PWR-TPI6020

Two-Level Three-Phase Inverter Module

Hardware Reference Manual

v1.3

speedgoat

real-time simulation and testing

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Document Version History

Version Number	Document Action	Author	Date
1.0	First version of PWR-TPI6020 Manual	RM	24 September 2019
1.1	Added information about limitation when using specific configuration with IO397 I/O module	RM	12 February 2020
1.2	Picture and connectors description update	RM	22 April 2020
1.3	Supported voltage range update	RM	21 July 2020

1   Technical Information

Description

The PWR-TPI6020 module is a modular, multiple half-bridge inverter with three phases and individual gate driver control. This module is fully compatible with Speedgoat FPGA technologies such as the IO323 or IO397 I/O modules and can easily be connected to any real-time target machine.

The module is optimized for use as a three-phase inverter. Its modular design, however, also makes it ideal as a full bridge or a high-side or low-side driver.

The PWR-TPI6020 enables you to control each single gate driver, and monitor the phase current and bus voltage of your closed-loop applications.

When used with FPGA I/O modules, the PWR-TPI6020 is ideal for closed-loop applications using MATLAB® and Simulink® with closed-loop rates up to 20 kHz and faster using HDL Coder™.

Features

Half-Bridge Drivers

- Three half-bridge phases with individual gate control

- 12 to 48 VDC nominal DC Bus voltage

- Up to 20 A continuous RMS current

- Up to 50 kHz switching frequency

Monitoring

- DC Bus voltage

- DC Bus current

- AC Phase currents

- Temperature

Protection Functionality

- Overvoltage, Overcurrent, Overtemperature, Deadband

PWR-TPI6020 block diagram

2 Handling and Operating Instructions

2.1. ESD Protection

	The module is sensitive to static electricity. Appropriate care must be taken when packing, unpacking and handling the module.

2.2. Hot Surface

	The surface of the module may become hot and can cause burns. Allow the module to cool before handling.

2.3. Electrical Shock

	Certain parts of the module may carry hazardous voltages (for example, power supplies, busbars, and so on). Disregarding this warning may lead to severe injury or cause serious damage. This module must be used in electric/electronic equipment in accordance with applicable standards and safety requirements and in compliance with the operating instructions.

3 Absolute Maximum Ratings

Parameter	Typical	Units
Minimum DC bus voltage[a]	10	V
Maximum DC bus voltage	80	V
Maximum DC bus ripple current (at 100 Hz)[b]	10	A
Maximum continuous drain current	20	A
Maximum continuous sum of diodes current[c]	12	A
Maximum input voltage on digital input lines	4.0	V
Minimum input voltage on digital input lines	-0.5	V
Maximum analog output current	±10	mA
Maximum digital output current	±8	mA
Minimum deadband (without signal alteration)[d]	1	us

[a] Minimum voltage to ensure the control power supply
[b] The maximum ripple current is defined by the equivalent series resistance (ESR) of the capacitors and relates to Joule losses and capacitor lifetime. All single-phase inverter applications (for example, using two-phase legs and generating a 50 Hz sine wave) must be limited to this value in order not to affect the capacitor lifetime.
[c] Higher losses are generated by the current flowing into the diodes rather than in the MOSFETs when complementary switches in a phase are not used (for example, applications as high-side or low-side drive). Higher losses reduce the performance of the system and may lead to a thermal protection being triggered.
[d] Below this value, internal logic enforces a 1 us deadtime.

4   Technical Specifications

Physical	
Dimensions	170 x 85 mm
Connectors	2-pin male ELCON MINI header for DC Bus voltage
	3-pin male ELCON MINI header for AC outputs
	26-pin female HDR connectors for analog measurements
	26-pin male HDR connectors for digital control
Weight	760 gr.
Environmental	
Operating temperature	5 °C to +50 °C[a]
Relative humidity	5 to 95 %, non-condensing
Electrical Characteristics – Power side	
Type	Two-Level Three-Phase Inverter
DC bus input voltage	12 to 48 VDC
DC bus continuous current	30 A
Phase continuous output current	Up to 20 Arms
Switching frequency	Up to 50 kHz
Power switches	N-channel MOSFET, 100 V (Infineon IPD082N10N3GATMA1)
MOSFET Rdson	< 8 mOhm (Id = 20 A)
Diode forward voltage	0.75 V (Id = 20 A)
MOSFET turn-on energy	< 40 uJ (Vdc = 48 V, I = 20 A)
MOSFET turn-off energy	< 15 uJ (Vdc = 48 V, I = 20 A)
Gate drivers	GaAsP optical isolated IGBT gate driver 3.75 kV
Electrical Characteristics – Control side	
Power supply	Self-supplied from DC bus
Electrical isolation power side to control side	1.5 kV 1 min. factory tested
High level input voltage	2.0 to 3.9 V
Low level input voltage	-0.3 to 0.8 V
Maximum high-level output voltage	2.6 V
Maximum low-level output voltage	0.4 V
Current Measurement Characteristics	
Linear measuring range	37.5 A
Sensitivity (sensor + amplifier)	66.6 mV/A
Bandwidth	120 kHz
Sensor	ACS709LLFTR-35BB-T
Total output error	± 3.5 % FS
Offset error	± 2 % FS
Propagation delay	4 us typ.

Voltage Measurement Characteristics	
Measuring range	110 V (±3.3 V voltage range)
Sensitivity (sensor + amplifier)	30 mV/V
Bandwidth	100 kHz
Sensor	ACPL-C87A-000E
Total output error	± 1.7 % FS
Offset error	± 0.6 % FS
Propagation delay	7 us typ.
Protections	
Voltage (DC Bus)	> 70 V
Current (DC Bus)	> 30 A
Current (AC output)	> 30 A
Reaction time (voltage & current)	< 5 us + sensor propagation delay
Temperature	> 70 °C (internal sensor)
Reaction time (temperature)	> 10 ms

[a] Effective environmental temperature support depends on the application, and the performance is limited by the temperature protection. Each module benefits from passive cooling. Higher temperatures may arise inside the enclosure. Active cooling can be used to increase the performance.

5   I/O Interface

The PWR-TPI6020 is mounted in a 170 x 120 mm Speedgoat power enclosure. Connection ports are available on the front and rear plates.

5.1.   Front Plate

PWR-TPI6020 front plate

The following interfaces are available on the front plate:

- 1x 2-Pin ELCON MINI connector for DC Bus supply (VDC+, VDC-)
- 1x 3-Pin ELCON MINI connector for AC phases (LEG A, LEG B, LEG C)
- 1x 6 LED indicators for Power, Gate Enabled and Protection Functionality

5.2.   Rear Plate

PWR-TPI6020 rear plate

The following connection ports are available on the rear plate:

- 2x 26-Pin HDRA connectors for digital (PWMs, Enables, Faults) and analog (Voltage, Current, Temperature) I/Os.

   Please note that Speedgoat offers different integrated solutions of the PWR-TPI6020 inverter. For solutions with direct connection to the IO397 I/O module, or the Electric Motor Control Kit, M12 connectors are used.

6 Functional Description

Electrical connectors and position
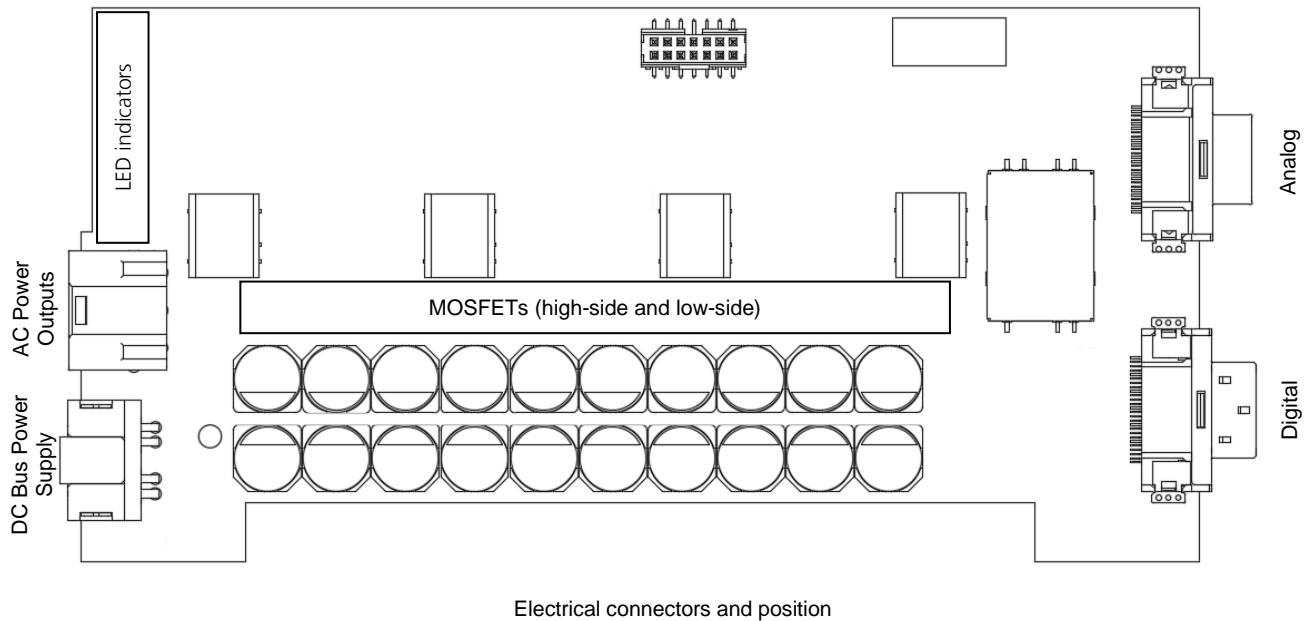
6.1. DC Bus Power Supply

Each module requires a 12 V to 48 V supply for the DC Bus. The DC Bus is used to power all three phases. The same power supply is used to provide 3.3 V and 5 V to the local circuit and gate driver logic.

The DC Bus voltage is supplied over the X1 2-Pin ELCON MINI connector. Unterminated cables or Banana type K-41 (on request) are delivered with the module.

VDC+   VDC-

DC Bus connector

6.2. AC Power Outputs

Each module features three independent two-level phase outputs with optically isolated gate drivers.

Each single phase of the module is accessible over the X2 3-Pin ELCON MINI connector. Unterminated cables or Banana type K-41 (on request) are delivered with the module.

LEG   LEG   LEG
A   B   C

AC output connector

6.3. Digital Interface

The module uses a total of 12 digital TTL I/O lines to control the three phase outputs:

- 6 gate driver control input lines (PWM), 2 signals per phase
- 2 gate enable input lines
- 1 fault reset input line*
- 3 fault output lines (voltage, current and temperature)*

* not available on all configurations with the IO397 I/O module.

6.3.1. Gate Driver Control Lines (PWMs)

Each module consists of six PWM lines controlled independently by any Speedgoat FPGA I/O module.

Each line is optically isolated over independent IGBT Gate Driver Optocouplers.

Two-level three-phase diagram
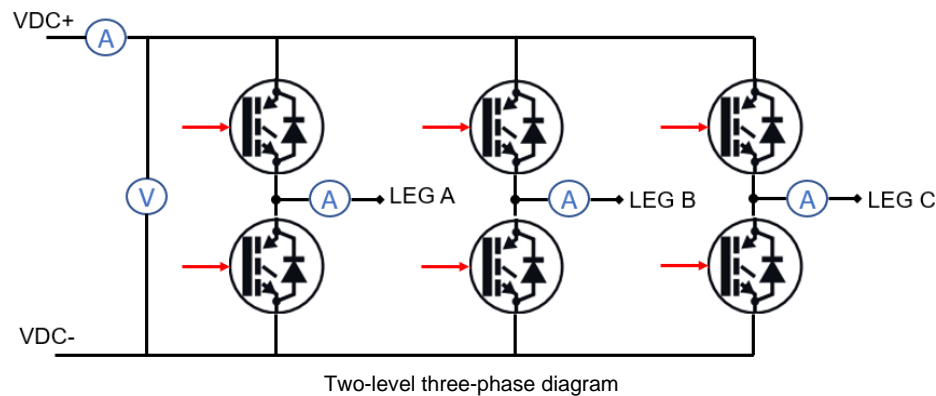
6.3.2. Enable Control Lines

Each module provides two control lines to enable or disable all the gate drivers. When the gate drivers are disabled, no signal is present at the output of the three phases.

The gate drivers are activated by writing a logic '1' to the Enable Pin (EN) and a logic '0' to the nEnable Pin (nEN). This set up of the control lines also acts as a safety mechanism to prevent unexpected behavior on the output when the model is being downloaded to the real-time target machine.

Control logic
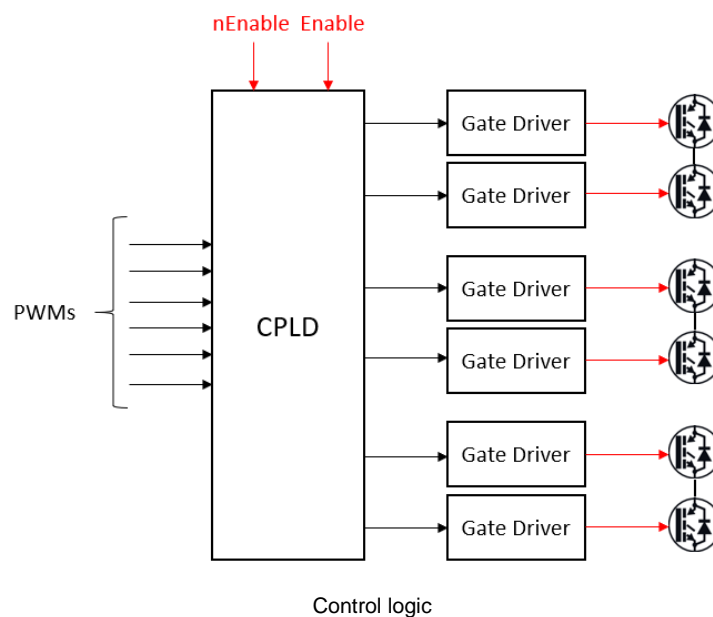
6.3.3. Fault Lines

Each module features three digital output fault lines and a fault reset input line. A fault is generated by the module in the event of:

- Overvoltage: if the voltage on the DC Bus exceeds 70 V
- Overcurrent: if the current on any phase exceeds 20 A or if the current on the DC bus exceeds 32 A
- Overtemperature: if the temperature measured by the on-board sensor exceeds 70 °C

When a fault is generated, the system disables the signal generation at the output of the phases. Faults can only be cleared by toggling the Fault Reset Pin (refer to your FPGA or Adapter Box pin mapping to find the channel position of the Fault Reset Pin). A fault is not cleared if the voltage, current or temperature drop back under the limits.

The fault lines are available on all FPGA I/O modules expect for the configuration including the *Adapter Box – 2x IO397 to 2x PWR-TPI6020* (Item ID 350301)

Refer to section 6.5 for additional information about protection functionality.

6.4.   Analog Interface

The module features six differential output lines for analog measurements, which are available through the analog 26-pin HDRA connector.

- Current measurement for Phase A, Phase B and Phase C
- Current measurement on the DC Bus
- Voltage measurement on the DC Bus
- Temperature measurement on the board

Voltage and current measurement points
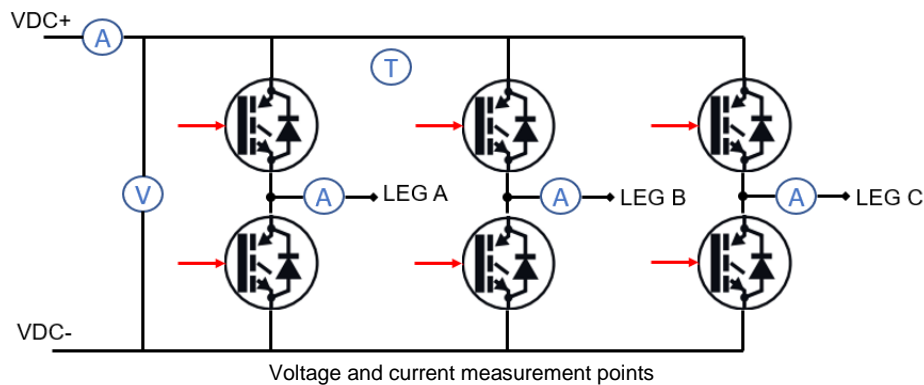
6.4.1.   Current Measurement

The voltage-to-current conversion for the phase and DC bus current is obtained by the following equation:

$$\text{Current}_{\text{Measurement}} = (\text{Voltage}_{\text{Measurement}} / \text{Gain}) + \text{Bias}$$

The total gain for the current sensor and amplifier is **66.6 mV / A**. Bias can be compensated by calibration (refer to section 6.4.4). Use the ±5 V range on your FPGA I/O module to acquire the full current measurement spectrum.

The current sensors are electrically isolated.

6.4.2. Voltage Measurement

The DC Bus voltage is obtained by the following equation:

$$DCBusVoltage_{Measurement} = (Voltage_{Measurement} / Gain) + Bias$$

The total gain for the voltage sensor and amplifier is **30.0 mV / V**. Bias can be compensated by calibration (refer to section 6.4.4). Use the ±5 V range on your FPGA I/O module to acquire the full current measurement spectrum.

The voltage sensor is electrically isolated.

6.4.3. Temperature Measurement

Temperature is measured with an on-board NTC thermistor:

$$Voltage_{Measurement} = 3.3 \text{ V} * RT / (10 \text{ k}\Omega + RT)$$

The NTC thermistor characteristic is as follows:

R_{25}: 10 kΩ
$B_{25/85}$: 3980 K
RT: Thermistor value at a given temperature

T (°C)	RT/R25	RT (Ω)	Voltage$_{Measurement}$ (V)
0	3.2657	32657	2.526
10	1.9907	19907	2.197
20	1.2494	12494	1.833
30	0.80552	8055.2	1.472
40	0.53229	5322.9	1.146
50	0.35981	3598.1	0.873
60	0.24837	2483.7	0.657
70	0.17479	1747.9	0.491
80	0.12523	1252.3	0.367
90	0.091227	912.27	0.276
100	0.067488	674.88	0.209
110	0.050647	506.47	0.159
120	0.03852	385.2	0.122

Resistance and voltage output for different temperatures

Voltage vs. Temperature
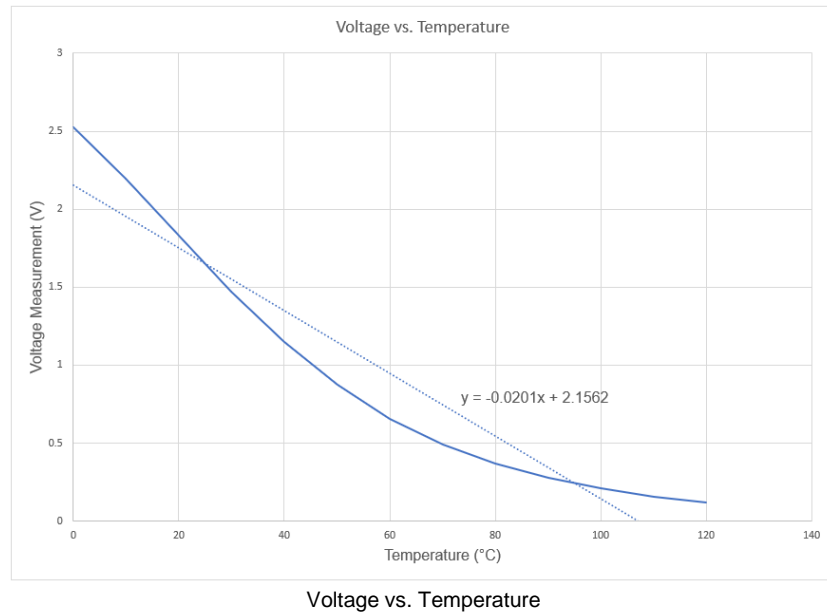
Temperature is a single-ended output, measured over a differential signal pair with the negative line referenced to ground.

6.4.4.   Calibration

Each module must be calibrated once to compensate for bias errors in the analog measurements. The bias is the voltage measurement read by the module when no current is flowing in the phases.

To measure the bias, the analog signals must be read by your FPGA I/O module when the gate drivers are **disabled**. Speedgoat suggest acquiring at least 1000 samples and using the average as the bias component.

The calibration must be performed at least once for each module.

6.5.   Protection Functionality

Different protection functions are available on the module:

- Overvoltage on the DC Bus
- Overcurrent on the DC bus and on all three phases
- Overtemperature on the board
- Deadtime on any of the three phases

Speedgoat recommend using a current limitation or electronic fuses on the power supply to protect the module against unexpected behavior and failures.

6.5.1.   Overvoltage Protection Functionality

Continuous overvoltage on the DC bus may eventually break the switching components or the DC capacitors. Each module features 70-V overvoltage protection functionality.

Power can flow from the AC to the DC side over the freewheeling diodes (providing Vac>Vdc), resulting in a DC bus overvoltage which cannot be avoided.

6.5.2. Overcurrent Protection Functionality

Overcurrent on the DC bus or the three AC phases may lead to excessive heat and potentially break internal components. Each module features 20-A overcurrent protection functionality.

6.5.3. Overtemperature Protection Functionality

Excessive losses due to fast switching signals or DC/DC converters can lead to overheating and break the converters.

Each module features an on-board thermal protection functionality. If the internal temperature exceeds 70 °C, the gates are automatically disabled.

6.5.4. Deadtime

To avoid short-circuits on the DC Bus or breaking the switching components, the module features integrated deadtime (bad PWM) protection. This is set to 20 µs.

A deadtime protection equal to or greater than 20 µs must be enabled on the FPGA I/O module to prevent the fault protection functionality being activated.

6.5.5. Issue Prevention

The following table provides an overview of different issues that may arise and how the module prevents them.

Issue	Impact	Action	Note
Overvoltage on DC bus	Will eventually break MOSFETs or DC bus capacitors	Stop switching at 70 V to avoid damaging MOSFETS. Issue is also indicated by an LED	Power can flow from the AC to the DC side over the freewheeling diodes (if Vac>Vdc), resulting in a DC bus overvoltage which cannot be avoided
Overvoltage on DC-earth	Galvanic isolation may break above 100 V	None	
Overcurrent on DC bus + AC legs	Converter will generate too much heat and potentially break internal components	Disable gates, stop switching.	
Overtemperature	Converter may break with overtemperature (excessive losses).	Disable gates, stop switching. Issue is also indicated by an LED	Excessive losses may also be generated by switching signals too quickly
Bad PWM (Deadtime)	Instant destruction of MOSFETS	Covered by CPLD. Issue is also indicated by an LED	
Short-circuit on DC bus	Damage to the bus capacitors. Uncontrolled flow from the AC side (if powered) that can break the MOSFETS (if I>50A).	None	
Short-circuit on any of the AC terminals	High risk of damage to the MOSFETS if I>50A.	None	

6.6.　LED Indicators

LED	Description	Status
Power	Activated if the DC Bus is powered	Green: Power ON
Gates	Activated if the gate drivers are enabled and the MOSFETs can switch. Use the two Enable pins to control the Gates.	Green: Gates are enabled
Voltage	Activated if an overvoltage occurs	Red: Overvoltage protection enabled
Current	Activated if an overcurrent occurs	Red: Overcurrent protection enabled
Temp.	Activated if an overtemperature occurs	Red: Overtemperature protection enabled
PWM	Activated if deadtime protection is enabled	Red: Deadtime protection enabled

DC Bus is powered ON as soon as power is applied to the VDC+ and VDC- pins.

Gates can be controlled over the two available Enable pins.

Faults can only be cleared by toggling the Fault Reset Pin. A fault is not cleared if the voltage, current or temperature drop back under the limits.

7   I/O Connectors

7.1.   DC Power Supply

Pin count	2 pins
Connector type	ELCON MINI 2P RA HEADER (TE part no. 1982295-1)
Mating connector type	ELCON MINI 2P CABLE CONN (TE part no. 1982299-4)

VDC+: DC Bus Power Supply (+)
VDC-: DC Bus Power Supply (-)

VDC+   VDC-

7.2.   AC Power Outputs

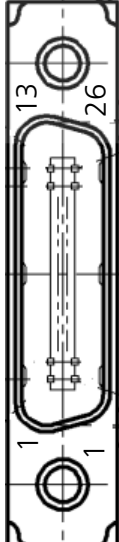| Pin count	3 pins
Connector type	ELCON MINI 3P RA HEADER (TE part no. 2204529-1)
Mating connector type	ELCON MINI 3P CABLE CONN, PULL-TAB (TE part no. 2204534-1)

LEG A: Output of Phase A
LEG B: Output of Phase B
LEG C: Output of Phase C

LEG   LEG   LEG
 A   B   C

7.3. Digital Interface

Pin count	26 pins
Connector type	HDR-EA26LMYPG1-SLG+ (HTK)
Mating connector type	HDR-E26FAG1+ (HTK)
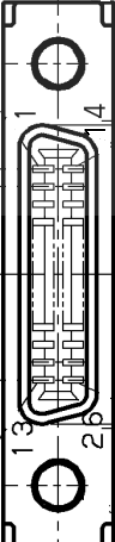
Signal	Dir	Pin		Pin	Dir	Signal
PWM Hi Leg A	IN	1		14		GND
PWM Lo Leg A	IN	2		15		GND
PWM Hi Leg B	IN	3		16		GND
PWM Lo Leg B	IN	4		17		GND
PWM Hi Leg C	IN	5		18		GND
PWM Lo Leg C	IN	6		19		GND
GND		7		20		GND
Enable	IN	8		21		GND
nEnable	IN	9		22		GND
Fault reset	IN	10		23		GND
Temperature fault	OUT	11		24		GND
Voltage fault	OUT	12		25		GND
Current fault	OUT	13		26		GND

Refer to your FPGA or Adapter Box pin mapping for the exact pin assignment for your setup. Depending on your configuration, the fault lines may not be available.

A M12 connector is used for the integrated solutions with direct connection to the IO397 I/O module or for the Electric Motor Control Kit.

7.4. Analog Interface

Pin count	26 pins
Connector type	HDR-EA26LFYPG1-SLG+ (HTK)
Mating connector type	HDR-E26MAG1+ (HTK)

Signal	Dir	Pin
GND		1
AC current sense Leg A+ (Analog output +)	OUT	2
GND		3
AC current sense Leg B+ (Analog output +)	OUT	4
GND		5
AC current sense Leg C+ (Analog output +)	OUT	6
GND		7
DC bus voltage + (Analog output +)	OUT	8
GND		9
DC bus current + (Analog output +)*	OUT	10
GND		11
Temperature (Analog output)*	OUT	12
GND		13

Pin	Dir	Signal
14		GND
15	OUT	AC current sense Leg A- (Analog output -)
16		GND
17	OUT	AC current sense Leg B- (Analog output -)
18		GND
19	OUT	AC current sense Leg C- (Analog output -)
20		GND
21	OUT	DC bus voltage - (Analog output -)
22		GND
23	OUT	DC bus current - (Analog output -)[a]
24		GND
25		GND
26		GND

[a] Not available with the IO397 I/O module

Refer to your FPGA or Adapter Box pin mapping for the exact pin assignment for your setup.

A M12 connector is used for the integrated solutions with direct connection to the IO397 I/O module or for the Electric Motor Control Kit.

8 Thermal Safety Precautions

The semiconductor losses mostly depend on the switching frequency, current load and the DC Bus voltage.

To prevent overheating and damaging the components, power losses must be lower than the thermal capacity of the heatsink.

Speedgoat recommend using an additional active fan if the module is used close to its operational limits or if there is overheating, as this could damage the module.

An on-board 70 °C thermal protection mechanism prevents the components from being broken. Users should nonetheless carefully monitor the operating temperature to avoid coming into contact with surfaces that could cause burns.

9 Legal

As used herein, the term "Seller" shall mean Speedgoat GmbH, and term "Buyer" shall mean the person, firm or corporation executing a purchase order for "goods", sold by Seller (hereinafter "Products").

9.1. Limited Warranty

Seller warrants that the Products delivered hereunder shall be free from defects in workmanship and material under normal use and wear in accordance with Seller's instructions and specifications for a period of twenty-four (24) months from date of delivery to the Buyer, including component parts of Products sold as spare, replacement, maintenance or storage parts, which are also warranted for twenty-four (24) months from date of delivery, provided, however, in either case, that notice of any such defect is provided to Seller within thirty (30) days of its discovery by the Buyer. THE WARRANTY SET FORTH IN THIS SECTION SHALL BE IN LIEU OF ALL OTHER WARRANTIES, AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTY OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, AND FITNESS FOR ORDINARY PURPOSE USED OR PURPOSE INTENDED, ARE EXCLUDED. IN NO EVENT SHALL SELLER, ITS EMPLOYEES OR SUPPLIERS BE LIABLE, EITHER DIRECTLY OR BY WAY OF INDEMNIFICATION, TO BUYER OR ANY THIRD PARTY FOR (A) AN AMOUNT EXCEEDING THE PURCHASE PRICE OF THE PRODUCT IN QUESTION AND (B) ANY PUNITIVE, EXEMPLARY, SPECIAL, INDIRECT OR CONSEQUENTIAL LOSSES, DAMAGES OR INJURIES regardless of whether such claim is based upon delays in delivery or payment, breach of warranty, breach of contract, strict liability, negligence, or any theory now known or hereinafter adopted by legislation or by any court. Neither Seller nor its affiliates shall be liable for any damage or loss to exposure of Products and/or their packaging to the elements (including but not limited to rain, snow, sleet, sun, wind, floods, etc.); chemicals, corrosive solvents or soils; unauthorized or improper use, maintenance, storage or repair; due to any failure to follow Seller's manuals, warnings, notices or instructions; or due to any malfeasance, recklessness or negligence by Buyer, any employee or costumer of Buyer or any other third party.

EXCLUSIVE REMEDY: In any event, the Buyer's exclusive remedy hereunder is limited to the furnishing of replacement parts on an exchange basis, or, at the option of Seller, to the repair or replacement of defective Products or replacement parts at one of Seller's locations, but in either case only if the defective Product or part has been submitted to Seller during the period of warranty. The Buyer accepts and acknowledges that the foregoing allocation of risk is reflected in the purchase price.

The parties further agree that if any portion of the foregoing exclusion of damages is held to be voidable or void by reason of public policy or unenforceable for any other reason whatsoever, all remaining portions of the foregoing exclusion shall continue in effect.

THE WARRANTY SET FORTH ABOVE DOES NOT EXTEND TO: Any systems which have been damaged or rendered defective as a result of accident, misuse, or abuse; by the use of parts not manufactured, authorized or sold by Seller; by modification or as a result of service by anyone other than Seller; systems not containing original components or original replacement of components; damage during shipment, unless due to incorrect packaging by Seller; systems which fail or are damaged after delivery due to shipment, handling, storage, operation, use or maintenance in manner or environment not conforming to any published instructions or specifications issued by Seller.

In-warranty repaired or replacement parts or Products are covered by warranty only for the remaining unexpired portion of the original warranty period applicable to the repaired or replaced parts or Products. In other words, repair or replacement of Products or parts under warranty does not extend the original warranty period.

Products that are no longer part of the regular sales offering are considered EOL (end-of-life) and are repaired on a best-effort basis.

EXTENDED HARDWARE WARRANTY SERVICE

Extended Hardware Warranty Service is available as an option and must be purchased at the time the Products are purchased for which the warranty shall be extended.

The **Level One Hardware Warranty Service** extends the standard 24-month warranty period by 12 months resulting in a 36-month warranty period.

The **Level Two Hardware Warranty Service** extends the standard 24-month warranty period by 36 months resulting in a 60-month warranty period.

Hardware warranty terms exceeding the 60-month range are available on request.

9.2. Return

Buyer shall not return any Product without Seller's prior written consent. An R.M.A. (Return Material Authorization) number issued by Seller must accompany all returned material. An RMA number can be obtained by contacting the Seller's support department (support@speedgoat.com).

Within Warranty, Products returned and needing corrective repair are serviced at no-charge in accordance with the terms of Seller's Warranty policy.

Repairs on out of Warranty Products are performed at Buyer's expense.

Please pack the returned Products in their original shipping cartons, or in equivalent strong protective shipping cartons. Shipping costs from Buyer to Seller associated with warranty repairs or replacements shall be borne by the Buyer. Shipping costs for the return of repaired goods from Seller to Buyer shall be borne by Seller.

9.3. Systems Software Maintenance and Support Services

Delivery of Seller systems and hardware/software components by default include 12 months (1 year) of Systems Software Maintenance and Support Services.
Subscription to Systems Software Maintenance and Support Services includes access to Seller tools and driver software compatible with future releases of MathWorks software and professional technical support by phone and e-mail.

Subscription to Systems Software Maintenance and Support Services does not include free updates of existing custom implementations (FPGA bitstreams).

Software Maintenance and Support Renewal
For uninterrupted Systems Software Maintenance and Support Services in subsequent years Buyer may opt to renew its subscription annually to maintain its investment. Reinstatement if elapsed is possible on request, but incurs back maintenance charges of up to 6 months. Staying subscribed is the most cost-effective way to access latest advances and technical support.

9.4. Use of Speedgoat Software Including Tools and Drivers

LEGAL INFORMATION ABOUT THE USE OF SPEEDGOAT TOOLS AND DRIVERS: Speedgoat tools and drivers are optimized for hardware purchased from Seller and may be used only in conjunction with the hardware (serial no.) for which the tools and drivers were purchased for. Access to the Speedgoat tools and drivers is only available if the target machine component has active subscription to Systems Software Maintenance and Support Services.

Terms and Conditions for software components are defined in the Speedgoat End-User License Agreement (EULA).

10 Contact Information

For further information:

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