Technical Description

Authors: Thomas Zirlewagen, Fenna Yola Tykwer
Case Study: Fabrizio Plessi, *Liquid Time II* (1993)
Publisher: ZKM / Center for Art and Media Karlsruhe
Date: April 2007

Contents

Technical Description

Introduction

A technical description was prepared to document the state of the object in 2004. As an experiment, illustrations from a 3D program were used in this description (see "Visualization"), and they form the basis of most of the illustrations in this text. The steel construction of *Liquid Time II* consists essentially of a rotating steel wheel, approximately four meters in diameter that is held by two supports, much like a watermill. These wheel supports rise up on one end of a 17.76 -meter long channel, through which water flows. The steel used has been deliberately rusted on the outer sides of the object.
The entire object is broken down here to provide a better overview of the various components of the construction, and their names and functions will be discussed in detail below (see Fig. 1 and 2).

Terminology of the individual components arranged by number

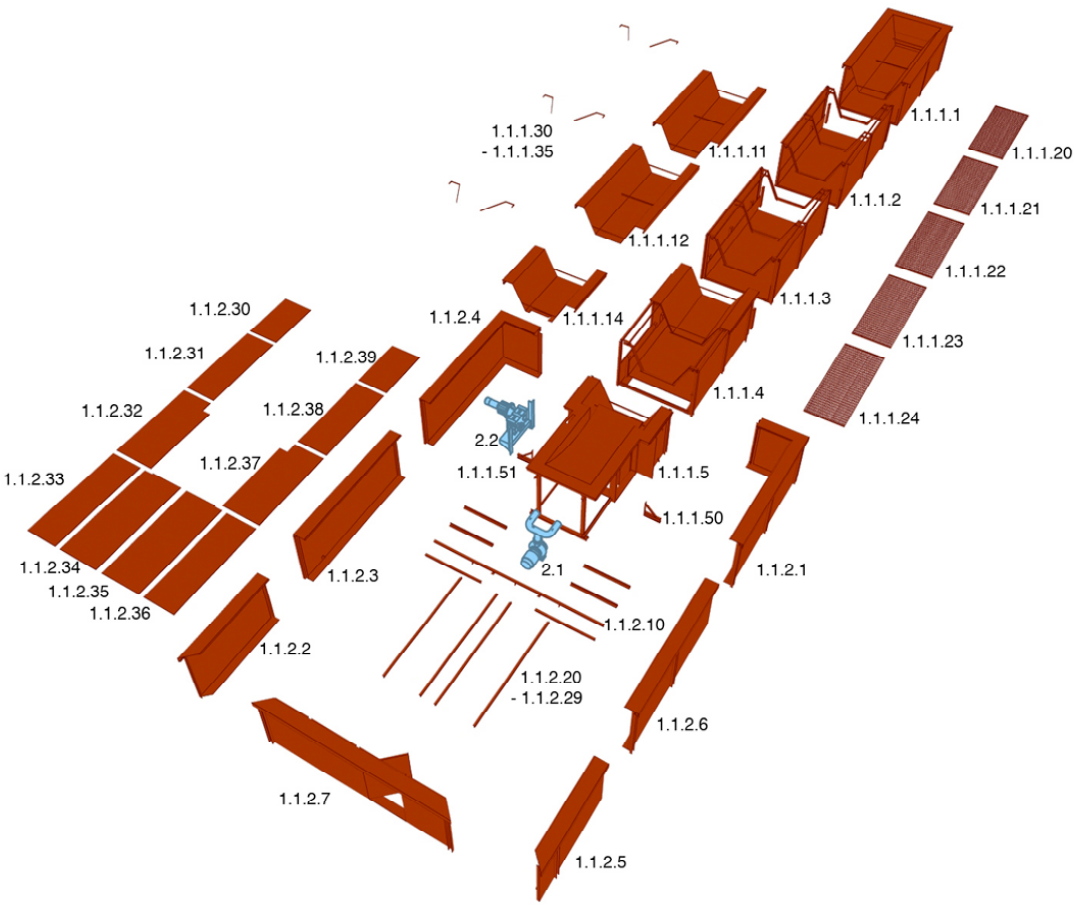


Fig. 1: Location drawing of the substructure (electrical components are marked blue) (illustration: Volker Möllenhoff)

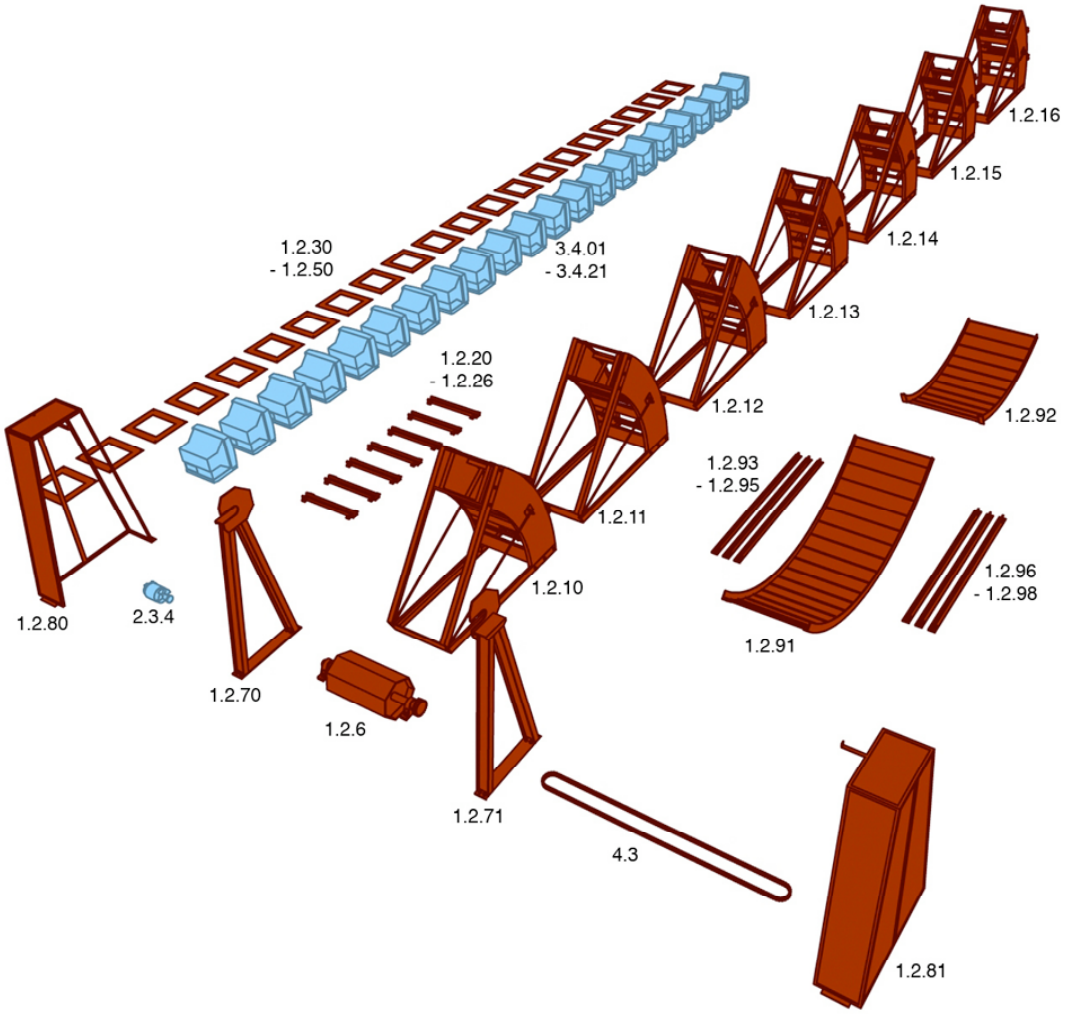


Fig. 2: Location drawing of the wheel construction (electrical components are marked blue) (illustration: Volker Möllenhoff)

(1) Steel construction

(1.1)	**Substructure**
(1.1.1)	Water channel
(1.1.1.1 - 1.1.1.5)	5 channel components
(1.1.1.10 - 1.1.1.15)	6 tank panels (2nd, 3rd, and 5th removable)
(1.1.1.20 - 1.1.1.24)	5 grilles
(1.1.1.30 - 1.1.1.35)	6 metal bands (joint coverings)
(1.1.1.40 - 1.1.1.44)	5 wooden tank components
(1.1.1.50 & 1.1.1.51)	2 side supports
(1.1.1.6)	Base plate (for motor)
(1.1.2)	Base cover
(1.1.2.1 - 1.1.2.7)	7 side panels (numbered 13–19)
(1.1.2.10)	1 crossbeam
(1.1.2.20 - 1.1.2.29)	10 struts
(1.1.2.30 - 1.1.2.39)	10 cover panels
(1.1.3)	Subconstruction
(1.1.3.1)	Polyethylen foil
(1.1.3.2)	Rubber mats
(1.1.3.3)	Blockboards
(1.2)	**Wheel construction**
(1.2.10 - 1.2.16)	7 wheel segments
(1.2.20 - 1.2.26)	7 U-profiles

(1.2.30 - 1.2.50) (1.2.51) 21 monitor shades (+ one replacement shade)
(1.2.6) Axle construction (axle/drum/sprocket)
(1.2.70 & 1.2.71) 2 wheel supports
(1.2.80 & 1.2.81) 2 protective grills (on the sides of wheel supports)
(1.2.9) Wheel cover
(1.2.91) large component
(1.2.92) small component
(1.2.93 - 1.2.98) 6 T-profiles

(2) Electrical components
(2.1) Pump
(2.2) Motor
(2.3) Power supply
(2.3.1) Rotary electrical connection (threephase)
(2.3.2) Fuse box
(2.3.3) Distributor
(2.3.4) Slip ring unit
(2.3.50 - 3.3.54) 5 turn-on delays
(2.3.6) Cabling
(2.3.7) Lighting
(2.3.7.1) (2 tripod spotlights)
(2.3.7.2) (2 tripods)
(2.3.7.3) 2 halogen lamps
(2.3.7.4) 2 fluorescent lamps (work lighting in the base)
(2.3.8) 2 water sensors

(3) Video system
(3.1) Video signal source
(3.1.1) Laserdisc player
(3.1.2) Laserdisc
(3.1.3) Flashcard player
(3.1.4) Flashcard
(3.1.5) (DVD player)
(3.1.6) (DVD)
(VHS player)
(VHS cassette)
(3.2) 2 video distributors /amplifiers
(3.3) Coaxial cable (RG-59) with BNC and SCART plugs
(3.4.01 - 3.4.23) 21 TV monitors (+ 2 replacement monitors)
Slip ring unit (2.3.4)

(4) Kinetic system
(4.1) Motor unit
Motor (2.2)
Gearbox (2.2.1)
(4.2) Chain
(4.3) Axle/bearing
Slip ring unit (2.3.4)

(5) Water circulation
(5.1) Pump system
Pump (2.1)
Pump housing (2.1.1)
Pump motor (2.1.2)
Pump wheel (2.1.3)
(5.1.1) Pipes
(5.1.2) Intake socket

(5.2) Reflux channel
(5.2.1) Wooden tank
5 wooden tank components (1.1.1.40–1.1.1.44)
(5.2.2) Truck tarpaulin (blue)
(5.2.3) pond film (black)

(5.2.40 - 5.2.51) 12 Polystyrene blocks

Tools

Mobile bridge crane

Technical Description of Fabrizio Plessi's *Liquid Time II*
(State of the object in 2004)

The water channel (1.1.1) is divided into five separate components (see fig. 3), all of which have been deliberately rusted on the outer side and have a welded support inside. The support is used to attach the so-called tank panels (1.1.1.10 - 1.1.1.15) (see fig. 4), which are individually fitted to each tank.

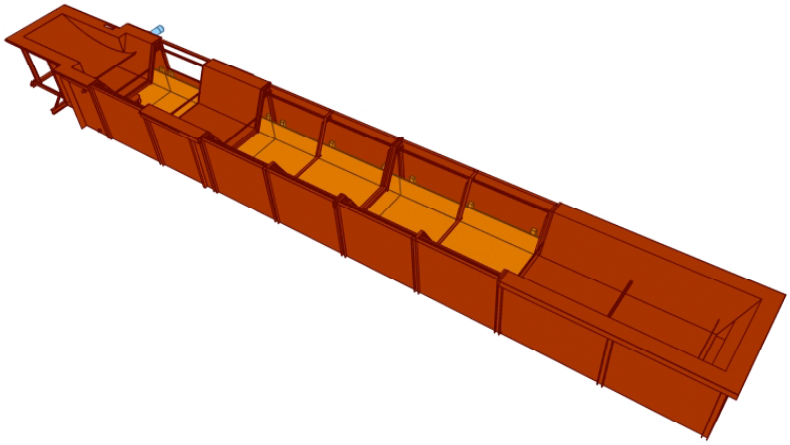


Fig. 3: Top view of the water channel with all not removeable tank panels (illustration: Volker Möllenhoff)

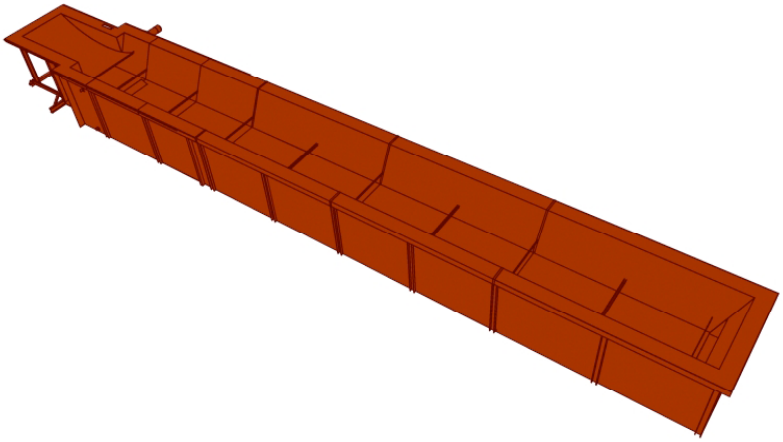


Abb. 4: Top view of the water channel with all tank panels (illustration: Volker Möllenhoff)

Channel component I (1.1.1.1) forms the end of the channel and is permanently fixed to the associated tank panel (see fig. 5).

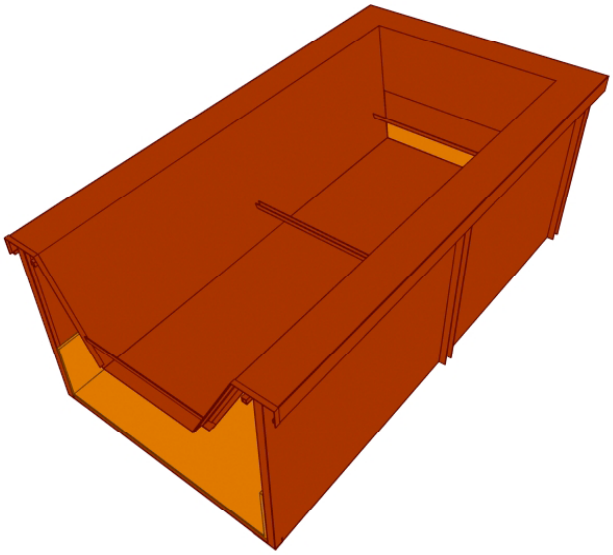


Fig. 5: Channel component I (illustration: Volker Möllenhoff)

By contrast, the tank panels for channel components II (1.1.1.2) and III (1.1.1.3) are removable (see fig. 6).

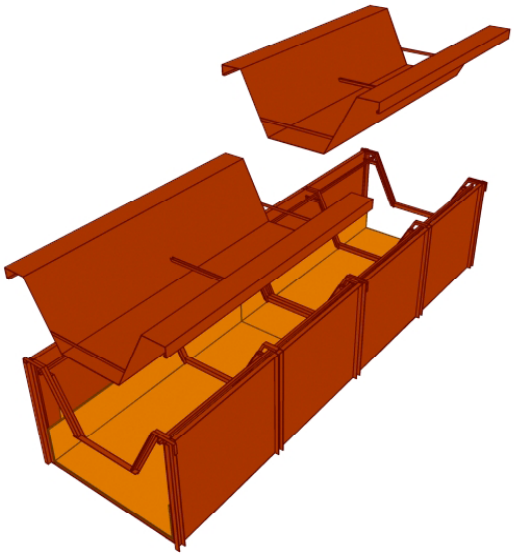


Fig. 6: Channel component II and III with the removable tank panels (illustration: Volker Möllenhoff)

The tank panel for channel component IV (1.1.1.4) (see fig. 7) is made of two parts; one of them is called the “mobile tank”, because unlike the other part it can be removed. The “mobile tank piece” makes it possible to provide an additional water drain to the pump via a crevice in the floor.

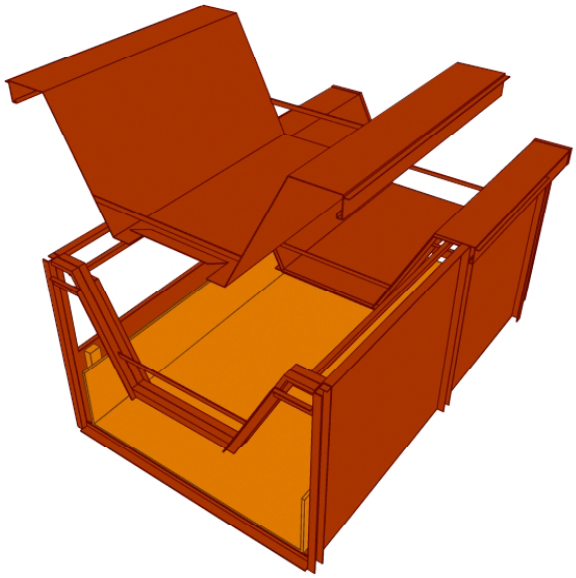


Fig. 7: Channel component IV with the “mobile tank” (illustration: Volker Möllenhoff)

Channel component V (1.1.1.5) (see figs. 9, 12 and 13) is essentially the head of the object. There, in the lower part of the channel component, is the pump (2.1) and its motor (2.2), the motor for the wheel drive (4.1), and all of the electrical boxes (2.3.2). The intake socket (5.1.2) for the pump (2.1) is also located here. The kinetic system (4) is composed of the motor (2.2) (MGM motori elettrici Sp.A, Serravalle, ITALY; with the classification BA 7154 and 50 Hz; 0,37 KW and 380 V) and a gearbox (2.2.1) (Bonfiglioli Riduttori, Bologna, Italy; with the classification MAS 30/RAP 60N). They drive the wheel with the monitors by a chain (4.2) (see fig. 8).

Fig. 8: Motor (silver) with gearbox (blue) and chain; chain protection (white perforated metal plate) (photo: ZKM)

Two supports (1.1.1.50 & 1.1.1.51) on the outer sides of the channel component provide stability.

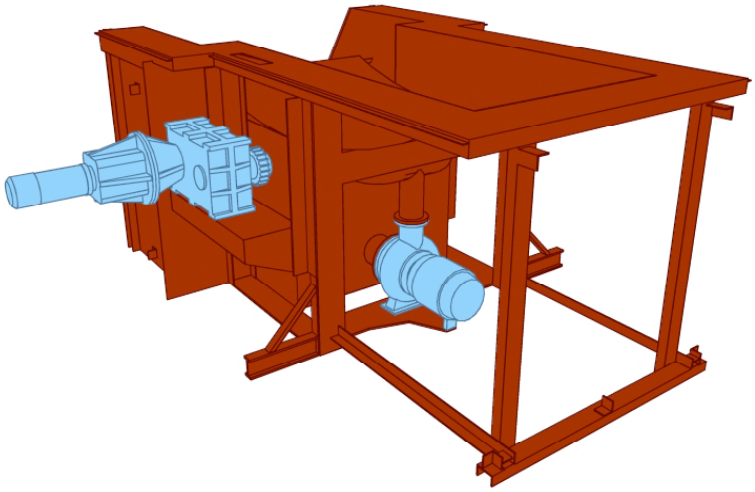


Fig. 9: Channel component V with view onto the pump, the motor of the wheel and the two side supports (illustration: Volker Möllenhoff)

On top of channel component V there is a curved steel sheet to cover the beginning of the water channel where the water enters (see fig. 10).

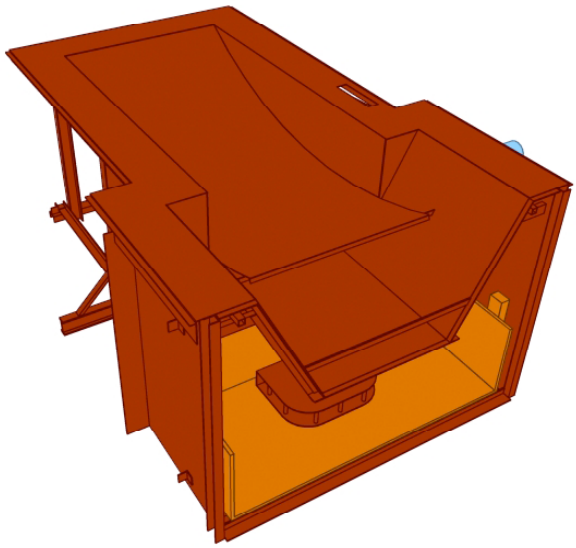


Fig. 10: Topview of channel component V (illustration: Volker Möllenhoff)

Moreover, this channel component contains the electric pump that circulates the water. It is a circulating pump (2.1) manufactured by Calpeda (with the classification: NW4 100/20C, 380 V).

The water is pumped from the lower channel to the upper one (see fig. 11).

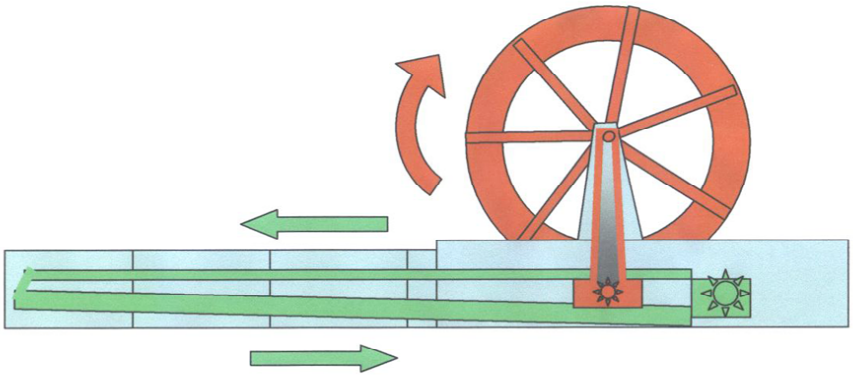


Fig. 11: Water circulation (the water pump and the circulation of the water are green, the wheel and its motor are red coloured) (illustration: ZKM)

The electrical components include the entire power supply (2.3) and the pump (2.1) and its motor (2.2) for circulating the water. The work's electrical system is illustrated in detail in the diagram below (see fig. 12).

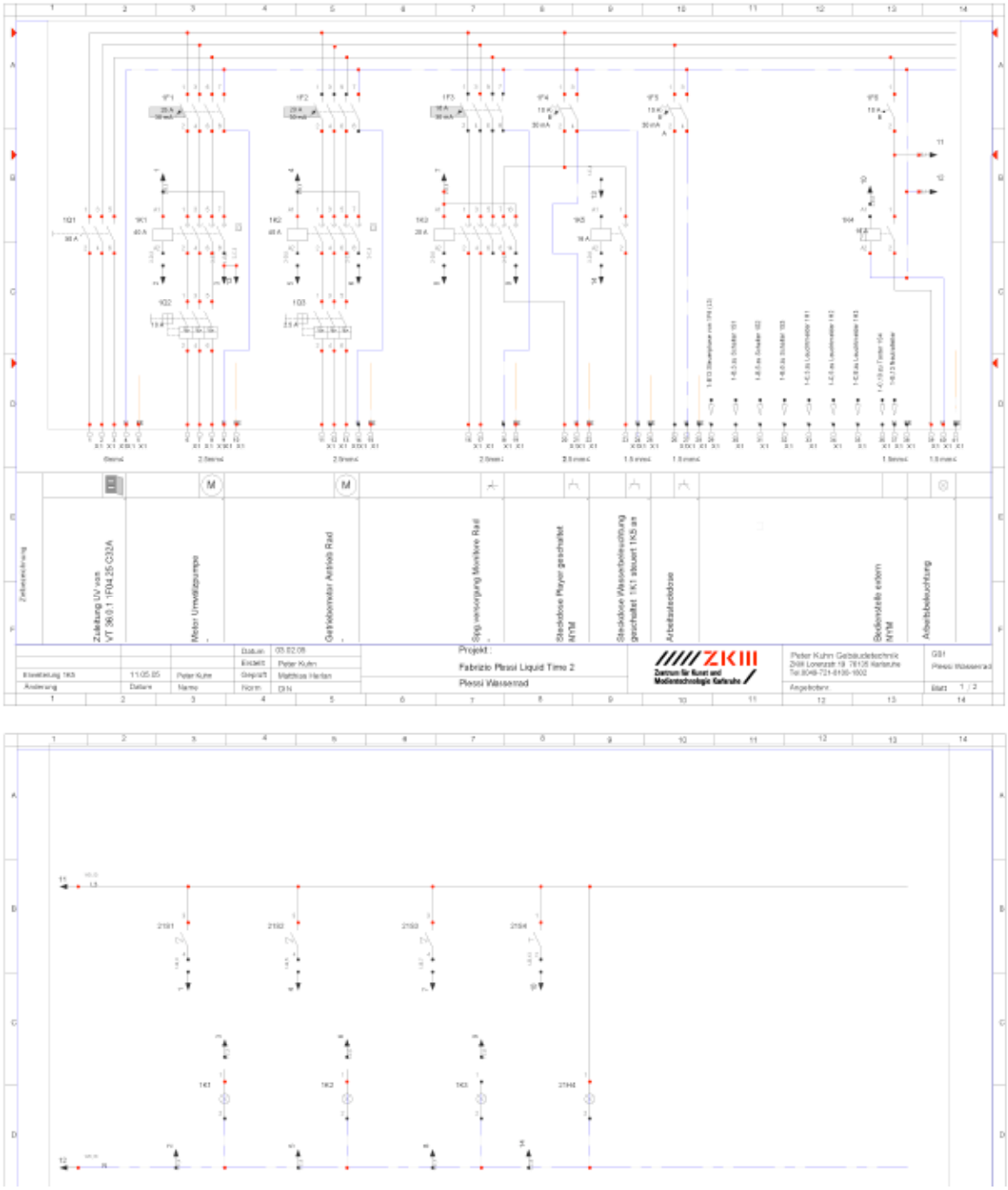


Fig. 12: Diagram of the electrical system of the artwork (diagram illustration: Peter Kuhn)

From the diagram it is clear that the video sculpture is supplied with electricity via a rotary current connection (2.3.1). There is a fuse box (2.3.2) and a distributor box (2.3.3) in the base, both of which are connected to the individual parts listed below. The sliding contact (2.3.4) (slipring 1: 50 A, slipring 2: 30 A, slipring 3: 20 A, 600 V, AC/DC) both provides power for the individual video components and TV monitors and conveys the video signal. In addition, the motors of the pump and of the chain drive are connected to the distributor box. Also the lighting (halogen lamps) (2.3.7.3) in the water channel depends on this electrical circuit, as does the work lighting (2.3.7.4) in the base and the water sensors (2.3.8).

In the tank panels of channel components I, II, and III there are welded cross-braces just slightly above the floor of the tank element. They provide support for a total of five grilles (1.1.1.20 - 1.1.1.24) that cover the water channel (see fig. 13).

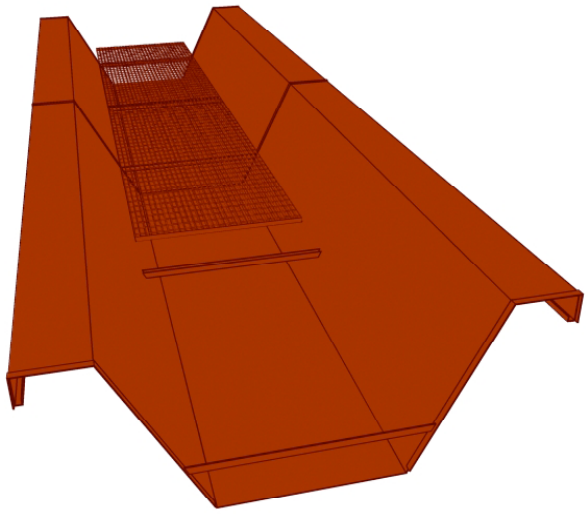


Fig. 14: Illustration of one grille in a tank panel (illustration: Volker Möllenhoff)

The small gaps between the tank panels are concealed with metal bands (1.1.1.30 - 1.1.1.35) (see fig. 15).

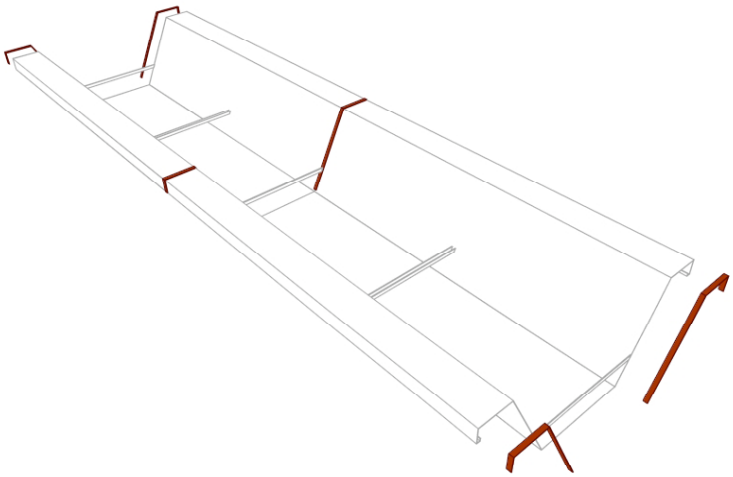


Fig. 15: Metal bands on the tank panels (illustration: Volker Möllenhoff)

The wheel construction (2.1) consists of seven elements of identical construction - the so-called wheel segments (1.2.10 - 1.2.16). They are in the form of segments of a circle, and each provides room for three TV monitors (see fig. 16).

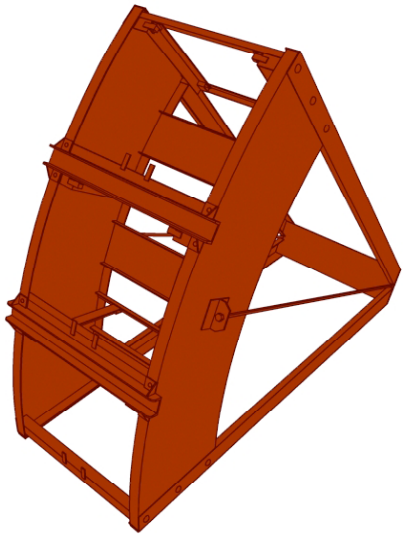
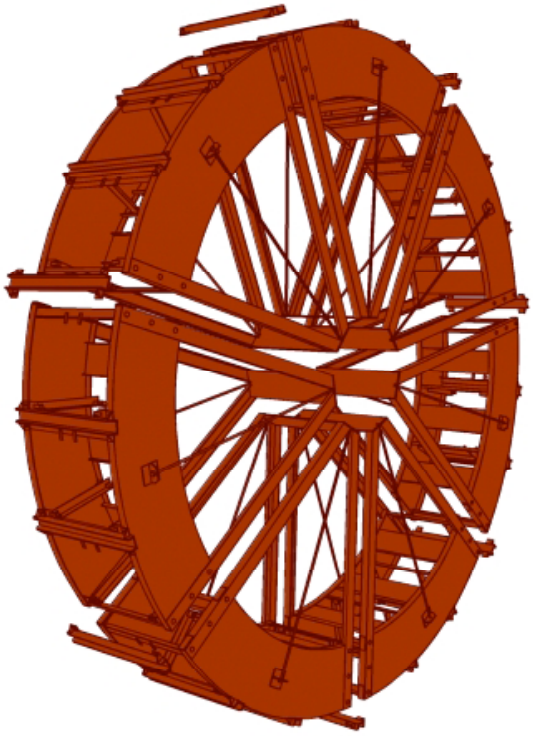


Fig. 16: Illustration of one wheel segment (illustration: Volker Möllenhoff)

The wheel segments are arranged around an axle and attached to it with screws. Moreover, the segments are secured with U-profiles (1.2.20 - 1.2.26) to the places where they overlap for structural reasons to form the wheel (see fig. 17).



Fig, 17: Illustration of the wheel construction (seven wheel segments and U-profiles in a small distance to each other) (illustration: Volker Möllenhoff)

For each of the monitor compartments there is a so-called monitor shade (1.2.30 - 1.2.51), which prevents the viewers from looking into the device's housing, revealing only the screen of the TV monitor (see fig. 18).

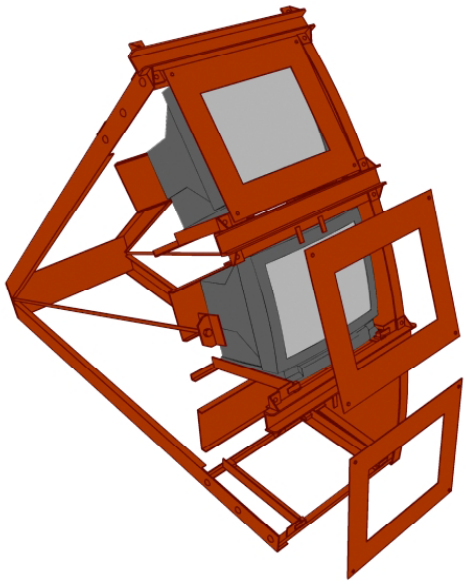


Fig. 18: Illustration of the monitor shades in front of the TV monitors (illustration: Volker Möllenhoff)

The construction of the axle itself (1.2.6) consists of a drum and a sprocket for the chain drive (see fig. 19).

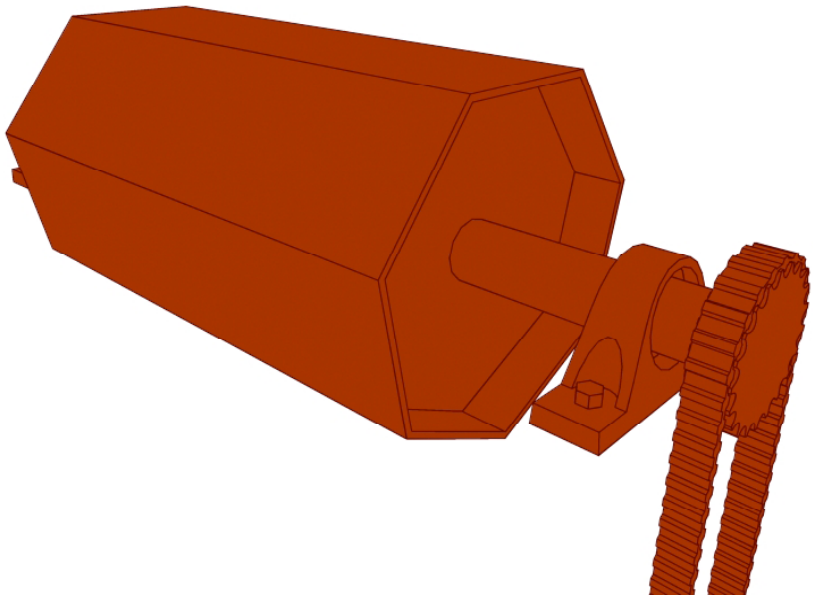


Fig. 19: Illustration of the axle drum with the sprocket and the chain (illustration: Volker Möllenhoff)

The drum is held by two wheel supports (1.2.70 & 1.2.71) found on the edge of channel component V (see fig. 20), which is under the wheel and is part of the object's so-called substructure.

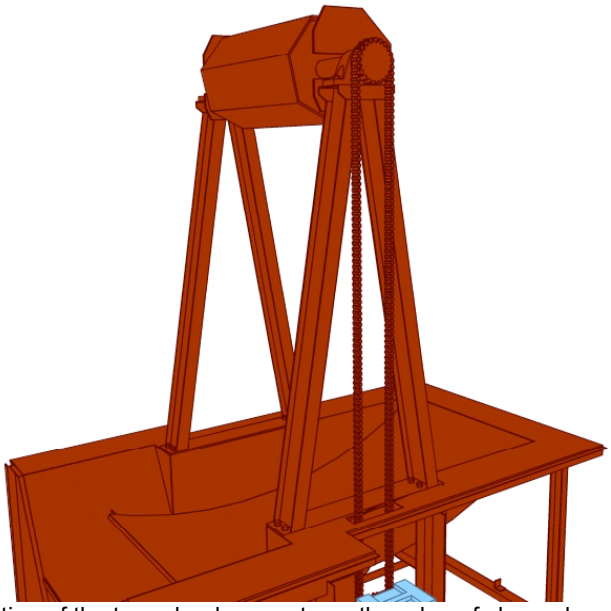


Fig. 20: Illustration of the two wheel supports on the edge of channel component V (illustration: Volker Möllenhoff)

To every side of the wheel supports there is a protective grill (1.2.80 & 1.2.81), which both prevents anyone from grabbing the running drive chain (4.2) and protects the sliding contact (2.3.4) attached to the axle from unauthorized access (seel fig. 21).

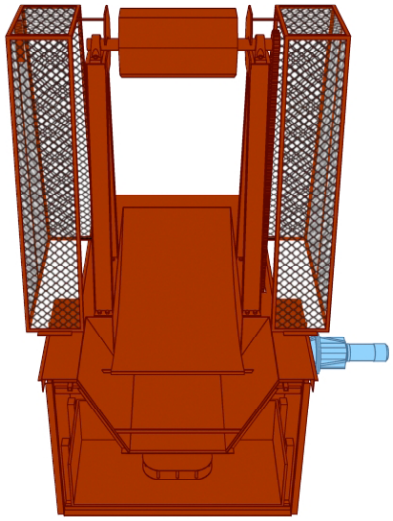


Fig. 21: Illustration of the protective grills on the sides of wheel supports (illustration: Volker Möllenhoff)

In the area around the wheel, the substructure widens on all side, and together with seven side panels (1.1.2.1 - 1.1.2.7) forms a kind of space around the end of the water channel that is also known as the base zone (see fig. 22).

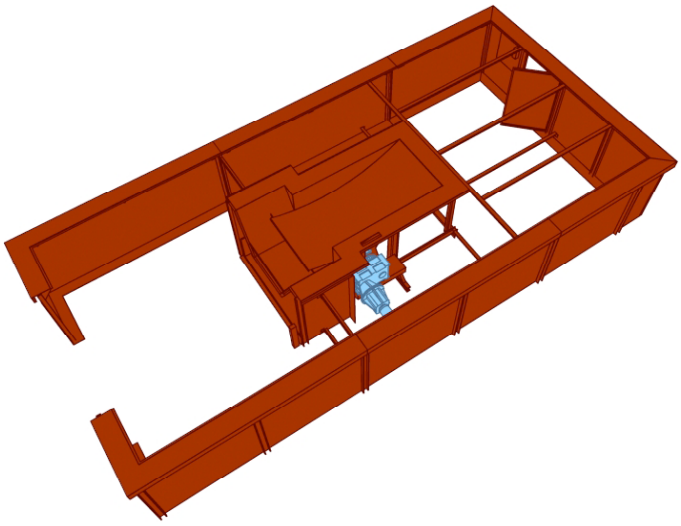
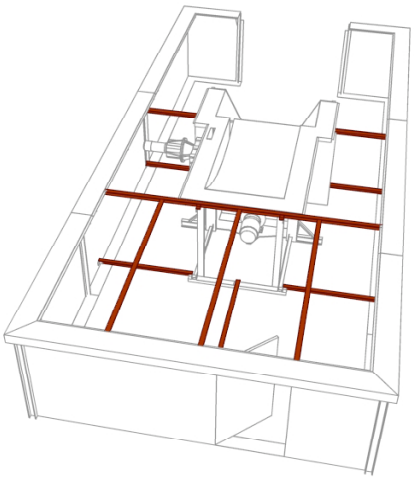


Fig. 22: Illustration of the base zone with channel component V (illustration: Volker Möllenhoff)

The cover of the base is held together by ten metal struts (1.1.2.20 - 1.1.2.29) and a crossbeam (1.1.2.10), which ensure that the side panels are kept a certain distance from the water channel and that the ten covering panels (1.1.2.30 - 1.1.2. 39) of various sizes can be placed on top of the base zone to cover it (see figs. 23 and 24).



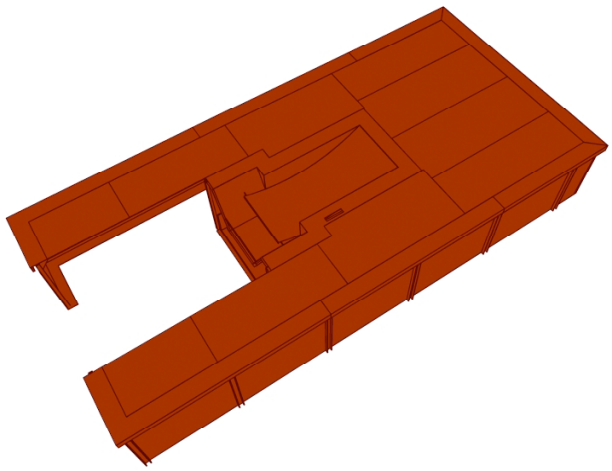


Fig. 23: Illustration of the metal struts and the crossbeam (illustration: Volker Möllenhoff) and
Fig. 24: Illustration of the base zone with the covering panels (illustration: Volker Möllenhoff)

The backside of the wheel is covered by the wheel cover (1.2.9), so that the viewer can only see the TV monitors from the water channel side. The cover is composed of two parts. The smaller component (1.2.92) is attached to the substructure (channel component V) and carries the larger component (1.2.91). They are fixed to the two wheel supports with a total of six T-profiles (1.2.93 - 1.2.98), three on each side (see fig. 25).

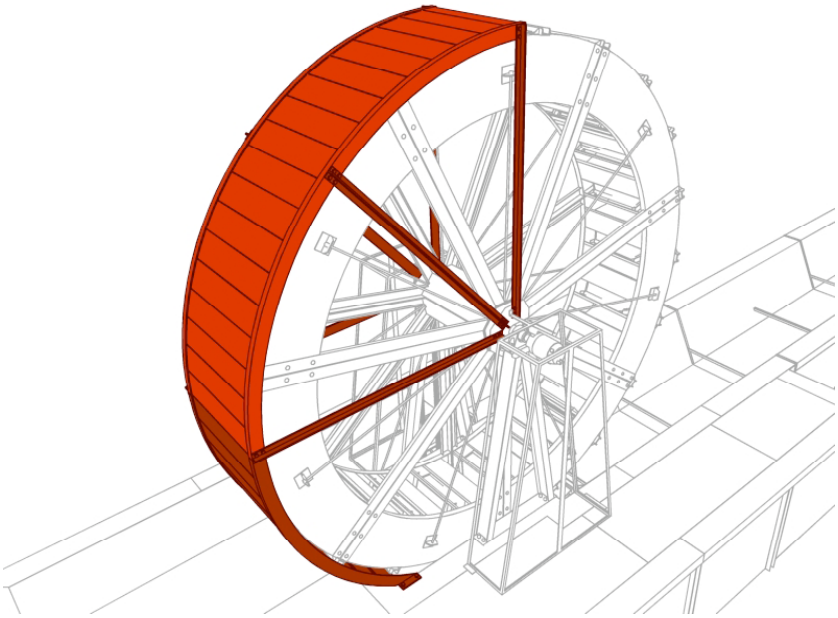


Fig. 25: Illustration of the wheel cover and the T-profiles (illustration: Volker Möllenhoff)

Video system

The video sculpture *Liquid Time II* is a single-channel video work. All 21 TV monitors receive the same signal from a Laserdisc player (3.1.1). The player in question is not the original device (that was a Philips Laserdisc player 22 VP 380) but one belonging to the ZKM (Pioneer CLD-S310, serial number: PF 740 37 47 YD). The Laserdisc (3.1.2) itself (PAL, colour), by contrast, appears to be original.
The video signal from the player is transmitted by a coaxial cable (RG-59) (3.3) first to the slip ring unit (2.3.4) that is fastened to the side of the wheel axle and then on to the first video distributor (3.2). The devices used are, strictly speaking, both signal amplifiers and signal distributors, but for simplicity's sake we refer to them as video distributors. The outputs of the first video distributor are connected, on the one hand, with the TV monitors in the compartments 1, 2, 3, 4, 5, 6, 18, 19, 20, and 21 and, on the other, by means of another output, with the second video distributor. The latter provides a signal for the TV monitors in the compartments 7 to 17. The video distributors (3.2) (each of which has twelve outputs) are placed at two different places in the wheel (monitor compartments 2 and 14) and bolted permanently to the corresponding segment of the wheel. The distribution of the video signal by the distributors of the individual TV monitors is achieved by means of cable connections the museum made itself (by Jochen Saueracker in 1997) consisting of coaxial cables (HF cables) with a BNC plug on one side (video distributor) and a SCART plug on the other (TV monitor). The video distributors

themselves are provided with 9 volts by means of individual power supplies (with 3, 6, 9, and 12 volt settings) located in the monitor compartment right next to the device in question.
The 21 TV monitors (3.4.01 - 3.4.23) are normal consumer devices with a diagonal image size of 59 cm (23 inch monitors). The product name is Philips Matchline 100 Hz 8500 VL. The screen of the cathode ray tube is slightly curved, so that the image on the picture tube is slightly cut off by the monitor shades (1.2.30 - 1.2.50).
In June 2006, in response to numerous problems with the transmission of the video signal, a flashcard player (MM-1002, Bässgen AV-Technik GmbH) (3.1.3) and three new video distributors (two devices with ten outputs each and one with five outputs; composite video distribution amplifier from ProCon Technology) were built into the wheel. The video material was digitized by the Laboratory for Antique Video Systems at ZKM, and in the process (player: Sony Lasermax, Lasercision Videodisk Player LDP-3300P; digital convertor: AJA IO LA with Final Cut Pro Version 5.1.1; Apple G5) a MPEG2 file was created from the aforementioned Laserdisc and then stored on a compact flashcard (1024 MB, made by Kingston).

On the illustration that follows, the individual components of the video system are depicted together with the power supply for the flashcard player, the video distributors, and all of the TV monitors to provide a better overview (see fig. 27). All of the video components are blue; the elements of the power supply are red; and the flashcard player is yellow.

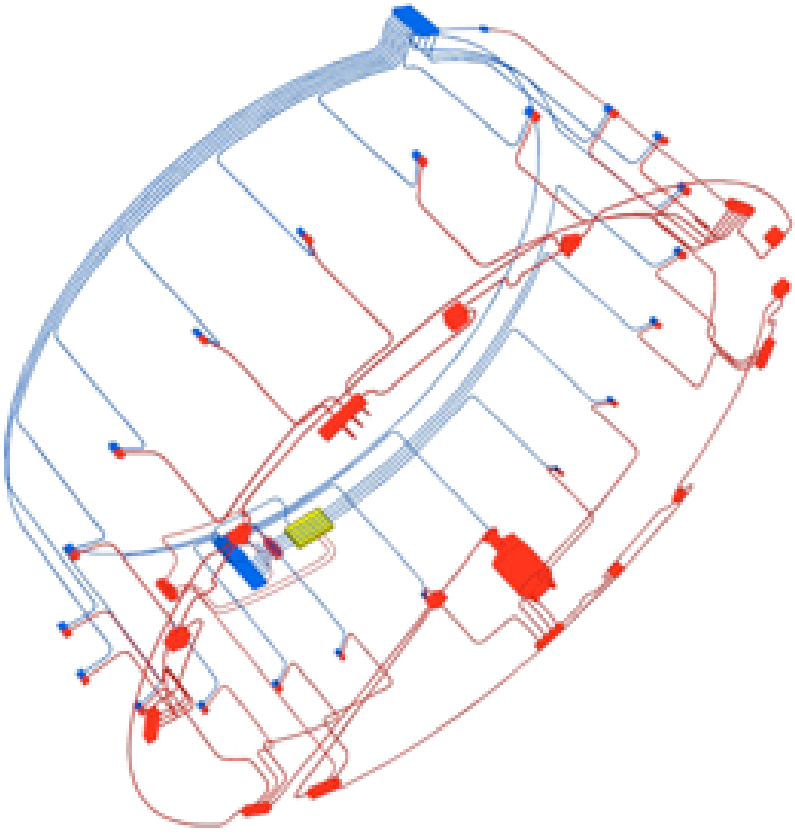


Fig. 27: Illustration with the video components (blue), the power supply (red) and the flashcard player (yellow) (illustration: Volker Möllenhoff)

Acknowledgements

The authors warmly thank the following persons for their contributions to this publication:

Martin Häberle, Jochen Saueracker,
Volker Becker, Claudius Böhm, Martin Braun, Rainer Eisch, Mirco Frass, Peter Gather, Reiner Gabler, Gregor Gaissmaier, Johannes Gfeller, Ronny Haas, Dirk Heesacker, Bastian Hemminger, Matthias Herlan, Franziska Herzog, Christof Hierholzer, Heiko Hoos, Werner Hutzenlaub, Hartmut Kampe, Peter Kuhn, Gisbert Laaber, Marianne Meister, Volker Möllenhoff, Dorcas Müller, Irene Müller, Christian Nainggolan, Martina Pfenninger, Marco Preitschopf, Phillip Stähle, Martin Wittwer, Christina Zartmann

Authors: Thomas Zirlewagen (conservator), T.Zirlewagen@gmx.net
Fenna Yola Tykwer (conservator), tykwer@zkm.de

Contributors: Volker Möllenhoff (illustrator)
Peter Kuhn (diagram of the electrical system)

Translation: Steven Lindberg

Center for Art and Media Karlsruhe
Lorenzstr. 9
D - 76135 Karlsruhe
http://www.zkm.de