**Mestra**

Triggers & Programs

Michel Keijzers, © 2017

# History

Table 2: History

|  |  |
| --- | --- |
| **Date/period** | **Actions** |
| Nov 8, 2017 | Initial Version |

# Table of Contents

Contents

[Open Issues / Early TODOs 2](#_Toc489634921)

[History 2](#_Toc489634922)

[Abbreviations 2](#_Toc489634923)

[Glossary 2](#_Toc489634924)

[Useful Links 3](#_Toc489634925)

[Table of Contents 4](#_Toc489634926)

[List of Tables 13](#_Toc489634927)

[List of Figures 14](#_Toc489634928)

[1 Introduction 15](#_Toc489634929)

[1.1 System Boundaries 15](#_Toc489634930)

[1.2 One or more Arduinos 15](#_Toc489634931)

[1.3 Devices 15](#_Toc489634932)

[1.3.1 Device Descriptions 16](#_Toc489634933)

[1.4 Chapter Division 16](#_Toc489634934)

[2 Generic 18](#_Toc489634935)

[2.1 AP, Hardware and Software 18](#_Toc489634936)

[2.1.1 Requirements 18](#_Toc489634937)

[2.1.2 Design 18](#_Toc489634938)

[2.2 Generic Hardware 18](#_Toc489634939)

[2.2.1 Requirements 18](#_Toc489634940)

[2.2.2 Design 19](#_Toc489634941)

[2.3 Generic Software 25](#_Toc489634942)

[2.3.1 Requirements 25](#_Toc489634943)

[2.3.2 Design 27](#_Toc489634944)

[2.4 Testing 28](#_Toc489634945)

[2.4.1 Unit Tests 28](#_Toc489634946)

[2.4.2 Integration Tests 28](#_Toc489634947)

[3 Application (AP) 29](#_Toc489634948)

[3.1 Requirements 29](#_Toc489634949)

[3.2 Design 29](#_Toc489634950)

[3.2.1 Programming Language 29](#_Toc489634951)

[3.3 Testing 29](#_Toc489634952)

[3.3.1 Unit Tests 29](#_Toc489634953)

[3.3.2 Integration Tests 29](#_Toc489634954)

[4 Controller 30](#_Toc489634955)

[4.1 Generic 30](#_Toc489634956)

[4.1.1 Requirements 30](#_Toc489634957)

[4.2 Hardware 30](#_Toc489634958)

[4.2.1 Requirements 30](#_Toc489634959)

[4.2.2 Inputs/Outputs 30](#_Toc489634960)

[4.2.3 Design 30](#_Toc489634961)

[4.2.4 Breadboard Layout 32](#_Toc489634962)

[4.2.5 Proto Layout 32](#_Toc489634963)

[4.2.6 Component List 33](#_Toc489634964)

[4.3 Software 33](#_Toc489634965)

[4.3.1 Requirements 33](#_Toc489634966)

[4.3.2 Design 33](#_Toc489634967)

[4.3.3 Memory Usage 33](#_Toc489634968)

[4.3.4 Timing Performance 34](#_Toc489634969)

[4.4 Testing 34](#_Toc489634970)

[4.4.1 Unit Tests 34](#_Toc489634971)

[4.4.2 Integration Tests 34](#_Toc489634972)

[5 Audio 36](#_Toc489634973)

[5.1 Generic 36](#_Toc489634974)

[5.1.1 Requirements 36](#_Toc489634975)

[5.2 Hardware 36](#_Toc489634976)

[5.2.1 Requirements 36](#_Toc489634977)

[5.2.2 Inputs/Outputs 36](#_Toc489634978)

[5.2.3 Design 36](#_Toc489634979)

[5.2.4 Breadboard Layout 36](#_Toc489634980)

[5.2.5 Proto Layout 36](#_Toc489634981)

[5.2.6 Component List 36](#_Toc489634982)

[5.3 Software 36](#_Toc489634983)

[5.3.1 Requirements 36](#_Toc489634984)

[5.3.2 Design 36](#_Toc489634985)

[5.3.3 Memory Usage 36](#_Toc489634986)

[5.3.4 Timing Performance 36](#_Toc489634987)

[5.4 Testing 37](#_Toc489634988)

[5.4.1 Unit Tests 37](#_Toc489634989)

[5.4.2 Integration Tests 37](#_Toc489634990)

[6 DMX 38](#_Toc489634991)

[6.1 Generic 38](#_Toc489634992)

[6.1.1 Requirements 38](#_Toc489634993)

[6.2 Hardware 38](#_Toc489634994)

[6.2.1 Requirements 38](#_Toc489634995)

[6.2.2 Inputs/Outputs 38](#_Toc489634996)

[6.2.3 Design 38](#_Toc489634997)

[6.2.4 Breadboard Layout 38](#_Toc489634998)

[6.2.5 Proto Layout 38](#_Toc489634999)

[6.2.6 Component List 38](#_Toc489635000)

[6.3 Software 38](#_Toc489635001)

[6.3.1 Requirements 38](#_Toc489635002)

[6.3.2 Design 38](#_Toc489635003)

[6.3.3 Memory Usage 38](#_Toc489635004)

[6.3.4 Timing Performance 38](#_Toc489635005)

[6.4 Testing 39](#_Toc489635006)

[6.4.1 Unit Tests 39](#_Toc489635007)

[6.4.2 Integration Tests 39](#_Toc489635008)

[7 Drum Pad 40](#_Toc489635009)

[7.1 Generic 40](#_Toc489635010)

[7.1.1 Requirements 40](#_Toc489635011)

[7.2 Hardware 40](#_Toc489635012)

[7.2.1 Requirements 40](#_Toc489635013)

[7.2.2 Inputs/Outputs 40](#_Toc489635014)

[7.2.3 Design 40](#_Toc489635015)

[7.2.4 Breadboard Layout 40](#_Toc489635016)

[7.2.5 Proto Layout 40](#_Toc489635017)

[7.2.6 Component List 40](#_Toc489635018)

[7.3 Software 40](#_Toc489635019)

[7.3.1 Requirements 40](#_Toc489635020)

[7.3.2 Design 40](#_Toc489635021)

[7.3.3 Memory Usage 40](#_Toc489635022)

[7.3.4 Timing Performance 40](#_Toc489635023)

[7.4 Testing 41](#_Toc489635024)

[7.4.1 Unit Tests 41](#_Toc489635025)

[7.4.2 Integration Tests 41](#_Toc489635026)

[8 Drums Trigger 42](#_Toc489635027)

[8.1 Generic 42](#_Toc489635028)

[8.1.1 Requirements 42](#_Toc489635029)

[8.2 Hardware 42](#_Toc489635030)

[8.2.1 Requirements 42](#_Toc489635031)

[8.2.2 Inputs/Outputs 42](#_Toc489635032)

[8.2.3 Design 42](#_Toc489635033)

[8.2.4 Breadboard Layout 42](#_Toc489635034)

[8.2.5 Proto Layout 42](#_Toc489635035)

[8.2.6 Component List 42](#_Toc489635036)

[8.3 Software 42](#_Toc489635037)

[8.3.1 Requirements 42](#_Toc489635038)

[8.3.2 Design 42](#_Toc489635039)

[8.3.3 Memory Usage 42](#_Toc489635040)

[8.3.4 Timing Performance 42](#_Toc489635041)

[8.4 Testing 43](#_Toc489635042)

[8.4.1 Unit Tests 43](#_Toc489635043)

[8.4.2 Integration Tests 43](#_Toc489635044)

[9 GUI 44](#_Toc489635045)

[9.1 Generic 44](#_Toc489635046)

[9.1.1 Requirements 44](#_Toc489635047)

[9.2 Hardware 44](#_Toc489635048)

[9.2.1 Requirements 44](#_Toc489635049)

[9.2.2 Inputs/Outputs 44](#_Toc489635050)

[9.2.3 Design 44](#_Toc489635051)

[9.2.4 Breadboard Layout 44](#_Toc489635052)

[9.2.5 Proto Layout 44](#_Toc489635053)

[9.2.6 Component List 44](#_Toc489635054)

[9.3 Software 44](#_Toc489635055)

[9.3.1 Requirements 44](#_Toc489635056)

[9.3.2 Design 44](#_Toc489635057)

[9.3.3 Memory Usage 44](#_Toc489635058)

[9.3.4 Timing Performance 44](#_Toc489635059)

[9.4 Testing 45](#_Toc489635060)

[9.4.1 Unit Tests 45](#_Toc489635061)

[9.4.2 Integration Tests 45](#_Toc489635062)

[10 Microphones 46](#_Toc489635063)

[10.1 Generic 46](#_Toc489635064)

[10.1.1 Requirements 46](#_Toc489635065)

[10.2 Hardware 46](#_Toc489635066)

[10.2.1 Requirements 46](#_Toc489635067)

[10.2.2 Inputs/Outputs 46](#_Toc489635068)

[10.2.3 Design 46](#_Toc489635069)

[10.2.4 Breadboard Layout 46](#_Toc489635070)

[10.2.5 Proto Layout 46](#_Toc489635071)

[10.2.6 Component List 46](#_Toc489635072)

[10.3 Software 46](#_Toc489635073)

[10.3.1 Requirements 46](#_Toc489635074)

[10.3.2 Design 46](#_Toc489635075)

[10.3.3 Memory Usage 46](#_Toc489635076)

[10.3.4 Timing Performance 47](#_Toc489635077)

[10.4 Testing 47](#_Toc489635078)

[10.4.1 Unit Tests 47](#_Toc489635079)

[10.4.2 Integration Tests 47](#_Toc489635080)

[11 MIDI 48](#_Toc489635081)

[11.1 Requirements 48](#_Toc489635082)

[11.2 Hardware 48](#_Toc489635083)

[11.2.1 Requirements 48](#_Toc489635084)

[11.2.2 Inputs/Outputs 48](#_Toc489635085)

[11.2.3 Design 48](#_Toc489635086)

[11.2.4 Breadboard Layout 50](#_Toc489635087)

[11.2.5 Proto Layout 50](#_Toc489635088)

[11.2.6 Component List 50](#_Toc489635089)

[11.3 Software 50](#_Toc489635090)

[11.3.1 Requirements 50](#_Toc489635091)

[11.3.2 Design 50](#_Toc489635092)

[11.3.3 Memory Usage 51](#_Toc489635093)

[11.3.4 Timing Performance 52](#_Toc489635094)

[11.4 Testing 52](#_Toc489635095)

[11.4.1 Unit Tests 52](#_Toc489635096)

[11.4.2 Integration Tests 52](#_Toc489635097)

[12 Proximity 54](#_Toc489635098)

[12.1 Generic 54](#_Toc489635099)

[12.1.1 Requirements 54](#_Toc489635100)

[12.2 Hardware 54](#_Toc489635101)

[12.2.1 Requirements 54](#_Toc489635102)

[12.2.2 Inputs/Outputs 54](#_Toc489635103)

[12.2.3 Design 54](#_Toc489635104)

[12.2.4 Breadboard Layout 54](#_Toc489635105)

[12.2.5 Proto Layout 54](#_Toc489635106)

[12.2.6 Component List 54](#_Toc489635107)

[12.3 Software 54](#_Toc489635108)

[12.3.1 Requirements 54](#_Toc489635109)

[12.3.2 Design 54](#_Toc489635110)

[12.3.3 Memory Usage 54](#_Toc489635111)

[12.3.4 Timing Performance 55](#_Toc489635112)

[12.4 Testing 55](#_Toc489635113)

[12.4.1 Unit Tests 55](#_Toc489635114)

[12.4.2 Integration Tests 55](#_Toc489635115)

[13 Pedals/Switches 56](#_Toc489635116)

[13.1 Generic 56](#_Toc489635117)

[13.1.1 Requirements 56](#_Toc489635118)

[13.2 Hardware 56](#_Toc489635119)

[13.2.1 Requirements 56](#_Toc489635120)

[13.2.2 Inputs/Outputs 56](#_Toc489635121)

[13.2.3 Design 56](#_Toc489635122)

[13.2.4 Breadboard Layout 56](#_Toc489635123)

[13.2.5 Proto Layout 56](#_Toc489635124)

[13.2.6 Component List 56](#_Toc489635125)

[13.3 Software 56](#_Toc489635126)

[13.3.1 Requirements 56](#_Toc489635127)

[13.3.2 Design 56](#_Toc489635128)

[13.3.3 Memory Usage 56](#_Toc489635129)

[13.3.4 Timing Performance 57](#_Toc489635130)

[13.4 Testing 57](#_Toc489635131)

[13.4.1 Unit Tests 57](#_Toc489635132)

[13.4.2 Integration Tests 57](#_Toc489635133)

[14 Remote 58](#_Toc489635134)

[14.1 Generic 58](#_Toc489635135)

[14.1.1 Requirements 58](#_Toc489635136)

[14.2 Hardware 58](#_Toc489635137)

[14.2.1 Requirements 58](#_Toc489635138)

[14.2.2 Inputs/Outputs 58](#_Toc489635139)

[14.2.3 Design 58](#_Toc489635140)

[14.2.4 Breadboard Layout 58](#_Toc489635141)

[14.2.5 Proto Layout 58](#_Toc489635142)

[14.2.6 Component List 58](#_Toc489635143)

[14.3 Software 58](#_Toc489635144)

[14.3.1 Requirements 58](#_Toc489635145)

[14.3.2 Design 58](#_Toc489635146)

[14.3.3 Memory Usage 58](#_Toc489635147)

[14.3.4 Timing Performance 59](#_Toc489635148)

[14.4 Testing 59](#_Toc489635149)

[14.4.1 Unit Tests 59](#_Toc489635150)

[14.4.2 Integration Tests 59](#_Toc489635151)

[15 USB MIDI 60](#_Toc489635152)

[15.1 Generic 60](#_Toc489635153)

[15.1.1 Requirements 60](#_Toc489635154)

[15.2 Hardware 60](#_Toc489635155)

[15.2.1 Requirements 60](#_Toc489635156)

[15.2.2 Inputs/Outputs 60](#_Toc489635157)

[15.2.3 Design 60](#_Toc489635158)

[15.2.4 Breadboard Layout 60](#_Toc489635159)

[15.2.5 Proto Layout 60](#_Toc489635160)

[15.2.6 Component List 60](#_Toc489635161)

[15.3 Software 60](#_Toc489635162)

[15.3.1 Requirements 60](#_Toc489635163)

[15.3.2 Design 60](#_Toc489635164)

[15.3.3 Memory Usage 60](#_Toc489635165)

[15.3.4 Timing Performance 60](#_Toc489635166)

[15.4 Testing 61](#_Toc489635167)

[15.4.1 Unit Tests 61](#_Toc489635168)

[15.4.2 Integration Tests 61](#_Toc489635169)

[16 Debug 62](#_Toc489635170)

[16.1 Generic 62](#_Toc489635171)

[16.1.1 Requirements 62](#_Toc489635172)

[16.2 Hardware 62](#_Toc489635173)

[16.2.1 Requirements 62](#_Toc489635174)

[16.2.2 Inputs/Outputs 62](#_Toc489635175)

[16.2.3 Design 62](#_Toc489635176)

[16.2.4 Breadboard Layout 63](#_Toc489635177)

[16.2.5 Proto Layout 63](#_Toc489635178)

[16.2.6 Component List 63](#_Toc489635179)

[16.3 Software 63](#_Toc489635180)

[16.3.1 Requirements 63](#_Toc489635181)

[16.3.2 Design 63](#_Toc489635182)

[16.3.3 Memory Usage 63](#_Toc489635183)

[16.3.4 Timing Performance 63](#_Toc489635184)

[16.4 Testing 63](#_Toc489635185)

[16.4.1 Unit Tests 63](#_Toc489635186)

[16.4.2 Integration Tests 63](#_Toc489635187)

[Appendix A: New device template 64](#_Toc489635188)

[17 New Device Template 64](#_Toc489635189)

[17.1 Generic 64](#_Toc489635190)

[17.1.1 Requirements 64](#_Toc489635191)

[17.2 Hardware 64](#_Toc489635192)

[17.2.1 Requirements 64](#_Toc489635193)

[17.2.2 Inputs/Outputs 64](#_Toc489635194)

[17.2.3 Design 64](#_Toc489635195)

[17.2.4 Breadboard Layout 64](#_Toc489635196)

[17.2.5 Proto Layout 64](#_Toc489635197)

[17.2.6 Component List 64](#_Toc489635198)

[17.3 Software 64](#_Toc489635199)

[17.3.1 Requirements 64](#_Toc489635200)

[17.3.2 Design 64](#_Toc489635201)

[17.3.3 Memory Usage 64](#_Toc489635202)

[17.3.4 Timing Performance 65](#_Toc489635203)

[17.4 Testing 65](#_Toc489635204)

[17.4.1 Unit Tests 65](#_Toc489635205)

[17.4.2 Integration Tests 65](#_Toc489635206)

# List of Tables

[Table 1: Open Issues 2](#_Toc489635207)

[Table 2: History 2](#_Toc489635208)

[Table 3: Abbreviations 2](#_Toc489635209)

[Table 4: Glossary 2](#_Toc489635210)

[Table 5: Useful Links 3](#_Toc489635211)

[Table 6: Devices 15](#_Toc489635212)

[Table 7: Device Descriptions 16](#_Toc489635213)

[Table 8: Chapter Division 16](#_Toc489635214)

[Table 9: Requirements G 18](#_Toc489635215)

[Table 10: Requirements GH 18](#_Toc489635216)

[Table 11: Power Comparison 19](#_Toc489635217)

[Table 12: Power source location/type 20](#_Toc489635218)

[Table 13: Communication Comparison 20](#_Toc489635219)

[Table 26: Generic Diagnostics LEDs 25](#_Toc489635220)

[Table 14: Requirements GS 25](#_Toc489635221)

[Table 15: Requirements AP 29](#_Toc489635222)

[Table 16: Comparison Programming Languages 29](#_Toc489635223)

[Table 17: Requirements CH 30](#_Toc489635224)

[Table 18: Comparison External Memory 31](#_Toc489635225)

[Table 19: Comparison Communication Ext Application/PC 31](#_Toc489635226)

[Table 26: Controller Diagnostics LEDs 32](#_Toc489635227)

[Table 21: Diagnostics Controller 32](#_Toc489635228)

[Table 22: Components Controller 33](#_Toc489635229)

[Table 23: Requirements CS 33](#_Toc489635230)

[Table 26: Audio Diagnostics LEDs 36](#_Toc489635231)

[Table 26: DMX Diagnostics LEDs 38](#_Toc489635232)

[Table 26: Drums Trigger Diagnostics LEDs 40](#_Toc489635233)

[Table 26: Drums Trigger Diagnostics LEDs 42](#_Toc489635234)

[Table 26: GUI Diagnostics LEDs 44](#_Toc489635235)

[Table 26: Microphones Diagnostics LEDs 46](#_Toc489635236)

[Table 24: Requirements MG 48](#_Toc489635237)

[Table 25: Requirements MH 48](#_Toc489635238)

[Table 26: MIDI Diagnostics LEDs 49](#_Toc489635239)

[Table 27: Requirements MS 50](#_Toc489635240)

[Table 26: Audio Diagnostics LEDs 54](#_Toc489635241)

[Table 26: Pedals/switches Diagnostics LEDs 56](#_Toc489635242)

[Table 26: Remote Diagnostics LEDs 58](#_Toc489635243)

[Table 26:USB MIDI Diagnostics LEDs 60](#_Toc489635244)

[Table 28: : Requirements EG 62](#_Toc489635245)

[Table 26: Debug Diagnostics LEDs 62](#_Toc489635246)

[Table 26: NEW\_DEVICE Diagnostics LEDs 64](#_Toc489635247)

# List of Figures

**No table of figures entries found.**

# Introduction

This document describes the application software, which transforms the (text) file containing triggers and programs/instruction towards a file that is read by the Mestra Controller.

# Requirements

This paragraph shows all requirements common to all Mestra (embedded) software.

Table : Requirements GS

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ID** | **Base ID** | **Version** | **Category** | **Item** | **Description** |
| GenS100 | - | 1.0 | Rules | Amount | At least 100 rules can be defined.  *Rationale: to have a useful system, enough programming flexibility is needed.* |
| GenS200 | - | 1.0 | Rules | Simultaneously | At least 20 rules can be active simultaneously.  *Rationale: to have a useful system, enough programming flexibility is needed.* |
| GenS210 | - | 1.0 | Triggers | Amount | At least 100 triggers can be defined.  *Rationale: to have a useful system, enough programming flexibility is needed.* |
| GenS220 | - | 1.0 | Commands | Amount | At least 100 commands can be defined.  *Rationale: to have a useful system, enough programming flexibility is needed.* |
| GenS230 | - | 1.0 | Commands | Per Trigger | At least 10 commands per trigger can be defined.  *Rationale: to have a useful system, enough programming flexibility is needed.* |
| GenS300 | - | 1.0 | Communication | No noise from other devices | Slaves should work also when other (non Mestra) devices using the same type of communication are present.  *Rationale: when using wireless communication, other RF or WIFI should not interfere with Mestra devices.* |
| GenS310 | - | 1.0 | Communication | No noise to other devices | Other devices should not be interfered more than needed by the use of Mestra devices.  *Rationale: except for the channels/ports/resources used by Mestra devices, all other non Mestra devices using the same communication should not be interfered with.* |
| GenS320 | G20 | 1.0 | Communication | Protocol | The communication protocol for all devices will be similar.  *Rationale: Adding devices need to communicate with the controller.* |
| GenS400 | G1 | 1.0 | Performance | Prevent Messages | Prevent sending messages from a slave to the Controller when not needed.  *Rationale: Sending (and the resulting received message(s)) cost a lot of time, also it pollutes the bandwidth.* |
| GenS500 |  | 1.0 | Testing | Unit testing | Testing of software can be performed automatically by using unit testing.  *Rationale: Manual testing is too time consuming and software will be complex.* |

## Design