

## High -Performance Real-time Controller Multiple Fiber-Optic Loop Control, Multi-channel I/O and System Interlocks



### Features

- Dedicated high performance real-time controller for critical applications
- Processing power sufficient for complex data analysis and decision making at high rates
- High reliability QNX real time operating system
- Software releases developed to IEC 62304 available for medical applications
- Based on a very high performance SoC with ten processor cores
- Multiple communication options, including two gigabit Ethernet ports, ten 10 Mb/s deterministic fiber optic loop channels.
- Multi-channel isolated and buffered analog and digital I/O
- Integrated interlock safety relay and status connectors for process control
- Front panel diagnostic displays
- Compact 2U chassis operating from 24 VDC power

### Applications

- Beam scan and dose controller for proton therapy systems
- Accelerator and beamline control systems
- Applications that require real-time deterministic control of multiple devices and/or real-time data processing.
- Integration of large scale distributed systems.
- Data acquisition and control systems for noisy environments



**Specifications**

Processor cores	Texas Instruments AM5728 SoC containing: Two ARM Cortex A15s @ 1.5-GHz Two C66x Digital Signal Processors (DSPs) @ 700-MHz Two ARM Cortex M4 @ 212-MHz Four programmable real-time Units (PRUs) @ 200-MHz
Memory	2 GB DDR3
Operating system	Blackberry QNX Neutrino® real time OS designed for safe and reliable embedded systems. Option to port to QNX® OS for Medical, documented as conforming to IEC 62304.
Ethernet	Dual RJ-45 network ports A & B, fully transformer isolated. Auto negotiation 1000/100/10 Mbps, MDIX capability. TCP/IP and UDP. Static or DHCP IP4 address assignment.
Fiber-optic communication ports	Ten 10 Mbps real time ports for connecting Pyramid devices, up to 15 looped devices per port. ST bayonet connectors. 640 nm visible light via 200 µm core step-index fiber. Peer-to-peer communication between Q580s.
Fiber-optic digital I/O	Two fiber optic transmitter/receiver pairs for digital logic, pulse signals and triggers.
Interlocks	Two 8-pin header connectors HDR9, HDR10. Hardware interlock system coordinated by dual redundant CPLDs. Relays can be configured for current loop or 24 volt logic. Watchdog monitoring of the Q580 processor health, plus software-definable analysis of real-time data incoming. +24 VDC provided for 24 V logic operation. Interlock relay: two potential-free n/o contact pairs in series on safety-rated SR4D4 relay. Status relay 1: potential-free n/o contact pair. Status relay 2: potential-free n/o contact pair. Enable input: opto-isolator input (anode and cathode), 2.5 kohm current limiting resistor. Override digital input, connect to ground (pin 6 to pin 5) to set override state. Front panel indication that override state is set. This state only affects software interlocking according to the installed code, not hardware interlocking.



**Specifications (continued)**

I/O	<p>Sixteen +/- 10 V buffered analog single-ended inputs, 30 kHz (- 3 dB) LP filtering, 16 bit. 1 M<math>\Omega</math> input impedance, 4.7 k<math>\Omega</math> inrush limiting. ADC A to H on BNC connectors, ADC 9 to 16 to on 9-pin Dsub connector pins.</p> <p>Eight +/- 10 V buffered analog outputs, 16 bit. DAC A to D on BNC connectors, DAC E to H on 9-pin Dsub connector pins.</p> <p>Eight isolated digital outputs, TTL levels on 9-pin Dsub connector pins.</p> <p>Eight opto-isolated digital inputs, polarity and transient protected, TTL up to 24 V logic levels on 9-pin Dsub connector pins. 499 <math>\Omega</math> current limiting resistor.</p> <p>Isolated ground references for digital signals can be connected to customer ground.</p>
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Power input	<p>+24V (+/- 2V) DC, 1500 mA. Protected with PTC fuses 1.1A (internal circuits), 1.8 A (24 V to external devices), 0.2 A (fan supply).</p>
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Controls	None
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Displays	<p>Front panel OLED 20 x 4 character alphanumeric displays for system status. Front panel illuminated logo for power on indication. Front panel illuminated override warning.</p>
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**Environmental**

Case	<p>19" rack mounting, 2U. Stainless steel sheet, with aluminium front panel. IP23 ingress protection. Mount in 19" rack mount cabinet for improved protection.</p>
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Front panel-mounted air inlet fan venting at top of rear panel.

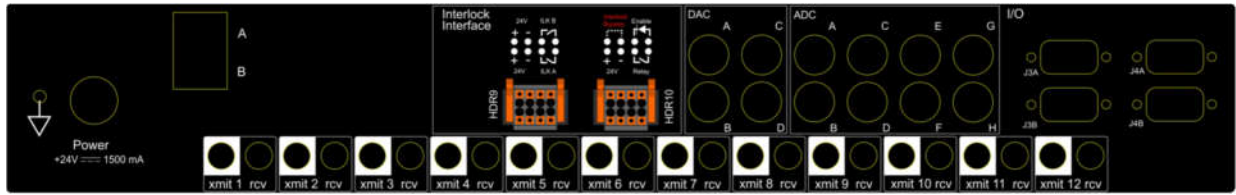
Weight	4.0 kg (8.8 lb)
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Operating environment	10 to 35C, < 80% humidity, non-condensing, vibration < 0.1g all axes, 1 to 100 Hz
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Storage environment	0 to 50C, < 80% humidity, non-condensing, vibration < 2g all axes, 1 to 100 Hz
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Connectors



Ethernet	Dual RJ-45 socket, suitable for standard Ethernet 8-way plug and CAT5 or higher cable.																																
Fiber optics	Twelve transmitter/receiver pairs, Avago HFBR ST bayonet.																																
Interlocks	<p>Two Phoenix Combicon 1787030.                      Mating connectors types Phoenix 1790506 and 1790315 . Spring lock clamping of wire 16 to 24 AWG, 10 mm insulation removed.                      +24 VDC fused supply provided.</p> <p><b>HDR9</b></p> <table border="1"> <tr> <td>1</td> <td>+24 VDC out</td> <td>5</td> <td>+24 VDC out</td> </tr> <tr> <td>2</td> <td>24 V return</td> <td>6</td> <td>24 V return</td> </tr> <tr> <td>3</td> <td>Hard interlock safety relay contact com</td> <td>7</td> <td>Soft interlock relay contact com</td> </tr> <tr> <td>4</td> <td>Hard interlock safety relay contact n/o</td> <td>8</td> <td>Soft interlock relay contact com n/o</td> </tr> </table> <p><b>HDR10</b></p> <table border="1"> <tr> <td>1</td> <td>+24 VDC out</td> <td>5</td> <td>Gnd</td> </tr> <tr> <td>2</td> <td>24 V return</td> <td>6</td> <td>Digital input set override</td> </tr> <tr> <td>3</td> <td>Status relay contact com</td> <td>7</td> <td>Digital enable input opto cathode</td> </tr> <tr> <td>4</td> <td>Status relay contact n/o</td> <td>8</td> <td>Digital enable input opto anode</td> </tr> </table>	1	+24 VDC out	5	+24 VDC out	2	24 V return	6	24 V return	3	Hard interlock safety relay contact com	7	Soft interlock relay contact com	4	Hard interlock safety relay contact n/o	8	Soft interlock relay contact com n/o	1	+24 VDC out	5	Gnd	2	24 V return	6	Digital input set override	3	Status relay contact com	7	Digital enable input opto cathode	4	Status relay contact n/o	8	Digital enable input opto anode
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DAC outputs A-D	Four BNC female coaxial																																
ADC inputs A-H	Eight BNC female coaxial																																



**Connectors (continued)**

I/O

Four nine-pin DSub male.

**J3A**

1	Digital out 1	6	Digital out 2
2	Digital in 1	7	Digital in 2
3	Isolated gnd 1	8	Gnd
4	Analog in J	9	Analog out E
5	Analog in I		

**J3B**

1	Digital out 3	6	Digital out 4
2	Digital in 3	7	Digital in 4
3	Isolated gnd 2	8	Gnd
4	Analog in L	9	Analog out F
5	Analog in K		

**J4A**

1	Digital out 5	6	Digital out 6
2	Digital in 5	7	Digital in 6
3	Isolated gnd 3	8	Gnd
4	Analog in N	9	Analog out G
5	Analog in M		

**J4B**

1	Digital out 7	6	Digital out 8
2	Digital in 7	7	Digital in 8
3	Isolated gnd 4	8	Gnd
4	Analog in P	9	Analog out H
5	Analog in O		

Power in

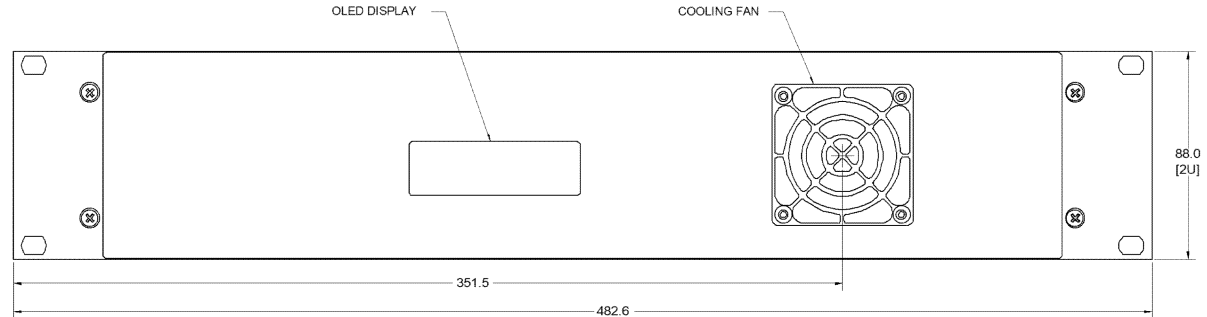
Lemo Redel PXG.M0.2GG.NG two-pin locking connector, UL rated. Mates with Redel PAG.M0.2 type or PFG.M0.2 type free plugs.

1	+24 VDC	2	Return
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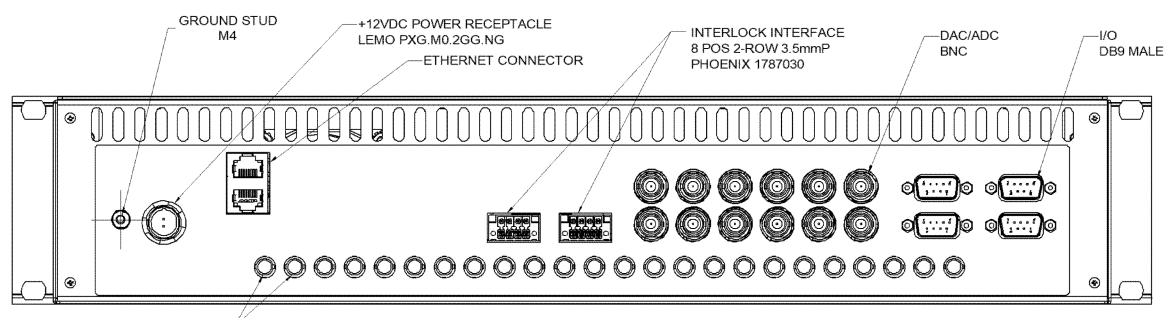
Ground connection

M4 threaded stud





FRONT VIEW



12X FIBER-OPTIC XMIT/RCV PAIR AVAGO HFBR-1515B/2515B

REAR VIEW

Dims mm

**Ordering information**

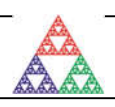
Q580	Q580 real-time controller with dual Ethernet ports, fiber-optic loop ports, analog and digital I/O and hardware interlocks.
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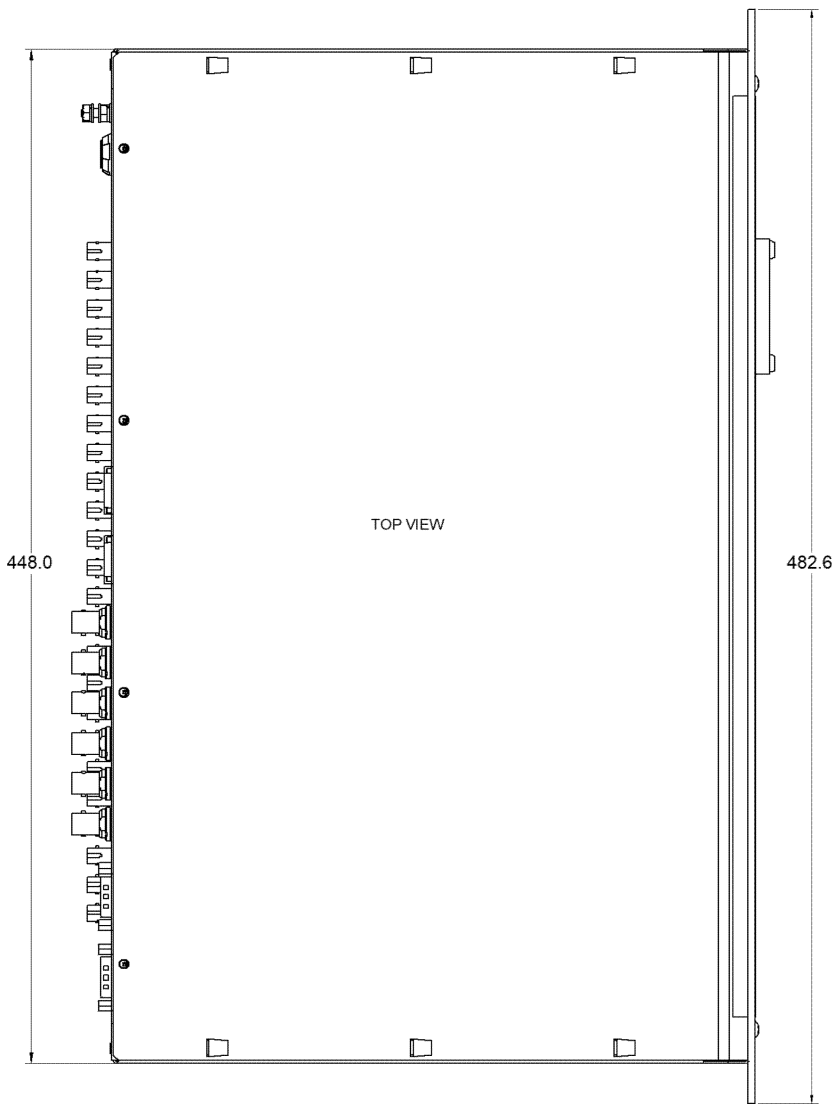
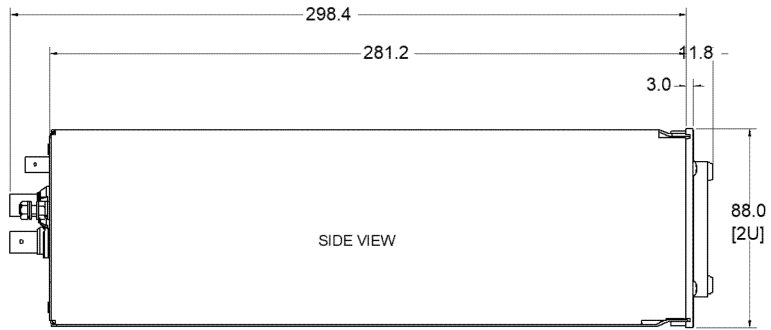
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Q580\_DS\_200313





Dims mm

