PRE-INFORMATION

ROTARY SWIVEL LINEAR HEAD RSLH35T 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 ***Rotary-Swivel-Linear-axis Laser Head RSLH35T*** 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 RSLH35T is a laser beam guidance product with three motorized axis and has been designed and developed to be mounted in a fiber laser machine for 3D laser applications (λ = 1030-1080 nm), like cutting of deep-drawn parts or other three-dimensional profiles.

1.4 Product description

The RSLH35T laser head consists primarily of three main units made from LT-Ultra

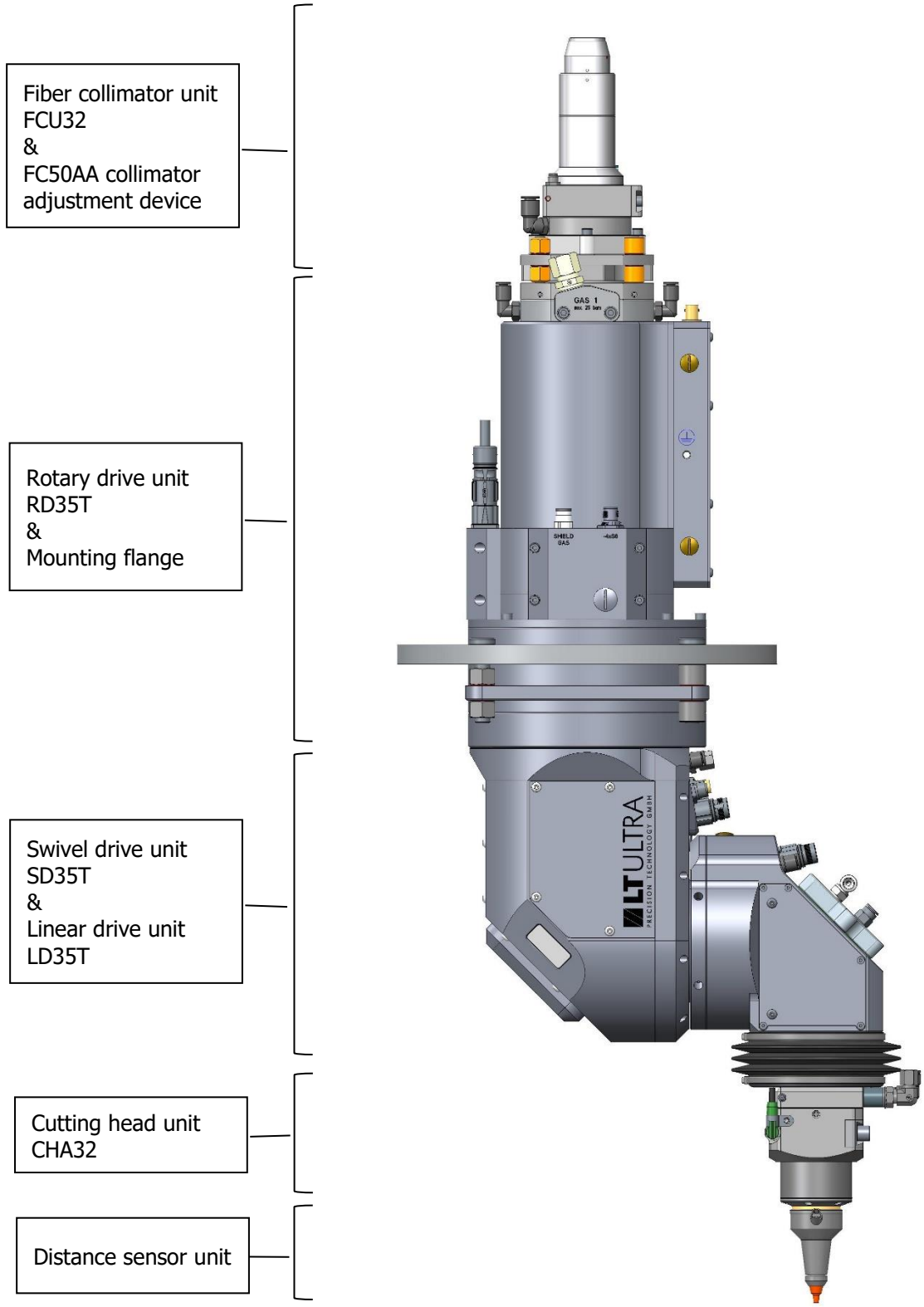
- a ***collimator*** unit to collimate the expanded laser light coming from the laser fiber
- a ***multi-axis drive*** unit with three torque motors to enable 3D movement, including a fast linear axis for compensatory movements, and two mirrors to guide the collimated laser light to the cutting unit
- a ***focusing*** unit to focus the laser light 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 we use an adaptive mirror (pneumatically deformable mirror) instead of a moved lens in the CHA cutting unit.

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

The linear axis drive is designed to enable a high dynamic distance regulation between work piece and laser cutting nozzle.



RSLH35T laser head (with optional distance sensor):

1.5 Axis designations

endless rotary axis = **C-axis**	swivel axis = **A-axis**	linear axis = **Z-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 Product training

We recommend attending a product training in our company before you make the first installation of one of our 3D laser heads. We focus out the main subjects of the operating manual and have the possibility to discuss customized subjects. This training will provide you practical and theoretical information for your work with the laser head.

1.8 Data overview

Fiber connector mount	• QB or QD
Focusing lengths	• collimator FCU32: CL 80, ***100 (standard)***, 120 mm • cutting unit CHA32: FL 120, ***150 (standard)***, 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) • LEAKAGE (feed-through inspection tube; ***always open***) • GAS I (gas line max. 25 bar) • GAS II (gas line max. 10 bar) • SHIELD GAS (optional use) • BRAKE (gas line max. 8 bar) • AD/AM (gas line max. 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°)
Rotary axis (C)	• rotation range: endless • max. speed: 120 1/min *) • max. acceleration: 20 1/s² *) • torque motor 420 V_{AC} • measuring system: absolute
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
Linear axis (Z)	• linear range: ± 10 mm • max. speed: 20 1/min *) • max. acceleration: >2.5 G *) • torque motor 230 V_{AC} • 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	• ~35 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

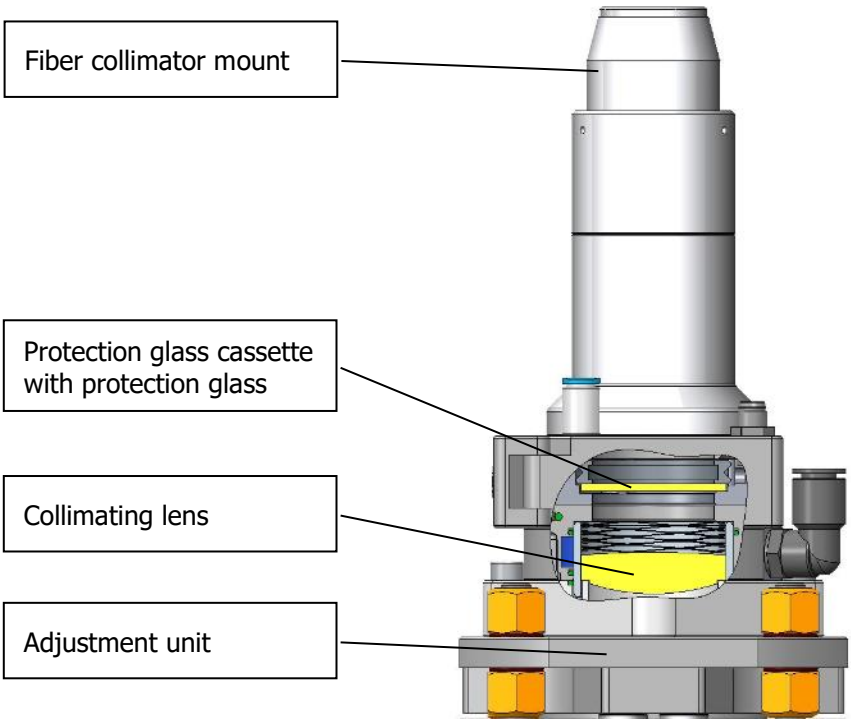
To connect your laser fiber with the laser head you can choose between a QB and a QD mount version. In the picture below, you see the common QB mount.

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 (QB) & FC50AA adjustment unit:

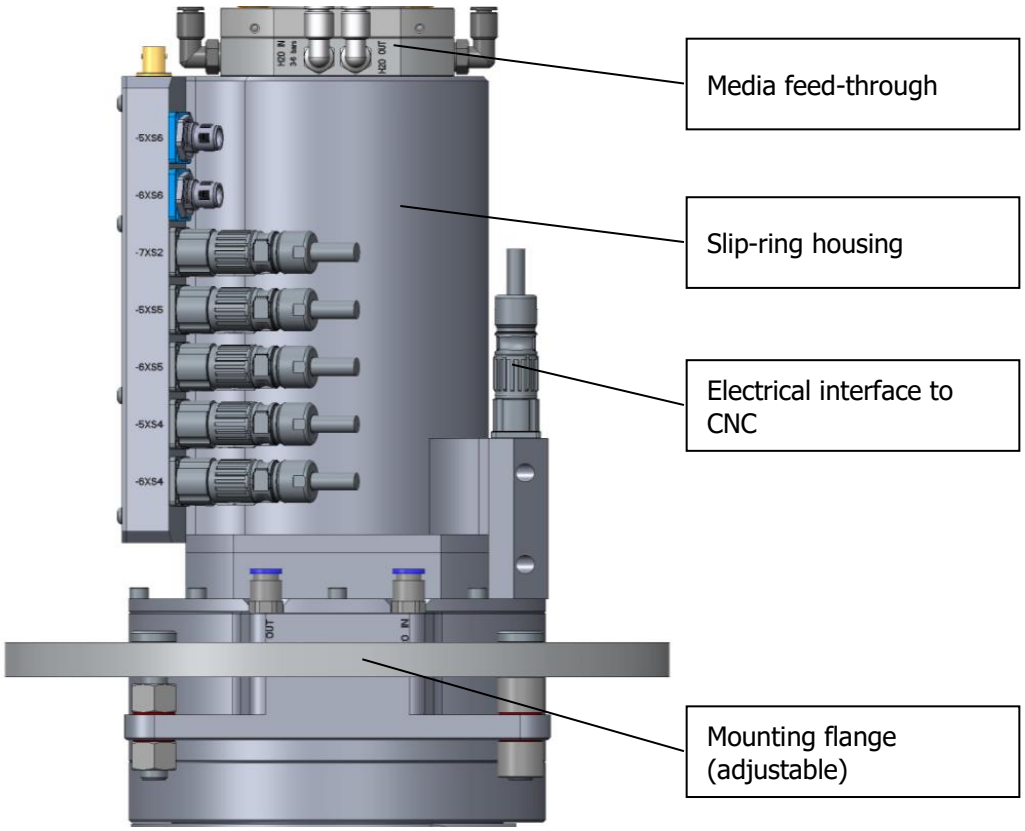
2.2 Adjustment unit FC50AA

This unit allows adjusting the collimator, respectively the laser beam in both main directions to the Rotary-C-axis. After fixing the screws, this unit hold the collimator in a defined and stiff way.

2.3 Rotary drive unit RD35T – C-axis

The mechanical interface to your laser machine is the mounting flange at the RD35T housing. In the standard version, this flange is adjustable.

For the rotary 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.



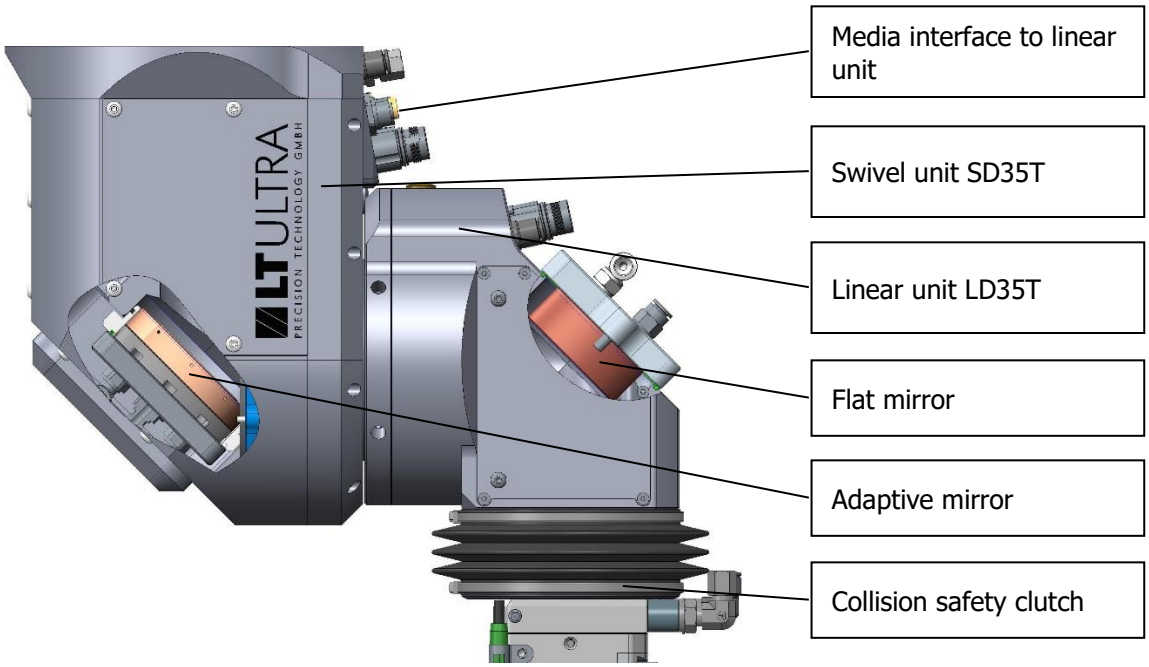
RD35T rotary unit:

To enable the RD35T unit to rotate endless, this unit contains a media feed-through and a slip-ring for all electrical lines from swivel and linear axis.

2.4 Swivel drive unit SD35T – A-axis

For the swivel drive, we use the same torque motor technology as for the rotary axis. 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 & LD35T linear 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.

2.5 Linear drive unit LD35T – Z-axis

For the linear drive, we use the same torque motor technology as for the rotary and swivel axis. The motor is water cooled and equipped with a KTY and PTC temperature sensor.

A tooth belt transforms the rotary in a linear movement.

2.6 Collision safety clutch

The bottom interface flange of the linear axis 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.

2.7 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.

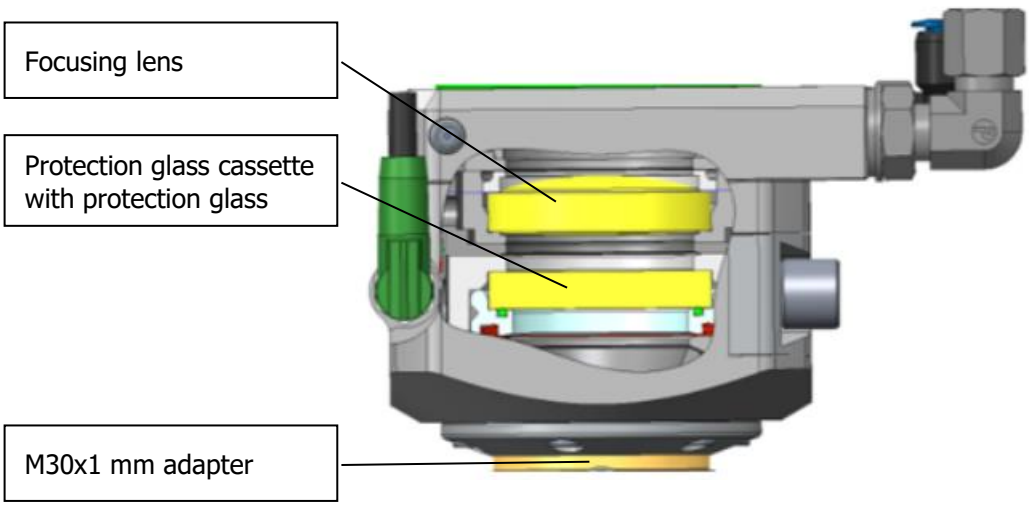
2.8 Cutting head unit CHA32

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:

2.9 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 DRIVES

3.1 Motor power supply

For this laser head construction, we use ***3-phase synchronous frameless torque*** motors. Note the different requirements for CNC motor drive hardware.

- Motor rotary C-axis: ***420 V_{AC} (600 V_{dc})***
- Motor swivel A-axis: ***230 V_{AC} (300 V_{dc})***
- Motor linear Z-axis: ***230 V_{AC} (300 V_{dc})***

3.2 Motor specifications – C-axis rotary drive

	Parameter	Remarks	Symbol	Unit	Torque Motor C-Axis 753319
Performance	Motor type Max. voltage ph-ph				**3-phase synchronous frameless Torque 420$V_{ac\ rms}$ (600V_{dc})**
	Peak Torque	motor temp. increase 6°C per second	T_p	Nm	58.3
	Continuous Torque		T_c	Nm	(36.3) *)
	Maximum speed	@T_c	n_{max}	rpm	(385) **)
	Motor Torque constant	up to I_c	K_t	Nm/A_{rms}	9.20
	Motor constant		K_m	$(Nm)_2/W$	2.29
Electrical	Peak Current		I_p	A_{rms}	7.4
	Maximum Continuous Current		I_c	A_{rms}	(3.95) *)
	Back EMF Phase-$Phase_{peak}$		K_e	V/krpm	787
	Back EMF Phase-$Phase_{RMS}$		K_e	V/krpm	556
	Coil Resistance per Phase	coils @ 25°C ex. cable	R	Ω	12.3
	Coil induction per Phase		L	mH	47.9
	Electrical Time Constant	coils @ 25°C	τ_e	ms	3.88
	Poles		N_{mgn}	nr	36 (= 18 pole pairs)
Thermal	Continuous Power Loss	coils @ 100°C	P_c	W	750
	Thermal Time Constant	up to 63% max. coil temp. (100°C)	τ_{th}	s	29
	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 specifications – A-axis swivel drive

	Parameter	Remarks	Sym bol	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*

3.4 Motor specifications – Z-axis linear drive

	Parameter	Remarks	Symbol	Unit	Torque Motor Z-Axis 753321
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	3.9
	Continuous Torque		T_c	Nm	(3.2) *)
	Maximum speed	@T_c	n_{max}	rpm	(3579) **)
	Motor Torque constant	up to I_c	K_t	Nm/A_{rms}	0.595
	Motor constant		K_m	$(Nm)_2/W$	0.061
Electrical	Peak Current		I_p	A_{rms}	7.56
	Maximum Continuous Current		I_c	A_{rms}	(5.34) *)
	Back EMF Phase-$Phase_{peak}$		K_e	V/krpm	51
	Back EMF Phase-$Phase_{RMS}$		K_e	V/krpm	36
	Coil Resistance per Phase	coils @ 25°C ex. cable	R	Ω	1.93
	Coil induction per Phase		L	mH	4.05
	Electrical Time Constant	coils @ 25°C	τ_e	ms	2.1
	Poles		N_{mgn}	nr	20 (= 10 pole pairs)
Thermal	Continuous Power Loss	coils @ 100°C	P_c	W	214
	Thermal Time Constant	up to 63% max. coil temp. (100°C)	τ_{th}	s	16
	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*

3.5 Motor temperature sensors

Each 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.

3.6 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

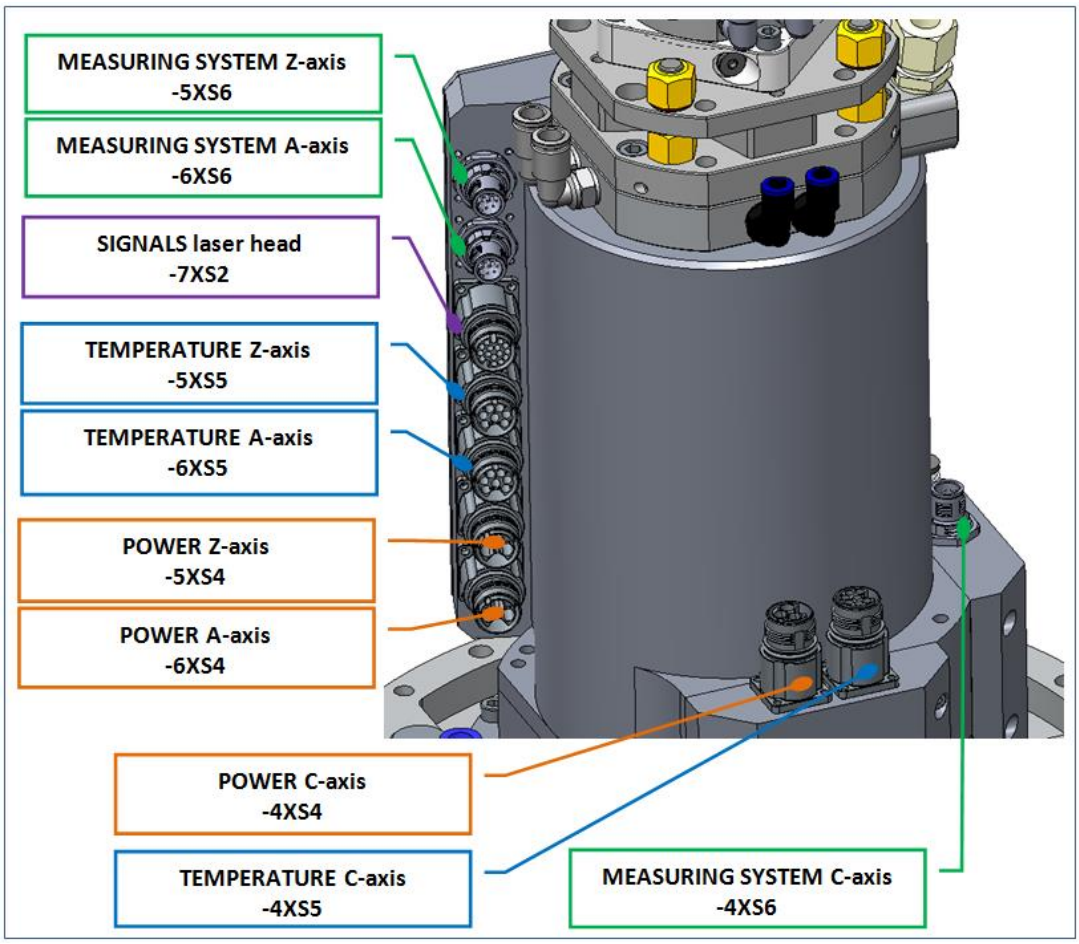
For more detailed information observe the data sheets on Renishaw homepage.

4 MEDIA INTERFACES

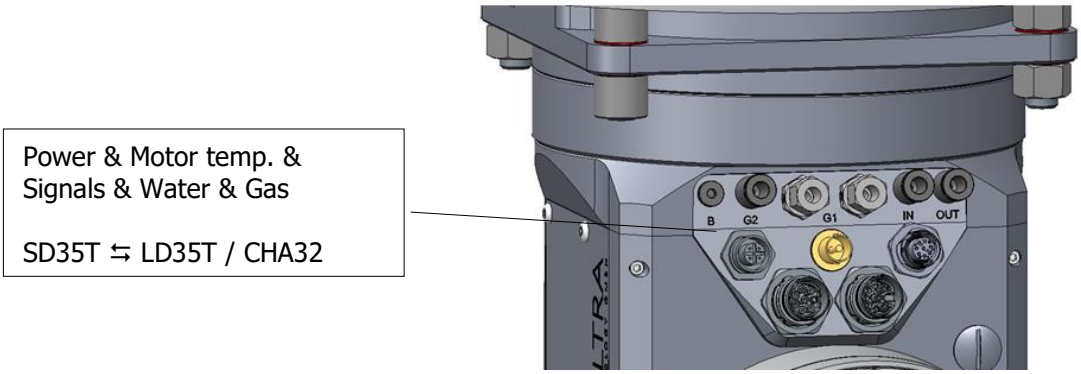
Media inter-face	Medium	Operating pressure *)	Specifications	Fitting
WATER IN WATER OUT	Cooling water	2 – 6 bar	observe information in the manual	Push-in Ø 8 mm
LEAK Feed-through	Cooling water leakage	open hose		Push-in Ø 6 mm
GAS I Cutting gas	Process gas	≤ 25 bar		Bolting (G1/4")
G1/4”-thread (channel GAS I)	For optional sensor	≤ 25 bar		Locking screw (G1/4")
GAS II (shield gas Z-axis)	Clean gas	< 1 bar		Push-in Ø 6 mm
BRAKE A-axis	Compressed air	6 – 8 bar		Push-in Ø 6 mm
AD/AM Adaptive mirror	Compressed air	≤ 8 bar		Push-in Ø 6 mm
CLEAN GAS Collimator (optional)	Clean gas	~ 0.1 bar		Push-in Ø 6 mm
SHIELD GAS (optional)	Clean gas	< 1 bar		Push-in Ø 6 mm

**) static pressure*

Overview gas and water connections:

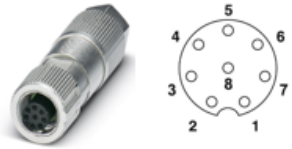
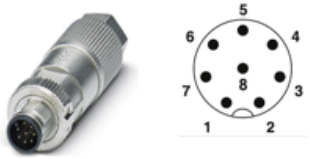


Electrical cabling to CNC:



Electrical cabling and media tubing to swivelled units:

Electrical interfaces and cabling:

	Connectors at RSLH35T laser head	Connectors at lengthening cables for RSLH35T laser head	
Connector	POWER C,A,Z-axis - interface to lengthening cables	POWER C / A,Z-axis - interface to laser head	POWER C,A,Z-axis - interface to customer
Quantity	3	3	3
Example	Phoenix Contact ST-3EP1N8AW400S (M17-SPEEDCON)	Phoenix Contact ST-3ES1N8A8K03S (M17-SPEEDCON)	LAPP EPIC® POWER LS1 F6 5+PE (M23)
			
Connector	TEMPERATUR C,A,Z-axis - interface to lengthening cables	TEMPERATUR C,A,Z-axis - interface to laser head	TEMPERATUR C,A,Z-axis - interface to customer
Quantity	3	3	3
Example	Phoenix Contact ST-6EP1N8AW400S (M17)	Phoenix Contact ST-6ES1N8A8004 (M17)	SIEMENS 6FX2003-0SA07 (M17)
			
Connector	MEASURING SYSTEM C,A,Z-axis - interface to lengthening cables	MEASURING SYSTEM C,A,Z-axis - interface to laser head	MEASURING SYSTEM C,A,Z-axis - interface to customer or Drive-CliQ-box
Quantity	3	3	3
Example	Phoenix Contact SACC-DSI-M12MS-8CON-M16 SH (M12-SEEDCON)	Phoenix Contact SACC-FS-8QO-0,5 SH SCO (M12-SEEDCON)	Phoenix Contact SACC-MS-8QO-0,5 SH SCO (M12-SEEDCON)
			
Connector	SIGNALS - interface to lengthening cables	SIGNALS - interface to laser head	SIGNALS - interface to customer
Quantity	1	1	1
Example	Phoenix Contact ST-17P1N8AWQ00S (M17-SEEDCON)	Phoenix Contact ST-17S1N8A8004S (M17-SEEDCON)	Phoenix Contact CA-17P1N8A9007 (M23)
			

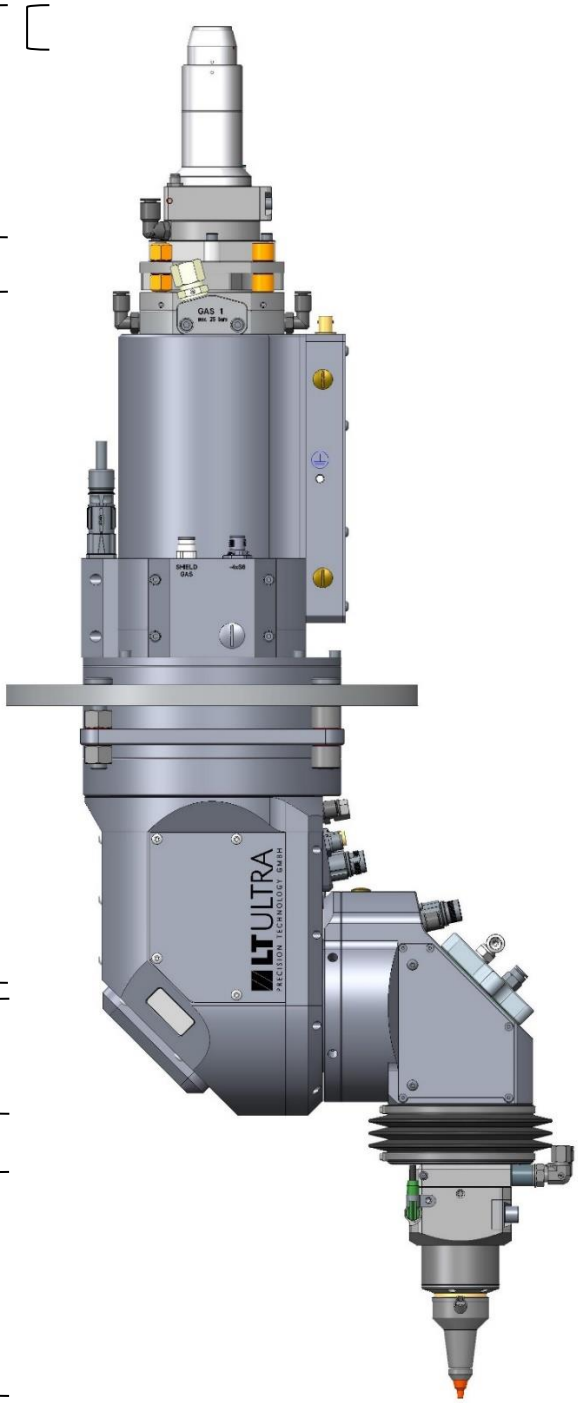
5 CONFIGURATION OVERVIEW

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



C-, A-, Z-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: