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#### HUMAC2015 New Feature List

The HUMAC2015 includes new features for each type of user. The table below lists the features and the users for whom they were designed. Descriptions and examples of each feature follow.

FEATURE	REHABILITATING PATIENTS	SENDING REPORTS TO PHYSICIANS	WORKING WITH STROKE OR WEAK PATIENTS	RESEARCHER
Dashboard Protocols	$\checkmark$			
Change Feedback Display	$\checkmark$			
Real-Time Range of Motion	$\checkmark$			
Display				
Position, Change the Count-	$\checkmark$			
Down Timer				
Print Multi-Page Reports as		$\checkmark$		
Single PDF				
Narrative Report		✓		
Preview Multi-Page Reports,		$\checkmark$		
Send to Printer				
Robotic Modes			✓	
Interrupted Stroke Test	✓		✓	✓
Set Isometric Feedback	$\checkmark$		$\checkmark$	$\checkmark$
Targets				
Export Reports and Group				$\checkmark$
Summaries to Excel				
Export Markers to Text File				✓
Easier Torque Calibration				$\checkmark$
Variable Sampling Rate				$\checkmark$
Adjust Test Parameters	$\checkmark$		$\checkmark$	
During Trial Reps				
Analyze and Export All Tests				$\checkmark$
in the Database				

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#### **Dashboard Protocols**

The Dashboard allows you to run System Protocols. To run a protocol:

- 1. Clear the Manual Settings checkbox.
- 2. Select a Protocol from the Pull-Down list.
- 3. Select the first row in the Protocol.
- 4. Click the **Single Set** or **All Sets** button.

Note: The **Single Set** or **All Sets** buttons (like the **Go** button) are only enabled after you have set the ROM.

- Feedback				F	eedback ——				
🗹 Manual Settings					🗌 Manual Settin	igs			
Mode and Action -	Action	Speed			Protocols	ata al (6	0/1 0/1		
С СРМ	€ Con/Con	60 09			z opeeu Pi		0/100)		
C Isometric	C Con/Ecc	60 0.0	Mode					3	8
O Isotonic	C Ecc/Con							Single Set	All Sets
<ul> <li>Isokinetic</li> </ul>	O Ecc/Ecc	- ECC TTQ			Mode	Setting	Right	Left	Terminati I
		50 <sub>09</sub>			Isokinetic Ci	60 - 60 deg/	Not Tested	Not Tested	5 Repetil
		50 0.9			Isokinetic D	180 - 180 de	Not Lested	Not lested	15 Hepe
- Feedback									
O Torque vs. 7	Time Curves								
<ul> <li>Torque vs. I</li> </ul>	Position Curves		Feedback						
O Velocity vs.	Time Curves	🗌 Display Targ	iets						
C Per-Rep To	orque Bars				•				Þ

#### **Set Isometric Feedback Targets**

You can set Isometric Feedback targets for testing protocols.

- 1. From the **Protocol Editor**, select the **Set** to edit and click the **Edit** button.
- 2. From the **Protocol** form, select **Isometric** mode.
- 3. Click the **Feedback** button.
- 4. In the **Isometric Targets** area, select **Enabled** and set the **Min** and **Max** values. In this example, the targets will be set to 20% and 40% of the patient's MVC.

Isometric Targets						
🔽 Enabled						
Min:	20	-				
Max:	40	▲ ▼				
	40	▼				

5. Before the first set, the HUMAC will have the patient perform a Maximum Voluntary Contraction. This will be used when scaling the targets.



*Note:* You cannot mix Con/Ecc and Ecc/Con sets with this feature.



#### **Change Feedback Display**

You can change the feedback display directly from the real-time feedback screen. To change the display, click the desired button. The options include:

#### Isokinetic, Isometric, CPM Mode

- 1. Torque vs. Time
- 2. Torque vs. Position
- 3. Single Torque Bar
- 4. Per-Repetition Torque Bars
- 5. Single Work Bar
- 6. Per-Repetition Work Bars

#### Isokinetic, Isometric, CPM Mode

- 1. Power vs. Time
- 2. Power vs. Position
- 3. Single Power Bar
- 4. Per-Repetition Power Bars
- 5. Single Work Bar
- 6. Per-Repetition Work Bars

**Note:** When changing displays, the HUMAC erases the previous display and begins drawing the new display with the current real-time data. All data from the start of the test is saved.



### **Real-Time Range of Motion Display**

The HUMAC includes a real-time ROM display along the right side of the patient feedback. This helps patients know how far they need to move to reach their full range of motion.



### **Interrupted Stroke Test**

The HUMAC2015 allows you to perform Interrupted Stroke Testing.

- 1. From the **Protocol Editor**, select the **Set** to edit and click the **Edit** button.
- 2. From the **Protocol** form, select **Isokinetic** mode.
- 3. Select Interrupted Stroke.

- Mode	
C CPM	Zero Gravity
Isometric	Interrupted Stroke
C Isotonic	
<ul> <li>Isokinetic</li> </ul>	

4. Set the Repetitions for the number of valid repetitions you want to select, e.g. 3 if you want to select 3 repetitions. The HUMAC allows the patient to perform up to 10 repetitions.

During the test, the HUMAC displays the following screen:

ltem	Description
Instructions	Instructions to the patient, e.g. "Relax", "Move to Full Flexion".
Next Rep	Perform another repetition for the indicated motion.
Zoom	Zoom-in the repetitions performed. (Figure 2)
1, 2, 3	Select the repetitions you want to accept.
Large Display	Patient feedback.





Figure 2 IST Zoom for Rep Selection

#### Print Multi-Page Reports as Single PDF

Multi-page HUMAC reports are now rendered as a single, multi-page PDF file.



# **Robotic Modes**

The HUMAC implements a number of Robotic Modes which utilize Concentric Torque Thresholds. You can think of the course of rehabilitation as follows:

Mode	Setting	Description
CPM, No Torque Threshold	Torque Linits-Con       EXTS=FLXS       EXTS/FLXS       Torque Threshold       Overtorque mode	<ol> <li>HUMAC beings the CPM motion automatically.</li> </ol>
CPM, Torque Threshold	Torque Limits-con       ♥ EXTS/FLXS       50 •       50 •       Torque Threshold       10 •       Overtorque mode	<ol> <li>The patient must generate the Torque Threshold (in this case 10 ft-lbs) to initiate each CPM motion.</li> <li>Once the motion is initiated, the motion continues until the End of Range is reached.</li> </ol>
Isokinetic, No Torque Threshold	Torque Linits-Con       EXTS=FLXS       EXTS/FLXS       500       Torque Threshold       0       Overtorque mode	<ol> <li>The HUMAC begins the isokinetic motion as soon as any concentric torque is generated.</li> <li>The patient can change direction at any point in the Range of Motion.</li> </ol>
Isokinetic, Torque Threshold, Continue	Torque Limits-Con       EXTS=FLXS       EXTS/FLXS       500 _ 500       Torque Threshold       10 _ 10       Overtorque mode	<ol> <li>The patient must generate the Torque Threshold to initiate the Isokinetic motion.</li> <li>Once the motion is initiated the patient no longer needs to maintain the Threshold to continue the motion.</li> <li>The patient must go through the full range of motion before they can change direction.</li> </ol>
Isokinetic, Torque Threshold, Wait	Torque Limits-Con EXTS=FLXS EXTS/FLXS Torque Threshold Overtorque mode Wait	<ol> <li>The patient must generate the Torque Threshold to initiate the Isokinetic motion.</li> <li>The patient must maintain the Torque Threshold to continue the motion.</li> <li>If they fall below the Threshold the input adapter will stop.</li> <li>Once they generate the Threshold again, the adapter will resume moving.</li> <li>The patient must go through the full range of motion before they can change direction.</li> </ol>

# **Export Reports and Group Summaries to Excel**



When exporting a test, two Worksheets are created in the Spreadsheet.

P	age	Descr	iption									
0	Average or Maximum values based on File, Preferences											
1	1 Per-repetition values											
	Α	0	Р	Q	R	S	Т	U	V	W	Х	Y
1	FullName	Side	Motion	Stat	Inv	Dom	pt	pt_bw	t_deficit	t_ratio	InitialPeal	InitialPealI
2	Sample X>	0	0	C	TRUE	FALSE	51	31	-24	114	51	31
3	Sample X>	0	0	1	TRUE	FALSE	0.139255	0	0	0	0	0
4	Sample X>	0	1	C	TRUE	FALSE	58	35	-9	0	58	35
5	Sample X>	0	1	1	TRUE	FALSE	0.116464	0	0	0	0	0
6	Sample X>	1	0	C	FALSE	TRUE	39	24	0	136	39	24
7	Sample X>	1	0	1	FALSE	TRUE	0.156024	0	0	0	0	0
8	Sample X>	1	1	C	FALSE	TRUE	53	32	0	0	53	32
9	Sample X>	1	1	1	FALSE	TRUE	0.166011	0	0	0	0	0
10	Sample X>	0	0	C	TRUE	FALSE	51	31	-24	114	51	31
11	Sample X>	0	0	1	TRUE	FALSE	0.140846	0	0	0	0	0
12	Sample X>	0	1	C	TRUE	FALSE	58	35	-7	0	58	35

#### **Narrative Report**

The Narrative Report allows you to merge data from a patient test with a Word Document.

#### **Printing the Report**

- 1. From the main HUMAC Screen, click the **Patient** button to select the patient.
- 2. Click the **Report** button.
- 3. Select the **Test Protocol** to be included in the report.
- 4. Click the **Narrative** button to add **Modalities** and **Goals** for the report.
- 5. From the Print/Preview area, select **Narrative Report** as the report type.
- 6. Click the **Preview** button to preview the report on the screen or the **Print** button to send the report to the printer.
- 7. The HUMAC will display the Windows Open dialog box. Select the Word Document you want to merge with the Test Data and click the Open button.

	//AC2014	► Narrative Reports - 49	Search Narrative Reports	٩
Organize 👻 New	folder		8≡ ▼ [	0
Google Drive Goog	E	Name Output Single Speed Isokinetic.docx Two Speed Isokinetic Progress.docx Two Speed Isokinetic.docx	Date modified 12/16/2013 6:46 AM 12/14/2013 7:55 AM 12/14/2013 8:39 AM 12/14/2013 7:55 AM	Type File folder Microsoft Microsoft
Nonegroup	+ 4	III		
1	File name	s <mark>*.doc?</mark> •	Narrative Reports (*.doc) Open	• ncel

8. The HUMAC will open the merged document in Word and save a copy in the Output folder.

*Note:* You can also create Narrative Reports from the Progress Report screen.

#### **Editing the Word Document**

The HUMAC Narrative Reports are created using Microsoft Word. When creating a narrative report, the HUMAC looks for the following tags (<FullName>, <PTRI[s]>) and replaces them with data from the patient's test. The default location for the Narrative Reports is C:\Users\Public\Documents\CSMi\HUMAC2015\Narrative Reports.

As the HUMAC can now create multi-set and Progress Narrative Reports, the tags have been expanded to include the Set and Test numbers. For example:

Tag	Description
<ptri[0]></ptri[0]>	Single Test, <b>P</b> eak <b>T</b> orque, <b>R</b> ight <b>S</b> ide, Initial Motion, First Set.
<ptri[1]></ptri[1]>	Single Test, <b>P</b> eak <b>T</b> orque, <b>R</b> ight <b>S</b> ide, Initial Motion, Second Set.
<ptri[0,0]></ptri[0,0]>	Progress Report, <b>P</b> eak <b>T</b> orque, <b>R</b> ight <b>S</b> ide, Initial Motion, First Test, First Set.
<ptri[1,0]></ptri[1,0]>	Progress Report, <b>P</b> eak <b>T</b> orque, <b>R</b> ight <b>S</b> ide, Initial Motion, Second Test, First
	Set.
<ptri[0,1]></ptri[0,1]>	Progress Report, <b>P</b> eak <b>T</b> orque, <b>R</b> ight <b>S</b> ide, Initial Motion, First Test, Second
	Set.
<ptrichange[0]></ptrichange[0]>	Progress Report, <b>P</b> eak <b>T</b> orque, <b>R</b> ight <b>S</b> ide, Initial Motion, Change from First
	to Second Test, First Set.

### **Patient Information**

Tag	Description
<fullname></fullname>	Patient Full Name
<firstname></firstname>	Patient First Name
<lastname></lastname>	Patient Last Name
<doctor></doctor>	Doctor
<injury></injury>	Injury

# **Test Information**

Tag	Description
<mgi[s]></mgi[s]>	Muscle Group Initial Motion
<mgr[s]></mgr[s]>	Muscle Group Reciprocal Motion
<angle[s]></angle[s]>	Isometric Angle
<muscle[s]></muscle[s]>	Isometric Muscle Group
<settinginit[s]></settinginit[s]>	Setting (Speed, Torque, Angle) for initial motion
<settingrecip[s]></settingrecip[s]>	Setting (Speed, Torque, Angle) for reciprocal motion
<termination[s]></termination[s]>	Termination (repetitions)

#### Narrative Report button on Report screen.

Tag	Description
<modalities[s]></modalities[s]>	Selected Modalities
<goals[s]></goals[s]>	Selected Goals

#### **Torque Values**

Single Test	Progress Report	Progress Change	Description
<ptri[s]></ptri[s]>	<ptri[t,s]></ptri[t,s]>	<ptrichange[s]></ptrichange[s]>	Peak Torque Right Side Initial Motion
<ptli[s]></ptli[s]>	<ptli[t,s]></ptli[t,s]>	<ptlichange[s]></ptlichange[s]>	Peak Torque Left Side Initial Motion
<ptdi[s]></ptdi[s]>	<ptdi[t,s]></ptdi[t,s]>	<ptdichange[s]></ptdichange[s]>	Peak Torque Initial Motion R/L Deficit
<ptrr[s]></ptrr[s]>	<ptrr[t,s]></ptrr[t,s]>	<ptrrchange[s]></ptrrchange[s]>	Peak Torque Right Side Reciprocal Motion
<ptlr[s]></ptlr[s]>	<ptlr[t,s]></ptlr[t,s]>	<ptlrchange[s]></ptlrchange[s]>	Peak Torque Left Side Reciprocal Motion
<ptdr[s]></ptdr[s]>	<ptdr[t,s]></ptdr[t,s]>	<ptdrchange[s]></ptdrchange[s]>	Peak Torque Reciprocal Motion R/L
			Deficit

# **Torque Plots**

Тад	Description
<ptgraphinit[s]></ptgraphinit[s]>	Trq vs. Pos Graph for Initial Motion
<ptgraphrecip[s]></ptgraphrecip[s]>	Trq vs. Pos Graph for Reciprocal Motion

### **Export Markers to Text File**

The HUMAC Export to Text now adds a number of annotations, e.g. where each repetition ran, the peak torque location. This saves researchers the task of manually annotating the data. The following points are annotated in the data:

Annotation	Description
EndPnt 0	Repetition/motion extent
Pos Start	Position Start. Point where the patient moved ½ degree into the motion.
Peak Trq Start	Start of Peak Torque production
Peak Trq End	End of Peak Torque production.
Half Peak Trq	Half Peak Torque Point (Isometric Tests)
Stim	Simulus to patient (Reaction Time Test).
<b>Reaction Start</b>	Patient moved toward stimulus (Reaction Time Test)
Target Found	Patient entered the Target (Reaction Time, LOS Test)
Target End	Patient was in target for required time (Reaction Time, LOS Test)

**Note:** Because there is an initial and reciprocal motion, the annotations are numbered:

Number	Description
0	Initial Motion, First Repetition
1	Reciprocal Motion, First Repetition
2	Initial Motion, Second Repetition

Time (Seconds)	Position (Degrees)	Torque (Foot-Pounds)	Speed (deg/sec)	End Pnt 0	Peak Trq Start
1.44	97.3	2.5333	8	0	
1.45	97.1	0.0222	16.6	0	
1.46	96.9	2.9	25.1	0	
1.47	96.6	6.1	32.2	0	
1.48	96.3	9.7556	37.4	0	
1.49	95.8	14.3	43.6	0	
2.14	57.5	133.7556	59.6	0	
2.15	56.8	134.1111	59.7	0	
2.16	56.2	134.3556	59.9	0	
2.17	55.7	134.5111	59.9	0	
2.18	54.9	134.5778	60	0	0
2.19	54.4	134.4889	59.9	0	
2.2	53.8	134.2556	59.8	0	
3.1	0.9	4.0556	16.4	0	
3.11	0.8	0	2.1	1	
3.12	0.8	0	-9.9	1	
3.13	0.9	0	-19.2	1	
3.14	1.3	0	-30.3	1	

Time (Seconds)	Position (Degrees)	Torque (Foot-Pounds)	Speed (deg/sec)	End Pnt 0	Peak Trq Start
3.15	1.6	0.6296	-35.8	1	
3.16	1.9	8.4864	-40.1	1	

#### **Preview Multi-Page Reports, Send to Printer**

The HUMAC Report Preview Screen displays multi-page reports as a single scrolling window making it much easier to review all of the sets.



The Preview screen includes a Print button to send reports directly to the printer.

**Note:** For speed the preview screen uses reduced resolution graphs. For the best printed resolution, reports should be printed from the HUMAC Report screen, not the preview screen.



### Position, Change the Count-Down Timer

The Count-down timer options can be set from the File, Preferences command.

Style	
Show clock face.	
Location	

#### **Patient Information**

Tag	Description
Show Clock Face	When checked the analog clock dial and digital counter are displayed. Many patients like the analog dial. When cleared only the digital counter is displayed which allows you to see more of the underlying screen.
Location, Center	Center the clock on the screen.
Up-Right	Place the clock on the upper-right-hand side of the screen.

#### **Test Information**



## **Easier Torque Calibration**

The Torque Calibration and Verification only requires the user to place 100 pounds on the NORM one time and 25 pounds on the NORM one time. The calibration procedure automatically moves the weights to each of the required positions.

Cali	bration
ঘ	Set the ROM Stons at Teal "II" and Gray "II"
I.	Set the arm to number 45. (Pin should click in-place)
	Best the input adapter against the Teal "II" Ston
	Set dynamometer tilt to nacition 0
	Mave area toward Tabl "O" with the last in place
M	iviove arm toward Teal Q until it locks in-place.
	Calibration
₽	Place 100 pounds on the arm. (Weights #1, 2, 3 and 4).
	Verification
₽	Place 100 pounds on the arm. (Weights #1, 2, 3 and 4).
₽	Place 25 pounds on the arm. (Weight #1).
₽	Remove all weight from the input arm assembly.
	OK Cancel Help

### Variable Sampling Rate

When using the HUMAC 64-bit interface you can select different sampling rates for testing and exercise sessions.

1. From the File, Preferences screen in the Machine area, select a sampling rate from 10 to 1,250 Hz.

Machine		
Type:	Extremity	-
Machine:	NORM	•
Interface:	USB2	•
Sampling:	500	-
	100	
TMC Locatio	<b>n</b> 250	
C Left	500	ht .

### **Adjust the Test Parameters**

The HUMAC allows you to adjust the test parameters from the Feedback screen. For example, if a patient can't reach a high test speed, you can reduce the test speed from the feedback screen to a speed they can reach and use the new setting during the test.

- 1. From the Feedback Screen, while doing Trial Reps, change the Speed or Force settings.
- 2. You can select increments of 1, 5 or 10 when changing the settings.



3. After making the change and clicking Cancel to leave the feedback screen, the HUMAC will ask if you want to update the protocol with the new settings. If you answer yes, when you proceed to the test screen, the new settings will be used. **Note:** Data collected on the opposite side for that set will be erased because the settings under which it was run have changed. To independently set Right and Left side values, use two sets.

HUMAC	2015 🛛 🕅
(į)	Update Protocol with new settings?
	Yes No

#### Analyze and Export All Tests and Exercise Sets in the Database

From the Group Summary you can analyze every test and exercise session in the database and export the complete set of results to an Access database.

- 1. From the Group Summary click the **ALL TO ACCESS** button.
- 2. The HUMAC will analyze every test and exercise session in your database and export the result to an Access table.

Group Summary Database				
Pattern Protocol	Options Knee Extension/Flexion	•	Add (	All To Access