

# SYNRAD Technical Bulletin

# 018b

Technical Issue: Difference in DB-9 Pin Configuration Between Firestar ti-Series Lasers versus t-Series/t70i Lasers

Date: 12 April 2011

Models Affected: ti-Series SA Models Only. This Bulletin is not applicable to fan-cooled (KF/SF) or water-cooled (KW/SW) models

## Description:

The pinout and functionality of the side-mounted DB-9 connector on **ti-Series** SA model lasers is **not** the same as the DB-9 connector on t-Series or t70i SA model lasers. Firestar ti60/ti80 OEM air-cooled (SA) model lasers incorporate a side-mounted DB-9 connector that provides several functions including supplying power for customer-supplied 48 VDC cooling fans. The DB-9 pin configuration was substantially changed from the configuration used on Firestar t-Series and t70i SA model lasers. Updated configuration information is available in ti-Series operator's manuals created on or after version 1.3, dated December 2010.

This Bulletin covers the following topics:

- Firestar ti60/ti80 DB-9 pin descriptions
- 48 VDC fan speed control
- Isolated cooling fan connections

## Firestar ti60/ti80 DB-9 pin descriptions

The side-mounted DB-9 connector on SA model lasers provides a *Shutter Switch* input, auxiliary +5 V power, and +48 VDC for powering user-supplied 48 V cooling fans. Figure 1 illustrates DB-9 pinouts and Table 1 describes the function of each pin on the DB-9 connector.

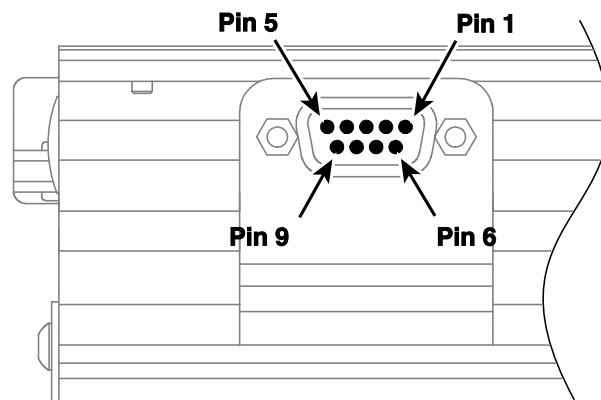


Figure 1 DB-9 connector pinouts

**Table 1 Side-mounted DB-9 pin descriptions**

Pin	Function	Description
1	PWM Control Output (ti80 laser only)	This optoisolated output provides a 0–5 V pulse-width modulated (PWM) signal to drive the PWM input on variable-speed DC fans. This output is not current-limited or fused. The PWM output is driven by internal circuitry based on the laser’s output power and chassis temperature.
2	Shutter Switch Input	In <i>Keyswitch</i> models, this input connects to the physical <i>Shutter Switch</i> . Leave this input open to enable lasing. Grounding this pin indicates that the shutter is Closed, which disables lasing. If connecting an external shutter switch to Pin 2, the circuit path must be grounded to Pin 6 or Pin 7, Signal Ground. There is a five-second delay imposed from the time the shutter input is opened to the time that PWM Command signals are accepted.
3	+ 5 VDC Auxiliary Power Output	This output provides +5 V for driving external inputs or outputs (like a diode pointer). The +5 VDC Auxiliary Power Output (Pin 3) is protected by a 0.5 A self-resetting fuse. The return (ground) path is through Pin 6 or Pin 7, Signal Ground.
4	+ 48 VDC Fan Power Output	This output provides +48 V for powering a customer-supplied cooling fan. The + 48 VDC Fan Power Output (Pin 4) is sourced directly from the user’s 48 V DC power supply and is protected by a 1.1 A self-resetting fuse. Pin 4 and Pin 8 can only source a <b>combined</b> current of 1.0 A total.
5	Fan Power Return	This connection provides a return (ground) path for Pin 4 and Pin 8 (+ 48 VDC Fan Power Output) when using internal PWM fan control. Pin 5 and Pin 9 (Fan Power Return) can only sink a <b>combined</b> current of 1.0 A total. Internal circuitry allows the laser to control fan speed based on the laser’s output power and chassis temperature. See <i>48 VDC fan speed control</i> for detailed information.
6	Signal Ground	Pin 6 and Pin 7 provide a return (ground) path for Pin 2 (Shutter Switch Input), Pin 3 (+5 VDC Auxiliary Power Output), or Pin 4/Pin 8 (+ 48 VDC Fan Power Output) when fan speed control is <b>not</b> required. Pin 6 and Pin 7, Signal Ground, are the only DB-9 pins connected to chassis ground. Do not use these pins if DC power is provided by an external customer-supplied DC power source.
7	Signal Ground	Pin 6 and Pin 7 provide a return (ground) path for Pin 2 (Shutter Switch Input), Pin 3 (+5 VDC Auxiliary Power Output), or Pin 4/Pin 8 (+ 48 VDC Fan Power Output) when fan speed control is <b>not</b> required. Pin 6 and Pin 7, Signal Ground, are the only DB-9 pins connected to chassis ground. Do not use these pins if DC power is provided by an external customer-supplied DC power source.

Pin	Function	Description
8	+ 48 VDC Fan Power Output	This output provides +48 V for powering a customer-supplied cooling fan. The + 48 VDC Fan Power Output (Pin 8) is sourced directly from the user's 48 V DC power supply and is protected by a 1.1 A self-resetting fuse. Pin 4 and Pin 8 can only source a <b>combined</b> current of 1.0 A total.
9	Fan Power Return	This connection provides a return (ground) path for Pin 4 and Pin 8 (+ 48 VDC Fan Power Output) when using internal PWM fan control. Pin 5 and Pin 9 (Fan Power Return) can only sink a <b>combined</b> current of 1.0 A total. Internal circuitry allows the laser to control fan speed based on the laser's output power and chassis temperature. See <i>48 VDC fan speed control</i> for detailed information.

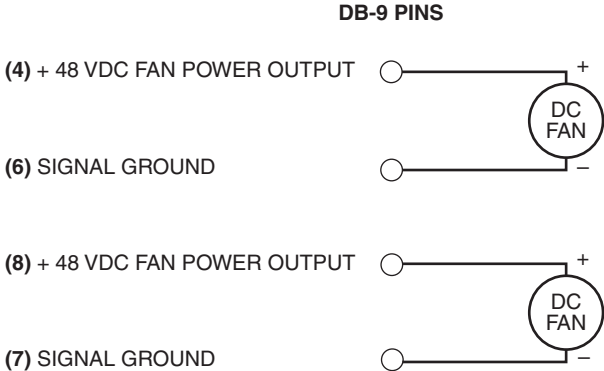
### 48 VDC fan speed control

When operating air-cooled (SA model) ti-Series lasers with customer-supplied cooling fans, you can choose to run fans continuously at full-speed (no fan speed control) or at a variable speed using internal or external (ti80 only) fan speed control. Each option is described below.

#### No fan speed control

To operate 48 VDC cooling fans continuously at full-speed, connect the positive (+) fan leads to Pin 4 and Pin 8, + 48 VDC Fan Power Output, and connect the negative (-) fan leads to Pin 6 and Pin 7, Signal Ground as shown in Figure 2.

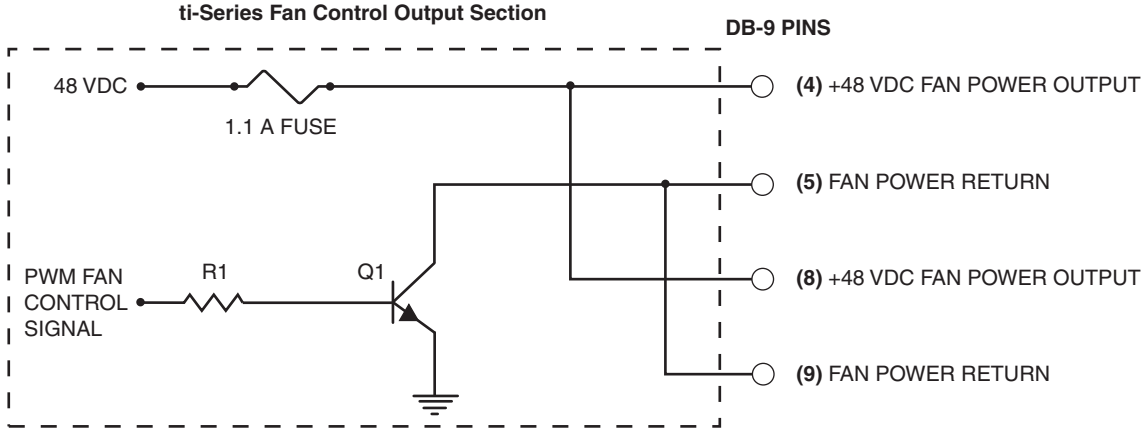
**Important Note:** The total current draw of **both** fans must not exceed 1.0 A to prevent tripping the internal 1.1 A self-resetting fuse.



**Figure 2 48 VDC fan connection – no speed control**

**Internal fan speed control**

The side-mounted DB-9 connector on SA model lasers has internal circuitry that controls fan speed based on the laser’s output power and chassis temperature. At tickle, or very low PWM duty cycles, cooling fans run at reduced speed to minimize noise; at higher PWM duty cycles, fan speed increases to match the cooling rate to power output. Fan speed is controlled by pulse width modulation (PWM) of the Fan Power Return lines (Pin 5/Pin 9) as shown in Figure 3.

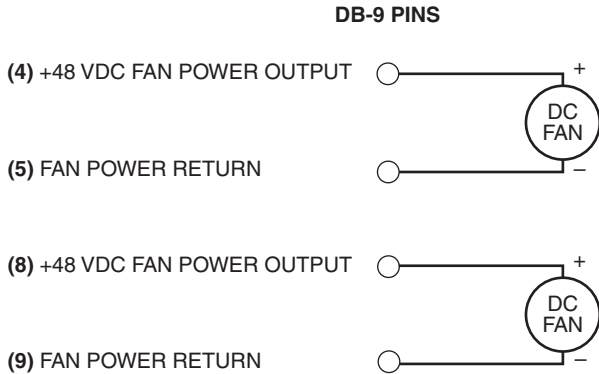


**Figure 3 Internal fan speed control circuitry**

Figure 4 illustrates the connections for internal fan speed control when using customer-supplied 48 VDC cooling fans. Connect the positive (+) fan leads to Pin 4 and Pin 8, +48 VDC Fan Power Output, and connect the negative (-) fan leads to Pin 5 and Pin 9, Fan Power Return.

Some types of cooling fans are not designed for PWM control and will stall at low speeds. SYNRAD has tested Delta EFB1248SHE cooling fans with good results.

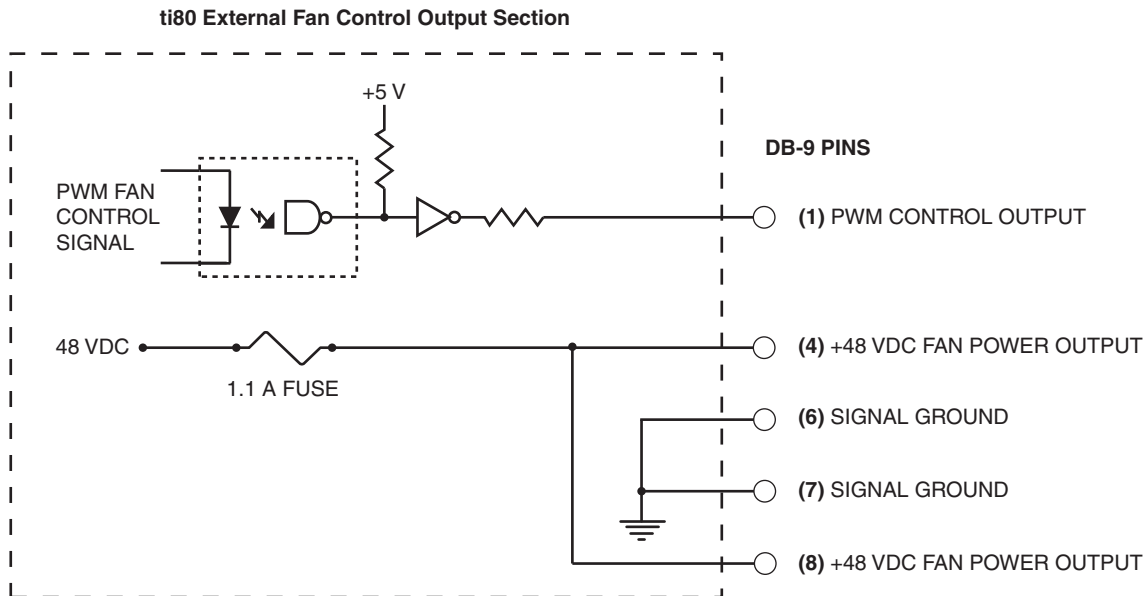
**Important Note:** The total current draw of *both* fans must not exceed 1.0 A to prevent tripping the internal 1.1 A self-resetting fuse.



**Figure 4 48 VDC fan connection – internal speed control**

**External fan speed control (ti80 only)**

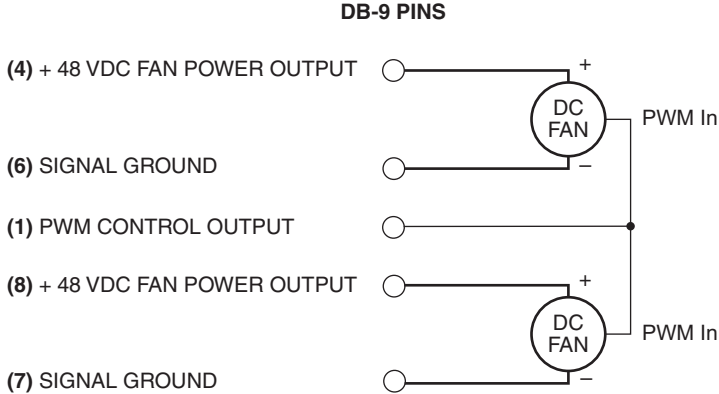
On Firestar ti80SA lasers only, the side-mounted DB-9 connector also provides an external PWM output, PWM Control Output, on Pin 1. This output provides a 5 V PWM signal for controlling the speed of PWM-enabled cooling fans based on the laser's output power and chassis temperature as shown in Figure 5. At tickle, or very low PWM duty cycles, cooling fans run at reduced speed to minimize noise; at higher PWM duty cycles, fan speed increases to match the cooling rate to laser power output.



**Figure 5 External fan speed control circuitry**

Figure 6 illustrates the connections for external fan speed control when using customer-supplied 48 VDC cooling fans with PWM control capability. Connect the positive (+) fan leads to Pin 4 and Pin 8, +48 VDC Fan Power Output, connect the negative (-) fan leads to Pin 6 and Pin 7, Signal Ground, and connect Pin 1, PWM Control Output, to the PWM input terminal of both fans.

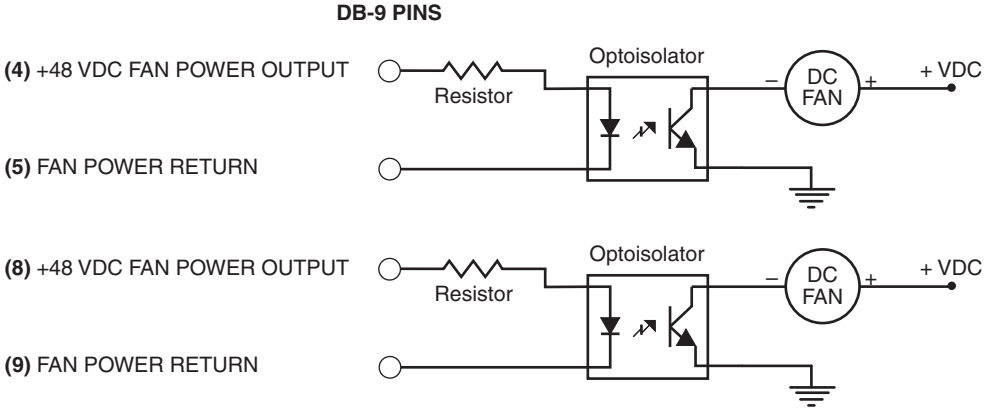
**Important Note:** The total current draw of **both** fans must not exceed 1.0 A to prevent tripping the internal 1.1 A self-resetting fuse.



**Figure 6 48 VDC fan connection – external speed control**

**Isolated cooling fan connections**

To connect cooling fans operating at voltages other than 48 VDC or with currents greater than 1.0 A, a customer-designed isolation circuit like that shown in Figure 7 could power almost any type of DC cooling fan (with a suitably sized resistor and optoisolator device) while minimizing voltage or current spikes that might damage the laser’s control board.



**Figure 7 Alternate fan connections**

For fans with PWM control capability, follow the circuit above except connect the optoisolator returns to Pin 6 and Pin 7, Signal Ground (instead of Pins 5 and 9), and connect Pin 1, PWM Control Output, to the PWM input terminal of both fans.

For further information contact SYNRAD at 1.800.796.7231; outside the U.S., dial +1.425.349.3500 or fax us at +1.425.349.3667.