# MEDCAPTAIN[]

Nein Navi30/60

Service manual

Version V1.0English



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- All replacement parts, supporting accessories and consumables used during the maintenance are provided by MEDCAPTAIN;
- Maintenance records for product are reserved.

## Version Information

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# Content

IN	FELLI	LECTUAL PROPERTY RIGHTS	2
DE	CLAR	RATION	2
1	IN	MPORTANT INFORMATION	5
	1 1	SERVICE PERSONNAL	5
	1.2	LIMITATION OF THE SERVICE MANUAL	5
	1.3	DEVICE MAINTENANCE AND INSPECTION	5
	1.4	QUALITY CONTROL	5
	1.5	SAFETY TIPS	6
	1.6	LIST OF ABBREVIATED	6
	1.7	LIST OF SYMBOLS	6
	1.8	CONTACTS	6
2	SI	YSTEM INSTRUCTION	8
	91	SCODE OF THE ADDITCATION	Q
	2.1	PRODUCT FEATURES	۰ ع
	2.3	PRINCIPLE OF THE OPTICAL PATH	8
	2.4	SPECIFICATIONS	9
	2.5	COMPOSITION	
	2.6	Appearance	10
3	HÆ	IARDWARE	13
	3.1	CIRCUIT DIAGRAM	13
	3.2	MAIN CONTROL BOARD	
	3.3	CCD	
	3.4	TRANSFER BOARD	14
	3.5	Projector	15
	3.6	BATTERY	15
4	TE	EST AND MAINTENANCE	16
	4.1	CLEANING	16
	4.2	CLEANING STEPS	16
	4.3	CHECK BEFORE EACH USE:	16
	4.	<i>1. 3. 1 appearance inspection</i>	
	4.	<i>t. 3. 2</i> data line detection	
	4.	<i>A. 3. 3</i> check the built-in battery (every 6 months)	
5	CA	ALIBRATION	18
	5.1	ACCURACY TEST:	18
	5.2	CALIBRATION	

6	TF	ROUBLESHOOTING	20
	6.1	COMMON FAULTS AND TROUBLESHOOTING	20
7	DI	ISSEMBLY AND ASSEMBLY	22
	7.1	Remove the battery	22
	7.2	Remove the shell	22
	7.3	REMOVE THE MAIN CONTROL BOARD AND THE LIGHT PATH MODULE	24
	7.4	Remove the OLED display screen (Navi 60)	25
	7.5	Remove the fan	25
	7.6	Assembly	26
8	MA	AINTENANCE SPARE PARTS LIST	27

## 1 Important Information

## 1.1 Service personnal

This service manual is intended for qualified service personnel only. Service must only be conducted by personnel who

- Have basic knowledge of electronic circuits and mechanical engineering.
- Have basic knowledge of medical devices and clinical applications thereof.
- Have received proper training on maintenance and servicing of MEDCAPTAIN products and have certainknowledge of the applicable device principles, structure, performance and operation.
- Have the necessary equipment and instruments available.
- Have written permission of MEDCAPTAIN to conduct servicing.
- 1.2 Limitation of the service manual

This service manual describes all performance and configurations of the listed device only. Other devices' performance and configurations are not included here. There are differences between the published manual and the actual status of the device, especially when a device has been modified, corresponding maintenance information may be needed. Therefore, this service manual may be used together with some follow-up complementary information.

MEDCAPTAIN will complement the relevant information in time according to the actual situation of the device modification.

## 1.3 Device maintenance and inspection

- The power supply of this device can reach to 100-240V. Maintenance in violation of the requirements of the service manual may cause electric shock, serious injury or even death.
- Maintenancein violation of the requirements of this service manual may seriously damage the device.
- The service personnel must be trained and must be trained and permitted in writing by MEDCAPTAIN to do so.
- The maintenance must be performed under electrostatic discharge (ESD) protective conditions. Do not touch PCBA or semiconductors by hand without any protective measure.
- Do not work on the display by using sharp objects. Sharp objects may damage the display.
- Do not disinfect the Navi30/60 by using high-pressure steam sterilization.
- Before testing the internal battery operation, check the battery to ensure that sufficient power is available. Recharge, if required.
- Liquid intrusion into the AC power socket, USB or nurse call socket may cause short-circuit. When connecting the power cable, check if the connecting parts are dry. If liquid have spilled onto the infusion pump, clean the pump with a dry cloth. Recheck the previous steps before attempting to connect the power cable.
- Use the maintenance parts and accessories provided by MEDCAPTAIN to replace and maintain the device.
- Do not use the infusion pump in a flammable environment.
- After maintenance, perform a focus test and cleaning as required in this manual.
- 1.4 Quality control

MEDCAPTAIN has met the criteria set for the ISO9001 and ISO13485 Certificates of Quality. The product mentioned in this manual has also passed CE Certification, in line with the requirements of MDD directive.

## 1.5 Safety tips

## Warning:

- The power supply of this device can reach to 100-240V. Maintenance contrary to the requirements of the service manual may cause electric shock, serious injury or even death.
- Maintenance in violation of the requirements of this service manual may seriously damage the device.
- 1.6 List of abbreviated

ESD	Electro-Static discharge		
РСВА	Printed Circuit Board Assembly		
ISO	International Standardization Organization		
CE	Council of Europe		
MDD	Medical Device Directive		
IPX2	Level of Protection from Liquid instruction		
ON/OFF	ON/OFF key		
HOME	Main Menu Key		
CPU	Central Processing Unit		
N/A	Not Applicable		

## 1.7 List of symbols

Symbol	Description	Symbol	Description
	CAUTION! Read the accompanying document.		Type CF equipment
$\sim$	Alternating current	IPX2	Level of protection from liquid instruction
	Direct current	Φ	ON/OFF
•••	Manufacturer	~~~	Date of manufacture
	HOME		

## 1.8 Contacts

a) Under normal use and maintenance conditions, the company provides users with free repair (excluding adapter, appearance component update, etc.) for one year after purchase.Due to the fault caused by other factors, the company charges a certain part replacement fee.

b) If you have any question when using the infusion pump, please contact local distributor or directly contact us at any time.

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## System Instruction

## 2 System instruction

2.1 Scope of the application

NAVI30/60 was used to observe superficial venous vessels under the skin and assist venipuncture.

2.2 Product features

MEDCAPTAIN NAVI30/60 is a portable medical device for angiography.Infrared light is used to detect blood vessels under the skin, and then light is used on the surface of the skin above the blood vessels to indicate where the blood vessels are.Qualified medical personnel can find the appropriate size and location of venous vessels for puncture by observing the vascular system shown on the skin surface.

- Subcutaneous blood vessels were detected by near infrared light and projects onto the body surface by a high-definition venous display. Display the vascular position accurately and in real time.
- When the device is irradiated at any Angle above the detection area, the vascular position can be accurately projected without fixing the device at a specific position above the detection area.
- Simple operation, one key switch machine.
- The structure design is light and portable
- It is available for medical personnel to handle, ergonomic design, and hold comfortably.
- Five different projection colors are optional, and you can select the corresponding color invert mode
- The brightness of the projection can be adjusted to different environments
- The projection window can be adjusted to suit different patients and different detection sites
- It can detect and show the depth of blood vessels under the skin
- NAVI-60 is equipped with the operation screen, which displays the current power, mode, color, projected size and other operation information
- Built-in lithium battery power supply, for long time portable use
- You can plug in the power cord and use it while charging
- Support and support support, supporting the use of trolley

#### 2.3 Principle of the optical path

In this product, the CCD imaging module is perpendicular to the optical path of the object under test.Infrared LED is perpendicular to the light path of the object under test.The optical path of the subject is parallel to the projection machine, and the angiography is projected vertically to the subject through a semi-inverse semi-lens.



## 2.4 Specifications

## a)specification

name	venography
model	NAVI-30、NAVI-60
0verall	224(W) ×68(H)×64(D)mm
dimensions	
weight	0.5kg
Power supply	Input voltage: AC 100-240V 50/60Hz1.5A
	Input power: 45VA
	output voltage: DC 12V3.5A
	Internal battery: lithium battery 7.4 V 3000 mAh
battery	Time of continuous use: no less than 2.5 hours
	Recharging time for lithium battery: no more than 4 hours after power off.
	charging mode: the battery can be charged through the adapter when ac input.
Display mode	projection
The light source	Near-infrared light
type	
Infrared	850nm Double light source
wavelengths	

Optimum focusing bit	210mm±30mm
Imaging depth of field	>30mm
Infrared radiation energy	$\leq 0.6 \text{mW/m}^2$
The working conditions	Environmental temperature 5 °C and 40 °C relative humidity: 20% to 90% the condensation of atmospheric pressure: 70 kPa - 106.0 kPa
Storage and transportation conditions	Ambient temperature: - 20 °C - + 55 °C relative humidity: 10% to 95%, the condensation of atmospheric pressure: 61.7 kPa 107.4 kPa
Use period	5years
classification	<ul> <li>1.class I, Internal power supply equipment;</li> <li>2.IPX0;</li> <li>3.Non-sterilizing equipment;</li> <li>4.Non-ap /APG device;</li> <li>5.Run continuously;</li> </ul>
Major safety standards	GB 9706.1-2007 Medical electrical equipment part 1: general safety requirements YY 0505-2012 Medical electrical equipment part 1-2: safety general requirements parallel standards: electromagnetic capacity requirements and testing

b) Model differences

Model	differences
NAVI-30	No display screen
NAVI-60	Equip display screen

## 2.5 composition

Main engine + power cord + desktop bracket (optional) + trolley (optional)

## 2.6 Appearance

a) Front



- 1 display screen
- 2 Running light

- 4 Power lamp
- 7 Mode button
  - b) Back

- 5 The brightness buttons 6 Size buttons
- 8 Switch button
- 3 Battery lamp



- 1-Projection window
- 2- Infrared lamp
- 3-Battery compartments
- 4-The power interface

c) Annex appearance drawing



## Hardware Introduced

## 3 Hardware

## 3.1 Circuit diagram

NAVI-60The circuit diagram of the whole machine is shown in figure 2. The description of each part is as follows:



Figure2:Hardware structure diagram

## 3.2 Main control board

## a. Circuit introduction:

The main control board is the bottom board of DSP core board, which contains DC12V and battery input circuit, and DC12V to VCC5V circuit, realizing image processing, power management, system control and other functions. It can be powered by the external power supply or the battery, which can be converted to the power supply of the whole product through the level. When the external power is supplied, the battery can be automatically charged. The main control board controls the work of the optical machine and camera first class module

No.	Testing point	name	range	unit	remark
1	TP2	12VDc voltage	11. 4–12. 6	V	/
2	TP3	4.8VDc voltage	4.56-5.04	V	/
3	TP5	A5VDc voltage	4.56-5.04	V	/
4	TP6	1.1VDc voltage	1.05-1.16	V	/

## b. Main testing point:

5	TP7	3.3VDc voltage	3. 14-3. 47	V	/
6	TP8	1.2VDc voltage	1.14-1.26	V	/
7	TP9	1.8VDc voltage	1.71-1.89	V	/

c. Circuit Socket Number and Definition:

No	socket	PIN number	name	description	
1	CN1	14	The transfer plate	connect to the transfer plate	
			connects the row needle		
2	CN3	14	DSP board connection seat	connect to the DSP main board	
3	CN4	36	DSP board connection seat	connect to the DSP main board	
4	CN7	4	Fan outlet	Including both sides of the ground	
				pipe pin, connected to the cooling	
				fan	
5	CN8	4	NC	Including both sides of the ground	
				pipe pin	
6	CN10	2	The battery socket	Connect battery holder	
7	CN12	3	External power outlet	Connect external power supply, dc	
				12V input	
8	CN13	10	LCD panel mount	Both sides of the grounding pipe	
				pin, connected to the LCD screen	

d. Caution:

• While using a multimeter or oscilloscope to test, the pens must not short out the live parts in the circuit board, or the circuit board will be damaged.

## 3.3 CCD

a. Circuit introduction:

CCD can directly convert optical signals into analog current signals, and through amplification and analog conversion, image acquisition, storage, transmission, processing and reproduction can be realized

- b. Main testing point:None
- c. Circuit Socket Number and Definition:None

## 3.4 Transfer board

## a. Circuit introduction:

The transfer board connects the main control board and the drive board of the optical machine, infrared lamp, camera and CCD module, realizing the function of signal transfer. The circuit is as follows

- 1) CCD interface circuit: provides power supply and video transmission signal path for CCD;
- 2) Double pin interface circuit: motherboard butt, switching power supply and control signals;
- 3) Power supply circuit: 3.3v power supply to the image conversion chip of the switch board;

4) Video conversion circuit :converts analog video signals into digital video signals and outputs them to the optical machine;

b. Main testing point:

No.	Testing point	Description	Range	Unit	Remark
1	TP1	5V power	4.71-5.21	V	/
2	TP2	3.3V power	3. 14-3. 47	V	/

c. Circuit Socket Number and Definition

No	socket	PIN number	name	description
1	CN1	14	Main board joint	Connect to the main board
2	CN2	6	Infrared light cable	Includes two side grounding pin,
				connect infrared lamp connector
3	CN3	5	CCD interface	Including both sides of the grounding
				pipe pin, connected to the CCD
				connector
4	CN4	8	The optical source	Includes both sides of grounding pipe
				pin, light machine connector
5	CN6	5	NC	Unused, with two grounded pins
6	J1	51	Optical connection	Connect the FPC cable to the optical
			seat	drive plate

## 3.5 Projector

a. Circuit introduction:

Main function: projection digital image to the object under test. Pressure sensor signal processing: pressure sensor signal input, amplification and filtering, output to the motherboard.

- b. Main testing point: None
- c. Circuit Socket Number and Definition:None

## 3.6 Battery

a. Introduction:

NAVI30/60 adopts lithium ion battery pack with 7.4v /3000 mA.

b. Main testing point

No.	Testing point	Description	Range	Unit	Remark
1	red-black cable	Battery voltage	5.85-8.94	V	The battery power affects the voltage

Note: the battery pack voltage cannot determine the quality of the battery pack, and the actual working time needs to be measured by a connected camera.

c. Circuit Socket Number and Definition:

No	socket	PIN number	name		descript	tion		
1	/	2	Connect	battery	Connect	the main	control	board
			socket					

## Maintenance

#### 4 Test and maintenance

## 4.1 Cleaning

## **M** warning:

- Do not dip the device into the liquid;
- Do not let the liquid infiltrate into the equipment shell;
- > Do not use organic solvent, halide or petroleum base, glass cleaner, acetone or other stimulant cleaner;
- The equipment can only be cleaned by hand, and the automatic cleaning method cannot be used for the equipment

## 4.2 Cleaning steps

- When cleaning the equipment surface, use soft gauze without flocculation to immerse in neutral or weak alkaline cleaner. After the gauze is fully wet, wring dry until no liquid drops. Wipe the equipment surface with gauze
- ② All surfaces of the device should be wiped in turn until contaminants escape from the device surface
- ③ Wipe clean the lens surface with lens paper. Drop a few drops of anhydrous ethanol on the lens paper and gently wipe the lens surface in one direction.
- ④ Make sure the edges and corners of the equipment are cleaned while wiping
- (5) Wipe dry after use without flocculant gauze to remove residual detergent solution The following is the recommended cleaner for use in this equipment

name	methods
Clear water	wipe
Soapy water (PH: 7.0-10.5)	wipe

4.3 check before each use:

## 4.3.1 appearance inspection

- Appearance inspection: no crack or damage
- Button operation: the button is operated smoothly and effectively.

## 4. 3. 2 data line detection

• Check the appearance of the data cable. If the skin is damaged and the plug and socket are not in good contact, please contact the dealer for replacement

• If the power adapter is connected, the deep vein thrombosis pump cannot be started, please contact the dealer for maintenance.

## 4. 3. 3 check the built-in battery (every 6 months)

• The device is fully charged for 4 hours continuously. The working time of the built-in battery should not be less than 2.5 hours, otherwise it is recommended to replace the battery

## Calibration

## 5 Calibration

## 5.1 accuracy test:

As a precision medical assistant instrument, the operator should use the precision test card to check the accuracy of the instrument after it is first started up or transported.

The accuracy test card is placed in the projection area of the host, and the position deviation between the projected image and the test card is verified at the optimal focus (projection aperture distance: 210 + 30mm). If the deviation is less than 1mm, the instrument can be normally used. If the deviation is greater than 1mm, the adjustment accuracy shall be required.



#### Accuracy test

## 5.2 Calibration

- Remove the shell, fix the machine on the desktop bracket, press the "switch" button, and press the "parameter selection" button in the "common image" mode to adjust the positioning accuracy.
- 2. Press the "parameter selection" button again, you can switch the four parameters of "left and right", "up and down", "short edge" and "long edge", "parameter increase" and "parameter decrease".
- 3. After the adjustment, press the "parameter save" button to determine the parameter save and stop the projection screen.Restart the device and see if the projection alignment is correct.If the projection position is still inaccurate after the restart, repeat this step until the projection position is correct.
- 4. During the test, the length of the sides around the template can be precisely checked to check the alignment degree

5. When "left and right" and "up and down" cannot be adjusted to the most appropriate level, you can use the zoom and zoom functions of "short edge" and "long edge" to make up for it and complete the adjustment. Short press the switch button to shut down the machine.



## Troubleshooting

## 6 Troubleshooting

#### Warning!

- There are 90-240V AC high-voltage currents inside the Navi 30/60 and 400V DC high-voltage currents produced by the switching power supply. A careless touching of electric parts may cause serious personal injury to the service engineer when they are conducting checks and troubleshooting. Please stay strict in accordance with the described requirements and the outlined rules and regulations to maintain the device by qualified service engineers.
- When using equipment to check power board or other parts, short-circuiting or incorrect measurements may cause serious personal injury or severe damage to the device.
- > After each disassembly and maintenance, check the safety and function of the device.

## 6.1 **Common faults and troubleshooting**

- 1) Adapter switched on without display
- a, Reason

The external power supply is not properly connected or the external power supply has no voltage

Incorrect power adapter used to cause power panel damage in device.

b. Check the method:

Check whether the power adapter is well connected to the equipment. If it is in good contact, the power indicator light will be on

The battery power supply can be turned on, and the power adapter cannot be turned on

2) A blurred or marked projection

Possible reason: the lens is dirty

Solution: please clean the outgoing lens according to the method in 4.2 cleaning section

3) Battery power on without display

Possible reason: Battery running out of power or storage environment wet to battery damage

Solution:Connect the power adapter to charge the battery.Or use external power supply directly for power supply

If the machine is still unable to boot, the equipment may be abnormal, please contact the customer service staff

4) Battery life is short

Possible reason: the battery is not fully charged or the battery life is naturally impaired

Check method: connect the power adapter. If the battery indicator is flashing, the battery is not full. If the battery indicator is not on, it means the battery has been fully charged. It is because the battery life is reduced due to the increase of charging and discharging times and the battery life decreases naturally.

Solution: if the battery life is too short and needs to be replaced, please contact the after-sales engineer for consultation

5) The equipment occasionally gets stuck or dies

Possible reason: too long use time, equipment internal overheating.

Solution: turn off the equipment for cooling for a while. If not, replace the main control board

## Dissembly and Assembly

## 7 Dissembly and Assembly

## 7.1 Remove the battery



No.	Material code	Name	Number
1	1405-00066-01	MV01Screw plug 3	1
2	1417-00043-01	Cross slotted head screw M2.5X5 iron nickel plating	1
3	1404-00460-01	MV01Battery cover	1
4	1457-00009-01	MV01 battery3180mAh	1

1) Remove the screw plug 3 with forceps (No.1);

2) Remove a M2.5 screw with cross screw (No.2);

3) Remove the battery cover (No.3);

4) Separate the battery plug and socket and remove the battery (No.4)  $\ensuremath{\scriptstyle \circ}$ 

## 7.2 Remove the shell



No.	Material code	Name	Number
1	1405-00065-01	MV01 Screw plug2	1
2	1405-00066-01	MV01 Screw plug3	1
3	1405-00064-01	MV01 Screw plug1	1
4	1417-00043-01	Cross slotted head screw M2.5X5 iron nickel plating	3
5	1404-00440-01	MV01shell	1

- Remove the screw plug 3, screw plug 2and screw plug 1 with forceps (No.1, 2, 3);
- 2) Remove three M2.5 screw with cross screw (No.4) ;
- 3) Remove the shell.



## 7.3 Remove the main control board and The light path module

No.	Material code	Name	Number
1	1417-00043-01	Cross slotted head screw M2.5X5 iron nickel plating	3
2	1417-00165-01	MV01Hexagon copper stud M2.5X35	1
3	1458-00021-01	MV01 the light path module	1
4	1417-00043-01	Cross slotted head screw M2.5X5 iron nickel plating	4
5	1458-00022-01	MV01 main control board	1

- 1) Remove the cable
- 2) Remove the screw with cross screw (No. 4) , remove the main control board (No. 5);
- 3) Remove three M2.5 screw with cross screw (No.1) ;

- 4) Remove the Hexagon copper stud M2.5X35 (No.2) ;
- 5) Remove the light path module (No.3);

7.4 Remove the OLEDdisplayscreen(Navi 60)



No.	Material code	Name	Number
1	1456-00013-66	MV01 OLEDdisplayscreen	1
2	1404-00440-01	MV01 shell	1

- 1) remove the lower shell first;
- 2) remove the OLED display (No.1);
- 7.5 Remove the fan



No.	Material code	Name	Number
1	1404-00398-01	MV01the former case	1
2	1460-00053-01	MV01fan	1
3	1417-00153-01	Cross groove small plate head screw PM2.5X10	2

- 1) remove the following shell components first;
- 2) take out the former shell assembly (No.1);
- 3) remove 2 PM2.5X10 screw with cross screw (No. 3);
- 4) remove the fan (No.2)  $_{\circ}$

## 7.6 Assembly

The installation process is reversed according to the steps of disassembly. The following points should be noted during the installation process:

- 1) types and specifications of screws shall not be misused;
- 2) parts and components shall not be misloaded or missed;
- 3) parts coated with grease during machine disassembly shall be reapplied if the grease is erased;

# Maintenance spare parts list 维

## 8 Maintenance spare parts list

Directions: refer to the section of the steps for the disassembly of spare parts in the table Note: the spare parts list should be updated regularly according to the change of products and the need of maintenance

No.	Name	Code	Picture
1	MV01the light path module	1458-00021-01	
2	Battery cover	1404-00460-01	
3	MV01main control board	1458-00022-01	
4	MV01battery 7.4V , 3000mAh	1457-00006-01	
5	MV01fan	1460-00053-01	
6	MV01 shell assembly (NAVI-30)	1202-00225-01	

7	MV01shell assembly (NAVI-60)	1202-00226-01	
8	MV01the former case	1404-00398-01	
9	MV01Left in the shell	1404-00399-01	
10	MV01Right in the shell	1404-00400-01	
11	MV01The interface plate	1404-00401-01	
12	MV01Accuracy test card	1490-00089-01	

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