OWNERS MANUAL

V2.1

H-3342

ABSOLUTE SHAFT ENCODER WITH LCD DISPLAY, SDI-12 AND 4-20MA OUTPUTS

WATER LOG

a xylem brand

D49 0115

CONTENTS & WARRANTY

This user manual is a guide for the H-3342 shaft encoder. For more information, updated manuals, brochures, technical notes, and supporting software on the H-3341/H-3342 shaft encoder, please refer to waterlog.com or contact your sales representative.

For additional assistance, please contact us at +1.435.753.2212 or sales@waterlog.com

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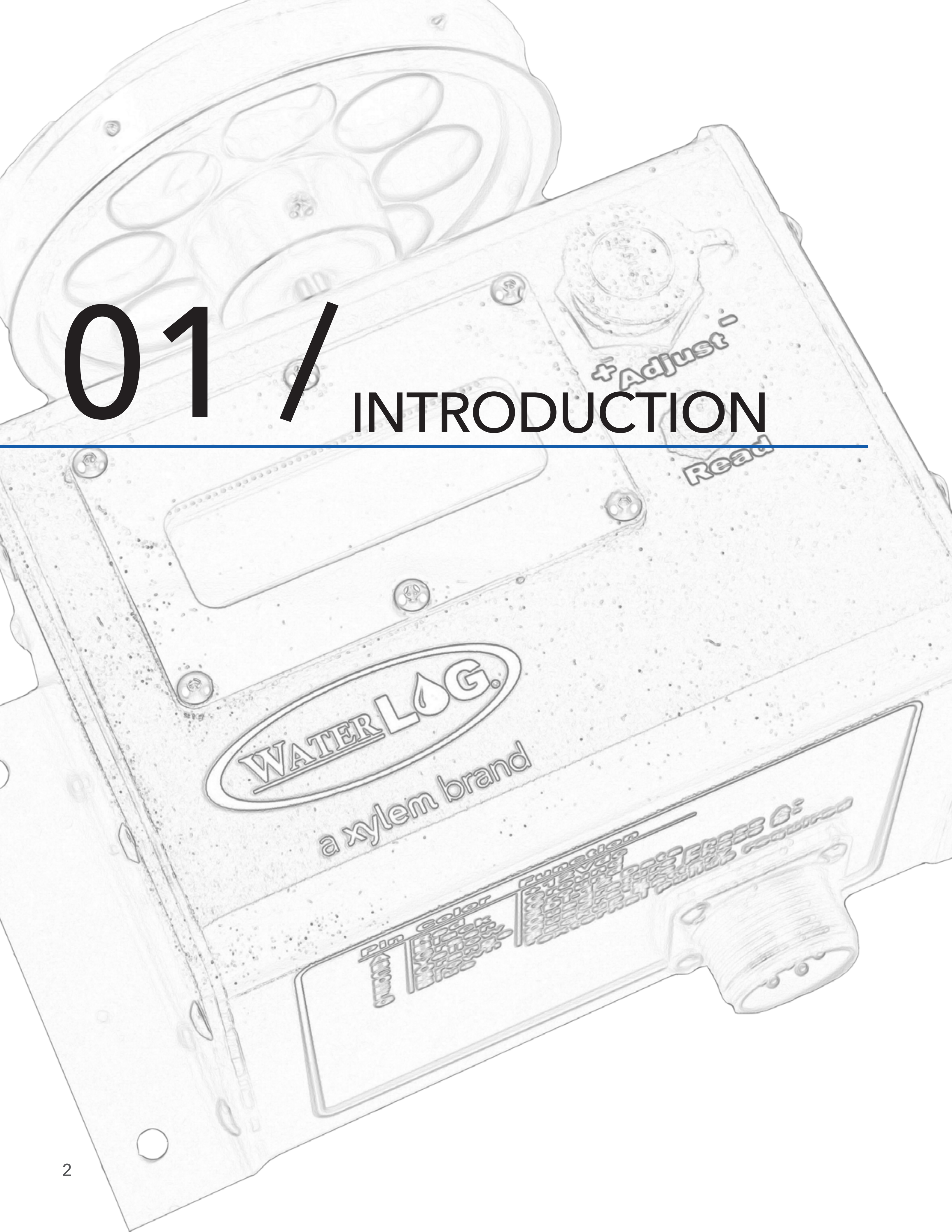
01 / INTRODUCTION



The WaterLOG® H-3342 is a digital shaft encoder which measures water depth by monitoring the position of a float and pulley. It is easy to use and works with any SDI-12 data recorder. The "Serial-Digital Interface" is ideal for data logging applications with the following requirements:

• Battery powered operation with minimal current drain
• Multiple sensors on a simple three wire cable
• Up to 250 feet of cable between a sensor and the data recorder (Use of H-423, SDI-12 to RS485 converter extends the range to 1000's of feet, a H-4500 fiberoptic media converter works up to 1.2 miles)

The H-3342 has the following features:

• Non-contact optical encoder
• Absolute shaft position is not lost if the power fails or is disconnected
• High resolution (65,536 counts/rev)
• ±32,768 max turns
• Zero backlash
• Scales the encoder position into user units of feet, meters, etc.
• Precision ball bearing design with special low temperature lubricant
• Threaded shaft compatible with existing pulleys
• Sealed enclosure protects from moisture and dirt
• Low current operation (less than 150 microamps typical standby)
• Water resistant connector provides easy hookup
• Continuous display readout always shows last measured value.
• 'Read' button causes the H-3342 to continuously update the display while the button is pressed
• Front panel adjustment for manually setting the stage
• Front panel control for setting the SDI-12 address
• Optically isolated 4-20mA output

Operation

This precision shaft encoder has a resolution of 65,536 counts per revolution (.000015 feet with 1.0 ft circumference pulley). With two non-contact encoders mounted on the same shaft, an optical encoder measures the shaft angle, and a magnetic turns counter counts the number of revolutions. The optical rotary position sensor measures the shaft angle within a 360 ° range.

As opposed to incremental encoders, the optical encoder measures the absolute position rather than the change in position. Internally, an infrared LED flashes through a circular bar code onto a linear array sensor. A microcontroller decodes the image into a unique position. Due to manufacturing tolerances of the bar code, the accuracy is less than the resolution; 4096 counts per revolution (.00024 feet with 1.0 ft circumference pulley). The turn counter monitors complete revolutions of the shaft and can count up to ±32,768 revolutions. Together the encoders provide an "absolute" measurement. The shaft position will not be lost if the power is removed, even if the shaft rotates while the power is off.

During normal operation, the SDI-12 data recorder sends an address together with a command to the encoder. The encoder wakes up from its low power sleep mode, converts the shaft position into feet, meters or other units and stores this data in its data buffer. Once the data is ready, the data recorder collects the data from the encoder's data buffer.

INTRODUCTION

LCD Display

The H-3342 has a 4-1/2 digit LCD display which shows the last measured value. The display uses negligible power and is always visible. The display will show either ±199.99 or ±19999 digits depending on how the encoder is configured.

"Read" Button

When pressed, the 'Read' button causes the H-3342 to continuously make measurements and update the display. The "±" sign flashes while making measurements indicating the display is being updated even if the value is not changing. When the button is released the display will hold the last measured value. Measurements initiated from an attached SDI-12 data logger will also cause the display to update.

Using the Adjust Knob to Change the Stage

While the 'Read' button is pressed, the Adjust screw may be turned to increase or decrease the current Stage reading. The offset adjustment is accessed by removing the attached dust cover. The encoder has a slot and is easily rotated with a screwdriver or other flat blade tool. Turn the adjustment screw clock-wise to increase the Stage and counterclockwise to decrease the Stage. Turning the adjust screw slowly will change the hundredths
digit while turning the screw fast changes the tenths digit. This allows one control to make both fine and course adjustments. Replace the dust cap whenever the adjustment is not being used.

Using the Adjust Knob to Change the SDI-12 Address

If the 'Read' button is held down while the H-3342 is being powered up, the display will show the encoder's current SDI-12 address. The SDI-12 address may be changed using the Adjust screw. Turning the Adjust screw will change the address in the range of 0 to 9. When the Read button is released, the new SDI-12 address is saved and the display switches to the normal stage readout. To change the SDI-12 address again, the power must be disconnected and the special power-up sequence repeated. The H-3342 address may also be changed with an extended SDI-12 command (see chapter 3).

4-20mA Output

The H-3342 has a 12-bit digital-to-analog converter (DAC), precision voltage reference and a 4-20mA current transmitter. The SDI-12 and 4-20mA sections are isolated from each other with a high voltage digital opto-coupler. The Stage is scaled into a 12-bit value and loaded into the digital-to-analog converter to control the current transmitter.

The 4-20mA output is updated whenever a measurement is made. If no measurements are made, the 4-20mA output becomes "stale". For industrial applications where the H-3342 is connected to a SCADA or PLC system and low-power is not of concern, the H-3342 can be programmed to make continuous measurements (see chapter 3). The H-3342 comes from the factory with the power mode set to the Sleep mode.

NOTE: When the H-3342 is first powered up, the output current is set to 4.0mA. It remains at 4.0mA until the first measurement sequence. The digital-to-analog converter is powered from the loop side of the opto-isolator. If the loop power is disconnected or is applied after the SDI-12 side is powered up, the data in the digital-to-analog converter will be lost. When the loop power is restored, the 4-20mA output will be at an unknown value. Once a fresh SDI-12 measurement is made, the digital-to-analog converter will be loaded with new valid data.

02 / INSTALLATION

INSTALLATION

Installation

The H-3342 is suitable for outdoor environments but must be installed in a protective enclosure or gauge house. Normally, the housing is screwed or bolted to a shelf in the gauge station with the pulley and tape protruding over the edge of the shelf above the water. Make certain the housing is level and the pulley and tape do not rub on any obstructions.

Making Output Connections

The H-3342 is an SDI-12 V1.2 compliant sensor that connects directly to any data recorder with SDI-12 capability. In addition, the H-3342 has an optically isolated 4-20mA output.

The power for the H-3342 is supplied by the +12Volt DC input. The table below shows the proper connections. The wiring diagram is printed on the H-3342's housing. A 6-conductor cable is supplied with the H-3342.

Table 1: H-3342 Cable Connections

Pin	Wire	Name
A	Red	+12V DC
B	Black	Ground
C	Green	Ground
D	Yellow	SDI-12 Data
E	Orange	4-20mA +
F	Brown	4-20mA -

Figure 1: H-3342 Wiring Diagram

4-20mA Output

Current loop sensors output a current rather than a voltage. The 4-20mA output will drive standard industrial telemetry and process control instrumentation. Since the signal to noise margin of 4-20mA is not large, take care to protect the wiring from noise and interference. The loop power supply must be sufficient to maintain 8.5 to 35 Volts across the H-3342's output terminals, in addition to whatever voltage is needed to maintain 20mA across the loop receiver and interconnect wiring. The +12.0V SDI-12 power source will work if the resistance of your loop receiver and wiring is less than 150 ohms.

$$8.5V + (150ohms * 20mA) = 11.5V$$

The 4-20mA output is reverse diode protected.
- Make certain there is 8.5 to 35V across the 4-20mA output terminals.
- Make certain the H-3342 is receiving +12V power from the SDI-12 bus.
- Use shielded 4-20mA cables in noisy environments.

Programming Your Data Recorder

You must prepare your data recorder to receive and record the H-3342 data. Since data recorders differ widely, we recommend you refer to your recorder manufacturer's directions. In general, program the data recorder to input three values via the SDI-12 port. Usually only one or two of the parameters is actually recorded. Your data recorder must issue an "aM!" command, then collect the data with a "aD0" command, as explained in Chapter 3. The H-3342 places three parameters in its data buffer:

a+BB.BBB+CC.CCC+D

Where:

a	= Is the SDI-12 address 0-9, A-Z
BB.BBB	= Stage in user units of Feet, Meters etc.
CC.CCC	= Raw encoder position in units of revolutions (turns)
D	= Encoder status:

0 = no error
1 = not enough light
2 = too much light
3 = misalignment or dust
4 = misalignment or dust
5 = misalignment or dust
6 = hardware problem
7 = fast mode error
8 = multi turn position not initialized
15 = no response from the encoder (data is unusable)
16 = turn counter error (data is unusable)

Programming the H-3342

The H-3342 comes from the factory with the following settings:

SDI Address: 0	Power_Mode: 0 (sleep)
StageSlope: 1.00	4-20mA_Hi: 20.0 Ft
StageOffset: 0.000	4-20mA_Lo: 4.0 Ft
LCD_Digits: 2 (±199.99)	SDI_Digits: 3 (±xxx.xxx)

With these values the data will be in units of feet when used with a pulley having a circumference of 12 inches. The slope can be changed to accommodate other pulley circumferences or to change the data to other engineering units such as inches or Meters.

The LCD display can display the Stage in one of two formats: ±199.99 or ±19999. By default SDI-12 measurement data is sent with more precision than will fit on the LCD display. The default is three digits (x.xxx). Some users prefer to have the SDI-12 measurement data exactly match the value on the LCD display. If this is the case, use the aXWSDInn command and set SDI-Digits to 2, such that two digits beyond the decimal point are sent in the SDI-12 response (x.xx).

The setups are stored in EEPROM within the H-3342 and will not be lost if the power is disconnected. See Chapter 3 for detail on extended commands for changing these setups.

INSTALLATION

Programming the SDI-12 Address

If more than one sensor is to be connected to the SDI-12 bus, make certain each sensor has a different sensor address. The H-3342 comes from the factory with its address set to “0”. The address can be programmed with either an SDI-12 command (see Chapter 3) or using the offset adjust control on the H-3342’s faceplate.

To change the address with the adjust control, press and hold the ‘Read’ button while the H-3342 is being powered up. The display will show the current SDI-12 address, which may be changed in the range of 0 to 9 using the adjust screw. When the Read button is released the new SDI-12 address is saved and the display switches to the normal stage readout. To change the SDI-12 address again, the power must be disconnected and the special power-up sequence repeated.

Setting the Stage

Many applications use the shaft encoder to monitor water in a stilling well. A float and pulley translate the water level to rotation of the encoder’s shaft. Because the H-3342 is an absolute encoder, the turn count and shaft angle cannot be “reset”. When the H-3342 is first installed, you will want to adjust the StageOffset such that the LCD display and SDI-12 data correspond to the current water elevation or stage as determined with a staff gauge or other datum.

With the shaft pointing toward you, rotating the encoder shaft clockwise produces an increasing (positive) shaft position value. If this is backwards from your needs, either program the StageSlope with a negative value, or exchange the float and counter weight on the pulley. To adjust the Stage, press the “Read” button and rotate the Adjust screw on the faceplate.

Turn the adjustment screw clock-wise to increase the Stage and counter-clock wise to decrease the Stage. Turning the adjust screw slowly will change the hundredths digit while turning the screw fast changes the tenths digit. This allows one control to make both fine and course adjustments.

Alternatively, an extended SDI-12 command is convenient to quickly set the Stage reading to match the current water level. The “aXSCSdd.d!” command causes the H-3342 to take a fresh measurement and automatically update the Offset as needed to produce the desired Stage (see chapter 3).

Example of an extended “Set Current Stage” command:

Command	Response	Time	Values	Description
“aXSCS2.3!”	“a0021<cr><lf>”	2 sec	1	Set the Stage to 2.3

Subsequent Command	Response	Description
“aD0”	a+12.80<cr><lf>	The new Offset

Programming the 4-20mA Output

The H-3342 scales the current Stage data to drive the 4-20mA output. The 4-20mA_Hi and 4-20mA_Lo settings control how the Stage data is processed. The 4-20mA_Lo should be set to the desired Stage corresponding a 4.00mA output. The 4-20mA_Hi should be set to the desired Stage corresponding to a 20.00mA output. For testing purposes, the H-3342 comes from the factory with 4-20mA_Hi = 20.0 and 4-20mA_Lo = 4.00 (see chapter 3).

The extended "aXS!" command allows convenient testing of the 4-20mA output. This command allows the user to temporarily force the Stage to a test value. For example, the user can force the shaft position (Stage)

to several different values while calibrating or monitoring the attached 4-20mA instrumentation. Once a fresh measurement is made via a SDI-12 measurement or by pressing the "Read" button, the temporary Stage data is overridden.

The 4-20mA output is updated whenever a measurement is made. If no measurements are made, the 4-20mA output becomes "stale". For industrial applications where the H-3342 is connected to a SCADA or PLC system (or no data logger is employed) and low-power is not of concern, the H-3342 can be programmed to make continuous measurements (see chapter 3). The H-3342 comes from the factory with the power mode set to the Sleep mode.

Testing

After completing the installation, test the encoder by manually rotating the pulley. Press and hold the "Read" button to observe the Stage data. Make certain the readout matches the expected measurement.

03 / SDI-12 COMMAND & RESPONSE PROTOCOL

This is a brief description of the Serial Digital Interface (SDI-12) Command and Response Protocol used by the WATERLOG® Series Model H-3342 sensor. Included is a description of the commands and data format supported by the H-3342.

Refer to the document "A SERIAL DIGITAL INTERFACE STANDARD FOR HYDROLOGIC AND ENVIRONMENTAL SENSORS." Version 1.2 April 12, 1996 Coordinated by the SDI-12 Support Group, 135 East Center, Logan, Utah.

During normal communication, the data recorder sends an address together with a command to the H-3342 SDI-12 sensor. The H-3342 then replies with a "response." In the following descriptions, SDI-12 commands and responses are enclosed in quotes. The SDI-12 address and the command/response terminators are defined as follows:

"a"	Is the sensor address. The following ASCII Characters are valid addresses: "0-9", "A-Z", "a-z", "*", "?". Sensors will be initially programmed at the factory with the address of "0" for use in single sensor systems. Addresses "1 to 9" and "A to Z" or "a to z" can be used for additional sensors connected to the same SDI-12 bus. Address "*" and "?" are "wild card" addresses which select any sensor, regardless of its actual address.
"!"	Is the last character of a command block.
"<cr><lf>"	Are carriage return (0D) hex and line feed (0A) hex characters. They are the last two characters of a response block.

Note:

- All commands/responses are upper-case printable ASCII characters.
- Commands must be terminated with a "!" character.
- Responses are terminated with <cr><lf> characters.
- The command string must be transmitted in a contiguous block with no gaps of more than 1.66 milliseconds between characters.

Measure Command

The Measure Command causes a measurement sequence to be performed. Data values generated in response to this command are stored in the sensor's buffer for subsequent collection using "D" commands. The data will be retained in the sensor until another "M", " C", or "V" command is executed.

Example of an extended "Set Current Stage" command:

Command	Response	Description
"aM!"	"atttn<cr><lf>"	Initiate measurement

Where:

a is the sensor address ("0-9", "A-Z", "a-z", "*", "?").

M is an upper-case ASCII character

SDI-12 COMMAND & RESPONSE PROTOCOL

ttt is a three digit integer (000-999) specifying the maximum time, in seconds, the sensor will take to complete the command and have measurement data available in its buffer.

n is a single digit integer (0-9) specifying the number of values that will be placed in the data buffer. If “n” is zero (0), no data will be available using subsequent “D” commands.

Upon completion of the measurement, a service request “a<cr><lf>” is sent to the data recorder indicating the sensor data is ready. The data recorder may wake the sensor with a break and collect the data any time after the service request is received or the specified processing time has elapsed.

Example of an “aM!” command:

Command	Response	Time	Values	Description
“aM!”	“a0023<cr><lf>”	2 sec	3	Make measurement

Subsequent Command	Response
“aD0”	a+AA.AAA+BB.BBB+CC<cr><lf>

Where:

AA.AAA = Stage
BB.BBB = Raw Encoder Position (turns)
CC = Encoder Status:

- 0 = no error
- 1 = not enough light
- 2 = too much light
- 3 = misalignment or dust
- 4 = misalignment or dust
- 5 = misalignment or dust
- 6 = hardware problem
- 7 = fast mode error
- 8 = multi turn position not initialized
- 15 = no response from the encoder (data is unusable)
- 16 = turn counter error (data is unusable)

Concurrent Measurement Command

This is a new command for the Version 1.2 SDI-12 Specification. A concurrent measurement is one which occurs while other SDI-12 sensors on the bus are also taking measurements. This command is similar to the "aM!" command, however, the nn field has an extra digit and the sensor does not issue a service request when it has completed the measurement. Communicating with other sensors will NOT abort a concurrent measurement. Data values generated in response to this command are stored in the sensor's buffer for subsequent collection using "D" commands. The data will be retained in the sensor until another "M", "C", or "V" command is executed.

Example of a "Concurrent Measurement" command:

Command	Response	Description
"aC!"	"atttnn<cr><lf>"	Initiate measurement

Where:

a is the sensor address ("0-9", "A-Z", "a-z", "*", "?").

M is an upper-case ASCII character

ttt is a three digit integer (000-999) specifying the maximum time, in seconds, the ensor will take to complete the command and have measurement data available in its buffer.

nn is a two digit integer (00-99) specifying the number of values that will be placed in the data buffer. If "n" is zero (0), no data will be available using subsequent "D" commands.

The data recorder may wake the sensor with a break and collect the data anytime after the specified processing time has elapsed.

Send Data Command

The Send Data command returns sensor data generated as the result of previous "aM!", "aC!", or "aV!" commands. Values returned will be sent in 33 characters or less. The sensor's data buffer will not be altered by this command.

Example of a "Send Data" command:

Command	Response
"aD0!" through "aD9!"	"apd.d ... pd.d<cr><lf>"

Where:

a is the sensor address ("0-9", "A-Z", "a-z", "*", "?").
D0..D9 are upper-case ASCII characters.

p	Is a polarity sign (+ or -)
d.d	represents numeric digits before and/or after the decimal. A decimal may be used in any position in the value after the polarity sign. If a decimal is not used, it will be assumed to be after the last digit. For example: +3.29 +23.5 -25.45 +300

If one or more values were specified and a "aD0!" returns no data (a<CR><LF> only), it means that the measurement was aborted and a new "M" command must be sent.

Example of an "aD0!" command:

Previous Command	Response
"aM!"	"a0023<cr><lf>"
Subsequent Command	Response
"aD0"	a+AA.AAA+BB.BBB+CC<cr><lf>

Where:

AA.AAA	= Stage
BB.BBB	= Raw Encoder Position
CC	= Encoder Status (see aM! command)

Continuous Measurements

This is a new command for the Version 1.2 SDI-12 Specification. Sensors that are able to continuously monitor the phenomena to be measured, such as a cable position, do not require a start measurement command. They can be read directly with the R commands (R0!...R9!). The R commands work exactly like the D (D0!...D9!) commands. The only difference is that the R commands do not need to be preceded with an M command.

The H-3342 DOES NOT support the aR0! continuous measurement commands.

Send Acknowledge Command

The Send Acknowledge Command returns a simple status response which includes the address of the sensor. Any measurement data in the sensor's buffer is not disturbed.

Example of a "Send Acknowledge" command:

Command	Response
"a!"	"a<cr><lf>"

Where:

a Is the sensor address ("0-9", "A-Z", "a-z", "*", "?").

Initiate Verify Command

The Verify Command causes a verify sequence to be performed. The result of this command is similar to the “aM!” command except that the values generated are fixed test data and the results of diagnostic checksum tests. The data generated in response to this command is placed in the sensor’s buffer for subsequent collection using “D” commands. The data will be retained in the sensor until another “M”, “C”, or “V” command is executed.

Command	Response	Description
“aV!”	“atttn<cr><lf>”	Initiate verify sequence

Where:

a is the sensor address (“0-9”, “A-Z”, “a-z”, “*”, “?”)

V is an upper-case ASCII character

ttt is a three digit integer (000-999) specifying the maximum time, in seconds, the sensor will take to complete the command and have data available in its buffer.

N is a single digit integer (0-9) specifying the number of values that will be placed in the data buffer. If “n” is zero (0), no data will be available using subsequent “D” commands.

Example of an“aV!” command:

Command	Response	Time	Values	Description
“aV!”	“a0013<cr><lf>”	1 sec	3	Return fixed data and diagnostic data for testing purposes.

Subsequent Command	Response
“aD0”	a+123.456+78.9+y<cr><lf>

Key	Description	Units
+123.456	Fixed test data	
+78.9	Fixed test data	
y	ROM checksum test	0 = Failed, 1 = Passed

Send Identification Command

The Send Identification Command responds with sensor vendor, model, and version data. Any measurement data in the sensor’s buffer is not disturbed.

Command	Response
“aI!”	“aIlccccccccmmmmmmvvvxx...xx<cr><lf>”

Where:

a is the sensor address (“0-9”, “A-Z”, “a-z”, “*”, “?”)

I is an upper-case ASCII character

ll is the SDI-12 version compatibility level, e.g. version 1.2 is represented as “12”

cccccccc is an 8 character vendor identification to be specified by the vendor and usually in the form of a company name or its abbreviation.

mmmmmm is a 6 character field specifying the sensor model number

vvv is a 3 character field specifying the sensor version number

xx...xx is an optional field of up to a maximum of 13 characters to be used for serial number or other specific sensor information not relevant to operation of the data recorder.

Example of an“aI!” command:

“a12 DAA H-3341vvvS#nnnnnnVkkk<cr><lf>”

H-3342 implementation of the optional 13 character field: S#nnnnnnVkkk (12 bytes total)

Where:

"nnnnnn" is a six character sensor serial number

"kkk" is a three digit sensor firmware revision level

Change Sensor Address

The Change Sensor Address Command allows the sensor address to be changed. The address is stored in non-volatile EEPROM within the sensor. The H-3341 will not respond if the command was invalid, the address was out of range, or the EEPROM programming operation failed.

Command	Response	Description
“aAn!”	“n<cr><lf>”	Change sensor address

Where:

a is the current (old) sensor address ("0-9", "A-Z", "a-z", "*", "?"). An ASCII "*" may be used as a "wild card" address if the current address is unknown and only one sensor is connected to the bus.

A is an upper-case ASCII character

n is the new sensor address to be programmed ("0-9", "A-Z", "a-z", "*", "?")

NOTE: To verify the new address use the "Identify Command."

Example of a "Change Sensor Address" command:

Command	Response	Description
"aA2!"	"2<cr><lf>"	Change sensor address to "2"

Extended Set_Stage

This command is used for convenience in testing the 4-20mA output. This command allows the user to temporarily force the Stage to a test value. For example, the user can force the shaft position (Stage) to several different values while calibrating or monitoring the attached 4-20mA instrumentation. Once a fresh measurement is made via a SDI-12 measurement or by pressing the "Read" button, the temporary Stage data is overridden.

Example of a "Change Sensor Address" command:

Command	Response	Time	Values	Description
"aXS2.3!"				Set the Stage to 2.3

Extended Set_Current_Stage

The H-3342 processes the raw shaft position with a Stage = mX+b equation. During installation it is convenient to quickly set the H-3342's Stage reading to match the current stage or elevation of the water as determined by a staff gauge or other datum. This command causes the H-3342 to make a fresh measurement and automatically update the Offset (b) term as needed to produce the desired Stage.

Example of a "Change Sensor Address" command:

Command	Response	Time	Values	Description
"aXSCS2.3!"	"a0021<cr><lf>"	2 sec	1	Set the Stage to 2.3

Subsequent Command	Response	Description
"aD0"	a+12.80<cr><lf>	The new Offset

Extended Read/Write Stage_Offset and Read/Write Stage_Slope

The H-3342 processes the raw shaft position with a Stage = mX+b equation. The Slope (m) and Offset (b) terms are programmable, allowing the user to scale the reading into other engineering units. These commands allow the user to read or write (change) the Stage_Slope and Stage_Offset terms. The slope is set to 1.00 and the offset to 0.00 at the factory. With the Stage_Slope set to 1.00 the Stage will be in units of shaft revolutions (1 rev =1.0). The new values are stored in non-volatile EEPROM within the sensor. Once the new Stage_Slope or Stage_Offset value is written to the EEPROM, a copy is sent to the sensor data buffer for verification. This data can be viewed by using a subsequent "D" command. To verify these settings any other time, use the "XRSS" or "XRSO" commands.

Command	Response	Description
"aXRSS!"	"a0011<cr><lf>"	Read StageSlope
"aXRSO!"	"a0011<cr><lf>"	Read StageOffset
"aXWSSddd!"	"a0011<cr><lf>"	Write StageSlope
"aXWSOddd!"	"a0011<cr><lf>"	Write StageOffset

Where:

a	is the sensor address ("0-9", "A-Z", "a-z", "*", "?")
XRSS	are upper case characters
XRSO	are upper case characters
XWSS	are upper case characters
XWSO	are upper case characters
ddd	is the new slope or offset value (For example: 20.0 0.195 -500)

This command takes 001 seconds to complete and places 1 value in the data buffer. Use the "aD0" command to collect and view the slope or offset.

Example of a "Read Stage_Slope" command:

Command	Response	Time	Values	Description
"aXRSS!"	"a0011<cr><lf>"	1 sec	1	Read StageSlope

Command	Response	Description
"aD0!"	"a+1.00<cr><lf>"	StageSlope is 1.00

Example of a "Write Stage_Slope" command:

Command	Response	Time	Values	Description
"aXWSS1.234!"	"a0011<cr><lf>"	1 sec	1	Write StageSlope

Command	Response	Description
"aD0!"	"a+1.234<cr><lf>"	StageSlope is 1.234

Extended Read/Write 4-20mA_Hi and Read/Write 4-20mA_Lo

The H-3342 scales the current Stage data to drive the 4-20mA output. The 4-20mA_Hi and 4-20mA_Lo settings control how the Stage data is processed. The 4-20mA_Lo should be set to the desired Stage corresponding a 4.00mA output. The 4-20mA_Hi should be set to the desired Stage corresponding to a 20.00mA output. These settings are stored in non-volatile EEPROM within the sensor. Once the new value is written to the EEPROM, a copy is sent to the sensor data buffer for verification. This data can be viewed by using a subsequent "D" command. To verify these settings any other time, use the "XRIH" or "XRIL" commands. For testing purposes, the H-3341 comes from the factory with 4-20mA_Hi = 20.0 and 4-20mA_Lo = 4.00.

Command	Response	Description
"aXRIH!"	"a0021<cr><lf>"	Read 4-20mA_Hi
"aXRIL!"	"a0021<cr><lf>"	Read 4-20mA_Lo
"aXWIHddd!"	"a0021<cr><lf>"	Write 4-20mA_Hi
"aXWILddd!"	"a0021<cr><lf>"	Write 4-20mA_Lo

Where:

a	is the sensor address ("0-9", "A-Z", "a-z", "*", "?")
XRIH	are upper case characters
XRIL	are upper case characters
XWIH	are upper case characters
XWIL	are upper case characters
ddd	is the new value

This command takes 001 seconds to complete and places 1 value in the data buffer. Use the "aD0" command to collect and view the slope or offset.

Example of an extended "Read 4-20mA_Hi" command:

Command	Response	Time	Values	Description
"aXRIH!"	"a0011<cr><lf>"	1 sec	1	Read 4-20mA_Hi

Command	Response	Description
"aD0!"	"a+20.00<cr><lf>"	4-20mA_Hi is 20.00

Example of an extended "Write 4-20mA_Hi" command:

Command	Response	Time	Values	Description
"aXWIH30.0!"	"a0011<cr><lf>"	1 sec	1	Write 4-20mA_Hi

Command	Response	Description
"aD0!"	"a+30.0<cr><lf>"	4-20mA_Hi is 30.00

Extended Read LCD_Digits and Write LCD_Digits

The LCD display can display the Stage in one of two formats: ±199.99 or ±19999. This command is used to change the format. The default 2-digit format (±199.99) is used when displaying the shaft position in units of feet or inches. The 0-digit format (±19999) format is useful for display in millimeters (0 thru 19.999 meters).

Once a new value is written, a copy is sent to the sensor data buffer for verification. This data can be viewed by using a subsequent "D" command. To read or verify the value any other time, use the "XRLCD" command.

Command	Response	Description
"aXRLCD!"	"a0011<cr><lf>"	Read LCD_Digits
"aXWLCDn!"	"a0011<cr><lf>"	Write LCD_Digits

Where:

a	is the sensor address ("0-9", "A-Z", "a-z", "*", "?")
XRLCD	are upper case characters
XWLCD	are upper case characters
n	is the new setting (0 or 2) 0 = ±19999 2 = ±199.99

This command takes 001 seconds to complete and places 1 value in the data buffer. Use the "aD0" command to collect and view the current value.

Example of an extended "Read LCD_Digits" command:

Command	Response	Time	Values	Description
"aXRLCD!"	"a0011<cr><lf>"	1 sec	1	Read LCD_Digits

Command	Response	Description
"aD0!"	"a+2<cr><lf>"	Format is ±199.99

Example of an extended "Write LCD_Digits" command:

Command	Response	Time	Values	Description
"aXWLCD0!"	"a0011<cr><lf>"	1 sec	1	Write LCD_Digits

Command	Response	Description
"aD0!"	"a+0<cr><lf>"	Format is ±19999.

Extended Read Power_Mode and Write Power_Mode

The 4-20mA output is updated whenever a measurement is made. For industrial applications where the H-3341 is connected to a SCADA or PLC system and low-power is not of concern, the H-3341 can be programmed to make continuous measurements. This command is used to change the power mode. The H-3341 comes from the factory with the power mode set to the Sleep mode.

Once a new value is written, a copy is sent to the sensor data buffer for verification. This data can be viewed by using a subsequent "D" command. To read or verify the value any other time, use the "XRPMD" command.

Command	Response	Description
"aXRPMD!" "	a0011<cr><lf>"	Read Power_Mode
"aXWPMDn!"	"a0011<cr><lf>"	Write Power_Mode

Where:

a	is the sensor address ("0-9", "A-Z", "a-z", "*", "?")
XRPMD	are upper case characters
XWPMD	are upper case characters
n	is the new setting (0 or 1) 0 = Sleep between measurements 1 = Make continuous measurements

This command takes 001 seconds to complete and places 1 value in the data buffer. Use the "aD0" command to collect and view the current value.

Example of an extended "Read Power_Mode" command:

Command	Response	Time	Values	Description
"aXRPMD!"	"a0011<cr><lf>"	1 sec	1	Read Power_Mode

Command	Response	Description
"aD0!"	"a+0<cr><lf>"	Mode = Sleep

Example of an extended "Write Power_Mode" command:

Command	Response	Time	Values	Description
"aXWPMD1!"	"a0011<cr><lf>"	1 sec	1	Write Power_Mode

Command	Response	Description
"aD0!"	"a+1<cr><lf>"	Mode = Always On

Extended "XTEST"

This command is used for installation or production testing and requires the use of a H-4191 RS-232 to SDI-12 interface and a PC. This command causes the H-3341 to transmit unsolicited real-time data for testing purposes. The test mode is used to help troubleshoot the installation by providing a continuous readout of shaft position. This is not compliant with the SDI-12 specification and is not used with data loggers.

To activate the test mode, send the command "aXTEST!" from the PC. The H-3341 will enter the test mode and automatically display 3 new measurements per second. The test mode is exited by sending a break or any new command on the SDI-12 bus. It may take a few tries to exit if the command is sent at the same time data is being sent from the H-3341. Removing power from the H-3341 also causes it to exit this mode.

Format= SensorAddress+Stage+RawShaftPosition+EncoderStatus

"aXTEST" displays the following data:

a +1.202 +3.222 +0
a +1.212 +3.232 +0
a +1.222 +3.342 +0
a +1.232 +3.352 +0
a +1.232 +3.352 +0
etc.

Appendix A
Specifications

General

Input:	Shaft Angle + Turn count
Encoder:	Absolute, non-contact (optical & magnetic)
Outputs:	SDI-12 & 4-20mA
Display:	4-1/2 digits x .4 in characters (±199.99 or ±19999.)
Resolution (SDI):	65,536 (16-bit) counts/rev
Accuracy:	1/4096 (.00024 rev)
Max Turns:	±32,768 rev
Max Rotation Speed:	20 rev/sec
Offset Adjust:	SDI-12 or front panel adjust

4-20mA Output

Type:	4-20mA, optically isolated
Loop Voltage:	Min: 8.5V (no load) Max: 35V
Resolution:	4µA (12-bit DAC)

SDI-12 Output

Baud Rate:	1200
Protocol:	SDI-12, 7-bit even parity, 1 stop bit
Output Voltage Levels:	Min high level: 3.5 volts Max low level: 0.8 volts
Maximum cable length:	250 ft

Power Requirements

Voltage Input:	9.6 to 30.0 Volts DC
Current:	150µA typical (sleep) 40mA typical (measurement)

Turn Count Battery (internal):

Type:	CR-1/3N (3.3V, 160mAh, lithium)
Lifetime:	10 years

Environmental

Operating Temperature:	-40 to 60 °C
Storage Temperature:	-40 to 70 °C
Humidity:	0 to 100%

Mechanical

Bearing:	Double bearing with external seal
Starting Torque:	0.15 oz in typical 0.50 oz in max over temperature
Shaft:	5/16 " dia x 1.75" long with setscrew flat
Optional Threaded Shaft:	5/16" dia x 1.75" long 24 threads per inch 0.75"
Material:	Anodized Aluminum
Size:	7 in. wide (base plate) 4-1/4 in. high (not including adjustment knob) 4 in. deep (not including shaft or connectors)

Connector

Bulkhead:	Amphenol MS3102R14S-6P (6-Pin male)
Cable:	Amphenol MS3106A14S-6S (6-Pin female)
Bulkhead:	Amphenol MS3102R14S-2P (4-Pin male)
Cable:	Amphenol MS3106A14S-2S (4-Pin female)

(cable connectors available, order separately)

Warranty

The WaterLOG® H-3342 is warranted against defects in materials and workmanship for two years from the date of shipment.

Xylem

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're 12,000 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

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Xylem—WaterLOG
1700/1725 Brannum Lane
Yellow Springs, Ohio,
45387, USA
Tel: (435) 753-2212
Fax: (435) 753-7669
sales@waterlog.com