Datasheet I128

Integrated Controller and Readout for Position-sensitive Ionization Chambers

Features

- 128 parallel integrator channels for strip or wire readout.
- Multirange I-V converter and gated integrator input for dose plane readout.
- External trigger input and trigger passthrough
- Dose target, dose accumulation and beam control
- Monitor pulse output
- Integrated digitization and calibration using precision current sources
- Fast Ethernet connection and internal buffering allows contiguous data at high rates
- Integrated HV supply with loopback verification
- Integrated analog and digital input/output lines for ionization chamber environmental sensor read-out or other purposes
- Integrated pneumatic actuator control
- On-board processors for real time beam position and shape verification, dose control and map execution
- Integrated dosimetry safety features including beam enable safety relay and override switch
- Dual fiber-optic loop controller capability to handle multiple slave devices
- Fiber optic fast beam control line
- Multiple host interface options

Applications	• Particle therapy beam position measurement and dosimetry • Multistrip ionization chamber readout. • Particle range verifier readout • General multichannel low-current measurement.
Options	• HV range and polarity selections • Strip input current range selection

Specifications

Strip inputs	
Number	128, parallel independent
Signal type	Current, 0 to +600 nA (higher ranges can be specified).
Circuit type	No-lost charge switched integrators
Input impedance	< 2 kohm
Input noise charge	< 10 fC one sigma
Input offset current	< +/-0.5 pA typical, less than +/- 6 pA maximum (before zero correction)
Digitization	20 bit delta-sigma
Charge integration time	55 usec to 1000 usec. Longer integrations are achieved by on-board numerical averaging of up to 255 integrations.

Dose plane input	
Number	One, multirange I-V converter or gated integrator operating modes (software selectable).
Summing modes	Two input pins A and B are connected to the input as A only (B grounded) or B only (A grounded) under software control. The -DSUM option changes the input configurations to A only (B grounded) or A+B.
Measurement type	Current, 0 to +/-20 µA (I-V converter) Charge 0 to +/- 10 nC (gated integrator)
Ranges	20 µA, 10 µA, 5 µA, 1 µA (I-V converter) 100 pC, 10 nC (gated integrator)
External accuracy	Better than 0.1% of full scale (I-V converter) Better than 0.2% of full scale (gated integrator, up to 20 µA)
Calibration accuracy	Calibration source external accuracy better than 0.01%
Input impedance	< 1 ohm (I-V converter); < 3 kohm (gated integrator)
Input noise	< 0.05% of full scale rms (>1 msec averaging or integration)
Digitization	Successive approximation 16 bit bipolar, 200 kSa/s (I-V converter) Integration ramp sampling (gated integrator)
Averaging	Block averages, 1 to 65535 samples per reading (I-V converter)

Specifications (continued)

General I/O	
Analog inputs	Three, differential, +/-10 V (inputs 2 and 3 multiplexed)
Analog outputs	Two, +/- 10V
Digital inputs	Four, TTL levels, active low (5V internal pull-up)
Digital outputs	Four, TTL levels, 3 mA maximum source or sink per channel

Actuator control	
Solenoid control	24 VDC output, 200 mA fused, plus relay contact pair
Limit switch sense	Two, opto-isolated, active low.

Dose monitor pulse	
Pulse type	TTL or NIM-standard fast negative-going; transformer isolated (jumper selectable) Able to drive 50 ohm load
Charge quantum	Software configurable, derived from integral plane input reading

Measurement gates	
Gate in	TTL levels 2.5 kohm input impedance
Gate out	TTL levels Able to drive 50 ohm load

Dosimetry interlocks	
Enable input	Opto isolated digital input pair (anode and cathode)
Enabled output	Potential-free relay contact pair n/o
Status output	Potential-free relay contact pair n/o
Interlock output	Potential-free safety-rated relay contact pair n/o (Tyco SR4D4)

Beam control	
Beam enable out	Fiber optic on/off (640 nm)
Status out	Fiber optic on/off (640 nm)

Specifications (continued)

High voltage	
Voltage range options	20 V to 200 V. Line <0.01%, Load <0.05%, Ripple <0.01% 50 to 500 V. Line <0.01%, Load <0.01%, Ripple <0.01% 100 to 1250 V. Line <0.001%, Load <0.005%, Ripple <0.001% 200 to 2000 V Line <0.01%, Load <0.01%, Ripple <0.001% Supplies can be either polarity (specify at time of order)
Output power	1 watt
Line regulation	< 0.001%

General	
Power input	+24V (+/- 2V) DC, 750 mA typ, 1500 mA max.
Controls	Front panel override key-switch; key retained in override state. Two rear panel rotary switches for fiber optic loop address and comms mode/baud rate.
Displays	Front panel indicator for power on Front panel LEDs for override switch position and HV on Four rear panel LEDs for device status
Case	1U 19” rack mounting steel chassis with Al alloy front panel Filtered cooling fan fitted to rear panel. Ventilation outlet holes on rear panel 4.8 mm diameter.
Weight	3.5 kg (7.7 lb)
Operating environment	10 to 35 C (15 to 25 C recommended to reduce drift and offset) , < 70% humidity, non-condensing, vibration < 0.1g all axes (1 to 100 Hz)
Shipping and storage environment	-10 to 50 C, < 80% humidity, non-condensing, vibration < 1g all axes, 1 to 100 Hz

Interfacing

Interfaces	Ethernet 10/100/1000 Mbps. UDP and TCP/IP. Auto MDIX.
	Fiber-optic loop, 10 Mbit/sec serial, 9-bit asynchronous binary.
	Two fiber-optic receiver/transmitter pairs. Configurable as peer to peer synchronization channels or as slave device loop control ports.
	Serial for diagnostics and configuration. Baud rate 115 kbps. The electrical interface can be set to RS-232 or full duplex differential RS-485.

Connectors

Strip signal inputs

Four high-density 44-pin DSub female. Base 0 identifiers are PCB references.

Inputs 1 to 32

1	Ch29 (In28)	16	Ch31 (In30)	31	Ch32 (In31)
2	Ch28 (In27)	17	Ch30 (In29)	32	Shield
3	Ch26 (In25)	18	Ch27 (In26)	33	KGnd
4	Ch 24 (In23)	19	Ch25 (In24)	34	KGnd
5	Ch22 (In21)	20	Ch23 (In22)	35	KGnd
6	Ch20 (In19)	21	Ch21 (In20)	36	KGnd
7	Ch18 (In17)	22	Ch19 (In18)	37	KGnd
8	Ch16 (In15)	23	Ch17 (In16)	38	KGnd
9	Ch14 (In13)	24	Ch15 (In14)	39	KGnd
10	Ch12 (In11)	25	Ch13 (In12)	40	KGnd
11	Ch10 (In09)	26	Ch11 (In10)	41	KGnd
12	Ch08 (In07)	27	Ch09 (In08)	42	KGnd
13	Ch06 (In05)	28	Ch07 (In06)	43	Shield
14	Ch04 (In03)	29	Ch05 (In04)	44	Ch03 (In02)
15	Ch02 (In01)	30	Ch01 (In00)		

Inputs 33 to 64

1	Ch61 (In60)	16	Ch63 (In62)	31	Ch64 (In63)
2	Ch60 (In59)	17	Ch62 (In61)	32	Shield
3	Ch58 (In57)	18	Ch59 (In58)	33	KGnd
4	Ch56 (In55)	19	Ch57 (In56)	34	KGnd
5	Ch54 (In53)	20	Ch55 (In54)	35	KGnd
6	Ch52 (In51)	21	Ch53 (In52)	36	KGnd
7	Ch50 (In49)	22	Ch51 (In50)	37	KGnd
8	Ch48 (In47)	23	Ch49 (In48)	38	KGnd
9	Ch46 (In45)	24	Ch47 (In46)	39	KGnd
10	Ch44 (In43)	25	Ch45 (In44)	40	KGnd
11	Ch42 (In41)	26	Ch43 (In42)	41	KGnd
12	Ch40 (In39)	27	Ch41 (In40)	42	KGnd
13	Ch38 (In37)	28	Ch39 (In38)	43	Shield
14	Ch36 (In35)	29	Ch37 (In36)	44	Ch 35 (In34)
15	Ch34 (In33)	30	Ch33 (In32)		

Connectors

Strip signal inputs (continued)

Inputs 65 to 96

1	Ch93 (In92)	16	Ch95 (In94)	31	Ch96 (In95)
2	Ch92 (In91)	17	Ch94 (In93)	32	Shield
3	Ch90 (In89)	18	Ch91 (In90)	33	KGnd
4	Ch88 (In87)	19	Ch89 (In88)	34	KGnd
5	Ch86 (In85)	20	Ch87 (In86)	35	KGnd
6	Ch84 (In83)	21	Ch85 (In84)	36	KGnd
7	Ch82 (In81)	22	Ch83 (In82)	37	KGnd
8	Ch80 (In79)	23	Ch81 (In80)	38	KGnd
9	Ch78 (In77)	24	Ch79 (In78)	39	KGnd
10	Ch76 (In75)	25	Ch77 (In76)	40	KGnd
11	Ch74 (In73)	26	Ch75 (In74)	41	KGnd
12	Ch72 (In71)	27	Ch73 (In72)	42	KGnd
13	Ch70 (In69)	28	Ch71 (In70)	43	Shield
14	Ch68 (In67)	29	Ch69 (In68)	44	Ch67 (In66)
15	Ch66 (In65)	30	Ch65 (In64)		

Inputs 97 to 128

1	Ch125 (In124)	16	Ch127 (In126)	31	Ch128 (In127)
2	Ch124 (In123)	17	Ch126 (In125)	32	Shield
3	Ch122 (In121)	18	Ch123 (In122)	33	KGnd
4	Ch120 (In119)	19	Ch121 (In120)	34	KGnd
5	Ch118 (In117)	20	Ch119 (In118)	35	KGnd
6	Ch116 (In115)	21	Ch117 (In116)	36	KGnd
7	Ch114 (In113)	22	Ch115 (In114)	37	KGnd
8	Ch112 (In111)	23	Ch113 (In112)	38	KGnd
9	Ch110 (In109)	24	Ch111 (In110)	39	KGnd
10	Ch108 (In107)	25	Ch109 (In108)	40	KGnd
11	Ch106 (In105)	26	Ch107 (In106)	41	KGnd
12	Ch104 (In103)	27	Ch105 (In104)	42	KGnd
13	Ch102 (In101)	28	Ch103 (In102)	43	Shield
14	Ch100 (In99)	29	Ch101 (In100)	44	Ch99 (In98)
15	Ch98 (In97)	30	Ch97 (In96)		

Connectors

Integral plane input

Four pin Lemo 0B-size female.

1	Signal in	3	Aux signal in
2	AGnd	4	Chassis

General I/O

25 pin DSub female.

1	24 V rtn	14	24 VDC out fused
2	Chassis	15	AGnd
3	Analog in 1 +	16	Analog in 1 -
4	Dig out 1	17	Dig out 2
5	Analog in 2 +	18	Analog in 2 -
6	Analog in 3 +	19	Analog out 1
7	Analog in 3 -	20	Analog out 2
8	DGnd	21	+ 5V out
9	DGnd	22	Dig out 3
10	Dig out 4	23	DGnd
11	Dig in 4	24	Dig in 3
12	Dig in 2	25	Dig in 1
13	DGnd		

Actuator control

9 pin DSub female

1	Relay pole A	6	Relay pole B
2	24 V rtn	7	Opto in 2
3	n/c	8	24 V rtn
4	24 VDC out fused	9	24 VDC out fused
5	Opto in 1		

Gate in

Lemo 00 coaxial

Gate out

Lemo 00 coaxial

Monitor out

Lemo 00 coaxial

Connectors

<table>
<tr><td>Enable</td><td>Phoenix 8 pin 3.5 mm female
<table>
<tr><td>1</td><td>24 V rtn</td><td>5</td><td>Enabled out relay contact</td></tr>
<tr><td>2</td><td>24 VDC out fused</td><td>6</td><td>Enabled out relay contact</td></tr>
<tr><td>3</td><td>Enable in opto anode</td><td>7</td><td>Override switch sense contact</td></tr>
<tr><td>4</td><td>Enable in opto cathode</td><td>8</td><td>Override switch sense contact</td></tr>
</table></td></tr>
<tr><td>Interlock</td><td>Phoenix 5 pin 3.5 mm female
<table>
<tr><td>1</td><td>24 V rtn</td><td>4</td><td>Safety relay contact</td></tr>
<tr><td>2</td><td>24 VDC out fused</td><td>5</td><td>n/c</td></tr>
<tr><td>3</td><td>Safety relay contact</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>Relay output</td><td>Phoenix 4 pin 3.5 mm female
<table>
<tr><td>1</td><td>24 V rtn</td><td>3</td><td>Relay contact</td></tr>
<tr><td>2</td><td>24 VDC out fused</td><td>4</td><td>Relay contact</td></tr>
</table></td></tr>
<tr><td>High voltage out</td><td>SHV</td></tr>
<tr><td>High voltage sense</td><td>SHV</td></tr>
<tr><td>RS-232 / RS-485</td><td>Six pin mini-DIN (“PS/2”)
<table>
<tr><td>1</td><td>Tx / RS-485 Tx+</td><td>4</td><td>n/c</td></tr>
<tr><td>2</td><td>Rx / RS-485 Rx+</td><td>5</td><td>RS-485 Tx-</td></tr>
<tr><td>3</td><td>Gnd</td><td>6</td><td>RS-485 Rx+</td></tr>
</table></td></tr>
<tr><td>Fiber optics</td><td>Two receiver transmitter pairs.
Two transmitter outputs
Avago HFBR ST bayonet (compatible with 1 mm POF and 200 µm HCS fiber)</td></tr>
<tr><td>Ethernet</td><td>RJ-45 jack</td></tr>
<tr><td>Power in</td><td>Lemo Redel PXG
<table>
<tr><td>1</td><td>+24 VDC in</td></tr>
<tr><td>2</td><td>24 V rtn</td></tr>
</table></td></tr>
<tr><td>Ground</td><td>M4 threaded stud</td></tr>
</table>

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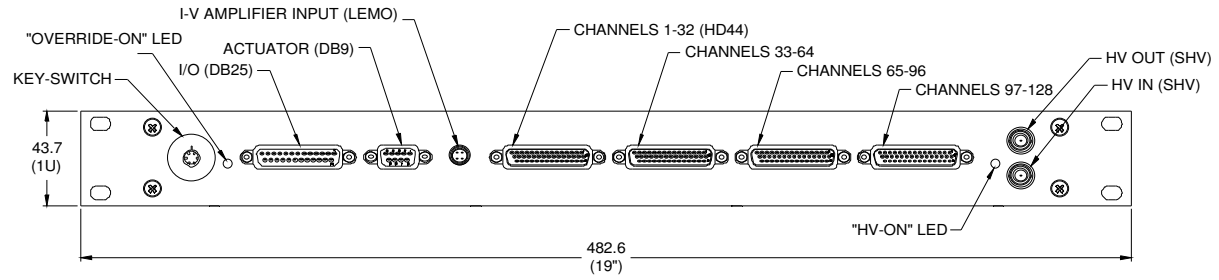
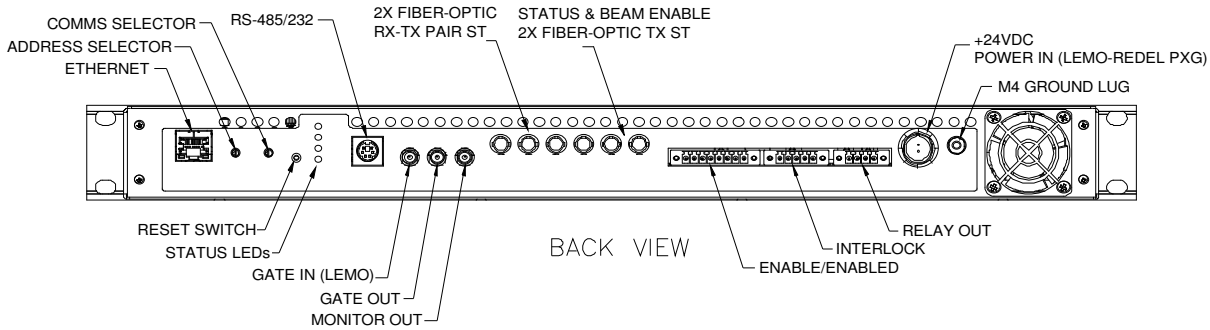


FRONT VIEW

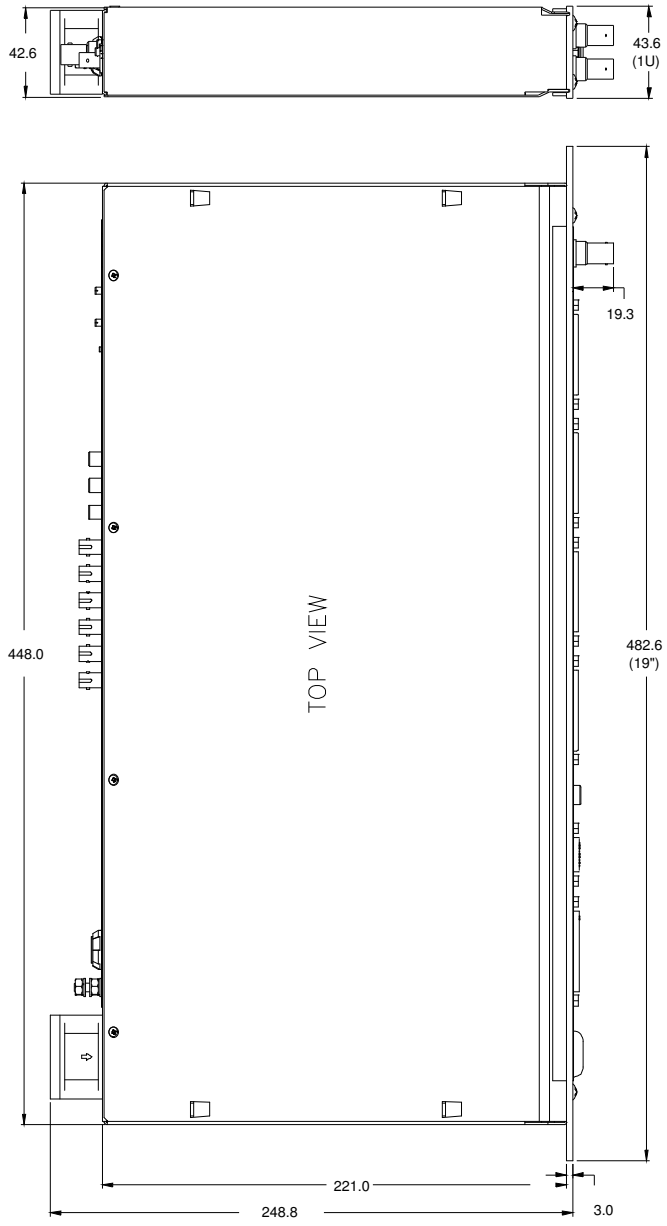


BACK VIEW

Dims mm

Ordering information

I128	I128 position sensing ionization chamber controller with 128 electrometer channels plus one channel for integral plane readout.
-XP20/12/05/02	Add HV supplies positive 2000/1250/500/200 volts
-XN20/12/05/02	Add HV supply negative 2000/1250/500/200 volts
-DSUM	Integral dose plane input configured to select A or A+B (default is A or B)
	(Alternative current ranges—enquire)



Dims mm

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