Oregon Micro Systems, Inc.™
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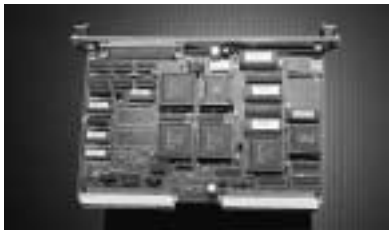

ISO 9001
CERTIFIED

VME58

Intelligent Motion Controller for PC

VME58 FEATURES

- **Controller capabilities**
  - → Up to 8 axes of Servo or Stepper control
  - → Consumes a single VME slot
- **Communications**
  - → VME C.1
  - → Dual-Port RAM interface for high speed communications
    Motion parameters available in DP RAM for near real time profile status
    Electronic "mail box" in DP RAM for priority commands, i.e. abort
  - → 4K memory block with control status and data registers
  - → Interrupt or Polling communication
- **Sophisticated Control Functionality**
  - → 12 bit DAC analog resolution
  - → Independent and coordinated motion of all axes at the same time
  - → Slip & Stall detection with encoder feedback
  - → Crystal controlled step pulse from 0 to 1,044,000 steps per second
  - → Configurable PID filter with feedforward coefficients
  - → Circular interpolation
  - → Constant Velocity linear interpolation (all axes)
  - → Electronic Gearing
- **32 bit processor for extensive co-processing**
  - → Does not burden the host with overhead
  - → Parabolic, "S"-curve & Linear trajectory profiles
  - → Patented technology to minimize torque ripple and velocity modulation
  - → Internal Watchdog timer for safety
- **Control signals**
  - → 100 pin shielded high density connector on front panel
  - → Axis control signals are also on P2 connector
  - → 40 dedicated I/O
  - → 20 "user" definable I/O
  - → Output is +/-10V, PWM or Step & Direction
  - → Independent home and plus / minus over-travel inputs
- **Software programming**
  - → High level programming expertise not required
  - → Over 150 commands, "universal" to all OMS controllers
  - → Commands are ASCII characters
  - → Automatic conversion to "user" defined units, i.e. inches / revolutions
- **Factory Direct Technical Support**
  - → Person to person toll-free tech support - 800-707-8111
  - → Published application notes
  - → Example programs provided
  - → All OMS controls are 100% burned-in, tested and quality inspected

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WEBSITE: www.omsmotion.com

DESCRIPTION

The VME58 brings the Oregon Micro Systems, Inc. (OMS) intelligent motion control technology to servo applications as well as stepping motors. This new generation of motion control products provides up to 8 axes of motion control on a single card to VME bus compatible computers. Outputs are provided for 12 bit analog or PWM servo output as well as step and direction for stepper applications. A state of the art PID filter is provided with 8 user adjustable parameters. Limit and home switch inputs are provided for all axes as well as user definable I/O for synchronization and control of other events. Incremental encoder feedback is used for all servo axes and is available on stepper axes on some models. This is used for position feedback and may also be used for slip or stall detection. Electronic gearing is also available for tracking with another motor or manual input device.

The bus interface uses dual port RAM technology for communication of commands from the host and feedback of motion control parameters. Commands may be written to this RAM by the host, eliminating the communication bottlenecks of I/O port based communications. Critical motion parameters such as position and velocity are available in the dual port RAM allowing the host to interrogate these parameters in real time while the motion is in progress. This RAM may be mapped to any desired 4K boundry within the computer short address memory space.

Interrupt control and other data is available through a block of 9 memory mapped registers. These registers include interrupt vector, interrupt control and status, limit and home switch status, done flag status and slip status for each axis as well as the user definable I/O. Some commands may be passed to the VME58, bypassing the communication channel using the mailbox system. These commands cause an immediate interrupt and may be used for critical commands such as abort. Each axis may perform individual unrelated moves or they can be coordinated as required by the application.

Simple ASCII commands may be easily sent to the board from any high level language. Complex move sequences, time delays and control of other external events may be programmed through the VME58 interface.

The IO58 companion module for the VME58 provides an efficient means of connecting the VME58 signals to external devices. It includes a 100 conductor shielded cable and individual connectors that separate each axis and the I/O signals of the VME58.

PROGRAMMING

The VME58 motion controls are easily programmed with double character ASCII commands through an extensive command structure. The commands are combined into character strings to create sophisticated motion profiles and are passed to the VME58 through the dual port RAM communication buffer. Separate 256 character buffers are provided in the RAM for communication in both directions. A separate command queue for each axis is used to store the parsed commands by the VME58 until they are executed allowing the host to send a complex command sequence and attend to other tasks while the VME58 manages the motion process. These command queues store 200 commands and parameters and include a command loop counter which allows multiple executions of any command string.

The following commands are available in the VME58 family of motion controllers. Some commands expect one or more numerical operands to follow. These commands are identified with a '#' after the command. The '#' indicates a signed integer input parameter or a signed fixed point number of the format ##.# when user units are enabled. With user units defined, distances, velocity and acceleration parameters may be input in inches, revolutions, etc.

Synchronized moves may be made by entering the AA or AM command. This command performs a context switch which allows entering commands of the format MRx#,y#,z#,t#,u#,v#,r#,s#;. Numbers are entered for each axis which is to be commanded to move. An axis may be skipped by entering the comma with no parameter. The command may be prematurely terminated with a ";", i.e. a move requiring only the X and Y axes would use the command MRx#,y#; followed by the GO command. Each axis programmed to move will start together upon executing the GO command. The VME58 can be switched back to the unsynchronized mode by entering the desired axis command such as AX.

The following summarizes the VME58 command set:

AXIS SPECIFICATION COMMANDS

The following commands specify the axis to which the commands are to be directed. They remain in effect until replaced by another command of the same type.

AA AXIS ALL

The AA command will perform a context switch to the synchronized mode.

AM AXES MULTITASKING

The AM mode allows several tasks to be managed simultaneously. For instance, a task may be performing coordination motion on 2 axes, while a second task is performing unrelated but simultaneous motion on another axis.

AX AXIS X

The AX command directs all the following commands to the X axis.

AY AXIS Y

The AY command directs all the following commands to the Y axis.

AZ AXIS Z

The AZ command directs all the following commands to the Z axis.

AT AXIS T

The AT command directs all the following commands to the T axis.

AU AXIS U

The AU command directs all the following commands to the U axis.

AV AXIS V

The AV command directs all the following commands to the V axis.

AR AXIS R

The AR command directs all the following commands to the R axis.

AS AXIS S

The AS command directs all the following commands to the S axis.

SYSTEM CONTROL COMMANDS

These commands allow control of various system parameters and operating modes to allow the user to optimize the response of the system for his/her application needs.

EN ECHO ON

The EN command enables echoing from the VME58.

EF ECHO OFF

The EF command disables echoing from the VME58.

HH HOME HIGH

The HH command sets the sense of the home switch on the current axis to active high.

HL HOME LOW

The HL command sets the sense of the home switch on the current axis to active low.

LF LIMITS OFF

The LF command turns off the limit switches for the addressed axis. This allows the stage to move beyond the limit switch and should be used with caution.

LN LIMITS ON

The LN command restores the operation of the limit switches for the addressed axis.

SL SOFT LIMIT

The SL command changes the operation of the limit inputs causing the output pulse train to ramp down instead of terminating immediately. The output queue is not flushed except for the current move.

SF SOFT LIMIT OFF

The SF command restores the normal operation of the limit switches.

CN COSINE ON

The CN command enables cosine velocity ramps, i.e. half sinusoid acceleration profiles for all axes.

PN# PARABOLIC ON

The PN command enables parabolic ramps. The parameter selects the point of truncation.

PF PARABOLIC OFF

The PF command restores linear acceleration and deceleration ramps.

PI# PWM PERIOD

The PI command sets the period for the PWM output signal.

BI BIPOLAR

The BI command sets the analog and PWM torque outputs to bipolar.

UN UNIPOLAR

The UN command sets the analog and PWM torque outputs to unipolar.

RS RESET

The RS command is a software reset which causes the VME58 microprocessor to reset. All programmable values are set to factory defaults.

MOVE SPECIFICATION COMMANDS

These commands allow specification of move parameters. They allow move parameters to be tailored to the user's system requirements.

AC# ACCELERATION

The AC command sets the acceleration/deceleration value. This value is used to establish the rate of acceleration and deceleration when a move command is invoked.

VL# VELOCITY

The VL command sets the maximum velocity value of the axis being programmed. The value is used to establish the maximum velocity when one of the move execution commands is invoked.

VB# VELOCITY BASE

The VB command allows the velocity ramp to start at the specified velocity. This allows faster acceleration and the ability to pass through resonance quickly in some applications.

LP# LOAD POSITION

The LP command will immediately load the position supplied as a parameter into the absolute position register of the axis.

MA# MOVE ABSOLUTE

The MA command will set up the axis to move to the absolute position supplied as a parameter.

MR# MOVE RELATIVE

The MR command will set up the axis to move relative from the current position at the time the move is executed.

MT#,# MOVE TO

The MT command uses linear interpolation to perform a straight line move to the specified absolute position. Up to eight axes may be moved together in the AA or AM modes.

ML#,# MOVE LINEAR

The ML command uses linear interpolation to perform a straight line relative move to the new location. Up to eight axes may be moved together in the AA or AM modes.

RM# REMAINDER

The RM command will divide the position counter by the parameter supplied and replace both the position counter and the encoder position register with the resulting remainder. This command is useful in continuously rotating axis applications.

MOVE EXECUTION COMMANDS

These commands allow execution of the moves which have been previously specified.

GO GO

The GO command will initiate the move which has been previously programmed with such commands as MA, MR, MT, and ML.

GD GO AND RESET DONE FLAG

The GD command resets the done flags on the active axes then proceeds with the move identical to the GO command.

JG# JOG

The JG command is a velocity command and will jog the axis at the velocity supplied as a parameter. The velocity may be changed without stopping by entering another JG command.

JF# JOG FRACTIONAL VELOCITIES

The JF command will jog the current axis at fractional rates for applications requiring very slow velocities.

FL FLUSH QUEUE

The FL command will immediately flush the command queue. If the stage is moving it continues to move at the current velocity.

MOVE TERMINATION COMMANDS

The following commands allow termination of move sequences in process.

ST STOP

The ST command flushes the queue for the currently addressed axis only and causes the axis to decelerate to a stop at the rate previously specified in an AC command.

SA STOP ALL

The SA command flushes all queues and causes all axes to decelerate to a stop at the rate previously specified in an AC command.

SD STOP AND RESET DONE

The SD command will stop all axes and clear any done flags.

KL KILL

The KL command will flush the command queue and terminate pulse generation of all axes immediately.

LOOP CONTROL COMMANDS

These commands allow move sequences to be repeated within loops. Loops can be nested up to four levels deep on each axis.

LS# LOOP START

The LS command sets the loop counter for the axis being programmed. The parameter specifies the number of times the loop will be executed. Loops may be nested up to 4 levels deep.

LE LOOP END

The LE command terminates the most recent LS command.

The following commands can be used to synchronize multiple VME58 boards or synchronize them to external events.

WS# WHILE SYNC TRUE

The WS command will execute the commands between the WS and WD commands as a loop, while the general purpose input line is true, i.e. low. The test is at the bottom of the loop and thus will always be executed at least once.

WD WHILE END

The WD command serves as the loop terminator for the WS command.

WH WHILE

The WH command will execute all commands until the terminating WG command as a loop, until terminated by a CW command. This allows indefinite loops to be terminated by the host computer.

WG WHILE FLAG END

The WG command serves as the terminator for the WH command.

CW CLEAR WHILE

The CW command terminates the WH command sequence upon execution of the next WG instruction. This loop is always executed at least once.

HOME AND INITIALIZATION CONTROL COMMANDS

These commands allow the coordination of the physical stage home position with the VME58 position register.

HM# HOME COMMAND

The HM command will find home and initialize the position counter to the position supplied as a parameter.

HR# HOME REVERSE

The HR command will find home in the reverse direction and initialize the position counter to the position supplied as a parameter.

KM HOME AND KILL

The KM command will find home and stop generating pulses immediately, i.e. no deceleration ramp will be generated. The position counter is not affected.

KR HOME REVERSE AND KILL

The KR command will find home in reverse and stop generating pulses immediately, i.e. no deceleration ramp will be generated. The position counter is not affected.

MOVE SYNCHRONIZATION COMMANDS

These commands allow the synchronization of moves with external events or multiple axis sequences.

ID INTERRUPT DONE

The ID command will return the done flag to the host and interrupt the host if the interrupt has been enabled.

II INTERRUPT INDEPENDENT

The II command allows each axis to interrupt the host when it completes its move independent of the status of the other axes.

IN# INTERRUPT NEARLY DONE

The IN command will interrupt the host when the move is nearly complete. The parameter specifies the number of counts left in the move when the interrupt request is generated.

IC INTERRUPT CLEAR

The IC command will clear the done and error flags.

CA CLEAR AXIS DONE FLAG

The CA command operates like the IC command, except it clears the done flag of the addressed axis only.

WA WAIT FOR AXES

The WA command, only valid in the AA mode, allows a command to wait until all moves on all axes are finished before it executes.

WQ WAIT FOR QUEUE TO EMPTY

The WQ command is a special command that stops the board from processing any new command until the queue for the current axis mode is empty.

SW# SYNC WAIT

The SW command can be used to synchronize to external events by commanding the VME58 to wait for the input line to go false.

WT# WAIT TIME

The WT command will wait for the specified number of milliseconds before proceeding with the next command.

SYSTEM STATUS REQUEST COMMANDS

These commands allow the host to request the status of various move parameters, including the status of limit and home switches.

WY WHO ARE YOU

The WY command returns the model and firmware revision of the board or system being addressed.

***RP RETURN POSITION**

The RP command requests the current position.

RQ RETURN QUEUE STATUS

The RQ command returns the number of entries available in the command queue.

***RA RETURN AXIS INTERRUPT STATUS**

The RA command returns the state of the limit and home switches, and the done and direction flags for the currently addressed axis. The done flag is reset.

***RI RETURN INTERRUPT STATUS**

The RI command returns the state of the limit and home switches, and the done and direction flags for all axes. The done flags are reset.

***QA QUERY AXIS**

The QA command returns the status of the single addressed axis like the RA command, except the status register and flags are not affected.

***QI QUERY INTERRUPT STATUS**

The QI command returns the status of all axes like the RI command, except the status register and flags are not affected.

***RC REQUEST ACCELERATION**

The RC command will return the current programmed acceleration or deceleration of the current axis.

***RV REQUEST VELOCITY**

The RV command will return the current velocity at which the axis is moving.

RU REPORT POSITION IN USER UNITS

The RU command returns the current position in user units.

Note: The commands identified with an '*' are for backward compatibility with previous generation OMS controls and should not be used with new designs. Other preferred mechanisms such as reading directly from the dual port RAM are available for this data.

USER UNIT COMMANDS

The following commands allow specification of move parameters in user defined units. The OMS controls will automatically convert all move parameters to these units once they have been initialized.

UU# USER UNITS

The UU command converts all move velocities, distances, etc. to user specified units by multiplying by the parameter given in this command.

UF USER UNITS OFF

The UF command turns off user units and causes the VME58 board to use its default units.

USER I/O COMMANDS

The following commands allow manipulation and testing of the user definable I/O.

AN AUXILIARY ON

The AN command sets the auxiliary output to the high level. The open collector driver is off allowing the output to be pulled high by a pull-up resistor. It may be used to change power level on driver modules so equipped or as a user specified output.

AF AUXILIARY OFF

The AF command sets the auxiliary output to the low level. The open collector driver is on causing the line to be near ground. It may be used to change power level on driver modules so equipped or as a user specified output.

PA# POWER AUTOMATIC

The PA command will perform an AN command at the beginning of each move and an AF command after the move. See AN and AF commands.

SE# SETTLING TIME

The SE command allows specification of a settling time, in milliseconds, to be used before the power is reduced, when using the PA mode.

BL# BIT LOW

The BL command sets the selected general purpose output on, i.e. logic low.

BH# BIT HIGH

The BH command sets the selected general purpose output off, i.e. logic high.

BX BIT REQUEST IN HEX

The BX command returns the state of the general purpose I/O bits in hex format.

RB RETURN OUTPUT BITS

The RB command returns the direction of the general purpose I/O lines as they are currently defined in hex format.

CONSTANT VELOCITY CONTOURING COMMANDS

The contouring command set allows the building of a command sequence which can later be executed at constant velocity for machine tool and other similar applications.

AF#,# AUXILIARY OFF

The AF command turns off any combination of auxiliary ports, when encountered in the command stream, allowing control of other peripherals such as a laser beam for machining.

AN#,# AUXILIARY ON

The AN commands turns on any combination of auxiliary output ports when encountered in the contouring command stream.

CD#,#; CONTOUR DEFINE

The CD command allows entry of a contour definition which will start at the position specified. Any combination of axes may be used in the contour mode.

CE CONTOUR END

The CE command ends the definition of the contour sequence, i.e. terminate the CD mode or ramp to a stop and exit when the contour is executed.

CK CONTOUR END AND KILL

The CK command ends the definition of the contour sequence and stops output generation immediately when executed.

CR#,#,# CIRCULAR INTERPOLATION

The CR command causes the axes defined by the CD command to move in a circular pattern from the entry position. The parameters specify the center of the circle and distance to travel in radians. The CR command is only valid with contours of 2 axes.

CV# CONTOUR VELOCITY

The CV command allows the specification of the contouring velocity.

CX CONTOUR EXECUTE

The CX command causes the VME58 controller to execute the previously defined contour sequence.

MT#,# MOVE TO

The MT command causes the axes defined by the CD command to move to the specified absolute position using linear interpolation at constant velocity.

RQ REQUEST QUEUE STATUS

The RQ command returns the number of entries available in the contouring queue.

PID FILTER CONTROL COMMANDS

The following commands set the PID filter parameters for servo axes

KP# PROPORTIONAL GAIN COEFFICIENT

The KP command sets the proportional gain coefficient on servo axes.

KI# INTEGRAL GAIN COEFFICIENT

The KI command sets the integral gain coefficient on servo axes.

KD# DIFFERENTIAL GAIN COEFFICIENT

The KD command sets the differential gain coefficient on servo axes.

KV# VELOCITY FEEDFORWARD COEFFICIENT

The KV command sets the velocity feedforward coefficient on servo axes.

KA# ACCELERATION FEEDFORWARD COEFFICIENT

The KA command sets the acceleration feedforward coefficient on servo axes.

KO# OFFSET COEFFICIENT

The KO command sets a DC offset to compensate for torque offset in the load.

KN# INTEGRATION INTERVAL COEFFICIENT

The KN command sets the integration interval. The interval is 2 to the power supplied as a parameter update intervals.

ENCODER COMMANDS

The following are encoder support commands for use with the VME58.

The following are position maintenance control commands:

ER#,# ENCODER RATIO (for digital output only)

The ER command allows specification of encoder ratio by entering encoder counts followed by motor counts, for position maintenance mode.

HV# HOLD VELOCITY

The HV command specifies maximum position hold correction velocity. This is the peak velocity which will be used while making position corrections.

HG# HOLD GAIN PARAMETERS

The HG command specifies the position hold gain parameter for stepper axes. The position error is multiplied by this gain factor in determining the velocity during position correction.

HD# HOLD DEADBAND

The HD command specifies deadband counts for position hold. The VME58 will consider the control in position when the stage is within the specified parameter counts during position correction.

HF HOLD OFF

The HF command disables position hold, stall detection and tracking modes for stepper axes and turns off servo axes.

HN HOLD ON

The HN command enables position correction or turns on servo axes.

IP INTERRUPT WHEN IN POSITION

The IP command operates like the ID command, except the interrupt is deferred until the stage is within the specified deadband.

The following commands control the slip or stall detection mode.

ES# ENCODER SLIP TOLERANCE

The ES command parameter specifies tolerance before slip or stall is flagged in the status register.

TN SLIP TOLERANCE KILL ON

The TN command enables additional action taken by the encoder slip tolerance system when the position error exceeds that specified by the ES command. When this mode is on, the controller will flush the command queue, terminate the motion, set the slip flag and disable position maintenance for that particular axis.

TF SLIP TOLERANCE KILL OFF

The TF command disables the TN command.

IS INTERRUPT ON SLIP

The IS command will enable interrupts to the host when the position error during a move exceeds the parameter specified by an ES command. The interrupt will occur if the done interrupt has been enabled in the control register. A bit in the status register is also set to flag the source of the interrupt.

RL RETURN SLIP STATUS

The RL command returns the slip detection status of each axis. An S is returned if slip has occurred for that axis, or else an N is returned.

The following command controls the tracking mode of the controls.

ET ENCODER TRACKING

The ET command turns on the encoder tracking mode. The axis will track its encoder input, thus allowing one axis to follow the activity of another or a thumbwheel for manual positioning or the movement of another device that produces a signal compatible to the encoder inputs.

The following commands control the home sequence when used with an encoder.

HE HOME ENCODER

The HE command enables the encoder index mode, i.e. home is defined as the logical AND of the encoder index, the external home enable and the encoder quadrant.

HS HOME SWITCH

The HS command enables non-encoder (switch only) home mode.

The following commands return status information about the encoder to the host.

EA ENCODER STATUS

The EA command returns the encoder status of the currently addressed axis.

***RE REQUEST ENCODER POSITION**

The RE command returns the current encoder position of the currently addressed axis in encoder counts.

VELOCITY STAIRCASE COMMANDS

The following commands describe the velocity staircase mode. This mode is useful in applications requiring a change in velocity at a prescribed position without stopping.

MP MOVE POSITIVE

The MP command sets the direction logic to move in the positive direction.

MM MOVE MINUS

The MM command sets the direction logic to move in the negative direction.

MV#,# MOVE VELOCITY

The MV command causes the motor to run to the new absolute position at the specified velocity. A velocity staircase may be generated by queuing a sequence of MV commands.

SP# STOP AT POSITION

The SP command will cause the axis to stop at the specified position.

FP# FORCE POSITION

The FP command will flush the command queue and attempt to stop at the specified position.

PROGRAMMING EXAMPLES

In a typical move requirement where it is desired to home the stage then move to a specified position, the following will demonstrate the programming:

- Initialize the velocity and acceleration parameters to a low value suitable for homing. Set a PID filter proportional gain of 2 and derivative gain of 6. Perform the home operation initializing the position counter to zero.
- Initialize the velocity and acceleration parameters to perform a faster motion and move to an absolute position of 10,000 counts from home in the negative direction and set the done flag when finished.

The following would be input from the host computer:

```
AX
VL1000 AC10000
KP2 KD6 HN
HM0
VL5000 AC50000
MA-10000 GO ID
```

In a move requiring a three axis coordinated move to a position in free space the following could be used:

```
AX KP2 KD6 HN
AY KP2 KD6 HN
AZ KP2 KD6 HN
AM
VL5000,5000,5000;
AC50000,50000,50000;
MA1000,2000,3000; GO ID
```

The controller would calculate the relative velocities required to perform a straight line move from the current position to the desired position.

The following demonstrates cutting a hole with a 10,000 count radius using constant velocity contouring and circular interpolation:

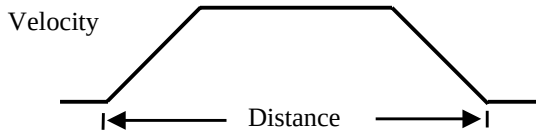
- The contouring velocity is set to 1000 counts per second. A contour is defined beginning at coordinates 0,0 on the Z and T axes.
- Auxiliary output on the X axis is turned on, which could turn on the cutting torch or laser starting the cut at the center of the circle.
- A half circle is cut from the center to the outside of the hole positioning the cutting tool at the start of the hole.
- The hole is then cut, the torch turned off, the stage stopped and the contour definition completed.
- The stage is then positioned and the contour definition executed.

The following would be input from the host computer:

```
CV1000
CD,,0,0;
AN0;
CR0,5000,3.1415926
CR0,0,6.2831853
AF0;
MT-10,10000
CE
MT,,-1000,0; GO
CX
```

OPERATING PRINCIPLE

The VME58 family of motion controls provide closed or open loop operation. In the closed loop servo operation the encoder feedback logic will continuously monitor position and filter the error signal with a PID filter before applying it to the amplifier or driver module. The PID filter parameters are user adjustable to allow the system parameters to be adjusted for optimum system stability. The velocity profile may be selected as a trapezoidal (linear acceleration), truncated parabola or half cosine velocity. Open loop operation with step motors may also be used with the same velocity profile options. Encoder verification with open loop operation is available on some models.



Linear Velocity Profile

Moves may be chained together to provide a more complex pattern. An internal queue can store up to 200 command parameters in a separate input queue for each axis as well as 256 characters in the dual port RAM communication buffer. This allows a complicated move sequence to be performed without host intervention. A flag may be passed to the host through an I/O port indicating the completion of a sequence or at any intermediate point in the command stream.

SPECIFICATIONS

Velocity

0 to 1,044,000 counts per second simultaneous on each axis

Acceleration

0 to 8,000,000 counts per second per second

Position range

67,000,000 counts (±33,500,000)

Accuracy

Position accuracy and repeatability ±0 counts for point to point moves

Environmental

Operating temperature range 0 to 50 degrees centigrade

Storage temperature range -20 to 85 degrees centigrade

Humidity 0 to 90% non-condensing

Power

+5VDC at 1.75 amps typical (from the VME bus)

Dimensions

10.3 x 7.4 x 0.8 inches high

Host interface

Meets all signal specifications for VME bus specifications

Limit switch inputs

TTL input levels with on board 2.2K pull up resistor, requires only external switch closure to ground or TTL level input signal. Input sense (low or high true) selectable by on board jumper for each axis.

Home switch inputs

TTL input levels with on board 2.2K pull up resistor, requires only external switch closure to ground or TTL level input signal. Input sense (low or high true) selectable under software control for each axis.

User definable I/O

22 bits of user definable I/O. TTL input levels with on board 2.2K pull up resistor, requires only external switch closure to ground or TTL level input signal. The auxiliary outputs are TTL open collector outputs (7406) which can be converted to TTL totem pole outputs (7404). The auxiliary outputs are fixed as outputs. 12 bits are user configurable as inputs or outputs, and 2 bits are fixed as outputs. Factory default is 8 inputs (7402) and 6 outputs (7408). These are jumper selectable as input or output as groups of four with a change in IC type which is socketed and a jumper change.

Analog and PWM outputs

±10VDC = analog, PWM = open collector TTL level signal

Analog bipolar and unipolar outputs are jumper selectable

Step pulse output

Pulse width 50% duty cycle. Open collector TTL level signal.

Direction output

Same as step pulse output

VME interrupt vector

Interrupt vector user selectable levels 2 through 7. The factory default is level 5.

VME register interface

VME BUS REGISTER INTERFACE		
AD-DRESS OFFSET	DESCRIPTION	FUNCTION
0FE1	Control Register	Read/Write
0FE3	Status Register	Read
0FE5	User Definable I/O (0-7)	Read
0FE7	Slip Flags	Read
0FE9	Done Flags	Read
0FEB	User Definable I/O (8-13)	Read
0FED	Limit Switch Status	Read
0FEF	Home Switch Status	Read
0FF1	Interrupt vector	Read/Write

CONTROL REGISTER BIT ASSIGNMENTS	
BIT	DESCRIPTION
0	Data Area Update Request
1	Unused
2	Encoder Slip Interrupt Enable
3	Limit Register Interrupt Enable
4	Done Register Interrupt Enable
5	Interrupt Request to the VME58
6	I/O bits 0 & 1 interrupt enable
7	Interrupt Request Enable

STATUS REGISTER BIT ASSIGNMENTS	
BIT	DESCRIPTION
0	Command Error
1	Initialized (power up complete)
2	Encoder Slip
3	Overtravel Encountered
4	Done
5	Interrupt Request Status to the VME58
6	Direct Interrupt Request from the VME58
7	Interrupt Request Status

DONE FLAG REGISTER AND SLIP FLAG REGISTER DESCRIPTION	
BIT	DESCRIPTION
0	Status of X Axis
1	Status of Y Axis
2	Status of Z Axis
3	Status of T Axis
4	Status of U Axis
5	Status of V Axis
6	Status of R Axis
7	Status of S Axis

The following table describes the Limit status for the host PC, and the Home status for the host computer.

LIMIT INPUT AND HOME INPUT SWITCH REGISTER	
BIT	DESCRIPTION
0	X Axis Input
1	Y Axis Input
2	Z Axis Input
3	T Axis Input
4	U Axis Input
5	V Axis Input
6	R Axis Input
7	S Axis Input

USER I/O BITS 0-7	
BIT	DESCRIPTION
0	Bit 0
1	Bit 1
2	Bit 2
3	Bit 3
4	Bit 4
5	Bit 5
6	Bit 6
7	Bit 7

USER I/O BITS 8-13	
BIT	DESCRIPTION
0	Bit 8
1	Bit 9
2	Bit 10
3	Bit 11
4	Bit 12 (output only)
5	Bit 13 (output only)
6	Unused
7	Unused

DUAL PORT RAM MEMORY OFFSET ASSIGNMENTS		
ADDRESS OFFSET	DESCRIPTION	FUNCTION
0-1	Input Put Index	Read
2-3	Output Get Index	Read
4-515	Input Buffer	Read
516-1023	Reserved	Read
1024	X Encoder Position	Read
1028	X Command Position	Read
1032	X Command Velocity	Read
1036	X Acceleration	Read
1040	X Maximum Velocity	Read
1044	X Base Velocity	Read
1048	X Proportional Gain	Read
1052	X Differential Gain	Read
1056	X Integral Gain	Read
1060	X Acceleration Feed Forward	Read
1064	X Velocity Feed Forward	Read
1068	X Offset	Read
1072-1151	Reserved	Read
1152	Y Encoder Position	Read
1156	Y Command Position	Read
1160	Y Command Velocity	Read
1164	Y Acceleration	Read
1168	Y Maximum Velocity	Read
1172	Y Base Velocity	Read
1176	Y Proportional Gain	Read
1180	Y Differential Gain	Read
1184	Y Integral Gain	Read
1188	Y Acceleration Feed Forward	Read
1192	Y Velocity Feed Forward	Read
1196	Y Offset	Read
1200-1279	Reserved	Read
1280	Z Encoder Position	Read
1284	Z Command Position	Read
1288	Z Command Velocity	Read
1292	Z Acceleration	Read
1296	Z Maximum Velocity	Read
1300	Z Base Velocity	Read
1304	Z Proportional Gain	Read
1308	Z Differential Gain	Read
1312	Z Integral Gain	Read
1316	Z Acceleration Feed Forward	Read
1320	Z Velocity Feed Forward	
1324	Z Offset	
1328-1407	Reserved	Read

DUAL PORT RAM MEMORY OFFSET ASSIGNMENTS		
ADDRESS OFFSET	DESCRIPTION	FUNCTION
1408	T Encoder Position	Read
1412	T Command Position	Read
1416	T Command Velocity	Read
1420	T Acceleration	Read
1424	T Maximum Velocity	Read
1428	T Base Velocity	Read
1432	T Proportional Gain	Read
1436	T Differential Gain	Read
1440	T Integral Gain	Read
1444	T Acceleration Feed Forward	Read
1448	T Velocity Feed Forward	Read
1452	T Offset	
1456-1535	Reserved	Read
1536	U Encoder Position	Read
1540	U Command Position	Read
1544	U Command Velocity	Read
1548	U Acceleration	Read
1552	U Maximum Velocity	Read
1556	U Base Velocity	Read
1560	U Proportional Gain	Read
1564	U Differential Gain	Read
1568	U Integral Gain	Read
1572	U Acceleration Feed Forward	Read
1576	U Velocity Feed Forward	Read
1580	U Offset	Read
1584-1663	Reserved	Read
1664	V Encoder Position	Read
1668	V Command Position	Read
1672	V Command Velocity	Read
1676	V Acceleration	Read
1680	V Maximum Velocity	Read
1684	V Base Velocity	Read
1688	V Proportional Gain	Read
1692	V Differential Gain	Read
1696	V Integral Gain	Read
1700	V Acceleration Feed Forward	Read
1704	V Velocity Feed Forward	Read
1708	V Offset	Read
1712-1791	Reserved	Read
1792	R Encoder Position	Read
1796	R Command Position	Read
1800	R Command Velocity	Read
1804	R Acceleration	Read

DUAL PORT RAM MEMORY OFFSET ASSIGNMENTS		
ADDRESS OFFSET	DESCRIPTION	FUNCTION
1808	R Maximum Velocity	Read
1812	R Base Velocity	Read
1816	R Proportional Gain	Read
1820	R Differential Gain	Read
1824	R Integral Gain	Read
1828	R Acceleration Feed Forward	Read
1832	R Velocity Feed Forward	Read
1836	R Offset	
1840-1919	Reserved	Read
1920	S Encoder Position	Read
1924	S Command Position	Read
1928	S Command Velocity	Read
1932	S Acceleration	Read
1936	S Maximum Velocity	Read
1940	S Base Velocity	Read
1944	S Proportional Gain	Read
1948	S Differential Gain	Read
1952	S Integral Gain	Read
1956	S Acceleration Feed Forward	Read
1960	S Velocity Feed Forward	Read
1964	S Offset	
1968-2047	Reserved	Read
2048-2049	Output Put Index	Read/Write
2050-2051	Input Get Index	Read/Write
2052-2563	Output Buffer	Read/Write
2564-3975	Reserved	Read/Write
3976	Mailbox	Read/Write
3980-4063	Reserved	Read/Write
4064-4095	Registers	

Connector Pin Lists

Pins are shown in their actual relative position as viewed from the connector.

MODEL VME58-8S			
FUNCTION	PINS		FUNCTION
User I/O 0	1	51	+5VDC
User I/O 2	2	52	User I/O 1
User I/O 4	3	53	User I/O 3
User I/O 6	4	54	User I/O 5
User I/O 8	5	55	User I/O 7
User I/O 10	6	56	User I/O 9
User I/O 12	7	57	User I/O 11
User I/O 13	8	58	Ground
Analog Ground	9	59	+5VDC
X Phase A	10	60	Ground
X Phase B	11	61	X Index
X Direction	12	62	X Axis Output
X Auxiliary Output	13	63	X Positive Limit
X Home	14	64	X Negative Limit
Y Phase A	15	65	Y Index
Y Phase B	16	66	Y Axis Output
Y Direction	17	67	Y Positive Limit
Y Auxiliary Output	18	68	Y Negative Limit
Y Home	19	69	+5VDC
Analog Ground	20	70	Ground
Z Phase A	21	71	Z Index
Z Phase B	22	72	Z Axis Output
Z Direction	23	73	Z Positive Limit
Z Auxiliary Output	24	74	Z Negative Limit
Z Home	25	75	T Index
T Phase A	26	76	T Axis Output
T Phase B	27	77	T Auxiliary Output
T Direction	28	78	T Positive Limit
T Home	29	79	T Negative Limit
Analog Ground	30	80	+5VDC
U Phase A	31	81	Ground
U Phase B	32	82	U Index
U Direction	33	83	U Axis Output
U Auxiliary Output	34	84	U Positive Limit
U Home	35	85	U Negative Limit
V Phase A	36	86	V Index
V Phase B	37	87	V Axis Output
V Direction	38	88	V Positive Limit
V Auxiliary Output	39	89	V Negative Limit
V Home	40	90	+5VDC
Analog Ground	41	91	Ground
R Phase A	42	92	R Index
R Phase B	43	93	R Axis Output
R Direction	44	94	R Positive Limit
R Auxiliary Output	45	95	R Negative Limit
R Home	46	96	S Index
S Phase A	47	97	S Axis Output
S Phase B	48	98	S Auxiliary Output
S Direction	49	99	S Positive Limit
S Home	50	100	S Negative Limit

MODEL VME58-4S4			
FUNCTION	PINS		FUNCTION
User I/O 0	1	51	+5VDC
User I/O 2	2	52	User I/O 1
User I/O 4	3	53	User I/O 3
User I/O 6	4	54	User I/O 5
User I/O 8	5	55	User I/O 7
User I/O 10	6	56	User I/O 9
User I/O 12	7	57	User I/O 11
User I/O 13	8	58	Ground
Analog Ground	9	59	+5VDC
X Phase A	10	60	Ground
X Phase B	11	61	X Index
X Direction	12	62	X Axis Servo Output
X Auxiliary Output	13	63	X Positive Limit
X Home	14	64	X Negative Limit
Y Phase A	15	65	Y Index
Y Phase B	16	66	Y Axis Servo Output
Y Direction	17	67	Y Positive Limit
Y Auxiliary Output	18	68	Y Negative Limit
Y Home	19	69	+5VDC
Analog Ground	20	70	Ground
Z Phase A	21	71	Z Index
Z Phase B	22	72	Z Axis Servo Output
Z Direction	23	73	Z Positive Limit
Z Auxiliary Output	24	74	Z Negative Limit
Z Home	25	75	T Index
T Phase A	26	76	T Axis Servo Output
T Phase B	27	77	T Auxiliary Output
T Direction	28	78	T Positive Limit
T Home	29	79	T Negative Limit
Analog Ground	30	80	+5VDC
	31	81	Ground
	32	82	
U Direction	33	83	U Axis Step Output
U Auxiliary Output	34	84	U Positive Limit
U Home	35	85	U Negative Limit
	36	86	
	37	87	V Axis Step Output
V Direction	38	88	V Positive Limit
V Auxiliary Output	39	89	V Negative Limit
V Home	40	90	+5VDC
Analog Ground	41	91	Ground
	42	92	
	43	93	R Axis Step Output
R Direction	44	94	R Positive Limit
R Auxiliary Output	45	95	R Negative Limit
R Home	46	96	
	47	97	S Axis Step Output
	48	98	S Auxiliary Output
S Direction	49	99	S Positive Limit
S Home	50	100	S Negative Limit

MODEL VME58-8			
FUNCTION	PINS		FUNCTION
User I/O 0	1	51	+5VDC
User I/O 2	2	52	User I/O 1
User I/O 4	3	53	User I/O 3
User I/O 6	4	54	User I/O 5
User I/O 8	5	55	User I/O 7
User I/O 10	6	56	User I/O 9
User I/O 12	7	57	User I/O 11
User I/O 13	8	58	Ground
Analog Ground	9	59	+5VDC
	10	60	Ground
	11	61	
X Direction	12	62	X Axis Step Output
X Auxiliary Output	13	63	X Positive Limit
X Home	14	64	X Negative Limit
	15	65	
	16	66	Y Axis Step Output
Y Direction	17	67	Y Positive Limit
Y Auxiliary Output	18	68	Y Negative Limit
Y Home	19	69	+5VDC
Analog Ground	20	70	Ground
	21	71	
	22	72	Z Axis Step Output
Z Direction	23	73	Z Positive Limit
Z Auxiliary Output	24	74	Z Negative Limit
Z Home	25	75	
	26	76	T Axis Step Output
	27	77	T Auxiliary Output
T Direction	28	78	T Positive Limit
T Home	29	79	T Negative Limit
Analog Ground	30	80	+5VDC
	31	81	Ground
	32	82	
U Direction	33	83	U Axis Step Output
U Auxiliary Output	34	84	U Positive Limit
U Home	35	85	U Negative Limit
	36	86	
	37	87	V Axis Step Output
V Direction	38	88	V Positive Limit
V Auxiliary Output	39	89	V Negative Limit
V Home	40	90	+5VDC
Analog Ground	41	91	Ground
	42	92	
	43	93	R Axis Step Output
R Direction	44	94	R Positive Limit
R Auxiliary Output	45	95	R Negative Limit
R Home	46	96	
	47	97	S Axis Step Output
	48	98	S Auxiliary Output
S Direction	49	99	S Positive Limit
S Home	50	100	S Negative Limit

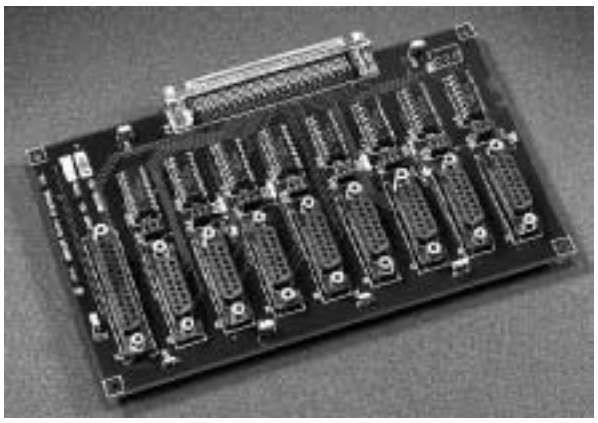
MODEL VME58-4E			
FUNCTION	PINS		FUNCTION
User I/O 0	1	51	+5VDC
User I/O 2	2	52	User I/O 1
User I/O 4	3	53	User I/O 3
User I/O 6	4	54	User I/O 5
User I/O 8	5	55	User I/O 7
User I/O 10	6	56	User I/O 9
User I/O 12	7	57	User I/O 11
User I/O 13	8	58	Ground
Analog Ground	9	59	+5VDC
	10	60	Ground
	11	61	
X Direction	12	62	X Axis Step Output
X Auxiliary Output	13	63	X Positive Limit
X Home	14	64	X Negative Limit
	15	65	
	16	66	Y Axis Step Output
Y Direction	17	67	Y Positive Limit
Y Auxiliary Output	18	68	Y Negative Limit
Y Home	19	69	+5VDC
Analog Ground	20	70	Ground
	21	71	
	22	72	Z Axis Step Output
Z Direction	23	73	Z Positive Limit
Z Auxiliary Output	24	74	Z Negative Limit
Z Home	25	75	
	26	76	T Axis Step Output
	27	77	T Auxiliary Output
T Direction	28	78	T Positive Limit
T Home	29	79	T Negative Limit
Analog Ground	30	80	+5VDC
X Phase A	31	81	Ground
X Phase B	32	82	X Index
	33	83	
	34	84	
	35	85	
Y Phase A	36	86	Y Index
Y Phase B	37	87	
	38	88	
	39	89	
	40	90	+5VDC
Analog Ground	41	91	Ground
Z Phase A	42	92	Z Index
Z Phase B	43	93	
	44	94	
	45	95	
	46	96	T Index
T Phase A	47	97	
T Phase B	48	98	
	49	99	
	50	100	

The mating connector is an AMP, Inc. part #749621-9 with a #749081-1 hood and strain relief. These are available as part of the IO58 option or separately as part # CON58.

P2 CONNECTOR PIN ASSIGNMENTS		
ROW C FUNCTION	PINS	ROW A FUNCTION
X Index	1	X Phase B
X Phase A	2	X Axis Output
X Dir	3	X Pos. Limit
X Home	4	X Neg. Limit
Y Index	5	Y Phase B
Y Phase A	6	Y Axis Output
Y Dir	7	Y Pos. Limit
Y Home	8	Y Neg. Limit
Z Index	9	Z Phase B
Z Phase A	10	Z Axis Output
Z Dir	11	Z Pos. Limit
Z Home	12	Z neg. Limit
T Index	13	T Phase B
T Phase A	14	T Axis Output
T Dir	15	T Pos. Limit
T Home	16	T Neg. Limit
U Index	17	U Phase B
U Phase A	18	U Axis Output
U Dir	19	U Pos. Limit
U Home	20	U Neg. Limit
V Index	21	V Phase B
V Phase A	22	V Axis Output
V Dir	23	V Pos. Limit
V Home	24	V Neg. Limit
R Index	25	R Phase B
R Phase A	26	R Axis Output
R Dir	27	R Pos. Limit
R Home	28	R Neg. Limit
S Index	29	S Phase B
S Phase A	30	S Axis Output
S Dir	31	S Pos. Limit
S Home	32	S Neg. Limit

Some pins may be unused on some models.

IO58 ADAPTER MODULE



IO58 Input/Output module for the VME58

The IO58 is an adapter module for use with the VME58 to provide separate connectors to each driver axis and each encoder input. It is supplied with a 3 meter cable and mating connector to the VME58.

IO58 SPECIFICATIONS

Dimensions

7.25 x 4.25 x 0.78 inches tall

Power

No external power required

CONNECTIONS TO IO58

The following table defines the IO58 connections to the drivers. The mating connectors are 15 pin subminiature D, AMP, Inc. part #747946-2 or equivalent.

INDIVIDUAL CONNECTOR PER AXIS			
FUNCTION	PINS		FUNCTION
+5VDC	1	9	Output
Phase A+	2	10	Direction
Phase A-	3	11	Auxiliary
Index +	4	12	Analog Ground
Index -	5	13	Positive Limit
Phase B+	6	14	Negative Limit
Phase B-	7	15	Home
Ground	8		

Note: Encoder inputs are on separate connectors on -E models. See the VME58 connector pin lists.

The following table defines the IO58 connections to the user definable I/O. The mating connector is a 25 pin subminiature D, AMP, Inc. part #747948-2 or equivalent.

IO58 CONNECTIONS TO USER DEFINABLE I/O			
FUNCTION	PINS		FUNCTION
Ground	1	14	Ground
I/O Bit 0	2	15	I/O Bit 1
I/O Bit 2	3	16	I/O Bit 3
+5VDC	4	17	+5VDC
I/O Bit 4	5	18	I/O Bit 5
I/O Bit 6	6	19	I/O Bit 7
Ground	7	20	+5VDC
Ground	8	21	I/O Bit 9
I/O Bit 8	9	22	I/O Bit 11
I/O Bit 10	10	23	+5VDC
+5VDC	11	24	I/O Bit 13
I/O Bit 12	12	25	Ground
Ground	13		

CON58 CONNECTOR KIT

The CON58 connector kit is a mating connector and hood for connecting the VME58 to driver modules, limit switches, etc. No cable is included. It is available as an option.

CBL58 CABLE

The CBL58 is a 100 wire shielded cable 3 meters long with a connector and hood on each end. It is supplied with the IO58 and is available separately.

ORDERING INFORMATION

MODEL	AXES OF SERVO	AXES OF STEP	AXES OF FEEDBACK
VME58-4S	4	0	4
VME58-8S	8	0	8
VME58-2S2	2	2	2
VME58-2S6	2	6	2
VME58-4S4	4	4	4
VME58-6S2	6	2	6
VME58-4	0	4	0
VME58-4E	0	4	4
VME58-8	0	8	0
CBL58	All models		
CON58	All models		
IO58	All models		

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Revision C

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