SIMTRUM

GIA100

Gated Integrating Amplifier

HIGHLIGHTS

• Fast switching	1 µs max.
• Fast settling	25 µs max. to 0.1%
• Output	integrating analogue
• Dimensions (2 channel unit)	130 x 66 x 120 (W x H x L)

APPLICATIONS

- Sensitive photodiode preamplification
- Optical pulse energy measurement
- Signal recovery
- OEM

MEASUREMENT PRINCIPLE

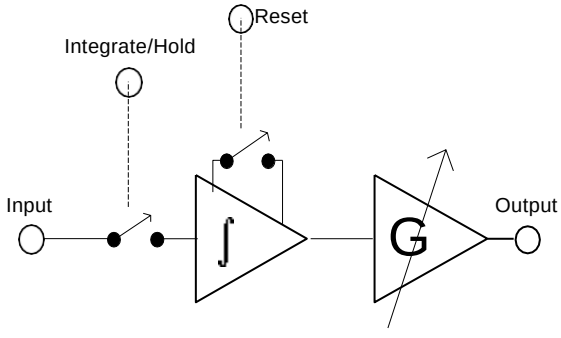
The GIA100 series of gated integrating amplifiers employ dual monolithic switched integrators. This design results in very low leakage error, charge injection error and pickup. The precision input stage may be configured for current or voltage inputs.

FIELDS OF APPLICATION

The GIA100 series of gated integrators is useful for signal processing in a wide range of applications such as photodiode monitoring and time domain signal analysis. The output is a voltage linearly proportional to the integral of the input during a period of time set by a TTL-compatible gate. Between gates, the output is held constant for readout or digital conversion via an external A/D-converter or I/O-card (not included).

The fast response time at high signal-noise-ratio makes the GIA100 series particularly useful in online production control.

The GIA100 series is insensitive to electromagnetic interference by design, an important factor when working in „dirty“ industrial environments. The case wings provide for mounting on standard 25mm and 1“ optical table tops and for OEM applications. 19“ rack mounting is also available.



ABSOLUTE MAXIMUM RATINGS

	Current Input	Voltage Input
Average input	± 5 mA	± 5 V
Temperature Range	0 – 60 °C	0 – 60 °C

ORDERING INFORMATION

Order code: GIA100 c i n

	Options	Description
Case style	G	OEM style with gullwing mounts
	R	19” Rack module
Input	I	Current
	V	Voltage
Number of channels	2	
	4	

For example, a 2 channel, OEM style unit with current input (for example for photodiode measurement) would be ordered as:

GIA100GI2

For 19“ rack systems or mixed systems (mixed amplifiers or receptacles), please contact us.

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SPECIFICATIONS

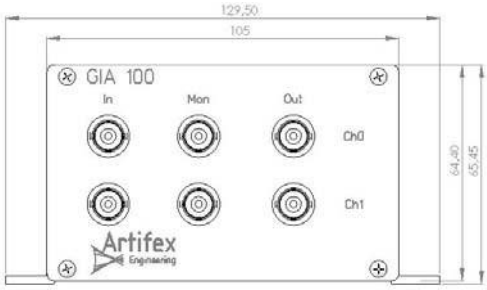
Parameter	Conditions	Current Input			Voltage Input			Units
		Min	Typ	Max	Min	Typ	Max	
Input								
Range (Min=noise equivalent input, Max=full scale)		1 nA		100 µA	10 µV		1 V	
Connectors		BNC or BR2[1]			*			
Output								
Range (full scale)				10V			*	
Function		Linear analogue $V_{out} = \frac{scale}{100\,pF} \int I_{in}\,dt$			Linear analogue $V_{out} = \frac{scale}{1\mu s} \int V_{in}\,dt$			
Output scale			1, 2, 5, 10			*		
Connectors		BNC[1] and DB9			*			
Settling time (0.1%)				25			*	µs
Accuracy		± 3			*			%
Linearity				± 0.1			*	% FSR
Output impedance				1			*	Ω
Logic								
Switching time (integrate / hold, reset, gain)				1			*	µs
Power Supply								
Type		Wall plug (supplied)			*			
Dimensions		30 x 60 x 50			*			mm
Dimensions								
	2 channels	130 x 66 x 120 mm (w x h x l)			*			mm
	4 channels	130 x 106 x 120 mm (w x h x l)			*			mm
	> 4 channels	19“ rack, 3U			*			

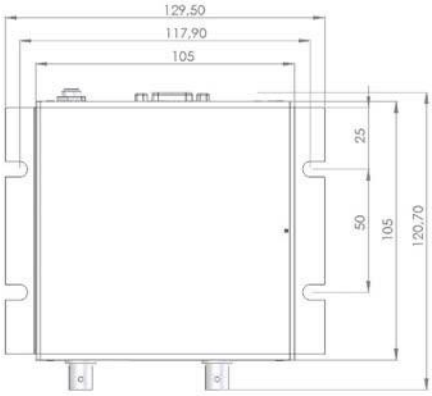
* Identical values as for current input version

[1] Adapters for other connector systems available.

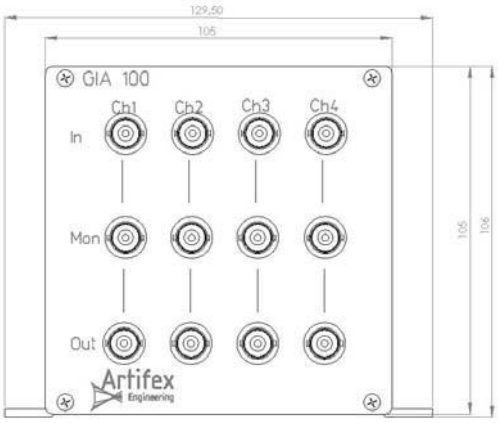
CASE STYLES

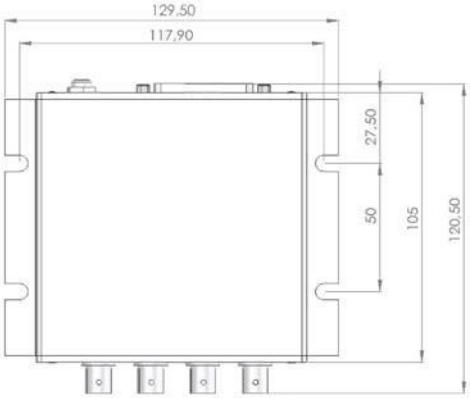
2 Channel:





4 Channel:





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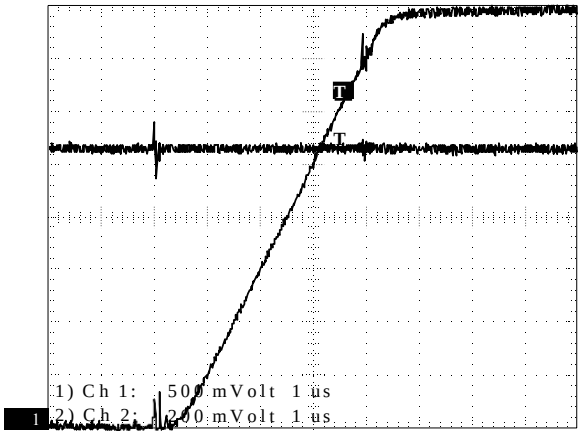
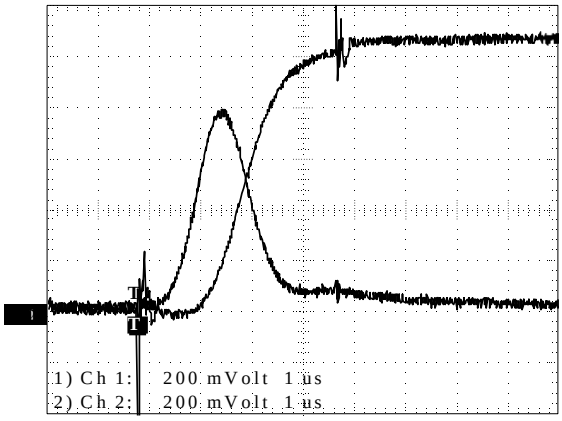
PERFORMANCE

Output (4μs integration time)



Input: 1.0 VDC

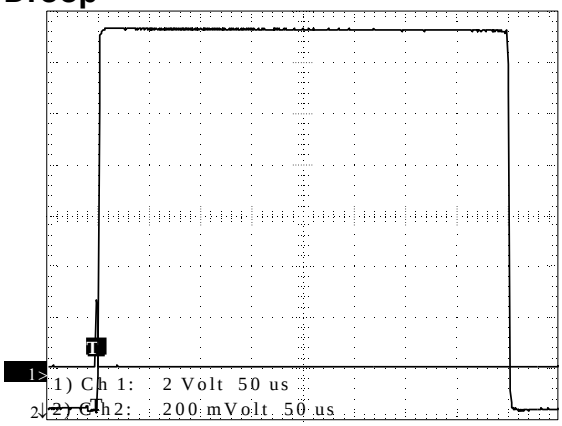
Output: 1.0 V/μs



Input: 800 mV 1.2μs FWHM

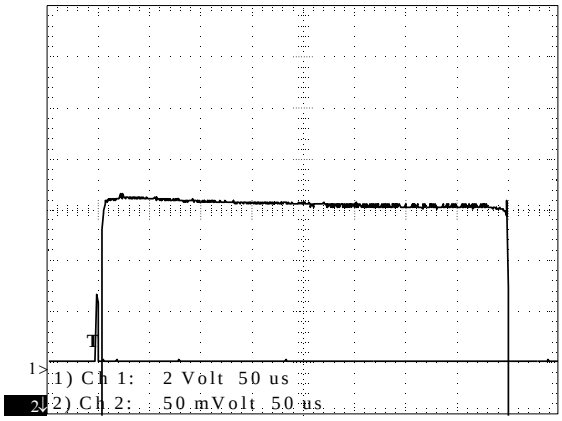
Output: < 1% overshoot

Droop



lower trace: 2 VDC input

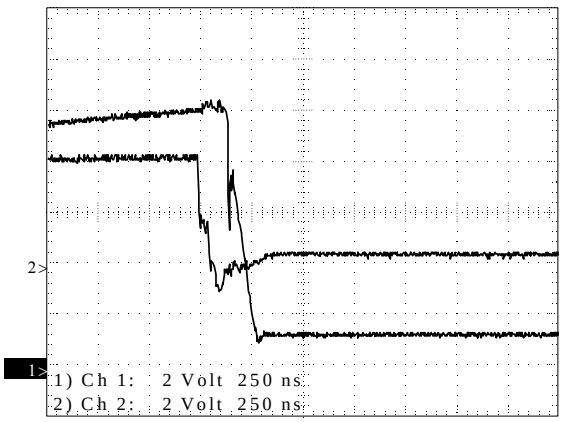
upper trace: GIA output (1.5 V) held for 400 μs following 4 μs integration



upper trace: as previous graph; 4x expanded vertical scale

Gain Switching Dead Time

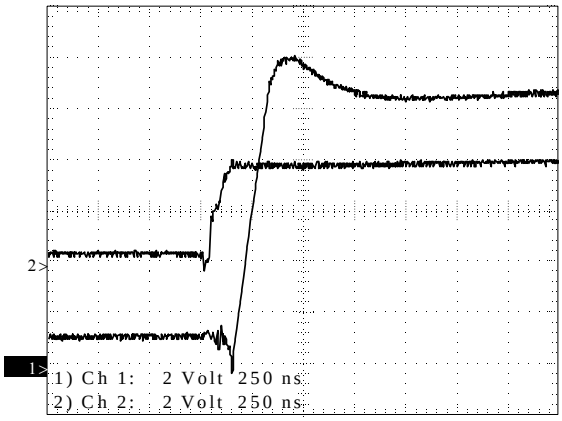
high sensitivity → low sensitivity



4V step: control voltage

8V step: GIA100 output

low sensitivity → high sensitivity



INSTRUCTIONS FOR MEASUREMENT

The GIA100 gated integrating amplifier comprises pairs of independent measurement channels, from 2 to 16 channels per unit depending on the model chosen. Each channel consists of an input (current or voltage), a function output and a logic monitor output. These three user interfaces are arranged in logical groups on the front plate.

To make a measurement, proceed as follows:

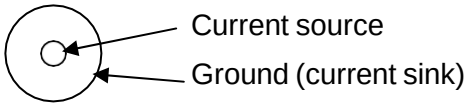
1. Turn the unit on. For the most accurate measurement, please allow for a 15 minute warm up before using.
2. Connect an electrical source to the desired channel via the corresponding receptacle. Caution: see „Absolute Maximum Ratings “ for maximum allowed input values.
3. Connect a BNC-cable from the BNC output socket directly underneath the chosen input receptacle to a suitable measurement instrument (voltmeter, oscilloscope, I/O card, etc.). Alternatively, the output may be taken from the interface receptacle using the interface cable supplied with the unit (see „Interface“).
4. Select the appropriate range setting for the expected signal (see „Interface “).
5. Provide digital control signals for integration, result hold and reset via the interface (see „Interface“).
6. Monitor the input signal and the logic monitor simultaneously on an oscilloscope. The timing of the „integrate/hold“ and „reset“ gates may now be set and optimised.
7. Read the voltage output.

INPUTS

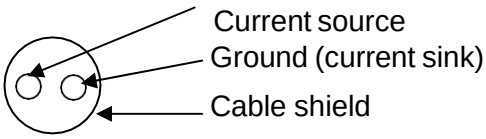
There are two types of input receptacles: BNC and BR2. The BR2 receptacle should be used when shielding of the signal source is required.

The connections of these two connectors is as follows.

Current Input

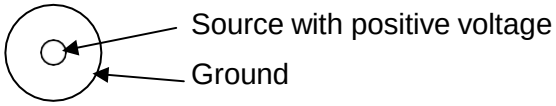


BNC

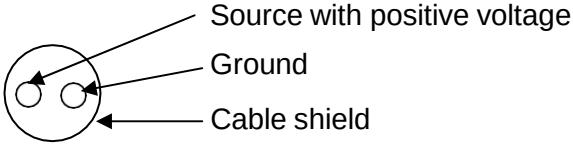


BR2

Voltage Input



BNC



BR2

Note that when connecting photodiodes as the signal source, the photodiode anode is the current source and the cathode is the current sink.

OUTPUTS

The analogue output is provided via standard BNC sockets as well as through the interface. The output is a voltage linearly proportional to the integral of the input during a period of time set by a TTL-compatible gate. Between gates, the output is held constant for readout or digital conversion via an external A/D-converter or I/O-card (not included).

INDICATORS

LEDs

Power (red): The unit is powered.

The interface provides an additional power indicator, useful for automated operation:

Pin 19: +5 V = power on 0 V (analogue ground) = power off

LOGIC

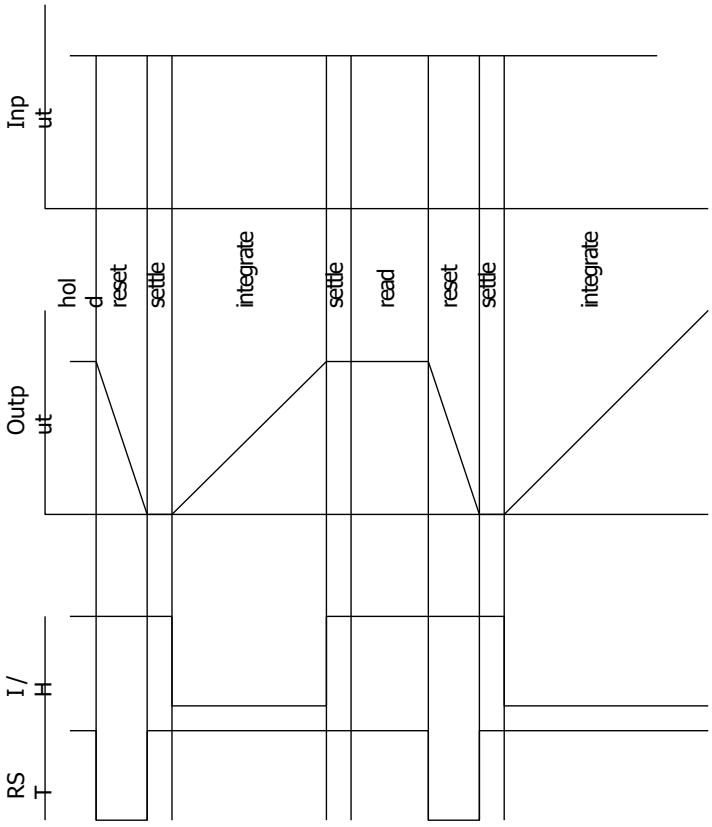
Logic control is via the DB37 interface. This instrument uses +5 V / 0 V (= analogue ground) logic, which may be TTL[2]. The pin assignment is described under „Interface“.

Function	LO	HI
Integrate / Hold	integrate	hold
Reset	reset	enable

The status of the logic for each channel may be monitored by connecting the corresponding BNC logic monitor socket to an oscilloscope. This output is HI during „reset“ and „integrate“ and is LO at all other times. This is useful for setting the gate positions and durations.

A typical measurement begins by resetting the channel in question by setting the „reset“ wire LO for a minimum of 25 µs, in order to allow the amplifiers to settle (see „Output“). During this time it is convenient to hold the „integrate / hold“ wire HI. When the „reset“ wire is held HI, the channel is enabled for integration and holding. Set the „integrate / hold“ wire LO for the period of time required for the integration. At the end of the integration period, the „integrate / hold“ wire is switched to HI to hold the value. After the settling time of 25 µs, the measured value may be read out. This sequence may now be repeated for further measurements.

This sequence is depicted in the following diagramme:



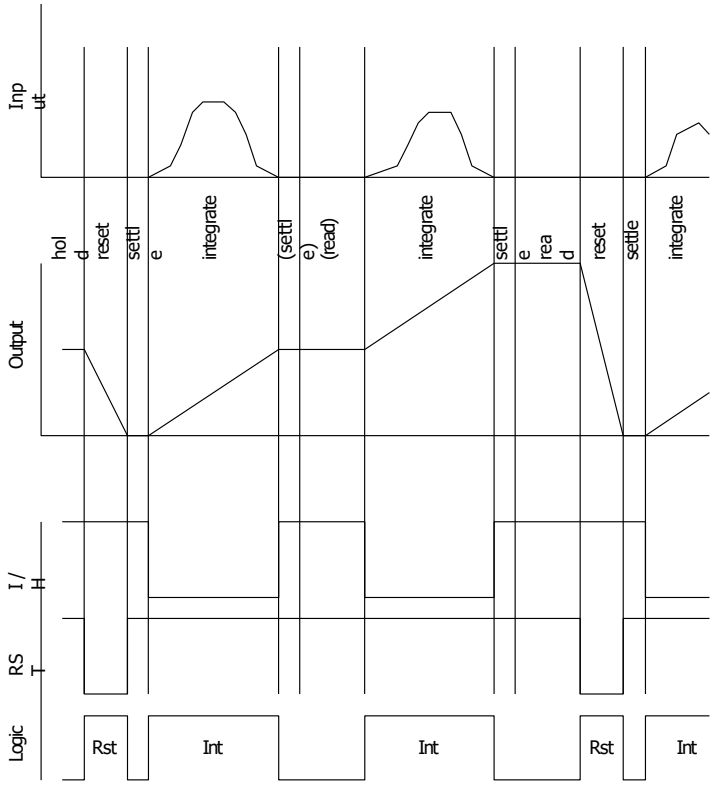
[2] LO = TTL low (-0,3 .. +0,8 V); HI = TTL high (+2,4 .. +5,1V)

Note that when using the GIA100 for photodiode monitoring, the photodiode itself will store charge during the time between the end of the reset period and the beginning of the integration period. Thus, for photodiode monitoring purposes, the effective integration time is from the end of the reset period to the end of the integration period.

The only restriction here is that the voltage on the photodiode due to the charge stored during the time between the end of the reset period and the beginning of the integration period should be kept below 500mV. For example, a photodiode with a capacitance of 100pF must not be allowed to collect more than 100pF • 500mV = 50pC of charge. Depending on the illumination of the photodiode, the settling time after the reset pulse may have to be adjusted accordingly.

Note further that the charge storage capability of photodiodes can be effectively used for the measurement of the total energy of short light pulses, even if the speed of the GIA100 itself is not high enough to follow in real time. A short pulse of light, from a pulsed laser for example, will produce a charge on a photodiode which can then be read out by the GIA100 with no loss of signal. We will be happy to assist you with questions regarding photodiode monitoring.

In order to improve the signal-to-noise ratio of repetitive signals, the GIA100 may be used to integrate isolated events as a „boxcar integrator“. In this case, the output is not reset between measurements, until the desired number of events have been integrated. This sequence is depicted in the following diagramme:



LOGIC MONITOR

The status of the logic for each channel may be monitored by connecting the corresponding BNC-socket to an oscilloscope. This output is:

HI during „reset“ and „integrate“

LO at all other times.

This is useful for setting the gate positions and durations.

DAMAGE

The unit may be damaged by exceeding the maximum average inputs. Please read „Absolute Maximum Ratings“ for these maximum values before working with the instrument.

Use only the power supply and power supply cable provided with the unit.

INTERFACE

The interface on the back panel allows readout of the measurement values, as well as control of the unit. The pin correlation of the interface connector and the cable supplied with the unit is given in the following table.

Pin	Function	Pin	Function
1	Gain Channel 1, MSB[3]	20	Gain Channel 3, MSB
2	Gain Channel 1, LSB[4]	21	Gain Channel 3, LSB
3	S/H Channel 1	22	S/H Channel 3
4	RST Channel 1	23	RST Channel 3
5	AGND[5]	24	AGND
6	AGND	25	AGND
7	AGND	26	AGND
8	DGND[6]	27	DGND
9	RST Channel 2	28	RST Channel 4
10	S/H Channel 2	29	S/H Channel 4
11	Gain Channel 2, MSB	30	Gain Channel 4, MSB
12	Gain Channel 2, LSB	31	Gain Channel 4, LSB
13	AGND	32	AGND
14	Output Channel 2	33	Output Channel 4
15	AGND	34	AGND
16	AGND	35	AGND
17	Output Channel 1	36	Output Channel 3
18	AGND	37	AGND
19	Power On Indicator (+5V)		

Gain	MSB	LSB
1	LO	LO
2	LO	HI
5	HI	LO
10	HI	HI

[3] MSB = most significant bit

[4] LSB = least significant bit

[5] AGND = analogue ground

[6] DGND = digital ground

TROUBLE SHOOTING

In the event that a measurement is not successful, the following possibilities should be analysed:

Symptom	Possible Errors	Correction
No output and power LED is not on	• System is not switched on	• Ensure the power cord is connected at both ends and switch the system on.
	• Fuse blown	• Secondary, internal self resetting fuses, only. In the event that a secondary fuse „blows“, shut off the power, correct the fault and wait a few minutes before switching the power back on.
No output and power LED is on	• Input too low	• Switch to more sensitive range or increase input
Output at full scale, independant of input	• Range too sensitive	• Switch to a less sensitive range or lower the input

In the unlikely event that you are not able to obtain a measurement in spite of these trouble shooting measures, please contact us. We will be pleased to help you solve your problem.

NOTICE

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