TSM Tool Stand

Manual

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Engineered Products for Robotic Productivity

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Foreword

Please contact ATI Industrial Automation with any questions concerning a particular model.

CAUTION: This manual describes the function, application, and safety considerations of this product. This manual must be read and understood before any attempt is made to install or operate the product, otherwise damage to the product or unsafe conditions may occur.

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Glossary

Term	Definition
Alignment Pins	The alignment pin attaches to the tooling interface plate or a tool hanger module.
Adapter module	The adapter module provides a mounting surface for a mounting module to be attached to a post module or end of a horizontal extension.
End-Effector	A tool or other device attached to the robot arm in order to perform a task.
Horizontal module	A horizontal rail that supports multiple tool positions.
Master plate	The half of the Tool Changer that is mounted to an interface plate, robot, or end-effector adjacent to the robot.
Modules	Optional components that can be added to the Master and Tool plates to enhance the capabilities of the Tool Changer, e.g. Fluid/Air, Electrical, DeviceNet, Servo, High-Current, etc.
Mounting module	Provides a mount on the tool stand for the tooling interface plate or can mount the Tool Changer Tool plate directly for some specific models.
Pin and Bushing Mounting	A Tool Stand configuration that uses mounting modules with alignment pins and a bushing to support and accurately locate the Tool plate and customer tooling.
Post module	Combines the base, vertical rail, and gusset assemblies into a group of components.
Proximity Sensor	Provides a signal indicating the tool is located in the tool stand.
Sensor Holder	The sensor holder provides a mounting on the tool stand for the proximity sensor.
Tooling Interface Plate	A machined plate that adapts the Tool body to an end-effector and provides mounting features for a tool stand.
Tool Hanger	The half of the Tool Changer that is installed to a mounting flat on the Tool Changer.
Tool plate	The half of the Tool Changer that is mounted to a tooling interface plate or customer-supplied tooling.
Tool Stand	A fixture supplied by ATI for holding of the Tool plate when not in use.
Horizontal Extension	A fixture that provides more tool clearance for customer tooling than the standard TSM post module.
Vertical Mounting module	A mount on the tool stand for the vertical tooling interface plate. The Tool Changer can mount directly for some specific models.
Vertical Tooling Interface Plate	A machined plate with a vertical surface that adapts the customer tooling and provides mounting features for a tool stand.

1. Safety

The safety section describes general safety guidelines to be followed with this product, explanations of the notifications found in this manual, and safety precautions that apply to the product. Product specific notifications are imbedded within the sections of this manual (where they apply).

1.1 Explanation of Notifications

These notifications are used in all ATI manuals and are not specific to this product. The user should heed all notifications from the robot manufacturer and/or the manufacturers of other components used in the installation.

DANGER: Notification of information or instructions that if not followed will result in death or serious injury. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.

WARNING: Notification of information or instructions that if not followed could result in death or serious injury. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.

CAUTION: Notification of information or instructions that if not followed could result in moderate injury or will cause damage to equipment. The notification provides information about the nature of the hazardous situation, the consequences of not avoiding the hazard, and the method for avoiding the situation.

NOTICE: Notification of specific information or instructions about maintaining, operating, installing, or setting up the product that if not followed could result in damage to equipment. The notification can emphasize, but is not limited to: specific grease types, best operating practices, and maintenance tips.

1.2 General Safety Guidelines

This system is intended for use in industrial applications for tool changing and storage and therefore requires the use of a Tool Changer.

Prior to purchase and installation, the customer should verify that the Tool Changer selected is rated for the maximum loads and moments expected during operation. Refer to the applicable Tool Changer manual or contact ATI for assistance.

WARNING: The customer is responsible for ensuring that the area between the Tool and the Tool Stand is clear of foreign objects during tool drop-off. Failure to do so may result in serious injury to personnel.

WARNING: The gap between the Master and Tool sides is a pinch point. All personnel should be prevented from placing any part of their body or clothing in the gap, especially during actuation of the tool hanger mechanism.

1.3 Safety Precautions

WARNING: Do not perform maintenance or repair(s) on the Tool Changer or modules unless the Tool is safely supported or placed in the tool stand, all energized circuits (e.g. electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from circuits in accordance with the customer specific safety practices and policies. Injury or equipment damage can occur with the Tool not placed and energized circuits on. Place the Tool in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, and verify all circuits are de-energized before performing maintenance or repair(s) on the Tool Changer or modules.

WARNING: During operation, the area between the Master and Tool must be kept clear. Failure to keep area clear will result in damage to Tool Changer, modules, or end-of-arm tooling and could cause injury to personnel.

CAUTION: The TSM system is only to be used for intended applications and applications approved by the manufacturer.

2. Product Overview

The ATI TSM (Tool Stand Medium) system is compatible with ATI Tool Changer sizes QC-20 through QC-110. The stand is designed to fit most customer applications. The modular system allows for a user to essentially "build their own" tool storage rack based on the number of tools, desired positioning, and mounting arrangements. Three types of TSM systems are available, and an overview of each is the in following sections:

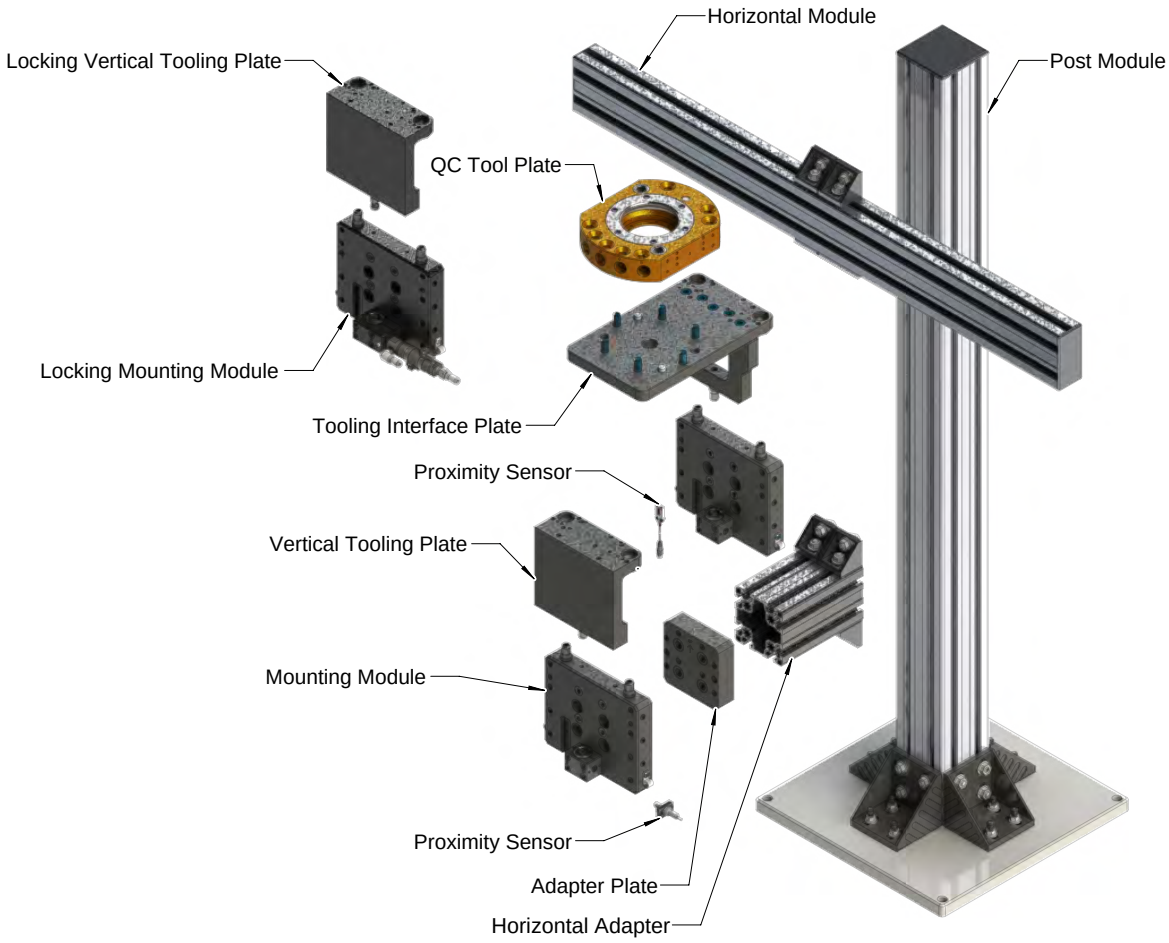
- *Section 2.1—TSM System with Pin and Bushing Style Mounting*
- *Section 2.2—TSM System with V-Block Style Mounting*
- *Section 2.3—TSM System with Tool Hanger Mounting Module*

For the most current product information on TSM systems, click the following link to the ATI website: *TSM Systems*.

2.1 TSM System with Pin and Bushing Style Mounting

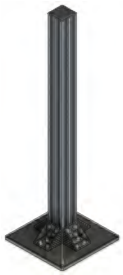
A pin and Bushing module adapts to either a horizontal or vertical interface plate that attaches to the ATI Tool plate and customer tooling. Pin and bushing module configuration examples are in the following figure:

Figure 2.1—TSM System with Pin and Bushing Style Mounting



2.1.1 Post Module Kits

The post module kit is a common component to all TSM systems. The post module kit is available in different post heights and combines the base, rail, and gusset assemblies into a group of components.



Item	Part Number	Refer to Drawing #
Post module kit 914 mm (36”)[1,2]	9120-TSM-PM-3317	*9630-20-TSM-PM-3317*
Post module kit 1520 mm (60”)[1,2]	9120-TSM-PM-3353	

Notes:
1. May specify other rail lengths – cut charge will apply.
2. The post module is available factory assembled - an assembly charge will apply.

2.1.2 Horizontal Modules

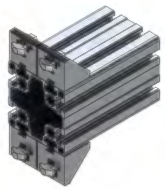
The horizontal module mounts to the post module and can be adjusted vertically or horizontally using the rail gussets to accommodate customer tooling. The rail is an aluminum extrusion and comes in standard lengths. Multiple Tool plate assemblies can be added to the rail, depending on the tool spacing requirements.

Item	Part Number	Refer to Drawing #
Horizontal module 914 mm (36”)[1]	9120-TSM-HM-3317	*9230-20-1880*
Horizontal module 1520 mm (60”)[1]	9120-TSM-HM-3353	

Notes:
1. May specify other rail lengths – cut charge will apply.

2.1.3 Horizontal Extensions

The horizontal extension is used when customer tooling requires extra clearance from the rail or other tooling. The horizontal extension mounts to the post module.



Item	Part Number	Refer to Drawing #
TSM Horizontal Extension, 3.15”	9120-TSM-HE-3403	*9230-20-1880*
TSM Horizontal Extension, 6”	9120-TSM-HE-3320	
TSM Horizontal Extension, 10”	9120-TSM-HE-3321	

2.1.4 TSM Adapter Module

To install a mounting module on a horizontal extension, use an adapter module.

Item	Part Number	Refer to Drawing #
TSM Adapter Module - Mounting Module to TSM HE[1]	9120-TSM-AM-9982	*9630-20-TSM-AM-9982*

Notes:
1. Adapts to the TSM horizontal extension.

2.1.5 Pin and Bushing Mounting Module

Pin and bushing modules include two vertical alignment pins and one vertical bushing. The module includes mounting fasteners and is designed to mount to a post module, horizontal module, or horizontal extension. The pin and bushing modules can be supplied as a stand alone unit and can be integrated with customer specific fixtures. The module provides mounting features for the sensor modules.

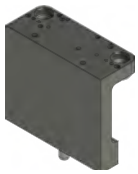
Item	Part Number	Refer to Drawing #
Pin and Bushing Mounting module, Rigid.[1, 2]	9120-TSM-MMB-8432	*9630-20-TSM-MMB-8432*

Notes:

1. Used with Tooling Interface Plates: 9120-TSM-HBQ-8439, 9120-TSM-VBB-8441, 9120-TAM-VBQ-8442.
2. Used with sensor modules: 9120-TSM-SMA-8437 and 9120-TSM-SMA-8439.

2.1.6 Tooling Interface Plates

There are two types of interface plates: tooling interface plates and vertical tooling interface plates. The tooling interface plate attaches horizontally to the Tool Changer and the customer tooling. The vertical tooling plate attaches to the customer tooling and the Tool Changer is attached to the customer tooling, either directly or using an interface plate. Both types of interface plates have two bushings and one alignment pin to position the tooling interface plate to the pin and bushing mounting module.



Item	Part Number	Refer to Drawing #
TSM Tooling Interface Plate for QC-50 - Blank.[1]	9120-TSM-HBQ-9566	*9630-20-TSM-HBQ-9566*
TSM Tooling Interface Plate for QC-76 - Blank [1]	9120-TSM-HBQ-9224	*9630-20-TSM-HBQ-9224*
TSM Tooling Interface Plate for QC-110 - Blank [1]	9120-TSM-HBQ-8439	*9630-20-TSM-HBQ-8439*
TSM Tooling Interface Plate - Blank [1]	9120-TSM-HBB-9223	*9630-20-TSM-HBB-9223*
Vertical Tooling Interface Plate		
TSM Tooling Interface Plate - Blank [1]	9120-TSM-VBB-8441	*9630-20-TSM-VBB-8441*
TSM Tooling Interface Plate - J16 Pattern [1]	9120-TSM-VBQ-8442	*9630-20-TSM-VBQ-8442*

Notes:

1. Used with mounting modules: 9120-TSM-MMB-8432.

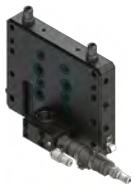
2.1.7 Retrofit Locking Assembly

The retrofit locking assembly includes a replacement alignment pin and a replacement bushing block with air cylinder for 9120-TSM-MMB-8432.

Item	Part Number	Refer to Drawing #
Pin and Bushing Retrofit Locking Assembly	9005-20-8444	N/A

2.1.8 Pin and Bushing Locking Mounting Module

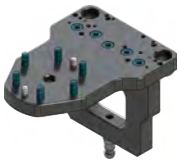
Pin and bushing locking modules include two vertical alignment pins and one vertical bushing with an air cylinder. The module includes mounting fasteners, and is designed to mount to a post module, horizontal module, or horizontal extension. The pin and bushing locking modules can be supplied as a stand alone unit and can be integrated with customer specific fixtures. The module includes two sensors on the air cylinder.



Item	Part Number	Refer to Drawing #
Pin and Bushing Locking Mounting module, Rigid.[1]	9120-TSM-MMBL-8432	*9630-20-TSM-MMBL-8432*
Notes: 1. Used with Tooling Interface Plates: 9120-TSM-HBBL-9223, 9120-TSM-HBQL-10189, 9120-TSM-VBBL-8441		

2.1.9 Tooling Interface Plates Locking

There are two types of interface plates, tooling interface plates and vertical tooling interface plates. The tooling interface plate attaches horizontally to the Tool Changer and the customer tooling. The vertical tooling plate attaches to the customer tooling and the Tool Changer is attached to the customer tooling either directly or using an interface plate. Both types of interface plates have two bushings and one alignment pin to position the tooling interface plate to the pin and bushing mounting module. The tooling interface plates can be integrated with customer specific features, including a locking mechanism that secures tools in the tool stand, preventing unintional tool drops, wear, and potential damage.



Item	Part Number	Refer to Drawing #
TSM Tooling Interface Plate - Blank-Locking [1]	9120-TSM-HBBL-9223	*9630-20-TSM-HBBL-9223*
TSM Tooling Interface Plate for QC 40- Locking-MA03 [1]	9120-TSM-HBQL-10189	*9630-20-TSM-MBQL-10189*
Vertical Tooling Interface Plate		
TSM Tooling Interface Plate - Blank-Locking [1]	9120-TSM-VBBL-8441	*9630-20-TSM-VBBL-8441*
Notes: 1. Used with mounting modules:9120-TSM-MMBL-8432		

2.1.10 Proximity Sensor Modules

The proximity sensor mounts directly to the mounting module. The proximity sensor provides a signal indicating the Tool is located in the tool stand.

Item	Part Number	Refer to Drawing #
TSM Sensor module, PNP, 8 mm Barrel [1]	9120-TSM-SMA-8439	*9630-20-TSM-SMA-8439* *9630-20-TSM-SMA-8437* *9230-20-1905*
TSM Sensor module, NPN, 8 mm Barrel [1]	9120-TSM-SMA-8437	
Photoelectric Sensor Kit [1]	9005-20-2152	N/A
Notes: 1. Used with mounting module: 9120-TSM-MMB-8432.		

2.2 TSM System with V-Block Style Mounting

The system is compatible with QC-20 through QC-110 Tool Changers. The tool stand can be equipped with vertical mounting modules, horizontal modules, or with use of an adapter module to a horizontal extension and can be positioned anywhere along the rail. This system combines the ease of the V-block mounting module with adjustable tool spacing to accommodate customer tooling. There is an optional sensor holder that can attach to the mounting module.

Options are limited to the lengths of horizontal modules to accommodate multiple tool mounts depending on the size of the tooling. Contact ATI for more information.

Figure 2.2—TSM System with V-Block Horizontal Mounting

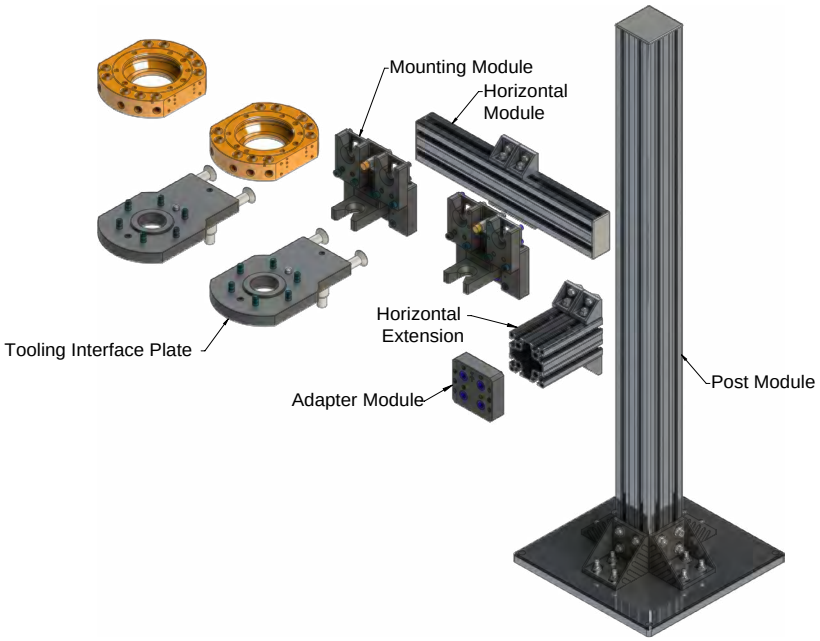
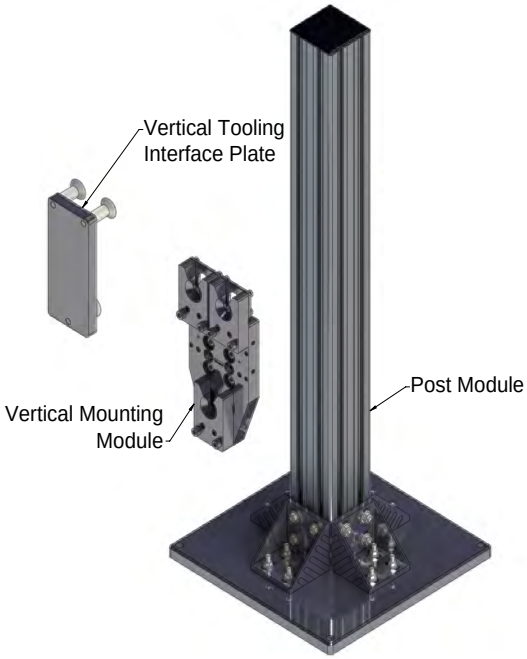
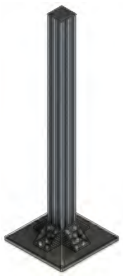


Figure 2.3— TSM System with V-Block Vertical Mounting



2.2.1 Post Module Kits

The post module kit is a common component to all TSM systems. The post module kit is available in different post heights and combines the base, rail, and gusset assemblies into a group of components.



Item	Part Number	Refer to Drawing #
Post module kit 914 mm (36”)[1,2]	9120-TSM-PM-3317	*9630-20-TSM-PM-3317*
Post module kit 1520 mm (60”)[1,2]	9120-TSM-PM-3353	

Notes:
1. May specify other rail lengths – cut charge will apply.
2. The post module is available factory assembled - an assembly charge will apply.

2.2.2 Horizontal Modules

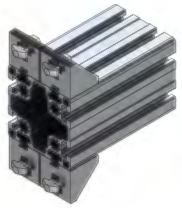
The horizontal module mounts to the post module and can be adjusted vertically or horizontally using the rail gussets to accommodate customer tooling. The rail is an aluminum extrusion and comes in standard lengths. Multiple Tool plate assemblies can be added to the rail depending on the tool spacing requirements.

Item	Part Number	Refer to Drawing #
Horizontal module 914 mm (36”)[1]	9120-TSM-HM-3317	*9230-20-1880*
Horizontal module 1520 mm (60”)[1]	9120-TSM-HM-3353	

Notes:
1. May specify other rail lengths – cut charge will apply.

2.2.3 Horizontal Extensions

The horizontal extension is used when customer tooling requires extra clearance from the rail or other tooling.



Item	Part Number	Refer to Drawing #
TSM Horizontal Extension, 3.15”	9120-TSM-HE-3403	*9230-20-1880*
TSM Horizontal Extension, 6”	9120-TSM-HE-3320	
TSM Horizontal Extension, 10”	9120-TSM-HE-3321	

2.2.4 TSM Adapter Module

To install a mounting module on a horizontal extension, use an adapter module.

Item	Part Number	Refer to Drawing #
TSM Adapter Module - Mounting Module to TSM HE[1]	9120-TSM-AM-9982	*9630-20-TSM-AM-9982*

Notes:
1. Adapts to the TSM horizontal extension.

2.2.5 Mounting Modules

The mounting module includes three pin receivers. The assembly includes mounting fasteners, and is designed to mount to the horizontal module or with use of an adapter module to the post module or end of a horizontal extension. The mounting modules can be positioned anywhere along the rail to accommodate customer tooling. A mounting module is required for each tool position. The mounting module provides mounting holes for an optional sensor holder (see *Section 2.2.9—Sensor Holders*).

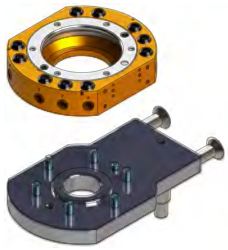
Item	Part Number	Refer to Drawing #	QC-Models
Mounting module [1,3]	9120-TSM-MMV-3597	*9630-20-TSM-MMV-3597*	QC-40 ~ QC-76
Mounting module [2,4]	9120-TSM-MMV-4018	*9630-20-TSM-MMV-4018*	QC-100 ~ QC-110

Notes:

1. Uses Sensor Holder 9120-TSM-SM-4205
2. Uses Sensor Holder 9120-TSM-SM-4206
3. Used with Tooling Interface Plates 9120-TSM-HVQ-XXXX except 9120-TSM-HVQ-4059.
4. Used with Tooling Interface Plates 9120-TSM-HVQ-4059 and 9120-TSM-HVB-7961.

2.2.6 Tooling Interface Plates

The tooling interface plate provides an interface from the customer tooling and Tool Changer to the tool stand. The tooling interface plate attaches to the Tool Changer and provides a mounting surface for the customer tooling. The tooling interface plate uses three tooling pins to position the tooling interface plate to the mounting module. Tooling interface plates listed in table below require a machined mounting pattern for customer tooling. Custom machined tooling interface plates are available, contact ATI for more information.



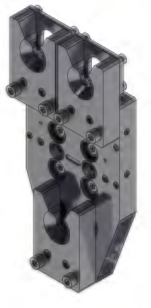
Item	Part Number	Refer to Drawing #	QC-Models
Tooling Interface Plate [2]	9120-TSM-HVQ-4055	*9630-20-TSM-HVQ-4055*	QC-40
Tooling Interface Plate [1, 2]	9120-TSM-HVQ-4627	*9630-20-TSM-HVQ-4627*	QC-40 Euro
Tooling Interface Plate [2]	9120-TSM-HVQ-4056	*9630-20-TSM-HVQ-4056*	QC-41
Tooling Interface Plate [2]	9120-TSM-HVQ-4057	*9630-20-TSM-HVQ-4057*	QC-60
Tooling Interface Plate [2]	9120-TSM-HVQ-6660	*9630-20-TSM-HVQ-6660*	QC-62
Tooling Interface Plate [2]	9120-TSM-HVQ-4058	*9630-20-TSM-HVQ-4058*	QC-71
Tooling Interface Plate [2]	9120-TSM-HVQ-7290	*9630-20-TSM-HVQ-7290*	QC-76
Tooling Interface Plate [3]	9120-TSM-HVQ-4059	*9630-20-TSM-HVQ-4059*	QC-100
Tooling Interface Plate [3, 4]	9120-TSM-HVB-7961	*9630-20-TSM-HVQ-7961*	QC Blank

Notes:

1. Euro Tool Changer only
2. Used with mounting module 9120-TSM-MMV-3597
3. Used with mounting module 9120-TSM-MMV-4018
4. Blank - No QC boss or QC mounting pattern.

2.2.7 Vertical Mounting Module

The vertical mounting module includes three pin receivers. The mounting module includes mounting fasteners, and is designed to mount to the horizontal module, horizontal extension, or directly to the post module. The mounting module can be positioned anywhere along the rail to accommodate customer tooling. A mounting module is required for each tool position. The mounting module provides mounting holes for an optional sensor holder (see *Section 2.2.9—Sensor Holders*).



Item	Part Number	Refer to Drawing #	QC-Models
Vertical Mounting module[2,3]	9120-TSM-MMV-4068	*9630-20-TSM-MMV-4068*	QC-40 ~ QC-76
Vertical Mounting module[1,4]	9120-TSM-MMV-4070	*9630-20-TSM-MMV-4070*	QC-100 ~ QC-110

Notes:
1. Uses Sensor Holder 9120-TSM-SM-4205
2. Uses Sensor Holder 9120-TSM-SM-4206
3. Used with Vertical Tooling Interface Plates 9120-TSM-VVB-4069
4. Used with Vertical Tooling Interface Plates 9120-TSM-VVB-4071

2.2.8 Vertical Tooling Interface Plate

The vertical tooling interface plate provides an interface from the tool and Tool Changer to the TSM system. The tooling interface plate attaches to a flat on the customer tooling or Tool Changer. The tooling interface plate uses the (3) tooling pins to position the tooling interface plate with the mounting module.

Item	Part Number	Refer to Drawing #	QC-Models
Vertical Tooling Interface Plate-Blank[1]	9120-TSM-VVB-4069	*9630-20-TSM-WB-4069*	QC-40 ~ QC-76
Vertical Tooling Interface Plate-Blank (Large)[2]	9120-TSM-VVB-4069	*9630-20-TSM-WB-4071*	QC-100 ~ QC-110

Notes:
1. Used with mounting module 9120-TSM-MMV-4068
2. Used with mounting module 9120-TSM-MMV-4070

2.2.9 Sensor Holders

The TSM sensor holders accommodate barrel-type proximity sensors with 18 x 1.0 thread. For operation, thread the sensor into the desired position to detect the surface of the TSM tooling interface plate as it is dropped off in the stand. ATI offers the following proximity sensor (see *Section 2.2.10—Proximity Sensor*).

Item	Part Number	Refer to Drawing #	QC-Models
Sensor Holder	9120-TSM-SM-4206	*9230-20-1905* *9630-20-TSM-SMA-8437* *9630-20-TSM-SMA-8439*	QC-40 ~ QC-76
Sensor Holder	9120-TSM-SM-4205		QC-100 ~ QC-110

2.2.10 Proximity Sensor

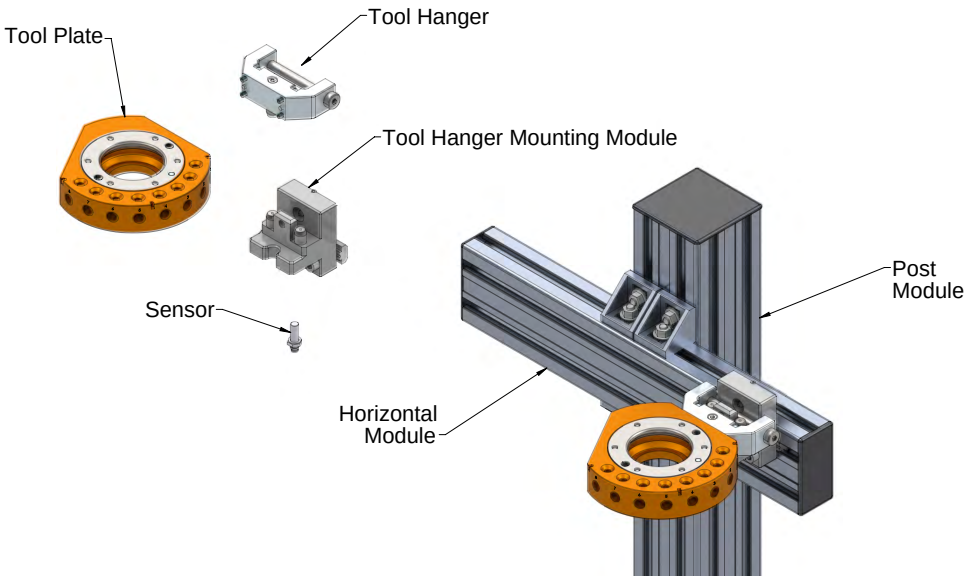
The proximity sensor screws directly into the sensor holder. The proximity sensor provides a signal indicating the Tool is located in the tool stand.

Item	Part Number	Refer to Drawing #	QC-Models
PNP 3-Wire DC Sensor	8590-9909999-45	*9230-20-1905* *9630-20-TSM-SMA-8437* *9630-20-TSM-SMA-8439*	QC-40 ~ QC-110

2.3 TSM System with Tool Hanger Mounting Module

The tool hanger mounting module is compatible with QC-20 through QC-71 Tool Changers and includes a rigid block that interfaces with the tool hanger. The mount assembly includes the mounting fasteners, and is designed to mount to extruded rail components and the flats on the Tool Changer. The assembly can be mounted to any other surface that has the corresponding mounting features.

Figure 2.4—Tool Hanger Mounting



2.3.1 Post Module Kits

The post module kit is a common component to all TSM systems. The post module kit is available in different post heights and combines the base, rail, and gusset assemblies into a group of components.

Item	Part Number	Refer to Drawing #
Post module kit 914 mm (36”)[1,2]	9120-TSM-PM-3317	*9630-20-TSM-PM-3317*
Post module kit 1520 mm (60”)[1,2]	9120-TSM-PM-3353	

Notes:

1. A customer may specify other rail lengths – cut charge will apply.
2. The post module is available factory assembled - an assembly charge will apply.

2.3.2 Horizontal Modules

The horizontal module mounts to the post module and can be adjusted vertically or horizontally using the rail gussets to accommodate customer tooling. The rail is an aluminum extrusion and comes in standard lengths. Multiple Tool plate assemblies can be added to the rail depending on the tool spacing requirements.

Item	Part Number	Refer to Drawing #
Horizontal module 914 mm (36”)[1]	9120-TSM-HM-3317	*9230-20-1880*
Horizontal module 1520 mm (60”)[1]	9120-TSM-HM-3353	

Notes:

1. A customer may specify other rail lengths – cut charge will apply.

2.3.3 Tool Hanger Mounting Modules

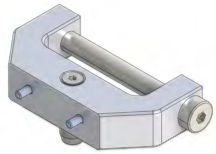
The tool hanger mounting module includes a rigid block with locating pins.

Item	Part Number	Refer to Drawing #	QC-Models
Tool Hanger Mounting module	9120-TSM-MM-5496	*9630-20-TSM-MM-5496*	QC-20 ~ QC-71

Note:
1. Used with 9120-TSM-TH-5891, 9120-TSM-TH-5923, and 9120-TSM-TH-5497

2.3.4 Tool Hangers

The tool hanger provides an interface between the Tool Changer and mounting module. The tool hangers are sized and designed to correspond with the Tool Changer module flats. The tool hanger also includes (2) steel alignment features—a shoulder bolt that aligns with the mounting module groove and a locating pin to align with the corresponding slot in the mounting module.



Item	Part Number	Refer to Drawing #	QC-Models
Tool Hanger[3]	9120-TSM-TH-5891	*9630-20-TSM-TH-5891*	QC-20[1], QC-21[1], QC-21E [1]
Tool Hanger[3]	9120-TSM-TH-5923	*9630-20-TSM-TH-5923*	QC-21[2], QC-21E[2]
Tool Hanger[3]	9120-TSM-TH-5497	*9630-20-TSM-TH-5497*	QC-40[1, 2], QC-40Q[1, 2], QC-41[1], QC-71[1, 2]

Notes:
1. Mounts to Flat A
2. Mounts to Flat B
3. Used with mounting module 9120-TSM-MM-5496

2.3.5 Proximity Sensor and Cables for Tool Hanger Mounting Module

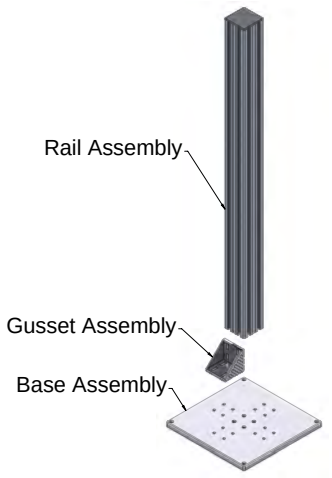
The proximity sensor can be screwed into the tool hanger mounting module. The proximity sensor provides a signal indicating the Tool is located in the tool stand. Sensor cables are available in various lengths. This proximity sensor is not compatible with the V-block mounting module.

Proximity Sensor		
Item	**Part Number**	**QC-Models**
Proximity Sensor PNP 3 wire DC	8590-9909999-34	QC-20 ~ QC-71
Sensor Cables		
Item	**Part Number**	**QC-Models**
2 meter female	8590-9909999-07	QC-20 ~ QC-71
5 meter female	8590-9909999-12	QC-20 ~ QC-71

2.4 Post Module Components

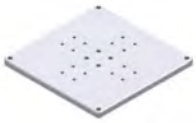
The post module is a common component to all TSM systems. The post module is available in different post heights and combines the base, rail, and gusset assemblies into a group of components.

Figure 2.5—Post module Components



2.4.1 Base Plate

The base plate consists of a square aluminum machined plate. The base provides a secure foundation on which to build the TSM system.



Item	Part Number	Refer to Drawing #
Base Plate	3700-20-3589	*9630-20-TSM-PM-3317*

2.4.2 Rail Assemblies

The rail assembly mounts to the base assembly. The standard rail is an aluminum extrusion and is available in a variety of lengths. Customers can request custom lengths when ordering.

Item	Part Number	Refer to Drawing #
Post Rail 914 mm (36”)	3710-20-3435	*9630-20-TSM-PM-3317*
Post Rail 1016 mm (40”)	3710-20-3382	
Post Rail 1220 mm (48”)	3710-20-3318	
Post Rail 1520 mm (60”)	3710-20-3334	
Post Rail 1828 mm (72”)	3710-20-3322	

Note:
1. The customer may specify other rail lengths – cut charge will apply.

2.4.3 Gusset Assembly

The gusset assembly provides structural support at the base of the post module. The gusset assembly mounts to the base of the post module and includes mounting fasteners. Note: Remove tabs from the gusset so that the surface of the gusset is flush with the base assembly.

NOTICE: Remove the tabs from the gusset so that the back surface of the gusset is flush with the base assembly surface.

Item	Part Number	Refer to Drawing #
Gusset	9120-TSS-GA-1030	*9630-20-TSM-PM-3317*

2.5 Determining The Tool Stand Configuration

Determining the components needed for a tool stand requires knowledge of the system being designed. When determining the tool stand components, consider the following questions:

- What model Tool Changer will be used, and are Tool Changer modules required?
- How many tools must the stand accommodate?
- What are the dimensions and weight of the tooling that will be used?
- What is the size, reach, and capability of the robot being used?
- How much floor space is available to accommodate the tool stand?
- How much area between tool positions are required for pneumatic fittings, hoses, electrical cabling and other utilities?

Figure 2.6—Tool Stand and Tool Spacing

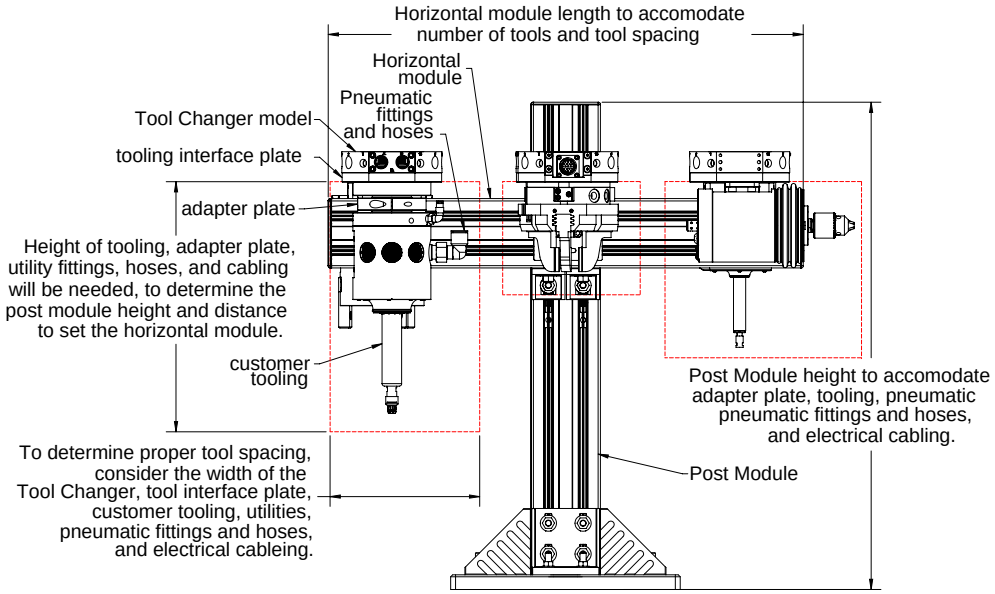
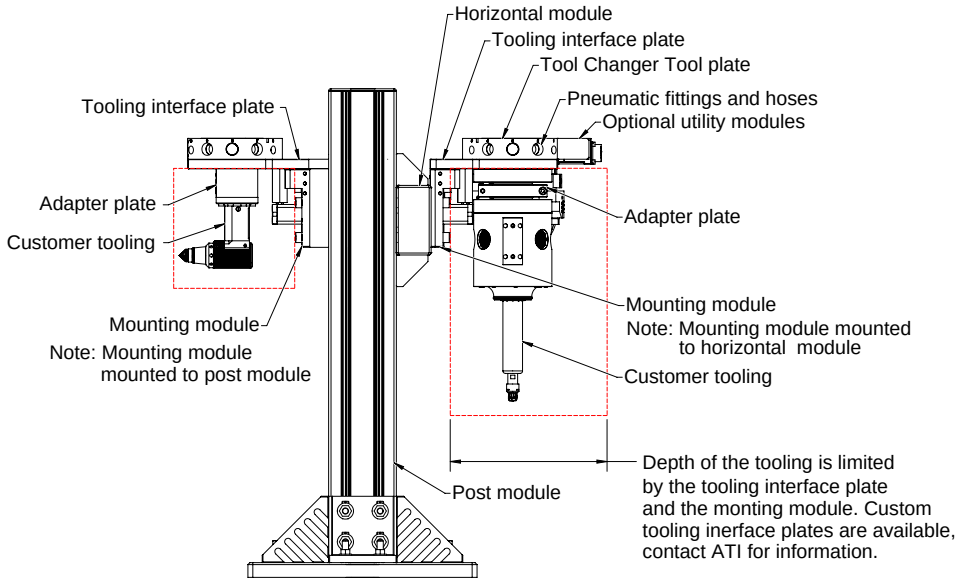


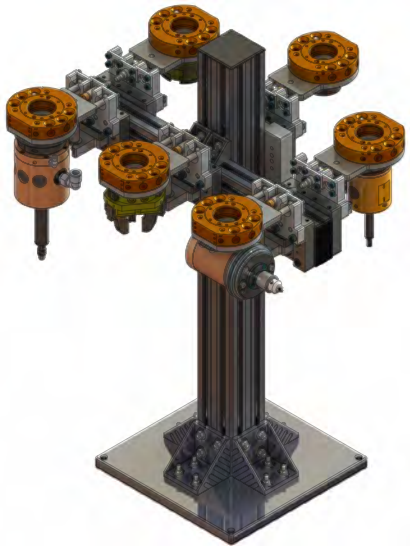
Figure 2.7—Tool Stand Configurations



2.5.1 Configuring a TSM System with Horizontal Mounting

A TSM system with horizontal mounting provides variable spacing tool positions and tool sensing options for Tool Changer models QC-40 through QC-110. The mounting module can mount to the post module using an adapter module for up to two tool positions, or mount to an optional horizontal module to accommodate multiple tool positions. Refer to *Section 2.2—TSM System with V-Block Style Mounting* for detailed information.

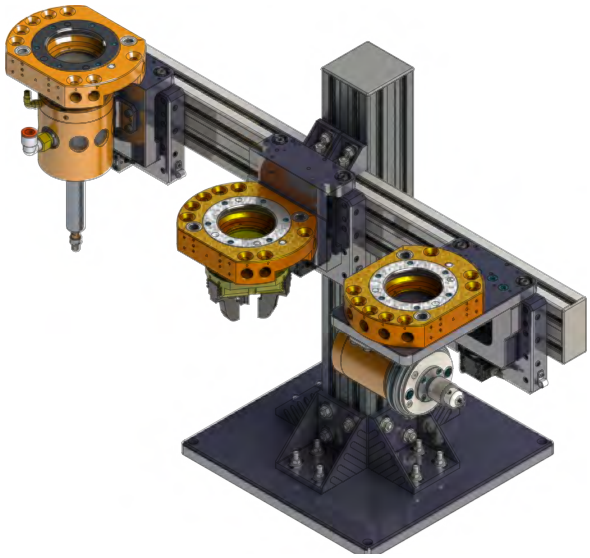
Figure 2.8—Horizontal Mounting System Configurations



2.5.2 Configuring a TSM System with Pin and Bushing Mounting

A TSM system with pin and bushing mounting provides variable spacing tool positions and tool sensing options for Tool Changer models. The mounting module can mount to the post module using an adapter module for up to two tool positions, or mount to an optional horizontal module to accommodate multiple tool positions. Refer to *Section 2.1—TSM System with Pin and Bushing Style Mounting* for detailed information.

Figure 2.9—Pin and Bushing Mounting System Configurations



2.5.3 Configuring a TSM System with Vertical Mounting

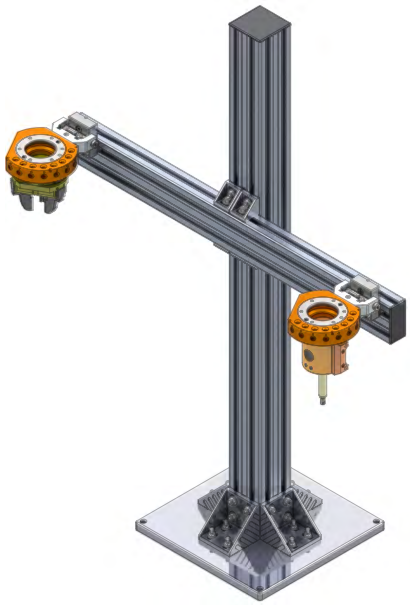
A TSM system with vertical mounting can mount directly to the post module for up to two tool positions or mount to an optional horizontal module to accommodate multiple tool positions. Refer to *Section 2.2—TSM System with V-Block Style Mounting* for detailed information.

Figure 2.10—Vertical Mounting Configurations

2.5.4 Configuring a TSM System with Tool Hanger Mounting

Tool hanger mounting provides multiple tool positions for Tool Changer models QC-20 through QC-71. The mounting module is mounted to the horizontal module or vertical post. Optional proximity sensors can be added for Tool presence sensing. Refer to *Section 2.3—TSM System with Tool Hanger Mounting Module* for detailed information.

Figure 2.11—Tool Hanger Configurations



3. Installation

The tool stand is shipped unassembled. The customer must perform the final assembly and determine the proper location for the tool stand.

WARNING: All pneumatic fittings and tubing must be capable of withstanding the repetitive motions of the application without failing. The routing of electrical and pneumatic lines must minimize the possibility of over stressing, pullout, or kinking the lines. Failure to do so can cause critical electrical and/or pneumatic lines to malfunction and might result in injury to personnel or damage to equipment.

CAUTION: Improper cable routing can result in wires and cables being pinched in the joint between the Tool Changer plates and premature failure of the electrical connectors. Properly route and secure all cables, particularly on the Master side.

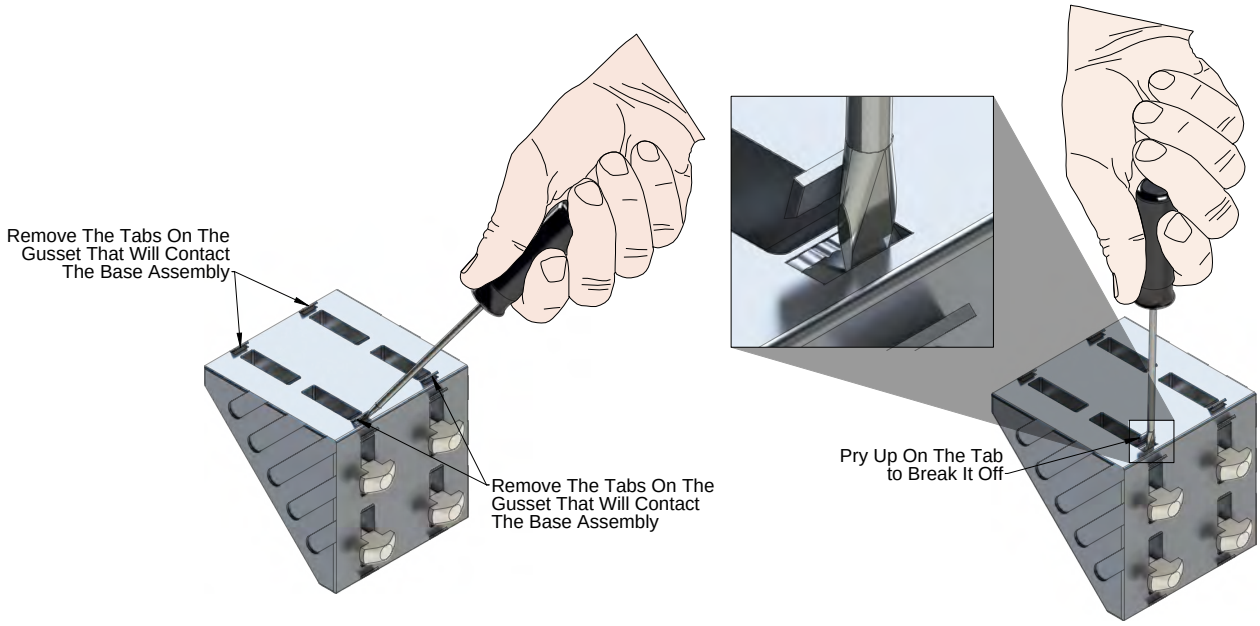
CAUTION: Thread locker applied to fasteners must not be used more than once. Fasteners might become loose and cause equipment damage. Always apply new thread locker when reusing fasteners.

3.1 Installing Base, Rail, and Gusset assemblies

Tools required: *6 mm and 10 mm hex key, 13 mm socket wrench, screw driver, torque wrench*

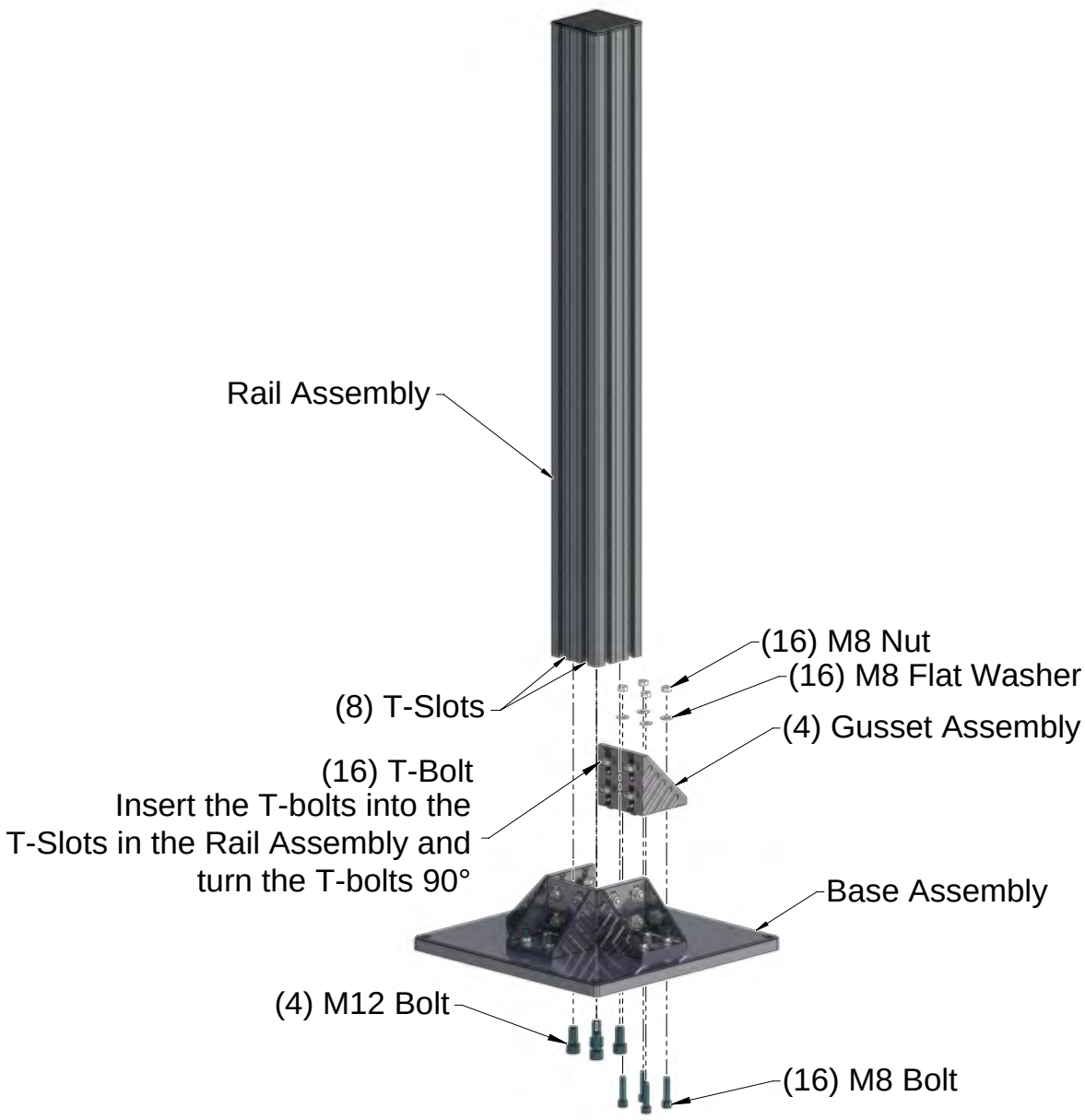
1. Determine the proper location and configuration of the tool stand. Assemble the base, rail and gusset assemblies prior to anchoring the TSM base.
2. Assemble the gussets to the rail by inserting the T-bolts into the T-slots in the rail and turning the T-bolts 90°.
3. Insert a screw driver into the slot under the tab.
4. Pry up on the tab to break it off.
5. Remove any burrs that may not allow flush contact to the base assembly.

Figure 3.1—Removing Tabs on Gussets Using Screw Driver



6. Assemble the rail to the base with the (4) M12 socket head cap screws using a 10 mm hex key, refer to drawing *9630-20-TSM-PM-3317* for specific details on torque and thread tool hanger requirements.
7. Insert the M8 socket head cap screws through the base and gussets. Secure with the M8 flat washer and nut. Using a 6 mm hex key, tighten the nuts on the T-bolts holding the gussets to the rail using a 13 mm socket wrench. Refer to drawing *9630-20-TSM-PM-3317* for specific details on torque and thread requirements.

Figure 3.2—Installing Base, Rail, and Gusset assemblies



8. Anchor the TSM base to a smooth flat surface using the (4) 13 mm through holes provided (fasteners not included).
9. To continue installation, refer to the following sections:

- *Section 3.2—Installing Pin and Bushing or Horizontal V-Block Mounting Module to Tool Stand*
- *Section 3.3—Installing Vertical V-Block Mounting Module to Tool Stand*
- *Section 3.4—Installing Tool Hanger Mounting Module to Tool Stand*
- *Section 3.5—Installing Horizontal Extension to Tool Stand*

3.2 Installing Pin and Bushing or Horizontal V-Block Mounting Module to Tool Stand

Tools required: *6 mm hex key, 13 mm socket wrench, torque wrench*

1. For information to assemble the model, refer to the specific drawings in *Section 2.2—TSM System with V-Block Style Mounting*. The drawings provide torque, thread, and other specific requirements.
2. Assemble the horizontal module to the post module by inserting the T-bolts into the T-slots in the rail. Turn the T-bolts 90° and torque.
3. Adjust the height of the horizontal module to accommodate the tooling and tighten the nuts on the T-bolts to secure the vertical position of the rail, further adjustments to horizontal module may be required using a 13 mm socket wrench.
4. Remove the horizontal module end cap and assemble the mounting module to the horizontal module by sliding the T-nuts into the T-slots on the horizontal module.
5. Install additional mounting modules if needed.
6. Position the horizontal module and the mounting modules to accommodate the tool spacing desired and tighten the T-bolts for the horizontal position of the rail. Tighten the M8 socket head cap screws to secure the mounting modules using a 6 mm hex key.
7. Place the end cap on the horizontal module.

Figure 3.3—Installing Tooling Interface Plates (V-Block Shown)

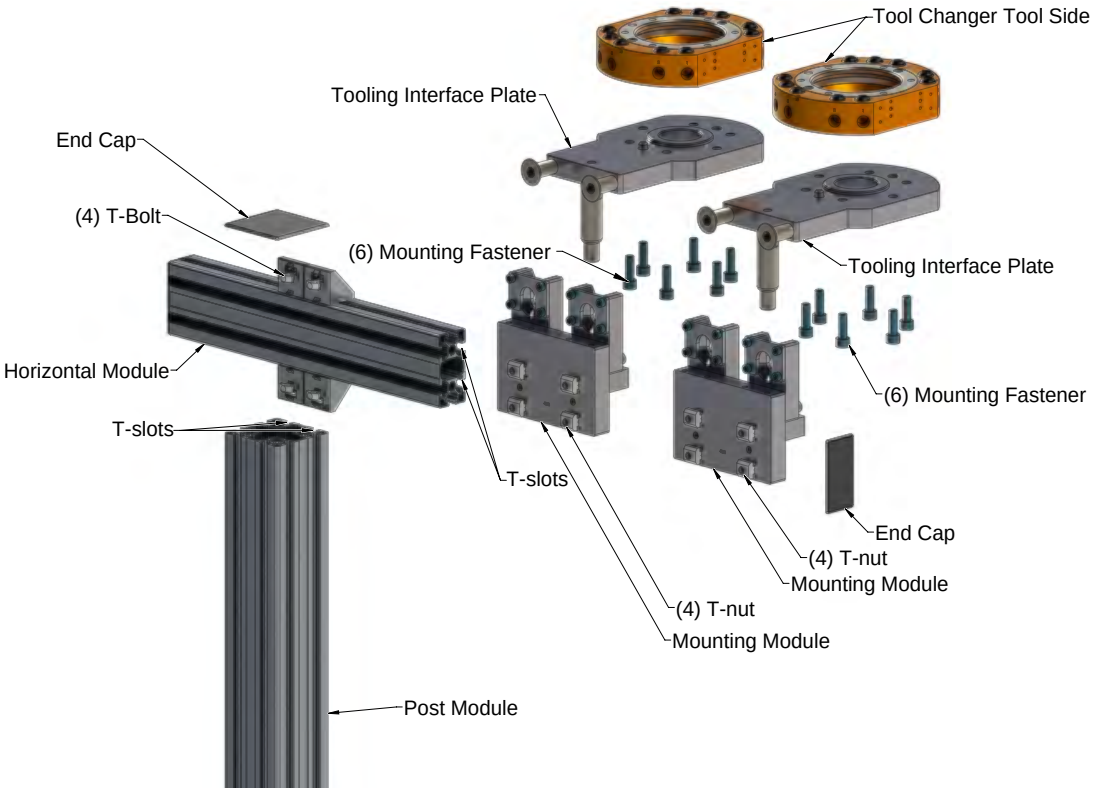
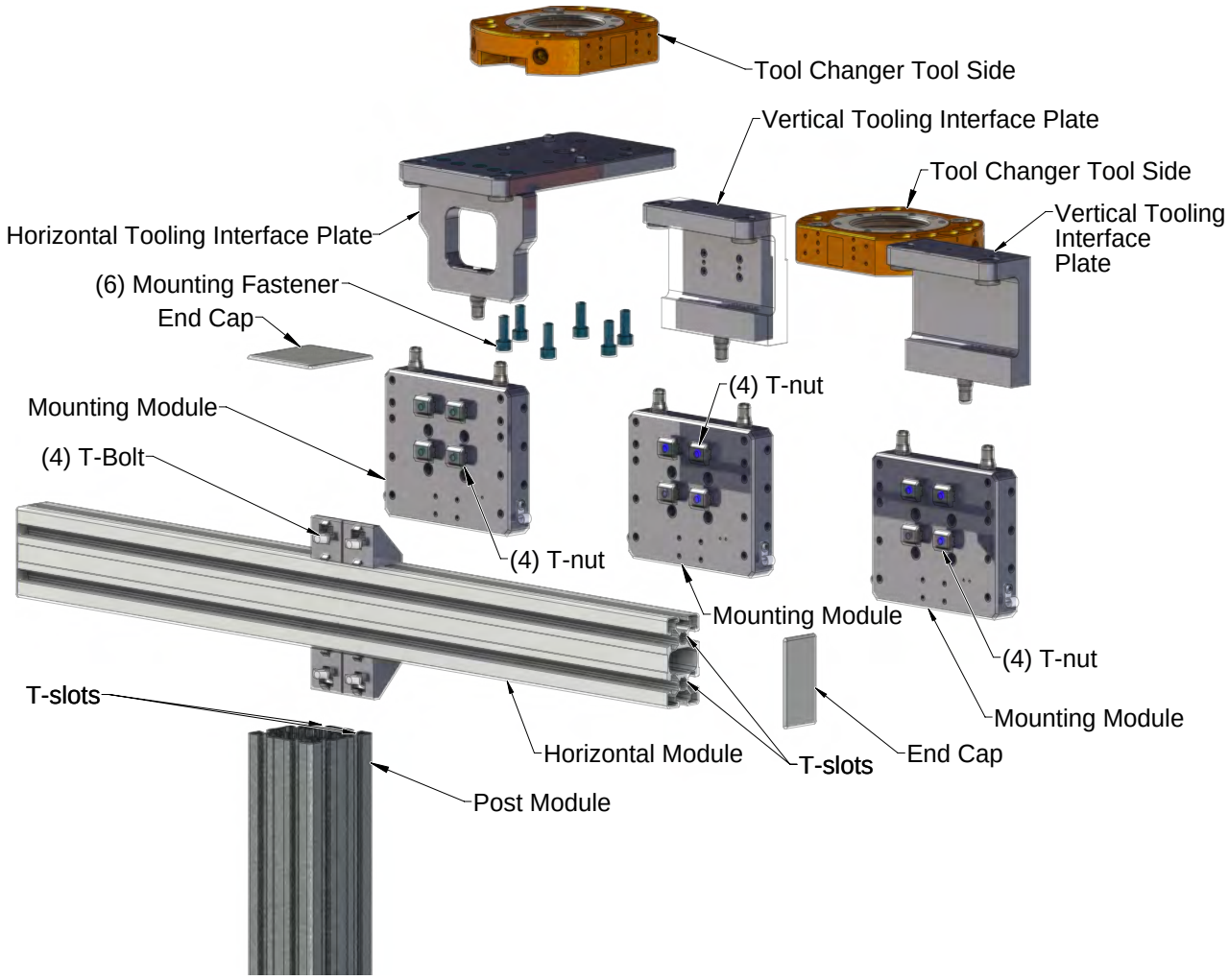


Figure 3.4—Installing Tooling Interface Plates (Pin and Bushing Shown)



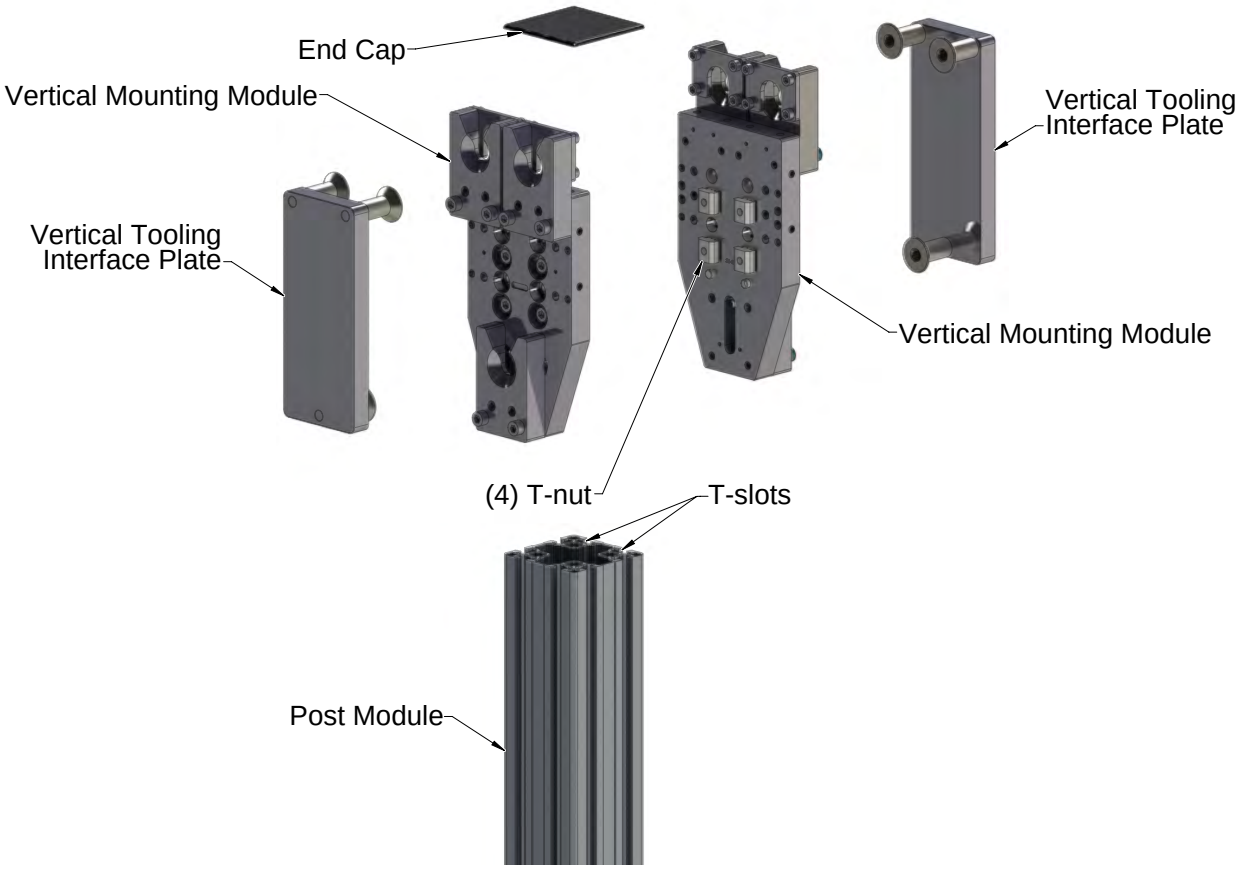
8. If equipped, install the optional proximity sensor to the mounting module. Refer to *Section 3.6—Installation of Proximity and Photoelectric Sensor (for Pin and Bushing)* and *Section 3.7—Proximity Sensor Installation for V-Block (Sensor Holder 9120-TSM-SM-4205).*
9. If the tooling interface plate is a blank plate, it will need to be machined with the mounting pattern for the Tool Changer and/or customer tooling desired. Refer to the drawings in *Section 2.1—TSM System with Pin and Bushing Style Mounting* for the specific Tool Changer being used for the mounting pattern required.
10. Assemble the customer tooling and Tool Changer to the tooling interface plate assembly. Then place on the mounting module. Refer to the appropriate Tool Changer manual for proper installation of the tooling interface plate.

3.3 Installing Vertical V-Block Mounting Module to Tool Stand

Tools required: *6 mm hex key, torque wrench*

1. For information to assemble the model, refer to the specific drawings in *Section 2.2—TSM System with V-Block Style Mounting*. The drawings provide torque, thread, and other specific requirements.
2. Remove the post module end cap. Refer to *Figure 3.5*.
3. Assemble the mounting module to the post module by sliding the T-nuts into the T-slots in the rail.
4. Adjust the height of the mounting module or horizontal module to accommodate the tooling for the application and tighten the M8 socket head cap screws using a 6 mm hex key.
5. Place the end cap on the post module.
6. If the tooling interface plate is a blank plate it will need to be machined with the mounting pattern for the Tool Changer and/or customer tooling desired. Refer to the drawings in *Section 2.2—TSM System with V-Block Style Mounting* for the specific Tool Changer being used for the mounting pattern required.
7. Assemble the customer tooling and/or Tool Changer to the tooling interface plate. Then place on the mounting module.

Figure 3.5—Installing Vertical Tooling Interface Plates



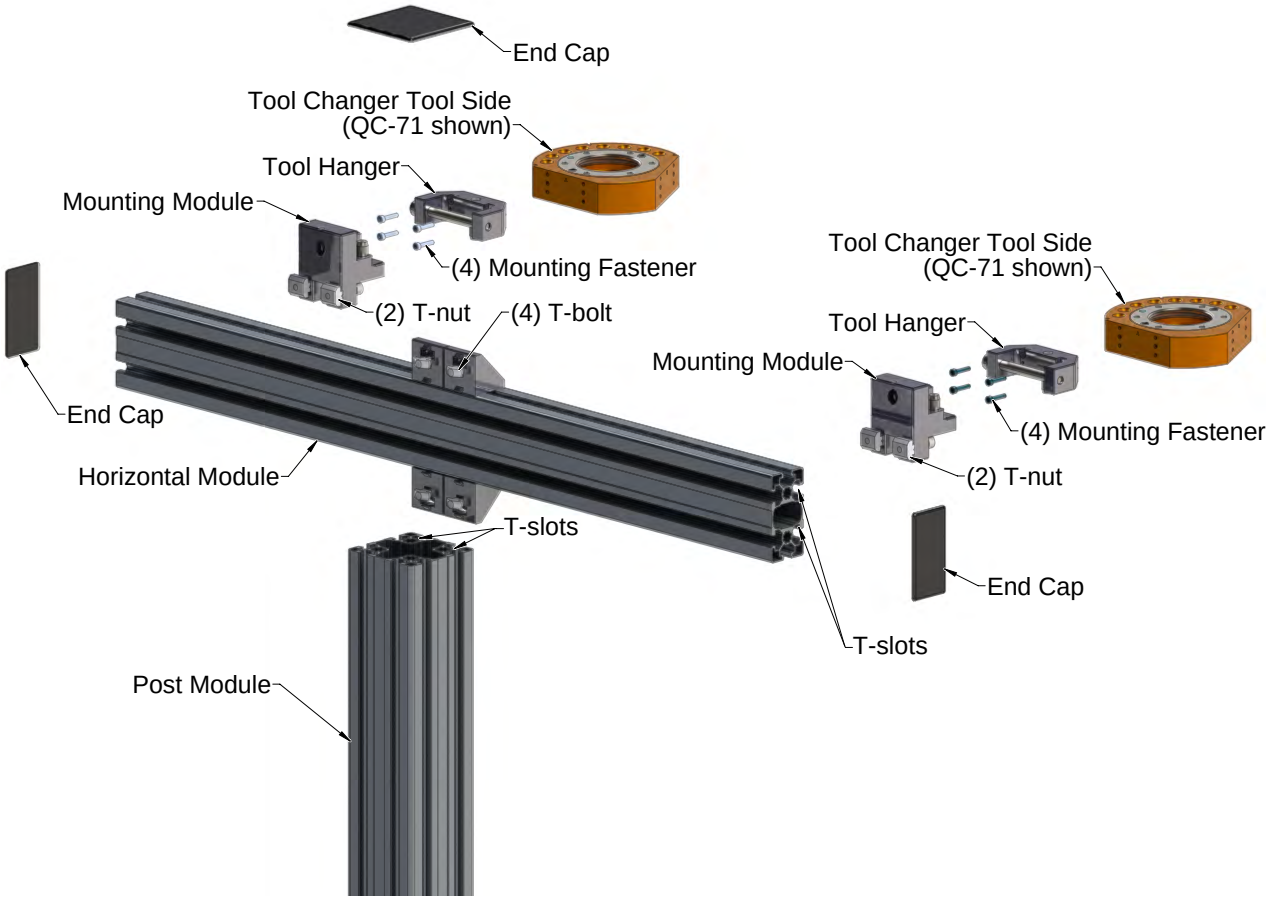
8. If equipped, install the optional sensor holder and proximity sensor. Refer to *Section 3.7—Proximity Sensor Installation for V-Block (Sensor Holder 9120-TSM-SM-4205).*

3.4 Installing Tool Hanger Mounting Module to Tool Stand

Tools required: *6 mm hex key, 13 mm socket wrench, torque wrench*

1. For information to assemble the model, refer to the specific drawing in *Section 2.3—TSM System with Tool Hanger Mounting Module*. The drawings provide torque, thread, and other specific requirements.
2. Assemble the horizontal module to the post module by inserting the T-bolts into the T-slots in the rail. Turn the T-bolts 90° and torque.
3. Adjust the height of the horizontal module to accommodate the tooling for the application and tighten the nuts on the T-bolts to secure the vertical position of the rail using a 13 mm socket wrench. Further adjustments to horizontal module may be required.
4. Remove the horizontal module end cap and assemble the mounting module to the horizontal module by sliding the T-nuts into the T-slots on the horizontal module.
5. Adjust the height of the mounting module to accommodate the tooling for the application and tighten the M8 socket head cap screws.
6. Place the end cap on the horizontal module.
7. Assemble the customer tooling and Tool Changer to the tool hanger. Then place on the mounting module.

Figure 3.6—Installing Tool Hanger Mounting Modules



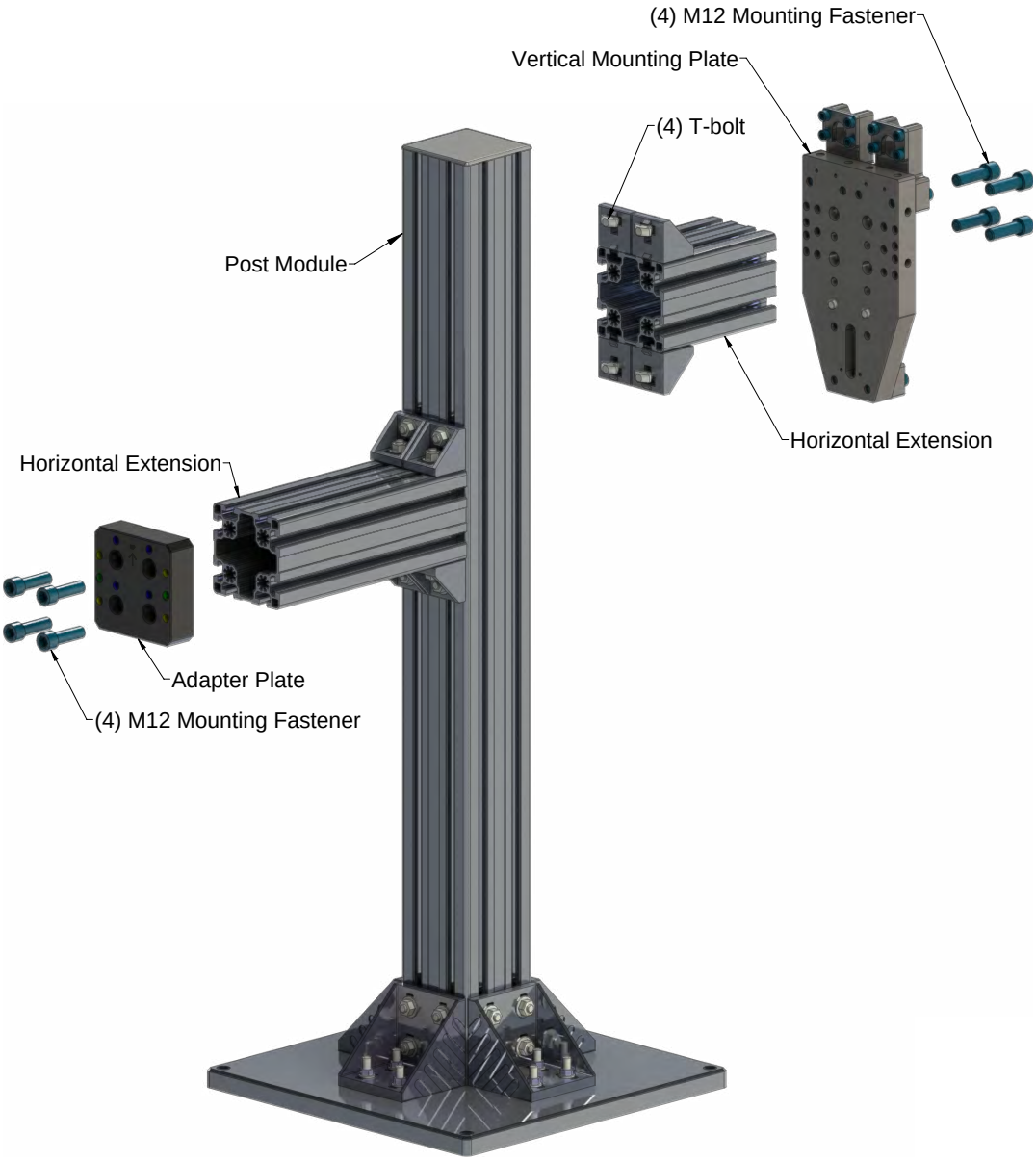
8. If equipped, install the optional proximity sensor. Refer to *Section 3.9—Proximity Sensor installation for TSM Tool Hanger*

3.5 Installing Horizontal Extension to Tool Stand

Tools required: *6 mm and 10 mm hex key, 13 mm socket wrench, torque wrench*

1. For information to assemble the model, refer to the specific drawings in *Section 2.2—TSM System with V-Block Style Mounting*. The drawings provide torque, thread, and other specific requirements.
2. Assemble the horizontal extension to the rail by inserting the T-bolts into the T-slots in the rail. Turn the T-bolts 90° and finger tighten.
3. Adjust the height of the horizontal extension to accommodate the tooling for the application and tighten the nuts to proper torque on the T-bolts to secure the vertical position of the extension using a 13 mm socket wrench.
4. Assemble the adapter module or vertical mounting plate to the end of the horizontal extension with the M12 mounting fasteners using a 10 mm hex key.

Figure 3.7—Installing Horizontal Extension



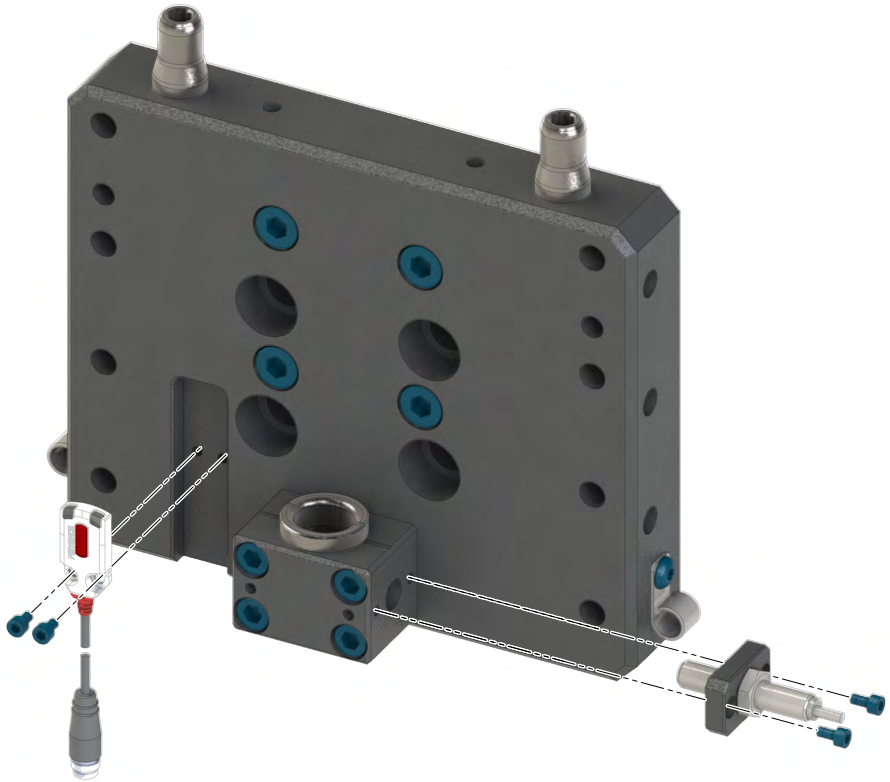
3.6 Installation of Proximity and Photoelectric Sensor (for Pin and Bushing)

Tools required: *2.5 mm hex key, torque wrench*

Supplies required: *Loctite® 222™*

1. Install the barrel proximity sensor:
   a. Apply Loctite® 222™ to the threads of the (2) M3 socket head cap screws.
   b. Use a 2.5 mm hex key to install the (2) M3 socket head cap screws that secure the sensor holder to the block on the mounting module. Tighten to 50 in-lbs (5.6 Nm).
2. (Optional) Install the photoelectric sensor:
   a. Apply Loctite® 222™ to the threads of the (2) M3 socket head cap screws.
   b. Use a 2.5 mm hex key to install the (2) M3 socket head cap screws that secure the sensor to the slot on the mounting module. Tighten to 10 in-lbs (1.1 Nm).
   c. Attach the sensor cable to the sensor connector.

Figure 3.8—Installation of Sensor for Pin and Block



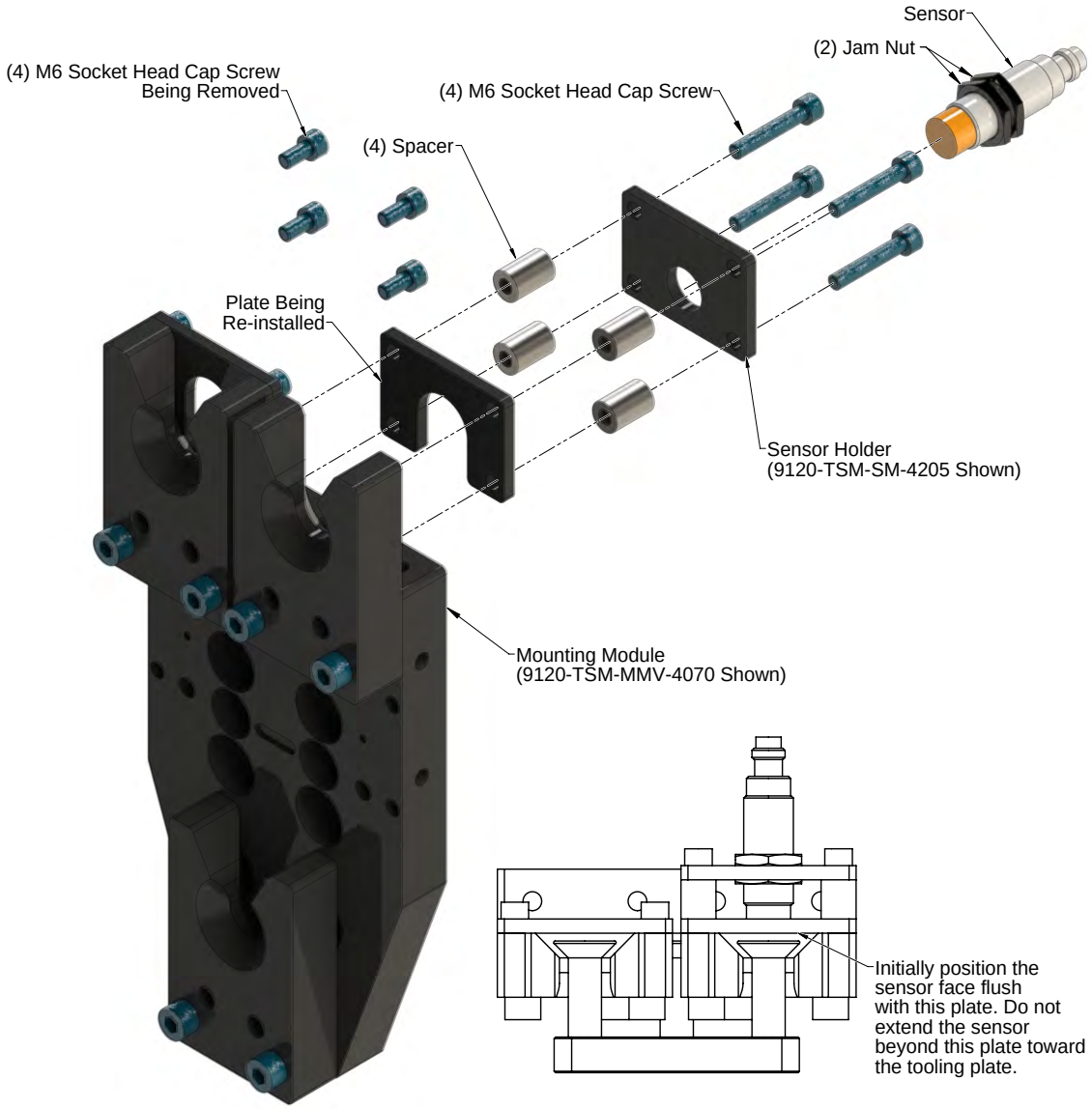
3.7 Proximity Sensor Installation for V-Block (Sensor Holder 9120-TSM-SM-4205)

Tools required: *5 mm hex key, 24 mm wrench, torque wrench*

Supplies required: *Loctite® 222™*

1. Remove the (2) M6 socket head cap screws using a 5 mm hex key from the inside of each of the top pin receivers on the mounting module.
2. Apply Loctite® 222™ or similar to the (4) M6 socket head cap screws used to mount the proximity sensor holder.
3. Attach the proximity sensor holder to the mounting module with the (4) M6 socket head cap screws using a 5 mm hex key and spacers if required. Tighten to 6 in-lbs (0.68 Nm).
4. Screw the proximity sensor into the holder and initially position so the face of the sensor is flush with the plate being reinstalled as shown in *Figure 3.9.* Do not extend the sensor beyond the face of the plate toward the tooling plate.
5. Turn the jam nuts finger-tight, and connect the sensor cable.
6. Adjust sensing distance, as needed, and tighten the jam nuts using a 24 mm wrench.

Figure 3.9—Proximity Sensor Position for V-Block (Sensor Holder 9120-TSM-SM-4205)



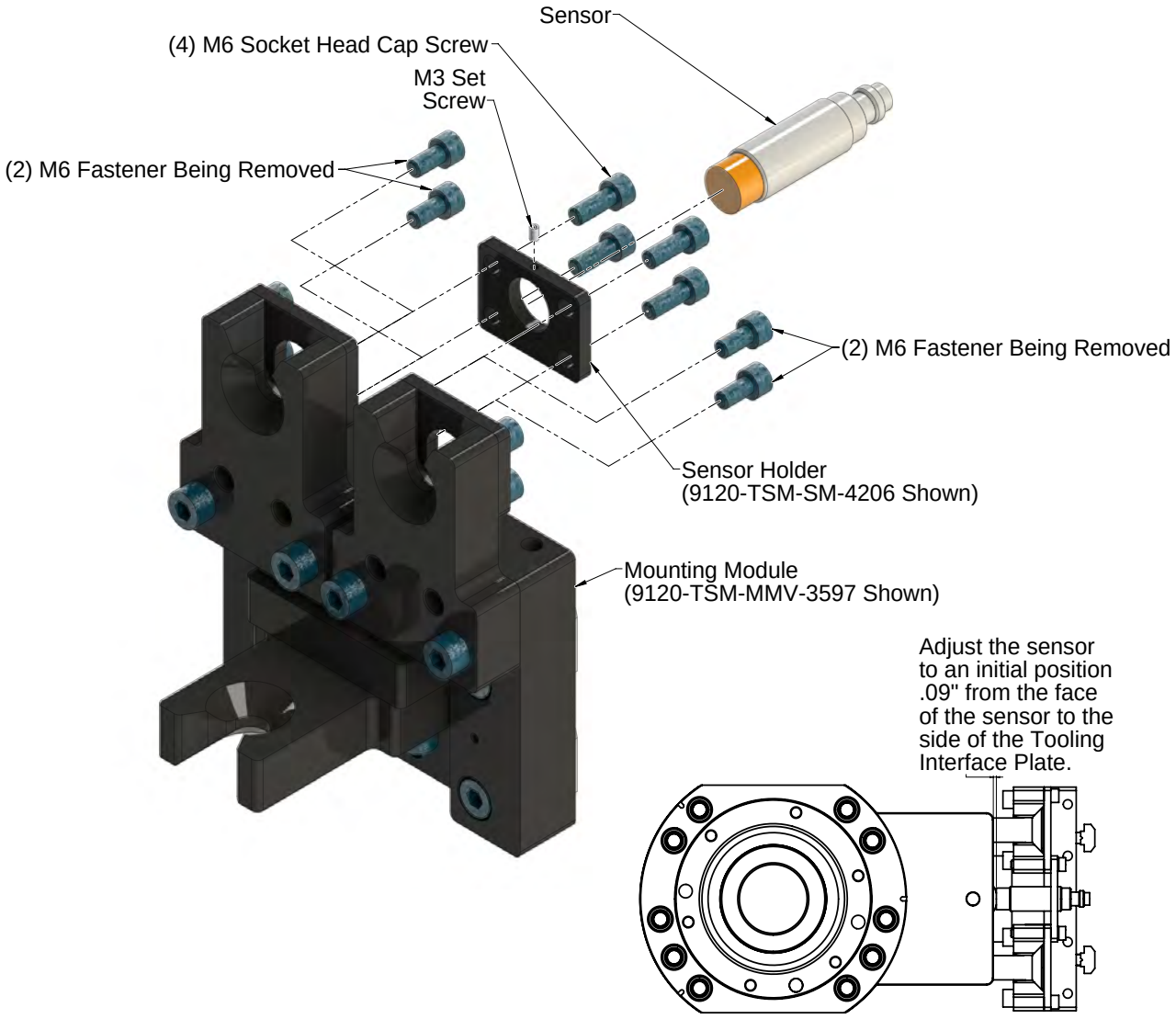
3.8 Proximity Sensor Installation for V-Block (Sensor Holder 9120-TSM-SM-4206)

Tools required: *2.5 mm and 5 mm hex key, torque wrench*

Supplies required: *Loctite® 222™*

1. Remove the (2) M6 socket head cap screws using a 5 mm hex key from the inside of each of the top pin receivers on the mounting module.
2. Apply Loctite® 222™ (or similar) to the (4) M6 socket head cap screws using a 5 mm hex key to mount the proximity sensor holder.
3. Attach the proximity sensor holder to the mounting module with the (4) M6 socket head cap screws and spacers (if required). Tighten to 6 in-lbs (0.68 Nm) using a 5 mm hex key.
4. Screw the proximity sensor into the holder and initially position so the face of the sensor is .09″ from the side of the tooling interface plate as shown in *Figure 3.10*.
5. Tighten the M3 set screw using 2.5 mm hex key and connect the sensor cable.
6. Adjust sensing distance as needed.

Figure 3.10—Proximity Sensor Position for V-Block (Sensor Holder 9120-TSM-SM-4206)

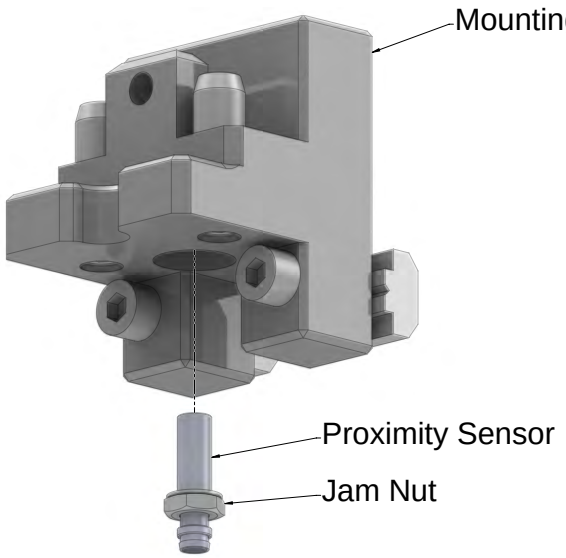


3.9 Proximity Sensor installation for TSM Tool Hanger

Tools required: *13 mm socket wrench, torque wrench*

1. Attach the proximity sensor to the mounting module by screwing the sensor into the bottom of the mounting module. Tighten to 6 in-lbs (0.68 Nm).
2. Position the sensor so the sensor face is flush with the surface of the mounting module.
3. Adjust sensor position as needed.
4. Tighten the jam nut on the sensor against the mounting module using a 13 mm wrench.
5. Attach the sensor cable to the proximity sensor.

Figure 3.11—Proximity Sensor Position for TSM Tool Hanger



4. Operation

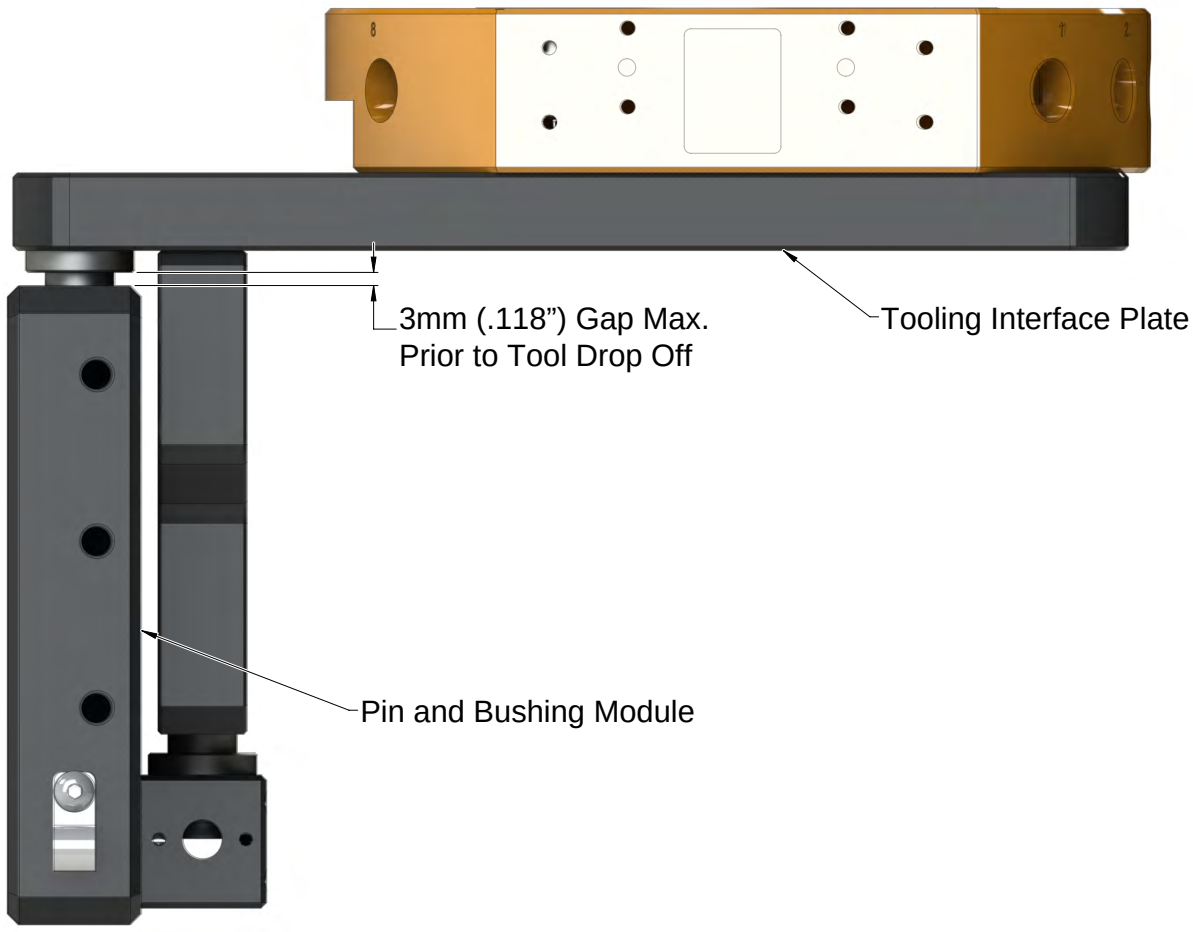
The ATI TSM system is intended for use with Tool Changer sizes QC-20 through QC-110.

CAUTION: Damage will occur if contact is made between the TSM pin and bushing tooling Plate and the mounting module prior to tool drop-off

4.1 TSM System with Pin and Bushing Style Mounting Operation

For proper tool drop-off, ATI recommends 3 mm (0.118”) maximum clearance between TSM pin and bushing mounting module contact surfaces and the TSM tooling interface plate contact surface.

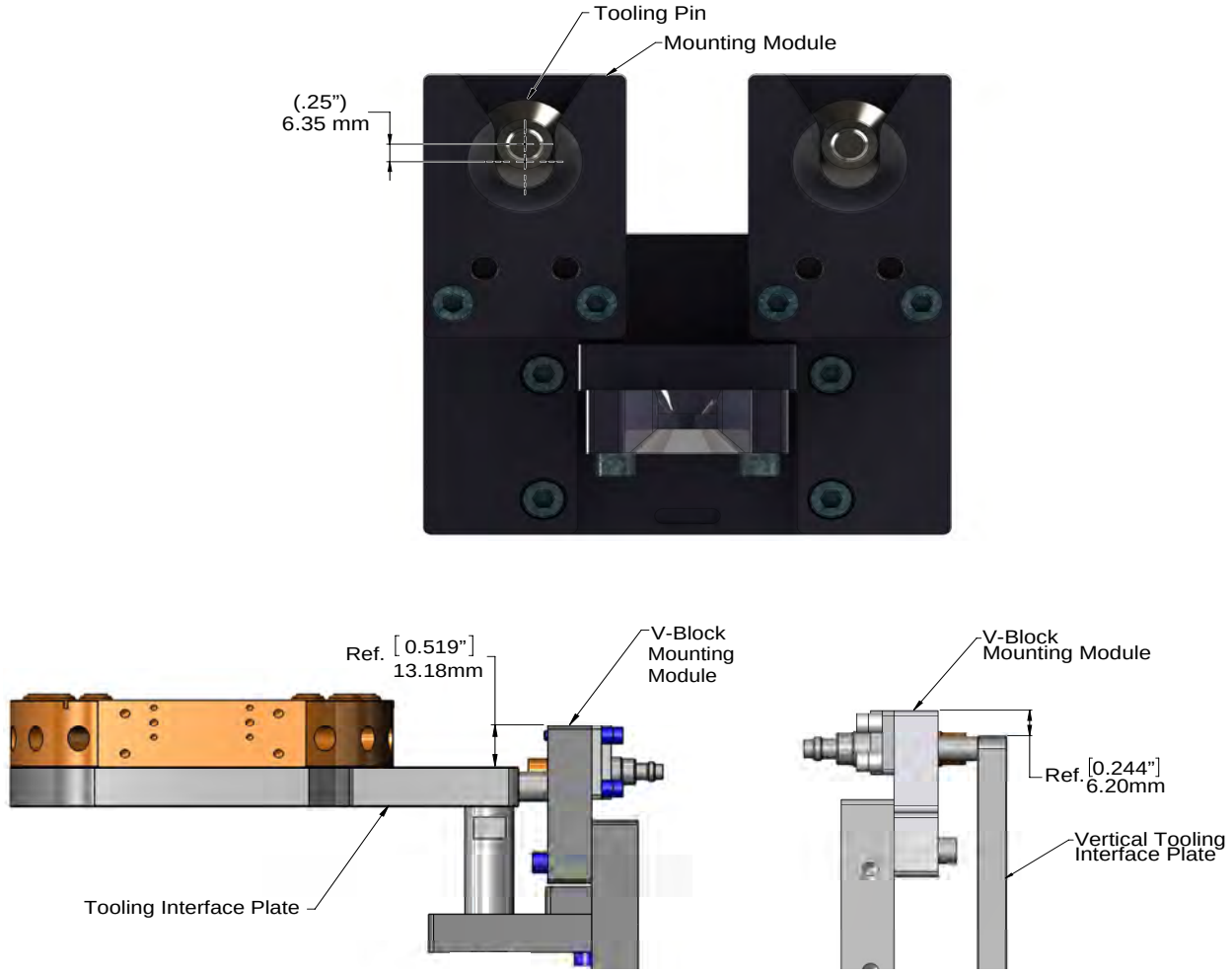
Figure 4.1—Maximum Clearance for Proper Tool Drop-off for Pin and Bushing Style Mounting



4.2 TSM V-Block Systems Operation

For proper tool drop-off, ATI recommends 6.35 mm (.25”) maximum distance from the center point of the tooling pin on the interface plate and the center point of the pin slot on the pin receiver. A reference dimension is shown (refer to *Figure 4.2*) for ease of measuring.

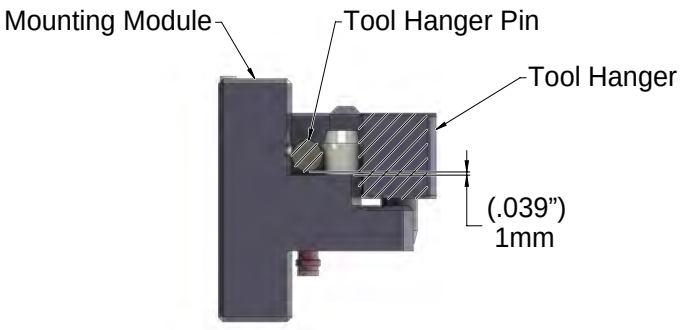
Figure 4.2—Proper Clearance for V-Block Tool Drop-off



4.3 TSM Tool Hanger System Operation

For proper tool drop-off, ATI recommends 1 mm maximum clearance between the TSM tool hanger mounting module contact surfaces and the tool hanger contact surfaces. A reference dimension is shown (refer to *Figure 4.3*) for ease of measuring.

Figure 4.3—Tool Hanger Systems Maximum Clearance for Proper Tool Drop-off



5. Maintenance

WARNING: Do not perform maintenance or repair(s) on the Tool Changer or modules unless the Tool is safely supported or placed in the tool stand, all energized circuits (e.g. electrical, air, water, etc.) are turned off, pressurized connections are purged and power is discharged from circuits in accordance with the customer's safety practices and policies. Injury or equipment damage can occur with the Tool not placed and energized circuits on. Place the Tool in the tool stand, turn off and discharge all energized circuits, purge all pressurized connections, and verify all circuits are de-energized before performing maintenance or repair(s) on the Tool Changer or modules.

It is recommended to check the following areas at least once every 100,000 cycles. Earlier intervention may be necessary if a problem is identified prior to the scheduled maintenance checks.

5.1 All TSM Systems

- Verify that the horizontal module or extension has not loosened. Tighten if required. Refer to *Section 3.2—Installing Pin and Bushing or Horizontal V-Block Mounting Module to Tool Stand* and *Section 3.5—Installing Horizontal Extension to Tool Stand.*
- Verify that the mounting module has not loosened. Tighten if required. Refer to *Section 3.2—Installing Pin and Bushing or Horizontal V-Block Mounting Module to Tool Stand, Section 3.4—Installing Tool Hanger Mounting Module to Tool Stand,* and *Section 3.3—Installing Vertical V-Block Mounting Module to Tool Stand*
- Verify that the gussets have not loosened. Tighten if required. *Section 3.1—Installing Base, Rail, and Gusset assemblies*
- Verify that the base has not loosened. Tighten if required. *Section 3.1—Installing Base, Rail, and Gusset assemblies*
- Verify that the proximity sensor and holder have not loosened. Tighten if required. *Section 3.7—Proximity Sensor Installation for V-Block (Sensor Holder 9120-TSM-SM-4205),* and *Section 3.9—Proximity Sensor installation for TSM Tool Hanger*
- Inspect sensor cables and all utility lines for wear.
- Inspect and wipe clean all sensor faces to ensure proper function.

5.2 Pin and Bushing TSM Systems

Clean and lubricate pin and bushing module. Check the (3) alignment pins for looseness, wear, and damage. If components are loose, apply threadlocker and tighten; if components are worn or damaged, replace.

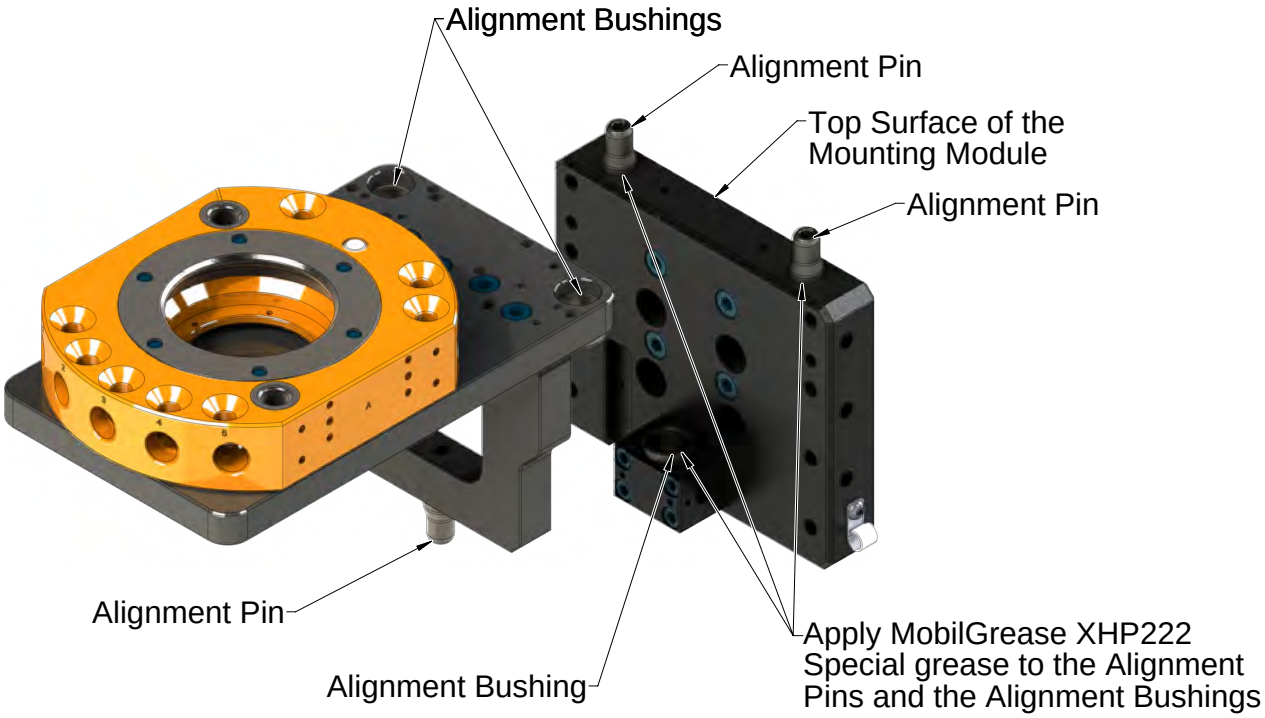
5.2.1 Clean, Lubricate, and Replace Alignment Pins and Bushings

Parts required: *Refer to the specific drawings in Section 2.1—TSM System with Pin and Bushing Style Mounting.*

Supplies required: *Clean rag, MobilGrease XHP222*

1. Remove the Tool from the tool stand.
2. Using a lint free rag, remove the debris from the alignment pins, alignment bushing, and top surface of the mounting module. Also remove the debris form the (2) bushings and alignment pin in the tooling interface plate shown in *Section Figure 5.1.*

Figure 5.1—Clean and Lubricate the Alignment Pins and Alignment Bushings

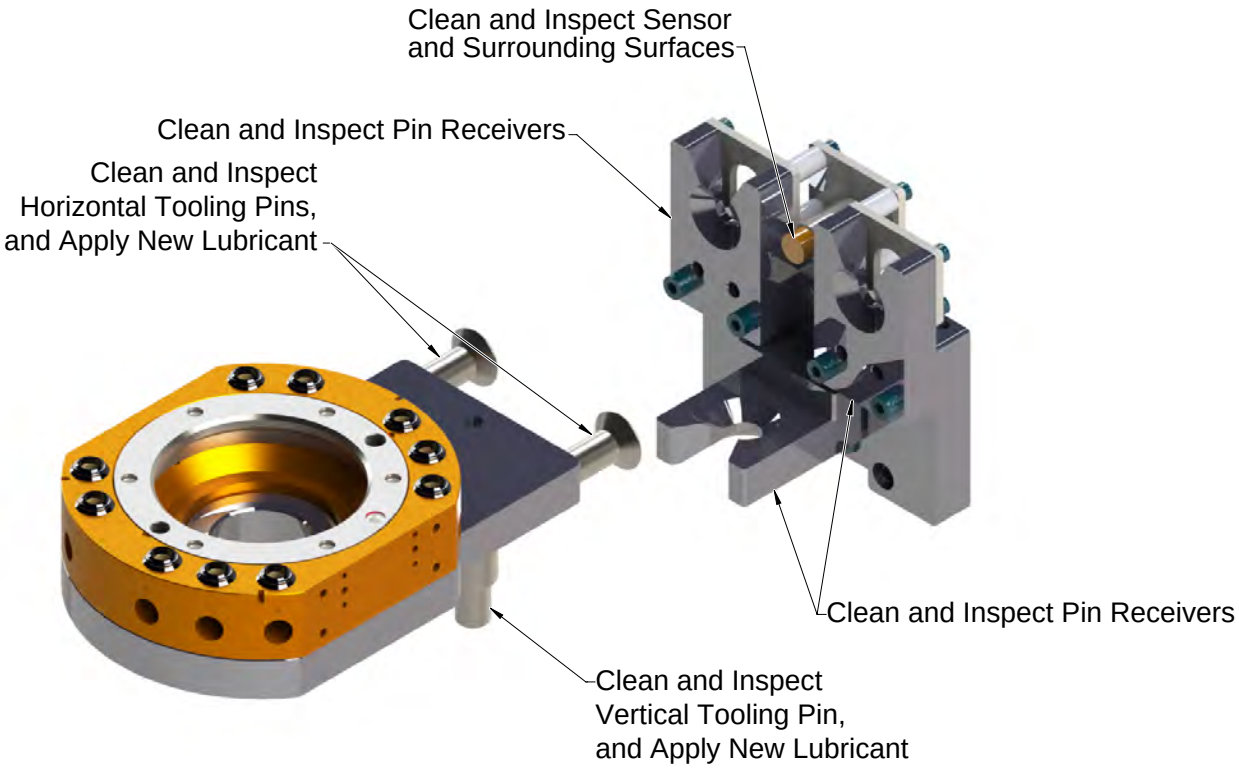


3. Inspect the (3) alignment pins for looseness, wear, or damage.
   a. If worn or damaged remove, discard, and replace with new alignment pin. Apply Loctite® 242™ to the threads of the new pin and thread into the mounting module. Tighten to 80 in-lbs (9.04 Nm).
   b. If loose, remove and apply Loctite® 242™ to the threads. Thread into the mounting module. Refer to *the specific drawings in Section 2.1—TSM System with Pin and Bushing Style Mounting* for torque.
4. Inspect the (3) alignment bushings for wear or damage. If worn or damaged remove, discard, and replace with new alignment bushing. Press out old bushing using an arbor press, then press in new bushing.
5. Apply liberal amounts of MobilGrease® XHP222 Special grease to the alignment pins and the alignment bushing on the mounting module as shown in *Section Figure 5.1*
6. Place the Tool in the tool stand.

5.3 TSM V-Block Systems

- Inspect the tooling pins and pin receivers for cracks and wear. Replace if necessary.
- Lubricate tooling pins and pin receivers, see *Section Figure 5.2* for details.
- Check the tooling pins for looseness. Refer to *Section Figure 5.2*.
    - The torque for the tooling pins on the following tooling plates 9120-TSM-HVQ-4055 (QC-40), 9120-TSM-HVQ-4627 (QC-40 Euro), 9120-TSM-HVQ-6660 (QC-62), 9120-TSM-HVQ-4058 (QC-71), 9120-TSM-HVQ-7290 (QC-76), 9120-TSM-HVQ-4059 (QC-100), are: 2 horizontal tooling pins (180 in-lbs), vertical tooling pin (250 in-lbs).
    - The torque for the tooling pins on the following tooling plates 9120-TSM-HVQ-4056 (QC-41), 9120-TSM-HVQ-4057 (QC-60), 9120-TSM-HVQ-7961 (QC-Blank), both horizontal pins and vertical pin are 250 in-lbs.
    - Vertical tooling interface plate 9120-TSM-VVB-4069 (QC-40 ~ QC76) the torque for the 3 tooling pins is 180 in-lbs.
    - Vertical tooling interface 9120-TSM-VVB-4071 (QC-100 ~ QC110) the torque for the 3 tooling pins is 250 in-lbs.
- Check to verify that the mounting module has not loosened. Tighten if required. Refer to *Section 3.2—Installing Pin and Bushing or Horizontal V-Block Mounting Module to Tool Stand*, *Section 3.4—Installing Tool Hanger Mounting Module to Tool Stand*, and *Section 3.3—Installing Vertical V-Block Mounting Module to Tool Stand*.

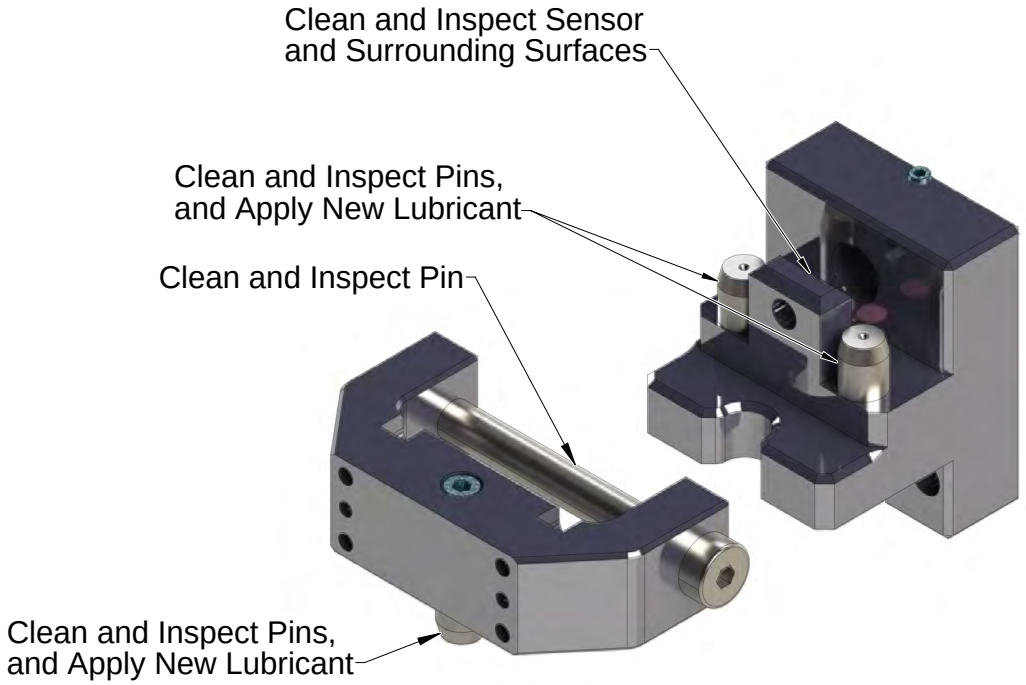
Figure 5.2—Sensor Cleaning and Lubrication Locations (V-Block System)



5.4 TSM Tool Hanger Systems

- Inspect the hanger pins and mounting module for cracks and wear. Replace, if necessary (refer to *Section 7—Serviceable Parts*, *9630-20-TSM-MM-5496*, *9630-20-TSM-TH-5891*, *9630-20-TSM-TH-5923*, and *S9630-20-TSM-TH-5497*).
- Lubricate the mounting module pins, see *Figure 5.3*.
- Verify that the mounting module is not loose (refer to *Section 3.4—Installing Tool Hanger Mounting Module to Tool Stand*).

Figure 5.3—Sensor Cleaning and Lubrication Locations (Tool Hanger System)



6. Troubleshooting

For troubleshooting information, refer to the following table.

Table 6.1—Troubleshooting

Symptom	Possible Cause	Correction
Tool drop-off location is no longer repeatable.	Tool alignment pin may be loose or missing.	Tighten or replace if necessary.
Tool position while in storage is no longer straight and parallel.	Tool alignment pin may be loose, worn, damaged, or missing.	Tighten or replace alignment pins if necessary. Refer to *Section 5.2.1—Clean, Lubricate, and Replace Alignment Pins and Bushings*.
	Alignment bushing may be worn.	Inspect the alignment bushings for wear. Replace if necessary. Refer to *Section 5.2.1—Clean, Lubricate, and Replace Alignment Pins and Bushings*.
Proximity sensor fails	Debris build up on proximity sensor.	Check for debris build up and clean if necessary.
	Proximity sensor loose or not positioned properly.	Verify that the correct distance between sensing face and target is set. Adjust if necessary. Refer to *Section 3.7 Figure 3.9—Proximity Sensor Position for V-Block (Sensor Holder 9120-TSM-SM-4205), ,* and *Section 4.1—TSM System with Pin and Bushing Style Mounting Operation.*
	Sensor cable broken or damaged.	Inspect sensor cable for damage, test continuity, replace, if damaged.
	Proximity sensor damaged or not functioning.	Inspect proximity sensor for damage, test sensor.
Tool/end effector malfunctioning	Utility lines and cables damaged.	Inspect utility lines and cables for wear. Inspect all connections for damage. Verify Tool Changer for proper function.
	Tool Changer or utility modules not functioning properly.	Verify Tool Changer and utility modules for proper function. Refer to the Tool Changer and Module Installation and Operation manual for troubleshooting.

7. Serviceable Parts

Items that are commonly used as spare parts (for the TSM system) are in the following table (other components are available upon request):

Table 7.1—Serviceable Parts

Model	Part Number	Name	Used For	Torque Spec.
Common TSM Pin and Bushing System Components (Refer to *Section 2.1—TSM System with Pin and Bushing Style Mounting*	3700-20-8434	TSM Pin & Bushing, alignment pin, Dual Taper	All TSM pin and bushing mounting modules	80 in-lbs (9 Nm)
	3700-20-8436 (Elongated) 3700-20-8435 (Round)	Drill Bushing, Flanged, 16 mm ID	All TSM pin and bushing mounting modules	NA
Common TSM V-Block System Components (Refer to *Section 2.2—TSM System with V-Block Style Mounting*)	3700-20-3594	Tooling Pin - Short	M10 Threaded Tooling Plates	180 in-lbs (20 Nm)
	3700-20-4016	Tooling Pin - Long	M10 Threaded Tooling Plates	80 in-lbs (9 Nm)
	3700-20-3590	Tooling Pin - Short	M12 Threaded Tooling Plates	180 in-lbs (20 Nm)
	3700-20-4017	Tooling Pin - Long	M12 Threaded Tooling Plates	80 in-lbs (9 Nm)
Tool Hanger TSM System Components (Refer to *Section 2.3—TSM System with Tool Hanger Mounting Module*)	8590-9909999-34	Proximity Sensor	To detect Tool in Tool Stand	NA
	3690-62014001-11	Alignment Pin	Tool hanger mounting modules and Tool hangers.	52 in-lbs (5.8 Nm)
	3500-2069080-11	Socket Cap Shoulder Screw, 10 mm x 80 mm, M8 Thread, Steel	Tool hangers	40 in-lbs (4.5 Nm)

7.1 Part Number Cross Reference

7.1.1 TSM V-Block Systems

The TSM tool stand part numbers and descriptions have been changed to provide a consistent numbering and naming scheme for all components of the tool stand system. The following tables provide a cross reference from the originally used part numbers to the current part numbers.

Original Part Number	Current Part Number	Description
Section 2.2.8—Vertical Tooling Interface Plate		
9120-TSM-TP-4069	9120-TSM-VVB-6604	Vertical Tooling Interface Plate-Blank
9120-TSM-TP-6604	9120-TSM-VVC-6604	Vertical Tooling Interface Plate with (4) 1/4” Counter Bores
9120-TSM-TP-4071	9120-TSM-VVB-4071	Vertical Tooling Interface Plate-Blank (Large)
Section 2.2.6—Tooling Interface Plates		
9120-TSM-TP-4055	9120-TSM-HVQ-4055	Tooling Interface Plate-Blank QC-40
9120-TSM-TP-4627	9120-TSM-HVQ-4627	Tooling Interface Plate-Blank QC-40 Euro
9120-TSM-TP-4056	9120-TSM-HVQ-4056	Tooling Interface Plate-Blank QC-41
9120-TSM-TP-4057	9120-TSM-HVQ-4057	Tooling Interface Plate-Blank QC-60
9120-TSM-TP-6660	9120-TSM-HVQ-6660	Tooling Interface Plate-Blank QC-62
9120-TSM-TP-4058	9120-TSM-HVQ-4058	Tooling Interface Plate-Blank QC-71
9120-TSM-TP-7290	9120-TSM-HVQ-7290	Tooling Interface Plate-Blank QC-76
9120-TSM-TP-4059	9120-TSM-HVQ-4059	Tooling Interface Plate-Blank QC-100
9120-TSM-TP-7961	9120-TSM-HVB-7961	Tooling Interface Plate-Blank

8. Specifications

Weights shown in the following tables are prior to custom machining and additional tooling requirements.

8.1 Common TSM System Components

Part Description	Material	Weight-Mass
TSM Base	T-6 Aluminum	2.4 lbs.
TSM Sensor Holder	Anodized T-6	.3 lbs.
TSM Post	Anodized T-6 Extruded Aluminum	Varies.
TSM Gusset	Cast Aluminum	6.8 lbs.

8.2 TSM Pin and Bushing System Components

Part Description	Material	Weight-Mass
TSM Pin and Bushing Mounting module	Anodized T-6 Aluminum	5.4 lbs.
9120-TSM-MMB-8432	Anodized T-6 Aluminum	5.4 lbs.
TSM Pin and Bushing Tooling Interface Plate	Anodized T-6 Aluminum	3.0 - 5.8 lbs.
9120-TSM-HBQ-9566	Anodized T-6 Aluminum	4.5 lbs
9120-TSM-HBQ-8439	Anodized T-6 Aluminum	5.8 lbs.
9120-TSM-VBB-8441	Anodized T-6 Aluminum	3.1 lbs.
9120-TSM-VBQ-8442	Anodized T-6 Aluminum	3.0 lbs
9120-TSM-MMBL-8432	Anodized T-6 Aluminum	TBD
9120-TSM-HBBL-9223	Anodized T-6 Aluminum	5.5 lbs
9120-TSM-HBQL-10189	Anodized T-6 Aluminum	4 lbs
9120-TSM-VBBl-8441	Anodized T-6 Aluminum	TBD

8.3 TSM V-Block System Components

Part Description	Material	Weight-Mass
Tooling Pins	Stainless Steel	.01 - .5 lbs.
TSM Horizontal modules and Extensions	Anodized T-6 Aluminum	Varies.
TSM Pin Receiver	4140 Hardened Steel Black Oxide	1.25 lbs.
TSM Tooling Interface Plate	Anodized T-6 Aluminum	1.6 - 6.6 lbs.
9120-TSM-HVQ-4055	Anodized T-6 Aluminum	1.76 lbs.
9120-TSM-HVQ-4627	Anodized T-6 Aluminum	1.76 lbs.
9120-TSM-HVQ-4056	Anodized T-6 Aluminum	1.95 lbs.
9120-TSM-HVQ-4057	Anodized T-6 Aluminum	2.12 lbs.
9120-TSM-HVQ-6660	Anodized T-6 Aluminum	2.63 lbs.
9120-TSM-HVQ-7290	Anodized T-6 Aluminum	3.03 lbs.
9120-TSM-HVB-7961	Anodized T-6 Aluminum	6.59 lbs.
9120-TSM-VVB-4069	Anodized T-6 Aluminum	1.61 lbs.
9120-TSM-VVB-4071	Anodized T-6 Aluminum	2.70 lbs.
TSM Mounting modules	Anodized T-6 Aluminum	5 - 7 lbs.
TSM Adapter module	Anodized T-6 Aluminum	2.2 lbs

8.4 TSM Tool Hanger System Components

Part Description	Material	Weight-Mass
TSM Tool Hanger Mounting module	Anodized T-6 Aluminum	.8 lbs.
TSM Tool Hanger	Anodized T-6 Aluminum	.5 - .6 lbs.
9120-TSM-TH-5891	Anodized T-6 Aluminum	.531 lbs.
9120-TSM-TH-5923	Anodized T-6 Aluminum	.516 lbs
9120-TSM-TH-5497	Anodized T-6 Aluminum	.563 lbs.
TSM Alignment Pins	Stainless Steel	.036 lbs.

9. Drawings

Drawings are available on the *TSM website* or by contacting an ATI representative.