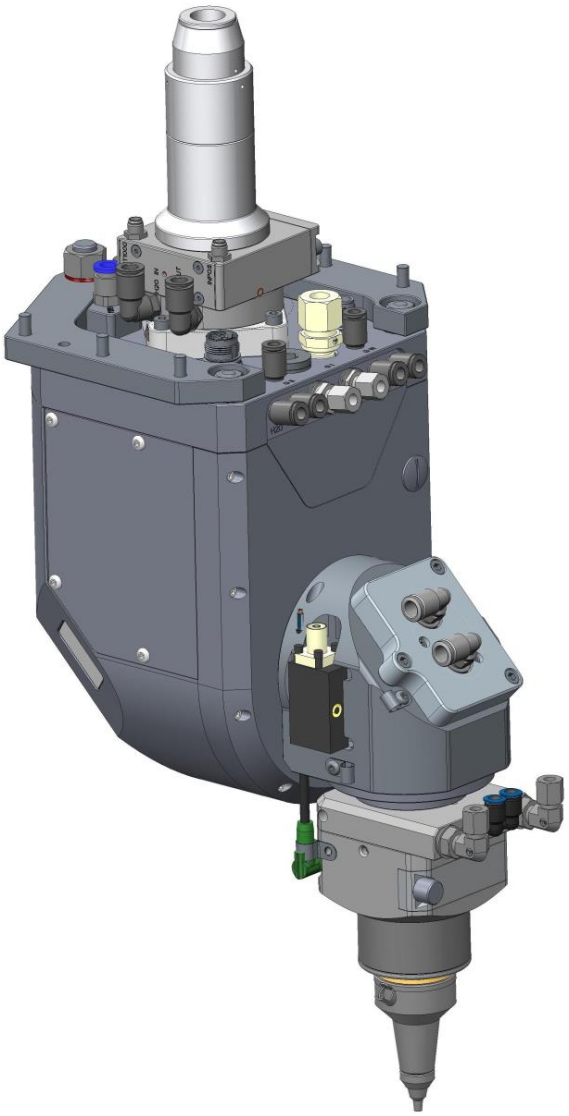
PRE-INFORMATION

SWIVEL HEAD
SH35T
for fiber laser



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CONTENT

1 GENERAL INFORMATION

1.1 Pre-information

This pre-information gives you an overview about the main functions and main components of our ***Swivel-axis Laser Head SH35T*** and describes the interfaces and needs to plan the integration into your laser machine.

1.2 Legal provisions

1.3 Use for intended purpose

The SH35T is a laser beam guidance product with one motorized swivel axis and has been designed and developed to be mounted in a fiber laser machine for laser cutting applications (λ = 1030-1080 nm), like cutting of tubes or profiles.

1.4 Product description

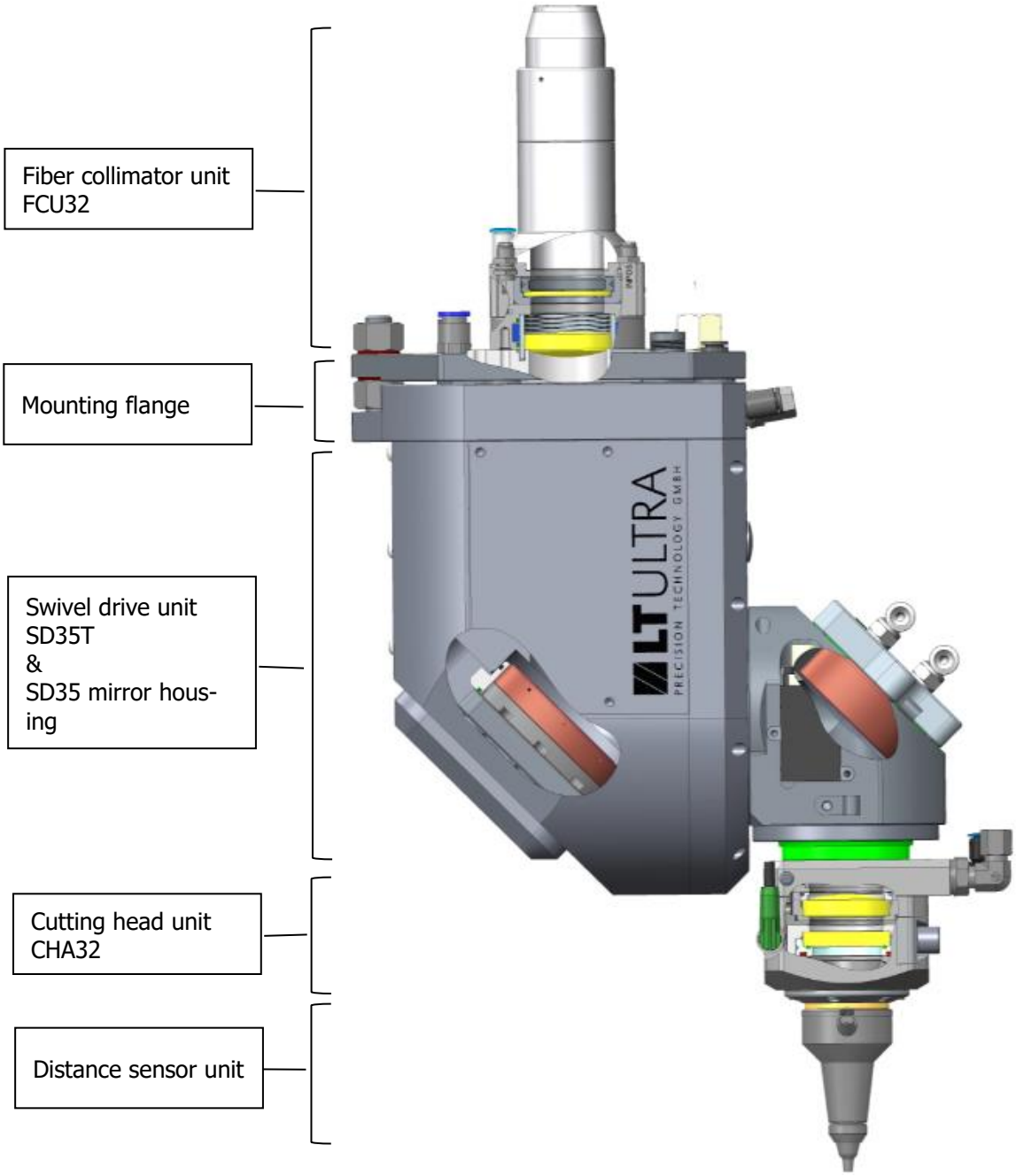
The SH35T laser head consists primarily of three main units made from LT-Ultra

- a ***collimator unit*** to collimate the expanded laser beam coming from the laser fiber
- a ***swivel-axis drive unit*** with a torque motor to swivel the cutting head unit in one vertical plane and two mirrors to guide and deform the collimated laser beam.
- a ***focusing unit*** to focus the laser beam for cutting applications

The laser head is prepared to mount a distance sensor system with M30 x 1 mm interface and pre-amplifier. Ask our sales department for this optional add-on part.

To set the focus position relative to the nozzle tip this laser head use an adaptive mirror (pneumatically deformable mirror) instead of a moved lens in the CHA cutting unit.

Water-cooled torque motor and laser head components enable the laser head to operate for high dynamic applications and high laser power.



SH35T laser head main units:

1.5 Axis designation

swivel axis = **A-axis**

1.6 Functional tests

All mechanical and electrical functions of this product have been tested at our Siemens SINUMERIK 840D SL test stand. These function tests include various positioning tests and an endurance test for some hours. The reports are attached to the delivery.

1.7 Data overview

Fiber connector mount	• QB or QD
Focusing lengths	• collimator FCU32: CL80, 100, 120 mm • cutting unit CHA32: FL120, 150, 200 mm
Focus movement range	• 10 up to 40 mm (depending on FL of CHA32)
Mechanical aperture	• 32 mm (limited by collimator and cutting unit)
Media connectors	• Water IN / OUT (cooling water / max. 6 bar) • GAS I (process gas / max. 25 bar) • GAS II (process gas / max. 10 bar) • GAS III (process gas / max. 10 bar) • BRAKE (gas / max. 8 bar) • AD/AM (gas adaptive mirror / max. 6 or 8 bar) • pressure sensors for GAS I and AM optional on request
Mirror optics	• FMU-E401 flat mirror unit (not adjustable) • AM-E501 adaptive mirror unit (adjustable)
Installation	• Horizontal (Levelling device ± 1,25°)
Swivel axis (A)	• swivel range: approx. ± 135° • max. speed: 120 1/min *) • max. acceleration: 30 1/s² *) • torque motor 230 V_{AC} • brake: pneumatic (min. 6 bar) • measuring system: absolute
Safety elements	• protection glass collimator • collision safety clutch • protection glass cutting unit
Water cooled elements	• torque motors (SS, anodized AL) • lens holders and mirrors (SS, CU) • housing parts (SS, anodized AL)
Weight	• ~14 kg
Storage temperature	• - 15° C to + 50° C, short time + 60°C (24h)
Environmental conditions	• temperature 10°C to + 45°C / humidity < 80%

2 LASER HEAD COMPONENTS

2.1 Fiber collimator unit FCU32

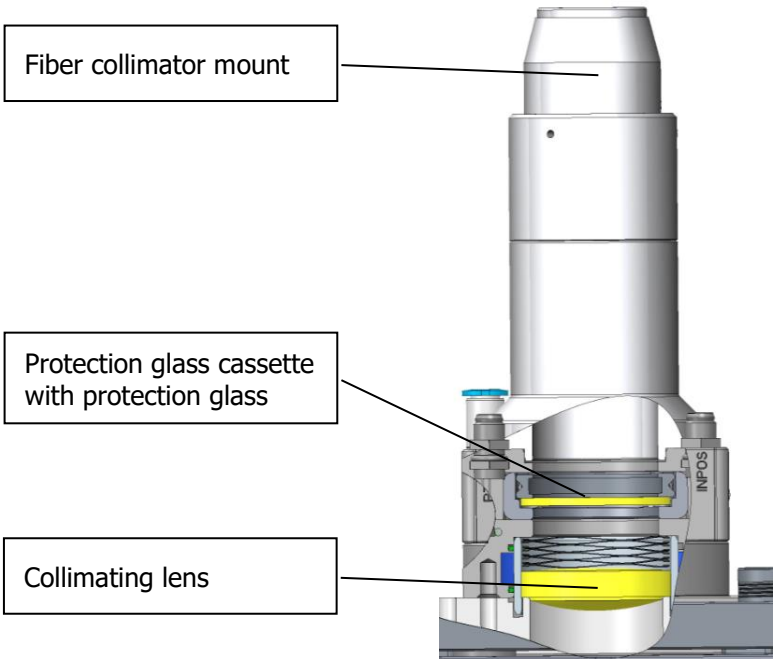
To connect your laser fiber with the laser head you can choose between a QB and a QD mount version. In the picture below, you see the common QB mount.

For best optical performance, we use an aspherical lens to collimate the laser beam. Depending on your laser application, you can choose between focal length 80, 100 or 120 mm. The maximum mechanical aperture of the beam path is 32 mm.

Between fiber mount and lens, is a protection glass (Ø 38 x 2 mm) which helps to avoid that particles or dust contaminates the collimating lens especially while plugging or unplugging the laser fiber. The protection glass is in a removable cassette to enable an easy visual check and change. An inductive sensor control if the cassette is in or not.

A PT1000 temperature sensor measure the temperature in the collimator housing.

The collimator is to connect to a water cooling circuit to cool the holder of the collimating lens. As all other water-cooled components of the laser head, the connection is in line, never parallel.



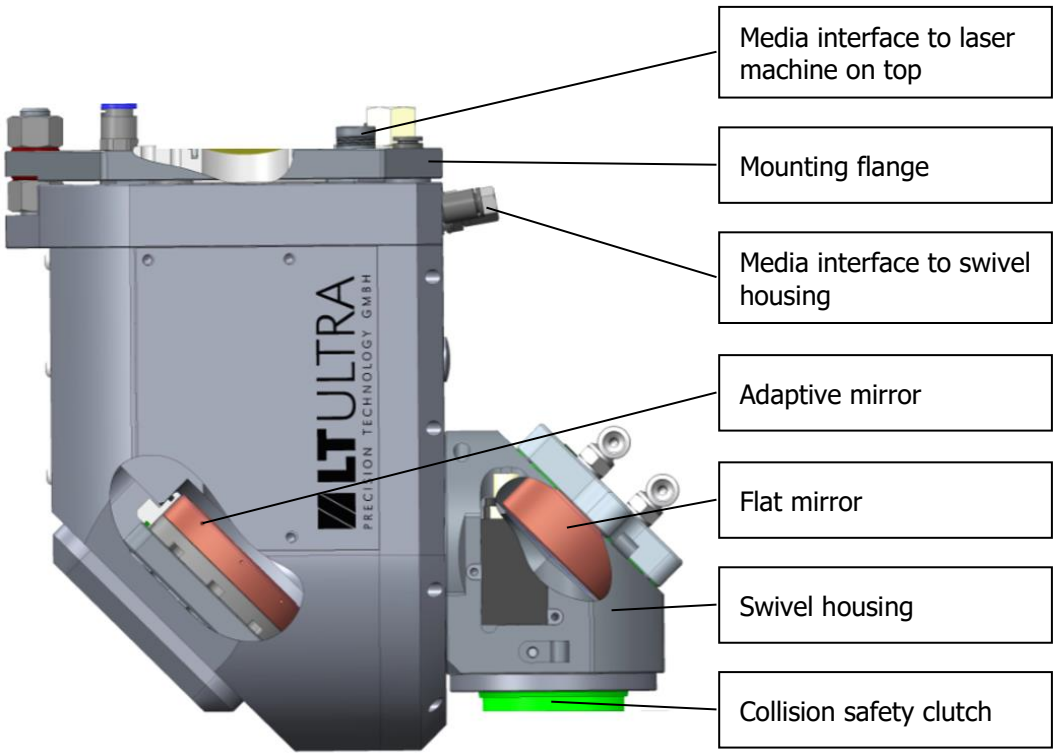
FCU32 collimator:

2.2 Swivel drive unit SD35T – A-axis

The mechanical interface to your laser machine is the mounting flange at the top of the SD35T housing. In the standard version, this flange is adjustable.

For the swivel drive, we use a modern, backlash-free, high performance torque motor technology, that assures good dynamics and high precision. The motor is water cooled and equipped with a KTY and PTC temperature sensor.

In the standard version, the swivel axis is equipped with a brake. To open the brake you need compressed air (cleaned according to FESTO valve specification) of minimum 6 bar.



SD35T swivel unit:

The adaptive mirror (AM) is mounted in the bottom of the SD35T unit. The mounting plate of the AM is adjustable.
The second mirror is the flat mirror. It´s mounted in the swivel housing in a fixed position with defined reference surfaces. Precisely manufactured mirror fixing points speed up the restart of your laser machine after a mirror change.
Both mirrors are water-cooled.

2.3 Collision safety clutch

The bottom interface flange of the swivel housing is designed as a collision safety clutch which reduce the risk that laser head and other laser machine components get damaged irreversible in case of a lateral or axial collision with the laser head tip.
In case of a lateral collision the CHA-unit can swing out some degrees in all directions or in case of an axial collision can move some less millimetres into the laser head. The newest collision clutch design has direct electrical contacts so that even the smallest tilting of the CHA-unit will interrupt the electrical line to your CNC immediately.
The clutch flange will move back automatically in the straight 0° position after the collision.

2.4 Adaptive mirror

With the adaptive mirror technology, you shift the focus position up and down pneumatically, while the lens is always in a fixed position. The pressurized rear of the adaptive mirror deform the mirror surface and shift the focus position in a defined way. The little variation of the beam diameter is normally not significant.
Lower pressure shift the focus up, higher pressure shift the focus down. The relationship between pressure and focus shift is nearly linear.
The total possible focus shift is limited by the focal length of the CHA32 unit. Typical values you see in the table below. This information is without considering mechanical and optical tolerances.

	max. pressure Adaptive Mirror (AM)	
Focal length CHA	6 bar	8 bar
120 mm	11 mm	15 mm
150 mm	18 mm	24 mm
200 mm	32 mm	44 mm

The focus shift range is separated in a “focus +” part (focus is positioned above the material like for an oxygen cut) and in a “focus -“ part (focus is positioned below the material surface like for a nitrogen high pressure cut).
If you use our longer adapter to mount the distance sensor or if you use your own longer cutting nozzles, you can customize the “focus +” part.

To complete the adaptive mirror technology we deliver a 6 bar or optional 8 bar high precision pneumatic servo valve.

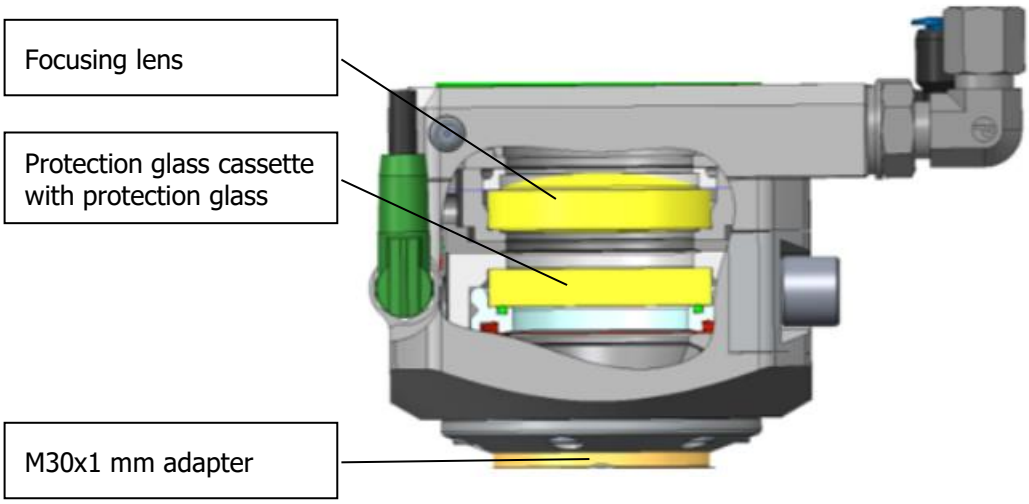
2.5 Cutting head unit CHA32

For best optical performance, we use an aspherical lens to focus the laser beam. Depending on your laser application, you can choose between focal length 120, 150 or 200 mm. The maximum mechanical aperture of the beam path is 32 mm.

The protection glass (Ø 1,5" x 0,250") below the lens has two functions. It seals the pressure chamber to the laser head and it protect the lens from sparks during the laser process. The protection glass is in a removable cassette to enable an easy visual check and change. An inductive sensor control if the cassette is in or not.

A PT1000 temperature sensor measure the temperature in the CHA housing.

The CHA unit is to connect in line (not parallel) to the cooling water circuit.



CHA32 cutting unit:

2.6 Distance sensor unit

The cutting head unit CHA has an M30x1 thread interface to mount for example a Precitec distance sensor system in KN or KS version. Such a system is an optional add-on part to complete the laser head.

Note! We refer to Precitec for service and all questions on functions and needs to use a Precitec distance sensor system in combination with your laser machine.

3 MOTOR DRIVE

3.1 Motor power supply

For this laser head construction, we use a ***3-phase synchronous frameless torque*** motor.
Requirement for CNC motor drive hardware: ***230 V_{AC} (300 V_{dc})***

3.2 Motor specifications – A-axis swivel drive

	Parameter	Remarks	Symbol	Unit	Torque Motor A-Axis 753577
Performance	Motor type Max. voltage ph-ph				**3-phase synchronous frameless Torque 230$V_{ac\ rms}$ (300V_{dc})**
	Peak Torque	motor temp. increase 6°C per second	T_p	Nm	13.1
	Continuous Torque		T_c	Nm	(10) *)
	Maximum speed	@T_c	n_{max}	rpm	(910) **)
	Motor Torque constant	up to I_c	K_t	Nm/A_{rms}	2.09
	Motor constant		K_m	$(Nm)_2$/W	0.344
Electrical	Peak Current		I_p	A_{rms}	7.31
	Maximum Continuous Current		I_c	A_{rms}	(4.77) *)
	Back EMF Phase-$Phase_{peak}$		K_e	V/krpm	179
	Back EMF Phase-$Phase_{RMS}$		K_e	V/krpm	126
	Coil Resistance per Phase	coils @ 25°C ex. cable	R	Ω	4.23
	Coil induction per Phase		L	mH	11.5
	Electrical Time Constant	coils @ 25°C	τ_e	ms	2.72
	Poles		N_{mgn}	nr	28 (= 14 pole pairs)
Thermal	Continuous Power Loss	coils @ 100°C	P_c	W	375
	Thermal Time Constant	up to 63% max. coil temp. (100°C)	τ_{th}	s	19
	Motor Temperature safety sensor				PTC 1kΩ sensor
	Motor temperature monitoring				modified KTY sensor

All specifications ±10%

**) @ 20°C motor temperature. For higher temperatures the continuous current and torque must be reduced.*

***) effective usable maximum speed is limited by laser head design*

3.3 Motor temperature sensors

The motor has two temperature sensors. A "***KTY"-sensor*** to observe and monitor the current motor temperature and a "***PTC"-sensor*** (1 kΩ) for an automatically power switch-off in case of impermissible motor temperature.

3.4 Measuring system

The axis of this laser head is equipped with an absolute angle encoder from Renishaw.
Type: ***RESOLUTE™ absolute encoder system with RESA rotary (angle) ring***

The read heads are available in different versions for different CNC systems.
For example:

- Siemens DRIVE-CLiQ FS
- BiSS-C
- Fanuc
- YASKAWA

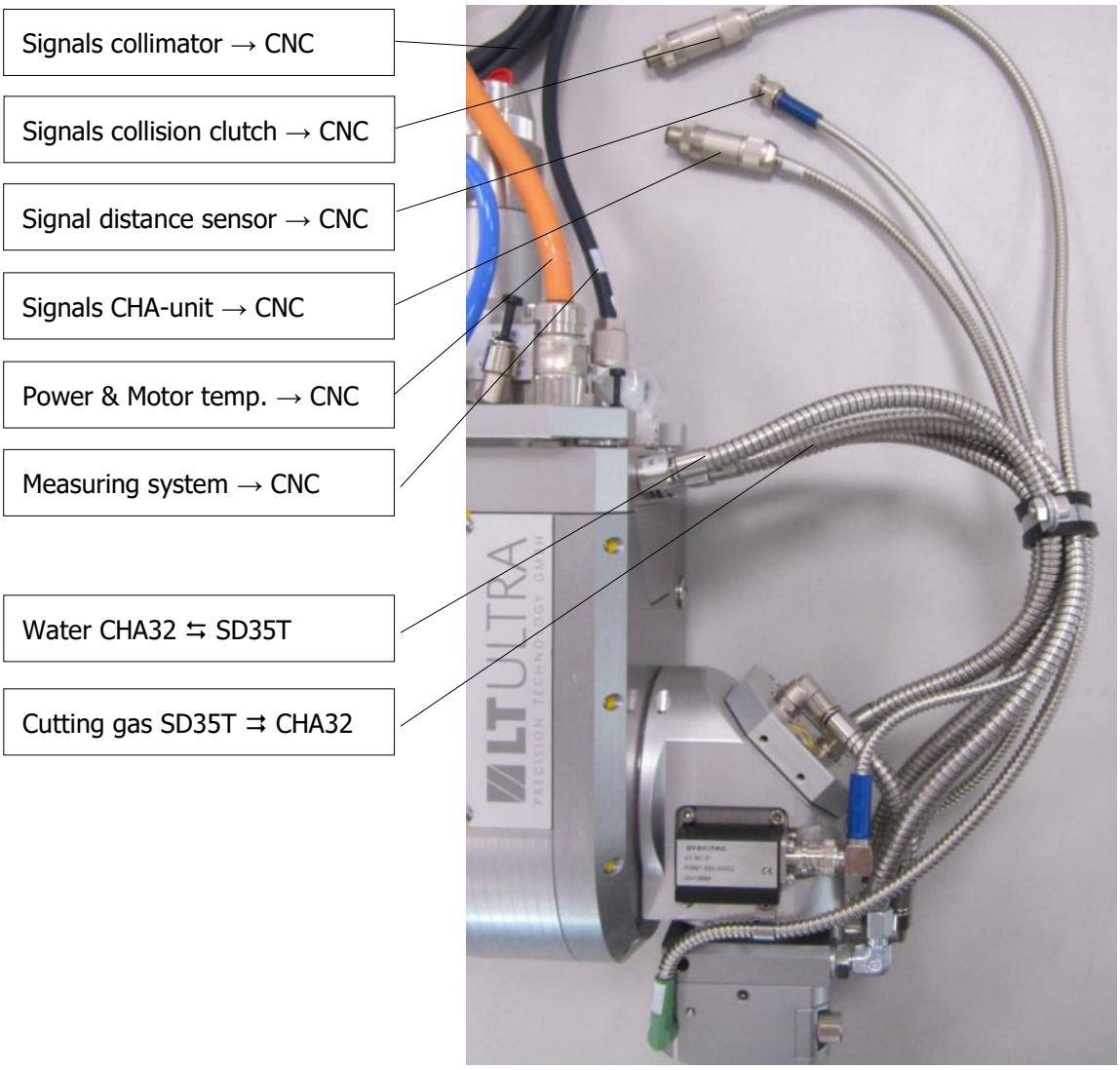
For more detailed information observe the data sheets on Renishaw homepage.

4 MEDIA INTERFACES

Media interface	Medium	Operating pressure *)	Specifications	Fitting
Water IN Water OUT	Cooling water	2 – 6 bar	observe information in the manual	Push-in Ø 8 mm
GAS I (cutting gas)	Process gas	≤ 25 bar		Bolting (G1/4")
G1/4”-thread (GAS I channel)	optional sensor	≤ 25 bar		Locking screw (G1/4")
GAS II (optional gas)	Process gas	≤ 10 bar		Push-in Ø 6 mm
GAS III (optional gas)	Process gas	≤ 10 bar		Push-in Ø 6 mm
BRAKE A-axis	Compressed air	6 – 8 bar		Push-in Ø 6 mm
AD (adaptive mirror)	Compressed air	≤ 8 bar		Push-in Ø 6 mm
G1/4”-thread (AD channel)	For optional sensor	≤ 8 bar		Locking screw (G1/4")
CLEAN GAS (optional)	Clean gas	~ 0.1 bar		Push-in Ø 6 mm

**) static pressure*

Overview gas and water connections:



Electrical cabling to CNC and media tubing at SH35T laser head:

Connector	Connectors at SH35T laser head	Connectors at lengthening cables for SH35T laser head
Quantity	POWER & Motor Temp. A-axis - interface to lengthening cables 1	POWER & Motor Temp. A-axis - interface to laser head 1
Example	Phoenix Contact ST-7EP1N8AH100S (M17-SPEEDCON)	Phoenix Contact ST-7ES1N8A8005S (M17-SPEEDCON)
Connector	MEASURING SYSTEM A-axis - interface to lengthening cables	MEASURING SYSTEM A-axis - interface to laser head
Quantity	1	1
Example	Phoenix Contact SACC-DSI-M12MS-8CON-M16 SH (M12-SPEEDCON)	Phoenix Contact SACC-FS-8QO-0,5 SH SCO (M12-SPEEDCON)
Connector	SIGNALS (collision clutch) - interface to lengthening cables	SIGNALS (collision clutch) - interface to laser head
Quantity	1	1
Example	Phoenix Contact SACC-E-M 8MS-5CON-M 8/0,5DN	Phoenix Contact SAC-5P- 1,5-115/M8 FRB

Connector	Connectors at lengthening cables for SH35T laser head
Quantity	POWER & Motor Temp. A-axis - interface to customer 1
Example	LAPP EPIC® POWER LS1 F6 3+PE+4 (M23)
Connector	MEASURING SYSTEM A-axis - interface to customer or Drive-CliQ-box
Quantity	1
Example	Phoenix Contact SACC-MS-8QO-0,5 SH SCO (M12-SPEEDCON)
Connector	SIGNALS (collision clutch) - interface to customer
Quantity	1
Example	Phoenix Contact SACC-M12MS-5SC SH DN (M12-SPEEDCON)

Electrical interfaces and cabling:

5 CONFIGURATION OVERVIEW

Fiber connector

*) QB: 232419
QD: 702624

Fiber collimator unit FCU32

*) Protection glass 2 mm: 211258
Lens CL 80 mm: 211203
*) Lens CL 100 mm: 211131
Lens CL 120 mm: 211195

A-axis Read head measuring system

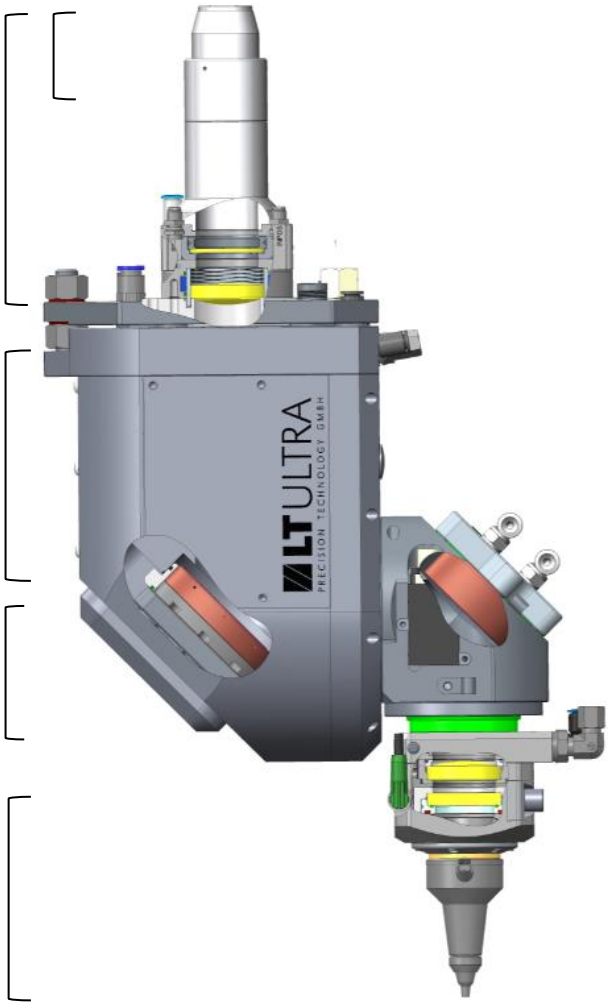
*) Siemens
Fanuc
*) Biss

Mirrors

*) Adaptive mirror: 211486
*) Flat mirror: 211572

Cutting head unit CHA32

Lens FL 120 mm: 211195
*) Lens FL 150 mm: 211132
Lens FL 200 mm: 211133
*) Protection glass 6,35 mm: 211525
*) Insulator M30x1 mm: 232279
Insulator 3 mm extended: 233211
distance sensor optional



*) *standard configuration*

6 INQUIRY TEMPLATE

Please send the completed sheet together with your inquiry to us.

Company:	
Contact Person / responsible for:	

Wished configuration:

	Fiber mount		Collimator FCU32			Focusing CHA32		
	QB	QD	80 mm	100 mm	120 mm	120 mm	150 mm	200 mm
1.								
2.								

Application:		
Focus shift range:	max. “focus +”:	max. “focus –“:

Laser:	Supplier / power:	Wave length:	BPP:
Cooling water temperature:	MIN:	MAX:	
CNC:	Supplier:	Type:	Motor drive module: O 230 O 420 Vac
Distance sensor:	O no sensor	O sensor:	

Comments: