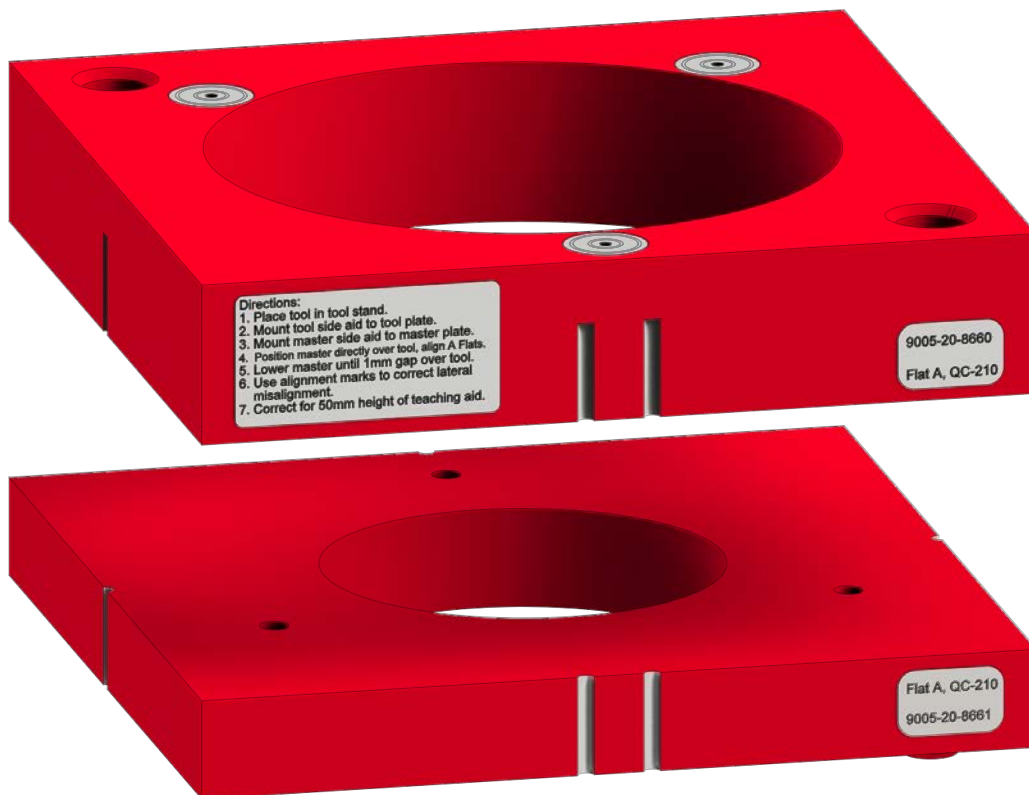




Third Generation Teach Aids for Tool Changers

Manual



Document #: 9610-20-3370

Engineered Products for Robotic Productivity

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Foreword

This manual contains basic information applicable to all ATI robotic Tool Changers. Certain models have their own manuals that contain more detailed information. Also, additional information about electrical, pneumatic, fluid, high-power and high-current modules and other options are available in other manuals and documents.

Please contact ATI Industrial Automation with any questions concerning your 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 |
|--------------|--|
| Bearing Race | Hardened steel ring in the Tool plate that is engaged by the locking balls during the locking process. |
| Master Plate | The half of the Tool Changer that is mounted to a robot. The Master plate contains the locking mechanism. |
| No-Touch™ | Design feature of all ATI products that allows coupling the Master plate and Tool plate without physical contact prior to locking. |
| Tool Plate | The half of the Tool Changer to which various tools or end-effectors are mounted. |
| Tool Stand | Holds Tools not being used by the robot. This is usually supplied by the customer and is specific to the application. |

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. More specific notifications are imbedded within the sections of the manual where they apply.

1.1 Explanation of Notifications

The following notifications are specific to the product(s) covered by this manual. It is expected that the user 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

The customer is responsible for ensuring that the area between the Master and Tool sides is clear of foreign objects during mating and subsequent coupling. Failure to do so may result in serious injury to personnel.

The customer is responsible for understanding the function of the Tool Changer and implementing the proper hardware and/or software to operate the Tool Changer safely.

1.3 Safety Precautions



DANGER: The gap between the Master and Tool sides as well as the gap between the Master plate and Master side teaching aid are pinch points. Physical contact in these pinch points will result in serious or permanent injury to personnel. All personnel should be prevented from placing any body part or clothing in the gap, especially during actuation of the locking mechanism.



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



WARNING: The Master and Tool teaching aids are only to be used with the Tool Changer for intended applications and applications approved by the manufacturer. Using these products in applications other than intended will result in damage to Tool Changer, Teaching Aids, modules, or end-of-arm tooling and could cause injury to personnel.



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.

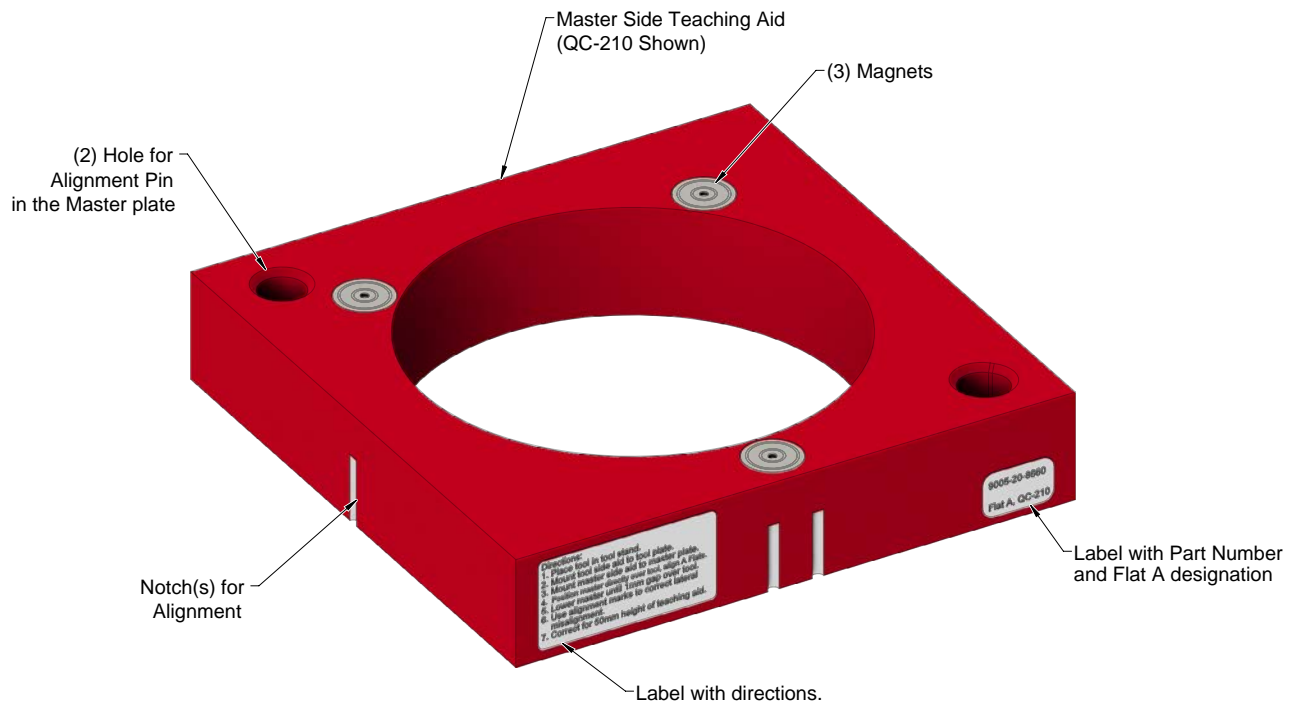
2. Product Overview

Teaching Aids facilitate the programming of a robot to work with ATI Tool Changers. Without using fasteners or special tools, Teaching Aids can reduce the time required to teach the robot to pick up and drop off customer tooling and ensure optimal X, Y, and Z alignment. Teaching Aids help extend the life of the Tool Changer alignment pins and bushings by reducing unnecessary wear. ATI Teaching Aids have high-contrast alignment marks to aid the user in the set-up process. When positioned, the Master Side Teaching Aid and Tool Side Teaching Aid must have a 1 mm clearance between them. This distance ensures the No-Touch Locking zone for the Tool Changer is set correctly. Refer to the drawings in [Section 8—Drawings](#) for more information. The following is a hyperlink to a video that demonstrates how to use ATI's Teaching Aids for robotic Tool Changers: http://www.ati-ia.com/library/video_listing.aspx.

2.1 Master Side Teaching Aid

The Master Side Teaching Aid is a red, aluminum body. The interior bore fits over the Tool Changer locking mechanism. Alignment holes are custom fitted for ATI Tool Changer alignment pins. Unlike the first generation of Teaching Aids, the Tool Changer Master plate locking mechanism can be locked or unlocked, when installing the Teaching Aid to the Master plate. Magnets secure the Teaching Aid to the flange of the Master plate male coupling.

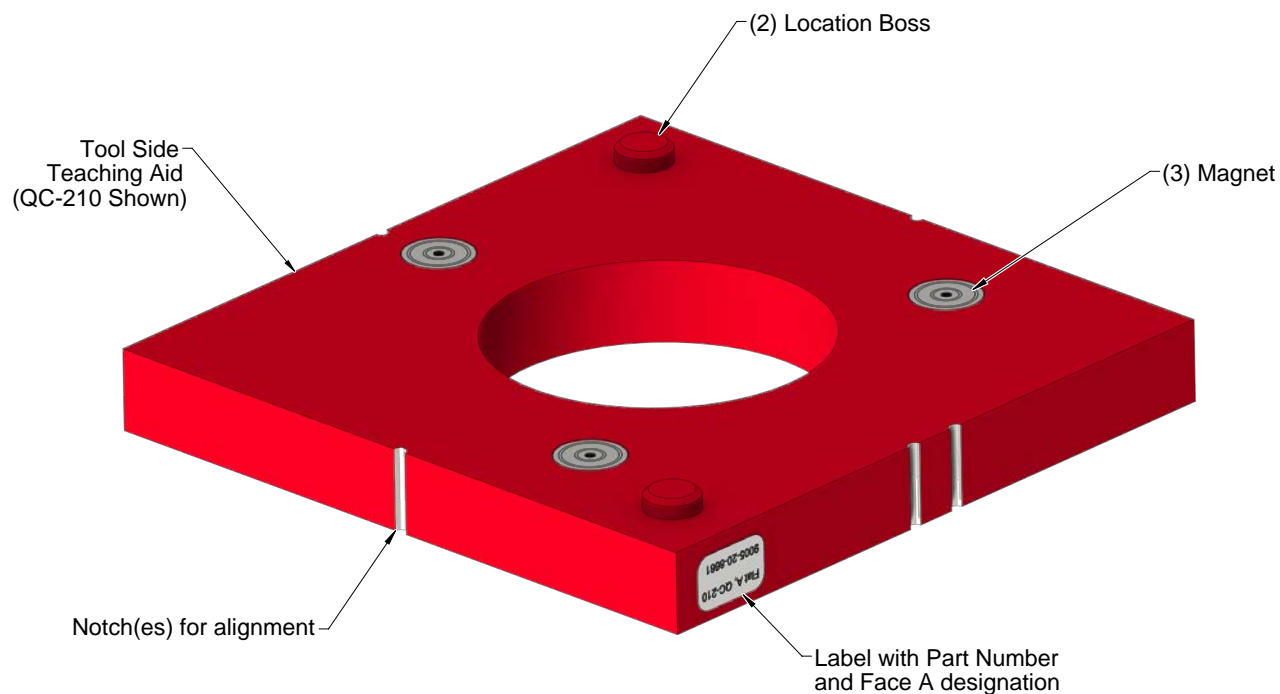
Figure 2.1—Master Side Teaching Aid (QC-210 Shown)



2.2 Tool Side Teaching Aid

The Tool Side Teaching Aid is a red, aluminum body. (2) location bosses fit into the Tool plate alignment bushings. Magnets attach to the Tool plate interior race and secure the Teaching Aid to the Tool plate.

Figure 2.2—Tool Side Teaching Aid (QC-210 Shown)



3. Installing and Aligning (Tool Changer Set-up)

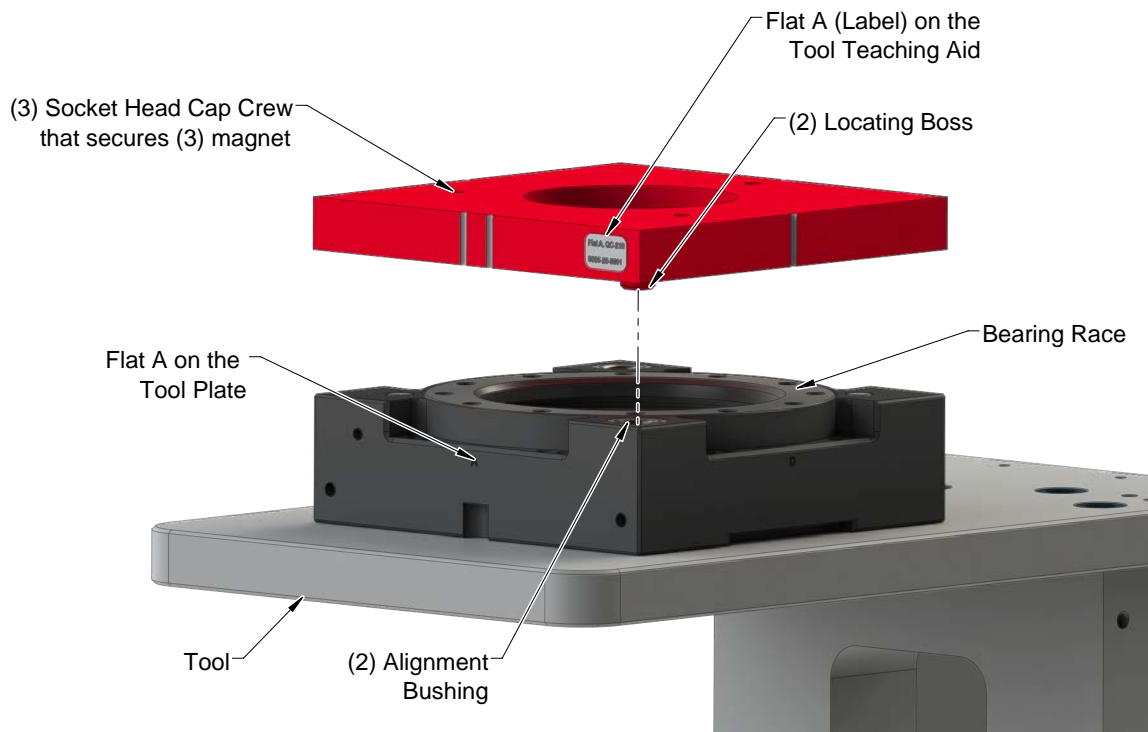


DANGER: The gap between the Master and Tool Side Teaching Aids is a pinch point. Physical contact in these pinch points will result in serious or permanent injury to personnel. All personnel should be prevented from placing any body part or clothing in the gap, especially during actuation of the locking mechanism.

The following instructions apply to all Teaching Aids. Additionally, labels with abbreviated operating instructions are on the Master side. On the ATI website, http://www.ati-ia.com/library/video_listing.aspx, there is a video that demonstrates how to use ATI's Teaching Aids for robotic Tool Changers. To install and align a Teaching Aid, complete the following steps:

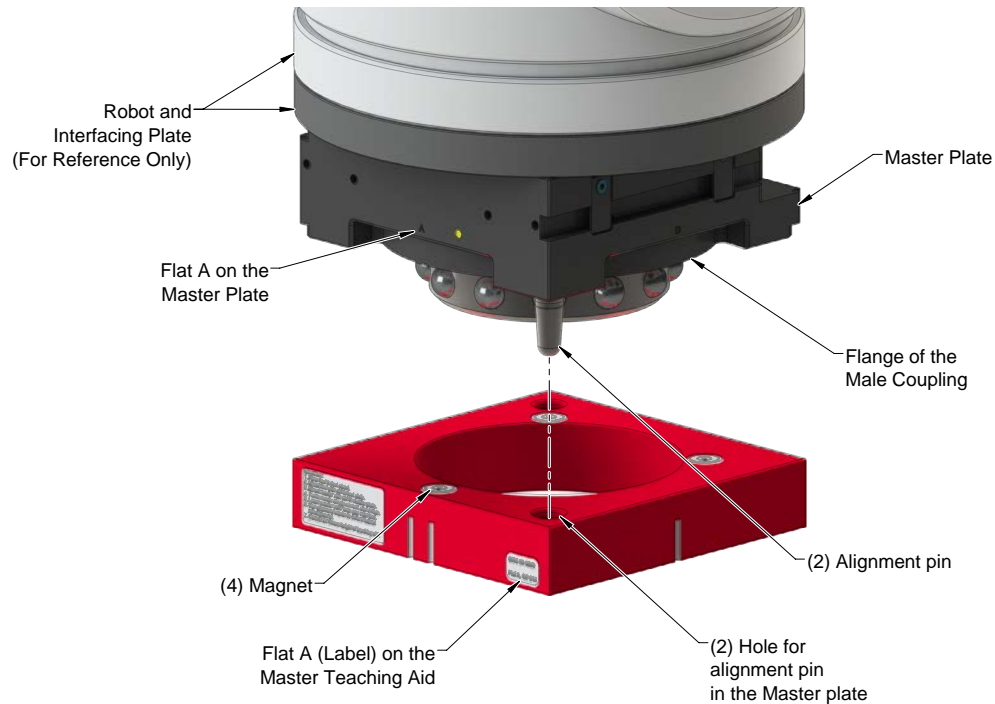
1. Place the Tool plate in the tool stand. Robot programs should be written with the Tool plate resting in the Tool stand.
2. Orient the Tool Side Teaching Aid such that the 'A' flat corresponds to the 'A' flat on the Tool plate.
3. Mount the Tool Side Teaching Aid over the Tool plate by inserting the (2) locating bosses into the alignment bushings. The magnets in the Teaching Aid attach to the Tool plate.

Figure 3.1—Tool Teaching Aid Installation (QC-210 Shown)



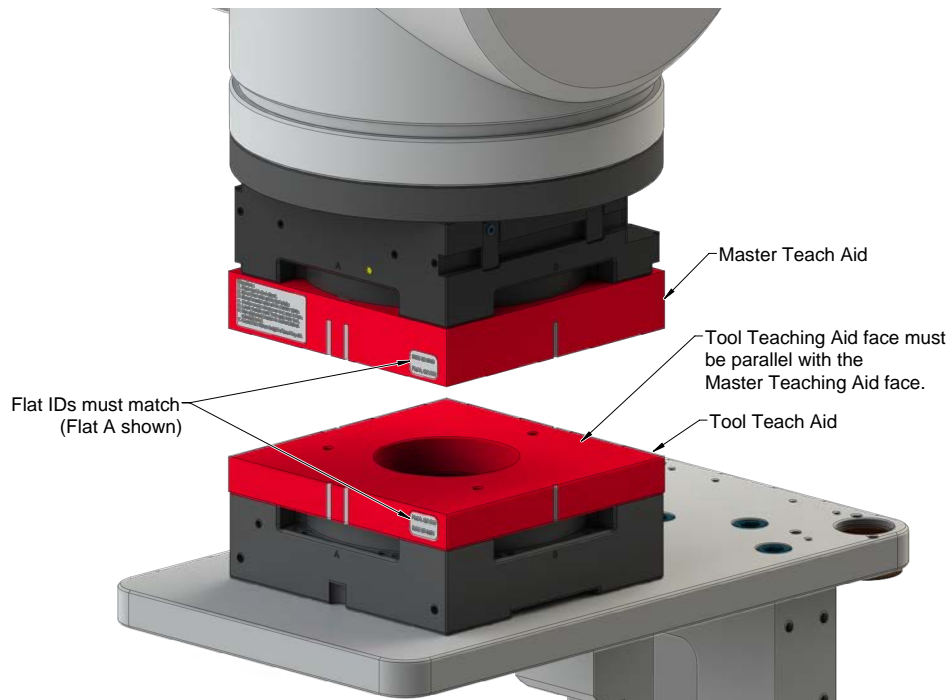
4. Align the Master plate flat A to the Master Side Teaching Aid flat A.
5. Mount the Master Side Teaching Aid to the Tool Changer Master plate by inserting the alignment pins into the corresponding holes in the Teaching Aid. The magnets secure the Teaching Aid to the Master plate.

Figure 3.2—Master Side Teaching Aid Installation (QC-210 Shown)



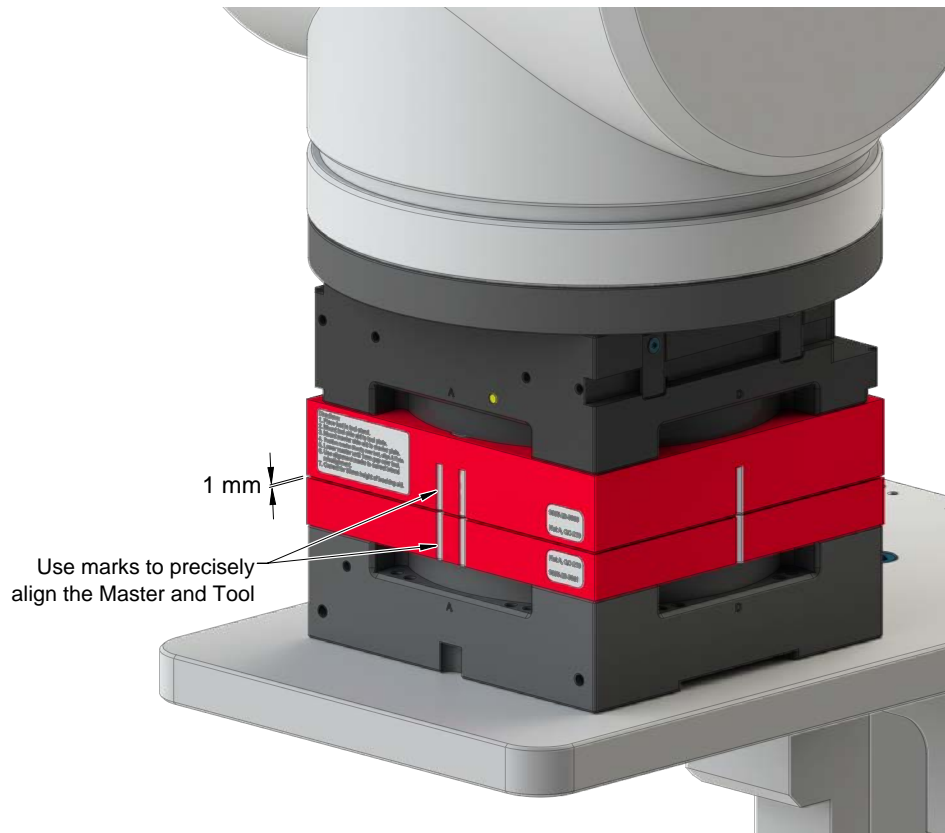
6. Position the Master plate directly over and parallel to the Tool plate. Align the Master and Tool flats; for example: Master plate flat A is aligned with Tool plate flat A.

Figure 3.3—Positioning the Master Plate Towards the Tool Plate



7. Move the Master plate slowly toward the Tool plate until the Master Side and Tool Side Teaching Aids are 1 mm apart.
8. Use the alignment marks or flats to align the Tool Side and Master Side Teaching Aids.

Figure 3.4—Final Alignment Position of the Teaching Aids



9. Record the robot coordinates.
10. Move the Master plate away from the Tool plate so that the Master Side and Tool Side Teaching Aids can be removed from the Tool Changer.
11. To account for the thickness of the Tool and Master Side Teaching Aids, the user must calculate a correction so that the “pick-up” and “replacement” coordinates are correct. Perform the applicable calculation from [Table 3.1](#) to determine the pick-up and replacement location.

| Table 3.1—Calculating the Correct “Pick-Up” Coordinate | |
|--|---|
| Teaching Aid | Formula for “Pick-Up” Coordinate |
| (QC-40) 9120-40-TEACH | ‘Z’ Pick-up Coordinate = (‘Z’ coordinate from Step 9)-(40 mm) |
| (QC-46) 9120-46-TEACH | ‘Z’ Pick-up Coordinate = (‘Z’ coordinate from Step 9)-(41 mm) |
| (QC-210) 9120-210-TEACH3 | ‘Z’ Pick-up Coordinate = (‘Z’ coordinate from Step 9)-(50 mm) |

4. 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.

If the Tool Changer is used in environments susceptible to contamination; for example, welding or deburring applications, you can minimize exposure by covering idle Tool assemblies. Also limit the Tool Changer Master plate exposure. ATI offers a full range of dust covers for a variety of applications. To learn more, consult the ATI website.

Under normal conditions, no special maintenance is necessary. If needed, use a clean rag to thoroughly remove lubricant and debris from surfaces of the Teaching Aid plates.

5. Troubleshooting and Service Procedures

The following section provides troubleshooting and service information to help diagnose conditions with the Teaching Aid plates.



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.

5.1 Troubleshooting Procedures

Refer to [Table 5.1](#) for troubleshooting information.

| Table 5.1—Troubleshooting | | |
|---|--|---|
| Symptom | Cause | Resolution |
| The Teaching Aid plate is not secure to the Tool Changer plate. | The surfaces of the Teaching Aid plate have debris. | Use a clean rag to remove debris and lubrication from the Teaching Aid plate surfaces (especially the magnets). |
| | The fasteners that attach the magnets to the Teaching Aid plate are loose. | Tighten fasteners with thread locker. Refer to Section 5.2.1—Replacing Magnets step 5. |

5.2 Service Procedures

The following procedures provide instructions for component replacement and adjustment.

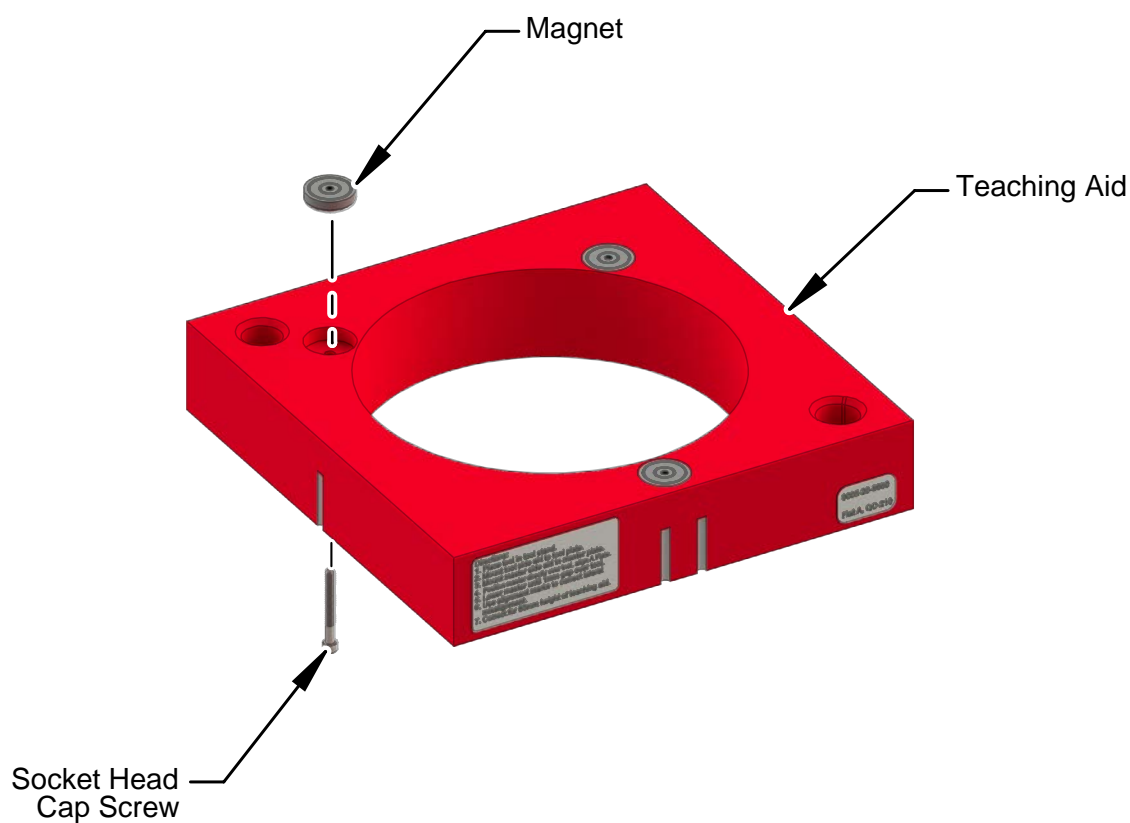
5.2.1 Replacing Magnets

Parts required: Refer to [Section 6—Serviceable Parts](#)

Supplies required: Loctite® Primer 7649 and Loctite 262, 3/32 (for 4-40 Socket Head Cap Screw), torque wrench

1. Using the appropriate Allen wrench, remove the fasteners from the Teaching Aid plate. Refer to [Figure 5.1](#).
2. Remove the magnets that require replacement.
3. Place the new magnet(s) in the Teaching Aid plate.
4. Apply Loctite Primer 7649 and Loctite 262 to the fastener threads.
5. Insert the fasteners into the Teaching Aid plate. Using the appropriate Allen wrench, thread into the magnet. Tighten to 12 in-lbs (0.8 Nm).

Figure 5.1—Adjustment or Installation of Magnets



6. Serviceable Parts

6.1 Master Teaching Aid Serviceable Parts

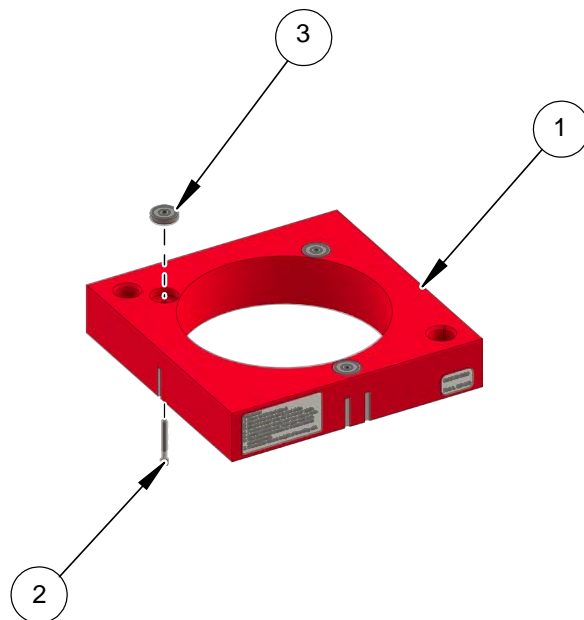


Table 6.1—Master Side Teaching Aid

| Item No. | Configuration | Qty | Part Number | Description |
|----------|---------------|-----|-----------------|---|
| - | QC-40 | - | 9005-20-8801 | Master side Teaching Aid assembly |
| 1 | | 1 | 3700-20-11094 | Master side Teaching Aid |
| 2 | | 2 | 3500-1010062-11 | 4-40 X 5/8", socket head cap screw, stainless steel |
| 3 | | 2 | 3710-20-3484 | Magnet, 0.625" x 0.18" |
| - | QC-46 | - | 9005-20-9210 | Master side Teaching Aid assembly |
| 1 | | 1 | 3700-20-11652 | Master side Teaching Aid |
| 2 | | 3 | 3500-1010062-11 | 4-40 X 5/8", socket head cap screw, stainless steel |
| 3 | | 3 | 3710-20-3484 | Magnet, 0.625" x 0.18" |
| - | QC-210 | - | 9005-20-8660 | Master Side Teaching Aid Assembly, 3rd Generation |
| 1 | | 1 | 3700-20-10468 | Master Side Teaching Aid, 3rd Generation |
| 2 | | 3 | 3500-1010100-21 | 4-40 x 1 Socket Head Cap Screw, Stainless Steel |
| 3 | | 4 | 3710-20-3484 | Magnet, 0.625" x 0.18" |

6.2 Tool Teaching Aid Serviceable Parts

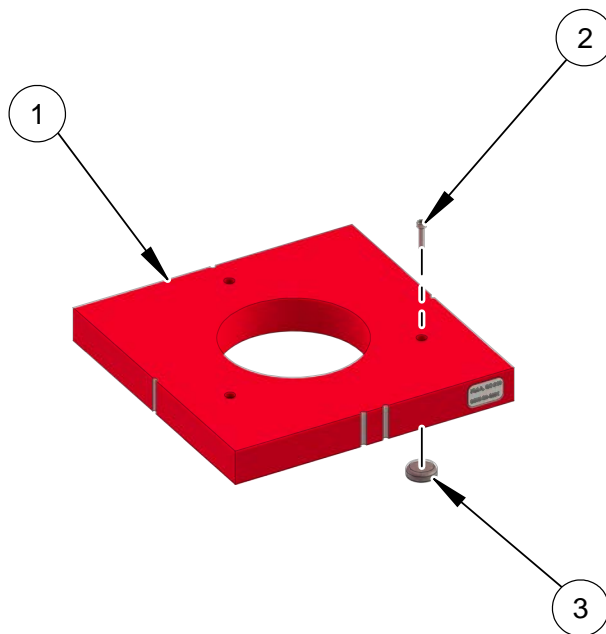


Table 6.2—Tool Side Teaching Aid

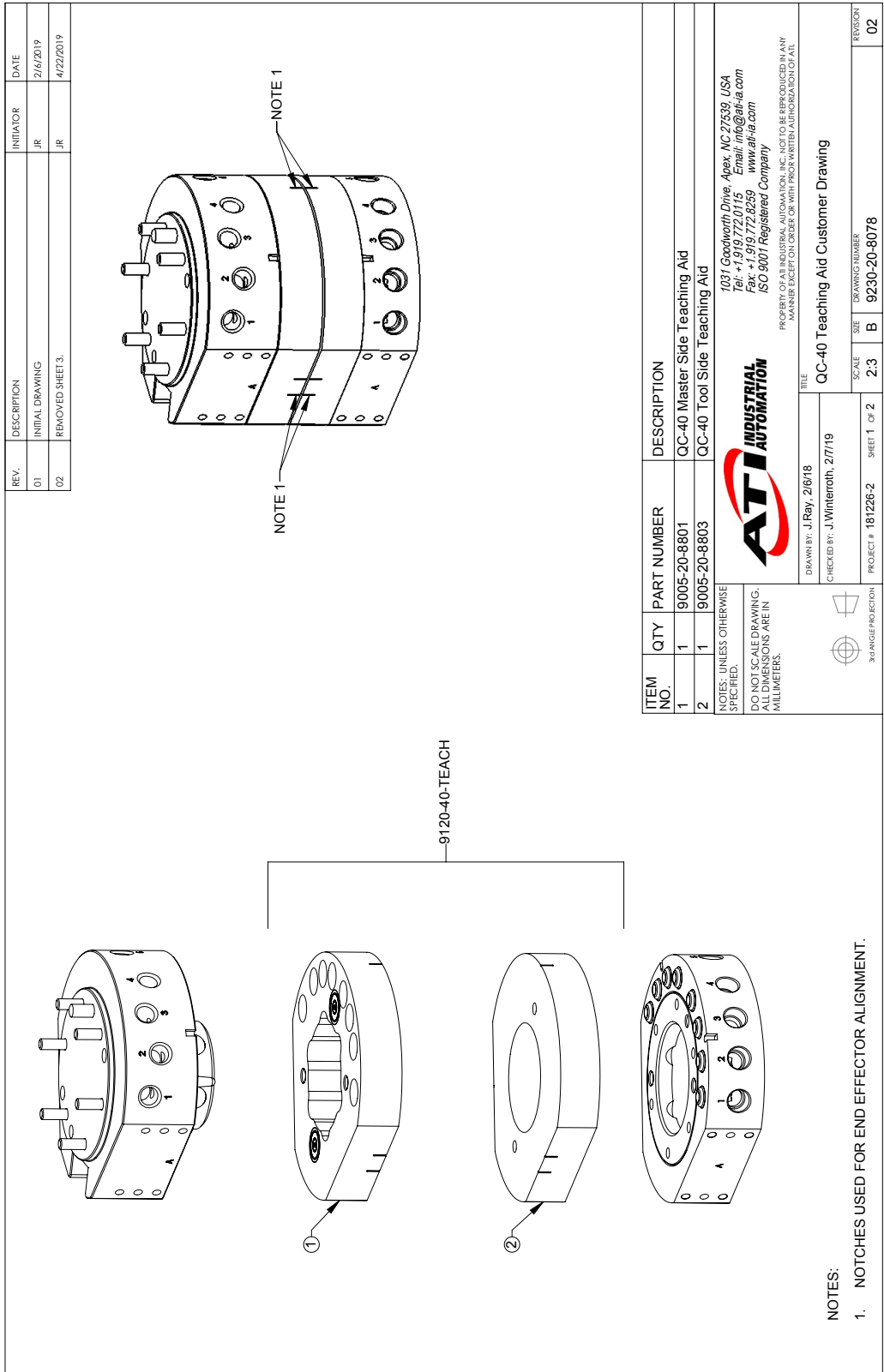
| Item No. | Configuration | Qty | Part Number | Description |
|----------|---------------|-----|-----------------|--|
| - | QC-40 | - | 9005-20-8803 | Tool side Teaching Aid assembly |
| 1 | | 1 | 3700-20-11095 | Tool side Teaching Aid |
| 2 | | 2 | 3500-1010050-21 | 4-40 x 1/2" socket head cap screw, stainless steel |
| 3 | | 2 | 3710-20-3484 | Magnet, 0.625" x 0.18" |
| - | QC-46 | - | 9005-20-9211 | Tool side Teaching Aid assembly |
| 1 | | 1 | 3700-20-11653 | Tool side Teaching Aid |
| 2 | | 3 | 3500-1010062-11 | 4-40 x 5/8" socket head cap screw, stainless steel |
| 3 | | 3 | 3710-20-3484 | Magnet, 0.625" x 0.18" |
| - | QC-210 | - | 9005-20-8661 | Tool side Teaching Aid assembly |
| 1 | | 1 | 3700-20-10469 | Tool side Teaching Aid |
| 2 | | 3 | 3500-1010050-21 | 4-40 x 1/2" socket head cap screw, Stainless Steel |
| 3 | | 3 | 3710-20-3484 | Magnet, 0.625" x 0.18" |

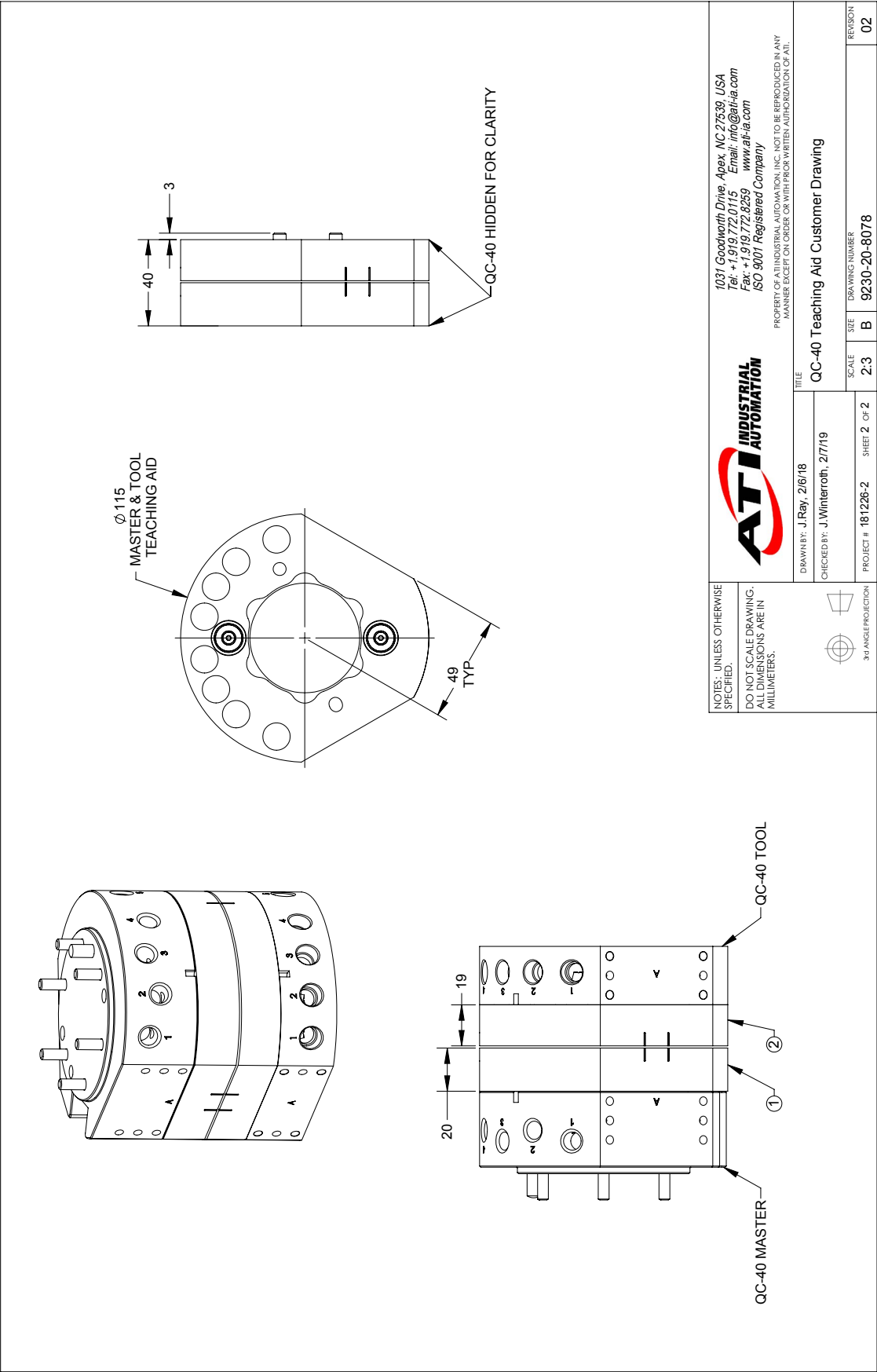
7. Specifications

| Table 7.1—Teaching Aid Specifications | | | |
|---------------------------------------|----------------------|-------------------|-----------------|
| Part Number | Description | Weight | Stack Height |
| 9120-40-TEACH | QC-40 Teaching Aids | 1.6 lb (0.74 kg) | 40 mm (1.5 in) |
| 9120-46-TEACH | QC-46 Teaching Aids | lb (kg) | 41 mm (1.6 in) |
| 9120-210-TEACH3 | QC-210 Teaching Aids | 4.26 lb (1.93 kg) | 50 mm (1.97 in) |

8. Drawings

8.1 QC-40 Teaching Aid Assembly





8.2 QC-46 Teaching Aid Assembly

Notes:
1. Slots used for End Effector Alignment.

| REV. | DESCRIPTION | INITIATOR | DATE |
|------|-----------------|-----------|------------|
| 01 | INITIAL RELEASE | SJJ | 11/04/2021 |

| ITEM NO. | QTY | PART NUMBER | DESCRIPTION |
|----------|-----|----------------------|---|
| 1 | 1 | 9005-20-9210 | QC-46 Master Side Teaching Aid Assembly |
| 2 | 1 | 9005-20-9211 | QC-46 Tool Side Teaching Aid Assembly |
| 3 | 1 | 9120-046AM-0-0-000-0 | QC-46 BASE MASTER ASSEMBLY, NO OPTIONS |
| 4 | 1 | 9120-046JT-0-0-000-0 | QC-46 BASE TOOL ASSEMBLY, 63mm RECESS |

NOTES: UNLESS OTHERWISE SPECIFIED,
DO NOT SCALE DRAWING.
ALL DIMENSIONS ARE IN MILLIMETERS.

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| | | | |
|----------------------------|----------------|-----------------------------|----------|
| DRAWN BY: Sam J 11/03/21 | TITLE | QC-46 T.A. Customer Drawing | REVISION |
| CHECKED BY: kenba 11/12/21 | SCALE | 1:2 | 01 |
| PROJECT #: 200730-1 | DRAWING NUMBER | 0630-20-46-TEACH | |
| SHEET 1 OF 2 | SIZE | B | |

| | | | | |
|----------|--|-----|----------------------|---|
| ITEM NO. | | QTY | PART NUMBER | DESCRIPTION |
| 1 | | 1 | 9005-20-9210 | QC-46 Master Side Teaching Aid Assembly |
| 2 | | 1 | 9005-20-9211 | QC-46 Tool Side Teaching Aid Assembly |
| 3 | | 1 | 9120-046AM-0-0-000-0 | QC-46 BASE MASTER ASSEMBLY, NO OPTIONS |
| 4 | | 1 | 9120-046JT-0-0-000-0 | QC-46 BASE TOOL ASSEMBLY, 63mm RECESS |

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DRAWN BY: Sam J 11/03/21
 CHECKED BY: kenba 11/12/21
 TITLE: QC-46 T.A. Customer Drawing

SCALE: 1-2
 SIZE: B
 DRAWING NUMBER: 0630-20-46-TEACH
 REVISION: 01

PROJECT #: 200730-1
 SHEET 1 OF 2

Notes:
 1. Slots used for End Effector Alignment.

8.3 QC-210 Teaching Aid Assembly

| Rev. | Description | Initiator | Date |
|------|-----------------|-----------|-----------|
| 01 | Initial Drawing | DJB | 8/31/2017 |

Step 1:
Place the Tool Plate in the Tool Stand. Programs should be written with the Tool Plate resting in the Tool Stand.

Step 2:
Mount the Tool Side Aid over the Tool Plate by inserting the Locating Bosses into the Bushings. Magnets will ensure the Tool Side Aid will remain in place.

Step 3:
Mount the Master Side Aid to the QC Master Plate ensuring that the taper pins enter the holes in the Master Side Aid. Magnets will ensure the Master Side Aid will remain in place.

Step 4:
Bring the Master Plate Assembly to a position directly over the Tool Plate Assembly. The Master Plate Assembly's face should be parallel to the Tool Plate Assembly's face. Ensure that the orientation of the Master and Tool assemblies are such that the Flat ID's correspond (i.e. A Master to A Tool, etc.).

Step 5:
Move the Master Plate Assembly slowly downward until the Master and Tool Side Aids are approximately 1mm apart.

Step 6:
Adjust the position of the robot to correct for any lateral misalignment. Use the edges of the Teaching Aid to align the Tool Side and Master Side.

Step 7:
Record the robot coordinates from Step 6. A correction must now be made to the Axial Tool Coordinate to account for the thickness of the Tool and Master Side Teaching Aids. Only in this way can the correct "Pick-up" and "Replacement" coordinates be determined. Perform the following calculation to determine the "Pick-up" and "Replacement" location:

Z "Pick-up" Coordinate = (+ Z Coordinate from Step 6) - (50mm)

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| | | | |
|------------------------------|--------------------------------|-----------------------------------|-----------------|
| TITLE | | QC-210 TEACH3 Instruction Drawing | |
| DRAWN BY: D. Bohle 8/31/2017 | CHECKED BY: M. Galia 9/18/2017 | SCALE | SIZE |
| | | 1:5 | D 0230, 20 9004 |
| PROJECT # 170828-3 | | SHEET 1 OF 1 | |

9. Terms and Conditions of Sale

The following Terms and Conditions are a supplement to and include a portion of ATI Standard Terms and Conditions, which are on file at ATI and available upon request.

ATI warrants to Purchaser that robotic Tool Changer products purchased hereunder will be free from defects in material and workmanship under normal use for a period of three (3) years from the date of shipment. The warranty period for repairs made under a RMA shall be for the duration of the original warranty, or ninety (90) days from the date of repaired product shipment, whichever is longer. ATI will have no liability under this warranty unless: (a) ATI is given written notice of the claimed defect and a description thereof within thirty (30) days after Purchaser discovers the defect and in any event not later than the last day of the warranty period; and (b) the defective item is received by ATI not later ten (10) days after the last day of the warranty period. ATI entire liability and Purchaser sole remedy under this warranty is limited to repair or replacement, at ATI election, of the defective part or item or, at ATI election, refund of the price paid for the item. The foregoing warranty does not apply to any defect or failure resulting from improper installation, operation, maintenance or repair by anyone other than ATI.

ATI will in no event be liable for incidental, consequential or special damages of any kind, even if ATI has been advised of the possibility of such damages. ATI aggregate liability will in no event exceed the amount paid by purchaser for the item which is the subject of claim or dispute. ATI will have no liability of any kind for failure of any equipment or other items not supplied by ATI.

No action against ATI, regardless of form, arising out of or in any way connected with products or services supplied hereunder may be brought more than one (1) year after the cause of action accrued.

No representation or agreement varying or extending the warranty and limitation of remedy provisions contained herein is authorized by ATI, and may not be relied upon as having been authorized by ATI, unless in writing and signed by an executive officer of ATI.

Unless otherwise agreed in writing by ATI, all designs, drawings, data, inventions, software and other technology made or developed by ATI in the course of providing products and services hereunder, and all rights therein under any patent, copyright or other law protecting intellectual property, shall be and remain ATI property. The sale of products or services hereunder does not convey any express or implied license under any patent, copyright or other intellectual property right owned or controlled by ATI, whether relating to the products sold or any other matter, except for the license expressly granted below.

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Without ATI prior written permission, Purchaser will not use such information for any other purpose or provide or otherwise make such information available to any third party. Purchaser agrees to take all reasonable precautions to prevent any unauthorized use or disclosure of such information.

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