



Gated Integrating Amplifier

HIGHLIGHTS

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

APPLICATIONS

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

MEASUREMENT PRINCIPLE

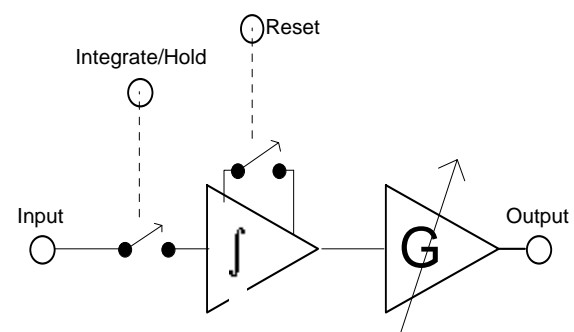
The GIA100 series of gated integrating amplifiers employ dual monolithic switched integrators. This design results in very low leakage error, charge injection error and pickup. The precision input stage may be configured for current or voltage inputs.

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.

SPECIFICATIONS

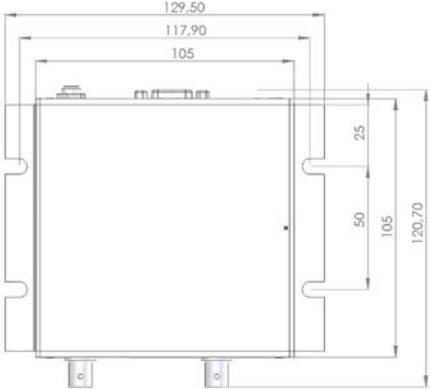
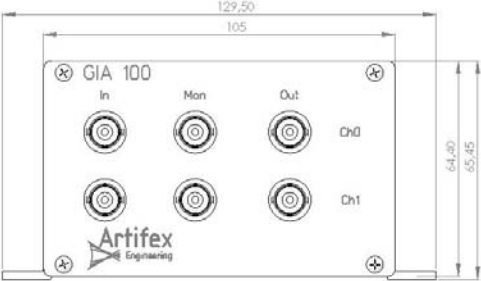
| Parameter | Conditions | Current Input | | | Voltage Input | | | Units |
|--|--------------|--|-------------|--------|---|-----|-----|-------|
| | | Min | Typ | Max | Min | Typ | Max | |
| Input | | | | | | | | |
| Range (Min=noise equivalent input, Max=full scale) | | 1 nA | | 100 µA | 10 µV | | 1 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

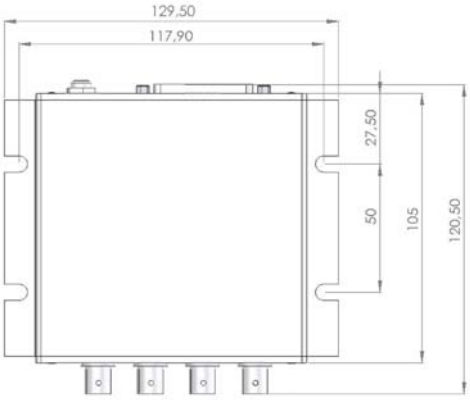
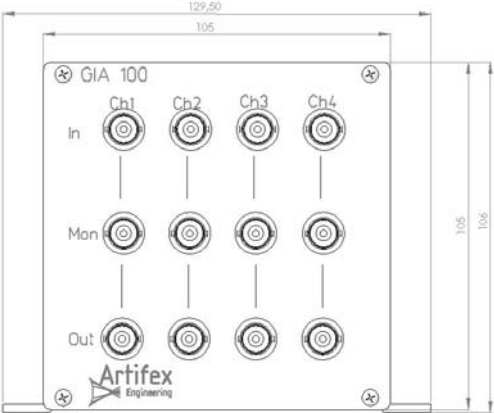
¹ Adapters for other connector systems available.

CASE STYLES

2 Channel:

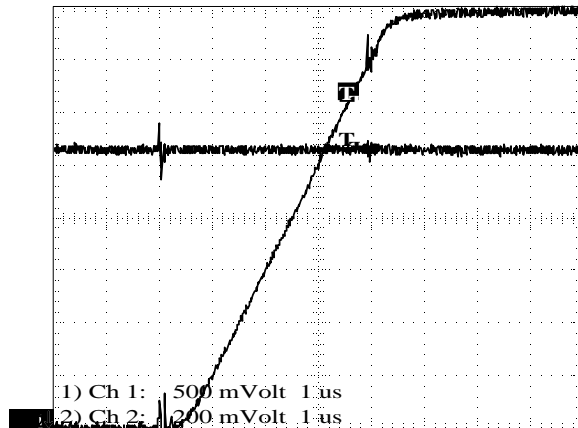


4 Channel:



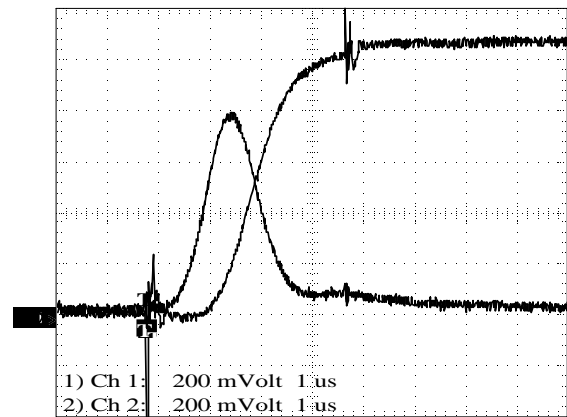
PERFORMANCE

Output (4 μ s integration time)



Input: 1.0 VDC

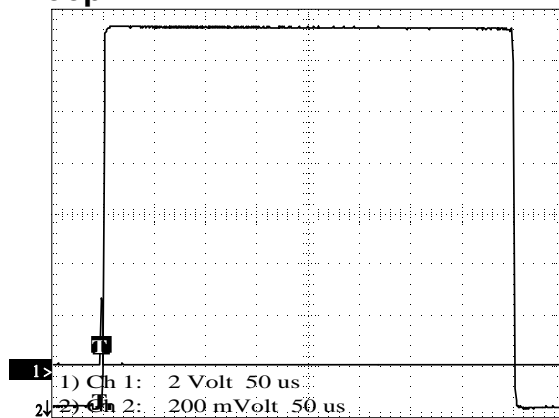
Output: 1.0 V/ μ s



Input: 800 mV 1.2 μ s FWHM

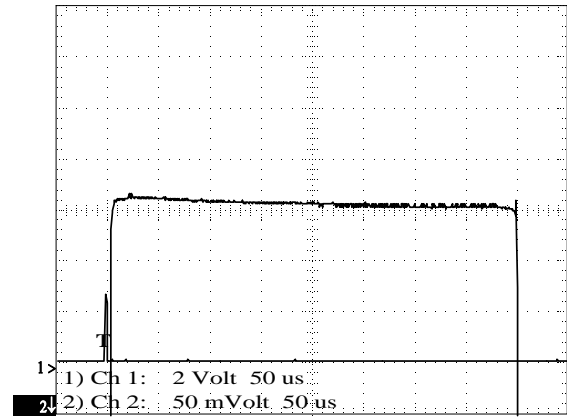
Output: < 1% overshoot

Droop



lower trace: 2 VDC input

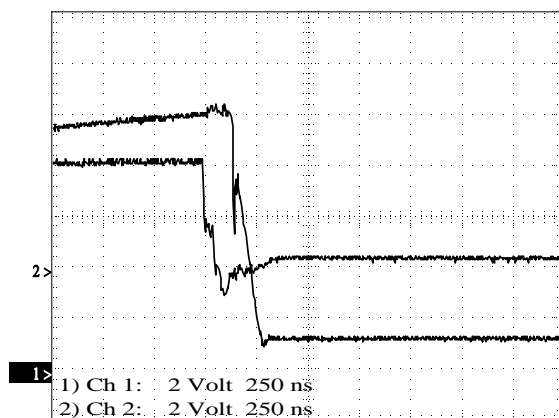
upper trace: GIA output (1.5 V) held for 400 μ s following 4 μ s integration



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

Gain Switching Dead Time

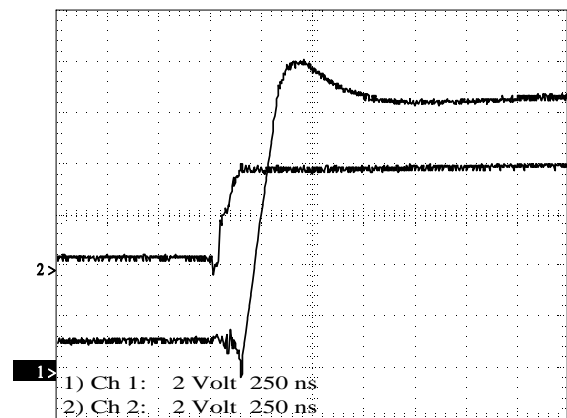
high sensitivity \rightarrow low sensitivity



4V step: control voltage

8V step: GIA100 output

low sensitivity \rightarrow 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:

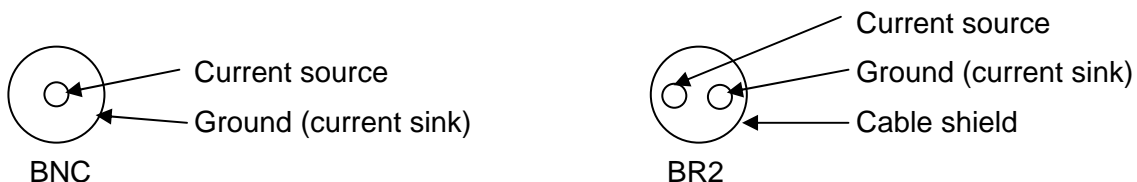
1. Turn the unit on. For the most accurate measurement, please allow for a 15 minute warm up before using.
2. Connect an electrical source to the desired channel via the corresponding receptacle. Caution: see „Absolute Maximum Ratings “ for maximum allowed input values.
3. Connect a BNC-cable from the 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

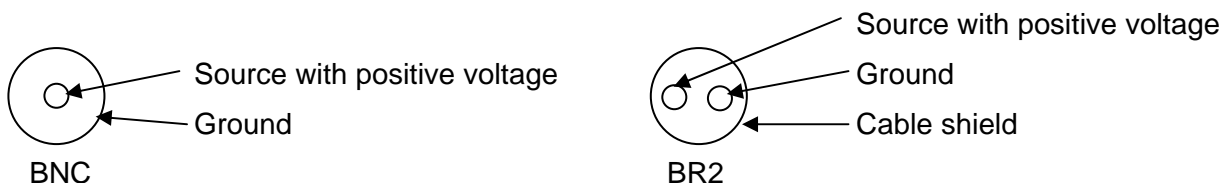
There are two types of input receptacles: BNC and BR2. The BR2 receptacle should be used when shielding of the signal source is required.

The connections of these two connectors is as follows.

Current Input



Voltage Input



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

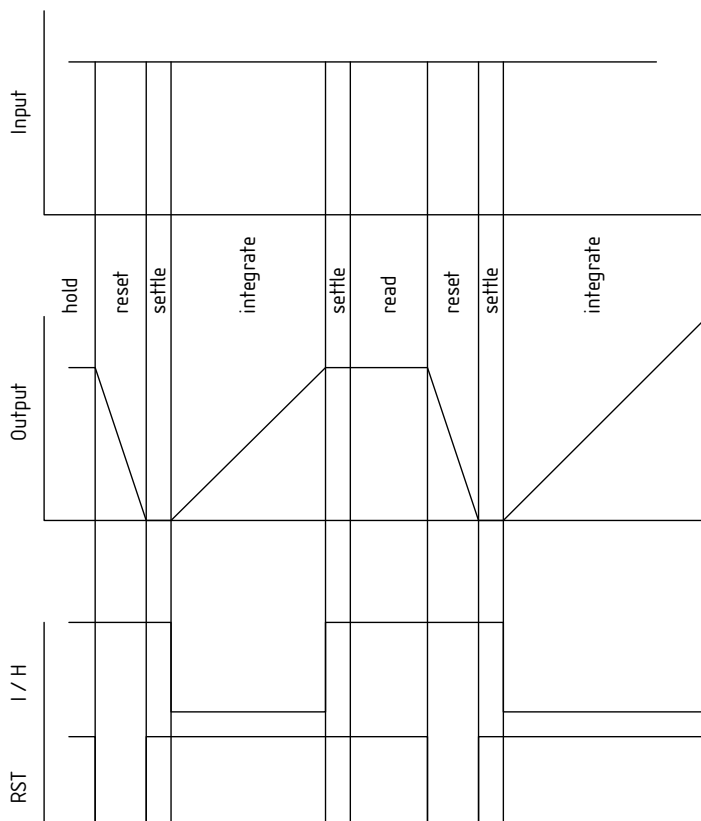
Logic control is via the DB37 interface. This instrument uses +5 V / 0 V (= analogue ground) logic, which may be TTL². The pin assignment is described under „Interface“.

| 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 μ s, 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 μ s, the measured value may be read out. This sequence may now be repeated for further measurements.

This sequence is depicted in the following diagramme:



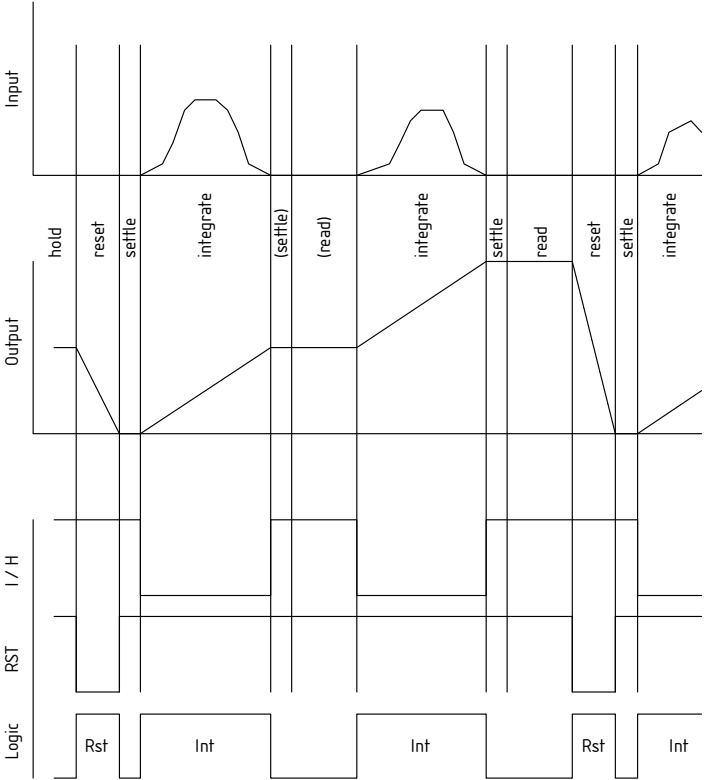
² LO = TTL low (-0,3 .. +0,8 V); HI = TTL high (+2,4 .. +5,1V)

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 $100\text{pF} \cdot 500\text{mV} = 50\text{pC}$ 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

TRUBLE 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 | <ul style="list-style-type: none">• System is not switched on• Fuse blown | <ul style="list-style-type: none">• Ensure the power cord is connected at both ends and switch the system on.• 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 | <ul style="list-style-type: none">• Input too low | <ul style="list-style-type: none">• Switch to more sensitive range or increase input |
| Output at full scale, independant of input | <ul style="list-style-type: none">• Range too sensitive | <ul style="list-style-type: none">• 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.

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