Specifications:

Performance:

- Stepping accuracy: +/-0 steps of preset distance.
- Velocity accuracy: +/-0.02% of maximum rate.
- Velocity range: 0.017 steps/sec. to 1,092,267 steps/sec.
- Position Range: +/-2,147,483,647 steps.
- Acceleration range: 0.00001 steps/sec./sec. to instantaneous.

Power:

- +5 VDC, 1.7A nominal, 2.5A maximum; provided by user's VME bus back-plane.

Inputs:

- VME bus: 23 Address, 6 Address modifier, 8 Data, 11 Handshaking, 7 interrupt, VME bus compatible.
- Other inputs: Home, CW and CCW limit; 6 trigger Bits, 3 Jog inputs, external clock input. All TTL compatible. Configurable to interface with Model 852 Joystick for interactive manual control.
- Encoder: TTL compatible two phase incremental optical encoder with Z channel. Single ended or differential drive.

Outputs:

- Differential drive Step and Direction: 0.75V max. low, 3.5V min. high, +/-60 mA.
- TTL Step and Direction: 0.5 max. low, 2.5V min. high. High level source -400 uA, low level sink 8 mA max.
- Open collector CW and CCW Step: - 300 mA at up to 40V max. sink.
- Other outputs (including 2 user-programmable): 0.75V max. low, 3.5V min. high, +/-60 mA.

Environmental:

Operating:

32 to 130 degrees F (0 to 55 C), 0-95% humidity, non-condensing.

Storage:

-22 to 185 degrees F (-30 to 85 C)

Physical Dimensions:

Size:

Non-expanded bus, double height VME board, double wide panel takes two card guide slots, but only one plugs into the VME backplane.

6.3" D x 1.58" W x 10.25" H (16.0 cm x 4.0 cm x 26.0 cm)

Weight:

1.25 lb (0.6 kg) Net, 3.0 lbs (1.4 kg) Shipping

Inputs and Outputs

There are four external connectors on the 1830 indexer, three located on the top board edge and the VMEbus P1 connector. The VMEbus P2 connector is, not used. The three front panel connectors are: Auxiliary, Motor-Driver, and Encoder. For pinout listings of these connectors see Appendix C.

The electrical characteristics and functions described in this section use the term LS TTL equivalent load. This means an input at a TTL high level (2.0 volts to 5.5 volts) will sink 20 microamps of current, and an input at a TTL low level (0.8 volts to 0 volts) will source 0.4 milliamps of current.

The following format is used to describe the three front panel connectors' signals.

SIGNAL (DIRECTION WITH RESPECT TO THE 1830 INDEXER)
ACTIVE STATE (omitted if this is undefineable)

Paragraph describing the signal's function.

Description of the signal's electrical characteristics.

The four connectors to be described, in the order of their description, are the AUXILIARY connector, the ENCODER connector, the MOTOR/DRIVER connector, and the VMEbus P1 connector.

AUXILIARY CONNECTOR

The AUXILIARY connector is a 25-pin "D" header. All outputs are 3.7 volts nominal, 60 milliamp maximum sink

or source, short-circuit protected, unless otherwise noted. Inputs are two LS TTL equivalent loads or less with 3.3 Kohm pullups and 0.1 microfarad noise filter capacitors to ground, unless otherwise noted.

SHUTDOWN IN (INPUT)
ACTIVE LOW

Activating this input can cause the motor to shutdown. This input must first be enabled via a command to the indexer, "enable SHUTDOWN IN." If the enabling command is not issued activating SHUTDOWN IN will have no effect. If one issues the command "turn on/off the remote power shutdown" and this input has been enabled the command will have no effect. Thus, control over the remote power shutdown output bit (SHUTDOWN on the MOTOR/DRIVER connector) belongs exclusively to either this input or the aforementioned command, not to both at the same time.

CW LIMIT (INPUT)
ACTIVE HIGH

Extreme mechanical limit stop. Activation of this input causes the indexer to stop any motor motion in the clockwise direction within 200 microseconds. The signal must remain active for a minimum duration of 75 microseconds.

This input may be configured via an on-board switch to be isolated or non-isolated. For isolated operation, the input must provide 10 mA at 3V for logic high for the limit to be considered "not active." If the input is not present (open, or low level), the motor will stop if moving clockwise. The "CW Opto Return" pin should be used in this isolated operation.

For non-isolated operation, this input may be wired to a normally closed limit switch of suitable contact rating. The polarity, normally closed, is "fail safe" in that an open connection causes the motor to stop if moving clockwise. An on-board switch is provided to bypass this input if no limit switch is connected to the input.

CCW LIMIT (INPUT)
ACTIVE HIGH

Same as CW LIMIT except it affects motion in the counterclockwise direction.

HOME LIMIT (INPUT)
ACTIVE HIGH OR LOW

This input is not used to stop motion as the CW and CCW LIMIT inputs are. It identifies a "HOME position" that may be used as a reference point. For example, exercising the command "go to the HOME limit switch" will cause the indexer to search for the HOME limit switch. This input is shared with the HOME ENABLE input on the ENCODER connector and, therefore, will be interpreted as the HOME ENABLE signal if a closed loop Home command being performed.

This input is not switch defeatable.

TRIGGER #1 and #6 (INPUT)
ACTIVE HIGH EDGE

These are user defined inputs. There are several commands that can be issued to the indexer that pertain to these inputs, such as "wait for trigger 1 to go active." These are "high-speed" inputs, response will be within 200 microseconds for #1 and 400 microseconds for #2. To assure proper operation, the input signal should be held high for 1 millisecond.

May be connected to a normally-closed limit switch like those connected to the CW and CCW LIMITs (non-isolated).

TRIGGER #2-#5 (INPUT)
ACTIVE HIGH OR LOW LEVEL

These are user defined inputs. Unlike TRIGGERs #1 and #2, TRIGGERs #2-#5 are not "high-speed" inputs, they are "low-speed" inputs. They may be used with the command "wait for trigger X to go active high (or low)." The worst case response to them is 3 milliseconds. The signal must be active for at least 4 milliseconds to ensure proper response.

The active sense of these inputs is determined by the user.

JOGPOS, JOGNEG AND JOGLO (INPUTS)
ACTIVE LOW

These inputs have two sets of definitions selected via commands to the indexer. They are level sensitive inputs. Refer to the "Jog Input" section under the heading "Operation" for a complete description of all the combinations of these inputs. These inputs are polled as the lowest priority inputs and may take in excess of 30 msecs if the 1830 is busy. They are meant to be used with manually activated switches, or with the Compumotor Model 852 Joystick.

EXT CLK (INPUT)

This input gives the user a way to provide a variable frequency clock input to the rate multiplier via a command to the indexer. A TTL signal is required at this input. The pulse width of the resulting motor steps will be equal to the period of this input.

PROGRAMMABLE OUTPUTs #1 and #2 (OUTPUT)
ACTIVE LOW OR HIGH

These outputs are user defineable outputs via commands to the indexer, such as "set programmable output 1."

+5 VOLTS (OUTPUT)

Five volt supply. This supply voltage is connected to the VMEbus +5 volts via a one ohm resistor. It is limited to 250 milliamps.

SHIELD

Connected to the front panel chassis ground via a conductive shell on the auxilliary "D" connector. Provides a SHIELD GROUND point for external cables coming into the "D" bulkhead connector without splitting that wire out, if that shield is not grounded elsewhere.

ENCODER

The ENCODER connector is a 25-pin "D" header. All outputs are capable of driving twenty LS TTL equivalent loads, unless otherwise noted. Inputs are two LS TTL equivalent loads or less with 3.3 Kohm pullups and a 0.1 microfarad noise filter capacitor to ground, unless otherwise noted.

CH. A+ and B+ (INPUT)

Refers to 90 degree out of phase signals that are normally provided by incremental encoders.

High impedance (100k ohm nominal) input from one phase of a quadrature encoder signal. Normally a TTL level compatible signal.

CH. A- and B- (INPUT)

High impedance (100k ohm nominal) input optionally connected to a complementary output of a quadrature encoder signal. Should be left unconnected if this input is not used or not required.

CH. Z+ (INPUT)

Identical to CH. A+ (above) except that this input applies to the HOME channel of the encoder signal.

CH. Z- (INPUT)
ENCODER-15

Identical to CH. A- (above) except that this input applies to the HOME channel of the encoder signal.

HOME ENABLE (INPUT)
ACTIVE HIGH

This signal is used with systems having Channel Z connected to a rotary encoder. This input marks the encoder revolution in which the HOME bit from CH. Z is valid.

This input is usually connected to a normally closed limit switch of suitable contact rating. This input is shared with the HOME LIMIT input on the AUXILIARY connector and therefore cannot be used if the HOME LIMIT input on the AUXILIARY connector is being used.

STEP OUT (OUTPUT)
ACTIVE HIGH

STEP output from the quadrature detector. This output can be used to monitor encoder pulses after the quadrature detector has conditioned the quadrature input signals. The encoder circuitry is a times four detector, therefore, four pulses will be seen for every line of the encoder. Pulses are nominally 229 nanoseconds wide with a maximum repitition rate of 4.37 MHz.

DIRECTION OUT (OUTPUT)

DIRECTION output from the quadrature detector. This output can be used to track the direction of the pulses coming out of

STEP OUT (above). A switch on the 1830 board inverts the polarity of this signal.

+5 VOLTS (OUTPUT)

This supply voltage is connected to the VMEbus +5 volt signal via a one ohm resistor. It is limited to 250 milliamps of current.

SHIELD

Connected to front panel chassis ground via o conductive shell on the auxilliary "D" connector. This line provides a shield ground point for an external cable coming into the "D" connector, if that shield is not grounded at the encoder or elsewhere.

MOTOR/DRIVER

A 25-pin "D" header. Outputs are 3.7 volts nominal, 60 milliamp maximum sink or source, short circuit protected, unless otherwise noted. Inputs are two LS TTL equivalent loads with 3.3 Kohm pullup resistors and 0.1 microfarad noise filter capacitors to ground, unless otherwise noted. Returns for the following outputs are differentially driven, they are not grounds, unless othewise noted.

STEP (OUTPUT)
ACTIVE HIGH

Step pulse to Motor-Driver. Pulse width is a function of chosen velocity range with minumum width equal to 229 microseconds at a maximum repitition rate of 2.18 megahertz. Pulse width is always one half the period of the maximum frequency out for the chosen velocity range. (Velocity ranges are a function of move definitions and of velocity-streaming mode definitions.)

DIRECTION (OUTPUT)

This signal is high when motion in the CW direction is expected and low when motion in the CCW direction is expected.

TTL STEP AND DIRECTION (OUTPUT)

These signals are the same as STEP and DIRECTION except that they are LS TTL outputs.

REMOTE SHUTDOWN (OUTPUT)
ACTIVE HIGH

Compumotor drives will turn off current to the motor's windings when this signal goes active. The return for this output is signal ground.

CW STEP (OUTPUT)
ACTIVE LOW

Same as STEP output except active only for clockwise motion. This output is intended for driving non-Compumotor drives.

This output is an open-collecter driver. A maximum pullup voltage of 40 volts may be used and it will sink a maximum of 300 milliamps.

CCW STEP (OUTPUT)
ACTIVE LOW

Same as STEP output except active only for counterclockwise motion. This output is intended for driving non-Compumotor drives.

This output is an open-collector driver. A maximum pullup voltage of 40 volts may be used and it will sink a maximum of 300 milliamps.

MOTOR/DRIVER +5 VOLTS (OUTPUT)

This supply voltage is connected to the VMEbus +5 volt signal via a one ohm resistor. It is limited to 250 milliamps of current.

SHIELD

Connected to front panel chassis ground via a conductive shell on the auxilliary "D" connector. Provides a shield ground point for external cables coming into the "D" bulkhead connector without splitting that wire out.

VMEbus P1

This connector is the main VMEbus connector. All loading, drive capabilities, and timing of signals on this connector conform to the VMEbus specifications as outlined in the VMEbus Manual Rev. B." This publication is available from:

Signetics Corporation
P. O. Bqx 9052
811 East Arques Avenue
Sunnyvale, CA 94086

Ask for publication SMMAN6000. Chapters 2, 4, and 7 and Appendices A, B, C, and E of the above publication describe in detail the requirements of all of the defined VMEbus signals on the P1 connector. The following VMEbus signals are used on the 1830 Indexer P1 connector:

D01/ through D07/	Eight bit data bus
A01/ through A23/	Twenty bit address bus
DS0/ and DS1/	Data strobe lines
AS/	Address Strobe
AM0 through AM5	Six address modifiers
WRITE/	READ/WRITE signal
IRQ7/ through IRQ1/	Seven Interrupt lines
SYSRESET/	System reset line
DTACK/	Data transfer acknowledge
BERR/	Buss error signal
LWORD/	Long word signal
IACK/	Interrupt acknowledge
IACKIN/	Daisy chain IACK in
IACKOUT/	Daisy chain IACK out

1830 COMMAND DESCRIPTIONS

Following is a list of the commands that can be issued to the 1830 Indexer. Each of the commands is a single binary byte (represented here by hex numbers), giving a maximum of 256 commands. You will note that not all of the commands have been defined. Undefined commands will be ignored. Some commands require additional bytes, called parameter bytes, in order to completely specify the command.

Command list by command number (in hex)

The format of the list of commands is (horizontally),

1.) the command number (in hex),
2.) the number of parameter bytes required (in hex), and
3.) the command's definition.

Cmd	Param	Description
00	0	Null command, does nothing, page 69
01	1	Interrupt "X", page 69
08	1	Write "X" to the user defined status bits, page 69
09	1	Set user defined status bit number "X", page 70
0A	1	Clear user defined status bit number "X", page 70
0B	1	Set programmable output bit number "X", page 71
0C	1	Clear programmable output bit number "X", page 71
0D	1	Write "X" to the programmable output bits, page 71
0F	3	Define bit "X" to indicate state "Y", page 72
10	1	Disable/Enable the JOG inputs, page 74
11	1	Define JOG input functions, page 74
12	1	Turn off/on remote power shutdown, page 75
13	1	Disable/enable the "remote shutdown in" bit, page 76
14	1	Set CW motion equal to +/-, page 76
18	1	Turn off/on post-move position maintenance, page 77
19	1	Turn off/on move termination on stall detect, page 78
20	3	Repeat the following "X" commands "Y" times, page 78
21	1	Repeat the following "X" commands until a CONTINUE is received, page 79
28	1	Wait for a CONTINUE, page 79
29	4	Wait "X" milliseconds, page 79
2A	2	Wait "X" seconds, page 80
2B	2	Wait "X" minutes, page 80
2C	2	Wait for TRIGGER "X" to go active, page 81
2E	4	Define the absolute open-loop postion as "X", page 81
2F	4	Define absolute closed-loop position, page 82
30	0	Define present position as the absolute zero position, page 82

31	A	Define default velocity & default acceleration, page 83
32	1	Perform the default move (trapezoidal continuous), page 84
33	4	Go to relative position "X" at default velocity and acceleration, page 84
34	4	Go to absolute position "X" at default velocity and acceleration, page 84
35	4	Go to relative encoder position "X", page 85
36	4	Go to absolute encoder position "X", page 85
38	4	Define HOME location (open loop), page 86
38	4	Define HOME location (closed loop), page 89
39	1	Go HOME at the default velocity and acceleration, page 90
3A	1	Go to encoder HOME at the default velocity and acceleration, page 91
40	1	Perform move number "X", page 92
41	1	Perform sequence buffer "X", page 92
42	0	Perform the velocity streaming buffer, page 92
48	0	CONTINUE (perform the next command), page 93
50	0	Enter open loop indexer mode, page 93
51	6	Enter velocity-distance streaming mode , page 93
52	8	Enter velocity-time streaming mode , page 95
70	0	STOP motion, page 97
71	0	Discontinue the sequence buffer, page 98
72	0	Suspend the sequence buffer; wait for a CONTINUE to resume, page 98
73	0	Discontinue any singular command currently being performed, page 98
74	3	STOP motion when TRIGGER "X" goes active, page 99
75	3	Discontinue the sequence buffer when TRIGGER "X" goes active, page 99
76	3	Suspend seq. buffer when TRIGGER "X" goes active; wait for CONTINUE, page 100
77	3	Discontinue any singular command when TRIGGER "X" goes active, page 101
78	0	KILL motion, page 102
79	0	KILL the sequence buffer, page 102
7A	0	KILL current sequence singular command; wait for a CONTINUE, page 102
7B	0	KILL the velocity streaming buffer, page 102
7C	3	KILL motion when TRIGGER "X" goes active, page 103
7D	3	KILL the sequence buffer when TRIGGER "X" goes active, page 103
7E	3	KILL current sequence singular command when TRIGGER "X" goes active; wait for a CONTINUE, page 104
7F	3	KILL the velocity streaming buffer when TRIGGER "X" goes active, page 105
80	0	Request position relative to the beginning of the cur-

		rent move, page 106
81	0	Request position relative to the end of the current move, page 106
82	0	Request position relative to the HOME limit switch, page 107
83	0	Request position relative to the absolute zero position, page 108
84	0	Request current direction, page 109
85	0	Request current velocity, page 109
86	0	Request current acceleration, page 110
88	0	Request current move status, page 111
89	0	Request state of the limit switches, page 112
8A	0	Request state of the HOME limit switch, page 113
8B	0	Request direction of travel, page 113
8C	0	Request whether motor is moving or not moving, page 114
8D	0	Request whether motor is at constant, nonzero velocity or not, page 114
8E	0	Request whether motor is or is not accelerating, page 115
8F	0	Request whether motor is or is not decelerating, page 115
90	0	Request present mode, page 116
91	1	Request move parameters for move number "X", page 117
92	1	Request commands stored in the sequence buffer, page 117
93	0	Request state of the move definitions (complete or incomplete), page 118
94	0	Request state of the TRIGGER inputs (2-5), page 119
95	0	Request state of the JOG inputs, page 120
96	0	Request the state of the Channel Z home input, page 121
97	0	Request the state of the programmable output bits, page 121
98	0	Request relative encoder count, page 122
99	0	Request relative error from desired closed-loop position, page 122
9A	0	Request absolute encoder count, page 123
9B	0	Request slip detect status, page 124
9C	0	Request motor pulse to encoder pulse ratio, page 125
9D	0	Request motor resolution, page 126
9E	0	Request backlash sigma (motor steps), page 126
9F	0	Request position maintenance alg., const., and max. velocity, page 127
A0	1	Interrupt at the start of the next move, page 128
A1	1	Interrupt at the start of every move, page 128
A2	1	Interrupt at constant nonzero velocity of the next move, page 129
A3	1	Interrupt at constant nonzero velocity of every move, page 129
A4	1	Interrupt at the next end of motion, page 130
A5	1	Interrupt at every end of motion, page 130
A6	1	Interrupt on next stall detect, page 130
A7	1	Interrupt on every stall detect, page 131
A8	1	Interrupt the next time the motor hits

		the + limit, page 131
A9	1	Interrupt every time the motor hits the + limit, page 132
AA	1	Interrupt the next time the motor hits the - limit, page 132
AB	1	Interrupt every time the motor hits the - limit, page 132
AC	2	Interrupt on TRIGGER "X" active, page 133
AF	0	Inhibit all of the above interrupts, page 133
B0	4	Define motor pulse to encoder pulse ratio, page 133
B1	4	Define motor resolution, page 134
B2	4	Define backlash sigma (motor steps), page 135
B3	7	Define position maintenance alg., const., and max. velocity, page 135
B4	4	Define the number of rotor teeth, page 136
B5	4	Define the deadband region in encoder pulses, page 137
C8	E	Definemove"X,"asarelative trapezoidal move, page 138
CB	E	Define move "X" as absolute trapezoidal move, page 139
CE	B	Define move "X" as a continuous move, page 142
D4	E	Define move "X," define it as a relative, closed-loop move, page 143
D5	E	Define move "X," define it as an absolute, closed-loop move, page 146
D6	4	Define the start/stop velocity, page 148
D7	1	Delete move "X", page 148
D8	0	End definiton of sequence buffer, page 148
D9	1	Begin definition of sequence buffer "X", page 149
DA	1	Delete sequence buffer "X", page 149
E0	C	Place data into the velocity-distance buffer, page 150
E1	E	Place data into the velocity-time buffer, page 151
E2	0	Request # of free bytes in velocity-streaming/sequence buffer, page 152
EE	5	Define command to be executed during the velocity streaming buffer. (or Define bogus velocity streaming value), page 153
FD	0	Request software part number and revision, page 154
FF	0	Perform the test switch function, page 155