Bray CONTROLS
® A Division of BRAY INTERNATIONAL, Inc.

S52 2N1 ProxSensor Valve Status Monitor

Operation and Maintenance Manual

Version 1.0

TABLE OF CONTENTS:

Introduction

Note: The following information is intended to assist individuals with the use and support of the Bray S52 Valve Status Monitors.

The Series 52 Valve Status Monitor has been designed to provide valve position indication. The 2N1™ ProxSensor is available in several configurations:

- DC Version 10-30VDC PNP (Sourcing)

- DC Version 10-30VDC NPN (Sinking)

- DC NAMUR Intrinsically Safe Version (to be used with IS Barrier)

- AC Version 20-250VAC, 50-60Hz

- Fieldbus capable Versions

    1. AS-i (Actuator Sensor Interface)
    2. DeviceNet
    3. PROFIBUS DP (Process Fieldbus Decentralized Peripherals)

Each of these configurations will be covered in more detail on the pages that follow. Additionally, examples of how to apply some of these products will be given.

All Bray S52 Valve Status Monitors utilize solid state switches. Although the solid state switch performs the same function as a conventional mechanical switch, there are differences in the way solid state switches operate. **It is very important for the user to pay close attention to the exact specifications of their sensor in order to avoid damaging the unit.** Solid state switches have current restrictions imposed by the semi conducting materials used to form the sensor. These current limitations have to be accounted for during setup. Unlike mechanical switches, which can normally handle several amperes of current flowing through them, solid state switches are generally rated for half an ampere or less.

When working with the S52, several parameters must be considered. A few of which (with significant importance) are listed here: operating voltage, maximum switching current, output voltage drop, and residual current. Using an S52 outside of these parameter limits can cause damage to the unit and void factory warranty.

Operating voltage is the amount of voltage necessary for the sensor to operate. The maximum switching current is the largest amount of current that the sensor's solid state electronics can have flowing through them in the On-State (when the target is in proximity of the sensor). During commissioning, it is up to the user to correctly apply the sensor to their control system in order to limit the current flowing through the device. This is done through the use of a load; all the wiring diagrams associated with the S52s specify where this load needs to be placed in the circuit. Common control systems utilize a digital input card to monitor devices like the S52; these cards have loads (parameter usually referred to as "input impedance") – it is the responsibility of the user to ensure that this load is sufficiently sized to limit the current flowing through the S52 below the maximum switching current, yet above the On-State input current minimum of their monitoring device. We will cover an example of this on page 15-16.

Output voltage drop is defined as the amount of voltage that will drop across the solid state switch. This voltage drop will often vary with the amount of current flowing through the sensor and the load. This drop in voltage becomes paramount when connecting several valve status monitors in series, each unit will have a voltage drop across it – adding each subsequent drop and subtracting from the supply voltage yields the resulting voltage at the end of the series connection. The user needs to ensure that the supply voltage is large enough so that the resulting voltage after all the drops is above the min. operating voltage of the last S52 in the series connection. Sensors located a great distance from the load require consideration as well, as a general rule, every 1000 ft. of wire will have a resistance of 10Ω (see electrical code references for the resistance value of specific wire sizes), it is important for the customer to ensure that the distance between the S52 and the control panel is not long enough to cause the voltage drop to fall below the minimum operating voltage of the sensor.

Residual current is often referred to as leakage current. In the "Off" state (target is NOT in proximity of the sensor) the sensor draws a small amount of current in order to power the device's electronics. This is necessary for the device to sense the target at any point in time when the supply voltage is applied. It is important that this residual current is below the maximum Off-State current rating of the control system.

Target Mounting

All configurations of the S52 are offered with two types of targets; adjustable and non-adjustable. Standard S52 (AC, DC, and DC Intrinsically Safe units) utilize inductive proximity sensing technology to provide valve position indication; the fieldbus capable versions utilize hall effect sensing technology to accomplish the same objective. When applying fieldbus capable S52s, the same targets are used; however, small magnets are located in the small chambers behind the metal inserts on the sides of the targets.

Adjustable Target Mounting

The adjustable versions are for customers that want the flexibility to position their indication limits outside of the standard 0 to 90°. The components that come in the adjustable target kit are displayed in Figure 1. Figure 2 shows the components of the High Visibility Indicator Kit and the adjustable target kit.
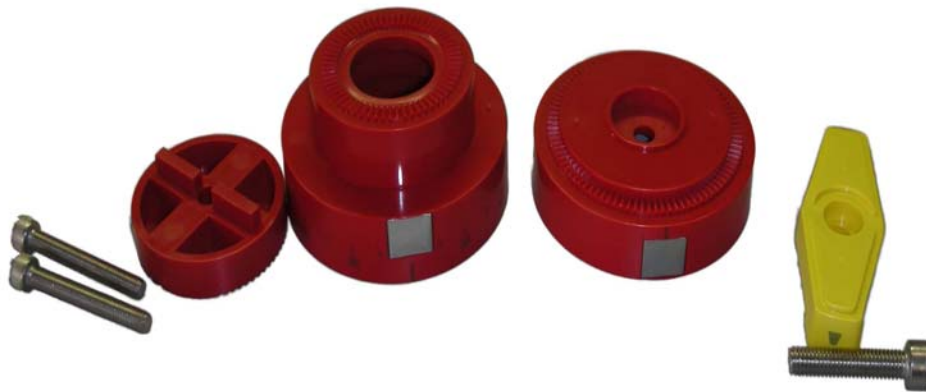

Figure 1: Adjustable Target Kit. From Left to Right: (1) S52 Mounting Screws, (2) Base, (3) Middle Piece, (4) Top, (5) Yellow Pointer w/ mounting screw

Figure 2: High visibility indicator with adjustable target. Pictured from left to right:
(1) Indicator cover w/mounting screws, (2) indicator w/mounting screw, and (3) adjustable target.

The steps required to set up the adjustable target for your S52 2N1 Valve Status Monitor are covered below:

Step 1: Place the base on top of your pneumatic actuator's output pinion.

Step 2: Place the middle piece on top of the base so that the metal target is in front of where the bottom switch (labeled 2) of the S52 will be located.

Step 3: Place the top piece so that the metal target will be directly in front of the top switch (labeled 1) on the S52 when the actuator rotates to it's opposite end of travel position. If you have a high visibility indicator kit, jump to step 5 - otherwise proceed to step 4.

Step 4: Place the yellow pointer in your desired orientation and tighten the mounting screw. *Note: Units assembled at the factory will have yellow pointers in line with valve discs.*

Step 5: Mount the high visibility beacon on top of the target to display 'Open' and 'Closed' according to your actuator/valve mounting orientation.

Step 6: Tighten the mounting screw to ensure that your indicator and target are secured to the pinion of the actuator. *Note: damage to the indicator can result from over tightening the screw.*

Step 7: Place the S52 on the actuator, aligning the holes in the sensor with the mounting holes of the actuator. Insert the cover over the indicator and align the mounting holes of the cover with those of the sensor. Use the longer mounting bolts supplied with your kit and tighten the cover and sensor to the actuator.

Non-Adjustable Target Mounting

The S52 Valve Status Monitor is offered with a non-adjustable target. The non-adjustable target is a one piece puck style target with metal inserts offset by 90°. The yellow pointer however is adjustable and can be positioned however you require; when the unit is mounted at the factory the pointer will be in line with the valve disc. All components of the non-adjustable kit are shown below in Figure 3. The procedure for mounting the non-adjustable target is described on the next page. *Note: when configuring this target with your input monitoring device pay close attention to metal insert position versus sensor position as your actuator rotates from open to close.*

Figure 3: Non-Adjustable Target with pointer.

Mounting of the non-adjustable target:
Insert the target on the pinion of the pneumatic actuator. Based on what position your pinion/actuator is in, one of the metal inserts of the target will be directly in front of switch '1' or switch '2' on your sensor. When your quarter turn actuator rotates 90° to its opposite travel limit, the other metal insert of the target will be directly in front of switch '2' or switch '1', respectively. Position your actuator to yield your desired indication results.

Figure 4: Non-adjustable Target mounting

The Standard S52 (non fieldbus capable versions) are offered with two types of connections; the DC versions are offered with a 4-pin M12 connection, and the AC versions are offered with a 5-pin 7/8" connection. Both types are pictured below:

4-pin M12 Connector

5-pin 7/8" Connector

Figure 5: Standard S52 Connectors

The following pages cover each of the configurations of the S52 in more detail.

DC Version 10-30VDC PNP (Sourcing)
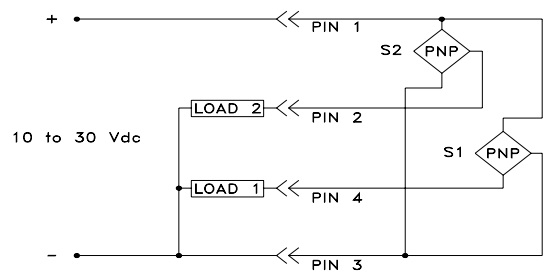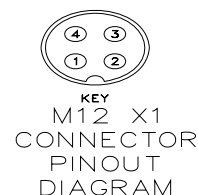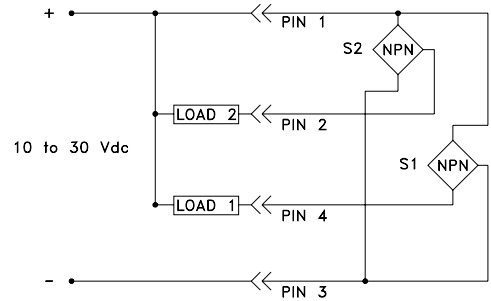
WIRING DIAGRAM

Specifications:

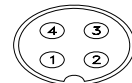| Operating Voltage	10 to 30VDC
Target Type	Metallic
Electrical Configuration	DC - PNP
Maximum Switching Current	200mA
Output Voltage Drop	2VDC
Residual Current (Off State Current)	20µA

M12 X1
CONNECTOR
PINOUT
DIAGRAM

DC Version 10-30VDC NPN (Sinking)

WIRING DIAGRAM

Specifications

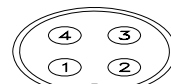| Operating Voltage	10 to 30VDC
Target Type	Metallic
Configuration	DC - NPN
Maximum Switching Current	200mA
Output Voltage Drop	2VDC
Residual Current (Off State Current)	20µA

M12 X1
CONNECTOR
PINOUT
DIAGRAM

DC Intrinsically Safe Version

Any approved Intrinsically Safe apparatus with Entity Concept parameters as follows:
V_{oc} or $V_t \le 15V$
I_{sc} or $I_t \le 53mA$
$C_a = C_{cable} + 220nF$
$L_a > L_{cable} + 280 uH$

Any approved Intrinsically Safe apparatus with Entity Concept parameters as follows:
V_{oc} or $V_t \le 15V$
I_{sc} or $I_t \le 53mA$
$C_a = C_{cable} + 220nF$
$L_a > L_{cable} + 280 uH$
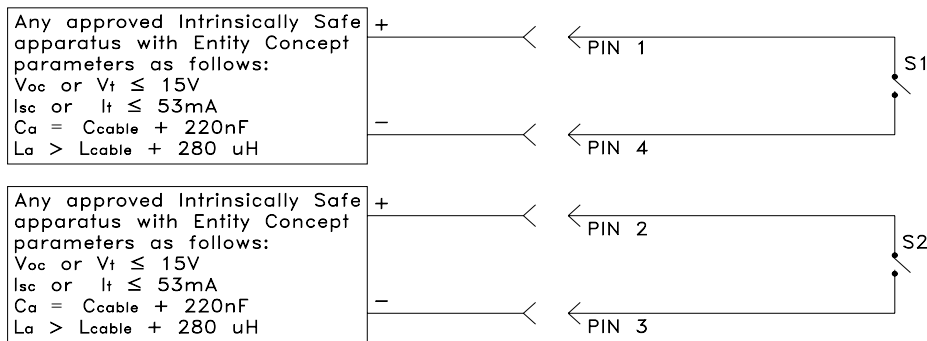
WIRING DIAGRAM

Specifications:

Operating Voltage	7 to 12VDC
Target Type	Metallic
Electrical Configuration	NAMUR

M12 X1
CONNECTOR
PINOUT
DIAGRAM

AC Version 20-250VAC, 50-60Hz
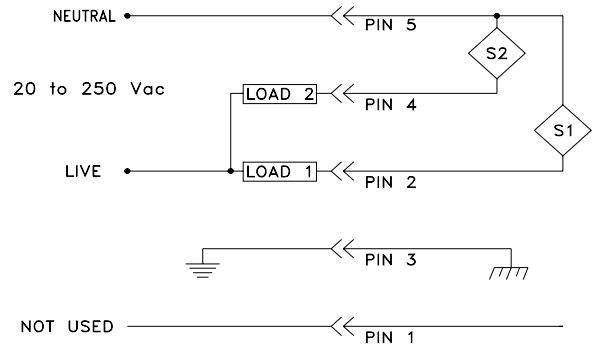
WIRING DIAGRAM

Specifications:

Operating Voltage	20 to 250 VAC
Target Type	Metallic
Electrical Configuration	AC
Maximum Switching Current	500mA
Output Voltage Drop	< 5VAC
Residual Current (Off State Current)	< 1mA
Minimum Switching Current	3 mA
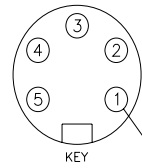
NOTE:
WIRES NOT USED SHOULD BE
COILED AND TAPED FOR
PROTECTION

7/8" 16 UN CONNECTOR
PINOUT DIAGRAM
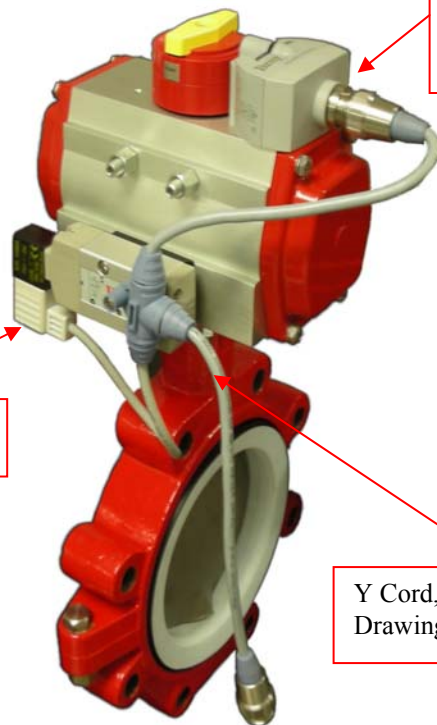
Bray P/N: **52-1004-12624-536** (Kit) includes:
 - 52-1004-71114-536 (S52)
 - 52-1000-14811-533 (target & std. indicator)
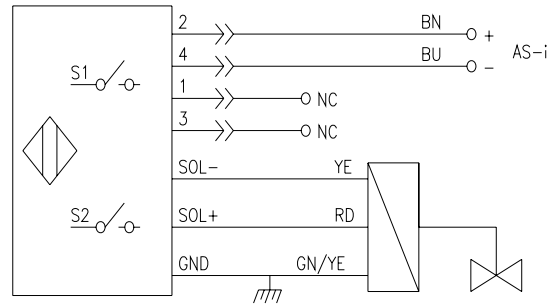Drawing: **ES11A-0544**

S63 Solenoid, Bray P/N:
63-0250-21520-536

PLC with Digital
AC Input Module

Y Cord, Bray P/N: **60-0250-23661-536**
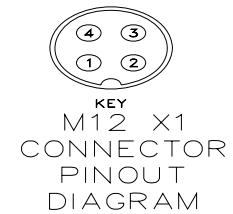Drawing#: **ES11A-0559**

AS-i (Actuator Sensor Interface) Version
with M12 quick connector

WIRING DIAGRAM

Specifications

Operating Voltage	30.5VDC by AS-i Network	
Target Type	Magnetic Target	
Electrical Configuration	AS-i Spec. 3.2 (1),(2)	
Maximum Switching Current	150mA	
Consumption Current	< 30mA	
Addressing	62 (0 to 31A or B)	
Data Bits	bit 0:	Sensor 1
	bit 1:	Sensor 2
	bit 2:	Output to Solenoid
(1) Hardware AS-i Version 3.0 - configured as AS-i Version 2.1		
(2) Full backwards compatibility is maintained with earlier AS-i networks and products		

KEY
M12 X1
CONNECTOR
PINOUT
DIAGRAM

AS-i S52, Bray P/Ns:
52-1005-12624-536 (Kit) includes:
 - 52-1005-71114-536 (S52)
 - 52-1000-14821-533 (target)
52-1000-14805-533 (high visibility
   indicator)

AS-i Controller and
AS-i 24VDC Power Supply

AS-i bus

AS-i (Actuator Sensor Interface) Version
With standard AS-i connector

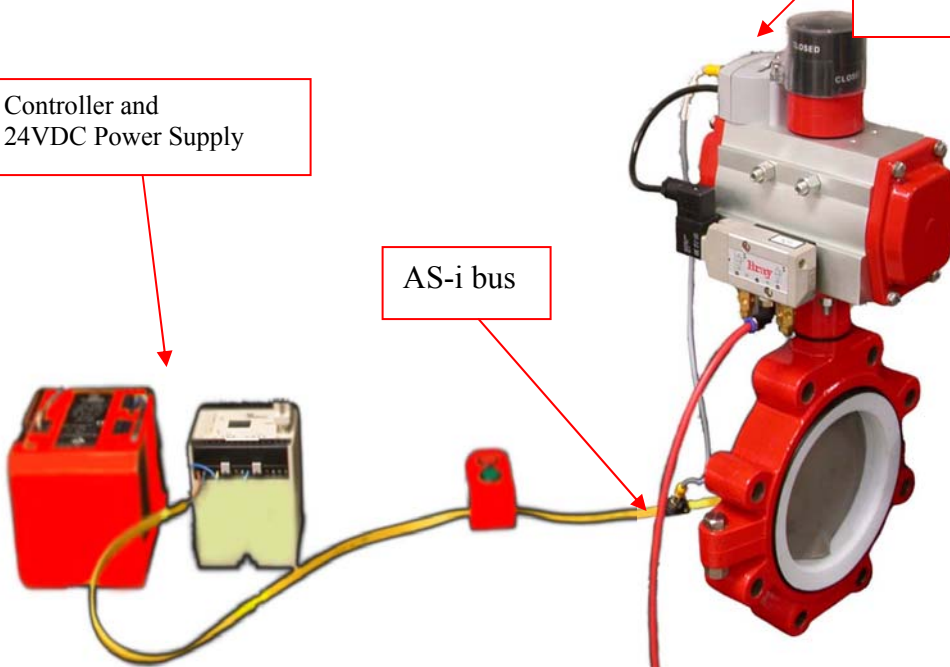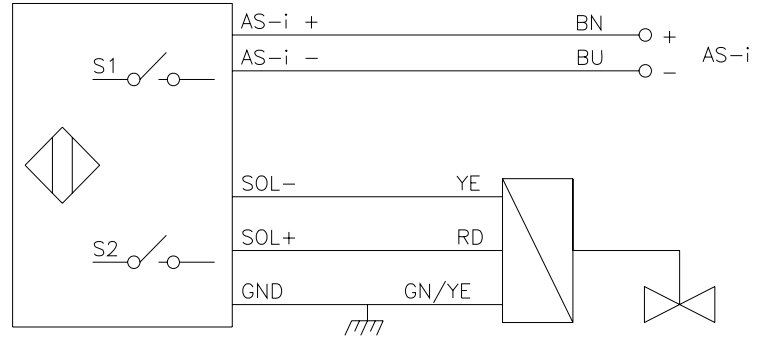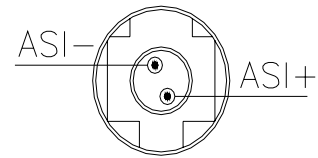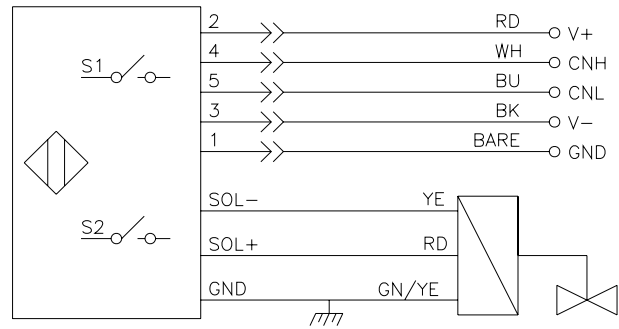WIRING DIAGRAM

Specifications

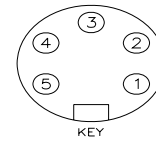|	
Operating Voltage	30.5VDC by AS-i Network
Target Type	Magnetic Target
Electrical Configuration	AS-i Spec. 3.2 (1),(2)
Maximum Switching Current	150mA
Consumption Current	< 30mA
Addressing	62 (0 to 31A or B)
Data Bits	bit 0: Sensor 1
	bit 1: Sensor 2
	bit 2: Output to Solenoid
(1) Hardware AS-i Version 3.0 - configured as AS-i Version 2.1	
(2) Full backwards compatibility is maintained with earlier AS-i networks and products	

DeviceNet Version

WIRING DIAGRAM

Specifications

Operating Voltage	24VDC by DN Network
Target Type	Magnetic Target
Electrical Configuration	DeviceNet
Maximum Switching Current	150mA
Consumption Current	< 20mA
Output Voltage Drop	< 2.5VDC
Addressing	0 to 63 software configured
Data Bits	Input Bit 0: Sensor 1
	Input Bit 1: Sensor 2
	Output Bit 0: Solenoid

PINOUT DIAGRAM
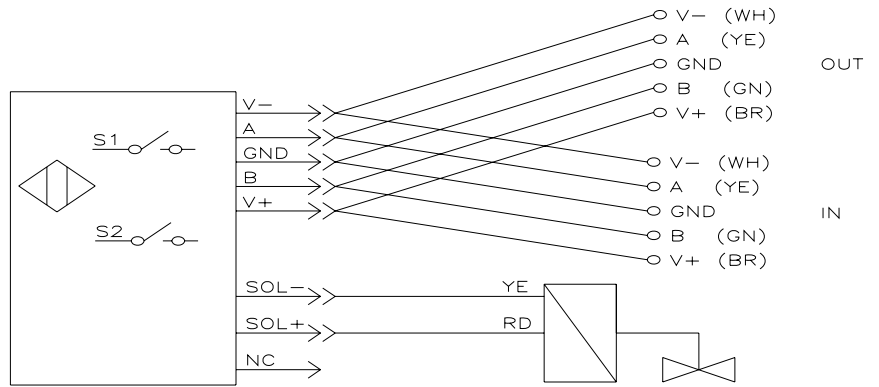

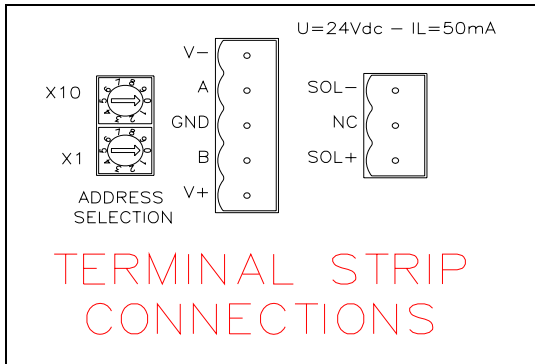
High Visibility Indicator,
Bray P/N: **52-1000-14805-533**

DeviceNet S52, Bray P/Ns:
52-1007-12624-536 (kit) includes:
  - 52-1007-71114-536 (S52)
  - 52-1000-14821-536 (target)
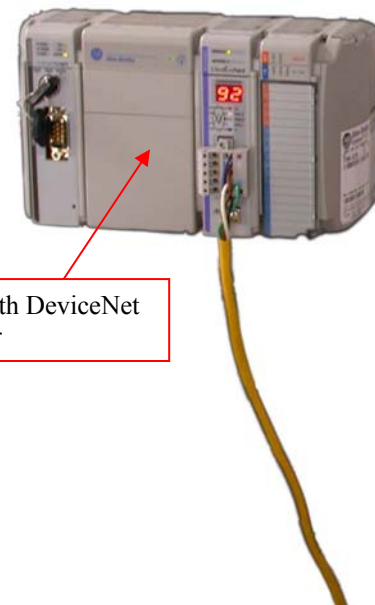
PLC with DeviceNet Scanner

PROFIBUS DP Version

WIRING DIAGRAM

TERMINAL STRIP
CONNECTIONS

Specifications

Operating Voltage	24VDC by DP Network
Target Type	Magnetic Target
Electrical Configuration	PROFIBUS DP
Maximum Switching Current	150mA
Consumption Current	< 20mA
Output Voltage Drop	< 2.5VDC
Addressing	0 to 99 programmable
Data Bits	Input Bit 0: Sensor 1
	Input Bit 1: Sensor 2
	Output Bit 0: Solenoid

In order to install the Profibus DP S52, follow the steps described below:

Step1: Purchase several PROFIBUS DP S52s from your local Bray Distributor.

Step 2: Separate the connection module from the sensor module by loosening the two fastening screws.

Step 3: Take an inventory of all components of the PROFIBUS DP S52 to ensure that you have all the necessary parts of the module. Clockwise from the top left on the image above, you should have the following: (a) connection module, (b) PG connectors, (c) sensor module, (d) connection plate, (e) terminal connectors.

Step 4: Use the adjustment knobs to set your device's network address.

Step 5: Insert your solenoid cable and your PROFIBUS DP & BUS power cable through the cable glands of the connection module. Terminate the wires into the labeled connectors.

Step 6: Heat shrink the terminations and pull the excess cable back through the cable glands, aligning the connectors with the chambers of the connection module.

Step 7: Place the connection plate on the connection module and tighten the fastening screws.
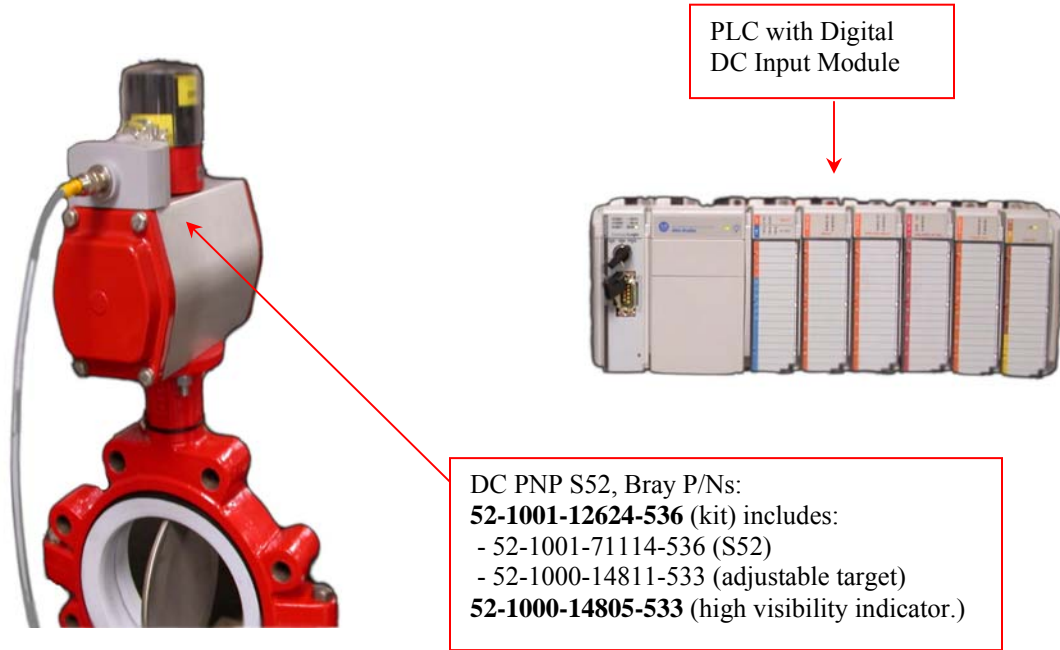
Step 8: Align the connector module to the sensor module and tighten the fastening screws. Your sensor is now ready to be mounted on your actuator.

PLC with Profibus DP Scanner
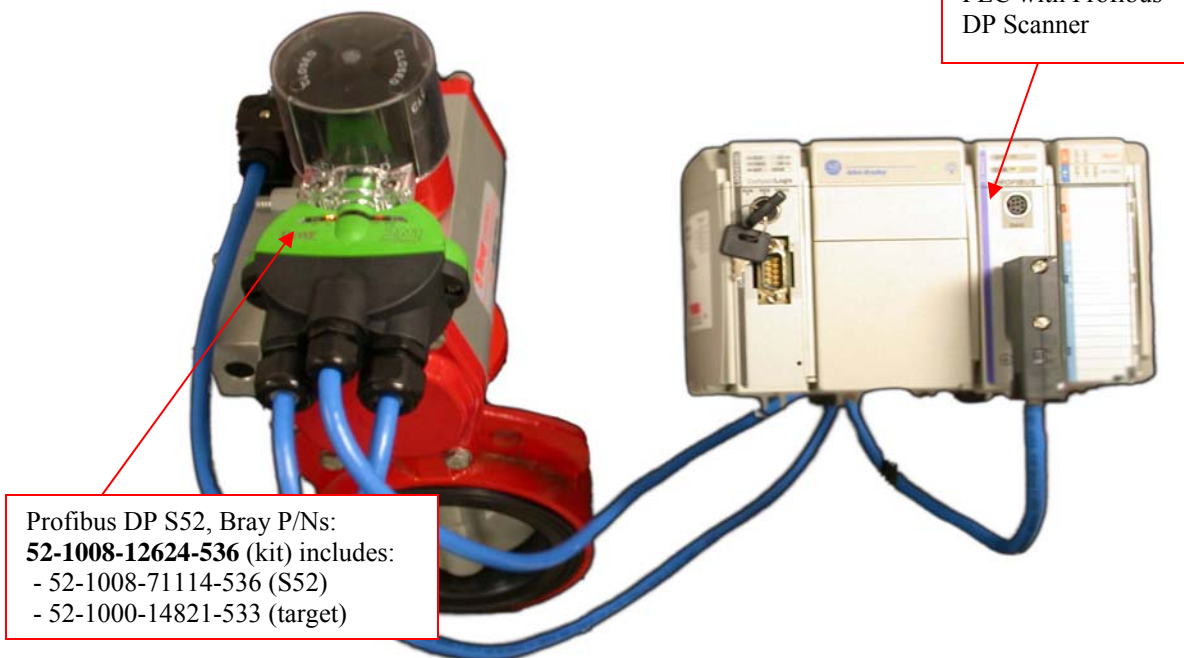
Profibus DP S52, Bray P/Ns:
52-1008-12624-536 (kit) includes:
  - 52-1008-71114-536 (S52)
  - 52-1000-14821-533 (target)

Application Example #1 (DC PNP S52)

PLC with Digital
DC Input Module

DC PNP S52, Bray P/Ns:
52-1001-12624-536 (kit) includes:
 - 52-1001-71114-536 (S52)
 - 52-1000-14811-533 (adjustable target)
52-1000-14805-533 (high visibility indicator.)

Customer has an Allen Bradley CompactLogix 1769 PLC platform with DC Input Module Model # 1769-IQ6XOW4. In order for you to determine if the Bray S52 2N1 DC Prox Sensor is compatible with this device, reference the specifications of each device. Using the manufacturer's website, you should be able to find a manual for your customers DCS or PLC. In this documentation, you can do a search for the input module in question. Below are some important specifications from Allen Bradley's literature on this specific card:

Model #: 1769-IQ6XOW4

Voltage Input Type	24V dc, sinking or sourcing
Voltage, On-State Input, Min.	10V dc
Voltage, On-State Input, Max.	30V dc @ 30 °C (86 °F) 26.4V dc @ 60 °C (140 °F)
Number of Inputs	6
Voltage, Off-State Input, Max.	5V dc
Current, Off-State Input, Max.	1.5 mA
Current, On-State Input, Min.	2 mA
Input Impedance, Nom.	3 KΩ

From this information, and the DC PNP S52 specifications on page 7, you should be able to determine that these two devices are compatible.

- The operating voltage of the DC S52 (specified as: 10-30VDC) is within the acceptable On-State Input Voltage Min. and Max. range of the Input Module (specified as: 10VDC to 30VDC @86°F/26.4Vdc @140°F).

- The Residual Off-State Current of the DC S52 (specified as: 20 µA) is below the Off-State Current Max. of the Input Card (specified as: 1.5mA). *Note: this means that the leakage current of the S52 will not cause false readings.*

- The Nominal Impedance of the Input Card (specified as: 3kΩ) is sufficient enough to limit the current flowing through the proximity switch below its Max. Switching Current (specified as: 200mA).

  Ohm's Law: V = IR (V = Voltage, I = Current, R = Resistance*)
  24VDC = I x 3 KΩ
  24/3000 = .008 A or 8 mA

  This value is the amount of current that will flow through the S52 in the On-State (when the target is in proximity of the sensor). This value, 8 mA, is below the Max. Switching Current of the S52 (current exceeding 200mA can damage the device) and above the Min. On-State Input Current of the input module (specified as: 2mA). *Note: Resistance in this case is referred to as Input Impedance*

Once you have determined the compatibility of the two devices; you can wire the two devices together using their appropriate wiring diagrams. The diagram in Figure 5 below shows you how to do this correctly.

Note: Each proximity switch in the S52 will require a separate input into the PLC card; thus, (1) S52 will utilize (2) inputs into the PLC Input Module. One input for 'Valve Open' indication and one for 'Valve Close' indication. Because this specific input module only has 6 inputs, three S52 can be wired into this device. The number of necessary modules grows quite rapidly when you have several devices in use; this is why fieldbus capable versions can be so cost effective, for more information please see the fieldbus application example.
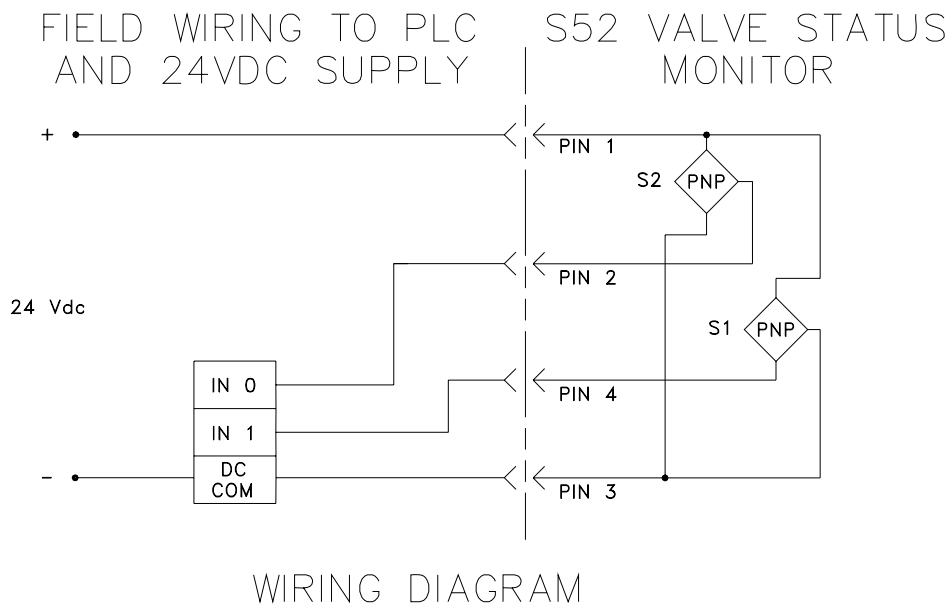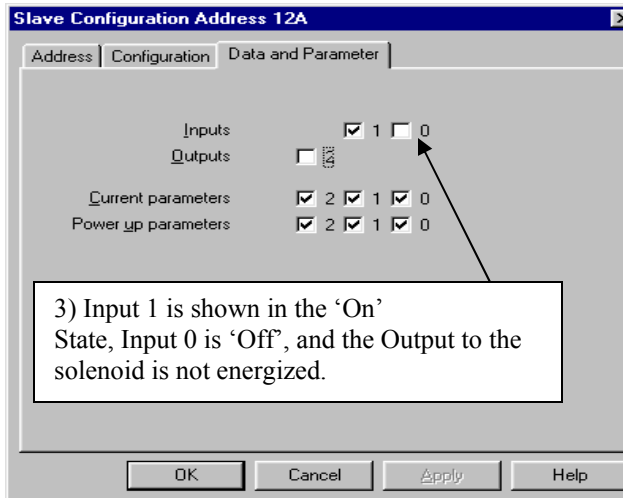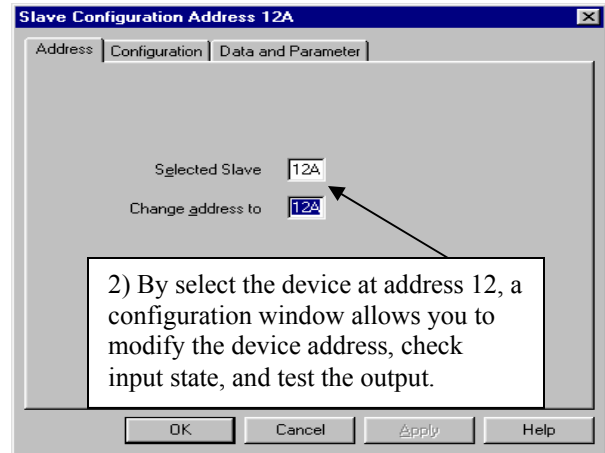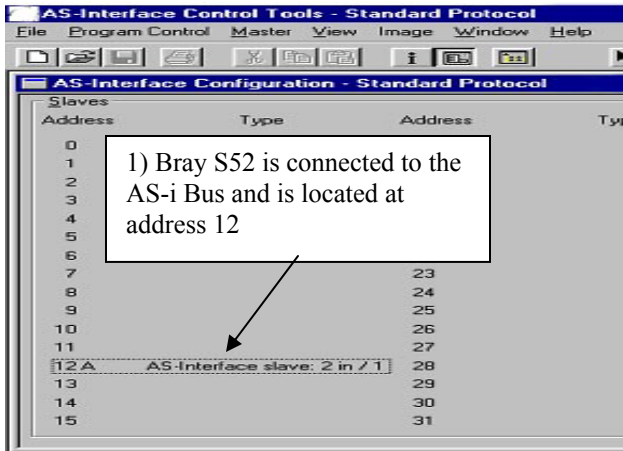

Figure 5: Wiring diagram showing how to wire a DC PNP S52 to an
Allen Bradley Model # 1769-IQ6XOW4 DC Input Module.

Application Example #2 (AS-i S52)

Customer has an AS-i (Actuator Sensor Interface) controller with an AS-i approved 24VDC power supply. Once your customer has the configuration software (usually provided with the controller) they can scan the bus and configure any AS-i device connected. Up to 62 devices can be connected to one controller (V2.1 or 3), in applications requiring several valve status monitors, cost is greatly reduced when only one single module can control 62 devices versus having to purchase a PLC input module for every three to four S52s that you have.

1) Bray S52 is connected to the AS-i Bus and is located at address 12

2) By select the device at address 12, a configuration window allows you to modify the device address, check input state, and test the output.

3) Input 1 is shown in the 'On' State, Input 0 is 'Off', and the Output to the solenoid is not energized.

AS-i slave (1 of 62), Bray S52 P/Ns:
52-1005-12624-536 (kit) includes:
 - 52-1005-71114-536 (S52)
 - 52-1000-14821-533 (target)
52-1000-14805-533 (indicator)

AS-i Controller and
AS-i 24VDC Power Supply

AS-i bus