Post Office Box 242
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Tel: 408/727-0100 Fax: 408/727-2100
www.fjaind.com

Giving Robotics A Hand©

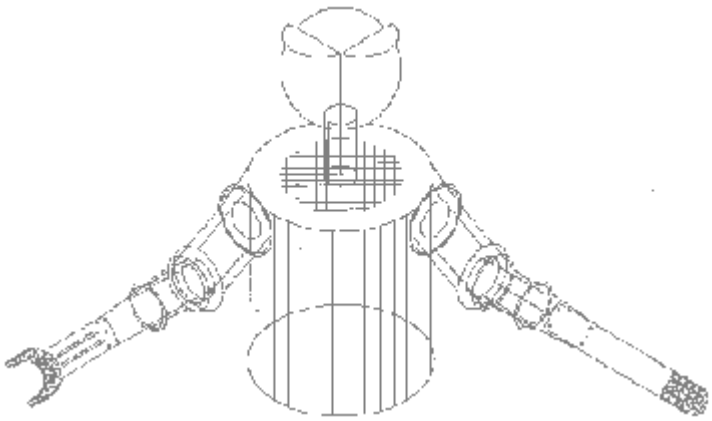
END-
EFFECTORS,
INC.

End-Effectors Accessories

LDP-10 Load Distribution Plate
CMA Series Mounting Adapters
TMA Series Mounting Adapters
CEA-10 Series Custom Adapters
FSC-10
TWA-10 Series Aligners
WTP-10 Series Wafer Transports
MMS-70 Micro Switch
MTP-10 Mask Transport
EEB-10 Bible

End-Effectors, Inc. provides the following accessories in order to glean from its products the greatest possible benefits for our users. Because there are numerous robotic systems of commercial design and also application specific systems of both commercial and user development, we have provided numerous options to assist our customers with the implementation of our products.

While the selection is large we always welcome the opportunity to assist our customers with their individual needs. Often a new customer requirement will lead to the development of a product line development.



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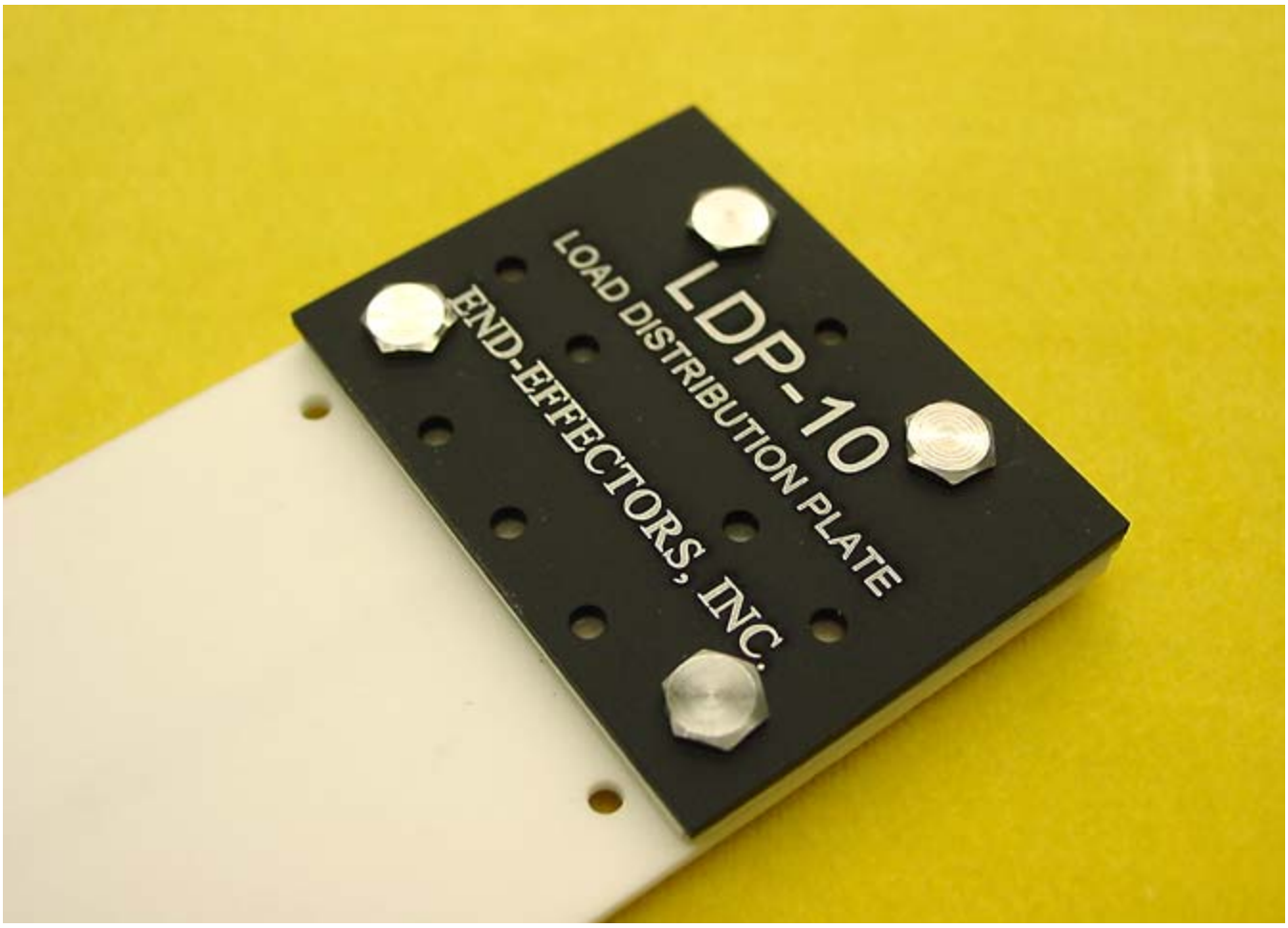
11-8-02, 2002



LOAD DISTRIBUTION PLATE

LDP-10

FEATURES

- Damage reduction
- Secure holding
- Easy replacement
- Low cost
- Universal Mounting Pattern

The load distribution plate is a simple device which securely clamps an end-effector in place. While intended for use on ceramic end-effectors, the LDP-10 can be used on any end-effector using the standard universal mounting pattern. The primary use of this product is the robot manufacturer or robot user wanting to upgrade a robot's end-effector capability. The primary benefit of this product is its ability to equally distribute the clamping load generated by the mounting screws and prevent damage to ceramic end-effectors. See the reverse side of this sheet for layout data and "O" ring seal specifics.

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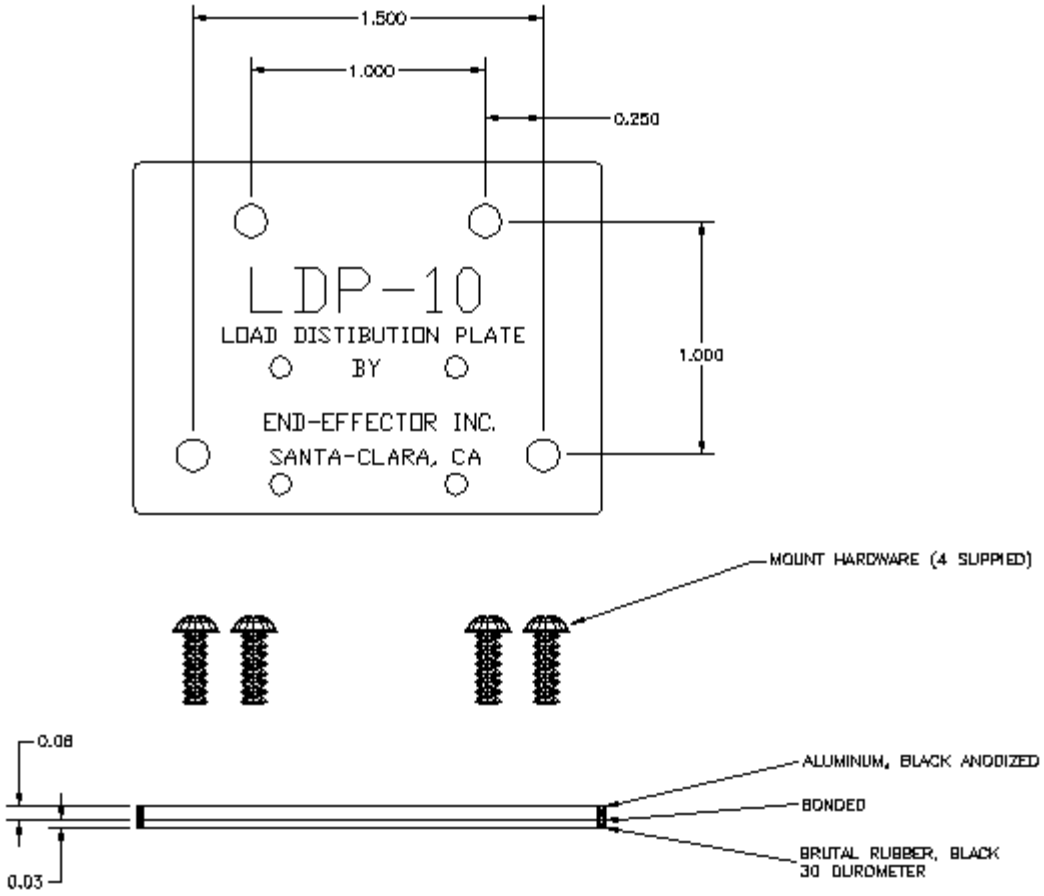
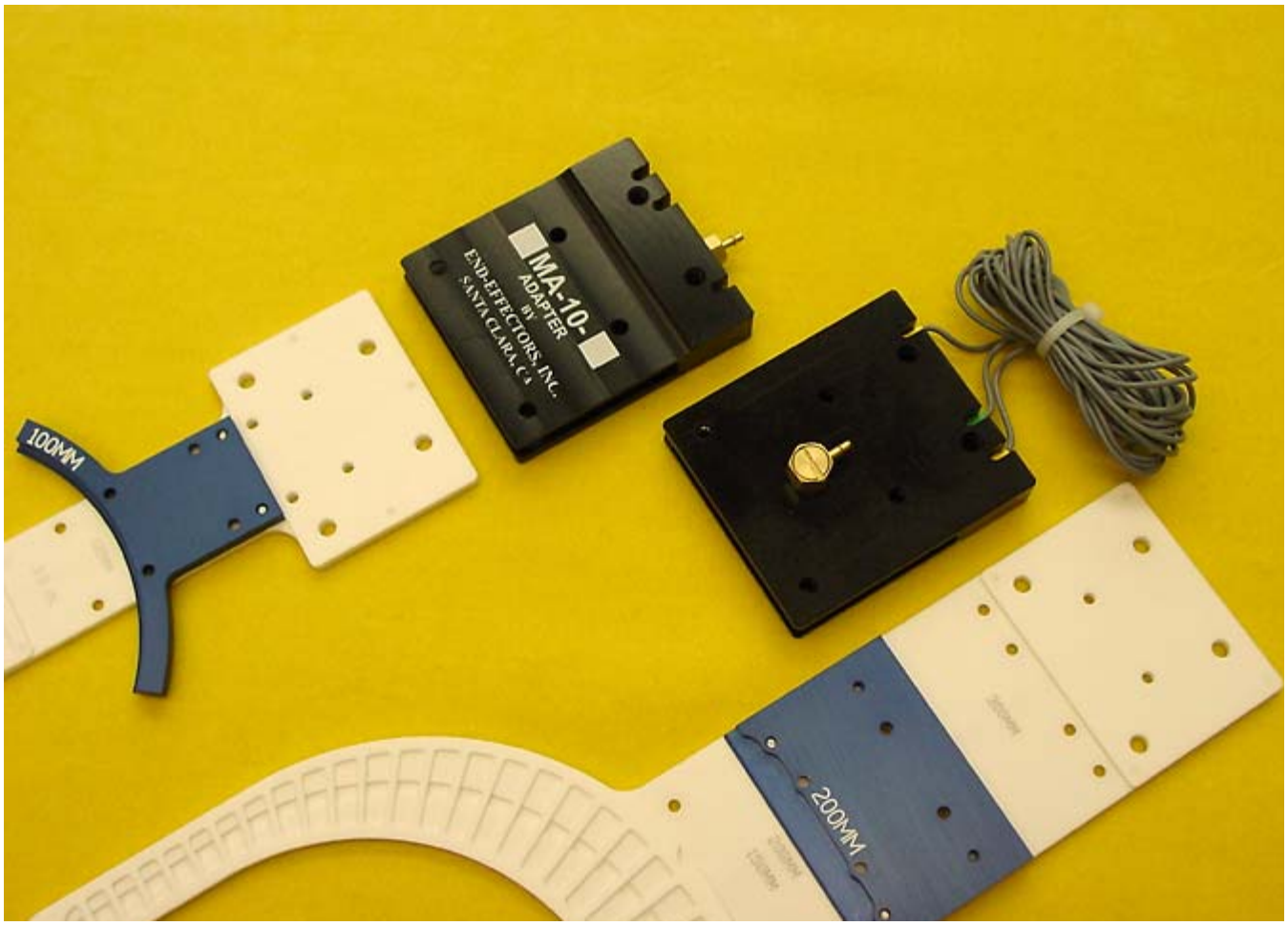

1.500
1.000
0.250
LDP-10
LOAD DISTIBUTION PLATE
BY
END-EFFECTOR INC.
SANTA-CLARA, CA
1.000
MOUNT HARDWARE (4 SUPPIED)
0.08
0.03
ALUMINUM, BLACK ANODIZED
BONDED
BRUTAL RUBBER, BLACK
30 DUROMETER



STANDARD MOUNTING ADAPTERS

CMA SERIES

FEATURES

- Rapid installation - 2 screws
- Universal mount - 6 configurations
- Quick change - vacuum & pressure types
- Utility interface - pneumatic, electric & optical
- Secure holding - no slippage or leakage
- Rigid design - no flexing
- No end-effector damage
- Inexpensive - reusable and refurbishable

A high-tech ceramic end-effector requires a high-tech mounting adapter. The CMA series of end-effector mounting adapters provide both rigid mounting and utilities interfacing for the Standard Ceramic end-effector series.

The CMA adapters provide pneumatic coupling for vacuum driving; electrical connections for wafer seating sense switches as well as ESD dissipation; fiber optic clamping for photonic wafer presence and location sensing, and electrical input for heater power and control.The CMA adapters are designed to securely hold ceramic end-effectors without fear of damage. An additional feature is the ability to stack end-effectors for multiple wafer handling.

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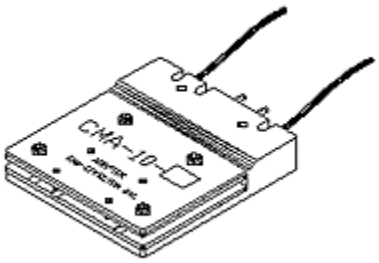
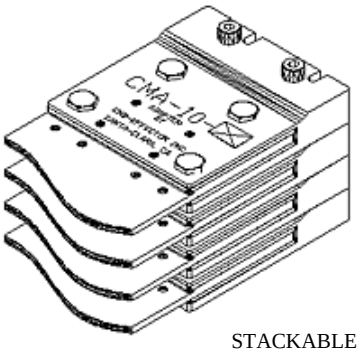
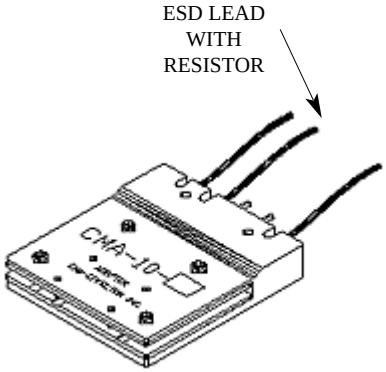
CMA-10 and -11 CERAMIC END-EFFECTOR MOUNTING ADAPTERS



PRESENCE SWITCH I/O

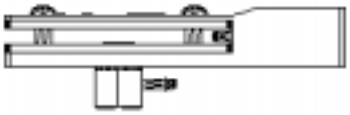


STACKABLE



ESD I/O

STAN-



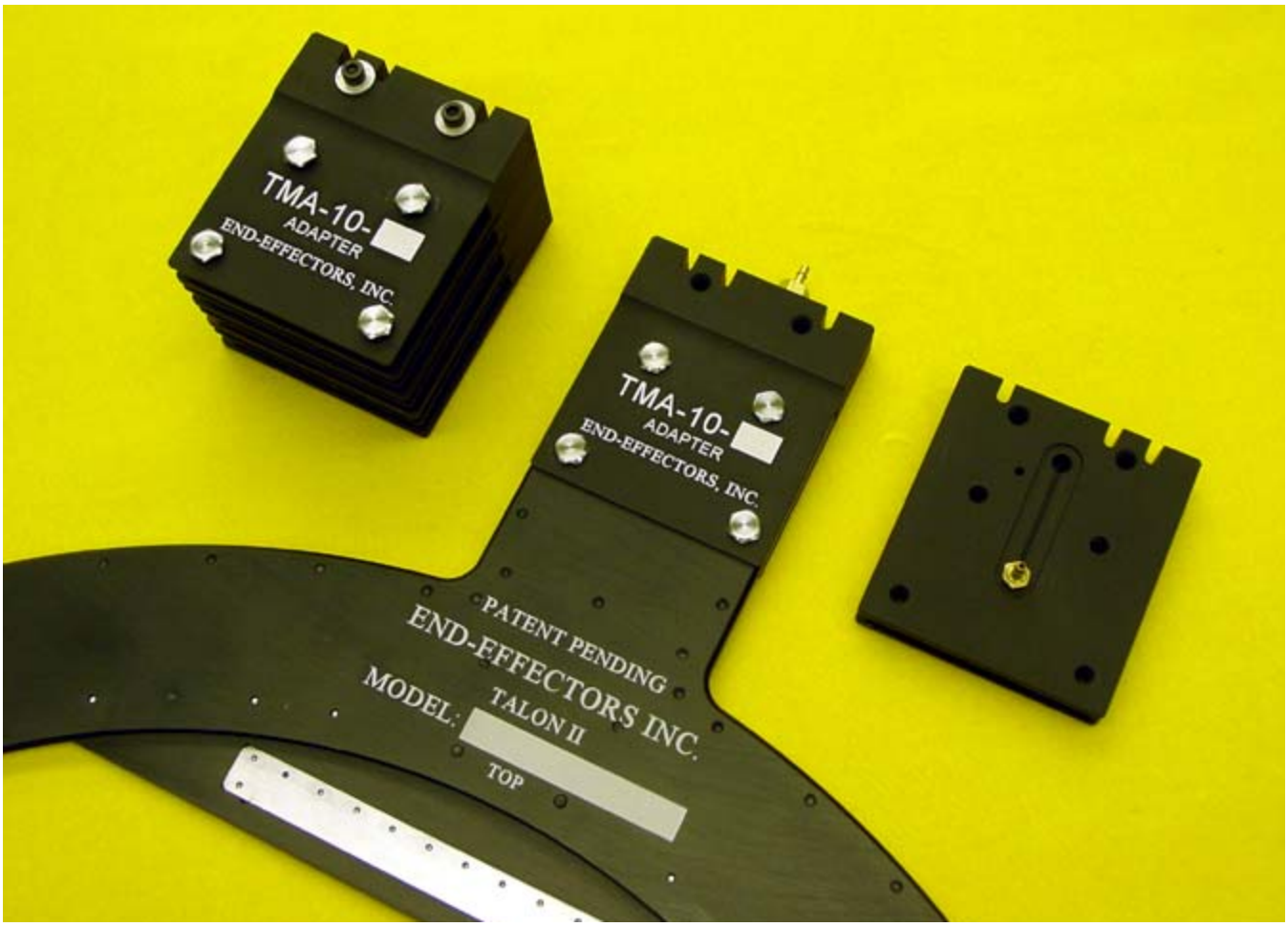
SPECIAL ORDER

STAN-

CMA-10 (Bottom Port)

CMA-11 (Edge Port)

PART NO.	BOTTOM PORT	EDGE PORT STACKABLE	STATIC WICK	SWITCH I/O	HEATER I/O
CMA-10-1	✓				
CMA-10-2	✓		✓		
CMA-10-3	✓			✓	
CMA-10-4	✓				✓
CMA-10-5	✓		✓	✓	
CMA-10-6	✓		✓		✓
CMA-10-7	✓			✓	✓
CMA-10-8	✓		✓	✓	✓
CMA-11-1		✓			
CMA-11-2		✓	✓		
CMA-11-3		✓		✓	
CMA-11-4		✓			✓
CMA-11-5		✓	✓	✓	
CMA-11-6		✓	✓		✓
CMA-11-7		✓		✓	✓
CMA-11-8		✓	✓	✓	✓



STANDARD MOUNTING ADAPTERS

TMA SERIES

FEATURES

- Rapid installation - 2 screws
- Universal mount - 6 configurations
- Quick change - vacuum & pressure types
- Utility interface - pneumatic, electric & optical
- Secure holding - no slippage or leakage
- Rigid design - no flexing
- No end-effector damage
- Stackable to 25 units
- Inexpensive - reusable and refurbishable

A high-tech pneumatic end-effector such as the Talon, demands a high-tech mounting adapter. The TMA series of end-effector mounting adapters provide both rigid mounting and utilities interfacing for the Talon end-effectors as a standard product from stock.

The TMA adapters provide pneumatic coupling for 60 psi driving gases; electrical connections for wafer seating sense switches as well as ESD dissipation; and fiber optic coupling for photonic wafer presence and location sensing.

The TMA adapters are designed to securely hold end-effectors without fear of damage, and to assure the user that the interface to the robot's controller is easily and reliably made. These

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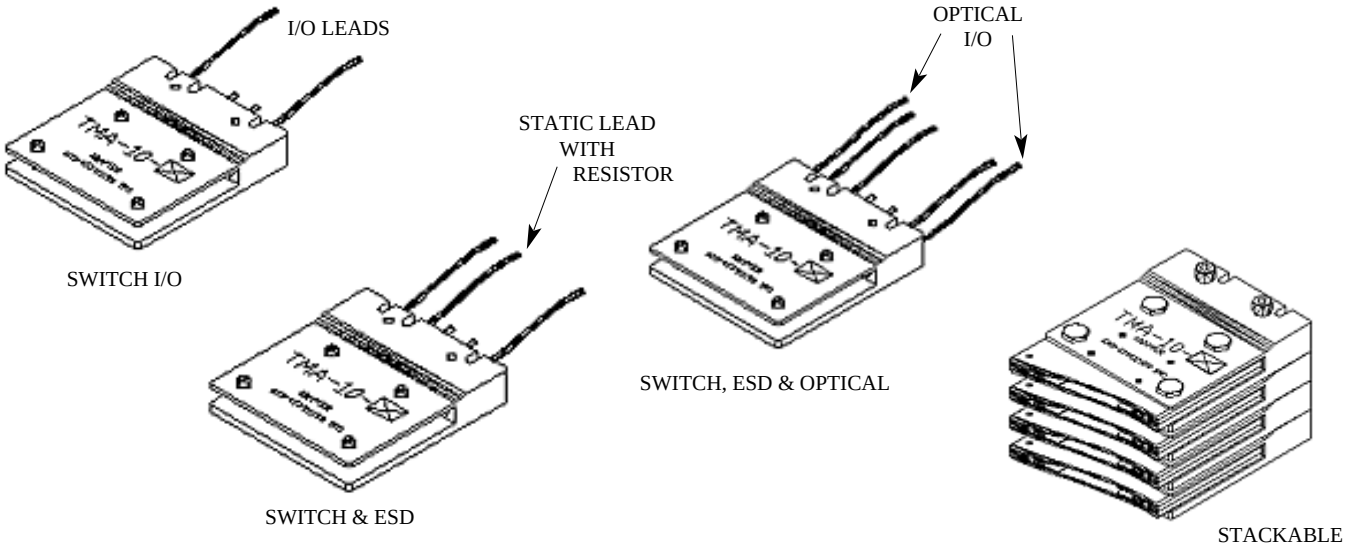
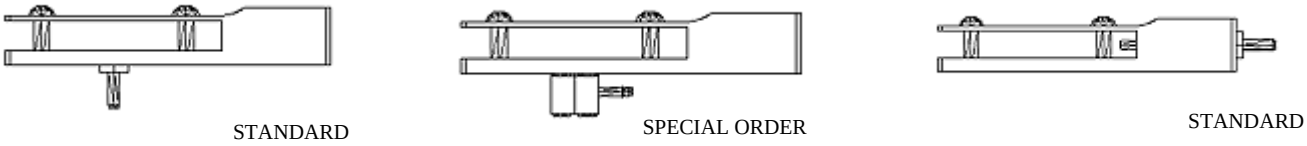
TMA-10 AND -11 TALON END-EFFECTOR MOUNTING ADAPTERS





TMA-10 (Bottom Port)

TMA-11 (Edge Port)

PART NO.	BOTTOM PORT	EDGE PORT	SWITCH I/O	STATIC WICK	OPTICAL I/O	PARTICLE VACUUM
TMA-10-1	✓		✓			
TMA-10-2	✓		✓	✓		
TMA-10-3	✓		✓		✓	
TMA-10-4	✓		✓			✓
TMA-10-5	✓		✓	✓	✓	
TMA-10-6	✓		✓	✓		✓
TMA-10-7	✓		✓		✓	✓
TMA-10-8			✓	✓	✓	✓
TMA-11-1		✓	✓			
TMA-11-2		✓	✓	✓		
TMA-11-3		✓	✓		✓	
TMA-11-4		✓	✓			✓
TMA-11-5		✓	✓	✓	✓	
TMA-11-6		✓	✓	✓		✓
TMA-11-7		✓	✓		✓	✓
TMA-11-8		✓	✓	✓	✓	✓

CUSTOM END-EFFECTOR ADAPTERS

CEA-10 SERIES

FEATURES

- Increased machine efficiency
- Accurate wafer positioning
- Secure wafer hold
- Multiple wafer hold
- Electrical I/O
- Fluidic I/O
- Optical I/O

In order to provide the maximum through-put efficiency for production equipment, EEI provides design and manufacturing services to end-effector users. The ability of our customers to maximize their equipment's performance can be realized by the co-operative efforts of our design teams. Whether one part is being handled or twenty-five parts are handled simultaneously, either in line or at odd angles, there is generally an acceptable solution which will increase machine efficiency.

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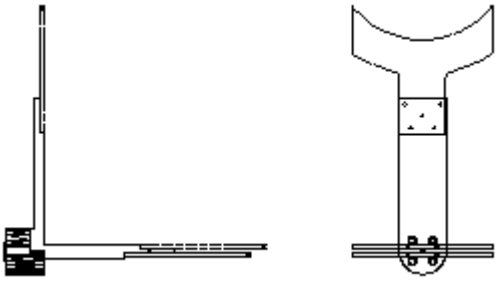

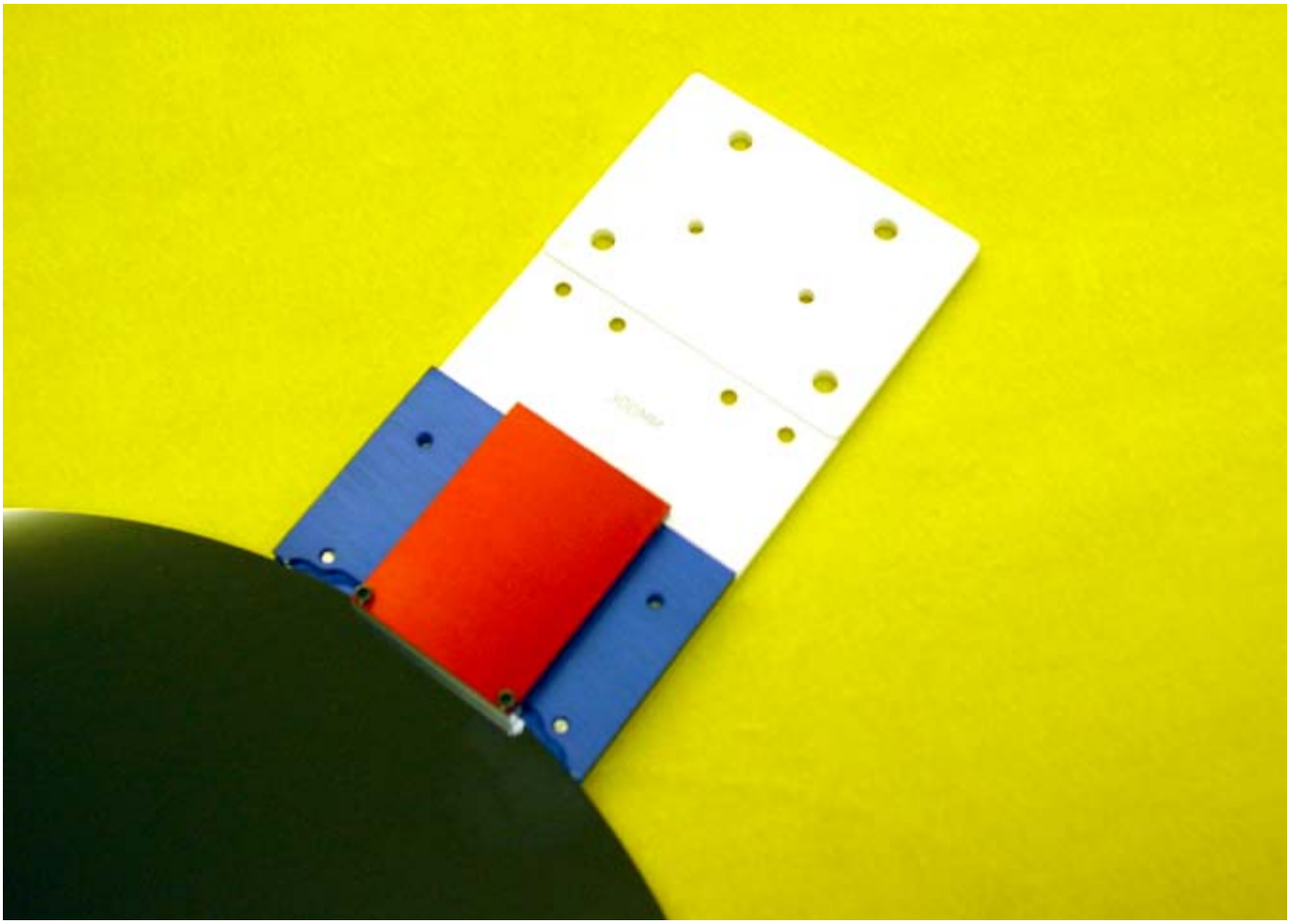

FAIL-SAFE CLAMP - VACUUM

FSC-10

VACUUM DRIVEN FOR VACUUM END-EFFECTORS

FEATURES

- Compatible with standard ceramic end-effectors
- Prevents wafer loss
- Can be mounted on metal end-effectors
- Protects all wafer sizes

The FSC-10 Fail-Safe Clamp was designed to afford vacuum gripping type end-effectors a means to safely hold wafers when there is a system failure. The FSC-10 was intended for use with EEI's SC Series of standard ceramic end-effectors but can be adapted to any end-effector. Incorporating a positive spring loaded clamping device and silicone/peek contacts, this device is actuated upon failure of the primary vacuum system. Upon actuation, the wafer is securely held in place while the system shuts down, preventing damage and loss.

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CLAMPING AREA

The FSC-10 mounts with four (4) screws of proper length for the specific application. Standard supplied screws for EEI standard SC Series and 0-80 flat head, slotted screws of .250 length

OPERATING INSTRUCTIONS:

TALON WAFER ALIGNER

TWA-10 SERIES

FEATURES

- Aligns wafer
- Non-contact alignment
- Edge-gripping
- Permits foup mapping
- Permits wafer centering

The TWA-10 Talon Wafer Aligner was designed to assist a robot in its capture of a substrate. In cases where there are gross errors in the location of a wafer, either horizontal or vertical, the TWA-10 appliance can be used. Using differential pressure, the TWA-10 captures the wafer and positions it without physical contact. Once properly positioned the standard Talon clamping mechanism can be used to capture the wafer and the same signal can be used to terminate the differential pressure system. The TWA-10 is designed for use with the Talon II series of end-effectors. Custom wafer aligners can be fabricated for any end-effector or system. Please contact our facility for details.

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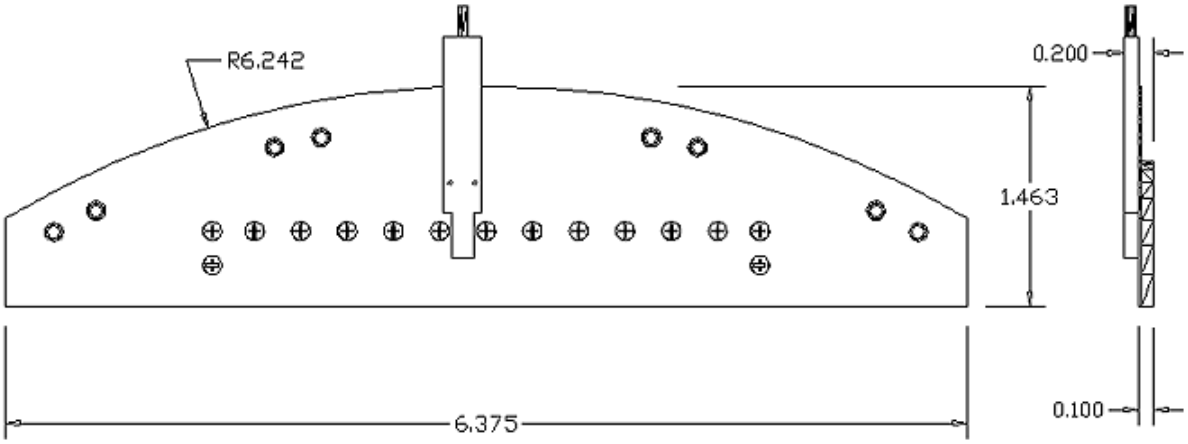
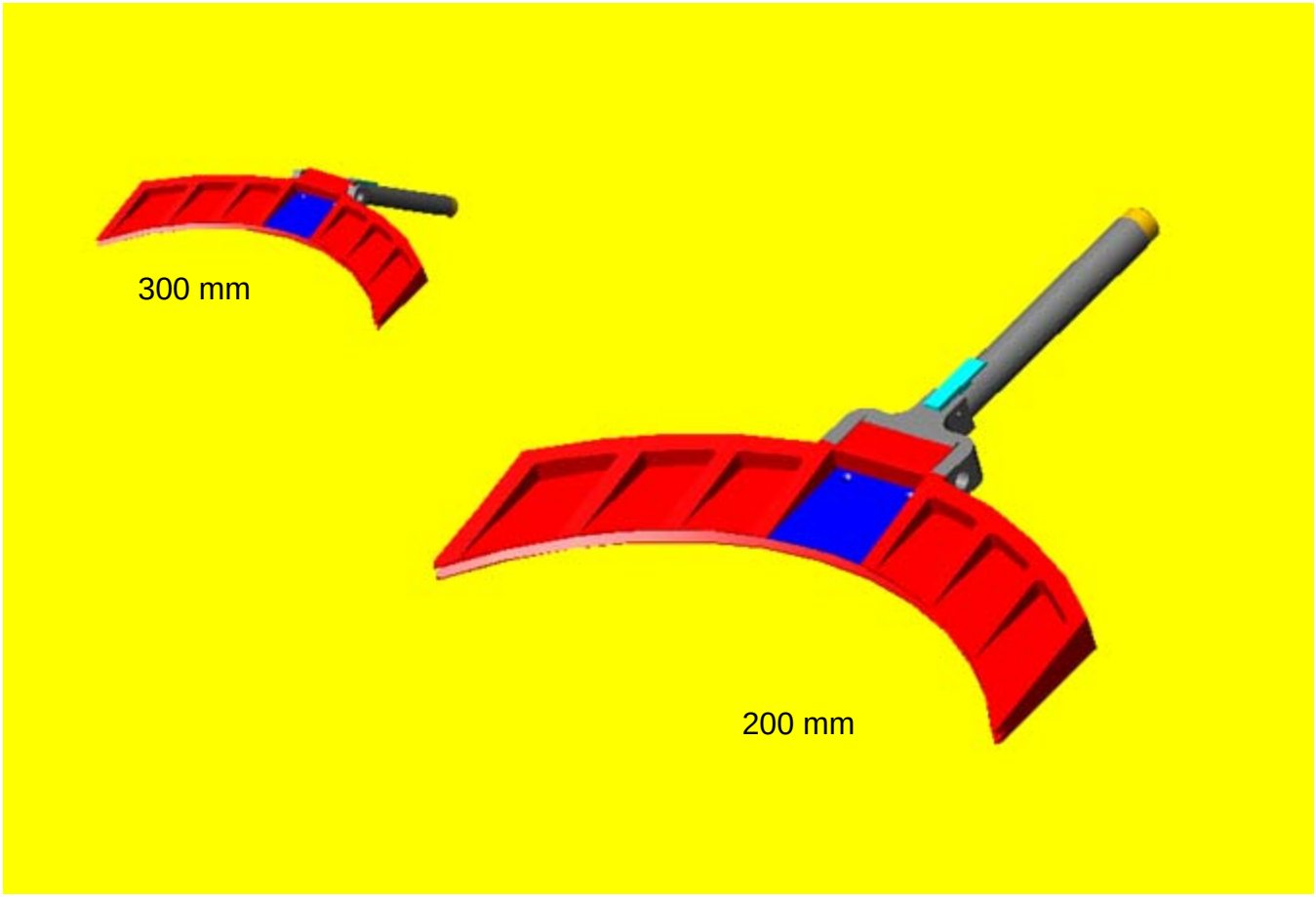


Part Number	Used On
TWA-10-1	TAL-II-300
TWA-10-2	TAL-II-200
TWA-10-3	TAL-II-150
TWA-10-4	TAL-II-100



WAFER TRANSPORT, FAIL-SAFE

WTP-10 SERIES

1 (ONE) MM EDGE GRIPPING

FEATURES

- 100% fail safe
- Will not drop wafer
- Compatible with any holder
- Grips outside non-intrusion area
- Peek Contact Points
- Non contaminating
- Positive hold (5 Gs min.)
- Adjustable head angle
- Vacuum driven - tethered
- Mechanically driven - untethered
- Available for 125 mm to 300 mm

End-Effectors Inc. presents a convenient tool for the safe handling of wafers. Based on the same principles which have made the Talon end-effectors efficient and popular, these hand held products allow wafer handling in a positive and efficient manner. In addition to efficient and safe handling, the parts are only held at the outer edge, outside the non-intrusion zone and within a one millimeter grip area.

These light weight, positive hold transports can be supplied as mechanically driven or vacuum driven systems. Upon special order they can be supplied in a pressure driven format.

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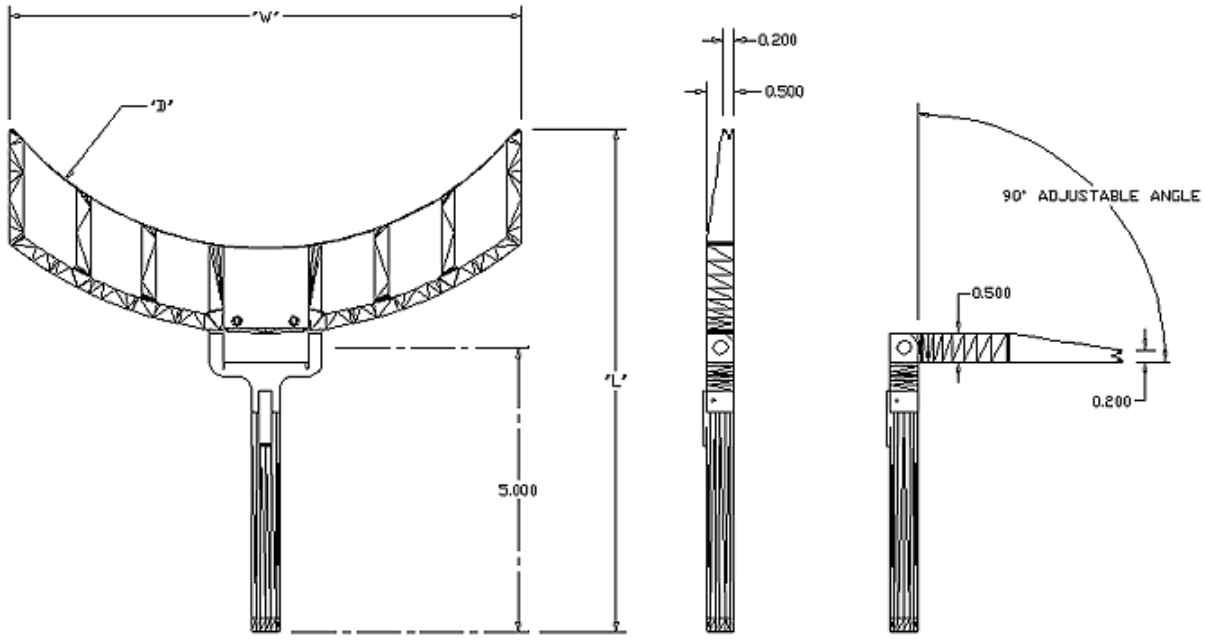


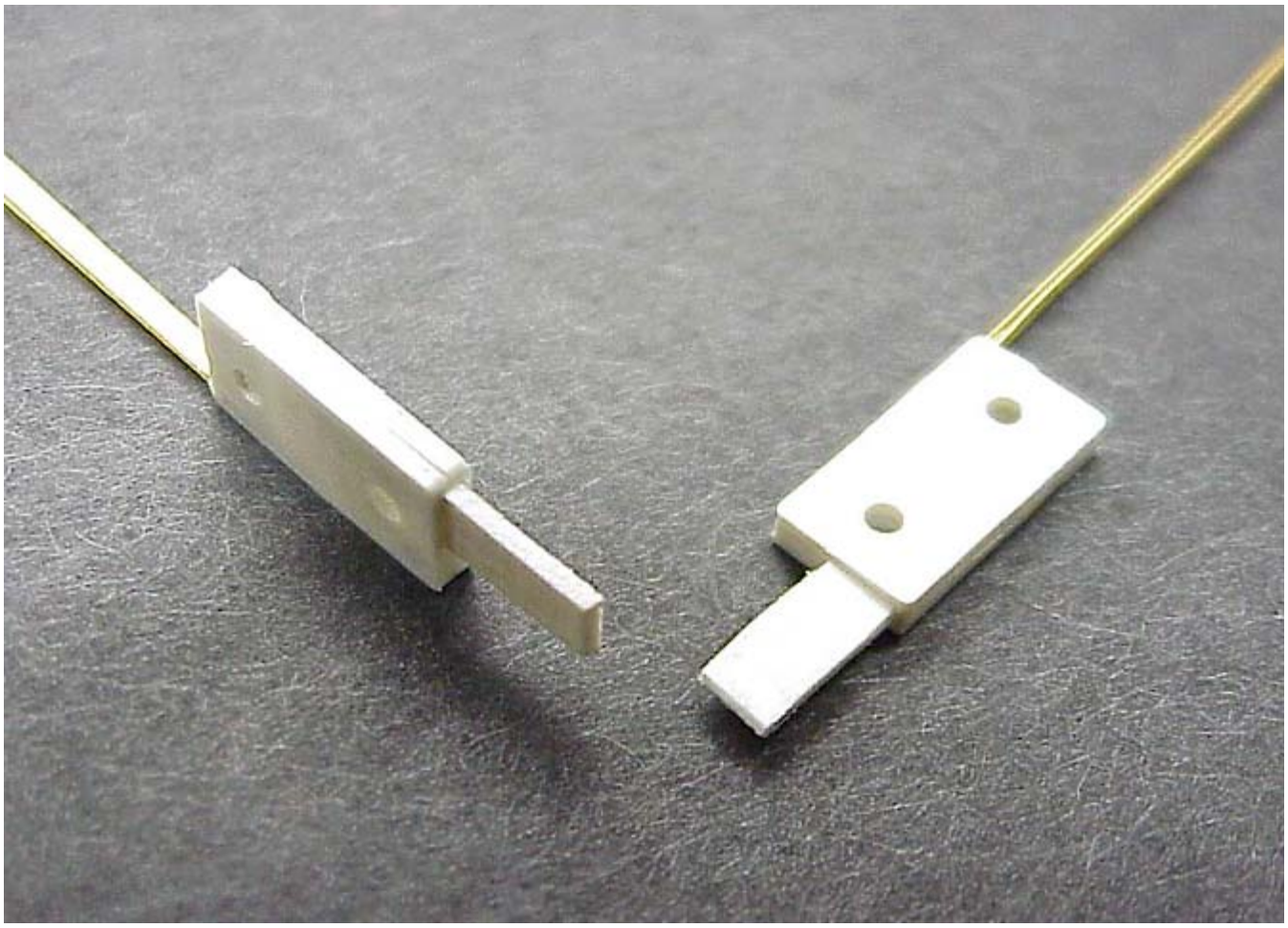
PART NUMBER FORMAT: WTP-10 - *VERSION* - *OPTIONS*

EXAMPLE: WPT-10-200-1

VERSION:

DASH NO.	WAFER DIAMETER	"L" DIMENSION
-100	4.00 IN./100MM	
-125	5.00 IN./125MM	
-150	6.00 IN./150MM	
-200	8.00 IN./200MM	
-300	12.00 IN./300MM	

OPTIONS: -0 : None
-1 : ESD Ground Line with Resistor



MINI MICRO-SWITCH

MMS-70

SPST-SWITCH FOR WAFER SENSING

FEATURES

- .070 thick
- Gold alloy contacts
- One millimeter stroke
- Selectable plunger length (customer performed)
- Hermetically sealed and booted (MS-71)

The MMS-70 series of Mini Micro-Switches were designed to meet the specific needs of the semiconductor industry. Compact size and reliable operation for positive wafer sensing are achieved by this unique design. Due to the need for sensing the wafers' edge and to do so in the horizontal plane the MMS-70 was made only .070 inches thick (1.75 mm). This compact size permits employment in applications where space is at a premium.

In addition to size and performance the switch plunger can be sized by the user for any reach dimension his design requires. The use of a sizing tool allows the user to customize the plunger length for his specific application. Typical contact resistance is 60 milliohms and part life is typically one million cycles plus. The switch can be mounted on pins or using 0-80 screws or both.

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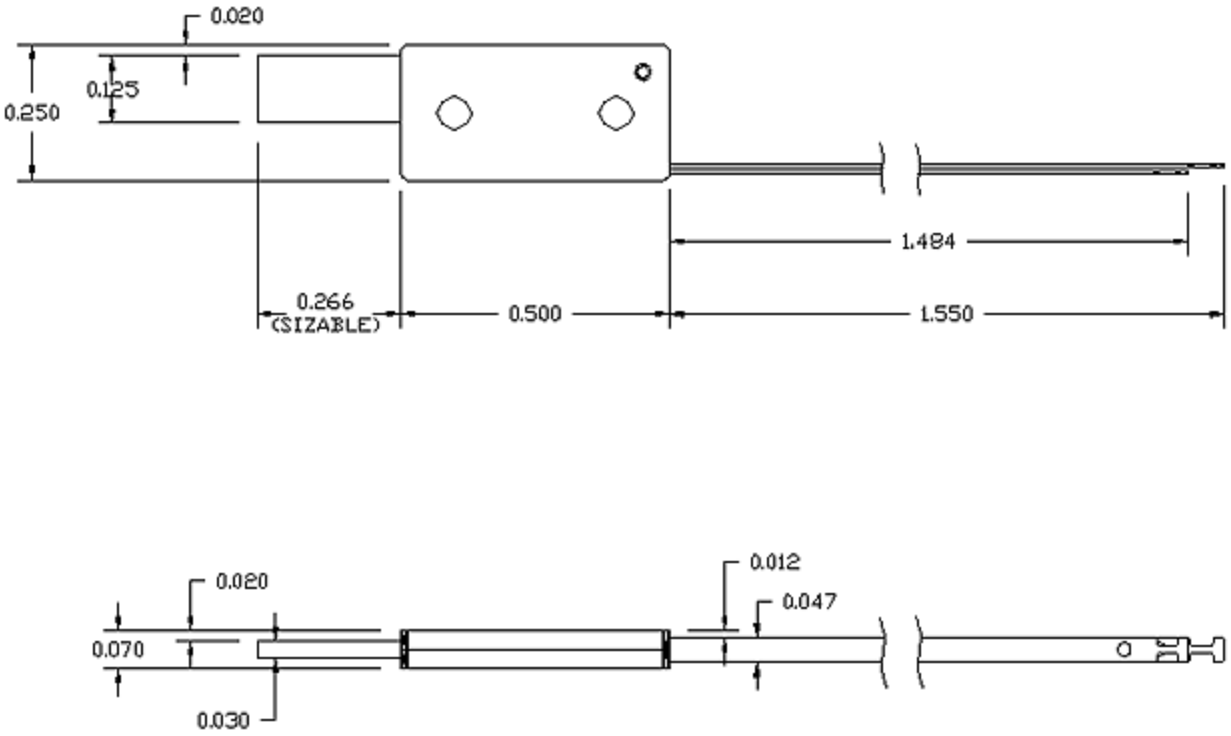
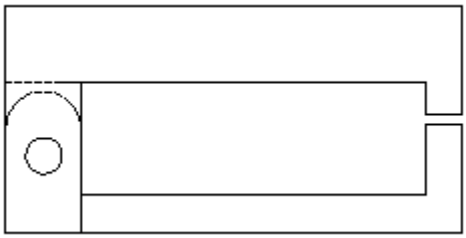
July, 2002



MS-70 UNSEALED (NOT BOOTED)

MS-71 SEALED AND BOOTED



PART NO: SST-10

SIZING TOOL

MASK TRANSPORT, FAIL-SAFE

MTP-10

EDGE-GRIPPING

FEATURES

- 100% fail safe
- Will not drop mask
- Compatible with any holder
- Grips outside non-intrusion area
- Silicone Contact Points
- Non contaminating
- Positive hold (5 Gs min.)
- Adjustable head angle
- Vacuum driven - tethered
- Mechanically driven - untethered
- Available for $2^1/_2$ inch to 13 inch

End-Effectors Inc. presents a convenient tool for handling glass masks. Based on the same principles which have made the Talon end-effectors efficient and popular, these hand held products allow glass mask handling in a positive and efficient manner. In addition to efficient handling, the parts are only held at the outer edge, outside the active mask area and within a three millimeter grip area. These light weight, positive hold transports can be supplied as mechanically clamped or vacuum driven systems. Upon special order they can be supplied in a pressure driven format.

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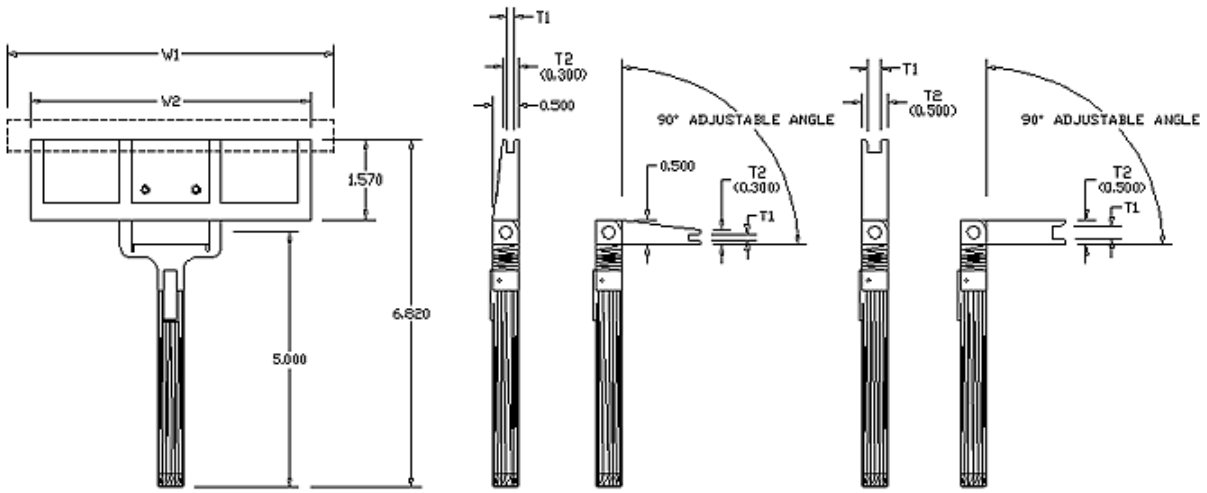

PART NUMBER FORMAT: MTP-10 *- VERSION - OPTIONS*

EXAMPLE: MTP-10-060-0

VERSION:

DASH NO.	MASK THICKNESS
-030	
-060	
-090	
-125	
-187	

OPTIONS: -0 : None
-1 : ESD Ground Line with Resistor

THE END-EFFECTOR BIBLE

EEB-10

TOPICS

Holding Methods
Sensing Methods
Materials employed
Electrical Properties
Physical Properties
Comparison of Materials
Failure Modes
Design Considerations

A technical book written for equipment designers who are responsible for handling product in an automated world. This book provides the reader both an understanding of the methods used to capture and hold parts, as well as the methods to sense part presence. Furthermore the parameters for designing in ceramic are presented and discussed. The use of materials for end-effector employment and their properties is also discussed. Technical data are compared with specific reference to the semiconductor industry although applicable to part handling in general.

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June 1, 2001