TecDRIVE/ TecBOOSTER

V2.1

TEC driver/booster with heating and cooling capability

Manual
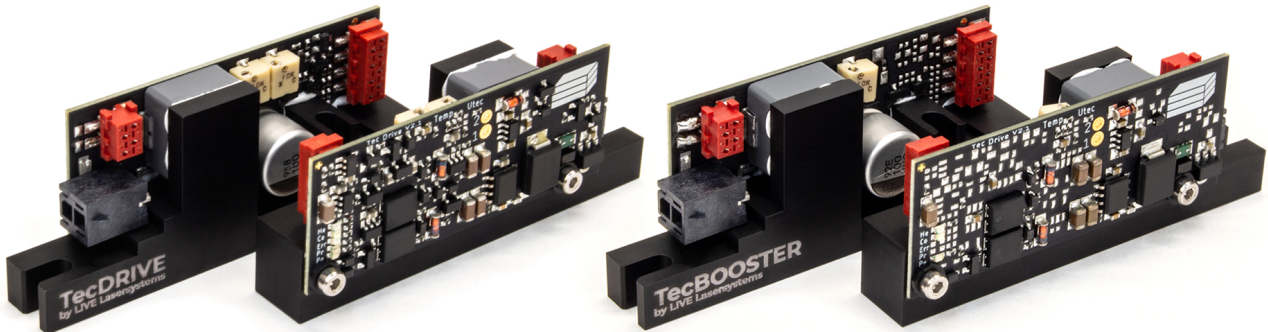
Written by Stephan Schwarz me

Features

- Easy to integrate
- Up to 50V operating voltage
- Standard NTC 10k compatible
- 5-50V @ 5A drive capability per driver
- Temp OK output at excessive and subnormal temperatures
- NTC short/open detection
- ColorBUS compatible
- Heating and cooling capability
- TecBOOSTER compatible (240W / 48V @ 5A per booster)
- High efficiency

Applications

- Laser Show Display Systems
- Industrial Positioning Systems
- DNA Sequencing
- Optogenetics
- And more ...

Description

TecDRIVEs are designed to be efficient and versatile.
The drivers offer a high operation voltage, stable regulation in a small and easy to integrate form factor.
The 240W maximum output power of TecDRIVEs can be extended to up to 1200W with the use of the TecBOOSTER technology.
TecBOOSTERs enable to drive up to 48V @ 25A TECs with minimal cost and maximum efficiency.
A temperature good output (power reduction) enables an easy integration of the driver in any system. It offers the possibility to check if the TEC driver has reached the desired temperature e.g., if everything is working as it should. The driver also features a NTC sensor error detection.
Both drivers are fully compatible with the ColorBUS system.
ColorBUS makes it possible to connect everything in a tidy way and furthermore uses the power reduction (PR) output (temp ok) to command a reduced drive current from our ColorDRIVEs to protect the laser diodes if a TEC should fail.
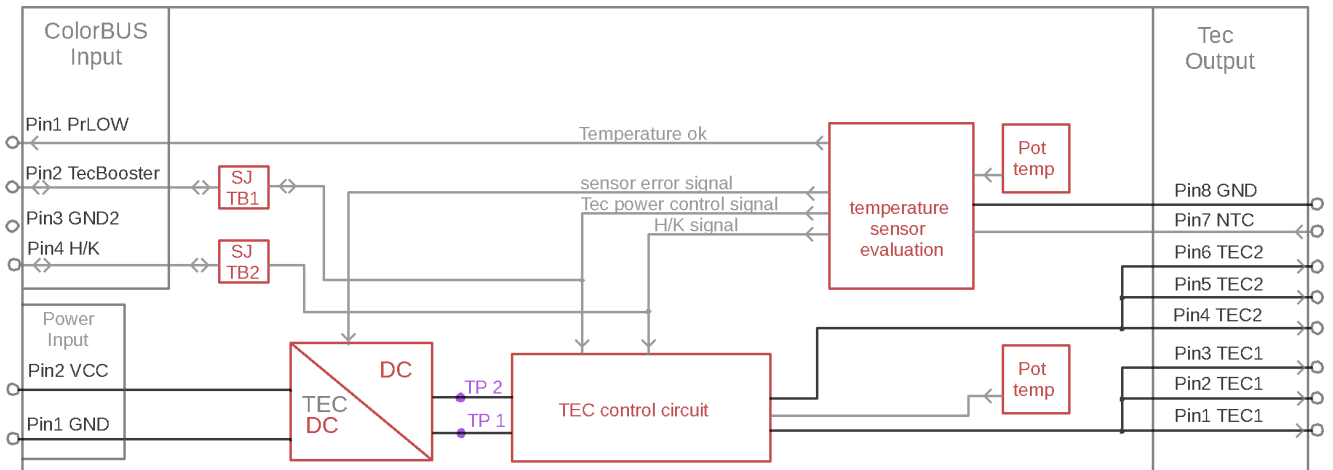
Information

Every driver is designed and manufactured in Austria to meet our high standards at LIVE Lasersystems.
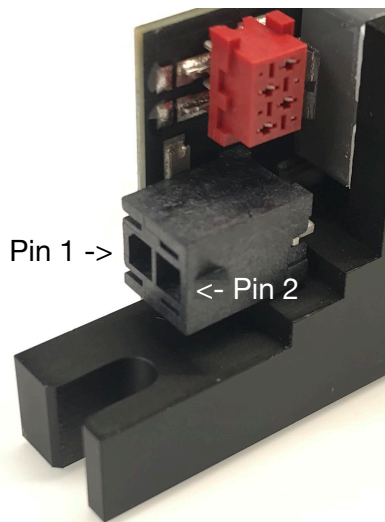Drivers are shipped ready to use.
TecDRIVE/BOOSTER comes with all needed connectors.
For more information, please contact LIVE Lasersystems.

Functional block diagram

Power input connector

Pin 1 ->

<- Pin 2

Pin		I/O	Description
No.	Name		
1	GND	I	Negative supply voltage
2	VCC	I	Positiv supply voltage

Power input considerations

The power supply input connector uses WR-MPC connectors. TecDRIVE ships with all needed connector housings and crimp contacts. Make sure to use the right tool to crimp the contacts. We also offer pre-crimped cabling. Contact us for more information. You need to use low impedance connections, e.g., use short wires that can withstand the current your application requires. The driver has limited reverse polarity and surge protection. The voltage surge protection is useful against transients only, please make sure to use power supplies of good quality from reputable brands only. You can also contact LIVE Lasersystems for advice on choosing the right power supply for your application.

Input Configuration and Functions

Colorbus In
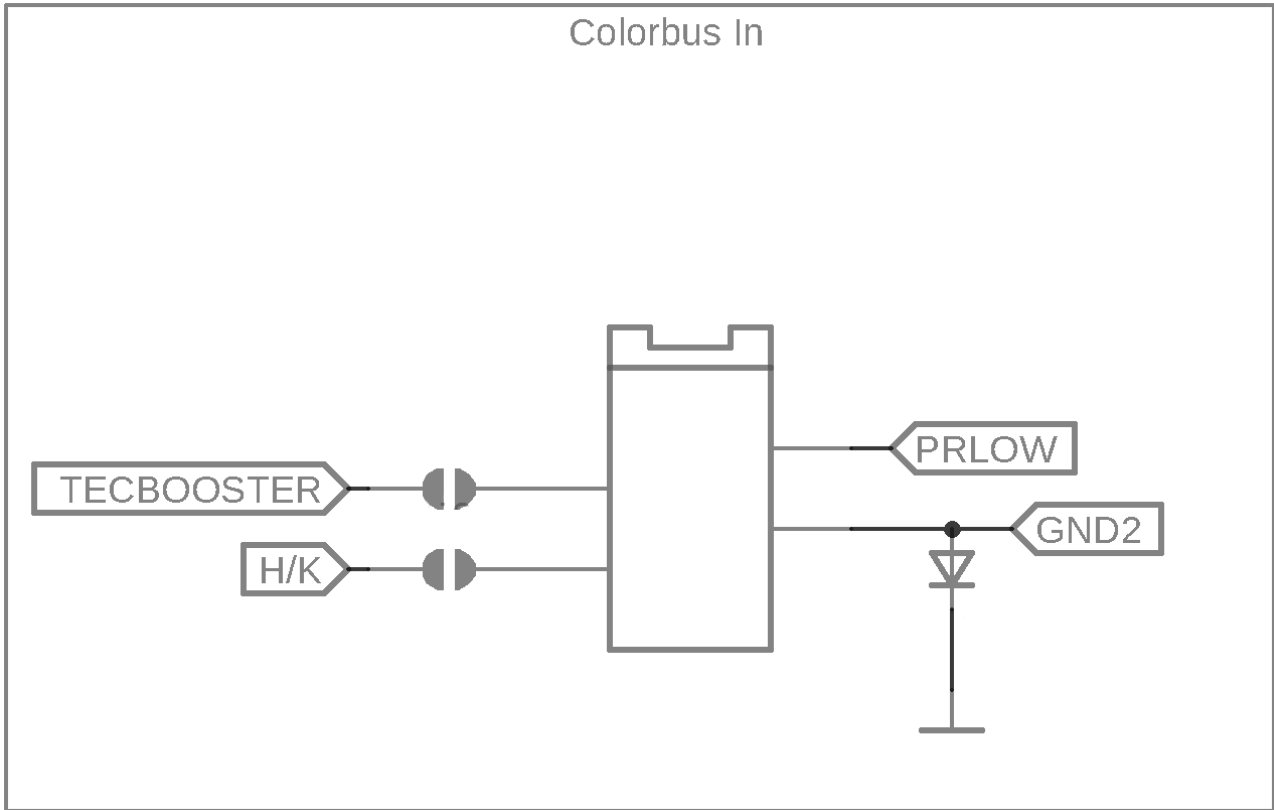
Pin Configuration and Function

Pin		I/O	Description
No.	Name		
1	PRLOW	I/O	Power reduction pin, if the driver detects a temperature problem with the module this pin gets internally connected to RETURN.
2	TECBOOSTER	O	Output pin for TecBOOSTERs, control power needed to reach set temperature, -5V if 100% power needed, 5V if 0% power is needed
3	GND2	-	Return pin for all control signals
4	H/K	O	Output pin for TecBOOSTERs high if driver is in cooling mode, low if driver is in heating mode.

Jumpers: Please consider that the jumpers are preconfigured to match the application e.g. a TecBOOSTER will always ship with jumpers preconfigured.
No need for any change, but of course possible if desired.

Pin Configuration and Function
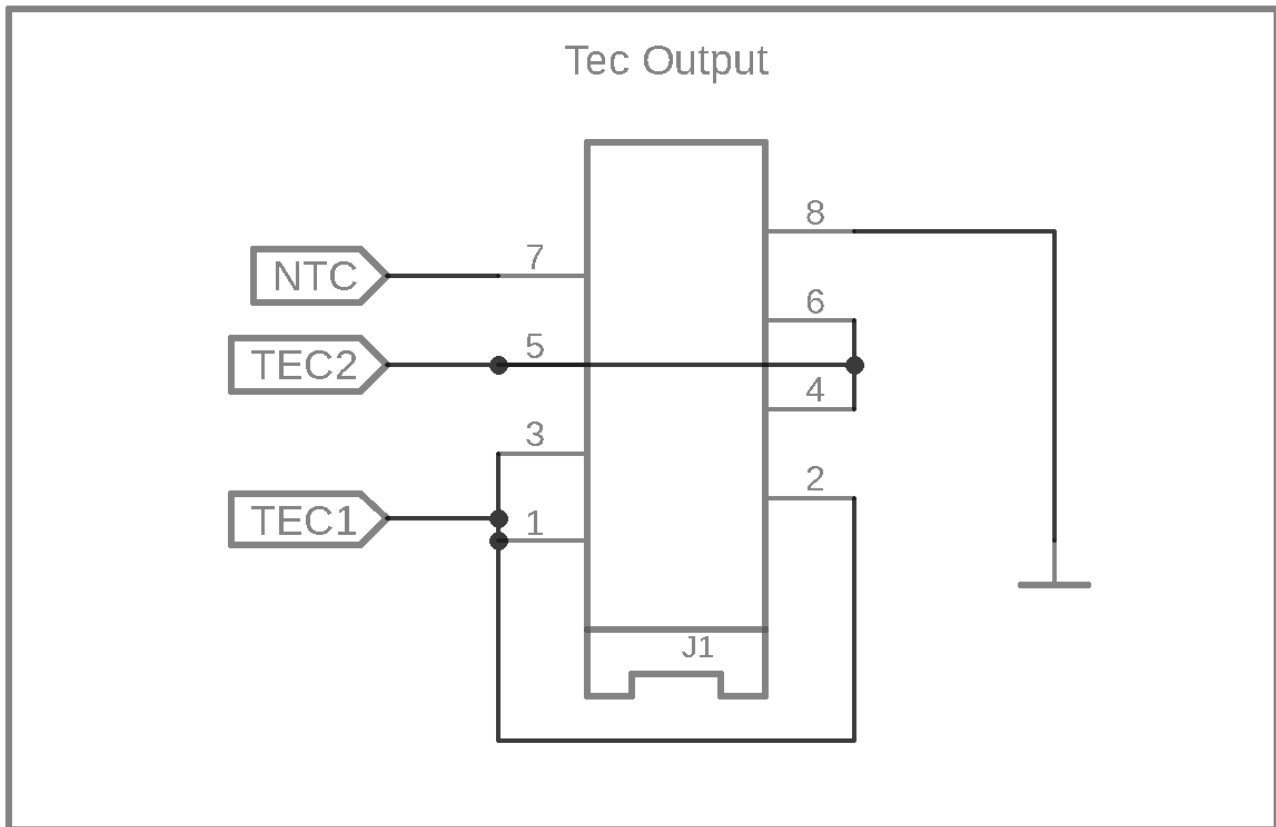
Connectors: WR-MM 8Pin Art.Nr.: 690157000872

Pin				
No. No. MM		Name	I/O	Description
1		TEC1	O	Output pin for TEC, if driver is in cooling mode this becomes positive
2		TEC1	O	Output pin for TEC, if driver is in cooling mode this becomes positive
3		TEC1	O	Output pin for TEC, if driver is in cooling mode this becomes positive
4		TEC2	O	Output pin for TEC, if driver is in cooling mode this becomes negative
5		TEC2	O	Output pin for TEC, if driver is in cooling mode this becomes negative
6		TEC2	O	Output pin for TEC, if driver is in cooling mode this becomes negative
7		NTC	I	Temperature sense pin Connect one lead from NTC to this pin, do not connect anything else
8		GND	O	GND pin, connect one lead from the NTC to this pin, do not connect anything else

Potentiometer/Measurement Points Configuration and Function
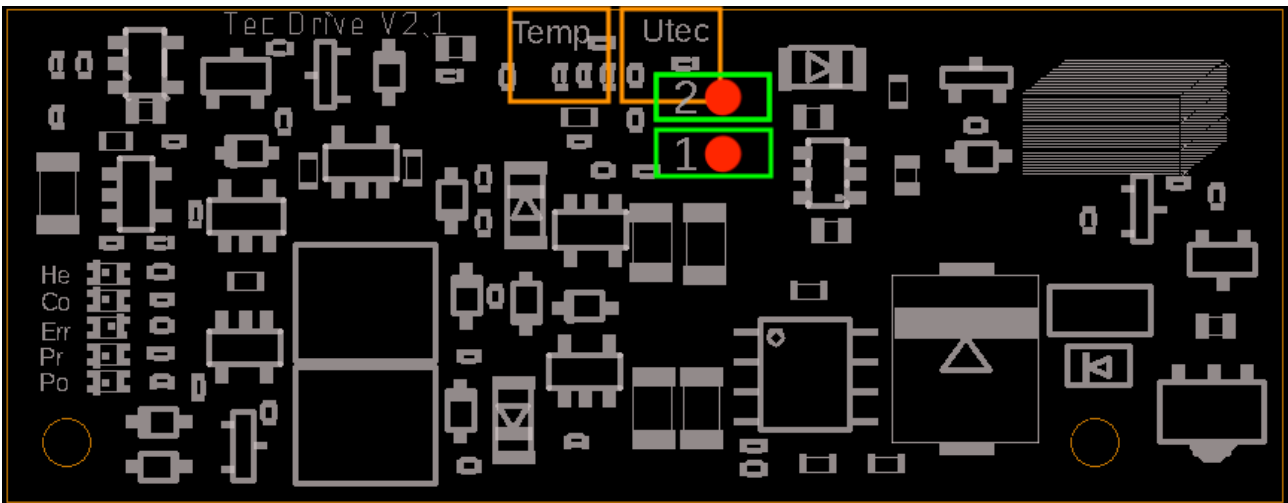
Potentiometer considerations

Each potentiometer increases the value CCW and decreases the value CW.
Please be careful with your adjustment tool. The potentiometers can break away easily from the PCB excessive force is used!

Potentiometer		Min	Max	Unit
UTEC	Voltage for TEC	5	50	V
TEMP	Set temperature	-15	+30	°C

Probe Points

The probe points are labeled on the PCB. Use a volt-meter for all measurements. Make sure the meter has a high input impedance. Otherwise, the measurements will be inaccurate. Every probe point is protected against short circuits.

Measurement Point		Min	Max	Unit
0	GND	0	0	V
1	TEC voltage	0	50	V

Difference between TecDRIVE and TecBOOSTER

The TecDRIVE and the TecBOOSTER feature the same PCB but use different components and are designed for different applications.

TecDRIVE

Our TecDRIVE is a stand-alone continuous regulation driver e.g. it regulates the power going in to the Peltier element not only by switching it on and off but also by reducing the drive power to a level that is needed to keep the set temperature. To do this, TecDRIVE reads a 10k NTC, determines the difference between set temperature and actual temperature and regulates the output accordingly. It also acts as a master for TecBOOSTERs. To act as a master the solder jumpers need to be set. TecDRIVE is also DVT compatible, so it can be connected to the ColorBUS even if it uses a different power supply or the negative supply rail. All ColorBUS connected laser drivers receive the temperature good signal and adjust their output current accordingly.

TecBOOSTER

The TecBOOSTER is a slave for any TecDRIVE and ColorDRIVE only.
It only boosts the output power of one master driver. To do this it needs to be connected to a TecDRIVE or a ColorDRIVE with integrated TecDRIVE. It can not be used as a stand-alone device.
Therefore it needs to receive control information from another TecDRIVE/ColorDRIVE
This is possible through the ColorBUS.
To use a TecBOOSTER the master TecDRIVE/ColorDRIVE needs to have the solder jumpers set.
TecBOOSTER is not DVT compatible, so it needs to share the same ground as its master driver to function correctly.
You can use up to 4 TecBOOSTERs to extend the output power of one master.
The TEC outputs of master and slave have to be isolated. You can not connect them in parallel to drive TECs with more than 5A current demand. But you can use more TECs to drive the same thermal load.
The outputs of slave drivers do not need to have the same or same number of TECs connected, the output power of each slave/master can be adjusted individually.
If you need more than one master driver on a ColorBUS you can break the H/K and TecBOOSTER lines between master drivers to separate the different thermal loads.

ColorBUS connection example

First example:
One ColorDRIVE and one TecBOOSTER are driving thermal load 1.
One TecDRIVE and one TecBOOSTER are driving thermal load 2.
ColorDRIVE will react to over/under temperature of both thermal loads and reduce drive current.
Two different set temperatures for the different thermal loads can be set.
Drivers for the second thermal load do not need to be powered by the same supply rail as the drivers for the first load. E.g., thermal load one drivers can be powered from +-24V while thermal load two drivers are power by -24v only.

Second example:
ColorDRIVE as master with 2 TecBOOSTERs as a slave, driving 6 TECs with the TecBOOSTERs and driving 3 TECs with the ColorDRIVE. So 9 TECs in total driving the same thermal load.

Example 2

TecBooster1

Input — Output

1 PRLOW	TEC1	1/2/3	+ TEC + TEC + TEC −
2 TECBOOSTER			
3 GND2	TEC2	4/5/6	
4 H/K			

Power Supply: 2 +24V, 1 −24V

PRLOW 9
TECBOOSTER 10
GND2 11
H/K 12

to ColorDrive

+24V
−24V

TecBooster2

Input — Output

1 PRLOW	TEC1	1/2/3	+ TEC + TEC + TEC −
2 TECBOOSTER			
3 GND2	TEC2	4/5/6	
4 H/K			

Power Supply: 2 +24V, 1 −24V

Supply 1 / Supply 2
+24V
GND
−24V

Example 1

TecBooster (Thermal Load 1)

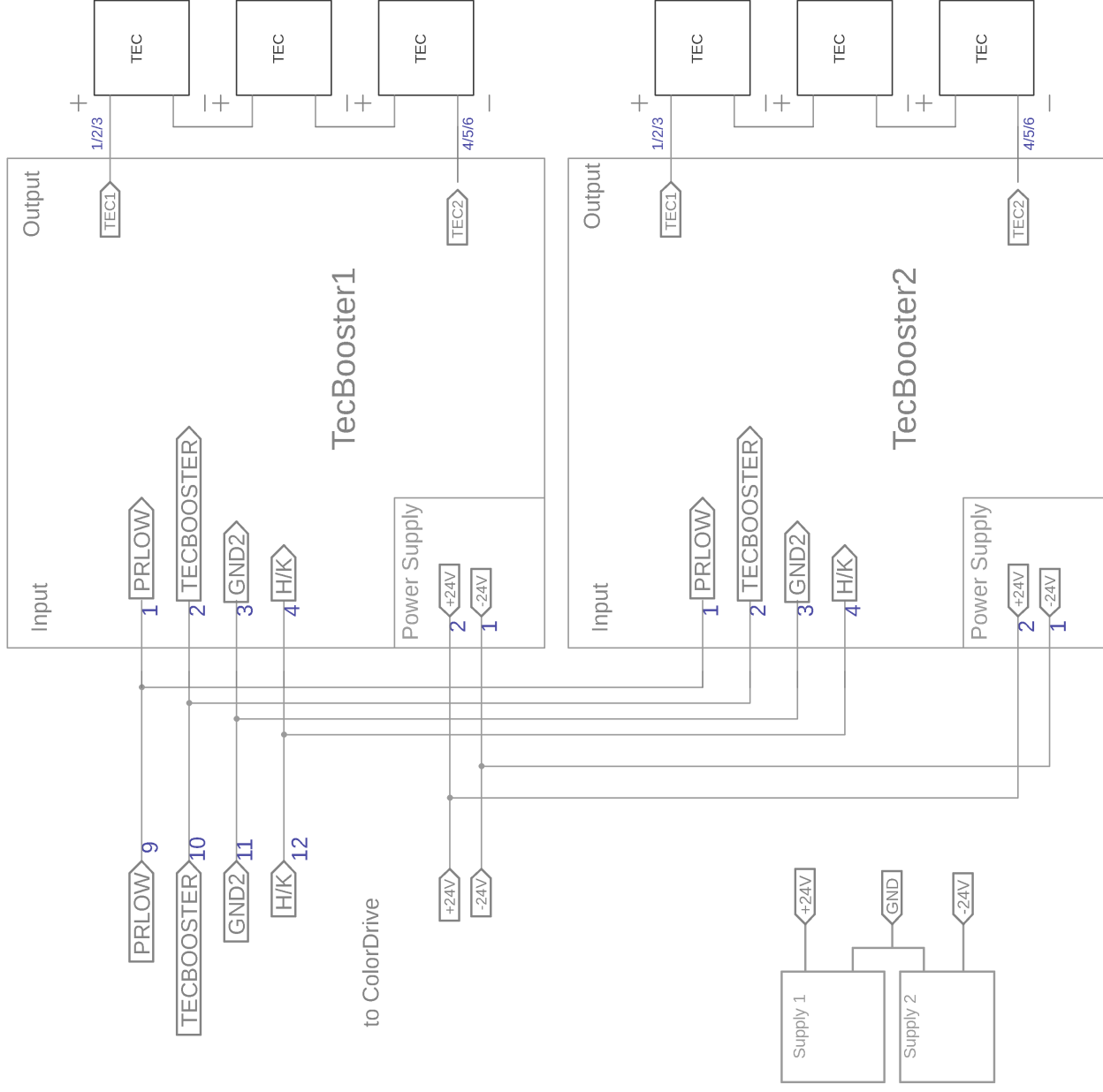Input — Output

1 PRLOW	TEC1	1/2/3	+ TEC + TEC + TEC
2 TECBOOSTER			
3 GND2	TEC2	4/5/6	
4 H/K			

Power Supply: 2 +24V, 1 −24V

PRLOW 9
TECBOOSTER 10
GND2 11
H/K 12

to ColorDRIVE (Thermal Load 1)

+24V
−24V

<- Disconnected ColorBUS to have different master drivers for different thermal loads

TecDRIVE (Thermal Load 2)

Input — Output

1 PRLOW	TEC1	1/2/3	+ TEC + TEC + TEC
2 TECBOOSTER			
3 GND2	TEC2	4/5/6	
4 H/K			

Power Supply: 2 GND, 1 −24V

TecBOOSTER (Thermal Load 2)

Input — Output

1 PRLOW	TEC1	1/2/3	+ TEC + TEC −
2 TECBOOSTER			
3 GND2	TEC2	4/5/6	
4 H/K			

Power Supply: 2 GND, 1 −24V

Supply 1 / Supply 2
+24V
GND
−24V

Specifications

Absolute Maximum Ratings (1)		Min	Max	Unit
Input Voltage	Power input connector	-0.3	50	V
Output Voltage	ColorBUS connector 1-3	-5	5	V
	NTC	-	1.25	
	TEC	3	50	V
	Output ripple @ 48Vin 15Vout 5Aout BW20Mhz		45	mV
Source current	NTC	120	130	µA
Sink current	PRLOW	5	5	mA
Storage temperature		-40	+80	°C
Driver temperature	Measured at heatsink	-50	+75	°C

(1) Stress beyond the listed ratings may cause permanent damage to the driver.

Adjusting for your application

If you want to tune a TecDRIVE to your connected Peltier element, first turn the UTec pot fully CW to reduce the TEC voltage to the minimum. After that you can connect your Peltier element and NTC.
Supply power to your driver and turn the temp pot CW until the temperature LED lights up.
The driver should now supply maximum current to the connected Peltier element to reach the set temperature. You can measure the voltage using the measurement points and turn the UTEC pot CCW to increase it to the desired drive voltage.
Next you need to set the temperature via the temp pot to a level that suits your application.

If you want to tune a TecBOOSTER, almost the same procedure applies.
First turn the UTec pot on the TecBOOSTER fully CW to reduce the TEC voltage to the minimum. Now connect your Peltier element and NTC.
Supply power to slave and master driver and turn the temp pot at the master CW until the temperature LED lights up.
The driver should now supply maximum current to the connected Peltier element to reach the set temperature. You can measure the voltage using the measurement points at the slave driver and turn the UTEC pot at the BOOSTER CCW to increase it to your desired drive voltage.
Next you need to set the temperature via the temp pot to a level that suits your application.

Status LEDs

The drivers have built-in status LEDs to let the user know their status.
The driver has 5 LEDs that are labeled accordingly. The table below shows the associated function.

LED label	Color	Status if lit	Status if off	Solution
pwg (power good)	green	Driver is enabled and working correctly	driver faulty	Contact LIVE Lasersystems.
			Input voltage to low	Use correct voltage specified on measurement report.
Pr (power reduction)	yellow	Module temperature not correct	Module temperature regulated correctly	Make sure the heatsink temperature is held within the absolute maximums and wait until module has reached operating temperature.
Err (Error)	red	NTC/cabling defective	NTC working properly	Please check 10k NTC and check cabeling for short / open.
Co (cooling)	blue	Driver is cooling the module	The LED shows the required power to keep the module at its operating temperature	-
He (heating)	red	Driver is heating the module		
Both He and Co	-	Pulsating: driver to hot or output current to high. Also: Output voltage higher than input Voltage.	Pulsating: driver too hot or output current too high. Also: Output voltage higher than input voltage.	Mount the driver to a bigger heatsink. Adjust Utec to a lower level to reduce the drive current and voltage.

Technical drawings