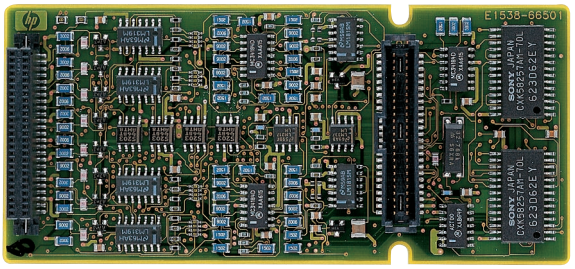
Enhanced Frequency/Totalize/PWM SCP HP E1538A

Technical Specifications

- **8-channel, non-isolated, variable input level**
- **Frequency counter input to 100 kHz**
- **Totalize to >16 million counts**
- **PWM output — square wave or variable pulse width**
- **Pulse width measurement**
- **Quadrature count and stepper motor control**



HP E1538A

Description

The HP E1538A Enhanced Frequency/Totalize/PWM SCP has eight channels. Each of the eight channels can be individually configured to perform input or output functions. Input functions include frequency measurement and totalize, pulse width measurement, rpm, and quadrature count. Output functions can free run or can be triggered. Output functions include square waves, pulse trains, angular position pulse, and stepper motor control.

Any channel can be configured as a one-bit variable level digital input or output. Additionally, two channels may be configured for low-level sensors.

Use the HP E1538A with the following VXI modules:

Model	Description
HP E1415A	Algorithmic Closed Loop Controller
HP E1419A	Multifunction Measurement and Control Module

Refer to the HP Website for recent product updates, if applicable.

Wide Range of Input/Output Functionality

The HP E1538A channels can be individually configured to either an input or an output function.

Input functions include:

- static digital state
- frequency measurement
- totalize positive or negative digital transitions
- pulse width measurement
- rotational velocity (senses added or missing cogwheel teeth)
- quadrature count (two channels required)

Output functions include:

- static digital state
- single pulse per trigger
- pulse width modulation
- frequency modulation
- rotationally position pulse
- stepper motor control

The logical sense of input and output channels can be configured as inverted or normal.

Input channels have individual threshold levels up to ± 48 V.

Output channels can be configured as either open drain or passive pull-up.

Input Functions

Digital Input: Each channel has a programmable threshold comparator. The digital input threshold can be programmatically set from –48 V to + 47 V. The digital input polarity may also be changed.

Low Level Sensors: The first two channels provide variable level inputs compatible with magnetic pickup sensors or variable reluctance sensors, like turbine flowmeters, that provide signals within the level and frequency ranges specified below. These channels are configured with adaptive amplifiers to sense the wide range of sensor output voltages. The HP E1538A can directly sense voltage from 100 mV to 10 V. Voltages up to 120 V can be sensed using an external resistor.

Totalize, Frequency and Period: Totalize on either positive or negative transitions. Measure frequency with a programmable aperture time. Measure logical 1 pulse widths from 1.5 µs to 1 s.

Quadrature Count: Use two channels to make 24-bit quadrature counts. One channel provides the count, the second channel controls the count direction (up or down). Counts from 0 to 16,777,215.

Rotational Velocity: One HP E1538A input channel can be used to sense rotational velocity using a toothed wheel sensor. The tooth-to-tooth periods are measured and converted into revolutions-per-second (RPS). Use this function with sensors that have either a missing or extra tooth to mark their index position.

Output Functions

Digital Output: Each HP E1538A output "open-drain" MOSFET can switch from 0 to 48 V and sink up to 100 mA. An internal pull-up resistor is provided for driving logic devices directly. Output logical polarity is programmable.

Pulse Output: Each HP E1538A channel can be programmed to output a variety of pulses and pulse trains. Variable width, PWM, FM and rotationally positioned pulse outputs are available.

Stepper Motor Control: The HP E1538A can control 2- or 4-phase motors in either full- or half-step mode. The SCP can directly drive four-phase stepper motors requiring <100 mA phase current. Higher phase current requirements are possible using external output amplifier circuits.

Product Specifications

Output Characteristics

Current source (logic 1):
- **Pull-up off:** 0 mA
- **Pull-up on:** 380 mA @ 1.2 V

Current sink (logic 0):
- **Pull-up off:** 100 mA
- **Pull-up on:** 100 mA

Voltage (logic 1):
- **Pull-up off:** 0 V
- **Pull-up on:** 5 V (no load)

Voltage (logic 0):
- **Pull-up off:** 0.1 V max.@ 100 mA load
0.05 max. @ 20 mA load
- **Pull-up on:** 0.1 V max. @ 100 mA
0.5 max. @ 20 mA load

Input Characteristics

Equivalent circuit:
- **Pull-up off:** 120 k Ω connected to 0 V
- **Pull-up on:** 9.2 k Ω connected to 4.6 V

Maximum input low:
- **Pull-up off:** –46 V to 46 V prog.
- **Pull-up on:** –46 V to 46 V prog.

Minimum input high:
- **Pull-up off:** –46 V to 46 V prog.
- **Pull-up on:** –46 V to 46 V prog.

Maximum voltage:
- **Applied to input terminal:** –48 V to 48 V
- **Applied to output terminal:** 0 V to 48 V (diode clamped at –0.3 V)

Totalizer

Capacity: 24 bits or 16,777,215 counts
Minimum pulse width: 500 ns
Frequency range: 0-100 kHz

Frequency Counter

Gate time ($t_{aperture}$): 1 ms to 1 s, resolution $1/f_{in}$
Range: $1/t_{aperture}$ to 100 kHz
Accuracy: 0.01%
Resolution: $f_{in}/(t_{aperture} \times 4.194\ MHz)$
Min. pulse width: 500 ns

Rotational Velocity Measure

Range in RPS: $1/n_{teeth}$ to $100{,}000/n_{teeth}$
Accuracy: 0.01%
Resolution in RPS: $(n_{teeth} \times \beta^2/4.194\ MHz$
Minimum pulse width: 500 ns

Pulse Width Measure

Periods averaged: 1 to 255
Range: 1.5 µS to 1 S
Accuracy: ±(100nS + 0.1%)
Resolution: 59.6 nsec

Frequency Source

Range:
- **Square wave:** 64 Hz to 40 kHz
- **Other shapes:** 128 Hz to 40 kHz

Accuracy: 0.01%
Resolution: $(f_{out})^2$ / 4.194 MHz

Pulse Source

Range:
- **Pulse width:** 7.87 µs to 1/f-7.87 µs
- **Pulse per trig:** 7.87 µs to 7.812 ms

Accuracy: 200 µs + 0.01%
Resolution: 238.4 ns

Current Requirements (Amps)

5 V max	24 V max	-24 V max
0.2	0.054	0.025

Ordering Information

Description	Product No.
Enhanced Frequency/Totalize/PWM SCP	HP E1538A

Related Literature

1998 Test System and VXI Products Data Book,
HP Pub. No. 5966-2812E

1999 Test System and VXI Products Catalog,
HP Pub. No. 5968-3698

Warranty

Standard Hewlett-Packard VXIbus hardware products are warranted against defects in materials and workmanship for a period of three years unless otherwise noted. HP software and firmware products that are designated by HP for use with a hardware product, when properly installed on that hardware product, are warranted not to fail to execute their programming instructions due to defects in materials and workmanship.

For a complete and detailed warranty statement please see the HP *Test System and VXI Products Data Book* or visit the HP Website at http://www.hp.com/go/vxi.

Website Directory

HP VXI Product Information
http://www.hp.com/go/vxi

HP VXI Channel Partners
http://www.hp.com/go/vxichanpart

HP VEE Application Website
http://www.hp.com/go/hpvee

Data Acquisition and Control Website
http://www.hp.com/go/data_acq

HP Instrument Driver Downloads
http://www.hp.com/go/inst_drivers

Electronics Manufacturing Test Solutions
http://www.hp.com/go/manufacturing

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For more information about Hewlett-Packard test & measurement products, applications, services, and for a current sales office listing, visit our website, *http://www.hp.com/go/tmdir.* **You can also contact one of the following centers and ask for a test & measurement sales representative.**

United States:
Hewlett-Packard Company
Test and Measurement Call Center
P.O. Box 4026
Englewood, CO 80155-4026
1 800 452 4844

Canada:
Hewlett-Packard Canada Ltd.
5150 Spectrum Way
Mississauga, Ontario L4W 5G1
(905) 206 4725

Europe:
Hewlett-Packard
European Marketing Centre
P.O. Box 999
1180 AZ Amstelveen
The Netherlands
(31 20) 547 9900

Japan:
Hewlett-Packard Japan Ltd.
Measurement Assistance Center
9-1, Takakura-Cho, Hachioji-Shi,
Tokyo 192, Japan
Tel: (81) 426 56 7832
Fax: (81) 426 56 7840

Latin America:
Hewlett-Packard
Latin American Region Headquarters
5200 Blue Lagoon Drive, 9th Floor
Miami, Florida 33126
U.S.A.
Tel: (305) 267-4245
(305) 267-4220
Fax: (305) 267-4288

Australia/New Zealand:
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
Australia
1 800 629 485

Asia Pacific:
Hewlett-Packard Asia Pacific Ltd.
17-21/F Shell Tower, Times Square,
1 Matheson Street, Causeway Bay,
Hong Kong
Tel: (852) 2599 7777
Fax: (852) 2506 9285

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