

# ICAM

Type 5073A...

## Industrial Charge Amplifier for Applications in Manufacturing

The industrial charge amplifier manufacturing (ICAM) converts a charge signal into a low-impedance voltage signal. Depending on version, up to four sensors can be connected at the same time. The ICAM is controlled via digital inputs or the serial interface.

- Wide, variable measuring range  $\pm 100 \dots \pm 1\,000\,000$  pC
- Fully configurable via serial interface
- With ManuWare setup and test software
- Industrial models with degrees of protection IP60, IP65 and IP67
- Integrated peak value memory



### Description

The charge amplifier Type 5073A... with its sealed metal case is designed for harsh industrial environments. Depending on version, up to four measuring channels can be accommodated in a single case. A single-channel version with four summed charge inputs is also available. With its variable measuring range, acquisition of peak values, programmable offset, programming interface and excellent technical data, the ICAM is extremely versatile. The charge input is protected against electrostatic discharge. A differential stage compensates for potential differences between sensor and case ground. Optocouplers isolate the digital inputs electrically.

### Application

The ICAM is suitable for applications with nearly all piezoelectric sensors. The output signals can be used for monitoring, control and optimization of an industrial measuring process. Its floating-potential digital inputs are designed for integration in a machine control system.

### Technical Data

#### Versions

Number of channels		1, 2, 3 or 4
Special version		4 charge inputs summed on 1 channel
Alternative input connectors		BNC, TNC
Alternative output signals	V mA	-10 ... 10 4 ... 20

#### Charge Inputs

Measuring range	pC	$\pm 100 \dots \pm 1\,000\,000$
Charge range, low	pC	$\pm 100 \dots \pm 10\,099$
Charge range, high	pC	$\pm 10\,100 \dots 1\,000\,000$

Note:

Above the threshold of  $\pm 10\,099$  pC, switching of the measuring range without measuring error is only possible in the RESET mode.

Time constant	s	<100 000 (long)
Drift (at 25 °C)	pC/s	< $\pm 0,05$ (Type 5073A1...)
		< $\pm 0,05$ (Type 5073A2...)
		< $\pm 0,07$ (Type 5073A3...)
		< $\pm 0,09$ (Type 5073A4...)

#### Voltage Output (Types 5073Axx1)

Output voltage	V	-10 ... $\pm 10$	
Max. output current	mA	$\pm 5$	
Output impedance	$\Omega$	10	
Output voltage limitation	V	$> \pm 11$	
Digital offset adjustable (via RS-232C)	V	$\pm 1$	
Resolution of offset adjustment	mV	2	
Error	% Meas. range	$< \pm 0,5$	
Zero point deviation	mV	$< \pm 30$	
Output interference signal	0,1 Hz ... 1 MHz	mVpp	$< 30$
	with internally switchable low-pass filter (10, 200 and 3 000 Hz)	mVpp	$< 10$
In both cases without data transmission via RS-232C interface			

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Frequency range (-3 dB)		
Charge range <10 000 pC (pos. or neg.)	kHz	≈0 ... 20
Charge range between 10 000 and 100 000 pC (pos. or neg.)	kHz	≈0 ... 2
In both cases without data transmission via RS-232C interface.		

**Outputs Current (Types 5073Axx2)**

Output current range	mA	4 ... 20
Output impedance	MΩ	>2
Max. load	Ω	500

Allocation  
4 mA corresp. to 0 V  
20 mA corresp. to 10 V

Note 1:  
The peak value is also output as a signal voltage in the case of ICAMS with current outputs.

Note 2:  
Current outputs are only available for the single- and two-channel version (Types 5073A1x2 and 5073A2x2)

Error	% Meas. range	<±1
Zero error	mA	<±0,3

Frequency range (-3 dB)		
Charge range <10 000 pC (pos. or neg.)	kHz	≈0 ... 10
Charge range between 10 000 and 100 000 pC (pos. or neg.)	kHz	≈0 ... 2
In both cases without data transmission via RS-232C interface.		

**Accuracy of Measurement**

Repeatability	% Meas. range	<±0,05
Reset/Measure jump	pC	<±2

**Signal Transmission Characteristics**

Low pass filter Butterworth (Limit frequency -3 dB; 5th order)	Hz	10/200/3 000 or switched off
Group delay time		
without low pass filter	μs	<15
with 3 000 Hz low pass filter	μs	<300
200 Hz low pass filter	ms	<4
10 Hz low pass filter	ms	<80

1) not condensing  
2) Unit ready for use, though differences may be possible in the technical data / not condensing

**Acquisition of Peak Values**

Error	%	<±1,5
Zero point deviation	mV	<±50
Rise time (0 ... 99 %)	ms	<0,35
Modes		+Peak -Peak (Peak-Peak)2
Reset		to the new meas. cycle (MEASURE)
Max. output current	mA	±5
Output impedance	Ω	10

Note:  
The displayed peak value corresponds to the absolute peak of the signal, i.e. including the programmed offset voltage.

**Operating Conditions**

Operating temperature range <sup>1)</sup>	°C	0 ... 60
Min./Max. temperature <sup>2)</sup>	°C	-40/80
Max. relative humidity	%	60

**Power Supply**

Supply voltage	VDC	18 ... 30
Power consumption (without load or voltage output, typical at 24 V)		
1-channel amplifier	mA	<125 (3 W)
2-channel amplifier	mA	<167 (4 W)
3-channel amplifier	mA	<210 (5 W)
4-channel amplifier	mA	<250 (6 W)

**Control Inputs (Bipolar Optocouplers)**

Threshold voltage	VDC	2,4 ... 30, any polarity
Current consumption	mA	0,3 ... 6,2
'Measure'		
Switching and reset time		
Q <±10 000 pC	ms	<9
Q <±1 000 000 pC	ms	<90
De-energized state		reset
Applicability		common to all channels
'Range II'		
Switching time	ms	<2
De-energized state		Range I
Applicability		each channel can be switched individually

**Plug Connectors**

Sensors (Connector 'Sensor x')	Type	
Type 5073Ax1x	Type	BNC (IP60)
Type 5073Ax2x	Type	TNC (IP65)

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Supply, control inputs, signal outputs (connector 'Exct/Control/Signal Out')	Type	D-Sub 15-pole pos. (IP40; IP67 with connected special connector Art. No. 7.640.085)
Serial interface	Type	D-Sub 9-pole pos. (IP40; IP67 with cover Art. No. 5.211.477)

**LED**

Reset		green flashing
Measure		green constant
Overload		red flashing
System error		red constant

**Serial Interface**

ANSI/EIA Standard		RS-232C
Data bits		8
Stop bit		1
Parity		none
Handshake		none
Transmission speed	Bits per second (baud rate)	115 200 (fixed)
Max. cable length	m	5
Max. input voltage, constant	V	<±20
Max. voltage between case and protective ground	V <sub>rms</sub>	<±20

**Mechanical Data**

Vibration resistance (20 ... 2 000 Hz, constant 16 Min., cycle 2 Min.)	g <sub>p</sub>	10
Shock resistance (1 ms)	g	200
Case material		die-cast aluminum
Weight	g	≈320

**EMC (Meeting Requirements of Directive 2004/108/EC)**

Immunity		EN61000-6-2:2005 EN61326-1:2006 (Class A+B equipment)
Emission		EN61000-6-4:2007 EN61326-1:2006 (Class A+B equipment)

**Special Notes**

**Principle of Operation of Charge Amplifier**

The charge amplifier converts the charge generated by the sensor into a proportional low-impedance voltage signal. The amplifier always measures an electric charge relatively, i.e. from the zero level, irrespective of the preload. Even with a preloaded sensor, measurement is therefore always from 0 pC. At the start of measurement (digital input Measure activated) the signal output always shows 0 V, which corresponds to 0 pC. The connected sensor can now be loaded (force, strain, pressure, etc.). If the sensor is unloaded again, the charge is also reduced again, and the output voltage of the charge amplifier consequently drops to 0 V again.

If the digital input Measure is deactivated, measurement is ended and the output voltage is set to 0 V again.

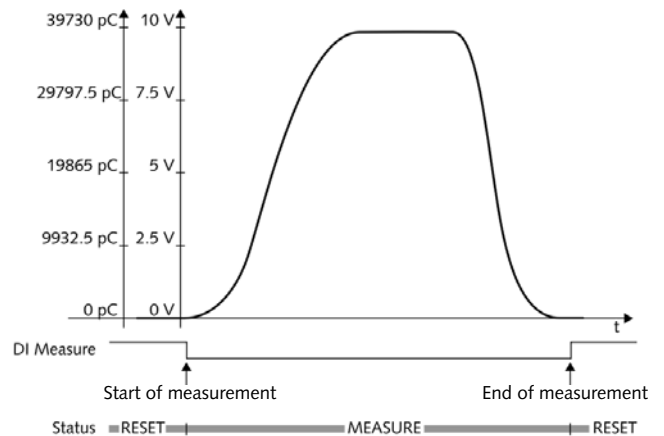


Fig 1: Example of a measuring cycle (measuring range 39 730 pC = 10 V)

**Overload**

'OVERLOAD' means the sensor has generated more charge than the ICAM can accept ( $Q >$  measuring range). This can give rise to measuring errors. After measurement has been ended ('RESET' mode), the original situation is restored. The LED flashes red to indicate an 'OVERLOAD'.

**Control Inputs**

The logic of the control inputs can be determined by the wiring of the Common control pin (connector 'Exct/Control/Signal Out', pin 7). (Common Control = 0 V corresponds to 'Active High'; Common Control = Vcc corresponds to 'Active Low').

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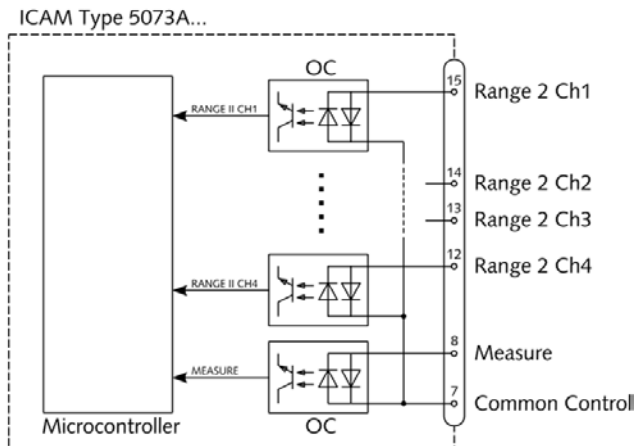


Fig. 2: Block circuit diagram of control inputs

The control input Measure always affects all channels at the same time. The measuring range can be chosen with a separate signal for each channel.

**Acquiring Peak Values**

Peak values are acquired in the form of a drag indicator. The current value is output as a -10 ... 10 V analog signal or can be sampled via the serial interface. Whether +Peak, -Peak or (Peak-Peak)/2 is to be saved or output can also be determined via this interface. The peak memory can still be read out in analog or digital form after the cycle in the reset mode. The start of the new cycle (MEASURE) sets peak value acquisition to 0 V again.

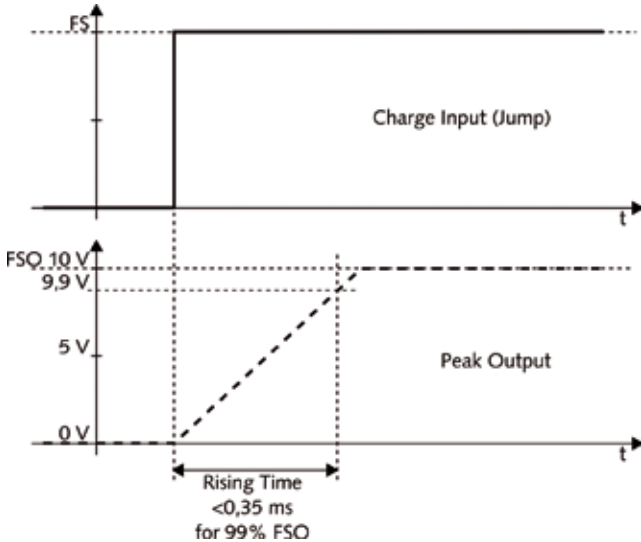


Fig 3: Minimum rising time after a full scale jump at the charge input.

**ManuWare Setup and Test Software**

ManuWare, which is included free of charge on a CD, offers the following possibilities:

- **Setting** all parameters
- **Controlling** several ICAMs via the serial interface (cycle control and range switching)
- **Displaying the current status of the ICAM**, and all of the digital inputs in real time
- **Graphical representation of measurement data** with reduced data rate for commissioning a measuring chain
- **Scaling measuring channels** to known measurands (help in determining system sensitivity)
- **Backup and Restore** of amplifier settings

ManuWare is a general-purpose software which supports other industrial products such as transmitters in addition to ICAMs. An individual interface for configuring and displaying an entire measuring system can be defined. Any number of ICAMs is supported simultaneously.

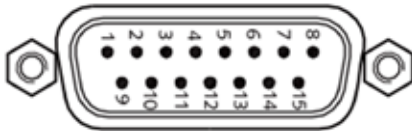


Fig. 4: ManuWare setup and test software

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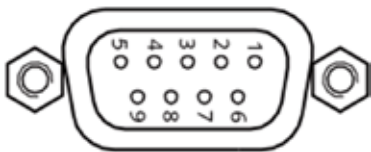
**Pin Allocation**

Connector 'Exct/Control/Signal Out', D-Sub 15-pole pos.



- 1 Signal Out Ch3
- 2 Signal Out Ch2
- 3 Signal Out Ch1 (or summing signal for Type 5073A5...)
- 4 Signal Out Ch4 (or Peak Ch3 for Type 5073A3...)
- 5 Peak Ch2
- 6 Peak Ch1
- 7 Common Control (see chapter 'Control inputs')
- 8 Measure
- 9 Exct GND
- 10 Signal GND
- 11 +Exct 18 ... 30 VDC
- 12 Range 2 Ch4
- 13 Range 2 Ch3
- 14 Range 2 Ch2
- 15 Range 2 Ch1

Connector 'RS-232C', D-Sub 9 pole neg.



- 1 not connected
- 2 RxD
- 3 TxD
- 4 not connected
- 5 Exct GND
- 6 not connected
- 7 not connected
- 8 not connected
- 9 not connected

**Dimensions**

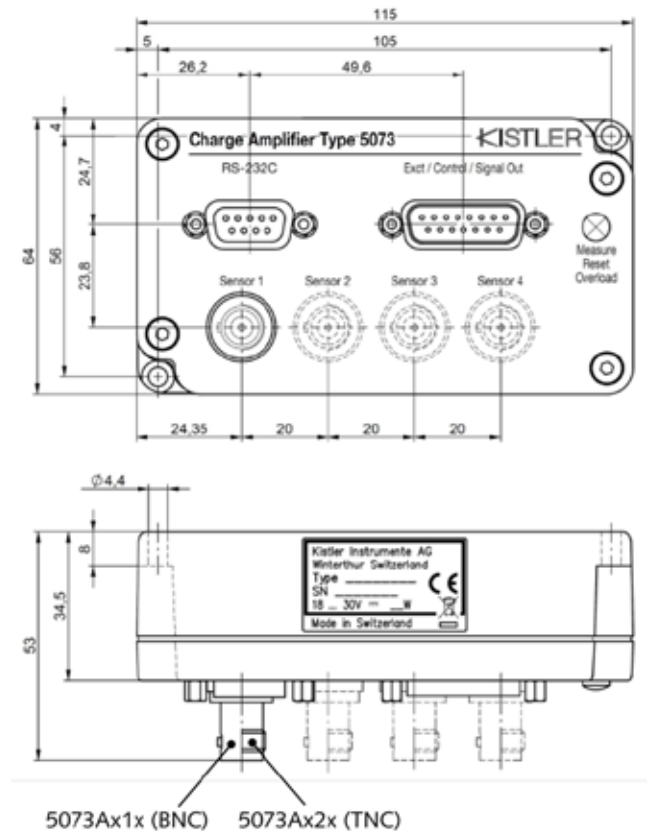


Fig. 5: Dimensions of Types 5073Ax1x (with BNC connectors) and 5073Ax2x (with TNC connectors)

3D CAD data can be downloaded free of charge from <http://kistler.partcommunity.com>

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**Block Schematic Diagram**

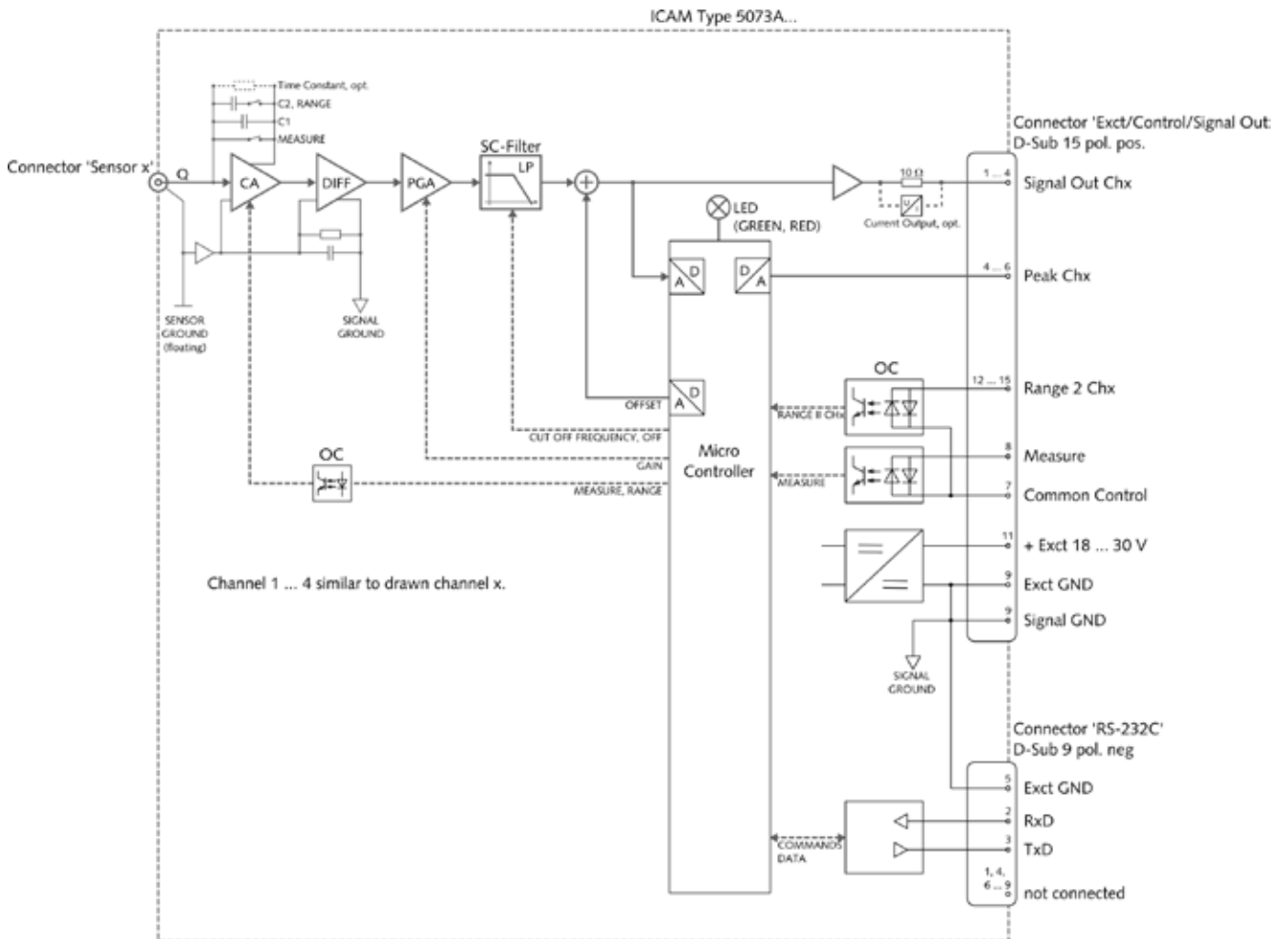


Fig. 6: Block circuit diagram of the ICAM Type 5073A... .  
The relevant components are duplicated for the multichannel versions.

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**Accessories Included**

- Instruction manual with ICAM CD Art. No./Type  
5073A\_002-327
- ManuWare CD with 7.643.035
  - ManuWare program
  - Firmware for all supported ICAMs
  - Flashloader programs for all supported ICAMs
- Connector D-Sub 15-pole neg., 7.640.063  
IP40, with metallized cover  
and lifting screws
- Null modem mini adapter, 1489  
D-Sub 9-pole pos. – D-Sub 9-pole neg.
- Cover IP67 for D-Sub 9-pole 5.211.477
- Protective caps for the charge inputs
- Calibration certificate

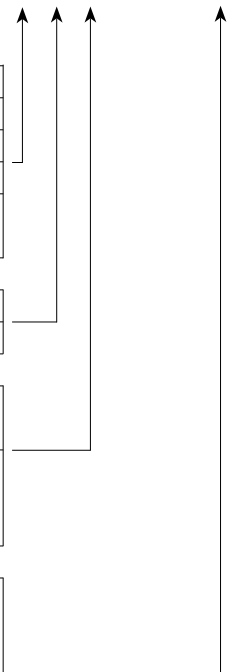
**Accessories (Optional)**

- RS-232C cable, D-Sub 9-pole pos. – Art. No./Type  
1200A27  
D-Sub 9-pole neg.
- Connector D-Sub 15-pole neg., 7.640.085  
IP67, with lifting screws M20x1,5  
for cable diameter 6 ... 12 mm
- Cable D-Sub 15-pole neg. – open ends, 1500A41A5  
l = 5 m
- Cable D-Sub 15-pole neg. – open ends, 1500A41Asp  
Length according to order  
(Lmin = 1 m / Lmax = 10 m)
- USB convertor to RS-232C; 2867  
USB connector Type A –  
D-Sub 9-pole pos.; USB 1.1
- Coupling TNC pos. – BNC neg. 1709

**Ordering Key**

1 channel/1 peak memory	1
2 channels/2 peak memories	2
3 channels/3 peak memories	3
4 channels/2 peak memories	4
4 charge inputs summed on 1 channel	5
BNC neg. connector (IP60)	1
TNC neg. connector (IP65)	2
Output signal voltage –10 ... 10 V	1
Output signal current 4 ... 20 mA (only available for 1- and 2-channel versions)	2
With fixed custom time constant; specify for each channel with order, incl. high (>10 000 pC) or low (<10 000 pC)	488
for supply voltage of 9 ... 16 V	489

Type 5073A    (opt.) Y0



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