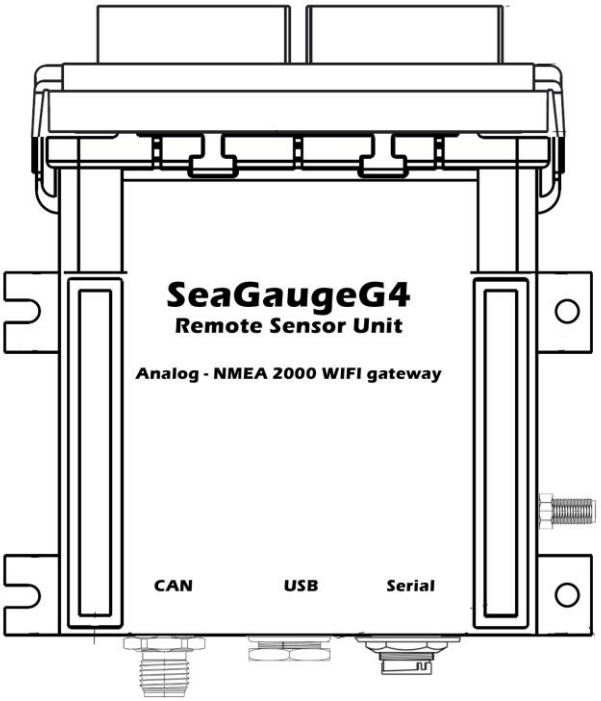
Application Note

ANSS024103101 – SeaGauge G4 Modify Calibration Files



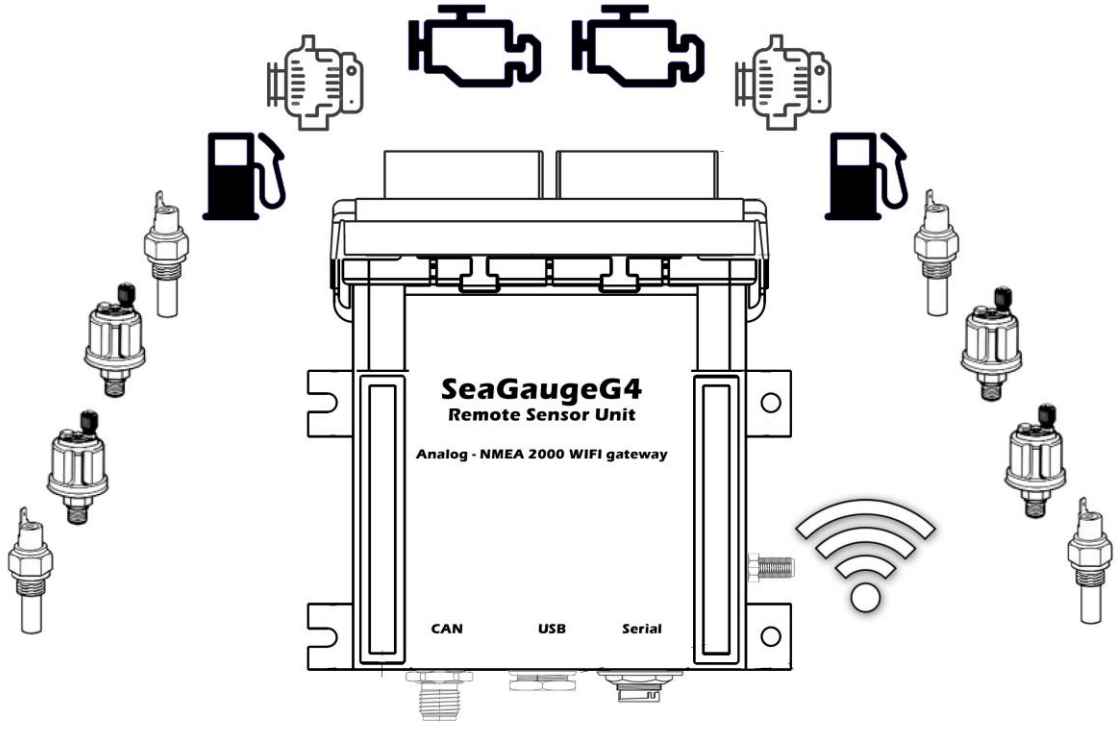
Chetco Digital Instruments, Inc

Revision 103124

SeaGaugeG4 supports up to 12 resistive or voltage style sensor inputs and 3 pulse style inputs.

Sensors are connected to the dual 20 pin Molex style connectors and analog voltages converted to digital protocol compatible with CAN bus and WIFI interfaces.

SeaGaugeG4 can trigger multiple alarms based on sensor voltages from any of the 12 analog inputs, 4 indicator inputs, and 3 pulse inputs



SeaGaugeG4 supports up to 12 analog sensor inputs and 8 indicator/relay drive via a 20 pin Molex MX150 plug (black) and 3 pulse style inputs via separate 20 pin Molex MX150 plug (white).

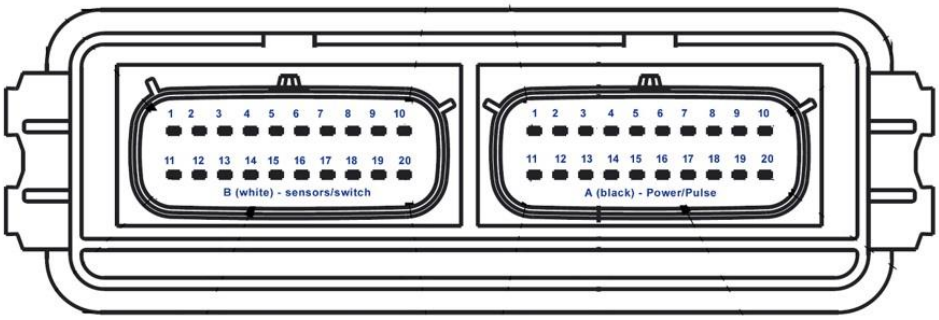
Molex style crimp pins are provided to attach 18 gauge tinned wire and insert into appropriate locations in supplied plugs.

The 12 analog inputs (SEN00-SEN11) are compatible with resistive and voltage style sensors using user configurable internal switches to select operating ranges.

Three pulse inputs are compatible with inductive and hall effect sensors with an AC range of 1Vpp to 18Vpp

Four relay drive (12VDC) outputs (SW4-SW7) can be used as alarm drivers based on user configurable triggers. Alarm outputs are capable of sinking up to 470mA to ground when active - suitable for driving 12VDC relays, indicator lights, or audio buzzers.

SeaGaugeG4 Header

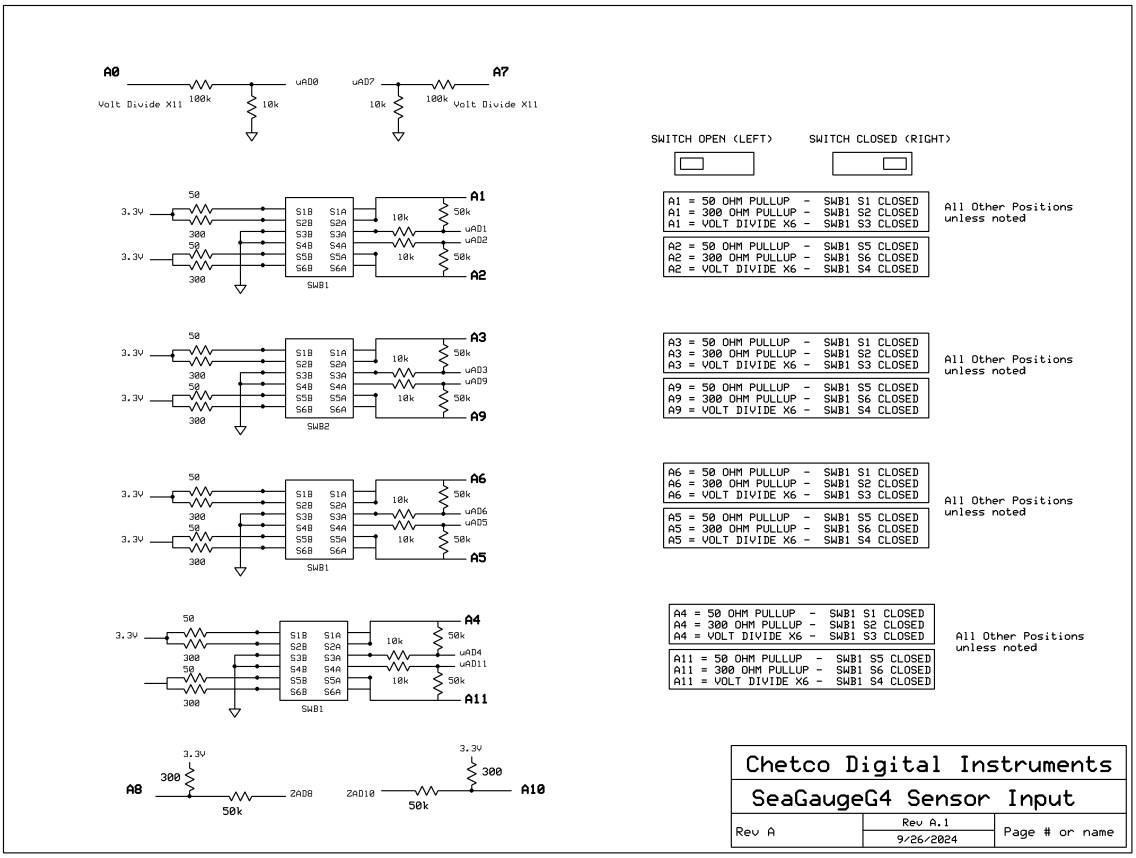


B1 - NC	B11 - NC	A1 - SW5	A11 – SW4
B2 - NC	B12 - NC	A2 - SW7	A12 – SW6
B3 – SEN10 (SBOOST)	B13 – SEN11 (STRAN)	A3 - NC	A13 - NC
B4 – SEN04 (STEMP)	B14 – SEN05 (SOIL)	A4 – P1 (SRPM)	A14 - GND
B5 – SEN06 (SFUEL)	B15 – SEN07 (SBAT)	A5 – P0 (PRPM)	A15 - GND
B6 – SEN00 (PBAT)	B16 – SEN01 (PFUEL)	A6 – P2	A16 - GND
B7 – SEN02 (PTEMP)	B17 – SEN03 (POIL)	A7 – 5VOUT	A17 – 5VOUT
B8 – SEN08 (PBOOST)	B18 – SEN09 (PTRAN)	A8 - GND	A18 - GND
B9 – INC03	B19 – INC02	A9 – 12VIN	A19 = 12VIN
B10 – INC01	B20 – INC00	A10 - NC	A20 - NC

For resistive senders SeaGaugeG4 will provide a 3.3V reference voltage via a user selectable 50 ohm or 300 ohm pullup resistor. Use 50 ohm for sensors with a max range of below 300 ohm and 300 ohm for sensors greater then 300 ohm.

Voltage inputs are scaled and clamped via 6X resistance divider to accept a maximum of 19V.

Separate dedicated dual high voltage inputs up to 36V is available on A0 and A1 for alternator and other applications



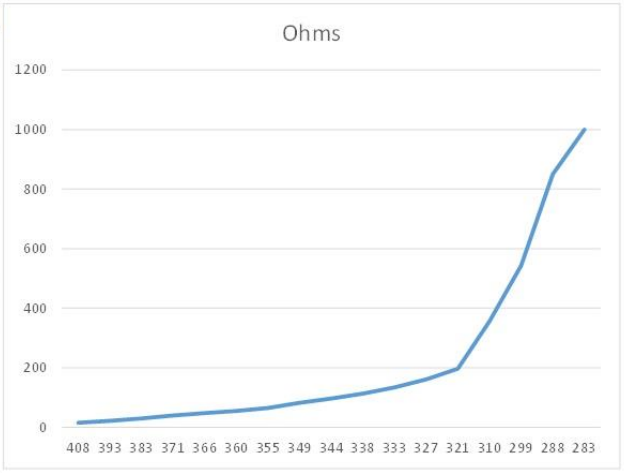
SeaGaugeG4 uses a collection of sensor calibration files to map voltages created by sensor resistance/voltage profiles to physical measurements

Sensor voltages are scaled to a maximum of 3.2VDC and converted to digital values with a range of 0 to 255 resulting in a measurement resolution of 0.4%

Calibration Files contain 256 entries that map the sensor voltages generated by the resistance profiles into corresponding temperature/pressure/voltage/fluid level values based on the sensor type

Temperature VDO 250F Single Station

DegreesC	DegreesK	Ohms	Volts	Index
135	408	15	0.2	12
120	393	22	0.2	17
110	383	30	0.3	23
98	371	40	0.4	30
93	366	48	0.4	35
87	360	55	0.5	40
82	355	65	0.6	46
76	349	82	0.7	55
71	344	97	0.8	63
65	338	113	0.9	70
60	333	134	1.0	79
54	327	161	1.1	89
48	321	197	1.3	101
37	310	356	1.7	139
26	299	543	2.1	165
15	288	850	2.4	189
10	283	1000	2.5	197



Since many sensor profiles do not fit a simple straight line, using 256 calibration points allows for very precise measurements and customized calibrations.

Customized calibration files allows for accurate mapping of non-symmetrical fluid tanks and temperature sensors.

Using an example for a typical engine temperature sensor with a resistance range from 1000 ohms@ 10C (50F) to 15 ohms@130C (299F), we can calculate the voltage range using a 300 ohm pull up resistor to 3.2VDC as

1000/(1000 + 300) * 3.2VDC = 0.76 * 3.2 VDC = 2.43 VDC @ 10C

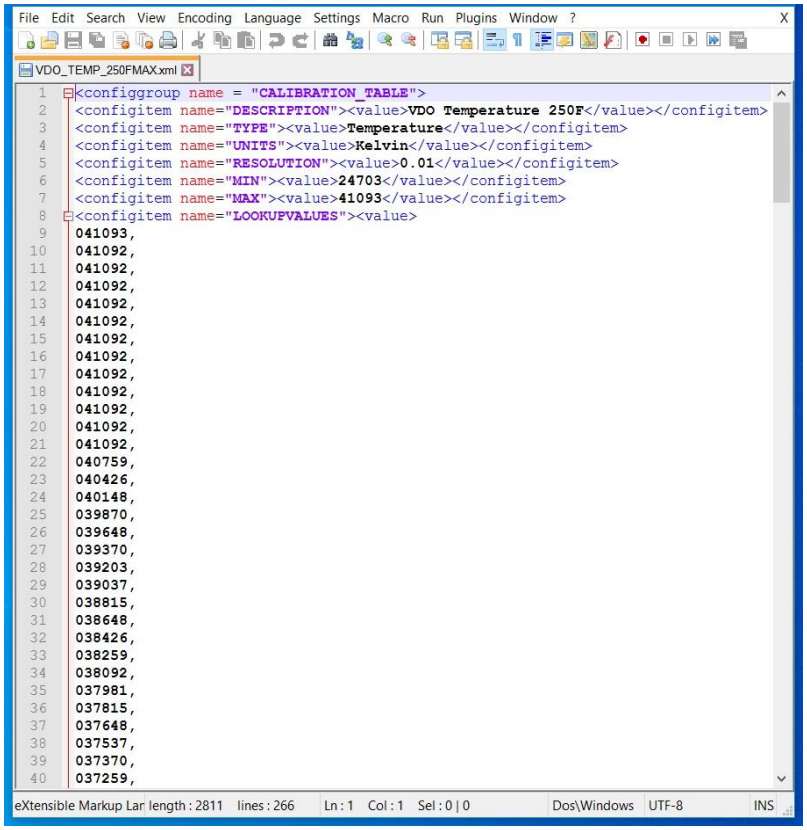
15/(15 + 300) * 3.2VDC = 0.047 * 3.2 VDC = 0.15 VDC @ 150C

If we map the 3.2VDC to an index range of 256. We calculate the table index as

0.76 * 256 = index 197 @ 10C and 0.047 * 256 = index 12 @ 130C

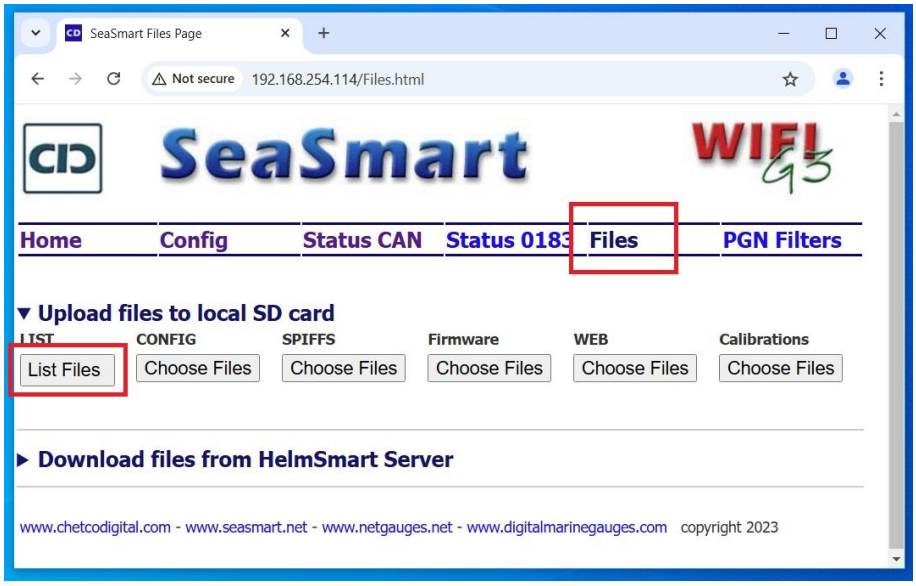
Finally, since the table units are in 0.01 degrees kelvin, we convert degrees C to Kelvin and multiply by 100

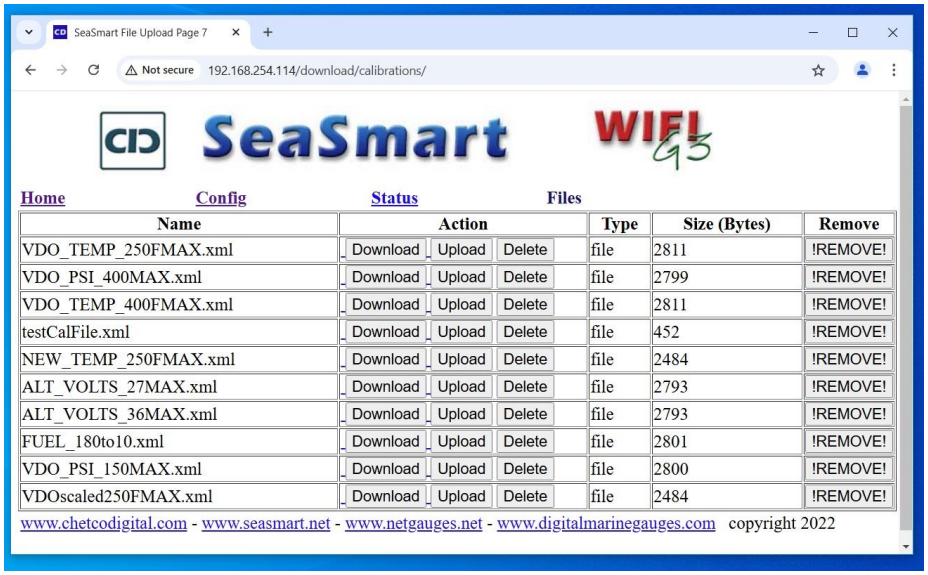
Index 197 = (10 + 273) * 100 = 028300 and Index 5 = (130 + 273) * 100 = 040300



SeaGaugeG4 stores sensor calibration files in the \calibration directory on the internal SD memory card

A library of files are available for a large variety of common sensors and can loaded onto the SD card using the web browser interface or directly copied from local browser device.

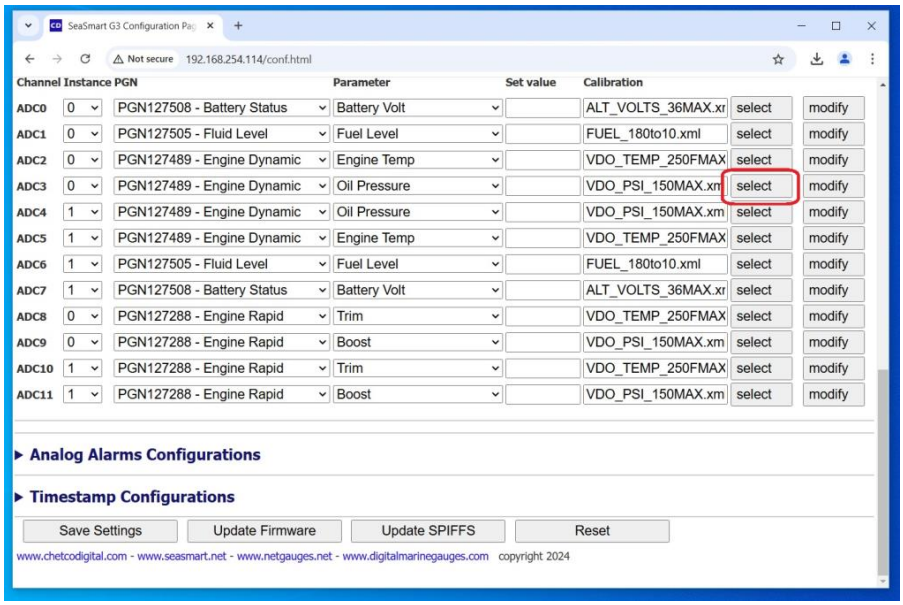


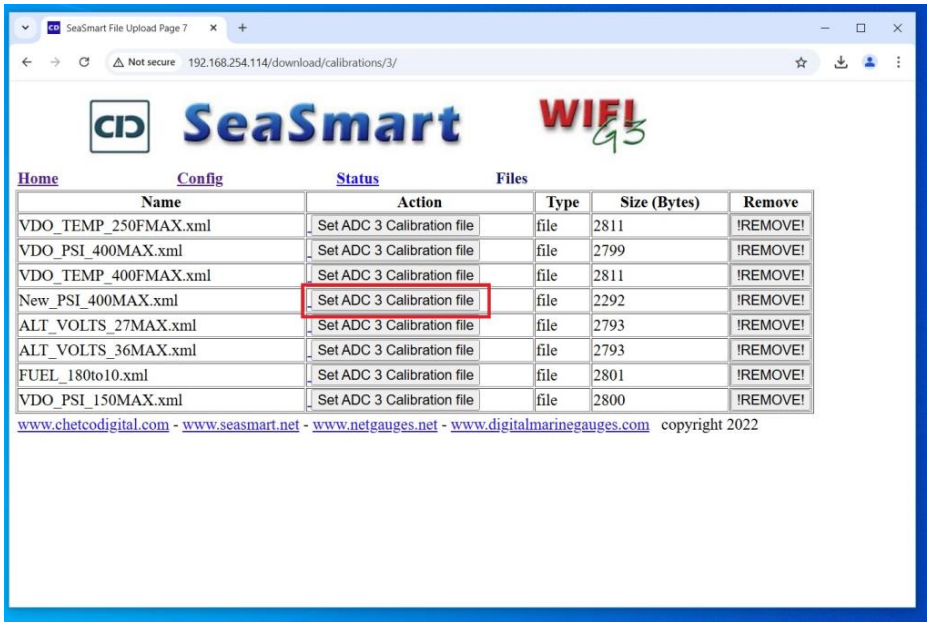


The embedded browser interface allows assigning any of the stored calibration files to the desired sensor input channel

The Analog Input Configuration section of the Configuration page will show the currently assigned calibration files used for each sensor channels

SELECT will allow changing the current file used for the target channel

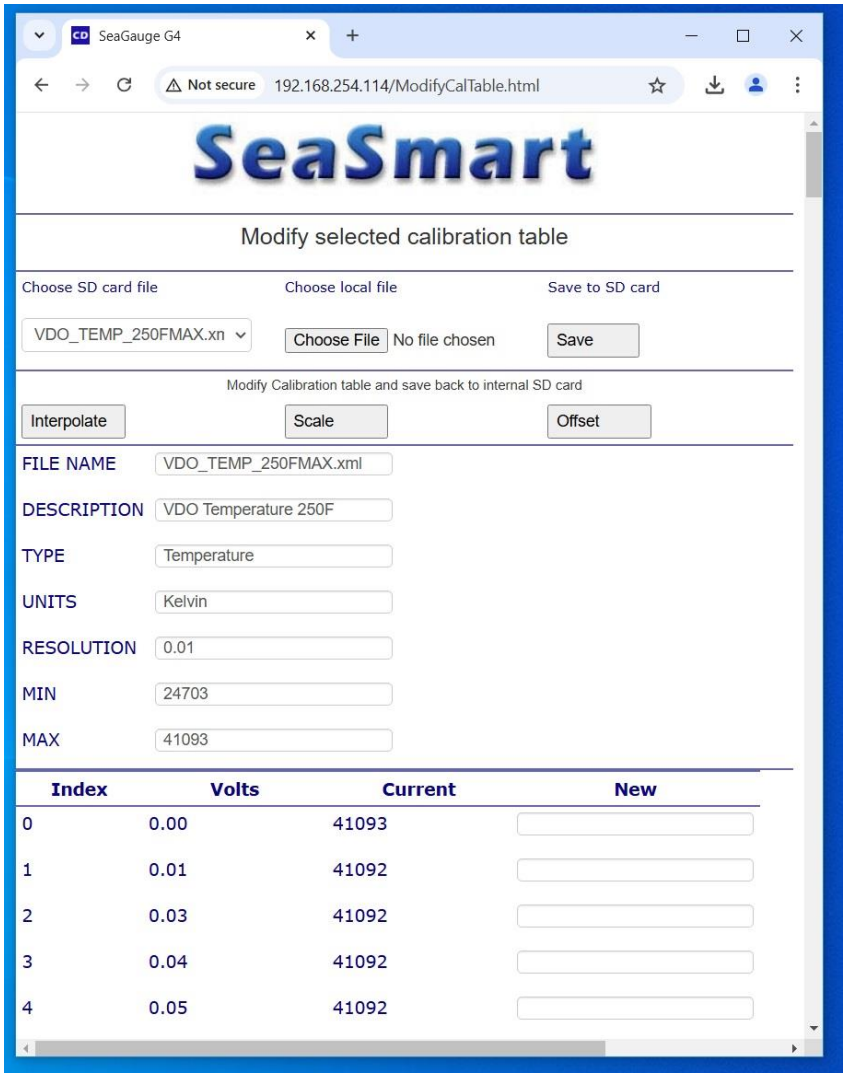




New calibration files can be created, and existing ones modified using the embedded browser page.

You can access it directly using the device url
http://www.seagaugeg4-XXX.local/ModifyCalTable.html

Or by using the MODIFY button on the Analog Input Configuration page



Start configuration be connecting to the SeaGaugeG4 WIFI interface via Access Point (AP) mode or Station mode (STA).

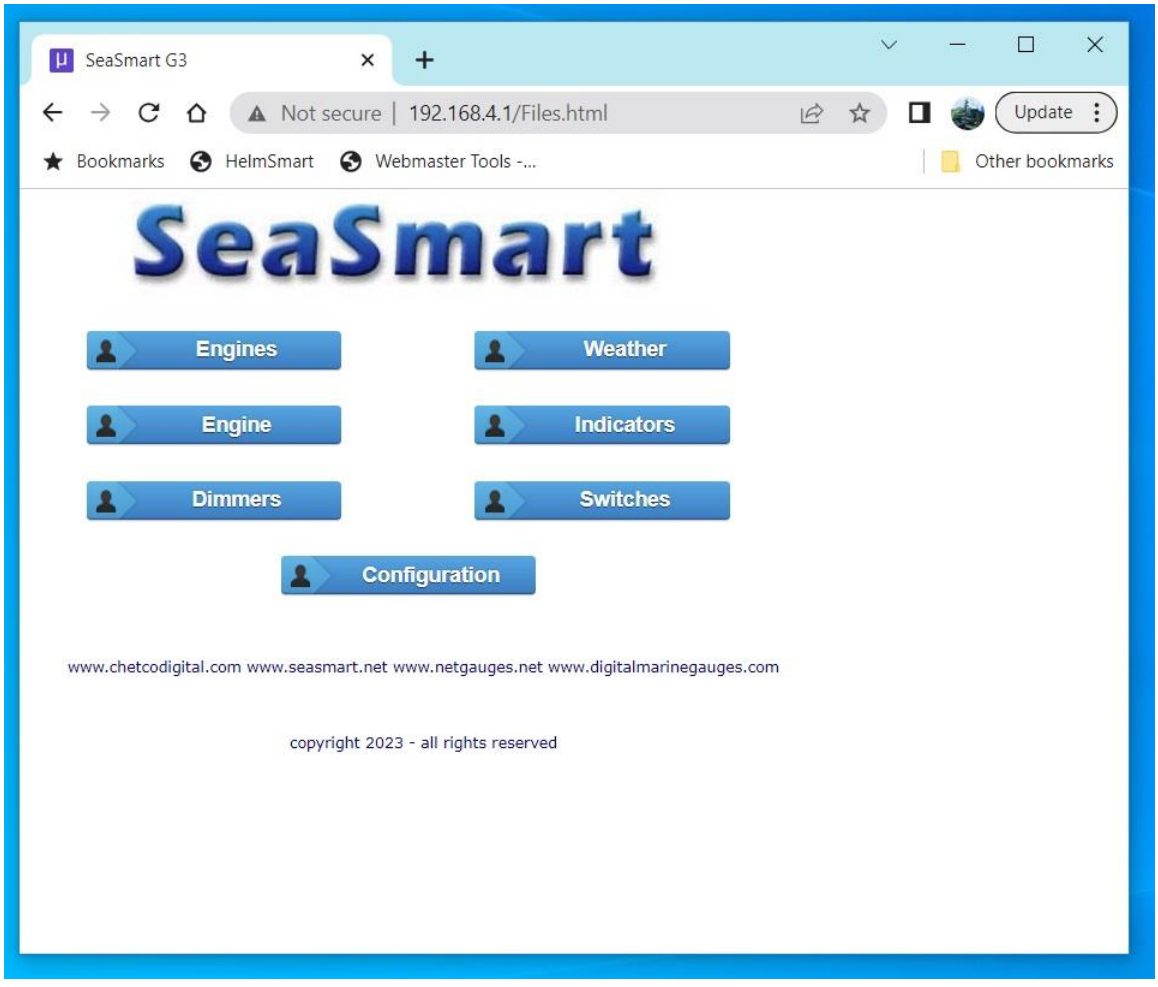
AP mode is used when connecting directly to SeaGaugeG4 without using a local router or internet connection. Full CAN bus function can still be enabled and configured in AP mode.

Station mode is used for joining an existing local WIFI network and requires entering the SSID and password of the local network.

Once connected, enter the default IP http://192.168.4.1 for AP.

For station mode the default protocol is DHCP enabled which means the local router will automatically assign the IP address for SeaGaugeG4. If mDNS is enabled and supported by your browser you can use the default url printed on the SeaGaugeG4 network label.

For example http://seagaugeg4-XXX.local where XXXX is the last 4 digits of the device MAC address



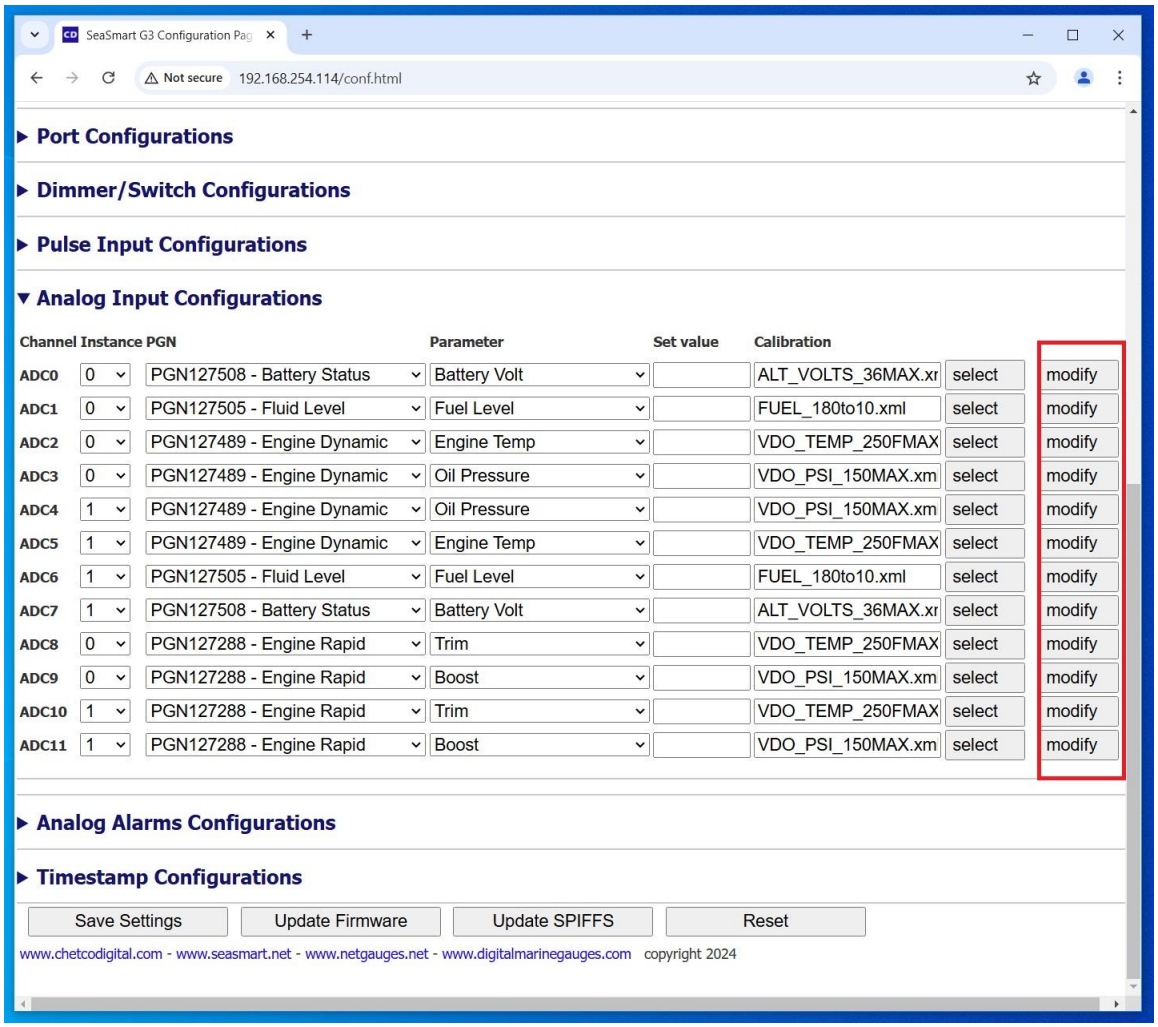
Once connected to the SeaGaugeG4 Home page you can navigate to the CONFIGURATION page

The CONFIGURATION page will have two additional sections for SeaGaugeG4 only - Analog Input Configuration and Analog Alarms Configurations.

Expand the Analog Input Configuration by clicking the arrow on the left

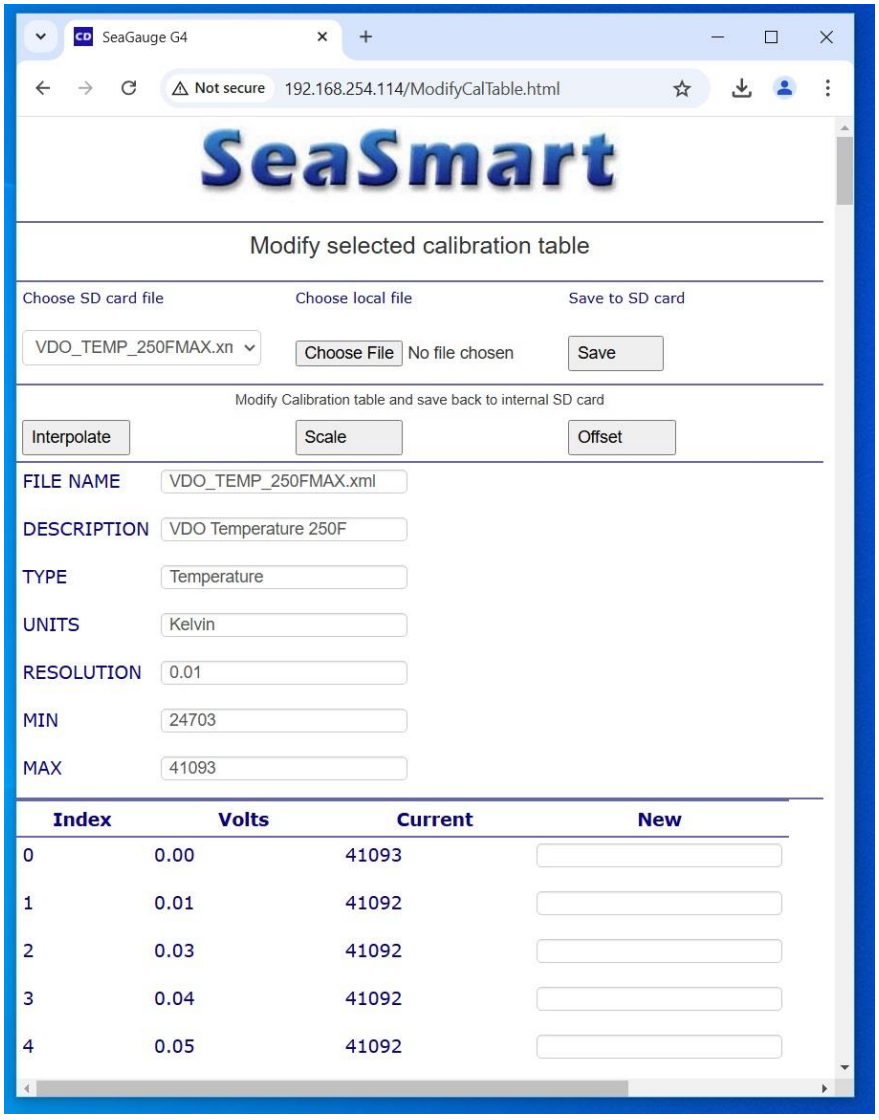
You will now see a list of options for each of the 12 analog inputs with assigned parameters and calibration files

Selecting the MODIFY button will open a new screen to allow modification of any of the stored calibration files



The ModifyCalTable.htm page allows selection of any of the stored files, modifying the tables and then writing the new file back to the SD card.

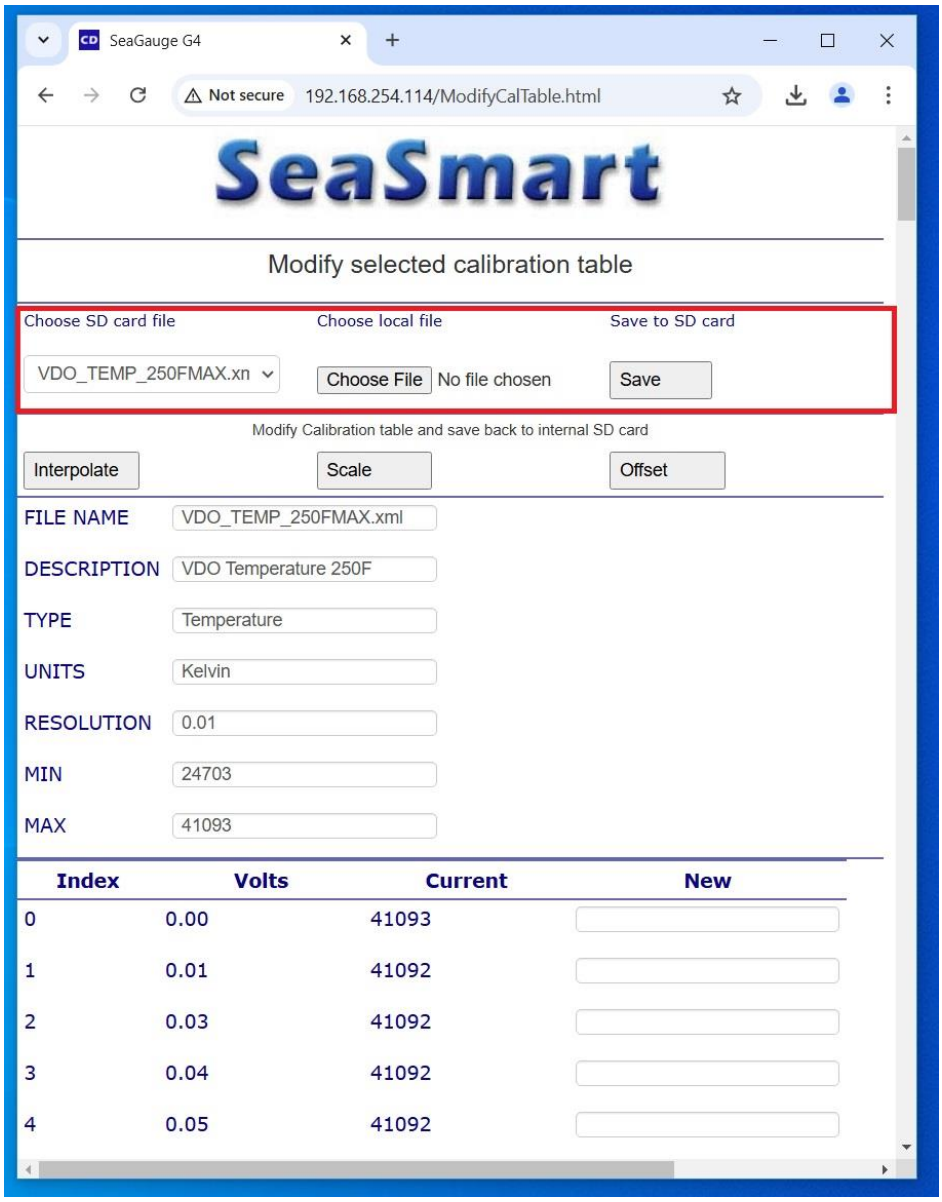
The modified file can either retain the original name or be assigned a new file name entered in the FILE NAME text box.



The top section allows for choosing the file and saving the results

Files can be picked directly from the internal SD card or from a local file on the browser device.

Any modified files are stored back directly to the SD card as browser security will not allow saving files locally



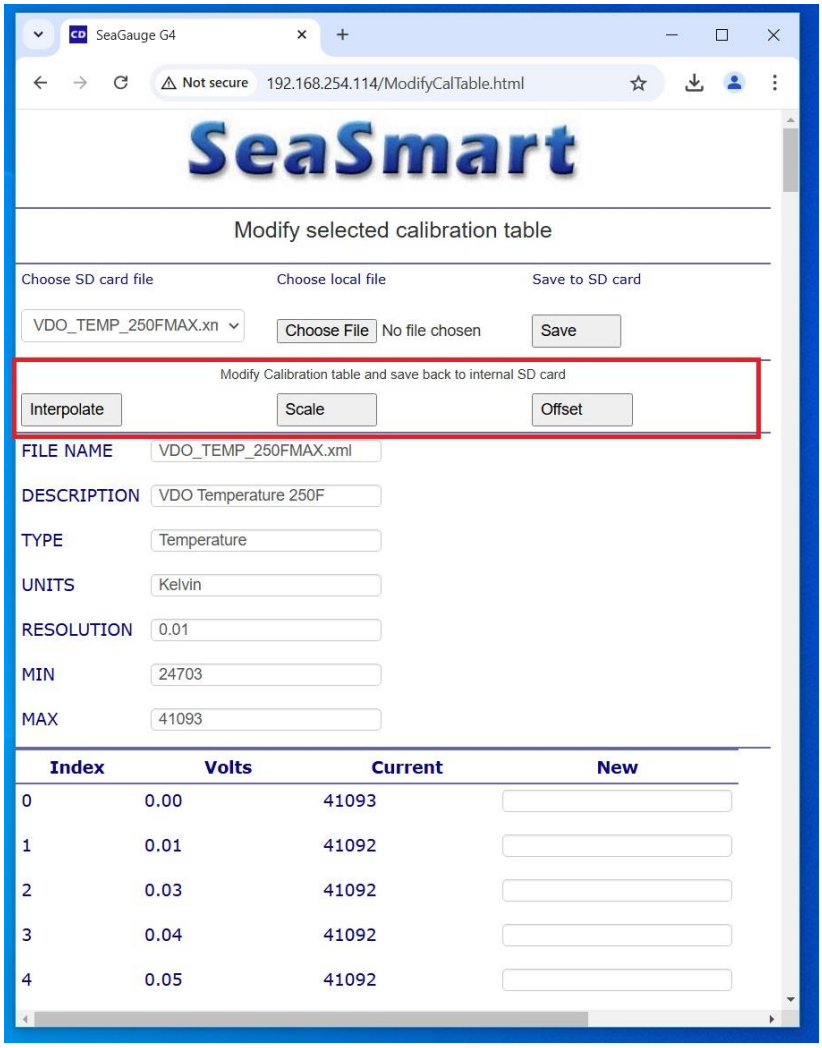
The next section defines the type of file modification

INTERPOLATE – will allow entering new data points from 2 to 255 any performing a straight line interpolation between all points entered. The more points entered results in a more accurate calibration

SCALE – a simple scaling of all the values in the calibration table

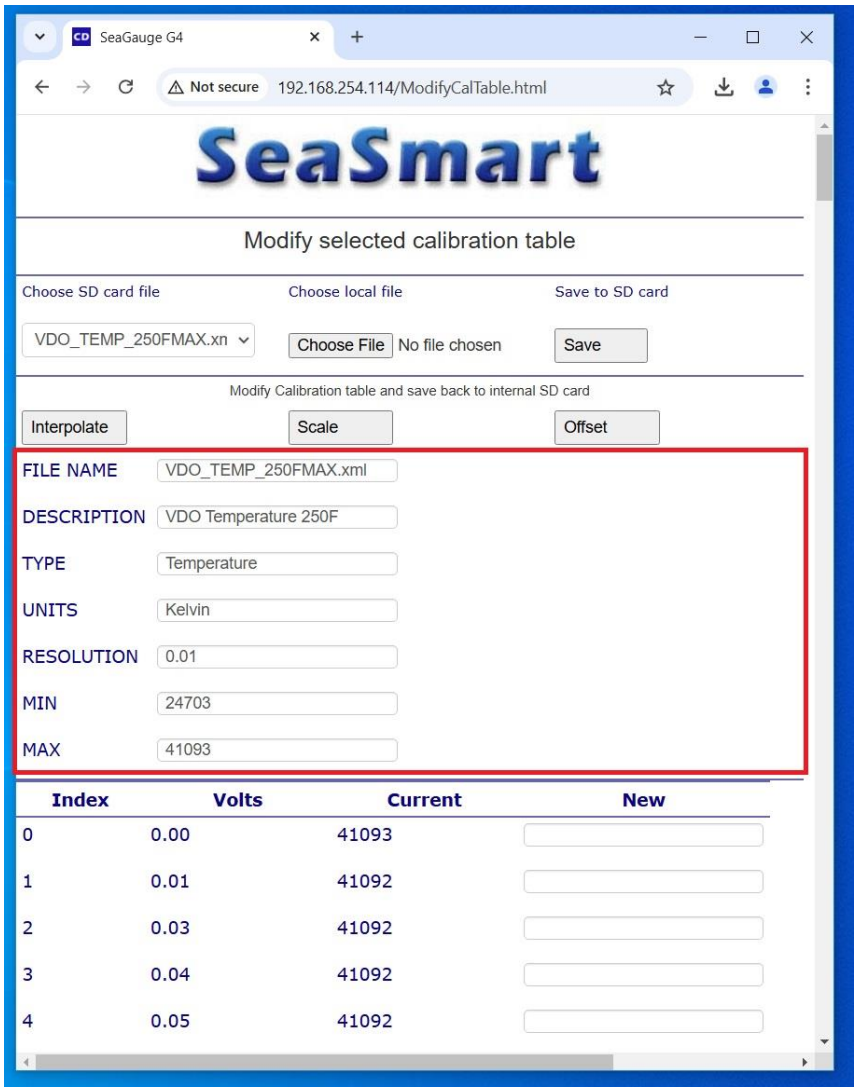
OFFSET – adds/subtracts a constant to all values in the table

Operations can not be combined without saving the file first



The FILE HEADER section contains the current file info and can be modified by entry into the appropriate text field.

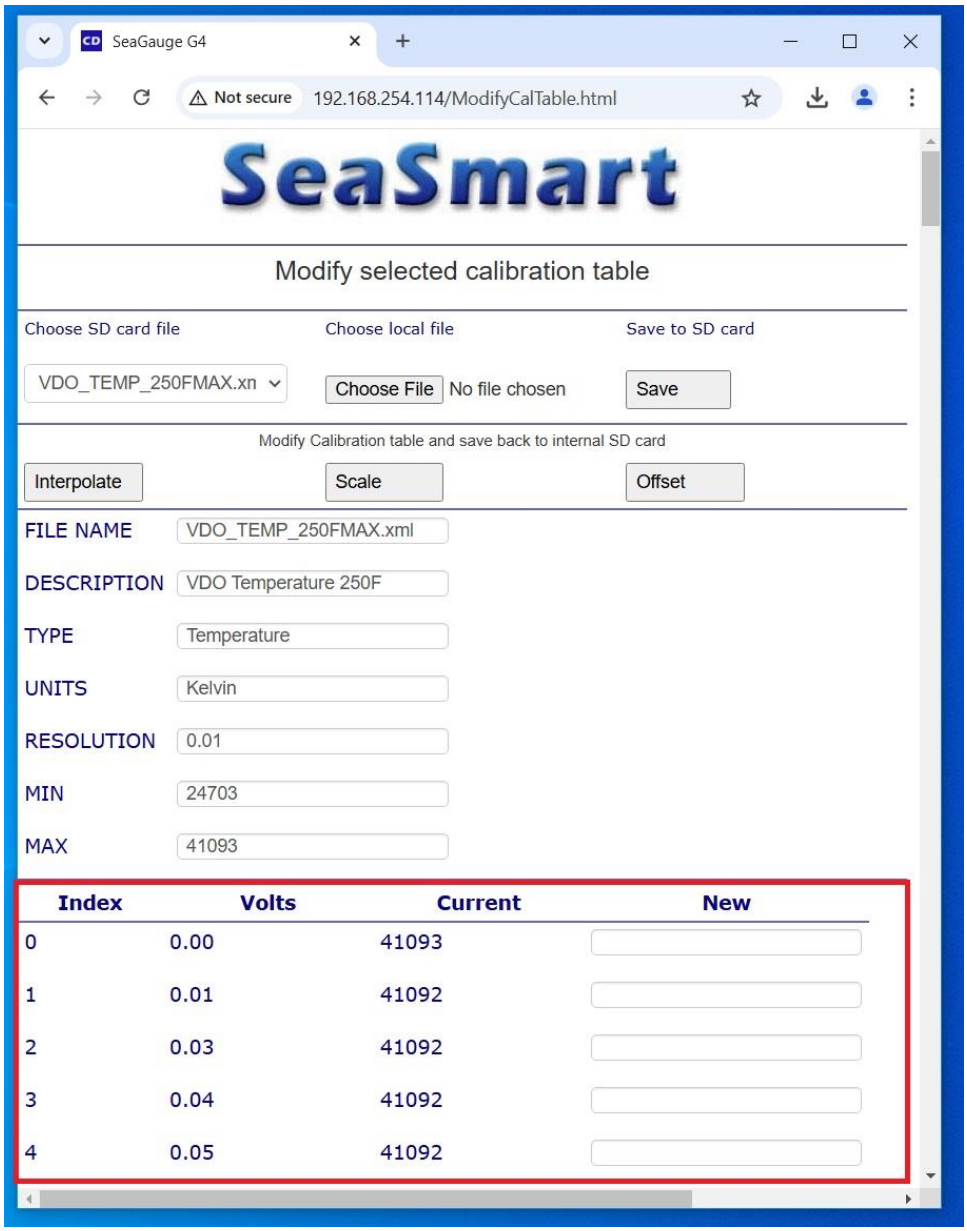
HEADER values are for information only and are not used in any calibration calculations other then to describe the file contents



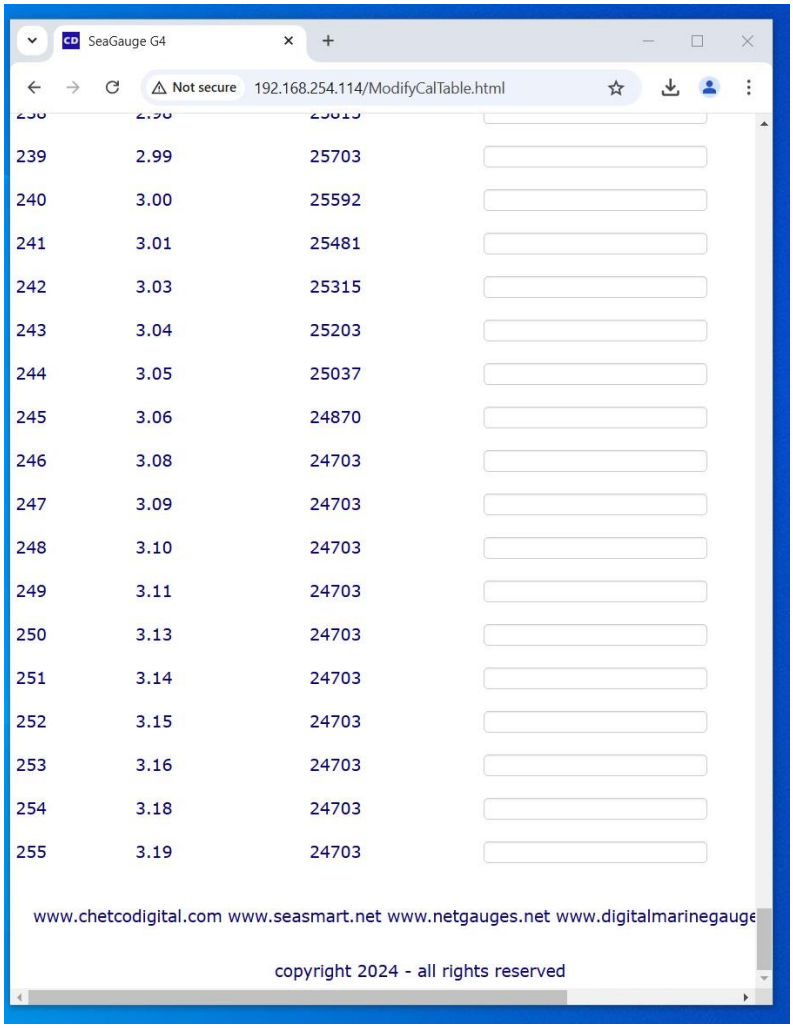
The DATA section contains the actual calibration lookup data from index 0 to 255

The existing values can be modified by entry into NEW field in each row.

Selecting any row will automatically enter the CURRENT value into the NEW field.

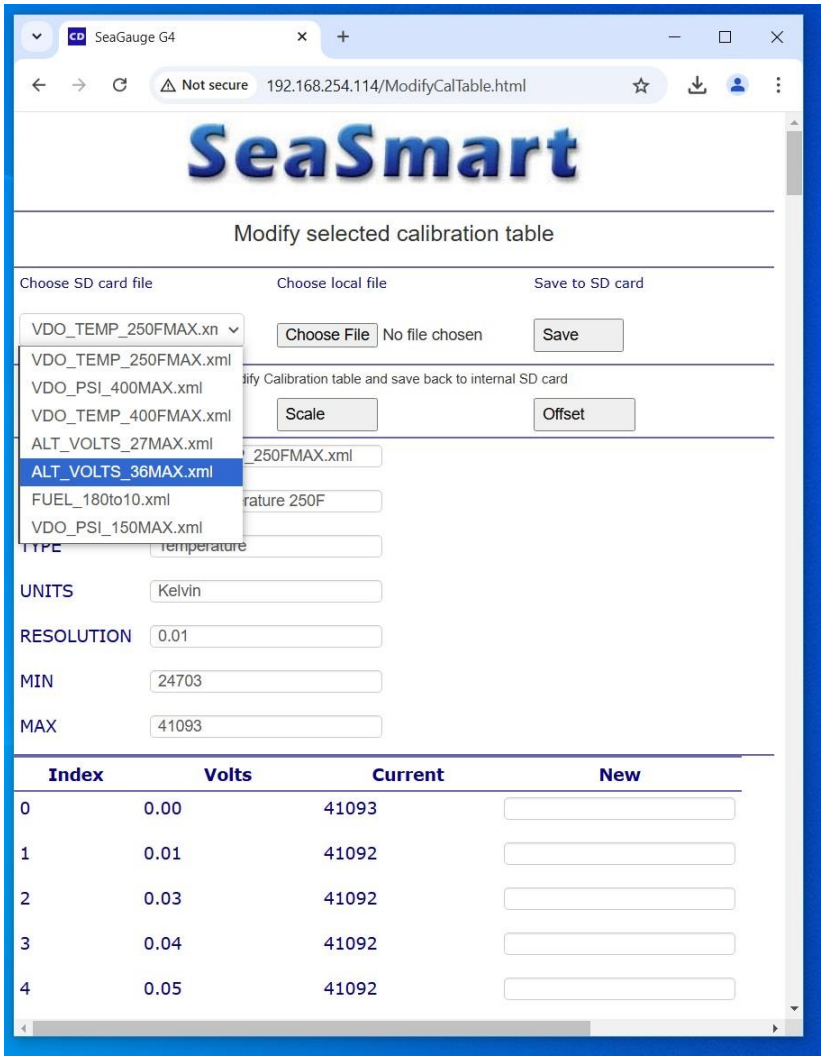


Scroll down the table rows to view all entries

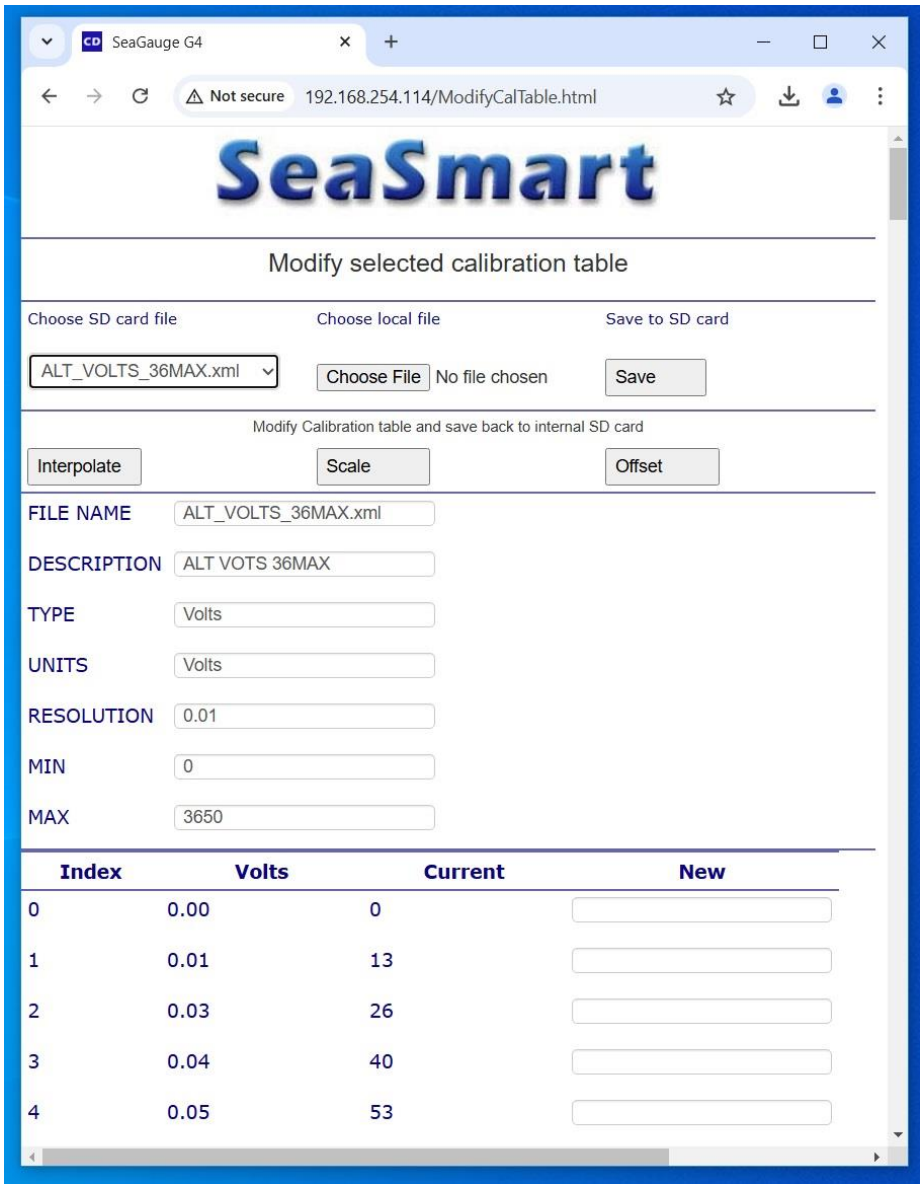


CHOOSE SD FILE will allow selection of calibration files stored on internal SD card.

Once modified, these files are stored back to the SD card

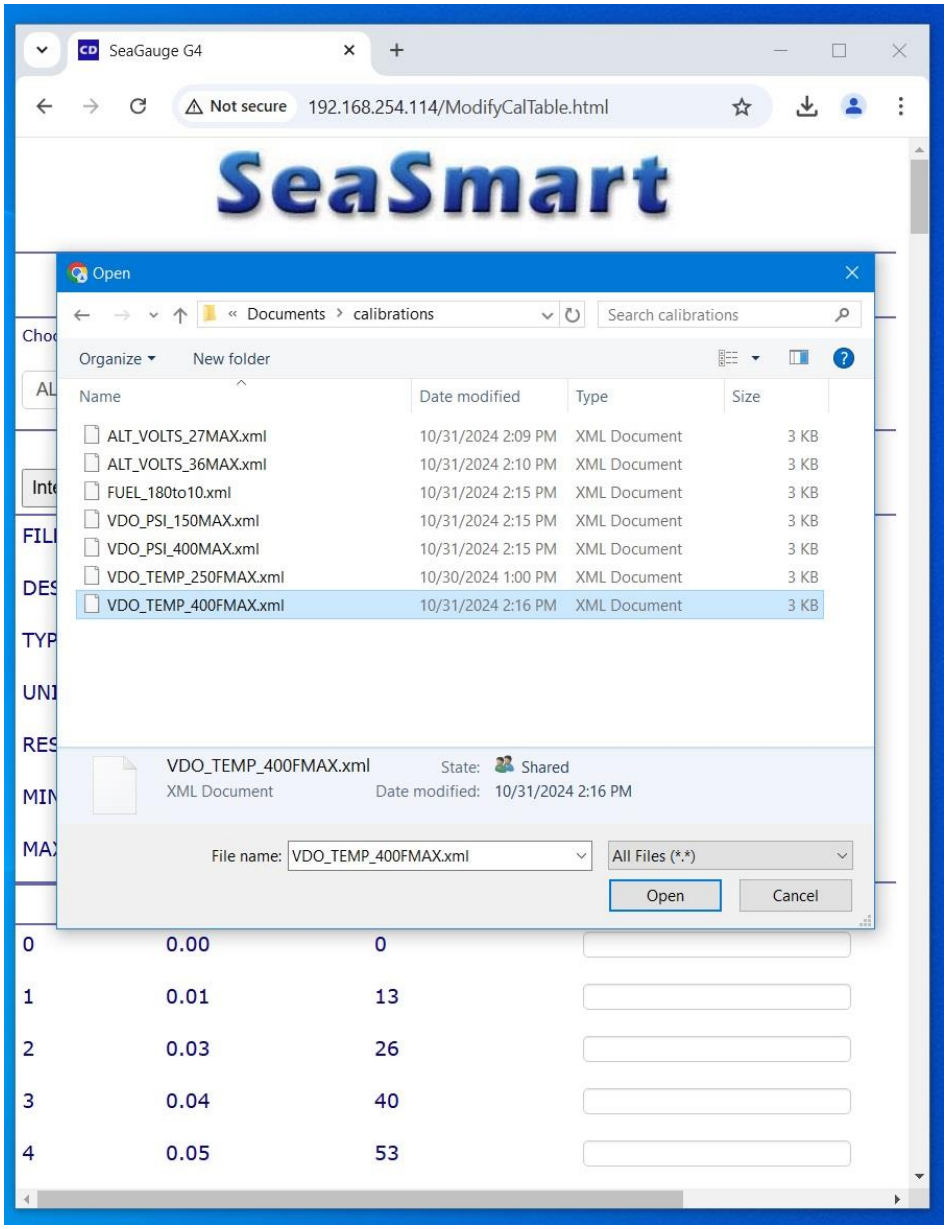


Selecting a new file will automatically load the selected calibration file and update the HEADER and DATA sections for edit

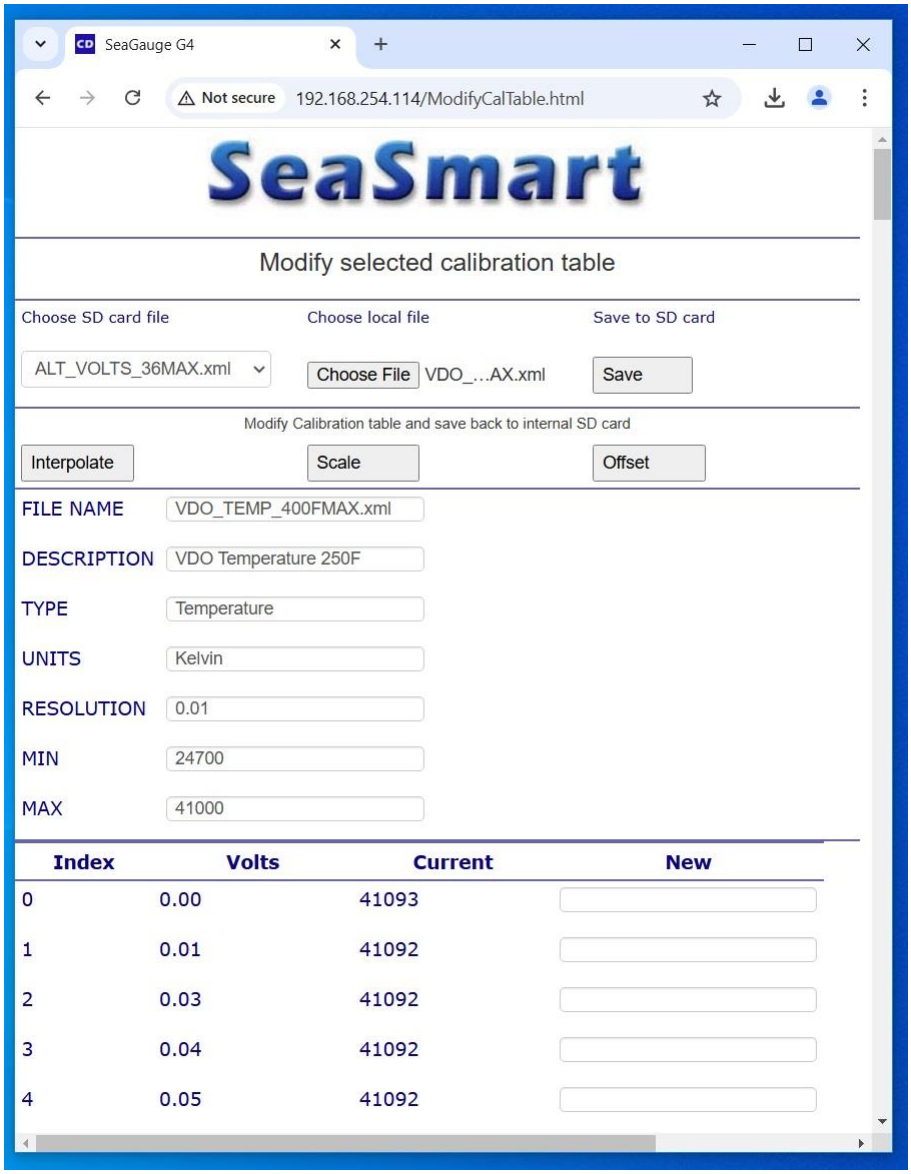


Choosing a local file is also possible by using the file picker.

If modifying a local file – the modified file is always stored back the SD card for security reasons

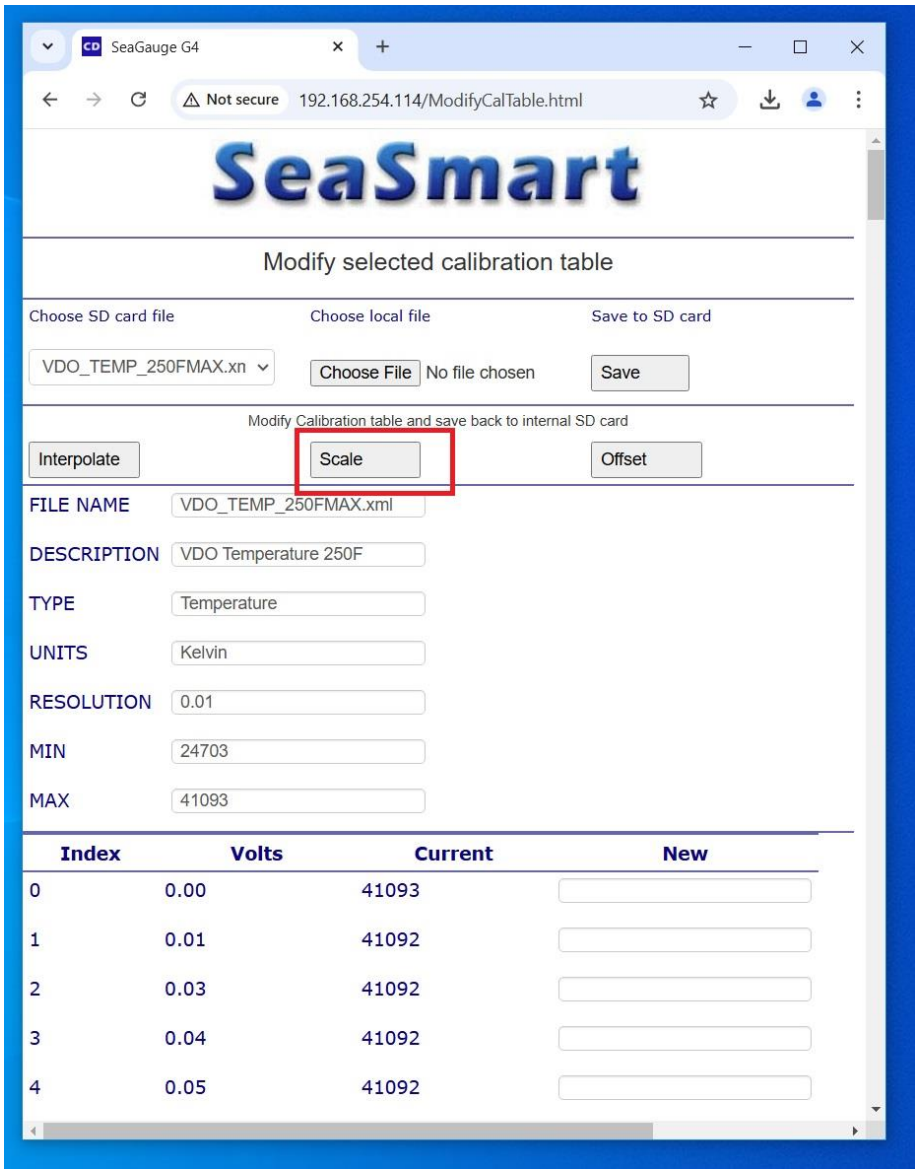


Choosing a local file will also autoload the file contents



Once a file is loaded – modification options are available

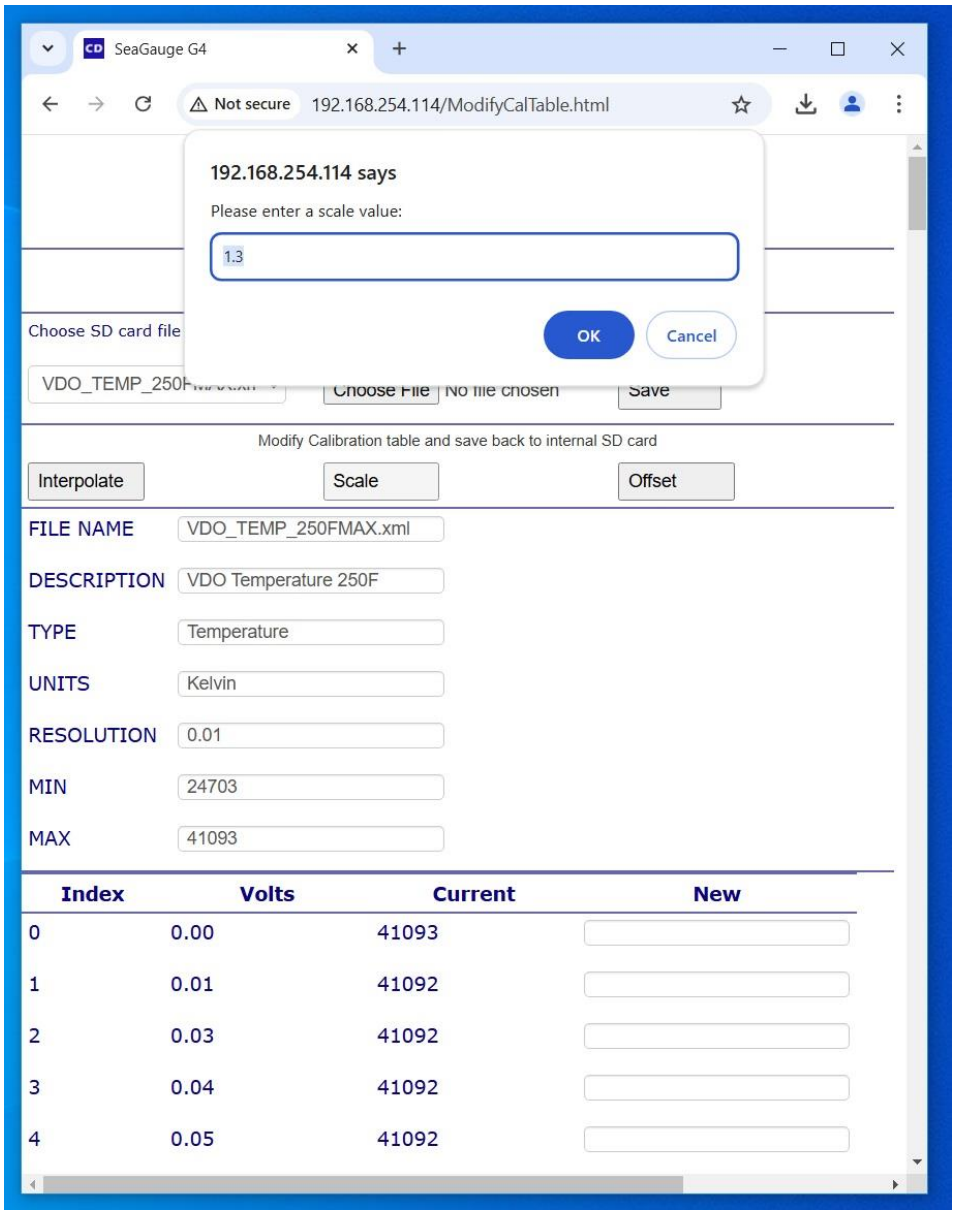
Scale is a simple multiply of all values in the loaded file by a constant value.



Enter the desired scale factor in the popup dialog

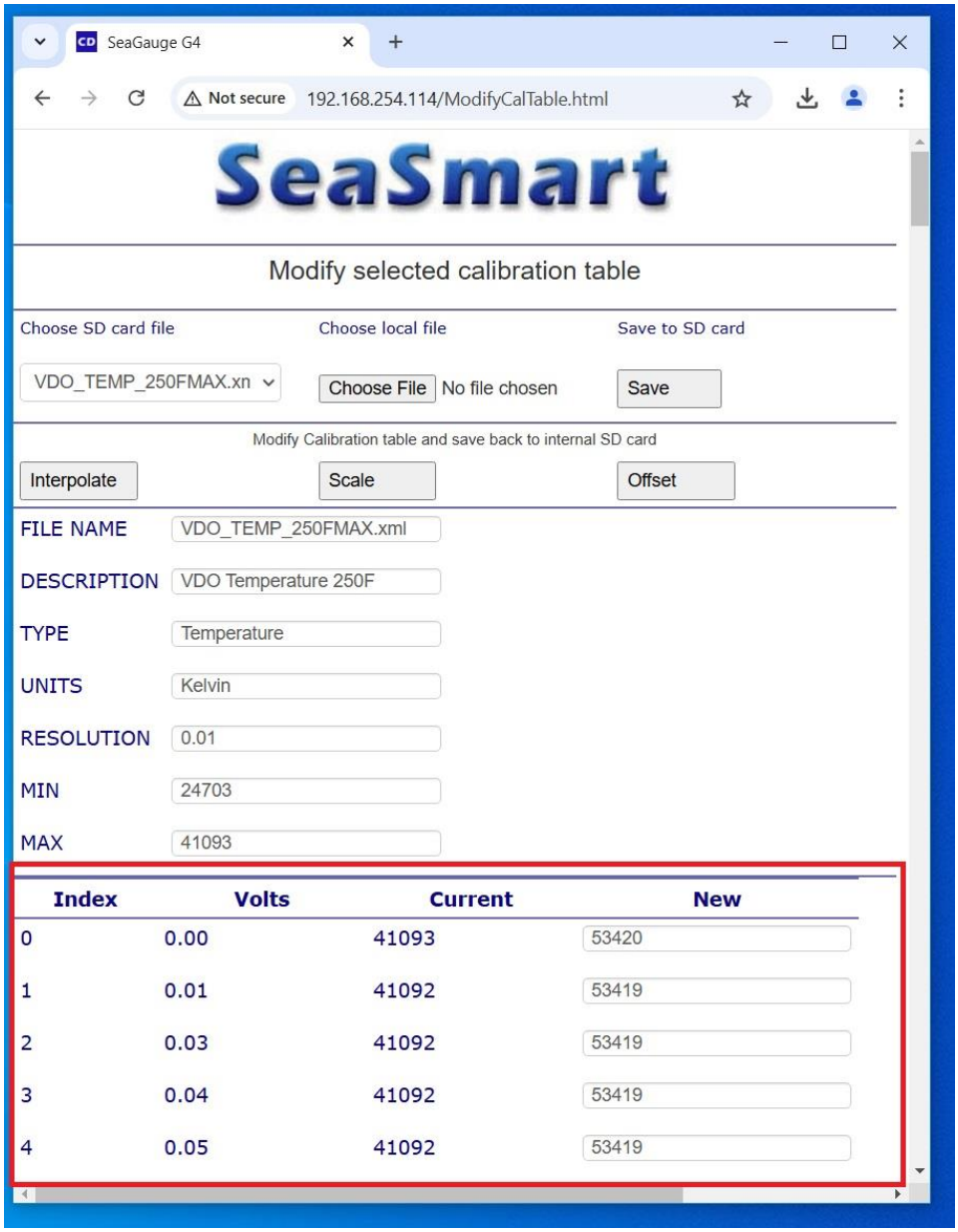
Be aware the all values are positive only and can not exceed the maximum of 65536.

Any values beyond the maximum will be clipped to 65536

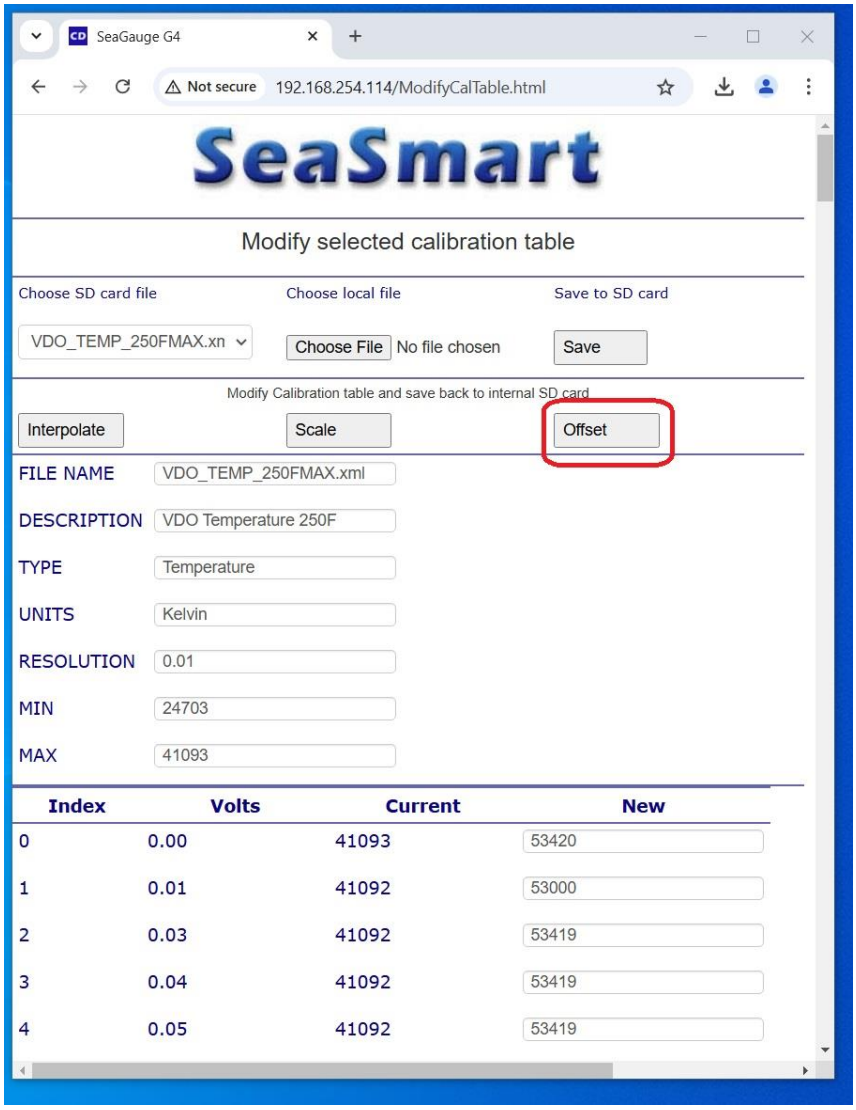


The resulting scaled values will be displayed in the NEW column.

Any value in the NEW column can be edited.



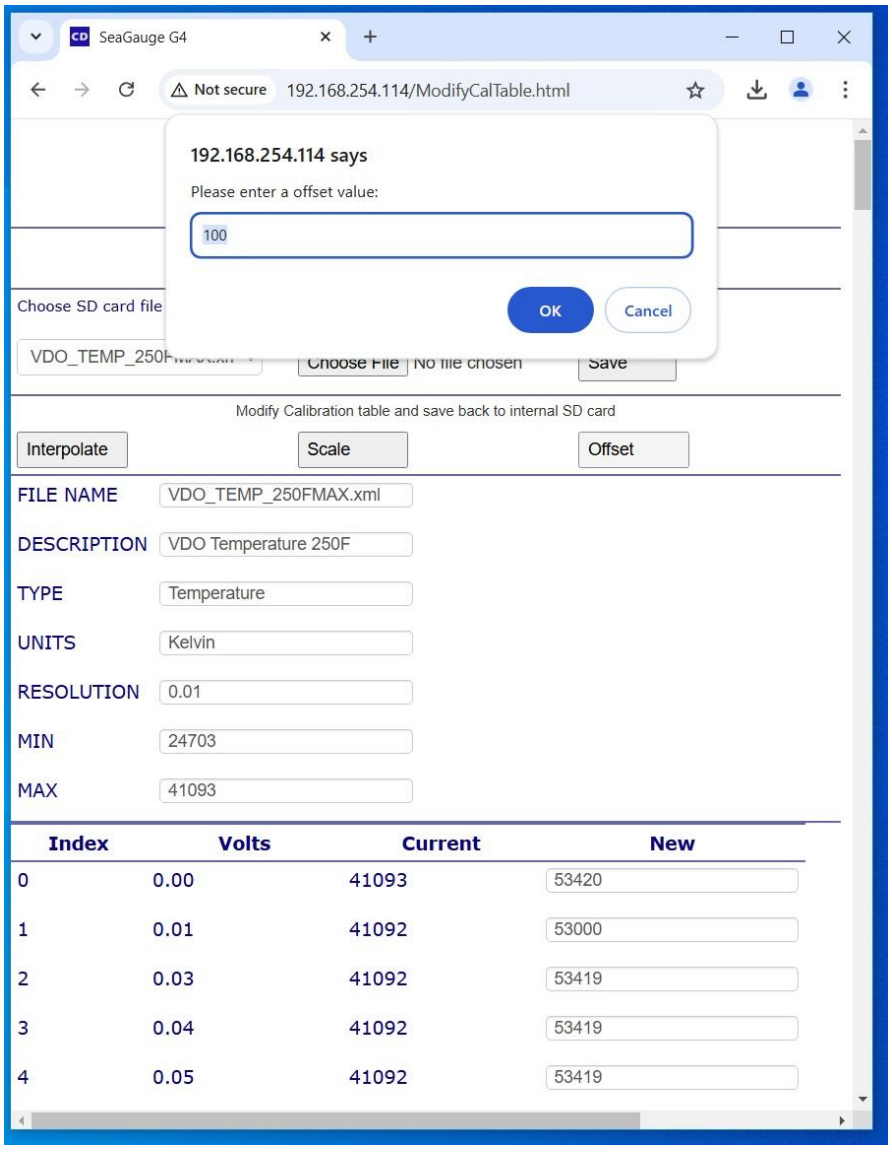
OFFSET is a simple adder to each value in the table



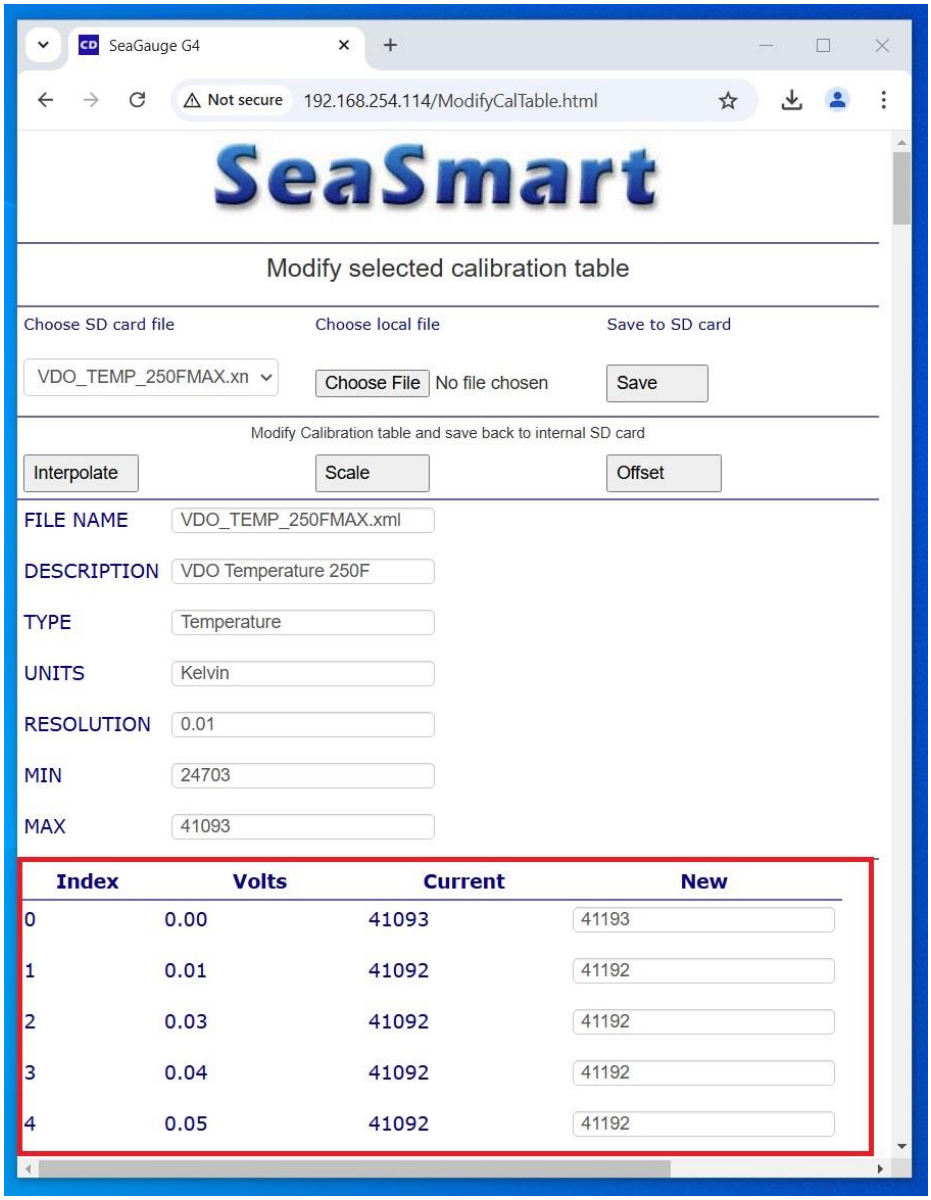
Enter the desired offset value in the popup dialog

Be aware the all values are positive only and can not exceed the maximum of 65536.

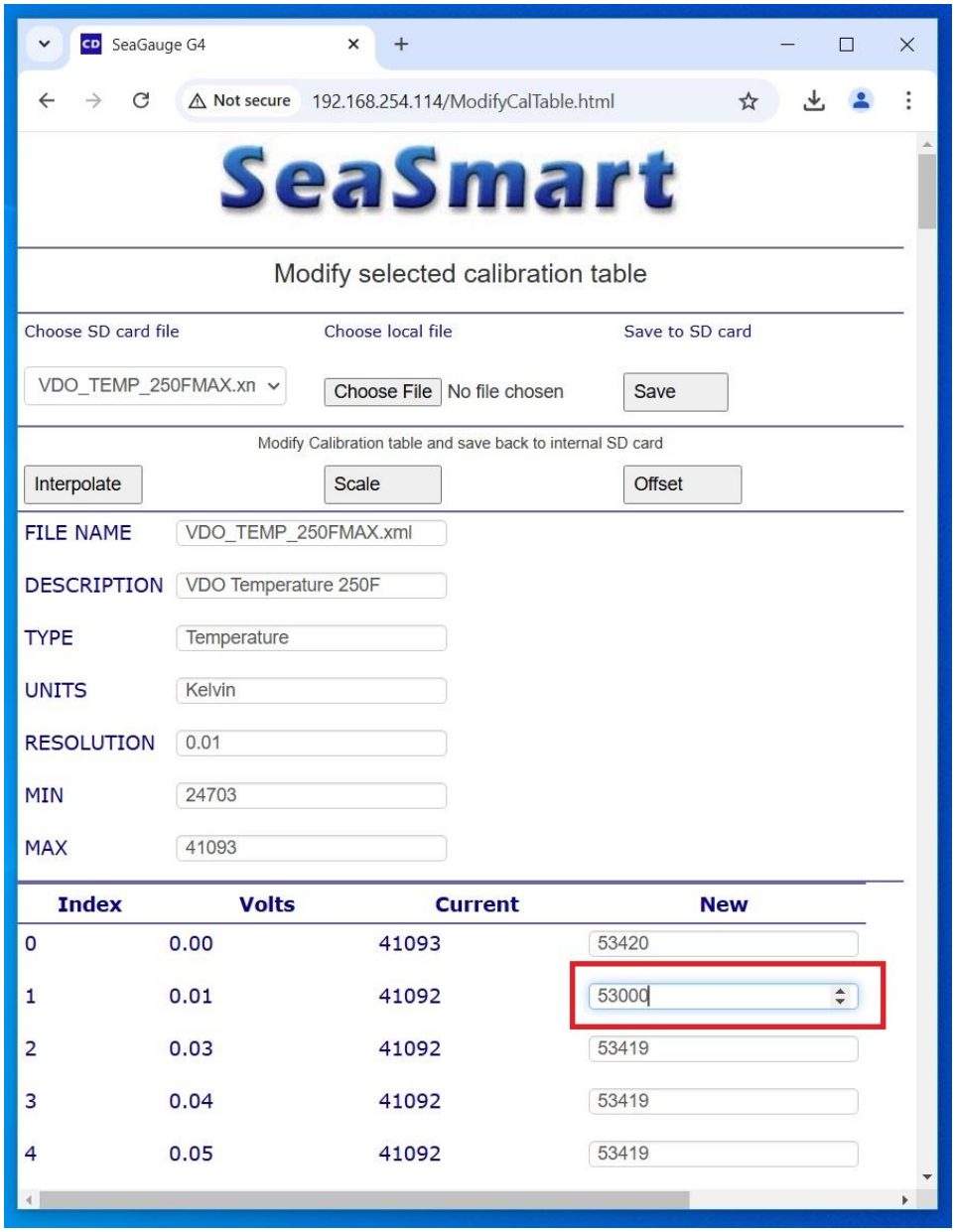
Any values beyond the maximum will be clipped to 65536 or 0



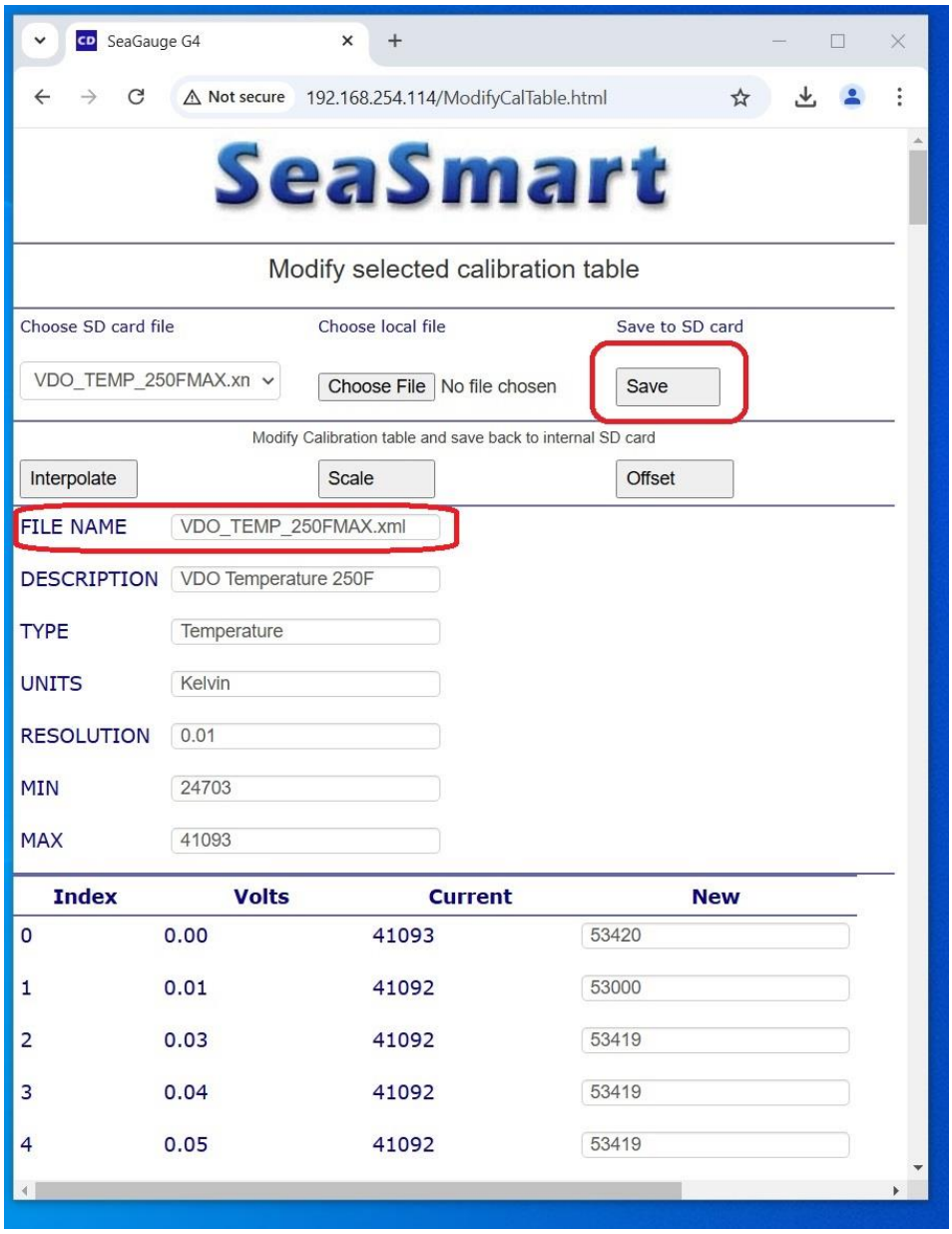
The resulting offset values will be displayed in the NEW column



Any NEW value can be edited by selecting the desired row and entry of a new value



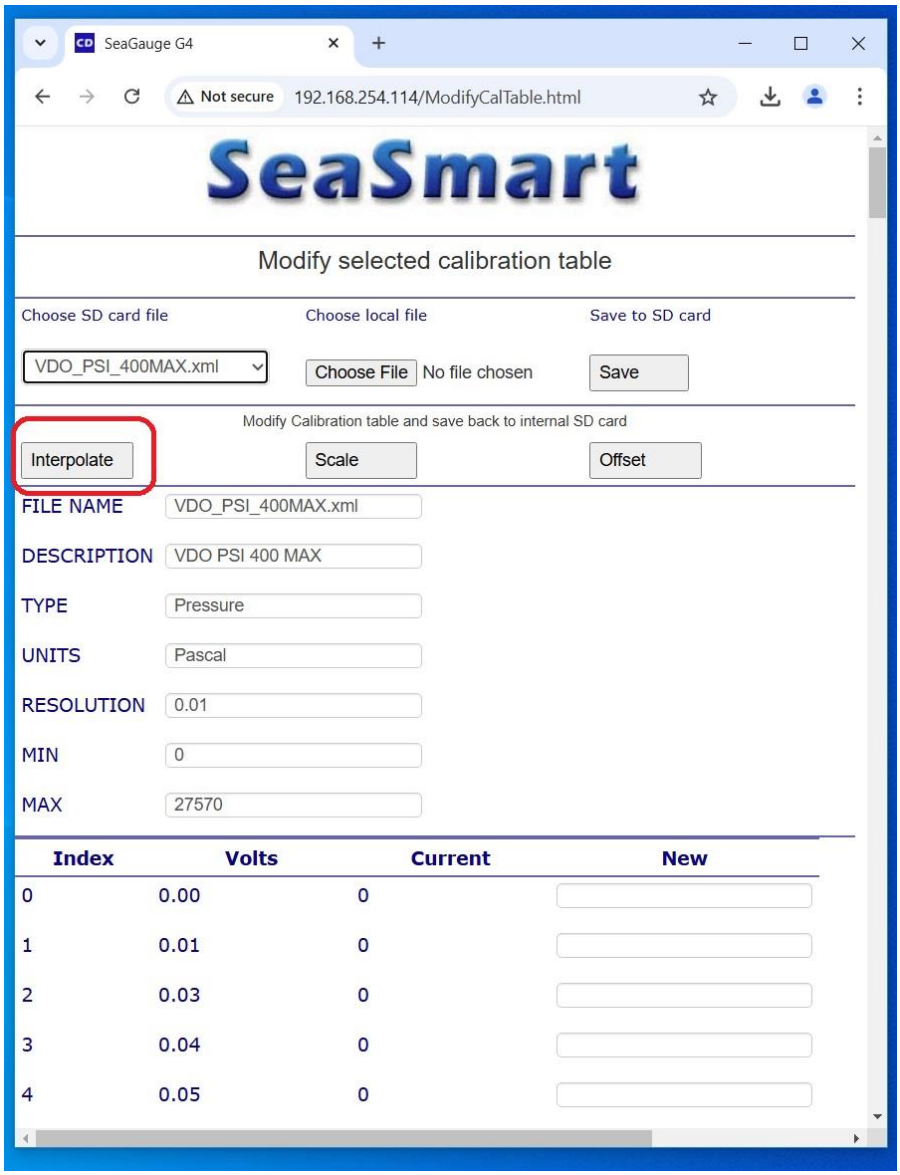
The resulting modified file can be saved back to SD card using the entry in the FILE NAME field



INTERPOLATION allows entry of 2 to 255 new data points that are then connected by straight line interpolations.

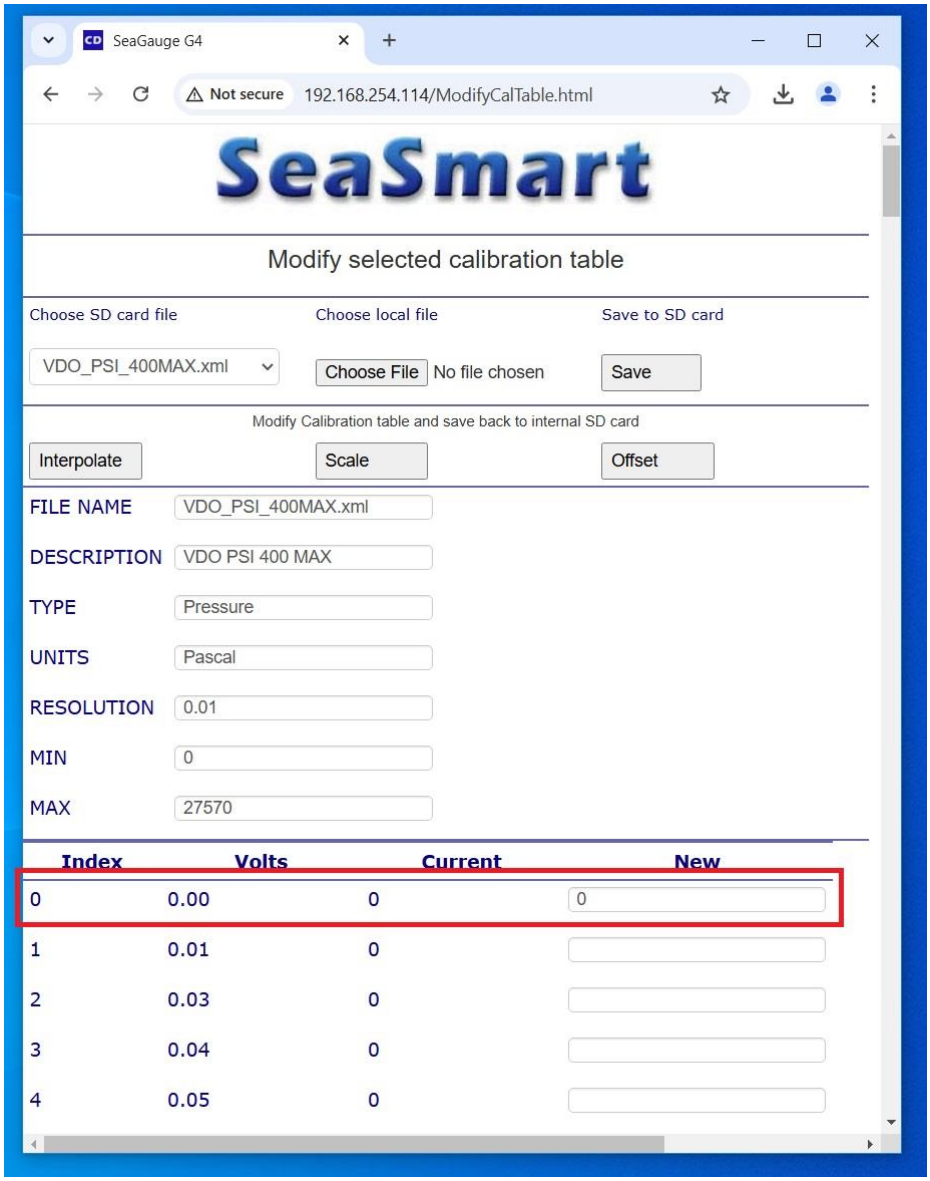
The more data points entered will result in a very precise calibration.

This type of modification is commonly done for fluid tanks and when trying to match existing analog gauge installations

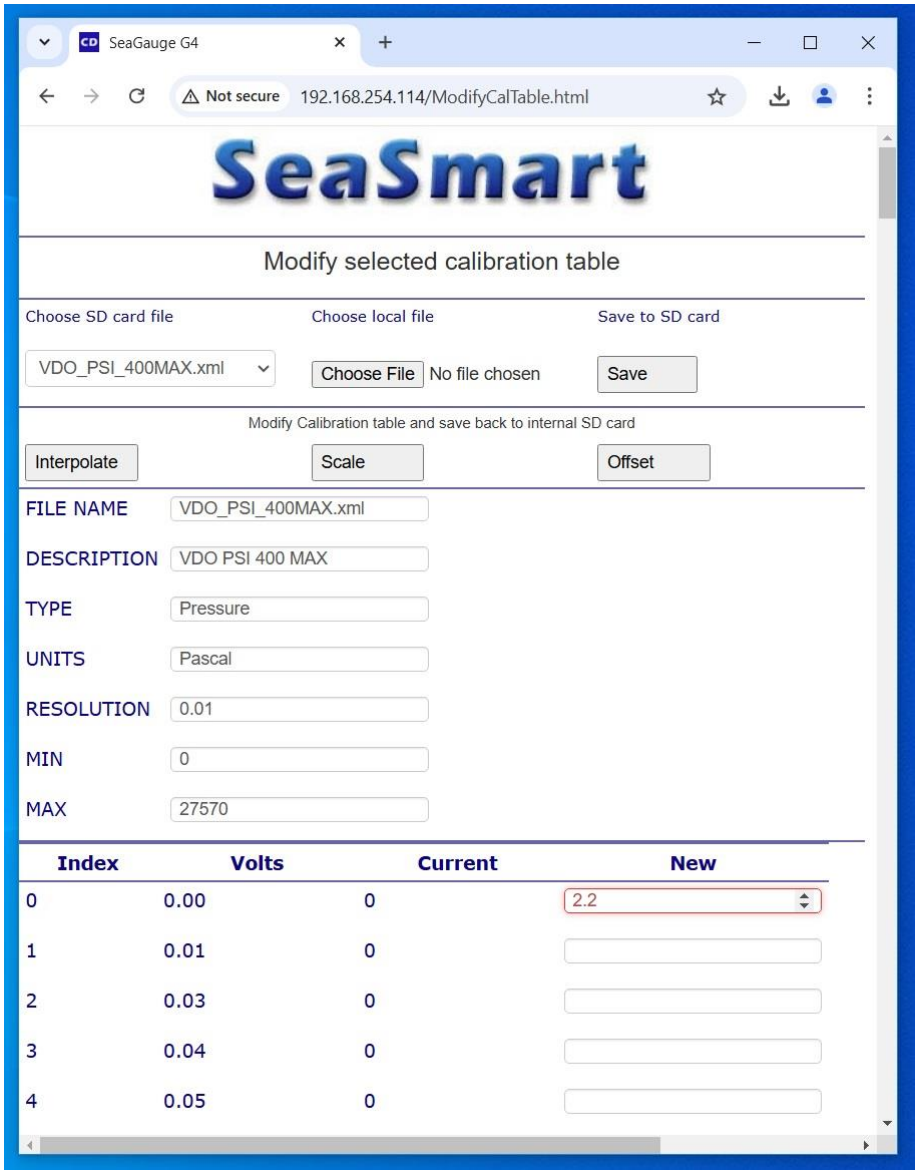


Interpolation starts with entering the first and last data points.

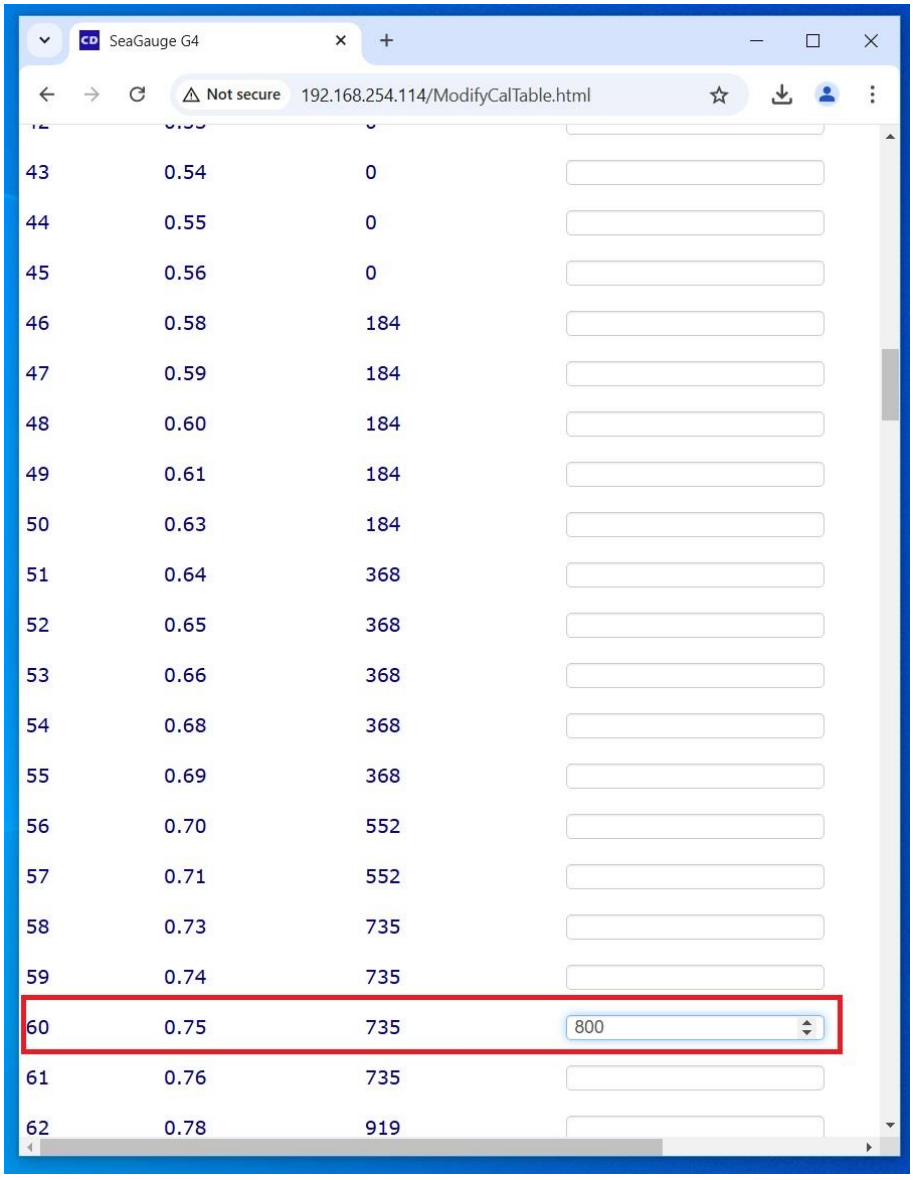
Clicking on any row will automatically copy the CURRENT value to the NEW value



Any NEW value can then be modified

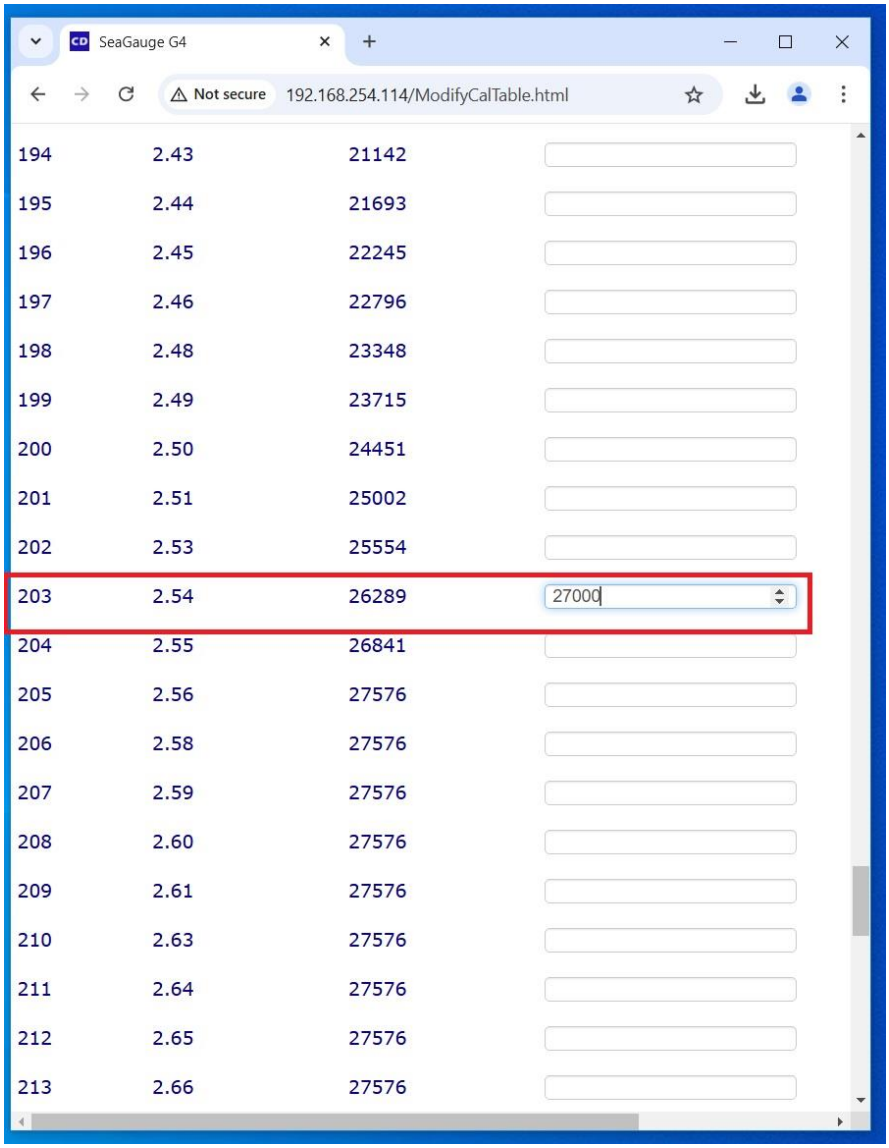


Scroll down through the data section to enter new values at each interpolation point



43	0.54	0	
44	0.55	0	
45	0.56	0	
46	0.58	184	
47	0.59	184	
48	0.60	184	
49	0.61	184	
50	0.63	184	
51	0.64	368	
52	0.65	368	
53	0.66	368	
54	0.68	368	
55	0.69	368	
56	0.70	552	
57	0.71	552	
58	0.73	735	
59	0.74	735	
60	0.75	735	800
61	0.76	735	
62	0.78	919	

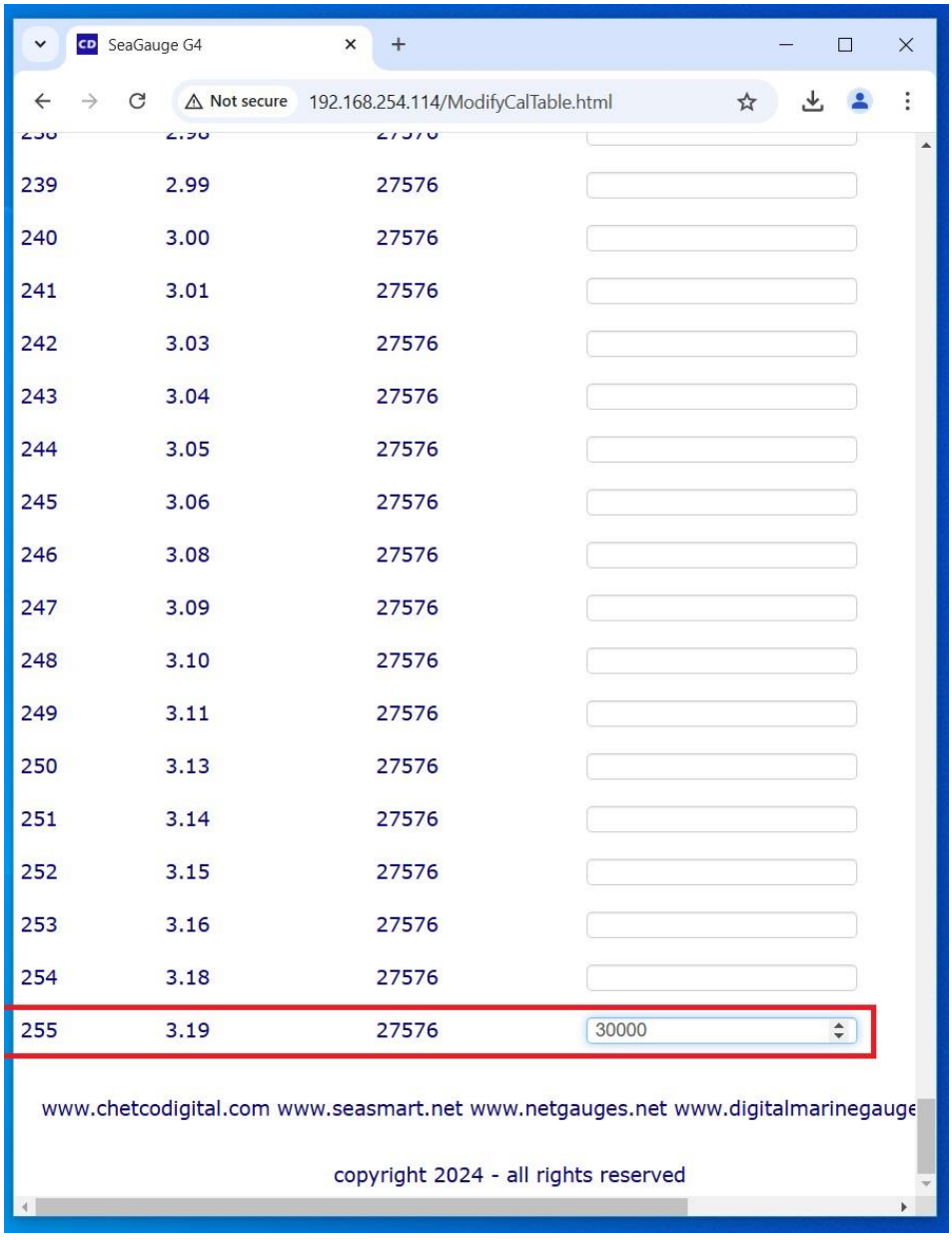
Be sure to use enough entries to approximate the desired calibration curve



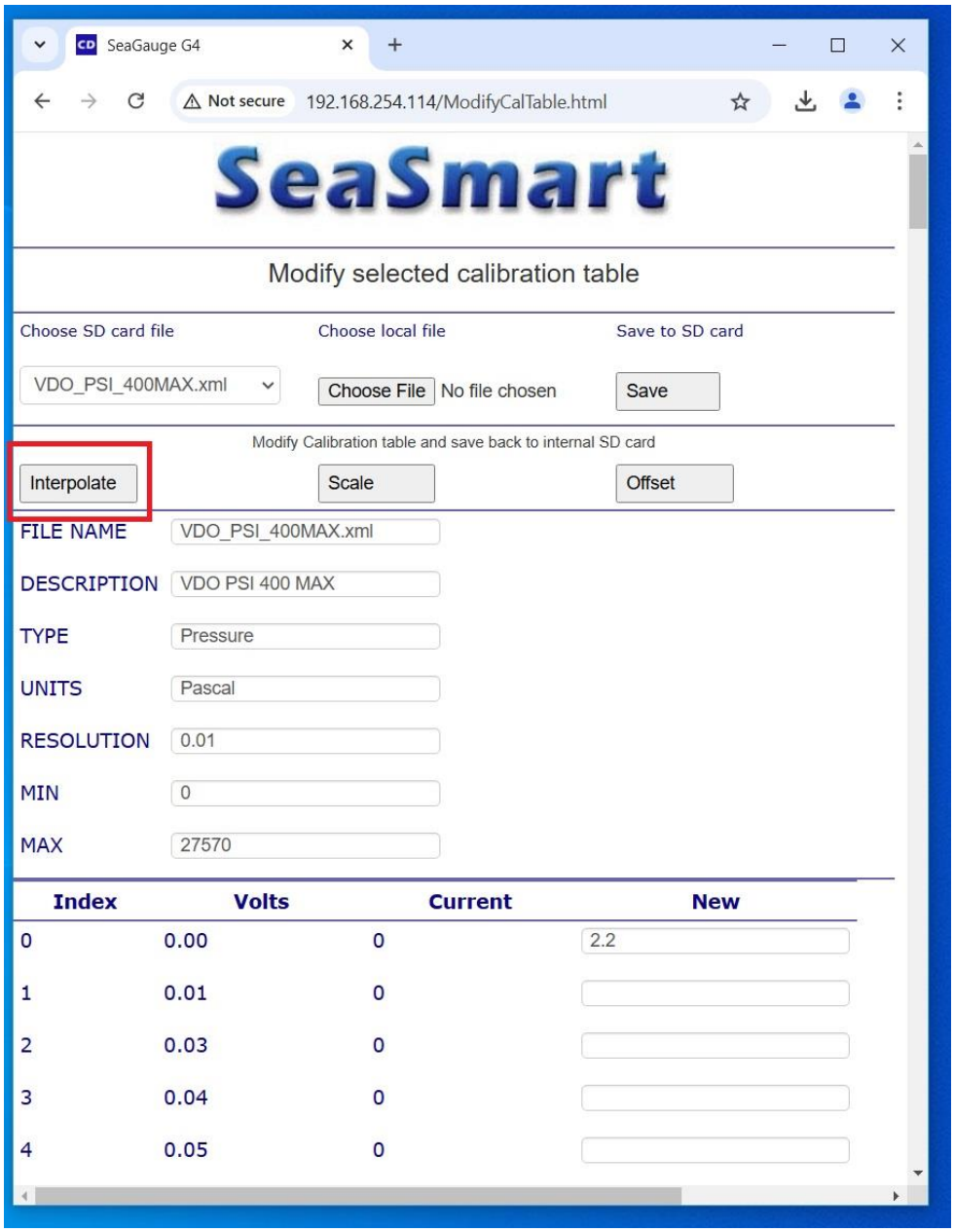
194	2.43	21142	
195	2.44	21693	
196	2.45	22245	
197	2.46	22796	
198	2.48	23348	
199	2.49	23715	
200	2.50	24451	
201	2.51	25002	
202	2.53	25554	
203	2.54	26289	27000
204	2.55	26841	
205	2.56	27576	
206	2.58	27576	
207	2.59	27576	
208	2.60	27576	
209	2.61	27576	
210	2.63	27576	
211	2.64	27576	
212	2.65	27576	
213	2.66	27576	

Finally, be sure to enter the last value to complete the table.

If no new entry is made for the first and last value – the current values will be used by default.

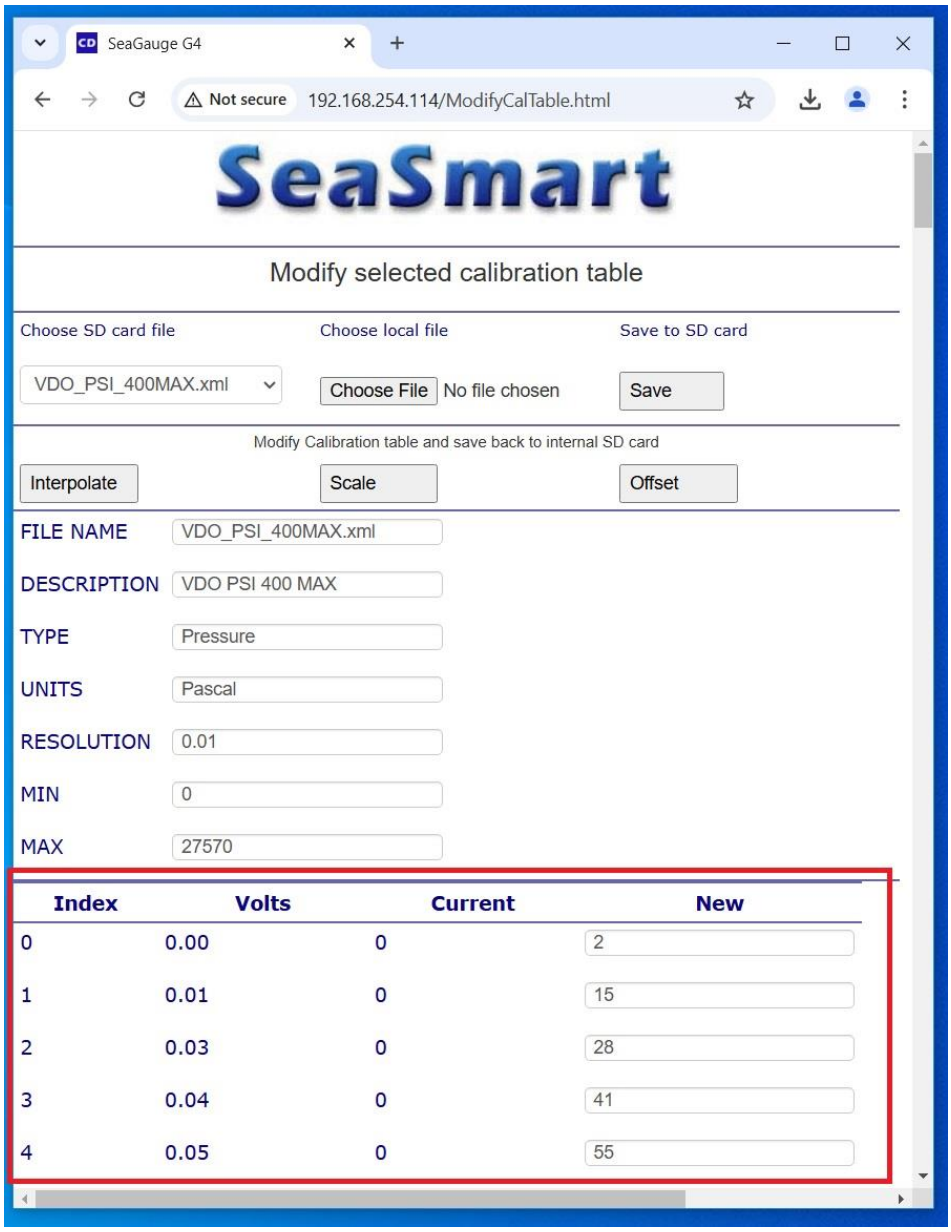


Once data entry is complete, click the INTERPOLATE button to calculate the NEW values



NEW values will be shown in the data section

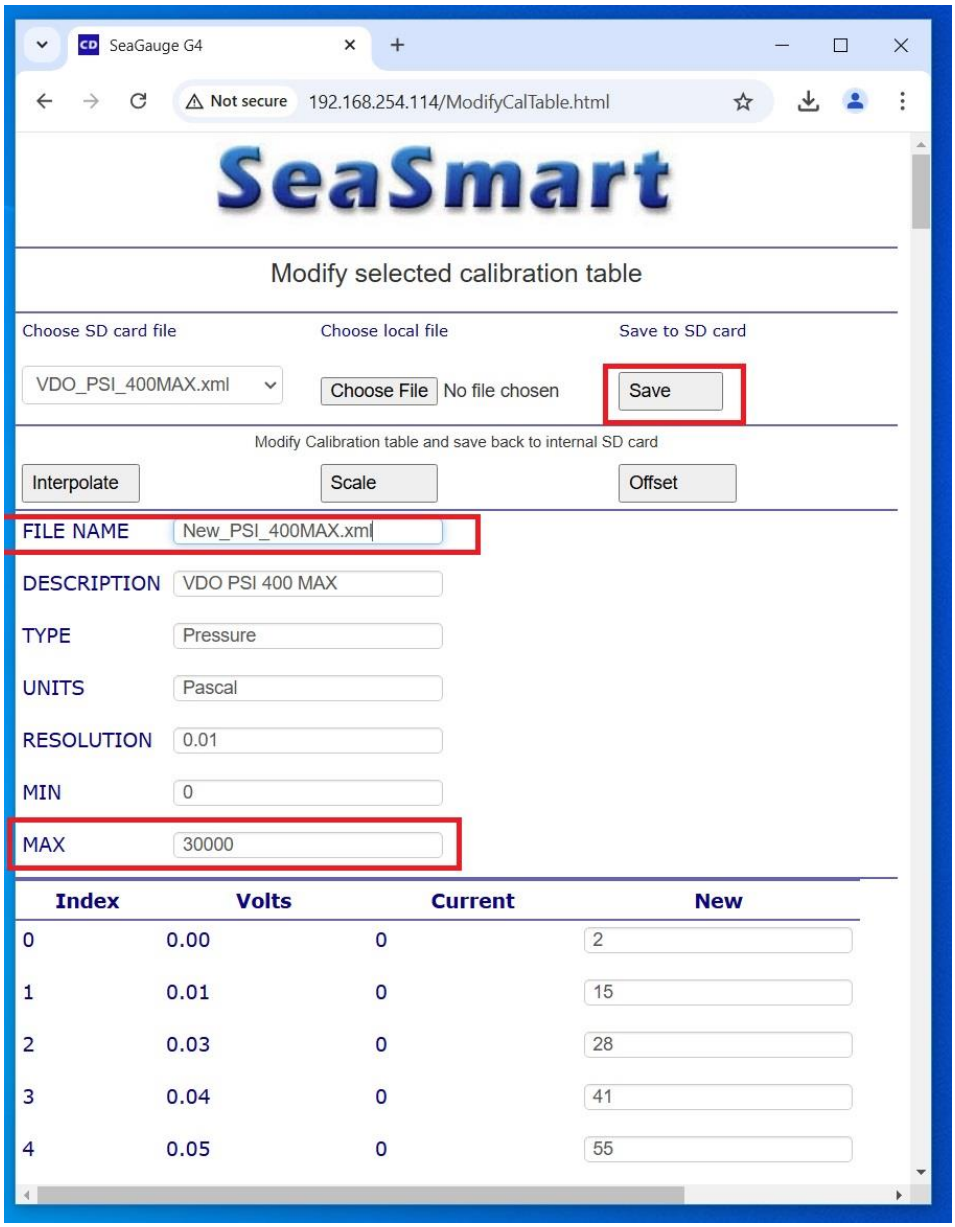
Any row can still be modified at this time



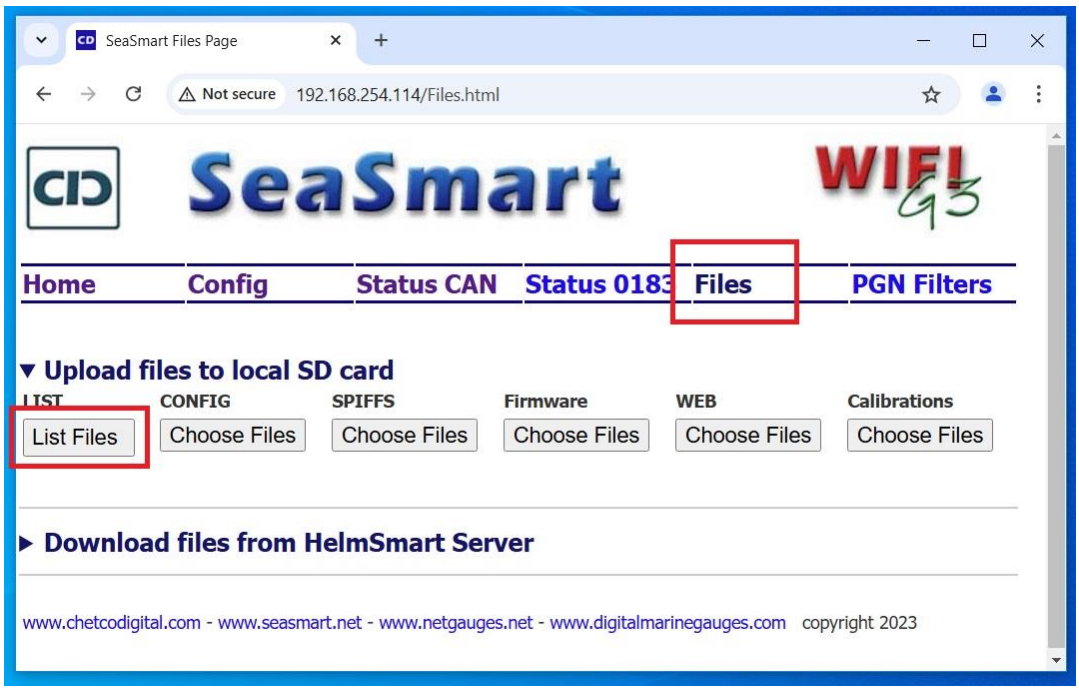
Once interpolation is complete, save the resulting calibration back to the SD card.

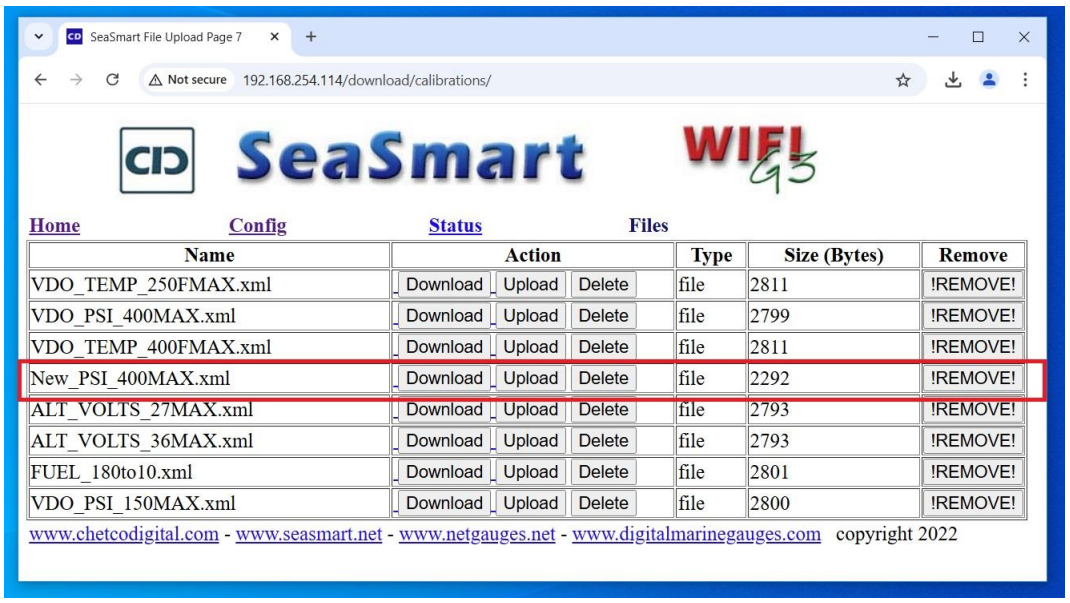
The FILE NAME can be updated to create a new file if desired.

All other HEADER information can also be updated before saving file

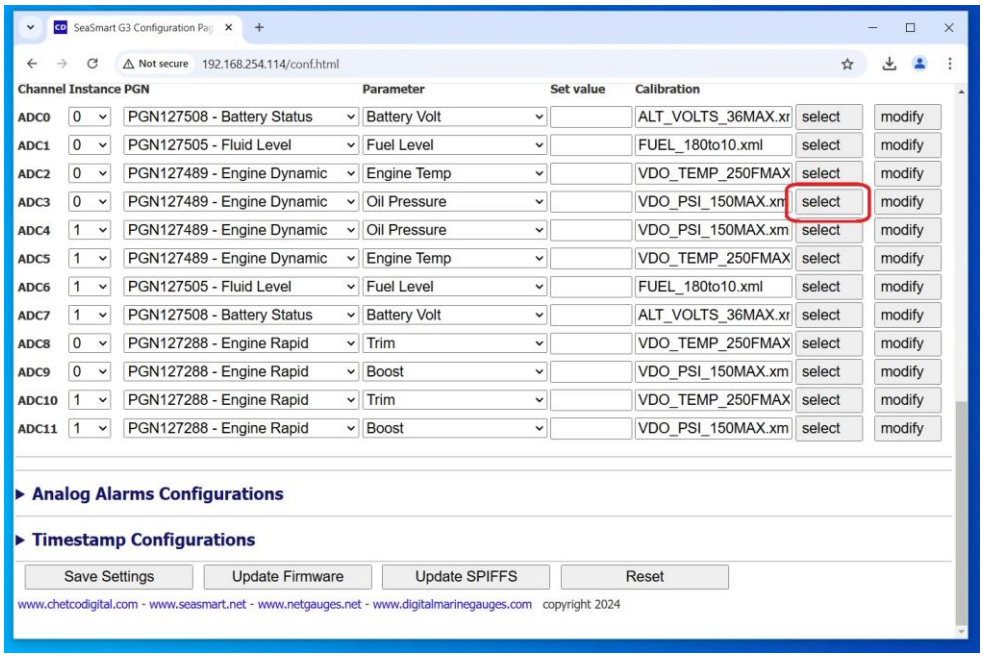


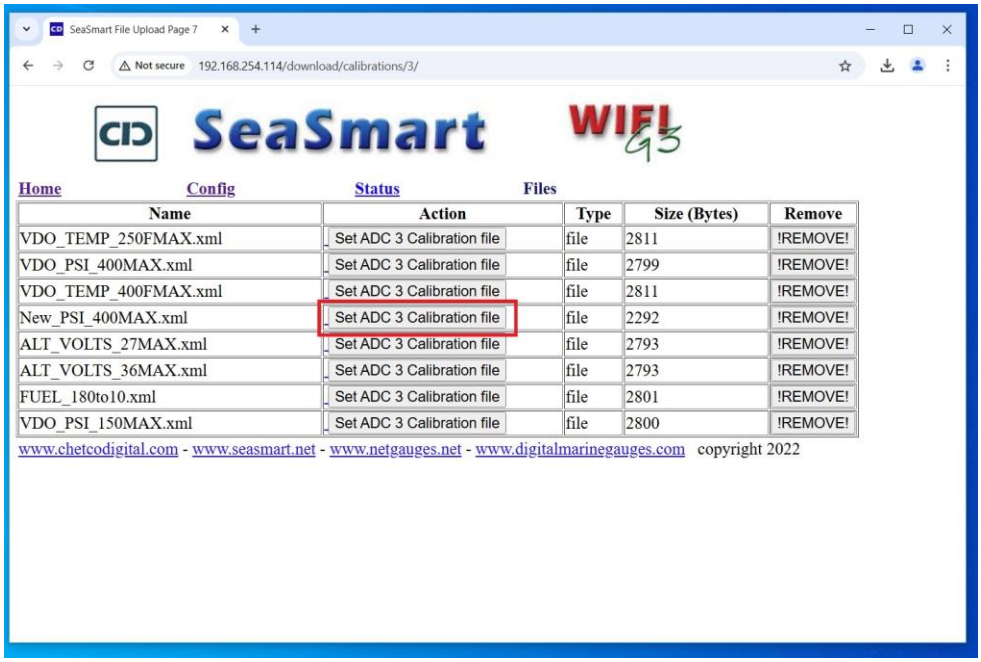
The new/modified calibration file can now be viewed on the SD card



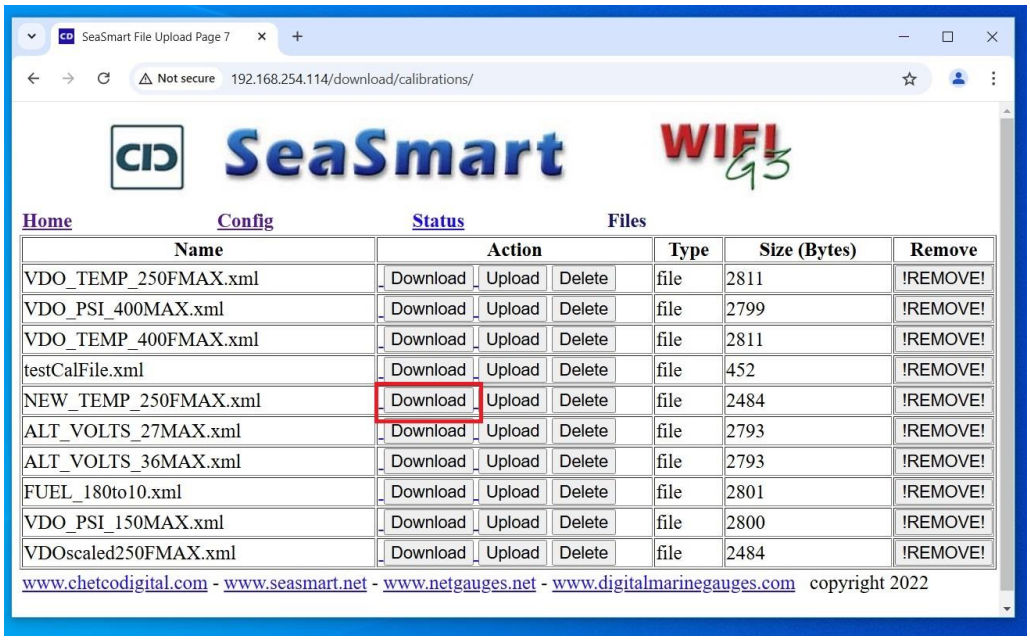


Modified calibration files are now available for assignment to sensor ADC channels





Calibration Files can be transferred from the internal SD card to local browser device by using the DOWNLOAD button



Name	Action	Type	Size (Bytes)	Remove
VDO_TEMP_250FMAX.xml	Download Upload Delete	file	2811	!REMOVE!
VDO_PSI_400MAX.xml	Download Upload Delete	file	2799	!REMOVE!
VDO_TEMP_400FMAX.xml	Download Upload Delete	file	2811	!REMOVE!
testCalFile.xml	Download Upload Delete	file	452	!REMOVE!
NEW_TEMP_250FMAX.xml	Download Upload Delete	file	2484	!REMOVE!
ALT_VOLTS_27MAX.xml	Download Upload Delete	file	2793	!REMOVE!
ALT_VOLTS_36MAX.xml	Download Upload Delete	file	2793	!REMOVE!
FUEL_180to10.xml	Download Upload Delete	file	2801	!REMOVE!
VDO_PSI_150MAX.xml	Download Upload Delete	file	2800	!REMOVE!
VDOscaled250FMAX.xml	Download Upload Delete	file	2484	!REMOVE!

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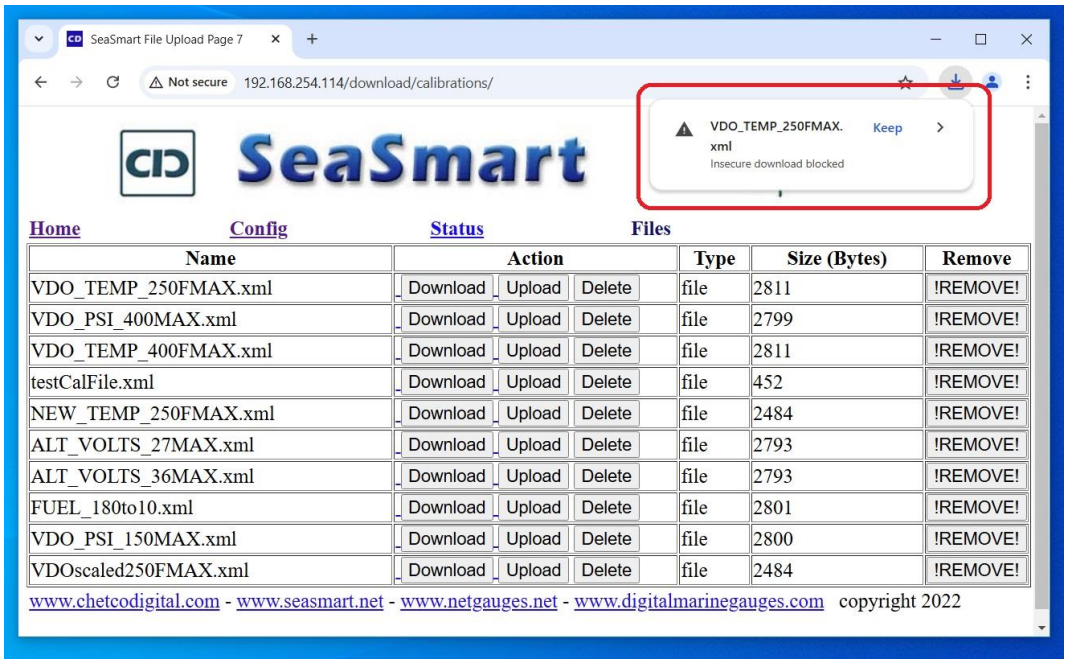
The downloaded file will be stored on the local browser device



Name	Action	Type	Size (Bytes)	Remove
VDO_TEMP_250FMAX.xml	Download Upload Delete	file	2811	!REMOVE!
VDO_PSI_400MAX.xml	Download Upload Delete	file	2799	!REMOVE!
VDO_TEMP_400FMAX.xml	Download Upload Delete	file	2811	!REMOVE!
testCalFile.xml	Download Upload Delete	file	452	!REMOVE!
NEW_TEMP_250FMAX.xml	Download Upload Delete	file	2484	!REMOVE!
ALT_VOLTS_27MAX.xml	Download Upload Delete	file	2793	!REMOVE!
ALT_VOLTS_36MAX.xml	Download Upload Delete	file	2793	!REMOVE!
FUEL_180to10.xml	Download Upload Delete	file	2801	!REMOVE!
VDO_PSI_150MAX.xml	Download Upload Delete	file	2800	!REMOVE!
VDOscaled250FMAX.xml	Download Upload Delete	file	2484	!REMOVE!

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SeaGaugeG4 contains an embedded WEB page interface for configuring the analog inputs to transmit NMEA 2000 or J1939 style messages via its CAN bus interface. These messages are also passed to its embedded Web Server to enable viewing using the local browser interface