



I-404 FOUR CHANNEL CHARGE INTEGRATOR

TECHNICAL DATA SHEET



I-404 Four Channel Charge Integrator

Applications

- Beam Position Monitors readouts and biasing
- Quadrant photodiode readouts
- Low current and charge measurement

Features

- Four independent integrator channels with common gate
- Dynamic range $<1\text{pA}$ to $120\mu\text{A}$
- Integrated digitization and filtering
- Fibre-optic, RS-232 and RS-485 interfaces
- Integrated calibration test sources
- Full control provided of integration modes
- External trigger capability
- Four independent analogue monitor outputs, configurable to show various analogue parameters, including current and position
- Four independent frequency monitor outputs
- Optional HV output
- EPICS drivers available

Options

- Auxiliary HV output options up to $\pm 3000\text{V}$
- Alternative feedback capacitor options

Specifications

Operating Principle	Gated integrator
Integration capacitor	Dual, software selectable. Default values 100pF and 3300pF
Input noise	< 200fA rms unloaded (1s integration, 10 pF capacitor at ≤ 25°C ambient)
Input offset	< 10pA, 15°C to 25°C, < 3pA typical. Offset can be removed by zero subtraction
Stability	Output drift < 200fA / hr at 25°C ± 1°C ambient after stabilisation
External accuracy	Better than 0.5% of full scale in use, integration time 500µs to 1s, after calibration with built-in current source
Integration time	User selectable, 100µs to 65s
External gate	TTL 10kΩ impedance
Trigger modes	Internal (autorun), external
Digitisation	16 bit bipolar
Averaging modes	Multiple conversions per integration; multiple integrations per reading to increase digital resolution up to 20 bits
Auxiliary HV PSU	(Factory option) 0 to 3kV programmable (polarity and maximum voltage factory selectable), 1mA max. Noise and ripple < 0.1%
Power input	+24V ± 2V DC, 350mA typ, 500mA max
Controls	Two rotary switches for loop address and comms mode/ baud rate
Displays	Four status LEDs, "HV on" LED
Case material	Stainless steel sheet
Weight	1.64kg (3.6 lb)
Operating environment	10°C to 35°C (15°C to 25°C recommended to reduce drift and offset), < 70% humidity, non-condensing, vibration < 0.1g all axes (1 to 1000Hz) Vibration must be as low as possible to measure at the lower limit of the dynamic range
Shipping and storage environment	-10°C to 50°C, < 80% humidity, non-condensing, vibration < 2g all axes, 1 to 1000Hz

Interfacing

Interfaces	RS-232 or RS-485, 8-bit ASCII. Selectable baud rate up to 115 kbps. The electrical interface can be set to be RS-232, or full-duplex differential RS-485. Fibre-optic loop, 10 Mbit/sec serial, 9-bit asynchronous binary. Ethernet connection to host through A300 or A500 loop controllers
Host Computer	ASCII serial communications based on SCPI. Diagnostic host program supplied for Microsoft® .NET framework DLLs available for Microsoft® .NET, National Instruments™, LabVIEW™ and Microsoft® C++

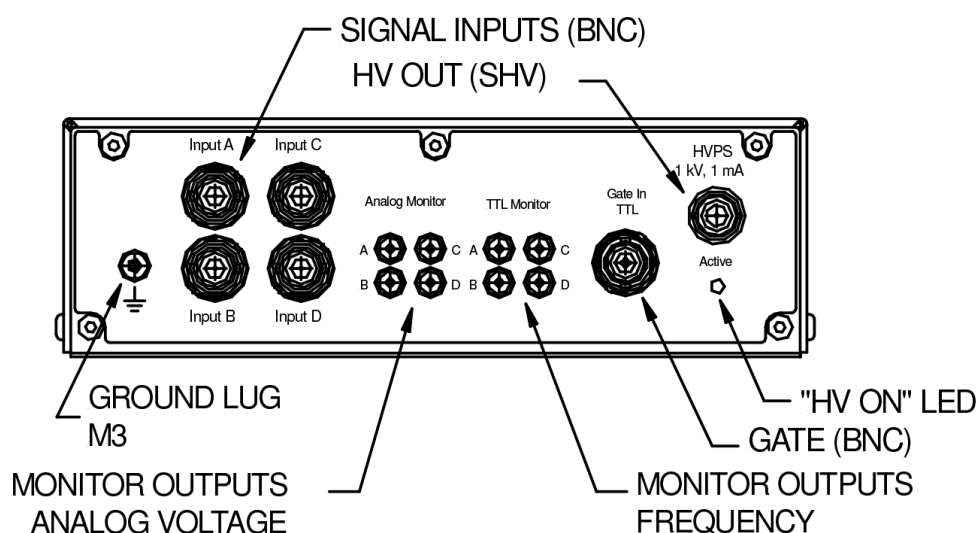
Monitors Outputs

Number	Four, independent analogue voltage Four, independent frequency TTL levels
Signal type	Analogue voltage ± 10V into 10 kΩ Frequency 0 to 1 MHz 5V into 50Ω
Software selectable output parameter options	Current, (relative to selected full scale for integration time and capacitor in use) Independent position, outputs A and B active: $X = (INA - IND) / (INA + IND)$ $Y = (INB - INC) / (INB + INC)$ Quadrant position, outputs A and B active: $X = ((INA + INC) - (INB + IND)) / (INA + INB + INC + IND)$ $Y = ((INA + INB) - (INC + IND)) / (INA + INB + INC + IND)$

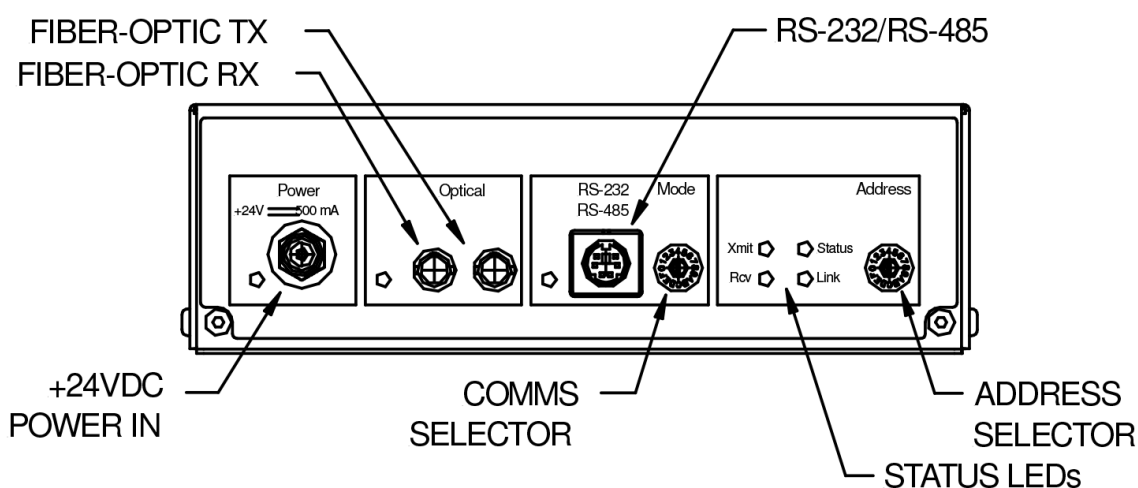
Connectors

Signal inputs	Four BNC female
HV bias out	SHV
External gate in	BNC (isolated from chassis)
Monitor outputs	Four Lemo coax size 00 for analogue voltage Four Lemo coax size 00 for frequency
RS-232/RS-485	6 pin mini-DIN ("PS/2") 1. Tx/RS-485 2. Rx/RS-485 Rx+ 3. Gnd 4. n/c 5. RS-485 Tx+ 6. RS-485 Rx-
Fibre-optics	TX & RX ST bayonet, suitable for 1mm plastic fibre or 200µm HCS fibre
Power in	2.1mm threaded jack. Mates with Switchcraft S761K or equivalent
Ground	M3 threaded stud

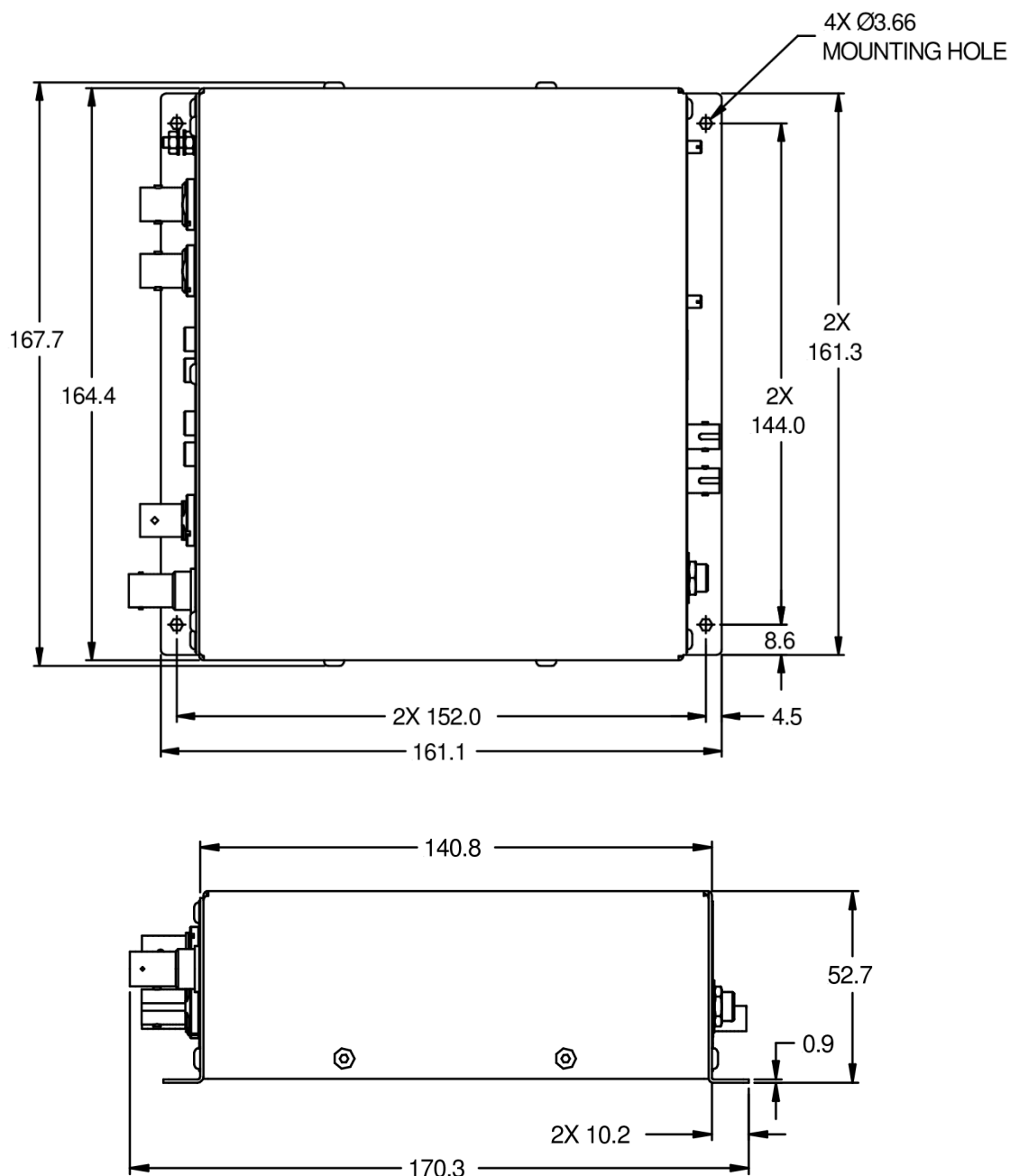
Signal inputs and outputs



Communications and power



I-404 Dimensions (mm)



Ordering Information

Part Number	Description
I404	I-404 four channel charge integrator, user manuals, software drivers, calibration data
XP30/20/10/05/02/002	Auxiliary HV bias supply positive +3000 / +2000 / +1000 / +500 / +200 V
XN30/20/10/05/02/002	Auxiliary HV bias supply negative -3000 / -2000 / -1000 / -500 / -200 V

