

# WAVEFLEX 6000X CPM

## Technical & Service Manual

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MM6KTM1 Rev E  
October 2014



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### WaveFlex 6000X Hand CPM

Technical & Service Manual  
MM6KTM1 REV. E  
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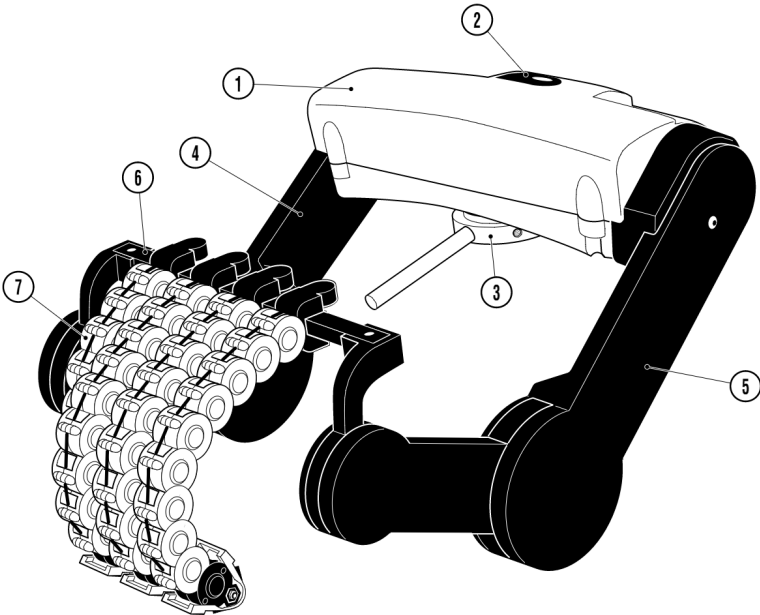
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# 1.0 GENERAL OVERVIEW

- 1.1 WaveFlex 6000X Technical Drawing  
Major Components Overview:  
WaveFlex 6000X Hand CPM Actuator  
(see next page)

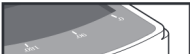
WaveFlex 6000X Hand CPM Actuator	
No.	Includes
1	Actuator Housing
2	Remote Stop Switch
3	Splint Clamp
4	Right Bridge Arm
5	Left Bridge Arm
6	Drive Bar
7	Finger Actuators



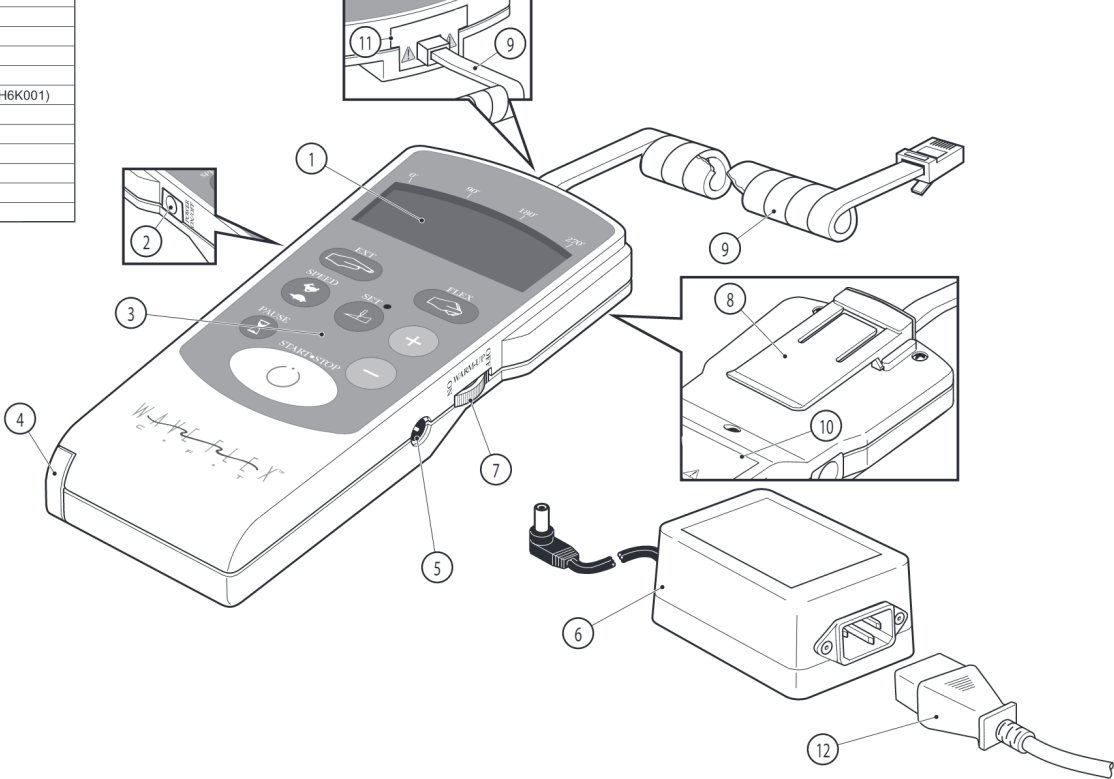
**1.2 WaveFlex 6000X Technical Drawing**  
 Major Components Overview:  
 WaveFlex 6000X Hand CPM Motion Controller  
 (see next page)

**WaveFlex 6000X Technical Drawing:**  
 Major Components Overview

WaveFlex 6000X Hand Controller	
No.	Includes
1	Liquid Crystal Display



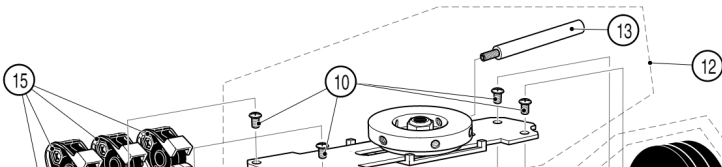
2	Power – On/Off Switch
3	Key Pad
4	Battery Compartment
5	5 Volt DC Power Input
6	Power Supply, 100 – 230 VAC, 5 VDC (part no. H6K001)
7	Warm-Up On/Off Switch
8	Belt Clip
9	Coil Cord
10	Serial Number Label
11	Coil Cord Retention Label
12	Power Cord



1.3 WaveFlex 6000X Technical Drawing  
Exploded Assembly Drawing:  
WaveFlex 6000X Hand CPM Actuator  
(see next page)

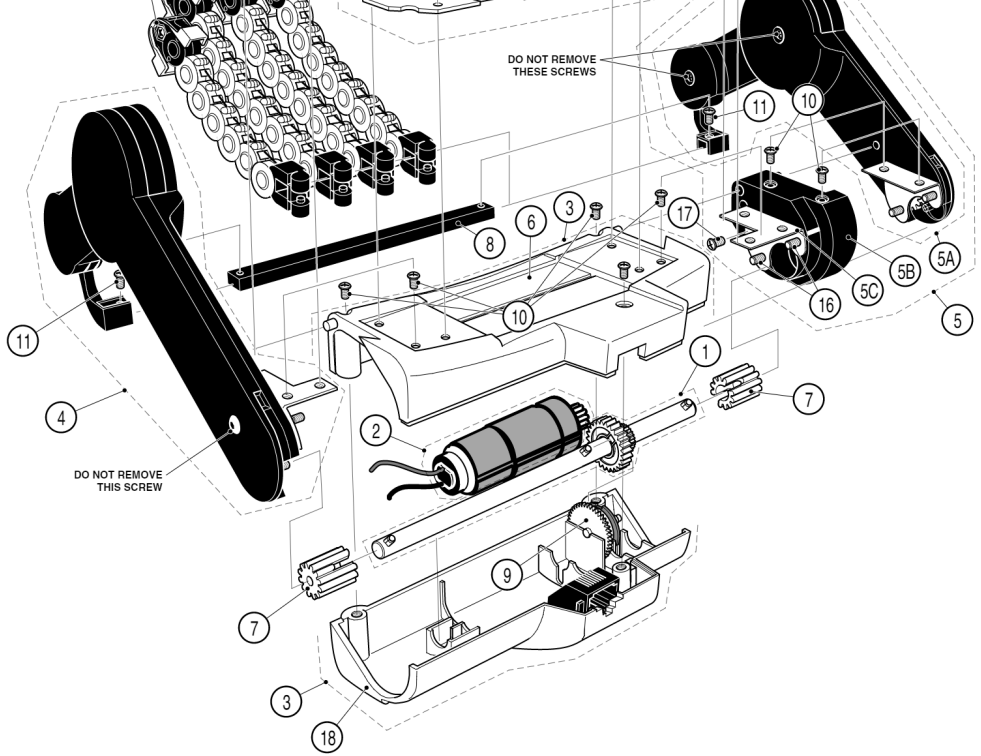
WaveFlex 6000X Technical Drawing:  
WaveFlex 6000X Exploded Assembly

WaveFlex 6000X Hand CPM Actuator			
No.	Description	Part No.	Qty.
1	Cross Shaft Assembly (includes Shaft Drive Gear (item no. 19))	H6KX008	1
2	Motor Assembly	H6KX009 or	1



3	Actuator Housing Assembly (includes Lower Housing (6) and Upper Housing Assembly (18))	H6K003 *	1
4	Bridge Arm Assembly, Right	223101-1	1
5	Bridge Arm Assembly, Left - 6000X (complete with Spacer (item no. 5B) and Bridge Plate (item no. 5C))	223101-3	1
5A	Bridge Arm, Left - 6000X (without Spacer (item no. 5B) and Bridge Plate (item no. 5C))	223101-3B	1
5B	Spacer, 6000X	223239-1	1
5C	Bridge Plate, 6000X	223240-1	1
6	Lower Housing	223152	1
7	Arm Drive Gear	223145-1	2
8	Drive Bar, 6000X	223242-1	1
9	Actuator Encoder Gear Assembly (included as part of Upper Housing Assembly (item no. 18))	223103A	1
10	Screw, 4-40 x 3/8" Pan head PMS *	FS440AI	13 or 14*
11	Screw, 4-40 x 1/4" Pan head PMS *	FS440X	2
12	Splint Clamp Assembly Kit	223290	1
13	Handle	H6KX011	1
15	Finger Actuators: Kit of One Large (White, 10 Links) Kit of One Medium (Black, 9 Links) Kit of One Small (Blue, 7 Links)	6506 6507 6508	1 1 1
16	Screw, 4-40 x 3/8" SHCS *	1010280	2
17	Screw, 4-40 x 5/16" Pan head PMS *	1010304	1
18	Upper Housing Assembly (includes Actuator Encoder Gear Assembly (item no. 9))	□	1

**Notes:**  
 \* Available only in bags of 25 pieces.  
 □ Part not available.  
 - - - Defines an Assembly within an Assembly.  
 - Alternate for units with 4 screw housings (after Serial # 30016).



1.4 Introduction

The WaveFlex 6000X Hand CPM device is designed to provide Continuous Passive Motion to the hand, offering a fully adjustable range of motion.

The unique drive arrangement makes possible several important features:

- Anatomic free-linkage movement
- Easy to set up and operate
- Five operation force settings
- Warm-up mode
- Durable, compact and fully portable
- Lightweight and comfortable
- Reverse-on-Load safety feature

The WaveFlex 6000X Hand CPM unit consists of four major components:

- the Drive Unit
- the Splint
- the Hand Controller
- the Power Supply

This Technical Service Manual describes service procedures for the WaveFlex 6000X Hand CPM. For instructions on operating the unit, refer to the Operating Manual.

1.5 Specifications and Operating Limits

**Specifications**  
**Device Weight**  
 Drive Assembly .45 kg (1 lb.)  
 Hand Controller .23 kg (0.48 lb.)  
 Patient Kit .21 kg (0.46 lb.)  
**Range of Motion (ROM)**  
 MCP: 0° - 90° PIP: 0° - 110° DIP: 0° - 70°  
**Warm-Up:** Device cycles between 50% of last programmed limits to full limits, incrementally increasing ROM on each cycle  
**Speed (programmable):** 30 to 120 seconds per cycle

**Pause** Independently programmable from 0 to 30 seconds in extension and/or flexion.  
**Reverse-on Load Force** 1.5 kg (3.5 lbs.) low to 4.3 kg (9.5 lbs.) high  
**Lock-Out** Programmable hidden feature keeps the patient from changing the settings  
**User Compliance** Hidden feature monitors patient therapy time. This can be cleared after each use.  
**Electrical**  
Power Rating: 5V, 1A  
Power Supply: Battery 6V-AAA or use Power Supply WSA150M.  
Input: 100-240VAC, 50/60Hz 40VA Output: 5VDC, 2.5A  
Fuse Rating: 1.5 A PTC resistor, non serviceable. Reset by removing power.  
**Environmental**  
Storage/Shipping conditions:  
Ambient Temperature -40°C to +70°C  
Relative Humidity 10% to 100%  
Atmospheric Pressure 500 hPa to 1060 hPa  
Operating Conditions:  
Ambient Temperature 10°C to 40°C  
Relative Humidity 30% to 75%  
Atmospheric Pressure 700 hPa to 1060 hPa

1.6 Power Supply

The Power Supply unit for the WaveFlex 6000X (Part No. H6K001) accepts voltages between 100 and 230 VAC (50/60 Hz). It has a removeable Power Cord (part. no. depends on country or region of use; see table below).

Country	Part No.
UK	14157.2
Europe	14157.3
Australia	14157.4
Canada, USA, Japan	14157.5
Switzerland	14157.6
Italy	14157.7

1.7 Safety Features

1.7.1 Reverse-on-Load

The WaveFlex 6000X CPM Controller is equipped with Reverse-on-Load (ROL) safety circuitry. This patient safety feature allows the unit to reverse direction at five preset load levels if the patient sufficiently resists motion or the motion is obstructed.

1.7.2 Remote Stop Switch

The Actuator is equipped with a Remote Stop Switch. This switch normally generates an Error 7 code when pressed. Cycling the power off and on again will reset the unit.

1.8 Batteries

The Hand Controller uses four batteries. Use non-rechargeable alkaline batteries only, and replace all four at the same time.

1.9 Programming Procedure

1.9.1 Programming the Hand Controller

- Step 1**  
Turn the power on and press *Set* to enter the programming mode. The orange LED will illuminate.
- Step 2**  
Select the function to be adjusted and change it with the *Up* or *Down* arrow buttons.
- Step 3**  
Press *Set* again to return the unit to the normal operating mode.

1.9.2 Hidden Features

A. Patient Compliance Hour Meter

- Step 1**  
Press and hold the *Pause* button, and turn the Power switch on while continuing to hold the *Pause* button. This enables the Hour Meter read-and-reset mode.
- Step 2**  
View the Patient Compliance Hour Meter in the display. Press the *Down* arrow button and the meter will reset to zero and the unit will return to the normal operating mode.

B. Extension and Flexion Force Settings

- Step 1**  
Press and hold the *Speed* button, and turn the Power switch on while continuing to hold the *Speed* button. This enables the Extension and Flexion Force setting mode.

- Step 2**  
Press the *Ext* hand button to view the hand extension force settings. Adjust the settings 1 through 5 with the *Up* and *Down* arrow buttons.
- Step 3**  
Press the *Flex* hand button to view the hand flexion force settings. Adjust the settings 1 through 5 with the *Up* and *Down* arrow buttons.
- Step 4**  
Press the *Set* button to return the Hand Controller to the normal operating mode.

C. Feature Lock-out

- Step 1**

- Step 1**  
Press and hold the *Set* button, and turn the Power switch on while continuing to hold the *Set* button. This enables the Patient Lock-out setting mode, indicated by a padlock on the display.
- Step 2**  
Select the function to be locked against changes by the patient.
- Step 3**  
Press the *Set* button to return the Hand Controller to the normal operating mode.
- Step 4**  
Repeat Steps 1 through 3 above to turn off the feature lock-out.

## 2.0 DRIVE UNIT

### 2.1 Introduction

The following are the major components that comprise the Drive Unit:

- Actuator
- Right and Left Bridge Arms
- Drive Bar
- Splint Clamp

This section gives procedures for disassembly and servicing of the Drive Unit and the major components listed above.

### 2.2 Replacement of the Splint Clamp Assembly

(refer to Figure 1)

#### 2.2.1 Removal

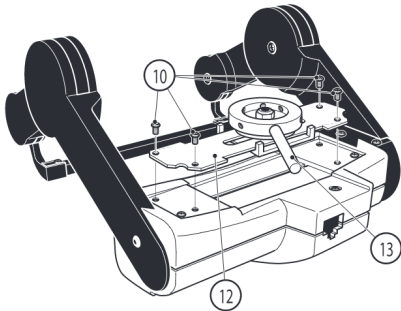
**Tools Needed**  
• No. 1 Phillips  
Screwdriver

**Step 1**  
Using a No. 1 Phillips screwdriver, remove the four pan head machine screws (10).

**Step 2**  
Remove the Splint Clamp Assembly (12) from the Actuator. Remove the Handle (13) from the assembly if it needs replacing.

- ☒ **Note:** The Splint Clamp Assembly (12), not including the Handle (13), is not field-serviceable and must be replaced as an assembly.

**Figure 1**  
Removal of Splint  
Clamp Assembly



### 2.3 Replacement of Drive Bar

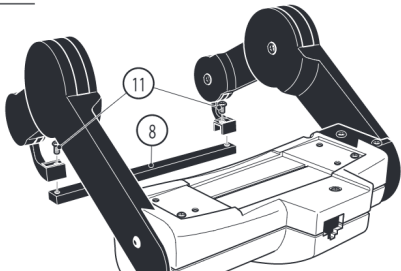
(refer to Figure 2)

#### 2.3.1 Removal

**Tools Needed**  
• No. 1 Phillips  
Screwdriver

**Step 1**  
Using a No. 1 Phillips screwdriver, remove the two pan head machine screws (11) and Drive Bar (8). The Finger Actuators (15) (not shown in Fig. 2) need not be removed from the Drive Bar unless they are being replaced or rearranged.

**Figure 2**  
Removal of Bridge  
Arm Assemblies





2.3 Removal of Right and Left Bridge Arm Assemblies  
(refer to Figure 3)

- ❑ **Note:** After the Bridge Arm assemblies are removed, the calibration procedure described in Section 2.5.1 must be completed before they can be reinstalled.

**Tools Needed**

- No. 1 Phillips Screwdriver
- 3/32" Allen Wrench

**Step 1**  
Using a No. 1 Phillips screwdriver, remove the two pan head machine screws (10) from the Actuator Housing.

**Step 2**  
Remove the Right and Left Bridge Arm Assemblies, (4) and (5) from the Actuator.

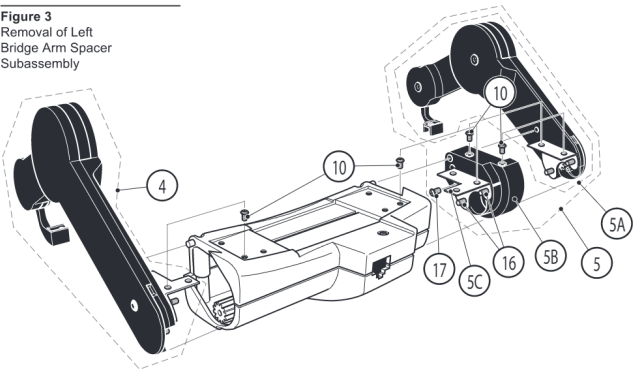
- ❑ **Note:** The Right Bridge Arm (4) is not field-serviceable and must be replaced as an assembly or returned to OrthoRehab or an authorized service depot for servicing. The Left Bridge Arm (5) is partially serviceable; see steps 3 and 4, below.

**Step 3**  
Using a No. 1 Phillips screwdriver, remove the two pan head machine screws (10) and remove the Left Bridge Arm Spacer (5B) as a subassembly from the Left Bridge Arm (5A).

**Step 4**  
Using a No. 1 Phillips screwdriver and a 3/32" Allen wrench, remove the pan head screw (17) and the two socket head cap screws (16) and remove the Bridge Plate (5C) from the Bridge Arm Spacer (5B).

- ❑ **Note:** The Left Bridge Arm (5A) is not field-serviceable and must be replaced as an assembly or returned to OrthoRehab or an authorized service depot for servicing. The Bridge Plate (5C) and Left Bridge Arm Spacer (5B) should be reused when the Left Bridge Arm (5A) is replaced.

**Figure 3**  
Removal of Left Bridge Arm Spacer Subassembly



2.4 Removal of Actuator Housing, Motor and Cross Shaft  
(refer to Figure 4)

**Tools Needed**

- No. 1 Phillips Screwdriver
- Soldering Iron

**Step 1**  
Using a No. 1 Phillips screwdriver, remove the three pan head machine screws (10) and lift off the lower half (6) of the Actuator Housing (3).

- ❑ **Note:** The upper half of the Housing assembly (18), complete with switch, potentiometer disc and modular jack, is not field-serviceable and must be replaced as an assembly or returned to OrthoRehab or an authorized service depot for servicing.

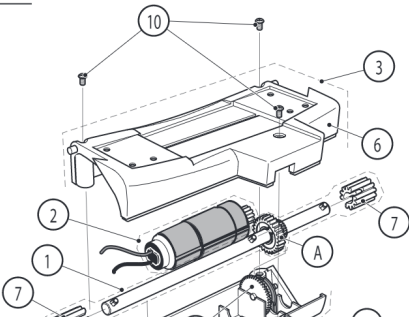
**Step 2**  
Lift out the Cross Shaft assembly (1) and Drive Gears (7). The Drive Gears can be removed from the Cross Shaft assembly by pulling.

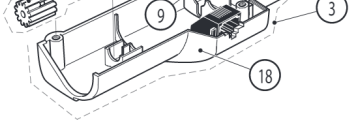
- ❑ **Note:** The Cross Shaft assembly (1), complete with Cross Shaft Gear (A) and split pins, is not field-serviceable and must be replaced as an assembly or returned to OrthoRehab or an authorized service depot for servicing.

**Step 3**  
Lift out the Motor (2) and de-solder the two wires to disconnect it.

- ❑ **Note:** The Motor assembly (2), complete with insulation, cable tie and pinion gear, is not field-serviceable and must be replaced as an assembly.

**Figure 4**  
Removal of Actuator Housing, Motor and Cross shaft





## 2.5 Recalibration and Reassembly of Actuator

### 2.5.1 Recalibration (refer to Figure 5)

#### Step 1

Solder the wires to the new Motor (2). Observe the colour of the wires and the (+) polarity mark on the Motor.

#### Step 2

Place the Motor (2) and the Cross Shaft (1) into the Actuator Housing (16) together. Make sure the locating pin on the Motor is oriented to slide down into the slot in the Actuator Housing.

#### Step 3

Locate the timing marks on the Potentiometer Gear (9) and Cross Shaft Gear (A). Slide the Cross Shaft Gear on to the Split Pin in the Cross Shaft (1).

#### Step 4

Position the timing marks on the two gears so they are offset by one tooth and just visible above the divider in the Actuator Housing (see Figure 5A).

#### Step 5

Rotate the two gears by turning the Pinion Gear on the Motor until the timing mark on the Potentiometer Gear (9) disappears below the divider in the housing and only the Timing Mark on the Cross Shaft Gear (A) is visible. (see Figure 5C). The Position Sensing Potentiometer is now set at 0°.

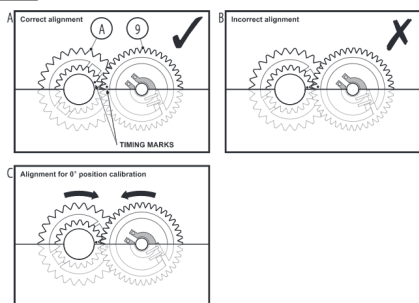
#### Step 6

Install the bottom half of the Actuator Housing (6). Secure the two halves of the Actuator together with three screws (10). Make sure there are no wires pinched between the two halves of the Actuator.

#### Step 7

Connect the Hand Controller to the Actuator and turn the power on. Make sure the Hand Controller indicates 0°, then turn the power off and disconnect the Hand Controller.

**Figure 5**  
Calibration of Cross  
Shaft and  
Potentiometer Gears



### 2.5.2 Reassembly (refer to Figure 6)

#### Step 1

Reassemble the left Bridge Arm (5).

#### Step 2

Install the two brass Drive Gears (7) on to each end of the Cross Shaft assembly (1).

#### Step 3

Adjust the two Bridge Arm **fully** in the direction of the arrow (see Figure 6) until both moving segments of each arm come to a stop. The Bridge Arms are now at the 0° position.

#### Step 4

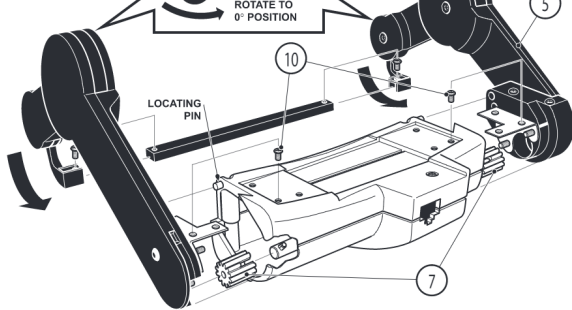
With the two Bridge Arms held firmly in the 0° position, insert each into the ends of the Actuator Housing, making sure the gears are properly meshed and the locating pins at each end of the Actuator Housing (see Figure 6) go into the corresponding holes in the Bridge Arms. Fasten the Bridge Arms with the two screws (10). Make sure that both Bridge Arms have remained at the 0° position.

#### Step 5

Connect the Hand Controller to the Actuator and turn the power on. Make sure the Controller indicates 0°. Run unit from 0° to 270° and back to 0°. Stop the unit and make sure that both Bridge Arms assemblies have stopped at the 0° position.

**Figure 6**  
Reassembly of Bridge  
Arms





3.0 HAND CONTROLLER

3.1 Introduction

The Hand Controller contains the Microcontroller and its associated circuitry and the Batteries to permit portable operation.

The following are the major components that comprise the Drive Unit:

- Hand Controller Assembly
- Cord
- Power Supply

This section gives procedures for disassembly and servicing of the Hand Unit Assembly. Refer to Section 1.1 for an overview of the Hand Controller and its major components.

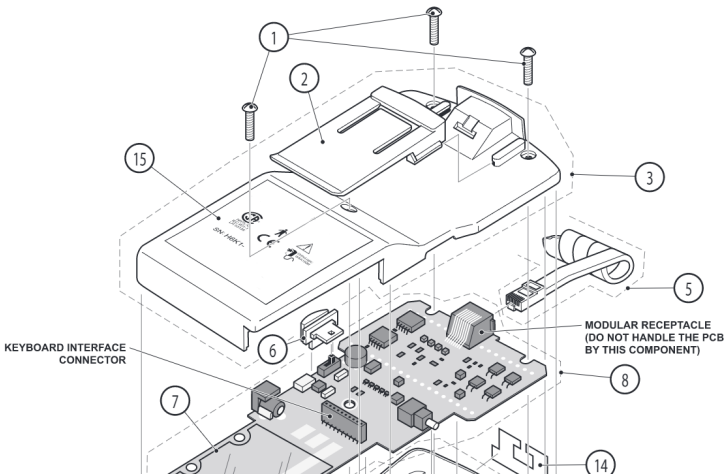
⚠ **Note:** The Cord and Power Supply are not field-serviceable and must be replaced.

3.2 WaveFlex 6000X Technical Drawing

Exploded Assembly Drawing:  
WaveFlex 6000X Hand Controller  
(see next page)

WaveFlex 6000X Technical Drawing:  
WaveFlex 6000X Exploded Assembly

WaveFlex 6000X Motion Controller			
No.	Description	Part No.	Qty.
1	Screw, 4-40 x 1/2" Pan PMS †	FS440AR	3
2	Belt Clip	223174	1
3	Bottom Case Assembly (not including Serial Number Label (item 15))	H6KX015	1
4	Top Case Assembly (Kit of H6KX014 And H6KX015)	H6KX014 H6KX013	1
5	Coil Cord Kit (includes one Cable Retention Label (item no. 14))	6640038	1
6	Actuator Warm-Up Switch	223171	1
7	PCB Insulator *	223177	1
8	Main PCB Assembly (includes one Programmed PROM Assembly (item no. 13))	H6KX012	1
9	Spring Contact †	3020003	2
10	Actuator Power Switch	223170	1
11	Battery Door Assembly	223178	1
12	Keypad	223167	1
13	Programmed PROM Assembly	223176	1

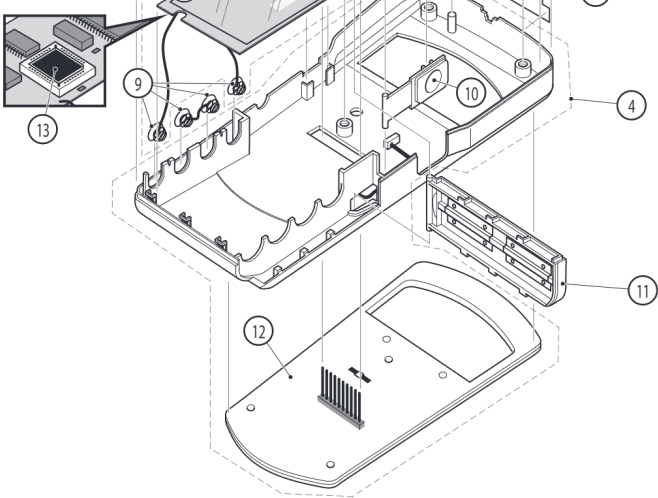


13	Programmed PROM Assembly (included with Main PCB Assembly (item no. 8))	223176	1
14	Cable Retention Label * (included with Coil Cord Kit (item no. 5))	H6KL03	1
15	Serial Number Label		1

Notes:  
 \* Available only in bags of 10 pieces.  
 † Available only in bags of 25 pieces.  
 □ Part not available.  
 --- Defines an Assembly within an Assembly.



Caution: The CPM Controller is a Static Sensitive Device. Repair should be attempted by qualified personnel only. All static device safety precautions must be observed.



### 3.3 Replacement of the Cord

Some older Hand Controllers have Coil Cords that are attached differently than the current style of Hand Controller. If the Coil Cord needs to be replaced, follow the instructions below to determine which style of Coil Cord attachment exists and proceed with the accompanying method for removal. Coil Cords should be replaced with the current style. This includes a Security Label affixed to the Hand Controller Housing after the Coil Cord is attached.

#### 3.3.1 Removal

##### A. Old Style 1 (refer to Figure 7, Inset A)

###### Step 1

If there is **no** Security Label (see item 14 in Figure 7, Inset C), and if the small locking tab (A) on the connector at the end of the Coil Cord is **protruding** from the modular receptacle in the Hand Controller, press the tab toward the connector and pull out the connector.

##### B. Old Style 2 (refer to Figure 7, Inset B)

###### Step 1

If there is **no** Security Label (see item 14 in Figure 7, Inset C), and there is **no** small locking tab **protruding** from the modular receptacle in the Hand Controller, use a No. 1 Phillips screwdriver to remove the two pan head machine screws (1) on either side of the Belt Clip and loosen the one screw in the middle of the Hand Controller Housing, enough to separate the two halves of the Housing.

Note: Take care not to dislodge the Battery Compartment Door or the two Switches.

###### Step 2

Raise the PCB (A) slightly and remove and discard the metal Retaining Clip (B).

###### Step 3

Using a small screwdriver or suitable tool in the space in the modular receptacle (C) above the Cord, release the locking tab (D) by pressing it towards the connector. Remove the Cord (5).

###### Step 4

Replace and tighten the three screws removed or loosened in Step 1.

##### C. New Style (refer to Figure 7, Inset C)

Tools Needed

- No. 1 Phillips Screwdriver
- Small Tip Screwdriver

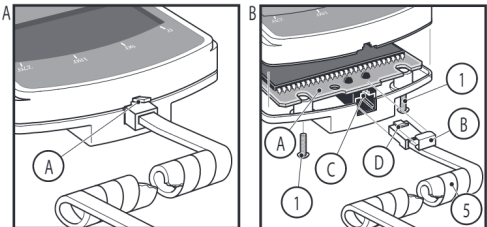
#### Step 1

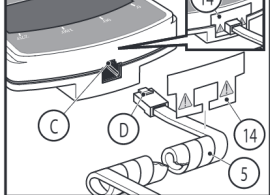
If there is a Security Label (14), peel it off the Security Label (14) to expose the space (C) in the modular receptacle above the connector at the end of the Coil Cord (5).

#### Step 2

Using a small screwdriver or suitable tool in the space in the modular receptacle (C) above the Cord, release the locking tab (D) by pressing it towards the connector. Remove the Cord (5).

Figure 7  
Cord Removal





### 3.3.2 Reassembly

#### Step 1

One end of the new Cord has a shortened locking tab on the connector. Make sure this end of the Cord goes into the modular receptacle on the Controller; the end of the cord with the longer, unmodified locking tab will plug into the Actuator. Insert the connector into the modular receptacle until it locks in place. Pull gently on the Cord to ensure that it is secure.

#### Step 2

Make sure the area on the Housing around the connector is clean and free of oil and grease. Slide the new Security Label (14) over the Cord and peel off the backing to expose the adhesive. Align the Label so that it surrounds the connector and covers the access hole to the locking tab on the modular jack. Press the Label firmly into place.

## 3.4 Replacement of the Belt Clip

(refer to Figure 8)

### 3.4.1 Removal

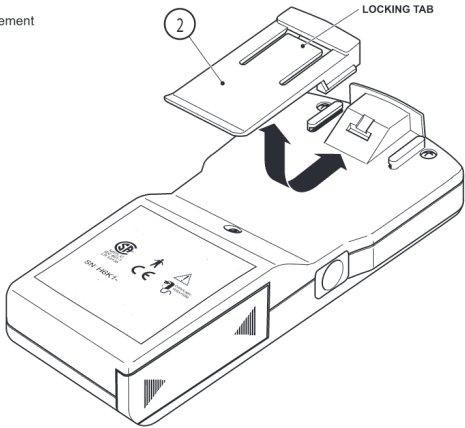
#### Tools Needed

- Flat Tip Screwdriver

#### Step 1

Use the blade of a flat screwdriver to gently lift the locking tab on the Belt Clip (2). Slide the Belt Clip out of the slots on the Controller Housing and replace it with a new one.

**Figure 8**  
Belt Clip Replacement



## 3.5 Disassembly of the Hand Controller

(refer to drawing in Section 3.2)



**Caution:** The Hand Controller is a Static Sensitive Device. Repair should be attempted by qualified personnel only. All static device safety precautions must be observed.

### 3.5.1 Removal of the Hand Controller Housing

#### Step 1

If the Hand Controller is a new style unit and has a Security Label (14) surrounding the Coil Cord connector, peel off the Security Label (refer to Section 3.3 for more information about the Coil Cord and Security Label).

#### Step 2

Using a No. 1 Phillips screwdriver, remove the three pan head machine screws (1) and lift off the back half of the Hand Controller Housing (3).

- ☐ **Note:** The back half of the Hand Controller Housing (3) has a serial number label. If the housing is replaced, this label must be removed and transferred to the new housing.

### 3.5.2 Removal of the Switch Actuators and Battery Compartment Door

#### Step 1

The Warm-up Switch Actuator (6), Power Switch Actuator (10) and Battery Compartment Door (11) all lift out of the front half of the Hand Controller Housing (4).

### 3.5.3 Removal of the Battery Spring Contacts

#### Tools Needed

- No. 1 Phillips Screwdriver

### 3.5.3 Removal of the Battery Spring Contacts

#### Step 1

Slide the two centre Spring Contacts (9) out of the slots in the front half of the Hand Controller Housing (4).

❏ **Note:** The two outer Spring Contacts (9) are part of the PCB assembly (8).

### 3.5.4 Removal of the PCB

#### Step 1

Slide the two outer Spring Contacts (9) out of the slots in the front half of the Hand Controller Housing (4). Observe where the two wires pass through the small grooves in the top edge of the divider that holds the Spring Contacts; the wires will need to be routed through these grooves when the Hand Controller is reassembled.

#### Step 2

Lift out the PCB (8) by pulling on the keyboard interface connector; **do not** pull on the modular receptacle or the PCB may be damaged (see figure in Section 3.2). Take care not to bend the Keypad (12) contact pins projecting through the front half of the Hand Controller Housing (4).

### 3.5.5 Removal of the Keypad

#### Step 1

The Keypad (12) is held in place on the front half of the Hand Controller Housing (4) with a layer of self-adhesive. Remove the Keypad by pressing on the backside through the openings in the Housing.

### 3.5.6 Reassembly of the Hand Controller Components

#### Step 1

Remove the backing layer from the self-adhesive on the backside of the Keypad (12). Press the Keypad into place on the front half of the Hand Controller Housing (4) with the contact pins projecting through the rectangular opening. Take care not to bend the Keypad contact pins.

#### Step 2

Set the PCB (8) into place in the front half of the Hand Controller Housing (4). Make sure the Keypad contact pins are properly aligned with the row of holes in the PCB before pushing the PCB into place, and make sure the PCB is properly seated on the plastic locating pins at the top and bottom ends of the Hand Controller Housing.

#### Step 3

Slide the two centre Spring Contacts (9) into the slots in the Hand Controller Housing.

#### Step 4

Slide the two Spring Contacts (9) attached to the PCB into the slots in the Hand Controller Housing. Make sure the wires are properly routed through the small grooves in the top edge of the divider that holds the Spring Contacts.

#### Step 5

Set the Warm-up Switch Actuator (6) into place with the small square hole over the sliding switch on the PCB. Make sure it is properly seated in the corresponding slot in the front half of the Hand Controller Housing (4).

#### Step 6

Set the Power Switch Actuator (10) into place with round pin seated in the corresponding hole in the front half of the Hand Controller Housing (4). The spring-loaded switch on the PCB will hold the Power Switch Actuator in place.

#### Step 7

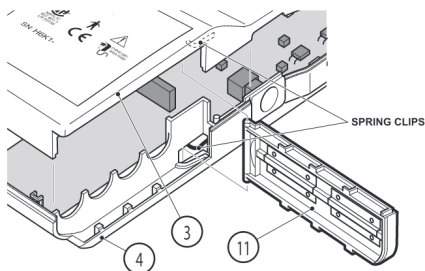
Set the back and front halves of the Hand Controller Housing (3 and 4) together with the back half at an angle and the bottom ends touching. Make sure the clips at the bottom ends are properly seated and interlocked before swinging the two halves together.

#### Step 8

Separate the two halves enough to insert the Battery Door (11). Set

the Battery Compartment Door (11) in place with each hinge pin resting against the spring clips in the Hand Controller Housing (see Figure 9).

**Figure 9**  
Battery Compartment  
Door Replacement



#### Step 9

Close the two halves of the Housing together again. As the two halves are closed, make sure the Battery Compartment Door (11), Warm-up Switch Actuator (6) and Power Switch Actuator (10) are all properly located and the hinge pins on the Battery Compartment Door and Power Switch Actuator go into the corresponding pin locations in the back half of the Housing. Secure the two halves together with the three screws (1).

# APPENDIX A

## A.1 Troubleshooting

The following tables provide some common problems that may be encountered with the WaveFlex 6000X CPM, with probable causes and solutions. Error codes are displayed on the three digits of the LCD screen on the Hand Controller. In all cases, the CPM will stop if an error code is displayed.

### A.1.1 CPM Hand Controller Troubleshooting

Problem	Probable Cause	Solution
• Error Code E1	• Incorrect Workmode. The software cannot find which workmode (i.e. Run Ext., Set Flex Limit) to put the unit in.	• Switch the power off, wait 10 seconds, then turn the power back on. If the problem persists, call Technical Support.
• Error Code E2	• Failure to read EEPROM. During the power-up sequence, saved settings cannot be read from the EEPROM.	• Switch the power off, wait 10 seconds, then turn the power back on. If the problem persists, call Technical Support.
• Error Code E3	• Failure to write to the EEPROM.	• Call Technical Support.
• Error Code E7	• Emergency Stop. The emergency stop button on the Actuator has been pressed; or, the Actuator has been disconnected from the Hand Controller Coil Cord; or, an electronic reset command has been issued by the supply voltage monitor.	• Make sure the Hand Controller Coil Cord is properly connected to the Actuator. Check the supply voltage. Switch the power off, wait 10 seconds, then turn the power back on. If the problem persists, call Technical Support.
• Error Code E8	• Motor Update Failure. The current position of the Actuator is lost and the control signal for the Motor cannot be updated.	• Make sure the Hand Controller Coil Cord is properly connected to the Actuator. Switch the power off, wait 10 seconds, then turn the power back on. If the problem persists, call Technical Support.

cont'd.

Problem	Probable Cause	Solution
• Error Code E10	• Actuator Range Low. The Actuator position measurement is too low.	• Examine the Potentiometer, Coil Cord and Connectors for damage or broken connections. Troubleshoot the main PCB in the Hand Controller. Switch the power off, wait 10 seconds, then turn the power back on. If the problem persists, call Technical Support.
• Error Code E11	• Actuator Range High. The Actuator position measurement is too high.	• Examine the Potentiometer, Coil Cord and Connectors for damage or broken connections. Troubleshoot the main PCB in the Hand Controller. Switch the power off, wait 10 seconds, then turn the power back on. If the problem persists, call Technical Support.
• Error Code E12	• Actuator Hardware Error. An error has occurred with the Actuator.	• Make sure the Hand Controller Coil Cord is properly connected to the Actuator. Check the outside limits. Switch the power off, wait 10 seconds, then turn the power back on. If the problem persists, call Technical Support.
• Error Code E13	• Invalid Settings. There	• Reprogram all of the



is a value greater or lesser than allowable for any one of the settings for speed, force, limits or pause time.

settings. Switch the power off, wait 10 seconds, then turn the power back on. If the problem persists, call Technical Support.

A.1.2 Actuator Bridge Arm Troubleshooting

Problem	Probable Cause	Solution
• Drive Bar angled	• The Left and Right Bridge Arm Assemblies have been installed incorrectly if both do not reach an indicated 0° at the same time.	• Recalibrate the unit and reinstall the Left and Right Bridge Arm Assemblies.
	• One or both of the Bridge Arm Assemblies have been taken apart and reassembled incorrectly.	• The Bridge Arms do not both reach the end of travel and stop at the same time. Send the Bridge Arm Assemblies back to OrthoRehab for recalibration.

A.1.3 Actuator Troubleshooting

Problem	Probable Cause	Solution
• Clicking noise from motor and actuator does not run.	• Forcing the actuator to move by pushing on the Drive Bar when the power is off damaged the motor.	• Replace the motor.
• Loud clicking noise from the actuator when motion is resisted.	• Forcing the actuator to move by pushing on the Drive Bar when the power is off caused the Arm Drive Gear Support Pin to break.	• Remove and inspect Left and Right Bridge Arm Assemblies for broken Support Pins and replace the assemblies as required. Recalibrate the unit.
• The Actuator stops when it reverses.	• Low battery power	• Replace batteries with four new Alkaline batteries.
• Pause function is activated but the Actuator does not pause at the end of the Range of Motion.	• Actuator is changing direction because Reverse-on-Load function has been activated.	• Increase the Force setting to allow unit to reach the set reverse point. N.B. This Feature is hidden from the patient.
• Unit does not reach full Range of Motion.	• Warm-up feature has been activated.	• Stop unit and turn off warm-up feature.
• Some settings cannot be changed.	• Keypad has been damaged	• Replace keypad.
	• Lock feature has been activated. N.B. Padlock symbol visible on LCD.	• Turn Lock feature off. N.B. This Feature is hidden from the patient.

APPENDIX B

B.1 Glossary of Terminology and Abbreviations

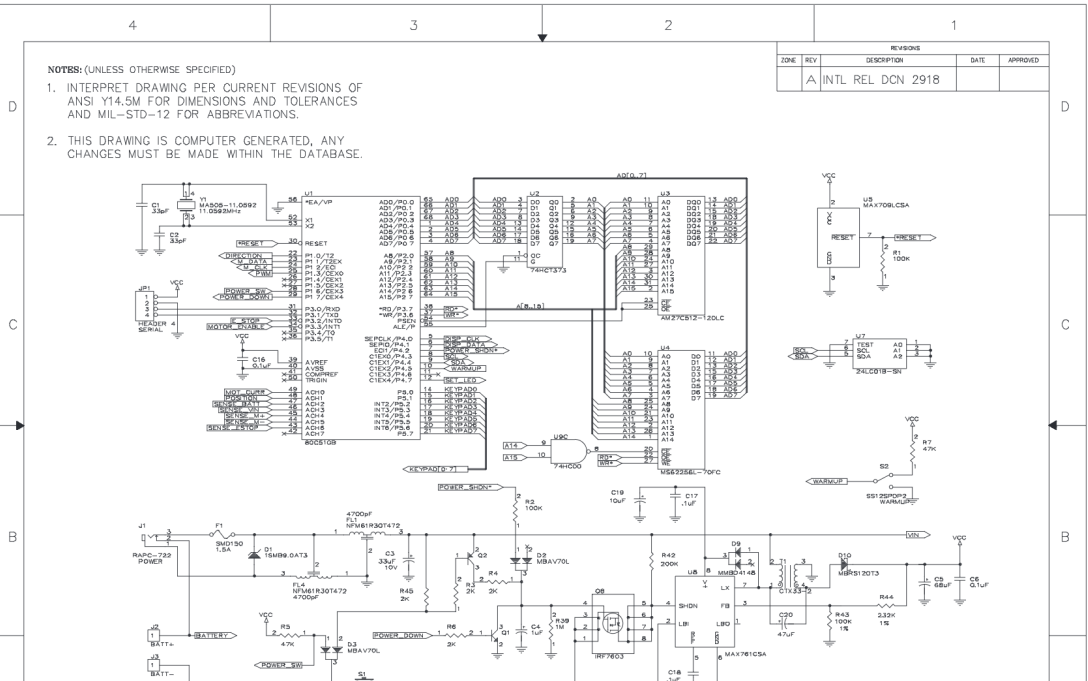
- EEPROM** electrically erasable programmable read-only memory
- LCD** liquid crystal display
- LED** light emitting diode, Indicator Light
- PCB** printed circuit board
- PMS** Phillips machine screw
- POT** potentiometer
- PROM** programmable read-only memory
- ROL** reverse-on-load
- ROM** range of motion
- BHCS** button head cap screw
- FHCS** flat head cap screw
- SHCS** socket head cap screw
- SMS** slotted machine screw



APPENDIX C

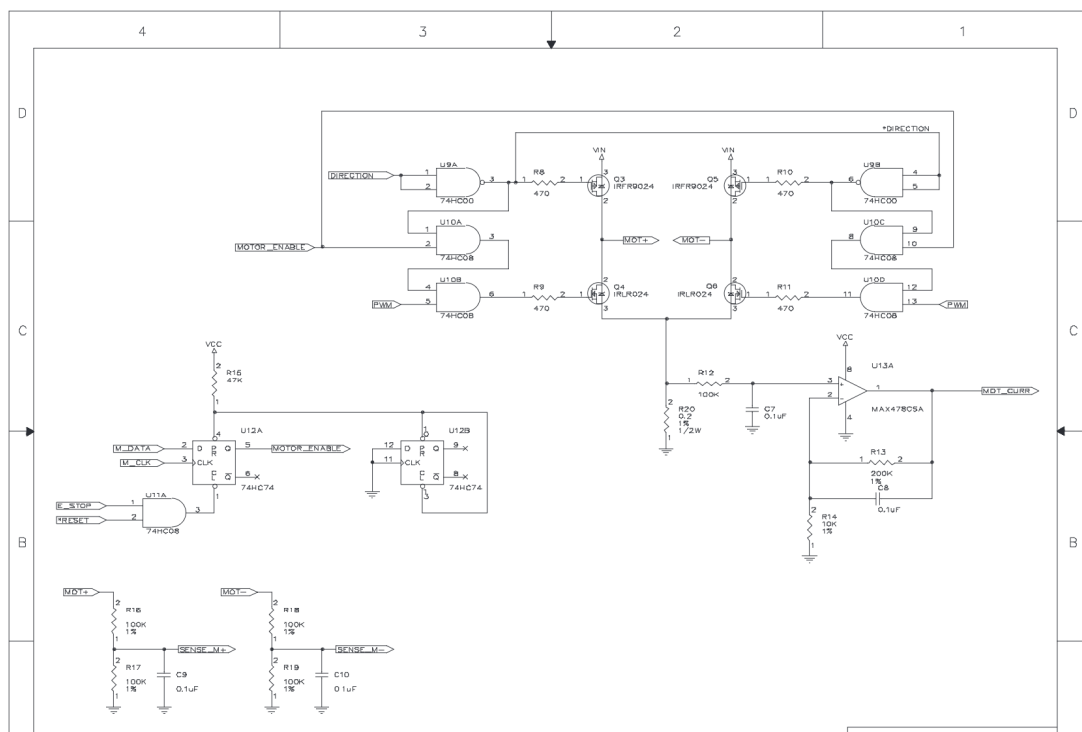
C.1 WaveFlex 6000X Technical Drawing  
WaveFlex 6000X Processor Circuit Wiring Schematic  
(see next page)

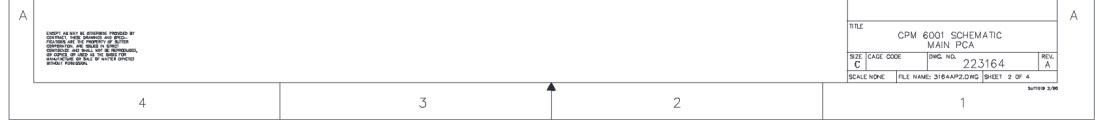
WaveFlex 6000X Technical Drawing:  
WaveFlex 6000X Processor Circuit Wiring Schematic



WaveFlex 6000X Motor Control Circuit Wiring Schematic  
(see next page)

### WaveFlex 6000X Motor Control Circuit Wiring Schematic





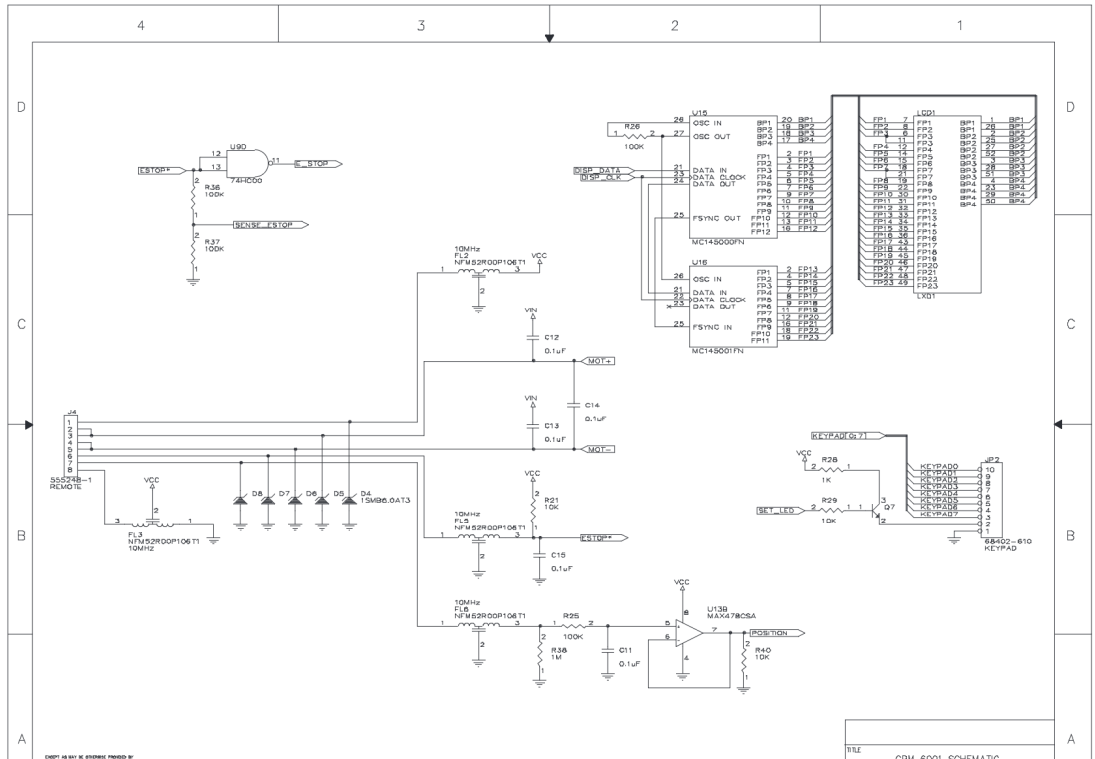
## APPENDIX E

### E.1 WaveFlex 6000X Technical Drawing

WaveFlex 6000X Display and Keypad Control Circuit  
Wiring Schematic  
(see next page)

### WaveFlex 6000X Technical Drawing:

WaveFlex 6000X Display and Keypad Control Circuit Wiring Schematic



WAVEFLEX 6000X POWER SUPPLY CIRCUIT WIRING SCHEMATIC REVISED 10/2018 WAVEFLEX 6000X POWER SUPPLY CIRCUIT WIRING SCHEMATIC REVISED 10/2018				SIZE C	CAGE CODE C	DWG. NO. 223164	REV. A
				SCALE NONE	FILE NAME: 3084APL3.DWG	SHEET 3 OF 4	DATE: 10/18/2018

APPENDIX F

F.1 WaveFlex 6000X Technical Drawing  
WaveFlex 6000X Power Supply Circuit Wiring Schematic  
(see next page)

WaveFlex 6000X Technical Drawing:  
WaveFlex 6000X Power Supply Circuit Wiring Schematic

