

Application note

NEP-5000 turbidity SDI-12 option

Use with H-22+ & H-500XL loggers

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Status: Final

Confidentiality: Not confidential

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Document history

The Observator range is in continuous development and so specifications may be subject to change without prior notice. When in doubt about the accuracy of this document, contact the Observator Group.

Reference documents

Type of document / tool	Product type and name (incl. url)
Software	NEP-5000
CFG files	NEP-5000
Datasheet	NEP-5000
Manual	NEP-5000
Application notes	NEP-5000-SDI-12 option with Campbell logger
	NEP-5000-SDI-12 option for H-522+ & H-500XL loggers
	NEP-5000-SDI-12 option with Hydros spider logger
	NEP-5000-SDI-12, RS485 and analogue: wiper operations
	NEP-5000 multi-point calibration
	NEP-5000 firmware updating procedure
	Pressure calibration
	Shroud installation
	Temperature calibration
	Wiper replacement
Videos	NEP-5000

Revision history

Date	Amendments	Company, position
2019-02-06	Initial document creation: Completed simple reading of turbidity section	Observator Australia, Document Controller
2019-02-14	Completed reading of turbidity after optical wipe section	Observator Australia, Document Controller
2019-03-17	Added reference documents	Observator Australia, Document Controller
2019-04-05	Removed advanced operation sections	Observator Australia, Document Controller
2019-07-03	Quality review	Observator Australia, Operation Manager
2020-01-30	Updated document format	Observator Australia, Document Controller
2020-03-08	Updated basic operation section	Observator Australia, Document Controller
2022-10-09	Update video links	Observator Australia, Document Controller

Procedure sign-off:

Date	Company, position	Status
2019-02-14	Observator Australia, Document Controller	Finished
2019-12-06	Observator Australia, Managing Director	Approved
2020-03-05	Observator Group, Communication Officer	Approved

Distribution list

Date	Company, position
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Summary

The NEP-5000 family of sensors offers a comprehensive list of functionalities using its built in SDI-12 interface. The list below shows a few common scenarios for which the sensor can be used in SDI-12 mode. Please select the most appropriate methods for your application. Each scenario consists of sensor information using the NEP-5000 configuration software and WaterLOG® system H-522+ & H-500XL family logger's setup configurations (using keypad, serial terminal) including each recommended electrical wiring.

2. “Basic operations”

- **2.1. “Simple reading of turbidity (general use)”**
- **2.2. “Reading of turbidity using auto-range or single feature after an optical wipe (recommended option)”**

Important note: All examples and procedures that are discussed in this document are best applied to firmware version C2.032 and above.

Important note: End users may request NEP-5000 settings from the factory according to the above scenarios during the time of ordering.

Important note: All sensor configurations that are described below require the user to connect to the sensor's calibration software. Please refer to the NEP-5000 manual.

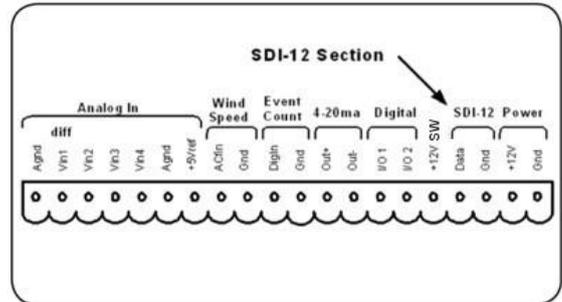
Important note: Advanced users may directly download, update and load our configuration file “example” to test their logger (use the keypad “System Config Opts” menu in “System Setup”):

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1 Wiring diagrams

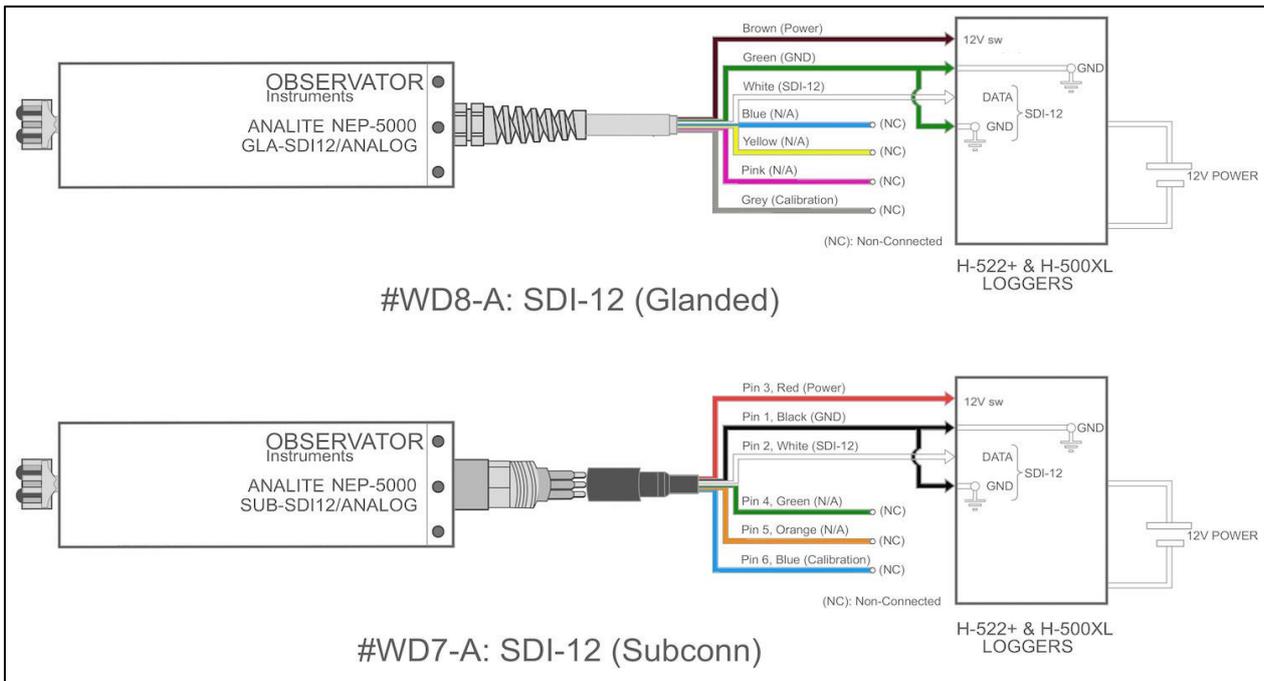
This chapter describes the required wiring to connect H-522+ & H-500XL loggers to your NEP-5000 turbidity probe using SDI-12 communication protocol.



Use the following NEP-5000 sensor wiring for the following scenarios:

2. "Basic operations"

- 2.1. "Simple reading of turbidity (general use)"
- 2.2. "Reading of turbidity using auto-range or single feature after an optical wipe (recommended option)"



2 Basic operations

2.1 Simple reading of turbidity (general use)

2.1.1 Setting up your NEP-5000 family turbidity sensor for simple turbidity readings (general use)

This setup requires the user to have the following:

- NEP-5000 family sensor.
- NEP-5000 calibration module (calibration kit).
Or request these settings during time of ordering.
- 12V Direct Current (DC) power supply.
- NEP-5000 user manual.

2.1.2 Mode of operation

The logger powers up the sensor, using one of its power control switches and waits for the sensor to boot up (allowing total time of about twenty seconds to accommodate the power on the wipe feature).

Note: That in this scenario the sensor will automatically carry out an optical clean (wipe) soon after the boot up. Once the fifty seconds of boot up and wiping time has elapsed, the logger issues a measure command (aM!) followed by read command (aD0!) to retrieve the newly measured turbidity value.

2.1.3 The following settings must be applied to the NEP-5000, using the Personal Computer configuration software

The sensor configurations that are shown below requires users to connect to the sensor using its calibration software.

- Turbidity measuring range = auto or desired single range.
In calibration software under “Sensor Stage” > “Sensor calibration”.
- Data acquisition time = 10 seconds or more if auto-range is selected or four seconds when single range is selected.
In calibration software under “Output Stage” > “SDI12 tab”.
- SDI12 address = 0 (default) or any desired address.

- Communication protocol of the sensor = SDI12.

The image shows two alternative configurations for the Range Calibration software. The left configuration is labeled 'Auto-Range' and shows the 'Auto' radio button selected under 'SET Operating Range'. Below, the 'Range transition settings' table is visible, and the 'accusation time' is set to 10 seconds. The right configuration is labeled 'Single Range' and shows the 'High NTU' radio button selected. Below, the '2 point calibration' table shows values for '0NTU (Input RAW)', 'TopEnd NTU (Input RAW)', and 'TopEnd NTU Value'. In both configurations, the 'accusation time' is highlighted with a red circle and labeled 'accusation time'.

To commit above settings to permanent memory please press set followed by save calibration.

- Wiper operation set to power on wipe.
In calibration software under “Wiper Control”.

The screenshot shows the 'Wiper Control' tab in the software. Under 'Wiping mode Set', 'Basic Motor Controls' is set to 'Single_direction_Wipe'. 'Wiper Timeout' is set to 10. The 'Wipe On PowerUp' checkbox is checked and highlighted with a red box. Below, 'Wiping Options' shows 'Wiper Option OR Autowipe(in seconds 60000max)' set to 'OFF'. On the right, 'Power On Raw Output(Analoge out)' is set to 'Analoge RAW out value during sensor startup.' with a value of '0'.

2.1.4 Setup/configuring information for logger H-522+ & H-500XL

The logger can be configured using the built-in key pad or the terminal commands. Please select the most appropriate option for your preference.

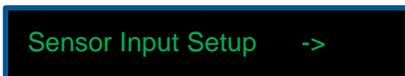
- Section 1, to 6 shows how to program using built-in key pad.
- Section 7 to 13 shows how to program using terminal menu.

1. Reset the logger

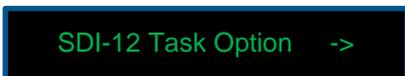
This section describes how to reset the logger to its default factory calibration setup. Doing so will remove all other previous SDI-12 instructions in the logger.

Using keypad

- In the main menu, select “Sensor Input Setup” by pressing on the right arrow.



- Press on the bottom arrow until you reach the “SDI-12 Task Option” menu. Then use the right arrow to “Enter”.



- Press on the bottom arrow until you reach the “Reset to Defaults” function, then select “Enter” to reset the tasks to factory default.



2. System setup after logger reset

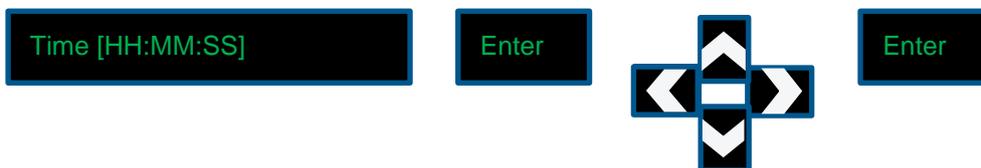
This section describes how to setup the basic system configuration of the logger.

Using keypad

- In the main menu, select “System Setup” by pressing on the right arrow.



- In “Time”, press “Enter” and use the arrows to modify the time & press “Enter”.



- Press on the bottom arrow until you reach the “Date” menu, press “Enter” and use the arrows to modify the date & press “Enter”.



- Press on the bottom arrow until you reach the “Site ID” menu, Press “Enter” and use the arrows to modify the site ID number & press “Enter”.



3. Logger setup for measurement interval

This section describes how to set up the scanning interval/measurement interval of the logger.

Using keypad

- In the Main menu, select “Scan Setup” by pressing on the right arrow.



- Enable the “Scanning” to “On” by pressing on “Enter”, use the arrows and “Enter”.



- Press on the bottom arrow until you reach the “Scan Rate” menu. Press “Enter” and use the arrows to modify the scanning interval to 10 minutes and press “Enter”.



Note 1: User should not select a scanning interval of less than five min, otherwise it does not leave enough time to change the value manually using the keypad.

Note 2: Please pay attention to your SDI-12 full operation cycle when selecting the scan rate. If scan rate is less than the full operation cycle, the logger may display intermittent behaviours.

- You can now check when the next scan will occur by pressing on the bottom arrow until you reach the “Nxt Scn” menu.

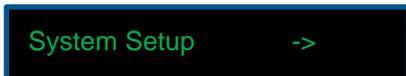


4. Setup sensor power control switch

This section describes how to use the logger's power control output to shut down the sensor during sleeping and power up during measurement/scanning times. This helps to conserve the power and helps to restart the sensor in the event of failure (SDI-12 bus, wiper jam and etc...).

Using keypad

- In the main menu, select "System Setup" by pressing on the right arrow.



- Press on the bottom arrow until you reach the "Advanced Options" menu and select the right arrow to enter in the "Advanced Options" menu.



- Press on the bottom arrow until you reach the "AutoOff Enabled/Disabled" menu, press "Enter" to enable it. This feature will cut the power to the sensor once the measurement is complete before the logger goes into sleep-mode.



- Press on the top arrow until you reach the "Sys TimeOut" menu, press "Enter" and use the arrows to enter the time in seconds that you want to allocate before the logger goes into sleep-mode.



Note: This value should always be superior to one hundred seconds.

- Press on the bottom arrow until you reach the "Excite Warmup [00]Sec" menu, press "Enter" and use the arrows to select twenty seconds and press "Enter". This delay forces the logger to wait for twenty seconds allowing the sensor to boot up and complete its optical wipe operation.



- Press on the bottom arrow until you reach the “+12VX On” menu, press “Enter” and use the arrows to select “At scan” and press “Enter”. This feature automatically turns on the sensor power prior to the scanning sequence. Also note that the “AutoOff” feature must be set to turn off the sensor once the scanning is complete.



5. Powers up delay (warm up delay) also show about offset time

This delay allows time for the sensor to boot up and complete an optical clean (about twenty seconds in average). If power on the wipe condition is not selected, the warm up time may be reduced to four seconds. The logger has to input twenty seconds of scan offset delay time if the warm up time is set to twenty seconds.

Using keypad

- In the Main menu, select “Scan Setup” by pressing on the right arrow.



- Make sure the “Scanning” is “On” (if not, select “Enter”, “top arrow” and “Enter” again).



- Press on the bottom arrow until you reach the “Scan Offset Tm” menu. Press “Enter” and use the arrows to modify the offset interval to twenty seconds in minute and seconds and press “Enter” to save the value.



6. Setup the measurement information

This shows how to setup the parameter, the number, the name, SDI-12 address and SDI-12 measurement command (aM!) followed by data read command (aD0!).

Using keypad

- In the main menu, select “Sensor Input Setup” by pressing on the right arrow.



- Press on the bottom arrow until you reach the “SDI-12 Task Option” menu. Then, enter in the “SDI-12 Task Table” menu using the right arrow.



- Select the right arrow to enter in “Value 1” menu. Press “Enter” and use the arrows to select “0” and press “Enter”.



- Press on the bottom arrow until you reach the “Address 1” section. Press “Enter” and use the arrows to select “1” and press “Enter”.



- Press on the bottom arrow until you reach the “Parameter 1” section. Press “Enter” and use the arrows to select “1” and press “Enter”.



Note: Setting up the parameter name can only be performed in terminal mode. Please refer to **Section 13** “Setup the measurement information” for the full terminal procedure.

You have now completed the sensor setup in basic mode via built-in display. Please run the setup and verify.

To verify your setup, enter in the “SDI-12 Task Table”, you can evoke by pressing the right arrow. Press on the bottom arrow until you reach the “Scan Task 1” section. Then press “Enter” to activate the measurement. Select the top arrow to view the measured turbidity value displayed for “Value 1”.

Disclaimer:
The above setup and tests verify that the logger is capable of reading data from the NEP-5000 sensor.
Please refer to the appropriate logging options and appropriate source options to evoke the above setup in automated manner or contact your logger company provider.

7. Login to the data logger using terminal program

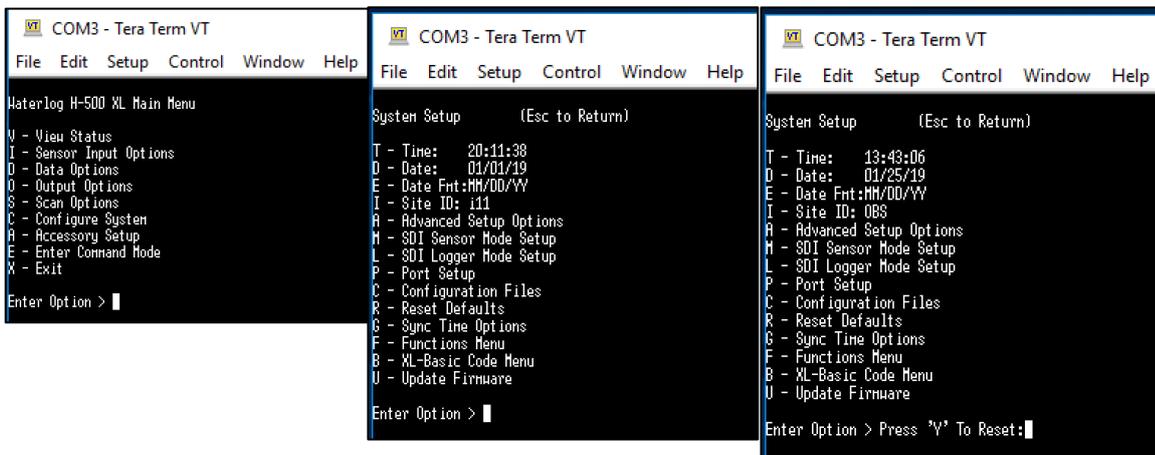
- Connect your probe to the data logger.
- Connect your computer to the data logger using the Universal Serial Bus (USB) to RS232 cable.
- Download the “Tera Term” terminal program onto your Windows desktop.
- Launch “Tera Term” and select “Esc”.

8. Reset the logger

This section describes how to reset the logger to its default factory calibration setup. Doing so will remove all other previous SDI-12 instructions in the logger.

Using terminal

- In the Main menu, select “Configure System” by selecting “C” then select “Reset Defaults” by selecting “R”. Finally confirm your choice with “Y”.



Note: Resetting to default will change the serial port back to RS-232-1.

9. System setup after logger reset

This section describes how to setup the basic system configuration of the logger.

Using terminal

- In the main menu, select “Configure System” by selecting “C”.

```

COM3 - Tera Term VT
File Edit Setup Control Window Help
Waterlog H-500 XL Main Menu
V - View Status
I - Sensor Input Options
D - Data Options
O - Output Options
S - Scan Options
C - Configure System
A - Accessory Setup
E - Enter Command Mode
X - Exit
Enter Option >

COM3 - Tera Term VT
File Edit Setup Control Window Help
System Setup (Esc to Return)
T - Time: 20:11:38
D - Date: 01/01/19
E - Date Fmt:MM/DD/YY
I - Site ID: i11
A - Advanced Setup Options
M - SDI Sensor Mode Setup
L - SDI Logger Mode Setup
P - Port Setup
C - Configuration Files
R - Reset Defaults
G - Sync Time Options
F - Functions Menu
B - XL-Basic Code Menu
U - Update Firmware
Enter Option >
  
```

- Configure the following:
 - Configure the “Time” by selecting “T”, enter the “Time” and press “Enter”.
 - Configure the “Date” by selecting “D”, enter the “Date” and press “Enter”.
 - Configure the “Site ID” by selecting “I”, enter the “Site ID” and press “Enter”.

```

COM3 - Tera Term VT
File Edit Setup Control Window Help
System Setup (Esc to Return)
T - Time: 20:11:45
D - Date: 01/01/19
E - Date Fmt:MM/DD/YY
I - Site ID: i11
A - Advanced Setup Options
M - SDI Sensor Mode Setup
L - SDI Logger Mode Setup
P - Port Setup
C - Configuration Files
R - Reset Defaults
G - Sync Time Options
F - Functions Menu
B - XL-Basic Code Menu
U - Update Firmware
Enter Option > Enter New Time [13:36:08]

COM3 - Tera Term VT
File Edit Setup Control Window Help
System Setup (Esc to Return)
T - Time: 13:36:32
D - Date: 01/25/19
E - Date Fmt:MM/DD/YY
I - Site ID: i11
A - Advanced Setup Options
M - SDI Sensor Mode Setup
L - SDI Logger Mode Setup
P - Port Setup
C - Configuration Files
R - Reset Defaults
G - Sync Time Options
F - Functions Menu
B - XL-Basic Code Menu
U - Update Firmware
Enter Option > Enter New Date [01/25/19]

COM3 - Tera Term VT
File Edit Setup Control Window Help
System Setup (Esc to Return)
T - Time: 13:37:04
D - Date: 01/25/19
E - Date Fmt:MM/DD/YY
I - Site ID: i11
A - Advanced Setup Options
M - SDI Sensor Mode Setup
L - SDI Logger Mode Setup
P - Port Setup
C - Configuration Files
R - Reset Defaults
G - Sync Time Options
F - Functions Menu
B - XL-Basic Code Menu
U - Update Firmware
Enter Option > Enter New Site ID [ ]
  
```

10. Logger setup for measurement interval

This section describes how to setup the scanning interval or measurement interval of the logger.

Using terminal

- In the main menu, select “Scan Options” by selecting “S”.

<pre> VT COM3 - Tera Term VT File Edit Setup Control Window Help Waterlog H-500 XL Main Menu V - View Status I - Sensor Input Options D - Data Options O - Output Options S - Scan Options C - Configure System A - Accessory Setup E - Enter Command Mode X - Exit Enter Option > █ </pre>	<pre> VT COM3 - Tera Term VT File Edit Setup Control Window Help Scan Options (Esc to Return) Current Time: 19:36:15 Next Scan: 00:03:44 S - Scanning: On R - Scan Rate: 00:10:00 O - Scan Offset Time: 00:01 N - Next Scan At: 19:39:59 F - Start A New File: Enter Option > █ </pre>
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Configure the following:

- Configure “Scanning” by selecting “S”. Enable the “Scanning” to “On” by using the top/bottom keyboard arrows and “Enter”.
- Configure “Scan Rate” by selecting “R”. Type the new scanning interval of “ten minutes” and press “Enter”.

<pre> VT COM3 - Tera Term VT File Edit Setup Control Window Help Scan Options (Esc to Return) Current Time: 19:36:22 Next Scan: 00:03:37 S - Scanning: On R - Scan Rate: 00:10:00 O - Scan Offset Time: 00:01 N - Next Scan At: 19:39:59 F - Start A New File: Enter Option > Select Scanning Mode [On] █ </pre>	<pre> VT COM3 - Tera Term VT File Edit Setup Control Window Help Scan Options (Esc to Return) Current Time: 19:56:27 Next Scan: 00:03:32 S - Scanning: On R - Scan Rate: 00:10:00 O - Scan Offset Time: 00:01 N - Next Scan At: 19:59:59 F - Start A New File: Enter Option > Enter New Scan Rate [00:10:00] █ </pre>
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11. Setup sensor power control switch

This section describes how to use the loggers power control output to shut down the sensor during sleeping and power up during measurement/scanning times. This helps to conserve the power and helps to restart the sensor in event of failure (SDI-12 bus, wiper jam and etc...).

Using terminal

- In the main menu, select “Configure System” by selecting “C”, then, select “A” for “Advanced Setup Options”.

<pre>COM3 - Tera Term VT File Edit Setup Control Window Help Waterlog H-500 XL Main Menu V - View Status I - Sensor Input Options D - Data Options O - Output Options S - Scan Options C - Configure System A - Accessory Setup E - Enter Command Mode X - Exit Enter Option > █</pre>	<pre>COM3 - Tera Term VT File Edit Setup Control Window Help System Setup (Esc to Return) T - Time: 20:11:38 D - Date: 01/01/19 E - Date Fmt:MM/DD/YY I - Site ID: i11 A - Advanced Setup Options M - SDI Sensor Mode Setup L - SDI Logger Mode Setup P - Port Setup C - Configuration Files R - Reset Defaults G - Sync Time Options F - Functions Menu B - XL-Basic Code Menu U - Update Firmware Enter Option > █</pre>	<pre>COM3 - Tera Term VT File Edit Setup Control Window Help Advanced System Setup Options (Esc to Return) H - Welcome Message: # E - PassHord Enabled: No P - PassHord: #123 T - System Timeout: 600 A - AutoOff Enabled: Yes B - Side Button Mode: Hold to Update U - User Mode: Normal D - Excitation Delay: 20 S - Switched Excitation On: At Scan G - GOES Radio Type: SE-1200 C - Data Card Type: ATA Enter Option > █</pre>
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- Configure the following:
 - Configure “AutoOff Enabled” by selecting “A”. Enable the “Auto Off” to “Yes” by using the top/bottom keyboard arrows and “Enter”. This feature will cut the power to the sensor once the measurement is complete before the logger goes into sleep-mode.
 - Configure “Excitation Delays” by selecting “D”. Enter “20” seconds Excitation Delay and press “Enter”. This delay forces the logger to wait for 20 seconds allowing the sensor to boot up and complete its optical wipe operation.
 - Configure “Switched Excitation On” by selecting “S”. Set the Excitation “At scan” by using the top/bottom keyboard arrows and “Enter”. This feature automatically turns on the sensor power prior to the scanning sequence. Also note that the “AutoOff” feature must be set to enable in order to turn off the sensor once the scanning is complete.

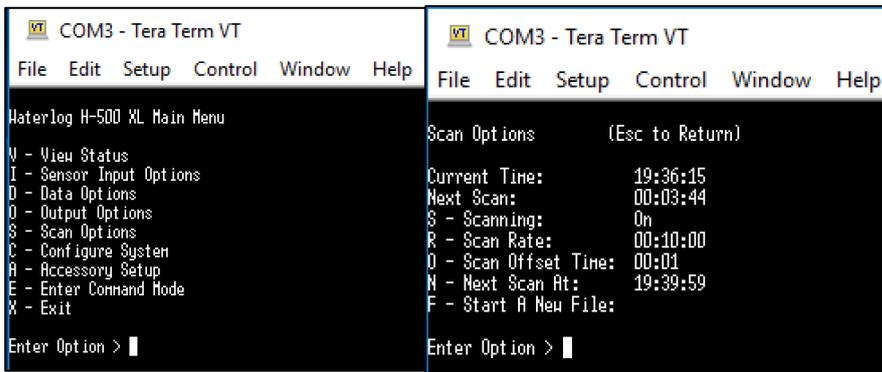
<pre>COM3 - Tera Term VT File Edit Setup Control Window Help Advanced System Setup Options (Esc to Return) H - Welcome Message: # E - PassHord Enabled: No P - PassHord: #123 T - System Timeout: 600 A - AutoOff Enabled: Yes B - Side Button Mode: Hold to Update U - User Mode: Normal D - Excitation Delay: 20 S - Switched Excitation On: At Scan G - GOES Radio Type: SE-1200 C - Data Card Type: ATA Enter Option > Auto Off Enabled [Yes]</pre>	<pre>COM3 - Tera Term VT File Edit Setup Control Window Help Advanced System Setup Options (Esc to Return) H - Welcome Message: #Sign On Message E - PassHord Enabled: No P - PassHord: #123 T - System Timeout: 300 A - AutoOff Enabled: Yes B - Side Button Mode: Hold to Update U - User Mode: Normal D - Excitation Delay: 0 S - Switched Excitation On: Always G - GOES Radio Type: SE-1200 C - Data Card Type: ATA Enter Option > Enter Excite Delay [20] Seconds</pre>	<pre>COM3 - Tera Term VT File Edit Setup Control Window Help Advanced System Setup Options (Esc to Return) H - Welcome Message: #Sign On Message E - PassHord Enabled: No P - PassHord: #123 T - System Timeout: 300 A - AutoOff Enabled: Yes B - Side Button Mode: Hold to Update U - User Mode: Normal D - Excitation Delay: 20 S - Switched Excitation On: Always G - GOES Radio Type: SE-1200 C - Data Card Type: ATA Enter Option > Select Excitation Mode [At Scan]</pre>
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12. Setup the powers up delay (warm up delay) also show about offset time

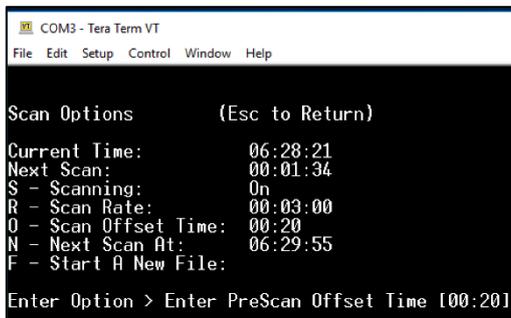
This delay allows time for the sensor to boot up and complete an optical clean (approximately twenty seconds is the average time). If power on the wipe condition is not selected, the warm up time may be reduced to four seconds. The logger has to input twenty seconds of scan offset delay time if the warm up time is set to twenty seconds.

Using terminal

- In the main menu, select “Scan Options” by selecting “S”. Then, select “Scan Offset Time” by selecting “O”.



- Set the new “Scan Offset Time” to “20 seconds” and press “Enter”.

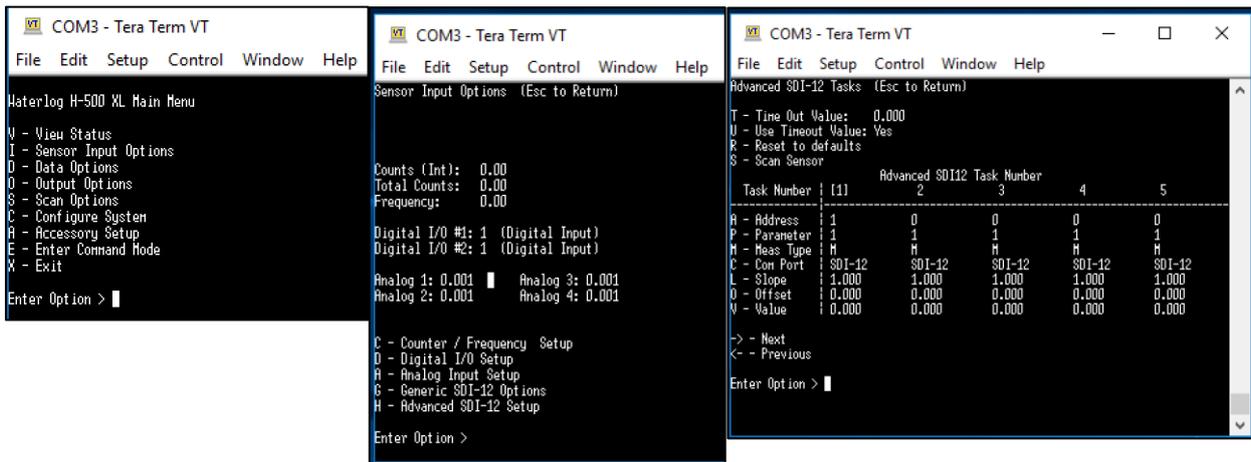


13. Setup the measurement information

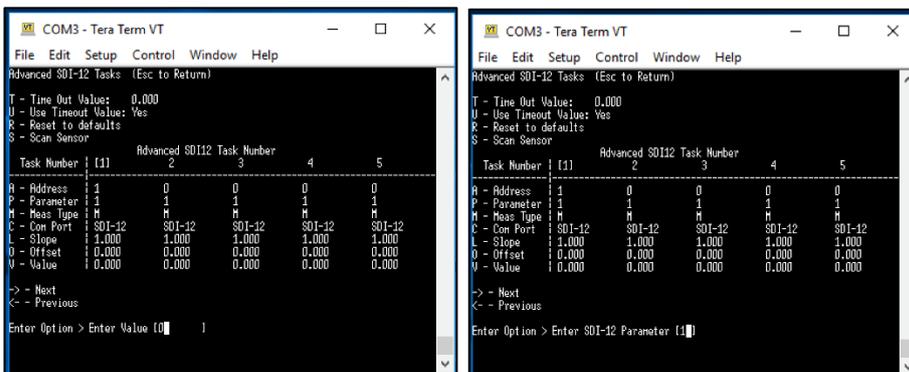
This shows how to setup the parameter number & name, SDI-12 address and SDI-12 measurement command (aM!) followed by data read command (aD!).

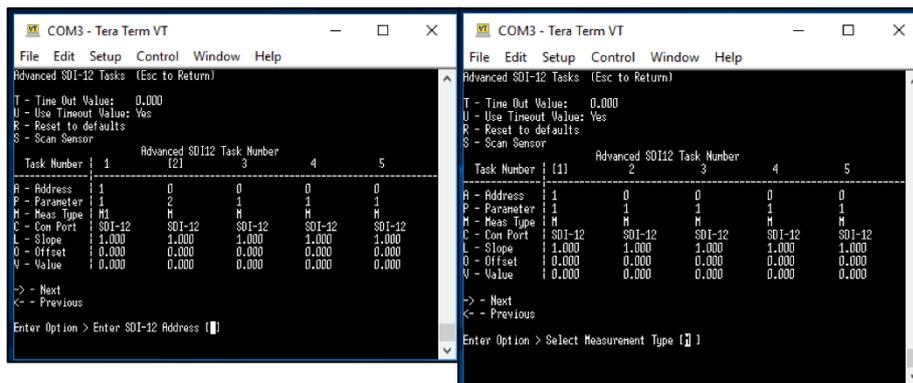
Using terminal

- In the main menu, select “Sensor Input Options” by selecting “1”, then, select “Advanced SDI-12 Setup” by selecting “H”.

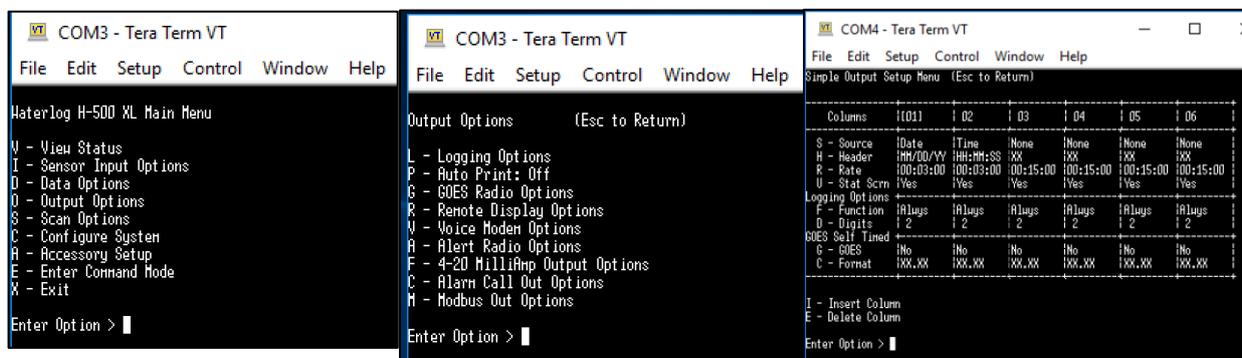


- Configure the following for task [1]:
 - Select “Value” by selecting “V”. Type the new “Value”: “0” and press “Enter”.
 - Select “Parameter” by selecting “P”. Type the new “Parameter”: “1” and press “Enter”.
 - Select “Address” by selecting “A”. Type the new “Address”: “1” and press “Enter”.
 - Select “Meas Type” by selecting “M”. Select the new “Measurement” type: “M” using the top/bottom keyboard arrows and Press “Enter”. The logger will automatically issue a D-command following a measurement.





- To change the parameter name, in the main menu, select “Output Options” by selecting “O”, then, select “Logging Options” by selecting “L”.



- Use the arrows to select the column you wish to modify, then proceed as follow for each task name you wish to set up:
 - Select “Header” by typing “H”. Enter the new header name and press “Enter”.
 - Select “Source” by typing “S”. Use the arrows to select the task name and press “Enter”.
 - Select “Rate” by typing “R”. Use the arrows to type the scanning rate as defined in **Section 10**: “Logger setup for measurement interval”.

You have now completed the sensor setup in basic mode via terminal mode. Please run the setup and verify.

To verify your setup, return to the “Advanced SDI-12 Setup” and select “S” to scan the sensor. The turbidity value will be displayed in value 1.

```

COM3 - Tera Term VT
File Edit Setup Control Window Help
Advanced SDI-12 Tasks (Esc to Return)
T - Time Out Value: 40.000
U - Use Timeout Value: No
R - Reset to defaults
S - Scan Sensor

Task Number : [1]      Advanced SDI12 Task Number
-----
A - Address   : 1      0      0      0      0
P - Parameter : 1      1      1      1      1
M - Meas Type : H      H      H      H      H
C - Con Port  : SDI-12 SDI-12 SDI-12 SDI-12 SDI-12
L - Slope     : 1.000  1.000  1.000  1.000  1.000
O - Offset    : 0.000  0.000  0.000  0.000  0.000
V - Value     : 366.800 368.100 40.000  40.000  40.000

-> - Next
<- - Previous
Enter Option >

```

Disclaimer:
The above setup and tests verify that the logger is capable of reading data from the NEP-5000 sensor.

Please refer to appropriate logging options and appropriate source options to evoke the above setup in automated manner or contact your logger company provider.

2.2 Reading of turbidity using auto-range or single feature after an optical wipe (recommended option)

2.2.1 Setting up your NEP-5000 family turbidity sensor for stable turbidity readings and allowing wiper control via SDI-12

This setup requires the user to have the following:

- NEP-5000 family sensor.
- NEP-5000 calibration module (calibration kit).
Or request these settings during time of ordering.
- 12V DC power supply.
- NEP-5000 user manual.

2.2.2 Mode of operation

The logger powers up the sensor using one of its power control switches and waits for the sensor to boot up (takes approximately four seconds).

After the boot up delay has elapsed, the logger will send a SDI-12 wipe command (0M1!) followed by 16 seconds of wipe completion delay. Once the wipe completion delay has elapsed, the logger issues a measure command (aM!) followed by automatic read command (aD0!) to retrieve the newly measured turbidity value.

2.2.3 Use Personal Computer configuration software

The sensor configurations that is shown below requires users to connect to the sensor using its calibration software.

- Turbidity measuring range = Auto or desired single range.
In calibration software under “Sensor Stage” > “Sensor calibration”
- Data acquisition time = 4 seconds or more if auto range is selected or two seconds when single range is selected.
In calibration software under “Output Stage” > “SDI12 tab”.
- SDI12 address = 0 (default) or any desired address.

- Communication protocol of the sensor = SDI12.

- Wiper operation set not (untick) to power on wipe. In calibration software under “Wiper Control”.

2.2.4 Setup/configuring information for logger H-522+ & H-500XL

The logger can be configured using the built-in key pad or the terminal commands. Please select the most appropriate option for your preference.

- Section 1 to 6 shows how to program using the built-in key pad.
- Section 7 to 13 shows how to program using the terminal menu.

1. Reset the logger

This section describes how to reset the logger to its default factory calibration setup. Doing so will remove all other previous SDI-12 instructions in the logger.

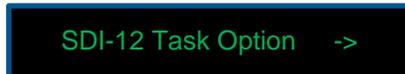
Using keypad

- In the main menu, select “Sensor Input Setup” by pressing on the right arrow.

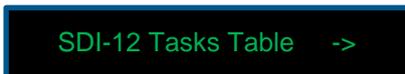


Sensor Input Setup ->

- Press on the bottom arrow until you reach the “SDI-12 Task Option” menu. Then use the right arrow to “Enter”.



SDI-12 Task Option ->



SDI-12 Tasks Table ->

- Press on the bottom arrow until you reach the “Reset to Defaults” function, then select “Enter” to Reset the tasks to factory default.



Reset to Defaults Enter

2. System setup after logger reset

This section describes how to setup the basic system configuration of the logger.

Using keypad

- In the main menu, select “System Setup” by pressing on the right arrow.



- In “Time”, press “Enter” and use the arrows to modify the time & press “Enter”.



- Press on the bottom arrow until you reach the “Date” menu. Press “Enter” and use the arrows to modify the date & press “Enter”.



- Press on the bottom arrow until you reach the “Site ID” menu, press “Enter” and use the arrows to modify the site ID number & press “Enter”.



3. Logger setup for measurement interval

This section describes how to set up the scanning interval/measurement interval of the logger.

Using keypad

- In the main menu, select “Scan Setup” by pressing on the right arrow.



- Enable the “Scanning” to “On” by pressing on “Enter”, use the arrows and “Enter”.



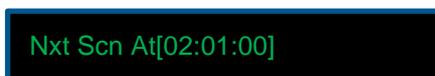
- Press on the bottom arrow until you reach the “Scan Rate” menu. Press “Enter” and use the arrows to modify the scanning interval to 10 minutes and press “Enter”.



Note 1: The user should not select a scanning interval of less than five minutes, otherwise it does not leave enough time to change the value manually using the keypad.

Note 2: Please pay attention to your SDI-12 full operation cycle when selecting the scan rate. If the scan rate is less than the full operation cycle, the logger may display intermittent behaviours.

- You can now check when the next scan will occur by pressing on the bottom arrow until you reach the “Nxt Scan” menu.



4. Setup sensor power control switch

This section describes how to use the logger's power control output to shut down the sensor during sleeping and power up during measurement/scanning times. This helps to conserve the power and helps to restart the sensor in event of failure (SDI-12 bus, wiper jam and etc...).

Using keypad

- In the main menu, select "System Setup" by pressing on the right arrow.



System Setup ->

- Press on the bottom arrow until you reach the "Advanced Options" menu, then, select the right arrow, to enter in the advanced options menu.



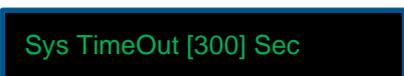
Advanced Options ->

- Press on the bottom arrow until you reach the "AutoOff Enabled/Disabled" menu. Press "Enter" to enable it. This feature will cut the power to the sensor once the measurement is completed before the logger goes into sleep-mode.



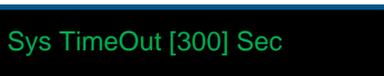
Enter AutoOff Enabled

- Press on the top arrow until you reach the "Sys TimeOut" menu, press "Enter" and use the arrows to enter the time in seconds that you want to allocate before the logger goes into sleep-mode.



Sys TimeOut [300] Sec

- Press on the bottom arrow until you reach the "Excite Warmup [00]Sec" menu, press "Enter" and use the arrows to select four seconds and press "Enter". This delay forces the logger to wait for a minimum of four seconds allowing the sensor to boot up and complete its optical wipe operation.



Sys TimeOut [300] Sec

Note: This value should always be superior to one hundred seconds.

- Press on the bottom arrow until you reach the “Excite Warmup [00]Sec” menu, press “Enter” and use the arrows to select four seconds and press “Enter”. This delay forces the logger to wait for a minimum of four seconds allowing the sensor to boot up and complete its optical wipe operation.



- Press on the bottom arrow until you reach the “+12VX On” menu. Press “Enter” and use the arrows to select “At scan” and press “Enter”. This feature automatically turns on the sensor power prior to the scanning sequence. Also note that the “AutoOff” feature must be set in order to turn off the sensor once the scanning is complete.



5. Setup the powers up delay (warm up delay) also show about offset time

This delay allows time for the sensor to boot up and complete an optical clean (averaging about four seconds). If power on the wipe condition is not selected, the warm up time may be reduced to four seconds. The logger has to input four seconds of scan offset delay time if the warm up time is set to four seconds.

Using keypad

- In the main menu, select “Scan Setup” by pressing on the right arrow.



- Make sure the “Scanning” is “On” (if not, select “Enter”, “top arrow” and “Enter” again).



- Press on the bottom arrow until you reach the “Scan Offset Tm” menu. Press “Enter” and use the arrows to modify the Offset interval to four seconds in minute and seconds and press “Enter” to save the value.



6. Setup up the measurement information

This shows how to setup the parameter, the number, the name, SDI-12 address and SDI-12 measurement command (aM!) followed by data read command (aD!).

Note: Setting up the output Functions require both terminal and keypad access. Please refer to **Section 13** "Setup the measurement information" and follow the procedure.

7. Login to the data logger using terminal program

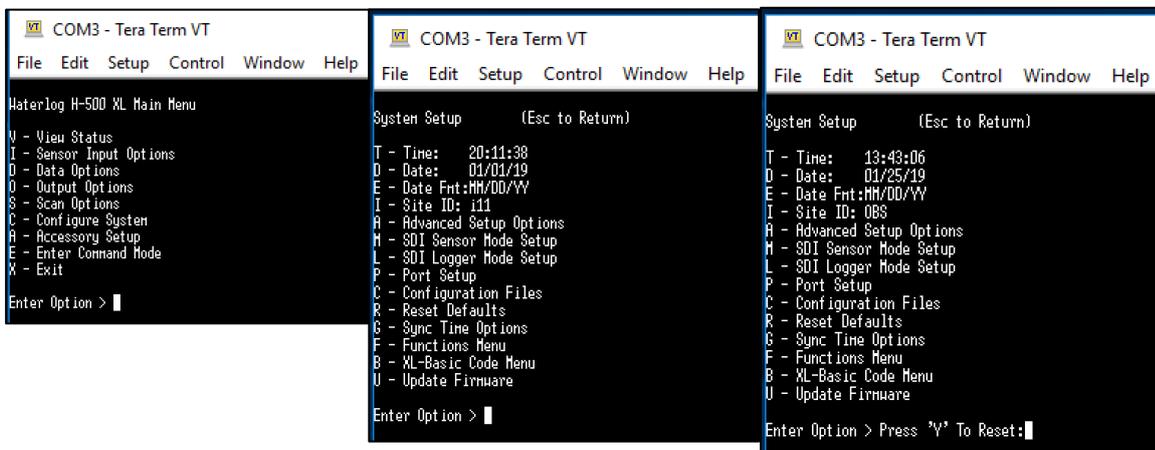
- Connect your probe to the data logger.
- Connect your computer to the data logger using the USB to RS232 cable.
- Download the "Tera Term" terminal program onto your Windows desktop.
- Launch "Tera Term" and select "Esc".

8. Reset the logger

This section describes how to reset the logger to its default factory calibration setup. Doing so will remove all other previous SDI-12 instructions in the logger.

Using terminal

- In the main menu, select "Configure System" by selecting "C" then select "Reset Defaults" by selecting "R". Finally confirm your choice with "Y".



Note: Resetting to default will change the serial port back to RS-232-1.

9. System setup after logger reset

This section describes how to setup the basic system configuration of the logger.

Using terminal

- In the main menu, select “Configure System” by selecting “C”.

```

COM3 - Tera Term VT
File Edit Setup Control Window Help
Waterlog H-500 XL Main Menu
V - View Status
I - Sensor Input Options
D - Data Options
O - Output Options
S - Scan Options
C - Configure System
A - Accessory Setup
E - Enter Command Mode
X - Exit
Enter Option >

COM3 - Tera Term VT
File Edit Setup Control Window Help
System Setup (Esc to Return)
T - Time: 20:11:38
D - Date: 01/01/19
E - Date Fmt:MM/DD/YY
I - Site ID: i11
A - Advanced Setup Options
M - SDI Sensor Mode Setup
L - SDI Logger Mode Setup
P - Port Setup
C - Configuration Files
R - Reset Defaults
G - Sync Time Options
F - Functions Menu
B - XL-Basic Code Menu
U - Update Firmware
Enter Option >
    
```

- Configure the following:
 - Configure the “Time” by selecting “T”, enter the “Time” and press “Enter”.
 - Configure the “Date” by selecting “D”, enter the “Date” and press “Enter”.
 - Configure the “Site ID” by selecting “I”, enter the “Site ID” and press “Enter”.

```

COM3 - Tera Term VT
File Edit Setup Control Window Help
System Setup (Esc to Return)
T - Time: 20:11:45
D - Date: 01/01/19
E - Date Fmt:MM/DD/YY
I - Site ID: i11
A - Advanced Setup Options
M - SDI Sensor Mode Setup
L - SDI Logger Mode Setup
P - Port Setup
C - Configuration Files
R - Reset Defaults
G - Sync Time Options
F - Functions Menu
B - XL-Basic Code Menu
U - Update Firmware
Enter Option > Enter New Time [13:36:08]

COM3 - Tera Term VT
File Edit Setup Control Window Help
System Setup (Esc to Return)
T - Time: 13:36:32
D - Date: 01/25/19
E - Date Fmt:MM/DD/YY
I - Site ID: i11
A - Advanced Setup Options
M - SDI Sensor Mode Setup
L - SDI Logger Mode Setup
P - Port Setup
C - Configuration Files
R - Reset Defaults
G - Sync Time Options
F - Functions Menu
B - XL-Basic Code Menu
U - Update Firmware
Enter Option > Enter New Date [01/25/19]

COM3 - Tera Term VT
File Edit Setup Control Window Help
System Setup (Esc to Return)
T - Time: 13:37:04
D - Date: 01/25/19
E - Date Fmt:MM/DD/YY
I - Site ID: i11
A - Advanced Setup Options
M - SDI Sensor Mode Setup
L - SDI Logger Mode Setup
P - Port Setup
C - Configuration Files
R - Reset Defaults
G - Sync Time Options
F - Functions Menu
B - XL-Basic Code Menu
U - Update Firmware
Enter Option > Enter New Site ID [ ]
    
```

10. Logger setup for measurement interval

This section describes how to set up the scanning interval or measurement interval of the logger.

Using terminal

- In the main menu, select “Scan Options” by selecting “S”.

<pre> VT COM3 - Tera Term VT File Edit Setup Control Window Help Waterlog H-500 XL Main Menu V - View Status I - Sensor Input Options D - Data Options O - Output Options S - Scan Options C - Configure System A - Accessory Setup E - Enter Command Mode X - Exit Enter Option > </pre>	<pre> VT COM3 - Tera Term VT File Edit Setup Control Window Help Scan Options (Esc to Return) Current Time: 19:36:15 Next Scan: 00:03:44 S - Scanning: On R - Scan Rate: 00:10:00 O - Scan Offset Time: 00:01 M - Next Scan At: 19:39:59 F - Start A New File: Enter Option > </pre>
--	--

- Configure the following:
 - Configure “Scanning” by selecting “S”. Enable the “Scanning” to “On” by using the top/bottom keyboard arrows and “Enter”.
 - Configure “Scan Rate” by selecting “R”. Type the new scanning interval of “10 minutes” and press “Enter”.

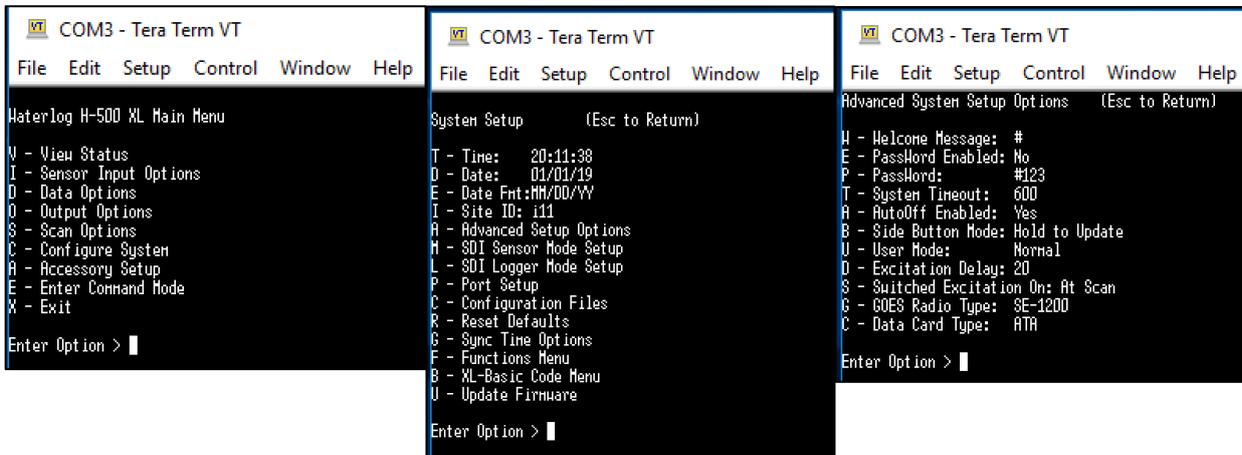
<pre> VT COM3 - Tera Term VT File Edit Setup Control Window Help Scan Options (Esc to Return) Current Time: 19:36:22 Next Scan: 00:03:37 S - Scanning: On R - Scan Rate: 00:10:00 O - Scan Offset Time: 00:01 M - Next Scan At: 19:39:59 F - Start A New File: Enter Option > Select Scanning Mode [On] </pre>	<pre> VT COM3 - Tera Term VT File Edit Setup Control Window Help Scan Options (Esc to Return) Current Time: 19:56:27 Next Scan: 00:03:32 S - Scanning: On R - Scan Rate: 00:10:00 O - Scan Offset Time: 00:01 M - Next Scan At: 19:59:59 F - Start A New File: Enter Option > Enter New Scan Rate [00:10:00] </pre>
--	---

11. Setup sensor power control switch

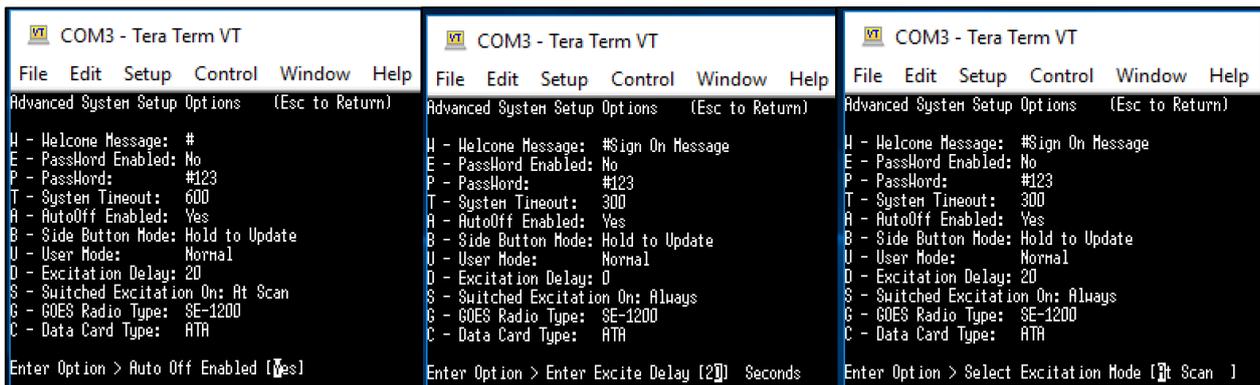
This section describes how to use the loggers power control output to shut down the sensor during sleeping and power up during measurement/scanning times. This helps to conserve the power and helps to restart the sensor in event of failure (SDI-12 bus, wiper jam and etc...).

Using terminal

- In the main menu, select “Configure System” by selecting “C”, then, select “A” for “Advanced Setup Options”.



- Configure the following:
 - Configure “AutoOff Enabled” by selecting “A”. Enable the “Auto Off” to “Yes” by using the top/bottom keyboard arrows and “Enter”. This feature will cut the power to the sensor once the measurement is complete before the logger goes into sleep mode.
 - Configure “Excitation Delays” by selecting “D”. Enter “20” seconds excitation delay and press “Enter”. This delay forces the logger to wait for twenty seconds allowing the sensor to boot up and complete its optical wipe operation.
 - Configure “Switched Excitation On” by selecting “S”. Set the excitation “At scan” by using the top/bottom keyboard arrows and “Enter”. This feature automatically turns on the sensor power prior to the scanning sequence. Also note that the “AutoOff” feature must be set in order to turn off the sensor once the scanning is complete.

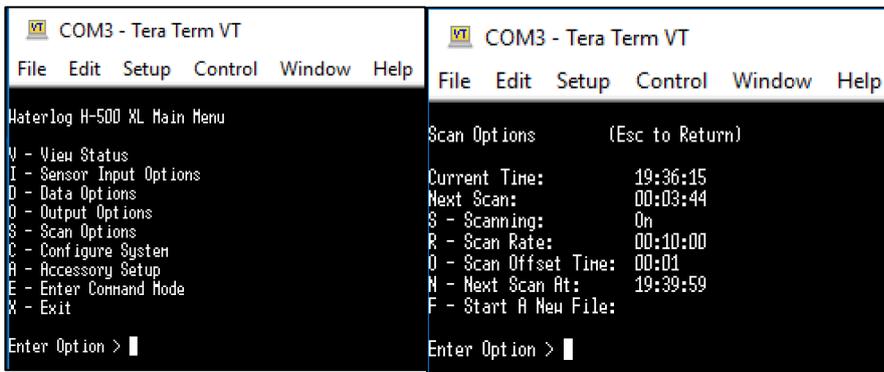


12. Setup the powers up delay (warm up delay) also show about offset time

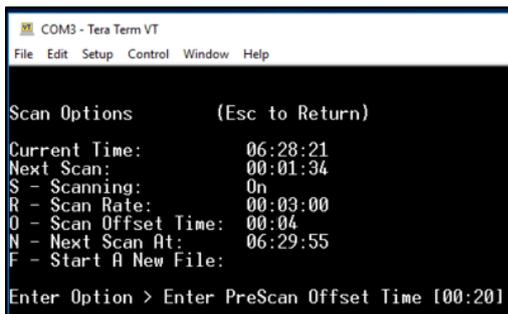
This delay allows time for the sensor to boot up and complete an optical clean (averaging about twenty seconds). If power on the wipe condition is not selected, the warm up time may be reduced to four seconds. The logger has to input twenty seconds of scan offset delay time if the warm up time is set to twenty seconds.

Using terminal

- In the main menu, select “Scan Options” by selecting “S”. Then, select “Scan Offset Time” by selecting “O”.



- Set the new “Scan Offset Time” to “4 seconds” and press “Enter”.



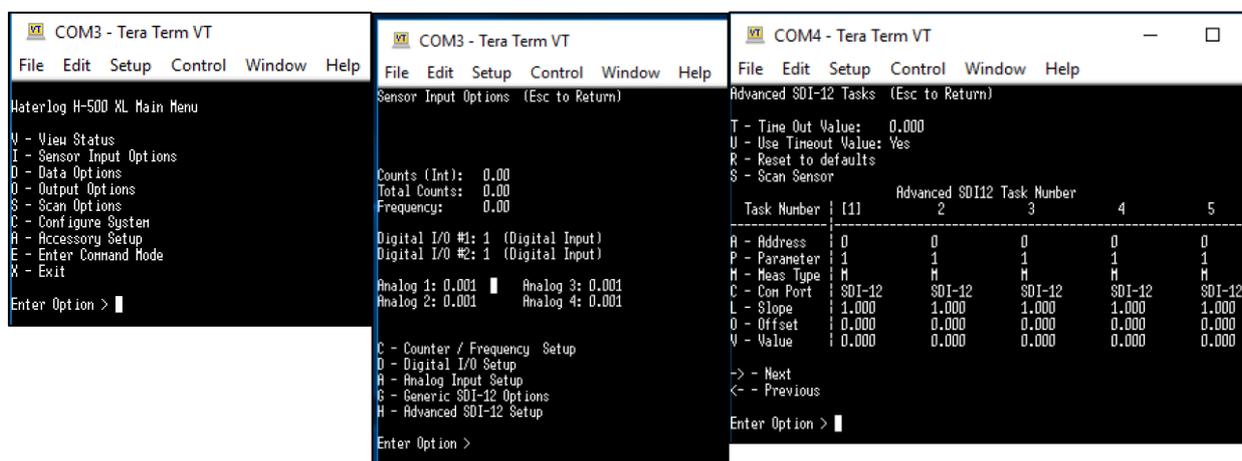
13. Setup the measurement information

This shows how to setup parameter number & name, SDI-12 address and SDI-12 measurement command (aM!) followed by data read command (aD0!).

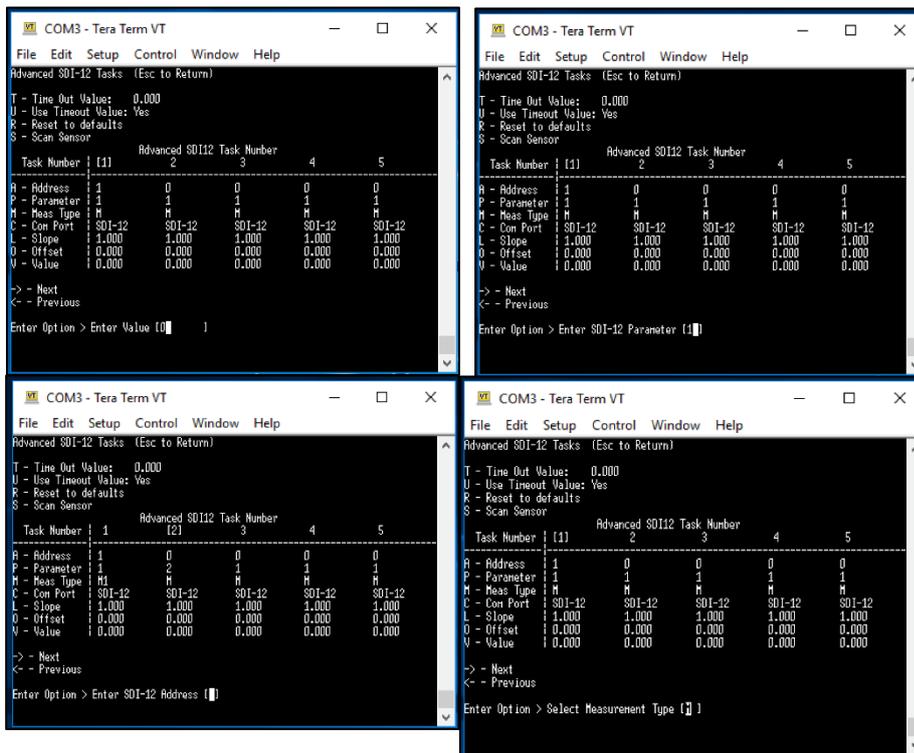
Note: Setting up the output functions require both terminal and keypad access.

Terminal section

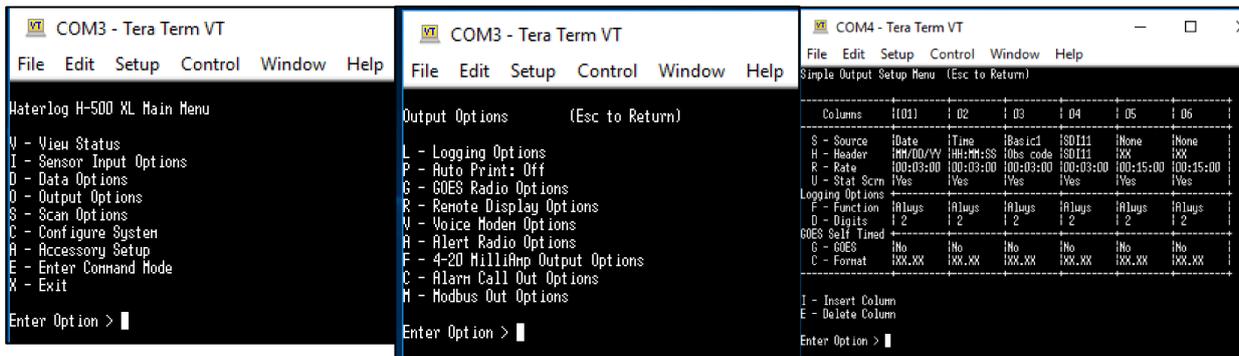
- In the main menu, select “Sensor Input Options” by selecting “I”, then, select “Advanced SDI-12 Setup” by selecting “H”.



- Configure the following for all tasks (we will load a Basic program instead of using the task table in this section):
 - Select “Value” by selecting “V”. Type the new “Value”: “0” and press “Enter”.
 - Select “Parameter” by selecting “P”. Type the new “Parameter”: “1” and press “Enter”.
 - Select “Address” by selecting “A”. Type the new “Address”: “0” and press “Enter”.
 - Select “Meas Type” by selecting “M”. Select the new “Measurement” type:”M” using the top/bottom keyboard arrows and press “Enter”.



- To change the parameter name, in the main menu, select “Output Options” by selecting “O”, then, select “Logging Options” by selecting “L”.



- Use the arrows to select the column you wish to modify, then proceed as follows for each task name you wish to set up:
 - Select “Header” by selecting “H”. Enter the new header name and press “Enter”.
 - Select “Source” by selecting “S”. Use the arrows to select the task name and press “Enter”.
 - Select “Rate” by typing “R”. Use the arrows to type the scanning rate as defined in **Section 10** “Logger setup for measurement interval”.

Output function may be entered as follows to load the Basic program 1 performing a single wipe every three minutes followed by a measurement reading:

	[01]	02	03	04
S - Source	Date	Time	Basic1	SDI11
H - Header	MM/DD/YY	HH:MM:SS	"Code name"	Turbidity value
R - Rate	00:03:00	00:03:00	00:03:00	00:03:00

Keypad section

Follow the following instruction to load the basic program to issue a wipe command followed by a measurement.

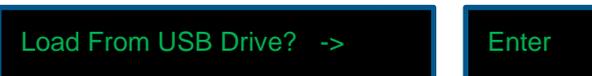
- Download the "[Wipe.bas](#)" file from the link.
- Copy "[Wipe.bas](#)" file onto an empty USB key (format the key as necessary).
- Plug the USB key onto your logger.
- In the logger main menu, select "System Setup" by pressing on the right arrow.



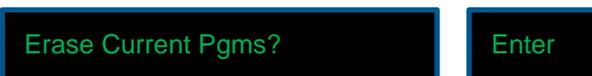
- Press on the bottom arrow until you reach the "XL-Basic Options" menu, then, select the right arrow, to enter in the "XL-Basic Options".



- Press on the bottom arrow until you reach the "Load From USB Drive?" menu, then, select "Enter".



- Press "Enter" to erase current programs.



- Press the bottom arrow to select the "Wipe.bas" for program 1.



- Wait and press “Enter” for program 2-5. The program will warm up and start scanning. You should hear the sensor performing a wipe.

Warming Up 5 ...

Scanning ...

You have now completed the sensor setup, please wait until the system has performed a few scans, then check the turbidity value in your data file to verify that the turbidity value was logged properly on a normal scan rate basis.

```
COM4 - Tera Term VT
File Edit Setup Control Window Help
View Last 15 Lines Of Current Data File... Please Wait...
02/13/19 17:24:00 0.00 403.35
Press Any Key To Continue
```

You can also use an “SDI-12 Verifier” to check the commands are running properly:

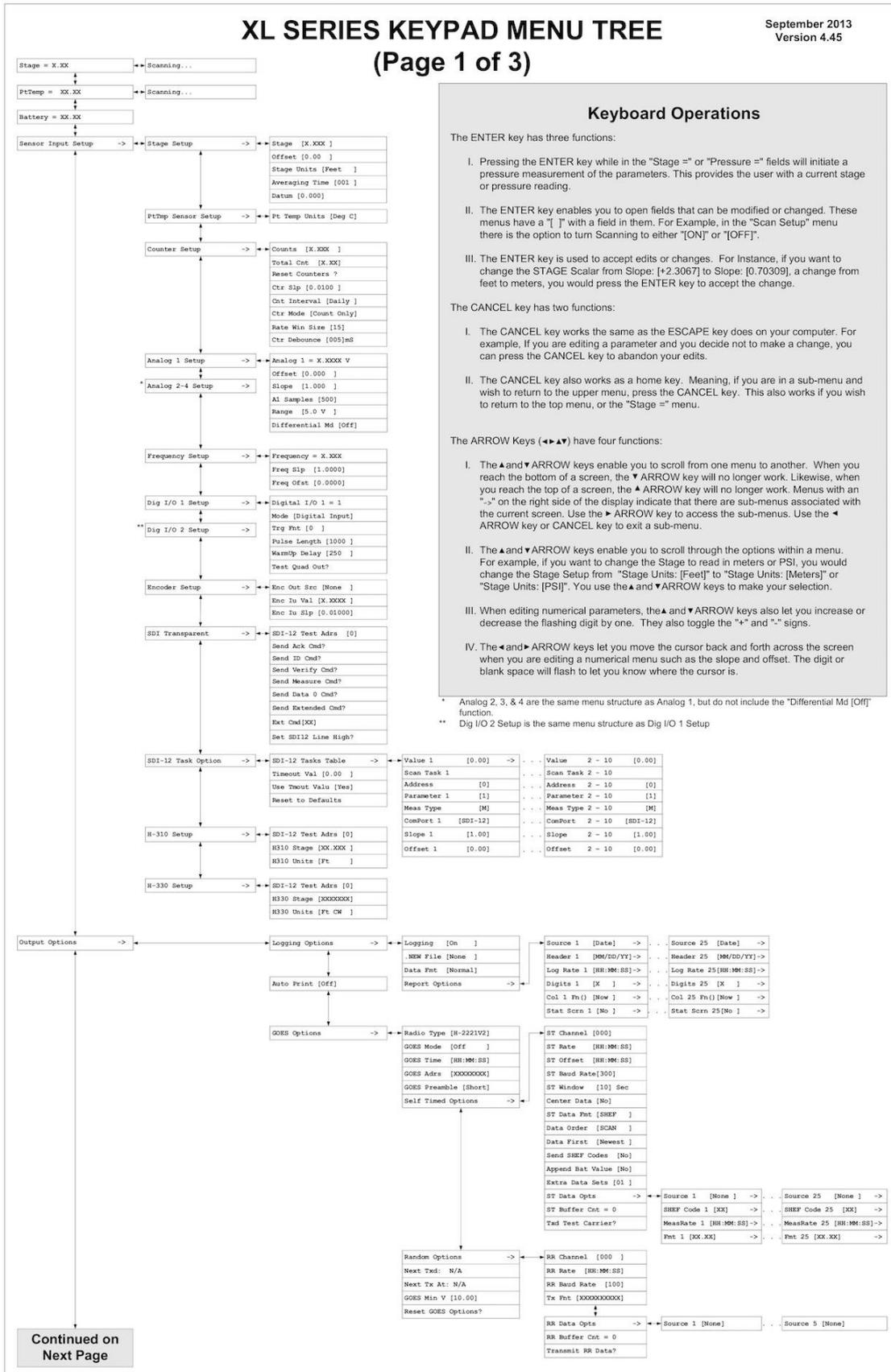
```
SDI-12 Verifier (Monitor)
File Configure Mode Transmit Sensors Hardware Stop Help
17:47:51 break: 15.5 ms
00:00:00.010 1M!10161
17:48:03 break: 15.5 ms
00:00:00.009 1D0!1+0.00
17:48:03 break: 15.5 ms
00:00:00.009 1M!10111
17:48:16 break: 15.5 ms
00:00:00.010 1D0!1+404.31 ← Turbidity value = 404.31
17:50:51 break: 15.5 ms
00:00:00.010 1M!10161
17:51:03 break: 15.5 ms
00:00:00.010 1D0!1+0.00
17:51:03 break: 15.5 ms
00:00:00.009 1M!10111
17:51:16 break: 15.5 ms
00:00:00.010 1D0!1+403.81 ← Turbidity value = 403.81
```

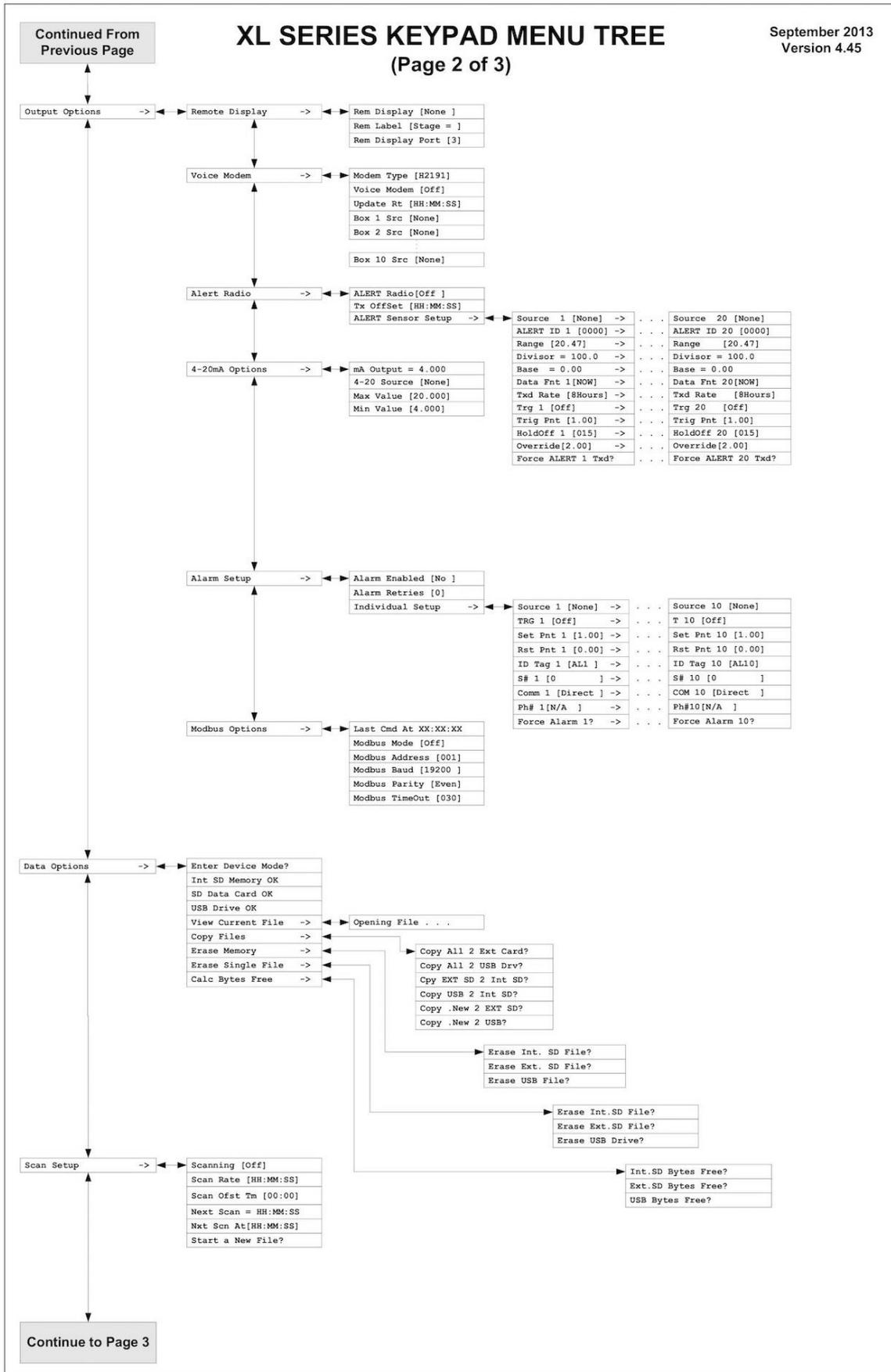
3 Appendix A: Logger commands

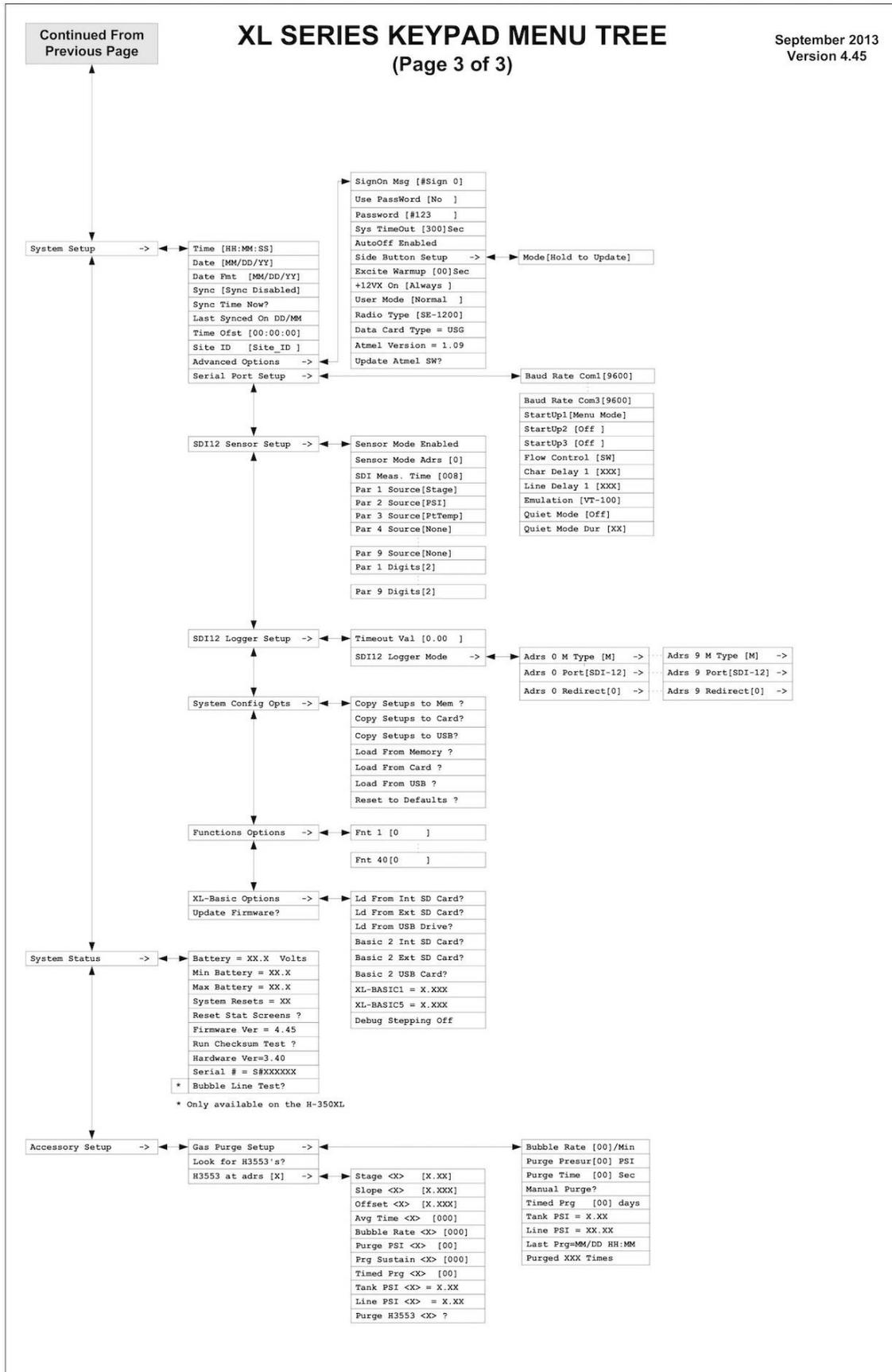
Here is a non-exhaustive list of command to be used for SDI-12:

Commande	Function	Return
aM!	Start measurement	20011<CR><LF> aM! atttn<CR><LF>
aM1!	***Wipe command*** Wipe action will be completed in 16s	a0161<CR><LF> Eg- 20161<CR><LF>
aM2!	High range (5,000NTU)	a0010<CR><LF>
aM3!	Medium range (400NTU)	a0010<CR><LF>
aM4!	Low range (40NTU)	a0010<CR><LF>
aM5!	Auto range	a0001<CR><LF>
aM6!	Start statistical measurement	20066<CR><LF> aM6! atttn<CR><LF>
aD0!	***Single measurement read*** Send data command	a+NTU<CR><LF>
aD1!	**** Full statistical measurement read****	a+TT.TT+MMMM.MM+AAAA.AA+LLLL.LL+SSSS.SS<CR><LF> Eg- 1+23.58+714.53+714.52+714.24+714.85<CR><LF>

4 Appendix B: Logger keypad menu tree







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