

Model
H-340SDI

“Smart” SDI-12 Tipping Bucket
Rain Gauge



Owner's Manual
Version 1.1



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User Agreement/ WATERLOG® Warranty

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This is a binding agreement, and if not understood, USER should seek competent legal advice. By paying for the PRODUCT and opening the package, USER acknowledges to have read this Agreement and have agreed to be bound by its terms and conditions.

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Chapter 1

H-340SDI Operation

1.1 Introduction

The **WATERLOG**[®] H-340SDI is a Tipping Bucket Rain Gauge with built-in SDI-12 electronics. The SDI-12 feature converts a standard tipping bucket rain gauge into a “smart” SDI-12 sensor with additional capabilities. The H-340SDI is easy to use and works with any data recorder/logger with a SDI-12 interface. The “Serial-Digital Interface” is ideal for data logging applications with the following requirements:

- Battery powered operation with minimal current drain
- Low system cost
- Up to 200 feet of cable between a sensor and the data recorder

The H-340SDI has the following features:

- Connects directly to any data recorder with a SDI-12 port.
- Scales the bucket tips into units of inches, meters etc
- Provides built-in accumulation of daily and total rainfall
- Provides mathematical correction for bucket volume errors due to varying rainfall rate.

1.2 Theory of Operation

The H-340SDI has a built-in microprocessor which monitors the tipping bucket sensor. Whenever a bucket tip occurs the microprocessor wakes up from its low power sleep mode and adds an appropriate rainfall increment to the rainfall accumulators. The electronics has a filter circuit which prevents contact bounce in the bucket tip reed switch from causing false counts. In addition, the time between bucket tips is measured, bucket tips which occur less than 500mS apart are ignored. This helps protect from false counts of a poorly adjusted bucket mechanism.

The H-340SDI protects its rainfall accumulations with a software flag or “signature.” If the power is interrupted momentarily the H-340SDI will resume operation using the accumulation values in memory. If the power is lost long enough to destroy the signature, when the power is restored the H-340SDI resets the rainfall accumulators to 0000. To intentionally reset the H-340SDI's accumulators, disconnect the power for 5 to 10 seconds or use the extended “aXRA” command.

The H-340SDI provides daily rainfall accumulation values which are useful for data loggers which do not have special provisions for computing daily rainfall. The H-340SDI has a built-in real-time-clock which triggers a “daily reset time” event. When this event occurs the H-340SDI automatically updates its “yesterday’s total accumulation” value using “today’s total accumulation”, then zeros the “today’s total accumulation” value.

During normal operation, the data recorder sends an address together with a command to the H-340SDI sensor. The H-340SDI wakes up from its low power sleep mode and stores the requested data in its data buffer. Once the data is ready, the data recorder collects the data from the H-340SDI's data buffer.

1.3 “Smart Bucket” Theory

Tipping bucket rain gauges have a reputation for being inaccurate. Inaccuracies can be caused by algae in the bucket, evaporation and poor calibration. The greatest source of inaccuracy however, is the volume at which the tipping bucket mechanism tips is sensitive to rainfall rate. This occurs because the water droplets cause surface waves in the bucket and high rainfall rates cause superposition or “pile up” of extra water in the bucket before it actually tips over. The following graph shows the relationship between bucket volume and rainfall rate of a typical tipping bucket. In this example the bucket volume/tip changes from .009 in/tip to .013 in/tip (a 70% change) as the rainfall changes from 0 to 25 in/hour. To overcome this problem the microprocessor in the H-340SDI uses an electronic timer to precisely measure the time between bucket tips. This time value corresponds to the current rainfall rate. On a bucket-by-bucket basis the microprocessor uses a built-in polynomial to correct for the intensity sensitivity of the bucket mechanism. For example, bucket tips which are 50 seconds apart (1 in/hr) are computed with a 0.09in/tip accumulation. Bucket tips 2 seconds apart (25 in/hr) produce a .012in/tip accumulation.

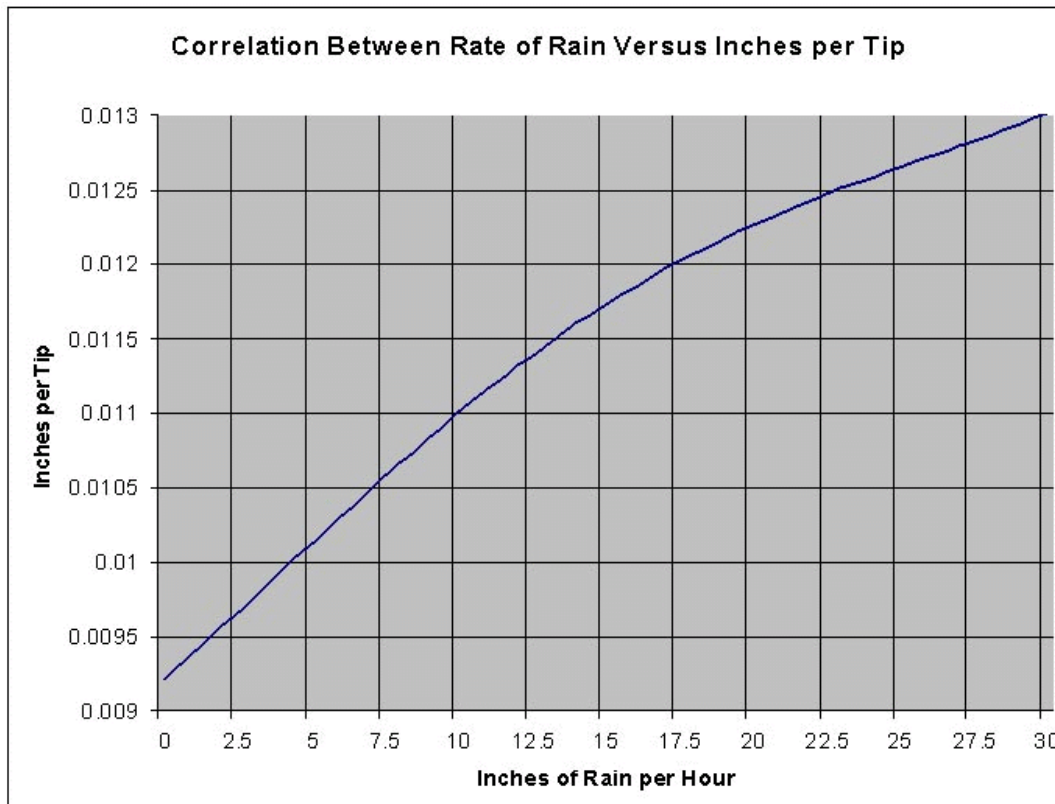
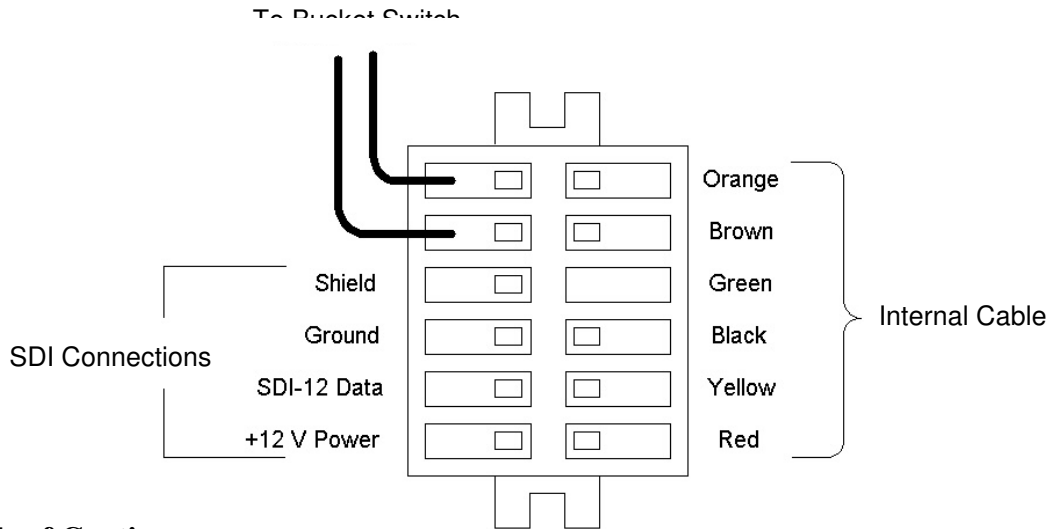


Figure 1 Bucket tip mechanism sensitivity

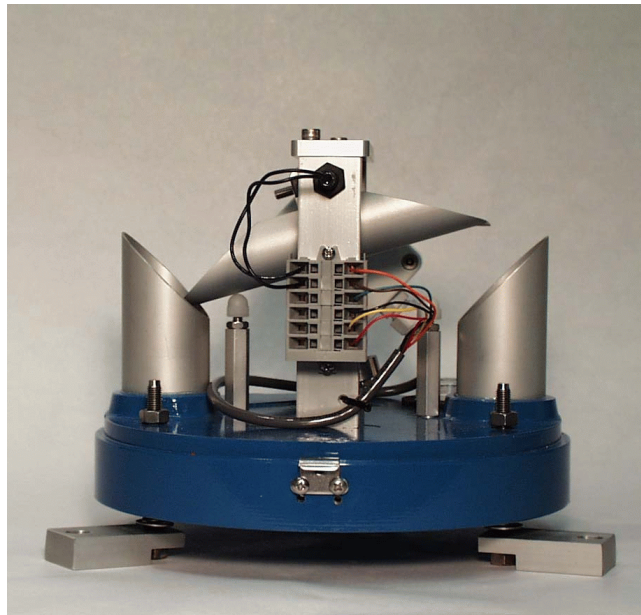
1.4 Making Connections to the H-340SDI

The H-340 has a 6-pin “WAGO” wiring terminal block for connecting the data logger and power. The terminal block has spring clamp terminals which work with both large and small wires and provide reliable long-term connections. To open the spring clamp to insert or remove a wire, insert a small flat screwdriver blade in the square opening adjacent to the wire and twist or pry carefully to one side.



Words of Caution

- Keep the lead wires as short as possible.
- Use shielded cables in noisy environments.



1.5 Installation

Install the H-340SDI in an open location where it will not be in the rain shadow of trees or buildings. A rooftop location helps prevent vandalism and the accumulation of leaves and debris. Bolt or screw the 3-mounting feet to the structure to prevent upset in high winds. Adjust the three self-leveling screws until the “bulls eye” level is centered.

1.6 Programming Your Data Recorder

You must prepare your data recorder to receive and record the H-340SDI data. Since data recorders differ widely, refer to your recorder manufacturer's directions. In general, program the data recorder to input five 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 2. The H-340SDI places five data values in its data buffer:

+AA.AAA+BBB+CC.CCC+DD.DDD+EE.EEE

Where:

+AA.AAA	= Rainfall accumulation since last measurement	(inches of rain)
+BB	= Number of raw bucket tips since last measurement	(counts)
+CC.CCC	= Total rainfall accumulation since reset.	(inches of rain)
+DD.DDD	= Total rainfall accumulation today	(inches of rain)
+EE.EEE	= Total rainfall accumulation yesterday	(inches of rain)

All five of these parameters are automatically reset at power-up, or manually with the extended SDI-12 “aXRA” Reset Accumulators command.

1.7 Programming the H-340SDI

The H-340SDI comes from the factory with the following settings:

SDI Address:	0
Slope:	1.0
Daily Reset Time:	00:00:00
Time of day:	00:00:00

With these values the data will be in units of inches of rainfall. The setup is stored in EEPROM within the H-340SDI and will not be lost if the power is disconnected. The extended commands for changing the slope and sensor address are described in detail in Chapter 2. If more than one sensor is to be connected to the SDI-12 bus, make certain each sensor has a unique sensor address.

In some cases the user may wish to preset the H-340's Total Accumulation value to match the current rainfall of the water year. The H-340 has an offset value stored in memory which is automatically added to the Total Accumulation value. The offset value can be written or read with two extended SDI-12 commands (“aXWO” and “aXRO”), see Chapter 2 for details. Please note both the Total Accumulation and Offset values are reset at power-up, or with the extended SDI-12 Reset Accumulators (“aXRA”) command. To change the Total Accumulation to a new value you must first reset the accumulators with the “aXRA” command, **then** set the offset with the “aXWO” command.

1.8 Factory Calibration

The H-340SDI is calibrated in the factory with an apparatus which provides a constant 4in/hour flow rate. The water exiting from the bottom of the rain gauge is captured in a precision graduated cylinder. After 100 bucket tips or more have occurred, the flow is stopped and the volume in the graduated cylinder is measured. The procedure is as follows:

1. Issue an extended “aXRA!” (reset accumulator) SDI-12 command.
2. Empty the graduated cylinder.
3. Start the water flow into the funnel.
4. Wait until at least 100 bucket tips have occurred (1% resolution).
5. Stop the water flow.
6. Observe and record the water volume in the graduated cylinder.
7. Use the formula below to compute the actual *rainfall* accumulation.
8. Issue a SDI-12 “aM!” measure command and record the “smart bucket” accumulation.
9. Compare the difference between the smart bucket rainfall reading the *rainfall* volume in the graduated cylinder.
10. Adjust the counterweight as needed and repeat until the two values are identical or within an acceptable difference.

The rainfall “volume” equation below converts the volume in the graduated cylinder (mL) into the equivalent rainfall (in inches) captured by an 8 inch diameter funnel.

$$RAINFALL_{inches} = \frac{NmL \times \frac{L}{1000mL} \times 61.025 \frac{in^3}{L}}{\pi(4.0in)^2} = NmL \times 1.21405 \times 10^{-3} \frac{inches}{mL}$$

Other related equations of interest:

$$RATE \frac{in}{hr} = \frac{RAINFALL_{inches}}{N_{min}} \times 60 \frac{min}{hr}$$

$$RAINFALL \frac{inches}{tip} = \frac{RAINFALL_{inches}}{N_{tips}}$$

1.9 User Calibration

The “smart bucket” processor uses a fixed polynomial to compute each bucket volume as a function of rainfall rate. The factory calibration should be sufficiently accurate for all rainfall rates from 0 to 25 inches/hour. If the user requires an exact calibration at a rate other than 4.0 inches/hour, or if the tipping bucket mechanism is damaged or changed the bucket mechanism may need to be recalibrated. The procedure for adjusting the counterweight is included below. Please note that the “smart bucket” feature is calibrated somewhat differently than a normal tipping bucket device. With a simple tipping bucket, a known amount of water is passed through the gauge and the number of bucket tips is recorded. The counter weight is then adjusted for the desired number of tips. With the H-340SDI “smart bucket” feature, the number of bucket tips is not used in the calibration, instead, the SDI-12 measurement value is used. This is different because the H-340SDI's microprocessor is using a non-linear polynomial expression to compute the volume. With the aid of the polynomial you can get an accurate field calibration without using the constant flow apparatus which is used at the factory. Just remember to use the SDI-12 “aM” measurement values and not the number of bucket tips.

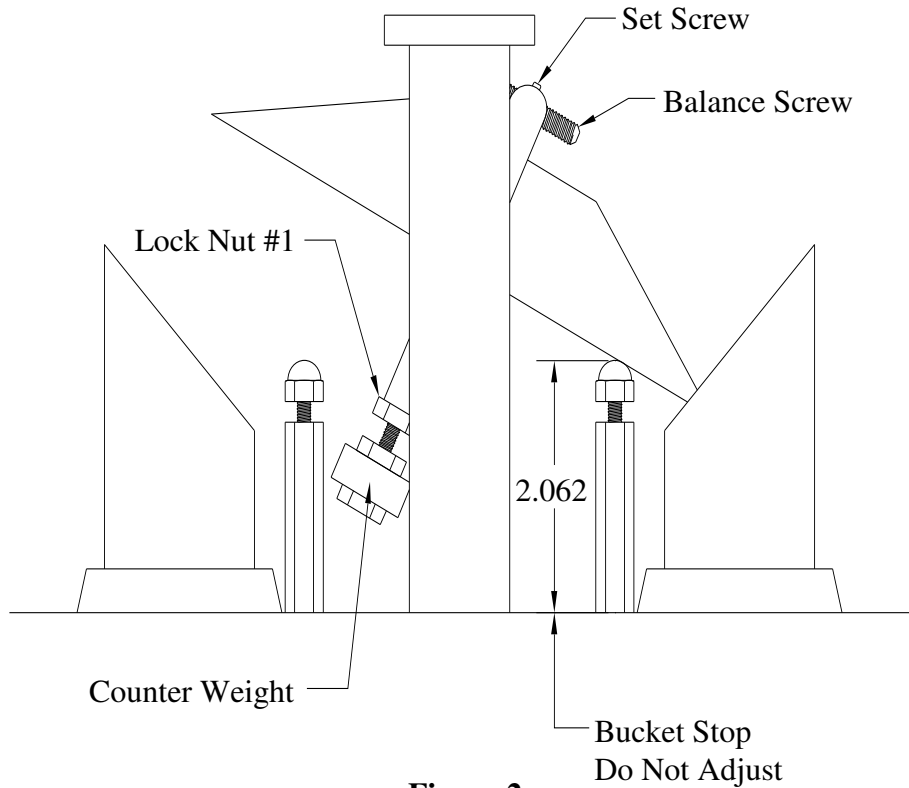


Figure 2

1.10 Adjusting the Tipping Bucket Mechanism

Warning: DO NOT ADJUST THE BUCKET STOPS.

Adjusting the stop posts causes a false reading of equal amounts of water in each bucket. This is due to the variation of distance the bucket center must travel after passing the bottom of the funnel. Do not adjust the bucket stops in an attempt to balance the weight of the buckets. Instead, the H-340SDI provides an **adjustable screw** parallel to the buckets by which the bucket weight balance can be accomplished. This eliminates the need to adjust the stops and compensates for any inequality of weight due to manufacture and assembly, and gives equal travel to each bucket as the center passes the flow of water.

The counter weight underneath the bucket mechanism can be adjusted (up or down,) to set the bucket volume (# tips/unit rainfall). See Figure 2. The up/down counter weight adjust instructions in steps 1 and 2 may seem to be intuitively backwards however, realize the center of gravity of the bucket and counterweight is above the pivot.

1. To adjust for more tips (more rainfall volume), release nut #1 and turn weight counter clockwise (down). Re-lock nut #1.
2. To adjust for less tips (less rainfall volume) release nut #1 and turn weight clockwise (up) . Re-lock nut #1.
3. To adjust for equal amounts of water in each bucket, loosen set screw #2, turn adjusting screw toward the bucket with the most amount of water, then re-lock the setscrew.

Chapter 2

SDI-12 Command and Response Protocol

2.1 SDI-12 Command and 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-340SDI sensor. Included is a description of the commands and data format supported by the H-340SDI.

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-340SDI sensor. The H-340SDI 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. |

Notes:

- 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.

2.2 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.

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
- 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 anytime after the service request is received or the specified processing time has elapsed.

Example of a H340SDI "aM!" command:

Command	Response	Time	Values	Description
"aM!"	"a0015<cr><lf>"	1 sec	5	Return current accumulations

Subsequent Command	Response
"aD0"	a+AA.AAA+BB+CC.CCC+DD.DDD+EE.EEE<cr><lf>

Where:

AA.AAA	= Rainfall accumulation since last measurement	(inches of rain)
BB	= Number of bucket tips since last measurement	(raw count)
CC.CCC	= Total accumulation since reset	(inches of rain)
DD.DDD	= Total accumulation today	(inches of rain)
EE.EEE	= Total accumulation yesterday	(inches of rain)

2.3 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.

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

Where:

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

2.4 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.

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 a H-340SDI "aD0!" command:

Previous command	Response
-----	-----
"aM!"	"a0015<cr><lf>"
Subsequent Command	Response
-----	-----
"aD0"	a+AA.AAA+BB+CC.CCC+DD.DDD+EE.EEE<cr><lf>

Where:

AA.AAA	= Rainfall accumulation since last measurement	(inches of rain)
BB	= Number of bucket tips since last measurement	(raw count)
CC.CCC	= Total accumulation since reset	(inches of rain)
DD.DDD	= Total accumulation today	(inches of rain)
EE.EEE	= Total accumulation yesterday	(inches of rain)

2.5 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, 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-340SDI **DOES NOT** supports the aR0! continuous measurement command.

2.6 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 a H-340SDI "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

2.7 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.

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

Where:

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

2.8 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!"	----- "allccccccmmmmmvvxx...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".
- ccccccc is an 8 character vendor identification to be specified by the vendor and usually in the form of a company name or its abbreviation.
- mmmmm 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 a H-340SDI "aI!" command:

```
"a12 DAA H-340vvvS#nnnnnnVkkk<cr><lf>"
```

H-340 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

2.9 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-340SDI 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"

2.10 Extend "Read Slope" Command

The H-340SDI processes the rainfall accumulation values with a "mX" equation. The slope (m) term is programmable, allowing the user to scale the rainfall value into other engineering units. This command allows the user to read the current slope term. At the factory the slope is set to 1.000 which provides output data in "inches" of rainfall.

Command	Response	Description
----- "aXRS!"	----- "a0011<cr><lf>"	----- Read Slope

Where:

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

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

Example of a H-340SDI Extended "Read Slope" command:				
Command	Response	Time	Values	Description
"XRS!"	"a0011<cr><lf>"	1 sec	1	Read Slope
Subsequent Command		Response		
"aD0"	a+1.000<cr><lf>			

2.11 Extended "Write Slope" Command

The H-340SDI processes the raw rainfall values with a "mX" equation. The slope (m) term is programmable, allowing the user to scale the rain fall value into other engineering units. This command allows the user to write (change) the current slope term. At the factory the slope is set to 1.000 which provides output data in "inches" of rainfall. The new value is stored in non-volatile EEPROM within the sensor. Once the new slope 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 the Slope any other time, use the "Read Slope" command.

Command	Response	Description
"aXWSddd!"	"a0011<cr><lf>"	Write Slope

Where:

- a is the sensor address ("0-9", "A-Z", "a-z", "*", "?").
- XWS are upper case characters.
- ddd is the new slope value. The input format is very flexible. Some examples are shown below.

20.0
0.195
-500
5.93E-4

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

Example of a H340SDI extended "Write Slope" command:

Command	Response	Tim	Values	Description
"aXWS1.234!"	"a0011<cr><lf>"	1 sec	1	Set slope to 1.234
Subsequent Command	Response			
"aD0"	a+123.4<cr><lf>			

2.12 Extend "Read Offset" Command

The H-340SDI maintains an offset value in RAM which is automatically added to the Total Accumulation value. The offset value can be used to match the H340's Total Accumulation to the current water year rainfall. This command allows the user to read the current offset value. The offset is automatically set to zero at power-up or with the "aXRA" command.

Command	Response	Description
"aXR0!"	"a0011<cr><lf>"	Read Offset

Where:

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

XRO are upper case characters

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

Example of a H-340SDI Extended "Read Offset" command:

Command	Response	Time	Values	Description
"XRO!"	"a0011<cr><lf>"	1 sec	1	Read Offset
Subsequent Command		Response		
"aD0"	a+0.000<cr><lf>			

2.13 Extended "Write Offset" Command

The H-340SDI maintains an offset value in RAM which is automatically added to the Total Accumulation value. The offset value can be used to match the H340's Total Accumulation to the current water year rainfall. This command allows the user to write (change) the current offset. The offset is automatically set to zero at power-up or with the "aXRA" command. To change the Total Accumulation to a new value you must first reset the accumulators with the "aXRA" command, **then** set the offset with the "aXWO" command.

The new value is stored in RAM within the sensor and is not preserved if the power is lost. Once the new offset value is written to the RAM, a copy is sent to the sensor data buffer for verification. This data can be viewed by using a subsequent "D" command. To verify the Offset any other time, use the "Read Offset" command.

Command	Response	Description
"aXWOddd!"	"a0011<cr><lf>"	Write Offset

Where:

- a is the sensor address ("0-9", "A-Z", "a-z", "*", "?").
- XWO are upper case characters.
- ddd is the new offset value. The input format is very flexible. Some examples are shown below.

20.0
0.195
-500
5.93E-4

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

Example of a H340SDI extended "Write Offset" command:

Command	Response	Tim	Values	Description
"aXW01.234!"	"a0011<cr><lf>"	1 sec	1	Set offset to 1.234
Subsequent Command	Response			
"aD0"	a+123.4<cr><lf>			

2.14 Extended "Get Time" Command

The H-340SDI has a built-in real time clock. This command allows the user to read the current time of day.

Command	Response	Description
"aXGT!"	"a0013<cr><lf>"	Read time of day

Where:

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

This command takes 001 seconds to complete and places 3 values in the data buffer. Use the "aD0" command to collect and view the data.

Example of a H340SDI extended "Get Time" command:

Command	Response	Time	Values	Description
"aXGT!"	"a0013<cr><lf>"	1 sec	3	Get current time of day

Subsequent Command	Response
"aD0"	a+HH+MM+SS<cr><lf>

Where:

HH = Hours (24 hour format)

MM = Minutes

SS = Seconds

2.15 Extended "Set Time" Command

The H-340SDI has a built-in real time clock. This command allows the user to change the current time of day.

Command	Response	Description
"aXSTHHMMSS!"	"a0013<cr><lf>"	Set time of day

Where:

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

XST are upper case characters.

HHMMSS is the new time in Hours:Minutes:Seconds (24-Hour format)

This command takes 001 seconds to complete and places 3 values in the data buffer. Use the "aD0" command to collect and view the data.

Example of a H340SDI extended "Set Time" command:

Command	Response	Time	Values	Description
----- "aXST234537"	----- "a0011<cr><lf>"	----- 1 sec	----- 1	----- Set time of day to 23:45:37
Subsequent Command	Response			
----- "aD0"	----- a+23+45+37<cr><lf>			

2.16 Extended "Get Daily Reset Time" Command

The H-340SDI automatically resets the daily accumulations a certain time each day. For example, one *day* may be calculated from 6:00 AM of one day to 6:00 AM of the next day. This command reads the time of day at which the reset is scheduled.

Command	Response	Description
----- "aXGDRT!"	----- "a0013<cr><lf>"	----- Read daily reset time

Where:

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

XGDRT are upper case characters

This command takes 001 seconds to complete and places 3 values in the data buffer. Use the "aD0" command to collect and view the data.

Example of a H340SDI extended "Get Daily Reset Time" command:

Command	Response	Time	Values	Description
----- "aXGDRT!"	----- "a0013<cr><lf>"	----- 1 sec	----- 3	----- Get daily reset time
Subsequent Command	Response			
----- "aD0"	----- a+HH+MM+SS<cr><lf>			

Where:

HH = Hours (24 hour format)

MM = Minutes

SS = Seconds

2.17 Extended “Set Daily Reset Time” Command

The H-340SDI automatically resets the daily accumulations a certain time each day. For example, one *day* may be calculated from 6:00 AM of one day to 6:00 AM of the next day. This command sets the time of day at which the reset is scheduled.

Command	Response	Description
----- "aXSDRThhmmss!"	----- "a0013<cr><lf>"	----- Set daily reset time

Where:

- a is the sensor address ("0-9", "A-Z", "a-z", "*", "?").
- XSDRT are upper case characters.
- hhmmss is the new time in HOURS:MINUTES:SECONDS (24-Hour format). Use fixed format. For example 010233 for 01:02:33

This command takes 001 seconds to complete and places 3 values in the data buffer. Use the “aD0” command to collect and view the data.

Example of a H340SDI extended "Set Time" command:

Command	Response	Time	Values	Description
----- "aXSDRT230537"	----- "a0013<cr><lf>"	----- 1 sec	----- 3	----- Set daily reset time to 23:05:37
Subsequent Command	Response			
----- "aD0"	----- a+23+05+37<cr><lf>			

2.18 Extended “XTEST” Command

This command is primarily used for production testing and requires the use of a H-419 or SDI-12 verifier and a PC. This command causes the H-340 to transmit unsolicited real-time data for testing purposes. This is not compliant with the SDI-12 specification and is not used with data loggers.

To activate the test mode, first send the command “aXTEST!”, then enter the verifier’s MONITOR mode. Whenever a bucket tip occurs, the H-340 now transmits the time between bucket tips and the adjusted rainfall for the bucket tip. This test mode may be used to help troubleshoot the installation by providing a continuous readout of bucket tip timing and rainfall. The test mode is exited by

sending any new command on the SDI-12 bus (a BREAK terminates). It may take a few tries to exit if the command is sent at the same time data is being sent from the H-340. Removing power from the H-340SDI also causes it to exit this mode. Note: bucket tips less than 500mS apart are discarded (ignored) by the H340SDI.

Example of the XTEST test display:

+1.200+.013 *(Time between tip is 1.2 Seconds, rainfall for this tip is 0.013 inches)*
+60.00+.009
+4.400+.012
+2.2+.011
etc.

Appendix A Specifications

General

Output: SDI-12

Power Input

Voltage: 9.6 to 16.0 Volts DC

Current:

Standby Mode: 150 μ A

Raining: 3.7 mA for 60 sec

Communicating: 9.8 mA

Timing

SDI-12: 1 second measurement sequence

SDI-12 Output

Baud Rate: 1200

Protocol: SDI-12, 7-bit even parity, 1 stop bit

Output Voltage Levels:

minimum high level: 3.5 volts

maximum low level: 0.8 volts

maximum cable length: 200 ft.

Environmental (electronics)

Operating Temperature: -40 to 50 °C

Storage Temperature: -50 to 70 °C

Mechanical

Operating Temperature: -0 to 50 °C

Connectors

SDI-12 Output: 4-position spring clamp terminal block (WAGO).

Mechanical

Bucket Tip

Sensor: Magnetic reed switch.

Aperture: 8" diameter funnel

Housing: 8" diameter extruded aluminum tube. Cast aluminum base with drain tubes in the bottom. Anodized aluminum internal parts. Stainless steel screws and fasteners. Powder painted base, funnel and housing.

Mounting: 3 leveling screws with bolt down feet.

Weight: 8 pounds

Calibration

Built in processor measures the time between bucket tips (rainfall rate) and uses this data to compute the bucket volume per tip at the current rainfall rate. A built-in polynomial provides corrected bucket volume for rainfall rates between 0 and 25 in/hour.

Warranty

The **WATERLOG**® H-340SDI is warranted against defects in materials and workmanship for one year from date of shipment.

