

# CCD multichannel detector heads



C7043

C7044

## Designed for back-thinned CCD area image sensor

The C7043 and C7044 are high sensitivity multichannel detector heads for use with back-thinned FFT-CCD area image sensors (S7033/S7034 series) that offer large full well capacity. The C7043 is designed for the non-cooled back-thinned type (S7033 series), while the C7044 for the one-stage TE-cooled type (S7034 series) for detection at even lower light levels. Both the C7043 and C7044 incorporate a low-noise driver/amplifier circuit that provides reliable operation from simple external signals. The C7044 also includes a highly stable temperature controller that cools the sensor to a preset temperature level ( $T_{chip} = -10\text{ }^{\circ}\text{C}$ ) as soon as the power is turned on. If the cooler fails and causes internal circuitry to overheat, the built-in protection circuit automatically turns off the power to the thermoelectric cooler. Despite its compact size, the housing configuration is designed for good heat dissipation, and threaded mounting holes on the front panel allow connections to other devices such as monochrometers. Controller for multichannel detector head C7557-01 is also available. The software supplied with the C7557-01 allows easy control of the multichannel detector head and data acquisition.

### Features

- Designed for back-thinned CCD area image sensor\*1  
C7043: for non-cooled type  
C7044: for TE-cooled type
- Line binning operation\*2/area scanning operation
- Driver/amplifier circuit for low noise CCD operation
- Highly stable temperature controller (C7044)
- Simple signal input operation
- Compact configuration

### Applications

- Fluorescence spectroscopy
- Raman spectroscopy
- Other low-light-level detection

### Selection guide

The table below shows CCD area image sensors applicable for the C7043 and C7044. Since the C7043 and C7044 do not include a CCD area image sensor, so select the desired sensor and order it separately.

Type no.	CCD Area image sensor			
	Type no.	Number of pixels	Number of effective pixels	Image area [mm (H) × mm (V)]
C7043	S7033-0907	532 × 128	512 × 122	12.288 × 2.928
	S7033-1007	1044 × 128	1024 × 122	24.576 × 2.928
C7044	S7034-0907S	532 × 128	512 × 122	12.288 × 2.928
	S7034-1007S	1044 × 128	1024 × 122	24.576 × 2.928

\*1: In normal CCD image sensors that receive light from the front surface, the active area is covered with electrodes for charge transfer. These electrodes cut off UV radiation incident on the image sensor and also reduce the quantum efficiency. In contrast, back-thinned CCD image sensors have a unique structure in which the back of the active area is finely ground to allow light to enter from the back surface. This structure ensures high UV sensitivity and quantum efficiency because incident light need not pass through the electrodes.

\*2: The CCD area image sensor can be operated like a linear image sensor having a large active area by transferring all the pixel signals in the vertical direction to the horizontal register (this is referred to as line binning).

**▣ Absolute maximum ratings**

Parameter	Symbol	Min.	Typ.	Max.	Unit	
Supply voltage (for digital circuitry)	VD1, VD2	-0.5	-	+7	V	
Supply voltage (for analog circuitry)	VA1+	-	-	+18		
	VA1-	-	-	-18		
	VA2	-	-	+30		
Supply voltage	Vp	-	-	+7		
	Vf	-	-	+14		
Digital input voltage	-	-	-	VD1		
Operating temperature	C7043	Topr	0	-	+50	°C
	C7044		+10	-	+35*3	
Storage temperature	C7043	Tstg	-20	-	+70	
	C7044		0	-	+50	

\*3: The maximum value may be lower, depending on the drive frequency and the number of sensor pixels.

Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

**▣ Electrical characteristics**

(Ta=25 °C, VD1=+5 V, VA1+=+15 V, VA1=-15 V, VA2=+24 V, VD2=+5 V, Vp=+5 V, Vf=+12 V, unless otherwise noted)

Parameter	Symbol	Min.	Typ.	Max.	Unit	
Digital input	High level	V <sub>IH</sub>	+2.0	-	V <sub>D</sub> (1, 2)	V
	Low level	V <sub>IL</sub>	-0.5	-	+0.8	V
CLK frequency	f <sub>CLK</sub>	-	-	1	MHz	
Data video readout frequency	f <sub>v</sub>	-	-	f <sub>CLK</sub> /4	Hz	
Start pulse width	t <sub>st</sub>	1/f <sub>CLK</sub>	-	-	s	
Digital output	High level (I <sub>O</sub> =-6 mA)	V <sub>IH</sub>	+2.0	-	-	V
	Low level (I <sub>O</sub> =+6 mA)	V <sub>IL</sub>	-	-	+0.8	V
Power supply operating conditions						
Voltage	Digital circuitry	VD1	+4.75	+5.0	+5.25	V
	Analog circuitry	VA1+	+14.5	+15.0	+15.5	V
		VA1-	-14.5	-15.0	-15.5	V
		VA2	+23.5	+24.0	+24.5	V
	Other*4	VD2	+4.75	+5.0	+5.25	V
		Vp	+4.75	+5.0	+5.25	V
Vf		+11.75	+12.0	+12.25	V	
Current	VD1 (+5 VDC)	-	-	-	+200	mA
	VA1+ (+15 VDC)	-	-	-	+100	mA
	VA1- (-15 VDC)	-	-	-	-100	mA
	VA2 (+24 VDC)	-	-	-	+30	mA
	VD2 (+6 VDC)*4	-	-	-	+30	mA
	Vp (+6 VDC)*4	-	-	-	+2.5	A
	Vf (+12 VDC)*4	-	-	+100	-	mA

\*4: C7044

**▣ Electrical and optical characteristics**

[Ta=25 °C, Tchip=-10 °C (C7044), VD1=+5 V, VA1+=+15 V, VA1=-15 V, VA2=+24 V, VD2=+5 V, Vp=+5 V, Vf=+12 V]

Parameter	Symbol	Min.	Typ.	Max.	Unit	
Spectral response range	SR	-	200 to 1100	-	nm	
Full well capacity	Vertical	Fw	180	360	-	ke <sup>-</sup>
	Horizontal		-	3400	-	
Conversion gain*5	Sv	-	3	-	μV/e <sup>-</sup>	
Dark current*6	C7043	DS	-	100	1000	e <sup>-</sup> /pixel/s
	C7044		-	3	30	
Readout noise	N <sub>read</sub>	-	60	-	e <sup>-</sup> rms	
Dynamic range	Drange	-	56667	-	-	
Photoresponse nonuniformity*7	PRNU	-	±3	±10	%	

\*5: Including the circuit gain

\*6: Horizontal register value

\*7: Measured at 50% of the full well capacity

**Specifications for temperature controller (C7044)**

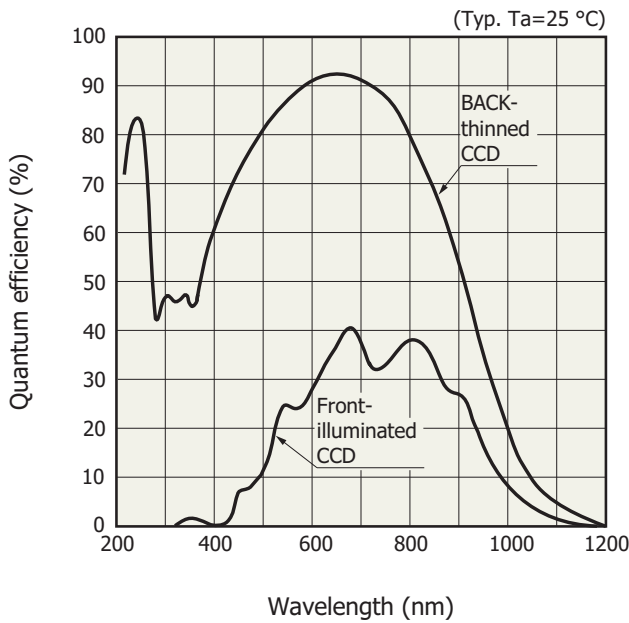
( $T_a=25\text{ }^\circ\text{C}$ ,  $V_{D1}=+5\text{ V}$ ,  $V_{A1+}=+15\text{ V}$ ,  $V_{A1-}=-15\text{ V}$ ,  $V_{A2}=+24\text{ V}$ ,  $V_{D2}=+5\text{ V}$ ,  $V_p=+5\text{ V}$ ,  $V_f=+12\text{ V}$ )

Parameter**8	Symbol	Min.	Typ.	Max.	Unit
Cooling temperature	$T_s$	-11.5	-10	-8.5	$^\circ\text{C}$
Temperature control range	$\Delta T_s$	-0.05	-	+0.05	$^\circ\text{C}$
Power dissipation of TE-cooler element	$P_p$	-	-	7	W
Cool down time to reset temperature	$t_o$	-	-	5	min.
Setting temperature for overheat protection*9	$T_o$	-	+45	-	$^\circ\text{C}$

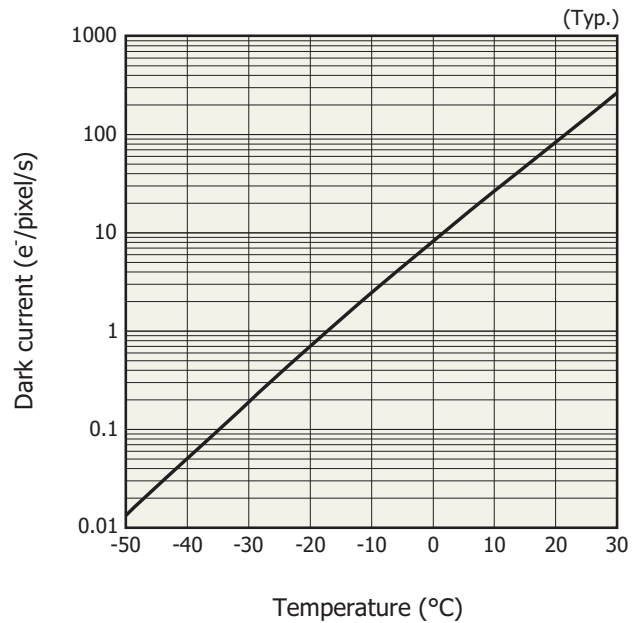
\*8: Other functions include error display, automatic power off, and detection of electrical opens and shorts by the thermosensor.

\*9: Temperature of rear-side of housing (part to fix fan)

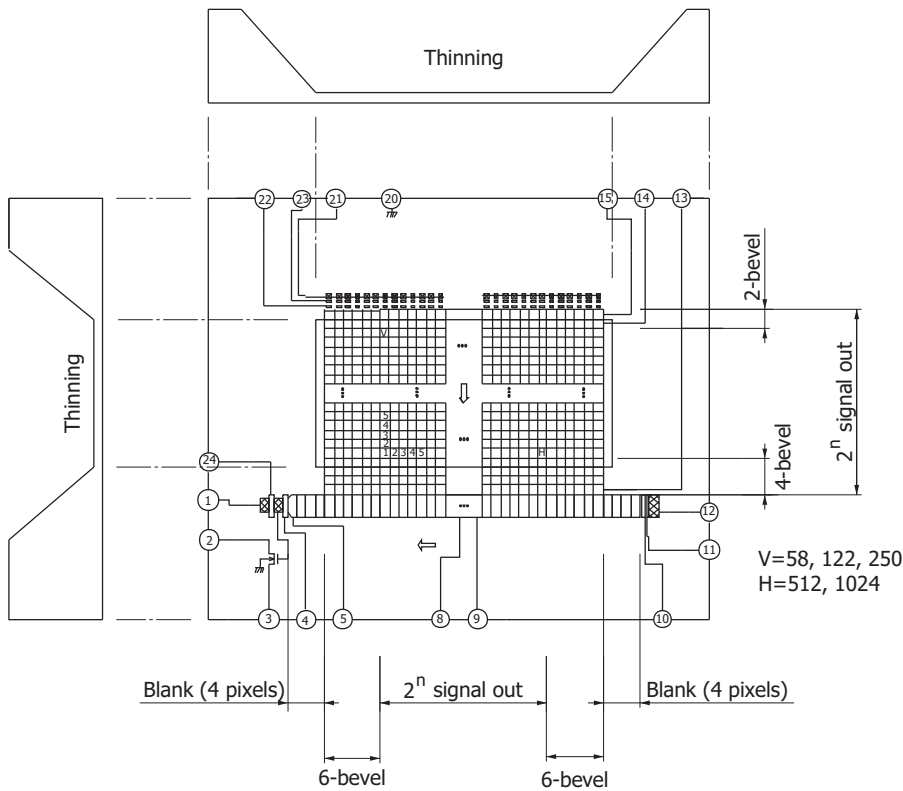
**Spectral response**



**Dark current vs. temperature**

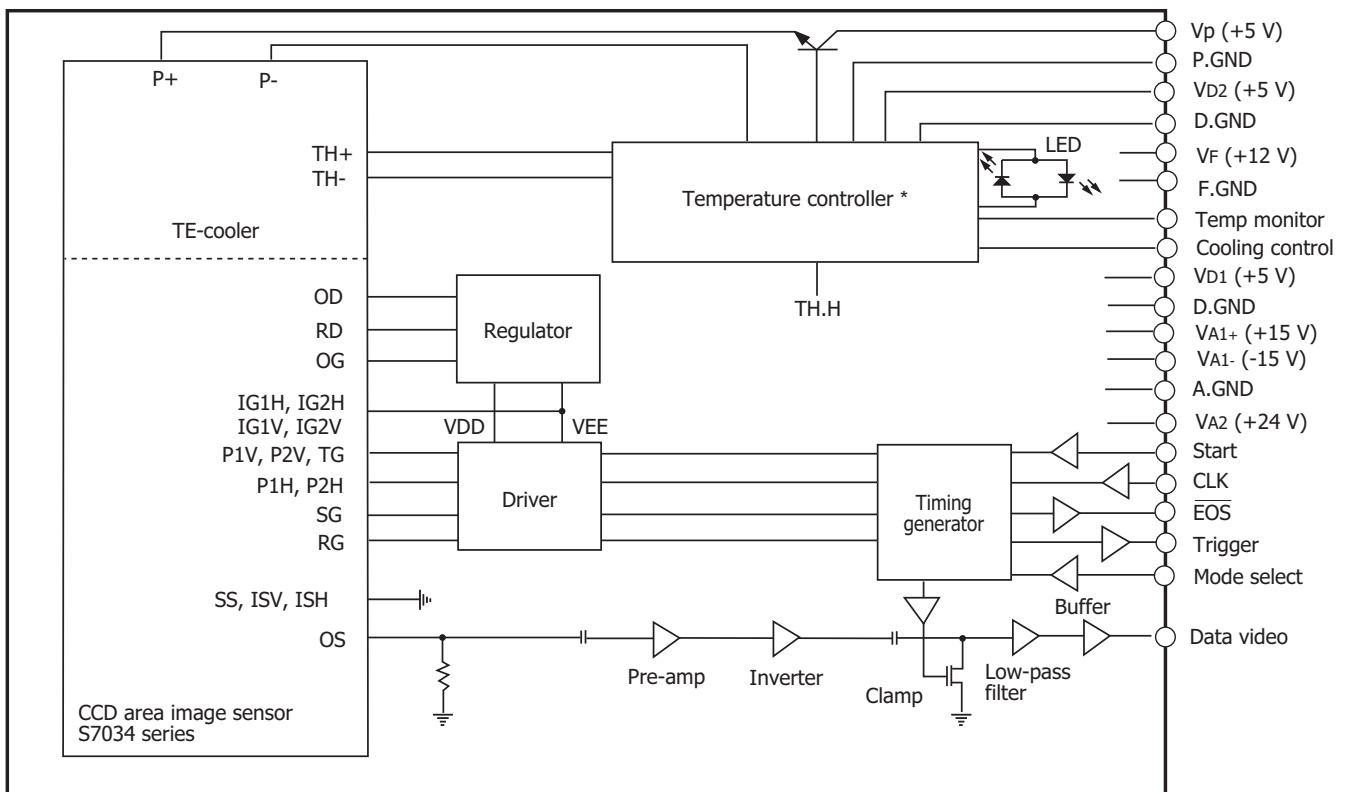


Block diagram (S7033/S7034 series)



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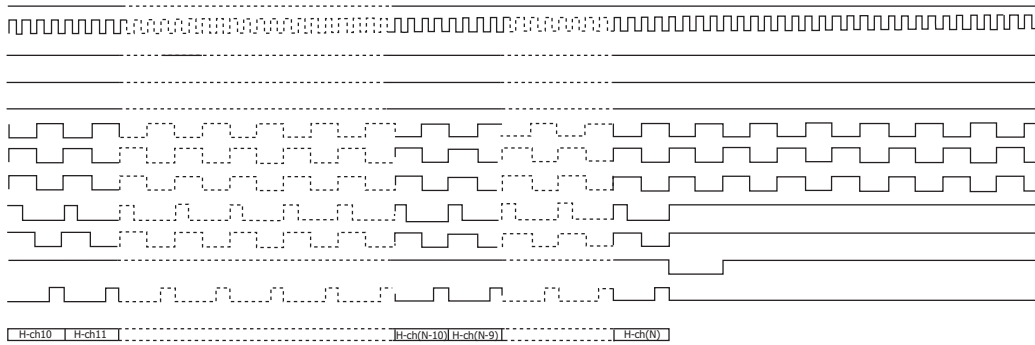
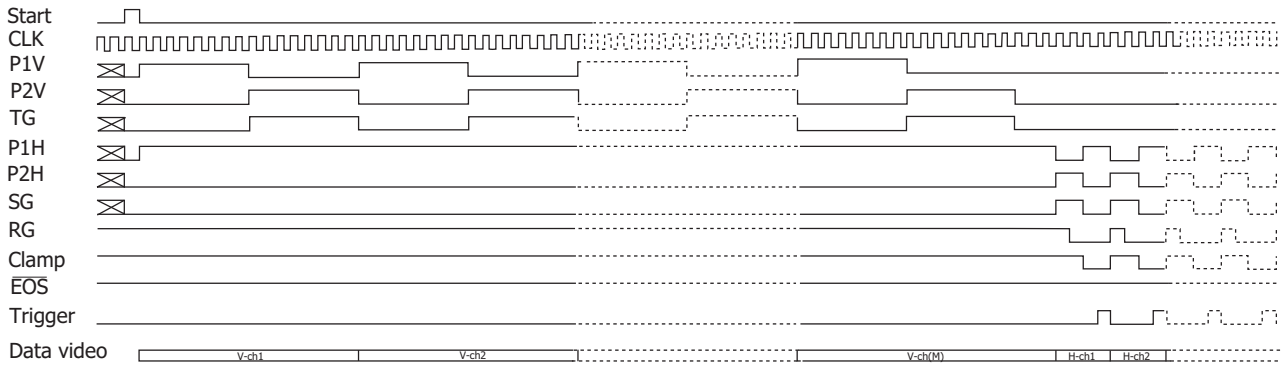
Block diagram (C7044)



\* The C7043 does not include the temperature controller and TE-cooler.

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**Timing chart (line binning operation)**

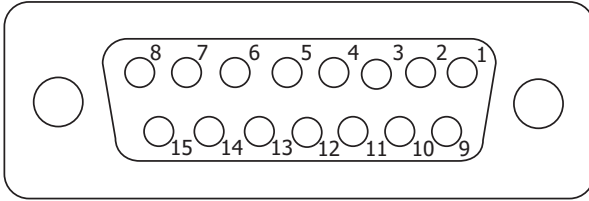


M=128 N=532, 1044  
 V-ch1--V-ch2, V-ch (M-3)--V-ch (M): Isolation pixels  
 H-ch1--H-ch4, H-ch (N-3)--H-ch (N): Blank pixels  
 H-ch5--H-ch10, H-ch (N-9)--H-ch (N-4): Isolation pixels

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**Pin connections of "SIGNAL I/O" connector**

15-pin D-sub connector

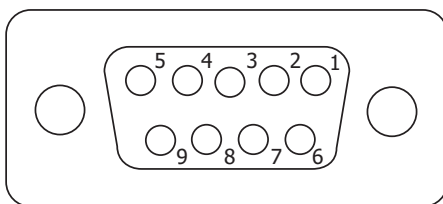


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Pin no.	Terminal name	Description
1	Mode select	Digital input signal used to select between the line binning operation and area scanning operation. HCMOS compatible. High level or left open: line binning operation Low level: area scanning operation
2	Data video	Analog video output. Positive polarity.
3	VA1+ (+15 V)	Analog power supply
4	VA1- (-15 V)	Analog power supply
5	VD1 (+5 V)	Digital power supply
6	Start	Digital input signal for initializing the circuit. HCMOS compatible. Positive logic. The interval of the Start pulses determines the integration time of the CCD image sensor.
7	CLK	Digital input signal for operating the circuit. HCMOS compatible. Rising edge operation.
8	$\overline{\text{EOS}}$	Digital output signal for indicating end-of-scan of the image sensor. HCMOS compatible. Negative logic.
9	A.GND	Analog ground
10	A.GND	Analog ground
11	VA2 (+24 V)	Analog power supply
12	D.GND	Digital ground
13	D.GND	Digital ground
14	D.GND	Digital ground
15	Trigger	Digital output signal for A/D conversion. HCMOS compatible. Positive logic.

**Pin connections of "TE CONTROL I/O" connector (C7044)**

9-pin D-sub connector



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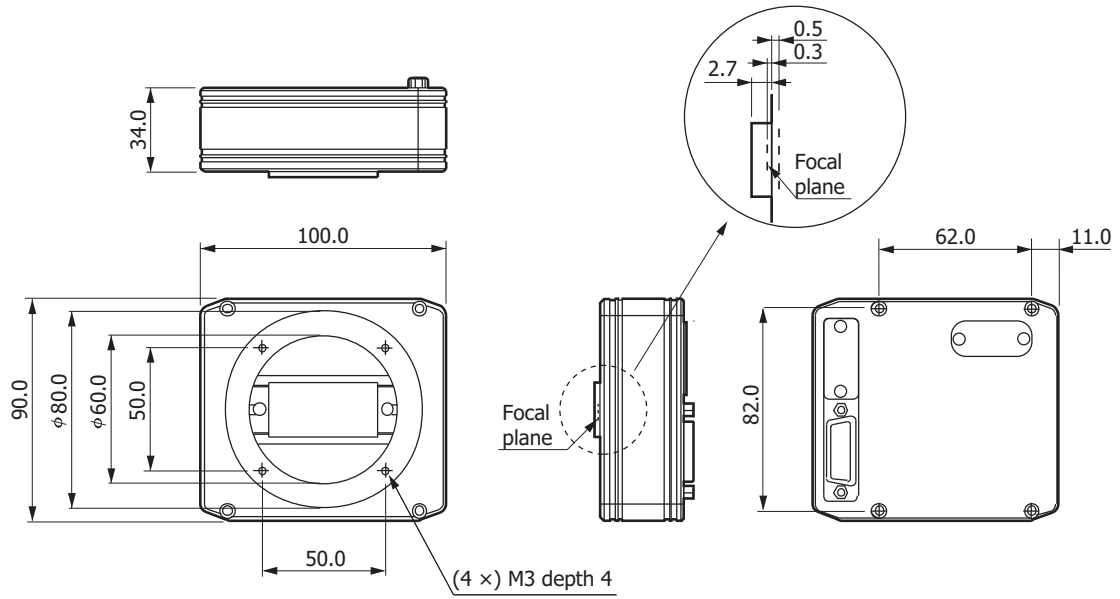
Pin no.	Terminal name	Description
1	VD2 (+5 V)	Digital power supply
2	Temp monitor	Analog output signal of the temperature of the CCD image sensor
3	Cooling control	Digital input signal for starting to cool down. HCMOS compatible. High level or left open: cooling Low level: stand-by
4	Vp (+5 V)	Power supply for the thermoelectric cooler in the CCD image sensor
5	Vf (+12 V)	Power supply for cooling fan
6	D.GND	Ground for temperature control circuit
7	D.GND	Ground for temperature control circuit
8	P.GND	Power supply return of the thermoelectric cooler mounted in the CCD image sensor
9	F.GND	Power supply return for cooling fan

Available for using same power supply (+5 V) for "+VD2" and "+Vp".

Caution: Do not connect "VD2" and "Vp" together on the backside of the 9-pin D-sub connector. These may be connected (shorted) at the power supply end, not 9-pin D-sub connector.

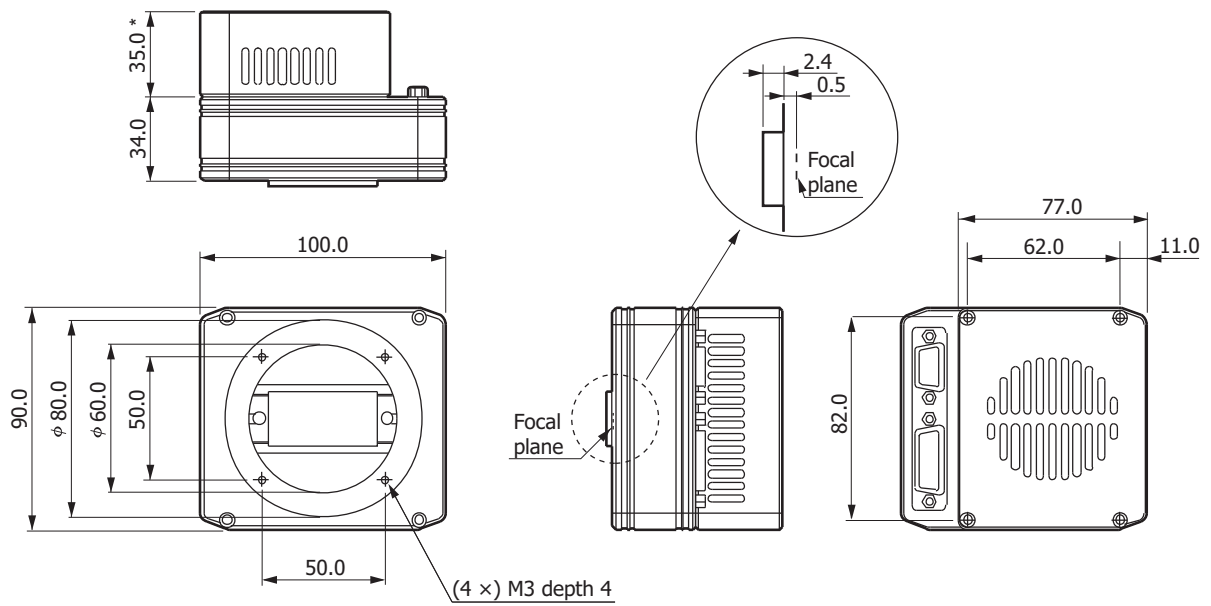
Dimensional outlines (unit: mm)

C7043



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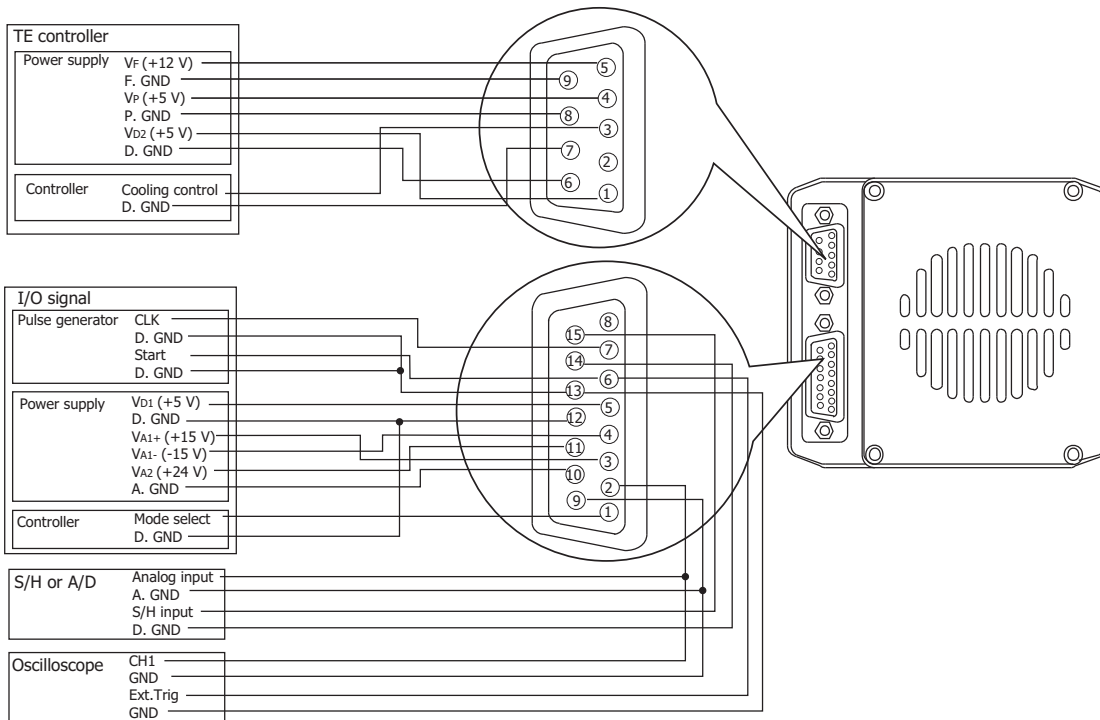
C7044



\* The part is removable.

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**Pin connections**



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**Related information**

[www.hamamatsu.com/sp/ssd/doc\\_en.html](http://www.hamamatsu.com/sp/ssd/doc_en.html)

- Precautions
- Disclaimer



Multichannel detector head controller C7557-01

When connected to a Hamamatsu multichannel detector head and a personal computer, the C7557-01 allows easy control of the detector head and data acquisition by using dedicated software that comes with the unit.

**Suitable multichannel detector head**

C7020/-02, C7021/-02, C7025/-02, C7040, C7041, C7043, C7044, C7180, C7181, C8061-01, C8062-01, C10150-01, C10151-01, C5964 series, C8892

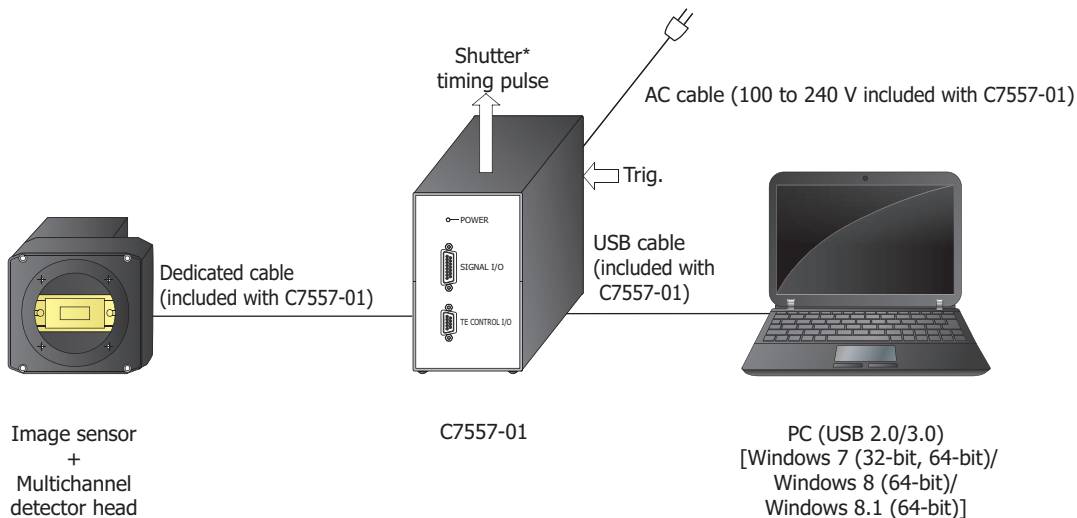


**Accessories for C7557-01**

- Spare fuse (2.5 A)\*10
- AC cable
- 2 to 3 conversion adapter
- USB cable
- Detector head connection cables (for "SIGNAL I/O" and "TE CONTROL I/O" terminal of multichannel detector head)
- CD-R (MCD USB driver, software, operation manual)
- MOS adapter

\*10: Contained in the holder just above the AC cable connector on the C7557-01 rear panel.

**Connection example**



\* Shutter, etc. are not available.

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Information described in this material is current as of May 2020.

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