

Turbo-ICT & BCM-RF

Turbo Integrating Current Transformer RF Beam Charge Monitor



Preliminary data sheet
Turbo-ICT and BCM-RF are new instruments.
When additional measurements become available, this data sheet will be updated

~0.1 μArms^* (!) total
wideband current noise
current measurement
~10 fC* (!) noise in single
bunch measurement

*with Turbo2 option

Optimized for low beam current $\leq 20\text{mA}$
Optimized for low bunch charge $\leq 100\text{pC}$

CW and macropulse current measurement

Maximum current 20mA
RF from 1 MHz to 350 MHz
Output bandwidth >5 MHz
Total noise ~ 0.1 μA rms over DC to 5 MHz.

Single bunch charge measurement

Bunch length 1 fs to 1 ns
Bunch charge 100 fC to 100 pC
Noise in single bunch measurement 10 fC (!)
Output DC voltage held until next bunch
Maximum bunch repetition rate 2 MHz

80-dB measuring range without range change
Resolution / accuracy 1% of measured value
Output voltage logarithm of current or charge
USB 2.0 output (to be announced)
Negligible temperature dependance
Negligible magnetic fields dependance
Simple installation between two flanges
UHV Ultra-High Vacuum down to 10^{-10} mbar
Core material radiation tolerance* $>10^{16}$ n/cm²

* Est.: IRMM Geel, Dr. J.-M. Salomé

Innovative features in Turbo-ICT* and BCM-RF

A lower-loss alloy to transfer charge through Turbo-ICT up to 350 MHz, while core loss remains under 1%. Output pulse duration is 3 ns compared to 70ns for traditional ICT. The increased output amplitude improves the signal-to-noise ratio by 5.

Turbo-ICT is made with more than one core: 2, 4 or 8 cores adjacent or superposed in a single In-flange package.

Core windings connect with each other in series to increase output voltage or in parallel to increase output current.

A combination of series and parallel windings allows to control the Turbo-ICT output impedance in order to match the first amplifier input impedance to lower the amplifier noise.

Improved EMI/RFI immunity results from narrow-band transmission between Turbo-ICT and BCM-RF via a TV-frequency carrier.

Turbo-ICT amplifier and RF modulator are powered from BCM-RF via the transmission cable to avoid ground loop.

BCM-RF is essentially an RF receiver. with two modes of operation:

- Track-Continuous for CW and long macropulses.
- Sample&Hold for single bunch, with auto trigger feature.

Output is log of the beam current or bunch charge.

*Patent INPI 12/00667 March 6, 2012

Turbo-ICT dimensions and order codes

Model (mating flange)	ID (mm)	Pipe dia.	Part number Order code
CF3"3/8 (DN50 NW50CF)	22.2	1"	ICT-CF3"3/8-22.2-40-UHV-
CF4"1/2 (DN63 NW63CF)	34.9	1.5"	ICT-CF4"1/2-34.9-40-UHV-
CF4"1/2 (DN63 NW63CF)	38.0	40mm	ICT-CF4"1/2-38.0-40-UHV-
CF6" (DN100 NW100CF)	47.7	2"	ICT-CF6"-47.7-40-UHV-
CF6" (DN100 NW100CF)	60.4	2.5"	ICT-CF6"-60.4-40-UHV-
CF6"3/4 (DN130 NW130CF)	96.0	4"	ICT-CF6"3/4-96.0-40-UHV-
CF8" (DN160 NW150CF)	96.0	4"	ICT-CF8"-96.0-40-UHV-
CF10" (DN200 NW200CF)	147.6	6"	ICT-CF10"-147.6-40-UHV-
CF12" (DN250 NW250CF)	198.4	8"	ICT-CF12"-198.4-40-UHV-

Turbo-ICT options and order codes

Option	Available on all models
-Turbo1	1 core only
-Turbo2	2 cores
-Turbo4	4 cores
-Turbo8	8 cores
-CAW	Calibration winding
-H	Improved radiation tolerance
-316	AISI-316LN instead of 304
-ARBxxx	Non-round arbitrary aperture



One BCM-RF-E module plugged into powered BCM chassis

Turbo-ICT assembly

Improved radiation tolerance on option
 UHV compatible to 10^{-10} mbar
 Ceramic gap vacuum-brazed over kovar transitions
 Material AISI-304. 316LN on option
 Non-round arbitrary shape aperture on option
 1 core, 2 cores, 4 cores or 8 cores on option
 Calibration winding on option (limited coupling)

BCM-RF-E dimensions and order code

BCM-RF-E: Eurocard format 100 x 160mm, 20mm wide to be plugged into BCM-RFC chassis station
 May be mixed with BCM-IHR-E in same chassis

BCM-RFC chassis and order code

BCM-RFC/xx: 19"x3U RF-shielded chassis with xx wired stations (max. 10)
 AC mains 90-125Vac or 220-245Vac, switch selectable 50/60Hz

Performance measured with Turbo2 option

Beam type	CW beam and macropulses	Single bunch
Set BCM-RF to:	Track-Continuous mode	Sample&Hold mode
Measurement single range	10 uA - 100 mA	100 fC - 100 pC
Bunch repetition frequency	1 MHz - 350 MHz	Single bunch - 2 MHz
Output specifications		
Voltage	0 - +5V, log of beam current	0 - +5V, log of bunch charge
Risetime	<70 ns	
Reaction time	100 ns for RF=100 MHz 300 ns for RF=10 MHz	500 ns to >99% final value
Noise	0.1 uArms or 1% of current	10 fC (!) or 1% of charge
Non-linearity	~2 %	~2 %
Time response	Reports current variation to 10 MHz	Hold till next bunch

Distributors

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Instrumentation