

New-PCT

New Parametric Current Transformer

for non-destructive measurement of average beam current...

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.

Full scale range from $\pm 20\text{mA}$ to $\pm 20\text{A}$ controlled by TTL levels

5 $\mu\text{A}/\sqrt{\text{Hz}}$ resolution in every range
1 $\mu\text{A}/\sqrt{\text{Hz}}$ or lower resolution on option

Frequency response DC to 10 kHz

Linearity error $< 0.1\%$

Sensor inner diameter from 55 to 245 mm to fit around any vacuum chamber



NPCT with 175-mm sensor head

New-PCT vs. "Old" PCT comparison

Insensitivity to synchrotron revolution frequency (either single bunch mode or uneven fill pattern)

Residual modulator ripple is eliminated (full bandwidth usable down to very low current)

Electronics can be 130 meters from the sensor, far away from radiation sources

Independent external calibration possible up to $\pm 20\text{A}$

Test function injects +100mA in sensor under user control

Range remote control by TTL levels

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 machine tuning and commissioning.

The large dynamic range, the wide bandwidth and high resolution make it the ideal instrument to measure beam lifetime in storage rings.

It is often the only truly calibrated beam instrument in an accelerator and serves as a reference to calibrate other beam diagnostics.

Operating principle

The NPCT works on the principle of the zero-flux DC current transformer (DCCT). The DC component of the current flowing through the toroid sensor is detected by a magnetic modulator also called fluxgate or second harmonic detector.

The AC component is detected by a 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.

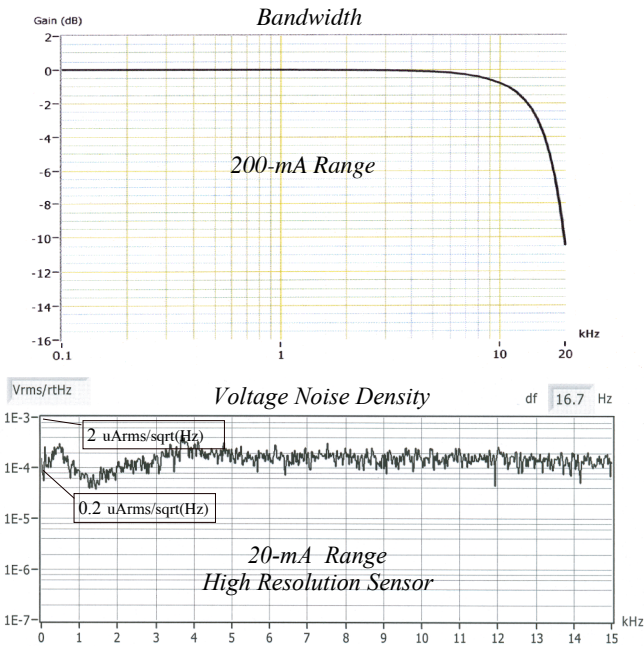
NPCT package includes spares for electronics and power supply



New-PCT Chassis with NPCT-E electronics and power supplies

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 μs
Resolution	
Standard model	< 5 $\mu\text{A}/\sqrt{\text{Hz}}$
High Resolution model	< 1 $\mu\text{A}/\sqrt{\text{Hz}}$
Very High Resolution model	< 0.5 $\mu\text{A}/\sqrt{\text{Hz}}$
Output accuracy	$\pm 0.1\%$ \pm zero-offset (can be zeroed) \pm magnetic field and temperature drift
Linearity error	< 0.1%
Temperature coefficient	< 0.1 $\mu\text{A}/\text{K}$ typ.
Operating temperature	-40...80°C
Output impedance	100 Ω
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 (2A max, $Z > 100\ \Omega$)
Calibration connectors	Isolated BNC on rear panel and front panel



NPCT package includes:

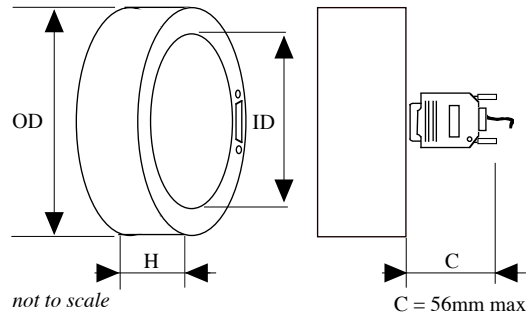
- One NPCT sensor head
- One interconnect cable
- One 19" 3U RF-shielded chassis, with
- Two power supplies, autorange AC input (one as spare)
- Two NPCT electronics cassettes (one as spare)

Ordering codes

NPCT	
-XXX	Sensor Inner diameter (mm)
-CXXX	Cable length (max. 130m)
-HR	High resolution: 1 $\mu\text{A}/\sqrt{\text{Hz}}$
-VHR	Very High resolution: 0.5 $\mu\text{A}/\sqrt{\text{Hz}}$
-H	Radiation-resistant sensor option

Sensor head

Connector	DB15 male
Temperature coefficient	5 $\mu\text{A}/\text{K}$ typ.
Sensor baking	< 120°C, 250°F.
Radiation resistance	Optional radiation-resistant sensor made of radiation-resistant halogen-free materials
Destructive level	DC current: Unlimited Pulse charge > 100 mC
Sensor saturation flux	10 mT (axial) typ. 2 mT (radial) typ.
Sensor sensitivity to external magnetic fields	10 $\mu\text{A}/\text{mT}$ (axial) typ. 1 mA/mT (radial) typ.



NPCT-xxx order codes	ID (min)	OD (max)	H (max)	Weight (Kg)
NPCT-055-	55	98	108	0.9
NPCT-075-	75	118	108	1.2
NPCT-115-	115	158	108	1.7
NPCT-130-	130	175	108	2.0
NPCT-175-	175	222	108	2.4
NPCT-195-	197	250	108	2.6
NPCT-202-	202	248	108	2.7
NPCT-245-	245	298	108	3.3

Distributors

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