Pyxis

Pyxis Lab

Digital Probe Communications User's Guide

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Document Control

Revision History			
Issue	**Date**	**Author**	**Comments**
Draft 1.0	Jun 13, 2018	Tim Xu	Initial Draft
Version 1.2	Jul 20, 2018	Tim Xu	Add ST-500 cleanliness check
Version 1.3	Jul 24, 2018	Tim Xu	Add ST-600 and CR-300
Version 1.4	Aug 27, 2018	Tim Xu	Add ST-712 calibration
Version 1.5	Dec 31, 2019	Tim Xu	Add ST-604
Version 1.5.1	Jan 29, 2020	Tim Xu	Add ST-730B
Version 1.5.2	Feb 1, 2020	Tim Xu	Correct ST-723 section
Version 1.5.3	Feb 17, 2020	Tim Xu	Add firmware version register
Version 1.5.4	Mar 11, 2020	Tim Xu	Add LS-202 and LS-200
Version 1.5.5	Mar 31, 2020	Tim Xu	Fix CR-300 alloy factor data type
Version 1.5.6	Apr 7, 2020	Tim Xu	Add 4-20mA span settings for ST-730B
Version 1.5.7	Apr 14, 2020	Tim Xu	Add CR-300 calibration procedure
Version 1.5.8	Jun 16, 2020	Tim Xu	Add HM-500 series probe
Version 1.5.9	Jun 28, 2020	Tim Xu/Sudong Xiao	Add LT-739 low turbidity probe
Version 1.6.0	Jul 25, 2020	Tim Xu	Correct ST-500RO range
Version 1.6.1	Sep 28, 2020	Tim Xu	Increase ST-720 range to 100,000 mS
Version 1.6.2	Oct 23, 2020	Tim Xu	Add ST-588
Version 1.6.3	Oct 25, 2020	Tim Xu	Add ST-590, ST-600T/601T/604T
Version 1.6.4	Dec 18, 2020	Tim Xu	Add ST-726
Version 1.6.6	Jan 27, 2021	Tim Xu	Add ST-772
Version 1.6.7	Feb 3, 2021	Tim Xu	Remove old ST-600 and ST-604
Version 1.6.8	Feb 5, 2021	Tim Xu	Correct ST-601 measurement range
Version 1.6.9	May 19,2021	Tim Xu	Add ST-720 (0-100,000µS/cm)
Version 1.7.0	May 20,2021	Tim Xu	Add ST-600/601/604 cleanliness check, slope and intercept registers
Version 1.7.1	May 27,2021	Tim Xu	Add Modbus address model notes
Version 1.7.2	Jul 8, 2021	Tim Xu	Add ST-765
Version 1.7.3	Jul 19,2021	Tim Xu	Add ST-71XSS-D probes
Version 1.7.4	Aug 31,2021	Tim Xu	Add RT-100 Refractive meter
Version 1.7.5	Oct 19,2021	Tim Xu	Add LT-737 low turbidity probe
Version 1.7.6	Nov 9,2021	Tim Xu	Add ST-750 and ST-773
Version 1.7.7	Nov 23,2021	Tim Xu	Add ST-774
Version 1.7.8	Dec 15,2021	Tim Xu	Revise ST-710/711/712 Add LS-200 comm parameters
Version 1.7.9	Dec 17,2021	Tim Xu	Add LT-736, ST-731, ST-735, ST-776
Version 1.8.0	Feb 8, 2022	Tim Xu	Add CR-300 Modbus slave address change
Version 1.8.1	Apr 18, 2022	Tim Xu	Fix HM-510 Modbus slave address error and measurement range error Fix HM-520 measurement range error
Version 1.8.2	Jun 22, 2022	Tim Xu	Add ST-725 Probe
Version 1.8.3	Jun 24, 2022	Tim Xu	Increase ST-600 upper range to 20%
Version 1.8.4	Jul 20, 2022	Tim Xu	Correct ST-725 modus registers Add ST-728
Version 1.8.5	Aug 10, 2022	Tim Xu	Add EM-500 and HM-610
Version 1.8.6	Aug 12, 2022	Tim Xu	Fix HM-610 calibration solution data type error
Version 1.8.7	Oct 15, 2022	Tim Xu	Fix ST-710/711/712 pH and ORP calibration result error
Version 1.8.8	Oct 27, 2022	Tim Xu	Add LT-632/635
Version 1.8.9	Jan 10, 2023	Tim Xu	ST-710, ST-712 add cleanliness definition
Version 1.9.0	Jan 24, 2023	Tim Xu	Add CR-300 4-20mA scale settings
Version 1.9.1	Feb 9, 2023	Tim Xu	Add CR-301 and ORP in ST-765SS-FCL
Version 1.9.2	Mar 20, 2023	Tim Xu	Add RT-50, update RT-100
Version 1.9.3	Apr 04, 2023	Tim Xu	Fix ST-773 Modbus address error
Version 1.9.4	May 30, 2023	Tim Xu	Add ST-732
Version 1.9.5	Jun 04, 2023	Tim Xu	Add LSR-801

Version 1.9.6	Jun 05, 2023	Tim Xu	Add cross-sectional area settings for LSR-801
Version 1.9.7	Jun 14, 2023	Tim Xu	Correct ST-588 restore to factory procedure
Version 1.9.8	Aug 3, 2023	Tim Xu	Add ST-765 change Modbus address procedure
Version 1.9.9	Sep 05, 2023	Linghui Kong	Add ST-765 Series (ST-765SS- CLO/Br /DCL/SO3/O3/NCL) Correct ST-765SS-FCL error descriptions
Version 2.0.0	Sep 10, 2023	Tim Xu	Add LT-731 and LT-733 probe Add smoothing factor for LT-73X probes
Version 2.0.1	Oct 17, 2023	Tim Xu	Add ST-735 Modbus RTU example packet
Version 2.0.2	Nov 2, 2023	Tim Xu	Add FS-100 and FS-101
Version 2.0.3	Nov 9, 2023	Tim Xu	Clarify ST-730B calibration procedure
Version 2.0.4	Dec 3, 2023	Tim Xu	Add ST-587
Version 2.0.6	Jan 9, 2024	Tim Xu	Add pH process calibration for ST-710/712 and ST-765SS series probes
Version 2.0.7	Feb 19, 2024	Tim Xu	Add ST-525SS-HR
Version 2.0.8	Apr 9, 2024	Tim Xu	Add ORP to ST-765SS series probes
Version 2.0.9	May 17, 2024	Tim Xu	Add RT-200
Version 2.1.0	May 30, 2024	Tim Xu	Add Zero calibration for ST-525SS and ST-565T probe
Version 2.1.1	Jun 18, 2024	Tim Xu	Add ST-730SS
Version 2.1.2	Jul 23, 2024	Tim Xu	Fix ST-525 calibration standard register error
Version 2.1.3	Sep 03, 2024	Tim Xu	Add ST-540 and ST-540SS-HR probes
Version 2.1.4	Sep 10, 2024	Tim Xu	Fix ST-720 4mA and 20mA span register error
Version 2.1.5	Mar 27, 2025	Tim Xu	Add ST-724 probe Fix ST-774 4-20mA register error Add ST-774 high point calibration in ppb format Add ST-774 process calibration
Version 2.1.6	Jun 16, 2025	Tim Xu	Add ST-722
Version 2.1.7	Jun 25, 2025	Tim Xu	Add ST-540SS
Version 2.1.8	Jun 30, 2025	Tim Xu	Fix ST-565T Modbus address error Update RT-100 registers
Version 2.1.9	Jan 21, 2025	Tim Xu	Add ST-766 series probe

Table of Contents

Document Description

This document describes communication interface of Pyxis digital probes, all Pyxis probes comply with Modbus RTU protocol, different types of probes can be connected to one single RS485 bus as they have different Modbus slave address.

This document also describes how to read process values from Pyxis probes and how to calibrate Pyxis probes with Modbus RTU protocol.

General Communication Settings

- Baudrate: 9600 bps
- Databit: 8-bit
- Stopbit: 1 bit
- Parity Check: Even
- Bus Type: RS485

Modbus RTU Protocol

- Register Address Model: PLC Address (Base 1)
- Byte Order: CDAB (Little Endian Byte Swap)
- Supported Function Code:
  - ☐ 03 – Read Holding Register
  - ☐ 06 – Write Single Register
  - ☐ 16 – Write Multiple Registers

Register Map

ST-500

Modbus Slave Address: 10

Product Number: 50661

Probe Type: Fluorescence probe

Unit of Measure: ppb

Measurement Range: 0-300 ppb

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	1032	32bit	UINT32
Fluorescence value	1006	32bit	Float
Turbidity value	1012	32bit	Float
4-20 mA value	1014	32bit	Float
Turbidity Slope	1008	32bit	Float
Turbidity Intercept	1010	32bit	Float
Standard solution	1026	16bit	UINT16
Calibration command	1025	16bit	UINT16
Calibration status	1031	16bit	UINT16
Firmware version	1034	16bit	UINT16
Firmware revision	1035	16bit	UINT16
Modbus Address	1037	16bit	UINT16
Parameter command	1044	16bit	UINT16

Zero Point Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Write value 4 to Calibration command register
4) Read Calibration status register
    - 0 - OK
    - 2048 - probe was fouled
    - 4096 - deionized water has fluorescence

Slope Calibration Procedure

1) Rinse probe with standard solution for a few times
2) Put probe into standard solution
3) Write calibration standard solution (e.g., 100) to Standard solution register
4) Wait for 2 seconds
5) Write value 3 to Calibration command register
6) Read Calibration status register
    - 0 - OK
    - 256 - solution too high
    - 1024 - solution too low

Change Modbus Address Procedure

1) Write new address to Modbus Address register (1037)
2) Wait for 2 seconds
3) Write value 2 to Parameter command register (1044)
4) Power cycle the probe

* Note - ST-500 firmware does not support turbidity calibration, however, users are allowed to change turbidity slope and intercept to get a correct turbidity value. We will provide ST-500 turbidity calibration in next release.

ST-500RO

Modbus Slave Address: 37

Product Number: 50669

Probe Type: Fluorescence probe for RO application

Unit of Measure: ppb

Measurement Range: 0-40 ppb

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	1032	32bit	UINT32
Fluorescence value	1006	32bit	Float
4-20 mA value	1014	32bit	Float
Standard solution	1026	16bit	UINT16
Calibration command	1025	16bit	UINT16
Calibration status	1031	16bit	UINT16
Firmware version	1034	16bit	UINT16
Firmware revision	1035	16bit	UINT16
Modbus Address	1037	16bit	UINT16
Parameter command	1044	16bit	UINT16

Zero Point Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Write value 4 to Calibration command register
4) Read Calibration status register
   - 0 - OK
   - 2048 - probe was fouled
   - 4096 - deionized water has fluorescence

Slope Calibration Procedure

1) Rinse probe with standard solution for a few times
2) Put probe into standard solution
3) Write calibration standard solution (e.g., 10) to Standard solution register
4) Wait for 2 seconds
5) Write value 3 to Calibration command register
6) Read Calibration status register
   - 0 - OK
   - 256 - solution too high
   - 1024 - solution too low

Change Modbus Address Procedure

1) Write new address to Modbus Address register (1037)
2) Wait for 2 seconds
3) Write value 2 to Parameter command register (1044)
4) Power cycle the probe

ST-525SS

Modbus Slave Address: 10

Product Number: 50666

Probe Type: Fluorescein probe

Unit of Measure: ppb

Measurement Range: 0-60 ppb

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	1032	32bit	UINT32
Fluorescein value	1006	32bit	Float
4-20 mA value	1014	32bit	Float
Standard solution	1010	32bit	Float
Calibration command	1025	16bit	UINT16
Calibration status	1031	16bit	UINT16
Firmware version	1034	16bit	UINT16
Firmware revision	1035	16bit	UINT16
Modbus Address	1037	16bit	UINT16
Parameter command	1044	16bit	UINT16

Zero Calibration Procedure

1) Write value 4 to Calibration command register
2) Read Calibration status register
    - 0 - OK

Slope Calibration Procedure

1) Write calibration standard solution (e.g., 30) to Standard solution register
2) Write value 3 to Calibration command register
3) Read Calibration status register
    - 0 - OK
    - 256 - solution too high
    - 1024 - solution too low

Change Modbus Address Procedure

1) Write new address to Modbus Address register (1037)
2) Write value 2 to Parameter command register (1044)
3) Power cycle the probe

ST-525SS-HR

Modbus Slave Address: 10

Product Number: 50915

Probe Type: High range Fluorescein probe

Unit of Measure: ppb

Measurement Range: 0-500 ppb

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Firmware Version	41031	16-byte	CHAR[16]
Modbus Address	42001	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
Command	43006	16bit	UINT16
Calibration Solution	44002	32bit	Float
Calibration Status	48035	16bit	UINT16
Fluorescein Value	46001	32bit	Float
Cleanliness Value [1]	46007	32bit	Float
Fluorescein 4-20mA Value	46003	32bit	Float
Fluorescein 4-20 mA Scale	48010	16bit	UINT16

[1] - Cleanliness values range from 0.0 - 100.0, with 100 being the cleanest and 0 being the dirtiest.

Zero Calibration Procedure

3) Write value 3 to Command register
4) Read Calibration status register
    - 0 - OK

Slope Calibration Procedure

1) Write calibration standard solution (e.g., 200) to Calibration solution register
2) Wait for 2 seconds
3) Write value 4 to Calibration command register
4) Read Calibration status register
    - 0 - OK
    - 3 - solution too high
    - 4 - solution too low
    - 5 – slope error

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Power cycle the probe

ST-540

Modbus Slave Address: 10

Product Number: 50621

Probe Type: NDSA probe

Unit of Measure: ppb

Measurement Range: 0-500 ppb

Register Name	Register Address	Data Length	Data Type
Restore Status	41003	16bit	UINT16
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Firmware Version	41031	16-byte	CHAR[16]
Parameter Command	41040	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
Command	43006	16bit	UINT16
Calibration Solution	44002	32bit	Float
Calibration Status	48031	16bit	UINT16
NDSA Value	46001	32bit	Float
NDSA 4-20mA Value	46003	32bit	Float
NDSA 4-20 mA Scale	48010	16bit	UINT16

Zero Calibration Procedure

1) Write value 3 to Command register
2) Read Calibration status register
   - 0 - OK
   - 1 - Probe was fouled
   - 2 - DI water over range

Slope Calibration Procedure

1) Write calibration standard solution (e.g., 200) to Calibration solution register
2) Write value 4 to Calibration command register
3) Read Calibration status register
   - 0 - OK
   - 3 - Solution too high
   - 4 - Solution too low
   - 5 - Slope is invalid

Restore Factory Parameters

1) Write value 103 to Parameter Command register
2) Write value 103 to Command register within 30 seconds
3) Wait for 1 second and read Restore Status register
   - 517 - Restore succeed

- 515 - Restore failed
- 512 - Invalid command

ST-540SS

Modbus Slave Address: 10

Product Number: 50667

Probe Type: NDSA probe

Unit of Measure: ppb

Measurement Range: 0-500 ppb

Register Name	Register Address	Data Length	Data Type
Restore Status	41003	16bit	UINT16
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Firmware Version	41031	16-byte	CHAR[16]
Parameter Command	41040	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
Command	43006	16bit	UINT16
Calibration Solution	44002	32bit	Float
Calibration Status	48031	16bit	UINT16
NDSA Value	46001	32bit	Float
NDSA 4-20mA Value	46003	32bit	Float
NDSA 4-20 mA Scale	48010	16bit	UINT16

Zero Calibration Procedure

1) Write value 3 to Command register
2) Read Calibration status register
   - 0 - OK
   - 1 - Probe was fouled
   - 2 - DI water over range

Slope Calibration Procedure

1) Write calibration standard solution (e.g., 200) to Calibration solution register
2) Write value 4 to Calibration command register
3) Read Calibration status register
   - 0 - OK
   - 3 - Solution too high
   - 4 - Solution too low
   - 5 - Slope is invalid

Restore Factory Parameters

1) Write value 103 to Parameter Command register
2) Write value 103 to Command register within 30 seconds
3) Wait for 1 second and read Restore Status register
   - 517 - Restore succeed

- 515 - Restore failed
- 512 - Invalid command

ST-540SS-HR

Modbus Slave Address: 10

Product Number: 58982

Probe Type: High range stainless steel NDSA probe

Unit of Measure: ppb

Measurement Range: 0-2500 ppb

Register Name	Register Address	Data Length	Data Type
Restore Status	41003	16bit	UINT16
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Firmware Version	41031	16-byte	CHAR[16]
Parameter Command	41040	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
Command	43006	16bit	UINT16
Calibration Solution	44002	32bit	Float
Calibration Status	48035	16bit	UINT16
NDSA Value	46001	32bit	Float
NDSA 4-20mA Value	46003	32bit	Float
NDSA 4-20 mA Scale	48010	16bit	UINT16
Cleanliness Value	46007	32bit	Float
Cleanliness 4-20mA Value	46009	32bit	Float

Zero Calibration Procedure

1) Write value 3 to Command register
2) Read Calibration status register
   - 0 - OK
   - 1 - Probe was fouled
   - 2 - DI water over range

Slope Calibration Procedure

1) Write calibration standard solution (e.g., 200) to Calibration solution register
2) Write value 4 to Calibration command register
3) Read Calibration status register
   - 0 - OK
   - 3 - Solution too high
   - 4 - Solution too low
   - 5 - Slope is invalid

Restore Factory Parameters

1) Write value 103 to Parameter Command register
2) Write value 103 to Command register within 30 seconds

3) Wait for 1 second and read Restore Status register
    - 517 - Restore succeed
    - 515 - Restore failed
    - 512 - Invalid command

ST-565T

Modbus Slave Address: 83

Product Number: 50676

Probe Type: HST/TTA probe

Unit of Measure: ppm

Measurement Range: 0-6.25 ppm

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	1032	32bit	UINT32
TTA value	1006	32bit	Float
4-20 mA value	1014	32bit	Float
Standard solution	1026	16bit	UINT16
Calibration command	1025	16bit	UINT16
Calibration status	1031	16bit	UINT16
Firmware version	1034	16bit	UINT16
Firmware revision	1035	16bit	UINT16
Modbus Address	1037	16bit	UINT16
Parameter command	1044	16bit	UINT16

Zero Calibration Procedure

1) Write value 4 to Calibration command register
2) Read Calibration status register
   - 0 - OK

Slope Calibration Procedure

1) Write calibration standard solution (e.g., 30) to Standard solution register
2) Write value 3 to Calibration command register
3) Read Calibration status register
   - 0 - OK
   - 256 - solution too high
   - 1024 - solution too low

Change Modbus Address Procedure

1) Write new address to Modbus Address register (1037)
2) Write value 2 to Parameter command register (1044)
3) Power cycle the probe

ST-710

Modbus Slave Address: 11

Product Number: 53001

Probe Type: pH probe

Unit of Measure: N/A

Measurement Range: 0-14

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	41015	128bit	CHAR[16]
pH value	46001	32bit	Float
pH 4-20 mA value	46003	32bit	Float
Temperature value (℃)	46005	32bit	Float
pH voltage (mV)	48007	32bit	Float
pH Acid buffer	48011	32bit	Float
pH Base buffer	48017	32bit	Float
pH process calibration value	48043	32bit	Float
Calibration command	43006	16bit	UINT16
Calibration status	41003	16bit	UINT16
Firmware version	41031	128bit	CHAR[16]
Modbus Address	42001	16bit	UINT16

Calibration Procedure

1) Write value 8 to Calibration command register to start pH 7 calibration
2) Read calibration status register
   - 6 - Calibration success
   - 4 - pH voltage out of range
3) Write pH acid buffer value (e.g., 4) to acid buffer register
4) Write pH base buffer value (e.g., 9) to base buffer register
5) Write value 4 to Calibration command register to start Acid calibration
6) Wait 4 seconds
7) Read calibration status register
   - 1 - Calibration success
   - 3 - Buffer value out of range
   - 5 - Buffer value invalid
   - 7 - Slope value out of range
   - 8 - Intercept value out of range
8) Write value 5 to Calibration command register to start Base calibration
9) Wait 4 seconds
10) Read calibration status register
    - 2 - Calibration success
    - 3 - Buffer value out of range
    - 5 - Buffer value invalid

- 7 - Slope value out of range
- 8 - Intercept value out of range

pH Process Calibration

1) Write pH process value to pH process calibration value register
2) Write value 10 to Calibration command register to start pH process calibration
3) Wait 2 seconds
4) Read calibration status register
    - 1 - Calibration success
    - 3 - Invalid process value or process value out of range [1]
    - 7 - Process calibration out of range [2]

* Note [1] - Valid pH process value input range is pH 1.0 to 13.0

* Note [2] - Valid process calibration offset is pH -0.9 to 0.9. i.e., if ST-710 measures pH 7.6, user does a process calibration with input pH process value 7.8, ST-710 will accept the calibration; if user does a process calibration with input pH process value 8.6, ST-710 will reject the calibration;

* Note [3] - pH process calibration is only available for firmware version **109** and higher

Reset to Factory Parameters

1) Write value 16 to Calibration command register
2) Wait 4 seconds
3) Read calibration status register
    - 517 - Reset factory parameters success
    - 514 - No factory parameters found

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Power cycle the probe

Cleanliness Check

1) Put the probe into pH 7 buffer and wait a few minutes
2) Read pH voltage register (48007)
3) Probe is clean if **-5mV < pH voltage < 5mV**
4) Probe is becoming fouled if **5mV < pH voltage < 10mV** or **-10mV < pH voltage < -5mV**
5) Probe is fouled if **pH voltage > 10mV** or **pH voltage < -10mV**

ST-711

Modbus Slave Address: 12

Product Number: 53002

Probe Type: ORP probe

Unit of Measure: mV

Measurement Range: -1500mV – 1500mV

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	41015	128bit	CHAR[16]
ORP value (V unit)	46007	32bit	Float
ORP 4-20 mA value	46009	32bit	Float
ORP value (mV unit)	46013	32bit	Float
Temperature value (℃)	46005	32bit	Float
Standard solution	44002	32bit	Float
Calibration command	43006	16bit	UINT16
Calibration status	41003	16bit	UINT16
Firmware version	41031	128bit	CHAR[16]
Modbus Address	42001	16bit	UINT16

Calibration Procedure

1) Write standard solution value (e.g., 0.2*) to standard solution register
2) Write value 6 to Calibration command register to start standard A calibration
3) Read Calibration status register
    - 2 - Calibration success
    - 3 - Buffer value out of range
    - 5 - Buffer value invalid

Reset to Factory Parameters

1) Write value 16 to Calibration command register
2) Wait 4 seconds
3) Read calibration status register
    - 517 - Reset factory parameters success
    - 514 - No factory parameters found

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Power cycle the probe

* Note [1] - the unit of measure for Standard solution is voltages, 0.2 means 0.2 Voltage

* Note [2] - software version before 2.7 only supports ORP value read from 46007 register, software version after 2.7 supports ORP value read from 46007 and 46013

* Note [3] - read software version from register 41031, read continuously 8 words, and convert to ascii code, for instance, the result would be “2.8.1”

ST-712

Modbus Slave Address: 13

Product Number: 53003

Probe Type: pH and ORP probe

Unit of Measure:

pH - N/A

ORP – mV

Measurement Range: reference ST-710 and ST-711

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	41015	128bit	CHAR[16]
pH value	46001	32bit	Float
pH 4-20 mA value	46003	32bit	Float
ORP value (V unit)	46007	32bit	Float
ORP 4-20 mA value	46009	32bit	Float
ORP value (mV unit)	46013	32bit	Float
Temperature value (℃)	46005	32bit	Float
pH Voltage (mV)	48007	32bit	Float
pH Acid buffer	48011	32bit	Float
pH Base buffer	48017	32bit	Float
ORP Standard solution	44002	32bit	Float
Calibration command	43006	16bit	UINT16
Calibration status	41003	16bit	UINT16
Firmware version	41031	128bit	CHAR[16]
Modbus Address	42001	16bit	UINT16

Calibration check follows same procedure as ST-710 and ST-711

Cleanliness check follows same procedure as ST-710

Reset to Factory Parameters

1) Write value 16 to Calibration command register
2) Wait 4 seconds
3) Read calibration status register
   - 517 - Reset factory parameters success
   - 514 - No factory parameters found

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Power cycle the probe

* Note [1] - Software version before 2.7 only supports ORP value read from 46007 register, software version after 2.7 supports ORP value read from 46007 and 46013

* Note [2] - Read software version from register 41031, read continuously 8 words, and convert to ascii code, for instance, the result would be “2.8.1”

ST-720 (0-10,000 µS/cm)

Modbus Slave Address: 14

Product Number: 53101

Probe Type: Conductivity probe

Unit of Measure: µS/cm

Measurement Range: 0-100,000 µS/cm

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	41015	128bit	CHAR[16]
Conductivity value	46001	32bit	Float
4-20 mA value	46003	32bit	Float
Temperature value (℃)	46005	32bit	Float
Standard solution	44002	16bit	UINT16
Calibration command	44004	16bit	UINT16
Calibration status	41003	16bit	UINT16
Firmware version	41031	128bit	CHAR[16]
Modbus Address	42001	16bit	UINT16

Calibration Procedure

1) Write calibration standard solution to Standard solution register
2) Write value 1 to Calibration command register
3) Read Calibration status register
   - 1 - OK
   - 2 - solution value out of range
   - 3 - calibration failed

* Note - the maximum supported calibration solution is 65mS due to standard solution register data type limitation.

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Power cycle the probe

* Note - Conductivity measurement requires a strict timing control, therefore Modbus communication may be interrupted or delayed, we suggest PLC or any SCADA systems retry Modbus request for 3 times if a Modbus request is timeout.

ST-720 (0-100,000 µS/cm)

Modbus Slave Address: 14

Product Number: 53101

Probe Type: Conductivity probe

Unit of Measure: µS/cm

Measurement Range: 0-100,000 µS/cm

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	41015	128bit	CHAR[16]
Hardware version[1]	41023	128bit	CHAR[16]
Software version	41031	128bit	CHAR[16]
Modbus address	42001	16bit	UINT16
Modbus parity check[2]	42003	16bit	UINT16
Modbus Baudrate	42004	32bit	UINT32
Temperature unit[3]	43007	16bit	UINT16
4mA conductivity value	45002	32bit	Float
20mA conductivity value	45004	32bit	Float
Conductivity value	46001	32bit	Float
4-20 mA value	46003	32bit	Float
Temperature value (℃)	46005	32bit	Float
4-20 mA for Temperature	46007	32bit	Float
Standard solution	44011	32bit	Float
Calibration command	44004	16bit	UINT16
Calibration status	41003	16bit	UINT16
Firmware version	41031	128bit	CHAR[16]

[1] Hardware version

Less than 3.0 - ST-720 with 0-10,000 µS/cm range

3.0 and above - ST-720 with 0-100,000 µS/cm range

[2] Modbus parity check

0 - NO parity check

1 - ODD

2 - EVEN

[3] Temperature unit

1 - Celsius

2 - Fahrenheit

Calibration Procedure

1) Write calibration solution value (in µS/cm) to Standard solution register
2) Write value 1 to Calibration command register
3) Read Calibration status register
   - 1 - OK
   - 2 - solution value out of range
   - 3 - calibration failed

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Power cycle the probe

* Note - Conductivity measurement requires a strict timing control, therefore Modbus communication may be interrupted or delayed, we suggest PLC or any SCADA systems retry Modbus request for 3 times if a Modbus request is timeout.

ST-722

Modbus Slave Address: 14

Product Number: 53103

Probe Type: Low Range Conductivity probe

Unit of Measure: µS/cm

Measurement Range: 10-10000 µS/cm

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware version	41023	16-byte	CHAR[16]
Software version	41031	16-byte	CHAR[16]
Parameter command	41040	16bit	UINT16
Modbus address	42001	16bit	UINT16
Modbus parity check[1]	42003	16bit	UINT16
20mA conductivity value	43002	32bit	Float
Calibration command	44004	16bit	UINT16
Calibration solution	44029	32bit	Float
Calibration result	41003	16bit	UINT16
Conductivity value	46001	32bit	Float
Conductivity 4-20mA value	46003	32bit	Float
Temperature value	46005	32bit	Float

[1] Modbus parity check
0 - NO parity
1 - ODD
2 - EVEN

Calibration Procedure

1) Put the probe into calibration solution
2) Write calibration solution value (10 - 10000 µS/cm) to Calibration solution register (44029) and wait for probe stabilizing reading
3) Write value 1 to Calibration command register (44004) and wait for 1 second
4) Read Calibration result register (41003)
   - 1 - OK
   - 3 - calibration failed

Restore Factory Parameters

1) Write value 103 to parameter command register (41040)
2) Write value 103 to command register (44004) within 30 seconds
3) Wait for 1 second and read result register (41003)
   - 517 - Restore succeed
   - 515 - Restore failed
   - 512 - Invalid command

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Power cycle the probe

* Note - Conductivity measurement requires a strict timing control, therefore Modbus communication may be interrupted or delayed, we suggest PLC or any SCADA systems retry Modbus request for 3 times if a Modbus request is timeout.

ST-723

Modbus Slave Address: 14

Product Number: 53106

Probe Type: Conductivity probe for boiler application

Unit of Measure: µS/cm

Measurement Range: 0-20,000 µS/cm

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	41015	128bit	CHAR[16]
Conductivity value	46001	32bit	Float
4-20 mA for Conductivity	46003	32bit	Float
Temperature value (℃)	46005	32bit	Float
4-20mA for Temperature	46015	32bit	Float
Standard solution	44002	16bit	UINT16
Calibration command	44004	16bit	UINT16
Calibration status	41003	16bit	UINT16
Firmware version	41031	128bit	CHAR[16]
Modbus Address	42001	16bit	UINT16

Calibration Procedure

1) Write calibration standard solution to Standard solution register (44002)
2) Write value 1 to Calibration command register
3) Read Calibration status register
   - 1 - OK
   - 3 - calibration failed

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Power cycle the probe

* Note - Conductivity measurement requires a strict timing control, therefore Modbus communication may be interrupted or delayed, we suggest PLC or any SCADA systems retry Modbus request for 3 times if a Modbus request is timeout.

ST-724

Modbus Slave Address: 14

Product Number: 10009

Probe Type: Low Range Conductivity probe

Unit of Measure: µS/cm

Measurement Range: 0.02-1000 µS/cm

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware version	41023	16-byte	CHAR[16]
Software version	41031	16-byte	CHAR[16]
Parameter command	41040	16bit	UINT16
Modbus address	42001	16bit	UINT16
Modbus parity check[1]	42003	16bit	UINT16
20mA conductivity value	43002	32bit	Float
Calibration command	44004	16bit	UINT16
Calibration solution	44029	32bit	Float
Calibration result	41003	16bit	UINT16
Conductivity value	46001	32bit	Float
Conductivity 4-20mA value	46003	32bit	Float
Temperature value	46005	32bit	Float

[1] Modbus parity check
0 - NO parity
1 - ODD
2 - EVEN

Calibration Procedure

5) Put the probe into calibration solution
6) Write calibration solution value (0.02 - 1000 µS/cm) to Calibration solution register (44029) and wait for probe stabilizing reading
7) Write value 1 to Calibration command register (44004) and wait for 1 second
8) Read Calibration result register (41003)
   - 1 - OK
   - 3 - calibration failed

Restore Factory Parameters

4) Write value 103 to parameter command register (41040)
5) Write value 103 to command register (44004) within 30 seconds
6) Wait for 1 second and read result register (41003)
   - 517 - Restore succeed
   - 515 - Restore failed
   - 512 - Invalid command

Change Modbus Address Procedure

3) Write new address to Modbus Address register (42001)
4) Power cycle the probe

* Note - Conductivity measurement requires a strict timing control, therefore Modbus communication may be interrupted or delayed, we suggest PLC or any SCADA systems retry Modbus request for 3 times if a Modbus request is timeout.

ST-725

Modbus Slave Address: 14

Product Number: 53108

Probe Type: Low Range Conductivity probe

Unit of Measure: µS/cm

Measurement Range: 0.02-200 µS/cm

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware version	41023	16-byte	CHAR[16]
Software version	41031	16-byte	CHAR[16]
Parameter command	41040	16bit	UINT16
Modbus address	42001	16bit	UINT16
Modbus parity check[1]	42003	16bit	UINT16
20mA conductivity value	43002	32bit	Float
Calibration command	44004	16bit	UINT16
Calibration solution	44029	32bit	Float
Calibration result	41003	16bit	UINT16
Conductivity value	46001	32bit	Float
Conductivity 4-20mA value	46003	32bit	Float
Temperature value	46005	32bit	Float

[1] Modbus parity check
0 - NO parity
1 - ODD
2 - EVEN

Calibration Procedure

9) Put the probe into calibration solution
10) Write calibration solution value (0.02 - 100 µS/cm) to Calibration solution register (44029) and wait for probe stabilizing reading
11) Write value 1 to Calibration command register (44004) and wait for 1 second
12) Read Calibration result register (41003)
    - 1 - OK
    - 3 - calibration failed

Restore Factory Parameters

7) Write value 103 to parameter command register (41040)
8) Write value 103 to command register (44004) within 30 seconds
9) Wait for 1 second and read result register (41003)
    - 517 - Restore succeed
    - 515 - Restore failed
    - 512 - Invalid command

Change Modbus Address Procedure

5) Write new address to Modbus Address register (42001)
6) Power cycle the probe

* Note - Conductivity measurement requires a strict timing control, therefore Modbus communication may be interrupted or delayed, we suggest PLC or any SCADA systems retry Modbus request for 3 times if a Modbus request is timeout.

ST-728

Modbus Slave Address: 14

Product Number: 53117

Probe Type: Low Range Conductivity probe

Unit of Measure: µS/cm

Measurement Range: 0.02-10 µS/cm

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware version	41023	16-byte	CHAR[16]
Software version	41031	16-byte	CHAR[16]
Parameter command	41040	16bit	UINT16
Modbus address	42001	16bit	UINT16
Modbus parity check[1]	42003	16bit	UINT16
20mA conductivity value	43002	32bit	Float
Calibration command	44004	16bit	UINT16
Calibration solution	44029	32bit	Float
Calibration result	41003	16bit	UINT16
Conductivity value	46001	32bit	Float
Conductivity 4-20mA value	46003	32bit	Float
Temperature value	46005	32bit	Float

[1] Modbus parity check
0 - NO parity
1 - ODD
2 - EVEN

Calibration Procedure

1) Put the probe into calibration solution
2) Write calibration solution value (0.02 - 10 µS/cm) to Calibration solution register (44029) and wait for probe stabilizing reading
3) Write value 1 to Calibration command register (44004) and wait for 1 second
4) Read Calibration result register (41003)
   - 1 - OK
   - 3 - calibration failed

Restore Factory Parameters

1) Write value 103 to parameter command register (41040)
2) Write value 103 to command register (44004) within 30 seconds
3) Wait for 1 second and read result register (41003)
   - 517 - Restore succeed
   - 515 - Restore failed
   - 512 - Invalid command

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Power cycle the probe

* Note - Conductivity measurement requires a strict timing control, therefore Modbus communication may be interrupted or delayed, we suggest PLC or any SCADA systems retry Modbus request for 3 times if a Modbus request is timeout.

ST-730

Modbus Slave Address: 15

Product Number: 53201

Probe Type: Turbidity probe

Unit of Measure: NTU

Measurement Range: 0-100 NTU

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial number	1032	32bit	UINT32
Turbidity value	1006	32bit	Float
4-20 mA value	1014	32bit	Float
Standard solution	1026	16bit	UINT16
Calibration command	1025	16bit	UINT16
Calibration status	1031	16bit	UINT16
Firmware version	1034	16bit	UINT16
Firmware revision	1035	16bit	UINT16
Modbus Address	1037	16bit	UINT16
Parameter command	1044	16bit	UINT16

Calibration Procedure

1) Write calibration standard solution to Standard solution register
2) Write value 3 to Calibration command register
3) Read Calibration status register
   - 0 – OK

Change Modbus Address Procedure

1) Write new address to Modbus Address register (1037)
2) Write value 2 to Parameter command register (1044)
3) Power cycle the probe

ST-730SS

Modbus Slave Address: 15

Product Number: 50626

Probe Type: Turbidity probe stainless steel

Unit of Measure: NTU

Measurement Range: 0-100 NTU

Note: ST-730SS follows same registers definition as ST-730 and same calibration command as ST-730.

ST-730B

Modbus Slave Address: 27

Product Number: 53202

Probe Type: Turbidity probe

Unit of Measure: NTU

Measurement Range: 0-1000 NTU

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial number	1032	32bit	UINT32
Turbidity value	1012	32bit	Float
4-20 mA value	1014	32bit	Float
4-20mA span settings	1016	16bit	UINT16
Standard solution	1050	32bit	Float
Calibration command	1025	16bit	UINT16
Measure status	1026	16bit	UINT16
Calibration status	1031	16bit	UINT16
Firmware version	1034	16bit	UINT16
Firmware revision	1035	16bit	UINT16
Modbus Address	1037	16bit	UINT16
Parameter command	1044	16bit	UINT16

Zero Calibration Procedure

1) Rinse probe with DI water for a few times
2) Put probe into DI water, wait at least 10 seconds for probe stabilizing reading
3) Write value 4 to Calibration command register (1025)
4) Read Calibration status register (1031)
   - 0 - OK

Low-range Calibration Procedure

1) Put probe into 100 NTU turbidity solution
2) Write solution value 100 into standard solution register (1050)
3) Wait at least 10 seconds for probe stabilizing reading
4) Write value 3 to Calibration command register (1025)
5) Read status register (1031)
   - 0 - OK

High-range Calibration Procedure

1) Put probe into 1000 NTU turbidity solution
2) Write solution value 1000 into standard solution register (1050)
3) Wait at least 10 seconds for probe stabilizing reading
4) Write value 5 to Calibration command register (1025)
5) Read status register (1031)
   - 0 - OK

Change 4-20mA Span Settings

1) Write span settings value to 4-20mA span settings register (1016)
2) Write value 2 to Parameter command register (1044)

Change Modbus Address Procedure

1) Write new address to Modbus Address register (1037)
2) Write value 2 to Parameter command register (1044)
3) Power cycle the probe

ST-731

Modbus Slave Address: 28

Product Number: 53205

Probe Type: Turbidity probe

Unit of Measure: NTU

Measurement Range: 0-10 NTU

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial number	1032	32bit	UINT32
Turbidity value	1012	32bit	Float
4-20 mA value	1014	32bit	Float
Standard solution	1010	32bit	Float
Calibration command	1025	16bit	UINT16
Calibration status	1031	16bit	UINT16
Firmware version	1034	16bit	UINT16
Firmware revision	1035	16bit	UINT16
Modbus Address	1037	16bit	UINT16
Parameter command	1044	16bit	UINT16

Zero Calibration Procedure

5) Rinse probe with DI water for a few times
6) Put probe into DI water, wait at least 10 seconds for probe stabilizing reading
7) Write value 4 to Calibration command register
8) Read Calibration status register
   - 0 - OK

Slope Calibration Procedure

1) Put probe into 2NTU turbidity solution, wait at least 10 seconds for probe stabilizing reading
2) Write value 3 to Calibration command register
3) Read Calibration status register
   - 0 - OK
4) Put probe into 10NTU turbidity solution, wait at least 10 seconds for probe stabilizing reading
5) Write value 3 to Calibration command register

6) Read Calibration status register
    - 0 - OK

Change Modbus Address Procedure

1) Write new address to Modbus Address register (1037)
2) Write value 2 to Parameter command register (1044)
3) Power cycle the probe

ST-732

Modbus Slave Address: 29

Product Number: 53218

Probe Type: Suspended solids probe

Unit of Measure: mg/L

Measurement Range: 0-100 mg/L

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial number	1032	32bit	UINT32
Suspended solids value	1012	32bit	Float
4-20 mA value	1014	32bit	Float
4-20mA span settings	1016	16bit	UINT16
Calibration command	1025	16bit	UINT16
Standard solution	1026	16bit	UINT16
Calibration status	1031	16bit	UINT16
Firmware version	1034	16bit	UINT16
Firmware revision	1035	16bit	UINT16
Modbus Address	1037	16bit	UINT16
Parameter command	1044	16bit	UINT16

Zero Calibration Procedure

1) Rinse probe with DI water for a few times
2) Put probe into DI water, wait at least 10 seconds for probe stabilizing reading
3) Write value 4 to Calibration command register
4) Read Calibration status register
   - 0 - OK

Slope Calibration Procedure

1) Put probe into calibration solution (e.g., 50mg/L), wait at least 10 seconds for probe stabilizing reading
2) Write calibration value (e.g., 50) to standard solution register, wait 2 seconds
3) Write value 3 to Calibration command register
4) Read Calibration status register
   - 0 - OK

Change 4-20mA Span Settings

1) Write span settings value to 4-20mA span settings register
2) Write value 2 to Parameter command register

Change Modbus Address Procedure

1) Write new address to Modbus Address register
2) Write value 2 to Parameter command register
3) Power cycle the probe

ST-735

Modbus Slave Address: 28

Product Number: 53204

Probe Type: Turbidity probe

Unit of Measure: NTU

Measurement Range: 0-10000 NTU

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial number	1032	32bit	UINT32
Turbidity value	1012	32bit	Float
4-20 mA value	1014	32bit	Float
Standard solution	1050	32bit	Float
Calibration command	1025	16bit	UINT16
Calibration status	1031	16bit	UINT16
Firmware version	1034	16bit	UINT16
Firmware revision	1035	16bit	UINT16
Modbus Address	1037	16bit	UINT16
Parameter command	1044	16bit	UINT16

Zero Calibration Procedure

1) Rinse probe with DI water for a few times
2) Put probe into DI water, wait at least 10 seconds for probe stabilizing reading
3) Write value 4 to Calibration command register
4) Read Calibration status register
    - 0 - OK

Low-Range Slope Calibration Procedure

1) Put probe into low-range turbidity solution (100 NTU), wait at least 10 seconds for probe stabilizing reading
2) Write low point turbidity solution value 100 to standard solution register
3) Write value 3 to Calibration command register
4) Read Calibration status register
    - 0 - OK

Mid-Range Slope Calibration Procedure

1) Put probe into mid-range turbidity solution (1000 NTU), wait at least 10 seconds for probe stabilizing reading
2) Write value 5 to Calibration command register
3) Read Calibration status register
    - 0 - OK

High-Range Slope Calibration Procedure

1) Put probe into high-range turbidity solution (e.g., 4000 NTU), wait at least 10 seconds for probe stabilizing reading
2) Write value 6 to Calibration command register
3) Read Calibration status register

- 0 - OK

Change Modbus Address Procedure

5) Write new address to Modbus Address register
6) Write value 2 to Parameter command register
7) Power cycle the probe

CR-300

Modbus Slave Address: 23

Product Number: 51007

Probe Type: Linear Polarization Resistance

Unit of Measure: mpy

Measurement Range: 0-10.0 mpy

Register Name	Register Address	Data Length	Data Type
Firmware version	41031	128bit	CHAR[16]
Modbus slave address	42001	16bit	Unsigned int 16
Sample cycle (minute)	43001	16bit	Unsigned int 16
Calibration command	43006	16bit	Unsigned int 16
Calibration standard	44001	32bit	Float
Calibration result	44003	16bit	Unsigned int 16
Corrosion rate	46001	32bit	Float
Corrosion 4-20 mA value	46003	32bit	Float
Pitting rate	46005	32bit	Float
Pitting 4-20 mA value	46007	32bit	Float
Temperature (℃)	46009	32bit	Float
Alloy coefficient	48001	32bit	Float
Corrosion 4-20mA scale	48019	32bit	Float
Pitting 4-20mA scale	48023	32bit	Float

Slope Calibration Procedure

1) Write calibration standard value to Calibration standard register (valid range 0.02-100 mpy)
2) Wait 1 second
3) Write value 3 to Calibration command register
4) Wait 1 second
5) Read Calibration result register

   0 - Calibration Success

   1 - Input calibration value out of range

   2 - Current measurement value too low

   3 - Current measurement value too high

   Other - Unknown error

Change Modbus Address Procedure

1) Write new address to Modbus slave address register
2) Wait 2 seconds
3) Power cycle the probe

Note:

[1] Default sample cycle is 3 minutes, if sample cycle is set to a value less than 3, CR-300 only outputs corrosion rate, no pitting rate output.

[2] Default alloy coefficient is 1.0, which is for carbon steel. Alloy coefficient value range is 0.1 - 5.0

CR-301

Modbus Slave Address: 23

Product Number: 51021

Probe Type: High Temp/Pressure Linear Polarization Resistance Probe

Unit of Measure: mpy

Measurement Range: 0-10.0 mpy

Register Name	Register Address	Data Length	Data Type
Firmware version	41031	128bit	CHAR[16]
Modbus slave address	42001	16bit	Unsigned int 16
Sample cycle (minute)	43001	16bit	Unsigned int 16
Calibration command	43006	16bit	Unsigned int 16
Calibration standard	44001	32bit	Float
Calibration result	44003	16bit	Unsigned int 16
Corrosion rate	46001	32bit	Float
Corrosion 4-20 mA value	46003	32bit	Float
Pitting rate	46005	32bit	Float
Pitting 4-20 mA value	46007	32bit	Float
Temperature (℃)	46009	32bit	Float
Alloy coefficient	48001	32bit	Float
Corrosion 4-20mA scale	48019	32bit	Float
Pitting 4-20mA scale	48023	32bit	Float

Slope Calibration Procedure

1) Write calibration standard value to Calibration standard register (valid range 0.02-100 mpy)
2) Wait 1 second
3) Write value 3 to Calibration command register
4) Wait 1 second
5) Read Calibration result register

   0 - Calibration Success

   1 - Input calibration value out of range

   2 - Current measurement value too low

   3 - Current measurement value too high

   Other - Unknown error

Change Modbus Address Procedure

1) Write new address to Modbus slave address register
2) Wait 2 seconds
3) Power cycle the probe

Note:

[1] Default sample cycle is 3 minutes, if sample cycle is set to a value less than 3, CR-301 only outputs corrosion rate, no pitting rate output.

[2] Default alloy coefficient is 1.0, which is for carbon steel. Alloy coefficient value range is 0.1 - 5.0

LS-202

Modbus Slave Address: 66

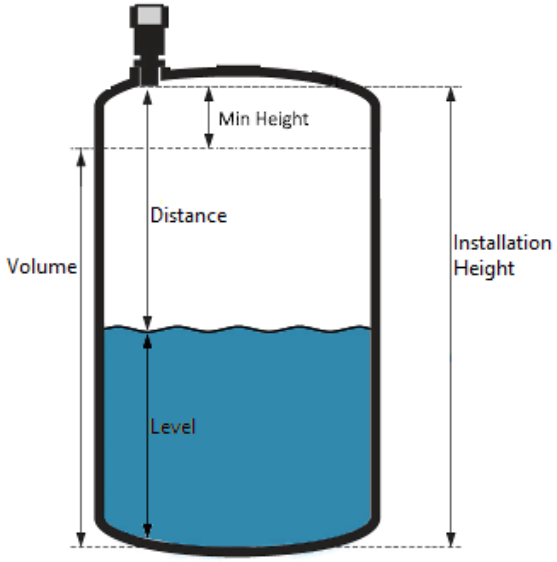
Product Number: 54002

Probe Type: Ultrasonic level sensor

Unit of Measure: meter

Measurement Range: 0.1-2 meter

Register Name	Register Address	Data Length	Data Type
Distance	46001	32bit	Float
Level	46003	32bit	Float
Remaining volume	46005	32bit	Float
Used volume	46007	32bit	Float
Tank sectional area	43003	32bit	Float
Installation height	43005	32bit	Float
Min height	43007	32bit	Float
Sample period	43013	16bit	UINT16
Screen auto off time	43048	16bit	UINT16
System auto off time	43049	16bit	UINT16
Unit	43051	16bit	UINT16



Setup LS-202 after installation in following steps

1. Set **Tank sectional area** value to register address 43003, unit is m^2
2. Set **Installation height** value to register address 43005, unit is mm
3. Set **Min height** value to register address 43007, unit is mm

Read LS-202 output

1. Read **Level** value from register address 46003, unit is meter
2. Read **Distance** value from register address 46001, unit is meter
3. Read **Remaining volume** value from register address 46005, unit is Liter
4. Read **Used volume** value from register address 46007, unit is Liter

In addition, the following parameters can be set

1. **Sample period**: set how frequently the level be measured, sample period can be
   - 0xFFFF - do not measure at tall
   - 0x0000 - continuously measure
   - Other value - sample interval time, unit is second, e.g., value 60 means LS-202 will measure level data every 60 seconds
2. **Screen auto off time**: LS-202 LCD screen auto turn off time, unit is seconds
3. **System auto off time**: LS-202 system auto turn off time, unit is seconds, e.g., if sample period is 30 min, and system auto off time is 5 min, LS-202 will measure level data every 30 minutes, afterwards LS-202 will stay active for 5 minutes and then run into sleep mode to save battery power
4. **Unit**: LCD display unit, it can be
   - 0x11 - meter and liter
   - 0x12 - cm and liter
   - Other value - inch and gallon

LS-200

Modbus Slave Address: 66

Product Number: 54011

Probe Type: Ultrasonic level sensor

Unit of Measure: meter

Measurement Range: 0.1-2 meter

Register Name	Register Address	Data Length	Data Type
Distance	46001	32bit	Float
Level	46003	32bit	Float
Remaining volume	46005	32bit	Float
Used volume	46007	32bit	Float
Tank sectional area	43003	32bit	Float
Installation height	43005	32bit	Float
Min height	43007	32bit	Float
Sample period	43013	16bit	UINT16
System auto off time	43049	16bit	UINT16
Modbus slave address	42001	16bit	UINT16
Modbus databits	42002	16bit	UINT16
Modbus stopbit	42003	16bit	UINT16
Modbus parity	42004	16bit	UINT16
Modbus baudrate	42005	32bit	UINT32

Note: LS-200 follows same procedure as LS-202, however it does not have screen auto off time.

Change Modbus Address Procedure

1) Write new address to Modbus slave address register
2) Wait 2 seconds
3) Power cycle the probe

Change Modbus communication parameters

1) Write new baudrate value to Modbus Baudrate register
2) Write new parity value to Modbus parity register
3) Wait 2 seconds
4) Power cycle the probe

*** Note**

[1] LS-200 firmware version earlier than version 72 does not support Modbus communication parameters change.

[2] Valid baudrate value: 9600, 19200, 38400, 57600 and 115200

[3] Valid parity value: 0 - None, 1 - ODD, 2 - EVEN

HM-500

Modbus Slave Address: 20

Product Number: 52101

Probe Type: Oil in water probe

Unit of Measure: mg/L

Measurement Range: 0-10 mg/L

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	1032	32bit	UINT32
Oil in water value	1006	32bit	Float
4-20 mA value	1014	32bit	Float
Standard solution	1026	16bit	UINT16
Calibration command	1025	16bit	UINT16
Calibration status	1031	16bit	UINT16
Firmware version	1034	16bit	UINT16
Firmware revision	1035	16bit	UINT16
Modbus Address	1037	16bit	UINT16
Parameter command	1044	16bit	UINT16

Zero Point Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Write value 4 to Calibration command register (1025)
4) Read Calibration status register
    - 0 - OK
    - 2048 - probe was fouled
    - 4096 - deionized water contaminated

Slope Calibration Procedure

1) Rinse probe with standard solution for a few times
2) Put probe into standard solution
3) Write calibration standard solution (e.g., 10) to Standard solution register (1026)
4) Write value 3 to Calibration command register (1025)
5) Read Calibration status register
    - 0 - OK
    - 256 - solution too high
    - 1024 - solution too low

Change Modbus Address Procedure

1) Write new address to Modbus Address register (1037)
2) Write value 2 to Parameter command register (1044)
3) Power cycle the probe

HM-510

Modbus Slave Address: 24

Product Number: 52102

Probe Type: Oil in water probe

Unit of Measure: mg/L

Measurement Range: 0-1000 mg/L

Note: Modbus register map is same as HM-500, ZERO and SLOPE calibration follows the same procedures as HM-500

HM-520

Modbus Slave Address: 20

Product Number: 52106

Probe Type: Oil in water probe

Unit of Measure: mg/L

Measurement Range: 0-100 mg/L

Note: Modbus register map is same as HM-500, ZERO and SLOPE calibration follows the same procedures as HM-500

HM-610

Modbus Slave Address: 31

Product Number: 52112

Probe Type: Inline UVAS probe

Unit of Measure: ppm

Measurement Range: 0-300 ppm

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	1032	32bit	UINT32
UVAS value	1006	32bit	Float
4-20 mA value	1014	32bit	Float
Standard solution	1010	32bit	Float
Calibration command	1025	16bit	UINT16
Calibration status	1031	16bit	UINT16
Firmware version	1034	16bit	UINT16
Firmware revision	1035	16bit	UINT16
Modbus Address	1037	16bit	UINT16
Parameter command	1044	16bit	UINT16

Zero Point Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Write value 4 to Calibration command register
4) Read Calibration status register
   - 0 - OK

Slope Calibration Procedure

1) Rinse probe with standard solution for a few times
2) Put probe into standard solution
3) Write calibration standard solution (e.g., 100) to Standard solution register
4) Write value 3 to Calibration command register
5) Read Calibration status register
   - 0 - OK

   Note: Please cover the probe to prevent ambient light interference during calibration.

Change Modbus Address Procedure

1) Write new address to Modbus Address register
2) Write value 2 to Parameter command register
3) Power cycle the probe

EM-500

Modbus Slave Address: 19

Product Number: 50501

Probe Type: Inline Chlorophyl-A probe

Unit of Measure: ppb

Measurement Range: 0.1-50

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Firmware Version	41031	16-byte	CHAR[16]
Modbus Address	42001	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
Chlorophyl-A Value	46001	32bit	Float
Chlorophyl-A 4-20mA Value	46003	32bit	Float
Cleanliness	46011	16bit	UINT16
Chlorophyl-A 4-20 mA Scale	43002	32bit	Float
Calibration Solution	44002	32bit	Float
Command	43006	16bit	UINT16
Calibration Status	48031	16bit	UINT16

Zero Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Write value 3 to command register
4) Read calibration status register
    - 0 - OK
    - 1 - probe was fouled
    - 2 - deionized water has Chlorophyl-A background

Slope Calibration Procedure

1) Rinse probe with standard solution for a few times
2) Put probe into standard solution
3) Write calibration solution value (e.g., 50) to calibration solution register
4) Wait 1 or 2 seconds
5) Write value 4 to command register
6) Read calibration status register
    - 0 - OK
    - 3 - Calibration solution over range
    - 4 - Calibration solution under range
    - 5 - Slope value error

Note: Please cover the probe to prevent ambient light interference during calibration.

Change Modbus Address Procedure

1) Write new address to Modbus address register
2) Power cycle the probe

Change Baudrate

1) Write new Baudrate value to Baudrate register
2) Power cycle the probe

Change Parity Check

1) Write new parity value to parity check register
2) Power cycle the probe

Parity definition: 0 - No parity, 1 - ODD, 2 – Even

Cleanliness Check

Read cleanliness register to get probe cleanliness status, the higher the value, the cleaner it is. The maximum cleanliness value is 100.

LT-631

Modbus Slave Address: 81

Product Number: 53249

Probe Type: Inline turbidity probe with brush

Unit of Measure: NTU

Measurement Range: 0-500 NTU

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Turbidity value	46001	32bit	Float
Turbidity 4-20mA output	46003	32bit	Float
Mid-range calibration solution	44005	32bit	Float
High-range calibration solution	44009	32bit	Float
Smoothing Factor	43004	32bit	Float
Command	43006	16bit	UINT16
Status	41003	16bit	UINT16
Serial number	41015	128bit	CHAR[16]
Hardware version	41023	128bit	CHAR[16]
Software version	41031	128bit	CHAR[16]
Parameter command	41040	16bit	UINT16
Modbus address	42001	16bit	UINT16
Modbus parity	42003	16bit	UINT16
Modbus baudrate	42004	32bit	UINT32
Cyclical brushing control	48033	16bit	UINT16
Number of brushings per cycle	48034	16bit	UINT16
Brush cycle time	48035	32bit	UINT32

Note: The smaller the value of the smoothing factor, the more stable the turbidity value, but the slower the response of the turbidity probe. Valid range of smoothing factor is from 0.0 to 1.0.

DI Calibration Procedure

1) Rinse probe with DI water for a few times
2) Put probe into DI water
3) Wait a few seconds for probe stabilizing reading
4) Write value 24 to command register
5) Read status register
    - 769 - Calibration succeed
    - 264 - Raw signal over range

Mid-Range Calibration Procedure

1) Rinse probe with mid-range solution for a few times
2) Put probe into mid-range turbidity solution (e.g., 80 NTU)
3) Write solution value (e.g., 80) into mid-range calibration solution register

4) Wait a few seconds for probe stabilizing reading
5) Write value 25 to command register
6) Read status register
    - 769 - Calibration succeed
    - 260 - Mid-range solution value over range
    - 264 - Raw signal over range

Note: Allowed mid-range calibration solution range is from 20 to 120 NTU

High-Range Calibration Procedure

1) Rinse probe with high-range solution for a few times
2) Put probe into high range turbidity solution (e.g., 300 NTU)
3) Write solution value (e.g., 300) into high-range calibration solution register
4) Wait a few seconds for probe stabilizing reading
5) Write value 26 to command register
6) Read status register
    - 769 - Calibration succeed
    - 261 - High-range solution value over range
    - 264 - Raw signal over range

Note: Allowed high-range calibration solution range is from 200 to 1000 NTU

Restore Factory Parameters

1) Write value 103 to parameter command register
2) Wait 5 seconds
3) Write value 103 to command register
4) Wait 2 seconds
5) Read status register
    - 512 - Invalid command
    - 515 - Restore factory parameter failed
    - 517 - Restore factory parameter OK

Change Modbus Address Procedure

1) Write new address to Modbus address register
2) Wait 2 seconds
3) Power cycle the probe

Change Modbus Baudrate

1) Write new baudrate to Modbus baudrate register
2) Wait 2 seconds
3) Power cycle the probe

Note: 9600, 19200, 38400 are valid baudrate values

Change Modbus Parity

1) Write new parity to Modbus baudrate register
2) Wait 2 seconds

3) Power cycle the probe

Note: 0 - None, 1 - ODD, 2 - EVEN are valid parity values

Brush Control

Manually activate brush

Write value 32 to command register to start one brushing action

Disable cyclical brushing

Write value 0 to cyclical brushing control register

Enable cyclical brushing

Write value 1 to cyclical brushing control register

Adjust number of brushings per cycle

Write desired value N to Number of brushings per cycle register, minimum value is 1

Adjust brush cycle

Write desired value N to brush cycle time register, cycle time = N * 0.1 seconds, minimum value is 600, i.e., minimum cycle time is 60 seconds

LT-632

Modbus Slave Address: 81

Product Number: 53250

Probe Type: Inline turbidity probe with brush

Unit of Measure: NTU

Measurement Range: 0-1000 NTU

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Turbidity value	46001	32bit	Float
Turbidity 4-20mA output	46003	32bit	Float
Mid-range calibration solution	44005	32bit	Float
High-range calibration solution	44009	32bit	Float
Smoothing Factor	43004	32bit	Float
Command	43006	16bit	UINT16
Status	41003	16bit	UINT16
Serial number	41015	128bit	CHAR[16]
Hardware version	41023	128bit	CHAR[16]
Software version	41031	128bit	CHAR[16]
Parameter command	41040	16bit	UINT16
Modbus address	42001	16bit	UINT16
Modbus parity	42003	16bit	UINT16
Modbus baudrate	42004	32bit	UINT32
Cyclical brushing control	48033	16bit	UINT16
Number of brushings per cycle	48034	16bit	UINT16
Brush cycle time	48035	32bit	UINT32

Note: The smaller the value of the smoothing factor, the more stable the turbidity value, but the slower the response of the turbidity probe. Valid range of smoothing factor is from 0.0 to 1.0.

DI Calibration Procedure

1) Rinse probe with DI water for a few times
2) Put probe into DI water
3) Wait a few seconds for probe stabilizing reading
4) Write value 24 to command register
5) Read status register
    - 769 - Calibration succeed
    - 264 - Raw signal over range

Mid-Range Calibration Procedure

1) Rinse probe with mid-range solution for a few times
2) Put probe into mid-range turbidity solution (e.g., 80 NTU)
3) Write solution value (e.g., 80) into mid-range calibration solution register
4) Wait a few seconds for probe stabilizing reading
5) Write value 25 to command register
6) Read status register
    - 769 - Calibration succeed
    - 260 - Mid-range solution value over range
    - 264 - Raw signal over range

Note: Allowed mid-range calibration solution range is from 20 to 120 NTU

High-Range Calibration Procedure

1) Rinse probe with high-range solution for a few times
2) Put probe into high range turbidity solution (e.g., 300 NTU)
3) Write solution value (e.g., 300) into high-range calibration solution register
4) Wait a few seconds for probe stabilizing reading
5) Write value 26 to command register
6) Read status register
    - 769 - Calibration succeed
    - 261 - High-range solution value over range
    - 264 - Raw signal over range

Note: Allowed high-range calibration solution range is from 200 to 1000 NTU

Restore Factory Parameters

1) Write value 103 to parameter command register
2) Wait 5 seconds
3) Write value 103 to command register
4) Wait 2 seconds
5) Read status register
    - 512 - Invalid command

- 515 - Restore factory parameter failed
- 517 - Restore factory parameter OK

Change Modbus Address Procedure

1) Write new address to Modbus address register
2) Wait 2 seconds
3) Power cycle the probe

Change Modbus Baudrate

1) Write new baudrate to Modbus baudrate register
2) Wait 2 seconds
3) Power cycle the probe

Note: 9600, 19200, 38400 are valid baudrate values

Change Modbus Parity

1) Write new parity to Modbus baudrate register
2) Wait 2 seconds
3) Power cycle the probe

Note: 0 - None, 1 - ODD, 2 - EVEN are valid parity values

Brush Control

Manually activate brush

Write value 32 to command register to start one brushing action

Disable cyclical brushing

Write value 0 to cyclical brushing control register

Enable cyclical brushing

Write value 1 to cyclical brushing control register

Adjust number of brushings per cycle

Write desired value N to Number of brushings per cycle register, minimum value is 1

Adjust brush cycle

Write desired value N to brush cycle time register, cycle time = N * 0.1 seconds, minimum value is 600, i.e., minimum cycle time is 60 seconds.

LT-633

Modbus Slave Address: 81

Product Number: 10002

Probe Type: Inline turbidity probe with brush

Unit of Measure: NTU

Measurement Range: 0-4000 NTU

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Turbidity value	46001	32bit	Float

Turbidity 4-20mA output	46003	32bit	Float
Mid-range 1 calibration solution	44005	32bit	Float
Mid-range 2 calibration solution	44007	32bit	Float
High-range calibration solution	44009	32bit	Float
1000 NTU calibration solution	44017	32bit	Float
Smoothing Factor	43004	32bit	Float
Command	43006	16bit	UINT16
Status	41003	16bit	UINT16
Serial number	41015	128bit	CHAR[16]
Hardware version	41023	128bit	CHAR[16]
Software version	41031	128bit	CHAR[16]
Parameter command	41040	16bit	UINT16
Modbus address	42001	16bit	UINT16
Modbus parity	42003	16bit	UINT16
Modbus baudrate	42004	32bit	UINT32
Cyclical brushing control	48033	16bit	UINT16
Number of brushings per cycle	48034	16bit	UINT16
Brush cycle time	48035	32bit	UINT32

Note: The smaller the value of the smoothing factor, the more stable the turbidity value, but the slower the response of the turbidity probe. Valid range of smoothing factor is from 0.0 to 1.0.

DI Calibration Procedure

1) Rinse probe with DI water for a few times
2) Put probe into DI water
3) Wait a few seconds for probe stabilizing reading
4) Write value 24 to command register
5) Read status register
    - 769 - Calibration succeed
    - 264 - Raw signal over range

Mid-Range 1 Calibration Procedure

1) Rinse probe with mid-range 1 solution for a few times
2) Put probe into mid-range 1 turbidity solution (e.g., 80 NTU)
3) Write solution value (e.g., 80) into mid-range 1 calibration solution register
4) Wait a few seconds for probe stabilizing reading
5) Write value 25 to command register
6) Read status register
    - 769 - Calibration succeed
    - 260 - Mid-range 1 solution value over range
    - 264 - Raw signal over range

Note: Allowed mid-range 1 calibration solution range is from 20 to 120 NTU

Mid-Range 2 Calibration Procedure

1) Rinse probe with mid-range 2 solution for a few times

2) Put probe into mid-range 2 turbidity solution (e.g., 500 NTU)
3) Write solution value (e.g., 500) into mid-range 2 calibration solution register
4) Wait a few seconds for probe stabilizing reading
5) Write value 27 to command register
6) Read status register
    - 769 - Calibration succeed
    - 261 - Mid-range 2 solution value over range
    - 264 - Raw signal over range

Note: Allowed mid-range 2 calibration solution range is from 450 to 550 NTU

1000NTU Calibration Procedure

1) Rinse probe with 1000 NTU solution for a few times
2) Put probe into 1000 NTU turbidity solution
3) Write solution value (e.g., 1000) into 1000 NTU calibration solution register
4) Wait a few seconds for probe stabilizing reading
5) Write value 29 to command register
6) Read status register
    - 769 - Calibration succeed
    - 261 - 1000 NTU solution value over range
    - 264 - Raw signal over range

Note: Allowed 1000 NTU calibration solution range is from 950 to 1050 NTU

High-Range Calibration Procedure

1) Rinse probe with high-range solution for a few times
2) Put probe into high range turbidity solution (e.g., 2000 NTU)
3) Write solution value (e.g., 2000) into high-range calibration solution register
4) Wait a few seconds for probe stabilizing reading
5) Write value 26 to command register
6) Read status register
    - 769 - Calibration succeed
    - 261 - High-range solution value over range
    - 264 - Raw signal over range

Note: Allowed high-range calibration solution range is from 2000 to 3000 NTU

Restore Factory Parameters

1) Write value 103 to parameter command register
2) Wait 5 seconds
3) Write value 103 to command register
4) Wait 2 seconds
5) Read status register
    - 512 - Invalid command
    - 515 - Restore factory parameter failed
    - 517 - Restore factory parameter OK

Change Modbus Address Procedure

1) Write new address to Modbus address register
2) Wait 2 seconds
3) Power cycle the probe

Change Modbus Baudrate

1) Write new baudrate to Modbus baudrate register
2) Wait 2 seconds
3) Power cycle the probe

Note: 9600, 19200, 38400 are valid baudrate values

Change Modbus Parity

1) Write new parity to Modbus baudrate register
2) Wait 2 seconds
3) Power cycle the probe

Note: 0 - None, 1 - ODD, 2 - EVEN are valid parity values

Brush Control

Manually activate brush

Write value 32 to command register to start one brushing action

Disable cyclical brushing

Write value 0 to cyclical brushing control register

Enable cyclical brushing

Write value 1 to cyclical brushing control register

Adjust number of brushings per cycle

Write desired value N to Number of brushings per cycle register, minimum value is 1

Adjust brush cycle

Write desired value N to brush cycle time register, cycle time = N * 0.1 seconds, minimum value is 600, i.e., minimum cycle time is 60 seconds

LT-635

Modbus Slave Address: 81

Product Number: 53251

Probe Type: Inline sludge probe with brush

Unit of Measure: g/L

Measurement Range: 0-30 g/L

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Turbidity value	46001	32bit	Float
Turbidity 4-20mA output	46003	32bit	Float
Mid-range calibration solution	44005	32bit	Float
High-range calibration solution	44009	32bit	Float

Smoothing Factor	43004	32bit	Float
Command	43006	16bit	UINT16
Status	41003	16bit	UINT16
Serial number	41015	128bit	CHAR[16]
Hardware version	41023	128bit	CHAR[16]
Software version	41031	128bit	CHAR[16]
Parameter command	41040	16bit	UINT16
Modbus address	42001	16bit	UINT16
Modbus parity	42003	16bit	UINT16
Modbus baudrate	42004	32bit	UINT32
Cyclical brushing control	48033	16bit	UINT16
Number of brushings per cycle	48034	16bit	UINT16
Brush cycle time	48035	32bit	UINT32

Note: The smaller the value of the smoothing factor, the more stable the turbidity value, but the slower the response of the turbidity probe. Valid range of smoothing factor is from 0.0 to 1.0.

DI Calibration Procedure

1) Rinse probe with DI water for a few times
2) Put probe into DI water
3) Wait a few seconds for probe stabilizing reading
4) Write value 3 to command register
5) Read status register
    - 769 - Calibration succeed
    - 264 - Raw signal over range

Mid-Range Calibration Procedure

1) Rinse probe with mid-range solution for a few times
2) Put probe into mid-range turbidity solution (e.g., 8000)
3) Write solution value (e.g., 8000) into mid-range calibration solution register
4) Wait a few seconds for probe stabilizing reading
5) Write value 25 to command register
6) Read status register
    - 769 - Calibration succeed

Note: Allowed mid-range calibration solution range is from 2000 to 10000

High-Range Calibration Procedure

1) Rinse probe with high-range solution for a few times
2) Put probe into high range turbidity solution (e.g., 15000)
3) Write solution value (e.g., 15000) into high-range calibration solution register
4) Wait a few seconds for probe stabilizing reading
5) Write value 26 to command register
6) Read status register
    - 769 - Calibration succeed

Note: Allowed high-range calibration solution range is from 10000 to 30000

Restore Factory Parameters

1) Write value 103 to parameter command register
2) Wait 5 seconds
3) Write value 103 to command register
4) Wait 2 seconds
5) Read status register
    - 512 - Invalid command
    - 515 - Restore factory parameter failed
    - 517 - Restore factory parameter OK

Change Modbus Address Procedure

1) Write new address to Modbus address register
2) Wait 2 seconds
3) Power cycle the probe

Change Modbus Baudrate

1) Write new baudrate to Modbus baudrate register
2) Wait 2 seconds
3) Power cycle the probe

Note: 9600, 19200, 38400 are valid baudrate values

Change Modbus Parity

1) Write new parity to Modbus baudrate register
2) Wait 2 seconds
3) Power cycle the probe

Note: 0 - None, 1 - ODD, 2 - EVEN are valid parity values

Brush Control

Manually activate brush

Write value 32 to command register to start one brushing action

Disable cyclical brushing

Write value 0 to cyclical brushing control register

Enable cyclical brushing

Write value 1 to cyclical brushing control register

Adjust number of brushings per cycle

Write desired value N to Number of brushings per cycle register, minimum value is 1

Adjust brush cycle

Write desired value N to brush cycle time register, cycle time = N * 0.1 seconds, minimum value is 600, i.e., minimum cycle time is 60 seconds

LT-736

Modbus Slave Address: 73

Product Number: 53215

Probe Type: Low turbidity probe

Unit of Measure: NTU

Measurement Range: 0.01-1000 NTU

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Turbidity value	46001	32bit	Float
Turbidity 4-20mA output	46003	32bit	Float
Low point calibration solution	44003	32bit	Float
Mid-low calibration solution	44005	32bit	Float
Mid-high calibration solution	44007	32bit	Float
High point calibration solution	44009	32bit	Float
Command	43006	16bit	UINT16
Status	41003	16bit	UINT16
Serial number	41015	128bit	CHAR[16]
Hardware version	41023	128bit	CHAR[16]
Software version	41031	128bit	CHAR[16]
Parameter command	41040	16bit	UINT16
Modbus address	42001	16bit	UINT16
Modbus parity	42003	16bit	UINT16
Modbus baudrate	42004	32bit	UINT32

Low Point Calibration Procedure

1) Rinse probe with low point solution (e.g., DI water) for a few times
2) Put probe into low turbidity solution
3) Write solution value (e.g., 0.1) into low point calibration solution register
4) Wait 10 seconds for probe stabilizing reading
5) Write value 3 to command register
6) Read status register
    - 256 - OK
    - 259 - Turbidity solution over range
    - 264 - Raw signal over range

Mid-low Calibration Procedure

1) Rinse probe with mid-low solution for a few times
2) Put probe into mid low turbidity solution (e.g., 10 NTU)
3) Write solution value (e.g., 10) into mid-low calibration solution register
4) Wait 10 seconds for probe stabilizing reading
5) Write value 5 to command register
6) Read status register

- 257 - OK
- 259 - Turbidity low point solution over range
- 260 - Turbidity mid-low solution over range
- 261 - Turbidity mid-high solution over range
- 262 - Low range slope error
- 263 - Mid range slope error
- 264 - Raw signal over range

Mid-high Calibration Procedure

1) Rinse probe with mid-high solution for a few times
2) Put probe into mid high turbidity solution (e.g., 100 NTU)
3) Write solution value (e.g., 100) into mid-high calibration solution register
4) Wait 10 seconds for probe stabilizing reading
5) Write value 6 to command register
6) Read status register
   - 257 - OK
   - 259 - Turbidity mid-low solution over range
   - 260 - Turbidity mid-high solution over range
   - 261 - Turbidity high point solution over range
   - 262 - Mid range slope error
   - 263 - High range slope error
   - 264 - Raw signal over range

High Point Calibration Procedure

1) Rinse probe with high point solution for a few times
2) Put probe into high turbidity solution (e.g., 1000 NTU)
3) Write solution value (e.g., 1000) into high point calibration solution register
4) Wait 10 seconds for probe stabilizing reading
5) Write value 4 to command register
6) Read status register
   - 258 – OK
   - 260 - Turbidity mid-high solution over range
   - 261 - Turbidity high point solution over range
   - 263 - High range slope error
   - 264 - Raw signal over range

Restore Factory Parameters

1) Write value 103 to parameter command register
2) Wait 5 seconds
3) Write value 103 to command register
4) Wait 2 seconds
5) Read status register
   - 512 - Invalid command
   - 515 - Restore factory parameter failed

- 517 - Restore factory parameter OK

Change Modbus Address Procedure

1) Write new address to Modbus address register
2) Wait 2 seconds
3) Power cycle the probe

Change Modbus Baudrate

1) Write new baudrate to Modbus baudrate register
2) Wait 2 seconds
3) Power cycle the probe

Note: 9600, 19200, 38400 are valid baudrate values

Change Modbus Parity

1) Write new parity to Modbus baudrate register
2) Wait 2 seconds
3) Power cycle the probe

Note: 0 - None, 1 - ODD, 2 - EVEN are valid parity values

LT-737

Modbus Slave Address: 74

Product Number: 53216

Probe Type: Low turbidity probe

Unit of Measure: NTU

Measurement Range: 0.01-5 NTU

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Turbidity value	1006	32bit	Float
Low-range calibration solution	1008	32bit	Float
Mid-range calibration solution	1010	32bit	Float
High-range calibration solution	1012	32bit	Float
4-20 mA value	1014	32bit	Float
Calibration command	1025	16bit	UINT16
Serial number	1032	32bit	UINT32
Software version	1035	16bit	UINT16
Modbus address	1037	16bit	UINT16
Parameter reset	1044	16bit	UINT16
Smooth factor	1046	32bit	Float
Status	1055	16bit	UINT16

Low-range Calibration Procedure

1) Rinse probe with low-range solution for a few times
2) Put probe into low turbidity solution (< 0.2 NTU)
3) Write solution value (e.g., 0.1) into low-range calibration solution (1008)
4) Write value 3 to Calibration command register (1025)
5) Wait 4 seconds for probe stabilizing reading
6) Read status register (1055)
    - 256 - OK
    - 259 - turbidity solution over range

Mid-range Calibration Procedure

1) Rinse probe with mid-range solution for a few times
2) Put probe into mid turbidity solution (1 - 2 NTU)
3) Write solution value (e.g., 2) into mid-range calibration solution (1010)
4) Write value 4 to Calibration command register (1025)
5) Wait 4 seconds for probe stabilizing reading
6) Read status register (1055)
    - 257 - OK
    - 260 - turbidity solution over range
    - 262 - low to mid-range slope over range
    - 263 - mid to high-range slope over range

High-range Calibration Procedure

1) Rinse probe with high-range solution for a few times
2) Put probe into high turbidity solution (3 - 5 NTU)
3) Write solution value (e.g., 5) into high-range calibration solution (1012)
4) Write value 5 to Calibration command register (1025)
5) Wait 4 seconds for probe stabilizing reading
6) Read status register (1055)
    - 258 - OK
    - 261 - turbidity solution over range
    - 263 - slope over range

Restore Factory Parameters

1) Write value 16 to parameter reset register (1044)
2) Read status register (1055)
    - 517 - Restore factory parameter OK
    - 515 - Restore factory parameter failed

Change Modbus Address Procedure

1) Write new address to Modbus Address register (1037)
2) Write value 2 to Parameter command register (1044)
3) Power cycle the probe

LT-739

Modbus Slave Address: 28

Product Number: 53221

Probe Type: Low turbidity probe

Unit of Measure: NTU

Measurement Range: 0.01-40 NTU

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Turbidity value	1006	32bit	Float
Low-range calibration solution	1008	32bit	Float
Mid-range calibration solution	1010	32bit	Float
High-range calibration solution	1012	32bit	Float
4-20 mA value	1014	32bit	Float
Calibration command	1025	16bit	UINT16
Serial number	1032	32bit	UINT32
Software version	1035	16bit	UINT16
Modbus address	1037	16bit	UINT16
Parameter reset	1044	16bit	UINT16
Smooth factor	1046	32bit	Float
Status	1055	16bit	UINT16

Low-range Calibration Procedure

6) Rinse probe with low-range solution for a few times
7) Put probe into low turbidity solution (0 - 2 NTU)
8) Write solution value (e.g., 0.1) into low-range calibration solution (1008)
9) Write value 3 to Calibration command register (1025)
10) Wait 4 seconds for probe stabilizing reading
11) Read status register (1055)
    - 256 - success
    - 259 - low calibration solution out of range
    - 260 - mid calibration solution out of range
    - 262 - slope value over range
    - 264 - raw signal over range

Mid-range Calibration Procedure

1) Rinse probe with mid-range solution for a few times
2) Put probe into mid turbidity solution (5 - 10 NTU)
3) Write solution value (e.g., 10) into mid-range calibration solution (1010)
4) Write value 4 to Calibration command register (1025)
5) Wait 4 seconds for probe stabilizing reading
6) Read status register (1055)
    - 257 - success
    - 259 - low calibration solution out of range

- 260 - mid calibration solution out of range
- 262 - slope value over range
- 264 - raw signal over range

High-range Calibration Procedure

1) Rinse probe with high-range solution for a few times
2) Put probe into high turbidity solution (20 - 40 NTU)
3) Write solution value (e.g., 40) into high-range calibration solution (1012)
4) Write value 5 to Calibration command register (1025)
5) Wait 4 seconds for probe stabilizing reading
6) Read status register (1055)
   - 258 - success
   - 260 - mid calibration solution out of range
   - 261 – high calibration solution out of range
   - 263 - slope value over range
   - 264 - raw signal over range

Restore Factory Parameters

1) Write value 16 to parameter reset register (1044)
2) Read status register (1055)
   - 517 - Restore factory parameter OK
   - 515 - Restore factory parameter failed

Change Modbus Address Procedure

1) Write new address to Modbus Address register (1037)
2) Write value 2 to Parameter command register (1044)
3) Power cycle the probe

ST-587

Modbus Slave Address: 79

Product Number: 50906

Probe Type: Fluorescence and Turbidity probe

Unit of Measure: ppb for Fluorescence, NTU for Turbidity

Measurement Range: 0-500 ppb for Fluorescence, 0-200 NTU for Turbidity

Register Name	Register Address	Data Length	Data Type
Restore Status	41003	16bit	UINT16
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Firmware Version	41031	16-byte	CHAR[16]
Storage Flag	41040	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
Command	43006	16bit	UINT16
Fluorescence Calibration Solution	44002	32bit	Float
Turbidity Calibration Solution	44004	32bit	Float
Fluorescence Value	46001	32bit	Float
Fluorescence 4-20mA Value	46003	32bit	Float
Turbidity Value	46007	32bit	Float
Turbidity 4-20mA Value	46009	32bit	Float
Cleanliness Value [1]	46029	16bit	UINT16
Florescence 4-20 mA Scale	48018	16bit	UINT16
Turbidity 4-20 mA Scale	48019	16bit	UINT16
Fluorescence Calibration Status	48050	16bit	UINT16
Turbidity Calibration Status	48051	16bit	UINT16

[1] - Cleanliness value is only available with firmware version greater than Revision 126.

Fluorescence Zero Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Write value 3 to command register
4) Read fluorescence calibration status register
   - 0 - OK
   - 1 - probe was fouled
   - 2 - deionized water has fluorescence background

Fluorescence Slope Calibration Procedure

1) Rinse probe with standard solution for a few times
2) Put probe into standard solution

3) Write calibration solution value (e.g., 200) to fluorescence calibration solution register
4) Wait 1 or 2 seconds
5) Write value 4 to command register
6) Read fluorescence calibration status register
    - 0 - OK
    - 3 - solution too high
    - 4 - solution too low
    - 5 - slope value invalid

Turbidity Zero Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Write value 5 to command register
    - Read tagged polymer calibration status register
    - 0 - OK
    - 2 - deionized water has turbidity background

Turbidity Slope Calibration Procedure

1) Rinse probe with standard solution for a few times
2) Put probe into standard solution
3) Write calibration solution value (e.g., 100) to turbidity calibration solution register
4) Wait 1 or 2 seconds
5) Write value 6 to command register
6) Read tagged polymer calibration status register
    - 0 - OK
    - 3 - solution too high
    - 4 - solution too low
    - 5 - slope value invalid

Restore Factory Parameters

1) Write value 103 to storage flag register
2) Wait 1 second
3) Write value 103 to command register
4) Wait 1 second
5) Read value from restore status register
    - 517 - restore success
    - 515 - restore failed

Change Modbus Address Procedure

1) Write new address to Modbus address register
2) Power cycle the probe

Change Baudrate

1) Write new Baudrate value to Baudrate register
2) Power cycle the probe

Change Parity Check

1) Write new parity value to parity check register
2) Power cycle the probe

Parity definition: 0 - No parity, 1 - ODD, 2 - Even

ST-588

Modbus Slave Address: 70

Product Number: 50692

Probe Type: Fluorescence and Tagged Polymer probe

Unit of Measure: ppb for Fluorescence, ppm for Tagged Polymer

Measurement Range: 0-200 ppb for Fluorescence, 0-20 ppm for Tagged Polymer

Register Name	Register Address	Data Length	Data Type
Restore Status	41003	16bit	UINT16
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Firmware Version	41031	16-byte	CHAR[16]
Storage Flag	41040	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
Fluorescence Value	46001	32bit	Float
Fluorescence 4-20mA Value	46003	32bit	Float
Tagged Polymer Value	46007	32bit	Float
Tagged Polymer 4-20mA Value	46009	32bit	Float
Florescence 4-20 mA Scale	43002	32bit	Float
Tagged Polymer 4-20 mA Scale	43009	32bit	Float
Fluorescence Calibration Solution	44002	32bit	Float
Tagged Polymer Calibration Solution	44004	32bit	Float
Command	43006	16bit	UINT16
Fluorescence Calibration Status	48050	16bit	UINT16
Tagged Polymer Calibration Status	48051	16bit	UINT16

Fluorescence Zero Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Write value 3 to command register
4) Read fluorescence calibration status register
   - 0 - OK
   - 1 - probe was fouled
   - 2 - deionized water has fluorescence background

Fluorescence Slope Calibration Procedure

1) Rinse probe with standard solution for a few times
2) Put probe into standard solution
3) Write calibration solution value (e.g., 100) to fluorescence calibration solution register
4) Wait 1 or 2 seconds
5) Write value 4 to command register

6) Read fluorescence calibration status register
   - 0 - OK
   - 3 - solution too high
   - 4 - solution too low
   - 5 - slope value invalid

Tagged Polymer Zero Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Write value 5 to command register
4) Read tagged polymer calibration status register
   - 0 - OK
   - 2 - deionized water has tagged polymer background

Tagged Polymer Slope Calibration Procedure

1) Rinse probe with standard solution for a few times
2) Put probe into standard solution
3) Write calibration solution value (e.g., 10) to tagged polymer calibration solution register
4) Wait 1 or 2 seconds
5) Write value 6 to command register
6) Read tagged polymer calibration status register
   - 0 - OK
   - 3 - solution too high
   - 4 - solution too low
   - 5 - slope value invalid

Restore Factory Parameters

1) Write value 103 to storage flag register
2) Wait 1 second
3) Write value 103 to command register
4) Wait 1 second
5) Read value from restore status register
   - 517 - restore success
   - 515 - restore failed

Change Modbus Address Procedure

1) Write new address to Modbus address register
2) Power cycle the probe

Change Baudrate

1) Write new Baudrate value to Baudrate register
2) Power cycle the probe

Change Parity Check

1) Write new parity value to parity check register
2) Power cycle the probe

Parity definition: 0 - No parity, 1 - ODD, 2 - Even

ST-590

Modbus Slave Address: 60

Product Number: 50690

Probe Type: Tagged Polymer probe

Unit of Measure: ppm

Measurement Range: 0-30 ppm

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial Number	1032	32bit	UINT32
Tagged Polymer Value	1006	32bit	Float
4-20 mA Value	1014	32bit	Float
4-20 mA Scale	1016	16bit	UINT16
Calibration Solution	1026	16bit	UINT16
Calibration Command	1025	16bit	UINT16
Calibration Status	1031	16bit	UINT16
Firmware Version	1034	16bit	UINT16
Firmware Revision	1035	16bit	UINT16
Modbus Address	1037	16bit	UINT16
Parameter Command	1044	16bit	UINT16

Zero Point Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Write value 4 to Calibration command register
4) Read Calibration status register
   - 0 - OK
   - 2048 - probe was fouled
   - 4096 - deionized water has fluorescence

Slope Calibration Procedure

1) Rinse probe with calibration solution for a few times
2) Put probe into calibration solution
3) Write calibration standard solution (e.g., 20) to Standard solution register
4) Wait 1 or 2 seconds
5) Write value 3 to Calibration command register
7) Read Calibration status register
   - 0 - OK
   - 256 - solution too high
   - 1024 - solution too low

Restore Factory Parameters

- Write value 16 to Parameter Command register

Change Modbus Address Procedure

1) Write new address to Modbus Address register
2) Wait 1 or 2 seconds

3) Write value 2 to Parameter Command register
4) Power cycle the probe

ST-600

Modbus Slave Address: 32

Product Number: 50231

Probe Type: Bleach probe with ATC

Unit of Measure: %

Measurement Range: 0-20%

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Firmware Version	41031	16-byte	CHAR[16]
Modbus Address	42001	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
Bleach Value	46001	32bit	Float
Bleach 4-20mA Value	46003	32bit	Float
Temperature Value	46007	32bit	Float
Temperature 4-20mA Value	46009	32bit	Float
Bleach 4-20 mA Scale	43002	32bit	Float
Temperature 4-20 mA Scale	43009	32bit	Float
Calibration Solution	44004	32bit	Float
Command	43006	16bit	UINT16
Calibration Status	48026	16bit	UINT16
Transmittance intensity	48010	16bit	UINT16
Bleach slope	48018	32bit	Float
Bleach intercept	48020	32bit	Float

Zero Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Write value 3 to command register
4) Read calibration status register
5) 0 - OK
6) 1 - probe was fouled
7) 2 - deionized water has bleach background

Slope Calibration Procedure

1) Rinse probe with standard solution for a few times
2) Put probe into standard solution
3) Write calibration solution value (e.g., 10) to calibration solution register
4) Wait 1 or 2 seconds
5) Write value 4 to command register
6) Read calibration status register

- 0 - OK
- 3 - solution too low

Change Modbus Address Procedure

1) Write new address to Modbus address register
2) Power cycle the probe

Change Baudrate

1) Write new Baudrate value to Baudrate register
2) Power cycle the probe

Change Parity Check

1) Write new parity value to parity check register
2) Power cycle the probe

Parity definition: 0 - No parity, 1 - ODD, 2 – Even

ST-601

Modbus Slave Address: 35

Product Number: 50232

Probe Type: ClO2 probe with ATC

Unit of Measure: %

Measurement Range: 0-0.35%

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Firmware Version	41031	16-byte	CHAR[16]
Modbus Address	42001	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
ClO2 Value	46001	32bit	Float
ClO2 4-20mA Value	46003	32bit	Float
Temperature Value	46007	32bit	Float
Temperature 4-20mA Value	46009	32bit	Float
ClO2 4-20 mA Scale	43002	32bit	Float
Temperature 4-20 mA Scale	43009	32bit	Float
Calibration Solution	44004	32bit	Float
Command	43006	16bit	UINT16
Calibration Status	48026	16bit	UINT16
Transmittance intensity	48010	16bit	UINT16
Bleach slope	48018	32bit	Float
Bleach intercept	48020	32bit	Float

Zero Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Write value 3 to command register
4) Read calibration status register
   - 0 - OK
   - 1 - probe was fouled
   - 2 - deionized water has bleach background

Slope Calibration Procedure

1) Rinse probe with standard solution for a few times
2) Put probe into standard solution
3) Write calibration solution value (e.g., 0.5) to calibration solution register
4) Wait 1 or 2 seconds
5) Write value 4 to command register
6) Read calibration status register

- 0 - OK
- 3 - solution too low

Change Modbus Address Procedure

1) Write new address to Modbus address register
2) Power cycle the probe

Change Baudrate

1) Write new Baudrate value to Baudrate register
2) Power cycle the probe

Change Parity Check

1) Write new parity value to parity check register
2) Power cycle the probe

Parity definition: 0 - No parity, 1 - ODD, 2 – Even

ST-604

Modbus Slave Address: 32

Product Number: 50233

Probe Type: Bleach probe with ATC

Unit of Measure: %

Measurement Range: 0-2%

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Firmware Version	41031	16-byte	CHAR[16]
Modbus Address	42001	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
Bleach Value	46001	32bit	Float
Bleach 4-20mA Value	46003	32bit	Float
Temperature Value	46007	32bit	Float
Temperature 4-20mA Value	46009	32bit	Float
Bleach 4-20 mA Scale	43002	32bit	Float
Temperature 4-20 mA Scale	43009	32bit	Float
Calibration Solution	44004	32bit	Float
Command	43006	16bit	UINT16
Calibration Status	48026	16bit	UINT16
Transmittance intensity	48010	16bit	UINT16
Bleach slope	48018	32bit	Float
Bleach intercept	48020	32bit	Float

Zero Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Write value 3 to command register
4) Read calibration status register
    - 0 - OK
    - 1 - probe was fouled
    - 2 - deionized water has bleach background

Slope Calibration Procedure

1) Rinse probe with standard solution for a few times
2) Put probe into standard solution
3) Write calibration solution value (e.g., 1) to calibration solution register
4) Wait 1 or 2 seconds
5) Write value 4 to command register
6) Read calibration status register

- 0 - OK
- 3 - solution too low

Change Modbus Address Procedure

1) Write new address to Modbus address register
2) Power cycle the probe

Change Baudrate

1) Write new Baudrate value to Baudrate register
2) Power cycle the probe

Change Parity Check

1) Write new parity value to parity check register
2) Power cycle the probe

Parity definition: 0 - No parity, 1 - ODD, 2 – Even

ST-726

Modbus Slave Address: 14

Product Number: 53114

Probe Type: Conductivity probe

Unit of Measure: µS/cm

Measurement Range: 10-300,000 µS/cm

Register Name	Register Address	Data Length	Data Type
Conductivity value	46001	32bit	Float
4-20 mA for Conductivity	46003	32bit	Float
Temperature value (℃)	46005	32bit	Float
4-20mA for Temperature	46007	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Calibration Command	44004	16bit	UINT16
Calibration Solution	44011	32bit	Float
Calibration Status	41003	16bi	UINT16

Calibration Procedure

1) Write calibration standard solution to calibration solution register
2) Wait 1 or 2 seconds
3) Write value 1 to calibration command register
4) Wait 1 or 2 seconds then read calibration status register
    - 1 - Calibration success
    - 3 - Calibration failed

Change Modbus Address Procedure

1) Write new address to Modbus address register
2) Power cycle the probe

* Note - Conductivity measurement requires a strict timing control, therefore Modbus communication may be interrupted or delayed, we suggest PLC or any SCADA systems retry Modbus request for 3 times if a Modbus request is timeout.

ST-750

Modbus Slave Address: 64

Product Number: 53501

Probe Type: Colorimetric Probe

Unit of Measure: degree

Measurement Range: 1-500 degree

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Software Version	41031	16-byte	CHAR[16]
Colorimetric value	46001	32bit	Float
4-20 mA for Colorimetric	46003	32bit	Float
Modbus Address	42001	16bit	UINT16
Calibration Command	43006	16bit	UINT16
Calibration Solution	44002	32bit	Float
Calibration Status	48028	16bi	UINT16

Calibration Procedure

1) Rinse probe with deionized water for a few times
2) Put probe into deionized water
3) Wait 1 or 2 seconds
4) Write value 3 to get zero absorbance value
5) Rinse probe with colorimetric solution a few times
6) Put probe into colorimetric solution water
7) Write colorimetric solution value to calibration solution register
8) Wait 1 or 2 seconds
9) Write value 4 to start slope calibration
10) Wait 1 or 2 seconds then read calibration status register
    - 0 - Calibration success
    - Other value - Calibration failed

Change Modbus Address Procedure

1) Write new address to Modbus address register
2) Power cycle the probe

ST-772

Modbus Slave Address: 67

Product Number: 53703

Probe Type: Dissolved Oxygen probe

Unit of Measure: ppm

Measurement Range: 0.004-20 ppm

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Software Version	41031	16-byte	CHAR[16]
Humidity Coefficient	44028	32bit	Float
Temperature Value	46009	32bit	Float
DO Value	46011	32bit	Float
Pressure Value	46013	32bit	Float
4-20mA for DO	46037	32bit	Float
Modbus Address	42001	16bit	UINT16
Calibration Command	43006	16bit	UINT16
Calibration Status	41003	16bi	UINT16

Air Calibration Procedure

1) Place the probe in the air with a stable temperature or in air-saturated water
2) Let the probe stand for a minimum of 6 minutes
3) Write humidity value to Humidity coefficient register, if you are using air for calibration, please write the real-time humidity value; if you are using air-saturated water for calibration, please write humidity value 1
4) Write value 7 to calibration command register
5) Wait 5 seconds then read calibration status register
    - 1 - Air calibration succeed
    - 2 - Air calibration failed

Zero Calibration Procedure

1) Place the probe in Nitrogen Gas or 5% Sodium Sulfite solution (anaerobic water)
2) Let the probe stand for a minimum of 15 minutes
3) Write value 8 to calibration command register
4) Wait 5 seconds then read calibration status register
    - 3 - Zero calibration succeed
    - 4 - Zero calibration failed

ST-773

Modbus Slave Address: 67

Product Number: 53709

Probe Type: Dissolved Oxygen probe (plastic enclosure)

Unit of Measure: ppm

Measurement Range: 0.004-20 ppm

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Software Version	41031	16-byte	CHAR[16]
Humidity Coefficient	44028	32bit	Float
Temperature Value	46009	32bit	Float
DO Value	46011	32bit	Float
Pressure Value	46013	32bit	Float
4-20mA for DO	46037	32bit	Float
Modbus Address	42001	16bit	UINT16
Calibration Command	43006	16bit	UINT16
Calibration Status	41003	16bi	UINT16

Air Calibration Procedure

1) Place the probe in the air with a stable temperature or in air-saturated water
2) Let the probe stand for a minimum of 6 minutes
3) Write humidity value to Humidity coefficient register, if you are using air for calibration, please write the real-time humidity value; if you are using air-saturated water for calibration, please write humidity value 1
4) Write value 7 to calibration command register
5) Wait 5 seconds then read calibration status register
    - 1 - Air calibration succeed
    - 2 - Air calibration failed

Zero Calibration Procedure

1) Place the probe in Nitrogen Gas or 5% Sodium Sulfite solution (anaerobic water)
2) Let the probe stand for a minimum of 15 minutes
3) Write value 8 to calibration command register
4) Wait 5 seconds then read calibration status register
    - 3 - Zero calibration succeed
    - 4 - Zero calibration failed

ST-774

Modbus Slave Address: 67

Product Number: 53715

Probe Type: Ultra Low Dissolved Oxygen probe

Unit of Measure: ppb

Measurement Range: 0-2000 ppb

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Software Version	41031	16-byte	CHAR[16]
Calibration solution	44044	32bit	Float
Temperature Value	46009	32bit	Float
DO Value (in ppm unit)	46011	32bit	Float
Pressure Value	46013	32bit	Float
4-20mA for DO	46023	32bit	Float
Modbus Address	42001	16bit	UINT16
Command	43006	16bit	UINT16
Calibration Status	41003	16bi	UINT16

Zero Calibration Procedure

1) Place the probe in Nitrogen Gas or 5% Sodium Sulfite solution (anaerobic water)
2) Let the probe stand for a minimum of 15 minutes
3) Write value 8 to command register
4) Wait 5 seconds then read calibration status register
   - 3 - Zero calibration succeed
   - 4 - Zero calibration failed

High Point Calibration with solution in PO2 format

1) Place the probe in calibration environment with known partial pressure of oxygen (e.g., 0.05% PO2)
2) Write PO2 value (e.g., 0.05) to calibration solution register
3) Let the probe stand for a minimum of 15 minutes
4) Write value 12 to command register
5) Wait 5 seconds then read calibration status register
   - 7 - High point calibration succeed
   - 8 - High point calibration failed

High Point Calibration with solution in ppb format

1) Place the probe in calibration environment with known oxygen concentration (e.g., 20 ppb dissolved oxygen)
2) Write ppb value (e.g., 20) to calibration solution register
3) Let the probe stand for a minimum of 15 minutes

4) Write value 13 to command register
5) Wait 5 seconds then read calibration status register
    - 7 - High point calibration succeed
    - 8 - High point calibration failed

***NOTE**: The ppb format high point calibration is only available when the firmware version is equal to or greater than 132.

Process Calibration in ppb format

1) Write process value (e.g. 23) to calibration solution register
2) Write value 14 to command register
3) Wait 5 seconds then read calibration status register
    - 7 - Process calibration succeed
    - 8 - Process calibration failed

***NOTE**: The ppb format process calibration is only available when the firmware version is equal to or greater than 132.

Factory Parameter Restore

Write value 9 to command register

ST-776

Modbus Slave Address: 67

Product Number: 53717

Probe Type: Ultra Low Dissolved Oxygen probe for Boiler application

Unit of Measure: ppb

Measurement Range: 1-2000 ppb

Register Name	Register Address	Data Length	Data Type
Product Number	41005	32bit	UINT32
Serial Number	41015	16-byte	CHAR[16]
Hardware Version	41023	16-byte	CHAR[16]
Software Version	41031	16-byte	CHAR[16]
Humidity Coefficient	44028	32bit	Float
Oxygen calibration solution	44044	32bit	Float
Temperature Value	46009	32bit	Float
DO Value (in ppm unit)	46011	32bit	Float
Pressure Value	46013	32bit	Float
4-20mA for DO	46037	32bit	Float
Modbus Address	42001	16bit	UINT16
Command	43006	16bit	UINT16
Calibration Status	41003	16bi	UINT16

Zero Calibration Procedure

1) Place the probe in Nitrogen Gas or 5% Sodium Sulfite solution (anaerobic water)
2) Let the probe stand for a minimum of 15 minutes
3) Write value 8 to command register
4) Wait 5 seconds then read calibration status register
    - 3 - Zero calibration succeed
    - 4 - Zero calibration failed

High Point Calibration Procedure

1) Place the probe in a gas with known oxygen concentration (e.g., 0.05% Oxygen)
2) Write oxygen concentration value (e.g., 0.05) to Oxygen concentration solution
3) Let the probe stand for a minimum of 15 minutes
4) Write value 12 to command register
5) Wait 5 seconds then read calibration status register
    - 7 - High point calibration succeed
    - 8 - High point calibration failed

Factory Parameter Restore

Write value 9 to command register

ST-765SS-FCL

Modbus Slave Address: 10

Product Number: 53607

Probe Type: Inline Free Chlorine & pH & Temperature Probe

Free Chlorine Range: 0 - 5.0 ppm

pH Range: 0 - 14

Register Name	Register Address	Data Length	Data Type
Free Chlorine Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature	46009	32bit	Float
ORP	46019	32bit	Float
Probe Status	41001	16bit	Uint16
Modbus Address	42001	16bit	Uint16
Databits	42002	16bit	Uint16
Parity	42003	16bit	Uint16
Baudrate	42004	32bit	Uint32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

Free Chlorine Zero Calibration

1) Place the probe into a breaker containing Pyxis Zero Chlorine Calibration Standard Solution and wait for readings stabilize
2) Write value 1 to calibration command register (44001), and wait for half second
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   255 - Calibration success

Free Chlorine Slope Calibration

1) Place the probe into a known free chlorine solution water
2) Write free chlorine concentration value into calibration solution register (44029)
3) Write value 2 to calibration command register (44001), and wait for half second
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 - Invalid solution value
   4 - Invalid slope value

255 - Calibration success

pH 7 Calibration

1) Place the probe into pH 7 buffer and wait for reading stabilize
2) Write value 3 to calibration command register (44001), and wait for 2 seconds
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   4 - Invalid calibrated value
   255 - Calibration success

pH Acid Calibration

1) Place the probe into Acid buffer (e.g., pH 4) and wait for reading stabilize
2) Write pH buffer value (e.g., 4) into calibration solution register (44029)
3) Write value 4 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 - Invalid buffer value
   4 - Invalid calibrated value
   255 - Calibration success

pH Base Calibration

1) Place the probe into Base buffer (e.g., pH 10) and wait for reading stabilize
2) Write pH buffer value (e.g., 10) into calibration solution register (44029)
3) Write value 5 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 – Invalid buffer value
   4 - Invalid calibrated value
   255 - Calibration success

pH Process Calibration

1) Write pH process value into calibration solution register (44029)
2) Write value 10 to Calibration command register (44001) to start pH process calibration
3) Wait 2 seconds
4) Read calibration status register
   1 - Calibration is busy
   2 - Calibration failed
   3 – Invalid process value
   4 - Invalid calibrated value
   255 - Calibration success

* Note [1] - Valid pH process value input range is pH 1.0 to 13.0

* Note [2] - Valid process calibration offset is pH -0.9 to 0.9. i.e., if ST-765 measures pH 7.6, user does a process calibration with input pH process value 7.8, ST-765 will accept the calibration; if user does a process calibration with input pH process value 8.6, ST-765 will reject the calibration;

* Note [3] - pH process calibration is only available for firmware version **391** and higher

ORP Calibration

1) Write ORP solution value into calibration solution register (44029), valid range is -1500 to 1500
2) Write value 7 to Calibration command register (44001) to start ORP calibration

    1 - Calibration is busy
    2 - Calibration failed
    3 - Invalid ORP solution value
    4 - Invalid calibrated value
    255 - Calibration success

Restore Factory Default Parameters

1) Write value 7 into general command register (43036)
2) Read from command result register (44002)

    1 - Restore is busy
    2 - Restore failed
    254 - Restore success

Note: Cl-F range is 0-2.0 mg/L if probe serial number is less than 220037.

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Wait for 1 second
3) Write value 5 into general command register (43036)
4) Power cycle the probe

ST-765SS-CLO

Modbus Slave Address: 10

Product Number: 53608

Probe Type: Inline Dioxide chlorine & pH &Temperature Probe

ClO2 Range: 0 - 5.0 ppm

pH Range: 0 - 14

Register Name	Register Address	Data Length	Data Type
ClO2 Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature	46009	32bit	Float
ORP	46019	32bit	Float
Probe Status	41001	16bit	Uint16
Modbus Address	42001	16bit	Uint16
Databits	42002	16bit	Uint16
Parity	42003	16bit	Uint16
Baudrate	42004	32bit	Uint32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

Dioxide Chlorine Zero Calibration

1) Place the probe into a breaker containing Pyxis Zero Chlorine Calibration Standard Solution and wait for readings stabilize
2) Write value 1 to calibration command register (44001), and wait for half second
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   255 - Calibration success

Dioxide Chlorine Slope Calibration

1) Place the probe into a known Dioxide chlorine solution water
2) Write Dioxide chlorine concentration value into calibration solution register (44029)
3) Write value 2 to calibration command register (44001), and wait for half second
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 - Invalid solution value
   4 - Invalid slope value

255 - Calibration success

pH 7 Calibration

1) Place the probe into pH 7 buffer and wait for reading stabilize
2) Write value 3 to calibration command register (44001), and wait for 2 seconds
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   4 - Invalid calibrated value
   255 - Calibration success

pH Acid Calibration

1) Place the probe into Acid buffer (e.g., pH 4) and wait for reading stabilize
2) Write pH buffer value (e.g., 4) into calibration solution register (44029)
3) Write value 4 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 - Invalid buffer value
   4 - Invalid calibrated value
   255 - Calibration success

pH Base Calibration

1) Place the probe into Base buffer (e.g., pH 10) and wait for reading stabilize
2) Write pH buffer value (e.g., 10) into calibration solution register (44029)
3) Write value 5 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 – Invalid buffer value
   4 - Invalid calibrated value
   255 - Calibration success

pH Process Calibration

1) Write pH process value into calibration solution register (44029)
2) Write value 10 to Calibration command register (44001) to start pH process calibration
3) Wait 2 seconds
4) Read calibration status register
   1 - Calibration is busy
   2 - Calibration failed
   3 – Invalid process value
   4 - Invalid calibrated value
   255 - Calibration success

* Note [1] - Valid pH process value input range is pH 1.0 to 13.0

* Note [2] - Valid process calibration offset is pH -0.9 to 0.9. i.e., if ST-765 measures pH 7.6, user does a process calibration with input pH process value 7.8, ST-765 will accept the calibration; if user does a process calibration with input pH process value 8.6, ST-765 will reject the calibration;

* Note [3] - pH process calibration is only available for firmware version **391** and higher

ORP Calibration

1) Write ORP solution value into calibration solution register (44029), valid range is -1500 to 1500
2) Write value 7 to Calibration command register (44001) to start ORP calibration

   1 - Calibration is busy

   2 - Calibration failed

   3 - Invalid ORP solution value

   4 - Invalid calibrated value

   255 - Calibration success

Restore Factory Default Parameters

1) Write value 7 into general command register (43036)
2) Read from command result register (44002)

   1 - Restore is busy

   2 - Restore failed

   254 - Restore success

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Wait for 1 second
3) Write value 5 into general command register (43036)
4) Power cycle the probe

ST-765SS-Br

Modbus Slave Address: 91

Product Number: 59643

Probe Type: Inline Bromine & pH &Temperature Probe

Bromine Range: 0 - 5.0 ppm

pH Range: 0 - 14

Register Name	Register Address	Data Length	Data Type
Bromine Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature	46009	32bit	Float
ORP	46019	32bit	Float
Probe Status	41001	16bit	Uint16
Modbus Address	42001	16bit	Uint16
Databits	42002	16bit	Uint16
Parity	42003	16bit	Uint16
Baudrate	42004	32bit	Uint32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

Bromine Zero Calibration

1) Place the probe into a breaker containing Pyxis Zero Oxidizer Calibration Standard Solution and wait for readings stabilize
2) Write value 1 to calibration command register (44001), and wait for half second
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   255 - Calibration success

Bromine Slope Calibration

1) Place the probe into a known Bromine solution water
2) Write Bromine concentration value into calibration solution register (44029)
3) Write value 2 to calibration command register (44001), and wait for half second
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 - Invalid solution value
   4 - Invalid slope value

255 - Calibration success

pH 7 Calibration

1) Place the probe into pH 7 buffer and wait for reading stabilize
2) Write value 3 to calibration command register (44001), and wait for 2 seconds
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   4 - Invalid calibrated value
   255 - Calibration success

pH Acid Calibration

1) Place the probe into Acid buffer (e.g., pH 4) and wait for reading stabilize
2) Write pH buffer value (e.g., 4) into calibration solution register (44029)
3) Write value 4 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 - Invalid buffer value
   4 - Invalid calibrated value
   255 - Calibration success

pH Base Calibration

1) Place the probe into Base buffer (e.g., pH 10) and wait for reading stabilize
2) Write pH buffer value (e.g., 10) into calibration solution register (44029)
3) Write value 5 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 – Invalid buffer value
   4 - Invalid calibrated value
   255 - Calibration success

pH Process Calibration

1) Write pH process value into calibration solution register (44029)
2) Write value 10 to Calibration command register (44001) to start pH process calibration
3) Wait 2 seconds
4) Read calibration status register
   1 - Calibration is busy
   2 - Calibration failed
   3 – Invalid process value
   4 - Invalid calibrated value
   255 - Calibration success

* Note [1] - Valid pH process value input range is pH 1.0 to 13.0

* Note [2] - Valid process calibration offset is pH -0.9 to 0.9. i.e., if ST-765 measures pH 7.6, user does a process calibration with input pH process value 7.8, ST-765 will accept the calibration; if user does a process calibration with input pH process value 8.6, ST-765 will reject the calibration;

* Note [3] - pH process calibration is only available for firmware version **391** and higher

ORP Calibration

1) Write ORP solution value into calibration solution register (44029), valid range is -1500 to 1500
2) Write value 7 to Calibration command register (44001) to start ORP calibration

   1 - Calibration is busy

   2 - Calibration failed

   3 - Invalid ORP solution value

   4 - Invalid calibrated value

   255 - Calibration success

Restore Factory Default Parameters

1) Write value 7 into general command register (43036)
2) Read from command result register (44002)

   1 - Restore is busy

   2 - Restore failed

   254 - Restore success

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Wait for 1 second
3) Write value 5 into general command register (43036)
4) Power cycle the probe

ST-765SS-SO3

Modbus Slave Address: 110

Product Number: 53624

Probe Type: Inline Sulfite & pH &Temperature Probe

Sulfite Factory standard Range: 0 - 5.0 ppm (*can be Adjustable to 100ppm Max via uPyxis)*

pH Range: 0 - 14

Register Name	Register Address	Data Length	Data Type
Sulfite Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature	46009	32bit	Float
ORP	46019	32bit	Float
Probe Status	41001	16bit	Uint16
Modbus Address	42001	16bit	Uint16
Databits	42002	16bit	Uint16
Parity	42003	16bit	Uint16
Baudrate	42004	32bit	Uint32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

Sulfite Slope Calibration (One-point calibration, Titration method)

1) Place the probe into a known Sulfite solution water
2) Write Sulfite concentration value into calibration solution register (44029)
3) Write value 2 to calibration command register (44001), and wait for half second
4) Read from command result register (44002)

1 - Calibration is busy
2 - Calibration failed
3 - Invalid solution value
4 - Invalid slope value
255 - Calibration success

pH 7 Calibration

1) Place the probe into pH 7 buffer and wait for reading stabilize
2) Write value 3 to calibration command register (44001), and wait for 2 seconds
3) Read from command result register (44002)

1 - Calibration is busy
2 - Calibration failed
4 - Invalid calibrated value

255 - Calibration success

pH Acid Calibration

1) Place the probe into Acid buffer (e.g., pH 4) and wait for reading stabilize
2) Write pH buffer value (e.g., 4) into calibration solution register (44029)
3) Write value 4 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   - 1 - Calibration is busy
   - 2 - Calibration failed
   - 3 - Invalid buffer value
   - 4 - Invalid calibrated value
   - 255 - Calibration success

pH Base Calibration

1) Place the probe into Base buffer (e.g., pH 10) and wait for reading stabilize
2) Write pH buffer value (e.g., 10) into calibration solution register (44029)
3) Write value 5 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   - 1 - Calibration is busy
   - 2 - Calibration failed
   - 3 – Invalid buffer value
   - 4 - Invalid calibrated value
   - 255 - Calibration success

pH Process Calibration

1) Write pH process value into calibration solution register (44029)
2) Write value 10 to Calibration command register (44001) to start pH process calibration
3) Wait 2 seconds
4) Read calibration status register
   - 1 - Calibration is busy
   - 2 - Calibration failed
   - 3 – Invalid process value
   - 4 - Invalid calibrated value
   - 255 - Calibration success

* Note [1] - Valid pH process value input range is pH 1.0 to 13.0

* Note [2] - Valid process calibration offset is pH -0.9 to 0.9. i.e., if ST-765 measures pH 7.6, user does a process calibration with input pH process value 7.8, ST-765 will accept the calibration; if user does a process calibration with input pH process value 8.6, ST-765 will reject the calibration;

* Note [3] - pH process calibration is only available for firmware version **391** and higher

ORP Calibration

1) Write ORP solution value into calibration solution register (44029), valid range is -1500 to 1500
2) Write value 7 to Calibration command register (44001) to start ORP calibration

   1 - Calibration is busy

   2 - Calibration failed

   3 - Invalid ORP solution value

   4 - Invalid calibrated value

   255 - Calibration success

Restore Factory Default Parameters

1) Write value 7 into general command register (43036)
2) Read from command result register (44002)

   1 - Restore is busy

   2 - Restore failed

   254 - Restore success

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Wait for 1 second
3) Write value 5 into general command register (43036)
4) Power cycle the probe

ST-765SS-O3

Modbus Slave Address: 87

Product Number: 53614

Probe Type: Inline Ozone & pH &Temperature Probe

Ozone Range: 0 - 2.0 ppm

pH Range: 0 - 14

Register Name	Register Address	Data Length	Data Type
Ozone Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature	46009	32bit	Float
ORP	46019	32bit	Float
Probe Status	41001	16bit	Uint16
Modbus Address	42001	16bit	Uint16
Databits	42002	16bit	Uint16
Parity	42003	16bit	Uint16
Baudrate	42004	32bit	Uint32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

Ozone Slope Calibration (One-point calibration)

1) Place the probe into a known Ozone solution water
2) Write Ozone concentration value into calibration solution register (44029)
3) Write value 2 to calibration command register (44001), and wait for half second
4) Read from command result register (44002)

1 - Calibration is busy
2 - Calibration failed
3 - Invalid solution value
4 - Invalid slope value
255 - Calibration success

pH 7 Calibration

1) Place the probe into pH 7 buffer and wait for reading stabilize
2) Write value 3 to calibration command register (44001), and wait for 2 seconds
3) Read from command result register (44002)

1 - Calibration is busy
2 - Calibration failed
4 - Invalid calibrated value

255 - Calibration success

pH Acid Calibration

1) Place the probe into Acid buffer (e.g., pH 4) and wait for reading stabilize
2) Write pH buffer value (e.g., 4) into calibration solution register (44029)
3) Write value 4 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   - 1 - Calibration is busy
   - 2 - Calibration failed
   - 3 - Invalid buffer value
   - 4 - Invalid calibrated value
   - 255 - Calibration success

pH Base Calibration

1) Place the probe into Base buffer (e.g., pH 10) and wait for reading stabilize
2) Write pH buffer value (e.g., 10) into calibration solution register (44029)
3) Write value 5 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   - 1 - Calibration is busy
   - 2 - Calibration failed
   - 3 – Invalid buffer value
   - 4 - Invalid calibrated value
   - 255 - Calibration success

pH Process Calibration

1) Write pH process value into calibration solution register (44029)
2) Write value 10 to Calibration command register (44001) to start pH process calibration
3) Wait 2 seconds
4) Read calibration status register
   - 1 - Calibration is busy
   - 2 - Calibration failed
   - 3 – Invalid process value
   - 4 - Invalid calibrated value
   - 255 - Calibration success

* Note [1] - Valid pH process value input range is pH 1.0 to 13.0

* Note [2] - Valid process calibration offset is pH -0.9 to 0.9. i.e., if ST-765 measures pH 7.6, user does a process calibration with input pH process value 7.8, ST-765 will accept the calibration; if user does a process calibration with input pH process value 8.6, ST-765 will reject the calibration;

* Note [3] - pH process calibration is only available for firmware version **391** and higher

ORP Calibration

1) Write ORP solution value into calibration solution register (44029), valid range is -1500 to 1500
2) Write value 7 to Calibration command register (44001) to start ORP calibration

   1 - Calibration is busy

   2 - Calibration failed

   3 - Invalid ORP solution value

   4 - Invalid calibrated value

   255 - Calibration success

Restore Factory Default Parameters

1) Write value 7 into general command register (43036)
2) Read from command result register (44002)

   1 - Restore is busy

   2 - Restore failed

   254 - Restore success

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Wait for 1 second
3) Write value 5 into general command register (43036)
4) Power cycle the probe

ST-765SS-NCL

Modbus Slave Address: 89

Product Number: 53623

Probe Type: Inline Chloramine & pH &Temperature Probe

Chloramine Range: 0 - 5.0 ppm

pH Range: 0 - 14

Register Name	Register Address	Data Length	Data Type
Chloramine Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature	46009	32bit	Float
ORP	46019	32bit	Float
Probe Status	41001	16bit	Uint16
Modbus Address	42001	16bit	Uint16
Databits	42002	16bit	Uint16
Parity	42003	16bit	Uint16
Baudrate	42004	32bit	Uint32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

Chloramine Zero Calibration

1) Place the probe into a breaker containing Pyxis Zero Oxidizer Calibration Standard Solution and wait for readings stabilize
2) Write value 1 to calibration command register (44001), and wait for half second
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   255 - Calibration success

Chloramine Slope Calibration

1) Place the probe into a known Chloramine solution water
2) Write Chloramine concentration value into calibration solution register (44029)
3) Write value 2 to calibration command register (44001), and wait for half second
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 - Invalid solution value
   4 - Invalid slope value

255 - Calibration success

pH 7 Calibration

1) Place the probe into pH 7 buffer and wait for reading stabilize
2) Write value 3 to calibration command register (44001), and wait for 2 seconds
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   4 - Invalid calibrated value
   255 - Calibration success

pH Acid Calibration

1) Place the probe into Acid buffer (e.g., pH 4) and wait for reading stabilize
2) Write pH buffer value (e.g., 4) into calibration solution register (44029)
3) Write value 4 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 - Invalid buffer value
   4 - Invalid calibrated value
   255 - Calibration success

pH Base Calibration

1) Place the probe into Base buffer (e.g., pH 10) and wait for reading stabilize
2) Write pH buffer value (e.g., 10) into calibration solution register (44029)
3) Write value 5 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 – Invalid buffer value
   4 - Invalid calibrated value
   255 - Calibration success

pH Process Calibration

1) Write pH process value into calibration solution register (44029)
2) Write value 10 to Calibration command register (44001) to start pH process calibration
3) Wait 2 seconds
4) Read calibration status register
   1 - Calibration is busy
   2 - Calibration failed
   3 – Invalid process value
   4 - Invalid calibrated value
   255 - Calibration success

* Note [1] - Valid pH process value input range is pH 1.0 to 13.0

* Note [2] - Valid process calibration offset is pH -0.9 to 0.9. i.e., if ST-765 measures pH 7.6, user does a process calibration with input pH process value 7.8, ST-765 will accept the calibration; if user does a process calibration with input pH process value 8.6, ST-765 will reject the calibration;

* Note [3] - pH process calibration is only available for firmware version **391** and higher

ORP Calibration

1) Write ORP solution value into calibration solution register (44029), valid range is -1500 to 1500
2) Write value 7 to Calibration command register (44001) to start ORP calibration

   1 - Calibration is busy

   2 - Calibration failed

   3 - Invalid ORP solution value

   4 - Invalid calibrated value

   255 - Calibration success

Restore Factory Default Parameters

1) Write value 7 into general command register (43036)
2) Read from command result register (44002)

   1 - Restore is busy

   2 - Restore failed

   254 - Restore success

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Wait for 1 second
3) Write value 5 into general command register (43036)
4) Power cycle the probe

ST-765SS-DCL

Modbus Slave Address: 99

Product Number: 58444

Probe Type: Inline Free Chlorine & Sulfite & pH &Temperature Probe

Free Chlorine Range: 0 - 5.0 ppm

Sulfite Range: 0 - 100 ppm (auto-range)

pH Range: 0 - 14

Register Name	Register Address	Data Length	Data Type
Free Chlorine Concentration	46025	32bit	Float
Sulfite Concentration	46031	32bit	Float
pH	46003	32bit	Float
Temperature	46005	32bit	Float
Probe Status	41001	16bit	Uint16
Modbus Address	42001	16bit	Uint16
Databits	42002	16bit	Uint16
Parity	42003	16bit	Uint16
Baudrate	42004	32bit	Uint32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float
Free Chlorine Calibration	45037	32bit	Float
Sulfite Calibration	45043	32bit	Float

Probe Status

0 - Normal working status

1 - Power on initialization status

2 - Self-cleaning status

3 - Post self-cleaning status

Free Chlorine Zero Calibration

1) Place the probe into a breaker containing Pyxis Zero Chlorine Calibration Standard Solution and wait for readings stabilize
2) Write value 13 to calibration command register (44001), and wait for half second
3) Read from command result register (44002)

   1 - Calibration is busy

   2 - Calibration failed

   255 - Calibration success

Free Chlorine Slope Calibration

1) Place the probe into a known free chlorine solution water
2) Write free chlorine concentration value into free chlorine calibration register (45037)
3) Write value 14 to calibration command register (44001), and wait for half second
4) Read from command result register (44002)

1 - Calibration is busy
2 - Calibration failed
3 - Invalid solution value
4 - Invalid slope value
255 - Calibration success

Sulfite Slope Calibration (One-point calibration, Titration method)

1) Place the probe into a known Sulfite solution water
2) Write Sulfite concentration value into sulfite calibration register (45043)
3) Write value 16 to calibration command register (44001), and wait for half second
4) Read from command result register (44002)

1 - Calibration is busy
2 - Calibration failed
3 - Invalid solution value
4 - Invalid slope value
255 - Calibration success

pH 7 Calibration

1) Place the probe into pH 7 buffer and wait for reading stabilize
2) Write value 3 to calibration command register (44001), and wait for 2 seconds
3) Read from command result register (44002)

1 - Calibration is busy
2 - Calibration failed
4 - Invalid calibrated value
255 - Calibration success

pH Acid Calibration

1) Place the probe into Acid buffer (e.g., pH 4) and wait for reading stabilize
2) Write pH buffer value (e.g., 4) into calibration solution register (44029)
3) Write value 4 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)

1 - Calibration is busy
2 - Calibration failed
3 - Invalid buffer value
4 - Invalid calibrated value
255 - Calibration success

pH Base Calibration

1) Place the probe into Base buffer (e.g., pH 10) and wait for reading stabilize
2) Write pH buffer value (e.g., 10) into calibration solution register (44029)
3) Write value 5 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)

1 - Calibration is busy
2 - Calibration failed
3 – Invalid buffer value
4 - Invalid calibrated value

255 - Calibration success

pH Process Calibration

1) Write pH process value into calibration solution register (44029)
2) Write value 10 to Calibration command register (44001) to start pH process calibration
3) Wait 2 seconds
4) Read calibration status register
   - 1 - Calibration is busy
   - 2 - Calibration failed
   - 3 – Invalid process value
   - 4 - Invalid calibrated value
   - 255 - Calibration success

* Note [1] - Valid pH process value input range is pH 1.0 to 13.0

* Note [2] - Valid process calibration offset is pH -0.9 to 0.9. i.e., if ST-765 measures pH 7.6, user does a process calibration with input pH process value 7.8, ST-765 will accept the calibration; if user does a process calibration with input pH process value 8.6, ST-765 will reject the calibration;

* Note [3] - pH process calibration is only available for firmware version **391** and higher

Restore Factory Default Parameters

1) Write value 7 into general command register (43036)
2) Read from command result register (44002)
   - 1 - Restore is busy
   - 2 - Restore failed
   - 254 - Restore success

ST-766SS-FCL

Modbus Slave Address: 10

Product Number: 51154

Probe Type: Inline Free Chlorine & pH/ORP & Temperature & Conductivity Probe

Free Chlorine Range: 0 - 5 ppm

pH Range: 0 - 14

ORP Range: -1500 - 1500 mV

Conductivity Range: 0 - 10000 µS/cm

Register Name	Register Address	Data Length	Data Type
Free Chlorine Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature (℃)	46009	32bit	Float
Temperature (℉)	46023	32bit	Float
ORP	46019	32bit	Float
Conductivity	48047	32bit	Float
Probe Status	41001	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Databits	42002	16bit	UINT16
Parity	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

Free Chlorine Zero Calibration

1) Place the probe into a breaker containing Pyxis Zero Chlorine Calibration Standard Solution and wait for readings stabilize
2) Write value 1 to calibration command register (44001), and wait for half second
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   255 - Calibration success

Free Chlorine Slope Calibration

1) Place the probe into a known free chlorine solution water
2) Write free chlorine concentration value into calibration solution register (44029)
3) Write value 2 to calibration command register (44001), and wait for half second

4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 - Invalid solution value
   4 - Invalid slope value
   255 - Calibration success

pH 7 Calibration

1) Place the probe into pH 7 buffer and wait for reading stabilize
2) Write value 3 to calibration command register (44001), and wait for 2 seconds
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   4 - Invalid calibrated value
   255 - Calibration success

pH Acid Calibration

1) Place the probe into Acid buffer (e.g., pH 4) and wait for reading stabilize
2) Write pH buffer value (e.g., 4) into calibration solution register (44029)
3) Write value 4 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 - Invalid buffer value
   4 - Invalid calibrated value
   255 - Calibration success

pH Base Calibration

1) Place the probe into Base buffer (e.g., pH 10) and wait for reading stabilize
2) Write pH buffer value (e.g., 10) into calibration solution register (44029)
3) Write value 5 to calibration command register (44001), and wait for 2 seconds
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 - Invalid buffer value
   4 - Invalid calibrated value
   255 - Calibration success

pH Process Calibration

1) Write pH process value into calibration solution register (44029)
2) Write value 10 to Calibration command register (44001) to start pH process calibration
3) Wait 2 seconds
4) Read calibration status register
   1 - Calibration is busy
   2 - Calibration failed

3 - Invalid process value
4 - Invalid calibrated value
255 - Calibration success

* Note [1] - Valid pH process value input range is pH 1.0 to 13.0

* Note [2] - Valid process calibration offset is pH -0.9 to 0.9. i.e., if ST-766 measures pH 7.6, user does a process calibration with input pH process value 7.8, ST-766 will accept the calibration; if user does a process calibration with input pH process value 8.6, ST-766 will reject the calibration;

ORP Calibration

1) Write ORP solution value into calibration solution register (44029), valid range is -1500 to 1500
2) Write value 7 to Calibration command register (44001) to start ORP calibration

1 - Calibration is busy
2 - Calibration failed
3 - Invalid ORP solution value
4 - Invalid calibrated value
255 - Calibration success

Conductivity Calibration

1) Write conductivity solution value into calibration solution register (44029), valid range is 50 to 10000
2) Write value 11 to calibration command register (44001) to start calibration

1 - Calibration is busy
2 - Calibration failed
3 - Invalid conductivity solution value
4 - Invalid calibrated value
255 - Calibration success

Restore Factory Default Parameters

1) Write value 7 into general command register (43036)
2) Read from command result register (44002)

1 - Restore is busy
2 - Restore failed
254 - Restore success

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Wait for 1 second
3) Write value 5 into general command register (43036)
4) Power cycle the probe

ST-766SS-TCL

Modbus Slave Address: 88

Product Number: 51379

Probe Type: Inline Total Chlorine & pH/ORP & Temperature & Conductivity Probe

Total Chlorine Range: 0 - 5 ppm

pH Range: 0 - 14

ORP Range: -1500 - 1500 mV

Conductivity Range: 0 - 10000 µS/cm

Register Name	Register Address	Data Length	Data Type
Total Chlorine Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature (℃)	46009	32bit	Float
Temperature (℉)	46023	32bit	Float
ORP	46019	32bit	Float
Conductivity	48047	32bit	Float
Probe Status	41001	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Databits	42002	16bit	UINT16
Parity	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

Total Chlorine Zero Calibration

1) Place the probe into a breaker containing Pyxis Zero Chlorine Calibration Standard Solution and wait for readings stabilize
2) Write value 1 to calibration command register (44001), and wait for half second
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   255 - Calibration success

Total Chlorine Slope Calibration

1) Place the probe into a known total chlorine solution water
2) Write total chlorine concentration value into calibration solution register (44029)
3) Write value 2 to calibration command register (44001), and wait for half second

4) Read from command result register (44002)

1 - Calibration is busy
2 - Calibration failed
3 - Invalid solution value
4 - Invalid slope value
255 - Calibration success

pH, ORP, Conductivity calibrations follow the same procedure as ST-766SS-FCL probe. Restore to factory default parameters and change Modbus address follow the same procedure as ST-766SS-FCL probe.

ST-766SS-Br

Modbus Slave Address: 91

Product Number: 52743

Probe Type: Inline Bromine & pH/ORP & Temperature & Conductivity Probe

Bromine Range: 0 - 5 ppm

pH Range: 0 - 14

ORP Range: -1500 - 1500 mV

Conductivity Range: 0 - 10000 µS/cm

Register Name	Register Address	Data Length	Data Type
Bromine Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature (℃)	46009	32bit	Float
Temperature (℉)	46023	32bit	Float
ORP	46019	32bit	Float
Conductivity	48047	32bit	Float
Probe Status	41001	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Databits	42002	16bit	UINT16
Parity	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

Bromine Zero Calibration

1) Place the probe into a breaker containing Pyxis Zero Oxidizer Calibration Standard Solution and wait for readings stabilize
2) Write value 1 to calibration command register (44001), and wait for half second
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   255 - Calibration success

Bromine Slope Calibration

1) Place the probe into a known bromine solution water
2) Write bromine concentration value into calibration solution register (44029)
3) Write value 2 to calibration command register (44001), and wait for half second

4) Read from command result register (44002)

1 - Calibration is busy
2 - Calibration failed
3 - Invalid solution value
4 - Invalid slope value
255 - Calibration success

pH, ORP, Conductivity calibrations follow the same procedure as ST-766SS-FCL probe. Restore to factory default parameters and change Modbus address follow the same procedure as ST-766SS-FCL probe.

ST-766SS-SO3

Modbus Slave Address: 110

Product Number: 58305

Probe Type: Inline Sulfite & pH/ORP & Temperature & Conductivity Probe

Sulfite Range: 0 - 100 ppm

pH Range: 0 - 14

ORP Range: -1500 - 1500 mV

Conductivity Range: 0 - 10000 µS/cm

Register Name	Register Address	Data Length	Data Type
Sulfite Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature (℃)	46009	32bit	Float
Temperature (℉)	46023	32bit	Float
ORP	46019	32bit	Float
Conductivity	48047	32bit	Float
Probe Status	41001	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Databits	42002	16bit	UINT16
Parity	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

Sulfite Slope Calibration (One-point calibration, Titration method)

1) Place the probe into a known Sulfite solution water
2) Write Sulfite concentration value into calibration solution register (44029)
3) Write value 2 to calibration command register (44001), and wait for half second
4) Read from command result register (44002)

   1 - Calibration is busy
   2 - Calibration failed
   3 - Invalid solution value
   4 - Invalid slope value
   255 - Calibration success

pH, ORP, Conductivity calibrations follow the same procedure as ST-766SS-FCL probe. Restore to factory default parameters and change Modbus address follow the same procedure as ST-766SS-FCL probe.

ST-766SS-O3

Modbus Slave Address: 87

Product Number: 54828

Probe Type: Inline Ozone & pH/ORP & Temperature & Conductivity Probe

Ozone Range: 0 - 2 ppm

pH Range: 0 - 14

ORP Range: -1500 - 1500 mV

Conductivity Range: 0 - 10000 µS/cm

Register Name	Register Address	Data Length	Data Type
Ozone Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature (℃)	46009	32bit	Float
Temperature (℉)	46023	32bit	Float
ORP	46019	32bit	Float
Conductivity	48047	32bit	Float
Probe Status	41001	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Databits	42002	16bit	UINT16
Parity	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

Ozone Slope Calibration (One-point calibration)

1) Place the probe into a known Ozone solution water
2) Write Ozone concentration value into calibration solution register (44029)
3) Write value 2 to calibration command register (44001), and wait for half second
4) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   3 - Invalid solution value
   4 - Invalid slope value
   255 - Calibration success

pH, ORP, Conductivity calibrations follow the same procedure as ST-766SS-FCL probe. Restore to factory default parameters and change Modbus address follow the same procedure as ST-766SS-FCL probe.

ST-766SS-NCL

Modbus Slave Address: 89

Product Number: 54731

Probe Type: Inline Chloramine & pH/ORP & Temperature & Conductivity Probe

Chloramine Range: 0 - 5 ppm

pH Range: 0 - 14

ORP Range: -1500 - 1500 mV

Conductivity Range: 0 - 10000 µS/cm

Register Name	Register Address	Data Length	Data Type
Chloramine Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature (℃)	46009	32bit	Float
Temperature (℉)	46023	32bit	Float
ORP	46019	32bit	Float
Conductivity	48047	32bit	Float
Probe Status	41001	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Databits	42002	16bit	UINT16
Parity	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status

1 - Power on initialization status

2 - Self-cleaning status

3 - Post self-cleaning status

Chloramine Zero Calibration

1) Place the probe into a breaker containing Pyxis Zero Oxidizer Calibration Standard Solution and wait for readings stabilize
2) Write value 1 to calibration command register (44001), and wait for half second
3) Read from command result register (44002)

   1 - Calibration is busy

   2 - Calibration failed

   255 - Calibration success

Chloramine Slope Calibration

1) Place the probe into a known Chloramine solution water
2) Write Chloramine concentration value into calibration solution register (44029)
3) Write value 2 to calibration command register (44001), and wait for half second

4) Read from command result register (44002)

1 - Calibration is busy
2 - Calibration failed
3 - Invalid solution value
4 - Invalid slope value
255 - Calibration success

pH, ORP, Conductivity calibrations follow the same procedure as ST-766SS-FCL probe. Restore to factory default parameters and change Modbus address follow the same procedure as ST-766SS-FCL probe.

ST-766SS-DCL

Modbus Slave Address: 99

Product Number: 57300

Probe Type: Inline Free Chlorine & Sulfite & pH/ORP & Temperature & Conductivity Probe

Free Chlorine Range: 0 - 5 ppm

Sulfite Range: 0 - 100 ppm

pH Range: 0 - 14

ORP Range: -1500 - 1500 mV

Conductivity Range: 0 - 10000 µS/cm

Register Name	Register Address	Data Length	Data Type
Free Chlorine Concentration	46025	32bit	Float
Sulfite Concentration	46031	32bit	Float
pH	46003	32bit	Float
Temperature	46005	32bit	Float
ORP	46019	32bit	Float
Conductivity	48047	32bit	Float
Probe Status	41001	16bit	Uint16
Modbus Address	42001	16bit	Uint16
Databits	42002	16bit	Uint16
Parity	42003	16bit	Uint16
Baudrate	42004	32bit	Uint32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float
Free Chlorine Calibration	45037	32bit	Float
Sulfite Calibration	45043	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

Free Chlorine Zero Calibration

1) Place the probe into a breaker containing Pyxis Zero Chlorine Calibration Standard Solution and wait for readings stabilize
2) Write value 13 to calibration command register (44001), and wait for half second
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   255 - Calibration success

Free Chlorine Slope Calibration

1) Place the probe into a known free chlorine solution water
2) Write free chlorine concentration value into free chlorine calibration register (45037)
3) Write value 14 to calibration command register (44001), and wait for half second
4) Read from command result register (44002)
   - 1 - Calibration is busy
   - 2 - Calibration failed
   - 3 - Invalid solution value
   - 4 - Invalid slope value
   - 255 - Calibration success

Sulfite Slope Calibration (One-point calibration, Titration method)

1) Place the probe into a known Sulfite solution water
2) Write Sulfite concentration value into sulfite calibration register (45043)
3) Write value 16 to calibration command register (44001), and wait for half second
4) Read from command result register (44002)
   - 1 - Calibration is busy
   - 2 - Calibration failed
   - 3 - Invalid solution value
   - 4 - Invalid slope value
   - 255 - Calibration success

pH, ORP, Conductivity calibrations follow the same procedure as ST-766SS-FCL probe. Restore to factory default parameters and change Modbus address follow the same procedure as ST-766SS-FCL probe.

ST-766SS-CLO

Modbus Slave Address: 10

Product Number: 55821

Probe Type: Inline Chlorine Dioxide & pH/ORP & Temperature & Conductivity Probe

ClO2 Range: 0 - 5 ppm

pH Range: 0 - 14

ORP Range: -1500 - 1500 mV

Conductivity Range: 0 - 10000 µS/cm

Register Name	Register Address	Data Length	Data Type
ClO2 Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature (℃)	46009	32bit	Float
Temperature (℉)	46023	32bit	Float
ORP	46019	32bit	Float
Conductivity	48047	32bit	Float
Probe Status	41001	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Databits	42002	16bit	UINT16
Parity	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

Chlorine Dioxide Zero Calibration

1) Place the probe into a breaker containing Pyxis Zero Oxidizer Calibration Standard Solution and wait for readings stabilize
2) Write value 1 to calibration command register (44001), and wait for half second
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   255 - Calibration success

Chlorine Dioxide Slope Calibration

1) Place the probe into a known chlorine dioxide solution water
2) Write chlorine dioxide concentration value into calibration solution register (44029)

3) Write value 2 to calibration command register (44001), and wait for half second
4) Read from command result register (44002)
   - 1 - Calibration is busy
   - 2 - Calibration failed
   - 3 - Invalid solution value
   - 4 - Invalid slope value
   - 255 - Calibration success

pH, ORP, Conductivity calibrations follow the same procedure as ST-766SS-FCL probe. Restore to factory default parameters and change Modbus address follow the same procedure as ST-766SS-FCL probe.

ST-766SS-PAA

Modbus Slave Address: 85

Product Number: 54803

Probe Type: Inline Peroxyacetic acid & pH/ORP & Temperature & Conductivity Probe

PAA Range: 0 - 100 ppm

pH Range: 0 - 14

ORP Range: -1500 - 1500 mV

Conductivity Range: 0 - 10000 µS/cm

Register Name	Register Address	Data Length	Data Type
PAA Concentration	46003	32bit	Float
pH	46007	32bit	Float
Temperature (℃)	46009	32bit	Float
Temperature (℉)	46023	32bit	Float
ORP	46019	32bit	Float
Conductivity	48047	32bit	Float
Probe Status	41001	16bit	UINT16
Modbus Address	42001	16bit	UINT16
Databits	42002	16bit	UINT16
Parity	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
General Command	43036	16bit	UINT16
Calibration Command	44001	16bit	UINT16
Command Result	44002	16bit	UINT16
Calibration solution	44029	32bit	Float

Probe Status

0 - Normal working status
1 - Power on initialization status
2 - Self-cleaning status
3 - Post self-cleaning status

PAA Zero Calibration

1) Place the probe into a breaker containing Pyxis Zero Oxidizer Calibration Standard Solution and wait for readings stabilize
2) Write value 1 to calibration command register (44001), and wait for half second
3) Read from command result register (44002)
   1 - Calibration is busy
   2 - Calibration failed
   255 - Calibration success

PAA Slope Calibration

5) Place the probe into a known PAA solution water
6) Write PAA concentration value into calibration solution register (44029)
7) Write value 2 to calibration command register (44001), and wait for half second

8) Read from command result register (44002)

1 - Calibration is busy
2 - Calibration failed
3 - Invalid solution value
4 - Invalid slope value
255 - Calibration success

pH, ORP, Conductivity calibrations follow the same procedure as ST-766SS-FCL probe. Restore to factory default parameters and change Modbus address follow the same procedure as ST-766SS-FCL probe.

ST-710SS-D

Modbus Slave Address: 11

Product Number: 53038

Probe Type: pH probe

Unit of Measure: N/A

Measurement Range: 0-14

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	41015	128bit	CHAR[16]
pH value	46001	32bit	Float
Temperature value (℃)	46005	32bit	Float
Standard A	48011	32bit	Float
Standard B	48017	32bit	Float
Calibration command	43006	16bit	UINT16
Calibration status	41003	16bit	UINT16
Firmware version	41031	128bit	CHAR[16]
Modbus Address	42001	16bit	UINT16

Calibration Procedure

1) Write value 8 to Calibration command register to start pH 7 calibration
2) Read calibration status register
   - 6 - Calibration success
   - 4 - calibration failed
3) Write pH standard solution A value (e.g., 4) to Standard A register
4) Write pH standard solution B value (e.g., 9) to Standard B register
5) Write value 4 to Calibration command register to start standard A calibration
6) Read calibration status register
   - 1 - Calibration success
   - 3 - Buffer value out of range
   - 5 - Buffer value invalid
   - 7 - Slope value out of range
   - 8 - Intercept value out of range
7) Write value 5 to Calibration command register to start standard B calibration
8) Read calibration status register
   - 2 - Calibration success
   - 3 - Buffer value out of range
   - 5 - Buffer value invalid
   - 7 - Slope value out of range
   - 8 - Intercept value out of range

Change Modbus Address Procedure

5) Write new address to Modbus Address register (42001)
6) Power cycle the probe

ST-711SS-D

Modbus Slave Address: 12

Product Number: 53039

Probe Type: ORP probe

Unit of Measure: mV

Measurement Range: -1500mV – 1500mV

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	41015	128bit	CHAR[16]
ORP value (V unit)	46007	32bit	Float
ORP value (mV unit)	46013	32bit	Float
Temperature value (℃)	46005	32bit	Float
Standard solution	44002	32bit	Float
Calibration command	43006	16bit	UINT16
Calibration status	41003	16bit	UINT16
Firmware version	41031	128bit	CHAR[16]
Modbus Address	42001	16bit	UINT16

Calibration Procedure

1) Write standard solution value (e.g., 0.2*) to standard solution register
2) Write value 6 to Calibration command register to start standard A calibration
3) Read Calibration status register
   - 2 - Calibration success
   - 3 - Buffer value out of range
   - 5 - Buffer value invalid

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Power cycle the probe

* Note [1] - the unit of measure for Standard solution is voltages, 0.2 means 0.2V

* Note [2] - software version before 2.7 only supports ORP value read from 46007 register, software version after 2.7 supports ORP value read from 46007 and 46013

* Note [3] - read software version from register 41031, read continuously 8 words, and convert to ascii code, for instance, the result would be “2.8.1”

ST-712SS-D

Modbus Slave Address: 13

Product Number: 53040

Probe Type: pH and ORP probe

Unit of Measure:

pH - N/A

ORP – mV

Measurement Range: reference ST-710 and ST-711

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Serial number	41015	128bit	CHAR[16]
pH value	46001	32bit	Float
ORP value (V unit)	46007	32bit	Float
ORP value (mV unit)	46013	32bit	Float
Temperature value (℃)	46005	32bit	Float
pH Standard A	48011	32bit	Float
pH Standard B	48017	32bit	Float
ORP Standard solution	44002	32bit	Float
Calibration command	43006	16bit	UINT16
Calibration status	41003	16bit	UINT16
Firmware version	41031	128bit	CHAR[16]
Modbus Address	42001	16bit	UINT16

Calibration follows same procedure as ST-710SS-D and ST-711SS-D

Change Modbus Address Procedure

1) Write new address to Modbus Address register (42001)
2) Power cycle the probe

* Note [1] - Software version before 2.7 only supports ORP value read from 46007 register, software version after 2.7 supports ORP value read from 46007 and 46013

* Note [2] - Read software version from register 41031, read continuously 8 words, and convert to ascii code, for instance, the result would be “2.8.1”

RT-200

Modbus Slave Address: 77

Product Number: 57124

Probe Type: High temperature refractometer

Unit of Measure:

Refractive index - N/A

PG concentration - %

EG concentration - %

ALV concentration - %

Brix concentration - %

ALV plus concentration - %

GEO concentration - %

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Modbus Address	42001	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
Command Result	41002	16bit	UINT16
Calibration Status	41003	16bit	UINT16
Operation Command	43001	16bit	UINT16
Customized measure enable	43030	32bit	UINT32
Customized measure name	43032	8 bytes	CHAR[8]
Temperature 4mA Value	43045	32bit	Float
Temperature 20mA Value	43047	32bit	Float
Temperature (℃)	46003	32bit	Float
Refractive Index	46005	32bit	Float
PG Concentration	46007	32bit	Float
EG concentration	46009	32bit	Float
ALV concentration	46011	32bit	Float
Brix concentration	46013	32bit	Float
ALV Plus concentration	46035	32bit	Float
GEO concentration	46038	32bit	Float
Customized measure concentration	46058	32bit	Float
Brix 4mA Value	52001	32bit	Float
Brix 20mA Value	52003	32bit	Float
EG 4mA Value	52005	32bit	Float
EG 20mA Value	52007	32bit	Float
PG 4mA Value	52009	32bit	Float
PG 20mA Value	52011	32bit	Float
ALV 4mA Value	52013	32bit	Float
ALV 20mA Value	52015	32bit	Float
ALV Plus 4mA Value	52017	32bit	Float

ALV Plus 20mA Value	52019	32bit	Float
GEO 4mA Value	52021	32bit	Float
GEO 20mA Value	52023	32bit	Float
Customized measure 4mA Value	52025	32bit	Float
Customized measure 20mA Value	52027	32bit	Float

Add Customized measurement

Please use uPyxis App to add customized measurement

Air Calibration Procedure

1) Place the measurement window in air with stable temperature (Please avoid direct light)
2) Write value 13 to operation command register (43001), then wait 20 seconds
3) Read calibration status register (41003)
   0 - Calibration is busy
   1 - Calibration succeed
   2 - Calibration failed

Change Communication Settings Procedure

1) Write communication settings value to corresponding register, e.g., write parity check value to Parity Check register (42003)
2) Wait for 1 second
3) Write value 7 to operation command register (43001), then wait 2 seconds

Restore Factory Parameters

1) Write value 4 to operation command register (43001)
2) Read command result register (41002)
   0 - Restore is busy
   1 - Restore succeed
   2 - Restore failed

RT-100

Modbus Slave Address: 77

Product Number: 55105

Probe Type: Refractometer

Unit of Measure:

Refractive index - N/A

PG concentration - %

EG concentration - %

ALV concentration - %

Brix concentration - %

ALV plus concentration - %

GEO concentration - %

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Modbus Address	42001	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
Command Result	41002	16bit	UINT16
Calibration Status	41003	16bit	UINT16
Operation Command	43001	16bit	UINT16
Customized measure OLED disable enables	43030	32bit	UINT32
Customized measure name	43032	8 bytes	CHAR[8]
Customized measure fitting curve X^3 coefficients	43036	32bit	Float
Customized measure fitting curve X^2 coefficients	44050	32bit	Float
Customized measure fitting curve X^1 coefficients	44048	32bit	Float
Customized measure fitting curve X^0 coefficients	44046	32bit	Float
Customized measure 4-20mA lower limit	52025	32bit	Float
Customized measure 4-20mA upper limit	52027	32bit	Float
Brix 4-20mA lower limit	52001	32bit	Float
Brix 4-20mA upper limit	52003	32bit	Float
EG 4-20mA lower limit	52005	32bit	Float
EG 4-20mA upper limit	52007	32bit	Float
PG 4-20mA lower limit	52009	32bit	Float
PG 4-20mA upper limit	52011	32bit	Float
Alv 4-20mA lower limit	52013	32bit	Float
Alv 4-20mA upper limit	52015	32bit	Float
Alv Plus 4-20mA lower limit	52017	32bit	Float

Alv Plus 4-20mA upper limit	52019	32bit	Float
GEO 4-20mA lower limit	52021	32bit	Float
GEO 4-20mA upper limit	52023	32bit	Float
Temperature 4-20mA lower limit	43045	32bit	Float
Temperature 4-20mA upper limit	43047	32bit	Float
Temperature (℃)	46003	32bit	Float
Refractive Index	46005	32bit	Float
PG Concentration	46007	32bit	Float
EG concentration	46009	32bit	Float
ALV concentration	46011	32bit	Float
Brix concentration	46013	32bit	Float
ALV Plus concentration	46035	32bit	Float
GEO concentration	46038	32bit	Float
Customized measure concentration	46058	32bit	Float

Add Customized measurement

1) Write measure name to register 43032, support up to 8 ASCII characters.
2) Write the fitting coefficients to the 4 coefficients registers of the customized measure fitting curve, the relation is Y = A*Brix^3+B*Brix^2+C*Brix^1+D*Brix^0 (generally the cubic function A = 0 is good enough). Customized measure generally has a polynomial function of the Brix concentration, and the Brix value is read by the device in real time from register 46013.
3) Write 4-20mA lower and upper limits to registers 52025 and 52027.
4) Enable OLED display: read the register 43030, assume the value read is X, please set X = X | (1<<9), and then write it to register 43030.
5) Write value 11 to operation command register 43001 to save the change.

Note: It is recommended to use uPyxis App to add customized measurement.

Air Calibration Procedure

1) Place the measurement window in air with stable temperature (Please avoid direct light)
2) Write value 13 to operation command register (43001), then wait 20 seconds
3) Read calibration status register (41003)
   0 - Calibration is busy
   1 - Calibration succeeds
   2 - Calibration failed

Change Communication Settings Procedure

1) Write communication settings value to corresponding register, e.g., write parity check value to Parity Check register (42003)
2) Wait for 1 second
3) Write value 7 to operation command register (43001), then wait 2 seconds

Restore Factory Parameters

1) Write value 4 to operation command register (43001)
2) Read command result register (41002)
   0 - Restore is busy
   1 - Restore succeeds
   2 - Restore failed

RT-50

Modbus Slave Address: 77

Product Number: 10013

Probe Type: Refractometer

Unit of Measure:

Refractive index - N/A

Brix concentration - %

Customized concentration - %

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Modbus Address	42001	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
Command Result	41002	16bit	UINT16
Calibration Status	41003	16bit	UINT16
Operation Command	43001	16bit	UINT16
Customized measure enables	43030	32bit	UINT32
Customized measure name	43032	8 bytes	CHAR[8]
Temperature 4-20mA lower limit	43045	32bit	Float
Temperature 4-20mA upper limit	43047	32bit	Float
Temperature (℃)	46003	32bit	Float
Refractive Index	46005	32bit	Float
Brix concentration	46013	32bit	Float
Customized measure concentration	46058	32bit	Float
Brix 4mA Value	52001	32bit	Float
Brix 20mA Value	52003	32bit	Float
Customized measure 4-20mA lower limit	52025	32bit	Float
Customized measure 4-20mA upper limit	52027	32bit	Float

Add Customized measurement

Please reference to RT-100 chapter.

Air Calibration Procedure

1) Place the measurement window in air with stable temperature (Please avoid direct light)
2) Write value 13 to operation command register (43001), then wait 20 seconds
3) Read calibration status register (41003)

   0 - Calibration is busy

   1 - Calibration succeeds

   2 - Calibration failed

Change Communication Settings Procedure

1) Write communication settings value to corresponding register, e.g., write parity check value to Parity Check register (42003)
2) Wait for 1 second
3) Write value 7 to operation command register (43001), then wait 2 seconds

Restore Factory Parameters

1) Write value 4 to operation command register (43001)
2) Wait for 1 second
3) Read command result register (41002)

   0 - Restore is busy

   1 - Restore succeed

   2 - Restore failed

FS-100/FS-101

Modbus Slave Address: 95

Product Number: 54200

Probe Type: Flow sensor

Unit of Measure: ml/min

Measurement Range: 10-3000 ml/min

Register Name	Register Address	Data Length	Data Type
Product number	41005	32bit	UINT32
Modbus Address	42001	16bit	UINT16
Databits	42002	16bit	UINT16
Parity Check	42003	16bit	UINT16
Baudrate	42004	32bit	UINT32
Slope	44001	32bit	Float
Intercept	44003	32bit	Float
Setpoint	44025	32bit	Float
PID_P	44027	32bit	Float
PID_I	44029	32bit	Float
PID_D	44031	32bit	Float
PID_T	44033	32bit	Float
Dead Zone	44035	32bit	Float
Calibration Command	44040	16bit	UINT16
Calibration Result	44041	16bit	UINT16
Calibration Value	44042	32bit	Float
Flow Rate	46003	32bit	Float
Temperature	46005	32bit	Float
TOF UP	46007	32bit	Float
TOF DOWN	46009	32bit	Float
TOF	46011	32bit	Float
System Error Flag	46019	16bit	UINT16
Flow Rate 4-20mA Output	46023	32bit	Float
Temperature 4-20mA Output	46025	32bit	Float
Runtime	46031	32bit	UINT32
Work Mode	48001	16bit	UINT16
Screen Orientation	48002	16bit	UINT16
Low Alarm Settings	48003	32bit	Float
High Alarm Settings	48005	32bit	Float
Detection Time	48007	16bit	UINT16
Flow 4mA Settings	48009	32bit	Float
Flow 20mA Settings	48011	32bit	Float
Temperature 4mA Settings	48013	32bit	Float
Temperature 20mA Settings	48015	32bit	Float
Language	48017	16bit	UINT16

LSR-801

Modbus Slave Address: 93

Product Number: 54027

Probe Type: Level sensor

Unit of Measure: m

Measurement Range: 0.01-15 m

Register Name	Register Address	Data Length	Data Type	Default Unit
Product number	41005	4 bytes	UINT32	N/A
Serial number	41015	16 bytes	CHAR[16]	N/A
Hardware version	41023	16 bytes	CHAR[16]	N/A
Software version	41031	16 bytes	CHAR[16]	N/A
Modbus address	42001	2 bytes	UINT16	N/A
Modbus parity	42003	2 bytes	UINT16	N/A
Modbus baudrate	42004	4 bytes	UINT32	N/A
Command	43001	2 bytes	UINT16	N/A
Max level	43003	4 bytes	Float32	m
Installation height	43005	4 bytes	Float32	m
Measure unit	43007	2 bytes	UINT16	N/A
Tank cross-sectional area	43021	4 bytes	Float32	m^2
Distance	46001	4 bytes	Float32	m
Level	46010	4 bytes	Float32	m
Remaining volume	46012	4 bytes	Float32	m^3
Used volume	46014	4 bytes	Float32	m^3
Max volume	46016	4 bytes	Float32	m^3

To measure tank level, please follow the steps below to setup LSR-801

1) Set max volume value to **Max volume** register (46016), unit is m^3
2) Set max level value to **Max level** register (43003), unit is m
3) Calculate tank cross-sectional area by dividing **Max volume**/**Max level** and set this value to **Tank cross-sectional area** register (43021), unit is m^2
4) Set installation height value to **Installation height** register (43005), unit is m

To measure the height of open water level, please follow the steps below

1) Set installation height value to **Installation height** register (43005), unit is m
2) Set max level value to **Max level** register (43003), unit is m

Please note, the level sensor outputs level and distance value in m unit, and outputs volume value in m^3 unit. Customer will need to convert values into desired units by themselves.

Application Notes

ST-500 Cleanliness Check

1. Place ST-500 into DI water, read register 1021 (UINT16), if the register value < 600, then probe may be fouled
2. Or place ST-500 into 100ppb PTSA solution water, read register 1022 (UINT16), if the register value < 600, then probe may be fouled
3. Or read register 1024 when ST-500 is in cooling water, if the register value > 3000, then the probe may be fouled.

* Note: conduct step 1 with step 3 or step 2 with step 3 usually give a more credible result.

HM-500 Cleanliness Check

1. Place HM-500 into DI water, read register 1021 (UINT16), if the register value < 600, then probe may be fouled
2. Or place HM-500 into 100ppb PTSA solution water, read register 1022 (UINT16), if the register value < 600, then probe may be fouled
3. Or read register 1024 when HM-500 is in sample water, if the register value > 3000, then the probe may be fouled.

* Note: conduct step 1 with step 3 or step 2 with step 3 usually give a more credible result.

ST-600/601/604 Cleanliness Check

Place probe into DI water, read Transmittance intensity register 48010 (UINT16), if the register value < 400, then the probe may be fouled.

ST-735 Modbus RTU Example Packets

Read Product Number

Request Packet (HEX format) [10 03 A0 2C 00 02 24 83]

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x03
Starting Address	2 Bytes	0xA02C
Quantity of Registers	2 Bytes	0x0002
CRC	2 Bytes	0x2483

Response Packet

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x03
Byte Count	1 Byte	0x04
Registers Value	4 Bytes	0xCFD40000
CRC	2 Bytes	CRC data

Note: Probe returns 4 bytes data **0xCF 0xD4 0x00** and **0x00**, converts to CDAB format get **0x0000CFD4**, further converts to uint32 get **53204**.

Read Turbidity Value

Request Packet (HEX format) [10 03 03 F3 00 02 37 3D]

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x03
Starting Address	2 Bytes	0x03F3
Quantity of Registers	2 Bytes	0x0002
CRC	2 Bytes	0x373D

Response Packet

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x03
Byte Count	1 Byte	0x04
Registers Value	4 Bytes	0xC52C3FE2
CRC	2 Bytes	CRC data

Note: Probe returns 4 bytes data **0xC5 0x2C 0x3F** and **0xE2**, converts to CDAB format get **0x3FE2C52C**, further converts to float get **1.7716** NTU.

Write Calibration Solution Value

Request Packet (HEX format) [10 10 04 19 00 02 04 00 00 44 7A E2 D6]

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x10
Starting Address	2 Bytes	0x0419
Quantity of Registers	2 Bytes	0x0002
Byte Count	1 Byte	0x04
Registers Value	4 Bytes	0x0000447A
CRC	2 Bytes	0xE2D6

Response Packet

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x10
Starting Address	2 Bytes	0x0419
Quantity of Registers	2 Bytes	0x0002
CRC	2 Bytes	CRC data

Note: Host sends 4 bytes data **0x00 0x00 0x44** and **0x7A**, converts to CDAB format get **0x447A0000**, further converts to float get **1000.0** NTU.

Write Zero Calibration Command

Request Packet (HEX format) [10 06 04 00 00 04 8A 78]

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x06
Starting Address	2 Bytes	0x0400
Register Value	2 Bytes	0x0004
CRC	2 Bytes	0x8A78

Response Packet

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x06
Starting Address	2 Bytes	0x0400

Register Value	2 Bytes	0x0004
CRC	2 Bytes	CRC data

Write Low-Range Calibration Command

Request Packet (HEX format) [10 06 04 00 00 03 CB BA]

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x06
Starting Address	2 Bytes	0x0400
Registers Value	2 Bytes	0x0003
CRC	2 Bytes	0xCBBA

Response Packet

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x06
Starting Address	2 Bytes	0x0400
Register Value	2 Bytes	0x0003
CRC	2 Bytes	CRC data

Write Mid-Range Calibration Command

Request Packet (HEX format) [10 06 04 00 00 05 4B B8]

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x06
Starting Address	2 Bytes	0x0400
Registers Value	2 Bytes	0x0005
CRC	2 Bytes	0x4BB8

Response Packet

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x06
Starting Address	2 Bytes	0x0400
Register Value	2 Bytes	0x0005
CRC	2 Bytes	CRC data

Write High-Range Calibration Command

Request Packet (HEX format) [10 06 04 00 00 06 0B B9]

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x06
Starting Address	2 Bytes	0x0400
Registers Value	2 Bytes	0x0006
CRC	2 Bytes	0x0BB9

Response Packet

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x06
Starting Address	2 Bytes	0x0400
Register Value	2 Bytes	0x0006
CRC	2 Bytes	CRC data

Read Calibration Result

Request Packet (HEX format) [10 03 04 06 00 01 66 7A]

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x03
Starting Address	2 Bytes	0x0406
Quantity of Registers	2 Bytes	0x0001
CRC	2 Bytes	0x667A

Response Packet

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x03
Byte Count	1 Bytes	0x02
Register Value	2 Bytes	0x0000
CRC	2 Bytes	CRC data

Reset Factory Default

Request Packet (HEX format) [10 06 04 13 00 10 7B B2]

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x06
Starting Address	2 Bytes	0x0413
Registers Value	2 Bytes	0x0010
CRC	2 Bytes	0x7BB2

Response Packet

Modbus Address	1 Byte	0x10
Function Code	1 Byte	0x06
Starting Address	2 Bytes	0x0413
Register Value	2 Bytes	0x0010
CRC	2 Bytes	CRC data