

ARTROMOT®- S3



Service Manual

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1 History

Revision	Date	Name	Change
1	01.06.2003	S. Herr	Service Manual created
2	05.04.2004	S. Herr	Update Pos. 13, 40
3	03.01.2005	S. Herr	Update Pos. 28, 30, 32,40, function test
4	01.09.2007	S. Herr	New graphics hand held programming unit
5	01.10.2008	S. Herr	Update chapter 11
6	13.07.2012	S. Rietsche	Update Pos. 5, 11,12
7	11.06.2013	S. Herr	Update fuse S/N > 20000
8	02.07.2013	S. Herr	New Design, Update Chapter 3, 10, 11

2 Purpose

The purpose of this Service Manual is to help you to make simple repairs on the device. Only authorized staff may perform repairs and maintenance as the manufacturer's warranty and liability would otherwise be invalidated.

Only original parts may be used for servicing in accordance with the attached spare parts list.

3 General

3.1 Declaration of symbol/label



Do not move or pull!



Reading instruction manual!

3.2 Electronics, connection cables

No plugs may be connected or disconnected while the unit is switched on. Always switch the ARTROMOT®-S3 off before connecting or disconnecting a plug.

The locks for spiral cable for the hand held programming unit and the motor element assembly have to be closed at all times.

When you assembling with electronic parts make sure to use ESD (electro static discharge) equipment.

Only original chipcards may be used. Insert the chipcards so that ARTROMOT® is visible.

Possible errors: Errors will be displayed on the hand held programming unit. Depending on the version of the hand held programming unit there are different error messages.

3.3 Error messages version text hand held programming unit

Following error messages will be shown on the display:

Chipcard not readable

This chipcard was not readable or it contains invalid data

- Format the chipcard
- Use new chipcard
- Replace hand held programming unit

Chipcard unkown

A foreign or defective chipcard was inserted

- Use new chipcard

Chipcard missing

No chipcard is inserted

- Insert chipcard

Chipcard not writable

The chipcard is not writeable

- Use new chipcard
- Replace hand held programming unit

Chipcard K2 PRO or S2PRO or S3

Chipcard of the CPM knee or CPM shoulder was inserted

- Use new chipcard
- Format the chipcard

Error motor X Calibration

The calibration data for the motor X is invalid or lost.

- Motor X needs to be calibrated

Error motor X Potentiometer

Potentiometer reading was invalid

- Replace motor element assembly

Error motor X Pot. Contact

Potentiometer connection is broken

- Replace motor element assembly

Error motor X Motor driver

The motor driver IC reported an error

- Replace motor element assembly

Error motor X Motor error

The motor did not turn properly

- Replace motor element assembly

Error motor X over current

The current for motor X exceeded the maximum limit

- Replace motor element assembly

Error motor X Motor control

Internal error in motor control

- Replace motor element assembly

Error motor X CPM error

Memory error in motor control of motor X

- Replace motor element assembly

Error motor X Communication

Communication to motor X not possible

- Check spiral cables and connectors
- Replace motor element assembly



Error motor X CPM device error

General error in motor control of motor X

- Replace motor element assembly

Error motor X Enable timeout

Motor X could not be enabled in time

- Replace motor element assembly

Error motor X Inval. Parameter

Motor control X has received an invalid parameter from the hand held programming unit

- Replace motor element assembly
- Replace hand held programming unit

Error motor X Mot. Release

The motor could not be released

- Replace motor element assembly
- Replace hand held programming unit

Error motor X Stop unexpected

The motor X stopped unexpectedly

- Check spiral cable and connectors
- Replace motor element assembly

Error motor X Motor disabled

The motor control X disabled the motor

- Replace motor element assembly

Error motor X ROM exceeded

Motor X moved beyond the programmed range of motion

- Replace motor element assembly

Error motor X CPM 5V supply

5V supply of motor control X not sufficient

- Replace motor element assembly

Error motor X CPM 24 V supply

24 V supply of motor control X not sufficient

- Replace motor element assembly

Error motor X Enable error

The motor X could not be enabled

- Replace motor element assembly

Error motor X Disable timeout

The motor X could not be disabled

- Replace motor element assembly

Error motor X internal com.

Invalid interchip communication inside motor X

- Replace motor element assembly

Error motor X Unknown CPM err.

Unknown error in motor control X

- Replace motor element assembly

Error Motor X Undefined err.

Undefined error in motor control X

- Replace motor element assembly

Handset error H. Set ROM error

Memory error in the hand held programming unit

- Replace hand held programming unit

Handset error HS 24V supply

24V supply of the hand held programming unit not sufficient

- Replace electronic complete
- Replace hand held programming unit

Handset error HS 5V supply

5V supply of the hand held programming unit not sufficient

- Replace hand held programming unit

Handset error HS 3.3V supply

3.3V supply of the hand held programming unit not sufficient

- Replace hand held programming unit

Handset Error Internal com.

Invalid interchip communication inside the hand held programming unit

- Replace hand held programming unit

Handset error Bus error

System bus error

- Replace motor element assembly
- Replace hand held programming unit
- Replace electronic complete

Parameter not valid

Internal error in the hand held programming unit

- Replace hand held programming unit

Configuration not valid

Invalid configuration of the hand held programming unit

- Replace hand held programming unit

Wrong product combination

Mixed between non compatible chair and hand held programming unit

- Use correct hand held programming unit

Chair Memory error

Defective memory chip inside the chair

- Replace electronic complete

3.4 Error messages version graphics hand held programming unit

Following error codes in numbers will be shown on the display:



ERROR
XX

(xx = Number of the Error)

01 Potentiometer error

Wrong angle information provided from potentiometer

- Replace motor element assembly

02 Failure at the potentiometer

Connection to the potentiometer is interrupted

- Replace motor element assembly

03 Motor driver error

The motor driver IC reported an error

- Replace motor element assembly

04 Motor error

The motor did not turn properly

- Replace motor element assembly

05 Motor over current

Motor current overload

- Replace motor element assembly



06 Motor control error

Internal error in the motor control

- Replace motor element assembly

07 Eprom access error

Memory error in the access of the eprom

- Replace hand held programming unit

08 CPM ROM error

Memory error in the motor control

- Replace motor element assembly

09 Communication

Communication to the motor control is not possible

- Check cables and connectors
- Replace hand held programming unit
- Replace motor element assembly

10 Unkown error in the motor control

Unknown error in the motor control

- Replace motor element assembly

11 Motor enable timeout

Motor could not be enabled in time

- Replace motor element assembly

12 Invalid parameter motor error

- Replace hand held programming unit
- Replace motor element assembly

13 Stop release error

The motor could not be released

- Replace hand held programming unit
- Replace motor element assembly

14 Unexpected motor stop

- Check cables and connectors
- Replace motor element assembly

15 Motor disabled

Motor control disabled the motor

- Replace motor element assembly

16 Wrong command in the motor

- Replace hand held programming unit
- Replace motor element assembly

17 5V supply error

5V supply of motor control not sufficient

- Replace motor element assembly

18 Initialise error real time clock

- Replace hand held programming unit

19 Communication error real time clock

- Replace hand held programming unit

20 Error real time clock

- Replace hand held programming unit

21 Range exceeded

The measured angle is out of the range of motion

- Replace motor element assembly

22 ROM error in the hand held programming unit

Memory error in the hand held programming unit

- Replace hand held programming unit

23 Invalid parameter

Internal error in the hand held programming unit

- Replace hand held programming unit

24 24V supply error motor control

Error in the 24V supply in the motor control

- Replace hand held programming unit
- Replace electronic complete

25 Bus error

Bus system error

- Replace the spiral cable of the hand held programming unit
- Replace hand held programming unit
- Replace motor element assembly

26 24V supply hand held programming unit

24V supply of the hand held programming unit is defective

- Replace hand held programming unit

27 5V supply hand held programming unit

5V supply of the hand held programming unit is defective

- Replace hand held programming unit

28 3.3V supply hand held programming unit

3.3V supply of the hand held programming unit is defective

- Replace hand held programming unit

29 Calibration

The calibration data in the motor control are wrong

- Perform a calibration

30 Calibration error

- Repeat the calibration
- Replace motor element assembly

31 Calibration timeout

- Replace motor element assembly

32 Motor enable error

- Replace motor element assembly

33 Motor disable error

The motor could not be disabled

- Replace motor element assembly

34 Motor stop error

- Replace motor element assembly

35 Configuration error

Invalid configuration of the hand held programming unit

- Replace hand held programming unit

36 Parameter not valid chipcard

- Replace chipcard
- Replace hand held programming unit

37 Checksum error chipcard

- Replace chipcard
- Replace hand held programming unit

38 Unknow chipcard error

- Replace hand held programming unit

39 A chipcard of another ARTROMOT® product got used

- Formate the chipcard
- Replace chipcard

40 Unknown chipcard

- Replace chipcard

41 Chipcard is missing

No chipcard is insert

- Insert chipcard
- Replace chipcard

42 Chipcard write error

The chipcard is not writable

- Replace chipcard
- Replace hand held programming unit

43 Chipcard read error

Chipcard is not readable

- Replace chipcard
- Replace hand held programming unit

44 Chipcard verify

- Replace chipcard
- Replace hand held programming unit

45 Wrong product combination

Mixed between non compatible device and hand held programming unit

- Replace hand held programming unit

46 Handset error internal communication

Invalid interchip communication inside the hand held programming unit

- Replace hand held programming unit

47 Internal communication error motor control

Internal communication error motor control

- Replace motor element assembly

48 User stoped the special function**49 Unknown error in the motor control**

- Replace motor element assembly

50 Decoding unit keyboard not programmed/ defect

- Replace hand held programming unit

54 Decoding unit rotary encoder not programmed/ defect

- Replace electronic complete

3.5 Motor element assembly

No plugs may be connected or disconnected while the unit is switched on. Always switch the device off before connecting or disconnecting a plug.

The motor element assembly plugs have to be locked at all times.

The moveable screws should not be completely unscrewed when adjustments are being made. Make sure that the moveable screws are tightened for operation and transport.

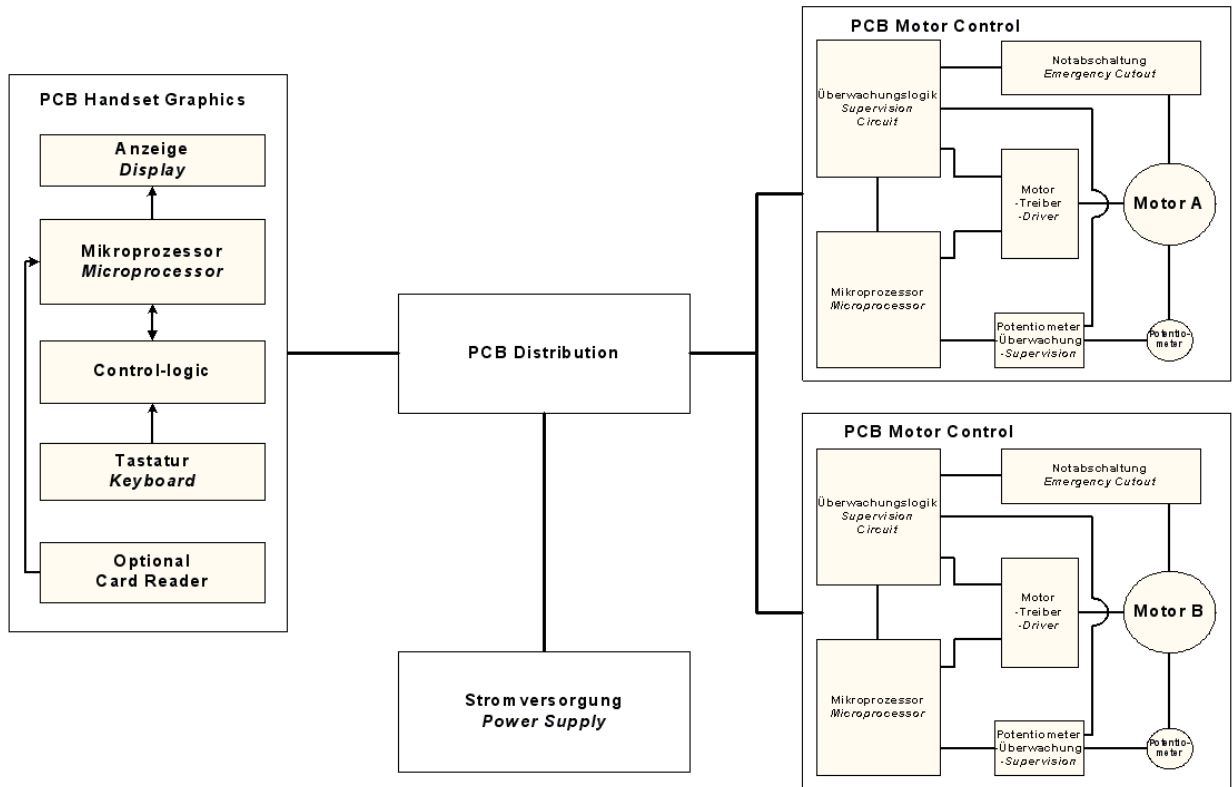
Make sure that no load is on the profile when making adjustments on the upper arm. To remove the load, slightly lift motor B.

3.6 Other

The scale profiles with the labeling 2,3 and 5 must not be lubricated or oiled.

No solvents may be used when cleaning the device.

4 Block diagram of the electronic parts



5 Bill of materials for service parts

Position	Description	Ordernumber
1.1	Hand held programming unit S3 Standard + spiral cable (Text version)	0.0034.080
1.2	Hand held programming unit S3 Comfort + spiral cable (Text version)	0.0034.081
1.3	Hand held programming unit S3 Standard + spiral cable (Graphics version)	0.0034.300
1.4	Hand held programming unit S3 Comfort + spiral cable (Graphics version)	0.0034.310
	Spiral cable for hand held programming unit (Text version)	2.0034.355
	Spiral cable for hand held programming unit (Graphics version)	2.0037.035
	Protection for hand held programming unit	0.0037.103
4	Armrest assembly	2.0034.022
5	Wheel assembly	0.0034.006
6-8	Electronic S3 complete up to s/n 19999	0.0034.041
	Electronic S3 complete starting with s/n 20000	0.0034.341
10	Wing screw backrest	2.0034.044
14	Clamping piece exchange kit up to S/N 3386	0.0034.060
	Clamping piece exchange kit starting with S/N 3387	0.0034.059
16 + 21	Motor element assembly complete (with both motors)	0.0034.030
18	Lever assembly	0.0034.012
20	Wing nut elbow joint	GN532-40-M8-E
22	Elbow cup pad	2.0034.255
23	Armrest cup complete	0.0034.190
24	Belt loop	2.0003.001
26	Lever assembly	0.0034.012
28	Wing nut swing bar	GN532-40-M8-E
30	Head rest black complete	0.0034.044
	Head rest blue complete	0.0034.095
	Wing screw head rest	0.0034.077
31	Shoulder fixation black complete	0.0034.045
	Shoulder fixation blue complete	0.0034.096
	Wing screw shoulder	GN-531-32-M6-25
	Bar cushion black	2.0034.073
	Bar cushion blue	2.0034.078
32	Wing screw for neck support holder	0.0034.075
	Distance disk	0.0034.137
	Insertion aid	2.0034.374
	Neck support holder	2.0034.069
34	Tube safety	0.0034.249
35	Chair leg right	0.0034.079
36	Chair leg left	0.0034.078
	Option for S3 Comfort: Upper arm rest	2.0034.011
	Add-on kit blue head rest and shoulder	0.0034.070
	Chipcard ARTROMOT	0.0034.048
	Fuse T1A up to s/n 19999	0.0000.005
	Fuse T2A starting with s/n 20000	0.0000.107
	Power cord EU version	0.0034.118
	Power cord US version	0.0034.011

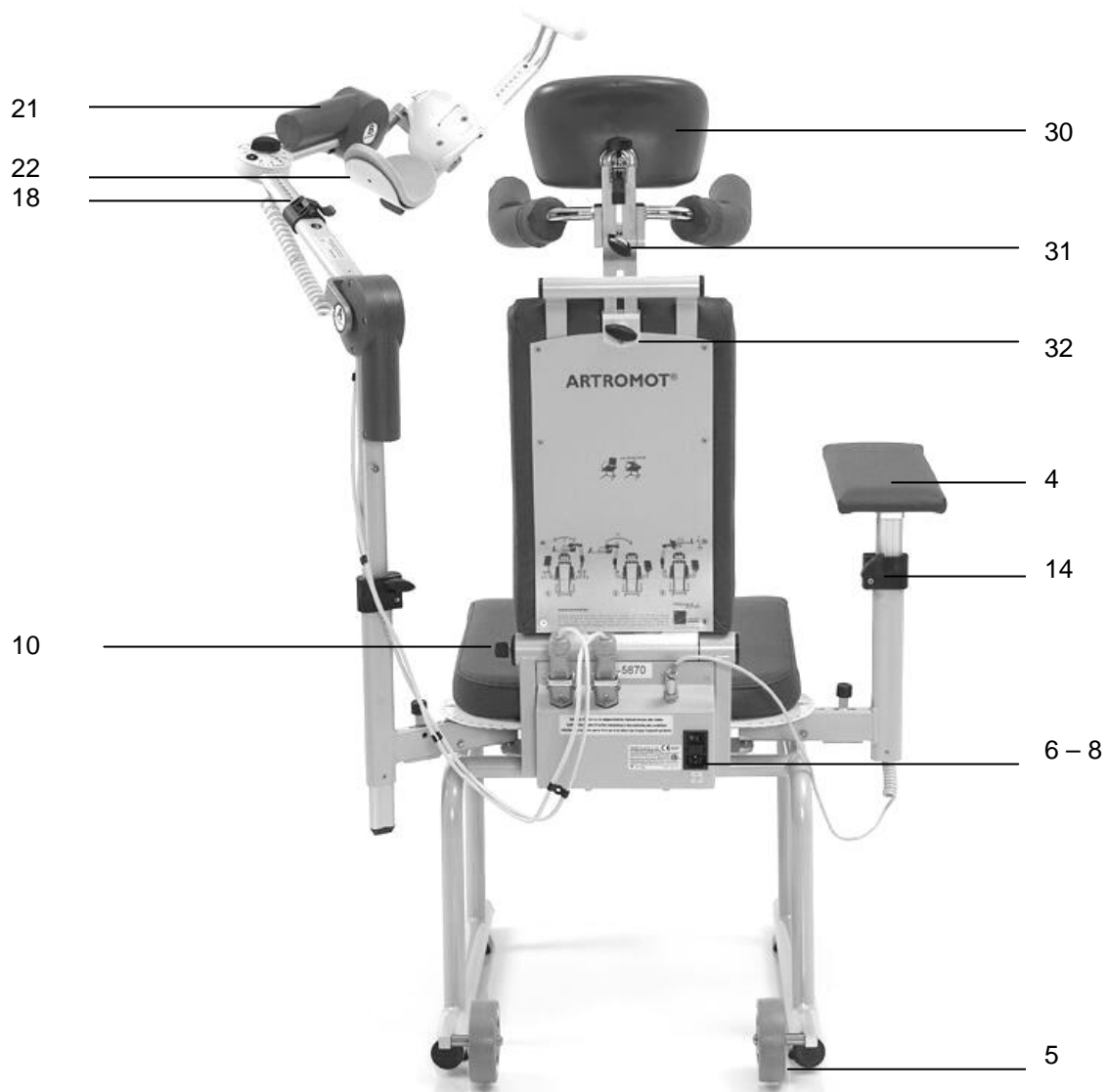
6 Figure for bill of materials

Position 1.1 + 1.2



Position 1.3 + 1.4





7 Special function Service Menu for text hand held programming unit

Possible function of the special function Service Menu

Device runtime
Factory settings
Error log
Calibration

Entering the service menu

Switch to the programming mode.
Press FUNC.
Select Service Menu by using the + and – keys.
Press SET for 5 seconds.
FOR SERVICE ONLY is flashing.
Select a special function of the Service Menu by using + and – keys.



7.1 Device runtime

Display: Device runtime
Press SET.
The display shows the device runtime of each motor
Display: A: X h B: X h.

7.2 Factory settings (=Packaging setting)

Display: Factory settings
Press SET.
Display: Werkseinstellung Bereit.
Device changes language to German
Press STOP
Display: Bereich anfahren START drücken.
Press START, device moves to factory settings
Display: STOP Dauerbetrieb

7.3 Error log

Display: Error log.
Press SET.
Display: Error log Up + and Down -.
By using the + and – keys you can see the entire of the error log.
General note to the error log:
Entries are always in English.
The entries are ordered by causer and not in temporal order.
In the first line is shown the causer (e.g Motor A) and below the error message in short form.

7.4 Calibration

Display: Calibration
Press SET, Display: Enter key.
Press + and – keys simultaneously.
Display: Select motor With +/- → A.
Press SET.
Display: Move Mot A to 90° Press SET.
Move motor A to 90° by using + and – keys.
Press SET.
Display: Calibrating M.A Please wait.
Motor A moves in the complete range of motion automatically.
After motor A stops the display shows: Calibration M. A successful.

Press STOP
 Display: Select motor With +/- → A.
 Press +
 Display: Select motor With +/- → B.
 Press SET.
 Display: Move Mot B to 0° Press SET.
 Move motor B to 0° by using + and – keys.
 Press SET.
 Display: Calibrating M.B Please wait.
 Motor B moves in the complete range of motion automatically.
 After motor B stops the display shows: Calibration M. B successful.
 Press STOP two times.
 Display: Move to ROM Press START

8 Special function Service Menu for graphics hand held programming unit

Possible function of the special function Service Menu

Menu level 1

Calibratiion motor A	Calibration motor B	Display contrast	Error log
Runtime motor A	Runtime motor B		



Entering the service menu

Press the menu key until Service Menu shows up



Press the key for 5 seconds

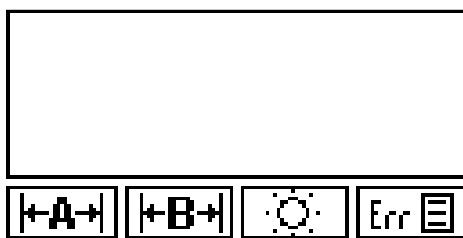
Is flashing on the display

The display will change and show
 Entering code.

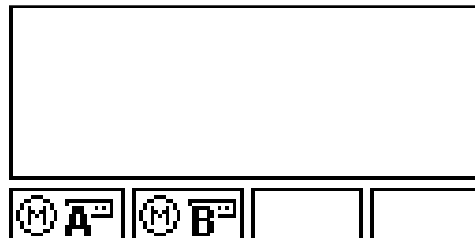


For the code press: 1 3 2 4

Now you see the symbols of the service menu



menu level 1



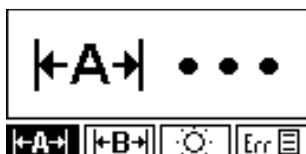
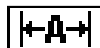
menu level 2

8.1 Calibration

Attention: Before you do a calibration switch the device OFF an ON.

Calibration motor A

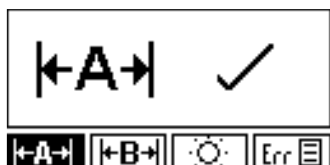
Press the symbol calibration motor A



Press + and – to move motor A to 90 degrees.

Press START. The calibration starts automatically. Motor A moves in the range of motion.

Wait until motor A stops. If the calibration was successful motor A stops at 90 degrees and show following symbols on the display:



Press STOP twice to leave the Service Menu.

Calibration motor B

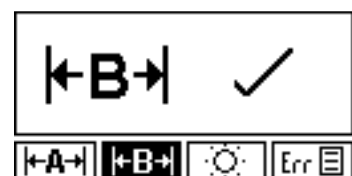
Press the symbol calibration motor B



Press + and – to move motor B to 0 degrees.

Press START. The calibration starts automatically. Motor B moves in the range of motion.

Wait until motor B stops. If the calibration was successful motor B stops at 0 degrees and show following symbols on the display:



Press STOP twice to leave the Service Menu.

8.2 Display contrast

Press the symbol display contrast



Press + or – to set up the requested display contrast. You can set the display contrast form 0 – 100%. Press STOP twice to save the setting and to leave the Service Menu.

8.3 Error log

Press the symbol error log

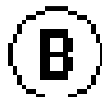


You will find following information on the display.

Upper line: Number of the current showed error message and the total number of the saved error messages. Number on the right is the error code of the error message (see chapter 3.1).

Lower line: Error message.

Left side of lower line: The symbol of the causer.



Hand held programming unit

motor A

motor B

electronic complete

Press + or – to see the entries of the error log.

General note to the error log:

Entries are always in english.

The entries are ordered by causer and not in temporal order.

Press STOP twice to leave the Service Menu.

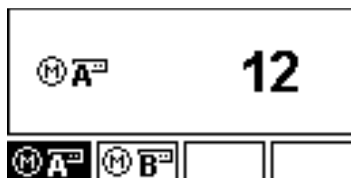
8.4 Runtime

Runtime motor A

Press the symbol for runtime motor A.



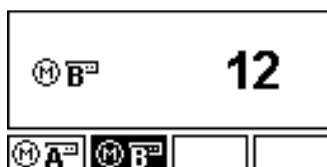
The display shows the runtime of motor A:



Press the symbol for runtime motor B.



The display shows the runtime of motor B:



Press STOP twice to leave the Service Menu.

9 How to perform repairs

9.1 Electronic (Pos. 6, 8)

ATTENTION!

When you assembling with electronic parts make sure to use ESD (electro static discharge) equipment.

Switch off the ARTROMOT®-S3.

First, the plug for the power cord, the motor element assembly and the plug for the hand held programming unit's spiral cable have to be unplugged. Then remove the 4 screws in the plate and take the whole electronic complete with plate off the ground wire plug connection.

Once the spare part has been installed, a safety and function test has to be performed.

9.2 Clamping piece exchange kit (Pos. 14)

The exchange kit of clamping pieces contains 2 clamping pieces (1 left, 1 right) with all of the required screws and an exact instruction for mounting.

The complete clamping piece has to be regularly serviced.

9.3 Lever assembly (Pos. 18, 26)

Remove one of the side retaining rings and pull out the pin so that the defective lever can be taken out. When using the new lever, make sure that both springs are properly set. The retaining rings then have to be put onto both side of the pin.

The complete lever assembly has to be regularly serviced.

9.4 Elbow cup pad (Pos. 22)

First, the defective pad has to be removed carefully so that the new pad can be attached.

9.5 Armrest cup complete (Pos. 23)

Armrest cup complete consist of one Armrest cup with required screws and mounting instruction.

9.6 Belt loop (Pos. 24)

Pull the belt out through the metal loop, exchange the belt loop and install the new belt loop.

9.7 Wing nut (Pos. 20, 28)

Make sure that the new wing nut is tight.

Attention: Wing nut must not be interchanged.

9.8 Wing screw (Pos. 10, 30, 31, 32)

Wing sure that the new wing screw is tight.

Attention: Wing screw must not be interchanged.

9.9 Option upper arm rest complete

The upper arm rest complete is an option for ARTROMOT®-S3 Comfort. It contains upper arm rest cup, mounting plate, belt, all required screws and an exact instruction for mounting.

9.10 Fuse

Switch off the ARTROMOT®-S3 and disconnect the power cord. Remove the fuse holder below the main switch and plug it back in after the fuses have been exchanged. Only use the appropriate fuses

9.11 Drive unit and motor control

ATTENTION!

Only authorized and certified staff may perform repairs and maintenance at the drive unit and motor control otherwise the manufacturer's warranty and liability will be invalidated.

ATTENTION!

When you assembling with electronic parts make sure to use ESD (electro static discharge) equipment.

11 Checklist of safety and function test up to serial number 19999 (graphics hand held programming unit)

Safety test	Measured value	Date/ Signature
Protective earth conductor resistance $\leq 0,1$ Ohm	Ohm	
Ground leakage current IEC 62353/VDE 0751-1 ≤ 500 μ A	μ A	
Or		
Ground leakage current as in UL 2601 ≤ 500 μ A	μ A	

Function test	OK	Error
<p>Switch on the ARTROMOT®-S3. Press the two outer buttons simultaneously. Display: Software version VX.X XX.XX.XX (x=optional)</p> <p>Keep on pressing. Display: ARTROMOT-S3 "Product version"</p>		
<p>The range of motion for add/ abduction (motor A) is 30 to 175 degrees. At 90 degrees, the angle is to be checked with a tolerance of +/- 5 degrees.</p>		
<p>The range of motion for rotation (motor B) is -90 to 90 degrees. At 0 degrees, the angle is to be checked with a tolerance of +/- 5 degrees.</p>		
<p>Check the emergency-off function.</p> <p>Switch the ARTROMOT®-S3 on in continuous operation. Press any key to stop motors A and B immediately. Check this for all keys.</p>		
<p>Set up the special function NEW PATIENT. Following settings set up automatically:</p> <p>Add/ Abduction -> Display: 39 41 Rotation -> Display: -1 1 Pause -> Display: 0 Motors ON/OFF -> Display: ON Speed -> Display: 100% Timer -> Display: 00:00</p>		
<p>Press START. Motor A moves to 40 degrees. Motor B moves to 0 degrees.</p>		

