data and right click as shown below, select Chart CH0
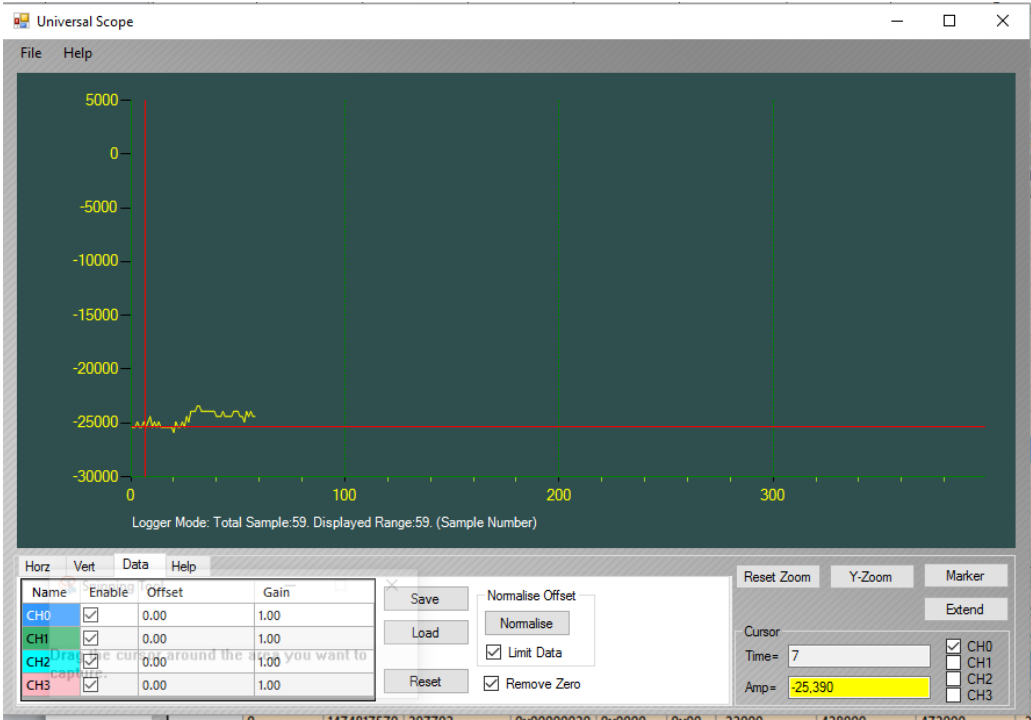

This pop up chart window

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Some few useful feature, if you looking into noise of the sensor data, use <Normalise> button to remove offset so you can see noise floor or variation of data.

The chart has rolling mode which is used for real time data collection, uncheck this from Horz tab as shown below
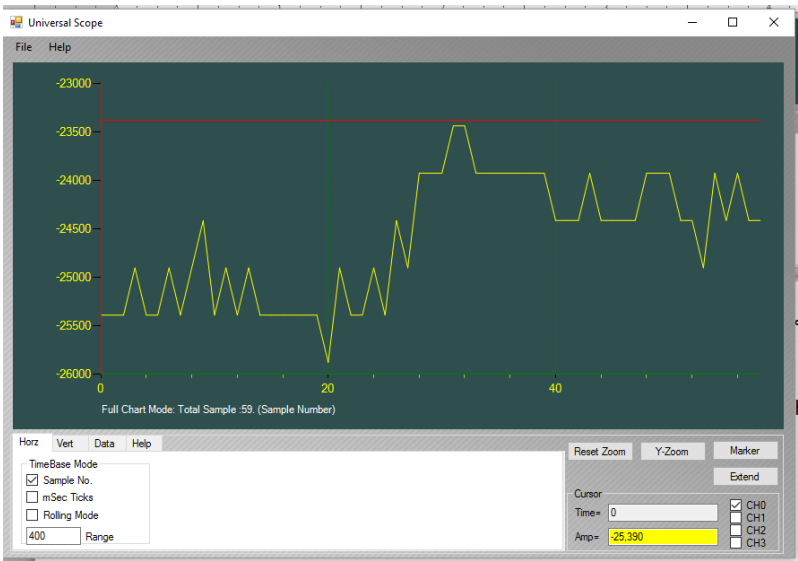
The red cross is the cursor measurement which reference to row number or mSec Tick (there is checkbox within TimeBase Mode). The red cursor is shown on at the bottom right window.

Up to 4 channel is supported with color : Yellow, Red, Cyan and Purple.

6   Battery Capacity

6.1   Battery Specification

When tool is not in use or put to storage or transit, it recommended to disconnect the battery to reduce cost and reduce wastage.

	Details	Note
Battery Type	SAFT LS17500 3600mA	Similar vendor of size and shape may be used. Alkaline battery is not recommend and it will not fits.
Battery Technology	Lithium-Thionyl chloride	*Special care is required for handling of the battery; refer to SAFT vendor for more details. In case of large quality transport or storage requires competence safety trained personal.* *There are restrictions on this type of battery in context of shipping, storage and safe disposal.* **THIS TYPE OF BATTERY IS HIGHLY REACTIVE TO WATER (EXPLOSIVE). KEEP DRY. IT CAN LEAD TO SERIOUS INJURY**
Battery Voltage	3.6V + 3.6V = 7.2V typ.	
Battery Temp	Min -40C Max 125C	
Survey Operation Lifetime	17 day or 408Hr	Based on 3 x Gyro and 1x Gyro/Data survey at 25C.
25% capacity	100Hr left	
10% capacity	41Hr left	
Survey current consumption. (typ 25C).	8mA (Gyro), 10mA (Data)	Gyro every 2.5 Second (fixed) Data every 10 second (can be adjustable). Data include gyro, magnetometer and accels. NB: Sleep mode shutdown current into KXBR sensor and MCU device. Gyro always powered.

6.2   Next Revision Note

The next revision will be major change where UDT will be phased out leaving stand-alone BG Drilling App.

7   Tool Specification

7.1   General

	Details	Note
Minimum operation voltage	4V0	
Survey Temperature	-20C to +85C due to sensor constraints.	Build in temperature sensor. Warranty will be invalid if exceed this temperature range.
Logger Memory	16Mb with optional 32Mb	One of two bank fitted as default. Auto detect one or two bank and expand capacity.
Logger Memory Log Period	Approx. 20 Hours	Based on default survey frame: 3 Gyro and 1 Data Shorter periods if Survey Frame has 1 Data only.
Logger Memory Erase Period	10-20 second	
Operation Mode	Survey Mode Normal Mode	Survey Mode where it collects data and store in logger memory. Normal Mode where it on standby for tool configuration and debug purpose.
Power Failure event (POR reset)	In case of survey mode, it recover back to Survey mode and continue operation.	Power failure due to battery chatter cause by vibration. After power up reset, the RIT will be reset. The $F log will indicates this type of failure mode and stored in logger memory.
Firmware failure event (WDT reset)	In case of survey mode, it recover back to Survey mode and continue operation.	This unlikely to occurred but in case of bug or abnormal behaviour of software will lead to power up reset. After power up reset, the RIT will be reset. The $F log will indicates this type of failure mode and stored in logger memory.
Low Battery Failure event	In case of survey mode, it attempt to continue in case of power on reset.	==Low battery does not suspend survey operation.== The voltage drop may degrade the sensor readout. The $F log will indicates this type of failure mode and stored in logger memory.
LEMO cable Connection and Disconnection interference	Protected. ie Will not fall back to Normal Mode.	Under Survey mode, the tool will ignore any spurious serial message cause by LEMO connection or disconnection event. It only accept any message that contain new line and '(' and ')' which is typical command frame.
Survey Frame	10-11 second approx.	3 x Gyro only (Each Gyro = 2.5 Second) and 1 x Data (Data include Gyro and Accel and Mag data). This is default setting, it can be adjustable.
Axis Calibration	Based on OGC Axis policy	See section 5.3

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7.2   Sensor

TBA

7.3   Axis Policy

ADT/MC AXIS POLICY (FINAL)

Force of Gravity is downward thus
$1G = g = +9.8 m/s^2$

Device = GX
Tool = GX = 0G
(Stay zero for 2D experiment)

Device = GY
Tool = GZ = 0G

To Drill Bit Z-Axis

Device = GZ
Tool = GY = +1G

Device = GZ
Tool = GY = 0.707G

Device = GY
Tool = GZ = 0.707G

To Drill Bit Z-Axis

Device = GZ
Tool = GY = 0G

Device = GY
Tool = GZ = 1G

To Drill Bit Z-Axis

Inclination = 90 **Because GZ = horz.** *NB: The Highside Hs=0*	**Inclination = 45**	**Inclination = 0** **Because GZ = vert.**	**Oil/Gas Convention** **(OGC)**
MRC: Inc=0	**MRC: Inc = -45**	**MRC Inc=-90**	**Material Resource Convention (MRC)**

Reference point on
the SVR tool

HS=0

HS=45

View: Looking down the
tool towards the bit

Sensors

Gravity
direction

Gx

Gy

Highside = ATAN2(Gy,Gx)

HS	X	Y	HS Calc		HS 0-360
	SIN(RADIANS(C4))	COS(RADIANS(C4))	DEGREES(ATAN2(E4,D4))		
0	0	1	0		0
45	0.707106781	0.707106781	45		45
90	1	6.12574E-17	90		90
135	0.707106781	-0.707106781	135		135
180	1.22515E-16	-1	180		180
225	-0.707106781	-0.707106781	-135		225
270	-1	-1.83772E-16	-90		270
315	-0.707106781	0.707106781	-45		315

OGC:Inc= 90deg
MRC:Inc= 0deg

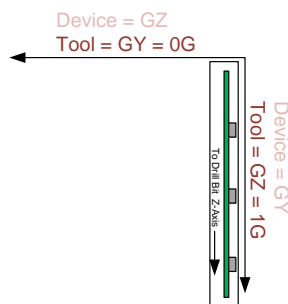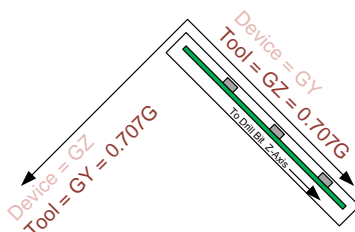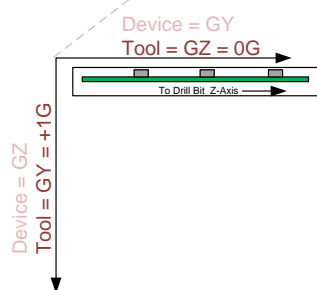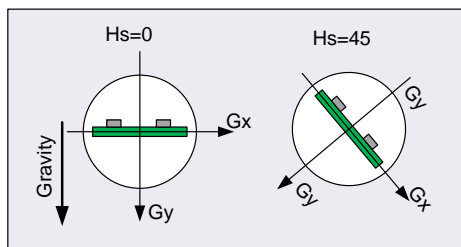| CONTROLLED TECHNICAL DOCUMENT User Guide	DOC No: BG: 700137	
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8   Appendix: Folder Structure
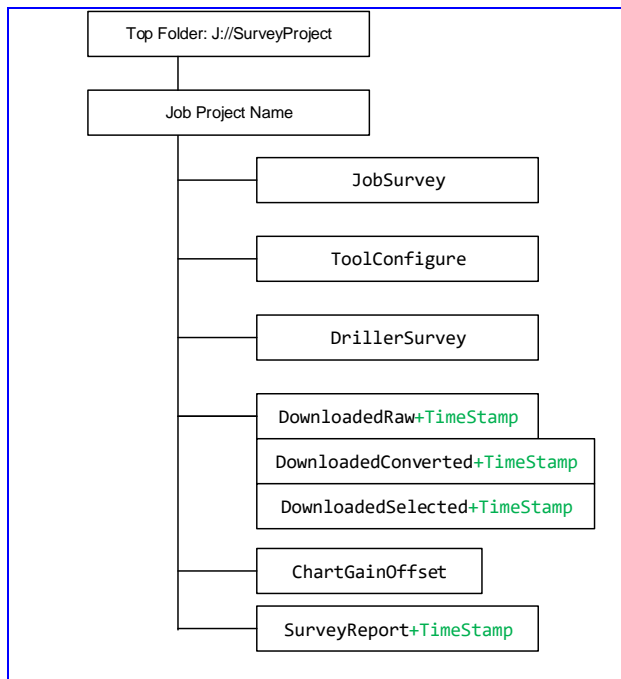
It is critically important to keep all data together into folder.

Top Folder:	Top Level Folder begins with SurveyProject with designated drive.
Job Project Name:	Sub-Folder with foldername related to client project, location or date such as <Sofia_040316>
JobSurvey:	This contains records of basic survey configuration and description of client contract and project.
ToolConfiguration	This is advanced tool configuration, which is not covered here. This is optional file.
DrillerSurvey:	This contains downhole distance records and timestamp for surface operator to enter.
DownloadedRaw	This is raw downloaded data from Tools EEPROM, unconverted and in Hex data. It comes with header frame which is definition of the data and format frame which is definition of type of data.
DownloadedConverted	This is converted format from the Raw data, it rely on special frame called Format-Frame to perform HEX or String to data conversion.
SurveyReportSelected	This is file in CVS which contains selected data that based on matching timestamp between DownloadedConverted and DrillerSurvey filename.
ChartGainOffset	This is optional file for chart scope which store the offset and gain for CH1,CH2,CH3 and CH4 waveform.
DirectionalReport	This is final report from the above data collection files. It contain summary of the job and directional results.