FU.SEN.RSC.001 4-20mA Heterodyne Contact Sensor IP65
S/N 561YYXXXX

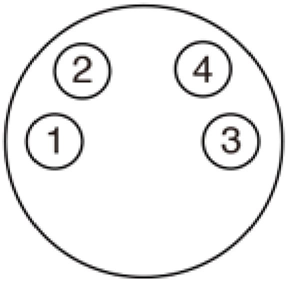
General description:

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 contact Sensor designed for ultrasound driven lubrication, steam systems inspection and valve inspection. Sensitive to friction impact and turbulence, RSC delivers an analog signal indicative of the machine or accessories condition.

Features:

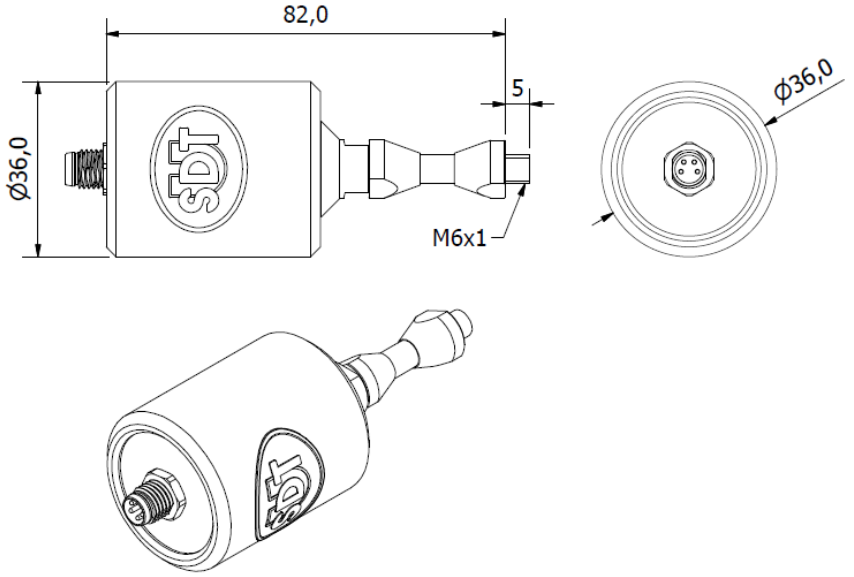
- Static or dynamic output;
- On board amplification stages;
- Hardware calibration;
- On board ambient T° measurement (through serial communication);
- Non-volatile memory (used to save configuration and recover sensor state/mode upon power outage);
- Unique ID;
- Digital I/O communication for simple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

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



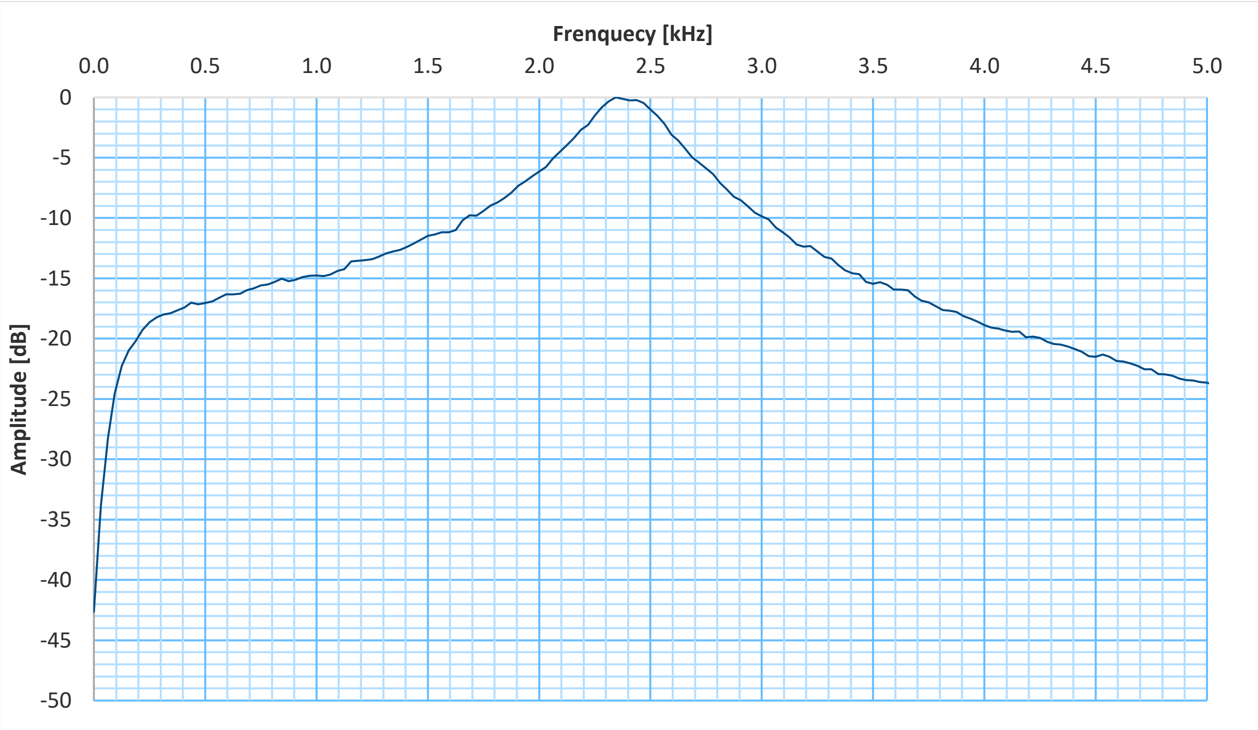
1 = POWER SUPPLY (BN)
2 = OUTPUT CURRENT (WH)
3 = GROUND (BU)
4 = COMMUNICATION LINE - should be left floating if not used – (BK)

Technical data:

General specifications	
Dimensions [mm]	
Weight	126 [Gram] / 4.44 [Oz]
IP rating	IP65
Installation	
Power supply	10 [V] to 30 [V]
Operating temperature	-20 [°C] to +85 [°C]
Pinout voltage	GROUND to VDD
Recommended maximum cable length	30 [m] / 100 [feet]
Recommended mounting torque	2 N.m
Sensor signal (Typical)	
Resonant frequency	37 [kHz] +/- 1 [kHz]
Gain range	0 [dB] to 60 [dB]
Gain step G	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]

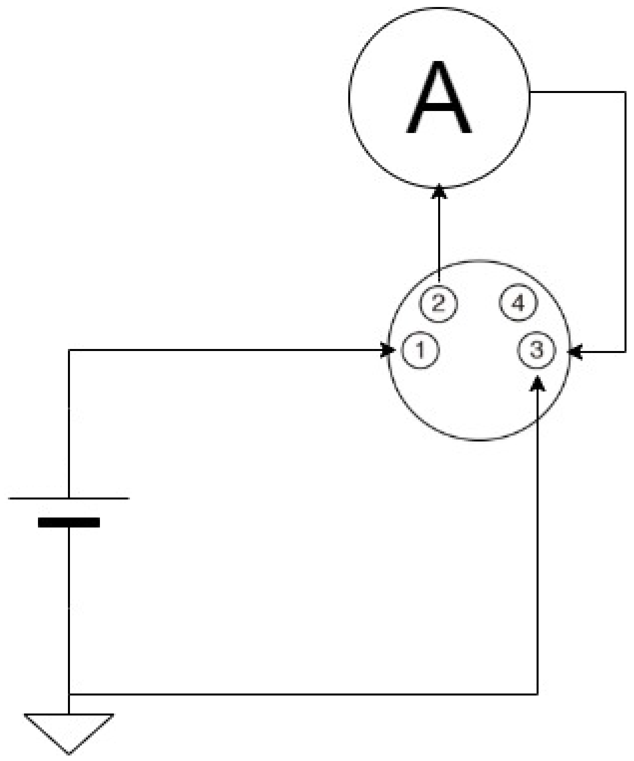
Absolute maximum current output range	2 [mA] to 40 [mA]
Factory configuration	
Signal mode	Dynamic
Gain	60 dB
Optional accessories offered by SDT	
Cables with Straight M8 Connector	
FU.RSC.CABL.01.015-1	SENSOR-/ACTOR CABLE M8 4PF <> FREE END 1.5m - STRAIGHT SHIELDED
FU.RSC.CABL.01.030-1	SENSOR-/ACTOR 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
FA.RSC.ACC.002-01	CONMONSense - HEAT SINK - AISI303 Ø30,0 (M6) x74,5mm

Normalized heterodyned response curve (typical)



Wiring configuration:

Standalone

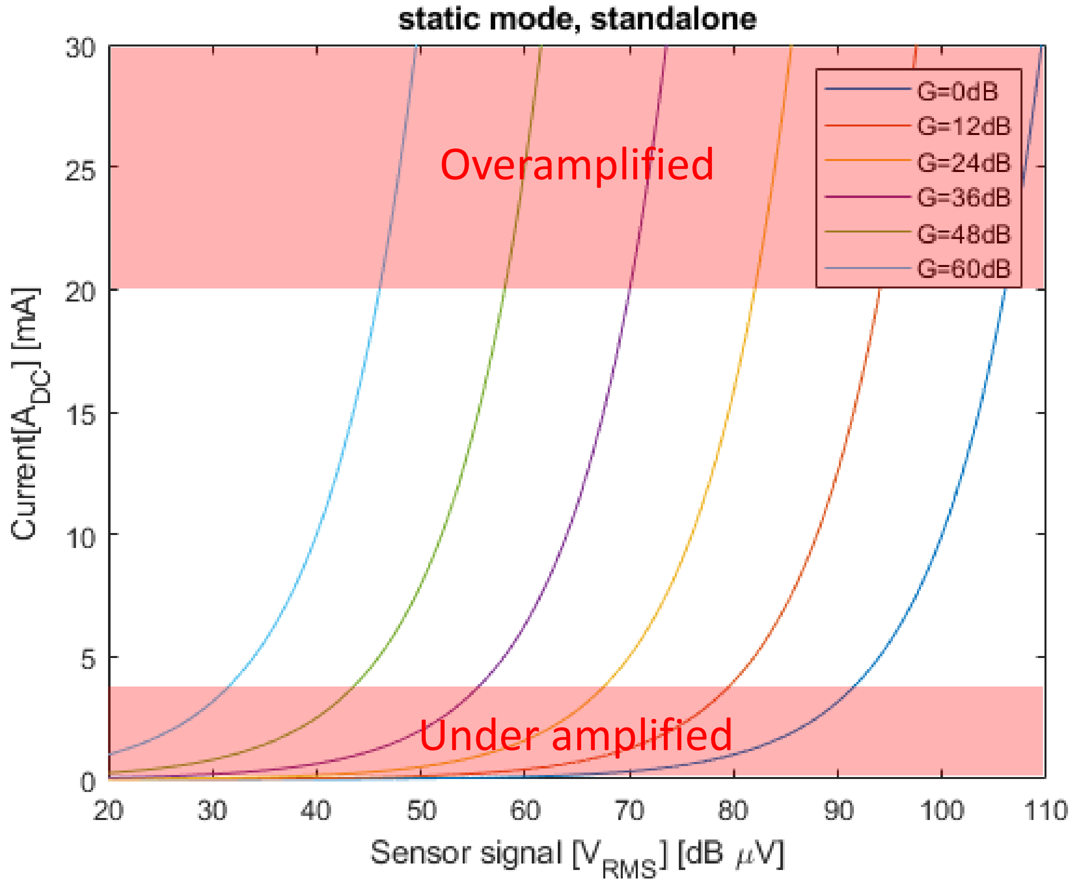


Static output equation:

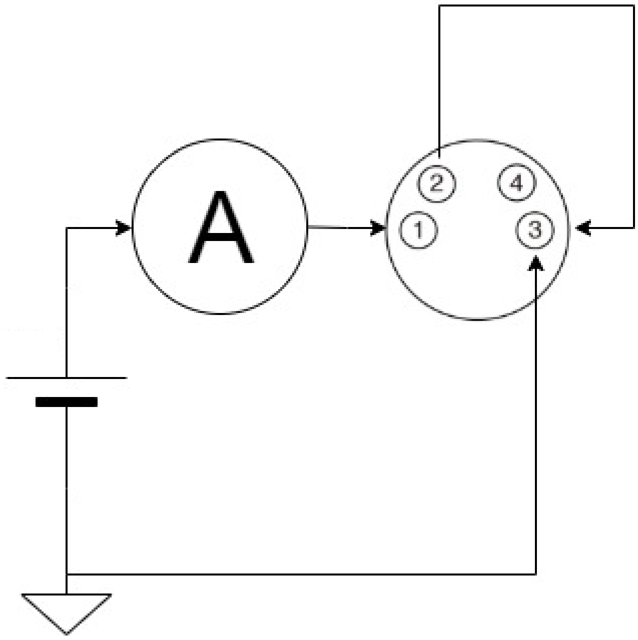
$$Sensor\ signal\ [V_{\mathrm{RMS}}] = \frac{Current\ [A_{DC}] * 10\ [\Omega]}{Amplification\ [1]}$$

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

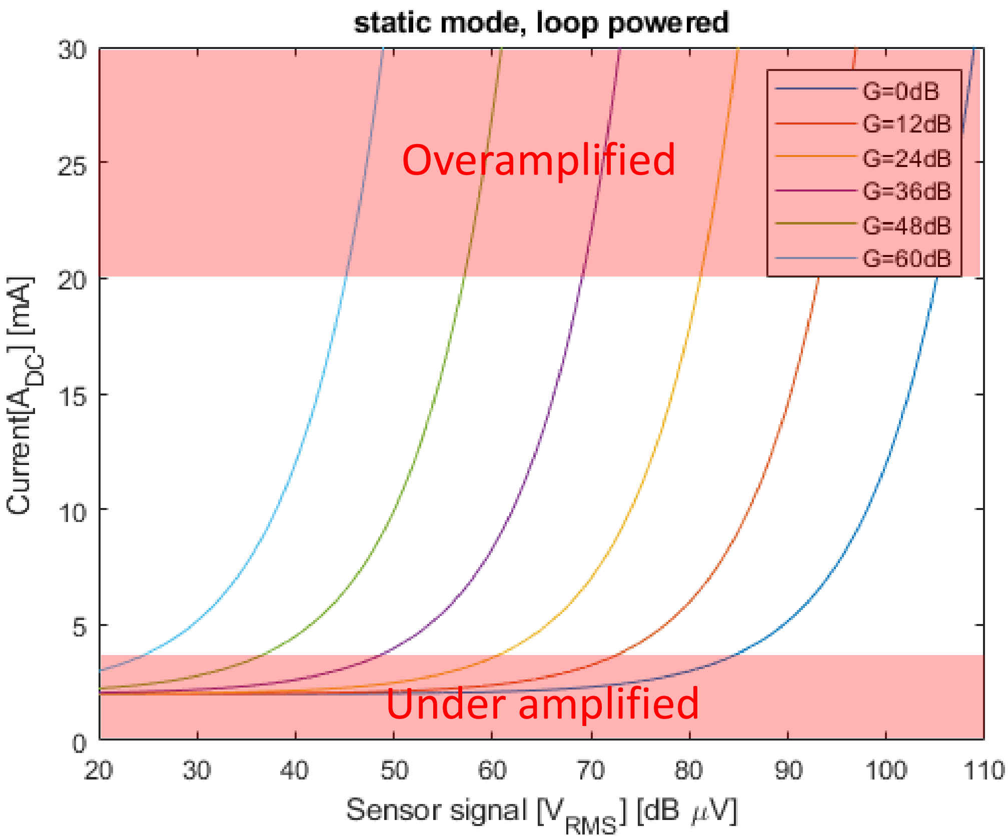


Static output equation:

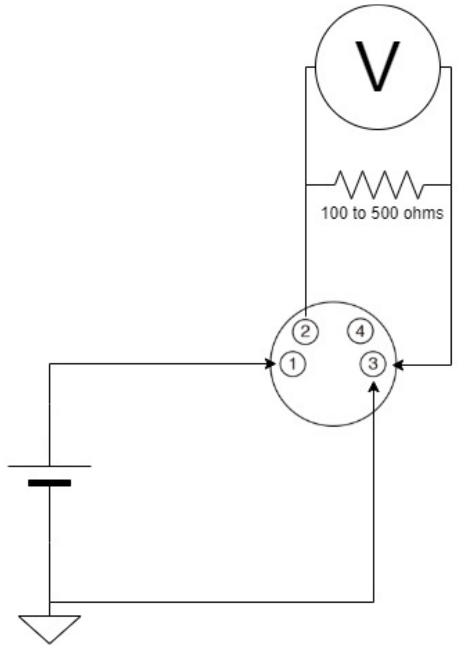
$$Sensor\ signal\ [V_{\mathrm{RMS}}] = \frac{(current\ [A_{DC}] - 0.002\ [A_{bias}]) * 10\ [\Omega]}{Amplification\ [1]}$$

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.

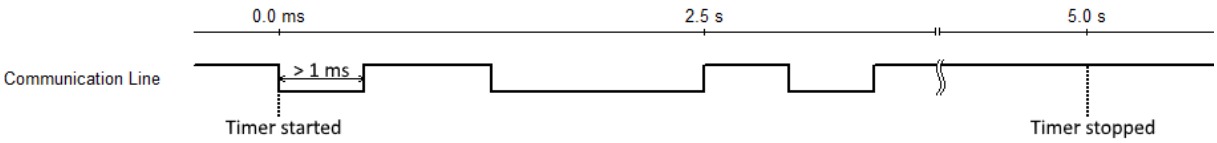
After the first pulse is initiated a 5 [s] internal timer is started. When the 5 [s] timeout occurs, the sensor counts how many pulses it received during this time-lapse:

- 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:

1) The serial communication is initialized by the user by sending the header byte <AAh>;
2) 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;
3) The third byte is the memory address (see below) that the user wants to write or to read;
4) The fourth byte is the operation: <00h> for a write operation; <01h> for a read operation;
5)
   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.
6)
   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 a 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
08	CMA 10/11/2020	Cable length under brackets/ graphs / U-I conversion	RGO
07	CMA 05/11/2020	New info in table + factory reset	RGO
06	RGO 03/11/2020	Removed internal diagram	CMA
05	CGI 29/10/2020	No commas but dots	CGI
04	RGO 21/10/2020	Added serial number	CGI
03	RGO 20/10/2020	Corrected static output equation	CGI
02	RGO 20/10/2020	Modified Serial Communication	CGI
01	RGO 26/08/2020	Original version	CGI
Revision	**Writer**	**Nature of modification**	**Approved**