



Pneumatic Division
Richland, Michigan 49083

Installation Instructions: V341BP

Generation 3.0

ISSUED: July, 2004

Supersedes: July, 1999

Doc.# V-341P, ECN# 040681, Rev.# 2

GENERATION 3.0

SERIAL ADDRESSABLE MODULE

Installation and User's Guide

 **WARNING**
BEFORE SERVICING THIS UNIT!

Hazardous voltages and fluid pressures may be present. Disconnect all external power, BUS connections and air supply prior to the servicing of this device.

 **WARNING**

To avoid unpredictable system behavior that can cause personal injury and property damage:

- Disconnect electrical supply (when necessary) before installation, servicing, or conversion.
- Disconnect air supply and depressurize all air lines connected to this product before installation, servicing, or conversion.
- Operate within the manufacturer's specified pressure, temperature, and other conditions listed in these instructions.
- Medium must be moisture-free if ambient temperature is below freezing.
- Service according to procedures listed in these instructions.
- Installation, service, and conversion of these products must be performed by knowledgeable personnel who understand how pneumatic products are to be applied.
- After installation, servicing, or conversion, air and electrical supplies (when necessary) should be connected and the product tested for proper function and leakage. If audible leakage is present, or the product does not operate properly, do not put into use.
- Warnings and specifications on the product should not be covered by paint, etc. If masking is not possible, contact your local representative for replacement labels.

 **WARNING**

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application, including consequences of any failure and review the information concerning the product or systems in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

EXTRA COPIES OF THESE INSTRUCTIONS ARE AVAILABLE FOR INCLUSION IN EQUIPMENT / MAINTENANCE MANUALS THAT UTILIZE THESE PRODUCTS. CONTACT YOUR LOCAL REPRESENTATIVE.

DeviceNet™

DeviceNet™ is an open serial communications network based on industry standard Controller Area Network “CAN” technology. The DeviceNet communication link offers a level of interchangeability between like devices from multiple vendors, such as limit switches, valve manifolds, motor starters and PLC’s.

Advantages

- Power available along the bus: both signal and power lines contained in the trunkline
- Multiple supplies can be used for additional power or as back-up
- Node removal without breaking trunk line
- Supports up to 64 nodes
- Selectable data rates
- Standardized open and sealed type device connectors

Data Rates

Data Rate	Distance	Drop Length	
		Max Drop	Cumulative
125K	500m (1640 ft)	6m (20 ft)	156m (512 ft)
250K	250m (820 ft)	6m (20 ft)	78m (256 ft)
500K	100m (328 ft)	6m (20 ft)	39m (128 ft)

Features

Parker Serial Addressable Module is a powerful, compact serial bus valve package. While ideal for the packaging and conveyor industries, SAM can be applied to a wide array of pneumatic applications. Available for use in stand alone subbase valves or in small manifold assemblies, SAM allows the valve to be located nearer to the intended application. No longer are you required to manifold together large numbers of valves. SAM gives you the flexibility to size your valves according to the flow requirements of each actuator, not for the worst case scenario.

Input / Output

- SAM features 4 outputs and 4 inputs in manifold version
- SAM features 2 outputs and 2 inputs in subbase version
- 24 watts per output
- NPN and PNP inputs

Diagnostics

- A total of 6 diagnostic input bits
- 4 diagnostic input bits for shorted coils
- 1 general purpose input/power supply bit
- 1 latched fault input bit
- Diagnostic LED to maximize productivity

*Compliant to DeviceNet™
Conformance Test Version 18*

Technical Specifications

CAN Electrical Specifications

Voltage Range: 11 to 25 VDC
 Node Current Consumption: 60 mA at 24 VDC
 Data Rates: 500 Kbps, 250 Kbps, 125 Kbps
 Bus and Drop Length: Refer to DeviceNet specifications

Input Specifications

Input Type: NPN or PNP
 Number: Up to 4 in manifolded assemblies, 2 in subbase
 Voltage Range: 10 to 30VDC

DeviceNet is a trademark of Open DeviceNet Vendor Association, Inc. Smart Distributed System is a trademark of Honeywell, Inc.

Output Specifications

Number: Up to 4 in manifolded assemblies, 2 in subbase.
 Voltage Range: 24 VDC
 Power Rating: 24 Watts each @ 24 VDC

Environmental

Temperature Range:
 Operating: 0 to +60°C (23 to +140°F)
 Storage: -40 to +85°C (-40 to +185°F)
 Humidity: 95% RH, Non-condensing
 Sealing: NEMA 4/IP65 (Dependent on valve selection.)

Solenoid Requirements

Power Requirement: Bus power must be 24VDC when used to power valves to avoid solenoid damage. (Consult appropriate valve section for solenoid power requirements.)
 Max. Solenoids per Unit: 4
 External Power: 24VDC external power is required in most applications. Consult the DeviceNet specification for details on bus powered device limitations.

Status Error Indications

Communications Module: LED indicates power and Network / Module status.

Combined Module / Network Status LED

For this state:	LED is:	To indicate:
Not Powered/Not On-line	Off	Device is not on-line • The device has not completed the Dup_MAC-ID test yet.
Device Operational AND On-line, Connected	Green	The device is operating in a normal condition and the device is on-line with connections in the established state. • For a Group 2 Only device it means that the device is allocated to a Master.
Device Operational AND On-line, Not Connected or Device On-line AND Device needs commissioning	Flashing Green	The device is operating in a normal condition and the device is on-line with no connections in the established state. • The device has passed the Dup_MAC_ID test, is on-line, but has no established connections to other nodes. • For a Group 2 Only device it means that the device is not allocated to a Master.
Minor Fault and/or Connection Time-Out	Flashing Red	Recoverable fault and/or one or more I/O connections are in the Timed-Out state. Diagnostic Bit Set.
Critical Fault or Critical Link Failure	Red	The device has an unrecoverable fault, may need replacing. Failed communication device. The device has detected an error that has rendered it incapable of communicating on the Network (Duplicate MAC ID, or Bus-off.)

DeviceNet™

DeviceNET Features

Device Type: Generic Device (Type 0)	Master Scanner	N
Explicit Peer to Peer Messaging	I/O Slave Messaging	N
I/O Peer to Peer Messaging	• Bit Strobe	N
Configuration Consistency Value	• Polling	Y
Faulted Node Recovery	• Cyclic	Y
Baud Rates	125k, 250k, 500k	• Change of State (COS) Y

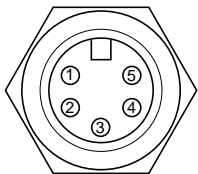
DeviceNet Power Requirements

Refer to the DeviceNet specifications for determining bus power capacity and whether or not external power is required.

This device transmits 1 byte and receives 2 bytes. The EDS file is enclosed with the device and must be installed at the time of configuration.

Power / Bus Wiring

Bus Connector



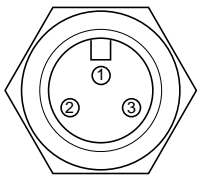
Face View, Male

Pins	Function
1	Shield
2	VDC+
3	Common (V-)
4	CAN_H
5	CAN_L

Bus Mini Connector: (or equivalent)

Brad Harrison #1A5000-34, 5-pin female straight connector

Manifold Mini External Power Connector



Face View, Male

Pins	Function
1	Com (V-)
2	VDC+
3	Not Used

Power Connector: (or equivalent)

Brad Harrison #1A3000-34, 3-pin female straight connector

Subbase Micro External Power Connector



Face View, Male

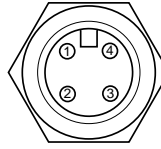
Pins	Function
1	VDC+
2	Com (V-)
3	Not Used
4	Not Used

Power Connectors: (or equivalent)

Brad Harrison #8A4000-31, 4-pin female straight connector

Brad Harrison #8A4001-31, 4-pin female 90° connector

Field Input Connector Wiring



Face View, Male

Pin No.	Main	Auxiliary
1	VDC+	VDC+
2	GIPIB	GPID
3	Ground	Ground
4	GPIA	GPIC

Field Wiring Connectors: (or equivalent)

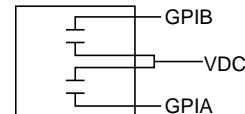
Turck BS 8141-0, 4-pin male straight connector

Turck BS 8241-0, 4-pin male 90° connector

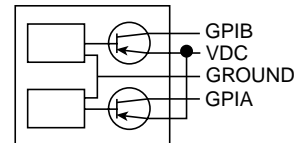
PNP

Double Input

2 Wire DC PNP Sensor (Sourcing)



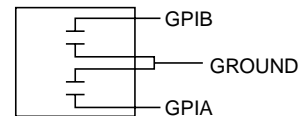
3 Wire DC PNP Sensor (Sourcing)



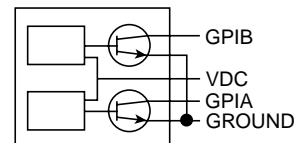
NPN

Double Input

2 Wire DC NPN Sensor (Sinking)



3 wire DC NPN Sensor (Sinking)



Note: The Com (V-) must be the same potential as the bus V.

Device Profile

Node Configuration

Baudrate and MACID are determined in one of two ways:

- If the serial EEROM has not been utilized, then the MACID = 63 and the baudrate is 125Kbaud.
- If the serial EEROM has been utilized, then the baudrate and MACID are determined by the values programmed through the users network configuration software.

Identification of I/O Assembly Instances

Number	Type	Name
102	Input	Sensors & Diagnostic
122	Output	Pneumatic Valves

Format of I/O Assembly Data Attribute Assembly #102

Byte	7	6	5	4	3	2	1	0
0	Fault	0	0	0	GPID	GPIC	GPIB	GPIA
1	0	0	0	VFLT	OD4	OD3	OD2	OD1

The FAULT bit (Byte 0, Bit 7) is a latched bit. If any fault occurs and is detected then this bit will be set. It does not affect the operation of the device, and must be explicitly reset.

The GPI[A..D] bits represent the four (4) general purpose inputs, and correspond to signals with those names on the schematic for the board.

The OD[4..1] bits are the output diagnostic bits, which correspond to bits PC[04..01] in the output assembly. When an OD bit is a one it indicates a fault. These bits are not sampled continuously, they are sampled approximately every fifty (50) milliseconds. There will be some delay between turning on a shorted coil and observing the fault condition. On each individual channel the driver chip will detect the fault and turn the output switch off. This happens regardless of the state of the input for that channel. When the fault is detected by the processor the input for the faulted channel is turned off, and the FAULT bit is set.

The VFLT bit indicates that the power supply for GPIA through GPID has a short.

Format of I/O Assembly Data Attribute Assembly #122

Byte	7	6	5	4	3	2	1	0
0	RES	0	0	0	PC04	PC03	PC02	PC01

The RES bit is used to explicitly reset the FAULT bit. When this bit is a zero (0) it has no effect. When it is a one (1) it will clear the FAULT bit. There may be a delay from RES = 1 to observing FAULT = 0.

The PC0[4..1] bits correspond to the four (4) high side outputs. A one (1) will turn the output on; a zero (0) will turn the output off.

Standard Objects

Identity Object

There is a single instance of the identity object for the device. No class attributes are supported. All of the instance attributes are contained in ROM or EEPROM and are gettable but not settable. The table below shows the values.

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Vendor	UINT	0x0004
2	Get	Product Type	UINT	0x0000
3	Get	Product Code	UINT	0x0007
4	Get	Revision	STRUCT	02.01
5	Get	Status	WORD	0x0000
6	Get	Serial #	UDINT	0x00000C00
7	Get	Product Name	STRUCT	4, "Gen 3"
8	Get	State	USINT	[0..5]
9	Get	CCV	UINT	[0..65535]
10	Get / Set	Heartbeat	USINT	[0.255]

Identity Object Services

Service Code	Service Name	Description
05	Reset	Reset the device to power up configuration
0E	Get - Attribute - Single	Return the contents of the specified attribute
10	Set - Attribute - Single	Sets the contents of the specified attribute

Device Profile

DeviceNet Object

There is a single instance of the DeviceNet Object for the device.

DeviceNet Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	0x0002

DeviceNet Object Class Services

Service	Service Code	Parameters
Get Attribute Single	0x0E	Attribute ID

DeviceNet Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get / Set	MACID	USINT	Default = 63 or EEPROM
2	Get / Set	Baudrate	USINT	Default = 0 or EEPROM
3	Get / Set	BOI	BOOL	0x00 Fault
4	Get / Set	Bus-Off Counter	USINT	0x00
5	Get	Allocation Information	STRUCT	Allocation Choice Master MACID

The MACID and baudrate are initialized to values stored in the serial EEPROM. If the serial EEPROM has not been initialized then the MACID defaults to 63 and the baudrate defaults to 125Kbaud.

DeviceNet Object Instance Services

Service	Service Code	Parameters
Get Attribute Single	0x0E	Attribute ID
Set Attribute Single	0x10	Attribute ID
Allocate	0x4B	Allocation Choice Master MACID
Release	0x4C	Release Choice

Connection Object

There are two instances of the Connection Object in the device. Instance #1 is assigned to the explicit messaging connection. Instance #2 is assigned to the Polled I/O connection. No class attributes are supported. The tables on the next two pages show typical values for the attributes of the two instances of the connection class

Connection Object Services

Service	Service Code	Parameters
Get Attribute Single	0x0E	Attribute ID
Set Attribute Single	0x10	Attribute ID

Explicit Message Connection (Instance #1)

Attribute List

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0x03
2	Get	Instance_Type	USINT	0x00
3	Get	Xport Class Trigger	USINT	0x83
4	Get	Produced Connection ID	UINT	0x5FB for MAC ID 63
5	Get	Consumed Connection ID	UINT	0x5FC for MAC ID 63
6	Get	Initial Comm Characteristics	USINT	0x21
7	Get	Produced Connection Size	UINT	0x0007
8	Get	Consumed Connection Size	UINT	0x0007
9	Get / Set	Expected Packet Rate	UINT	Application Dependent
10	N/A	N/A	N/A	Not Used
11	N/A	N/A	N/A	Not Used
12	Get	Watchdog Timeout Action	USINT	0x01
13	Get	Produced Path Length	UINT	0x0000
14	Get	Produced Path	Array of USINT	<NULL>
15	Get	Consumed Path Length	UINT	0x0000
16	Get	Consumed Path	Array of USINT	<NULL>
17	Get	Production Inhibit Timer	UINT	0x0000*

Poll I/O Message Connection (Instance #2)

Attribute List

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0x03
2	Get	Instance_Type	USINT	0x01
3	Get	Xport Class Trigger	USINT	0x82
4	Get	Produced Connection ID	UINT	0x5FF for MAC ID 63
5	Get	Consumed Connection ID	UINT	0x5FD for MAC ID 63
6	Get	Initial Comm Characteristics	USINT	0x01
7	Get	Produced Connection Size	UINT	0x0002
8	Get	Consumed Connection Size	UINT	0x0001
9	Get / Set	Expected Packet Rate	UINT	Application Dependent
10	N/A	N/A	N/A	Not Used
11	N/A	N/A	N/A	Not Used
12	Get	Watchdog Timeout Action	USINT	0x00
13	Get	Produced Path Length	UINT	0x0000
14	Get	Produced Path	Array of USINT	20.04.24.01.30.03
15	Get	Consumed Path Length	UINT	0x0000
16	Get	Consumed Path	Array of USINT	20.04.24.02.30.03
17	Get	Production Inhibit Timer	UINT	0x0000 poll app.dep. cos/cyc

**COS/Cyc I/O Message Connection (Instance #4)
Attribute List**

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	State	USINT	0x03
2	Get	Instance_Type	USINT	0x01
3	Get	Xport Class Trigger	USINT	0x12 COS 0x02 Cyc 0x10 COS, no Ack 0x00 Cyc, no Ack
4	Get	Produced Connection ID	UINT	0x37F for MAC ID 63
5	Get	Consumed Connection ID	UINT	0x5FA 0xFFFF, no Ack for MAC ID 63
6	Get	Initial Comm Characteristics	USINT	0x01 0x0F, no Ack
7	Get	Produced Connection Size	UINT	See Configuration Table
8	Get	Consumed Connection Size	UINT	0x0000
9	Get / Set	Expected Packet Rate	UINT	Application Dependent
10	N/A	N/A	N/A	Not Used
11	N/A	N/A	N/A	Not Used
12	Get / Set	Watchdog Timeout Action	USINT	0x00 Time Out
13	Get	Produced Path Length	UINT	0x0006
14	Get	Produced Path	Array of USINT	See Configuration Table
15	Get	Consumed Path Length	UINT	0x0004 or 0x0000, no Ack
16	Get	Consumed Path	Array of USINT	20.2B.24.01 <NULL> no Ack
17	Get	Production Inhibit Timer	UINT	app dependent



Pneumatic Division
Richland, Michigan 49083
269-629-5000

PDNSG-1

Pneumatic Division Safety Guide

ISSUED: August 1, 2006

Supersedes: June 1, 2006

Safety Guide For Selecting And Using Pneumatic Division Products And Related Accessories

⚠ WARNING:

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF PNEUMATIC DIVISION PRODUCTS, ASSEMBLIES OR RELATED ITEMS ("PRODUCTS") CAN CAUSE DEATH, PERSONAL INJURY, AND PROPERTY DAMAGE. POSSIBLE CONSEQUENCES OF FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THESE PRODUCTS INCLUDE BUT ARE NOT LIMITED TO:

- Unintended or mistimed cycling or motion of machine members or failure to cycle
- Work pieces or component parts being thrown off at high speeds.
- Failure of a device to function properly for example, failure to clamp or unclamp an associated item or device.
- Explosion
- Suddenly moving or falling objects.
- Release of toxic or otherwise injurious liquids or gasses.

Before selecting or using any of these Products, it is important that you read and follow the instructions below.

1. GENERAL INSTRUCTIONS

- 1.1. Scope:** This safety guide is designed to cover general guidelines on the installation, use, and maintenance of Pneumatic Division Valves, FRLs (Filters, Pressure Regulators, and Lubricators), Vacuum products and related accessory components.
- 1.2. Fail-Safe:** Valves, FRLs, Vacuum products and their related components can and do fail without warning for many reasons. Design all systems and equipment in a fail-safe mode, so that failure of associated valves, FRLs or Vacuum products will not endanger persons or property.
- 1.3. Relevant International Standards:** For a good guide to the application of a broad spectrum of pneumatic fluid power devices see: ISO 4414:1998, Pneumatic Fluid Power – General Rules Relating to Systems. See www.iso.org for ordering information.
- 1.4. Distribution:** Provide a copy of this safety guide to each person that is responsible for selection, installation, or use of Valves, FRLs or Vacuum products. Do not select, or use Parker valves, FRLs or vacuum products without thoroughly reading and understanding this safety guide as well as the specific Parker publications for the products considered or selected.
- 1.5. User Responsibility:** Due to the wide variety of operating conditions and applications for valves, FRLs, and vacuum products Parker and its distributors do not represent or warrant that any particular valve, FRL or vacuum product is suitable for any specific end use system. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The user, through its own analysis and testing, is solely responsible for:
 - Making the final selection of the appropriate valve, FRL, Vacuum component, or accessory.
 - Assuring that all user's performance, endurance, maintenance, safety, and warning requirements are met and that the application presents no health or safety hazards.
 - Complying with all existing warning labels and / or providing all appropriate health and safety warnings on the equipment on which the valves, FRLs or Vacuum products are used; and,
 - Assuring compliance with all applicable government and industry standards.
- 1.6. Safety Devices:** Safety devices should not be removed, or defeated.
- 1.7. Warning Labels:** Warning labels should not be removed, painted over or otherwise obscured.
- 1.8. Additional Questions:** Call the appropriate Parker technical service department if you have any questions or require any additional information. See the Parker publication for the product being considered or used, or call 1-800-CPARKER, or go to www.parker.com, for telephone numbers of the appropriate technical service department.

2. PRODUCT SELECTION INSTRUCTIONS

- 2.1. Flow Rate:** The flow rate requirements of a system are frequently the primary consideration when designing any pneumatic system. System components need to be able to provide adequate flow and pressure for the desired application.
- 2.2. Pressure Rating:** Never exceed the rated pressure of a product. Consult product labeling, Pneumatic Division catalogs or the instruction sheets supplied for maximum pressure ratings.
- 2.3. Temperature Rating:** Never exceed the temperature rating of a product. Excessive heat can shorten the life expectancy of a product and result in complete product failure.
- 2.4. Environment:** Many environmental conditions can affect the integrity and suitability of a product for a given application. Pneumatic Division products are designed for use in general purpose industrial applications. If these products are to be used in unusual circumstances such as direct sunlight and/or corrosive or caustic environments, such use can shorten the useful life and lead to premature failure of a product.
- 2.5. Lubrication and Compressor Carryover:** Some modern synthetic oils can and will attack nitrile seals. If there is any possibility of synthetic oils or greases migrating into the pneumatic components check for compatibility with the seal materials used. Consult the factory or product literature for materials of construction.
- 2.6. Polycarbonate Bowls and Sight Glasses:** To avoid potential polycarbonate bowl failures:
 - Do not locate polycarbonate bowls or sight glasses in areas where they could be subject to direct sunlight, impact blow, or temperatures outside of the rated range.
 - Do not expose or clean polycarbonate bowls with detergents, chlorinated hydro-carbons, ketones, esters or certain alcohols.
 - Do not use polycarbonate bowls or sight glasses in air systems where compressors are lubricated with fire resistant fluids such as phosphate ester and di-ester lubricants.

Pneumatic Division Safety Guide

- 2.7. Chemical Compatibility:** For more information on plastic component chemical compatibility see Pneumatic Division technical bulletins Tec-3, Tec-4, and Tec-5
- 2.8. Product Rupture:** Product rupture can cause death, serious personal injury, and property damage.
- Do not connect pressure regulators or other Pneumatic Division products to bottled gas cylinders.
 - Do not exceed the maximum primary pressure rating of any pressure regulator or any system component.
 - Consult product labeling or product literature for pressure rating limitations.

3. PRODUCT ASSEMBLY AND INSTALLATION INSTRUCTIONS

- 3.1. Component Inspection:** Prior to assembly or installation a careful examination of the valves, FRLs or vacuum products must be performed. All components must be checked for correct style, size, and catalog number. DO NOT use any component that displays any signs of nonconformance.
- 3.2. Installation Instructions:** Parker published Installation Instructions must be followed for installation of Parker valves, FRLs and vacuum components. These instructions are provided with every Parker valve or FRL sold, or by calling 1-800-CPARKER, or at www.parker.com.
- 3.3. Air Supply:** The air supply or control medium supplied to Valves, FRLs and Vacuum components must be moisture-free if ambient temperature can drop below freezing

4. VALVE AND FRL MAINTENANCE AND REPLACEMENT INSTRUCTIONS

- 4.1. Maintenance:** Even with proper selection and installation, valve, FRL and vacuum products service life may be significantly reduced without a continuing maintenance program. The severity of the application, risk potential from a component failure, and experience with any known failures in the application or in similar applications should determine the frequency of inspections and the servicing or replacement of Pneumatic Division products so that products are replaced before any failure occurs. A maintenance program must be established and followed by the user and, at minimum, must include instructions 4.2 through 4.10.
- 4.2. Installation and Service Instructions:** Before attempting to service or replace any worn or damaged parts consult the appropriate Service Bulletin for the valve or FRL in question for the appropriate practices to service the unit in question. These Service and Installation Instructions are provided with every Parker valve and FRL sold, or are available by calling 1-800-CPARKER, or by accessing the Parker web site at www.parker.com.
- 4.3. Lockout / Tagout Procedures:** Be sure to follow all required lockout and tagout procedures when servicing equipment. For more information see: OSHA Standard – 29 CFR, Part 1910.147, Appendix A, The Control of Hazardous Energy – (Lockout / Tagout)
- 4.4. Visual Inspection:** Any of the following conditions requires immediate system shut down and replacement of worn or damaged components:
- Air leakage: Look and listen to see if there are any signs of visual damage to any of the components in the system. Leakage is an indication of worn or damaged components.
 - Damaged or degraded components: Look to see if there are any visible signs of wear or component degradation.
 - Kinked, crushed, or damaged hoses. Kinked hoses can result in restricted air flow and lead to unpredictable system behavior.
 - Any observed improper system or component function: Immediately shut down the system and correct malfunction.
 - Excessive dirt build-up: Dirt and clutter can mask potentially hazardous situations.

Caution: Leak detection solutions should be rinsed off after use.

- 4.5. Routine Maintenance Issues:**
- Remove excessive dirt, grime and clutter from work areas.
 - Make sure all required guards and shields are in place.
- 4.6. Functional Test:** Before initiating automatic operation, operate the system manually to make sure all required functions operate properly and safely.
- 4.7. Service or Replacement Intervals:** It is the user's responsibility to establish appropriate service intervals. Valves, FRLs and vacuum products contain components that age, harden, wear, and otherwise deteriorate over time. Environmental conditions can significantly accelerate this process. Valves, FRLs and vacuum components need to be serviced or replaced on routine intervals. Service intervals need to be established based on:
- Previous performance experiences.
 - Government and / or industrial standards.
 - When failures could result in unacceptable down time, equipment damage or personal injury risk.
- 4.8. Servicing or Replacing of any Worn or Damaged Parts:** To avoid unpredictable system behavior that can cause death, personal injury and property damage:
- Follow all government, state and local safety and servicing practices prior to service including but not limited to all OSHA Lockout Tagout procedures (OSHA Standard – 29 CFR, Part 1910.147, Appendix A, The Control of Hazardous Energy – Lockout / Tagout).
 - Disconnect electrical supply (when necessary) before installation, servicing, or conversion.
 - Disconnect air supply and depressurize all air lines connected to system and Pneumatic Division products before installation, service, or conversion.
 - Installation, servicing, and / or conversion of these products must be performed by knowledgeable personnel who understand how pneumatic products are to be applied.
 - After installation, servicing, or conversions air and electrical supplies (when necessary) should be connected and the product tested for proper function and leakage. If audible leakage is present, or if the product does not operate properly, do not put product or system into use.
 - Warnings and specifications on the product should not be covered or painted over. If masking is not possible, contact your local representative for replacement labels.
- 4.9. Putting Serviced System Back into Operation:** Follow the guidelines above and all relevant Installation and Maintenance Instructions supplied with the valve FRL or vacuum component to insure proper function of the system.