SYNRAD Technical Bulletin

021b

Technical Issue: Intermittent Laser Reset Behavior

Date: 09 March 2011

Models Affected: All Firestar Lasers with DB-15 User I/O Connector

Description:

Laser processing systems using the *Remote Reset/Start Request* input on Firestar lasers may experience false reset conditions that inhibit laser output for brief intervals. This Technical Bulletin explains how electrical noise can induce transient voltages that cause this behavior and describes steps you can take to eliminate the problem.

Overview

All Firestar lasers, with the exception of the Firestar v30, incorporate a 15-pin *User I/O* connector that provides input/output (I/O) signals between the laser and user's control system. In addition to the five status outputs, this connector accepts three input signals from the control system—a *Remote Reset/Start Request* input on Pin 2, a *Remote Interlock* input on Pin 3, and a *Shutter Open Request* input on Pin 10.

As noted in the laser's Operator's Manual, these three bi-directional, optoisolated inputs have a maximum Off State voltage that is greater than –1.0 to less than +1.0 V (0.0 V typical) and a minimum On State voltage of ±5.0 VDC (+5.0 to +24.0 V typical). For *Remote Interlock* and *Shutter Open Request* inputs, this means that a voltage level greater than or equal to ±5.0 V is required to ***enable*** lasing.

For the *Remote Reset/Start Request* input, a voltage level between –1.0 to +1.0 V (0.0 V typical) is required to ***enable*** lasing and voltages of ±5.0 V or greater will inhibit or disable lasing. However, voltages between 1.0 to 5.0 V are in an undefined logic state and may also ***inhibit*** lasing. When a typical noise-related voltage transient occurs, the duration can be long enough to cause input circuitry to disable lasing, but short enough that the *RDY* LED appears to remain switched On. Although the *RDY* indicator is On, laser output is halted and disabled until the mandatory five-second start-up delay has timed out.

Eliminating noise-induced voltage transients

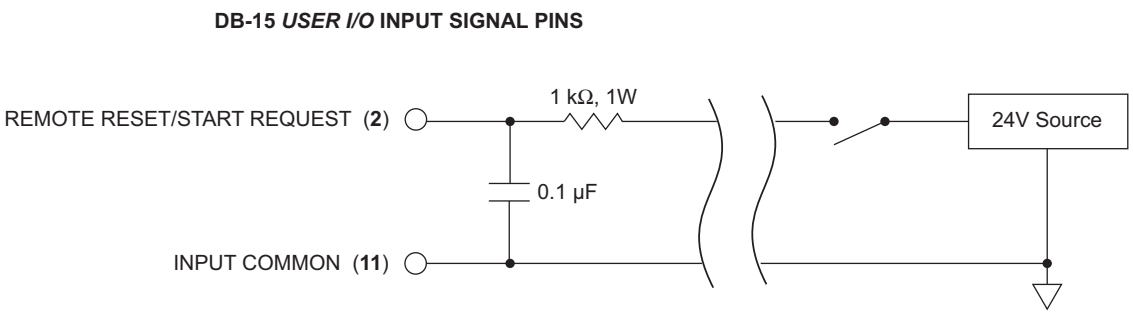
If you are operating in an industrial environment and experience brief intervals where the laser is commanded to lase, but does not, this behavior may be caused by electrical noise on the *Remote Reset/Start Request* input that unintentionally inhibits lasing because of (1) improperly shielded or grounded I/O wiring or (2) excessive electrical noise; for example, from an improperly shielded or grounded variable-frequency drive (VFD) or other electrically-noisy device.

There are several steps you can take to eliminate the voltage transients that cause unintentional activation of the *Remote Reset/Start Request* input:

1 Make sure that all wiring to/from the laser's *User I/O* connector uses shielded (with ground) or twisted pair cable. Ground the control system end of this cable only; leave the laser end of the cable ungrounded at the *User I/O* connector to prevent ground loops.

2 Refer to Figure 1 below and construct a filter circuit for the *Remote Reset/Start Request* input. Although this sample circuit is designed for a 24 V input, you can modify resistor and capacitor values to accommodate other input voltages (between 5–24 V) or adjust the RC time constant (response time) of the input.

The 1 kOhm resistor and 0.1 µF capacitor should be installed as close as possible to the laser's *User I/O* connector. The goal is to keep wiring to Pin 2 as short and well shielded as possible to prevent noise-induced voltage transients.



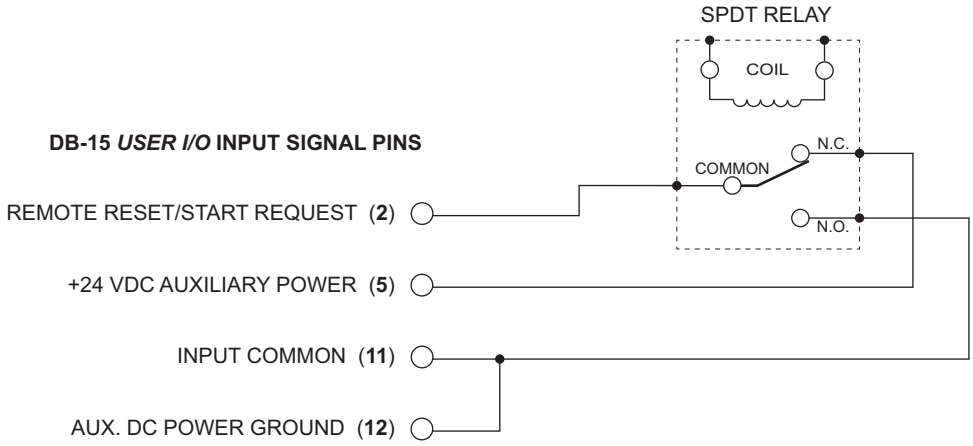
The 24V source can be supplied from an external 24V DC power supply or can be supplied from the laser's internal 24V source, Pin 5 (+24 VDC Aux. Power), on the DB-15 *User I/O* connector.

Figure 1 *Remote Reset/Start Request* Filter Circuit

3 In extremely noisy environments, a grounding circuit, rather than a filtering circuit, may produce better results. Figures 2a, 2b, and 2c illustrate acceptable grounding circuits for the *Remote Reset/Start Request* input. These circuits ensure the *Remote Reset/Start Request* input is grounded and not left floating when lasing is enabled.

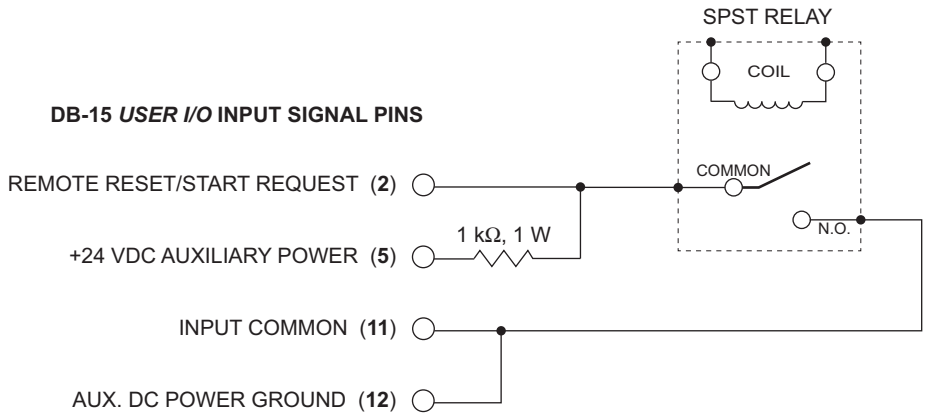
Figures 2a and 2b show wiring connections when using the laser's internal 24V auxiliary power supply while Figure 2c shows circuit wiring when using an external 24V power source.

In all cases, wiring must be shielded and the control relay should be installed as close as possible to the laser's *User I/O* connector. **Even when using a grounding circuit, wire runs must be as short and as well shielded as possible to prevent noise-induced voltage transients.**



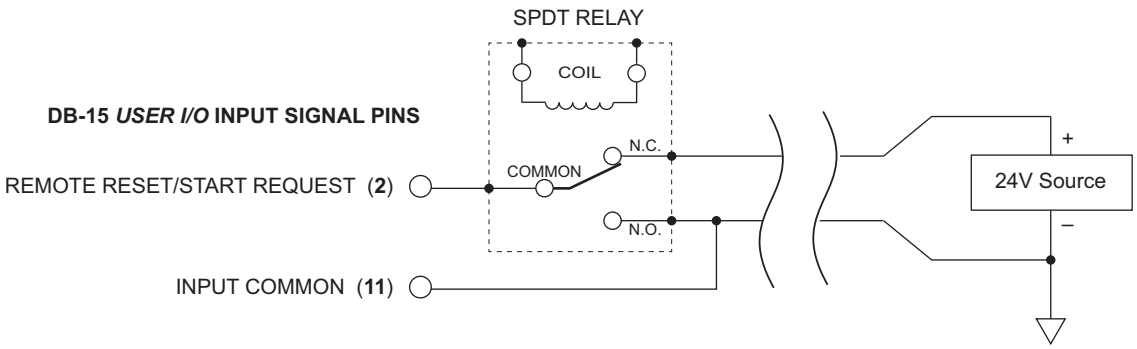
When the Single Pole, Double Throw (SPDT) relay is energized, Pin 2 (the Remote Reset/Start Request input) is switched from a high-level voltage to ground potential (O VDC) and lasing is enabled.

Figure 2a *Remote Reset/Start Request* Grounding Circuit – Laser Power Source



When the Single Pole, Single Throw (SPST) relay is energized, the high-level voltage on Pin 2 (the Remote Reset/Start Request input) is switched to ground potential (O VDC) and lasing is enabled.

Figure 2b *Remote Reset/Start Request* Grounding Circuit – Laser Power Source



When the Single Pole, Double Throw (SPDT) relay is energized, Pin 2 (the Remote Reset/ Start Request input) is switched to ground potential (O VDC) and lasing is enabled.

Figure 2c *Remote Reset/Start Request* Grounding Circuit – External Power Source

Other “best practices” for eliminating or reducing electromagnetic interference (EMI) in industrial environments include the following:

1 Run the system’s control/communication wiring away from power wiring in separate metal conduit. If the system includes both high-voltage and low-voltage control wiring, run each voltage level in separate metal conduit or properly spaced in metal cable tray.

2 When the system contains one or more variable-frequency (VFD) or adjustable-speed (ASD) drives, follow the manufacturer’s installation instructions for bonding and grounding the equipment precisely. Use separate metal conduits or VFD cables for input and output power.

3 If the VFD or ASD unit does not include an EMI filter, add an external EMI filter on the input.

4 Use both low-frequency (LF) and high-frequency (HF) grounding methodology. Verify that all equipment in the system uses the same ground reference point for both low- and high-frequency grounds.