



Principle developed by K. Unser

ICT with BCM-IHR-E provides accurate bunch charge measurements

ICT can be used alone with an oscilloscope or a digitizer

For FELs, transfer lines, injection/extraction monitoring or Laser-Plasma accelerators

Single short bunches are measured with high accuracy. Microsecond long trains of short pulses are integrated with good accuracy. Resolution is better than 1 pC

Operating principle

ICT combines two nested transformers: a shorted one-turn current transformer loads the full bunch charge instantly into capacitors. Then the charge is transferred to the output by a readout transformer, at a slow pace, to achieve a well-integrable signal.

The ICT signal can be integrated by BCM-IHR-E, a boxcar type asynchronous differential detector.

BCM-IHR-E output voltage proportional to the beam pulse charge. Its value is maintained up to 400 μ s, then reset. Pulses can be measured with up to 20 kHz repetition rate

Two packaging types for the ICT



In-flange ICT are mounted directly in the beam line. UHV compatible. Available for many pipe diameters from 22.2 mm to 198.4 mm. Also with elliptical aperture or other arbitrary shape aperture. Ceramic gap, shields and wall current bypass are included. Bellows are not required.



In-air ICT are installed over the vacuum chamber. It requires a "gap" in the vacuum chamber to prevent the wall current from flowing through the ICT aperture. The gap can be a brazed ceramic ring or an organic material O-ring depending on the vacuum requirements. Typical installations include bellows, a wall current bypass and an electromagnetic shield enclosing the ICT.

Electronics BCM-IHR-E



BCM-IHR-E inserts into a wired station of BCM-RFC, the 19" 3U RF-shielded chassis including power supplies. Up to 10 stations per chassis can be installed.

Operating range

Using a 10Vs/C sensitive ICT, the noise per single bunch measurement is < 1 pCrms.

MANUFACTURER

BERGOZ Instrumentation
www.bergoz.com
Espace Allondon Ouest
01630 Saint Genis Pouilly, France
info@bergoz.com

DISTRIBUTORS

U.S.A.: GMW Associates
www.gmw.com
sales@gmw.com

Japan: Hayashi-Repic Co.
www.h-repic.co.jp
sales@h-repic.co.jp

India: GEEBEE International
www.geebeinternational.com
info@geebinternational.com

China: Beijing Conveyi Limited
www.conveyi.com
sales@conveyi.com

ICT Specifications

Sensitivity (nominal)	0.5	1.25	2.5	5.0	10.0	Vs/C
Turns ratio (old reference)	50:1	20:1	10:1	5:1	2x 5:1	
Output pulse (full length)	70	70	70	70	70	ns
Droop	< 3	< 6	< 10	< 32	< 157	%/μs
Droop with Low Droop option	< 0.2	< 1	< 3	< 8	< 32	%/μs
Max. charge/pulse	2000	324	81	20	5	μC
Max. rms current (f > 10 kHz)	2.7	2.7	2.7	2.7	2.7	A
Max. peak current (pulse = 1 ns)	0.4	0.2	0.1	0.1	0.1	kA
For 10 Vs/C sensitivity specifications, please ask						

Integrating Current Transformer

Position dependence	Negligible
ICT output connectors	SMA, Radiation tolerant on option

Beam Charge Monitor - Integrate-Hold-Reset

Full scale ranges	Selectable in a range of 50:1 by TTL
Most sensitive range	800 pC, using 5 Vs/C ICT
Least sensitive range	400 nC, using 0.5 Vs/C ICT
Range control	Full scale and polarity (4 TTL bits)
Noise on single bunch	0.55 pCrms, limited by dynamic range
Dynamic range	>35'000, limited by resolution
Output	±8 V, available 50 μs after trigger, held for 400 μs (up to 10 ms on option)
Trigger	TTL, ≥10 ns (NIM on option)
Trigger frequency	20 kHz max. (ask factory for preset)
Front panel connectors	BNC 50 Ω for oscilloscope: Signal View, Output View, Timing View
Back panel connectors	SMA Input, SMA Trigger input, SMA Output, DB9 for control lines
Front-panel controls	Integration window time potentiometer Trigger delay potentiometer
Calibration pulses	1 pC, 10 pC, 100 pC, 1 nC, accuracy ±2 %
Calibration controls	Enable, polarity and charge, by TTL
Front-panel control	Calibration ON/OFF switch Calibration pulse delay potentiometer

Power Supply

Output	±15 Vdc, 2 x 400 mA, linear
Mains	95/125 Vac - 215/245 Vac, 48-62 Hz, 30 VA

In-flange ICT dimensions

In-flange ICT sensor order code	Pipe OD	Mating flange	ID (mm)	H (mm)	
ICT-CF3"3/8-22.2-40-UHV	1"	DN/NW50CF	22.2	40.0	
ICT-CF4"1/2-34.9-40-UHV	1.5"	DN/NW63CF	34.9		
ICT-CF4"1/2-38.0-40-UHV	40 mm	DN/NW63CF	38.0		
ICT-CF6"-47.7-40-UHV	2"	DN/NW100CF	47.7		
ICT-CF6"-60.4-40-UHV	2.5"	DN/NW100CF	60.4		
ICT-CF6"3/4-96.0-40-UHV	4"	DN/NW130CF	96.0		
ICT-CF8"-96.0-40-UHV	4"	DN160/NW150CF	96.0		
ICT-CF10"-147.6-40-UHV	6"	DN/NW200CF	147.6		
ICT-CF12"-198.4-40-UHV	8"	DN/NW250CF	198.4		
ICT-CFXX"-XXX-40-UHV-5.0 Vs/C and lower					40.0
ICT-CFXX"-XXX-XX-UHV-10.0 Vs/C, please ask for dimensions					

Environment

Temperature	
In-air models:	100 °C (212 °F) any time
In-flange models:	100 °C (212 °F) any time
On option:	150 °C (300 °F)
	185 °C (365 °F)
	200 °C (392 °F)
Core saturation	2 mT radial field 2 A DC current
Radiation damage	
Standard SMA	PTFE: 10 ³ Gray max
On option:	
Rad-tolerant SMA	PEEK: 6 x 10 ⁷ Gray max 10 ¹⁷ n/cm ² max

Order codes

ICT	See codes in above tables
BCM-IHR-E	Beam Charge Monitor Integrate-Hold-Reset electronics module
BCM-RFC/xx	19"x3U RF-Shielded chassis, with xx equipped stations (max. 10)
BCM-Cxxx	SMA-SMA cable with PTFE dielectric plugs, XXX meters
BCM-RHCxxx	SMA-SMA cable with PEEK dielectric plugs, XXX meters

Options

-LD	Low droop
-316LN	AISI 316LN instead of AISI 304
-ARB#xx	Arbitrary shape aperture
-BK150C	150 °C (300 °F) bakeable, In-flange only
-BK185C	185 °C (365 °F) bakeable, In-flange only
-BK200C	200 °C (392 °F) bakeable, In-flange only
-VAC	Degassed in-air sensor
-H	Radiation tolerant sensor and connector
-CAW1_50	1-turn calibration winding, loaded 50 Ω (0.25 W), insulated SMA connector*

* If ICT sensitivity is 10 Vs/C, please ask Bergoz Instrumentation for feasibility

In-air ICT dimensions

In-air ICT sensor order code	ID (min)	OD (max)	H (max)	
ICT-016	16	42	40.0	
ICT-028	28	64		
ICT-055	55	91		
ICT-082	82	118		
ICT-122	122	156		
ICT-178	178	226		
ICT-XXX-2.5 V/A and lower				32
ICT-XXX-5.0 V/A				45
ICT-XXX-10.0 V/A, please ask for dimensions				

MANUFACTURER

BERGOZ Instrumentation
www.bergoz.com
Espace Allondon Ouest
01630 Saint Genis Pouilly, France
info@bergoz.com

DISTRIBUTORS

U.S.A.: GMW Associates
www.gmw.com
sales@gmw.com
Japan: Hayashi-Repic Co.
www.h-repic.co.jp
sales@h-repic.co.jp

India: GEEBEE International
www.geebeinternational.com
info@geebeinternational.com

China: Beijing Conveyi Limited
www.conveyi.com
sales@conveyi.com