



# Vision<sup>®</sup>

# Components

**The Smart Camera People** 

## VC nano Series Operating Manual

## Hardware specifications and special software functions

of VC nano Smart Cameras

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W W W . V I S I O N - C O M P O N E N T S . C O M

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#### Please also consult the following resources for further reference:

"Knowledge Base / FAQ" for a searchable data base of SW and HW questions / answers

Description	Title on Website	Download Area on VC website
Ruick start Manual for VC camera set up and programming	Getting Started VC Smart Cameras with TI DSP	Service & Support > Download Center
Schnellstart VC – deutsche Version of "Getting Started VC".	Schnellstart VC Smart Kameras	Service & Support > Download Center
Introduction to VC Smart Camera programming	Programming Tutorial for VC20XX and VC40XX Cameras	Service & Support > Download Center
Demo programs and sample code used in the Programming Tutorial	🖳 Tutorial Code	Service & Support > Download Center
VC40xx Hardware Manual	VC40XX Smart Cameras Hardware Documentation	Service & Support > Download Center
VCRT Operation System Functions Manual	VCRT 5.0 Software Manual	Service & Support > Download Center
VCRT Operation System TCP/IP Functions Manual	VCRT 5.0 TCP/IP Manual	Service & Support > Download Center
VCLIB 2.0 /3.0 Image Processing Library Manual	VCLIB 2.0/ 3.0 Software Manual	Service & Support > Download Center



The Light bulb highlights hints and ideas that may be helpful for a development.



This warning sign alerts of possible pitfalls to avoid. Please pay careful attention to sections marked with this sign.

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## **1** General Information



VC4012nano / VC6212nano Smart Cameras



VC6010nano Smart Camera



VC6210nano Smart Camera



VC6211nano Smart Camera

The **nano Series** Smart Cameras have been designed for high resolution image processing with a very small form factor. The **VC nano Series Smart Cameras** are the ideal compromise between high performance and low system costs, and its very compact form factor of only 80 x 45 x 20 mm and 170g (incl. mounting block) makes it one of the smallest Smart Cameras on the market.

Employing CMOS sensors, the image resolution can be changed to the ROI required.

Like with all VC Smart Cameras with Texas Instruments DSP, the operating system VCRT allows multi-tasking. This means for instance that user interface commands can execute in parallel without stopping the inspection process. It is also possible to transfer live images via TCP/IP using a background task.

Interfaces include a video output onto a PC via 100MBit Ethernet interface, a high speed trigger input and output, 12-24 V digital inputs and outputs.

The extremely low power consumption of only 1.5W makes this camera ideally suitable for use in mobile devices.



VC6210nano cube dual Smart Camera



VC6210nano tube Smart Camera head

The new VC nano cube Smart Camera and VC nano tube Smart Camera take the concept and the housing of the standard VC nano camera series and adds an amazing new feature: the remote head.

The VC nano cube allows to connect one (**VC nano cube single**) or two (**VC nano cube dual**) remote heads, extending the application field of the VC nano while keeping the compactness and low power consumption.

In addition, the VC nano tube integrates an LED lighting.

## **2** Technical Specifications

## 2.1 Technical Specifications VC4012nano

Component / Feature	Specification
CMOS Sensor:	1/2.5" Aptina MT9P031 - also available with color sensor (Bayer Filter)
Active pixels:	2592(H) x 1944(V) (5.0 million pixels)
Pixel size:	2.2(H) x 2.2(V) μm
Active sensor size:	5.70(H) x 4.28(V) mm
High-speed shutter:	28.4 μs + steps of 43.7 μs
Low-speed shutter:	up to 30 sec. adjustable integration time
Integration:	"Electronic rolling shutter" (ERS) and "Global Reset Release" (GRR)
Picture taking:	program-controlled or external high speed trigger, full-frame (11,6 frames per second) & partial scanning, jitterfree acquisition
Parallel image acquisition	Not available
Clamping:	Internal to sensor
A/D conversion:	80 MHz / 12 bit, only the 8 most significant bits used for grey values
Input LUT	none
Image Display	Via 100 Mbit Ethernet onto PC
Processor:	Texas Instruments TMS320C64XX signal processor 400 MHz, 3200MIPS
RAM:	64 Mbytes SDRAM (synchronous dynamic RAM)
Memory capacity:	Up to 13 full-size grey value images in format 2592 x 1944
Flash EPROM:	4 Mbytes flash EPROM (nonvolatile memory) for programs and data, in- system programmable, 3 MB available to user
SD card:	Not available
Process interface:	2 inputs / 4 outputs, outputs 4x400 mA
Trigger:	1 picture trigger input, 1 flash trigger output, 24V
Ethernet interface:	10/100 Mbit
CE certification:	CE Certification from Vision Components
Storage Conditions	Temperature: -20 to 60 deg C, Max. humidity: 90%, non condensing.
Operating Conditions	Temperature: 0 +55 deg C, Max. humidity: 80%, non condensing.
Power Supply	24V +/-20% DC, max. 300 mA
Power Consumption	≈1.5W
Lens Mount	C or CS Mount, no IR-filter

Component / Feature	Specification
CMOS Sensor:	1/3" Aptina MT9V034 - also available with color sensor (Bayer Filter)
Active pixels:	752(H) x 480(V) (Wide VGA)
Pixel size:	6.0(H) x 6.0(V) μm
Active sensor size:	4.51(H) x 2.88(V) mm
High-speed shutter:	34 μs + steps of 34 μs
Low-speed shutter:	up to 2 sec. adjustable integration time
Integration:	Global shutter
Picture taking:	program-controlled or external high speed trigger, full-frame (55 frames per second) & partial scanning, jitterfree acquisition
Parallel image acquisition	Not available
Clamping:	Internal to sensor
A/D conversion:	25 MHz / 10 bit, only the 8 most significant bits used for grey values
Input LUT	none
Image Display	Via 100 Mbit Ethernet onto PC
Processor:	Texas Instruments TMS320DM6431 "Da Vinci" DSP 300 MHz, 2400MIPS
RAM:	128 Mbytes SDRAM (synchronous dynamic RAM)
Memory capacity:	Up to 300 full-size grey value images in format 752 x 480
Flash EPROM:	32 Mbytes flash EPROM (nonvolatile memory) for programs and data, in-system programmable
SD card:	Not available
Process interface:	2 inputs / 4 outputs, outputs 4x400 mA
Trigger:	1 picture trigger input, 1 flash trigger output, 24V
Ethernet interface:	10/100 Mbit
CE certification:	CE Certification from Vision Components
Storage Conditions	Temperature: -20 to 60 deg C, Max. humidity: 90%, non condensing.
Operating Conditions	Temperature: 0 +55 deg C, Max. humidity: 80%, non condensing.
Power Supply	24V +/-20% DC, max. 300 mA
Power Consumption	≈1.5W
Lens Mount	C or CS Mount, no IR-filter

## 2.2 Technical Specifications VC6010nano

Component / Feature	Specification
CMOS Sensor:	1/3" Aptina MT9V034 - also available with color sensor (Bayer Filter)
Active pixels:	752(H) x 480(V) (Wide VGA)
Pixel size:	6.0(H) x 6.0(V) μm
Active sensor size:	4.51(H) x 2.88(V) mm
High-speed shutter:	34 µs + steps of 34 µs
Low-speed shutter:	up to 2 sec. adjustable integration time
Integration:	Global shutter
Picture taking:	program-controlled or external high speed trigger, full-frame (55 frames per second) & partial scanning, jitterfree acquisition
Parallel image acquisition	Not available
Clamping:	Internal to sensor
A/D conversion:	25 MHz / 10 bit, only the 8 most significant bits used for grey values
Input LUT	none
Image Display	Via 100 Mbit Ethernet onto PC
Processor:	Texas Instruments TMS320DM6435 "Da Vinci" DSP 700 MHz, 5600MIPS
RAM:	128 Mbytes SDRAM (synchronous dynamic RAM)
Memory capacity:	Up to 300 full-size grey value images in format 752 x 480
Flash EPROM:	32 Mbytes flash EPROM (nonvolatile memory) for programs and data, in-system programmable
SD card:	Not available
Process interface:	2 inputs / 4 outputs, outputs 4x400 mA
Trigger:	1 picture trigger input, 1 flash trigger output, 24V
Ethernet interface:	10/100 Mbit
CE certification:	CE Certification from Vision Components
Storage Conditions	Temperature: -20 to 60 deg C, Max. humidity: 90%, non condensing.
Operating Conditions	Temperature: 0 +55 deg C, Max. humidity: 80%, non condensing.
Power Supply	24V +/-20% DC, max. 300 mA
Power Consumption	≈1.5W
Lens Mount	C or CS Mount, no IR-filter

## 2.3 Technical specifications VC6210nano

Component / Feature	Specification
CMOS Sensor:	1/3" Aptina MT9V034 - also available with color sensor (Bayer Filter)
Active pixels:	752(H) x 480(V) (Wide VGA)
Pixel size:	6.0(H) x 6.0(V) μm
Active sensor size:	4.51(H) x 2.88(V) mm
Sensor heads:	1 (single) or 2 (dual)
Sensor cable length:	Up to 3m
High-speed shutter:	34 μs + steps of 34 μs
Low-speed shutter:	up to 2 sec. adjustable integration time
Integration:	Global shutter
Picture taking:	program-controlled or external high speed trigger, full-frame (55 frames per second) & partial scanning, jitterfree acquisition
Parallel image acquisition	Not available
Clamping:	Internal to sensor
A/D conversion:	25 MHz / 10 bit, only the 8 most significant bits used for grey values
Input LUT	none
Image Display	Via 100 Mbit Ethernet onto PC
Processor:	Texas Instruments TMS320DM6435 "Da Vinci" DSP 700 MHz, 5600MIPS
RAM:	128 Mbytes SDRAM (synchronous dynamic RAM)
Memory capacity:	Up to 300 full-size grey value images in format 752 x 480
Flash EPROM:	32 Mbytes flash EPROM (nonvolatile memory) for programs and data, in-system programmable
SD card:	Not available
Process interface:	2 inputs / 4 outputs, outputs 4x400 mA
Trigger:	1 picture trigger input, 1 flash trigger output, 24V
Ethernet interface:	10/100 Mbit
CE certification:	CE Certification from Vision Components
Storage Conditions	Temperature: -20 to 60 deg C, Max. humidity: 90%, non condensing.
Operating Conditions	Temperature: 0 +55 deg C, Max. humidity: 80%, non condensing.
Power Supply	24V +/-20% DC, max. 300 mA
Power Consumption	≈1.5W (with one sensor head)
Lens Mount	S Mount, no IR-filter

## 2.4 Technical specifications VC6210nano cube

Component / Feature	Specification
CMOS Sensor:	1/3" Aptina MT9V034 - also available with color sensor (Bayer Filter)
Active pixels:	752(H) x 480(V) (Wide VGA)
Pixel size:	6.0(H) x 6.0(V) μm
Active sensor size:	4.51(H) x 2.88(V) mm
Sensor heads:	1 (single) or 2 (dual)
Sensor cable length:	Up to 3m
High-speed shutter:	34 μs + steps of 34 μs
Low-speed shutter:	up to 2 sec. adjustable integration time
Integration:	Global shutter
Picture taking:	program-controlled or external high speed trigger, full-frame (55 frames per second) & partial scanning, jitterfree acquisition
Parallel image acquisition	Not available
Clamping:	Internal to sensor
A/D conversion:	25 MHz / 10 bit, only the 8 most significant bits used for grey values
Input LUT	none
Image Display	Via 100 Mbit Ethernet onto PC
Processor:	Texas Instruments TMS320DM6435 "Da Vinci" DSP 700 MHz, 5600MIPS
RAM:	128 Mbytes SDRAM (synchronous dynamic RAM)
Memory capacity:	Up to 300 full-size grey value images in format 752 x 480
Flash EPROM:	32 Mbytes flash EPROM (nonvolatile memory) for programs and data, in-system programmable
SD card:	Not available
Process interface:	2 inputs / 4 outputs, outputs 4x400 mA
Trigger:	1 picture trigger input, 1 flash trigger output, 24V
Ethernet interface:	10/100 Mbit
Lighting	Integrated LED lighting
CE certification:	CE Certification from Vision Components
Storage Conditions	Temperature: -20 to 60 deg C, Max. humidity: 90%, non condensing.
Operating Conditions	Temperature: 0 +55 deg C, Max. humidity: 80%, non condensing.
Power Supply	24V +/-20% DC, max. 300 mA
Power Consumption	≈1.5W (with one sensor head)
Lens Mount	S Mount, no IR-filter

### 2.5 Technical specifications VC6210nano tube

The following diagram shows the **maximum** reachable (with the shortest shutter time) framerate according to the number of captured lines for the VC6010, VC6210 and VC6210 nano Cube, in 2 cases:

- with an image width of 752 pixels
- with an image width of 640 pixels or less



The following table gives some example values.

Number of lines	Max. framerate (FPS) dx = 752	Max. framerate (FPS) dx = 640 or less
480	56	64
360	72	83
240	102	119
120	178	202
64	265	303
32	375	422
16	475	535
8	545	612
4	588	664
2	612	696
1	612	696

2.6	Technical Specifications VC6211nano		

Component / Feature	Specification
CMOS Sensor:	1/1.8" e2V EV76C560 - also available with color sensor (Bayer Filter)
Active pixels:	1280(H) x 1024(V)
Pixel size:	5.3(H) x 5.3(V) μm
Active sensor size:	6.8(H) x 5.5(V) mm
High-speed shutter:	21 μs + steps of 21 μs
Low-speed shutter:	up to 1.35 sec. adjustable integration time
Integration:	Global shutter
Picture taking:	program-controlled or external high speed trigger, full-frame (50 frames per second) & partial scanning (up to 4500 fps for 1280x1), jitterfree acquisition
Parallel image acquisition	Not available
Clamping:	Internal to sensor
A/D conversion:	100 MHz / 10 bit, only the 8 most significant bits used for grey values
Input LUT	none
Image Display	Via 100 Mbit Ethernet onto PC
Processor:	Texas Instruments TMS320DM6435 "Da Vinci" DSP 700 MHz, 5600MIPS
RAM:	128 Mbytes SDRAM (synchronous dynamic RAM)
Memory capacity:	Up to 90 full-size grey value images in format 1280 x 1024
Flash EPROM:	32 Mbytes flash EPROM (nonvolatile memory) for programs and data, in-system programmable
SD card:	Not available
Process interface:	2 inputs / 4 outputs, outputs 4x400 mA
Trigger:	1 picture trigger input, 1 flash trigger output, 24V
Ethernet interface:	10/100 Mbit
CE certification:	CE Certification from Vision Components
Storage Conditions	Temperature: -20 to 60 deg C, Max. humidity: 90%, non condensing.
Operating Conditions	Temperature: 0 +55 deg C, Max. humidity: 80%, non condensing.
Power Supply	24V +/-20% DC, max. 300 mA
Power Consumption	≈1.5W
Lens Mount	C or CS Mount, no IR-filter

The following diagram shows the **maximum** reachable (with the shortest shutter time) framerate according to the number of captured lines for the VC6211:



The following table gives some example values.

Resolution	Max. framerate (FPS)
1280 x 1024	50
1280 x 768	63
1280 x 512	94
1280 x 256	181
1280 x 128	339
1280 x 64	598
1280 x 32	965
1280 x 16	1392
1280 x 8	1795
1280 x 4	2092
1280 x 2	2280
1280 x 1	4500

#### 2.7 Technical specifications VC6212nano

Component / Feature	Specification
CMOS Sensor:	1/2.5" Aptina MT9P031 - also available with color sensor (Bayer Filter)
Active pixels:	2592(H) x 1944(V)
Pixel size:	2.2(H) x 2.2(V) μm
Active sensor size:	5.70(H) x 4.28(V) mm
High-speed shutter:	28.4 μs + steps of 43.7 μs
Low-speed shutter:	up to 30 sec. adjustable integration time
Integration:	"Electronic rolling shutter" (ERS) and "Global Reset Release" (GRR)
Picture taking:	program-controlled or external high speed trigger, full-frame (11,6 frames per second) & partial scanning, jitterfree acquisition
Parallel image acquisition	Not available
Clamping:	Internal to sensor
A/D conversion:	80 MHz / 12 bit, only the 8 most significant bits used for grey values
Input LUT	none
Image Display	Via 100 Mbit Ethernet onto PC
Processor:	Texas Instruments TMS320DM6435 "Da Vinci" DSP 700 MHz, 5600MIPS
RAM:	128 Mbytes SDRAM (synchronous dynamic RAM)
Memory capacity:	Up to 25 full-size grey value images in format 2592 x 1944
Flash EPROM:	32 Mbytes flash EPROM (nonvolatile memory) for programs and data, in-system programmable
SD card:	Not available
Process interface:	2 inputs / 4 outputs, outputs 4x400 mA
Trigger:	1 picture trigger input, 1 flash trigger output, 24V
Ethernet interface:	10/100 Mbit
CE certification:	CE Certification from Vision Components
Storage Conditions	Temperature: -20 to 60 deg C, Max. humidity: 90%, non condensing.
Operating Conditions	Temperature: 0 +55 deg C, Max. humidity: 80%, non condensing.
Power Supply	24V +/-20% DC, max. 300 mA
Power Consumption	≈1.5W
Lens Mount	C or CS Mount, no IR-filter

Similarly to the VC6210 and VC6211, it is possible to set the ROI size on the VC6212. The FPS values will be added as soon as they are available.

Component / Feature	Specification
CMOS Sensor:	1/1.8" e2V EV76C570 - also available with color sensor (Bayer Filter)
Active pixels:	1600(H) x 1200(V)
Pixel size:	4.5(H) x 4.5(V) μm
Active sensor size:	7.2(H) x 5.4(V) mm
High-speed shutter:	1 µs
Low-speed shutter:	up to 1.28 sec. adjustable integration time
Integration:	Global shutter
Picture taking:	program-controlled or external high speed trigger, full-frame (42 frames per second) & partial scanning, jitterfree acquisition
Parallel image acquisition	Not available
Clamping:	Internal to sensor
A/D conversion:	100 MHz / 10 bit, only the 8 most significant bits used for grey values
Input LUT	none
Image Display	Via 100 Mbit Ethernet onto PC
Processor:	Texas Instruments TMS320DM6435 "Da Vinci" DSP 700 MHz, 5600MIPS
RAM:	128 Mbytes SDRAM (synchronous dynamic RAM)
Memory capacity:	Up to 60 full-size grey value images in format 1600 x 1200
Flash EPROM:	32 Mbytes flash EPROM (nonvolatile memory) for programs and data, in-system programmable
SD card:	Not available
Process interface:	2 inputs / 4 outputs, outputs 4x400 mA
Trigger:	1 picture trigger input, 1 flash trigger output, 24V
Ethernet interface:	10/100 Mbit
CE certification:	CE Certification from Vision Components
Storage Conditions	Temperature: -20 to 60 deg C, Max. humidity: 90%, non condensing.
Operating Conditions	Temperature: 0 +55 deg C, Max. humidity: 80%, non condensing.
Power Supply	24V +/-20% DC, max. 300 mA

#### 2.8 Technical specifications VC6215nano

Similarly to the VC6210 and VC6211, it is possible to set the ROI size on the VC6215. The FPS values will be added as soon as they are available.

C or CS Mount, no IR-filter

≈1.5W

**Power Consumption** 

Lens Mount

## 3 Camera Interfaces



#### The VC nano Series cameras incorporate the following connector interfaces:

- 1: LAN / Ethernet interface
- 2: PLC IO, power supply and trigger interface

The pin assignments, electrical specifications as well as available accessories are shown for each interface connector in the following sections.

#### 3.1 LAN / Ethernet Interface

#### 3.1.1 Pin Assignments LAN / Ethernet Interface

Signal	Pin
T+	2
T-	1
R+	6
R-	5
-	3
-	4



#### 3.1.2 Available Accessories for LAN / Ethernet socket



Signal	Pin (to cam.)	Pin (to PC)	Cable Color	Cable Color
			20m patch cable	10m patch cable
T+	2	1	yellow	white/pink
Т-	1	2	orange	pink
R+	6	3	white/green	white/green
R-	5	6	green	green
-	3	NC	-	-
-	4	NC	-	-

Refer to section 5.1 for a list of available cables with order numbers.

#### 3.2 Power Supply, I/O interface and trigger interface

This connector includes the camera Power Supply, the digital PLC IOs and the trigger interface.

Pin	Signal	Calbe Colors
1	12-24V PLC	red
2	12-24V IN Cam	red / blue
3	GND IN com.	black.
4	INP 1	pink
5	OUT 3	yellow
6	OUT 2	green
7	OUT 1	brown
8	OUT 0	white
9	12-24V PLC	grey / pink
10	Trigger OUT	purple
11	Trigger IN	blue
12	INP 0	grey

#### 3.2.1 Pin assignments Power Supply and IO Interface

rear view camera socket:



#### 3.2.2 Electrical specifications Camera Power Supply



With the **VC nano Series** cameras the PLC supply contacts are internally connected with the camera power supply pin 2. In this case pin 1 and 9 require the same voltage level as the camera power supply pin 2. Refer to section 4.2.3 for details on the different PLC interface features.

	VC4012nano & VC6210nano
Nominal Voltage	12 V – 24 V
Absolute Voltage Limits	9 V -30 V
Minimum nominal Operating voltage	12V
and corresponding current	116mA
Maximum nominal Operating voltage	24V
and corresponding current	70mA
Nominal Power Consumption	1.5W

In general the camera power supply is regulated in the camera, so an unregulated power source is sufficient. However the absolute voltage levels specified above should never be exceeded.

In case of unstable power supply (voltage spikes or power interruptions) it is recommended to backup the power supply by a capacitor or a battery large enough to prevent power interruptions.

It is recommended to switch on the low voltage supply (12 to 24V) when booting the camera. Some 110/ 220V power supplies increase the output voltage too slow or drop the voltage under load at start – up which might cause the camera not to boot properly! A power supply able to supply a much higher than nominal boot current for a few milliseconds may be an alternative approach.

#### 3.2.3 Electrical Specifications digital PLC IO / trigger Interface

The VC nano Series Smart Cameras feature digital inputs and outputs that allow e.g. direct input of light barriers signals or the control of pneumatic valves, as well as a trigger input and output. Please observe the current and voltage ratings specified in the following sections.

The PLC circuit of all VC Professional and Optimum Smart Cameras is separated from the camera power supply. This however is not the case with models VC4016/4018/4002L and VC nano Series.

The different interface features for these camera ranges are shown in the following table.

	VC nano Series (same as VC4016/4018/4002L)
Separation of PLC/trigger output voltage	PLC outputs supply <b>not</b> separated from power supply
PLC/trigger Input Voltage	Identical with power supply voltage
PLC/trigger Input Current (max)	1.0 mA at 12V to 2.0mA @ 24V
PLC/trigger Output Voltage	Identical with power supply Voltage – internally connected
PLC/trigger Output	4 x 400 mA
Current (max)	Max total of all outputs: 1A
Max Current for 1 Power / PLC connector pin	500 mA
Power failure detection	-



When using the PLC/trigger outputs connect all camera supply and PLC supply pins (pin 1, pin 2 and pin 9) in order to limit the connector pin current.

The maximum combined current of all outputs should not exceed 1 A.

Supply Voltage [V]	Current drawn [mA]	Power Consumption [W]
9	153	1.37
10	138	1.38
12	116	1.39
14	100	1.40
16	90	1.44
18	80	1.44
20	72	1.44
22	66	1.45
24	62	1.48
26	57	1.48
28	54	1.51
30	51	1.53

#### Power consumption depending on supply voltage:

#### 3.2.3.1 Connection of PLC/trigger inputs VC nano Series



- 2 digital inputs
- 1 trigger input
- Operating Voltage 12 to 24 V
- Threshold Voltage 8V (input high for signals greater 8V)
- Maximum Voltage: 30V
- Reverse voltage protection
- Input Current 2mA @ 24V
- Signal debouncing hardware: none

#### 3.2.3.2 Connection of PLC/trigger outputs VC nano Series



#### 4 digital outputs

- 1 trigger output

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- Operating Voltage 12 to 24 V
- current per output: 400 mA (total current all outputs < 1000 mA)</li>
- Connect 12-24 V PLC and camera power supply pins 1, 2 and 9.
- bit = 1 output will switch positive voltage
- short-circuit and over- temperature protection (2A)

#### 3.2.4 Available Accessories / Cables for Power Supply and IO Interface



Signal	Pin No.	Cable color
OŪTO	8	white
OUT1	7	brown
OUT2	6	green
OUT3	5	yellow
INO	12	grey
IN1	4	pink
Trig IN	11	blue
Trig OUT	10	purple
24V IN Cam	2	red/blue
GND IN com.	3	black
24V PLC	1	red
24V PLC	9	grey /pink

Equipped on one end with a Hirose plug jack, length 5m, 10m or 25m Refer to section 5.1 for a list of available cables with order numbers.

#### 3.3 VC nano Series LED

The VC nano Smart Cameras features 8 LED providing status information on power supply, PLC I/Os and trigger input.



#### 3.4 VC nano cube & VC nano tube sensor head cable connectors

The sensor head cables must be connected with the arrow on the connector showing to the upper side of the VC nano cube camera, as shown in the picture below.



If you have only one sensor head, connect it to the connector #1 on the picture!



Hot swapping is no possible! A newly plugged head only becomes active when the camera is rebooted (also when unplugged and re-plugged).

## 4 Accessories

#### 4.1 Order numbers of VC nano Series cameras

The VC nano Series Smart Cameras support by default CS-mount lenses, but standard delivery also includes a 5 mm adjustment ring for C-mount lenses.

Cameras	Order Number
VC4012nano Smart Camera, b/w sensor	VK000430
VC4012nano Smart Camera, Bayer sensor	VK000431
VC6010nano Smart Camera, b/w sensor	VK001089
VC6010nano Smart Camera, Bayer sensor	VK001090
VC6210nano Smart Camera, b/w sensor	VK001035
VC6210nano Smart Camera, Bayer sensor	VK001036
VC6211nano Smart Camera, b/w sensor	VK001071
VC6211nano Smart Camera, Bayer sensor	VK001094
VC6212nano Smart Camera, b/w sensor	VK001133
VC6212nano Smart Camera, Bayer sensor	VK001134
VC6215nano Smart Camera, b/w sensor	VK001287

#### 4.2 Order numbers of VC nano cube cameras

Cameras	Order Number
VC6210nano cube single, b/w sensor	VK001117
VC6210nano cube dual, b/w sensor	VK001241
VC6210nano cube additional sensor head, b/w sensor	VK001242
VC6210nano cube single, Bayer sensor	VK001074
VC6210nano cube dual, Bayer sensor	VK001240
VC6210nano cube additional sensor head, Bayer sensor	VK001243

#### 4.3 Order numbers of VC nano tube cameras

Cameras	Order Number
VC6210nano tube single, b/w sensor	VK002003
VC6210nano tube dual, b/w sensor	VK002004
VC6210nano tube single, Bayer sensor	VK001260
VC6210nano tube dual, Bayer sensor	VK001259

#### 4.4 Order numbers of all available VC nano Series Accessories

For interface cables and connectors available also consult the corresponding section in chapter 0 of this manual as well as the "*VC Smart Camera Accessories*" section – under the "Product" section on our website www.vision-comp.com.

#### Ethernet Cables (Refer to section 4.1.2):

Article Description	Order Number	Camera Connector	Second Connector
		HRS connector female 6 pin	RJ45
5m LAN-C6-Cable	VK000149	0	and the second s
10m LAN-C6-Cable	VK000150	HRS connector female 6 pin	RJ45
25m LAN-C6-Cable	VK000151	HRS connector female 6 pin	RJ45
Ethernet Cross Module	VK000156	RJ45	RJ45 female socket

#### Power Supply and IO Interface Cables (refer to section 6.3.5):

Article Description	Order Number	Camera Connector	Second Connector
5m Power / PLC-Cable C6	VK000008	HRS female 12 pin	without connector
10m Power / PLC-Cable C6	VK000114	HRS female 12 pin	without connector
25m Power / PLC-Cable C6	VK000161	HRS female 12 pin	without connector

#### **Further Accessories:**

Article Description	Order Number	Camera Connector
Power Adapter C6 24V, with 12 pins conn. 3m	VK000119	HRS connector female 12 pin
Power adapter for rail mounting, Input Voltage 100 - 240VAC 50/60 Hz, Output Voltage DC 24V +/-5%, max. 300 mA (7.5 W), Equipped with connecting clamps for AC input and 24V output, CE cert. Using this power supply with VC Base Cameras (VC4018 and VC4016) is only possible when booting by switching the 24V secondary side! 15W power supply needed if switching the mains supply!	VK000036	

All cable lengths are 0.5m unless stated otherwise.

Please also refer to the VC website **www.vision-components.com** for an up to date list of accessories.

## 5 Programming VC nano Series Smart Cameras

#### 5.1 General settings

Programming the VC6210nano requires at least the VCRT library version 5.29.6, for the VC4012nano VCRT 5.29 is needed. The VC6010nano & VC6211nano camera require at least VCRT 5.29.18, the VC6212nano VCRT 5.30.1, the VC nano cube VCRT 5.30.11.

Please note that all features (like polarity setting, see **chapter 5.4**) of trigger input and trigger output **are only fully functional from VCRT 5.29.18**!

#### 5.2 Compiling and linking with the VC6xxx nano

It is advised to build your C-code as **relocatable code** (standard setting in the VC template Code Composer project files from VCRT 5.29). In this case VCRT manages the program memory allocation by itself (see Programming Tutorial for more details).

For customers who prefer absolute linking, please pay attention to the fact that the memory start address of the VC6xxx nano has changed in comparison to previous VC cameras. In your link file, replace the memory section with this one:

MEMORY

```
{
    PMEM: o = 080100000h l = 100000h /* intended for initialization */
    BMEM: o = 080090000h l = 40000h /* .bss, .system, .stack, .cinit */
}
```

#### 5.3 Image Acquisition

The CMOS sensors of the VC nano Series cameras allow extra features like:

- partial scanning
- 2x / 4x image binning
- use of Global Reset Release Shutter instead of Rolling Shutter (VC4012nano / VC6212nano only, other VC nano series cameras use a global shutter).

For demo programs showing those features, please have a look at the **Demo Programs section** in the Download Center of our website, or contact our support at **support**@vision-components.com.

#### 5.4 Image acquisition VC6210 nano cube & nano tube

In case of two connected sensor heads, image acquisition is always synchronized (also with external trigger signal), and shutter and gain values are identical for both sensors.

VCRT detects how many sensor heads are connected at camera startup and allocates the image memory and sets the system variables accordingly.



The pitch value is slightly different from the image width!

#### One head connected (and standard VC6210nano):







#### 5.5 Trigger functions

Apart from the inverse TTL logic and the different status registers, the trigger works like with the VC4XXX cameras.

Please refer to the VCRT5.pdf manual – available from the download area of the VC website.

To query the trigger input, use the following command, valid for all VC nano cameras (see demo program trigin.c):

if (TRIGINP\_PIN)
print("external trigger = 1\n");
else
print("external trigger = 0\n");

A capture can be triggered on rising edge with TRIGINP\_POS() and on falling edge with TRIGINP\_NEG().



The trigger output can be set to exposure controlled mode – for instance to control a light source. With TRIGOUT\_EXP() combined with TRIGOUT\_POS(), the trigger output is high during exposure. TRIGOUT\_EXP() combined with TRIGOUT\_NEG(), the trigger output is low during exposure.



The trigger macros are also described in our programming tutorial.



For VC6xxx nano cameras, the macros TRIGOUT\_USR(), SET\_TRIGOUT() and RES\_TRIGOUT() (manual trigger output control) are only available from board version 1.2 (version is written on the board, above the sensor)! For VC6210 camera from S/N 7100068 and for VC6211 camera from S/N 7700029.

## Appendix A: Block diagram VC nano Series

The image is formed by a high-resolution 5 mega pixel CMOS sensor (VC4012nano & VC6212nano), a Wide-VGA CMOS sensor (VC6010nano & VC6210nano) or a 1.3 megapixel CMOS sensor (VC6211nano). The image is then stored in SDRAM memory, which has been increased to 64MB (VC4012nano) / 128MB (VC6010nano, VC6210nano, VC6211nano & VC6212nano).

Unlike most other Vision Component Smart Cameras, the VC nano Series cameras do not have a direct video output. However if monitoring of the camera image is required, this can be done by downloading via Fast Ethernet port to PC and display on screen (see "Image Transfer" demo software under "Support -> Customer Area -> Software Utilities").

The TMS320C64xx DSP is one of the fastest 32bit DSPs. It features a RISC-like instruction set, up to 8 instructions can be executed in parallel, two L1 cache memories (16 Kbytes each) and a 128 Kbytes L2 cache on chip. Its high speed 64-channel DMA controller gives additional performance. The DSP uses fast external SDRAM as main memory. A flash EPROM provides non-volatile memory.



#### Block diagram VC nano Series

## **Appendix B: Dimensions VC nano Series**

Maximal torque for M6 screws : **10 Nm** C Mount not present on VC nano cube!



**Tolerances:** All circuit board dimensions: +/- 0.1mm

## Appendix C: Dimensions VC nano cube sensor head



Tolerances: All circuit board dimensions: +/- 0.1mm

## Appendix D: Dimensions VC nano tube sensor head





Tolerances: All circuit board dimensions: +/- 0.1mm

## Smart Cameras made in Germany



Visit the Vision Components site **www.vision-components.com** for further information, documentation and software downloads:

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