MOBILE SURGICAL
X-RAY SYSTEMS BV25-S

VOLUME 2 OF 2
VIDEO INFORMATION

VIDEO INFORMATION (VOLUME 2 OF 2)

LIST OF DOCUMENTS IN THIS BINDER:

O DIGITAL SCOPOFIX MDP(M)
O DETACHABLE CASSETTE HOLDER FOR BV25
O SET STERILE COVERS FOR BV25 II-SHIELD, C-ARM, AND TANK UNIT
O SPRINGBOW FOR BV25 C-ARM
O SPACER FOR BV25
O
O
O II CASCADE GENERATOR
O TV CAMERA XTV8S FOR BV25
O HT CONV. TANK
O HM 17" TV MONITOR
O 15 CM II-TUBE
O VIDEO HARD COPY UNIT
O 15 CM II-SHIELD
O 15 CM II-SHIELD ASSY FOR SURGERY

NOTE:
O Indicates documents present in this binder.

OTHER Binder: SYSTEM INFORMATION
SERVICE VIDEO INFORMATION
BV25 SYSTEM

MODULE CODE NUMBER : 4522 983 54971

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4522 983 26041
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4522 983 13981
4522 983 13971
4522 983 13991
4522 983 17381
4522 983 29421
SERVICE MANUAL-UNIT

Digital Scopofix MDP

9807 721 0.001

This manual contains descriptive information on the equipment identified by the typenumber as stated above.

IPSC: Best

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BEST THE NETHERLANDS

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</tr>
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<td>(91.0)E</td>
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<td></td>
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<tr>
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<td>(91.0)E</td>
<td></td>
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<tr>
<td>C-5</td>
<td>(91.0)E</td>
<td></td>
</tr>
<tr>
<td>C-6</td>
<td>(91.0)E</td>
<td></td>
</tr>
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<td>(91.0)E</td>
<td></td>
</tr>
<tr>
<td>F-2</td>
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<td>(91.0)E</td>
<td></td>
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<tr>
<td>F-4</td>
<td>(91.0)E</td>
<td></td>
</tr>
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<td>F-5</td>
<td>(91.0)E</td>
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</tr>
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CONNECTOR AND LOCATION AZ-1
MDP REAR CONNECTOR AZ-2
FRONT VIEW BACK PANEL AZ-3
SECTION A

1. PURPOSE

The Medical Dual Image Processor (MDP) is a digital video image memory for use in surgical X-ray systems (BV 25N). It has image processing capabilities for use in surgical X-ray systems and kidney Lithotriper.

2. VERSIONS

- 9807 721 00001 : basic MDP version compatible with: BV25-N family.
- 9807 721 02001 : Basic MDP version, EMC-modified compatible with: BV25-N family and XTV8.

3. ITEMS SUPPLIED

- MDP built in a 19” rack
- front plate.
- installation material.

The rack consists of:

- Power supply
- Back Panel pcb (WHD10)
- AD converter/ADNR pcb (WHD11)
- Noise Reducer pcb (WHD13)
- 2 Memory pcb’s (WHD15,17)
- Subtractor pcb (WHD19)
- Local Control pcb (WHD20)
- Controller pcb (WHD25)

The installation material consists of:

- 4x screw M4 to mount the front plate.
- 4x screw M6 to mount the MDP-rack in the BV-25 trolley.

4. EQUIPMENT IDENTIFICATION

The type numberplate is mounted on the front (left inside) of the rack.
5. TECHNICAL DATA

5.1. DIMENSIONS AND WEIGHT

Height : 300 mm  
Width  : 412 mm  
Depth  : 435 mm  
Weight : 25 kg

5.2. PERFORMANCE DATA

5.2.1. Power supply

Supply voltage : 220 ±10% V  50/60 Hz  
Supply current : < 2 A  
turn on current : < 25 A  
Leakage current : < 3.5 mA

5.2.2. Connectors

Video input (connector WHD:X3):

Source impedance : 75 Ohm  
Video amplitude : 1100 mV ±5%  
Sync amplitude : 300 mV ±50 mV  
Bandwidth : 8 MHz

Video output 1 and 2 (connector WHD:X4, WHD:X5):

Impedance : 75 Ohm  
Bandwidth : 8 MHz  
Video amplitude : 1100 mV ±5%  
Sync amplitude : 300 mV ±50 mV

Synchronisation is normally locked to incoming video. When no input signal is available a standard interlaced SYNC-signal is internally generated, X-tal locked.

Remote control interface (connector WHD:X2)

All command lines are 5V LOC莫斯-compatible and active-HIGH.
SECTION A

Input circuit:

- All inputs are low pass filtered
- Input impedance : 47 KOhm
- Input voltage HIGH : > 3.5 V
- Input voltage LOW : < 1.5 V

Output circuit:

- All outputs are buffered and protected with diodes.
- Output voltage HIGH : > 3.5 V (at -1 mA).
- Output voltage LOW : < 0.5 V (at +1 mA).

8 lines are reserved for automatic identification of the different memory units.

<table>
<thead>
<tr>
<th>IDENT</th>
<th>FUNCTION</th>
<th>STATUS #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Single frame store + averaging</td>
<td>LOW</td>
</tr>
<tr>
<td>2</td>
<td>Dual frame store + averaging + integration</td>
<td>HIGH</td>
</tr>
<tr>
<td>3</td>
<td>Disc option</td>
<td>HIGH</td>
</tr>
<tr>
<td>4</td>
<td>Subtraction</td>
<td>HIGH</td>
</tr>
<tr>
<td>5</td>
<td>Zoom option (future feature)</td>
<td>LOW</td>
</tr>
<tr>
<td>6</td>
<td>Gamma correction</td>
<td>HIGH</td>
</tr>
<tr>
<td>7</td>
<td>Contour correction (future feature)</td>
<td>LOW</td>
</tr>
<tr>
<td>8</td>
<td>Spare</td>
<td>LOW</td>
</tr>
</tbody>
</table>

# = Status for switched-on MDP-unit
5.2.3. TV Line Systems

- Interlaced or Non-interlaced possible.
- Jumper for selection 50Hz/60Hz.

<table>
<thead>
<tr>
<th></th>
<th>50 Hz (CCIR)</th>
<th>60 Hz (EIA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>625 lines, interlaced</td>
<td>525 lines, interlaced</td>
</tr>
<tr>
<td></td>
<td>2 x 313 lines, non-interlaced</td>
<td>2 x 263 lines, non-interlaced</td>
</tr>
</tbody>
</table>

5.2.4. Image Matrix Size

The total unblanking period is stored.

AD conversion: 8 bits
Sampling rate: appr. 19 MHz
Memory depth: 10 bits

50 Hz: 576 lines of 975 pixels
60 Hz: 478 lines of 975 pixels

5.3. ENVIRONMENTAL DATA

The MDP-unit complies with classification C1 (UXW 13600).

Ambient temperature:

storage: -25°C to +70°C.
operation: +10°C to +40°C.

Relative humidity:

storage: 10% to 90%
operation: 10% to 85%

5.4. APPLICABLE STANDARDS

- UL 478
- CSA C22.2 nr. 154
- HHS certified
- IEC 435
- CISPR 11 and 11A
- FCC rules CFR 47 part 2 and 15
- VDE 871 level B
Figure 1: Rear view MDP-unit

<table>
<thead>
<tr>
<th>Connector</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHD:1</td>
<td>Safety ground</td>
</tr>
<tr>
<td>WHD:2</td>
<td>Signal current</td>
</tr>
<tr>
<td>WHD:X1</td>
<td>Mains supply</td>
</tr>
<tr>
<td>WHD:X2</td>
<td>Remote connector interface</td>
</tr>
<tr>
<td>WHD:X3</td>
<td>Video input</td>
</tr>
<tr>
<td>WHD:X4</td>
<td>Video output 1</td>
</tr>
<tr>
<td>WHD:X5</td>
<td>Video output 2</td>
</tr>
</tbody>
</table>

Figure 2: Connector locations
<table>
<thead>
<tr>
<th>INPUT FUNCTION</th>
<th>PIN</th>
<th>OUTPUT FUNCTION</th>
<th>PIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>START</td>
<td>08</td>
<td>IDENT1</td>
<td>36</td>
</tr>
<tr>
<td>MEM1</td>
<td>10</td>
<td>IDENT2</td>
<td>40</td>
</tr>
<tr>
<td>MEM2</td>
<td>11</td>
<td>IDENT3</td>
<td>42</td>
</tr>
<tr>
<td>LIH</td>
<td>13</td>
<td>IDENT4</td>
<td>44</td>
</tr>
<tr>
<td>ER</td>
<td>14</td>
<td>IDENT5</td>
<td>46</td>
</tr>
<tr>
<td>NR1</td>
<td>19</td>
<td>IDENT6</td>
<td>48</td>
</tr>
<tr>
<td>NR2</td>
<td>20</td>
<td>IDENT7</td>
<td>50</td>
</tr>
<tr>
<td>NR3</td>
<td>21</td>
<td>IDENT8</td>
<td>49</td>
</tr>
<tr>
<td>NR4</td>
<td>22</td>
<td>BUSY</td>
<td>37</td>
</tr>
<tr>
<td>DISK OPTION</td>
<td>02,04,06</td>
<td>DISK OPTION</td>
<td>33</td>
</tr>
<tr>
<td>GAMMA1</td>
<td>24</td>
<td>+5V/500 Ohm</td>
<td>30,32</td>
</tr>
<tr>
<td>GAMMA2</td>
<td>25</td>
<td>SPARE1</td>
<td>31</td>
</tr>
<tr>
<td>SUB1</td>
<td>27</td>
<td>SPARE2</td>
<td>35</td>
</tr>
<tr>
<td>SUB2</td>
<td>28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZOOM</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INVERT</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRACE</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESERVED</td>
<td>41,45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0V</td>
<td>01,03,05,07,09,15,18,23,26</td>
<td>0V</td>
<td>29,34,36,39,43,47</td>
</tr>
</tbody>
</table>
Figure 4: Front view Back panel
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   3.2. SUBTRACTOR BOARD (WHD19) ........................................ 3
   3.3. Controller board (WHD25) ............................................. 4
4. INSTALLATION INSTRUCTIONS ........................................... 5
1. INTRODUCTION

The instructions how to install the MDP-unit in a BV 25 system will be found in the System Service Manual of the BV 25 system.

2. TOOLS AND TEST EQUIPMENT

- Standard toolset.

3. PROGRAMMING FACILITIES

![Diagram of switches and jumpers at the front of the rack]

Figure 1: Switches and jumpers at the front of the rack

3.1. AD CONVERTER BOARD / AD-NOISE REDUCER BOARD (WHID11)

Depending on the MDP version, basic or basic modified for XTV-8, an AD converter board (up to 4522 107 87052) or an ADNR board (4522 105 1962) is placed in the MDP. The ADNR board is downwards compatible with the AD-converter board. It contains the same functionality however the ADNR board is extended with a recursive digital filter.

Programming facilities:

AD converter board  
: Switch WHID11:S1 activates the internal video test-pattern.

ADNR board  
: Switch WHID11:S1 activates the internal video test-pattern.  
: Jumper WHID11:W1 enables/disables the noise reduction function.
3.2. SUBTRACTOR BOARD (WHD19)

Figure 2 gives a simplified diagram to explain the function of the switches WHD19:S1 -> S4. Figure 3 shows selection possibilities of the switches WHD19:S1 -> S4.

Figure 2: Simplified diagram of the subtractor board
### Table: Selection possibilities of the switches S1 -> S4 on the Subtractor board (WHD19)

<table>
<thead>
<tr>
<th>SWITCH</th>
<th>SELECT</th>
<th>SELECTED FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>0</td>
<td>multiply factor (SUB1)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>S2</td>
<td>0</td>
<td>multiply factor (SUB2)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>S4.2</td>
<td>open</td>
<td>selection from S4.1</td>
</tr>
<tr>
<td></td>
<td>closed</td>
<td>selection from S3</td>
</tr>
<tr>
<td>S4.1</td>
<td>open</td>
<td>selected memory</td>
</tr>
<tr>
<td></td>
<td>closed</td>
<td>non-selected memory</td>
</tr>
<tr>
<td>S3</td>
<td>0</td>
<td>black</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>grey level</td>
</tr>
<tr>
<td></td>
<td></td>
<td>step ± 69 mV</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>0 - 94%</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>white</td>
</tr>
</tbody>
</table>

Figure 3: Selection possibilities of the switches S1 -> S4 on the Subtractor board (WHD19).

### 3.3. Controller board (WHD25)

Depending upon the TV-line system of the applied video, the jumper WHD25:W1 has to be set in the position 50 Hz (1-2) or 60 Hz (1-3).
4. INSTALLATION INSTRUCTIONS

1. Mount the unit as described in the relevant Service Manual-System.

2. Set switches and jumpers in the for application required position (see relevant Service Manual-System).

**NOTE**

Factory settings of switches and jumpers are marked **bold** in next tables

<table>
<thead>
<tr>
<th>SWITCHES</th>
<th>POSITION</th>
<th>SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHD11:S1</td>
<td>OFF</td>
<td>Test pattern OFF</td>
</tr>
<tr>
<td>WHD19:S1.1</td>
<td>2</td>
<td>Multiply factor 1 for SUB1</td>
</tr>
<tr>
<td>:S2.1</td>
<td>1</td>
<td>Multiply factor 2 for SUB2</td>
</tr>
<tr>
<td>:S3.1</td>
<td>3</td>
<td>non selected memory</td>
</tr>
<tr>
<td>:S4.1</td>
<td>Closed</td>
<td>added as background</td>
</tr>
<tr>
<td>:S4.2</td>
<td>Open</td>
<td></td>
</tr>
</tbody>
</table>

Table for application settings

Jumpersettings ADNR-board (4522 108 1962.):

<table>
<thead>
<tr>
<th>JUMPERS</th>
<th>POSITION</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHD11:W1</td>
<td>1-2</td>
<td>Noise reduction OFF</td>
</tr>
<tr>
<td></td>
<td>1-3</td>
<td>Noise reduction ON (XTV8)</td>
</tr>
</tbody>
</table>

# = in case of XTV5 camera, set jumper in position 1-2

Jumpersettings Controller board (WHD25):

<table>
<thead>
<tr>
<th>JUMPERS</th>
<th>POSITION</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHD25:W1</td>
<td>1-2 @</td>
<td>50 Hz</td>
</tr>
<tr>
<td></td>
<td>1-3</td>
<td>60 Hz</td>
</tr>
</tbody>
</table>

@ = set jumper in correct position
3. Connect cables to the rear of MDP-unit.

**WARNING**

*When the 220V-supply cable (WHD-X1) has been connected, some parts of the unit will have a 220V tension (also when the power switch is in the OFF-position)*

<table>
<thead>
<tr>
<th>CONNECTOR</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHD-X1</td>
<td>220V supply</td>
</tr>
<tr>
<td>WHD-X2</td>
<td>system interface</td>
</tr>
<tr>
<td>WHD-X3</td>
<td>video input</td>
</tr>
<tr>
<td>WHD-X4</td>
<td>video output 1</td>
</tr>
<tr>
<td>WHD-X5</td>
<td>video output 2</td>
</tr>
</tbody>
</table>

Connections at rear of MDP-unit.
SECTION C: SETTING TO WORK

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5. SETTING UP AND TESTING ............................................ 6
1. INTRODUCTION

Pcb's are factory adjusted but in case of a disturbance of the adjustment, it can be necessary to re-adjust. Therefore in section F an additional description for adjustments is given.

*NOTE*
the unit does not work properly with PCB's on extender boards because of the high frequency used.

2. EQUIPMENT REQUIRED

- standard toolset

3. CONTROLS AND INDICATORS

3.1. AD CONVERTER/ADNR BOARD (WHD11)

- Led WHD11:H1 is lighting when the internal video is disturbed.

3.2. MDP OPERATIONAL FUNCTIONS

On the Local Control board (WHD20) commands can be given to select functions or modes. Local commands are overruled by remote commands. Acceptance of a command (both local or remote) is indicated by lighting of the appropriate LED on the Local Control board (WHD20).

3.2.1. Digital bypass

With digital bypass, the video signal passes the path: video in - ADC - DAC - video out, without memory store. Therefore:

- de-activate all local commands (no LED's on the Local Control board are lighting).

3.2.2. Processing functions

Applicable for both live and frozen images.

*Gamma correction:*

- activate GAMMA1 (curve 1) or GAMMA2 (curve 2).

Curve 1 is intended for contrast enhancement.
Curve 2 is intended for correction of film non-linearity in hard copy units.
Subtraction:
The activated memory is the live image.

1. Activate MEM1  (SUB=MEM1-MEM2)
2. Activate SUB1  (SUB=MEM2-MEM1)
3. Activate INVERT  (INVERT inverts subtraction result)

3.2.3. Noise reduction
Applicable for live images.

Last Image Hold:

1. Select a memory (MEM1 or MEM2)
2. Activate LIH and START

   NOTE:
   For live noise reduction, START must be active. De-activate START to freeze the noise reduced image.

3. Select noise reduction grade:
   NR1: K=1/2
   NR2: K=1/4
   NR3: K=asymmetry defined (K=1/4 -> 1/2)
   NR4: K=asymmetry defined (K=1/8 -> 1/4)

   NOTE:
   No selection of noise reduction grade will result in: K=1 (live image).

Electronic Radiography:

1. Select a memory
2. Activate ER and START
3. Select number of images for integration:
   NR1: N=2
   NR2: N=4
   NR3: N=8
   NR4: N=16

4. De-activate START after appearance of the frozen image.
3.2.4. Trace

1. Select a memory
2. Activate TRACE and START

NOTE:
For live tracing, START must be active. De-activate START to freeze the traced image.

3. Select trace-white or trace-black:
   NR1: white
   NR2: black

NOTE:
NR3, NR4 or no selection disables the TRACE

4. ADJUSTMENT FACILITIES

AD Converter board / ADNR board (WHD11)

Potentiometer WHD 1:R1 adjusts the maximum amplitude for the AD convertor (factory adjusted to video amplitude of 1100 mV).

Measuring points on front of the board:

<table>
<thead>
<tr>
<th>MEASURING POINT</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHD11:-5V</td>
<td>-5V</td>
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<tr>
<td>WHD11:+5V</td>
<td>+5V</td>
</tr>
<tr>
<td>WHD11:-12V</td>
<td>-12V</td>
</tr>
<tr>
<td>WHD11:0V</td>
<td>0V</td>
</tr>
<tr>
<td>WHD11:+12V</td>
<td>+12V</td>
</tr>
</tbody>
</table>
Memory board 1 (WHD15) and Memory board 2 (WHD17)

WHD15/17:R1 : adjustment output amplitude (factory-adjusted to 1100 mV).
WHD15/17:MP1 : measuring point for video output.

Figure 1: Measuring and adjusting points at the front of the MDP-rack
5. SETTING UP AND TESTING

This paragraph describes the setting up and functional test of an installed unit. Therefore if the related Service Manual-System prescribes other or additional checks, follow these instructions.

The MDP-unit is factory adjusted to an input-to-output ratio of 1 ± 5% (at 1100 mV) and needs no further adjustment.

**NOTE**
*After switching ON (or OFF), wait 30 seconds before switching off (or on) again.*

1. Prior to power-on, check the correct settings of jumpers and switches, the proper connection of cables and the unlock position of the shipping security, as described in section B.

2. Switch power on and check:
   a. Power-on lamp WHD:H1 is lighting.
   b. All LED's on Local Control board (WHD20) are lighting up for about 1 second.

3. For a new delivered MDP-unit, the AD/ADNR- and Memory-boards are factory adjusted to an input-to-output ratio of 1:1 (at 1100 mV) and need no further adjustment.

4. Check all the processing functions as mentioned in paragraph "Controls and indicators" of this section.
# SECTION F: CORRECTIVE MAINTENANCE

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1. **INTRODUCTION**

This section gives procedures for adjustments, replacements and identification of a faulty power supply or faulty pcb's. PCB's are to be replaced and not repaired.

2. **EQUIPMENT REQUIRED**

- standard toolset
- multimeter (R > 10 Mohm)
- oscilloscope (dual channel)

3. **ADJUSTMENTS**

Place jumper WHD11:W1 in position 1-2 (if present).

For the correct adjustment it is necessary to follow the sequence of the procedure:

1. Output gain
2. Input offset
3. Overall gain

During the adjustments the outputs WHD:X4 and WHD:X5 of the unit should be connected to either a 75 ohm impedance or a monitor (75 ohm termination).

**IMPORTANT**

*The remote control connector WHD:X2 must be disconnected.*

If the measured video-signal on WHD15/17:MP1 (Memory boards) contains too much noise, use the output connector (WHD:X4 or WHD:X5).

After adjustment, place jumper WHD11:W1 in position 1-3 (if present).

**Output gain**

1. Switch the power on.
2. Set on the AD Converter/ADNR board the switch WHD11:S1 in position 'test'.
3. Connect measuring point WHD15:MP 1 of Memory 1 or output WHD:X4 to channel A of an oscilloscope.
4. Measure a staircase pattern like the one in fig. 1.
5. Adjust with potentiometer WHD15:R1 on Memory 1 board, the maximum amplitude of the signal to 1100 mV ± 5%.
6. Connect measuring point WHD17:MP 1 of Memory 2 board or output WHD:X5 to channel B of the oscilloscope.
7. The pattern on channel B must be covering the pattern on channel A. This can be accomplished by the adjustment of potentiometer WHD17:R1 on Memory 2.

8. Switch the test-switch WHD11:S1 off.

![Figure 1: The generated test-pattern](image)

**Input offset**

1. Disconnect input-signal on connector WHD:X3 of the unit.

2. Turn the potentiometer WHD11:R2 on the AD Converter/ADNR board fully counter clock wise (ccw). On the oscilloscope a DC-level with sync-pulses appears.

3. Turn the potentiometer WHD11:R2 slowly clock wise (cw). The DC-level will decrease with steps of 4 mV. (Can only be seen with a 1:1-probe).

4. Turn the potentiometer WHD11:R2 cw until the DC-level just equals zero.

**Overall gain (1:1)**

1. Apply on WHD:X3 video (from the system).

2. Measure on WHD:X3 and on WHD17:MP1 of Memory 2 or output WHD:X5 the amplitude of the video-signal.

3. Adjust with potentiometer WHD11:P1 on the AD Converter/ADNR board the input gain. The input/output-ratio must be 1.

4. Check the adjustment procedure as follows.

5. Change the connection of the oscilloscope from Memory 2 to Memory 1 and measure the amplitude of the output video signal from Memory 1.

6. If both ratio's are 1 then the adjustments are correct. If not, then the total adjustment procedure has to be repeated.
4. REPLACEMENTS

Sometimes inserting of the power supply unit in the glider entry causes problems. It is possible to remove the front support (plate) of the power supply unit first. After placing the power supply in the glider, the support can be mounted again.

5. FAULT FINDING PROCEDURE

5.1. INTRODUCTION

IMPORTANT
Disconnect the remote control connector (WHD-X2) to enter TEST-mode.

WARNING
Although the power switch is in the OFF-position, some parts of the unit still have a 220V tension!!

CAUTION
Before inserting, connecting or disconnecting boards or wiring, always switch OFF the power supply!!

NOTE
The unit does not work properly with PCB's on extender boards because of the high frequency used

5.2. POWER SUPPLY

(see chapter 5.1., IMPORTANT, WARNING, CAUTION and NOTE).

1. Remove front cover and switch the unit on.
2. Check if 220V is present (watch the neon indicator).
3. Measure on the measuring points WHD11: +12V, +5V, -5V and -12V of the AD Converter board if the correct voltages are present (tolerance ± 5%).
4. When the correct voltages are not present, successively disconnect the flatcable connections at the Controller (WHD25) and measure the voltages. When correct, the Local Control Board (WHD20) or the flatcables are defective. Replace or change successively.
5. When still no correct, disconnect with the exception of the AD Converter/ADNR board (WHD11) all the boards. Measure again the voltages. When correct, one of the boards is defect. Replace successively to find out which one.

6. In case of fault change successively the AD Converter/ADNR board and power supply. When no voltages present, the backpanel or wiring is defective.

7. Switch OFF the power.

**NOTE**

After using a new AD Converter/ADNR board and/or a new power supply, check the adjustments mentioned in chapter 3.

5.3. MDP-FUNCTION

(see chapter 5.1., IMPORTANT, WARNING, CAUTION and NOTE.

1. Remove the front cover and switch the unit off.

2. Disconnect/remove with the exception of the AD Converter/ADNR board all the boards.

5.3.1. Controller/Local Control-board

Boards connected: AD Converter/ADNR board (WHD11).

1. Insert the Controller-board (WHD25) and connect the Local Control-board (WHD20).

2. Switch the power on. All LED’s on the Local Control-board are on for about 10sec. After that time they should ALL be off.

3. If this has not happened, change successively, after the power has been switched off, the AD/ADNR-, Controller- and Local Controller-board and the flat-cable connection.

4. Test again. If the problem is not solved, the backpanel is defective.

5.3.2. Analog Bypass

Boards connected: AD Converter/ADNR board (WHD11)
Controller (WHD25)
Local Control-board (WHD20)

1. Switch the power off.

2. Insert Memory 1 (WHD15) and connect the video-cables between the AD Converter/ADNR board (WHD11) and Memory 1 (WHD15) and between Memory 1 (WHD15) and connector WHD:4.
3. Apply a video-signal to connector WHD:X3 of the unit.

4. Watch the output-video from connector WHD:X4 on a monitor. If this is not present, it will be caused by one of the following faults:

   . input relais AD Converter/ADNR board defective.
   . output relais Memory 1 defective. Exchange Memory boards to check.
   . video-cables defective.

---

**Figure 2: Analog bypass**

**Figure 3: Digital bypass**
5.3.3. Digital Bypass

Boards connected: AD Converter/ADNR board (WHD11)
Controller (WHD25)
Local Control-board (WHD20)
Memory 1 (WHD15)

1. Place jumper WHD11:W1 in position 1-2 (if present).

2. Insert the Noise Reducer-board (WHD13), the second Memory board (WHD17) and connect the video-cables between Memory 2 (WHD17) and connector WHD:X5.

3. Switch the power on. Check again if all LED’s on the Local Control-board (WHD20) are on for about 10 sec., when not change the AD Converter/ADNR board (WHD11).

4. Video must be again present on connector WHD:X4 and because of the second memory also on connector WHD:X5. If the video is not present a Memory, AD Converter/ADNR or Noise reducer board can be defective.

5. After test, place jumper WHD11:W1 in position 1-3 (if present).

5.3.4. Test Generator

Boards connected: AD Converter/ADNR board (WHD11)
Controller (WHD25)
Local Control-board (WHD20)
Memory 1 (WHD15)
Memory 2 (WHD17)
Noise reducer (WHD13)

1. Place jumper WHD11:W1 in position 1-2 (if present).

2. Switch with the switch WHD11:S1 on the AD Converter/ADNR board the test generator on. A staircase video-signal is generated, resulting in two white-to-black bar patterns on the monitor screen. If not the AD Converter/ADNR board is defective.

3. Place jumper WHD11:W1 in position 1-3 (if present).

5.3.5. Noise Reducer Functions

Boards connected: AD Converter/ADNR board (WHD11)
Controller (WHD25)
Local Control-board (WHD20)
Memory 1 (WHD15)
Memory 2 (WHD17)
Noise reducer (WHD13)

setting: switch WHD11:S1 -> on
In case of AD converter board (up to 4522 107 87053):

1. Press switch LER on the Local Control-board.

2. Press switch LNR1 to select subtract circuit of Noise reducer-board and with an oscilloscope measure the signal on connector WHD:X4 or watch the monitor screen of Memory 1 (WHD15) (fig 4b). A DC-voltage of 550 mV with sync pulses can be measured or on the monitor a grey level can be seen.

3. Press switch LNR2 to select add circuit in addition (fig 4c). Nothing should change.

4. Press switch LNR3 to select multiplication circuit in addition (fig 4d). The original staircase can be measured or on the monitor the bar pattern can be seen.

5. Press LER and LNR3 again to reset the functions.

6. Repeat the test but instead of pressing key LER use key LLIH. Measure the signal on connector WHD:X5 or watch the monitor screen of Memory 2 (WHD17).

7. When only function LER is faulty, change Memory 1 (WHD15). When only function LLIH is faulty, change Memory 2 (WHD17). When both functions are faulty, or when LNR1 works fine but LNR2 or LNR3 does not, change the Noise Reducer-board (WHD13).

8. Repeat the tests. If there is still something wrong, change the backpanel.

In case of ADNR board (4522 108 1962):

To test the MDPM noise reducer function, follow the same procedure as described by the AD converter board (see above). On the ADNR PCB an extra noise reduction function (for XTV-8) is available. This extra function can be tested as follows:

1. Place jumper WHD11:W1 in position 1-3

2. Switch OFF the MDPM noise reducer function (Switch off: LNR1, LNR2, LNR3 and LNR4 on local control board).

The following signals must be active:

- START
- LIIH
- MEM1 or MEM2

3. Obtain a moving noisy image (fluoroscopy with moving object)

Results: when the image does not corresponds with one or more of next points, replace ADNR board.

1. The image must contain less noise in case the noise reduction function is activated. To compare, change jumper position WHD11:W1 1-2 and 1-3.
2. During fluoroscopy, in the image moving artefacts (smearing) must be visible.
3. The outcoming video image may not contain irregularities.
5.3.6. **Subtractor-board**

Boards connected and settings: see paragraph "Noise Reducer Functions"

1. Switch the power OFF.
2. Mark the settings of the switches WHD19:S1, S2, S3 and S4.2 of the Subtractor-board.
3. Select "grey-level" (switch WHD19:S4.2 closed) and select 3 for the level with switch S3.
4. Select for LSUB1 a multiplication factor 1 (switch WHD19:S1 position 2) and for LSUB2 a multiplication factor 2 (switch WHD19:S2 position 1).
5. Insert the Subtractor-board.
6. Disconnect the input video from WHD:X3, switch the power on and store the test-pattern in Memory 1 by pressing the keys LLIH, LMEM1 and twice LSTART on the Local Control-board.
7. Switch off the test-pattern and store the black level in Memory 2 by pressing LMEM2 and twice LSTART.
8. Subtract the memory images by pressing key LSUB1.
9. Return to memory 1 (LMEM1). The result is a new bar pattern. If we compare this pattern with the original one we can see that the new one has a much larger white bar which is the result of the addition of the grey level with the test-pattern.

<table>
<thead>
<tr>
<th>KEYS</th>
<th>CLIPPED BAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUB1</td>
<td>white (small)</td>
</tr>
<tr>
<td>SUB1, INVERT</td>
<td>black (large)</td>
</tr>
<tr>
<td>SUB2</td>
<td>white (medium)</td>
</tr>
<tr>
<td>SUB2, INVERT</td>
<td>black (very large)</td>
</tr>
</tbody>
</table>

Figure 4: Keys on the Local Control-board.

10. Repeat the subtract function. Instead of using LSUB 1 use the keys selections of fig. 4.
11. Switch the power off, pull out the Subtractor-board and exchange it when something was incorrect else reset the original switches settings and insert the board.
Figure 5: a) Test generator, b) Test mode NR1, c) Test mode NR2, d) Test mode NR3

Figure 6: Subtraction
5.3.7. Gamma Corrections

All boards connected switch WHD11:S1 -> on

1. Switch the power on.
2. Select Memory 1 (LMEM1).
3. Measure with an oscilloscope on connector WHD:X4. If you press one of the two gamma correction keys the level of some steps of the staircase will change.
4. Test both gamma corrections. When incorrect change Memory 1 (WHID15).
5. Repeat the test for Memory 2. Select Memory 2 (LMEM2) and measure on WHD:X5.
SECTION G: EXPLANATIONS

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4. MEMORY BOARD ....................................................... 4
5. SUBTRACTOR BOARD .................................................. 5
6. CONTROLLER BOARD .................................................. 6
1. **INTRODUCTION**

See diagram Z1.2.

In diagram Z1.2. 6 parts can be discerned (see also figure 1.). On the AD Converter/ADNR board the applied analog video-signal is converted into an 8 bit digital signal and sent to the Noise Reducer. On the Noise Reducer some noise reduction functions are possible, using the images coming from the AD Converter/ADNR board and from the selection of one of the two Memory boards. The image at the output of the Noise Reducer is saved in the selected memory.

Each memory has a DAC, so the contents of each memory can be displayed on a monitor.

Using the Subtractor and the DAC on one of the two memory boards, the contents of the memories can be subtracted and displayed on a monitor, without affecting the contents of the memories.

On the Controller a micro-processor is used for the mode selection and timing- and control-signals.

Figure 1: Functional block diagram of the MDP-unit

2. **AD CONVERTER- or ADNR- BOARD**

The input video is connected to WHD:X3 and via bypass- switch and buffer sent to the clamping circuit. After clamping the video to 0 V, the video is converted into an 8 bit digital signal. Then in case of ADNR-board, recursive filtered and after that buffered (outputbus AD-OUT 0 to 7).

For test purpose a digital staircase is generated (WHDI1:S1 on TEST) resulting in two white-to-black bar patterns on the monitor.

The sync pulses from the video are separated into horizontal and vertical sync pulses and buffered (output signals V-pulse and H-pulse).

The sync detector/oscillator detects if no sync pulses are present and then generates X-tal controlled sync pulses.

The PLL-oscillator, locked by the horizontal sync, is running at a frequency of about 40 MHz; after clipping, pulse stretching, dividing by two and buffering we get signals CLOCK and CLOCK-N of 20 MHz.

The clock signals, sent to the processor and the memory boards, are synchronised with the incoming video-syncs.
3. **NOISE REDUCER BOARD**

The selected memory signal, from Memory 1 (WHD15) or Memory 2 (WHD17), is subtracted from the live signal and the result is multiplied with a factor K (0<K<1) and then added to the selected memory signal.
SECTION G

The factor K:

Fixed K: Value K is supplied by the processor (K=1/4 or 1/2).

Moving K: Dependent upon the value of the subtracted signal (D) a PROM makes a
K-factor (K=1/4 <-> 1/2 or K=1/8 <-> 1/4, application requirements).

Tracing K: The factor K is defined by the selection trace white / trace black and by the value of
the subtracted signal D.
This results in storage of the minimum respectively maximum value of each pixel.

<table>
<thead>
<tr>
<th>TRACE WHITE</th>
<th>TRACE BLACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>D&gt;0</td>
<td>K=1</td>
</tr>
<tr>
<td>D&lt;0</td>
<td>K=0</td>
</tr>
</tbody>
</table>

4. MEMORY BOARD (Memory 1 and Memory 2 are identical)

After buffering, the digital video is set in the Charge-Coupled-Device (CCD) memory. Via the output and
input switches of the CCD memory (field 1 and 2) the memory is refreshed.
The output of the CCD memory is buffered and sent to the noise reducer and subtractor. The selector
switch chooses between the output of the CCD and the output of the subtractor.
The digital to analog convertor (DAC) gets its input from the selector switch which selects:

a. Input-video of memory.
b. Output-video of CCD memory / Output-video of subtractor.
c. Gamma corrected signal as b.
5. **SUBTRACTOR BOARD**

Figure 4 gives a simplified diagram of the subtractor.

![Simplified diagram of the subtractor](image)

Figure 4: Simplified diagram of the subtractor

With the switches S1 - S4 and the keys LMEM 1, LMEM 2, LSB 1, LSB 2 and LINVERT on the Local control-board the next algorithm can be filled in.

**INVERT * (SEL - NON SEL) * MULT.FACTOR + ADDITION**

Where:

- LMEM 1 or LMEM 2 is the memory which is marked as SEL (SELECTED). (NON SEL = NON SELECTED memory).
- LSB 1 or LSB 2 selects the multiplication factor which is set by the switches S1 and S2 (see fig. 3).
- LINVERT: non-active = -1; active = +1.
- Addition is filled in by the switches S4.1, S4.2 and S3. (See fig. 3).
After latching memory 1 and 2, one of the memory busses is inverted and added to the other (non-inverted) memory bus resulting in: Memory 1 - Memory 2. The subtracted digital video-signal is multiplied by a factor 1/2, 1, 2 or 4 and added to a selected background. This selected background is one of the next three possibilities:

a. Image from Memory 1.
b. Image from Memory 2.
c. Grey-level.

If the subtracted and multiplied digital video signal is negative or the amplitude is too high, the signal is limited. The negative signal is converted to black level and the signal level higher than the maximum amplitude is set to white level.

6. CONTROLLER BOARD

The microprocessor on the Controller board is driven by clock pulses, being generated on the AD Converter/ADNR board. Those pulses have been synchronised to the horizontal and vertical sync pulses of the video-signal. When no video sync pulses are present, then an internal generator on the AD Converter/ADNR board supplies the sync-pulses.

On-board timers generate internal and external timing signals, which are transferred to the data control bus through output X2 A15 : C27.
SERVICE PARTSLIST UNIT

PEI: 9807 721 02001

DESCRIPTION: DIGITAL SCOPOFIX MDP

SERIAL NR:

List of pages and drawings

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P- 1   (91.0)
P- 2   (91.0)
PZ-1  (88.0)  9807 721 0.001

*printing instructions 4522 983 32261

9807 721 02001  (91.0)  P-00
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DIGITAL SCOPOFIX MDP

Section Z: DRAWINGS

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