XCL-S900 (B/W)
XCL-S900C (Color)

CL Output | Progressive Scan | 1/1 Type CCD | Square Pixels | C Lens Mount | 9 MEGA Output | Long Exposure | Normal Shutter
External Trigger Shutter | Auto Shutter | Bulk Trigger | Sequential Trigger | Trigger range | Partial Scan | Shading Correction | Temperature Readout
Defect Correction | *1 One-Push White Balance | *1 Manual White Balance | LUT | RS232C Control | *2 B/W | *1 RGB RAW | *2 Near-IR Sensitivity

Connection Diagram P58

*1 : XCL-S900C *2 : XCL-S900

Outline

The XCL-S Series cameras incorporate a 1/1-type EXview HAD CCD II™ sensor which provides extremely high sensitivity. The XCL-S900 series (XCL-S900/S900C) cameras achieve high-resolution image capturing with 9 megapixels. With their compact size (50(W) x 50(H) x 57.5(D) mm) and useful features, these cameras are suitable for various applications.

Features

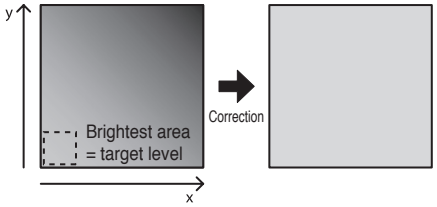
■ High definition and high speed image capture
The unit includes a 9,000,000-pixel CCD, with high speed read out depending on each model. You can select 1ch, 2ch or 4ch sensor output.
The frame rate depends on the channel selected.

CCD/Image size		B/W Model	Color Model
1/1-type CCD	9 Mega	XCL-S900	XCL-S900C

Sensor Tap	Frame rate	Maximum output of pixels (H x V)
4ch	18 fps	3,388 x 2,712
2ch	9 fps	
1ch	5 fps	

■ Near-infrared Sensitivity: XCL-S900
Utilizing EXview HAD CCD II technology enables to capture clear images in near-infrared wavelengths.

■ Shading Correction
Shadings caused by a drop in the amount of light around the lens or light source variation are corrected. The shading correction can be set to ON or OFF.
• XCL-S900/S900C: 6 settings



■ Temperature Readout
The camera's internal temperature can be read from the temperature sensor installed in the circuit board.

■ Defect correction
It corrects clear defect points and opaque defect points which increase under the high/low temperature or when exposed for a long time (seconds). From the peripheral pixels, correction is performed on coordinate pixels in which defects are detected. Factory setting and user setting can be selected.
* Factory setting: OFF

■ Trigger modes
Free run/Special trigger mode
(Bulk trigger/Sequential trigger)

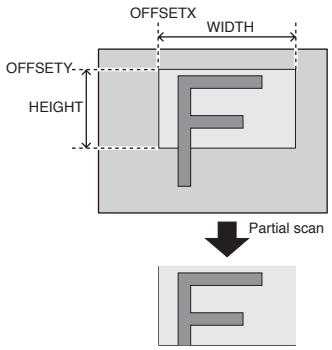
■ Readout modes
Normal/Binning (Monochrome camera only)/Partial scan

■ Binning (Monochrome camera only)

<Vertical Binning/Horizontal Binning>
By adding 2 vertical pixels or 2 horizontal pixels, the frame rate in vertical binning is increased along with the sensitivity. The color camera cannot set this. This can be set with or without a trigger. Partial scan can be used concurrently and horizontal and vertical can be set at the same time.

■ Partial scan

Only the area selected from the effective pixel area can be read out. Clearing unnecessary parts at high-speed allows high-speed reading. The area size is selected by the HEIGHT and WIDTH commands, and the read beginning point is selected by the OFFSETX and OFFSETY commands.



	WIDTH (Pixel)	HEIGHT (Line)
XCL-S900 XCL-S900C	16 to 3388	4 to 2712

* Binning(horizontal and vertical)can be used at the same time. The value will be half during Binnig operation.
* Configurable values: WIDTH: 2-step increments, HEIGHT: 4-step increments

■ Shutter: Manual/External trigger shutter/Auto

■ Shutter speed: Manual 2sec to 1/100,000 sec in 1 µs increments

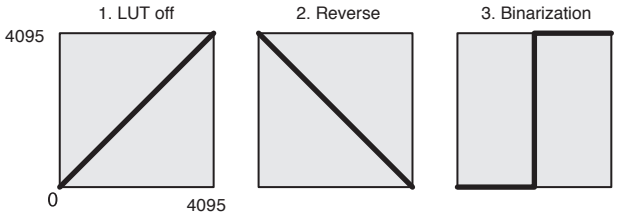
■ Synchronization: Hardware trigger, Software trigger

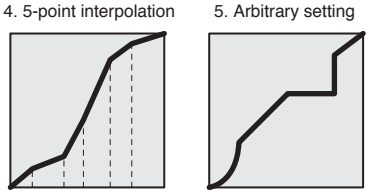
■ White balance (color camera only)

- One push WB
  The white balance can be automatically adjusted once when the WHITEBALANCE-AUTO command is executed.
  The detection area is set to the screen center by default.
  The detection frame can be changed arbitrarily (AWB-FRAME).
- Manual
  Each Gain of R, G, and B is adjustable manually.

■ Readout features

- Built-in test pattern
  B/W model: monochrome chart
  Color model: monochrome chart/color chart
- LUT (Look-Up Table)
  The following Five types of presets are provided. Binarization, 5-point interpolation, and arbitrary setting can be changed.
  LUT off, Reverse, Binarization, 5-point interpolation, Arbitrary setting.





■ 3 x 3 filter

Utilizing the 3 x 3 filter, you can obtain images in various processing conditions.
Depending on the patterns of parameters, you can reduce noise, apply edge enhancement and extract the contour.

3 x 3 filter: OFF　　Laplacian filter

■ Sensor Tap and Camera Link Tap

1tap output or 2tap output can be selected, regardless of the camera settings. The output of sensor tap4 is only available for the selection of camera link tap2. Output clock frequencies are as follows.

Sensor Tap	CameraLink Tap	
	1	2
1	available (Clock 54 MHz)	available (Clock 27 MHz)
2	available (Clock 84 MHz)	available (Clock 42 MHz)
4	unavailable	available (Clock 84 MHz)

■ Camera Link (PoCL*)
*PoCL: Power over Camera Link

■ Dimensions (excluding protrusions):
50 (W) × 50 (H) × 57.5 (D) mm

■ Mass: Approx. 181 g

■ C-mount

■ High Shock and Vibration Resistance

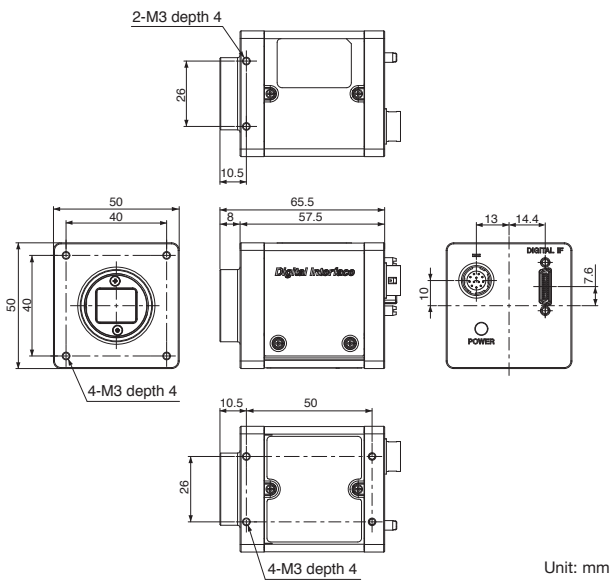
Accessories

■ Compact camera adaptor
DC-700/700CE

■ 12-pin camera cable (CE standard)
CCXC-12P02N (2 m)
CCXC-12P05N (5 m)
CCXC-12P10N (10 m)
CCXC-12P25N (25 m)

■ Tripod adaptor
VCT-ST70I

Dimensions



Unit: mm

Specifications

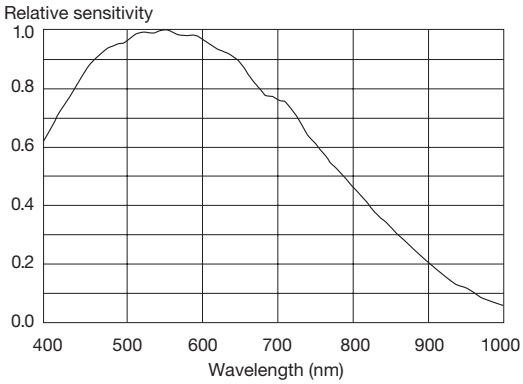
			XCL-S900	XCL-S900C
Basic specifications				
	Image type		B/W	Color
	Image size		9 Mega	9 Mega
	Image sensor		1/1-type PS IT CCD (EXview HAD CCD II)	1/1-type PS IT CCD (EXview HAD CCD II)
	Number of effective pixels (H × V)		3,388 x 2,712	
	Cell size (H × V)		3.69 µm x 3.69 µm	
	Standard output pixels (H × V)		3,384 x 2,704	
	Color filter		—	RGB color mosaic filter
	Frame rate		18 fps (Sensor output 4ch) 9 fps (Sensor output 2ch) 5 fps (Sensor output 1ch)	
	Minimum illumination		0.5 lx (Iris: F1.4, Gain: 18 dB, Shutter: 1/18 s)	6 lx (Iris: F1.4, Gain: 18 dB, Shutter: 1/18 s)
	Sensitivity		F8 (400 lx, Gain: 0 dB)	F8 (2000 lx, Gain: 0 dB)
	SNR		More than 50 dB (Lens close, Gain: 0 dB, 8 bits)	
	Gain		Auto, Manual: 0 dB to 18 dB	
	Shutter speed		Auto, Manual: 2 s to 1/100,000 s in 1 µs increments	
	White balance		—	Manual, One push
Camera Features				
	Readout modes		Normal, Binning (2 × 1, 1 × 2, 2 × 2), Partial scan	Normal, Partial scan
	Readout features		LUT (Binarization, Gamma (arbitrary setting), Test pattern (monochrome chart), 3 x 3 filter	LUT (Binarization, Gamma (arbitrary setting), Test pattern (Monochrome chart/color chart), 3 x 3 filter, Color matrix (for RGB output)
	Synchronization		Internal/External (Hardware trigger, Software trigger)	
	Trigger modes		OFF (Free run), ON (Trigger edge detection, Trigger width detection), Special trigger (Bulk/Sequential)	
	User Set/Memory channel		16 channels	
	User memory		32 kbytes + 64 bytes x 16 ch	
	Partial scan	W (Pixel)	16 to 3388	
		H (Line)	4 to 2712	
	GPO		EXPOSURE/Strobe/LVAL/FVAL/Sensor readout/Trigger through/Pulse generation signal/User definition 1, 2, 3, 4 (Selectable)	
	Other features		Shading correction, Defect correction, Temperature readout, Sensor tap switching	
Interface				
	Video data output		digital Mono 8, 10, 12-bit (default setting 8 bits)	digital Raw 8, 10, 12-bit (default setting Raw 8 bits), RGB
	Digital interface		LVDS	
	Camera specification		Base Configuration, CameraLink® Version 1.2	
	Output data clock		Sensor Tap 1ch 54 MHz (1 tap)/27 MHz(2 tap) Sensor Tap 2ch 84 MHz (1 tap)/42 MHz(2 tap) Sensor Tap 4ch — /84 MHz(2 tap)	
	Digital I/O		TTL IN (x1), TTL IN/OUT (x2), ISO IN (x1), ISO OUT (x2)	
General				
	Lens mount		C-mount	
	Flange focal length		17.526 mm	
	Power requirements		DC +12 V (10.5 V to 15.0 V: DC IN terminal)	
	Power consumption		6.0 W	
	Operating temperature		–10°C to +45°C	
	Performance guarantee temperature		0°C to 40°C	
	Storage temperature		–30°C to +60°C	
	Operating humidity		20% to 80% (no condensation)	
	Storage humidity		20% to 95% (no condensation)	
	Vibration resistance		10 G (20 Hz to 200 Hz, 20 minutes for each direction - x, y, z)	
	Shock resistance		70 G	
	Dimensions (W × H × D)		50 × 50 × 57.5 mm (excluding protrusions)	
	Mass		Approx. 181 g	
	MTBF		76,300 hours (Approx. 8.7years)	
	Regulations		UL60950-1, FCC Class A, CSA C22.2-No.1, IC Class A Digital Device, CE: EN61326 (Class A), AS EMC: EN61326, VCCI Class A, KCC	
	Supplied accessories		Lens mount cap (1), Operating Instructions (1)	

Spectral Sensitivity Characteristics

B/W model

· XCL-S900

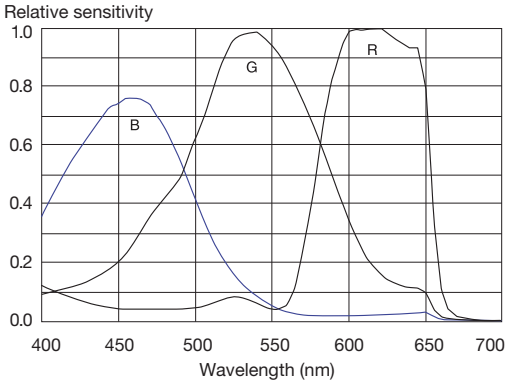
(Lens characteristics and light source characteristics excluded.)



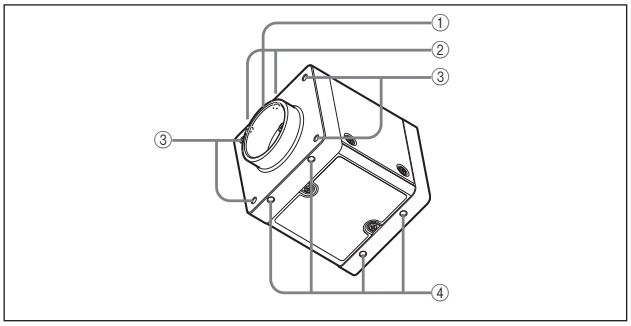
Color model

· XCL-S900C

(Lens characteristics and light source characteristics excluded.)



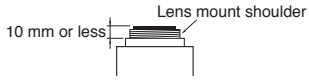
Location and Function of Parts and Controls



① **Lens mount (C-mount)**
Attach any C-mount lens or other optical equipment.

Note

The lens must not project more than 10 mm from the lens mount.

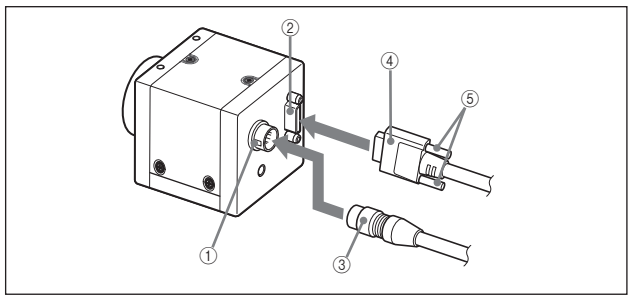


② **Guide screw holes (Top)**

③ **LED light screw holes**
Use these screw holes to attach the LED light to the camera module. Use an adapter appropriate for the LED light as required.

④ **Guide screw holes / Tripod screw holes (Bottom)**
These precision screw holes are for locking the camera module. Locking the camera module into these holes secures the optical axis alignment.
When using a tripod, use these four screw holes to attach a VCT-ST70I tripod adaptor.

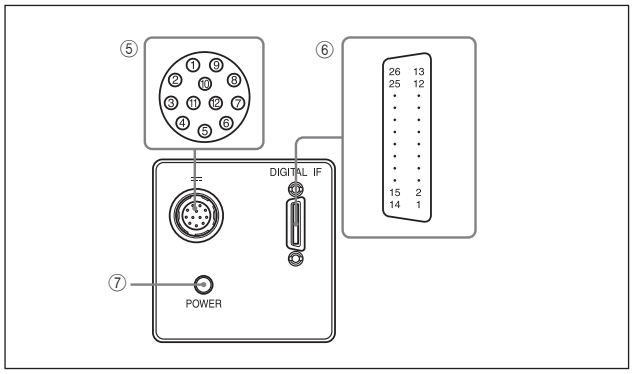
Connecting the Cables



Connect the camera cable to the DC IN connector and the Camera Link cable to the DIGITAL IF cable respectively. When you connect the Camera Link cable, turn the two fastening screws on the connector to secure the cable tightly.
Connect the other end of the camera cable to the DC-700/700CE and the other end of the Camera Link cable to the camera module interface board.

① DC IN Connector
② DIGITAL IF connector
③ Camera Cable
④ Camera Link Cable
⑤ Fastening Screws

Rear Panel/Pin Assignments



⑤ **DC IN (DC power input) connector (12-pin)**

Pin No.	Signal	Pin No.	Signal
1	Ground	7	GPI3/GPO3 *
2	DC +12 V	8	GPI4 (ISO-)
3	ISO Ground	9	GPO4 (ISO)
4	GPI1/GPO1 *	10	GPI4 (ISO+)
5	GPO2 (ISO-)	11	GPI2
6	GPO2 (ISO+)	12	ISO Ground

Power input
Pin 1 (Ground) and pin 2 (DC +12 V) are used.

Signal input
Pins 4, 7, 10 and 11 (GPI1/3/4/2) are used for GPI input or trigger input.
When selecting 1 system for GPI (ISO):
– GPI4 (ISO+) (pin 10) and GPI4 (ISO-) (pin 8) are used.
When selecting 2 systems for GPI:
– GPI1 (pin 4*) and Ground (pin 1) are used.
– GPI3 (pin 7*) and Ground (pin 1) are used.
* Pins 4 and 7 can switch GPI input and GPO output, by external command. The initial value is GPI.

Signal output
Pins 4, 6, 7 and 9 (GPO1/2/3/4) allow you to select GPO from the exposure signal, strobe control signal, Hi/Low fixed value, etc.
When selecting 2 systems for GPO (ISO):
– GPO4 (ISO) (pin 9) and ISO Ground (pins 3 and 12) are used.
– GPO2 (ISO+) (pin 6) and GPO2 (ISO-) (pin 5) are used.
When selecting 2 systems for GPO:
– GPO1 (pin 4*) and Ground (pin 1) are used.
– GPO3 (pin 7*) and Ground (pin 1) are used.
* The initial value of pins 4 and 7 is GPI. Switch to GPO output by external command.

⑥ **DIGITAL IF (Interface) connector (26-pin)**
Camera Link Base Configuration:

Pin No.	Signal	Pin No.	Signal
1	Ground	14	Ground
2	X0–	15	X0+
3	X1–	16	X1+
4	X2–	17	X2+
5	XCLK–	18	XCLK+
6	X3–	19	X3+
7	SerTC+	20	SerTC–
8	SerTFG–	21	SerTFG+
9	CC1–	22	CC1+
10	CC2+	23	CC2–
11	CC3–	24	CC3+
12	CC4+	25	CC4–
13	Ground	26	Ground

⑦ **Status LED (Green)**
When power is on, this LED lights up.

Controlling the Camera From the Host Device

You can control the camera from host device such as a computer. The following table shows the major control functions.

Control functions	Description	
Operating mode	Free run/Trigger	
Shutter speed	Free run	1/100,000 s to 2 s
	Trigger edge detection	1/100,000 s to 2 s
	Trigger pulse width detection	Setting by trigger pulse width
Gain	0 dB to 18 dB	
Partial Scan	Variable, 4-line increments	
LUT (Look Up Table)	OFF/ON (Mode: 5 types)	
External trigger input	DIGITAL IF connector/DC IN connector	
Video output switch	Monochrome model: Mono 8/10/12-bit Color model: Raw 8/10/12-bit, RGB 24-bit	
Binning (Monochrome camera only)	2 × 1, 1 × 2, 2 × 2	
Defect correction	OFF/ON	
Shading correction	OFF/ON	

Trigger Signal Input

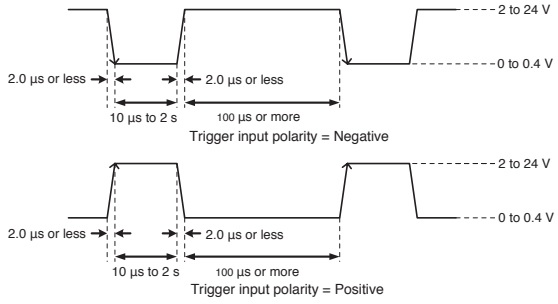
Trigger signals can be input via the 4th/7th/10th/11th pins of the DC IN connector, the CC1, CC2, CC3, CC4 pins of the Digital IF connector, or the software command. Switchover of the trigger signal can be changed via the TRG-SRC command.

command	param	Trigger signal assigned pin
TRG-SRC	4	DC IN connector 4th pin*
	7	DC IN connector 7th pin*
	10	DC IN connector 10th pin
	11	DC IN connector 11th pin
	101	Digital IF connector 22nd [+]/9th [-] (CC1)
	102	Digital IF connector 10th [+]/23th [-] (CC2)
	103	Digital IF connector 24th [+]/11th [-] (CC3)
	104	Digital IF connector 12nd [+]/25th [-] (CC4)
	0	Software command (TRG-SOFT)
	20	OR of DC IN connector 4th/7th/10th/11th pin

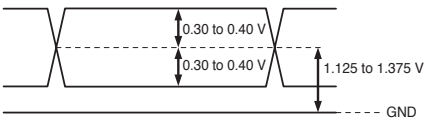
* DC IN connector 4th pin and 7th pin are available only when the GPIO input/output setting is switched to input.

Trigger Signal Specifications

DC IN connector specification



Digital IF connector specifications



Note

When inputting a trigger signal to the camera using the DC-700/DC-700CE, use DC 5 V or less at the logical high level.

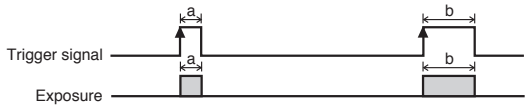
Trigger Modes

There are three modes, Free run, Special trigger (Bulk Trigger/ Sequential Trigger).

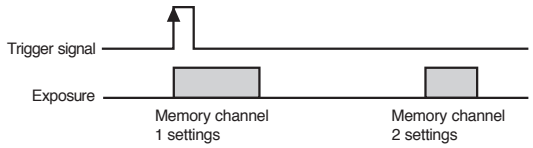
Free Run
The camera operates without a trigger signal and performs the video output operation continuously after the shutter (exposure) is finished when operating in Free run mode.

• Trigger edge detection (Polarity: positive)

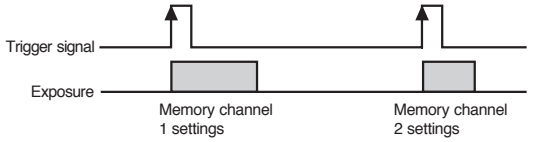
• Trigger width detection (Polarity: positive)



Bulk Trigger
Different camera setting configurations are stored in memory channels beforehand, with the different settings applied to acquire multiple video images at each trigger event. In the following diagram, two images are acquired in one cycle.



Sequential Trigger
Different camera setting configurations are stored in memory channels beforehand, with the different settings applied in sequence to acquire a different image with each trigger event. In the following diagram, two images with different exposure settings are acquired in one cycle.



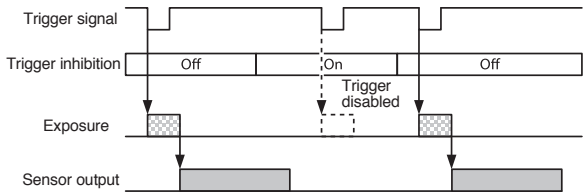
External Trigger Signals and Timing of Shooting

In Trigger Edge mode, the time from when detecting a trigger signal to when starting exposure is 1.1 to 1.4 µs (differ depending on the cameras). In Trigger Width mode, “Minimum Delay” operation (1.2 to 1.5 µs) or “Exact Exposure Time” operation can be selected.

Trigger Inhibition

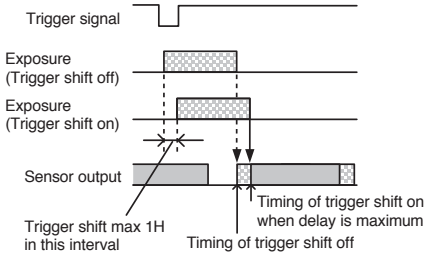
Trigger input can be disabled. This function is effective when disabling the trigger signal to a specific camera in the environment where multiple cameras are connected by the same trigger signal and when preventing false operations caused by noise contamination to the trigger signal line (due to the installed environment).

• Exposure condition (detecting the drop edge):



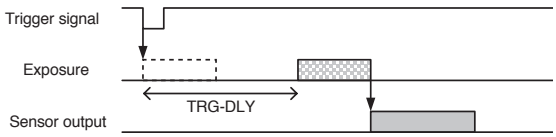
Trigger Shift

This device can accept exposure by the next trigger even while a video is output (except for the special trigger operation). In this case, the trigger signal can become a noise source. When trigger shift is enabled, adjustment is made automatically for operations from trigger input to exposure to prevent noise contamination. (The time from trigger input to exposure start will be delayed up to 1 line.)



Trigger Delay

The camera can delay the trigger signal.



Trigger Range Limit

Only signals in the set trigger width can be accepted as the trigger signal. This functions as a noise filter, which removes chattering or disturbance noise in the trigger signal line. This also functions as a trigger selector, whereby only a specific camera can be operated by the trigger when multiple cameras share one trigger signal line.

User Set

Main set values can be saved to the channels 1 to 16 of USERSET. User set is available during special trigger mode (Bulk Trigger/Sequential Trigger).

Gain

The camera provides both manual and automatic gain control.

Manual gain control
This manual gain control can be variably set from 0 to 18 dB in 1 dB unit, or 0.0358 dB steps.
In addition to the above, the XCL-S900/S900C/S600/S600C provides independent left and right controls (GainL and GainR).

Auto gain control
The camera provides the auto gain control function to automatically control image brightness according to a userspecified detection frame and image average level (variable from 0 to 16383 in 14 bit). The variable range is the same as for manual gain control. Also, the auto gain control detection frame showing each area’s image average level can be displayed and adjusted. The detection frame is defined by Offset X and Y, Width and Height percentage values (relative to the [100%] width and height of the output video image).

Switching Sensor Tap

This unit has a CCD with 4-channel output which is available for 4-channel, 2-channel and 1-channel reading. The reading speed becomes faster as the value of the channel number increases.

GPIO

Switching input/output setting is available on the DC IN connector 4th pin and 7th pin.
The input/output setting of the next startup is set to input, because the setting is not saved to User Set/Memory Channel.

GPI
The value can be checked by detecting the signals input to the DC IN connector 4th, 7th, 10th, and 11th using the GPI command. Since 11th pin is pulled up, 1 (Hi level) is returned if they are opened. Pins 10 and 8 can switch ISO input.

GPO
GPO output can be transmitted from the DC IN connector 4th, 6th, 7th and 9th pins. After selecting a signal, the output polarity should be determined by GPO-INVERTER. DC IN connector 9th/3th pins and 6th/5th pins can switch ISO output.

command	param1	param2	Setting
GPO-SRC	4/6/7/9*	0	Exposure signal
		1	Strobe control signal
		2	LVAL signal
		3	FVAL signal
		4	Sensor readout signal
		5	Trigger through signal
		6	Pulse generation signal
		7	User definition 1
		8	User definition 2
		9	User definition 3
		10	User definition 4

* DC IN connector 4th pin and 7th pin are available only when the GPIO input/output setting is switched to input.