Multi-function Card (USB Series)

DASYLab
DIAdem
EdasWin
LabVIEW
LABWindows/CVI

Unterstützte Applikationssoftware

E.d.a.s.WinPlus™

DASYLab™ Data Acquisition System Laboratory

NATIONAL INSTRUMENTS™ DIAdem™

NATIONAL INSTRUMENTS™ LabVIEW™

™

API für C/C++, Delphi, Phython unter Windows Linux, MacOS und Android und für DotNET(C#, F#, VB.NET, IronPhython, …)

Web: http://www.goldammer.de

The next generation of intelligent metering

The devices of the G0A series are easy to install, versatile and portable due to their USB port. They support USB full speed and high speed, so a data rate of up to 480MBit/s. The built in digital signal processor (DSP) has several builtin timers to independently clock and control various measurement procedures. The heart of the MultiChoice USB consists of a Freescale signal processor DSP56311, which is clocked at 150 MHz and features a computing power of 225 Mips.

The DSP has 128 * 24 KB of internal memory and a fast 1.5 MB SRAM external memory, which can be divided into data and program memory blocks. Inside this memory the sequential control for the measurements as well as a possible online function on measured data is performed. Again, the DSP performs not only control tasks, but also real time data processing tasks, which are not otherwise possible via the USB bus, called the Online Functions.

These online functions are freely programmable. You can select from several filter algorithms, a PID controller or Fourier analysis. With these functions, the measurement data is processed directly on the card and can generate output signals directly when needed, bypassing the PC as a controller. Real time PID controllers and trigger functions, which can switch digital outputs, are available with these USB devices.

The response time of such controller/trigger is within one sampling period, i.e. at 100 kHz, which corresponds to 10us (10e-5 seconds). Due to the versatile power supply, the box can also operate in stand-alone mode. For this use the measurement process can be programmed by the PC, then the connection to the PC is cut and the box independently keeps running its control task.

If the same process is used very often, it can be stored in a flash chip on device. After switching on the box with no connection to a PC, this stored task is automatically started, the standard use is always possible in parallel by connecting the USB cable on startup.

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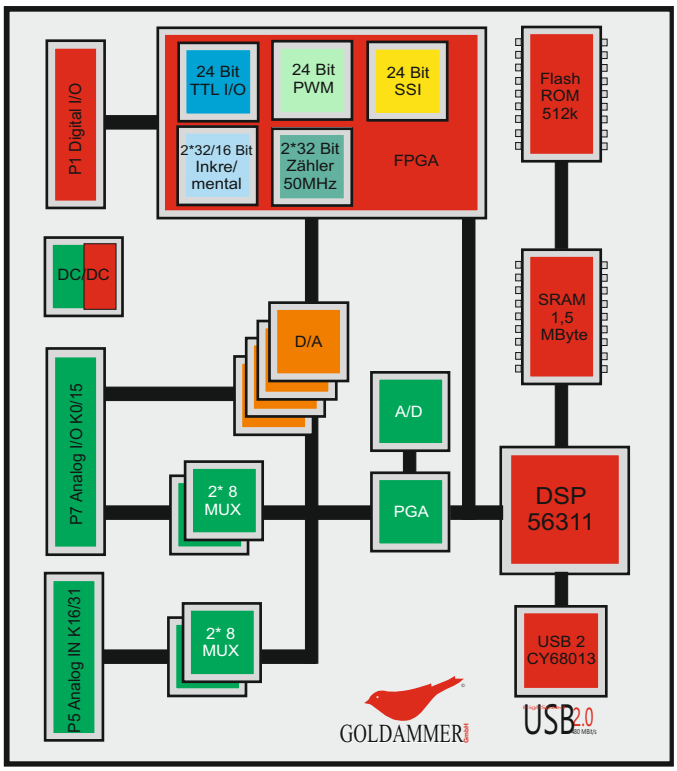
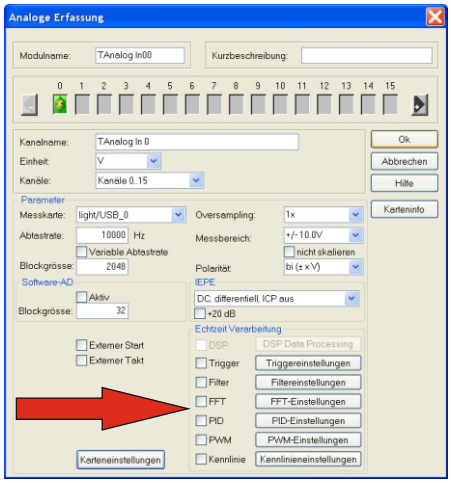
card scheme



G0A-1024-i + G0A-30E0-4



Dialog of the online functions under DASYLab

Cardinformation

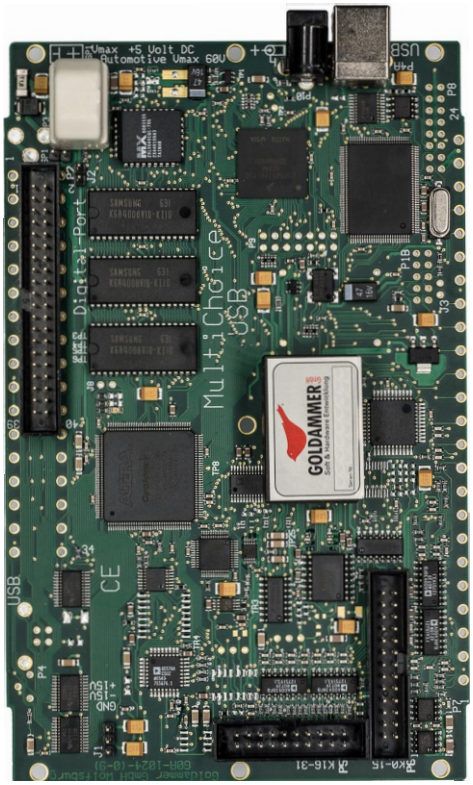
The next generation of intelligent metering

- **USB2.0 480 MBit (USB 1.1 12MBit compatible)**
- **Several Connection Options: Screwable Terminals or BNC**
- **OEM Version 160x100x12mm can be Integrated in Existing Systems**
- **Powerful Signal Processor DSP56311 (255 MIPS)**
- **Analog Inputs/Outputs with 12 Bits or 16 Bits**
- **12 Bit Version 8/16(32) ADC 12 Bit 500kHz, 4*12DAC 200kHz or**
- **16 Bit Version 8/16(32) ADC 16 Bit 500kHz, 4*16DAC 100kHz**
- **Up to Three Measuring Processes in Parallel**
- **24 Digital Inputs/Outputs Switchable Bit by Bit**
- **2*32 Bit Counter, Pulse Width, Period Length, Frequency Counter**
- **2*32 Bit Incremental Encoder Measurement, 16 Bit Time Stamp**
- **24 Bit Pulse Width Modulation 2Hz-2500kHz, Resolution 100ns**

The OEM version
which can be integrated in existing systems, is extremely compact and sized to euro board format (160x100x12mm). It is available with 12 bit or 16 bit resolution and with 16 or 32 analog inputs. The design of this euro board OEM version (100x160x12mm (3HE)) also permits the integration in 19" racks.

G0A-1024-3

G0A-1024-0



G0A-1024-9

G0A-1024-4

Delivery release MultiChoiche USB

Detection functions at a glance

Analog

The input signals are digitized with the multiplex method. There are 16(32) single ended and 8(16) dual ended inputs. The averaged sample rate is 500 kHz with 12 bit and 16 bit resolution. The 16 bit version runs with an averaged sample rate of 400 kHz if used in multi channel measurements. The input circuitry consists of a software programmable precision amplifier with a selectable 1/2/4/8-fold gain. The input voltage ranges are: ±1.25V, ±2.5V, ±5V, ±10V, 0-1.25V, 0-2.5V, 0-5V, 0-10V.

Analog Output

MultiChoice USB offers four analog outputs. The output rate ist 200 kHz with 12 bit resolution. The 16 bit version works with 200 kHz per channel. A current of up to ±5 mA can be sourced. The output voltage ranges are 0-10V und ±10 V. It is also possible to upload data to MultiChoice USB and to output it to the DAC converters time synchronized by the DSP.

Digital Inputs/Outputs

There are 24 digital inputs/outputs available. Any of these ports can be controlled by the DSP. Any of the 24 bits can be programmed as input or output individually.

Measuring modes:

There are several independent channel lists avaliable for time domain measurements and output: A mixed channel list for measurements of all input channel types, a separate list for counter channels, a PWM output list and an output list for analog signals. Each of them has an individual sample/oputput rate and can be started and stopped separately, manually or signal triggered. Since the mixed channel list samples analog and digital signals on the same time reference, the synchronization of the signals is already guaranteed while

Counting Pulses:

Counting pulses up to 32 bit values (0 to 4294967295) and a maximum frequency of approx. 20MHz. It is possible to set an initial value. The counter can be used in up or in down mode.

Measuring Frequencies:

The method of „measuring frequencies by counting in a time window“ depends on the definition of the frequency (number of oscillations or periods per second). After starting the measurement a clock generator keeps open the „time window“ for a certain period of time. The time window can be set in 1000, 100, 10 and in 1 millisecond(s). Within the time window the number of pulses of the the input signal are counted. The number of pulses can be read directly as frequency value shown in Hz and can be used for the display. The highest resolution is available within the one second range because it is counted exactly to 1 Hz. Indeed a new result can be displayed once a second because the time window is one second long.

An input frequency of 12563 Hz will output the following values (column "display") depending on a different referencefrequency (column "resolution"):

resolution	display
1 Hz	12563 Hz
10 Hz	12560 Hz
100 Hz	12600 Hz
1000 Hz	13000 Hz

Measuring the Pulse Width (Pulse/Pause Ratio):

Measuring the pulse width is used to determine pulse width modulated signals. Depending on the selected mode the positive or the negative part of the signal is processed. If two counters are used to measure the pulse width, and one of them is programmed to be triggered by the negative and the other one by the positive edge of the input signal, the summed up result will show the period length. If the input signals are stopped the last measured value becomes available.

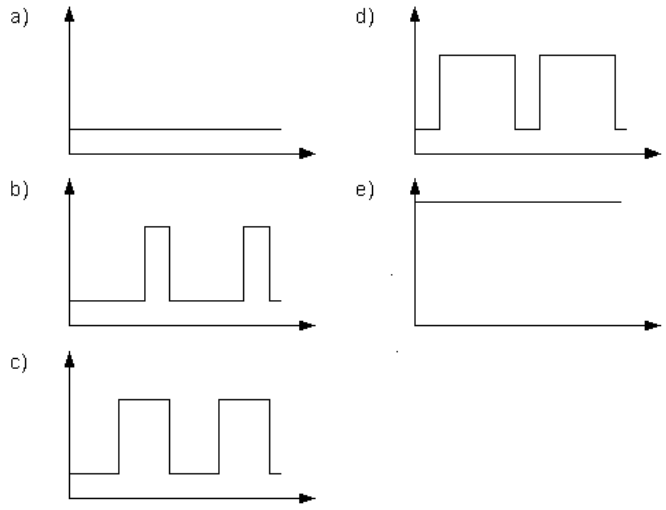
Zählermodus im Überblick

Measuring with Incremental Encoders

Two counters with 32 bit resolution including direction detection and a 16 bit counter for time stamping are available. Interpolation can be switched between 1x, 2x, and 4x and it is equipped with a zero position detection with programmable edges which can be activated/deactivated at any time. Therefore the board is the perfect choice for tasks like flow measurements. The time stamp serves to measure the velocity of the measured object exactly.

Pulse Width Modulation

MultiChoice can output PWM signals with a resolution of 100ns and output frequencies between 2Hz up to 2,500,000Hz. Pulse width modulation is a kind of special feature in the world of measurement. It is a design of Goldammer GmbH. For this kind of pulse width modulation no interruptions or pulse discontinuities are permitted. If frequency or pulse width is changed, the actual period is emitted until it is fully completed and then the new settings are used without any discontinuities. Modulation of frequency and pulse width is supported at the same time and it is fully transparent to the user who only specifies a frequency and the pulse width in percent. If the frequency is changed the percentage is kept, if the pulse width is changed, the corresponding frequency is kept.



Pulse Width wiht a)0%, b)25%, c)50%, d)75%, e)100%

Period measurement

To measure the length of a period a time window is compared with the length of the period of the signal to determine and the number of pulses within this window are counted. The counter pulses are generated by a 10 MHz clock oscillator. This is the equivalent of a counter resolution of 100ns.

The measuring of the length of the period is to prefer for high precision or very fast frequency measures because for each period a new reciprocal value of the frequency is available. If an input frequency of 1 kHz is fed into the counter the display shows 10000 which means 10000 * 100 (*20)ns. Other than the frequency measurement the counter reading without a signal, in example if a pulse generator is not turned on any more, is not refreshed, because the second reference pulse is missing. The calculation into rotations per second or into a frequency will not lead to a zero value in the display, instead the last value is displayed. This is caused by technical details because a zero frequency means the length of the period had to be infinite – a value that is limited by the properties of the real hardware. These circumstances make it difficult to detect a signal loss. Starting with Firmware Update 02.2014, the customer is given the opportunity to adapt the value range of the counter to in order to respond more quickly to an interrupted input signal:

	10Mhz	50Mhz
32Bit	429,00000s	85,00000s
24Bit	1,67778s	0,33550s
16Bit	0,00655s	0,00131s
8Bit	0,00003s	-

Onlinefunktionen im Überblick

Online Functionality
The measurement cards offer a wide variety of online functions like filters, signal analysis like FFT, control algorithms (PID), and treshold observation. Any of these functions are run on the signal processor without any effort of the PC. So any of the measured values can be processed immediately after measuring it.

A controller is able to adjust the manipulated value in an extremly short period of time if the input value changes respectively. For none of these operations any effort has to be made by the PC. The processing of data is achieved immediately after measuring it without any additional delay. Filters suppress undesired frequencies and distortions. Therefore the user gets useful data only. A combination of filters and controllers permit to remove distortions first and depending on the data to control the control loop then.

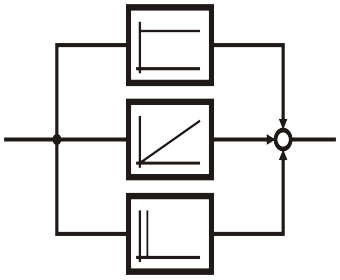
All of these functions are part of the boards without any additional hardware. So distortions caused by cabling, inbetween signal conditioning, or bad contacts are avoided. Furthermore the delay between input and output is extremly short which permits real time control. Sometimesthe different time associations of measurement hardware of different manufacturers can lead to problems.

If analog channels, digital inputs and counter readings are measured with different components it is normally impossible to associate this signals to a certain time. This gap is closed by MultiChoice too. The signal processor offers the possiblity to observe digital inputs and counter signals like analog inputs and to measure data with synchronized time. Channels of any type are measured and stored as a single sample which ensures time synchronization.

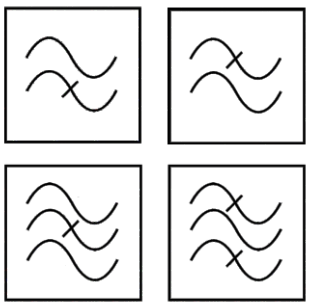
Triggers
There are several trigger conditions available: Borders, threshold checking, checking of edges, limits, or window conditions. Measured data can be processed mathematically and in dependence of the steepness of the resulting curve (steepness of gradient), processing can be initiated even in threshold and window conditions. Trigger conditions becoming true can start or stop a measurement, can set digital outputs or control analog outputs.

As an option trigger conditions can activate or deactivate themselves crossover. So a network of dynamic triggers is available depending on the proceedings of the measurement. Trigger conditions can be configured to be retriggerable. After a certain condition becomes true, they are activated or deactivated to achieve the same or a changed observation.

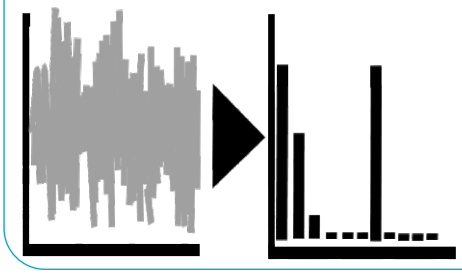
PID-Controller



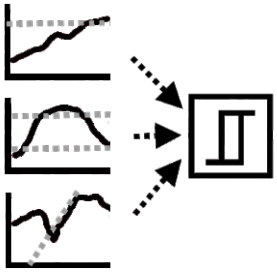
Digital Filters



FFT Analysis



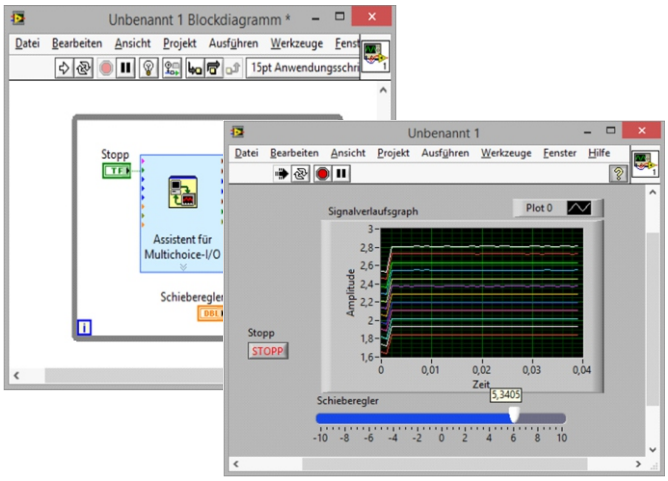
Event Trigger



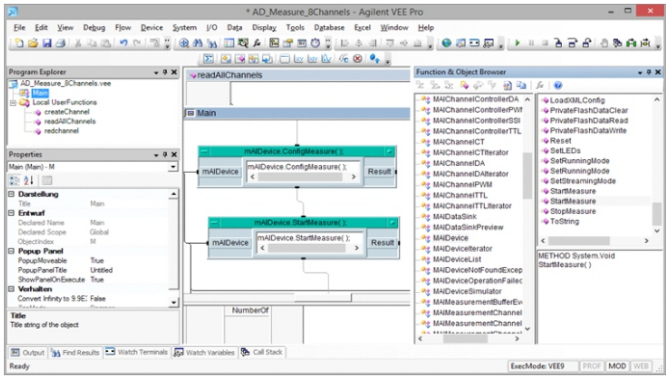
Software Applications Overview

Software:

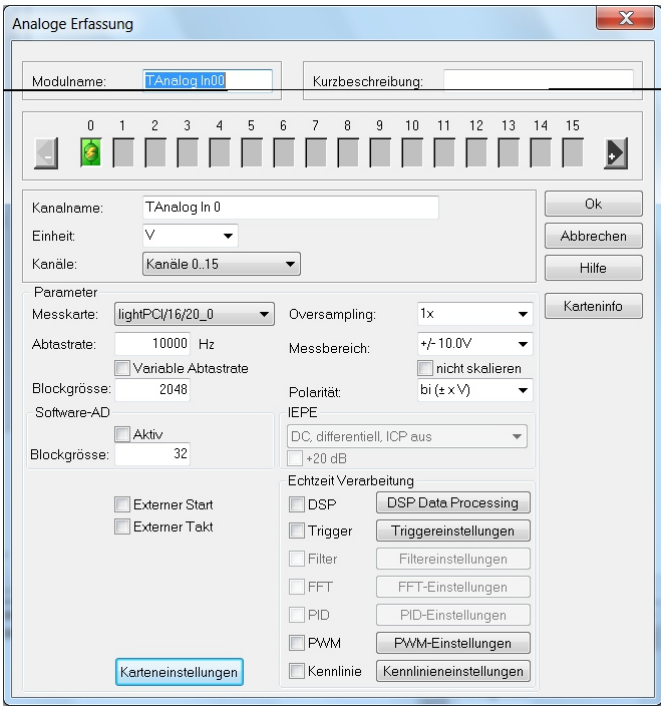
For all Goldammer MultiChoice measurement systems there are free drivers or plugins for the applications DasyLAB, DIAdem, IPEMotion and LabWiew available. Likewise, the programming interface "Messurement Application Interface Version 2" (MAIv2) for using the hardware in self-created programs. This API has been designed with the goal to allow the user maximum flexibility in hardware access, at the same it is completely identical for all card types, PCI to USB Basic and even Ethernet. It exists as a native version, eg. for use with Python, Delphi or C ++ as well as a DotNET version that can be used not only in C #, F # and VB.NET programs, but just as easily in MATLAB scripts, from Agilent VEE, IronPython, or even the Windows PowerShell. Many examples facilitate the entry into programming.



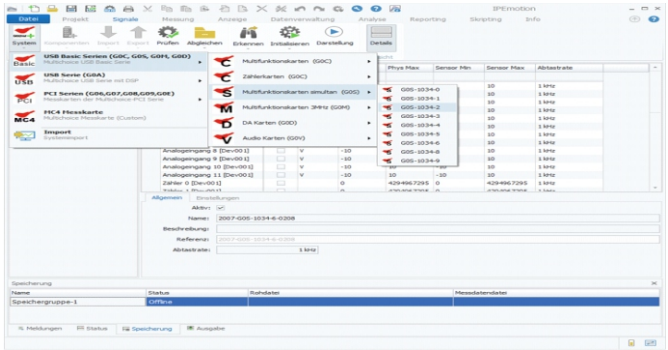
LabVIEW integration



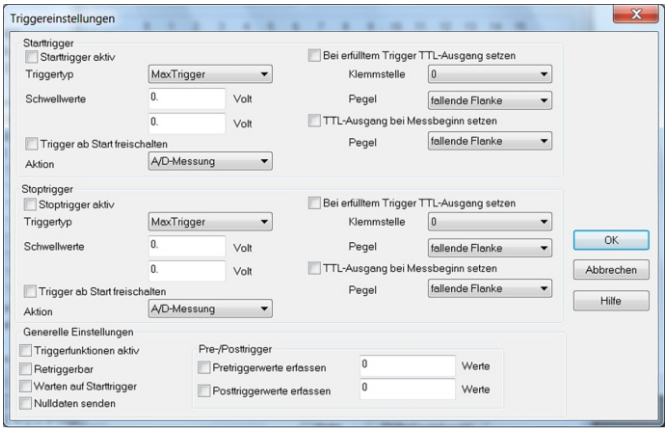
Agilent VEE integration via DotNET



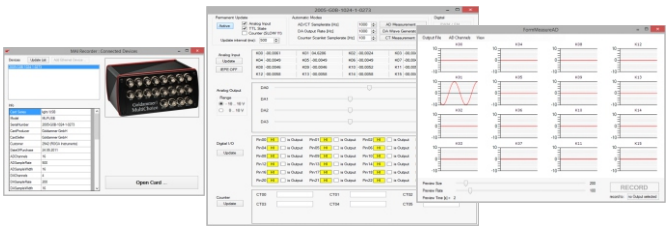
Channel setting under DasyLAB



Configuration screen IPE Motion



Triggersettings under DasyLAB



MAIRecorder:Open source demo application in measuring in C#

Features at a glance

		sampling		D/A	onlinefunctions						sync.		counter in/output								connection						
Articelcode	Analog In	Resolution A/D Bit	500 kHz Sum	IEPE supply 24V	4*D/A Resolution bit	Realtime-FFT	Online-scaling	FIR and IIR filter	Realtime PID	Functiongenerator Prosys-RT for Matlab	Master	Slave	24 In/output TTL	32 Bit Universalcoun.	Pulse/frequency 10Hz	Optional:	incrementalcounter	Pulse width / period	32 bit UP/Down coun.	SSI 16 bis 24 Bit *1	Output PWM 24 Bit	*Analog In/Out*	BNC	Connector Phoenix	terminal strips	*Digital I/O*	Connector Phoenix	terminal strips
G0A-1024-0	16SE/8DI	12	•		12						•	•			•				•				•				•	
G0A-1024-1	16SE/8DI	16	•		16						•	•			•				•				•				•	
G0A-1024-2		12	•		12						•	•			•				•				•				•	
32SE/16DI		16	•		16						•	•			•				•				•				•	
G0A-1024-3		12	•		12						•	•			•				•					•		•		
32SE/16DI		16	•		16						•	•			•				•					•		•		
G0A-1024-4	16SE/8DI	12	•		12						•	•			•				•						•			•
G0A-1024-5	16SE/8DI	16	•		16						•	•			•				•						•			•
G0A-1024-6	16SE/8DI	12	•		12						•	•			•				•						•			•
G0A-1024-7	16SE/8DI	16	•		16						•	•			•				•						•			•
G0A-1024-8																												
32SE/16DI		16		•	16	•	•				•	•	•	•	•		•	•	•				•				•	
G0A-1024-9												•																
32SE/16DI												•					4											
												•					4											
G0A-1024-i												•		•	•			8										
16SE/16DI												•		•	•			8										
												•									8							
G0A-1015-0												•									8							
G0A-1015-1																			8									
G0A-1023-0																			8									

Hardware options and upgrades:

G0A-30D0-0 16-Channel differential amplifier (required G0A-30E0-4)
G0A-30D0-1 32-Channel differential amplifier (required G0A-30E0-4)
G0A-30D0-2 16-Channel differential amplifier enhance. with input voltage range ±50Volt (req. G0A-30E0-4)
G0A-30D0-5 16-Channel differential amplifier common-mode voltage range ±100 Volt (req. G0A-30E0-4)
G0A-3090-0 Counter extension
G0A-30A0-0 PWM extension
G0A-30I0-0 incrementalcounter - extension
G0A-30E0-0 Automotiv - supply 9-60V DC / 5W (required G0A-30E0-1)
G0A-30E0-1 Supply 220V AC / 24V DC (for G0A-30E0-0)
G0A-30E0-4 Automotiv - supply 9-60V DC / 10 W (for G0A-30D0-x)
G0A-30S0-0 1-Channel SSI signal detection
G0A-30C0-0 Holder for wall mounting

Software options for real-time signal processing:

G0A-4010-0 Realtime-FFT
G0A-4020-0 Online-scaling of the measurement data
G0A-4030-0 Realtime-FIR-and IIR-filter
G0A-4040-0 Realtime-PID
G0A-4050-0 Functiongenerator Output of sine, triangle, square, pulse, sawtooth, noise and files
G0A-40X0-0 All functions to the package price
G0A-4060-0 Prosys-RT embedded for Matlab

Specifications at a glance

Analoginput	12 bit	16 bit	Analogoutput	12 Bit	16 Bit
Converter type	ADS7835	Ad7665		DAC7714	DAC7734
Number of input	8/16(32)	8/16(32)	Number of output	4	4
A/Dsample rate	500 kHz	500/400kHz	D/A sample rate	200 kHz	100kHz
Resolution	12 Bit	16 Bit		12 Bit	16 Bit
Conversion time	2µ	2µ		±20 V 5µ	±20 V 10µ
Input voltage ranges	±1,25,±2,5, ±5, ±10	±1,25, ±2,5, ±5,±10V		±1V 1µ	±1V 1µ
	0-1,25,0-2,5,0-5,0-10V	0-1,25,0-2,5,0-5,0-10V	Output ranges	0-10V,±10V	0-10V,±10V
Precision of system	±0,05 %	0,009%=1,8mV	Output current	±5mA	±5mA
	0,0025%-0,5V 16fach oversampling		Output impedancy	0,2R	0,2R
Maximum input voltage in	±10V	±10V			
In operation/non operating	±40V/±20V	±40V/±20V			
BIAS-Strom	±40nA	±40nA			
Non linearity	<±0,5LSB	±3 LSB mit 16 x oversampling ±1,5		±1 LSB	±2 LSB
Digitalization error	<±1 LSB	±3 LSB mit 16 x oversampling ±1,5		±1 LSB	±2 LSB
Quantification error	<±1 LSB	<±1 LSB			
Effective precesion	1,5 Bit	13,5 with oversampling 15,5 Bit			
Range error	adjustable	adjustable		<±0,025 %typ	<±0,025 %typ
Zero error	adjustable	adjustable		<±0,0025 %typ	<±0,025 %typ
ADC bias drift	±7ppm/℃	±7ppm/℃		±5ppm/℃	±5ppm/ ℃
Monotonicity	±1,0 LSB	±1,5 LSB		12 Bit	15 Bit

Digital Input / Output		Counter		PWM		Incremental/SSI	
Number of inputs	24	Number of counters	2	Number	1	Number	2/2
Logic Family	LVCMOS	Resolution	32	Resolution	24	Resolution	32/16
Logic Sense	High	Modes		Frequency range		Incremental / time stamp	
Maximum input voltage		Event counting up/down		2 Hz -2500 kHz adjustable		max. 20 Mhz	
In operation	±5 V	Frequency measurement		in 100ns steps		Interpolation	1/2/4
Logie High Input Voltage	2,0V	Resolution 1/10/100/1000Hz		Logic High Output	3,1 V		2,0 V
Logic Low Input Voltage	0,8V	Period lenght measurement/ pulse		Logic Low Output	0,1 V		0,8 V
Logic High Input Current	0,5µA	width measurement resolution 20/100ns					0,5µA
Logic Low Input Current	0,1µA						0,1µA
Logic High Output Current	2,5mA						
Logic Low Output Current	-2,5mA						

DSP56311 signal processor, 150 MHz clock frequency 7.5ns, 255MIPS, 128k * 24 bit internal and external 1.5 Mbyte memory

Power supply +5 V; max. 350 mA as counter version via USB multifunction card 5V 800mA supply via mains adapter

Connection Phoenix MDSTB (digital) and MSTBA (analog) or BNC (analog)

USB 2.0 480MBit, USB 1.1 12MBit compatibel

Dimensions 160x100x12 OEM, 117x167x80mm screw terminals, BNC 16 150x167x80 channel, BNC 32-channel 201x167x80mm

GOLDAMMER GmbH

Includet software MAIRecorder

The link to download MAIRecoder

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