ATI F/T Sensor URCaps Software Installation and Setup Manual for UR CB-Series Robots

Document #: 9610-05-1036

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Note

Please read the manual before calling customer service and have the following information available:

1. Serial number (e.g., FT01234)

2. Sensor model (e.g., Axia)

3. Calibration (e.g., US-15-50, SI-65-6, etc.)

4. Accurate and complete description of the question or problem

5. Computer and software information (operating system, PC type, drivers, application software, and other relevant information about the application's configuration)

Be near the F/T system when calling (if possible).

Please contact an ATI representative for assistance, if needed:

Sale, Service, and Information about ATI products:

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Glossary

Term	Definition
Acceptable Status Condition	A user set state during which the ATI URCap software ignores certain status bits from the ATI F/T sensor so that the UR robot can continue operation.
Algorithm	A process or set of rules the robot uses to provide force feedback to control the robot motion.
ATI Ethernet Axia Sensor or ATI NET F/T Sensor	An ATI F/T sensor that uses Ethernet protocol.
"ATI FT Daemon failed" Error	An error that occurs if the ATI URCap's Python™ script is unable to run correctly. The Python™ script/Daemon runs in the background on the UR controller's Linux computer.
ATI NET F/T Sensor	An ATI Ethernet F/T sensor that is not an Axia80.
ATI F/T URCap Software	An ATI software program that enables the UR robot to use data from an ATI F/T sensor for force feedback control.
Center of Gravity (CG)	The point of a mass around which the resultant torque from gravity forces is zero.
Daemon	A Python™ program that runs continuously on the UR controller's Linux computer. It handles periodic service requests that the ATI URCap software expects to receive. The daemon program can forward these requests to other programs or processes as appropriate.
Demo Program	A downloadable program that demonstrates the capabilities of the ATI URCap software and ATI F/T sensor.
DoF	Degrees of Freedom (refer to the following definition: Six Degrees of Freedom)
Ethernet	An IEEE standard for local network technology.
Force	The push or pull exerted on an object. Mathematically, force is expressed as: Force = mass x acceleration
F/T	Force/Torque
F/T Sensor	The device that converts sense loads from force and torque into an electrical signal.
Interface Plate	A separate plate that attaches the sensor to another surface. Interface plates are often used if the bolt pattern on the MAP or TAP doesn't match the bolt pattern on the robot arm or customer tooling. The interface plate has two bolt patterns on either side of the plate. One side is for the MAP or TAP. The other side is for the robot arm or customer tooling.
Mounting Adapter Plate	MAP	The surface of the sensor that attaches to a fixed surface like an interface plate or robot arm.
Plug-in Technology	A customized program that when downloaded and installed onto a host device adds a specific feature to an existing computer program.
P/N	Part Number
Polyscope	UR software on the teach pendant.
Six Degrees of Freedom	Fx, Fy, Fz, Tx, Ty, and Tz
Sense loads	The ATI F/T sensor detects sense loads that are a cumulation of forces and torques acted upon the customer tooling.
Status Bit	A unit of computer data sent from the ATI F/T sensor.
Tool Adapter Plate	TAP	The surface of the sensor that attaches to a fixed surface like an interface plate or the customer tooling.

Term	Definition
TCP	Tool Center Point
Teach Pendant	A handheld device or control box for programming the motions of a robot.
Torque	The measurement of force exerted on an object causing it to rotate. Mathematically, torque is expressed as: Torque = Force x Moment Arm Distance
UR CB-series robot	A collaborative robot manufactured and distributed by the company, Universal Robots (UR). CB denotes a robot from the CB-series product line.
UR Kit	A packaged option that includes an ATI Ethernet Axia F/T sensor, interface plate(s), cables, mounting hardware, and downloadable ATI URCap software. This kit can be used with a UR or URe robot.
USB Drive	A USB (universal serial bus) drive is a device that data such as the downloaded ATI URCap software and can be attached to a host device with plug-in technology. Sometimes a USB drive is called a USB stick or USB disk.

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 of 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

The customer should verify that the sensor selected is rated for maximum loads and torques expected during operation. Because static forces are less than the dynamic forces from the acceleration or declaration of the robot, be aware of the dynamic loads caused by the robot.

1.3 Safety Precautions

⚠	**WARNING:** Performing maintenance or repair on the sensor when circuits (for example: power, water, and air) are energized could result in death or serious injury. Discharge and verify all energized circuits are de-energized in accordance with the customer's safety practices and policies.

|	
⚠	**CAUTION:** Ensure the cable shield is properly grounded. Improper shielding on the cables can cause communication errors and an inoperative ATI F/T sensor.

2. Overview

This manual provides an overview of the ATI F/T Axia kits compatible with a UR CB-series robot and procedures to set-up the ATI URCaps software. For programming the ATI URCaps software and demo programs, refer to the *9610-05-1041* manual. The ATI URCaps software enables the customer to use a UR robot with an ATI Ethernet Force/Torque (F/T) sensor.

F/T sensors convert sensed loads from forces and torques into electrical signals. The F/T sensor provides data to the robot. This data is the six DoF (degrees of freedom): $F_x \setminus F_y \setminus F_z \setminus T_x \setminus T_y \setminus T_z$. UR robots have algorithms to use force feedback to control robot motion. By using plug-in technology, the ATI URCaps software allows a user to input data from an ATI sensor into UR algorithms.

The customer drawing (ATI P/N 9230-05-1507) for the sensor is available on the ATI website: *https://www.ati-ia.com/app_content/Documents/9230-05-1507.auto.pdf*.

Communicating with the sensor and UR CB-series robot requires a knowledge of Ethernet protocol, and how to operate the UR CB-series teach pendant interface *Polyscope*. For more information about UR products, refer to *https://www.universal-robots.com/support/.* For more information on the ATI F/T sensors, refer to the following table:

Table 2.1—ATI F/T Sensor Manuals	
ATI F/T Sensor	**Manual P/N**
Ethernet Axia	*9610-05-Ethernet Axia*
All Other Ethernet Sensors	*9620-05-NET FT* and *9620-05-Transducer Section*

Figure 2.1—Overview
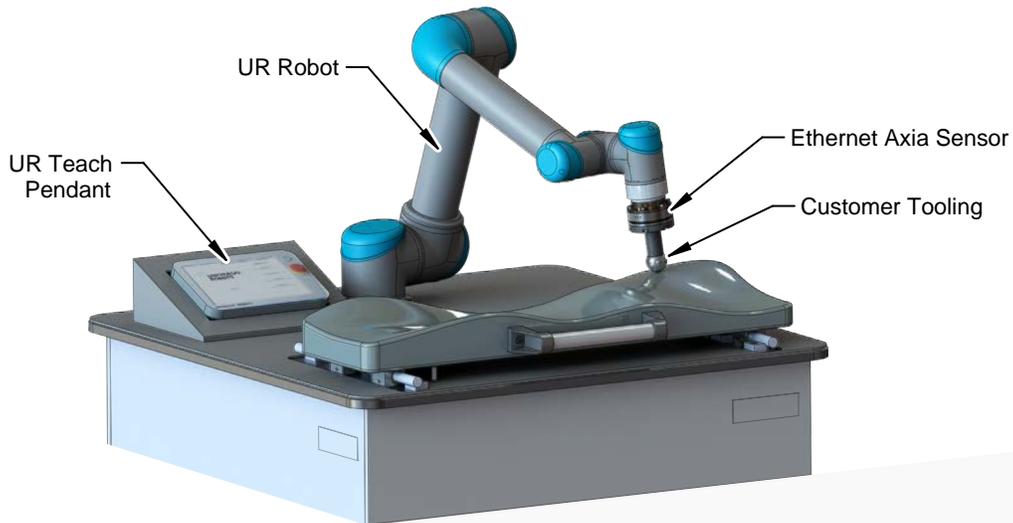
2.1 ATI F/T Kits for Ethernet Axia

ATI provides the following kit options:

Table 2.2—ATI F/T Axia Kits			
		ATI Kit P/N	
Item	**P/N**	**9105-COB-UR-AXIA80-01** (*Figure 2.2*)	**9105-COB-UR-AXIA80-02** (*Figure 2.2*)
Ethernet Axia F/T Sensor	9105-NET-AXIA80-M20	✓	✓
Mounting Interface Plate Assembly	9105-IP-2126	✓	✓
Tool Interface Plate Assembly	9105-IP-2191	✓	
Ethernet and Power Cable Kit	9105-CKIT-ZC22-ZC28-4	✓	✓
Split Power and RJ45 Ethernet Cable: 8-pin M12 connector that splits to a RJ45 Ethernet connection and an unterminated end for power	9105-C-ZC28-U-RJ45S-4	✓	✓
Note:			
1. Part number used to be 9105-NET-AXIA80-M20-ZC22.			

The mounting interface plate assembly (ATI P/N 9105-IP-2126) includes the following:

- (1) interface plate (ATI P/N 3700-05-2126) that mounts the MAP to the robot arm
- (6) M5-0.8 x 12 mm socket head cap screws (ATI P/N 3500-1064012-15) for mounting the sensor to the interface plate
- (4) M6-1 x 18 mm socket head cap screws (ATI P/N 3500-1066018-15) for mounting the interface plate to the robot arm
- (2) M4 x 12 mm dowel pins for aligning the sensor to the interface plate
- (1) M6 x 12 mm dowel pin for aligning the interface plate to the robot
- (1) clamp loop for routing the 9105-C-ZC22-ZC28-4 cable
- (1) 4 mm low profile hex key (ATI P/N 3810-05-2182) for the M5 socket head cap screws

The tool interface plate assembly (ATI P/N 9105-IP-2191) includes the following:

- (1) interface plate (ATI P/N 3700-05-2191) that mounts the TAP to the customer tooling
- (6) M5-0.8 x 12 mm socket head cap screws (ATI P/N 3500-1064012-15) for mounting the interface plater to the sensor
- (1) M3 x 16 mm dowel pin for aligning the sensor to the interface plate
- (1) M4 x 16 mm dowel pin for aligning the sensor to the interface plate

The Ethernet and Power Cable Kit (ATI P/N 9105-CKIT-ZC22-ZC28-4) includes the following:

- (1) Ethernet and power cable (ATI P/N 9105-C-ZC22-ZC28-4) with a 6-pin sensor connector and an 8-pin M12 connector
- (1) L-bracket kit (ATI P/N 9005-05-1076) for cable routing
- (1) P-clip kit and (6) cable straps for cable routing (ATI P/N 9005-05-1077)

Figure 2.2—UR Kit, P/N 9105-COB-UR-AXIA80-01 and 9105-COB-UR-AXIA80-02

Robot Arm

4 mm low profile hex key for the M5 screws
(Part of ATI Kit P/N 9105-IP-2126)

L-bracket kit (ATI P/N 9005-05-1076)

Power/Ethernet Cable
(ATI P/N 9105-C-ZC22-ZC28-4)

Power/Ethernet Cable to
the customer's application
(ATI P/N 9105-C-ZC28-U-RJ45S-4)

(6) M5 Socket Head Cap Screw

Mounting Interface Plate
(ATI P/N 9105-IP-2126)

P-clip kit (ATI P/N 9005-05-1077, cable straps not shown)

(4) M6 Socket Head Cap Screw

Ethernet Axia Sensor
(ATI P/N 9105-NET-AXIA80-M20)

Tool Interface Plate
(ATI P/N 9105-IP-2191)*

(6) M5 Socket Head Cap Screw*

*Available with the 9105-COB-UR-AXIA80-01 Kit

2.1.1 Unpacking the ATI F/T Kit

Upon receipt of a kit, complete the following:

- Check the shipping container and components for damage that may have occurred during shipping. Report damage to ATI Industrial Automation (refer to *page 2*).

- Verify the components from the packing list are included in the kit.

- For standard components included in the kit, refer to *Section 2.1—ATI F/T Kits for Ethernet Axia*.

3. Installation

> ⚠️ **WARNING:** Performing maintenance or repair on the sensor when circuits (for example: power, water, and air) are energized could result in death or serious injury. Discharge and verify all energized circuits are de-energized in accordance with the customer's safety practices and policies.

3.1 Installing an ATI F/T Ethernet Sensor to the UR CB-series Robot

Refer to the applicable manual in *Table 2.1*.

> **NOTICE:** Before using the sensor and URCAP, the IP address of the sensor MUST be on the same local subnet as the IP address of the robot. To change the IP address of the robot, refer to the appropriate UR manual. To change the IP address of the sensor, refer to the applicable manual in *Table 2.1*.

4. Setup of the ATI F/T URCaps Software

To use an ATI F/T sensor with a UR CB-series robot, the user must first install and set-up the ATI URCaps software to the robot. For more detailed information on the UR CB-series teach pendant software functionality such as safety, operation, programing, and UR nomenclature, refer to the *UR Polyscope Manual, Version 5.1.0*. For consistency, UR nomenclature is used in the following procedures.

4.1 Downloading ATI F/T URCaps Software from the ATI Website

Supplies required: Computer with web browser and internet access, USB drive

1. Using a web browser, navigate to *http://www.ati-ia.com/Products/ft/software/axia_software.aspx*.

2. Download the ATI F/T URCap software package **F/T Universal Robots Software**.

3. Save the file to a local drive. (right click on the folder, and select **Export** or **Export All**)

4. Unzip the file.

5. Save the **ATI_FT-*.urcap** file to a portable USB drive.

6. (Optional) save the **ATI Demo Program.urp** and **ATI Simple Demo Program.urp** to a portable USB drive for transfer to the teach pendant.

7. Eject the USB drive.

4.2 Loading the ATI F/T URCaps Software on the Teach Pendant

To load the ATI F/T URCaps software from the USB drive to the teach pendant, refer to the following steps:

1. Insert a USB drive that contains the ATI F/T URCaps package into the USB port on the top of the teach pendant.

Figure 4.1—Insert USB Drive into USB Port on the Teach Pendant

2. Turn power on the teach pendant. The **Welcome** screen appears on the teach pendant.

3. Select the **Setup Robot** button.

Figure 4.2—Welcome Screen
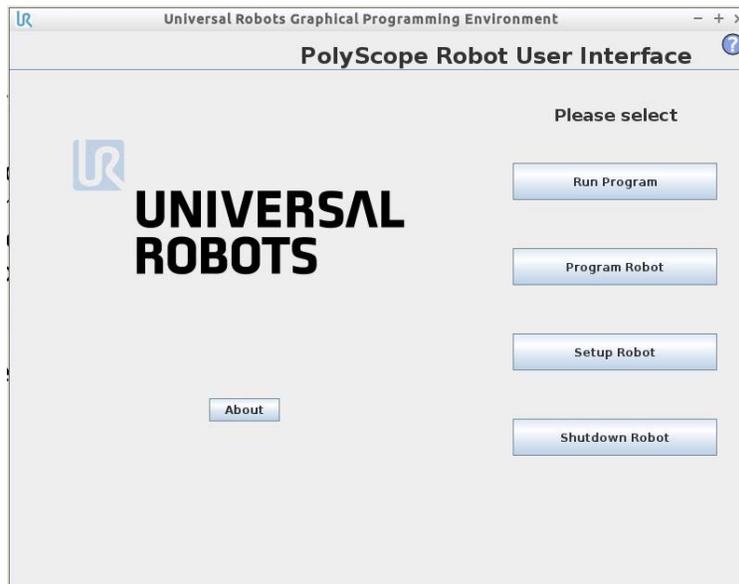
4. On the **Setup Robot** screen, select the **URCaps** button.

Figure 4.3—Setup Robot Screen

5. The **URCaps** screen opens. Load the ATI F/T URCaps software from the USB drive.

   a. On the bottom of the screen, click the + button.

Figure 4.4—Settings Window
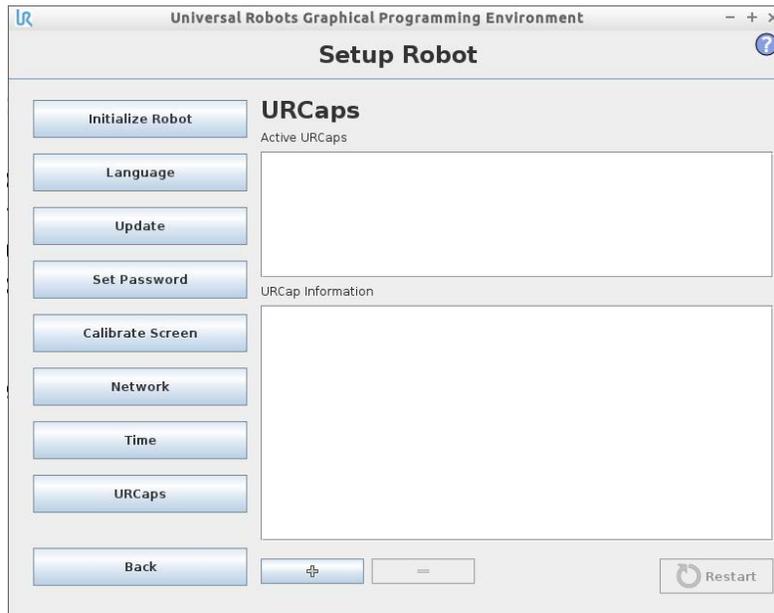
   b. From the drop-down menu, select **URCaps**.

   c. Select the + button on the lower left hand of the screen.

d. Navigate to the directory where the ATI F/T URCaps software file is saved on the USB drive.

Figure 4.5—Open the File
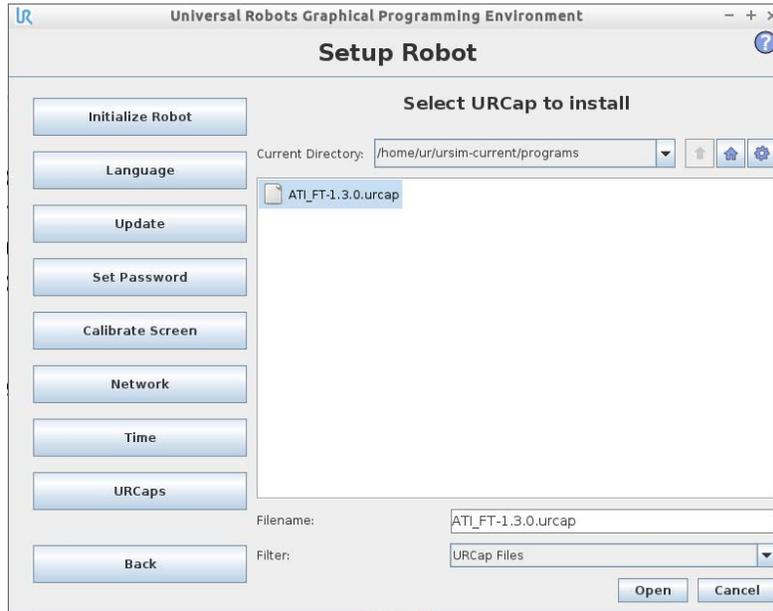
e. Select the file.

f. Click **Open**. The file loads onto the teach pendant.

6. When the file has loaded, the software **ATI Axia Force/Torque Sensor** appears in the **Active URCaps** field.

NOTICE: The UR system prompts a reboot of the robot, after the user installs the URCap software.

Figure 4.6—Active URCaps

7. (Optional) Select the file, **ATI Axia Force/Torque Sensor** and information appears in the **URCap Information** field.

8. Remove the USB drive.

9. The user can now setup the sensor on the teach pendent (refer to *Section 4.3—Set-up an ATI F/T Ethernet Sensor on the Teach Pendant*).

4.2.1 Remove the ATI F/T URCaps Software from the Teach Pendant

To remove the ATI F/T URCaps software from the teach pendant, complete the following procedure:

1. From the **Welcome** screen (*Figure 4.2*), click the **Setup Robot** button.

2. From the left side of the **Setup Robot** screen (*Figure 4.3*), select the **URCaps** button.

3. In the **Active URCaps** field, select the file to uninstall from the teach pendant.

4. Click the **-** button on the bottom of the screen.

Figure 4.7—Active URCaps

4.3 Set-up an ATI F/T Ethernet Sensor on the Teach Pendant

Once the user loads the ATI F/T URCaps software on the teach pendant, now the user may set-up the ATI F/T Ethernet sensor on the teach pendant.

1. On the **Welcome** screen, click the **Program Robot** button.

Figure 4.8—Welcome Screen
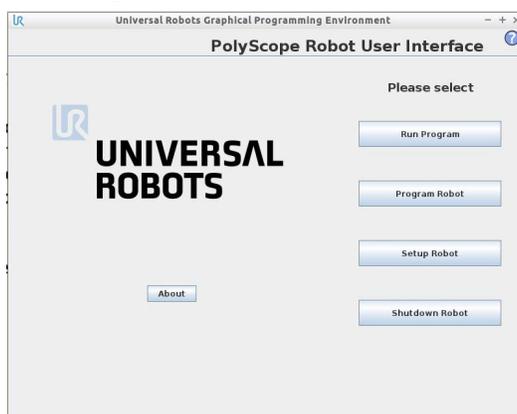
2. Select the **Installation** tab.

3. On the left side, select **TCP Configuration**.

NOTICE: The TCP position, payload, and center of gravity information should include the ATI products (kits) plus the customer tooling.

4. On the **Tool Center Point** screen, type values in the fields, as applicable to the application. For assistance in determining these values, refer to *Section 4.4—Determining the Tooling Mass and Offset*.

- *Figure 4.9*: The values entered in this figure are an example of a configuration that includes the ATI mounting interface plate, the Axia sensor, and the tool interface plate. These values are from *customer drawing*. To these values, the user may need to add additional offset and payload to account for the customer tooling.

Figure 4.9—TCP Screen (with tool interface plate)
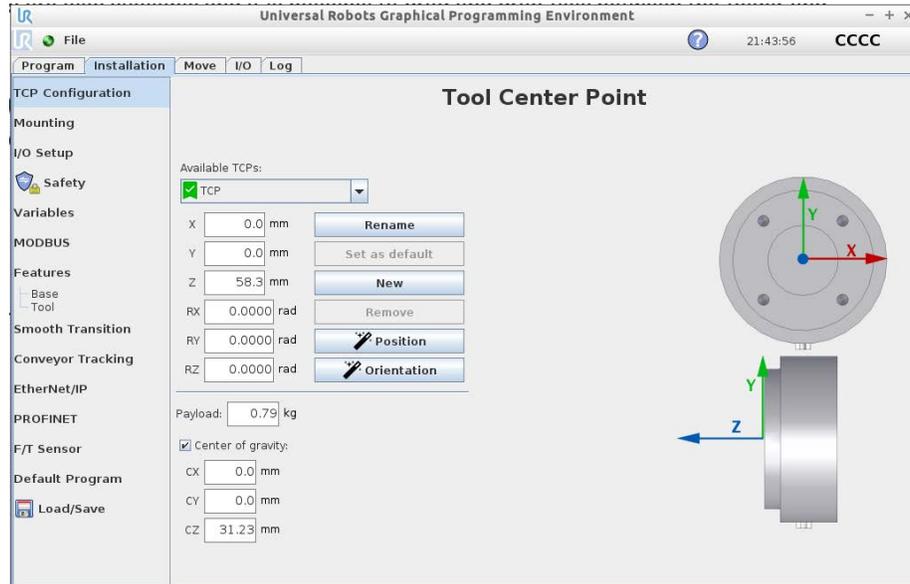
- *Figure 4.10*: The values entered in this figure are an example of a configuration that includes the ATI mounting interface plate and the Axia sensor. These values are from the *customer drawing*. To these values, the user may need to add additional offset and payload to account for the customer tooling.

Figure 4.10—TCP Screen (without tool interface plate)
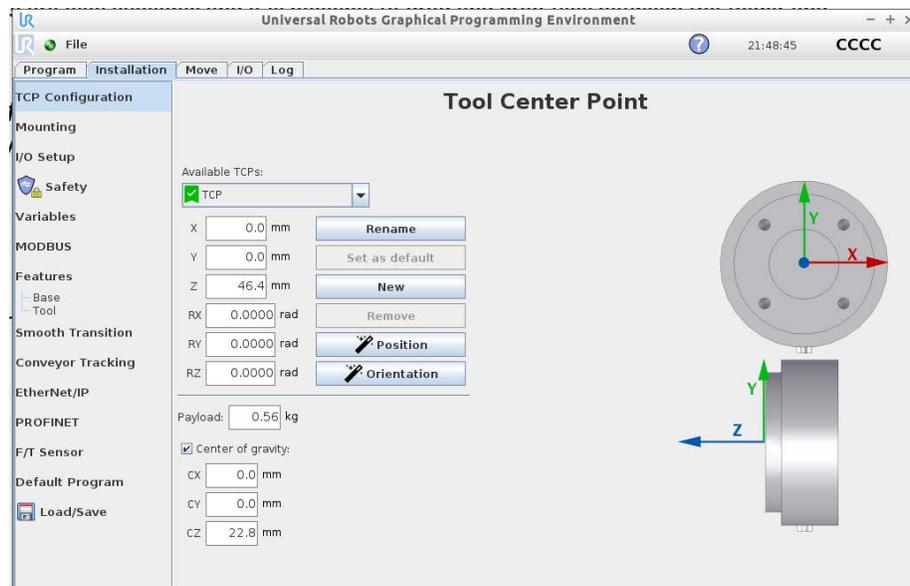
5. On the left side, select **F/T Sensor**.

6. In the **F/T Sensor Address** field, type the IP address of the sensor: for example, 192.168.1.1

> **NOTICE:** ATI ships the sensor with a default IP address: 192.168.1.1. However, the user must set the sensor to an IP address on the same local subnet as the UR CB-series robot. For instructions on how to change or determine the IP address of the following:
>
> • ATI F/T Ethernet sensor, refer to the applicable manual in *Table 2.1*.
>
> • Robot, refer to the applicable UR manual.

7. Leave blank or keep the default value in the **F/T Sensor Baud Rate** field. This field is ignored when using an Ethernet sensor with an IP address.

8. On the bottom of the screen, type the information for the following fields: **Sensor Mass**, **Sensor Measuring Offset**, and **Sensor Center of Gravity**.

   • In parenthesis, ATI includes recommended values next to the **Sensor Measuring Offset** and **Sensor Center of Gravity** fields. Use different values, if using a custom mounting interface plate.

Figure 4.11—Force/Torque Screen
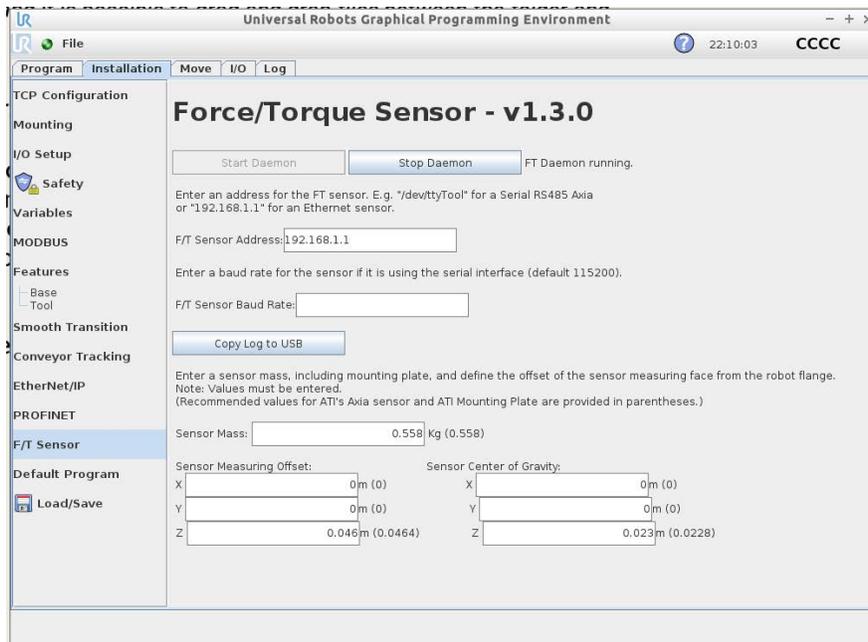
9. Press the **Start Daemon** button.

> **NOTICE:** When the Daemon is running, the Stop Daemon is highlighted with a blue shadow box, and the notice "FT Daemon running" appears.
>
>

10. Save changes.

   a. On the left side of the screen, select **Load/Save**.

b. Select the **Save** or **Save As...** button to save changes.

Figure 4.12—Save
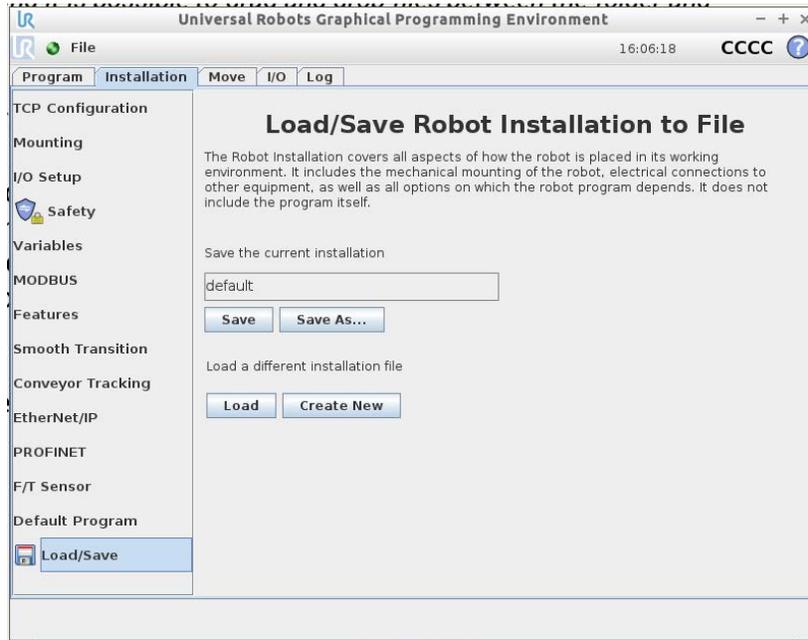
11. Once the sensor and robot are setup, the user can now create a program or run an ATI demo program (refer to the *9610-05-1041* manual for programming).

4.4   Determining the Tooling Mass and Offset

> ⚠️ **CAUTION:** Do not enter the following default values into the robot controller without accounting for the tooling mass by using the following equations. Failure to account for the tooling mass and offset reduces the performance of the UR robot. Properly account for the customer tooling, when setting up the tool center point or TCP.

Determining the tooling mass and offset depends upon the system configuration: sensor type, interface plate characteristics, and the customer tooling. The following sections explain how to calculate the mass and offset for two scenarios: a sensor with only a mounting interface plate or a sensor with mounting and tool interface plates.

4.4.1   Tooling Mass and Offset for a Sensor and Mounting Interface Plate

The ATI provided F/T sensor and mounting interface plate have the following mass characteristics, measuring offset, and CG with no customer tooling installed (for more information, refer to the *customer drawing*):

Figure 4.13—Mass and Offset

Robot Flange

46.4 mm

Mass of mounting interface plate
+
Mass of ATI Ethernet Axia Sensor   = 0.558 kg

Sensor Reference Face
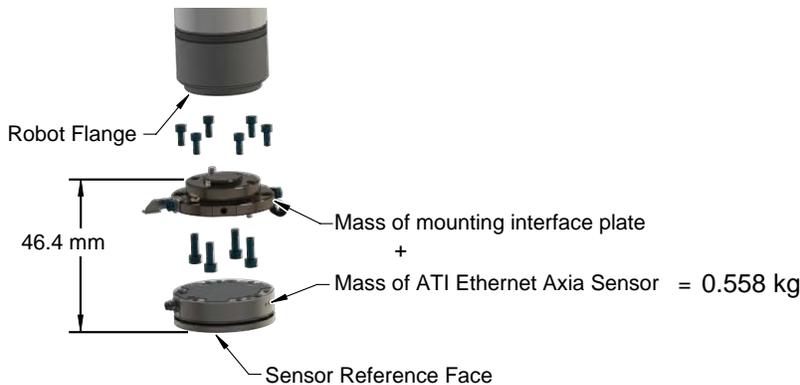
Table 4.1—Sensor and Mounting Interface Plate Mass		
Sensor and Mounting Plate Models		
	ATI Axia F/T Sensor and ATI mounting interface plate	**ATI F/T Ethernet Sensor and Custom Mounting Interface Plate[2]**
Mass	0.558 kg[1]	mass (refer to the *9620-05-Transducer Section* manual) + mass of the custom mounting interface plate
Notes:		
1. This value assumes the use of an ATI F/T Axia80 sensor and ATI 9105-IP-2126 mounting interface plate.		
2. Different sensor models and mounting plates have different measurements.		

Table 4.2—Sensor Measuring Offset (with mounting interface plate)		
Axis	**Sensor and Mounting Interface Plate Models**	
	ATI Axia F/T Sensor and ATI mounting interface plate	**ATI F/T Ethernet Sensor and Custom Mounting Interface Plate[2]**
X	0 m[1]	distance from the center of the robot flange to the center of the sensor reference face
Y	0 m[1]	
Z	0.0464 m[1]	

Notes:

1. This value assumes the use of an ATI F/T Axia80 sensor and ATI 9105-IP-2126 mounting interface plate.
2. Different sensor models and mounting plates have different measurements.

Table 4.3—Sensor Center of Gravity (with mounting interface plate)		
Axis	**Sensor and Mounting Plate Models**	
	ATI Axia F/T Sensor and ATI mounting interface plate	**ATI F/T Ethernet Sensor and Custom Mounting Interface Plate[2]**
X	0 m[1]	distance from the center of the robot flange to the center of the CG of the sensor and mounting interface plate
Y	0 m[1]	
Z	0.0228 m[1]	

Notes:

1. This value assumes the use of an ATI F/T Axia80 sensor and ATI 9105-IP-2126 mounting interface plate.
2. Different sensor models and mounting plates have different measurements.

Use the following equations in *Figure 4.15* to determine the values to enter in the fields of the **TCP** screen. Use the following diagram as a reference for the equations.

Figure 4.14—Center of Gravity Diagram
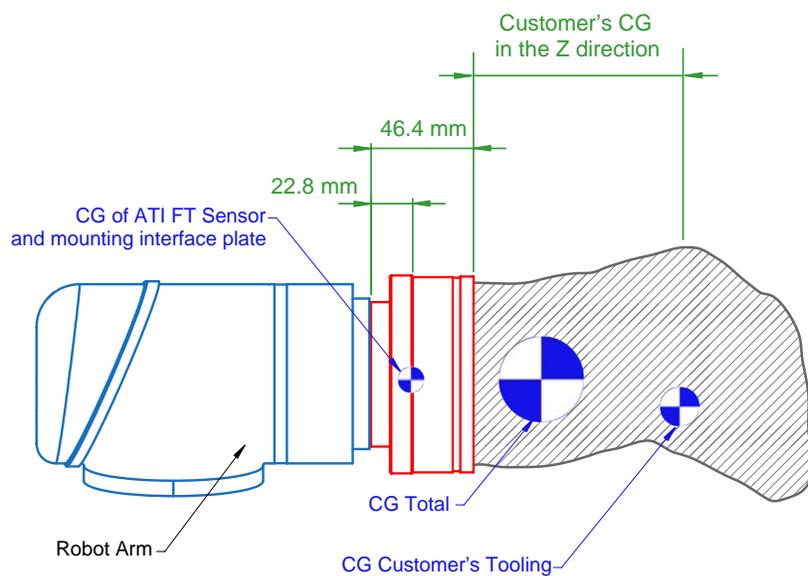
Figure 4.15—Equations

$$\text{Payload(kg)} = 0.558 \text{ kg} + \text{Customer's Tooling Mass}$$

$$\text{Center of Gravity (x, mm)} = \frac{\text{Customer's Tooling Mass} \times \text{Customer's CG in the x direction}}{0.558 \text{ kg} + \text{Customer's Tooling Mass}}$$

$$\text{Center of Gravity (y, mm)} = \frac{\text{Customer's Tooling Mass} \times \text{Customer's CG in the y direction}}{0.558 \text{ kg} + \text{Customer's Tooling Mass}}$$

$$\text{Center of Gravity (z, mm)} = \frac{12.7224 \text{ kg-mm} + \text{Customer's Tooling Mass} \times (\text{Customer's CG in the z direction} + 46.4 \text{ mm})}{0.558 \text{ kg} + \text{Customer's Tooling Mass}}$$

Where:

Center of Gravity (CG):

The point of a mass around which the resultant torque from gravity forces is zero.

Customer's Center of Gravity in the X, Y, Z Direction:

The distance in mm from the F/T sensor's sensing reference frame origin (refer to the *customer drawing*) to the center of gravity of the customer's tooling.

This should include the mass and location of all customer-provided fasteners and not ATI-provided parts.

The location of a center of gravity can be found in most CAD packages used to design robot tooling.

Customer's Tooling Mass:

The mass of the customer's tooling that includes all fasteners not provided by ATI, in kilograms.

F/T Mass:

The mass of the F/T sensor including the interface plate and all hardware required to connect the F/T sensor to the robot.

The F/T mass does not include any hardware the customer uses to mount tooling to the F/T sensor.

4.4.2 Tooling Mass and Offset for Sensor with Mounting and Tool Interface Plates

The ATI provided F/T sensor with mounting and tool interface plates have the following mass characteristics, measuring offset, and CG with no customer tooling installed (for more information, refer to the *customer drawing*):

Figure 4.16— Mass and Offset
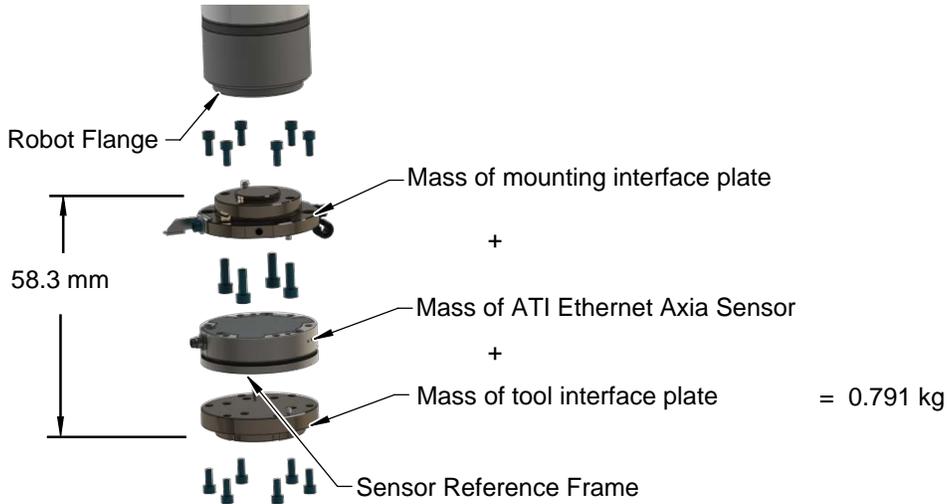
	Table 4.4—Mass of a Sensor with Mounting and Tool Interface Plates	
	Sensor and Interface Plate Models	
	ATI Axia F/T Sensor with Mounting and Tool Interface Plates	**ATI F/T Ethernet Sensor with Custom Interface Plates[2]**
Mass	0.791 kg[1]	mass (refer to the *9620-05-Transducer Section* manual) + mass of the mounting interface plate + mass of the tool interface plate
Notes: 1. This value assumes the use of an ATI F/T Axia80 sensor and ATI 9105-IP-2126 mounting interface plate and ATI 9105-IP-2191 tool interface plate. 2. Different sensor models and interface plates have different measurements.		

Table 4.5—Measuring Offset with Mounting Interface Plate		
Axis	**Sensor and Mounting Interface Plate Models**	
	ATI Axia F/T Sensor with Mounting Interface Plate	**ATI F/T Ethernet Sensor with Custom Mounting Interface Plate[2]**
X	0 m[1]	distance from the center of the robot flange to the center of the sensor reference face
Y	0 m[1]	
Z	0.0464 m[1]	

Notes:

1. This value assumes the use of an ATI F/T Axia80 sensor and ATI 9105-IP-2126 mounting interface plate. Tooling offsets, including interface plates, are not accounted for in sensor measuring offset.
2. Different sensor models and mounting plates have different measurements.

Table 4.6—Center of Gravity of a Sensor with Mounting and Tool Interface Plates		
Axis	**Sensor and Mounting Plate Models**	
	ATI Axia F/T Sensor and ATI Mounting Interface Plate	**ATI F/T Ethernet Sensor and Custom Mounting Interface Plate[2]**
X	0 m[1]	distance from the center of the robot flange to the center of the CG of the sensor and custom mounting interface plate
Y	0 m[1]	
Z	0.0228 m[1]	

Notes:

1. This value assumes the use of an ATI F/T Axia80 sensor and ATI 9105-IP-2126 mounting interface plate. Tooling, including interface plates, is not accounted for in the sensor center of gravity.
2. Different sensor models and mounting plates have different measurements.

Use the following equations in *Figure 4.18* to determine the values to enter in the fields of the **TCP** screen. Use the following diagram as a reference for the equations.

Figure 4.17—Center of Gravity Diagram
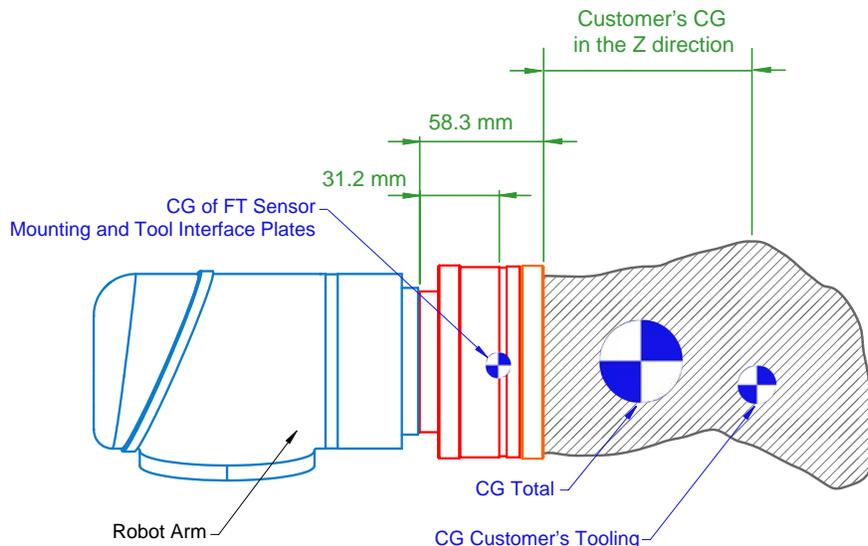
Figure 4.18—Equations

$$\text{Payload(kg)} = 0.791 \text{ kg} + \text{Customer's Tooling Mass}$$

$$\text{Center of Gravity (x, mm)} = \frac{\text{Customer's Tooling Mass} \times \text{Customer's CG in the x direction}}{0.791 \text{ kg} + \text{Customer's Tooling Mass}}$$

$$\text{Center of Gravity (y, mm)} = \frac{\text{Customer's Tooling Mass} \times \text{Customer's CG in the y direction}}{0.791 \text{ kg} + \text{Customer's Tooling Mass}}$$

$$\text{Center of Gravity (z, mm)} = \frac{24.7 \text{ kg-mm} + \text{Customer's Tooling Mass} \times (\text{Customer's CG in the z direction} + 58.3 \text{ mm})}{0.791 \text{ kg} + \text{Customer's Tooling Mass}}$$

Where:

Center of Gravity (CG):

The point of a mass around which the resultant torque from gravity forces is zero.

Customer's Center of Gravity in the X, Y, Z Direction:

The distance in mm from the F/T sensor's sensing reference frame origin (refer to the *customer drawing*) to the center of gravity of the customer's tooling.

This should include the mass and location of all customer-provided fasteners and not ATI-provided parts.

The location of a center of gravity can be found in most CAD packages used to design robot tooling.

Customer's Tooling Mass:

The mass of the customer's tooling that includes all fasteners not provided by ATI, in kilograms.

F/T Mass:

The mass of the F/T sensor including the interface plate and all hardware required to connect the F/T sensor to the robot.

The F/T mass does not include any hardware the customer uses to mount tooling to the F/T sensor.

5. Troubleshooting

This section includes answers to some issues that might arise when setting up and using the ATI UPCaps software with an ATI sensor. In , the question or problem is listed on the left followed by the plausible solution to the right.

The information in this section should answer many questions that might arise in the field. Customer service is available to users, who have problems or questions addressed in the manuals.

> Note
>
> Please read the manual before calling customer service. Before calling, have the following information available:
>
> 1. Serial number (e.g., FT01234)
> 2. Sensor model (e.g., Ethernet Axia80)
> 3. Calibration (e.g., US-15-50, SI-65-6, etc.)
> 4. Accurate and complete description of the question or problem
> 5. Computer and software information (operating system, PC type, drivers, application software, and other relevant information about the application's configuration)
>
> If possible, be near the F/T system when calling.

For additional troubleshooting information or to speak with a customer service representative, please contact ATI:

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Apex, NC 27539 USA
www.ati-ia.com
Tel: +1.919.772.0115
Fax: +1.919.772.8259

Application Engineering
Tel: +1.919.772.0115, Extension 511
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E-mail: *ft_support@ati-ia.com*

5.1 Errors with the ATI URCap Software

The following table lists basic problems and possible answers/solutions for the operation of the ATI URCap software.

Table 5.1—Errors with the ATI URCap Software	
Problem	**Answer/Solution**
After clicking **Start Daemon** on the **Force/ Torque Sensor** screen, an error message "ATI FT Daemon failed appears.	The ATI F/T Sensor address entered may be incorrect, or the sensor's IP address may not be on the same local subnet as the robot controller. Verify the address and reenter. Refer to *Section 4.3—Set-up an ATI F/T Ethernet Sensor on the Teach Pendant*.
The ATI F/T sensor is malfunctioning.	Refer to the applicable manual in *Table 2.1*.

6. Terms and Conditions of Sale

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

ATI warrants to Purchaser that force torque sensor products purchased hereunder will be free from defects in material and workmanship under normal use for a period of one (1) year 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 with 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 than ten days after the last day of the warranty period. ATI's entire liability and Purchaser's sole remedy under this warranty is limited to repair or replacement, at ATI's election, of the defective part or item or, at ATI's 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's aggregate liability will in no event exceed the amount paid by the 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 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's property. The sale of products or services hereunder does not convey any expressed 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.

In the course of supplying products and services hereunder, ATI may provide or disclose to Purchaser confidential and proprietary information of ATI relating to the design, operation, or other aspects of ATI's products. As between ATI and Purchaser, ownership of such information, including without limitation any computer software provided to Purchaser by ATI, shall remain in ATI and such information is licensed to Purchaser only for Purchaser's use in operating the products supplied by ATI hereunder in Purchaser's internal business operations.

Without ATI's prior written permission, Purchaser will not use such information for any other purpose of 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.

Purchaser will not be liable hereunder with respect to disclosure or use of information which: (a) is in the public domain when received from ATI, (b) is thereafter published or otherwise enters the public domain through no fault of Purchaser, (c) is in Purchaser's possession prior to receipt from ATI, (d) is lawfully obtained by Purchaser from a third party entitled to disclose it, or (f) is required to be disclosed by judicial order or other governmental authority, provided that, with respect to such to maintain the confidentiality of such information.