



## HUMIDITY MEASUREMENT

### Low Temperature Capacitive Sensor **G-US.13**

**This family of micro-modules, which is intended to quantify the ambient atmosphere's relative humidity rate, is made of *passive or active* versions.**

The passive version G-US.13 is equivalent to a variable capacitor as a function of humidity.

Designed using SPSI UPSICAP *MSS Bi-face* technology, this module *integrates* the humidity sensor created in-situ on the substratee upper side while its lower side carries the output connector for both passive and active version (see G-UCN.32-33-34 and G-TUCN.32-33-34 for active version).

This internationally patented technology is a major step forward in the field of sensor-transmitters with long-term stability and reduction of mass production cost.

***MSS Bi-Face original concept***

***Exclusive SPSI technology***

***Micro-system with capacitive output***

***High accuracy and reliability***

***Operating from 0 % RH to 100 % RH***

***Operating very low temperature -90°C***

***Ultra fast response***

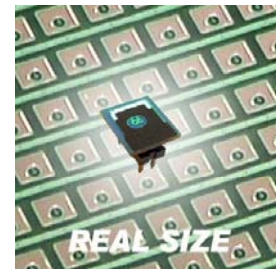
***Full interchangeability without recalibration***

***Output connector for soldering or socket***

***Instantaneous desaturation***

***Best quality price ratio of the world market***

***Integrated production***



### MAIN CHARACTERISTICS

- |   |  |
|---|--|
| ➤ Qualified measurement range RH:               | 2 % RH to 98 % RH                                |
| ➤ Time constant RH:                             | 0.25 sec. to 20 sec. according to model Rx or Lx |
| ➤ Operating temperature RH:                     | - 90° C to + 85° C                               |
| ➤ Accuracy (calibration – interchangeability) : | ± 5 % Hr (option ± 3 %)                          |
| ➤ Nominal capacitor:                            | 270 pF at 55 % RH                                |
| ➤ Recovery time 100 % RH 150 h:                 | 2 sec. to 100 sec. according to model Rx or Lx   |
| ➤ Output signal:                                | Capacitive variation                             |
| ➤ Operating power supply voltage:               | 1 V to 10 V                                      |
| ➤ Operating frequency:                          | 3 kHz to 20 kHz                                  |
| ➤ Basic transfer function:                      | $C = C_{55} (0.8955 + 0.002 RH)$                 |
| ➤ Surface dimensions:                           | 9 mm x 8 mm                                      |

**ORIGINAL TECHNOLOGY UPSICAP – MSS BI-FACE**

*UPSI* product range are based on two fundamental concepts *UPSICAP* and *MSS Bi-Face* elaborated and developed by the *Société d'applications électroniques pour la Physique, la Science et l'Industrie* (international patent <http://www.patentstorm.us/patents/6450026-claims.html>)

**The MSS Bi-Face concept incorporates on the same substrate both, the humidity sensor on the main face and electronic device, including connections, on the opposite side.**

The humidity cell is not added on the substrate but carried out directly *in situ*.

Accuracy, stability and reliability are improved, connecting the sensor to the acquisition electronic circuit with continuum solid vias excluding link wires or printed circuit.

The surface electrode in contact with water vapor is connected to 0V (ground) provides shielding against surrounding electrical field and its thickness provide high robustness atmospheric filter.

The absence of electrical connections on the sensitive face does away with a barrier irregularity reducing the airborne dust on this side and enhancing reliability in the event mechanical action affecting the cell.

For harsh environment, a complementary filter could be placed on the sensing side.

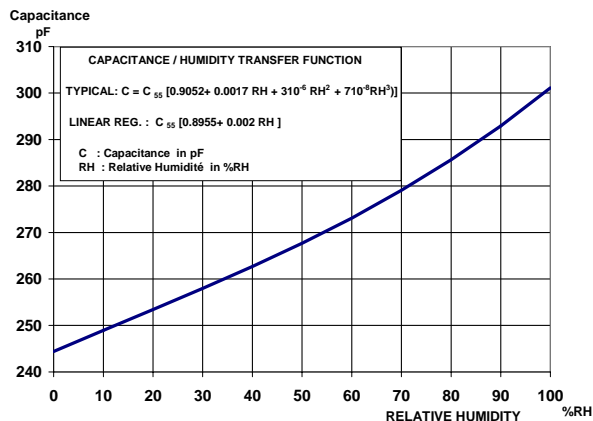
The additional function (transmitter) component quantity is divided by 2 using some multifunction device increasing the reliability and decreasing area and cost (original electronic concept).

This technology allow to supply an analogic or digital sensor transmitter with 100 μW - 20 μA.

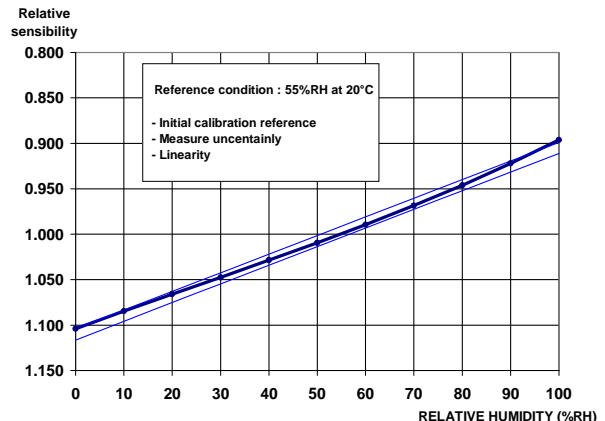
The operating range until 100% RH is insured by a specific treatment (substrate and components impregnation).

**TRANSFER FUNCTIONS**

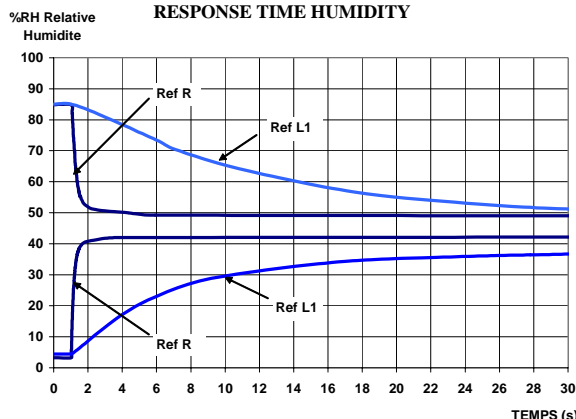
**CAPACITANCE VERSUS RELATIVE HUMIDITY**



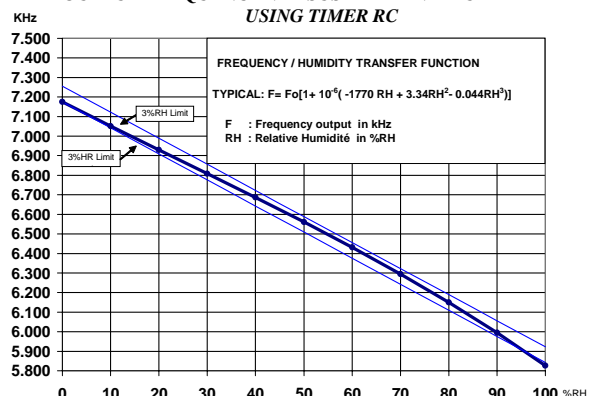
**RELATIVE CAPACITANCE VERSUS RELATIVE HUMIDITY**



**RESPONSE TIME HUMIDITY**



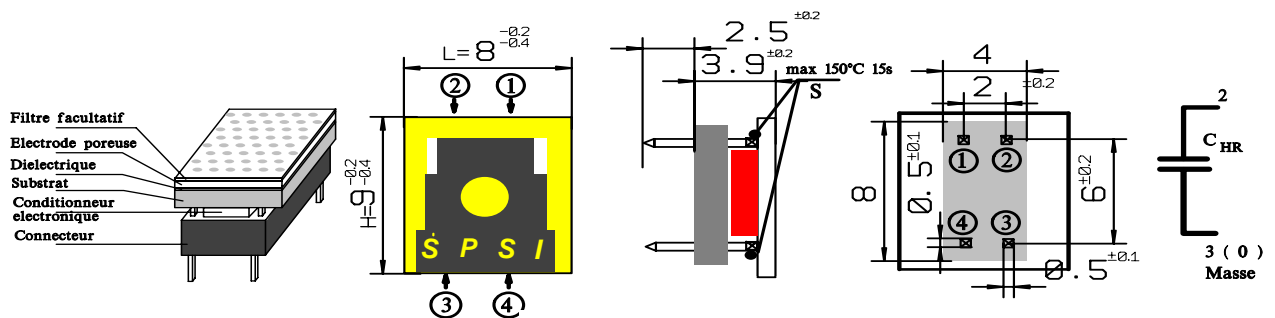
**OUTPUT FREQUENCY VERSUS RELATIVE HUMIDITY USING TIMER RC**



**ELECTRICAL AND MEASURING SPECIFICATIONS**

Measured or influencing values	Définition	Values			Unit
		Min.	Nom.	Max.	
<b>Relative humidity RH</b>	RH measurement range	2	→	98	% RH
	RH operating range	0	→	100	% RH
	Hysteresis		< 1,5		% RH
	Accuracy to reference conditions	3	5		% RH
	<b>Conformity error (2 % RH to 98 % RH)</b>		1.5		% RH
	<b>Time constant</b> Fast version R	0.25 ↑	<b>0.30</b>	0.40 ↓	sec.
	Version L1	30 ↑	<b>40</b>	50 ↓	sec.
	Recovery time (100 % RH 150 hours)	2 ( R )		100(L1)	sec.
	Absolute humidity Specified metrology		0.12		Kg/Kg
Maximum Metrology outside tolerance		0.35		Kg/Kg	
Degraded metrology		0.5		Kg/Kg	
<i>Output signal</i>	Capacitive variation as a function of RH	244	→	301	pF
	Nominal capacitor at 55 % RH		270		pF
<i>Transfer</i>	$C = C_{55} (0.9052 + 0.0017 RH - 3 \cdot 10^{-6} RH^2 + 7 \cdot 10^{-8} RH^3)$				
	Standard calibration 12 % RH	246	250	254	pF
	$C_{55} = 270$ pF 55 % RH	267	270	273	pF
	97.5 % RH	295	300	305	pF
	Sensitivity (33 % RH à 76 % RH)	0.53	0.55	0.57	pF / %RH
In association with oscillator G-UCN.32 : $F = F_{55} (1.1045 - 0.002 RH + 4 \cdot 10^{-6} RH^2 - 5 \cdot 10^{-8} RH^3)$	0.995	1	1.005	F / F <sub>55</sub>	
<i>Electrical power supply</i>	Operating voltage	1	5	10	V
<i>Stability</i>	Instantaneous modulation (noise)	0.005	0.01	0.05	% RH
	Thermal sensitivity		400		ppm
	Thermal stability from 5° C to 60° C		± 5		% RH
<b>Temperature</b>	Long term storage	- 50	+ 25	+ 85	°C
	Specified operating range	- 90		+ 85	°C

**MECHANICAL SPECIFICATIONS - ELECTRICAL CONNECTION**



**APPLICATIONS**

**UNITE DE PRODUCTION DE SYSTEMES INDUSTRIELS**

S.A.R.L au capital de 660 000 € RCS Créteil B 433 547 643 Siret 433 547 643 00018 Code NAF 321 C

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