PNEUMATIC VALVE ISLANDS

Consult the online configurator - CAD files on: www.asco.com

501 Series Valve Islands

502 Series Valve Islands

503 Series Valve Islands

2035 Series Valve Islands

G3 Electronics

580 Electronics

501 Series Valve Islands, Ex

502 Series Valve Islands, Ex

G3 Electronics

580 Electronics, Ex

622 Series Valve Islands, ATEX

ISO 5599/2 Valve Islands

Zone Safety Manifold

Spool valves, 502 & 503 Series, with integrated M12 (ISO 15407-1)

Spool valves, 502 & 503 Series, with integrated M12 on subbase (ISO 15407-2)

All leaflets are available on: www.asco.com
## PNEUMATIC VALVE ISLANDS
### Quick Selection Chart

<table>
<thead>
<tr>
<th>ports/positions</th>
<th>pipe connections</th>
<th>ports</th>
<th>main operating pressure (bar)</th>
<th>flow rate (l/min)</th>
<th>series</th>
<th>illustration</th>
<th>cabinet mounting</th>
<th>zoned safety</th>
<th>UML Sheet</th>
<th>page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x 3/2 52-32 52-33</td>
<td><img src="images/1.png" alt="Images" /></td>
<td>8 400</td>
<td>501</td>
<td><img src="images/2.png" alt="Images" /></td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 x 3/2 52-32 52-33</td>
<td><img src="images/3.png" alt="Images" /></td>
<td>8 650</td>
<td>502</td>
<td><img src="images/4.png" alt="Images" /></td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 x 3/2 52-32 52-33</td>
<td><img src="images/5.png" alt="Images" /></td>
<td>8 1400</td>
<td>503</td>
<td><img src="images/6.png" alt="Images" /></td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 x 3/2 52-32 52-33</td>
<td><img src="images/7.png" alt="Images" /></td>
<td>8 400</td>
<td>501</td>
<td><img src="images/8.png" alt="Images" /></td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Pneumatic valve islands, series 2035
| 52-33 | ![Images](images/9.png) | 10 3820 | 2035 | 41 mm | ![Images](images/10.png) | - | | | | | 51 |
### G3 Electronics

**Multipol IP65**
- Buslink
  - DeviceNet
  - EtherCAT
  - Modbus TCP
  - PROFINET
  - POWERLINK
  - CANopen
  - EtherCAT

| 501 | 502 | 503 | 2035 | ![Images](images/11.png) | - | - | - | - | - | 73..120 |
### 580 Electronics

| 580 (501) | 580 (502) | 580 (503) | ![Images](images/12.png) | - | - | - | - | - | - | 121 |

### Sub-Base Mounted Valves to ISO 5599/2
| 52-53 | ![Images](images/13.png) | 16 1420 | ISO1 | ![Images](images/14.png) | - | - | - | - | - | 245 |
| 52-53 | ![Images](images/15.png) | 3165 | ISO2 | ![Images](images/16.png) | - | - | - | - | - | |
| 52-53 | ![Images](images/17.png) | 5730 | ISO3 | ![Images](images/18.png) | - | - | - | - | - | |
### Series 502 & 503 (M12) (ISO 15407-1 / ISO 15407-2 - 18 & 26 mm)
| 52-53 | ![Images](images/19.png) | 10 500 | 502 | ![Images](images/20.png) | - | - | - | - | - | 305 |
| 52-53 | ![Images](images/21.png) | 1200 | 503 | ![Images](images/22.png) | - | - | - | - | - | 319 |
| 52-53 | ![Images](images/23.png) | 8 500 | 502 | ![Images](images/24.png) | - | - | - | - | - | 333 |
| 52-53 | ![Images](images/25.png) | 1200 | 503 | ![Images](images/26.png) | - | - | - | - | - | 339 |

All leaflets are available on: [www.asco.com](http://www.asco.com)
PNEUMATIC VALVE ISLANDS
Quick Selection Chart

<table>
<thead>
<tr>
<th>Pneumatic valve islands, series 501 and 502</th>
</tr>
</thead>
<tbody>
<tr>
<td>ports/positions</td>
</tr>
<tr>
<td>2-4</td>
</tr>
<tr>
<td>5/2-5/3</td>
</tr>
<tr>
<td>2 x 3/2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pneumatic valve islands, series 622</th>
</tr>
</thead>
<tbody>
<tr>
<td>ports/positions</td>
</tr>
<tr>
<td>5/2</td>
</tr>
</tbody>
</table>

G3 Electronics

Multipol /IP65  Buslink
- CANopen®, CC-Link, EtherCAT®, DEVICE LOGIX, DeviceNet®, EtherNXTM, EtherNET/IP®, EtherCAT®, MODBUS TCP/IP, POWERLINK®, PROFIBUS-DP®, PROFINET®, EtherNET/IP® DLR

<table>
<thead>
<tr>
<th>G3 Electronics</th>
</tr>
</thead>
<tbody>
<tr>
<td>series</td>
</tr>
<tr>
<td>501</td>
</tr>
<tr>
<td>G3</td>
</tr>
</tbody>
</table>

580 Electronics

<table>
<thead>
<tr>
<th>580 ATEX (501)</th>
</tr>
</thead>
<tbody>
<tr>
<td>series</td>
</tr>
<tr>
<td>580 ATEX (501)</td>
</tr>
</tbody>
</table>
Series 501 valve platform

Plug-in Electrical connection

Plug-in valve
Page 3

Subbases

Fourfold Joinable

End plates

Pneumatic pad mount
High flow
400 l/min ANR

With bottom ports

Page 45

Ex versions
Page 239
Valves technology

Rubber packed
all pneumatic functions including double 3/2 NC and NO

Sandwich Accessories

Plugged between valve and subbase:

Sandwich Speed Control

Shut off

Blank station plate

Pressure regulator

Multiwire or Fieldbus I/O Modules

Multiwire connection

G3/580 Electronics

I/O Fieldbus Module

599

580

580 Electronics

Assemblies

580 Electronics

Page 121

Configurator - CAD Files

Page 211

Valve manifolds

Page 3

Ex versions +

Page 211
## Series 502 & 503 Valve

### M12 Electrical Connection

- **M12 Valve**
  - ISO 15407-1

Pages 305/333

### Subbases

#### Single
- ISO 15407-1
  - 502: 500 l/min ANR
  - 503: 1200 l/min ANR

#### Double Joinable
- ISO 15407-1
  - 502: 500 l/min ANR
  - 503: 1200 l/min ANR

### End Plates

- Side ports

### Plug-in Electrical Connection

- **Plug-in Valve**

### Subbases

#### Single
- ISO 15407-2
  - 502: 500 l/min ANR
  - 503: 1200 l/min ANR

#### Double Joinable
- ISO 15407-2
  - 502: 500 l/min ANR
  - 503: 1200 l/min ANR

#### With Bottom Ports

- Pneumatic pad mount
  - High flow
  - 502: 650 l/min ANR
  - 503: 1400 l/min ANR

Pages 16/27
**Valves technology**

**Rubber packed**
all pneumatic functions including double 3/2

**Spool & Sleeve**
Very high life time > 200 M cycles

**Sandwich Accessories**

Plugged between valve and subbase:
Sandwich Speed Control
Exhaust block
Shut off
Blank station plate
Pressure block
Pressure regulator

**Assemblies**

M12 valve on ISO 15407-1 single subbase

M12 valves on ISO 15407-1 joinable subbases

**580 Electronics**

Valve on ISO 15407-2 single subbase M12 electrical interface on the subbase

**Multipol ou bus de terrain Modules E/S**

Multiwire connection
- G3/580 Electronics
- I/O Fieldbus Module

**580**

+ Ex versions (502)

**Configurator - CAD Files**

**Fielbus Electronics - VII**
Three key concepts for the design of machinery and their safety functions have emerged from the implementation of the new Machinery Directive 2006/42/EC:

- A risk analysis prior to design
- A particular consideration of the quantitative aspect of the safety functions in addition to the qualitative approach
- The use of performance levels (PL)

**Risk Evaluation:**
The manufacturer or supplier of a machine must see to it that a risk evaluation is conducted to determine the health and safety requirements for persons involved in its operation. The machine must then be designed and constructed in accordance with the results of the risk evaluation.

**Safety component VERSUS safety related part of a control system (SRP/CS)?**

- A safety component is evaluated to operate for a complete safety function.
- A safety-related part of a control system (SRP/CS) is evaluated for its safety level and will be included in a complete safety loop (SRP/CS). The complete SRP/CS must be evaluated according to the risk evaluation by the manufacturer or supplier of a machines.

In accordance with the 2006/42/CE machine directive in accordance with EN ISO 13849 the manufacturer or supplier of a machines must estimate the level of performance achieved by the complete safety control system using these components and is responsible for the risk assessment.
Reliability DATA
The products’ reliability data (MTTF, MTTFd, B10, B10d...) gained from reliability tests under standard conditions can be downloaded in the SISTEMA format from our website www.asco.com

Actuators (pneumatic cylinders) are not taken into consideration in the calculation of performance levels (PL). Since actuators are not an integral part of the control systems, they do not fall under EN ISO 13849-1 requirements. Manufacturers are, however, required to integrate the risks related to a failure of the actuator into their risk evaluation (EN ISO 14121 and EN ISO 12100).

“Good engineering practice + probabilistic calculations”

CONSTRUCTION AND RISK EVALUATION OF MACHINES

EN ISO 12100
Safety of machinery
Basic concepts, general principles for design

EN 1050 (EN ISO 14121-1)
Safety of machinery
Risk assessment - Part 1: Principles

Functional and safety-relevant requirements for safety-related control systems

SISTEMA (Safety Integrity Software Tool for the Evaluation of Machine Applications)
SISTEMA software available for download at www.dguv.de/ifa/en

SISTEMA will assist in the determination of the Performance Level (PL)

PL = SIL

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All leaflets are available on: www.asco.com
EN/IEC 62061 - EN ISO 13849-1

SURVEY OF THE SAFETY FUNCTIONS OF A MACHINE:
- Functional specifications to determine dangerous malfunction
- Safety-related specifications

Select a system architecture among types:
- A, B, C or D EN/IEC 62061
- Category B, 1, 2, 3 or 4 ISO 13849-1

Select the system components involved in the safety functions taking their reliability data into account
- MTTF, MTTFₐ, Bₚₐₜ, B₁₀₀ₚ, etc.

Specify the diagnostic means for each component to ensure the required DC (Diagnostic Coverage)

Specify the other requirements:
- CCF (Common Cause Failure)
- Software
- Architectural requirements
- System integrity

Create a reliability model or graph for each function to support the different calculations

Calculate
- \( \lambda_d \)
  EN/IEC 62061
- MTTFₐ and DC per channel
  ISO 13849-1

Derive the safety performance level achievable by the system from:
- SIL EN/IEC 62061 • PL ISO

RELIABILITY DATA for components from manufacturers, standards, databases etc.
MTTFd: Mean time to dangerous failure – Value expressed in years

<table>
<thead>
<tr>
<th>Rating for each channel</th>
<th>MTTFd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>3 years &lt; MTTFd &lt; 10 years</td>
</tr>
<tr>
<td>Medium</td>
<td>10 years &lt; MTTFd &lt; 30 years</td>
</tr>
<tr>
<td>High</td>
<td>30 years &lt; MTTFd &lt; 100 years</td>
</tr>
</tbody>
</table>

B₁₀d: Number of cycles after which 10% of a random sample of wearing components fail dangerously – Value expressed in number of cycles.

DC: Diagnostic Coverage

<table>
<thead>
<tr>
<th>DIAGNOSTIC COVERAGE</th>
<th>None</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC ≥ 60%</td>
<td>60% &lt; DC &lt; 90%</td>
<td>90% &lt; DC &lt; 99%</td>
<td>99% &lt; DC</td>
<td></td>
</tr>
</tbody>
</table>

CCF: Common Cause Failure. Measures to be taken to prevent a given cause (and its effect) from concurrently disabling the multiple channels of a safety circuit.

Mission time T₁₀: In line with “good engineering practice” as recommended in EN ISO 13849-1, components attaining this value must be replaced (precautionary principle).

All leaflets are available on: www.asco.com

X - Fielbus Electronics
Only the pneumatic part is described in the form of a subsystem in these examples. Other safety-related components (e.g. protective devices, electrical logic elements) must be added to ensure the safety function is complete.

The examples shown here only relate to the stopping of hazardous movements. In pneumatics, safety measures concerning the interruption of energy sources, the evacuation of potential energy (pressure contained in a part of the circuit), and a “progressive” start-up after an unexpected shutdown should not be omitted.

To attain a PL = c, category 1 architecture

Category 1, 1 channel

Reliable components of the SRP/CS (DIN EN ISO 13849-2 A.4/B.4/D.4)

0 Fault safety (DIN EN ISO 13849-1 Pt. 6.2.4)

MTTFd ≥ 30 years

Safety function: Stopping of the potentially hazardous movement of cylinder 1A.

- Functional description:

  - Input 'I': not represented, movable guard or light barrier, etc.
  - Logic element 'L': not represented, PLC

- Calculation of the probability of dangerous failure:

<table>
<thead>
<tr>
<th>Safety function</th>
<th>Working hours / day</th>
<th>Working days / year</th>
<th>Cycles / year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cycle = 5 s</td>
<td>16 h</td>
<td>240 days</td>
<td>2,764,800 cycles</td>
</tr>
</tbody>
</table>

  \[ B_{10d} (1V1A – series 520) = 130,000,000 cycles, i.e. an operating time of 47 years, MTTF_d = 470 years “high” \]

By limiting the valve’s operating time to 47 years, this corresponds to a PL = c
To attain a PL = c, category 2 architecture

Category 2, 1 channel

MTTFD of the test channel has to be greater than half the MTTFD of the functional channel. The functions are checked at suitable intervals by the machine control system. (test frequency 100 times the frequency of use).

At start up of the machine and/or periodically.

0 Fault safety between the test phases (DIN EN ISO 13849-1 Pt. 6.2.5)

or testing may occur immediately upon demand of the safety function, if the overall time to detect the fault and to bring the machine to a non-hazardous condition (usually the machine is stopped) is shorter than the time to reach the hazard. Here ISO 13855 for the calculation of safety distances is referenced.

• Safety function: Stopping of the potentially hazardous movement of cylinder 1A.

• Functional description:

Stop of cylinder ensured by: Diagnostics ensured by:

Output O: Valve 1V1B Cross-monitoring in L1 of the supply status coherence of coils 1V1Ba and 1V1Bb and the limit switches 1S1

0V1: Energy isolating valve: ensures the system is exhausted in case of loop failure.

• Calculation of the probability of dangerous failure:

<table>
<thead>
<tr>
<th>Safety function</th>
<th>Working hours / day</th>
<th>Working days / year</th>
<th>Cycles / year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cycle = 5 s</td>
<td>16 h</td>
<td>240 days</td>
<td>2,764,800 cycles</td>
</tr>
</tbody>
</table>

B_{162} (valve 1V1B - series 542) = 44,912,670 cycles, i.e. an operating time of 16.2 years,
MTTF_{d} = 162 years “high”

MTTF_{s} (sensors 1S1) = 45 000 000h, i.e. 11,718 years “high”

The case study shows: DC (Diagnostic Coverage) = 60% “low”

By limiting the valve’s operating time to 16.2 years, this corresponds to a PL = c for the safety loop.
To attain a PL = d, category 3 architecture

Category 3, 2 channels
(DIN EN ISO 13849-1 Pt. 6.2.7) Some, but not all faults are detected before or during the next request

1 Fault safety: Multiple undetected faults lead to the loss of SF.

MTTFd ≥ 30 years
Redundancy + partial monitoring

Category 4, 2 channels
(DIN EN ISO 13849-1 Pt. 6.2.7) Every fault must be detected before or during the next request > 1 fault safety

MTTFd ≥ 30 years
Redundancy + PERMANENT monitoring
- Safety function: Stopping of the potentially hazardous movement of cylinder 1A.
- Functional description:

Inputs ‘I1’ and ‘I2’: not represented, movable guard or light barrier, etc.
Logic elements ‘L1’ and ‘L2’: not represented, PLC

Safety function

Working hours / day | Working days / year | Cycles / year
---|---|---
1 cycle = 15 s | 16 h | 240 days | 921,600 cycles
1 cycle = 15 s | 16 h | 240 days | 921,600 cycles

Global MTTFd

\[
\frac{1}{\text{MTTF}_d (\text{channel 1})} = \frac{1}{\text{MTTF}_d (I1)} + \frac{1}{\text{MTTF}_d (L1)} + \frac{1}{\text{MTTF}_d (O1)}
\]

Chanel 1 = 198 years "high" / Chanel 2 = 33 years "high"

DC (diagnostic coverage)

Inputs (I1 and I2): Manufacturer data: 99%
Logic (L1 and L2): Manufacturer data: 99%

Outputs (O1 and O2)

O1 = 60% / O2 = (2V1) 75% - (1Z1) 75%

MTTFd rating for each channel = low
MTTFd rating for each channel = medium
MTTFd rating for each channel = high

DC avg = \[
\frac{1}{\text{MTTF}_{D1}} + \frac{1}{\text{MTTF}_{D2}} + \ldots + \frac{1}{\text{MTTF}_{DN}}
\]

DCavg = 81%

PL Performance Levels

By limiting the operating time of the pressure switch and rod lock to 4.34 years, this corresponds to a PL = d for the safety loop.
Exemple of ASCO Numatics product which can be integrate in (SRP/CS)

<table>
<thead>
<tr>
<th>Distribution function</th>
<th>Point-of-Use Pneumatics cylinders, stop cylinder and check valve (^{(1)})</th>
<th>Actuator control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spool valve - 551553 Series</td>
<td>Spool valves L1 and L2 Series</td>
<td>Pressure switch AP</td>
</tr>
<tr>
<td>Spool valves 520 Series</td>
<td>Spool valves ISO 1 2 3 Series</td>
<td>Pressure switch P</td>
</tr>
<tr>
<td>Spool valves IS3 Series</td>
<td>Spool valves 551553 Series</td>
<td>Cylinders with Rod lock</td>
</tr>
<tr>
<td>VL/VT Series</td>
<td>Cylinders</td>
<td></td>
</tr>
<tr>
<td>Stopper cylinder</td>
<td>Quick Exhaust</td>
<td>Non-return valve</td>
</tr>
</tbody>
</table>

\(^{(1)}\) Actuators (pneumatic cylinders) are not taken into consideration in the calculation of performance levels (PL). Since actuators are not an integral part of the control systems, they do not fall under EN ISO 13849-1 requirements. Manufacturers are, however, required to integrate the risks related to a failure of the actuator into their risk evaluation (EN ISO 14121 and EN ISO 12100).