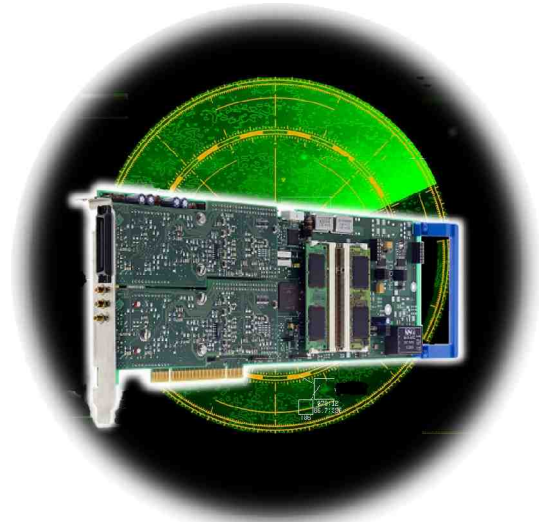


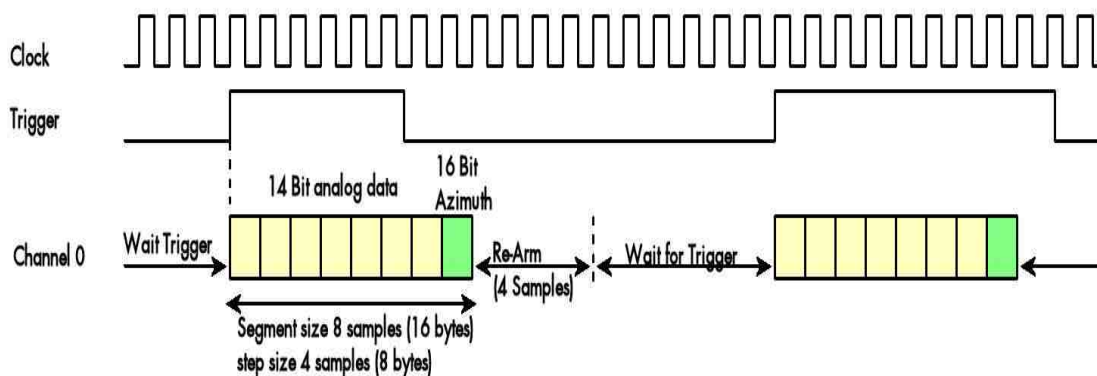
## M2i.4028 / 4038 radar signal capture card – Operational notes.

For engineers requiring a PC based radar signal and antenna position capture card, Dataquest Solutions provides the “Spectrum” M2i.4038, which incorporates a ultra high speed 50MSample/sec signal capture module coupled with a digital input module.

Looking closer at the technical details, this card has three inputs available into the analogue section, these being signal input, external clock and external trigger. The card incorporates a high-resolution 14-bit A/D converter with excellent dynamic properties to ensure accurate radar signal recording. Sample clocking can be externally supplied from the users own equipment, or generated internally by the cards own clock engine utilising a low jitter on board oscillator. The trigger input connection also allows full control of the sampling window and an option to allow each trigger to be time-stamped. On the digital side of the M2i.4038 the azimuth encoder counter connection is very straight-forward just having 2 lines, one for the encoder pulse signal the other for a reset. The cards pulse counter provides 16 bits of resolution, so with the capacity to record up to 65536 pulses on per rotation, this gives the opportunity to acquire with an exceptionally good positional accuracy. Another possibility is for the M2i.4038 to acquire data in parallel 16-bit. This digital port wide capture could be used for antenna elevation as well as azimuth, though each would have to share the 16 bits. It is always possible to use a second separate digital I/O card from the Spectrum series to do all the azimuth and elevation captures, as all cards have the capability for clock and/or trigger synchronisation and available in models up to 64 bits wide.



In operation the radar card can be used in two ways. First there is the special multiple record option, where the trigger, either externally derived or from the arrival of the radar pulse, starts a recording window of finite length digitising the pulse and recording the azimuth position at the end of the window. Using this mode of operation allows breaks in the recording at times when data is not required / unimportant, so reducing file sizes and bandwidth required for data transfer to the PC. Below is a timing diagram that exemplifies this; here the capture of the radar signal data occurs on the analogue channel (channel 0). Note the recording of the 16 bit angular position this is done at the end of each data capture “window”. This window length (here eight samples) can be adjusted through the driver software to suit the operator requirements in multiples of 4 samples minimum.



A second method is to run the capture continuously, with a radar pulse recorded simultaneously with azimuth on every clock pulse, which at 50M sample/sec is a 20 nano second repeat period, (note that to suit your requirements this sampling rate may be varied). The card can be equipped with up to 4Gbyte of on-board memory to cope with the large amounts of data, or by choosing either the PCI 33/ 66MHz (PCI-X) or PCI-Express interface model, continuous data can real-time streamed to PC RAM, its potential capacity now greatly extended in the new 64 bit Windows and Linux environments.

The radar card is also available in a lower cost 20MSample/sec version, (model number M2i.4028), which still has all the features of the faster card, including the excellent support for Windows and Linux software environments (32 and 64bit). The existing *Spectrum* drivers are used for programming the board, so whilst there are no specific displays or post processing algorithms for radar applications, the flexibility of the code drivers allows the programmer to build and design an application to exactly meet requirements and a standard set of standard programming examples are provided to illustrate the boards main signal capture functions. Extensive support includes; Visual C++, Borland C++, Gnu C++, Visual Basic and Delphi code, as well as third party package options; LabVIEW, LabWindows, MATLAB, VEE and DASyLab.

This special card comes with a 2-year manufacturer guarantee. Please contact Dataquest Solutions for pricing, delivery and any further technical details that you might require. We will be pleased to help.

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(Technical data sheet – see next page)

## Technical Data

### Analog Inputs

Resolution	14 bit
Differential non linearity (DNL)	$\leq \pm 0.5$ LSB (ADC)
Integral non linearity (INL)	$\leq \pm 1$ LSB (ADC)
Offset error	can be calibrated by user
Gain error	$< 1\%$ of current value
Programmable input offset	$\pm 200\%$ of current input range
Crosstalk 1 MHz signal, 50 Ohm term	$< -80$ dB between any adjacent channels
Crosstalk 1 MHz signal, 1 MOhm term	$< -65$ dB between any adjacent channels
Input signal with 50 Ohm termination	max 5 V rms
Analog Input impedance	50 Ohm / 1 MOhm    25 pF
Over voltage protection (range $\leq \pm 1$ V)	$\pm 5$ V
Over voltage protection (range $> \pm 1$ V)	$\pm 50$ V
Connector (analog and trigger/clock)	3 mm SMB male

### Digital Inputs

Input Impedance (programmable)	110 Ohm / 50 kOhm    15 pF
110 Ohm termination voltage	2.5V
Standard input levels	low $\leq 0.8$ V, High $\geq 2.0$ V
Absolute maximum input levels	$\geq -0.5$ V and $\leq 7.0$ V
Data Input current sink (no termination)	-1.0 $\mu$ A (0.0 V), +1.0 $\mu$ A (3.3V), +20.0 $\mu$ A (5.0V)

### Trigger

Multi, Gate: re-arming time	$< 4$ Samples
Max Pretrigger at Multi, Gate, FIFO	8176 Samples as sum of all active channels
Internal trigger accuracy	1 Sample
Analog Channel trigger resolution	10 bit
Trigger output delay	One positive edge after internal trigger event
External trigger type	3.3V LVTTL compatible (5V tolerant)
External trigger input	Low $\leq 0.8$ V, High $\geq 2.0$ V, $\geq 2$ clock periods
External trigger maximum voltage	-0.5 V up to +5.7 V (internally clamped to 5.0V, 100 mA max. clamping current)
External trigger accuracy	1 Sample
External trigger output levels	Low $\leq 0.4$ V, High $\geq 2.4$ V, TTL compatible
digital trigger impedance (programmable)	110 Ohm / high impedance ( $> 4k\Omega$ )

### Software programmable parameters

Analog Input Range	$\pm 200$ mV, $\pm 500$ mV, $\pm 1$ V, $\pm 2$ V, $\pm 5$ V, $\pm 10$ V
Analog Input impedance	50 Ohm / 1 MOhm
Analog Input Offset	$\pm 200\%$ of input range in steps of 1%
Clock mode	Int. PLL, int. quartz, ext. clock, ext. divided, ext. reference clock, sync
Clock impedance	50 Ohm / high impedance ( $> 4k\Omega$ )
Trigger impedance	50 Ohm / high impedance ( $> 4k\Omega$ )
Trigger mode	Channel, Extern, SW, Auto, Window, Pulse, Re-Arm, Or/And, Delay
Analog Trigger level	10 bit resolution: 1/1024 to 1023/1024 of input range
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

### 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	$\leq 1\%$ of range (100M, 10M, 1M, 100k,...)
Internal clock setup granularity example	range 1M to 10M: stepsize $\leq 100k$
Reference clock: external clock range	$\geq 1.0$ MHz and $\leq 125.0$ MHz
External clock range	500 kS/s to max (see table below)
External clock delay to internal clock	5.4 ns
External clock type	3.3V LVTTL compatible
External clock input	Low $\leq 0.8$ V, High $\geq 2.0$ V, duty 45% - 55%
External clock maximum voltage	-0.5 V up to +3.8 V (internally clamped to 3.3V, 100 mA max. clamping current)
External clock output levels	Low $\leq 0.4$ V, High $\geq 2.4$ 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 starhub 5)	1 full size slot
Width (starhub 16)	2 full size slots
Width (with digital inputs)	1 full size slots + 1 half size slot
Weight (depending on options)	290g
Warm up time	10 minutes
Operating temperature	0°C - 50°C
Storage temperature	-10°C - 70°C
Humidity	10% to 90%

### BaseXIO (Option)

BaseXIO Connector (extra bracket)	8 x SMB (8 x MMCX internal)
BaseXIO input	TTL compatible: Low $\leq 0.8$ V, High $\geq 2.0$ V
BaseXIO input maximum voltage	-0.5 V up to +5.5 V
BaseXIO output levels	TTL compatible: Low $\leq 0.4$ V, High $\geq 2.4$ V
BaseXIO output drive strength	32 mA maximum current

### PCI / PCI-X specific details

PCI / PCI-X bus slot type	32 bit 33/66 MHz
PCI / PCI-X bus slot compatibility	32/64 bit, 33-133 MHz, 3.3 V and 5 V I/O

### PCI EXPRESS specific details

PCIe slot type	x1
PCIe slot compatibility	x1/x4/x8/x16*

\*Some x16 PCIe slots are for graphic cards only and can not be used for other cards.

### Certifications and Compliances

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