INSTRUCTION MANUAL

HI510
HI520

Universal Process Controller

Modbus RTU Protocol and Remote Device Control

Dear Customer,

Thank you for choosing a Hanna Instruments® product.

Please read this instruction manual carefully as it provides details on Modbus RTU protocol, function codes, controller wiring and setup configuration for remote control and monitoring.

This manual has been written as a companion for HI510 and HI520 process controller manuals.

Scan the QR code to download MAN510 or follow the link:
https://manuals.hannainst.com/HI510.

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https://manuals.hannainst.com/HI520.

If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com.
Visit www.hannainst.com for more information about Hanna Instruments and our products.

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General Safety Precautions & Installation Recommendations

HI510 and HI520 safety precautions and installation recommendations apply.

Procedures and instructions detailed in this section may require special precautions to ensure the safety of the personnel performing the operations.

- Electrical connection, installation, start-up, operation, and maintenance must be carried out by specialized personnel only.
- The specialized personnel must have read and understood the instructions in this manual and should adhere to them.
- User serviceable connections are all accessible inside the enclosure.
- Do not operate or energize the instrument with the case open.
- Before powering the controller, verify wiring has been done properly.
- Always disconnect the instrument from power when making electrical connections.
- Do not run other cables through the same cable gland with the power cable.
- A clearly marked disconnect switch must be installed in the vicinity of the instrument to ensure that the electrical circuit is completely de-energized for service or maintenance.

1. INTRODUCTION

Modbus is a request-response software protocol intended for efficient and immediate remote industrial process control.

Main Features

- Allows immediate response to a problem with equipment (even from different plants)
- Minimizes production downtime as mechanical issues are quickly identified
- Traceability of stored data
- Monitors and controls processes remotely

2. MODBUS PROTOCOL BASICS

Modbus protocol defines a communication structure that occurs in pairs. One device initiates a request and then waits for a response. The initiating device is responsible for initiating every interaction (query).
The initiating device can address individual requests (client responds) or initiate a broadcast message to several clients (client does not respond).

Default parameters

Modbus communication protocol is implemented through a serial communication channel that makes controller data available to a remote user. Physical layer is implemented on a RS485 line with the following default parameters:

half duplex	8 bit data	1 start bit	1 stop bit	no parity

RTU (Remote Terminal Unit) mode

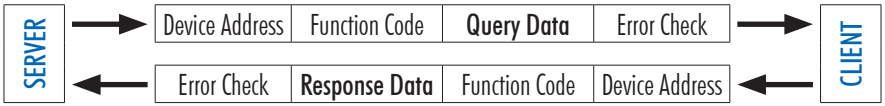
Bytes are transferred as they are and checksum is calculated over CRC algorithm.

START	ADDRESS	FUNCTION	DATA	CRC CHECK	END
T1-T2-T3-T4	8 bits	8 bits	N x 8 bits	16 bits	T1-T2-T3-T4

Note: *T1-T2-T3-T4 = 3.5 characters times at no communication*

- Address Field – client address range is 1 – 247 (0 kept for broadcasting).
- Function Field – values range is 1 – 255.
  Field is used by client device to echo server query function field for normal case or sets most significant bit of query function to 1 if an error occurs.
- Data Field – information regarding required operation.
  Data field can be of various lengths or 0. Data uses "big-endian" convention, whereby numerical data with a size greater than 1 byte is sent with the most significant byte first e.g. 0x1234 is sent as 0x12,0x34.

General query message structure



- Device Address – individual client address
- Function Code – type of action
- Query Data / Response Data – transmitted data
- Error Check – data integrity error check field

Changing a specific parameter

1. Enter Remote Control Edit Mode.
2. Change a specific Parameter Value.
3. Save Settings.

Edit Mode	**Inputs**	Controller is not in Manual, Calibration, or Local Edit Mode • Set password register • Set specific value for Remote Control Mode register
	Actions	A copy of the current settings is made. All further requests (writings) will address that copy.
	Outputs	Remote Control Edit Mode will be available for reading in Remote Control Mode register • A timeout value is configured for the Remote Control Edit Mode • Timeout is reloaded on each successful transaction
Change Value	**Inputs**	Controller is in Remote Control Edit Mode.
	Actions	Use write actions for coils or holding registers.
	Outputs	Settings are visible with read-specific functions. • Timeout for Remote Control Edit Mode is refreshed with each transaction
Save Settings	**Inputs**	Issue a specific value for Remote Control Mode register.
	Actions	Validity of changes made in the *settings image area* is tested. If correct, settings are transferred to *work area*. • Controller enters Hold Mode to allow saving new values and process control initialization • Controller exits from Remote Control Edit Mode and enters Run Mode
	Outputs	Remote Control Mode register will be updated with the new values.

Modbus Functions

Modbus data types

- **Coil** (1 bit), read/write access, 1 to 9999 address range
  – forces the ON/OFF state of discrete outputs (DO) or modifies mode / status of client devices
- **Discrete Input** (1 bit), read-only, 10001 to 19999 address range
  – requests input status of field discrete inputs (DI) or the client devices status
- **Input Register** (16 bit), read-only access, 30001 to 39999 address range
  – provides field analog inputs (AI) or client device information
  – floating or double integer data can be handled if consecutive addresses are assigned
- **Holding Register** (16 bit), read/write access, 40001 to 49999 address range
  – receives data from field analog outputs (AO) or sets information on client devices
  – floating or double integer data handled only if consecutive addresses are assigned

Access type	Access size	Internal data type	Function Name	Code Dec	Code Hex
Data	bit	Physical discrete inputs	Read Discrete Inputs	2	0x02
		Internal bits or physical coils	Read Coils	1	0x01
			Write Coil	5	0x05
			Write Multiple Coils	15	0x0F
	16 bit	Physical input register	Read Input Register	4	0x04
		Internal register or physical output register	Read Holding Register	3	0x03
			Write Single Register	6	0x06
			Write Multiple Registers	16	0x10
			Read/Write Multiple Registers	23	0x17
			Mask Write Register	22	0x16
			Read FIFO Queue	24	0x18
	File record access		Read File Record	20	0x14
			Write File Record	21	0x15
Diagnostic			Read Exception Status	7	0x07
			Diagnostic	8	0x08
			Get COMM Event Counter	11	0x0B
			Get COMM Event Log	12	0x0C
			Report Server ID	17	0x11
			Read Device ID	43	0x2B

Read Coils (0x01)

Read from 1 to 2000 maximum contiguous status of coils

Request	Function code	1 byte	**0x01**	**1**
	Starting address	2 bytes	0x0000 to 0xFFFF	0 to 65535
	Quantity of coils	2 bytes	0x0001 to 0x07D0	1 to 2000
Normal response	Function code	1 byte	**0x01**	**1**
	Bytes count	1 byte	N = Quantity of coils / 8 (if the remainder is other than 0, then N = N+1)	
	Coil status	N×1 byte		

Read Discrete Inputs (0x02)

Read from 1 to 2000 maximum contiguous status of discrete inputs

Request	Function code	1 byte	**0x02**	**2**
	Starting address	2 bytes	0x0000 to 0xFFFF	0 to 65535
	Quantity of discrete inputs	2 bytes	0x0001 to 0x07D0	1 to 2000
Normal response	Function code	1 byte	**0x02**	**2**
	Bytes count	1 byte	N = Quantity of discrete inputs / 8 (if the remainder is other than 0, then N = N+1)	
	Discrete inputs	N×1 byte		

Read Holding Registers (0x03)

Read from 1 to 125 maximum contiguous holding registers

Request	Function code	1 byte	**0x03**	**3**
	Starting address	2 bytes	0x0000 to 0xFFFF	0 to 65535
	Quantity of holding registers	2 bytes	0x0001 to 0x007D	1 to 125
Normal response	Function code	1 byte	**0x03**	**3**
	Bytes count	1 byte	2×N	N = 1 to 125
	Holding register	N×2 bytes		

Read Input Registers (0x04)

Read from 1 to 125 maximum contiguous input registers

Request	Function code	1 byte	**0x04**	**4**
	Starting address	2 bytes	0x0000 to 0xFFFF	0 to 65535
	Quantity of input registers	2 bytes	0x0001 to 0x007D	1 to 125
Normal response	Function code	1 byte	**0x04**	**4**
	Bytes count	1 byte	2×N	N = 1 to 125
	Input register	N×2 bytes		

Errors	Function code	1 byte	Function code + 0x80
	Exception status	1 byte	01 or 02 or 03 or 04

Write Single Coil (0x05) Write a single output to either ON or OFF

Request	Function code	1 byte	**0x05**	**5**
	Coil address	2 bytes	0x0000 to 0xFFFF	0 to 65535
	Coil value	2 bytes	0x0000 or 0xFF00	0 or 65280
Normal response	Function code	1 byte	**0x05**	**5**
	Coil address	2 bytes	0x0000 to 0xFFFF	0 to 65535
	Coil value	2 bytes	0x0000 or 0xFF00	0 or 65280

Write Single Register (0x06) Write a single holding register

Request	Function code	1 byte	**0x06**	**6**
	Register address	2 bytes	0x0000 to 0xFFFF	0 to 65535
	Register value	2 bytes	0x0000 to 0xFFFF	0 to 65535
Normal response	Function code	1 byte	**0x06**	**6**
	Register address	2 bytes	0x0000 to 0xFFFF	0 to 65535
	Register value	2 bytes	0x0000 to 0xFFFF	0 to 65535

Write Multiple Coils (0x0F) Used to force each coil in a sequence of coils to either ON or OFF

Request	Function code	1 byte	**0x0F**	**15**
	Starting address	2 bytes	0x0000 to 0xFFFF	0 to 65535
	Quantity of outputs	2 bytes	0x0001 to 0x07B0	1 to 1968
	Byte count	1 byte	N = Quantity of outputs / 8 (if the remainder is other than 0, then N = N+1)	
	Outputs Value	N×1 byte		
Normal response	Function code	1 byte	**0x0F**	**15**
	Starting address	2 bytes	0x0000 to 0xFFFF	0 to 65535
	Quantity of outputs	2 bytes	0x0001 to 0x07B0	1 to 1968

Write Multiple Registers (0x10) Write a block of contiguous registers (1 to 123)

Request	Function code	1 byte	**0x10**	**16**
	Starting address	2 bytes	0x0000 to 0xFFFF	0 to 65535
	Quantity of registers	2 bytes	0x0001 to 0x007B	1 to 123
	Byte count	1 byte	2×N	(N = Quantity of Registers)
	Registers value	N×2 bytes		
Normal response	Function code	1 byte	**0x10**	**16**
	Starting address	2 bytes	0x0000 to 0xFFFF	0 to 65535
	Quantity of registers	2 bytes	0x0001 to 0x007B	1 to 123

Errors	Function code	1 byte	Function code + 0x80
	Exception status	1 byte	01 or 02 or 03 or 04

Read Device Identification (function 43/14; 0x2B / 0x0E)

This function code allows reading the identification and additional information relative to the physical and functional description of a remote device. The Read Device Identification interface is modeled as an address space / composed of a set of addressable data elements identified by an object ID.

Controller responds to three types of queries:

- Queries for basic information i.e. mandatory objects (Vendor Name, Product Code, Revision Number)
- Queries for regular information i.e. optional objects (e.g. Model Name)
- Queries for extended information i.e. optional objects (e.g. private data regarding device location)

Controller responds to the following access requests.

- **01**: request to get basic device identification (stream access)
- **04**: request to get one specific identification object (individual access)

ID	Category	Type	Data	Description
0x00	Basic	Mandatory	ASCII String	Vendor Name
0x01				Product Code
0x02				Major / Minor Revision Number
0x03	Regular	Optional		Vendor URL
0x04				Product Name
0x05				Model Name
0x06				User Application Name
0x07…0x7F				Reserved
0x80…0xFF	Extended		Device Dependent	Private Objects

"Vendor Name" (ID = 0x00) query message structure (individual access)

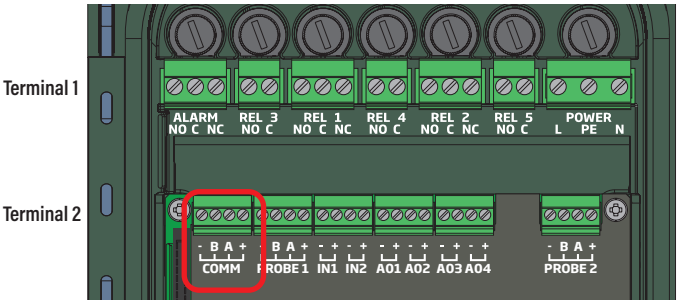
Query	Response
0x2B = Function Code	0x2B = Function Code
0x0E = MEI Type	0x0E = Modbus Encapsulated Interface
0x04 = Read Device ID Code	0x04 = Individual Object
0x00 = Object ID	0x81 = Conformity Level
	0x00 = More Follows (NO)
	0x00 = Next Object ID (None)
	0x01 = Number of Objects (1 object)
	0x00 = Object ID (Vendor Name)
	0x11 = Object Length (17 characters)
	"Hanna Instruments" = Object Value

3. WIRING & SETTINGS CONFIGURATION

3.1. WIRING

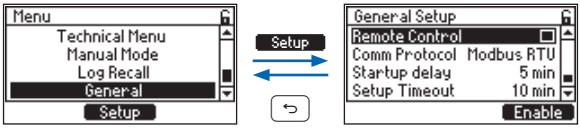
Follow ⊖⊕ lead markings to ensure that output leads are correctly wired to the **COMM** position on the main board.

Note: *removable terminal connector marked* **PROBE 2** *is only part of HI520 (two-channel process controller) hardware structure.*



3.2. SETUP

- Press the [≡] key to access the main menu.
- Press the [▲] [▼] keys to navigate to General setup.
- Enable Remote Control option.
- Press **Setup** to configure Communication Protocol parameters (to match the Modbus server).



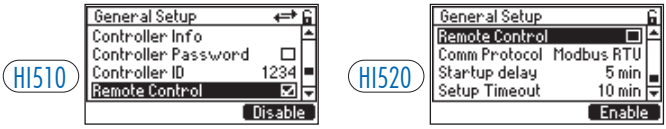
3.2.1. Configurable parameters

Remote Control

Option: Enabled, Disabled

Option must be enabled when using the Modbus protocol.

The check mark confirms the option as enabled ☑ or disabled ☐.

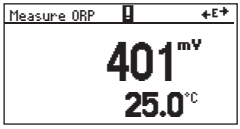


Displayed icons

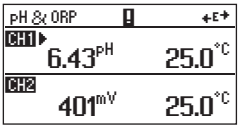
remote connection to a Modbus server established

remote connection to a Modbus server established (controller operating in editing mode)

HI510



HI520



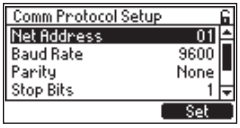
Comm Protocol (Communication Protocol)

Parameter indicates supported transmission mode (Modbus RTU).

Parameter	Options	Default
Modbus Protocol	Modbus RTU	Modbus RTU
Net Address	01 to 99	01
Baud Rate	9600, 19200, 38400, 57600, 115200, 256000	19200
Parity	None, Even, Odd	None
Stop Bits	1 or 2 bits	1 bit
RemLink_Timeout	60 to 1200 seconds	60 seconds
RemEdit_Timeout	30 to 1200 seconds	30 seconds
Bit Length	7 or 8 bits	8 bits

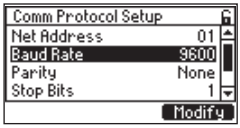
Net Address: sets the controller's Modbus address.

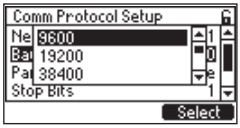
- With item selected, press **Set** to modify.
- Press the ▲ ▼ keys to increase or decrease the value (keep the key pressed to increase editing speed). Press **CFM** to save.



Baud Rate: Set the desired speed for the serial communication (baud rate in bps.).

- With item selected, press **Modify** for the drop-down list to display.
- Use the ▲ ▼ keys to navigate between options. Press **Select** to save.

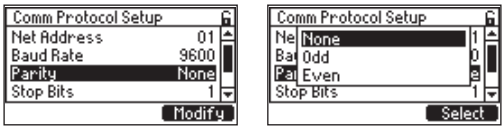




Note: *The controller and the Modbus Server must have the same Baud Rate.*

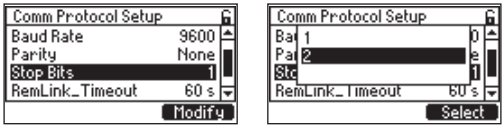
Parity: sets communication parity based on the parity mode of the connected device.

- With item selected, press **Modify** for the drop-down list to display.
- Press the ▲ ▼ keys to navigate between options. Press **Select** to save.



Stop Bits: sets stop bit option based on the stop bit of the connected device.

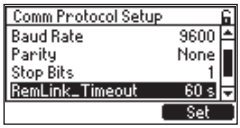
- With item selected, press **Modify** for the drop-down list to display.
- Use the ▲ ▼ keys to navigate between options. Press **Select** to save.



RemLink_Timeout

Number of seconds a remotely connected device should wait for a command acknowledgement before timing out.

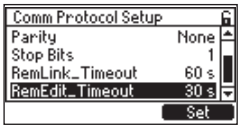
- With item selected, press **Set** to modify.
- Press the ▲ ▼ keys to increase or decrease the value (keep the key pressed to increase editing speed). Press **CFM** to save.



RemEdit_Timeout

Number of seconds that a remotely connected device should wait before exiting Edit mode.

- With item selected, press **Set** to modify.
- Press the ▲ ▼ keys to increase or decrease the value (keep the key pressed to increase editing speed). Press **CFM** to save.



4. OPERATION MODES WHEN USING MODBUS

Mode Type	Scope	Description
Manual	Local control, controller operated manually	Controller operated manually. ***Note:*** *Remote Control is not available.*
Local Edit	Local edit of settings & parameters	Local edit of controller's settings and parameters. ***Note:*** *Remote Control is not available.*
Calibration	System calibration	Allows for controller's system calibration. ***Note:*** *Remote Control is not available.*
Remote Control	Remote Control Mode	Remote operation is available. When not enabled, controller reverts to manual mode.
Remote View	View parameter & settings values	Remote Control Mode must be enabled. Use Modbus function codes to view or retrieve data. ***Note:*** *Parameters cannot be updated in this mode.*
Remote Edit	View & change parameter and settings values	Remote Control Mode must be enabled. Value contained in the data field is outside range or not accepted as configurable value.
Remote Save	Saves data entered in Edit Mode	Remote Control Mode must be enabled. After editing/changing parameters, the controller is placed on Hold and data saved.
Init (Initialization)	Loads new parameter & settings values	Following a Remote Save, the controller automatically runs through an initialization procedure to ensure new data/parameters are being used.

4.1. MODBUS GENERAL STEPS

Prerequisite for controller remote operation

The controller must not be in Manual, Calibration, or Local Edit Mode as these modes prevent remote operation.

Steps

1. Ensure remote communication is enabled and serial communication parameters match the Modbus server.
   - Displayed ⇄ symbol confirms connection to the server is established.
   - 40003 Holding Register contains status and link information that is not password protected.
2. Ensure the controller has the correct Modbus ID set for use with the Modbus server.
   Default controller Modbus ID is 1(1 to 99 configurable range).
   - Each Modbus device has a configurable ID which must be set in order for the Modbus server to communicate with the device.
3. Determine if the unit is password protected.
   - If yes, continue with Step 4.
   - If not, skip Step 4 and continue with Step 5.

4. Send a 32-bit password to the controller using 2 consecutive Write Single Holding Register (06) Modbus Function Codes or a single Write Multiple Holding Registers (16) Function Code to the controller. The password register addresses are:
   - 40001 – Lower half of 32-bit value (bytes 1-0)
   - 40002 – Upper half of 32-bit value (bytes 3-2)

   ▶ Enter the password to enable remote operation. The password does not need to be resent unless RemLink or RemEdit timeouts are registered or settings are saved.

   ▶ Each Modbus transaction resets the timeout timer. (See *RemLink_Timeout* and *RemEdit_Timeout*).
5. Continue data reading and writing.

Note: *If during reading parameter values, a communication pause causes a Remote Link timeout, Modbus General Steps need to be repeated.*

4.2. MODBUS SPECIAL HOLDING REGISTERS

Three special holding registers can be read and written to, regardless of operating mode, to allow a Modbus server to access controller's password, check status, as well as view and set remote operating modes.

Address	Register	Size	Note
40001	Remote Password	32-bit	Low part of 32-bit password (bytes 1-0)
40002			High part of 32-bit password (bytes 3-2)
40003	Remote Control Mode	8-bit	**B0 Remote link** (read only) 0 = No link between controller and server 1 = Link established between controller and server **B1 Set Remote Control, View Mode** 0 = Controller settings configured locally 1 = Controller settings configured remotely only **B2 Set Remote Control, Edit Mode** 0 = Settings cannot be configured remotely 1 = Settings are configured remotely on an image of controller configurable parameters **B3 Save Settings done on Remote Control, Edit Mode** 1 = Settings configured remotely (with controller in Edit Mode) are saved pending validity check

4.3. RETRIEVING CONTROLLER PARAMETERS

1. Ensure device is correctly configured for remote communication and RemLink or RemEdit have not timed out.

   ▶ Controller is ready for reading data.

   ▶ 40003 Holding Register contains status and link information that is not password protected.
2. Use function code Write Single Holding Register (06) to set B1 in 40003 Holding Register i.e. enable remote viewing.

   ▶ Controller settings are locked (view only) and cannot be changed remotely (or locally).
3. Use function code Read Holding register (03) to confirm the B1 has been set in 40003 Holding Register.

   ▶ Controller is in Remote View mode.

4. Use Read Coil (01), Read Input (02), Read Holding Register (03), or Read Input Register (04) function codes to read parameter values off the controller. See *Modbus Functions* for register details.
5. Repeat step 4 as needed.
   - Modbus Exception Codes may be encountered. See *Exception Codes*.
   - Each transaction with the controller resets the timeout timer.
6. At the end of the process, use function code Write Single Holding Register (06) to clear B1 from 40003 Holding Register and disable remote viewing (allow local editing).
   - Stopping Modbus server communication with the controller until the link timeout expires, causes the Remote View mode to exit.
7. Use function code Read Holding Register (03) to confirm the B1 has been cleared from 40003 Holding Register.
   - Confirmation that controller exited Remote View mode.

4.4. EDITING & SAVING CONTROLLER PARAMETERS

1. Ensure device is correctly configured for remote communication and RemLink or RemEdit have not timed out:
   - controller is ready for reading data
   - 40003 Modbus Holding Register contains status and link information that is not password protected
2. Use function code Write Single Holding Register (06) to set B1 **and** B2 in 40003 Holding Register i.e. enable remote editing.
   - A copy of the controller's settings is made and should be saved before exiting the Remote Edit mode (any changes will be lost).
   - Subsequent Modbus read/write transactions are with this copied image.
3. Use function code Read Holding Register (03) to confirm B1 **and** B2 have been set in 40003 Holding Register.
   - Confirms the controller is in the Remote Edit mode.
4. Use correct Modbus function codes to read and write parameters. See *Modbus Functions* sections for details.
5. Repeat Step 4 as needed.
   - Controller could return Modbus Exception Codes. See *Exception Codes*.
   - Each transaction with the controller resets a timeout timer.
6. At the end of process, use function Write Single Holding Register (06) to set B3 in 40003 Holding Register.
   - A successfully sent command is followed by the controller entering Remote Save mode. A parameter's working image is stored to the controller's non-volatile memory. During this time the controller enters Hold Mode and the new values are stored. Subsequently, the controller runs an initialization process to reload new values.
7. Use function code Read Holding register (03) to confirm B2 and B3 have been cleared from 40003 Holding Register during the Remote Save process.
   - This confirms the controller has exited Remote Editing mode.

5. MODBUS FUNCTIONS

Controller's parameters can be read or modified via Modbus functions.
Parameters are grouped based on their function.
Not all addresses are used; unused addresses are not shown.

5.1. SUPPORTED FUNCTION CODES

HI510 and HI520 support following standard Modbus function codes:

Decimal	Hex	Function Name
1	0x01	Read Coil
2	0x02	Read Input
3	0x03	Read Holding Register
4	0x04	Read Input Register
5	0x05	Write Single Coil
6	0x06	Write Single Holding Register
15	0x0F	Write Multiple Coils
16	0x10	Write Multiple Holding Registers
43	0x2B	Read Device ID

5.2. EXCEPTION CODES

Standard Modbus exception codes are returned by the controller for an unsuccessful programming request using function code:

Code	Name	Description
01	Illegal function	Received function code can not be executed as an action
02	Illegal data address	Received data address can not be accessed
03	Illegal data value	Value contained in data field is out of range or not allowed
04	Server device failure	An error occurred while attempting to perform requested action

5.3. COIL REGISTERS FUNCTIONS (0XXXX ADDRESSES)

Decimal	Hex	Name
1	0x01	**Read** Coil
5	0x05	**Write Single** Coil
15	0x0F	**Write Multiple** Coils

Address	Coil Function
00001	Key Beep
00002	Error Beep
00003	Hold Input, enable
00004	Cleaning, enable
00012	AO1, enable 22 mA on Alarm
00013	AO2, enable 22 mA on Alarm
00014	AO3, enable 22 mA on Alarm
00015	AO4, enable 22 mA on Alarm
00017	Enable CH1
00018	CH1 Setpoint 1, enable control
00019	CH1 Setpoint 2, enable control
00020	CH1 Main Parameter, enable Alarm High
00021	CH1 Main Parameter, enable Alarm Low
00022	CH1 Temperature Parameter, enable Alarm High
00023	CH1 Temperature Parameter, enable Alarm Low

Address	Coil Function
00025	Enable CH2
00026	CH2 Setpoint 1, enable control
00027	CH2 Setpoint 2, enable control
00028	CH2 Main Parameter, enable Alarm High
00029	CH2 Main Parameter, enable Alarm Low
00030	CH2 Temperature Parameter, enable Alarm High
00031	CH2 Temperature Parameter, enable Alarm Low
00033	Math CH, enable Alarm0_High
00034	Math CH, enable Alarm0_Low
00035	Math CH, enable Alarm1_High
00036	Math CH, enable Alarm1_Low
00037	Math CH, enable Alarm2_High
00038	Math CH, enable Alarm2_Low
00039	Math CH, enable Alarm3_High
00040	Math CH, enable Alarm3_Low

Note: *Channel 2 (CH2)/Math Channel (Math CH) addresses do not apply to HI510.*
Readings related to CH2/Math CH address items are routed as requests to the corresponding CH1 address item.
Writing to CH2/Math CH address items generates a response error.

5.4. DISCRETE INPUTS FUNCTIONS (1XXXX ADDRESSES)

Decimal	Hex	Name
2	0x02	**Read** Discrete Inputs

Address	Input Function
10001	Hold In Alarm
10002	Main Power Failed Alarm
10003	Remote Control Enable Status
10004	Controller Key USR0 Status
10005	Controller Key Menu Status
10006	Controller Key ESC Status
10007	Controller Key USR1 Status
10008	Controller Key Up Status
10009	Controller Key Down Status
10010	Controller Key USR2 Status
10011	Controller Key Help Status
10012	Controller Key Right Status
10013	Digital Input 1 Value
10014	Digital Input 2 Value
10015	Smart Input Value
10019	Alarm Relay Value
10020	Relay 1 Value
10021	Relay 2 Value
10022	Relay 3 Value
10023	Relay 4 Value
10024	Relay 5 Value
10033	Controller EEPROM Memory Error
10034	EEPROM Analog Out Factory Calibration Error
10035	Controller EEPROM Memory Checksum Error
10036	Controller Flash Memory Error
10037	EEPROM SN Error
10038	Flash Ctrl MFS Error
10039	EEPROM Pressure Factory Calibration Error
10040	Analog Out Power Error
10041	Microcontroller Temperature Error
10042	IO Power Error
10049	CH1 Setpoint 1, Overtime Alarm
10050	CH1 Setpoint 2, Overtime Alarm
10051	CH1 Main Parameter Alarm High
10052	CH1 Main Parameter Alarm Low
10053	CH1 Temperature Parameter Alarm High
10054	CH1 Temperature Parameter Alarm Low
10055	CH1 Main Parameter Over_Range Alarm
10056	CH1 Main Parameter Under_Range Alarm
10057	CH1 Temperature Parameter Over_Range Alarm
10058	CH1 Temperature Parameter Under_Range Alarm
10059	CH1 Probe Reconnect Alarm
10060	CH1 Number Probe Alarm
10061	CH1 Number Parameters Loaded Alarm
10062	CH1 Probe Error
10063	CH1 Temperature sensor broken
10065	CH2 Setpoint 1 Overtime Alarm
10066	CH2 Setpoint 2 Overtime Alarm
10067	CH2 Main Parameter Alarm High
10068	CH2 Main Parameter Alarm Low
10069	CH2 Temperature Parameter Alarm High
10070	CH2 Temperature Parameter Alarm Low
10071	CH2 Main Parameter Over_Range Alarm
10072	CH2 Main Parameter Under_Range Alarm
10073	CH2 Temperature Parameter Over_Range Alarm
10074	CH2 Temperature Parameter Under_Range Alarm
10075	CH2 Probe Reconnect Alarm
10076	CH2 Number Probe Alarm
10077	CH2 Number Parameters Loaded Alarm
10078	CH2 Probe Error
10079	CH2 Temperature Sensor Broken
10081	Math CH Alarm High Status
10082	Math CH Alarm Low Status

Note: *Channel 2 (CH2)/Math Channel (Math CH) addresses do not apply to HI510.*
Readings related to CH2/Math CH address items are routed as requests to the corresponding CH1 address item.
Writing to CH2/Math CH address items generates a response error.

5.5. INPUT REGISTERS FUNCTIONS (3XXXX ADDRESSES)

Decimal	Hex	Name
4	0x04	**Read** Input Register

Address	Parameter	Size	Note
30501	Reserved	512 bytes	Reserved for internal use, not related to controller status and settings.
30513	Controller Serial Number	12 bytes	bytes 1-0
30514			bytes 3-2
30515			bytes 5-4
30516			bytes 7-6
30517			bytes 9-8
30518			bytes 11-10
30519	Controller FW Version	14 bytes	bytes 1-0
30520			bytes 3-2
30521			bytes 5-4
30522			bytes 7-6
30523			bytes 9-8
30524			bytes 11-10
30525			bytes 13-12
30526	Controller Status	uint32_t	bytes 1-0
30527			bytes 3-2
30528	Alarm Events	uint64_t	bytes 1-0
30529			bytes 3-2
30530			bytes 5-4
30531			bytes 7-6
30532	Error Events	uint64_t	bytes 1-0
30533			bytes 3-2
30534			bytes 5-4
30535			bytes 7-6
30536	Warning Events	uint64_t	bytes 1-0
30537			bytes 3-2
30538			bytes 5-4
30539			bytes 7-6
30540	Green LED Status Value	uint8_t	0 = Off 1 = On 2 = Blink
30541	Red LED Status Value	uint8_t	0 = Off 1 = On 2 = Blink
30542	Hold LED Status Value	uint8_t	0 = Off 1 = On 2 = Blink
30543	Buzzer Value	uint16_t	0 = Buzzer Off > 0 = Time to sound x 100 ms

Address	Parameter	Size	Note
30545	CH1 Main Parameter Value	float	Low part of float (bytes 1-0)
30546			High part of float (bytes 3-2)
30547	CH1 Main Parameter Engineering Unit	8 bytes	bytes 1-0
30548			bytes 3-2
30549			bytes 5-4
30550			bytes 7-6
30551	CH1 Main Parameter Value Measure Resolution	uint8_t	
30552	CH1 Main Parameter Value Display Resolution	uint8_t	
30553	CH1 Main Parameter Measure Status	uint8_t	bit 0 = Measure Stable bit 1 = Measure Underrange bit 2 = Measure Overrange bit 3 = Sensor Broke bit 4 = Measurement Out of Calibration Range bit 5 = Measurement stays on a Fixed Range bit 6 = Measurement Source is Manual bit 7 = Measure Out of Range
30554	CH1 Temperature Parameter Value	float	Low part of float (bytes 1-0)
30555			High part of float (bytes 3-2)
30556	CH1 Temperature Parameter Engineering Unit	8 bytes	bytes 1-0
30557			bytes 3-2
30558			bytes 5-4
30559			bytes 7-6
30560	CH1 Temperature Parameter Value Measure Resolution	uint8_t	
30561	CH1 Temperature Parameter Value Display Resolution	uint8_t	
30562	CH1 Temperature Parameter Measure Status	uint8_t	bit 0 = Measure Stable bit 1 = Measure Underrange bit 2 = Measure Overrange bit 3 = Sensor Broke bit 4 = Measurement Out of Calibration Range bit 5 = Measurement stays on a Fixed Range bit 6 = Measurement Source is Manual bit 7 = Measure Out of Range
30563	CH1 Aux. 1 Parameter Value	float	Low part of float (bytes 1-0)
30564			High part of float (bytes 3-2)
30565	CH1 Aux. 1 Parameter Engineering Unit	8 bytes	bytes 1-0
30566			bytes 3-2
30567			bytes 5-4
30568			bytes 7-6
30569	CH1 Aux. 1 Parameter Value Measure Resolution	uint8_t	
30570	CH1 Aux. 1 Parameter Value Display Resolution	uint8_t	

Address	Parameter	Size	Note
30571	CH1 Aux. 1 Parameter Measure Status	uint8_t	bit 0 = Measure Stable bit 1 = Measure Underrange bit 2 = Measure Overrange bit 3 = Sensor Broke bit 4 = Measurement Out of Calibration Range bit 5 = Measurement stays on a Fixed Range bit 6 = Measurement Source is Manual bit 7 = Measure Out of Range
30572	CH1 Aux. 2 Parameter Value	float	Low part of float (bytes 1-0)
30573			High part of float (bytes 3-2)
30574	CH1 Aux. 2 Parameter Engineering Unit	8 bytes	bytes 1-0
30575			bytes 3-2
30576			bytes 5-4
30577			bytes 7-6
30578	CH1 Aux. 2 Parameter Value Measure Resolution	uint8_t	
30579	CH1 Aux. 2 Parameter Value Display Resolution	uint8_t	
30580	CH1 Aux. 2 Parameter Measure Status	uint8_t	bit 0 = Measure Stable bit 1 = Measure Underrange bit 2 = Measure Overrange bit 3 = Sensor Broke bit 4 = Measurement Out of Calibration Range bit 5 = Measurement stays on a Fixed Range bit 6 = Measurement Source is Manual bit 7 = Measure Out of Range
30585	CH2 Main Parameter Value	float	Low part of float (bytes 1-0)
30586			High part of float (bytes 3-2)
30587	CH2 Main Parameter Engineering Unit	8 bytes	bytes 1-0
30588			bytes 3-2
30589			bytes 5-4
30590			bytes 7-6
30591	CH2 Main Parameter Value Measure Resolution	uint8_t	
30592	CH2 Main Parameter Value Display Resolution	uint8_t	
30593	CH2 Main Parameter Measure Status	uint8_t	bit 0 = Measure Stable bit 1 = Measure Underrange bit 2 = Measure Overrange bit 3 = Sensor Broke bit 4 = Measurement Out of Calibration Range bit 5 = Measurement stays on a Fixed Range bit 6 = Measurement Source is Manual bit 7 = Measure Out of Range

Address	Parameter	Size	Note
30594	CH2 Temperature Parameter Value	float	Low part of float (bytes 1-0)
30595			High part of float (bytes 3-2)
30596	CH2 Temperature Parameter Engineering Unit	8 bytes	bytes 1-0
30597			bytes 3-2
30598			bytes 5-4
30599			bytes 7-6
30600	CH2 Temperature Parameter Value Measure Resolution	uint8_t	
30601	CH2 Temperature Parameter Value Display Resolution	uint8_t	
30602	CH2 Temperature Parameter Measure Status	uint8_t	
30603	CH2 Aux. 1 Parameter Value	float	Low part of float (bytes 1-0)
30604			High part of float (bytes 3-2)
30605	CH2 Aux. 1 Parameter Engineering Unit	8 bytes	bytes 1-0
30606			bytes 3-2
30607			bytes 5-4
30608			bytes 7-6
30609	CH2 Aux. 1 Parameter Value Measure Resolution	uint8_t	
30610	CH2 Aux. 1 Parameter Value Display Resolution	uint8_t	
30611	CH2 Aux. 1 Parameter Measure Status	uint8_t	
30612	CH2 Aux. 2 Parameter Value	float	Low part of float (bytes 1-0)
30613			High part of float (bytes 3-2)
30614	CH2 Aux. 2 Parameter Engineering Unit	8 bytes	bytes 1-0
30615			bytes 3-2
30616			bytes 5-4
30617			bytes 7-6
30618	CH2 Aux. 2 Parameter Value Measure Resolution	uint8_t	
30619	CH2 Aux. 2 Parameter Value Display Resolution	uint8_t	
30620	CH2 Aux. 2 Parameter Measure Status	uint8_t	bit 0 = Measure Stable bit 1 = Measure Underrange bit 2 = Measure Overrange bit 3 = Sensor Broke bit 4 = Measurement Out of Calibration Range bit 5 = Measurement stays on a Fixed Range bit 6 = Measurement Source is Manual bit 7 = Measure Out of Range
30625	Math CH Parameter Value	float	Low part of float (bytes 1-0)
30626			High part of float (bytes 3-2)
30627	Math CH Main Parameter Engineering Unit	8 bytes	bytes 1-0
30628			bytes 3-2
30629			bytes 5-4
30630			bytes 7-6
30631	Math CH Main Parameter Value Measure Resolution	uint8_t	
30632	Math CH Main Parameter Value Display Resolution	uint8_t	
30633	Math CH Main Parameter Measure Status	uint8_t	

Address	Parameter	Size	Note
30641	CH1 Probe Model	uint8_t	16 = pH probe
30642	CH1 Probe Code	14 bytes	bytes 1-0
30643			bytes 3-2
30644			bytes 5-4
30645			bytes 7-6
30646			bytes 9-8
30647			bytes 11-10
30648			bytes 13-12
30649	CH1 Probe Parameters Number	uint8_t	
30650	CH1 Probe SN	12 bytes	bytes 1-0
30651			bytes 3-2
30652			bytes 5-4
30653			bytes 7-6
30654			bytes 9-8
30655			bytes 11-10
30656	CH1 Probe FW Version	7 bytes	bytes 1-0
30657			bytes 3-2
30658			bytes 5-4
30659			Byte 6
30660	CH1 Probe Measure Mode	uint8_t	
30661	CH1 Probe Measure Unit	uint8_t	
30665	CH1 Main Parameter Name	8 bytes	bytes 1-0
30666			bytes 3-2
30667			bytes 5-4
30668			bytes 7-6
30669	CH1 Main Parameter Engineering Unit Basic Name	8 bytes	bytes 1-0
30670			bytes 3-2
30671			bytes 5-4
30672			bytes 7-6
30673	CH1 Main Parameter Low Limit Value	float	Low part of float (bytes 1-0)
30674			High part of float (bytes 3-2)
30675	CH1 Main Parameter High Limit Value	float	Low part of float (bytes 1-0)
30676			High part of float (bytes 3-2)
30677	CH1 Main Parameter Limits Resolution	uint8_t	
30678	CH1 Temperature Parameter Name	8 bytes	bytes 1-0
30679			bytes 3-2
30680			bytes 5-4
30681			bytes 7-6
30682	CH1 Temperature Parameter Engineering Unit Basic Name	8 bytes	bytes 1-0
30683			bytes 3-2
30684			bytes 5-4
30685			bytes 7-6
30686	CH1 Temperature Parameter Low Limit Value	float	Low part of float (bytes 1-0)
30687			High part of float (bytes 3-2)

Address	Parameter	Size	Note
30688	CH1 Temperature Parameter High Limit Value	float	Low part of float (bytes 1-0)
30689			High part of float (bytes 3-2)
30690	CH1 Temperature Parameter Limits Resolution	uint8_t	
30691	CH1 Aux. 1 Parameter Name	8 bytes	bytes 1-0
30692			bytes 3-2
30693			bytes 5-4
30694			bytes 7-6
30695	CH1 Aux. 1 parameter Engineering Unit Basic Name	8 bytes	bytes 1-0
30696			bytes 3-2
30697			bytes 5-4
30698			bytes 7-6
30699	CH1 Aux. 1 Parameter Low Limit Value	float	Low part of float (bytes 1-0)
30700			High part of float (bytes 3-2)
30701	CH1 Aux. 1 Parameter High Limit Value	float	Low part of float (bytes 1-0)
30702			High part of float (bytes 3-2)
30703	CH1 Aux. 1 Parameter Limits Resolution	uint8_t	
30704	CH1 Aux. 2 Parameter Name	8 bytes	bytes 1-0
30705			bytes 3-2
30706			bytes 5-4
30707			bytes 7-6
30708	CH1 Aux. 2 parameter Engineering Unit Basic Name	8 bytes	bytes 1-0
30709			bytes 3-2
30710			bytes 5-4
30711			bytes 7-6
30712	CH1 Aux. 2 Parameter Low Limit Value	float	Low part of float (bytes 1-0)
30713			High part of float (bytes 3-2)
30714	CH1 Aux. 2 Parameter High Limit Value	float	Low part of float (bytes 1-0)
30715			High part of float (bytes 3-2)
30716	CH1 Aux. 2 Parameter Limits Resolution	uint8_t	
30721	CH2 Probe Model	uint8_t	16 = pH
30722	CH2 Probe Code	14 bytes	bytes 1-0
30723			bytes 3-2
30724			bytes 5-4
30725			bytes 7-6
30726			bytes 9-8
30727			bytes 11-10
30728			bytes 13-12
30729	CH2 Probe Parameters Number	uint8_t	
30730	CH2 Probe SN	12 bytes	bytes 1-0
30731			bytes 3-2
30732			bytes 5-4
30733			bytes 7-6
30734			bytes 9-8
30735			bytes 11-10

Address	Parameter	Size	Note
30736	CH2 Probe FW Version	7 bytes	bytes 1-0
30737			bytes 3-2
30738			bytes 5-4
30739			Byte 6
30740	CH2 Probe Measure Mode	uint8_t	
30741	CH2 Probe Measure Unit	uint8_t	
30745	CH2 Main Parameter Name	8 bytes	bytes 1-0
30746			bytes 3-2
30747			bytes 5-4
30748			bytes 7-6
30749	CH2 Main Parameter Engineering Unit Basic Name	8 bytes	bytes 1-0
30750			bytes 3-2
30751			bytes 5-4
30752			bytes 7-6
30753	CH2 Main Parameter Low Limit Value	float	Low part of float (bytes 1-0)
30754			High part of float (bytes 3-2)
30755	CH2 Main Parameter High Limit Value	float	Low part of float (bytes 1-0)
30756			High part of float (bytes 3-2)
30757	CH2 Main Parameter Limits Resolution	uint8_t	
30758	CH2 Temperature Parameter Name	8 bytes	bytes 1-0
30759			bytes 3-2
30760			bytes 5-4
30761			bytes 7-6
30762	CH2 Temperature Parameter Engineering Unit Basic Name	8 bytes	bytes 1-0
30763			bytes 3-2
30764			bytes 5-4
30765			bytes 7-6
30766	CH2 Temperature Parameter Low Limit Value	float	Low part of float (bytes 1-0)
30767			High part of float (bytes 3-2)
30768	CH2 Temperature Parameter High Limit Value	float	Low part of float (bytes 1-0)
30769			High part of float (bytes 3-2)
30770	CH2 Temperature Parameter Limits Resolution	uint8_t	
30771	CH2 Aux. 1 Parameter Name	8 bytes	bytes 1-0
30772			bytes 3-2
30773			bytes 5-4
30774			bytes 7-6
30775	CH2 Aux. 1 Parameter Engineering Unit Basic Name	8 bytes	bytes 1-0
30776			bytes 3-2
30777			bytes 5-4
30778			bytes 7-6
30779	CH2 Aux. 1 Parameter Low Limit Value	float	Low part of float (bytes 1-0)
30780			High part of float (bytes 3-2)
30781	CH2 Aux. 1 Parameter High Limit Value	float	Low part of float (bytes 1-0)
30782			High part of float (bytes 3-2)

Address	Parameter	Size	Note
30783	CH2 Aux. 1 Parameter Limits Resolution	uint8_t	
30784	CH2 Aux. 2 Parameter Name	8 bytes	bytes 1-0
30785			bytes 3-2
30786			bytes 5-4
30787			bytes 7-6
30788	CH2 Aux. 2 Parameter Engineering Unit Basic Name	8 bytes	bytes 1-0
30789			bytes 3-2
30790			bytes 5-4
30791			bytes 7-6
30792	CH2 Aux. 2 Parameter Low Limit Value	float	Low part of float (bytes 1-0)
30793			High part of float (bytes 3-2)
30794	CH2 Aux. 2 Parameter High Limit Value	float	Low part of float (bytes 1-0)
30795			High part of float (bytes 3-2)
30796	CH2 Aux. 2 Parameter Limits Resolution	uint8_t	
30801	CH1 Probe Constant1 Value	uint16_t	

0 = Incremental (–Min. Range Value ÷ Max. Range Value)
1 = Unit

DO probe

- DO saturation (%DO) — 0 or 1
- DO concentration (mg/L) — 0
- DO concentration (ppm) — 1

EC probe

- EC mode (µs) — 0 or 1
- TDS mode (mg/L) — 0
- TDS mode (ppm) — 1
- Sal % (%) — 0 or 1
- Sal ppt (ppt) — 0 or 1
- Sal psu (psu) — 0 or 1
- Resistivity (Ω) — 0 or 1

2 = Check Glass Impedance
3 = Check Reference Impedance
4 = Temperature Compensation (–Min. Range Value ÷ Max. Range Value)
5 = Manual Temperature Compensation (–Min. Range Value ÷ Max. Range Value)
6 = Temperature Offset (–Min. Range Value ÷ Max. Range Value)
7 = Calibration Timeout (–Min. Range Value ÷ Max. Range Value)
8 = Resolution (–Min. Range Value ÷ Max. Range Value) — {0,1,2,3}
9 = Calibration Buffer

- Hanna — 0
- NIST — 1

10 = Measured Mode (probes measure in different parameters)

DO probe

- DO saturation (%DO) — 0
- DO concentration (mg/L) — 1

EC probe

- Conductivity (µs, mS) — 0
- Total Dissolved Solids (ppm, ppt, mg/L, g/L) — 1
- Resistivity (Ω, kΩ, MΩ) — 2
- Salinity % (%) — 3
- Sal ppt (ppt) — 4
- Sal psu (psu) — 5

11 = Parameter Source

- Internal — 0
- External — 1

Address	Parameter	Size	Note
	12 = EC Temperature Compensation Mode • Linear • Natural • Standard • None		 0 1 2 3
30802	CH1 Probe Constant1 Resolution	uint8_t	{0,1,2,3}
30803	CH1 Probe Constant1 Type	uint8_t	
	0 = Incremental Type 1 = Unit Type 2 = Check Glass Impedance 3 = Check Reference Impedance 4 = Temperature Compensation Type 5 = Incremental Temperature Type 6 = Incremental Temperature Offset Type 7 = Incremental Calibration Timeout 8 = Incremental Resolution Type 9 = Incremental Buffer Type 10 = Meter Mode 11 = Parameter Source 12 = EC Temperature Compensation Type		
30804	CH1 Probe Constant1 Name	24 bytes	bytes 1-0
30805			bytes 3-2
30806			bytes 5-4
30807			bytes 7-6
30808			bytes 9-8
30809			bytes 11-10
30810			bytes 13-12
30811			bytes 15-14
30812			bytes 17-16
30813			bytes 19-18
30814			bytes 21-20
30815			bytes 23-22
30816	CH1 Probe Constant2 Value	uint16_t	
30817	CH1 Probe Constant2 Resolution	uint8_t	
30818	CH1 Probe Constant2 Type	uint8_t	
30819	CH1 Probe Constant2 Name	24 bytes	bytes 1-0
30820			bytes 3-2
30821			bytes 5-4
30822			bytes 7-6
30823			bytes 9-8
30824			bytes 11-10
30825			bytes 13-12
30826			bytes 15-14
30827			bytes 17-16
30828			bytes 19-18
30829			bytes 21-20
30830			bytes 23-22
30831	CH1 Probe Constant3 Value	uint16_t	

Address	Parameter	Size	Note
30832	CH1 Probe Constant3 Resolution	uint8_t	
30833	CH1 Probe Constant3 Type	uint8_t	
30834	CH1 Probe Constant3 Name	24 bytes	bytes 1-0
30835			bytes 3-2
30836			bytes 5-4
30837			bytes 7-6
30838			bytes 9-8
30839			bytes 11-10
30840			bytes 13-12
30841			bytes 15-14
30842			bytes 17-16
30843			bytes 19-18
30844			bytes 21-20
30845			bytes 23-22
30846	CH1 Probe Constant4 Value	uint16_t	
30847	CH1 Probe Constant4 Resolution	uint8_t	
30848	CH1 Probe Constant4 Type	uint8_t	
30849	CH1 Probe Constant4 Name	24 bytes	bytes 1-0
30850			bytes 3-2
30851			bytes 5-4
30852			bytes 7-6
30853			bytes 9-8
30854			bytes 11-10
30855			bytes 13-12
30856			bytes 15-14
30857			bytes 17-16
30858			bytes 19-18
30859			bytes 21-20
30860			bytes 23-22
30861	CH1 Probe Constant5 Value	uint16_t	
30862	CH1 Probe Constant5 Resolution	uint8_t	
30863	CH1 Probe Constant5 Type	uint8_t	
30864	CH1 Probe Constant5 Name	24 bytes	bytes 1-0
30865			bytes 3-2
30866			bytes 5-4
30867			bytes 7-6
30868			bytes 9-8
30869			bytes 11-10
30870			bytes 13-12
30871			bytes 15-14
30872			bytes 17-16
30873			bytes 19-18
30874			bytes 21-20
30875			bytes 23-22

Address	Parameter	Size	Note
30876	CH1 Probe Constant6 Value	uint16_t	
30877	CH1 Probe Constant6 Resolution	uint8_t	
30878	CH1 Probe Constant6 Type	uint8_t	
30879	CH1 Probe Constant6 Name	24 bytes	bytes 1-0
30880			bytes 3-2
30881			bytes 5-4
30882			bytes 7-6
30883			bytes 9-8
30884			bytes 11-10
30885			bytes 13-12
30886			bytes 15-14
30887			bytes 17-16
30888			bytes 19-18
30889			bytes 21-20
30890			bytes 23-22
30891	CH1 Probe Constant7 Value	uint16_t	
30892	CH1 Probe Constant7 Resolution	uint8_t	
30893	CH1 Probe Constant7 Type	uint8_t	
30894	CH1 Probe Constant7 Name	24 bytes	bytes 1-0
30895			bytes 3-2
30896			bytes 5-4
30897			bytes 7-6
30898			bytes 9-8
30899			bytes 11-10
30900			bytes 13-12
30901			bytes 15-14
30902			bytes 17-16
30903			bytes 19-18
30904			bytes 21-20
30905			bytes 23-22
30906	CH1 Probe Constant8 Value	uint16_t	
30907	CH1 Probe Constant8 Resolution	uint8_t	
30908	CH1 Probe Constant8 Type	uint8_t	
30909	CH1 Probe Constant8 Name	24 bytes	bytes 1-0
30910			bytes 3-2
30911			bytes 5-4
30912			bytes 7-6
30913			bytes 9-8
30914			bytes 11-10
30915			bytes 13-12
30916			bytes 15-14
30917			bytes 17-16
30918			bytes 19-18

Address	Parameter	Size	Note
30919			bytes 21-20
30920			bytes 23-22
30921	CH1 Probe Constant9 Value	uint16_t	
30922	CH1 Probe Constant9 Resolution	uint8_t	
30923	CH1 Probe Constant9 Type	uint8_t	
30924	CH1 Probe Constant9 Name	24 bytes	bytes 1-0
30925			bytes 3-2
30926			bytes 5-4
30927			bytes 7-6
30928			bytes 9-8
30929			bytes 11-10
30930			bytes 13-12
30931			bytes 15-14
30932			bytes 17-16
30933			bytes 19-18
30934			bytes 21-20
30935			bytes 23-22
30936	CH1 Probe Constant10 Value	uint16_t	
30937	CH1 Probe Constant10 Resolution	uint8_t	
30938	CH1 Probe Constant10 Type	uint8_t	
30939	CH1 Probe Constant10 Name	24 bytes	bytes 1-0
30940			bytes 3-2
30941			bytes 5-4
30942			bytes 7-6
30943			bytes 9-8
30944			bytes 11-10
30945			bytes 13-12
30946			bytes 15-14
30947			bytes 17-16
30948			bytes 19-18
30949			bytes 21-20
30950			bytes 23-22
	CH1 Probe Constant11 Value	uint16_t	
	0 = Incremental (–Min. Range Value ÷ Max. Range Value) 1 = Unit **DO probe** • DO saturation (%DO) • DO concentration (mg/L) • DO concentration (ppm) **EC probe** • EC mode (µs) • TDS mode (mg/L) • TDS mode (ppm) • Sal % (%) • Sal ppt (ppt) • Sal psu (psu) • Resistivity (Ω) 2 = Check Glass Impedance		 0 or 1 0 1 0 or 1 0 1 0 or 1 0 or 1 0 or 1 0 or 1

Address	Parameter	Size	Note
	3 = Check Reference Impedance 4 = Temperature Compensation (–Min. Range Value ÷ Max. Range Value) 5 = Manual Temperature Compensation (–Min. Range Value ÷ Max. Range Value) 6 = Temperature Offset (–Min. Range Value ÷ Max. Range Value) 7 = Calibration Timeout (–Min. Range Value ÷ Max. Range Value) 8 = Resolution (–Min. Range Value ÷ Max. Range Value) 9 = Calibration Buffer • Hanna • NIST		{0,1,2,3} 0 1
	10 = Measured Mode (probes measure in different parameters) **DO probe** • DO saturation (%DO) • DO concentration (mg/L) **EC probe** • Conductivity (µs, mS) • Total Dissolved Solids (ppm, ppt, mg/L, g/L) • Resistivity (Ω, kΩ, MΩ) • Salinity % (%) • Sal ppt (ppt) • Sal psu (psu) 11 = Parameter Source • Internal • External 12 = EC Temperature Compensation Mode • Linear • Natural • Standard • None		 0 1 0 1 2 3 4 5 0 1 0 1 2 3
30952	CH1 Probe Constant11 Resolution	uint8_t	{0,1,2,3}
30953	CH1 Probe Constant11 Type 0 = Incremental Type 1 = Unit Type 2 = Check Glass Impedance 3 = Check Reference Impedance 4 = Temperature Compensation Type 5 = Incremental Temperature Type 6 = Incremental Temperature Offset Type 7 = Incremental Calibration Timeout 8 = Incremental Resolution Type 9 = Incremental Buffer Type 10 = Meter Mode 11 = Parameter Source	uint8_t	
30954	CH1 Probe Constant11 Name	24 bytes	bytes 1-0
30955			bytes 3-2
30956			bytes 5-4
30957			bytes 7-6
30958			bytes 9-8
30959			bytes 11-10
30960			bytes 13-12
30961			bytes 15-14
30962			bytes 17-16
30963			bytes 19-18
30964			bytes 21-20
30965			bytes 23-22

Address	Parameter	Size	Note
30985	CH2 Probe Constant1 Value	uint16_t	
	0 = Incremental (–Min. Range Value ÷ Max. Range Value)		
	1 = Unit		
	DO probe		
	• DO saturation (%DO)		0 or 1
	• DO concentration (mg/L)		0
	• DO concentration (ppm)		1
	EC probe		
	• EC mode (µs)		0 or 1
	• TDS mode (mg/L)		0
	• TDS mode (ppm)		1
	• Sal % (%)		0 or 1
	• Sal ppt (ppt)		0 or 1
	• Sal psu (psu)		0 or 1
	• Resistivity (Ω)		0 or 1
	2 = Check Glass Impedance		
	3 = Check Reference Impedance		
	4 = Temperature Compensation (–Min. Range Value ÷ Max. Range Value)		
	5 = Manual Temperature Compensation (–Min. Range Value ÷ Max. Range Value)		
	6 = Temperature Offset (–Min. Range Value ÷ Max. Range Value)		
	7 = Calibration Timeout (–Min. Range Value ÷ Max. Range Value)		
	8 = Resolution (–Min. Range Value ÷ Max. Range Value)		{0,1,2,3}
	9 = Calibration Buffer		
	• Hanna		0
	• NIST		1
	10 = Measured Mode (probes measure in different parameters)		
	DO probe		
	• DO saturation (%DO)		0
	• DO concentration (mg/L)		1
	EC probe		
	• Conductivity (µs, mS)		0
	• Total Dissolved Solids (ppm, ppt, mg/L, g/L)		1
	• Resistivity (Ω, kΩ, MΩ)		2
	• Salinity % (%)		3
	• Sal ppt (ppt)		4
	• Sal psu (psu)		5
	11 = Parameter Source		
	• Internal		0
	• External		1
	12 = EC Temperature Compensation Mode		
	• Linear		0
	• Natural		1
	• Standard		2
	• None		3
30986	CH2 Probe Constant1 Resolution	uint8_t	{0,1,2,3}
30987	CH2 Probe Constant1 Type	uint8_t	
	0 = Incremental Type		
	1 = Unit Type		
	2 = Check Glass Impedance		
	3 = Check Reference Impedance		
	4 = Temperature Compensation Type		
	5 = Incremental Temperature Type		
	6 = Incremental Temperature Offset Type		

Address	Parameter	Size	Note
30987	7 = Incremental Calibration Timeout 8 = Incremental Resolution Type 9 = Incremental Buffer Type 10 = Meter Mode 11 = Parameter Source 12 = EC Temperature Compensation Type		
30988	CH2 Probe Constant1 Name	24 bytes	bytes 1-0
30989			bytes 3-2
30990			bytes 5-4
30991			bytes 7-6
30992			bytes 9-8
30993			bytes 11-10
30994			bytes 13-12
30995			bytes 15-14
30996			bytes 17-16
30997			bytes 19-18
30998			bytes 21-20
30999			bytes 23-22
31000	CH2 Probe Constant2 Value	uint16_t	
31001	CH2 Probe Constant2 Resolution	uint8_t	
31002	CH2 Probe Constant2 Type	uint8_t	
31003	CH2 Probe Constant2 Name	24 bytes	bytes 1-0
31004			bytes 3-2
31005			bytes 5-4
31006			bytes 7-6
31007			bytes 9-8
31008			bytes 11-10
31009			bytes 13-12
31010			bytes 15-14
31011			bytes 17-16
31012			bytes 19-18
31013			bytes 21-20
31014			bytes 23-22
31015	CH2 Probe Constant3 Value	uint16_t	
31016	CH2 Probe Constant3 Resolution	uint8_t	
31017	CH2 Probe Constant3 Type	uint8_t	
31018	CH2 Probe Constant3 Name	24 bytes	bytes 1-0
31019			bytes 3-2
31020			bytes 5-4
31021			bytes 7-6
31022			bytes 9-8
31023			bytes 11-10
31024			bytes 13-12
31025			bytes 15-14

Address	Parameter	Size	Note
31026			bytes 17-16
31027			bytes 19-18
31028			bytes 21-20
31029			bytes 23-22
31030	CH2 Probe Constant4 Value	uint16_t	
31031	CH2 Probe Constant4 Resolution	uint8_t	
31032	CH2 Probe Constant4 Type	uint8_t	
31033	CH2 Probe Constant4 Name	24 bytes	bytes 1-0
31034			bytes 3-2
31035			bytes 5-4
31036			bytes 7-6
31037			bytes 9-8
31038			bytes 11-10
31039			bytes 13-12
31040			bytes 15-14
31041			bytes 17-16
31042			bytes 19-18
31043			bytes 21-20
31044			bytes 23-22
31045	CH2 Probe Constant5 Value	uint16_t	
31046	CH2 Probe Constant5 Resolution	uint8_t	
31047	CH2 Probe Constant5 Type	uint8_t	
31048	CH2 Probe Constant5 Name	24 bytes	bytes 1-0
31049			bytes 3-2
31050			bytes 5-4
31051			bytes 7-6
31052			bytes 9-8
31053			bytes 11-10
31054			bytes 13-12
31055			bytes 15-14
31056			bytes 17-16
31057			bytes 19-18
31058			bytes 21-20
31059			bytes 23-22
31060	CH2 Probe Constant6 Value	uint16_t	
31061	CH2 Probe Constant6 Resolution	uint8_t	
31062	CH2 Probe Constant6 Type	uint8_t	
31063	CH2 Probe Constant6 Name	24 bytes	bytes 1-0
31064			bytes 3-2
31065			bytes 5-4
31066			bytes 7-6
31067			bytes 9-8
31068			bytes 11-10
31069			bytes 13-12

Address	Parameter	Size	Note
31070			bytes 15-14
31071			bytes 17-16
31072			bytes 19-18
31073			bytes 21-20
31074			bytes 23-22
31075	CH2 Probe Constant7 Value	uint16_t	
31076	CH2 Probe Constant7 Resolution	uint8_t	
31077	CH2 Probe Constant7 Type	uint8_t	
31078	CH2 Probe Constant7 Name	24 bytes	bytes 1-0
31079			bytes 3-2
31080			bytes 5-4
31081			bytes 7-6
31082			bytes 9-8
31083			bytes 11-10
31084			bytes 13-12
31085			bytes 15-14
31086			bytes 17-16
31087			bytes 19-18
31088			bytes 21-20
31089			bytes 23-22
31090	CH2 Probe Constant8 Value	uint16_t	
31091	CH2 Probe Constant8 Resolution	uint8_t	
31092	CH2 Probe Constant8 Type	uint8_t	
31093	CH2 Probe Constant8 Name	24 bytes	bytes 1-0
31094			bytes 3-2
31095			bytes 5-4
31096			bytes 7-6
31097			bytes 9-8
31098			bytes 11-10
31099			bytes 13-12
31100			bytes 15-14
31101			bytes 17-16
31102			bytes 19-18
31103			bytes 21-20
31104			bytes 23-22
31105	CH2 Probe Constant9 Value	uint16_t	
31106	CH2 Probe Constant9 Resolution	uint8_t	
31107	CH2 Probe Constant9 Type	uint8_t	
31108	CH2 Probe Constant9 Name	24 bytes	bytes 1-0
31109			bytes 3-2
31110			bytes 5-4
31111			bytes 7-6
31112			bytes 9-8
31113			bytes 11-10

Address	Parameter	Size	Note
31114			bytes 13-12
31115			bytes 15-14
31116			bytes 17-16
31117			bytes 19-18
31118			bytes 21-20
31119			bytes 23-22
31120	CH2 Probe Constant10 Value	uint16_t	
31121	CH2 Probe Constant10 Resolution	uint8_t	
31122	CH2 Probe Constant10 Type	uint8_t	
31123	CH2 Probe Constant10 Name	24 bytes	bytes 1-0
31124			bytes 3-2
31125			bytes 5-4
31126			bytes 7-6
31127			bytes 9-8
31128			bytes 11-10
31129			bytes 13-12
31130			bytes 15-14
31131			bytes 17-16
31132			bytes 19-18
31133			bytes 21-20
31134			bytes 23-22
31135	CH2 Probe Constant11 Value	uint16_t	

0 = Incremental (–Min. Range Value ÷ Max. Range Value)
1 = Unit

DO probe

- DO saturation (%DO) — 0 or 1
- DO concentration (mg/L) — 0
- DO concentration (ppm) — 1

EC probe

- EC mode (µs) — 0 or 1
- TDS mode (mg/L) — 0
- TDS mode (ppm) — 1
- Sal % (%) — 0 or 1
- Sal ppt (ppt) — 0 or 1
- Sal psu (psu) — 0 or 1
- Resistivity (Ω) — 0 or 1

2 = Check Glass Impedance
3 = Check Reference Impedance
4 = Temperature Compensation (–Min. Range Value ÷ Max. Range Value)
5 = Manual Temperature Compensation (–Min. Range Value ÷ Max. Range Value)
6 = Temperature Offset (–Min. Range Value ÷ Max. Range Value)
7 = Calibration Timeout (–Min. Range Value ÷ Max. Range Value)
8 = Resolution (–Min. Range Value ÷ Max. Range Value) — {0,1,2,3}
9 = Calibration Buffer

- Hanna — 0
- NIST — 1

Address	Parameter	Size	Note
31135	10 = Measured Mode (probes measure in different parameters) **DO probe** • DO saturation (%DO) • DO concentration (mg/L) **EC probe** • Conductivity (µs, mS) • Total Dissolved Solids (ppm, ppt, mg/L, g/L) • Resistivity (Ω, kΩ, MΩ) • Salinity % (%) • Sal ppt (ppt) • Sal psu (psu) 11 = Parameter Source • Internal • External 12 = EC Temperature Compensation Mode • Linear • Natural • Standard • None		 0 1 0 1 2 3 4 5 0 1 0 1 2 3
31136	CH2 Probe Constant11 Resolution	uint8_t	{0,1,2,3}
31137	CH2 Probe Constant11 Type 0 = Incremental Type 1 = Unit Type 2 = Check Glass Impedance 3 = Check Reference Impedance 4 = Temperature Compensation Type 5 = Incremental Temperature Type 6 = Incremental Temperature Offset Type 7 = Incremental Calibration Timeout 8 = Incremental Resolution Type 9 = Incremental Buffer Type 10 = Meter Mode 11 = Parameter Source	uint8_t	
31138	CH2 Probe Constant11 Name	24 bytes	bytes 1-0
31139			bytes 3-2
31140			bytes 5-4
31141			bytes 7-6
31142			bytes 9-8
31143			bytes 11-10
31144			bytes 13-12
31145			bytes 15-14
31146			bytes 17-16
31147			bytes 19-18
31148			bytes 21-20
31149			bytes 23-22

Note: *Channel 2 (CH2)/Math Channel (Math CH) addresses do not apply to HI510.*
Readings related to CH2/Math CH address items are routed as requests to the corresponding CH1 address item.
Writing to CH2/Math CH address items generates a response error.

5.6. HOLDING REGISTERS FUNCTIONS (4XXXX ADDRESSES)

Decimal	Hex	Name
3	0x03	**Read** Holding Register
6	0x06	**Write Single** Holding Register
16	0x10	**Write Multiple** Holding Registers

Address	Register Function	Size	Min. Value	Max. Value	Default Value	Details
40001	Remote Password	uint32_t				Low part of uint32_t (bytes 1-0)
40002						High part of uint32_t (bytes 3-2)
40003	Remote Mode Control	uint8_t				**B0 Remote Link (read only)** 0 = No Link between controller and server 1 = Link established between controller and server **B1 Set Remote Control View Mode** 0 = Controller settings configured locally 1 = Controller settings configured remote **B2 Set Remote Control Edit Mode** 0 = Settings cannot be configured remotely 1 = Settings configured remotely on an image of controller settable parameters **B3 Save Settings Configured on Remote Control Edit Mode** 1 = Settings Configured on Remote Control Edit Mode are saved to controller after change validation
40009	Log Interval	uint8_t	0	10	0	0 = 10 s 1 = 30 s 2 = 1 min. 3 = 2 min. 4 = 5 min. 5 = 10 min. 6 = 15 min. 7 = 30 min. 8 = 60 min. 9 = 120 min. 10 = 180 min.
40010	Date Format	uint8_t	0	5	0	0 = yyyy-mm-dd 1 = dd-mm-yyyy 2 = mm-dd-yyyy 3 = yyyy/mm/dd 4 = dd/mm/yyyy 5 = mm/dd/yyyy
40011	Time Format	uint8_t	0	1	0	0 = hh:mm:ss 24 h 1 = hh:mm:ss 12 h
40012	Decimal	uint8_t	.	,	.	
40013	Temperature Unit	uint8_t	0	1	0	0 = °C 1 = °F
40014	Controller ID	uint16_t	0	9999	1	
40015	Startup Delay	uint8_t	1	30	5	[minutes]
40016	Setup Timeout	uint8_t	1	30	10	[minutes]

Address	Register Function	Size	Min. Value	Max. Value	Default Value	Details
40017	Communication Protocol	uint8_t	0	–	0	0 = Modbus RTU
40018	Bus Address	uint8_t	1	99	1	
40019	Baud Rate	uint8_t	0	5	1	0 = 9K6 1 = 19K2 2 = 38K4 3 = 57K6 4 = 115K2 5 = 256K0
40020	Parity	uint8_t	0	2	0	0 = None 1 = Odd parity 2 = Even parity
40021	Stop Bits	uint8_t	0	2	0	0 = 1 Stop bit 1 = 1.5 Stop bits 1 = 2 Stop bits
40022	Remote Edit Timeout	uint16_t	10	1200	30	[seconds]
40023	Remote Link Timeout	uint16_t	10	1200	60	[seconds]
40025	Cleaning Enable	uint8_t	0	1	0	0 = Cleaning disable 1 = Cleaning enable
40026	Cleaning Type	uint8_t	0	1	0	0 = Simple 1 = Advanced
40027	Cleaning Internal Trigger Type	uint8_t	0	2	1	0 = Disabled 1 = Timer 2 = Schedule
40028	Cleaning Interval Time	uint16_t	1	1440	480	[minutes]
40029	Cleaning Pre_Wash Time	uint16_t	5	300	20	[seconds]
40030	Cleaning Wash Time	uint16_t	5	300	20	[seconds]
40031	Cleaning Post Wash Time	uint16_t	5	999	20	[seconds]
40032	Cleaning Recovery Time	uint16_t	5	120	10	[seconds]
40033	Cleaning Wash Cycles	uint8_t	1	10	1	
40034	Cleaning Rinse Only Cycles	uint8_t	0	10	0	
40035	Cleaning Schedule 1st Time to Start Hour	uint8_t	0	23	0	
40036	Cleaning Schedule 1st Time to Start Minute	uint8_t	0	59	0	
40037	Cleaning Schedule 1st Time to Start Enabled	uint8_t	0	1	0	0 = Start disabled 1 = Start enabled
40038	Cleaning Schedule 2nd Time to Start Hour	uint8_t	0	23	0	
40039	Cleaning Schedule 2nd Time to Start Minute	uint8_t	0	59	0	
40040	Cleaning Schedule 2nd Time to Start Enabled	uint8_t	0	1	0	0 = Start disabled 1 = Start enabled
40041	Cleaning Schedule 3rd Time to Start Hour	uint8_t	0	23	0	
40042	Cleaning Schedule 3rd Time to Start Minute	uint8_t	0	59	0	
40043	Cleaning Schedule 3rd Time to Start Enabled	uint8_t	0	1	0	0 = Start disabled 1 = Start enabled
40044	Cleaning Schedule Monday	uint8_t	0	1	0	
40045	Cleaning Schedule Tuesday	uint8_t	0	1	0	
40046	Cleaning Schedule Wednesday	uint8_t	0	1	0	
40047	Cleaning Schedule Thursday	uint8_t	0	1	0	
40048	Cleaning Schedule Friday	uint8_t	0	1	0	

Address	Register Function	Size	Min. Value	Max. Value	Default Value	Details
40049	Cleaning Schedule Saturday	uint8_t	0	1	0	
40050	Cleaning Schedule Sunday	uint8_t	0	1	0	
40051	Input1 Function	uint8_t	0	2	0	0 = Disabled 1 = Hold 2 = Clean
40052	Input1 Active Level	uint8_t	0	1	0	0 = Low 1 = High
40053	Input2 Function	uint8_t	0	2	0	0 = Disabled 1 = Hold 2 = Clean
40054	Input2 Active Level	uint8_t	0	1	0	0 = Low 1 = High
40057	Relay 1 Function	uint8_t	0	5	0	0 = Disabled 1 = Ctrl SetP1 2 = Ctrl SetP2 3 = Rinse 4 = Wash 5 = Hold
40058	Relay 2 Function	uint8_t	0	5	0	
40059	Relay 3 Function	uint8_t	0	5	0	
40060	Relay 4 Function	uint8_t	0	5	0	
40061	Relay 5 Function	uint8_t	0	5	0	
40062	Hold Delay	uint8_t	0	99	5	[seconds]
40063	AO1 Mode	uint8_t	0	1	0	0 = Disabled 1 = Track channel
40064	AO1 Data Channel	uint8_t	0	1	0	0 = CH1 (Probe 1) 1 = CH2 (Probe 2)
40065	AO1 Parameter to Follow	uint8_t	0	4	0	0 = Ctrl SetP1 1 = Ctrl SetP2 2 = Main 3 = Temperature 4 = Auxiliary
40066	AO1 mA Range	uint8_t	0	1	0	0 = "0-20 mA" 1 = "4-20 mA"
40067	AO1 Value in Hold Option	uint8_t	0	1	0	0 = "Last value" 1 = "Fix value"
40068	AO1 22 mA on Hold Option	uint8_t	0	1	0	0 = "Disabled" 1 = "Enabled"
40069	AO1 Parameter Value for Maximum Output	float				Low part of float (bytes 1-0)
40070						High part of float (bytes 3-2)
40071	AO1 Parameter Value for Minimum Output	float				Low part of float (bytes 1-0)
40072						High part of float (bytes 3-2)
40073	AO1 Parameter Value in Hold	float				Low part of float (bytes 1-0)
40074						High part of float (bytes 3-2)
40075	AO2 Mode	uint8_t	0	1	0	0 = Disabled 1 = Track Channel
40076	AO2 Data Channel	uint8_t	0	1	0	0 = CH1 (Probe 1) 1 = CH2 (Probe 2)

Address	Register Function	Size	Min. Value	Max. Value	Default Value	Details
40077	AO2 Parameter to Follow	uint8_t	0	4	0	0 = Ctrl SetP1 1 = Ctrl SetP2 2 = Main parameter 3 = Temp. Param. 4 = Auxiliary Param.
40078	AO2 mA Range	uint8_t	0	1	0	0 = "0-20 mA" 1 = "4-20 mA"
40079	AO2 Value in Hold Option	uint8_t	0	1	0	0 = "Last value" 1 = "Fix value"
40080	AO2 22 mA on Hold Option	uint8_t	0	1	0	0 = "Disabled" 1 = "Enabled"
40081	AO2 Parameter Value for Maximum Output	float				Low part of float (bytes 1-0)
40082						High part of float (bytes 3-2)
40083	AO2 Parameter Value for Minimum Output	float				Low part of float (bytes 1-0)
40084						High part of float (bytes 3-2)
40085	AO2 Parameter Value in Hold	float				Low part of float (bytes 1-0
40086						High part of float (bytes 3-2)
40087	AO3 Mode	uint8_t	0	1	0	0 = Disabled 1 = Track Channel
40088	AO3 Data Channel	uint8_t	0	1	0	0 = CH1 (Probe 1) 1 = CH2 (Probe 2)
40089	AO3 Parameter to Follow	uint8_t	0	4	0	0 = Ctrl SetP1 1 = Ctrl SetP2 2 = Main Param. 3 = Temp. Param. 4 = Auxiliary Param.
40090	AO3 mA Range	uint8_t	0	1	0	0 = "0-20 mA" 1 = "4-20 mA"
40091	AO3 Value in Hold Option	uint8_t	0	1	0	0 = "Last value" 1 = "Fix value"
40092	AO3 22 mA on Hold Option	uint8_t	0	1	0	0 = "Disabled" 1 = "Enabled"
40093	AO3 Parameter Value for Maximum Output	float				Low part of float (bytes 1-0)
40094						High part of float (bytes 3-2)
40095	AO3 Parameter Value for Minimum Output	float				Low part of float (bytes 1-0)
40096						High part of float (bytes 3-2)
40097	AO3 Parameter Value in Hold	float				Low part of float (bytes 1-0
40098						High part of float (bytes 3-2)

Address	Register Function	Size	Min. Value	Max. Value	Default Value	Details
40099	AO4 Mode	uint8_t	0	1	0	0 = Disabled 1 = Track Channel
40100	AO4 Data Channel	uint8_t	0	1	0	0 = CH1 (Probe 1) 1 = CH2 (Probe 2)
40101	AO4 Parameter to Follow	uint8_t	0	4	0	0 = Ctrl SetP1 1 = Ctrl SetP2 2 = Main parameter 3 = Temp. Param. 4 = Auxiliary Param.
40102	AO4 mA Range	uint8_t	0	1	0	0 = "0-20 mA" 1 = "4-20 mA"
40103	AO4 Value in Hold Option	uint8_t	0	1	0	0 = "Last value" 1 = "Fix value"
40104	AO4 22 mA on Hold Option	uint8_t	0	1	0	0 = "Disabled" 1 = "Enabled"
40105	AO4 Parameter Value for Maximum Output	float				Low part of float (bytes 1-0)
40106						High part of float (bytes 3-2)
40107	AO4 Parameter Value for Minimum Output	float				Low part of float (bytes 1-0)
40108						High part of float (bytes 3-2)
40109	AO4 Parameter Value in Hold	float				Low part of float (bytes 1-0)
40110						High part of float (bytes 3-2)
40113	Controller Clock_Year	uint8_t	20	99	22	
40114	Controller Clock_Month	uint8_t	1	12	1	
40115	Controller Clock_Day	uint8_t	1	31	1	
40116	Controller Clock_WeekDay	uint8_t	0	6	1	
40117	Controller Clock_Hour	uint8_t	0	23	12	
40118	Controller Clock_Minute	uint8_t	0	59	0	
40119	Controller Clock_Second	uint8_t	0	59	0	
40129	CH1 Setpoint 1 Parameter Number	uint8_t	0	1	0	0 = Main parameter 1 = Temperature
40130	CH1 Setpoint 1 Status	uint8_t	0	1	0	0 = Disabled 1 = Active
40131	CH1 Setpoint 1 Control Mode	uint8_t	0	2	0	0 = On/Off control 1 = prop. control 2 = PID control
40132	CH1 Setpoint 1 Overtime	uint16_t	10	120	30	[minutes] 0 = Overtime alarm disabled
40133	CH1 Setpoint 1 Minim OnTime	uint16_t	1	10	3	[seconds]
40134	CH1 Setpoint 1 Value	float	Low limit parameter	High Limit parameter	Param. default control	Low part of float (bytes 1-0)
40135						High part of float (bytes 3-2)

Address	Register Function	Size	Min. Value	Max. Value	Default Value	Details
40136	CH1 Setpoint 1 Control Action	uint8_t	0	1	0	0 = Low direction 1 = High direction
40137	CH1 Setpoint 1 Control Period	uint16_t	10	1800	60	[seconds]
40138	CH1 Setpoint 1 Deviation	float	Parameter dependent	Parameter dependent	Parameter dependent	Low part of float (bytes 1-0)
40139						High part of float (bytes 3-2)
40140	CH1 Setpoint 1 Hysteresis	float	Parameter dependent	Parameter dependent	Parameter dependent	Low part of float (bytes 1-0)
40141						High part of float (bytes 3-2)
40142	CH1 Setpoint 1 Reset Time	uint16_t	60	60000	60000	[seconds]
40143	CH1 Setpoint 1 Rate Time	uint16_t	0	60000	0	[seconds]
40144	CH1 Setpoint 2 Parameter Number	uint8_t	0	1	0	0 = Main parameter 1 = Temperature
40145	CH1 Setpoint 2 Status	uint8_t	0	1	0	0 = Disabled 1 = Active
40146	CH1 Setpoint 2 Control Mode	uint8_t	0	2	0	0 = On/Off control 1 = Prop. control 2 = PID control
40147	CH1 Setpoint 2 Overtime	uint16_t	10	120	30	[minutes] 0 = Overtime alarm disabled
40148	CH1 Setpoint 2 Minim OnTime	uint16_t	1	10	3	[seconds]
40149	CH1 Setpoint 2 Value	float	Low limit parameter	High Limit parameter	Param. default control	Low part of float (bytes 1-0)
40150						High part of float (bytes 3-2)
40151	CH1 Setpoint 2 Control Action	uint8_t	0	1	0	0 = Low direction 1 = High direction
40152	CH1 Setpoint 2 Control Period	uint16_t	10	1800	60	[seconds]
40153	CH1 Setpoint 2 Deviation	float	Parameter dependent	Parameter dependent	Parameter dependent	Low part of float (bytes 1-0)
40154						High part of float (bytes 3-2)
40155	CH1 Setpoint 2 Hysteresis	float	Parameter dependent	Parameter dependent	Parameter dependent	Low part of float (bytes 1-0)
40156						High part of float (bytes 3-2)
40157	CH1 Setpoint 2 Reset Time	uint16_t	60	60000	60000	[seconds]
40158	CH1 Setpoint 2 Rate Time	uint16_t	0	60000	0	[seconds]
40161	CH1 Main Param. Alarm High Enable	uint8_t	0	1	0	0 = Disable 1 = Enable
40162	CH1 Main Param. Alarm Low Enable	uint8_t	0	1	0	0 = Disable 1 = Enable
40163	CH1 Main Param. Alarm High Delay Off Time	uint16_t	5	999	5	[seconds]
40164	CH1 Main Param. Alarm High Mask Time	uint16_t	0	1800	5	[seconds]

Address	Register Function	Size	Min. Value	Max. Value	Default Value	Details
40165	CH1 Main Param. Alarm High Value	float	Param. low limit measured	Param. high limit measured	Param. dep. default	Low part of float (bytes 1-0)
40166						High part of float (bytes 3-2)
40167	CH1 Main Param. Alarm Low Value	float	Param. low limit measured	Param. high limit measured	Param. dep. default	Low part of float (bytes 1-0)
40168						High part of float (bytes 3-2)
40169	CH1 Temp. Param. Alarm High Enable	uint8_t	0	1	0	0 = Disable 1 = Enable
40170	CH1 Temp. Param. Alarm Low Enable	uint8_t	0	1	0	0 = Disable 1 = Enable
40171	CH1 Temp. Param. Alarm High Delay Off Time	uint16_t	5	999	5	[seconds]
40172	CH1 Temp. Param. Alarm High Mask Time	uint16_t	0	1800	5	[seconds]
40173	CH1 Temp. Param. Alarm High Value	float	Param. low limit measured	Param. high limit measured	Param. dep. default	Low part of float (bytes 1-0)
40174						High part of float (bytes 3-2)
40175	CH1 Temp. Param. Alarm Low Value	float	Param. low limit measured	Param. high limit measured	Param. dep. default	Low part of float (bytes 1-0)
40176						High part of float (bytes 3-2)
40185	CH2 Setpoint 1 Parameter Number	uint8_t	0	1	0	0 = Main parameter 1 = Temperature
40186	CH2 Setpoint 1 Status	uint8_t	0	1	0	0 = Disabled 1 = Active
40187	CH2 Setpoint 1 Control Mode	uint8_t	0	2	0	0 = On/Off control 1 = Prop. control 2 = PID control
40188	CH2 Setpoint 1 Overtime	uint16_t	10	120	30	[minutes] 0 = Overtime alarm disabled
40189	CH2 Setpoint 1 Minim OnTime	uint16_t	1	10	3	[seconds]
40190	CH2 Setpoint 1 Value	float	Low limit parameter	High Limit parameter	Param. default control	Low part of float (bytes 1-0)
40191						High part of float (bytes 3-2)
40192	CH2 Setpoint 1 Control Action	uint8_t	0	1	0	0 = Low direction 1 = High direction
40193	CH2 Setpoint 1 Control Period	uint16_t	10	1800	60	[seconds]
40194	CH2 Setpoint 1 Deviation	float	Parameter dependent	Parameter dependent	Parameter dependent	Low part of float (bytes 1-0)
40195						High part of float (bytes 3-2)
40196	CH2 Setpoint 1 Hysteresis	float	Parameter dependent	Parameter dependent	Parameter dependent	Low part of float (bytes 1-0)

Address	Register Function	Size	Min. Value	Max. Value	Default Value	Details
40197						High part of float (bytes 3-2)
40198	CH2 Setpoint 1 Reset Time	uint16_t	60	60000	60000	[seconds]
40199	CH2 Setpoint 1 Rate Time	uint16_t	0	60000	0	[seconds]
40200	CH2 Setpoint 2 Parameter Number	uint8_t	0	1	0	0 = Main parameter 1 = Temperature
40201	CH2 Setpoint 2 Status	uint8_t	0	1	0	0 = Disabled 1 = Active
40202	CH2 Setpoint 2 Control Mode	uint8_t	0	2	0	0 = On/Off control 1 = Prop. control 2 = PID control
40203	CH2 Setpoint 2 Overtime	uint16_t	10	120	30	[minutes] 0 = Overtime alarm disabled
40204	CH2 Setpoint 2 Minim OnTime	uint16_t	1	10	3	[seconds]
40205	CH2 Setpoint 2 Value	float	Low limit parameter	High Limit parameter	Param. default control	Low part of float (bytes 1-0)
40206						High part of float (bytes 3-2)
40207	CH2 Setpoint 2 Control Action	uint8_t	0	1	0	0 = Low direction 1 = High direction
40208	CH2 Setpoint 2 Control Period	uint16_t	10	1800	60	[seconds]
40209	CH2 Setpoint 2 Deviation	float	Parameter dependent	Parameter dependent	Parameter dependent	Low part of float (bytes 1-0)
40210						High part of float (bytes 3-2)
40211	CH2 Setpoint 2 Hysteresis	float	Parameter dependent	Parameter dependent	Parameter dependent	Low part of float (bytes 1-0)
40212						High part of float (bytes 3-2)
40213	CH2 Setpoint 2 Reset Time	uint16_t	60	60000	60000	[seconds]
40214	CH2 Setpoint 2 Rate Time	uint16_t	0	60000	0	[seconds]
40217	CH2 Main Param. Alarm High Enable	uint8_t	0	1	0	0 = Disable 1 = Enable
40218	CH2 Main Param. Alarm Low Enable	uint8_t	0	1	0	0 = Disable 1 = Enable
40219	CH2 Main Param. Alarm High Delay Off Time	uint16_t	5	999	5	[seconds]
40220	CH2 Main Param. Alarm High Mask Time	uint16_t	0	1800	5	[seconds]
40221	CH2 Main Param. Alarm High Value	float	Param. low limit measured	Param. high limit measured	Param. dep. default	Low part of float (bytes 1-0)
40222						High part of float (bytes 3-2)
40223	CH2 Main Param. Alarm Low Value	float	Param. low limit measured	Param. high limit measured	Param. dep. default	Low part of float (bytes 1-0)
40224						High part of float (bytes 3-2)

Address	Register Function	Size	Min. Value	Max. Value	Default Value	Details
40225	CH2 Temp. Param. Alarm High Enable	uint8_t	0	1	0	0 = Disable 1 = Enable
40226	CH2 Temp. Param. Alarm Low Enable	uint8_t	0	1	0	0 = Disable 1 = Enable
40227	CH2 Temp. Param. Alarm High Delay Off Time	uint16_t	5	999	5	[seconds]
40228	CH2 Temp. Param. Alarm High Mask Time	uint16_t	0	1800	5	[seconds]
40229	CH2 Temp. Param. Alarm High Value	float	Param. low limit measured	Param. high limit measured	Param. dep. default	Low part of float (bytes 1-0)
40230						High part of float (bytes 3-2)
40231	CH2 Temp. Param. Alarm Low Value	float	Param. low limit measured	Param. high limit measured	Param. dep. default	Low part of float (bytes 1-0)
40232						High part of float (bytes 3-2)
40241	Math CH Function	uint8_t	0	4	0	0 = Disabled 1 = Difference 2 = Ratio 3 = Passage 4 = Rejection
40242	Math CH Alarm0_HighValue	float				bytes 1-0
40243						bytes 3-2
40244	Math CH Alarm0_LowValue	float				bytes 1-0
40245						bytes 3-2
40246	Math CH Alarm1_HighValue	float				bytes 1-0
40247						bytes 3-2
40248	Math CH Alarm1_LowValue	float				bytes 1-0
40249						bytes 3-2
40250	Math CH Alarm2_HighValue	float				bytes 1-0
40251						bytes 3-2
40252	Math CH Alarm2_LowValue	float				bytes 1-0
40253						bytes 3-2
40254	Math CH Alarm3_HighValue	float				bytes 1-0
40255						bytes 3-2
40256	Math CH Alarm3_LowValue	float				bytes 1-0
40257						bytes 3-2
40258	Math CH Enable Alarm0 High	uint8_t	0	1	0	0 = Disabled 1 = Enabled
40259	Math CH Enable Alarm0 Low	uint8_t	0	1	0	
40260	Math CH Enable Alarm1 High	uint8_t	0	1	0	
40261	Math CH Enable Alarm1 Low	uint8_t	0	1	0	
40262	Math CH Enable Alarm2 High	uint8_t	0	1	0	
40263	Math CH Enable Alarm3 Low	uint8_t	0	1	0	
40264	Math CH Enable Alarm0 High	uint8_t	0	1	0	
40265	Math CH Enable Alarm0 Low	uint8_t	0	1	0	
40266	Math CH Alarm0 Mask Time	uint16_t	0	1800	5	[seconds]
40267	Math CH Alarm0 Delay Off Time	uint16_t	0	999	5	[seconds]

Address	Register Function	Size	Min. Value	Max. Value	Default Value	Details
40268	Math CH Alarm1 Mask Time	uint16_t	0	1800	5	[seconds]
40269	Math CH Alarm1 Delay Off Time	uint16_t	0	999	5	[seconds]
40270	Math CH Alarm2 Mask Time	uint16_t	0	1800	5	[seconds]
40271	Math CH Alarm3 Delay Off Time	uint16_t	0	999	5	[seconds]
40272	Math CH Alarm3 Mask Time	uint16_t	0	1800	5	[seconds]
40273	Math CH Alarm3 Delay Off Time	uint16_t	0	999	5	[seconds]

Note: *Channel 2 (CH2)/Math Channel (Math CH) addresses do not apply to HI510.*
Readings related to CH2/Math CH address items are routed as requests to the corresponding CH1 address item.
Writing to CH2/Math CH address items generates a response error.

6. ABBREVIATIONS

ASCII	American Standard Code for Information Interchange
COMM	Communication
EEPROM	Electrically Erasable Programmable Read-Only Memory
FIFO	First-In-First-Out
FW	Firmware
IO	Input-Output
LED	Light-Emitting Diode
MEI	Modbus Encapsulated Interface
MFS	Master File System
NIST	National Institute of Standards and Technology
SN	Serial Number
uint	Unsigned Integer

CERTIFICATION

All Hanna® instruments conform to the **CE European Directives** and **UK standards**.

Disposal of Electrical & Electronic Equipment. The product should not be treated as household waste. Instead hand it over to the appropriate collection point for the recycling of electrical and electronic equipment which will conserve natural resources.

Ensuring proper product and battery disposal prevents potential negative consequences for the environment and human health. For more information, contact your city, your local household waste disposal service, or the place of purchase.

RECOMMENDATIONS FOR USERS

Before using this product, make sure it is entirely suitable for your specific application and for the environment in which it is used. Any variation introduced by the user to the supplied equipment may degrade the controller's performance. For yours and the controller's safety do not use or store the instrument in hazardous environments.

WARRANTY

HI510 and HI520 are warrantied for two years against defects in workmanship and materials when used for its intended purpose and maintained according to instructions. Damage due to accidents, misuse, tampering, or lack of prescribed maintenance is not covered.

If service is required, contact your local Hanna Instruments office. If under warranty, report the model number, date of purchase, serial number, and the nature of the problem. If the repair is not covered by the warranty, you will be notified of the charges incurred. If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization (RGA) number from the Technical Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packed for complete protection.