

# Technical Documentation - Advance Information

## Single Board Progressive Scan Cameras SBC38

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### 1. General information

The SBC Series Single Board Cameras are compact, light-weight black-and-white video cameras on a single PCB with video memory and an image processor.

They integrate a high-resolution progressive scan CCD sensor with a fast image-processing signal processor. SDRAM is used to store data and video images. Interfaces allow communication with the outside world. The cameras set standards for performance and integration density.

These cameras are built for industrial OEM applications. High goals were set in the design of the product. They are fully functional compatible to the manufacturer's VC38 industrial cameras.

Only one supply voltage is required to operate the boards (12 volts). An image processing system or a PC with a frame grabber board is not necessary. Simple control problems can even be implemented with the integrated process interfaces. For more complex control tasks, the cameras can be connected with, for example, a PLC.

This documentation describes the **hardware**. However, in many cases the **software** documentation is decisive. For this, please consult the software manuals.

### 2. Basic structure

The image is formed by a high-resolution CCD sensor. With the appropriate control chips, it itself is in many ways comparable with a conventional video camera. However, instead of an ordinary video signal, a staircase-shaped signal is sent which is very advantageous for the later digitalization.

The staircase-shaped signal is digitized. This 8-bit video signal can be used for various purposes. Via a bidirectional buffer, it is sent to the DMA interface of the ADSP2183 signal processor, which in turn controls the functions "Record", "Stills", etc. Additionally, the digital video signal is sent to the video output, where it is converted to an analog signal and can be connected to a video monitor.

The electronic circuitry placed on one board plus a sensor board.

<b>Description</b>	<b>Designation</b>	<b>Function</b>
Sensor board	SEN084	Receives signals from and controls the CCD sensor, produces the video and clock signals, black-and-white and color versions
SBC38 main board	SBC38-MAIN	Digitalization of the video signal, complete signal processor with memory, DAC for video output signal in black-and-white, interfaces (V24, PLC), power supply 3W

### 3. Documentation of the boards

#### 3.1 "SEN084" Board

This board takes the picture. The progressive scan CCD sensor ICX084AL (black-and-white) is used. This board controls the CCD sensor and processes the analog signal. It outputs a pixel clock signal and the video signal.

The signal processor can configure the controller chip for the CCD sensor. This involves the following modes:

The sensor is operated solely in **progressive scan mode**. This means:

- A full-frame image can be taken at an arbitrary instance of time even with high shutter speed (The image is „frozen on demand“)
- The shutter speed may be set from approx. 100  $\mu$ sec to several seconds
- The image is transferred from the CCD sensor to image memory column by column, line by line
- There are no half images, no frame/field integration modes etc.
- A video refresh memory is necessary to display the image on a monitor

For the exact setting of the configuration, refer to the description of the configuration program in the **software documentation**.

### 3.3 "SBC38-MAIN", Main Board

The board contains an ADSP 2183 signal processor with 80 KBytes of internal RAM, plus dynamic RAM (SDRAM), as well as nonvolatile flash EPROM memory.

The board performs the A/D conversion of the video signal. The signal processor's DMA function allows the video signal to be stored in SDRAM. The stored or the live video signal is sent to a video refresh memory, which processes the signal for output to a VGA monitor.

An image overlay supplied directly by the signal processor is also forwarded to the video output. This overlay makes it possible to display additional graphics, text, crosshairs, etc., on the monitor in color.

<b>processor</b>	ADSP2183 50.35MHz
<b>SDRAM</b>	8 MBytes
<b>Flash-EPROM</b>	8 MBytes
<b>wait states (SDRAM)</b>	0(20 MB/sec)
<b>performance</b>	100 %
<b>clamping</b>	analog

The board includes the video DAC: the digital video signal is converted to an analog signal. The overlay bit and the synchronization signal are heterodyned. The resulting analog output video signal is fed to a PCB connector.

The board contains a high-efficiency wide-range DC/DC converter as power supply. It is also responsible for the galvanic separation of the signals, and tailors the levels of the PLC-signals (4 inputs, 4 outputs).

The board is supplied with a nominal voltage of 12 V (9,5 - 18V). An electronic stabilization of the supply voltage is not necessary. The board is internally galvanically separated from the supply voltage by means of a DC/DC converter, in order to avoid the ground loops and electromagnetic compatibility disturbances which are common. A reverse-voltage protection diode protects the board in case the supply voltage poles are confused.

PLC I/O signals:

The board has four optically decoupled inputs and four decoupled outputs for controlling machines and processes.

The PLC-compatible inputs (12-V- to 24-V level, the positive signal is switched) include an input protection circuit. When the inputs are operated at 24 V, the input current is approximately 5 mA. At least 8 volts are required to reliably sense a logic high signal. At this voltage, the current is 1 mA. The inputs are optically decoupled.

The PLC outputs are also optically decoupled. The output signal of the optocoupler controls a MOS-FET which in turn switches the 12 - 24 V signal. A diode protects the transistor, for example in case of inductive loads.

A protective diode ensures the poles of the supply voltage from the power supply of the PLC cannot be confused. It is important for both the external supply voltage of the outputs (+12 to +24V) as well as GND (GNDIn) of the power supply of the PLC to be connected.

The outputs are protected against short circuit or overload with a 0.5 A resettable fuse. However it takes several seconds for this fuse to switch into high-impedance state in case of overload.

**It is therefore highly recommended to use an additional 2A fast fuse for the positive voltage supply.**

Technical data on the I/O signals:

#### Inputs:

Operating voltage:	12 V to 24 V
Absolute maximum voltage:	voltages greater than 40 V can destroy the inputs
Type:	galvanically separated by optocoupler
Input current:	5 mA
Threshold value:	8 V
Internal signal delay:	approx. 500 nsec
Interrupt input:	only IN0, otherwise polling operation

#### Outputs:

Operating voltage:	12 V to 24 V, external source
Absolute maximum voltage:	voltages greater than 40 V can destroy the outputs
Type:	galvanically separated by optocoupler / P-channel MOSFET
Switching voltage:	+12 V or + 24 V is switched
Current:	175 mA per output
Absolute maximum current:	currents greater than 700 mA can destroy plugs and cables Always consider the total sum of all output currents
Switching power:	max. 4.2 W (24 V * 175 mA)
Reverse voltage protection	yes, for external voltage
Protection against inductive loads:	reverse diode
Overcurrent protection:	built-in resettable fuse, 0.5A
Resistance when switched on:	< 0,5 Ohm

**Since the outputs are not short circuit protected, we recommend a 2A fast fuse for the positive voltage supply.**

#### 4. Plug Assignments

The boards have three PCB connectors and an alternative connector, which have the following functions:

<b>V24(RS232) and Video</b>	<b>P2</b>	
<b>POWER</b>	<b>P3</b>	
<b>PLC-I/O (24 Volts)</b>	<b>P4</b>	
<b>VGA video connector</b>	<b>P6</b>	
TTL-I/O	P5	(optional, as an alternative to P4)

All use the same ultra-compact 10 pin crimp style connectors ZHR-10  
An assembled version of the connector with multi color open ended cables is available.

**Pin Assignment for the V24 (RS232) Interface (P2)**

Signal	Pin	cable color
V24 RxD	1	white
V24 TxD	2	brown
V24 CTS	3	green
V24 RTS	4	yellow
V24 GND	5	grey
V24 +12V Out	6	pink
Video Out (Green)	7	blue
Video GND	8	purple
	9	red
	10	black

**Pin Assignment for the Power Connector (P3)**

Signal	Pin	cable color
Power GND	1	white
Power GND	2	brown
Power 12V	3	green
Power 12V	4	yellow
Reset GND	5	grey
Reset In	6	pink
-15V In (*)	7	blue
+15V In (*)	8	purple
+5V In (*)	9	red
GND In (*)	10	black

(\*) These pins should not be connected - they are reserved for a version without DC/DC converter power supply.

**Pin Assignment for the PLC I/O Connector (P4)**

Signal	Pin	cable color
OUT0	1	white
OUT1	2	brown
OUT2	3	green
OUT3	4	yellow
IN0	5	grey
IN1	6	pink
IN2	7	blue
IN3	8	purple
+24V IN	9	red
GND IN	10	black

**Pin Assignment for the TTL I/O Plug (P5)**

Signal	Pin	cable color
Q0	1	white
Q1	2	brown
Q2	3	green
Q3	4	yellow
I0	5	grey
I1	6	pink
I2	7	blue
I3	8	purple
+5V Out	9	red
GND	10	black

this connector is optional and will be mounted on prior request as an alternative to connector P4 (PLC I/O) It is not possible to use both. All signals have TTL level. They are not intended to be used outside a shielded environment (e.g. a cabinet). They are therefore not EMI protected.

**Pin Assignment for the VGA Video Connector (P6)**

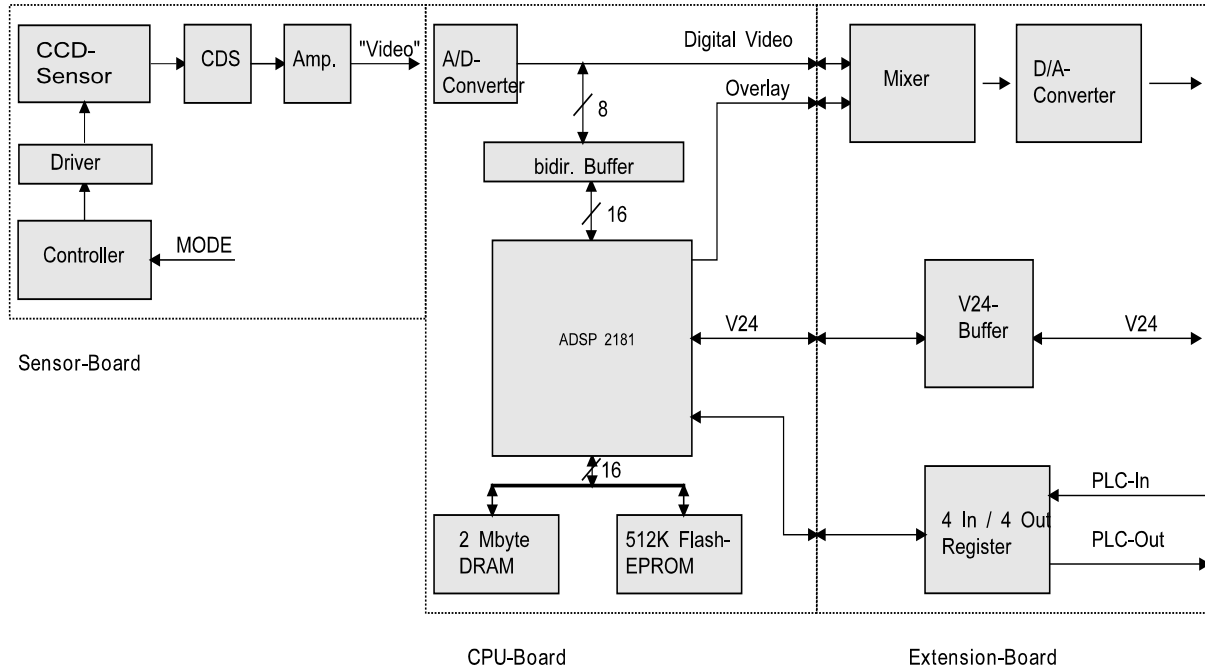
Signal	Pin	cable color
R Out	1	white
R GND	2	brown
G Out	3	green
G GND	4	yellow
B Out	5	grey
B GND	6	pink
HS Out	7	blue
HS GND	8	purple
VS Out	9	red
VS GND	10	black

**Pin Assignment for the connectors**

## Location of plugs and mechanical dimensions

5. Block Diagrams, Technical Specifications

Blockdiagram VC11,VC13,VC51



(C) Vision Components

## 5.1 Technical Specifications SBC38

Sensor:	1/3" SONY ICX084AL
Number of pixels:	640(H) x 480(V)
Pixel size:	7.4(H) x 7.4(V) $\mu\text{m}$
Chip size:	5.84(H) x 4.94(V) mm
High-speed shutter:	up to 1/10,000 sec., adjustable in steps of 64 $\mu\text{sec}$ (full-frame shutter)
Low-speed shutter:	up to 20 sec. adjustable integration time
Integration:	full-frame
Picture taking:	without delay, program-controlled or triggered externally, full-frame
Clamping:	zero offset integrating digital clamping
A/D conversion:	12.288 MHz / 8-bit
Image display:	black-and-white, Pseudo Color from color lookup table: 16 out of 4096 colors live image, still image, graphics
Overlay:	1-bit overlay with LUT (1 out of 4096 colors), or 4-bit + 1-bit overlay with LUT, can be switched off
Processor:	Analog Devices ADSP2183 signal processor 50.35 MHz
Image/data memory:	8 MBytes SDRAM
Memory capacity:	17 full-size images or 34 half-size image in format 640 x 480 (640 x 240) 34 full-size images or 64 half-size image in format 512 x 480 (512 x 240)
Flash EPROM:	2 MBytes flash EPROM (nonvolatile memory) for programs and data, programmable in the system
Process interface:	4 inputs / 4 outputs, optically decoupled 12 V to 24 V, outputs 4x175 mA
Built-In Output Fuse:	0.5 A resettable fuse $t = 4$ sec at $I = 4$ A (additional fast fuse recommended)
Serial interface:	V24 (RS232) max. 115200 baud
Video output:	RGB, 3x75 Ohm, 1 Vpp, VGA output, HSYNC, VSYNC separate
Horizontal frequency:	31.5 kHz
Vertical frequency:	60.00 Hz
Resolution VGA:	640x480
Pixel frequency:	25.175 MHz
Power supply:	built-in switching power supply with galvanic separation
Supply voltage:	12V +/-20% (max. 18 V) , DC, max. 350 mA
Electrical connections:	4 connectors (all 10pin): <b>DC IN, V24/Video Out, VGA Out, I/O</b>
Operating temperature:	0 C to 45 C, 80% relative humidity, noncondensing
Storage temperature:	-20 C to 60 C, 90% relative humidity, noncondensing
Thermal resistance:	camera body temperature to ambient air = 4K/W
Shock acceleration:	< 50g
Vibrations:	< 3g (11 - 200 Hz)
Dimensions:	120x70x18 mm
Lens connection:	None
Back focal length:	N/A
Weight:	approx. 100g

## 6. Connecting the V24 cable

### 6.1 Connecting a compatible PC with a 9-pin D sub plug

Pin (PC)	Name	name	cable color	Pin (camera)
1	DCD	Data Carrier Detect	- / -	- / -
2	RxD	Receive Data	brown	2
3	TxD	Transmit Data	white	1
4	DTR	Data Terminal Ready	- / -	- / -
5	<b>GND</b>	<b>Ground</b>	<b>gray</b>	<b>5</b>
6	DSR	Data Set Ready	- / -	- / -
7	RTS	Request to Send	green	3
8	CTS	Clear to Send	yellow	4
9	RI	Ring Indicator	- / -	- / -

leave pink cable open

### 6.2 Connecting a compatible PC with a 25-pin D sub plug

Pin (PC)	Name	name	cable color	Pin (camera)
2	TxD	Transmit Data	white	1
3	RxD	Receive Data	brown	2
4	RTS	Request to Send	green	3
5	CTS	Clear to Send	yellow	4
6	DSR	Data Set Ready	- / -	- / -
7	<b>GND</b>	<b>Ground</b>	<b>gray</b>	<b>5</b>
20	DTR	Data Terminal Ready	- / -	- / -

leave pink cable open

**Accessories (all prices in EURO, not including VAT)**

<b>type</b>	<b>product</b>	<b>1000+</b>	<b>500+</b>	<b>300+</b>	<b>200+</b>	<b>100+</b>
CON-SBC	10 pin connector with cable AWG26, UL1061 0,5m	2.92	3.08	3.14	3.18	3.24
LHLD12	lens holder for 12mm lens	9.46	9.99	10.19	10.30	10.51
LHLDCM	lens holder CMOUNT	12.99	13.71	14.00	14.14	14.43
LENS2.5	lens f=2.45mm d=12mm	13,71	14.47	14.77	14.93	15.23
LENS3.7	lens f=3.7mm d=12mm	9,61	10.15	10.36	10.47	10.68
LENS4.3	lens f=4.3mm d=12mm	9,61	10.15	10.36	10.47	10.68
LENS5.0	lens f=5.0mm d=12mm	9,61	10.15	10.36	10.47	10.68
LENS8.0	lens f=8.0mm d=12mm	9,61	10.15	10.36	10.47	10.68
LENS12.0	lens f=12.0mm d=12mm	9,61	10.15	10.36	10.47	10.68

add 40% on 100+ price for samples