

**High Sensitive Digital Monochrome (b/w)
Line Scan Camera**

System: **IEEE1394a**

Baumer FWL120 NeuroCheck Edition

Art. No: **OD106434**

- IEEE1394a (FireWire™) Progressive Scan CCD Camera
- 2048 Pixels
- Outstanding Image Quality
- High Sensitivity
- Frame based Image Capture up to 8 MByte Image Data per Frame
- Freely Programmable True Partial Scan Function (ROI)
- External Synchronisation (Frame Trigger / Line Sync)
- Encoder Pulse Divider Register
- Integrated Online 14 Bit Shading Correction
- Automatic Exposure Control for Stable Image Quality at Web Speed Tolerances down to Stand Still
- Integrated 16 MByte RAM for Temporarily Image Data Buffering
- Compact Robust Aluminium Housing
- Industrial IEEE1394 Connector
- Camera Parameter in Real Time programmable
- Powerful Baumer FCAM1394 Driver / Software Development Kit for Windows
- System Compatible to Baumer FireWire Matrix Cameras
- IEEE1394a Interface compliant to OHCI Standard



shown lens needs to be
ordered separately

1. Overview

| | |
|--------------------------------------|---|
| Sensor | interline progressive scan CCD |
| Shutter / readout mode | global shutter / progressive scan readout |
| Number of pixels | 2048 |
| Number of lines | up to 4095 |
| Pixel size | 14.0 µm x 14.0 µm |
| Color filter | no |
| Operation modes | |
| Frame trigger mode | yes, edge controlled / status controlled |
| Free running mode | yes (frame based) |
| Line sync mode | external encoder input / free running time controlled |
| Signal processing | real time software programmable |
| Pixel clock | 6.5 MHz |
| Max. line rate | 2.8 kHz |
| A/D converter | 14 Bit |
| Exposure control (t _{exp}) | total: 0 µsec .. 65 msec, step 1 µsec automatic exposure control |
| Gain control | 0 .. 15 dB |
| Offset (black level) | 0 .. 255 LSB (8bit) |
| Shading correction | yes, online (14 bit) |
| Image data buffer | 16 MByte |
| Image acquisition | |
| Data format | raw image data from camera |

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Preliminary



| Camera image format modes (see item 3) | Format (pixel) | Bit per pixel | Pixel clock MHz | Lines per sec. *) |
|---|--|---------------|-----------------|-------------------|
| Full frame | 2048 x 4095 | 8 | 6.5 | 2.8 KHz |
| Partial scan function | yes, format freely programmable | | | |
| | # pixel horizontal * lines + 256 < 8 MPixel | 8 | 6.5 | 2.8 KHz |
| Test pattern function | yes | | | |
| Data quality | at 20 °C, gain = 1, exposure time = 0.35 msec, | | | |
| Readout noise | $\sigma < 0.5$ (8 Bit) typical | | | |
| Dynamic range | typ. > 54 dB | | | |
| Optical interface | F-Mount | | | |
| Optical filter | no option : super polished, IR-cut filter or no filter | | | |
| Process interface functions | | | | |
| Frame trigger | yes, edge trigger or status controlled | | | |
| Line sync | yes | | | |
| External line sync divider | encoder pulse divider (16 bit) | | | |
| Frame delay | yes, free programmable | | | |
| Software reset | yes, in free running mode, delay up to 32 msec | | | |
| Image data header | yes | | | |
| Electrical interface | | | | |
| Data / control / power | standard single cable IEEE1394a / 6 pins option: screw lock type connector | | | |
| Digital input | 1: frame trigger, opto decoupled, 5 V .. 30 V / 20 mA min. trigger impulse length (t_{min}): 4 μ sec max. trigger delay (t_{delay}): 4 μ sec | | | |
| | 2: line sync, opto decoupled, 5 V .. 30 V / 20 mA min. trigger impulse length (t_{min}): 4 μ sec max. trigger delay (t_{delay}): 4 μ sec | | | |
| Digital output | no | | | |
| LED | green: power on / image data transfer not active yellow: power on / image data transmission active yellow flashing: error | | | |
| Power consumption | < 6 Watt | | | |
| Environmental | | | | |
| Storage temperature | -10 °C .. +70 °C | | | |
| Operating temperature | +5 °C .. +50 °C | | | |
| Humidity | 10 % .. 90 % non condensing | | | |
| Housing | Aluminium | | | |
| Dimensions | 56 x 73 x 93.9 mm ³ | | | |
| Weight | 370 g | | | |
| IEEE1394a interface | OHCI standard compliant | | | |
| Software | Baumer FCAM1394 Driver / SDK for Windows 2000 / Windows XP | | | |

*) maximum line rate depending on set exposure time

2. Camera Factory Settings after Camera Start-Up

| | camera factory settings after camera start up |
|-----------------------------|---|
| Operation modes | free running mode |
| Signal processing | |
| Exposure control | 0.35 msec |
| Gain control | 5 dB |
| Offset (black level) | 0 |
| Shading correction | off |
| Image acquisition | |
| Camera image format mode | full frame |
| Partial scan function | not active |
| Electrical interface | |
| Digital output | - |

3. SDK Supported Image Formats

| Camera Mode | SDK Image Mode | | | | |
|-------------|----------------|-------------|--------------|------------------|-------------------|
| | Mode ID | Description | Image Format | Color Coding | Functions / State |
| Full Frame | 0 | Full Frame | 2048 x 4095 | RawMono8, Mono8, | PS, FT, LS, Mono |

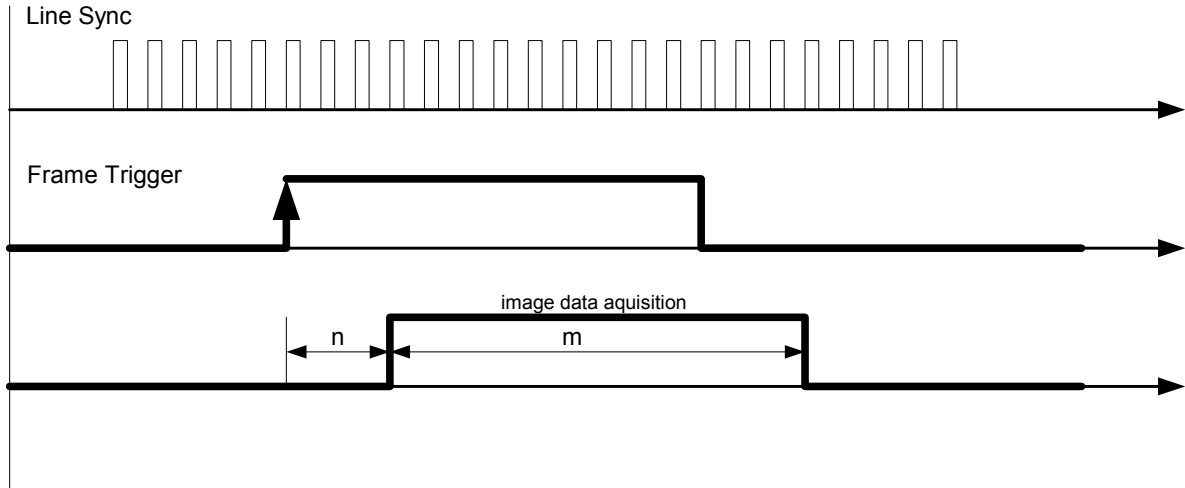
SDK - software development kit
 PS - partial scan
 FT - frame trigger
 LS - line sync
 Mono - monochrome mode

RawMono8 - unmanipulated pixel data for monochrome camera modes in 8 bit
 Mono8 - software corrected image data for monochrome camera modes in 8 bit

4. Timing, Operation

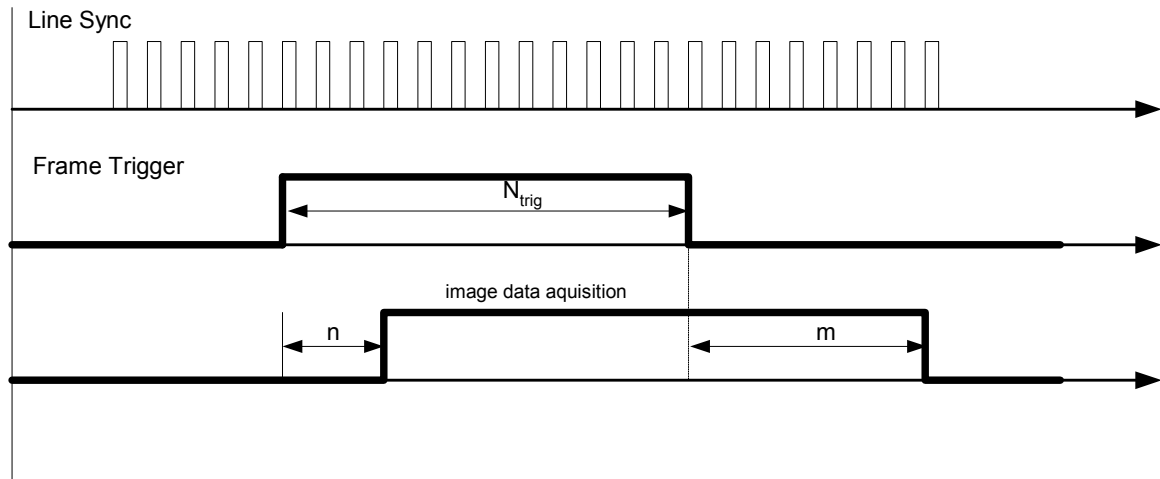
4.1. Frame Trigger Mode

4.1.1 Edge Controlled



n – start of acquisition delay in # of lines, programmable (FrameBeginRegister)
m – acquisition in # of lines, programmable (FrameLengthRegister)

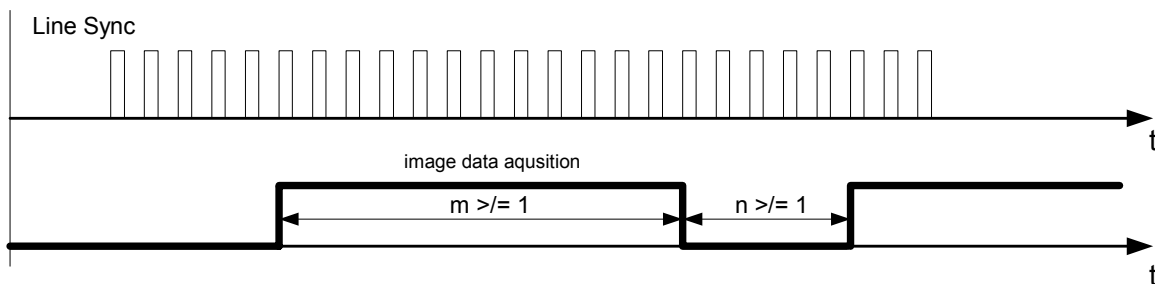
4.1.2 Status Controlled



n – start of acquisition delay in # of lines, programmable (FrameBeginRegister)
m – end of acquisition delay in # of lines, programmable (FrameLengthRegister)

| | acquired # of lines |
|-------------------|---------------------|
| Edge controlled | m |
| Status controlled | $N_{trig} - n + m$ |

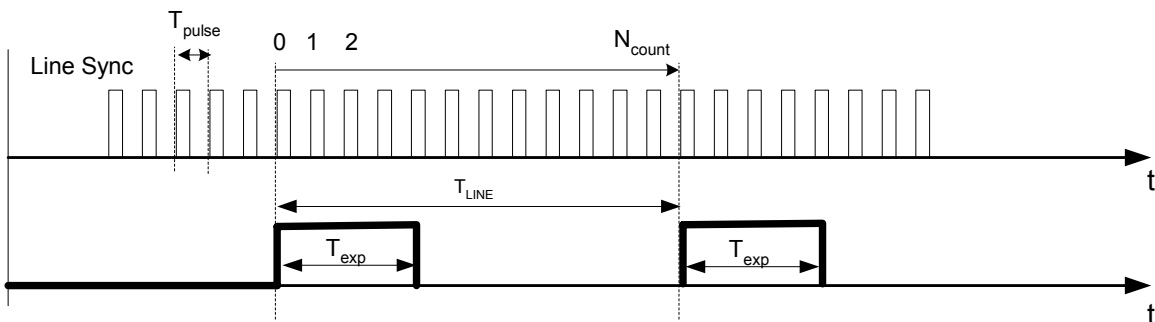
4.2 Frame Free Running Mode



n – gap between two image data acquisitions in # of lines, programmable (FrameBeginRegister)
 m – acquisition in # of lines, programmable (FrameLengthRegister)

4.3 Line Synchronization

4.3.1 External Synchronization (Encoder) in trigger mode



T_{exp} = Exposure time

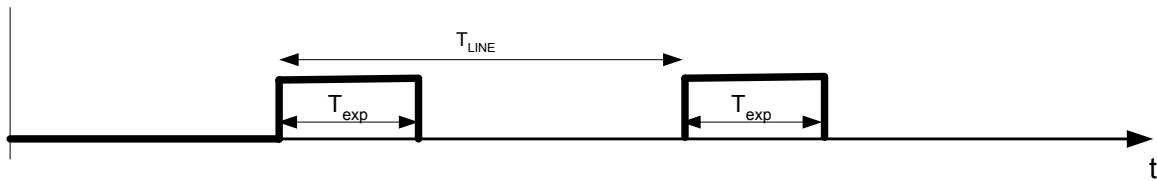
T_{pulse} = Time between two encoder pulses

N_{count} = Encoder Divider Register

$T_{readout}$ = Readout time = 0.35 msec

$T_{LINE} = \text{Max} (T_{exp}, T_{pulse} * (N_{count} + 1), T_{readout})$

4.4 Line Free Running Mode



T_{exp} = Exposure time

$T_{readout}$ = Readout time = 0.35 msec

T_{int} = Timerregister

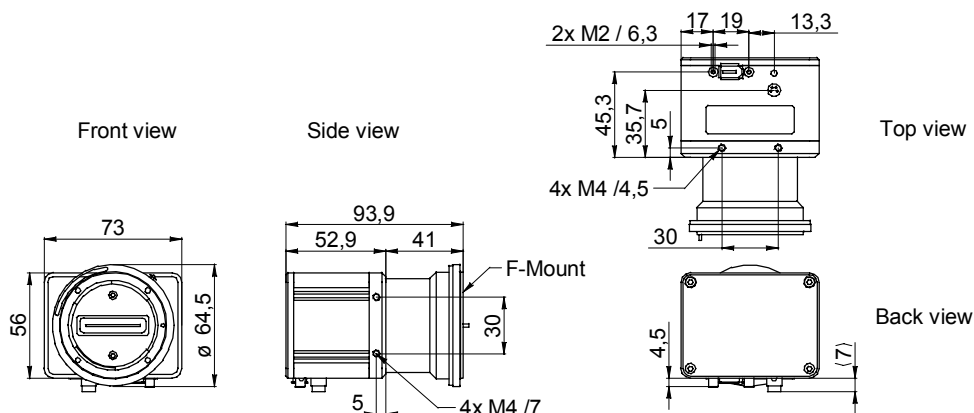
$T_{LINE} = \text{Max} (T_{exp} , T_{int} , T_{readout})$

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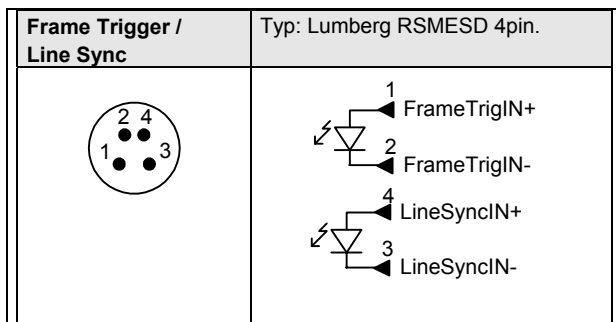


5. Housing



6. Connectors / Electrical Interfaces

| | Pin |
|---------------|--|
| IEEE 1394a | 1: Power 2: GND 3: TPB- 4: TPB+ 5: TPA- 6: TPA+ |



End of Document

History of TDS FWL120 NC Edition

| Date | Version | Name | Pages/ Chapter | Change |
|------------|---------|----------|----------------|---|
| 01.09.2003 | 1.0 | ovi, lsc | all | document created |
| 26.09.2003 | 1.0 | lsc | all | document revised |
| 02.10.2003 | 1.0 | lsc | 4/6 | process interface revised |
| 17.10.2003 | 1.0 | lsc | 4/6 | process interface revised |
| 06.11.2003 | 1.0 | lsc | all 2/1 | number of lines revised power range of digital input revised |
| 18.12.2003 | 1.1 | dni | all | document revised |
| 16.01.2004 | 1.1 | dni | 1 | new picture added |