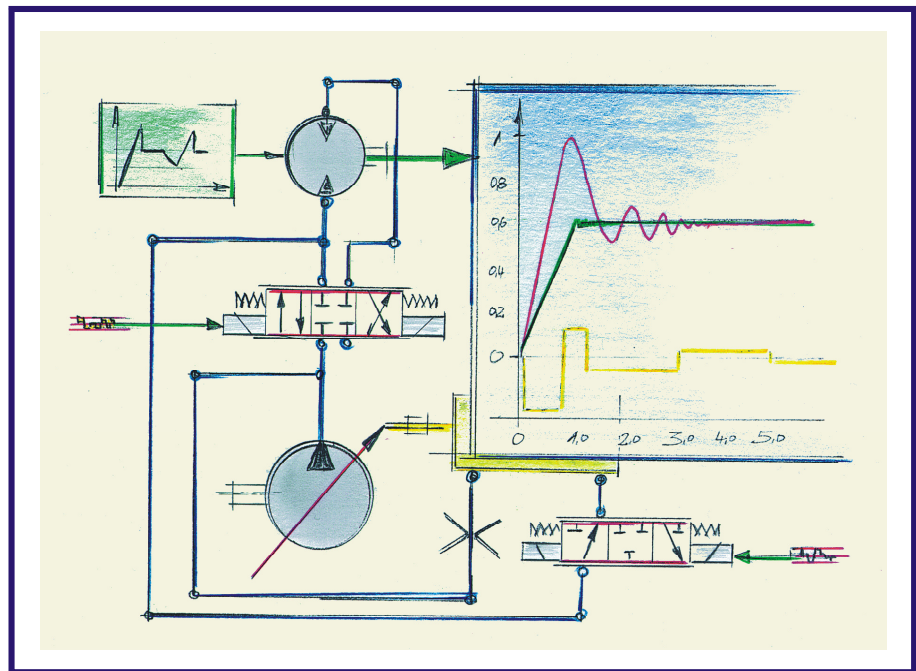


Component Manual

Miscellaneous



DSH^{plus}

Copyright © 1995-2008 by
FLUIDON® Gesellschaft für Fluidtechnik mbH
Jülicher Straße 336
52070 Aachen
Germany

Tel. +49 (0) 241 - 9 60 92 60
Fax +49 (0) 241 - 9 60 92 62

www.fluidon.com
e-mail info@fluidon.com

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In the course of further development of the software, parts of this manual can lose their validity.

Introduction

The component manual describes the components of the library. In accordance with the component categories in the library, the manual subdivides itself into several parts:

- Component library Hydraulics
- Component library Pneumatics
- Component library Control,
- Component library Mechanics
- Component library Thermal Hydraulics
- Component library Modules
- Component library Miscellaneous

The **HYDRAULICS** part contains all hydraulic components of the library. This includes pumps and motors, flow valves, pressure valves, check valves, and directional valves as well as accumulators and pipes.

The **PNEUMATICS** part of the library includes many components for pneumatic systems. The components range from cylinders and resistors to directional valves and sensors.

In the manual part **MECHANICS** the mechanical components are described. These are the masses and the spring damper components as well as other mechanical components.

The component library of *DSHplus* includes analog and digital components for control tasks that are explained in the chapter **CONTROL**.

The **THERMAL HYDRAULICS** part contains thermal hydraulic components of the library. This includes pumps and motors and directional valves as well as accumulators and pipes.

The component manual should help to select the right component for a model and to parameterize it. Furthermore, there is information about the kind of modeling of the components, e. g. whether they were modeled in accordance with the physical qualities of the real components or whether only their dynamic characteristics were taken.

The **MODULES** contains the components for the *DSHplus*-STC and for the sub model prepare. The part **MISCELLANEOUS** contains other components to which the nodes in particular belong.

All components are described according to the same scheme. The following page shows an example component with which the scheme is explained.

ComponentName

Symbol of the component

Symbol

Sketch

Drawing of the component

Connectors and Variables

Name	Type	Unit	Description
<i>Hydraulic connector</i>	Hydr	Unit	<i>short description</i>
<i>Hydraulic volume less connector</i>	Hvol	Unit	<i>short description</i>
<i>Thermal hydraulic connector</i>	THydr	Unit	<i>short description</i>
<i>Pneumatic connector</i>	Pneu	Unit	<i>short description</i>
<i>Signal input</i>	In		<i>short description</i>
<i>Signal output</i>	Out		<i>short description</i>
<i>Mechanical connector</i>	Mech		<i>short description</i>
<i>Internal variable</i>	V		<i>short description</i>

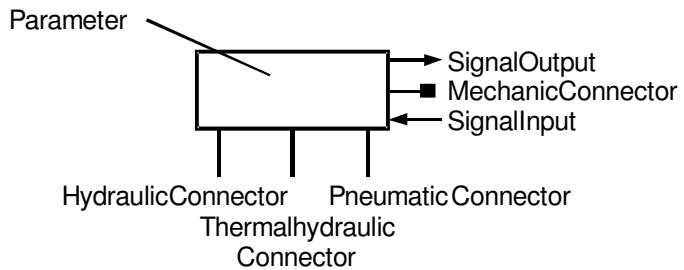
Parameters

Name	Value	Unit	Description
<i>Parameter name</i>	<i>Value</i>	<i>Unit</i>	<i>short description</i>

Notes

Remarks about function and application

Comments to the example component:

	The component symbol is the symbol with which a component appears in the library and in the model.														
	The component with its parameters and its connectors is represented in the component drawing according to the following figure:  The arrows at the component specify whether the connector is an input, an output or a mechanical connection. The direction of state variables is defined by a coordinate system.														
	In the table Connectors and Variables , all connectors and variables of a component are listed.														
	The connectors and variables of a component can be subdivided into different types. They are characterized in the column Type in accordance with: <table> <tbody> <tr> <td>Hydr:</td><td>hydraulic connector</td></tr> <tr> <td>Pneu:</td><td>pneumatic connector</td></tr> <tr> <td>Thydr:</td><td>thermal hydraulic connector</td></tr> <tr> <td>In:</td><td>input of a signal</td></tr> <tr> <td>Out:</td><td>output of a signal</td></tr> <tr> <td>Mech:</td><td>mechanical connector</td></tr> <tr> <td>V:</td><td>internal variable (state variable)</td></tr> </tbody> </table>	Hydr:	hydraulic connector	Pneu:	pneumatic connector	Thydr:	thermal hydraulic connector	In:	input of a signal	Out:	output of a signal	Mech:	mechanical connector	V:	internal variable (state variable)
Hydr:	hydraulic connector														
Pneu:	pneumatic connector														
Thydr:	thermal hydraulic connector														
In:	input of a signal														
Out:	output of a signal														
Mech:	mechanical connector														
V:	internal variable (state variable)														
	Units (column Unit) were assigned to the variables. In so far as the customer does not change the Units, the graphic or numeric edition of the variables occurs with these Units. The units for the values of the other connectors are listed only for better understanding.														
	In the parameter list, all parameters are listed with its Values and Units with which a component is described.														
	The Notes give further remarks to the function and the application of the component.														
	The following spelling is used: COMPONENTNAME <i>Parameters, Connectors and Variables</i>														

Contents

Nodes	3
HydroNode	3
MechTransNode.....	6
MechRotNode.....	7
SignalNode	8
PneumatNode	9
HydroVLNode.....	10
ThermoHydroNode.....	11
DigitalSignalNode	13
Miscellaneous	14
BlackBox	14

Miscellaneous Nodes

HydroNode



Symbol

Connectors and Variables

Name	Type	Unit	Description
Pressure	V	bar	pressure at the node
Initial pressure	V	Bar	Initial pressure at the node

Parameters

Name	Value	Unit	Description
Volume	1	l	hydraulic fluid volume between the components
Temp. Difference	0	K	Deviation of the global temperature from the global system temperature
Bulk Modulus Calculation look-up table			Calculating options Calculation of the bulk-modulus with a look-up table
explicit by equation			equation based calculation
Bulk-Modulus	14000	bar	bulk-modulus of the hydraulic fluid including the surroundings at high pressure
Characteristics of Air			Correction of the bulk-modulus
Prop. undissolved Air	0.1	%	proportion of undissolved air
Polytropic exponent	1.1	-	polytropic exponent for the change of the air volume
Options			Characteristics of hoses
VolumeChange	0	%	volume change under <i>Reference</i> (parameter for hoses)
Reference	100	bar	Pressure, relating to <i>VolumeChange</i>
Limitations			

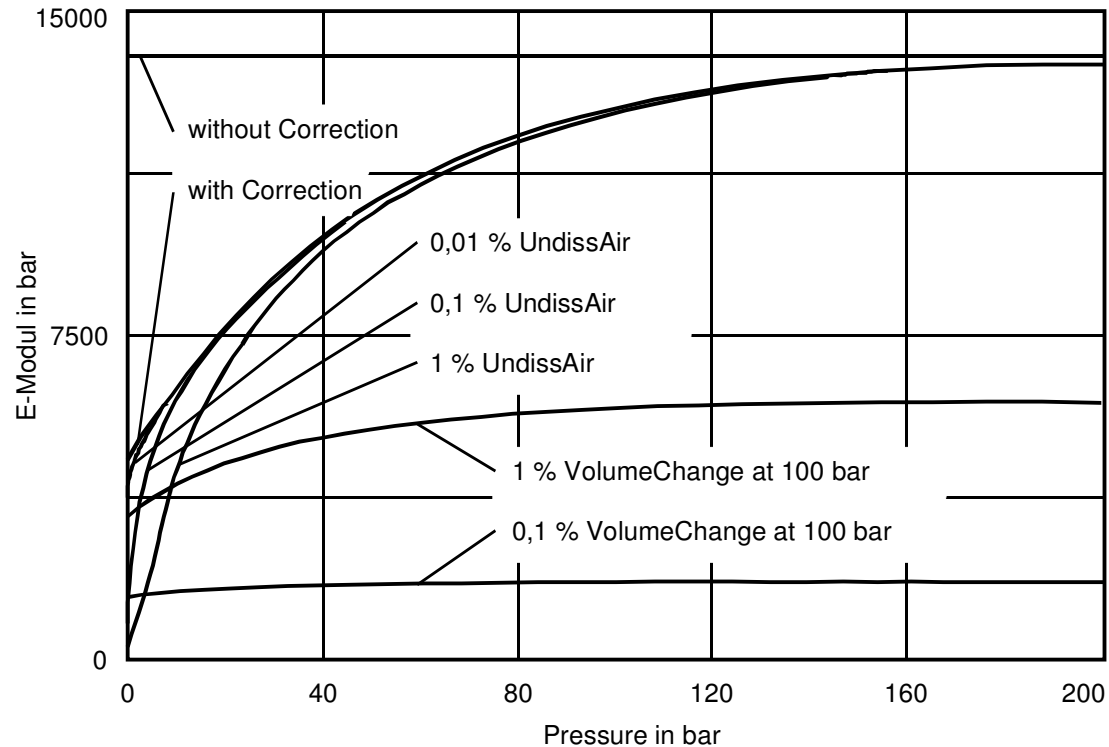
Name	Value	Unit	Description
Max. Gradient	1E99	bar/s	gradient of maximum and minimum pressure drop
Cavitation Limit	-1	bar	pressure limit, at which cavitation occurs

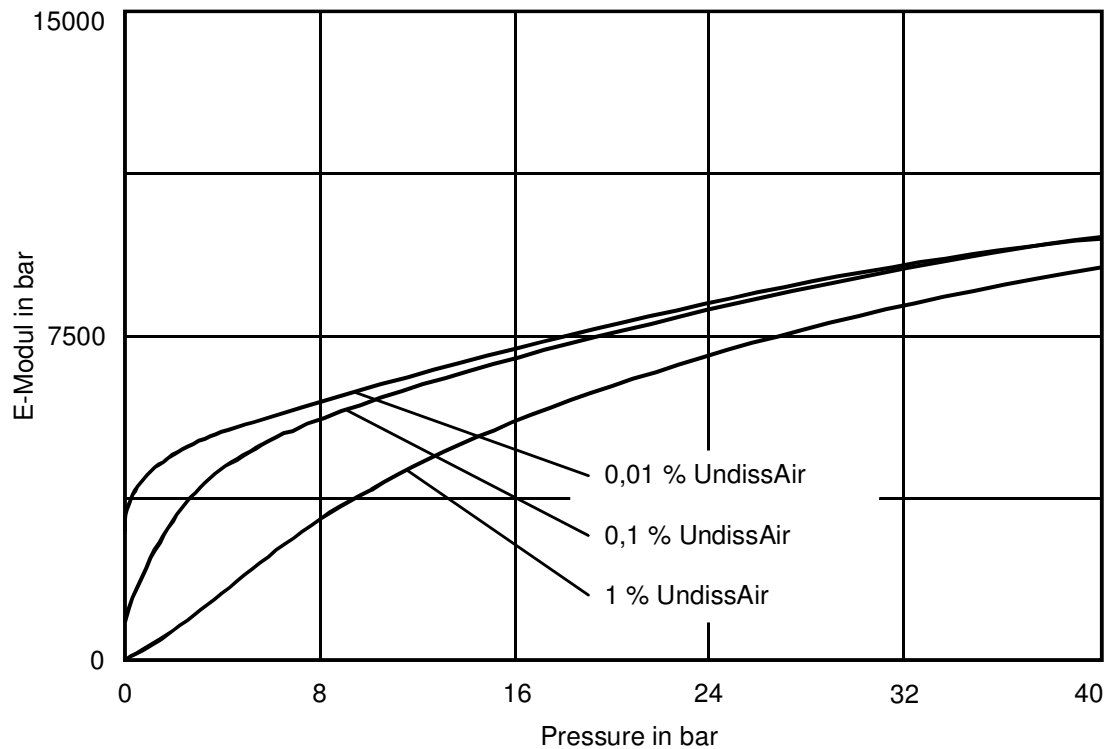
Notes

The HYDRONODE represents the volume of the hydraulics liquid between the connected components. The liquid volume consists of the volume of the lines, which connects the components, and the dead volumes. The dead volumes are those volumes, which are not able to be displaced (in e.g. valves: the volume between connection and control edge).

The parameterization of the node is done via a specific input dialog. If the *Correction* of the bulk-modulus is marked, the bulk modulus of the hydraulics liquid is corrected depending on the pressure. Otherwise, the bulk modulus remains constant.

The two following figures shows the influence of the correction of the bulk modulus with default setting (Bulk-Modulus: 14000 bar, *Polytropic exponent: 1,1*). The second figure shows an enlargement of the range of 0 to 40 bar for different air proportions.





Via the parameter Max. *GRADIENT* the gradient of the pressure raise and drop can be limited.

As many hydraulic connections as desired can be connected to a **HYDRONODE**. If a signal input is connected to a node, this connection works as a pressure sensor. If a signal output is connected to a hydraulic node, it changes into a **SIGNALNODE** (in the drawing area visible by the green color). The *Pressure* in the node is determined by the signal output.

HYDRONODES and the hydraulic lines between the components are represented in blue color.

MechTransNode



Symbol

Connectors and Variables

Name	Type	Unit	Description
x	V	-	Stroke
v	V	-	Velocity
F	V	-	Force

Parameters

Name	Value	Unit	Description
-	-	-	

Notes

A MECHTRANSNODE transmits the signals for a stroke (x), a velocity (v) and a force (F) between the mechanical connections of different components. The MECHTRANSNODE and the connecting lines between the components are represented in the drawing area in dark gray color.

MechRotNode



Symbol

Connectors and Variables

Name	Type	Unit	Description
phi	V	-	angle
omega	V	-	angular velocity
M	V	-	torque

Parameters

Name	Value	Unit	Description
-	-	-	

Notes

A MECHROTNODE transmits the signals for an angle (*phi*), an angular velocity (*omega*) and a torque (*M*) between the mechanical connections of different components. The MECHROTNODE and the connecting lines between the components are represented in the drawing area in light gray color.

SignalNode



Symbol

Connectors and Variables

Name	Type	Unit	Description
Value	V	-	transmitted signal

Parameters

Name	Value	Unit	Description
-	-	-	

Notes

A SignalNode transmits a signal between the signal connectors of different components.

As many input connectors as desired can be connected to a SignalNode, but only one output connector.

If a signal output is connected to a HydroNode, it changes into a SignalNode. The pressure in the node is determined by the signal value.

SignalNodes and the connections between the components are represented in the drawing area in green color.

PneumatNode



Symbol

Connectors and Variables

Name	Type	Unit	Description
Pressure	Pneu	bar	Pressure at the node
T	Pneu	K	Temperature at the node
Pdot	V	-	internal auxiliary variable
Tdot	V	-	internal auxiliary variable

Parameters

Name	Value	Unit	Description
Volume	1	l	Gas volume between the components
Source	0	-	Switch for activation of pressure source function

Notes

The PNEUMATNODE represents the gas volume between the connected components as an ideal capacity without any resistance behavior. The volume which can be parameterized consists of the volume of the line which connects the components and the dead volumes. The dead volumes are those gas volumes, which can not be displaced (in e.g. valves, the volume between connection and control edge). Furthermore, the correction volumes are automatically added to the node. An accumulator delivers e. g. a constant correction volume, and a cylinder a variable correction volume.

If the parameter *source* is marked, the pressure source function the node is switched on. As a result the PNEUMATNODE works as a constant pressure source and both the pressure and the temperature were adjusted over the initial values.

PNEUMATNODE and the pneumatic lines between the components are represented in the drawing area in a dark blue color.

HydroVLNode



Symbol

Connectors and Variables

Name	Type	Unit	Description
p	V	bar	pressure
Q	V	l/min	flow
A	V	-	
C	V	-	

Parameters

Name	Value	Unit	Description
-	-	-	

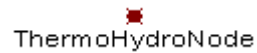
Notes

The component HYDROVLNode allows the connection of special hydraulic components without any volume.

The HYDROVLNode transmits the signals for pressure (p), flow (Q) and the variables A and C between the connectors of the components. Just two components can be connected.

The HYDROVLNodes and the hydraulic lines between the components are represented in magenta color.

ThermoHydroNode



Symbol

Connectors and Variables

Name	Type	Unit	Description
pressure	V	bar	pressure at the node
T	V	K	temperature of the volume

Parameters

Name	Value	Unit	Description
Volume	1	l	hydraulic fluid volume between the components
Temperature	293.15	K	Local temperature
Bulk Modulus Calculation look-up table			Calculating options Calculation of the bulk-modulus with a look-up table
explicit by equation			equation based calculation
Bulk-Modulus	14000	bar	bulk-modulus of the hydraulic fluid including the surroundings at high pressure
Characteristics of Air			Correction of the bulk-modulus
Prop. undissolved Air	0.1	%	proportion of undissolved air
Polytropic exponent	1.1	-	polytropic exponent for the change of the air volume
Options			Characteristics of hoses
VolumeChange	0	%	volume change under <i>Reference</i> (parameter for hoses)
Reference	100	bar	Pressure, relating to <i>VolumeChange</i>
Limitations			
Max. Gradient	1E99	bar/s	gradient of maximum and minimum pressure drop
Cavitation Limit	-1	bar	pressure limit, at which cavitation occurs

Notes

The THERMOHYDRONODE represents the volume of the hydraulics liquid between the connected components. The liquid volume consists of the volume of the lines, which connects the components, and the dead volumes. The dead volumes are those volumes, which are not able to be displaced (in e.g. valves: the volume between connection and control edge).

Beside the calculation of the pressure the temperature of the fluid is calculated in the THERMOHYDRONODE. The basis for this are heat flows that are generated or dissipated of thermo-hydraulically components.

The parameterization of the node is done via a specific input dialog. Normally the bulk-modulus depends on the fluid that is chosen in the central fluid parameters. It is corrected in dependence of pressure and temperature.

If the **Manual Setting of Bulk-Modulus** is chosen, the given bulk-modulus is used for calculation.

If the **Correction of Bulk-modulus** is marked, the bulk-modulus of the hydraulics liquid is corrected depending on the pressure. Otherwise, the bulk-modulus remains constant.

Via the parameter *Max. PressureGradient* the gradient of the pressure raise and drop can be limited.

As many hydraulic connections as desired can be connected to a THERMOHYDRONODE.

THERMOHYDRONODES and the hydraulic lines between the components are represented in dark red color.

DigitalSignalNode



Symbol

Connectors and Variables

Name	Type	Unit	Description
Wert	V	-	transmitted signal

Parameters

Name	Value	Unit	Description
-	-	-	-

Notes

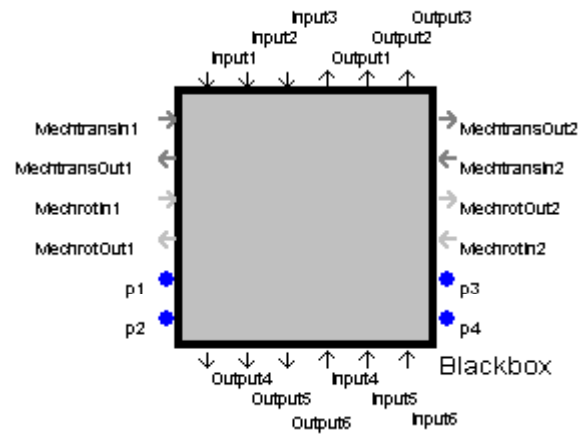
A DigitalSignalNode transmits a signal between the signal connectors of different digital components.

As many input connectors as desired can be connected to a DigitalSignalNode, but only one output connector.

SignalNodes and the connections between the components are represented in the drawing area in dark green color.

Miscellaneous

BlackBox



Symbol

Connectors and Variables

Name	Typ	Unit	Description
p1	Hydr	bar	
p2	Hydr	bar	
p3	Hydr	bar	
p4	Hydr	bar	
Input1	in	-	
Input2	in	-	
Input3	in	-	
Input4	in	-	
Input5	in	-	
Input6	in	-	
Output1	Out	-	
Output2	Out	-	
Output3	Out	-	
Output4	Out	-	
Output5	Out	-	
Output6	Out	-	
MechtransIn1	Mech	-	
MechtransIn1F	Out	N	
MechtransIn1x	In	Mm	
MechtransIn1v	In	m/s	

Name	Typ	Unit	Description
MechtransIn2	Mech	-	
MechtransIn2F	Out	N	
MechtransIn2x	In	Mm	
MechtransIn2v	In	m/s	
MechrotIn1	Mech	-	
MechrotIn1M	Out	Nm	
MechrotIn1phi	In	Rad	
MechrotIn1omega	In	rad/s	
MechrotIn2	Mech	-	
MechrotIn2M	Out	Nm	
MechrotIn2phi	In	rad	
MechrotIn2omega	In	rad/s	
MechtransOut1	Mech	-	
MechtransOut1F	In	N	
MechtransOut1x	Out	mm	
MechtransOut1v	Out	m/s	
MechtransOut2	Mech	-	
MechtransOut2F	In	N	
MechtransOut2x	Out	Mm	
MechtransOut2v	Out	m/s	
MechrotOut1	Mech	-	
MechrotOut1M	In	Nm	
MechrotOut1phi	Out	rad	
MechrotOut1omega	Out	rad/s	
MechrotOut2	Mech	-	
MechrotOut2M	In	Nm	
MechrotOut2phi	Out	rad	
MechrotOut2omega	Out	rad/s	

Parameter

Name	Value	Unit	Description
Parameter1	0	-	
Parameter2	0	-	
Parameter3	0	-	
Parameter4	0	-	
Parameter5	0	-	
Parameter6	0	-	
Parameter7	0	-	
Parameter8	0	-	
Parameter9	0	-	

Miscellaneous

Name	Value	Unit	Description
Parameter10	0	-	

Notes

The component BLACKBox is an element in DSHplus to interface with the external functions. For more details please look at the User manual.