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Find the *Datel DVME-613A* at our website: *Click HERE*

PRODUCT DATA

DVME-613
Isolated Industrial 16S or 8D Channel VME A/D Board

FEATURES

- **16 single-ended or 8 differential analog input channels**
- **12, 14, or 16-bit A/D resolution**
- **Isolation to ±500V**
- **On-board programmable gain amplifier and start timer**
- **8 in and 8 out discrete digital lines**
- **Programmable vectored VME interrupt**
- **Simple programming for any operating system or language**



Designed for industrail data acquisition, process control, and factory automation, the DVME-613 is a low-cost isolated analog input board for VME bus computers. The DVME-613 will accept sixteen single-ended or eight differential input channels which are all isolated from the VME bus by ±500 Volts. In addition, each channel is protected from adjacent channel overloads up to ±150 Volts. The common mode voltage range is ±11 Volts relative to isolated analog ground.

The analog input range is selectable as ±10 Volts for bipolar inputs or 0 to +10 Volts unipolar. By using an on-board programmable gain amplifier (PGA), inputs may be accepted directly from bridges, load cells, RTD's, and strain gauges. The PGA includes selectable gain ranges of times one, ten, and on hundred for low level inputs.

An optional signal conditioning pad area accepts shunt resistors, attenuators, hash filters, and clamps. This allows direct input from isolated 1-5 mA or 4-20 mA transmitters and from voltage sources greater than ±10 Volts full scale. For bridge-type sensors, on-board regulated DC excitation voltage is provided which is fully isolated from VME bus.

The DVME-613 inputs are plug compatible with DATEL's DVME-691 rack-mount signal conditioning panel for screw terminal inputs. Three A/D converter options are offered. The DVME-613A is a 12-bit A/D converter with overall accuracy of ±0.05% of full scale. Resolution of the DVME-613A is 2.5 millivolts per count for unipolar inputs.

The DVME-613B offers a 14-bit A/D converter and for highest resolution inputs, a 16-bit converter is included on the DVME-613C. All models produce left-justified data outputs so that boards may be interchanged without having to rewrite existing software to scale the data. A/D conversion takes 24 microseconds for the DVME-613A. The sampling A/D converter design offers continuous automatic recalibraion. To insure reliability in industrial process control environments, lcoal channels may be dedicated to ground and reference inputs for self-testing of signal paths.

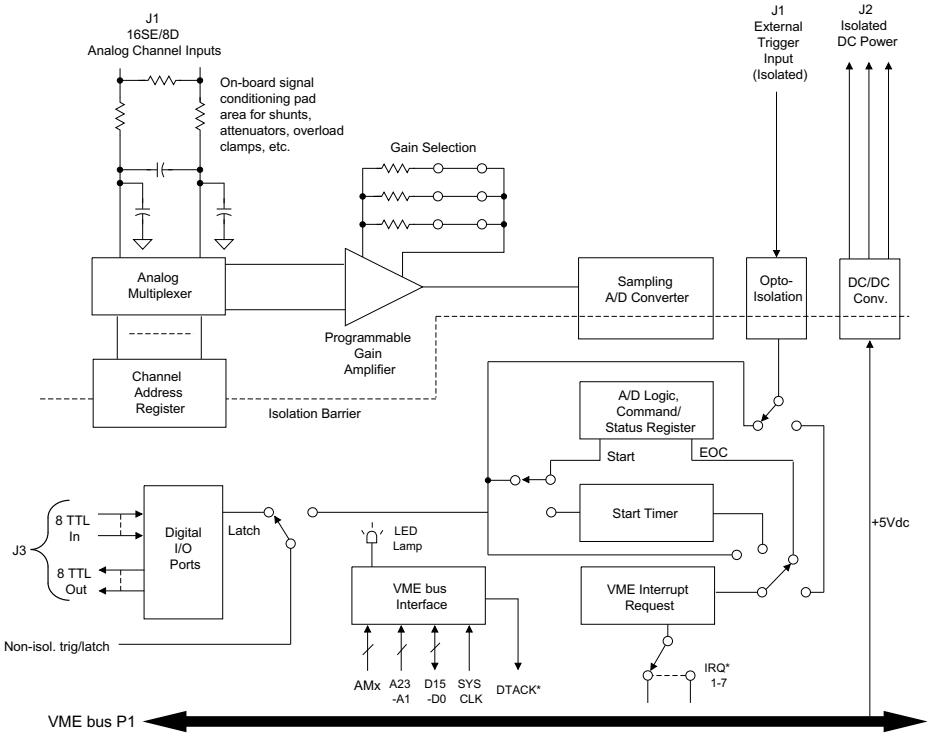


Figure 1. DVME-613 Simplified Block Diagram

A/D conversion may be started from several sources including an external isolated trigger input, the local start timer, a memory write from the host or a read of the A/D data register. The maskable vectored VME bus interrupt may originate from an external trigger, the local timer or the A/D EOC data ready signal.

VME bus interrupts are fully vectored using selectable IRQ 1-7 levels.

The A/D data ready EOC signal is indicated in a status register and maskable VME bus interrupt. All modes are software controlled by local command and status registers.

The DVME-613 provides 16 digital lines for logic control of devices such as pumps, heaters, and valves. These lines are TTL logic compatible and arranged as eight inputs and eight outputs. A separate control input latches the eight TTL input lines.

The DVME-613 is a VME bus SA24:SD16 slave. The board appears to the VME bus as a memory-mapped 8-word contiguous block of 16-bit registers using 24-bit addressing and six address modifiers. All types of 16- and 32-bit host CPU's may control the board on 16-bit word access using any software language.

The VME bus interface uses only the P1 backplane connector for compatibility with most hosts. All analog and digital port interfacing uses front panel connectors to avoid conflict with P2 bus connector usage. A front panel LED lamp may be programmed by host software for board power-up test or for alarms.

Operating temperature range of the DVME-613 is 0 to +60°C. The board measures 9.19" x 6.3" x 0.6", using the standard 6U VME bus outline. All power is supplied by VME bus requiring +5 Volts DC at 2.5 Amps.

The board includes a free software program disk and a comprehensive user's manual. The source-code software is heavily commented and may be easily adapted for any operating system or host language. Application engineering consultation is available to users.

FUNCTIONAL SPECIFICATIONS

(Typical at +25°C, gain = 1, unless otherwise noted)

ANALOG INPUTS	
Number of Channels	16SE or 8 diff. channels
Full Scale Input Ranges	Unipolar / Bipolar
Gain = 1	0 to 10V / ±10V
Gain = 10	0 to 1V / ±1V
Gain = 100	0 to 100 mV / ±100 mV
Input Isolation	±500V max. from analog section to VME bus
Isolation Capacitive Coupling	25 pF analog section to VME
Isolation Resistive Coupling	100 MΩ analog to VME
Common Mode Voltage Range	±11V to isolated ground
Common Mode Rejection	86 dB, dc to 60 Hz, gain = 100, 1 KΩ source unbalance
Channel-to-Channel Protection	±150V max. sustained
Input Bias Current	±200 picoamps
Input Impedance (power on)	100 MΩ to isolated ground
Input Impedance (power off)	33 KΩ to isolated ground
Programmable Gain Amplifier	Jumper selectable for gains of 1, 10, or 100. Will accept precision resistor for user defined gain.
PGA Settling Delay	10 µs, gain = 1 (after channel selection)20 µs, gain = 10; 100 µs, gain = 100
A/D Output Resolution	12 bits (DVME-613A) 14 bits (DVME-613B) 16 bits (DVME-613C)
A/D Output Coding	Selectable as unipolar straight binary or bipolar offset binary
Accuracy at +25°C	
(After recalibration)	
(Gain = 1 or 10)	613A: ±0.05% of FSR
(Gain = 100)	613A: ±0.1% of FSR
(Gain = 1)	613B: ±0.0125% of FSR
(Gain = 1)	613C: ±0.0075% of FSR
Nonlinearity	±0.5 LSB
Temp. Coefficient of Zero	±20 ppm/°C of FSR
Temp. Coefficient of Gain	±20 ppm/°C of FSR
A/D Conversion Period	613A: 24 µs* 613B: 28 µs* 613C: 32 µs*
A/D Converter Start Sources	External isolated TTL trigger, local pacer start clock, VME command write, or VME A/D data read. The TTL trigger occurs on the rising edge. Trigger width 0.1 to 5 µs.
Monotonicity	No missing codes

DIGITAL SECTION	
A/D Start Clock	May be jumpered to start an A/D conversion/VME bus interrupt
Start Clock Range	32 µs to 5 minutes, jumperable in x2 steps. Derived from 16 MHz VME bus SYSCLK.
Discrete I/O Lines	8 inputs and 8 outputs, non-isolated, latch control for inputs
Discrete I/O TTL Levels	Inputs: "0" <0.8V, "1"> 2.0V Outputs: "0" <0.4V, "1"> 2.4V
Discrete TTL I/O Loading	1 TTL-LS load plus 4.7 KΩ pullup to +5V output. Output: 24 mA
LED Lamp	Front panel lamp software controlled by register bit. May be used for power up test, alarms, etc. Defaults to dark at power up or bus reset.

VME BUS INTERFACE	
Standards of Compliance	IEEE P1014/D1.0
Architecture	SAD24:SD16 slave consisting of 8 continguous word registers
Data Bus Width	16 bits using P1 connector
Address Bus	24 address lines (A23-A1) plus 6 Address Modifiers
Address Modifier Codes	39 or 3D hex, selectable
VME bus Interrupt	1 line, selectable IRQ 1-7*. Asserts maskable programmable 8-bit vector ID code.
Interrupt Source	Selectable from external trigger, start timer, or A/D data ready.
Data Transfer	Uses 16 MHz VME bus SYSCLK signal to generate DTACK* signal with selectable delay.
CONNECTORS	
VME bus, P1	96-pin male DIN connector. The P2 connector is not used.
Local Isolated Analog Intput and Isolated Trigger	J1 connector, 25-pin DB-25S female on front panel, pin-compatible to DVME-691 screw terminator.
Isolated DC Power	J2 connector, 25-pin DB-25S female on front panel. Power available: ±15V dc at 25 mA max.
Discrete Digital I/O	J3 connector, 25-pin DB-25S female on front panel

MISCELLANEOUS	
Power Required	+5V dc, ±5% at 2.5A max. from VME bus
Operating Temp. Range	0 to +60 °C
Storage Temp. Range	–20 to +80 °C
Relative Humidity	10% to 90%, non-condensing
Altitude	0 to 10,000 feet
Outline Dimensions	Double height VME, 6U outline. 9.19”W x 6.3”D x 0.6”H (233,5 x 160 x 15,24 mm)
Weight	17 oz. (482 grams)

*Single channel conversion rates are shown. For mutlichanenl inputs, an additional 20 µs must be allowed after channel selection before the next A/D conversion start.

TYPICAL BRIDGE-TYPE INPUT CONNECTIONS

Figure 2 shows the DVME-613 connected to a bridge-type transducer. Notice that the bridge excitation is derived from the +15V dc power available from the DVME-613. The excitation voltage is regulated but not extremely high-precision.

To compensate for this, use a precision voltage divider and measure the excitation supply using a spare differential channel. Then use this value to do a software autocalibration with each channel scan.

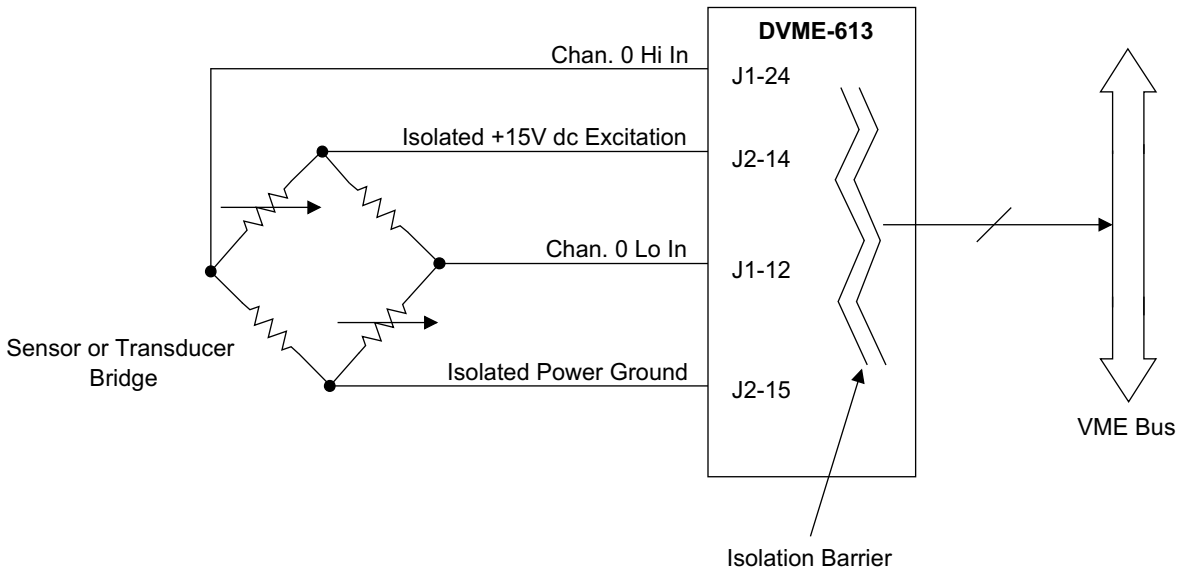


Figure 2. Typical Bridge-type Input Connections

REGISTER PROGRAMMING

Register Memory Mapping

BASE address switches must be selected for even address boundaries. All registers must be accessed on 16-bit word memory operations.

Address (hex)	Direction	Description
BASE + 0	Write	Command register
BASE + 0	Read	Status register
BASE + 2	Write	Channel address register
BASE + 4	Write	Start A/D conversion register
BASE + 6	Read	A/D data register
BASE + 8	Write	Interrupt vector ID register
BASE + 8	Read	Interrupt vector ID register
BASE + A	Write	Calibrate A/D converter
BASE + C	Write	TTL digital output port register
BASE + E	Read	TTL digital inut port register

Command/Status Register (Write/Read BASE + 0)

15 — 8	7	6	5	4	3	2	1 0
EOC OVR SMP	INT ENB	LED ON	X	X	X	CNV ENB	Start Mode

("x" bits are don't care or not defined)

If interrupt is not used, the host should poll EOC before reading A/D data. Teh read of the A/D data register resets EOC to 0 even if anotehr conversion is not started.

End of Conversion EOC [Bit 15]
0 = Conversion in progress. Data not valid.
1 = Conversion done. Data ready.

Over Sample Error OVR SMP [Bit 8] (read only)
0 = No error
1 = Oversampling error (conversion start while EOC = 0, A/D busy)

VME Interrupt Enabled INT ENB [Bit 7] R/W
0 = Interrupt disabled
1 = Interrupt enabled (interrupts may be jumpered from A/D EOC, external trigger or internal timer)

Front Panel Lamp LED [Bit 6] R/W
0 = LED lamp off
1 = LED lamp on

A/D Conversion Enabled CNV ENB [Bit 2] R/W
0 = Disable A/D conversions
1 = Enable A/D conversions

A/D Start Mode [Bits 1, 0] R/W
Source of A/D start:
00 = Host write to BASE + 4
01 = Read A/D data register
10 = Internal start timer
11 = External TTL trigger

Program the command register last. All registers default to zeroes at power-up.

Channel Address Register (Write BASE + 2)

15 — 7	6	5	4	3	2	1	0
X — GP1	GP0	X	X	Chn Adr 3	Chn Adr 2	Chn Adr 1	Chn Adr 0

GP1, GP0 (bits 7, 6) - These are spare unassigned register output bits available for any purpose. They appear at integrated circuit U19-10, 12.

Chn Adr (bits 3-0) - Channel Address input corresponds to A/D channels 0 through 7 (differential) or 0 through 15 (single-ended).

Start A/D Conversion Register (Write BASE + 4)

15 — 7	6	5	4	3	2	1	0
X — X	X	X	X	X	X	X	X

An A/D conversion may be started by a write to this register if enabled by the command register mode 00. EOC willb e set to 0 after conversion is started and until data is ready.

A/D Data Register (Read BASE + 6)

15 — 7	6	5	4	3	2	1	0
MSB ALL			LSB 12		LSB 14		LSB 16

A/D data is left justified for all converters. The least significant bit for the 12-bit DVME-613A is bit 4 with bits 3-0 filled with zeroes. The LSB for the 14-bit DVME-613B is bit 2 with zero vill. For the 16-bit DVME-613C, the LSB is bit 0.

For bipolar converters, the MSB is used as a polarity bit and is set to offset binary (1 = positive).

VME bus Interrupt ID Register (Read/Write BASE + 8)

15 — 7	6	5	4	3	2	1	0
X — V07	V06	V05	V04	V03	V02	V01	V00

An 8-bit interrupt ID code is used. Before writing the ID code from the host, this register may be sued for board testing. A valid power-up test would be to write then readback and confirm a range of values to this register before enabling interrupts. Portions of the command/status register may also be used for write/readback tests. Such tests would confirm the bus interface and register logic. Furhter testing may be done using the dedicated reference inputs to the A/D converter. If all tests succeed, the front panel LED lamp may be lit.

Calibrate A/D Converter (Write BASE + A)

15 ——— 7	6	5	4	3	2	1	0
X ——— X	X	X	X	X	X	X	X

Writing to this register will start an A/D calibration cycle for approximately 320 milliseconds until EOC. This operation should be done once after power up. During calibration, the A/D converter makes internal corretins. Periodic calibration is optional in stable temperature environments but is suggested frequently with changing temperatures.

Discrete Digital Output Register (Write BASE + C)

15 ——— 7	6	5	4	3	2	1	0
X ——— D07	D06	D05	D04	D03	D02	D01	D00

Discrete Digital Input Register (Read BASE + E)

15 ——— 7	6	5	4	3	2	1	0
X ——— V07	V06	V05	V04	V03	V02	V01	V00

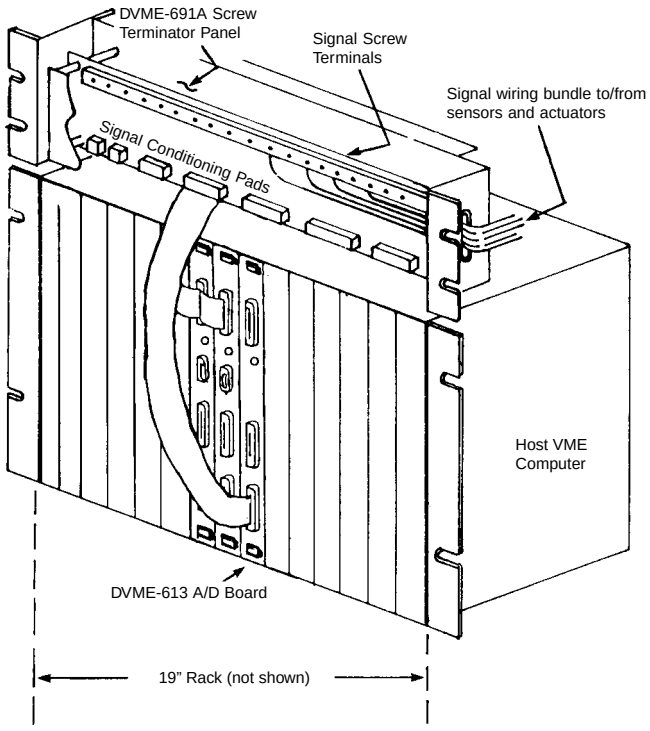
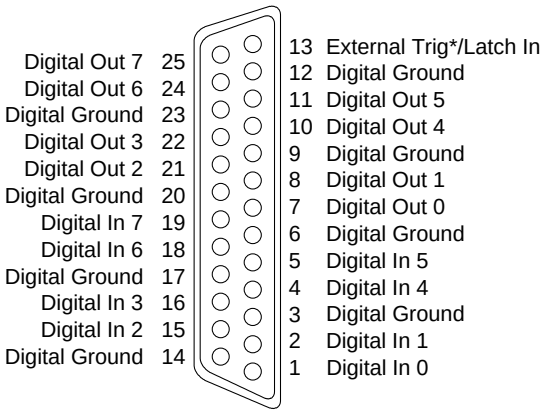


Figure 3. Cabling the DVME-613 using DATEL's DVME-691 Screw Terminator Panel

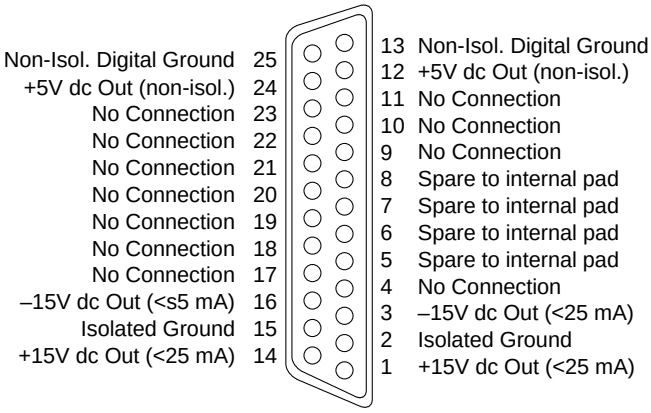
FRONT PANEL INPUT/OUTPUT CONNECTIONS

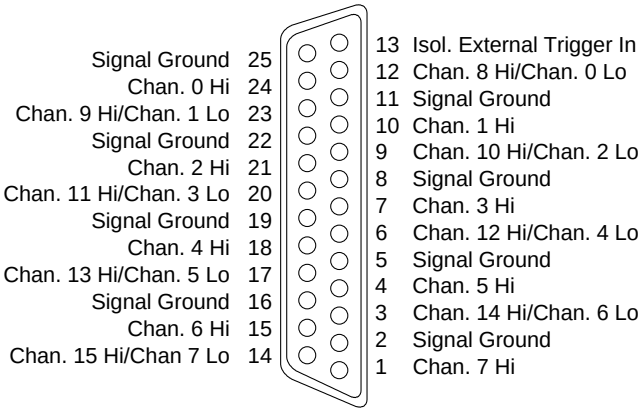
Pin numbering is shown as viewed from the front panel

Discrete Non-isolated Digital I/O - Connector J3



Isolated DC Power Out - Connector J2





Isolated Analog Inputs - Connector J1

Channel address notation: Single-ended/Differential

PROGRAMMING

The DVME-613 appears to the host computer as a block of 16-bit memory-mapped registers. To program the DVME-613, read/write emmory word operations may be sued from any language. In “C”, short pointers will access these registers. In 680X0 assembly language, move word (move.w) operations do the job. Since the DVME-613 is addressed as absolute memory, any host language or operating system may be used. In UNIX, a library function may ben needed to map absolute physical addresses to logical addresses.

Either polled status bits or interrupts may be used to indicate when A/D data is ready. If you wish to use interrupts, a simple device driver may be used to send a flag to the Operating System. A device driver is not necessary for polled operation.

A sample “C” program to control the DVME-613 is listed below:

```
/* 613c.c demo 4may89 ldc */

#include <stdio.h>
#include <io.h>

#define SAMPLES 8 /* last channel + 1 to scan */

/* The base address below is set by board switches before
iinstallation. Change this base address for your system */

#define BASPTR 0xFF0000 /* 24-bit address */

/* Make sure all shorts declared below refer to 16-bit words */

unsigned short *base_ptr; /* base address */

/* offsets to board registers: */
unsigned short *ctl_ptr, /* command-status */
    *chan_ptr, /* channel address */
    *start_ptr, /* start conversion */
    *addat_ptr; /* A/D data */

unsigned short outdata[8]; /* array to store A/D samples */
int scan(int samples), channel, wait(int delay);

main( ){
    /* initialize pointers to registers.
    Note pointer (cast) */
    base_ptr = (unsigned short *) BASPTR;
    ctl_ptr = (unsigned short *) (BASPTR + 0);
    chan_ptr = (unsigned short *) (BASPTR + 2);
    addat_ptr = (unsigned short *) (BASPTR + 6);

    scan (SAMPLES);
    printf(“\nA/D data (hex):”);
    for(channel=0 ; channel < SAMPLES ; channel++ )
        printf(“\nChan. %d = %x”, channel, outdata [channel]);
}/* end of main */

/*  Functions
*/

wait(delay){
while(delay--)
    ;
}
/* Scan( ) collects one scan of A/D samples to outdata[ ] with
sequential channel addressing starting at channel 0. */

scan(samples){
    int channel = 0; /* current channel address started at 0 */

    /* Initialize command register, no interrupts, LED on,
    converter enabled, trigger on A/D data read: */
    *ctl_ptr = 0x0045;
    *chan_ptr = 0; /* start at channel 0 */
    wait(10); /* Adjust this for a 20 microsecond minimum
settling delay whenever the channel address is changed */

    /* Do one dummy A/D read to start conversion. This
sample will be overwritten: */
    outdata [channel] = *addat_ptr;

    while( channel < samples ) {
        /* wait for EOC true */
        while(( 0x8000 & *ctl_ptr ) != 0x8000 )
            ;
        *chan_ptr = channel + 1; /* bump channel address */
        wait(10); /* settling delay */
        /* store the last channel and start the next one */
        outdata [channel++] = *addat_ptr;
    }
}
```

ORDERING GUIDE

Model	Description
DVME-613A	12 -bit A/D board
DVME-613A	12 -bit A/D board
DVME-613A	12 -bit A/D board

All models include a comprehensive user’s manual and a software disk. All boards are burn-in tested under power-cycled conditions and include a one-year warranty. DATEL will review custom signal conditioning for quantity requirements.

Accessories

DVME-691A Screw terminator panel for 19-inch rack mount. Includes flat signal cables to the DVME-613.

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