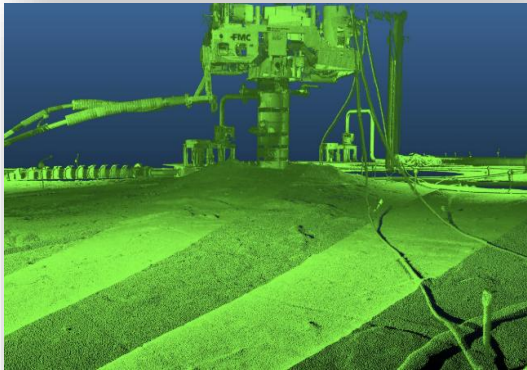
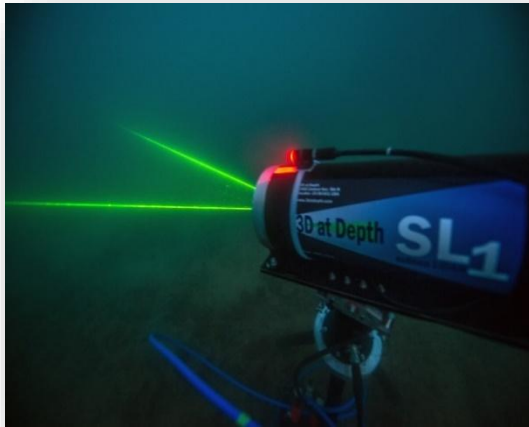


3D Collect SLX v7.01.02.xxx

MBARI HANDBOOK



Apr 2024

Revision 7.01.02.xxx

Suitable for Wissel2/MBARI

Version	Author	Short Change Discription	Date
1.0	C, Emanuel	Initial Release	17 Nov 18
6.03.16	D Florin	SL1 auto select primary cable set, Increased the upper limit of the Pan Tilt Temperature Fault to 6000 (so fault value is above the bad Sidus temperature read) This was done since there was not an explicit disable of the fault.	12 Dec 18
6.03.17	J Jeong	CTD dropdown menu, GPS Sync, and INS Data type in User CFG Dialog are added. Ports for Pantilt and Aux-Sensor in Factory CFG dialog are added.	2 Jan 19
6.04.00	D Florin	Raw file format v6 updated CTD Mini is added at CTD menu Ambiguous option on TimeSync removed	Feb 2019
6.04.02	D Florin & J Jeong	Added ICD command and control over UDP, configuration selection	Mar 2019
6.04.05	D Florin	CTD from TCP to GUI, Corrected Mount settings, OPERATOR CTD updates at 1 Hz, Status lights for NAV and CTD. Default parameters if read fails.	Apr 2019
6.04.10	D Florin	CTD menu and Enhanced Precision mode updated, collar and washer selection picture. GUI Time Sync. Auto update on parameter changes. UPD writes parameters local. CTD Laptop status LED. Log location changed. Scan Skip option. Digitizer signal counts in diagnostic. Support CTD with or without salinity (will calculate). Open limits on Pan/Tilt. Support for miniCTD on Pan Port; disable Pan/Tilt move controls.	May 2019
6.04.16	D Florin	Added Nuclear sizes 14,500 x 1,450. Removal of NI controls on main window. Checksum for CCI interface.	Sept 2019
6.04.17		Timer shutdown, Default size for non Nuclear size,	Nov 2019
6.04.18	D Florin	Added CCI, Mailbox pan/tilt, Fault enables (user, factory and Laptop CFG updates)	Mar 2020
6.04.20	D. Florin	Nuclear size is max 10,000 pts/line with 5 points. All logs now YYYYMMDD. Added HHMMSS to GUI messages. Fix Resolution updating. Some fields were not getting limited correctly (min/max points). Have ports 0-20 for mailbox selection.	Apr 2020
6.04.22	D. Florin	Added Command and Control Interface (CCI) with Pan and Tilt, script mode and wait command. Parameter viewer for saved CCI configuration sets. Logging of fault conditions in GUI.	May 2020
6.04.23	D. Florin	Modified so any extra thickness over a collar is assumed to be the wash and will show the image.	Jun 2020
6.05.00	D. Florin	Added Nuclear thermistor, updated inital splash screen with patents, Factory parameters: Added Range calibration and thermistor calibration	Oct 2020
6.05.01	D. Florin	Added some fixes for CCI version to support both v0 and v1.	Oct 2020
6.05.03	D. Florin	Added check if user sends a configuration of zero that it is ok to start scanning right away (CCI interface). 3rd order pitch/roll cal. Match EC defaults on factory parameters for CSV output. Added another patent.	Dec 2020
6.05.04	D. Florin	Added the nuclear thermal calibration parameters to CSV output	Jan 2021
6.05.05	D. Florin	Validate T1 and FF before scan, if zero pop up warning of no valid data.	Feb 2021

6.06.00	D. Florin	Added SL4 and SL5 system types. Removed Sim uniqueness (key off of shared drive letter: “/”, “C” or “D”) Updated Estimated scan time. Range parameter in Scripts is now used (Bug) Skip Pan/Tilt command if the current location is already in tolerance (as defined in the User Parameters). Max points are 14.5 Million for Nucelar – can split them different ways. Update Scan limits when new CTD data comes in, applies latest index with telemetry, not just when the user clicks “scan”. Allow move while scanning (quick look). 3D PanTilt support. PanTilt power down now will not just stop but actually power down.	Oct 2021
6.06.01	D. Florin	Script move complete looks at actual end position, uses 3x stability. Added another patent in. Updates to factory mode to support Av1, 2, 10, 100, 1000. Not backwards compatible (EC v6.06.07 for SL3, EC v6.06.02 for SL4) Fix for bug if last scripted scan is skipped the pan would get into a disabled state / non-responsive.	Nov 2021
6.06.02	D. Florin	Added Laser gain at start and end of scan – adjusts between. Make Scan parameters unique for SL3 vs SL4 Load script will look for two gains, but duplicate if only 1 gain specified Force reload of parameters when using Estop Populate Mount Settings for user (static scan types, dynamic still require mount information be set). Name change of HiRes to Enhanced Precision. Fix X-Axis for SL3 factory mode raw data plot. Delay of read parameters does not generate errors, just message.	Jan 2022
6.06.03	D. Florin	CCI laser start/end power Pan/Tilt limits in scripts now match Laptop Configuration Changed minimum range limit for scripts to 1 meter Show the automatic file name when the fileTag field is empty Added indicator of what SL type the GUI is connected to SL3 or SL4 Fast scan type removed for SL4	Feb 2022
6.06.04	D. Florin	Allow SL4 to have 14.5 Million point scans (3800x3800 or 10000x1450) Fix bug with check of SL type and name Fix bug with taking the file name from script Remove “.local” from sensor name/IP address so hard drive access works (Linux support). Fixed Scan Time calculation If file name field is emptied, then the autoname will be generated in place. Allow scanner shift of upto 30. Added Sensor name to the top of the GUI so user knows who is attached (taken from the Factory name)	Feb 2022
6.06.06	D. Florin	Larger Scanner shift, Improved automatic mount selection. LED status for disconnect now turn all lights yellow until communication is restored. Added in Configuraiton packet exchange for User and Factory parameters. Removed popup windows for verifying configuration since they were not useful. Gui init will recalcualte resolution and scan time.	Apr 2022
6.06.07	D. Florin	Large images sizes allowed for nuclear had a bug where SL4 also can do large images sizes but it broke the nuclear path. SLXN-XXX the N specifies that the system is nuclear.	Apr 2022

6.06.08	D. Florin	Only ask about motion settings for line scans if not motion Added in Az/EI stability measurement in Temperature Calibration	Jun 2022
6.06.09	D. Florin	More info in logging during Temperature calibration. Check laser is on during same test and exit if laser is found off.	July 2022
6.06.10	D. Florin	Added Fast scans for SL4 – the scan repeats for 65,534 times or until the user cancels. SL3 number of segments allowed reduced some, had reports of failures at the maximum. Fix to Range Calibration test for SL3.	Sep 2022
6.07.00	D. Florin	Major update for Remote Operations	Oct 2022
6.07.01	D. Florin	Clear followers if they no longer communicate after some period of time. Found port number collision, moved Remote Ops ports.	Oct 2022
6.07.02	D. Florin	Status packet not setup correctly, fixed. Sample segments limit for SL3 is 1600, not 1900 (SL4).	Nov 2022
6.07.03	D. Florin	Minimum eyesafe depth calibraton fixed, added more scan time before timeout, Populate cmd angles for 3D PT on startup, Added “J” mount configuration for 3D PT, Check sensor type and re-load if changes. Several minor fixes for UDP commanding and Remote Ops interaction.	Dec 2022
7.00.00	D. Florin	Gen 2 Remote Operations update. Running scripts from Sensor (CCI style). All scan types can now be scripted. Display estimated script run time and percent complete. Sync script with remote observer. Added a watchdog on communicaitons, minimum non-eyesafe laser operation check. A few new internal commands, moved and added parameters, structure updates. CCI version 2. Not backwards compatable due to parameters that moved as well as missing fuctionality.	Jan 2023
7.00.00.xxx	D. Florin	Added Unique Username and Password Fix for mount parameters not getting filled out correctly and automatically for static scans. Added minimum depth fault check for non-eyesafe laser power – turn off laser or prevent scan from starting if not in limit. Added EC reset command. Added Software Versions that display version of software for EC, InstaCloud, RTV and CGUI. Added User Parameter default button, reduced number of parameters seen and automatically set groups. Disable fields that do not apply to current configuration. Log Pitch and Roll all the time, even when moving the Pan Tilt. Adjusted position of the emergency off button so it will not accidentally be pressed while near the ok or cancel of pop up windows. Run Script without a Pan Tilt in the system (will zero all Pan Tilt commands) Limit min max Az/EI range on loading of script to what can be done, but still load scan (warning messages). More robust mount settings determined then used for running scripts on the sensor Remote Ops Gen2 (large update). Multiple NEMA messages per second Allow scans to continue for Watchdog Time (configuration parameter) even if communications is down. Allow Remote CGUIs to set CTD values when configured for this CTD source. Fix for configuration path corruption between SL3 and SL4 when switching. Ethernet connect/reconnect is faster and cleaner in response.	Mar 2023
7.00.01.xxx	D. Florin	Added Pan Tilt Relative moves, ignore limits before home is done. Set commanded Pan/Tilt value on relative moves. Stability info changes in User Config & Status. Added daughter card version. Added letter for message level indicator {Info, Warn, Error}.	Apr 2023

7.00.02.xxx	D. Florin	Reduce number of "Using new User/Factory Configuration" log messages. On EC/InstaCloud reboot, make sure to perform time sync again. Fix the Pan Tilt move button, added to factory v3.4: signal PRF, sim PRF and A2D channel select. Always using CCI v2 structures. Added CCI NextScript cmd to end current scan and move to next one. Fix error in check of Factory parameters. Set defaults so Prime runs scans from GUI, while !Prime runs from sensor. Adjusted the PT start time before verify position. Allow 1 char long file tags in scripts.	Jul 2023
7.00.03.xxx	D. Florin	Fix auto Filename length for 10,000 shots Pull A2D channel from factory config for ScanCFG Fix status shown to user for pan tilt move complete, button stuck. Added popup if laser tag does not match (wrong optical head) Allow filename to be of size 1. Adjusted EP scan limits to be 100x100x4, script and GUI match. Stability default is 0.1 degrees. Limit Fault popup occurrences. Added display of scan parameters if not controller (Rops), fixed which items are greyed out vs active by mode. Fix reconnect taking both follower channels in Rops. Adjusted Runtime calculation. Fix extra PT move beep before move. Added EC request of a time update that occurs on startup and when asked for. Added end of scan Beep.	Oct 2023
7.00.04.xxx	D. Florin	Relative move status. Pan Tilt Stability fix. Ability to edit the Pan Tilt Stability Degree move tolerance, was always getting reset to 0.3 on view/load (would actually change if commanded but could not see it). Added Factory calibration for Laser Gain 1 temperature	Dec 2023
7.01.00.xxx	D. Florin	Added in Kyst Pan Tilt, Baud rate is 115200. Updated Scan Configuration to version 4. Adjusted CCI command bit pattern. Performance enhancements for move speed and scripts. Structure updates make bit patterns not backwards compatible (EC, InstaCloud, RTV, CGUI and 3D Cloud Motion all updated). Dynamic Laser Command. Added Field Power Supply description.	Sep 2024
7.01.01.xxx	D. Florin	Added in TIm and Cmds for MBARI/Spinner specifically. Laser, attenuator, and TEC status / temperature. Factory mode spinner commands. CTD Yellow status. Added in Laser Class 4 for MBARI, enable features by type { SL3, SL4, Spinner, MBARI }. PT status clear on power down or reset. Modify PT power status.	Nov 2024
7.01.02.xxx	D. Florin	Allow Manual mode to be side by side with main GUI. Added MBARI specific parameters and controls. Adjusted fault limits. Fix gain setting to 1 for calibration to apply. Name Communication reset requester. Max power of 60%. Power in uW and mW	Mar 2025

CONTENTS

1. OVERVIEW.....	9
2. The 3D Data Flow	9
3. 3D Collect, Main User GUI	10
4. Menu Tree Layout/Definition	12
5. CFG Menu.....	17
6. Edit User CFG Dialog	18
6.1. CTD Hardware and Communication Selection	19
6.1.1. Factory Mode-Air	20
6.1.2. Laptop Operator	20
6.1.3. Laptop Extern CTD	20
6.1.4. External Nuclear Thermistor	21
6.1.5. MBARI (Sensor TCP Server).....	21
6.1.6. IXBLUE (Sensor NAVCTD)	21
6.1.7. MIDAS (Sensor Serial)	21
6.1.8. MINI_CTD (Sensor Serial, Salinity Computed)	22
6.2. Selection of Time Synchronization, GPS Sync Clock	23
6.3. Selection of INS data Source.....	23
7. Edit Factory CFG Dialog.....	24
8. Edit Laptop CFG Dialog.....	25
9. View User CFG Dialog.....	27
10. View Factory CFG Dialog.....	28
11. View Laptop CFG Dialog.....	30
12. Edit or View CCI CFG Dialog	31
13. Laptop IO Menu	35
14. Mount Settings Menu	36
14.1. Scan Type Settings	37
14.2. Mount Selection Settings	37
14.2.1. Direction Settings.....	38
14.2.2. INS Settings	38
14.2.3. Mount Settings	38

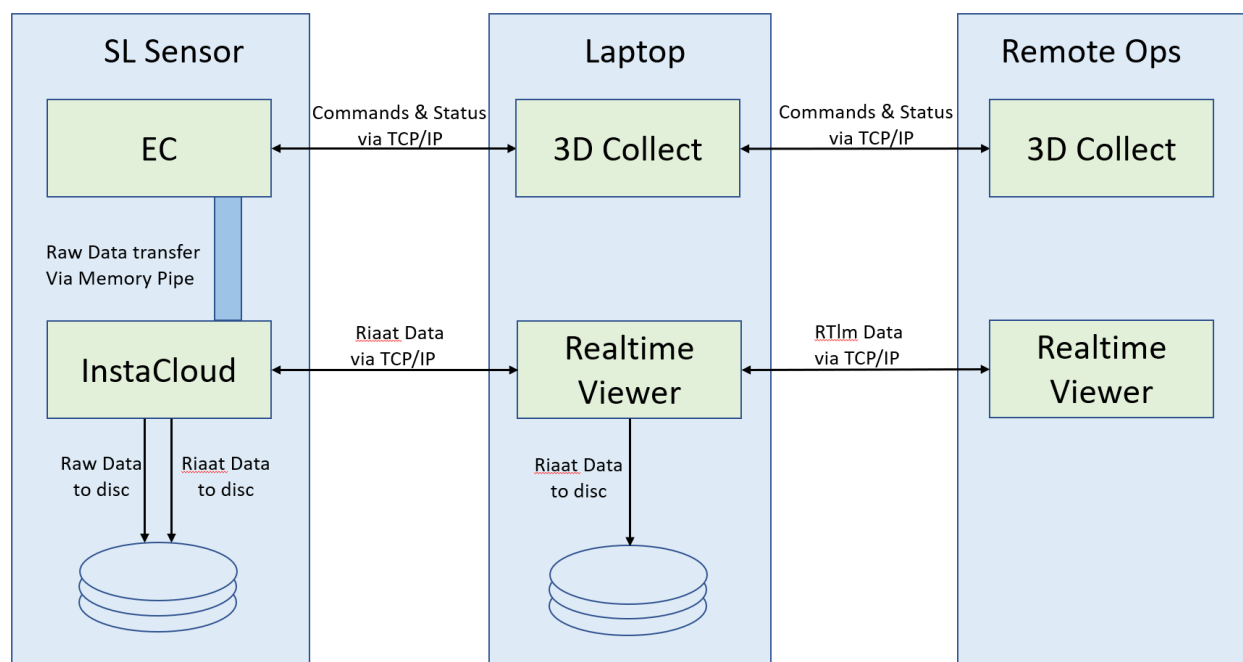
15.	Scan Patterns	39
16.	Laser Power.....	41
17.	Laser Safety	43
18.	Scan and Script Buttons	45
19.	Script Dialog	46
20.	Pan Tilt Control Dialog	48
21.	Factory Menu	50
22.	Factory Settings Dialog	50
23.	Factory Settings Control Layout Definition.....	51
24.	Scan Time Estimation.....	53
25.	Standard Operation	55
26.	Remote Operations.....	62
27.	Command and Control Interface (CCI).....	62
28.	Network and Ports	65
29.	Field Power Supply.....	65
30.	Trouble Shooting.....	66
31.	Communication Errors	70
31.1.	Configuration file errors	70
31.2.	Waviness Issue.....	71
32.	Faults.....	72
32.1.	OCB_TEMPERATURE_LIMIT_C.....	72
32.2.	OCB_HUMIDITY_LIMIT	72
32.3.	PB_TEMPERATURE_LIMIT_1_C	72
32.4.	PB_TEMPERATURE_LIMIT_2_C	72
32.5.	PB_HUMIDITY_LIMIT	72
32.6.	DIG_TEMPERATURE_LIMIT_C.....	73
32.7.	PAN_TEMPERATURE_LIMIT_C.....	73
32.8.	TILT_TEMPERATURE_LIMIT_C.....	73
32.9.	LSR_TEMPERATURE_LIMIT_C.....	73
32.10.	OPB_TEMPERATURE_LIMIT_C	73
32.11.	Min Depth EyeSafe.....	73
32.12.	Watchdog	74
32.1.	Laser PRF.....	74

33.	Error Messages	75
34.	3D Collect Scan Script	78

1. OVERVIEW

The 3D Collect tool is the primary tool for user control and for viewing runtime status between the Offshore laptop computer and the Electronics Controller (EC) application on the sensor computer. 3D Collect gives the user a Graphical User Interface (GUI) for configuring and executing scan commands and monitoring the status of the sensor. The Real Time Viewer (RTV) application is the output of a sensor scan and is focused only on the sensor results, not on real time status or commanding. Remote Ops added in another computer that can be on shore and show what is going on in Observer mode or take control of the sensor through the Laptop 3D Collect in Controller mode.

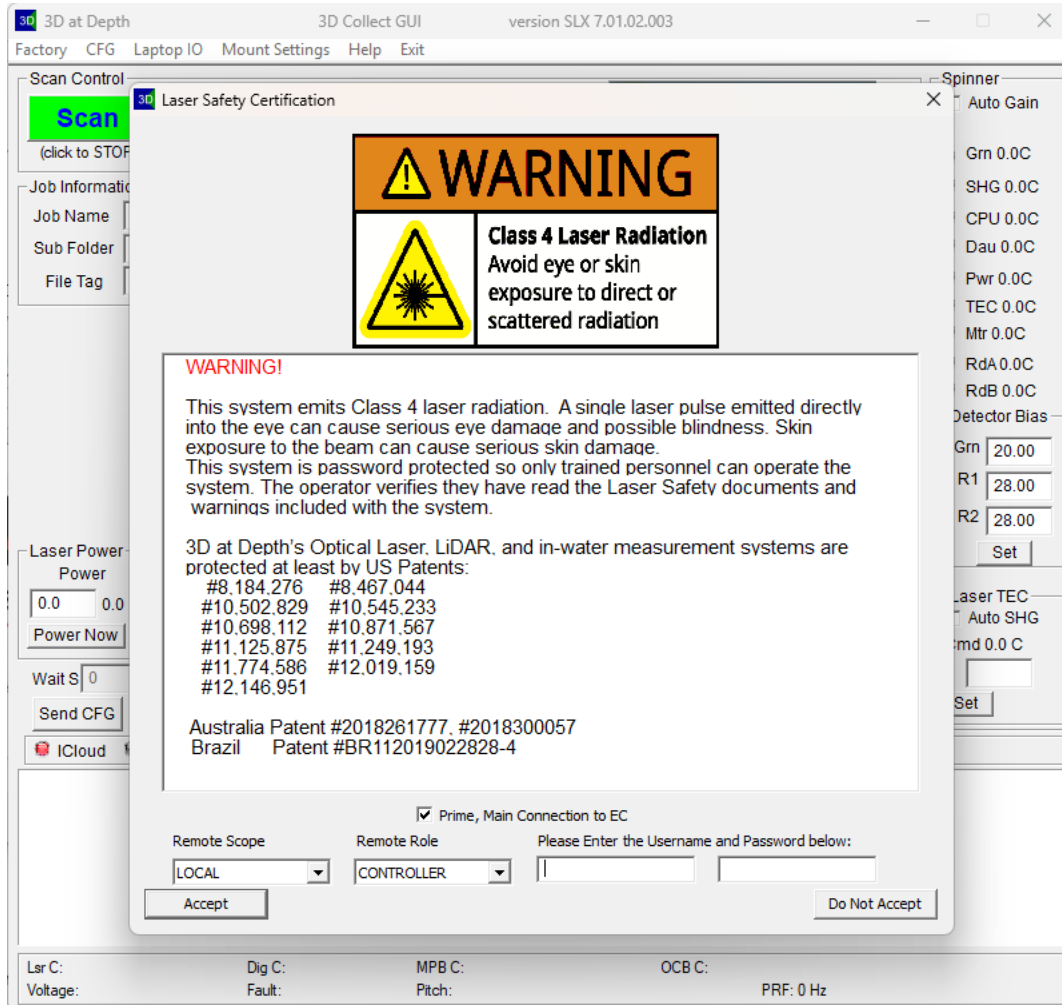
2. The 3D Data Flow



EC:	On board sensor Electronic Controller application.
InstaCloud:	On board sensor Raw to RIAAT conversion application.
Realtime Viewer:	Remote laptop live RIAAT data visualization tool.
3D Collect:	Remote laptop configuration and control tool for the sensor.
Remote Ops:	On Shore connection that shows same information as Laptop.

3. 3D Collect, Main User GUI

The primary 3D Collect Application Graphical User Interface (GUI) is shown below. This is the main user command and control interface for the sensor. This runs on the Laptop and connects to the sensor using TCP IP connections. If not performing Remote Operations, the default settings are appropriate.



Put in the user name "ec" and password "3d" to start up the GUI. This will be replaced with user unique names and passwords in the near future. This was needed due to Remote Operations security.

Before connected, the name will be “SLX” and the background is grey. This will be filled out with the factory parameter provided SL name so the user knows which sensor the GUI is connected to.



3D at Depth 3D Collect GUI version SLX 7.01.02.003

Factory CFG Laptop IO Mount Settings Help Exit

Scan Control

Scan **Script** Script: Scan: Active CfgNum: 0

Job Information

Job Name: Mbari
Sub Folder: rtv
File Tag: line

Scan Pattern

☐ Raster
☐ Fast Scan
☒ Line Scan AZ
☐ Enhanced Precision
Average: 1

Scan Parameters

Max Range (m): 12.000
Swath Width: Start (deg): 0.00 Stop (deg): 180.00
Num Pts: 7000
Swath Height: Spin (Hz): 0.01
Num Lines: 500
Scan Time: 3 Min
Pts: 3500
Resolution: 5.407 mm
Resolution Travel

CTD

Temperature (C): 0.0
Salinity (psu): 0.000
Pressure (dbar): 0.0

Laser Power

Power: 0.0 Attenuator: 0.0
Power Now: 0.00 mW OFF

Remote Ops

Non-EyeSafe Allowed
Prime
Controller
Local
Followers:

Safety

Laser Emmission Indicator: Laser Radiation OFF
Sensor Interlock: EMERGENCY STOP 0 uW

Spinner

☐ Auto Gain
Grn 0.0C
SHG 25.8C
CPU 0.0C
Dau 0.0C
Pwr 0.0C
TEC 0.0C
Mtr 0.0C
RdA 0.0C
RdB 0.0C

Detector Bias

Grm 20.00
R1 28.00
R2 28.00
Set

Laser TEC

☐ Auto SHG
Cmd 25.3 C
Set

Wait S: 0 CfgNum: 0
Send CFG Next CFG: 0

ICloud PPS ZDA SL Comm CTD Sensor CTD Laptop

095553:3D: Ethernet connection established with SL Sensor.
095553:EC: Ethernet connection established with 3DCollect
095553:EC: 3D at Depth SL3 Sensor: SL3N-000, Firmware Version 07.01.01.004
095553:3D: Error: SerialNumber != Configuration, but config is for an SL4
095553:3D: Starting index: 1.340
095554:EC: EC Time Updated: 04 21 2025 09:55:54
095603:3D: Successfully read Sensor User Configuration.
095603:3D: Successfully read Factory Configuration.
100039:3D: UserConfig param GPS SYNC CLOCK = FALSE.

Lsr: 25 C Dig: 36 C DB: 0 C, 0 % Motor 40.0 C, Spin 0.0 Hz, Az 0.008 Deg
Voltage: 3.3 bus, 5.0 lsr FAULTS: Voltage Pitch: 0.0 deg Roll: 0.0 deg Temp 0.0 C PRF: 0 Hz

The GUI provides entry for job specific information, scan pattern type selection, scan parameters, Pan & Tilt control, emergency stop and real time status. Scan control and automatic scan script controls are both controlled from here as well. Menu descriptions are provided in the next section.

The Spinner type of sensors, that is Pipeline and MBARI, we have no pan/tilt. The spinner and TEC status is on the right side of the GUI. Each TEC has an LED status: Grey = Off, Blue=Cold, Green=Good (in range), Yellow=Almost over, Red=Hot/Unstable.

4. Menu Tree Layout/Definition

Menu tree descriptions, with select parameter definitions are below. This is not an exhaustive definition since many of the parameters are self-describing.

1. Menu section
 - a. Factory Menu: Opens Factory Mode dialog
 - b. CFG Menu:
 - i. Software Versions: Report Software versions (EC, InstaCloud, RTV, CGUI)
 - ii. Load Scan CFG: Opens scan config file
 - iii. Save Scan CFG: Saves current scan config to file
 - iv. Change Sensor CFG: Inactive
 - v. Edit User CFG: Open Sensor User config dialog
 - vi. Edit Factory CFG: Open Sensor Factory config dialog
 - vii. Edit Laptop CFG: Open Laptop config dialog
 - viii. View User CFG: Open Sensor User config dialog
 - ix. View Factory CFG: View Sensor Factory config dialog
 - x. View Laptop CFG: View Laptop config dialog
 - xi. Edit CCI CFG: Open CCI config dialog
 - xii. View CCI CFG: View CCI config dialog
 - xiii. Reset EC and InstaCloud Will issue a reboot command to the Software.
 - c. Laptop IO Menu:
 - i. Laptop Extern IO setup dialog
 - ii. View Remote Connections
 - d. Mount Settings: Opens the Mount Settings dialog
 - e. Help Opens the corresponding help PDF
 - f. Exit Exit the program
2. Scan Control section
 - a. Scan Button: Sends the scan configuration to EC for execution
 - b. Script Button: Opens the scan script configuration dialog
 - c. Script Run Time: Displays the estimated time left in a script
 - d. Script Complete bar: Displays progress of the current script
 - e. Scan Complete bar: Displays progress of the current scan
 - f. Active CfgNum: Displays the sensor scan configuration ID (sensor scripts)
 - g. Sensor identifier Displays the sensor name that the GUI is connected to
 - h. Little empty box at lower right of 3D at Depth logo, check to allow window to go into the background. If not checked, then this window will stay on top, all the time.
3. Job Information section (C:\Data\<JobName>\<SubFolder>\<FileTag><TimeStamp>.riaat)
 - a. Job Name: Used to configure main file save folder location
 - b. Sub Folder: Used to configure the secondary file save folder location

- c. File Tag: Coupled with a time stamp used to create the scan file name
- 4. Scan Pattern section
 - a. Raster: Single scan mode
 - b. Fast Scan: Continuous low resolution scan mode
 - c. Line Scan AZ: Motion horizontal scan mode
 - d. Line Scan EL: Motion vertical scan mode
 - e. Enhanced Precision: Enhanced Precision scan mode
 - i. Average: Number of samples for averaging at Enhanced Precision mode
- 5. Scan Parameters section
 - a. Max Range: Maximum sensor data collection distance in meters
 - b. Swath Width
 - i. Start Deg: Scan azimuth start position in degrees relative to home
 - ii. Stop Deg: Scan azimuth stop position in degrees relative to home
 - iii. Num Pts: Number of points collected by the sensor per scan line/rotation
 - iv. Resolution: Calculated horizontal distance between scan points
 - v. Pts: Spinner, the number of points between start/stop angles.
 - c. Swath Height
 - i. Start Deg: Scan elevation start position in degrees relative to home (SL4)
 - ii. Stop Deg: Scan elevation stop position in degrees relative to home (SL4)
 - iii. Num Pts: Number of vertical scan lines (SL4)
 - iv. Resolution: Calculated vertical distance between scan points
 - v. Spin (Hz) For Spinners, the spin speed of the motor
 - vi. Num Lines For Spinners, the number of scan lines in a file
- 6. Pan Tilt section (SL4 only – Spinners do not have)
 - a. Pan Tilt Control Button: Opens the Pan Tilt Control dialog
 - b. Pan Temp: Temperature of the Pan motor, C
 - c. Pan requested angle: Requested pan angle in degrees
 - d. Pan actual angle: Actual pan angle in degrees relative to Home/Zero position
 - e. Tilt Temp: Temperature of the Tilt motor, C
 - f. Tilt requested angle: Requested tilt angle in degrees
 - g. Tilt actual angle: Actual tilt angle in degrees relative to Home/Zero position
 - h. Move/Stop Button: Executes the move command to the requested angles
 - i. Pan Tilt Command State/Status (based on previous commands)
 - i. POWER OFF
 - ii. POWER ON
 - iii. SETTLING
 - iv. MOVE_COMPLETE
 - v. INIT COMPLETE
 - vi. HOMED
 - vii. ...
 - j. Pan Tilt Current State
 - i. RUN (ready for the next command)
 - ii. RUN_BUSY (working on a command)
 - iii. WAIT FOR INIT

- iv. STOP1 (pan stopped)
- v. STOP2 (tilt stopped)
- vi. STOP_COMPLETE (Can now be cleared to continue)
- vii. ...

7. Laser Power section

- a. Laser Power dropdown (3 power settings, 4 gain settings, used to create 12 power settings from 1 – 4000). Settings 1 to 4 are all eye safe (<0.39 mW). Levels 5 and above are all considered Class 3B (from 5 mW to 499 mW – Avoid beam exposure to eye).
- b. Start box is the starting laser gain, the End box is the end laser gain. Software will adjust gains between scan lines in equal increments from start to end. All data is in one scan file. SL4 continues scanning even while laser power is adjusted – so some data may be missed while filters are getting into position or be of a different power level. Amount of data missed is very small.
- c. Power MBARI, laser power level percent of full power to command.
- d. Attenuator MBARI, attenuator level percent that reduces the laser power.
- e. Power Button MBARI Power xxx, text will show the calculated output Class when pressed. Next to it is the calculated output power level in microwatts (uW) or milliwatts (mW). This is an immediate command and can be used at anytime.
- f. OFF Button MBARI laser power off button. Press at any time to turn laser off.

CTD section

- g. Temperature (c): Temperature of the water at scan location
- h. Salinity (psu): Salinity of the water at scan location
- i. Pressure (dbar): Pressure on the sensor at scan location

8. Scripts on Sensor

- a. Send CFG : Write parameters into a CCI configuration file on sensor
- b. Wait Time S : Time in the CCI configuration to wait between move and scan
- c. CfgNum : The CCI configuration number, sets file name and reference
- d. Next CFG : The next CCI configuration that is done after current one (script)

9. Remote Ops

- a. Maximum power level that could be asked for – EyeSafe Only or NonEyeSafe allowed
- b. 3D Collect designation – Prime (connected to EC) or computer name (Remote Ops)
- c. Current role – Observer, Standby or Controller
- d. Network scope – Local (to EC; Offshore) or Remote (On shore)
- e. Followers: Status for each of the followers that are connected (CGUI to CGUI connections)

10. Safety section

- a. Laser Emission Indicator: Flashes Laser classification level
- b. Remote Interlock Connector: Emergency stop button for shutting down the sensor
- c. Telemetry reported laser power level that is active.

11. Instrument Status section, grey LED if not in use.

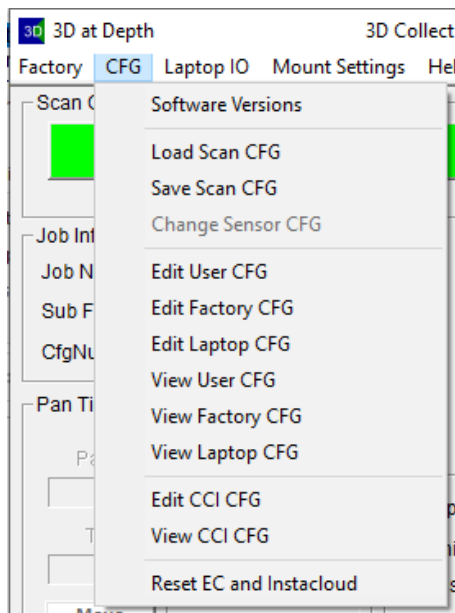
- a. ICloud Displays green when connection is established with InstaCloud
- b. PPS Displays green when Pulse Per Second time sync is being collected
- c. ZDA Displays green when ZDA time sync is being collected

- d. Pan Tilt: (SL4) Displays green when Pan Tilt is on, Initialized and Homed.
 - e. SL Comm: Displays green when connection is established with EC
 - f. Pitch Roll: (SL4) Displays green when the pitch roll sensor is on
 - g. Nav: (SL4) Displays green when the Navigation data is coming in (Motion)
 - h. CTD Sensor: Displays green when CTD data is received, turns red if missing (left),
 - i. CTD Laptop: Displays green when CTD coming into Laptop (only if external)
12. Status Message section: Displays EC, InstaCloud, RTV, and 3D Collect, messages.
13. Temp Bar section
- a. Lsr Laser temperature (driver heat reject)
 - b. Dig Digitizer temperature
 - c. MPB (SL4)
 - i. Main Power Board Temperature 1 C
 - ii. Board Temperature 2 C
 - iii. Humidity %
 - d. OCB (SL4 Optical Control Board)
 - i. OCB Temp C
 - ii. Humidity %
 - e. OPBT (SL4) Optical Power Board Temp
 - f. Voltage Ok / Fault
 - g. FAULTS None/Fault name
 - h. Pitch
 - i. Pitch Current pitch reading
 - ii. Roll Current roll reading
 - iii. Temp Current pitch roll temperature
 - i. PRF The PRF rate of the laser, good for diagnostics.
 - j. DB (Spinner) Daughter card temperature and humidity
 - k. Motor (Spinner)
 - i. Motor coil temperature (if equipped)
 - ii. Spin rate of motor in Hz
 - iii. Az position of motor in degrees
14. Spinner (MBARI or Pipeline)
- a. Auto Gain Checkbox to enable or disable – Future –
 - b. Grn Green detector board temperature in C
 - c. SHG Secondary Harmonic Gain module Temperature (TEC controlled)
 - d. CPU Temperature of the CPU in C
 - e. Dau Daughtercard temperature (mounted above CPU) in C
 - f. Pwr Power Board temperature in C
 - g. TEC Tec board temperature in C
 - h. Mtr Motor board temperature in C
 - i. RdA Red channel A temperature in C
 - j. RdB Red channel B temperature in C
 - k. Detector Bias
 - i. Grn Green channel detector bias voltage
 - ii. R1 Red channel A detector bias voltage

- iii. R2 Red channel B detector bias voltage
- iv. Set Button Send detector bias voltage setpoints
- I. Laser TEC
 - i. Auto SHG Automatic optimization of the SHG TEC control temperature, requires a trigger to be found in Factory mode or while scanning to work.
 - ii. Command SHG TEC setpoint temperature and telemetry readback of current temperature in C
 - iii. Set Button Send command to set the SHG temperature.

5. CFG Menu

Configuration are set using the configuration tab and selected submenu. The submenu configurations are shown below however some parameters are only useful in factory mode and beyond the scope of this user manual. Configurations are parameters that are needed for flexibility and change from job to job but usually will have the same value throughout a job or while operating in a specific setup. It is highly recommended that the Laptop and User parameters are reviewed at the start of each job even if they are not changed. Laptop parameters are stored on the Laptop while User and Factory parameters are stored on the sensor. Only the Remote operations role of Controller may modify parameters. Remote operation roles of Standby or Observer can only view parameters but may not make changes.



Software Versions: Show what version of software is running in the system

Load Scan CFG: Loads a previously existing set of 3D Collect scan settings into 3D Collect.

Save Scan CFG: Saves the current 3D Collect scan settings to a file.

Edit User CFG: Loads the binary Sensor User config file for editing.

Edit Factory CFG: Loads the binary Sensor Factory config file for editing.

Edit Laptop CFG: Loads the binary Laptop config file for editing.

View User CFG: Open dialog for loading, viewing, and saving Sensor User config files.

View Factory CFG: Open dialog for loading, viewing, and saving Sensor Factory config files.

View Laptop CFG: Open dialog for loading, viewing, and saving Laptop config files.

Edit CCI CFG: Loads the binary CCI config file for editing.

View CCI CFG: Open dialog for viewing CCI config files.

Reset EC and InstaCloud: Command for EC and InstaCloud to exit and restart

6. Edit User CFG Dialog

User configurations parameters often change between jobs depending on what hardware is available and how the system is setup. Select the type of hardware present and the communication method with the hardware. Writing configuration files to the sensor will take approximately 10 seconds, please keep power applied for at least this length of time. Not allowing the file time to write can leave your configuration file in a corrupted state (see trouble shooting). 3D Collect uses the configuration file to enable or disable specific status lights based on selections in this file. If a light should be red or green (in use) but is greyed out (not used), re-verify the parameter selection. Fields will grey out or be enabled based on which parameters are selected and are useful. For example if the 3D Pan Tilt is selected, then the Pan Acceleration is used, but if sidus is selected that parameter has no effect and so it is greyed out. Pan Tilt Type should be selected first before baud rate, port or acceleration since this higher level selection will effect the fields. Below shows all fields (before hiding was done)

Sensor User Configuration
×

Parameters

SENSOR_RAW_ARCHIVE_PATH	D:\DATA
MOTION_SCANS_PER_FILE	500
PAN_PRE_HOME_ANGLE	0.000
TILT_PRE_HOME_ANGLE	0.000
PAN_HOME_TIMEOUT_SEC	150.000
TILT_HOME_TIMEOUT_SEC	60.000
PAN_SPEED_DEG_SEC	1.4000
TILT_SPEED_DEG_SEC	1.4000
PAN_OVERSHOOT_DEG	4.000
PAN_TILT_STABILITY_DEG	0.300
CTD	Laptop Operator
EMERGENCY_SHUTDOWN	TRUE
GPS_SYNC_CLOCK	NO_TIME_SYNC
L_D_CABLE_SET	PRIMARY
ARCHIVE_RAW_DATA	FALSE
ARCHIVE_RIAAT_DATA	FALSE
SENSOR_CFG_PATH	D:\3D\CFG
INS_DATA_TYPE	NO_NAV_DATA
PAN_STOW_DEG	90.0
TILT_STOW_DEG	20.0
PAN_POS_SOFT_STOP_DEG	100.0
PAN_NEG_SOFT_STOP_DEG	-100.0
TILT_POS_SOFT_STOP_DEG	29.0
TILT_NEG_SOFT_STOP_DEG	-29.0
PITCH_ROLL_LOG_RATE_SEC	1

PAN_TILT_TYPE	3D_PANTILT
PAN_TILT_LOCATION	OPTICALHEAD
PAN_TILT_METHOD	COMM
PAN_TILT_PORT	2
PAN_TILT_BAUD_RATE	115200

☒ Pan Only
 ☐ Pan and Tilt
 ☐ Connected to Pan

☒ Auto Brake

PAN_ACCEL_DEG_SEC2	500.0000
TILT_ACCEL_DEG_SEC2	500.0000
PAN_TILT_HOLD_AMPS	0.12500
PAN_LOGGING_PERIOD_S	4

Fault Enables

☒ PT Supply V	☒ OCB Temperature
☒ PT Current A	☒ OCB Humidity
☒ PT Linear Comp	☒ PB Temperature 1
☒ PT Leak	☒ PB Temperature 2
☒ Pan Temperature	☒ PB Humidity
☒ Tilt Temperature	☒ Digitizer Temperature
☒ OPB Temperature	☒ Laser Temperature
☐ Min Depth Eyesafe	☐ Watchdog

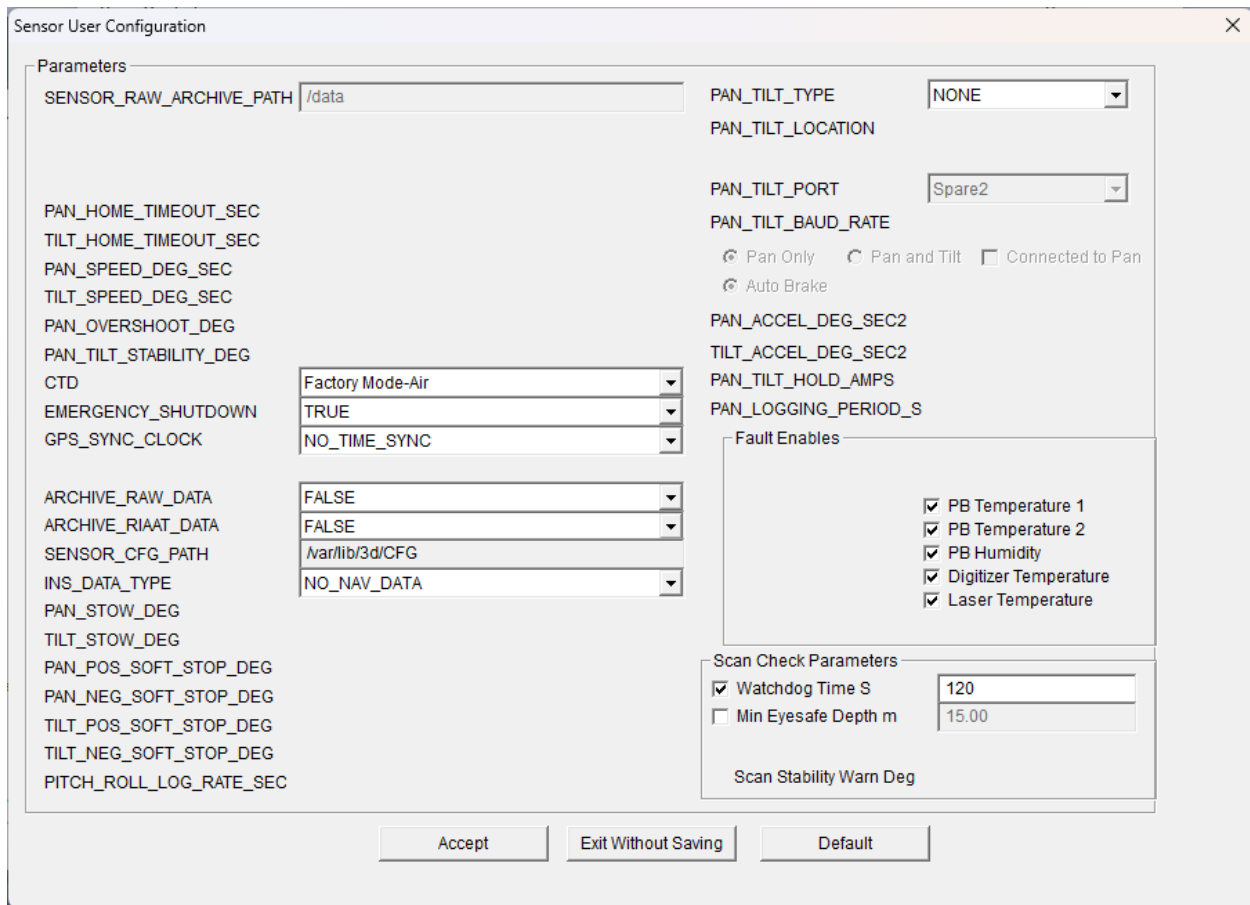
Fault Parameters

WATCHDOG_TIME_S	100
MIN_EYESAFE_DEPTH_M	15.00

Accept

Exit Without Saving

Below is the updated window that removes the unneeded parameters. For Sidus Pan or Pan Tilts the baud rate is a fixed value and cannot be modified by the user. Spinners don't have a Pan Tilt option, so many more fields are closed. Spinner style MBARI is shown below:



The "Sensor User Configuration" window displays various parameters for sensor setup. The parameters are organized into two main columns. The left column includes fields for archive paths, timeouts, speeds, overshoot, stability, CTD mode, emergency shutdown, GPS sync, and data types. The right column includes fields for pan/tilt type, location, port, baud rate, acceleration, hold time, logging period, and fault enables. At the bottom, there are buttons for "Accept", "Exit Without Saving", and "Default".

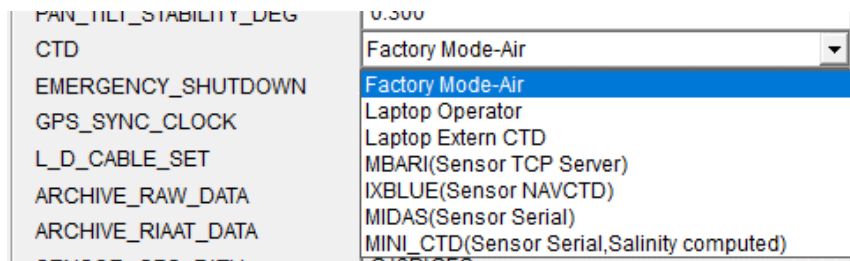
Parameter	Value
SENSOR_RAW_ARCHIVE_PATH	/data
PAN_HOME_TIMEOUT_SEC	
TILT_HOME_TIMEOUT_SEC	
PAN_SPEED_DEG_SEC	
TILT_SPEED_DEG_SEC	
PAN_OVERSHOOT_DEG	
PAN_TILT_STABILITY_DEG	
CTD	Factory Mode-Air
EMERGENCY_SHUTDOWN	TRUE
GPS_SYNC_CLOCK	NO_TIME_SYNC
ARCHIVE_RAW_DATA	FALSE
ARCHIVE_RIAAT_DATA	FALSE
SENSOR_CFG_PATH	/var/lib/3d/CFG
INS_DATA_TYPE	NO_NAV_DATA
PAN_STOW_DEG	
TILT_STOW_DEG	
PAN_POS_SOFT_STOP_DEG	
PAN_NEG_SOFT_STOP_DEG	
TILT_POS_SOFT_STOP_DEG	
TILT_NEG_SOFT_STOP_DEG	
PITCH_ROLL_LOG_RATE_SEC	
PAN_TILT_TYPE	NONE
PAN_TILT_LOCATION	
PAN_TILT_PORT	Spare2
PAN_TILT_BAUD_RATE	
Pan Only	☒
Pan and Tilt	☐
Connected to Pan	☐
Auto Brake	☒
PAN_ACCEL_DEG_SEC2	
TILT_ACCEL_DEG_SEC2	
PAN_TILT_HOLD_AMPS	
PAN_LOGGING_PERIOD_S	
Fault Enables	☒ PB Temperature 1 ☒ PB Temperature 2 ☒ PB Humidity ☒ Digitizer Temperature ☒ Laser Temperature
Scan Check Parameters	☒ Watchdog Time S: 120 ☐ Min Eyesafe Depth m: 15.00
Scan Stability Warn Deg	

Choosing "Exit Without Saving" will leave the User config file in the current state (NO changes made).

Choosing "Accept" will save any changes to UserParams.bin config file located on the sensor.

Pressing "Default" will populate the User parameters to a default selection, which can then be further modified. The parameters are not applied until accepted or can be canceled by exiting without saving.

6.1. CTD Hardware and Communication Selection



A dropdown menu showing the selection of CTD hardware and communication options. The selected option is "Factory Mode-Air".

Parameter	Value
PAN_TILT_STABILITY_DEG	0.500
CTD	Factory Mode-Air
EMERGENCY_SHUTDOWN	Factory Mode-Air
GPS_SYNC_CLOCK	Laptop Operator
L_D_CABLE_SET	Laptop Extern CTD
ARCHIVE_RAW_DATA	MBARI(Sensor TCP Server)
ARCHIVE_RIAAT_DATA	IXBLUE(Sensor NAVCTD)
SENSOR_CFG_PATH	MIDAS(Sensor Serial)
	MINI_CTD(Sensor Serial,Salinity computed)
	CTD(Sensor Serial)

The CTD dropdown menu is used to choose which source to get the CTD values from. MBARI is now UDP not TCP, per there request, but the name has not yet been updated.

6.1.1. Factory Mode-Air

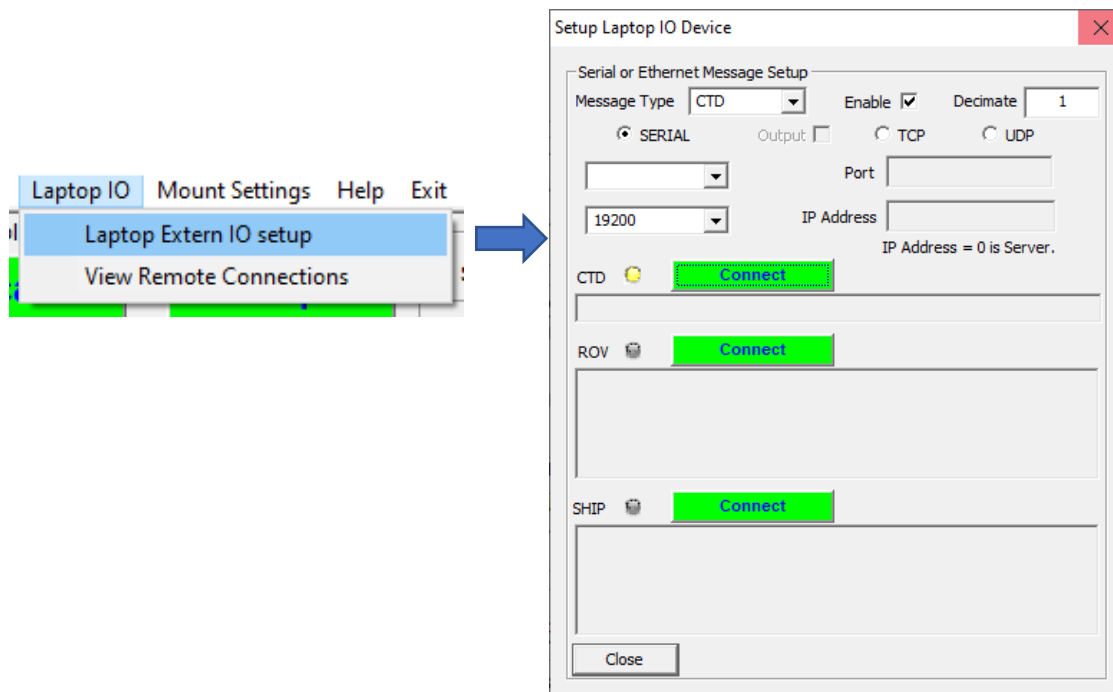
Factory Mode-Air does not require CTD information and so it will be zeroed out for operation of the sensor in air.

6.1.2. Laptop Operator

The **Laptop Operator** selection for CTD will send the user entered CTD data to the sensor at 1 Hz. CTD data is captured on a scan line by scan line basis, while scanning. This is primarily to support Motion jobs where line scans run for long periods of time and need to continue to receive updated CTD values even though the scan is not stopped and restarted.

6.1.3. Laptop Extern CTD

If using the MIDAS_SVX hardware device, select **Laptop Extern CTD** and then there is another menu to finish setting it up (see image below). This device needs to set the connection type (Serial or TCP IP) and related parameters: serial COM port and speed OR IP address and Port number and to connect by separate dialog using **Laptop CTD** menu item:



6.1.4. External Nuclear Thermistor

The **External Nuclear Thermistor** selection fills in the temperature and allows the user to enter in the salinity and depth in the GUI of the CTD data which will be sent to the sensor at 1 Hz. This is targeted to nuclear jobs where the scanner is mounted on a pole, however, it may also work for other jobs. The Temperature is greyed out since it updates automatically, while the other two fields are white for user input.

CTD	
Temperature (C)	0.0
Salinity (psu)	0.000
Pressure (dbar)	0.0

6.1.5. MBARI (Sensor TCP Server)

If the CTD information is going to be delivered to the Sensor directly over TCP IP, then select **MBARI (Sensor TCP Server)** This interface can accept two different formats. The first is a binary packet

Header: Tag 0x3D03, Version 0x01, Size 0x03, double waterTemp_C, double waterSalinity_psu, double waterPressure_dbar.

The second is the miniCTD data as ASCII text but over TCP IP.

Pressure in dBar <TAB> Temperature in C <TAB> Conductivity in mS/cm <TAB>
<CR><LF>

Either packet type will work, software automatically tries binary packet format first, and will switch and try ASCII if the binary packet fails the check for header tag.

6.1.1. MBARI (Sensor UDP Server)

If the CTD information is going to be delivered to the Sensor directly over UDP IP, then select **MBARI (Sensor UDP Server)** This interface can accept two different formats. The first is a binary packet

Header: Tag 0x3D03, Version 0x01, Size 0x03, double waterTemp_C, double waterSalinity_psu, double waterPressure_dbar.

The second is the miniCTD data as ASCII text but over UDP IP.

Pressure in dBar <TAB> Temperature in C <TAB> Conductivity in mS/cm <TAB>
<CR><LF>

Either packet type will work, software automatically tries binary packet format first, and will switch and try ASCII if the binary packet fails the check for header tag.

6.1.2. IXBLUE (Sensor NAVCTD)

If the user selects **IXBLUE (Sensor NAVCTD)** then the user must also set **INS_DATA_TYPE** to be **NAVIGATION_CTD**, since that is where this comes from. This is checked in the Sensor and will result in a startup error (will not finish startup) if the configuration set is not valid.

6.1.3. MIDAS (Sensor Serial)

MIDAS (Sensor Serial) sets up to use the AUX port at 19,200 baud (Fixed) to talk to a MIDAS CTD. Format expected is:

```
Sound Velocity<TAB> Units<TAB> Depth<TAB> Units<TAB> Temperature<TAB>
Units<TAB> Conductivity<TAB> Units<TAB>Salinity<TAB>Units<TAB><CR><LF>
```

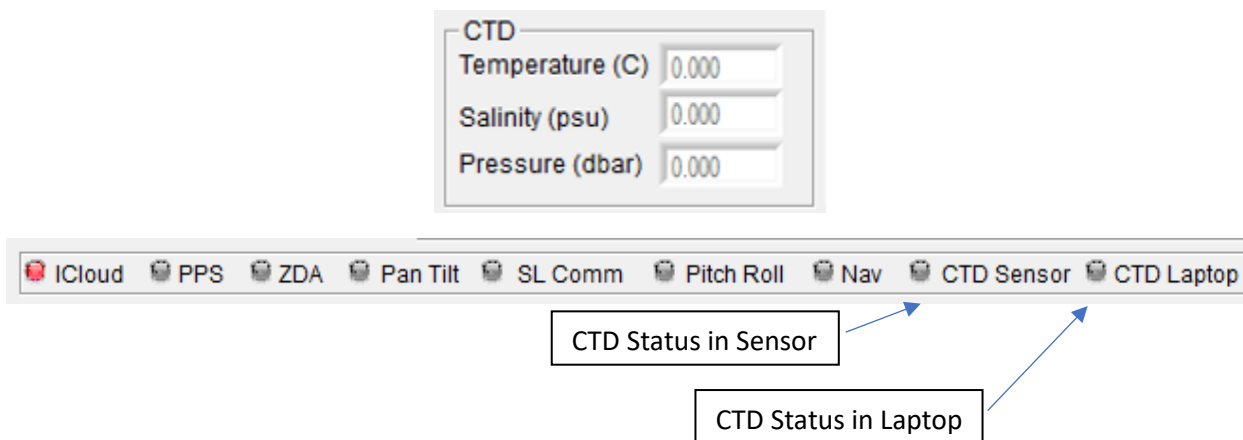
6.1.4. MINI_CTD (Sensor Serial, Salinity Computed)

If the user selects **MINI_CTD (Sensor Serial, Salinity Computed)**, then the sensor will look for the CTD to be on the AUX port (for all static jobs) using a Fixed baud rate (Fixed value in software). For motion jobs, or any job that requires **GPS_SYNC_CLOCK** to have a value and which will then also uses the AUX port, the software will instead look for the miniCTD on the Pan Port which is on the optical head. The data rate is also fixed on this port as well however the CTD data is only collected every 5 seconds (Fixed in software), rather than the once per second rate it is collected when on the AUX port.

The CTD baud rate for EC versions 6.05.11 or before is 115,200. The CTD baud rate after EC version 6.05.12 is 19,200 baud (the default for the devices) since we have seen that some CTD have a hard time saving the configuration settings and tend to reset themselves back to the factory rate over time.

6.1.5. CTD status in 3D Collect

If the setup is successful, the CTD values will be reported in 3D Collect (see image below of where they are reported). Look for the values reported to be changing value to verify the data is getting read in correctly. The sensor will pick up the values and put them into any scan data collected. Any CTD device selection should also light the CTD Status LED (left side) when the data is coming into the sensor.



Troubleshooting of the CTD if the device times out. Connect CTD to the aux port of a sensor and power on the sensor. Remote desktop into the sensor, open FireDaemon and stop the EC process.

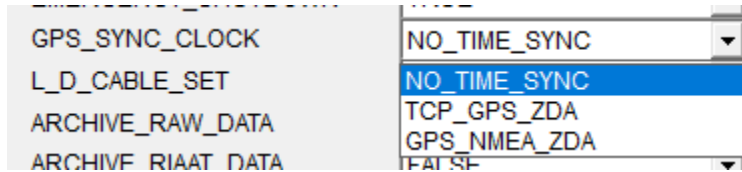
Open up IOCtrlTester on the sensor. Click 'Power Aux Port'. This sends power to the CTD, connected to the Aux port.

Open Tera Term on the sensor. Setup TeraTerm on sensor to have Command Return+ Line Feed (CR+LF in Terminal settings). Set the baud rate in Setup - Serial Port to the baud rate the CTD is currently using. Then use the following commands in TeraTerm to change the baud rate to 19200.

```
· stop: #
· baud: #059;19200
· run: M1
```

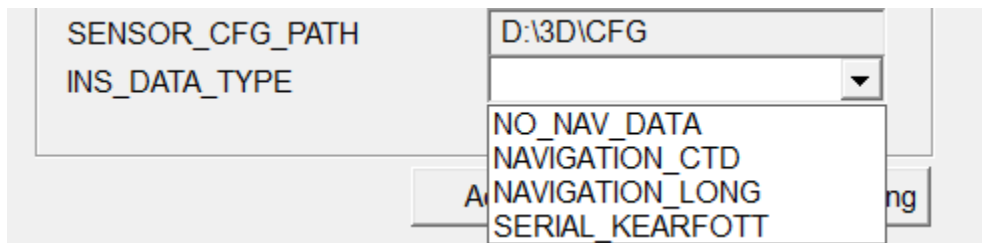
Once you see data coming in, then you can shut down tera term and close IOCtrlTester, then restart EC. There is a short power cycle on startup of EC, and sometimes the CTD will not have the configuration settings stick, therefore redoing this step a few times may be of benefit. Alternatively, you could use the CTD's test cable, power with a bench supply, and connect it to a laptop for serial comms. This brings in the CTD data as an External source.

6.2. Selection of Time Synchronization, GPS Sync Clock



The **GPS_SYNC_CLOCK** dropdown menu is used to choose which source to synchronize the system time stamp. The sensor automatically tunes its system time to synchronize with the source. **TCP_GPS_ZDA** option uses TCP/IP protocol through ethernet port. **GPS_NMEA_ZDA** options use serial communications. For SL3 this is the Auxiliary (labeled as AUX) port, at the configuration file defined baud rate which is the in Factory Parameters - AUXSENSOR_COM_PORT – the first number is baud rate, with 8 bits, no parity and 1 stop bit. Default baud rate is typically 57600. Note that auxiliary PPS connection is necessary for either case and so if any time sync is selected for SL3, this must be on the AUX port and if a miniCTD is also needed, then it will have to be on the Pan Port (Optical head). The **TCP_GPS_ZDA** option uses port 2007 for communication. The EC is the server so the data source must use the sensor IP address to deliver data as a TCP client.

6.3. Selection of INS data Source



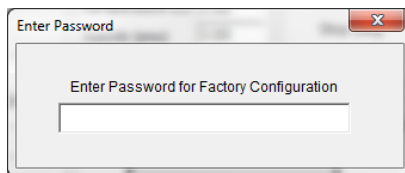
The **INS_DATA_TYPE** dropdown menu is used to choose a type of INS data packet, used along with the scan. Typically, this would only be used for a Motion job where an xBlue INS is available. For static scans the **NO_NAV_DATA** is selected. For navigation data to be correctly attached using **NAVIGATION_CTD**, or **NAVIGATION_LONG**, a time sync must also be selected for **GPS_SYNC_CLOCK**. Note that **NAVIGATION_CTD** uses port 2005 and **NAVIGATION_LONG** uses 2006 for TCP/IP communication. Both are servers, so the data source must deliver data as a TCP client to the sensor IP address. Also note that if **NAVIGATION_CTD** is selected then the user may choose to select the **CTD as IXBLUE (Sensor NAVCTD)**, although the user could also pick a different source for CTD.

The Pan Tilt type, location and communication method with port and baud rate arguments all set behavior of the pan tilt.

There is also a Fault Enable section, this enables or disables faults in the system on an individual bases. If the pan temperature fault is going off and reading an impossible value, then disabling the fault to continue operations is the correct way to handel this problem.

7. Edit Factory CFG Dialog

The Factory Configuration parameters are predominantly set in the factory during sensor build and calibration. Most of these parameters are specific to each sensor and cannot be shared between sensors. There are a few fields that the advanced user may need to change, however, this should be rare. The fields that have been changed before are the Comm port settings, mainly the Baud rate. Example from below for **AUXSENSOR COMM_CFG** is 115200 = Baud rate, N= No parity, 8 = bits, 1 = stop bits, 10000 = timeout in ms. Not all port settings are used for all activities, some are hard-coded. The other parameters that have changed before are the Emergency Fault limits. There was a problem with a Sidus Pan/Tilt unit that was incorrectly reporting temperature and that would cause a fault and shutdown a scan; Setting the fault limit to a very large value (for example 9000 C if the pan temperature were reported as 7777 C; which is impossible so we can safely ignore it) effectively disabled the fault and allowed the sensor to continue working. The fault disable is now a part of the User Parameters. For other parameters it is recommended that the user has help from the factory for value modifications. Incorrect values can make the sensor stop working, lead to erroneous data and may possibly lead to hardware damage. This is why getting into the factory mode parameters requires a password: 3d8depthcfg.



Factory Configuration

Data SENSOR_SERIAL_NUMBER: SL4N-001 RAW_ARCHIVE_PATH: /data		Comm Ports OCB_COMM_PORT: /dev/ttyS0 OCB_COMM_CFG: 115200,N,8,1,10000 PANTILT_COMM_PORT: /dev/ttyS5 PANTILT_COMM_CFG: 9600,N,8,1,10000 AUXSENSOR_COMM_PORT: /dev/ttyS3 AUXSENSOR_COMM_CFG: 57600,N,8,1,10000		Air Range Calibration T1_AIR: 6.3644090 FF_AIR: 1.0000000		Emergency Fault Values OCB_TEMPERATURE_LIMIT_C: 55.00 OCB_HUMIDITY_LIMIT_%: 50.00 PB_TEMPERATURE_LIMIT_1_C: 75.00 PB_TEMPERATURE_LIMIT_2_C: 75.00 PB_HUMIDITY_LIMIT_%: 50.00 DIG_TEMPERATURE_LIMIT_C: 75.00 PAN_TEMPERATURE_LIMIT_C: 48.0000 TILT_TEMPERATURE_LIMIT_C: 48.0000 LSR_TEMPERATURE_LIMIT_C: 50.00 OPB_TEMPERATURE_LIMIT_C: 50.00 CFG_PATH: /var/lib/3d/CFG																																																	
Quad Angle Calibration AZ_AI_NEG_V_TO_DEG: 4.2553062 AZ_AI_POS_V_TO_DEG: 4.2481513 EL_AI_NEG_V_TO_DEG: 4.2578864 EL_AI_POS_V_TO_DEG: 4.2489371		Water Range Calibration <table border="1"> <tr><td>T1_WATER_G4000</td><td>6.0445194</td><td>T1_WATER_G400</td><td>6.2517862</td><td>T1_WATER_G4</td><td>4.0000000</td></tr> <tr><td>FF_WATER_G4000</td><td>0.9827470</td><td>FF_WATER_G400</td><td>0.9837710</td><td>FF_WATER_G4</td><td>1.0000000</td></tr> <tr><td>T1_WATER_G3000</td><td>6.1885967</td><td>T1_WATER_G300</td><td>6.2178140</td><td>T1_WATER_G3</td><td>4.0000000</td></tr> <tr><td>FF_WATER_G3000</td><td>0.9843170</td><td>FF_WATER_G300</td><td>0.9833510</td><td>FF_WATER_G3</td><td>1.0000000</td></tr> <tr><td>T1_WATER_G2000</td><td>6.1475778</td><td>T1_WATER_G200</td><td>4.0000000</td><td>T1_WATER_G2</td><td>4.0000000</td></tr> <tr><td>FF_WATER_G2000</td><td>0.9837290</td><td>FF_WATER_G200</td><td>1.0000000</td><td>FF_WATER_G2</td><td>1.0000000</td></tr> <tr><td>T1_WATER_G1000</td><td>6.2230287</td><td>T1_WATER_G100</td><td>4.0000000</td><td>T1_WATER_G1</td><td>4.0000000</td></tr> <tr><td>FF_WATER_G1000</td><td>0.9839190</td><td>FF_WATER_G100</td><td>1.0000000</td><td>FF_WATER_G1</td><td>1.0000000</td></tr> </table>		T1_WATER_G4000	6.0445194	T1_WATER_G400	6.2517862	T1_WATER_G4	4.0000000	FF_WATER_G4000	0.9827470	FF_WATER_G400	0.9837710	FF_WATER_G4	1.0000000	T1_WATER_G3000	6.1885967	T1_WATER_G300	6.2178140	T1_WATER_G3	4.0000000	FF_WATER_G3000	0.9843170	FF_WATER_G300	0.9833510	FF_WATER_G3	1.0000000	T1_WATER_G2000	6.1475778	T1_WATER_G200	4.0000000	T1_WATER_G2	4.0000000	FF_WATER_G2000	0.9837290	FF_WATER_G200	1.0000000	FF_WATER_G2	1.0000000	T1_WATER_G1000	6.2230287	T1_WATER_G100	4.0000000	T1_WATER_G1	4.0000000	FF_WATER_G1000	0.9839190	FF_WATER_G100	1.0000000	FF_WATER_G1	1.0000000	Scan Parameters AZ_AO_DEG_TO_VOLT: 2.20 EL_AO_DEG_TO_VOLT: 2.20 T1: 4.00 FF: 0.98		Additional Configuration OCB_DIFF_COMMS: TRUE SCANNER_SHIFT_CTS: 2300000 AUTO_SHUTDOWN_TIME_LIMIT_SEC: 1200 LASER_START_TIME_SEC: 3	
T1_WATER_G4000	6.0445194	T1_WATER_G400	6.2517862	T1_WATER_G4	4.0000000																																																		
FF_WATER_G4000	0.9827470	FF_WATER_G400	0.9837710	FF_WATER_G4	1.0000000																																																		
T1_WATER_G3000	6.1885967	T1_WATER_G300	6.2178140	T1_WATER_G3	4.0000000																																																		
FF_WATER_G3000	0.9843170	FF_WATER_G300	0.9833510	FF_WATER_G3	1.0000000																																																		
T1_WATER_G2000	6.1475778	T1_WATER_G200	4.0000000	T1_WATER_G2	4.0000000																																																		
FF_WATER_G2000	0.9837290	FF_WATER_G200	1.0000000	FF_WATER_G2	1.0000000																																																		
T1_WATER_G1000	6.2230287	T1_WATER_G100	4.0000000	T1_WATER_G1	4.0000000																																																		
FF_WATER_G1000	0.9839190	FF_WATER_G100	1.0000000	FF_WATER_G1	1.0000000																																																		
Mailbox Pan Tilt Settings PAN_COMP_ZERO_IP1: 0 PAN_COMP_ZERO_IP2: 0 TILT_COMP_ZERO_IP1: 0 TILT_COMP_ZERO_IP2: 0		PT Configuration PT_SUPPLY_MAX_LIMIT_V: 30.0 PT_SUPPLY_MIN_LIMIT_V: 20.0 PT_CURRENT_MAX_LIMIT_A: 0.310 PT_COMP_LIMIT_MM: 1.000 PT_LEAK_LIMIT: 2.00		TO Configuration PROC_NUM_LOS: 5 NUM_PROC_UPSAMPLE: 2 MF_TO_POSITION: 70 MF_START_PROC: 122 TRIGGER_LEVEL_MV: 100		Temp Calibration TEMP_COMP_POLY2: 0.0001498 TEMP_COMP_POLY1: -0.0361510 TEMP_COMP_POLY: 0.7332889 X_OFFSET_M: -0.013210 Y_OFFSET_M: 0.168760 Z_OFFSET_M: 0.195530 FRNTGLS_TO_FRNTSNSR_M: 0.003990 LASER_SERIAL_NO: GR1302545																																																	
External Temperature Calibration EXT_THERM_COMP_POLY0: 0.760672987 EXT_THERM_COMP_POLY1: 17.869554520 EXT_THERM_COMP_POLY2: 2.090163946 EXT_THERM_COMP_POLY3: -0.627102017 EXT_THERM_BOARD_0: 0.000000000 EXT_THERM_BOARD_1: 0.000000000		Pitch Roll Calibration ROLL_EQN_OFFSET: 0.121355 ROLL_EQN_X: 0.999729 ROLL_EQN_X2: -0.000029 ROLL_EQN_X3: 0.000000 ROLL_COMP_POLY0: 0.000000000 ROLL_COMP_POLY1: 0.000000000 ROLL_COMP_POLY2: 0.000000000 ROLL_COMP_POLY3: 0.000000000		PITCH Calibration PITCH_EQN_OFFSET: 0.092260 PITCH_EQN_Y: 1.003783 PITCH_EQN_Y2: 0.000074 PITCH_EQN_Y3: -0.000010 PITCH_COMP_POLY0: 0.000000000 PITCH_COMP_POLY1: 0.000000000 PITCH_COMP_POLY2: 0.000000000 PITCH_COMP_POLY3: 0.000000000		SL4 Specific SIGNAL_PRF: 6000 SIM_PRF: 6250 A2D_CHANNEL_SEL: 8																																																	

Accept Exit Without Saving

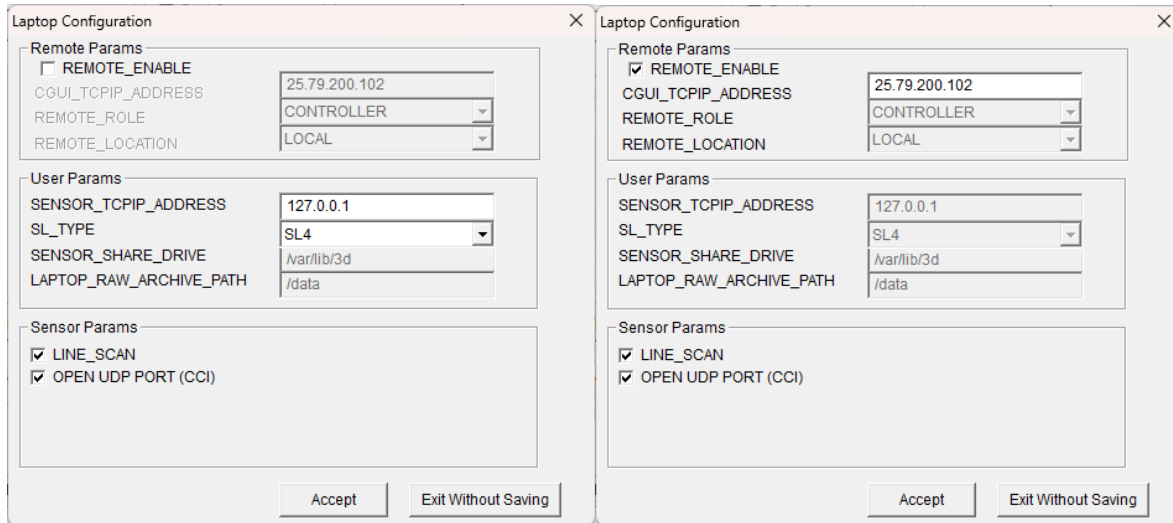
Choosing “Exit Without Saving” will leave the User config file in the current state.

Choosing “Accept” will save any changes to FactoryParams.bin config file located on the sensor.

Writing configuration files to the sensor will take approximately 10 second. Be sure to follow the prompts and allow time for the config file to write to the sensor. Not allowing the file time to write can leave your configuration file in a corrupted state (see trouble shooting).

8. Edit Laptop CFG Dialog

Laptop configuration parameters are stored on the Laptop and are needed to connect to the sensor and to set commands allowed. Sensor TCPIP address is typically 192.168.168.130 when static and sensor share drive is D. The software will now understand a computer name like “EC” or “SL4N-001.local”. Use a command prompt and Ping to verify that the name exists and is linking to the computer, if there is a question. The below values are the simulation settings for running on the Laptop. If a different address is required for the sensor then it would change here and also via remote desktop on the sensor but only if it needed to be different. In order for the address to carry through a reboot, the hard drive would need to be unlocked. This is not a trivial change but it can be done. For Remote Ops, only the partner CGUI IP address, role and location is needed, everything else will be greyed out. MBARI has the sensor name “SL4M-001” and the sensor type is SL4. There is both a static IP and dynamic IP address, they are equivalent to each other. For proper operation, an IPV 4 address is needed, not just an IPV6.



Choosing “Exit Without Saving” will leave the User config file in the current state.

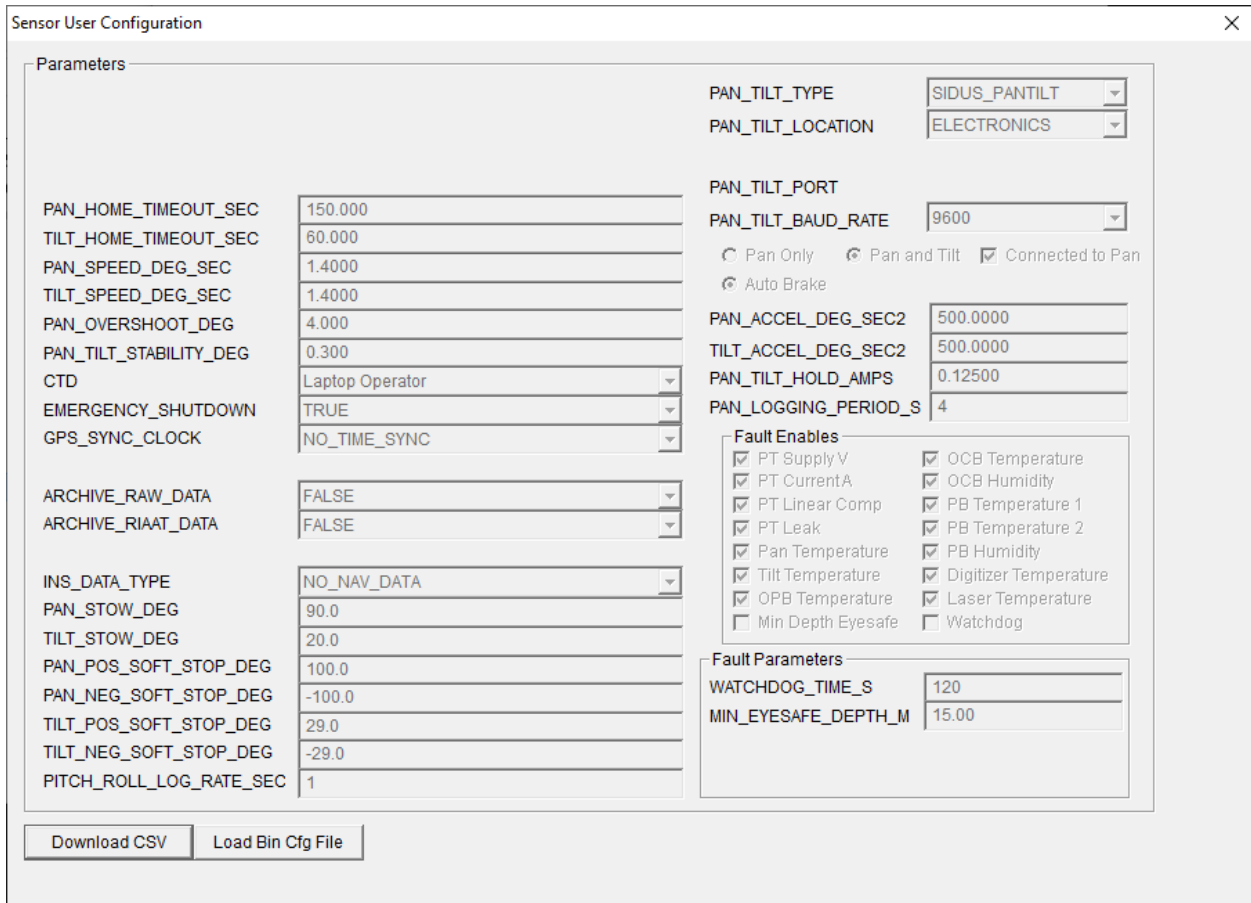
Choosing “Accept” will save any changes to LaptopParams.bin config file located on the laptop.

“Line Scan” checkbox allows line scan mode for Motion jobs (Az and El lines).

“Open UDP Port” checkbox option is for Command and Control Interface (CCI) UDP communication.

9. View User CFG Dialog

Review of user configurations should be done at the start of the job and each time a new user takes over on a sensor (swap of controllers). The settings define what hardware is used and how it is used. Incorrect settings can lead to erroneous data and could make the data useless requiring new data collection. Options while viewing the User Parameters and only viewing is allowed for Remote Operators that are not in the role of Controller.



Sensor User Configuration

Parameters

PAN_HOME_TIMEOUT_SEC	150.000
TILT_HOME_TIMEOUT_SEC	60.000
PAN_SPEED_DEG_SEC	1.4000
TILT_SPEED_DEG_SEC	1.4000
PAN_OVERSHOOT_DEG	4.000
PAN_TILT_STABILITY_DEG	0.300
CTD	Laptop Operator
EMERGENCY_SHUTDOWN	TRUE
GPS_SYNC_CLOCK	NO_TIME_SYNC
ARCHIVE_RAW_DATA	FALSE
ARCHIVE_RIAAT_DATA	FALSE
INS_DATA_TYPE	NO_NAV_DATA
PAN_STOW_DEG	90.0
TILT_STOW_DEG	20.0
PAN_POS_SOFT_STOP_DEG	100.0
PAN_NEG_SOFT_STOP_DEG	-100.0
TILT_POS_SOFT_STOP_DEG	29.0
TILT_NEG_SOFT_STOP_DEG	-29.0
PITCH_ROLL_LOG_RATE_SEC	1

PAN_TILT_TYPE: SIDUS_PANTILT
PAN_TILT_LOCATION: ELECTRONICS

PAN_TILT_PORT: 9600
PAN_TILT_BAUD_RATE: 9600

☐ Pan Only ☒ Pan and Tilt ☒ Connected to Pan
☒ Auto Brake

PAN_ACCEL_DEG_SEC2: 500.0000
TILT_ACCEL_DEG_SEC2: 500.0000
PAN_TILT_HOLD_AMPS: 0.12500
PAN_LOGGING_PERIOD_S: 4

Fault Enables

☒ PT Supply V	☒ OCB Temperature
☒ PT Current A	☒ OCB Humidity
☒ PT Linear Comp	☒ PB Temperature 1
☒ PT Leak	☒ PB Temperature 2
☒ Pan Temperature	☒ PB Humidity
☒ Tilt Temperature	☒ Digitizer Temperature
☒ OPB Temperature	☒ Laser Temperature
☐ Min Depth Eyesafe	☐ Watchdog

Fault Parameters

WATCHDOG_TIME_S	120
MIN_EYESAFE_DEPTH_M	15.00

Download CSV Load Bin Cfg File

Choosing “Download CSV” will save a csv version of the currently loaded binary config file in the C:\3D\CFG folder on the laptop.

Choosing “Load Bin Cfg File” will allow you to select a binary config file to load and view.

10. View Factory CFG Dialog

Allows the user to look at the factory configuration values and can be useful if there is a question on how a port is configured or what the fault limits are. Most fields require factory support if the value needs to be modified. Incorrect value can cause erroneous data and it is possible to cause hardware damage under specific conditions, so some care is warranted when changing parameters.

Factory Configuration			
Data SENSOR_SERIAL_NUMBER: SL4N-001 RAW_ARCHIVE_PATH: /data		Comm Ports OCB_COMM_PORT: /dev/ttyS0 OCB_COMM_CFG: 115200,N,8,1,10000 PANTILT_COMM_PORT: /dev/ttyS5 PANTILT_COMM_CFG: 9600,N,8,1,10000 AUXSENSOR_COMM_PORT: /dev/ttyS3 AUXSENSOR_COMM_CFG: 57600,N,8,1,10000	
Quad Angle Calibration AZ_AI_NEG_V_TO_DEG: 4.2553062 AZ_AI_POS_V_TO_DEG: 4.2481513 EL_AI_NEG_V_TO_DEG: 4.2578864 EL_AI_POS_V_TO_DEG: 4.2489371		Air Range Calibration T1_AIR: 6.3644090 FF_AIR: 1.0000000 Scan Parameters AZ_AO_DEG_TO_VOLT: 2.20 EL_AO_DEG_TO_VOLT: 2.20 T1: 4.00 FF: 0.98	
Water Range Calibration T1_WATER_G4000: 6.0445194 FF_WATER_G4000: 0.9827470 T1_WATER_G3000: 6.1885967 FF_WATER_G3000: 0.9843170 T1_WATER_G2000: 6.1475778 FF_WATER_G2000: 0.9837290 T1_WATER_G1000: 6.2230287 FF_WATER_G1000: 0.9839190		Emergency Fault Values OCB_TEMPERATURE_LIMIT_C: 55.00 OCB_HUMIDITY_LIMIT_%: 50.00 PB_TEMPERATURE_LIMIT_1_C: 75.00 PB_TEMPERATURE_LIMIT_2_C: 75.00 PB_HUMIDITY_LIMIT_%: 50.00 DIG_TEMPERATURE_LIMIT_C: 75.00 PAN_TEMPERATURE_LIMIT_C: 48.0000 TILT_TEMPERATURE_LIMIT_C: 48.0000 LSR_TEMPERATURE_LIMIT_C: 50.00 OPB_TEMPERATURE_LIMIT_C: 50.00 CFG_PATH: /var/lib/3d/CFG	
Mailbox Pan Tilt Settings PAN_COMP_ZERO_IP1: 0 PAN_COMP_ZERO_IP2: 0 TILT_COMP_ZERO_IP1: 0 TILT_COMP_ZERO_IP2: 0		TO Configuration PROC_NUM_LOS: 5 NUM_PROC_UPSAMPLE: 2 MF_TO_POSITION: 70 MF_START_PROC: 122 TRIGGER_LEVEL_MV: 100	
External Temperature Calibration EXT_THERM_COMP_POLY0: 0.760672987 EXT_THERM_COMP_POLY1: 17.869554520 EXT_THERM_COMP_POLY2: 2.090163946 EXT_THERM_COMP_POLY3: -0.627102017 EXT_THERM_BOARD_0: 0.000000000 EXT_THERM_BOARD_1: 0.000000000		Temp Calibration TEMP_COMP_POLY2: 0.0001498 TEMP_COMP_POLY1: -0.0361510 TEMP_COMP_POLY: 0.7332889 X_OFFSET_M: -0.013210 Y_OFFSET_M: 0.168760 Z_OFFSET_M: 0.195530 FRNTGLS_TO_FRNTSNSR_M: 0.003990 LASER_SERIAL_NO: GR1302545	
Pitch Roll Calibration ROLL_EQN_OFFSET: 0.121355 ROLL_EQN_X: 0.999729 ROLL_EQN_X2: -0.000029 ROLL_EQN_X3: 0.000000 ROLL_COMP_POLY0: 0.000000000 ROLL_COMP_POLY1: 0.000000000 ROLL_COMP_POLY2: 0.000000000 ROLL_COMP_POLY3: 0.000000000		SL4 Specific SIGNAL_PRF: 6000 SIM_PRF: 6250 A2D_CHANNEL_SEL: 8	
Download CSV Load Bin Cfg File			

Choosing “Download CSV” will save a csv version of the currently loaded binary config file in the C:\3D\CFG folder on the laptop.

Choosing “Load Bin Cfg File” will allow you to select a binary config file to load and view.

The serial communication ports for each connection are set in the Factory Configuration dialog. Not all port settings are used for all activities, some are hard-coded.

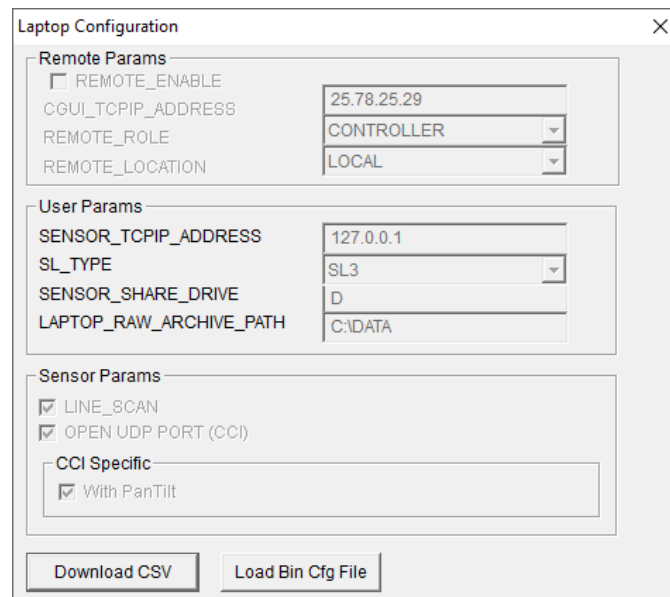
Comm Ports	
OCB_COMM_PORT	COM7
OCB_COMM_CFG	115200,N,8,1,100000000
PANTILT_COMM_PORT	COM2
PANTILT_COMM_CFG	9600,N,8,1,10000
AUXSENSOR_COMM_PORT	COM10
AUXSENSOR_COMM_CFG	115200,N,8,1,10000

Comm Ports	
OCB_COMM_PORT	/dev/ttyS0
OCB_COMM_CFG	115200,N,8,1,10000
PANTILT_COMM_PORT	/dev/ttyS5
PANTILT_COMM_CFG	9600,N,8,1,10000
AUXSENSOR_COMM_PORT	/dev/ttyS3
AUXSENSOR_COMM_CFG	57600,N,8,1,10000

The Comm Configs are in a format of the communication speed specified in Bits Per Second and also known as Baud rate is first, N for No parity bit, 8 Data bits, 1 stop bit, and Reading timeouts in milliseconds is the last item. Generally, these should not need to be modified. On the left is the example for an SL3, on the right is an example of an SL4. Note that the PORT fields are quite different. Normally the user does not need to worry about specifying the PORT locations. On Rare occasions the baud rate may need to be modified, depending on the device getting attached. MBARI has no external serial ports and should never need to modify these parameters. Internally the Evolase Laser does use a serial communication, however, the factory parameters are not used for this connection.

11. View Laptop CFG Dialog

If 3D Collect cannot connect to a sensor or if a command/scan type is not available, then a quick review of the Laptop configuration may show the problem. The SENSOR_TCPIP_ADDRESS must match the sensor address so the GUI knows how to communicate with the sensor. For running in Remote Operations, the computer address of the first CGUI connected to the sensor is used (identified as Prime). Even if that CGUI has both followers used, it will respond and redirect the connecting CGUI to an IP address where it can attach. Make sure that a VPN is setup so a IPV4 address can be acquired. SL4 typically use the Hamachi network, but any other could be used as well. Verify network is up before Launching CGUI so the Hamachi address is correctly identified (the address range is specifically searched first, but will continue to all available networks). View of the Laptop config, below.



Choosing “Download CSV” will save a csv version of the currently loaded binary config file in the C:\3D\CFG folder on the laptop.

Choosing “Load Bin Cfg File” will allow you to select a binary config file to load and view.

The OPEN UDP PORT (CCI) will show the CCI specific items when selected or hide them if not selected.

12. Edit or View Other parameters

For Spinners like MBARI, there are a few other parameters sources that were added to separate files: Extra_Parameters.txt, Attenuator_Parameters.txt, and Background.txt. The first three are all located on the Sensor in the CFG directory, path is xxxxx (or using SAMBA: xxx)

The last file, default.cfg, is some scan parameters that don't change often but could be modified for individual scans. This was extended by MBARI and some of these may migrate to a tab in the 3D Collect GUI. TBR. This file is on the controlling laptop in "C:\3D\CFG" folder. Used by 3D collect. <todo – when is this read – start of each scan? Think so, verify.>

The first item is the value, the separator is commas and the second column is the parameter name, the third column is a description of the item. The parameter name must match the expected line or the parameter will be rejected by EC with an error message. Missing parameters will also generate error messages.

12.1. Extra_Parameters.txt

```
0,TRIGGER_TO_GLASS_CNTS, Offset of Trigger To Glass. Value subtracted from counts between trigger
and signal.
5,SPINNER_AIR_EL_DEG, Define forward looking scan angle (assume constant)
10,TEC_SETPOINTS_C[0], TEC thermal Setpoint 0 Green Detector
50,TEC_SETPOINTS_C[1], TEC thermal Setpoint 1 Laser
50,TEC_SETPOINTS_C[2], TEC thermal Setpoint 2 CPU
50,TEC_SETPOINTS_C[3], TEC thermal Setpoint 3 Daughter
50,TEC_SETPOINTS_C[4], TEC thermal Setpoint 4 Power
50,TEC_SETPOINTS_C[5], TEC thermal Setpoint 5 TEC board
50,TEC_SETPOINTS_C[6], TEC thermal Setpoint 6 Motor
50,TEC_SETPOINTS_C[7], TEC thermal Setpoint 7 Red 1
50,TEC_SETPOINTS_C[8], TEC thermal Setpoint 8 Red 2
0,TEC_ENABLES, bits 0-8 for TEC 0-8 where 1=on, 0=off
28,DETECTOR_BIAS_V[0], Green Detector Bias voltage
28,DETECTOR_BIAS_V[1], Red 1 Detector Bias voltage
28,DETECTOR_BIAS_V[2], Red 2 Detector Bias voltage
6.4,LASER_BIAS_V, Laser Bias voltage (Pipeline only)
9,BUS_VOLTAGE_RANGE_V[0],MBARI incoming bus voltage range: [0]=minimum v [1]=maximum v
40,BUS_VOLTAGE_RANGE_V[1],MBARI incoming bus voltage range: [0]=minimum v [1]=maximum v
20,LASER_VOLTAGE_RANGE_V[0],MBARI outgoing laser voltage range: [0]=minimum v [1]=maximum v
25,LASER_VOLTAGE_RANGE_V[1],MBARI outgoing laser voltage range: [0]=minimum v [1]=maximum v
50,MAX_AUTO_SPIN_RATE_HZ, Maximum motor spin speed while scanning
0,CAL_INT_2_RANGE_M, calibration int^2 to meters
0,CAL_INT_1_RANGE_M, calibration int^1 to meters
0,CAL_INT_0_RANGE_M, calibration int^0 to meters
0,ENCODER_RAW_2_MOUNT_DEG, Raw encoder angle to the output mount reference mark in degrees
3,RAW_DATA_TYPE, Raw data type: 0=debug, 1=Raw&Cross, 2=Peaks, 3=Fit, 4=RIAT, 5=RIAT+Thermal
0,FILE_TYPE, Archive file type: 0=RIAAT (classic), 1=SRIAT
```

12.2. Attenuator_Parameters.txt

```
21,Number of elements in the Attenuator Calibration,,,,,
2.0007,volts,0.5,Attenuated,99.5,percent output power,line,1
2.0313,volts,5,Attenuated,95,percent output power,line,2
```

```

2.0653,volts,10,Attenuated,90,percent output power,line,3
2.0993,volts,15,Attenuated,85,percent output power,line,4
2.1295,volts,20,Attenuated,80,percent output power,line,5
2.1597,volts,25,Attenuated,75,percent output power,line,6
2.1899,volts,30,Attenuated,70,percent output power,line,7
2.2210,volts,35,Attenuated,65,percent output power,line,8
2.2527,volts,40,Attenuated,60,percent output power,line,9
2.2843,volts,45,Attenuated,55,percent output power,line,10
2.3187,volts,50,Attenuated,50,percent output power,line,11
2.3560,volts,55,Attenuated,45,percent output power,line,12
2.3932,volts,60,Attenuated,40,percent output power,line,13
2.4384,volts,65,Attenuated,35,percent output power,line,14
2.4855,volts,70,Attenuated,30,percent output power,line,15
2.5433,volts,75,Attenuated,25,percent output power,line,16
2.6080,volts,80,Attenuated,20,percent output power,line,17
2.6935,volts,85,Attenuated,15,percent output power,line,18
2.8146,volts,90,Attenuated,10,percent output power,line,19
3.0245,volts,95,Attenuated,5,percent output power,line,20
3.9000,volts,99.5,Attenuated,0.5,percent output power,line,21
0.623,Laser Full Pulse Output Power Level (uJ). (last Line),,,,,,

```

13. Edit or View CCI CFG Dialog

If 3D Collect cannot connect to a sensor then the starting parameters for CCI are a default generated set. The parameter viewer shows all the parameters that are saved on the sensor for CCI commanding. These files are saved with a configuration number 1 – 65535. The config number 0 is special and is executed immediately without saving it. This reduces bandwidth for commanding and allows sequences to be built up for very low bandwidth commanding options. For Remote Operations, this is the method used to run scripts from the sensor so that if the network connection from ship to shore is interrupted, the script can continue. The Status Watchdog check determines how long the script can continue without sending a status to a CGUI while the Min Depth is an extra safety check for non-eye safe laser operations can only occur below the minimum depth set in nMinDepth_m (CTD data is used to determine the depth). Below is the SL4 version of CCI. MBARI requires a few extra fields to be defined.

<todo – define and update CCI entry. Laser Pwr, Atten Pwr, replace EI with motor spin calculation?, SHG setpoint/auto, maybe detector bias, hide invalid faults, PRF?>

Command and Control Configuration Parameters

Parameters		Version		Mount Settings	
JobName	Mfg	nCfgNumber	3	☒ Static	Direction
Subfolder	Test	nNextCfgNumber	1	☐ Motion	☐ Port
FileName	R_p15an15e_01_0400x0400	nNumScans	0	☐ PanTilt	☐ Port-Down
nGain	1 (eye safe)	SensorSerialNumber	1	☐ Pan	☐ Down
nGainEnd	1 (eye safe)		SL3-000	☐ 3D PanTilt	☐ Starboard-Down
startProcessing_m	1			☐ Kyst	☐ Starboard
endProcessing_m	20			☐ No PanTilt	☐ Inversion Ring
mode	AZEL_SCAN			Collar: INS to Plate in mm 0	
numSamplesPerSegment	600	Faults			
nPtsPerScanLine	400	☒ PT Supply V	☒ OCB Temperature	☒ PB Humidity	☒ Pan Temperature
nPtsToAverage	1	☒ PT Current A	☒ OCB Humidity	☒ Digitizer Temperature	☒ Tilt Temperature
nScanLinesPerScan	400	☒ PT Linear Comp	☒ PB Temperature 1	☒ Laser Temperature	☒ Min Depth
azStart_degopt	15	☒ PT Leak	☒ PB Temperature 2	☒ OPB Temperature	☒ Watchdog
azStop_degopt	-15	nStatusWatchdog_s	30	nMinDepth_m	20
elStart_degopt	-15	☐ bArchiveRaw		Pan Tilt Control	
elStop_degopt	15	☐ bArchiveRiaat		☐ bPanTiltMove	
CTD_Source	FACTORY MODE - AIR	☐ bEmergencyShutdown		nPan_deg	0
INU_Source	NO_NAV_DATA	☐ nCfgDigitizer		nTilt_deg	0
Sync_Source	NO_TIME_SYNC	☐ nShareDrive		Wait Delay Control	
\\127.0.0.1\D\3D\CFG\Scripts\Configuration1.bin				☐ bWaitEn	
				nWaitTimeS 0	
				☒ bScanEn	
				Estimated Configuration Run Time (hh:mm:ss) 00:01:01	
				Script Count 1	
				☐ NoOperation	

Download CSV Load Bin Cfg File Save Cfg File Exit Without Saving ☐ Raw Values

The raw option on the lower right will change all parameters into the fixed-point actual numbers, the default is to not have this selected and show the parameters in engineering units for the parameters that have different engineering units. Not all parameters have engineering units. The Download CSV will create a csv excel file that shows both the raw values and the engineering values. While parameters can be edited or viewed with this screen, the main GUI will populate all the fields and save a configuration that has all the settings set. Running a Script from the Sensor or Send CFG saves the scan(s) settings onto the sensor as a file. This file is triggered by running the configuration id number, starting the move, wait, then scan sequence. If the configuration settings “bPanTiltMove” is selected, then a pan move and a wait can also be done in a single CCI configuration setting. If the Pan/Tilt is powered on, it is assumed that the bPanTiltMove is true when creating scan configurations from the script dialog or main CGUI window. Mount settings are pulled from that dialog and the Faults settings from the User parameters when the file is created. The setting are specific to each configuration and could changed between configurations. The NoOperations field (bottom center) allows the entire configuration to be skipped if it was loaded and ran, while keeping the values in all the other fields.

In view the fields can only be inspected, not changed.

Load Bin Cfg File will allow the user to select other configuration files to load. Save Cfg File will save any changes made, but not exit. After desired changes are saved then select Exit Without Saving to close the window (or use the X in the corner). The parameters shown are a collection of parameters and settings from other configurations as well as the main GUI window.

```

UINT8  Version;                // This packet version number = 2, - v2 moved
UINT16 nCfgNumber;             // unique configuration number identifier
UINT8  nGainEnd : 4;           // 1-12, sets laser power End
UINT8  nGain : 4;              // 1-12, sets laser power Start
UINT8  startProcessing_m;       // # = m*255/50, start processing at this range
UINT8  endProcessing_m;         // # = m*255/50, end processing at this range
UINT8  mode;                   // Scan type
UINT16 numSamplesPerSegment;    // Digitizer samples per shot
UINT16 nPtsPerScanLine;         // points per scan line
UINT16 nPtsToAverage;           // Shots to average into one point
UINT16 nScanLinesPerScan;       // Number of scan lines per scan file (even)
INT16  azStart_degopt;          // # = deg/30*32767, Az starting angle
INT16  azStop_degopt;           // # = deg/30*32767, Az ending angle
INT16  elStart_degopt;          // # = deg/30*32767, El starting angle
INT16  elStop_degopt;           // # = deg/30*32767, El ending angle
//UINT8 Version;                // This packet version number = 2, v2 moved this.
UINT8  CTD_Source;              // See table for this
UINT8  INU_Source;              // See table for this
UINT8  Sync_Source;             // See table for this

UINT8  bArchiveRaw : 1; // Archive RAW data (on sensor) – these get large!
UINT8  bArchiveRiaat : 1; // Archive RIAAT data (on sensor)
UINT8  bEmergancyShutdown : 1; // 1 = If error system shuts down. 0 = continue on error
UINT8  nShareDrive : 1; // Usually 0; 0 = D: 1 = C: (allow debug)
UINT8  nCfgDigitizer : 1; // 0=(default) internal trigger, SL3; 1=external trigger SL2
UINT8  Spare : 3;

UINT8  SENSOR_TYPE;             // v2, 3=SL3, 4=SL4, 5=SL5
UINT8  SENSOR_SERIAL_NUMBER;    // v2, SL<type>-# usually something like "005"
UINT16 nMinDepth_m;             // Minimum Depth for scan, fault parameter
UINT16 nStatusWatchdog_s;       // Status request watchdog time in seconds, fault parameter
UINT16 nFaultEnable;            // Which faults are enabled/disabled see ICDStructFaultCode

////////// v1 ////////// Added for PT control and file name //////////
//UINT8  Subfolder[24];         // subfolder name - v2 moved

UINT32  nPan_deg : 13; // v2, # = |deg|/360*8191, Pan angle to go to (8191 was 511)
UINT32  nTilt_deg : 13; // v2, # = |deg|/360*8191, Tilt angle to go to (8191 was 511)
UINT32  bPanNeg : 1; // Pan direction 1 = negative, 0 = positive
UINT32  bTiltNeg : 1; // Tilt direction 1 = negative, 0 = positive
UINT32  bPanTiltMove : 1; // 1 = enable move, 0 = skip pan/tilt move, first action
UINT32  bWaitEn : 1; // 1 = enable wait, 0 = skip wait, second action
UINT32  bScanEn : 1; // 1 = enable scan, 0 = skip scan, third action
UINT32  SpareV1 : 1; // v2, room to grow.

UINT32  MountScanType : 2; //{"ST","MO","ZZ"}, Scan Type Static, Motion, none
UINT32  MountPanType : 2; //{"PT","PA","3D","ZZ"}, Pan Type Sidus Pan&Tilt, Sidus Pan, 3D, none
UINT32  MountDir : 4; //{"PO","PD","DO","SD","ST","ZZ","IR"}, Direction Port, Port-down, down,
// starboard down, starboard, none
UINT32  MountIns : 2; //{"PH","RO","ZZ"}, INS Type Phins, Rovins, none
UINT32  MountCollar : 1; //{"CO","ZZ"} Collar, none
UINT32  MountCollar_mm : 10; // mm of collar
UINT32  bNuclear : 1; // Nuclear sensor
UINT32  nWaitTimeS : 9; // v2, 0-511 seconds length of time to wait
UINT32  bNoOp : 1; // v2, NoOp - disable this scan cfg when true.

UINT16  nNextCfgNumber; // Continue onto next config (script-mode), 0=end.
// size to here is 45 bytes + 24 (subfolder moved) = 69 (spare removed,SENSOR_TYPE added).

```

```

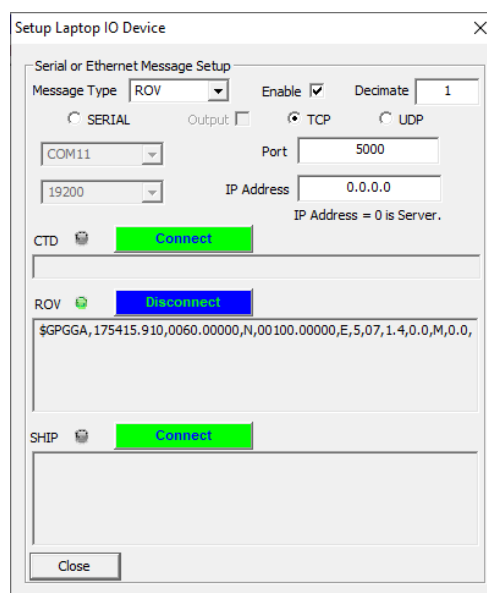
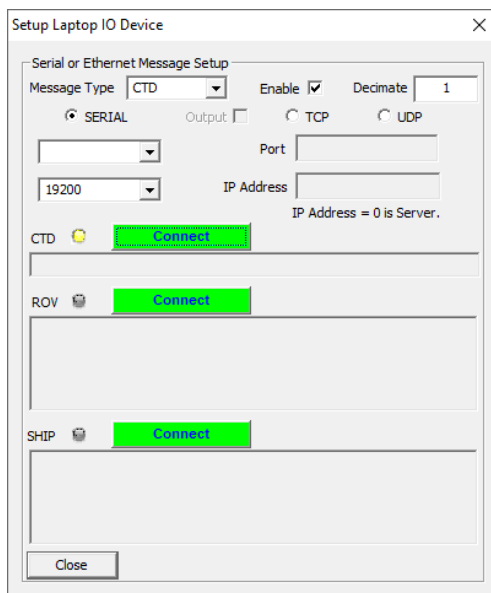
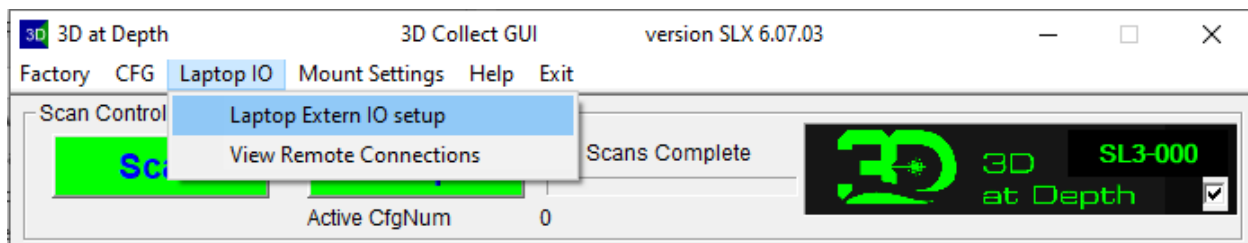
////////// v2 ////////// Updated to use with Remote Ops //////////
UINT8   JobName [24];           // job name
UINT8   Subfolder[24];         // subfolder name, v2 moved
UINT8   FileName [24];         // filename (if empty, will autogenerate one)
// file auto is: <Time> <Pan ang> <Tilt ang> <Gain> <row>x<col>.riaat
UINT8   nNumScans;              // repeat scan count, limit sets. (255==forever / continuous) to be
// implemented
UINT16   nEstTimeS;             // Estimated time to run config in seconds
UINT8   nTotalScriptCnt;        // part of a sequence of this size. Updated for tlm only.
UINT8   nLastRunStatus;         // 0=yet to run, 1=Running, 2=done good, 3=early exit, 3>=other errors.
// Updated for tlm only.
} ICDStructScanConfig; // version 2 which added Job, Filename, EstTimeS and adjusted others. Size = 122

```

For more information on CCI structures and command layout, see SL Sensor ICD_C7 (or whatever is the latest version). And for more information about using CCI see SL Sensor CCI_Manual_C3 (or whatever is the latest version).

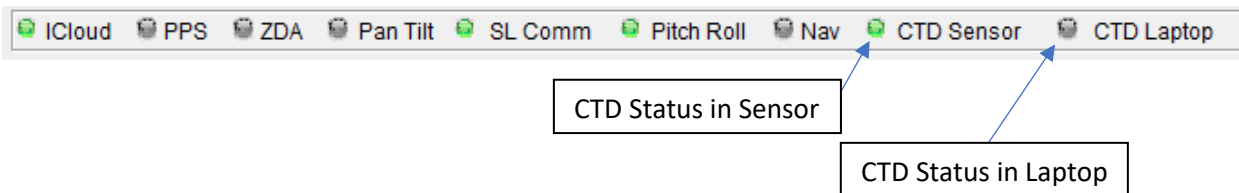
14. Laptop IO Menu

Laptop CTD device settings can be configured by the menu item **Laptop IO** with sub menu **Laptop Extern IO setup**. Used when “Laptop Extern CTD” is selected for the CTD type in the User Config Dialog.



Select Message Type, options are {CTD, ROV or SHIP}, then enable control options. Setup of the device allows the user to choose “Serial”, “TCP” or “UDP” connection protocol. When “Serial” is selected, COM

port and the baud rate are selectable. When TCP or UDP is chosen, it is the IP address that selects if 3D Collect will open the port as a server or a client. To set as the server, the IP address must be '0.0.0.0'. As a client, the IP address must be the IP address of the CTD device (or other computer that is generating the message; use 127.0.0.1 if it is on the same computer), and set the port to be the same value as set in the CTD device (or other computer that is generating the message). Finally select the Connect button after the appropriate parameters are set to start trying to communicate with the device. The raw ASCII message will be shown in the Setup Laptop IO Device window, so proper message form can be verified. For CTD only one message, the last one is shown. For ROV or SHIP there are four messages shown. These are populated as the first three message types that show up and the last message is replaced if it is not one of the previous three. This allows seeing the last message of a specific type. The LED to the right of each of the message types {CTD, ROV, SHIP} will indicate communication status to the Laptop. For CTD data coming into the laptop, on the main CGUI window there is an additional status LED that turns green when working:

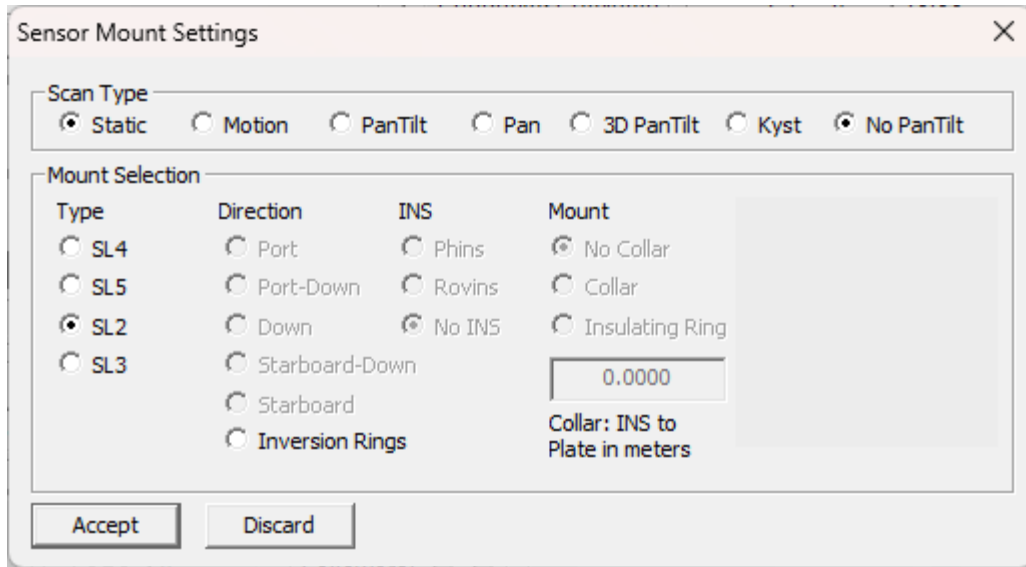


Both ROV and SHIP messages are always inputs to the Prime computer (that is the first one connected to EC) and every other CGUI in the system is an output that can, when enabled, replicate the messages. The NEMA message will be sent over our Hamachi network. The way the message gets into the system is independent of how it can come out of the system. For example, the ROV message in might be a Serial com port message into the system while the output on shore can be a TCP IP message. In order to see the messages onshore there must be something to send the message to for the TCP or UDP communication types (it can be putty or Tera Term) but something needs to accept the message the CGUI is generating in order to see the message show up in Setup Laptop IO Device. If there is no need to connect to anything else, select the Serial type since we can still see the messages in the window when that type is selected even without anything on the other side. Sending the message to Putty or Tera Term is another way to do it.

Closing the window does NOT shut it down, only disconnect will stop that interface from running. The Setup Laptop IO Device window can be left open or not as the user wishes. The window will always be in front of the CGUI window.

15. Mount Settings Menu

The User must select how the sensor is being used at least once each time 3D Collect is launched if running a dynamic scan (line scans). This configuration data is attached to the sensor data so that when processing the data, the correct offsets and setting can be used and known. If these are marked incorrect, then the ChangeHeader application will need to be used to set them correctly. For most static scans the parameters will be filled in automatically by using information from the Factory parameters, Pan/Tilt power control and the scan type selected. If using the Inversion Rings to mount the sensor, then that will have to be selected by the user. Dynamic scans still require the user to fill out Mount, INS and Direction information. <todo – update sensor mount settings>



The dialog box is titled "Sensor Mount Settings" and has a close button (X) in the top right corner. It contains two main sections: "Scan Type" and "Mount Selection".

Scan Type: A row of radio buttons with the following options: Static (selected), Motion, PanTilt, Pan, 3D PanTilt, Kyst, and No PanTilt.

Mount Selection: A section containing three columns of radio buttons: "Type", "Direction", and "INS".

Type	Direction	INS
☐ SL4	☐ Port	☐ Phins
☐ SL5	☐ Port-Down	☐ Rovins
☒ SL2	☐ Down	☒ No INS
☐ SL3	☐ Starboard-Down	
	☐ Starboard	
	☐ Inversion Rings	

To the right of these columns is a "Mount" section with three radio buttons: "No Collar" (selected), "Collar", and "Insulating Ring". Below these is a text input field containing "0.0000". At the bottom of the Mount Selection section is the text "Collar: INS to Plate in meters".

At the bottom of the dialog box are two buttons: "Accept" and "Discard".

Choose Accept to save your mount settings as part of your scan file. These setting will be used by 3D Cloud (Static or Motion) to help automate your raw and RIAAT file processing. This information is saved in the Raw and Riaat file.

*****NOTE***** Incorrectly configured Mount Settings can cause incorrect processed files from 3D Cloud.

15.1. Scan Type Settings

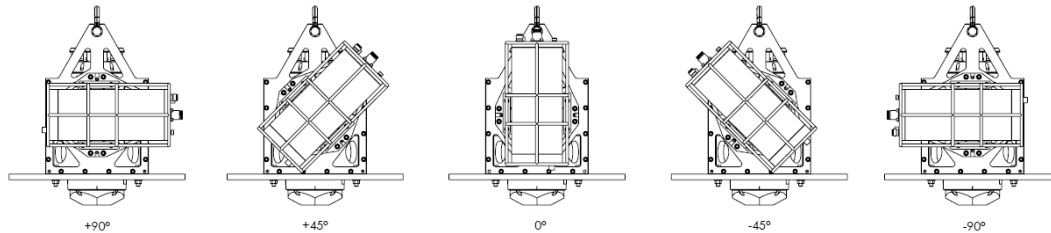
If this is a **Static** scan then the user only needs to select if there is a **Pan**, **PanTilt** or **No PanTilt** (this is a mutually exclusive set, only one option may be selected at a time), if inversion rings are used and the SL sensor type. If **Motion** is already selected then selecting it again will also change the scan type to **Static** and unselect the **Motion** option. When the Pan Tilt is powered on, the type can be determined, so it is set from status at power on. There is no way to determine Inversion rings (yet) so user must make sure they are correct – default is not using them.

15.2. Mount Selection Settings

Select the **Type** of SL system that is being used. SL type is read and populated from the Factory configuration name on connection to a sensor automatically. User can still verify.

15.2.1. Direction Settings

In order for **Direction**, **INS** and **Mount** options to be selectable, the **Scan Type** must be **Motion**. Select the appropriate direction that the sensor is mounted: **Port** (look left), **Port-Down**, **Down**, **Starboard-Down**, or **Starboard** (look right). See diagram below for direction examples.



The newly added inversion ring selection allows a sensor to be mounted hanging from a pan tilt. The diagram shown when selected should make that clear, with the bar on top of the image is the pan/Tilt mounting bracket; so that pan is above the sensor. Some tight scans require the sensor to be hanging to get a good view of the area to scan. This is **ONLY** for Static scanning (right now, motion is not supported).

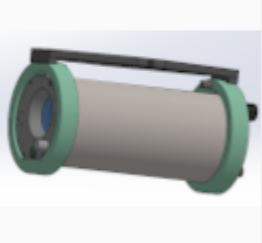
Sensor Mount Settings

Scan Type

☒ Static
☐ Motion
☐ PanTilt
☐ Pan
☐ 3D PanTilt
☒ No PanTilt

Mount Selection

Type	Direction	INS	Mount
☐ SL4	☐ Port	☐ Phins	☒ No Collar
☐ SL5	☐ Port-Down	☐ Rovins	☐ Collar
☐ SL2	☐ Down	☒ No INS	☐ Insulating Ring
☒ SL3	☐ Starboard-Down		0.0000
	☐ Starboard		Collar: INS to Plate in meters
	☒ Inversion Rings		



Accept

Discard

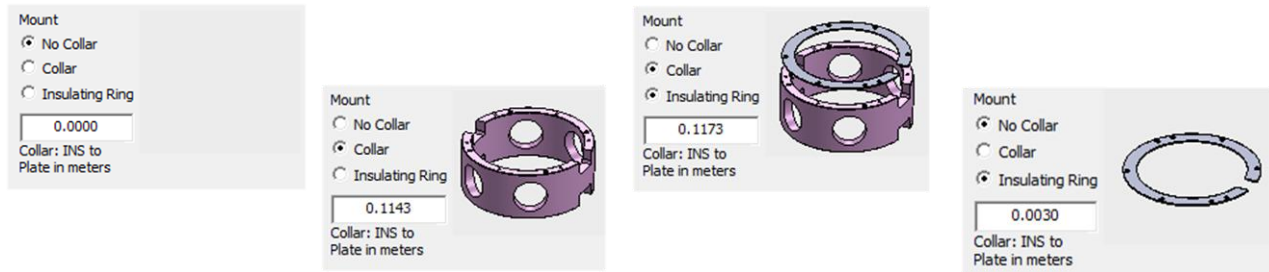
15.2.2. INS Settings

The **INS** selection is either **Phins**, **Rovins**, or **No INS**. The type should be indicated on the INS bottle itself if there is a question as to which it is.

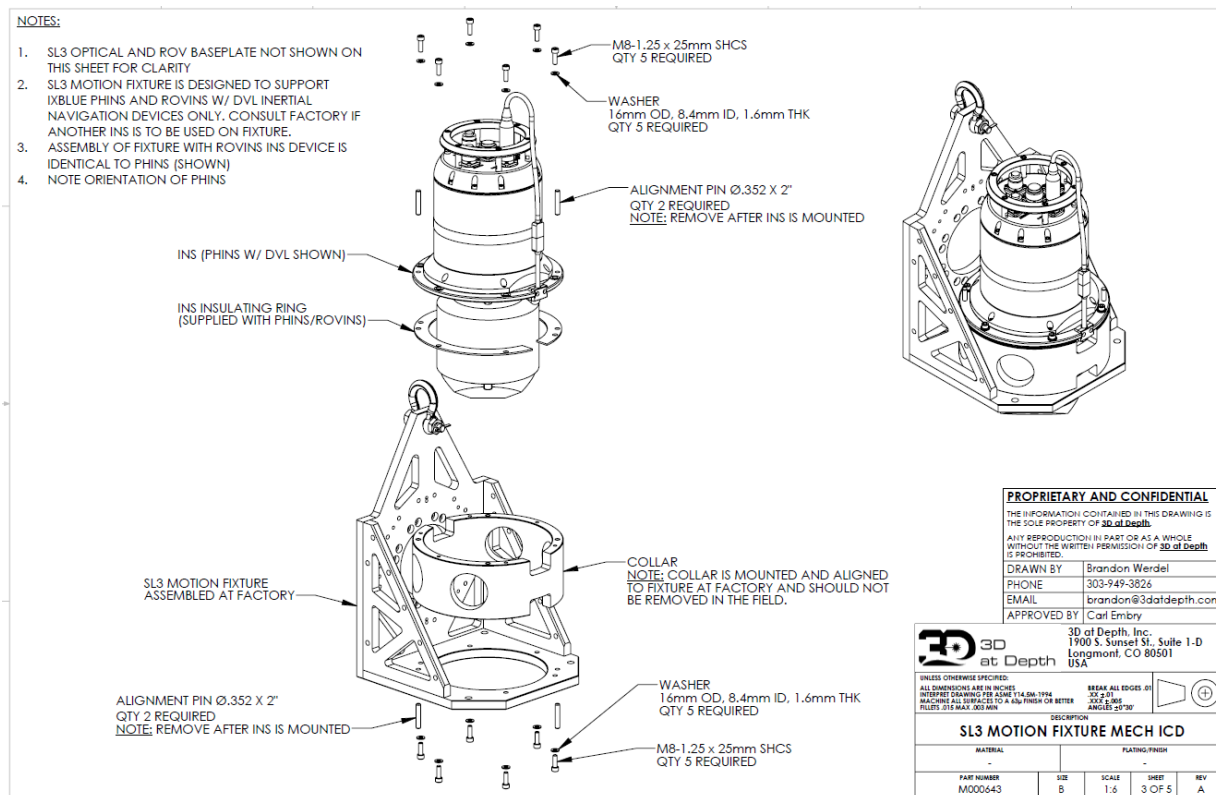
15.2.3. Mount Settings

The **Collar** and **Insulation Ring** options allow the user to increase or decrease the standoff between plate and INS. Select the orientation for the INS mounting. As the options are selected, images will show the user what is currently being accounted for. The standard **Collar** thickness is 0.1143 meters with no other washers or rings. The **Insulation Ring** is 0.003 meters thick (standard but thickness should be verified as this might be different). If the collar is not there then select the **No Collar** option, this will also set the distance to zero. It is possible to not have the collar but to have the insulating ring. The collar selection is also used to add thickness for items like an extra insulating ring, or any other standoffs that

might be used. These values should be measured and added to any value that is already there but only after selecting the **Collar** and/or **Insulating Ring** options since selection will modify the starting distance. See drawings below.

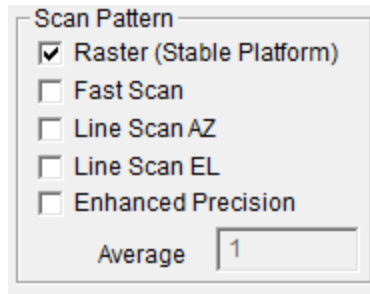


Detailed drawing showing the INS with the collar and insulation ring as well as the hardware frame.



16. Scan Patterns

The scan pattern area selects the type of scans that are allowed. The two line scans are only available if the "LINE_SCAN" box is checked in the laptop configuration. The Enhanced Precision averages a number of returns together for a single better measurement.



Raster is the standard rectangle type of scan. This has the number of points in a line defined by AZ and number of rows defined by points in EL.

Fast scan is a special type of raster scan that all the points can fit in memory at the same time, so rather than saving the data at the end of every scan line, the whole image is taken then downloaded. This allows motion and other faster changes to be imaged as quick as the scanning allows. This is limited in the number of points that can be asked for due to limited memory. For SL4, since all scans are fast already, this just keeps repeating the same scan over and over until the user cancels. The scan pattern is automatically reversed for optimization of mirror motions and this decreases the total scan time. For Spinners, there is no Fast scan option.

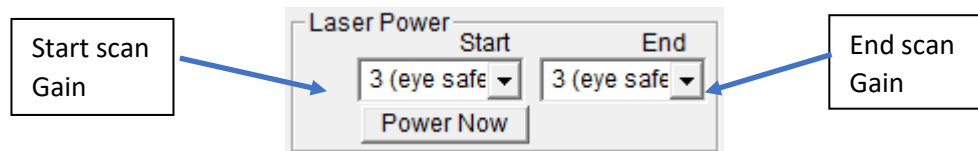
Line scan AZ is a scan that only uses the starting EL angle and goes from the Az start to Az end angle and repeats. This is mainly designed for motion jobs, but might get used for vibration or other object motion tracking. For Spinners, like MBARI, this is the primary scan type. The offset "El" angle is fixed as a parameter and fixed by the design of the system.

Line scan EL is a scan that only uses the starting AZ angle and goes from the El start to El end angle and repeats. This is mainly designed for motion jobs, but might get used for vibration or other object motion tracking.

Enhanced Precision Scan is a scan that takes several measurements of the same point and averages them together to reduce noise and improve accuracy. The number improves as $1 / \text{square root of } (N)$ where N is the number of averages that is performed. Normal standard deviation is 2 mm. So an average of 16 would improve this number by $2\text{mm} * 1/\text{sqrt}(16) = 0.5 \text{ mm}$. Since several shots are averaged together, it takes longer to acquire the data, recommend looking at the Scan Time Estimation section, before asking for too high of an average count. This scan will perform the same raster type of scan with points in Az and El, but at each of the points it does the Average. So, if the scan is 10 x 10 and the average is 16, that is $10 * 10 * 16 = 1600$ shots. It is recommended that Enhanced Precision scans be targeted to only the area of interest and it is usually prudent to perform a raster scan first to verify the field of view before any large average Enhanced Precision scan. This step may be skipped if the average is 2 or 3 since the time saved is lower. Enhanced Precision scans produce standard RIAAT files, but there are only 3 points returned, per shot, rather than 5 points. The strongest points 1 and 2 also have standard deviation and number of points averaged together information that is saved rather than the 4th and 5th point data in the RIAAT. If produce CSV is selected when processing the RIAAT with 3D Cloud, this data can be evaluated. The 3rd peak is just the averaged range data and no standard deviation information is known for this peak.

17. Laser Power

There are two fields for laser power. For SL3 and SL4 systems, the left is the start of scan laser power and the right is the end of scan laser power. The software will divide the scan into an equal number of power levels between the two values and adjust the laser power as the scan progresses. The power can increase, decrease or be the same. Each power level will get the same number of scan lines, rounded down if odd. The data will all be in one scan file, so processing it will look like just one scan.



For MBARI, the laser is an Evolas system. The first field is the laser power percent on. So a 50.0 laser command is 50% of full power. The GUI limits the user to less than 60% power right now, so that the attenuator is not damaged by high power. The second field is the attenuator and is also commanded as a percentage of full power. Thus a 50.0 attenuator command will drop the laser output by 50%. The laser classification is in Text on the Power button, to assist the user in knowing what classification of laser is about to be commanded. The calculated output power in milliwatts or microwatts is also displayed and updated each time the laser power or attenuator power is modified. Last is the telemetry value of what the laser power is right now. <todo – add image of laser power controls; label> When the Power button is pressed the laser will be turned on immediately – or as soon as the SHG reaches the correct setpoint temperature (usually it is already there, if not it will turn on the SHG TEC control). The laser power can be adjusted at any time. Power level of 0 is same as off. The last value commanded is used for the scan on power level <todo – verify where laser power is defined in a scan>

For MBARI the recommended way to get to a Class 1 laser is by setting the attenuator up to 99.9%, and then coming down as needed. Pay attention to the classification level on the button to stay in Class 1 if that is the goal. Reaching class 1 by attenuation is needed because the trigger cannot be seen in the system if the laser power is less than about 40% and without triggers, there is no data collected. Viewing of the waveform, including trigger level and return height, is best performed using the web factory mode (only available on SL4 systems). This can confirm if the trigger is large enough to be valid.

The “Power Now” button changes the current scan laser power dynamically. For SL4 and Pipe, if there is no ongoing scan, then it does nothing right now. MBARI will turn the laser on. Factory mode will allow the user to manually turn on a laser, if needed.

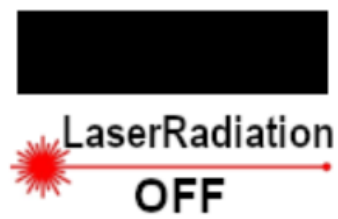
This ability was specifically asked for by both L3 and MBARI and is mostly a concern with motion scans or Fast and Line scans that just keep going. Laser power adjustment is why they often have to stop scanning and restart and there is potential for data missing while the system is stopped and then restarted on a moving platform.

Very large scans, like what occur in nuclear, also indicated that adjusting the laser power for a scan that was already running could save them significant time and prevent possible missing scan data. On multi-gain scans, the adjustment amount will follow through so that the next power level adjustment is increased by the same amount as occur when the command was issued. Provide feedback if this is the less common case and users would rather that the next power level stay the same (so this command is an early entry into the next power level).

18. Laser Safety

The GUI will display the current laser power hazard level. This system is capable of producing a Class 1 level (Gains 1-4), where direct exposure to the eye is not hazardous. This power level is similar to a laser pointer and viewing reflections on a diffuse surface are okay, however it is still recommended not to directly look into the beam at any time. All in-air testing should be done at the eye safe level, if at all possible. Gains 100-4000 produce a Class 3B laser beam, which is a hazard to the eye for direct exposure and specular reflections. A specular (shiny) surface reflection can be the same level of danger and eye protection is recommended (and provided) for all personal that could potentially observe the beam. Complex surfaces can reflect the beam in surprising and random directions. Even a single pulse from the laser at this level can cause damage to the eye. The movement speed of the laser (scanning) does not reduce the hazard level. Class 4 lasers (MBARI) have more power in the beam and even reflections can be dangerous especially if the beam is at full power. Proper protection is highly encouraged when working with system. Level 4 is dangerous to the skin and can cause burns. <todo – verify images, update if needed>

Power level indicators:



No laser power (off)



Class 1 (eye safe)



Class 3B (not eye safe)



Class 4 is not eye safe

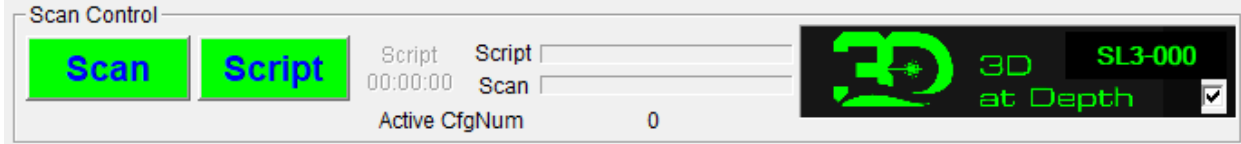
There is also a large button provided in case the system needs to be shut down quickly:



19. Scan and Script Buttons

Scan button starts a scan using the scan params configured in the 3D Collect dialog

Script button opens the **Script Dialog** (more detail in the next section)



The script with 00:00:00 is the current estimation of how long the current scan will take to complete. It is an estimation, and the actual scan can be longer or shorter, depending on conditions.

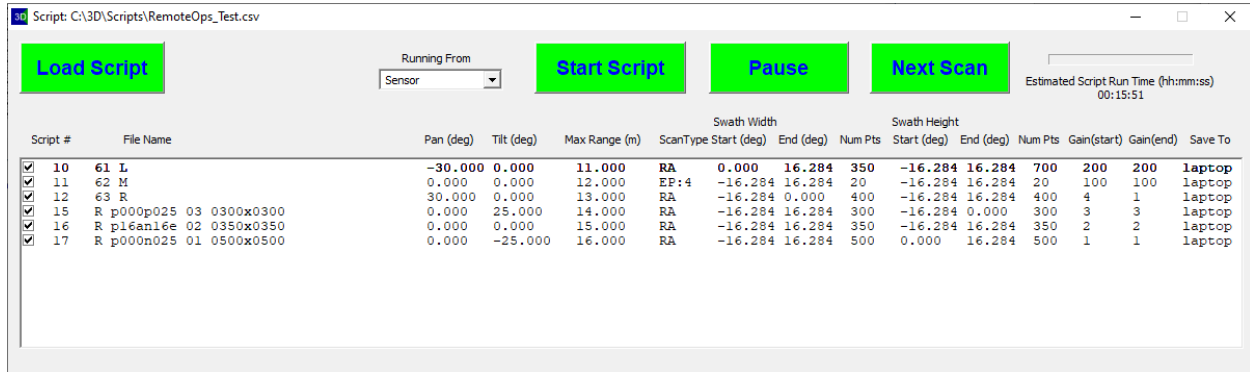
Script status bar is the percentage of the script that has run and shows how far along the script is. The script status is based on time, so it should move at a fairly even rate. The pan tilt motion is status as a single event for simplicity rather than looking at how close to the commanded angle it is and if overshoot has occurred and stability requirements. Scans are already status by percent complete so they are accounted for in smaller increments.

Scan status bar is the status percent of the current scan that is complete.

For running scripts on the sensor, which create CCI configurations, the Active CfgNum is the identifier of the CCI configuration of the scan. When running from the script dialog, the number of the first item in the script list is this identifier.

20. Script Dialog

Automatically Scan and move the Pan or Pan Tilt to another location and scan again. This automates several scans and moves for a user and allows fast operation of the sensor. <todo – update for Spinners / MBARI>



- Load Script Button:** Allows you to choose a script file containing scan instructions.
- Running from:** Run from 3D Collect or run from Sensor (default)
- Start Script Button:** Starts the loaded script files instructions. For selections running from Sensor this includes
- Pause Button:** Pauses a set of running scan instructions after the current scan completes.
Allows the user to resume but only if Running from 3D Collect.
- Next Button:** End current scan and move to next scan in script (running from 3D Collect).
- Boxes on left:** Used to enable or disable line. Can modify while scan is running to skip future scan options before the scan is started. Use Next if the scan is already going.

The Remote Operations Gen2 updated the scan type options for scripts. All scan types can now be specified, although the continues scan types will continue indefinitely until the user cancels. See the scan types table. Also note that if the File Name is less than 2 letters long, then the software will generate an automatic name for you. There are some examples in the above Script Dialog, entries 15, 16 and 17 all have automatic names assigned. By running the script from the sensor, the script can continue through short network interruptions and allows everyone to see in telemetry what the script running is. This is achieved by sending one scan item for each telemetry update and this cycles through the entire list basically sub commutating the information.

Scan Type	Description	Continuous
RA	Standard Raster Scan	No
EP:#	Enhanced Precision, # is the number of points averaged	No
AZ	Azimuth line scan	Yes
EL	Elevation line scan	Yes
FA	Fast Scan	Yes

The status of the scan is also reflected in the color of the script items after they run. Grey is a good status (no errors occurred), Red indicates that some kind of error occurred during the scan, Black is yet to be run. While running a script one line will be highlighted as green, indicating that line is currently being processed. Messages in 3D Collect will indicate the status of the Scan:

```
092001:SL Sensor: Ethernet CCI, Opened Configuration 12
092001:SL Sensor: Ethernet CCI, Opened Configuration 15
092002:SL Sensor: Ethernet CCI, Opened Configuration 16
092002:SL Sensor: Ethernet CCI, Opened Configuration 17
092002:SL Sensor: ERROR: Can not start scan, minimum depth not met
092002:SL Sensor: Scan Done, with status: RUN FAULT DEPTH
092002:SL Sensor: ERROR: Can not start scan, minimum depth not met
092003:SL Sensor: Scan Done, with status: RUN FAULT DEPTH
092003:SL Sensor: Moving Pan Tilt 30.0, 0.0
```

The Script Dialog will also show status. Here you can see Script number 10 and 11 are both red due to minimum depth not met for non-eyesafe laser power levels. Script number 17 is currently being run and is highlighted in green.

Script: C:\3D\Scripts\RemoteOps_Test.csv

Running From: Estimated Script Run Time (h:mm:ss) 00:15:51

Script #	File Name	Pan (deg)	Tilt (deg)	Max Range (m)	ScanType	Swath Width Start (deg) End (deg) Num Pts	Swath Height Start (deg) End (deg) Num Pts	Gain(start)	Gain(end)	Save To
10	61 L	-30.000	0.000	11.000	RA	0.000 16.284 350	-16.284 16.284 700	200	200	laptop
11	62 M	0.000	0.000	12.000	EP:4	-16.284 16.284 20	-16.284 16.284 20	100	100	laptop
12	63 R	30.000	0.000	13.000	RA	-16.284 0.000 400	-16.284 16.284 400	4	1	laptop
15	R p000p025 03 0300x0300	0.000	25.000	14.000	RA	-16.284 16.284 300	-16.284 0.000 300	3	3	laptop
16	R p16an16e 02 0350x0350	0.000	0.000	15.000	RA	-16.284 16.284 350	-16.284 16.284 350	2	2	laptop
17	R p000p025 01 0500x0500	0.000	-25.000	16.000	RA	-16.284 16.284 500	0.000 -16.284 500	1	1	laptop

21. Pan Tilt Control Dialog

Option for SL3 and SL4, not an option for Spinners like pipeline or MBARI. Power on the Pan or Pan Tilt, find home and go to the Stowed position (defined in User Parameters). The main GUI **Pan Tilt Control** button opens this dialog. For normal operation, select power first. Wait for the status to say initialization complete. The buttons will turn green when power is on indicating that the button can be pressed. The user may choose to perform Relative Moves (even before homing is done). This will move the Pan and Tilt the relative angle. To Home the motor, press the **Find** button to perform the homing operation. The 3D Pan Tilt does not need to home since it has an absolute encoder and it always knows where it is at. The user should always try to home, even if it fails for the Sidus units. The window can be closed for scanning operations. When powering down, select **Pan Tilt Control** from main GUI again to get this window back up. Usually, the Pan will be stowed before powering down so select **Stow** button, less the setup cannot move to the stow position for some reason. Last hit the **Pan Tilt Power** button to turn off. Once off, if the pan is needed again, then the process must be repeated including the **Find** of the home location. If home fails to work, then it is possible to use the Override, however, this may cause problems with data collection since the location of the Pan may change if the home feature is partly working or if power is removed, the next power on may not be in exactly the same place. User beware. Data taken when overriding the home location and power cycling multiple times will need cloud to cloud registration since the absolute position is not well known. The quality of the image is not impacted for a single scan or even a sector scan.

3D Pan Tilt and Kyst Pan Tilt do not require Homing. These are absolute sensors that always know positional location. Once powered, commands may be sent immediately. Relative commands may also be used. Note that the EC software enforces the min/max pan and tilt User parameters, so if the command results in an angle that is outside of the allowed user parameter range, the move will only move to the allowed in-range edge and stop. Redefine the allowable range if more movement is needed.

Kyst baud rate is fixed to 115200 in EC software and User parameter and/or Factory parameters for other baud rates is ignored. Currently the Kyst MUST be on the Aux port of the electronics bottle. There is no support for Kyst on the optical head (as of SL4 EC v7.01..03; SL3 EC has been coded but not yet tested with Kyst). There is no temperature sensor for Kyst so no fault protection on temperature can be enabled. The Supply, Current, Leak and Comp faults are also disabled (these are specific to 3D PanTilt). The average current level or brake status is not updated for Kyst (yet).



Pan Tilt Power Button: Turns on the pan tilt unit and indicates that the pan tilt is running.

Send Defaults: Send the default configuration settings, can take while to send.

Find Button: Rotates the pan tilt unit to a predefined Home location.

Zero: Resets Home to the current pan tilt location.

Home/Zero Status: Indicates Green if the Find/Home operation has been run.

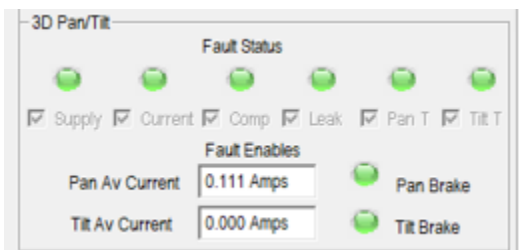
Stow Rotates the pan tilt unit to 90 for less invasive storing.

Message Bar Displays status of the last command.

Fault status For 3D Pan Tilt, the faults enabled and average current applied.

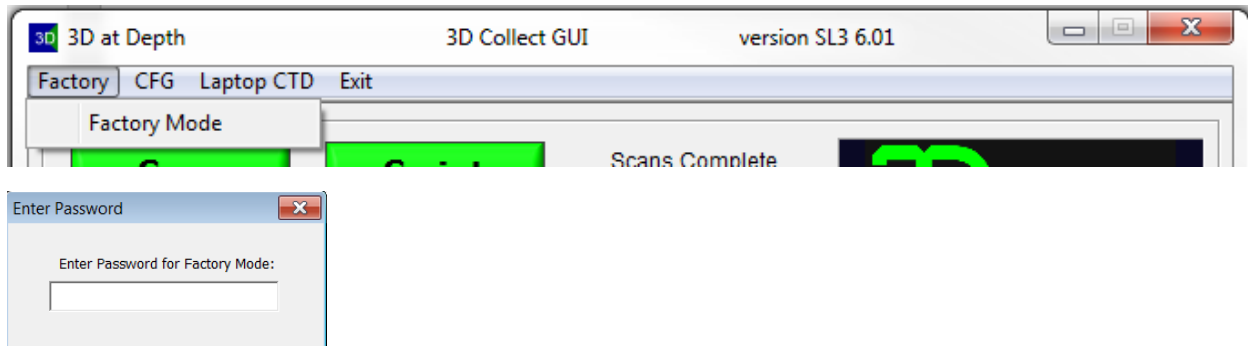
The 3D developed pan tilt has additional status. This includes the average current getting applied for each motor and whether the brake is on or off for each motor. Green light is break on, no light is off.

The Fault indicator lights are: Power **Supply** voltage minimum and maximum, **Current** limit, **Compensator** position minimum, **Leak** sensor (on/off), **Pan** Temperature maximum and **Tilt** Temperature maximum.



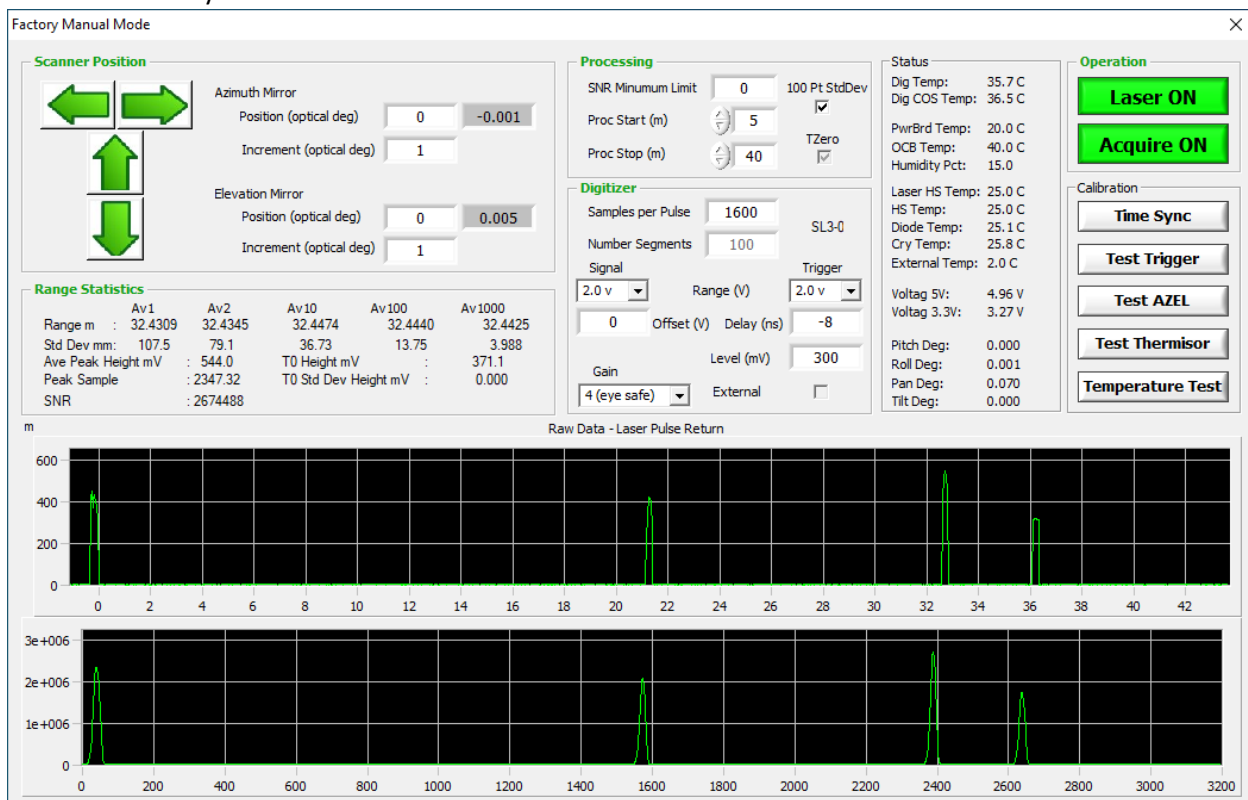
22. Factory Menu

Generally, the user should never have a need to run the factory mode and it is protected by a password, 3dmm. The screen is mainly used for detailed diagnostics and has limited usefulness for performing measurements. Factory modes is mainly used to look at digitizer settings, noise level, trigger level and internal temperatures, voltages and other housekeeping parameters.



23. Factory Settings Dialog

Operating mode for calibration, digitizer settings and to verify thermal performance. Below is an SL3/SL4 version of factory mode.



For Spinners like MBARI, some fields have been modified. The Az is control of pointing the motor and the El area is motor spin rate in Hz. Status reflects the system and some parameters are now fixed.
<todo – add screen shot of factory mode>

24. Factory Settings Control Layout Definition

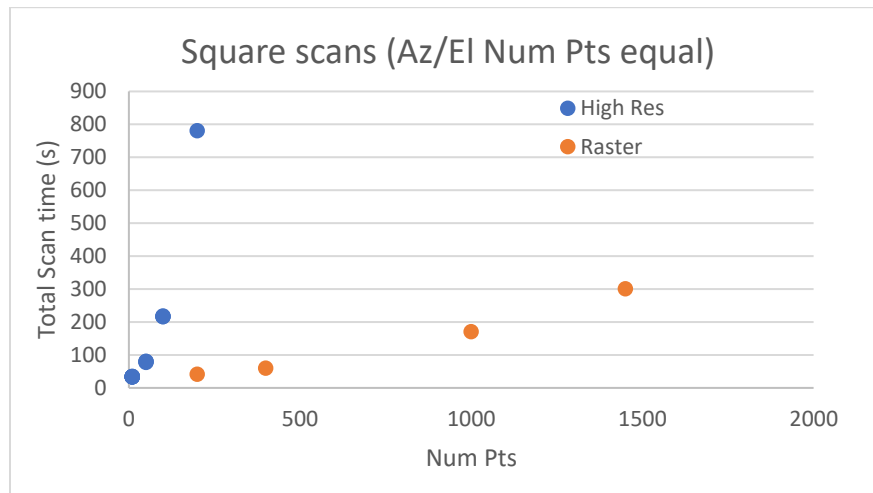
Define buttons and fields, not every item is defined. Some fields are populated from configuration files.

1. Scanner Position Section
 - a. Azimuth Position requested: The AZ position that is requested on enter
 - b. Azimuth Position actual: The actual AZ mirror position
 - c. Azimuth Increment: The AZ degrees that each arrow click moves the AZ
 - d. Elevation Position requested: The EL position that is requested on enter
 - e. Elevation Position actual: The actual EL mirror position
 - f. Elevation Increment: The EL position that each arrow click moves the EL
 - g. <todo – update>
2. Range Statistics
 - a. Range m: Distance from glass to the strongest return in range, m
 - b. Std Dev mm: Standard Deviation of the Range
 - c. Avg Peak Height mV: Average signal return in mv
 - d. Peak Sample: Maximum signal return in mv
 - e. SNR: Signal to noise ratio
 - f. T0 Height mV: Time Zero height in mV
 - g. T0 Std Dev Height mV: Standard Deviation of Time Zero
3. Processing section
 - a. SNR Minimum Limit: Minimum signal filter
 - b. Proc Start (M): Start processing at this range
 - c. Proc Stop (M): End processing at this range
 - d. 100 PT StdDev: Create 100 point standard deviation
 - e. TZero: Selected for SL3 unless TZero is undependable.
4. Digitizer section
 - a. Samples Per Pulse: Update Factory Configuration to keep settings.
how long to sample for (range dependate)
 - b. Number Segments: number of shots to combine
 - c. Signal Range V: Signal range
 - d. Signal Offset V: Offset for signal
 - e. Trigger Range V: Trigger range
 - f. Trigger Delay ns: Trigger Delay, set to negative value to pre-trigger
 - g. Trigger Level mv: Trigger level
 - h. Gain: Laser power level
 - i. External Trigger: SL3/SL4 is almost always internal
5. Status section
 - a. Dig Temp: Digitizer temperature C
 - b. Dig COS Temp: Digitizer Hot reject Temperature C
 - c. PwrBrd Temp: Power board temperature C
 - d. OCB Temp: Optical control board temperature C
 - e. Humidity Pct: Humidity in percent
 - f. Laser Hs Temp: Laser Hot Sink temperature C

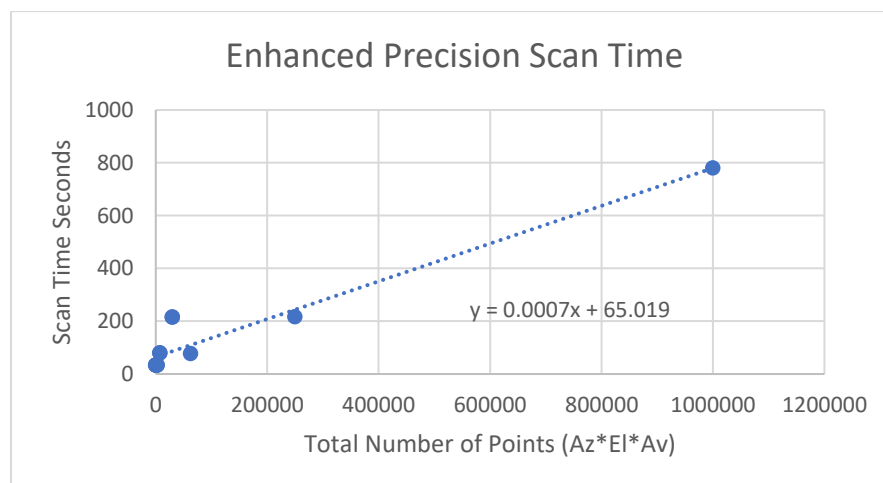
- | | |
|--------------------------------------|--|
| g. HS Temp | Hot Sink temperature C |
| h. Diode Temp | Diode Temperature C |
| i. Cry Temp | Cold side temperature C |
| j. External Temp | External Temperature C |
| k. Voltage 5v | 5 volt rail voltage |
| l. Voltage 3.3V | 3.3 volt rail voltage |
| m. Pitch Deg | |
| n. Roll Deg | |
| o. Pan Deg | |
| p. Tilt Deg | |
| 6. Operation section | |
| a. Laser Button: | Turns on the Laser |
| b. Acquire Button: | Turns on ability to capture laser return signal |
| 7. Calibration section | |
| a. Time Sync Button | Send a time message to EC to sync with laptop |
| b. Test Trigger | Vibration test (turn on Laser and Acquire) |
| c. Test AZEL Button | Az/EL stability test (CSV as well as statistics) |
| d. Test Thermistor | Log Thermistor value once per second |
| e. Temperature Test Button | Temperature calibration test sequence |
| 8. Raw Data Laser Pulse Return top | Can zoom in, double click reset. Y is mV, X is m |
| 9. Cleaned Laser Pulse Return bottom | Can zoom in, double click reset. Y is counts, X is samples |

25. Scan Time Estimation

Estimation of the scan time (SL3)



The above shows the scan time for square sized raster scans. This would read at the 400 pts location is 400 pts in Az and 400 pts in El which takes 60 seconds on an SL3 or about 10 seconds for SL4 while MBARI and pipeline would be done in less than 1 second. The Enhanced Precision scans had between 3 and 25 points averaged together and the amount of averaging did not impact the overall scan time by much (2-3 seconds) over the total time. For averaging a lot of points together the graph below is more useful. The x value is the total number of points in a scan, which is the Az points*El points*Average. This data was generated with averages of between 3 and 25 on a SL3 system. For SL4, the laser rate of about 40 KHz is the time it takes to collect the data. Time to collect a raster is number of points / laser rate and this scales. For SL4 EP scans, processing time is approximately twice the collection time – so a 60 second collection takes 120 seconds to process.



Due to the long scan times that can be encountered, large scans with a lot of averaging take long enough that static scan assumptions may not hold well over the entire scan area. If there is motion or water conditions change, the averaging of lots of points may produce points that have more noise not less noise. In practice keeping the average under 300 points seems to be an upper limit of what can be

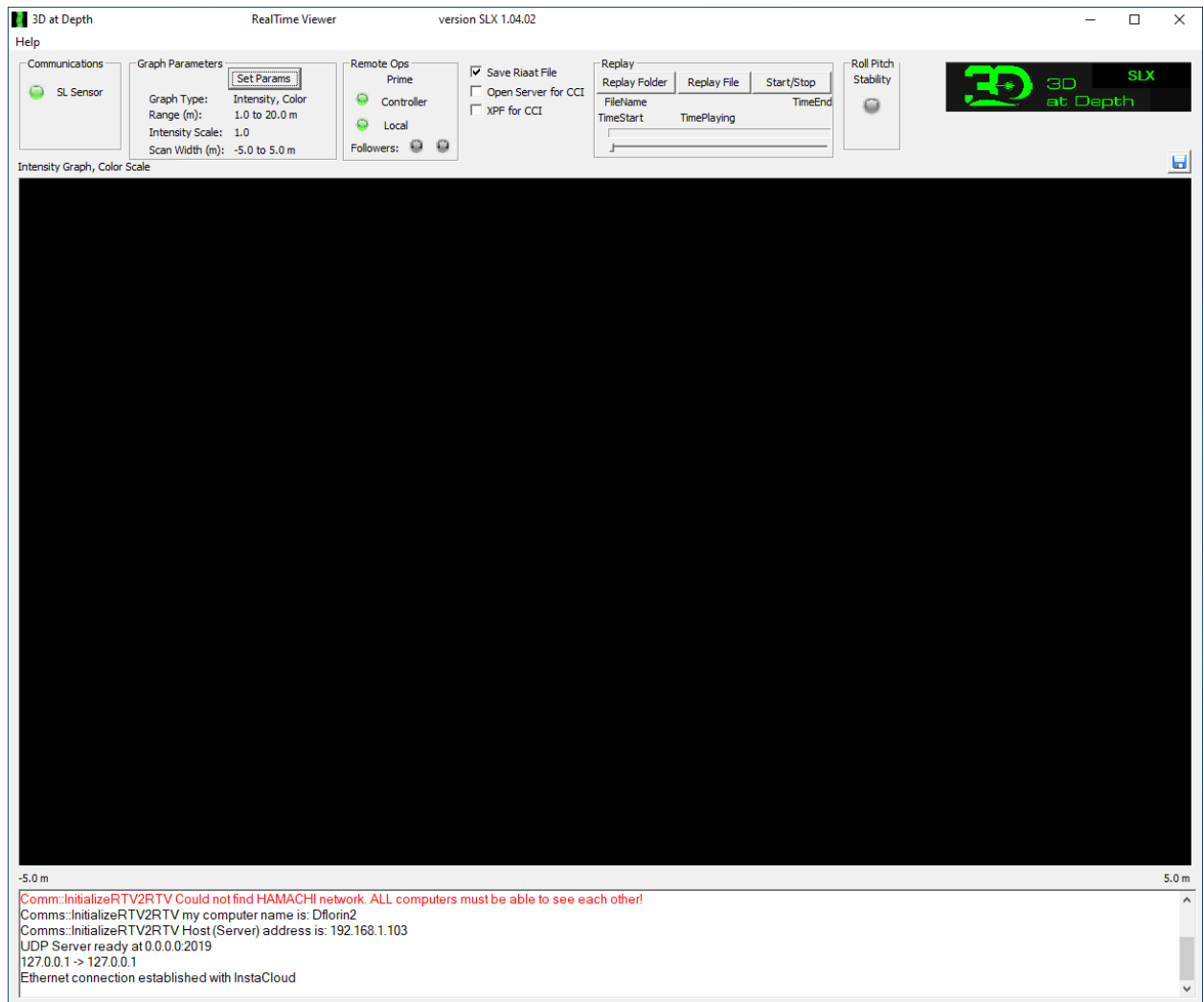
done and still improve results. The data should improve as $1/\sqrt{\text{number of points averaged}}$ so if 25 shots are averaged together, the noise should reduce by 1/5 of the single shot noise. For a standard SL3 this would be an improvement from around 2 mm to around 0.4 mm for a moderately strong return. SL4 has the same single shot accuracy of 2 mm. In the GUI is a scan time estimation in the top right hand side of the application, for any particular scan; this uses the data here to make that scan time calculation and it is adjusted for SL3 or SL4 sensor type.

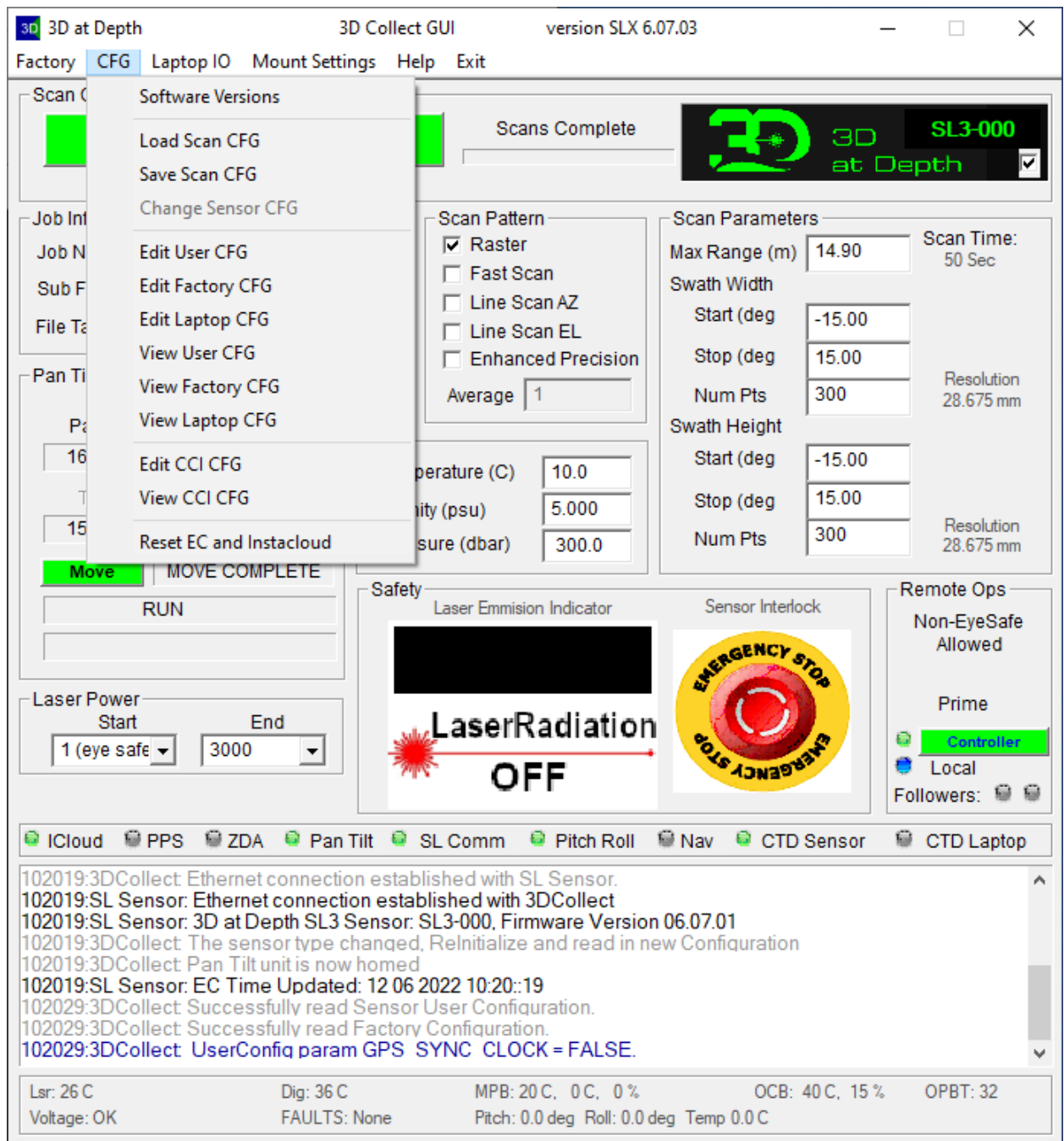
In general the SL4 is 6 times faster than the SL3 in time to collect data (scan time). This does not apply to pan tilt movement or warmup time so the actual end to end savings is less than a 6 x improvement. Data generation rate can be ~40 MB/second in bandwidth from InstaCloud to RTV. If ethernet communications can not support this transfer rate, then the processing of the scan data can be less, although the SL4 will still collect the data at full rate. The data is internally buffered and several of the largest scans can be buffered at the same time (multiple minutes of data). Even the largest buffer can only buy time, and the data must be moved off before the next scan can take place.

MBARI scan time is fixed by the laser scan rate and this can be from 200 Khz to 350 Khz. Collection time is the laser pulse rate. As before, the time to process the collected data can be longer than time it takes to collect. The processing usually keeps up at 200 Khz but is currently falling behind at 350 Khz. The fastest rate means that the buffer starts to fill up and it eventually runs out of space for new scan data. This will halt the scanning process and allow the data acquired to be processed off of the system. At last check this was on the order of two minutes or so. Future processing enhancements will allow the system to keep up even at the 350 Khz production rate.

26. Standard Operation

1. Start the sensor this will start the EC and InstaCloud applications on the sensor
2. Allow time for the EC application running on the sensor to initialize
3. Start 3D Collect from the desktop shortcut this will also start the Realtime Viewer application on the laptop after the user put in the appropriate password: 3d
4. Verify that Realtime viewer (RTV) has successfully connected to the InstaCloud application running on the sensor (**SL Communication** button is Green, message states communication established. Local LED will flash green/blue on each message exchanged to indicate the connection is alive.) RTV is normally automatically started with 3D Collect, if the name is incorrect the 3D Collect may report an error message and the user can launch or rename the RTV file and restart 3D Collect. Images will be created when a scan is running, if communication is successful.





- From the 3D Collect GUI choose **CFG/Edit User CFG** from the menu items. This will open the **Sensor User Configuration** dialog for viewing and editing

Sensor User Configuration

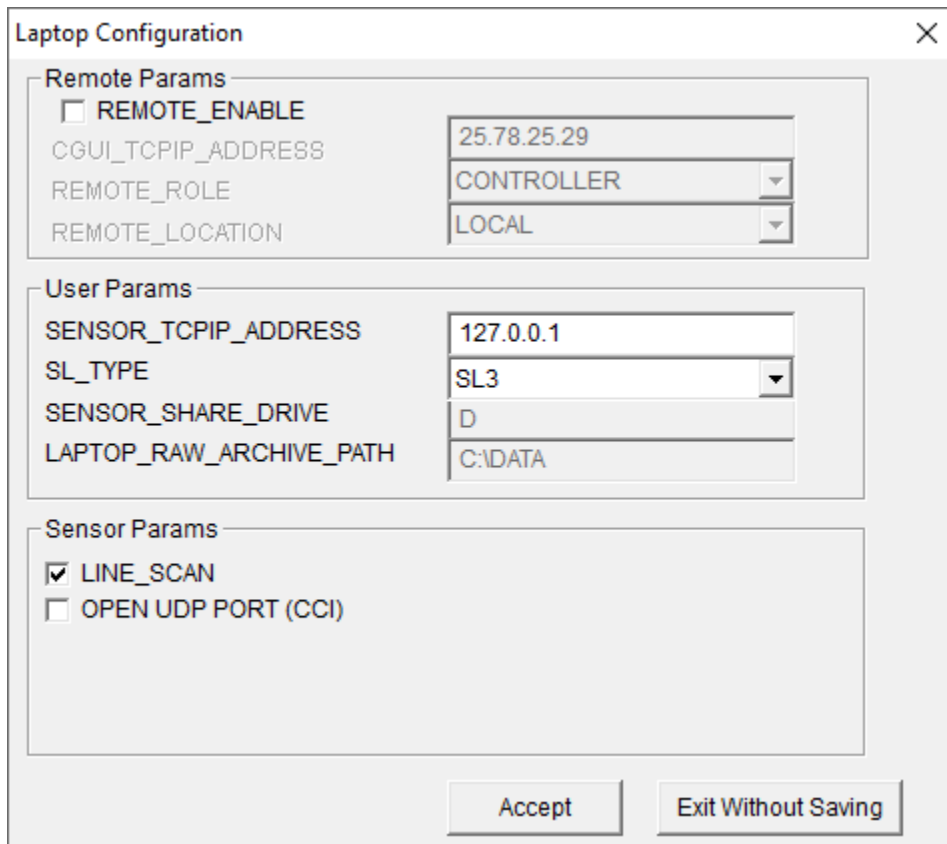
Parameters	
SENSOR_RAW_ARCHIVE_PATH	D:\DATA
MOTION_SCANS_PER_FILE	500
PAN_PRE_HOME_ANGLE	0.000
TILT_PRE_HOME_ANGLE	0.000
PAN_HOME_TIMEOUT_SEC	150.000
TILT_HOME_TIMEOUT_SEC	60.000
PAN_SPEED_DEG_SEC	1.4000
TILT_SPEED_DEG_SEC	1.4000
PAN_OVERSHOOT_DEG	4.000
PAN_TILT_STABILITY_DEG	0.300
CTD	Laptop Operator
EMERGENCY_SHUTDOWN	TRUE
GPS_SYNC_CLOCK	NO_TIME_SYNC
L_D_CABLE_SET	PRIMARY
ARCHIVE_RAW_DATA	FALSE
ARCHIVE_RIAAT_DATA	FALSE
SENSOR_CFG_PATH	D:\3DICFG
INS_DATA_TYPE	NO_NAV_DATA
PAN_STOW_DEG	90.0
TILT_STOW_DEG	20.0
PAN_POS_SOFT_STOP_DEG	100.0
PAN_NEG_SOFT_STOP_DEG	-100.0
TILT_POS_SOFT_STOP_DEG	29.0
TILT_NEG_SOFT_STOP_DEG	-29.0
PITCH_ROLL_LOG_RATE_SEC	1

PAN_TILT_TYPE	3D_PANTILT
PAN_TILT_LOCATION	OPTICALHEAD
PAN_TILT_METHOD	COMM
PAN_TILT_PORT	2
PAN_TILT_BAUD_RATE	115200
☒ Pan Only ☐ Pan and Tilt ☐ Connected to Pan	
☒ Auto Brake	
PAN_ACCEL_DEG_SEC2	500.0000
TILT_ACCEL_DEG_SEC2	500.0000
PAN_TILT_HOLD_AMPS	0.12500
PAN_LOGGING_PERIOD_S	4
Fault Enables	
☒ PT Supply V	☒ OCB Temperature
☒ PT Current A	☒ OCB Humidity
☒ PT Linear Comp	☒ PB Temperature 1
☒ PT Leak	☒ PB Temperature 2
☒ Pan Temperature	☒ PB Humidity
☒ Tilt Temperature	☒ Digitizer Temperature
☒ OPB Temperature	☒ Laser Temperature
☐ Min Depth Eyesafe	☐ Watchdog
Fault Parameters	
WATCHDOG_TIME_S	100
MIN_EYESAFE_DEPTH_M	15.00

Accept Exit Without Saving

- By default RIAAT data files are only saved to the laptop. In order to save RAW and/or RIAAT files to the sensor, you must change the corresponding **ARCHIVE_RAW_DATA**, **ARCHIVE_RIAAT_DATA** values to TRUE
- If you change any parameter values choose **Accept** to write the new UserParams.bin config file to the sensor. Follow the prompts to allow time for the configuration file to successfully write to the sensor before restarting the sensor. It is also recommended to restart the GUI if parameters are changed since status lights are enabled or disabled base on these settings and it needs to pick them up. As of 3D Collect v6.04.09 the GUI will pick up changes without shutting down however any parameters that affect RTV, EC or InstaCloud still require restart.

- From the 3D Collect GUI choose **CFG/Edit Laptop CFG** from the menu items. This will open the **Laptop Config** dialog for editing

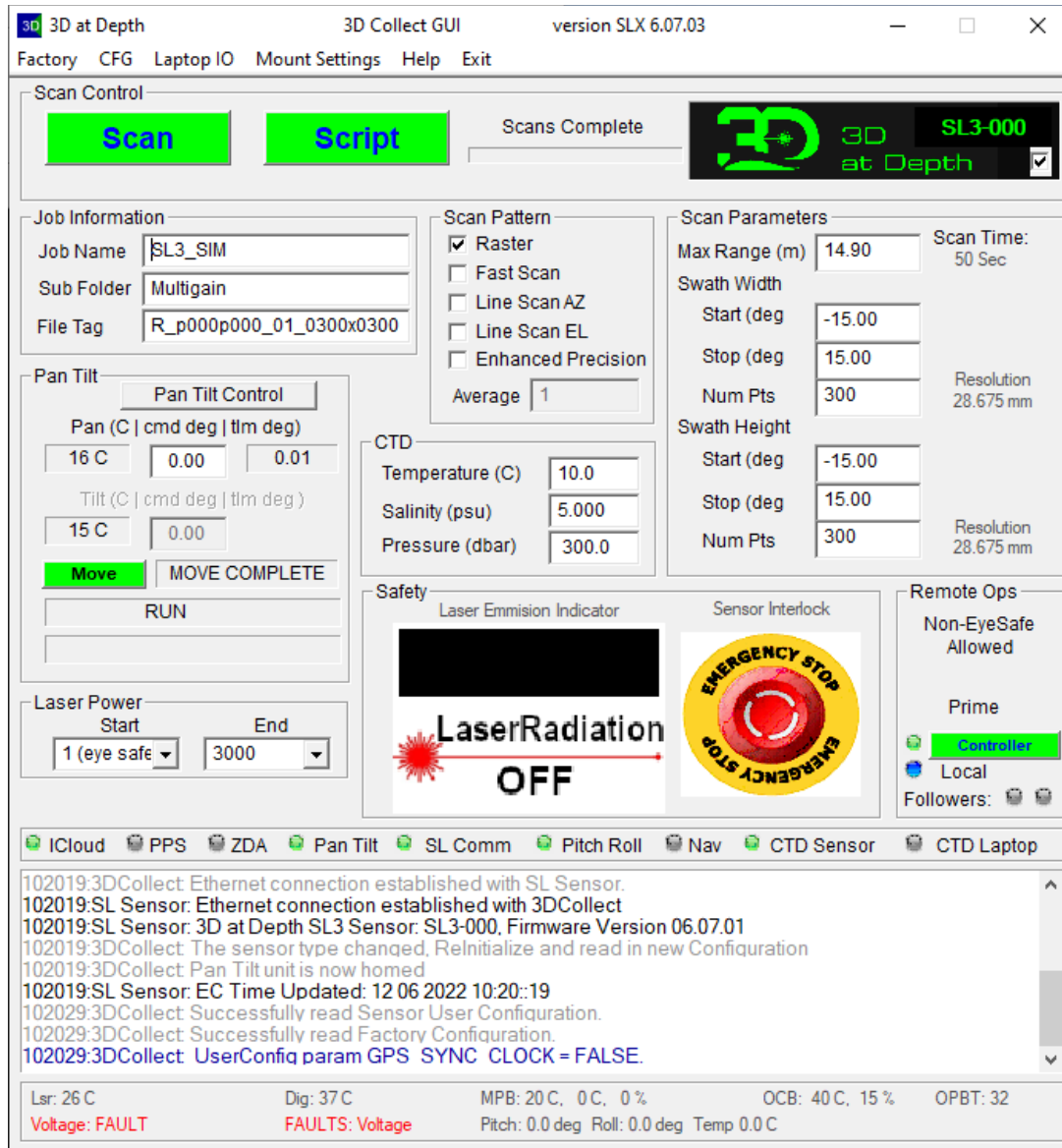


The screenshot shows the 'Laptop Configuration' dialog box with three sections: Remote Params, User Params, and Sensor Params. The Remote Params section includes a checkbox for REMOTE_ENABLE (unchecked), a text field for CGUI_TCPIP_ADDRESS (25.78.25.29), a dropdown for REMOTE_ROLE (CONTROLLER), and a dropdown for REMOTE_LOCATION (LOCAL). The User Params section includes a text field for SENSOR_TCPIP_ADDRESS (127.0.0.1), a dropdown for SL_TYPE (SL3), a text field for SENSOR_SHARE_DRIVE (D), and a text field for LAPTOP_RAW_ARCHIVE_PATH (C:\DATA). The Sensor Params section includes a checkbox for LINE_SCAN (checked) and a checkbox for OPEN_UDP_PORT (CCI) (unchecked). At the bottom are 'Accept' and 'Exit Without Saving' buttons.

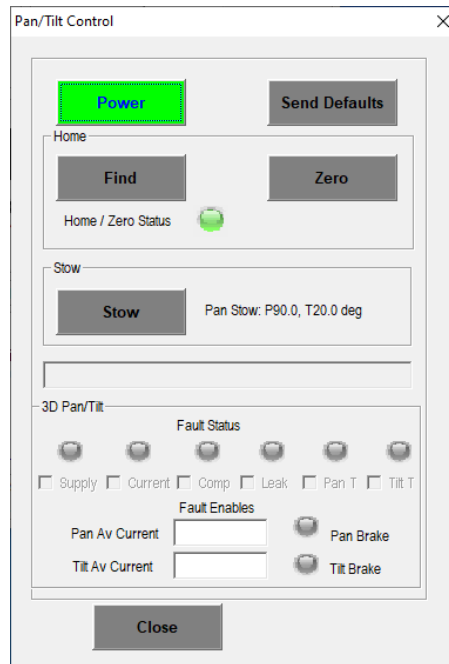
Section	Parameter	Value
Remote Params	REMOTE_ENABLE	☐
	CGUI_TCPIP_ADDRESS	25.78.25.29
	REMOTE_ROLE	CONTROLLER
	REMOTE_LOCATION	LOCAL
User Params	SENSOR_TCPIP_ADDRESS	127.0.0.1
	SL_TYPE	SL3
	SENSOR_SHARE_DRIVE	D
	LAPTOP_RAW_ARCHIVE_PATH	C:\DATA
Sensor Params	LINE_SCAN	☒
	OPEN_UDP_PORT (CCI)	☐

- If you change any parameter values choose **Accept** to write the new LaptopParams.bin configuration file to the laptop. Any of these changes are automatically picked up by 3D Collect and do not require restarting the GUI.

10. Verify that 3D Collect has started and successfully connected to the InstaCloud and EC applications running on the sensor. (**ICloud** and **SL Comm** buttons are Green)



11. If using a Pan or Pan/Tilt, Click **Pan Tilt Control** button this will bring up the **Pan Tilt Control** dialog
12. Click the **Pan Tilt Power** button this will power on and initialize the Pan Tilt. This step is complete when you receive the “Init Complete” message



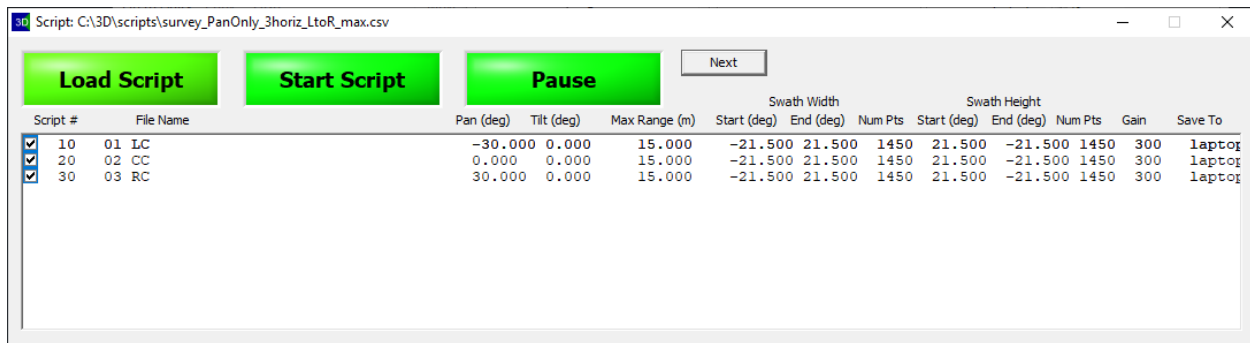
13. Click the **Find** button to locate the factory defined Pan Tilt 0/Home position. This step is complete when you receive the “Home Complete” message.

*** Warning Note

Should you wish to redefine the PanTilt home position, first home the PanTilt then move it to the desired Home location and click the “Override” button but only AFTER it is already homed. It is recommended that you first home the pan tilt before using the override since motion that travels through the home location will reset the motor position. Thus, if the override is done without homing, then the travel must never go through the true home location otherwise the position will be reset and the override location will change. If the Sidus unit cannot find home or the motion is severely limited so that home cannot be reached, then using Override without Homing is acceptable, just not ideal.

14. Close the **Pan Tilt Control** Dialog
15. Go to the 3D Collect GUI. Fill in the “Job Information Section”
 - a. **Job Name** <Job Name>
 - b. **Sub Folder** <Scan location>
 - c. **File Tag** <sensor>_<pan>_<tilt>_<number of pts>_<laser power>
 - d. Example: BlindFaith\StationManifold\ <DateTime>_SL301_0_0_350_1000
16. Set CTD values if manual mode, otherwise verify that they are getting updated (any automatic mode). The CTD should have a green status light on left, if the sensor is good. Right light is the Laptop CTD (if external CTD is being used) and it will be green if it is good. Grey is ok if not used.
17. Set up a Test/Fast Scan
 - a. Set Scan Pattern to **Fast Scan**

- b. Set Scan Parameters
 - i. **Max Range (m)** depending on estimated distance to target
 - ii. **Swath Width Start(deg)/Stop(deg)** and **Num Pts**: -15 to 15 and 350 pts
 - iii. **Swath Height Start(deg)/Stop(deg)** and **Num Pts**: -15 to 15 350 pts
 - c. Set Pan Tilt location (if have PanTilt)
 - i. Enter the desired pan and tilt positions
 - ii. Click the **Move** button
 18. Press the **Scan** button to run the fast scan.
 - a. Verify correct scan location in Realtime Viewer (ie the expected target is visible in the scan)
 - b. Verify correct Laser power intensity in Realtime Viewer (ie points located on the main target have enough definition and are not saturated)
 19. If the Fast scan looks good in Realtime Viewer click the **Script** button to bring up the **Script** dialog



20. Click on the **Load Script** button select the script for the scan you wish to run.
 - a. Verify that the Laser Power settings in the script are the same or have been adjusted with respect to your fast/test scan analysis. There is now a start gain and end gain laser setting option for v6.06.02 and above. Older scripts will automatically make end gain the same as the start gain.
 - b. Verify that the pan tilt settings in the script are the same or have been adjusted with respect to your fast/test scan analysis.
 21. Click the **Start Script** button.
 - a. Verify scans running in the script still look correct in the Realtime Viewer

27. Remote Operations

This is just a quick reference. Full documents are in Software SharePoint > Documents> Remote Operation. On the Laptop (ship side) first make sure the 3D Collect GUI is closed.

- Start and connect Hamachi
- Start the 3D Collect GUI with defaults (Prime selected). Verify Laptop parameters, sensor computer name and the SL type (SL3 or SL4). Also check User parameters if connection to sensor is successful and make any changes if they are known.
- Start 3D Cloud Motion (can be started at a later time, but put here). The Settings for Master and Puppet IP address must be correct. Puppet is this machine IP address. Master is the OnShore Computer IP address (look in Hamachi, if not connected yet come back to this). When settings are done unselect the “Master” box, that will make this a puppet.
- Now connect to the OnShore computer (VM machine) using TeamViewer
- Start and connect Hamachi
- Start the 3D Collect GUI as a remote with role Observer or Standby (Password required). Verify Laptop parameters and specifically the CGUI IP address (of the Sensor Laptop) is correct. Restart if the IP address needs to change.
- Start 3D Cloud Motion. The Settings for Master and Puppet IP address must be correct. Puppet is this the Sensor Laptop IP address. Master is this machine IP address. If not done the first time, check the Sensor 3D Cloud settings and the Maser IP address. Note that the “Master” box should remain checked for this side.
- Configure the 3D Cloud Remote Settings first (directories will come from scan parameters). Filters should be weaker or minimum set.
- Configure the Maser Target folder, select input as CRIAAT and select output products. Filters can be stronger on the Master side.
- Start Remote processing
- Start Processing on the Master side.
- In the 3D Collect ask for Control. The Scanner Laptop will have to OK the transfer or the watchdog wait time must be paid.
- Scan away.

28. Command and Control Interface (CCI)

This allows loading a configuration onto the sensor for a scan that will later be activated by running a very small activation command. The telemetry and command set is much smaller in size and this allows it to run over a very low frequency connection, like an acoustic modem. To enable this interface select Open UDP port in the Laptop configuration:

Laptop Configuration
✕

Remote Params

☐ REMOTE_ENABLE

CGUI_TCPIP_ADDRESS
25.79.200.102

REMOTE_ROLE
CONTROLLER

REMOTE_LOCATION
LOCAL

User Params

SENSOR_TCPIP_ADDRESS
192.168.1.87

SL_TYPE
SL4

SENSOR_SHARE_DRIVE
/var/lib/3d

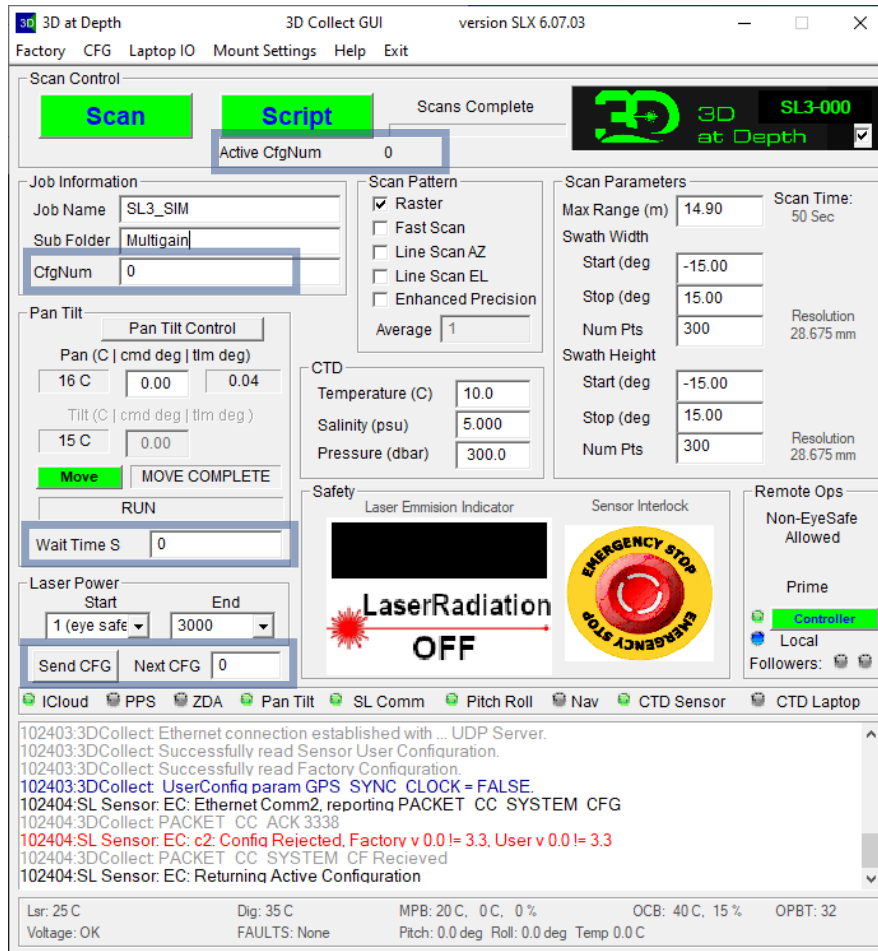
LAPTOP_RAW_ARCHIVE_PATH
/data

Sensor Params

☐ LINE_SCAN
☒ OPEN UDP PORT (CCI)

Accept
Exit Without Saving

This places the GUI into a mode to send configuration settings over a UDP connection. The parameters needed to define a complete configuration are pulled from many sources – user parameters, mount parameters, and will disable pan tilt moves if the pan tilt is now powered on. Most of the time these parameters are correct and appropriate. Sometimes they need to be modified slightly, like at what water depth the laser power level can be larger than eye safe. The configuration editor can be used to further tune any CCI configuration definitions that are needed before running the scans. Linking scans together into scripts is another example of turning with the editor.



If configuration number is zero, then it will run that configuration scan immediately. If the configuration number is non-zero, then the scan settings are saved on the sensor when Send CFG is pressed and uses CfgNum (set to a non-zero value) when Scan is pressed to command the sensor to load the configuration file defined by CfgNum that was saved on the sensor. Look at *SL Sensor CCI_Manual_C3.pdf* (or whatever is the latest version) for a more complete description on how the interface works. The structures are defined in *SL Sensor ICD_C7.pdf*.

This interface is especially suited for low or intermittent communication.

The main GUI has a few modifications for CCI. If the CCI command option is selected in Laptop parameters and the “With PanTilt” upgrade as well, then the GUI will show additional CCI specific items. These fields are different or hidden if not using the CCI interface. The Active CfgNum is what is reported in telemetry. CfgNum is the user provided number for starting a scan or naming a saved scan. Wait Time S is the amount of time in seconds to pause between a pan/Tilt move and a scan; this field is only available if the version 1 is active by selecting “With PanTilt” in laptop parameters. Send CFG will send the settings in the GUI to the sensor and create a CCI configuration binary file. Next CFG will call another configuration file when the current CfgNum is run. This allows scripting with multiple scans/pan tilt moves and/or wait times. The Next CFG is only available in version 1. To add a pan tilt move to the configuration, the Pan should be powered on and the command angles entered (do not need to

command the move) when the “Send CFG” is selected. Use the CCI parameter editor/viewer to verify settings, or modify them, as needed.

29. Network and Ports

Here is a list of the network ports used in the system:

// Standard communication ports

EC_PORT_COMM	= 2000; // TCP, GUI cmds (from CGUI to EC)
EC_PORT_DATA	= 2001; // TCP, Factory mode data (from EC to CGUI)
EC_PORT_XFER	= 2002; // TCP, This is RIAAT data from InstaCloud
EC_PORT_CTD	= 2003; // TCP, CTD over ethernet (from CGUI to EC)

// Dynamic communication ports for Navigation Data

EC_PORT_NAV_CTD	= 2005; // TCP, iXBlue NAV_CTD to EC
EC_PORT_NAV_LONG	= 2006; // TCP, iXBlue NAV_LONG to EC
EC_PORT_GPS_ZDA	= 2007; // TCP, iXBlue GPS_LIKE to EC
EC_PORT_PHINS_STD	= 2008; // TCP, iXBlue PHINS_STD to EC

// CCI communication ports (very low bandwidth goal)

EC_CC_PORT_COMM	= 2010; // UDP, CCI GUI cmds
EC_CC_PORT_TLM	= 2011; // UDP, CCI GUI tlm
EC_CC_PORT_TEXT	= 2012; // UDP, CCI GUI messages

// 3D Cloud Motion data processing

CRIAAT_PORT_COMM	= 2015; // UDP, 3D Cloud Motion, Remote Ops chain
CRIAAT_PORT_TLM	= 2016; // UDP, 3D Cloud Motion, Remote Ops chain

MSG_SERVER_PORT	= 2021; // InstaCloud messages - not implemented //(messages back through EC to CGUI)
-----------------	--

// Added for Remote Operations Gen 1

EC_PORT_COMM2	= 2025; // TCP, GUI IO - Remote ops chain, follower 1
EC_PORT_COMM3	= 2026; // TCP, GUI IO - Remote ops chain, follower 2
EC_PORT_REMOTE	= 2027; // UDP, - Remote ops chain, setup
INSTACLOUD_PORT_COMM2	= 2017; // TCP, RTV IO - Remote ops chain, follower 1
INSTACLOUD_PORT_COMM3	= 2018; // TCP, RTV IO - Remote ops chain, follower 2
INSTACLOUD_PORT_REMOTE	= 2019; // UDP, - Remote ops chain, setup

EC_CC_RTV_CFG	= 2100; // UDP, CCI - command and control interface for RTV config //(not implemented yet).
---------------	--

Support software for data collection systems and for onshore to offshore communication:

- Hamachi VPN : TCP 12975 and 32976, UDP 17771
- TeamViewer : TCP 80, 443, and 5938. UDP 5938
- MS Teams : TCP 80 and 443, UDP 3478 through 3481
- Clear Comms types depends on type, look here

<https://clear-com.atlassian.net/wiki/spaces/SF/pages/178749458/Minimal+Clear-Com+Port+Requirements>

30. Field Power Supply

The FPS is an AC to DC power supply that is able to power, and allows communication to, the sensor.

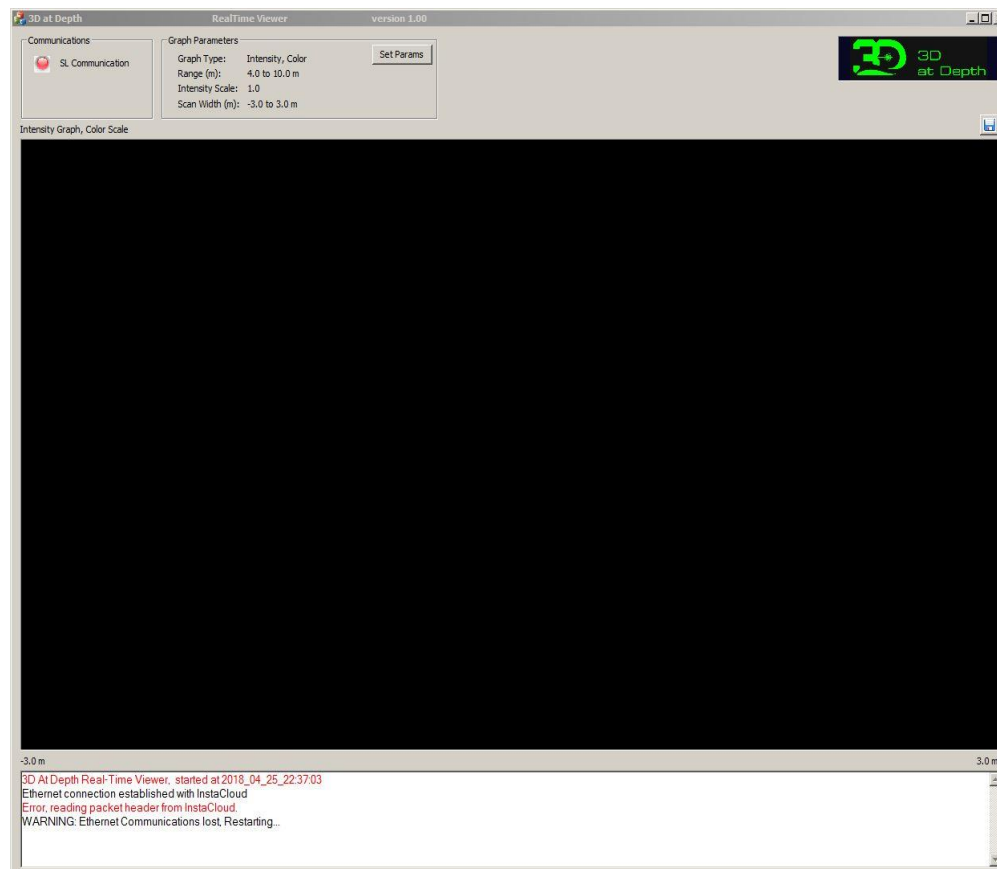
The input power is the US standard of 110-120 volts, 60 Hz, AC power. This produces a 26 volt DC power for the electronics bottle which then powers the optical head. The system has an AC plug and the main connector cable for the system. There is an RJ45 ethernet cable spliced into the cable that is the primary communication with a sensor. The RJ45 is usually attached to a network switch that also is connected to

the laptop, or if the only other device that needs to talk to the sensor is the laptop, the cable can be connected directly to the laptop. The FPS box has a rocker switch to turn power on or off. Fans provide air cooling to the power supply. The box provides protection to the system and a handle for easy transportation.

31. Trouble Shooting

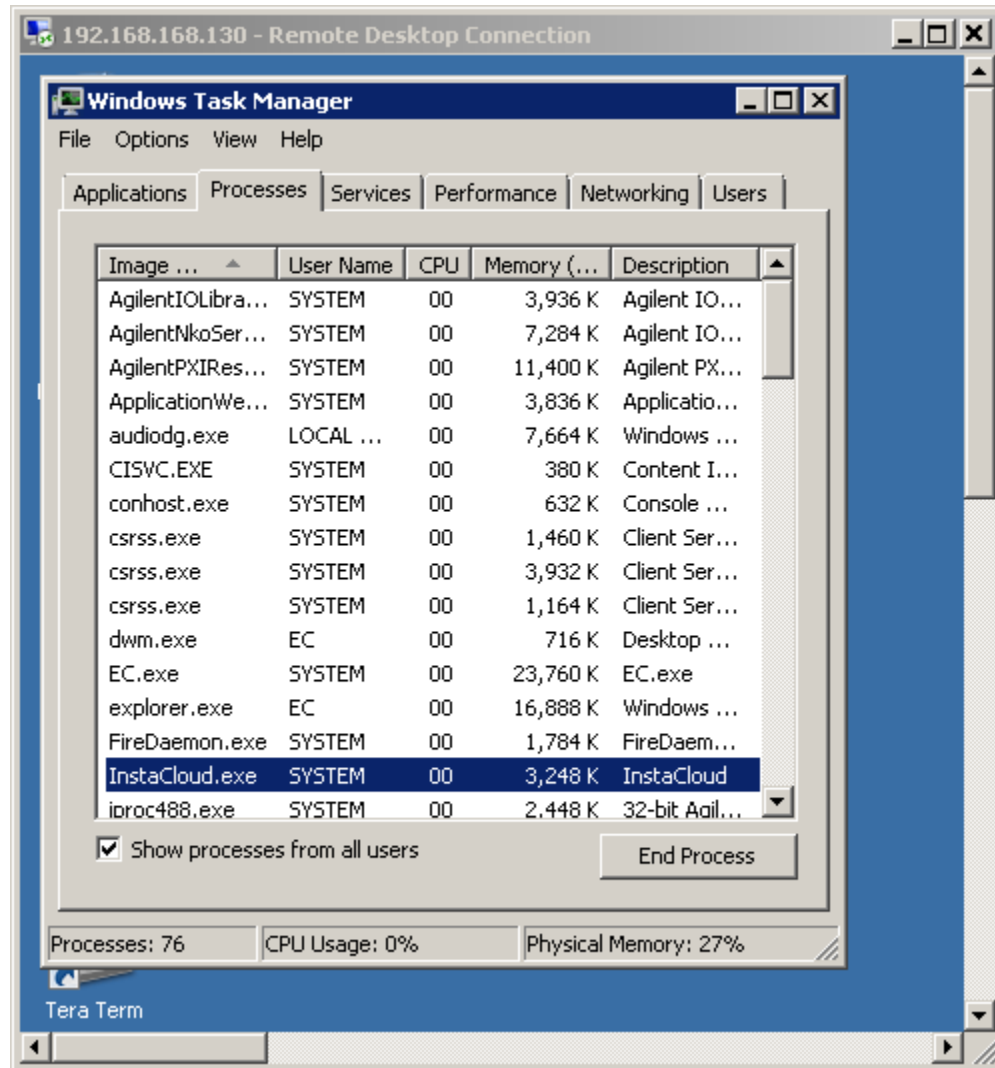
If you are having trouble viewing scans through the Realtime Viewer work through the following steps to find your issue.

1. Check network connection laptop to sensor
 - a. From the laptop command line ping 192.168.168.130 verify successful reply. If you don't receive a successful response then there is a problem with the ethernet connection between the laptop and the sensor.
2. Verify communication between Realtime Viewer and InstaCloud. Realtime Viewer should give a message saying "Ethernet connection established with InstaCloud". If it gives a message saying "Ethernet communications lost", check that InstaCloud is running correctly on the sensor.



- a. To verify that InstaCloud is running, Remote Desktop into the sensor (IP Address: 192.168.168.130, Username: EC, Password: 3d). On the sensor, go to Task Manager(type

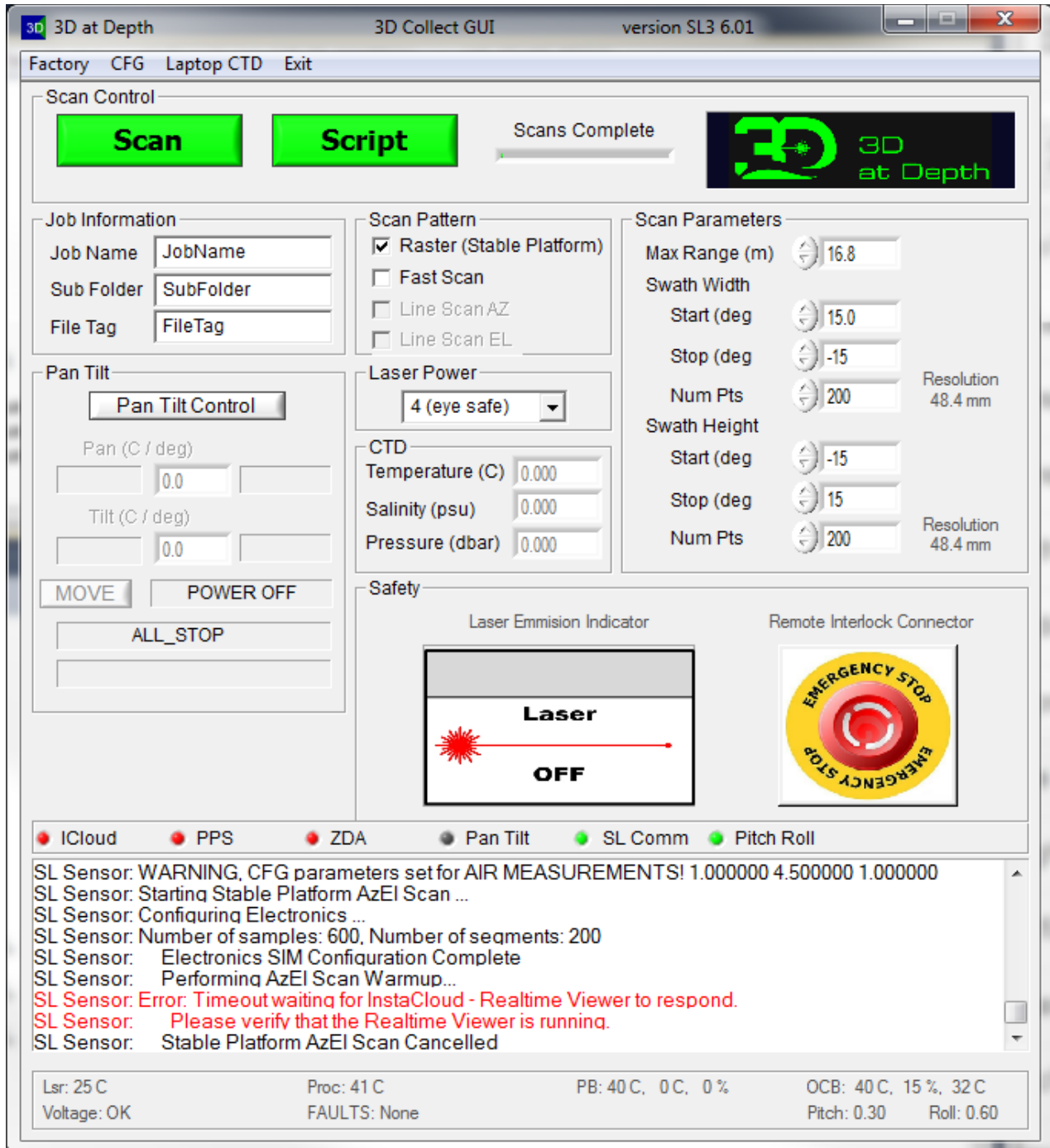
Ctrl-Shift-Esc or search under the start menu for Task Manager). Go to the Processes tab and select 'Show processes from all users.' If InstaCloud is running, you should see a process called InstaCloud.exe. If the process is not running verify that the copy of InstaCloud is correctly named InstaCloud.exe at \\192.168.168.130\d. Also validate that the correct EC has been copied and renamed to EC.exe and is located at [\\192.168.168.130\d](http://192.168.168.130/d).



- Verify communication between 3D Collect and EC. If 3D Collect gives you a message saying “Ethernet Communications lost” Check that EC is running correctly on the sensor.



- Verify communication between 3D Collect and Realtime Viewer (during a scan only). If the Realtime Viewer is not running, 3D Collect will display an error and suggest checking that the Realtime Viewer is running.



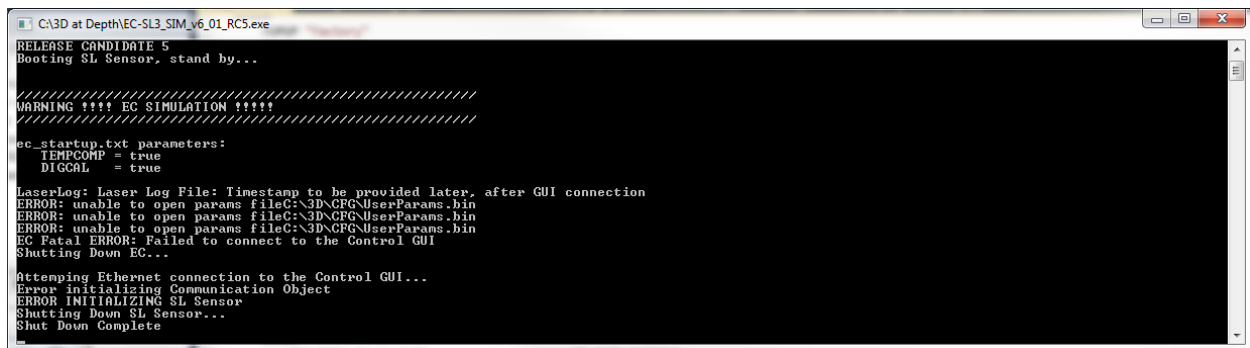
32. Communication Errors

Should you be experiencing communication errors between the different 3D applications stop all 3D applications and restart in the expected order. If the laptop has WiFi, please turn it off for the launch of the application, then it can be turned back on. Sometimes the laptop will not recognize the other ethernet connection (the hard line) if WiFi is enabled.

1. Restart the sensor (this will automatically restart InstaCloud)
 - a. If power cannot be cycled, then on the sensor (IP address 192.168.168.130) remote desktop in and manually stop EC (must be stopped in fire demon). After stopping EC, open Task Manager (type Ctrl-Shift-Esc or search under the start menu for Task Manager). Go to the Processes tab and select 'Show processes from all users.' If InstaCloud is running, you should see a process called InstaCloud.exe. If it is there, then it must be manually killed by selecting it and hitting the "End Process" button in task manager.
2. Restart Realtime Viewer
3. Restart 3DCollect

32.1. Configuration file errors

EC attempts to load both the UserParams.bin and FactoryParams.bin config files from d:\3D\CFG on startup. Should either of the files not exist, EC will not start.



```

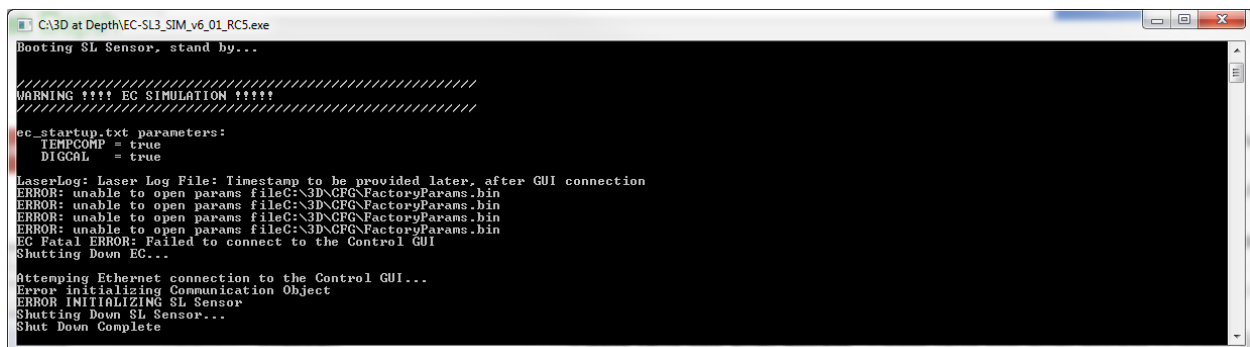
CA3D at Depth\EC-SL3_SIM_v6_01_RC5.exe
RELEASE CANDIDATE 5
Booting SL Sensor, stand by...

WARNING !!!! EC SIMULATION !!!!!

ec_startup.txt parameters:
  TEMPCOMP = true
  DIGCAL   = true

LaserLog: Laser Log File: Timestamp to be provided later, after GUI connection
ERROR: unable to open params fileC:\3D\CFG\UserParams.bin
ERROR: unable to open params fileC:\3D\CFG\UserParams.bin
ERROR: unable to open params fileC:\3D\CFG\UserParams.bin
EC Fatal ERROR: Failed to connect to the Control GUI
Shutting Down EC...

Attempting Ethernet connection to the Control GUI...
Error initializing Communication Object
ERROR INITIALIZING SL Sensor
Shutting Down SL Sensor...
Shut Down Complete
  
```



```

CA3D at Depth\EC-SL3_SIM_v6_01_RC5.exe
Booting SL Sensor, stand by...

WARNING !!!! EC SIMULATION !!!!!

ec_startup.txt parameters:
  TEMPCOMP = true
  DIGCAL   = true

LaserLog: Laser Log File: Timestamp to be provided later, after GUI connection
ERROR: unable to open params fileC:\3D\CFG\FactoryParams.bin
ERROR: unable to open params fileC:\3D\CFG\FactoryParams.bin
ERROR: unable to open params fileC:\3D\CFG\FactoryParams.bin
ERROR: unable to open params fileC:\3D\CFG\FactoryParams.bin
EC Fatal ERROR: Failed to connect to the Control GUI
Shutting Down EC...

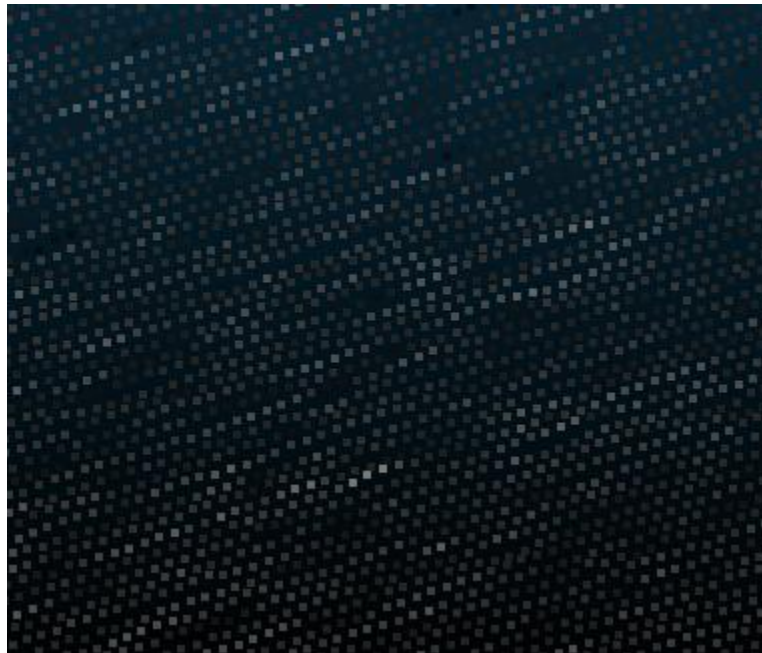
Attempting Ethernet connection to the Control GUI...
Error initializing Communication Object
ERROR INITIALIZING SL Sensor
Shutting Down SL Sensor...
Shut Down Complete
  
```

To correct this problem copy the latest UserParams_<timestamp>.bin file from the D:\3D\CFG\Archive folder and paste it in the D:\3D\CFG folder. Then rename it to UserParams.bin. The same procedure can be used for a missing or corrupted FactoryParams.bin file. This is the safest option.

Once the copy of the files is created you will be able to start EC and use 3D collect to open and edit the copies of the config files. If the files do not exist, 3D Collect will generate a default UserParams.bin file, that the user will then need to inspect and save. The Factory could be regenerated the same way, however, all the calibration data will be missing and the results are going to be poor. A factory configuration has to be correctly filled out in order for data to be valid.

32.2. Waviness Issue

Understanding SL4 data “Waviness” data that was seen in particular Nuclear data and with some SL4 systems, but can also be seen with SL3 systems. See figure below for an example of the “Waviness issue”



There are at least two different problems, both lead to a variable trigger rate which is used to move the mirrors:

1. Found that the laser was running faster than expected. There is a factory parameter that sets the maximum allowed PRF (SIGNAL_PRF) and we had been setting this to a value of 6000 ticks ($250,000,000/6000 = 41,666$ Hz). The new value to set this to is 5000 ticks ($250,000,000/5000 = 50,000$ Hz).
2. Adjust the trigger threshold down a bit more. We had been setting it at the 99% mark, however, that does mean that 1 in 100 shots is missed ... this is still too often. For example in a sensor, found ~2400 out of 240000 or 1% of the pulses were not getting acquired; moved from 350 mV to 300 mV for the trigger level and now miss rate was <0.1% and results improved. In 3D Collect Factory mode, the trigger level should be the peak –4 standard Deviations (about 1 in 10,000).

Both of these fixes are adjustments to Factory Configuration Parameters for the system. Trigger Level and Signal PRF.

A scan that shows the “Waviness” issue will have the Az points get compressed and stretched (kind of like a slinky) and this can also cause EL to wave a bit as well. When a shot is missed, the mirrors do not move (braking force or slowing the scan down). When we do the processing (3D Cloud Motion) for the

scanner shift correction, it does not apply the correct measurement to the right point (since it is a time delay not a specific number of “shots”).

Of note, SL3 also has some of the same issues although the maximum PRF rate is less restrictive but trigger size is often an issue and that is also linked to mirror movement. Thus, if the Tzero amplitude is low compared to the Trigger Level, this could easily lead to sensor data waviness issues. The trigger level parameter fix is the same for SL3, frequency acceptance is not a parameter for SL3.

33. Faults

Fault List, and parameter identifiers from the Factory configuration file. What each fault is, what can happen under fault, problems that can occur and recommended recovery options. All of the faults can now be enabled or disabled, on an individual basis in User Parameters CFG. Use the disable if a fault needs to be ignored.

33.1. OCB_TEMPERATURE_LIMIT_C

Upper limit of temperature in C of the Optical Control Board (sensor head). On Error, shutdown sensor and wait to cool before power back up. Control of the laser can become an issue when getting hot due to communication failure. At some point hardware lifetime could also be impacted. Default level is 55 C.

33.2. OCB_HUMIDITY_LIMIT

Upper limit of humidity in percent of the Optical Control Board (sensor head). On Error, shutdown sensor and bring sensor out of water before power back up. Inspect for water inside the sensor. This is a very serious error and can indicate a seal failure and water is inside of the sensor. Powering up the electronics could short them out and cause damage including the loss of the sensor. If sensor cools, the humidity could reduce some, however, it may not be safe since the water vapor could condense on a cold surface but still be present. Please always report to the factory and avoid using sensor in water unless water ingress can be eliminated as the cause. Default level is 50 %.

33.3. PB_TEMPERATURE_LIMIT_1_C

Upper limit of temperature in C of the Power Board (electronics bottle). On Error, shutdown sensor and wait to cool before power back up. Control of the laser can become an issue when getting hot due to communication failure. At some point hardware lifetime could also be impacted. Default level is 50 C.

33.4. PB_TEMPERATURE_LIMIT_2_C

Upper limit of temperature in C of the Power Board (electronics bottle). On Error, shutdown sensor and wait to cool before power back up. Control of the laser can become an issue when getting hot due to communication failure. At some point hardware lifetime could also be impacted. Default level is 50 C.

33.5. PB_HUMIDITY_LIMIT

Upper limit of humidity in percent of the Power Board (electronics bottle). On Error, shutdown sensor and bring sensor out of water before power back up. Inspect for water inside the electronics bottle is not possible, use alternate. This is a very serious error and can indicate a seal failure and water is inside of the bottle. Powering up the electronics could short them out and cause damage including the loss of the bottle and possibly the sensor as well, if it is connected. If bottle cools, the humidity could reduce some, however, it may not be safe since the water vapor could condense on a cold surface but still be

present. Please always report to the factory and avoid using the electronics bottle in water unless water ingress can be eliminated as the cause. Default level is 50 %.

33.6. DIG_TEMPERATURE_LIMIT_C

Upper limit of temperature in C of the Digitizer (electronics bottle). On Error, shutdown sensor and wait to cool before power back up. Reading laser data can become corrupt and is an issue when getting hot. Any scan results would be bad if the temperature gets too hot. Scan problem also start to occur at high temperatures. At some point hardware lifetime could also be impacted. Default level is 46 C.

33.7. PAN_TEMPERATURE_LIMIT_C

Upper limit of temperature in C of the Pan motor (Sidus pan and/or Pan Tilt unit). On Error, shutdown Pan mechanism and wait to cool before power back up. Moving to the correct location is a problem when it gets too hot. Pan location readback may become corrupt. Scanning with pan motion would produce results that would not be placed in the correct orientation when processed if the temperature gets too hot. At some point hardware lifetime could also be impacted. Default level is 55 C. Have seen temperature sensors go bad and that does require setting the limit above the erroneous value read, for example 9000.

33.8. TILT_TEMPERATURE_LIMIT_C

Upper limit of temperature in C of the Tilt motor (Sidus Pan Tilt unit). On Error, shutdown Pan Tilt mechanism and wait to cool before power back up. Moving to the correct location is a problem when it gets too hot. Tilt location readback may become corrupt. Scanning with tilt motion would produce results that would not be placed in the correct orientation when processed if the temperature gets too hot. At some point hardware lifetime could also be impacted. Default level is 55 C. Have seen temperature sensors go bad and that does require setting the limit above the erroneous value read, for example 9000.

33.9. LSR_TEMPERATURE_LIMIT_C

Upper limit of temperature in C of the Laser (Optical head). On Error, shutdown sensor and wait to cool before power back up. There is a risk of burning out the laser if it is run too hot. Sometimes scanning does not move correctly due to missing laser pulse output and that can corrupt scan images to a degree. Usually it is missing data. At some point hardware is damaged and lifetime is impacted if run while too hot. Default level is 55 C.

33.10. OPB_TEMPERATURE_LIMIT_C

Upper limit of temperature in C of the Optical Power Board (Optical head). On Error, shutdown sensor and wait to cool before power back up. There is a risk of burning out the power supply if it is run too hot. Sometimes scanning does not move correctly and the system can brown out in ways that leave the laser on while the OCB processor reboots and becomes confused (Laser safety issue). Often communication problems start to occur as well as scanning problems. At some point hardware is damaged and lifetime is impacted if run while too hot. Default level is 55 C.

33.11. Min Depth EyeSafe

Defines the minimum water depth, as measured by the CTD, that non-Eyesafe power levels may be used for scanning. When enabled scan can not start if the depth is not met and this is also checked while scanning if conditions change.

33.12. Watchdog

Defines the length of time that the laser can be on and there is no 3D Collect, which controls the system, attached to the sensor. This allows data to continue to be collected for some period of time under poor network conditions. If more than about 30 seconds of time is desired, then the Archive RIAAT Data should also be selected so the data generated can be saved on the sensor and the connection to the Real Time Viewer is not needed for scan to continue. Otherwise the internal buffers are used to save data and when full will stop the scan from continuing.

33.1. Laser PRF

Laser PRF is a fairly long average, and has become a key diagnostic on SL4 systems when there are scan problems. Seeing a laser frequency that is lower or higher than expected can indicate problems with how and when data is taken (trigger problems, cable problems, noise in the system, laser not on). It was getting used often enough that including it on the front panel seemed useful.

34. System Ports

Ports that could be used by the sensor and what is on them:

// Standard communication ports

```
const INT32 EC_PORT_COMM    = 2000; // TCP, GUI cmds (from CGUI to EC)
const INT32 EC_PORT_DATA    = 2001; // TCP, Factory mode data (from EC to CGUI)
const INT32 EC_PORT_XFER    = 2002; // TCP, This is RIAAT data from InstaCloud
const INT32 EC_PORT_CTD     = 2003; // TCP, CTD over ethernet (from CGUI to EC)
```

// Dynamic communication ports for Navigation Data

```
const INT32 EC_PORT_NAV_CTD  = 2005; // TCP, iXBlue NAV_CTD to EC
const INT32 EC_PORT_NAV_LONG = 2006; // TCP, iXBlue NAV_LONG to EC
const INT32 EC_PORT_GPS_ZDA  = 2007; // TCP, iXBlue GPS_LIKE to EC
const INT32 EC_PORT_PHINS_STD = 2008; // TCP, iXBlue PHINS_STD to EC
```

// CCI communication ports (very low bandwidth goal)

```
const INT32 EC_CC_PORT_COMM  = 2010; // UDP, CCI GUI cmds
const INT32 EC_CC_PORT_TLM    = 2011; // UDP, CCI GUI tlm
const INT32 EC_CC_PORT_TEXT   = 2012; // UDP, CCI GUI messages
```

// 3D Cloud Motion data processing

```
const INT32 CRIAAT_PORT_COMM = 2015; // UDP, 3D Cloud Motion, Remote Ops chain
const INT32 CRIAAT_PORT_TLM   = 2016; // UDP, 3D Cloud Motion, Remote Ops chain
const INT32 MSG_SERVER_PORT   = 2021; // InstaCloud messages - not implemented (messages back through EC to CGUI)
```

// Added for Remote Operations Gen 1

```
const INT32 EC_PORT_COMM2    = 2025; // TCP, GUI IO - Remote ops chain, follower 1
const INT32 EC_PORT_COMM3    = 2026; // TCP, GUI IO - Remote ops chain, follower 2
const INT32 EC_PORT_REMOTE    = 2027; // UDP,      - Remote ops chain, setup
```

```
const INT32 INSTACLOUD_PORT_COMM2 = 2017; // TCP, RTV IO - Remote ops chain, follower 1
const INT32 INSTACLOUD_PORT_COMM3 = 2018; // TCP, RTV IO - Remote ops chain, follower 2
const INT32 INSTACLOUD_PORT_REMOTE = 2019; // UDP,      - Remote ops chain, setup
```

```
const INT32 EC_CC_RTV_CFG          = 2100; // UDP, CCI - command and control interface for RTV
config
```

35. Error Messages

When you scan there are a number of checks made that the scan can be done and the system is ready and that the data will be good. This is not a complete list but is many of the most common messages the user might see.

List of error messages that the user may see when trying to scan. Red is the message, black is recommended action:

"Warning, System Not Initialized Yet" fix by waiting for the system to finish initialization.

"Cancel Current Scan?" The system is scanning, do you want to stop the system from scanning then select yes, otherwise select no.

"Cancel Script and Wait?" The system is running a CCI script and is in a wait state, yes to cancel out of the script, no to continue waiting.

"Cancel Script After Pan Move?" The system is running a CCI script and is moving the pan/tilt, yes to cancel out of the script after move is done, no to continue waiting. This is more graceful than a halt of the pan move that the stop move would perform.

"Cancel Script now?" The system is running a CCI script and is in an idle state, yes to cancel out of the script, no to continue waiting.

"Warning, Pan/Tilt has not been homed, continue Scan Operation?" If the pan position is not known, then placing this scan image properly with other scans taken at different orientations could be difficult. Home allows the pan to know the position and return to it if needed, otherwise the position is not initialized and is treated as random.

"Warning, Pan/Tilt is moving, unable to start scan" Wait for the pan to finish the move before trying to scan again.

"Please confirm Pan/Tilt operation. Do you still wish to continue?" The pan position changed unexpectedly, asking user to verify that is intended/desired.

"T1 and FF values are zero (No scan data), do you still wish to continue?" The factory parameters were found to be zero which will prevent valid data from showing up in RTV or in the RIAAT file, so the scan will not produce any valid data. This can be a result of an old factory parameter file which was not fully filled out for low power laser operations (below 200 gain) for water operations. If safe, a higher laser power could be used and would likely not have an issue.

"Validate CTD values, do you still wish to continue?" The CTD values look suspicious and could be out of range, asking user to check them for accuracy.

"Error: Mount Settings are not configured." Fix the mount settings and try the scan again.

"Error: Mount Settings have not been accepted/verified." Fill in mount settings and select accept.

"Ethernet ERROR: Received Invalid Sensor Command: XX" The command sent to EC was not recognized as a valid one. Here is the current list of different commands that 3D Collect supports, but if the software version of EC is old, it may not yet know of it.

Command Name	Command ID
EC_CMD_START_AUTO	1
EC_CMD_STOP_AUTO,	2
EC_CMD_START_MANUAL,	3
EC_CMD_STOP_MANUAL,	4
EC_CMD_START_MAN_ACQ,	5
EC_CMD_STOP_MAN_ACQ,	6
EC_CMD_START_LASER,	7
EC_CMD_STOP_LASER,	8
EC_CMD_AZ_POS_DEG,	9
EC_CMD_EL_POS_DEG,	10
EC_CMD_SCANNER_CAL,	11
EC_CMD_SHUTDOWN,	12
EC_CMD_DO_STDDEV,	13
EC_CMD_MANUAL_IO,	14
EC_CMD_PAN_TILT_POWER,	15
EC_CMD_PAN_TILT_GOTO,	16
EC_CMD_PAN_TILT_HOME,	17
EC_CMD_PAN_TILT_ESTOP,	18
EC_CMD_PITCH_ROLL_POWER,	19
EC_CMD_AUX_SENSOR_POWER,	20
EC_CMD_SCANNER_CAL_AZ,	21
EC_CMD_AZ_EL_POS_DEG,	22
EC_CMD_MANUAL_USE_TZERO,	23
EC_CMD_TEST_TRIGGER,	24
EC_CMD_TEST_AZEL,	25
EC_CMD_PAN_TILT_STOP,	26
EC_CMD_PAN_TILT_ZERO,	27
EC_CMD_PAN_TILT_ICMDS,	28
EC_CMD_CONFIGS,	29
EC_CMD_RESTART_EC,	30

To Decode the error message "SLMicroP, Command Failed: %d" Below is a list of the command numbers and what they are:

SLMicroP Command Name	Command Id
CMD_LASER_STATE	0
CMD_GAIN	1
CMD_AUTO_LASER_OFF	2
CMD_CLEAR_FAULTS	3
CMD_MANUAL_IO	4
CMD_POWER_DEVICE	5
CMD_START_PITCH_ROLL_AVE	6
CMD_GET_PR_AVE	7
CMD_GET_VERSION	8
CMD_PT_CFG	9
CMD_PT_CMD	10
CMD_PT_RSP	11
CMD_STATUS_LED	12
CMD_PT_INIT_CMDS	13
CMD_SHUTDOWN	14
CMD_CFG_PORT	15
CMD_MSG_PORT	16
CMD_SWEEP_MESSAGES	17
CMD_LASER_STATUS	18
CMD_NO_OP	19

Decode of error message: "ERROR: reading MicroP status, error %d"

Error Value -1: Failed to send the packet. The receive buffer is full, so the process on the other side is not reading out the data; optical head processing in this case is probably stuck and not working. Power cycle the optical head to attempt to fix, probably will not go away unless a power cycle is performed.

Error Value -2: Failure to receive an acknowledgment from the OCB that the packet was processed/received. Usually the right angle cable is missing or electrical issues here like a leaking cable connection. Can be intermittent.

Error Value -3 = Received data but packet was corrupt/bad and cannot be used. Checksum failure which can be caused by noise on the line/electrical issues, rare. Usually just resending/retrying the command will fix.

36. 3D Collect Scan Script

#	Pan Tilt			AZ	EL														
#	Pan Tilt			AZ	EL														
#	Enabled	JobName	SubFolde	FileTag	ScanNurr	MountNc	Pan	Tilt	Range	ScanType	AzStart	AzStop	AzPts	ElStart	ElStop	ElPts	GainStart	GainEnd	SaveTo
10	enabled	Rops	SL4	A	1	Note	-30	0	11 RA		-10	10	1450	-10	10	1450	3	3	laptop
11	enabled	Rops	SL4	A	1	Note	-30	0	11 RA		-10	10	2000	-10	10	2000	3	3	laptop
12	enabled	Rops	SL4	B	1	Note	30	0	13 EP:4		-3	3	1000	-3	3	1000	3	3	laptop
13	enabled	Rops	SL4	C	1	Note	0	0	12 RA		-10	10	1450	-10	10	1450	3	3	laptop
14	enabled	Rops	SL4	D	1	Note	-30	0	11 EP:4		-3	3	1000	-3	3	1000	3	3	laptop
15	enabled	Rops	SL4	E	1	Note	0	0	12 RA		-10	10	1450	-10	10	1450	3	3	laptop
16	enabled	Rops	SL4	F	1	Note	30	0	13 EP:4		-3	3	1000	-3	3	1000	3	3	laptop