

*The PU series of heat flux sensors consists of a number of “standard” sensors with different diameters and thicknesses.*

*Apart from the standard models, special models can be manufactured on demand.*

*In most cases the use of the PU series is associated with specific requirements concerning size (small or thin), temperature (up to 250 degrees C), mounting (flexible), chemical resistance (high) or the necessity to cover a large area.*

*The PU series is designed and manufactured by TNO-Science and Industry (former TNO-TPD).*

## INTRODUCTION

The PU series standard models consist of two categories: the PU category of 3 mm thickness and the PU-T category of 1 mm thickness.

Unique features of the PU series are:

- record breaking sensitivity per unit area
- small sensors available
- flexibility (for the PU-T category only)

The PU series is typically applied when one or a combination of these features is a technical necessity, for instance measurement of fluxes from human or animal bodies, or measurements on cylindrical surfaces. The sensor body of the PU series is made out of cast polyurethane.

In addition the PU manufacturing technology is applicable whenever very large sensors need to be manufactured.

## MORE INFORMATION / OPTIONS

In case the PU series specific characteristics are not relevant, typically one should consider using the “standard” Hukseflux models HFP01 and HFP03.

Special models can be made according to customer specification. Typical variables to be specified are:

- size (can be very large)
- area of sensitive part
- thickness (1 mm or higher)
- temperature / pressure range
- chemical resistance
- sensitivity
- flexibility
- heat flux range
- IP protection class

In particular many special designs are made of silicone. This material choice results in high temperature, chemically inert and more flexible sensors. The mechanical robustness however is less than that of polyurethane. In exceptional cases epoxies are used.

## PU SERIES SPECIFICATIONS

General:	see tables below
Optional temperature measurement:	Pt100 or thermocouple type K temperature range extended to 250 degrees C, improved chemical resistance. Typical minimum thickness: 1.2 mm. Less stiff than PU. Type indication SI.
Optional use of silicone:	to 110 bar
Optional pressure resistance:	to be resistant against certain chemicals, however at lower flexibility. Type indication EP.
Optional use of epoxy:	determination of temperature dependence
Optional calibration:	TNO-Science and Industry, former TNO-TPD
Manufacturing:	

**PU SERIES, PU CATEGORY,  
3 MM THICKNESS**

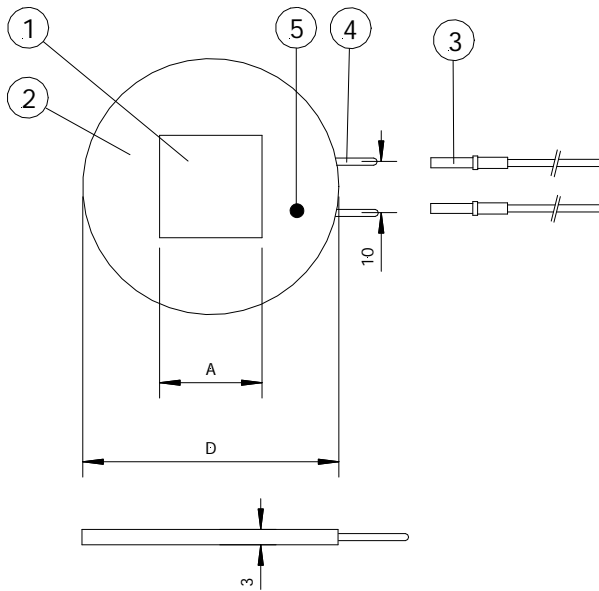


Figure 1 Dimensions of PU series, PU category of 3 mm thickness: sensitive area (1), guard (2), cable with miniplug (3), disconnectable miniplug (male) on sensor (4), optional temperature sensor (5)

Model		PU 11	PU 22	PU 32	PU 43	PU 54
Thickness	mm	3	3	3	3	3
Overall diameter	mm	25	50	75	100	150
Dimensions sensitive area	mm	10x10	20x20	25x25	30x30	50x50
Sensitivity (nominal)	$\mu\text{V}/\text{Wm}^{-2}$	20	50	50	170	300
Electrical resistance	Ohm	200	500	500	1500	3000
Filling material		PU	PU	PU	PU	PU
Temperature range	$^{\circ}\text{C}$	-20 to +90	-20 to +90	-20 to +90	-20 to +90	-20 to +90
Thermal resistance	$\text{m}^2\text{K}/\text{W}$	0.012	0.012	0.012	0.012	0.012
Expected accuracy	%	+5/-5% @ 20 degrees C, temperature dependence typically 0.17%/K				
Cable connection		disconnectable miniplug + cable 2m				
Minimum bending radius	mm	Infinite (rigid sensor)				

**1 MM THICKNESS  
PU SERIES, PU-T CATEGORY,  
1 MM THICKNESS**

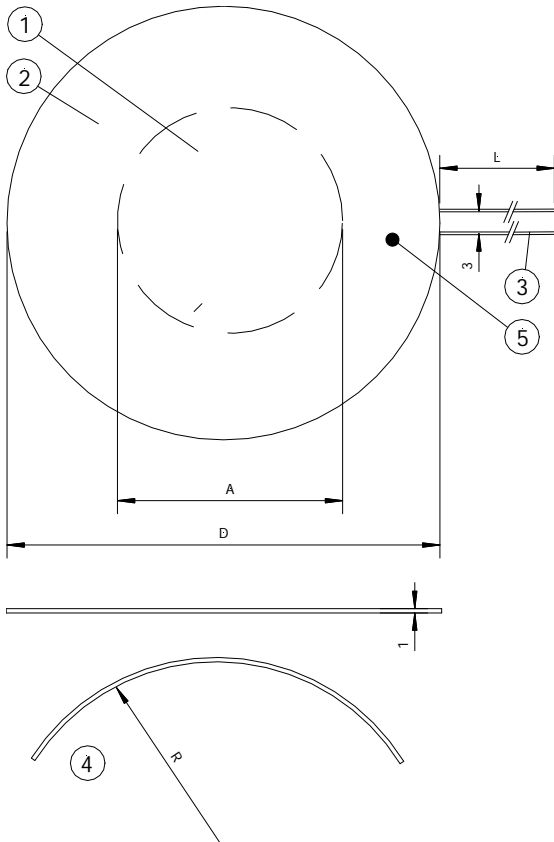


Figure 2 Dimensions of PU series, PU-T category of 1 mm thickness: sensitive area (1), guard (2), fixed wires (3), minimum bending radius (4), optional temperature sensor (5)  
NOTE: PU-T sensors can be bent, but are quite rigid. Installation typically requires taping.

Model		PU 11 T	PU 22 T	PU 32 T	PU 43 T
Thickness	mm	1	1	1	1
Overall diameter	mm	25	50	75	100
Dimensions sensitive area	mm	Ø 15	Ø 30	Ø 30	Ø 55
Sensitivity (nominal)	$\mu\text{V}/\text{Wm}^{-2}$	8	30	30	150
Electrical resistance	Ohm	400	1700	1700	7000
Filling material		PU	PU	PU	PU
Temperature range	° C	-20 to +90	-20 to +90	-20 to +90	-20 to +90
Thermal resistance	$\text{m}^2\text{K}/\text{W}$	0.004	0.004	0.004	0.004
Expected accuracy	%	+5/-5% @ 20 degrees C, temperature dependence typically 0.17%/K			
Cable connection		fixed wires 2m			
Minimum bending radius	mm	15	25	40	50