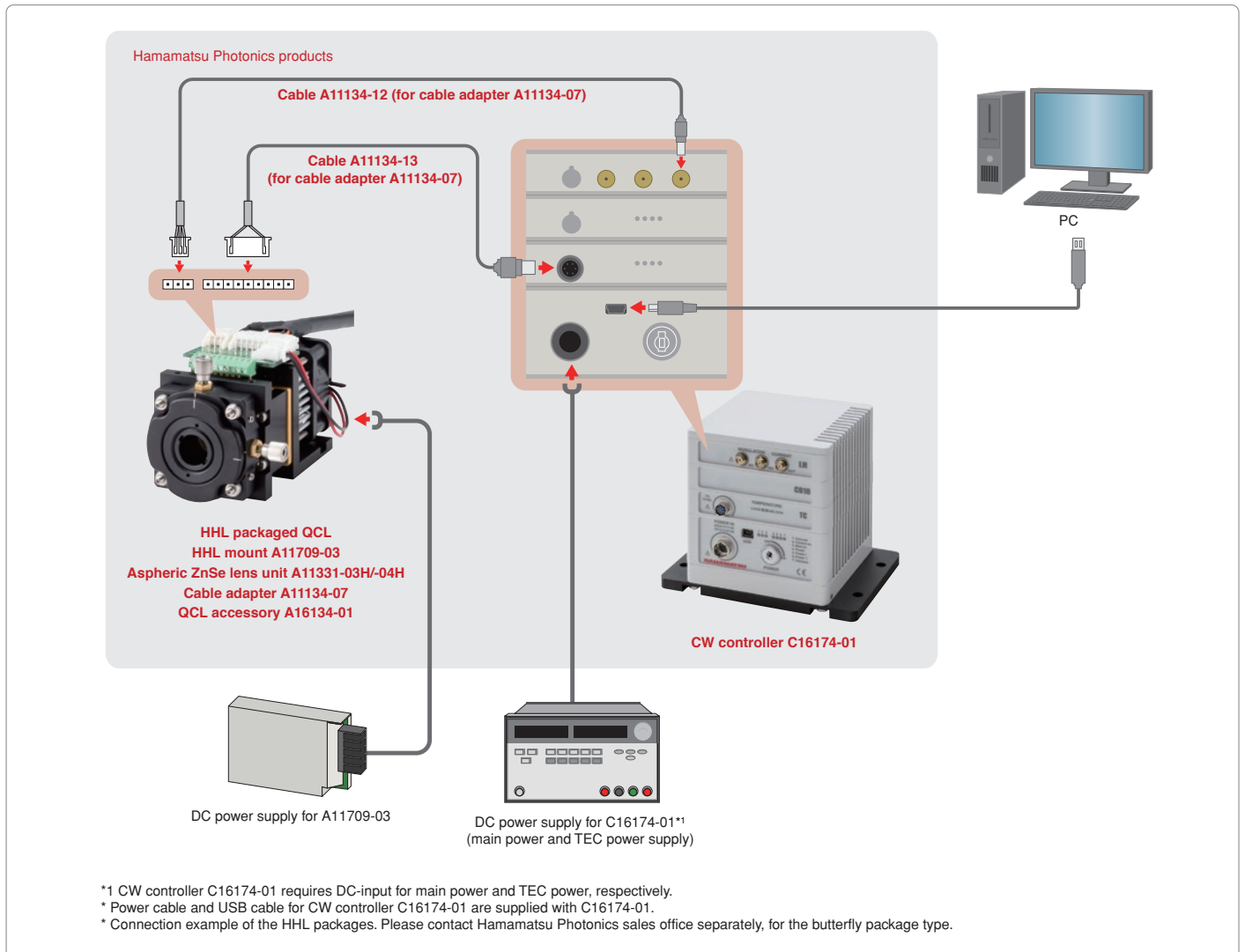


■ Accessories

● CW Controller	6	● Cable Adapter/Cable	8
● TEC Temperature Controller.....	6	● Lens/Lens Unit	12
● HHL Mount	8	● Thermal Viewing Cards.....	14



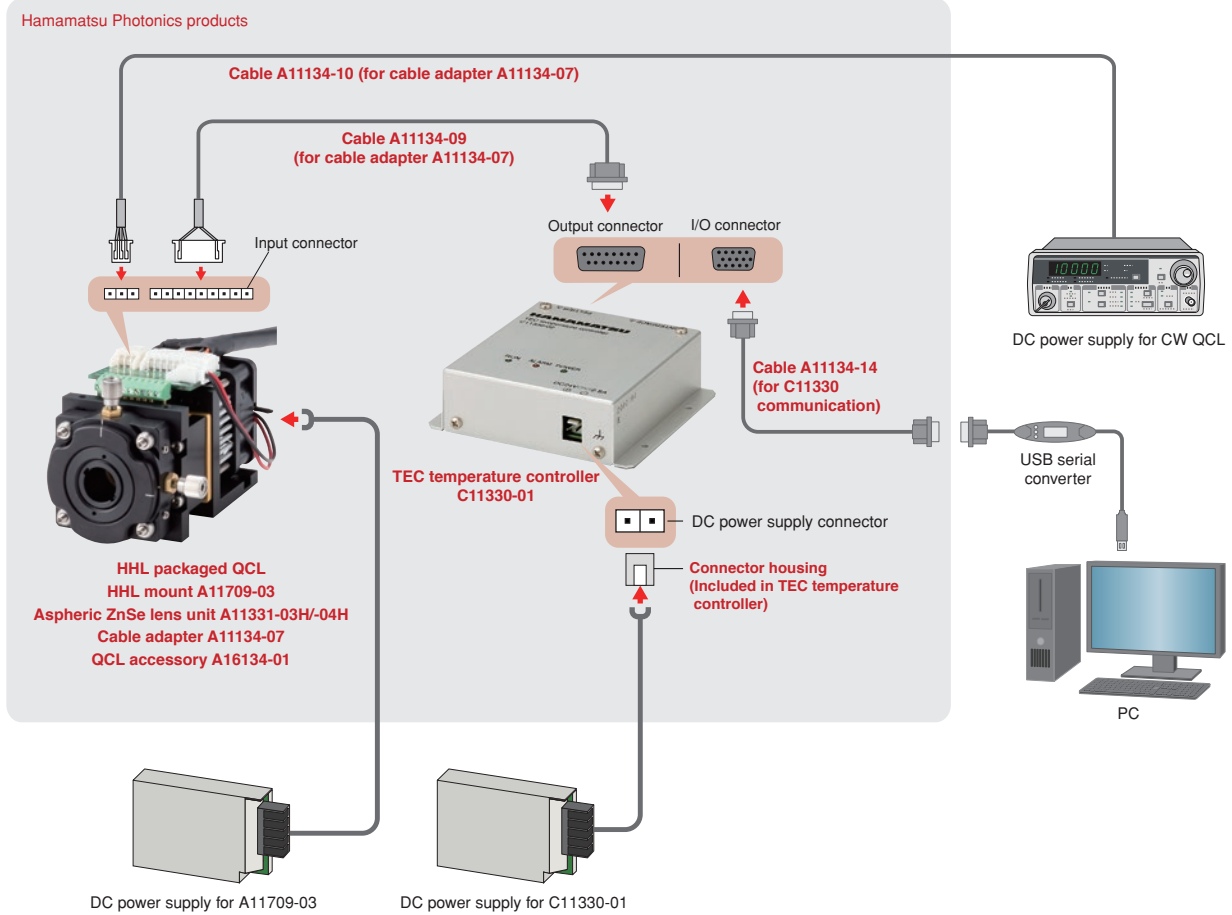
■ Components list

- CWQCL (HHL package type)
- CW controller C16174-01
- HHL mount A11709-03
- Aspheric ZnSe lens unit A11331-03H/-04H *1 *2
- QCL accessory A16134-01
- Cable adapter A11134-07
- Cable A11134-12
- Cable A11134-13

- TEC DC power supply for CW controller C16174-01 *3
- DC power supply for CW controller C16174-01 *3
- DC power supply for HHL mount A11709-03 *3
- PC *3

*1 Not required for the collimation lens built-in type QCL.
*2 Selection must be made according to the wavelength of laser.
*3 This is a drive device that needs to be prepared separately by the customer.
Please contact Hamamatsu Photonics sales office for the required performance.

Accessories for Quantum Cascade Lasers



* Connection example of the HHL packages. Please contact Hamamatsu Photonics sales office separately, for the butterfly package type.

■ Components list

- CWQCL (HHL package type)
- TEC temperature controller C11330-01
- HHL mount A11709-03
- Aspheric ZnSe lens unit A11331-03H/-04H *1 *2
- QCL accessory A16134-01
- Cable adapter A11134-07
- Cable A11134-09
- Cable A11134-10
- Cable A11134-14

- DC power supply for CWQCL *3
- DC power supply for TEC temperature controller C11330-01 *3
- DC power supply for HHL mount A11709-03 *3
- PC *3
- USB serial converter *3

*1 Not required for the collimation lens built-in type QCL.

*2 Selection must be made according to the wavelength of laser.

*3 This is a drive device that needs to be prepared separately by the customer.
Please contact Hamamatsu Photonics sales office for the required performance.

Accessories for Quantum Cascade Lasers

■ CW Controller C16174-01



Control unit for CWQCL. The outstanding low noise characteristic of CW controller contributes to improve the performance of laser spectroscopy.

■ Specifications

Parameter	Specification	Unit
Ambient operating temperature *1	-10 to +40	°C
Ambient storage temperature *1	-20 to +70	°C
Ambient operating relative humidity *1	30 to 60	%
Ambient storage relative humidity *1	20 to 80	%
Startup time	≤5 seconds	—
Usage location	Indoors, ≤2000 m	—
Dimensions (W × H × D)	100 × 120 × 140	mm
Weight	1.3	kg

*1 No condensation

■ Electrical characteristics

Parameter	Condition	Min.	Typ.	Max.	Unit
Current output *1	PS Las V = 24 V PS Las I = 3 A	0	—	960	mA
Resolution	—	1	—	—	mA
Noise current density *2	Noise frequency 100 Hz to 1 MHz	0.1	0.2	0.5	nA/√Hz
Ripple noise current *2	Noise frequency 10 Hz to 1 MHz	250	350	500	nArms
	Noise frequency 10 Hz to 100 kHz	50	100	200	
Compliance voltage	—	13.5	17.5	19	V
External modulation input voltage *3	—	-5	—	+5	V
External modulation bandwidth	-3 dB	—	—	2	MHz
External modulation input impedance	—	—	5	—	kΩ
Modulation gain 1 (IN 1)	—	—	20	—	mA/V
Modulation gain 2 (IN 2)	—	—	2	—	mA/V
TEC current	PS TEC I = 3 A PS TEC V = 12 V	—	—	±3	A
TEC compliance voltage		—	—	20	V
Temperature control stability *2	—	—	1	3	mK
Temperature sensor	Thermistor (NTC)	—	10	—	kΩ

*1 Use the CW controller within a range the absolute maximum rating of CWQCL.

*2 60 minutes warm-up time is required.

*3 External modulation input must be connected in a floating state isolated from any other circuits including peripheral devices.

* Ambient operating temperature $T_{op}=20$ °C, unless otherwise noted.

Accessories for Quantum Cascade Lasers

■Recommended operating conditions

Parameter		Symbol	Specification	Unit
Main power *1	Input voltage	PS Las V	DC24	V
	Input current	PS Las I	3	A
TEC power *1	Input voltage	PS TEC V	DC12	V
	Input current	PS TEC I	3	A
Ambient operating temperature *2		T _{op}	0 to +30	°C

*1 Floating output

*2 No condensation

■Contained items

Items	Quantity
Power cable (1.5 m)	1
USB cable (1.5 m)	1
Sample software (USB)	1
Instruction manual	1

■Required items

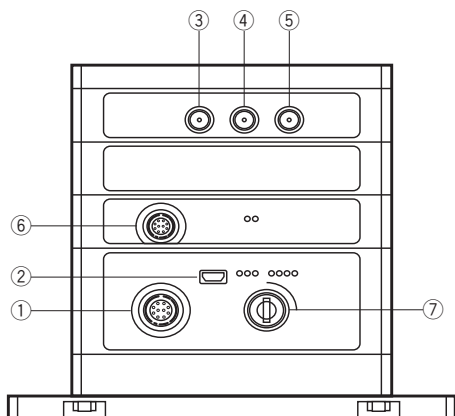
Items	Required specification	Recommendation
DC power supply for main power	DC power supply with floating output Output voltage: 24 V, Current capacity: 3.0 A Ripple: ≤ 3 mVrms	Recommendation ① Dual channel output DC source: RS components, RS PRO IPS3303
DC power supply for TEC power	DC power supply with floating output Output voltage: 12 V, Current capacity: 3.0 A Ripple: ≤ 3 mVrms	Recommendation ② Single channel output DC source *1: Keysight technologies, U8001A
Control PC	Windows10 (32 bit, 64 bit)	—
Voltage source for external modulation input *2	Voltage range: $\geq \pm 5$ V Bandwidth: ≥ 2 MHz	—

*1 Requires two single output DC power supplies.

*2 Required only when CWQCL is modulated.

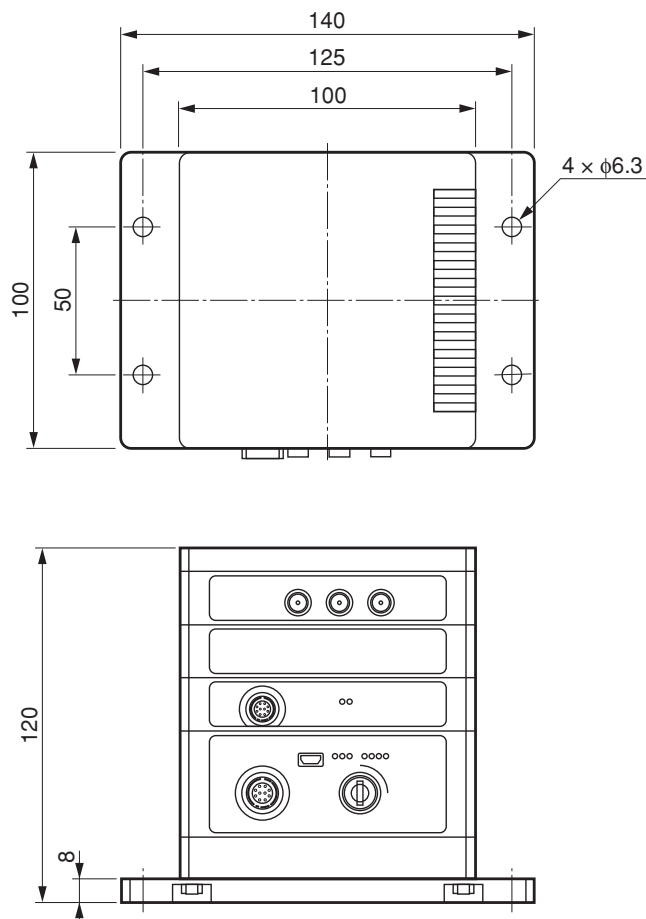
Accessories for Quantum Cascade Lasers

Figure 1: Function per connectors



No.	Name	Connector type	Function and description
①	POWER IN	HR10A-10R-10P (73) HIROSE ELECTRIC CO, LTD.	Input connector for main power and TEC power. A power cable would come with the product.
②	USB	Mini USB type-B	Connector for the communication with PC. A USB cable would come with the product.
③	MODULATION IN 1	SMA	Connector for the external modulation input. The cables have to be prepared by the user separately.
④	MODULATION IN 2		
⑤	CURRENT OUT	SMA	Connector for current output to CWQCL. A cable have to be prepared by the user separately. Recommended cable: A11134-12
⑥	TC CONTROL	HR10A-7R-6S (73) HIROSE ELECTRIC CO, LTD.	Connector for current output to TEC. A cable have to be prepared by the user separately. Recommended cable: A11134-13
⑦	POWER (KEY)	—	Key switch for supplying power to CW controller.

Figure 2: Dimensions (unit: mm)



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Accessories for Quantum Cascade Lasers

TEC Temperature Controller C11330 series



Peltier (TEC: thermoelectric cooler) driver is used to control QCL temperature with high accuracy and high stability. Designed to be built into an instrument.

Specifications

Parameter		C11330-01	C11330-02
Applicable product		CWQCL	Wavelength swept pulsed QCL
TEC output *1	TEC control current	-8.0 A to +8.0 A	-1.9 A to +1.9 A
	Compliance voltage	24 V	
DC power supply (DC)	Input voltage	24 V	
	Input current (Max.)	8.0 A *2	2.6 A *2
Temperature sensor *3	Thermistor	NTC, 2 lines	
	RTD sensor	3 line platinum temperature measurement resistance (Pt100)	
Temperature control	Temperature control range	-50 °C to +125 °C	-50 °C to +150 °C
	Temperature stability (Typ.)	0.01 °C	
	Control algorithm	Digital PID loop *4	
General	Host interface	RS-232C, RS-422	
	Operating ambient temperature *5	0 °C to +40 °C *6	
	Storage ambient temperature	-5 °C to +60 °C *6	
	Dimensions (W × H × D)	100 mm × 110 mm × 33 mm (except for protruding portion)	
	Weight	0.3 kg	

*1 Actual output depends on characteristics of the connected load (TEC module), and input power supply voltage and current.

*2 Required input current depends on the capacity of the connected load (TEC module). When using C11330-01, required output current of power supply (DC 24 V) is more than 4.0 A, and using C11330-02, more than 2.0 A is needed.

*3 Thermistor and Pt100 cannot be used simultaneously; select one of them.

*4 Auto-tuning function can be set by the host controller (PC).

*5 A heatsink may be required for this TEC temperature controller during high output operation.

*6 No condensation.

* External DC power supply (DC 24V), power cable, communication cable A11134-14 and host controller (PC) are separately needed.

* This product can only be controlled via serial communication.

* When controlling through a PC which does not have any ports or terminal emulators for serial communication, use an USB serial converter of Hamamatsu's recommendation (Windows 7 or later).

* Supplied with sample software. (Windows XP, 7 or later).

Accessories for Quantum Cascade Lasers

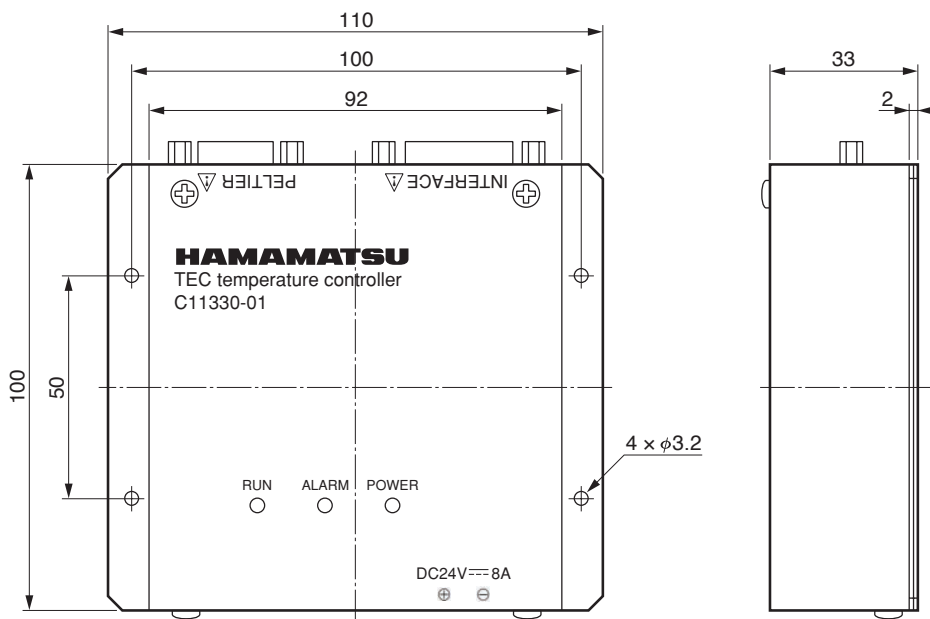
■Connector

Connector	Type of connector	Description
Power connector *1	VHR-2R / JST	Connecting to DC power supply
Output connector (PELTIER)	D-sub 15pin (female)	Connecting to Peltier (TEC) and/or Thermistor
I/O connector (INTERFACE)	High density D-sub 15 pin (female)	Connecting to host controller like a PC

*1 Housing matched to connector, and contact are supplied with C11330 series. Connect shield of power cable to frame terminal.

* Contact with hamamatsu sales as for pin assignment.

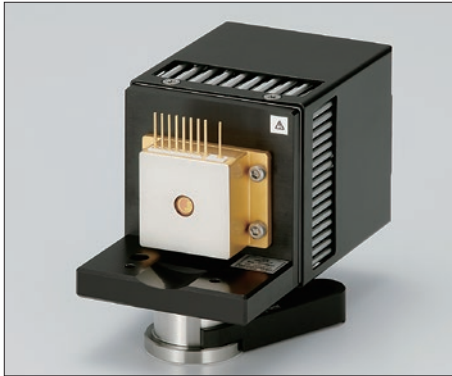
Figure 3: Dimensions (unit: mm)



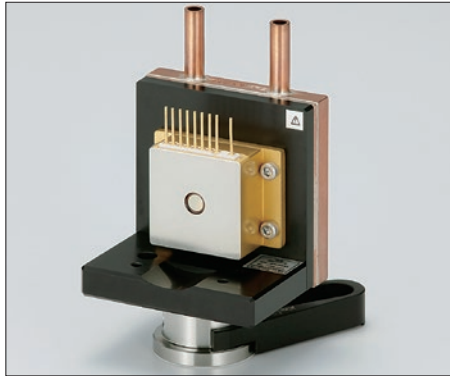
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Accessories for Quantum Cascade Lasers

■HHL Mount A11709 series



A11709-01 Forced air cooling



A11709-02 Water cooling



A11709-03 Forced air cooling

Cooling unit for HHL packaged QCL. Two types of cooling, forced air and water, are available. An aspheric ZnSe lens unit A11331-0xH can be mounted.

■Specifications

Parameter	A11709-01	A11709-02	A11709-03
Cooling method	Forced air cooling	Water cooling	Forced air cooling
Maximum heat discharge power	Approx. 30 W *1	Approx. 50 W *2	Approx. 15 W
Thermal resistance	Approx. 0.5 °C/W *1	Approx. 0.3 °C/W *2	0.3 °C/W
Operating temperature	0 °C to +40 °C		-20 °C to +60 °C
Dimensions (W × H × D)	68 mm × 82 mm × 117 mm	60 mm × 103 mm × 50 mm	46 mm × 46 mm × 49.5 mm
Weight	0.5 kg	0.52 kg	0.13 kg

*1 DC fan speed should be 7600 min⁻¹ at ambient temperature 25 °C.

*2 Necessary flow and water temperature: 2000 cc/min at 20 °C.

●A11709-01

Absolute maximum current	Operating voltage	Rotation speed	Maximum air generation	Maximum static pressure	Sound pressure level
0.47 A	10.8 V to 12.0 V	7600 min ⁻¹	1.05 m ³ /min	155.0 Pa	44 dB[A]

* Power supply for DC fan of forced air cooling mount is user-supplied.

●A11709-02

Refrigerant	Maximum flow rate	Recommended flow rate	Dimensions of I/O pipes	Material
Water	5000 cc/min	2000 cc/min	φ6.35 mm	Copper

* Do not use corrosive refrigerant. It is recommended to use chiller which has water cooling function in water circulation.

●A11709-03

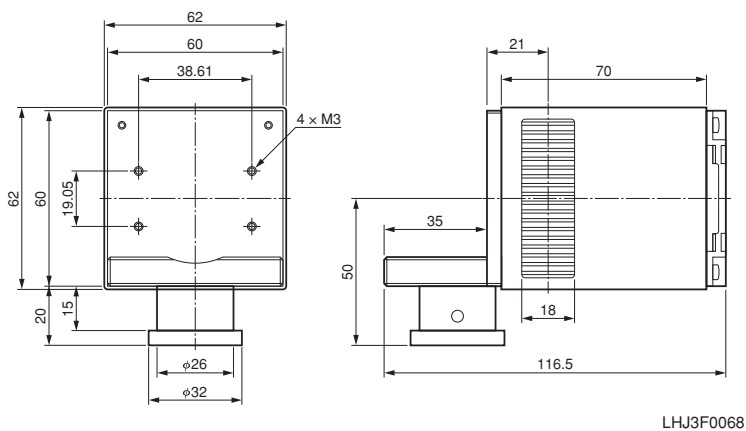
Maximum rated current	Rated voltage	Power connector	Power leads, length
0.07 A	DC12 V	HXP-2 (JST)	Red: +, Black: -, 0.1 m

* DC power supply for the air cooling fan would not come with A11709-03.

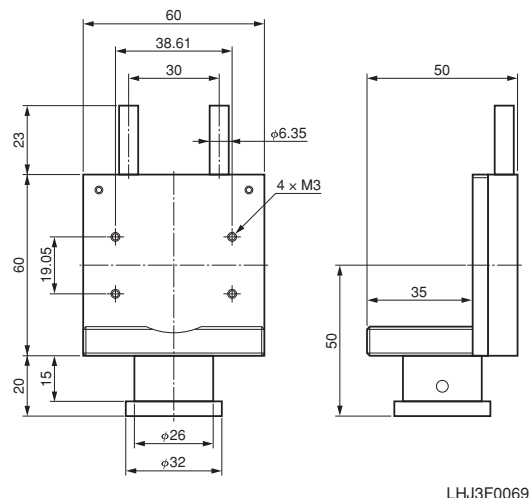
Accessories for Quantum Cascade Lasers

Figure 4: Dimensions (unit: mm)

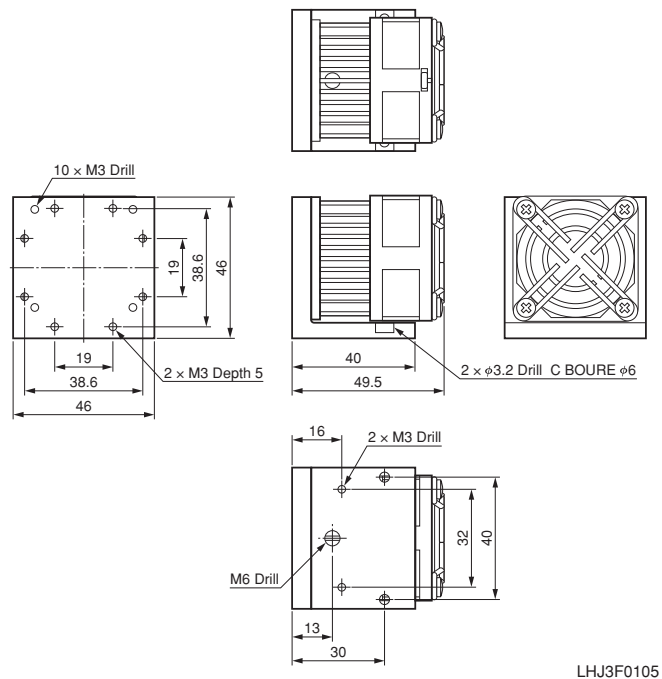
●A11709-01



●A11709-02



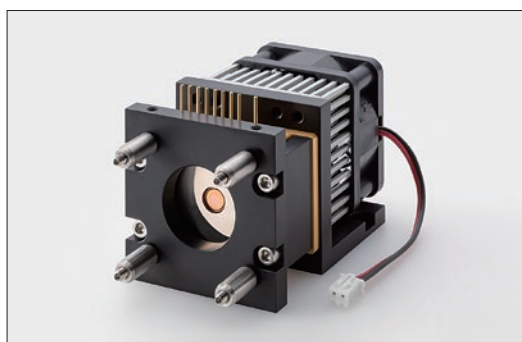
●A11709-03



■Applicable lens units

HHL mount	A11709-01/-02	A11709-03 *1
Aspheric ZnSe lens unit	A11331-01H/-02H	A11331-03H/-04H

*1 QCL accessory A16134-01 is required to mount Aspheric ZnSe lens unit.



A11709-03 with QCL accessory A16134-01

■ Lens / Lens Unit

●Aspheric ZnSe Lens A11331-0x



●Aspheric ZnSe Lens Unit A11331-0xH



Aspheric ZnSe lens designed for QCLs can be installed into lens unit A11331-0xH. The A11331-0xH series can be mounted onto HHL mount A11709 series. The A11331-0x series can also be used solely. Lens unit A11331-0xH supplied with an lens.

■Specifications

Parameter	Symbol	A11331-01/-01H/-03H	A11331-02/-02H/-04H
Primary designed wavelength *1	λ	8 μm	5 μm
Numerical aperture (NA)	NA	0.78	
Actual focal distance	EFL	4.8 mm	
Material	—	ZnSe	
Refractive index	n	2.417 at 8 μm	2.429 at 5 μm
AR coating	—	BBAR, T (ave)>97 % *2	BBAR, T (ave)>96 % *3
Weight	—	5 g	

*1 Choose either A11331-01 or -02 in accordance with wavelength of QCL.

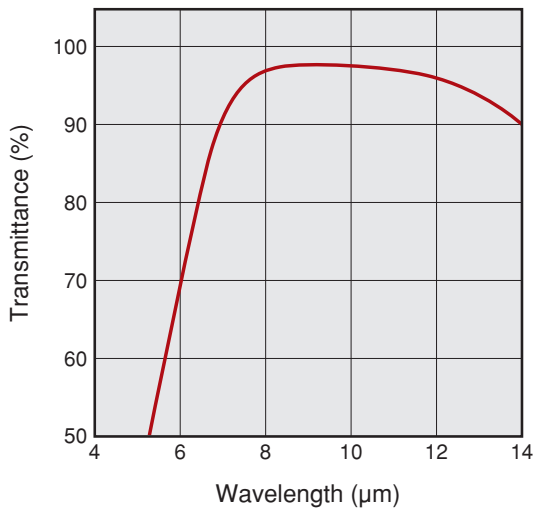
*2 $T_{(ave)}$: Average transmittance in wavelength between 8 μm and 12 μm .

*3 $T_{(ave)}$: Average transmittance in wavelength between 4 μm and 8 μm .

Figure 5: Wavelength transmissivity properties

●A11331-01/-01H/-03H

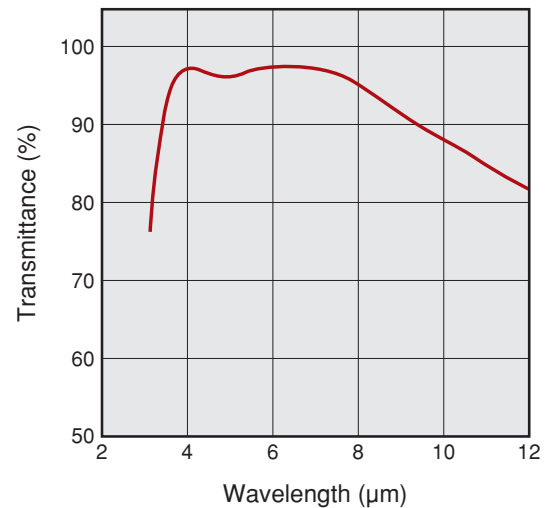
BBAR/8 μm to 12 μm



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●A11331-02/-02H/-04H

BBAR/4 μm to 8 μm

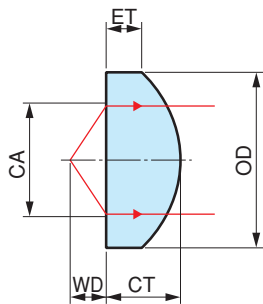


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Accessories for Quantum Cascade Lasers

Figure 6: Dimensions (unit: mm)

●Aspheric ZnSe lens (A11331-0x)

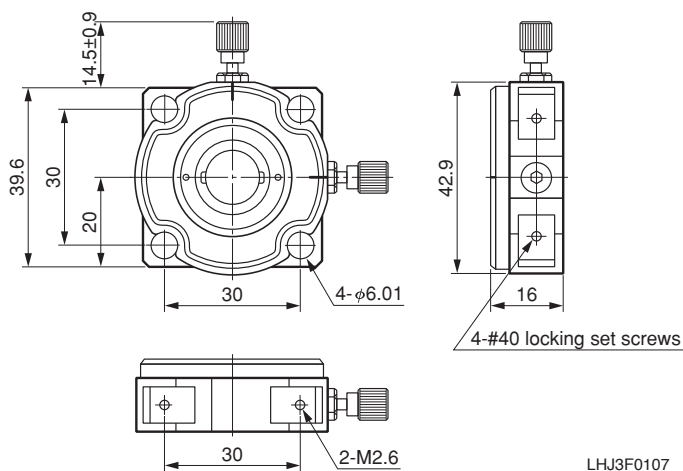


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Parameter	Symbol	A11331-01	A11331-02
Effective diameter	CA	10 mm	
Working distance	WD	3.0 mm	
Periphery	OD	14.9 mm to 15.0 mm	
Center thickness	CT	6.4 mm ± 0.2 mm	6.3 mm ± 0.2 mm
Edge thickness	ET	3 mm	

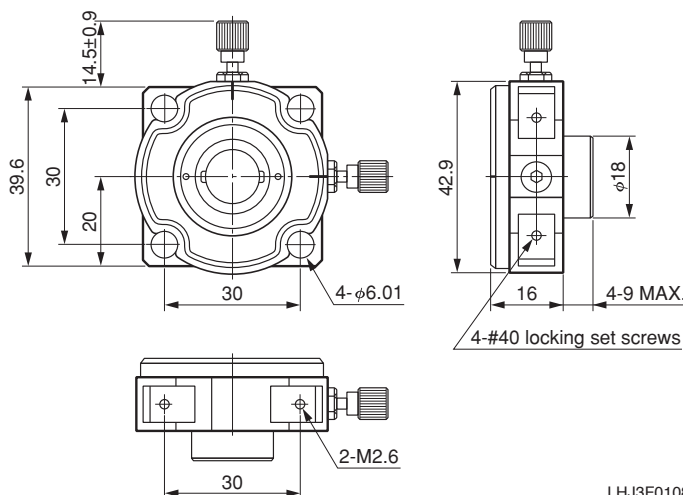
* ZnSe Aspheric lens unit is composed of lens mounting unit and XYZ translator.

●Aspheric ZnSe lens unit (A11331-01H/-02H)



LHJ3F0107

●Aspheric ZnSe lens unit (A11331-03H/-04H)



LHJ3F0108

Accessories for Quantum Cascade Lasers

■ Connection example with A11709 series



A11331-01H/-02H with A11709-01



A11331-01H/-02H with A11709-02



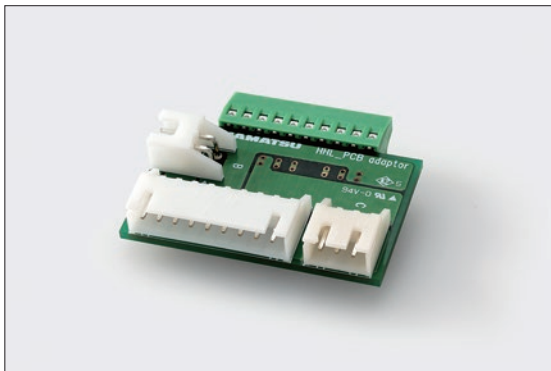
A11331-03H/-04H with A11709-03
and A11134-07

* QCL accessory A16134-01 is required to
mount them.

Accessories for Quantum Cascade Lasers

■ Cable adapter / Cable

● Cable Adapter A11134-07 (for HHL)

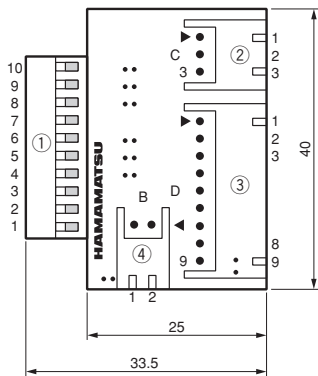


Cable adapter is exclusively used for HHL packaged QCL. QCL and its peripheral equipment are connected by cable adapter and cables A11134-08/-09, -10/-11.



Connection example with A11134-08(-09) and -10(-11)

Figure 7: Dimensions and connector (unit: mm)



Connector

Connector No.	Name	Type No. (Manufacture)
①	HHL terminal	1725737 (PHOENIX CONTACT GmbH & Co. KG)
②	QCL connector	S3BHX-A (J.S.T.MFG.CO.,LTD.)
③	TEC connector	S9BHX-A (J.S.T.MFG.CO.,LTD.)
④	DCFAN connector	S2BHX-A (J.S.T.MFG.CO.,LTD.)

■ Pin layout

Connected items	Pin No.	Connector	Connector No.	Pin No.	Connected cable	A11134-08/-09, -10/-11		
						Pin No. of connected cable	Color of cable	Function
HHL packaged QCL	10	①	②	1	A11134-10 or A11134-11	NC	—	—
	9	①		2		Signal line	—	QCL Anode (+)
	8	①		3	GND	—	QCL Cathode (-)	
	7	①	③	1	A11134-08 or A11134-09	10, 11	Orange/Black	TEC-
	6	①		2		8	Green	Frame grand
	5	①		3		15	Yellow/Black	Thermistor (sensor)
	4	①		4		7	Yellow	Thermistor (sensor)
	3	①		5		12	Gray/Black	Thermistor (heat sink)
	2 (N.C.)	①		6		4	Gray	Thermistor (heat sink)
	DC fan for forced air cooling	1	④	③	7	DC PS for DC fan	1, 2	Orange
2		④	8		White/Black		+	
1		④	9		White		-	

Reference: Pin assignment of standard HHL packaged QCL

Pin No. *1	Function	Pin No. *1	Function
1	TEC cathode (-)	7	QCL cathode (-)
3	N.C.	8	Thermistor (Top(c))
4	QCL anode (+)	9	Thermistor (Top(c))
5	Thermistor (Top(qcl))	10	TEC anode (+)
6	Thermistor (Top(qcl))	—	—

*1 Pin of ③ is electrically connected to the case; package body. All of other pins are floating to the case.

* This table indicates standard pin configuration of HHL packaged QCL. Confirm pin assignment of laser product firmly.

Accessories for Quantum Cascade Lasers

● Cable (for A11134-07)

■ Cable for laser driver

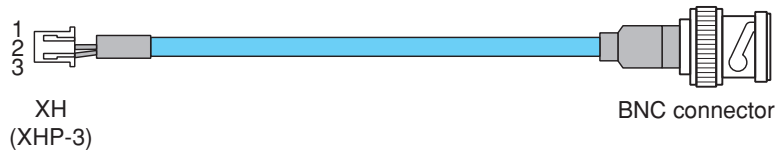
Type No.	Connected to	Termination		Cable length	
		Connector	Function		
A11134-10	Semiconductor laser driver	Cut-off *1	Signal wire *2	QCL anode (+)	2 m
			Shield *3	QCL cathode (-)	
A11134-11		BNC	Signal wire *2	QCL anode (+)	
			Shield *3	QCL cathode (-)	
A11134-12	CW controller C16174-01	SMA	Signal wire *2	QCL cathode (-)	
			Shield *3	QCL anode (+)	

*1 One end connected to the laser driver has to be terminated properly by the users.

*2 Inner conductor of coaxial cable.

*3 Outer conductor of coaxial cable.

• A11134-11



• A11134-12



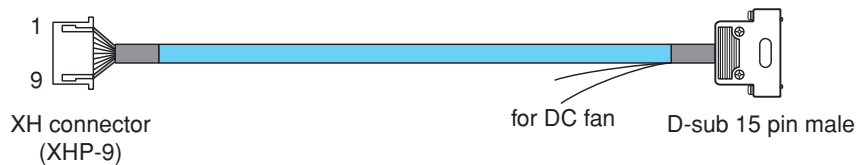
■ Cable for temperature controller

Type No.	Connected to	Termination			Cable length
		Connector	Color of wire	Function	
A11134-08	Temperature controller	Cut-off *1	Orange/Black	TEC cathode (-)	2 m
			Green	F.G.	
			Yellow/Black	Thermistor (Top(qcl))	
			Yellow	Thermistor (Top(qcl))	
			Gray/Black	Thermistor (Top(c))	
			Gray	Thermistor (Top(c))	
			Orange	TEC anode (+)	
A11134-09	TEC temperature controller C11330-01	D-sub 15 pin male			
A11134-13	CW controller C16174-01	HR10A-7R-6S (73)			

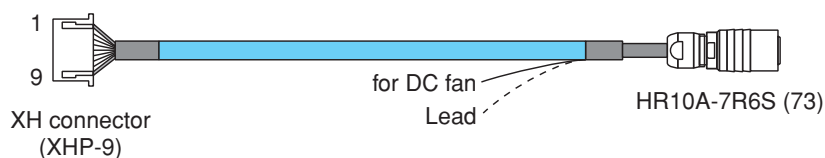
*1 One end connected to the temperature controller has to be terminated properly by the users.

* All these cables have the lead wires for power supply to the forced air cooling fans.

• A11134-09



• A11134-13



Accessories for Quantum Cascade Lasers

●Cable A11134-14 (for C11330 communication)

■D-sub 9 pin (an end of PC)

Pin No.	Signal	Pin No.	Signal
1	DCD	6	DSR
2	RxD	7	RTS
3	TxD	8	CTS
4	DTR	9	RI
5	GND	—	—

* When controlling through a PC which does not have the port of terminal eulators for serial communication, use an USB serial convertor (Windows 7 or later.)

* D-sub 9 pin (female) is fixed by Inch screw #4-40.

■D-sub 15 pin (an end of C11330)

Pin No.	Signal	Pin No.	Signal
1	INTERLOCK	9	GND
2	ALARM	10	FG
3	RS-422 Rx(+)	11	START
4	RS-422 Tx(+)	12	STABLE
5	RS-232C Rx	13	RS-422 Rx(-)
6	GND	14	RS-422 Tx(-)
7	GND	15	RS-232C Tx
8	GND	—	—

* D-sub 15pin (male) is fixed by milli screw M2.6.

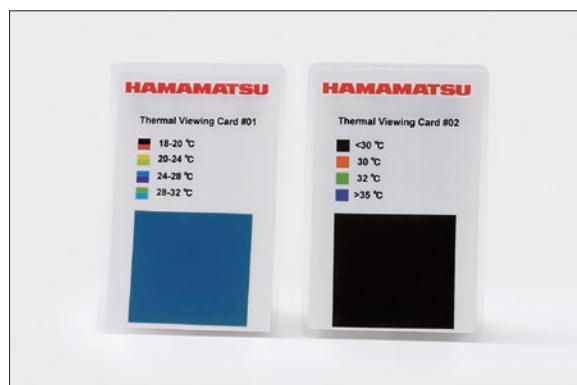
• A11134-14

D-sub 9 pin female ————— 1.5 m ————— High density D-sub 15 pin male



Accessories for Quantum Cascade Lasers

Thermal Viewing Cards A16134-02



It becomes easier beam alignment work by visualizing MIR laser with the thermal viewing cards.

Specifications

Parameter		Specification	Unit
Detectable temperature range	Card #01	+18 to +32	°C
	Card #02	+30 to +35	°C
Usage wavelength range		1.0 to 20	μm
Power required for visibility *1		Approx. 2 *2	mW/mm ²
Permissible incident energy density *1		Approx. 20 *2	mW/mm ²
Storage temperature *3		-5 to +60	°C
Heat sensitive section (W × H)		40 × 35	mm
Dimensions (W × H)		60 × 90	mm

*1 Average power density.

*2 Depends on exposure time. Value for the same exposure position and exposure time of 30 seconds.

*3 No condensation

Information described in this material current as of October 2023. Specifications are subject to change without notice.

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