

**HALdrive X20  
XY3-100 to Analogue Converter**



**Users Manual**

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### 3 Safety

The hardware described within this document is designed to control a laser scanner system. Laser radiation may effect a person's health or may otherwise cause damage. Prior to installation and operation compliance with all relevant safety regulations including additional hardware-controlled safety measures has to be secured. The client shall solely be responsible to strictly comply with all applicable and relevant safety regulations regarding installation and operation of the system at any time.

Beside of that some laser equipment can be damaged in case it is controlled with wrong signals or signals outside a given specification. Thus it is highly recommended to check the output generated by this hardware using e.g. an oscilloscope to avoid problems caused by wrong configurations. This should be done prior to putting a system into operation for the first time, whenever some parameters have been changed or whenever any kind of software update was installed.

The hardware described here is shipped without any cover and without prefabricated equipment for electric installation. It is intended to be integrated in machines or other equipment. It is not a device for use "as is", but a component which is intended to be used as part of a larger device, e.g. for integration in a machine with own housing or within an electrical cabinet. Prior to operation compliance with all relevant electric / electromagnetic safety regulations including additional hardware-controlled safety measures has to be secured. The client shall solely be responsible to strictly comply with all applicable and relevant regulations regarding installation and operation of the system at any time.

The hardware described here is an electrostatic sensitive device. This means it can be damaged by common static charges which build up on people, tools and other non-conductors or semiconductors. To avoid such a damage, it has to be handled with care and including all relevant procedures (like proper grounding of people handling the hardware, shielding/covering to not to let a person touch the hardware unwanted, proper packaging in ESD-bags, ...). For more information please refer to related regulations and standards regarding handling of ESD devices. The EMC Directive (2014/30/EU) does not apply to this hardware as it is not intended for an end user (a person without knowledge of EMC) and as it is not otherwise made available on the market.

The Low Voltage Directive (2014/35/EU) does not apply to this hardware as the voltage supply is below the 50V AC / 75V DC limit.

This document describes the HALdrive digital XY3-100 to analogue converter hardware but may contain errors or may be changed without further notice.

## 4 Overview

This document describes the HALdrive X20 converter board, its electrical characteristics and usage. This board is designed to receive digital XY3-100 scanner controller signals and to convert them to 2x synchronous analogue output signals. So it acts as some kind of converter between two different signal types for controlling scanning systems/scanheads.

This board is not a ready-to-use device but a component which is intended to be integrated in larger devices or to be operated with an own housing.

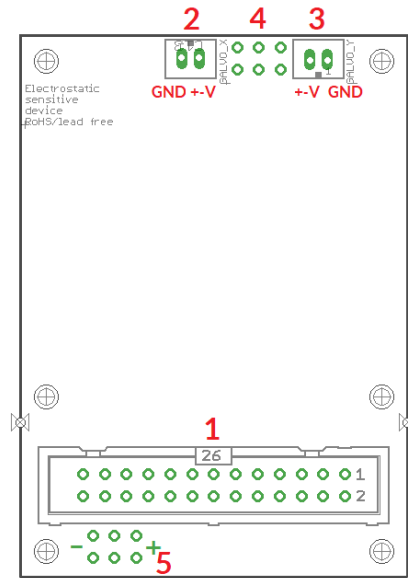
### 4.1 Features

The HALdrive converter board provides the following features:

- accepts 2D input signals in XY3-100 format (X and Y position data, Z is ignored if available)
- synchronous output of analogue X and Y position data in -5V..5V or -10V..+10V voltage range
- 20 bit output resolution
- 100 kHz sampling/output frequency
- available in variants for +-5V output and +-10V output
- instant-on, so there is no boot-up time until the device is available

# 5 HALdrive Board And Connectors

The board provides the following connectors:

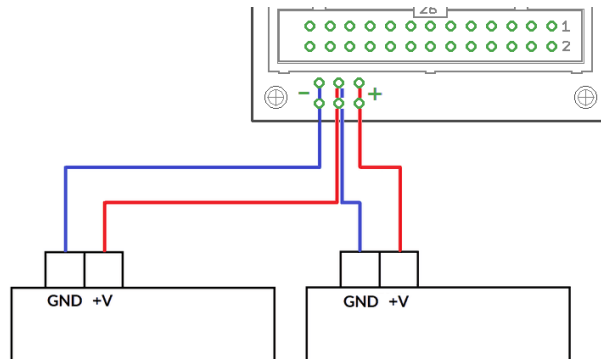


1. XY3-100 interface for power supply and scanner input signals (as described below)
2. Galvo-X analogue output with +5V / +-10V and GND pin (available only on hardware variant A)
3. Galvo-Y analogue output with +5V / +-10V and GND pin (available only on hardware variant A)
4. 2,54mm 6pin connector for Galvo-X and Galvo Y analogue signals, available only with hardware variant B, replaces the JST B2B-PH-K-S connectors of hardware variant A

Pin	Signal	Description
1	NC	Unused and reserved for future use, do not connect!
2	NC	Unused and reserved for future use, do not connect!
3	Galvo-Y	analogue output with voltage possible in range +5V .. +-10V
4	Galvo-X	analogue output with voltage possible in range +5V .. +-10V
5	GND	Common ground for Galvo-X
6	GND	Common ground for Galvo-Y

5.

6. Separate power supply input pin, when not provided via connector (1) here +-15V can be fed in. The two second pins are for -15V, the two middle pins are for GND and the two right pins are for +15V power input.  
When no power supply with symmetric/bipolar outputs is available, it is possible to combine two standard power supplies, here GND of the first power supply has to be connected with +V of the second power supply and with the GND-pins of the HALdrive:



## 5.1 Scanner Signals

The white 26 pin connector expects the XY3-100 position signals and the power supply for the HALdrive board:

Upper Row Of Pins	Signal	Voltage	Remarks	Lower Row Of Pins	Signal	Voltage	Remarks
1	A-		XY3-100-compatible signals	2	A+		XY3-100-compatible signals
3	B-			4	B+		
5	C-			6	C+		
7	D-			8	D+		
9				10			
11				12			
13				14			
15				16			
17	+V	+15V	Power supply from scanner card	18	+V	+15V	Power supply from scanner card
19	+V	+15V		20	GND	GND	
21	GND	GND		22	GND	GND	
23	-V	-15V		24	-V	-15V	
25	-V	-15V		26			

When the HALdrive is used together with the E1803D scanner controller card, a direct 1:1 connection can be established between the white, 26 pin scanner signal connector of the E1803D controller and this connector. Then power has to be supplied via the three screw-connectors of the E1803D (for details please refer to manual of [E1803D scanner controller card](#)).

## 5.2 Galvo X Signals

## 5.3 Galvo Y Signals

On hardware variant A: These connectors are male 2 mm, 2 pin JST connectors of type B2B-PH-K-S which can be used together with female connectors of type JST PH2P BU. They provide analogue signals synchronous to the XY3-100 position signals.

For the +-5V hardware variant: Pin 1 works in range -5V .. +5V. Pin 2 is connected to GND.



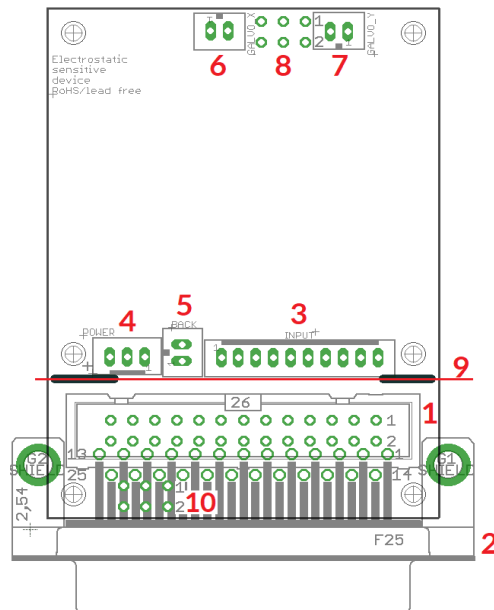
For the +-10V hardware variant: Pin 1 works in range -10V .. +10V. Pin 2 is connected to GND.

On hardware variant B: a 6 pin, 254 mm header, to be used with an IDC connector, for the pinout please refer the connectors overview above.

The maximum current to be pulled out of each of the outputs should never exceed 20 mA.

# 6 HALdrive OEM Board And Connectors

The HALdrive OEM is a customisable version of the standard HALdrive which is available to hardware manufacturers in larger batches and where the types of connectors/inputs/outputs to be used can be chosen. There are currently three different ways and connectors available as input for XY3-100 control data and two different connectors and signal types as output for the received X and Y position data:



1. XY3-100 interface for power supply and scanner input signals on IDC-connector with standard pinout as described in section “5.1 Scanner Signals” above, can be used instead of connectors (2) or (3), (4) and (5)
2. XY3-100 interface for power supply and scanner input signals on standard D-SUB25-connector with pinout according to the XY3-100 standard, can be used instead of connectors (1) or (3), (4) and (5); this connector also can be used as mechanical connection to the housing of a device
3. Alternative connector for scanner input signals, can be equipped with a JST PH10P type connector instead of (1) or (2) and provides the following pinout for XY3-100 control signal input:

Pin	Signal
1	GND
2	GND
3	Y- (D-)
4	Y+ (D+)
5	X- (C-)
6	X+ (C+)
7	CLK- (B-)
8	CLK+ (B+)
9	SYNC- (A-)
10	SYNC+ (A+)

4. Alternative connector for power supply, can be equipped with a JST PH3P type connector instead of (1), (2) or (10) and provides the following pinout for power supply input:

Pin	Signal
1	+15V
2	GND
3	-15V

- Alternative connector for feedback output channel, can be equipped with a JST PH2P type connector instead of (1) or (2) and provides the following pinout for feedback channel data output:

Pin	Signal
1	BACK- (F-)
2	BACK+ (F+)

- Galvo-X analogue output with voltage possible in range +5V .. +-10V and GND pin as described in section "5.2 Galvo X Signals" above, can be used instead of (8)
- Galvo-Y analogue output with voltage possible in range +5V .. +-10V and GND pin as described in section "5.3 Galvo Y Signals" above, can be used instead of (8)
- alternative, 2,54mm 6pin connector for Galvo-X and Galvo Y analogue signals, can be used instead of (6) and (7) and provides the following pinout

Pin	Signal	Description
1	NC	Unused and reserved for future use, do not connect!
2	NC	Unused and reserved for future use, do not connect!
3	Galvo-Y	analogue output with voltage possible in range +5V .. +-10V
4	Galvo-X	analogue output with voltage possible in range +5V .. +-10V
5	GND	Common ground for Galvo-X
6	GND	Common ground for Galvo-Y

- Predetermined breaking point to shear off the lower part of the PCB when connectors (1) or (2) are not used
- Additional power supply input, can be used with a 2,54 mm 6pin connector when no power is provided via connector (1), can not be used when D-SUB25 connector (2) is available. This connector provides the following pinout:

Pin	Signal	Description
1	+15V	Positive power input
2	+15V	
3	GND	Common ground for positive and negative power input
4	GND	
5	-15V	Negative power input
6	-15V	

## 6.1 HALdrive OEM for Z-Channel

By default the HALdrive OEM controls X and Y channels like commonly used for 2D galvos/scanheads. As an other option the HALdrive OEM is available in a variant with one Z channel. It can be used e.g. to drive a focus axis. When this option is used, the Z-channel is available:

- on IDC-header (1) at pins 9 (E-/Z-) and 10 (E+/Z+)
- on D-SUB25-connector (2) at pins 5 (E-/Z-) and 18 (E+/Z+)
- on JST PH10P header (3) at pins 3 (E-/Z-) and 4 (E+/Z+)

This is a hardware option, a HALdrive OEM for Z-channel can't be converted to the standard 2D variant or vice versa. Please specify your desired hardware configuration during order.

## 7 Initial Operation

After the HALdrive does not have a nameable boot-up time, putting it into operation consists of a few steps only:

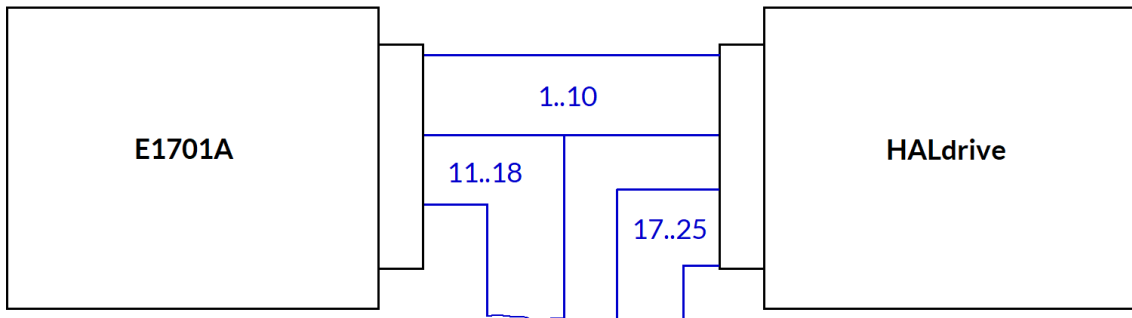
1. power up HALdrive and if necessary the connected scanner controller card
2. power-up connected galvo drivers (can be done together with powering the HALdrive)
3. start sending data from the scanner controller card to the HALdrive board

For security reasons it is recommended to not to send any data to the HALdrive while it is still turned off, so that it may start up in the middle of an already running data transmission. This may lead to a situation where the first valid position command received is at an extreme and unexpected position causing damage to the connected scanhead as it jumps to this extreme position too fast.

For the same reason also the galvo driver should be powered and be ready to use before the scanner controller sends any data, elsewhere when the connected galvos jump to an extreme position immediately, this may cause damage to the galvos and/or mirrors.

# APPENDIX A – Wiring between HALdrive and E1701D

To connect an E1701D scanner controller card with the HALdrive X20, a split cable is needed between the white laser/scanner interface connector of E1701D and the 26-pin connector of the HALdrive board:



E1701D pin		Description		HALdrive pin
1	-	XY3-100 signal lines	-	1
2	-		-	2
3	-		-	3
4	-		-	4
5	-		-	5
6	-		-	6
7	-		-	7
8	-		-	8
9	-		-	9
10	-		-	10
11	-	Laser and control signals	X	11
12	-		X	12
13	-		X	13
14	-		X	14
15	-		X	15
16	-		X	16
17	-	+15V (from power supply)	-	17
18	-		-	18
19	X	GND (from power supply)	-	19
20	X		-	20
21	X		-	21
22	X		-	22
23	X	-15V (from power supply)	-	23
24	X		-	24
25	X		-	25
26	X		X	26

“-” connection to be established between E1701D and HALdrive  
 “X” no connection allowed here

## APPENDIX B – Wiring between HALdrive and E1803D

For connection between E1803D and HALdrive X20 a simple 1:1 wire is needed between the white, 26-pin IDC connector of the E1803D and the white IDC connector of the HALdrive board.

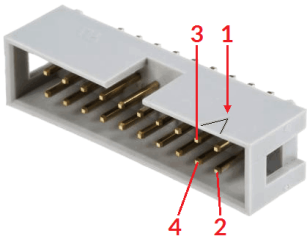
E1803D pin		Description		HALdrive pin
1	-	XY3-100 signal lines	-	1
2	-		-	2
3	-		-	3
4	-		-	4
5	-		-	5
6	-		-	6
7	-		-	7
8	-		-	8
9	-		-	9
10	-		-	10
11	O		O	11
12	O		O	12
13	O		O	13
14	O		O	14
15	O		O	15
16	O		O	16
17	-	+15V (via E1803D screw terminal)	-	17
18	-		-	18
19	-		-	19
20	-	GND (via E1803D screw terminal)	-	20
21	-		-	21
22	-		-	22
23	-	-15V (via E1803D screw terminal)	-	23
24	-		-	24
25	-		-	25
26	O		O	26

“-” connection to be established between E1803D and HALdrive

“O” currently unused signal but can be connected

# APPENDIX C – IDC connector pin numbering

Pin numbering of the white, 26 pin IDC connector (according to pinout-tables shown in hardware description sections above) can be seen in below image:



The first pin is marked by a small arrow in connector. Second pin is below of it, counting continues column-wise.

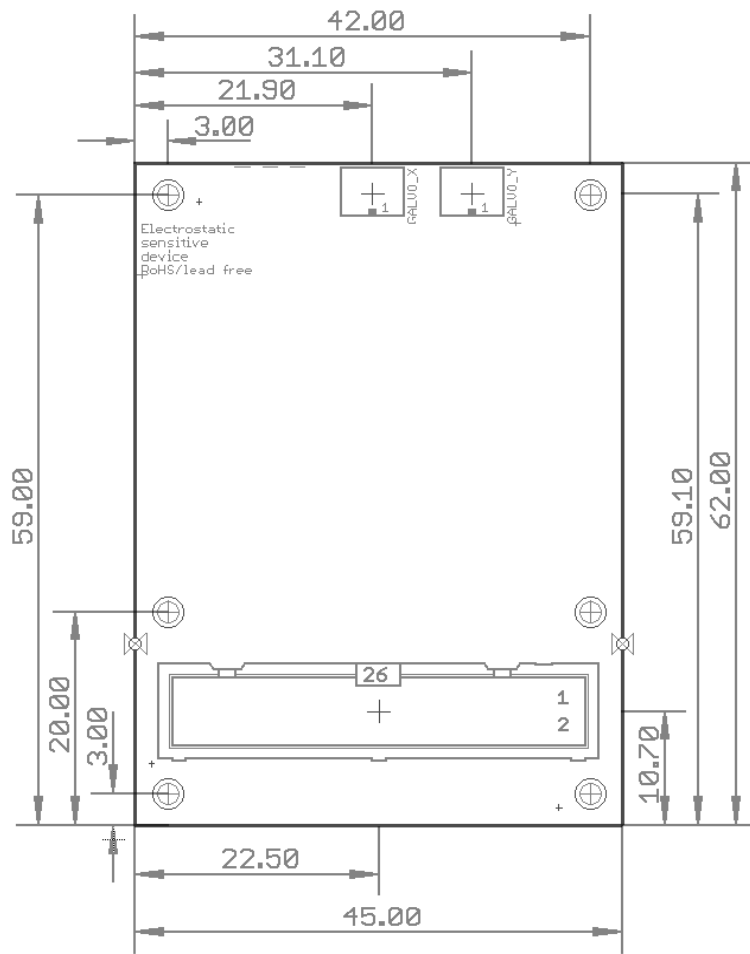
# APPENDIX D – XY3-100 protocol description

For details about the XY3-100 protocol, please refer to <https://lasia.org/documents.php>



# APPENDIX E – Board dimensions

Board dimension drawing, all values are given in unit mm.



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