



This article was first published in "Z-100 LifeLine" issue #77.



Mitsubishi M2896-63-02U 8" Floppy Drive

Mitsubishi Electric Model M2896-63 Eight Inch Flexible Drive

By Steven Vagts

Source: Zenith Data Systems
Z-207-6 OEM Manual

General Description:

The Mitsubishi M2896 Flexible Disk Drive is a half-height, double-sided, disk drive using a high-performance, standard 8-inch disk.

The drive employs two magnetic heads for reading and writing on one or both sides of the media at single or double density.

It is plug-compatible to the Industrial Standard interface with the same options as the Shugart SA850/850R.

The drive provides a stabilized, soft media contact by using an entirely new type of circular gimbal spring suspension in the mechanism for holding the magnetic heads with lower loading pressure. Thus, excellent read/write operation and long service life are offered. This mechanism significantly reduces the affects of jacket deformation or variations in thickness, thereby stabilizing read and write performance.

Disk quality variation has negligible affect on the drive's performance because of large window timing and off-track margins and wide environmental temperature and humidity ranges.

The magnetic read/write head cores consist of Manganese-Zinc ferrites, enabling higher performance. The heads require less or no write pre-compensation, enabling interchange ability with IBM systems.

The head loading mechanism uses a closed-loop electronic damping system employing a magnetic sensor. The magnetic heads load on the media's surface so softly that almost no scratching is caused by repeated loading and unloading (tap-tap). The heads are unloaded for both sides during waiting, eliminating unnecessary contact with the media.

With half-height thickness and reduced depth, two drives can be mounted in a standard 8" FDD space.

The drive has a brush-less and belt-less direct-drive DC spindle motor with no AC power supply, for simpler maintenance.

	Single Density	Double Density
Performance Specifications:		
Unformatted Memory		
Disk (kilobytes)	800	1600
Surface (kilobytes)	400	800
Track (bytes)	5208	10416
Formatted (bytes/sec)	128	256
Sectors	x 26 sectors	
Disk (kilobytes)	499.2	998.4
Surface (kilobytes)	249.6	499.2
Track (bytes)	3328	6656
Transfer Rate (kbits/sec)	250	500
Avg Latency Time (msecs)		83
Access Time (milliseconds)		
Track to track		3
Average (includes 3ms step time & settling time)		91
Settling Time		15
Head-loading Time		35
Motor-start Time (ms)		500

Functional Specifications:		
Record Density (bit/inch)	3408	6816
Magnetic Flux Inversion		
Density (FCI)	6816	6816
Encoding Method	FM	MFM
Track Density (tk/inch)		48
Number of Cylinders		77
Number of Tracks		154
Number of Heads		2
Rotational Speed (rpm)	360 ±3%	
(instantaneous)		
Rotational Period (msecs)	166.7 ±2%	
Index		1

Physical Specifications:

DC Power Requirements	
+ 5 Volt	+ 5V ±5%, 0.8A typical 1.0A maximum
+24 Volt	+24V ±10%, 0.8A typical 1.0A maximum
During motor start	1.3A max (typical 10ms)

Operating Environment

Ambient Temperature	41 to 109°F (5 to 43°C)
Relative Humidity	20 to 80%
(Max Wet Bulb Temp)	84°F (29°C)
Vibration	0.25g (10 to 100 Hz)

Non-operating Environment

Ambient Temperature	-14 to 122°F (-10 to 51°C)
Relative Humidity	20 to 80% (w/o condensation)
Vibration	2.0g (10 to 100 Hz)
Heat Dissipation	79 BTU/hr typ. (23 watts)
Physical Dimensions	(except for front panel)
Height	2.25" (57 mm)
Width	8.55" (217 mm)
Depth	12.4" (315 mm)
Front Panel Dimensions	2.25 x 8.55 x 0.39" (57 x 217 x 10 mm)
Weight	7.8 lbs (3.5 kg)

Reliability Specifications:

MTBF	> 10,000 power on hours
MTTR	30 minutes
Unit Life	5 yrs or 20,000 hrs of use
Media Life	
Rotational Life	> 3.5 x 10 ⁶ pass/track
Tap-tap	> 10 ⁵ on the same spot
Error Rate	
Soft Read Error	10 ⁻⁹ bit, with two retries
Hard Read Error	10 ⁻¹² bit
Seek Error	10 ⁻⁶ seek

M2896 Electrical Interface

There are two electrical interfaces:

DC Power interface - Feeds power (+5 Vdc and +24 Vdc) , via the J5/P5 connector, to the circuit board and to the stepper motor that drives the mechanism for positioning the read/write heads, door-lock magnet and the spindle motor. No AC power is used.

The DC Power Connector pin arrangement is:

Power Voltage:	Pin Number:
+23 Vdc	1
+24v Gnd (return)	2
DC Ground	3
(Not Used)	4
+5 Vdc	5
+5v Gnd (return)	6

Signal interface - Transmits and receives control signals and read/write data to and from the M2896 or the host system through the J1/P1 connector. The pin arrangement is:

Signal	Signal	Ground	
Name:	Pin #:	Return	Option:
Alternate I/O	2	1	Write Current Switch
Alternate I/O	4	3	
Alternate I/O	6	5	
Alternate I/O	8	7	True Ready
Alternate I/O	10	9	Two-sided
Alternate I/O	12	11	Disk Change
-Side Select	14	13	
Alternate I/O	16	15	In Use
Alternate I/O	18	17	HeadLoad/Motor Start
-Index	20	19	
-Ready	22	21	
(Not Used)	24	23	
-Drive Select 1	26	25	
-Drive Select 2	28	27	
-Drive Select 3	30	29	
-Drive Select 4	32	31	
-Direct Select	34	33	
-Step	36	35	
-Write Data	38	37	
-Write Gate	40	39	
-Track 00	42	41	
-Write Protect	44	43	
-Read Data	46	45	
(Not Used)	48	47	
(Not Used)	50	49	

The signal interface is classified into control signals and data signals. These interface signal lines are all at TTL levels. The signal level meaning and characteristics are as follows:

TRUE (logical "0")	= VL 0v to +0.4v Iin 40ma maximum
FALSE (logical "1")	= VH +2.5v to +5.25v Iin 0ma
Input Resistance	= 150 ohms

Input Signal Lines:

The M2896 has 12 input signal lines. Of these, 9 lines are standard and 3 are options configurable by the user.

Drive Select Lines, 1 to 4: When these lines are at the logical "0" level, a multiplexed input/output line becomes active to enable the read/write operation. These 4 separate input signal lines are provided to make it feasible to connect 4 drives to one system and multiplex them to one another.

Traces DS1, DS2, DS3 and DS4 on the circuit board are used to determine the drive select line to which the individual drives should correspond to become active. These changes of trace connections are made through jumpers. The factory setting is DS1.

Side Select: This interface line is used to select which disk surface of the disk should be read or written. When this line is logical "1", the head at Side 0 is selected. A logical "0" selects the head at Side 1.

When the polarity of the side select signal is reversed, the read/write operation must be delayed 100 us (microseconds) before execution. When a write operation is completed, the side select signal polarity reversal must be delayed 720 us.

This is because the head uses a tunnel erase system, with a physical gap between the read/write head and erase head. This, in turn, causes a timing difference between the areas at the data writing operation and erasing operation on the disk surface.

This is corrected by delaying the erase current cutoff for several hundred microseconds. So, during this delay time, the head select must not be reversed.

Direction Select: When step signal pulses are given, this interface line signal controls the direction, inward or outward, in which the read/write head moves.

When this signal is logical "1", the read/write head moves toward the outside of the disk. Logical "0" moves the head in the reverse direction.

In the jumper select option, this interface line can time-share two operations:

- Direction Select during a track access operation, and
- Side Select during a read/write operation.

The line becomes effective as a Side Select signal 14 ms (milliseconds) after the track access operation is completed (after the last step signal pulse has been sent).

The Direction Select line must be reversed 1 us or more before the leading edge of the first step pulse. It must be reversed again 25 us or more after the leading edge of the last step pulse.

Step: This interface line is a pulse signal to move the read/write head in the direction defined by the Direction Select line.

Each time a signal pulse is given to the step line, the read/write head moves by one track.

This line normally maintains a logical "1" level; the step operation starts from the leading edge of a negative-going pulse (reversal from logical "1" to logical "0").

Write Gate: At logical "0", this interface line makes the write driver active, and the data given to the write data line is written on the disk surface that has been side selected. At logical "1", the line makes the write driver inactive to enable the read data logic. The verified read data, however, is not obtained during 590 us (minimum) after the write gate becomes inactive.

Write Data: This interface line receives data to be written on the disk. This line, normally at logical "1", reverses the write current at the leading edge (reversal from logical "1" to logical "0" of the data pulse (negative-going pulse) and writes data bits. This line is enabled when the write gate is at logical "0".

Head Load (alternate input option): This interface line is an option selected by the user.

When the disk is inserted and the door is closed, this line goes to logical "0" and the read/write head loads on the disk surface. The read/write operation must be performed 35 ms or more after the head load line has become active. Using this signal enables the spindle motor start/stop to be controlled. In this case, head loading must be effected with the In Use signal.

In Use (alternate input option): This interface is an option selected by the user. When this interface line is at logical "0", the front panel indicator LED lights and the door can be locked. In addition, the Drive Select "OR" the In Use signals for these functions can be used for Head Load.

When the Head Load signal is used for MOTOR START, the In Use signal can be used for Head Load.

Outside Write Current Switch (alternate input option): An option selected by the user, this line at logical "1" provides a large write current for tracks 00 to 43. Logical "0" gives a small write current for tracks 44 to 76.

The current switch is designed to reduce the read data bit shift magnitude in the inner tracks. In the standard M2896, the track number is counted and current switching is performed by an internal circuit.

Output Signal Lines:

Five standard output signal lines are available from the M2896. In addition, two output line options and six alternate output lines can be selected.

Index: This interface line is normally maintained at logical "1". Each disk turn (166.7 ms period) provides a 1 to 8 ms width output at logical "0". The Index signal indicates the start of a track on the rotating disk.

Because the index hole on the jacket is located differently on the single and two sided disks, the drive has two detectors to find the index for whichever disk is inserted.

Track 00: When this interface line is at logical "0", it indicates that the read/write head in the drive is positioned to track 00. When the selected drive output is a logical "1", it indicates that the read/write head is positioned at a location other than track 00.

Ready: When this interface line is at logical "1", the door is open or the disk is not inserted into the drive.

A logical "0" (Ready) only occurs when all of the following has been completed:

- The disk is inserted into the drive
- The door is closed
- DC power (+5 Vdc and +24 Vdc) is on
- The index hole is correctly detected
- The index is detected two or more times

When a single-sided disk is inserted, if the read/write head at Side 0 is selected, this signal is logical "0", but at Side 1 selection, logical "1" is generated. For two sided disks, logical "0" is maintained independently of side selection.

Read Data: This interface line causes the read/write head to read the data stored on the disk surface and to output raw data (data and clock synthesis) converted to a Pulse signal.

This line is normally at logical "1", but sends logical "0" (negative-going pulse) output pulses during the read operation.

Write Protect: This interface signal informs the host system that a disk with a write protect notch is inserted into the drive. Inserting a write-protected disk into the drive generates a logical "0".

When this signal is at logical "0", a write operation on the disk is prohibited even when the write gate line is active.

Disk Change (alternate output option): When a not-selected drive becomes Ready after Not Ready (door is opened during not selected) and following drive select, goes active, the line of this option goes to the logical "0" level. The line resets at the point when the Drive Select signal reverses from logical "0" to logical "1".

Two-Sided (alternate output option): This signal discriminates between two-sided or single-sided disks. A logical "0" is output if a two-sided disk is inserted.

Alternate I/O Pins: These interface pins are options selected by the user and are discussed later.

True Ready (alternate output option): When power is applied to the DC motor and the motor rotates at the rated rpm (READY condition), when the seek is completed, logical "0" occurs 23 ±5 ms from the leading edge of the last step pulse. In addition, a logical "1" is generated 10 us or less from the leading edge of the first step pulse.

Functional Operation:

Power On Sequencing: To operate the M2896, DC power must be turned on. Read/write operation must not be performed within 0.5 seconds after the DC power is turned on, to allow the disk rotation to stabilize and to become system ready.

After DC power is turned on, the read/write head is probably not correctly positioned on the track. Before a read/write operation, make sure to perform a step-out operation with the controller until the Track 00 signal is detected at the interface line to enable the read/write head to be positioned correctly.

Drive Selection: The M2896 uses a daisy chain cabling system in which multiple drives connect to a single cable. The selection of an individual drive is actuated when the Drive Select line goes active. Only the drive whose selection line is active can communicate with the host system. When multiple drives are connected, the Drive Select line at each drive must be set for a different number, or the interface output signals mutually interfere and operating errors result.

Track Accessing: The seek operation moves the read/write head inward or outward to the desired position as determined by the polarity of the Direction signal, using the Step signal to move the head. To move plural tracks, step pulses should be emitted until the heads reach the desired tracks. Head motion starts with the leading edge of a step pulse.

Side Selection: The heads located on both sides of the disk are selected by the Side Select signal. When the Side Select line is high, the Side 0 head is selected; when it is low, the Side 1 head is selected.

Read Operation: FM (for single density) or MFM (double density) is used for coding data on the disk. A sophisticated PLO data separator is recommended for data interchangeability with other systems or drives.

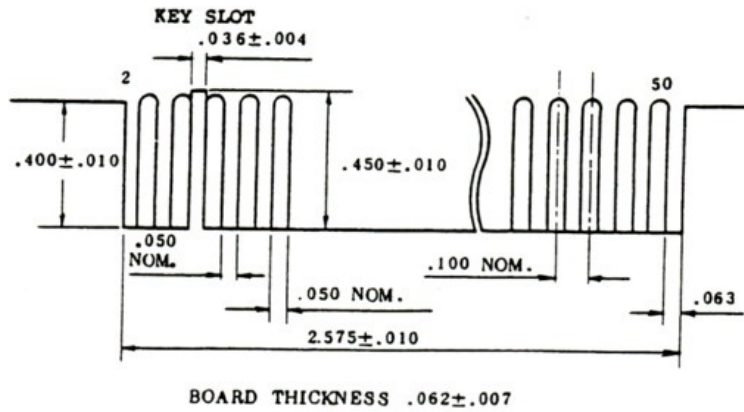
Write Operation: Either FM or MFM can be used for encoding write data. The M2896 incorporates high performance read/write heads having good contact stability between the head and disk. It is therefore unnecessary, when writing data with MFM (double density), to apply precompensation that corrects bit shift effect during write operations. But to harmonize with other precompensated systems, a maximum of 200 ns write precompensation may be applied.

Special Operation: The M2896 is provided with a Write Current switch that effectively reduces the bit shift value of read data pulses from the disk. It is also provided with a Switch Filter in the drive to generate signals that make the data separator timing margin high, even if the host system does not have an interface signal for post compensation, which compensates the read amplifier frequency band.

More specifically, the track numbers are sorted in the drive circuit so that the write current is switched at track 44 or above, and the switch filter is activated at track 60 or above.

The **Internal Write Current Switch** is activated by connecting the trace "SI" on the circuit board, which increases write current for tracks 00 to 43 and decreases it for tracks 44 to 76.

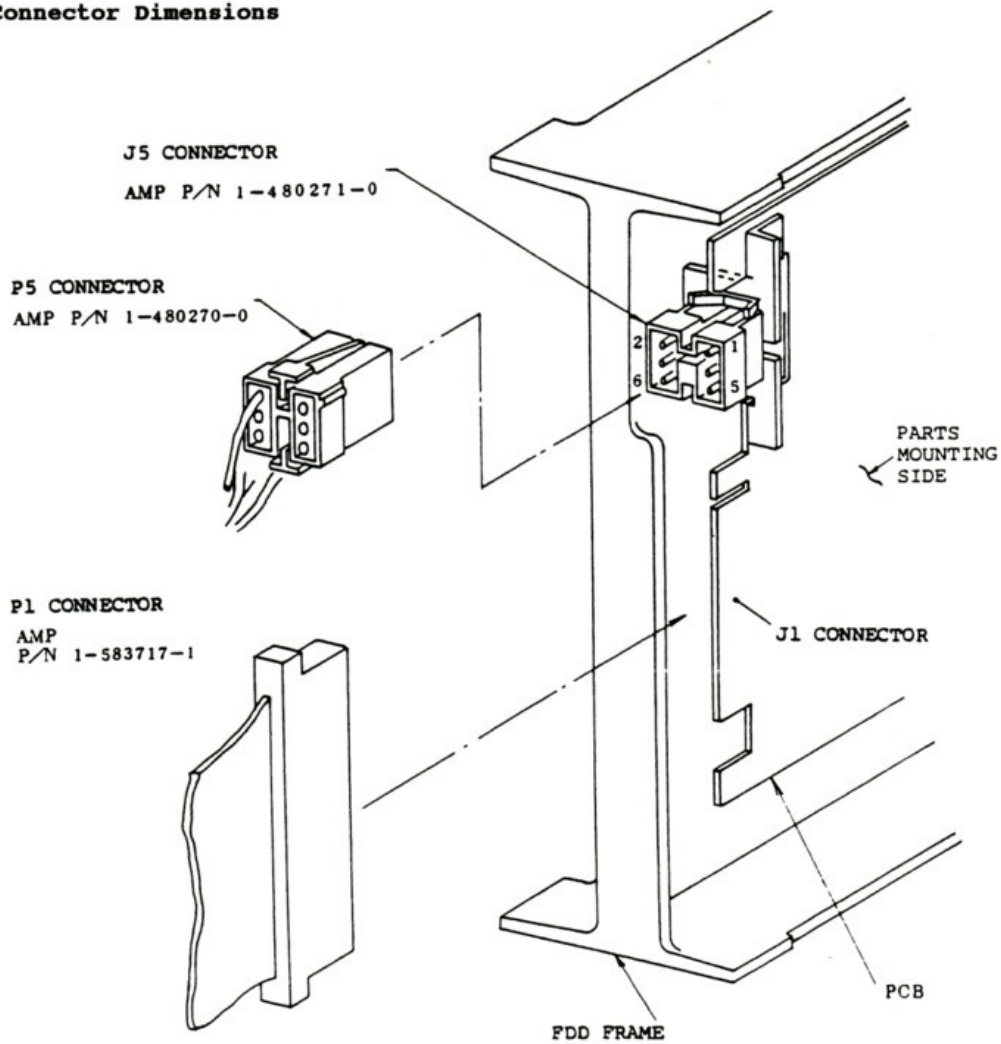
The **Internal Switch Filter** is activated by the LSI counter on the circuit board. It decreases the gain in the high area in the read preamplifier frequency bandwidth for tracks 00 to 59, and increases it for tracks 60 to 76, thereby effecting a decrease in bit shift variation.



DC Power Connector (J5/P5): is a DC power connector with six pins, attached to the printed-circuit board bracket.

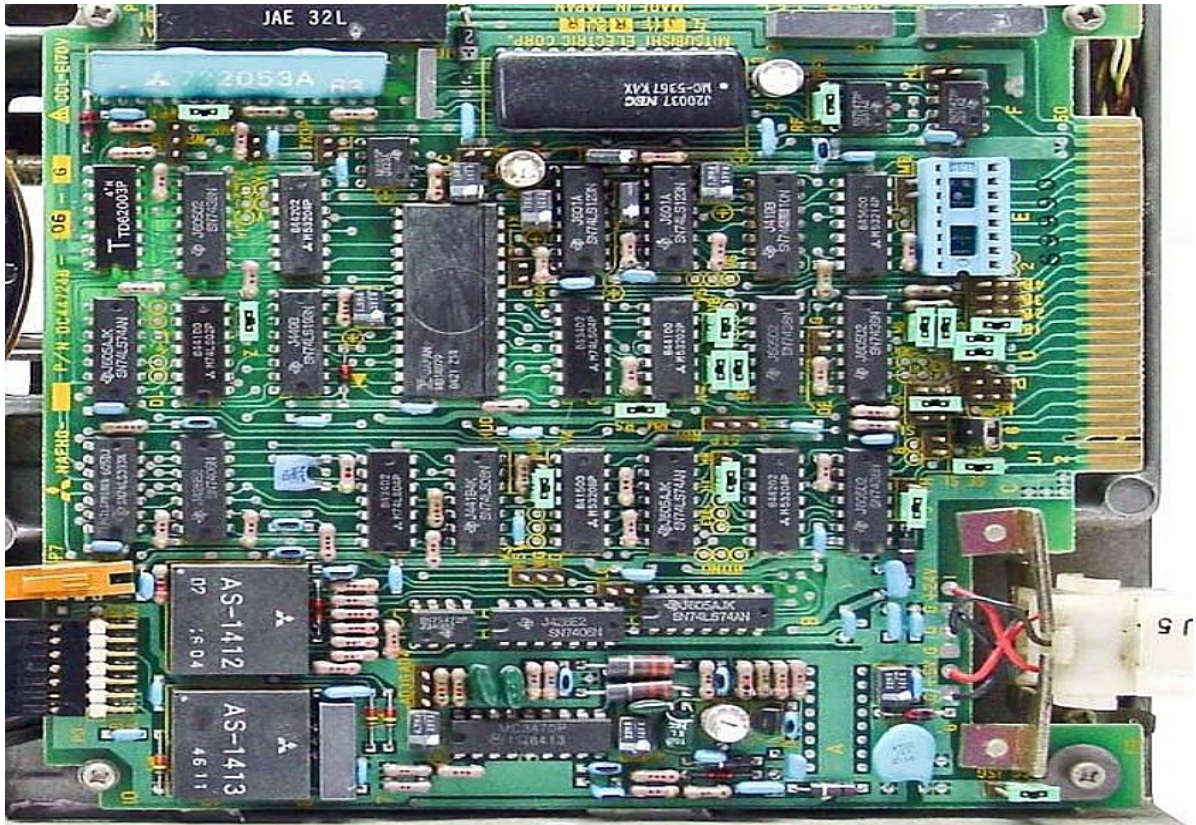
The diagram below shows the physical locations of these connectors.

J1 Connector Dimensions

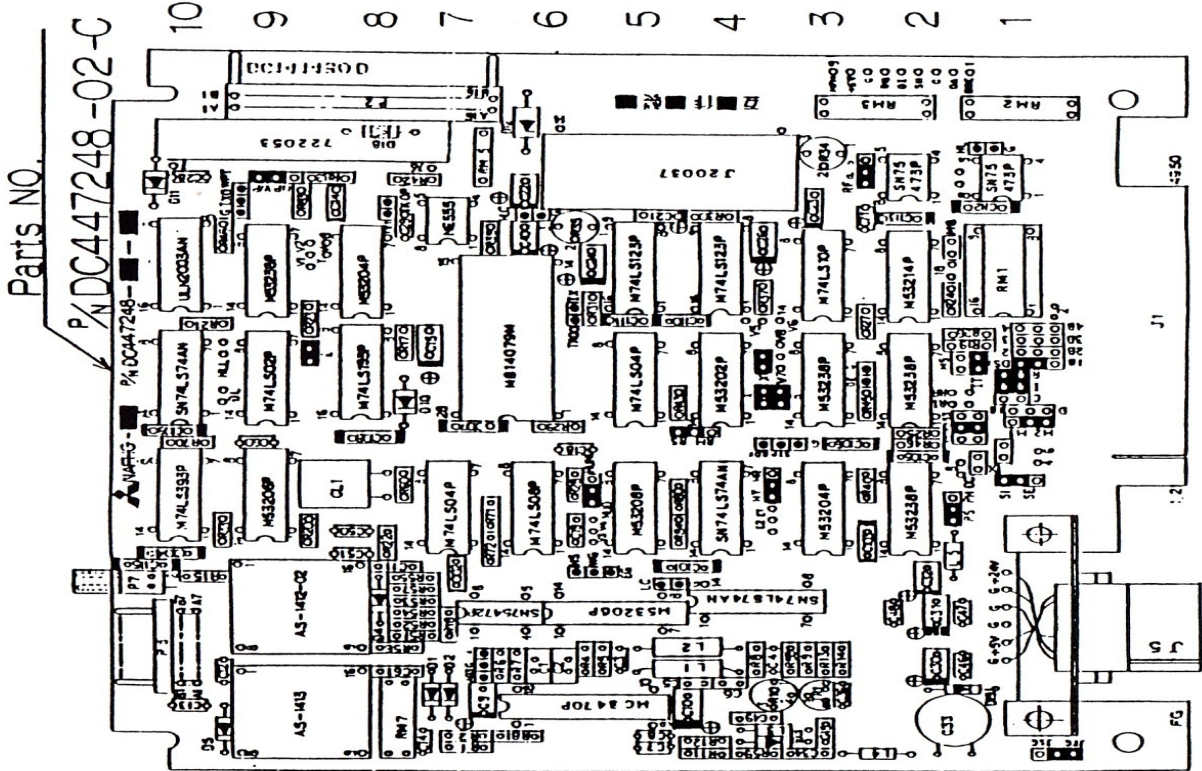


Location of Interface Connectors

Diagram 1.



Mitsubishi M2896-63-02U 8" Floppy Drive



A B C D E F

NOTE: ■ Indicates plugged

Diagram 2. Circuit Board Option Locations

Table of User CUT/ADD Trace Options:

<u>Trace Designator:</u>	<u>Location:</u>	<u>Description:</u>	<u>Factory Setting:</u>
TERMINATOR	E1	Input line terminator	Plugged
JFG	A1	Frame ground and signal ground are shorted	Plugged
JSG	A1	Frame ground and signal ground are open	Open
DS1	D1	DRIVE SELECT 1 Input	Plugged
DS2	D1	DRIVE SELECT 2 Input	Open
DS3	D1	DRIVE SELECT 3 Input	Open
DS4	D1	DRIVE SELECT 4 Input	Open
1B	D1	SIDE SELECT Option using DRIVE SELECT	Open
2B	D1	SIDE SELECT Option using DRIVE SELECT	Open
3B	D1	SIDE SELECT Option using DRIVE SELECT	Open
4B	D1	SIDE SELECT Option using DRIVE SELECT	Open
SE	C1	External WRITE CURRENT SWITCH	Open
SI	C1	Internal WRITE CURRENT SWITCH	Plugged
S	C1	"Keep Open"	Open
DC	C1	DISK CHANGE Option	Open
2S	C1	TWO-SIDED Status Output	Shorted
IT	D1	IN USE Terminator	Plugged
D	D1	Alternate Input - IN USE	Open
HI	D1	HEAD LOAD "OR" IN USE to the IN USE CIRCUIT	Open
C	D1	Alternate Input - HEAD LOAD	Open
I	D1	INDEX Output	Plugged
R	D1	READY Output	Plugged
S1	D1	SIDE SELECT Option using DIRECTION SELECT	Open
S2	D1	Standard SIDE SELECT Input	Plugged
S3	D1	SIDE SELECT Option using DIRECTION SELECT	Open
RS	D4	READY Standard	Plugged
RM	D4	READY Modified	Open
RFa	F2	"Don't Remove"	Plugged
RFb	F2	"Keep Open"	Open
MO	E1	MOTOR ON from HEAD LOAD	Open
MS	D1	MOTOR ON from DRIVE SELECT	Open
Z	D9	IN USE LED from DRIVE SELECT	Plugged
NP	F9	Allow Write when WRITE PROTECTED	Open
WP	F9	Inhibit Write when WRITE PROTECTED	Plugged
A	D4	Radial HEAD LOAD	Plugged
B	D3	Radial HEAD LOAD	Plugged
X	D4	Radial HEAD LOAD	Plugged
RI	D1	Radial INDEX	Shorted
RR	D1	Radial READY	Shorted
RI	C2	Radial INDEX	Shorted
RR	C3	Radial READY	Shorted
Y	E8	IN USE from HEAD LOAD	Open
V	E8	Door Lock from HEAD LOAD	Shorted
HLL	D10	HEAD LOAD Latch	Open
DL	D10	Door Lock Latch Option	Open
HUN	C5	HEAD UNLOAD Normal	Open
HUD	C5	HEAD UNLOAD Delay	Plugged
HR	C4	HOLD READY Output	Open
HY	C4	Standard READY	Plugged
M1	D1	Use J1 pin for MOTOR START	Open
M2	D1	Use J1 pin 18 for MOTOR START	Plugged
PS	C2	HEAD LOAD ANDED with Standard READY	Plugged
PH	C2	HEAD LOAD ANDED with HOLD READY	Open
E1	C4	"Keep Open"	Open
E2	C4	"Do NOT Cut"	Shorted
V1	E9	"Do NOT Cut"	Shorted
V2	E9	"Keep Open"	Open
V3	C5	"Do NOT Cut"	Shorted
V4	C5	"Keep Open"	Open
V5	E4	"Keep Open"	Open
V6	E4	"Do NOT Cut"	Shorted
V7	D3	"Keep Open"	Open
V8	D3	"Do NOT Cut"	Shorted

Table 1. Table of User CUT/ADD Trace Options

Physical Interface:

Electronic interfaces between the M2896 and the host system are accomplished with two connectors. The J1 connector is for signal interfaces and the J5 connector is for DC power.

Signal Connector (J1/P1): a card-edge type, 50-pin (both sides used with 25 pins per side) connector with the component side pins even numbered and the solder side pins odd numbered. There is a key slot between pin 4 and 6 to allow the use of a reverse-preventing key.

DC Power Connector (J5/P5): is a DC power connector with six pins attached to the printed circuit board bracket. Diagram 2 shows the physical locations of these connectors.

User Installation Options:

The M2896 can be modified so that the user can make optimum use of this drive in standard installations. These modifications are performed by connecting or disconnecting traces on the circuit board and/or using alternate I/O pins. Traces are connected with short-plugs and non-jumpers. The factory-installed position of the traces are shown in Table 1.

The following pages discuss the user selectable options in detail.

User CUT/ADD Trace Options:

1. Loading Heads With Drive Select "AND" Head Load Signal

In this option, loading the heads is accomplished by means of the Drive Select signal "AND" Head Load signal, therefore prolonging the life of heads and media. When the system requires the drive to perform a read/write operation, the Head Load line is made active (logical "0"). This causes the heads to load and the step motor to be fully powered.

The write or read operation must be performed 35 ms or more after the Head Load line goes active.

To perform the modification for this option, set traces as follows:

- o Short-plug "C" Short
- o Short-plug "X" Open
- o Short-plug "B" Short
- o Short-plug "A" Short

2. Loading Heads With Head Load Signal

(Selecting drive is accomplished by means of Drive Select signal)

This option enables a seek operation by drive selection without loading the heads or with the door open. In this case, as in the one above, make sure to perform the read or write operation 35 ms or more after the Head Load line goes active (logical "0"). This option is recommended because it provides longer media life.

To perform the modification for this option, set traces as follows:

- o Short-plug "C" Short
- o Short-plug "X" Short
- o Short-plug "B" Open
- o Short-plug "A" Short

3. Loading Heads with Head Load Signal

(Selecting drive is accomplished by means of Drive Select signal "AND" Head Load signal)

Head loading is accomplished by means of Head Load signals. These are independent of the Drive Select signals. This option is used for a mutual copy operation between disks in which the need for considering head load time can be eliminated and copy time can thus be reduced. Each drive remains in the head load condition for alternate input/output pins.

The read or write operation must be performed 18 ms or more after drive selection.

In this option, the "AND" logic condition of the Drive Select signals and Head Load signals represents the drive select condition.

To perform the modification for this option, set traces as follows:

- o Short-plug "C" Short
- o Short-plug "X" Short
- o Short-plug "B" Short
- o Short-plug "A" Open

4. Radial Ready

This option enables the ready line of each drive to be monitored without drive selection.

To perform the modification for this option, set traces as follows:

- For the first drive:
 - o Short-plug "R" Short
 - o Short-plug "RR" Open
- For the other drives:
 - o Short-plug "R" Open
 - o Short-plug "RR" Open
 - o Connect short-plug "R" and alternate I/O pin 4, 6, or 8.

Notes:

- To use alternate input/output pin #2, open trace "0-2" and set short-plug "SE" Open.
- The circuit relating to this modification is shown in Figure 1. on page 11.
- A stopper is controlled in the power-down mode except during the seek operation.

5. Radial Index

This option enables constant monitoring on the index line and reduces mean latency time.

To perform the modification for this option, set traces as follows:

- For the first drive:
 - o Short-plug "I" Short
 - o Short-plug "RI" Open

- For the other drives:
 - o Short-plug "I" Open
 - o Short-plug "RI" Open
 - o Connect short-plug "I" and alternate I/O pin 4, 6, or 8.

Notes:

- To use alternate input/output pin #2, open trace "0-2" and set short-plug "SE" Open.
- The circuit relating to this modification is shown in Figure 2. on page 11.

6. In Use Alternate Input (Activity LED)

When this alternate input becomes a logical "0", the activity LED on the front panel lights and the door of the drive locks.

Each condition under which the LED lights are selected by setting the short-plugs as follows:

- Plug settings to light LED with In Use "OR" Drive Select signal.
 - o Short-plug "D" Short
 - o Short-plug "IT" Short
 - o Short-plug "Y" Open
 - o Short-plug "Z" Short
- Plug settings to light LED with Head Load "OR" In Use signal .
 - o Short-plug "D" Short
 - o Short-plug "IT" Short
 - o Short-plug "Y" Short (jumper)
 - o Short-plug "Z" Open

Notes:

- Under the conditions listed above, the In Use conditions are not entered when the short-plug "D" is open. These conditions are added when the In Use switch (or Head Load latch) is used.
- The circuit relating to this modification is shown in Figure 3. on page 11.

7. Write Protection Option Use

When a disk with a write protect notch is inserted, the write protect is set so that writing is inhibited within the drive at delivery from the factory.

The modification for this option releases an inserted disk with a write protect notch from write inhibition, and informs the interface that a protected disk is inserted. This option is used to identify a special-use disk.

To perform the modification for this option, set traces as follows:

- o Short-plug "WP" Open
- o Short-plug "NP" Short

Note:

- The circuit relating to this modification is shown in Figure 4. on page 11.

8. Disk Change (Alternate Output)

When a Not-Selected drive becomes Ready after Not Ready (door is opened during Not Selected) and following Drive Select, goes active, the line of this option goes to the logical "0" level. The line resets at the point when the Drive Select reverses from logical "0" to logical "1".

To perform the modification for this option, set traces as follows:

- o Short-plug "DC" Short

9. Side Selection Using Direction Select

The side select can also be controlled by the Direction Select line.

This option provides control two ways:

- Controlling head motion direction during a seek operation, and
- Head Select control during a read/write operation.

To perform the modification for this option, set traces as follows:

- o Short-plug "S1" Short
- o Short-plug "S2" Open
- o Short-plug "S3" Open

10. Side Selection Using Drive Select

In a system using one or two M2896 drives, it is possible to separate each head and assign drive addresses to them individually. In this event, four drive select lines are used to select the four read/write heads.

To perform the modification for this option, set traces as follows:

- On both drives:
 - o Short-plug "S1" Open
 - o Short-plug "S2" Open
 - o Short-plug "S3" Short
- On the first drive:
 - o Short-plug "DS1" Short
 - o Short-plug "2B" Short
- On the second drive:
 - o Short-plug "DS3" Short
 - o Short-plug "4B" Short

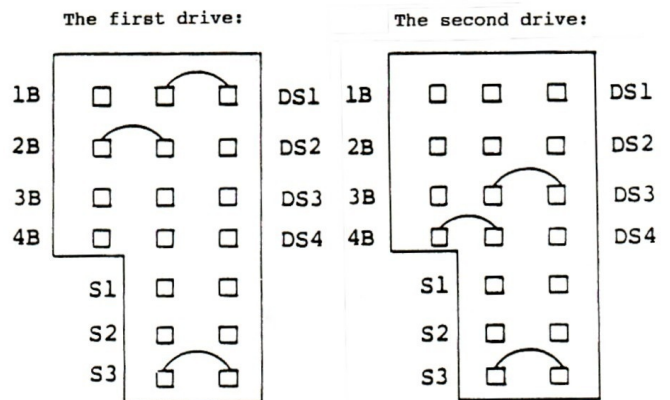


Diagram 3. Showing Short Blocks

Note: The drive select lines then perform the side select operation as follows:

- Drive Select 1 selects the first drive side 0
- Drive Select 2 selects the first drive side 1
- Drive Select 3 selects the second drive side 0
- Drive Select 4 selects the second drive side 1

11. Door Lock Latch

This option causes the door to be latched and to remain locked, under control of Drive Select, without maintaining In Use active.

When the In Use line is active (logical "0"), and the Drive Select line becomes active (logical "0"), the door is latched and a door lock condition is maintained. To release the door lock condition, make the In Use line inactive (logical "1"), and make the Drive Select line active.

To perform the modification for this option, set traces as follows:

- o Pattern "DL" Short (jumper)
- o Short-plug "D" Short
- o Short-plug "HI" Open

12. Two-Sided

This signal discriminates which type of disk (single-sided or double-sided) is inserted. A logical "0" is output for insertion of a two-sided disk.

To perform the modification for this option, set traces as follows:

- o Short-plug "2S" Short

13. Write Current Switch

By making this interface signal logical "0" for tracks 44 to 76, write current can be decreased; otherwise the current is controlled internally.

To perform the modification for this option, set traces as follows:

- o Short-plug "SI" Open
- o Short-plug "SE" Short

Note: When this option is NOT used, interface connector pin #2 can be used for an alternate input/output pin, with trace "0-2" disconnected.

14. Ready Standard/Ready Modified

This option is used to cause Ready to maintain a logical "0", when side 1 is selected while using a single-sided medium. This option is useful when Direction Select is used as Side Select.

To perform the modification for this option, set traces as follows:

- o Short-plug "RS" Open
- o Short-plug "R7" Short

15. Head Load Latch

This option is used to perform head load when the drive is not selected. When the head load is latched, it is necessary to cause the Drive Select line to be active, with the Head Load signal or In Use signal line being active (logical "0").

To perform the modification for this option, set traces as follows:

- When the Head Load signal is active and Drive Select is to be latched:
 - o Short-plug "IT" Open
 - o Short-plug "D" Open
 - o Short-plug "HI" Short
 - o Short-plug "C" Open
 - o Short-plug "X" Short
 - o Short-plug "B" Open
 - o Short-plug "A" Short
 - o Pattern "DL" Short (jumper)
 - o Pattern "HLL" Short (jumper)
- When the In Use signal is active and Drive Select is to be latched:
 - o Short-plug "IT" Short
 - o Short-plug "D" Short
 - o Short-plug "HI" Open
 - o Short-plug "C" Open
 - o Short-plug "X" Short
 - o Short-plug "B" Open
 - o Short-plug "A" Short
 - o Pattern "DL" Short (jumper)
 - o Pattern "HLL" Short (jumper)

Note: To release the head load latch, make the Head Load line or In Use line inactive (logical "1") and then select the drive.

16. Door Lock Condition

To perform the modification for this option, set traces as follows:

- Door lock with In Use "OR" Head Load signals:
 - o Short-plug "C" Short
 - o Short-plug "X" Short
 - o Pattern "V" Short (jumper)
 - o Pattern "Y" Open
- Door lock with In Use "OR" Drive Select signals:
 - o Short-plug "A" Short
 - o Short-plug "Z" Short
 - o Pattern "V" Open
 - o Pattern "Y" Short (jumper)

17. Motor Start

The spindle motor is normally actuated when the DC power supply is ON and a disk is inserted, however the short-plugs may be used to set the following three conditions.

Read/write operation should not be performed during the 500 ms interval required between Motor Start and READY.

To perform the modification for this option, set traces as follows:

- Motor Start with Head Load signal:
 - o Short-plug "MO" Short
 - o Short-plug "MS" Open
- Motor Start with Drive Select signal:
 - o Short-plug "MO" Open
 - o Short-plug "MS" Short
- Motor Start with Head Load "AND" Drive Select signal:
 - o Short-plug "MO" Short
 - o Short-plug "MS" Short

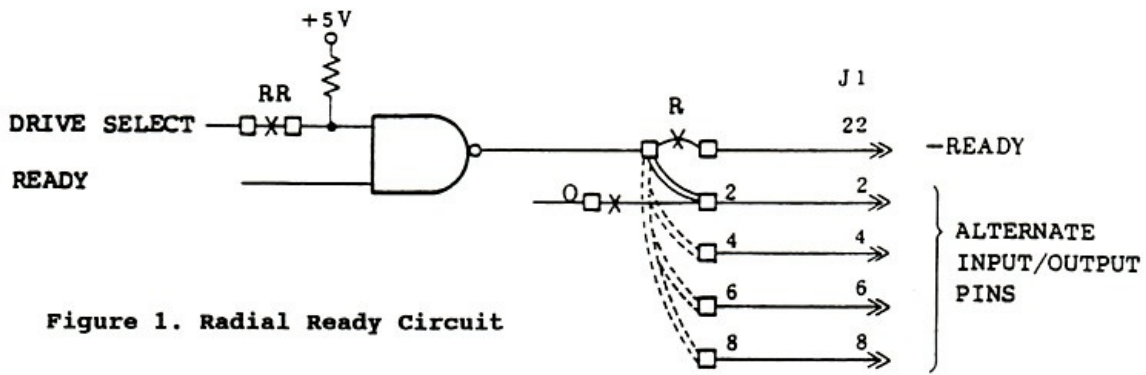


Figure 1. Radial Ready Circuit

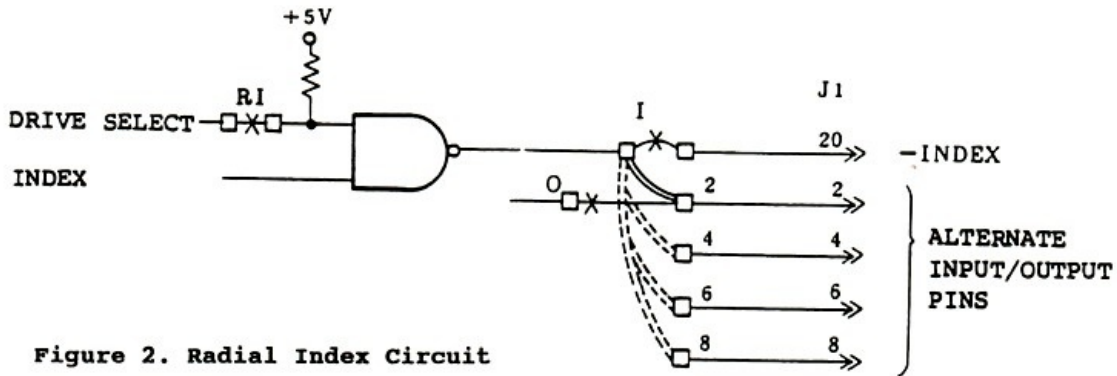


Figure 2. Radial Index Circuit

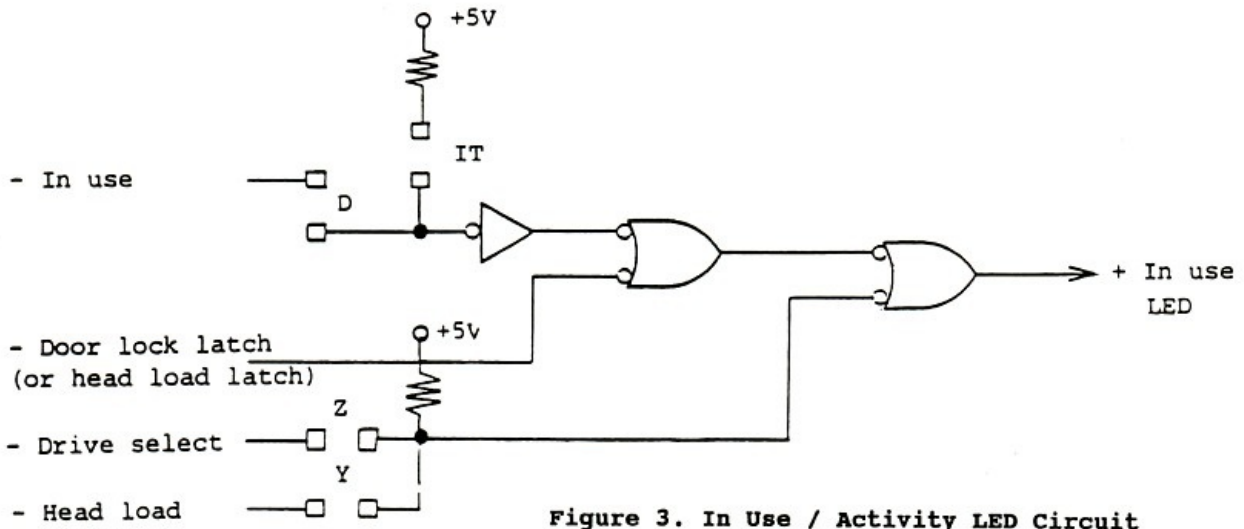


Figure 3. In Use / Activity LED Circuit

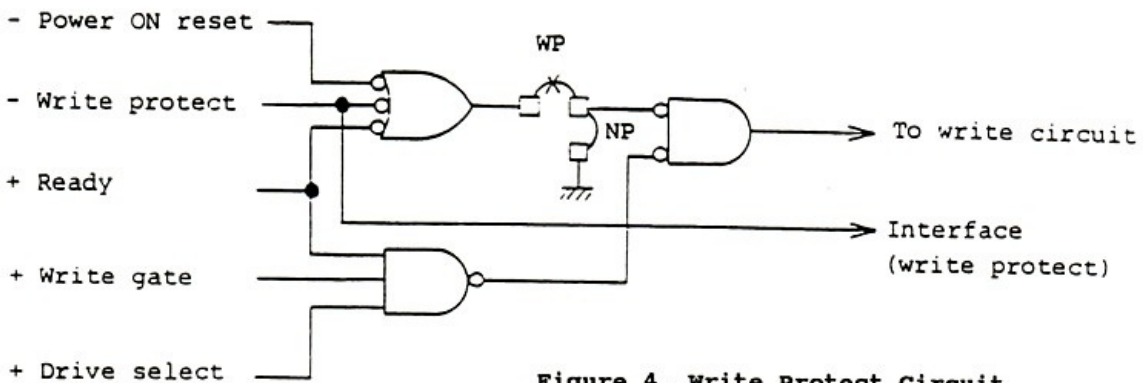


Figure 4. Write Protect Circuit

Cabling Method and Input Line Termination

The M2896 cable connection uses a daisy chain system. Ribbon cables or twisted-pair cables are connected with multiple connectors, enabling a maximum of 4 drives to be connected. The drives are controlled in a multiplex system using Drive Select lines so that any one drive can be accessed.

The M2896 input signal lines must be terminated in a maximum of 8 lines, if alternate input is included, except for the Drive Select lines. In order to operate the drive correctly, the termination must be at the drive connected to the end of the interface cable farthest from the host system.

The M2896 allows a detachable resistor module to be mounted on its printed-circuit board to terminate these input signal lines. Factory installed, this terminator must be removed from all the drives except the one that connects to the end of the interface cable.

The termination may also be ended at an unused connector at the cable end using a resistor pack. To do so, connect the input signal lines to 150 ohm, 1/4 watt resistors, and tie the other lead to +5 Vdc. In this external termination method, the resistor must be mounted at the last connector on the cable.

Mounting Recommendations

The M2896 can be installed in the vertical (door opens to the right or left), horizontal (door open upward), or slanted (w/i 10° of vertical or horizontal) positions. Ensure adequate air flow is maintained at all times.

I hope you found this article helpful. If you have any questions or comments, please email me at:

z100lifeline@swvagts.com

Cheers,

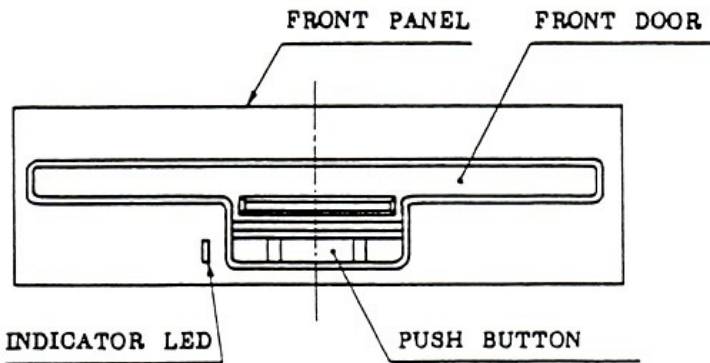
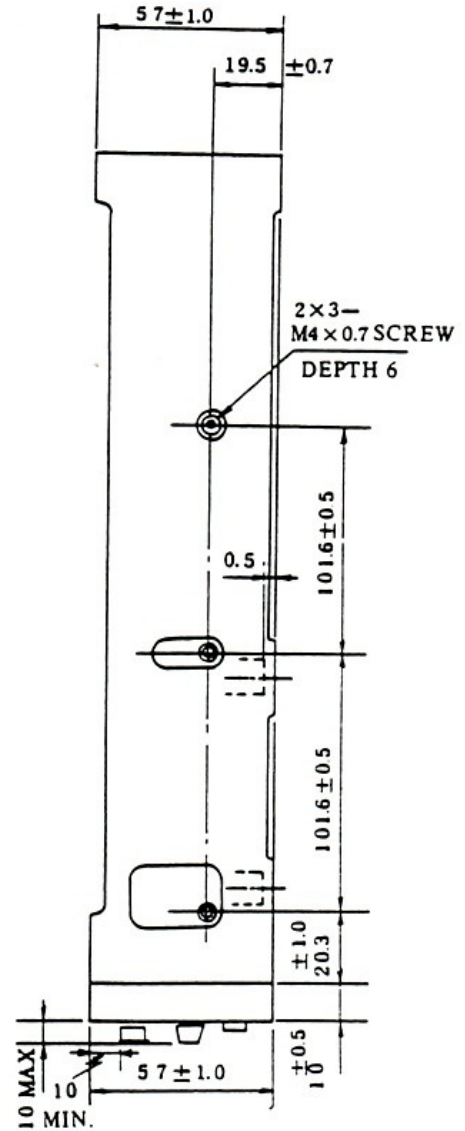
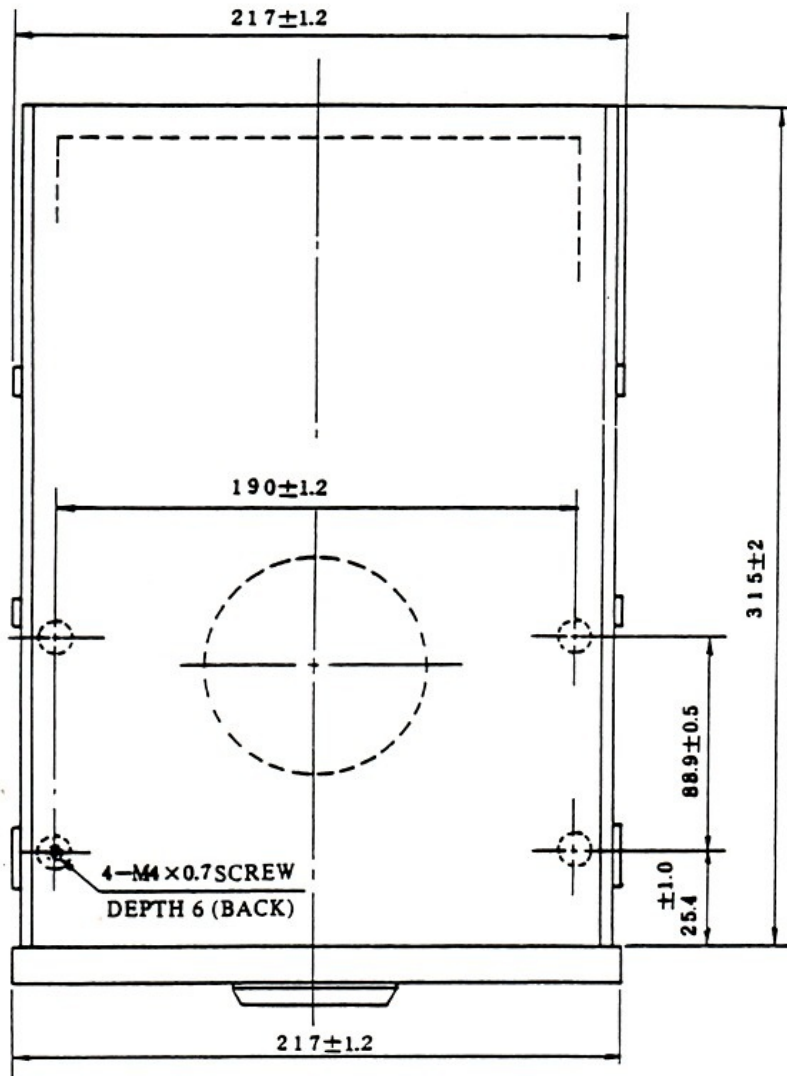


Steven W. Vagts





MitSubishi M2896 Drive Dimensions



* Position of knob when front door is opened.

Parts	Color
Front Panel	Ivory-white
Front Door	
Push Button	