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Accessories for Quantum Cascade Lasers

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●Cable 8
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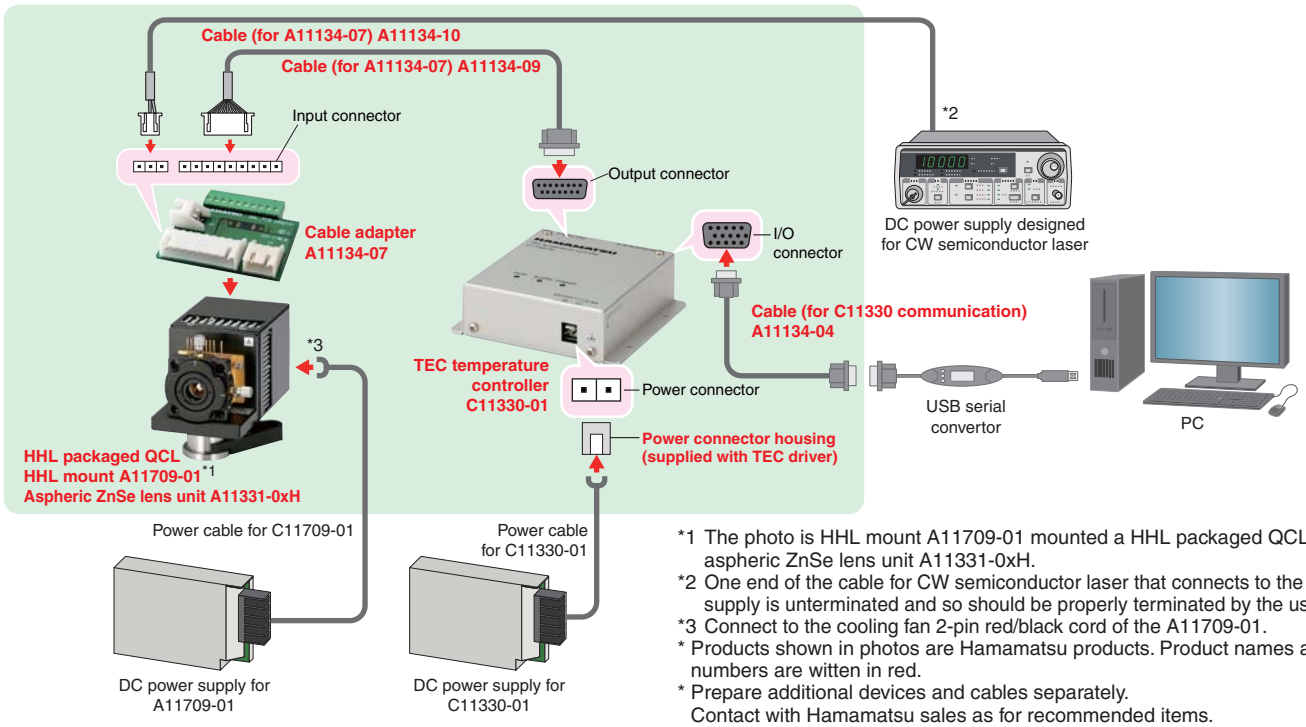
●Heatseeker 14

■Connection example of DFB-CW QCL

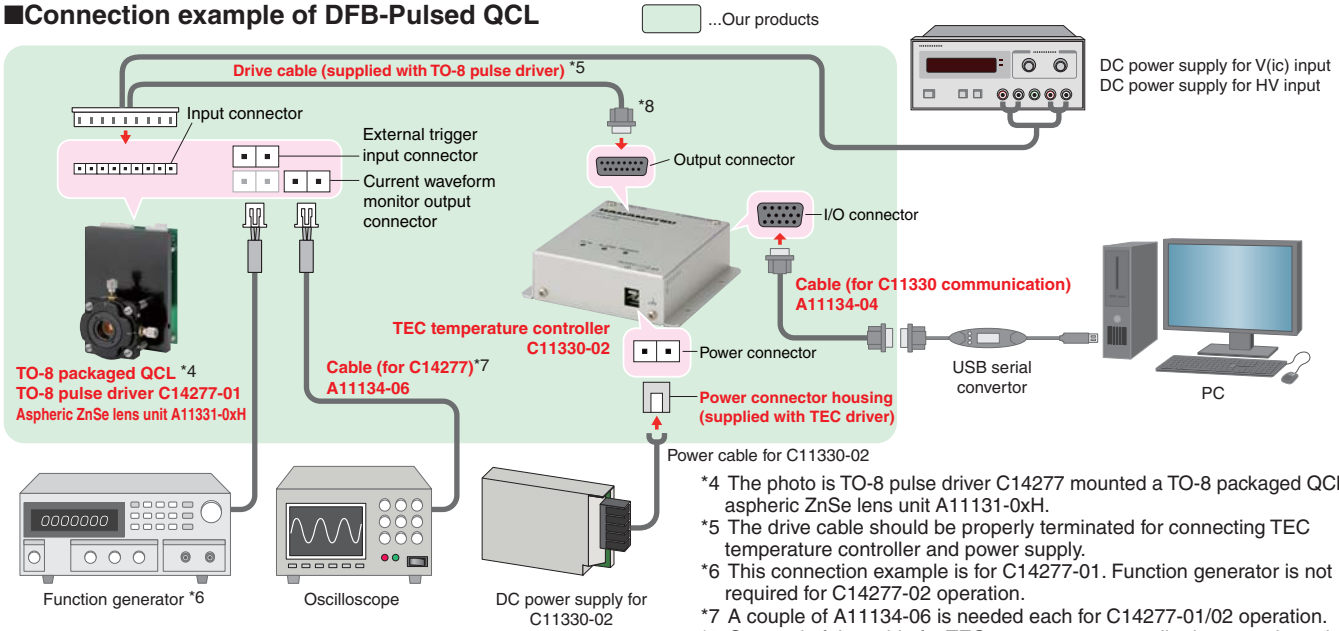
...Our products



*1 The photo is HHL mount A11709-01 mounted a HHL packaged QCL and a aspheric ZnSe lens unit A11331-0xH.
*2 One end of the cable for CW semiconductor laser that connects to the DC power supply is unterminated and so should be properly terminated by the user.
*3 Connect to the cooling fan 2-pin red/black cord of the A11709-01.
* Products shown in photos are Hamamatsu products. Product names and part numbers are witten in red.
* Prepare additional devices and cables separately. Contact with Hamamatsu sales as for recommended items.

■Connection example of DFB-Pulsed QCL

...Our products



*4 The photo is TO-8 pulse driver C14277 mounted a TO-8 packaged QCL and a aspheric ZnSe lens unit A11131-0xH.
*5 The drive cable should be properly terminated for connecting TEC temperature controller and power supply.
*6 This connection example is for C14277-01. Function generator is not required for C14277-02 operation.
*7 A couple of A11134-06 is needed each for C14277-01/02 operation.
*8 One end of the cable for TEC temperature controller is unterminated and so should be properly terminated by the user.
* Products shown in photos are Hamamatsu products. Product names and part numbers are written in red.
* Prepare additional devices and cables separately. Contact with Hamamatsu sales as for recommended items.

■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		CW QCL (HHL package)	Pulsed QCL (TO-8 package)
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 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 (Thermistor/RTD)	-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	
	Weight	0.3 kg	

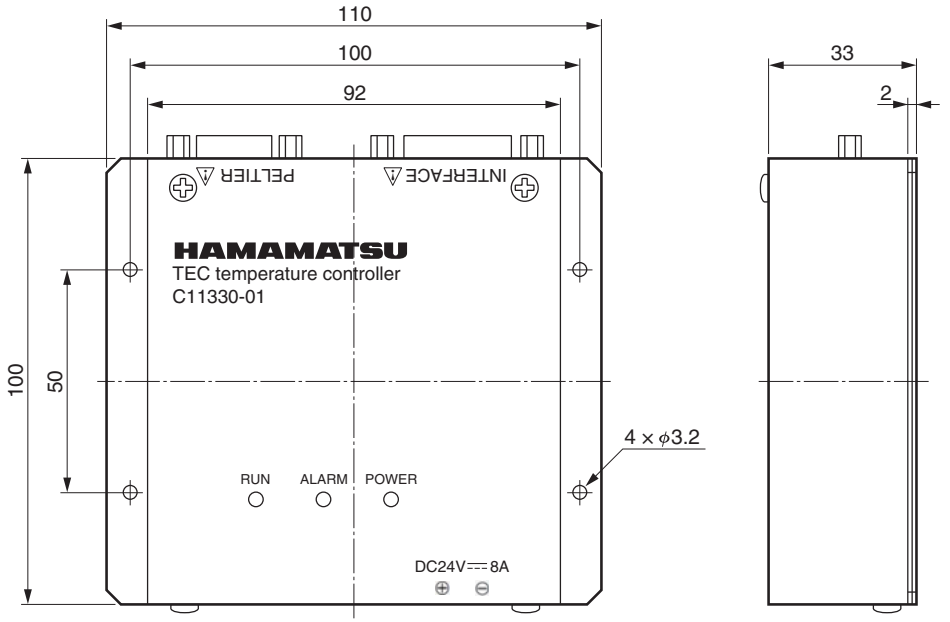
*1 Actural output depends on characteristics of the connected load (TEC module), and input power supply voltage and current.
*2 Required input current depends on the capacity of the connected load (TEC module). When using C11330-01, requred output current pf power supply (DC 24 V) is more than 4.0 A, 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 Heatshink 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(A11134-04) 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 therminal emulators for serial communication, use an USB serial convertor of Hamamatsu's recommendation (Windows 7 or later).
* Supplied with sample software. (Windows XP, 7 or later).

■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.

■Dimensional outline (Unit: mm)



LHJ3F0067

Accessories for Quantum Cascade Lasers

■HHL Mount A11709 series

A11709-01 Forced air cooling

A11709-02 Water 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
Applicable product	CW QCL (HHL package)	
Cooling method	Forced air cooling	Water cooling
Maximum heat discharge power	Approx. 30 W *1	Approx. 50 W *2
Thermal resistance	Approx. 0.5 °C/W *1	Approx. 0.3 °C/W *2
Operating temperature	0 °C to +40 °C	
Dimensions (W × H × D)	68 mm × 82 mm × 117 mm	60 mm × 103 mm × 50 mm
Weight	0.5 kg	0.52 kg

*1 DC fan speed should be 7600 min^{-1} at ambient temperature 25 °C.
*2 Necessary flow and water tempereture: 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.

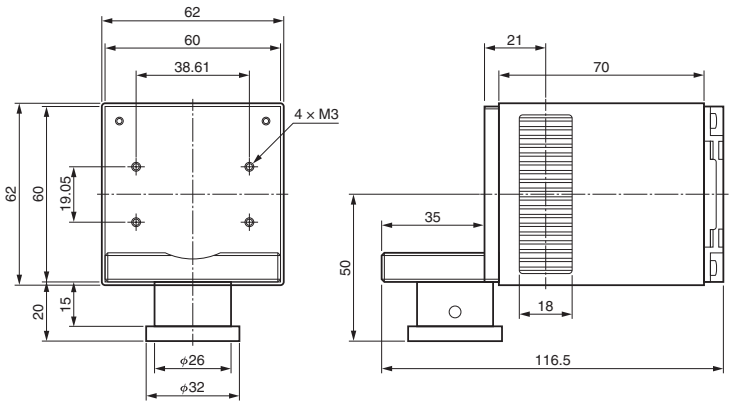
●A11709-02

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.

■Dimensional outline (Unit: mm)

●A11709-01



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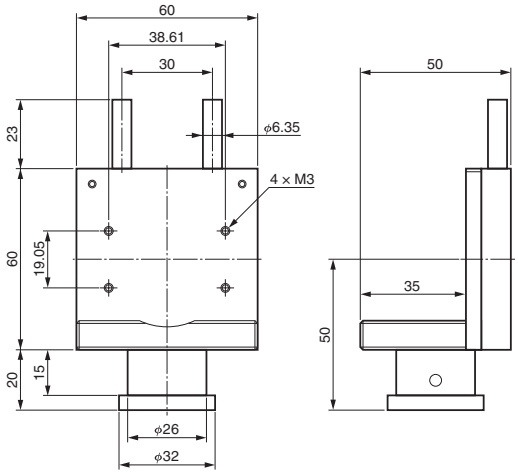
●A11709-02



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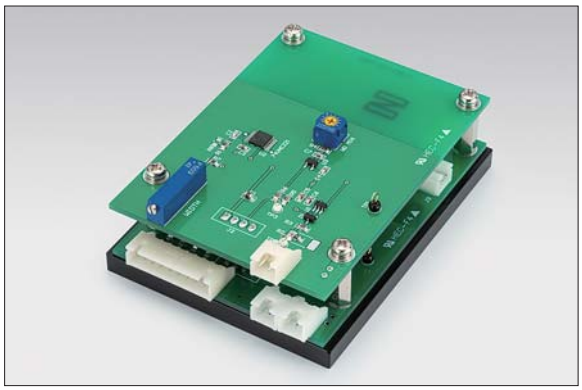
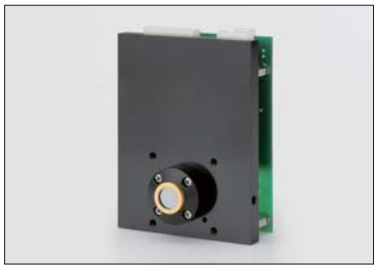
■TO-8 Pulse Driver

●C14277 series



C14277-01 External trigger

C14277-02 Internal trigger



* The photo is TO-8 pulse driver C14277 mounted a TO-8 packaged QCL.

* The photo is TO-8 pulse driver C14277 mounting a ZnSe lens unit A11331-0xH.

TO-8 pulsed driver is excusive use for pulsed QCL (TO-8 package). This product is designed to be built into equipment and does not work solely. Two types of trigger, external and internal, are available.

■Absolute maximum ratings

Parameter		Symbol	C14277-01	C14277-02
Output *1	Pulsed current	I_{out}	2.5 A *2	
	Pulsed width	t_w	2000 ns	
	Repetition frequency	f_r	1000 kHz	500 kHz
	Duty ratio	DR	5 % *3	
External bias (DC) *4	Bias voltage	V_{bias}	25 V	
	Bias current	I_{bias}	150 mA	
External trigger	Repetition frequency	f_r	1000	— *5
	Input voltage	—	TTL	— *5
Current voltage (DC)	$V_{(ic)}$ input	$V_{(ic)}$	12 V	
	HV input	HV	20 V	
Operating ambient temperature (body) *6		T_{op}	+5 °C to +60 °C	
Storage ambient temperature (body) *6		T_{stg}	-10 °C to +70 °C	

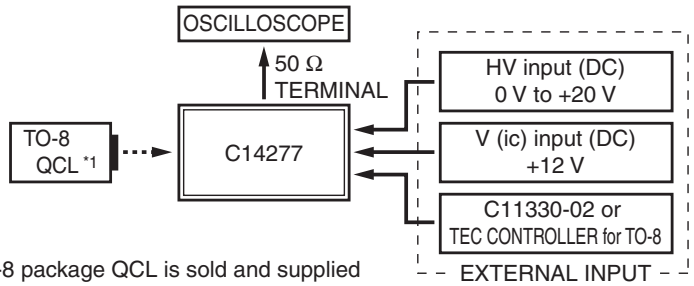
*1 The pulsed output current must be controlled within a range where the absolute maximum rating of the QCL is not exceeded even momentarily.
*2 The maximum amplitude of the pulsed output current depends on the electrical charecteristics of pulsed QCL.
*3 Sufficient heat dissipation from the driver circuit is required.
*4 Bias voltage should be floating from any other circuit, including other peripherals.
*5 C14277-02, which is internal trigger type, can not be complied external trigger.
*6 No condensation.

■Specifications

Parameter		Symbol	C14277-01	C14277-02
Applicable product		—	Pulsed QCL (TO-8 package)	
Output current *1	Pulsed current	I_{pulse}	0 A to +2.5 A *2	
	Pulsed width	P_W	20 ns to 2000 ns	
	Trigger mode	—	External trigger *3	Internal trigger
	Repetition frequency	f_r	150 kHz to 1000 kHz	50 kHz to 500 kHz
	Duty ratio (Max.)	DR	< 5 % *4	
Power supply voltage (DC)	$V_{(ic)}$ input	$V_{(ic)}$	12 V *5	
	HV input	HV	0 V to 20 V *6	
Dimensions (W × H × D)		—	88 mm × 31.6 mm × 66 mm	
Weight		—	0.13 kg	

*1 The pulsed output current must be controlled within a range where the absolute maximum rating of the QCL is not exceeded even momentarily.
*2 The maximum amplitude of the pulsed output current depends on the electrical charecteristics of pulsed QCL.
*3 Rise edge. External trigger source is required.
*4 Sufficient heat dissipation from the driver circuit is required.
*5 Operating voltage of driver circuit.
*6 Amplitude of the pulsed output current is controlled by HV input. The HV input must be set within a range where the absolute maximum rating for the pulse forward current of the QCL is not exceeded even momentarily.
* External DC power supplies and a TEC temperature controller are user-supplied.

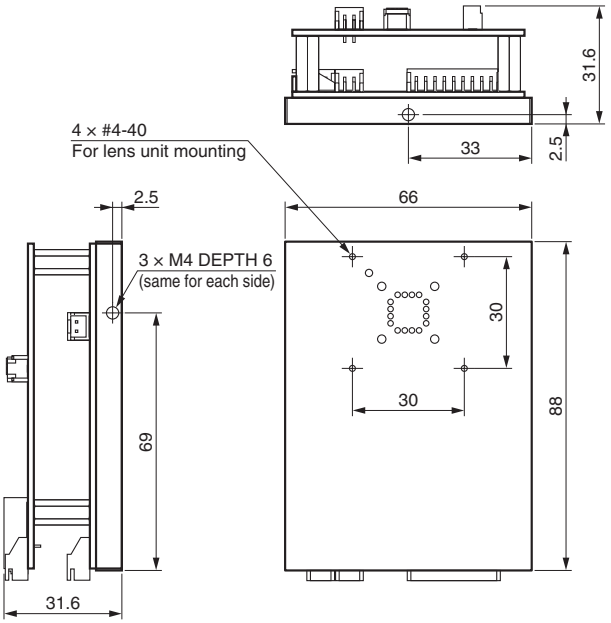
■Setup example



*1 TO-8 package QCL is sold and supplied separately from the pulse driver.
* C14277-01 requires an external trigger.
* Aspheric ZnSe lens unit A11331-0xH is not adaptable to C14277 series.

■Dimensional outline (Unit: mm)

●C14277-01



* Unspecified tolerances shall be ±0.2 mm.

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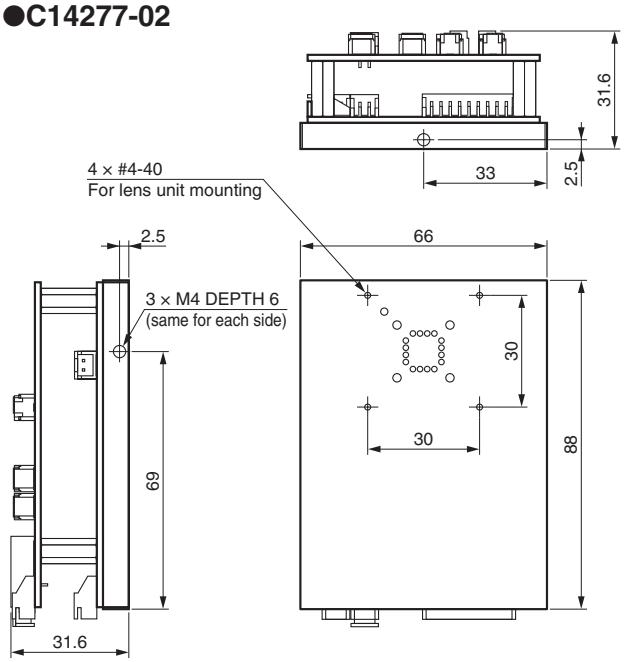
●C14277-02



* Unspecified tolerances shall be ±0.2 mm.

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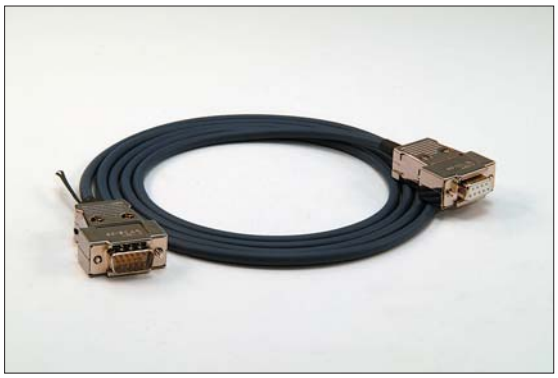
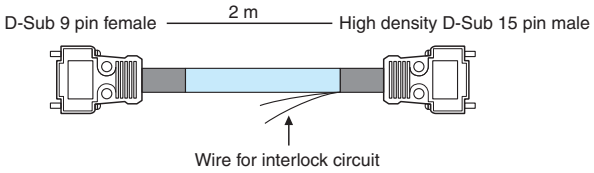
■Cable / Cable adapter

●A11134-04 (for C11330 communication)



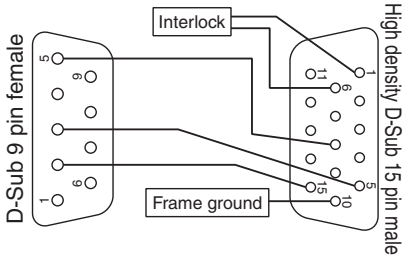
This cable excusive use for serial communication (RS-232C) with C11330 series.



■Pin layout

PC side
D-Sub 9 pin layout

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



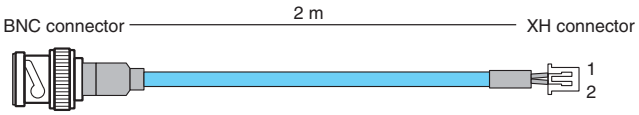
C11330-01/-02 side
High density D-Sub 15 pin layout

Pin No.	Signal	Pin No.	Signal
1	INTERLOCK	9	GND
2	ALARM	10	Frame ground
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		

* When controlling through a PC which does not have any ports or therminal emulators for serial communication, use an USB serial convertor of Hamamatsu's recommendation (Windows 7 or later).
* Securing screw of D-sub 9pin (female) is Inch screw #4-40, and D-sub 15 pin (male) is milli screw M2.6.

●A11134-06 (for C14277)

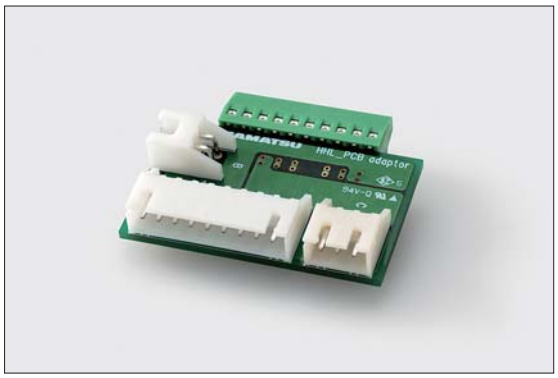
Coaxial cable excusive use for C14277 series operation and communication. Use by connecting JST XH connector of C14277 series.



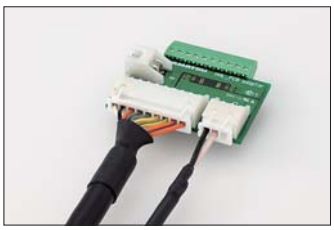
■Pin layout

Pin No.	Function	Type
1	Signal wire	XHP-2 (JST)
2	GND	—

●A11134-07 Cable adapter (for HHL)

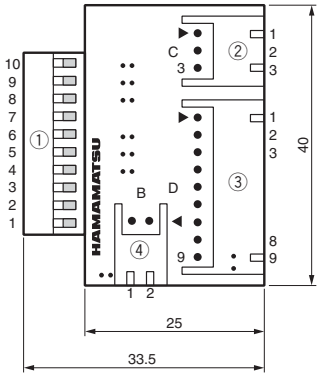


Cable adapter is exclusively used for HHL packaged DFB-CW QCL. QCL and its peripheral equipment are connected by Cable adopter and Cables A11134-08/-09, -10/-11.



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

■Dimensional outline and Connector · Pin No. (Unit: mm)



Connector

Connector No.	Name	Type No. (Manufacture)
①	HHL terminal	1725737 (Phoenix)
②	QCL connector	S3BHX-A (JST)
③	TEC connector	S9BHX-A (JST)
④	DCFAN connector	S2BHX-A (JST)

■Pin layout

Connected items	Pin No.	Connector
HHL packaged QCL	10	①
	9	①
	8	①
	7	①
	6	①
	5	①
	4	①
	3	①
	2 (N.C.)	①
	1	①
DC fan for forced air cooling	2	④
	1	④

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

Reference: Pin assignment of standard HHL packaged QCL

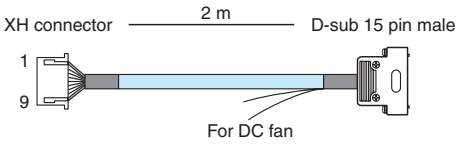
Pin No. *1	Function	Pin No. *1	Function
①	TEC cathode (-)	⑦	QCL cathode (-)
③	N.C.	⑧	Thermistor ($T_{op(c)}$)
④	QCL anode (+)	⑨	Thermistor ($T_{op(c)}$)
⑤	Thermistor ($T_{op(qcl)}$)	⑩	TEC anode (+)
⑥	Thermistor ($T_{op(qcl)}$)	—	—

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

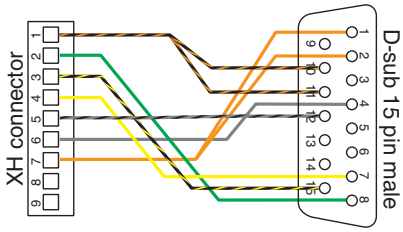
* This table indicates standard pin configuration of HHL packaged QCL. Confirm pin assignment of laser product firmly.

●A11134-08/-09 (for A11134-07)

This cable exclusive use for cable adapter A11134-07. This cable connects with TEC control equipment such as C11330 series.
As for the one end of A11134-08, which is connected to the TEC control instrument, is cut off.



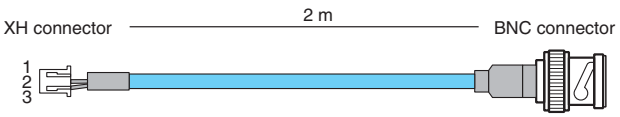
■Pin layout



Pin No.	Function	Pin No.	Function
1	TEC+	9	—
2	TEC+	10	TEC–
3	—	11	TEC–
4	Thermistor (heat sink)-A	12	Thermistor (heat sink)-B
5	—	13	—
6	—	14	—
7	Thermistor (sensor)-A	15	Thermistor (sensor)-B
8	Frame ground		

●A11134-10/-11 (for A11134-07)

This cable exclusive use for cable adapter A11134-07. This cable connects with TEC control equipment such as C11330 series.
The one end of A11134-10, which is connected to the laser driver, is cut off.

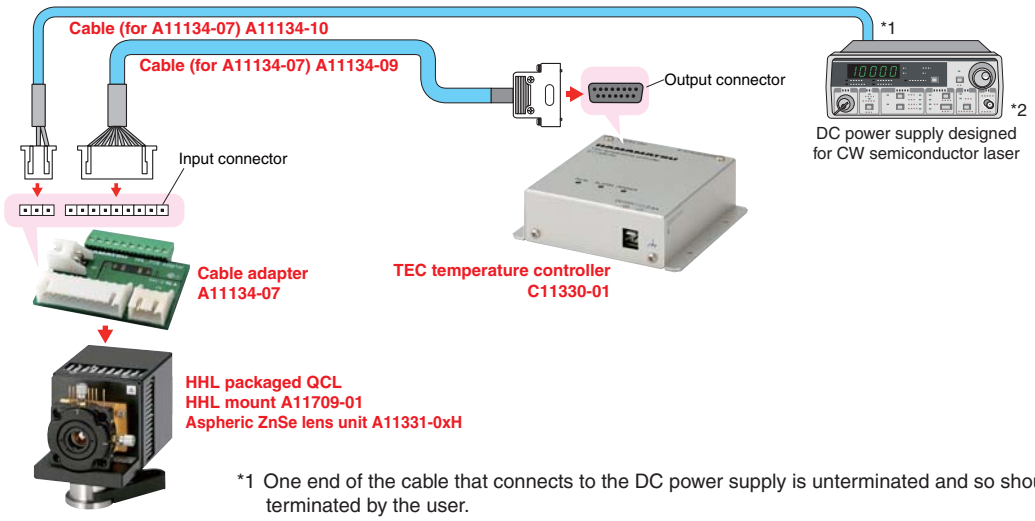


■Pin layout

Pin No.	Function	Type No.
1	N.C.	XHP-3 (JST)
2	Signal	
3	GND	

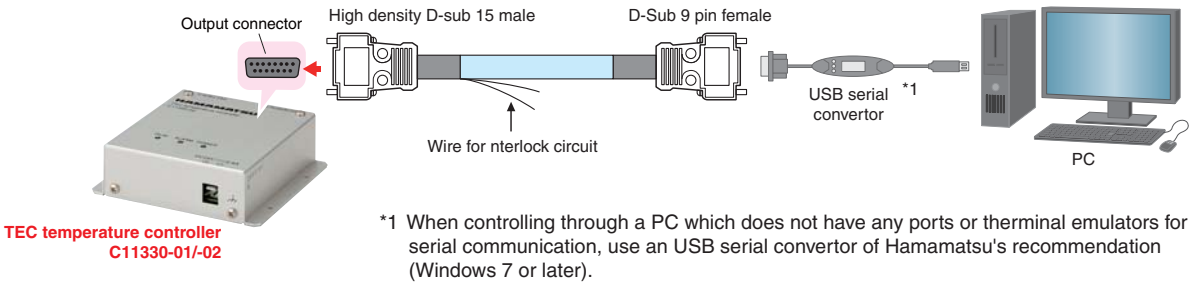
■Cable connection example

●A11134-07/-09/-10



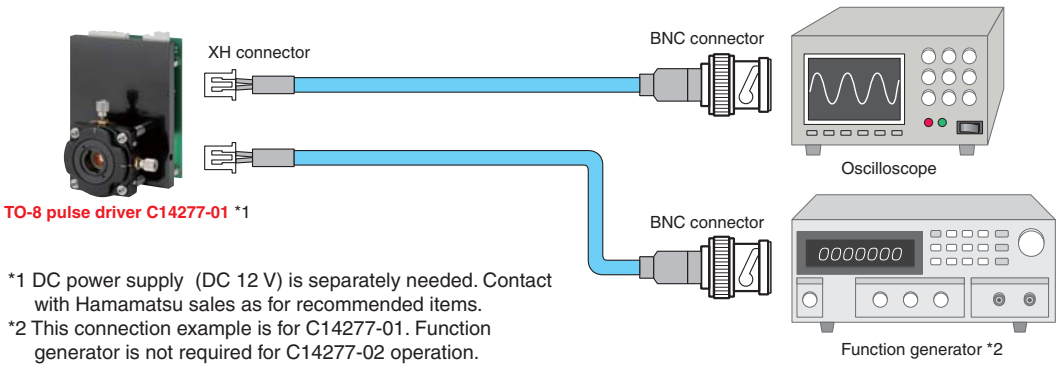
*1 One end of the cable that connects to the DC power supply is unterminated and so should be properly terminated by the user.
*2 DC power supply designed for CW semiconductor laser is separately needed. Contact with Hamamatsu sales as for recommended items.

●A11134-04



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

●A11134-06



*1 DC power supply (DC 12 V) is separately needed. Contact with Hamamatsu sales as for recommended items.
*2 This connection example is for C14277-01. Function generator is not required for C14277-02 operation.
* A couple of A11134-06 is needed each for C14277-01/02 operation.

■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 canbe mounted onto HHL mount A11709 series and/or TO-8 pulsed driver C11635. The A11331-0x series can also be used solely.
Lens unit A11331-0xH supplied with an lens.

■Specifications

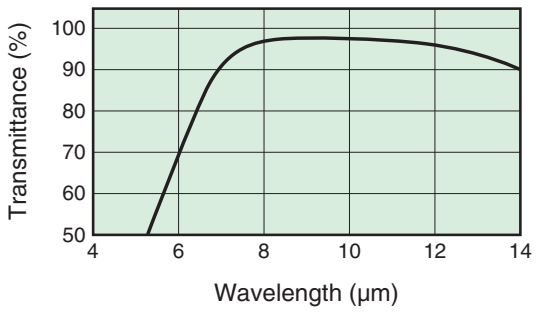
Parameter	Symbol	A11331-01	A11331-02
Primary designed wavelength *1	λ	8 µm	5 µm
Numerical aperture (NA)	NA	0.78	
Actual focal distance	EFL	4.8 mm	
Material	—	ZnSe	
Refractive index	n	2.417 at 8 µm	2.429 at 5 µm
AR coating	—	BBAR, T (ave)>97 % *2	BBAR, T (ave)>96 % *3
Weight	—	5 g	

*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.

■Wavelength transmissivity properties

●A11331-01 / A11331-01H

BBAR / 8 µm to 12 µm



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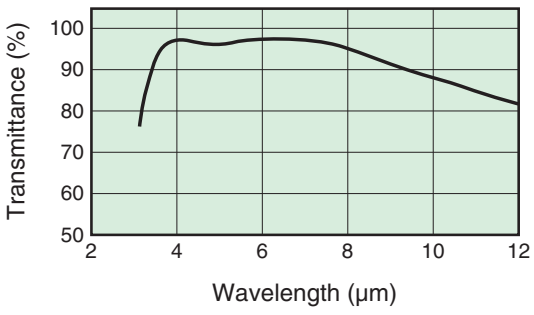
●A11331-02 / A11331-02H

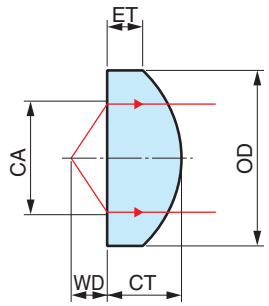
BBAR / 4 µm to 8 µm



LHJ3F0071

■Dimensional outline (Unit: mm)

●A11331-0x



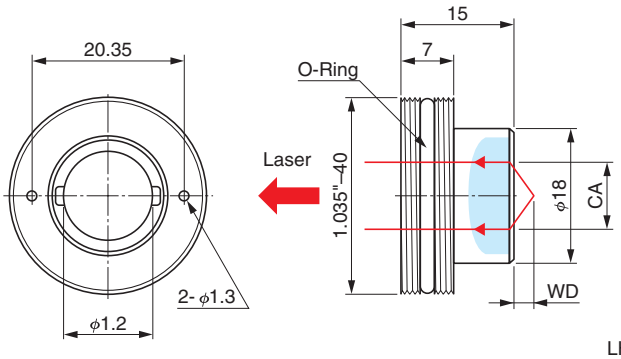
LHJ3F0072-01

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	

●A11331-0xH

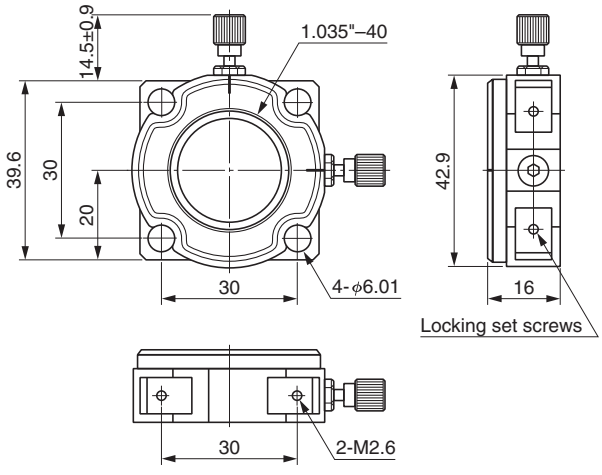
* Aspheric ZnSe lens unit is consisted of two parts; Lens mounting unit and XYZ translator.
* Attached lens specifications follow A11331-0x.

· Lens mounting unit



LHJ3F0072-02

· XYZ translator



LHJ3F0072-03

■Heatseeker A10767

Heatseeker A10767 consists of 2 types of thermal viewing cards and an alignment target. It can be used for visualization and alignment of the QCL laser beam.

Thermal viewing card

Thermal material provides visibility of the invisible IR laser beam and facilitates tracing of the beam. Two cards with different sensitivity ranges are provided.

Alughnment target

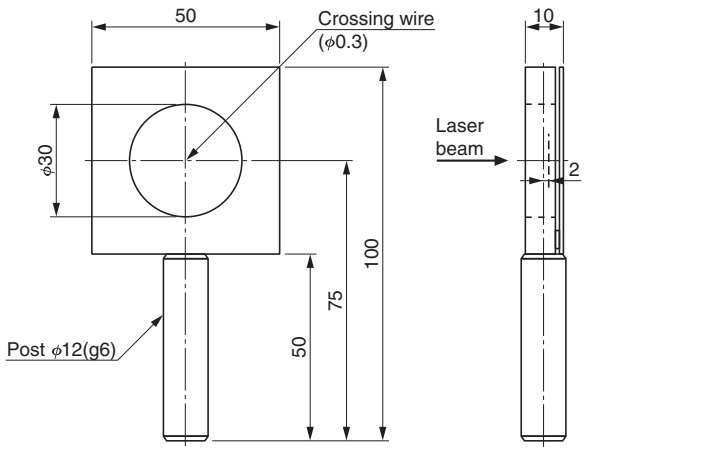
The light axis of the invisible IR laser beam can be easily aligned. Includes a cross target for checking the light axis. Thermal viewing cards can be inserted.

■Specifications

Parameter		Value / Description
Detectable temperature range	Thermal viewing card #01	18 °C to 32 °C
	Thermal viewing card #02	30 °C to 35 °C
Usage wavelength range		1.0 µm to 20 µm
Power required for visibility *1		>3 mW/mm^2
Damage threshold (Max. power density)		20 mW/mm^2
Maximum aperture		ϕ30 mm
Storage temperature		-5 °C to +60 °C *2
Dimensions (W × H × D)		50 mm × 100 mm × ϕ12 mm

*1 Average power density
*2 No condensation

■Dimensional outline (Unit: mm)



LHJ3F0073

MEMO

Accessories for Quantum Cascade Lasers

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