SDI-12 Commands Tech Note

Level TROLL 400/500/700 and Rugged TROLL 200

Level TROLL 400/500/700 data loggers and the Rugged TROLL 200 support the SDI-12 Version 1.3 commands and extensions listed below. Data recorders that support SDI-12 Version 1.3 can usually send standard commands to an SDI-12 "sensor", like the Level TROLL 400/500/700, automatically. See an SDI-12 reference for more information, such as those listed at the end of this document. Or consult your SDI-12 data recorder documentation.

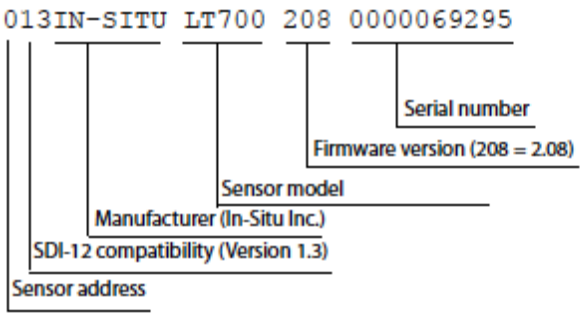
Sensor SDI-12 Defaults

Level TROLL 400/500/700 and Rugged TROLL 200 instruments support software-changeable addresses. Level TROLLs and Rugged TROLLs leave the factory with the following SDI-12 settings:

SDI-12 address:	0
Pressure units:	PSI
Temperature units:	degrees Celsius

Sensor Identification

In response to the "send identification" command, the Level TROLL 700, for example, will respond as follows:



SDI-12 V1.3 Command Set

Name	Command	Response
Address Query	?!	a<CR><LF>The wildcard address '?' character is only supported for the Address Query command. It is ignored as an invalid address for all other commands.
Acknowledge Active	a!	a<CR><LF>The device supports the basic address characters in the range '0' to '9' and the extended address characters in the ranges 'A' to 'Z' and 'a' to 'z'. All other characters are ignored as an invalid address. The default address is '0'.
Change Address	aAb!	b<CR><LF>Where 'a' is the current address and 'b' is the new address
Send Identification	aI!	a13IN-SITU LT700 vvv xxxxxxxxxx<CR><LF>where: vvv = device firmware version * 100 (208 = 2.08)xxx = 10-digit device serial number with leading zeroes

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Start Verification Send Data Additional Data	aV! aDO! aD1! ... aD9!	a0001<CR><LF>One result is available immediately for reading by the Send Data command.a+n<CR><LF>where: n = lower 16 bits of device status (0-65535) as described in the "Device Status" section of this document.a<CR><LF>No values are returned after an additional data command.
Start Measurement Start Measurement CRC Send Data Additional Data	aM! aMC! aDO! aD1! ... aD9!	a001n<CR><LF>n parameters will be available for reading by the Send Data command within 1 second. A service request (a<CR><LF>) will be sent when the parameters are ready. The number of parameters returned and their order is determined by the SDI-12 configuration file or the XO extended command. The default value for n is 2. a<values><CR><LF> ora<values><CRC><CR><LF>The number and type of parameters returned is determined by the SDI-12 configuration file. The default values are pressure in PSI followed by temperature in °C.a<CR><LF> or a<CRC><CR><LF>No values are returned after an additional data command.
Additional Measurements Additional with CRC Send Data Additional Data	aM1! ... aM9! aMC1! ... aMC9! aD0! aD1! ... aD9!	a0000<CR><LF> No additional measurements are available. a<CR><LF> or a<CRC><CR><LF> No values are returned after an additional measurement command.
Start Concurrent Start Concurrent CRC Send Data Additional Data	aC! aCC! aD0! aD1! ... aD9!	a001nn<CR><LF> nn parameters will be available for reading by the Send Data command within 1 second. No service request will be sent when the parameters are ready. The number of parameters returned is determined in the same manner as a start measurement command. a<values><CR><LF> or a<values><CRC><CR><LF> The number and type of parameters returned is determined by the SDI-12 configuration file in the same manner as a start measurement command. a<CR><LF> or a<CRC><CR><LF> No values are returned after an additional data command.
Additional Concurrent Additional with CRC Send Data Additional Data	aC1! ... aC9! aCC1! ... aCC9! aD0! aD1! ... aD9!	a00000<CR><LF> No additional concurrent measurements are available. a<CR><LF> or a<CRC><CR><LF> No values are returned after an additional concurrent measurement command.
Continuous Measurement Continuous with CRC	aR0! ... aR9! aRC0! ... aRC9!	a<CR><LF> a<CRC><CR><LF> The continuous measurement mode is not supported.

ISCO Compatibility	aXPR0!	aIxIxIxIx<CR><LF> where each Ix is a character pair identifying the parameter and units for each measurement. The number of Ix pairs will equal the number of data values returned for the Start Measurement and Start Concurrent commands. The following pairs are supported (all other units return "??"). Pressure, PSIA = "d0" Pressure, PSIG = "d2" Pressure, mmHg = "d3" Temperature, °C = "A0" Temperature, °F = "A1" Level, meters = "I0" Level, feet = "I1"
ISCO Additional	aXPR1…aXPR9!	a<CR><LF> No values are returned after an additional ISCO compatibility command.
Communication Diagnostics	aXCD!	a+A+C<CR><LF> where: A = contents of Modbus device address register 49200 C = contents of Modbus serial communication configuration register 49201
Set Pressure Units	aXPUnn!	a0001<CR><LF> where nn is the pressure units ID: 17 = PSI (default), 19 = Kpa, 20 = bar, 21 = mbar, 22 = mmHg, 23 = inHg, 24 = cmH2O, 25 = in H2O.
Send Data	aD0!	One result is available immediately for reading by the Send Data command.
Additional Data	aD1! ... aD9!	a+s<CR><LF> where: s = command status, 1 = command successful, 0 = invalid units ID or an attempt to change units while the device is logging. a<CR><LF> No values are returned after an additional data command.
Set Temperature Units	aXTUnn!	a0001<CR><LF> where nn is the temperature units ID: 01 = °C (default), 02 = °F. One result is available immediately for reading by the Send Data command.
Send Data	aD0!	a+s<CR><LF> where: s = command status, 1 = command successful, 0 = invalid units ID or an attempt to change units while the device is logging.
Additional Data	aD1 ... aD9!	a<CR><LF> No values are returned after an additional data command.

Set Level Units	aXLUnn!	a0001<CR><LF> where nn is the level units ID: 33 = mm, 34 = cm, 35 = meters, 37 = inches, 38 = feet (default). One result is available immediately for reading by the Send Data command.
Send Data	aD0!	a+s<CR><LF> where: s = command status, 1 = command successful, 0 = invalid units ID or an attempt to change units while the device is logging.
Additional Data	aD1! ... aD9!	a<CR><LF> No values are returned after an additional data command.
Set Level Mode	aXLMnn!	a0001<CR><LF> where nn is the level parameter ID: 03 = depth (default), 04 = level from top of casing, 05 = level in elevation. One result is available immediately for reading by the Send Data command.
Send Data	aD0!	a+s<CR><LF> where: s = command status, 1 = command successful, 0 = invalid units ID or an attempt to change the mode while the device is logging.
Additional Data	aD1! ... aD9!	a<CR><LF> No values are returned after an additional data command.
Set Output Sequence	aXOnnn!	a0001<CR><LF> where nnn = 1 to 3 characters (P = pressure, T = temperature, L = Level) in the required output order. One result is available immediately for reading by the Send Data command.
Send Data	aD0!	a+s<CR><LF> where: s = command status, 1 = command successful, 0 = invalid parameter characters.
Additional Data	aD1! ... aD9!	a<CR><LF> No values are returned after an additional data command.
Set Specific Gravity	aXSGpd.d!	a0001<CR><LF> where: pd.d = specific gravity p = polarity sign (+ or -) d = 1 to 7 digits (0 to 9) . = decimal point (optional) One result is available immediately for reading by the Send Data command.
Send Data	aD0!	a+s<CR><LF> where: s = command status, 1 = command successful, 0 = invalid parameter characters or an attempt is made to change the specific gravity while the device is logging.
Additional Data	aD1! ... aD9!	a<CR><LF> No values are returned after an additional data command.

Zero Pressure	aXPZ!	a0011<CR><LF> One value will be available for reading by the Send Data command within 1 second. A service request (a<CR><LF>) will be sent when the parameter is ready.
Send Data	aD0!	a+s<CR><LF> where: s = command status, 1 = command successful, 0 = invalid parameter characters.
Additional Data	aD1! ... aD9!	a<CR><LF> No values are returned after an additional data command.
Set Level Reference	aXLRpd.d!	a0011<CR><LF> where: pd.d = reference level in current units p = polarity sign (+ or -) d = digits (1 to 7) . = decimal point (optional) One value will be available for reading by the Send Data command within 1 second. A service request (a<CR><LF>) will be sent when the parameters are ready.
Send Data	aD0!	a+s<CR><LF> where: s = command status, 1 = command successful, 0 = invalid parameter characters.
Additional Data	aD1! ... aD9!	a<CR><LF> No values are returned after an additional data command.
Reset to Factory Defaults	aXRST!	a0901<CR><LF> One value will be available for reading by the Send Data command within 90 seconds. A service request (a<CR><LF>) will be sent when the parameter is ready.
Send Data	aD0!	a+s<CR><LF> where: s = command status, 1 = command successful, 0 = cannot reset while logging.
Additional Data	aD1! ... aD9!	a<CR><LF> No values are returned after an additional data command.

Device Status

The device status register holds general status information. Each set bit represents a status value. There are a limited number of standardized predefined status values that all devices will support. These predefined status values are contained in the lower register. The upper register is reserved for device specific status values.

Device Status Bit Values

Bit	Category	Description
0	Alarm	Sensor high alarm
1	Warning	Sensor high warning
2	Warning	Sensor low warning
3	Alarm	Sensor low alarm
4	Warning	Sensor calibration warning
5	Alarm	Sensor malfunction
6-7	N/A	Reserved
8	Status	Power management disabled
9	Status	Device off line
10	Alarm	Device hardware reset occurred
11	Alarm	Device malfunction
12	Status	No external power
13	Warning	Low battery – battery capacity < 5%
14	Warning	Low memory – data log memory capacity < 5%
15	N/A	Reserved
16-31	N/A	Available for device-specific status

Bits 0-7 of the device status register are reserved for sensor status. These bits are the logical OR of bits 0-7 of the sensor status register in each sensor connection.

Bits 8-15 of the device status register are reserved for common device status. Any bit in this range that is not applicable to a device will be set to zero.

Bits 16-31 of the device status register are available for device-specific status. Any bit in this range that is not utilized by a device will be set to zero.

SDI-12 Configuration File

The device's SDI-12 configuration file may be edited with a serial connection and Win-Situ® 5 Software. Change the device's SDI-12 address and specify the parameter reporting order for SDI-12 communications in the SDI-12 Setup dialog box (see below).

1 While connected to a device in Win-Situ 5, click the Setup tab, then click the SDI-12 Setup button. A dialog box like the one below will open.

2 Address Character. The device's current SDI-12 address is shown (factory default: 0). Enter the desired address character to change the address.

3 Select the sensor to report. All sensors supported by the connected device are available in the drop-down list.

4 Select the parameter to report. All parameters supported by the selected sensor are available in the drop-down list.

5 Click Add to add the parameter to the Output Order. Repeat for all desired parameters. If you wish to change the reporting order, select a parameter in the list and click the up arrow or the down arrow to change its position in the output order list.

6 Click OK when done. The software will write the SDI-12 configuration to the device.

References

1 SDI-12, A Serial-Digital Interface Standard for Microprocessor-Based Sensors, version 1.3. SDI-12 Support Group, Logan, Utah, January 12, 2009. Available at www.sdi-12.org.

2 In-Situ Modbus Communication Protocol. Available at www.in-situ.com.