FU.SEN.RSC.002 4-20mA Heterodyne Airborne Sensor IP65 S/N 565YYXXXX

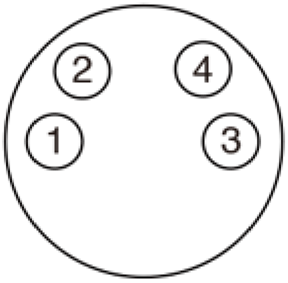
General description

RSC are standalone 4-20[mA] ultrasound heterodyned current output sensors designed to be used with industrial standard measurement system (such as PLC, DCS and SCADA systems). RSC uses a resonant Airborne Sensor designed for electrical inspection. Sensitive to friction, impact and turbulence, RSC delivers an analog signal indicative of the machine or accessories condition.

Features

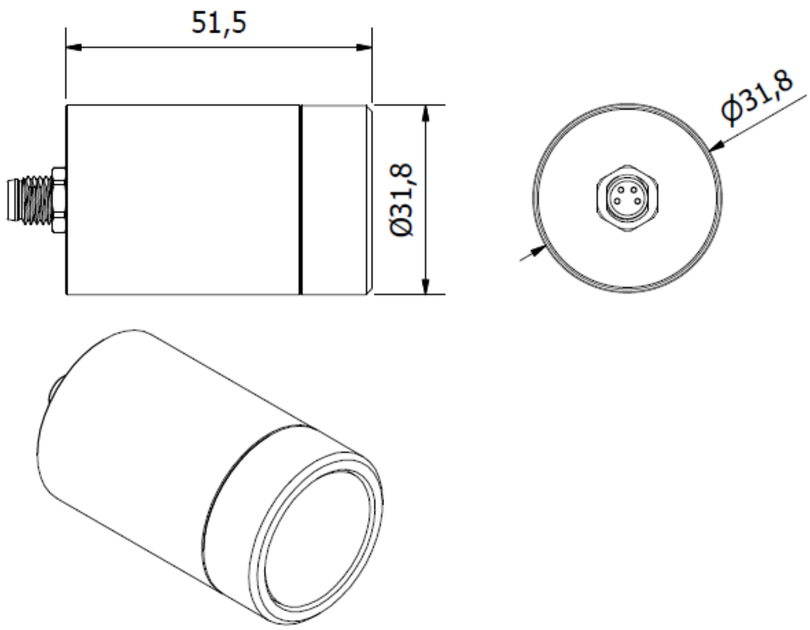
- Static or dynamic output;
- On board amplification stages;
- Hardware calibration;
- On board ambient T° measurement (through serial communication);
- Non-volatile memory (used to save configuration and recover sensor state/mode upon power outage);
- Unique ID;
- Digital I/O communication for simple use;
- Serial communication for advanced use.

Top view pinout (IEC 60947-5-2 compliant)

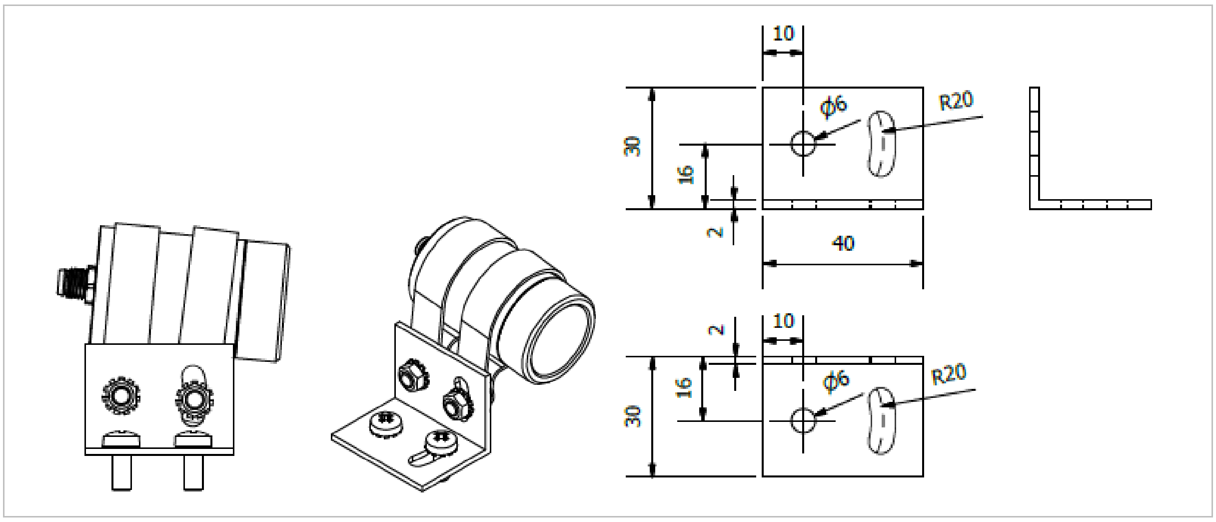


1 = POWER SUPPLY (BN)
2 = OUTPUT CURRENT (WH)
3 = GROUND (BU)
4 = COMMUNICATION LINE - should be left floating if not used – (BK)

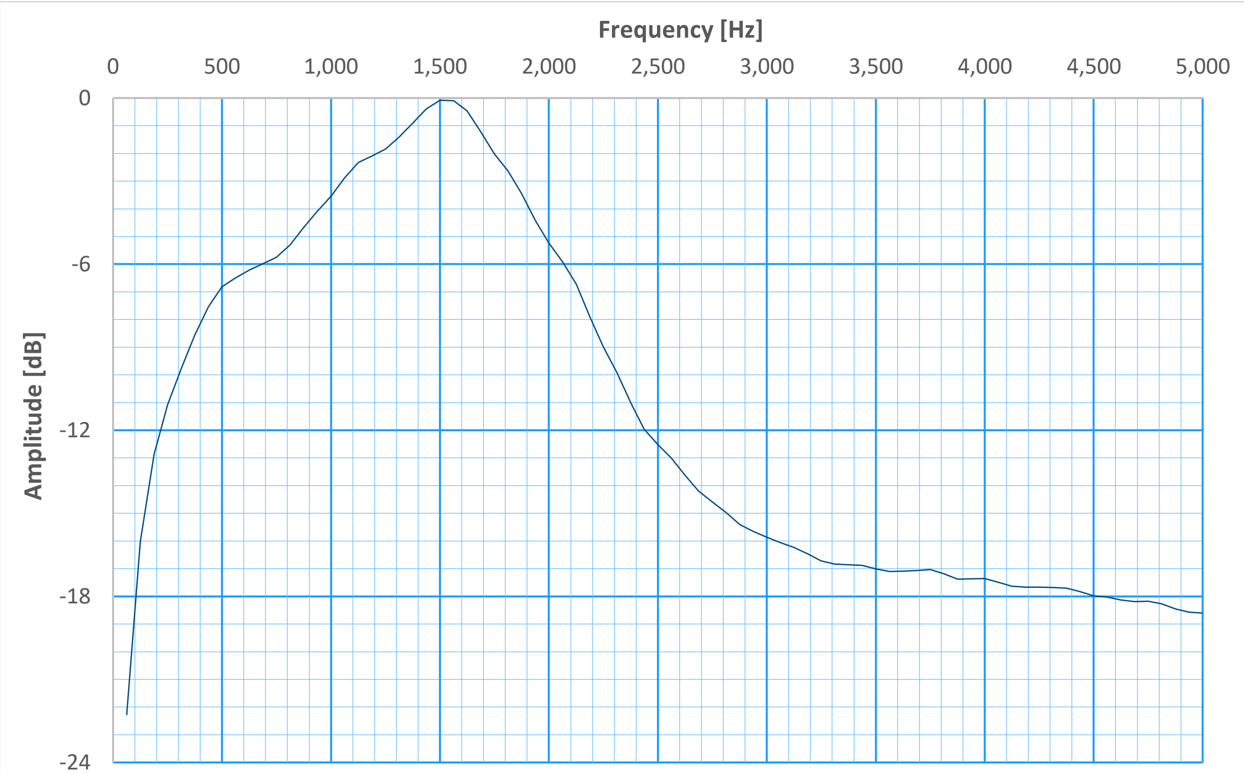
Technical data

General specifications	
Dimensions [mm]	
Weight	82 Gram / 2.9 Oz
IP rating	IP65
Installation	
Power supply	10 [V] to 30 [V]
Operating temperature	-20 [°C] to +70 [°C]
Pinout voltage	GROUND to VDD
Recommended maximum cable length	30 [m] / 100 [feet]

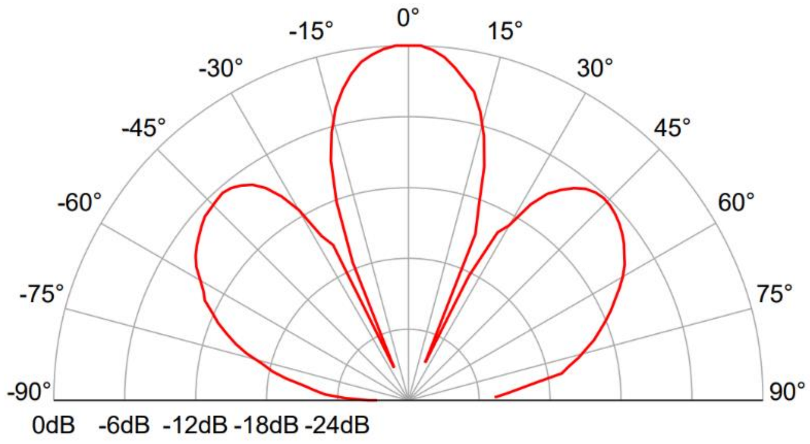
Sensor signal (Typical)	
Resonant frequency	40 [kHz] +/- 1 [kHz]
Gain range	0 [dB] to 60 [dB]
Gain step	12 [dB]
Connector size	M8 - 4 pin
Heterodyned signal (Typical)	
Heterodyne frequency	38.5 [kHz] +/- 10%
Bandwidth	[0.25 – 4] [kHz]
RMS Time Period in static mode	1 [s]
Absolute maximum current output range	2 [mA] to 40 [mA]
Factory configuration	
Signal mode	Dynamic
Gain	60 dB
Optional accessories offered by SDT	
Cables with Straight M8 Connector	
FU.RSC.CABL.01.015-1	SENSOR-/ACTOR CABLE M8 4PF <> FREE END 1.5m - STRAIGHT SHIELDED
FU.RSC.CABL.01.030-1	SENSOR-/ACTOR CABLE M8 4PF <> FREE END 3.0m - STRAIGHT SHIELDED
FU.RSC.CABL.01.050-1	SENSOR-/ACTOR CABLE M8 4PF <> FREE END 5.0m - STRAIGHT SHIELDED
FU.RSC.CABL.01.100-1	SENSOR-/ACTOR CABLE M8 4PF <> FREE END 10.0m - STRAIGHT SHIELDED
Cables with 90° M8 Connector	
FU.RSC.CABL.02.015-1	SENSOR-/ACTOR CABLE M8 4PF <> FREE END 1.5m - 90° SHIELDED
FU.RSC.CABL.02.030-1	SENSOR-/ACTOR CABLE M8 4PF <> FREE END 3.0m - 90° SHIELDED
FU.RSC.CABL.02.050-1	SENSOR-/ACTOR CABLE M8 4PF <> FREE END 5.0m - 90° SHIELDED
FU.RSC.CABL.02.100-1	SENSOR-/ACTOR CABLE M8 4PF <> FREE END 10.0m - 90° SHIELDED
Mounting bracket	
FA.RSC.ACC.001-01	4-20mA Heterodyne Mounting Accessories



Normalized heterodyned response curve (typical)

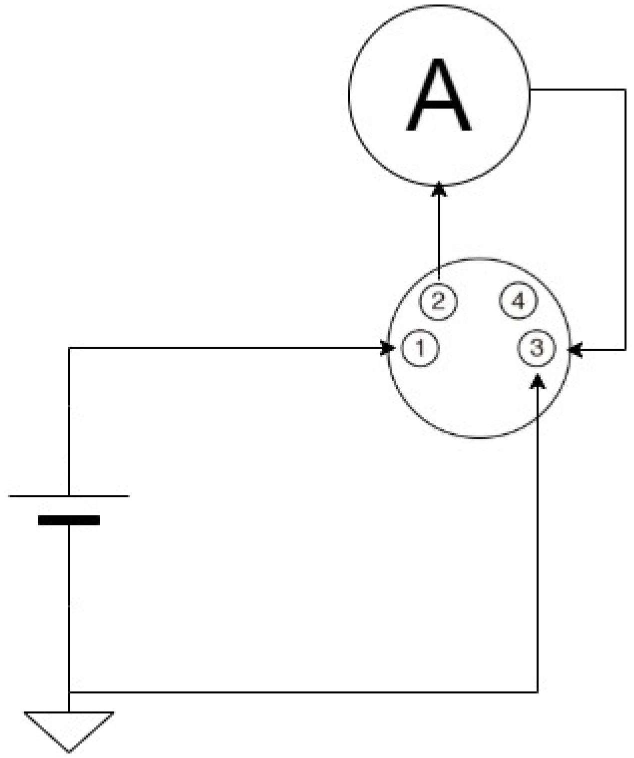


Beam angle



Wiring configuration:

Standalone

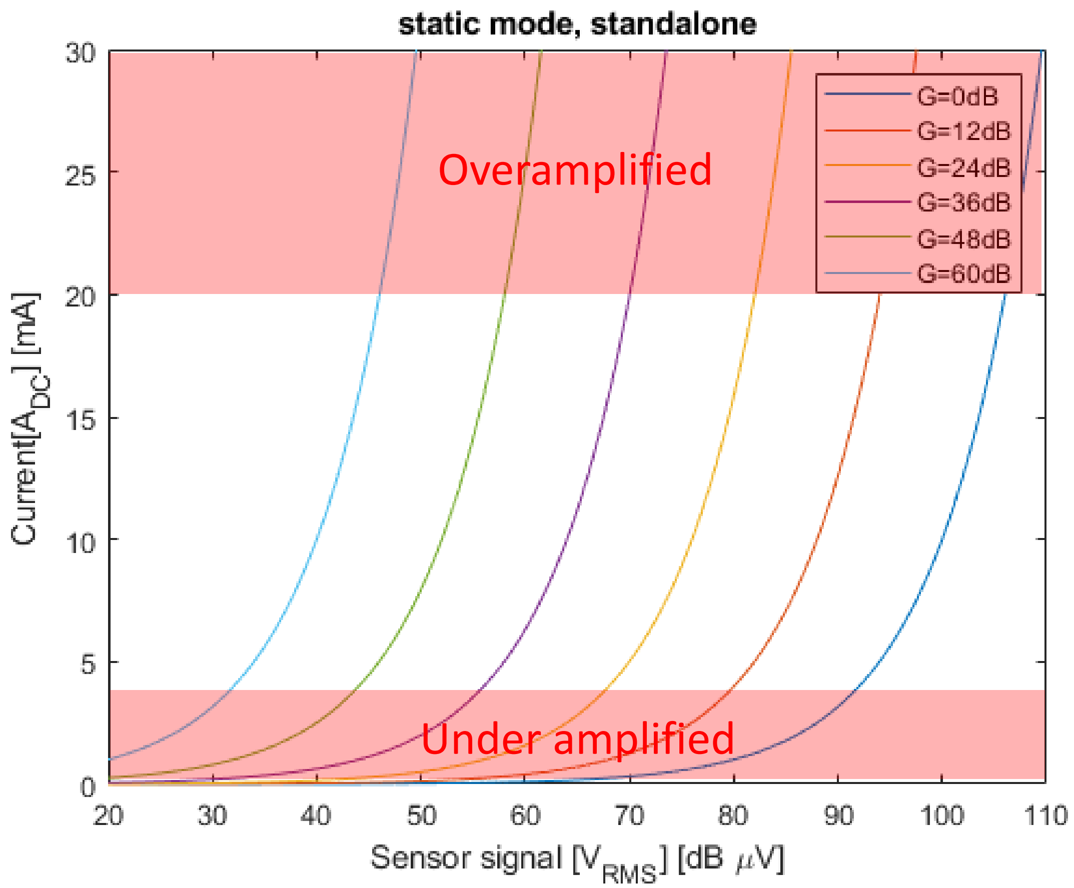


Static output equation:

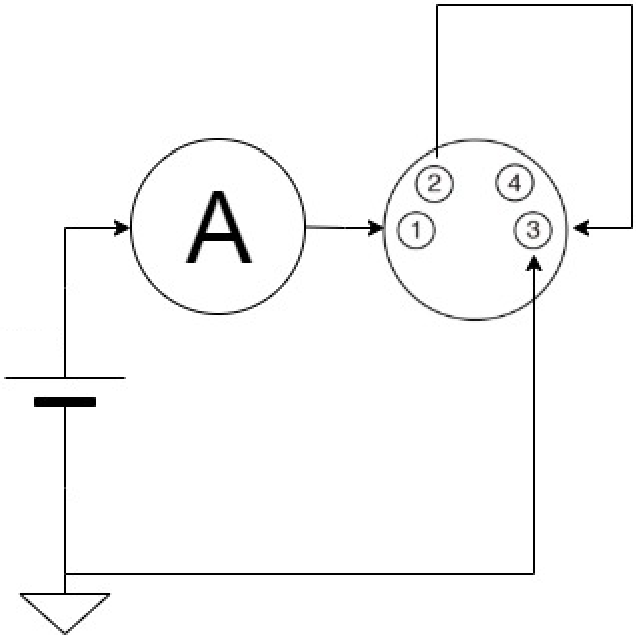
$$Sensor\ signal\ [V_{\mathrm{RMS}}] = \frac{Current\ [A_{DC}] * 10\ [\Omega]}{Amplification\ [1]}$$

Dynamic output equation:

$$Sensor\ signal\ [V_{AC}] = \frac{(current\ [A_{AC}] - 0.012\ [A_{bias}]) * 208.25\ [\Omega]}{Amplification\ [1]}$$


static mode, standalone
Overamplified
Under amplified
G=0dB
G=12dB
G=24dB
G=36dB
G=48dB
G=60dB
Current[A_DC] [mA]
Sensor signal [V_RMS] [dB µV]
0
5
10
15
20
25
30
20
30
40
50
60
70
80
90
100
110

Loop powered

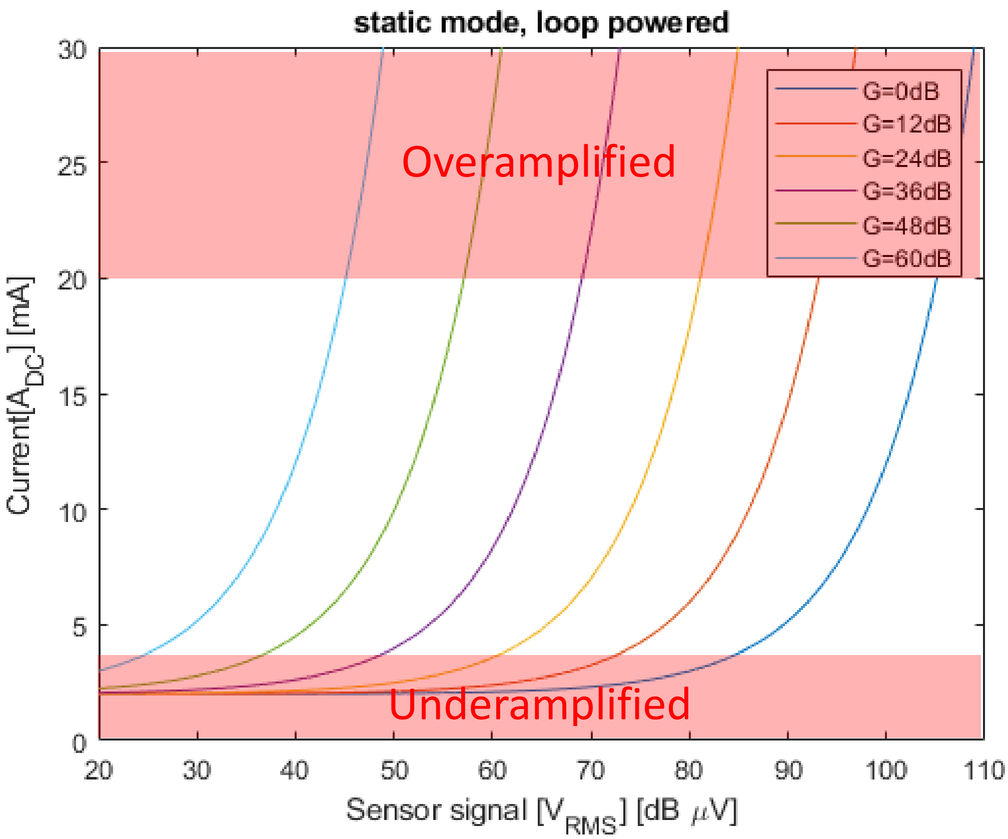


Static output equation:

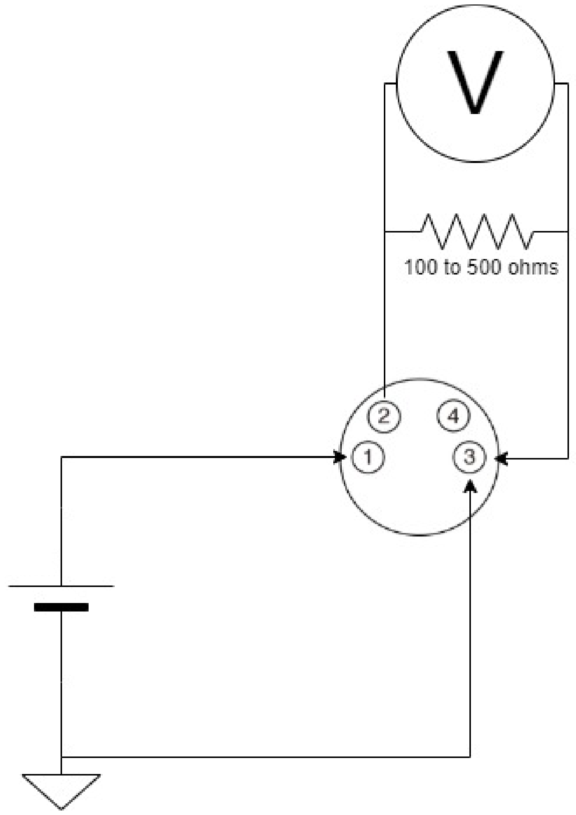
$$Sensor\ signal\ [V_{\mathrm{RMS}}] = \frac{(current\ [A_{DC}] - 0.002\ [A_{bias}]) * 10\ [\Omega]}{Amplification\ [1]}$$

Dynamic output equation:

$$Sensor\ signal\ [V_{AC}] = \frac{(current\ [A_{AC}] - 0.014\ [A_{bias}]) * 208.25\ [\Omega]}{Amplification\ [1]}$$



Voltage measurement



Static output equation:

$$Sensor\ signal\ [V_{\mathrm{RMS}}] = \frac{\left(\frac{voltage\ [V_{DC}]}{resistor\ [\Omega]}\right) * 10\ [\Omega]}{Amplification\ [1]}$$

Dynamic output equation:

$$Sensor\ signal\ [V_{AC}] = \frac{\left(\frac{voltage\ [V_{AC}]}{resistor\ [\Omega]} - 0.012\ [A_{bias}]\right) * 208.25\ [\Omega]}{Amplification\ [1]}$$

Communication:

Digital output mode

Gain and mode can be selected by generating pulses on the communication line.

The default state of the line is +VDD (pulled up internally with a 10 [kΩ] resistor) and a pulse consists of pulling the line down for at least 1 [ms] then releasing the line.

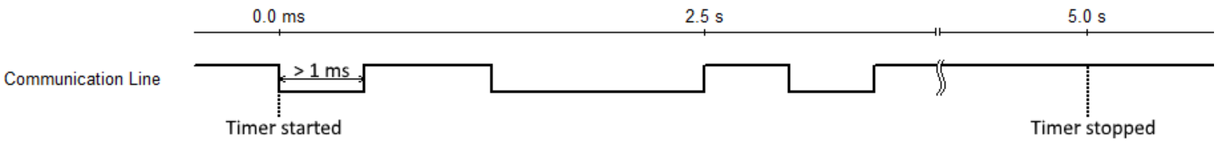
After the first pulse is initiated a 5 [s] internal timer is started. When the 5 [s] timeout occurs, the sensor counts how many pulses it received during this time-lapse:

- 1 pulse: increase the gain by 12 [dB] (has no effect if the gain is already at 60 [dB]);
- 2 pulses: decrease the gain by 12 [dB] (has no effect if the gain is already at 0 [dB]);
- 3 pulses: change the mode (switch between static and dynamic mode);
- 4 pulses: initialize the sensor in dynamic mode with a gain of 60 [dB](factory reset);

After any modification, data are saved inside a non-volatile memory and are restored on sensor power on.

Example

- Change the output mode (generate 3 pulses under 5 [s]).



Serial mode

The communication line can also be used for a serial communication allowing advanced features. The protocol used is UART 9600-8-E-1 (9600 bauds, 8 data bits, 1 even parity bit, 1 stop bit). The user can write data to the sensor and read them back:

- The serial communication is initialized by the user by sending the header byte <AAh>;
- The second byte is the device address or the generic address (<00h>). The sensor will only answer to its specific address or to the generic address;
- The third byte is the memory address (see below) that the user wants to write or to read;
- The fourth byte is the operation: <00h> for a write operation; <01h> for a read operation;
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  a) During a write, the fifth byte is sent by the user with the data that needs to be written;
  b) During a read, the fifth byte is sent by the user and contain the one-byte checksum.
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  c) During a write, the sixth byte is sent by the user and contain the one-byte checksum;
  d) During a read, the sixth byte is sent by the sensor containing the value of the memory address.

The one-byte checksum is the LSB (least signification byte) from the addition of all bytes sent.

After any modification, data are saved inside a non-volatile memory and are restored on sensor power on.

Memory address

00	Sensor specific address (R/W)	range 0 to 255
01	Sensor gain (R/W)	range 0 to 60 with step of 12
02	Sensor mode (R/W)	1 for static mode; 2 for dynamic mode
03	Temperature (R)	8bits integer temperature value
04	Temperature (R)	32bits float temperature value byte 1 (LSB)
05	Temperature (R)	32bits float temperature value byte 2
06	Temperature (R)	32bits float number temperature value byte 3
07	Temperature (R)	32bits float number temperature value byte 4 (MSB)
08	Firmware version (R)	32bits integer firmware version value byte 1 (LSB)
09	Firmware version (R)	32bits integer firmware version value byte 2
10	Firmware version (R)	32bits integer firmware version value byte 3
11	Firmware version (R)	32bits integer firmware version value byte 4 (MSB)

Examples

e) write a new specific device address, <11h> to the sensor:

User: <AAh 00h 00h 00h 11h BBh>

(Checksum is AAh + 11h = BBh)

f) Read the sensor gain (assuming the gain is set at 48 [dB] and the device specific address is set to <11h>):

User: <AAh 11h 01h 01h BDh>

Sensor: <30h>

(Checksum is AAh + 11h + 01h + 01h = BDh)

09	CMA 20/04/2021	Max cable length	RGO
07-08	CMA 10/11/2020	Cable length under brackets/ graphs / U-I conversion	RGO
06	CMA 05/11/2020	New info in tables + factory reset	RGO
05	RGO 03/11/2020	Removed internal diagram	CGI
04	CGI 29/10/2020	No commas but dots	CGI
03	RGO 21/10/2020	Added serial number	CGI
02	RGO 20/10/2020	Modified Serial Communication	CGI
01	RGO 26/08/2020	Original version	CGI
Revision	**Writer**	**Nature of modification**	**Approved**