heliDriver D3A

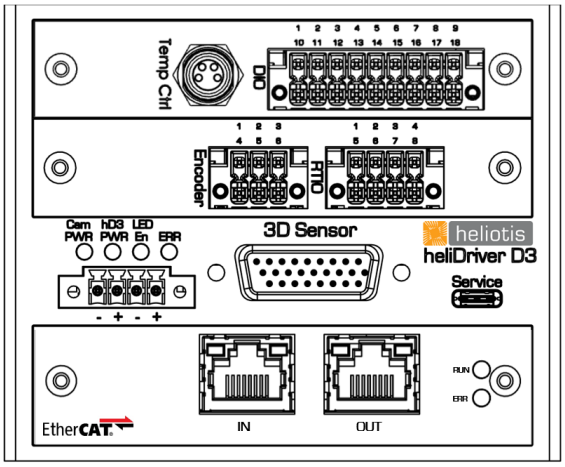
Heliotis AG

Feb 27, 2024

Contents

Modular
- power supply
- illumination driver
- optional communication interfaces

for 4th generation Heliotis devices
(heliInspect™ H8, heliInspect™ H9, heliCam™ C4)



1 Features

- Current driver for device internal light source
- Power supply routing and protection
- Encoder input from external scan motion
- Real-time I/O for microsecond-level synchronization between internal recording and external components
- General purpose digital I/O for millisecond-level exchange of status and synchronization
- Low-noise current control for external light sources (LEDs)

2 Applications

- Interface electronics
- Status and synchronization control data exchange in automated industrial landscapes

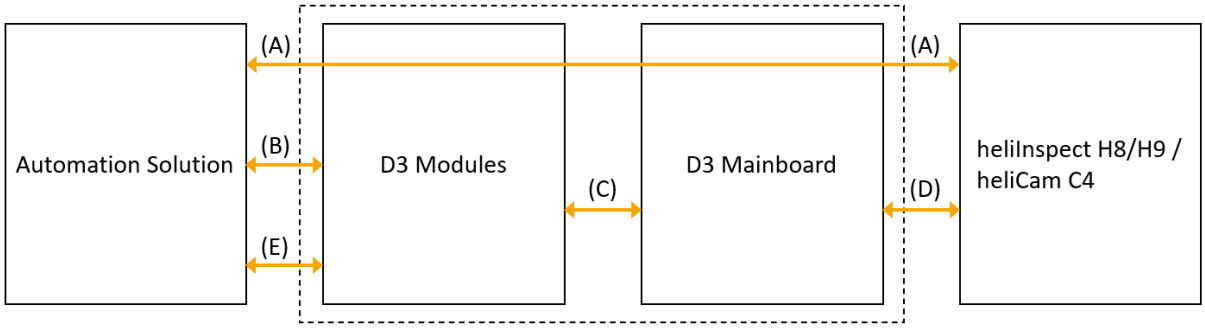
3 Approvals, Standards

- EtherCAT
- PROFINET
- RoHS
- REACH

4 Description

The heliDriver™ D3A is an interfacing device used in combination with gen4 Heliotis devices (heliInspect™ H8/H9, heliCam™ C4). It provides power connections and protection circuits and houses the LED current driver for the light source used in the measurement system. This version of the D3 also features extension slots for up to 2 I/O modules and 1 fieldbus module. These modules are integrated into the housing of the D3 when ordered. A compact version of the D3 without any extension modules is also available (heliDriver™ D3C) but not covered in this document. An overview of the different modules can be found in the *Ordering Information* section while detailed information on each module type is provided in the *Extension Module Specifications* section.

4.1 Interface Overview



A: Real-time I/Os
B: D3 I/Os and serial communication interfaces (I^2C, SPI, UART)
C: Interface between D3 mainboard and extension modules (I/Os, I^2C, SPI, UART)
D: Serial communication interface (UART)
E: Industrial ethernet

5 Specifications

5.1 Dimensional Drawings

(All dimensions are in mm)

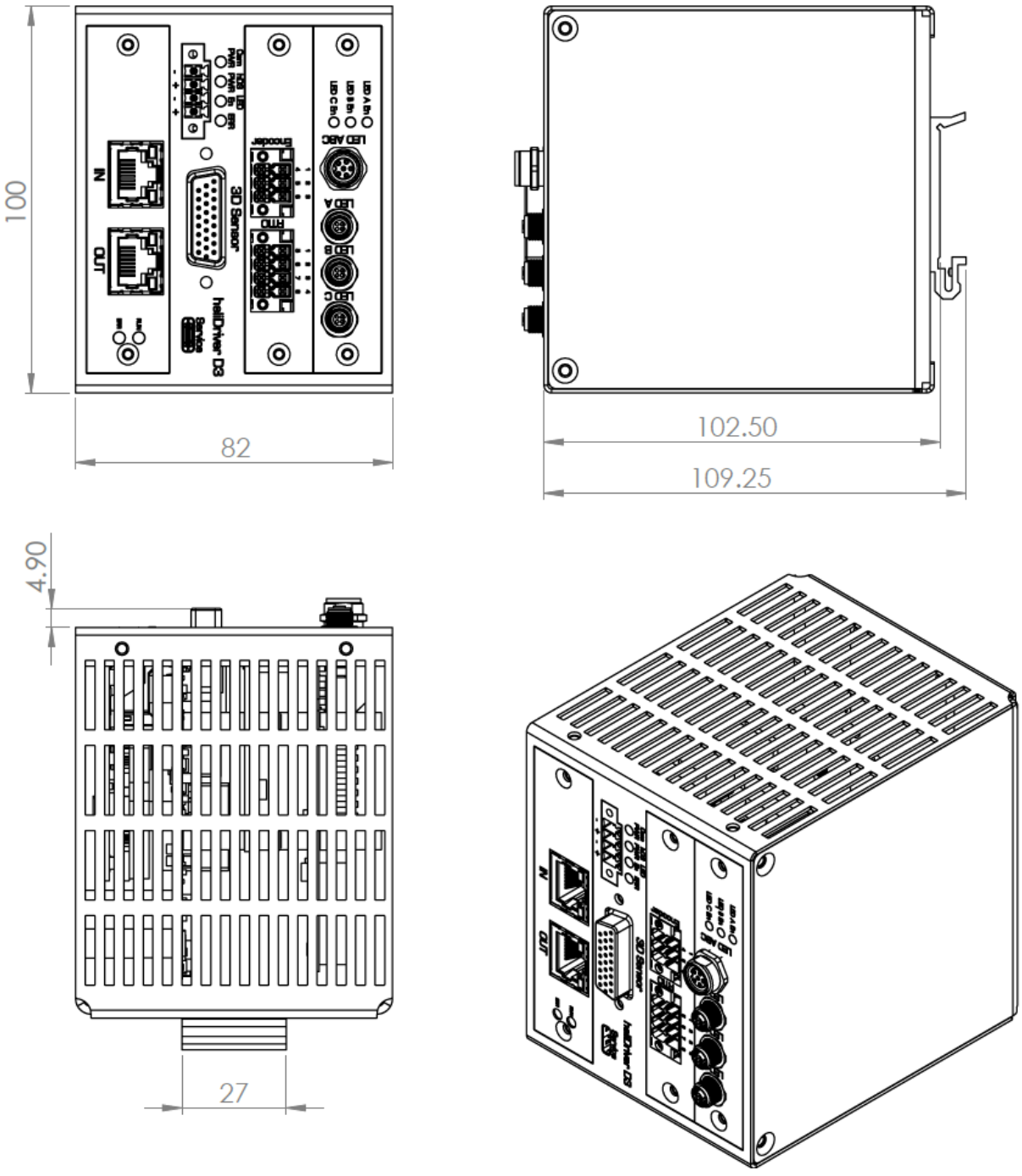


Fig. 5.1: D3A dimensions with DIN rail mounting option

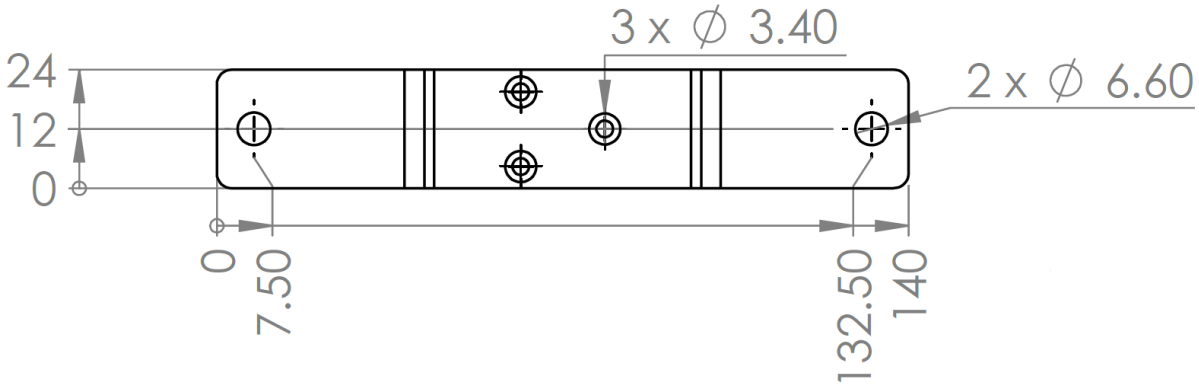


Fig. 5.2: Alternative mounting plate (included in delivery)

5.2 Mechanical Data

Specification	Value	Unit
Housing material	AISI 304 stainless steel	
Frontplate material	5754 AlMg3 Aluminum	
Weight *	730	g
Max weight	850	g
Degree of protection	IP30	

* Without any I/O- or fieldbus-modules installed

5.3 Electrical Characteristics

Specification	Value	Unit
Supply voltage	24 (+/-10%)	VDC
Max power consumption (with H8 connected)	36	W
Protection type	EN 60529: 2000-09	

The total power consumption depends on the built-in modules and the type of measurement head or camera is connected to the D3. For power consumption of the individual modules see the corresponding chapters of this document.

6 Mainboard Specifications

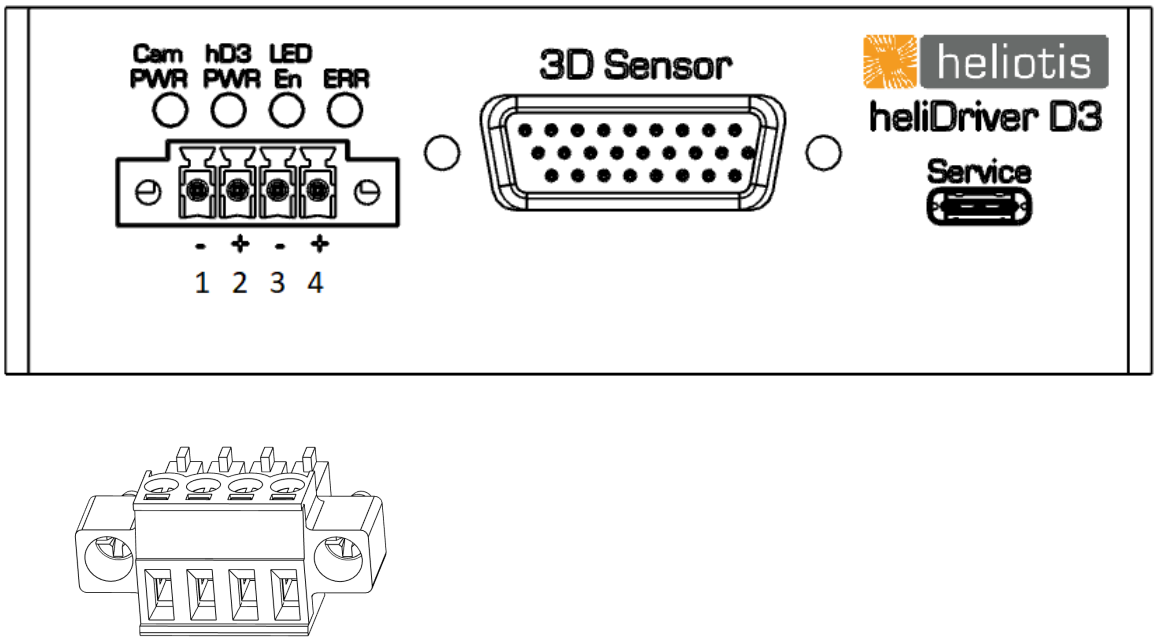


Fig. 6.1: power connector counterpart

The mainboard of the heliDriver™ D3 provides connections for the power supply of the D3 itself and the measurement head or camera connected to it. The gen4 device is connected to the heliDriver at the “3D Sensor” D-Sub connector. Additionally there is a USB-C “Service” port on the front panel. This connector is normally not used and serves mostly as a debugging interface. The four LEDs above the power connector give some visual status feedback during operation.

6.1 Pin assignment (power connector)

Pin #	Terminal designation	Description
1	GND	Camera GND (isolated from chassis, body and shield)
2	VDD	Camera supply 24V (internal 4A fuse)
3	UserGND	Camera User GND and heliDriver D3 GND (connected to chassis and shield)
4	UserVDD	Camera User supply and heliDriver D3 supply 24V (internal 5A fuse)

6.2 LED status indicators

Designation	LED colour	Status details
Cam PWR	Yellow (blinking)	heliDriver is booting
	Yellow	Camera is powered but not detected
	Green	Connection with camera is established
hD3 PWR	Red	Undervoltage on UserVDD supply
	Green	All on-board supplies within nominal range
LED En	Green	LED current driver enabled
ERR	Red	Fault (error description software readable: device feature HeliDriverStatus) (Will also be red during D3 reboot after a power cycle. Turns off when Cam PWR LED stops flickering.)

7 Extension Module Specifications

7.1 Real-time I/O module

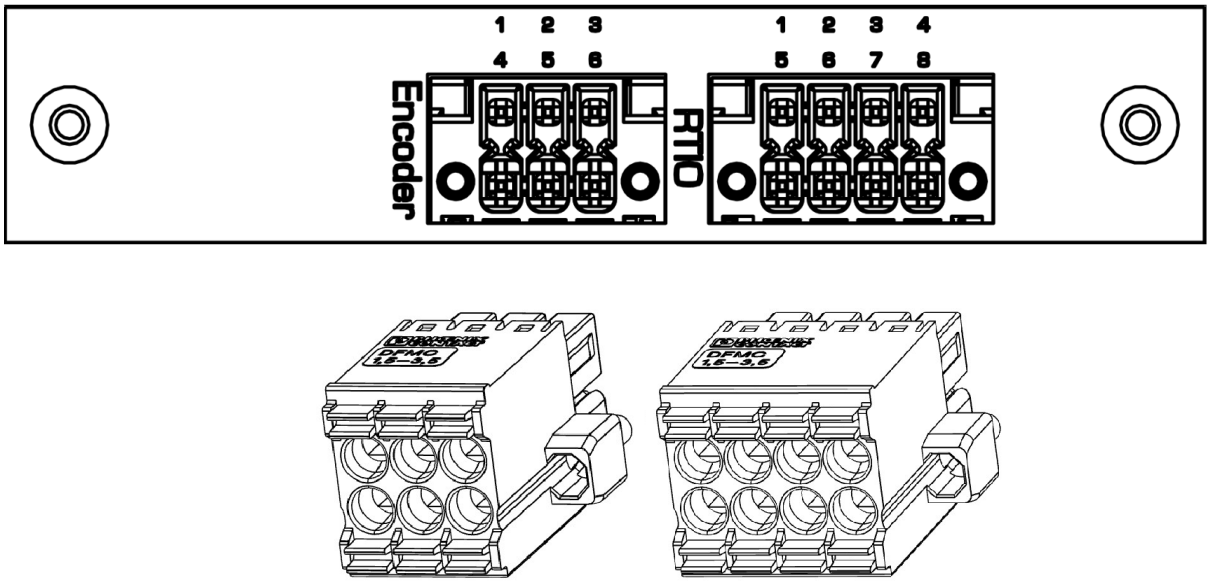


Fig. 7.1: encoder counterpart (left), RTIO counterpart (right)

The RTIO extension module enables the use of external WLI scan motion systems with heliotis gen4 devices. The scanner's encoder signals can be fed to the D3 through the Encoder connector on the module. This feature is used by the heliInspect™ H9 but can also be used for custom motion solutions. Per default this module supports RS-422 quadrature encoder signals. The connector also features a 5V power output to supply a connected encoder system. Contact heliotis support for single-ended and LVDS signaling options or other supply output voltages.

The RTIO connector offers real-time inputs and outputs with 24V voltage levels. These signals can, for example, be used for synchronisation or to trigger the start of an image acquisition. The heliInspect™ H9 uses one of the module inputs for the aforementioned trigger capability.

Pin #	Terminal designation	Description
Encoder:		
1	UserVddOut	5V supply output (0.3A max)
2	Encoder B+	Encoder input (EIA-422)
3	Encoder A+	Encoder input (EIA-422)
4	UserGND	heliDriver GND (connected to housing)
5	Encoder B-	Encoder input (EIA-422)
6	Encoder A-	Encoder input (EIA-422)
RTIO:		
1	UserGND	heliDriver GND (connected to housing)
2	Out2 (SyncOut)	Output (24V push-pull, 24V high-side switch, open drain) *
3	Out3 (FPGA Out7)	Output (24V push-pull, 24V high-side switch, open drain) *
4	In4	Input (IEC 61131-2 Type-3)
5	In5 (Reset In)	Input (IEC 61131-2 Type-3)
6	In6 (FPGA In6)	Input (IEC 61131-2 Type-3)
7	In7 (Trigger In)	Input (IEC 61131-2 Type-3)
8	In8 (LED modulation)	Analog input (0-1.1V)

* operating mode is configurable via camera features

7.2 Digital I/O module

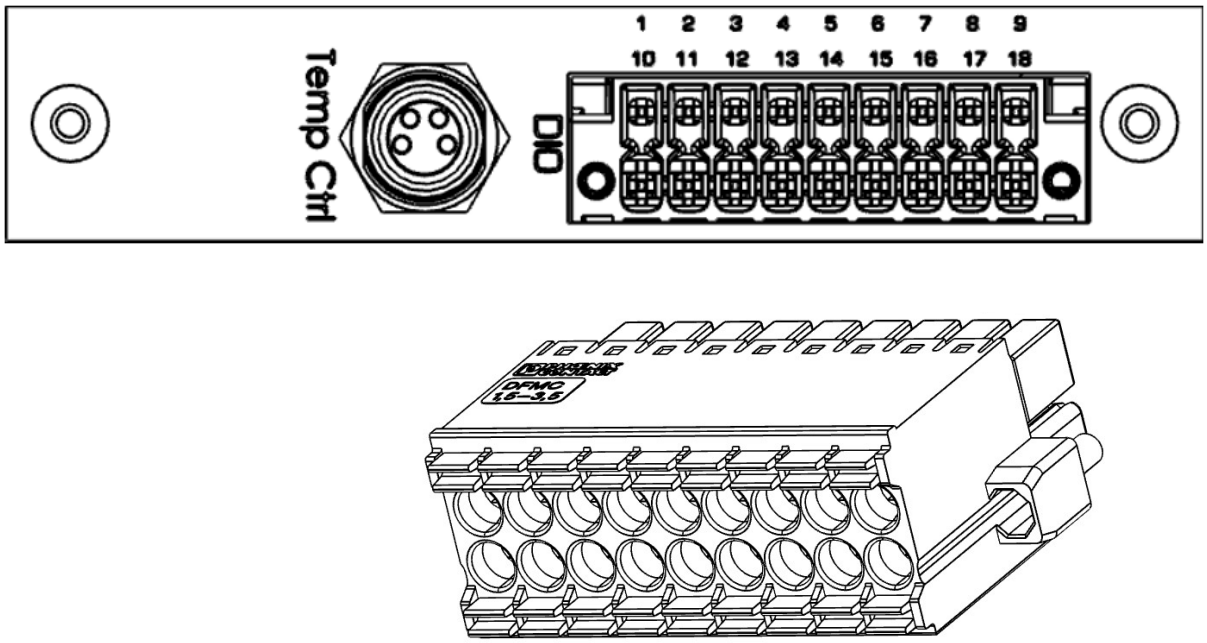


Fig. 7.2: DIO counterpart

On the DIO connector the module offers 8 digital inputs and 8 digital outputs that can be used to output status information or synchronize the device with external events. All I/Os are 24V compatible and the outputs can be configured by camera features to operate either in push-pull (PP) or high-side-switch (HSS) mode.

The Temp Ctrl connector can be used to supply and control the temperature controller of a WLI8-Mirau which can be used in combination with a heliInspect™ H8.

Pin #	Terminal designation	Description
Temp Ctrl:		
1	UserVDD	24V supply output (internal 2A fuse)
2	NC	Not internally connected
3	UserGND	heliDriver GND (connected to housing)
4	C/Q	I/O (IEC 61131-2 / IEC 61131-9)
DIO:		
1-8	DIO1-DIO8	Input (IEC 61131-2 Type-3)
9	UserGND	heliDriver GND (connected to housing)
10-17	DIO10-DIO17	Output (24V PP, 24V HSS) *
18	UserGND	heliDriver GND (connected to housing)

* operating mode is configurable via camera features

7.3 Lock-In Amplifier module

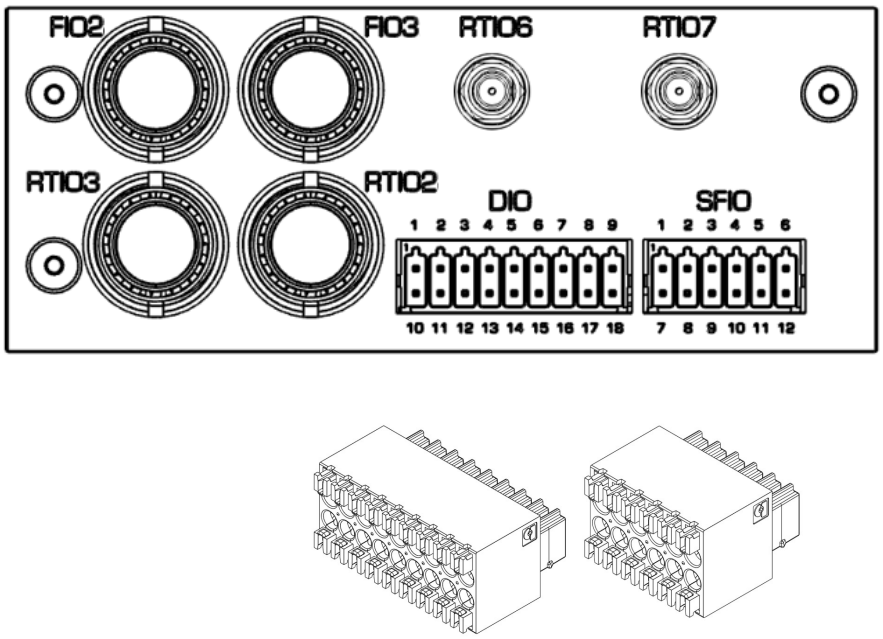


Fig. 7.3: DIO connector counterpart (left), SFIO counterpart (right)

The LIA module is intended for use in combination with the heliCam™ C4. It offers Real-time 5V I/Os on BNC connectors for compatibility with common lab equipment. The DIO and SFIO connectors provide additional 5V I/Os and a 5V supply output. The module also features a configurable sine wave generator that can be used to modulate the LED driver output current on the D3A mainboard.

Note: The LIA module takes up both I/O-Module slots in the heliDriver™ D3A housing. Combination with any other I/O-Modules is not possible.

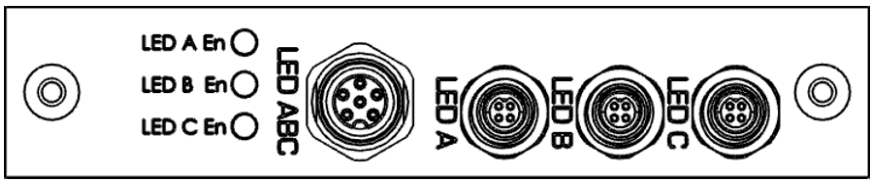
Pin #	Terminal designation	Description
DIO connector (general purpose digital inputs/outputs)		
1-8	DIO1-8	5V CMOS in/out *
9	USERVOUT	5V supply output (250mA limited)
10-17	DIO10-17	5V CMOS in/out *
18	USERGND	heliDriver GND (connected to housing)
SFIO connector (fast digital inputs/outputs, miscelaneous)		
1-4	SFIO1-4	PLD input (5V CMOS)
5	SFIO5	Analog modulation input 5V
6	USERVOUT	5V supply output (250mA limited)
7-10	SFIO7-10	PLD output (5V CMOS)
11	SFIO11	Analog modulation output 5V
12	USERGND	heliDriver GND (connected to housing)

* direction is configurable via camera features

Note: The 250mA limit is shared between the USERVOUT pins of both DIO and SFIO connectors

Connector type	Connector designation	Description
Coaxial cable connectors:		
BNC	FI2	Input (3.3V CMOS, 5V tolerant)
BNC	FI3	Input (3.3V CMOS, 5V tolerant)
SMA	RTIO6 (FPGA In6)	Input (3.3V CMOS, 5V tolerant)
SMA	RTIO7 (Trigger In)	Input (3.3V CMOS, 5V tolerant)
BNC	RTIO3 (FPGA Out7)	Output (5V CMOS)
BNC	RTIO2 (Sync Out)	Output (5V CMOS)

7.4 Triple LED-driver module



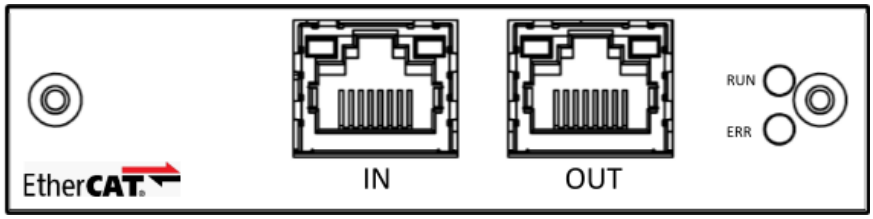
To support measurement systems with multiple illumination sources, the TriLED module features three LED current drivers. Each of them can drive up to 1A and can be dimmed and switched on or off independently. All driver outputs are combined on a 6p M8 connector but are also accessible separately on three 4p M5 connectors. Each LED driver has a status LED associated to it on the frontpanel which lights up in green when the driver is enabled.

Pin #	Terminal designation	Description
LED ABC connector (combined LED connection)		
1	CA_C	LED driver C cathode (-)
2	CA_B	LED driver B cathode (-)
3	AN_B	LED driver B anode (+)
4	CA_A	LED driver A cathode (-)
5	AN_A	LED driver A anode (+)
6	AN_C	LED driver C anode (+)
LED A / LED B / LED C connectors (separate LED connection)		
1	AN	LED driver anode (+)
2	CA	LED driver cathode (-)
3	NC	Leave this pin floating, do not connect anything
4	UserGND	heliDriver GND (connected to housing)

7.5 Industrial ethernet module (EtherCAT/PROFINET)

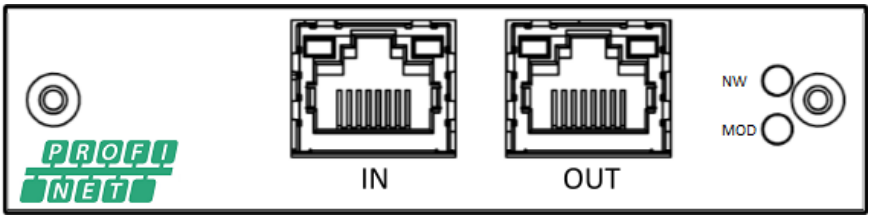
The fieldbus module enables real-time communication between the Heliotis gen4 device and other participants in the network. A PLC connected to the D3 can read status information or measurement results over the network or start an image acquisition. Currently two versions of the module are available: EtherCAT and PROFINET. Both versions support the same camera features.

EtherCAT version:



Designation	LED colour	Status details
RUN	Off	Device in “INIT”-state (or no power)
	Green	Device in “OPERATIONAL”-state
	Green, blinking	Device in “PRE-OPERATIONAL”-state
	Green, single flash	Device in “SAFE-OPERATIONAL”-state
	Flickering	Device in “BOOT”-state
	Red	If RUN and ERR turn red, this indicates a fatal event, forcing the bus interface to a physically passive state. Contact technical support.
ERR	Off	Device in “INIT”-state (or no power)
	Red, blinking	State change not possible (config error)
	Red, single flash	Device unexpectedly changed the EtherCAT state
	Red, double flash	Sync manager watchdog timeout
	Red	Hardware bus module in EXCEPTION. If RUN and ERR turn red, this indicates a fatal event, forcing the bus interface to a physically passive state. Contact technical support.
	Flickering	Booting error due to FW download failure

PROFINET version:



Designation	LED colour	Status details
NW	Off	Offline (or no power)
	Green	IO controller in RUN state
	Green, single flash	IO controller in STOP state
	Green, blinking	Blink for node identification
	Red	Major internal error (this indication is combined with a red MOD LED)
	Red, single flash	Station name not set
	Red, double flash	IP address not set
	Red, triple flash	Expected identification differs from real identification
MOD	Off	Module not initialized (or no power)
	Green	Module operating normally
	Green, single flash	Diagnostic event(s) present
	Red	Major internal error (this indication is combined with a red NW LED)

8 Ordering Information

Description	Type number (TN)	Article number (AN)
Advanced version of the heliDriver D3 with 2 I/O- and 1 industrial interface extension slots	D3A.0	40 81 10
RTIO extension module with EIA-422 quadrature encoder inputs	D3MRTIO.0-EIA422-VDD5.0	40 81 34
DIO extension module with 8 inputs and 8 outputs	D3MDIO.0	40 81 50
LIA extension module with signal generator and digital I/Os	D3MLIA.1	40 81 60
3-Channel LED current driver extension module	D3MTRILED.0	40 81 70
Industrial ethernet extension module with EtherCAT protocol	D3MRTETH.0-ETHERCAT	40 81 90
Industrial ethernet extension module with PROFINET protocol	D3MRTETH.0-PROFINET	40 81 95

9 Worldwide Support

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10 Document History

Version	Date	Changes	Responsible
1.0.0	30-11-2021	Initial version	cg
1.1.0	21-02-2024	Adopted new Heliotis style Added fieldbus module description Added LIA module description Added ordering information	sb