

# **HALscan 10X20 XY3-100 Scanhead**

## **Users Manual**

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# 1 Copyright

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HALscan scanheads, their hardware and design are copyright by HALaser Systems.

# 2 History

Date	Changes in document
08/2020	Added description of supported XY3-100 commands
08/2020	Power supply specifications updated and clarified
07/2020	Initial version

### 3 Safety

The hardware component described within this document is designed to be part of a laser scanner system which itself can be part of a machine. 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.

The hardware component described here is shipped without prefabricated equipment for electric installation. It is intended to be integrated in machines or other equipment. It is not for use "as is". 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 scanhead described here is designed to deflect an input laser beam and output it again. It can't block or weaken the laser beam. To prevent unwanted emission of the laser beam, above a particular danger class the laser device must be fitted with a shutter or any other suitable device. This laser device must be of sufficient quality so that the laser beam can only be emitted at the beam output on the deflection unit. Proper warning signs have to be attached at the machine or device where this scanhead is used to clearly inform any user about all possible dangerous operations.

The surfaces of the scanheads mirrors are extremely sensitive and should not be touched in any way and may only be cleaned by experienced personnel. Thus we strongly recommend sending the deflection unit in to HALaser Systems for the mirrors to be cleaned, as opening of the scanhead by unauthorized personnel voids the warranty.



To improve the optical properties of the mirrors, lenses or protection glasses, different material are applied as coatings. Some of them may be potentially hazardous to health if inhaled or swallowed. Under normal circumstances, no special precautions are necessary when handling or storing mirrors, lenses or protection glasses with such specific coatings.

In case of damage to such a component and/or coating, follow these instructions:

- switch off the laser immediately
- avoid inhaling dust of possibly broken or burned components
- leave the room for at least 30 minutes
- wear gloves and a mouth protector while performing all the subsequent steps
- pack the optical elements in an airtight sealed plastic container, in case of fragments carefully collect up all fragments
- clean all contaminated components and surfaces with a damp cloth and pack the cleaning cloths in a sealed plastic container too
- ensure professional disposal of the container, optionally you also can return them to your supplier

Please note: these general instructions are relevant only in case special coatings are used on any of the optical components. This includes also third party components which may be operated together with the HALscan scanhead (like F-Theta lenses or protection glasses). For detailed information about the used coatings, their dangerousness and for specific handling instructions in case of normal operation or damages, please contact the supplier of the related components.

## 4 Overview

This document describes the HALscan scanhead, its characteristics and usage.

This scanhead is a component according to Low Voltage Directive (LVD) 2006/95/EC of the European Union and related domestic directives, thus it will be used as part of a laser scanning system which itself can be part of a machine.

This document contains important information on qualified and safe handling of the HALscan scanhead. Therefore you should familiarize yourself with the content of this manual before using the scanhead for the first time. Furthermore this manual must be accessible to anyone who will be involved in developing, installing or using a laser device featuring the HALscan scanhead. When the scanhead is sold on, this operating manual or an authorized copy must be passed on with it.

## 5 Features and Technical Data

The HALscan scanhead offers the following interfaces, functions and features:



1. XY3-100 data interface and power connector
2. Beam entrance
3. M85x1 lens ring (can be removed)
4. M5 laser and head mounting screw holes

Interface	two-channel XY3-100 (2D)
Digital resolution/accuracy	20 bits <sup>1)</sup>
Power supply requirements	+/- 15 V / 2 A
Idle power consumption (no galvo movements)	< 7 W
Mirror size	10 mm
Maximum Laser Power	50 W <sup>2)</sup>
Screw thread for optics	M 79 x1 (M 85 x1 with included lens ring)
Positioning speed	up to 7 m/sec
Marking speed	up to 3,5 m/sec
Precision writing	650 cps
Resolution	10 $\mu$ rad
Total scanning angle	40 degrees
Scanner Lag (Tracking error)	0,18 msec
1% step response setting to 0,1% fs	0,36 msec
Scale drift	<80 ppm/ $^{\circ}$ C
Zero drift	<50 $\mu$ rad/ $^{\circ}$ C
Long term drift	0.3 mrad
Weight	1,7 kg (with lens ring)
Ambient temperature	25 $^{\circ}$ C +/- 10 $^{\circ}$ C <sup>3)</sup>

<sup>1)</sup> to gain full 20 bits accuracy at the output, marking speeds and in-polygon-delay need to be adjusted properly

<sup>2)</sup> at 1064 nm, requires precise central justification of the laser and utilisation of full available mirror surface; customer has to take care the laser does not hit the mounting points of the mirrors, this would lead to damage of the scanhead together with a loss of any kind of warranty. Depending on used pulses and frequency additional cooling of the head may be necessary.

<sup>3)</sup> depending on used pulses, frequency and laser power, additional cooling of the head may be necessary also when operated under recommended temperature conditions.

## 6 Functional Description

The HALscan scanhead can be used to deflect a laser beam in X and Y direction. This results in an area within which a laser can be moved to any position. This area is known as "marking field". This operation is performed by two mirrors, each of which is moved by a galvanometer scanner. The scanhead itself provides a beam input, into which the laser beam is fed, and a beam output, through which the laser beam is emitted from the unit after deflection. Only suitable lasers have to be fed into the beam input. Depending on some additional equipment and the working environment, the beam output is either open or fitted with an F-Theta lens or protection glass.

Comparing to other scanheads, the HALscan shows a nearly linear behavior. This means, there exists no nameable pillow distortion caused by the mechanical structure of the scanhead and the geometries of the mirrors. Thus for many applications no correction table is needed. This is true as long as no (F-Theta) lens is used. Independent from that, the user is still free to make use of correction files in order to get specific shapes of the output or to gain an additional level of accuracy for special applications.

An F-Theta lens is an optical component which is specially designed for use with 2-axis scanheads. It focuses the laser beam at optimum quality on any position in the marking field with a nearly constant beam length at all marking positions. Thus the desired marking field has to fit to an F-Theta lenses nominal size.

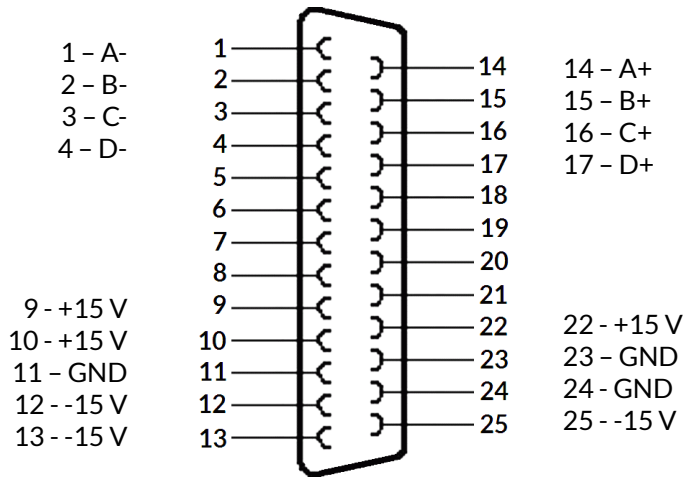
The HALscan scanhead supports the following XY3-100 features and commands:

- 24 bit XY3-100 raw frames with included 20 bit position data
- auto-calibration (`XY3_CMD_AUTOCALIB_ON/XY3_CMD_AUTOCALIB_OFF`); this function is enabled by default and adjusts the received position data permanently to have a linear behaviour of the scanhead
- temperature compensation (`XY3_CMD_TEMPCOMP_ON/XY3_CMD_TEMPCOMP_OFF`); this function is disabled by default, when this function is enabled, the internal temperature is measured and the temperature drift of the scanhead is adjusted permanently to stay as close to zero as possible





# 7 Electrical Connection

The scanhead is compatible with the industry standard XY3-100 data interface that is available on several industry-grade scanner controller cards (like E1803D controller). The pinout and voltage supply connections are shown below and require a male D-SUB25 connector:



The power supply needs to support up to 2 A current drain and needs to be a balanced +/- 15 V (+/- 0.5 V tolerance). The current draw will only exceed 1.0 A average under very heavy driving conditions.

 **ATTENTION:** When the scanhead is powered separately, power has to be fed into scanhead only but never into connected controller card!

 **ATTENTION:** During operation it has to be ensured the symmetric power with +15 V and -15 V is available all the time. Unplugging the D-SUB25 connector during operation or switching of one of both power lines for a longer time may damage electronics and - as follow up - the mirrors too.

## 8 Initial Operation

Since the HALscan scanhead does not have a nameable startup-procedure, putting it into operation consists of a few steps only:

1. power up HALscan and if necessary the connected scanner controller card
2. wait a few seconds until scanner is initialised
3. start sending data from the scanner controller card to the HALscan scanhead

For security reasons it is recommended to not to send any data to the HALscan head while it is still turned off, causing a situation where it may start up in the middle of an already running data transmission. This may lead to the first valid position command received is at an extreme and unexpected position. In such a situation, when it jumps to an extreme scanner position immediately, this may cause damage to the galvos and/or mirrors.

The same is true during operation: when the connection has been interrupted (e.g. because the DB25 connector cable was removed), it is not recommended to simply plug it back in, as this may lead to hard jumps to extreme positions too. In this case it is also recommended to power down the whole system and put it back into operation as described above.



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