

FreeCAD for Electronics Applications

Practical Introduction to 3D Modeling from Enclosure to Front Panel



Dr. Thomas Duden

FreeCAD for Electronics Applications

Practical Introduction to 3D Modeling from
Enclosure to Front Panel



Dr. Thomas Duden

● This is an Elektor Publication. Elektor is the media brand of
Elektor International Media B.V.
PO Box 11, NL-6114-ZG Susteren, The Netherlands
Phone: +31 46 4389444

● All rights reserved. No part of this book may be reproduced in any material form, including photocopying, or storing in any medium by electronic means and whether or not transiently or incidentally to some other use of this publication, without the written permission of the copyright holder except in accordance with the provisions of the Copyright Designs and Patents Act 1988 or under the terms of a licence issued by the Copyright Licensing Agency Ltd., 90 Tottenham Court Road, London, England W1P 9HE. Applications for the copyright holder's permission to reproduce any part of the publication should be addressed to the publishers.

● Declaration

The author, editor, and publisher have used their best efforts in ensuring the correctness of the information contained in this book. They do not assume, and hereby disclaim, any liability to any party for any loss or damage caused by errors or omissions in this book, whether such errors or omissions result from negligence, accident or any other cause. All the programs given in the book are Copyright of the Author and Elektor International Media. These programs may only be used for educational purposes. Written permission from the Author or Elektor must be obtained before any of these programs can be used for commercial purposes.

● British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

● **ISBN 978-3-89576-574-2** Print
ISBN 978-3-89576-575-9 eBook

● © Copyright 2023: Elektor International Media B.V.
Editors: Alina Neacsu; Jan Buiting MA
Prepress Production: D-Vision, Julian van den Berg
Print: Ipskamp Printing, Enschede (NL)

Elektor is the world's leading source of essential technical information and electronics products for pro engineers, electronics designers, and the companies seeking to engage them. Each day, our international team develops and delivers high-quality content - via a variety of media channels (including magazines, video, digital media, and social media) in several languages - relating to electronics design and DIY electronics. www.elektormagazine.com

Contents

Chapter 1 • Introduction	9
Chapter 2 • Starting Out With FreeCAD	11
2.1 Extending the Functionality of FreeCAD	11
2.1.1 AddOns	12
2.1.2 Workbenches	12
2.1.3 Macros	12
2.1.4. Starting the new Extensions	13
2.2 Workbenches and Context Menus	13
2.3 Automatic Workbench Switchover	13
2.4 The Tree View	14
2.5 The Output Window	15
Chapter 3 • Project Organization	16
3.1 Std-Part-Container versus Body	16
3.1.1. Placement versus Attachment	17
3.1.2 Assembly or Std-Part-Container?	18
3.2 The Topological Naming Problem	18
3.3 Sketches and Datum Objects	18
3.4 Other Strategies to Avoid the Topological Naming Problem	19
3.5 Avoidance of Repetitive Work by Project Structure	19
3.6 Always Start with the Std-Part-Container	19
3.7 Shape Binder and SubShapeBinder	20
3.7.1 The Shape Binder (blue)	21
3.7.2 The SubShapeBinder (green)	22
3.7.3 How to Reference Cut-and-Pasted Std-Part-Containers	22
3.7.4 Redefining the References after Paste	24
Chapter 4 • Creating Parts — First Steps	28
4.1 How Much Fidelity is Needed?	28
4.2 Simple Parts	28
4.2.1 The Simple Spacer, Step by Step	28
4.3 Color versus Appearance	35

4.4 Compound Parts	36
4.4.1 Fasteners for the Simple Spacer	36
4.5 Parts Packaged with Fasteners Save Time.	53
4.6 Displaying and Hiding Elements.	53
4.7 More Examples of Compound Parts	53
Chapter 5 • Working with Sheet Metal	54
5.1 Example: 9 V 6LR61 Battery Holder.	54
5.2 Creating the Unfold	69
5.3 Exporting the Unfold	71
5.4 Creating a Drawing of the Battery Holder	74
5.5 Create a Plan for the Bending Machine	83
5.6 Example Photos of the Battery Holder	86
Chapter 6 • Assemblies	88
6.1 “Assembly” Workbenches or Std-Part Container?.	88
Chapter 7 • An Assembly Example: The Elektor ESR Meter as a Front Panel Project.	89
7.1 Project Organization	89
7.2 Preparation – Starting the New Project Tree	89
7.3 Modeling the Front panel	90
7.4 Insertion of the Rotary Switch.	93
7.5 Generate an Associative Footprint with the SubShapeBinder.	96
7.6 The Knob and its Place in the Tree View	101
7.7 Testing the Associativity	102
7.8 The Binding Posts	105
7.9 Placement of the Panel Meter	119
7.10 Placing Components to the Rear Surface: The Anchor Plates.	123
7.11 Inserting the Battery Holder	129
7.12 Inserting the Circuit Board	134
Chapter 8 • Finalizing the Front Panel with Graphic Elements	148
8.1 Drawing Guide Lines	148
8.1.1 Sketch versus Path	148
8.1.2 Guide Lines for the Rotary Switch	148

8.2 A Guide Line for the Potentiometer	159
8.3 The Engravings	165
8.4 The 'TechDraw' Workbench and the DXF Export.	170
Chapter 9 • A More Complex Design: The Lab Transformer	174
9.1 The Front Panel	174
9.1.1 Setting up File and Std-Part-Container	174
9.1.2 Creating the Panel Sheet	175
9.1.3 Placement of the Components	183
9.1.4 Punching the Holes	193
9.1.5 Adding the Engraving	199
9.2 The Rear Panel	203
9.2.1 Prepare File and Std-Part-Containers.	203
9.2.2 Placing the Components	204
9.2.3 Punching the Holes	207
9.2.4 Adding the Engraving	210
9.3 The Chassis	211
9.3.1 Preparation of File and Std-Part-Container.	211
9.3.2 Bolts for the Chassis Sheet	224
9.4 Assembling the Chassis, Front and Rear Panel.	231
9.5 Placing the Transformer	239
9.6 Placing the Anchor Plates	243
9.7 Associative Generation of the Sheet Metal Cover	252
9.7.1 Where to Pick the References	252
9.7.2 Creating the Cover	253
9.8 Where do the Fasteners Belong?	278
9.8.1 Fasteners for the Cover	278
9.8.2 Fasteners for the Chassis.	282
9.8.3 Fasteners for Front and Rear Panel	285
9.9 Creating the Unfold of the Cover	294
9.10 Example Photos – Meeting the Reality	294
9.11 What to do Next	294
9.12 Component Libraries – Design Recycling.	295

- 9.13 Importing STEP Model Files.295
- Chapter 10 • FreeCAD and KiCad296**
- 10.1 Importing Data from KiCad to FreeCAD296
- 10.2 Creating 3D Models for KiCad296
- Chapter 11 • Community Resources.302**
- Sources.303**
- Appendix A • The Rotary Switch304**
- Appendix B • The Potentiometer327**
- Appendix C • The Banana Jack340**
- Appendix D • The Pilot Lamp362**
- Appendix E • The Toggle Switch.400**
- Appendix F • The IEC Power Inlet433**
- Appendix G • The 9 V Block (6F22) Battery458**
- Index474**