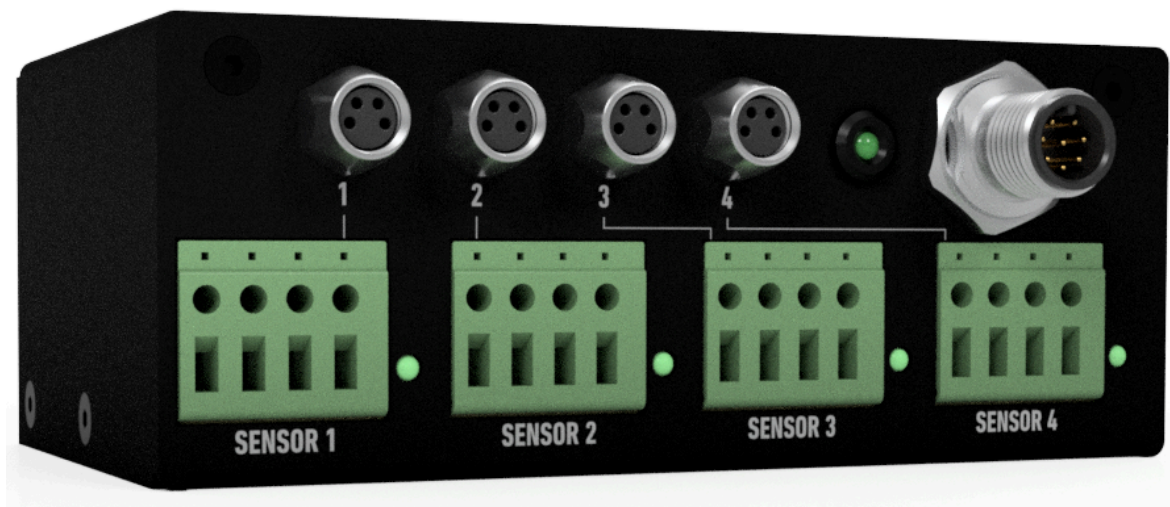# ADVANCED SENSOR HUB COMMUNICATION PROTOCOL

This document provides the information needed to communicate with the Advanced Sensor Hub module through direct UART communication.

UART Communication Protocol for Advanced Sensor Hub / Version: 01.01.00 / Date: August 2024

Introduction

The Advanced Sensor Hub can be controlled directly via an adapter (intermediary between the module and the computer) or it can be controlled via an Advanced Control Center. If you are using the Sensor Hub with the Advanced Control Center, refer to the Control Center communication protocol documentation for additional information.

This module is made of 4 sensor connection ports (either via M8 connectors or directly through the wire connection ports). You can:

- personalize the configuration of the sensor according to what's available for the sensor (slope, offset, resolution, liquid type, …)

- connect a sensor channel's values to a remote PI control (see Advanced Pressure Controller communication protocol for more information)

- monitor the sensor values integrated over time

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Serial connection settings

Baud rate: 230400

Data bits: 8

Stop bit: 1

Parity: none

Termination character: '\n'

Syntax

Command syntax

char 0: '<' to start the query

char 1 to 5: command name

char 6: '?' to read, '!' to write

then ':' to start a value. Can iterate over many arguments.

Error handling

In the answer to any command, the first information displayed after the read / write character is the error code '|xx|'. It is two characters that indicate the error code associated with the request. '00' means no error. Refer to the following table to check the possible error codes related to the Sensor Hub module:

Error code	Meaning
00	No error
C0	Channel error: wrong channel requested
L0	Locking error: you do not have writing access to this parameter
I0	Impossible command: this query can not be processed
P0	Pause error: this command can not be processed while pause is set to 1
NS	No sensor connected to this channel
B0	Argument value out of bound

Quickstart

A Sensor Hub module features four sensing communication heads (M8 connection ports or terminal block) for connecting sensors. This module can be connected to a Hub or a Control Center within a complex system. The sensor values from the Sensor Hub can then be utilized by other modules of the system for a deported feedback loop.

All the commands listed in this section (and additional ones) are grouped together in the [commands table](#).

Sensing

A Sensor Hub sensing unit has a hybrid module enabling direct analog reading of analog sensors, and it also features an I2C head for communication with digital sensors.

Sensor control

Elveflow digital sensors are automatically detected and read by the device when connected to the module. It's possible to apply offset, slope and quadratic coefficients to the values measured by the sensor using **SENCA** command to set these coefficients.
To use Elveflow analog sensors, it is first needed to set the appropriate sensor type using the **SENSO** command. To do so, follow the [correspondence table](#) that matches analog sensors with their corresponding integer types.

List of commands

- W means 'write', ie set value, available for this command if ticked
- R means 'read', ie get value, available for this command if ticked
- 'Mandatory arguments' corresponds to mandatory arguments to attach to command in R mode
- 'Arguments' corresponds to additional mandatory arguments to attach to command in W mode after the 'Mandatory arguments'
- 'Arguments' also corresponds to additional values in the answer resulting from the sent command (in W or R mode), after the 'Mandatory arguments'

Other auxiliary tables after this one.

Parameter	Mandatory arguments	Arguments	W	R	Number of characters returned	Example query	Typical answer	Note
PINGA		**float:** sensor value of channel 1 **int:** sensor type of channel 1 **float:** sensor value of channel 2 **int:** sensor type of channel 2		X	60	<PINGA?	>PINGA?|00|00000.00:00:00000.00:00:00000.00:00:-0039.99:04	

		float: sensor value of channel 3 **int:** sensor type of channel 3 **float:** sensor value of channel 4 **int:** sensor type of channel 4					
PING_	**int :** channel (1 to 4)	**float:** sensor value **int:** sensor type		X	26	<PING_?:2	>PING_?|00|02:00000.00:00
IDN		**str:** device name		X	22	<_IDN_?	>_IDN_?|00|SENSORHUB_
DEVSN		**str:** SN		X	18	<DEVSN?	>DEVSN?|00|S00001
FIRMV		**str:** firmware version		X	21	<FIRMV?	>FIRMV?|00|v01.03.01

RESET						<RESET		**reset firmware** i.e. soft reset of the device, i.e. simulates a power off-power on which resets all volatile variable (not saved in hard memory)
SENSO	**int :** channel (1 to 4)	**int:** sensor type	**X**	**X**	17	<SENSO?:1 <SENSO!:1:21	>SENSO?|00|01:04 >SENSO!|00|01:21	**Sensor types:** **00:** no sensor **01:** MFSD1 **02:** MFSD2 **03:** MFSD3 **04:** MFSD4 **05:** MFSD5 **21 to 44:** analog sensors

							(W mode only compatible with analog sensors)
SENCA	int : channel (1 to 4)	float: sensor slope float: sensor offset	X	X	32	<SENCA?:2 <SENCA!:2:2.31:0.04	>SENCA?|00|02:00001.00:00000.00 >SENCA!|00|02:00002.31:00000.04	
SENRE	int : channel (only 1)	int: sensor resolution	X	X	17	<SENRE?:1 <SENRE!:1:8	>SENRE?|00|01:04 >SENRE!|00|01:8	Sensor resolution corresponds to the number of bits used to code the sensor value (see Acquisition time table for sensor resolution for details). Compatible only with digital sensors type 1 to 5
SENLT	int : channel (1	int: liquid type	X	X	17	<SENLT?:1	>SENLT?|00|01:00	compatible with sensors MFSD2, MFSD3 and MFSD4

	to 4)					<SENLT!:1:3	>SENLT!|00|01:03	**only** **see Correspondence table for liquid types** **caution : liquid type is reset at each power up**
SENRA	**int :** channel (1 to 4)	**int:** sensor measured rate		X	17	<SENRA?:3	>SENRA?|00|03:119	
SEINT	**int :** channel (1 to 4)	**int:** start or stop instruction **float:** sensor value integral over time since start	X	X	25	<SEINT?:1 <SEINT!:1:0	>SEINT?|00|01:01:00010.34 >SEINT!|00|01:00:00011.26	**to start the integration : 1** **to stop the integration : 0** **when stopping the integration, the final integral value persists until another integration is started again**

Correspondence table for sensor types

Type id	Unit in output	Sensor type
0		No sensor connected
1	µL/min	MFS1 digital
2	µL/min	MFS2 digital
3	µL/min	MFS3 digital
4	µL/min	MFS4 digital
5	µL/min	MFS5 digital
6-20		Reserved
21	µL/min	MFS1 Analog
22	µL/min	MFS2 Analog
23		Reserved
24	µL/min	MFS3 Analog
25	µL/min	MFS4 Analog
26	µL/min	MFS5 Analog
27-29		Reserved
30	mbar	MPS0 Analog
31	mbar	MPS1 Analog
32	mbar	MPS2 Analog
33	mbar	MPS3 Analog
34	mbar	MPS4 Analog
35	mbar	MFP
36-39		Reserved

40	mV	Bubble detector
44	mV	Custom

Acquisition time table for sensor resolution

Resolution mode	Resolution (bit)	Processing Time Min. (ms)	Processing Time Typ. (ms)	Processing Time Max. (ms)
1	9	0.5	0.8	0.9
2	10	1.0	1.3	1.5
3	11	2.0	2.4	2.6
4	12	4.1	4.6	4.9
5	13	8.2	8.9	9.4
6	14	16.4	17.5	18.5
7	15	32.8	34.8	36.7
8	16	65.5	69.3	73.2

Correspondence table for liquid types

This table applies to the following sensors: digital sensors MFS2, MFS3 and MFS4.

Liquid ID	Corresponding liquid
0	Water
1	IPA
2	Not applicable (liquid type doesn't mean anything for the connected sensor)