# PXI-4130 Features

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# Contents

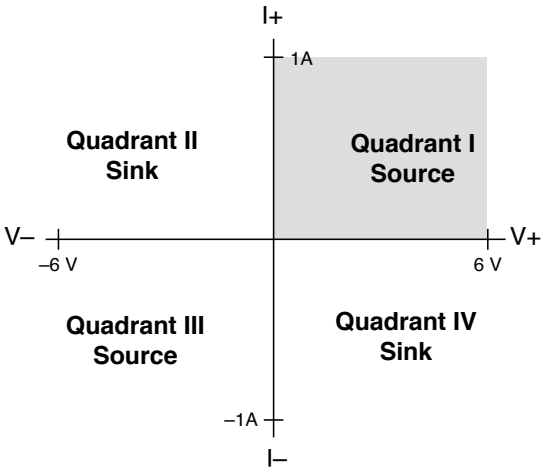
# PXI-4130

±20 V, 40 W PXI Source Measure Unit

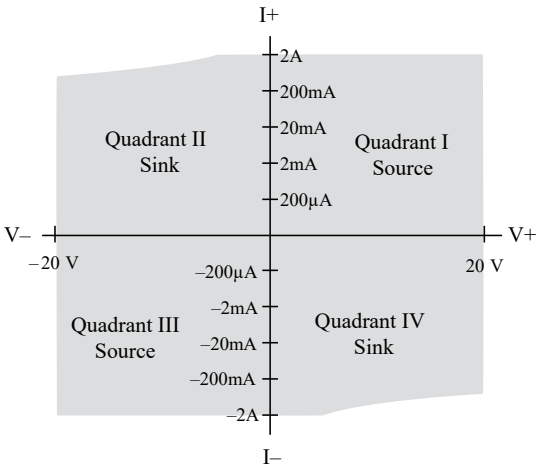
- ±20 V, ±2 A isolated single SMU channel
- Additional ±6 V, ±1 A utility channel
- 1 nA current sensitivity
- Current ranges: 200 µA, 2 mA, 20 mA, 200 mA, 2 A
- 3 kS/s maximum sampling rate and 3 kS/s maximum update rate

## Quadrant Diagram

PXI-4130




Channel 0: 6W in Quadrant I




Channel 1: 40W in Quadrants I and III,
10W in Quadrants II and IV



# PXI-4130 Pinout

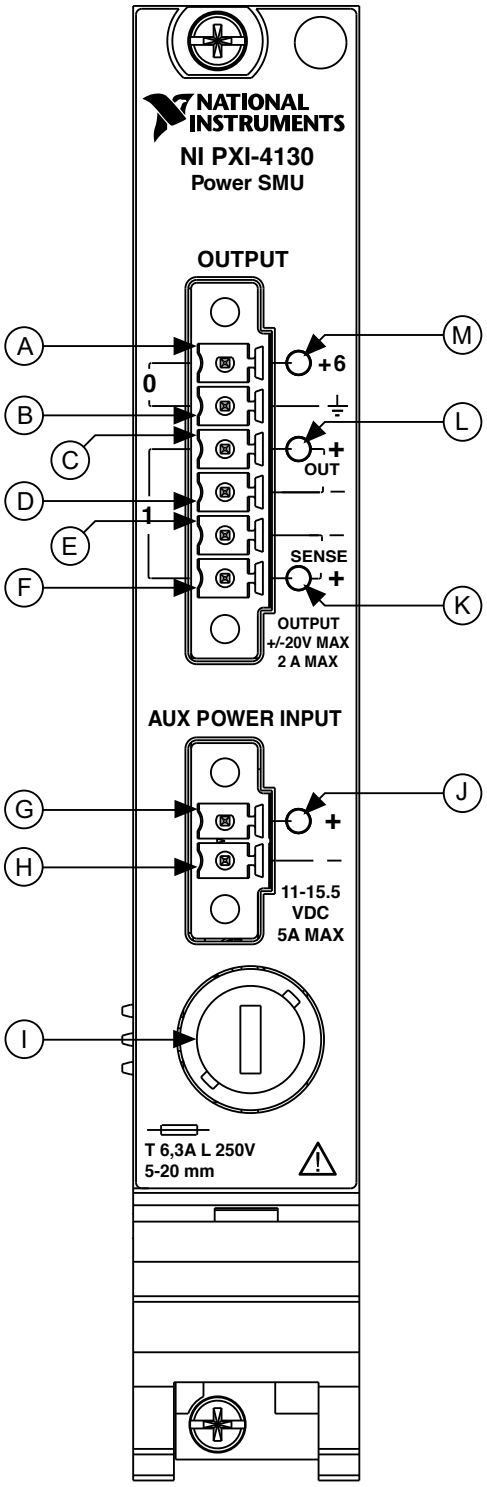



**Table 1.** Signal Descriptions

| Item | Signal | Description |
|---|---|---|
| A | Output Connector, Terminal 0 | Channel 0 (0 to +6 V) |

| Item | Signal | Description |
|---|---|---|
| B | Output Connector, Terminal 1 | GND |
| C | Output Connector, Terminal 2 | Channel 1 Output HI (±20 V) |
| D | Output Connector, Terminal 3 | Channel 1 Output LO |
| E | Output Connector, Terminal 4 | Channel 1 Remote Sense - |
| F | Output Connector, Terminal 5 | Channel 1 Remote Sense + |
| G | Auxiliary Power Input Connector, Terminal 0 | Auxiliary Power Input (+11 V to 15.5 V) |
| H | Auxiliary Power Input Connector, Terminal 1 | GND |
| I | Auxiliary Fuse Holder | — |
| J | Auxiliary Input Status Indicator | LED |
| K | Channel 1 Sense Status Indicator | LED |
| L | Channel 1 Output Status Indicator | LED |
| M | Channel 0 Output Status Indicator | LED |

**Table 2.** LED Channel Status Indicator

| Status Indicator | Channel Output State |
|---|---|
| (Off) | Disabled |
| Green | Enabled (Constant voltage mode) |
| Amber | Enabled (Constant current mode) |
| Red | Disabled because of error, such as an overtemperature condition |

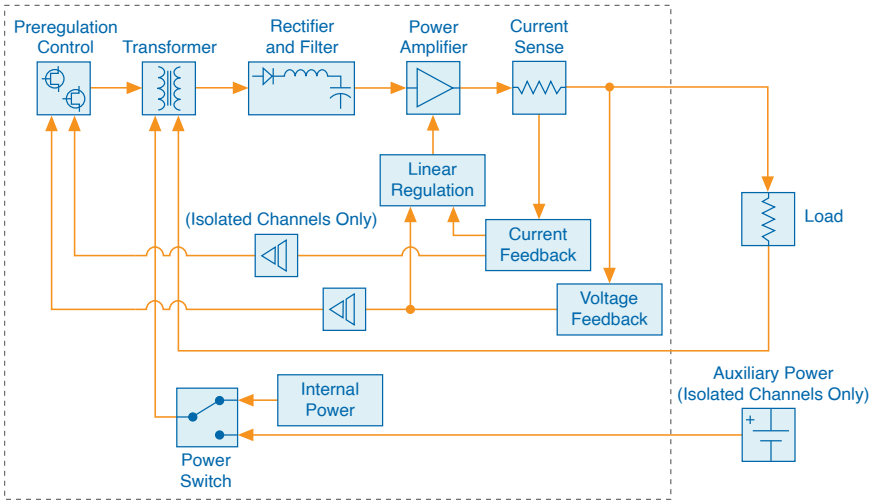
**Table 3.** LED Sense Status Indicator

| Status Indicator | Channel Sense State |
|---|---|
| (Off) | Local Sense enabled |
| Green | Remote Sense enabled |

**Table 4.** LED Auxiliary Input Status Indicator

| Status Indicator | Auxiliary Power Input State |
|---|---|
| (Off) | Auxiliary power input disconnected or out of range |
| Green[1] | Auxiliary power input connected and within range |

# PXI-4130 Block Diagram




# PXI-4130 Theory of Operation

The block diagram represents a single output channel on the PXI-4130.

Each output channel on the PXI-4130 has a preregulation switching stage and a linear regulation stage. To improve efficiency and to reduce heat dissipation on the power supply, the preregulation stage controls the voltage level across the control element in the linear regulation stage.

The voltage and current control loops work together through the linear regulation stage to provide the constant voltage mode and constant current mode. In constant current mode, the PXI-4130 acts as a precision current source. Thus, the current through the load is held constant at the programmed value, regardless of voltage,

unless the current limit is reached.

The isolated output (channel 1) on the PXI-4130 can operate from the PXI chassis power (internal power) or from an auxiliary DC power supply. When operating from internal power, the isolated output channels are restricted to lower power levels. When operating from an auxiliary power source, the isolated output channel can increase the current to 2 A, delivering a maximum of 40 W.

# PXI-4130 Ranges

**Note** If a range other than what is listed in the preceding table is selected, the range is coerced to the next-highest range. For example, requesting the 100 mA current limit range on channel 1 on the PXI-4130 coerces the current level range to 200 mA.

## PXI-4130 Voltage Ranges

For voltage output, the PXI-4130 uses the following ranges.

**Table 5.** PXI-4130 Voltage Levels

| Channel | Voltage Level Range | Voltage Level |
|---|---|---|
| 0 | 6 V | 0 V to +6 V |
| 1 | 6 V | -6 V to +6 V |
| | 20 V | -20 V to +20 V |

**Table 6.** PXI-4130 Current Limits

| Channel | Current Limit Range | Current Limit |
|---|---|---|
| 0 | 1 A | +0.02 A to +1 A |
| 1 | 200 µA | +4 µA to +200 µA |
| | 2 mA | +0.04 mA to +2 mA |
| | 20 mA | +0.40 mA to +20 mA |
| | 200 mA | +4 mA to +200 mA |

| Channel | Current Limit Range | Current Limit |
|---|---|---|
| | 2 A | +0.04 A to +2 A |

## PXI-4130 Current Ranges

For current output, the PXI-4130 uses the following ranges.

**Table 7.** PXI-4130 Current Levels

| Channel | Current Level Range | Current Level |
|---|---|---|
| 0 | 1 A | +0.02 A to +1 A |
| 1 | 200 µA | +4 µA to +200 µA and -4 µA to -200 µA |
| | 2 mA | +0.04 mA to +2 mA and -0.04 mA to -2 mA |
| | 20 mA | +0.40 mA to +20 mA and -0.40 mA to -20 mA |
| | 200 mA | +4 mA to +200 mA and -4 mA to -200 mA |
| | 2 A | +0.04 A to +2 A and -0.04 A to -2 A |

**Table 8.** PXI-4130 Voltage Limits

| Channel | Voltage Limit Range | Voltage Limit |
|---|---|---|
| 0 | 6 V | 0 V to +6 V |
| 1 | 6 V | 0 V to +6 V |
| | 20 V | 0 V to +20 V |

## PXI-4130 Overranging Capability

Enabling overranging for a particular channel of this instrument extends current and voltage output capabilities from 100% to 105% and current capabilities down from 2% to 1% for the output range.

Overranging is applicable to output ranges only and does not apply to measurement ranges. Measurements in any given range may be made up to 105% of the range by default without enabling overranging.

## PXI-4130 Overranging and Auxiliary Power

An auxiliary power supply providing at least 12 V at the input terminals, such as the APS-4100 included in the instrument kit, is required to enable overranging for channel 1.

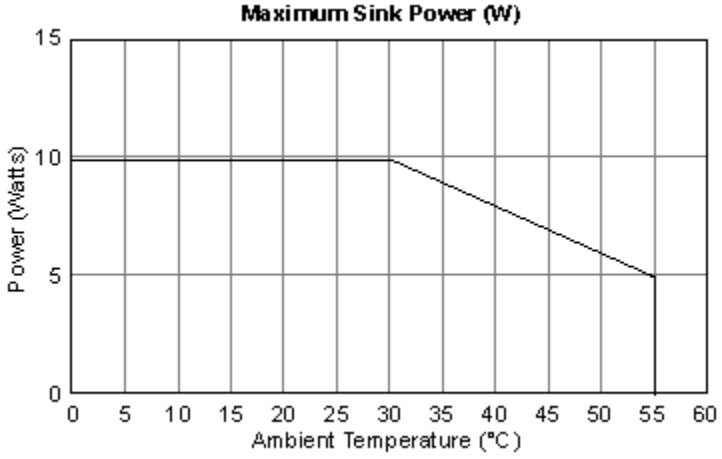
# PXI-4130 Thermal Limitations for Narrow Current Pulses

When generating currents >500 mA for durations <10 ms on channel 1, power dissipation on the PXI-4130 increases drastically. You can manage this additional power, which may overheat components of the PXI-4130, engage the thermal protection, and force a shutdown of the channel.

**Note** The PXI-4130 does not support programmatic pulsing via one of the pulse output functions of the NI-DCPower API. These limitations apply to generating current in Single Point source mode to replicate the functionality of generating timed pulses.

When sinking power pulses, the limiting parameter is the average power being dissipated by the channel. The maximum average power dissipation allowed is 10 W for ambient temperatures less than 30 °C. For higher ambient temperatures, the maximum average power must be derated by a factor of 0.2 W per degree Celsius.

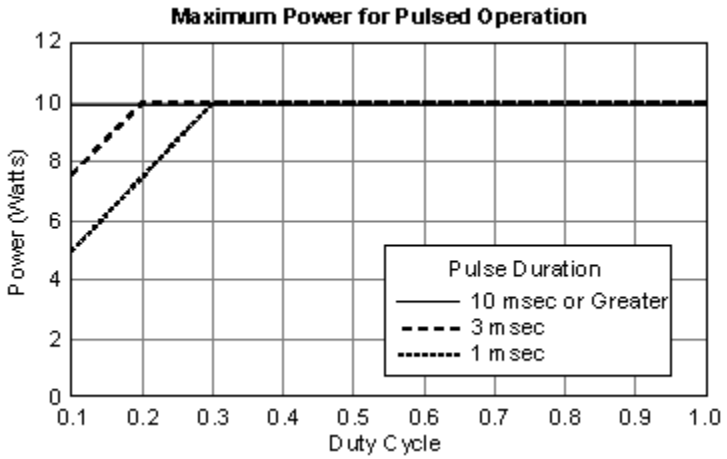
**Figure 1.** PXI-4130 Maximum Sink Power (W) Derating, Channel 1



**Notice** Exceeding the recommended maximum power sinking limits may result in undesired interruption of the PXI-4130 operation and excessive stress to the components that could result in damage to the instrument.

Figure 2 shows the conditions under which the channel 1 of the PXI-4130 can operate without interruption.

**Figure 2.** PXI-4130 Maximum Power for Pulsed Operation




**Note**

- This graph is only valid up to an ambient temperature of 30 °C. For higher ambient temperatures, derate according to the instrument specifications.
- For pulses longer than one second, the operation is considered to be continuous and the peak power should be limited instead of average power.

**Hot Surface** Do not touch the outer shield of the PXI-4130, as it may become very hot during an overtemperature condition.

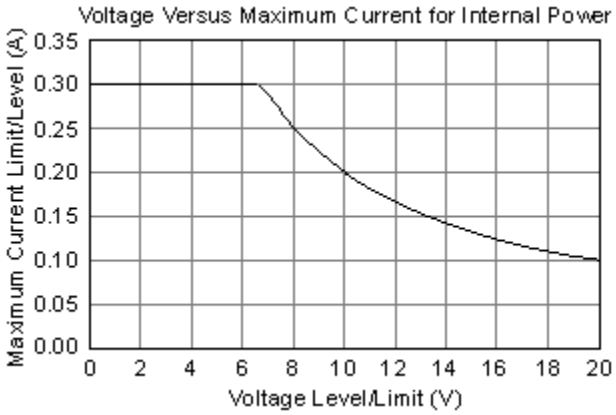
## PXI-4130 Internal and Auxiliary Power

The PXI-4130 can generate limited power on backplane power but requires the use of

an auxiliary power supply to generate up to its full current capability.

When drawing internal power from the PXI backplane, channel 1 of the PXI-4130 can source or sink up to 2 W of output power at ≤300 mA. Figure 1 shows the maximum capabilities of channel 1 when operating under internal power.

**Figure 3.** Voltage Versus Maximum Current for Internal Power




**Note** Channel 0 has the same output capabilities under internal power and auxiliary power.

If your application requires additional current on this channel, up to a maximum of 2 A, you must connect an auxiliary DC power supply that meets the following requirements:

- **Auxiliary power supply voltage**— 11 V to 15.5 V
- **Auxiliary power supply wattage**— ≥60 W

NI offers the APS-4100 auxiliary power source for this instrument. The power supply is included in the instrument kit.

## PXI-4130 Power Measurement Delay

For the PXI-4130, current and voltage measurements are not synchronized. As a result, you can expect an increase in execution time for PXI-4130 programs that compute power measurements.

Up to 250 µs may elaspse between the two measurements as returned by the Measure

Multiple function.

## PXI-4130 Unique Behavior for Disabling Output

This instrument has unique behavior around disabling the output.

Channels of this instrument power on as disabled. Channels of most other NI-DCPower instruments power on as enabled.

## Source Instability: Reactive Loads in Constant Current Mode

This instrument may experience instability with inductive loads in certain circumstances in constant current mode.

When operating in constant current mode, especially in higher current ranges, some inductive loads may cause instability.

Instability manifests as oscillating or unregulated behavior across the output terminals, which can result in excessive measurement noise, erratic behavior, or thermal shutdown.

If you notice abnormalities, you can attempt the following to troubleshoot:

- Verify the behavior of the channel by inspecting the voltage across the output terminals with an oscilloscope
- Use the Output Capacitance property to toggle the output capacitor

## PXI-4130 Replacing a Fuse

Channel 0 and the auxiliary power input connection on the PXI-4130 have user-replaceable fuses.

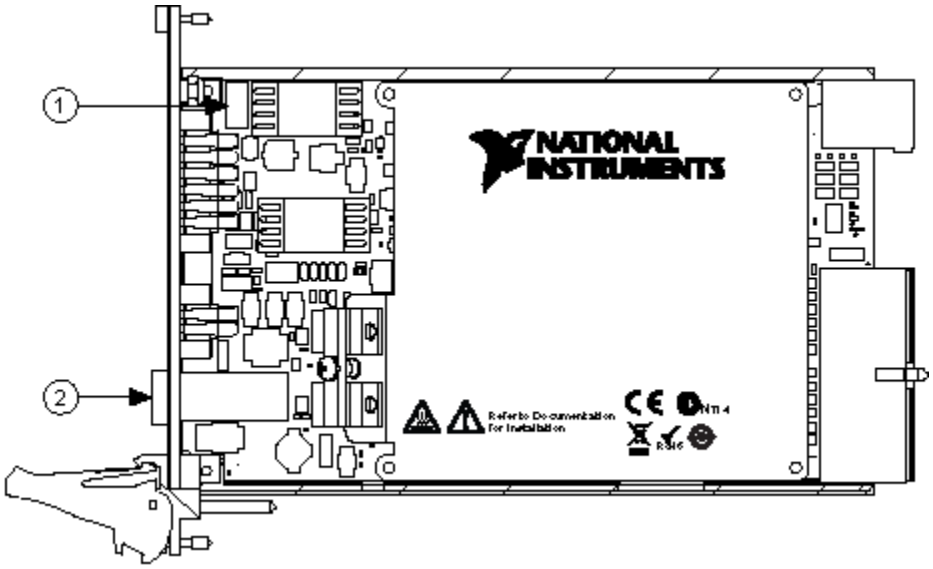
Refer to Table 1 for the recommended fuses and recommended fuses and required fuse ratings for each replaceable fuse on the PXI-4130.

**Table 9.** Supported Fuse Types

| Input/Output | Fuse Rating | Description | Recommended Manufacturer Part Number |
|---|---|---|---|
| Channel 0 (F1) | F 1.5 A 125 V | User-replaceable chip fuse | Littelfuse 045301.5 |
| Auxiliary power input | T 6.3 A L 250 V | User-replaceable<br>5 mm × 20 mm glass fuse | Littelfuse 21806.3 |

Figure 1 shows the locations of the fuses on the PXI-4130

**Figure 4.** Fuse Locations




1. CH 0 output fuse
2. Auxiliary power input fuse

To replace an output channel fuse, you need a pair of small pliers. To replace the auxiliary power input fuse, you need a flathead screwdriver.

Complete the following steps to replace a fuse on the PXI-4130.

1. Shut down the chassis.
2. Disconnect all output and auxiliary power connections.
3. Remove the instrument from the chassis.
4. Identify the fuse you need to replace using Figure 1.
5. Remove the fuse.
   - Output channel fuse: using the small pliers, gently pull the fuse to release it

from the fuse holder.
- Auxiliary power input fuse:
  a. Using the flathead screwdriver, turn the fuse holder cap counter-clockwise to release it from the front panel.
  b. Gently pull the fuse to release it from the fuse holder cap.

6. Install the replacement fuse.
   - Output channel fuse: using the small pliers, gently place the replacement fuse into the fuse holder.
   - Auxiliary power input fuse: Slide the replacement fuse into the fuse holder cap and screw the cap clockwise to lock it in the front panel.

Once you have replaced your fuse, you can reinstall the instrument in the chassis, reattach any connections to the front panel, and restart the chassis.

## PXI-4130 Combining Multiple Outputs

Channel 1 of the PXI-4130 is an isolated output and can be cascaded in series with other output channels to generate larger output voltages.

Any terminal on an isolated channel can be connected to ground.

**Caution** Do not exceed 60 V DC from any terminal to ground when cascading with multiple channel with a PXI-4130.

**Caution** The PXI-4130 does not provide isloation when using channel 0.

**Note** Auxiliary power is required for channel 1 to output greater than 2 W or 300 mA.

Channel 1 of the PXI-4130 cannot be combined in parallel with other channels to create larger output current because the channel is a four-quadrant supply; the output may begin to sink current when connected in parallel to another channel with a higher voltage.

# PXI-4130 Protection

The output channels and the auxiliary power input of the PXI-4130 are protected against overcurrent, overvoltage, inverse voltage (CH 0 only), and overtemperature conditions.

## Output Channel Protection

Both output channels on the PXI-4130 are current-limited, and channel 0 has a user-replaceable fuse. In the event of an overcurrent, overvoltage, or inverse voltage condition, this fuse may blow to protect the PXI-4130 and the load. When its fuse is blown, channel 0 can source only a few milliamperes of current regardless of the programmed current.

**Caution** Channel 0 can withstand the application of an external voltage up to 16 V. Applying an external voltage >16 V can damage the output channel.

**Caution** Channel 1 can withstand the application of an external voltage up to 50 V. Applying an external voltage >50 V can degrade or damage the output channel.

In the event of an overtemperature condition (that is, the enclosure or component temperatures exceed safe operating limits), the thermal shutdown circuits on the PXI-4130 disable the output channel that indicated the failure condition. When disabled, an output channel can be reset programmatically only after the failure condition is cleared.

## Auxiliary Input Protection

The auxiliary power input of the PXI-4130 can accept voltages from 11 V to 15.5 V. Applying a voltage below 11 V or above 15.5 V disables the auxiliary power input.

In the event of an overvoltage condition (that is, applying voltages >20 V to the auxiliary power input), ***crowbar protection*** is enabled. Crowbar protection shunts

the auxiliary power input to ground.

In the event of an overcurrent (>6.3 A) or an inverse voltage condition, the auxiliary power input fuse may blow to protect the PXI-4130 and the load. You can use the Auxiliary Power Source Available property to troubleshoot the auxiliary power input fuse.

## PXI-4130 Thermal Protections and Precautions

Both channels of the PXI-4130 are protected against excessive temperatures and shut down in the presence of excessive heat.

During normal sourcing operation on channel 1 (up to 40 W output), the thermal protection should not engage over the rated ambient temperature range of the instrument. Also, sinking power levels within the rated specifications of the instrument should not trigger the thermal protection when the instrument is within the ambient temperature range.

**Hot Surface** Do not touch the outer shield of the PXI-4130, as it may become very hot during an overtemperature condition.

Thermal protection for channel 1 may also become engaged if the output becomes unstable because of inductive loads in the highest current range. If you are operating the PXI-4130 within the rated specifications and the thermal protection is engaging, investigate whether output instability may be a factor in overtemperature operation of the instrument.

## PXI-4130 Transients During Power-Up and Power-Down

Attention must be paid to the setup and operation of your PXI-4130. Transients may appear across the terminals (typically <1 V) during power-up, power-down, and when loading the instrument driver.

To minimize the risk of damage to sensitive devices, NI recommends that you disconnect all power supplies and SMU connections while performing any of the above

operations.

In case of chassis power failure, transients may appear across the output terminals. Consider employing an uninterruptible power supply system to avoid damage to extremely sensitive devices.