

# Timber Column HO1+

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#### Basic Documentation – Overview

In addition to the individual program manuals, you will find basic explanations on the operation of the programs on our homepage <u>www.frilo.com</u> in the Campus-download-section.



## Application options

The HO1+ application is suitable for the design of timber columns.

Available are single-piece (circular, rectangular) and multi-piece cross sections that are connected to each other in a yielding manner. All partial cross sections of columns and spacers are the same and have the same moduli of elasticity.

#### Available standards

- EN 1995
- DIN EN 1995
- ÖNORM EN 1995
- NTC EN 1995
- BS EN 1995

#### Available structural systems:

- Cantilever columns
- Hinged columns with and without cantilever

#### Loads

Vertical loads: concentrated loads with eccentricities in the directions of both main axes.

Horizontal loads: distributed loads, block loads, trapezoidal loads, concentrated loads; all loads can apply in the direction of the main axes and with eccentricities.

#### Hot design

For one-part / composite cross-sections, verifications under fire exposure are available.

#### Calculation

Internal forces are determined according to theory 1st order. The design is carried out according to EN 1995 chapter 6. The stability verifications are carried out according to the equivalent bar method.

For the calculation of composite cross sections with yielding connections, the cross sectional properties are calculated for an ideal individual member. Subsequently, internal forces and deformations (with and without creep) are determined on the ideal member. In addition, the internal forces in the individual cross sections are determined.

The verifications are carried out on the ideal member and on the end cross sections. Verifications of the connecting components between the individual cross section parts (wood spacers, diagonal struts, fasteners) are performed in the connection.

Note: The calculation of composite, flexibly connected cross-sections (EN 1995 Annexes B and C) is approximation, mainly for hinged columns with predominantly axial force and small transverse loads from wind. Complex systems may in certain circumstances not sufficiently accurately recorded and in individual cases require expert control.

#### Fasteners

- Round nails
- Bolts
- Glue
- Dowel pins
- Fit bolts
- Special dowels





### Data entry

The definition of properties and control parameters is done in the menu of the left screen section. You can check the effect of the entered values in the graphical representation on the right screen section.

Fundamental information on the data-entry area and the data-entry options in the 3d graphical user interface is available in the document "Basic Operating Instructions-PLUS".

#### Definition wizard

The wizard is automatically launched when you start the software. It supports the user in defining the most important parameters for a new item. With the help of the wizard, you can quickly define a structural system and gain a first impression of the results. Subsequently, you can customize secondary parameters in a second step.

*Note:* You can disable the automatic start of the wizard via the corresponding option on the bottom of the window.

#### Basic parameters

Select the desired <u>standard</u>, the material (Softwood, Hardwood, Glulam or STEICO laminated veneer lumber), the usage class and the consequence class.

### Structural system

#### Column type and supports

Column type see ill.

L

Height of span on bottom and projection on top.

#### Supports

Here you specify the translational and torsional springs in the direction of and around the x and y axis for the upper and lower bearings. For a rigid support mark the appropriate option.

Furthermore, additional intermediate supports can be defined in the center of the column, the third and quarter points or at a user-defined position (coordinate x).

See also table toolbar.

	Properties			ą	
е	Basic Parameter	S		۹ 🕲	
in	Loads				
	⊕. Design				
	Basic_Parameters			0	
	Design code	BS	EN 1995:2012	-	
	Туре	Soft	wood	-	
h	Material code	Soft	wood		
1.	Strength class	Glula	am		
	Service Class	2		-	
	Consequence Class	CC :	2	-	
ing	Remarks			0	
	to System				
	to Result				
Prope	erties			<b></b>	Gr
Ba	asic Parameters			90	A.1
	vstem				BS
	Foot Binder				So
Lo	bads				
+ De	esign utput				
Static	Model			0	
Colum	n type		Common	- 📝	
Height	of Field below	L	Simply supporte	d	
Height	of Cantilever	L	restraint-hinged	nn column	
Bearin	ng upper		restraint-hinged Restraint-hinged	column bel d column at	low bove
Shift S	pring	Ту	Common		_
Shift S	pring	Tz		rigid 🔽	
Torsio	nal Spring about Axis	Rx		rigid 🔽	
Torsio	nal Spring about Axis	Ry	[kNm/rad]	0.0	
Torsio	nal Spring about Axis	Rz	[kNm/rad]	0.0	
Bearir	ng lower			0	
Shift S	pring	Ту		rigid 🔽	
Shift S	pring	Tz		rigid 🔽	
Torsio	nal Spring about Axis	Ry		rigid 🔽	
Torsio	nal Spring about Axis	Rz		rigid 🔽	
Inner	support			0	
Inner s	support z-direction		User defined	-	JI.
Inner s	support y-direction		User defined	•	
Inner	support 🛛 🕥 1.	/1	🗅 🗟 🗙 🗯	i	L
Coordi	nate	x	[m]	0.50	
Shift S	pring	Ту		rigid 🔽	
Shift S	pring	Tz		rigid 🔽	
Torsio	nal Spring about Axis	Rx		rigid 🔽	
Torsio	nal Spring about Axis	Ry	[kNm/rad]	0.0	
lorsio	nal Spring about Axis	Rz	[kNm/rad]	0.0	



Jointed with Packs

Direct jointed Beams

Circle Rectangle

Softwood

C24

[mm]

EN 338:2016

Connectors C1

b

h

a [cm]

L2 [mm]

L1

0

+

20.0

0

•

•

•

420.0

760.0

0

•

0.0 0.0 2 140.0 1 140.0

Cross Section

Width

Height Clear Distance

Туре

Height

Distance

Fastener

Туре

Material code

Strength class

User defined kc90

Cross Section Type

Cross Section Count n

Cross-connections

#### Cross section

Type of cross sectio	n
	<ul> <li>Circular</li> <li>Rectangular</li> <li>Multi-piece, direct connection</li> <li>Multi-piece with wood spacers</li> <li>Tip: After having selected the type of cross section, the corresponding data-entry fields are displayed in the dialog area on bottom.</li> </ul>
n	number of cross sections (2, 3 and/or 4)
d	diameter with circular cross sections
b/h	cross sectional dimensions of a rectangular column
а	clear distance of the column parts

#### Cross connections

Type/Material	a selection list is displayed.	Selection		C1 dc=50 M16-4.6
Strength class	Strengths and stiffnesses can be customized if	Sunk	t	[mm]
o il oligiti oldoo	necessary. The dialog for changing the values can be	Supporting action bo	lt	
	called up by pressing the F5 key in the input field of	Count along	n	
	the strength class. Basis of the design is the material	Distance along	а	[mm]
	derived from the standard.	Count transverse	n	
kc90	Optional entry of a value that better suits the situation.	Distance transverse	а	[mm]
L1	distance of the connecting components (in the z-direction representation)	, see also the gra	apł	nical
L2	height of the individual connecting components			

#### Fasteners

The corresponding data-entry fields are displayed when you select a multiplece cross section.

Туре	first select the type of fasteners (nails, bolts, etc.). The
	corresponding data-entry fields are displayed after the
	selection of the type:
	- Round nails
	- Bolts
	- Glue
	- Dowel pins
	- Fit bolts
	- Special dowels
	The corresponding data-entry fields are displayed after the
	selection of the type.

Fastener Туре Connectors C1 T Round Nails Selection Screws Sunk t Glue Dowel Pin Fit Bolt Supporting action bolt Count along Connectors A1 n Connectors A2 Distance along а Connectors A3 Connectors A4 Count transverse n Connectors A5 Distance transverse a Connectors A6 Type of Fasteners Connectors C3 Connectors C5 Connectors C6 Connectors C8 Connectors C10

Selection click on the *selected* button to access the fastener selection dialog. After having selected the type, the corresponding parameters displayed with defaults.

You can edit and customize the parameter setting if required. Click on the individual data-entry fields, options or selection lists to display a brief description in the <u>information area</u> (below the data-entry fields).



#### Foot binder (sleeper)

Tick this option to define a foot binder

Direction select the direction of the foot binder.

Specify the width, height, projections and the material of the foot binder.

#### Load-bearing capacity under transverse compression

Threshold pressure kc,90 automatically: - H01+ determines kc,90.

User defined kc90:

- The user can enter a value which suits better to the situation.

#### Load distribution plate

Component for load balancing, for example, a steel plate to reduce the compression.

Without design, without consideration of eccentric load position during compression.

Foot Binder			0
Foot Binder			
Preselection		Timber	-
Туре		Softwood	-
Material code		EN 338:2016	-
Strength class		C24	-
Direction		Y	-
Width	b	[cm]	16.0
Height	h	[cm]	6.0
Edge distance left	а	[cm]	20.0
Edge distance right	а	[cm]	20.0
Capacity transverse Pres	ssure	User defined ko	90 -
Coefficient k	c90		1.00
Load distribution plate			





#### Loads

Self-weight	If you tick this option, the self-weight of the components is automatically taken into account.
Plump line offset h/	specify the plump line offset/inclination. Example: for h/200 enter the value "200". Enter "0", if there is no plump line offset.

#### Load cases

Define the first load case directly in the data-entry mask.

Add additional load cases with the help of the load case toolbar: Loads  $0 \frac{1}{3} \times 2 \frac{1}{3} = 2$ 

- see Data entry via tables (basic operating instructions)

To add a load case always set up a new load case via the button (an empty load case mask is displayed each time).

Loads							0
Consider Dead Lo	oad aut	omaticall	Y				V
Loads	0	1/3		×	1		2
Load Type			CO	ncenti	rated loa	ad	•
Direction		Be	X				•
Load value		Q1	[k]	1]	4	0.0	ψ
Distance		a1	[m]			2	.75
Factor		f				1	.00
Eccentricity Y		ey	[m]			0	.00
Eccentricity Z		ez	[m]			0	.00
Action			Pe	mane	ent loads	s	•
Simultaneous Gro	pup						0
Alternative Group	)						0
Info Text			-				

Alternatively, add additional load cases via the load case table, which is accessible on the "Loads" tab (below the graphic screen).

			10.00
Type of load	concentrated, uniformly distributed, block or trapezoida Note: The corresponding data-entry fields are displayed of the selected load types on the bottom of the screen.	al load. I for each	1.17
Direction	the direction of action of the load: X/Y/Z – the load is s the 3d GUI and you can check your specifications - <i>tip:</i> <i>different view options</i> .	shown in <i>use the</i>	****
Ordinate Q1	load value Q1 (lower load value with trapezoidal loads)	. –	2
	By clicking on the arrow icon  you can access a load summary - see the description of the LOAD+ applicatio	d value	08E
Distance a1	distance of the load or the lower load value to the base	e point	
Load value Q2	upper load value with trapezoidal loads	10.00-	16
Length L2	with block and trapezoidal loads: length of the load	-	
Factor f	specification of a factor that multiplies the load value. e.g. for entering a line load = area load $[kN/m^2] *$ factor influence width [m] = kN/m.	Useful z v x	20 \$15,8,20+
Action group	select an action group from a list		16 <b>1</b> 6
Concurrent group	loads of a particular action group can be defined as "al	ways acting simultan	eously"
Alternative group	different variable load cases with similar actions can b case group via the allocation of an <u>alternative group nu</u>	e assigned to an alter <u>umber</u> . Only the decisi	rnative load ive load case
	of this alternative load case group is invoked in the superposition.	group of actions 1	group of actions 2
Info text	you can add a comment to each load case.		
		simultaneous group 1	simultaneous group 2

*Tip: A description is displayed in the status line each time you click into a particular input field.* 

alternative group 1



9.0

#### Design

#### Special options

Win: kmod	for wind (EN 1995), kmod(short) is used.	Properties	
	According to some NA's averaged kmod(short/very short) can be taken into account. Tick the option to calculate the averaged value according to NA.	Basic Parameters     System     Loads     Design     Buckling Leng	
G-portion	determines how the portion of permanent loads for the stability are calculated in each combination:	Fire Protection Fire Protection 	
	- no G-portion	Special Options	
	- permanent loads - permanent and quasi-permanent loads	With Wind: kmod ave	
		Stability (G-portion)	
		Combinatorial Anal	
Combinatorics		Wind Zone 3 or 4	
Wind zono 2 or 4	in the wind zones 3 and 4 snow must not be	Earthquake: Psi2(snov	
	taken into account as accompanying action	Fastener holes	
	when wind is the leading action.	Consider holes	
Earthquake: Psi2	in some countries. Psi2 for snow must be set	Deformation Limit	
	to 0.5 in earthquake combinations.	Deflection check	
	·	Winst	
Eastener holes		W net,fin	

System     Loads     Design     Buckling L     Fire Protec     Output	engths tion		Ť
Special Options			0
With Wind: kmod a	veraged		<b>V</b>
Stability (G-portion)		Depending on permanent	-
Combinatorial Ar	nalysis		0
Wind Zone 3 or 4			
Earthquake: Psi2(s	now)=0.5		
Fastener holes			0
Consider holes		Always	•
Deformation Lim	it	No In tensile stresses in the no	on-we
Deflection check		Always	orr me
W inst	h/	30	0.00
W net,fin	h/	30	0.00
W fin	h/	20	0.00
Set defaults		w inst = 1/300   w fin	2

For shear- and stress analysis of the end sections of the composite cross sections fastener holes can be taken into account.

no:	Not taken into account
always:	Holes will be taken into account
in tensile stresses:	Only with tensile stresses in the weakened crosssection the fastener holes will be taken into account. We assume that the steel in compression closes the hole positively. Areas without steel generally will be taken into account.

#### **Deformation limits**

Deformation check W inst	checking this option triggers the verification and output of the deformation resistance. limitation of deformation, elastic portion, for serviceability verifications.
W fin	limitation of deformation, elastic portion including creep, for serviceability verifications.
Wx net fin	limitation of deformation, elastic portion including creep and minus overhang (= 0), for serviceability verifications.
W (net)fin (STR)	limitation of deformation, elastic portion including creep, for load bearing capacity verifications.

Only the options required for the selected NA are visible.

In the output of the proofs, all four proofs always appear. proofs which are not required are issued only with deformation, but without utilization and permissible limit value.

The button "Set defaults" fills the input fields with useful default values within the limits of the standard/NA.

Note: EN 1995 and the associated NA may allow some bandwidth for the deflection limits.



#### Buckling lengths

0 0		Calculation of Buckling	Lengths	0
Determination	Eigenvalue: Calculation with bifurcation loads factor from framework application for each direction and every member section (recommended). System length: Calculation on rigid supports conditions and their distances for each direction and each member section	Determination by	Eigenvalue	•
		User-defined buckling	Eigenvalue System length	
		Flexural buckling sky		
		Flexural buckling skz		
		Lateral torsion buckling		
		n (clearly, simplified)		

The effective length sb is always be determined on the supports conditions.

#### User defined buckling lengths

Tick the options to show up the entry fields for sky/skz/sb. This allows you to overwrite each value from the automatic settings set above.

Each entry is valid for the whole column length.



#### Fire protection

For single-piece cross sections: tick the fire action option to display the corresponding data-entry fields and enable the calculation.

Fire resistance	burn-off period in minutes.
Same on all sides	disable this option to define fire action individually for <u>each</u> side.
Lining	none, GK A,B , GK F, GK F > 1,000 kg/m <sup>3</sup>
Number of plies	up to 3 plies
Ply thickness	specification in [mm]
Calculation method	entry of the tf-value for the failure time or HFA = Holzforschung Austria
Failure time	specify the tf-value in [min]

#### User defined charring rates

User defined charring rates override the charring rates of the standard. They are used for all materials (woods). A value of 0 means no fire stress.

For proofs where the assignment of the charring rate to the sides is not possible, the largest value is used.

### Output

The scope of output for text and graphics can be defined via the output profile.

Tick the output options you want.

#### Output as a PDF document

Via the <u>Document</u> tab, you can display the document in PDF and print it. See also <u>Output and printing.pdf</u>

### Reference literature

/1/ EN 01/01/1995:2004, EN 02/01/1995:2004, EN 1991-1-4:2006/AC:2008

Properties			Ф
Basic Parameters     System     Loads     Design     Buckling Lengths     Fire Protection     Output			۹ 🕲
Fire Protection			۵
Fire Stress			<b>V</b>
Fire Resistance		[min]	30
All Sides equal			<b>V</b>
Cladding			0
Cladding		GFB >1000kg/m <sup>3</sup>	-
Layer Count		1	-
Layer Thickness		[mm]	12.5
Calculating Method	tF	Input Value	-
Failure Period	tF	[min]	30.0
User defined charring rates		۵	
User defined charring rate	s		

Properties	<b>4</b>
Basic Parameters	0.0
System	~ w
Loads	
Design	
- Output	
Text	
Graphics	

Output		0
Output layout	Short Term	-
System and Loads		0
System		V
Remarks to System		1
Material Values		
Section Properties		
Partial Factors		
Combination Factors		
Loads		V
Load Cases		0
Combinations		0
Design		0