



STAGEMAKER CONTROLLERS R8CPU
THE FUTURE-ORIENTED INNOVATIVE
CHAIN-HOIST CONTROL



INTRODUCTION

The R8CPU hoist control system that is manufactured in close co-operation with Batalpha Bobach GmbH, a leading System-Provider off automation in stage-movement.

In this introduction you will find a inexpensive and comfortable solution of a control system not only for touring and renting business but also for flexible in-house applications. It allows both the positioning of chain-hoists and the programming of complex and automatic cue-lists.

In addition to this, R8CPU Motion Control has futuristic features you won't find in any other Control-System today or in the near future.

Innovation 1

The goal was to design a Motion-Control as universal as a Light-Control-System. That means that not only the software developed by us can address R8CPU Motion Control, but also consoles supplied by third-party manufacturers (also Light-Consoles with an extra Emergency-Stop-Module) could address our racks if they have Ethernet. Our Ethernet-Protocol is open (option).

Innovation 2

The system design is modular and can be used for drives of different type of hoist or winches. R8CPU Motion Control is nearly as flexible as a light-dimmer.

The big advantage for touring-companies

By a stock of several modular racks a number of customers could be served in the same period, offering a complete system or, without internal modifications, simply by reconnecting you can build a large or some medium large systems. This, in fact, is already built into the concept!

And in the unlikely event of the need of system-servicing...simply exchange a module and on with the show!

How do we get these ideas?

The development of the system began in 1997. A year later two prototypes were given to a company for extensive testing. The gathered experiences and professional advises were added to the continuing development. Since 1999 the system is manufactured in series. Of course the software is continuously subject of updating new and innovative ideas. The latest versions are available on our web-site and can be downloaded from our homepage www.STAGEMAKER.COM The R8CPU controller gets its latest upgrade automatically from the control-computer as soon as a new version is installed on the this PC.

THE PROBLEM

Lifting devices as chain hoist are developed almost exclusively for single use like is common in the industry. Owing the specific knowledge and requirements of entertainment, theatre and production establishments, we have specialized ourselves in adapting chain hoist to meet these special requirements.

As a consequence we introduced the programmable R8CPU controller, which allows you to pre-program up to 64 chainhoists individual or in groups over an almost unlimited number of cue's.

In order to coop with the highest security classification, it is available in accordance with the German BGV-C1 regulation (formerly VBG 70). For such occasions, the chainhoist should be accordingly as well.

The design of the chain hoists and their control suitable for use according to BGV-C1 is regulated in DIN 56925, theatre engineering, stage machinery point control winches, safety requirements and testing. If computers are assigned functions that affect safety, a requirement class according to DIN 19250 process control, general safety considerations for instrumentation protective devices, risk analysis must be determined and the system accordingly adapted to avoid and control faults.

THE SOLUTION:

A computer control with an Ethernet TCP/IP protocol various control systems. For system security, remote diagnosis and parallel availability, a server system can be set up.

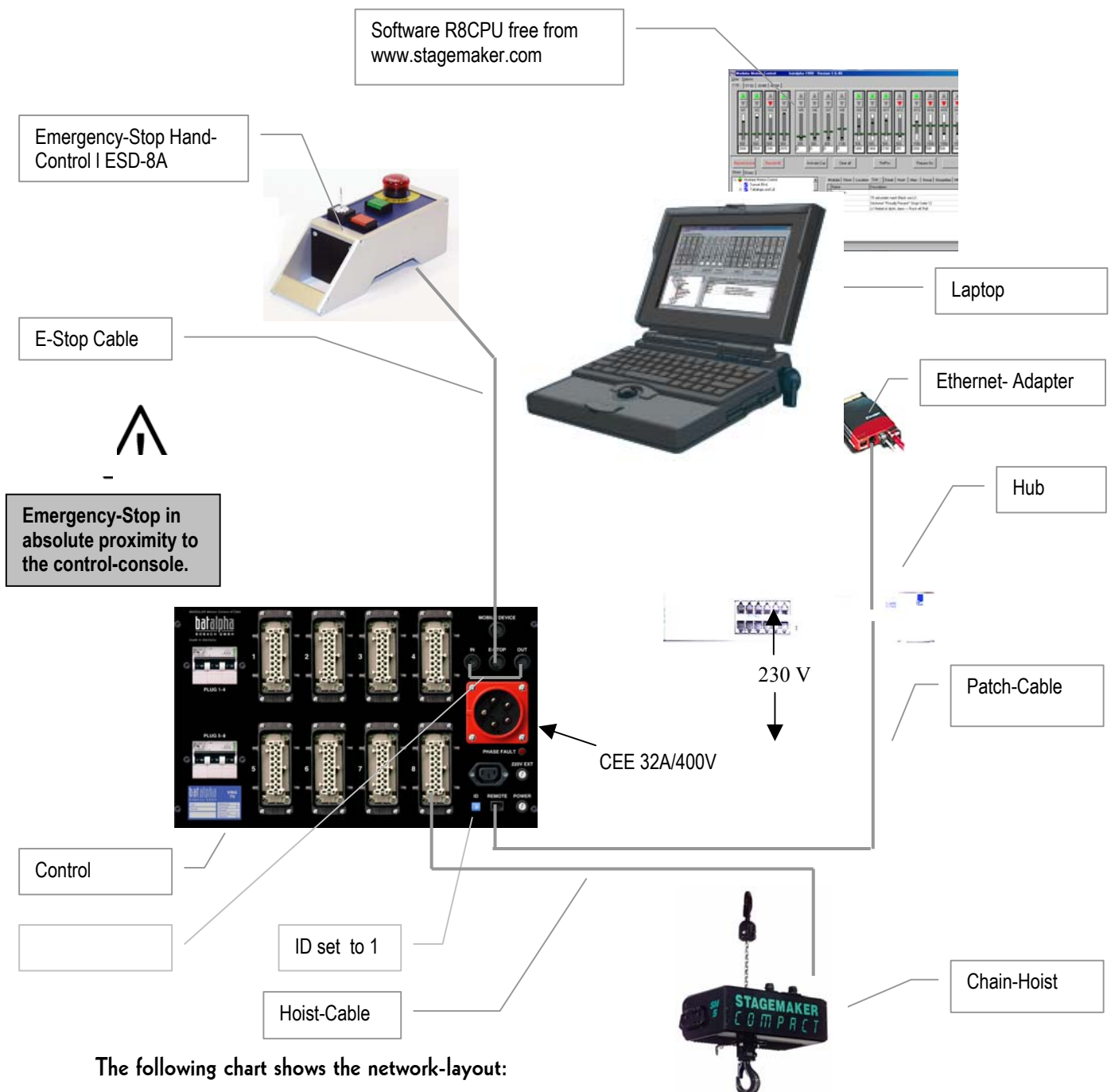
In addition to the currently used control systems R8CPU, further modules and options are under construction.

- This includes a Midi module, a multifunctional input and output module, which enables programs to run via Midi Time Code and also assigns 96 inputs and outputs specific tasks freely programmable, e.g. ceiling operation.

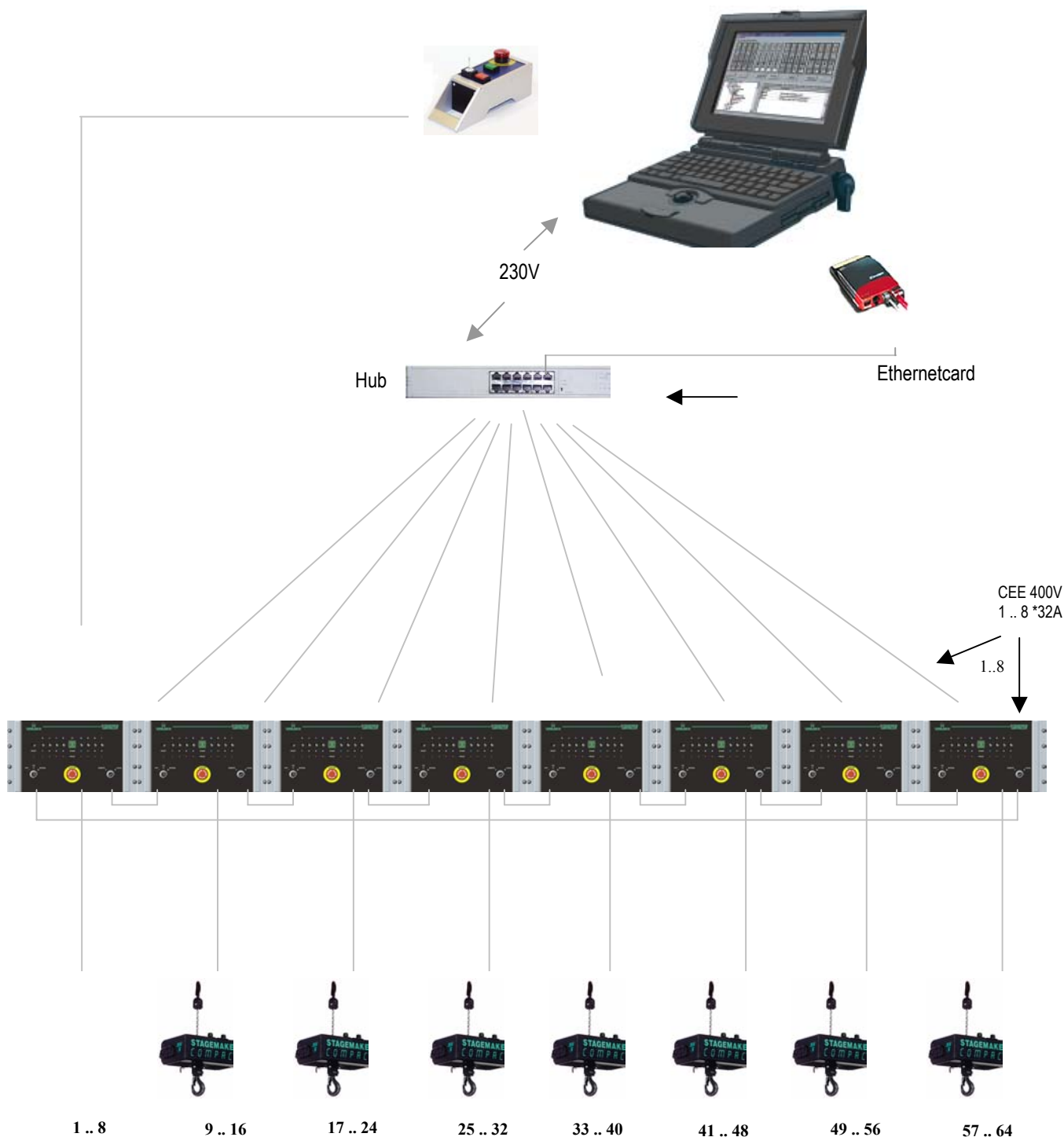
SYSTEM-OVERVIEW

With a 19"- control-rack (6U) eight drives can be controlled, every unit has its own Backup-Control. Altogether, eight rack can be linked, so that up to 64 hoists can be controlled synchronously by the system PC.

The following chart shows the system-layout:



The following chart shows the network-layout:



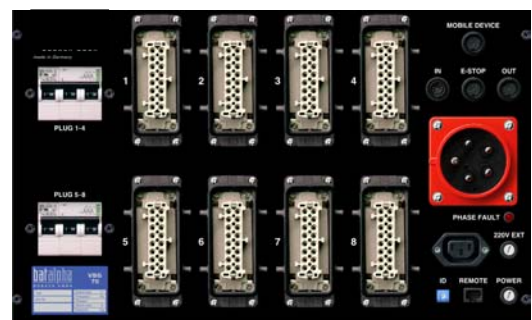
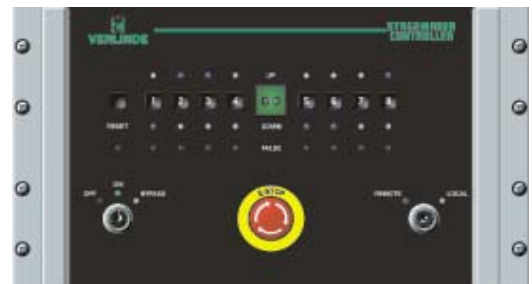
SYSTEM DESCRIPTION:

R8CPU controllers allows the positioning of chain-hoists or other drives with constant speed, and the programming of complex time-controlled and automated cues. Each unit can control up to eight drives and has its own complete Backup-Control. Up to eight units can be linked, so that all together 64 drives can be controlled synchronously via the higher-level computer.

Depending on the particular requirements, the units can be installed centralized or decentralized. The operation of drives with or without incremental encoders is possible. In those cases, the positioning is time related and as such the system calculates the running time in accordance to the hoist speed. Mixed use of drives with and without encoders is possible.

It has to be taken in consideration that the positioning (synchronization) of the time based mode is less accurate than the encoder based mode. In time based mode, the effective travel distance could be subject of discrepancies due to load related acceleration and deceleration timing.

- Measures: 19", 6HE, 42TE
- Weight: 16 kg
- I_{\max} 4 A per drive
- Over- and Under load processing
- Upper- and Lower-Limit processing
- Position range: -3 m to 30 m – larger range on request
- Synchronous movements of free to configure drive-groups
- Emergency-Stop as mushroom button on every rack
- ID-switch for system-ID
- Power-Connector for peripherals
- Fuses accessible without opening the housing
- Supply via 400 V / CEE 3 * 32 A with integrated phase reversing pole-changing connector and "Phase OK" indication
- On / Off / Bypass via key-switch
- Remote / Local via key-switch and indicated via LED
- Directional and fault indicator for each drive
- Connection to Hardware via Standard Ethernet with 10Base-T, TCP / IP-Protocol
- Position backup in case of Ethernet or power failure
- Complete backup integrated in every unit
- Software: cost-free control- and system-software for the rack
- System-Software is automatically updated by the Control-Computer
- Adaptation to different drives is possible



R8CPU controllers for advanced safety requirements, differ from the one for standard applications in terms of group related safety functions such as main-contactor, emergency limitswitches and electronic overload protection. The control software includes the coverage of these additional safety features.

R8CPU controllers are demanded by law in German and most of the German speaking countries of Europe and refer in particular to cases of non-secured moving objects above performers, audiences or any other open public location.

In most other countries, these strong recommendations are not applicable and standard controllers are sufficient. If in these countries additional safety precautions are to be taken, then usually these, double brakes - limit-switches - down rating, do effect just the hoist.

Since safety regulations usually require a hard wired emergency circuit, the R8CPU controllers are quipped with a totally independent from the software control, operating intervention facility. The PC and the rack's are linked through a separate cable that interconnects the E-stop functions of all controllers in charge. It enables the user in case of emergency to stop all connected hoists in one action, no matter of the motion was a programmed or manual.

At the same time, it allows the operator to combine other manual functions as "RUN" button, and selector switch for On / Off and By-pass.

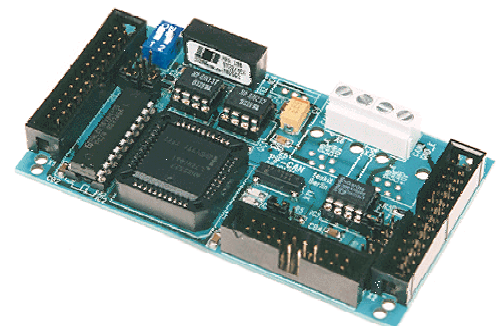
Special configurations:

For applications where advanced safety requirements are at stake, but no need for programmable features, there is a controller the R8PRM-C1 available based on the R8CPU, but without central processor inside. For later updates, it remains possible to add this board and the full controller specification is applicable, provided that the hoists are equipped with an encoder.



Processor board to transform a R8PRM-C1 into a R8CPU-C1.

To become totally independent of local references, absolute-encoders are to be used instead of incremental-encoders. In these cases an additional board has to be installed on the R8CPU motherboard. This add-on contains a CAN-Bus module to communicate with the absolute-encoder.



CAN-bus module for absolute-encoder adaptation.

Note: *absolute-encoders on SM hoists, are for the moment available only in combination with the discharge of the clutch as overload device and replaced by a load-sensor.*

CONTROL-COMPUTER LAPTOP

The central processor, or remote control of a R8CPU installation is a desktop PC or Laptop. The R8CPU units are through an Ethernet cable connected with the PC and as such a network configuration is realized.

For single connections (PC to one R8CPU rack) a direct connection cable could be used provided that it is one with inverted wires. For set-ups comprising more than one R8CPU rack, the add of a hub is required. The connection cables should be straight in that case.



With the computer you are able to set positions, program and save scenes, and control the show. The computer sends the data via the Ethernet hub to the connected racks.

The use of a standard PC ensures the possibility of switching to an other PC-product if needed. The computer enables you to work with standard-software like MS-Word or Excel since the system is based on Microsoft-Windows™ system control.

This Laptop is predestined for the rough stage environment and therefor the following specification is recommended.

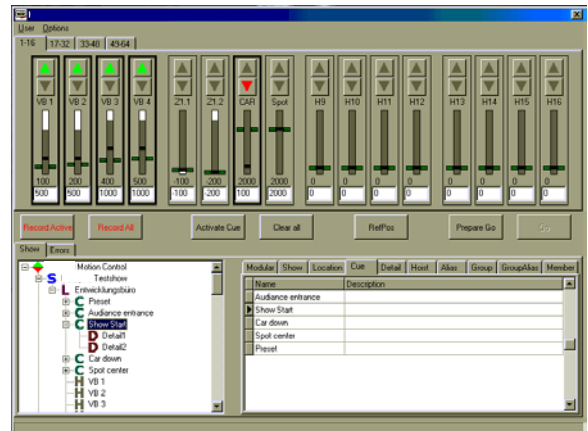
- LCD-case made of endurable magnesium-alloy
- 4 GB Hard-Drive gel-protected, vibration-protected
- Protected for falls from a height up to 30cm
- endurable handle (ideal for mobile anti-theft devices)
- Pentium II 266 MHz
- 32 MB SDRAM
- 12,1" TFT, 800*600 SVGA
- Card Bus (1*Typ III or 2* Typ II)
- Floppy-Disk-Drive

In case the PC is not positioned close to one of the rack's, an emergency-stop must be available in the direct proximity of the PC. For this purpose the E-stop must be installed within the reach of the operator, connected by means of the E-stop cable.

SOFTWARE (free of charge)

Software for the R8CPU controllers is because of the standard Windows 9x interface, easy tree-structures and intuitive system design the learning time is minimized. The software and it's updates are free of charge and continuously in the process of development. It can be downloaded from the internet at www.stagemaker.com. free of charge.

- easy Installation / de-installation of the software by InstallShield
- Online-Parameter-Setting of the Chain-Hoists
- easy tree-structure of shows and locations
- Error-Log
- Password-Protection (first entry password = "admin")
- no deep menu-structures, all functions are directly accessible
- unlimited number of shows/locations/cues, etc.
- very simple cue-system with group-functions and position-naming(Alias)
- comfortable installation-mode with quick interference possibilities
- colored status display of the hoists, position information is simultaneously displayed by numbers and graphically
- synchronous-movements-mechanisms with regulation possibility
- dead-Man function over mouse and keyboard
- comfortable use of positions in the cue-system (Teach In)
- record function exists as Tracking and Cue-Only
- import and export, creation and deletion of shows and locations, data can be copied on standard 3,5" discs.
- copying of Presets, Groups, Details, Cues, and Shows
- creation of different Hoists for different Shows
- Creating / Deleting Presets for one Hoist, Groups , Members for one Group, Cue Details for one Cue
- In each Cue the target positions and delay times for each single drive can be saved.
- offline Simulation-Mode
- Presets for rapid -Positions are possible, so that Cues don't have to be changed when switching locations
- negative heights are possible
- New software is automatically distributed by the computer control to the rack.



Control principal

The hoist contains only the relays and the transformer and rectifiers for the brakes or the circuits to detect overload or slack-wire (option).

This approach has a the advantage of easily mixing different type of motors sharing one CPU controller, still the electronics, the controls including E-stop and main fuses stay within your reach.

Drives

The R8CPU modular control is a universal control for different type of drives, Stagemaker Hoist as well as Tirlift universal winches, provided that they have contactor control and single speed motor.

The system allows positioning by:

- incremental-encoders
- time-control
- absolute-encoders
- manually by sight, without positioning

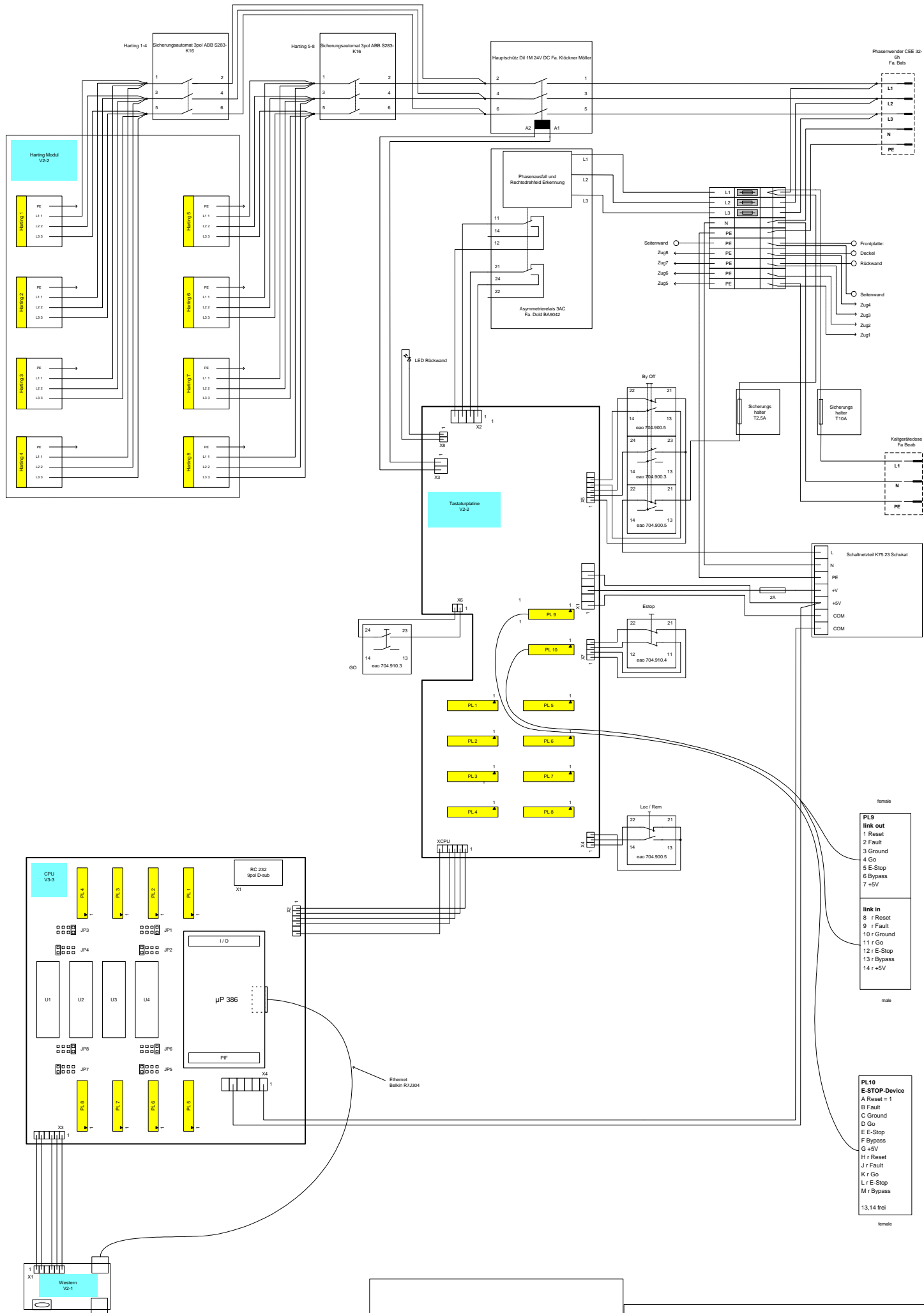
Chain-Hoists

It is most likely that incase of new investments hoist are already prepared to communicate with the R8CPU control, such hoist do have all the options required to optimize the system, the control, the safety and the precision. But in the event one has already a stack of hoists that still are in good condition, it could be a good and economical solution to have a number of these modified for a first experience before further investments are made. The modification contains the implementation of the low-voltage circuit and multi pin connector.

Such modified hoists are able to communicate with the R8CPU controller, but programming is restricted on time bases. The system calculates the travel time over the given distance. This calculation is made on the basis of the nominal speed under full load upwards as well as downwards.

One has to take in consideration that the precision is less accurate has on encoder basis. Another aspect has to be considerate is the non availability of electric end-switches as an additional "watch-dog" in case falls programming is made. One has to obtain certain safety margins to avoid excessive operation of the mechanical limit effected by the clutch.

To simplify the cabling between hoists and controller, the whole signal-processing, power supply and decoding is put in to one multi-core cable. It substantial reduces the erection and dismantling time of on tour systems.



STAGEMAKER CPU CONTROLLER PROXVALUE SETTING INSTRUCTIONS

In order to control the hoist position at any time, it is equipped with an encoder that gives a number of pulses per meter lift. These pulses are a reference for the CPU controller software and needs to be personalised in relation to the type of hoist or encoder used.

Internal hard ware settings:

The controller has 4 frequency input levels, to adapt the number of pulses to the software. Adaptation is made by jumpers JP1 to JP8 on the CPU board in side the controller

Jumper settings (Js):

- < 95Hz JP1 to 8 position 1 (Js=1)
- < 190Hz JP1 to 8 position 2 (Js=2)
- < 380Hz JP1 to 8 position 3 (Js=4)
- < 760Hz JP1 to 8 position 4 (Js=8)

Factory setting is made at 380 Hz. JP1 – 8 position 3.

Encoder value's (Pm):

- SM1 : 316.2 per meter lift
- SM5 : 1692.13 per meter lift
- SM10 : 186.14 per meter lift (a – till oct. 2003)
- SM10 : 278.25 per meter lift (b - from oct. 2003)

These values are applicable for single fall hoists. If the hoist has two falls, the numbers of pulses per meter lift are to be multiplied by 2.

Soft ware settings:

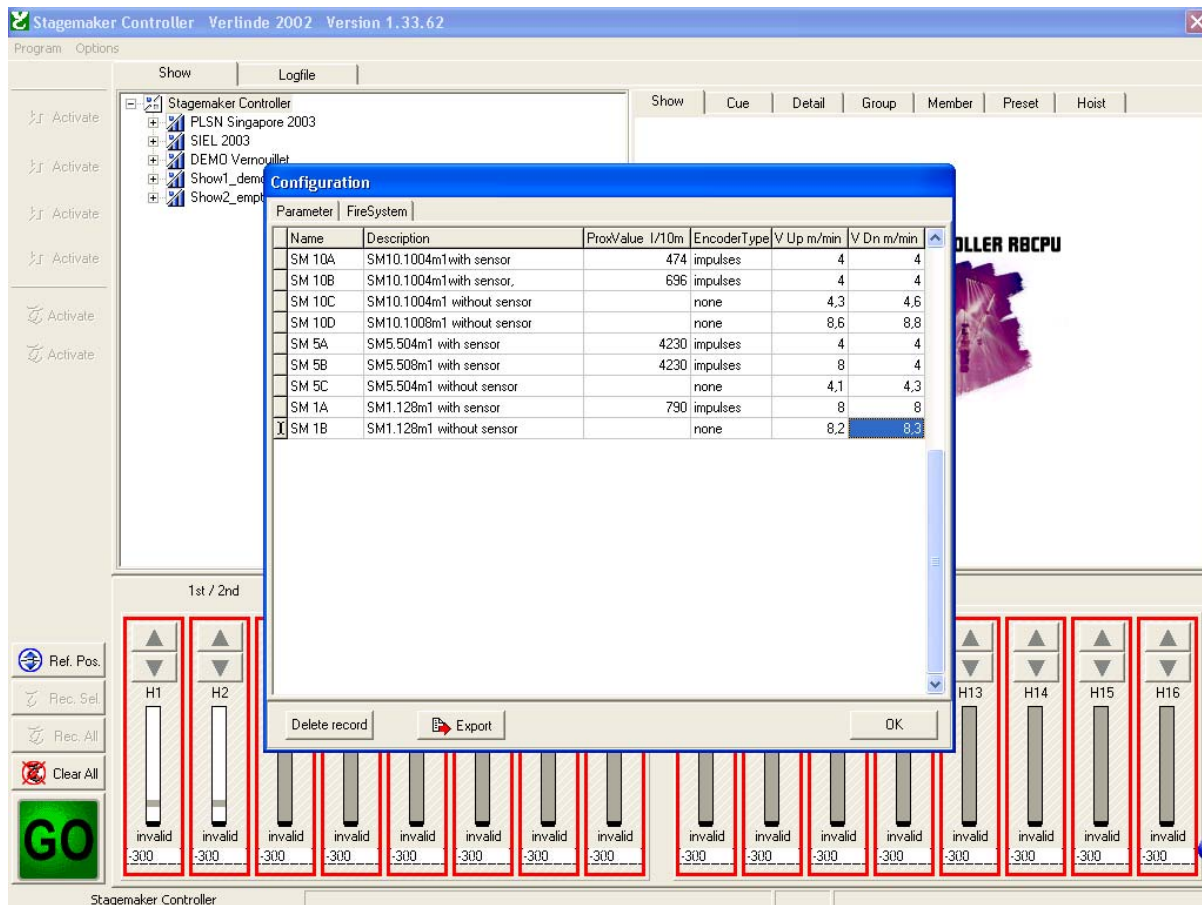
The individual encoder values are to be filled in the table that could be found under "options" – "configurations"

In the basic software there might be already value's given, but these need to be re-configured in line with the actual hoists supplied.

The table needs a value equal to 10 meter of lift.

The formula for the proxvalue is: **Pm x 10 / Js**

- | | | | |
|-------------------------------|-------------------------|---|------|
| For SM1 the proxvalue is | $316.2 \times 10 / 4$ | = | 790 |
| For SM5 the proxvalue is | $1692.13 \times 10 / 4$ | = | 4230 |
| For SM10 (a) the proxvalue is | $189.44 \times 10 / 4$ | = | 474 |
| For SM10 (b) the proxvalue is | $278.25 \times 10 / 4$ | = | 696 |



In the column “Encoder type” click in the right corner to activate a selection table. Click on “Impulses” to select the proxvalue mode. Details on the speed as given on the two remaining columns are not relevant in the “Impulse” mode.

Note:

Since the proxvalue is an artificial value calculated by the software, some fine-tuning might be needed to reach an optimal precision. For that purpose run the hoist in manual mode over a verified distance of for example 10 meter. Programme it to run by the program over the same distance and check eventual discrepancies. Add or subtract points from the corresponding proxvalue in the table to compensate the difference. Repeat this operation to find the correct balance between the theoretical and practical value.

Proceed this for each hoist model. (SM1 – SM5 or SM10). Once this has been done for one hoist, the data will be used for any hoist connected and selected by the code given in the first column of the table.

