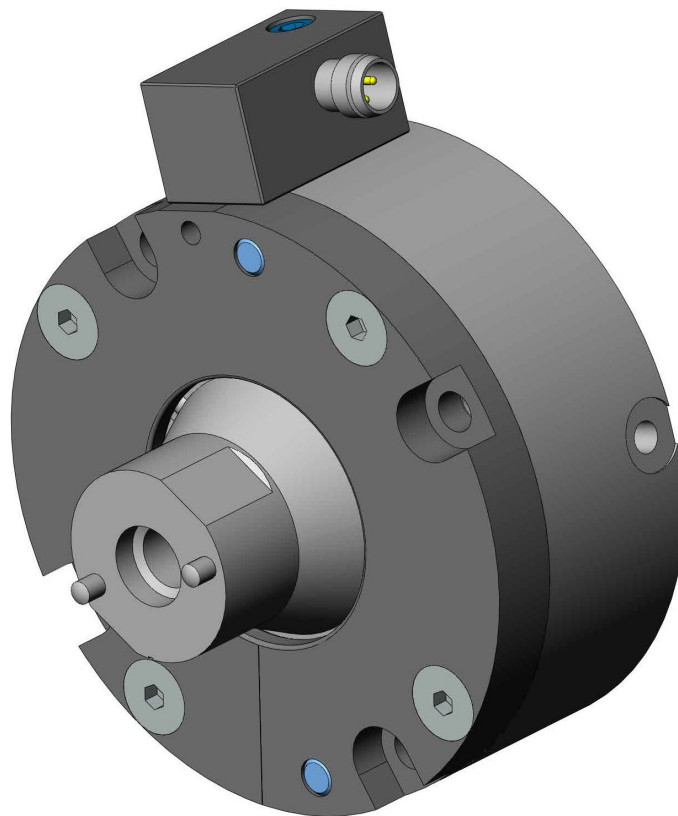




Protector™ Robotic Crash Protection Device

Product Manual



Document #9610-60-1000-10

Engineered Products for Robotic Productivity

FOREWORD

This product manual describes the installation and operation of the Protector, Crash Protection Device manufactured by ATI Industrial Automation. This manual must be read and understood before any attempt is made to install or operate the product. All precautions have been taken to ensure the safe operability of this product provided good common sense practices are used.

The information contained in this manual is confidential and reserved exclusively for the customers and authorized agents of ATI Industrial Automation and may not be divulged to any third party without prior written consent from ATI. No warranty including implied warranties is made with regard to fitness of this device for a particular application. ATI Industrial Automation assumes no responsibility for errors or omissions in this document. Customers are encouraged to evaluate and suggest changes to be included in future revisions of this documentation. The information in this manual is subject to change without notice. Contact ATI Industrial Automation with any questions related to the content and use of this manual.

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GLOSSARY OF TERMS

<u>TERM</u>	<u>DEFINITION</u>
Body	Cylindrical aluminum housing and air pressure chamber.
Base	Disk shaped stainless steel cover for Protector Body.
Cam	Stem shaped component which passes through the Base.
Connector	8mm electrical bulkhead mounted in block attached to the side of the Body.
Interface Plate	Optional component used to adapt the Protector Body or Cam to the customer's robot or tooling.
Crash	The result of a disturbance that displaces the Protector components from their standard, working position.
Reset	The ability of the Protector to return to its working position when a disturbing force or displacement is removed.

1. Overview

1.1 Introduction

The Protector is a pneumatically pressurized device offering protection to industrial robots and tooling in the event of accidental impacts and unanticipated loads. The devices are capable of “breaking away”, or crashing, from their working geometry in the event of excessive torsional, moment, axial forces, or any combination of these. The Protector cannot respond to pure axial tension, which is an unlikely mode of loading. Removal of the upsetting force or moment allows the Protector to return to its normal working geometry.

As a crash occurs, internal motion of the Protector components generates a signal by opening a normally closed switch. This is achieved by a dry contact. The signal may be supplied to robotic controllers to stop operations before damage to the robot or tooling occurs. The threshold at which the Protector breaks away is adjustable by controlling the air pressure supplied to the unit.

All Protector devices provide axial, torsional, and moment compliance. The units may be outfitted with a rotational limit option to prevent excessive rotation of the crashed Protector.

1.2 Safety Considerations

The Protector has not been designed for nor should it be used in situations involving the safety of humans or animals. The Protector was designed as a safety device to protect industrial components and machinery from damage resulting from collisions and impacts. In all situations the user is responsible for insuring that applicable safety practices are followed as outlined by the manufacturer of the equipment on which the Protector will be used.

The routing of electrical and pneumatic lines must minimize the possibility of stress pullout, kinking, rupture, etc. Failure of some critical electrical and/or pneumatic lines to function properly may result in injury to personnel and equipment.



CAUTION: The customer should lockout and discharge all energy to the work cell prior to working on any Protector™ system.

2. Component Description

The Protector consists of a machined aluminum piston housing (body) closed with a hardened stainless steel cap. The cap incorporates alignment components to accurately position a cam. The cam is a stem shaped component extending through the stainless end cap. The cam provides a mounting surface for customized adapter and interface plates. The second mounting component for the Protector is the piston housing itself. Tapped and through holes on the body allow its back surface to bolt directly to customer tooling.

An electrical connector block is mounted on the side of the Protector body. The connector block houses the crash detection switch and a miniature Brad-Harrison® connector. The customer connects to the switch using the Brad-Harrison® connector for which a variety of cables are available. The customer also must supply the Protector with dry, regulated, compressed air through a port on the side of the Protector body. The size and location of these connections are shown in the drawings provided at the end of this manual.

3. Installation

3.1 Operating Requirements

The Protector requires clean, dry, non-lubricated air delivered from a customer-supplied regulator. The self-reset versions of the Protector are not certified for accurate repeatability below 25 psi (1.7 bar) or above 120 psi (8 bar). For connection to the customer's controls, the Protector is equipped with a normally closed (NC) crash detection switch. When the Protector is in the crashed mode or the electrical cable to the switch is disconnected an open circuit is generated. The customer is responsible for connecting this to their controls and providing an "electrical load" in series with the crash detection switch. The switch is rated for instrument level signals of 125mA at 28V AC or DC (Maximums.)

Proper sizing of the Protector is imperative for the safe and reliable operation of the unit. Please see the charts at the rear of this manual and contact ATI for assistance in selecting the proper unit.

3.2 Mechanical

The Protector is commonly mounted with its piston housing toward the customer tooling and its cam toward the robot, however, this is not absolute. The Protector is mounted using the dowel holes and the clearance / tapped holes in the Protector body. Should this not be possible, additional adapter plates must be fabricated. A second interface / mounting plate is attached to the Protector cam. This may be ordered from ATI as a blank or machined for specific applications. The customer may also fabricate the adapter plate. (Should the customer wish to fabricate their own plate they should refer to the drawings at the rear of this manual.)

Once any required machining of the interface plates is complete, mount the Protector using hardware appropriately sized and rated for the application.

Connect an appropriately sized air line and fitting to the Protector. **Do not supply air pressure at this time.**

All mounting hardware should be tightened. The use of an industrial thread-locking compound is recommended for all fasteners.

M4-0.7 Flat Head Cap Screw	20–25 in-lbs.
M6-1.0 Flat Head Cap Screw	65–85 in-lbs.
M4-0.7 Cap Screw	25–30 in-lbs.
M5-0.8 Cap Screw	45–60 in-lbs.
M6-1.0 Cap Screw	80–1-5 in-lbs.
M8-1.25 Cap Screw	190–250 in-lbs.
M10-1.50 Cap Screw	390–520 in-lbs.
M12-1.75 Cap Screw	55–75 ft-lbs.

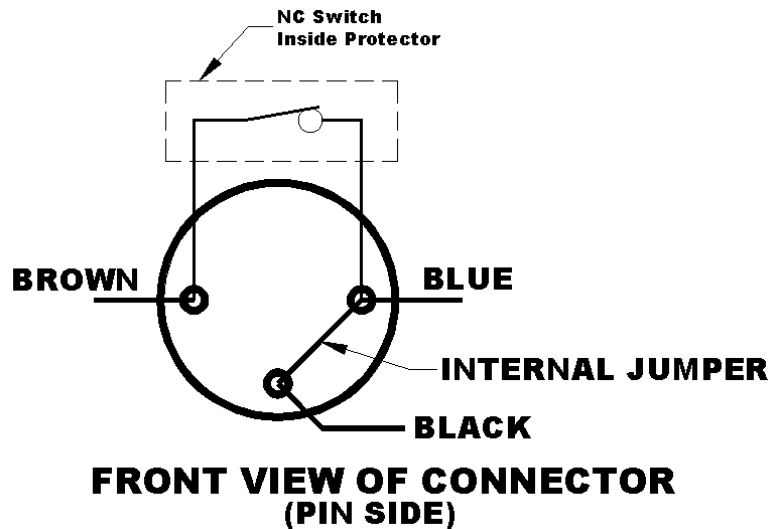
Table 3.1—Recommended torques for ATI-supplied fasteners



CAUTION: Before connecting or uncoupling the air supply to the Protector™ insure that the air supply is turned off and that all trapped air has been vented. The use of an industrial thread-locking compound is recommended for all fasteners.

3.3 Electrical

The Protector is connected to the customer’s control wiring as a normally closed, dry contact. The following sketch shows the wiring connections using the standard brown-blue-black cables supplied by ATI.





NOTE: The level of the desired or required air pressure will vary according to the weight, loading, and motion of the customer's tooling. Exercise caution while increasing the air pressure supplied to the Protector™. When the pneumatically-supplied force is sufficient to re-seat the Protector™ the tooling will move to its working position.

Once the Protector has been installed and connected as described in the preceding paragraphs proper electrical operation of the unit may be confirmed.

Align the scribe marks on the Protector base and cam. Supply the Protector with approximately 15 psi (1 bar) and insure that the unit is electrically connected to the customer's control circuit or a volt-ohm meter. The switch should appear closed.

Manually push the Protector to cause a crash while observing the switch output. When the crash occurs the switch will open and continuity will be lost.

Release the Protector and it will return to its working position. Continuity across the switch will be restored.

4. Operation

With the Protector mounted and connected pneumatically and electrically the unit may be placed into operation. If possible, for safety and convenience, position the Protector and the tooling vertically so that the load is suspended below the Protector. Before applying air pressure examine the Protector's cam and stainless end cap. Find and align by hand the scribe marks on these two components. (Alignment of these marks within approximately 20° is necessary for the unit to return to its working position when air pressure is applied.) With the two scribe lines positioned correctly, apply low-pressure air (2-15 psi, 0.15-1 bar) to the unit. Gradually increase the air pressure until the desired working pressure is applied.

In operation the Protector should be supplied with the minimum air pressure necessary to allow continuous, un-interrupted operation of the unit. Nuisance crashes caused by high accelerations and unanticipated loads will occur if the air pressure is too low. The magnitude of overhung loads, robot accelerations, and applied loads prevent ATI from recommending air pressure settings. Where high robot accelerations are anticipated the customer may wish to supply the Protector with electronically variable or multiple, switchable air supplies. Alternatively, where working loads are small the Protector may be outfitted with auxiliary springs and supplied with high-pressure air during robot moves. Using these techniques, the Protector may be supplied with higher air pressure when higher loads or accelerations are anticipated.

5. Maintenance

The Protector is a reliable device fabricated using heavy-duty components. In normal operation the unit requires no maintenance if proper air quality and pressures are maintained. No user-serviceable or adjustable components are used on the Protector. Should service be required please contact ATI.

6. Troubleshooting

The Protector will offer exceptional performance in normal operation. The Protector is not a compliance device and frequent crashing should be avoided to maximize performance and life. Protectors fitted with the standard reset option will return to their working position once the disturbing force is removed. Should this fail to happen the following examinations should be performed to verify proper operation of the unit.

- Check the supply air pressure. Insure that the supply air pressure is sufficient to support the loads placed upon the unit. If the supply pressure is too low the Protector will experience excessive nuisance crashes and fail to reset.
- Check the control wiring. Disconnect the cable from the Protector and use a volt-ohm meter on the Brad-Harrison® connector to confirm that the switch is closed when the Protector is in the working position. (The scribe lines on the Protector base and cam must be aligned. Remove tooling or increase air pressure if necessary to allow the unit to move to its working position.) If the switch is closed under this condition examine the system for control wiring and logic problems.
- Check for mechanical obstructions. The Protector will not be free to rotate back to its working position if obstructions prevent its free motion. Insure that there are no obstructions either on or around the tooling or the cam of the Protector. Pay particular attention to cables and tubing that may become trapped or snagged.
- If the Protector still fails to reset or if the switch fails to close when the unloaded unit is in its working condition, contact ATI.

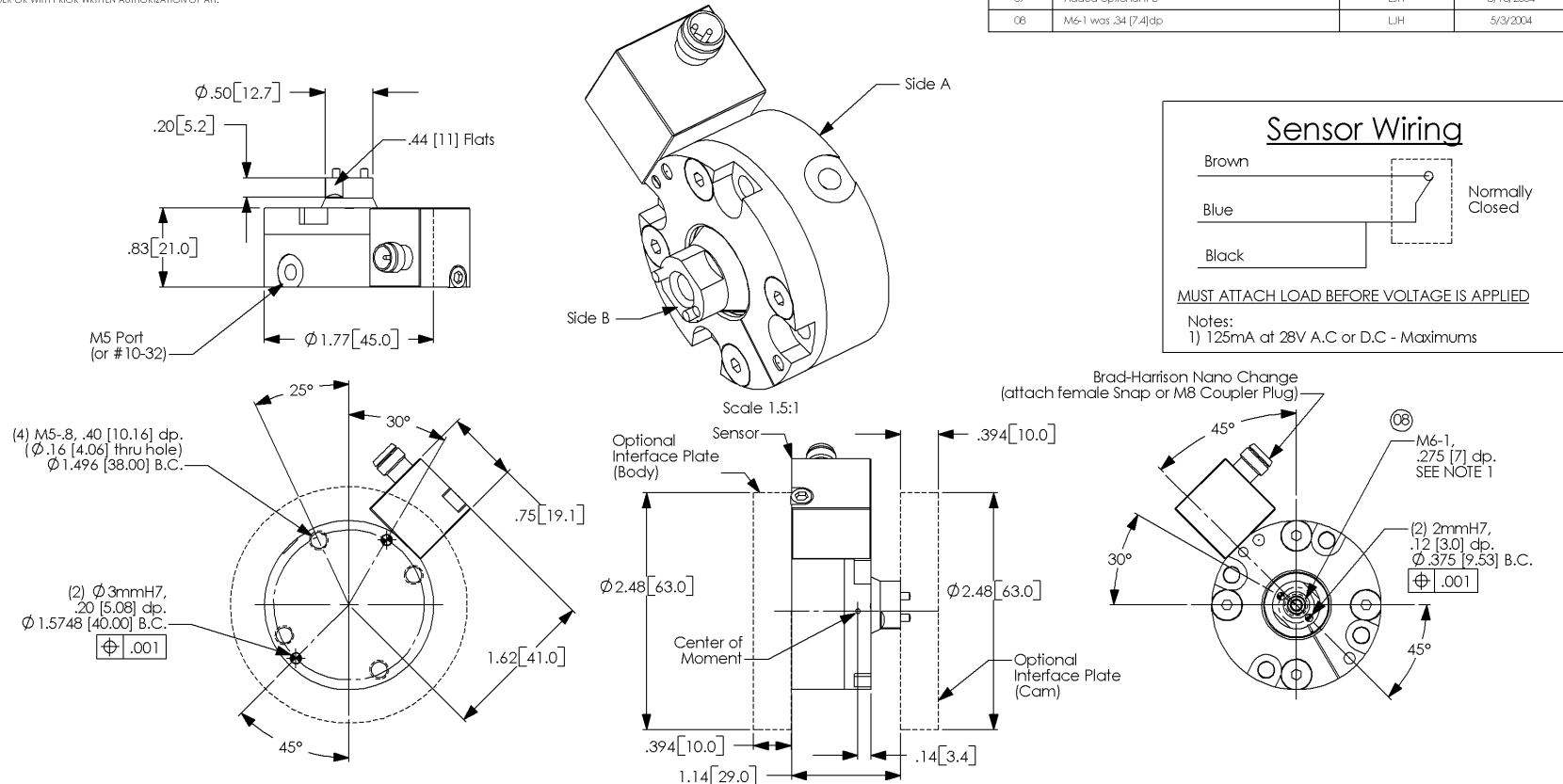


CAUTION: The components inside the Protector are factory set and not user serviceable. Opening the unit will void the warranty. User replaceable parts are limited to replacement switch assemblies available in kit form. Contact ATI for further assistance.

7. Drawings

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 ORDER OR WITH PRIOR WRITTEN AUTHORIZATION OF ATI.

Rev.	Description	Initiator	Date
07	Added optional IPB	LJH	3/16/2004
06	M6-1 was .34 [7.4]dp	LJH	5/3/2004



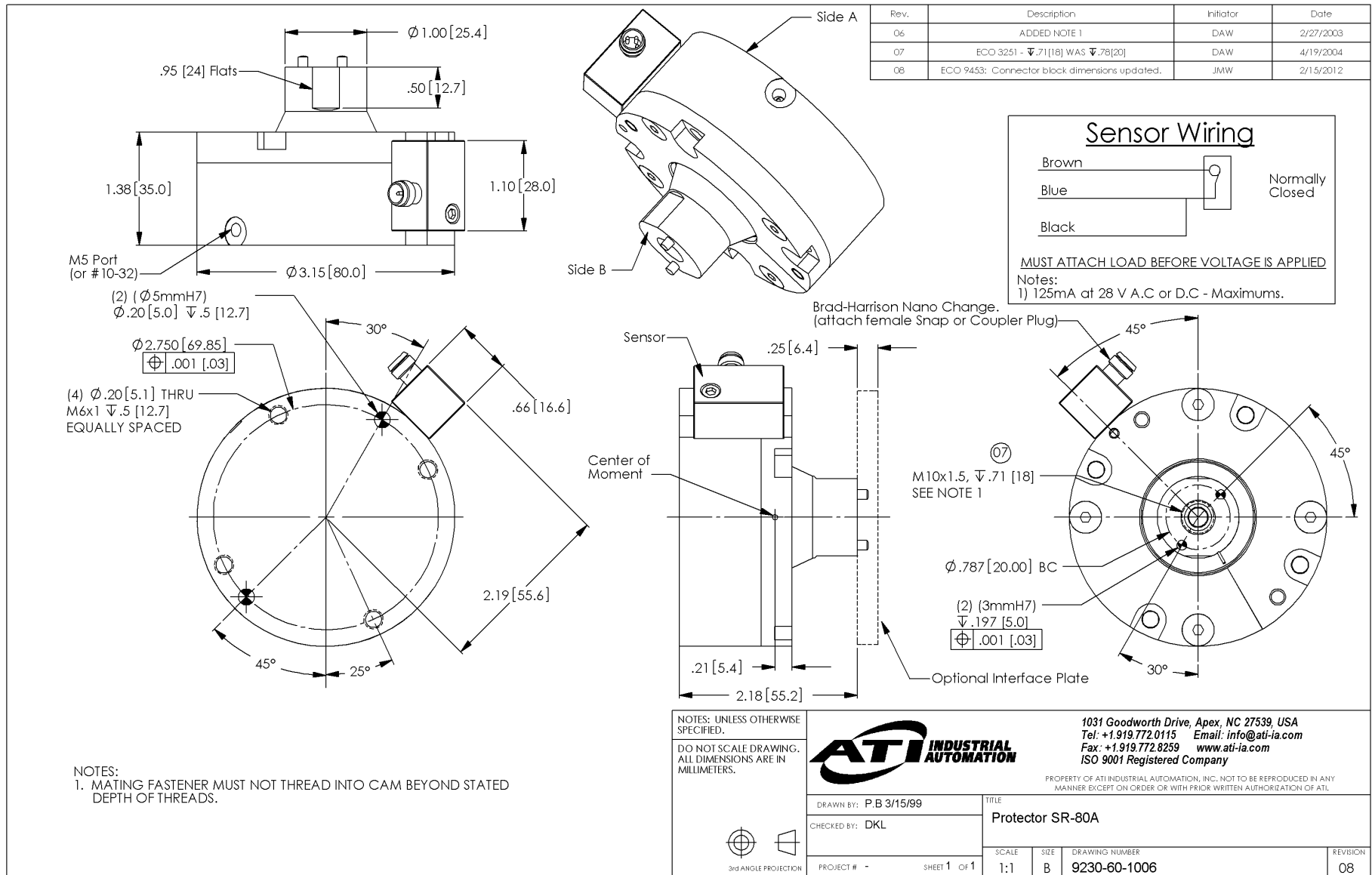
NOTES:
 1. MATING FASTENER MUST NOT THREAD INTO CAM BEYOND STATED DEPTH OF THREADS.

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



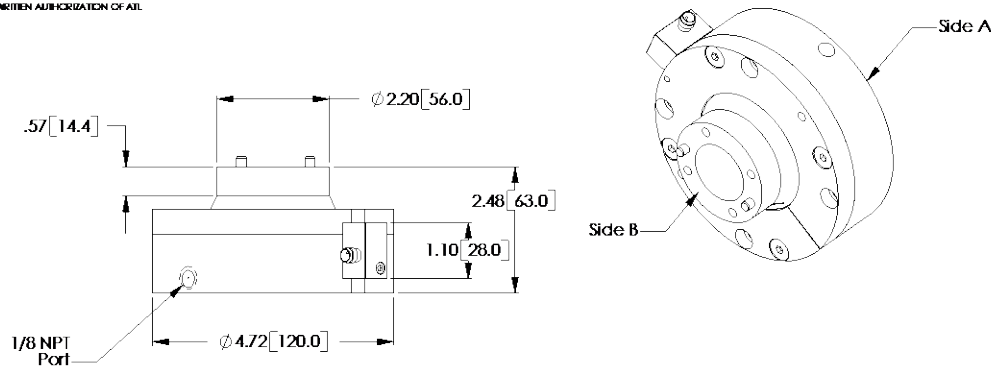
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 ISO 9001 Registered Company

DRAWN BY: P.B 06/11/99	TITLE: PROTECTOR SR-45
CHECKED BY: DAW 3/16/04	SCALE: 1:1
WEIGHT LBS:	SIZE: B
ASSEMBLY REF:	DRAWING NUMBER: 9230-60-1005-08
PRODUCT RELEASE #	DATE:
	SHEET 1 OF 1



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REVISION	DESCRIPTION	INITIATOR	DATE
02	CHANGED VOLTAGE RATING ON SWITCH, CHANGED "A" & "B" SIDE DESCRIPTIONS	DKL	3/3/00
03	Added dual dimensions	DKL	3/23/00
04	Revised Wiring	DKL	7/18/01



Sensor Wiring

Brown

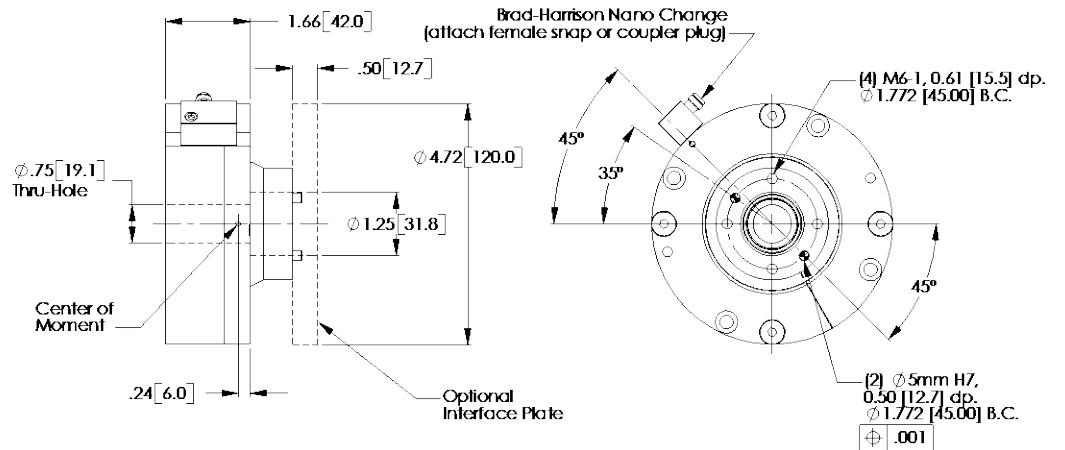
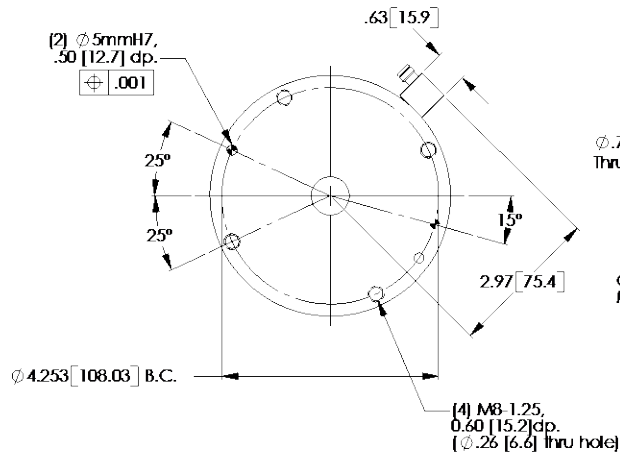
Blue

Black

Normally Closed

MUST ATTACH LOAD BEFORE VOLTAGE IS APPLIED

Notes:
 1) 125mA at 28V A.C. or D.C. - Maximums.

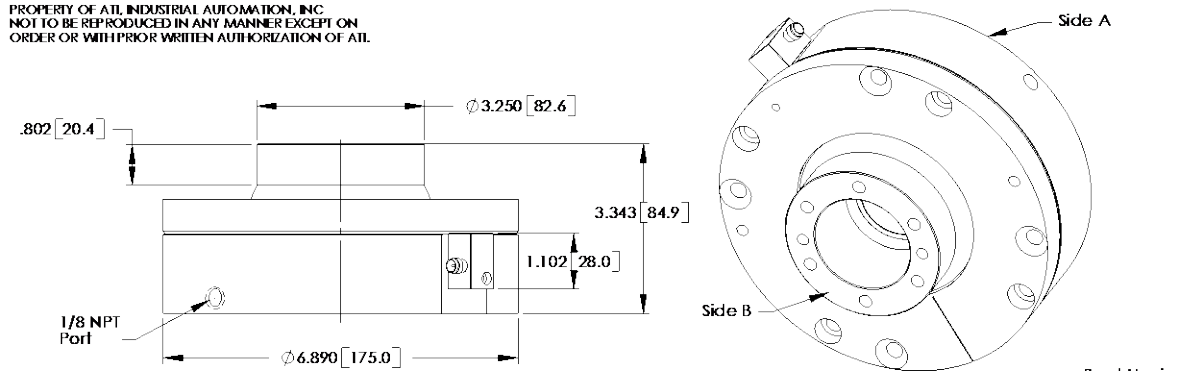


Dimensions: Inches [millimeters]	 ATI INDUSTRIAL AUTOMATION ISO 9001 Registered	1031 Goodworth Drive, Apex, NC 27502 Tel: 919.772.0115 Fax: 919.772.8259 Email: info@ati-ia.com http://www.ati-ia.com	
3rd ANGLE PROJECTION		DRG. NO.: P.B 6/15/99 CKD. BY: ENG. APPR: MFG. APPR: ASSEMBLY REF:	TITLE: Protector SR 120 SCALE: 1:2 SHEET: B-11X17 PD:

Protector Product Manual
Document #9610-60-1000-10

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REVISION	DESCRIPTION	INITIATOR	DATE
02	Revised switch ratings.	DKL	3/10/00
03	Added dual dimensions	DKL	3/23/00
04	Revised Wiring	DKL	7/18/01

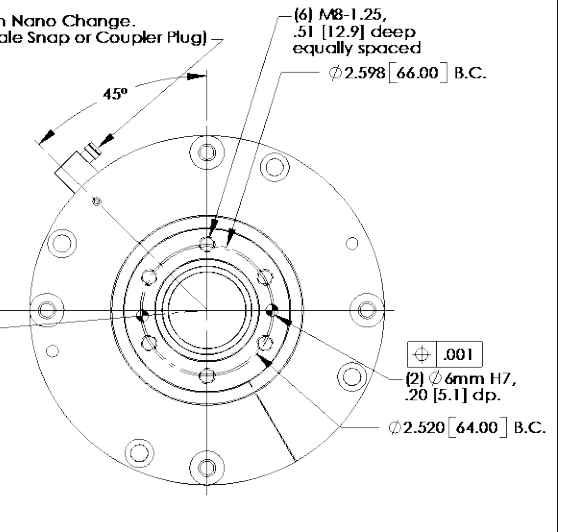
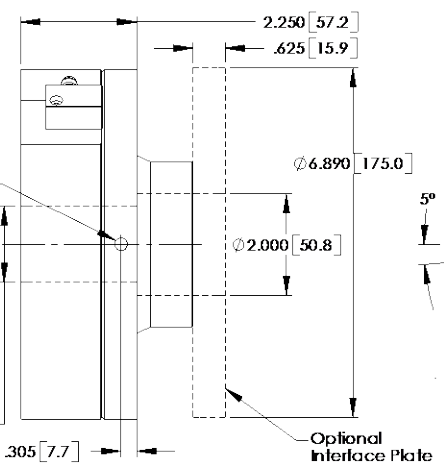
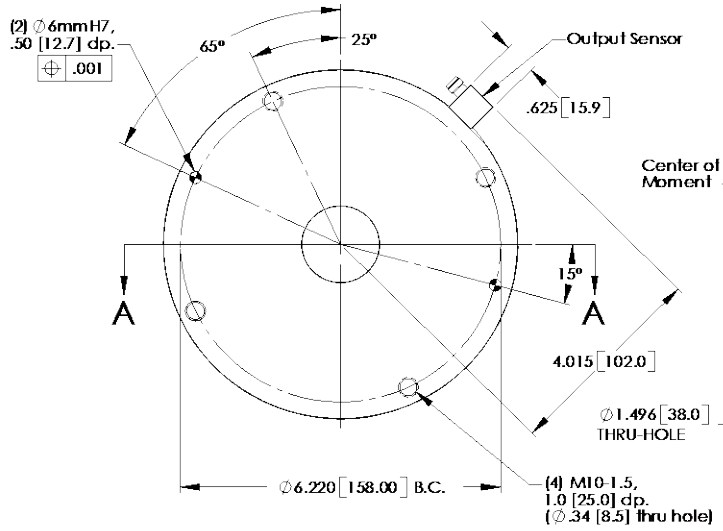


Sensor Wiring

Brown Normally Closed
Blue Normally Open
Black Common

MUST ATTACH LOAD BEFORE VOLTAGE IS APPLIED

Notes:
1) 125 mA at 28V A.C or D.C - Maximums.



Dimensions:
Inches [millimeters]

3rd ANGLE PROJECTION

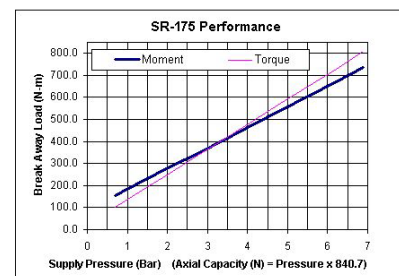
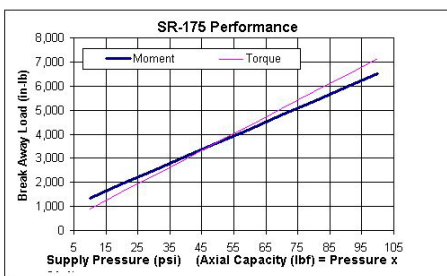
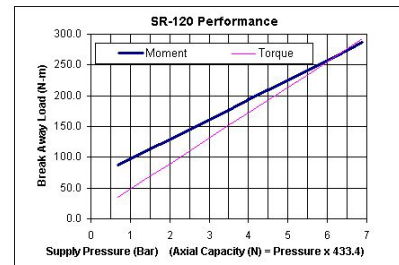
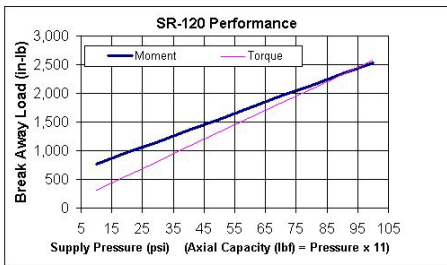
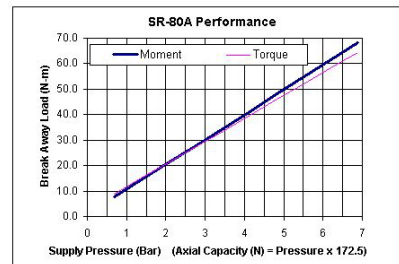
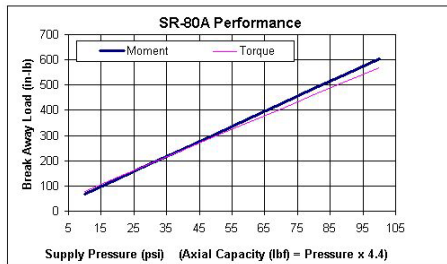
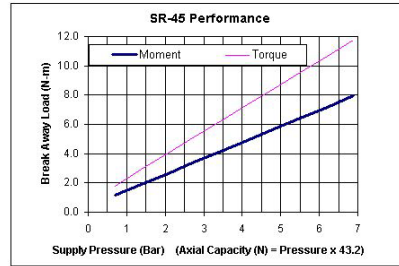
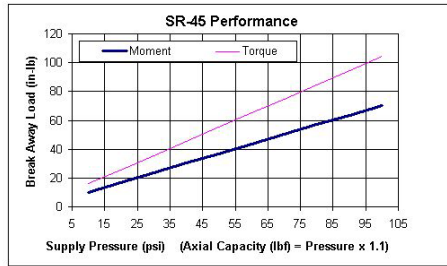
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Fax: 919.772.8259 http://www.ati-ia.com

DR. BY: J.SNAPE 4/26/99 TITLE: Protector SR-175
CKD. BY: _____
ENGR. APPR: _____
MFG. APPR: _____
ASSEMBLY REF: _____

SCALE: 1:2 SIZE: B-11X17 DRAWING NUMBER: 9230-60-1007-04
SHEET 1 OF 1

8. Ratings



9. 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 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. This warranty does not cover components subject to wear and tear under normal usage or those requiring periodic replacement. 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'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 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's 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.

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 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.

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 required disclosures, Purchaser gives ATI prior notice thereof and uses all legally available means to maintain the confidentiality of such information.

10. Addendum

Information in this section provides information on options available for the Protector product line and information pertinent to specific customer applications.

10.1 Protector Boots

Various Protector models are available with shields and /or boots. The boots attach to the stainless steel base of the Protector using a backup/retaining plate and button-head cap screws. These components provide basic dust, dirt, and water exclusion; however, the unit should not be considered waterproof.

Maintenance

1. To install or replace the boot components remove any customer-installed tooling from the Protector's cam.
2. If replacing the boot components remove the button-head cap screws securing the backup/retaining plate to the Protector Base and remove all these components from the Protector. If installing components for the first time proceed to the next step.
3. To install the boot components, fit the new rubber seal over the cam and align its holes and slots with those of the Protector base.
4. Fit the metal mesh guard (if required) over the rubber seal aligning it in the previous step.
5. Fit the backup/retaining ring as before.
6. Apply Loctite 242 to the button-head cap screws and thread them into the Protector base to secure the installed components. Tighten the screws until the rubber begins to compress but do not cause the backup/retaining ring to distort.

10.2 Spring-Only Units

Special Protector models have been designed to utilize only a spring for their actuation forces. All installation and functional data provided in the previous sections apply to these units. Warnings regarding air pressure do not apply, however, the energy stored in the springs represents a significant safety concern. DO NOT open these units in the field. There are no user serviceable internal parts.



DANGER: The force of the actuating springs represents a potential source of danger. DO NOT open these units in the field. There are no user serviceable internal parts

10.3 Switch-Kits

Service kits are available to replace the crash-detection switch in the field. The two items may be ordered as 9160-SK for SR-80A through SR-175 models or

9160-SK-45 for the SR-45 Protector. Separate instructions are supplied with these kits covering switch installation and adjustment.

10.4 Customer Drawings

Any unique customer drawings will be attached following this page.