

[More Info](#) | [Instructions](#) | [Get Quote](#)

# SDI-12 User Guide

## SDI-12/MODBUS Interface Cable

February 12, 2025



**Solinst**<sup>®</sup>



<b>1 Introduction</b>	<b>5</b>
1.1 Compatibility	5
1.2 SDI-12 Interface Cable Overview	5
1.3 SDI-12 Interface Cable Push Button and LED Status	7
1.4 SDI-12 System Components	9
1.4.1 Levellogger 5 Components	9
1.4.2 LevelVent 5 Components	10
<b>2 Solinst Datalogger Independent Recording Option</b>	<b>11</b>
2.1 Data Downloading and Programming in Field	11
<b>3 SDI-12 Setup and Installation</b>	<b>12</b>
3.1 Setting the SDI-12 Device Address	12
3.2 SDI-12 Wiring Installation	14
<b>4 SDI-12 Operation</b>	<b>15</b>
4.1 Activation and Verification	15
<b>5 SDI-12 Supported Commands</b>	<b>16</b>
5.1 Acknowledge Active Command: a!	16
5.2 Address Query Command: ?!	16
5.3 Send Identification Command: aI!	16
5.4 Change Address Command: aAb!	16
5.5 Start Measurement Command: aM!	17
5.6 Start Measurement Command with Checksum: aMC!	17
5.7 Send Data Command: aD0!	17
5.8 Start Concurrent Measurement Command: aC!	17
5.9 Start Concurrent Measurement Command with Checksum	17
5.10 Start Verification Command: aV!	18
<b>6 Maintenance and Troubleshooting</b>	<b>19</b>
6.1 Changing or Updating a Solinst Datalogger (Hot-Swapping)	19
6.2 Firmware Updates	19
6.3 Troubleshooting	21
<b>7 References</b>	<b>21</b>



## 1 Introduction

SDI-12 (Serial Data Interface at 1200 Baud) is a communications protocol designed to allow the interfacing of a number of low power analog sensors with a common SDI-12 recorder.

The Solinst Model Levellogger 5, Barologger 5, Levellogger 5 Junior, Levellogger 5 LTC, Rainlogger 5, LevelVent 5, and Levellogger Edge Series dataloggers are able to act as SDI-12 sensors in an SDI-12 network simply by using the Solinst SDI-12/MODBUS Interface Cable.

This User Guide focuses on configuration, communication, installation and description of the SDI-12 protocol. See the separate User Guide if you are configuring your datalogger with MODBUS.

**Note:** The Interface Cable may be configured as an SDI-12 device, or as a MODBUS device, but never both concurrently.

### 1.1 Compatibility

The Solinst SDI-12/MODBUS Interface Cable is compatible with latest Solinst datalogger firmware:

Datalogger	Firmware Version
Levellogger 5	1.006
Barologger 5	1.006
Levellogger 5 Junior	1.006
Levellogger 5 LTC	1.006
Rainlogger 5	1.006
LevelVent 5	1.006
Levellogger Edge	3.004
Barologger Edge	3.004
Levellogger Junior Edge	3.004
LTC Levellogger Edge	1.003
Rainlogger Edge	3.001
LevelVent	1.000

Table 1-1 Compatible Datalogger firmware

**Note:** The SDI-12/MODBUS Interface Cables have firmware that is upgradable, see Section 6.2.

### 1.2 SDI-12 Interface Cable Overview

Solinst 2-wire signals are converted to SDI-12 signals by the Solinst SDI-12/MODBUS Interface Cable. One end of this cable has three wires that connect to an SDI-12 recorder. These wires are colour-coded according to Table 1-2.

Wire Colour	SDI-12 Function	Connection
Red	+7~+30V DC	+12V DC at SDI-12 Recorder
Black	Ground Line	Ground at SDI-12 Recorder
White	Serial Data Line	SDI-12 Data at SDI-12 Recorder

Table 1-2 SDI-12 Interface Cable Wire Definitions

**Note:** It is recommended to also connect the Data Ground wire.

The other end of the cable terminates in a Direct Read connection. This connects to the top of a Direct Read Cable for connection to a Solinst Levellogger, or the Wellhead connection of a LevelVent. The Solinst datalogger has a self-contained battery and does not use +12V DC power. The SDI-12 Interface Cable circuitry requires the 12V connection, which is to be powered by the customer equipment.

**Note:** The power may be cycled off and on, and normally, no energy will be used for an LED indication.

The communication settings for the Solinst datalogger comply with the SDI-12 standard at 1200 baud, 1 start bit, 7 data bits, 1 parity bit (even parity), and 1 stop bit (Version 1.3 of the SDI-12 Specification). Solinst communication between the Interface Cable and the Solinst datalogger always runs the Solinst protocol at 9600 baud, using the device address 0xFF. Solinst Levelogger PC Software is used to specify the device address.

**Note:** When powering on, provided that the cable is not in Off-line mode, there will be a slight delay before the cable goes on-line with the SDI-12 recorder.

SDI-12 Interface Cable Technical Specifications	
Standard Compliance	SDI-12 Standard, Version 1.3, July 18, 2005
+12V Input	7V to 30V DC
Average Current Draw While Taking Readings	30 mA
Idle Power Draw	Baud < 9600" is 17uA @ 12v
Direct Read Cable – Max Length	450 m (1500 ft)
Vented Cable – Max Length	150 m (500 ft)
SDI-12 Cable Length – Max Length	60 m (200 ft)
Operating Temperature	-40°C to 80°C
Ingress Protection Level	IP65

Table 1-3 SDI-12/MODBUS Interface Cable Technical Specifications

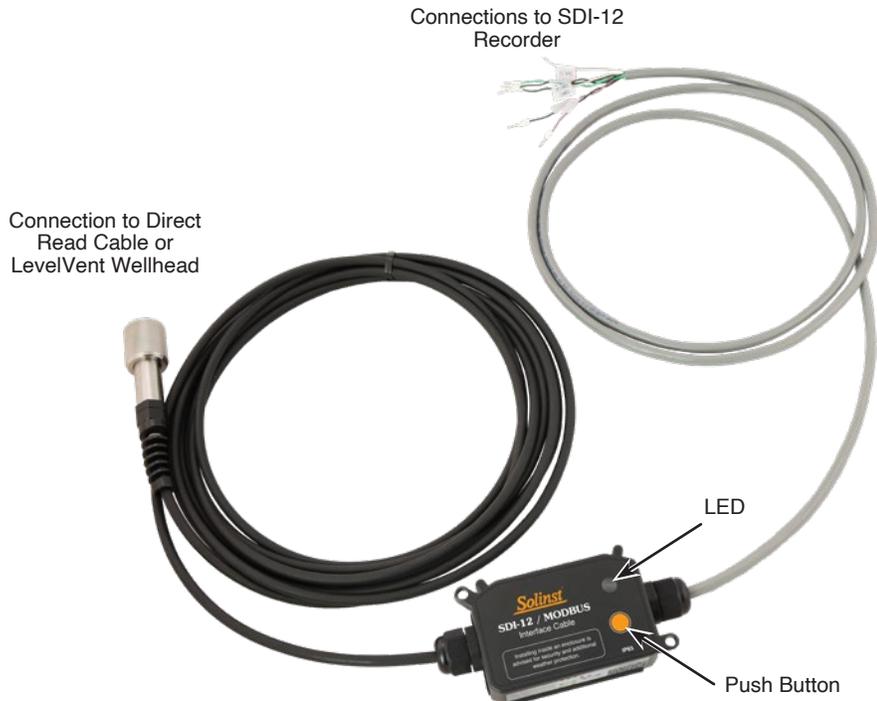


Figure 1-1 SDI-12/MODBUS Interface Cable

### 1.3 SDI-12 Interface Cable Push Button and LED Status

**Note:** See the label of the SDI-12/MODBUS Interface Cable for a summary of LED light status definitions.

#### **Push Button Control and LED Signals for Commissioning and Firmware Updates:**

The SDI-12/MODBUS Interface Cable may operate in Firmware Upgrade mode, SDI-12 mode, MODBUS mode, or Off-line.

Solid White – Button is pressed, ready to select BIT (Built-In Test) and datalogger synchronization, by releasing button.

Blinking White – Button has been released while LED was White. BIT and datalogger synchronization will begin after a time delay.

Solid Yellow – Button is still pressed, waiting for Firmware Upgrade (press well over 20 seconds), or release, whichever comes first.

Blinking Yellow – Button has been released with no action selected. Waiting for a time delay before resuming Normal operation.

**Note:** The button press will not respond correctly until after Normal operation resumes.

#### **Communication (Normal Operation) LED signals:**

Short blink Yellow – Command (includes broadcast) accepted from bus (and sending SDI-12 ack when appropriate).

Short blink Green – Normal response sent to commanding bus.

Short blink Magenta – Exception response sent to MODBUS.

Short blink Cyan – Message sent to datalogger.

Short blink Blue – Message received from datalogger.

#### **BIT (Built-In Test) LED signals:**

Cycling Blue/Red/Green – BIT (Built-In Test) in progress.

Long blink Green – BIT success.

Long blink White – BIT failure(s) - Followed by a series of Short Red blinks, of the following counts, with a pause in between:

1 - Logger communication and type recognition test.

2 - Cable voltage out of range test.

3 – Contact Solinst.

After blinking out the failure code(s), there will be a long pause before sending other signals.

**Datalogger Synchronization (settings configure bus communications) LED signals:**

Long blink Yellow – datalogger type un-recognized, communication is Off-line. Try a Firmware Upgrade, to accommodate newer datalogger types.

Long blink Red – datalogger not found, communication is Off-line.

Long blink Green – Configured for SDI-12 operation.

Long blink Blue – Configured for MODBUS operation.

**Power-Up LED signals:**

Long blink Red – Internal problem with Cable.

**Firmware Upgrade (BSL - Boot Strap Loader) LED signals:**

Solid Blue – Firmware Upgrade Mode.

Short blink Cyan – Msg out from BSL to upgrader host.

Short blink Green – Msg into BSL from upgrader host.

**Other LED signals:**

Solid Yellow – Low voltage lockout – May be followed by an attempted re-boot, which possibly may repeat, causing the appearance of a yellow LED flashing very slowly. Note that when power is shut off from the cable (as in the common practice of power cycling to save energy between samples), the yellow LED can only expend the small internally stored energy, not energy from the external battery.

## 1.4 SDI-12 System Components

### 1.4.1 Levellogger 5 Components

The Solinst Model 3001 Levellogger 5 requires the following components to complete a SDI-12 monitoring system:

- Levellogger 5
- SDI-12 Interface Cable
- Direct Read Cable
- PC Interface Cable (for programming the Levellogger) (Desktop Reader 5 or Field Reader 5 can also be used)
- Levellogger PC Software (free download on solinst.com)
- (User supplied equipment)

**Note:** For more information about the Levellogger, PC Interface Cable and Direct Read Cable, see the Levellogger User Guide.



Figure 1-2 Levellogger SDI-12 System Components

### 1.4.2 LevelVent 5 Components

The Solinst Model 3250 LevelVent 5 requires the following components to complete a SDI-12 monitoring system:

- LevelVent 5
- SDI-12 Interface Cable
- Vented Cable
- LevelVent 5 Wellhead
- PC Interface Cable (for programming the LevelVent)
- Levelogger PC Software (free download on solinst.com)
- (User supplied equipment)

**Note:** For more information about the LevelVent, Wellhead, PC Interface Cable, and Vented Cables, see the LevelVent User Guide.



Figure 1-3 LevelVent 5 SDI-12 System Components

## **2 Solinst Datalogger Independent Recording Option**

**Note:** For best operation, have the Solinst dataloggers not in logging mode, so all measurements are controlled and initiated by the SDI-12 recorder. The datalogger can be used in logging mode in the SDI-12 network, though it may require an occasional measurement retry by the recorder if the datalogger happens to be busy at that moment.

Solinst datalogger have the ability to record and store readings in their internal memory, independent from the SDI-12 network, while connected to an SDI-12 recorder. Before connecting the Solinst datalogger to the SDI-12 Interface Cable and recorder, it can be programmed and started using Solinst Levellogger Software.

**Note:** See Levellogger and LevelVent User Guides for detailed operating instructions.

All standard sampling options provided by Solinst Levellogger Software are available while the datalogger is operating as an SDI-12 sensor. The datalogger can be set to record at a user-defined sampling rate; event, linear, and scheduled sampling modes are available using the Levellogger Settings Window. This allows the datalogger to provide back-up data if the SDI-12 network fails. The datalogger stores the data in its internal memory, until it is downloaded.

**Note:** The Levellogger uses its internal battery each time the SDI-12 datalogger requests a reading. The internal battery will drain more quickly if the Levellogger is also set to record independently.

Each time the SDI-12 recorder asks the datalogger for a current reading, the internal datalogger battery is used to transmit the information to the SDI-12 recorder. The datalogger will also be using its internal battery if programmed to record independently – draining the battery more quickly. If the datalogger independent recording option is not used, the internal battery will only be used for communication with the SDI-12 network.

### **2.1 Data Downloading and Programming in Field**

If the datalogger has been programmed to record on its own independent schedule, data can be downloaded using a laptop PC and PC Interface Cable, Levellogger 5 App Interface, SRU or DataGrabber 5 in the field (see separate operating instructions). Temporarily disconnect the datalogger from the SDI-12 Interface Cable, preferably in between recordings by the SDI-12 recorder. Connect a laptop, Levellogger 5 App Interface, SRU or DataGrabber 5 to download the independently recorded data.

If the datalogger is disconnected from the SDI-12 network, and the SDI-12 recorder tries to communicate with the datalogger, the Red LED will flash as described in Section 1.3. This does not disrupt the SDI-12 recorder or the rest of the sensors in the network. The Red LED will stop flashing once the datalogger is reconnected.

After the data download is complete, the datalogger is easily connected back into the SDI-12 network without disruption. See Section 6.1.

### 3 SDI-12 Setup and Installation

#### 3.1 Setting the SDI-12 Device Address

To set the device address for the Solinst datalogger, it must be connected to the Levelogger PC Software. A Levelogger communicates to the PC using a PC Interface Cable connected to a Direct Read Cable (or by using a Desktop Reader 5 or Field Reader 5). A LevelVent communicates with the PC using a PC Interface Cable connected to the LevelVent Wellhead.

**Note:** For information on downloading and starting the Levelogger PC Software, see the Levelogger User Guide.



Figure 3-1 Communicating with Levelogger Software

After you start Levelogger Software, the Main Window will appear, with the Datalogger Settings tab open.

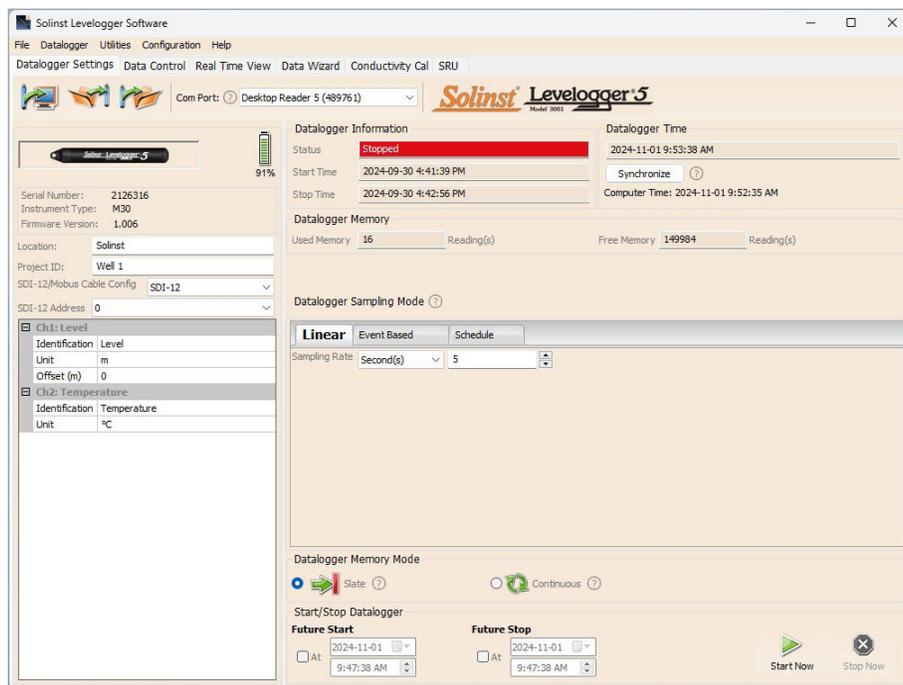


Figure 3-2 Levelogger 5 Dataloggers Settings Tab

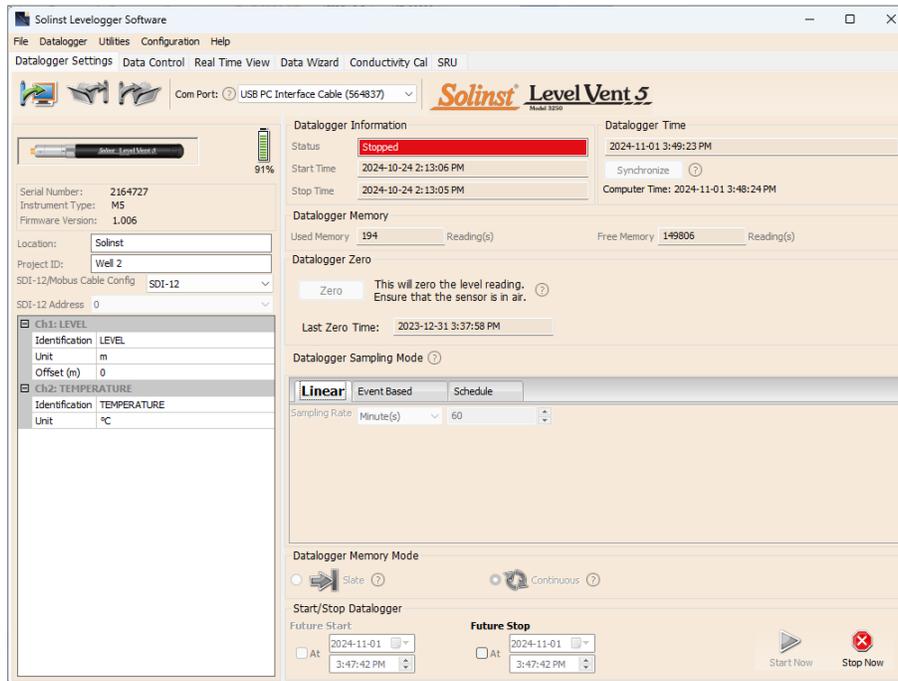


Figure 3-3 LevelVent 5 Dataloggers Settings Tab

Select the appropriate device from the centre "Com Port" drop-down menu.

Click  to retrieve the current settings from the connected datalogger.

After you have retrieved the settings of the connected datalogger, the Datalogger Settings tab will identify the Instrument Type, Serial Numbers, Firmware Versions, Project ID, Location, the Channel Settings and battery level.

Select SDI-12 from the "SDI-12/MODBUS Cable Config" drop-down menu.

Select the desired address from the "SDI-12 Address" drop-down menu.

You can also change the units that the datalogger will be measuring in for the Level and Temperature Channels.

Once you have set the address and any other desired settings, click the start button . This applies the address and settings to the datalogger, **AND starts the datalogger logging internally.**

**If you do not want your datalogger to log internally, independent of SDI-12 operation,** click the stop button .

(See Section 2 for more information on the independent recording option).

The settings will be transferred from the Solinst datalogger to the SDI-12 Interface Cable using the push button on the SDI-12 Interface Cable once all appropriate connections are made. See Section 3.2.

## 3.2 SDI-12 Wiring Installation

**Note:** Installing the SDI-12/MODBUS Interface Cable inside an enclosure is advised for security and additional water protection.

- 1) Be sure that the Levellogger is properly connected to the Direct Read Cable, or the LevelVent properly connected to the Vented Cable and Wellhead. See separate User Guides for more information.
- 2) Refer to the wiring diagram below for correct connection of the SDI-12 Interface Cable to the SDI-12 recorder, including external power (12V).

To avoid possible damage in case of a live (powered) network, always prevent the bare metal areas of wires and connectors from unintentionally touching each other, and use the following sequence:

- When connecting, Ground first, Data next, Positive power last.
- When disconnecting, Positive power first, Data next, Ground last.

The network end of the SDI-12/MODBUS Interface Cable contains 6 wires, plus a shield connection. Use only the wires needed for SDI-12 connection. You may leave the unused wire(s) open (securely insulated with tape) or grounded.

**Note:** The SDI-12/MODBUS Cable Power (supplied by the customer equipment) must be between 7V and 30V DC.

- 3) Connect the SDI-12 Interface Cable to the Levellogger's Direct Read Cable, or the LevelVent Wellhead.
- 4) Press the button on the SDI-12 Interface Cable for two seconds to bring it on-line.

**Note:** There will be a small delay between powering up the cable, and having the cable responsive to an SDI-12 command.



Figure 3-1 Datalogger SDI-12 Wiring Overview

**Note:** The Shield wire connection is not required for operation, but may be used to enhance protection against surges. Ideally, it should be connected to a chassis, earth ground, power ground, or the shield of the cable it is connecting to.

**Note:** Power Ground and Data Ground are connected internally. Solinst recommends also connecting them together at the terminal block, when it is convenient to do so, for maximum range and noise immunity.

**Note:** Wires are arranged inside the cable as twisted pairs, where each pair has one black wire and one wire of a colour that is unique among all the pairs. In case the labels are missing from the wire, colour scheme can be followed as shown in Fig. 3-1.

## **4 SDI-12 Operation**

Once the SDI-12 Interface Cable has been installed, powered up, and commissioned with a logger set up for SDI-12 protocol, and its device address set, you can start issuing SDI-12 commands to it.

Note that the SDI-12 Device Address of the SDI-12/MODBUS Interface Cable/Solinst datalogger must be unique among all devices on the SDI-12 network.

It can be helpful to have the LED of the SDI-12/MODBUS Interface Cable in view during the early parts of basic testing, which may be accomplished by having the SDI-12 recorder send out periodic commands to the Device Address of the SDI-12/MODBUS Interface Cable/datalogger, so that the LED will show a response as soon as it is hooked up and started successfully.

**Note:** In all the following SDI-12 commands discussed, 'a' = the SDI-12 device address assigned to the Interface Cable/Solinst datalogger.

### **4.1 Activation and Verification**

With your SDI-12 recorder, issue a Acknowledge Active Command (a!), to see if the device address is correct and you can communicate with the newly installed the SDI-12/MODBUS Interface Cable and Solinst datalogger. This makes sure that other SDI-12 devices are not being addressed and communicating at the same time on the SDI-12 network.

The Change Address Command (aAb!) may be used to change the SDI-12 device address of the SDI-12/MODBUS Interface Cable, however it is the responsibility of the user to be sure this new address does not place the device in contention with any other device on the network. Note: This command causes the SDI-12/MODBUS Interface Cable to write the new address into the attached datalogger, overriding the setting that was placed there previously. This ensures that any subsequent start up (commissioning) process will use the new address.

If the SDI-12/MODBUS Interface Cable/Solinst datalogger is the ONLY device on the SDI-12 network, the Address Query Command (?!) may be used as a diagnostic tool, since it uses a broadcast address, so that any SDI-12/MODBUS Interface Cable that is on-line in SDI-12 mode will respond by acknowledging the command and blinking its LED, regardless of what address it is set to. The acknowledging reply contains the current address setting, which may then be used by a Change Address Command (aAb!) to select the desired address.

Other useful commands include Send Identification Command (a!), which replies with the acquired datalogger identity, and Start Verification Command (aV!), which acquires the datalogger identity, and performs the BIT (Built-In Test), which stores results accessible through the Send Data Command (aD0!).

The most commonly used commands are the Start Measurement Command (aM!), used to take a measurement from the Solinst datalogger, and the Send Data Command (aD0!), used to retrieve the result.

For best operation, have the Solinst dataloggers not in logging mode, so all measurements are controlled and initiated by the SDI-12 recorder. The datalogger can also be used in logging mode in the SDI-12 network, though it may require an occasional measurement retry by the recorder if the datalogger happens to be busy at that time. To change the logging mode of the datalogger, use the Solinst Levelogger PC Software (see Sections 2 and 3.1).

## **5 SDI-12 Supported Commands**

Please refer to the document *SDI-12: A Serial Digital Interface Standard for Microprocessor-Based Leveloggers*, Version 1.3, for a complete description of the SDI-12 protocol. The following command summaries are intended to show which commands are supported by the Solinst SDI-12/MODBUS Interface Cable.

**Note:** In all the following SDI-12 commands discussed, 'a' = the SDI-12 device address assigned to the Interface Cable/Solinst datalogger.

The following commands are supported:

### **5.1 Acknowledge Active Command: a!**

This command is used to ensure that a Solinst datalogger is responding to the SDI-12 recorder. A typical command/reply would be: **0!0**<CR><LF> where the '0's represents the datalogger SDI-12 device address and <CR> represents a carriage return (Hex 0D) and <LF> represents a line feed (Hex 0A). All replies from an datalogger are terminated with <CR><LF>. All SDI-12 recorder commands are terminated with an exclamation mark '!' character.

### **5.2 Address Query Command: ?!**

Using a question mark (?) as the address character causes the datalogger to respond with the acknowledge active 'a!' command where 'a' represents the datalogger address. A typical command/reply would be: **?!0**<CR><LF>. The bold-faced characters are sent to the datalogger; the normal type-face is the datalogger's reply. In this case the datalogger address is "0". This command is good for determining the datalogger address, if it is the only sensor connected on the SDI-12 network.

### **5.3 Send Identification Command: a!**

This command is used to return the SDI-12 compatibility level, model number, and firmware version number of the datalogger. This command returns locally stored information only. To update this local information from the datalogger, first issue a (aV!) command.

A typical command/reply would be: **0! 013SOLINST M20 S2 1.000 1017687**<CR><LF> where the first "0" is the datalogger address, "13" represents SDI-12 V1.3 protocol support, "SOLINST " identifies the datalogger manufacturer (8 characters including trailing space character), "M20 " defines the datalogger model number (6 character string, left justified, padded with spaces, with trailing character always a space), "S2 " is the hardware identifier (3 characters, left justified, with alphabetic Hardware type followed by numeric Hardware version if it fits), "1.000" specifies the current firmware version (5 characters including decimal point, left justified, no leading zeros), and "1017687" represents the datalogger's serial number (7 characters, right justified, no leading zeros).

### **5.4 Change Address Command: aAb!**

This command changes the datalogger's address. A typical command/reply would be: **0A9!9**<CR><LF> where the first "0" is the current datalogger address and the "9" is the new datalogger address. The datalogger replies with a "9" to indicate that its address was successfully changed. The new address will be stored in the datalogger, so that the address will not change if the SDI-12/MODBUS Interface Cable push button is used later.

### 5.5 Start Measurement Command: aM!

This command tells the datalogger to take a measurement. However, the measurement is not returned after this command. Instead, the time and number of measurements that can be expected will be replied. For example: **OM!00102<CR><LF>** where the first “0” is the datalogger address, the next three digits “010” represent the time in seconds it will take the datalogger to take the readings, and the final “2” indicates how many readings will be returned. The Solinst datalogger will return a temperature and level measurement which are always ready to be read after the specified time. After that, the SDI-12 recorder can issue the Send Data command **OD0!** to retrieve the measurement data. Other start measurement commands such as aM1 to aM9 are reserved for future use. The reading format begins with “+” or “-”. Simple numbers may optionally contain “.”, and are limited to 7 digits. Dates and times (such as second and third readings from a Rainlogger) are formatted as “+ddmmyy” and “+hhmmss”.

### 5.6 Start Measurement Command with Checksum: aMC!

This command is identical to the aM! command with the exception that a three-character checksum is returned before the <CR><LF> as part of the Send Data command reply. The aMC1 to aMC9 commands are reserved for future use. Formatting is described under (aM!).

**Note:** Checksum is a form of redundant test, which is used to check for any errors in the data.

### 5.7 Send Data Command: aD0!

This command is used to get groups of data from the datalogger. An aD0! Command is issued by the recorder after a M, MC, C, CC, or V command. The datalogger responds by sending the data. For a Solinst datalogger, this is currently two data items, the temperature and level measurements, and possibly a third measurement depending on the type of datalogger. A typical command/reply is:

**OD0!0+24.2981+0.35212<CR><LF>** where the temperature is the “+24.2981” in Celsius degrees and the level is the “+0.35212” in meters. It is possible to change level units using the Solinst Levellogger PC Software but the actual units in use are not reported while the Solinst datalogger is in SDI-12 mode. In response to a checksum request i.e. MC, CC; a typical command/reply is: **OD0!0+24.2981+0.35212MQ\_<CR><LF>** where the temperature and level are as before and the final “MQ\_” is the checksum. Refer to the SDI-12 specification for details on the checksum generation. For the M and C commands if a measurement cannot be obtained, the D command will return **0000<CR><LF>** to indicate the measurement could not be obtained. The aD1 to aD9 commands are reserved for future use.

### 5.8 Start Concurrent Measurement Command: aC!

This command is similar to the Start Measurement Command except a concurrent measurement is taken. Like the Start Measurement Command, a Send Data Command is required to retrieve the data. For example: **OC!000302<CR><LF>**. The reply indicates that two readings (temperature and pressure) are available after 3 seconds. A OD0! command is then issued to read these datalogger values. The aC1 to aC9 commands are reserved for future use. Formatting is described under (aM!).

### 5.9 Start Concurrent Measurement Command with Checksum: aCC!

This command is similar to the Start Concurrent Measurement with the addition of a checksum. For example: **0CC!000302<CR><LF>** would then reply after 3 seconds to the aD0! command as follows:

**OD0!0+24.6038+0.34513L<DEL>j<CR><LF>**. Where “L<DEL>j” is the checksum for the two measurement values “+24.6038+0.34513”. The aCC1 to aCC9 commands are reserved for future use. Formatting is described under (aM!).

### 5.10 Start Verification Command: aV!

This command tells the datalogger to return a verification (self-test) code in response to a subsequent aD0! command. After performing the self test, the datalogger identification information will be retrieved and stored locally for use as a reply to an (a!) command.

In this case, the Solinst datalogger returns a non-zero time because the self-test execution verifies all internal memory checksums, and these operations take about 3 seconds. A typical session would appear as follows:

**0V!00031**<CR><LF> indicates that one status reading will be ready in about 3 seconds.

**0**<CR><LF> is a service request from the Solinst datalogger *within* 3 seconds to indicate that the BIT operations are complete and the verification code is available.

**0D0!0+000** is the Send Data command from the SDI-12 recorder to obtain the BIT verification code of “+000” which indicates that no faults were found. The possible fault codes are shown in Table 5-1. All the decimal representations of the individual faults are summed to arrive at the resultant BIT verification code. An included bit in a certain bit position means the corresponding test has failed.

Code Bit Position	Decimal Representation	Test Meaning
0	1	Read Write Solinst Datalogger
1	2	Solinst SDI-12/MODBUS Cable FRAM Memory Test
2	4	Solinst SDI-12/MODBUS Cable Prog Memory Checksum Test
3	8	Solinst SDI-12/MODBUS Cable Voltage Tests
4	16	Solinst SDI-12/MODBUS Cable BSL Memory Checksum Test
5	32	Solinst SDI-12/MODBUS Cable InfoA Memory Checksum Test
6	64	N/A
7	128	N/A

**Table 5-1 BIT Verification Fault Codes**

## **6 Maintenance and Troubleshooting**

### **6.1 Changing or Updating a Solinst Datalogger (Hot-Swapping)**

Hot-swapping a datalogger (replacing one with another WITHOUT performing the Commissioning process) should normally never happen. When it does happen, the communication settings from the datalogger will NOT be updated in the cable, but acquisition of the NEW datalogger identity can be performed remotely. This is done by issuing the SDI-12 'V' command. After the NEW datalogger identity is acquired, it is stored in the non-volatile memory of the SDI-12 Interface Cable, so all data will flow correctly thereafter.

Note that the SDI-12 device address CANNOT be changed remotely (except by using the SDI-12 'aAb!' command), and it is possible for a hot-swapped datalogger to function perfectly while assuming (but not adopting) the device address setting from a previous (forgotten) datalogger, so its SDI-12 device address may change unexpectedly next time the push button Commissioning method is finally employed.

Note that due to the non-volatile memory of the Interface Cable, there is no reason to issue any command for acquiring the datalogger Identity, unless a datalogger has been hot-swapped. Knowing this, you can avoid unnecessary energy consumption due to unnecessary repetition of commands.

### **6.2 Firmware Updates**

The SDI-12/MODBUS Interface Cable been designed with firmware that is easy to update whenever useful new functions or other improvements become available, as with software releases.

To update the firmware in your sensor, go to the Solinst Website at: <https://downloads.solinst.com> where you can sign-in or register to download the firmware upgrade file that is contained within a Zip Archive. Ensure you unzip the Archive to access the firmware \*.ssf file.

**Note:** It is important that the communication between the PC and the sensor is not interrupted during a firmware upload, so please make sure to close any other running programs, including screen savers, and do not disconnect the sensor before the upload is finished.

This process will also require the use of a Desktop Reader 5 or Field Reader 5, and the Firmware Upgrade Adaptor included with the SDI-12/MODBUS Interface Cable.



Figure 6-1 Firmware Upgrade Setup

To upload new firmware to a SDI-12/MODBUS Interface Cable, follow these steps:

- 1) Ensure your SDI-12/MODBUS Interface Cable is still connected to power.
- 2) Thread the SDI-12/MODBUS Cable to the Firmware Upgrade Adaptor, then place the optical end of the Adaptor in the Reader.
- 3) Open the Solinst Firmware Upgrade Utility that is downloaded along with Levellogger PC Software. Select the Com Port that the cable is connected to from the drop-down menu.
- 4) Click the 'Open' button , which should open a file dialog asking for the firmware file (\*.ssf) to upload. Navigate to the directory where the firmware file was saved on your PC, then click on the file and click 'Open'.
- 5) Check the 'File Information' box to make sure the opened file is correct.
- 6) Press and hold the button on the SDI-12 Interface Cable until the LED turns Blue (in Firmware Upgrade mode).

**Note:** Even if the LED fails to respond to the push button, a very long (well over 20 second) press will still force entry into the Firmware Upgrade mode, at which time the LED should respond normally.

- 7) Click the 'Upload Firmware' button , to start the firmware upload process.
- 8) The LED now rapidly alternates between Green and Cyan colours, which means the firmware upgrade process is running. The green progress bar starts to fill up in the Firmware Upgrade Utility window.
- 9) When complete, the Cyan light turns off and the green progress bar fills the entire space in the Firmware Upgrade Utility window.

**Note:** When conducting a firmware upgrade, DO NOT interrupt the process prior to completion (This may take 2 to 4 minutes).

**Note:** If the above process fails, try starting the process again. If the LED cannot confirm entry into upgrade mode when the button is pressed, cycle the power, and try again. If the LED never lights up for the firmware upgrade process, verify that a suitable power source is being applied to the cable. If all the above fails, contact Solinst for assistance.

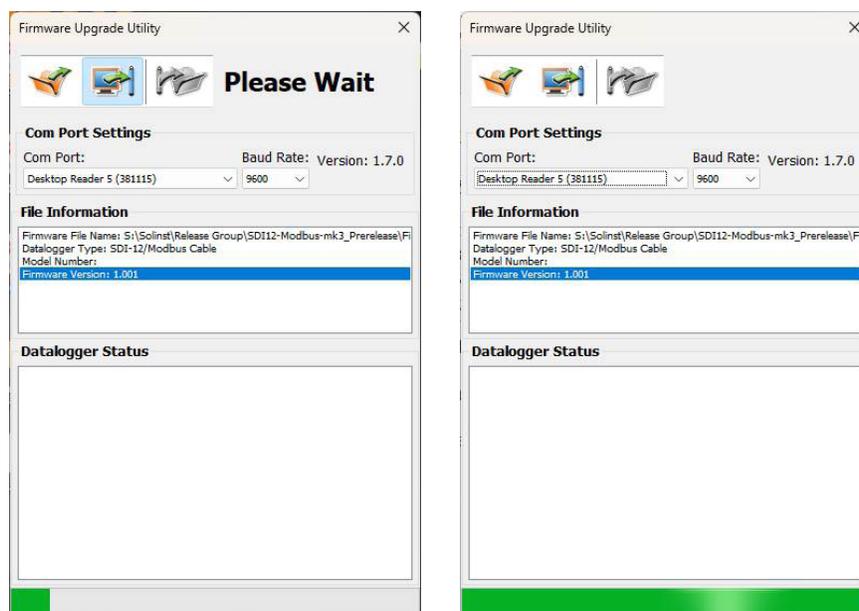


Figure 6-2 Firmware Upgrade Utility

### 6.3 Troubleshooting

#### Datalogger Does Not Reply

The most common error is that SDI-12 commands are being sent with an address which does not match the actual device address of the datalogger being used, in which case the datalogger will not reply. Try changing the address of the SDI-12 command being sent.

Another suggestion is to use a short press of the push button as a power indicator. If this triggers datalogger synchronization, be sure the resulting communication is On-line.

#### **The recorder receives badly formatted replies from the SDI-12 network of Datalogger.**

Check that all datalogger's on the network have different and unique device addresses. Otherwise there will be data bus collisions and scrambled data will be returned on replies to the recorder or SDI-12 recorder.

## **7 References**

SDI-12 Support Group (Technical Committee). *SDI-12: A Serial-Digital Interface Standard for Microprocessor-Based Sensors, Version 1.3, July 18, 2005*. Available [online]: <http://www.sdi-12.org/>

Additional link: [http://www.sdi-12.org/archives.php?file\\_id=8](http://www.sdi-12.org/archives.php?file_id=8)



[www.solinst.com](http://www.solinst.com)

*High Quality Groundwater and Surface Water Monitoring Instrumentation*

Solinst Canada Ltd., 35 Todd Road, Georgetown, ON L7G 4R8  
Tel: +1 (905) 873-2255; (800) 661-2023 Fax: +1 (905) 873-1992  
[instruments@solinst.com](mailto:instruments@solinst.com)

**Solinst**<sup>®</sup>