

CCD multichannel detector head C7020, C7021, C7025



Designed for front-illuminated CCD area image sensors

C7020, C7021 and C7025 are high sensitivity multichannel detector heads for use with front-illuminated FFT-CCD area image sensors. C7020 is designed for the non-cooled front-illuminated CCD image sensors (S7010 series), while C7021 and C7025 for the TE-cooled CCD image sensors (S7011/S7015 series) for detection at even lower light levels. C7020, C7021 and C7025 incorporate a low-noise driver/amplifier circuit that provide reliable operation from simple external signals. C7021 and C7025 also include a highly stable temperature controller that cools the sensor to a preset temperature level ($T_s = -10\text{ }^\circ\text{C}$) 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. The table below shows front-illuminated CCD image sensors for C7020, C7021 and C7025. C7020, C7021 and C7025 do not come with a CCD image sensor, so select the desired sensor and order it separately. Multichannel detector head controller C7310-02 is also available.

Features

- Designed for front-illuminated CCD area image sensor *1
C7020: for non-cooled type
C7021, C7025: for TE-cooled types
- Binning operation *2
- Driver/amplifier circuit for low noise CCD operation
- Highly stable temperature controller (C7021, C7025)
Cooling temperature: fixed at $-10 \pm 0.05\text{ }^\circ\text{C}$
($T_a = 10$ to $35\text{ }^\circ\text{C}$)
- 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 C7020, C7021, C7025. Since C7020, C7021, C7025 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 active pixels	Active area [mm (H) × mm (V)]
C7020	S7010-0906	532 × 64	512 × 60	12.288 × 1.440
	S7010-0907	532 × 128	512 × 124	12.288 × 2.976
	S7010-0908	532 × 256	512 × 252	12.288 × 6.048
	S7010-1006	1044 × 64	1024 × 60	24.576 × 1.440
	S7010-1007	1044 × 128	1024 × 124	24.576 × 2.976
	S7010-1008	1044 × 256	1024 × 252	24.576 × 6.048
C7021	S7011-0906	532 × 64	512 × 60	12.288 × 1.440
	S7011-0907	532 × 128	512 × 124	12.288 × 2.976
	S7011-1006	1044 × 64	1024 × 60	24.576 × 1.440
	S7011-1007	1044 × 128	1024 × 124	24.576 × 2.976
C7025	S7015-0908	532 × 256	512 × 252	12.288 × 6.048
	S7015-1008	1044 × 256	1024 × 252	24.576 × 6.048

*1: The FFT-CCD (full frame transfer CCD) has charge transfer sections that are also used as light receiving areas, being different from interline transfer CCD (IT-CCD) commonly used in video cameras. Compared to the IT-CCD, the FFT-CCD offers advantages of low dark current, a 100 % open area ratio and low image lag.

*2: The FFT-CCD was originally designed as a two-dimensional image sensor. However, it 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	-0.5	-	+7	V
Supply voltage (for analog circuitry)		VA1+	-	-	+18	
		VA1-	-	-	-18	
		VA2	-	-	+30	
Supply voltage *3		VD2	-	-	+7	
		Vp	-	-	+7	
		VF	-	-	+14	
Digital input voltage		-	-	-	VD (1, 2)	
Operating temperature	C7020	Topr	0	-	+50	°C
	C7021, C7025		+10	-	+35	
Storage temperature	C7020	Tstg	-20	-	+70	
	C7021, C7025		0	-	+70	

■ 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	VIH	+2.0	-	+VD	V	
	Low level	VIL	-0.5	-	+0.8	V	
CLK frequency		fclk	-	-	1	MHz	
Data video readout frequency		fv	-	-	fCLK/4	Hz	
Start pulse width		tst	1/fCLK	-	-	s	
Digital output	High level (Io= -6 mA)	VIH	+2.0	-	-	V	
	Low level (Io=+6 mA)	VIL	-	-	+0.8	V	
Power supply operating conditions							
Voltage	Digital circuitry	VD	+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	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 (+5 VDC) *3	-	-	-	+30	mA	
	Vp (+5 DC) *3	Ta=10 °C	-	-	+0.8	+2.5	A
		Ta=20 °C	-	-	+1.4	+2.5	A
		Ta=30 °C	-	-	+1.8	+2.5	A
		Ta=35 °C	-	-	+2.2	+2.5	A
VF (+12 VDC) *3	-	-	+100	-	mA		

■ Electrical and optical characteristics

(Ta=25 °C, Ts= -10 °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
Spectral response range		λ	-	400 to 1100	-	nm
Full well capacity	Vertical	Fw	150,000	300,000	-	e ⁻
	Horizontal		300,000	600,000	-	
Conversion gain *4		Sv	-	15	-	μV/e ⁻
Dark current *5		DS	-	15	45	e ⁻ /pixel/s
Readout noise		Nr	-	20	-	e ⁻ rms
Dynamic range		DR	-	30,000	-	-
Photo response non-uniformity *6		PRNU	-	-	±10	%

*3: C7021, C7025

*4: Including the circuit gain.

*5: At MPP mode. Vertical register value. The actual value equals the sum of the vertical direction because of the binning operation.

*6: Measured at 50 % of the full well capacity.

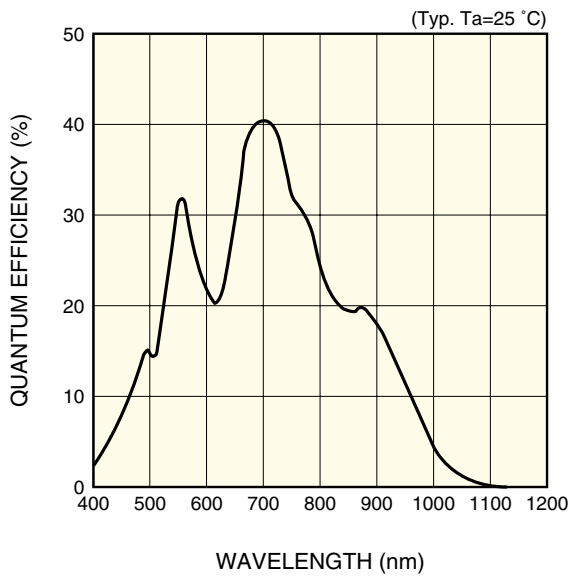
■ Specifications for temperature controller (C7021, C7025)

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

Parameter *7	Symbol	Min.	Typ.	Max.	Unit
Cooling temperature	T_s	-11	-10	-9	$^\circ\text{C}$
Temperature control range	ΔT_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	T_o	-	+45	-	$^\circ\text{C}$

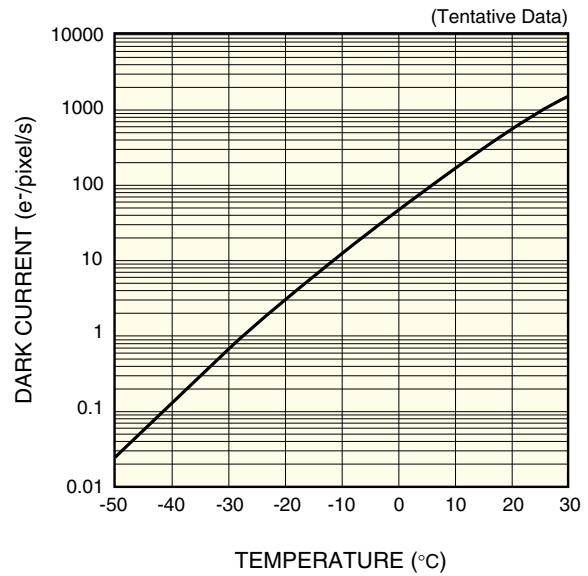
*7: Other functions include error display, automatic power off, and detection of electrical opens and shorts by the thermosensor.

■ Spectral response



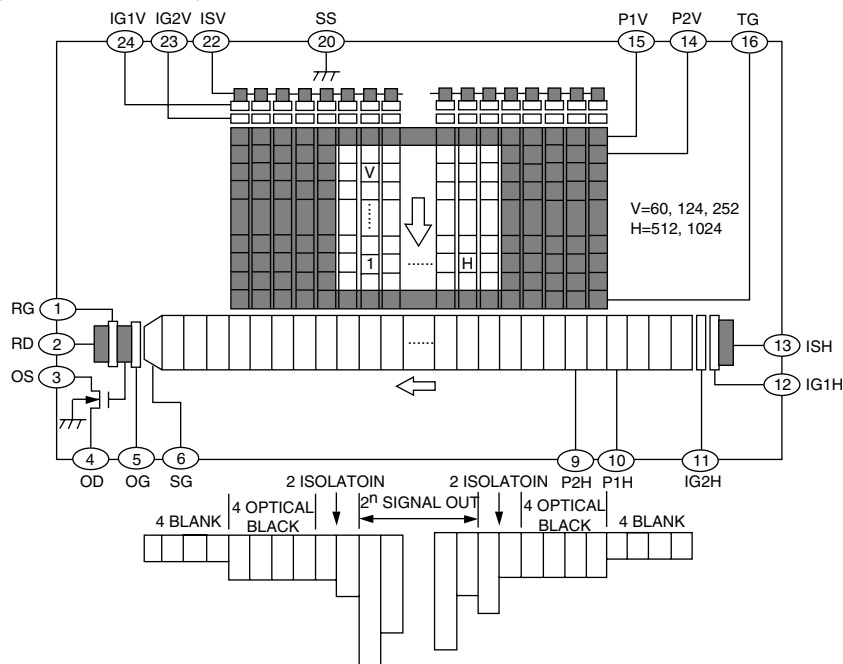
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■ Dark current vs. temperature



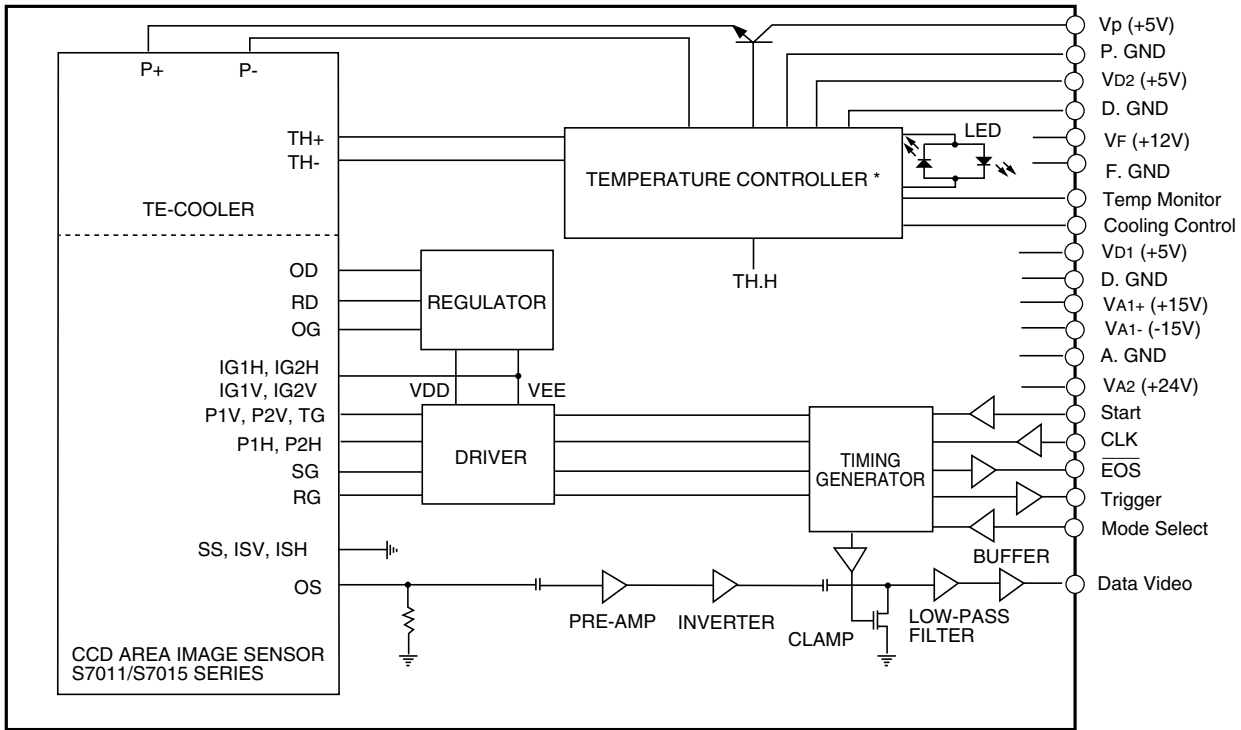
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■ Block diagram (front-illuminated CCD area image sensor)



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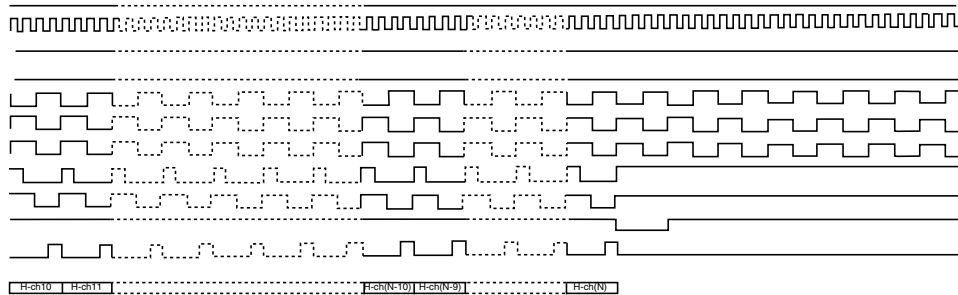
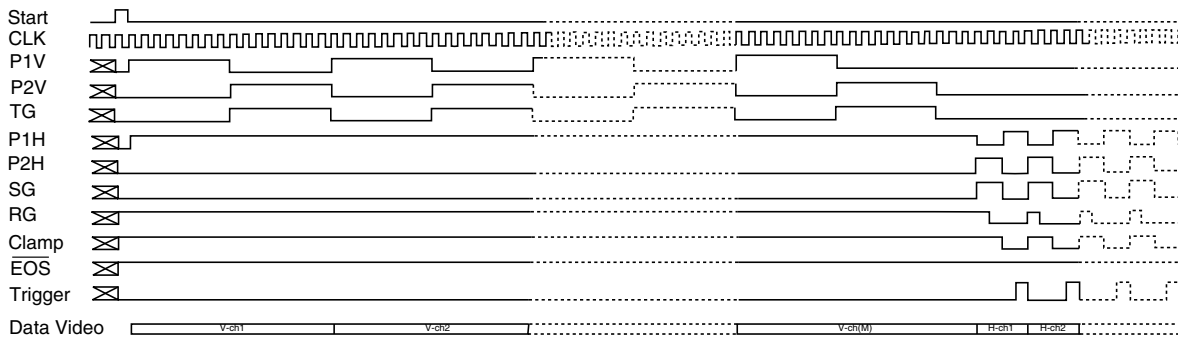
■ Block diagram of C7021, C7025



* C7020 does not include the temperature controller and TE-cooler.

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■ Timing chart

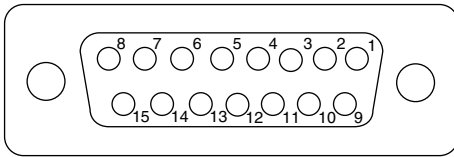


M=68, 132, 260 N=532, 1044
 V-ch1--V-ch2, V-ch (M-3)--V-ch (M): ISOLATION PIXELS
 H-ch1--H-ch4, H-ch (N-3)--H-ch (N): BLANK PIXELS
 H-ch5--H-ch10, H-ch (N-9)--H-ch (N-4): ISOLATION PIXELS

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■ Pin assignment of "SIGNAL I/O" connector

15-pin D-sub connector

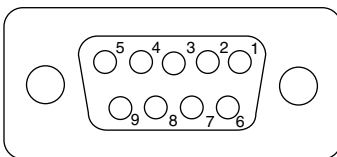


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Pin No.	Terminal name	Description
1	Mode select	Digital input signal used to select between the line binning operation and area scanning operation. HCMOS compatible. High level or left open: line binning operation Low level: area scanning operation
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 input 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 assignment of "TE CONTROL I/O" connector (C7021, C7025)

9-pin D-sub connector



KACCC0075EA

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. (Please use AWG 18 wire)
5	VF (+12 V)	Power supply for cooling fan
6	D. GND	Ground
7	D. GND	Ground
8	P. GND	Power supply return of the thermoelectric cooler mounted in the CCD image sensor. (Please use AWG 18 wire)
9	F. GND	Power supply return for cooling fan

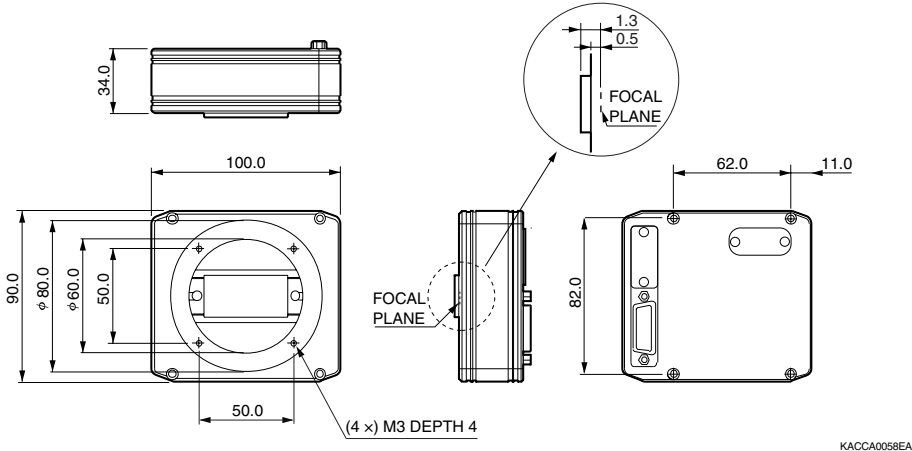
Available for using same power supply (+5 V) for "+VD2" and "+Vp".

Caution: Do not connect "VD2" and "Vp" together on the backside of the 9-pin D-sub connector.

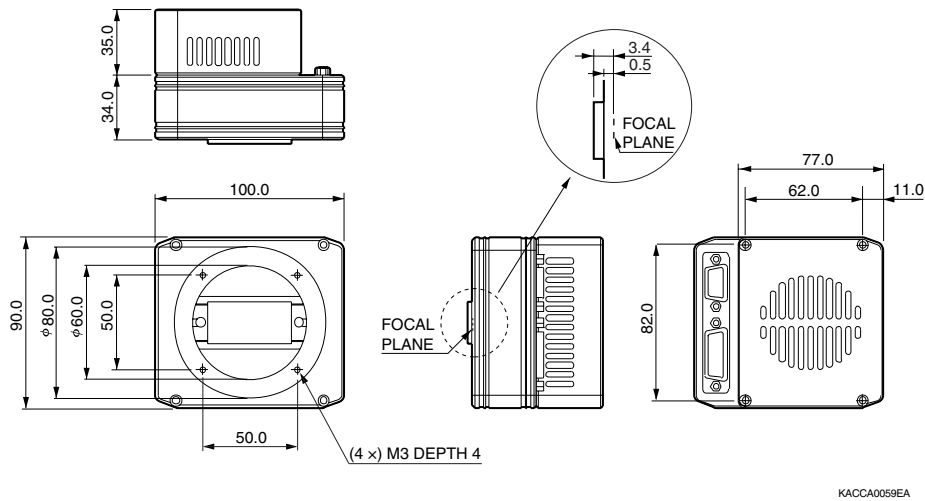
These may be connected (shorted) at the power supply end, not 9-pin D-sub connector.

■ Dimensional outlines (unit: mm)

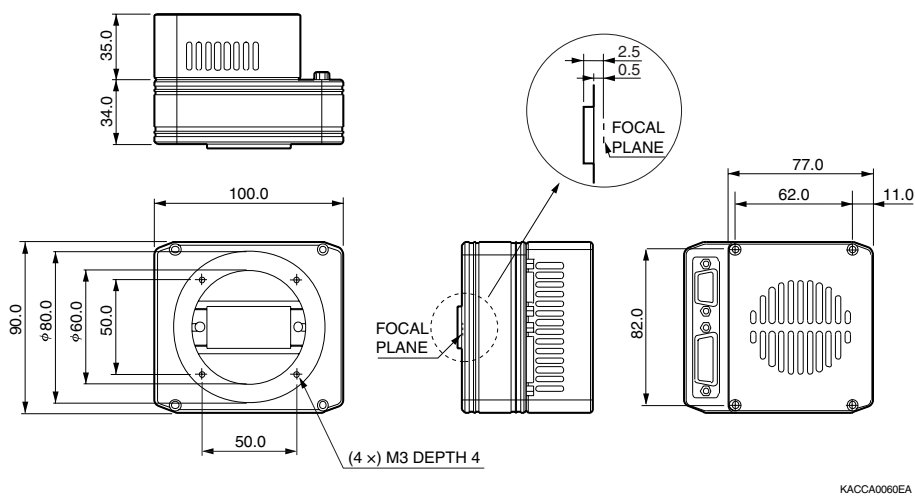
C7020



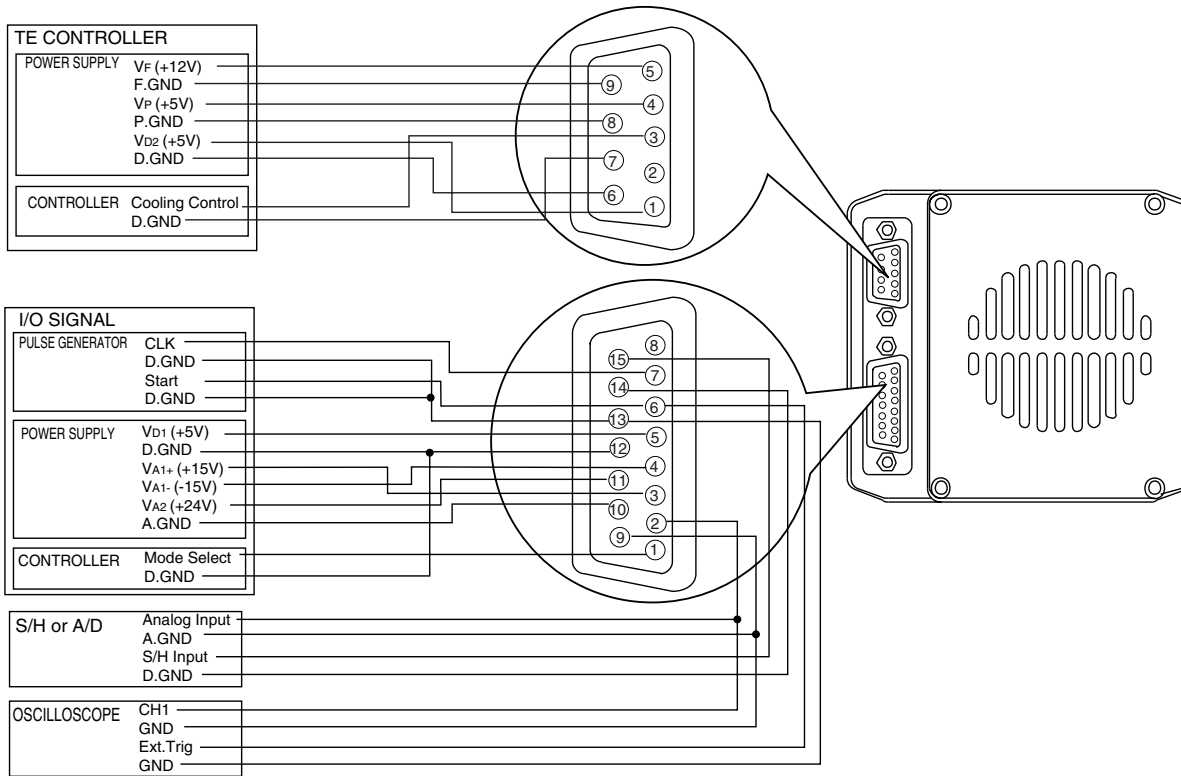
C7021



C7025



■ Connection example



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