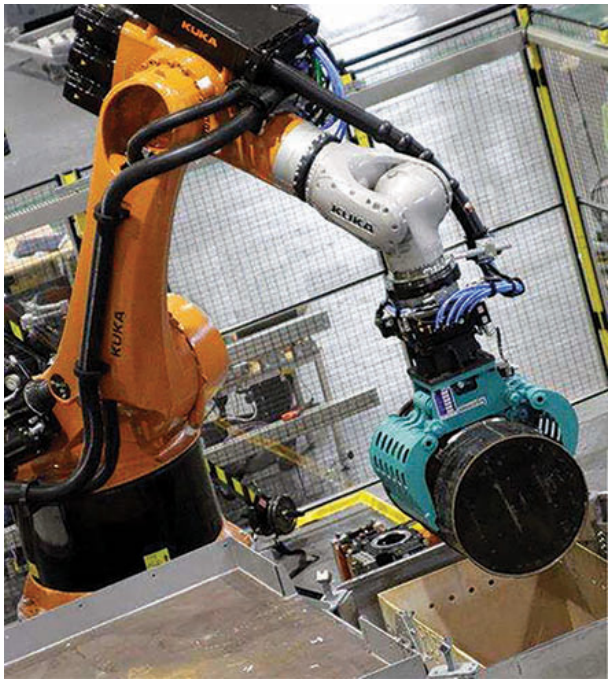
Manual Addendum for the Radiation Tolerant DAQ Transducer



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Pinnacle Park • 1031 Goodworth Drive • Apex, NC 27539 • Tel:+1 919.772.0115 • Fax:+1 919.772.8259 • *www.ati-ia.com*

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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. Transducer model (e.g., Theta, etc.)
3. Calibration (e.g., SI-2500-600)
4. Accurate and complete description of the concern or question
5. Computer and software information, for example: operating system, PC type, drivers, and application software

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:

ATI Industrial Automation
1031 Goodworth Drive
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
Fax: +1.919.772.8259
E-mail: *ft_support@ati-ia.com*

Table of Contents

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 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.

2. Overview

This addendum applies to 9105-RAD transducers and works in conjunction with the standard *DAQ F/T manual*, ATI P/N 9620-05-DAQ.

9105-RAD transducers are a subset of ATI's standard DAQ F/T transducers. These radiation-tolerant transducers differ from the 9105-TIF transducers as described in the following table:

Table 2.1—Difference Between 9105-RAD and 9105-TIF Transducers

Parameter	Description	
	9105-RAD	9105-TIF
Radiation Tolerant	Yes	No
Connector	Has extra pins for customer power supply inputs.	Has reserved pins that are not to be used by the customer.
Cable	ATI P/N 9105-C-x-x-x-ZR1	ATI P/N 9105-C-x-x-x
Output Signals	True Differential	Pseudo Differential

3. Transducer Signals

The transducer outputs values for the six strain gages that sense the transducer's loading and outputs a value for the temperature of the transducer. All output pairs are differentially driven analog voltages. If single-ended signals are required, an instrumentation amplifier can be used to convert these differential outputs to single ended. An instrumentation amplifier with unity gain produces a ±10 V range.

Electrical connection details for 9105-RAD-x and 9105-RAD-x-IPx transducers are in the following table:

NOTICE: Multi-colored wires are identified as follows:
- The first color is the predominant color of the wire.
- The second color is the stripe on the wire.

Table 3.1—Transducer Electrical Connections

Signal Name	Transducer Model Connector Pin		Wire Colors for Cables 9105-C-x-x-x-ZR1	Source
	9105-RAD-x	9105-RAD-x-IPX		
$-V_{ANA}$	11	2	Red/White	User
	16	6	Orange/White	
AGnd	10	4	Black	
	15	3	Black/White	
$+V_{ANA}$	2	5	Orange	
	6	1	Red	
+SG0	1	7	Brown	Transducer
-SG0	3	8	Brown/White	
+SG1	7	9	Yellow	
-SG1	12	10	Yellow/White	
+SG2	17	11	Green	
-SG2	20	12	Green/White	
+SG3	8	13	Blue	
-SG3	4	14	Blue/White	
+SG4	13	15	Violet	
-SG4	18	16	Violet/White	

Table 3.1—Transducer Electrical Connections				
Signal Name	**Transducer Model Connector Pin**		**Wire Colors for Cables 9105-C-x-x-x-ZR1**	**Source**
	9105-RAD-x	**9105-RAD-x-IPX**		
+SG5	9	17	Grey	Transducer
-SG5	5	18	Grey/White	
+T	14	19	White	
-T	19	20	White/Black	
Shield	Shell		Shield	N/A

4. Calculation Force and Torque Values

For information about using strain gage signals to create force and torque readings, refer to the *F/T Sensor Data Aquisition (DAQ) Systems* manual (ATI manual P/N 9620-05-DAQ).

5. Temperature Gage Reader

The temperature reader reports the transducer temperature as a voltage. The temperature of the transducer can be calculated from the voltage of the temperature reader by using the following transfer function:

$$Temperature\ _{°C} = \frac{3934.12}{\ln(1 - 0.1 \times T) - \ln(1 + 0.1 \times T) + 12.44} - 273.15$$

Where:

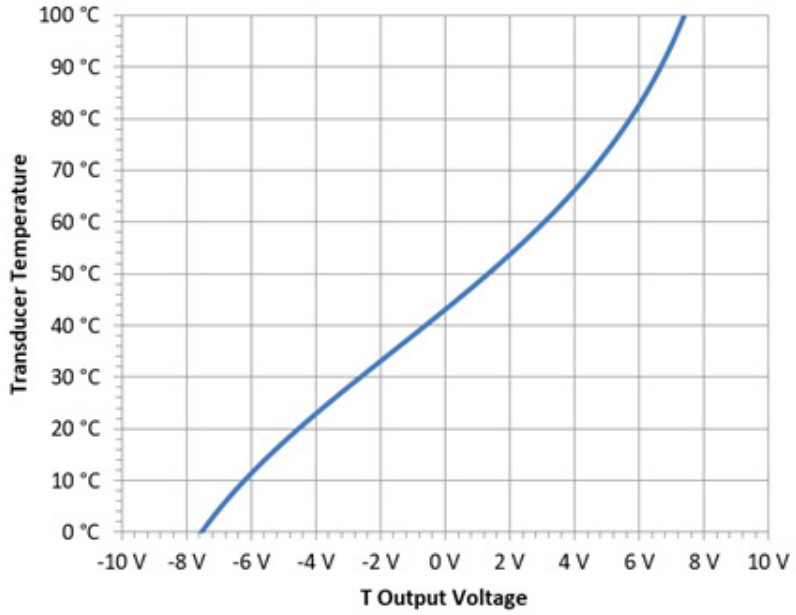
T = voltage of transducer's T output

Temperature $_{°C}$ = Reported transducer temperature in degrees Celsius

ln(x) = natural logarithm of x

For example: if T = -4.1746 Volts, then Temperature $_{°C}$ = 22.0 °C

Figure 5.1—Temperature Reader Transfer Function (Temperature vs. Voltage)



6. Electrical Connection Information

6.1 Signals and Power

Table 6.1—Signal Descriptions	
Signal Name	**Description**
+SG*x*	The non-inverted (positive) half of strain gage output SGx
-SG*x*	The inverted (negative) half of strain gage output SGx
+T	The non-inverted (positive) half of the temperature output
-T	The inverted (negative) half of the temperature output
$+V_{ana}$	Positive power supply used by the transducer
AGnd	Power supply return used by the transducer
$-V_{ana}$	Negative power supply used by the transducer

6.2 Electrical Specifications

Table 6.2—Transducer Power Requirements				
Signal	**Minimum**	**Typical**	**Maximum**	**Units**
$+V_{ana}$ Voltage	13.5	15	16.5	VDC
$-V_{ana}$ Voltage	13.5	15	16.5	VDC
$+V_{ana}$ Current	N/A		100	mA
$+V_{ana}$ Voltage	N/A		75	mA
$+V_{ana}$ Voltage	N/A		75	mV p-p
$+V_{ana}$ Voltage	N/A		0.5	%

6.2.1 Transducer Output Voltage Ranges

The transducer outputs are designed to work with a differential input DAQ system. Transducer outputs are fully differential signals. The output impedance of each signal is 100 Ω. The transducer output voltage ranges are in the following table:

Table 6.3—Transducer Output Ranges		
Signal	**Units (V)**	
	Minimum	**Maximum**
+SG*x*	$-V_{ana}$ +0.05	$+V_{ana}$ -0.1
-SG*x*		
+T		
-T		
+SG*x*, over the transducer's calibrated range	-5	+5
-SG*x*, over the transducer's calibrated range		
SG*x*, over the transducer's calibrated range (SGx = +SGx - -SGx)	-10	+10

6.3 Environmental

Table 6.4—Environmental Requirements			
Parameter	**Minimum**	**Maximum**	**Units**
Radiation	N/A	10,000	Grays
		1,000,000	Rads

7. 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 (10) 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.

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