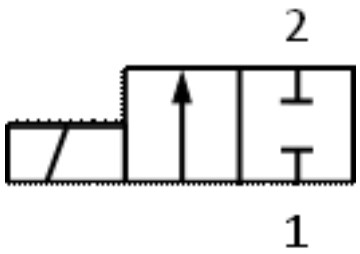
Valve22

```
<< C:\\Hopsan\Compgen\CompgenNG.mx

path = ToFileName[{"C:", "Users", "petkr14", "Dropbox",
     "HopsanComponents", "PneumaticDevelop", "PneumaticComponents"}];

path = ToFileName[{"H:", "PettersDropbox", "Dropbox",
     "HopsanComponents", "PneumaticDevelop", "PneumaticComponents"}];

domain = "Pneumatic";
displayName = "Valve22";
brief = "Pneumatic 22-valve";
componentType = "ComponentQ";
author = "Petter Krus <petter.krus@liu.se>";
affiliation = "Division of Fluid and Mechatronic Systems, Linköping University";
SetFilenames[path, domain, displayName];
ResetComponentVariables[];
Date[]
```

Component description

This is a simple pneumatic valve with two ports and two positions. It is closed when the input signal is zero and open when it is one. The opening is proportional to the input signal. There is no valve dynamics.




```
inputParameters = {
    {Cd, 0.65, double, "", "Discharge coefficient"},
    {R, 287., double, "J/Kg K", "Gas constant"},
    {cv, 718, double, "J/Kg K", "heatcoeff"},
    {eps, 0.02, double, "", "Linearisation coeff"},
    {A0max, 1. * 10^-5, double, "m2", "Max opening area"}
   };

inputVariables = {
    {xin, 1, double, "", "Input signal 0<xin<1"}
   };

outputVariables = {
    {qmP, 0., double, "kg/s", "Internal variable"},
    {qmN, 0., double, "kg/s", "Internal variable"}
   };
```

```
nodeConnections = {
    PneumaticQnode[1, 100000., "fluid port 1 "],
    PneumaticQnode[2, 100000., "fluid port 2 "]
  };
```

The system of equations

The input signal is limited between 0 and 1.

```
A0 = A0max limit[xin, 0, 1];
```

The flow at inlet and outlet are equal but with opposite sign.

```
qm1e = -qm2;
```

```
Ng1 = 1;
```

$$\text{Nga2} := \left(\text{signedSquareL}\left[\frac{\left(\frac{p2}{p1}\right)^{2/\text{kappa}} - \left(\frac{p2}{p1}\right)^{(\text{kappa}+1)/\text{kappa}}}{\text{Ndenom}}, \text{eps}\right]\right)$$

$$\text{Ngb2} := \left(\text{signedSquareL}\left[\frac{\left(\frac{p1}{p2}\right)^{2/\text{kappa}} - \left(\frac{p1}{p2}\right)^{(\text{kappa}+1)/\text{kappa}}}{\text{Ndenom}}, \text{eps}\right]\right)$$

$$\text{Ng} := \text{onPositive}[p1 - p2]\left(\text{onPositive}\left[\frac{p2}{p1} - \text{crit}\right]\text{Nga2} + \text{onNegative}\left[\frac{p2}{p1} - \text{crit}\right]\text{Ng1}\right) +$$
$$\text{onNegative}[p1 - p2]\left(\text{onPositive}\left[\frac{p1}{p2} - \text{crit}\right]\text{Ngb2} + \text{onNegative}\left[\frac{p1}{p2} - \text{crit}\right]\text{Ng1}\right);$$

Expressions that are evaluated before the system equations

$$\text{localExpressions} = \left\{\right.$$
$$\text{kappa} == 1 + \frac{R}{cv},$$
$$\text{Kg} == \sqrt{\frac{2^{\frac{\text{kappa}+1}{\text{kappa}-1}}\,\text{kappa}\left(\frac{1}{\text{kappa}+1}\right)^{\frac{\text{kappa}+1}{\text{kappa}-1}}}{R}},$$
$$\text{Ndenom} == 2^{\frac{\text{kappa}+1}{\text{kappa}-1}-1}(\text{kappa} - 1)\left(\frac{1}{\text{kappa} + 1}\right)^{\frac{\text{kappa}+1}{\text{kappa}-1}},$$
$$\text{crit} == 2^{\frac{\text{kappa}}{\text{kappa}-1}}\left(\frac{1}{\text{kappa} + 1}\right)^{\frac{\text{kappa}}{\text{kappa}-1}},$$
$$\text{cp} == cv + R$$
$$\left.\right\};$$

The system of equations

```
systemEquationsDA = Simplify[{
    qmP == p1 Cd A0 Kg Ng / Sqrt[T1],
    qmN == p2 Cd A0 Kg Ng / Sqrt[T2],
    qm2 == (onPositive[p1 - p2] qmP - onNegative[p1 - p2] qmN),
    dE1 == qm1e cp (onNegative[qm1e] T1 + onPositive[qm1e] T2),
    dE2 == qm2 cp (onNegative[qm2] T2 + onPositive[qm2] T1)
    }];
```

Boundaries

```
systemBoundaryEquations = {
   p1 == (c1 + Zc1 dE1),
   p2 == (c2 + Zc2 dE2)
  };
```

Independent Variables

```
systemVariables = {qmP, qmN, qm2, dE1, dE2, p1, p2};
```

Expressions

The inlet flow is calculated as the outlet flow with reversed sign.

```
expressions = {
   qm1 == -qm2
  };
```

```
Compgen[file]
```