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Revision History

Date	Revision	Author	Description
5/3/10	2.3	ST	"ppm" was omitted from the list of sensor units for the GSUNITS/SSUNITS commands when the sensor type is suspended solids. This has been corrected.
3/29/10	2.2	ST	<ul style="list-style-type: none">Added GCTCTYPE/SCTCTYPE commands (new)Documented the RSNSR command (old)Added some units of measure to SSUNITS command
12/12/08	2.1	ST	<ul style="list-style-type: none">Added commands GTDSF/STDSF, GSPNT, and GSSLOPEAdded sensor types 6 (Ozone), 7 (Low-Range Turbidity), 8 (High-Range Turbidity; Argus color), 9 (High-Range Turbidity; Argus IR), 10 (Chlorine), and 11 (Suspended Solids)

General

This document describes the commands received by the serial interface that the AquaSensors Universal Electronics Card (UEC) unit will interpret and execute.

There are two types of UECs; the first is the DataStick UEC. It's designed to be connected to a pH, ORP, DO, 2E, 0E, Ozone, Low-Range Turbidity, or Chlorine sensor head.

The second type of UEC is the Argus. This type has an RGB-IR emitter and two detectors. Depending upon the type of firmware programmed into the Argus it can measure high-range turbidity (Argus) or suspended solids (solids).

There are three types of firmware; the first is targeted for the DataStick UEC. It's called Aqua and supports pH (1), ORP (2), DO (3), 2E (4), 0E (5), ozone (6), low-range turbidity (7), and chlorine (10).

The second type of firmware is targeted for the Argus UEC. It's called Argus and supports high-range turbidity (9).

The third type of firmware is also targeted for the Argus UEC. It's called Solids and supports suspended solids (11).

Not all commands are present in all three types of firmware. The command description lists in which firmwares the command is present.

The UEC is always a server, responding to commands received. The UEC never initiates a command sequence. The transfer protocol for the commands will be of the form -

- Send command to UEC
- Receive report from UEC containing data requested. Note some commands do not generate a report.

The form of any command is -

KEYWORD P0 P1 P2....Pn [CR]

where the KEYWORD is the command identifier (e.g. GSNSR), the space character is the parameter separator, Pn is a command parameter, and [CR] is carriage return, the command terminator. All commands are sent in ASCII @9600 Baud, 8 data bits, no parity, 1 stop bit.

Note that all commands will generate reply. This will consist of the data requested by the command or if the UEC detects a command syntax or parameter error the reply will be "Error".

Those commands that do not generate a report will reply "OK". All replies are terminated with a CR character.

System & Test Commands

GSTATUS

Get Status

Returns the system status after power up. Note that system status is only set at power up and not at any other time.

After power up the status of the sensor eeprom, user parameter and universal card calibration data images as detected at power up are set as follows:

Sensor Status

The system looks at the sensor eeprom. This can have three possible states:

- | | | |
|---|---------------------------------|--|
| ① | Not present | No sensor connected or eeprom not responding |
| ② | Eeprom functional configuration | Eeprom detected but does not contain a valid |
| ③ | Eeprom valid | Eeprom detected and contains a valid configuration |

User configuration

The system examines that part of the flash memory which contains an image of the user parameters. This can have four states:

- | | |
|----------------------------------|---|
| <u>Cfg Initialised</u> | Flash did not contain a valid image of the user configuration and is reset to the defaults and this image saved. |
| <u>Cfg valid</u> | Flash does contain a valid image of the user configuration which corresponds to the current sensor type. |
| <u>Cfg valid and new sensor</u> | Flash contains a valid image but the current sensor is different to the sensor that was connected the last time the system was powered down. The cfg is updated with the sensor defaults and the new image saved. |
| <u>Cfg valid but new version</u> | Flash contains a valid image but a new version has been detected so the cfg data is set to the defaults for the new version and saved. |

Calibration Data

The system examines that part of the flash memory which contains an image of the universal card calibration data. This can have two states:

Cal initialised Flash does not contain a valid image of the calibration data and is reset to the default values and saved.

Cal valid Flash does contain a valid image of the calibration data

Cal valid but new version Flash contains a valid image but a new version has been detected so the cal data is set to the defaults for the new version and saved.

The GSTATUS command returns four parameters based on the state of the above.

Syntax GSTATUS

Parameters none

Reports Sensor status
 User parameter configuration flash memory image status
 Universal Card Calibration flash memory image status
 Run status.

The following shows the possible values:

Sensor Status	Description
0	Sensor not connected or eeprom not functional
1	Eeprom functional but does not contain valid sensor data
2	Eeprom contains valid sensor data
User Cfg Status	
1	Configuration initialised
2	Configuration valid
3	Configuration valid and new sensor
4	Configuration valid but new version
Card Cal Status	
1	Card calibration initialised
2	Card calibration valid
3	Card calibration valid but new version
Run Status	
0	System error
1	Sensor needs installing
2	System OK

TEST	Test Mode	
	Enables/Disables the UEC test mode. Some commands are only implemented by the UEC if the test mode is enabled. Those commands that require the TEST mode to be enabled will report an error if the test mode is disabled.	
	Syntax	TEST mode
	Parameters	mode 0 = test mode disabled 1 = test mode enabled
GTEST	Reports	nothing
	Get Test Mode	
	Returns the current test mode.	
	Syntax	GTEST
SMTEMP	Parameters	none
	Reports	0 = test mode disabled 1 = test mode enabled
	Set Manual Temperature.	
	Sets the manual temperature value. This value is used when test mode is enabled and the manual temperature mode enabled (STMODE 1).	
GMTEMP	Syntax	SMTEMP value
	Parameters	value temperature in DegC The value is limited to the range -25 to +110.
	Reports	nothing
	Get Manual Temperature	
GMTEMP	Returns the manual temperature value.	
	Syntax	GMTEMP
	Parameters	none
	Report	Manual Temperature value.

STMODE

Set Temperature Mode

Note that the manual temperature mode is only applied when Test mode is enabled, and is always disabled when the unit is reset.

Syntax	STMODE mode	
Parameters	mode	0 = manual temperature mode disabled 1 = manual temperature enabled
Reports	nothing	

GTMODE

Get Temperature Mode

Returns the manual temperature mode.

Syntax	GTMODE	
Parameters	none	
Reports	0 = manual temperature mode disabled 1 = manual temperature enabled	

RESET

Reset

Instructs the UEC to set the user configuration to their default values. Note that the TEST mode must be enabled for this command to operate.

Syntax	RESET	
Parameters	none	
Reports	nothing	

RSNSR

Reset Sensor (Added!)

Instructs the UEC to set the sensor configuration to their default values (this includes user calibration). Note that the TEST mode must be enabled for this command to operate.

Syntax	RSNSR	
Parameters	none	
Reports	nothing	

TSNSR

Test Sensor Eeprom

Tests the sensor eeprom one byte at a time and checks that there is no error. The GESTAT command must be used to check the progress of the procedure.

Syntax	TSNSR	
Parameters	none	
Reports	nothing	

SDAC

Set DAC

Sets the DAC output to the value to generate the required polarising volts. Note that the TEST mode must be enabled for this command to operate.

Syntax	SDAC value	
Parameters	value	the required polarising voltage in mV
Reports	nothing	

Note that the polarising voltage can be set from -250mV to +950mV.

$$\begin{aligned} &= 0.25 \sim 0.95 (-250 \sim 950) \\ &\cdot \frac{1.2V}{1200} (1200mV) \quad (1200) \\ &\frac{1200}{4096} = \underline{0.29mV} \end{aligned}$$

Sensor Installation Commands

SSTYPE

Set Sensor Type

Tells the UEC which type of measurement to make. Note that this can only be used in test mode, and the command will override the type of sensor connected to the UEC.

Test mode must be enabled for this command.

Syntax SSTYPE type

Parameters	type	1 = pH
		2 = ORP
		3 = DO
		4 = Contacting Conductivity
		5 = Non-Contacting Conductivity
		6 = Ozone
		7 = Low-Range Turbidity
		8 = High-Range Turbidity (Argus color; not used)
		9 = High-Range Turbidity (Argus IR)
		10 = Chlorine
		11 = Suspended Solids (Argus IR)

Reports nothing

GSTYPE

Get Sensor Type

Instructs the UEC to return the type of the sensor connected to the system. Note that if test mode is enabled the command will return the sensor type currently configured for test.

Syntax GSTYPE

Parameters none

Returns type, where

0 = No Sensor Connected or defined
1 = pH Sensor
2 = ORP sensor
3 = DO Sensor
4 = Contacting Conductivity Sensor
5 = Non-Contacting Conductivity Sensor
6 = Ozone
7 = Low-Range Turbidity
8 = High-Range Turbidity (Argus color; not used)
9 = High-Range Turbidity (Argus IR)
10 = Chlorine
11 = Suspended Solids (Argus IR)

SSCAT

Set Sensor Category

The sensor category depends on the sensor type and is used to define a sensor sub type.

Test mode must be enabled for this command.

Syntax SSCAT category

Parameters category depends on the sensor type

pH Sensor (type = 1)

0 = differential

1 = combination

ORP Sensor (type = 2)

0 = differential

1 = combination

DO Sensor (type = 3)

0 = ppm

1 = ppb

Contacting Conductivity (type = 4)

0 = 0.1 Cell Type

1 = 1.0 Cell Type

2 = 0.01 Cell Type

Reports nothing

GSCAT

Get Sensor Category

Returns the current sensor category. Note that the value of the returned parameter depends on the current sensor type. Also note that if test mode is enabled the command will return the sensor category currently configured for test.

Syntax GSCAT ,

Parameters none

Returns category where:

pH Sensor (type = 1)

0 = differential

1 = combination

ORP Sensor (type = 2)

0 = differential

1 = combination

DO Sensor (type = 3)

0 = ppm

1 = ppb

Contacting Conductivity (type = 4)

0 = 0.1 Cell Type

1 = 1.0 Cell Type

2 = 0.01 Cell Type

SSRNGE

Set the Sensor Range

Tells the UEC which gain range to use. Note that this can only be used in test mode, and the command will override the current sensor range.

Test mode must be enabled for this command.

Syntax SSRNGE range

Parameters range where

range = 0 – 2 (contacting conductivity)

range = 0 – 7 (non-contacting conductivity)

Returns nothing

GSRNGE

Get the Sensor Range

Currently only used for conductivity measurements. Returns the cell gain range. Note that, if test mode is enabled, the command will return the sensor category currently configured for test.

Syntax GSRNGE

Parameters none

Returns cell range, 0 – 7

SSSNO

Set the Sensor Serial Number

Sets the sensor serial number in the sensor eeprom.

Test mode must be enabled for this command.

Syntax SSSNO serial_number

Parameters serial number up to 10 ASCII characters

Reports nothing

GSSNO

Get the Sensor Serial Number

Returns the sensor serial number in the sensor eeprom.

Syntax GSSNO

Parameters none

Reports the sensor serial number

SFACT

Set Factory

Sets the sensor type, category, initial range, and serial number values in the sensor eeprom. This command can only be used in TEST mode. Note as this command involves writing data to the sensor eeprom, the sensor eeprom status command must be used to check that the data has been written correctly.

Syntax SFACT

Parameters none

Reports nothing

GESTAT

Get Sensor Eeprom Status

Returns the status of the last write to sensor eeprom command.

Syntax GESTAT

Parameters none

Reports Sensor eeprom status where:

0 = Sensor eeprom busy. I.e. data currently being written,
1 = Write to Sensor Eeprom ok.
2 = Write to Sensor Eeprom Fail

GSERR

Get Sensor Error

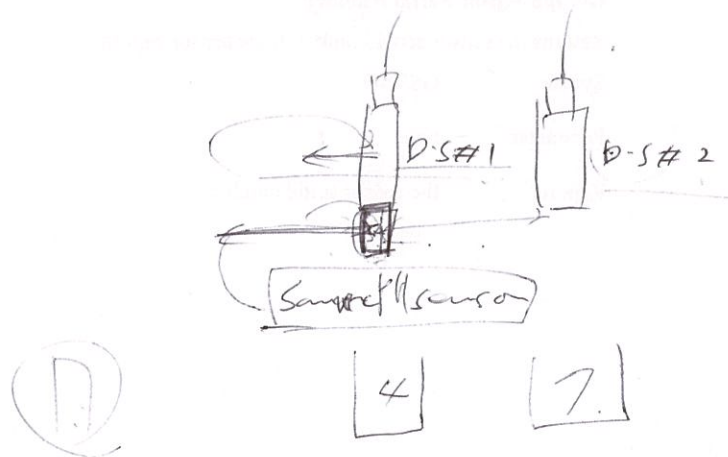
Returns the current sensor error status.

Syntax GSERR

Parameters none

Reports sensor error, where:

0 = Sensor not connected
1 = Sensor ok



Sensor Value Commands

CALL

Call Sensor and Temperature

Instructs the UEC to continually return the sensor value and temperature in the selected engineering units. Note that if the manual temperature mode is set the manual temperature value is returned.

Syntax CALL secs

Parameters secs 1 – 120

Reports sensor temperature

where:

value is the sensor value in engineering units.
temperature is the sensor temperature value

Note: Once the command has been sent to the UEC the report will be generated automatically at the interval specified in the secs parameter. To terminate the output send the ESCAPE character to the UEC.

GSNSR

Get Sensor

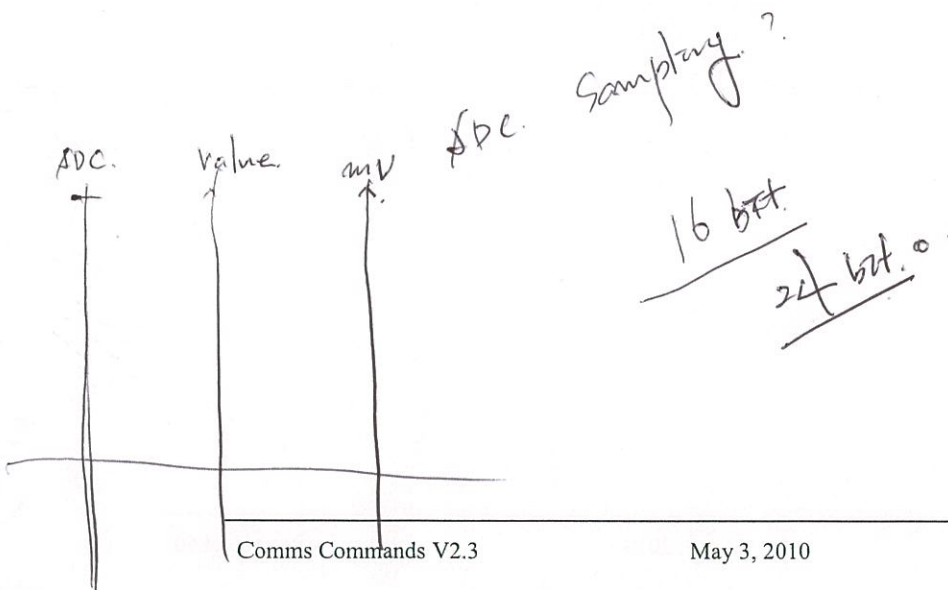
When the TEST mode is disabled, instructs the UEC to return the sensor value in engineering units. When the TEST mode is enabled the sensor value in adc counts is returned. ★

Note that the counts returned are the real adc counts as measured before any correction is applied.

Syntax GSNSR

Parameters none

Reports Test Mode Disabled – sensor value in engineering units
Test Mode Enabled – sensor value in measured adc counts



305. May
 CSNSR


Call Sensor

Instructs the UEC to continually return the sensor value in counts, mVolts and engineering units at the interval specified in the seconds parameter.

Note that the adc counts returned are the counts that have been corrected using the SCALDPO calibration.

Syntax	CSNSR secs		
Parameters	secs	1 – 120	
Reports	<u>counts</u>	<u>mvolts</u>	<u>value</u>

where:

counts are the corrected sensor adc counts.
 mvolts is the sensor mvolts as measured at the UEC circuit input.
 value is the sensor value in engineering units.

Note: Once the command has been sent to the UEC the report will be generated automatically at the interval specified in the secs parameter. To terminate the output send the ESCAPE character to the UEC.

GTEMP

Get Temperature

When the TEST mode is disabled, instructs the UEC to return the temperature value in engineering units. When the TEST mode is enabled the temperature value in adc counts is returned.

Note that the counts returned are the real adc counts as measured before any correction is applied.

Syntax	GTEMP
Parameters	none
Reports	Test Mode Disabled – temperature value in engineering units Test Mode Enabled – temperature value in measured adc counts

CTEMP

Call Temperature

Instructs the UEC to continually return the temperature value in counts, mVolts and engineering units at the interval specified in the seconds parameter.

Note that the adc counts returned are the counts that have been corrected using the SCALDPO calibration.

Syntax CTEMP secs#

Parameters secs 1 – 120

Reports counts mvolts value

where:

counts are the corrected temperature adc counts
mvolts is the temp mvolts as measured at the UEC circuit input
value is the temperature value in engineering units

Note: Once the command has been sent to the UEC the report will be generated automatically at the interval specified in the secs parameter. To terminate the output send the ESCAPE character to the UEC.

User Configuration Commands

SMSNO

Set Main Serial Number

Sets the universal pcb serial number.

Syntax SMSNO serial_number

Parameters serial_number up to 10 ASCII characters

Reports nothing.

GMSNO

Get Main Serial Number

Instructs the UEC to return the universal pcb serial number.

Syntax GMSNO

Parameters None

Reports the UEC pcb serial number.

GCVSN

Get Code Version

Instructs the UEC to return the firmware version

Syntax GCVSN

Parameters None

Reports the UEC firmware version.

Host Recent ? 03.29.
Version ?

SSUNITS

Set Sensor Units

Instructs the UEC to set the sensor units for the currently configured sensor. Note that the units parameter depends on the sensor type.

Syntax SSUNITS units#

Parameters units

For pH: 0 = pH
1 = mV

For ORP: 0 = mV

For DO: 0 = ppm
1 = %

For Conductivity: 0 = μ s
1 = concentration (%)
2 = tds (ppm)
3 = resistance ($M\Omega \cdot cm$)

For Ozone: 0 = ppm

For Low-Range Turbidity: 0 = NTU

For High-Range Turbidity: 0 = NTU

For Chlorine: 0 = ppm

For Suspended Solids: 0 = mg/l
1 = %
2 = ppm

Returns nothing

GSUNITS

Get Sensor Units

Instructs the UEC to return the currently configured sensor units.

Syntax	GSUNITS
Parameters	none
Returns	units, where the value is dependent on the sensor type. For pH: 0 = pH 1 = mV For ORP: 0 = mV For DO 0 = ppm 1 = % For Conductivity 0 = μ s 1 = concentration 2 = tds 3 = resistance ($M\Omega \cdot cm$) For Ozone: 0 = ppm For Low-Range Turbidity: 0 = NTU For Chlorine: 0 = ppm For Suspended Solids: 0 = mg/l 1 = % 2 = ppm

STUNITS

Set Temperature Units

Instructs the UEC to set the temperature

Syntax	STUNITS units#
Parameters	units 0 = DegC 1 = DegF
Returns	nothing

GTUNITS

Get Temperature Units

Instructs the UEC to return the currently configured temperature units.

Syntax	GTUNITS
Parameters	none
Returns	units, where 0 = DegC 1 = DegF.

SSFIL**Set Sensor Filter**

Instructs the UEC to set the sensor filter value in seconds

Syntax	SSFIL value#
Parameters	value 0 – 100.
Returns	nothing

GSFIL**Get Sensor Filter**

Instructs the UEC to return the currently configured sensor filter value in seconds.

Syntax	GSFIL
Parameters	none
Returns	value (0 – 100).

STFIL**Set Temperature Filter**

Instructs the UEC to set the temperature filter value in seconds.

Syntax	STFIL value#
Parameters	value 0 – 100.
Returns	nothing

GTFIL**Get Temperature Filter**

Instructs the UEC to return the currently configured temperature filter value in seconds

Syntax	GTFIL
Parameters	none
Returns	value (0 – 100)

SPHBUF**Set pH Buffer Type**

Tells the UEC which buffer type is being used during a one or two point buffer pH calibration.

Syntax	SPHBUF type
Parameter	type where 0 = 4, 7, 10 buffer type 1 = DIN Buffer type
Returns	nothing

GPHBUF	Get pH Buffer Type		
	Tells the UEC to return the currently configured pH buffer type.		
	Syntax	GPHBUF	
	Parameter	none	
SSALT	Returns	type	where 0 = 4, 7, 10 buffer type 1 = DIN buffer type
	Set DO Salinity		
	Instructs the UEC to set the user salinity value.		
	Syntax	SSALT value	
GSALT	Parameters	value	user salinity The value is limited to the range 0.0 – 999.9.
	Reports	nothing	
	Get DO Salinity		
	Instructs the UEC to return the user salinity value.		
SPRESS	Syntax	GSALT	
	Parameters	none	
	Reports	salinity value	
	Set DO Pressure		
GPRESS	Instructs the UEC to save the user pressure value. The default pressure is 760 mmHg.		
	Syntax	SPRESS	pressure
	Parameters	pressure	user pressure value in mmHg The value is limited to the range 792.4 – 539.2.
	Reports	nothing	
GPRESS	Get DO Pressure		
	Instructs the UEC to return the user pressure value.		
	Syntax	GPRESS	
	Parameters	none	
GPRESS	Report	user pressure value in mmHg	

STDSF**Set TDS Conversion Factor**

Instructs the UEC to save the user TDS conversion factor value. The default TDS conversion factor value is 0.492 ppm/ μ /cm.

Syntax	STDSF	value
Parameters	value	user TDS conversion factor value in ppm/ μ S/cm The value is limited to the range 0.01 – 99.99.
Reports	nothing	

GTDSF**Get TDS Conversion Factor**

Instructs the UEC to return the user TDS conversion factor value.

Syntax	GTDSF
Parameters	none
Report	user TDS conversion factor value in ppm/ μ S/cm

SCTCTYPE**Set the Conductivity Temperature Compensation Type (New!)**

Tells the UEC which type of conductivity temperature compensation to use.

Syntax	SCTCTYPE	type
Parameters	type	0 = Linear 1 = Natural Water 2 = None
Reports		nothing

GCTCTYPE**Get the Conductivity Temperature Compensation Type (New!)**

Syntax	GCTCTYPE
Parameters	none
Returns	type, where 0 = Linear 1 = Natural Water 2 = None 3 = User-entered 4 = Ammonia

SCRTEMP	Set the Conductivity Reference Temperature	
	Sets the value in the system configuration data. The default reference temperature is 25.0 DegC.	
	Syntax	SCRTEMP value
	Parameters	value the reference temperature in DegC. The value is limited to the range 0 – 100.
	Returns	nothing
GCRTEMP	Get the Conductivity Reference Temperature	
	Syntax	GCRTEMP
	Parameters	none
	Returns	the reference temperature in DegC.
SCCSLOPE	Set the Conductivity Compensation Slope	
	Sets the value in the system configuration data. The default compensation slope 2.0 %/DegC	
	Syntax	SCCSLOPE value
	Parameters	value the compensation slope in %/DegC. The value is limited to the range 0 – 9.99.
	Returns	nothing
GCCSLOPE	Get the Conductivity Compensation Slope.	
	Returns the value of the conductivity compensation slope.	
	Syntax	GCCSLOPE
	Parameters	none
	Returns	the compensation slope in %/DegC

GSSLOPE**Get the Sensor Slope.**

Returns the value of the sensor slope. This command first appeared in D3.22.

Syntax GSSLOPE

Parameters none

Returns sensor slope, where

pH sensor (type = 1)

units are mV/pH

all other sensors (types 0 and 2-13)

ERROR

DataStick (Aqua): Yes

High-Range Turbidity (Argus): No

Suspended Solids: No

SUPNT**Set User Table Point**

Sets the values of conductivity and concentration for a point in the user table. The table is used to convert conductivity to concentration. The table can have up to 10 pairs of points. If the table has fewer than 10 points the last point in the table must be set to zero conductivity and concentration. Thus a typical table with four points will have the form:-

Point	Conductivity ($\mu\text{S/cm}$)	Concentration (%)
0	0.0	0.0
1	1,000.0	10.0
2	5,000.0	50.0
3	10,000.0	99.99
4	0.0	0.0

All the points in a new table must be written to the sensor. These new values are held in a temporary area in the flash memory and are transferred to the working user table when the SUTBL (Set User Table) command is sent. This command validates the new table, and if there are no errors the old user table is replaced by the new table.

Note that the conductivity points must be monotonic and increasing in value. The concentration points must also be monotonic but can be either increasing or decreasing but not both.

Syntax SUPNT point cond conc

Parameters point point number (0 – 9)

cond conductivity value (0 – 2,000,000.0 $\mu\text{S/cm}$)

conc concentration value (0 – 99.99%)

Returns nothing

GSPNT	Get Scratch Table Point Values	
	Returns the conductivity and concentration values for the specified point. Note that the values are taken from the scratch user table, the values entered using the SUPNT command.	
	Syntax	GSPNT point
	Parameters	point table point (0 – 9)
GUPNT	Returns	conductivity & concentration for the specified point.
	Get User Table Point Values	
	Returns the conductivity and concentration values for the specified point. Note that the values are taken from the working user table, and not from the values entered using the SUPNT command until the table has been validated and entered using the SUTBL command.	
	Syntax	GUPNT point
SUTBL	Parameters	point table point (0 – 9)
	Returns	conductivity & concentration for the specified point.
	Set User Table	
	Validates the table values entered using the SUPNT command. The values for each point are checked as follows:- All successive conductivity point values must be monotonic and increasing and be within the bounds of 0 – 2,000,000.0 µS/cm. The concentration values must be monotonic and either increasing or decreasing and be within the bounds of 0 – 99.99%. If fewer than ten points are entered, then the table must be terminated with a last point containing zero values. Provided the above criteria are met, the values are transferred to the working user table, otherwise the current working user table is retained.	
SADDR	Syntax	SUTBL
	Parameters	none
	Returns	ERROR if table not valid, otherwise returns OK.
	Set Node Address	
	Sets the node address value (0 – 255).	
	Syntax	SADDR address
	Parameters	address node address 0 – 255
	Reports	nothing

GADDR**Get Node Address**

Returns the current value of the node address.

Syntax	GADDR
Parameters	none
Returns	node address

Universal Electronics Card Calibration Commands

SCALT

Set Calibration Temperature

Instructs the UEC to accept the passed values as calibration values for the universal electronics card temperature measurement circuit.

Syntax	SCALT count1 value1 count2 value2	
Parameter	countn valuen	counts for specified calibration point temp value for specified calibration point in DegC

Reports	nothing
---------	---------

Note: TEST mode must be enabled for this command. The calibration procedure should be of the form:

1. Connect 1,000 ohms (0 DegC) and use the GTEMP command to get the adc counts.
2. Connect 1,385 ohms (100 DegC) and use the GTEMP command to get the adc counts.
3. Send the SCALT command with the measured adc counts and temperatures.

GCALT

Get Calibration Temperature

Returns the UEC temperature calibration coefficients.

Syntax	GCALT
Parameter	none
Reports	slope offset where slope and offset are the temperature calibration coefficients

SCALDPO

Set Calibration DO PH ORP

Instructs the UEC to accept the passed values as calibration values for universal electronics card DO, pH and ORP measurement circuit.

Syntax	SCALDPO count1 value1 count2 value2	
Parameter	countn valuen	adc counts for specified calibration point mvolts value for specified calibration point

Reports	nothing
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Note that TEST mode must be enabled for this command. The calibration procedure should be of the form:

1. Connect -2000mV to the DO, PH, ORP input and use the GSNSR command to get the adc counts.
2. Connect +2000mV to the DO, PH, ORP input and use the GSNSR command to get the adc counts.
3. Send the SCALDPO command with the measured adc counts and mvolts.

GCALDPO

Get Calibration DO PH ORP

Returns the UEC DO, PH ORP calibration coefficients.

Syntax GCALDPO

Parameter none

Reports slope offset where slope and offset are the DO, PH, ORP calibration coefficients

SCALCE

Set Calibration Contacting Conductivity

Instructs the UEC to accept the passed values as calibration values for the universal electronics card contacting conductivity measurement circuit.

Syntax SCALCE cell range countslo countsmid countshi

Parameter	cell	cell type	0 = 0.1 cell 1 = 1.0 cell
	range	cell range	For 0.1 cell 0 = 0.05 – 1,000 μ S 1 = 0.05 – 100 μ S 2 = 0.05 – 10 μ S For 1.0 cell 0 = 0.5 – 5,000 μ S 1 = 0.5 – 1,000 μ S 2 = 0.5 – 100 μ S For 0.01 cell 0 = TBD 1 = TBD 2 = TBD
	counts	adc counts at the three specified calibration points for each range	

Reports nothing

Note that TEST mode must be enabled for this command. The calibration procedure should be of the form:

1. Use the "SSTYPE 04" command to set the contacting conductivity sensor type
2. Use the "SSCAT" command to set the sensor category (cell type for the conductivity sensor), where the cell value is as above.
3. Use the "SSRNGE" to set the required range where the range value is as above.
4. Set the required input resistance value from table below:
5. For each cell type and range, use the GSNSR command to get the adc counts for the respective lo, mid and hi cal points, and then use the SCALCE command to set the calibration values

Cell Type	Range	Resistance (ohm) for lo, mid and hi cal points
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Cell Type	Range	Resistance (ohm) for lo, mid and hi cal points
0.1 μ s	0	o/c, 333.3, 100.0
	1	o/c, 3,333.3, 1000.0
	2	o/c, 33,333.3, 10000.0
1.0 μ s	0	o/c, 500.00, 200.0
	1	o/c, 3,333.3, 1000.0
	2	o/c, 33,333.3, 10,000.0

GCALCE

Get Calibration Contacting Conductivity

Returns the UEC contacting conductivity calibration values.

Syntax GCALCE cell range

Parameter	cell	cell type	0 = 0.1 cell 1 = 1.0 cell
	range	cell range	For 0.1 cell 0 = 0.05 – 1,000 μ S 1 = 0.05 – 100 μ S 2 = 0.05 – 10 μ S For 1.0 cell 0 = 0.5 – 5,000 μ S 1 = 0.5 – 1,000 μ S 2 = 0.5 – 100 μ S For 0.01 cell 0 = TBD 1 = TBD 2 = TBD

Reports the three adc counts for the lo, mid and hi cal points for the specified cell type and range.

SCAL0E

Set Calibration Non Contacting Conductivity

Instructs the UEC to accept the passed values as calibration values for the universal electronics card non contacting conductivity measurement circuit.

Syntax SCAL0E cell range countslo countsmid countshi

Parameter	cell	cell type	must be set to zero
	range	gain range	0 = 0 – 5,200 mS 1 = 0 – 1,570 mS 2 = 0 – 473,000 μ S 3 = 0 – 157,000 μ S 4 = 0 – 47,250 μ S 5 = 0 – 14,250 μ S 6 = 0 – 4,300 μ S 7 = 0 – 1,300 μ S
	counts	adc counts at the three specified calibration points for each range	

Reports nothing

Note that TEST mode must be enabled for this command. The calibration procedure should be of the form:

- Use the "SSTYPE 05" command to set the non contacting conductivity sensor type
- Use the "SSCAT 0" command to set the sensor category (cell type for the non conductivity sensor).
- Use the "SSRNGE" to set the required range where the range value is as above.
- Set the required input resistance value from table below:
- For each cell type and range, use the GSNSR command to get the adc counts for the respective lo, mid and hi cal points, and then use the SCAL0E command to set the calibration values

Range	Loop Resistance (ohm) for lo, mid and hi cal points
0	o/c, 330.0, 100.0
1	o/c, 1,000.0, 330.0
2	o/c, 3,300.0, 1,100.0
3	o/c, 10,000.00, 3,300.0
4	o/c, 330.0, 110.0
5	o/c, 1,000.0, 360.0
6	o/c, 3,300.0, 1,200.0
7	o/c, 12,000.0, 4,000.0

GCAL0E**Get Calibration Non Contacting Conductivity**

Returns the UEC non contacting conductivity calibration values

Syntax GCAL0E cell range

Parameter	range	gain range	0 = 0 – 5,200 mS
			1 = 0 – 1,570 mS
			2 = 0 – 473,000 μ S
			3 = 0 – 157,000 μ S
			4 = 0 – 47,250 μ S
			5 = 0 – 14,250 μ S
			6 = 0 – 4,300 μ S
			7 = 0 – 1,300 μ S

Reports the three adc counts for the lo, mid and hi cal points for the specified range.

SCALDO**Set Calibration Dissolved Oxygen**

Instructs the UEC to accept the passed values as calibration values for the universal electronics card DO measurement circuit.

Note that the two calibration points represent a span of 20 ppm. The value of the high point below corresponds to a sensor with a sensitivity of –50.112 mV/ppm. If necessary adjust the high point input value to correspond to a span of 20 mV.

Syntax SCALDO counts_lo counts_hi

Parameters counts_lo = adc counts at sensor 0 mV input
counts_hi = adc counts at sensor –1,002.24 mV input.

Reports nothing

GCALDO**Get Calibration Dissolved Oxygen**

Returns the two card calibration counts.

Syntax GCALDO

Parameters none

Reports counts_lo counts_hi

default: 0:118
1:3319

SCALDAC

Set Calibration DAC

Instructs the system to accept the passed values as calibration values for the universal electronics card DAC. Note that the DAC output is used to set the polarising voltage output.

The DAC has two calibration points and each point must be calibrated so that the polarising voltage output is set to the correct value. The following table shows what the reading at the polarising voltage output should be.

Calibration Point	Polarising Voltage
Low (point = 0)	-0.200 V
High (point = 1)	+0.750 V

The passed counts are used to increment/decrement the existing calibration counts for the selected point, and update the polarising voltage output. Thus 'SCALDAC 0 +50' will increase the lower calibration point by 50 counts. When starting to calibrate a point use 'SCALDAC point 0' to set the polarising voltage output to the current calibration value.

Note that a change of 1 bit in the dac is approximately equivalent to a change in the polarising voltage output of 0.3 mV.

0.3 x 4096

= 1.228.8.

Syntax	SCALDAC <u>point counts</u>
Parameters	point the calibration point where point = 0, the low dac calibration point point = 1, the high dac calibration point
	counts the count value which is used to increment the calibration point counts.
Reports	nothing

GCALDAC

Get Calibration DAC

Instructs the system to return the dac calibration counts for the specified point.

Syntax	GCALDAC point
Parameters	point the calibration point where point = 0, the low dac calibration point point = 1, the high dac calibration point
Returns	the specified point's calibration counts (0 – 4095)

Generic Sensor Calibration Commands

CALSZERO

Calibrate Sensor Zero

Initiates the sensor zero calibration procedure. The command will return an error if either Test mode is set, no sensor is connected or a calibration procedure is in progress. Furthermore, an error will be returned if the currently connected sensor does not support a zero calibration.

CALSZERO

Parameters none

Returns nothing

CALS1PS

Calibrate Sensor 1 Point Sample

Initiates a sensor 1 point sample calibration procedure. The command will return an error if either Test mode is set, no sensor is connected or a calibration procedure is in progress. Furthermore, an error will be returned if the currently connected sensor does not support a 1 point sample calibration.

Syntax CALS1PS value

Parameters value user supplied 1 point sample value.
The sample value must be in the units for the connected sensor as follows:

PH Sensor	pH
ORP Sensor	mV
DO Sensor	ppm
CE Sensor	μS
OE Sensor	μS
Ozone	ppm
Low-Range Turbidity	NTU
Chlorine	ppm

Returns nothing

CALS2PS**Calibrate Sensor 2 Point Sample**

Initiates a sensor 2 point sample calibration procedure. The command will return an error if either Test mode is set, no sensor is connected or a calibration procedure is in progress. Furthermore, an error will be returned if the currently connected sensor does not support a 2 point sample calibration.

Syntax	CALS2PS point value	
Parameters	point	0 = first point 1 = second point
	value	user supplied sample value at the specified point. The sample value must be in the units for the connected sensor as follows: PH Sensor pH
Returns	nothing	

CALS1PB**Calibrate Sensor 1 Point Buffer**

Initiates a sensor 1 point buffer calibration procedure. The command will return an error if either Test mode is set, no sensor is connected or a calibration procedure is in progress. Furthermore, an error will be returned if the currently connected sensor does not support a 1 point buffer calibration.

Syntax	CALS1PB
Parameters	none
Returns	nothing

CALS2PB**Calibrate Sensor 2 Point Buffer**

Initiates a sensor 2 point buffer calibration procedure. The command will return an error if either Test mode is set, no sensor is connected or a calibration procedure is in progress. Furthermore, an error will be returned if the currently connected sensor does not support a 2 point buffer calibration.

Syntax	CALS2PB point	
Parameters	point	0 = first point 1 = second point
Returns	nothing	

CALSAIR

Calibrate Sensor in Air

Initiates a sensor air calibration procedure. The command will return an error if either Test mode is set, no sensor is connected or a calibration procedure is in progress. Furthermore, an error will be returned if the currently connected sensor does not support an air calibration.

Syntax CALSAIR

Parameters none

Returns nothing

GCALSZERO

Get Sensor Zero Calibration

Returns the sensor zero calibration offset counts for the specified point. Note that if no sensor is connected or if the currently connected sensor does not support a zero calibration an error will be returned.

Syntax GCALSZERO point

Parameters point the point value will depend on the sensor type as follows:

DO Sensor	0 (dummy value)
CE Sensor	0 – 2 (gain ranges)
OE Sensor	0 – 7 (gain ranges)

Returns zero correction offset ac counts

GCALS

GCALSN5R

Get Sensor Calibration

Returns the sensor calibration result. The value(s) returned will depend on the sensor connected. Note that if no sensor is connected an error will be returned.

Syntax	GCALS point	
Parameters	point	the point value will depend on the sensor type as follows: pH Sensor 0 or 1 ORP Sensor 0 (dummy) DO Sensor 0 (dummy) CE Sensor 0 (dummy) OE Sensor 0 (dummy)
Returns	the value(s) returned will depend on the connected sensor as follows: pH Sensor - value mvolts temperature where value = the cal point value in pH <u>mvolts</u> = the cal point pH sensor mvolts temperature = the cal point temperature in the set units ORP Sensor – zero offset value in mvolts DO Sensor – the DO partial oxygen factor CE Sensor – the calibrated cell constant value OE sensor – the calibrated cell constant value	

GCALSBUF

Get Sensor Calibration Buffer

Returns the buffer value found when doing a 1 or 2 point buffer calibration. Note that the buffer value returned is the value of the last buffer found during a calibration. If a buffer cal has not been performed, the cal is still in progress or a cal error has been detected then a value of 99.9 is returned.

Syntax	GCALSBUF
Parameters	none
Returns	value of last found buffer

CALSTIPS

Calibrate Sensor Temperature One Point Sample

Tells the system to perform a temperature calibration for the temperature element in the sensor. The command will return an error if either Test mode is set, no sensor is connected or a calibration procedure is in progress. Furthermore, an error will be returned if the currently connected sensor does not support a temperature calibration.

Syntax	CALSTIPS value	
Parameters	value	the user measured temperature value in DegC or DegF depending on the user set temperature units.
Returns	nothing	

GCALST

Get Calibration Sensor Temperature

Returns the temperature sensor offset correction held in the sensor eeprom.

Syntax	GCALST	
Parameters	none	
Returns	The temperature sensor offset in DegC or DegF depending on the user set temperature units	

CALSTATUS

Calibration Status

Returns the status of the current calibration procedure. Calibration functions proceed automatically until the calibration is successful, an error condition is detected, or the function is aborted by a CALABORT command.

Note that, if a CALSTATUS command is issued before a calibration procedure has been carried out, the sensor parameter will return the sensor type, but the type and status parameters will be set to zero. In addition, a CALABORT command will also set the type and status parameters to zero.

The CALSTATUS command should be used periodically to check the progress of the calibration function.

Syntax CALSTATUS

Parameters none

Returns returns three values as follows
 sensor type of sensor being calibrated where

0 = No Sensor Calibration
1 = pH Sensor
2 = ORP Sensor
3 = DO Sensor
4 = Contacting Conductivity Sensor
5 = Toroidal Conductivity Sensor
6 = Ozone Sensor
7 = Low-Range Turbidity Sensor
8 = Hi-Rng Turb (Argus color) Sensor (not used)
9 = High-Range Turbidity (Argus IR) Sensor
10 = Chlorine Sensor
11 = Suspended Solids

 type type of calibration procedure where

0 = No Sensor Calibration
1 = 1pt Buffer
2 = 2pt Buffer, 1st point
3 = 2pt Buffer, 2nd point
4 = 1pt Sample
5 = 2pt Sample 1st point
6 = 2pt Sample 2nd point
7 = Air Calibration
8 = Zero Calibration
10 = Temperature Calibration 1pt Sample

 status status of calibration procedure where

0 = No Sensor Calibration
1 = Cal in progress
2 = Cal OK
3 = Fail – Not Stable
4 = Fail – Buffer not found
5 = Fail – 1st buffer not found
6 = Fail – 2nd buffer not found
7 = Fail – Value too low
8 = Fail – Value too high
9 = Fail – Slope too low
10 = Fail – Slope too high

- 11= Fail – Offset too low
 12= Fail – Offset too high
 13= Fail – Points too close
 14= General Cal Fail (zero or sample)

The following table shows the possible values for the individual sensor types:

Sensor Type		Cal Type		Cal Status	
0	No sensor	0		0	
1	pH Sensor	1	1 pt buffer	1	Cal in progress
				2	Cal OK
				3	Not Stable
				4	Buffer not found
				9	Slope too low
				10	Slope too high
				11	Offset too low
				12	Offset too high
				13	Points too close
		2	2 pt buffer, 1 st pt	1	Cal in progress
				2	Cal OK
				3	Not Stable
				5	1 st buffer not found
		3	2 pt buffer, 2 nd pt	1	Cal in progress
				2	Cal OK
				3	Not Stable
				6	2 nd buffer not found
				9	Slope too low
				10	Slope too high
				11	Offset too high
				12	Offset too low
				13	Points too close
		4	1 pt sample	1	Cal in progress
				2	Cal OK
				3	Not Stable
				7	Value too low
				8	Value too high
				11	Offset too low
				12	Offset too high
		5	2 pt sample, 1 st pt	1	Cal in progress
				2	Cal OK
				3	Not stable
		6	2 pt sample, 2 nd pt	1	Cal in progress
				2	Cal OK
				3	Not Stable
				9	Slope too low
				10	Slope too high
				11	Offset too low
				12	Offset too high
				13	Points too close

Sensor Type		Cal Type		Cal Status	
2	ORP Sensor	4	1 pt sample	1	Cal in progress
				2	Cal OK
				3	Not Stable
				12	Offset too high
3	DO Sensor	7	Air calibration	1	Cal in progress
				2	Cal OK
				3	Not stable
				7	Value too low
				10	Slope too high
		4	1 pt sample	1	Cal in progress
				2	Cal OK
				3	Not stable
				7	Value too low
				10	Slope too high
		8	Zero Calibration	1	Cal in progress
				2	Cal OK
				3	Not stable
				14	Zero Cal Fail
4	CE Sensor	4	1 pt sample	1	Cal in progress
				2	Cal OK
				3	Not stable
				14	Cal fail
		8	Zero calibration	1	Cal in progress
				2	Cal OK
				3	Not stable
				14	Zero Cal fail
5	OE Sensor	4	1 pt sample	1	Cal in progress
				2	Cal OK
				3	Not stable
				14	Cal fail
		8	Zero calibration	1	Cal in progress
				2	Cal OK
				3	Not stable
				14	Zero Cal fail
6	Ozone	4	1 pt sample	1	Cal in progress
				3	Not stable
				7	Value too low
				10	Slope too high
		8	Zero Calibration	1	Cal in progress
				2	Cal OK
				3	Not stable
				14	Cal fail
7	Low-Range Turbidity	4	1 pt sample	1	Cal in progress
				2	Cal OK

Sensor Type		Cal Type		Cal Status	
				3	Not stable
				7	Value too low
				14	Cal fail
		8	Zero Calibration	1	Cal in progress
				2	Cal OK
				3	Not stable
				14	Zero Cal fail
8	Not used				
9	High-Range Turbidity	4	1 pt sample	1	Cal in progress
				2	Cal OK
					TBD
10	Chlorine	4	1 pt sample	1	Cal in progress
				2	Cal OK
				3	Not stable
				7	Value too low
				10	Slope too high
		8	Zero Calibration	1	Cal in progress
				2	Cal OK
				3	Not stable
				14	Zero Cal fail
11		4	1 pt sample	1	Cal in progress
				2	Cal OK
					TBD

When a sensor temperature element is calibrated, the CALSTATUS command will return the sensor type value, the value 10 for the Cal Type to indicate that a temperature 1pt sample calibration is being performed, and a cal status value as per the following table:

Sensor Type		Cal Type		Cal Status	
*	Sensor Type for Current sensor	10	1pt Sample	1	Cal in progress
				2	Cal OK
				3	Not Stable
				12	Offset too high

CALABORT

Calibration Abort

Aborts the current calibration procedure.

Syntax CALABORT

Parameters none

Returns nothing

PH Sensor Calibration Commands

CALPH1PB

Calibrate pH One Point Buffer

Tells the UEC to perform a pH one point buffer calibration. See the CALSTATUS command for the possible calibration status values set during this procedure.

Syntax CALPH1PB

Parameter none

Returns nothing

CALPH2PB

Calibrate pH Two Point Buffer

Tells the UEC to perform a pH two point buffer calibration. See the CALSTATUS command for the possible calibration status values set during this procedure.

Syntax CALPH2PB point

Parameter point 0 = first point
1 = second point

Returns nothing

CALPH1PS

Calibrate pH One Point Sample

Tells the UEC to perform a pH one point sample calibration. See the CALSTATUS command for the possible calibration status values set during this procedure.

Syntax CALPH1PS value

Parameter value the pH sample value

Returns nothing

Obsolete command. Use CALS1PS instead.

CALPH2PS

Calibrate pH Two Point Sample

Tells the UEC to perform a pH two point sample calibration. See the CALSTATUS command for the possible calibration status values set during this procedure.

Syntax CALPH1PS point value

Parameter point 0 or 1
value the pH sample value at the specified point

Returns nothing

Obsolete command. Use CALS2PS instead.

GCALPH**Get pH Calibration Values**

Tells the UEC to return the pH calibration values for the passed point.

Syntax GCALPH point

Parameters point 0 = cal point 0
 1 = cal point 1

Returns value temperature mvolts

where value = the cal point pH value
 temperature = the cal point temperature
 mvolts = the cal point pH sensor mvolts

GPHCBUF**Get PH Calibration Buffer**

Returns pH buffer value found when doing a 1 or 2 point pH buffer calibration. Note that the buffer value returned is the value of the last buffer found during a pH calibration. If pH cal has not been performed, the cal is still in progress or a cal error has been detected then a value of 99.9 is returned.

Syntax GPHCBUF

Parameters none

Returns value of last found pH buffer

ORP Sensor Calibration Commands

CALORP1PS **Calibrate ORP 1 Point Sample**

Sets a User zero value calibration value. Note that this command changes the zero point value but not the slope. See the CALSTATUS command for the possible calibration status values set during this procedure.

Syntax CALORP1PS value

Parameters value user zero point value in mvolts

Returns nothing

Obsolete command. Use CALS1PS instead.

GALORP **Get the ORP Calibration**

Returns the user zero value in mvolts

Syntax GALORP

Parameters none

Returns user zero value in mvolts.

Conductivity Sensor Calibration Commands

SCELL

Set the Cell Constant

Sets the cell constant value in the sensor eeprom.

Syntax SCELL value

Parameters value the cell constant value
0.01: Value limited to the range 0.005 – 0.02.
0.1: Value limited to the range 0.05 – 0.2.
1.0: Value limited to the range 0.5 – 2.

Returns nothing

GCELL

Get Cell Constant Value

Returns the cell constant value held in the sensor eeprom.

Syntax GCELL

Parameters none

Returns The cell constant value

CALCE1PS

Calibrate CE 1 Point Sample

Tells the system to perform a one point sample calibration for the contacting conductivity sensor. The CALSTATUS command should be used periodically to check the progress of the calibration procedure. The system checks that the current measurement is stable and that the new cell constant value is within +/- 30% of the nominal value. See the CALSTATUS command for the possible calibration status values set during this procedure.

Syntax CALCE1PS value

Parameters value of sample in μS

Returns nothing

Obsolete command. Use CALS1PS instead.

CALCEZERO

Calibrate CE Zero

Tells the system to perform a zero calibration for the contacting conductivity sensor. See the CALSTATUS command for the possible calibration status values set during this procedure.

Syntax CALCEZERO

Parameters none

Returns nothing

Obsolete command. Use CALSZERO instead.

CAL0E1PS**Calibrate 0E 1 Point Sample**

Tells the system to perform a one point sample calibration for the non contacting conductivity sensor. The CALSTATUS command should be used periodically to check the progress of the calibration procedure. The system checks that the current measurement is stable and that the new cell constant value is within +/- 30% of the nominal value. See the CALSTATUS command for the possible calibration status values set during this procedure.

Syntax CAL0E1PS

Parameters value of sample in μS

Returns nothing

Obsolete command. Use CALS1PS instead.

CAL0EZERO**Calibrate 0E Zero**

Tells the system to perform a zero calibration for the non contacting conductivity sensor. See the CALSTATUS command for the possible calibration status values set during this procedure.

Syntax CAL0EZERO

Parameters none

Returns nothing

Obsolete command. Use CALSZERO instead.

GCEZERO**Get CE Zero**

Returns the zero correction counts for the selected range for the contacting conductivity sensor.

Syntax GCEZERO range

Parameters range gain range (0 – 2)

Returns zero correction counts

G0EZERO**Get 0E Zero**

Returns the zero correction counts for the selected range for the non contacting conductivity sensor.

Syntax G0EZERO range

Parameters range gain range (0 – 7)

Returns zero correction counts

DO Sensor Calibration Commands

CALDOAIR

Calibrate DO In Air

Tells the system to perform a DO air calibration. The system checks that the current measurement is stable before updating the calibration. See the CALSTATUS command for the possible calibration status values set during this procedure.

Syntax CALDOAIR

Parameters none

Returns nothing

Obsolete command. Use CALSAIR instead.

CALDOSMP

Calibrate DO Sample

Tells the system to perform a DO sample calibration. The system checks that the current measurement is stable before updating the calibration. See the CALSTATUS command for the possible calibration status values set during this procedure.

Syntax CALDOSMP value

Parameters value of sample in ppm

Returns nothing

Obsolete command. Use CALS1PS instead.

GCALPO

Get Calibration Partial Oxygen Factor

Returns the DO calibration factor

Syntax GCALPO

Parameters none

Returns the calibration factor

CALDOZERO

Calibrate DO Zero

Tells the system to perform a DO zero calibration. The system checks that the current measurement is stable before updating the calibration. See the CALSTATUS command for the possible calibration status values set during this procedure.

Syntax CALDOZERO

Parameters none

Returns nothing

Obsolete command. Use CALSZERO instead.

GDOZERO

Get DO Calibration

Returns the zero correction counts for the DO zero calibration

Syntax	GDOZERO
Parameters	none
Returns	zero correction counts

Sensor Temperature Calibration

CALSTIPS

Calibrate Sensor Temperature One Point Sample

Tells the system to perform a temperature calibration for the temperature element in the sensor. See the CALSTATUS command for the possible calibration status values set during this procedure.

Syntax CALSTIPS value

Parameters value the user measured temperature value in DegC or DegF depending on the user set temperature units.

Returns nothing

GCALST

Get Calibration Sensor Temperature

Returns the temperature sensor offset correction held in the sensor eeprom.

Syntax GCALST

Parameters none

Returns The temperature sensor offset in DegC or DegF depending on the user set temperature units