

Product Update Information

Synrad 48-5 CO₂ Laser



Synrad ti60 CO₂ Laser



Previous Product Description Synrad 48-5 CO₂ Laser

Previous Part Numbers
Standard Water: 48-5SWN
Key-switch Water: 48-5KWN

Updated Product Description Synrad ti60 CO₂ Laser

Updated Part Numbers
Standard Air: FSTi60SAH-10.6, FSTi60SAH-10.2, FSTi60SAH-9.3
Standard Fan: FSTi60SFH-10.6, FSTi60SFH-10.2, FSTi60SFH-9.3
Standard Water: FSTi60SWH-10.6, FSTi60SWH-10.2, FSTi60SWH-9.3

Contact your local Novanta or Synrad account manager for more information about the high stability (-HS) ti Series models.

Synrad's ti60 laser is a common choice for customers looking to upgrade from the 48-5 laser. The ti60 laser is a newer design with significantly more output power and a shorter length than the 48-5 laser. This document summarizes some of the key differences that OEMs should consider when updating to the ti60 laser.

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Laser Specification Differences

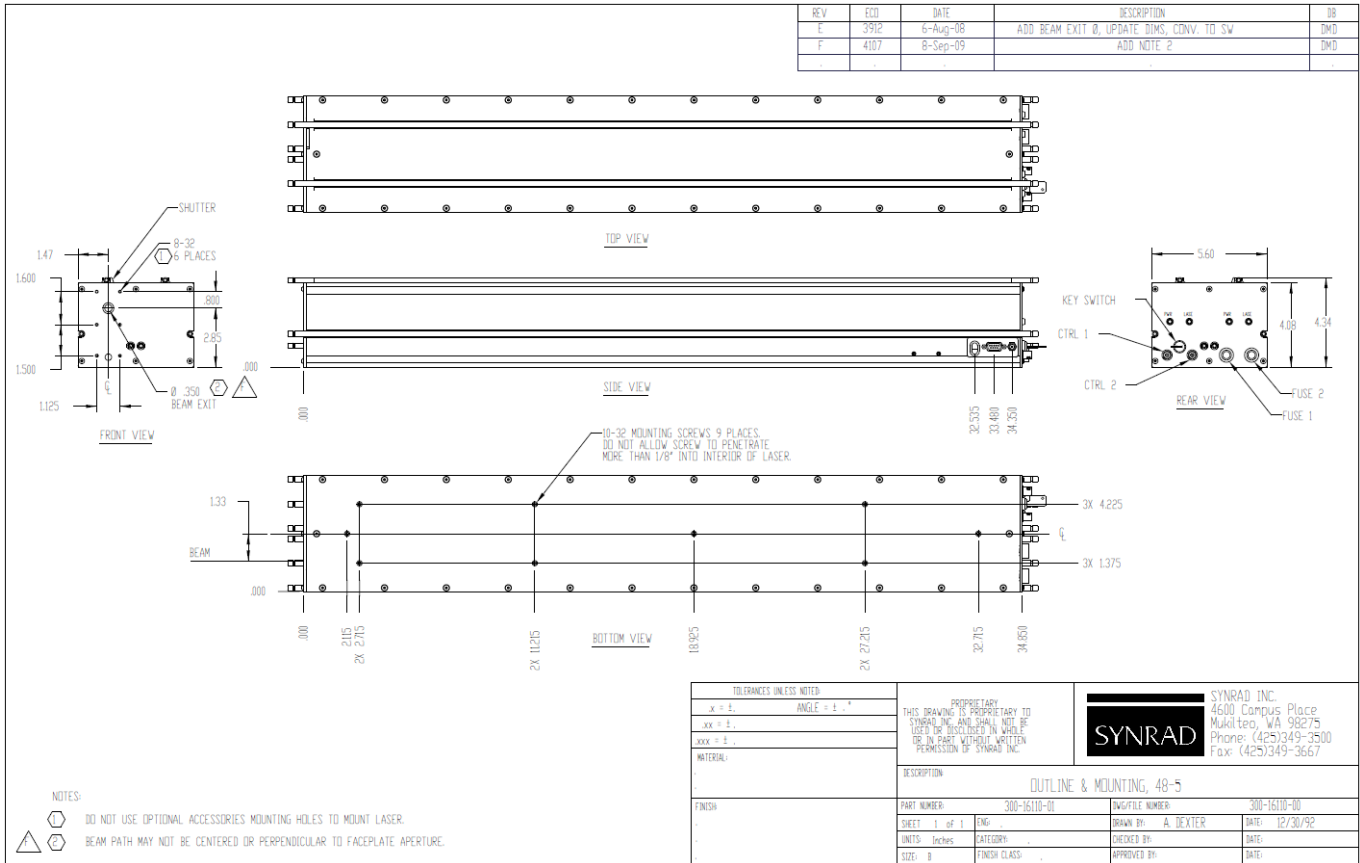
The following table summarizes the specification differences between the 48-5 and ti60 water-cooled lasers.

<i>Specification</i>	<i>48-5 laser</i>	<i>ti60 laser</i>	<i>Description of difference</i>
Output power	> 50 W	> 60 W	More power, longer standard warranty period. Note that ti60 lasers typically ship with about 90 W of average output power, and thus have a significantly better \$/W ratio than 48-2 lasers.
Wavelengths	10.6 μm	9,3 10,2 and 10.6 μm	No difference in linewidth at 10.6 μm . More wavelength options for ti60: 9.3 μm and 10.2 μm .
Rise time	< 150 μs	< 75 μs	Faster rise times.
Power stability from cold start	< $\pm 5\%$	< $\pm 7\%$ (or 4% with the HS model)	Power stability is slightly higher for the standard ti60 model. The ti60 is also available in a high-stability model: guaranteed power stability < $\pm 2\%$ after 3 minutes, typical cold start stability < $\pm 4\%$.
Operating frequency	0 – 20 kHz	0 – 160 kHz	Faster pulsing, up to 160 kHz
Beam diameter at faceplate (at $1/e^2$)	3.5 mm	2.0 mm	About 1.5 mm smaller. Note: 3x, 4x, and 5x beam expanders are available for ti series.
Divergence, full angle (at $1/e^2$)	< 4.0 mrad	< 7.0 mrad	May diverge up to 3 mrad faster.
Beam quality (M^2)	< 1.2	< 1.2	No difference.
Ellipticity	< 1.2	< 1.2	No difference.
Polarization	Random	Linear (Vertical)	Output is not randomly polarized.
Heat load	< 800 W	< 900 W	Power consumption may be higher, depending on operating conditions.
Flowrate, air	n/a	140 CFM, 2 fans required	Air cooling option available.
Flowrate, water	1.5 GPM, < 60 PSI	1 GPM, < 60 PSI	Lower water flow rate required.
Input voltage / current	30 VDC / 28 A	48 V / 18 A	Voltage standardized at 48 V and current lowered to 18 A
Dimensions (mm)	925 x 135 x 114 mm	584 x 143 x 150 mm, water	Significantly shorter length, wider & taller
Weight	20 kg	11.9 kg, water	Significantly lighter
Beam exit height	72.4 mm	73.8 mm	Similar beam exit height, less than 2 mm difference.
I/O Connection	Female DB-9 connector	Female DB-15 connector	Different number of pins and different control signals. See the sections “ I/O Connections ” and “ I/O Signals ” for more information.

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Technical Drawing: 48-5

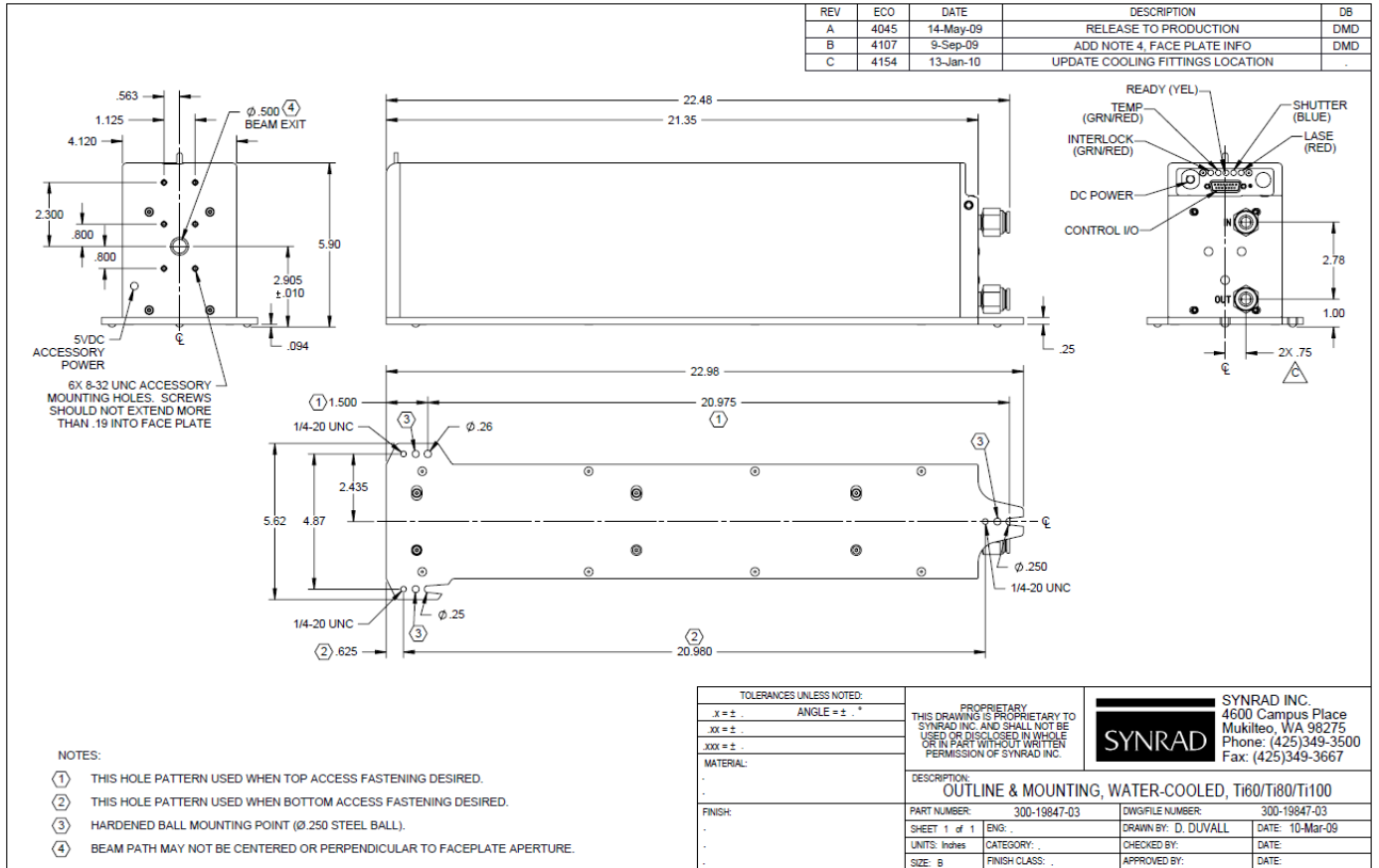
Outline and mounting features for the 48-5 lasers. Units are in inches.



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Technical Drawing: ti60

Outline and mounting features for the ti60 water-cooled lasers. Units are in inches.

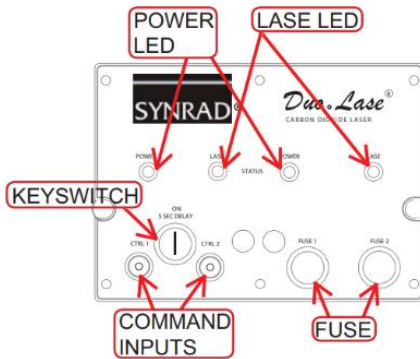


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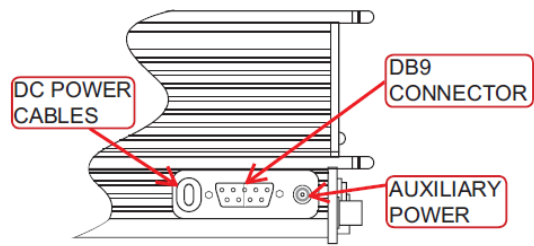
I/O Connections

The following diagrams show the I/O connections for the 48-5 and ti60 water-cooled lasers.

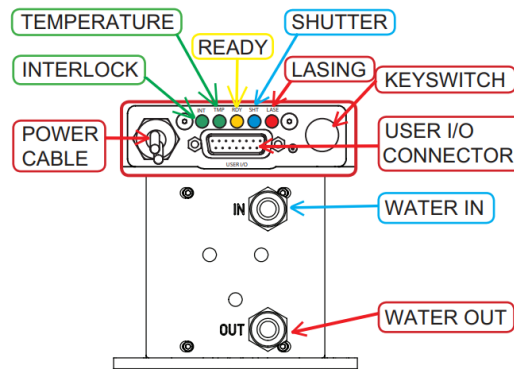
48-5 Back Panel



48-5 Side Panel

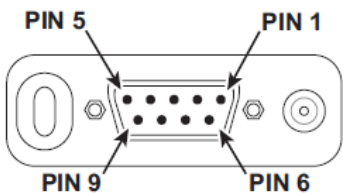


ti60 Back Panel

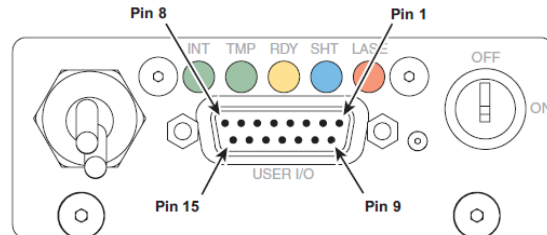


The 48-5 laser uses a female DB-9 connector and the ti60 laser uses a female DB-15 connector for I/O signals, as shown in the following diagrams.

48-5 Laser DB-9 Connector



ti60 Laser DB-15 Connector



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I/O Signals

The different functions and control signals for the 48-5 laser and the ti60 laser are shown in the following table. Please refer to the manuals for more information on the circuits and specifications for each of the control signals.

<i>Pin # and Description</i>		
Function	48-5 Laser	ti60 Laser
PWM Command	<ul style="list-style-type: none"> • BNC Command Input Not controlled with the DB-9 connector. There is a separate BNC connector on the rear panel of the laser, labeled CTRL, that accepts tickle and PWM signal inputs. This signal is connected to an optoisolator, the output of which is applied to the PWM switch control circuit. The PWM switch control circuit gates the PWM switch off and on at the frequency and duty cycle controlled by the modulation source. When the PWM switch closes, a potential of +30 VDC is applied to the RF driver. <ul style="list-style-type: none"> ○ Laser off: +0 VDC (+0.0 to +0.5 VDC) ○ Laser on: +5 VDC (+3.5 to +10 VDC) at 5 kHz nominal and up to 20 kHz ○ External tickle signal: +5 VDC at 5 kHz for 1 μs \pm0.2 μs 	<ul style="list-style-type: none"> • Pin 9 = PWM Positive Input Use this optoisolated voltage input for PWM signals referenced to the PWM Negative Input (Pin 1). <ul style="list-style-type: none"> ○ Laser off: +0 VDC (+0.0 to +0.8 VDC) ○ Laser on: +5 VDC (+3.5 to +6.7 VDC) at 5 kHz nominal and up to 160 kHz ○ Do <i>not</i> apply a tickle signal. There is a built-in tickle generator, so no external tickle signal is needed. Applying an external tickle signal may cause unintentional low-power lasing, also known as bleeding. • Pin 1 = PWM Negative Input This input provides the negative or return side of the opto-isolated PWM Command signal reference to PWM Positive (Pin 9).
Signal Ground or Input/Output Common	<ul style="list-style-type: none"> • Pin 2 and Pin 4 = Signal Ground Signal ground/chassis ground for Pins 1, 3, 5, 8, and 9. 	<ul style="list-style-type: none"> • Pin 12 = Auxiliary DC Power Ground This connection provides a ground (earth) connection for +5 and +24 VDC auxiliary power outputs. This pin is the only User I/O pin that is connected to chassis ground. Do not use this pin for grounding if DC power to external I/O circuits is supplied from an external customer-supplied DC power source. • Pin 11 = Input Common Use this pin to complete the return path for input connections: Remote Interlock (Pin 3), Shutter Open Request (Pin 10), and Remote Reset/Start Request lines (Pin 2).

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	<ul style="list-style-type: none">• Pin 13 = Output Common Use this pin to complete the return path for output connections: Laser Active (Pin 6), Fault Detected (Pin 7), Laser Ready (Pin 8), Shutter Open (Pin 14), and Interlock Open (Pin 15). The Output Common line is protected by a 0.25 A self-resetting fuse.
Fault Shutdown	<ul style="list-style-type: none">• Pin 1 = Fault Shutdown Output Indicates failure of internal circuitry or existence of over temperature ($>60^{\circ}\text{C} \pm 2^{\circ}\text{C}$), over voltage, or under voltage fault. This active low signal (referenced to Pin 2 or Pin 4) transitions from +15 V (normal operation) to 0 VDC when a fault occurs. Use this output signal to disable external processes during a fault.• Pin 7 = Fault Detected Output This bi-directional switched output is externally connected to Pin 13, Output Common, when an over temperature fault (TMP LED is red) or other improper operating condition (SHT LED is flashing) exists. This output is open, in a high-impedance state, when laser operation is within limits (TMP LED is green and SHT LED is blue)
Temp Warning	<ul style="list-style-type: none">• Pin 5 = Pre-shutdown Temp Warning Output This active low signal (referenced to Pin 2 or Pin 4) transitions from +15 V (normal operation) to 0 VDC when a pre-shutdown temperature warning occurs (when laser temperature reaches $54^{\circ}\text{C} \pm 2^{\circ}\text{C}$) and remains low until temperature falls 2°C. Use this output to notify user of need to increase laser cooling or risk shutdown.• Function not available with this laser.
Remote Interlock	<ul style="list-style-type: none">• Pin 3 = Remote Interlock Input Disables the laser when an interlock switch wired to this input from an equipment door or panel is opened. Ground this input to Pin 2 or Pin 4 only. Do not apply a voltage to this pin. As shipped, Pins 3 and 4 are connected by the factory installed jumper plug to enable the Remote Interlock function.• Pin 3 = Remote Interlock Input Apply a positive or negative voltage (± 5 to 24 VDC) with respect to Pin 11, Input Common, to enable lasing. If your system does not use an interlock, connect this pin to a ± 5 to 24 VDC source. On Keyswitch lasers, a five-second delay occurs after the interlock is enabled.• Pin 15 = Interlock Open Output This bi-directional switched output is internally connected to Pin 13, Output Common, when remote interlock circuitry is open (INT LED is red) indicating that

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lasing is disabled. The output is open, in a high-impedance state, when lasing is enabled.

Remote Keyswitch

- **Pin 6 = Remote Keyswitch Input**
Connect a remote relay or switch in series with the laser Keyswitch to control the laser On/Off/Reset functions. Connect Pin 6 to Pin 7 to run; open this connection to halt lasing or reset faults. As shipped, Pins 6 and 7 are connected by the factory-installed jumper plug to enable the Remote Keyswitch function.
- **Pin 7 = Remote Keyswitch Output**
Connect Pin 7 to Pin 6 to enable the Remote Keyswitch function (see Pin 6 description above). Pin 7 is at DC line potential (+30 VDC) only when the Keyswitch is set to ON. As shipped, Pins 6 and 7 are connected by the factory-installed jumper plug.
- **Pin 2 = Remote Reset/Start Request Input**
Apply a positive or negative voltage (± 5 to 24 VDC) with respect to Pin 11, Input Common, to reset or remote keyswitch the laser. The laser remains disabled while voltage is applied. Removing voltage from the Remote Reset/Start Request pin causes the lasers RDY LED to illuminate. On Keyswitch lasers, a five-second delay occurs before lasing is enabled.

Laser Enable

- Function not available with this laser.
- **Pin 9 = Laser Enable Input**
When this input is logic high (+5 V) the laser is enabled (RDY indicator illuminates yellow). The laser is disabled when the input is low (0 V). After this input goes high, a five-second delay occurs before tickle or PWM signals are applied to the RF circuit.

Lase Indicator

- **Pin 8 = Remote Lase LED Output**
Connect an LED or LED-optoisolator between Pin 8 and Signal Ground for a remote LASE indication. The output is limited to 11 mA at 2.4 VDC and is pulse width modulated at the input PWM command signal frequency (i.e. not a steady state on/off signal).
- **Pin 6 = Laser Active Output**
This bi-directional switched output is internally connected to Pin 13, Output Common, when the laser is actively lasing (LASE LED illuminated red). This output is open, in a high-impedance state, when no beam is being emitted (LASE LED Off).

Ready Indicator

- **Pin 9 = Remote Ready LED Output**
Connect an LED or LED-optoisolator between Pin 9 and Signal Ground for a
- **Pin 8 = Laser Ready Output**
This bi-directional switched output is internally connected to Pin 13, Output Common, when the laser is enabled (RDY

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remote Ready (PWR) indication. The output is limited to 11 mA at 2.4 VDC

LED illuminated yellow) indicating that lasing will occur when a PWM Command signal is applied to Pin 9 and Pin 1. This input is open, in a high-impedance state, when the laser is disabled (RDY LED is off).

Auxiliary Power

- Function not available with this laser.

- **Pin 4 = +5 VDC Auxiliary Power Output**
This connection provides +5 VDC for driving external inputs or outputs. It can source up to 0.5 A and is protected by a 0.5 A self-resetting fuse. The return (ground) path must be through Pin 12, Aux DC Power Ground.
- **Pin 5 = +24 VDC Auxiliary Power Output**
This connection provides +24 VDC for driving external inputs or outputs. It can source up to 0.5 A and is protected by a 0.5 A self-resetting fuse. The return (ground) path must be through Pin 12, Aux DC Power Ground.

- Shutter Open** • Function not available with this laser.

- **Pin 10 = Shutter Open Request Input**
Apply a positive or negative voltage (± 5 to 24 VDC) with respect to Pin 11, Input Common, to enable lasing. If your system does not use a shutter, connect this pin to a ± 5 to 24 VDC source. On Keyswitch lasers, a five-second delay occurs after this input is enabled.
- **Pin 14 = Shutter Open Output**
This bi-directional switched output is internally connected to Pin 13, Output Common, when the Shutter Switch is Open (in key switch-equipped lasers) and a Shutter Open Request signal is present (SHT LED illuminated blue) indicating that lasing may be enabled if other operating conditions are met. This output is open, in a high impedance state, when the laser is disabled (SHT LED off).

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Support & Updating Other Configurations

If you have other concerns about updating your specific system, please let us know. Our expert technical support teams are here to provide you with more information, answer any questions you may have, and offer guidance for installation, operation, and troubleshooting of your laser.

Synrad Technical Support Engineers have an average of 11 years of laser system experience and can connect with you directly via phone or email. With regional offices located in the USA, Europe, China, and Japan, our Technical Support Engineers respond quickly with the precise information you are seeking.

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