UF2 -4600 : 8 channel 16 bit A/D Digitizer cards up to 3 MS/s

- **PCI-X interface (100% compatible to PCI)**
- **2, 4 or 8 channels with 16 bit resolution per card**
- **Versions with 200 kS/s up to 3 MS/s**
- **Simultaneously sampling on all channels**
- **Software selectable single-ended or differential inputs**
- **Separate ADC and amplifier per channel**
- **complete on-board calibration**
- **8 input ranges: ±50 mV up to ±10 V**
- **Up to 2 GSample (4 GByte) on-board memory**
- **Sustained streaming mode up to 200 MB/s**
- **Window, pulse width, re-arm, OR/AND trigger**
- **Programmable input offset of ±5 V**
- **Multi-card synchronization option for up to 16 cards**
- **Options: ABA mode for slow/fast recording on trigger event**



Product range overview

Based on more than 16 years design pedigree, the UltraFast cards are high quality, low-noise instruments that replace traditional oscilloscopes and transient recorders.

Model	1 channel	2 channels	4 channels	8 channels
M2i-4620	200 kS/s	200 kS/s		
M2i-4621	200 kS/s	200 kS/s	200 kS/s	
M2i-4622	200 kS/s	200 kS/s	200 kS/s	200 kS/s
M2i-4630	500 kS/s	500 kS/s		
M2i-4631	500 kS/s	500 kS/s	500 kS/s	
M2i-4632	500 kS/s	500 kS/s	500 kS/s	500 kS/s
M2i-4640	1 MS/s	1 MS/s		
M2i-4641	1 MS/s	1 MS/s	1 MS/s	
M2i-4642	1 MS/s	1 MS/s	1 MS/s	1 MS/s
M2i-4650	3 MS/s	3 MS/s		
M2i-4651	3 MS/s	3 MS/s	3 MS/s	
M2i-4652	3 MS/s	3 MS/s	3 MS/s	3 MS/s

General Information

There are twelve different UF2 -4600 series cards with a choice of recording on two, four or eight channels and sampling rates of 200 kS up to 3 MS/s, to enable the user to find the most cost-effective solution. These cards offer outstanding A/D features both in resolution and speed for PCI/PCI-X. With of up to 2 GSample onboard memory, even the fastest signals can be recorded for long periods, useful for multi-card systems. Alternatively, the FIFO mode allows continuous streaming of even 8 channels with 3 MS/s each to memory or hard disk.

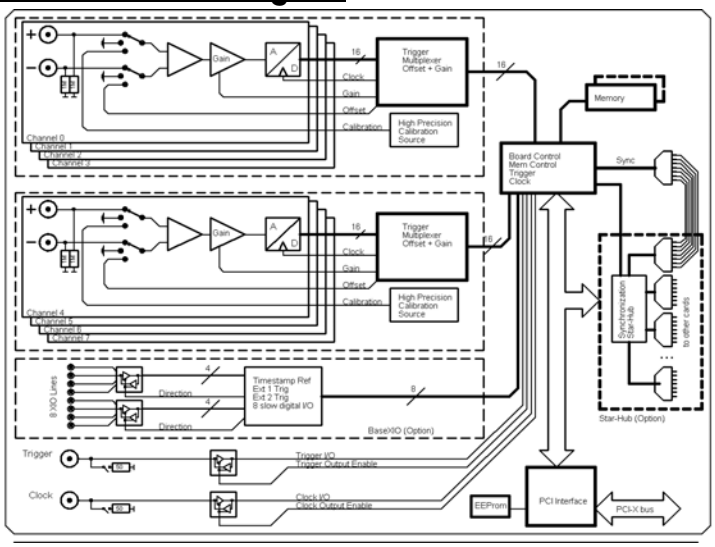
UF2

- Completely new developed base card
- 4 GByte memory with one slot width
- Optimized low jitter clock section
- Multi, Gate with programmable pre, posttrigger and timestamp
- Zero phase delay synchronization
- AND/OR conjunction of trigger/gate

Application examples

Automation	Military	Automotive
Quality control	Production	ATE

Hardware block diagram



Software programmable parameters

Input Range	±50 mV, ±100 mV, ±250 mV, ±500 mV, ±1 V, ±2 V, ±5 V, ±10 V
Input Offset (single-ended)	programmable to ±5 V in steps of 1 mV, not exceeding ±10 V input
Clock mode	Int. PLL, int. quartz, ext. clock, ext. divided, ext. reference clock, sync
Clock impedance	50 Ohm / high impedance (> 4kOhm)
Trigger impedance	50 Ohm / high impedance (> 4kOhm)
Trigger mode	Channel, Extern, SW, Auto, Window, Pulse, Re-Arm, Or/And, Delay
Trigger level resolution	14 bit
Trigger edge	Rising edge, falling edge or both edges
Trigger pulse width	0 to [64k - 1] samples in steps of 1 sample
Trigger delay	0 to [64k - 1] samples in steps of 1 sample
Memory depth	8 up to [installed memory / number of active channels] in steps of 4
Posttrigger	4 up to [8G - 4] samples in steps of 4
Multiple Recording segment size	8 up to[installed memory / 2 / active channels] in steps of 4
Multi / Gated pretrigger	0 up to [8k samples / number of active channels - 16]
ABA clock divider	1 up to [64k - 1] in steps of 1
Synchronization clock divider	2 up to [8k - 2] in steps of 2
Channel selection	1, 2, 4 or 8 channels

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Software Support

Windows drivers

The cards are delivered with drivers for Windows XP, Windows XP64, Windows Visa (Beta) and Windows XP64. Programming examples for Visual C/C++, Borland C++ Builder, Gnu C, LabWindows/CVI, Borland Delphi and Visual Basic are included.

Linux Drivers



All cards are delivered with full Linux support. Pre compiled kernel modules are included for the most common distributions like RedHat, Suse or Debian. The Linux support is enhanced by SMP support, versatile programming examples as well as the possibility to obtain the driver sources for compilation on your own PC.

SBench

A full licence of SBench, the easy-to-use measurement and signal generation program for the UltraFast cards, is included in the delivery. Version 6 is running under Windows as well as under Linux (KDE and GNOME)

Third-party products

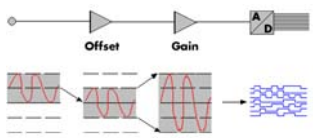
We offer the widest third-party products support. Optional drivers are available for LabVIEW, MATLAB, DASYLab and Agilent VEE. All drivers come with examples and detailed documentation.

UF Software compatibility layer

To allow easy migration from UF cards to the new UF2 cards for existing software, a special software compatibility layer is delivered with the cards. This DLL converts UF calls to UF2 calls and simulates a UF card in the software.

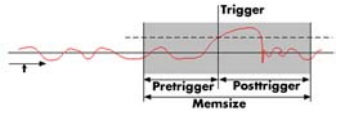
Hardware features and options

Input Amplifier



The analog inputs can be adapted to real world signals using a wide variety of settings that are individual for each channel. By using software commands one can select a matching input range and the signal offset can be compensated for.

Standard mode



The Standard mode allows the Digitizer card to sample at it's maximum rates and running independently of the host PC so that it's cpu can be used for other tasks. Data is written in a ring buffer on the board until a trigger event is detected. After this event the posttrigger values are recorded. The samples prior to the trigger event are also visible: Pretrigger = Memsize - Posttrigger. After the last sample of the measurement has been recorded, the data can then be transferred to the host PC memory (not before)

FIFO mode

The FIFO mode is designed for continuous data transfer between measurement board and PC memory, so that signals longer than the available card memory can be recorded directly to the PC. The maximum sampling rate is limited by the speed that data can be continuously offloaded from the card to the PC and stored. On a PCI-X slot (64 MHz/32-bit PCI bus) this is 200 MB/s, and up to 100 MB/s on a traditional PCI (33 MHz/32-bit) slot. The control of the data stream is automatically managed by the driver on interrupt request. All installed on-board memory is used for buffer data, making the continuous streaming extremely reliable. The standard memory supplied on the card is sufficient for reliable operation.

Channel trigger

The Digitizer boards provide a wide variety of trigger modes. Apart from the standard level and edge trigger found on traditional oscilloscopes, it is also possible to define a window trigger. All trigger modes can be combined with the pulsewidth trigger that makes it possible to trigger on signal errors, such as too long or too short pulses by defining a time-window when the event should/should not occur. There is also a re-arming mode for accurate trigger recognition on noisy signals. Finally, the card can be configured with a AND/OR combination of different trigger events. A unique feature of these cards is the possibility to select deactivated channels as trigger sources.

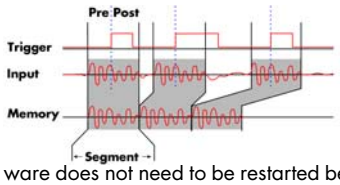
External trigger I/O

All boards can be triggered using an external TTL signal. It is possible to use positive or negative edge in combination with a programmable pulse width. An internally recognised trigger event can, when activated by software, be routed to the trigger connector to start external instruments.

Pulse width

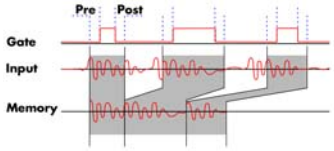
Defines the minimum or maximum width that a trigger pulse must have to generate a trigger event. Can be combined with channel trigger, pattern trigger and external trigger.

Multiple Recording



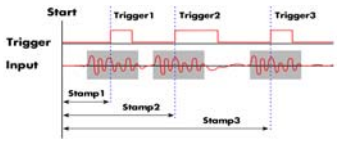
The Multiple Recording option is used to record a high-speed series of waveforms, each with a unique trigger event and an extremely short re-arming time. The hardware does not need to be restarted between triggers. The on-board memory is divided in segments of the same size. Each of them is filled with data if a trigger event occurs. Pre- and posttrigger of the segments can be programmed. The number of acquired segments is only limited by the used memory and is unlimited when using FIFO mode. A typical application is to record RADAR pulses.

Gated Sampling



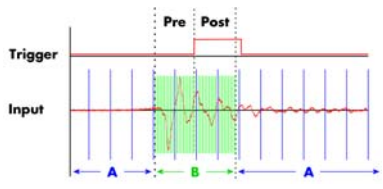
The Gated Sampling option allows data recording controlled by an external gate signal. Data is only recorded if the gate signal has reached a programmed level. In addition, a pre-segment before start of the gate signal as well as a post segment after end of gate signal can be acquired. The number of gate segments is only limited by the used memory and is unlimited when using FIFO mode.

Timestamp



The timestamp option writes the time positions of the trigger events in an extra memory. The timestamps are relative to the start of the recording, a defined zero time, externally synchronised to a radio clock, or a GPS receiver. With this option acquisitions of systems on different locations can be set in a precise time relation.

ABA mode

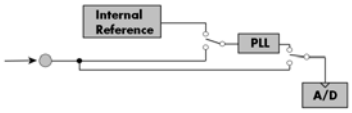


The optional ABA mode combines slow continuous data recording with fast acquisition on trigger events. The ABA mode works like a slow data logger combined with a fast digitizer. The exact position of the trigger events is stored as timestamps in an extra memory.

External clock I/O

Using a dedicated connector a sampling clock can be fed in from an external system. It is also possible to output the internally used sampling clock to synchronise external equipment to this clock.

Reference clock



The option to use a precise external reference clock (normally 10 MHz) is necessary to synchronise the board for high-quality measurements with external equipment (like a signal source). It is also possible to enhance the quality of the sampling clock in this way. The driver automatically generates the requested sampling clock from the fed in reference clock.

Star-Hub



The Star Hub is an additional module allowing phase stable synchronisation of up to 16 boards. There is no phase delay between any channels, independently of the number of boards. The Star Hub distributes trigger and clock information between all boards. As a result, all connected boards are running with the same clock and the same trigger. All trigger sources can be combined with OR/AND allowing all channels of all cards to be the trigger source. The Star Hub is available as a 5 card or a 16 card version. The 5 card version does not need an extra PCI slot width.

Technical Data

Analog Inputs

Resolution	16 bit
Differential non linearity (DNL)	465x: ±2 LSB, all others ±1 LSB
Integral non linearity (INL)	465x: ±2 LSB, all others ±1 LSB
Offset error (full speed)	≤ 1 LSB (after calibration)
Gain error (full speed)	≤ 0.1% (after calibration)
Programmable input offset	±5 V for single-ended ranges < ±10 V
Crosstalk: all ranges 100 kHz signal	≤ -110 dB on adjacent channels, 50 ohm term.
Analog Input impedance	1 MOhm against GND
Over voltage protection	±30 V all ranges (activated card)
CMRR for ±50 mV to ±500 mV	> 70 dB
CMRR for ±1 V to ±10 V	> 46 dB
Connector (analog)	MMCX female
Connector (trigger/clock)	3 mm SMB male

Trigger

Multi, Gate: re-arming time	< 4 samples
Max Pretrigger at Multi, Gate, FIFO	8176 Samples as sum of all active channels
Internal/External trigger accuracy	1 Sample
Channel trigger resolution	14 bit
Trigger output delay	One positive edge after internal trigger event
External trigger type	TTL compatible
External trigger input	Low ≤ 0.8 V, High ≥ 2.0 V, ≥ 2 clock periods
External trigger maximum voltage	-0.5 V up to +5.5 V
External trigger output levels	Low ≤ 0.4 V, High ≥ 2.4 V, TTL compatible
External trigger output drive strength	Capable of driving 50 ohm load

Power consumption (max speed)	**3,3 V**	**5 V**	**-12 V**	**+12 V**	**Total**
UF2-46x0 (32 MS memory)	1.9 A	0.6 A	n.u.	n.u.	9.3 W
UF2-46x1 (32 MS memory)	2.2 A	1.2 A	n.u.	n.u.	13.3 W
UF2-46x2 (32 MS memory)	2.8 A	2.4 A	n.u.	n.u.	21.2 W
UF2-4652 (2 GS memory), max power	3.9 A	2.4 A	n.u.	n.u.	24.9 W

Clock

Internal clock range (PLL mode)	1 kS/s to max (see table below)
Internal clock accuracy	20 ppm
Internal clock: max. jitter in PLL mode	TBD
Internal clock: max. jitter in quartz mode	TBD
Internal clock setup granularity	≤1% of range (100M, 10M, 1M, 100k,...)
Internal clock setup granularity example	range 1M to 10M: stepsize ≤ 100k
Reference clock: external clock range	≥ 4.0 MHz and ≤ 125.0 MHz
External clock range	1 kS/s to max (see table below)
External clock delay to internal clock	TBD
External clock input	Low ≤ 0.8 V, High ≥ 2.0 V, duty 45% - 55%
External clock maximum voltage	-0.5 V up to +5.5 V
External clock output levels	Low ≤ 0.4 V, High ≥ 2.4 V, TTL compatible
External clock output drive strength	Capable of driving 50 ohm load

Environmental and Physical details

Dimension (PCB only)	312 mm x 107 mm (full PCI length)
Width (Standard or star-hub 5)	1 full size slot
Width (star-hub 16)	2 full size slots
Weight (depending on options/channels)	290g (2/4 ch) up to 460g (8 ch + star-hub)
PCI / PCI-X bus slot compatibility	32 bit or 64 bit, 33 MHz up to 133 MHz
Warm up time	10 minutes
Operating temperature	0°C - 50°C
Storage temperature	-10°C - 70°C
Humidity	10% to 90%

Certifications and Compliances

EMC Immunity	Compliant with CE Mark
EMC Emission	Compliant with CE Mark

Dynamic Parameters

	UF2-4620 UF2-4621 UF2-4622		UF2-4630 UF2-4631 UF2-4632		UF2-4640 UF2-4641 UF2-4642		UF2-4650 UF2-4651 UF2.5652	
max internal or external clock	200 kS/s		500 kS/s		1 MS/s		3 MS/s	
-3 dB bandwidth	TBD		TBD		TBD		TBD	
Zero noise level	TBD		TBD		TBD		TBD	
Test - sampling rate	200 kS/s		500 kS/s		1 MS/s		3 MS/s	
Test signal frequency	1 kHz	10 kHz	1 kHz	10 kHz	10 kHz	100 kHz	10 kHz	100 kHz
SNR (typ)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
THD (typ)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
SFDR (typ), excl. harm.	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
ENOB (based on SINAD)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Dynamic parameters are measured at ± 1 V input range (if no other range is stated) and 50 Ohm termination with the samplerate specified in the table. Measured parameters are averaged 20 times to get typical values. Test signal is a pure sine wave of the specified frequency with > 99% amplitude. SNR and RMS noise parameters may differ depending on the quality of the used PC. SNR = Signal to Noise Ratio, THD = Total Harmonic Distortion, SFDR = Spurious Free Dynamic Range, SINAD = Signal Noise and Distortion, ENOB = Effective Number of Bits. For a detailed description please see application note 002.

Ordering Information

Versions

Order no.	1 channel	2 channels	4 channels	8 channels
UF2 -4620	200 kS/s	200 kS/s		
UF2 -4621	200 kS/s	200 kS/s	200 kS/s	
UF2 -4622	200 kS/s	200 kS/s	200 kS/s	200 kS/s
UF2 -4630	500 kS/s	500 kS/s		
UF2 -4631	500 kS/s	500 kS/s	500 kS/s	
UF2 -4632	500 kS/s	500 kS/s	500 kS/s	500 kS/s
UF2 -4640	1 MS/s	1 MS/s		
UF2 -4641	1 MS/s	1 MS/s	1 MS/s	
UF2 -4642	1 MS/s	1 MS/s	1 MS/s	1 MS/s
UF2 -4650	3 MS/s	3 MS/s		
UF2 -4651	3 MS/s	3 MS/s	3 MS/s	
UF2 -4652	3 MS/s	3 MS/s	3 MS/s	3 MS/s

Memory

Order no.	Option
UF2 -4600-64MS	Memory upgrade to 64 MSample (128 MB) total memory
UF2 -4600-128MS	Memory upgrade to 128 MSample (256 MB) total memory
UF2 -4600-256MS	Memory upgrade to 256 MSample (512 MB) total memory
UF2 -4600-512MS	Memory upgrade to 512 MSample (1 GB) total memory
UF2 -4600-1GS	Memory upgrade to 1 GSample (2 GB) total memory
UF2 -4600-2GS	Memory upgrade to 2 GSample (4 GB) total memory

Options

Order no.	Option
UF2 -4600-mr	Option Multiple Recording
UF2 -4600-mgt	Option pack including Multiple Recording, Gated Sampling, Timestamp
UF2 -4600-mgtab	Option pack including Multiple Recording, Gated Sampling, Timestamp, ABA mode
UF2 -4600-SH5 (1)	Synchronization Star-Hub for up to 5 cards, only 1 slot width
UF2 -4600-SH16 (1)	Synchronization Star-Hub for up to 16 cards
UF2 -4600-bxio	Option BaseXIO: 8 digital I/O lines usable as asynchronous I/O, timestamp ref-clock and additional external trigger lines, additional bracket with 8 SMB connectors

Cables

Order no.	Option
Cab-1m-9m-80	Adapter cable MMCX male to BNC male, 80 cm (for analog inputs)
Cab-1m-9f-80	Adapter cable MMCX male to BNC female, 80 cm (for analog inputs)
Cab-1m-9m-200	Adapter cable MMCX male to BNC male, 200 cm (for analog inputs)
Cab-1m-9f-200	Adapter cable MMCX male to BNC female, 200 cm (for analog inputs)
Cab-3f-9m-80	Adapter cable SMB female to BNC male, 80 cm (for clock and trigger I/O)
Cab-3f-9f-80	Adapter cable SMB female to BNC female, 80 cm (for clock and trigger I/O)
Cab-3f-3f-80	Adapter cable SMB female to SMB female, 80 cm (for clock and trigger I/O)
Cab-3f-9m-200	Adapter cable SMB female to BNC male, 200 cm (for clock and trigger I/O)
Cab-3f-9f-200	Adapter cable SMB female to BNC female, 200 cm (for clock and trigger I/O)
Cab-3f-3f-200	Adapter cable SMB female to SMB female, 200 cm (for clock and trigger I/O)

Drivers

Order no.	Option
UF2 -ml	MATLAB driver for all UF2 cards
UF2 -4600-lv	LabVIEW driver for all UF2 -4600 cards
UF2 -4600-dl	DASYLab driver for all UF2 -4600 cards
UF2 -4600-vee	Agilent VEE driver for all UF2 -4600 cards

technical changes and printing errors possible

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