Computer Sports Medicine, Inc. (CSMi)
HUMAC® Balance System (503607)
and
HUMAC® Balance & Tilt System (503746)
User's Guide

Disclaimer:

CSMi makes no representations or warranties regarding the contents of this manual. We reserve the right to revise this document at any time or to make changes to the product described within it without notice or obligation to notify any person of such revisions or changes.

Printed in the United States of America

Part Nbr: 300736 Rev: B

CE

IMPORTANT INFORMATION

Qualified Personnel Notice

WARNING: *The HUMAC Balance Systems contain no user serviceable parts. Repair of the HUMAC System should only be performed by qualified service personnel.*

Classification Information

- EMC Certified to: EN 60601-1-2.
- Class: Type (BF) equipment.
- CE Conformity to MDD 93/42/EEC.

Cleaning and Maintenance

CAUTION: *Do not use Benzene, thinner, or any volatile substance to clean the unit as they may leave a permanent mark.*

Balance Platform

- With the system turned OFF, use a lint free cloth damped with a mild detergent or 70% isopropyl alcohol to clean all outer surfaces.
- The user is responsible for disposal of any HUMAC components per local regulations.

Foam Pad

- Antimicrobial coated positioners and table pads are highly resistant to fluid infiltration. In order to maintain the original integrity of the coating, you should exercise care in their handling and use. Wipe your antimicrobial coated products clean as soon as possible after fluid contact or use. A soft cloth with 70% isopropyl alcohol or 10% bleach / water solution is recommended. An all-purpose cleaner similar to 409™ or Windex™ may also be used. Allow antimicrobial coated products to air dry in a flat (natural) position and store them in a flat (natural) position at a temperature not to exceed 170° F.

Assembly and Installation Notes

- The HUMAC System can be installed in any Ordinary Location.
- The HUMAC Balance system should be placed on a hard, flat and level surface.

Components

- HUMAC Balance Board with USB Cable.
- HUMAC Software on DVD
- HUMAC Balance User Guide

Available options

- Soft Surface with Grid

Specifications

Balance Board

Parameter	Value
Size	18” L x 10.5” W x 2.25” H.
Weight	8.25 lbs.
Power	USB-powered, 5v, 300 ma.
Patient weight capacity	330 lb. (150 kg).

Ratings

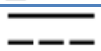
- The HUMAC System is not intended for use in the presence of flammable anesthetics.

- The HUMAC System is rated for Continuous Operation.
- Operating Temperature 10° Centigrade to 35° Centigrade.
- Storage Temperature -10° Centigrade to 55° Centigrade.
- Operating Relative Humidity 20% noncondensing to 80% noncondensing.
- Storage Relative Humidity 20% noncondensing to 80% noncondensing.
- Special cooling is not required for the operation of the HUMAC.
- Ordinary protection against ingress of waters must be provided.

Accessories

- The HUMAC must be operated with an ITE (Information Technology Equipment) compliant PC.
- Only CSMi approve accessories may be used with the HUMAC System.

Symbols

Symbol	Definition
	Caution
	WEES directive
	Temperature Limits
	Humidity Limits
	DC Voltage
	Type BF Applied Part
	Class II Equipment

Authorized Representative

The CSMi European Authorized Representative is: Cavendish Scott Ltd., Invision House Wilbury Way, Hitchin, Herts. England, SG4 0TY.

Additional Notes/Warnings

Symbol	Definition
	The user is responsible for disposal of the system in compliance with local regulations.

	***Note:*** *It is not recommended that the HUMAC System be changed in any way. If any changes are made, adherence to the CE standards becomes the owner's responsibility, if you have any questions, please contact the CSMI Customer Services Department at: (Voice) 781-297-2034 or (FAX) 781-297-2039 or (e-mail) service@csmisolutions.com.*
	***CAUTION:*** *Federal law restricts this device to sale of or on the order of a medical practitioner. When prescribed for therapeutic purpose, a physician should clearly define the parameters of use (i.e., total work, maximum heart rate, etc.) to reduce the risk of patient injury.*

Copyrights and Trademarks

IMPORTANT PRE-USE CONSIDERATIONS

Read carefully BEFORE operating the HUMAC Balance System

The HUMAC System provides a wide variety of choices for overall treatment of your patients. Adhere to the following precautions and instructions to ensure optimum patient safety and proper system usage. DO NOT operate the system until you fully understand its operation and have either:

- attended the in-service provided as a service by CSMI, or
- fully read and understand the documentation provided with the system.

NOTE: *Federal law restricts the use of this device to, or on the order of, a licensed physician or licensed practitioner. If you have any questions, please call the CSMi Technical Services Department at: 1-781-297-2034.*

When using the System, It is the operator's responsibility to:

- take the time to properly instruct all patients especially those who have difficulty following and carrying out instructions. It is highly recommended that such patients be continually coached and verbally guided throughout the session;
- closely monitor all patients using the system;
- ensure that a clinician is ready to assist in case of loss of balance when patients are working with their eyes closed;
- ensure the patient is standing in the center of the platform for optimal operation,
- position the display so that the patient can look straight at it. This will help ensure good posture during the test or exercise session.

Additional instructions:

- A walker can be used as needed for patient's that require or feel more comfortable with something to hold onto if needed.
- There is a learning curve that must be considered when testing with this device. Clinical research suggests practice trials be performed prior to testing.
- It is highly recommended that the clinician remain with the patient during testing or training.

IMPORTANT: *The HUMAC Balance system provides some compliance to adjust to non-level flooring. Leaning fully over the side of the platform can result in the platform tilting up to 3 degrees.*

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LIST OF FIGURES

HUMAC INSTALLATION AND SETUP

IMPORTANT: *Install the HUMAC software before connecting the HUMAC Balance Platform to the PC.*

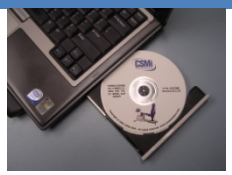
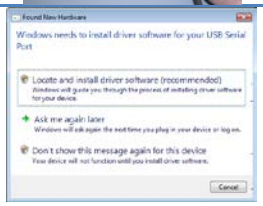
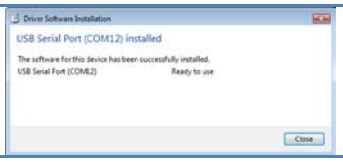
Minimum System Requirements

Parameter	Value
Operating System	32 or 64-bit version of Windows XP Home or Pro, Windows Vista Home, Business or Ultimate, Windows7 Home, Premium or Ultimate.
CPU Type	Pentium or Equivalent
CPU Speed	1.00GHz
System RAM	1GB

Package Contents

Item
HUMAC Balance Platform
HUMAC DVD
User Manual (hard copy & pdf on DVD

Installation Procedure

STEP	DESCRIPTION	DETAIL
1	Insert the **HUMAC CD** into the CDROM drive of the PC/Laptop. The HUMAC Installation Program should start automatically. If not select **Start**, **My Computer** and Double Click on the **CD Drive** that contains the HUMAC Software. Select **Next** to accept the default installation settings until the software installation process is complete. The last button in the process will read **Finish**.	
2	With the HUMAC CD still in the CDROM drive, plug the Balance Platform USB cable into the PC.	
3	Found New Hardware Wizard: A. When the "*Connect to Windows Update*" dialog box appears, select **No, not this time** and click the **Next** button to continue. B. Continue clicking **Next** to accept the default installation settings until the software installation process is complete. C. If a message "*This software has not passed the Windows Logo testing*" appears, click the **Continue Anyway** button. The **New Hardware Wizard** will run a second time. Select the same choices as listed in Steps A-C.	
4	The HUMAC Balance Installation is now complete.	

Overview

The HUMAC Balance System is a static force plate (Force Plate Mode) that measures Center of Pressure (COP) and Force. The HUMAC Balance & Tilt System adds a tilt sensor to the basic HUMAC Balance System allowing both static force (Force Plate Mode) and dynamic tilt (Tilt Mode) measurements. These parameters are used in a variety of protocols to access and improve the capabilities of balance, orthopedic, and neurologic patients. In many cases the same display can be used for all three types of patients for both Testing and Exercise. In addition real-time biofeedback will help your patients perform the exercises they are already doing better while making the exercises more engaging.

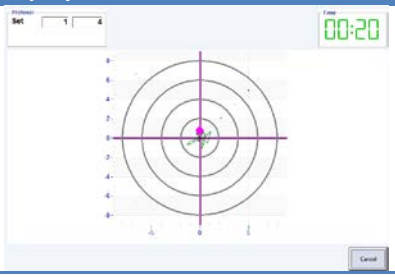
This manual starts by providing an overview of each feedback display,, followed by the steps to run a CTSIB test, and finally a description of each measured parameter and how it is calculated.

Feedback Displays

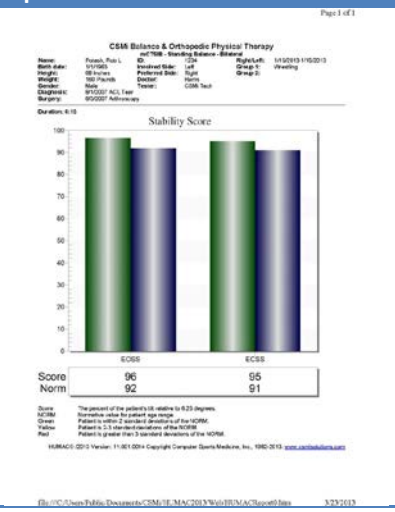
CTSIB (Force Plate Mode)

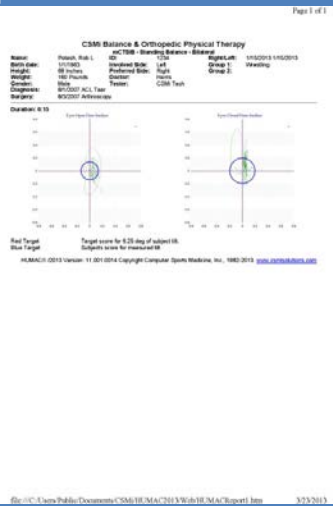
Clinical Test of Sensory Organization and Balance (CTSIB) is used to test how a patient's vision, vestibular, and somatosensory systems interact and if an deficit exists compared to a normal population. The CTSIB is sometimes referred to as the Romberg or Foam and Dome test.

Display

Display	Description
	• Provide a cursor (magenta ball) and tracing of the patient's Center of Pressure. • A count-down timer.

Report

Report	Description
	• Normative scores (Blue Bars) for the patient Age and Gender. • Green Bar: Patient within 1 Standard Deviation of Normative Data. • Yellow Bar: Patient within 2-3 Standard Deviations of Normative Data. • Red Bar: Patient > 3 Standard Deviations of Normative Data. • Score: The ratio of the patient's COP Std Dev to 6.25 degrees. • NORM: The ratio of the normative group's COP Std Dev to 6.25 degrees.

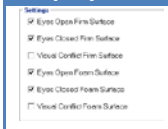
Report	Description
	• A tracing of the patients real-time COP during the test. • Blue circle: The Std Dev of the patient's COP. • Red circle: The Std Dev of 6.25 degrees.

Options

Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set
	Time	The duration (minutes:seconds) of each set.

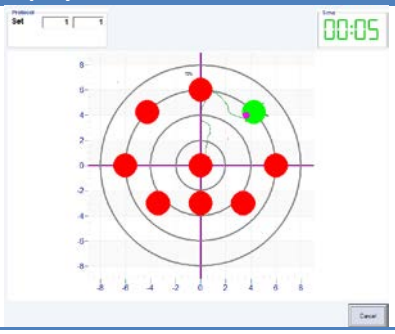
Settings

Display	Parameter	Definition
	**Settings**	1. Eyes open, firm surface 2. Eyes closed, firm surface 3. Visual Conflict, firm surface 4. Eyes closed, foam surface 5. Eyes closed, foam surface 6. Visual Conflict, foam surface A CTSIB protocol typically uses conditions 1, 2, 4, and 5.

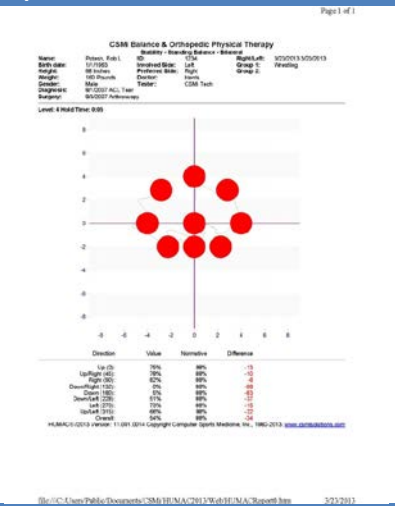
Stability (Force Plate Mode or Tilt Mode)

Stability test measures a patient's ability to stabilize their balance at locations around their neutral position. Results are reported as the percent of time a patient holds their COP in each of the eight targets.

Display

Display	Description
	• The current target flashes green when the patient is on-target and flashes yellow when they are off-target. • A count-down timer displays the remaining time on the current target. • The targets are selecting in a Clockwise order beginning with the target at 12:00.

Report

Report	Description
	• A plot of the targets and a tracing of the patient's COP during the test. • The **Score** (percent of time) they were on-target. • The **Normative** value (set will the File, Preferences command). • The **Difference** between the Patent's **Score** and the Normative value.

Options

Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set

Settings

Display	Parameter	Definition
	**Level**	Distance (degrees) to the center of the farthest target.
	Hold Time	Time in seconds the patient should remain on the target. ***Note:*** *The HUMAC counts-down the Hold Time so the patient knows when they should move to the next target.*

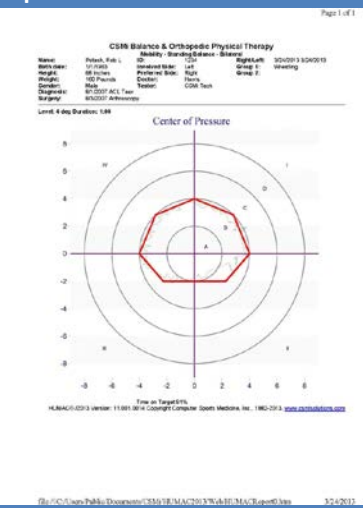
Mobility (Force Plate Mode or Tilt Mode)

Mobility is used to test a patient's ability to hold their Center of Pressure on moving target that circles around a patient's neutral balance point. Results are reported as the percent of time a patient holds their COP inside the moving target.

Display

Display	Description
	• The current target flashes green when the patient is on-target and flashes yellow when they are off-target. • A count-down timer displays the remaining time in the test.

Report

Report	Description
	• A plot of the target track and a tracing of the patient's COP during the test. • The **Score** (percent of time) they were on-target.

Options

Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set
	Time	The time (minutes:seconds) for the target to complete one revolution (one set).

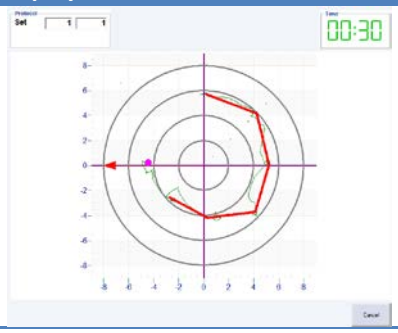
Settings

Display	Parameter	Definition
	**Level**	Distance (degrees) to the center of the farthest target.

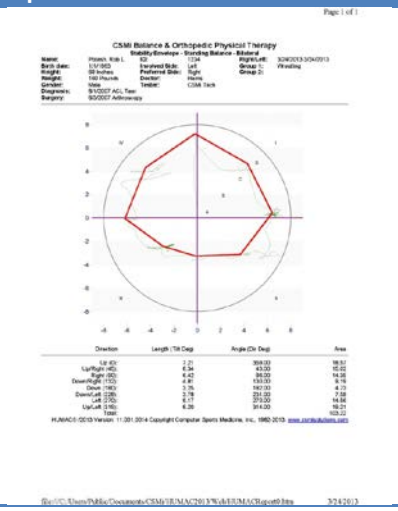
Stability Envelope (Force Plate Mode or Tilt Mode)

Stability Envelope measures a patients maximum Angle of Lean in 8 directions around their neutral balance point starting with the 12:00 position. The Patient is instructed to lean as far in the direction of the arrow as they feel comfortable. When the clinician feels the patient has stabilized their balance, the clinician clicks the location on the screen to record the patient position (indicated by the magenta target). Results document a patient's maximum stability envelope.

Display

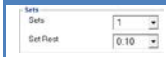
Display	Description
	• An arrow shows the current direction the patient should lean. • The magenta cursor shows the patient's location. • When the therapist clicks on the dot, the HUMAC records the mouse position and progresses to the next location. • A count-up timer displays the total time.

Report

Report	Description
	• A plot of the stability envelope (based on the locations recorded by the mouse clicks). • A tracing of the patient's COP during the test. • The **Tilt Length** (degrees of patient tilt) in each direction. • The **Tilt Angle** (orientation degrees) • The **Area** of the section from the current direction to the next direction in the sequence.

Options

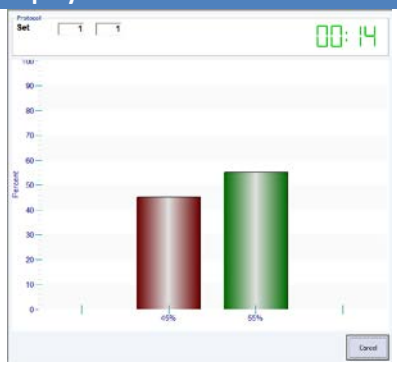
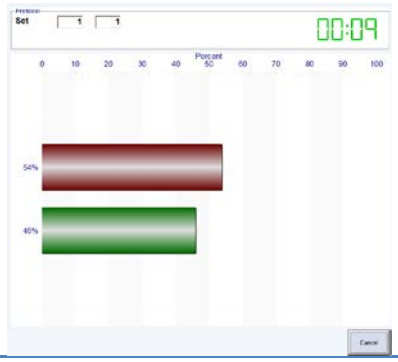
Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set

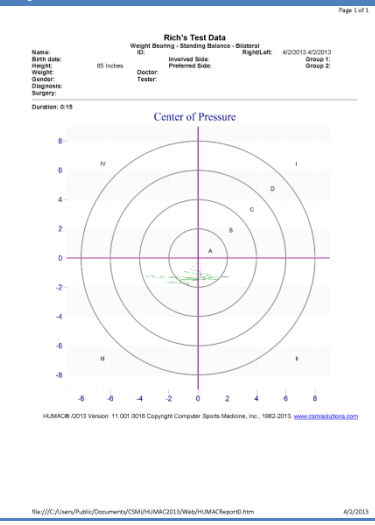
Weight Bearing (Force Plate Mode)

Display the Patient's Right/Left or Anterior/Posterior weight distribution.

Display

Display	Description
	Right/Left • A pair of bars showing the patient's Right/Left Weight Distribution. • The Right/Left Percent or Weight value. • A count-down timer (if a Duration time is selected) or a count-up timer (if an Unlimited Duration is selected).
	Anterior/Posterior • A pair of bars showing the patient's Anterior/Posterior Weight Distribution. • The Anterior/Posterior Percent or Weight value. • A count-down timer (if a Duration time is selected) or a count-up timer (if an Unlimited Duration is selected).

Report

Report	Description
	• A tracing of the patient's COP during the test.

Options

Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set
	Time	The time (minutes:seconds) for the target to complete one revolution (one set).

Mode and Action

Display	Parameter	Definition
	**>**	Display the Patient's Right/Left weight bearing.
	/	Display the Patient's Anterior/Posterior weight bearing.

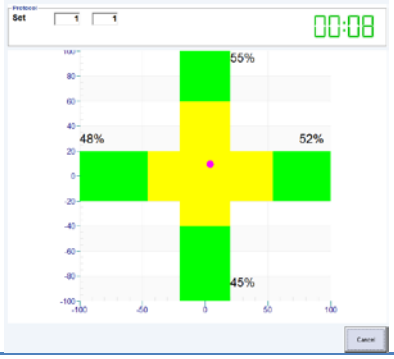
Settings

Display	Parameter	Definition
	**Display %**	Display the percent R/L or A/P values below the feedback bars.
	Display Weight	Display the weight (pounds or KG) values below the feedback bars.

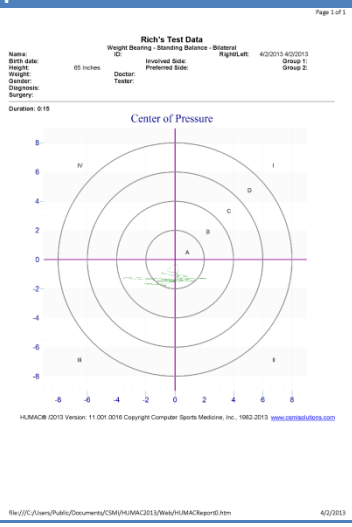
Weight Bearing XY (Force Plate Mode)

Display the Patient's Right/Left and Anterior/Posterior weight distribution.

Display

Display	Description
	• X and Y bars showing the patient's Right/Left and Anterior/Posterior Distribution. • The Percent value. • A count-down timer (if a Duration time is selected) or a count-up timer (if an Unlimited Duration is selected).

Report

Report	Description
	• A tracing of the patient's COP during the test.

Options

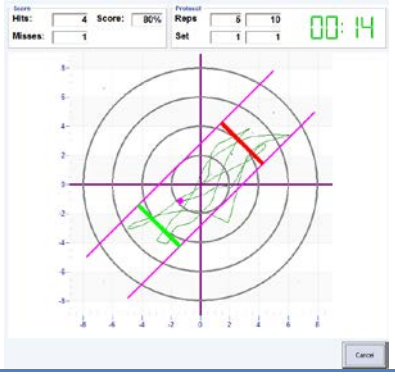
Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set
	Time	The time (minutes:seconds) for the target to complete one revolution (one set).

Weight Shift (Force Platform Mode and Tilt Mode)

Weight Shift measures a patient's ability to shift their COP from right to left, anterior to posterior, or in between without going outside the target zone. Results measure good hit to bad hit ratio and time needed to complete the exercise.

Display

Display	Description
	• The target for the patient to move through in green. • A Magenta Boundary the patient must stay within. • Their Score (Hits, Misses, Percent). • The number of Reps completed and the total number of Reps. • The number of Sets completed and the total number of Sets. • A count-up timer.

The goal is for the patient to move through the green maker in the correct direction while staying inside the magenta boundaries. If they stay within the boundaries a hit is scored (**Error! Reference source not found.**). If they move outside the boundaries a miss is scored (Figure 2). The patient must move through the marker in the correct direction for the system to move to the opposite marker. If the pass through in the wrong direction the same marker will stay green until they pass through in the correct direction (Figure 3). This would also be a miss since the patient went outside the magenta boundaries.

Hit	Miss	Wrong Direction

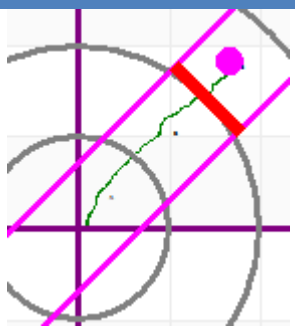
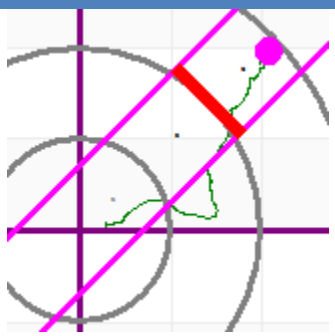
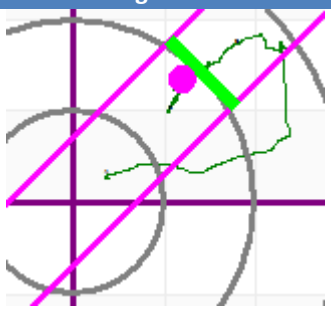
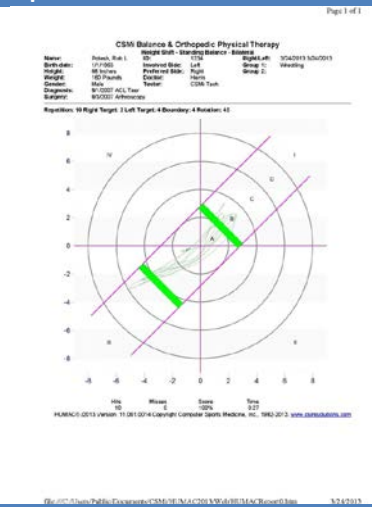

		

Figure 1 Hit	**Figure 2 Miss**	**Figure 3 Wrong Direction**

Report

Report	Description
	• The target display. • A tracing of the patient's COP during the test. • Their Score (Hits, Misses, Percent). • The Total Time to complete the test.

Options

Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set
	Reps	The number of repetitions. (A repetition is counted when the patient passes through either target).

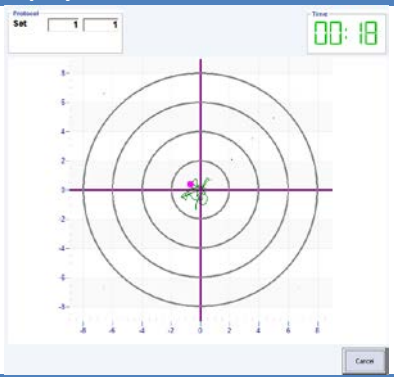
Settings

Display	Parameter	Definition
	**Left Target**	Distance (degrees) from the center to the Left target.
	Right Target	Distance (degrees) from the center to the Right target.
	Boundary	Total width (degrees) of the area the patient must stay within.
	Rotation	Rotation (degrees) of the display. 0: Horizontal, 90: Vertical.

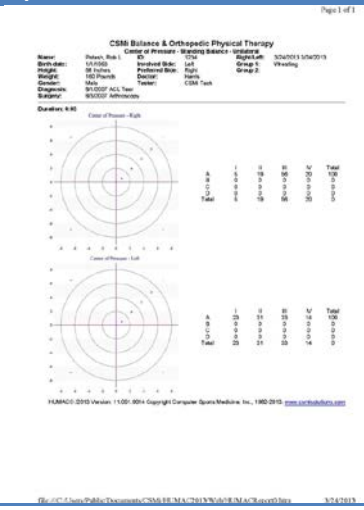
Center of Pressure (COP) (Force Plate Mode or Tilt Mode)

Center of Pressures is used to measure the variation in a patient's center of pressure during exercise.
Display the Patient's Right/Left and Anterior/Posterior weight distribution.

Display

Display	Description
	• A trace of the patient's Center of Pressure. • A count-down timer (if a Duration time is selected) or a count-up timer (if an Unlimited Duration is selected).

Report

Report	Description
	• A tracing of the patient's COP during the test. • The percent of time the patient spent in each Ring and each Quadrant.

Options

Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set
	Time	The time (minutes:seconds) for the target to complete one revolution (one set).

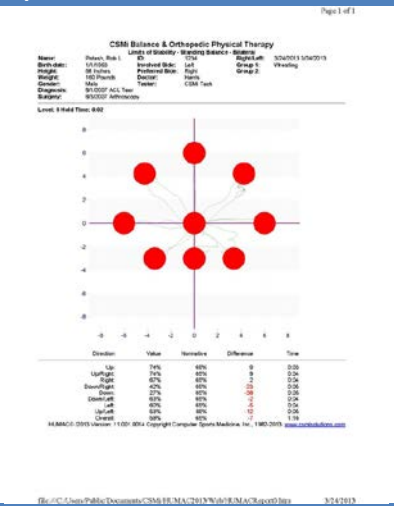
Limits of Stability (LOS) (Force Plate Mode or Tilt Mode)

The goal is for the patient to move the round cursor (their COP) to the highlighted target. After the patient remains in the target for the Hold Time, the system turns the target to gray and moves to the next target. The patient moves between the center target and each surrounding target in a random order.

Display

Display	Description
	• The current target flashes green when the patient is on-target and flashes yellow when they are off-target. • A count-up timer displays the total test time. • The targets are selecting in a random order. • The patient must return to the center target after each outer target. • A Skip Target button if the patient cannot reach the current target. ***Note:*** *You cannot skip the center target because the report shows how well the patient moved from the center to an outer target.*

Report

Report	Description
	• The target locations. • A tracing of the patient's COP during the test. • The **Score** (ratio between the distance the patient moved and a straight line. See Limits of Stability Score). • The Normative value (set with the File, Preferences command). • The Difference between the patient's Score and the Normative value. • The **Time** (minutes:seconds) required for the patient to complete each target.

Options

Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set

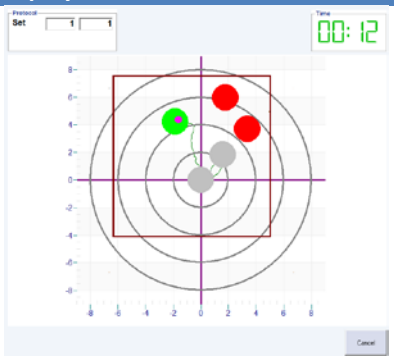
Settings

Display	Parameter	Definition
	**Level**	The distance (degrees) to the farthest target.
	Hold Time	The time (seconds) the patient must remain on each target before progressing to the next target.

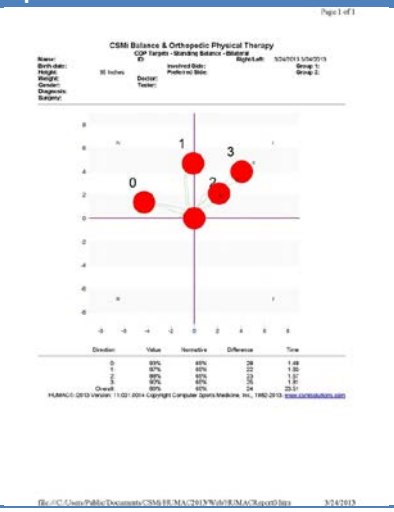
Targets (Force Plate Mode or Tilt Mode)

Place targets at specific locations which the patient must reach. After reaching each target, the patient must return to a neutral position.

Display

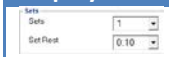
Display	Description
	• Click on a blank area to add a target. Patients will be required to progress through the targets in the order they are added to the screen. ***Note:*** *The patient's Range of Motion is displayed as a red boarder. Targets should be placed within this area.* • Click on an existing target to remove it from the screen. • After all targets are placed, click Go to begin the test. The targets cannot be changed once the test begins. • The current target flashes green when the patient is on-target and flashes yellow when they are off-target. • A count-up timer displays the total test time. • The targets are selecting in the order they are placed on the screen by the therapist. • The patient must return to the center after each target is reached.

Report

Report	Description
	• A plot of the targets and a tracing of the patient's COP during the test. • The targets are numbered in the order they were selected during the test. • The **Score** (percent of time) they were on-target. • The **Normative** value (set will the File, Preferences command). • The **Difference** between the Patent's **Score** and the Normative value. • The **Time** (minutes:seconds) to reach each target.

Options

Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set

Settings

Display	Parameter	Definition
	**Hold Time**	Time in seconds the patient should remain on the target. ***Note:*** *The HUMAC counts-down the Hold Time so the patient knows when they should move to the next target.*

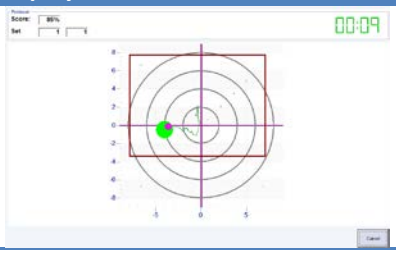
Range of Motion

Display	Parameter	Definition
	**Set AZ**	Set the patient's neutral standing position. Ask the patient to stand so they feel balanced Right/Left and Anterior/Posterior
	Start/Stop	Measure the patient's maximum R/L and A/P range. 1. Have the patient stand in a neutral position. 2. Click the start button. 3. Have the patient lean R/L and A/P. 4. Click the Stop button.

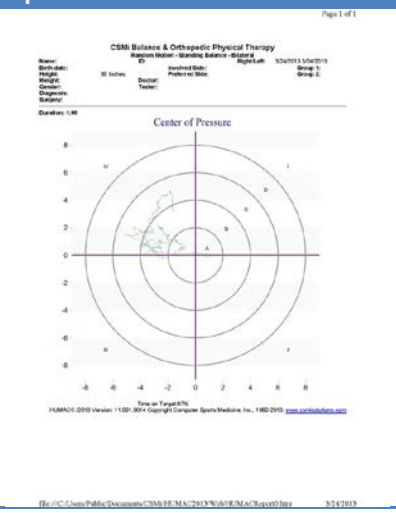
Random Motion (Force Plate Mode or Tilt Mode)

Provide a randomly moving target for the patient to follow.

Display

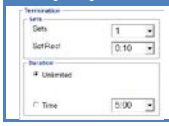
Display	Description
	• Provide a randomly moving target for the patient to follow. • Their score is the percent of time they were on the target. • If a Time is specified, the Timer counts-down, otherwise it counts up. • A red box indicates the patient's Range of Motion. The target moves randomly within this space.

Report

Report	Description
	• Display a tracing of the patient's movement during the exercise. • The Score is the percent of time they were on-target.

Options

Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set
	Time	The duration (minutes:seconds) of each set.

Settings

Display	Parameter	Definition
	**Speed**	The speed the target moves around the screen.

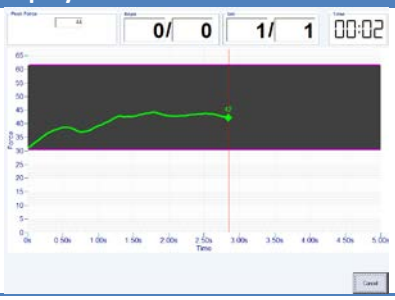
Range of Motion

Display	Parameter	Definition
	**Set AZ**	Set the patient's neutral standing position. Ask the patient to stand so they feel balanced Right/Left and Anterior/Posterior
	Start/Stop	Measure the patient's maximum R/L and A/P range. 5. Have the patient stand in a neutral position. 6. Click the start button. 7. Have the patient lean R/L and A/P. 8. Click the Stop button.

Force vs. Time (Force Plate Mode)

Force vs. Time plot used to measure a patient's single leg isometric weight bearing capabilities. Test Results display curves of the patient's force vs. time.

Display

Display	Description
	• The real-time force vs. time plots. • A cursor (dot) showing the patient's current force (Pounds or KG). • The cursor is green if the patient is within the Display Target range and red if they are outside the range. • The Peak Force during the test. • The current Rep and Number of Reps. • The current Set and Number of Sets. • A count-up timer showing the total test time.

In Target Range	Out Of Target Range

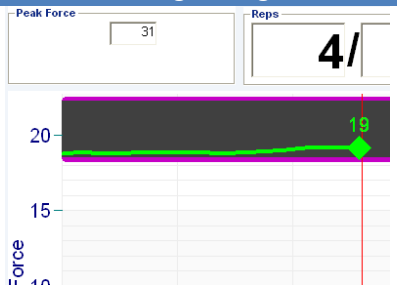
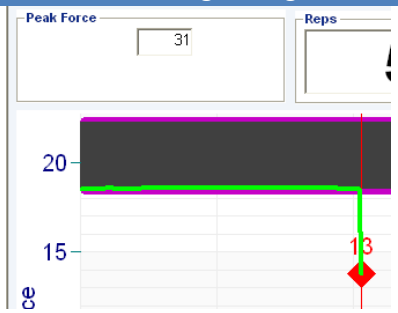
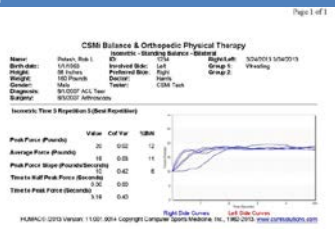

	

Figure 4 Force in Target	**Figure 5 Force Out of Target**

Report

Report	Description
	• Display the patient's Force vs. Time plots. • The Peak Force, Average Force, Peak Force Slope, Time to Half Peak Force and Time to Peak Force.

Options

Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set
	Reps	The number of repetitions to perform.

Settings

Display	Parameter	Definition
	**Hold Time**	Time (seconds) the patient should exert force on the platform for each repetition
	Relax Time	Time (seconds) at the end of each repetition
	Force Threshold	Minimum force the patient must meet for the Hold Time to begin
	Display Targets	Display minimum/maximum force targets for the patient to achieve. ***Note:*** *You can move the force targets by clicking and dragging them with the mouse.*
	Freeze Display	Stop the **Hold Time** counter if the patient is not within the **Targets**.

Force Limits

Note*: If* ***Display Targets*** *is not selected, Force Limits are not used.*

Display	Parameter	Definition
	**Delete**	Clear the force limits.
	Scale	The red-marker indicates the current force on the balance platform. The green band indicates the upper and lower force limits. To have the patient load one leg at 50 to 60% of their body weight, set the Lower to 50% and the Upper to 60% and have the patient step on to the platform to measure their body weight.
	Upper %	The percent of the maximum force used for the Upper Display Target. For example if you were exercising the patient involved side and wanted them to limit their force to 50% of their body weight you would have them stand on the platform to record the weight, set the **Upper%** to 50% and enable **Display Targets** and **Freeze Display if Outside Target**.
	Lower%	The percent of the maximum force used for the Lower Display Target. For example if you were exercising the patient involved side and wanted them to achieve a minimum of 25% of their body weight you would have them stand on the platform to record the weight, set the **Lower%** to 25% and enable **Display Targets** and **Freeze Display if Outside Target**.

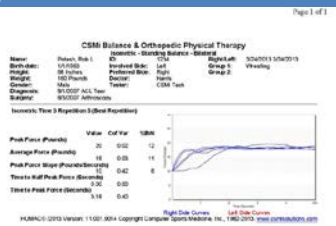
Scale (Force Plate Mode)

Show the patient's force on the platform using a scale display.

Display

Display	Description
	• A real-time pointer of the Force. • A lazy arm showing the Peak Force for the current repetition. • A Yellow band indicating the Forces below the Lower Target. • A Green band indicating Forces in the Target range. • A Red band indicating the Forces below the Lower Target. • The pointer color indicates if the force is Below, In, or Above the Target Range. • The current Rep and Number of Reps. • The current Set and Number of Sets. • A count-up timer showing the total test time.

Report

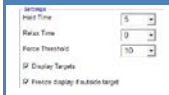
Report	Description
	• Display the patient's Force vs. Time plots. • The Peak Force, Average Force, Peak Force Slope, Time to Half Peak Force and Time to Peak Force.

Options

Termination

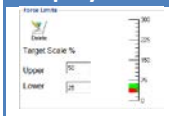
Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set
	Reps	The number of repetitions to perform.

Settings

Display	Parameter	Definition
	**Hold Time**	Time (seconds) the patient should exert force on the platform for each repetition
	Relax Time	Time (seconds) at the end of each repetition
	Force Threshold	Minimum force the patient must meet for the Hold Time to begin
	Display Targets	Display minimum/maximum force targets for the patient to achieve. ***Note:*** *You can move the force targets by clicking and dragging them with the mouse.*
	Freeze Display	Stop the **Hold Time** counter if the patient is not within the **Targets**.

Force Limits

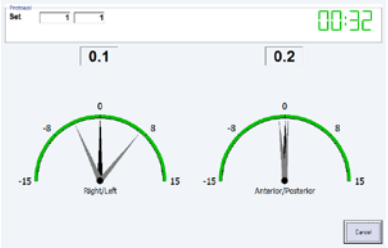
Note*: If* ***Display Targets*** *is not selected, Force Limits are not used.*

Display	Parameter	Definition
	**Delete**	Clear the force limits.
	Scale	The red-marker indicates the current force on the balance platform. The green band indicates the upper and lower force limits. To have the patient load one leg at 50 to 60% of their body weight, set the Lower to 50% and the Upper to 60% and have the patient step on to the platform to measure their body weight.
	Upper %	The percent of the maximum force used for the Upper Display Target. For example if you were exercising the patient involved side and wanted them to limit their force to 50% of their body weight you would have them stand on the platform to record the weight, set the **Upper%** to 50% and enable **Display Targets** and **Freeze Display if Outside Target**.
	Lower%	The percent of the maximum force used for the Lower Display Target. For example if you were exercising the patient involved side and wanted them to achieve a minimum of 25% of their body weight you would have them stand on the platform to record the weight, set the **Lower%** to 25% and enable **Display Targets** and **Freeze Display if Outside Target**.

Tilt (Force Plate Mode or Tilt Mode)

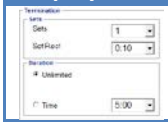
Shows the platform tilt in the Right/Left and Anterior/Posterior planes.

Display

Display	Description
	• Real-time pointers of the Tilt. • Lazy arms showing the maximum tilt in each direction. • A count-up timer showing the total test time.

Options

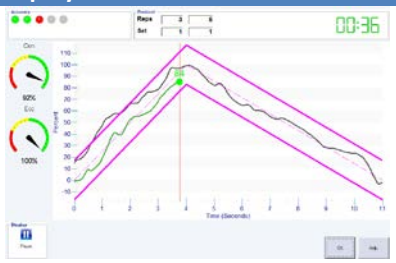
Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set
	Time	The duration (minutes:seconds) of each set.

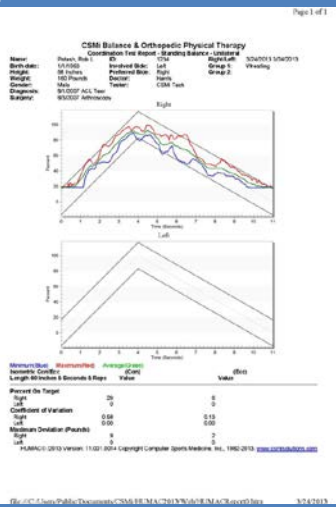
Roadway (Force Plate Mode or Tilt Mode)

Roadway can be used to measure a patient's ability to weight shift ((Force Plate Mode or Tilt Mode)) or load the involved limb ((Force Plate Mode). Test results report the accuracy of the patient's ability to weight shift or load their limb.

Display

Display	Description
	• The goal is for the patient to keep the round cursor between the roadway boundaries. (on-target). • In COP mode, the ball position corresponds to the patient's COP in the R/L or A/P plane. The Y-Axis displays the percent of the patient's total ROM. • In Force mode, the ball position corresponds to the patient's force production. The Y-Axis displays the percent of the patient's target force. • A green ball color indicates the patient is on-target, a red ball color indicates they are not on-target. • The Score dials indicate the percent of time the patient was on-target during the Concentric and Eccentric phases of the exercise. • The display shows the target in Magenta, the current repetition in yellow and the previous 9 repetitions in gray. • Pause/Continue buttons to freeze, un-freeze the display. This allows you to instruct the patient if they have questions on the display. • The Accuracy area shows the number of repetitions where the patient was within (green light) or below (red light) the target accuracy set in the Protocol for both the Concentric and Eccentric contraction. If the patient has three repetitions where either the Concentric or Eccentric score is below the Accuracy setting the display is halted.

Report

Report	Description
	• Display the patient's COP or Position vs. Time overlaide on the roadway. • The Peak Force, Average Force, Peak Force Slope, Time to Half Peak Force and Time to Peak Force.

Options

Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set
	Reps	The number of repetitions to perform.

Mode and Action

Display	Parameter	Definition
	**COP**	Display feedback based on the patient's Center of Pressure.
	>	Exercise the Patient in the Right/Left plane.
	/	Exercise the Patient in the Anterior/Posterior plane.
	Force	Display feedback based on the patient's Force on the platform.

Settings

Display	Parameter	Definition
	**Profile**	The Roadway Pattern. ***Note:*** *You can customize the patterns with the Utilities, Interactive Feedback Editor command.*
	Level	The width of the Roadway.
	Accuracy	The percent on-target the Con and Ecc phases of a repetition must be to count as a "good rep". ***Note:*** *Set this value to 0 if you do not want the HUMAC to track accuracy.*

Range of Motion

Display	Parameter	Definition
	**Set AZ**	Set the patient's neutral standing position. Ask the patient to stand so they feel balanced Right/Left and Anterior/Posterior
	Start/Stop	Measure the patient's maximum R/L and A/P range. 1. Have the patient stand in a neutral position. 2. Click the start button. 3. Have the patient lean R/L and A/P. 4. Click the Stop button.

Force Limits

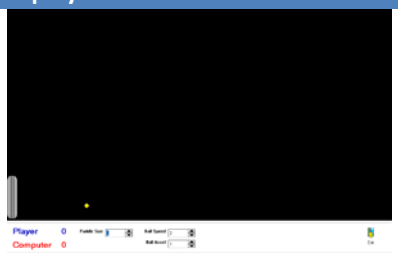
***Note**: If **Display Targets** is not selected, Force Limits are not used.*

Display	Parameter	Definition
	**Delete**	Clear the force limits.
	Scale	The red-marker indicates the current force on the balance platform. The green band indicates the upper and lower force limits. For example, to have the patient load one leg at 50 to 60% of their body weight, set the **Lower** to 50% and the **Upper** to 60% and the patient step on to the platform to measure their body weight.
	Upper %	The percent of the maximum force used for the Upper Display Target. For example if you were exercising the patient involved side and wanted them to limit their force to 50% of their body weight you would have them stand on the platform to record the weight, set the **Upper%** to 50% and enable **Display Targets** and **Freeze Display if Outside Target**.
	Lower%	The percent of the maximum force used for the Lower Display Target. For example if you were exercising the patient involved side and wanted them to achieve a minimum of 25% of their body weight you would have them stand on the platform to record the weight, set the **Lower%** to 25% and enable **Display Targets** and **Freeze Display if Outside Target**.

Pong (Force Plate Mode or Tilt Mode)

Pong has the patient play a tennis-like game against the computer.

Display

Display	Description
	• The tennis-like display with Player and Computer paddles. • The Player and Computer score. • Controls to adjust the Paddle Size, Ball Speed and Ball Acceleration.

Report

Reports are not available for the games.

Options

Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set
	Nbr Balls	The number of balls to play.

Mode and Action

Display	Parameter	Definition
	**COP**	Display feedback based on the patient's Center of Pressure.
	>	Exercise the Patient in the Right/Left plane.
	/	Exercise the Patient in the Anterior/Posterior plane.
	Force	Display feedback based on the patient's Force on the platform. (Force Plate Mode)

Settings

Display	Parameter	Definition
	**Ball Speed**	Ball Speed from 1 (Slowest) to 25 (Fastest).
	Ball Accel	Ball Acceleration (change in speed) after each paddle strike from 0 (No Acceleration) to 10 (Maximum Acceleration).
	Ball Size	Ball Size from 1 (Smallest) to 3 (Biggest).
	Ball Rest	Rest time (seconds) before each Ball launch.
	Computer Skill	Computer Skill playing against the patient from 0 (Beginner) to 100 (Expert).
	Paddle Size	The patient's paddle size from 1 (Smallest) to 10 (Biggest).

Range of Motion

Display	Parameter	Definition
	**Set AZ**	Set the patient's neutral standing position. Ask the patient to stand so they feel balanced Right/Left and Anterior/Posterior
	Start/Stop	Measure the patient's maximum R/L and A/P range. 5. Have the patient stand in a neutral position. 6. Click the start button. 7. Have the patient lean R/L and A/P. 8. Click the Stop button.

Force Limits (Force Plate Mode)

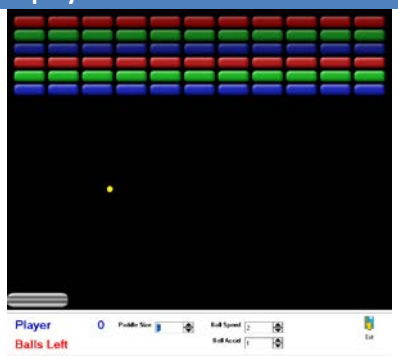
***Note**: If **Display Targets** is not selected, Force Limits are not used.*

Display	Parameter	Definition
	**Delete**	Clear the force limits.
	Scale	The red-marker indicates the current force on the balance platform. The green band indicates the upper and lower force limits. For example, to have the patient load one leg at 50 to 60% of their body weight, set the **Lower** to 50% and the **Upper** to 60% and the patient step on to the platform to measure their body weight.
	Upper %	The percent of the maximum force used for the Upper Display Target. For example if you were exercising the patient involved side and wanted them to limit their force to 50% of their body weight you would have them stand on the platform to record the weight, set the **Upper%** to 50% and enable **Display Targets** and **Freeze Display if Outside Target**.
	Lower%	The percent of the maximum force used for the Lower Display Target. For example if you were exercising the patient involved side and wanted them to achieve a minimum of 25% of their body weight you would have them stand on the platform to record the weight, set the **Lower%** to 25% and enable **Display Targets** and **Freeze Display if Outside Target**.

Breakout (Force Plate Mode or Tilt Mode)

Breakout has the patient move a paddle to knock blocks out of a wall.

Display

Display	Description
	• The breakout display with the Player paddle. • The Player Score (blocks destroyed). • The number of Balls left. • Controls to adjust the Paddle Size, Ball Speed and Ball Acceleration.

Report

Reports are not available for the games.

Options

Termination

Display	Parameter	Definition
	**Sets**	Number of sets to perform
	Set Rest	Rest period (seconds) at the end of each set
	Nbr Balls	The number of balls to play.

Mode and Action

Display	Parameter	Definition
	**COP**	Display feedback based on the patient's Center of Pressure.
	>	Exercise the Patient in the Right/Left plane.
	/	Exercise the Patient in the Anterior/Posterior plane.
	Force	Display feedback based on the patient's Force on the platform. (Force Plate Mode)

Settings

Display	Parameter	Definition
	**Ball Speed**	Ball Speed from 1 (Slowest) to 25 (Fastest).
	Ball Accel	Ball Acceleration (change in speed) after each paddle strike from 0 (No Acceleration) to 10 (Maximum Acceleration).
	Ball Size	Ball Size from 1 (Smallest) to 3 (Biggest).
	Ball Rest	Rest time (seconds) before each Ball launch.
	Computer Skill	Computer Skill playing against the patient from 0 (Beginner) to 100 (Expert).
	Paddle Size	The patient's paddle size from 1 (Smallest) to 10 (Biggest).

Range of Motion

Display	Parameter	Definition
	**Set AZ**	Set the patient's neutral standing position. Ask the patient to stand so they feel balanced Right/Left and Anterior/Posterior
	Start/Stop	Measure the patient's maximum R/L and A/P range. 9. Have the patient stand in a neutral position. 10. Click the start button. 11. Have the patient lean R/L and A/P. 12. Click the Stop button.

Force Limits (Force Plate Mode)

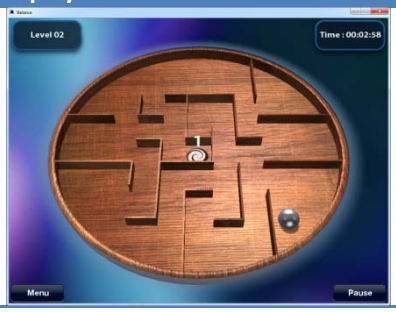
***Note**: If **Display Targets** is not selected, Force Limits are not used.*

Display	Parameter	Definition
	**Delete**	Clear the force limits.
	Scale	The red-marker indicates the current force on the balance platform. The green band indicates the upper and lower force limits. For example, to have the patient load one leg at 50 to 60% of their body weight, set the **Lower** to 50% and the **Upper** to 60% and the patient step on to the platform to measure their body weight.
	Upper %	The percent of the maximum force used for the Upper Display Target. For example if you were exercising the patient involved side and wanted them to limit their force to 50% of their body weight you would have them stand on the platform to record the weight, set the **Upper%** to 50% and enable **Display Targets** and **Freeze Display if Outside Target**.
	Lower%	The percent of the maximum force used for the Lower Display Target. For example if you were exercising the patient involved side and wanted them to achieve a minimum of 25% of their body weight you would have them stand on the platform to record the weight, set the **Lower%** to 25% and enable **Display Targets** and **Freeze Display if Outside Target**.

Balance Board (Force Plate Mode or Tilt Mode)

Two-dimensional balance game where player must tilt the board (by leaning R/L, A/P) to move the ball through a maze and into the target hole. 12 levels of increasing difficulty are available.

Display

Display	Description
	• The Balance Board Display. • A count-up timer of the total time played. • The current level. • A Menu button.

Report

Reports are not available for the games.

Options

Menu

Display	Description
	• Level: Select the Level to play and begin the game. • Play: Display the Levels. • Player: Select the player. • Scores: View the current player's scores. • Help: Display Help System. • Quit: Return to the Dashboard.

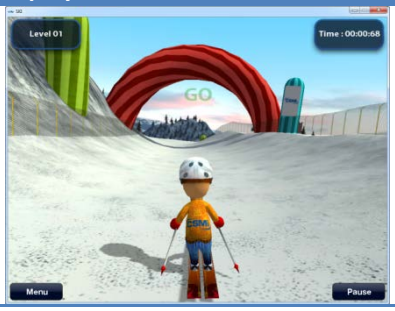
Range of Motion

Display	Parameter	Definition
	**Set AZ**	Set the patient's neutral standing position. Ask the patient to stand so they feel balanced Right/Left and Anterior/Posterior
	Start/Stop	Measure the patient's maximum R/L and A/P range. 1. Have the patient stand in a neutral position. 2. Click the start button. 3. Have the patient lean R/L and A/P. 4. Click the Stop button.

Skier (Force Plate Mode or Tilt Mode)

Two-dimensional ski-race game where patient must ski down a course. The patient's Right/Left tilt controls the skier's Right/Left position. The patients Anterior/Posterior tilt controls the skier's speed. 12 levels of increasing difficulty are available.

Display

Display	Description
	• The Skier Display. • The patient leans Right/Left to steer the skier. • The patient leans Anterior/Posterior to increase/decrease the skier's speed. • A count-up timer of the total time played. • The current level. • A Menu button.

Report

Reports are not available for the games.

Options

Menu

Display	Description
	• Level: Select the Level to play and begin the game. • Play: Display the Levels. • Player: Select the player. • Scores: View the current player's scores. • Help: Display Help System. • Quit: Return to the Dashboard.

Range of Motion

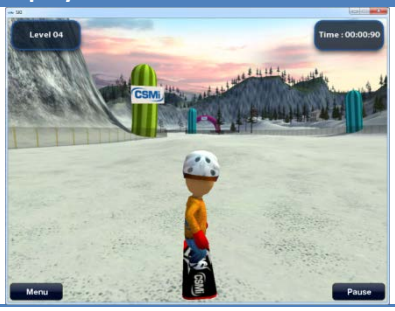
Display	Parameter	Definition
	**Set AZ**	Set the patient's neutral standing position. Ask the patient to stand so they feel balanced Right/Left and Anterior/Posterior
	Start/Stop	Measure the patient's maximum R/L and A/P range. 1. Have the patient stand in a neutral position. 2. Click the start button. 3. Have the patient lean R/L and A/P. 4. Click the Stop button.

Snowboarder (Force Plate Mode or Tilt Mode)

Two-dimensional snowboard-race game where patient must ski down a course. The patient's Anterior/Posterior tilt controls the snowboarder's Right/Left position. The patient's Right/Left tilt controls the skier's speed. 12 levels of increasing difficulty are available.

Note: *The balance platform should be oriented so the player's front foot is toward the display and the USB cable exits the board in front of the player.*

Display

Display	Description
	• The Snowboarder Display. • The patient leans Right/Left to steer the snowboarder. • The patient leans Anterior/Posterior to increase/decrease the snowboarder's speed. • A count-up timer of the total time played. • The current level. • A Menu button.

Report

Reports are not available for the games.

Options

Menu

Display	Description
	• Level: Select the Level to play and begin the game. • Play: Display the Levels. • Player: Select the player. • Scores: View the current player's scores. • Help: Display Help System. • Quit: Return to the Dashboard.

Range of Motion

Display	Parameter	Definition
	**Set AZ**	Set the patient's neutral standing position. Ask the patient to stand so they feel balanced Right/Left and Anterior/Posterior
	Start/Stop	Measure the patient's maximum R/L and A/P range. 1. Have the patient stand in a neutral position. 2. Click the start button. 3. Have the patient lean R/L and A/P. 4. Click the Stop button.

Mode and Action

Display	Parameter	Definition
	**Mode**	Select if the Snowboarder is **Regular** (left foot forward) or **Goofy** (right foot forward.

Pilot (Force Plate Mode or Tilt Mode)

Three-dimensional flight-race game where patient must fly through targets. The patient's Right/Left tilt controls the plane's Right/Left position. The patient's Anterior/Posterior tilt controls the plane's Climb/Descend speed. 12 levels of increasing difficulty are available.

Display

Display	Description
	• The Pilot Display. • The patient leans Right/Left to turn the plane Right/Left. • The patient leans Anterior/Posterior to have the plane Climb/Descend. • A count-up timer of the total time played. • The current level. • A Menu button.

Report

Reports are not available for the games.

Options

Menu

Display	Description
	• Level: Select the Level to play and begin the game. • Play: Display the Levels. • Player: Select the player. • Scores: View the current player's scores. • Help: Display Help System. • Quit: Return to the Dashboard.

Range of Motion

Display	Parameter	Definition
	**Set AZ**	Set the patient's neutral standing position. Ask the patient to stand so they feel balanced Right/Left and Anterior/Posterior
	Start/Stop	Measure the patient's maximum R/L and A/P range. 1. Have the patient stand in a neutral position. 2. Click the start button. 3. Have the patient lean R/L and A/P. 4. Click the Stop button.

The Main HUMAC Screen

The Main HUMAC Screen contains a number of components:

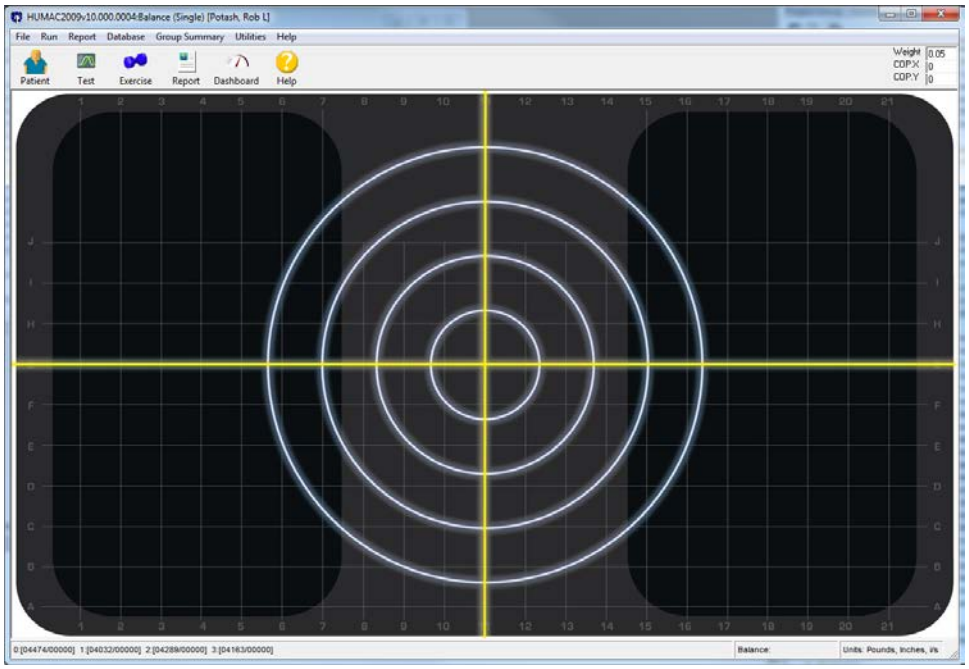


Figure 6 Main HUMAC Form

The **Title Bar** located at the top of the screen contains the Application Name and Version (HUMAC2013 Version 11.001.0016), the machine (Balance) and the current patient (Potash, Robert).

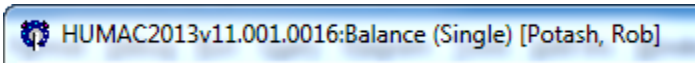


Figure 7 Title Bar

Just below the title bar is the **Menu Bar**. You can access all of the HUMAC functions from the menu bar. Each menu item has an underlined character. Holding the **Alt** key while pressing the underlined character selects the menu item. For example **Alt-F** selects the file menu.

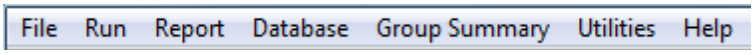


Figure 8 Menu Bar

The **Button Bar** contains shortcuts to the most commonly used HUMAC functions. When the HUMAC program begins, only the **Patient**, **Dashboard**, and **Help** options are available. Selecting a patient enables the **Test**, **Exercise**, and **Report** options.

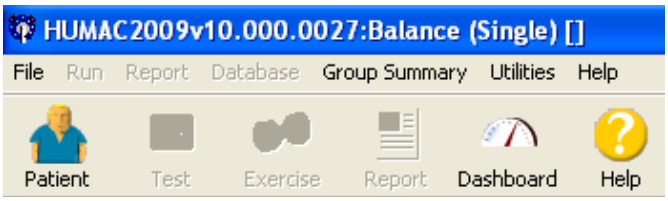


Figure 9 Button Bar No Patient Selected

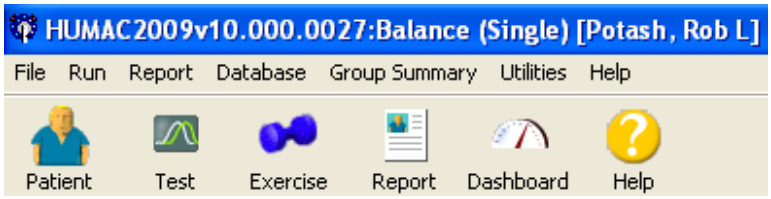


Figure 10 Button Bar Patient Selected

To the right of the button bar is a real-time display of the Balance data: **Weight**, **Tilt Angle**, and **Tilt Direction**.

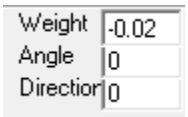


Figure 11 Real-Time Display

The bottom of the screen contains the **Status Bar** which displays the current test pattern and system units. The system units are displayed for the Force, Position, and Velocity measures.

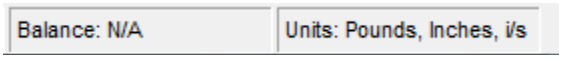


Figure 12 Status Bar

Starting HUMAC Program

The HUMAC Software is compatible with all of CSMi's testing and measurement devices such as the HUMAC NORM Extremity System, CYBEX NORM Extremity System, HUMAC 360 Exercise Guidance, and HUMAC Balance to name a few. The first time the HUMAC Software is launched after installation the program will default to the HUMAC360 Software. Following is the procedure to set the software to the HUMAC Balance System.

Steps

1. From the Menu Bar **File** option, select **Preferences**.
2. From the **General** tab, **Machine** area, select **Balance (Single)**.

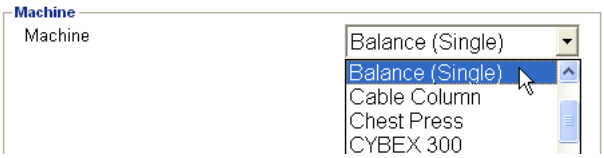


Figure 13 Select Machine Type

3. From the **Interface** area select **USB/COMM (Balance)**.

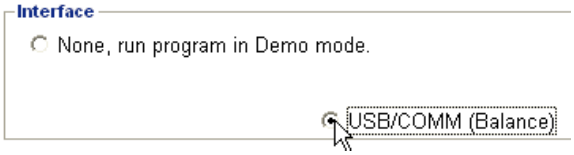


Figure 14 Select USB Port

4. Click the **OK** button to save your changes. The HUMAC will default to these settings the next time the program is started.
5. If the HUMAC Balance drivers are installed and the HUMAC Balance Board is plugged into the USB Port, the following dialog box is displayed.

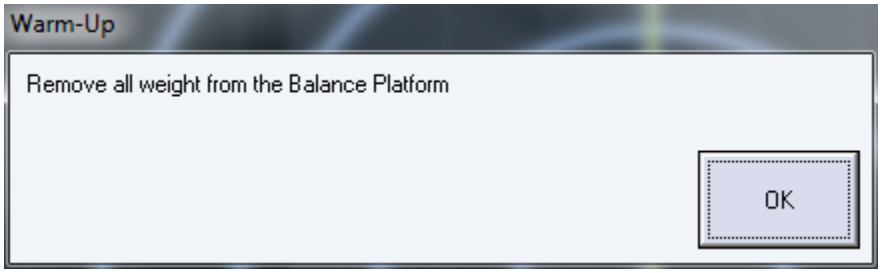


Figure 15 Warm-up Screen

6. Insure the platform is sitting on a flat surface and remove all weight from the Platform (no one is standing on the Platform).
7. Click the **OK** button to read the zero weight. The HUMAC will return to the Main Menu.

Testing a Patient

The process to test a patient is:

1. Select a Patient.
2. Select a Test.
3. Select a Protocol.
4. Run the Test.
5. Print a Report.

The following example demonstrates running and printing the results of a CTSIB test.

Note:

- When using a Balance System any barrier (shoes, socks) between the patient and the HUMAC Balance Board surface may affect their performance. In some situations you may want to remove all barriers. It depends on if you want to measure absolute vs. real-world performance. The normative data used in the HUMAC Balance CTSIB Report assumes no shoes with socks.
- Whichever condition testing you use is your decision. However if you plan to do follow-up comparisons it is important to keep all variables the same from test to test.

Patient Selection

The Select a Patient screen allows you to add, edit, or delete patients from the database.

Steps

1. From the Main Screen, click the **Patient** button.
2. The HUMAC will display the **Patient Selection Screen**.
3. For this example we will add a new patient. Click the **New** button.

Screen

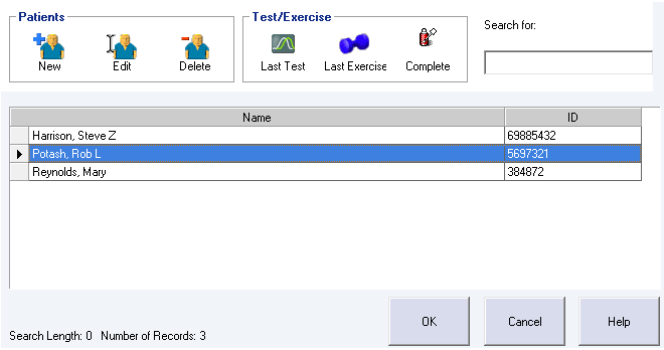


Figure 16 Patient Selection

Actions

Action	Definition
OK	Select the highlighted patient. You can also double-click a patient's name to select them.
Cancel	Cancel the patient selection and return to the main HUMAC screen.
Search	As you begin typing the patient's last name, the HUMAC automatically displays patients matching the search criteria.
New	Add a new patient to the database.
Edit	Edit the highlighted patient's background information (Name, Height, Weight, etc.).
Delete	Delete the highlighted patient from the HUMAC Database. ***IMPORTANT:*** *When you delete a patient from the HUMAC Database, all of their test and exercise data is deleted from the system. There is no way to recover deleted data.*
Last Test	Repeat the last test run on the patient. The HUMAC recalls the most recent test run on the patient and begins a new test session using the same pattern and protocol.
Last Exercise	Repeat the last exercise run on the patient. The HUMAC recalls the most recent exercise run on the patient and begins a new exercise session using the same pattern and protocol.
Complete	Complete the last test or exercise run on the patient. The HUMAC recalls the patient's previous test and goes directly to the test status screen. This is typically used if you are unable to complete the test, e.g. the patient stopped or there was a computer problem.

Adding a New Patient

Steps

1. The HUMAC will display a blank patient information screen. The patient information entered here will appear at the top of every report for the patient and can be used as filters in the Group Summary/Normative Database module. We recommend you complete as many fields as possible when adding a new patient.
2. After adding the patient information click **OK** to save new Patient information and return to the main HUMAC Screen. The patient name will then appear in the Title Bar and all of the buttons on the Button Bar including Test, Exercise, and Report will be active.

Screen

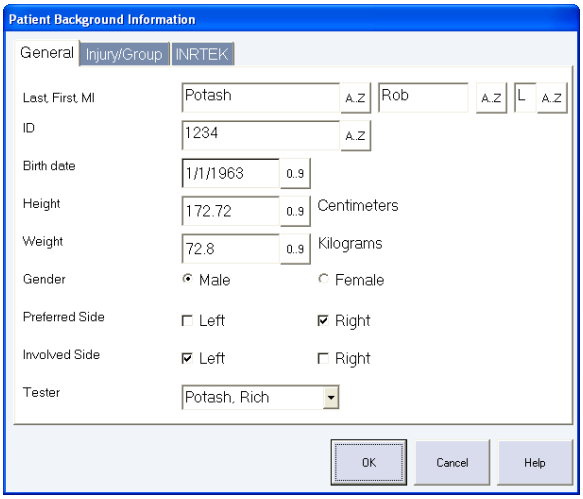


Figure 17 Patient Information - General

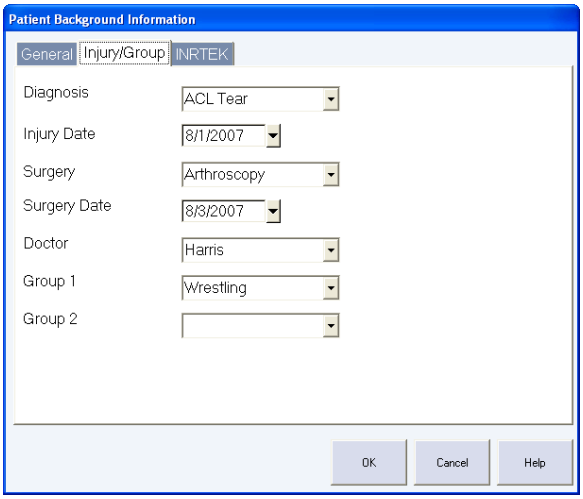


Figure 18 Patient Information – Injury/Group

Fields

Field Name	Description
Last, First, Middle	Enter Patient name. Press Tab to advance to next field
ID	Patient ID number.
Height	Enter according to the displayed units of measure. *Required field.*
Weight	Enter according to the displayed units of measure. *Required field*.
Gender	*Required field.*
Preferred Side	Patient's dominant side.
Involved Side	Injured side.
Tester	Name of perform performing the test. The pull-down list attached to this field should be edited to include the names of the clinicians using the HUMAC Balance.
Diagnosis	The pull-down list attached to this field should be edited to include the common diagnoses seen.
Injury Date	Pop-up calendar available.
Surgery	This pull-down list attached to this field should be edited to include the common surgeries seen
Doctor	The pull-down list attached to this field should be edited to include the names of the referring physicians
Group 1	Extra field to further define the patient. The pull-down list attached to this field can be edited.
Group 2	Second field to further define the patient. The pull-down list attached to this field can be edited.

Note:

- Click the Keypad buttons 

or 

to pop-up a keypad for data entry with a touch-screen monitor.
- *After a patient has been tested, use the **Edit Background** command to edit the information stored with the test.*
- *The **Patient Selection** screen lists the Patient Name and ID. By default the list is sorted by patient name. To sort by ID, click on the ID column heading.*
- Only one copy of the patient's Name, ID, Birth Date, and Sex are stored in the HUMAC database. Any changes to these fields will automatically appear on every test and exercise record for the patient.
- The Height, Weight, Preferred Side, Involved Side, Diagnosis, Injury Date, Surgery, Surgery Date, Doctor, Tester, Group1, and Group2 values are stored individually with each test and exercise session run. This allows changes to these fields to accurately reflect the patient's condition at the time of the test or exercise session. Use the **Edit Background** (Section 0) command to change the values for a test which has already been run.

Pattern Selection

Steps

1. From the HUMAC Button Bar, click **Test**.
2. The HUMAC will display the **Pattern Selection** screen.
3. The HUMAC allows tests to be run in a bi-laterally (standing on both feet) or a uni-laterally (standing on one foot).
4. Click on **Standing Balance Bilateral** row to highlight it. ***Note:*** *Most Balance Tests are performed Bi-laterally.*
5. Click **OK** advance to the Protocol Selection Screen

Screen

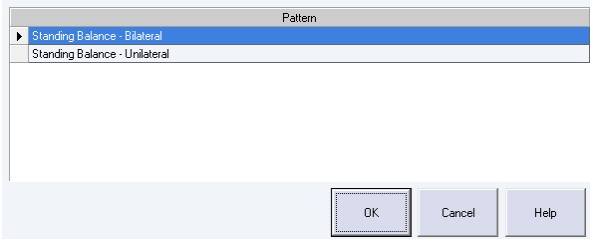


Figure 19 Pattern Selection

Actions

Field Name	Description
OK	Select the highlighted pattern. You can also double-click a pattern to select it.
Cancel	Cancel the pattern selection and return to the main HUMAC screen.

Protocol Selection

Protocols are collections of one or more sets which describe the Display, Termination, Rest Period and other test parameters. A protocol can contain up to 25 sets.

Steps

1. In the **Feedback** area, select **CTSIB**.
2. The HUMAC will display **Termination**, **Mode and Action** and **Settings** options applicable to the CTSIB test. ***Note:*** *The options for each feedback mode are described in the section titled* ***Error! Reference source not found.***.
3. The HUMAC will load the Protocol area, Select pull-down with all previous CTSIB protocols for this patient and all system-wide CTSIB protocols. For this example we will customize the protocol.
4. In the **Termination**, **Duration** area, set the **Time** to **0:30**.
5. In the **Settings** area, select **Eyes Open Firm Surface** and **Eyes Closed Firm Surface**.
6. In the **Protocol** area, **Rename** the protocol to **CTSIB – Firm – Eyes Open/Closed**. ***Note:***
    a. *The HUMAC will remember this protocol the next time you test the patient.*
    b. *Use to* ***Utilities, Protocol Editor*** *to create custom protocols which can be used with all patients.*
    c. *Use the* ***Select*** *pull-down box to select a pre-defined custom protocol.*
7. Click the **OK** button to save the Protocol and move to the **Test Status** screen.

Screen

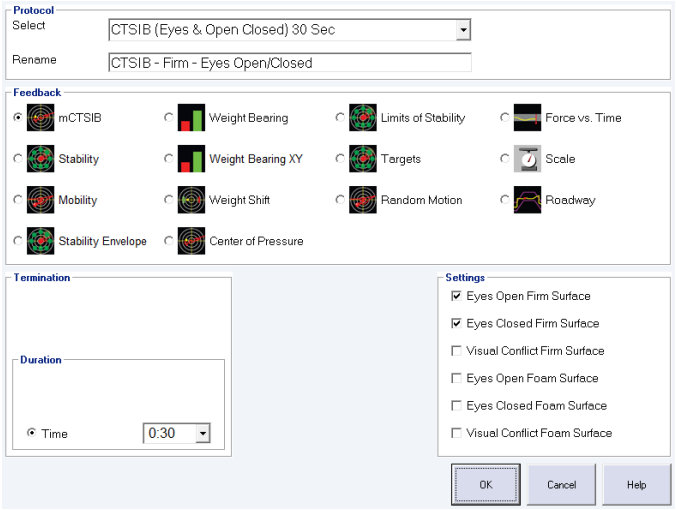


Figure 20 Protocol Selection

Actions

Field Name	Description
Select	The pull-down control displays a list of the protocols the patient has been tested with. The patient's most recent protocol at the top of the list. Following the patient's individual protocols, the HUMAC displays the system protocols. System protocols are available to all patients and are created using Utilities, Protocol Editor from the Main Screen.
Rename	A text description which is displayed in the Protocol control after the protocol is saved from this screen.
OK	Continue with the displayed protocol.
Cancel	Cancel the test/exercise session and return to the main HUMAC menu.
Termination	The number of sets and reps to be performed.
Mode and Action	The mode (Center of Pressure or Force) and the direction of the COP.
Settings	The settings for the feedback display.

Test Status

The Test Status screen displays all sets in the protocol and their status (Tested, Not Tested, Error).

Steps

1. Click the **All Sets** button to perform all of the sets in this protocol in sequential order.
2. The **Patient Setup** screen will appear.

Screen

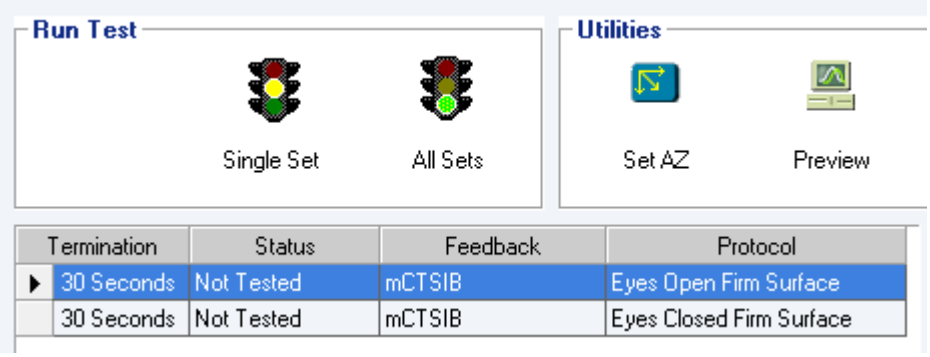


Figure 21 Test Status

Actions

Action	Definition
OK	Leave the Test Status screen and move to the Report screen. Once you leave the Test Status screen you cannot run additional sets from the protocol.
Side	Select the Side which will be tested. ***Note:*** *The side is not displayed for Bi-lateral patterns.*
Single Set	Run the currently highlighted set.
All Sets	Run all sets in the protocol starting with the selected set. Note: When you select All Sets the HUMAC deletes all data from any sets which are run. For example, if you completed all sets in a 3 set protocol, select the second set and click All Sets, the HUMAC will leave the data from the first set in-place and replace the data in the second and third set with the new data as the sets are re-run.
Set AZ	Re-set the patient's Foot Position. If you re-set the AZ you should re-run the sets.
Preview	Preview a test report. This allows you to quickly check the results of a set before leaving the Test Status screen.

Note: *If the patient stops in the middle of a set you may choose to re-run the set. When you re-run a set the HUMAC overwrites the previous data with the new data.*

Status

Status	Definition
Not Tested	The set as not been run yet.
Tested	The set was completed successfully.
Error	An error occurred while running the set, for example, the patient did not go through a full range of motion or the clinician aborted the set.

Patient Setup

The Patient Setup screen allows you to record the patient's foot position on the platform. The foot position is used by the HUMAC to compute the test results. If this setting is correct and the patient is standing in an anatomically correct position the patient COP should be centered on the Test Display screen.

Steps

1. Use the scales on the HUMAC Balance Board to record the patient's foot position.
    a. The **Angle** is read by comparing the foot angle to the angle display on the HUMAC board.
    b. The **Medial Malleolus** is read by selecting the letter row on the HUMAC board with is closest to the Medial Malleolus.
    c. The **Heel** is read by selecting the number column on the HUMAC board with is closest to the centerline of the heel.
2. Enter the **Angle**, **Medial Malleolus** and **Heel** positions.
3. Click the **OK** button to save the settings. ***Note:*** *Once these positions are recorded, the patient should not move their feet for the duration of the test.*
4. The HUMAC will display the **Anatomical Zero** screen.

Screen

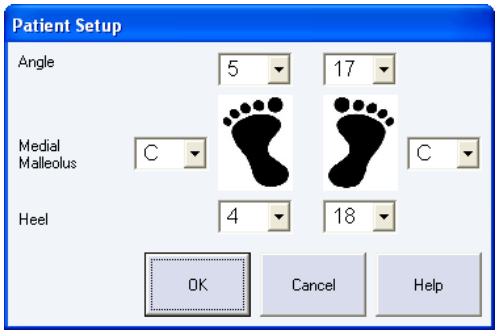


Figure 22 Patient Setup Screen

Anatomical Zero

If the patient setup values are correct and the patient is standing in a perfectly neutral position the patient COP should be centered on the Test Display screen. Many times due to body mechanics a patient is not centered even thought their foot position is recorded. For this reason there is the option to have the HUMAC Center the COP display.

Steps

1. Instruct the patient to stand in a neutral position.
2. Click the **OK** button to record this as their Anatomical Zero.
3. The HUMAC will move to the Patient Feedback screen.

Screen

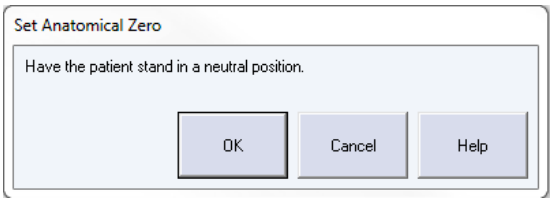


Figure 23 Set Anatomical Zero Screen

Move to COP Timer

Before tests which require the patient to start in the COP, the HUMAC displays a 5 second “Move to Center of Pressure” timer. During this time the patient can see there COP on the display but no data is collected.

Steps

1. Instruct the patient to adjust their balance so the COP marker (magenta ball) is in the center of the screen.

Display

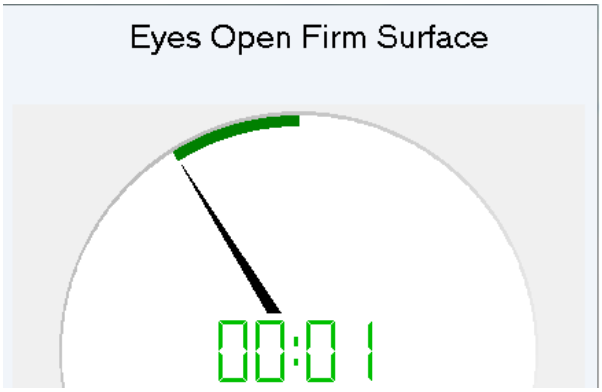


Figure 24 Move to COP Timer

Patient Feedback (CTSIB Test)

Steps

The CTSIB measures the patents ability to hold their Center of Pressure which is where the crosshairs meet on the center of the screen.

1. Instruct the patient to remain as steady as possible.
2. After the timer counts down the HUMAC will proceed to the next set. After all sets are completed the HUMAC will return to the **Test Status** screen.

Screen

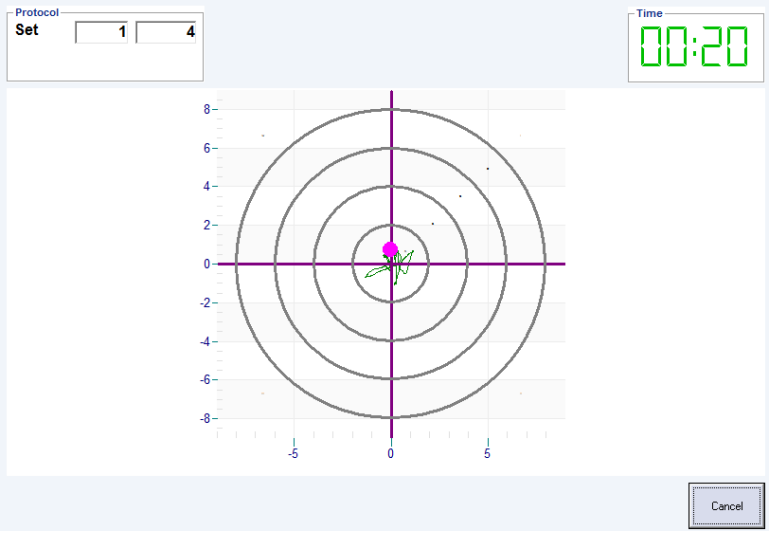


Figure 25 CTSIB Feedback Display (COP)

Test Status

At the conclusion of the test the HUMAC will return to the Status screen. Notice all of the tests under Status now read **Tested**.

Steps

1. Click the **OK** button. The HUMAC automatically stores the collected data in the database and proceeds to the **Report** screen.

Screen

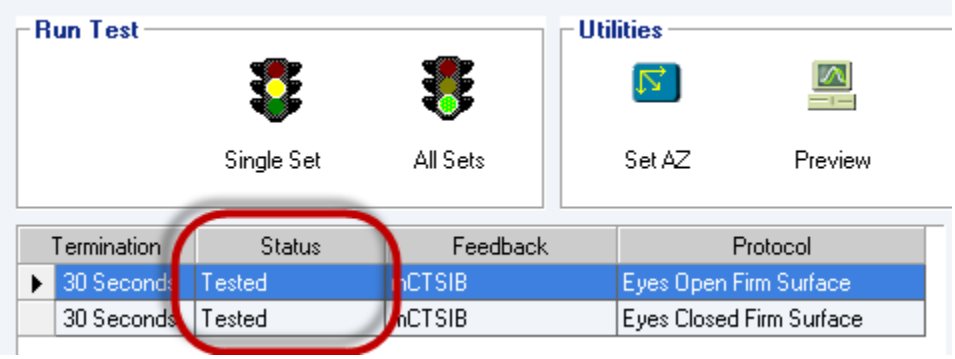


Figure 26 Status Screen - Tests Completed

REPORTS

Single Test Report

The HUMAC report screen lists all of the stored test results and report options. Results are listed in chronological order with the most recent at the top. When you select a test from the listing grid, the HUMAC automatically populates the reports types for the selected test.

Steps

1. From the Listing Grid, click the test to select it.
2. Click the Preview button to display the test report.

Screen

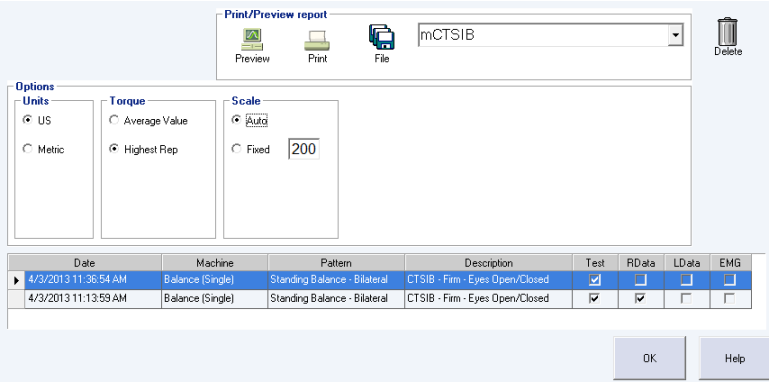


Figure 27 Reports Screen

Actions

Figure 28 Report: Actions

Status	Definition
Preview	Preview the selected report on the screen.
Print	Send the selected report to the printer.
File	Save the selected report to a disk file.
Type	Select the type of report to generate. When you select a report from the listing grid, the HUMAC populates the Type list with all reports which are available for the selected test.
Delete	Delete the selected test from the database.

Options

Figure 29 Report: Options

Options

The **Options** section allows you to change how the data is processed and reported for the selected test.

Status	Definition
Units	Display results in US or Metric Units.
Torque	Report the Average Value or Highest Rep for Torque vs. Time and Scale tests.
Scale	Auto-scale or use a fixed scale for Torque vs. Time and Scale tests.

Note: *Changes to the* ***options*** *only apply to the current report being generated and do not affect the* ***Preferences****. Use the* ***File****,* ***Preferences*** *command to set the default report options.*

Progress Report

The HUMAC Progress Report screen allows you to select two tests and print a Progress Report showing the initial values, the follow-up values and the change which occurred between the two.

Steps

1. From Reports menu, select Progress. The HUMAC will display the Progress Report screen.
2. From the Listing Grid, select the Initial test and click the Initial button.
3. From the Listing Grid, select the Follow-up test and click the Follow-Up button.
4. Click the Preview button to display the report. The HUMAC will confirm the protocols in the two tests match and if so, display the progress report.

Screen

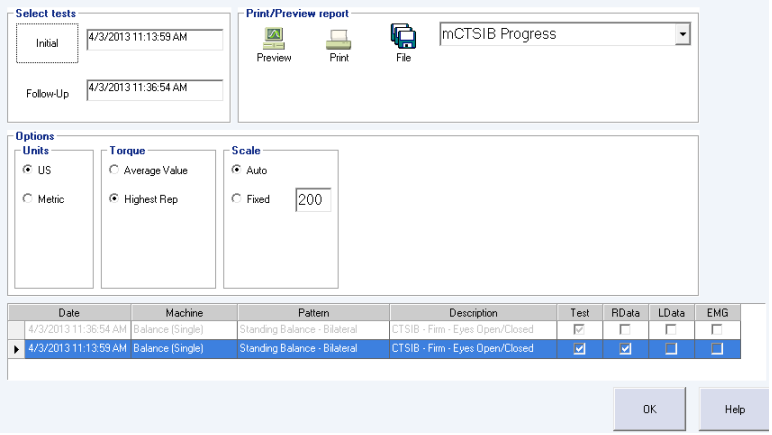


Figure 30 Progress Report Screen

Involved Side Re-Test Report

The Involved Side Re-test Report allows you to combine the results of an initial test for one side with the results of a follow-up test for the other side into a single report. This is typically used when you test both side during an initial evaluation and only re-test the involved side during a follow-up visit.

Steps

1. From Reports menu, select **Involved Re-Test**. The HUMAC will display the Re-Test Report screen.
2. From the Listing Grid, select the Right Side test and click the Right button.
3. From the Listing Grid, select the Left Side up test and click the Left button.
4. Click the Preview button to display the report. The HUMAC will confirm the protocols in the two tests match and if so, display the Re-Test report.

Screen

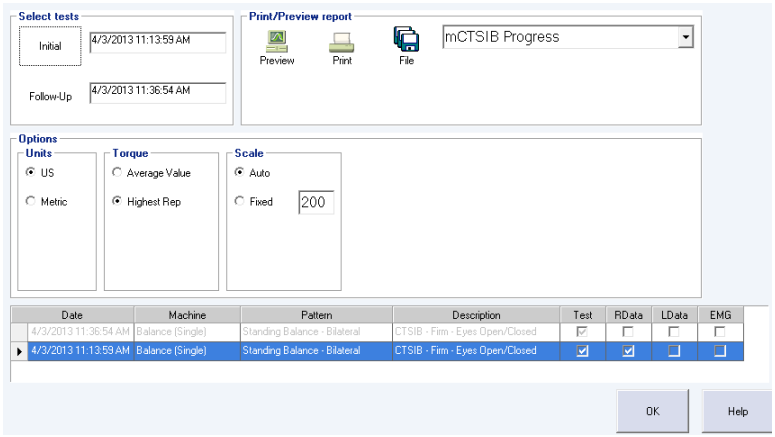


Figure 31 Re-Test Report Screen

DASHBOARD

The HUMAC Dashboard allows you to control the basic functions of the HUMAC and provide patient feedback without running a test or exercise protocol. Reports can be printed but data is not saved when using the Dashboard and the Patient's information does on appear at the top of report. ***Note:*** *The Dashboard Options are explained in detail in "Feedback Displays".*

Steps

1. From the Button Bar click the **Dashboard** button or from the **Utilities** menu, select **Dashboard**.

Screen

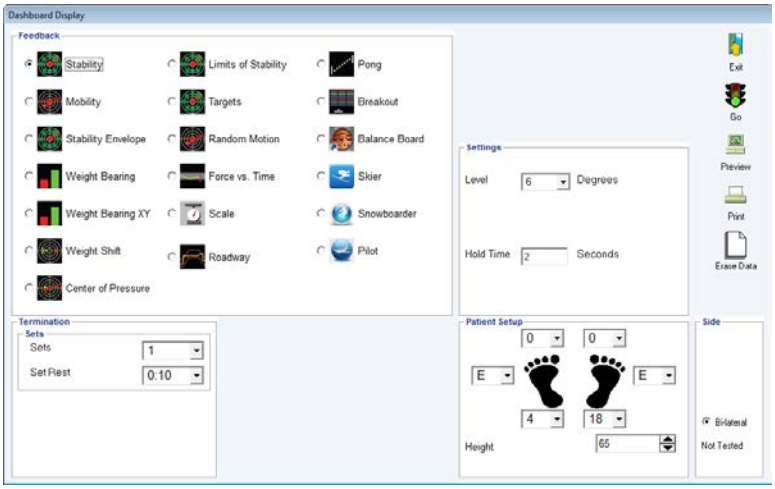


Figure 32 Dashboard Screen

Options

Status	Definition
Exit	Leave the Dashboard
Go	Start the selected Exercise
Preview	Preview a report from the recently completed exercise.
Print	Print a report from the recently completed exercise
Erase Data	Delete the data from the recently completed exercise

Side

The Side is used when printing reports. When you select a Feedback Display, the HUMAC displays Right/Left or Bi-Lateral as the side. Certain displays e.g. Force vs. Time allow Uni-lateral testing. In this case you can select whether the Right or Left side is being exercised and the data will be correctly reported.

The HUMAC displays the Status (Tested, No-Tested) indicating if there is data to be printed.

GROUP SUMMARY

The HUMAC Group Summary program computes summary data over various patient populations. Summaries are stored in a Group Summary database, allowing the clinic to build a library of summary data results. Reports can be printed for a stored group or comparing a patient to the group.

Computing a Group Summary

1. From the **Group Summary** menu, select **My Data**.

Adding a New Group Summary to the Database

Steps

1. Select the **Pattern**, e.g. Standing Balance - Bilateral.
2. Select the **Protocol**.
3. Click the **Add** button.
4. Enter the **Summary name**, e.g. CTSIB and click the OK button.
5. The HUMAC will add the new summary to the Group Summary Database.

Note: *The HUMAC has added a blank group summary record for the selected pattern and protocol. When you click the Summarize button, the HUMAC reads through the database of tests and populates the group summary record.*

Screen

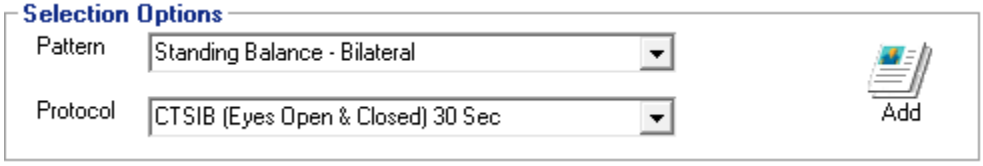


Figure 33 Group Summary: Add

Computing the Summary

Setting the Group Criteria

The Group Summary filter allows you to select which patients will be included in the summary. The following example includes patents from 25 to 40 years old when the test was performed with an ACL Tear. Only tests which were performed within 31 days of the injury will be included. You can independently specify the From and To values, e.g:

From	To	Data
Blank	**Blank**	Ignore the field
Blank	**40**	All patients <= 40 years old when the test was performed.
25	**Blank**	All patients >= 25 years old when the test was performed.
25	**40**	All patients from 25 to 40 years old when the test was performed.

Steps

1. Click the **Background** button.
2. Enter the **criteria**.
3. Click the **OK** button to save the criteria.

Screen

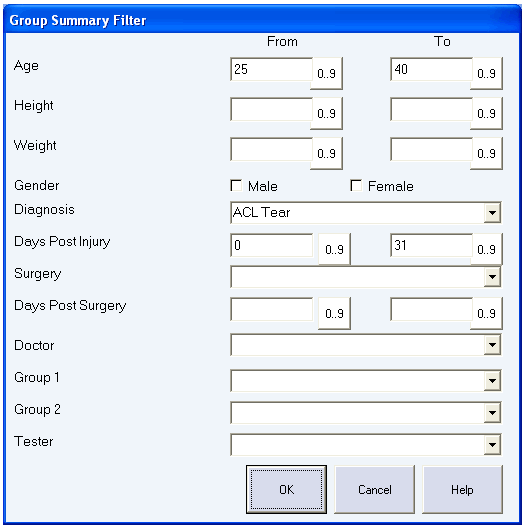


Figure 34Group Summary: Filter

Select Tests

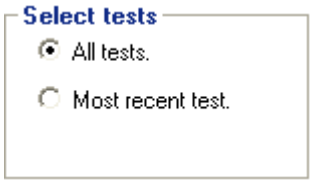


Figure 35 Group Summary: Select Tests

Options	Definition
All Testss	Include all tests for each patient in the summary.
Most Recent Test	Include the most recent test for each patient in the summary. This option prevents a patient who has been tested multiple times from skewing the results.

Side

Figure 36 Group Summary: Side

Side	Definition
Right vs. Left	Average Right side data vs. Left side data.
Dominant vs. Non-Dominant	Average Dominant side data vs. Non-Dominant side data.
Involved vs. UnInvolved	Average Involved side data vs. UnInvolved side data.

Summarizing the Data

Click the Summarize button. The HUMAC will read each test in the database, compute the measured parameters, and store them in the Summary Database.

Note:

1. *When you change the summary criteria, you must re-summarize the data to compute the results for the new group.*
2. *When you test additional patients which you want to include in the Group Summary, simply select the Stored Summary and click the **Summarize** button. The HUMAC will re-compute the summary for all tests stored in the database.*

Exporting a Summary to Microsoft Access

1. From the Group Summary database area, select the **Group Summary record** you want to Export.
2. Click the **Access** button.
3. The HUMAC will export the data computed in the Summary to the HUMAC **Results2009.MDB** file. Data from the Results database can be imported to other applications, e.g. SPSS.

Group Summary - Access Data Format

The Group Summary program stores the summarized data in the **Results2009.MDB** database file. The file is in the Access 2000 format.

Results.MDB includes a collection of tables containing the more detailed Patient Information, Dynamometer Settings, and Per-repetition values. Advanced users may want to use the Linked Table to perform advanced Queries and Data Analysis.

Tables

Table	Definition
Protocol	Table containing one row for each patient test or exercise session.
ProtocolRow	Table containing the settings for each set (row) in the Protocol.
Demographics	The patient background information for each Protocol.
Vals	The per-repetition values for each row in the ProtocolRow.

Fields

Each table include a description of its' data fields. To access the field descriptions:

1. Open the **Results2013.MDB** file with Access.
2. Single-click the **table** to select it.
3. Click the **Design** icon.
4. The **Description** column contains the field description.

Printing a Summary Report

1. In the **Group Summary database** area, select the Group Summary record you want to Preview/Print.
2. Click the **Preview** or **Print** button.

Comparing a Patient to a Group Summary

1. From the Main HUMAC menu, select the **Patient**.
2. From the **Group Summary** menu, select **My Data**.
3. In the **Group Summary Database** area, select the Group Summary record you want to compare the patient to.
4. In the **Patient** area, select the Patient session you want to compare to the Group Summary.
5. In the **Patient** area click the **Preview** or **Print** button.

Deleting a Group Summary

1. From the **Group Summary Database** area, select the Group Summary record you want to Delete.

2. Click the **Delete** button.

Note: *Deleting the Group Summary only deletes the summarized results. The original patient tests remain in the HUMAC database.*

UTILITIES

Edit Background Information

The HUMAC allows you to edit the patient background information for stored tests. This is typically used after you complete a test or exercise session and realize the patient's weight, injury, or other information was is incorrect.

Steps

1. Select the Patient who's data you want to edit.
2. On the **Database** menu, click **Edit Background**.
3. Click the **Test/Exercise record** you want to edit.
4. Click **Update** to open the patient background information form.
5. Edit the patient information and click **OK** to save your changes.

Screen

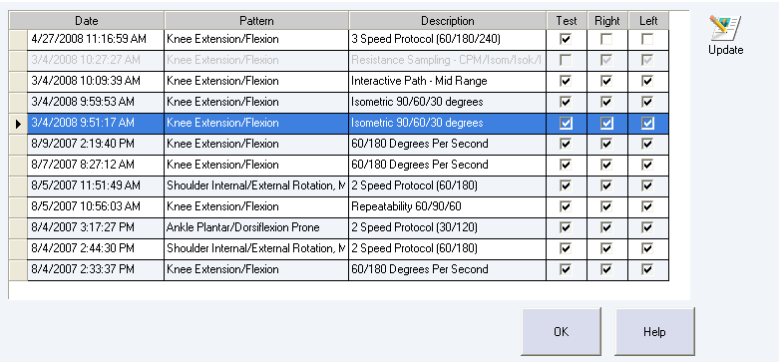


Figure 37 Edit Background Information

Deleting Stored Tests

The **Database**, **Delete Record** command allows you to delete stored test and exercise records from the database.

Steps

1. On the **Database** menu, click **Delete Record**.
2. Click the **Test/Exercise record** you want to delete.
3. Click **Delete** to delete the record.

Note

- Deleted records cannot be restored.
- Use the delete function in the patient selection form to quickly delete a patient and all their stored test and exercise sessions.

Screen

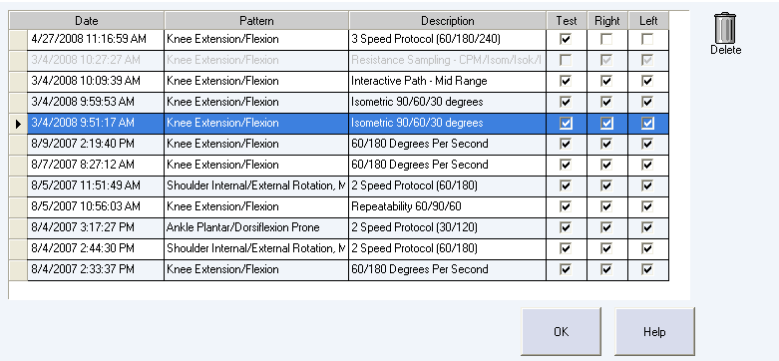


Figure 38 Delete Stored Test

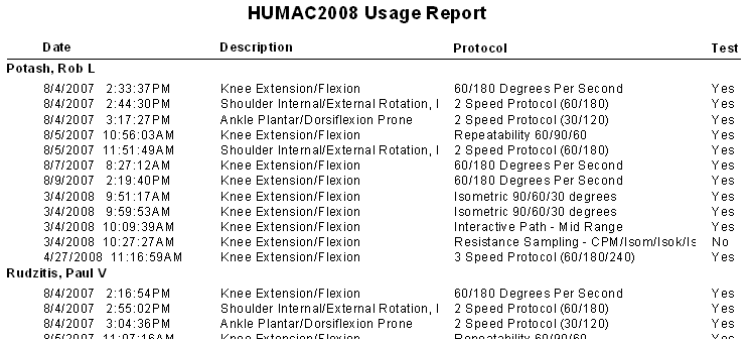
Usage Report

The Usage Report shows each protocol run on the system grouped by patient. The report is sorted first by Patient Name, then by the Date the protocol was run.

Steps

1. On the **File** menu, click **Usage Report**.

Screen



HUMAC2008 Usage Report

Date	Description	Protocol	Test
Potash, Rob L			
8/4/2007 2:33:37PM	Knee Extension/Flexion	60/180 Degrees Per Second	Yes
8/4/2007 2:44:30PM	Shoulder Internal/External Rotation, I	2 Speed Protocol (60/180)	Yes
8/4/2007 3:17:27PM	Ankle Plantar/Dorsiflexion Prone	2 Speed Protocol (30/120)	Yes
8/5/2007 10:56:03AM	Knee Extension/Flexion	Repeatability 60/90/60	Yes
8/5/2007 11:51:49AM	Shoulder Internal/External Rotation, I	2 Speed Protocol (60/180)	Yes
8/7/2007 8:27:12AM	Knee Extension/Flexion	60/180 Degrees Per Second	Yes
8/9/2007 2:19:40PM	Knee Extension/Flexion	60/180 Degrees Per Second	Yes
3/4/2008 9:51:17AM	Knee Extension/Flexion	Isometric 90/60/30 degrees	Yes
3/4/2008 9:59:53AM	Knee Extension/Flexion	Isometric 90/60/30 degrees	Yes
3/4/2008 10:09:39AM	Knee Extension/Flexion	Interactive Path - Mid Range	Yes
3/4/2008 10:27:27AM	Knee Extension/Flexion	Resistance Sampling - CPM/Isom/Isok/Is	No
4/27/2008 11:16:59AM	Knee Extension/Flexion	3 Speed Protocol (60/180/240)	Yes
Rudzitis, Paul V			
8/4/2007 2:16:54PM	Knee Extension/Flexion	60/180 Degrees Per Second	Yes
8/4/2007 2:55:02PM	Shoulder Internal/External Rotation, I	2 Speed Protocol (60/180)	Yes
8/4/2007 3:04:36PM	Ankle Plantar/Dorsiflexion Prone	2 Speed Protocol (30/120)	Yes

Figure 39 Usage Report

Backup

We suggest you perform periodic backups to assure your data can be restored in the event of a computer failure. You can do a backup via an **External File Copy** or with the **HUMAC Backup Command**.

Steps

2. On the **File** menu, click **Backup**.
3. Click **Set Backup Destination**.
4. From the Windows **File Open** dialog box, select the destination for the backup.
5. Select the **Files to Backup**. Typically you would select all files.
6. Click the **Backup** button.

Note *Some sites prefer to use CD-R or CD-RW media for backup. These media require special programs provided with the CD drive to write data to the CD. If you will be using the HUMAC Backup Command you must perform the backup to a folder on the computer's hard drive and then use the CD-supplied software to copy the HUMAC Backup.ZIP file to the CD.*

Screen

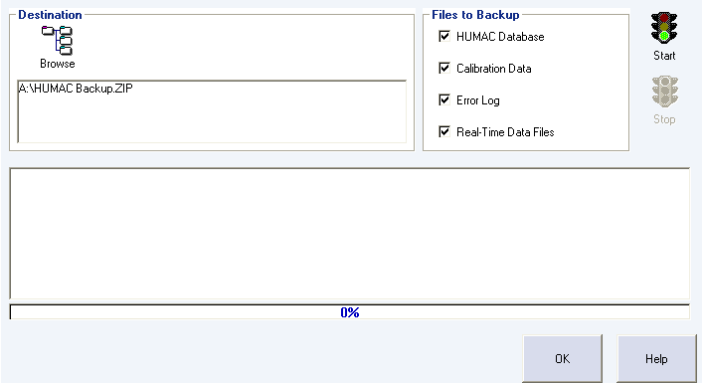


Figure 40 Backup Database

External File Copy

You can create a backup of your HUMAC data by copying the HUMAC data files to your backup media, e.g. CD-R or tape drive.

Options

Options	Definition
Set Backup Destination	During a backup the HUMAC compresses your data into a file called **HUMAC Backup.ZIP**. This file can be on floppy disk, a ZIP drive, a local hard drive (which should be different than the drive holding the HUMAC database), or a network. The **Set Backup Destination** option allows you to specify where the backup file will be created.
Files to Backup	The Files to Backup area allows you to select which files will be added to your backup. Typically you would select all of the files. When contacting CSMI to resolve a question, we may request you only select one type of file for backup and then send the backup to CSMI.
Backup	Start the backup.
Abort	Abort the backup currently in progress and delete the backup file.

Data File Location

The HUMAC database can be stored on your local computer or on a network.

Steps

1. On the **File** menu, click **Database**, **Open**.
2. When the Windows **Open File** dialog box appears, locate and open your HUMAC database (**User HUMAC2013.MDB**).

Compress

If you make frequent changes in the HUMAC database, sections of the database may become fragmented. Therefore, it is a good idea to periodically compress the database.

Schedule the compression depending on how much the data changes. If the data does not change that often, you do not have to compress that much. If there are many and frequent updates, inserts, and deletes, compress more. Even though there is no formal rule for how often to compact, Microsoft recommends that you compress on a regular basis.

For a detailed description of the compress function, see the Microsoft Knowledge Base article *Q209769 ACC2000: Defragment and Compact Database to Improve Performance*.

Steps

1. On the **File** menu, click **Compress**.
2. Click **Yes** to compress the database.

Note *During the compress function the mouse pointer will change to an hourglass. Because the compress function is a Microsoft internal database function you will not see any progress indicators. The HUMAC will display a message when the compression is successfully completed.*

Import: Database

The HUMAC **Import Database** command allows you to combine data from multiple HUMAC databases into a single database for reporting and group summary analysis. Each HUMAC Database is a unique GUID. Use the **Help**, **About** command to view the GUID for your database.

IMPORTANT: *The Import Database function is used to combine multiple databases into a single HUMAC Database at a central location. To upgrade an existing database to the HUMAC2009 format, use the File, Upgrade command.*
Steps

Importing Data When the Sending Sites Backup Their HUMAC Data

1. Each site creates a backup of their data and sends it to the central location.
2. On the **File** menu, click **Import**, **Database**.
3. Click **Set Source**.
4. From the Windows **File Open** dialog box, select the HUMAC Backup file submitted by the site.
5. Click **UnZip Data** to expand the HUMAC Backup file.
6. Click **Import Data** to import the submitted data into the main HUMAC database.

Importing Data When the Sending Sites Copy Their HUMAC Data

1. Each site copies the HUMAC Data Files to a CD-R, ZIP or other large-format storage media.
2. On the **File** menu, click **Import**, **Database**.
3. Click **Set Source**.
4. From the Windows **File Open** dialog box, select the **User HUMAC.MDB** file submitted by the site.
5. Click **Import Data** to import the submitted data into the main HUMAC database.

Screen

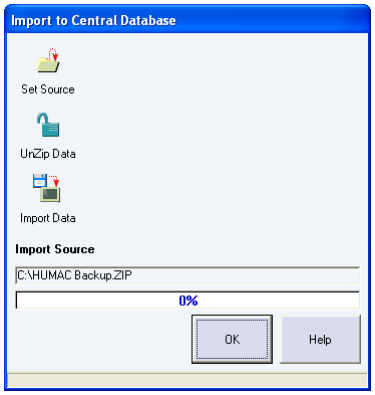


Figure 41 Import Database

Options

Options	Definition
Set Source	Point to the source media (CD, ZIP disk) containing the HUMAC Backup data.
UnZip Data	UnZip a HUMAC Backup file.
Import Data	Read the backup data into the database.

Import: Protocols

The HUMAC **Import Protocols** command allows you to import System Protocols from other users into your HUMAC System.

Steps

1. On the **File** menu, click **Import**, **Protocols**.
2. Each HUMAC protocol has a unique code. The HUMAC will ask if you want to **Overwrite duplicate protocols**, e.g. those with the same unique code.
    a. Yes: Import the protocol, overwriting the existing system protocol with the imported protocol. ***Note:*** *No changes are made to tests which were previously run with the protocol.*
    b. No: Do not import the protocol.
3. From the Windows **File Open** dialog box, select the **Protocols2009.MDB** file and click the **Open** button.
4. The HUMAC will import the System Protocols to your database.

Exporting Data

The HUMAC allows you to Export real-time data to an Excel Spreadsheet or to a Text File.

Steps

1. Select the Patient who's data you want to export.
2. On the **Database** menu, click **Export Data**.
3. Click the **Test/Exercise record** you want to export.
4. Click **Excel** to export the data to an Excel Spreadsheet. Click **Text** to export the data to a text file.

Excel File Format

The HUMAC will create an Excel Workbook containing one sheet for each test/exercise set. Each sheet will contain the real-time time, torque and position data along with a plot of the torque and position data vs. time.

Text File Format

The HUMAC will create a text file for each test speed and side run. The files are placed in the HUMAC/Export folder with the file name identifying the specific patient and test.

Patient Name, Date/Time of Test, Speed, Repetitions, Protocol Set Number, ".CSV"

The Protocol Set Number indicates the set in the protocol, because you can create a protocol with multiple sets of the same speed and number of repetitions. For example, if we tested Rob Potash on September 13 at 60 deg/sec 15 repetitions and 180 deg/sec 15 repetitions, the HUMAC would create the following files.

Potash_ Robert L 9_12_98 7_48_40 AM 60 5 Right 0.CSV
Potash_ Robert L 9_12_98 7_48_40 AM 60 5 Left 0.CSV
Potash_ Robert L 9_12_98 7_48_40 AM 180 15 Right 1.CSV
Potash_ Robert L 9_12_98 7_48_40 AM 180 15 Left 1.CSV

These tests can be read into Excel, by double-clicking the filename.

Submitting a Test to CSMi

The HUMAC allows you to submit tests to CSMi via for review.

Steps

1. Select the **Patient** who's data you want to submit.
2. On the **Database** menu, click **Database**, **Submit Test**.
3. Click the **Browse** button to set the destination for the submitted test file. If you do not have internet access from the computer, you can set the destination to a USB key and e-mail the test to CSMi from a different computer.
4. Select the **Test** or **Exercise** you want to submit.
5. Click the **Start** button to create the Submit file.
6. E-mail the file to service@csmisolutions.com. Add a description of the issue you would like CSMi to review in the body of the e-mail when submitting the test.

Note: *Patient identifying information (Name, ID, Doctor, etc.) is removed from the test before it is submitted to CSMi. In addition the Submit file is encrypted and password protected.*

System Protocols

The HUMAC allows you to define System Protocols. System Protocols can be selected for use by any patient.

Screen

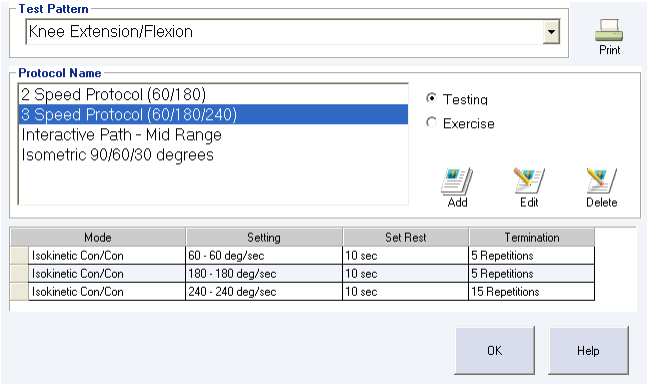


Figure 42 System Protocol Editor

Editing a System Protocol

1. From the **Utilities** menu, select **Protocol Editor**.
2. In the **Test Pattern** area, select the pattern you want to add/edit a protocol for. The HUMAC will display all available system protocols for the selected Pattern in the Protocol Name area.
3. Select **Testing** or **Exercise** to edit the appropriate protocol.
4. Single-click the protocol name. The HUMAC will display all sets in the selected protocol.
5. Select **Edit** to edit the selected protocol.

Adding a System Protocol

1. From the **Utilities** menu, select **Protocol Editor**.
2. In the **Test Patter**n area, select the pattern you want to add/edit a protocol for. The HUMAC will display all available system protocols for the selected Pattern in the Protocol Name area.
3. Select **Testing** or **Exercise** to edit the appropriate protocol.
4. Select **Add** to add a new protocol.

Deleting a System Protocol

1. From the **Utilities** menu, select **Protocol Editor**.
2. In the **Test Pattern** area, select the pattern you want to add/edit a protocol for. The HUMAC will display all available system protocols for the selected Pattern in the Protocol Name area.
3. Select **Testing** or **Exercise** to edit the appropriate protocol.
4. Single-click the protocol name. The HUMAC will display all sets in the selected protocol.
5. Select **Delete** to delete the selected protocol.

Printing Protocols

1. From the **Utilities** menu, select **Protocol Editor**.
2. Click the **Print** button.

Interactive Protocols

The HUMAC allows you to define a number of interactive protocols. The interactive protocols are described in detail below. The procedures for adding, editing and deleting interactive protocols are similar for each protocol type.

Adding a New Protocol

1. From the **Utilities** menu, select **Interactive Feedback Editor**, **Protocol Type**.
2. Click the **Add** button.
3. Enter the protocol values. The HUMAC automatically updates the feedback display.
4. In the area above the display enter a **Descriptive Name** for the protocol.

Editing a Protocol

1. From the **Utilities** menu, select **Interactive Feedback Editor**, **Protocol Type**.
2. In the table on the left, click the **Protocol Name** you want to edit.
3. Enter the protocol values. The HUMAC automatically updates the feedback display.
4. In the area above the display enter a **Descriptive Name** for the protocol.

Deleting a Protocol

1. From the **Utilities** menu, select **Interactive Feedback Editor**, **Protocol Type**.
2. In the table on the left, click the **Protocol Name** you want to delete.
3. Click the **Delete** button.

Protocol Editor: Roadway

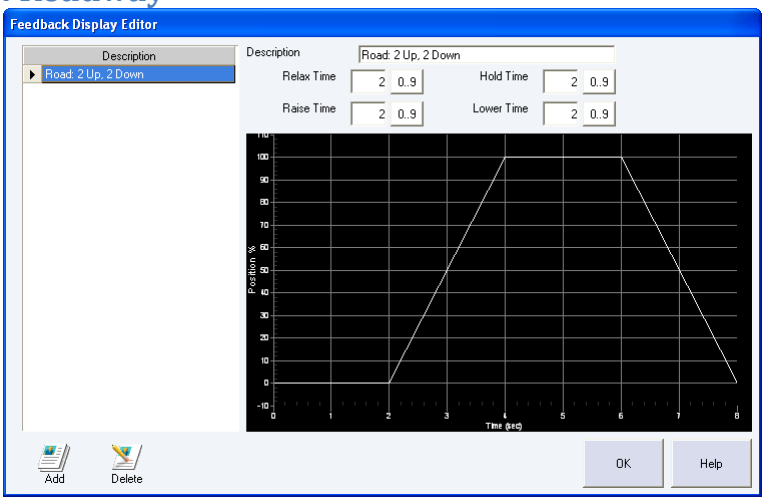


Figure 43 Protocol Editor: Roadway

Parameter	Definition (in seconds)
Relax Time	Time during which the patient relaxes at the start of a repetition.
Raise Time	Time during which the patient is moving toward the ROM target in Isotonic mode or the Torque target in Isometric mode.
Hold Time	Time during which the patient holds at the ROM target in Isotonic mode or the Torque target in Isometric mode.
Lower Time	Time during which the patient is relaxing and moving toward the starting position in Isotonic mode or not generating torque in Isometric mode.

HUMAC Data File Locations

Files

The HUMAC uses an Access Databases and a collection of real-time data files to store the Balance data.

FileName	Description
User HUMAC2013.MDB	Patient names, demographic information, dynamometer settings, protocols, and pointers to the real-time data files.
User Calibration2013.MDB	Dynamometer calibration and verification data.
User Error Log2013.MDB	Log of Errors reported by the HUMAC System.
Results2013.MDB	Exported Group Summary data.
***.H09**	Real-time data files containing the torque and position data collected during each test and exercise set.
Letter.Doc	Narrative Report merge document.
Letter-IsoM.Doc	Isometric Narrative Report merge document.

File Locations

Windows8, Windows7, Vista

FileName	Location
MDB Files	C:\Users\Public\Public Documents\CSMi\HUMAC2013
***.H09 files**	C:\Users\Public\Public Documents\CSMi\HUMAC2013\Data and all sub-folders.
Letter*.Doc	C:\Users\Public\Public Documents\CSMi\HUMAC2013\Letter
Exported Text Files	C:\Users\Public\Public Documents\CSMi\HUMAC2013\Export

WindowsXP

FileName	Location
MDB Files	C:\Documents and Settings\All Users\Shared Documents\CSMi\HUMAC2013
***.H09 files**	C:\Documents and Settings\All Users\Shared Documents\CSMi\HUMAC2013\Data and all sub-folders.
Letter*.Doc	C:\Documents and Settings\All Users\Shared Documents\CSMi\HUMAC2013\Letter
Exported Text Files	C:\Documents and Settings\All Users\Shared Documents\CSMi\HUMAC2013\Export

Windows98

FileName	Location
MDB Files	C:\Program Files\CSMi\HUMAC2013
***.H09 files**	C:\Program Files\CSMi\HUMAC2013\Data and all sub-folders.
Letter*.Doc	C:\Program Files\CSMi\HUMAC2013\Letter
Exported Text Files	C:\Program Files\CSMi\CSMi\HUMAC2013\Export

Users

The HUMAC program allows you to setup user accounts which include passwords and administrative privileges.

Steps

1. From the **File** menu, select **Setup Users**, **Setup**.

Adding a New User

1. Click the **Add** button.

Field	Description
Display Name	The therapist's name recorded in the access log.
Username	The therapist's login name.
Password	The therapist's login password. Note: Passwords are case sensitive.
Administrator	Only administrators can access the File, Setup Users function.

Editing an Existing User

1. Select the **user**.
2. Click the **Edit** button.

Deleting an Existing User

1. Select the user.
2. Click the **Delete** button.

Screen

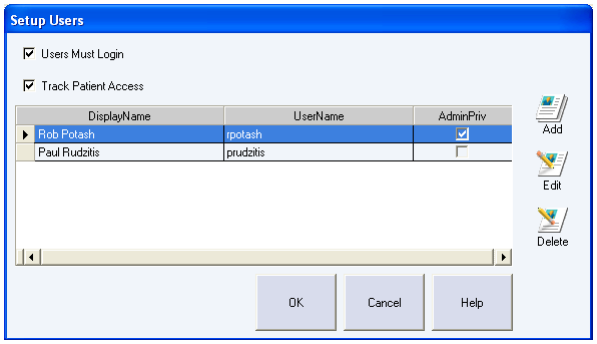


Figure 44 Setup Users

Options

Field	Description
Users Must Login	When the HUMAC starts, the user must enter their username and password.
Track Patient Access	Record the therapist name, patient name and date/time when a patient is selected.
Add	Add a new user
Edit	Edit the selected user's record.
Delete	Delete the selected user. ***Note:*** *Deleting the selected user removes them from the Login options. All recorded database access is retained after the user is deleted.*

The selected user is deleted from the database. No delete confirmation is requested. ***Note:*** *Deleting the selected user removes them from the Login options. All recorded database access is retained after the user is deleted.*

Login

Steps

1. If **Users Must Login** is selected, the HUMAC will display the **Login** screen at startup.

2. Use the **File**, **Setup Users**, **Login** command to change the logged-in user without re-starting the HUMAC,

Screen

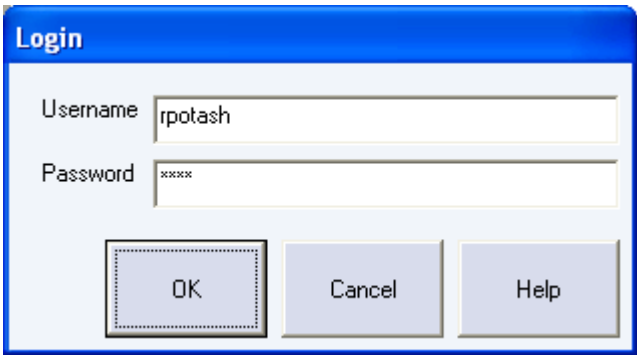


Figure 45 Login

Printing an Access Log

1. From the **File** menu, select **Report**, **Access Log**.

PREFERENCES

The HUMAC **File**, **Preferences** command allows you to customize the operation of your HUMAC System. The Preferences dialog box is divided into four tabs: **General**, **Data Analysis**, **Reporting,** and **Balance**.

Note: *Some of the preferences displayed in the HUMAC System apply to other CSMi devices, e.g. NORM, HUMAC360. Only those applicable to the balance system settings are described below.*

Language

The HUMAC is available in a number of languages. To set the language:

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **General** tab.
3. Select the **Language**.
4. Click the **OK** button.
5. Exit and re-start the HUMAC program to switch to the new language.

Note: *The Windows Operating System must include the fonts required to display the selected language. Selecting Japanese on an English version of Windows will display ??? for the text as the Japanese fonts are not available on English Windows systems.*

Touch Screen Display

The HUMAC can increase the grid sizing for use with touch screen monitors.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **General** tab.
3. Set the **Touch Screen** option.

Machine

The **Machine** setting selects the type of CSMi machine you are working with. The HUMAC program is compatible with the HUMAC NORM, HUMAC360, HUMAC/Balance, and Biodex System2 and System3.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **General** tab.
3. Select the type of machine you are working with from the **Machine** list.

Note: *When selecting the machine, there are options for* ***Balance (Single)****, which is Force Platform Mode, and* ***Tilt****, which is Tilt Mode. All HUMAC Balance Systems support Force Platform Mode. Only HUMAC Balance Systems with the included Tilt Sensor support both Force Platform Mode and Tilt Mode. If you select Tilt Mode with a non-compatible board, the HUMAC will display a message to indicate the board is not compatible with Tilt Mode.*

HUMAC Interface Type

Selects the type of interface (Demo, USB Port) used to connect to the HUMAC.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **General** tab.
3. Select the **Interface**.

Options

Option	Description
None, run program in Demo mode	This is used if you want to evaluate the HUMAC program before installation on a CSMi. The HUMAC will simulate the Balance System allowing you to test all HUMAC functions.
USBCOMM	Connect to the Balance Platform.

Use Sound to Count Repetitions

The HUMAC can count repetitions through the PC's speakers during testing and exercise.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **Feedback** tab.
3. Click on **Use sound to count repetitions**.

Reset Torque Scales for Each Set

The HUMAC auto-scales the feedback display during testing and exercise. The very first time a patient is tested, the HUMAC starts with a 20 ft-lbs scale. If the patient exceeds 20 ft-lbs, the HUMAC moves to a 50 ft-lbs scale. The HUMAC continues with 100, 200, and 500 ft-lbs scales until the best scale for the patient is found. This best value is stored in the HUMAC database. The next time the patient is tested, the HUMAC starts with best value.

Because of the potential strength difference between involved and un-involved limbs and different test speeds in a protocol, some clinicians prefer to have the HUMAC find the best torque scale for each set.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **Feedback** tab.
3. Check **Reset torque scales for each set** to have the HUMAC find the best torque scale for each set. Clear **Reset torque scales for each set** to have the HUMAC find the best torque scale for the patient and apply it to all sets.

Average vs. Best Values

The HUMAC can report the average value or the best value for multi-repetitions tests.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **Data Analysis** tab.
3. In the Torque Parameters area, select **Compute average value of all repetitions** or **Compute best value from all repetitions.**

Options

Option	Description
Compute average value of all repetitions	The HUMAC computes and reports the average value. The HUMAC report displays Peak Torque (Foot-Pounds - **Average Value**) to indicate the average of the repetitions is displayed.
Compute highest value from all repetitions	The HUMAC computes and reports the best value. The HUMAC report displays Peak Torque (Foot-Pounds - **Best Repetition**) to indicate the data is for the repetition with the best value.

Note:

1. *The best value is computed for the following parameters: Peak Torque, Peak Torque Slope, Average Torque, Work, Power, Reaction Time, Settling Time.*

2. *The Highest Value is the best value for the following parameters: Peak Torque, Peak Torque Slope, Average Torque, Peak Torque Slope, Work, Power, Peak Torque to Body Weight, Peak Torque Slope to Body Weight, Average Torque to Body Weight, Power to Body Weight, Percent On Target, Joint Angle at Peak Torque, Range of Motion, Time to Half Peak Torque, Time Peak Torque Held.*
3. *The Lowest Value is best for the following parameters; Torque Ratio, Peak Torque Slope Ratio, Average Torque Ratio, Work Ratio, Power Ratio, Torque Deficit, Initial Peak Torque Deficit, Peak Torque Slope Deficit, Average Torque Deficit, Work Deficit, Total Work Deficit, Power Deficit, Torque Fatigue Index, Work Fatigue Index, Reaction Time, Settling Time, Coefficient of Variation, Coefficient of Variation No Feedback, Maximum Deviation, Maximum Deviation No Feedback, Time To Peak Torque, Force Decay Time, Reciprocal Delay, Delay Time.*
4. *Because the HUMAC stores the real-time (unprocessed) data it is possible to print reports for a given test with the average value or the highest value. To do this, select **Compute average value of all repetitions** and print the report. Then select **Compute best value from all repetitions** and re-print the report.*

Torque vs. Position Plots

The HUMAC reports can plot the torque vs. position data for all repetitions in a set or only the repetition with the highest peak torque value.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **Reporting** tab.

Options

Option	Description
Plot repetition with the highest torque	Displays a single torque vs. position curve of the repetition with the highest peak torque value.
Plot all repetitions	Plot the torque vs. position curves for all repetitions.

Note:

1. *When **Plot repetition with the highest torque** is selected, the HUMAC plots the Initial and reciprocal curves from the repetition with the highest peak torque during the initial motion. For example, on a knee extension/flexion test, if the third repetition had the highest peak torque extension value, the HUMAC will plot the extension and flexion curves from the third repetition.*
2. *Because the HUMAC stores the real-time (unprocessed) data it is possible to plot two reports for a test, one with the single repetition plotted and one with all repetitions plotted by changing the Plot repetition with the highest torque and re-printing the report.*

Highlight Deficits

When printing reports, the HUMAC can automatically highlight right to left side deficits in red.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **Reporting** tab.
3. Select the **Highlight deficits greater than or equal to**.
4. Enter the threshold for deficits to be printed in red. Any right-left deficits less than this amount will be printed in black. Right-left deficits greater than or equal to this amount will be printed in red.

Highlight CV

When printing reports, the HUMAC can automatically highlight Coefficient of Variation values in red.

Steps

1. On the **File** menu, click **Preferences**.

2. Click the **Reporting** tab.
3. Select **Highlight CV values greater than**.
4. Enter the threshold for deficits to be printed in red. Any CV values less than this amount will be printed in black. DV values greater than or equal to this amount will be printed in red.

Default Torque Scale

The HUMAC can auto-scale the feedback display during testing and exercise. Some clinics prefer to use a fixed torque scale during patient feedback and report generation.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **Reporting** tab.
3. To use a fixed torque scale during feedback and report generation, check the **Default Torque Scale** box and enter the desired **Torque Scale**. To have the HUMAC auto-scale, clear the **Default Torque Scale** box.

Display Zoom Values

When previewing reports, the HUMAC can add a hyperlink to Zoom values, for example:

Peak Torque (Foot-Pounds - Best Repetition) - Zoom

Clicking the Zoom link displays the per-repetition values for the parameter.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **Reporting** tab.
3. Select the **Display Zoom Values** option.
    a. **Selected**. Hyperlinks to Zoom values are added to the reports.
    b. **Cleared**. Hyperlinks to Zoom values are not added to the reports.

Note: *Displaying Zoom Values will increase the time required to generate a report when the Preview option is selected. Zoom values has no effect on the time required to Print a report. The HUMAC can display Uni-Polar (absolute value of torque) or Bi-Polar (positive and negative torque) plots on the reports.*

Report Heading

The HUMAC allows you to specify a heading (typically your clinic name and address) to be printed at the top of each report.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **Reporting** tab.
3. Enter the **Report Heading**.

Units

The HUMAC supports US and Metric units.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **Reporting** tab.
3. In the **Units** section, select **US Units** or **Metric Units**.

Options

Data	US	Metric
Height	inches	centimeters
Weight	pounds	kilograms
Torque Limit	Foot-pounds	newton-meters
Torque	Foot-pounds	newton-meters
Work	Foot-pounds	newton-meters

Limits of Stability Normative Values

The HUMAC allows you to specify normative values for the Limits of Stability test.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **Balance** tab.
3. Enter the Normative Values for each target. ***Note:*** *The center target is the Normative Value for the Overall Score.*

Stability Hold Time

The HUMAC allows you to specify default **Hold Time** for the **Stability Test** used in the **Dashboard**.

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **Balance** tab.
3. Enter the **Hold Time** value.

Stability Goal

The HUMAC allows you to specify the Normative Value for the **Stability Goal.**

Steps

1. On the **File** menu, click **Preferences**.
2. Click the **Balance** tab.
3. Enter the **Stability Goal** value.

Weight Bearing Display

The HUMAC allows you to specify the Percent Right/Left or the Force Right/Left for the Weight-Bearing display.

Steps

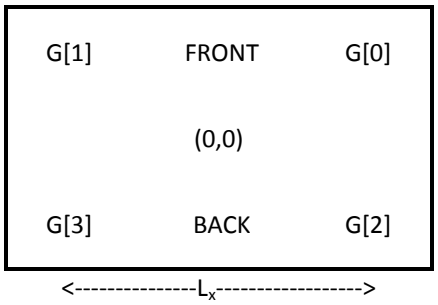
1. On the **File** menu, click **Preferences**.
2. Click the **Balance** tab.
3. In the **Weight Bearing** area, select **Display %** or **Display Weight**.

Measured Parameters

Sensor Layout

Force Platform Mode

The balance sensors are arranged as follows:



The board dimensions are defined as

Parameter	Definition
Lx	Distance from G[1] to G[0]
Ly	Distance from G[1] to G[3]

Tilt Mode

The Tilt Sensor is a single device which provides tilt measurement in the X and Y axes.

Patient Center of Mass (Force Platform Mode)

The Center of Mass for a patient is defined as 55% of their height.

Weight (Force Platform Mode)

The patient weight is computed as the sum of the four gauges

$$WEIGHT = \sum_{n=0}^{3} G[n]$$

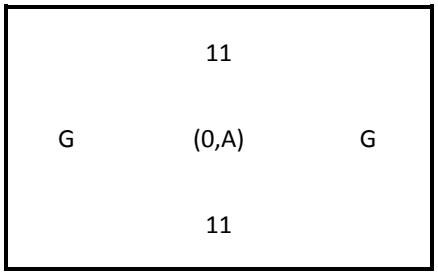
Center of Pressure – Balance Platform (Force Platform Mode)

The Center of Pressure on the board is computed as follows:

$$PLATFORM\_COP_X = \left(\frac{G[0] + G[2]}{WEIGHT}\right) * L_X - \frac{L_X}{2}$$

$$PLATFORM\_COP_Y = \left(\frac{G[0] + G[1]}{WEIGHT}\right) * L_Y - \frac{L_Y}{2}$$

Foot Position



The platform is arranged with 0.75" grid spacing.

X-Axis locations are specified as a letter running from "A" at the center of the board to "G" at each edge of the board.

Y-Axis locations are specified as a number running from 0 at the center of the board to 11 at each edge of the board.

The Foot Offset (in inches from (0,0) at the center of the board) is computed as follows:

$$FOOT\_OFFSET_X = (FOOT\_LOCATION_X - 11) * GRID\_SPACING$$

$$FOOT\_OFFSET_Y = (ASC(GRID\_LOCATION_Y) - ASC("G")) * GRID\_SPACING$$

Note: *ASC is the computer function which converts the letter to a numeric code so:*

$$ASC("G") - ASC("E") = 2$$

Center of Pressure - Patient (Force Platform Mode)

We need to adjust the measured COP relative to the patient's COP, not the Platform's COP. In this way when the patient is balanced the HUMAC will display the COP at (0,0) on the screen. We do this one of two ways:

1. Measure the Gauge Output when the therapist says the patient is in a neutral (Anatomical Zero) position.
2. Compute the AZ based on the Patient's Foot Offset from the board COP.

Anatomical Zero Based

If the therapist sets a Patient AZ, the HUMAC uses the AZ to compute the patient Center of Pressure.
The HUMAC assumes the feet are equally-spaced along the X-Axis from the centerline of the board.

$$PATIENT\_COP_X = PLATFORM\_COP_X - PATIENT\_AZ\_COP_X$$

$$PATIENT\_COP_Y = PLATFORM\_COP_Y - PATIENT\_AZ\_COP_Y$$

Foot Position Based

If an AZ is not set, the HUMAC uses the patient foot position to compute the Center of Pressure. The HUMAC computes the Foot Offset for the Y-Axis as the average offset from (0,0) of the patient's Right and Left side mandibular bones.

Axis	Location
X	Midway between their feet
Y	In-line with their mandibular bone

$$FOOT\_OFFSET_X = 0$$

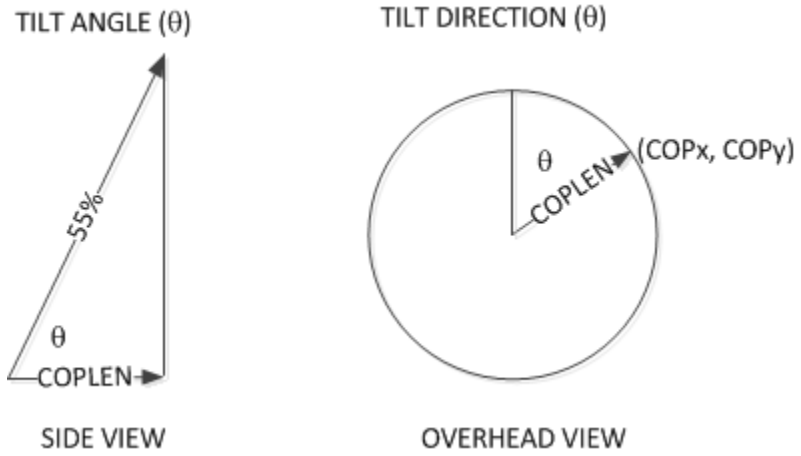
$$FOOT\_OFFSET_Y = \left(\frac{FOOT\_OFFSET_{RIGHT} + FOOT\_OFFSET_{LEFT}}{2}\right)$$

$$PATIENT\_COP_X = PLATFORM\_COP_X$$

$$PATIENT\_COP_Y = PLATFORM\_COP_Y - FOOT\_OFFSET_Y$$

The Patient Neutral COP is the COP where they feel they are standing in a centered position.

COP Length, Angle, Direction (Force Platform Mode)



The COP Length is computed as:

$$COP\_LENGTH = \sqrt{{COP_X}^2 + {COP_y}^2}$$

The Patient's Tilt Angle is the computed as:

$$TILT\_ANGLE = \cos^{-1}\left(\frac{COPLEN}{PATIENT\_HEIGHT * 0.55}\right)$$

The Patient's Tilt Direction is the computed as:

$$TILT\_DIRECTION = \tan^{-1}\left(\frac{COP_X}{COP_Y}\right)$$

Displayed Tilt Angle, Tilt Direction (Force Platform Mode)

The displayed COP is computed as a projection of the Tilt Angle and Direction onto the platform. For example if the patient was tilted 6 degrees directly to the right, the HUMAC would display the cursor on the 6 degree circle at 3:00.

$$PROJECTED\_COP_X = TILT\_ANGLE * \sin(TILT\_DIRECTION)$$

$$PROJECTED\_COP_Y = TILT\_ANGLE * \cos(TILT\_DIRECTION)$$

Displayed R/L and A/P Tilt Angle (Tilt Mode)

The displayed Right/Left and Anterior/Posterior Tilt Angles are read directly from the Tilt Sensor and indicate the Balance Platform angle.

$$PROJECTED\_COP_X = TILT\_ANGLE_{R/L}$$

$$PROJECTED\_COP_Y = TILT\_ANGLE_{A/P}$$

Percent Weight Bearing (Force Platform Mode)

Right/Left

The Right/Left Weight Bearing values are computed as:

$$PCT\_RIGHT = ABS\left(\frac{FOOT\_OFFSET\_LEFT_X - COP_X}{FOOT\_OFFSET\_LEFT_X - FOOT\_OFFSET\_RIGHT_X}\right) * 100$$

$$PCT\_LEFT = 100 - PCT\_RIGHT$$

The value is limited to 100%. Since the centerline of the patient's foot is recorded, it is possible they can shift all of their weight to the outer edge of their right foot which would cause the PCT_RIGHT to be greater than 100% since the COP_X would be outside the FOOT_OFFSET_RIGHT.

Front/Back

The Front/Back Weight Bearing values are computed as:

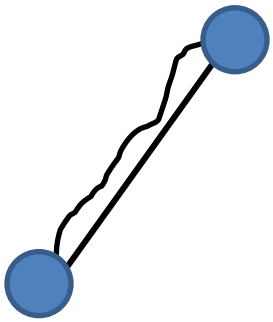
$$PCT\_FRONT = ABS\left(\frac{FOOT\_OFFSET\_LEFT_X - COP_Y}{FOOT\_OFFSET\_LEFT_X - FOOT\_OFFSET\_RIGHT_X}\right) * 100$$

$$PCT\_BACK = 100 - PCT\_FRONT$$

Note: *Since the patient is not shifting from one foot to the other in the Y-Axis there is no true percent weight bearing. The HUMAC uses the Right/Left foot positions for these calculations so an equivalent shift Front/Back in the COP results in the same reported percentage as the Right/Left.*

Limits of Stability Score (Force Platform Mode and Tilt Mode)

The ratio of the length a straight line between to targets to the length of the path traversed by the patient between the targets.



$$LOSSCORE = \left(\frac{LENGTH\_STRAIGHT}{LENGTH\_PATIENT}\right) * 100$$

Stability Score (Force Platform Mode and Tilt Mode)

The ratio of the percent of time the patient was on a target to the time the target was active.

$$STABILITY\_SCORE = \left(\frac{TIME\_ON\_TARGET}{TIME\_TARGET\_ACTIVE}\right) * 100$$

Mobility Score (Force Platform Mode and Tilt Mode)

The ratio of the percent of time the patient was on the target to the duration of the test.

$$MOBILITY\_SCORE = \left(\frac{TIME\_ON\_TARGET}{TOTAL\_TEST\_TIME}\right) * 100$$

CTSIB Score (Force Platform Mode)

The CTSIB Score is the ratio between the Patient's 95% confidence interval of Standard Deviation of their Tilt Angle to a Tilt Angle of 6.25 degrees. ***Note:*** *For simplicity the HUMAC computes the COP_LEN ratios internally.*

The COP_LENGTH is defined as:

$$COP\_LENGTH = \sqrt{{COP_X}^2 + {COP_y}^2}$$

Compute the Standard Deviation of the patients COP_LENGTH.

$$STDDEV = \sqrt{\frac{\sum_{n=1}^{N}(COP\_LEN)^2}{N} - \left(\frac{\sum_{n=1}^{N} COP\_LEN}{N}\right)^2}$$

Compute the COP_LENGTH for 6.25 degrees of tilt.

$$COP\_LENGH_{6.25} = 0.55 * PATIENTHEIGHT * \sin(6.25)$$

Compute the ratio between the Patient's COP_LENGTH and the 6.25° COP_LENGTH. **Note:** Multiplying the patient's STDDEV by 1.96 gives us the 95% Confidence Interval.

$$SCORE = \left(\frac{COP\_LEN_{6.25} - ABS(STDDEV * 1.96)}{COP\_LEN_{6.25}}\right) * 100$$

Excel Export Fields

The following fields are exported to Excel.

Field	Units	Definition
Status		Program Status (See below)
Time	Seconds	Elapsed Time
Gauge[0..3]	Pounds	The Force on each strain gauge
Platform (X, Y)	Inches	The Center of Pressure on the Balance Platform where (0,0) is the center of the platform.
Weight	Pounds	The patient's weight.
Patient COP (X,Y)	Inches	The patient's Center of Pressure in inches where (0,0) is the patient's center of balance.
Patient COP Len	Inches	The length in inches of the patient's COP.
Tilt Angle	Degrees	The patient's Tilt Angle in Degrees
Tilt Direction	Degrees	The Direction of the patient Tilt Angle where 0 is 12:00 with values increasing in a clockwise direction.
Tilt Projection (X, Y)	Degrees	The patients Tilt Angle and Direction projection in degrees where (0,0) is the patient's center of balance.
Pct Right	%	The Percent of Body Weight on the Right foot.
Pct Front	%	The percentage of Body Weight in the Forward direction.

Program Status fields.

Value (HEX)	Definition
0020	Isometric mode: Patient not in target area, display frozen.
0040	Next external stimulus is presented to patient. First point when the target moved to the new location.
0080	The challenge has begun. Used to ignore data at the front of a test where the patient is getting ready to start.
0100	Patient is within the target area.
0200	Patient was on target the required amount of time so we can move-on to the next target.
0400	Patient was unable to reach the target so therapist moved on to the next target.
7800	Four bits used to indicate active target number (0-15).
8000	Patient fell during the test.

ELECTROMAGNETIC COMPATIBILITY

Table 1

Guidance and Manufacturer's Declaration – Emissions Guidance and Manufacturer's Declaration – Electromagnetic Emissions

The HUMAC Balance is intended for use in the electromagnetic environment specified below. The customer or user of the HUMAC should ensure that it is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment – Guidance
RF Emissions CISPR 11	Group 1	The HUMAC uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF Emissions CISPR 11	Class A or B	B
Harmonics IEC 61000-3-2	Class A,B,C,D or N/A	A
Flicker IEC 61000-3-3	Complies or N/A	Complies
	[See 6.8.3.201 a) 3) and Figure 201]	The HUMAC is suitable for use in all establishments, including domestic, and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
RF Emissions CISPR 14-1	Complies	The HUMAC is not suitable for interconnection with other equipment.
RF Emissions CISPR 15	Complies	The HUMAC is not suitable for interconnection with other equipment.

Table 2

Guidance and Manufacturer's Declaration – Immunity All Equipment and Systems Guidance and Manufacturer's Declaration – Electromagnetic Immunity

The HUMAC is intended for use in the electromagnetic environment specified below. The customer or user of the HUMAC should ensure that it is used in such an environment.

Immunity Test	EN/IEC 60601 Test Level	Compliance Level	Electromagnetic Environment – Guidance
ESD EN/IEC 61000-4-2	±6kV Contact ±8kV Air	As specified	Floors should be wood, concrete or ceramic tile. If floors are synthetic, the r/h should be at least 30%
EFT EN/IEC 61000-4-4	±2kV Mains ±1kV I/Os	As specified	Mains power quality should be that of a typical commercial or hospital environment.
Surge EN/IEC 61000-4-5	±1kV Differential ±2kV Common	As specified	Mains power quality should be that of a typical commercial or hospital environment.
Voltage Dips/Dropout EN/IEC 61000-4-11	>95% Dip for 0.5 Cycle 60% Dip for 5 Cycles 30% Dip for 25 Cycles >95% Dip for 5 seconds	As specified As specified As specified As specified	Mains power quality should be that of a typical commercial or hospital environment. If the user of the HUMAC expects dips as specified and the HUMAC requires continued operation during power mains interruptions, it is recommended that the HUMAC be powered from an uninterruptible power supply or battery.
Power Frequency 50/60Hz EN/IEC 61000-4-8	3A/m	As specified	Power frequency magnetic fields should Magnetic Field be that of a typical commercial or hospital environment.

Table 3

Guidance and Manufacturer's Declaration – Emissions Equipment and Systems that are NOT Life-supporting Guidance and Manufacturer's Declaration – Electromagnetic Immunity

The HUMAC is intended for use in the electromagnetic environment specified below. The customer or user of the HUMAC should ensure that it is used in such an environment.

Immunity Test	EN/IEC 60601 Test Level	Compliance Level	Electromagnetic Environment – Guidance
Conducted RF EN/IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	(V1)Vrms	Portable and mobile communications equipment should be separated from the HUMAC360 by no less than the distances calculated/listed below: D=(3.5/V1)(Sqrt P) D=(3.5/E1)(Sqrt P) 80 to 800 MHz D=(7/E1)(Sqrt P) 800 MHz to 2.5 GHz where P is the max power in watts and D is the recommended separation distance in meters. Field strengths from fixed transmitters, as determined by an electromagnetic site survey, should be less than the compliance levels (V1 and E1). Interference may occur in the vicinity of equipment containing a transmitter.
Radiated RF EN/IEC 61000-4-3	3V/m 80 MHz to 2.5 GHz	(E1)V/m	

Table 4

Recommended Separation Distances between portable and mobile RF Communications equipment and the HUMAC Balance Equipment and Systems that are NOT Life-supporting

The HUMAC is intended for use in the electromagnetic environment in which radiated disturbances are controlled. The customer or user of the HUMAC can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF Communications Equipment and the HUMAC as recommended below, according to the maximum output power of the communications equipment.

Max Output Power (Watts)	Separation (m) 150kHz to 80MHz D=(3.5/V1)(Sqrt P)	Separation (m) 80 to 800MHz D=(3.5/E1)(Sqrt P)	Separation (m) 800MHz to 2.5GHz D=(7/E1)(Sqrt P)
0.01	.1166	.1166	.2333
0.1	.3689	.3689	.7378
1	1.1666	1.1666	2.3333
10	3.6893	3.6893	7.3786
100	11.6666	11.6666	23.3333