

## DC beam current non-destructive measurement

Four ranges  $\pm 20\text{mA}$ ,  $\pm 200\text{mA}$ ,  $\pm 2\text{A}$  and  $\pm 20\text{A}$   
 $< 0.5\mu\text{A}/\sqrt{\text{Hz}}$  noise, i.e. resolution, on option  
 DC to 10 kHz (-3dB) frequency response  
 $< 0.1\%$  linearity error  
 NPCT package includes spares for all electronics

The New Parametric Current Transformer is the latest evolution of the Unser Transformer, commonly called DCCT, developed at CERN in 1966 by Klaus B. Unser.

### Application

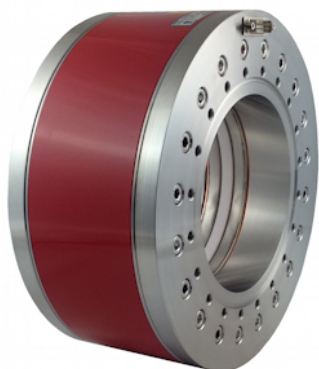
The Parametric Current transformer is used on most particles accelerators in the world to measure the average beam current. It is an essential instrument for accelerator tuning and operation. It is primarily used on particle sources, cyclotrons, medical synchrotrons, HEP research accelerators and light sources.

### Operating principle

The NPCT works on the second harmonic detection principle. Two cores are modulated to deep saturation in opposite phase. A primary DC current flowing through the cores shifts the cores' working point in opposite polarity which generates a second harmonic of the modulator frequency.

The primary current AC component is detected by an AC Hereward transformer. The two circuits are cascaded in a common feedback loop to generate a magnetic flux which always cancel the primary current flux. The NPCT output is the voltage developed by the feedback current passing through a precision resistor.

### Two packaging types for the NPCT sensor



**In-flange NPCT sensor** to mount in the beam line



**In-air NPCT sensor** for installation over the vacuum chamber



**NPCT Chassis with NPCT-E** electronics and power supplies

### DISTRIBUTORS

**U.S.A.:** GMW Associates  
[www.gmw.com](http://www.gmw.com)  
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### MANUFACTURER

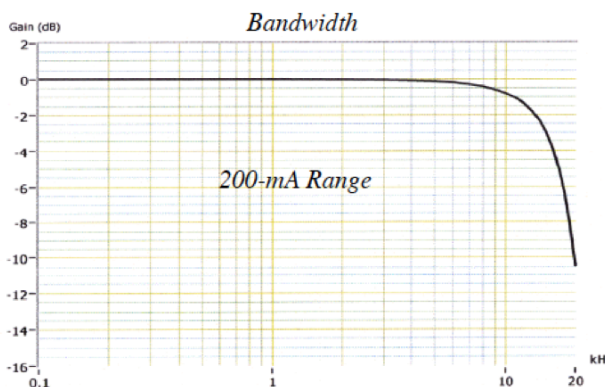
**BERGOZ Instrumentation**  
[www.bergoz.com](http://www.bergoz.com)  
 Espace Allondon Ouest  
 01630 Saint Genis Pouilly, France  
[sales@bergoz.com](mailto:sales@bergoz.com)

## Specifications

Full scale ranges	$\pm 20\text{mA}$ , $\pm 200\text{ mA}$ , $\pm 2\text{A}$ , $\pm 20\text{A}$
Range control	2 TTL lines on rear panel DB9
Output	$\pm 10\text{ V}$
Output over range	up to $\pm 12\text{V}$
Output bandwidth (-3dB)	8 kHz in 20-mA range 10 kHz in other ranges
Response time (@ 90%)	< 50 $\mu\text{s}$
Resolution	
Standard model	< $5\mu\text{ Arms}/\sqrt{\text{Hz}}$
High Resolution model	< $1\mu\text{ Arms}/\sqrt{\text{Hz}}$
Very High Resolution model	< $0.5\mu\text{ Arms}/\sqrt{\text{Hz}}$
Output accuracy	$\pm 0.1\% \pm \text{zero-offset}$ $\pm \text{magnetic field sensitivity}$ $\pm \text{temperature drift}$
Linearity error	< 0.1%
Temperature coefficient	< $0.5\mu\text{A/K typ.}$
Operating temperature	$-40...80^\circ\text{ C}$
Output impedance	100 $\Omega$
Output current	10mA max, source or sink
Output connectors	Isolated BNC on rear panel and front panel
Test function	Injects +100mA in sensor
Test control	TTL line on rear panel (DB9)
Calibration winding	10-turn floating calibration winding on sensor
Calibration current	from external source
Calibration connectors	(2A max, $Z > 100\Omega$ ) Isolated BNC on rear panel and front panel

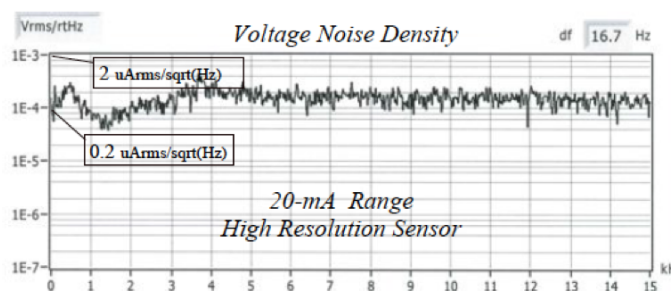
## Sensor head

Connector	DB15 male
Temperature coefficient	$5\mu\text{A/K typ.}$
Sensor baking	$< 100^\circ\text{ C}$ , 212F.
Destructive level	DC current: Unlimited
Pulse charge	$> 100\text{mC}$
Sensor saturation flux	10 mT (axial) typ. 2mT (radial) typ.
Sensor sensitivity to external magnetic fields	$10\mu\text{A/mT}$ (axial) typ. $1\text{mA/mT}$ (radial) typ.



## Dimensions & Ordering codes

In-flange NPCT order code	Pipe OD nominal	Mating flange	ID (mm)	H (axial)
NPCT-CF2"1/8-22.2-120-UHV-	1"	DN25 NW25CF	22.2	120
NPCT-CF2"3/4-34.9-120-UHV-	1.5"	DN40 NW35CF	34.9	120
NPCT-CF4"1/2-60.4-120-UHV-	2.5"	DN63 NW63CF	60.4	120
NPCT-CF6"-96.0-120-UHV-	4"	DN100 NW100CF	96.0	120
NPCT-CF8"-147.6-120-UHV-	6"	DN160 NW150CF	147.6	120
NPCT-CF10"-198.4-120-UHV-	8"	DN200 NW200CF	198.4	120
In-air NPCT order code	OD (mm)	Clears over flange	ID (mm)	H (axial)
NPCT-055-	98	DN16 NW16CF	55	108
NPCT-075-	118	DN40 NW35CF	75	108
NPCT-115-	158	DN63 NW50/63CF	115	108
NPCT-130-	175	DN63 NW50/63CF	130	108
NPCT-175-	222	DN100 NW100CF	175	108
NPCT-195-	250	Mitsubishi PT	197	108
NPCT-203-	248	DN160 NW150CF	203	108
NPCT-245-	298	DN200 reduced	245	108
Cable	Units	Type		
-Cxxx	meters	Polypropylene FR-LS		
-RHCxxx	meters	Siltem Radiation-tolerant R.I.>7		
Sensor options (In-flange NPCT only)				
-ARB#xxx	Arbitrary (noncircular) aperture drawing #			
-316LN	Made out of AISI 316LN instead of 304			
Higher resolution options (applies to all sensors)			Noise density	
-HR	High Resolution		<1μArms/rtHz	
-VHR	Very High Resolution		<0.5μArms/rtHz	
Radiation tolerant option (applies to sensor only)				
-H	Improved radiation tolerance		Improves critical materials radiation tolerance by 2-3 orders of magnitude	



## NPCT package includes:

- One NPCT sensor head
- One interconnect cable
- One 19" 3U RF-shielded chassis, with
- Two power supplies, autorange AC input (one as spare)
- Two NPCT electronics cassettes (one as spare)

## DISTRIBUTORS

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www.conveyi.com  
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Espace Allondon Ouest  
01630 Saint Genis Pouilly, France  
sales@bergoz.com