ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

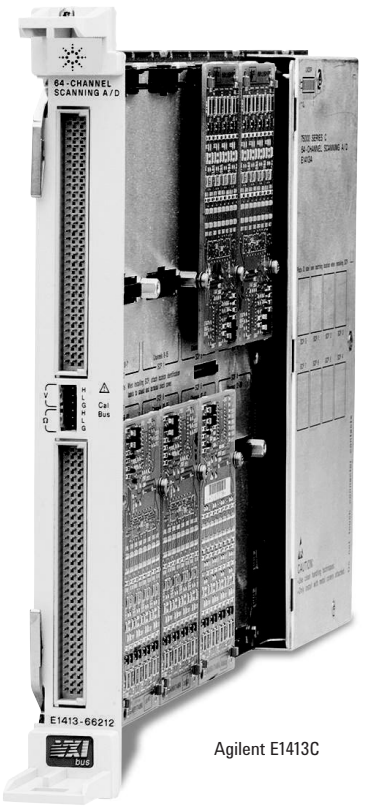
All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Keysight / Agilent E1413C* at our website: ***Click HERE***

Agilent E1413C 64-Channel Scanning A/D Converter, C-Size

Data Sheet

- **Comprehensive signal conditioning on board**
- **Flexible scanning/auto sequencing**
- **High-speed data transfers into controller**
- **On-board data reduction and hi/low limit checking**
- **Signal digitizing to 100 kHz sampling rate (*)**



Agilent E1413C

Description

The Agilent Technologies E1413C 64-Channel Scanning A/D is a **C-size, 1-slot, register-based VXI module**. It is designed for high-performance data acquisition and computer-aided test applications. The key requirements of these applications are high-speed scanning, 16-bit resolution, high accuracy (0.01% of reading), 4 mV to 16 V full-scale input (60 V with Agilent E1513A attenuator SCP), 64 kSa dual-ported FIFO buffer for fast data transfers, current value buffer for on-line monitoring, and automatic self-calibration.

The available ranges are determined by the SCP used. An SCP is required for every input. Each SCP normally supplies input signal conditioning for eight (8) channels. See the individual SCP Data Sheet for more information.

The unique design of the analog subsystem provides a new level of density by combining a 16-bit A/D with a 64-channel differential FET multiplexer. Up to eight Signal Conditioning Plug-ons (SCP's)—most with eight channels each—can be added to the E1413C to provide additional capabilities (i.e., direct input, 10 Hz low-pass filtering, fixed gain/filter per channel, etc.).

Refer to the Agilent Technologies Website for instrument driver availability and downloading instructions, as well as for recent product updates, if applicable.

(* 100 kSa/s maximum sampling/scanning rate divided by the number of channels in the scan list, which can be 1 to 64.)

Agilent Technologies

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Multifunction Measurement Capability

This module provides multifunction measurement capability within individual scans without any configuration re-programming. These include dc voltage, temperature, resistance, and strain.

Comprehensive Signal Conditioning On Board

A full range of signal conditioning is provided by optional Signal Conditioning Plug-on daughter boards (SCPs) that mount inside the E1413C. Most SCPs buffer the signal to be measured and filter or amplify it before presenting it to the E1413C's FET multiplexer and A/D converter. Other available SCPs provide more advanced functions such as sample-and-hold, and strain bridge excitation and completion. The SCPs supported by the E1413C are:

- E1501A 8-Channel Direct Input SCP
- E1502A 8-Channel 7 Hz Low-pass Filter SCP
- E1503A 8-Channel Programmable Filter and Gain SCP
- E1505A 8-Channel Current Source SCP
- E1506A 8-Channel 120 Ω Strain Completion & Excitation SCP
- E1507A 8-Channel 350 Ω Strain Completion & Excitation SCP
- E1508A 8-Channel x16 Gain & 7 Hz Fixed Filter SCP
- E1509A 8-Channel x64 Gain & 7 Hz Fixed Filter SCP
- E1510A 4-Channel Sample & Hold Input SCP
- E1511A 4-Channel Transient Strain SCP
- E1512A 8-Channel 25 Hz Fixed Filter SCP
- E1513A 8-Channel Divide-by-16 Fixed Attenuator & 7 Hz Low-pass Filter SCP
- E1518A 4-Wire Resistance Measurement SCP

Refer to the information on each individual SCP for more details.

Flexible Scanning/Auto Sequencing

Measurement scans can be made in any channel order using any function on any channel–all at full speed, including autoranging. Up to four unique scan lists, each with up to 1,024 channel entries, can be stored in RAM and selected on the fly with a single software command. In addition, these scan lists can be automatically sequenced with a unique auto sequencing scan list. Lists can be sequenced so as to simplify the scanning of channels at different rates.

High-Speed Data Transfers into Controller

Data transfer speed has been greatly improved because multiple E1413Cs can scan in parallel at full speed and then sequentially transfer data over the VXI backplane in D16 or D32 format at rates that match even the fastest embedded VXI computer. And the data is transferred in computer-ready, IEEE-754, 32-bit floating-point real Engineering Unit format. Two on-board RAMs facilitate overall performance. The FIFO RAM is a dual-ported high-speed buffer that stores up to 64,000 samples until the controller is ready for efficient fast data transfer. For on-line monitoring, the Current Value Table RAM contains the most recently measured values for each channel in use. The CVT and FIFO RAMs can be accessed asynchronously.

On-Board Data Reduction and Hi/Low Limit Checking

Averaging can be enabled on a scan basis to provide averaging for each channel over two to 256 samples in binary steps. The averaged data goes to both the CVT and the FIFO buffer. The maximum sample rate is >1.5 kSa/s per channel for 64 channels, although higher rates are possible with fewer channels. When averaging multiple channels in a scan list, scan list switching and autoranging are not allowed. This would distort the average.

Individual high and low limits per channel can be downloaded to the E1413C in engineering units format. If a limit is exceeded, an interrupt or trigger line can be pulled and the limit register can be read to determine the out-of-limit channel. A cumulative mode can be selected that holds the channel number of any out-of-limit reading since the last INIT command. The FIFO buffer can then be read to determine the actual out-of-limit readings.

Signal Digitizing

The E1413C is suitable for digitizing of multichannel transient signals up to a 1 kHz sampling rate when used with the E1510A 4-Channel Sample & Hold Input SCP anti-aliasing filters. Digitizing higher frequency signals using the E1501A 8-Channel Direct Input SCP will require the use of external anti-aliasing filters. The scan trigger, either internally or externally generated, is used to initiate the channel samples controlled by the internal sample timer. The typical scan trigger jitter time is ± 100 ps.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Signal Conditioning Plug-Ons

A Signal Conditioning Plug-on (SCP) is a small daughter board that mounts on Agilent's VXI scanning measurement and control modules. These SCPs provide a number of input and output functions. Several include gain and filtered analog inputs for measuring electrical and sensor-based signals.

Refer to the information on each individual SCP for more details.

Voltage Measurements

Use any of the following SCPs with the E1413C to make voltage measurements: E1501A, E1502A, E1503A, E1508A, E1509A, E1512A, or E1513A.

Temperature Measurements

Any of the input SCPs can be used to make temperature measurements with thermocouples, thermistors, or RTDs, but the E1503A/E1508A/E1509A SCPs provide higher accuracy with thermocouples.

Resistance Measurements

Resistance is measured using the E1505A 8-Channel Current Source SCP and an input SCP or the E1518A 4-Wire Resistance Measurement SCP. Measurements are made by applying a dc current to the unknown and measuring the voltage drop across the unknown. The current source is provided through the E1505A.

Static Strain Measurements

The E1506A and E1507A SCPs provide a convenient way to measure a few channels of static strain. When using the E1506A/E1507A for bridge completion, a second SCP is required to make the measurement connection. You can use the following SCPs for this type of static strain measurements:

- E1503A 8-Channel Programmable Filter/Gain SCP
- E1506A 8-Channel 120 Ω Strain Completion & Excitation SCP
- E1507A 8-Channel 350 Ω Strain Completion & Excitation SCP
- E1508A 8-Channel 7 Hz Fixed Filter & x16 Gain SCP
- E1509A 8-Channel 7 Hz Fixed Filter & x64 Gain SCP

For applications requiring more than eight channels of strain measurement, the combination of the Agilent E1422A/E1529A/E1539A provides a more cost effective approach to static (and dynamic) strain measurements.

Transient Measurements

When making higher speed measurements, a vital issue often is the time skew between channels. Ideally, in many applications, the sampled data is needed at essentially the same instant in time. The intrinsic design of the E1413C provides scanning of 64 channels with maximum skew of 640 µS between the first and last channels, far less than most sampled data systems.

Transient Voltage Measurements

The E1510A provides basic sample-and-hold capabilities on four channels. Six-pole Bessel filters provide alias and alias-based noise reduction while giving excellent transient response without overshoot or ringing. The E1510A can be used in strain applications primarily where the bridge is external.

Transient Strain Measurements

The E1511A, a double-wide SCP, has all the capabilities of the E1510A but adds on-board bridge excitation and completion functions. The four direct input channels are used for monitoring the bridge excitation. A maximum of four SCPs (16 channels) can be installed on an E1413C.

Automated Calibration for Better Measurements

The E1413C offers superior calibration capabilities that provide more accurate measurements. Periodic calibration of the scanning A/D is accomplished by connecting an external voltage measurement standard (such as a highly accurate multimeter) to the inputs of the scanning A/D. This external standard first calibrates the on-board calibration source. Then built-in calibration routines use the on-board calibration source and on-board switching to calibrate the entire signal path from the scanning A/D's input, through the signal conditioning plug-ons (SCPs) and FET MUX, to the A/D itself. Subsequent daily or short-term calibrations of this same signal path can be quickly and automatically done using the internal calibration source to eliminate errors introduced by the signal path through the SCPs and FET MUX, or by ambient temperature changes. All 64 channels can be quickly and productively calibrated to assure continued high-accuracy measurements.

In addition to the calibration of the signal path within the scanning A/D, the E1413C allows you to perform a "Tare Cal" to reduce the effects of voltage offsets and IR voltage drops in your signal wiring that is external to the scanning A/D. The Tare Cal uses an on-board D/A to eliminate these voltage offsets. By placing a short circuit across the signal or transducer being measured, the residual offset can be automatically measured and eliminated by the D/A. Tare Cal should not be used to eliminate the thermoelectric voltage of thermocouple wire on thermocouple channels.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

STEP4 Dionysos Job: 210%XXXX7985-0004 Agilent_E1413C Comp: 10-24-01 Time: 15:48 OP: NN

Configuration

Twelve E1413C modules may be used in a 13-slot, C-size mainframe for a total of 768 channels. A C-size configuration using MXIbus allows you to link together multiple mainframes on a single backplane for larger scanning A/D systems. The Agilent E1406A may require additional RAM to use this module.
Note: For field wiring, the use of shielded twisted pair wiring is highly recommended.

Timing Signals	
Timing:	Scan-to-scan timing and sample-to-sample timing can be set independently.
Scan triggers:	Can be derived from a software command or a TTL level from other VXI modules, internal timer, or external hardware. Typical latency 17.5 µs.
Synchronization:	Multiple E1413C modules can be synchronized at the same rate using the TTL trigger output from one E1413C to trigger the others.
Alternate synchronization:	Multiple E1413C modules can be synchronized at different integer-related rates using the scan timer/N mode and the TTL trigger output from one E1413C module to trigger the others.

Scan Triggers	
Internal:	100 µsec to 6.5536 sec
Resolution:	100 µsec
Trigger count:	1 to 65535 or infinite

Sample Timer	
Range:	10 µsec to 32768 msec
Resolution:	0.5 µsec

Measurement Specifications

The following specifications include the SCP and scanning A/D performance together as a unit. Accuracy is stated for a single sample. Averaging multiple samples will improve accuracy by reducing noise of the signal. The basic E1413C scanning A/D has a full scale range of ± 16 V and five autoranging gains of x1, x4, x16, x64, and x256. An SCP must be used with each eight channel input block to provide input protection and signal conditioning. Refer to the information on each individual SCP for measurement specifications.

Product Specifications

Measurement resolution:	16 bits (including sign)
Maximum reading rate:	100 kSamples/s divided by the number of channels in the scan. For example: 100k/64 = 1.56k samples/sec/ch 100k/16 = 6.25k samples/sec/ch
Memory:	64 kSa
Maximum input voltage:	Normal mode plus common mode
Operating:	<± 16 V peak
Damage level:	>± 42 V peak
Maximum common mode voltage:	
Operating:	<± 16 V peak
Damage level:	>± 42 V peak
SCP input impedance:	>100 MΩ differential
Maximum tare cal offset:	62.5 mV range ± 75% of full scale other ranges ± 25% of full scale
Jitter:	
Phase jitter scan-to-scan:	80 ps rms
Phase jitter card-to-card:	41 ns peak 12 ns rms

Measurement Accuracy

Specifications are 90 days, 23 ± /1 ° C, with *CAL done after a 1 hr warm-up and CAL:ZERO done within 5 minutes.
Note: Beyond the 5 min. limitation and CAL:ZERO not done, apply the following drift error: Drift = 10 µV/ ° C ÷ SCP gain, per ° C change from CAL:ZERO temperature.

Accuracy Data

Measurement accuracy is dependent upon the SCP module used. Refer to the accuracy tables and graphs for the individual SCP to determine the overall measurement accuracy.

Many definitions of accuracy are possible. Here we use single-shot with 3 sigma noise. To calculate accuracy assuming temperature is held constant within ± 1 ° C of the temperature at calibration, the following formula applies:

$$\text{Single Shot } 3\sigma = \pm\left(\sqrt{(\text{GainError})^2 + (\text{OffsetError})^2} + 3\sigma \text{ noise}\right)$$

Correcting for Temperature

To calculate accuracy over temperature range outside the ± 1 °C range, results after *CAL are given by replacing each of the above error terms as follows:
Replace
$(\text{GainError})^2$
with
$(\text{GainError})^2 + (\text{GainTempco})^2$
Replace
$(\text{OffsetError})^2$
with
$(\text{OffsetError})^2 + (\text{OffsetTempco})^2$

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Power Available for SCPs	
±24 V:	1 A
5 V:	3.5 A

General Specifications

VXI Characteristics	
VXI device type:	Register based
Data transfer bus:	A16/A24
Size:	C
Slots:	1
Connectors:	P1/2
Shared memory:	n/a
VXI buses:	TTL Trigger bus (T)

Instrument Drivers - See the Agilent Technologies Website (http://www.agilent.com/find/inst_drivers) for driver availability and downloading.

Command module firmware:	Downloadable
Command module firmware rev:	A.08
I-SCPI Win 3.1:	No
I-SCPI Series 700:	Yes
C-SCPI LynxOS:	Yes
C-SCPI Series 700:	Yes
Panel Drivers:	No
VXI*plug&play* Win Framework:	No
VXI*plug&play* Win 95/98/NT Framework:	Yes
VXI*plug&play* HP-UX Framework:	No

*The Agilent VEE application can use VXI*plug&play* drivers or panel drivers.

Module Current (with no SCPs installed)

	I_{PM} (A)	I_{DM} (A)
+5 V:	1.0	0.02
+12 V:	0.06	0.01
–12 V:	—	—
+24 V:	0.1	0.01
–24 V:	0.1	0.01
–5.2 V:	0.15	0.01
–2 V:	—	—

Cooling/Slot	
Watts/slot:	15.00
∆P mm H_2O:	0.08
Air flow liter/s:	0.08

Ordering Information

Description	Product No.
Scanning A/D Converter	E1413C
Service manual	E1413C 0B3
Interface to rack mount terminal panel	E1413C A3F
3 yr. retn. to Agilent to 1 yr. OnSite warr.	E1413C W01
Extra Terminal Block	E1413-80011
Term Blk A3F HI 50-pin Conn	E1413-80013
8-Channel Direct Input SCP	E1501A
8-Channel 7 Hz Low-pass Filter SCP	E1502A
8-Channel Programmable Filter/Gain SCP	E1503A
8-Channel Current Source SCP	E1505A
8-Channel 120 Ω Strain Completion & Excitation SCP	E1506A
8-Channel 350 Ω Strain Completion & Excitation SCP	E1507A
8-Channel x16 Gain & 7 Hz Fixed Filter SCP	E1508A
8-Channel x64 Gain & 7 Hz Fixed Filter SCP	E1509A
4-Channel Sample & Hold Input SCP	E1510A
4-Channel Transient Strain SCP	E1511A
8-Channel 25 Hz Fixed Filter SCP	E1512A
8-Channel ÷ 16 Fixed Attenuator & 7 Hz Low-pass Filter SCP	E1513A
4-Wire Resistance Measurement SCP	E1518A

For More Information

For more detailed information on individual SCPs, refer to the corresponding catalog pages for those products, or contact Agilent to request individual data sheets.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

STEP4 Dionysos Job: 210%XXXX7988-0006 Agilent_E1413C Comp: 10-24-01 Time: 15:48 OP: NN

Agilent Technologies' Test and Measurement Support, Services, and Assistance

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

Our Promise
Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

Your Advantage
Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

By internet, phone, or fax, get assistance with all your test & measurement needs.

Online assistance:
www.agilent.com/find/assist

Phone or Fax
United States:
(tel) 1 800 452 4844

Canada:
(tel) 1 877 894 4414
(fax) (905) 282 6495

China:
(tel) 800 810 0189
(fax) 1 0800 650 0121

Europe:
(tel) (31 20) 547 2323
(fax) (31 20) 547 2390

Japan:
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

Korea:
(tel) (82 2) 2004 5004
(fax) (82 2) 2004 5115

Latin America:
(tel) (305) 269 7500
(fax) (305) 269 7599

Taiwan:
(tel) 080 004 7866
(fax) (886 2) 2545 6723

Other Asia Pacific Countries:
(tel) (65) 375 8100
(fax) (65) 836 0252
Email: tm_asia@agilent.com

Product specifications and descriptions in this document subject to change without notice.

© Agilent Technologies, Inc. 2001
Printed in USA September 1, 2001
5965-5583E

Agilent Technologies

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP