NPCT

DC beam current non-destructive measurement

Four ranges ± 20 mA, ±200 mA, ±2 A and ± 20 A
<0.5 µA 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 New Parametric Current transformer is used in 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 and light sources.

Operating principle

The NPCT is based 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 cancels 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

MANUFACTURER

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NPCT

Specifications

Full scale ranges	±20 mA, ±200 mA, ±2 A, ±20 A
Range control	2 TTL lines on rear panel DB9
Output	±10 V
Output over range	up to ±12 V
Output bandwidth (-3dB)	7 kHz in 20-mA range 10 kHz in other ranges
Response time (@ 90%)	< 50 us
Resolution: Standard model High Resolution model Very High Resolution model	 < 5 µArms < 1 µArms < 0.5 µArms
Output accuracy	± 0.1% ± zero-offset ± magnetic field sensitivity ± temperature drift
Linearity error	< 0.1 %

Sensor head

Connector	DB15 male
Temperature coefficient	10 µA/K typ.
Sensor baking	<100 °C, 212 °F
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 µA/mT (axial) typ. 1 mA/mT (radial) typ.

Chassis and electronics

Temperature coefficient	< 0.5 uA/K typ.
Operating temperature	-40...80 °C
Output impedance	100 Ω
Output current	10 mA max, source or sink
Output connectors	Isolated BNC on rear panel and front panel
Test function	Injects +100 mA in sensor
Test control	TTL line on rear panel (DB9)
Calibration winding	10-turn floating calibration winding on sensor
Calibration current	from external source (2 A max, Z > 100 Ω)
Calibration connectors	Isolated BNC on rear panel and front panel

Dimensions & Ordering codes

In-flange NPCT sensors

In-flange NPCT sensor order code	Pipe OD	Mating flange	ID (mm)
NPCT-CF2"1/8-22.2-120-UHV	1"	DN/NW25CF	22.2
NPCT-CF2"3/4-34.9-120-UHV	1.5"	DN40/NW35CF	34.9
NPCT-CF3"3/8-38.0-120-UHV	40mm	DN/NW50CF	38.0
NPCT-CF4"1/2-47.7-120-UHV	2.5"	DN/NW63CF	47.7
NPCT-CF4"1/2-60.4-120-UHV	2.5"	DN/NW63CF	60.4
NPCT-CF6"-96.0-120-UHV	4"	DN/NW100CF	96.0
NPCT-CF8"-147.6-120-UHV	6"	DN160/NW150CF	147.6
NPCT-CF10"-198.4-120-UHV	8"	DN/NW200CF	198.4
		Axial length (mm)	120.0

In-air NPCT sensors

In-air NPCT sensor order code	ID (min)	OD (max)	H (max)
NPCT-055	55	98	108
NPCT-075	75	118	108
NPCT-115	115	158	108
NPCT-130	130	175	108
NPCT-175	175	222	108
NPCT-195	195	250	108
NPCT-202	202	248	108
NPCT-245	245	298	108

Cables

-CXXX	Polypropylene FR-LS cable, per meter
-RHCXXX	SILTEM™ radiation tolerant cable, per meter

Options

-316LN	AISI 316LN instead of AISI 304
-ARB#xx	Arbitrary shape aperture
-H	Radiation tolerant sensor. Improves critical materials radiation tolerance by 2-3 order of magnitude
-HR	High Resolution model
-VHR	Very High Resolution model

NPCT package includes

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

Interconnect cable to be acquired separately

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