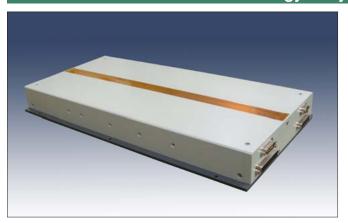# Dual energy X-ray line scan camera
# C10800 series

## Dual Energy X-ray Line Scan Camera

C10800 Series is a new high-speed and high-resolution dual energy X-ray line scan camera that can be used to effectively differentiate materials in a variety of nondestructive testing applications.

Using the commercial frame grabber board, the 12-bit digital output enables easy connection to a computer or other external instrument. Acquired image processing, data processing and filing can be performed, allowing the configuration of any system. The 12-bit digital output provides high resolution and high contrast image with a wide dynamic range.
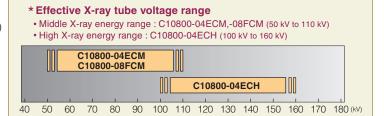
By using a variety of combinations of scintillator, filter and gain factor, it is possible to optimize for different object and X-ray conditions in order to cover a wide range of applications from high energy range applications such as mineral resources sorting to middle or low energy applications such as drug detection, meat inspection, foods inspection.
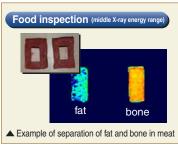
## FEATURES

- Extract a target material from multi-energy image data
- Optimized for middle X-ray energy range (50 kV to 110 kV) or high X-ray energy range (100 kV to160 kV) *
- 12-bit digital output
- High resolution and a wide dynamic range
- Very good energy separation accuracy with well aligned dual energy images
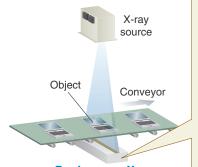
## APPLICATIONS

- Food inspection with high accuracy
- Composite material inspection or sorting
- Drug detection, Medicine quality control
- Security check
- Mineral resources sorting - Rare metals detection
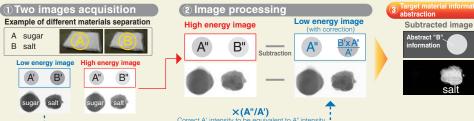- Waste sorting for recycling

**\* Effective X-ray tube voltage range**
- Middle X-ray energy range : C10800-04ECM,-08FCM (50 kV to 110 kV)
- High X-ray energy range : C10800-04ECH (100 kV to 160 kV)

C10800-04ECM
C10800-08FCM

C10800-04ECH

40  50  60  70  80  90  100  110  120  130  140  150  160  170  180 (kV)

### Food inspection (middle X-ray energy range)

fat    bone

▲ Example of separation of fat and bone in meat

### Security (high X-ray energy range)

▲ Example of model gun detection in briefcase

## OPERATING PRINCIPLE

X-ray source

Object

Conveyor

**Dual energy X-ray line scan camera**

**Acquire high energy image and low energy image by a single scanning by Dual energy X-ray line scan camera, and then extract a target material by applying image processing to two images.**

### ① Two images acquisition

Example of different materials separation

A  sugar
B  salt

Ⓐ    Ⓑ

Low energy image      High energy image

A'  B'        A"  B"

sugar  salt    sugar  salt

### ② Image processing

**High energy image**

A"  B"

Subtraction

**Low energy image** (with correction)

A"    B'×A"/A'

$\times (A''/A')$
Correct A' intensity to be equivalent to A" intensity

### ③ Target material information abstraction

Subtracted image

Abstract "B" information

salt

Intensity in high energy image and low energy image appears differently because every material has different X-ray transmittance efficiency. Depending on the ratio between them, adjust intensity level and then subtract unnecessary part to extract a target material information.

# HAMAMATSU

## PHOTON IS OUR BUSINESS

## SPECIFICATIONS

| Type number | C10800-04ECM | C10800-04ECH | C10800-08FCM |
|---|---|---|---|
| Detection method | Scintillator method | | |
| Recommended use range | Approx. 50 kV to 110 kV | Approx. 100 kV to 160 kV | Approx. 50 kV to 110 kV |
| Sensor element pitch | 0.8 mm | | 0.4 mm |
| Detection width | 409.6 mm (Possible to change upon request) | | |
| Resolution | 1/512 | | 1/1024 |
| Effective number of pixels *1 | 1024 (Lower energy image: 1st to 512th, Higher energy image: 513th to 1024th) | | 2048 (Lower energy image: 1st to 1024th, Higher energy image: 1025th to 2048th) |
| Line speed | 8 m/min to 200 m/min | | 4 m/min to 100 m/min |
| A/D conversion | 12 bit | | |
| Digital interface | RS-422 (Standard) | | |
| External control | RS-232C | | |
| Correction functions | Analog processing : dark correction (offset) <br> Digital processing : dark correction (offset), sensitivity correction | | |
| Multi analog gain control feature | Yes (option) | | |
| Ambient operating temperature | 0 ˚C to +40 ˚C | | |
| Ambient storage temperature | -10 ˚C to +50 ˚C | | |
| Ambient operating humidity | 30 % to 80 % (no condensation) | | |
| Power supply | DC + 5 V | | |

※ Please contact Hamamatsu for various options, other detection width, other Sensor element pitch, other Effective X-ray tube voltage range.

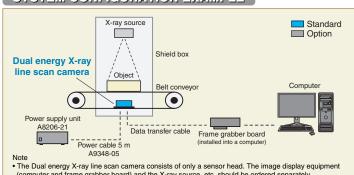*1 Acquired image data is output with the following format.

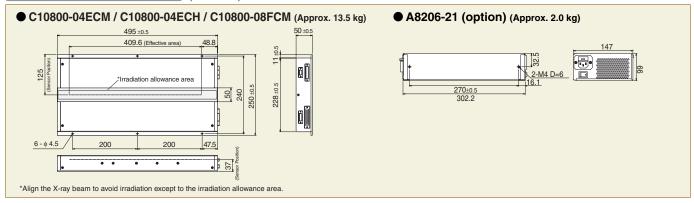● **C10800-04ECM / C10800-04ECH** ( C10800-08FCM )

1     512 (1024)     1024 (2048)

Time

**LOW** energy image data    **HIGH** energy image data    Pixel

## SYSTEM CONFIGURATION EXAMPLE



X-ray source

Shield box

**Dual energy X-ray line scan camera**

Object

Belt conveyor

Computer

Power supply unit A8206-21

Data transfer cable

Power cable 5 m A9348-05

Frame grabber board (installed into a computer)

Standard
Option

Note
• The Dual energy X-ray line scan camera consists of only a sensor head. The image display equipment (computer and frame grabber board) and the X-ray source, etc. should be ordered separately.
• The power supply unit is also optional.

## OPTIONS

● **Power supply unit: A8206-21**

● **Power cable 5 m: A9348-05**

● **Software API Support (Microsoft Windows)**
   **- DCAM-API (http://www.dcamapi.com)**

## DIMENSIONAL OUTLINES   (Unit : mm)

● **C10800-04ECM / C10800-04ECH / C10800-08FCM (Approx. 13.5 kg)**



495 ±0.5
409.6 (Effective area)
48.8
50 ±0.5
11 ±0.5
228 ±0.5
125 (Sensor Position)
*Irradiation allowance area
50
240
250 ±0.5
6 - φ 4.5
200
200
47.5
37 (Sensor Position)

*Align the X-ray beam to avoid irradiation except to the irradiation allowance area.

● **A8206-21 (option) (Approx. 2.0 kg)**



147
32.5
2-M4 D=6
16.1
99
270 ±0.5
302.2

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