



ziehm imaging

dedicated to clinical innovation

Ziehm Solo

Service Manual

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This document was produced in accordance with a certified QM system as per DIN EN ISO 13485. They conform to the requirements of Council Directive 93/42 EEC, Annex I, and other applicable norms. The information provided in this document may be updated at regular intervals. Subject to change without prior notice.

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Rev. 06/2010

With the Ziehm Solo, Ziehm Imaging GmbH provides an active medical device connected to the mains power supply. The above listed medical device is a non-contact device. It does not require any contact with the patient to perform its intended use. It provides contactless energy in the form of X-rays.

Ziehm Imaging GmbH authorizes only trained and skilled personnel to operate this medical device. The system is intended for use by health care professionals such as physicians, orthopedic surgeons, vascular surgeons, neurovascular surgeons, cardiologists, radiologists and technologists in hospitals, outpatient clinics and other clinical environments. Ziehm Imaging GmbH anticipates the system will be used on a nearly daily basis. Ziehm Imaging GmbH applications specialists and/or qualified site personnel provide on-site operator training in the proper use of the system.

The Ziehm Solo is a mobile C-arm. Using a non-invasive X-ray method during intervention, it provides image information and stores this temporarily.

The Ziehm Solo can be used for all medical indications where fluoroscopy is required.

The system is intended for use with human beings of any age. It is the physician's responsibility to decide whether to use the system with infants, children and adipose patients. The system can be used for the whole human body without restriction (e.g. organs, tissue, bones, implants) depending on the medical indication. This device is not intended for use in performing mammographic exposures.

The Ziehm Solo is intended to provide contactless fluoroscopy imaging, capturing, temporarily storing and display of non-invasive X-ray imaging of the patient using pulsed and continuous fluoroscopy during diagnostic and surgical procedures. Examples of clinical application may include cholangiography, endoscopic, urologic, orthopedic, neurologic, vascular, cardiac, critical care and emergency room fluoroscopy procedures. Radiographic film examinations can be made with an accessory cassette device when attached to the image intensifier. This device does not support and is not intended for use in performing mammographic imaging.

The system provides contactless fluoroscopy and according to this does not have applied parts.

The system may only be used in heights up to 6561.7 ft (2000 m) above sea level and must be used within the limits defined by the technical specification. The use of the system is only allowed in rooms used for medical purposes in accordance with EMC class A as well as with protective earth conductor. The system may only be used in an environment with an oxygen saturation of < 25%.

The system must be maintained regularly according to the maintenance procedures by qualified personnel authorized by Ziehm Imaging GmbH. The system may only be used in faultless condition and in accordance with the terms set forth by the operating instructions.

The system is not suitable for interventional procedures acc. to IEC 60601-2-43.

The monitors are not suitable for diagnostic purposes.

The system may only be operated by personnel who has undergone radiological training.

In the USA, Federal law restricts use of this device to trained personnel on the order of a physician.

Only authorized personnel are allowed to assemble and/or repair the medical equipment described in this document. Authorized personnel are persons who have attended an appropriate training course provided by the manufacturer.

The exposure of humans to ionizing radiation must always be medically justified. Especially when used on pregnant women, adolescents, children, and pediatric patients, all procedures using ionizing radiation should be used with caution or be avoided altogether. However, the final decision lies with the attending physician or attending surgeon.

The monitors are not suitable for diagnostic purposes.

The manufacturer accepts responsibility for the safety, reliability and performance of the system only if

- any installation, modification or repair work is carried out exclusively by persons authorized by the manufacturer;
- the electrical installation of the site where the system is operated complies with the requirements of VDE 0107 or the corresponding national regulations of the country of installation;

Preface

Intended use

Indications for use

Normal use

Exclusions

Operation

Operation (USA)

Authorized personnel

Contraindications to the use of X-rays

Exclusion of liability

- only original spare parts or components that comply with Ziehm Imaging's specifications are used;
- the system is used in accordance with the Operating Instructions.

The warranty becomes invalid in case that any repair, modification or installation work is carried out by unauthorized personnel, or any seals on components are broken. No consequential damages will be accepted either.

CE 1275

The equipment conforms to Class IIb according to Council Directive 93/42/EEC.

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0 Classification Mobile Stand / Viewing Station

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7	X-ray Generator	⊕	
8	Vision Track	⊕	
9	TFT Solo Center	⊕	⊕
10	Viewing Station (option)		⊕
11	Video Documentation	⊕	⊕
12	Monitors	⊕	⊕
13	Image Memory System	⊕	
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15	DICOM Conformance Statement	⊕	
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1

Warnings and Important Information

1 Warnings and Important Information

1.1 Safety Instructions

This manual does not constitute a complete catalog of all safety measures necessary for the operation of the respective medical equipment, since special operating conditions may require further measures. However, it does contain instructions which must be observed in order to ensure the personal safety of operating staff and patients as well as to avoid damage to property. These instructions are highlighted as follows:

⚠ DANGER



DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING



WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION



CAUTION

Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

NOTICE

Indicates a property damage message.



NOTE

Notes are informative. Additional useful information and hints are provided for the operator here.

1.2 Warnings

⚠ WARNING**WARNING**

The mobile stand power module contains live voltage, even if the unit has been switched off at the C-arm keyboard or the emergency switch is actuated. Make sure to disconnect the unit from the mains supply when performing service work on the unit.

⚠ WARNING**WARNING**

The pre-power supply within module 1 contains a large storage capacitor that filters the line voltage. The capacitor may contain high voltage even after the unit is disconnected from the mains supply. A warning lamp (GL1) on the pre-power supply board FG2025 indicates the state if the voltage of the capacitor is higher than 60 V_{DC}.

⚠ WARNING**WARNING**

The modules 1 (power supply) and 5 (X-ray generator) contain dangerous voltages. During operation the voltages exceed 250 V_{DC}.

⚠ WARNING**WARNING**

Parts of the C-arm may be contaminated infectiously. We strongly recommend to wear disposable vinyl gloves while doing service.

1.3 Required Tests After Service

The following tests have to be performed after every service:

- Is the mechanics working properly?
- Are all cables (P3,P4, mains and swivel cable) in good condition?
- Are the TFT keyboards working properly?
- Is the printout of the video printer okay? (If printer is available)
- Is the system working fine?
- Perform electrical safety check according to relevant national regulation of the country of installation.

Possible discrepancies have to be recorded in the service report.



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2

General

2 General

2.1 System Overview Mobile Stand

2.1.1 Left side

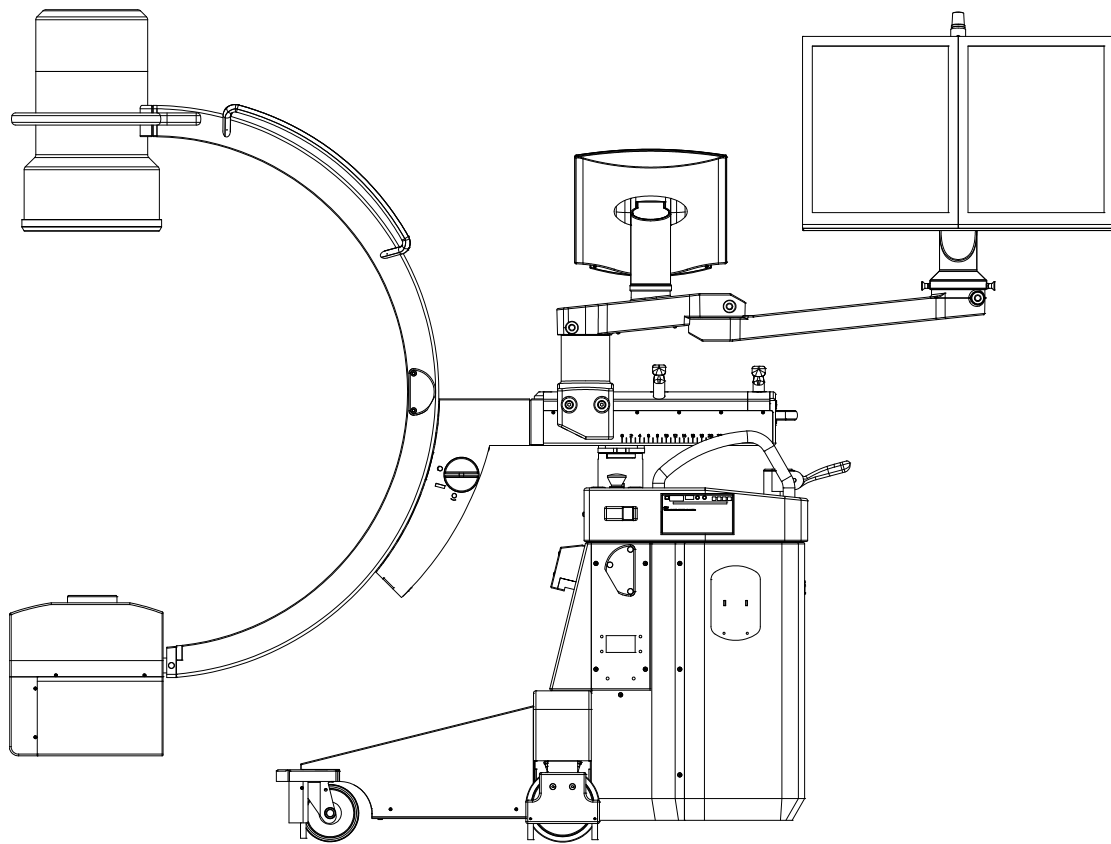


Fig. 2-1 System overview of mobile stand left side

2.1.2 Right side

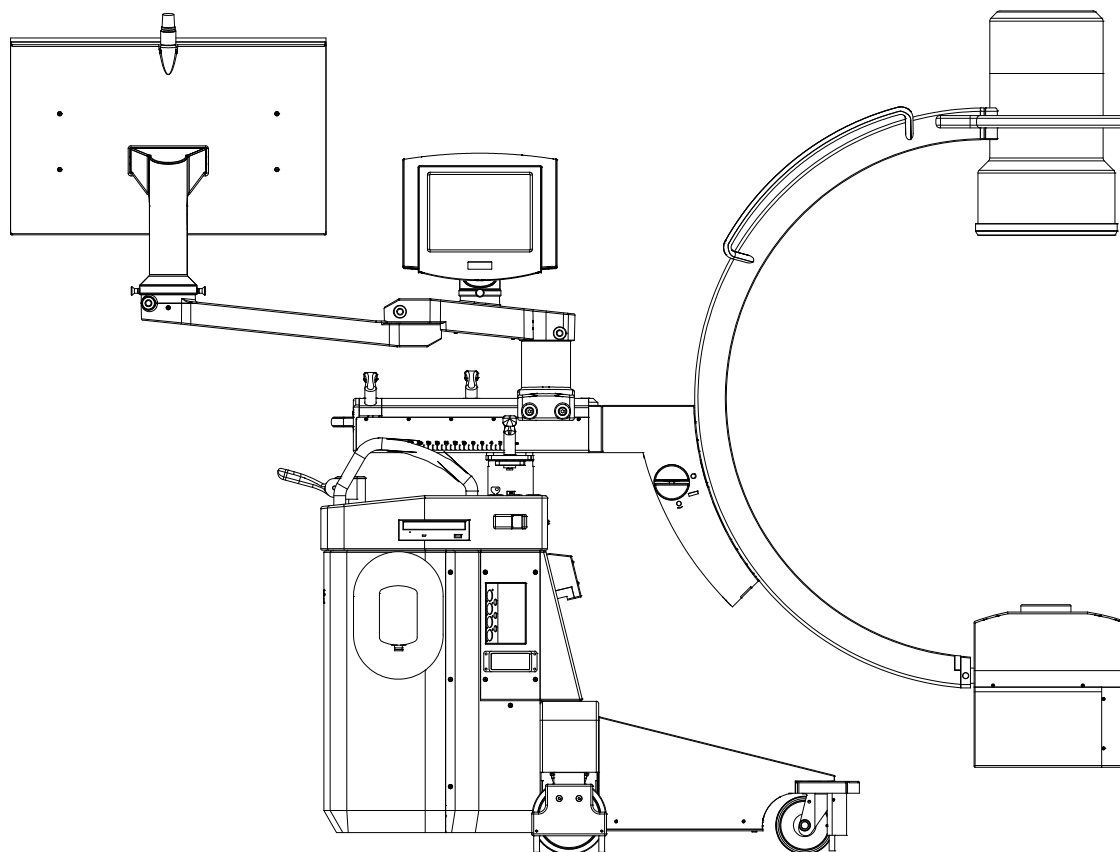


Fig. 2-2 System overview of mobile stand right side

2.2 Block Diagram CAN Fault Line

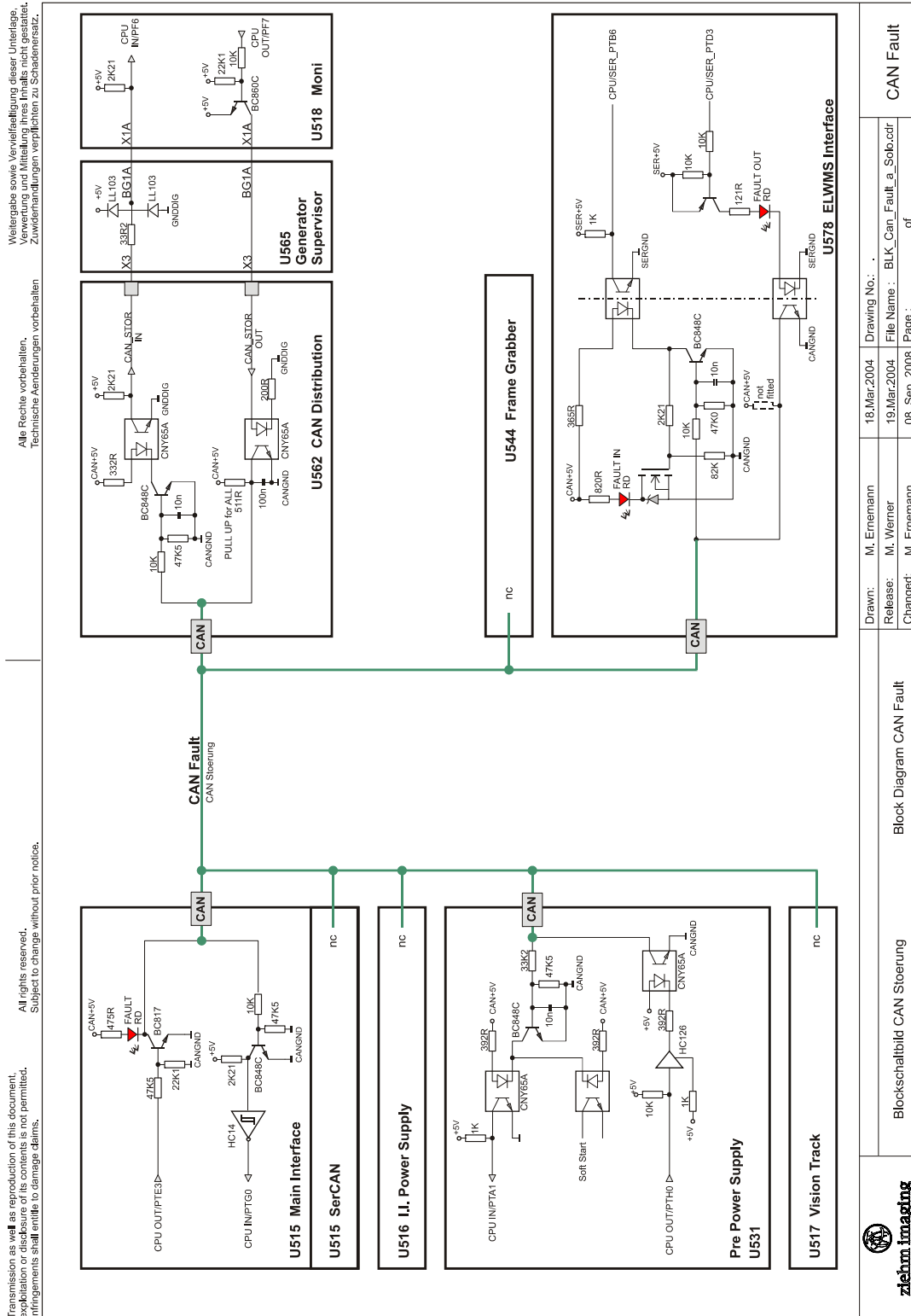


Fig. 2-3 Block diagram of CAN fault line

2.3 System Description

Mobility

With its compact design and combined steering & braking system, the Ziehm Solo offers unrestricted mobility at the operating table, even if space is scarce.

The easy adjustability of the ample C-arm and the perfect counterbalancing of the C-arm stand make it possible to access even the most difficult positions.

Anatomical programs

Computer-controlled anatomical programs ensure optimum exposure rate and image quality control as well as high operating comfort. A 'Soft' program for soft tissue visualization during foreign body localization and a 'Metal' program for suppressing image flare resulting from the use of metal implants and surgical instruments complete the automatic functions.

Radiation dose reduction

The superior penetration capabilities of the digital high-frequency generator enable a significant reduction in the patient skin dose.

Radiation-free collimation is provided by the system's 'Virtual Collimator'.

Image quality

18" flatscreen monitors guarantee flicker-free images. The advanced Full Frame Technology, which uses non-interlacing throughout the entire image processing chain, generates noise-free images without motion artifacts, even if the subject has moved.

Image adjustment

Comprehensive real-time image processing functions (customizable noise and area filtering, electronic contrast and brightness adjustment, zooming, radiation-free horizontal and vertical image reversal, digital image rotation) ensure perfect adaptation of the image quality and orientation on the screen to the surgeon's needs.

Further image processing functions are available for saved images (**post-processing**).

Image management

A patient-based image management system providing a 16-image mosaic view and menu-controlled user guidance guarantees efficient image data handling.

Documentation and output

For documentation purposes, a video printer is available.

For filmless archiving, the following devices are available:

- DVD writer
- USB port

Images can be stored in the following formats:

- PC-compatible TIF format
- PC-compatible JPEG format with reduced resolution and reduced color depth
- DICOM format
- DICOM format with reduced resolution and reduced color depth
- Multimedia format: Video CD format (CD) or MPEG2 format (DVD).

The system documents not only patient-related data, but also image-related data (e.g. the fluoroscopy parameters).

In addition, all systems have a video output.

Networkability

The optional DICOM 3.0 interface (Ziehm NetPort) enables integration into any network supporting DICOM, e.g. PACS. Thanks to 'Primary Capture' support, the original fluoroscopic images can be archived without the changes which may have been applied to them later. The following DICOM classes are available: Print, Storage (including multiframe capability), Media, Worklist, Query/Retrieve and Verification.

It is possible to connect and configure several DICOM servers for each DICOM Class.

For more information on DICOM, please refer to our DICOM Conformance Statement (→ Ch. 17, p. 17-1).

2.4 Board Numbers

Module	Board	Description
1		Power Supply
	U579	Voltage Distribution Mobile Stand
	U531	Pre-regulator
	FG 2025	Pre-Power-Supply
	FG 9938	24 V Power Supply
	U535	Capacitor discharge board
	F1	ETA Circuit Breaker
	TR1	Mains-Transformer
	X1,X2	Terminal Block
2		Mobile Stand Control
	U515	Main Interface
4		Image Intensifier
	U516/U632	I.I. controller
	U512	I.I. – DC/DC converter grid 1 and 2
	U513	I.I. – DC/DC converter grid 3
	U514	DC/DC converter anode
	U536	I.I. high-voltage cascade
	U830	Analog camera CCD board (FT18)
	U832	Analog camera power supply (FT18)
	U559	Analog camera power Supply (FT50)
	U560	Analog camera CCD Board (FT50)
5		Generator
	U604	High Voltage Power Stage
	U562	Generator connection and distribution
	U563	High Voltage Control
	U564	Filament Control + Power Supply
	U565 + U518	Generator Supervisor + Moni

Table 2-1 Board Numbers

Module	Board	Description
	U21	+HV Cascade (inside tank)
	U22	-HV Cascade (inside tank)
	U630	Tank connection board
	U602	12V Stabilization for coolant Pump
11		Digital Imaging System
	U544	Frame Grabber
	U622	Rotation/DSA/Display Board
	U621	Giga Star for TFT
	U404	External Floppy slot connector
	U578	Vision ELWMS Interface
	U633	Relay board, Driver for external radiation lamp
15		Vision Track
	U517/U608	Gen. Collimator Control
	U612	Servo Control Rotation
	U629	Servo Control V slot and slot collimator

Table 2-1 Board Numbers (cont.)

2 General

Module	Board	Description
Interface Panel		Viewing Station
	U406	Coax adapter for external video socket
	U634	TFT Interconnect Board
	U635	Power Distribution
18		Solo Center
	U592	TFT Connection Board passive Solo Center
	TFT	passive TFT

Table 2-1 Board Numbers (cont.)

2.5 CAN Bus

2.5.1 Numbers of CAN Modules

Module name	Circuit board number	CAN module number	Appears in Vision Studio as
C-arm stand			
Module 2 SERCAN	U515	1	SerFST
Module 2 Main interface	U515	4	FST
Module 5 Generator	U565 / U518	9	U506
Module 1 Pre-power supply	U531	10	U531
Module 15 Virtual collimator	U517/U608	17/18	U517/U608
Module 4 Image Intensifier	U516/U632	16/19	U516/U632
Module 11 Image Memory			
Frame grabber Vision	U544	6	MW
Power PC (located on frame grabber)	U544	136	U544
ELWMS Interface	U578	35	U578

Table 2-2 Numbers of CAN modules

The CAN module numbers are included in certain error messages (→ *Ch. 18.3.3, p. 18-13*). Using this table, you can identify faulty modules.

Fig. 2-4 CAN distribution in the mobile stand

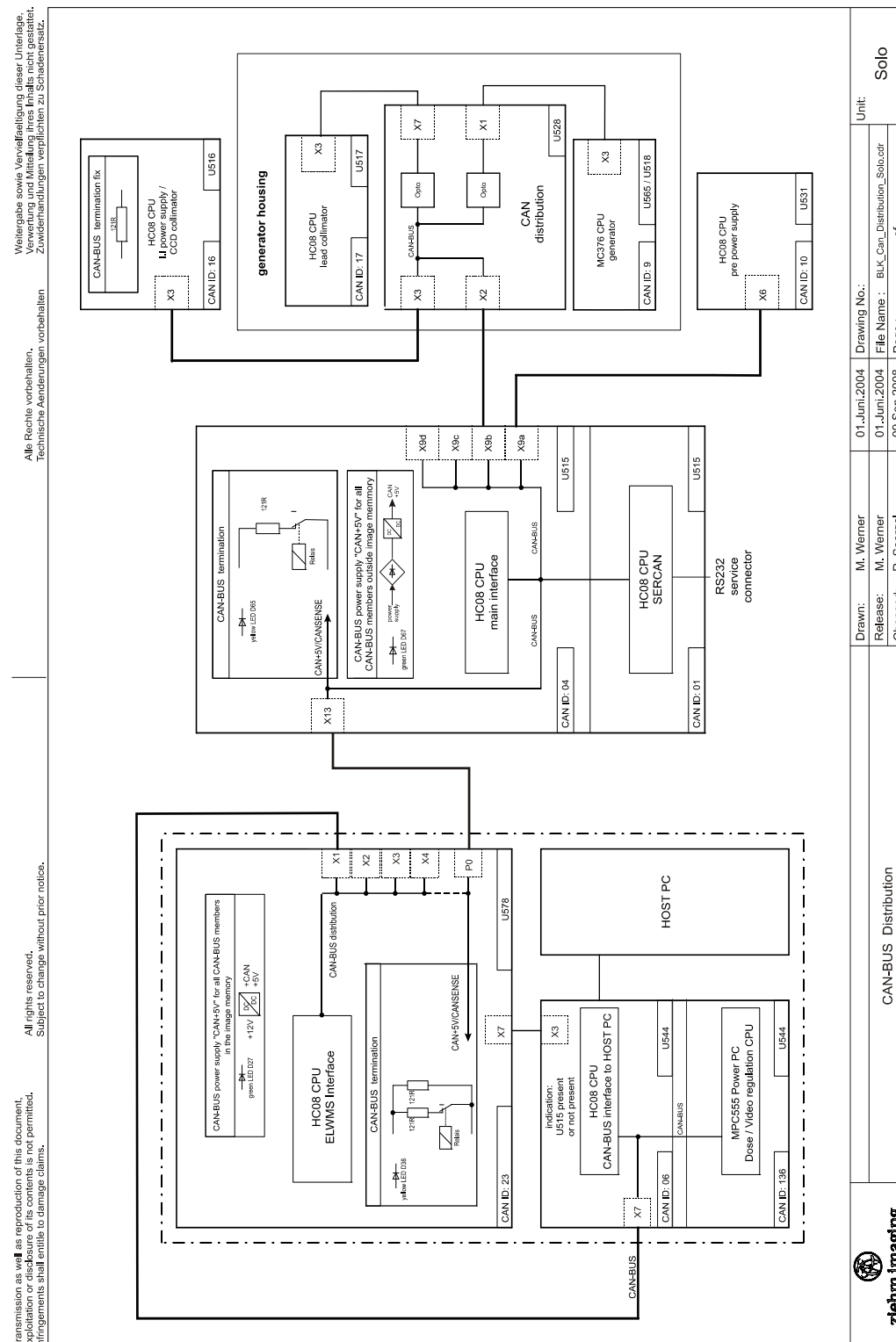


Fig. 2-4 CAN distribution in the mobile stand

2.6 Technical Data

2.6.1 General Technical Data

Image intensifier	Tube	
	Scintillator	Cesium iodide
	Nominal sizes	23 / 15 / 10 cm
	Anti-scatter grid	Pb 8/40
Monitors	24" flat-screen monitors	
	Display measurements	520 mm × 325 mm (20.4" × 12.8")
	Screen size (diagonal)	610 mm (24")
	Resolution in pixels	1920 × 1200
	18.1" flat-screen monitors	
	Display measurements	300 mm × 360 mm (11.45" × 14.28")
	Screen size (diagonal)	460 mm (18.1")
	Resolution in pixels	1280 × 1024 / 50 Hz or 60 Hz
Video standard output	CCIR, 50 Hz refresh rate, like PAL, no color	
	EIA 343, 60 Hz refresh rate, like NTSC, no color	
Environmental conditions	During storage/transport	
	Temperature	–5°C to +55°C
	Relative air humidity	20 % – 70 %
	Pressure	500 mbar – 1060 mbar
	Maximum vibration	10 Hz – 150 Hz
	Shock / vibration	25 g at 6 ms / 0.35 mm peak
	During operation	
	Temperature	+13°C to +35°C
	Relative air humidity	20 % – 70 %

Table 2-3 General technical data

Dimensions	C-arm	
	Source/image receptor distance	970 mm
	Vertical free space (generator/i.i.)	760 mm
	C-arm depth	680 mm
	Orbital rotation	135° (+45° – -90°)
	Angulation	±225°
	Swiveling (panning)	±10°
	Horizontal movement	220 mm
	Vertical movement	420 mm
Weight	C-arm stand	approx. 310 kg

Table 2-3 General technical data (cont.)

2.6.2 Systems with a voltage rating of 100 V, 120 V, 200 V

Systems with a voltage / frequency rating of:		100 V _{AC} ± 10%, 50/60 Hz	120 V _{AC} ± 10%, 50/60 Hz	200 V _{AC} ± 10%, 50/60 Hz
System	Power supply fuse rating	C 20 A or C 32 A (tripping characteristic C acc. to VDE 0641, Part 11; DIN EN 60898 + IEC 898)		
	Maximum line impedance	≤ 0.3 Ω	≤ 0.3 Ω	≤ 0.6 Ω
	Required residual current circuit breaker (RCD)	I _N ≥ 20 A, I _{AN} = 30 mA	I _N ≥ 20 A, I _{AN} = 30 mA	I _N ≥ 16 A, I _{AN} = 30 mA
	Typical power consumption, momentary			
		1980 VA	1950 VA	2040 VA
	Power supply in standby mode			
		350 VA (3.5 A)	350 VA (3 A)	360 VA (2 A)
	The values depend on the integrated documentation systems.			
Power input fuse		20 A slow (circuit breaker)	20 A slow (circuit breaker)	15 A slow (circuit breaker)
Equipment protection classification		Protection Class I, Type B, ordinary equipment, continuous operation		
Radiation controlled area (with generator in lowermost position and C-arm vertical)				
		23 cm image intensifier 4 m		
Generator	Power			
	Direct radiography			
		40–110 kV 12 mA min./ 20 mA max., 1.5 mAs min./ 100 mAs max.	40–110 kV 15 mA min./ 20 mA max., 1.5 mAs min./ 100 mAs max.	40–110 kV 15 mA min./ 20 mA max., 1.5 mAs min./ 100 mAs max.
	Fluoroscopy			
		40–110 kV 1.5–10 mA 1.5–20 mA (USA)	40–110 kV 1.5–10 mA 1.5–20 mA (USA)	40–110 kV 1.5–10 mA 1.5–20 mA (USA)
	Pulsed fluoroscopy			
		Pulse width 10–30 ms 1, 2, 4, 8, 12.5, 25 pulses/s (on systems with 50 Hz) 1, 2, 5, 10, 15, 30 pulses/s (on systems with 60 Hz)		

Table 2-4 Systems with a voltage rating of 100 V, 120 V, 200 V

2 General

Systems with a voltage / frequency rating of:		100 V _{AC} ± 10%, 50/60 Hz	120 V _{AC} ± 10%, 50/60 Hz	200 V _{AC} ± 10%, 50/60 Hz
Generator	Digital radioscopy (snapshot)			
		40–110 kV 0.1 mA min./ 20 mA max.		
	Operating frequency	20 kHz		
	Typical operating data with patient phantom			
	Fluoroscopy			
		80 kV / 9 mA		
	Direct radiography			
		80 kV / 9 mA		
	Max. operating data			
	Fluoroscopy			
		110 kV / 10 mA 110 kV / 18 mA (USA) 65 kV / 10 mA	110 kV / 10 mA 110 kV / 18 mA (USA) 80 kV / 10 mA	110 kV / 10 mA 110 kV / 18 mA (USA) 80 kV / 10 mA
	Direct radiography			
	110 kV / 12 mA 65 kV / 20 mA	110 kV / 15 mA 80 kV / 20 mA	110 kV / 15 mA 80 kV / 20 mA	
Digital radioscopy				
	110 kV / 12 mA 65 kV / 20 mA	110 kV / 15 mA 80 kV / 20 mA	110 kV / 18 mA 80 kV / 20 mA	
Max. power output				
Fluoroscopy				
	1100 W (110 kV / 10 mA)	1100 W (110 kV / 10 mA)	1100 W (110 kV / 10 mA)	
Direct radiography				
	1320 W (110 kV / 12 mA)	1650 W (110 kV / 15 mA)	1650 W (110 kV / 15 mA)	
Digital radioscopy				
	1320 W (110 kV / 12 mA)	1650 W (110 kV / 15 mA)	1980 W (110 kV / 18 mA)	
Nominal electric power (IEC 60601-2-7)				
	1000 W at 100 kV / 10 mA / 0.1 s	1000 W at 100 kV / 10 mA / 0.1 s	1000 W at 100 kV / 10 mA / 0.1 s	

Table 2-4 Systems with a voltage rating of 100 V, 120 V, 200 V (cont.)

Systems with a voltage / frequency rating of:		100 V _{AC} ± 10%, 50/60 Hz	120 V _{AC} ± 10%, 50/60 Hz	200 V _{AC} ± 10%, 50/60 Hz
Generator	X-ray tube	Single-focus stationary-anode tube		
	Focal spot nominal size, in relation to reference axis	0.6 acc. to IEC 336		
	Focal spot horizontal tolerance, in relation to reference axis	± 0.5 mm (controlled)		
	Anode angle, in relation to reference axis	8°		
	Anode material	Tungsten		
	Total filtration	≥ 3.9 mm Al equivalent incl. Cu ≥ 0.1 mm		
	Maximum X-ray tube loading factors for	1h; 3 mA at 110 kV		10800 mAs/h

Table 2-4 Systems with a voltage rating of 100 V, 120 V, 200 V (cont.)

2.6.3 Systems with a voltage rating of 220 V, 230 V, 240 V

Systems with a voltage / frequency rating of:		220 V _{AC} ± 10%, 50/60 Hz	230 V _{AC} ± 10%, 50/60 Hz	240 V _{AC} ± 10%, 50/60 Hz
System	Power supply fuse rating	C 16 A (tripping characteristic C acc. to VDE 0641, Part 11; DIN EN 60898 + IEC 898)		
	Maximum line impedance	≤ 0.6 Ω		
	Required residual current circuit breaker (RCD)	I _N ≥ 16 A, I _{AN} = 30 mA		
	Typical power consumption, momentary			
		2040 VA	2060 VA	2080 VA
	Power supply in standby mode			
		360 VA (approx. 16 A)	370 VA (approx. 16 A)	370 VA (approx. 16 A)
	The values depend on the integrated documentation systems.			
Power input fuse	15 A slow (circuit breaker)			
Equipment protection classification	Protection Class I, Type B, ordinary equipment, continuous operation			
Radiation controlled area (with generator in lowermost position and C-arm vertical)				
	23 cm image intensifier: 4 m			
Generator	Power			
	Direct radiography	40–110 kV 15 mA min./ 20 mA max., 1.5 mAs min./ 100 mAs max.		
	Fluoroscopy	40–110 kV 1.5–10 mA 1.5–20 mA (USA)		
	Pulsed fluoroscopy	Pulse width 10–30 ms 1, 2, 4, 8, 12.5, 25 pulses/s (on systems with 50 Hz) 1, 2, 5, 10, 15, 30 pulses/s (on systems with 60 Hz)		

Table 2-5 Systems with a voltage rating of 220 V, 230 V, 240 V

Systems with a voltage / frequency rating of:		220 V _{AC} ± 10%, 50/60 Hz	230 V _{AC} ± 10%, 50/60 Hz	240 V _{AC} ± 10%, 50/60 Hz
Generator	Digital radioscopy (snapshot)			
		40–110 kV 0.1 mA min./ 20 mA max.		
	Operating frequency	20 kHz		
	Max. operating data			
	Fluoroscopy	110 kV / 10 mA 110 kV / 18 mA (USA) 80 kV / 10 mA		
	Direct radiography	110 kV / 15 mA 110 kV / 18 mA (USA) 80 kV / 20 mA		
	Digital radioscopy	110 kV / 18 mA 80 kV / 20 mA		
	Typical operating data with patient phantom			
	Fluoroscopy	80 kV / 9 mA		
	Direct radiography	80 kV / 9 mA		
Max. power output				
Fluoroscopy	1100 W (110 kV / 10 mA)			
Direct radiography	1650 W (110 kV / 15 mA)			
Digital radioscopy	1980 W (110 kV / 18 mA)			
Nominal electric power (IEC 60601-2-7)				
	1000 W at 100 kV / 10 mA / 0.1 s			
X-ray tube				
	Single-focus stationary-anode tube			

Table 2-5 Systems with a voltage rating of 220 V, 230 V, 240 V (cont.)

2 General

Systems with a voltage / frequency rating of:		220 V _{AC} ± 10%, 50/60 Hz	230 V _{AC} ± 10%, 50/60 Hz	240 V _{AC} ± 10%, 50/60 Hz
Generator	Focal spot nominal size, in relation to reference axis	0.6 acc. to IEC 336		
	Focal spot horizontal tolerance, in relation to reference axis	± 0.5 mm (controlled)		
	Anode angle, in relation to reference axis	8°		
	Anode material	Tungsten		
	Total filtration	≥ 3.9 mm Al equivalent incl. Cu ≥ 0.1 mm		
	Maximum X-ray tube loading factors for	1h; 3 mA at 110 kV		10800 mAs/h

Table 2-5 Systems with a voltage rating of 220 V, 230 V, 240 V (cont.)

3

Connections

3 Connections

3.1 XP3 Cable

The XP 3 cable is used in order to connect an additional viewing station to the Ziehm Solo

3.2 Mains Connection Cable

There is a separate cable in order to connect the mains voltage to the Ziehm Solo. The Ziehm Solo will always be supplied by this cable, no matter if a viewing station is connected or not.

Voltage selection will be done by using different types of this cable depending on the line voltage.

3.3 C-arm - I.I. Housing

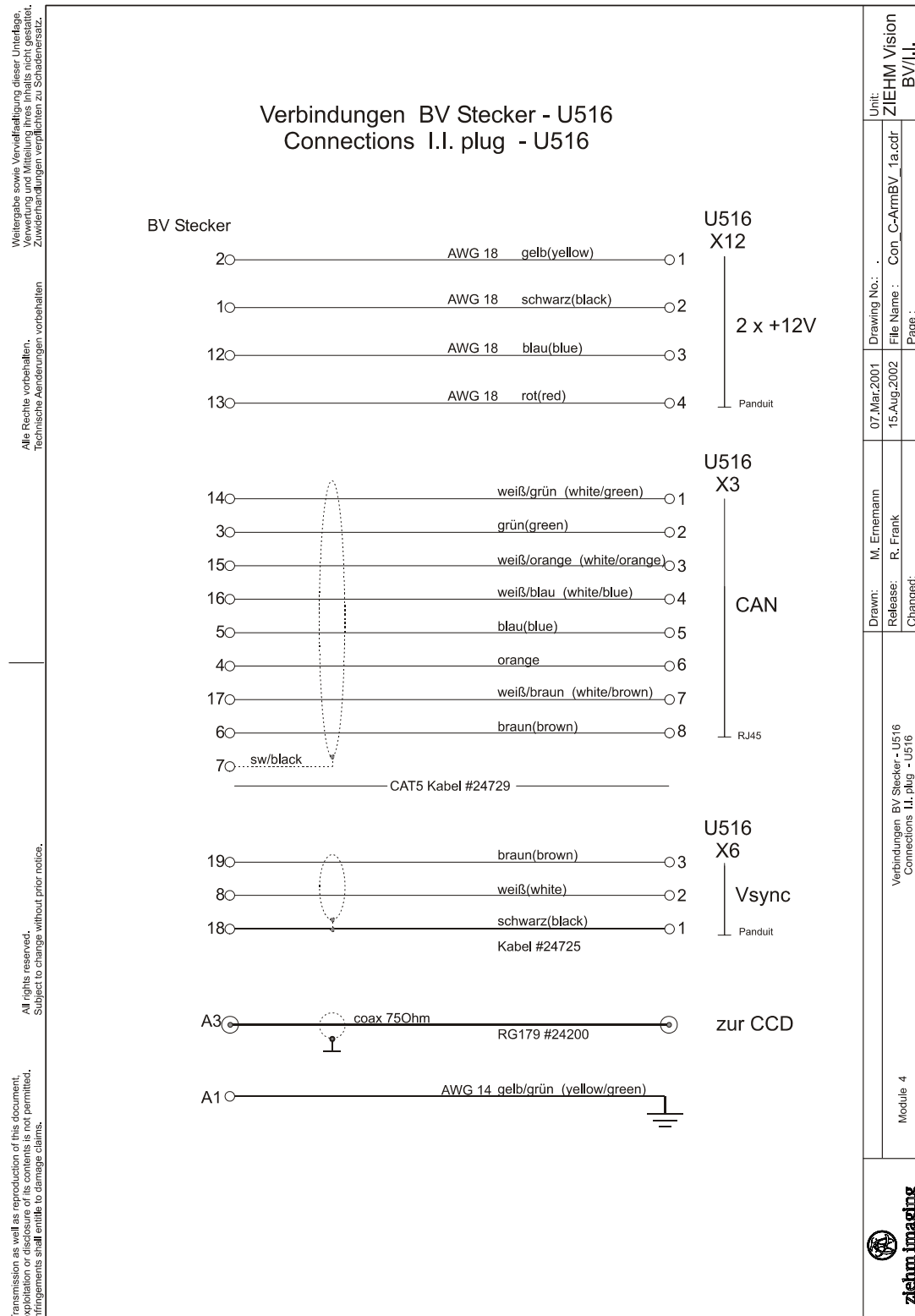


Fig. 3-1 Connection between I. I. housing and C profile

3.4 CAN - RJ-45-RJ-45

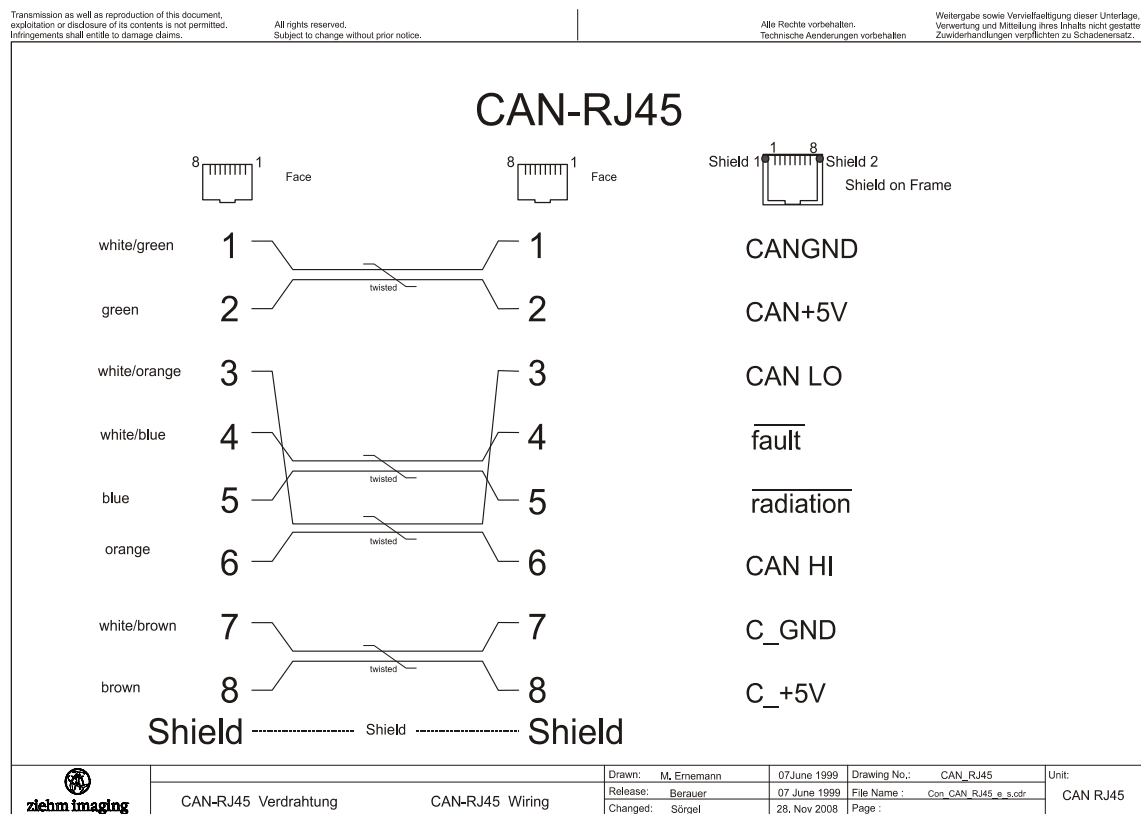


Fig. 3-2 Wiring CAN bus cable RJ-45-RJ-45

3.5 CAN - Molex–RJ-45

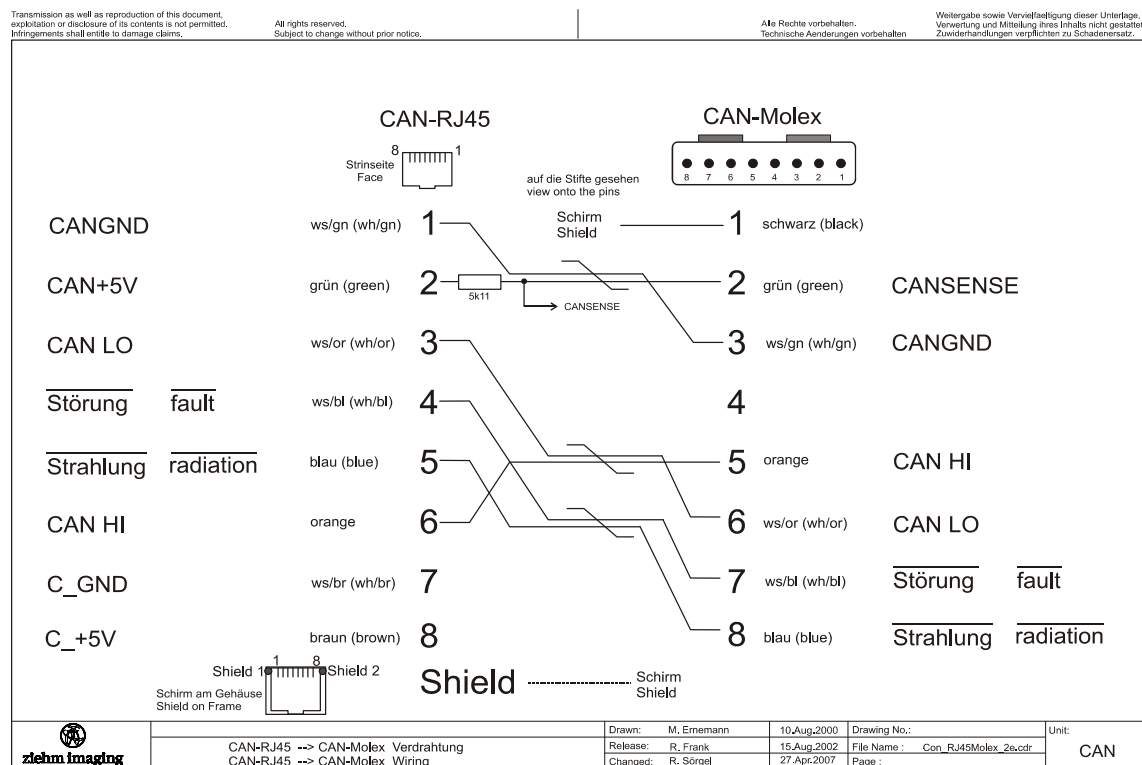


Fig. 3-3 Wiring CAN bus MOLEX–RJ-45

This wiring does not exist as a physical cable. It indicates the internal wiring on the U515 board from RJ-45 to Molex.

The Molex connector connects the CAN Bus to the Image Memory. If the image memory is connected, the CANSENSE line is pulled to low level. (approx. 1V)

3.6 Wiring of Hand and Foot Switches

3.6.1 Wiring of Hand Switch

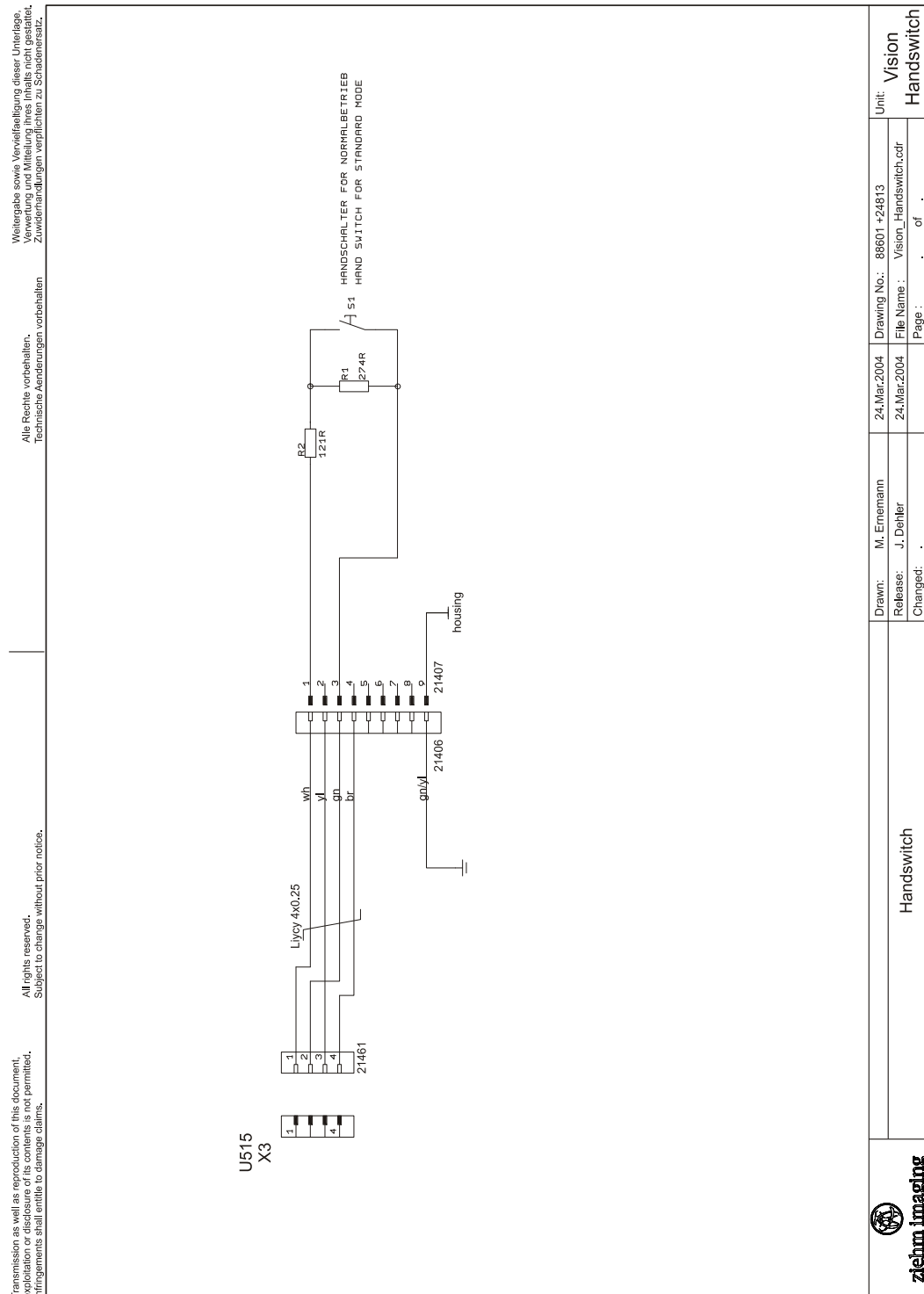


Fig. 3-4 Wiring of Hand Switch

3.6.2 Wiring of 2-pedal Foot Switch

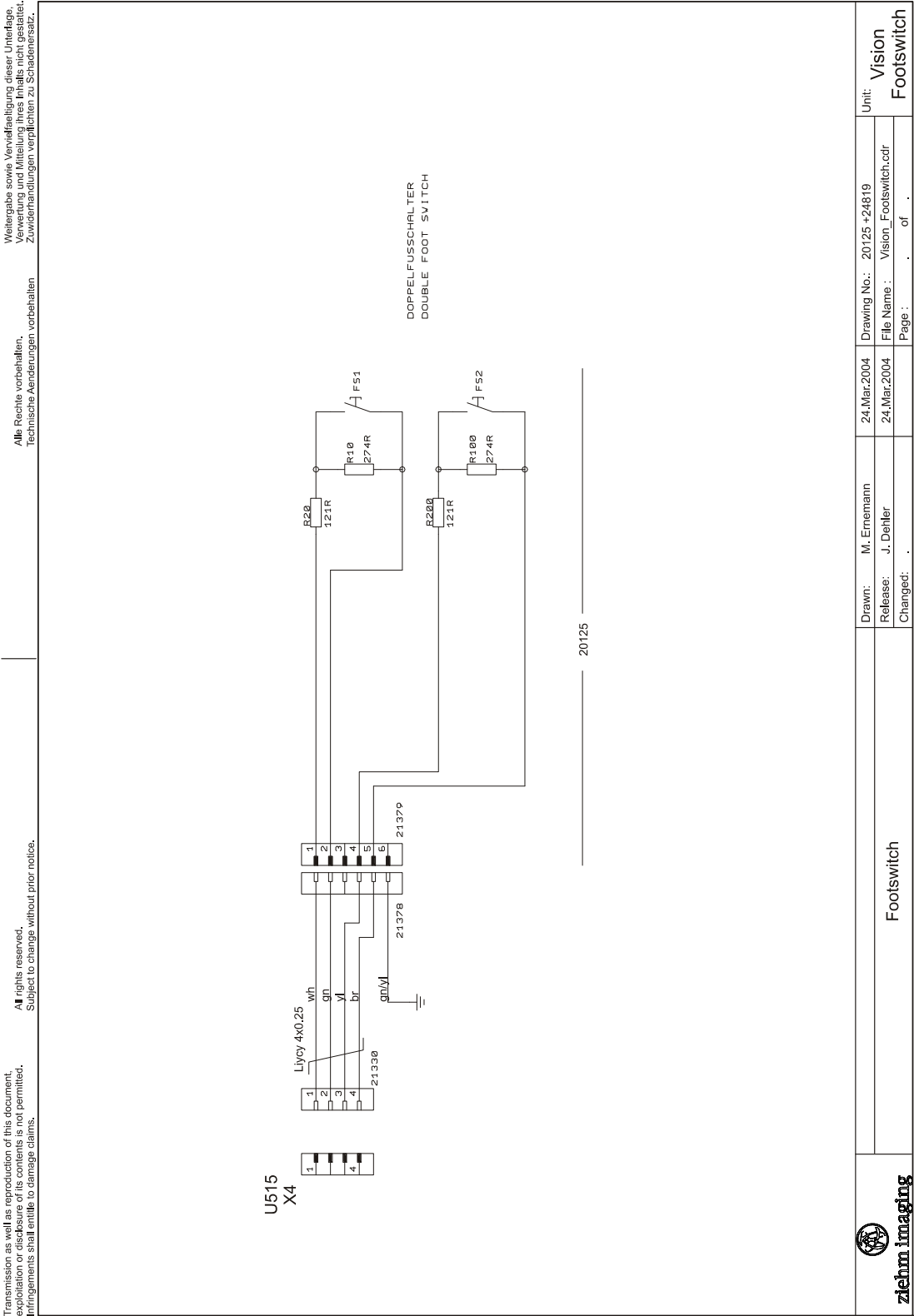


Fig. 3-5 Wiring of 2-pedal Foot Switch

3.7 Wiring of Mobile Stand

The following pages show the wiring diagrams of the Ziehm Solo.

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 Technische Änderungen vorbehalten

XP3
 Protective Earth AWG14 0pV
 Central Ground PE
 Left Hand Switch Hand 1,2
 Right Hand Switch Hand 1,2
 Port 1,2
 Port 3,4
 Port 1,2
 Port 3,4
 To interface cable
 user interface cable
 to the switches in the air

Module 11
 Image-System
 See page 9 and 10
 for description
 of the connections

Module 2 Main Interface
 U515
 CAN P0
 CAN P1
 CAN P2
 CAN P3
 CAN P4
 CAN P5
 CAN P6
 CAN P7
 CAN P8
 CAN P9
 CAN P10
 CAN P11
 CAN P12
 CAN P13
 CAN P14
 CAN P15
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Fig. 3-6 Module 1 and Module 2 wiring

3.7.2 Power Supply – Transformer

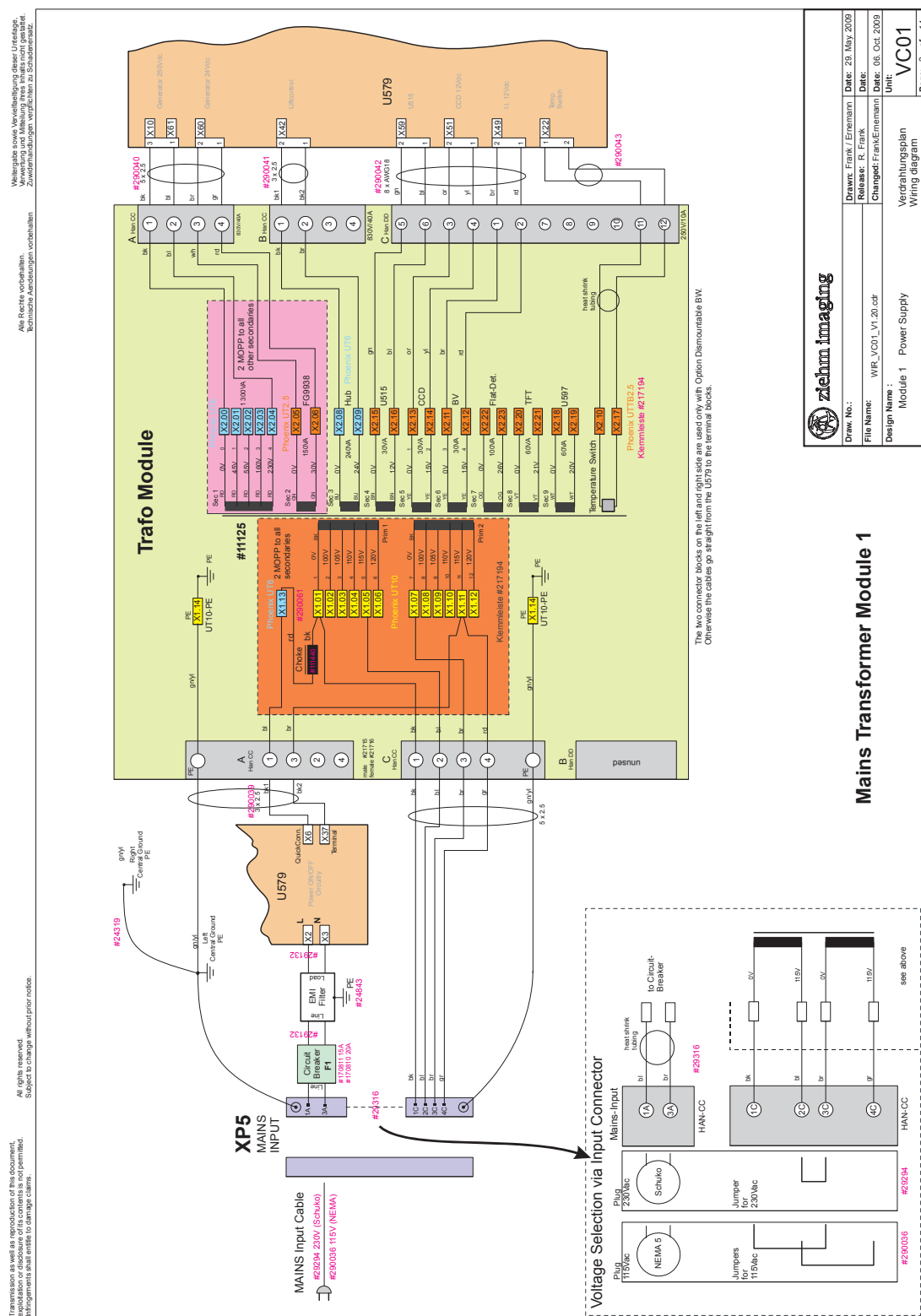


Fig. 3-7 Module 1 Transformer wiring

Fig. 3-8 Generator and monitor supply wiring

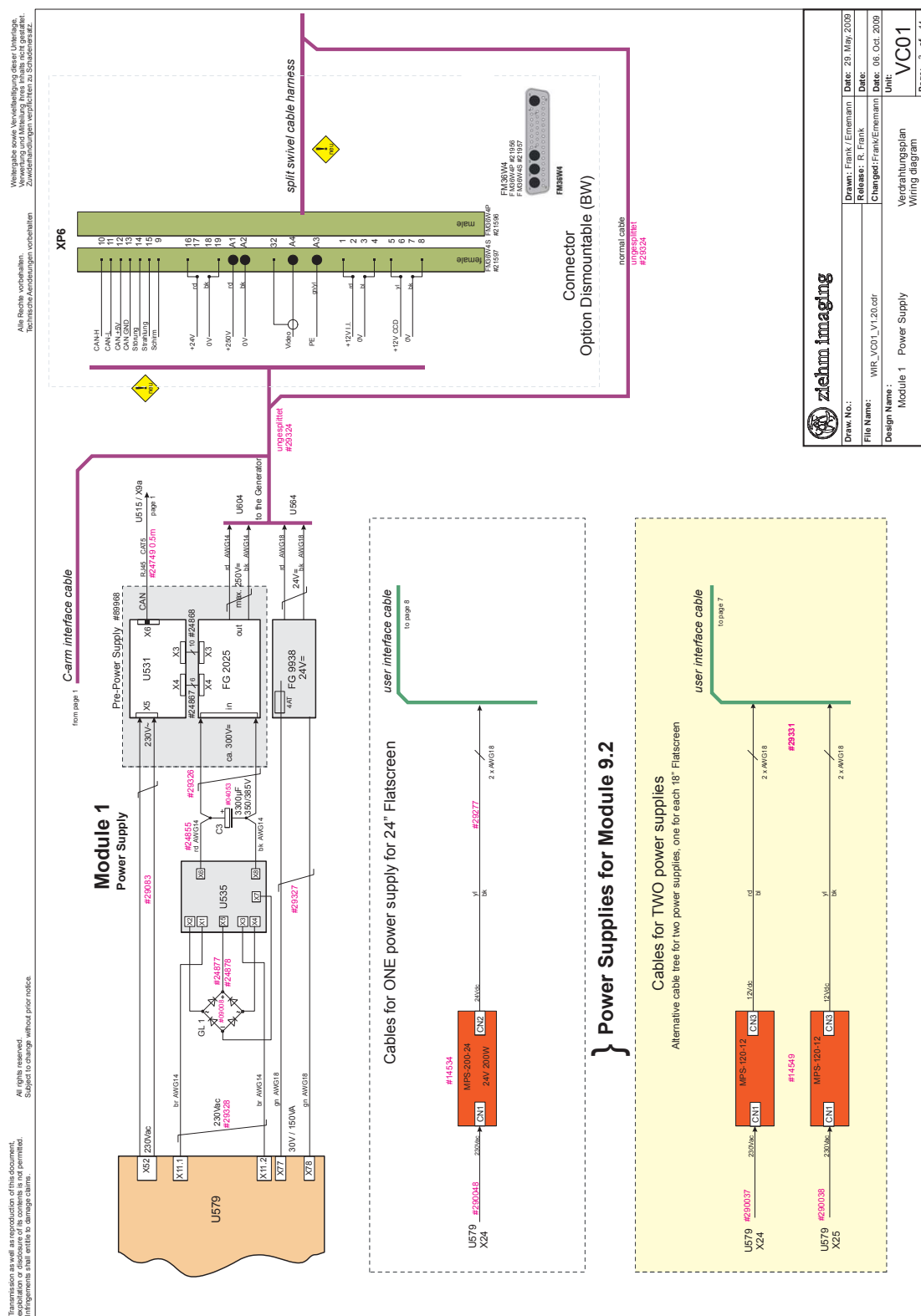


Fig. 3-8 Generator and monitor supply wiring

3.7.4 Image Intensifier

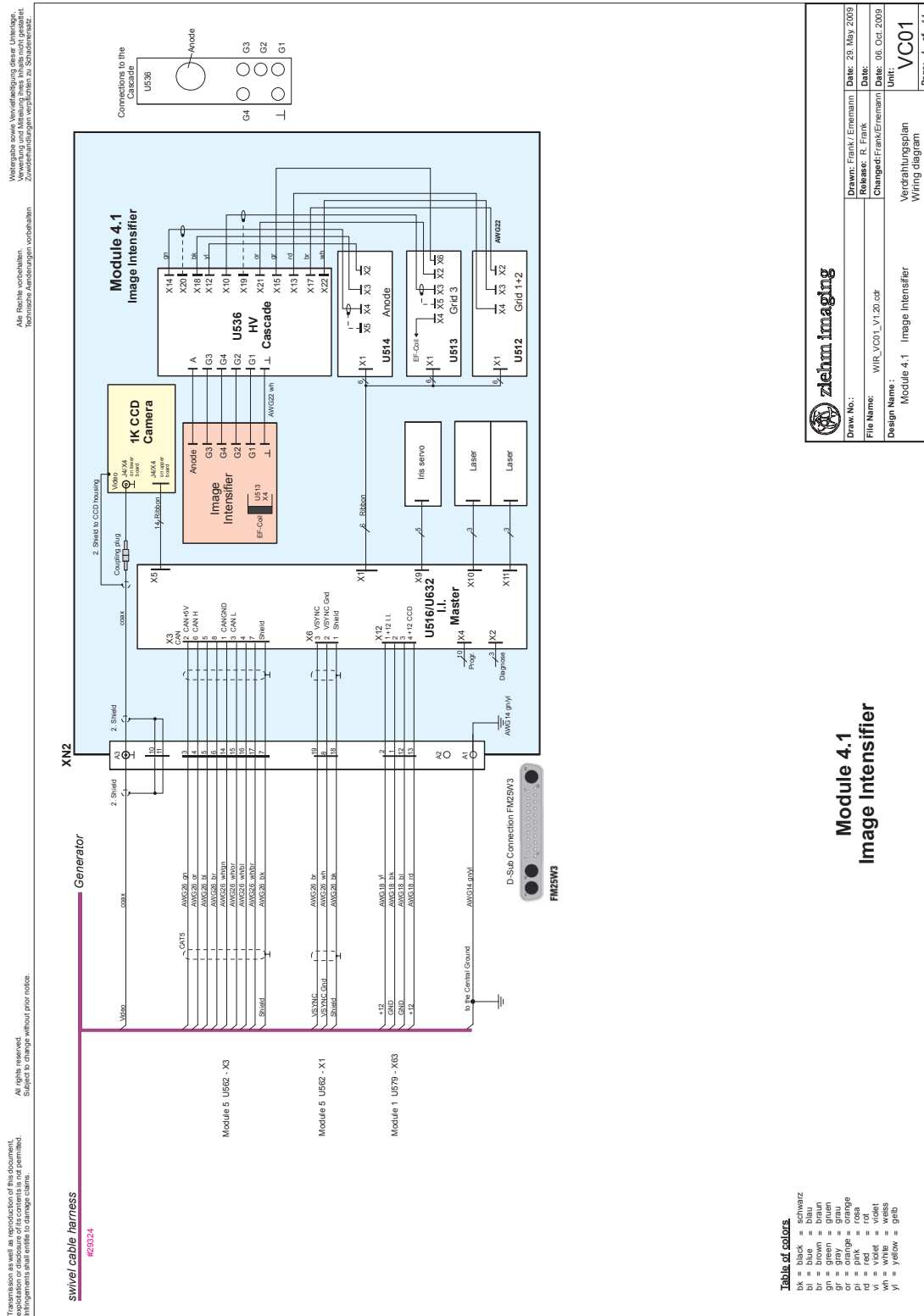
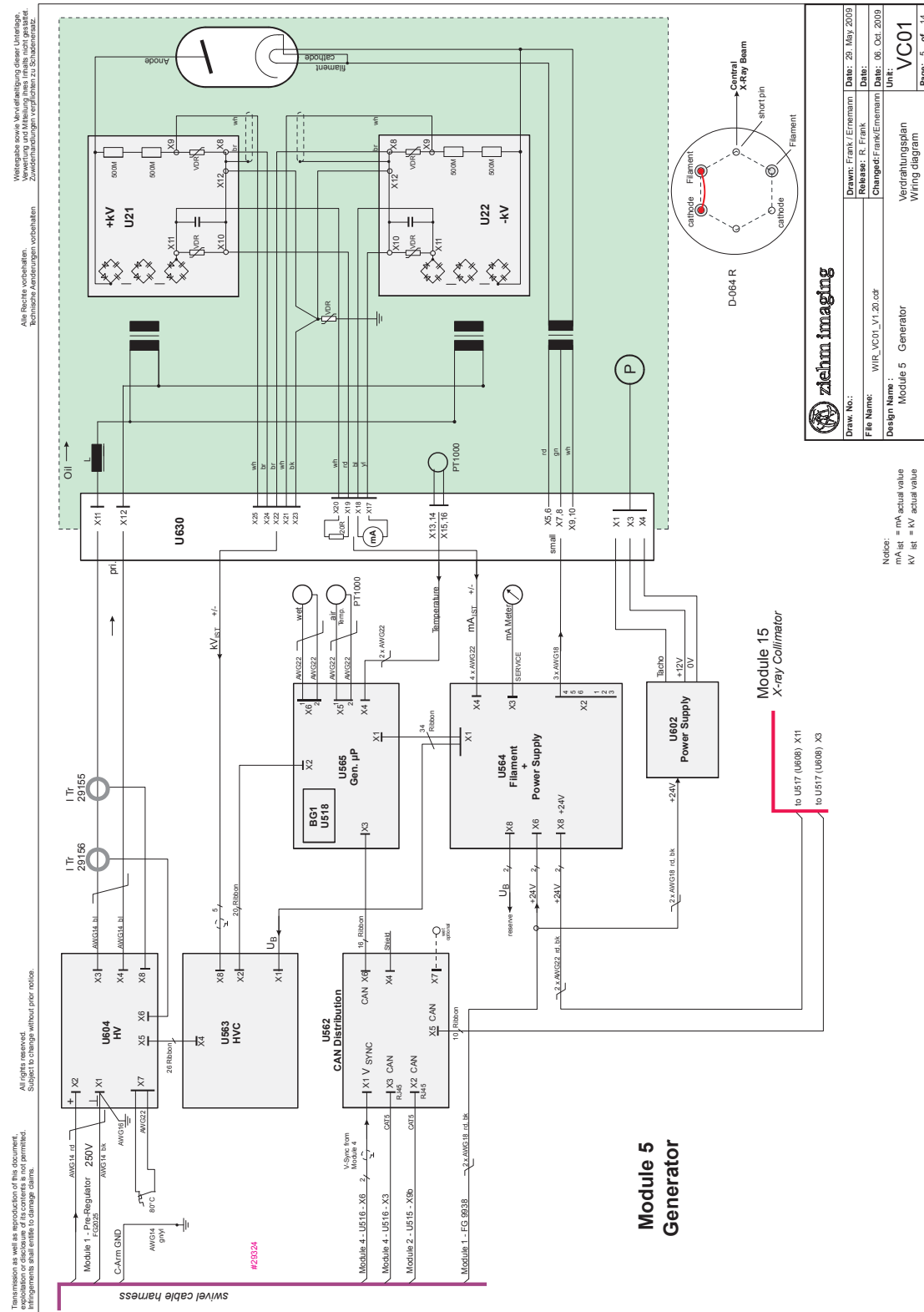
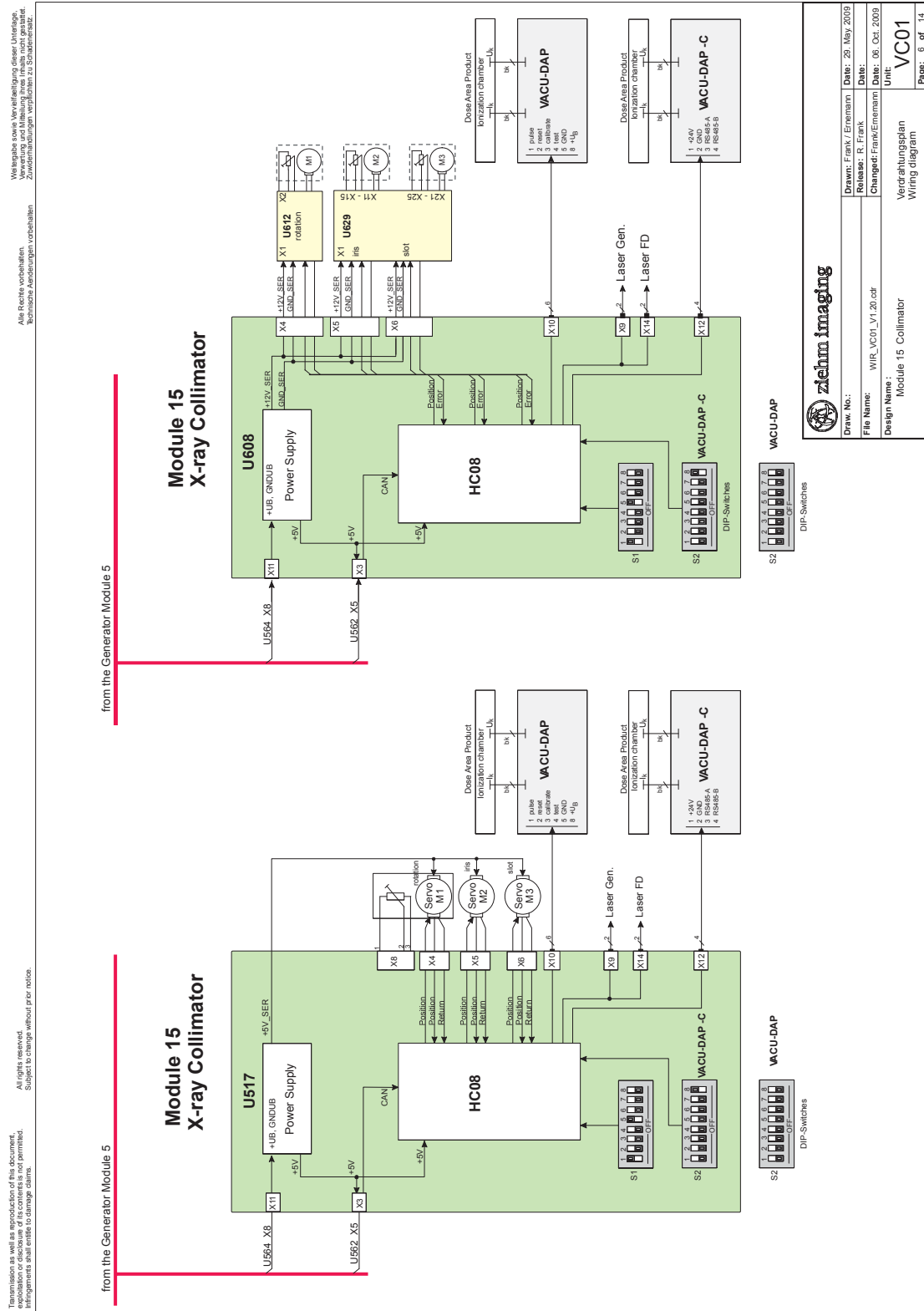


Fig. 3-9 Module 4 wiring

3.7.5 Generator



3.7.6 Vision Track



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VC01 XP4

TFT - Arm
User interface cable

Module 18 User Interface #14444

Two 18.1" Flat screens

User Interface Swivel Arm

VC01

Draw: Frank / Eremann
Release: R. Frank
File Name: WIRL_VC01_V1.20.cdr
Design Name: Module 18 Vision Center Flat screen
Wiring Diagram

Date: 26. May 2010
Date: 06. Oct 2010
Unit: VC01

Fig. 3-12 User interface swivel arm wiring 2 Monitors

3.7.8 User Interface Swivel Arm Split screen

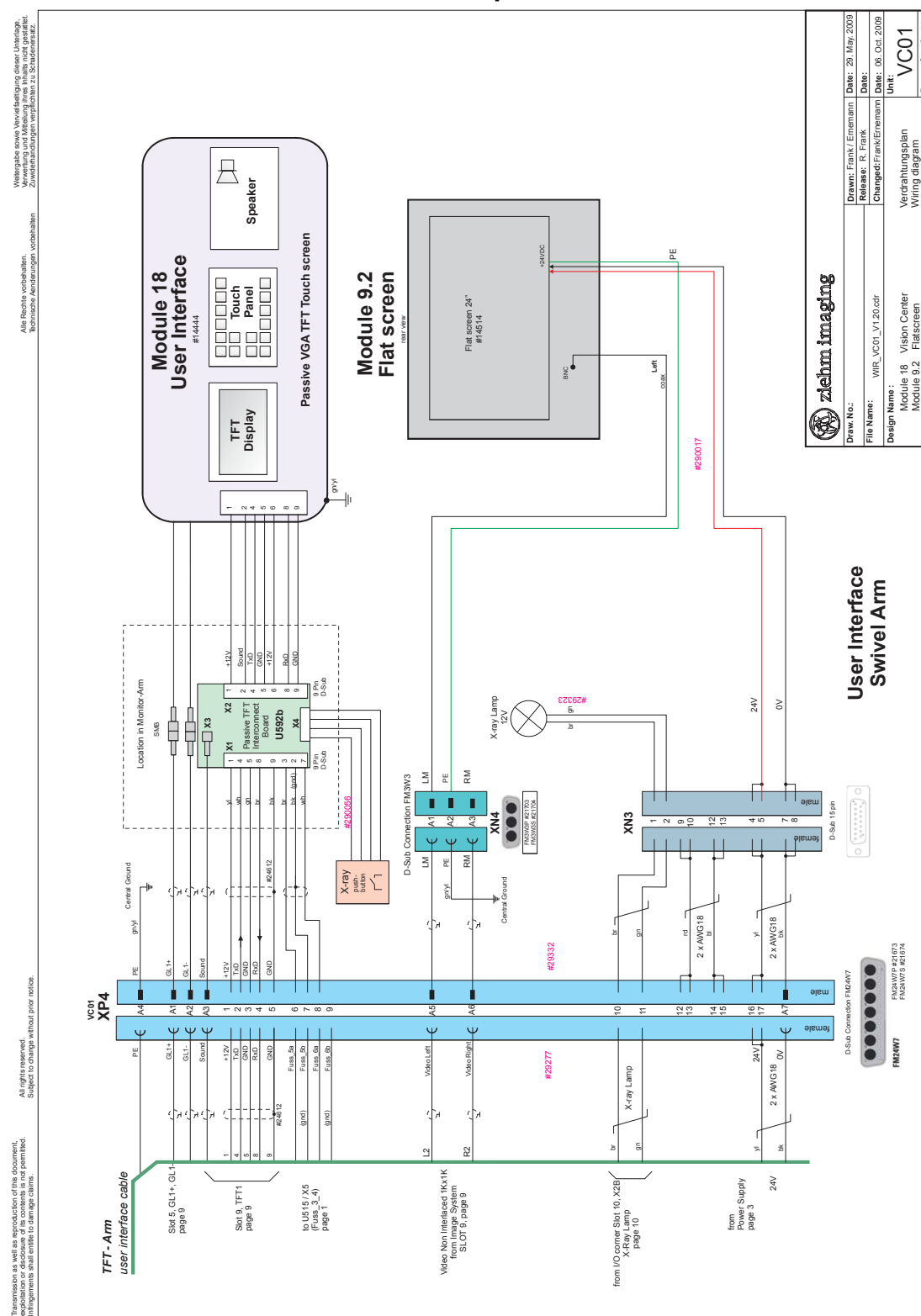
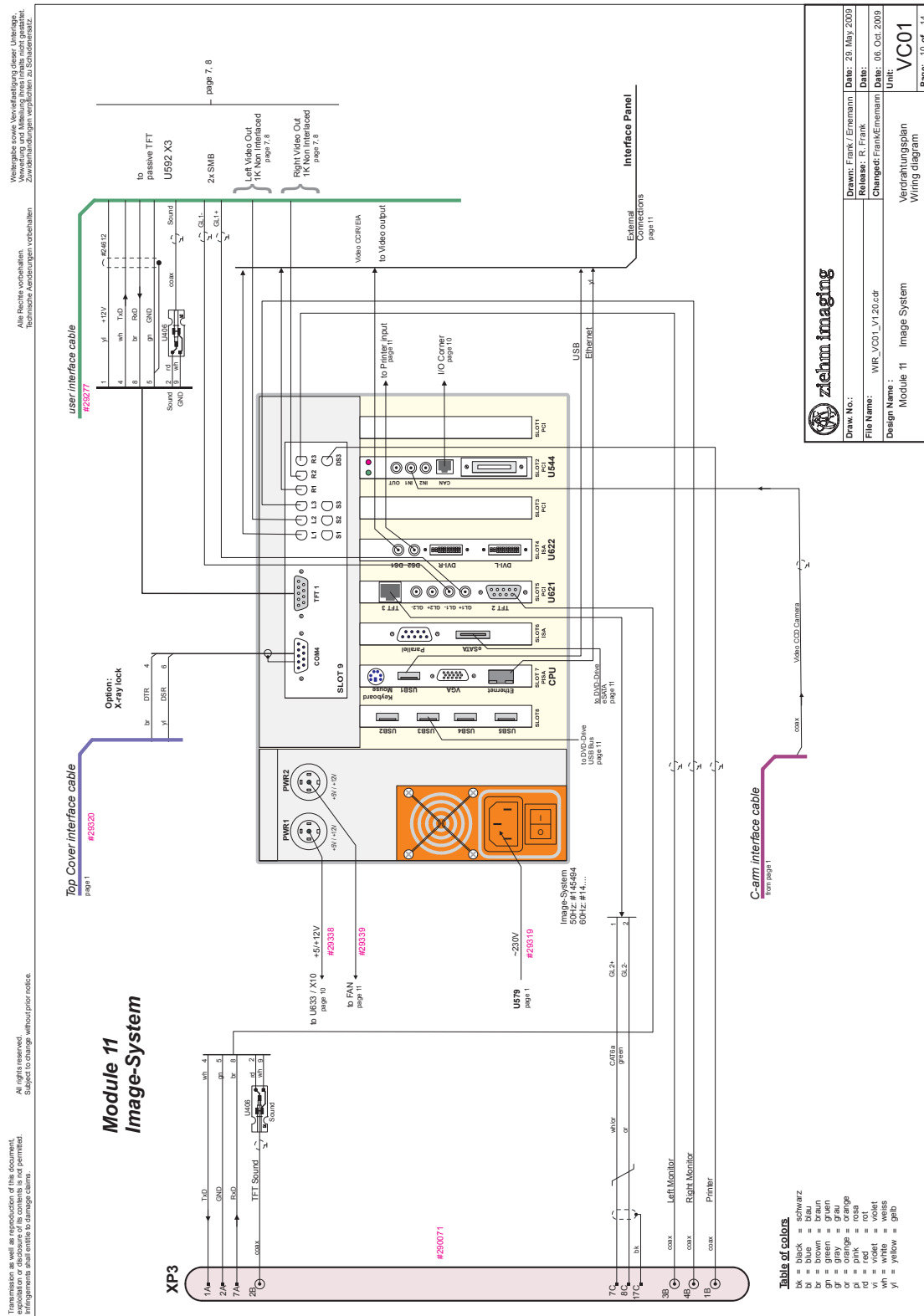


Fig. 3-13 User interface swivel arm wiring Split screen



3.7.10 Image System Front Interface with U622



3.7.11 Image System I/O Corner

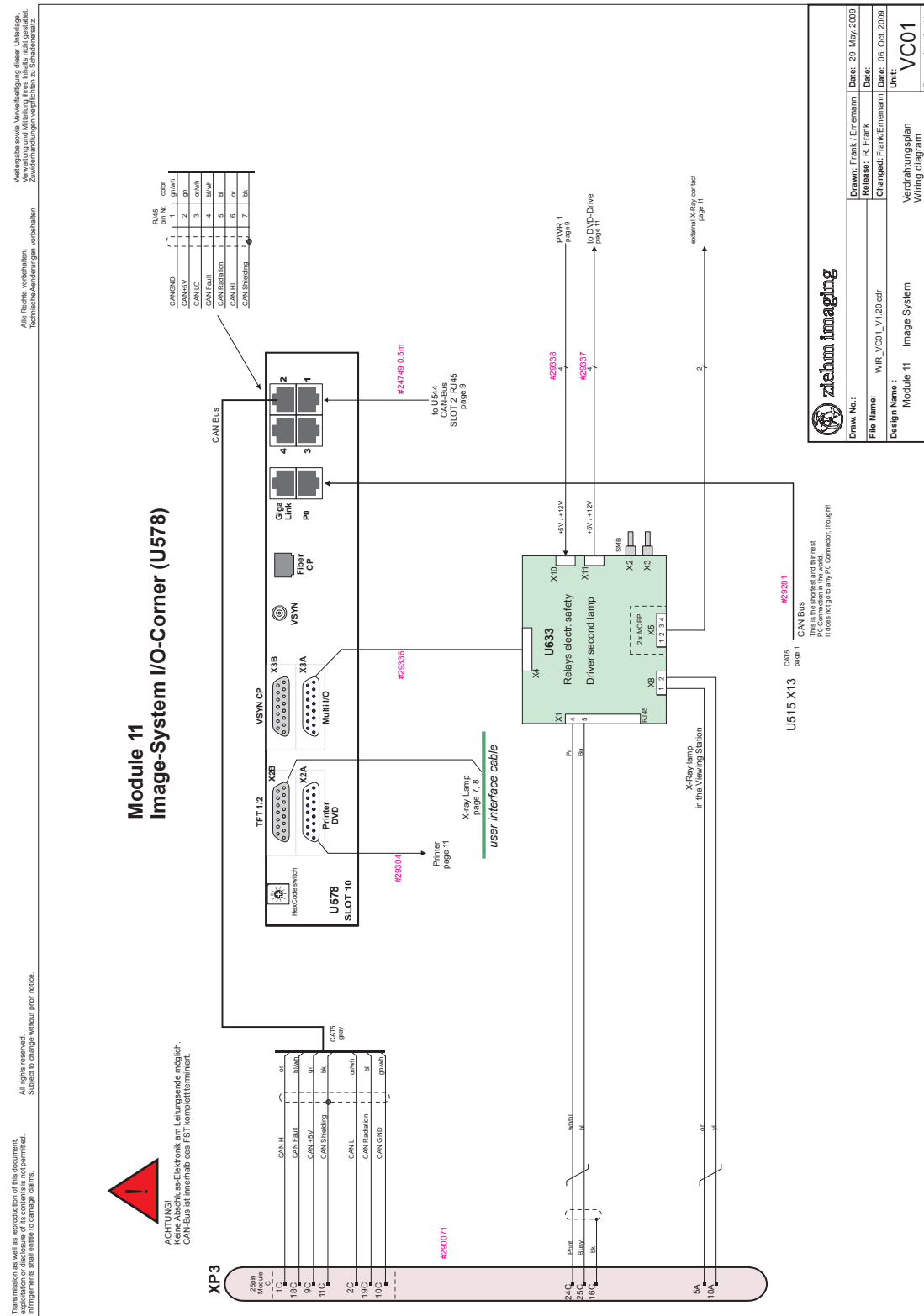


Fig. 3-16 Image system I/O corner wiring

3.7.12 Peripherals and External Connectors

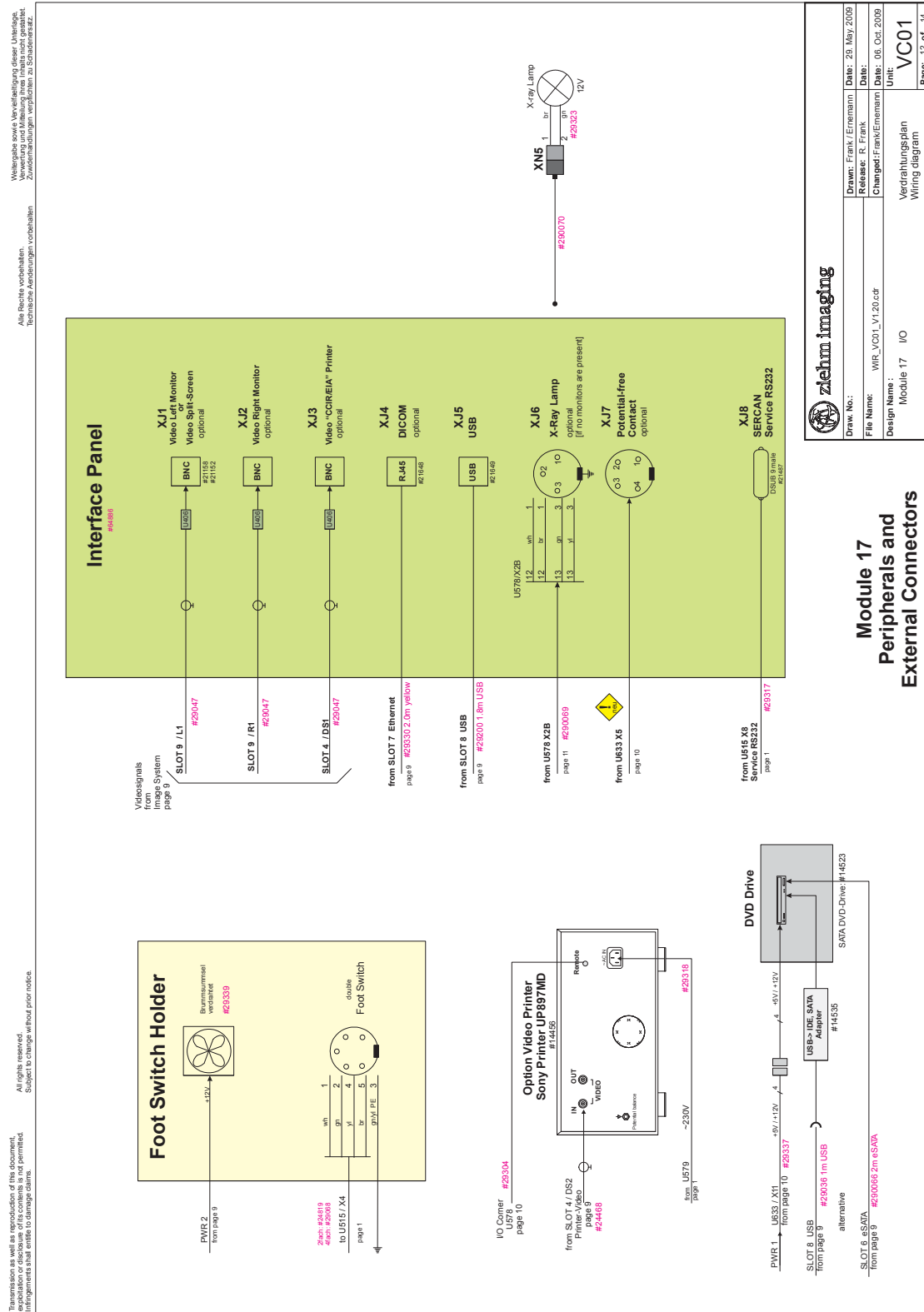
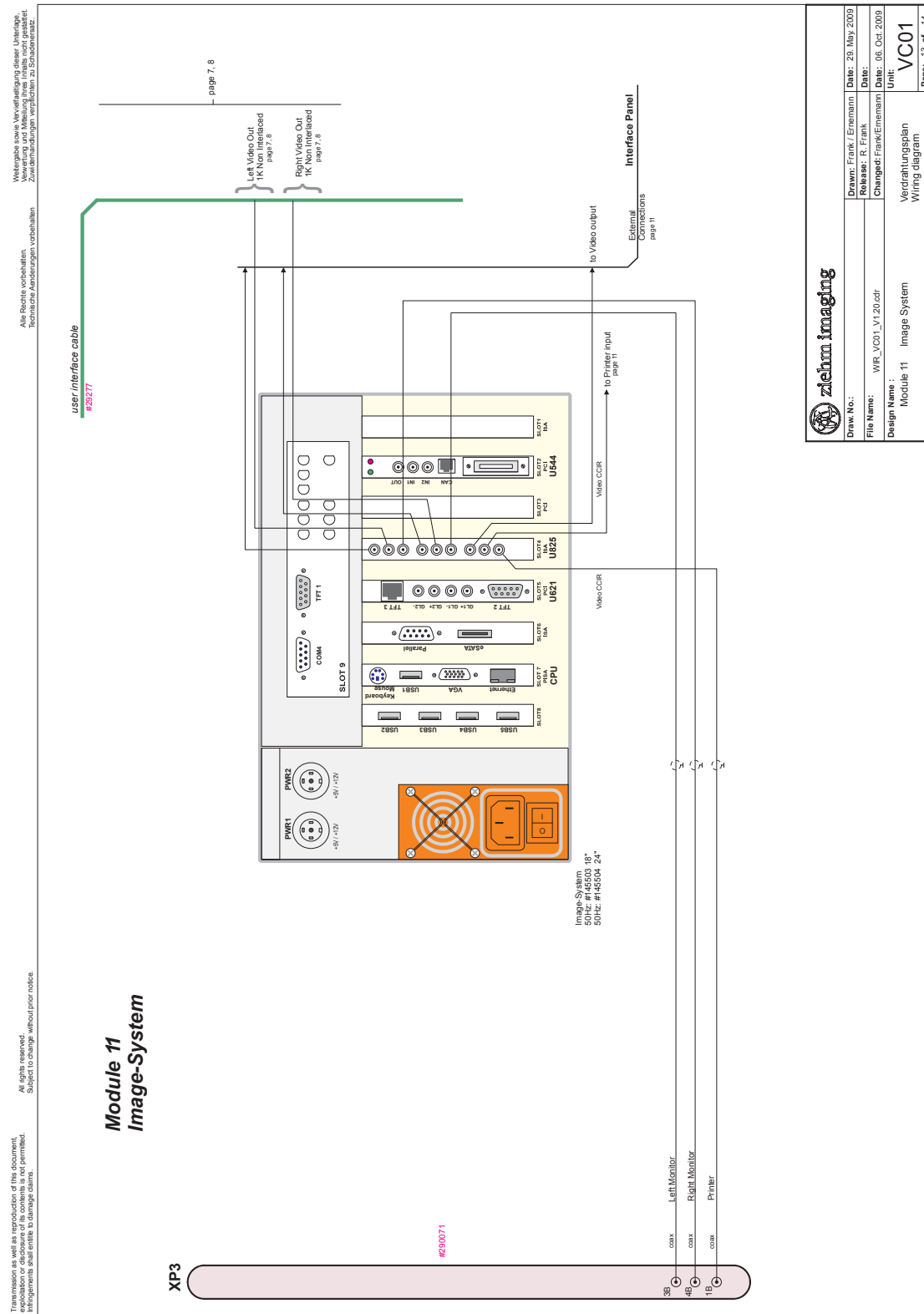


Fig. 3-17 Peripherals and external connectors wiring

3.7.13 Image System Front Interface with U825



3.7.14 Image System Front Interface with 2 x U825

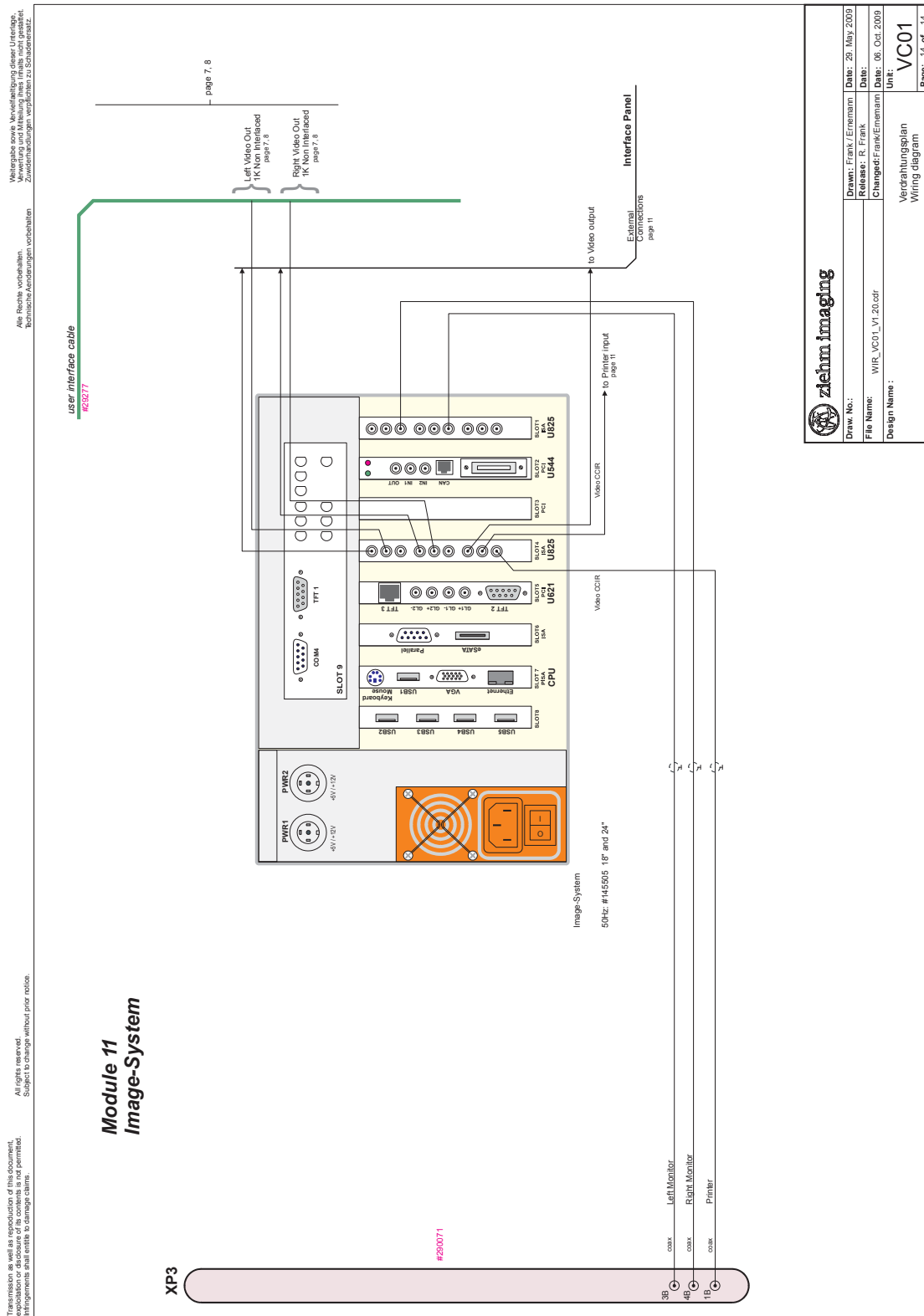


Fig. 3-19 Image system front interface wiring with 2 x U825

4

Power Supply

Module 1

4 Power Supply

4.1 Block Diagram

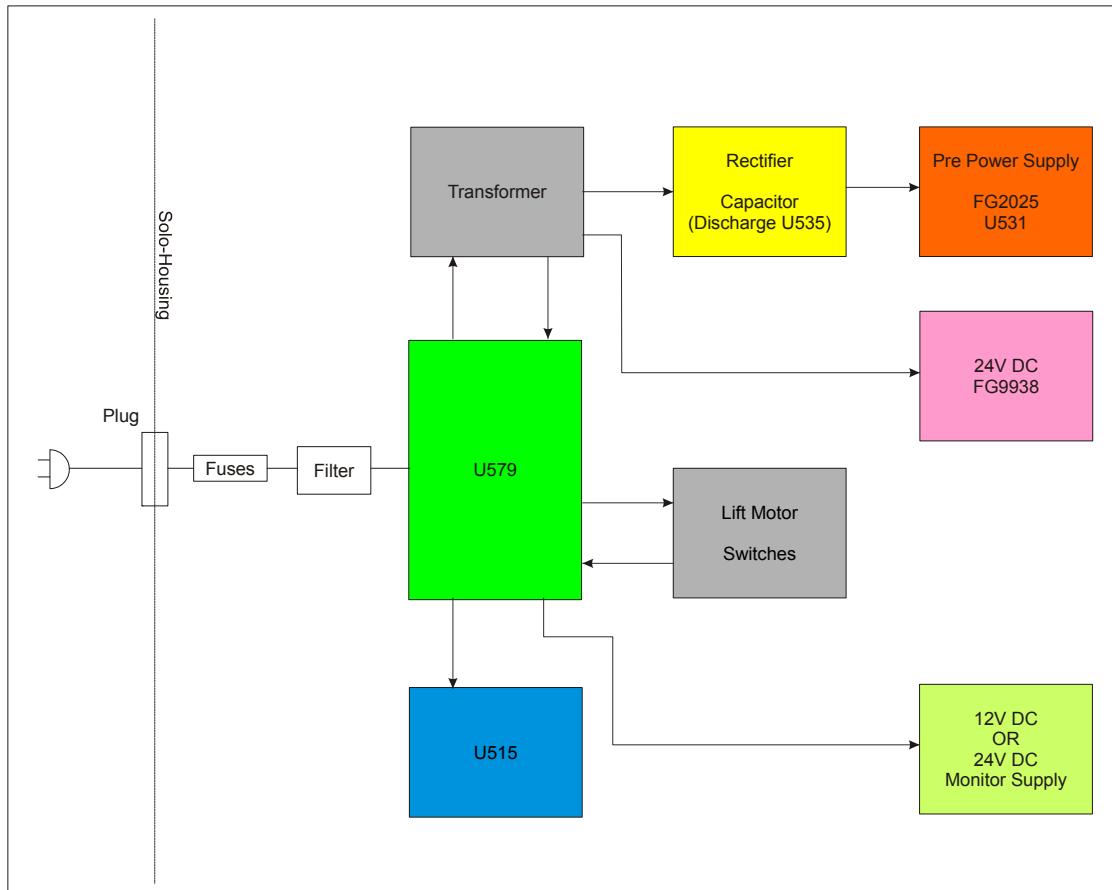


Fig. 4-1 Block Diagram of the Ziehm Solo Power supply

4.2 Functions of the Power Supply

4.2.1 Input

Line Power. The Power Supply is intended for a single phase line.

- Mains filter
- Voltage selection:
 - a) 100 V, 105 V, 110 V, 115 V, 120 V
 - b) 200 V, 210 V, 220 V, 230 V, 240 V
- Inrush current limitation
- Fusing

4.2.2 Output

Power supply of different functional groups:

- Regulated generator high voltage
- Generator electronic
- Lift motor
- U515 Central unit
- Image intensifier
- CCD camera
- Printer, Image Memory, flatscreen

4.2.3 Other Functions

- Mains on/off control (HC08 controller)
- Workstation shutdown control (HC08 controller)
- Lift motor control / Override protection

4.3 Pre-Power Supply

The pre-power supply supplies the power for the final stage which is generating the high voltage to the tube in the X-ray generator. It is controlled by CAN messages.

The pre-power supply gets a raw DC voltage as input and produces a stabilized DC output. The voltage is selectable by CAN messages in a range from 40 V_{DC} to 250 V_{DC}.

The output current is limited to a fixed value and it is adjusted in the factory.

The pre-power supply is based on the step-down converter principle and comprises two printed circuit boards.

4.3.1 FG 2025

The FG 2025 holds the power stage with the power semiconductors and heat sink. It holds a neon lamp as safety precaution for the service personnel. It indicates dangerous voltages present.

4.3.2 U531

The U531

- holds the pulse width modulator controller
- holds the closed-loop control circuits which compare the reference values for current and voltage with their respective actual values
- holds the microprocessor which handles the communication to the CAN bus
- holds all the power supplies necessary to operate the control electronics

The complete interface to the CAN bus and the interface to the PWM controller must be isolated with optocouplers good for 8 mm clearance / creepage.

A hardware enable signal directly operated from the FAULT signal contained on the CAN bus must shut down the PWM controller.

The high impedance resistors for the actual value of the voltage regulation provide the necessary second safety barrier for the required 12 mm in a 400 V section.

4 Power Supply

4.3.3 Block Diagram U531 and FG 2025

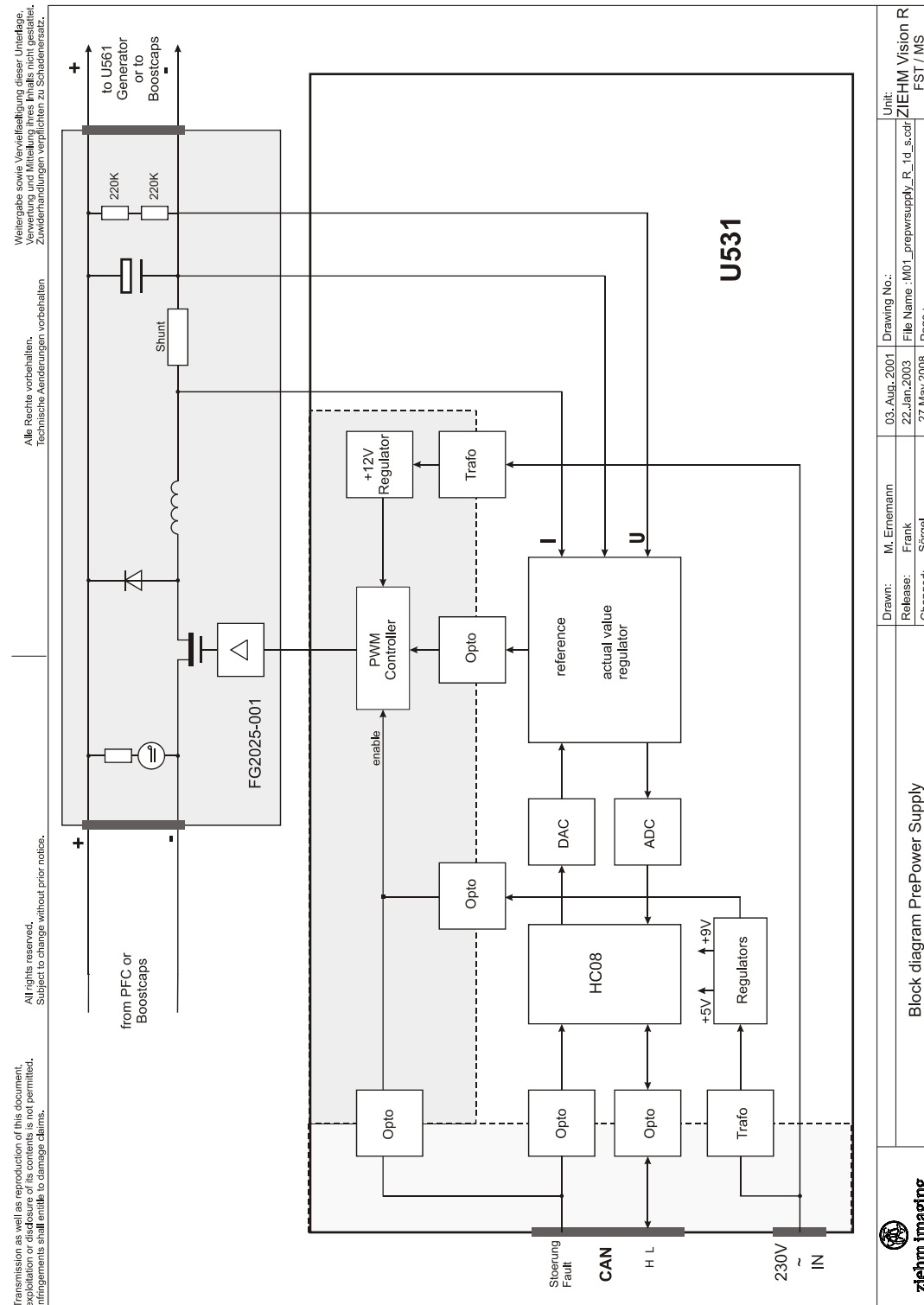


Fig. 4-2 Block diagram of pre-power supply

4.3.4 U531: Location of Connectors, LEDs and Switches

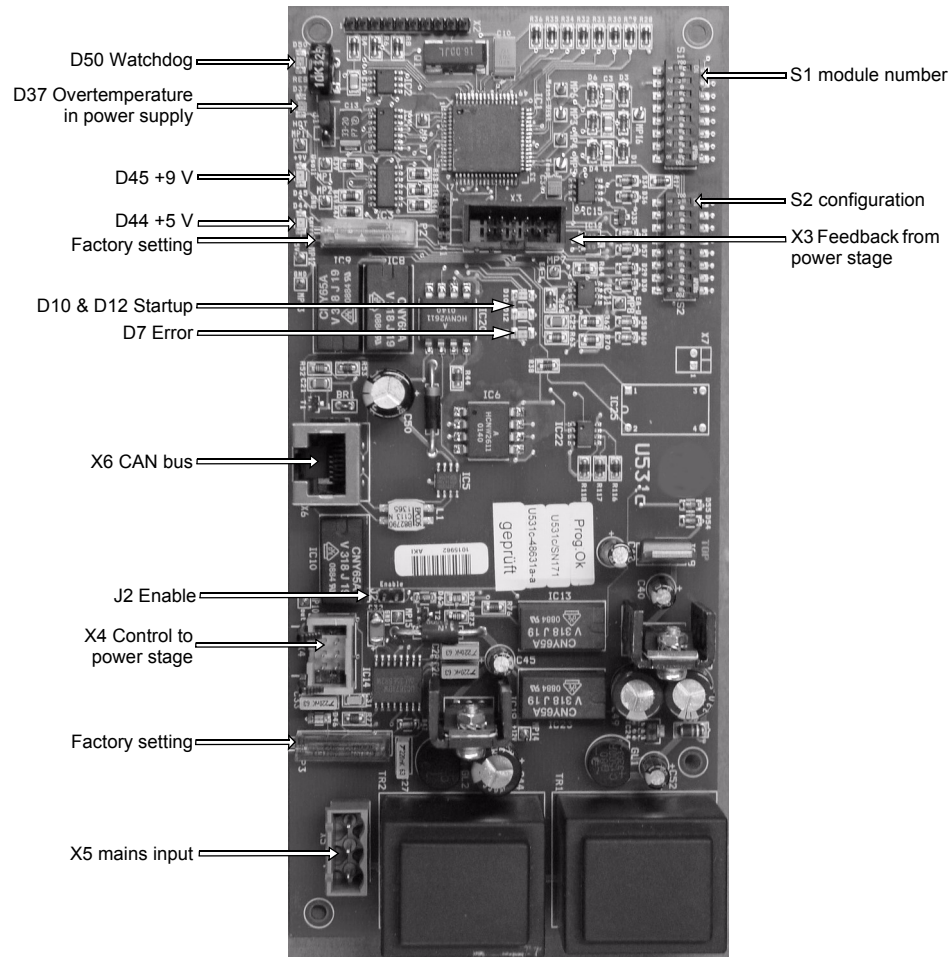


Fig. 4-3 U531 location of connectors, LEDs and switches

4.3.5 U531: Connectors

X3: Feedback from Power Stage Type: 10 pin cable connector	
Pin	Function
Pin 1	space for safety
Pin 2	space for safety
Pin 3	actual value current
Pin 4	temperature sensor
Pin 5	ground
Pin 6	+5 V
Pin 7	ground
Pin 8	space for safety
Pin 9	space for safety
Pin 10	actual value voltage

X4: Control Signals to Power Stage Type: 6 pin cable connector	
Pin	Function
Pin 1	PWM signal
Pin 2	feedback current MOSFET
Pin 3	+12 V
Pin 4	ground
Pin 5	+12 V
Pin 6	ground

X5: Mains Input for Control Electronics Type: 3 pin cable connector	
Pin	Function
Pin 1	230 V _{AC} input
Pin 2	
Pin 3	230 V _{AC} input

X6: CAN bus connector

Type: RJ-45

Pin	Function
Pin 1	CAN ground
Pin 2	CAN +5 V
Pin 3	CAN_L
Pin 4	CAN fault
Pin 5	CAN X-ray enable
Pin 6	CAN_H
Pin 7	n. c.
Pin 8	n. c.
Housing	earth

4.3.6 U531: LEDs

LED(s)	Status	Meaning
LED D10 LED D12	flashing OFF	Startup phase 1
LED D10 LED D12	OFF flashing	Startup phase 2
LED D10 and LED D12	flashing synchronously	Waiting for system to run
LED D10 and LED D12	flashing asynchronously	System is running
LED D7 (red) LED D7 (red)	ON OFF	One or more runtime error/s are set No runtime error is set
LED D50 (red)	ON	Hardware reset or watchdog is active
LED D37 (red)	ON	Overtemperature in pre-power supply
LED D44 (green)	ON	+5 V ok
LED D45 (green)	ON	+9 V ok
LED D46 (green)	ON	+12 V ok

4.3.7 U531: DIP Switches

DIP switch S1 (module number)	Setting
Bit 0 (switch 1): CAN bus address	OFF
Bit 1 (switch 2): CAN bus address	ON
Bit 2 (switch 3): CAN bus address	OFF
Bit 3 (switch 4): CAN bus address	ON
Bit 4 (switch 5): CAN bus address	OFF
Bit 5 (switch 6): CAN bus address	OFF
Bit 6 (switch 7): CAN bus address	OFF
Bit 7 (switch 8): CAN bus address	OFF

DIP switch S2 (configuration)	
Bit 0 (switch 1)	standalone for production requirements ON == standalone active
Bit 1 (switch 2)	reserved
Bit 2 (switch 3)	reserved
Bit 3 (switch 4)	reserved
Bit 4 (switch 5)	reserved
Bit 5 (switch 6)	reserved
Bit 6 (switch 7)	reserved
Bit 7 (switch 8)	reserved

4.3.8 FG 2025: Location of Connectors and Indicators

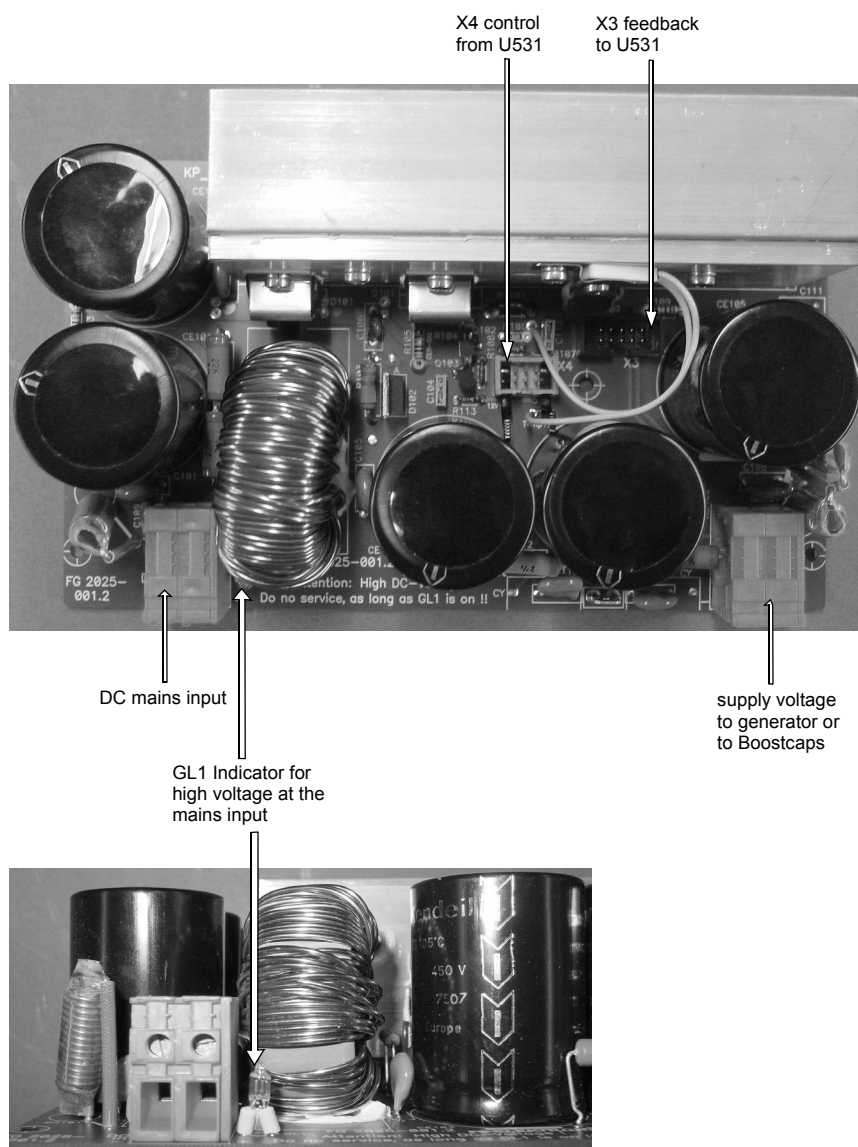


Fig. 4-4 FG 2025 location of connectors and indicators

 **WARNING**



WARNING

Do not perform any service work on the unit as long as GL1 is on!

4.3.9 Pre-power Supply Errors

Hardware is checked by software. Errors are indicated on the Solo Center.

- Startup errors:

Hardware checks by software (Startup)	
Check reference voltage DAC (MAX504)	E1302
Check data transfer to DAC (SPI interface between HC08 and MAX504)	E1300
Check output voltage (nominal value / "VOUT") from the DAC (MAX504)	E1303
Check temperature	E1301
EEPROM checksum error	E1304

- Runtime errors:

Hardware checks by software (Runtime)	
SPI Interface between HC08 and MAX504: Data transfer to DAC is checked every time the nominal value changes	E1350
Temperature: The temperature is checked permanently in the runtime phase.	E1351
CAN fault: The "CAN Fault" line is checked permanently in the runtime phase.	E1355

4.3.10 Replacing the Pre-power Supply

The potentiometer P2 on the U531 (current limiting) has to be adjusted to the shunt resistor on the FG2025 board. This can only be done at the factory using special equipment. If one of the boards U531 or FG2025 is faulty, both boards have to be replaced.
 Use heat-conductive paste for mounting the FG2025 board.
 The boards are shipped as a matched set (Part No.: 89968).

4.4 DC 24V Supply Unit FG 9938

4.4.1 General

FG 9938 voltages
Input approx. 34 V _{AC}
Output 24 V _{DC} with maximum 4 A ±2%

4.4.2 FG 9938: Location of Connectors, LEDs and Fuses

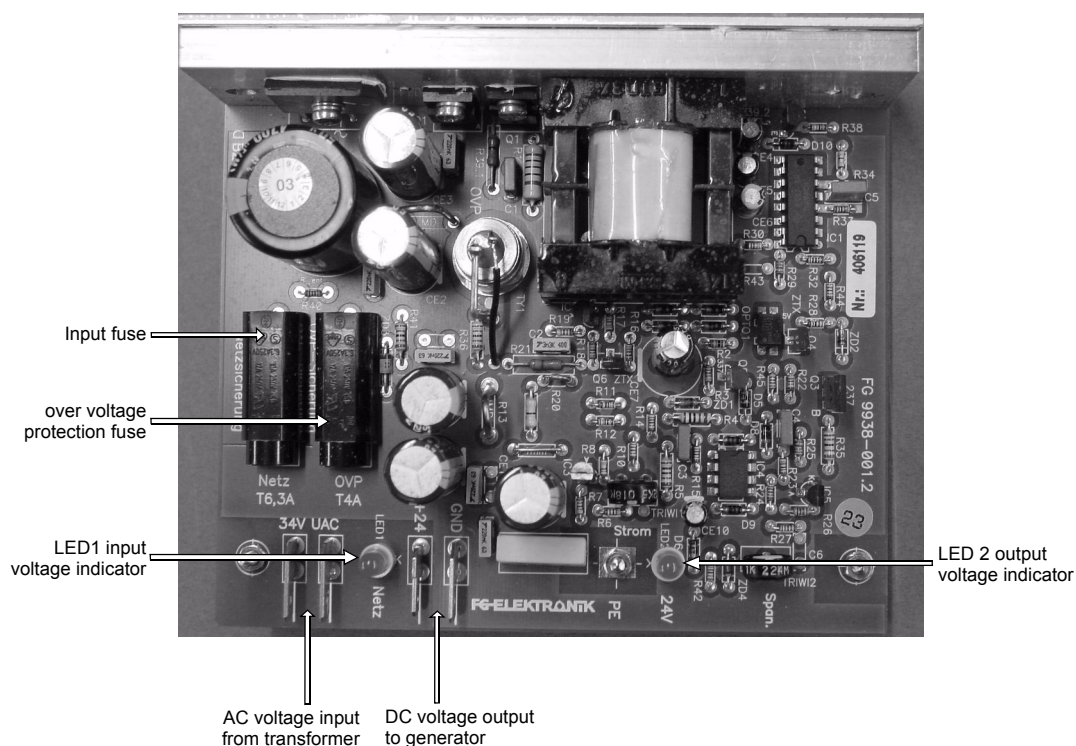


Fig. 4-5 FG 9938: Location of connectors, LEDs and fuses

4.4.3 FG 9938: Connectors

AC Input and DC Output	
A1	AC Input:
A2	6.3 mm flat connector
A3	6.3 mm flat connector
A4	DC Output:
A5	4.8 mm flat connector plus
A6	6.3 mm flat connector minus
	A1 and A2 indicated on the board as 34 V UAC A3 indicated on the board as +24 V A4 indicated on the board as GND

4.4.4 FG 9938: LEDs

AC present	
A1	Green LED indicating AC input voltage present
	A1 indicated on the board as Netz

DC present	
A1	Green LED indicating DC output voltage present
	A1 indicated on the board as 24V

4.4.5 FG 9938 Fuses

AC input fuse	
A1	Fuse in series to the bridge rectifier 6.3 A slow
	A1 indicated on the board as Netzsicherung

Overvoltage protection circuit fuse	
A1	Fuse in the ground wire 4 A slow
	A1 indicated on the board as OVP Fuse is blown by a SCR if the output voltage gets too high

4.4.6 FG 9938: Adjustments

Output voltage adjustment	
A1	Potentiometer indicated on the board as TRIWI2 “ Span. ”
	Output voltage is adjusted to 24 V _{DC} This is not intended for service adjustments!

Output current adjustment	
A2	Potentiometer indicated on the board as TRIWI1 “ Strom ”
	Output current is adjusted to 4 A _{DC} This is not intended for service adjustments!

4.4.7 FG 9938 Replacement

The FG 9938 board is shipped preadjusted. The board can be replaced without any additional adjustments (Part No.: 14249).

4.5 U579 Power Supply Control Board

The following functions are integrated on the U579:

- Mains on / off control with the mains contactor (microcontroller).
- Inrush current limiting / control.
- Lift motor control with option to “underride” the safe lifting range.
- Voltage regulator for the image intensifier.
- Voltage regulator for the CCD camera.

4 Power Supply

4.5.1 Transformer Wiring Diagram

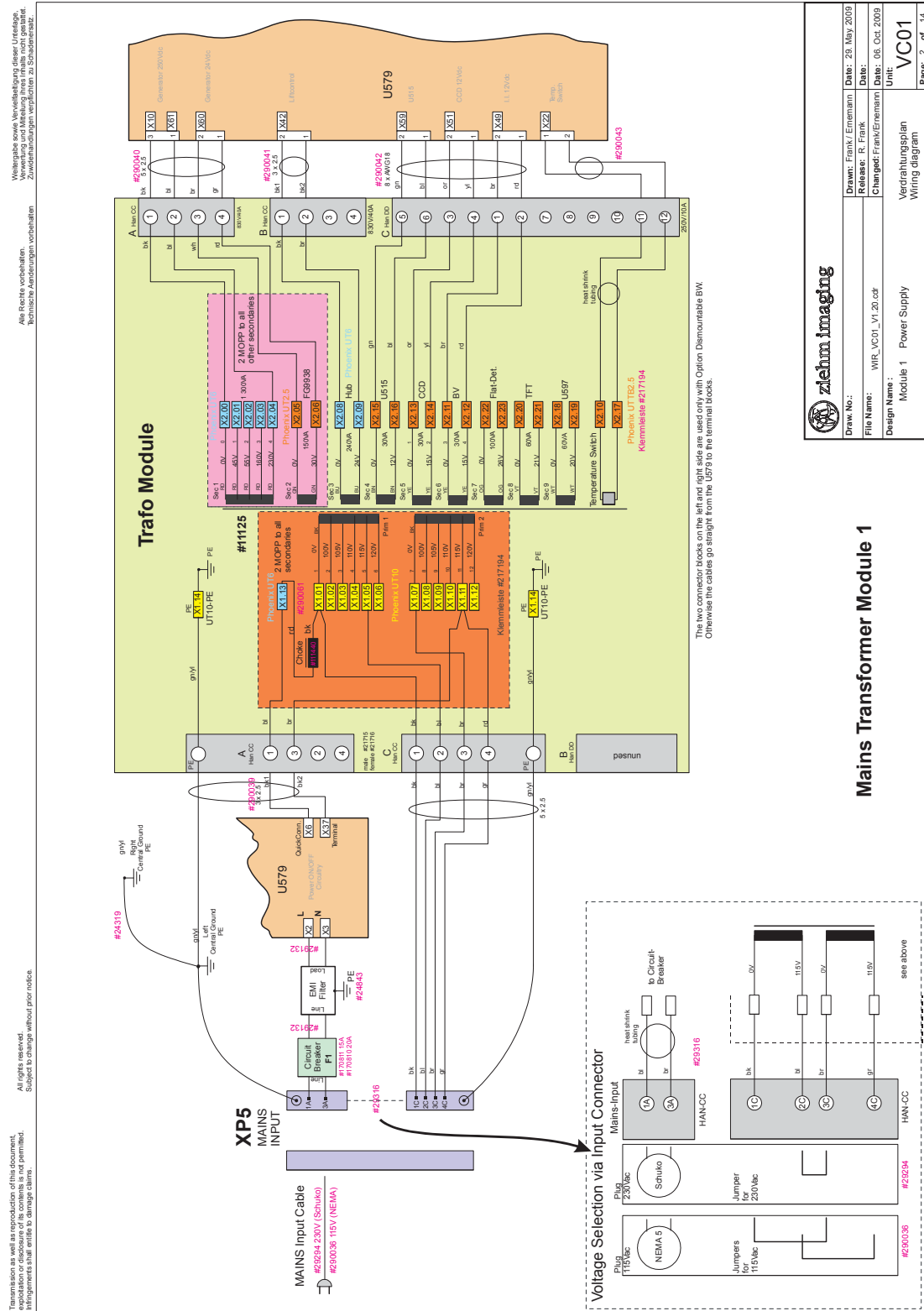


Fig. 4-6 Transformer wiring diagram

4.5.2 Transformer Input Voltage Selection

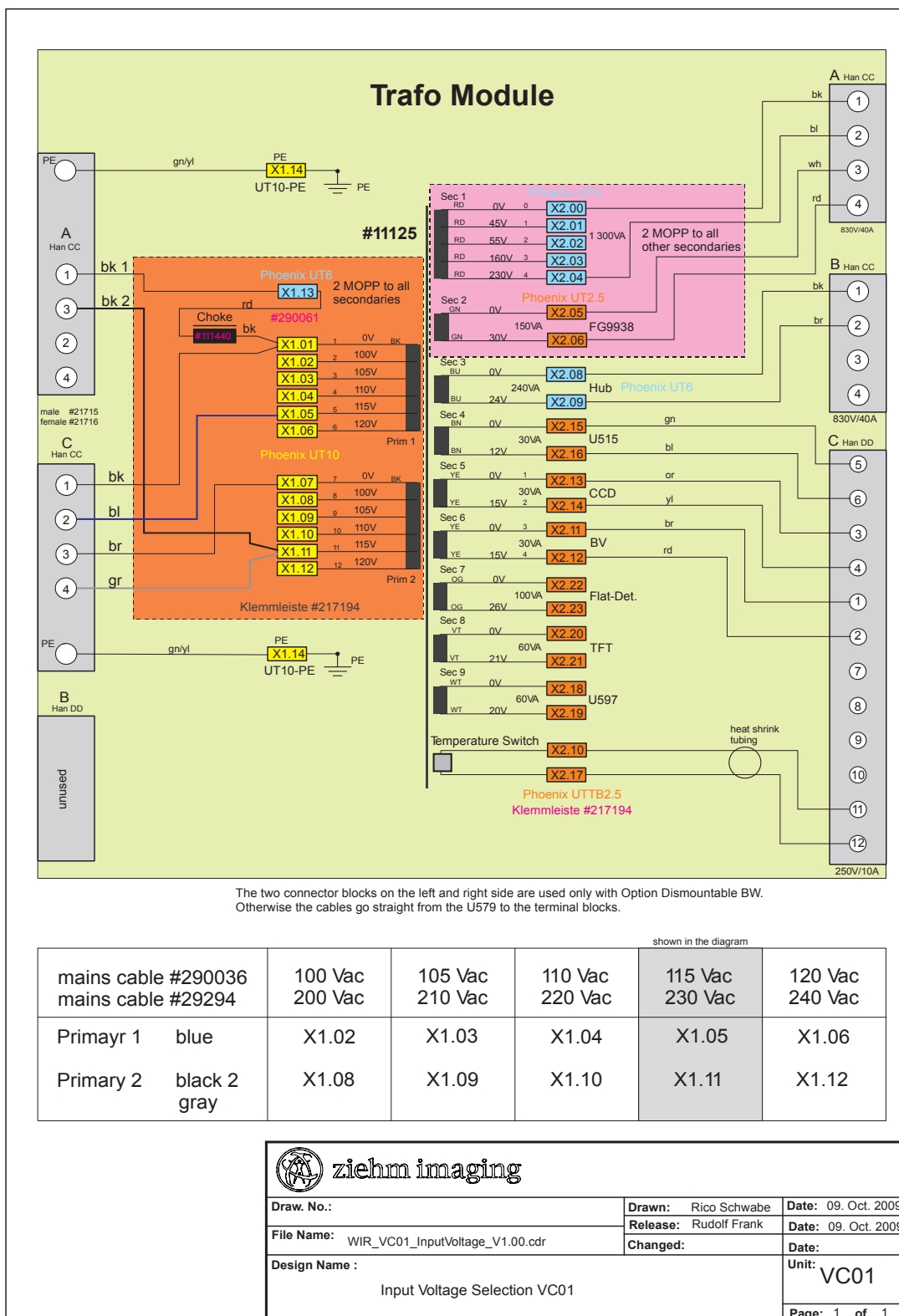


Fig. 4-7 Transformer input voltage selection

4 Power Supply

4.5.3 U579 Location of Connectors

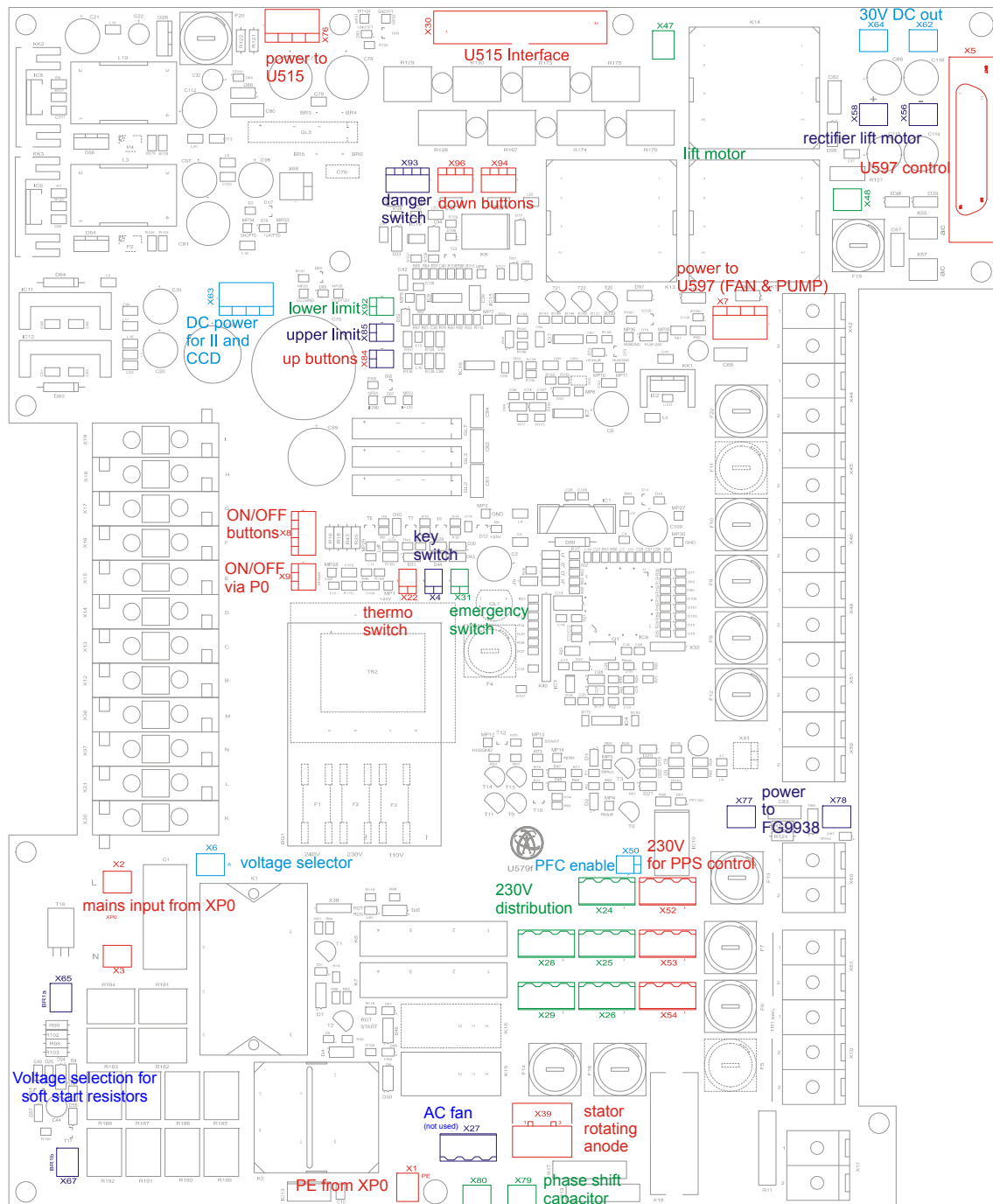


Fig. 4-8 U579 Location of Connectors

4.5.4 U579 Location of LEDs

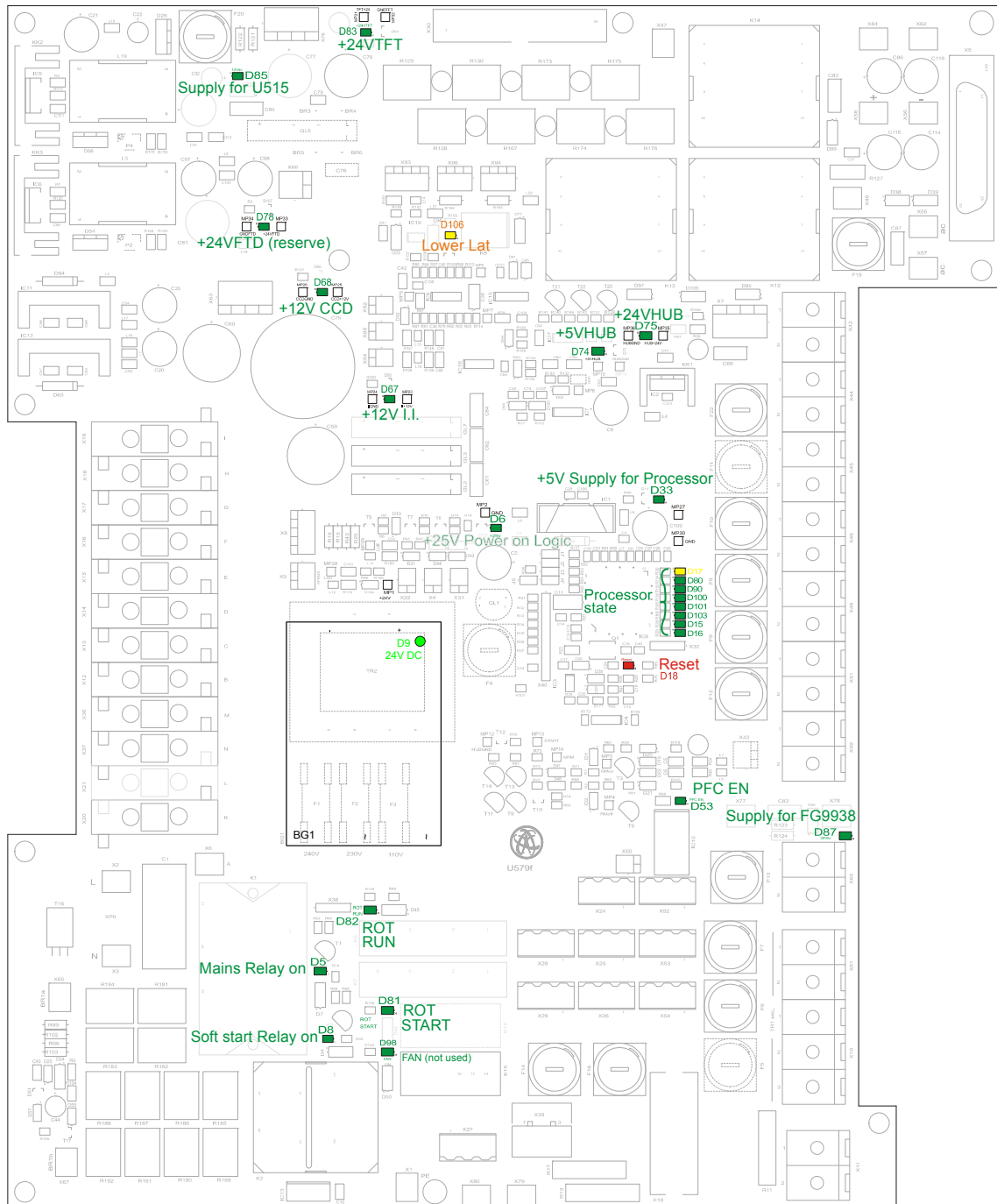


Fig. 4-9 U579 Location of LEDs

4.5.5 U579 Location of Fuses

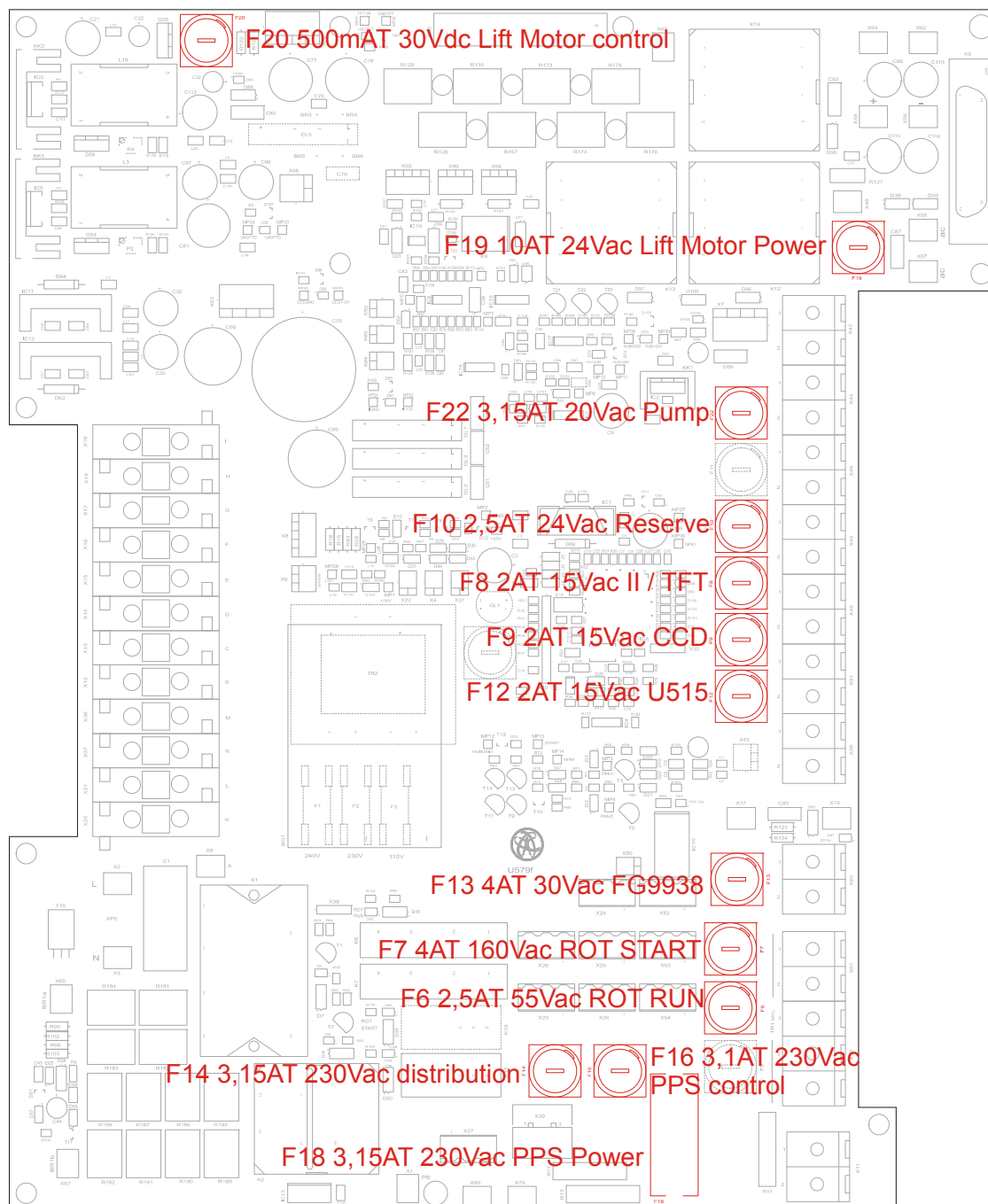


Fig. 4-10 U579 Location of Fuses

4.5.6 ON/OFF Control

4.5.6.1 ON / OFF Switching Operation

The system is connected to the wall outlet, it is still OFF.

The system is switched ON on the MS.

The inrush relay (MS) and the mains contactor (MS) are closed.

The system is running (ON).

4.5.6.2 Connectors for ON/OFF Control High Voltages

List of all terminals KDS10/SO dealing with high voltages	
Phoenix terminal KDS10/SO	
X12	not connected
X13	not connected
X14	not connected
X15	not connected
X16	not connected
X17	not connected
X18	not connected
X19	not connected
X20	not connected
X21	not connected
X36	not connected
X37	Trafo Module X1.13

List of all terminals MKDSP10 dealing with high voltages		
Phoenix terminal MKDSP10		
X10:3	To Transformer module X2.00	
X10:2	not connected	
X10:1	not connected	
X61:2	not connected	
X61:1	To Transformer module X2.04	
X11:1	230 V _{AC} to pre power supply	
X11:2	230 V _{AC} to pre power supply	

List of all connectors MSTB2.5/3 dealing with high voltages		
Phoenix MSTB2.5/3		
X24	secondary of transformer via F14: 230V	L. Monitor
X25	secondary of transformer via F14: 230V	R. Monitor
X26	secondary of transformer via F14: 230V	Video Printer
X27	secondary of transformer via F14: 230V / 160V	AC Fan
X28	secondary of transformer via F14 : 230V	Image Memory
X29	secondary of transformer via F14: 230V	
X52	secondary of transformer via F16: 230V	U531
X53	secondary of transformer via F16: 230V	U531
X64	secondary of transformer via F16: 230V	U531
X27 is switched by a relay and used for a fan motor.		

List of all connectors Faston dealing with high voltages		
6.3 mm Faston connector		
X1	protective earth	
X2	mains power in (L)	
X3	mains power in (N)	
X6	To Transformer module X1.13	

4.5.6.3 Connectors for Low Voltages

X4, X22 and X31 interrupting auxiliary voltage	
2 pin connector male, PANDUIT	
X4	key switch
X22:1	To Transformer module X2.10
X22:2	To Transformer module X2.17
X31	emergency switch
A bridge connector has to be installed if the respective option is not used. Otherwise there is no power ON/OFF – nothing at all.	

X8 to ON / OFF buttons	
5 pin connector male, PANDUIT	
pin1	GND
pin2	Power ON LED
pin3	Standby LED
pin4	ON
pin5	OFF

X9 to XP0 connector	
3 pin connector male, PANDUIT	
pin1	OFF
pin2	ON
pin3	GND

X32 serial interface TTL !DEBUG ONLY!	
4 pin connector male, 2.54 spacing	
pin1	TxD
pin2	RxD
pin3	GND
pin4	+5 V
normally not fitted	

4 Power Supply

X38 test pins	
4 pin connector male, 2.54 spacing	
Pin1	MAINS_1_ON
Pin2	
Pin3	INRUSH
Pin4	

X40 Programming Connector for 68HC08	
10 pin connector male, 2.54 spacing	
Pin1	PTC0
Pin2	PTC1
Pin3	PTC3
Pin4	/IRQ
Pin5	Disable Reset
Pin6	Master Reset
Pin7	PTA0
Pin8	---
Pin9	+5 V
Pin10	GND

4.5.6.4 LEDs

LEDs for ON / OFF	
LED D5 (gn)	Mains relay on
LED D6 (gn)	+25 V auxiliary voltage
LED D8 (gn)	Relay switch on resistors
LED D33 (gn)	+5 V to processor and logic
LED D15 (gn)	PTF5 on HC08
LED D16 (gn)	PTF6 on HC08
LED D17 (yl)	PTFE4 on HC08
LED D18 (rd)	Reset to HC08
LED D80 (gn)	PTF0 on HC08
LED D 90 (gn)	PTF1 on HC08
LED D 100 (gn)	PTF2 on HC08
LED D 101 (gn)	PTF3 on HC08
LED D 103 (gn)	PTF4 on HC08
gn = green, yl = yellow, rd = red	

Fuses for ON / OFF		
F1	not equipped	
F2	not equipped	
F3	not equipped	
F4	not equipped	
F14	3.15 A slow	230 V _{AC} Distribution
F16	1 A slow	230 V _{AC} for Pre Power Supply control boards U531
F18	15 A slow	230 V _{AC} path to the generator
F1, F2, F3: only one fuse is permitted to be inserted! One of (F1, F2 or F3) and F4 are fitted when TR2 is equipped		

4.5.6.5 Test Points

Measurement Test Points for ON / OFF	
MP1	+24V
MP2	GND (
MP27	+5 V

4.5.7 Lift Motor Control

The motor is switched ON and OFF using one relay which has three single-pole normally open contacts. These are connected together in series to achieve a safe off state.

Two more independent relays are used to select the rotation direction. Each relay's default state connects the motor to a low-impedance resistor acting as a brake load.

The control electronics for the relays is deliberately made by simple HC-MOS logic and not by programmable logic to get optimum reliability. It is actuated by simple push buttons (not on the board). Timing circuits ensure that the main relay is the last when the motor goes on and the first to go off when the motor should stop. With this the direction relay is decisive.

When the UP button and the DOWN button are pressed simultaneously, the movement stops immediately.

The motor is switched on only as long as one of the buttons is pressed. As soon as one of the buttons is released, the up/down movement stops.

The range of movement is 430 mm and is determined by limit switches. The upper limit switch is in series to the UP push buttons and the lower limit switch is in series to the DOWN push buttons. If the limit is reached or if a wire is broken, the movement stops immediately.

If the MS is equipped with a 12" I.I., an additional function is implemented: "Lower lateral". In the range between 0 mm and 50 mm a collision of the generator housing with the foot of the MS is possible. In the range between 50 mm and 430 mm all C-arm movements can be made without any risk of collision.

Danger switches and a flashing circuitry are added to comply with the wish of using the lower range. This is possible, when the first danger switch has opened, by pressing both DOWN buttons simultaneously. A second limit switch will power up the flashing circuitry.

One supply voltage is used for the motor (about 24 V_{DC}), and the 5 V_{DC} for the logic is derived from that voltage, too.

A new overcurrent circuitry is integrated to switch off the lift motor in case of a mechanical collision.

4.5.7.1 Connectors Lift Motor Control

X42 24 V_{AC} Input mains transformer secondary 3	
Phoenix terminal KDS10/SO	
X42:1	wire a blue
X42:2	wire b blue

X55, X56, X57, X58 Bridge Rectifier	
6.3 mm Faston connector	
X55	AC
X56	-
X57	AC
X58	+

X62, X64 about 30 V to U597	
6.3 mm Faston connector	
X62	-
X64	+

X47, X48 Lift motor	
6.3 mm Faston connector	
X47	+
X48	-

X84 up buttons	
2 pin connector male, PANDUIT	
Pin1	up, logic input
Pin2	up 2

4 Power Supply

X94, X96 down buttons		
4 pin connector male, PANDUIT		
Pin1	down, logic input	
Pin2	down 2	
Pin3	+24 V LED	
Pin4	GND LED	
The buttons are used with condition "normally open" !!		

X85 upper limit switch		
2 pin connector male, PANDUIT		
Pin1	up 1	
Pin2	up 2	
The limit switches are used with condition "normally closed" !!		

X92 lower limit switch		
2 pin connector male, PANDUIT		
Pin1	down 1	
Pin2	down 2	
The limit switches are used with condition "normally closed" !!		

X93 Danger Switch		
5 pin connector male, PANDUIT		
Pin1	normally open	Danger Switch 1
Pin2	common	Danger Switch 1
Pin3	normally closed	Danger Switch 1
Pin4	normally open	Danger Switch 2
Pin5	common	Danger Switch 2
The danger switch is used with condition "normally closed" !!		

4.5.7.2 LEDs of Lift Motor Control

LEDs for lift motor	
LED D106 (yl)	lower position indicator (flashing)
LED D75 (gn)	+24 V HUB
LED D74 (gn)	+5 V HUB
gn = green, yl = yellow, rd = red	

4.5.7.3 Fuses for Lift Motor

Fuses for lift motor			
F19	6.3 A slow	5 x 20	24 V AC
F20	500 mA slow	5 x 20	+24 V hub

4.5.7.4 Jumpers for Lift Motor

Jumpers for lift motor	
J5	disable short-circuit protection of IC5, 24 V for relays

4.5.7.5 Test Points for Lift Motor Control

Measurement Test Points for Lift motor	
MP5	Current Sense Amplifier
MP6	Differentiator Amplifier
MP7	Comparator
MP8	Stop Flip-Flop
MP9	+24 V
MP10	+5 V HUB
MP11	HUBGND

4.5.8 Other Functions

Besides the functions described above, there are some more functions on the U579:

- Power supply for I.I.
- Power supply for CCD
- Power supply for TFT displays
- Power supply for U515
- Power supply for generator electronics
- U515 Interface

4.5.8.1 Connectors

X49 15 V_{AC} Input for I.I. Power Supply / Solo Center mains transformer secondary 6	
Phoenix terminal MKDSP10	
X49:1	To Transformer module X2.11
X49:2	To Transformer module X2.12
Solo Center supplied by this output with U579f or modified U579d	

X51 15 V_{AC} Input for CCD supply Power Supply mains transformer secondary 5	
Phoenix terminal MKDSP10	
X51 : 1	To Transformer module X2.14
X51 : 2	To Transformer module X2.13

X63 DC Power to I.I. and CCD	
4 pin connector male, PANDUIT	
Pin1	+12 V to I.I.
Pin2	GND to I.I.
Pin3	+12 V to CCD
Pin4	GND to CCD

X45	
Phoenix terminal MKDSP10	
X45 :1	
X45 : 2	
Not used	

X59 12 V_{AC} Input for U515 Power Supply mains transformer secondary 4	
Phoenix terminal KDS10/SO	
X59 :1	To Transformer module X2.151
X59: 2	To Transformer module X2.16

X76 Power to U515	
4 pin connector male, PANDUIT	
Pin1	+24 V to TFT
Pin2	GND to TFT
Pin3	12 V _{AC} to U515
Pin4	12 V _{AC} to U515

X60 30 V_{AC} Input for FG 9938 Power Supply mains transformer secondary 2	
Phoenix terminal MKDSP10	
X60 : 1	To Transformer module X2.06
X60 : 2	To Transformer module X2.05

X77, X78 30 V_{AC} Output for FG 9938	
6.3 mm Faston Connector	
X77	wire a
X78	wire b

X46	
Phoenix terminal MKDSP10	
X46 : 1	not used
X46 : 2	not used

4 Power Supply

X66	
2 pin connector male, PANDUIT	
Pin1	not used
Pin2	not used

X44	
Phoenix terminal MKDSP10	
X44 : 1	not used
X44 : 2	not used

X7 Output to U597	
4 pin connector male, PANDUIT	
Pin1	not used
Pin2	not used
Pin3	not used
Pin4	not used

X50 PFC Modules enable	
2 pin connector male, PANDUIT	
Pin1	not used
Pin2	not used

4.5.8.2 LEDs for other Functions

LEDs for other functions	
LED D67 (gn)	+12 V I.I.
LED D68 (gn)	+12 V CCD
LED D83 (gn)	+24 V TFT
LED D85 (gn)	12 V _{AC} U515
LED D87 (gn)	30 V _{AC} FG 9939
LED D78(gn)	24 V _{AC} Flat-panel detector
LED D98 (gn)	Relay fan is ON
LED D53 (gn)	PFC enable
gn = green, yl = yellow, rd = red	

4.5.8.3 Fuses for all other Functions

Fuses for all other functions			
F8	2 A slow	5 x 20	I.I.
F9	2 A slow	5 x 20	CCD
F10	2.5 A slow	5 x 20	Flat-panel detector
F11	not equipped		
F12	2 A slow	5 x 20	U515 12 V _{AC}
F13	4 A slow	5 x 20	FG 9938

4.5.8.4 Test Points for all other Functions

Measurement Test Points for all other functions	
MP18	Magnetic Current Sensor +
MP19	Magnetic Current Sensor -
MP23	+12 V I.I.
MP24	GND I.I.
MP25	+12 V CCD
MP26	GND CCD
MP27	CAN GND
MP28	CAN +5 V
MP29	CAN_L
MP30	CAN_H
MP31	+24 V TFT
MP32	GND_TFT

4.5.9 U579 Layout

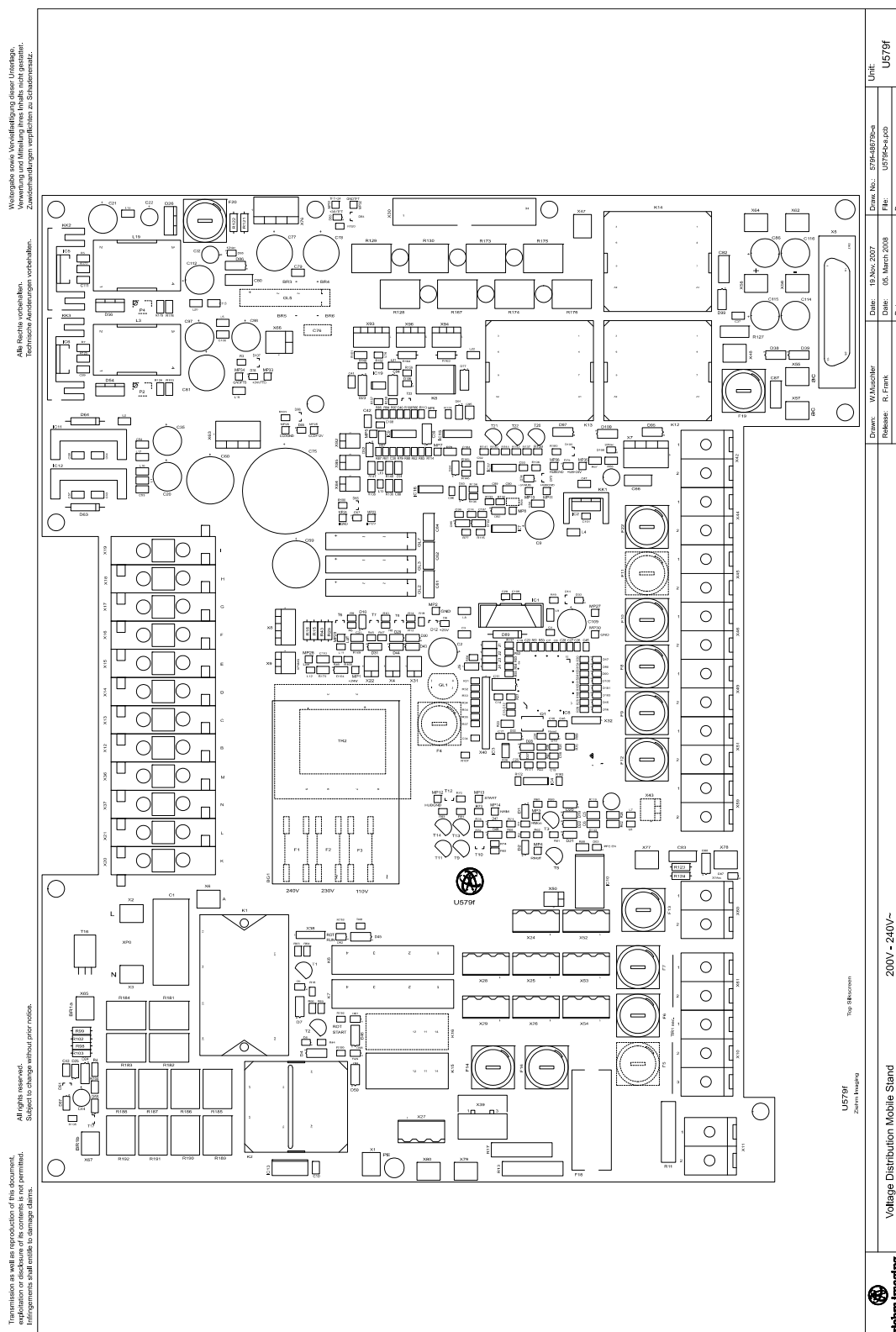


Fig. 4-11 U579 layout

4.5.10 U579 Schematic Diagrams

4.5.10.1 Mains ON/OFF

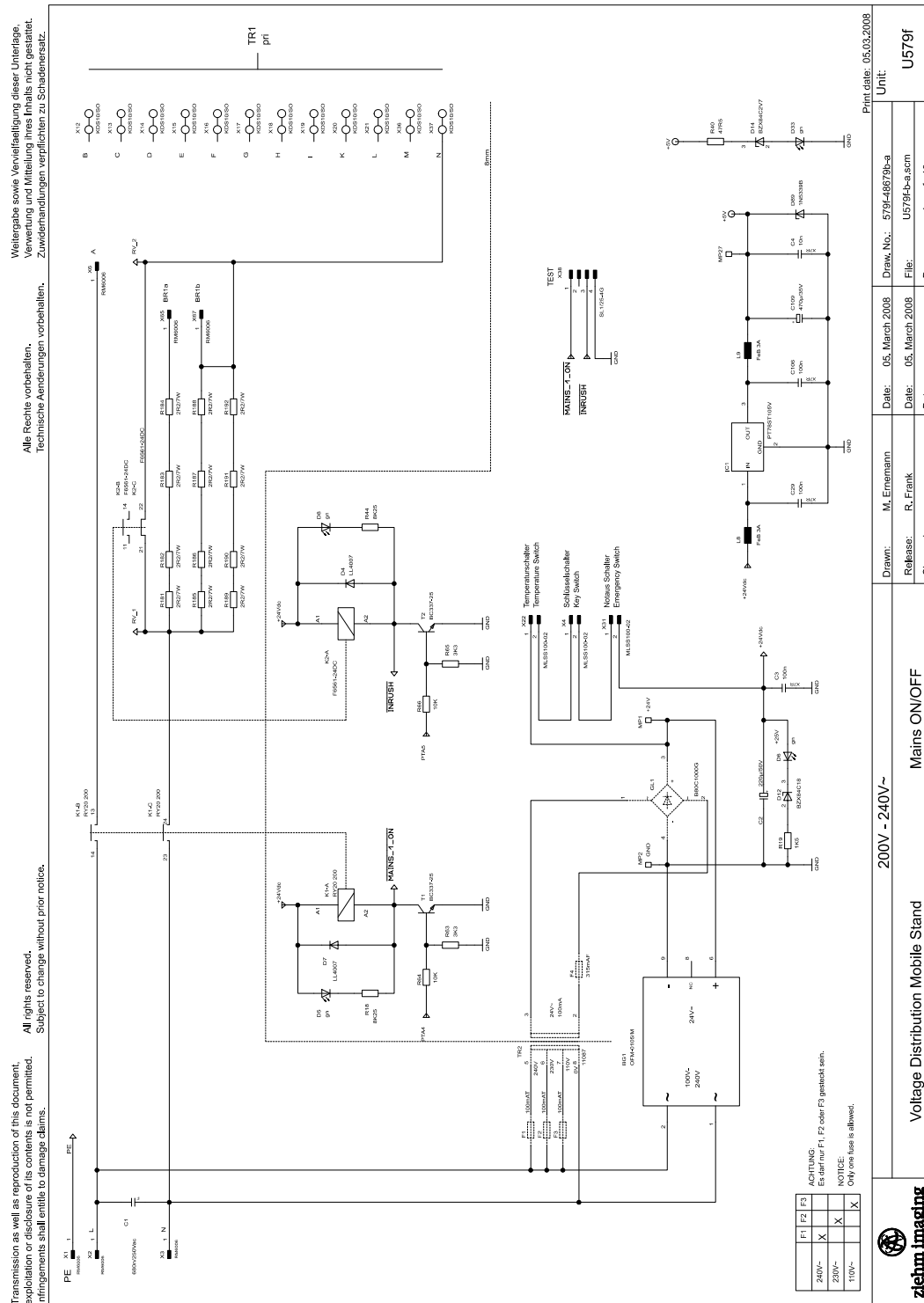


Fig. 4-12 Mains ON/OFF

4.5.10.2 Secondary 230V AC

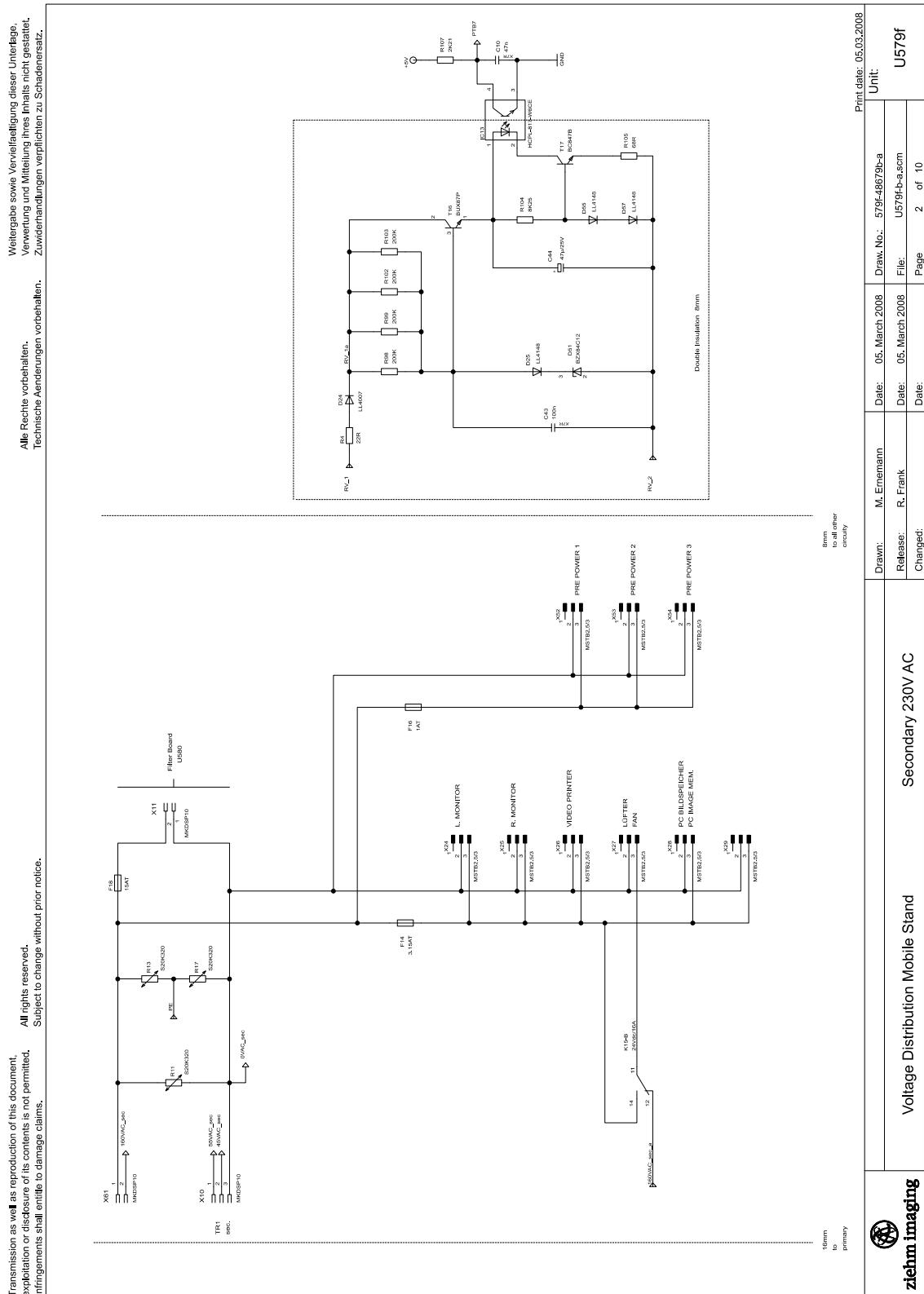


Fig. 4-13 Secondary 230 V_{AC}

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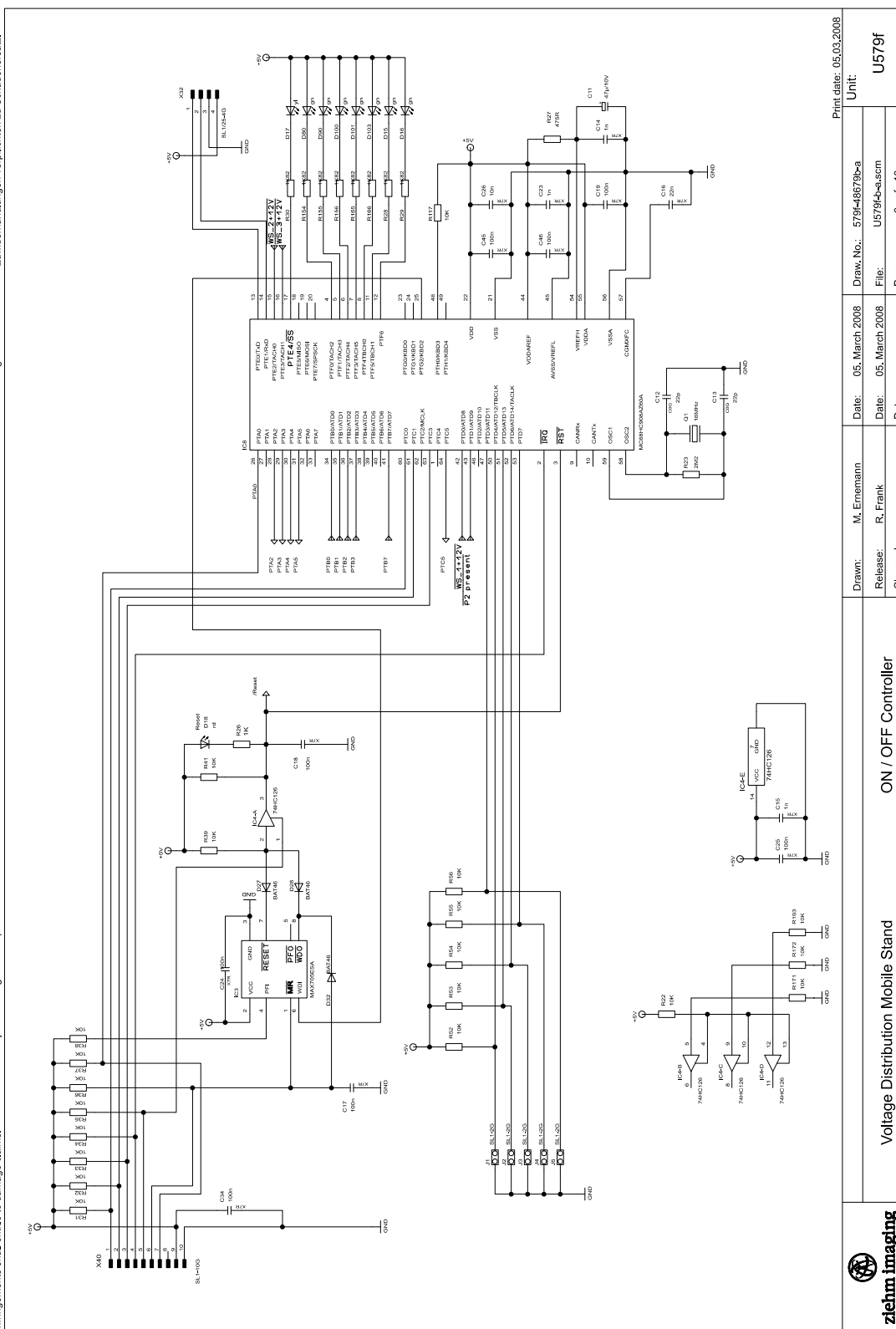


Fig. 4-14 ON/OFF controller

4.5.10.4 ON/OFF Controller

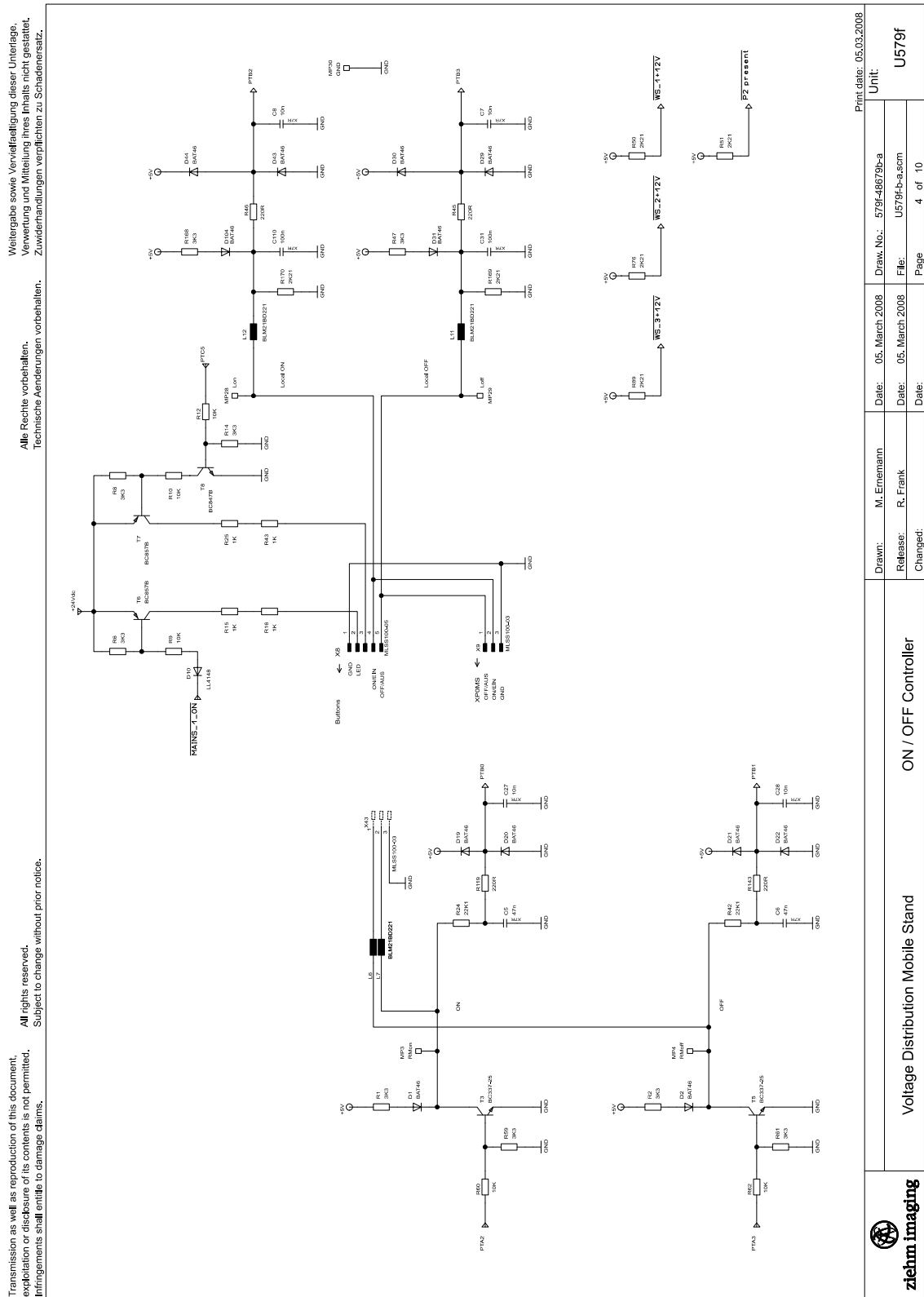
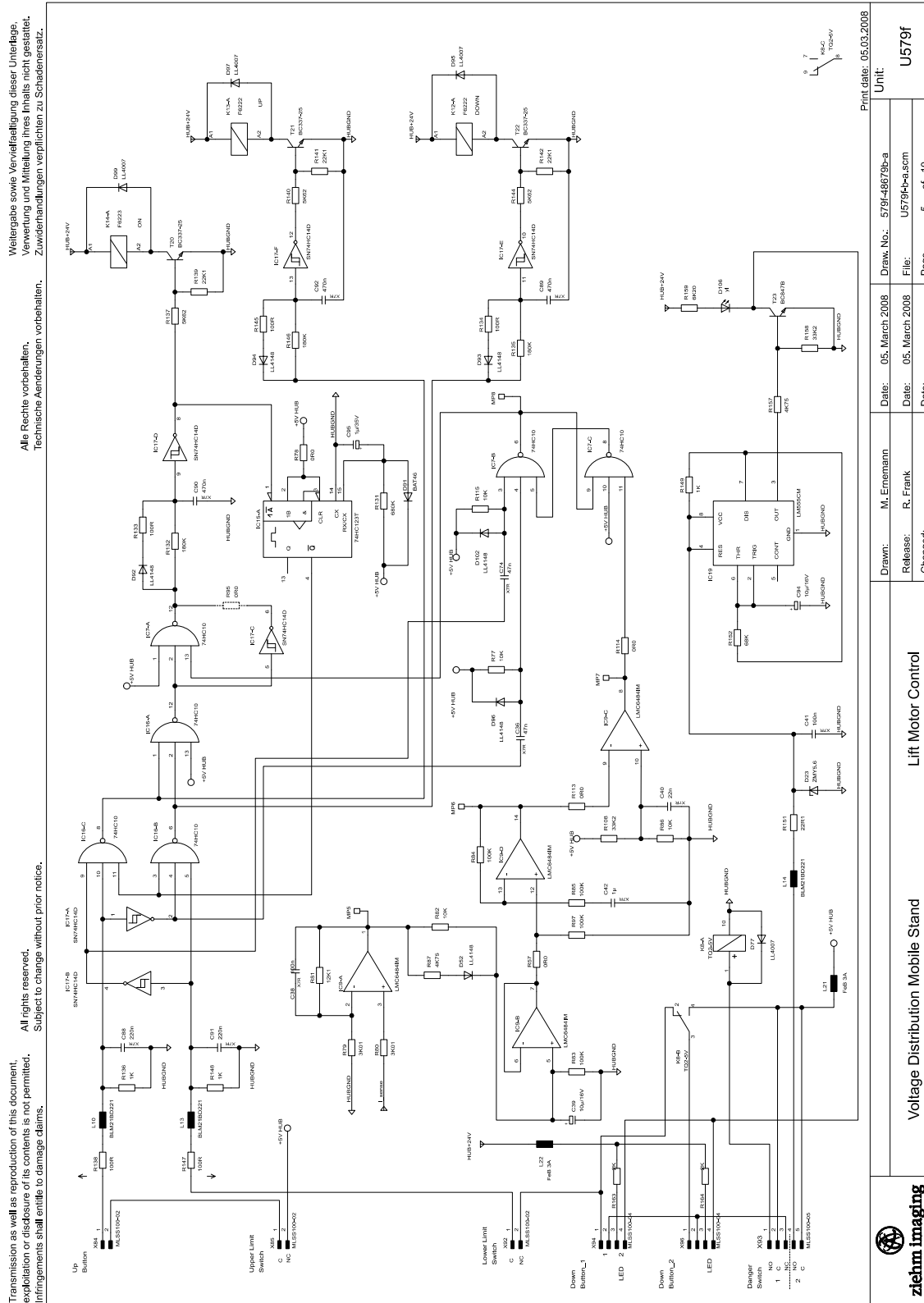


Fig. 4-15 ON/OFF controller

4 Power Supply

4.5.10.5 Lift Motor Control



4.5.10.6 Lift Motor Power

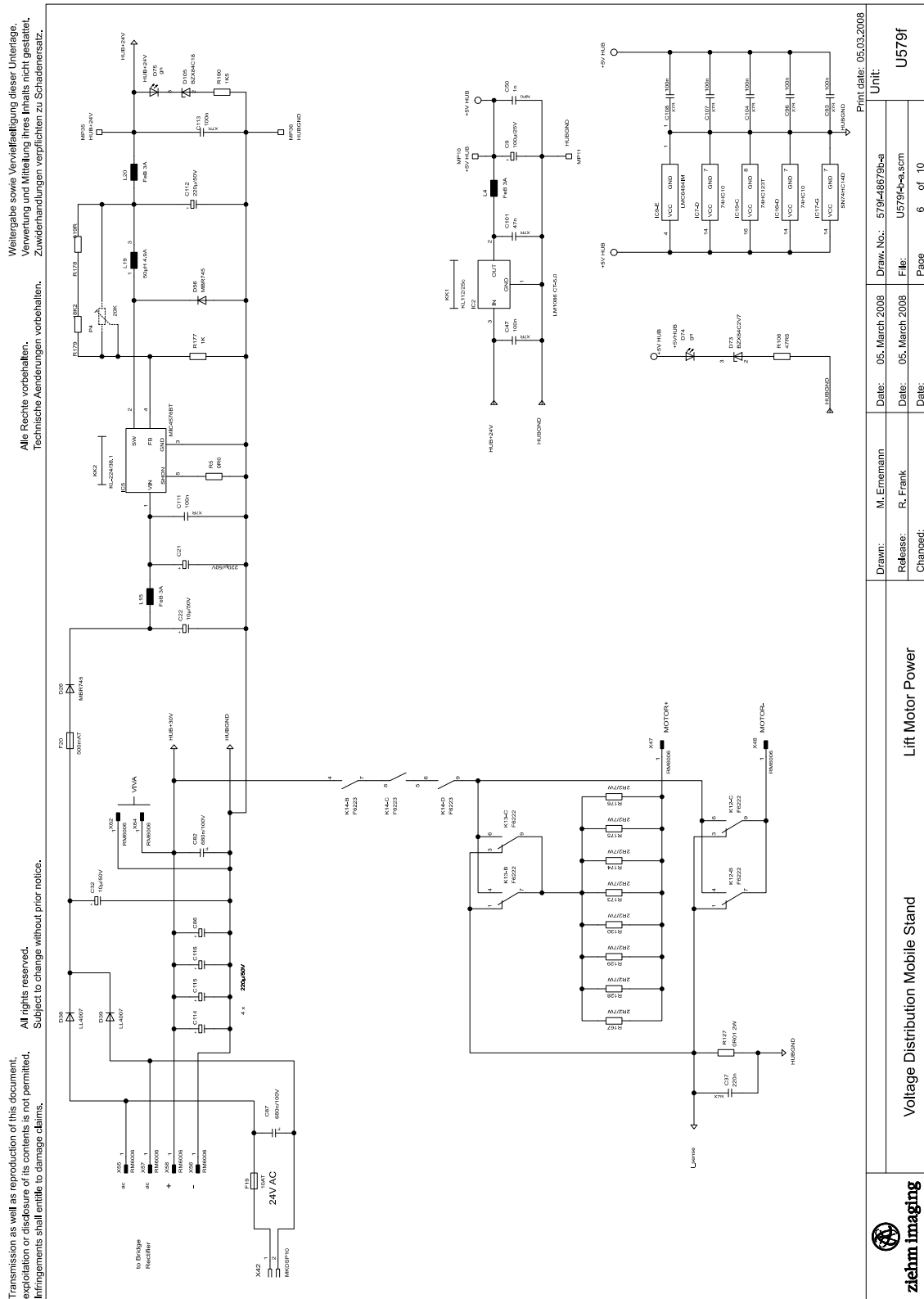


Fig. 4-18 Motor control for rotating anode

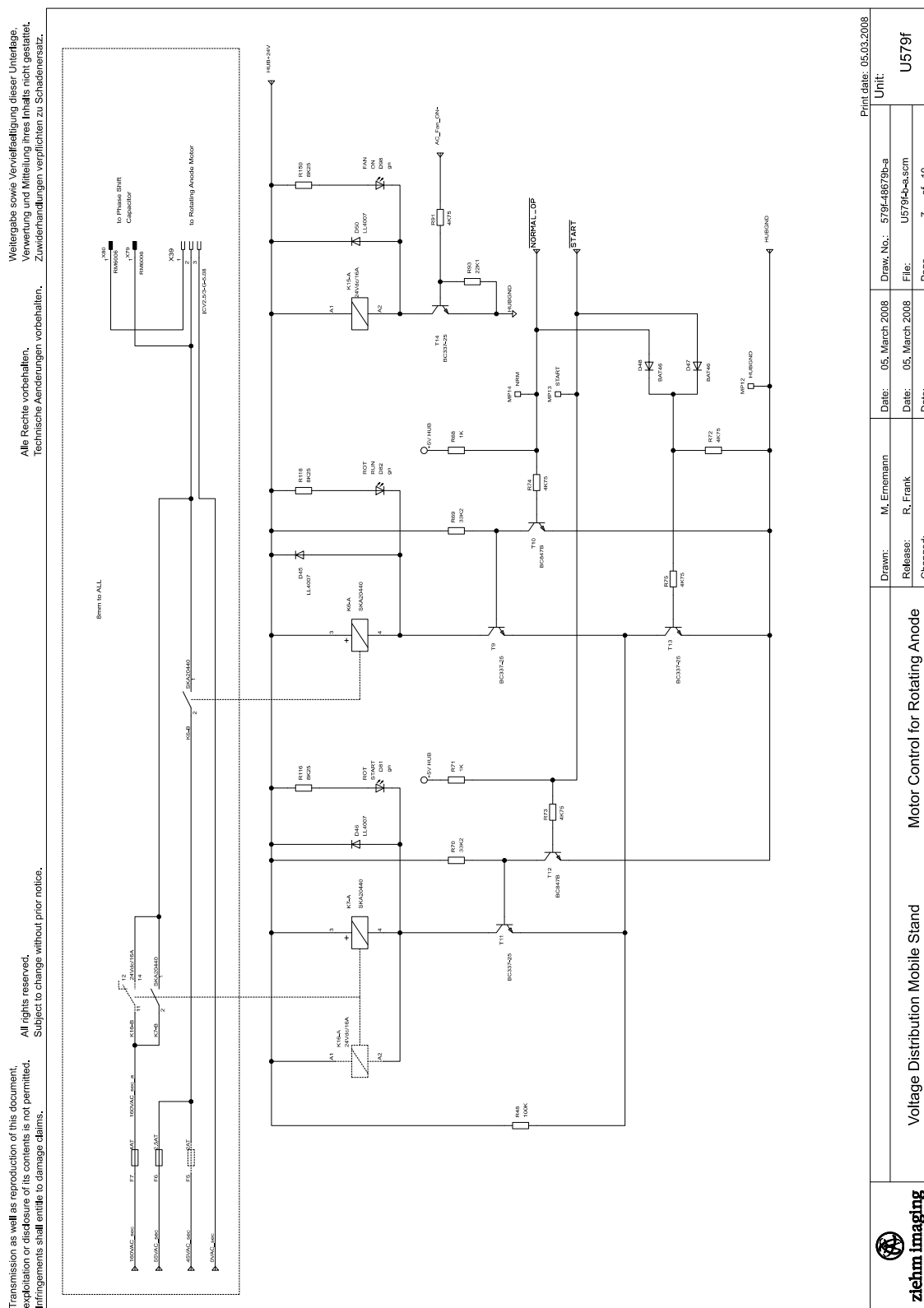


Fig. 4-18 Motor control for rotating anode

4.5.10.8 Water Pump Control

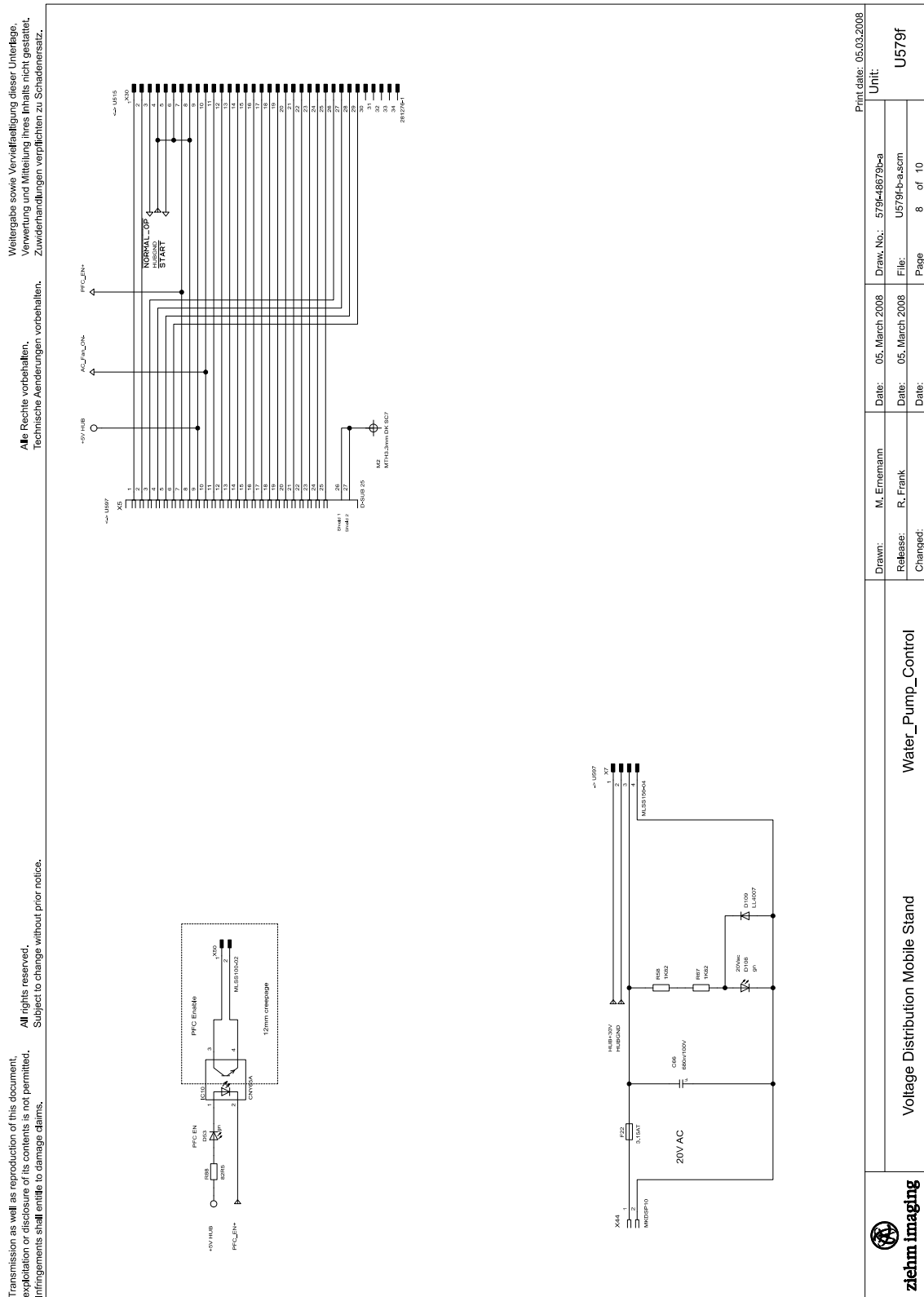


Fig. 4-19 Water pump control

4.5.10.9 Voltage Regulators for CCD / I.I / Flat

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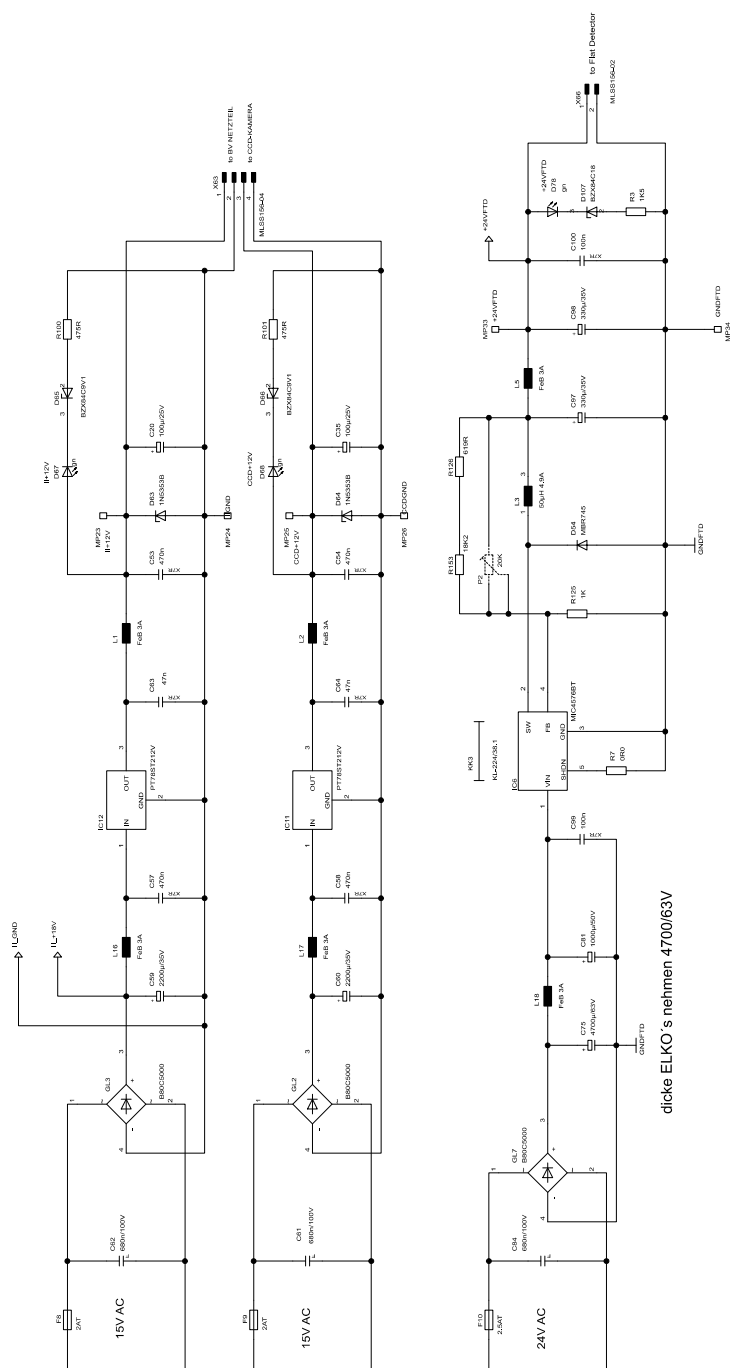


Fig. 4-20 Voltage regulators for CCD / I.I. / Flat

	Voltage Distribution Mobile Stand Regulators for CCD / I.I. / Flat	Drawn: M. Ensmann	Date: 05. March 2008	Draw. No.: 5794-48679-b-a	Unit:
		Release: R. Frank	Date: 05. March 2008	File: U5794-b-a.scm	
Print date: 05.03.2008					

4.5.10.10 Power for U515 / FG 9938

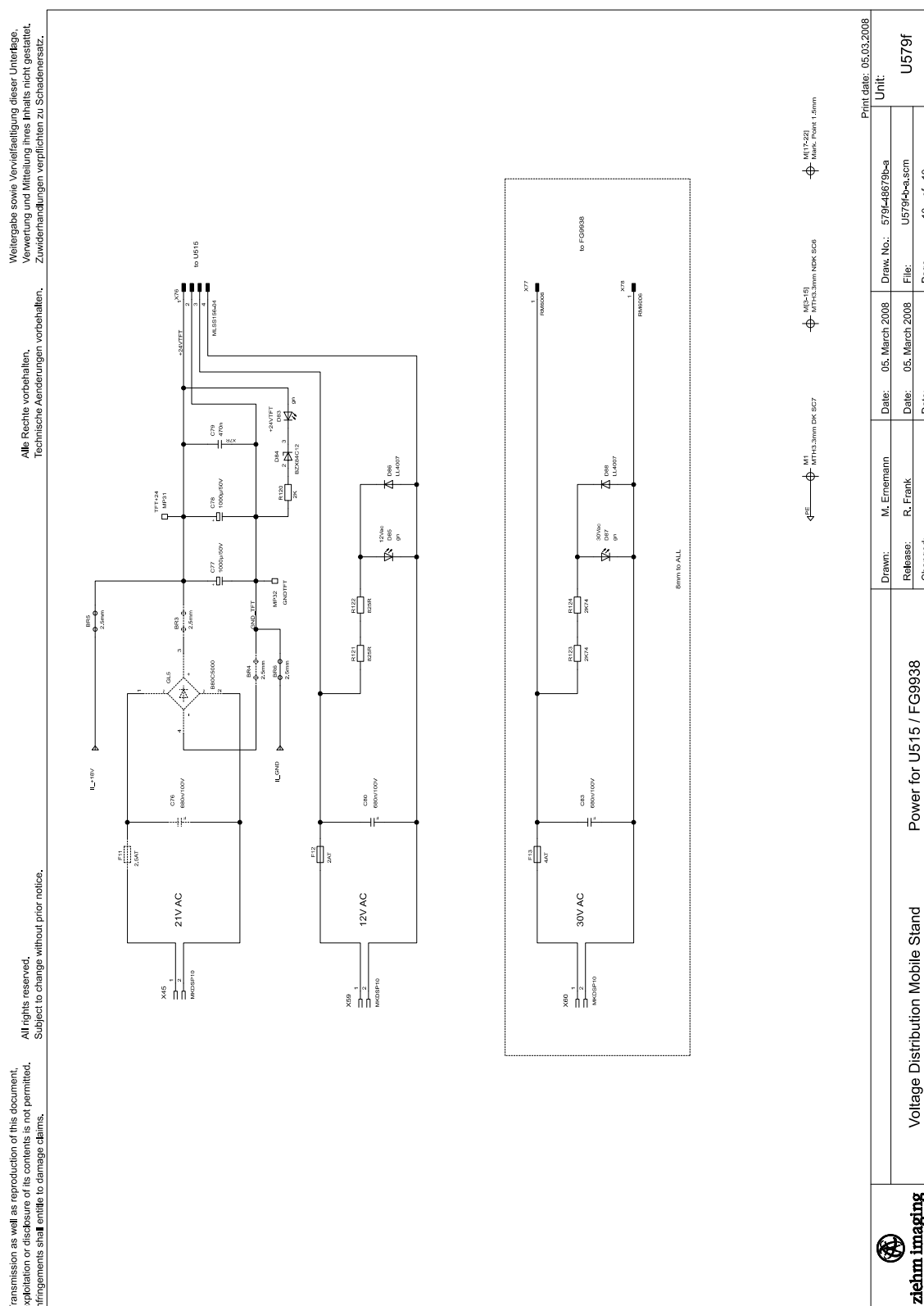


Fig. 4-21 Power for U515 / FG 9938

4.6 Transformer module

4.6.1 Mains Transformer T21

4.6.1.1 Primary / Secondary

Transformer T21 (11125)				color	usage
Primary 1	0-100-105-110-115-120 V			black	Mains input
Primary 2	0-100-105-110-115-120 V			black	Mains input
Secondary 1	0			red	
	45 V		60 VA	red	Not used
	55 V		100 VA	red	Not used
	160 V		640 VA	red	Not used
	230 V	5.56 A	1300 VA continuous	red	Generator
Secondary 2	30 V	5 A	150 VA	green	Gen. 24 V _{DC}
Secondary 3	24 V	10 A	240 VA	blue	Lift 24 V
Secondary 4	12 V	2.5 A	30 VA	brown	U515
Secondary 5	15 V	2 A	30 VA	yellow 1,2	CCD
Secondary 6	15 V	2 A	30 VA	yellow 3,4	I.I. and Solo Center
Secondary 7	24 V	4.2 A	100 VA	orange	Not used
Secondary 8	21 V	2.9 A	60 VA	violet	Not used
Secondary 9	20 V	3 A	60 VA	white	Not used

4.6.1.2 Temperature Switch

In the transformer there is a temperature switch. It will open when the temperature rises above 130° celsius. This causes the switch-off of the power supply, as it is connected to X22:U579.

4.6.2 Terminal blocks X1 and X2

List of all terminals UT6 dealing with high voltages	
Phoenix terminal UT6	
X2.00	mains transformer secondary 1: 0 V
X2.01	mains transformer secondary 1: 45 V
X2.02	mains transformer secondary 1: 55 V
X2.03	mains transformer secondary 1: 160 V
X2.04	mains transformer secondary 1: 230 V

List of all terminals dealing with low voltages	
Phoenix terminal	
X2.05	mains transformer secondary 2
X2.06	mains transformer secondary 2
X2.08	mains transformer secondary 3
X2.09	mains transformer secondary 3
X2.15	mains transformer secondary 4
X2.16	mains transformer secondary 4
X2.13	mains transformer secondary 5
X2.14	mains transformer secondary 5
X2.11	mains transformer secondary 6
X2.12	mains transformer secondary 6
X2.22	mains transformer secondary 7
X2.23	mains transformer secondary 7
X2.20	mains transformer secondary 8
X2.21	mains transformer secondary 8
X2.18	mains transformer secondary 9
X2.19	mains transformer secondary 9

List of all terminals UT6 dealing with high voltages	
Phoenix terminal UT6	
X1.13	Choke

List of all terminals UT10 dealing with high voltages

Phoenix terminal UT10

X2.00	mains transformer Primary 1 : 0 V
X2.01	mains transformer Primary 1 : 100 V
X2.02	mains transformer Primary 1 : 105 V
X2.03	mains transformer Primary 1 : 110 V
X2.04	mains transformer Primary 1 : 115 V
X2.04	mains transformer Primary 1 : 120 V

List of all terminals UT10 dealing with high voltages

Phoenix terminal UT10

X2.00	mains transformer Primary 2 : 0 V
X2.01	mains transformer Primary 2 : 100 V
X2.02	mains transformer Primary 2 : 105 V
X2.03	mains transformer Primary 2 : 110 V
X2.04	mains transformer Primary 2 : 115 V
X2.04	mains transformer Primary 2 : 120 V



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5

Main Interface

Module 2

5 Main Interface

5.1 Module 2 U515 Description

5.1.1 General

The U515 board includes two separate modules in one: The main interface module and the SERCAN service module.

Main Interface Mode:

The U515 provides a link between the Image Memory and the main interface by means of the CAN bus.

5 Main Interface

5.1.2 U515: Block Diagram

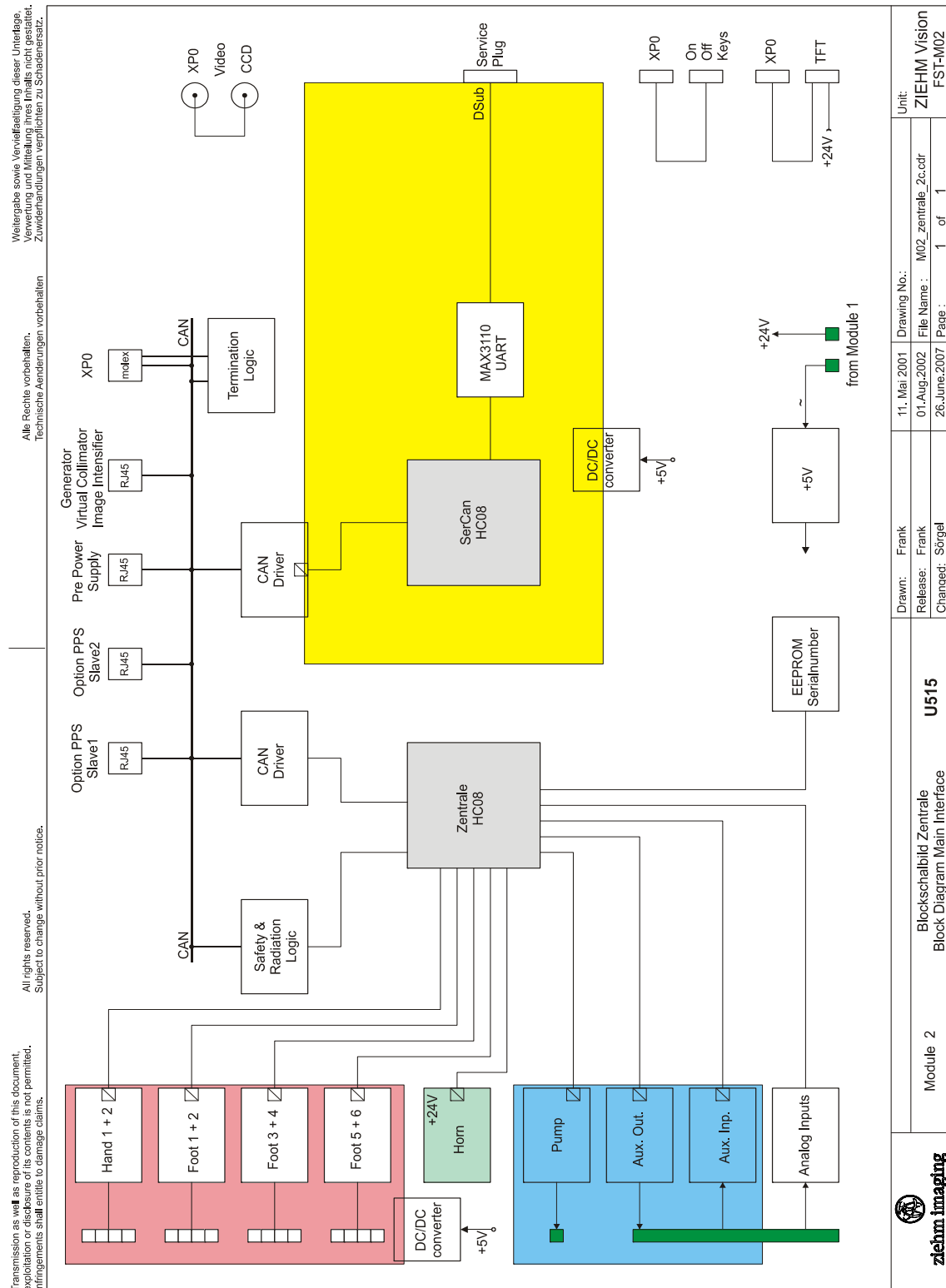


Fig. 5-1 U515 block diagram

5.1.3 U515: Location of Connectors

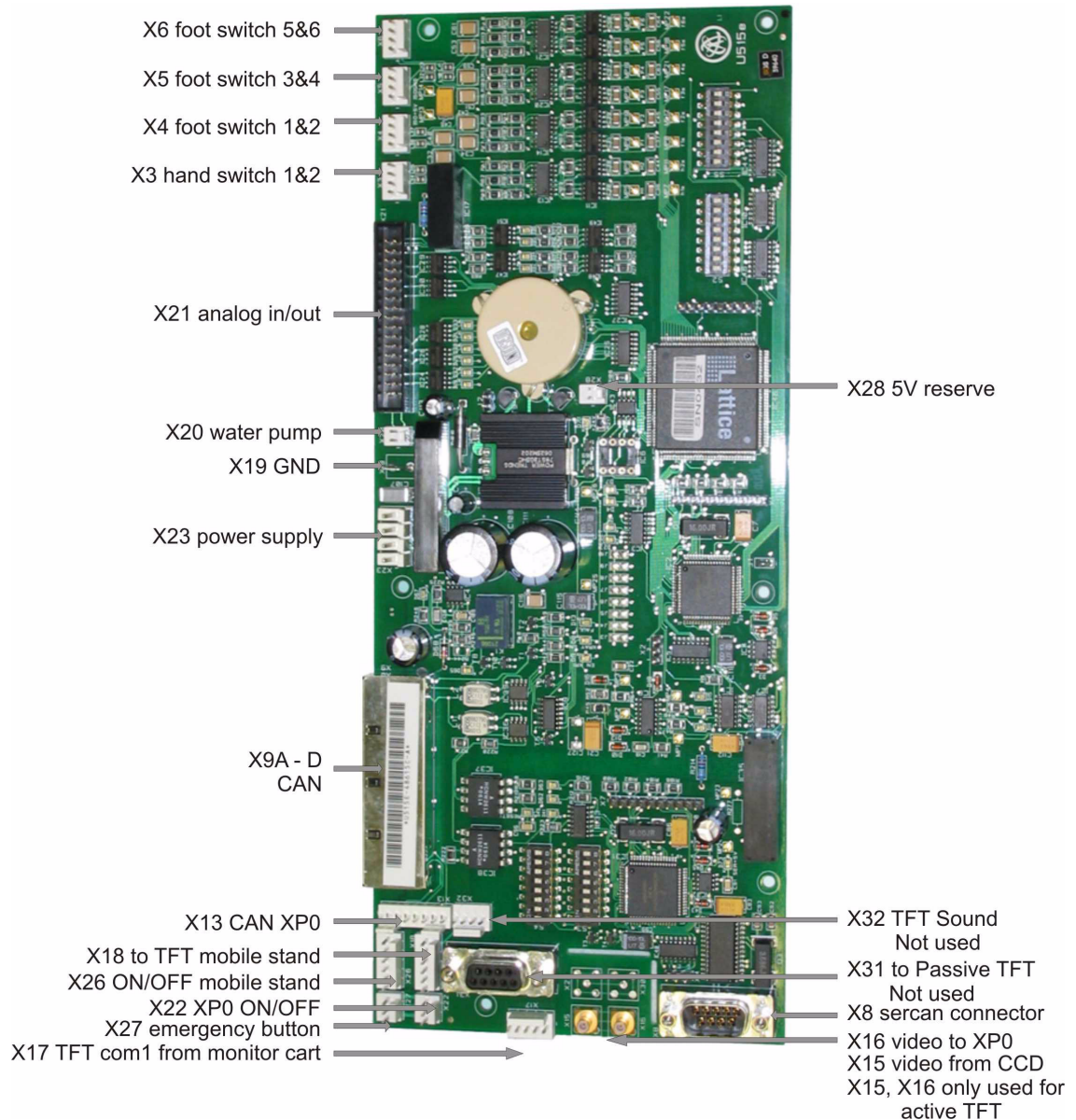


Fig. 5-2 U515 location of connectors

5.1.4 U515: Location of LEDs, Switches and Jumpers

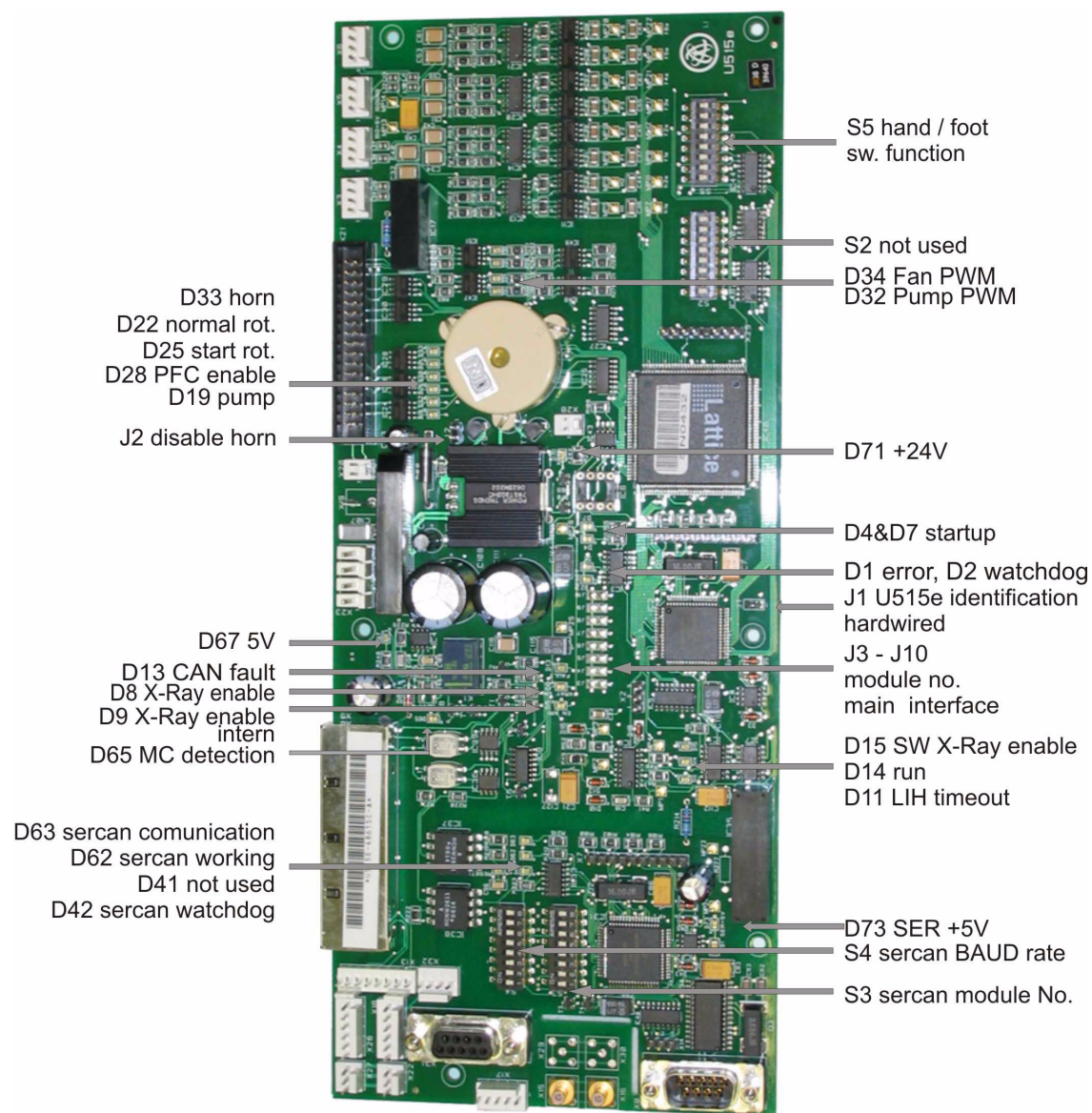


Fig. 5-3 U515 location of LEDs, switches and jumpers

5.2 Main Interface Functions

Main interface functions	Remarks
Mobile serial number (separate external EEPROM) is programmed, then installed on the board	
Control external I/O ports (with optocouplers)	
Control water pump and beeper	
Control hand switches and foot switches (push, release, short circuit)	
Control the "CAN XRAY ENABLE" signal	
Control the "CAN FAULT" signal in the startup phase	
Control external analog voltage inputs	
Power supply for CAN bus (CAN+5V/CANGND)	
Power supply for TFT display	
Automatic CAN termination (with/without monitor cart)	
CAN bus distribution	
Distribution of ON/OFF signals	not in Vision R / units with U579
Provides video distribution point from CCD camera to the image system by means of the XP0 cable.	Active units only
Gateway for service SERCAN and RS232 (external service PC)	
Storing the <i>vision.md</i> file in the HC08	Passive units only
Control the PFC (Power factor correction) enable signal	Vision R only
Control the fan (on/off and speed)	Vision R only
Control the relays for the rotating anode supply	Vision R only

5.2.1 EEPROM

The U515 board has an EEPROM for storing the serial number. These are factory default data.

5.2.2 Microprocessor

A hardware circuit monitors the operating voltage. If it is below 4.65 V the microprocessor gets a reset signal as long as the voltage is below this threshold.

The same circuit has to be triggered continuously by the microprocessor. If the software fails the so called watchdog issues a reset signal to the microprocessor.

Internal EEPROM data:

Software calculates the checksum from all EEPROM data during startup phase and checks this value with the legal checksum value. If the calculated checksum value and the legal value are not the same it sets an error bit (startup error).

5.2.3 External I/O

The external I/O are used in order to control the following in a Ziehm Vision R System:

- Fan Speed
- Pump Speed
- PFC Enable
- Rotating Anode Start
- Rotating Anode Run

5.2.4 X-ray Peeper and Alarm

The U515 board has a beeper which can be used for X-ray 5 min timer limit. It also indicates missing U515 machine data.

5.2.5 Hand/foot Switch Features

- Allow the hand/foot switch to control separate functions or radiation release. See hand/foot switch commands (→ *Ch. 5.5, p. 5-13*).
- Program hand and/or foot switch for specific operator/facility needs as required for specific modes of operation of the image and C-arm systems.
- U515 board controls the hand switch operations and safety interlocks.
- U515 sends CAN commands to U544 via CAN bus to inform the image system control that radiation is being requested and accordingly that a function is requested by pressing hand or foot switch.
- U544 handles radiation release request and sends start radiation signal to the generator.
- U544 handles the processing of the other CAN commands for the hand and foot switch, i.e. store image, change, select live image transfer mode, etc.

5.2.6 Control the “CAN XRAY ENABLE” Signal

The U515 board provides safety circuits. One of them is X-ray enable (→ *Ch. 5.10, p. 5-28*).

5.2.7 Control the “CAN FAULT” Signal in the Startup Phase

CAN FAULT signal can be accessed by all CAN modules and is controlled during startup by the U515.

5.2.8 Power Supply for CAN Bus and Solo Center

The U515 board provides power to the CAN bus interface modules located in the mobile stand only.

Module 1 (Pre-Power Supply)

Module 2 (U515 main interface)

Module 4 (Image Intensifier and CCD camera control)

Module 5 (X-ray Generator)

For the Solo Center the +24 V are connected straight to the Solo Center by the U592 board in the support arm.

5.2.9 CAN Bus Distribution

The U515 board provides a connection point for the XP0 cable and all the other modules in the mobile stand.

5.2.10 Gateway for Service SERCAN and RS232 (External Service PC)

The U515 is also responsible for a serial CAN interface called the “SERCAN”. This is the main gateway between the CAN and an external service PC. This allows separate standalone service software to communicate with all other modules in the C-arm. This interface allows the service and production personnel to load software, set certain module control parameters, read and write machine data to a specified CAN module as may be necessary (→ *Ch. 5.9.4, p. 5-27*).

5.3 U515: Errors

5.3.1 Startup Errors

Check hardware errors during startup phase	
Hand and foot switches are pressed	E1100 – E1106
Short circuit from hand and foot switches	E1108 – E1115
Data transmission over the SPI interface to the external I/O ports (PLD)	E1117
“CAN XRAY ENABLE” signal	E1116
EEPROM Checksum Error	E1118
Rationale: If transmission to the external I/O ports is not OK, all switches get the “short circuit” and “function switch” states.	

5.3.2 Runtime Errors

Check hardware errors during runtime	
Short circuit from hand and foot switches	E1164 – E1171
Data transmission over the SPI interface to the external I/O ports (PLD)	E1174
“CAN XRAY ENABLE” signal without switch pressed	E1172
“CAN FAULT” signal	E1173

5.3.3 X-ray Break Errors

Last error information after “X-ray break” was sent	
Short circuit from hand and foot switches	E1132 – E1139
Data transmission over the SPI interface to the external I/O ports (PLD)	E1142
“CAN XRAY ENABLE” signal not active	E1140
“CAN FAULT” signal	E1141
Timeout last image hold (no X-ray finished from the image system)	E1148

5.4 U515: SERCAN

5.4.1 SERCAN Specifications

Setting the Baud rate to match system operation and PC serial COM port.

It is recommended to set the PC serial port Baud rate to the maximum of 115200 bit/s in order to make the communication as fast as possible. Newer laptop models (newer than approx. 1997) provide this as an option for high-speed operation.

Available settings for Baud rate by means of DIP switch S4 on the U515 board:

Available Baud rate settings; serial communication
9600 bit/s
19200 bit/s
28800 bit/s
57600 bit/s
115200 bit/s

For connecting a computer to the U515, a nullmodem cable is required.

5.4.2 SERCAN Switches

5.4.2.1 DIP Switch S3

DIP switch S3 will set up the CAN bus module address.

DIP switch S3 (module number SERCAN)	
Switch 1	CAN bus address ON
Switch 2	CAN bus address OFF
Switch 3	CAN bus address OFF
Switch 4	CAN bus address OFF
Switch 5	CAN bus address OFF
Switch 6	CAN bus address OFF
Switch 7	CAN bus address OFF
Switch 8	CAN bus address OFF

Default setting:



Fig. 5-4 S3 default setting

NOTICE**NOTICE**

Do not change this setting!

5.4.3 DIP Switch S4

DIP switch S4 will set up the SERCAN Baud rate.

DIP switch S4 (option SERCAN, Baud Rate)	
1	Bit 0: (select the Baud rate)
2	Bit 1: (select the Baud rate)
3	Bit 2: (select the Baud rate)
4	Bit 3: not used
5	Bit 4: not used
6	Bit 5: not used
7	Bit 6: not used
8	Bit 7: not used

Baud rate:			
bit 2	bit 1	bit 0	
0	0	0	Baud rate = 9600 bit/s
0	0	1	Baud rate = 19200 bit/s
0	1	0	Baud rate = 28800 bit/s
0	1	1	Baud rate = 57600 bit/s
1	0	0	Baud rate = 115200 bit/s

Default setting:

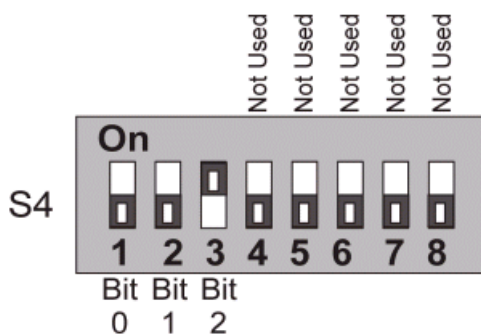


Fig. 5-5 S4 default setting



NOTE

Vision Studio will only work at 115200 bit/s.

5.4.4 SERCAN LEDs

LED(s)	Status	Meaning
LED D42 (red)	ON	Hardware reset or watchdog is active
LED D62 (green)	flashing	SERCAN is working
LED D63 (green)	ON	SERCAN received a character from the RS232

5.5 Hand/Foot Switch Commands to the Image System

5.5.1 Three Separate Operations of the Hand and Foot Switch

- 1 Radiation release:
 - All hand or foot switches can be programmed to perform radiation release.
- 2 Operation of a function:
 - Control functions such as store, laser on/off, select I.I. magnification etc.
 - Second foot and hand switch will be programmable for these operations.
- 3 Tap function:
 - Dual use of the hand and accordingly foot switches. The selected hand or foot switch is programmed via machine data to provide dual operation of function and accordingly radiation release.

Example:

If the hand switch for radiation release is pressed and held for more than the programmable tap time, this will cause U515 to send a CAN message for radiation release.

Tapping the hand switch quickly less than tap time will place the hand switch in a new functional operation, such as store, image transfer, etc. The tap time is programmable in the machine data of the U515 board.

Machine data for the hand/foot switch function mapping is located in the host software. Functional table in the service mode will allow for selection of foot and hand switch operation.

5.5.2 Hand Switches/Foot Switches Safety Functions

Switches are connected to SELV (Safety Extra-Low Voltage) circuitry.

Software checks if any hand- or foot switches are pressed during the startup phase.

Software checks during startup and system running if any of the hand or foot switches are short circuited.

Hardware function prevents radiation. Only if both software and hardware are working correctly and a switch is pressed the module 2 activates the hardware signal "CAN XRAY ENABLE" and sends a CAN message to the image system.

Software checks the transmission via the SPI (Serial Peripheral Interface) to the external I/O port interface IC to which the switches are connected. If the transmission is not OK, all switches get the state "short circuit" and "function switch".

5.5.3 Tap Time

- The tap time is defined in the U515 machine data.
- If the “tap time” is 0, the hand switch or foot switches are in normal operation.
- If the “tap time” is not 0, the hand- and accordingly foot switches have two functions:
- A short push (shorter than “tap time”) will activate a special programmed function.
- If the pushing is longer than the “tap time” the second programmed function will be activated.

5.5.4 Security Break Functions

There are two security X-ray break functions implemented:

- Hardware X-ray break 6 seconds after a hand or foot switch has been released.
- Software can only shorten the hardware X-ray break (0 to 6000 ms).
0 means that the X-ray stops immediately after releasing a hand or foot switch.

5.5.5 Hand and Foot Switch Functions

All functions that can be selected are listed in the following tables.

Switch function	Corresponding setting of S5	Tap function
No switch function	on	No switch function
Fluoroscopy	off	Save
Snapshot	off	5 minutes alarm off
Magnification (T)	on	Magnification (T)
Save	on	Image change
Print	on	DSA (T)
Cine (T)	on	Cine play toggle
DSA (T)	on	Browse forward
Laser (ON)	on	Browse backward
VCR-Pause (T)	on	Swap Ref. Monitor <--> S-Video
Switch through (DSA, RSA, MSA)	on	Ref. Monitor freeze toggle
Cine on	on	
Cine off	on	
Image change	on	
Cine play toggle	on	
Browse forward	on	
Browse backward	on	
Swap Ref. Monitor <--> S-Video	on	
Ref. Monitor freeze toggle	on	

Table 5-1 Hand switch functions

Fluoroscopy means: release radiation in selected mode.

Press interrupt function		
No switch function	This function is performed when the switch is released only for a short time.	
Save		



NOTE

Switch programming is done in the service settings → Ch. 16.2.6, p. 16-30.

5.6 HW Settings

5.6.1 Switches

5.6.1.1 DIP Switch S5

Depending on the use of the hand/foot switch the following table should be used to select the hand/foot switch for function or X-ray use.

DIP switch S5 (select hand/foot switch as function/X-ray switch)		corresponding switch of Ziehm Solo
Switch 1	ON = hand switch 1 function switch OFF = hand switch 1 X-ray switch	left hand switch
Switch 2	ON = hand switch 2 function switch OFF = hand switch 2 X-ray switch	not used
Switch 3	ON = foot switch 1 function switch OFF = foot switch 1 X-ray switch	left foot switch
Switch 4	ON = foot switch 2 function switch OFF = foot switch 2 X-ray switch	right foot switch
Switch 5	ON = foot switch 3 function switch OFF = foot switch 3 X-ray switch	button on solo center support arm
Switch 6	ON = foot switch 4 function switch OFF = foot switch 4 X-ray switch	not used
Switch 7	ON = foot switch 5 function switch OFF = foot switch 5 X-ray switch	right hand switch
Switch 8	ON = foot switch 6 function switch OFF = foot switch 6 X-ray switch	not used
Note: DIP switches are set to "on" (function) for inputs not used.		

Factory default setting for Ziehm Solo:

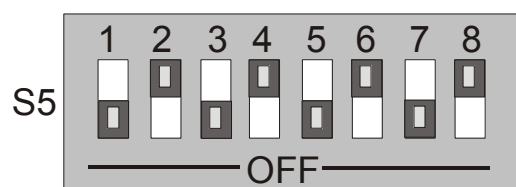


Fig. 5-6 S5 is located on the right side of board U515



NOTE

DIP switch settings will not take effect until the unit has been rebooted.

5.6.1.2 DIP Switch S2

(Option for main interface). No switch shown. S2 not used.

5.6.2 Jumpers

Jumper	Status	Meaning
J1 SW5.01 and above: (Type: 2-pin jumper)	open closed	U515d hardware U515e hardware (hardwired on U515e)
J2 (Type: 2-pin jumper)	open closed	signal horn enabled signal horn disabled

On U515e and above the DIP switch S1 is replaced by hardwired jumpers in order to set up the CAN module address.

Jumper	Status	Meaning
J3	closed	Can module address
J4	closed	
J5	open	
J6	closed	
J7	closed	
J8	closed	
J9	closed	
J10	closed	

5.7 LEDs

5.7.1 Startup Monitoring LEDs

LED(s)	Status	Meaning
LED D4 LED D7	flashing OFF	Startup phase 1
LED D4 LED D7	OFF flashing	Startup phase 2
LED D4 + LED D7	flashing synchronously	Waiting for system to run
LED D4 LED D7	OFF OFF	System is running

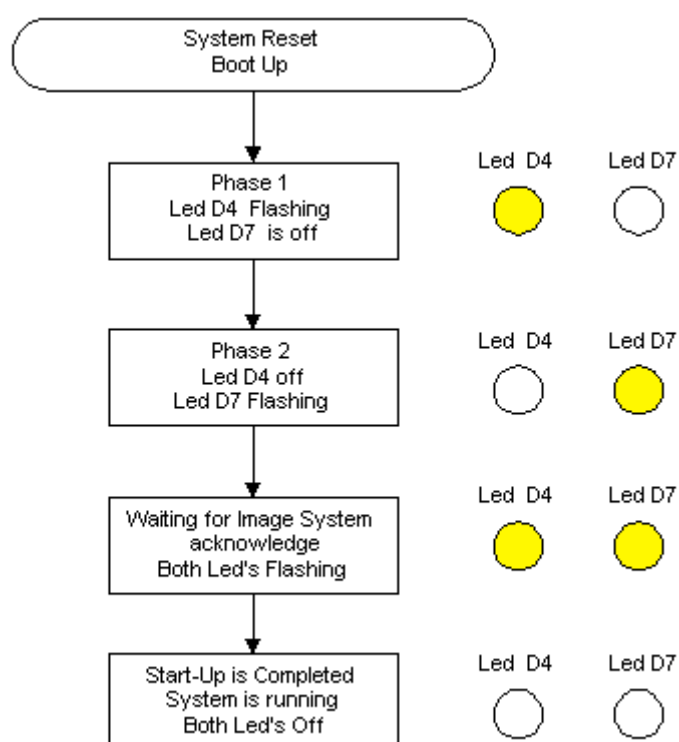


Fig. 5-7 Startup phase

5.7.2 Hardware Monitoring LEDs

LED	Status	Meaning
LED D1	OFF	No hardware error
	ON	Hardware error detected
LED D2	ON	Hardware reset or watchdog is active
LED D8	ON	"X-RAY ENABLE" signal is active
LED D9	ON	"X-RAY ENABLE" signal is active (internal)
LED D13	ON	"CAN FAULT" signal
LED D14	ON	Software toggle the "RUN" monostable
LED D15	ON	Software enable signal for "CAN XRAY ENABLE"
LED D19 (Horn LED)	ON	Audible alarm
		AUX Out 1
LED D32	ON	not used
LED D33	ON	not used
LED D34	ON	not used
LED D65 (CAN termination)	ON	with Image Memory
	OFF	without Image Memory
LED D67	ON	+5 V OK
LED D71	ON	+24 V OK
LED D73	ON	SER +5 V OK

5.8 Connectors

X3: Hand switch connector; 1 and 2 Type: 4-pin connector	
Pin	Function
Pin 1	hand switch 1
Pin 2	ISOGND
Pin 3	hand switch 2
Pin 4	ISOGND

X4: Foot switch connector; 1 and 2 Type: 4-pin connector	
Pin	Function
Pin 1	foot switch 1
Pin 2	ISOGND
Pin 3	foot switch 2
Pin 4	ISOGND

X5: Foot switch connector; 3 and 4 Type: 4-pin connector	
Pin	Function
Pin 1	foot switch 3
Pin 2	ISOGND
Pin 3	foot switch 4
Pin 4	ISOGND

X6: Foot switch connector; 5 and 6 Type: 4-pin connector	
Pin	Function
Pin 1	foot switch 5
Pin 2	ISOGND
Pin 3	foot switch 6
Pin 4	ISOGND

X8: RS232 SERCAN connector Type: 9-pin DSUB connector	
Pin	Function
Pin 1	n. c.
Pin 2	TxD
Pin 3	RxD
Pin 4	n. c.
Pin 5	Ground
Pin 6	n. c.
Pin 7	RTS
Pin 8	CTS
Pin 9	n. c.

Assignment of: X9, X10; X11; X12: CAN distribution on U515 up to version d X9A, X9B, X9C, X9D: CAN distribution on U515 version e and above		
Connector	Assignment in Ziehm Vision	Assignment in Ziehm Vision R
X12 / X9A	not connected	PPS Master
X11 / X9B	not connected	Generator
X10 / X9C	Pre-Power Supply	PPS Slave 2
X9 / X9D	Generator	PPS Slave 1

5 Main Interface

X9, X10; X11; X12: CAN distribution on U515 up to version d
X9A, X9B, X9C, X9D: CAN distribution on U515 version e and above
 Type: RJ-45 connectors

Pin	Function
Pin 1	CANGND
Pin 2	CAN+5V
Pin 3	CANL
Pin 4	CANSTÖR
Pin 5	CANSTR (X-ray enable)
Pin 6	CANH
Pin 7	C_GND
Pin 8	C +5 V
Pin 9	shield
Pin 10	shield

X13: CAN distribution; XP0
 Type: 8-pin connector

Pin	Function
Pin 1	shield
Pin 2	CAN sense
Pin 3	CAN ground
Pin 4	n. c.
Pin 5	CANH
Pin 6	CANL
Pin 7	CANSTÖR
Pin 8	CANSTR (X-ray enable)

X15: Video connector from CCD Type: SMB connector	
Pin	Function
Pin 1	shield
Pin 2	video

X16: Video connector to XP0 Type: SMB connector	
Pin	Function
Pin 1	shield
Pin 2	video

X17: TFT connector (from monitor cart) Type: 5-pin connector	
Pin	Function
Pin 1	ground (24 V)
Pin 2	→ to X18/Pin 3 (TFT TX)
Pin 3	→ to X18/Pin 4 (TFT RX)
Pin 4	→ to X18/Pin 5
Pin 5	→ to X18/Pin 6

X18: TFT connector (to TFT mobile stand) Type: 6-pin connector	
Pin	Function
Pin 1	ground (24 V)
Pin 2	+24 V
Pin 3	→ to X17/Pin 2 (TFT TX)
Pin 4	→ to X17/Pin 3 (TFT RX)
Pin 5	→ to X17/Pin 4
Pin 6	→ to X17/Pin 5

5 Main Interface

X19: Electrical ground to EARTH Type: 1-pin connector	
Pin	Function
Pin 1	ground / earth

X20: water pump Type: 2-pin connector	
Pin	Function
Pin 1	OAUX+1
Pin 2	OAUX-1

X22: ON/OFF switch (XP0) Type: 3-pin connector	
Pin	Function
Pin 1	NETZAUS
Pin 2	NETZEIN
Pin 3	NEAGND

X23: power supply connector Type: 4-pin connector	
Pin	Function
Pin 1	power supply "HORN" and TFT [+24 V _{DC}]
Pin 2	ground
Pin 3	power supply main interface [15 V _{AC}]
Pin 4	power supply main interface [15 V _{AC}]

X26: ON/OFF switch (mobile stand) Type: 6-pin connector	
Pin	Function
Pin 1	NETZAUS
Pin 2	NEAGND
Pin 3	NEAGND
Pin 4	NETZEIN
Pin 5	LED_ON (+5 V power supply)
Pin 6	GND

X31: TFT Connector (mobile stand, passive TFT) Type: 11-pin connector	
Pin	Function
Pin 1	+24 VB
Pin 2	to X18/Pin 5 Sound+
Pin 3	n. c.
Pin 4	to X18/Pin 3 TXD
Pin 5	GND 24 VB
Pin 6	+24 VB
Pin 7	to X18/Pin 6 Sound GND
Pin 8	to X18/Pin 4 RXD
Pin 9	GND 24VB
Pin 10	GND
Pin 11	GND

X32: TFT Connector (mobile stand, passive TFT Sound) Type: 4-pin connector	
Pin	Function
Pin 1	to X18/Pin 5 Sound +
Pin 2	to X18/Pin 6 Sound GND
Pin 3	GND 24 VB
Pin 4	GND 24 VB (Shield)

5.9 Replacement of U515 Main Interface Board

5.9.1 Safety when Exchanging U515

Take care when handling the U515. It may be damaged by electrostatic discharge (ESD). ESD is defined as the discharge of an accumulated static charge stored on operating personnel, furniture or other structures such as pushcarts. It is recommended for the personnel to wear grounding wristbands and that service and testing procedures be performed on anti-static mats.

5.9.2 Required Tools and Materials

- 1 Compatible laptop with serial port with 115 k Baud rate
- 2 General hand tools
- 3 ESD wrist band and grounding cable
- 4 HC08 software and machine data (included in Vision Studio)
- 5 Nullmodem serial cable with female-to-female DB 9-pin connector (connecting to mobile stand)
- 6 Serial cable with male-to-female DB 9-pin connector (connecting to monitor cart)

5.9.3 Disassembly and Fitting of the Board

When removing the connectors be careful not to damage the pin or cable insulation. Check connector locations before reinstalling to prevent damage to system electronics.

5.9.4 Adjustment/Programming

There are four DIP switch boards (S2 - S5) on U515:

- S2: not used
- S3: Address for SERCAN
- S4: Baud rate
- S5: Foot switch options

Check all DIP switches and adjust them if necessary according to the list
(→ Ch. 5.4.2, p. 5-10).

Programming:

Programming is performed by using the VISION STUDIO tool.
Refer to Ch. 18, Software Tools (→ Ch. 16, p. 16-1).



NOTE

Programming has to be performed via the USB-CAN adapter if the U515 SER-CAN has not been programmed yet.



NOTE

If the image memory is equipped with a U578 interface board, programming of the U515 board can only be performed via the USB-CAN adapter if the U515 SERCAN has not been programmed yet.

5.10 Hardware Radiation Logic

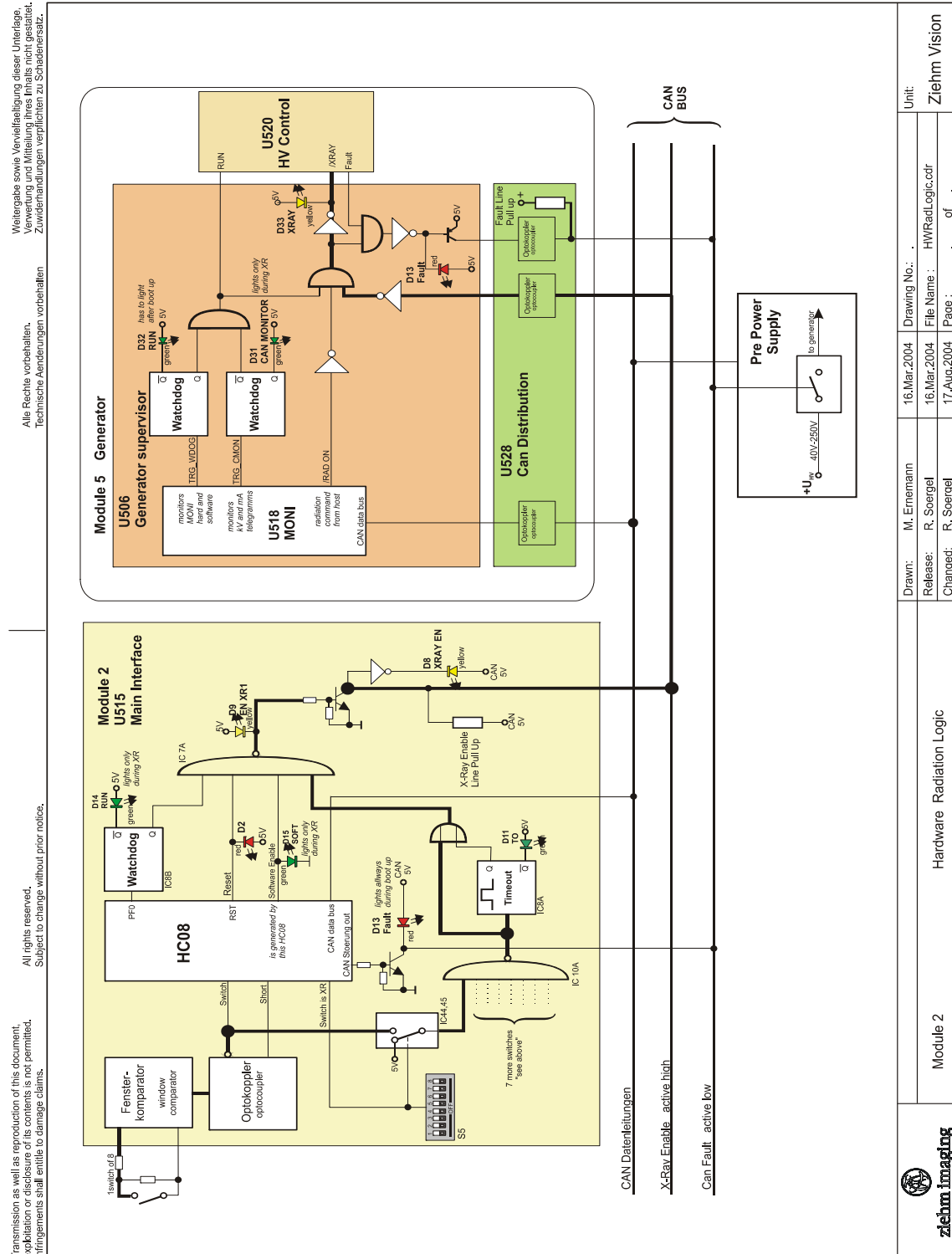


Fig. 5-8 Hardware radiation Logic



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6

Image Intensifier

Module 4

6 Image Intensifier

6.1 General Parts Location

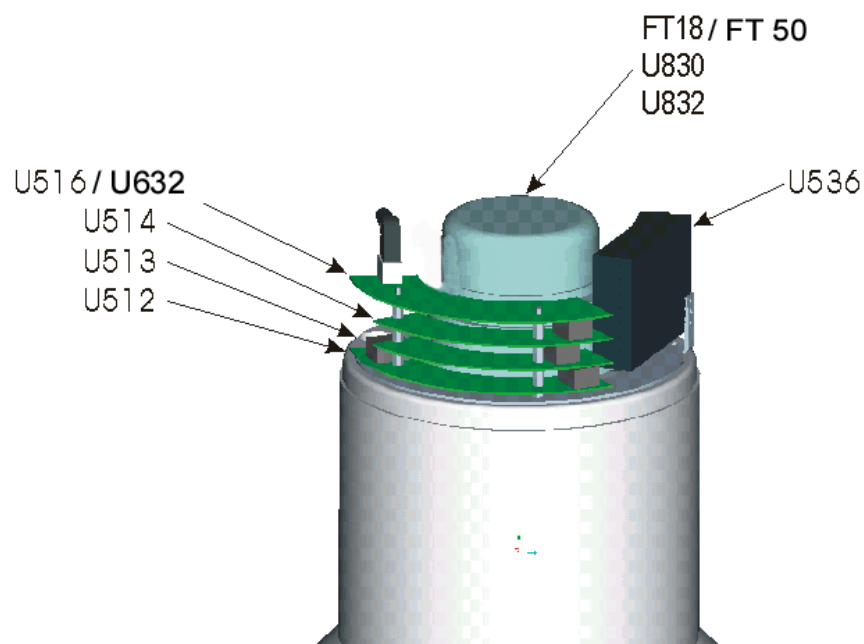


Fig. 6-9 Image intensifier parts location

6.2.1 Block Diagram



The camera consists of the boards U830 and U832.

6.2.2 Overview of I.I. Power Supply

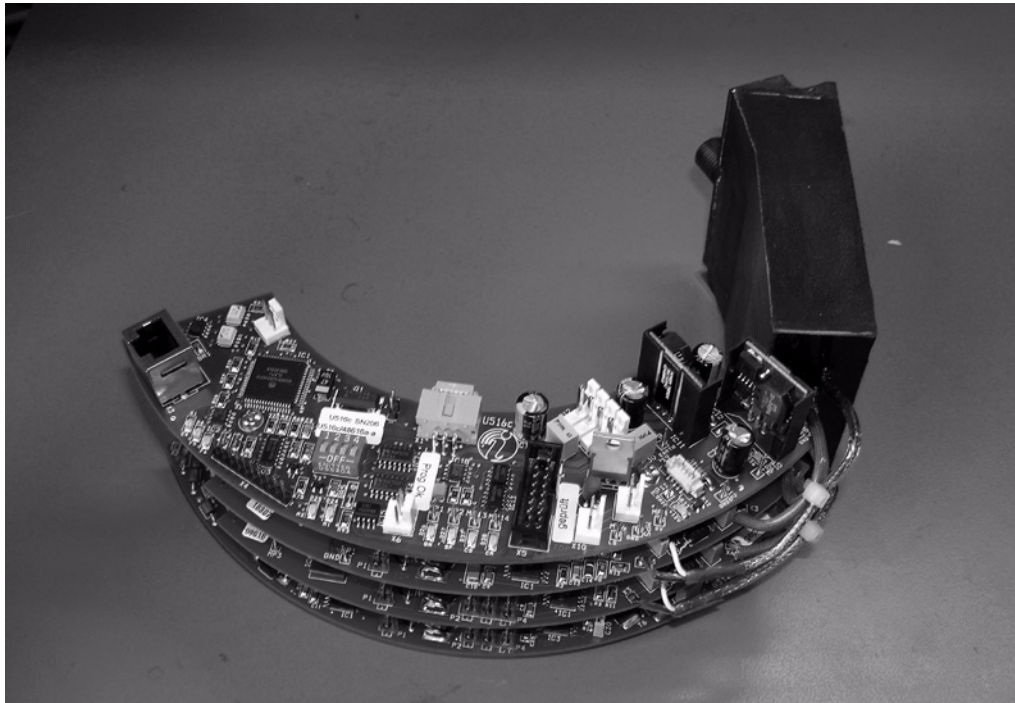


Fig. 6-2 Image intensifier power supply

6.2.2.1 General

The I.I. power supply provides the necessary voltages for the different image intensifiers. It also supplies the power for the CCD camera.

The CAN controller of the I.I. Power Supply runs software to control the iris, the laser switching, and the magnifier selection.

(Art. No. 88381)

6.2.2.2 Main Parts and their Functions

Main Part	Function	Remarks
Controller	Controls the magnification modes of the I.I. Controls the CCD iris. Controls laser switching. Provides CCD camera supply voltage.	
Power inverters	High voltages	
Cascade	Multiplies the voltages	

6.2.3 HW Description

6.2.3.1 PCBs

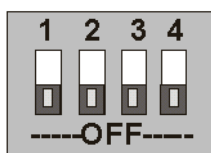
PCBs	
U512:	Grid 1 and Grid 2 inverter
U513:	Grid 3 inverter and magnetic choke (for static S-distortion correction)
U514:	Grid 4 and anode inverter
U516:	controller board

6.2.3.2 Cascade

PCB	
U536	30 kV cascade supports also Grid 4
	Grid 3 cascade
Rationale:	Cascade sealed in insulation material

6.2.3.3 Switches

DIP switch 1	
Bit 0	Standalone for production requirements ON = standalone active
Bit 1	RS232 debug interface ON/OFF
Bit 2 (switch 3)	reserved
Bit 3 (switch 4)	reserved



6.2.3.4 LEDs

Status LEDs for service requirements		
LED(s)	Status	Meaning
LED 1 (red)	flashing	startup phase 1
LED 4 (red)	flashing	startup phase 2
LED1 + LED4	flashing synchronously OFF	waiting for system ready system is running
LED 6 (green)	flashing	system is running
LED 24 (green)	ON	magnification 1 active
LED 25 (green)	ON	magnification 2 active
LED 26 (green)	ON	CCD gain on
LED 27 (green)	ON	CCD single frame enable
LED 31 (green)	ON	+5 V logic OK
LED 33 (green)	ON	CCD +12 V OK
LED 36 (green)	ON	+5 V servo motor OK
LED 37 (green)	ON	CCD single frame capture
LED 38 (green)	ON	CCD charge reset pulse

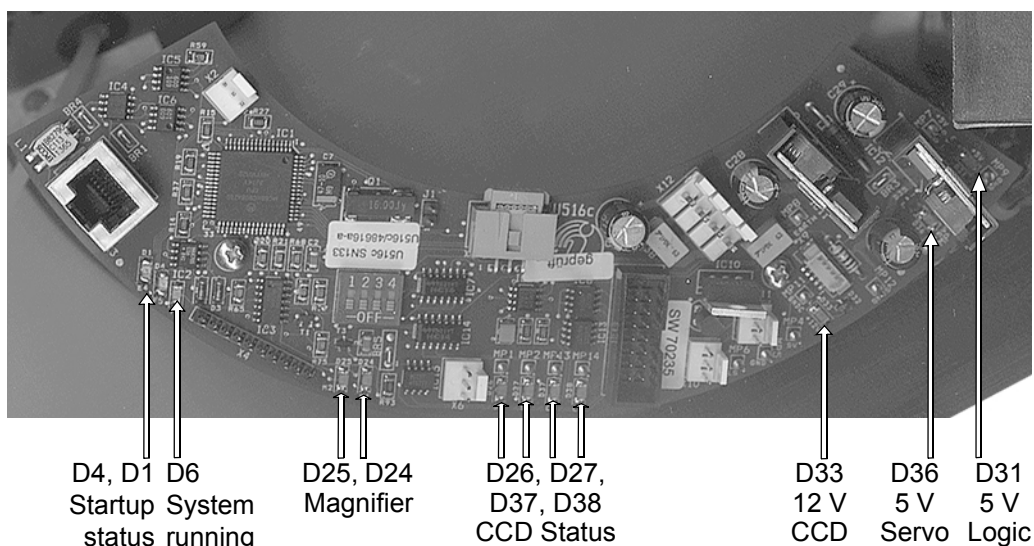


Fig. 6-3 U516 LEDs

6.2.3.5 U512: Connectors

X1: Power inverter connector Type: 6-pin ribbon cable connector	
Pin	Function
Pin 1	n. c.
Pin 2	Magnification 1
Pin 3	Magnification 2
Pin 4	Ground
Pin 5	+12 V
Pin 6	Ground

6.2.3.6 U513: Connectors

X1: Power inverter connector Type: 6-pin ribbon cable connector	
Pin	Function
Pin 1	n. c.
Pin 2	Magnification 1
Pin 3	Magnification 2
Pin 4	Ground
Pin 5	+12 V
Pin 6	Ground

X6: Magnetic choke connector Type: 3-pin Panduit connector	
Pin	Function
Pin 1	n. c.
Pin 2	+
Pin 3	Ground

6.2.3.7 U514: Connectors

X1: Power inverter connector Type: 6-pin ribbon cable connector	
Pin	Function
Pin 1	n. c.
Pin 2	Magnification 1
Pin 3	Magnification 2
Pin 4	Ground
Pin 5	+12 V
Pin 6	Ground

6.2.3.8 U516: Connectors

X1: Power inverter connector Type: 6-pin ribbon cable connector	
Pin	Function
Pin 1	n. c.
Pin 2	Magnification 1
Pin 3	Magnification 2
Pin 4	Ground
Pin 5	+12 V
Pin 6	Ground

X2: RS232 debug connector Type: 3-pin Panduit cable connector	
Pin	Function
Pin 1	Ground
Pin 2	TxD
Pin 3	RxD

X3: CAN bus connector J12 Type: RJ-45	
Pin	Function
Pin 1	CAN ground
Pin 2	CAN +5 V
Pin 3	CAN_L
Pin 4	CAN fault
Pin 5	CAN X-ray enable
Pin 6	CAN_H
Pin 7	ground (for Pin 8)
Pin 8	+5 V
Housing	earth

X4: Programming interface connector Type: 10-pin Panduit cable connector	
Pin	Function
Pin 1	PTC0
Pin 2	PTC1
Pin 3	PTC3
Pin 4	IRQ
Pin 5	RST
Pin 6	WDO
Pin 7	PTA0
Pin 8	OSC
Pin 9	+5 V output
Pin 10	Ground

X5: CCD Connector

Type: 14-pin ribbon cable connector

Pin	Function
Pin 1	V-sync +
Pin 2	V-sync -
Pin 3	Charge reset +
Pin 4	Charge reset +
Pin 5	Single capture +
Pin 6	Single capture -
Pin 7	+12 V CCD
Pin 8	Ground CCD
Pin 9	Gain
Pin 10	Ground in
Pin 11	Single frame enable
Pin 12	Blanking
Pin 13	+5 V out
Pin 14	H-sync

X6: Generator interface

Type: 3-pin Panduit cable connector

Pin	Function
Pin 1	Ground
Pin 2	V-sync -
Pin 3	V-sync +

X9: Servo motor interface

Type: 5-pin Molex cable connector

Pin	Function
Pin 1	+5 V
Pin 2	Ground
Pin 3	Servo control pulse
Pin 4	Feedback servo position
Pin 5	Servo return (there or not)

X10: Laser diode 1 connector

Type: 3-pin Panduit cable connector

Pin	Function
Pin 1	Laser -
Pin 2	Laser +
Pin 3	n. c.

X11: Laser diode 2 connector

Type: 3-pin Panduit cable connector

Pin	Function
Pin 1	Laser -
Pin 2	Laser +
Pin 3	n. c.

X12: I.I. power input connector

Type: 4-pin Panduit cable connector

Pin	Function
Pin 1	+12 V I.I. power supply
Pin 2	Ground I.I. power supply
Pin 3	Ground CCD
Pin 4	+12 V CCD

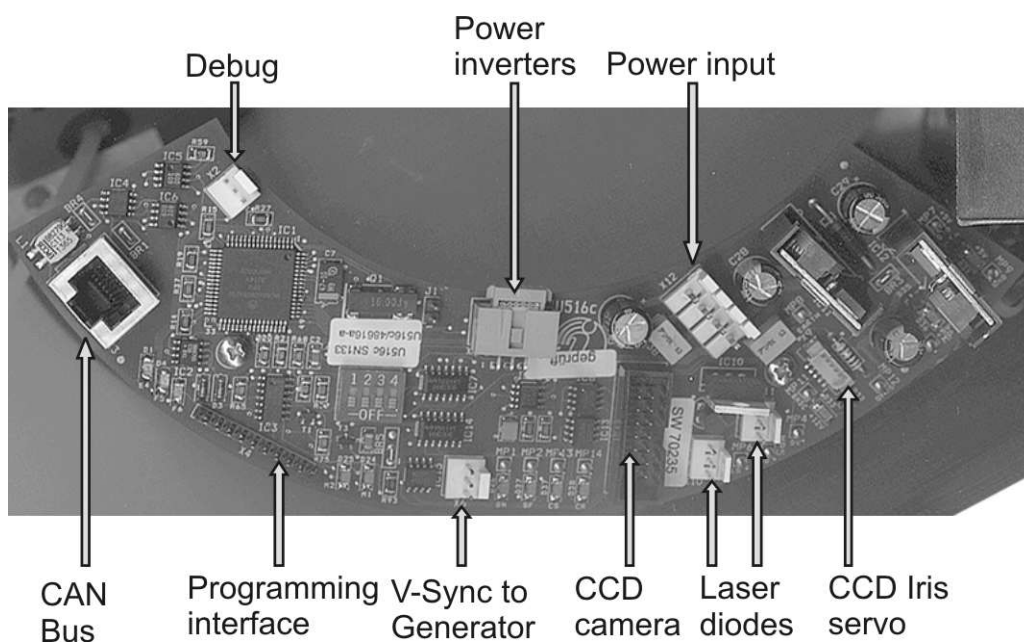


Fig. 6-4 U516 connectors

6.2.3.9 Connectors Cascade

Connectors	Range	Function
Anode	30 kV factory set	Anode Voltage
Grid 1	approx. 150 V 9" I.I. approx. 125 V 12" I.I.	Edge focus (depends on tube type)
Grid 2	approx. 0.5 kV – 2 kV	Focus adjustment
Grid 3	approx. 2 kV – 12 kV	Size adjustment
Grid 4	approx. 2.5 kV	Not adjustable
Ground		

6.2.3.9.1 Connectors Cascade Location



Fig. 6-1 Connectors cascade location

6.2.4 Adjustments

6.2.4.1 Potentiometer Location



Fig. 6-2 U512, U513, U514 potentiometer location

6.2.4.2 Adjusting the CCD Camera Iris

In order to get the camera working correctly, the CCD iris has to be adjusted. During this procedure the iris is moved stepwise to the end positions. The controller on the I.I. power supply records the corresponding servo position values and stores them in the I.I. power supply machine data.

This procedure has to be performed each time the camera or the i.i. power supply is changed.

To perform this setting, press the **Iris Adjust** button in the **Collimator** service settings section. **Wait until message box disappears and restart the Ziehm Solo.**

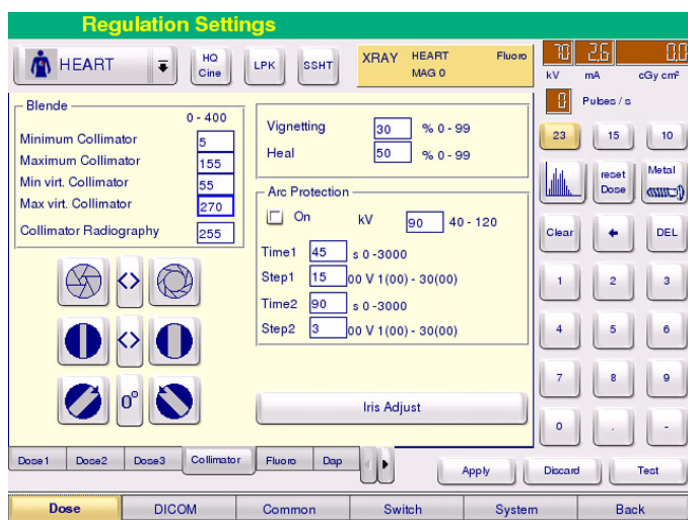


Fig. 6-3 Service menu "Collimator"

6.2.5 CCD Camera

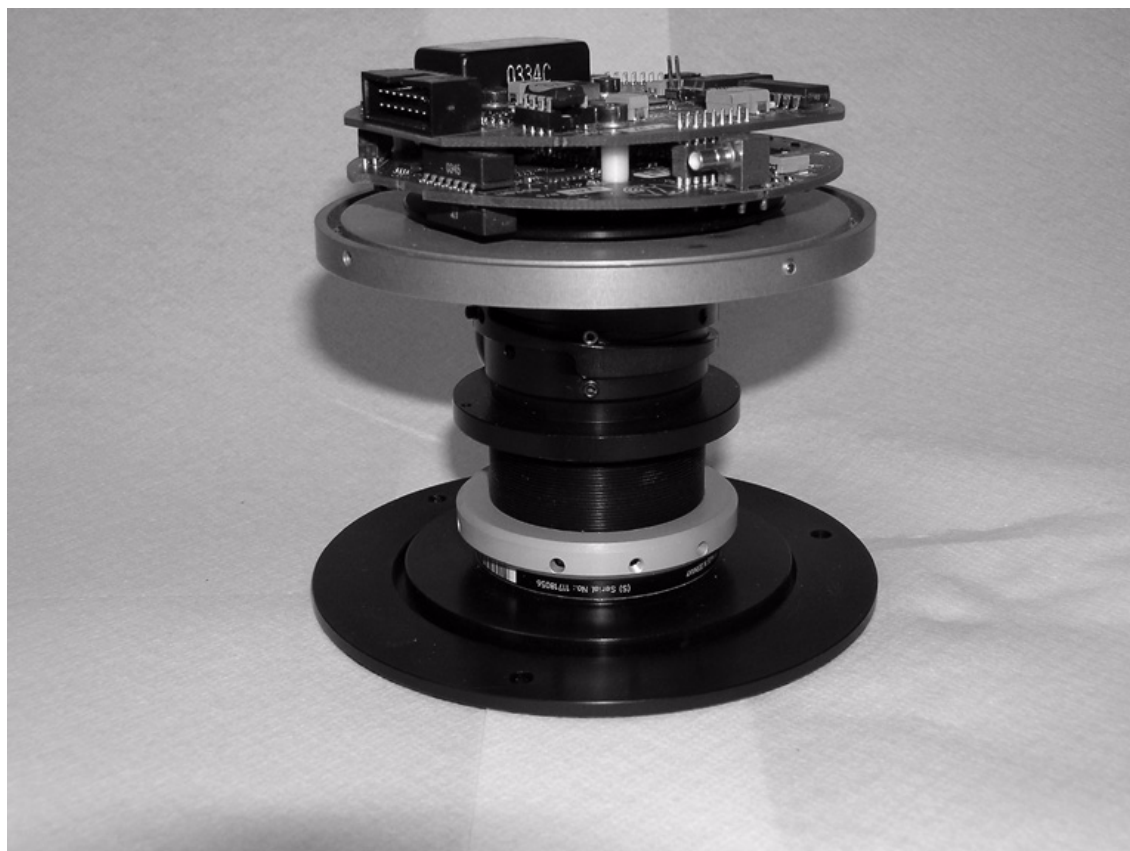


Fig. 6-4 CCD camera without cover

6.2.5.1 General Description

The CCD sensor is a solid-state imaging device that produces a 1024×1024 progressive scan, black and white image. Light entering wells in the sensor are converted to electrons, which are read out from the sensor, amplified and converted to a digital video signal. The video signal is transmitted via an analog video coaxial cable to the image processing system.

6.2.5.2 Functional Description

6.2.5.2.1 Block Diagram

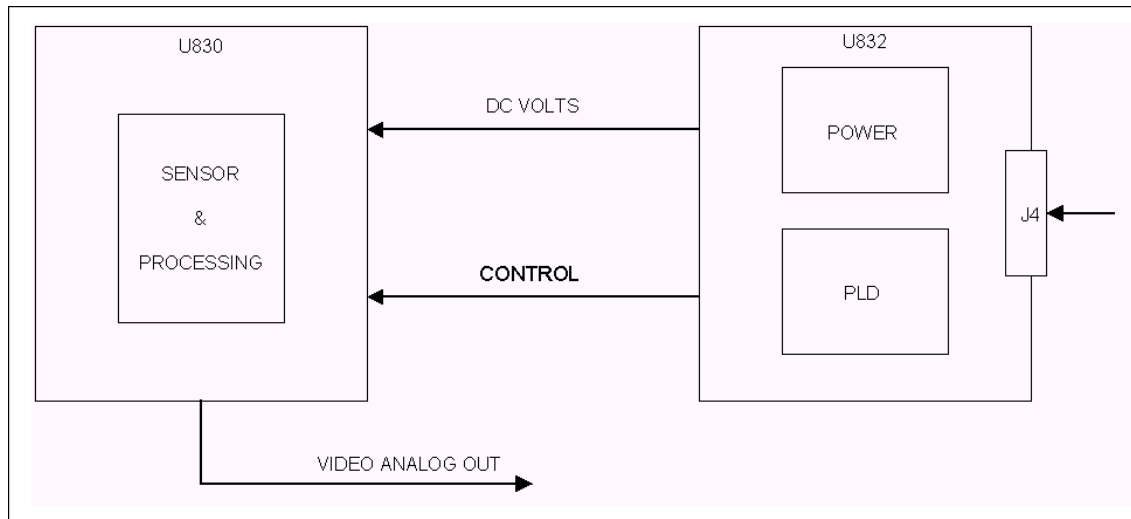


Fig. 6-5 CCD camera block diagram

6.2.5.2.2 Introduction to the Ziehm FT-18 Camera

The analog camera uses a charge-coupled device (CCD) sensor to capture images and convert them into an analog video signal. The CCD sensor converts light into electrons (charge). The electrons are amplified and formatted into a composite video signal. The brighter the light, the more electrons are generated in the CCD sensor, and hence the higher the resulting signal level.

6.2.5.2.3 CCD Sensor

The Philips FT18 CCD sensor has 1024 by 1024 active pixels in a 7.68 mm square area. Each light sensitive bin on the surface of the CCD sensor is called a "well". When light strikes the CCD material, the light is converted into electrons. The electrons accumulate in each of the 1024 by 1024 array of wells. The electron count in each well is read out from the sensor, amplified, and converted into a composite analog video signal.

The FT18 sensor has several advantages in this application. It uses frame transfer technology, and its peak sensitivity is around the 550 nm wavelength.

A frame transfer sensor has a 100% fill factor. Instead of transferring the image to temporary storage cells between the light sensitive wells (inter-line transfer), the image is transferred to another equally sized area that is not sensitive to light (frame transfer). This means that the entire surface of the CCD sensor is sensitive to light in a frame transfer sensor. In an inter-line transfer sensor, only 50% of the surface may be sensitive to light, since the temporary storage cells take up space between the light sensitive wells.

This application makes use of an image intensifier. The image intensifier output window has a green phosphor that is well matched to the spectrum of the FT18. Other CCD sensors have their peak sensitivity in the blue spectrum.

6.2.5.2.4 Modes of Operation

There are optically isolated input signals that select the camera modes.

**NOTE**

This mode is automatically set when power is turned on. No user intervention is required for the CCD to work properly.

6.2.5.2.5 Analog Video Output

The output from the camera is an analog composite video signal. It is called a composite signal because the sync signals are combined with the video. Instead of separate horizontal and vertical sync signals, the sync signals share the same cable with the video, but are at negative values with respect to the video black level.

The output video signal is typically 1 V_{pp} 300 mV sync and 700 mV video level. Adjustment of camera output amp can be made to increase to 900 mV for long cable runs. This would mean a total output signal of 1.2 V_{p-p}.

6.2.5.2.6 Frequency of Operation

The CCD camera operates at 36 MHz to support maximum CCD sensor data rates. The camera is a non interlaced output with Pixel Clock of 36 MHz.

**NOTE**

The frequency of the output together with the fact that the video rate is 25/30 Hz depending on operation of the image system at 50 or 60 Hz does not allow the use of a standard video monitor to view images directly from camera. The slower data rate will cause the monitor to flicker and be distorted. The recommended method of video test is to use an oscilloscope.

6.2.5.2.7 Power Consumption

- The CCD camera requires +12 V at pin 7 and 8 of connector J4 U832 board.
- Power consumption of CCD camera is less than 8 Watts with continuous operation.
- 500 mA at +12 V input continuous = 6 Watts
- 1.2 A momentary for less than 200 ms at power-up = 14.4 Watts less than 200 ms.

6.2.5.3 Setting the CCD Camera Distance

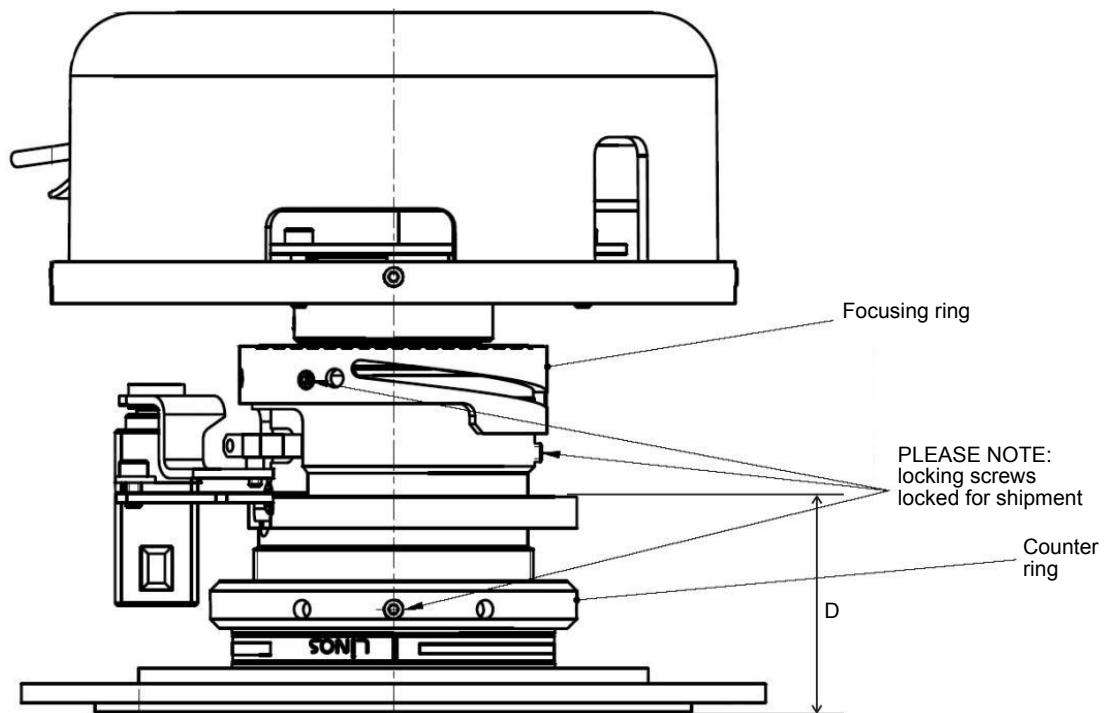


Fig. 6-6 Measuring the CCD camera distance

Refer to the table in order to set the CCD camera distance D. This distance has to be set correctly before electrical adjustment of the image intensifier is performed. The optical focus is adjusted for maximum resolution by using a line pair phantom.

I.I. Tube	Setting D [mm]	Scattered light lens assembled
9" HP	33.4	Yes

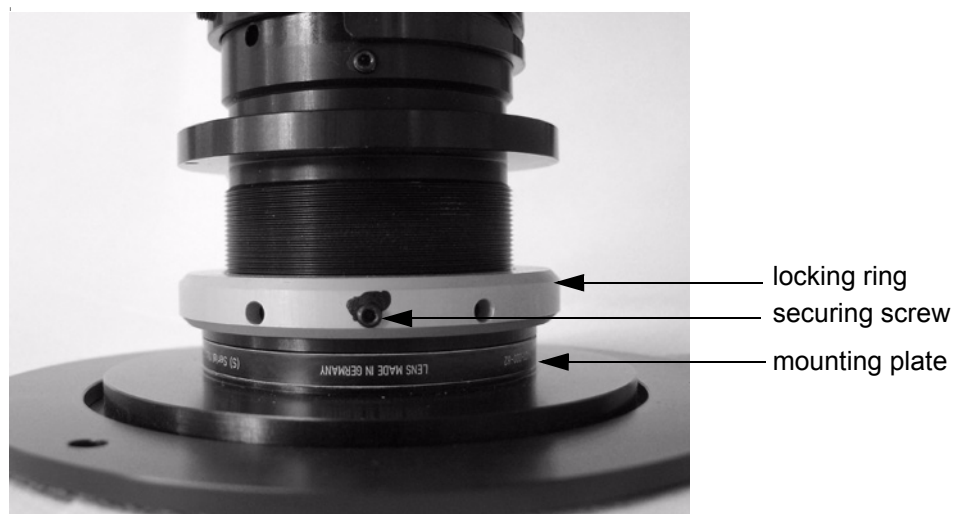


Fig. 6-7 Distance adjustment

To set the correct distance, do the following:

- Loosen the securing screw.
Now you can untighten the locking ring.
- Set the distance by turning the mounting plate.
- When the correct distance is set, fix this position by using the locking ring.
- Finally tighten the securing screw.
- Before the camera is mounted onto the image intensifier, check whether the scattered light lens will or will not be needed.

6.2.5.4 Scattered Light Lens



Fig. 6-8 Scattered light lens location

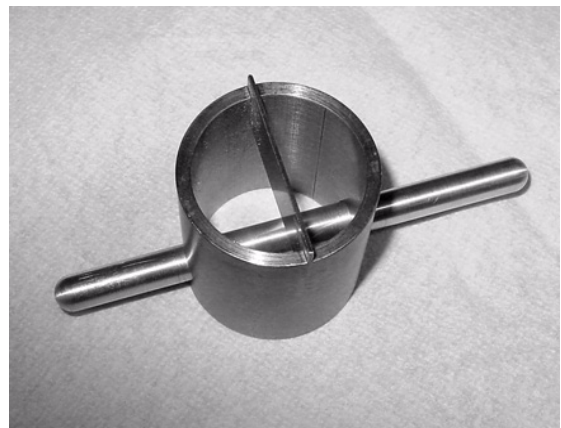


Fig. 6-9 Scattered light lens removed, lens removal tool

Check the tube type:

For a HX tube type, the lens has to be removed.

Use the lens removal tool to remove the lens. Art No 91126.

For a HP tube type the lens has to be installed.

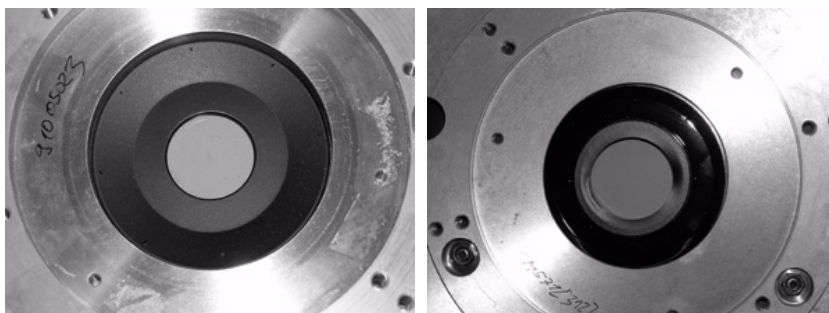


Fig. 6-10 I.I. tube types: HP type (left), HX type (right)

6.2.5.5 Mounting of the CCD Camera

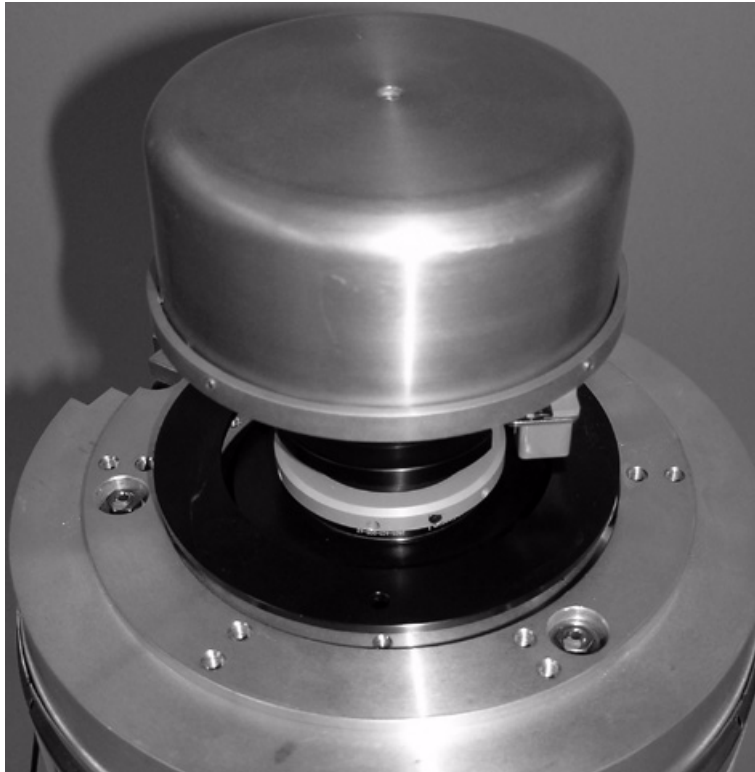


Fig. 6-11 Mounting of the CCD camera

The camera is put onto the output window and is fixed by the mounting ring using 3 Allen screws.

6.2.5.6 Focus Adjustment

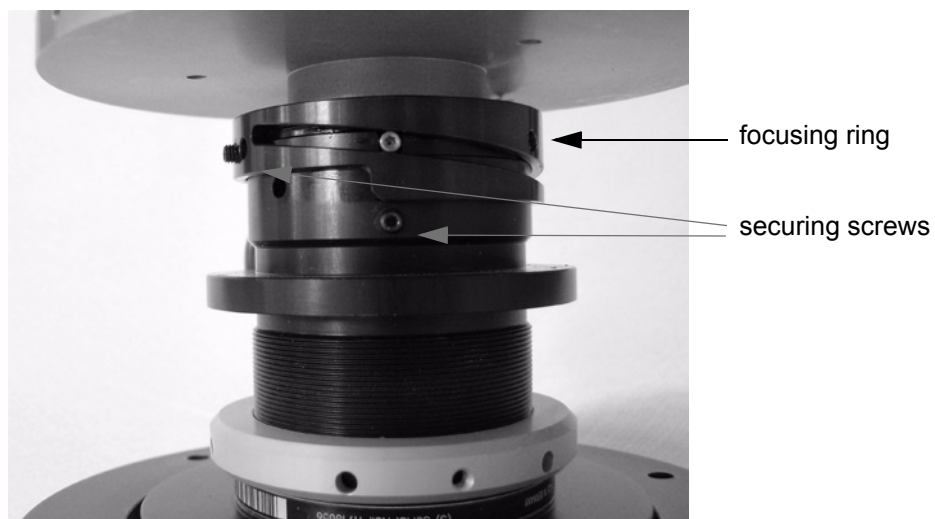


Fig. 6-12 Focus adjustment

To adjust the focus, do the following:

- Loosen the 2 locking screws.
- Adjust the focus by turning the focusing ring.
- Retighten the 2 securing screws.

6.2.5.7 Setting the CCD Camera Timing



Fig. 6-13 Location of Jumper 1 on the CCD camera

Jumper 1	
Not set	50 Hz
Set	60 Hz

Depending on the operation frequency of the unit, the camera timing has to be set to either 50 Hz or 60 Hz.

6.2.5.8 Adjustment Instruction for 9" Tube

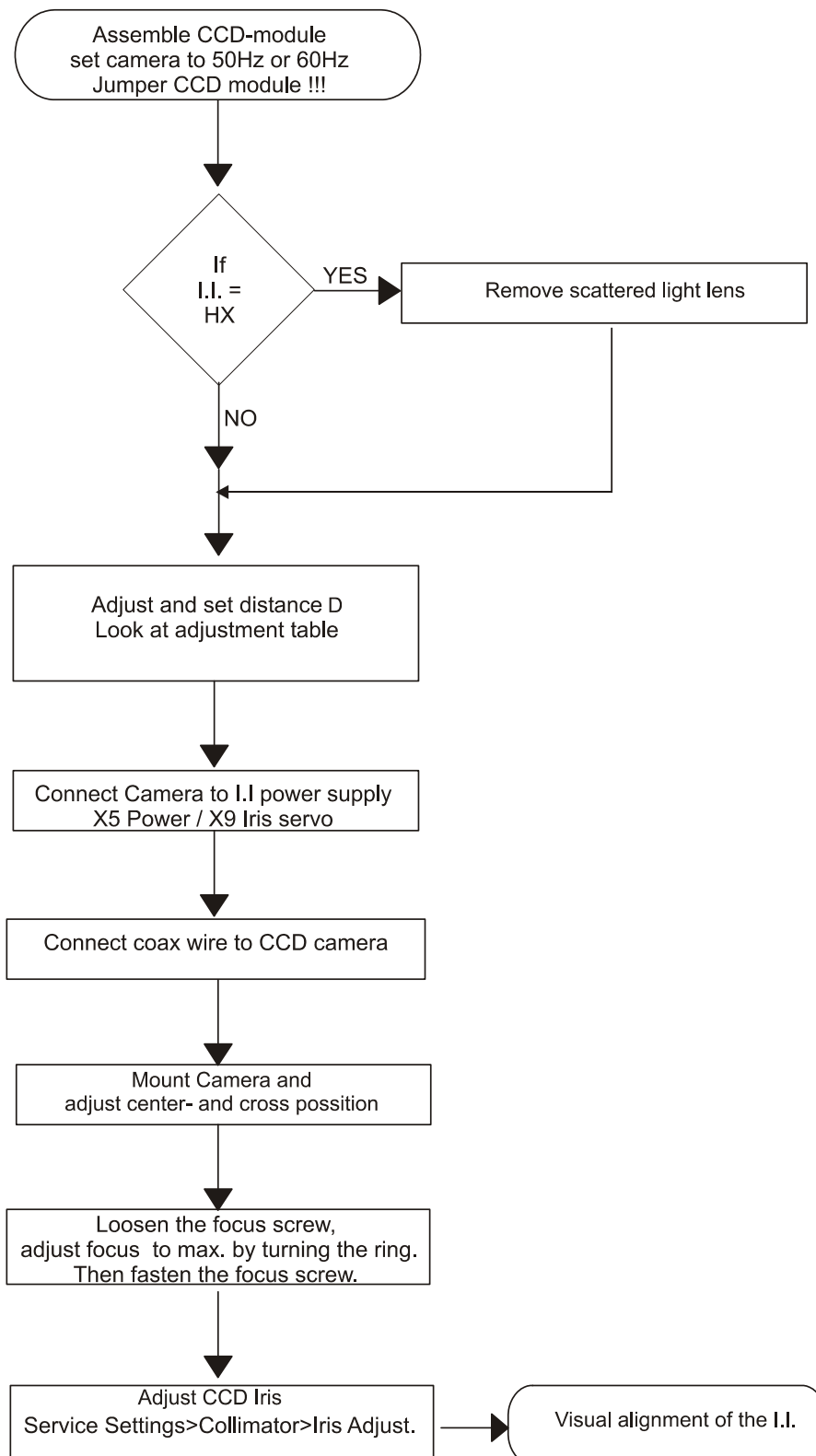


Fig. 6-14 Camera installation and adjustment

6 Image Intensifier

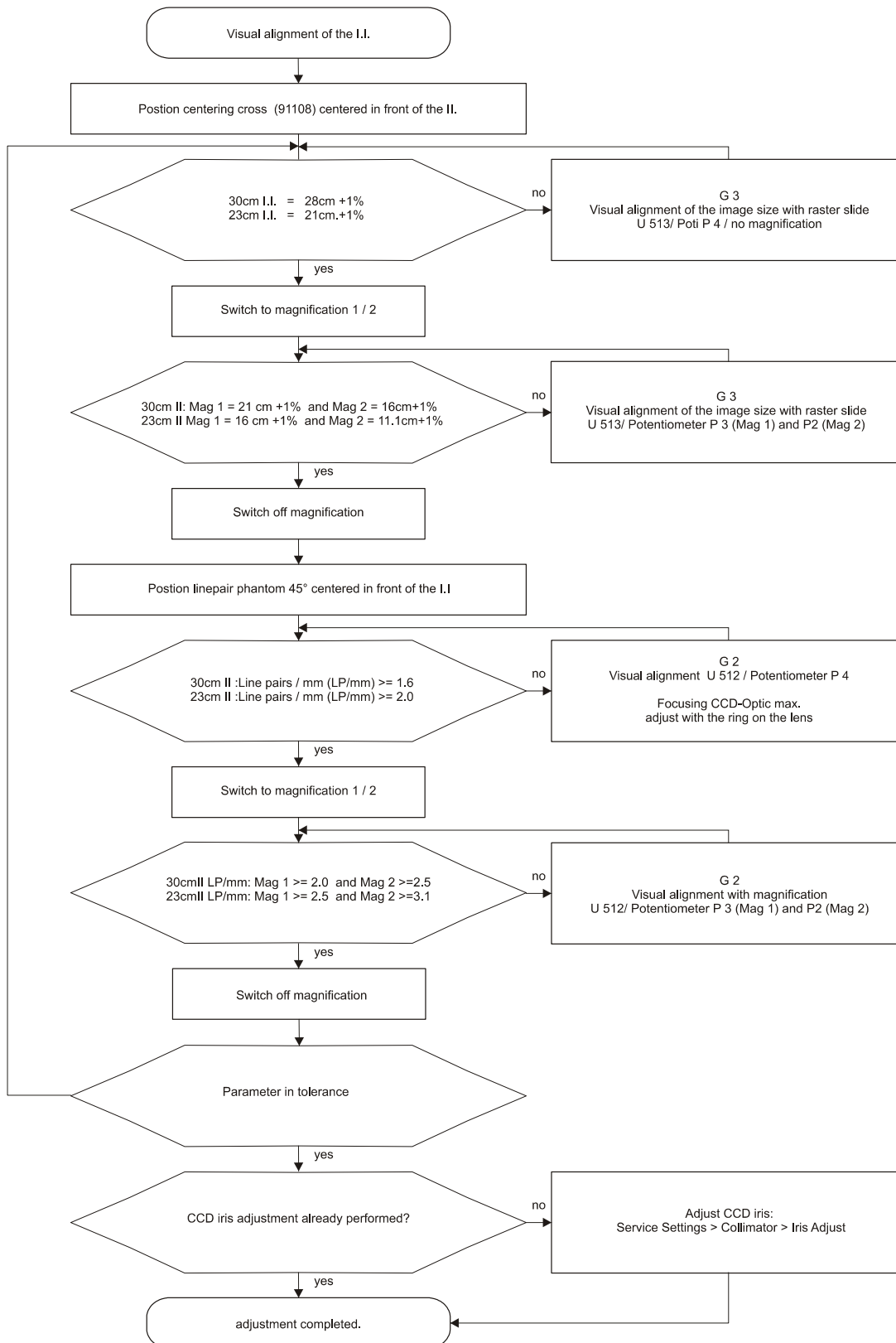


Fig. 6-15 I.I. power supply adjustment

6.2.5.9 Size and Resolution Requirements

6.2.5.9.1 Extremities Mode, without Patient Equivalent Filter, Automatic Dose

I.I. Type	23 cm			30 cm		
	N	M1	M2	N	M1	M2
Size [cm]	21	16	11.1	28	21	16
Resolution [lp/mm]	2.0	2.5	3.1	1.6	2.0	2.5

6.2.5.9.2 Extremities Mode, with 25 mm Al Patient Equivalent Filter, Automatic Dose

I.I. Type	23 cm			30 cm		
	N	M1	M2	N	M1	M2
Size [cm]	21	16	11.1	28	21	16
Resolution [lp/mm]	1.8	2.2	2.8	1.4	1.8	2.2

6.2.5.10 Adjusting the CCD Camera Iris

In order to get the camera working correctly, the CCD iris has to be adjusted. During this procedure the iris is moved to the end positions stepwise. The controller on the I.I. power supply records the corresponding servo position values and stores them in the I.I. power supply machine data.

This procedure has to be performed each time the camera or the I.I. power supply is changed.

To perform this setting, press the **Iris Adjust** button in the **Collimator** service settings section. **Wait until message box disappears and restart the Ziehm Solo.**

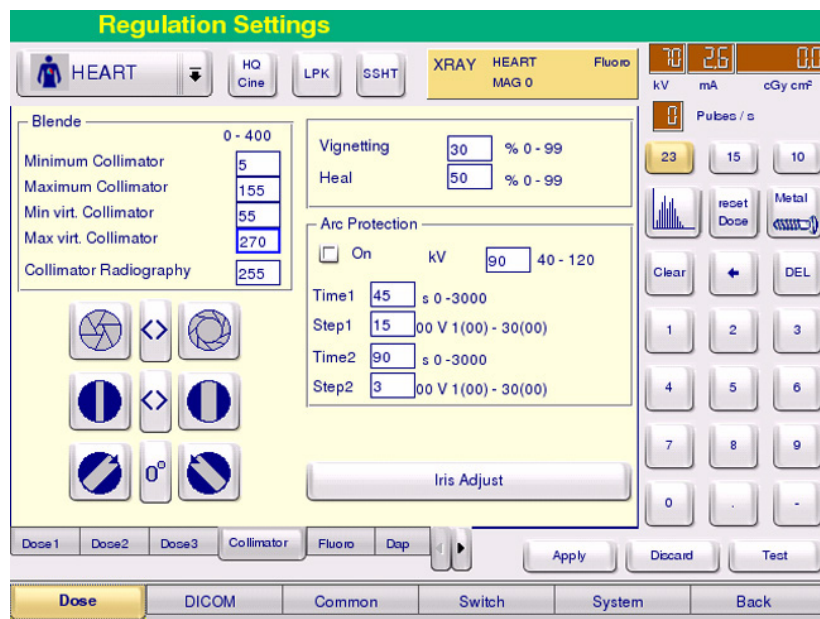


Fig. 6-16 Service menu "Collimator"

6.3 Image Intensifier with FT 50 Camera

6.3.1 Block Diagram

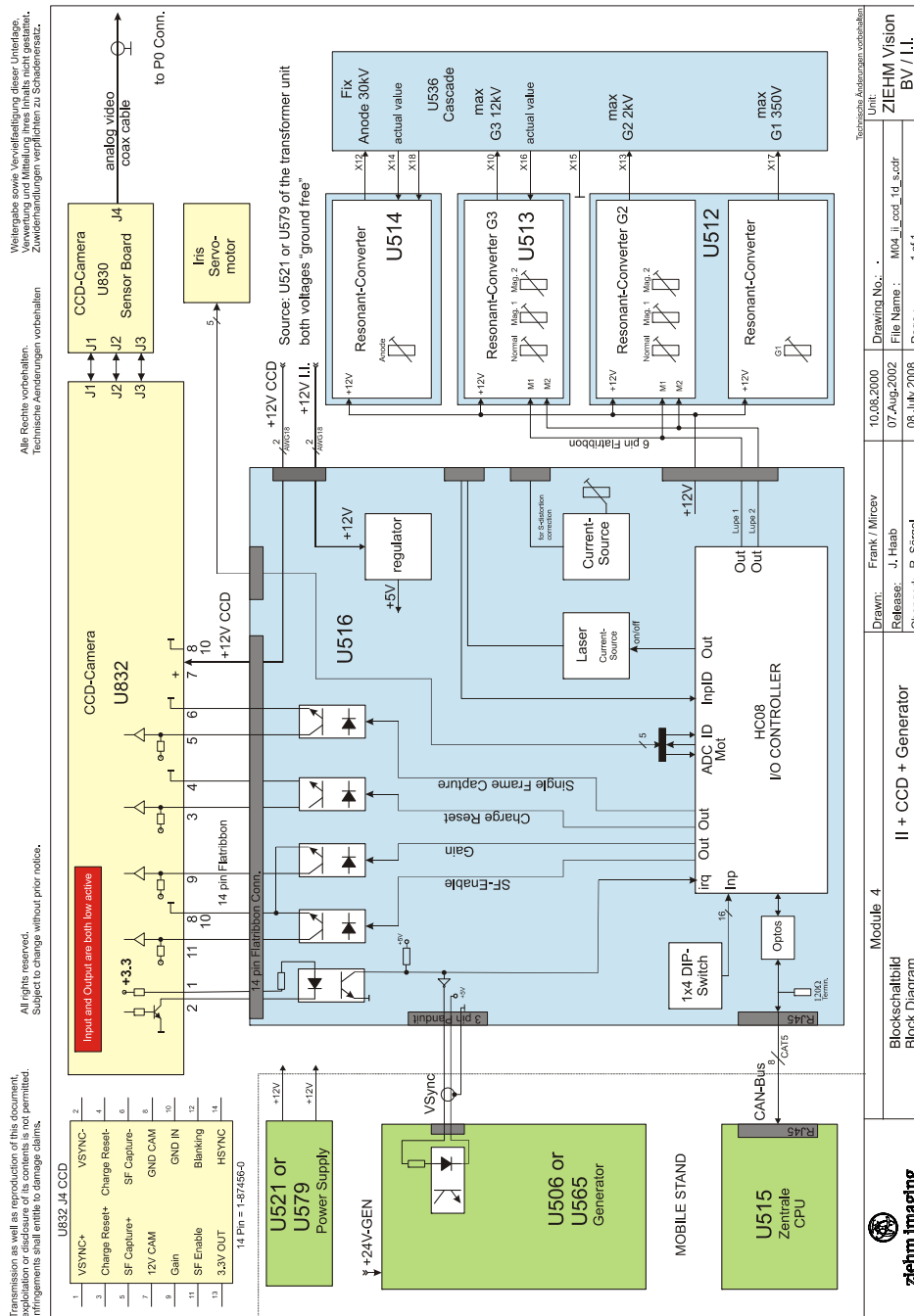


Fig. 6-1 Image intensifier block diagram

The image intensifier (I.I.) consists of the components: CCD camera, I.I. power supply and I.I. tube. The I.I. power supply consists of the boards U632, U512, U513 and U514.

The camera consists of the boards U830 and U832.

6.3.2 Overview of I.I. Power Supply



Fig. 6-2 Image intensifier power supply

6.3.2.1 General

The I.I. power supply provides the necessary voltages for the different image intensifiers. It also supplies the power for the CCD camera.

The CAN controller of the I.I. Power Supply runs software to control the iris, the laser switching, and the magnifier selection.

6.3.2.2 Main Parts and their Functions

Main Part	Function	Remarks
Controller	Controls the magnification modes of the I.I. Controls the CCD iris. Controls laser switching. Provides CCD camera supply voltage.	
Power inverters	High voltages	
Cascade	Multiplies the voltages	

6.3.3 HW Description

6.3.3.1 PCBs

PCBs	
U512:	Grid 1 and Grid 2 inverter
U513:	Grid 3 inverter and magnetic choke (for static S-distortion correction)
U514:	Grid 4 and anode inverter
U632:	controller board

6.3.3.2 Cascade

PCB	
U536	30 kV cascade supports also Grid 4
	Grid 3 cascade
Rationale:	Cascade sealed in insulation material

6.3.3.3 Jumpers

For debugging purposes	
J 16	Erase Flash Memory
J 7	RS232 debug interface ON/OFF
J 1	Laser installed

6.3.3.4 LEDs

Status LEDs for service requirements		
LED(s)	Status	Meaning
LED 1 (red)	ON	Error, ATMEGA
LED 2 (green)	ON	Servo OK, ATMEGA
LED 5 (red)	flashing	startup phase 1
LED 4 (red)	flashing	startup phase 2
LED5 + LED4	flashing synchronously OFF	waiting for system ready system is running
LED 6 (green)	flashing	system is running
LED 9 (red)	ON	Reset MC9S08
LED 24 (green)	ON	magnification 1 active
LED 25 (green)	ON	magnification 2 active
LED 26 (green)	ON	CCD gain on
LED 27 (green)	ON	CCD single frame enable
LED 31 (green)	ON	+5 V logic OK
LED 33 (green)	ON	CCD +12 V OK
LED 36 (green)	ON	+5 V servo motor OK
LED 37 (green)	ON	CCD single frame capture
LED 38 (green)	ON	CCD charge reset pulse
LED 40 (green)	ON	+12V I.I. OK

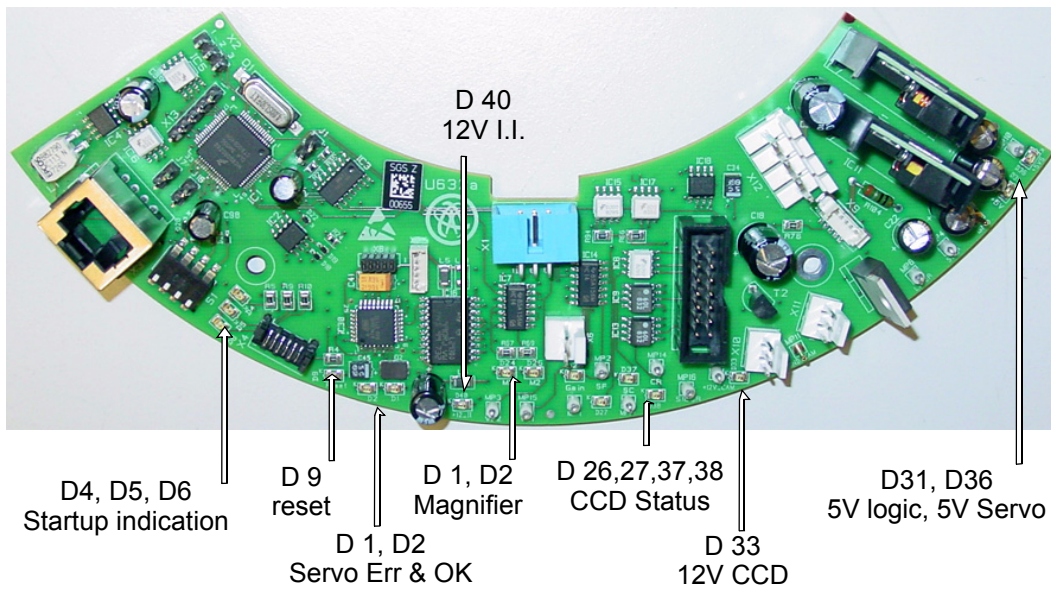


Fig. 6-3 U632 LEDs

6.3.3.5 U512: Connectors

X1: Power inverter connector Type: 6-pin ribbon cable connector	
Pin	Function
Pin 1	n. c.
Pin 2	Magnification 1
Pin 3	Magnification 2
Pin 4	Ground
Pin 5	+12 V
Pin 6	Ground

6.3.3.6 U513: Connectors

X1: Power inverter connector Type: 6-pin ribbon cable connector	
Pin	Function
Pin 1	n. c.
Pin 2	Magnification 1
Pin 3	Magnification 2
Pin 4	Ground
Pin 5	+12 V
Pin 6	Ground

X6: Magnetic choke connector Type: 3-pin Panduit connector	
Pin	Function
Pin 1	n. c.
Pin 2	+
Pin 3	Ground

6.3.3.7 U514: Connectors

X1: Power inverter connector Type: 6-pin ribbon cable connector	
Pin	Function
Pin 1	n. c.
Pin 2	Magnification 1
Pin 3	Magnification 2
Pin 4	Ground
Pin 5	+12 V
Pin 6	Ground

6.3.3.8 U632: Connectors

X1: Power inverter connector Type: 6-pin ribbon cable connector	
Pin	Function
Pin 1	n. c.
Pin 2	Magnification 1
Pin 3	Magnification 2
Pin 4	Ground
Pin 5	+12 V
Pin 6	Ground

X2: RS232 debug connector Type: 3-pin Panduit cable connector	
Pin	Function
Pin 1	Ground
Pin 2	TxD
Pin 3	RxD

X3: CAN bus connector J12

Type: RJ-45

Pin	Function
Pin 1	CAN ground
Pin 2	CAN +5 V
Pin 3	CAN_L
Pin 4	CAN fault
Pin 5	CAN X-ray enable
Pin 6	CAN_H
Pin 7	ground (for Pin 8)
Pin 8	+5 V
Housing	earth

X4: Programming interface connector

Type: 6-pin Picoflex connector

Pin	Function
Pin 1	serial data
Pin 2	GND
Pin 3	disable reset
Pin 4	Reset output
Pin 5	disable reset
Pin 6	+5V

X5: CCD Connector

Type: 14-pin ribbon cable connector

Pin	Function
Pin 1	+3.3 V_OUT (VSYNC +)
Pin 2	VSYNC- output
Pin 3	SPI "Clock" input
Pin 4	GND
Pin 5	SPI "MOSI" input
Pin 6	GND
Pin 7	+12 V CCD
Pin 8	GND
Pin 9	SPI "Chip-Select" input
Pin 10	GND
Pin 11	VSYNC Trigger input
Pin 12	SPI "MISO" output
Pin 13	+3.3 V_OUT
Pin 14	HSYNC output

X6: Generator interface

Type: 3-pin Panduit cable connector

Pin	Function
Pin 1	Ground
Pin 2	V-sync -
Pin 3	V-sync +

X7: Interface iris control of FT50 Optics

Type: 5-pin connector

Pin	Function
Pin 1	Motor +
Pin 2	Motor -
Pin 3	Potentiometer +5V
Pin 4	Potentiometer wiper
Pin 5	GND

X8: Programming Interface ATMEGA

Type: 5-pin connector

Pin	Function
Pin 1	Reset
Pin 2	MISO
Pin 3	SCK
Pin 4	MOSI
Pin 5	GND

X9: Servo motor interface

Type: 5-pin Molex cable connector

Pin	Function
Pin 1	+5 V
Pin 2	Ground
Pin 3	Servo control pulse
Pin 4	Feedback servo position
Pin 5	Servo return (there or not)

X10: Laser diode 1 connector

Type: 3-pin Panduit cable connector

Pin	Function
Pin 1	Laser -
Pin 2	Laser +
Pin 3	n. c.

X11: Laser diode 2 connector

Type: 3-pin Panduit cable connector

Pin	Function
Pin 1	Laser -
Pin 2	Laser +
Pin 3	n. c.

X12: I.I. power input connector
 Type: 4-pin Panduit cable connector

Pin	Function	
Pin 1	+12 V	I.I. power supply
Pin 2	Ground	I.I. power supply
Pin 3	Ground	CCD
Pin 4	+12 V	CCD

X13: SPI Interface MC9S08
 Type: 5-pin connector

Pin	Function	
Pin 1	/SS	
Pin 2	SCK	
Pin 3	MOSI	
Pin 4	MISO	
Pin 5	GND	

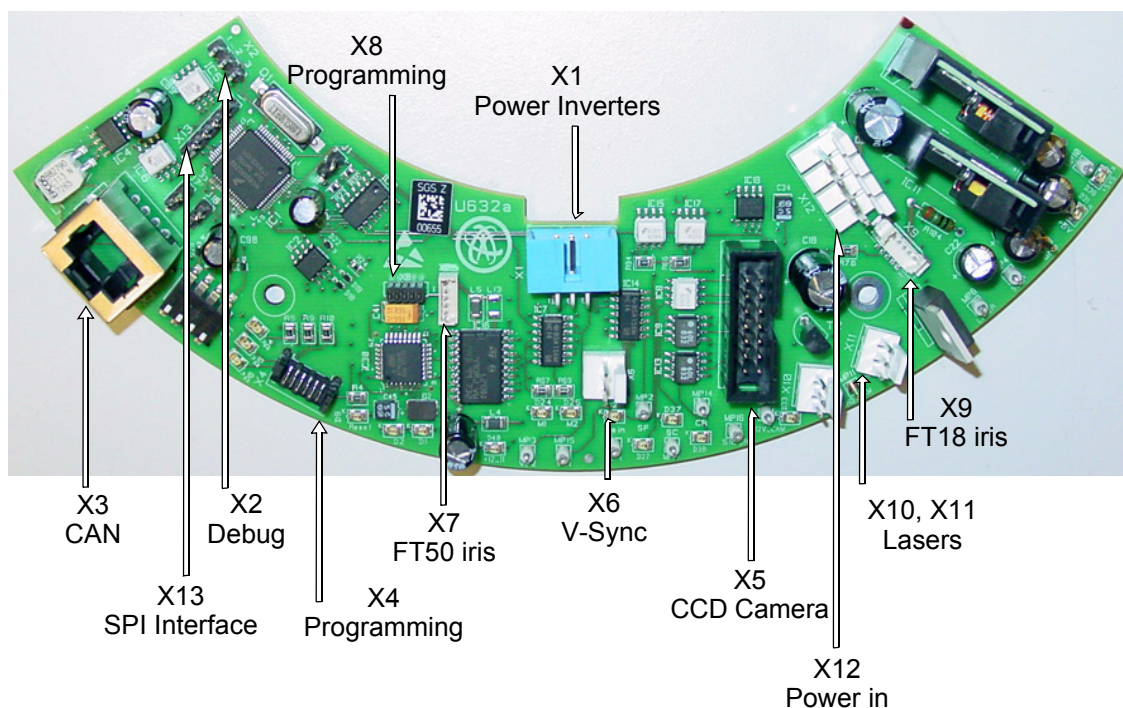


Fig. 6-4 U632 Connectors

6.3.3.9 Connectors Cascade

Connectors	Range	Function
Anode	30 kV factory set	Anode Voltage
Grid 1	approx. 150 V 9" I.I. approx. 125 V 12" I.I.	Edge focus (depends on tube type)
Grid 2	approx. 0.5 kV – 2 kV	Focus adjustment
Grid 3	approx. 2 kV – 12 kV	Size adjustment
Grid 4	approx. 2.5 kV	Not adjustable
Ground		

6.3.3.9.1 Connectors Cascade Location



Fig. 6-1 Connectors cascade location

6.3.4 Adjustments

6.3.4.1 Potentiometer Location



Fig. 6-2 U512, U513, U514 potentiometer location

6.3.4.2 Adjusting the CCD Camera Iris

In order to get the camera working correctly, the CCD iris has to be adjusted. During this procedure the iris is moved stepwise to the end positions. The controller on the I.I. power supply records the corresponding servo position values and stores them in the I.I. power supply machine data.

This procedure has to be performed each time the camera or the i.i. power supply is changed.

To perform this setting, press the **Iris Adjust** button in the **Collimator** service settings section. **Wait until message box disappears and restart the Ziehm Solo.**

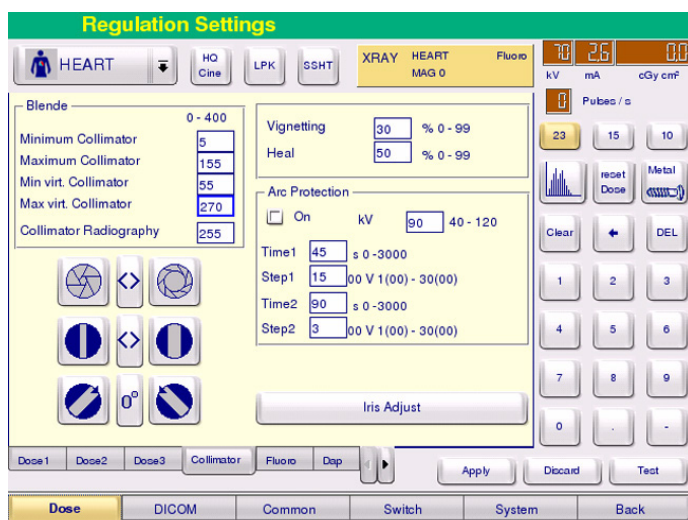


Fig. 6-3 Service menu "Collimator"

6.3.5 CCD Camera FT 50

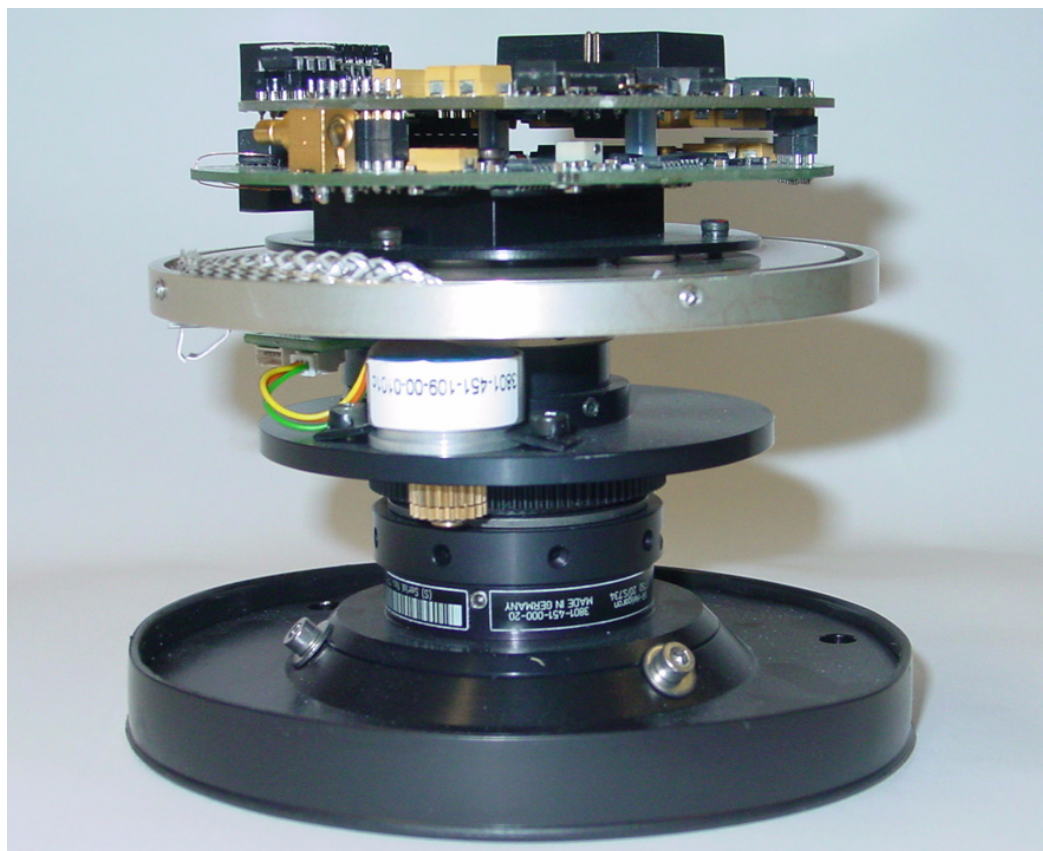


Fig. 6-4 CCD camera without cover

6.3.5.1 General Description

The CCD sensor is a solid-state imaging device that produces a 1024×1024 progressive scan, black and white image. Light entering wells in the sensor are converted to electrons, which are read out from the sensor, amplified and converted to a digital video signal. The video signal is transmitted via an analog video coaxial cable to the image processing system.

6.3.5.2 Block diagram

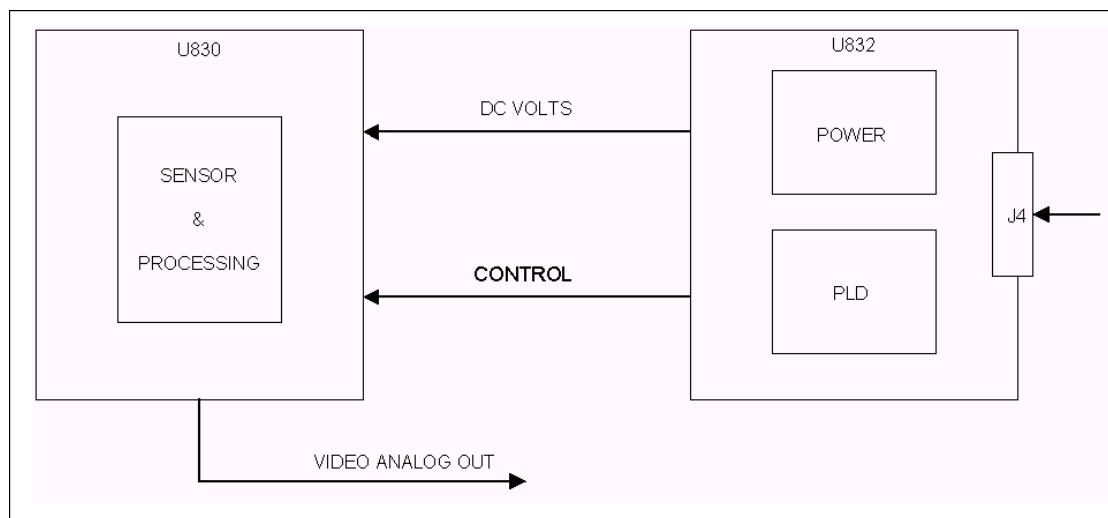


Fig. 6-5 CCD camera block diagram

6.3.5.3 Setting the CCD Camera Distance

The distance is determined by the mounting plate.

No further adjustment is necessary.

6.3.5.4 Mounting of the CCD Camera

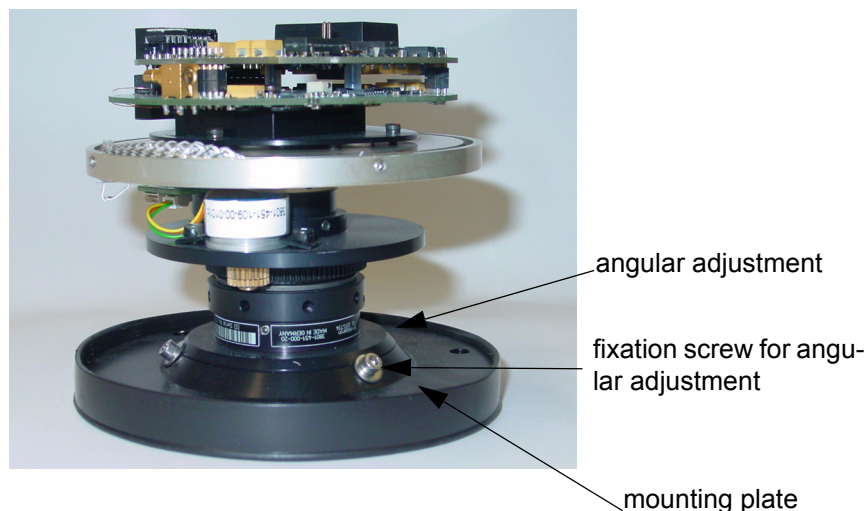


Fig. 6-6 Mounting of the CCD Camera

The camera is put onto the output window and is fixed by the mounting plate using 3 Allen screws.

Center adjustment is made by moving the mounting plate on the mounting base of the I.I.

Angular adjustment is made by turning the camera within the mounting ring. To do this, loosen the hexagonal fixation screws.

6.3.5.5 Focus Adjustment

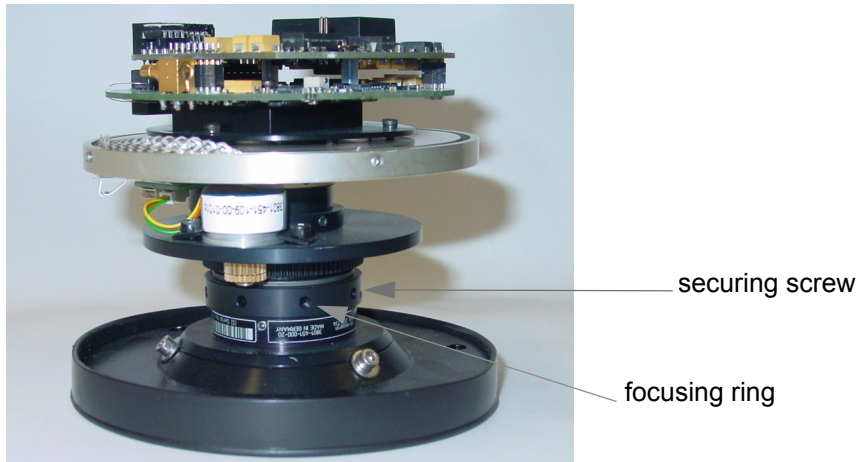


Fig. 6-7 Focus adjustment

To adjust the focus, do the following:

- Loosen the securing screw.
- Adjust the focus by turning the focusing ring.
- Retighten the securing screw.

6.3.5.6 Setting the CCD Camera Timing



Fig. 6-8 Location of Jumper 1 on the CCD camera

Jumper 1	
Not set	50 Hz
Set	60 Hz

Depending on the operation frequency of the unit, the camera timing has to be set to either 50 Hz or 60 Hz.

6.3.5.7 Adjustment Instruction for 9" Tube

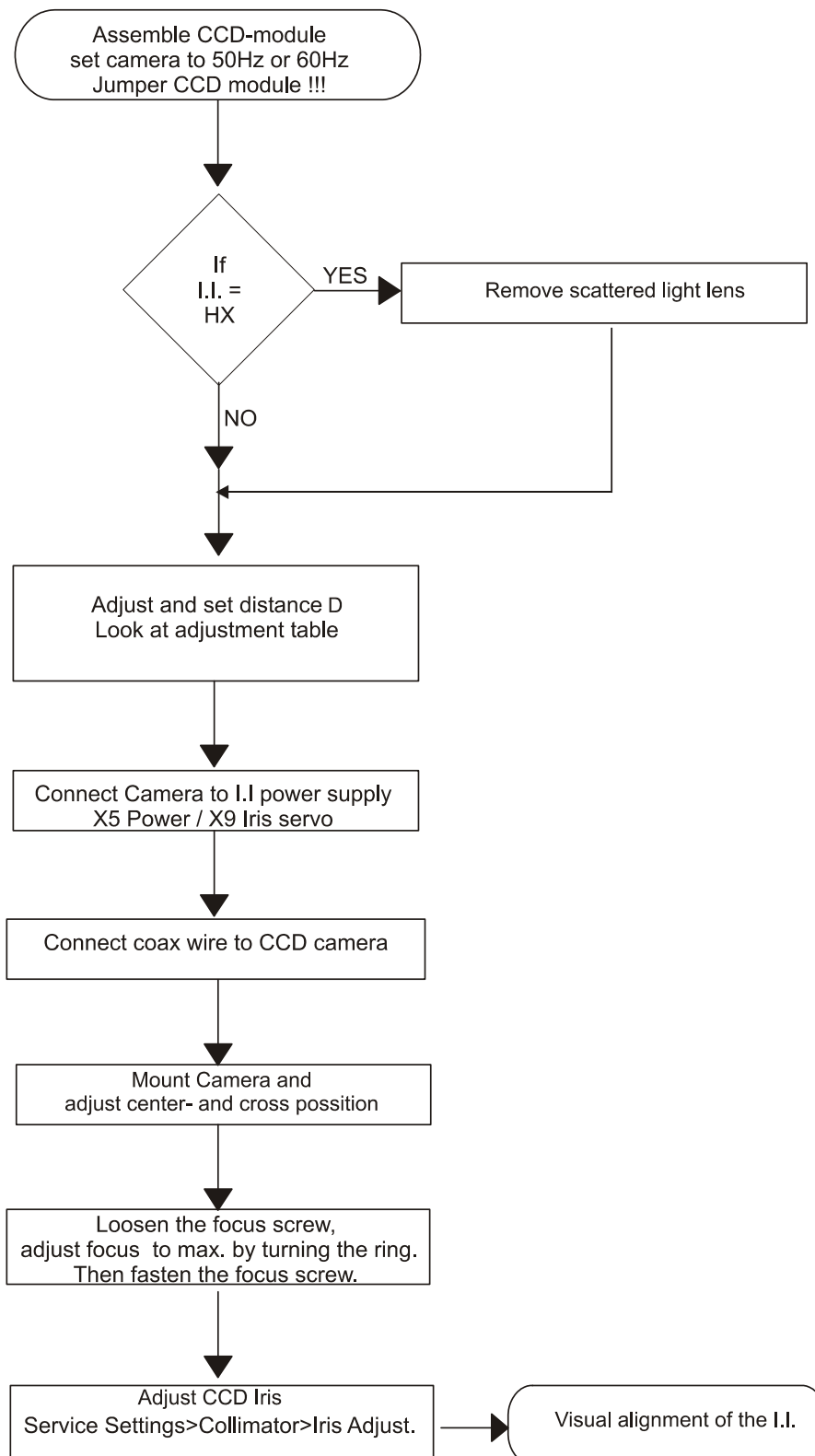


Fig. 6-9 Camera installation and adjustment

6 Image Intensifier

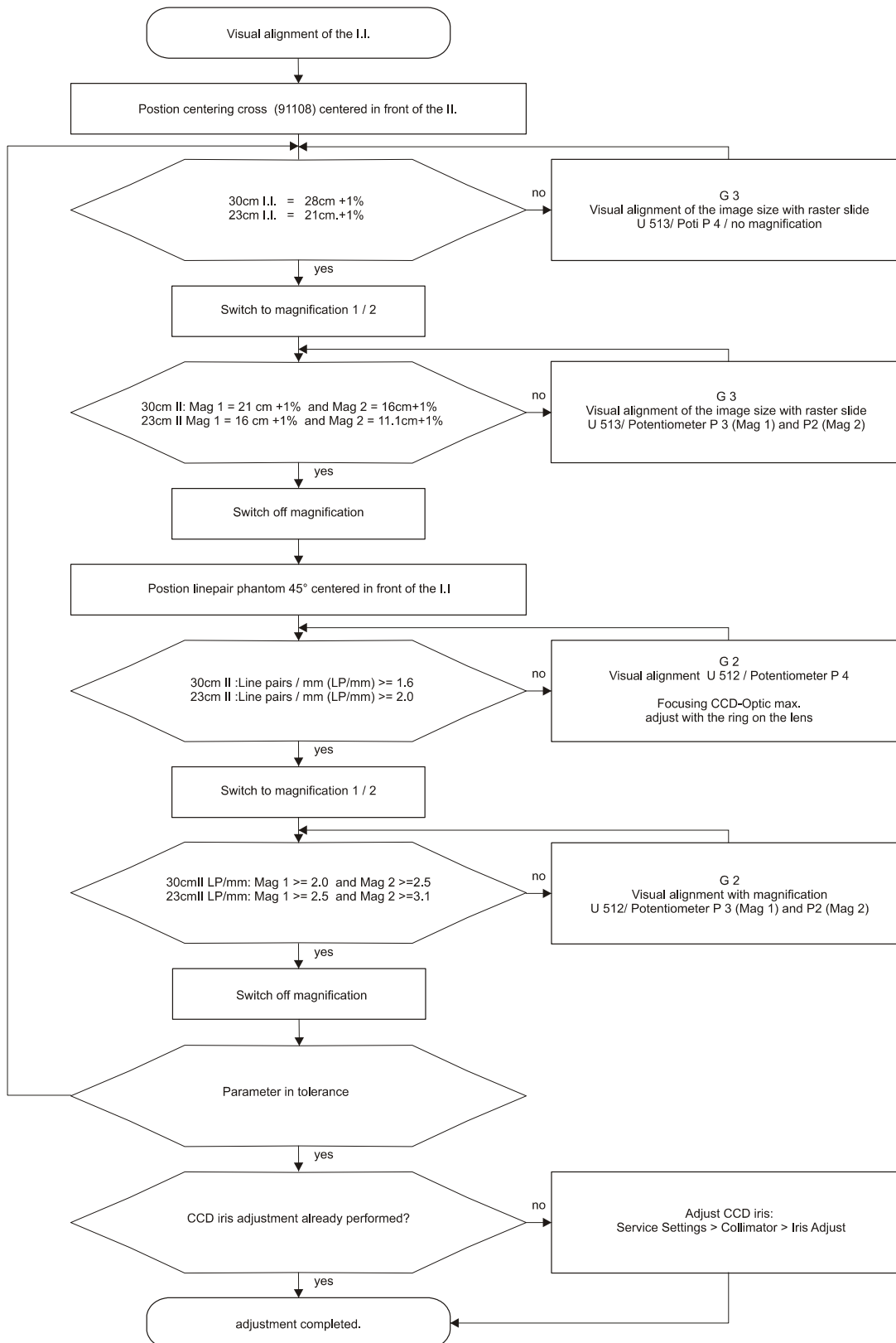


Fig. 6-10 I.I. power supply adjustment

6.3.5.8 Size and Resolution Requirements

6.3.5.8.1 Extremities Mode, without Patient Equivalent Filter, Automatic Dose

I.I. Type	23 cm			30 cm		
	N	M1	M2	N	M1	M2
Size [cm]	21	16	11.1	28	21	16
Resolution [lp/mm]	2.0	2.5	3.1	1.6	2.0	2.5

6.3.5.8.2 Extremities Mode, with 25 mm Al Patient Equivalent Filter, Automatic Dose

I.I. Type	23 cm			30 cm		
	N	M1	M2	N	M1	M2
Size [cm]	21	16	11.1	28	21	16
Resolution [lp/mm]	1.8	2.2	2.8	1.4	1.8	2.2

6.3.5.9 Adjusting the CCD Camera Iris

In order to get the camera working correctly, the CCD iris has to be adjusted. During this procedure the iris is moved to the end positions stepwise. The controller on the I.I. power supply records the corresponding servo position values and stores them in the I.I. power supply machine data.

This procedure has to be performed each time the camera or the I.I. power supply is changed.

To perform this setting, press the **Iris Adjust** button in the **Collimator** service settings section. **Wait until message box disappears and restart the Ziehm Solo.**

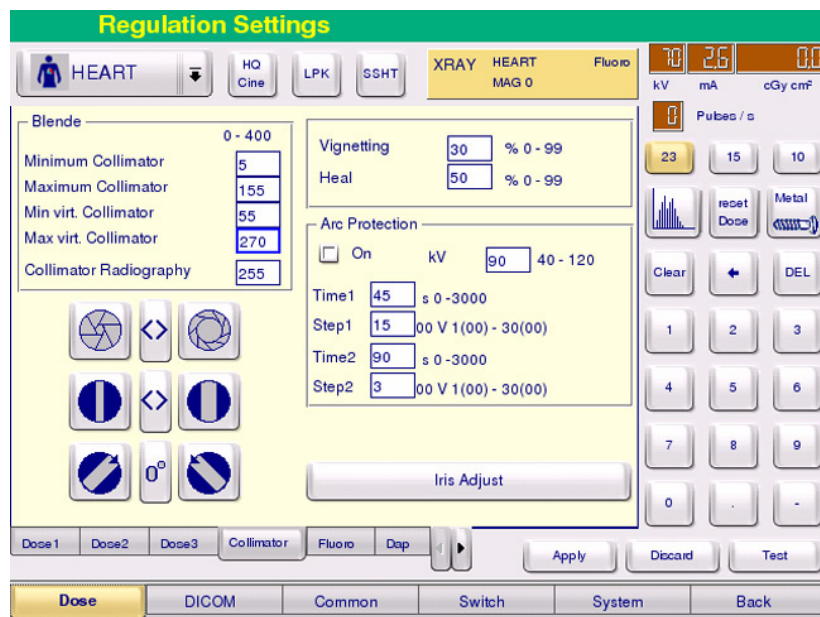


Fig. 6-11 Service menu "Collimator"

7

X-ray Generator

Module 5

7 X-ray Generator

7.1 Overview

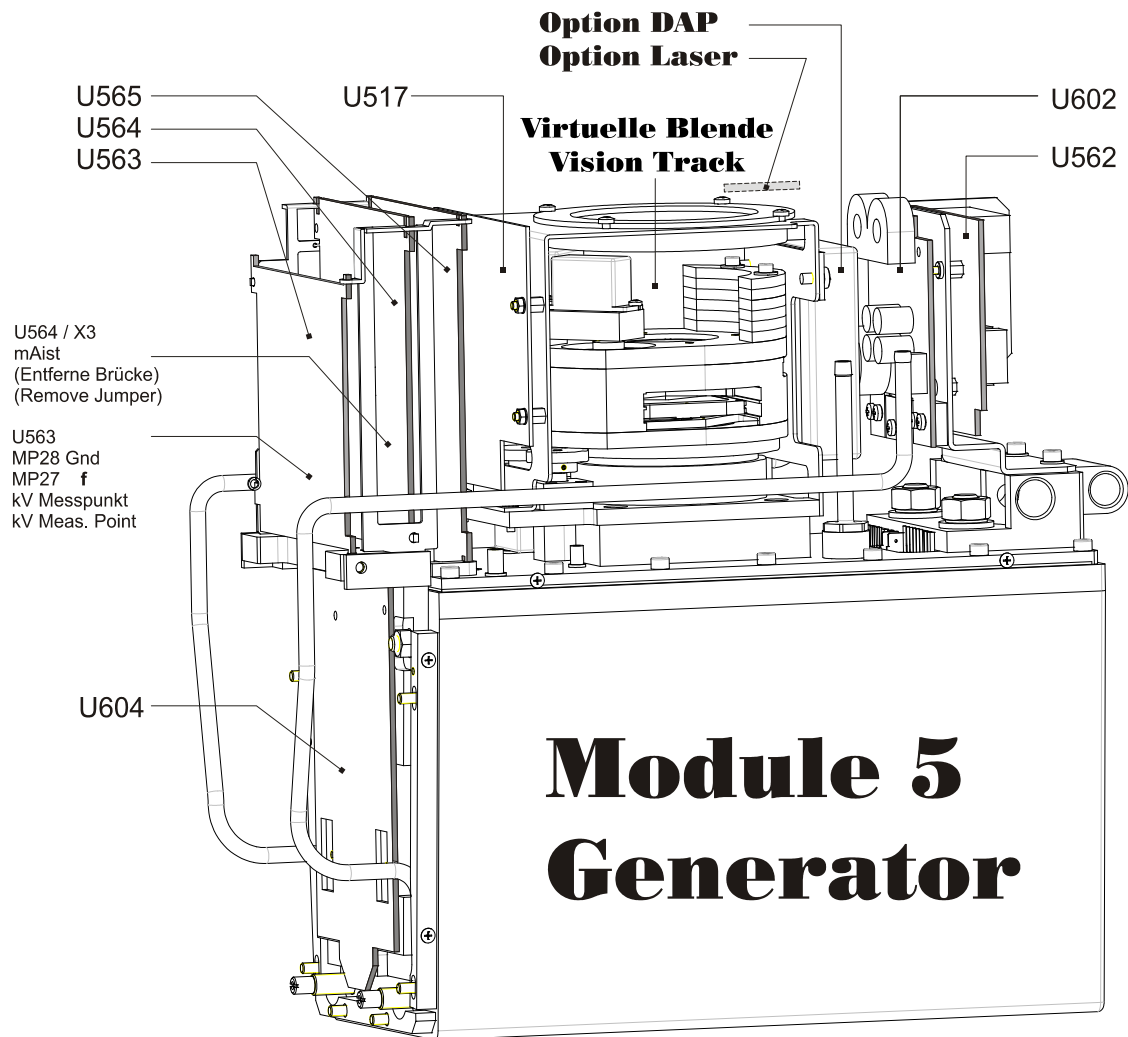


Fig. 7-1 Generator assembly



NOTE

The Ziehm Solo does not support active cooling.

7.2 Generator Block Diagram

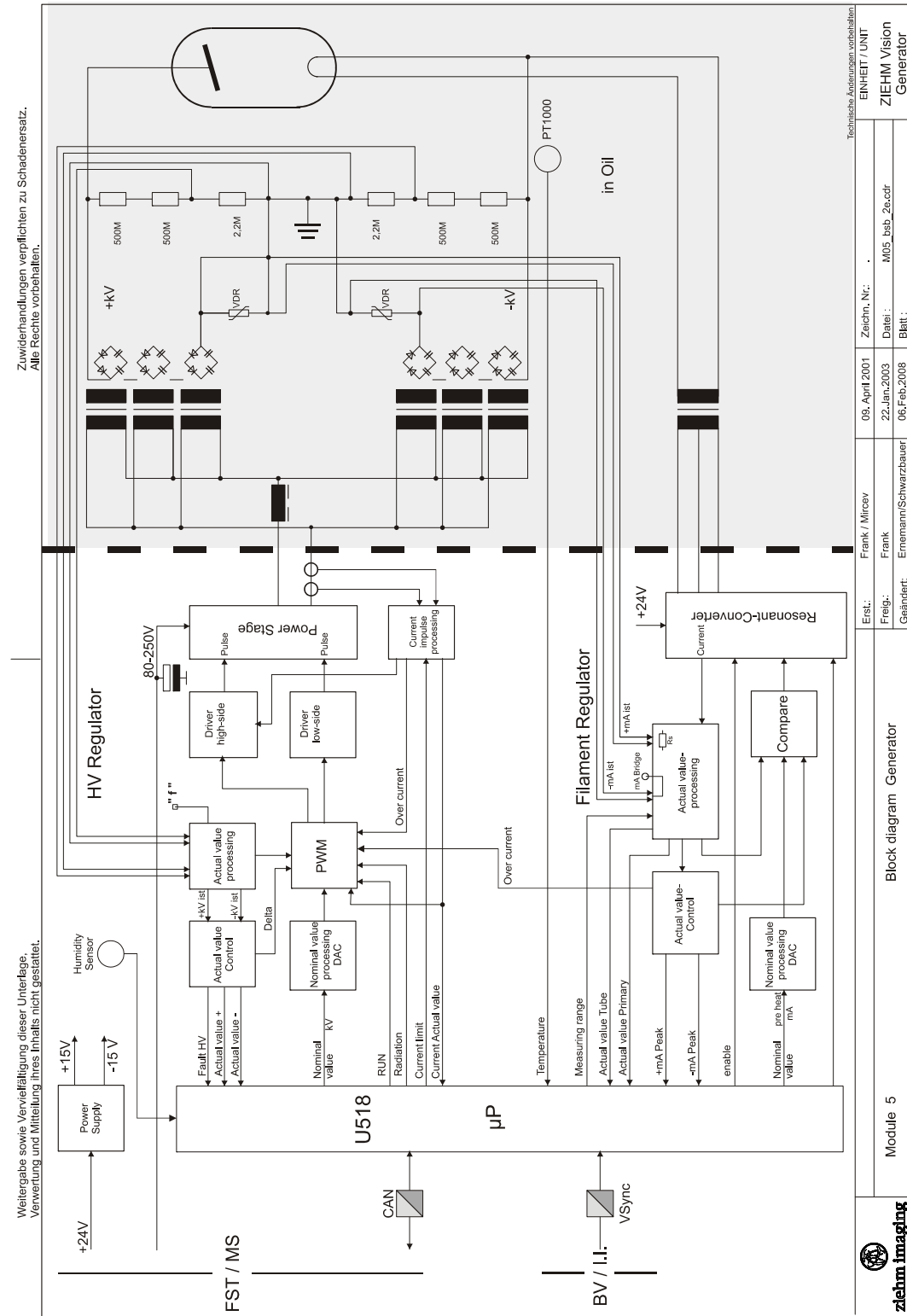


Fig. 7-2 Generator block diagram

7.3 Interface Generator - C-arm Stand

Command Interface
All commands sent through CAN bus
Power Interface
Regulated voltage 40 V to 230 V _{DC} / 20 A see pre-power supply for generator / Module 1
Stabilized voltage 24 V _{DC} / 4 A see FG 9938 / Module 1
Sync Interface
V-Sync from the CCD camera. See Module 4

7.4 Self Tests

7.4.1 During Bootup

Software Check the Hardware		
Hardware flip-flop for extreme interrupt	If not OK: error will be detected	E1008 / E1009
Checksum from machine data	If not OK: error will be detected	E1007
Filament (small and/or big focus if present MD) Must be operating.	If not: error will be detected	E1000 / E1001
Check v-sync (present or not) Must be present.	If not: error will be detected	E1002
Temperature 1 min/max Oil temperature	If not OK: error will be detected	E1003 / E1004
Temperature 2 min/max Oil temperature	If not OK: error will be detected	E1005 / E1006
Over-temperature switch oil	If not OK: error will be detected (reset via service)	E1014
Hardware signal/XRAY	If not OK: error will be detected and CAN fault line will be activated	E1010

7 X-ray Generator

Software Check the Hardware (Forts.)		
CAN X-ray enable signal Must be inactive during startup.	If not: error will be detected	E1011
Reference voltage D/A converter	If not OK: error will be detected	E1012
Actual voltage from kV (D/A converter)	If not OK: error will be detected	E1013
Valid data bytes and the version from the MD	If not OK: error will be detected	E1015
Humidity sensor active/not active	If not OK: error will be detected	E1016

7.4.2 During Runtime

Software Check the Hardware		
Check v-sync time	If not OK: error will be detected	E1068
Temperature 1 Oil temperature	If not OK: error will be detected	E1069
Temperature 2 Oil temperature	If not OK: error will be detected	E1070
CAN fault signal	If not: error will be detected	E1066
Basic heating from filament	If not OK: error will be detected	E1067
Hardware signal /XRAY missing during radiation	If not OK: error will be detected [1]	E1060
Over-temperature switch oil	If not OK: error will be detected	E1072
CAN X-ray enable signal	If not OK: error will be detected	E1056
Monostable RUN during radiation	If not OK: error will be detected	E1058
Monostable CAN_MONITOR during radiation	If not OK: error will be detected	E1057
Anode HVC error hardware signal		E1051
Cathode HVC error hardware signal		E1052

Software Check the Hardware (Forts.)		
HVC fault hardware signal		E1050
Difference value between actual [IST] and nominal [SOLL] kV value		E1054
Humidity sensor active/not active	If not OK: error will be detected [1]	E1073
Check positive kV actual value and negative kV	If the positive or negative actual value is greater than 2 kV (radiation is not active): error will be detected [1]	E1074
mA peak error hardware signal		E1053
If the generator gets the X-ray start CAN message and there is an error: – X-ray break CAN message is sent to all members – X-ray sequence is not started If the generator detects an error during radiation: – X-ray break CAN message is sent to all members – radiation is aborted [1] If this error is detected: The generator sends a CAN message to the pre-power supply (sets output of power supply to 0 V)		

7.5 General PCBs

PCBs summary	
U565	Generator supervisor (incl. U518)
U564	Filament board & power supply
U604	kV power stage
U563	High voltage controller board
U562	Generator connection & distribution board
U21	+HV Cascade (inside tank)
U22	-HV Cascade (inside tank)
U630	Tank connection board (inside tank)
U602	Power stabilization for oil pump

7.6 U565

7.6.1 General

Processor
Ziehm standard processor (Motorola 68376)
Programmable via CAN bus

Interfaces
Interface to U562 for CAN, wet sensor, V-sync
Two temperature sensor inputs (PT1000)
Controls U577 high voltage winding selector switch
Controls U564 filament inverter
Controls U563 high voltage inverter
Provides supply power for U517 Vision Track

Safety circuitry
Two independent watchdogs
CAN fault line overrides X-ray-ON signal to the generator
CAN X-ray enable line overrides X-ray-ON signal to the generator
Temperature switch manually resettable

7.6.2 Switches and Jumpers

J9: Standalone mode	
open	run mode
closed	standalone

J1–J8: Jumpers for CAN node number (hardwired)	
J1	closed
J2	closed
J3	closed
J4	closed

J1–J8: Jumpers for CAN node number (hardwired)	
J5	open
J6	closed
J7	closed
J8	open
Default node number	9

7.6.3 U565 LEDs

Status LEDs for service requirements		
LED 38:	RUN	(green)
LED 42:	CAN monitor	(green)
LED 43:	fault	(red)
LED 44:	X-ray ON	(yellow)
LED 50:	+5 V ok	(green)
LED 51:	-5 V ok	(green)
LED 52:	+15 V ok	(green)
LED 53:	-15 V ok	(green)

7.6.4 U565 Connectors

X1: to U564 filament controller	
34 pin flat ribbon cable connector	
1	GND
2	/Reset Error flip-flop
3	Filament Select
4	Tube Regulation
5	Actual value 25 mA Range
6	Filament ON
7	mA peak Error flip-flop
8	Reset PWM IC

X1: to U564 filament controller (Forts.)	
9	GND
10	mA Actual Tube
11	mA Actual Primary
12	GND
13	mA Reference
14	GND for pin 13
15	mA Reference
16	n. c.
17	n. c.
18	n. c.
19	n. c.
20	n. c.
21	mA over U564
22	GNDF
23	+5 V
24	-5 V
25	-15 V
26	-15 V
27	GNDF
28	GNDF
29	+15 V
30	+15 V
31	GND 24 V
32	GND 24 V
33	+24 V
34	+24 V

X2: to U563 high voltage controller	
20 pin flat ribbon cable connector	
1	GND
2	+kV Error
3	GND
4	Fault
5	Reset Error flip-flop /RES HV
6	Faster Pulse raise time FASTERISE
7	XRAY
8	KV Nominal
9	GND
10	+kV Actual +KVIST5
11	kV Ground
12	-kV Actual -KVIST5
13	kV Ground
14	RUN
15	GND KV Nominal
16	HV Primary Current IPP HV5
17	GND
18	REF 10 Volt
19	GND
20	Temperature Switch Off TEMP ERR

X3: to U562 CAN distribution board	
16 pin flat ribbon cable connector	
1	GND
2	Fault Out
3	Fault In
4	XRAY Enable In
5	CAN Rx
6	CAN Tx
7	XRAY Enable Out

X3: to U562 CAN distribution board (Forts.)	
8	GND
9	V-Sync
10	+5 V
11	Wet sensor
12	GND
13	n. c.
14	n. c.
15	n. c.
16	n. c.

X4: Temperature sensor 1 & 2	
2 pin MLSS100-2 connector	
1	Sensor 1
2	Sensor 1
3	Sensor 2
4	Sensor 2

X5: power for collimator	
2 pin MLSS156-02 connector	
1	+24 V
2	Ground

X8: serial interface for debugging	
4 pin SL1/25-4G connector	
1	TxD TTL
2	RxD TTL
3	Digital ground
4	+5 V

7.7 U564 Filament Board

7.7.1 General

Type of inverter
Resonant inverter
Switching frequency 50 kHz
Two push pull power stages (large and small focus)
Supply voltage 24 V _{DC}
Maximum power output 50 W
Separate inputs for positive and negative mA feedback values
Possibility to insert mA meter (for feedback value)
Adjustable offset error of input amplifier
Selectable measurement ranges 10 and 25 mA
PCB independently testable (no processor needed)
Sinus waveform

Monitor values to control unit
Primary power current
mA feedback value
Tube current greater 23 mA
Filament select signal

Control unit access
Reset over mA error flip-flops
Reset inverter
General enable signal
Regulation loop select signal
Analog reference value for mA

7.7.2 U564 Potentiometers

P1: mA nominal (service only)
Adjustment of mA nominal

P2: mA offset (service only)
Adjustment of mA offset

7.7.3 U564 LEDs

Status LEDs for service requirements		
LED 2	-15 V ok	(green)
LED 6	mA peak detection	(red)
LED 13	+15 V ok	(green)
LED 14	+5 V ok	(green)

7.7.4 U564 Connectors

X1: interface to/from U565
see U565 X1 (<i>page 7</i>)

X2: to filament transformer (oil)	
6 pin MLSS156-06 connector	
1	large focus left
2	large focus mid
3	large focus right
4	small focus left
5	small focus mid
6	small focus right

X3: mA meter for service	
2 pin MLSS100-3 connector	
1	meter
2	meter

X4: mA values from oil insert	
4 pin MLSS100-4 connector	
1	anode side +
2	anode side -
3	cathode side +
4	cathode side -

X6: power input +24 V from swivel cable	
2 pin MLSS156-02 connector	
1	+24 V
2	ground

X8: power for oil pump	
2 pin MLSS156-02 connector	
1	+24 V
2	ground

X10: earth connector to 24 V ground	
1 pin FASTON connector	
1	earth

7.8 U604 High Voltage Power Inverter

7.8.1 General

Type of inverter
Pulse width modulation
Switching frequency 22 kHz
Full bridge power stage
Supply voltage for bridge adjustable and current limited (up to 230 V and 20 A average see also pre-power supply)
Separate inputs for positive and negative high voltage feedback values
PCB independently testable (no processor needed)

Monitor values to control unit
Primary power current
Positive kV feedback value
Negative kV feedback value
DC equivalent to PWM signal alternative to REF 10 Volt
Positive kV greater than negative kV software give the limit
Positive kV less than negative kV software give the limit
Fault signal

Control unit access
Reset kV error flip-flops
General enable signal
X-ray on/off
Analog reference value for kV

7.8.2 U604 Connectors

X1: ground of 250 V power input	
Soldered cord	
1	ground of 250 V power input

X2: 250 V power input	
Soldered cord	
1	250 V power input

X3: to high voltage transformers (oil)	
M4 pem stud	
1	high voltage transformers (oil)

X4: to high voltage transformers (oil)	
M4 pem stud	
1	high voltage transformers (oil)

X5: interface to/from U563	
26 pin flat ribbon cable connector	
1	regulated pulses 1 / 4
2	GND
3	regulated pulses 2 / 3
4	GND
5	fixed pulses 1
6	GND
7	fixed pulses 2
8	GND
9	+5 V
10	+5 V
11	Cur. Sens H (for save stop, U604 output)
12	Cur. Sens L (for save stop, U604 output)
13	GND 24 V

X5: interface to/from U563	
14	GND 24 V
15	+24 V
16	+24 V
17	to X6: 1 Current sens 1
18	to X6: 2 Current sens 2
19	to X7: 2 +24 V_a (Temp-Err)
20	n. c.
21	n. c.
22	n. c.
23	n. c.
24	n. c.
25	n. c.
26	n. c.

X6: Current sens	
solder cord	
1	Current Sens 1
2	Current Sens 2

X7: Manual reset temperature switch	
2 pin MLSS156-02 connector	
1	+24 V
2	+24 V_a

X8: Current sens	
solder cord	
1	Current Sens 1
2	Current Sens 2

7.9 U563 HV Controller Board

7.9.1 U563 Potentiometers

P1: current limit
I LIM over current error detection
P2: PVM
P MAX Max. value PVM
P3: kV nominal
kV nominal for service application

7.9.2 U563 LEDs

Status LEDs for service requirements	
LED 6	fault (red)
LED 7	X-ray ON (yellow)
LED 8	KV ERR

7.9.3 U563 Connector

X1: power interface to/from U564	
16 pin flat ribbon connector	
1	n. c.
2	n. c.
3	mA over U564
4	GND
5	+5 V
6	-5 V
7	-15 V
8	-15 V
9	GND

X1: power interface to/from U564 (Forts.)	
10	GND
11	+15 V
12	+15 V
13	GND 24 V
14	GND 24 V
15	+24 V
16	+24 V

X2: to/from U565 microprocessor
see U565 X2 (<i>page 9</i>)

X4: interface to/from U604
26 pin flat ribbon connector
see U604 X5 (<i>page 15</i>)

X8: actual kV measurement (oil)	
5 pin MLSS100-5 connector	
1	+kV
2	+kV ground
3	-kV ground
4	-kV
5	shield
Pin 5 is monitored. If there is no GND present, X-raying is disabled.	

7.10 U562 Generator Connection and Distribution Board

7.10.1 U562 Connectors

X1: V-sync from I.I.	
3 pin MLSS100-3 connector	
1	shield
2	Vsync-
3	Vsync+

X2: CAN Ziehm Standard	
RJ-45	

X3: CAN Ziehm Standard	
RJ-45	

X4: CAN Shield	
6.3 mm FASTON connector	
1	shield

X5: To U517 Vision Track	
10 pin flat ribbon cable connector	
1	BL +5 V
2	n. c.
3	BL RXD
4	BL TXD
5	n. c.
6	BL GND
7	n. c.
8	n. c.
9	n. c.
10	n. c.

X6 to U518 via U565	
16 pin flat ribbon cable connector	
1	GND DIG
2	STOER OUT1
3	STOER IN
4	STR IN
5	GE RXD
6	GE TXD
7	STR OUT1
8	GND DIG
9	VSYNC
10	+5 V
11	n. c.
12	n. c.
13	n. c.
14	n. c.
15	n. c.
16	n. c.

X7: Wet sensor	
3 pin MLAS100-3 connector	
1	Wet sensor
2	n. c.
3	GND Wet sensor

7.11 U565 and U518 Features

7.11.1 U565

V-SYNC control and 1ms timer
Parameter: kV value and mA value
Pulse control parameters
Filament control
Generator and image system control
X-ray tube / radiation
Heat Unit Calculator
Rad exposure
Pre-power supply control
Water pump control

7.11.2 U518 Moni

32-bit microprocessor (MC68376)
PLD (ispLSI 1048E)
Voltage control chip (MAX791)
1 MBit / 512k x 16 Bit flash memory EPROM
2 x 32k x 8 bit EEPROMs
2 x 128k x 8 Bit RAMs
3 x 16 Bit bus driver
8 green LEDs; 1 red "RESET" LED
4.1943 MHz Quarz

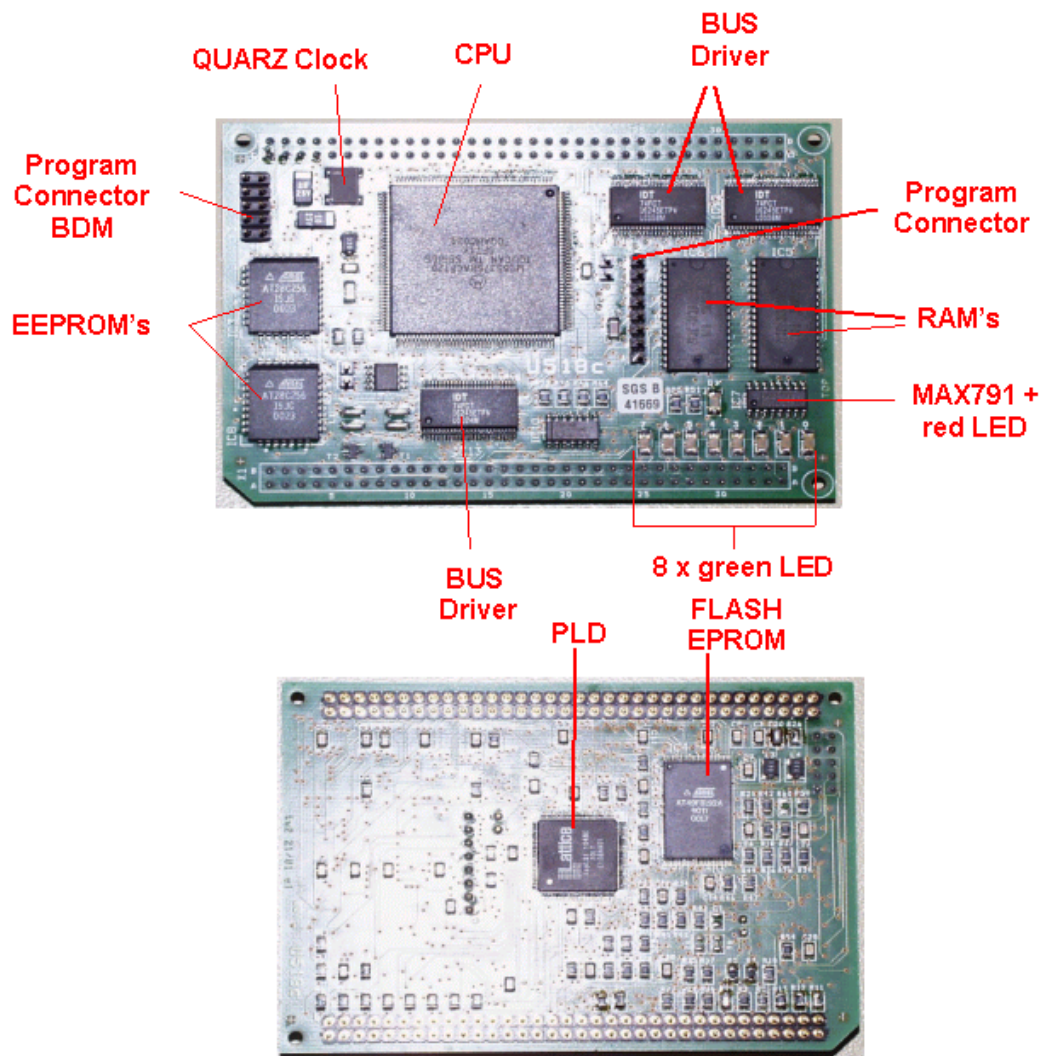


Fig. 7-3 U518 board (Moni)

7.11.3 U518: Block Diagram

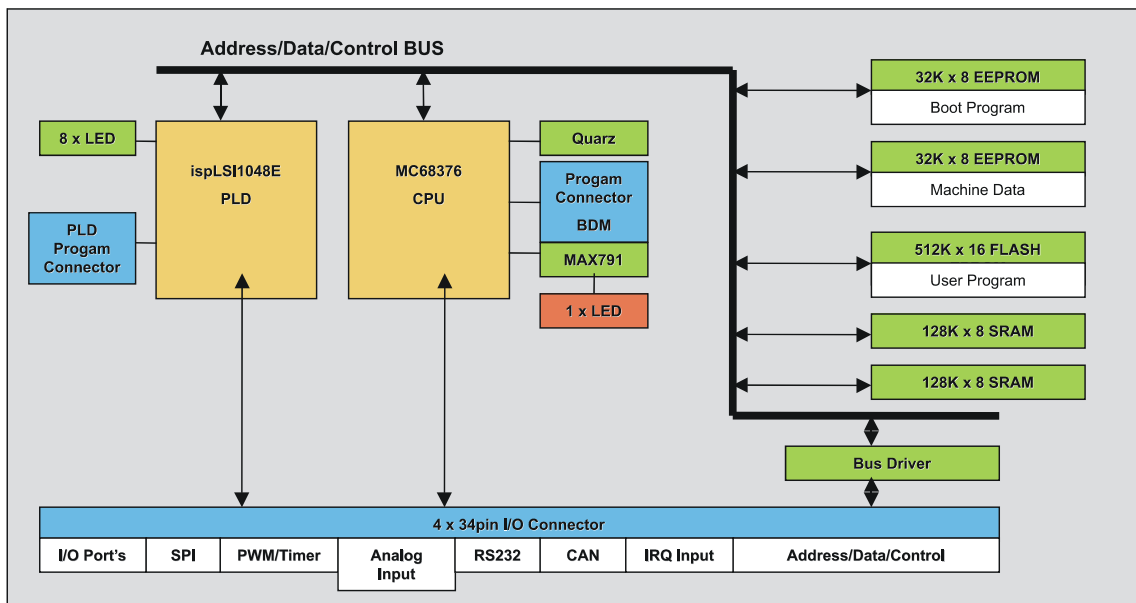


Fig. 7-4 U518 block diagram

7.11.4 U 518: Bootup

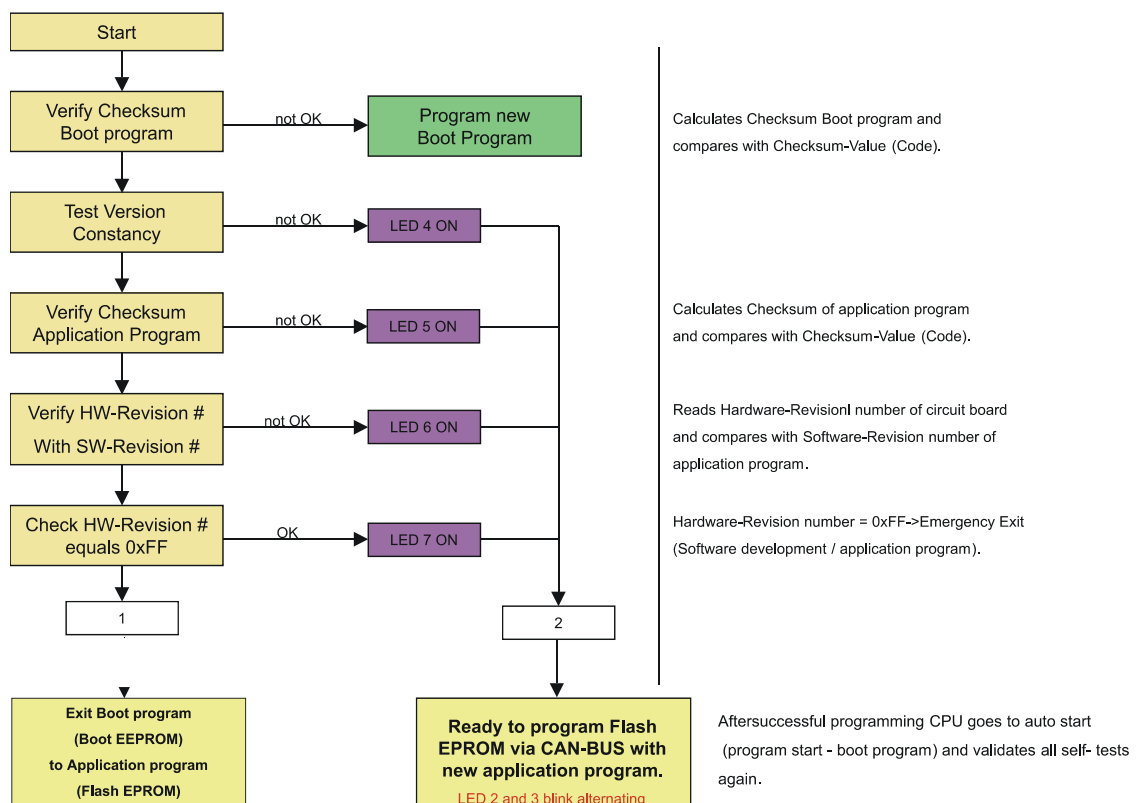


Fig. 7-5 U518 bootup sequence

7.12 Pulse Technology

7.12.1 Parameters for Pulse Control

- Preheat time: 200 ms
- 3 ms delay after V-SYNC, until radiation pulse starts
- 0 ms delay after V-SYNC for continued radiation
- 10 ms, 16 ms, 20 ms, 30 ms width pulse
- pulse sequence: 0 – 30

Amount of V-SYNCs with no radiation pulse commencement; radiation pulse omittance counter

Note:

- means: values cannot be changed
- means: values can be changed

7.12.2 Example of Pulsed Radiation

- Time span V-SYNC: 33 ms
- Pulse width: ____ 10 ms, 30 ms
- pulse sequence: 1

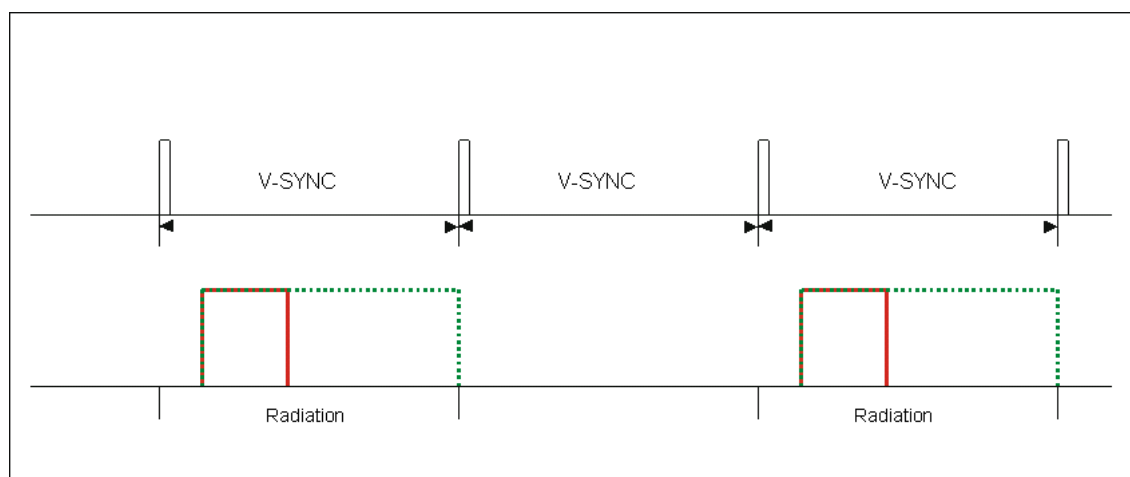


Fig. 7-6 Example of pulsed radiation

7.13 X-ray Tube Filament Control (Filament Wire)

7.13.1 Filament States

- Standby heat;
(MD value)
- Pre-heat;
depending on kV value and mA value
- In between pulse heating;
depending on kV value, mA value and pulse sequence value

7.13.2 Example of Filament Control

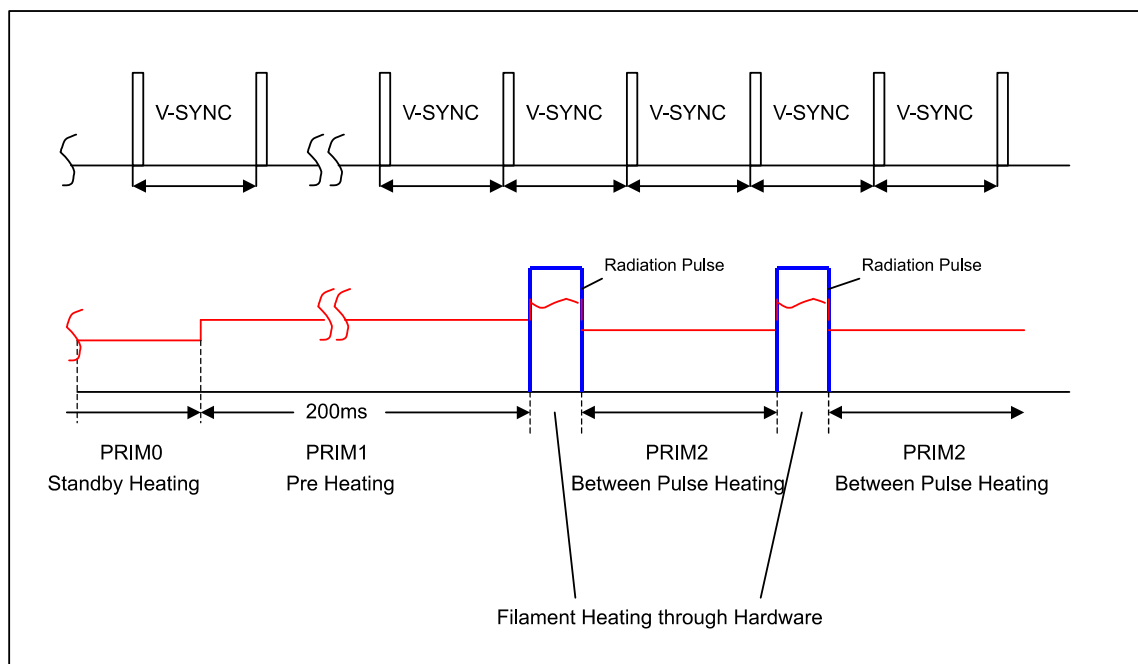


Fig. 7-7 Example of filament control

7.14 Heat Unit Calculator

7.14.1 Fluoroscopy

Surveillance of anode capacity "Heat Unit Calculator"

Tube specifications of tube VARIAN RAD-15:

- max. anode capacity: 200,000 J
- max. heat dissipation into oil: 870 Watt

Calculation of the active anode capacity:

$$\text{Cooling} = \text{HU} * 870 \text{ Watt} / 200,000 \text{ J}$$

$$\text{HU} = \text{actual HU} + (\text{power_in} - \text{Cooling})$$

"power_in" = average power per second

- actual kV value
- actual mA value
- V-SYNC time (33 ms or 40 ms)
- pulse width
- pulse sequence

Example:

kV value: 100 kV

mA value: 15 mA

pulse width: 20 ms

pulse sequence: 1

V-SYNC: 40 ms

average Power:

$$\frac{100\text{kV} * 15\text{mA} * 20\text{ms}}{40\text{ms}} * \frac{1}{2} = 750 \text{ Watt} * \frac{1}{2} = 375 \text{ Watt}$$

Pulse-Sequence

Pulse-Sequence

Fig. 7-8 Calculation of average anode power

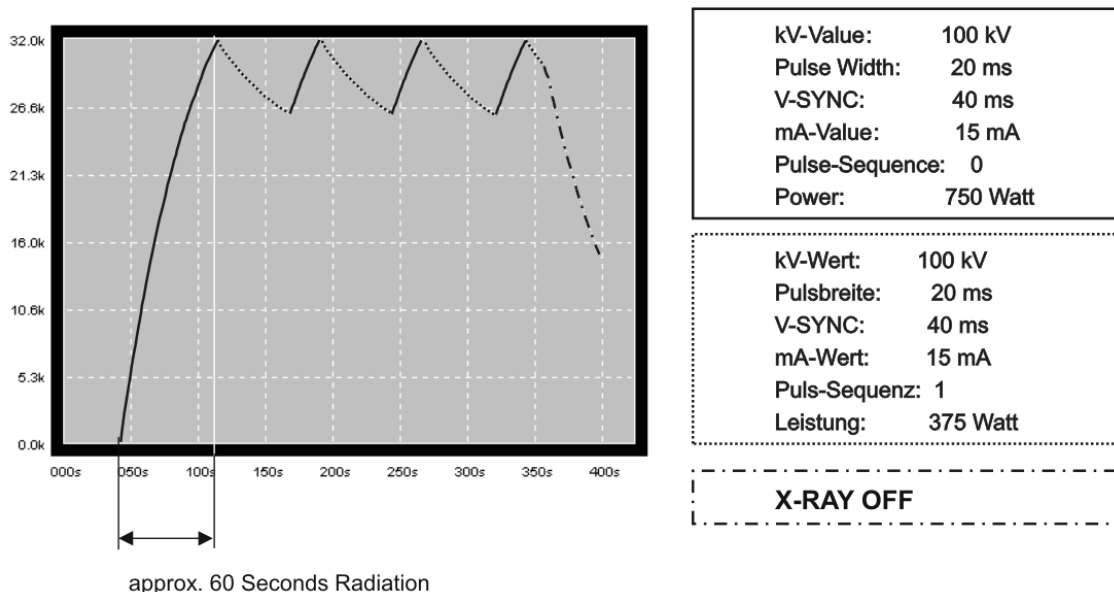


Fig. 7-9 Pulse radiation by Heat Unit Calculator

7.14.2 Power Management during DSA

When the system switches from regulation startup phase to DSA mode, it calculates the average actual power (kV, mA, pulse width, frame rate and V-Sync).

Afterwards it simulates the heating power for the tube (estimating X-ray time for DSA) and adds the actual anode heat capacity to that result.

If the result is greater than the max. anode heat capacity, it reduces the frame rate for the DSA.

7.14.3 Exposure

Why pause time calculation until radiation start release:

If the anode capacity is exceeded during exposure, the generator will set the maximum power output to the limit (600 W). The generator will automatically establish a pulse sequence value to limit the maximum power demand:

→ film will be underexposed.

Example:

- actual anode capacity, e.g. 28,000 J
- exposure 80 kV, 20 mA and 5 seconds
- anode capacity: 28,000 J + 8,000 Ws = 36,000 J

Pause time calculation:

Parameter:

- actual anode capacity, e.g. 28,000 J
- exposure 80 kV, 20 mA and 5 seconds Æ 8,000 Ws

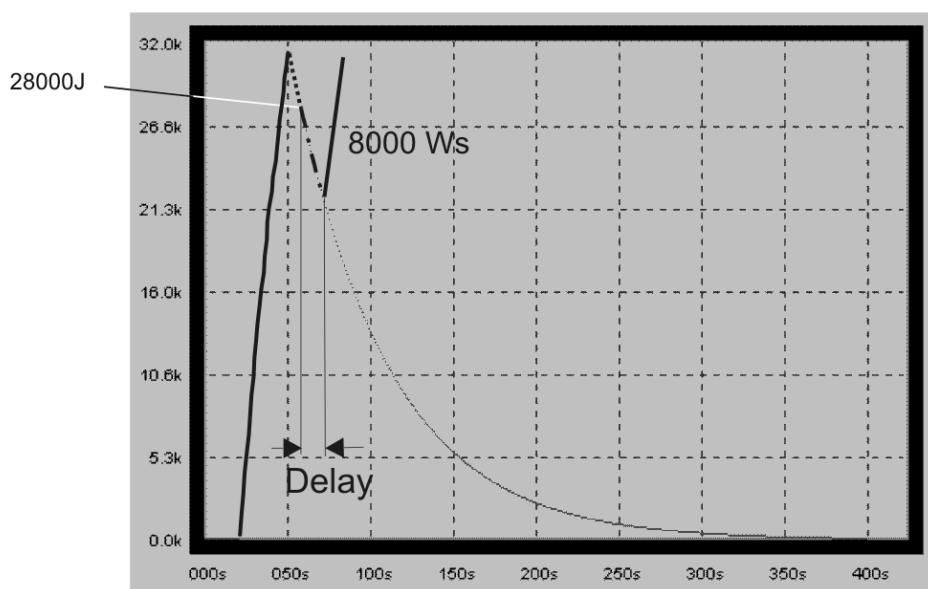


Fig. 7-10 Delay by Heat Unit Calculator

7.15 Calculation of Supply Voltage

Startup voltage “pre-power supply” U531:

The startup voltage of the pre-power supply depends on the actual kV value and the actual mA value.

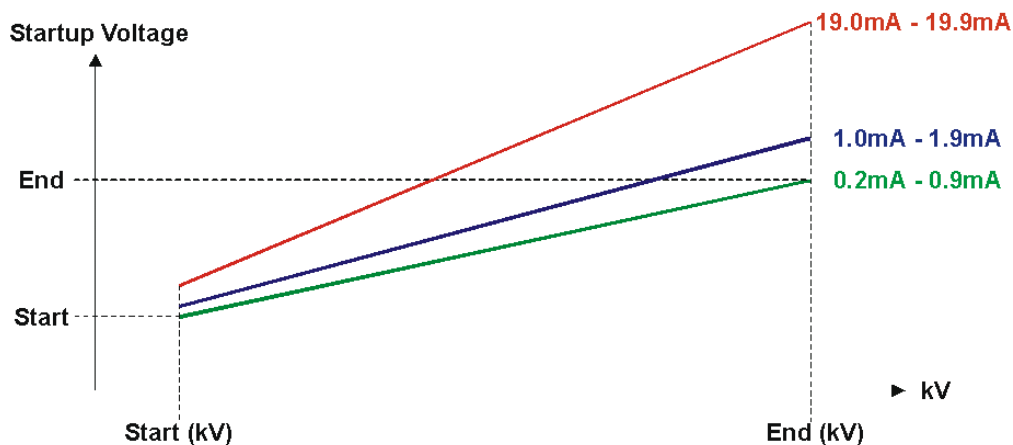


Fig. 7-11 Pre-power supply startup voltage

Machine data value:

- start value kV
- start value supply voltage
- end value kV
- end value supply voltage
- correction factor b
- correction factor d

Calculating from startup value (depending on mA value):

supply voltage = start value supply voltage + b * log₁₀ (mA value)

Calculating end value (depending on mA value):

supply voltage = end value supply voltage + b * log₁₀ (mA value) * d

Example for supply voltage (start value):

factor b = 42; start value power supply = 40.10 Volt

supply voltage = 40.10 Volt + 42 * log₁₀(2); current range 1.0 mA - 1.9 mA = 2

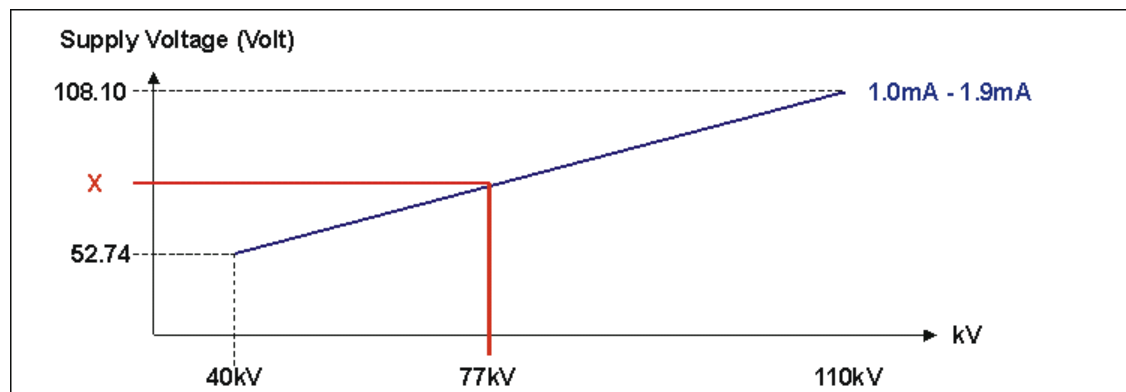
supply voltage = 52.74 Volt

Example for supply voltage (end value):

factor $b = 42$, $d = 2.2$; end value supply voltage = 80.20 Volt

supply voltage = $80.20 \text{ Volt} + 42 * \log_{10}(2) * 2.2$; current range 1.0 mA - 1.9 mA

supply voltage = 108.10 Volt

Calculation of supply voltage for 77 kV:

Formular: Determine position of slope

$X = y = m * x + b \rightarrow$ Supply Voltage = 82.00 Volt

Fig. 7-12 Calculation of Supply Voltage



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8

Vision Track

Module 15

8 Vision Track

8.1 View of Vision Track with U517

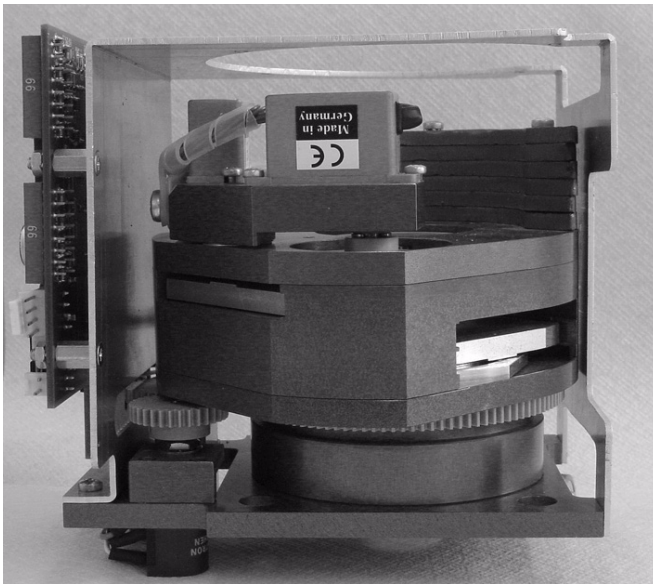


Fig. 8-1 Vision Track with U517

8.2 View of Vision Track with U608

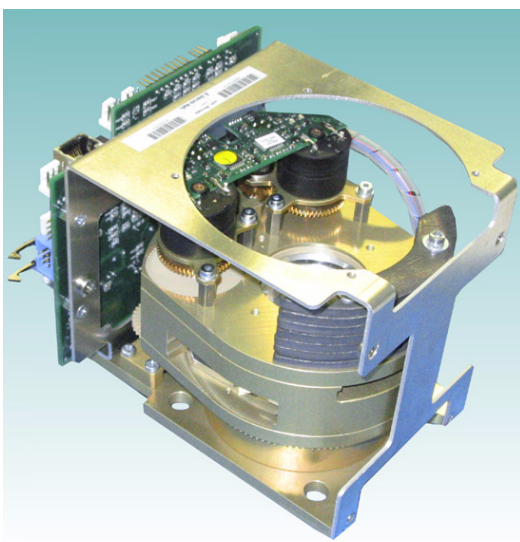


Fig. 8-1 Vision Track with U608

8.3 Vision Track with U517

8.3.1 Block Diagram

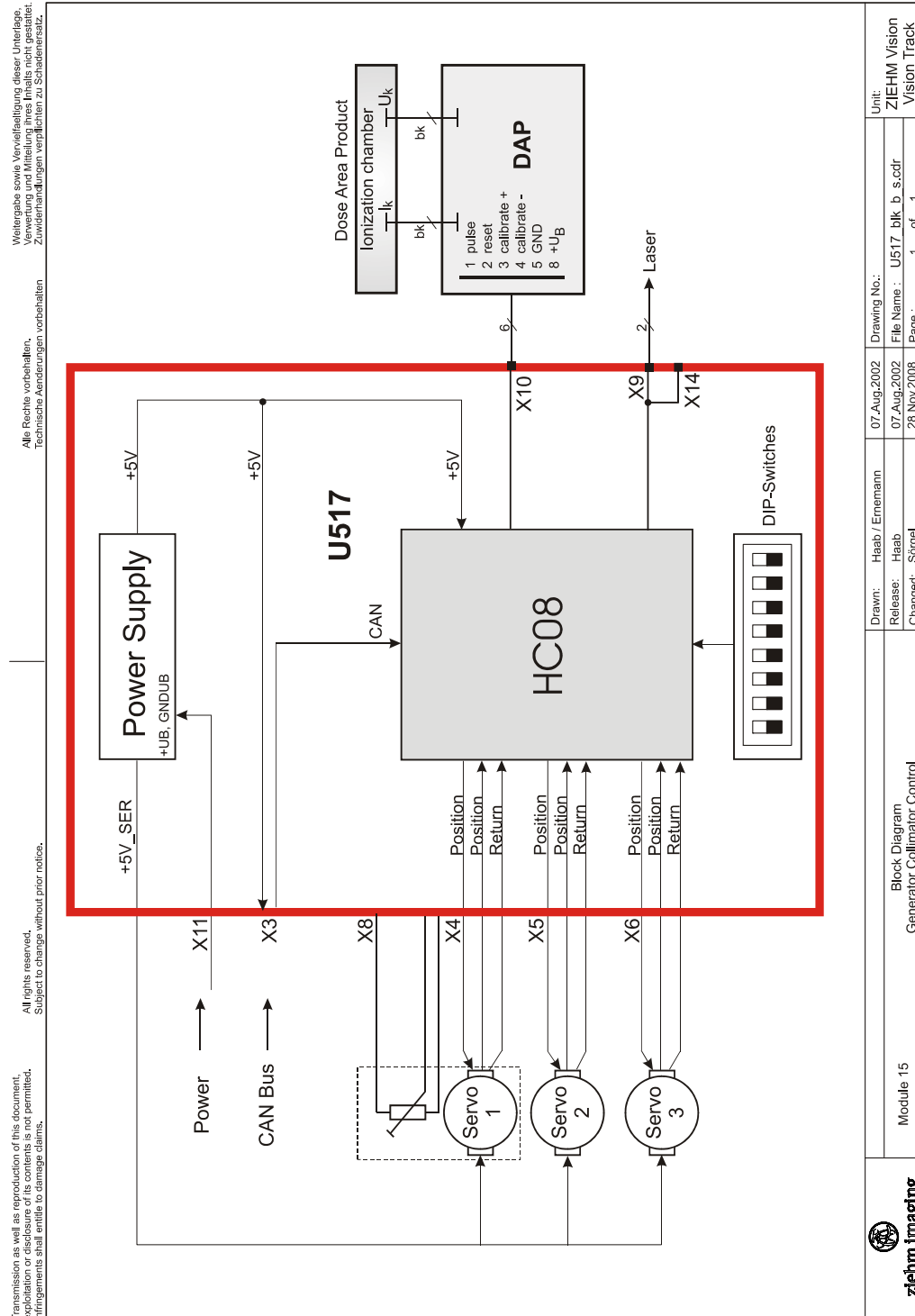


Fig. 8-2 Vision Track block diagram

8.3.2 U517d: Location of Connectors, Switches and LEDs

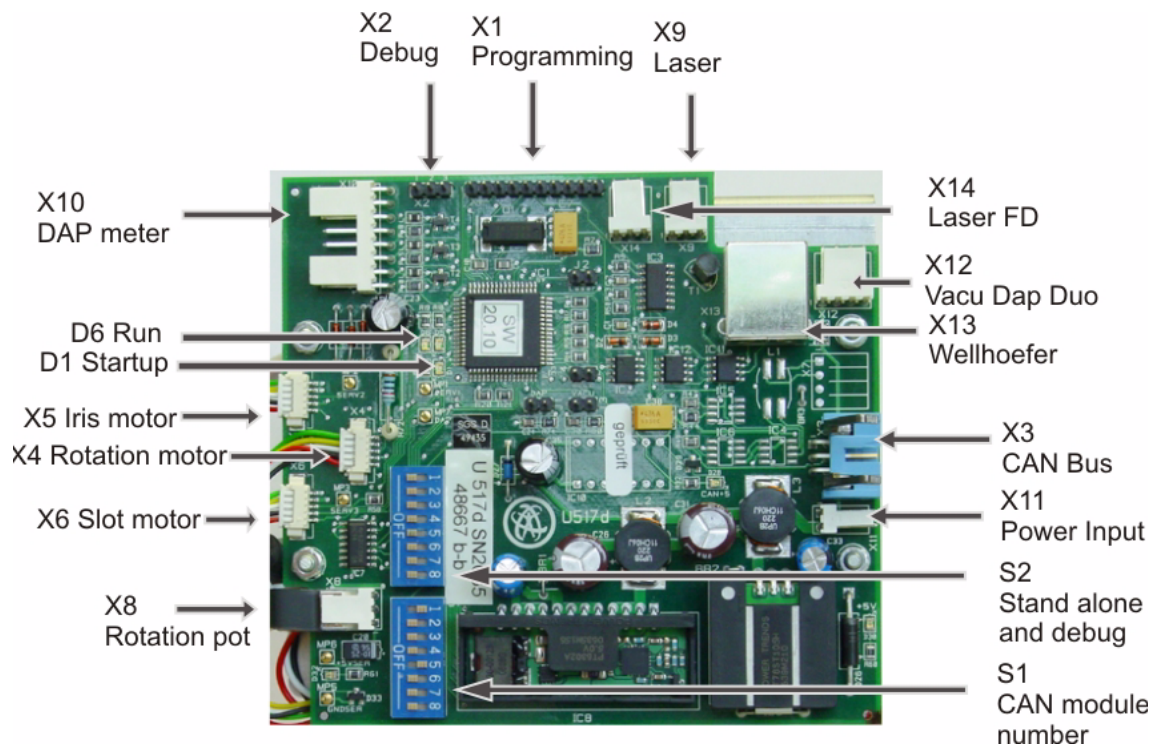


Fig. 8-3 U517d connectors, switches and LEDs

8.3.3 U517: Switches

DIP Switch 2	
Switch 1	Standalone mode for production requirements on == standalone active
Switch 2	RS232 debug interface on/off (only for R&D requirements)
Switch 3	reserved
Switch 4	reserved
Switch 5	reserved
Switch 6	reserved
switch 7	reserved
switch 8	on = VacuDAP-C / VacuDAP-C duo

All switches except 8 have to be turned off.
Setting switch 8 depends on type of dosimeter installed.

DIP Switch 1 module number Vision Track with U517	
Switch 1	CAN bus address ON
Switch 2	CAN bus address OFF
Switch 3	CAN bus address OFF
Switch 4	CAN bus address OFF
Switch 5	CAN bus address ON
Switch 6	CAN bus address OFF
switch 7	CAN bus address OFF
switch 8	CAN bus address OFF

Switches have to be set like indicated.

DIP switch factory setting

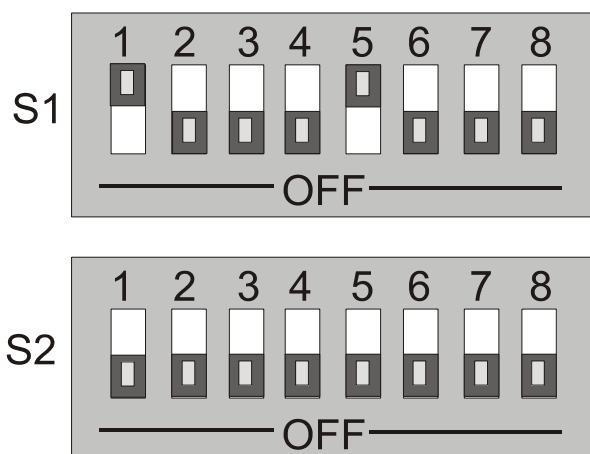


Fig. 8-4 U517 S1 and S2 factory settings

8.3.4 U517: LEDs

Status LEDs for Service Requirements	
LED 1 red	flashing: shows startup phase off: shows system is running
LED 5 red	reserved
LED 6 green	system is running

8.3.5 U517: Connectors

X1: Programming Interface Connector	
10-pin Panduit cable connector	
Pin 1	PTC0
Pin 2	PTC1
Pin 3	PTC3
Pin 4	IRQ
Pin 5	RST
Pin 6	WDO
Pin 7	PTA0
Pin 8	OSC
Pin 9	+5 V output
Pin 10	ground

X2: RS232 Debug Connector	
3-pin Panduit cable connector	
Pin 1	ground
Pin 2	TxD
Pin 3	RxD

X3: CAN Bus Connector J12	
6-pin flat ribbon cable connector	
Pin 1	CAN +5 V
Pin 2	n. c.
Pin 3	CAN_RxD
Pin 4	CAN_TxD
Pin 5	n. c.
Pin 6	ground

X4: Rotation Motor Connector	
5-pin molex cable connector	
Pin 1	+5 V
Pin 2	ground
Pin 3	servo control pulse
Pin 4	feedback servo position
Pin 5	servo return (there or not)

X5: Iris Motor Connector	
5-pin molex cable connector	
Pin 1	+5 V
Pin 2	ground
Pin 3	servo control pulse
Pin 4	feedback servo position
Pin 5	servo return (there or not)

X6: Slot Motor Connector	
5-pin molex cable connector	
Pin 1	+5 V
Pin 2	ground
Pin 3	servo control pulse
Pin 4	feedback servo position
Pin 5	servo return (there or not)

X8: Rotation Potentiometer	
3-pin Panduit cable connector	
Pin 1	+5 V
Pin 2	feedback voltage
Pin 3	ground

X9: Laser Diode 1 and 2 Connector	
3-pin Panduit cable connector	
Pin 1	Laser -
Pin 2	Laser +
Pin 3	n. c.

X10: DAP Connector	
8-pin molex cable connector	
Pin 1	count input
Pin 2	reset output
Pin 3	calibrate output +
Pin 4	calibrate output –
Pin 5	ground
Pin 6	n. c.
Pin 7	n. c.
Pin 8	+U _B 18 V

X11: Power Input	
2-pin Panduit cable connector	
Pin 1	ground
Pin 2	+24 V

8.4 Vision Track with U608

8.4.1 Block Diagram

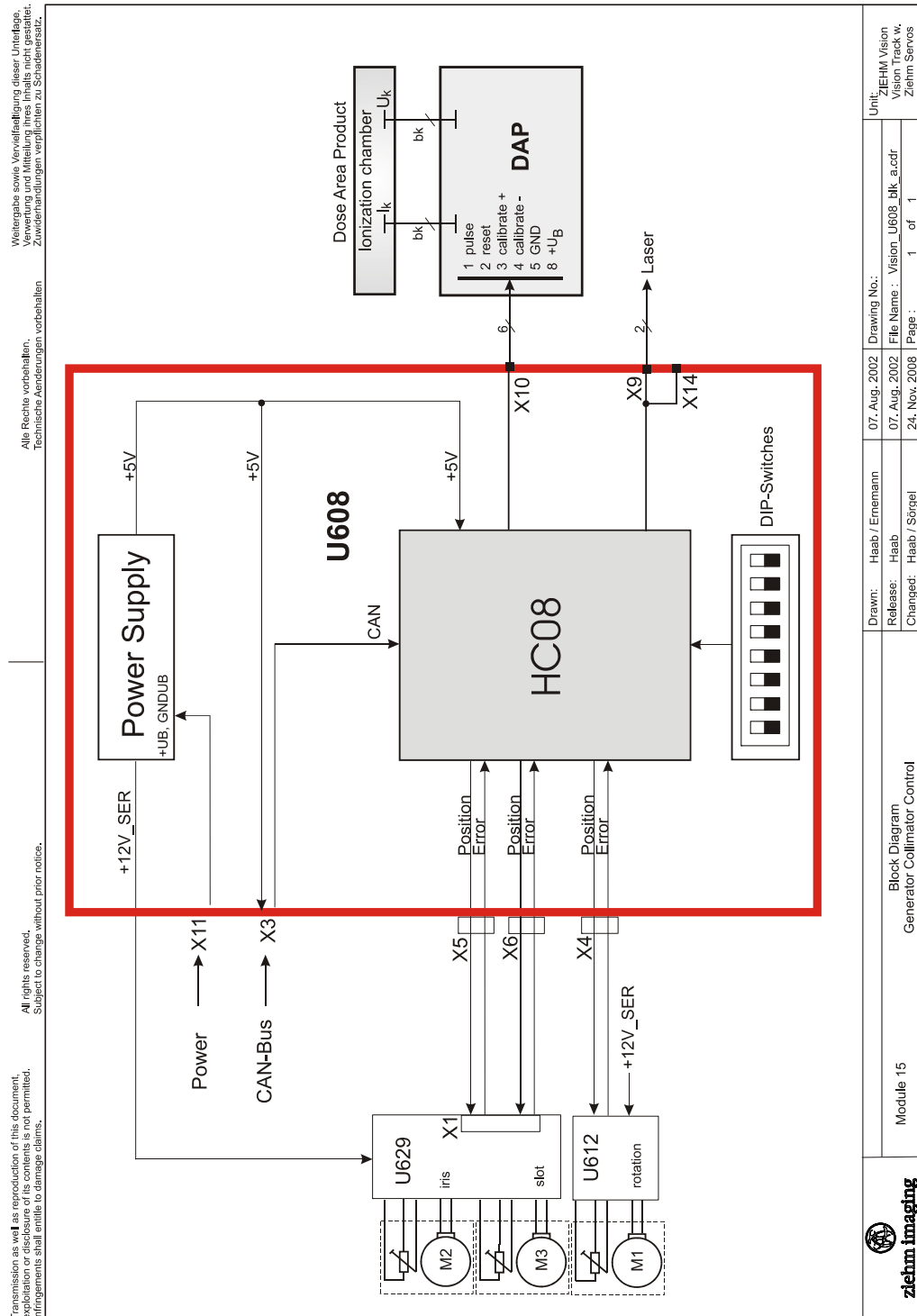


Fig. 8-5 Vision Track block diagram

8.4.2 U608b: Location of Connectors, Switches and LEDs

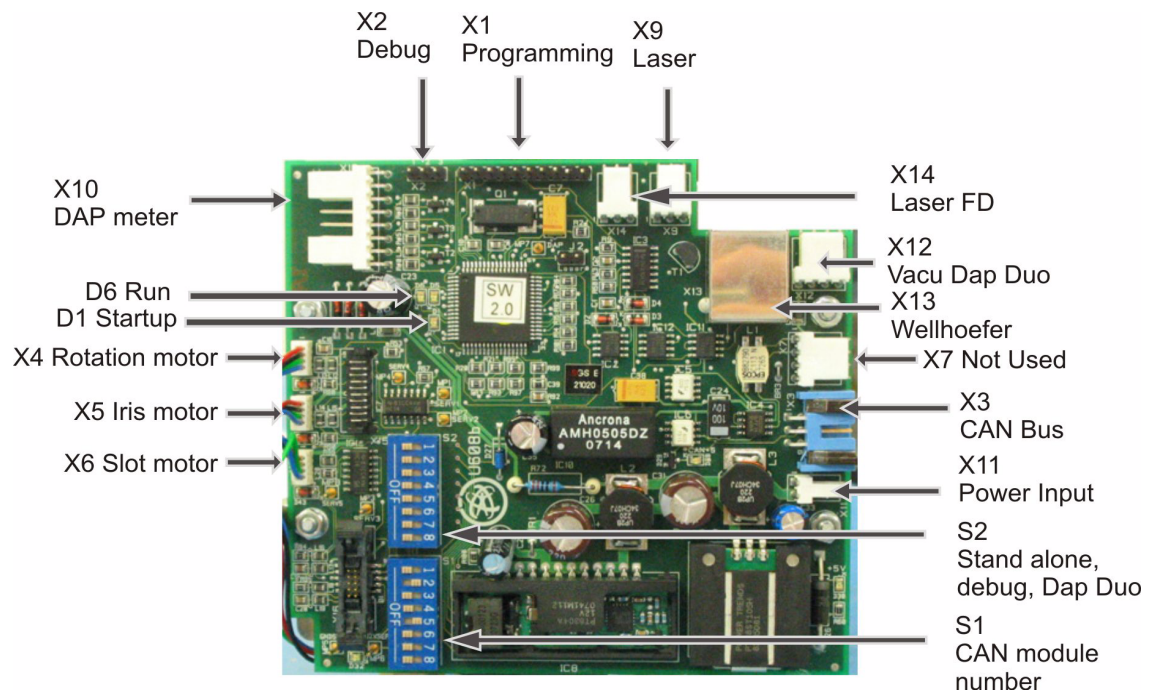


Fig. 8-6 U608b connectors, switches and LEDs

8.4.3 U608: Switches

DIP Switch 2	
Switch 1	Standalone mode for production requirements on == standalone active
Switch 2	RS232 debug interface on/off (only for R&D requirements)
Switch 3	reserved
Switch 4	reserved
Switch 5	reserved
Switch 6	reserved
switch 7	reserved
switch 8	on = VacuDAP-C / VacuDAP-C duo

All switches except 8 have to be turned off.
Setting switch 8 depends on type of dosimeter installed

DIP Switch 1 module number Vision Track with U608	
Switch 1	CAN bus address OFF
Switch 2	CAN bus address ON
Switch 3	CAN bus address OFF
Switch 4	CAN bus address OFF
Switch 5	CAN bus address ON
Switch 6	CAN bus address OFF
switch 7	CAN bus address OFF
switch 8	CAN bus address OFF

Switches have to be set like indicated.

Setting of S2 switch 8 depends on type of dosimeter installed.

DIP switch factory setting

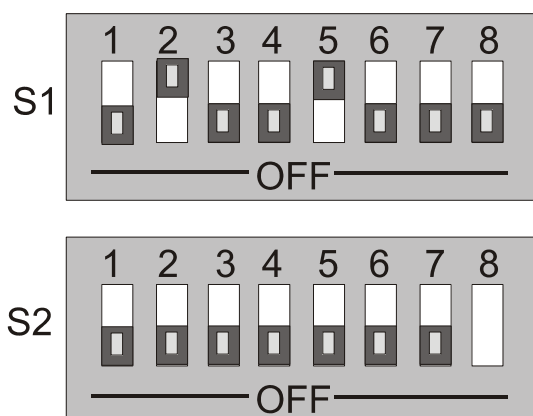


Fig. 8-7 U608 S1 and S2 factory settings

8.4.4 U608: LEDs

Status LEDs for Service Requirements	
LED 1 red	flashing: shows startup phase 1
LED 5 red	flashing: shows startup phase 2
LED 1 & 5 red	both flashing: waiting for system to start
LED 6 green	flashing: system is running

8.4.5 U608: Connectors

X1: Programming Interface Connector	
10-pin Panduit cable connector	
Pin 1	PTC0
Pin 2	PTC1
Pin 3	PTC3
Pin 4	IRQ
Pin 5	RST
Pin 6	WDO
Pin 7	PTA0
Pin 8	OSC
Pin 9	+5 V output
Pin 10	ground

X2: RS232 Debug Connector	
3-pin Panduit cable connector	
Pin 1	ground
Pin 2	TxD
Pin 3	RxD

X3: CAN Bus Connector J12	
6-pin flat ribbon cable connector	
Pin 1	CAN +5 V
Pin 2	n. c.
Pin 3	CAN_RxD
Pin 4	CAN_TxD
Pin 5	n. c.
Pin 6	ground

X4: Rotation Motor Connector	
4-pin molex cable connector	
Pin 1	+12 V
Pin 2	ground
Pin 3	servo control pulse
Pin 4	feedback servo error

X5: Iris Motor Connector	
4-pin molex cable connector	
Pin 1	+12 V
Pin 2	ground
Pin 3	servo control pulse
Pin 4	feedback servo error

X6: Slot Motor Connector	
4-pin molex cable connector	
Pin 1	+12 V
Pin 2	ground
Pin 3	servo control pulse
Pin 4	feedback servo error

X9: Laser Diode 1 and 2 Connector	
3-pin Panduit cable connector	
Pin 1	Laser -
Pin 2	Laser +
Pin 3	not connected

X10: VacuDAP-2002 Connector	
8-pin molex cable connector	
Pin 1	count input
Pin 2	reset output
Pin 3	calibrate output +
Pin 4	calibrate output –

X10: VacuDAP-2002 Connector	
Pin 5	ground
Pin 6	n. c.
Pin 7	n. c.
Pin 8	+U _B 18 V

X11: Power Input	
2-pin Panduit cable connector	
Pin 1	ground
Pin 2	+24 V

X12: VacuDAP-C Connector	
4-pin molex cable connector	
Pin 1	+24 V
Pin 2	GND
Pin 3	RS 485 A
Pin 4	RS 485 B

X13: Wellhoefer DAP-C connector	
RJ 45 connector	
Pin 1	RS 485 A
Pin 2	unused
Pin 3	+24 V
Pin 4	GND
Pin 5	RS 485 B
Pin 6	RS 485 Z
Pin 7	unused
Pin 8	RS 485 Y
Pin 9	GND
Pin 10	GND

X14: Laser diode 2 connector	
3-pin Panduit cable connector	
Pin 1	Laser +
Pin 2	Laser -
Pin 3	not connected

8.5 Changing the Collimator

8.5.1 Part Replacement

- Switch off the power.
- Remove connectors X3, X9, X10, X11, as applicable.
- Remove the 4 mounting screws.
With power switched off, the collimator can be rotated in order to access the screws.
- Mount the new collimator with the 4 screws. Take care about the pre-collimator. Do not tighten the screws, because centering is necessary.
- Connect X3, X9, X10, X11, as applicable. Power up the unit.

8.5.2 Mechanical Centering



Warning

Collimator adjustment is done while screening.
Take care for radiation protection.

- Press briefly reset button of each function of the collimator (iris, slot, rotation) to get the starting position.
- Close the iris collimator to a diameter of up to 10 cm.
- Screen in order to get an image of the collimator.
- Press briefly one of the collimator buttons to display the preview.
- Adjust the center of the collimator.
- Repeat the two steps mentioned above until collimator is centered to preview.
- If the image of the collimator is in the center and you can see a hexagon, the adjustment was successful.
- Fix the collimator using the screws.
- Press the reset button of the collimator control (iris, slot, rotation) to get the starting position.

8.5.3 Collimator Size Adjustment

- Enter the service functions on the C-arm stand TFT and select **collimator**.
- Set the collimator size for every image format with parameter "Maximum Collimator"
- The parameter "Minimum Collimator" defines the minimum closed position.

8.5.4 Preview Size Adjustment

- Enter the service functions on the C-arm stand TFT and select **collimator**.
- Set the preview size for every image format with parameters "Min virt. Collimator" and "Max virt. Collimator"

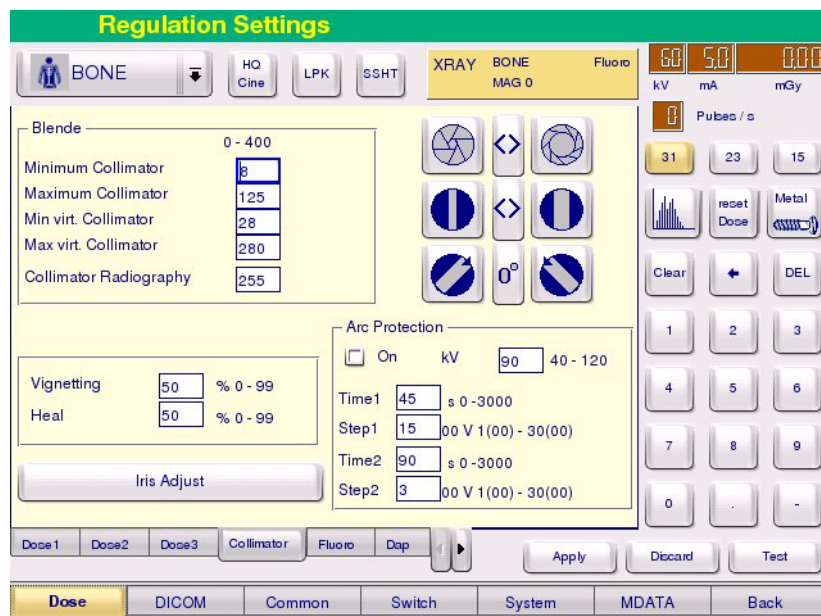


Fig. 8-8 Iris collimator settings

CAUTION



Caution

If option DAP calculated is installed, the DAP calculation needs to be calibrated after the collimator has been changed → Ch. 17.4, p. 17-18

9

TFT Solo Center

Module 18

9 TFT Solo Center

9.1 View of Solo Center

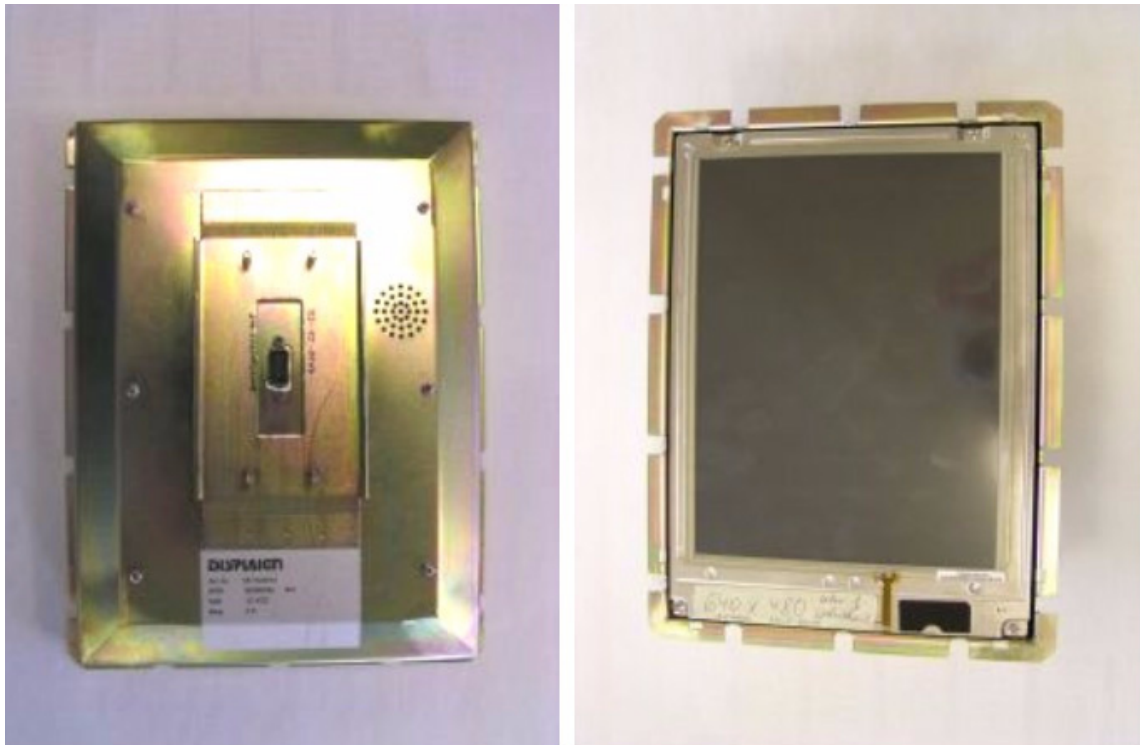


Fig. 9-1 TFT Solo Center view

9.2 General

The Solo Center is a passive VGA TFT touchscreen. It receives a serial video data stream via Giga link interface and sound via line input. It transmits the touch data via serial interface to the CPU.

It is used twice in the Ziehm Solo unit:

once in the mobile stand and once in the optional Viewing Station.

9.3 Solo Center Main Parts

Main Part	Function
TFT LCD 10.4" 640 x 460 pixels	Color TFT panel with backlight function
CCFL converter	Backlight-driving DC/AC converter
Touchscreen 10.4"	Analog resistive touchscreen
Solo Center board	Giga link interface Touch controller Power sequencing Audio amplifier DC power supply
Metal housing	EMC shielding
Integrated speaker	
Interface	Video data via serial giga link Touch data via RS232 Sound (line in) Power (10 V _{DC} ... 30 V _{DC})

9.4 Block Diagram

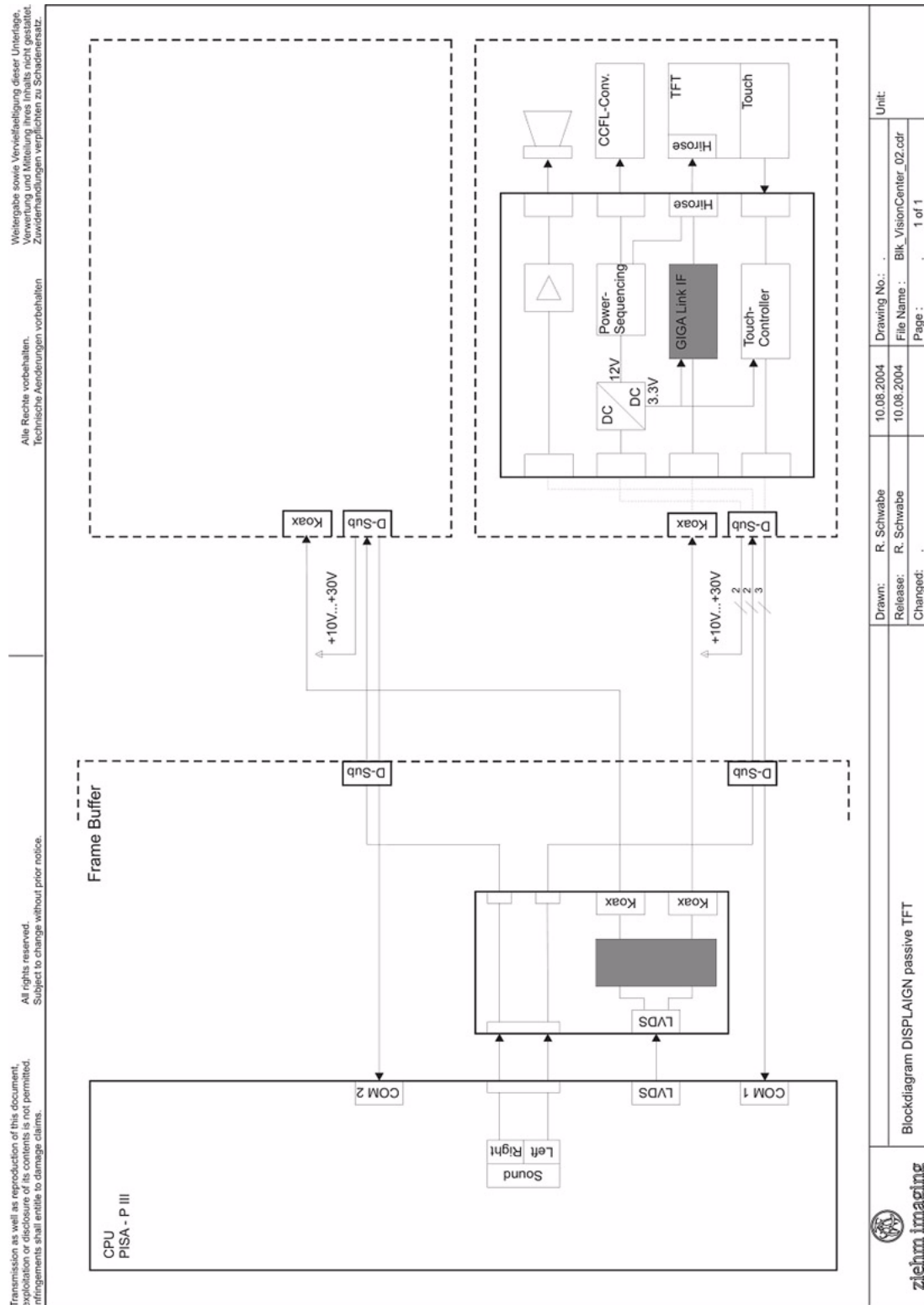


Fig. 9-2 Solo Center block diagram

9.5 Connectors

9 Pin D-Sub male	
pin 1	+ Vcc (+10 V _{DC} ... +30 V _{DC})
pin 2	GND (0 V)
pin 3	+ Sound (line in)
pin 4	GND Sound
pin 5	RS 232 Touch TxD
pin 6	RS 232 Touch RxD
pin 7	RS 232 Touch GND
pin 8	n. c.
pin 9	n. c.

SMB male	
	serial video data in (giga link)

9.5.1 U 592 Interconnection Board for the Solo Center

9.5.1.1 U592b: Location of Connectors

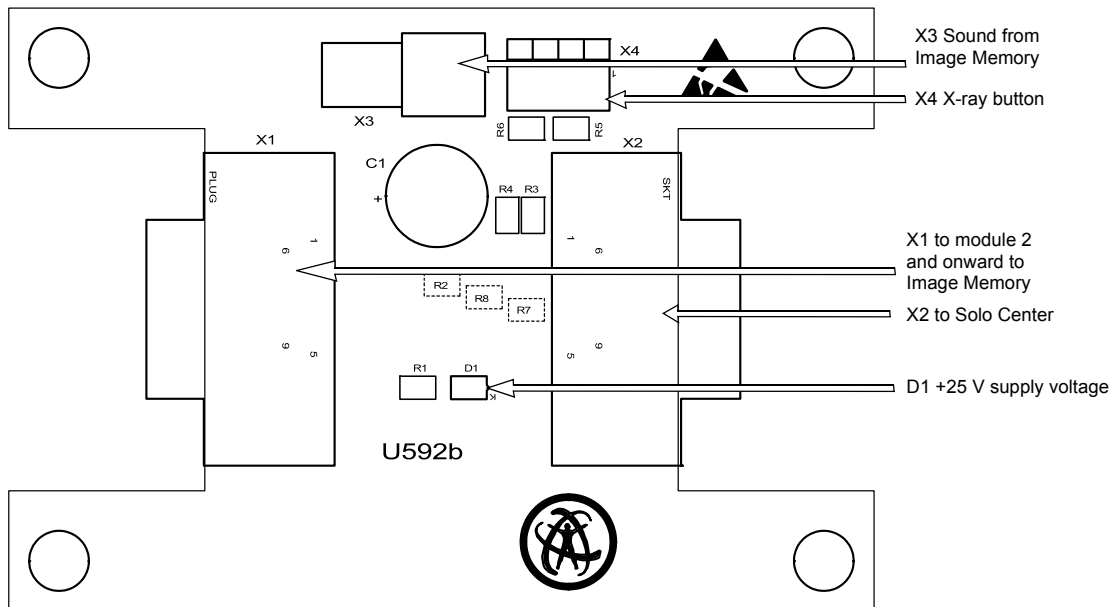


Fig. 9-3 U592b location of connectors

9.5.1.2 U592b Schematic Diagram

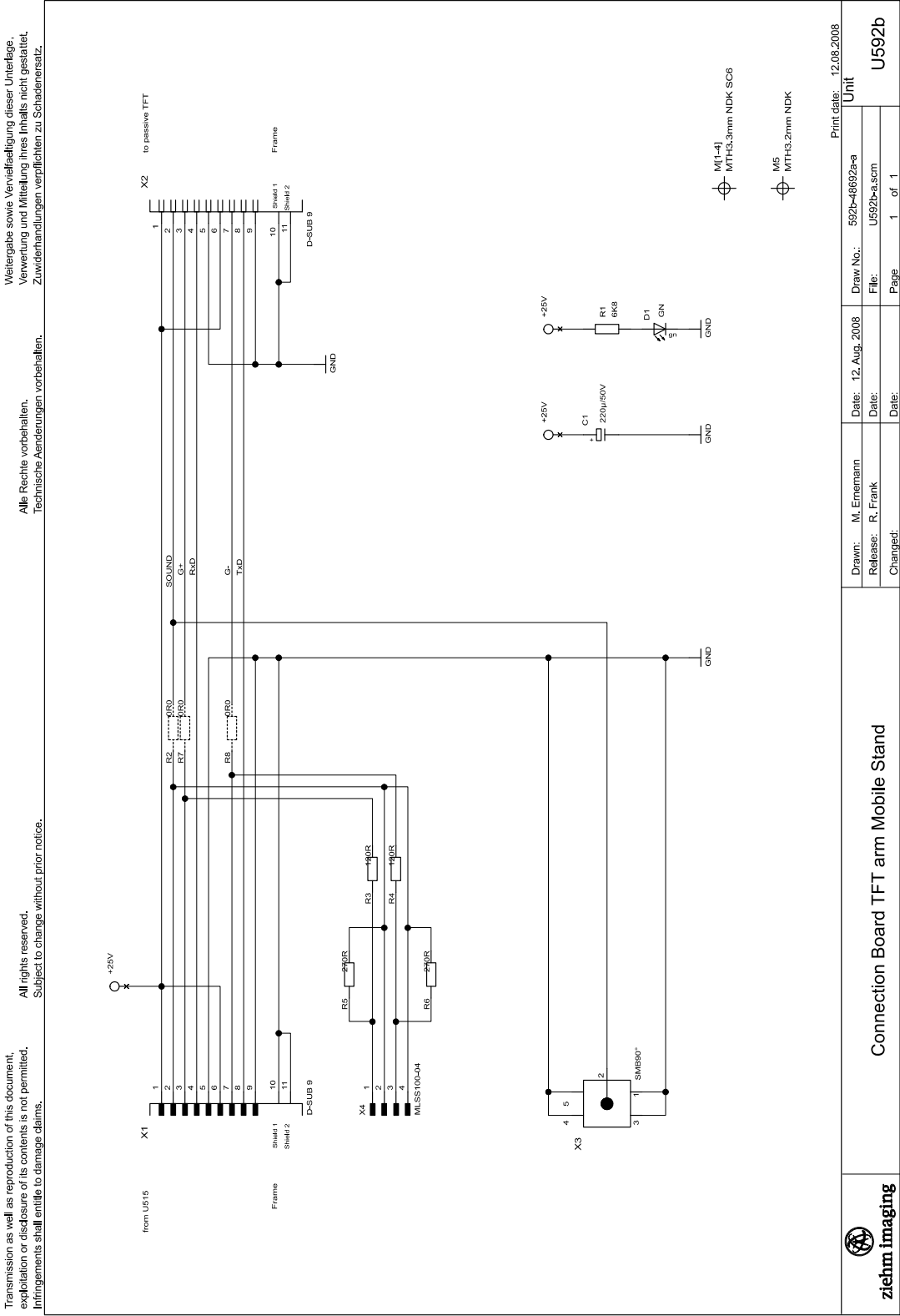


Fig. 9-4 U592b schematic diagram



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10

Viewing Station

10 Viewing Station

10.1 General

Optionally a Viewing Station can be added to the Ziehm Solo. This Viewing Station is not equipped with an Image Memory or a power supply.

10.2 Wiring diagrams

10.2.1 Solo Center

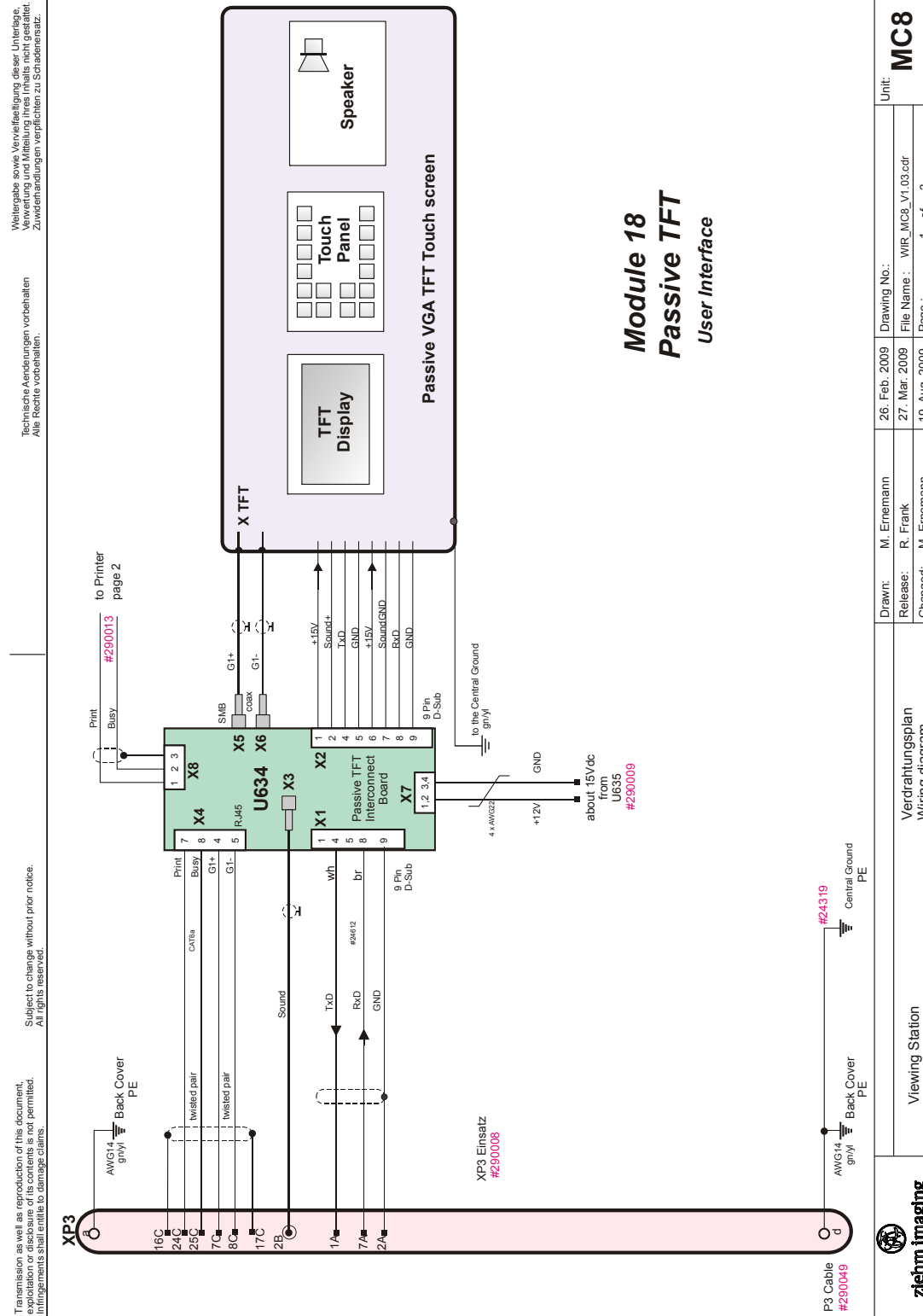


Fig. 10-5 Solo Center

10.2.2 Two 18" Monitors

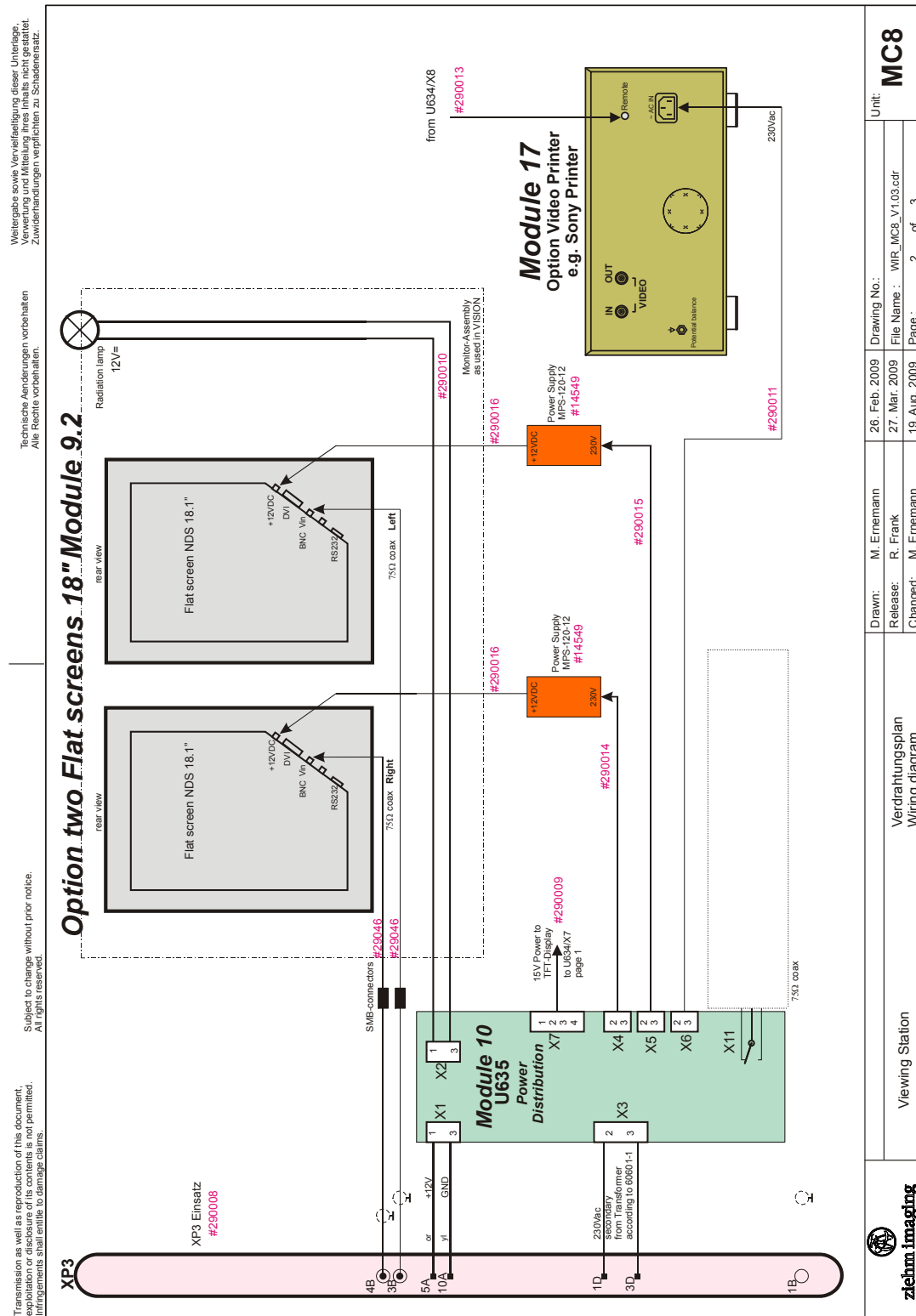


Fig. 10-6 Two 18" monitors

10.2.3 One 24" Monitor

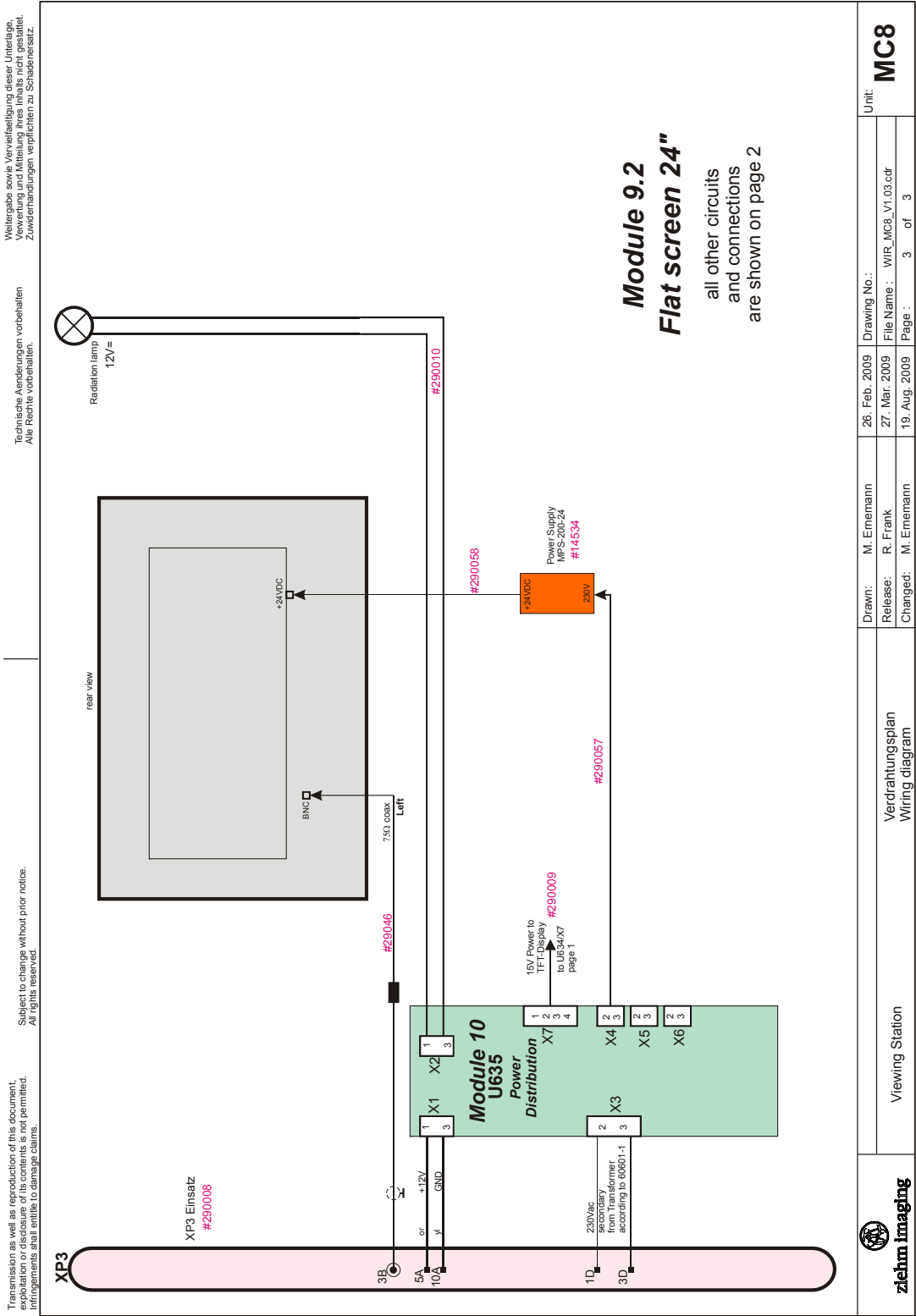


Fig. 10-7 One 24" monitor

11

Video Documentation

Module 7

11 Video Documentation

11.1 UP 990 Configuration

- Press the jog wheel on the printer.
- Turn the wheel, until the desired value is displayed.
- Press jog wheel again to select this value.
- Turn jog wheel to change the value.
- Press jog wheel to store the new value.
- In each menu level the option "back" is offered in order to exit without saving.
- Factory defaults can be restored by "INIT".
- Values different to factory setting are shown in the table below:

Media	SD	For thermal paper UPP-210SE
	HD	For thermal paper UPP-210HD
	BL	For thermal film UPT-210BL
SFT.H	86	
SFT.V	22	
SIZE.H	1224	
SIZE.V	584	
SHARP	7	
AT-CUT	OFF	

11.2 UP 970 Configuration

- Press the jog wheel on the printer.
- Turn the wheel, until the desired value is displayed.
- Press jog wheel again to select this value.
- Turn jog wheel to change the value.
- Press jog wheel to store the new value.
- In each menu level the option "back" is offered in order to exit without saving.
- Factory defaults can be restored by "INIT".
- Values different to factory setting are shown in the table below:

Media	SD	For thermal paper UPP-210SE
	HD	For thermal paper UPP-210HD
SFT.H	+16	
SFT.V	-2	
SHARP	5	

11.3 UP 897 Configuration

- Press the jog wheel on the printer.
- Turn the wheel, until the desired value is displayed.
- Press jog wheel again to select this value.
- Turn jog wheel to change the value.
- Press jog wheel to store the new value.
- In each menu level the option "back" is offered in order to exit without saving.
- Factory defaults can be restored by "INIT".
- Values different to factory setting are shown in the table below:

SFT.H	tbd	
SFT.V	tbd	
SHARP	2	



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12

Monitors

Module 9

12 Monitors

12.1 18.1" Flatscreen Monitor

12.1.1 Description

The 18.1" flatscreen monitor is a monochrome high-resolution LC display. It works as a separate module and is not integrated in the CAN bus. All settings and adjustments are made via an integrated setup menu.



Fig. 12-8 18.1" flatscreen monitor

12.1.2 Technical Data

Visible diagonal (inches)	18.1
Brightness (cd/m ² , typical)	700 (without anti-glare filter)
Native resolution	1280 x 1024
Dot pitch (mm)	0.28
Vertical viewing angle	170°
Horizontal viewing angle	170°
Contrast ratio (typical)	400:1
VGA input signal level at 75 Ohm	0.7V _{p-p}
BNC input signal level	1V _{p-p}
Power (nominal)	42W
Monitor weight	6.35 kg
Operating temperature	0°C to 40°C
Storage temperature	-20°C to 60°C
Relative humidity (non-condensing)	20% to 85%

12.1.3 Connectors

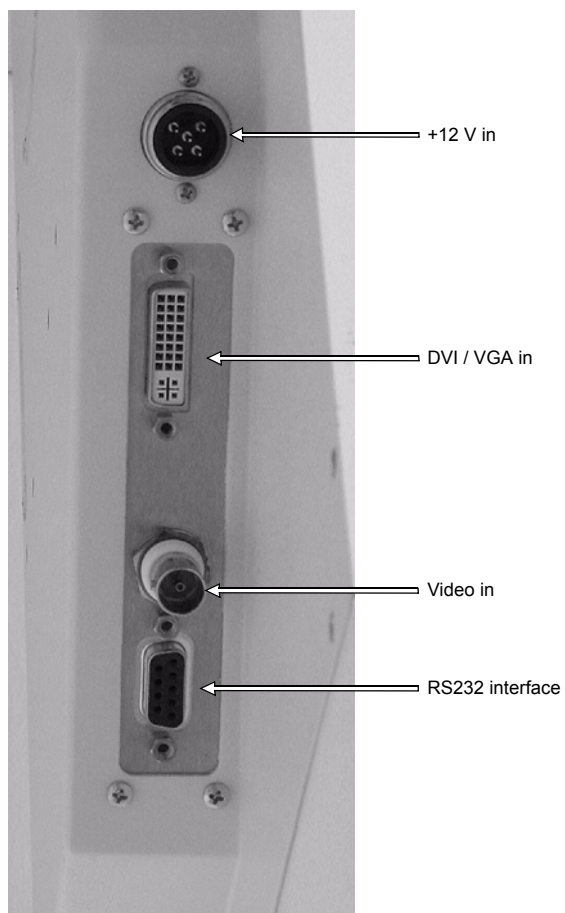


Fig. 12-9 Monitor connectors

12.1.4 On-screen Display

12.1.4.1 Locking and Unlocking the On-screen Display

The monitors are set up and adjusted via a on-screen display. The functions are controlled by an integrated keypad.

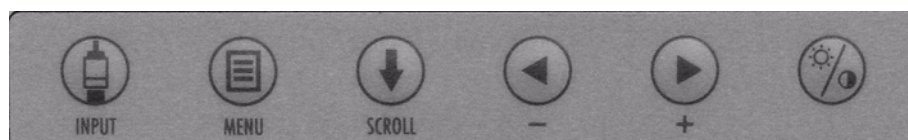


Fig. 12-10 Monitor keypad

The on-screen display is activated by pressing the “Menu” key. In the “Setup” section, you can lock the menu.



Fig. 12-11 Menu “Setup”

If this function is activated, the menu will disappear. Instead of the menu you will get a message “MENU LOCKED” for a short time. Now the access to the on-screen display is denied. You will get this message any time you press a key on the keypad.

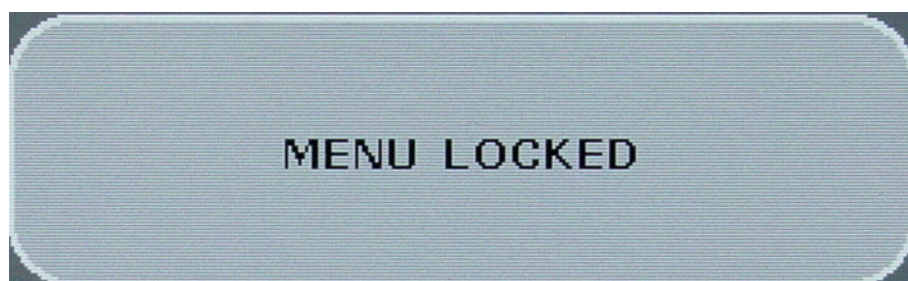


Fig. 12-12 Message MENU LOCKED

In order to unlock the menu, you must press the **“MENU”** and **“SCROLL”** keys simultaneously until you get a message **“MENU UNLOCKED”**.



Fig. 12-13 Message MENU UNLOCKED

You can use the **“MENU”** and **“SCROLL”** key combination also to lock the on-screen display directly. This function will toggle between **“MENU LOCKED”** and **“MENU UNLOCKED”**.

12.1.4.2 Restoring the Factory Settings

In the **“Defaults”** section of the on-screen display, you can restore the factory settings. The factory settings are optimized for the video output of the Vision image memory system, except **“Phase”** in the **“Picture”** section.

Phase has to be set to 26.

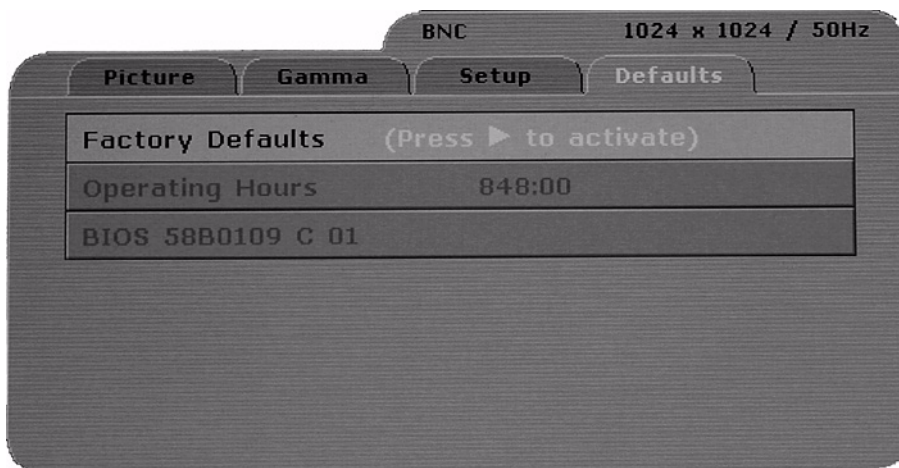


Fig. 12-14 Menu “Defaults”

13

Image Memory System

Module 11

13 Image Memory System

13.1 Features

The Image Memory System is mounted inside the mobile stand.

Mains	230 V _{AC}
Mains Cycles	50/60 Hz
Rating	300 W
CPU	IB930
Harddisk	8 GB Partition for system, Ziehm file system for images
Number of Images	10,000 / 55,000
Patient Folder System	Mosaic system with 16 small images and search function
Analog Video Input/ Digitizing	25 Hz (USA 30 Hz) non interlaced, 10 Bit for CCD camera
Digital Video Input	Camera link for flat panel detector
Scan Rate	37 MHz
Pixels	1024 × 1024 × 10 Bit
Alu	16 Bit
Filtering	Stack Filter: 1....16 Recursive Filter: 0....3 Real-time Edge Filter: 0....4
Subtraction	DSA; with Pixelshift and Landmarking
Rotation/Zoom	Digitally calculated Image reversal
Cine	1 / 2 / 4 / 8 frames per second Length: 100, 200, 300, 400 images or not limited
Monitor	75 Hz (USA 90 Hz) non interlaced / Split screen
VIDEO OUT external	50 Hz CCIR - 60Hz EIA
Interfaces	CAN, USB 2.0, RS232, Ethernet, eSATA (VGA + keyboard for service)
DVD-RW drive	for backup, TIF images, DICOM images or Multimedia format

13 Image Memory System

USB drive	for backup, TIF images or DICOM images; for Service Key
DICOM	RJ-45 Storage / Query / Retrieve / Print / Worklist / MPPS / Storage commitment / Media Storage
Paper Printer	UP970, UP990, UP897


NOTE

The availability of features depends on the options installed.

13.2 Front View with 2 x U825

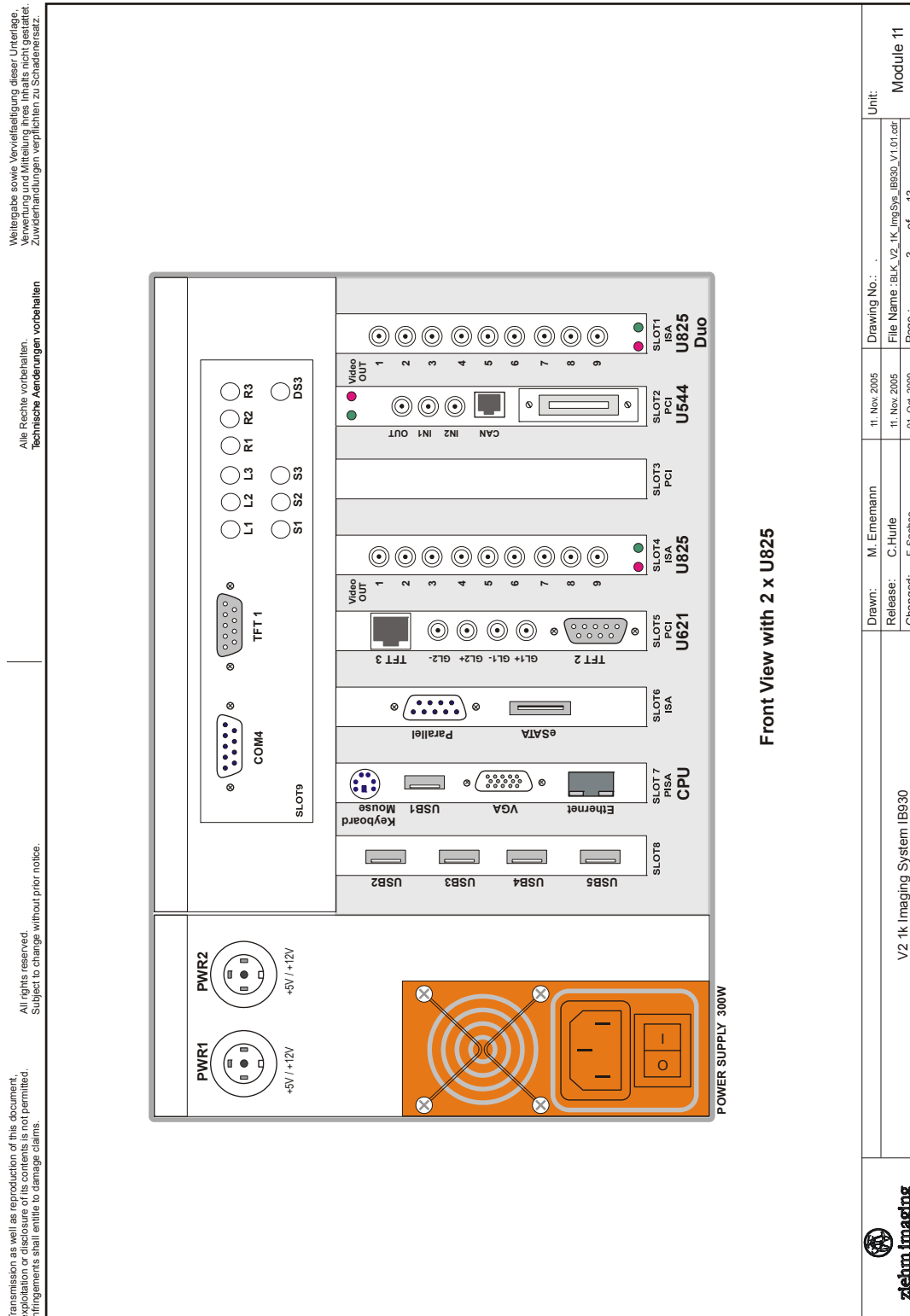


Fig. 13-15 Module 11 front view with 2 x U825

13.3 Front View with U622

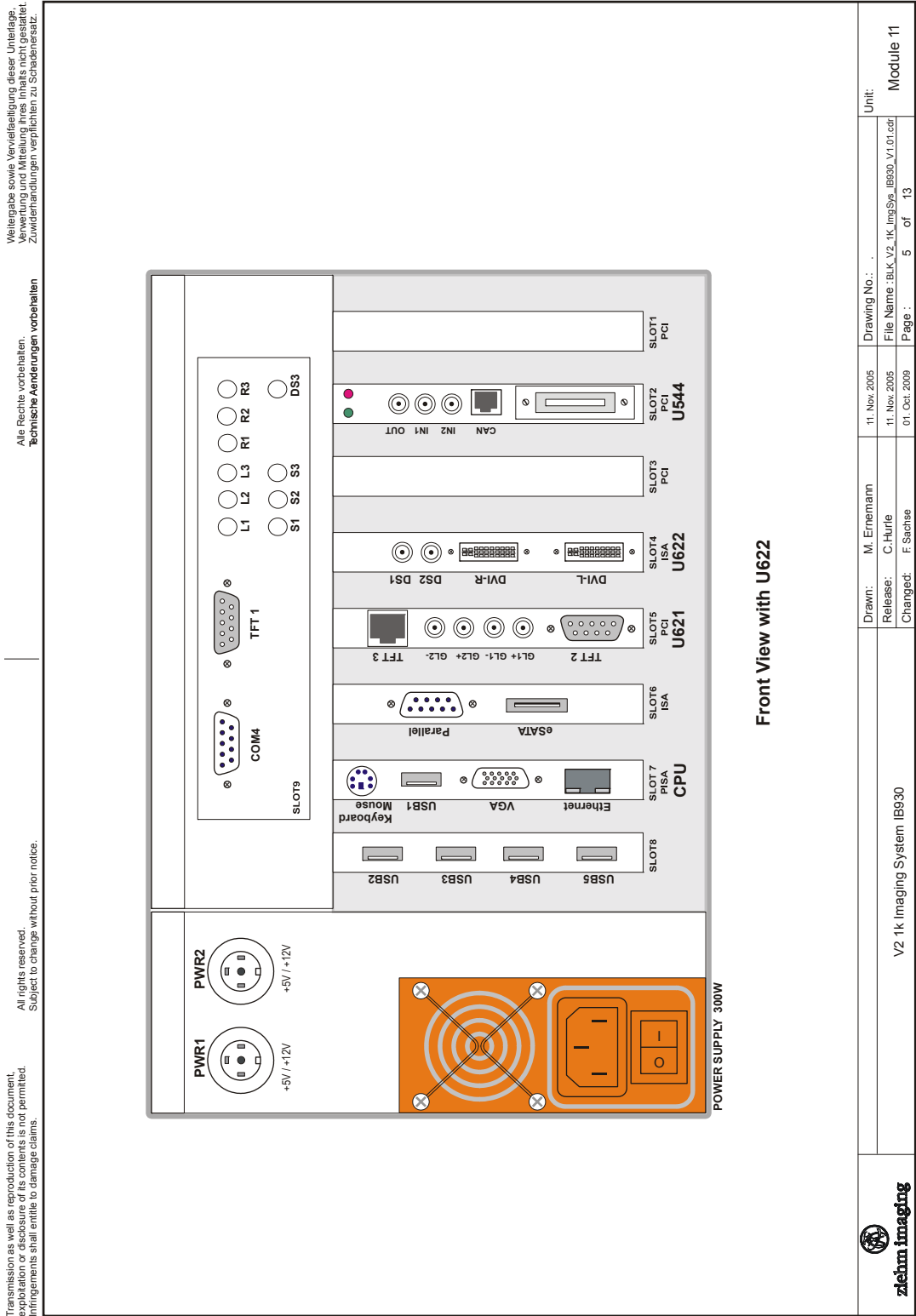


Fig. 13-16 Module 11 front view with U622

13.4 Side View

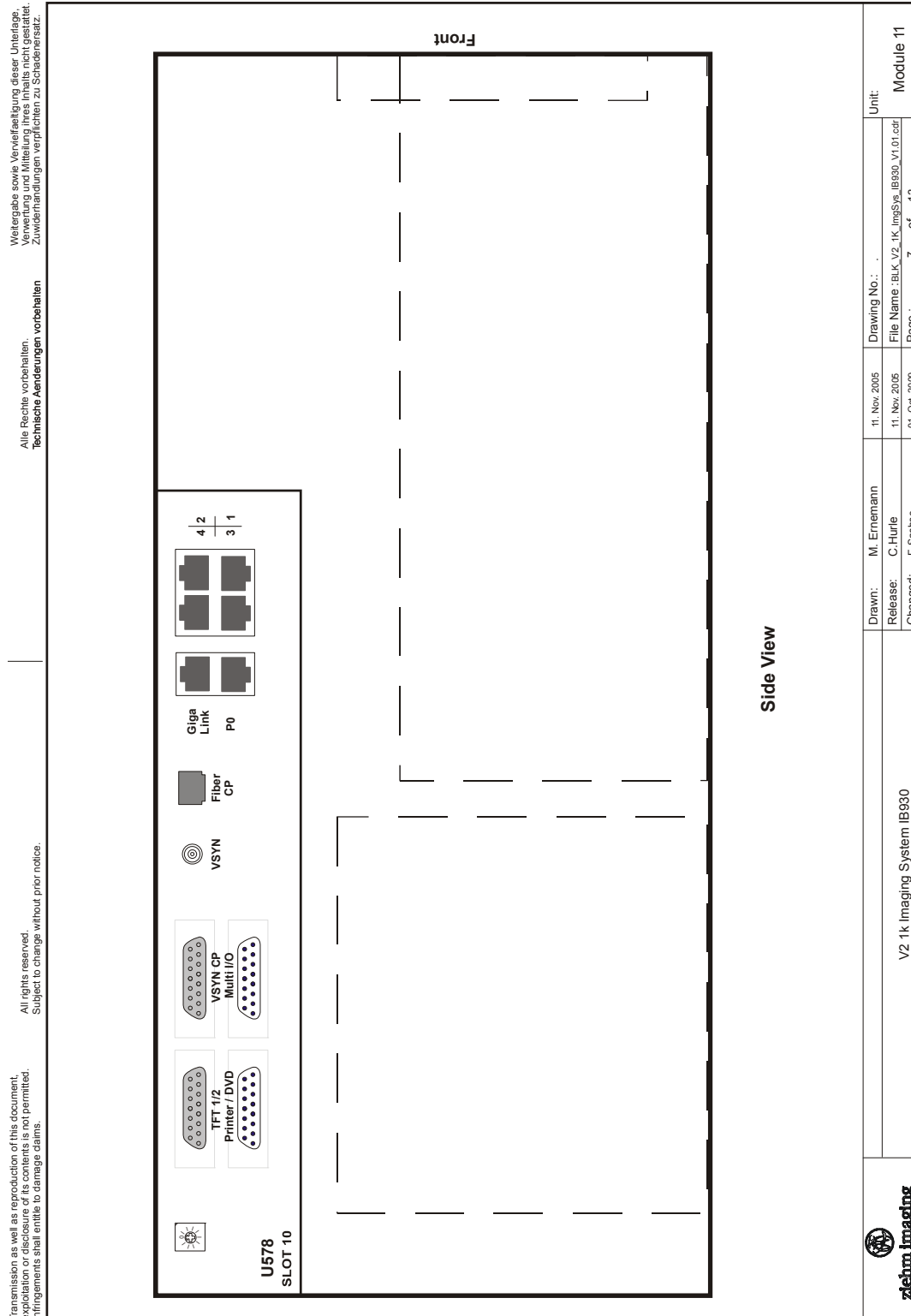


Fig. 13-17 Module 11 side view

13.5 Inside View with 2 x U825

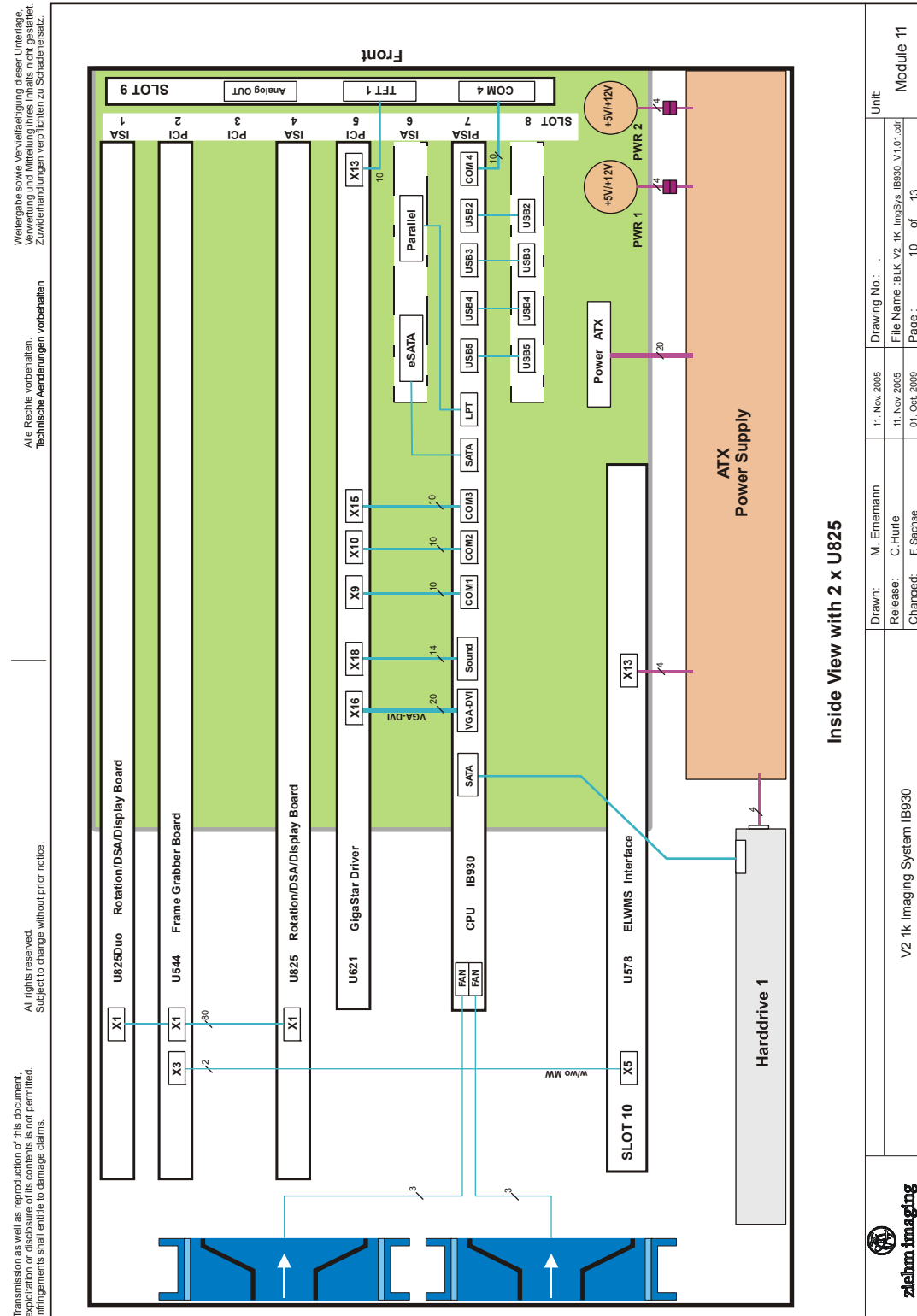


Fig. 13-18 Module 11 inside view with 2 x U825

13.6 Inside View with U622

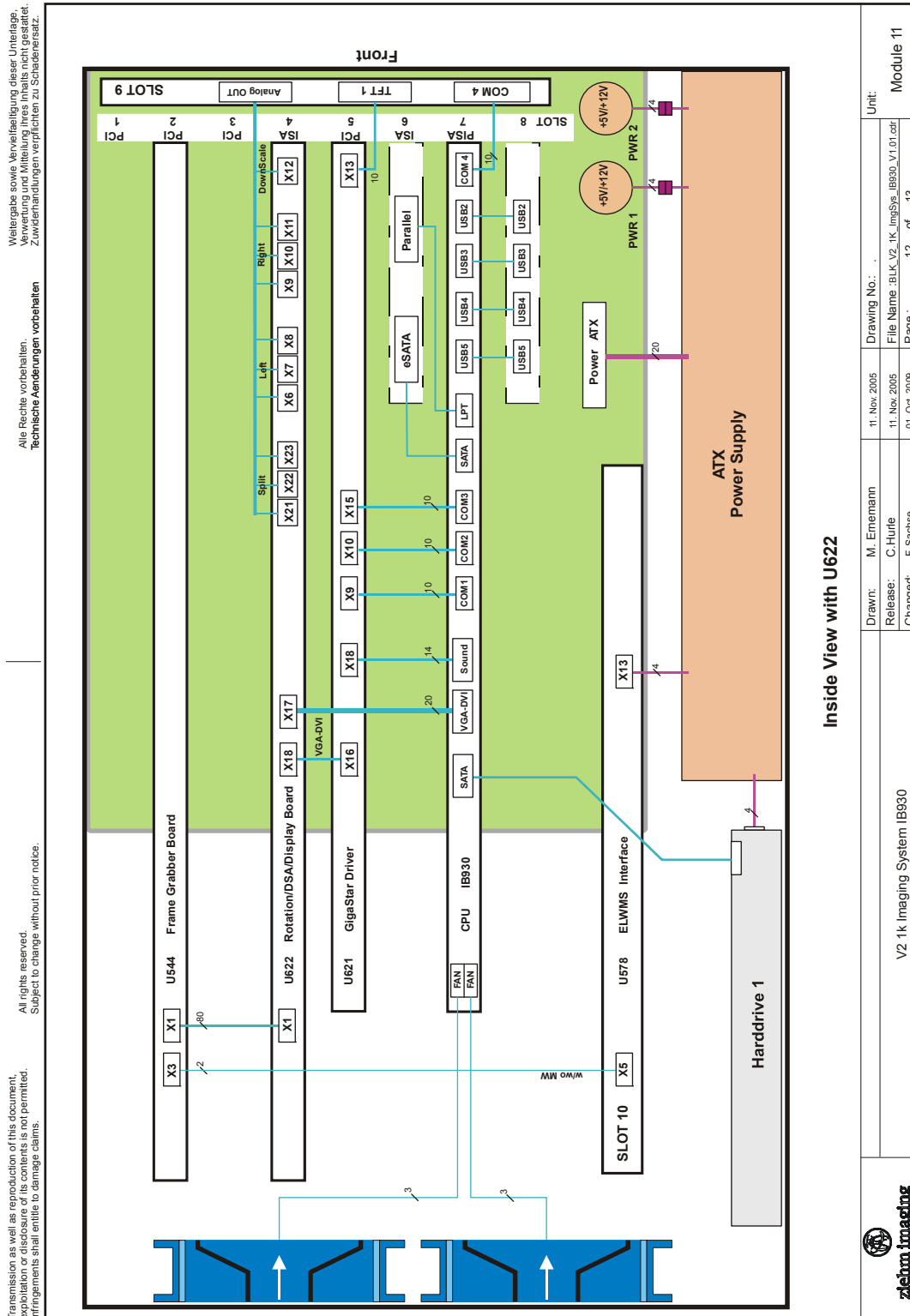


Fig. 13-19 Module 11 inside view with U622

13.7 Regulation Block Diagram

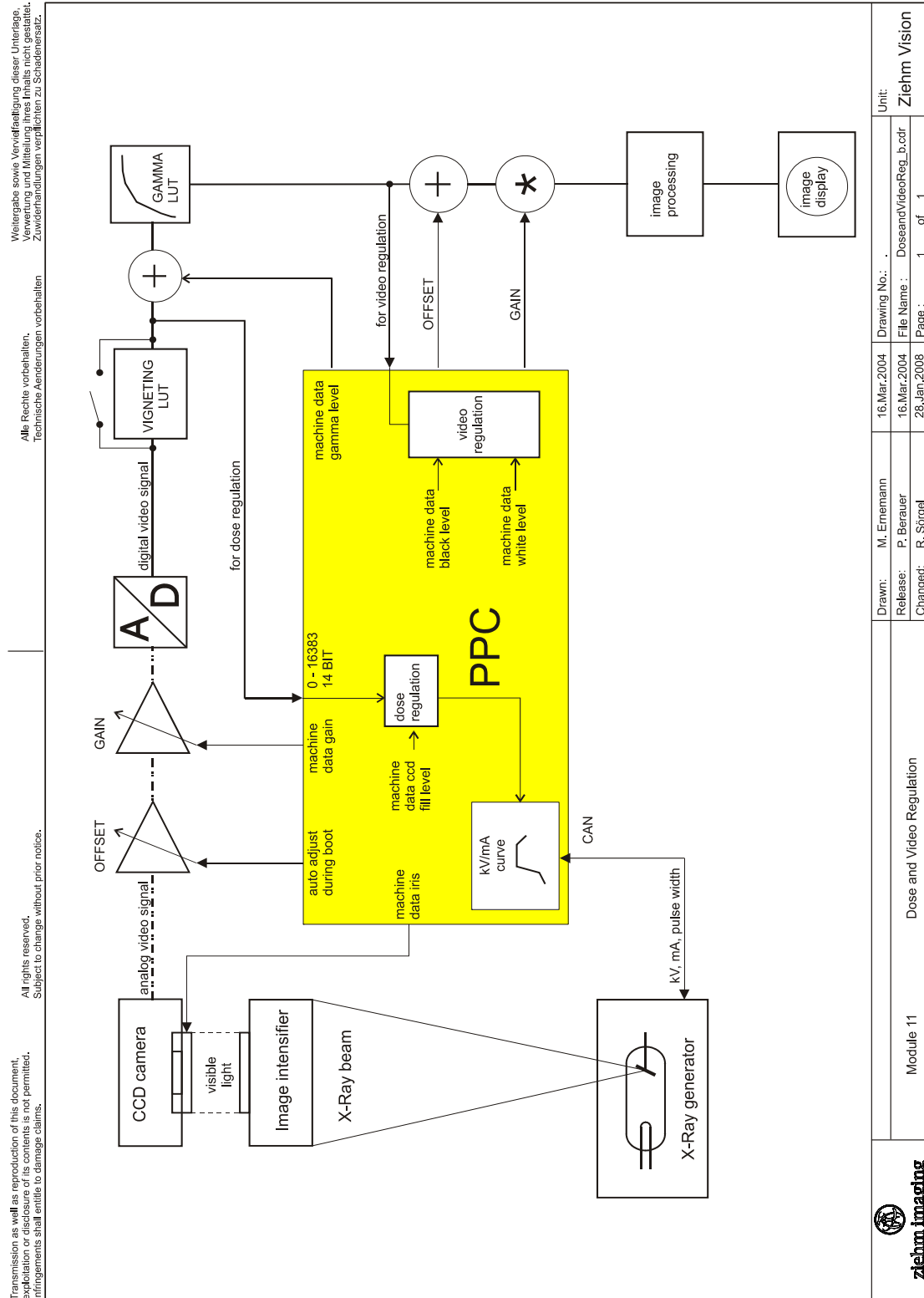


Fig. 13-20 Regulation block diagram

14

DICOM Configuration Manual

14 DICOM Configuration Manual

14.1 Overview

DICOM means **D**igital **I**maging and **C**ommunications in **M**edicine. This worldwide standard was developed by ACR and NEMA for the exchange of information between digital imaging computer systems in medical environments.

The Ziehm C-arm can be supplied with 5 DICOM options:

- 1 With the **DICOM Storage** option you can send X-ray documentation to a DICOM computer network. With **DICOM Storage Commitment** you can get a confirmation from the archive that an image is saved.
- 2 With the **DICOM Media Storage** option you can save X-ray documentation to a USB memory stick or DVD/CD.
- 3 The **DICOM Query/Retrieve** option is used to query patient, study, series and image data from a computer network.
- 4 The **DICOM Worklist** option is used to query a worklist job for today from a computer network. **MPPS** can be used to send worklist jobs into the status “in progress” and finally “completed”.
- 5 The **DICOM Basic Grayscale Print** option is used to print X-ray images to a computer network.

The basic document of the DICOM application is the “**Conformance Statement**”, which is obligation for every “DICOM participant”. With this document you can decide whether the communication between Ziehm C-arm (**SCU** = Service Class User) and server (**SCP** = Service Class Provider) will be successful.

The DICOM transmission needs the network parameters described in the following section:

14.2 Description of the Network Parameters

- IP address
(IP = Internet Protocol)
Every participant in the network gets an IP-address, a 32-bit number:
i.e. 192.168.127.80,
with 192.168.127 group address and 80 single participant
- IP subnet mask
255.255.255.0 (subnet mask "AND" IP address = group address)
- Hostname
Name of the participant in the network, i.e. sun-server with definite assignment to IP address.
- AE Title
(Application Entity)
Name of the DICOM application on the server, i.e. INOARCHIVE for DICOM Storage.
Must be 1 to 16 characters long, otherwise you will get an error message.
- Port Address
At this listen port the server is waiting for instructions from Ziehm NetPort.
Standard port address for DICOM = 104.
- IP Address Gateway
If the group of server and Ziehm NetPort is not the same, you have to define a gateway.
i.e. 192.168.127.250.

14.3 Entering the DICOM Configuration

The DICOM network configuration is performed in a dialog window on the Solo Center. You can access the dialog window in the following way:

Configuration > Service Settings [password or service key] > DICOM

You will get a window "loading configuration". After the configuration has been loaded, the following window will be shown:

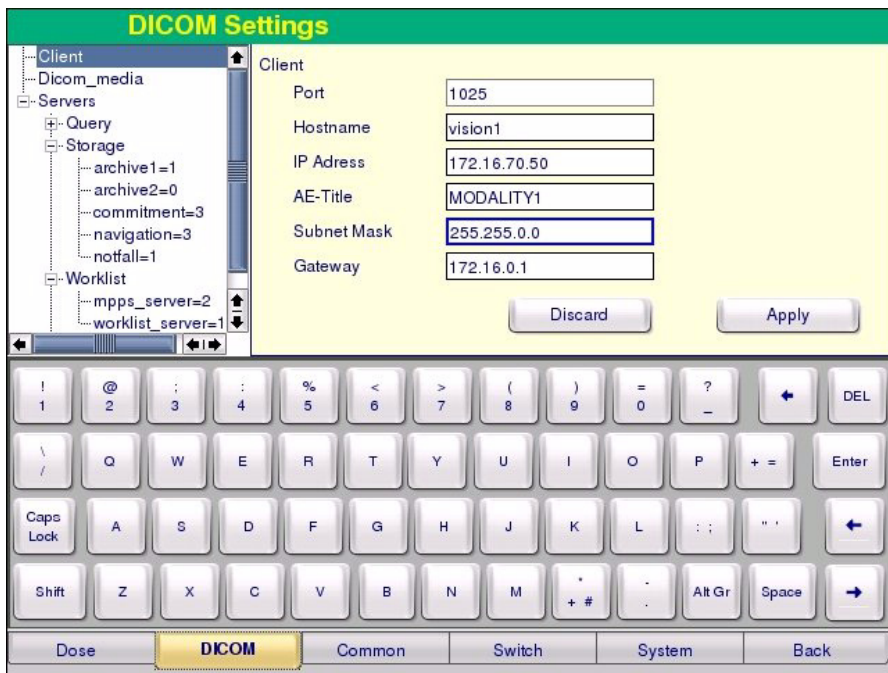


Fig. 14-1 Client configuration form (example parameters)

In the Client configuration form the settings concerning the Ziehm Vision are made.

In order to store the settings press "Apply". Before the settings are stored, they are checked if they are formally right. You will get a message "Verification successful" if everything is formally right. Otherwise you will get an error message, for example "Application Title not 1 - 16 bytes long [v2]".

14.4 Configuring DICOM Servers

14.4.1 Configuring DICOM Media

By clicking “DICOM media” you will get the Media class configuration form.



Fig. 14-2 Media class configuration form

The image attributes in this dialog are used to apply the filter algorithms of the Image Memory to the DICOM images which will be transmitted to the storage medium.

- Setting "off": The attributes are deactivated and the raw image data will be transmitted.
- Setting "on + Annot": The Attributes Rotation, Horizontal mirror, Vertical mirror, Windowing, Edge enhancement, Invert and Zoom will be applied to the transmitted image.
- Setting "on + Overlay": Same as setting "on + Annot", additionally the text overlay will be applied to the image.

An additional network parameter is the SOP (= Service Object Pair) Class:

- XA = X-ray-Angiography
- CR = Computed Radiography
- SC = Secondary Capture

The original model of images on the Ziehm C arm is “XA”.

“CR” and “SC” are implemented for DICOM image viewers that do not support XA.

14.4.2 Configuring DICOM Storage

To configure the storage server, you must click on “storage”. Then you must select a server.

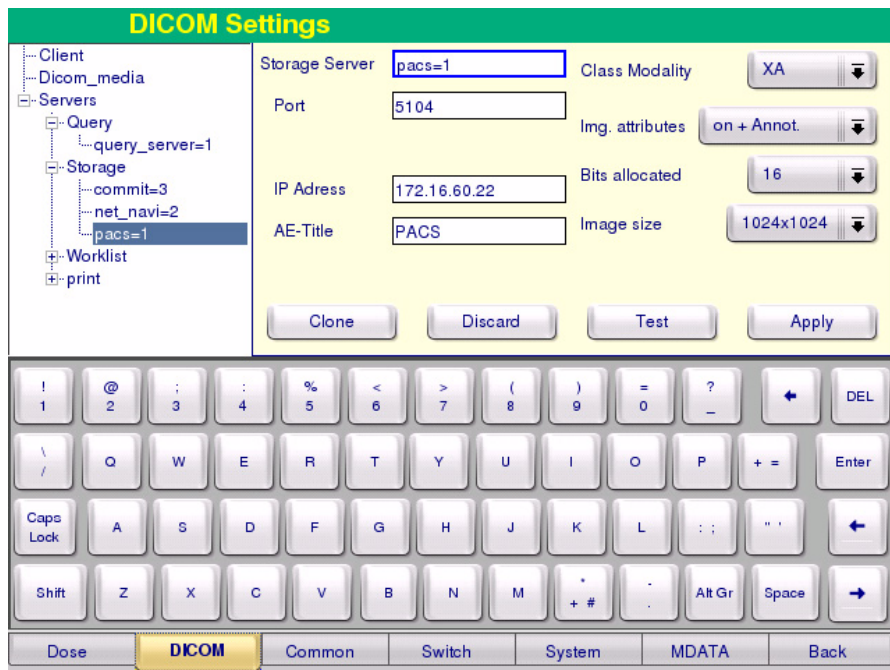


Fig. 14-3 Storage server configuration form (example parameters)

The image attributes in this dialog are used to apply the filter algorithms of the Image Memory to the DICOM images which will be transmitted to the network.

- Setting "off": The attributes are deactivated and the raw image data will be transmitted.
- Setting "on + Annot": The Attributes Rotation, Horizontal mirror, Vertical mirror, Windowing, Edge enhancement, Invert and Zoom will be applied to the transmitted image.
- Setting "on + Overlay": Same as setting "on + Annot", additionally the text overlay will be applied to the image.

An additional network parameter is the SOP (= Service Object Pair) Class

- XA = X-ray-Angiography
- CR = Computed Radiography
- SC = Secondary Capture

The original model of images on the Ziehm C arm is “XA”.

“CR” and “SC” are implemented for servers that do not support XA.

In order to reduce the file size of the transmitted images, the values "Image size" and "Bits allocated" can be selected.

"1024 x 1024" and "16 Bit" is the original resolution of the Image Memory system.

"Test" tests the association negotiation between SCU and SCP (inclusive “ping”), sends an ECHO request to SCP and waits for ECHO response (→ p. 14-13).

In case of success you will get the message “Verification successful”.

"Apply" will store the settings in the file "ae_titel.new". "Discard" will restore the old settings.

14.4.3 Configuring DICOM Storage Commitment

To configure the storage commitment server, you must clone the storage server (→ p. 14-10).

Select the cloned server.

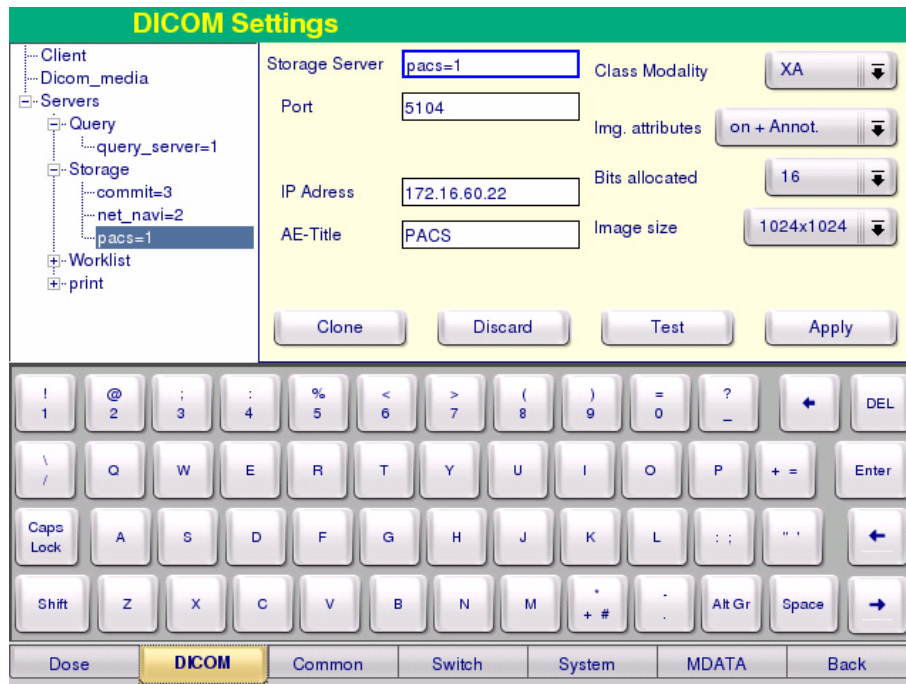


Fig. 14-4 Storage server configuration form (example parameters)

E.g., rename the cloned server to commitment=3. The number has to be 3.

Set up the server configuration and press test (→ p. 14-13).

If the test was successful, a message box "Ask Commitment for stored images ?" appears.

Press "YES" in order to activate automatic Storage Commitment.

Automatic Storage Commitment means:

After successful DICOM Store the Ziehm C-arm sends a Commitment Request to the commitment server and waits asynchronously for the response until the C-arm is switched OFF.

Otherwise:

The Commitment Request is sent by pressing the commitment key in the user dialog.

14.4.4 Configuring DICOM Query / Retrieve

To configure the query server, you must click on “Query”. Then you have to select a server.



Fig. 14-5 Query server configuration form (example parameters)

An additional network parameter is the Query-level.

PATIENT_ROOT: data on patient-level or STUDY_ROOT: data on study-level

The Ziehm NetPort supplies the same result in both models.

In order to set up a separate retrieve server, the query server has to be cloned (→ p. 14-10).

E.g., rename the cloned server to retrieve_server=0. The number must not be 1.

“Test” tests the Association Negotiation between SCU and SCP (inclusive “ping”), sends an ECHO request to SCP and waits for ECHO response (→ p. 14-13).

In case of success you will get the message “Verification successful”.

14.4.5 Configuring DICOM Worklist / MPSS

To configure the worklist server, you must click on "Worklist". Then you have to select a server.

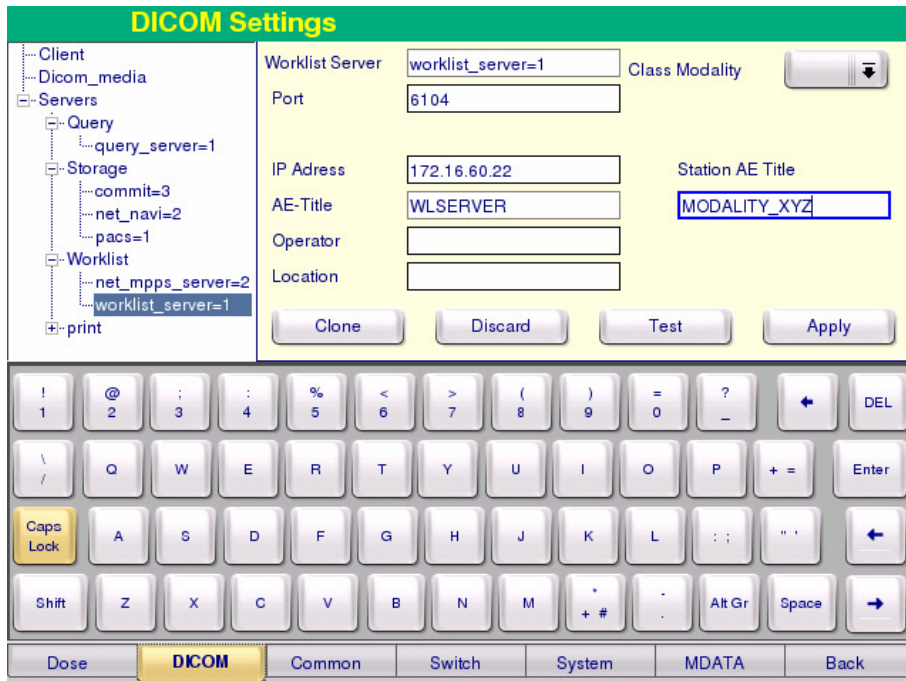


Fig. 14-6 Worklist server configuration form (example parameters)

The matching keys will filter information of the transmitted worklist.

- Class Modality: select type of images to appear
- Station AE title: only images for the AE Title configured in the client mask will appear in the worklist
YES or not: NO
- Location: description of location Ziehm NetPort, i.e. OP1, ...

Additionally:

- Operator: mandatory tag operator's name required for MPSS

In order to set up a separate MPSS server, the query worklist server has to be cloned (→ p. 14-10).

E.g., rename the cloned server to mpps_server=2. The number has to be 2.

Set up the server configuration and press test (→ p. 14-13).

If the test was successful, a message box "Do you want to activate MPSS ?" appears.

Press "YES" in order to activate MPSS.

14.4.6 Configuring DICOM Basic Grayscale Print

To configure the print server, you must press “Print”. Then you must select a server.



Fig. 14-7 Print server configuration screen (sample parameters)

Additional parameters for printer configuration:

- Number of copies: default 1 (1...10)
- Print Priority: default <empty string> (HIGH, MED, LOW)
- Medium Type: default <empty string> (PAPER, CLEAR FILM, BLUE FILM)
- Film Destination: default <empty string> (MAGAZINE, PROCESSOR, BIN_1, BIN_2, ... BIN_9)
- Film Session Label: default <free text>
- ID Film Size: default <empty string> (8INX10IN, 8_5INX11IN, 10INX12IN, 10INX14IN, 11INX14IN, 11INX17IN, 14INX14IN, 14INX17IN, 24CMX24CM, 24CMX30CM, A4, A3)
- Number/Page: default 1 (1, 2, 4, 6, 9, 12, 15, 16, 20, 24) “Multiform”
- Min/Max Density: default <empty string> (0...65535)

14.4.7 Cloning Servers

You can add up to 5 server configurations to every server class by using the “Clone” function.

- Enter a server configuration form.
- Press “Clone”.
- The tree of servers will collapse.
- Expand the corresponding server tree.
- Now the new configuration including the new server will be loaded.
The server will be named:CLONE=0.

Additional server settings are necessary for:

- Separate servers for query and retrieve
- Separate servers for storage and storage commitment
- Separate servers for Worklist and MPPS
- Navigation systems. For navigation systems, the additional server stores images automatically.

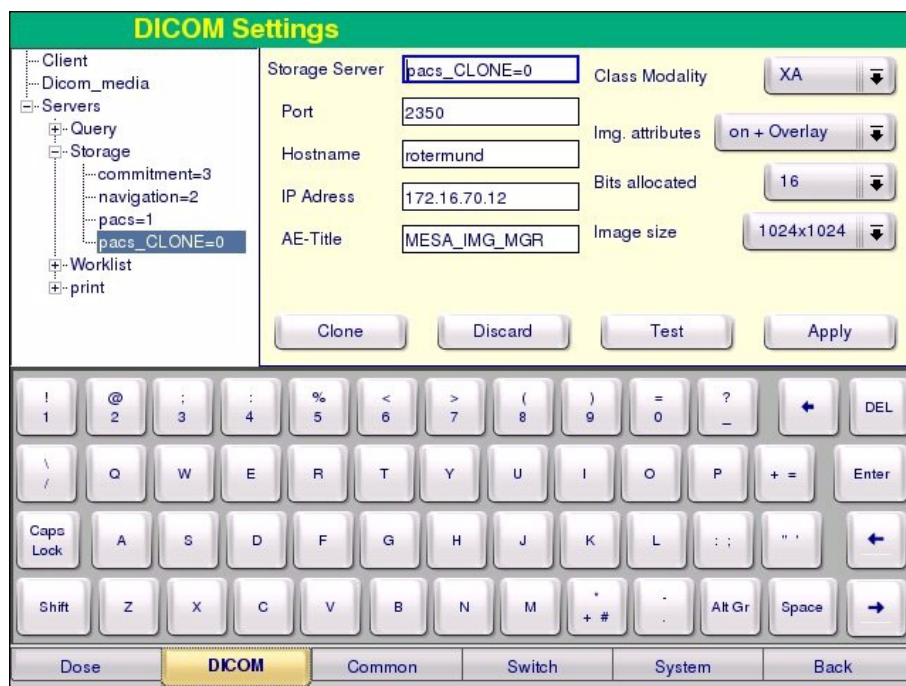


Fig. 14-8 Example for cloned servers

Server names ending in =0 are not active. They can be activated by renaming the server name ending to =1.

The active storage server can as well be selected by the user (→ p. 14-12).

14.4.8 Configuring a Navigation Server

- Clone a storage server.
- Name it net_navigation=2 (server name is the top entry).
- Configure the server settings.
- Change to “Config”, “Operation Settings”.
- Mark “Navigation” and press “Apply”
- Now every image is stored automatically to the navigation server.

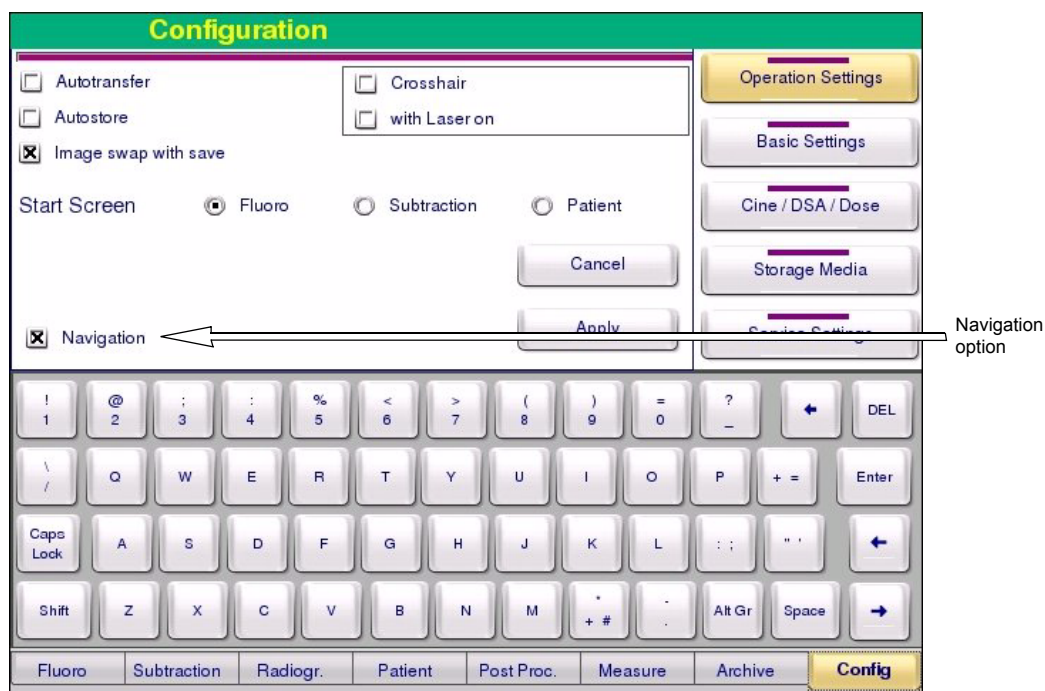


Fig. 14-9 Configuration window with “Navigation” option

14.4.9 Selecting the Storage Server

In the user configuration "Storage media" the different storage servers can be activated by using the dropdown menu.

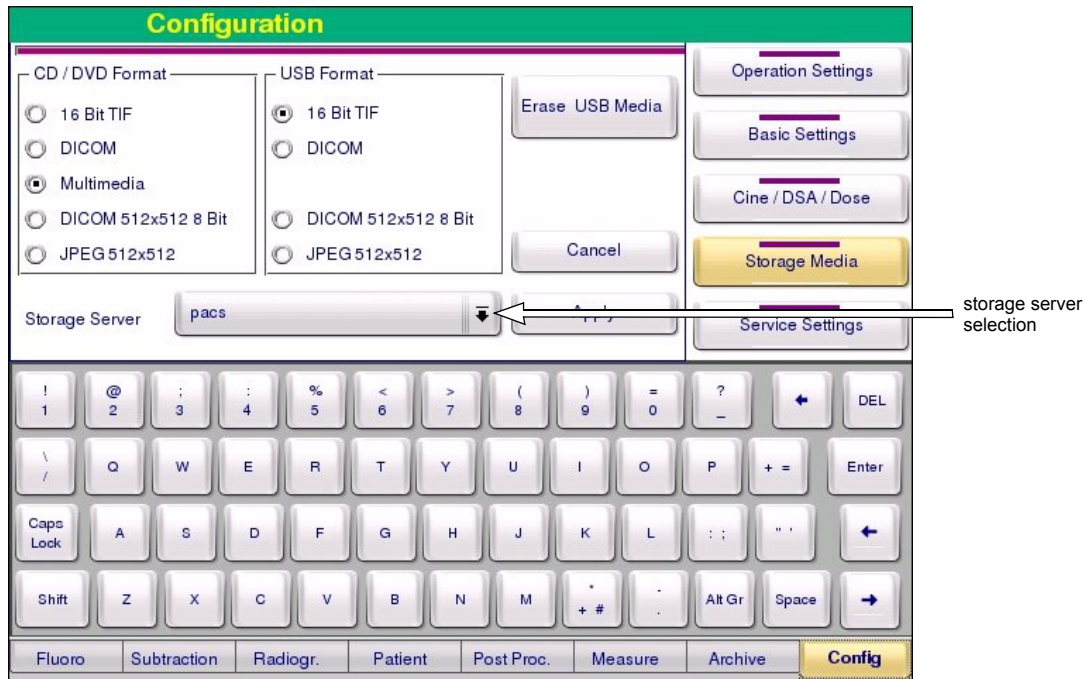


Fig. 14-10 Configuration window with storage server selection

14.4.10 Test of the Configuration with DICOM Verification (Echo)

After configuration of each server you can directly test with button "Test". The verification consists of a "ping"-call and a test of the "Association Negotiation".

The following error messages may occur:

Error message	Cause(s)
Failed to connect to remote host [v5]	Server is not switched on Port-Address DICOM Server is not correctly entered IP-address DICOM Server is not correctly entered IP Subnet Mask is not correctly entered
Unable to resolve host name to IP address [v5]	Hostname DICOM Server not correctly entered
Association negotiation failed [v5]	AE Title DICOM Server is not correctly entered AE Title ZIEHM NETPORT is not correctly entered (when registered on server) System is not registered on server (if server requires registration)
Connection aborted before association negotiation was completed [v5]	Port-Address DICOM Server does not exist Application on server doesn't run
Required Configuration Info Missing [v5]	Wrong mergecom.app
MERGE.INI file cannot be loaded [v1]	Software error
Network unexpectedly shutdown [v11]	Server sends no ECHO-Response but Association Negotiation is OK!
Message service unacceptable for this association [v8]	Wrong mergecom.app No STANDARD_ECHO defined
Time out waiting on network partner [v11]	
Network partner sent an invalid message [v11]	Server does not support Command C_ECHO-RQ Service STANDARD_ECHO (in some cases you have to shut down the server)

Error message	Cause(s)
No connection to server (or ping failed)	Server hardware is switched off IP address of DICOM server is not correctly entered Gateway is not set Subnet mask is not correctly entered Network is interrupted

Code numbers 0-15 are positions in source code, v for Verify, error messages from Storage are labeled by s, from Query q, from Worklist w and from Print p.

16

Software Tools

16 Software Tools

16.1 Vision Studio

The Vision Studio software is used for upgrading the CAN bus modules. It is also used for checking the communication to the CAN modules and for checking the module software versions.



NOTE

For the Ziehm Solo, only software as from version 5.25 is approvable.

16.1.1 Connection between Notebook and Ziehm Solo

There are two options to connect a notebook to the Ziehm Solo.

- To the mobile stand via a nullmodem cable → *Ch. 16.1.1.1, p. 16-2*
(RS232 to CAN interface located on U515 board "SERCAN")
 - requires nullmodem cable
 - access to RS232 interface without opening the system
 - lower data transfer rate compared to USB-CAN
- Directly to the CAN bus by USB-CAN Adapter → *Ch. 16.1.2.1, p. 16-3*
 - Provides faster programming,
 - requires separate USB-CAN Adapter,
 - necessary to open the system

The connection has to be configured in the Vision Studio interface dialog. → *Fig. 16-5, p. 16-4*

16.1.1.1 Connection via RS232 Serial Interface

16.1.1.1.1 Location of the Serial Connector

The serial connector is located on the interface panel at the mobile stand.

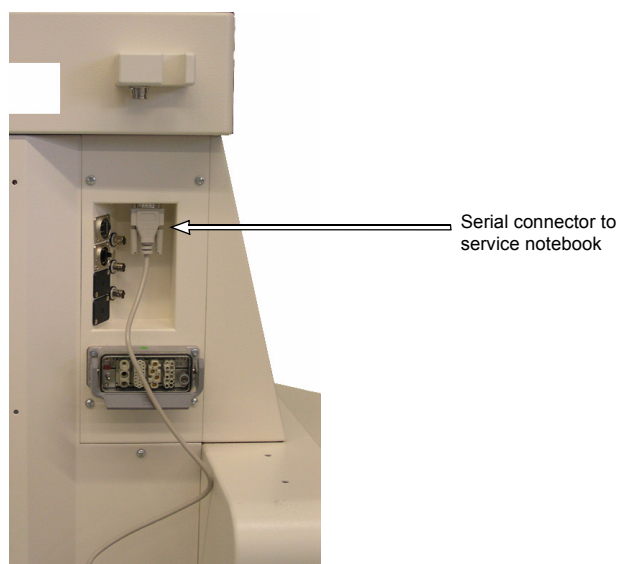


Fig. 16-1 Location of serial connector for notebook at the mobile stand

16.1.2 Connecting by RS232 Serial Interface

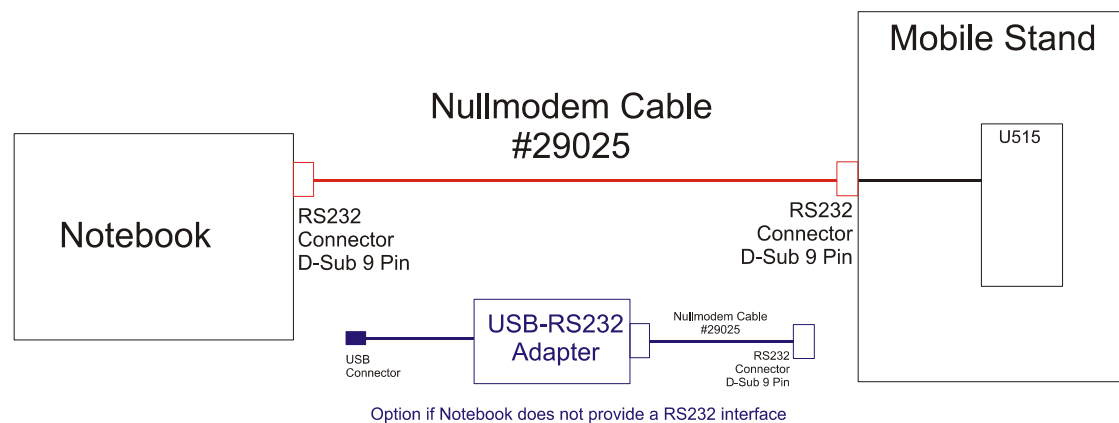


Fig. 16-2 SERCAN service connection

16.1.2.1 Connection via USB-CAN Adapter

16.1.2.1.1 Location of the CAN Connectors

In order to connect directly to the CAN-bus, the mobile stand has to be opened. The adapter cable can be connected to the CAN distribution either on the U515 main interface or the U578 interface of the Image memory.

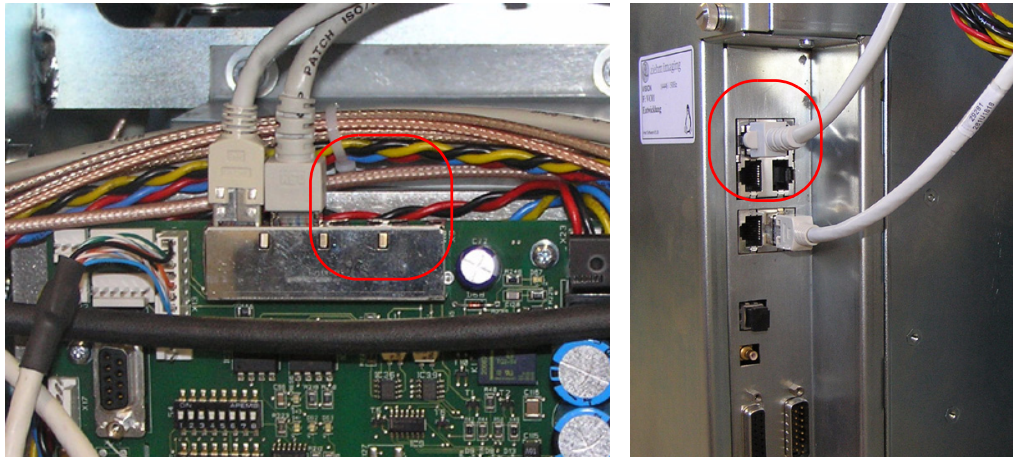


Fig. 16-3 Location CAN connectors

16.1.2.1.2 Connecting by USB-CAN Adapter

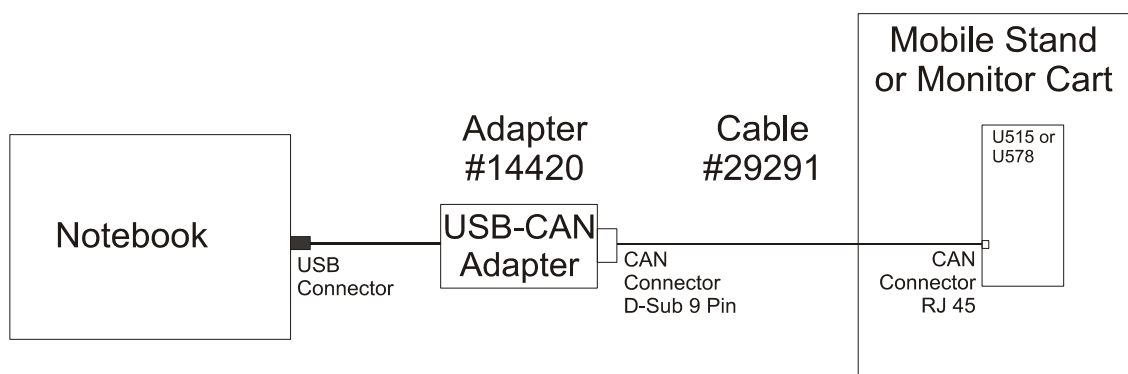


Fig. 16-4 CAN-USB service connection

16.1.3 Starting the Vision Studio

In order to start the Vision Studio, you will find the Vision Studio in the Start menu>Programs>Ziehm Imaging>Vision Studio.

It is recommended to create a shortcut on the desktop.

If you start the Vision Studio software the GUI (Graphical User Interface) possibly will not start. If you get a window "Connecting the vision", followed by a message box "Interface", the SERCAN or USB-CAN adapter cannot be found.

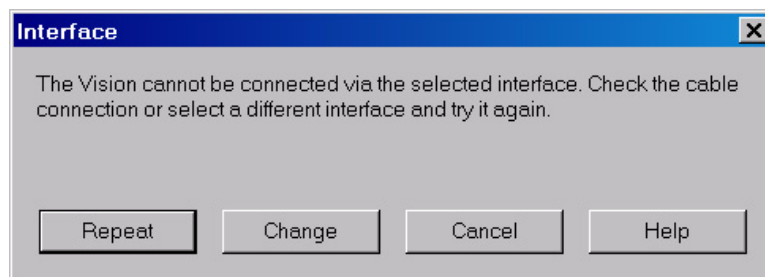


Fig. 16-5 Message box "Interface"

Check your cable connection. If the cable is connected correctly, press the "Change" button.

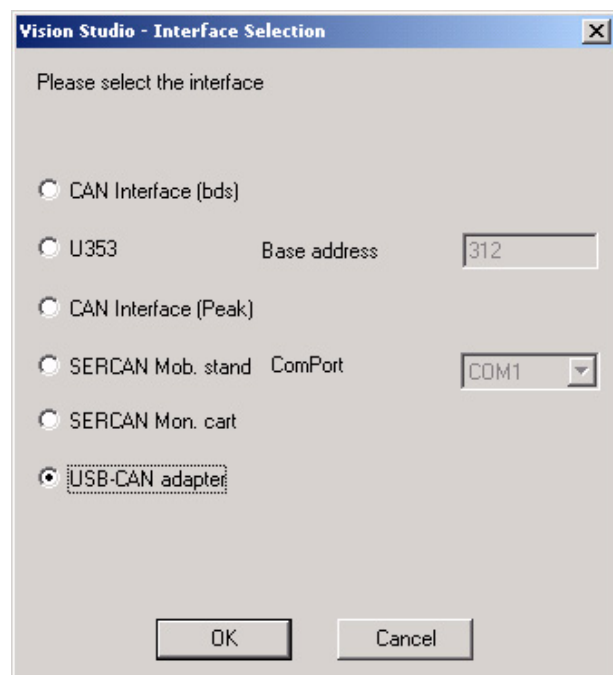


Fig. 16-6 "Interface Selection" dialog box

For the SERCAN connection select "SERCAN Mob. stand" Select the com port your notebook uses.

For The USB-CAN connection select USB-CAN adapter.

The other options refer to cards for stationary computers and are not used for field service.

If everything is configured correctly, after pressing "OK" the GUI will start.

16.1.4 Vision Studio User Interface

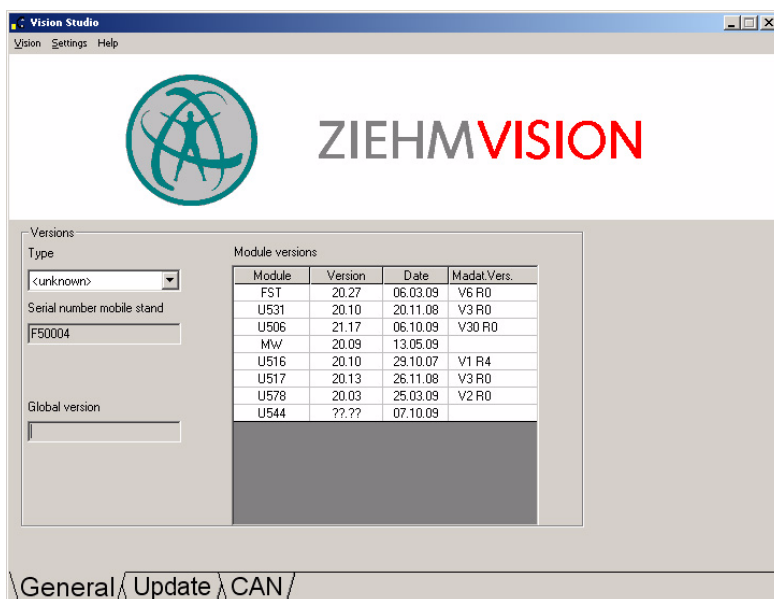


Fig. 16-7 Graphical user interface of Vision Studio

In the “General” section, you will get information about:

- C-arm type
- Serial number of the mobile stand (From EEPROM on U515)
- Global SW version
- SW versions and machine data versions of every CAN bus module



NOTE

If the C-arm is identified as "unknown", the C-arm type must be selected from the dropdown list.

If no Type is selected, an error message will appear if you try to select the section "Update" (→ Ch. 16.1.4.1, p. 16-6).



NOTE

A global software version is displayed only if the “Module version” information matches an entry in a file titled “convert.dat” (→ Ch. 16.1.8.1, p. 16-17).

16.1.4.1 C-arm Type Selection

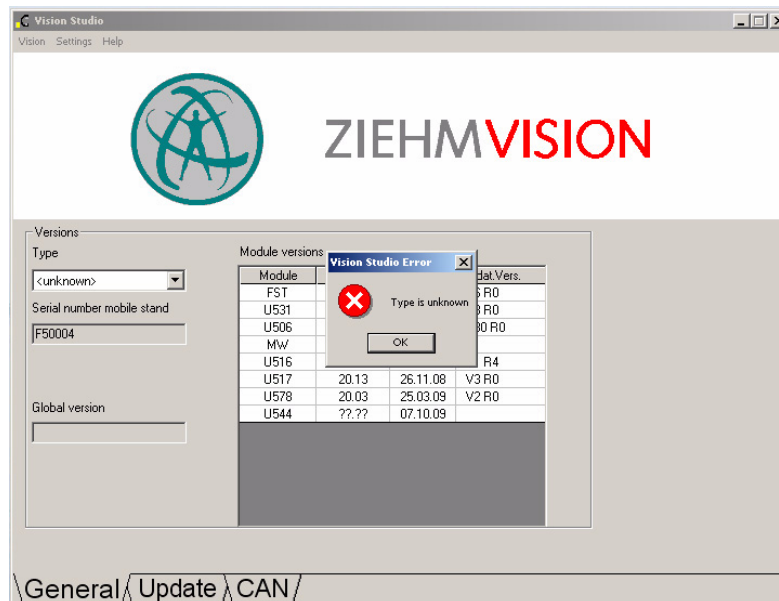


Fig. 16-8 "Type is unknown" Error

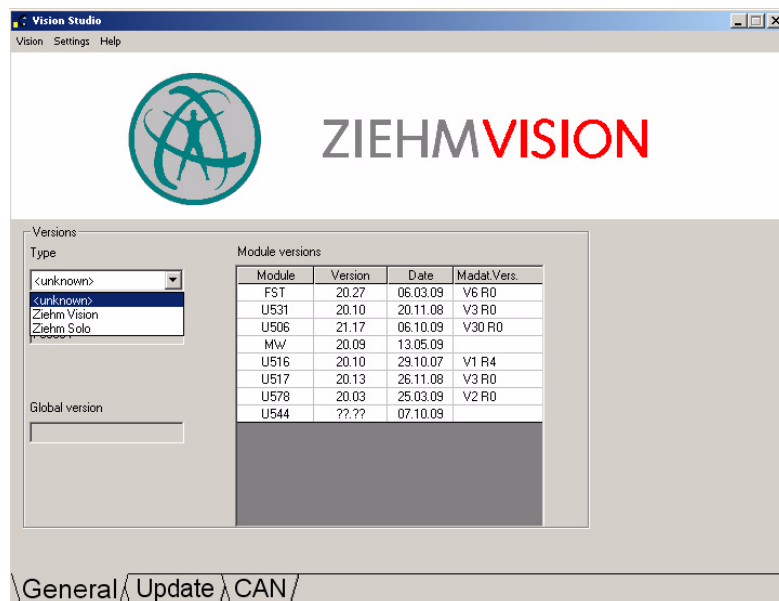


Fig. 16-9 Dropdown list to select C-arm type

16.1.4.2 Example of the "convert.dat" file

A global software version only is displayed if the "Module version" information matches an entry in a file called "convert.dat" (→ Ch. 16.1.8.1, p. 16-17).

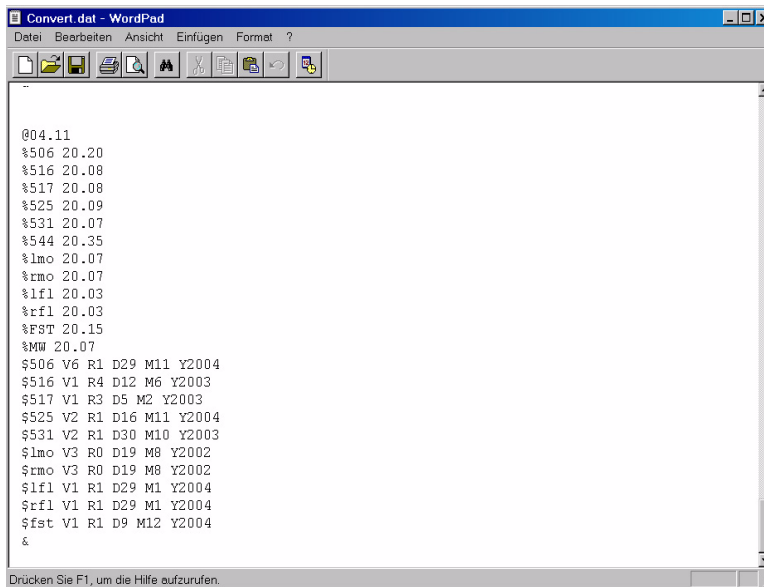


Fig. 16-10 Section of "convert.dat" file

16.1.5 Menu Bar of Vision Studio software

16.1.5.1 “Vision” Menu

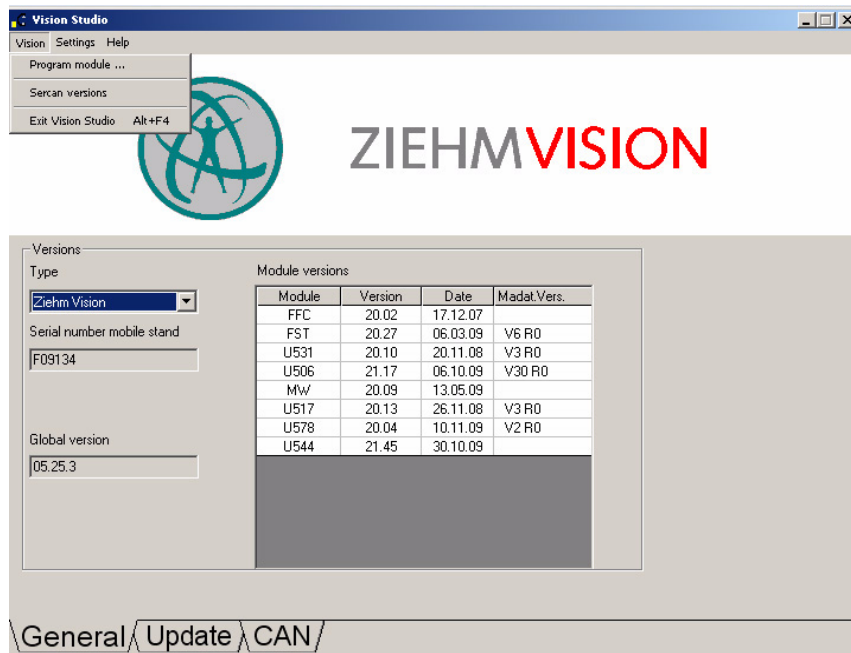


Fig. 16-11 “Vision” menu

The “Vision” menu offers three items:

- “Program module”
- “SERCAN versions”
- “Exit Vision Studio”

16.1.5.1.1 “Program Module...”

The “Program module...” item opens a window which allows to program single modules manually without machine data conversion and transmission. This is required if a module has no software and will not be displayed in the “Update” section anymore.

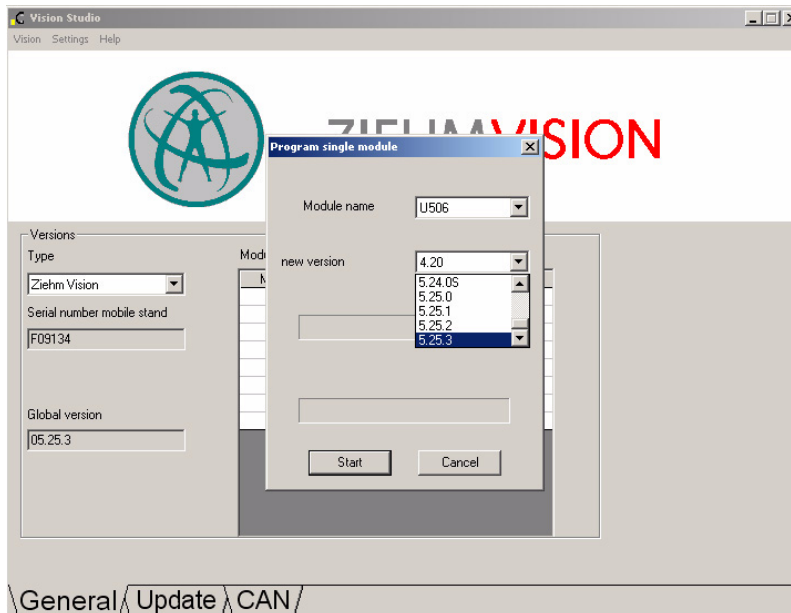


Fig. 16-12 “Program single module” dialog box

The module name and the required software version (corresponding to a global release) have to be selected. Now the programming can be started. After programming, machine data for the module has to be transmitted.

Available Modules are:

- U506 Generator
- U516 Image intensifier with U516 controller board
- U517 Virtual collimator
- U525 Printer control
- U531 Pre power supply / pre power supply master in Ziehm Vision R
- U544 Power PC located on U544
- LMon Left CRT monitor
- RMon Right CRT monitor
- RFlat Right flatscreen monitor controller (will not be present in any system)
- LFlat Left flatscreen monitor controller U545, for radiation lamp control only
- MW CAN bus master U544 inside the image memory
- FST U515 board inside the C-arm stand, C-arm control
- PPS1 Pre power supply slave 1 in Ziehm Vision R
- PPS2 Pre power supply slave 2 in Ziehm Vision R
- U578 ELWMS Interface inside image memory
- U608 Virtual collimator with U608
- U632 Image intensifier with U632 controller board
- FFC Flat Field Control (Auxiliary U544 in Ziehm Vision FD systems)
- SerFST SERCAN controller on U515
- SerMW SERCAN controller in Image Memory (Not available if U578 is equipped)

16.1.5.1.2 “SERCAN Versions”

The “SERCAN Versions” item will open a message box which displays the SERCAN versions.

The SERCAN modules can only be updated by the “Program module” option. Only the SERCAN which is currently not connected can be programmed.

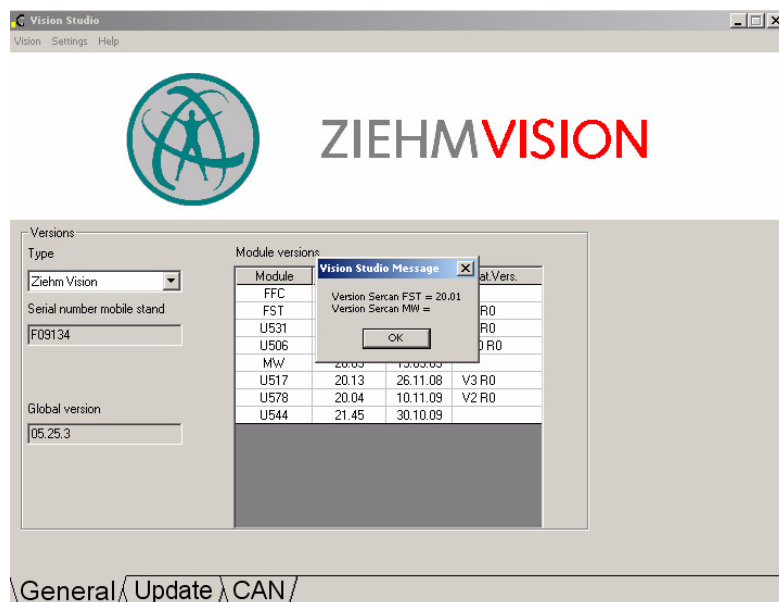


Fig. 16-13 “SERCAN Versions” message box

In Ziehm Solo systems the Sercan MW will not be present.

16.1.5.1.3 “Exit Vision Studio”

This will terminate the software.

16.1.5.2 “Settings” Menu

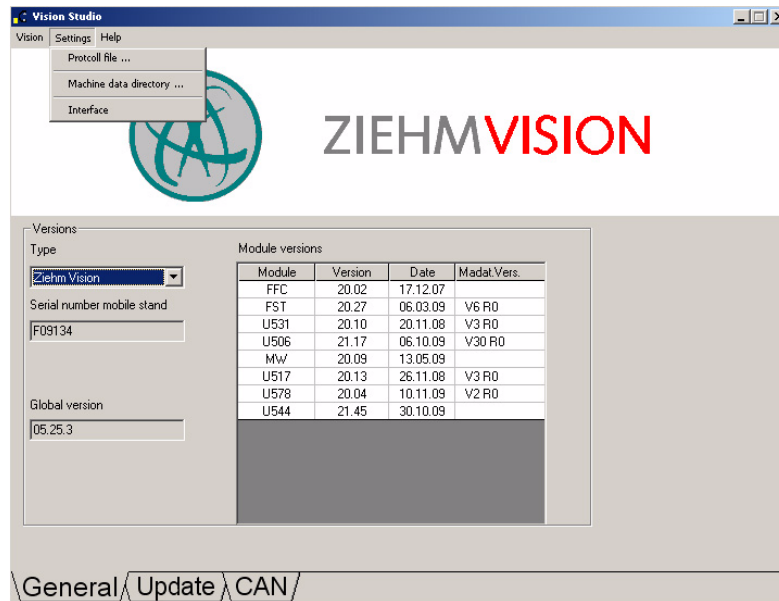


Fig. 16-14 “Settings” menu

The “Settings” menu offers three items:

- “Protocol file...” This function is not supported
- “Machine Data directory”
- “Interface”

16.1.5.2.1 “Machine Data Directory”

The “Machine data directory” item will open a browser window which allows you to set the working directory of the Vision Studio. The directory is required for:

- Storing the downloaded original machine data of the unit
- Storing the factory default machine data (copied from the installation directory)
- Storing the “**convert.dat**” file (copied from the installation directory)
- Storing the converted machine data (compiled from original and factory data during update)
- Backup of original machine data of the unit

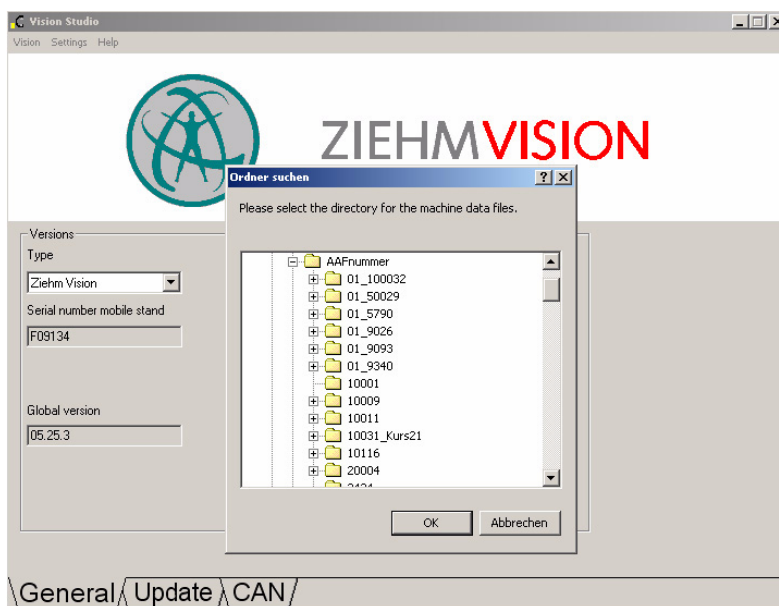


Fig. 16-15 Browser window for setting the machine data directory

16.1.5.2.2 “Interface”

This will open the interface selection dialog as described above (→ Ch. 16-6, p. 16-4).



NOTE

Opening the interface dialog will terminate an existing connection. Vision Studio has to be closed and restarted.

16.1.6 “Update” Section

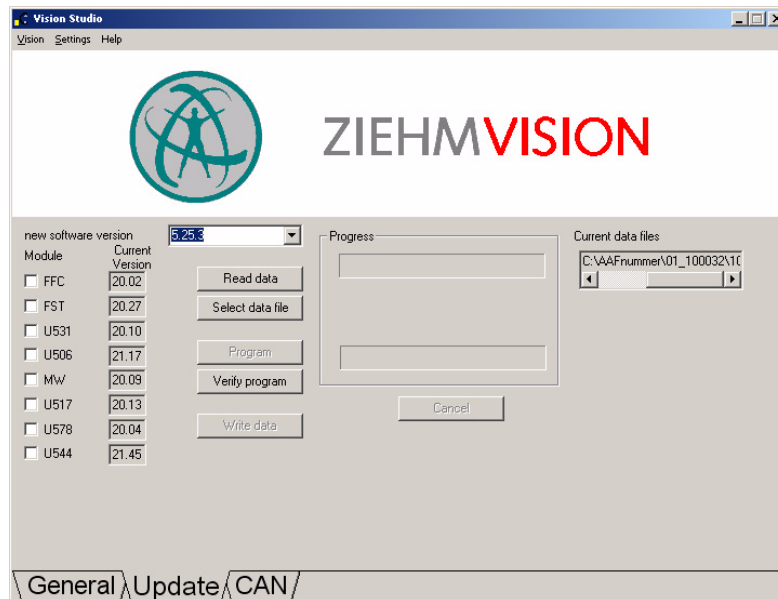


Fig. 16-16 Update dialog

The “Update” dialog is used to update the CAN module software, to download machine data to a storage medium and to restore machine data.

- “New software version”: Combo box for selecting the software version to be programmed.
- “Module”: Marked boxes indicate the modules that will be programmed. Modules which require an update are marked automatically when the software version is selected. Markers can be set or removed manually as well. Only modules detected in the bootup phase will be displayed. For programming missing modules use “Program module...”.
- “Current Version” indicates the currently installed module version. This item will disappear when programming of the concerning module has started.
- “Read data” will download the machine data to the selected machine data directory.
- “Select data file” allows to select and restore machine data from a storage medium (HD, FD, CD,). This has to be done individually for every file that needs to be restored.
- “Program” will start the semi-automatic programming procedure.
- “Verify” will compare the installed software to the software files of the Vision Studio.
- “Write data” will restore machine data files to the Ziehm Solo.
- “Progress” indicates the programming progress. The upper bar indicates the complete procedure, the lower bar indicates the current step.
- “Current data files” indicates the machine data folder which is currently used.

16.1.7 “CAN” Section

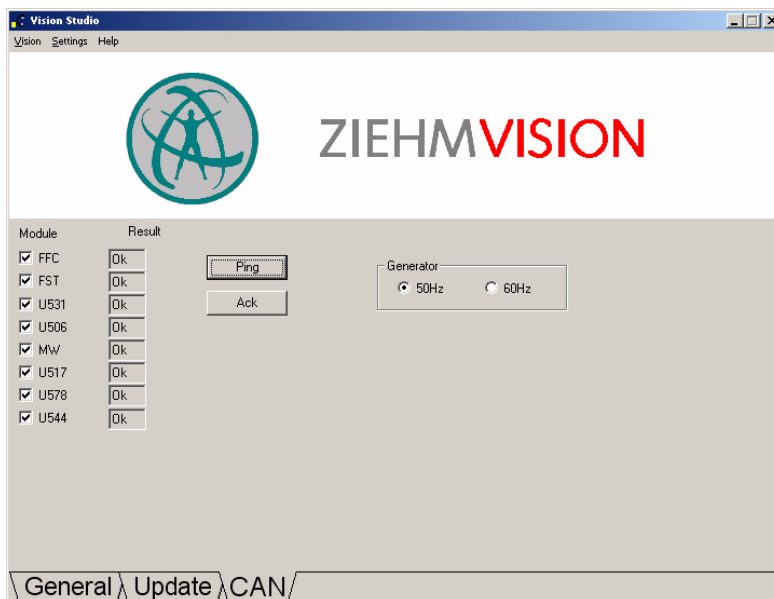


Fig. 16-17 CAN dialog

The CAN dialog allows to “ping” CAN modules and to display the acknowledge (answer of the module). Also the generator can be switched from 50Hz to 60Hz mode.

- “Module”: Marked boxes indicate the modules that will be pinged. Only modules detected in the bootup phase will be displayed
- “Result” indicates the result of the “Ping”:
 - “Ok”: the ping was successful, the pinged module has returned an acknowledge.
 - “Timeout”: the ping was not successful, the pinged module has not returned an acknowledge within a specified time window.
- “Ping” sends the ping to the selected modules.
- “Ack” clears the messages in the result fields.
- “Generator”: the generator can be switched from 50Hz to 60Hz mode in order to adapt to the CCD camera / Flat panel timing.
 Vision R generators and Vision generators equipped with U565 controller will automatically detect the correct setting. For those generator types the selection and Indication of 50Hz/ 60Hz is void.

16.1.8 Machine Data Folder

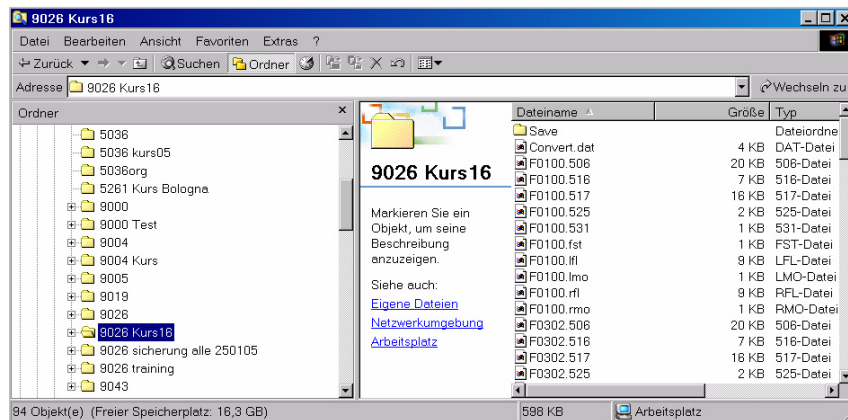


Fig. 16-18 Machine data folder with “Save” folder, “convert.dat” file and factory default data

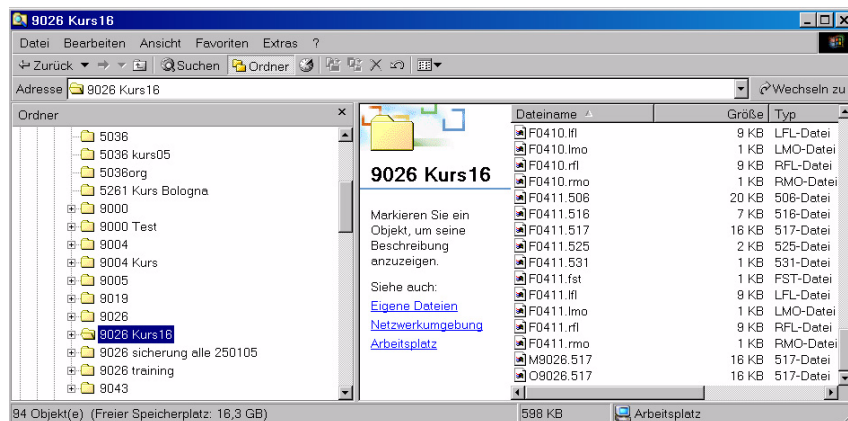


Fig. 16-19 Machine data folder with factory default-, original and converted machine data

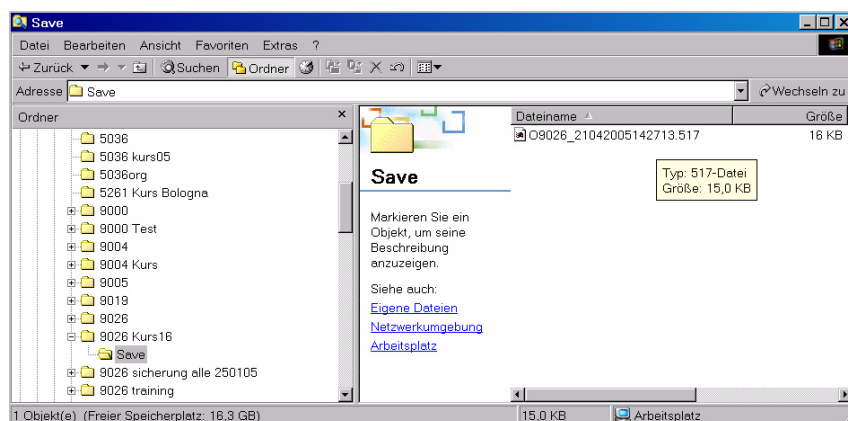


Fig. 16-20 “Save” folder with machine data backup

16.1.8.1 “Convert.dat” file

The “Convert.dat” file is copied to the machine data folder from the installation directory of the Vision Studio, when a new folder is selected.

The “Convert.dat” file defines the global software versions. The file consists of a list of global software versions. For every global software version, there is a list of software and machine data versions. The information about software and machine data versions downloaded from the Vision is compared to this list. If there is a match with a defined global software release, the version number is displayed in the “Global” section.

This file is also used to identify the modules which need to be changed to fit to a certain global software release. When a software version is selected in the update dialog, the existing software versions are compared to the corresponding entry in the Convert.dat file. Every module that does not match will be marked automatically for programming. Thereby only modules which have been changed for a new global software version are programmed.

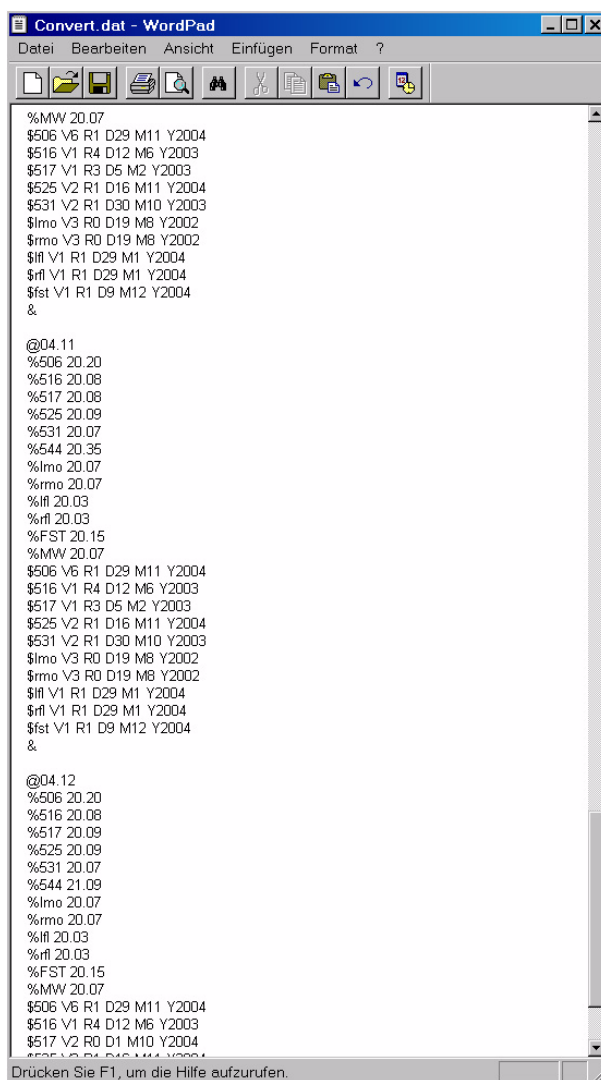


Fig. 16-21 “Convert.dat” file

16.1.8.2 Factory Machine Data

All file names starting with “F” are factory default machine data. They are copied to the machine data folder from the installation directory of the vision studio, when a new folder is selected.

Factory default machine data are used if new values have to be implemented or existing values have to be changed (For example different values for the generator supply power calculation).

For example: F0411.517

F (factory default data), 0411 (Version 04.11). 517 (for the module U517)

16.1.8.3 Original Machine Data

All file names starting with “O” are original machine data. They are downloaded from the Ziehm Solo to this folder when the “Read Data” button is pressed.

For example: O9026.517

O (original data), 9026 (serial number). 517 (for the module U517)

16.1.8.4 Converted Machine Data

All file names starting with “M” are converted machine data. These files are compiled from the original files and the factory default files when the program button is pressed. New values or values that have to be changed are taken from the factory data. Machine or user dependent data is taken from the original files.

The converted file will be restored to the Ziehm Solo during the update procedure.

For example: M9026.517

M (converted data) 9026 (serial number). 517 (for the module U517)

16.1.8.5 “Save” Folder

In the “Save” folder, a backup of the original machine data is stored. The file name is extended by date and time of the download. Since this is different for every download, the files here will not be overwritten, unlike the original data in the machine data folder.

If a backup machine data file has to be restored, the file has to be copied in the level above and the time and date information has to be removed. Now the file can be selected by “select data file” in the Update dialog.

For example: O9026_21042005142713.517

O (original data) 9026 (serial number) 21042005 (Date 21.04.2005) 142713 (Time 14:27:13)
517 (for the module U517)

16.1.9 Installation Directory

After installation you will find the folder “Vision Studio” in your program directory.

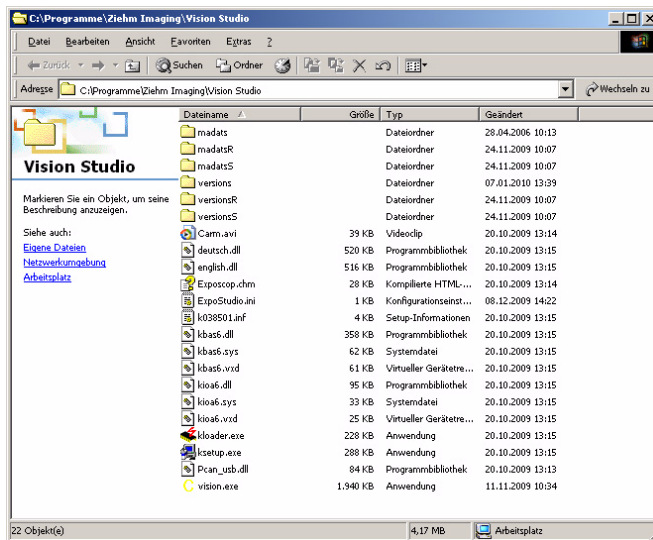


Fig. 16-22 Vision Studio installation directory

You will find the following files and folders:

- **madats:** folder that contains the factory default machine data and the “convert.dat” file madats for Vision, madatsR for Vision R, madatsS for Solo
- **versions:** folder that contains all software files for the CAN modules versions for Vision, versionsR for Vision R, versionsS for Solo
- **Carm.avi:** animation which is displayed during startup of the Vision Studio
- **deutsch.dll** and **english.dll:** language libraries
- **Exposcop.chm:** online help file (compiled html)
- **Exposcop.ini:** Initialization file
- All files starting with “k”: system files and libraries
- **Pcan_usb.dll:** library for CAN-USB interface
- **vision.exe:** Vision Studio, double-click to start Vision Studio

16.1.10 Update Procedure

- 1 Connect your notebook computer to the Ziehm Solo and start the Vision Studio.
- 2 Create a folder for the machine data. Name it e.g. by the serial number of the unit.
- 3 Select this folder by the menu "Settings" > "Machine data directory".
- 4 Change to section "Update"
- 5 Select the software version you want to install.
- 6 Modules which require programming are marked automatically.
- 7 Press "Read data"
- 8 Wait until Message box "Machine data read into current files" appears
- 9 Press "OK" button
- 10 Press "Program"
- 11 A semi-automatic programming procedure is started.
 - All selected modules are programmed and verified.
 - When the message box "**Please switch the system OFF and ON**" appears, do so in order to reset, wait until boot up has finished and press OK.
 - Machine data is transferred.
 - A message box "**Programming and machine data transfer from the current files successful**" appears.
 - Press "OK".
 - When the message box "**Please switch the system OFF and ON**" appears, do so in order to reset, wait until boot up has finished and press "OK".
- 12 Programming is finished.



NOTE

Error messages which may appear after the first reset of the unit (before converted machine data is transmitted) can be ignored.

16.2 Solo Center Service Settings

The service settings are used to do adjustments and set-up of the Ziehm Solo.



NOTE

Following screenshots refer to Software V5.28.

Other software versions may show different content.

16.2.1 Access to the Service Settings

There are two ways to access the Service settings:

1 Password

The password will give you limited access to the service settings.

If you are an authorized person, you can obtain the password from your local Ziehm dealer.

After pressing the button "Service Settings" a password window will open.

Type in the password and press the button "Continue"

2 Service Key (USB Pen Drive)

The Service Key will give you full access to the service settings.

You will obtain a Service Key during technical training on Vision Family systems.

The Service Key is valid for 2 years after issue.

After pressing the button "Service Settings" the service settings will open immediately, if a valid service key is connected to the USB port.

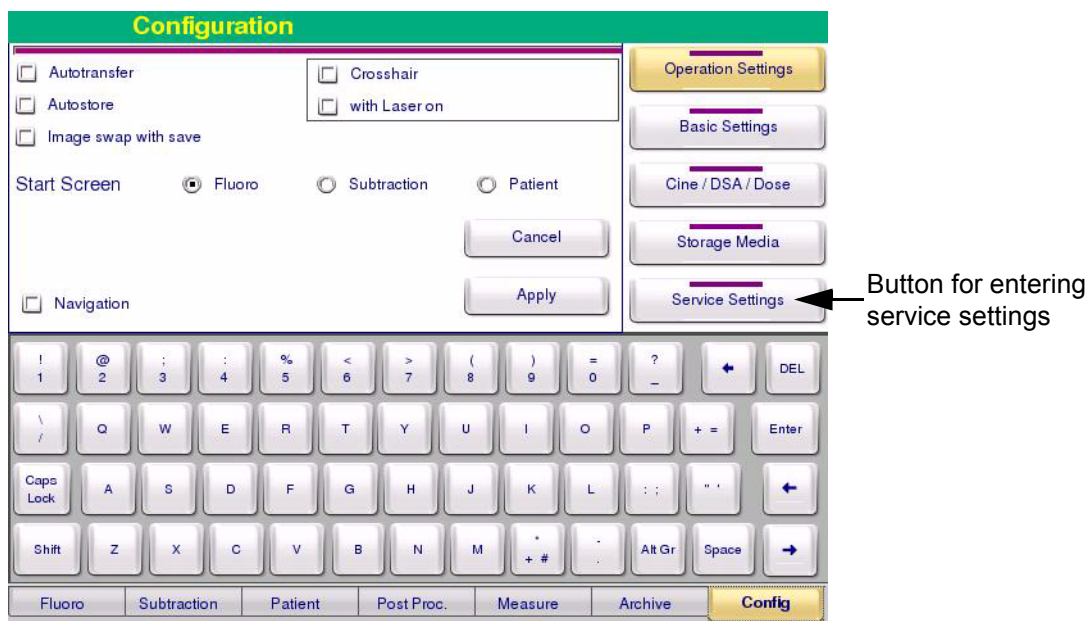


Fig. 16-23 Configuration page with button "Service Settings"

16.2.2 Service Settings Start Screen

After entering the service settings the following screen will be displayed:

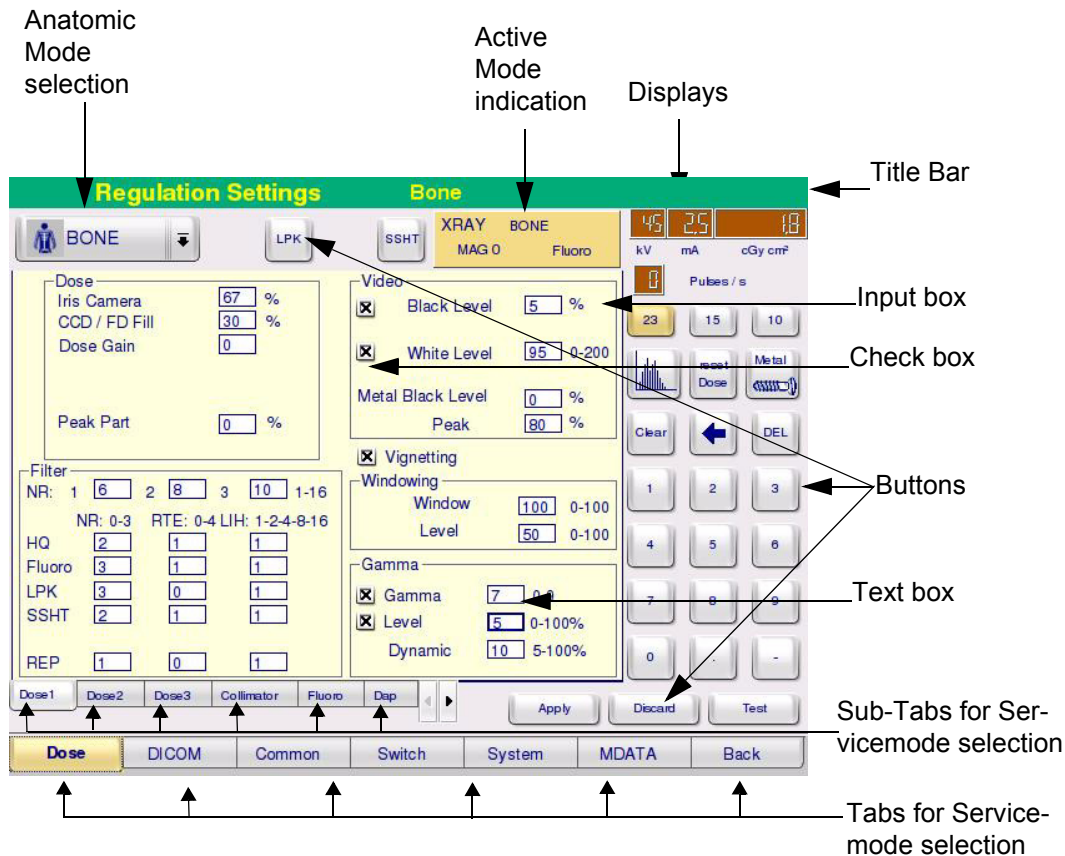


Fig. 16-24 Service mode start screen

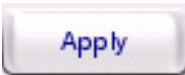
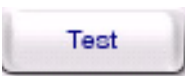
16.2.3 Service Mode "Dose"

After entering the service settings, the service mode "Dose" will be shown.

By pressing the sub-tabs the input boxes will change.

All other controls and indicators will remain the same as long as the service mode "Dose" is active.

Symbol(s)	Meaning
	Dropdown list to select anatomic mode to be adjusted. Press "Test" button to activate new selection
	High Quality. Selects the high quality supplementary function for adjustment. (not available in Ziehm Solo Systems) Press "Test" button to activate this selection
	Adipose Patient. Selects Adipose Patient supplementary function for adjustment. Press "Test" button to activate this selection
	Snapshot. Selects the snapshot supplementary function for adjustment. Press "Test" button to activate this selection
	Active mode indication. Shows currently activated mode. New mode selection will be displayed here after the "Test" button has been pressed
	Display. Displays kV, mA and Dose area product. kV and mA values are nominal values. Dose value is a measured or calculated actual value.
	Pulse rate display. Shows the current pulse rate. Will be "0" if Auto Dose Reduction is active and system does not screen.
	Magnify. Select the field size for adjustment. Press "Test" button to activate this selection
	Histogram. Activates the histogram function for video adjustment. → Ch. 17.2.2, p. 17-4
	Reset Dose. Manually resets the dose display.
	Metal. Activates the metal black level for adjustment.

Symbol(s)	Meaning
	Clear. Clears selected text box.
	Backspace. Deletes the character left of the cursor in the selected text box.
	Delete. Deletes the character right of the cursor in the selected text box.
	Keyboard. To enter values in the text boxes.
	Apply. Stores adjustments to the machine data file.
	Discard. Restores values from the machine data file. Press "Test" button to activate restored values.
	Test. Activates new selections and values temporarily. Values will not be stored in the machine data file. Original values can be restored by the "Discard" button as long as the "Apply" button has not been pressed.
	Sub-tabs. Selects the different input boxes of the dose adjustment mode.
	Scroll arrows. Scroll the Sub-Tabs.
	Tabs. Select the service modes. Tabs are displayed in all service modes.

16.2.3.1 Input Box

Dose Iris Camera % CCD / FD Fill 20 % Dose Gain 198 Dynamic 100 % Peak Part 0 % ☐ Vignetting		Video ☒ Black Level 5 % Peak 95 % ☒ White Level 90 0-200 Peak 95 % Metal Black Level 0 % Peak 80 %	
Filter NR: 1 2 5 3 10 1-16 NR: 0-3 RTE: 0-4 LIH: 1-2-4-8-16 HQ 2 0 1 Fluoro 2 0 1 LPK 3 4 16 SSHT 2 0 1 REP 1 0 1		Windowing Window 100 0-100 Level 50 0-100 Gamma ☒ Gamma 5 0-9 ☒ Level 5 0-100% Dynamic 10 5-100%	

Fig. 16-25 example of an Input box

The input boxes will change by selecting different sub-tabs.

For description of the particular input boxes, refer to the chapter 19 "Adjustment Instructions"
 → Ch. 17.3, p. 17-6

16.2.3.2 Dose Service Settings with opened Drop Down

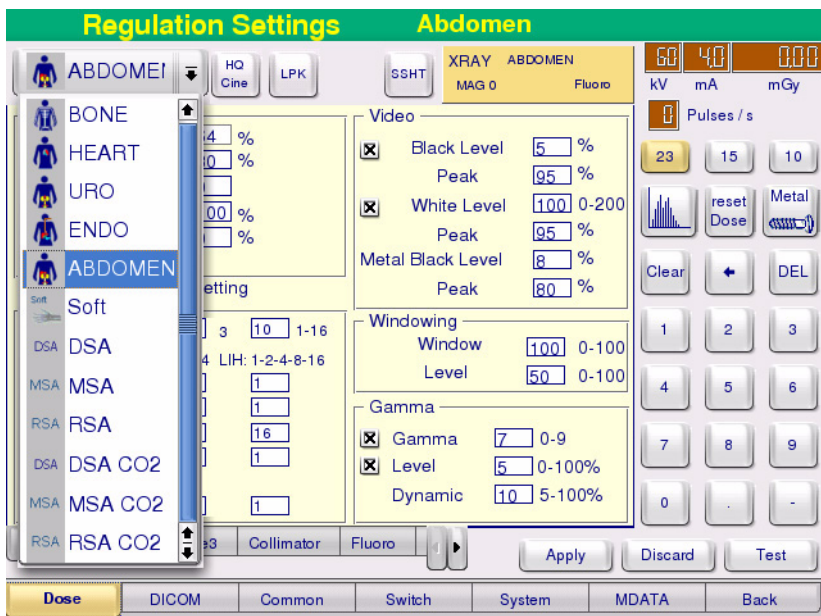


Fig. 16-26 Example of Dose service settings with opened drop down



NOTE

Number of displayed anatomic modes depends on the options installed.
 → Ch. 16.2.7.1, p. 16-33

16.2.4 Service Mode "DICOM"

For Dicom settings, refer to the Chapter "DICOM configuration manual" in this book.

→ Ch. 14.3, p. 14-3

16.2.5 Service Mode "Common"

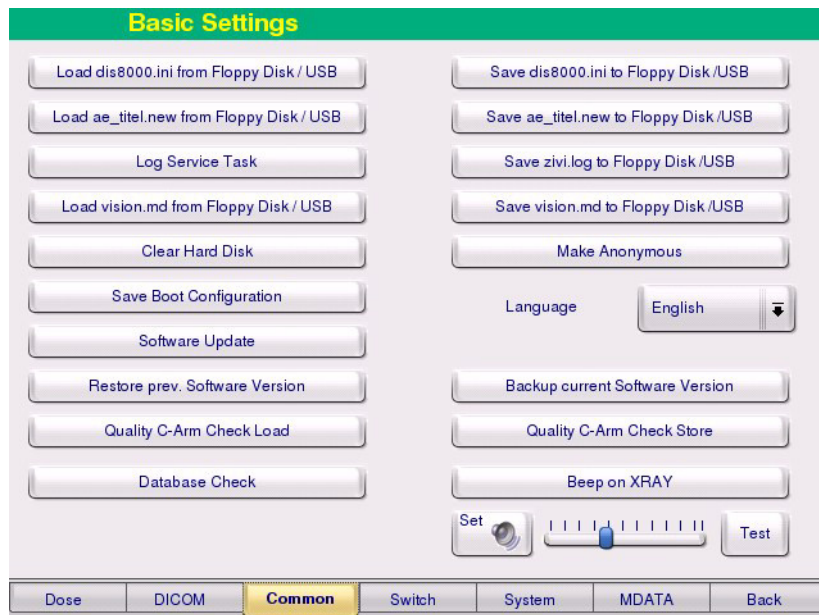


Fig. 16-27 Service Mode "Common"

16.2.5.1 "Load" Functions

This function uploads files from a Floppy Disk / USB to the image memory. The files have to be located in a folder called "VisionFiles" on the medium. → Ch. 16.3.2, p. 16-40

3 files can be uploaded:

- 1 dis8000.ini
A configuration file containing information about system settings.
- 2 ae_titel.new
The dicom configuration file.
- 3 vision_<serial_number>.md
This file contains regulation adjustments and settings. (e.g. Dose, Video....)

In order to upload the files, they have to be located in the folder "VisionFiles" and must be named like described above.

16.2.5.2 "Save" Functions

This function saves files to a Floppy Disk / USB.

The files will be saved to a folder called "VisionFiles" → *Ch. 16.3.2, p. 16-40*.

If the folder VisionFiles does not exist, it will be created automatically. 4 files can be saved:

- 1 dis8000.ini
A configuration file containing information about system settings.
- 2 ae_titel.new
The dicom configuration file.
- 3 zivi.log
The error log file.
- 4 vision_<serial_number>.md
This file contains regulation adjustments and settings. (e.g. dose, Video....)

16.2.5.3 Log Service Task

This function will create an entry in the zivi.log file:

Wed Jun 27 11:32:57 2007

Service task performed by: Name

Time and date is taken from the system clock, the name is taken from the service key.

16.2.5.4 Clear Hard Disk

This function will delete all images and patient data from the hard disk.

A message box "do you really want to clear the hard disk" will appear after this button has been pressed.

16.2.5.5 Make Anonymous

This function will replace all patient last names stored on the image memory hard disk by "ZIEHM"

The function will be performed immediately after this button has been pressed.

16.2.5.6 Save Boot Configuration

Using this function, a boot up configuration can be stored. Settings that can be stored are:

- Anatomic mode
- Image reversal horizontal
- Image reversal vertical
- Magnifier setting

In order to store a certain boot configuration:

- select anatomic mode, image orientation and magnifier setting in the fluoro mode.
- enter service settings, switch to tab common.
- Press button "Save boot configuration"
- Do not switch off the unit for approx. 10s after the button "Save boot configuration" has been pressed.

After restart, the Vision starts in the selected modes.

16.2.5.7 Software Update

This function performs a software update from the USB stick.

For detailed SW update description refer to Work instruction 19_2047 "Vision Software Update"

16.2.5.8 Language

Allows to switch to different user interface languages.

Reboot Vision after language has been changed.

16.2.5.9 "Quality C-arm Check" Functions

16.2.5.9.1 Quality C-arm Check Load

This function will restore an folder "Ziehm_QCC" to the archive.

This folder is located on a protected area of the hard disk. Even if the function "Clear Hard Disk" has been performed, the folder can still be restored.

The folder contains test images. Reference images can be added by the user.

16.2.5.9.2 Quality C-arm Check Save

This function will save all folders called "Ziehm_QCC" to a protected area of the hard disk.

This folders can be restored to the archive by using the function "Quality C-arm Check Load"

By this function, reference images can be stored permanently to the image memory.

16.2.5.10 Database Check

Performs a check to patient data and images database.

Result will be stored in the "zivi.log" file.

16.2.5.11 Beep on XRAY

Activates a sound during screening. Button will remain yellow if function is active.

16.2.5.12 Speaker Volume Control



Fig. 16-28 Speaker volume control

Move the slider to the right to increase the volume.

Push the button "Set" to activate the new setting.

The button "Test" allows to check the volume and has no additional function.

16.2.6 Service Mode "Switch"

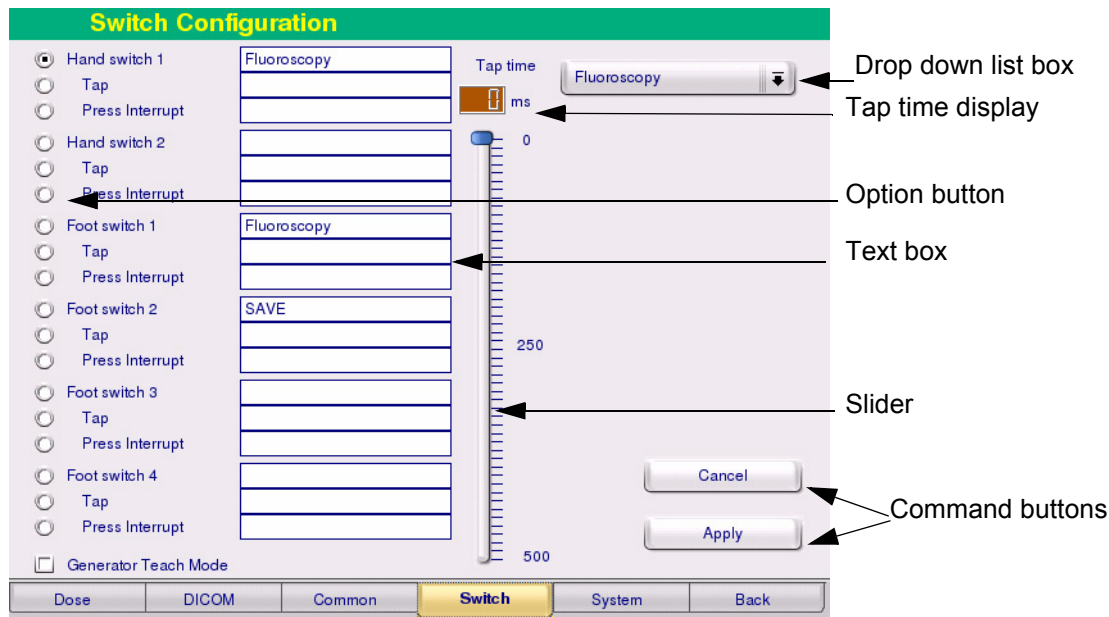


Fig. 16-29 Service Mode "Switch"

16.2.6.1 Option Button

With the option buttons, the switch that is to be programmed is selected

for every switch, there are 3 modes:

- 1 Hand/Foot switch
Sets up the function when the switch is pressed permanently.
- 2 Tap
Sets up the function when the switch is only pressed for a short time.
The time is set up with the slider.
- 3 Press interrupt
This mode is currently not supported.

16.2.6.2 Switch assignment in Ziehm Solo

hand switch 1	left hand switch
hand switch 2	not used
foot switch 1	left foot switch
foot switch 2	right foot switch
foot switch 3	button on solo center support arm
foot switch 4	not used



Note

The right hand switch is permanently configured for Fluoroscopy and can not be reprogrammed.

16.2.6.3 Drop Down List Box

With the drop down list box the switch functions can be selected. Offered options depend on the selected switch mode. The selected function will be displayed in the text box. If "No switch function" was selected, the text box will be empty.



NOTE

A hardware setting has to be changed if a switch is reprogrammed from function control to radiation release (→ *Ch. 5.6.1.1, p. 5-16*).

16.2.6.4 Tap Time Display and Slider

In order to activate the tap mode, a tap time has to be set up.

- select the tap mode of a switch by an option button
- select a function from the drop down list box
- select a tap time by using the slider The time will be shown in the tap time display
- Press the command button "Apply"

16.2.6.5 Command Buttons

- Apply
Stores the selected configuration.
- Cancel
Discards the selected configuration and restores the current configuration.

16.2.6.6 Generator Teach Mode

This function is currently not used. If check box "generator teach mode" is selected, the Vision will not screen. If the Vision is restarted, the function will be unselected automatically.

16.2.7 Service Mode "System"

The service mode "System" allows to view and download system information from the Ziehm Solo.

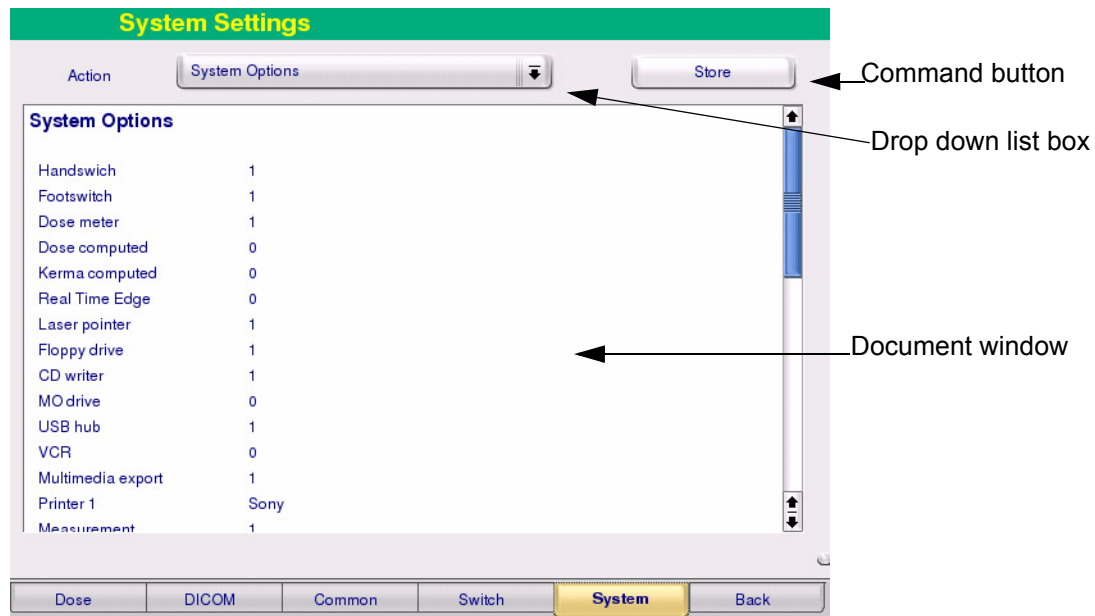


Fig. 16-30 Service Mode "System"

The Drop down list box allows to select different system informations to be displayed:

- System Options
- System Versions
- Network ifconfig
- dicom.log
- zivi.log

The selected information will be displayed in the document window.

By pressing the button "Store", files will be stored on the USB stick in the serial number folder. → Ch. 16.3.3, p. 16-41

16.2.7.1 System Options

This selection will show all the system options read from the USB dongle. The options are defined by the encrypted file "options.dat" on the USB dongle. The dongle is located at the USB port of the image memory inside the monitor cart.

By pressing the button "Store", the information will be stored in a file "options.html" on the USB stick in the serial number folder. → Ch. 16.3.3, p. 16-41

16.2.7.2 System Versions

This selection shows information about software versions, firmware versions and whether the main interface (U515) is detected or not.

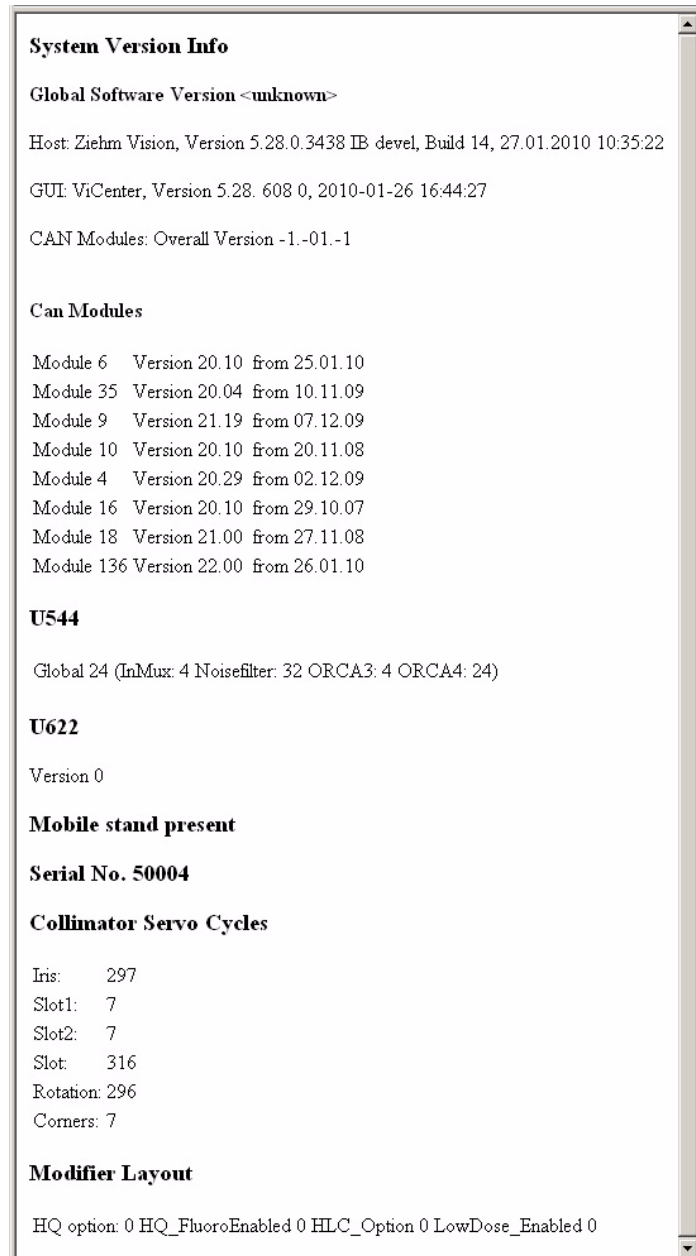


Fig. 16-31 Example of System versions, exported html file

- **System Version Info**
Shows a global software version, if image memory (Host) ,Vision Center and CAN software are belonging together
Shows the version of the image memory ,Vision Center and CAN software.
CAN software version is only shown if CAN Module software is belonging together.

- Can Modules
Shows the detected CAN modules and their software versions.
For identification of the modules, refer to CAN module list. → *Ch. 2.5.1, p. 2-9*
- U544
Shows the firmware versions of the U544 board (framegrabber) hardware.
- U816 / U825
Shows the firmware version of the U825 board (upscan board).
(formerly hardware used was U816)
- U622
Shows the firmware version of the U622 board (upscan board)
(alternatively to U825 board)
- Mobile stand present / Mobile stand NOT present
Indicates, whether the main interface (U515) was detected or not. Detection of the main interface is done by checking the CAN-sense line in the connection cable between main interface and Image Memory.
Mobile stand present means main interface is present.
- Serial number
Shows the Serial number that is stored in the file "option.dat". → *Ch. 16.2.7.1, p. 16-33*
- Collimator Servo Cycles
Counts the cycles of the corresponding servo motor.
- Modifier Layout:
Indicates which of the modifier keys is active.

By pressing the button "Store", the information will be stored in a file "system_version.html" on the USB stick in the serial number folder. → *Ch. 16.3.3, p. 16-41*

16.2.7.3 Network ifconfig

This selection shows information about the TCP/IP network interface of the image memory.

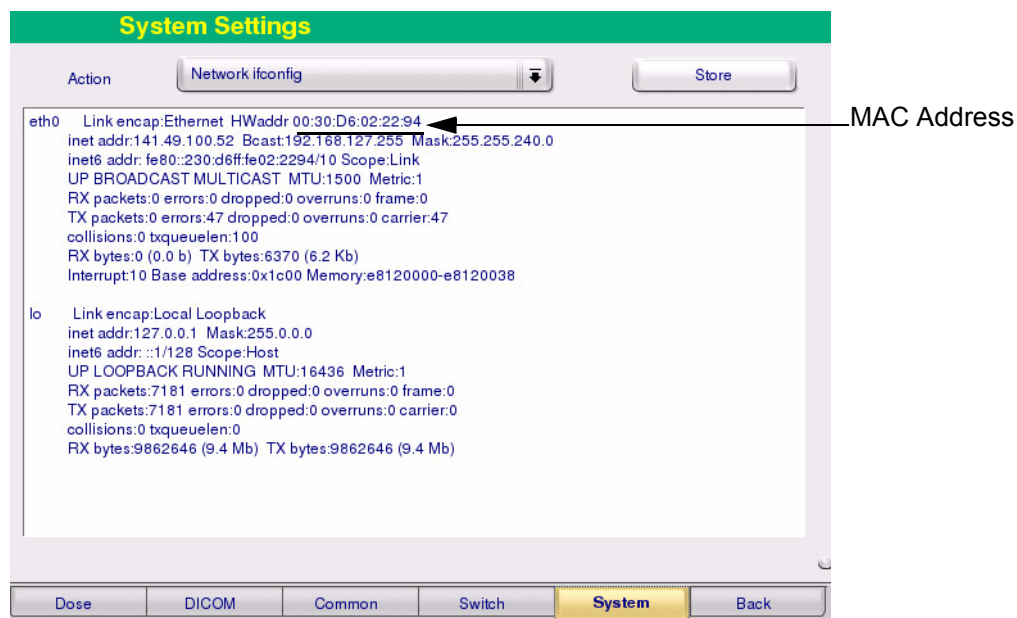


Fig. 16-32 System settings, Network ifconfig

The MAC address is shown. This information is required if the connection runs via a firewall in order to configure the firewall.

By pressing the button "Store", the information will be stored in a file "ifconfig.txt" on the USB stick in the serial number folder (→ Ch. 16.3.3, p. 16-41).

16.2.7.4 dicom.log

This selection shows the dicom.log file. This file contains information about DICOM connection establishment, data transfer and connection termination.

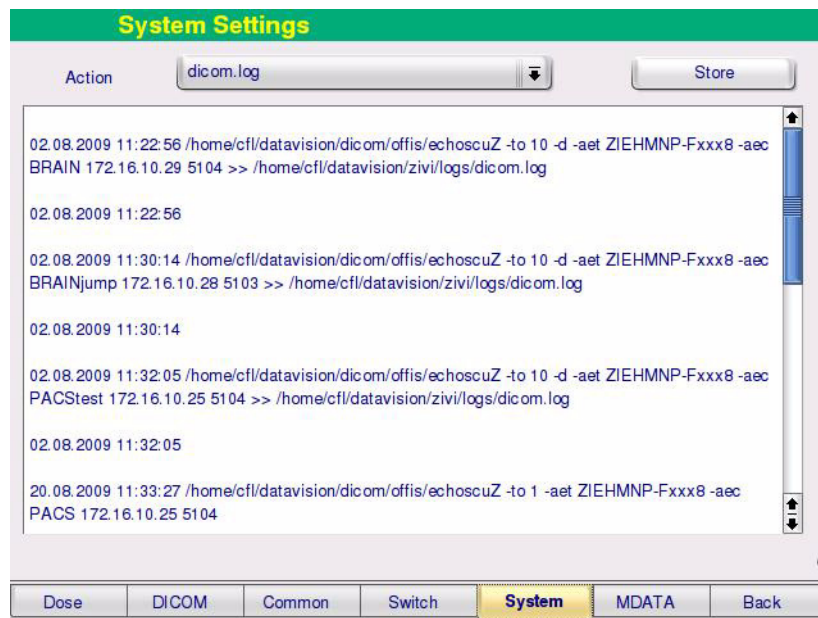


Fig. 16-33 System settings, dicom.log

By pressing the button "Store", the information will be stored in a file "dicom.log" on the USB stick in the serial number folder.→ *Ch. 16.3.3, p. 16-41*

16.2.7.5 zivi.log

This selection shows the zivi.log file. (zivi is an acronym for ziehm vision) This file contains all occurred errors, database check status and logged service tasks.

Some errors are not shown on the Solo Center but will only appear in the zivi.log file.

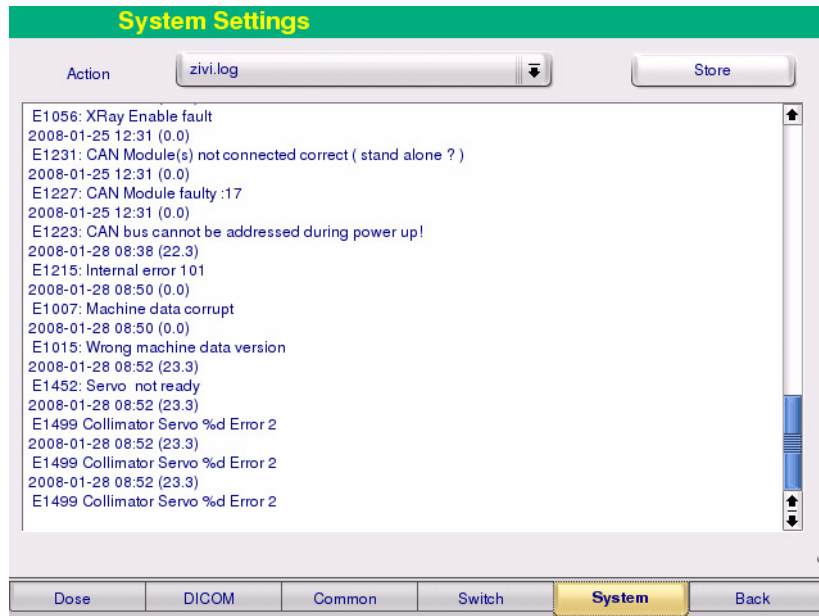


Fig. 16-34 System settings, zivi.log

By pressing the button "Store", the file "zivi.log" will be stored on the USB stick in the serial number folder.→ Ch. 16.3.3, p. 16-41

16.3 USB Service Key

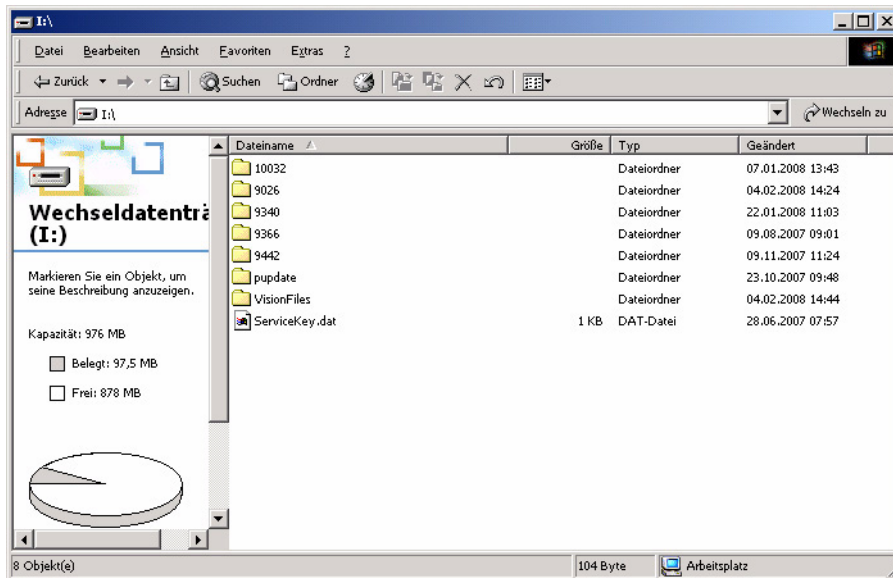


Fig. 16-35 Exemplary content of the Service Key

16.3.1 ServiceKey.dat

The file "ServiceKey.dat" provides access to the service settings of the Vision Family systems including Ziehm Solo. The file is encrypted and will only work on the related USB stick. Included in this file is the owners name and the expiry date. This information is stated on the USB stick label also. A backup copy of this file may be restored to the related stick.



NOTE

It is recommended to have a backup copy of the file "ServiceKey.dat" in case the file has been deleted from the USB stick accidentally.



NOTE

Do not format the USB stick!
Otherwise the file "serviceKey.dat" will not be valid anymore.

16.3.2 Folder "VisionFiles"

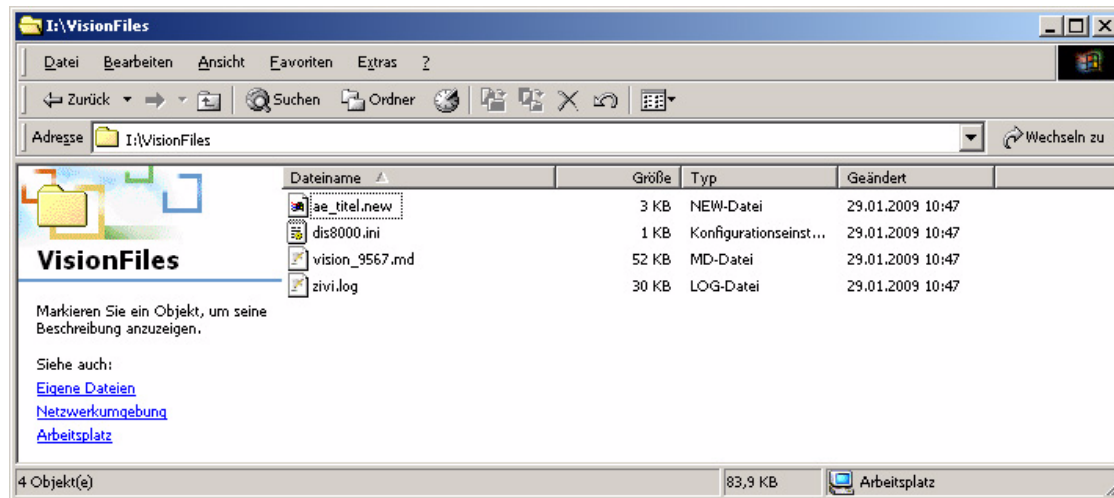


Fig. 16-36 Folder "VisionFiles" on USB stick

In the folder "VisionFiles" configuration files and the file "zivi.log" will be stored when the save functions of the service mode "Common" are used. → Ch. 16.2.5.2, p. 16-27

If the folder does not exist, it will be created automatically.

In order to restore the files by the load functions, the files name has to be like it was stored. (see above)

To restore a file from the serial number folder → Ch. 16.3.3, p. 16-41, the date information has to be removed from the file name.

If a valid file name is found in the folder "VisionFiles", the file will be restored to the system immediately when the corresponding load button is pressed.



NOTE

The VisionFiles folder should be kept clear when not in use to avoid accidental file restore.

To prevent accidental loading of a vision.md file from another device, the vision.md file is stored with the unit's serial number. The file has the format "vision_<serial_number>.md" When loading a vision.md from the service key, at first a vision_<serial_number>.md file of this device is searched for. If such a file is not found, a message box appears, as to whether a file "vision.md" (without serial number) shall be searched for and loaded.

16.3.3 Serial Number Folder

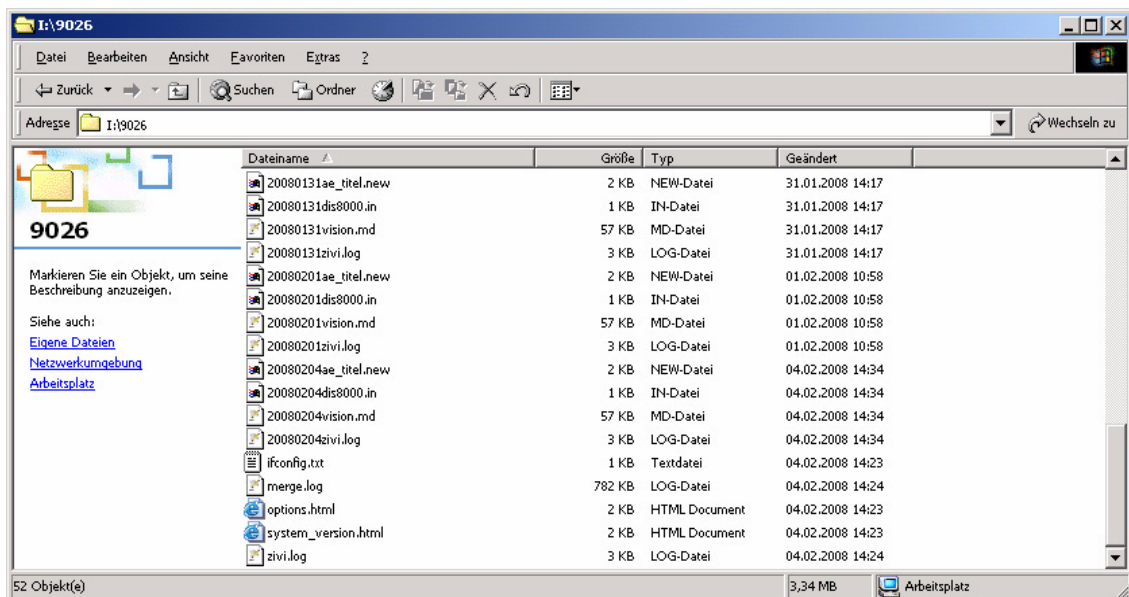


Fig. 16-37 Exemplary content of the serial number folder on USB stick

The configuration files and the error log file will be copied to a folder named after the serial number of the Ziehm Solo automatically when the service settings are entered with a valid service key.

If this folder does not exist yet, it will be created automatically.

There will be separate folders for every Ziehm Solo unit.

The files names will be extended by the current date. Existing files will be overwritten the same day.

If a configuration file has to be restored, it has to be copied to the folder "VisionFiles" and the date information has to be removed from the file name. → Ch. 16.3.2, p. 16-40

Also the system information files will be stored to this folder. → Ch. 16.2.7, p. 16-33

16.3.4 Folder "pupdate"

The folder "pupdate" is required to do software updates to the image memory. This folder has to be created manually. Update files have to be copied to this folder.

The name "pupdate" is an abbreviation for passive update.

This folder has to be used for all passive systems. (SW5.xx)

For detailed SW update description refer to Work instruction 19_2047 "Vision Software Update"

17

Adjustment Instructions

17 Adjustment Instructions

**Note**

For adjustment values refer to the document "Vision 2 Organ Adjustment Tables". This document can be downloaded from the Ziehm member service.
www.ziehm.com

17.1 Dose Adjustment

Dose adjustment has to be performed prior to video adjustment. The adjustment of dose is performed with 25 mm Al + 1.5 mm copper put onto the generator. The dose is measured in front of the image intensifier grid. The dose values have to be taken from the dose table. You can adjust dose with the following parameters:

17.1.1 Parameters for Dose Adjustment

- **CCD fill level** (Dose 1 Menu):
 - should be set to default values given in the anatomical program table (about 15 – 45 for average value regulation, about 45 – 90 for peak value regulation)
 - increasing the value will increase the dose
- **Iris Camera Default** (Dose 1 Menu):
 - This value influences the actual CCD iris collimator. Please take the value from the anatomical program table. A smaller value (in percent) leads to a higher dose and vice versa.
- **Dose Gain** (Dose 1 Menu):
 - increasing the value will decrease the dose
 - should be kept to zero if possible.

17.1.2 Strategy for Adjusting Dose

- First set CCD fill level to value given in the table CCD fill levels.
- Start with dose gain 0.
- Adjust CCD iris 20% < CCD iris < 95%
CCD iris up to 100% in LPK mode
- If dose value is not adjustable then increase gain and after that the CCD iris again.
- If gain does not help anymore then change CCD fill level.



NOTE

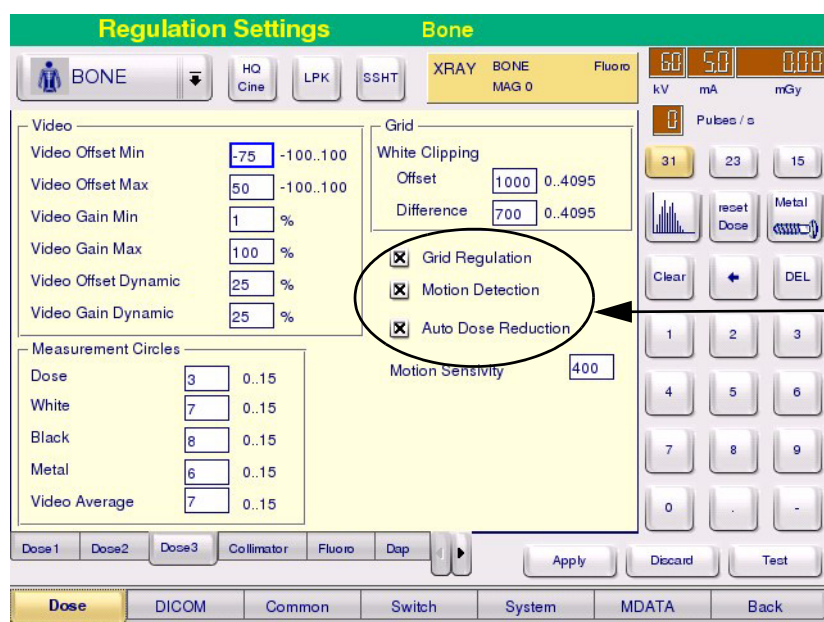
Before adjusting make sure that the following ODDC features are switched off:

- Grid Regulation
- Motion Detection
- Automatic Dose Reduction

Off = no Check Symbol

("Adjustment" dialog, "Dose 3" tab, SW 5.03 and below: "Dose2" tab)

After adjustment switch on again, if it was switched off for adjustment.



Features must be switched off temporarily during adjustment

Fig. 17-38 ODDC Features

17.1.3 Special Cases for Dose Adjustment

- **High Quality Mode (HQ):**

HQ is a modifier to each application program. Dose has to be adjusted in all programs, it will be the same value in all programs. HQ has also one individual kV/mA curve for all programs. Adjust dose to the value as is described in the dose tables.

- **Snapshot:**

Snapshot is a separate program, and it is adjusted by selecting the SSHT key in the adjustment dialog. Measure the accumulated dose for one shot. Do not measure the first shot, make sure that regulation has found its target before. Dose has to be below 2 μ G

- **Adipose Patient Key (LPK):**

LPK is a modifier to each application program. Dose has to be adjusted in all programs, it will be the same value in all programs. LPK has one individual kV/mA curve for all programs. Adjust dose to the value as is described in the dose tables.

- **DSA / MSA**

There are three dose adjustments for DSA / MSA / RSA possible out of which just two are important and active. Adjust for:

- 1 HQ DSA / MSA

- 2 LPK DSA / MSA

Adjust in Configuration Menu, always with pulse pause = 0.

Dose has to be measured with "Dose rate".

Adjust dose to the value as is described in the dose tables.

Copy the HQ values to the standard tables.

- **RSA**

RSA is a separate program, and it is adjusted by selecting the RSA function in the dropdown menu of the adjustment dialog.

17.2 Video Adjustment

17.2.1 Parameters for Video Adjustment

- **Video black level:**
 - influences the black level of the video signal.
 - increasing the value will increase the black level.
- **Video white level:**
 - influences the white level of the video signal.
 - increasing the value will increase the white level.
- **Video metal level:**
 - sets up a second black level if metal key is selected.
 - increasing the value will increase the second black level.

17.2.2 Histogram

For measuring the video signal, the histogram function is used. The histogram will be displayed on the right screen when the histogram function is active. It will be updated after every fluoroscopy. The histogram function can be activated by the histogram key that appears in the service menu. → *Ch. 16.2.3, p. 23*. After restarting the Ziehm Solo, the histogram function will be disabled automatically.

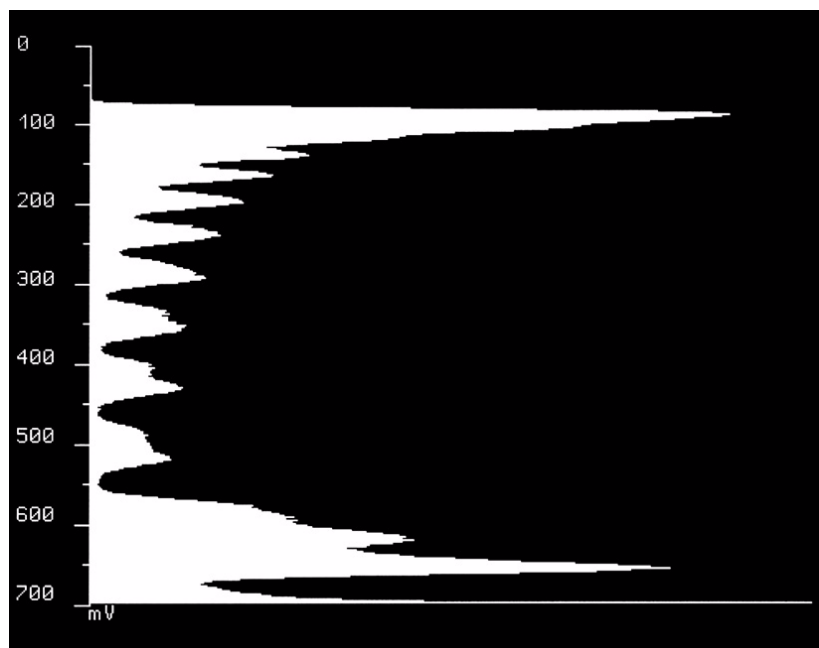
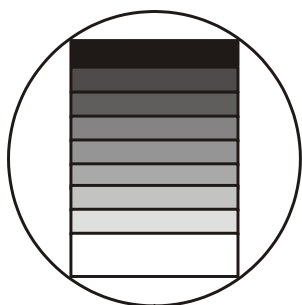


Fig. 17-39 Example of an histogram with stepwedge in the image

17.2.3 Strategy for Adjusting Video

- Put the grey step wedge into the optical path so that both angles of the grey step wedge (black) just contact the upper mask circle:

Position	I.I. Active area	Type and distance of the step wedge
 Fig. 17-40 Grey Step Wedge	31 cm: (N with 31 cm I.I.)	large, about 30 cm to I.I.
	23 cm: (N with 23cm I.I.) (M1 with 31cm I.I.)	large, about 10 cm to I.I.
	15 cm: (M1 with 23cm I.I.) positioning at N (M2 with 31cm I.I.) positioning at M1	large, about 10 cm to I.I.
	11 cm: (M2 with 23cm I.I.) positioning at M1	small, about 10 cm to I.I.

- Use histogram function in order to measure the video signal.
- Select **Service Settings – Dose 1**
- Adjust the **Black level** as described in the video adjustment table. For DSA set the given value.
- White level** is adjusted to 100% in all anatomical programs.
Exception: In Heart and HQ mode **White level** is adjusted to 90%.
- Adjust video **Metal level**. To do so, take a proper reference image without metal in each anatomical program. After getting metal in and pressing the metal switch, there should be no difference within the bone grayscale values of the image with or without metal.



CAUTION

Before making any adjustments not described here, please contact our Service department!

17.3 Input Boxes



NOTE

Following screenshots refer to Software V5.28.

Other software versions may show different content.

17.3.1 Input Boxes on the Dose 1 Tab

Fig. 17-41 Pop-up Window Dose 1

Name	Description
Dose	
Iris Camera	This value determines the dose with respect to the CCD. The value should be between 20% and 95%.
CCD fill level	This value determines the dose with respect to the mean/peak value coming out from the CCD camera. The value should be between 15% and 45% for mean and between 45% and 90% for peak depending on the application.
Dose gain	0...9: This value determines the analog CCD gain to higher levels in the 25/30 frames/s mode. If dose is too high this parameter will decrease the dose without affecting the regulation chain otherwise. The s/n ratio of the signal will decrease also which will give poorer image quality.

Name	Description
Dynamic (only up to SW 5.25.x)	This value corresponds to the speed at which the dose mean or peak value will be created. It is kind of a recursively created value, just using 0 to 100% of the next frame being added to the existing measurement.
Peak Part	This value determines the characteristic of dose regulation with respect to being a mean or a peak type of regulation. 0% will result in a pure mean regulation and 100% in a pure peak regulation. Values in between would create a characteristic of both types.

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Name	Description
Video	
Black Level	0–100%: Black color in the image will be regulated to this level. Checkbox checked means: function is active
Peak (only up to SW 5.25.x)	0–100%: This gives a certain percentage of peak information to the black value measurement
White Level	0–200%: White color in the image will be regulated to this level. Higher values than 100% will cut off in white. Checkbox checked means: function is active
Peak (only up to SW 5.25.x)	0–100%: This gives a certain percentage of peak information to the white value measurement
Metal black value	0–100%: Black color in the image will be regulated to this level if the "Metal" key is pressed
Peak	0–100%: This gives a certain percentage of peak information to the metal black value measurement
Filter	
NR 1	Default for recursive filter level 1 in the selected operating mode
NR 2	Default for recursive filter level 2 in the selected operating mode
NR 3	Default for recursive filter level 3 in the selected operating mode
NR	Active recursive filter out of NR 1 to 3 after switching to an anatomical program. The column below extends that value to the four different modes out of which HQ is High Quality (high dose mode), Fluoro is Standard (standard dose mode), LPK is Adipose Patient key (low dose mode) and Rep is Repositioning (motion in the image)
LIH	Last image hold filter This is adjustable to 1, 2, 4, 8 or 16 but it should never be less than the corresponding recursive filter; if this happens then better adjust to 1 Example: NR 8 and LIH 2 will not make sense, better use NR 8 and LIH 1 The column below extends that value to the four different modes out of which HQ is High Quality (high dose mode), Fluoro is Standard (standard dose mode), LPK is Adipose Patient key (low dose mode) and Rep is Repositioning (motion in the image)

Name	Description
RTE	Real Time Edge enhancement Five different settings are available, where 0 is off, 3 is maximum enhancement and 4 is a blurring filter. The column below extends that value to the four different modes out of which HQ is High Quality (high dose mode), Fluoro is Standard (standard dose mode), LPK is Adipose Patient key (low dose mode) and Rep is Repositioning (motion in the image)
Vignetting	Due to the fact that the outside area of image intensifiers provides less intensity for video levels, vignetting is increasing the outside area by using a square mathematical equation. The intensity of correction is adjustable from 0 to 99%. Changing this makes a reboot of the whole system necessary. The important value is in the anatomical program which the machine comes up with after bootup.
Gamma	
0-9	Ten different Gamma curves, 0-4 harder setup, 5-9 smoother setup out of them the lower the number the smoother the curve Different curves can be adjusted to different applications Checkbox checked means: Function is active
Level	0-100%: This parameter is the Gamma Black level which can be adjusted to be at a certain grey scale level on the curve. It could run from 0 to 100% of the input grey scale level. Input black is clamped to this level. Checkbox checked means: Function is active
Dyn.	5-100%: This Dynamic value corresponds to the speed at which the gamma black measurement value is created. It is kind of a recursively created value, just using 5 to 100% of the next frame being added to the existing measurement.
Windowing	
Window	0-100: This value is adjusting the size of the window which is automatically set when entering an anatomical program. The size is between 0 and 100%
Level	0-100: This value is adjusting the position of the window which is automatically set when entering an anatomical program. The position is between 0 and 100%, usually it will be set to 50%

17.3.2 Input Boxes on the Dose 2 Tab

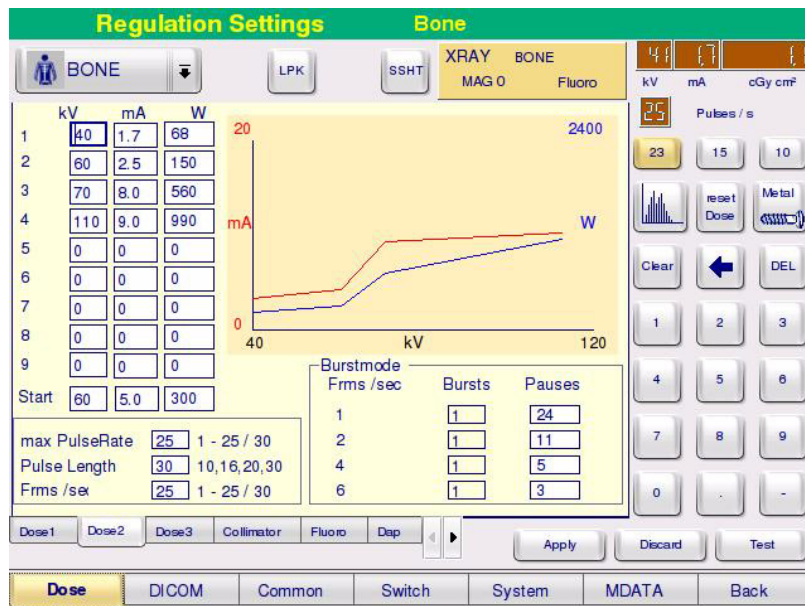


Fig. 17-42 Dose 2 tab for each anatomical program

Name	Description
Top Line	
Left scroll down button	Show organ program which is visible on screen
Modifiers	If one of the next three buttons is yellow, an organ program modifier is active. The value of the modifier is visible on the screen.
Yellow Box	Shows the active organ program. If you want to change to visible organ program, press "Test" or "Apply"
kV/mA Values	
kV	Input of the kV values for the kV-mA table of an anatomical program
mA	Input of the mA values for the kV-mA table of an anatomical program
W	This value indicates the amount of Watts the generator is driven with at this point of the kV/mA curve.
Generator	
Start value - kV	This is the kV value for dose regulation to start with
Start value - mA	This is the mA value for dose regulation to start with

Name	Description
Pulse length	10, 16, 20, 30: This parameter is the length for each X-ray pulse during a frame. It can be set to 10, 16, 20 or 30 ms. The setting is with respect to the application. The setting can be different in each anatomical program.
max PulseRate (SW 5.25.x and above)	1-25/30: This parameter defines the maximum allowed pulserate in the corresponding anatomical program.
Bilder/s	1-25/30: This parameter defines the default setting for the number of pulses per second.

17.3.3 Input Boxes on the Dose 3 Tab

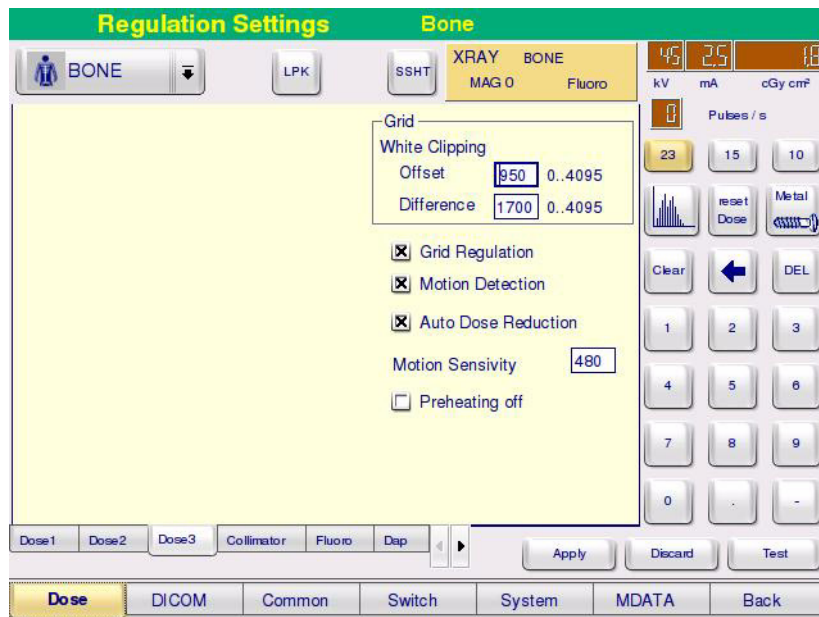


Fig. 17-43 Dose 3 tab

Name	Description
Video	
Video Offset Min (only up to SW 5.25.x)	-100...+100 This value is a limit to the Offset Minimum level. 100% is the whole video range. Video offset can be limited going to low by setting the Offset Min value between -100% to + 100%
Video Offset Max (only up to SW 5.25.x)	-100...+100 This value is a limit to the Offset Maximum level. 100% is the whole video range. Video offset can be limited going to high by setting the Offset Max value between -100% to + 100%
Video Gain Min (only up to SW 5.25.x)	This value is a limit to the Gain Minimum factor, it limits the negative gain. Values are valid between 1 and 100. 1 is a factor of 0.15, 100 is a factor of 15
Video Gain Max (only up to SW 5.25.x)	This value is a limit to the Gain Maximum factor, it limits the positive gain. Values are valid between 1 and 100. 1 is a factor of 0.15, 100 is a factor of 15
Video Offset Dynamic (only up to SW 5.25.x)	0 to 100%: This value corresponds to the speed at which the Offset measurement value is created. It is kind of a recursively created value, just using 0 to 100% of the next frame being added to the existing measurement.

Name	Description
Video Gain Dynamic (only up to SW 5.25.x)	0 to 100%: This value corresponds to the speed at which the Gain value measurement value is created. It is kind of a recursively created value, just using 0 to 100% of the next frame being added to the existing measurement.
Measuring Circles	
Dose (only up to SW 5.25.x)	This is the ROI (region of interest) to measure the dose. Ten circles centered to the image are available where 0 is the smallest and 9 is almost the whole image.
White (only up to SW 5.25.x)	This is the ROI (region of interest) to measure the video white level.
Black (only up to SW 5.25.x)	This is the ROI (region of interest) to measure the video black level.
Metal (only up to SW 5.25.x)	This is the ROI (region of interest) to measure the video black level when the Metal key is active
Video (only up to SW 5.25.x)	This is the ROI (region of interest) to measure the video white mean level
Grid	
White Clipping	Necessary to adjust white clipping function. All grids will be deleted if white level is greater than max. white - offset and white - black level greater than difference.
Offset	0.....4095 Usual range between 500.....1500
Difference	0.....4095 Usual range between 500.....1500
Grid Regulation	Object will be detected in any position Checkbox checked means: Function is active Option can be activated for each anatomical program separately
Motion Detection	If there is motion in image, NR-Filter value changes from Fluoro to Rep (values set in Dose 1) Checkbox checked means: Function is active Option can be activated for each anatomical program separately
Auto Dose Reduction:	The unit decreases pulses if there is no motion detected in image. Checkbox checked means: Function is active Option can be activated for each anatomical program separately

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Name	Description
Mot. Sensitivity 0.....4095	Value sets sensibility for Motion Detection Smaller value means more sensitive for motion in image Usual Range between 300...1000
Preheating off (SW 5.28 and above)	Disables preheating time

17.3.4 Input Boxes on the Grid Tab

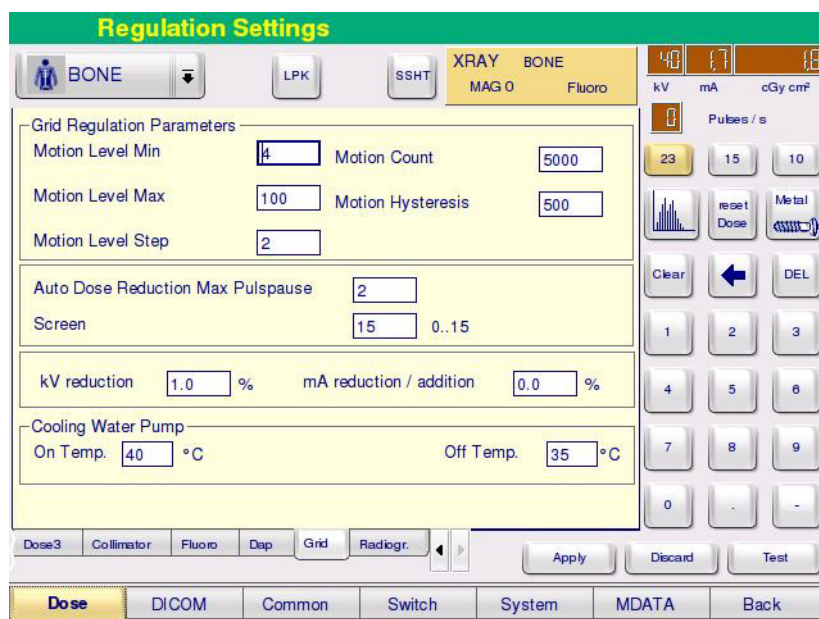


Fig. 17-44 Grid tab

Name	Description
Grid Regulation Parameter	• Motion level min = 4 • Motion level max = 100 • Motion level step = 2 • Motion count = 5000 • Motion hysteresis = 500 All these values are fixed
Auto Dose Reduction Max pulse pause	If no motion is detected, pulsing will be reduced to given value. E.g. 15 means down to 2 pulses/s on a 60 Hz system Default Value = 11 for 50 Hz

Name	Description
Screen Only for testing !!!	Has to be set to 15 for normal operation. For demonstration, - screen 13 shows activated grids - screen 4 shows motion detection - screen 7 shows measuring circle Dose - screen 8 shows measuring circle Black - screen 9 shows measuring circle White - screen 12 shows measuring circle Video Average
kV reduction	Reduces kV in pulsed fluoroscopy mode. Default setting for Vision with static anode is 0
mA reduction / addition	Reduces or increases mA in pulsed fluoroscopy mode. Default setting for Vision with static anode is 0
Cooling Water Pump	No effect in Ziehm Solo systems

17.3.5 Input Boxes on the Collimator Tab

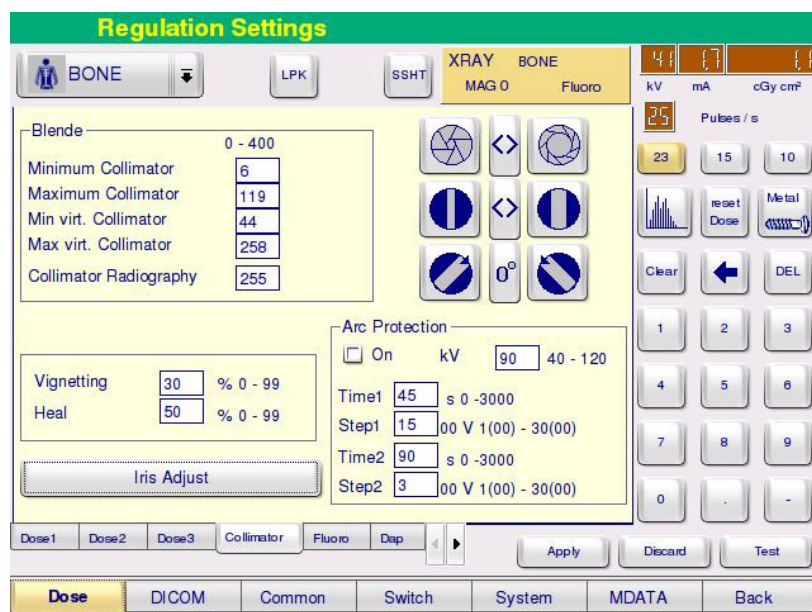


Fig. 17-45 Collimator tab

Name	Description
Blende	
Minimum Collimator	Set size of fully closed real iris collimator (must be less then 5 cm)
Maximum Collimator	Set size of fully open iris collimator (shadow of collimator must be visible on image border)
Minimum virt. Collimator	Set virtual collimator to smallest real collimator
Maximum virt. Collimator	Set virtual collimator to biggest visible real collimator
Collimator Radiography	Set real collimator for Radiography Each I.I. size is able to make one film size 9" = 24 cm 12" = 30 cm
Vignetting	
	Due to the fact that the outside area of an image intensifier provides less intensity, Vignetting is increasing the outside area by using a square mathematical equation. The intensity of correction is adjustable from 0 to 99%. A change here will require rebooting of the whole system.
Heal	
	Not Used

Name	Description
Arc Protection	
	This feature is intended to save the tube in higher kV range. If the unit works in higher kV range and has screened for longer than the set time value, regulation steps will be scaled down to the set value. There are two different time settings.
On	Checkbox checked means: Arc protection is active
kV	Start value of function; this means: Arc protection works from this value to max. kV
Time1	Time value for first step
Step1	Regulation step value for first step
Time2	Time value for second step
Step2	Regulation step value for second step

17.4 Adjusting computed DAP / Air Kerma

If the comparative measurement result is out of tolerance ($\pm 30\%$) this calibration needs to be performed.

Also, if the collimator has been changed, this adjustment needs to be performed.

17.4.1 Required Tools

- Dose meter for reference measurements. "reference dose meter"
- 100cm² hexagonal copper plate (Part No. 91153) "testing tool 100 cm²"

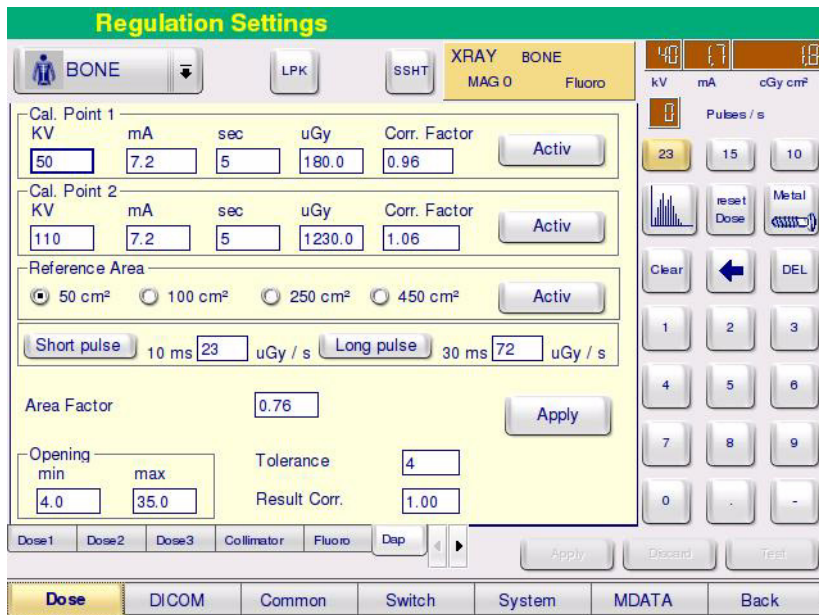
17.4.2 Options

Depending on the activated options → Ch. 16.2.7.1, p. 33 only DAP or DAP and Air Kerma will be displayed.

If only "Dose computed" is enabled, DAP result will be shown on the Solo Center as well as on the text overlay on the monitor.

If "Dose computed" and "Kerma computed" is active, the Solo Center will show air kerma rate during screening and air kerma after radiation is terminated. The DAP result will be shown only on the text overlay of the monitor.

17.4.3 Input Box on the DAP tab



Regulation Settings

☒ BONE ☐ LPK ☐ SSHT ☐ XRAY MAG 0 ☐ BONE Fluro

Cal. Point 1: KV [50] mA [7.2] sec [5] uGy [180.0] Corr. Factor [0.96]

Cal. Point 2: KV [110] mA [7.2] sec [5] uGy [1230.0] Corr. Factor [1.06]

Reference Area: ☒ 50 cm² ☐ 100 cm² ☐ 250 cm² ☐ 450 cm²

Short pulse: 10 ms [23] uGy / s Long pulse: 30 ms [72] uGy / s

Area Factor: [0.76]

Opening min [4.0] max [35.0] Tolerance [4] Result Corr. [1.00]

Dose1 Dose2 Dose3 Collimator Fluro **Dap**

Fig. 17-46 Input box DAP Computed

Name	Description
Cal Point	
kV, mA, sec	Defines 2 calibration reference points, factory default data
uGy	Text field to enter value measured with reference dose meter
Corr. Factor	Correction factor of reference dose meter. Also used to correct the KERMA result
Button "Activ"	Activates the calibration reference point
Reference area	
option buttons "xx cm²"	Sets the collimator to the selected size
Button "Activ"	Activates the selected collimator size
Pulse width correction	
Provides a result correction for shorter pulses.	
Buttons "Short pulse" and "Long pulse"	Sets the Vision to 10 ms or 30 ms pulse width and defined kv/mA values
uGy/s	Text field to enter values measured with reference dose meter
Area Factor	
Provides that the correct reference area is projected to the image intensifier / flat panel	
Text fields	Area factor to get the correct reference area size
Opening	
min / max	The minimum and maximum opening of the collimator in mm, factory default data
Tolerance	The backlash of the collimator, factory default data
Result Corr.	Correction factor for DAP calculation

17.4.4 Adjustment Procedure

Measurements are done without patient equivalent pre filter. The generator cover including filtration has to be mounted. The reference dose meter has to be set to 3mm Al prefiltering.

- 1 Determining reference values of calibration points
 - Place dose chamber of the reference dose meter close and centered to the image intensifier input
 - Select the DAP tab in the service settings
 - Press "Activ" in box Cal. Point 1

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- Screen and wait until radiation terminates automatically
 - Enter measured value in text box "uGy" of box Cal.Point1. Mind the unit of the value
 - Press "Activ" in box Cal. Point 2
 - Screen and wait until radiation terminates automatically
 - Enter measured value in text box "uGy" of box Cal.Point2. Mind the unit of the value
- 2 Determining reference values for pulse width correction
- Switch dose meter to dose rate measurement
 - Press button "Short pulse"
 - Screen and measure the dose rate
 - Enter measured value in text box "uGy" close to the button "Short pulse"
 - Press button "Long pulse"
 - Screen and measure the dose rate
 - Enter measured value in text box "uGy" close to the button "Long pulse"
- 3 Determining the area factor
- Select option button "100 cm²" and press button "Activ"
 - Place testing tool "100 cm²" close and centered to the image intensifier input
 - Match the testing tool to the collimator. Max allowed difference is 5%. Use the text box corresponding to the Image intensifier size. (lower value results in larger area)
 - Press apply when value had been changed
 - Screen and press Active button of the Reference Area box. Iris will open completely and then and close to the defined position

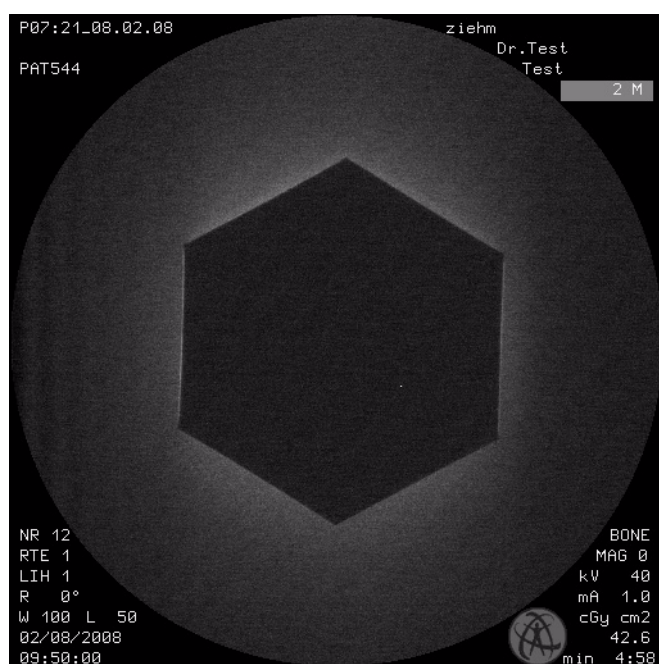


Fig. 17-47 Example of correctly set area factor

- 4 Exit Service settings and restart the Vision
- 5 Adjusting Kerma calculation (only if option calculated air kerma is enabled)
 - Place dose chamber of the reference dose meter 30 cm distant and centered to the image intensifier input
 - Set dose meter to dose measurement
 - Do not select a reference area
 - If the dose meter requires a correction factor this has to be entered in the text Boxes Corr. Factor. Default value is 1 (i.e. no correction)
 - Reset the dose measurement in the service settings
 - Set to user Fluoro mode, manual, 70kV, 3,5mA
 - Screen for approx 10s
 - Compare reading of external dose meter to the result on the Solo Center dose display. Mind the possible correction factor of the external dose meter.
 - Change both correction factors in Boxes Cal Point 1 and Cal Point 2 in order to adjust the kerma display
 - Repeat measurement after factor had been changed
 - Difference should be less than 10%
- 6 Adjusting DAP calculation
 - Place dose chamber close and centered to the image intensifier input
 - Set dose meter to dose measurement
 - Activate reference area 100 cm²
 - Screen until collimator has reached the 100 cm² position
 - Reset the dose measurement in the service settings
 - Set to user Fluoro mode, manual, 70kV, 3,5mA
 - Screen for approx 15s
 - Compare reading of reference dose meter to the result on the Monitor text overlay. Mind the possible correction factor of the external dose meter. 100uGy (corresponding to 100cm² reference area) equals 1cGycm² on the Monitor text overlay
 - Change result correction factor in order to adjust the displayed DAP value
 - Repeat measurement after factor had been changed
 - Difference should be less than 10%

17.5 Adjusting Measured DAP

If the self test (Dose Meter Check) fails, this calibration needs to be performed.

17.5.1 Required Tools

- Dose meter for reference measurements. "reference dose meter"
- 100cm² hexagonal copper plate (Part No. 91153) "testing tool 100 cm²"

17.5.2 Options

Depending on the activated options → *Ch. 16.2.7.1, p. 33*, only measured DAP or measured DAP and calculated Air Kerma will be displayed.

If only "Dose meter" is enabled, measured DAP result will be shown on the Solo Center as well as on the text overlay on the monitor.

For adjustment, only input box "DAP measured" is available.

If "Dose meter" and "Kerma computed" is active, the Solo Center will show calculated air kerma rate during screening and calculated air kerma when radiation is terminated. The measured DAP result will be shown only on the text overlay of the monitor.

For adjustment, both input box "DAP Meter" and input box "DAP computed" is available.

Input boxes are switched by the additional buttons "DAP Meter" and "DAP Computed"

There are two different types of DAP meters :

- VacuDAP 2002
- VacuDAP-C

The input boxes and the adjustment procedures are different

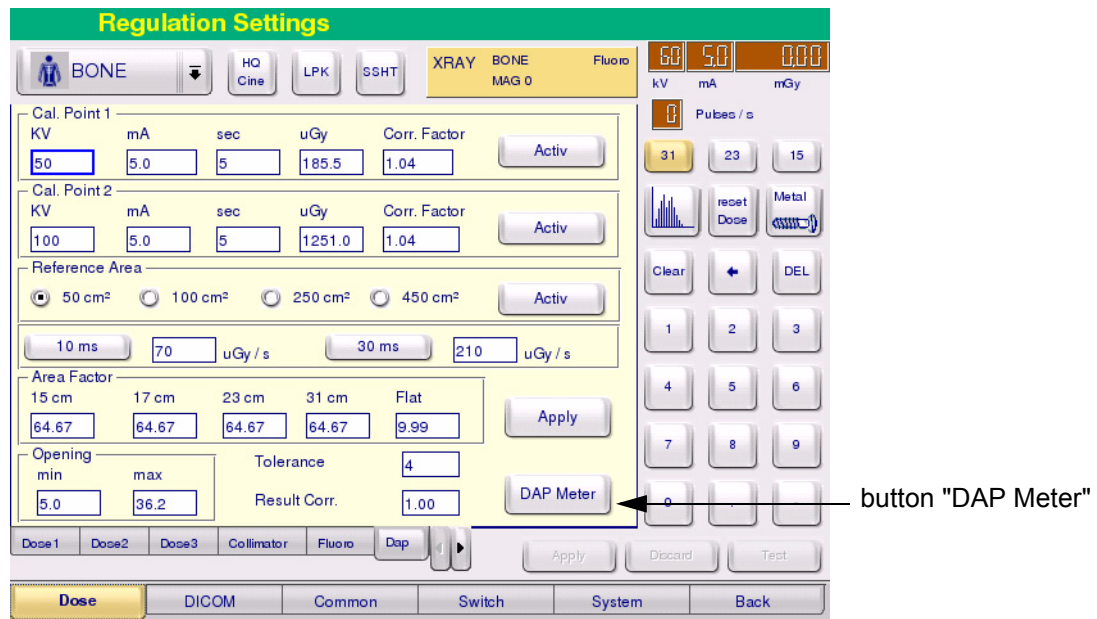


Fig. 17-48 Input box "Dap computed" with button "DAP Meter"

17.5.3 Input Box on the DAP tab

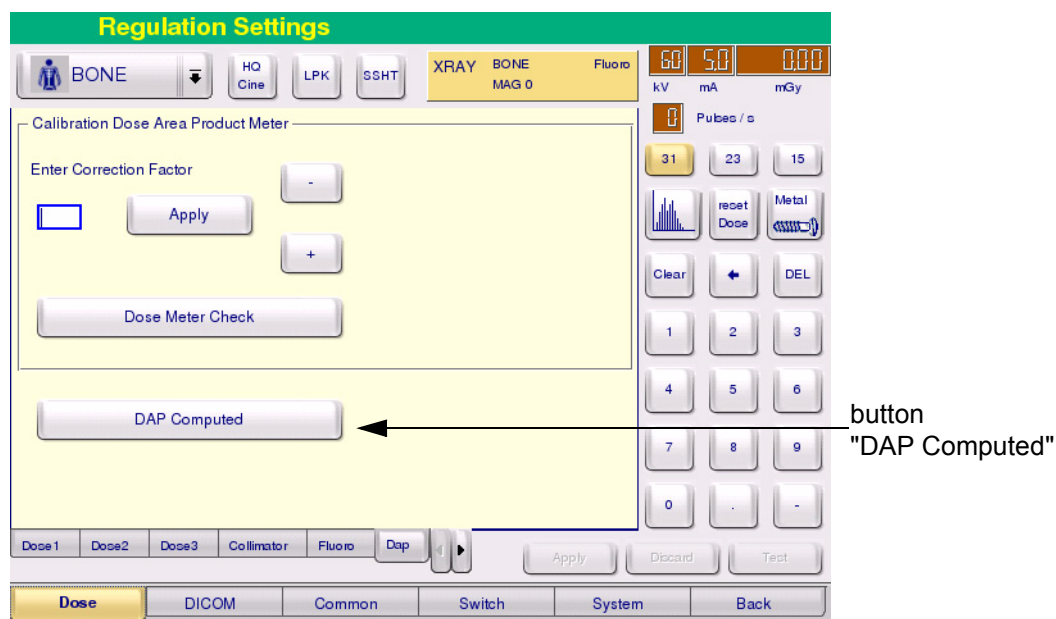


Fig. 17-49 Input box "DAP Meter" with button "DAP Computed"

Name	Description
Calibration Dose Area Product Meter	
Text field "Enter Correction Factor"	Text field to enter the new test result if a recalibration of the DAP meter had been necessary.
Button "Apply"	Stores the entered value as the new Dose Meter Check reference value.
Buttons "+" and "-"	Control buttons to calibrate the DAP Meter. If "+" button is pressed, the DAP Meter will count faster, If "-" button is pressed, the DAP Meter will count slower. Result has to match to the reading on the reference dose meter.
Button "Dose Meter Check"	Starts the self test procedure for the DAP meter. → Ch. 17.5.4, p. 25
Button "DAP Computed"	Switches the input box to DAP Computed. Only present, if option "kerma computed" is active.

17.5.4 Dap Self Test Procedure

After the button "Dose Meter Check" is pressed, a message box with a progress bar will appear. During the procedure the DAP meter will count internally generated pulses. This procedure works without radiation. After the test is finished, the result will be displayed in the message box. There are 2 possibilities:

- DAP ok; actual value: xxx
- DAP fault; nominal value: xxx, actual value: yyy

The result will be decided by comparing the test result to the reference value.

If a recalibration had been necessary, the actual value has to be entered in the text field "Enter Correction Factor"

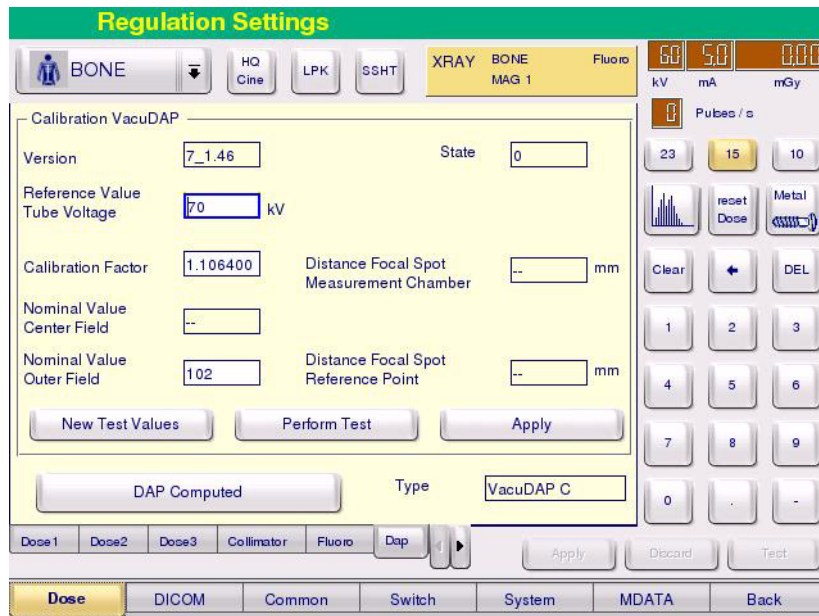
17.5.5 Adjusting DAP Measured

- Place dose chamber close and centered to the image intensifier input
- Set dose meter to dose measurement
- Close collimator to 100 cm². Use the "testing tool 100 cm²"
- Reset the dose measurement in the service settings
- Set to user Fluoro mode, manual, 70kV, 3,5mA
- Screen for approx 15s
- Compare reading of reference dose meter to the result on the Monitor text overlay. Mind the possible correction factor of the reference dose meter. 100uGy (corresponding to 100cm² reference area) equals 1cGycm² on the Monitor text overlay
- In order to adjust the displayed DAP value enter service mode Dap. Press button "DAP Meter" if input box DAP computed is shown. To adjust displayed DAP value use the buttons "+" or "-".
"++" will increase the result of the next measurement.
"--" will decrease the result of the next measurement.
Buttons may be pressed several times.
- Repeat measurement after adjustment
- Difference should be less than 10%
- If the DAP result is within tolerance, press button "Dose Meter Check"
- Result will be: DAP fault; nominal value: xxx, actual value: yyy
- Enter new actual value in the text field "Enter Correction Factor"
- Press button "Apply"
- Restart the Vision
- Enter service mode DAP
- Press button "Dose Meter Check"
- Result has to be: DAP ok; actual value: xxx

17 Adjustment Instructions

17.5.6 VacuDAP-C

17.5.6.1 Input Box on the DAP Tab



The screenshot displays the 'Regulation Settings' window for the 'DAP' tab. The 'Calibration VacuDAP' section contains the following fields and buttons:

- Version:** 7_1.46
- State:** 0
- Reference Value Tube Voltage:** 70 kV
- Calibration Factor:** 1.106400
- Distance Focal Spot Measurement Chamber:** -- mm
- Nominal Value Center Field:** --
- Nominal Value Outer Field:** 102
- Distance Focal Spot Reference Point:** -- mm
- Buttons:** New Test Values, Perform Test, Apply
- DAP Computed:** VacuDAP C
- Type:** VacuDAP C

The bottom of the window shows a navigation bar with tabs: Dose1, Dose2, Dose3, Collimator, Fluoro, Dap (selected), and buttons for Apply, Discard, and Test.

Fig. 17-50 Input box "DAP Meter" with VacuDAP-C

Name	Description
Calibration Dose Area Product Meter	
Version	Indicates firmware version of DAP meter
Reference Value Tube Voltage	Indicates currently activated tube voltage
Calibration Factor	Value to be entered during adjustment
Normal Value Center Field	Not used for DAP measurement
Normal Value Outer Field	Reference value for test function
State	System State → Ch. 17.5.6.4, p. 28
Distance Focal Spot Measurement Chamber	Not used for DAP measurement
Distance Focal Spot Reference Point	Not used for DAP measurement
Button "New Test Values"	To store test value as new reference value
Button "Perform Test"	To perform Self test
Button "Apply"	To store Calibration factor

17.5.6.2 DAP Self Test Procedure

After the button "Perform Test" is pressed, a message box with a progress bar will appear. During the procedure the DAP meter will count internally generated pulses. This procedure works without radiation. After the test is finished, the result will be displayed in the message box. There are 2 possibilities:

- DAP ok; actual value: xxx
- DAP test failed

The result will be decided by comparing the test result to the reference value.

If a re-calibration had been necessary, the actual value has to be stored by pressing "New Test Values"

17.5.6.3 Adjusting DAP measured

- Place dose chamber close and centered to the image intensifier input
- Set dose meter to dose measurement
- Close collimator to 100 cm². Use the "testing tool 100 cm²".
- Reset the dose measurement in the service settings
- Set to user Fluoro mode, manual, 70kV, 3.5mA
- Screen for approx 15s
- Compare reading of reference dose meter to the result on the Monitor text overlay.
Mind the possible correction factor of the reference dose meter. 100uGy (corresponding to 100cm² reference area) equals 1cGycm² on the Monitor text overlay.
- In order to adjust the displayed DAP value enter service mode Dap.
Press button "DAP Meter" if input box DAP computed is shown.
To adjust displayed DAP value change the value "Calibration Factor"
a lower value will increase the result of the next measurement.
a higher value will decrease the result of the next measurement.
factor one means no correction of the result
- Repeat measurement after adjustment
- Difference should be less than 10%
- If the DAP result is within tolerance, press button "New Test Values"
- Press button "Perform Test"
- Result has to be: DAP ok;

17.5.6.4 VacuDAP-C State

The error state of the VacuDAP-C is reported by a 8 Bit word (one Byte, Decimal 0 to 255) . Every bit indicates a certain error condition. This states can also appear as a combination. Value 0 means "System o.k." A value >0 has to be resolved according to the following table

BIT	decimal	Meaning (If Bit = 1)
0	1	Not used
1	2	TEST-Warning
2	4	DAP overflow
3	8	Zero check error (Radiation active during reset)
4	16	Error test function (Test value does not match reference value)
5	32	Voltage for measuring chamber is faulty
6	64	Firmware error
7	128	Not used

18

Error Messages & Fault Finding

18 Error Messages & Fault Finding

18.1 Error Message List

Code	Type	Description
Module 5: X-ray Generator		
E1000	Error	Thin filament defective
E1001	Error	Thick filament defective
E1002	Error	No V-sync
E1003	Error	Temperature 1 too low
E1004	Alert	Temperature 1 too high
E1005	Error	Temperature 2 too low
E1006	Alert	Temperature 2 too high
E1007	Error	Machine data corrupt
E1008	Error	Interrupt 1 flipflop defective
E1009	Error	Interrupt 2 flipflop defective
E1010	Error	HW signal X-ray active during power-up
E1011	Error	CAN X-ray enable active during power-up
E1012	Error	D/A converter reference voltage defective
E1013	Error	D/A converter kV defective
E1014	Error	Oil overtemperature switch active
E1015	Error	Wrong machine data version
E1016	Error	Moisture sensor alarm
E1017	Error	Test of 'FAULT' signal failed
E1018	Error	Debug switch is on
E1019	Error	Monitoring anode rotation does not work
E1050	Alert	High-voltage fault
E1051	Alert	High-voltage fault (anode)
E1052	Alert	High-voltage fault (cathode)
E1053	Alert	mA peak value fault

18 Error Messages & Fault Finding

Code	Type	Description
E1054	Alert	kV nominal/actual value fault
E1055	Alert	mA nominal/actual value fault
E1056	Alert	X-ray Enable fault
E1057	Alert	Life monitoring missing
E1058	Alert	Hardware monitoring missing
E1059	Alert	External radiation interrupt (X-ray break)
E1060	Alert	Signal / XRAY missing
E1061	Alert	High-voltage arc
E1062	Alert	Nominal kV value greater max. kV value
E1063	Alert	Nominal mA value greater max. mA value
E1064	Alert	Nominal power value greater max. power value
E1065	Alert	Nominal kV value less min. kV value
E1066	Alert	CAN fault line active
E1067	Error	Basic heating faults
E1068	Error	V-Sync faults
E1069	Alert	Temperature sensor 1
E1070	Alert	Temperature sensor 2
E1071	Error	Signal /X-ray without radiation
E1072	Error	Oil overtemperature switch active
E1073	Error	Moisture sensor alarm
E1074	Error	kV value too high (no radiation)
E1075	Error	test of rotating anode failed
E1082		Actual kV value below 10 kV
E1083		Rotating anode could not be started
E1084		Rotating anode failed
E1085		Average Power in Burst Mode > 600 Watt
E1086		mA-Value too high for thin filament
E1087		max Anode Capacity in BURST Mode reached
E1095	Alert	Generator overheated, recovery time %d seconds
E1098	Error	Generator power-up fault

Code	Type	Description
E1099	Error	Generator fault
Module 2: Main Interface		
E1100	Alert	Hand switch 1 pressed during power-up
E1101	Alert	Hand switch 2 pressed during power-up
E1102	Alert	Foot switch 1 pressed during power-up
E1103	Alert	Foot switch 2 pressed during power-up
E1104	Alert	Foot switch 3 pressed during power-up
E1105	Alert	Foot switch 4 pressed during power-up
E1106	Alert	Foot switch 5 pressed during power-up
E1107	Alert	Foot switch 6 pressed during power-up
E1108	Error	Short circuit in hand switch 1
E1109	Error	Short circuit in hand switch 2
E1110	Error	Short circuit in foot switch 1
E1111	Error	Short circuit in foot switch 2
E1112	Error	Short circuit in foot switch 3
E1113	Error	Short circuit in foot switch 4
E1114	Error	Short circuit in foot switch 5
E1115	Error	Short circuit in foot switch 6
E1116	Error	X-ray enable present during power-up
E1117	Error	External I/O fault
E1118	Error	Wrong EEPROM checksum
E1132	Alert	Short circuit in hand switch 1
E1133	Alert	Short circuit in hand switch 2
E1134	Alert	Short circuit in foot switch 1
E1135	Alert	Short circuit in foot switch 2
E1136	Alert	Short circuit in foot switch 3
E1137	Alert	Short circuit in foot switch 4
E1138	Alert	Short circuit in foot switch 5
E1139	Alert	Short circuit in foot switch 6
E1140	Alert	X-ray enable not active

18 Error Messages & Fault Finding

Code	Type	Description
E1141	Alert	CAN fault line active
E1142	Alert	External I/O fault
E1143	Error	Error Lifemonitoring Imaging System
E1148	Alert	Timeout post-fluoro time (LIH)
E1164	Error	Short circuit in hand switch 1
E1165	Error	Short circuit in hand switch 2
E1166	Error	Short circuit in foot switch 1
E1167	Error	Short circuit in foot switch 2
E1168	Error	Short circuit in foot switch 3
E1169	Error	Short circuit in foot switch 4
E1170	Error	Short circuit in foot switch 5
E1171	Error	Short circuit in foot switch 6
E1172	Error	X-ray enable without switch
E1173	Error	CAN fault line active
E1174	Error	External I/O fault
E1175	Error	Error Lifemonitoring Imaging System
E1176	Alert	Fan blocked
E1197	Error	Main interface X-ray break fault
E1198	Error	Main interface power-up fault
E1199	Error	Main interface fault
Module 11: Imaging System		
E1215	Error	Internal error %d (→ Ch. , p. 18-13)
E1216	Alert	Internal alert %d
E1217	Error	Error while clearing hard disk %d
E1218	Error	Timeout CAN module %d
E1219	Error	Unexpected ACK from CAN module %d
E1220	Alert	Function assigned to X-ray switch (%d), ignored!
E1221	Alert	XRAY command assigned to function switch (%d), ignored!
E1222	Alert	Temperature limit alert: Reduce radiation power!
E1223	Error	CAN bus cannot be addressed during power-up!

Code	Type	Description
E1224	Error	CAN module missing:
E1225	Alert	Radiation allowed after technique values are displayed!
E1226	Error	CAN modules missing:
E1227	Error	CAN module faulty: %d
E1228	Error	CAN module 6 U544 faulty
E1229	Error	CAN bus faulty BUS OFF
E1230	Error	Only CAN module 6 U544 present
E1231	Error	CAN module(s) not connected correct (standalone ?) → Ch. , p. 18-13
E1232	Error	Timeout: no answer from a CAN module
E1233	Error	Memory full. Image can not be stored!
E1234	Error	dis8000.ini missing!
E1235	Error	No acknowledge to %d from %d
E1236		vision.md does not match U544 firmware
E1237		vision.md does not match dongle
E1238		Machine data missing
E1239	Info	Service task performed by:
E1240	Info	Database OK
E1241	Info	Database damaged. Please clear hard disk !
E1242		Mobile stand not detected, but Main Interface present!
E1243		Iris calibration error !
E1244		vision.md: Section missing!
E1245		Radiation blocked by key switch
E1246		Flat Detector not ready.
E1299	Error	Image system fault
Module 1: Pre-Power Supply		
E1300	Error	SPI interface MAX 504
E1301	Alert	Overtemperature
E1302	Error	Reference voltage MAX 504
E1303	Error	Output voltage MAX 504
E1304	Error	Wrong EEPROM checksum

18 Error Messages & Fault Finding

Code	Type	Description
E1350	Error	SPI interface MAX 504
E1351	Alert	Overtemperature
E1352	Alert	Actual value too high
E1353	Alert	Actual value too low
E1354	Error	Output voltage MAX 504
E1355	Error	CAN fault line active
E1358	Alert	Output voltage beyond tolerance
E1398	Error	PPS power-up fault
E1399	Error	PPS fault
Module 15: Vision Track		
E1400	Error	Servo %d position fault
E1401	Error	Servo %d not connected
E1402	Error	Servo %d not ready
E1420		DAP meter error %d
E1421		DAP meter startup error %d
E1448		unknown DAP meter error
E1449	Error	Vision Track fault
Image Intensifier Power Supply		
E1450	Error	Servo position fault
E1451	Error	Servo not connected
E1452	Error	Servo not ready
E1499	Error	I.I. power supply fault
U525 - Remote Control VCR/Printer		
E1600	Alert	Busy printer 1 active
E1601	Alert	Busy printer 2 active
E1602	Error	Wrong EEPROM checksum
E1620	Alert	Printer 1 busy error
E1621	Alert	Printer 1 busy error
E1622	Alert	Printer 1 busy error
E1628	Alert	Printer 2 busy error

Code	Type	Description
E1629	Alert	Printer 2 busy error
E1630	Alert	Printer 2 busy error
E1649	Error	U525 fault
Module 136: Regulation		
E1700	Alert	kVmA table: kV not ascending
E1701	Alert	kVmA table: Power not ascending
E1702	Alert	kVmA table not finished
E1703	Alert	kV maximal value too high
E1704	Alert	mA maximal value too high
E1705	Error	No external video signal
E1708	Error	Generator pulse error
E1709	Error	No VSync
E1710	Error	No Interrupt
E1711	Error	No Communication PPC-generator
E1712	Error	mA from generator invalid
E1713	Error	XRAY not allowed
E1714	Error	Max mA value cannot be read.
E1716	Error	SDRAM PPC defective
E1717	Error	GammaLUT PPC defective
E1718	Error	Offset adjustment not possible
E1719	Error	Gain adjustment not possible
E1720	Error	Hardware Version, Release
E1721	Error	IRQ3 Error
E1722	Error	VSynC corrupt 30/25 Hz
E1723	Error	Video standard unknown
E1724	Error	Boot program unknown
E1725	Error	M-Data unknown
E1726	Alert	Collimator does not support DAP values
E1727	Error	Flatpanel not supported in this version
E1732	Error	Reference voltage defective

18 Error Messages & Fault Finding

Code	Type	Description
E1733	Error	AD14 Offset adjustment defective
E1734	Error	AD14 Gain adjustment defective
E1735	Error	AD14 Gain*4 adjustment defective
E1736	Error	AD8 Offset adjustment defective
E1737	Error	AD8 Gain adjustment defective
E1738	Error	No extreme video signal
E1740		Hardware doesn't support grid regulation
E1741		Hardware doesn't support motion detection
E1742		Hardware doesn't support DAP calculation
E1743		Hardware doesn't support automatic dose reduction
E1744		Histogrammer Hardware defective
E1799	Error	Error PPC

18.2 Fuse List

18.2.1 Input Fuse

Main Input Fuse	
Circuit Breaker	
F1	15A at mains supply 210-240V~
F1	20A at mains supply 100-200V~
	Whole unit will not work if circuit breaker is released

18.2.2 FG 9938 Fuses

FG 9938 Fuses	
AC input fuse	
Netz	Fuse 6.3 A slow, in series to the bridge rectifier
Overvoltage protection circuit fuse	
OVP	Fuse 4 A slow, in the ground wire Fuse is blown by a SCR if the output voltage gets too high
	E1226 CAN module missing 17,9 E1711 No communication PPC Generator (if you try screening)

18.2.3 U579 Fuses

Fuse	Value	Voltage	Source	Usage
F5	not equipped			Only used in Ziehm Vision R systems
F6	not equipped			Only used in Ziehm Vision R systems
F7	not equipped			Only used in Ziehm Vision R systems
F8	2 A slow	15 V	X49	Image intensifier Power Supply
	E1224 CAN module missing 16 E1002 No V-sync E1068 V-sync faults Unit does not screen			
F9	2 A slow	15 V	X51	CCD Camera
	E1068 V-sync faults E1002 No V-sync Unit does not screen			
F10	not equipped	24V	X46	Flat Panel (only used in Ziehm Vision FD systems)
F12	2 A slow	15 V	X59	+5 V U515 & CAN
	Unit does not screen, No error message Image memory runs in stand alone mode ("Mobile stand NOT present" shown in system versions)			
F13	4A slow	30 V	X60	FG 9938
	E1226 CAN modules missing 17,9 E1711 No communication PPC Generator (if you try screening)			
F14	3,15 A slow	230 V	X61/1 and X10/3	230V Distribution for Monitors, Printer, Image Memory
	Monitors and Solo Center will remain dark.			
F16	1 A slow	230 V	X61/1 and X10/3	to U531
	E1224 CAN module missing 10			
F18	6.3 A slow	24 V	X42	Lift motor power
	Lift motor does not work.			

Fuse	Value	Voltage	Source	Usage
F19	5AF	230V	F181X61/1 and X10/3	FG 2025
	E1054 kV nominal/actual value fault (this error will only appear in the zivi.log file and is not shown on the Solo Center)			
F20	0.5 A slow	24 V	Hub +30V	Lift motor control
	Lift motor does not work.			

18.3 Fault Finding

18.3.1 Power Faults

C-arm does not power up	
	Emergency switch and key switch respectively opened. Bridge missing if no key switch or emergency switch is equipped. (U579 X4 and X31) Temperature switch in transformer tripped (U579 / X22)
	F1A/F1B main input fuses tripped

18.3.2 Generator Faults

E1054 kV nominal/actual value fault (this error will only appear in the zivi.log file and is not shown on the Solo Center)	
	Supply voltage for generator final stage is missing.
	Fuse F19 tried
	Pre-power supply has no input voltage or is defective, Check cable terminals on FG 2025
	Generator defective
E1002 No V-Sync	
	CCD Camera does not work
	Power for CCD camera missing (U579 / F9) CCD Camera defective
	Cabling problems
	Check Flat cable of CCD camera Check cable from I.I. (U516 X6) to Generator (U562 X1)
	I.I. Power supply does not work properly
	Check supply power of I.I. Power Supply (U579 / F8) Optocoupler on I.I. Power Supply is defective

18.3.3 CAN Bus Faults

The CAN bus master is the U544 board in the image memory. Thus CAN bus errors are reported by the module 11, imaging system.

E1224 CAN module missing: address of module		
E1226 CAN modules missing: addresses of modules		
	CAN module(s) cannot be found during bootup	
		Check CAN bus cabling of the corresponding module(s). (Check Startup LEDs, have to show startup phases if connection to U544 is working.) Check supply power of the corresponding module(s). Try to reprogram corresponding module(s).
E1215 Internal Error: 214, 216, 219, 226, 227, 230, 233, 234, 244, 246, 247, 248		
	CAN module failed during operation (Subtract 210 to get the address of the module, e.g. 226-210=16, Module 16 has failed)	
		Check CAN bus cabling of the corresponding module(s). Check supply power of the corresponding module(s). Try to reprogram corresponding module(s).
E1229 CAN bus faulty BUS OFF		
E1223 CAN bus cannot be addressed during power-up!		
	CAN bus does not work after bootup	
		Perform CAN bus troubleshooting (→ Ch. 18.3.4, p. 18-14).
E1231 CAN module(s) not connected correct (standalone)		
	At least one CAN module is in stand alone mode.	
		Check CAN modules for stand alone mode setting.

For the module names refer to module number list (→ Ch. , p. 18-13).

18.3.4 CAN Bus Troubleshooting

If the system comes up with error 1229 "BUS OFF" the fault can be located as follows:

- Measure the CAN bus between H and L for short circuit. If Image Memory and U515 are connected via the CAN bus cable and the unit is switched off, you should get a reading of 30 Ohm. (all 4 termination resistors of 120 Ohm in parallel)
 - If there is a short circuit, locate it by stepwise removing bus participants.
- Measure the 5 V CAN. You have to measure at U515 and image memory separately.
 - If the supply voltage is missing check the 5 V line for short circuit, check the source of the supply voltage.
- Remove the Can cable from the image memory and start the Image Memory in standalone mode.
 - If the Image Memory starts up now, the fault is located in the remaining parts of the CAN bus.
 - Remove all RJ-45 connectors on the U515, connect the CAN termination resistor and start the Ziehm Solo
 - If the unit still comes up with E1229, check the cable between Image Memory and main interface.
 - Reconnect U531 and try bootup
 - Remove the termination resistor and reconnect the RJ-45 cable of the swivel harness (This connects to generator, vision track and image intensifier) and try bootup
 - Check the CAN cables and respectively replace the module that causes the Bus break down.
- If the Image Memory does not start in standalone mode, the fault is in the Image Memory.
 - Get to minimum configuration: remove all CAN connectors from the CAN distribution except the patch from CAN distribution to the U544. This is required to provide CAN +5 V inside the memory
 - If it still comes up with E1229, check if U578 D9 is lighting. The module is in reset state and blocks the CAN Bus. Replace U578.
 - Otherwise the image memory is faulty
 - Connect one participant after another and bootup. When E1229 appears again, check cable and replace corresponding module.

For measurements, use the service adapter for CAN bus, U587. It can be connected to any RJ-45 plug by the patch cable as well as directly to CAN cables.

Refer also to the CAN bus distribution diagram (→ Ch. 2.5.2, p. 2-10)



Fig. 18-51 U587 CAN bus service adapter

18.3.5 CAN Bus Startup

System power-up:

Every node must wait for the master (host) controller (U544).

Once the message “hello everybody” is coming from the master unit, every participant must send an acknowledgement to the master unit.

- 7 The master unit now checks that every important module is there.
- 8 The master unit now tells everybody how many nodes are there and in which group they are located.
- 9 The master unit now gives the command to everybody to start the “init 1 phase”. After all modules have sent back their acknowledgement, the master unit can send basic information to several modules.
- 10 The master unit now sends the “init 2 phase”. Every module starts the final initialization then, and after this procedure an acknowledgement must be sent back to the master unit.
- 11 The master unit now sends the “run phase”. Every module goes into “run state”.
- 12 The system is running.

“Hello everybody” command from master unit:

This message must be responded within 100 ms, otherwise the module will not be included in the system.

“Init one” phase command from master unit:

Every node initializes its own hardware.

Every node checks its own hardware for errors.

“Init two” phase command from master unit:

Every node initializes its own function depending on “machine data”.

Every node makes its own final initialization.

“Run phase” command from master unit:

Every module starts working.

Spy participants:

These are modules which keep silent during power-up.

These modules do not answer the “hello everybody” command and will be ignored by the master unit.

To work properly these “spies” must listen to the startup phase. After the master unit has sent the “run phase” command, these modules can get active. They also should never return an acknowledgement, but if they send a command to anybody in the system they must wait for the responses.

For example the SERCAN is a spy module on the CAN system.

This feature can be used for troubleshooting or reprogramming the system.

Other modules like “remote control” can be added to the system as well.

18.3.6 Image System Errors

E1234 dis8000.ini missing & Solo Center does not work properly & No radiation possible		
	USB Dongle not found	
		Check cabling from image memory to Dongle Check Dongle, you should see at least the options.dat and dis8000.ini files. You can read the Dongle using your notebook.
DVD drive does not work		
	Wiring problems	
		Check cabling from image memory to DVD drive Check if the power supply for the DVD drive is o.k.
	DVD recorder is defective	
		Replace DVD recorder
E1722 V-Sync corrupt		
	At least one V-sync pulse was missing at the input of the image memory.	
		Slack joint in the video signal wiring between CCD camera and image memory
E1738 No external video signal		
	No video signal at the input of the image memory.	
		Wiring problems in the video signal wiring between CCD camera and image memory

