Progressive scan CCD color camera
HV-F202SCL
Specifications

1. General

The HV-F202SCL is an UXGA high precision 3CCD progressive scan color camera, which has
single chip digital processing LSI, a C mount prism, three 1/1.8-inch 2,000,000 pixels square CCDs.
Our original digital image signal processing technology performs the high picture quality signal
processing and the picture compensating functions, beyond the capability of the other conventional
analog cameras.

Moreover, high frame rate 30 FPS(s) can be transmitted by miniCameraLink interface, which is of
digital camera standards for FA. The two connector arrangement is considered so that the collision
of cable does not occur at the time of Meidum Configuration connection which enrich the pixel
gradation expression.

2. Outstanding features

(1) High resolution and color fidelity

The 1/1.8-inch 2,000,000 pixels square lattice progressive scan CCD and the dichroic prism for
RGB color achieve a high resolution of UXGA (1600(H) x 1200(V)) picture and good color
reproduction.

(2) Small-sized camera

The new designed camera has small SDR connector for digital output. Therefore, the camera
has the realization of small-sized shape of 55 (W) x 55 (H) x 89 (D) mm.

(3) mini CameraLink interface

CameraLink Version 1.13 support

It is based on the industrial camera interface standard of AIA (Automated Image
Association) leadership. It is advantageous to the field, where high frame rate is needed
without losing camera performance, since the transmission speed of pixel clock can be
maintained by full screen output.

mini CameraLink

The SDR connector called mini CameraLink is adopted and two connectors are equipped in
a small case. Additionally, when using with L type connection, it is arranged as cable
collision does not occur.

Meidum Configuration connection support

It supports Meidum Configuration connection which enables the rich gradation expression
of each color of 10 bit or 12 bit.
(4) C mount lens adapter
The de facto industry standard C mount lens adapter allows choosing from a variety of lenses and optical systems.

(5) Digital processing for various picture quality enhancements
- Independent six colors masking is the Hitachi innovation for optimizing color balance. The saturation and the hue of 6 colors (Red, blue, green, cyan, magenta, and yellow) are adjusted independently to deliver the best color in image capture, microscope and other applications.
- It is equipped with the in out gradation control function using LUT. Other than normal gamma 0.45 conversion, the function can set the conversion of in out gradation using look up table (LUT) as a user option.

(6) Auto shading correction (ASC)
Color shading due to the aberration of C mount lens is automatically compensated (reduced).

(7) Versatile CCD drive functions
- Video frame capture on demand using external trigger signal.
  See detailed specifications item 8.
- Long integration mode.
- Auto electronic shutter (AES) mode for stabilized video level.

(8) Versatile imaging functions
- Four application files.
  User settings provided for sharpness (detail), masking etc.
- Scene color temperature is detected in dynamic for automatic white balance adjustment.
  By varying the detection area in a scene, the whole white balance can be controlled in only the area. Thus, even if a light source of a different color temperature enters the scene (e.g., situation often occurs in a retail showroom suddenly exposed to outdoor lighting when the entrance door opens), white balance is not severely disturbed.
- Auto exposure (ALC : auto level control)
  It can respond the changes in extremely high light by the digital measurement and AGC (Automatic gain control), AES control using micro computer. In addition, AUTO EXPOSURE (ALC) setting level and the peak/average of the AUTO EXPOSURE(ALC) characteristics can be set through menu screen.
- Gain control
  AGC(Automatic gain control) and manual gain control are available to select.
  - Master black, R/B black, and R/B gain are variable.
3. Specifications

(1) Imaging device (sensor type) 1/1.8-inch progressive scan interline CCD (x 3 sensor)
- Indication lens category 1/1.8 inch
- Effective pixels (Active area) 1600 (H) x 1200 (V) (x 3 sensor for RGB) : Resolution
  Pixel size 4.4 μm square lattice
- scanning area (Pixel area) 7.04mm (H) x 5.28mm (V), Diagonal 8.80mm (1/1.8 inch)
- Readout type, Transfer type progressive scan, Interline transfer

(2) scanning mode full pixel sequential scan

(3) scanning frequency Horizontal : 37.5kHz / Vertical : 29.95Hz / Pixel : 72.0MHz

(4) Optical system 1/1.8-inch F1.8 prism with IR cut filter

(5) Lens mount C mount Mount surface projection less than 4.0mm

(Lens selection guideline)
Use the lens less than 4.0mm as the projection item from the lens flange surface.
To obtain a good picture image by high resolution and few chromatic aberration, it is necessary to choose an appropriate high resolution 3CCD type lens.
When using lens other than 1/1.8 type, there may be vignetting or insufficiency of light around the image or occurrence of flare in the image, in this case combinational lens selection is necessary.

(6) Flange focal distance 17.526 mm (Air conversion)

(7) Sensitivity 2000 lx, F5.6, light source halogen lamp temp.: 3200K
  Shutter : 1/30s, Gain 0dB

(8) Minimum illumination 12 lx, Video Level 50%, Gamma = 0.45
  F1.8, Shutter : 1/30s, Gain +12dB

(9) Gamma 0.45 / 1.0 / LUT (Look Up Table : user customizable)

(10) Gain Manual : 0 to 12 dB / AGC : 0 to 12 dB (with limit setting)

(11) White balance Manual / One-push Auto / Continuance Auto

(12) Video output
CaemraLink Version 1.13 standard
  Base configuration ( only D.OUT 1 )
  Medium configuration ( using D.OUT 1 with D.OUT 2 )
  Control : Original

(13) Video output format Base configuration 24bit (R:8bit, G:8bit, B:8bit)

(14) Quantization level information Maximum data : 255 (8bit), 1023 (10bit), 4095 (12bit)
  Video 100% white : 255 (8bit), 1023 (10bit), 4095 (12bit)
  Video 0% black : 0, Minimum data : 0
(15) Electric shutter speed
Variable shutter mode
AES mode
Long time integration mode
Exposure time: approx. 1/100,000 to 1/30 second
Exposure time: approx. 1/100,000 to 1/29.95 (shutter OFF) second
Exposure time: approx. 1/30 to 10 seconds in 1 frame steps
(16) Sync system
Internal / VD external
(17) Frame on demand mode
Input mode
Trigger input
Input level
Output
Synchronous output
Output level
Exposure time: approx. 1/100,000 to 1/30 second
AES mode: Exposure time: approx. 1/100,000 to 1/29.95 (shutter OFF) second
Long time integration mode: Exposure time: approx. 1/30 to 10 seconds in 1 frame steps
(A) Fixed shutter mode: adjustable for polarity and delay
(B) ONE trigger mode: adjustable for polarity and delay
(C) VD reset mode: negative, frequency Approx. 29.95Hz
CameraLink (CC1) or DCIN/SYNC connector
VD output: negative, frequency Approx. 29.95Hz
DCIN/SYNC connector
5Vp-p ± 0.5V
strobe signal
5Vp-p
(18) Registration
Full screen 0.05% (not including lens response)
(19) Vertical contour correction
2H
(20) Sharpness (DTL)
Level, WIDTH
(21) Color masking
OFF / ON (6 color independent masking)
(22) Paint black
Adjustable
(23) Black level
Adjustable
(24) Knee
Adjustable (Knee point and Knee slope)
(25) Power supply
DC+12V ± 1V (input from DC IN / SYNC connector)
(26) Current consumption
DC+12V Approx. 600mA (Approx. 7.2W)
(27) Ambient temperature
Performance
Operation
Storage
0 to +40°C (+32 to +104 F), less than 90 % RH
-10 to +40°C (+14 to 104 F), less than 90 % RH
-20 to +60°C (-4 to 140 F), less than 70 % RH
(28) External dimensions
55(W) x 55(H) x 89(D) mm (not including protrusions)
(29) Mass
Approx. 350g (without lens)
(30) Remote control

(a) Signal system

- Control system: Start-stop synchronization system
- Transmission rate: 9600 bps
- Data length: 8 bits
- Start bit: 1 bit
- Stop bit: 1 bit
- Parity: None
- Bit transfer: LSB first

(b) Communications control system

Full control by remote control software, data send/receive by text data transfer to camera microprocessor (BSC system handshake)

(c) Control items

1. Variable shutter: 10 to 1/100,000 second
2. Trigger Mode: Fixed shutter, One trigger, VD reset
3. Gain
4. AUTO EXPOSURE
5. White balance
6. Gamma
7. 6 vector independent masking
8. Paint black
9. Sharpness
10. Brightness
11. 24bit / 30bit / 36bit: Factory setting: 24bit
12. Trigger pulse polarity: Factory setting: POS
13. Trigger input: CameraLink (CC1) or DCIN/SYNC connector
   Factory setting: CC1
14. Output signal: OFF, FLASH OUT and VD OUT
   Factory setting: OFF
15. Application files
4. Composition
(1) Camera
(2) Lens mount sheet
(3) DCIN/SYNC connector (HR10A-10P-12S)
(4) Installation guide

5. Optional accessories
(1) AC adaptor       JC-100 (junction box is included)
(2) Junction box      JU-F30
(3) Tripod adaptor    TA-F202
(4) 12pin plug        HR10A-10P-12S(01)
(5) Camera cable

<table>
<thead>
<tr>
<th></th>
<th>Molded type</th>
<th>Shield type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 m</td>
<td>C-201KSM</td>
<td>C-201KSS</td>
</tr>
<tr>
<td>5 m</td>
<td>C-501KSM</td>
<td>C-501KSS</td>
</tr>
<tr>
<td>10 m</td>
<td>C-102KSM</td>
<td>C-102KSS</td>
</tr>
</tbody>
</table>

In the CE Marking region, use the shield type and install clamp filter
(ZCAT2035-0930A: TDK) at both ends of the cable.

(1) DCIN connector

<table>
<thead>
<tr>
<th>PIN NO.</th>
<th>Signal</th>
<th>PIN NO.</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND (+12V)</td>
<td>7</td>
<td>TRIG-A / VD (H) IN</td>
</tr>
<tr>
<td>2</td>
<td>+12V</td>
<td>8</td>
<td>TRIG-B (C) IN</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>9</td>
<td>TRIG-B (H) IN</td>
</tr>
<tr>
<td>4</td>
<td>N.C.</td>
<td>10</td>
<td>FLASH / VD OUT</td>
</tr>
<tr>
<td>5</td>
<td>N.C.</td>
<td>11</td>
<td>N.C.</td>
</tr>
<tr>
<td>6</td>
<td>N.C.</td>
<td>12</td>
<td>TRIG-A / VD (C) IN</td>
</tr>
</tbody>
</table>

Connector (camera side) : SAMWOO SNH-10-12 (RPCB) or equivalent
Plug (matching cable plug) : Hirose HR10A-10P-12S (01) or equivalent

Please do not unplug and insert cable (camera cable) with a power supplied to a camera. Install clamp filter (ZCAT 2035-0930A; TDK) at both ends (camera and video processor ends) in the CE marking region.

TRIG-A/VD and TRIG-B are photo coupler input, 8/12/5 pin is isolated with 1/3 pin. When 8/12/5 pin is connected to GND, please connect to 3 pin.

Note: Please do not input any signal to N.C. pin because machine may break down.

(2) DIGITAL OUT connector

(a) Interrelation between number of DATA bits and number of used connector

<table>
<thead>
<tr>
<th>Number of Data bits</th>
<th>D.OUT1</th>
<th>D.OUT2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 24bit (R: 8bit G: 8bit B: 8bit)</td>
<td>O</td>
<td>–</td>
</tr>
<tr>
<td>2 30bit (R: 10bit G: 10bit B: 10bit)</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>3 36bit (R: 12bit G: 12bit B: 12bit)</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

O: Use
–: Not use
### Connector 1 (D.OUT1: 24bit / 30bit / 36bit)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal</th>
<th>Pin No.</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>14</td>
<td>GND</td>
</tr>
<tr>
<td>2</td>
<td>TXOUT 0 (-)</td>
<td>15</td>
<td>TXOUT 0 (+)</td>
</tr>
<tr>
<td>3</td>
<td>TXOUT 1 (-)</td>
<td>16</td>
<td>TXOUT 1 (+)</td>
</tr>
<tr>
<td>4</td>
<td>TXOUT 2 (-)</td>
<td>17</td>
<td>TXOUT 2 (+)</td>
</tr>
<tr>
<td>5</td>
<td>TXCLKOUT (-)</td>
<td>18</td>
<td>TXCLKOUT (+)</td>
</tr>
<tr>
<td>6</td>
<td>TXOUT 3 (-)</td>
<td>19</td>
<td>TXOUT 3 (+)</td>
</tr>
<tr>
<td>7</td>
<td>RX (+) [ SERTC (+) ]</td>
<td>20</td>
<td>RX (-) [ SERTC (-) ]</td>
</tr>
<tr>
<td>8</td>
<td>TX (-) [ SERTFG (-) ]</td>
<td>21</td>
<td>TX (+) [ SERTFG (+) ]</td>
</tr>
<tr>
<td>9</td>
<td>TRIG/VD (-) [ CC1 (-) ]</td>
<td>22</td>
<td>TRIG/VD (+) [ CC1 (+) ]</td>
</tr>
<tr>
<td>10</td>
<td>N.U. [ CC2 (+) ]</td>
<td>23</td>
<td>N.U. [ CC2 (-) ]</td>
</tr>
<tr>
<td>11</td>
<td>N.U. [ CC3 (-) ]</td>
<td>24</td>
<td>N.U. [ CC3 (+) ]</td>
</tr>
<tr>
<td>12</td>
<td>N.U. [ CC4 (+) ]</td>
<td>25</td>
<td>N.U. [ CC4 (-) ]</td>
</tr>
<tr>
<td>13</td>
<td>GND</td>
<td>26</td>
<td>GND</td>
</tr>
</tbody>
</table>

### Connector 2 (D.OUT2: 30bit / 36bit)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal</th>
<th>Pin No.</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND</td>
<td>14</td>
<td>GND</td>
</tr>
<tr>
<td>2</td>
<td>TYOUT 0 (-)</td>
<td>15</td>
<td>TYOUT 0 (+)</td>
</tr>
<tr>
<td>3</td>
<td>TYOUT 1 (-)</td>
<td>16</td>
<td>TYOUT 1 (+)</td>
</tr>
<tr>
<td>4</td>
<td>TYOUT 2 (-)</td>
<td>17</td>
<td>TYOUT 2 (+)</td>
</tr>
<tr>
<td>5</td>
<td>TYCLKOUT (-)</td>
<td>18</td>
<td>TYCLKOUT (+)</td>
</tr>
<tr>
<td>6</td>
<td>TYOUT 3 (-)</td>
<td>19</td>
<td>TYOUT 3 (+)</td>
</tr>
<tr>
<td>7</td>
<td>N.U.</td>
<td>20</td>
<td>N.U.</td>
</tr>
<tr>
<td>8</td>
<td>N.U.</td>
<td>21</td>
<td>N.U.</td>
</tr>
<tr>
<td>9</td>
<td>N.U.</td>
<td>22</td>
<td>N.U.</td>
</tr>
<tr>
<td>10</td>
<td>N.U.</td>
<td>23</td>
<td>N.U.</td>
</tr>
<tr>
<td>11</td>
<td>N.U.</td>
<td>24</td>
<td>N.U.</td>
</tr>
<tr>
<td>12</td>
<td>N.U.</td>
<td>25</td>
<td>N.U.</td>
</tr>
<tr>
<td>13</td>
<td>GND</td>
<td>26</td>
<td>GND</td>
</tr>
</tbody>
</table>

N.U.: Not used

- D.OUT2 is used for Medium configuration.
- The digital out cable should be comprised of a twisted pair of wires having 100 ohm characteristic impedance and an outer sheath shield type conductor.
- Connect the shield (ground) of the digital out cable to the ground terminal of the video equipment, frame grabber, etc.
- Install clamp filter (ZCAT2035-0930A: TDK) at both ends (camera and video processor ends) in the CE marking region.
- TX: Transmit data from camera to PC
- RX: Transmit data from PC to camera

(Note) Please do not unplug and insert cable (digital out cable) with a power supplied to a camera.
7. Video output format (Typical example)

<table>
<thead>
<tr>
<th>Data length</th>
<th>Horizontal Pixels</th>
<th>Vertical Pixels</th>
<th>FRAME RATE</th>
<th>support standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>R:8bit, G:8bit, B:8bit</td>
<td>1600</td>
<td>1200</td>
<td>Approximately 29.95FPS</td>
<td>Base configuration (using D.OUT1 only)</td>
</tr>
<tr>
<td>R:10bit, G:10bit, B:10bit</td>
<td>1600</td>
<td>1200</td>
<td>Approximately 29.95FPS</td>
<td>Medium configuration</td>
</tr>
<tr>
<td>R:12bit, G:12bit, B:12bit</td>
<td>1600</td>
<td>1200</td>
<td>Approximately 29.95FPS</td>
<td>Medium configuration</td>
</tr>
</tbody>
</table>

8. Timing chart

8-1. Transmitter LVDS output

(1) DATA TIMING (H)

(2) DATA TIMING (V)

1H = 1920 clk = 26.667μs
(3) LVDS SERIAL DATA

(a) Base configuration 24bit

D.OUT 1

CLKX

Previous Cycle  

T_{CLK} 13.889ns (72.0MHz)

Next Cycle

R7-1  R6-1  N.U.  B7  B6  G7  G6  R7  R6

R3-1  R2-1  N.U.  FVAL  LVAL  B5  B4  B3  B2

G2-1  G1-1  B1  B0  G5  G4  G3  G2  G1

R1-1  R0-1  G0  R5  R4  R3  R2  R1  R0

0±3ns

N.U.: Not used
(b) Medium configuration 36bit / [30bit]

**D.OUT 1**

```
CLKX

Previous Cycle       Next Cycle

X3
R7-1  R6-1  N.U.  B7  B6  B11 [N.U.]  R7  R6
B3-1  B2-1  N.U.  FVAL  LVAL  B5  B4  B3  B2
R10-1  R9-1  [N.U.]  B1  B0  B9  B8  R11  R10  R9
R1-1  R0-1  R8  R5  R4  R3  R2  R1  R0

0±3ns
```

N.U.: Not used

**D.OUT 2**

```
CLKY

Previous Cycle       Next Cycle

Y3

0±3ns
```

N.U.: Not used
8-2. Normal mode

Shutter time setting

Data output

VD

FVAL

12H 37H 1252 H

12H 3H 1200 H
8-3. Fixed shutter mode

When external trigger signal is POSITIVE (high active), after the trigger signal rise, exposure starts. The exposure time is set by the camera electronic shutter speed. The video output is obtained immediately after the end of fixed exposure. The strobe signal start/end can be set to shutter time. Trigger signal input during exposure is disabled.

8-4. ONE Trigger mode

When external trigger signal is POSITIVE (high active), after the trigger signal rise, exposure starts. At the trigger signal falling edge, the internal VD signal is reset and the video data are transmitted. The trigger signal width equals the exposure time.
8-5. VD reset mode

NOTE: If the external VD of cycle which does not match the camera operation mode is input, shutter time has an error.
9. Spectral sensitivity characteristics

HV-F202SCL/GV spectrum

Example by the integrated value of the representative sample data of the optical component and the image sensor in the camera.

10. External view
Warranty and service:

1) The guarantee period is two year after the data purchase. However, the defects due to erroneous use or intentional act are excluded.

2) As the defect after expiration of the guarantee period, where product repair is possible, repair will be performed at charge.

3) The present Warranty pertains only to the camera unit. Secondary malfunctions attributable to camera failure as well as expenses incurred by disassembly and reassembly of the related system, are beyond the scope of this Warranty.

4) Compensation for loss of business, loss or damage to software, database and other contingent losses are beyond the scope of this Warranty.

5) Hitachi Kokusai Electric Inc. is not liable for the losses caused when the equipment is used in a system, use for business trades, production process, medical fields, crime prevention applications, etc.

6) The parts used in the equipment have their respective lives. The lives of such parts will be shortened under the environments of high temperature or high humidity. When the stable operation is required for a long time, it is recommended to perform periodical maintenance and inspection every year or every two years.

Notice:
These specifications are subject to change without prior notice due to product improvement. Confirm the most recent specifications at time of order.
Hitachi Kokusai Electric certifies this product complies with the standard warranty conditions of Hitachi Kokusai Electric, and that quality control is implemented to the extent required to comply with these conditions.
## Modification history

<table>
<thead>
<tr>
<th>SIMBLE</th>
<th>DATE</th>
<th>CORRECTION AND REASONS</th>
<th>DESIGNED</th>
</tr>
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