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Assembly Instructions

The following are step-by-step instructions for the Smart System® 20/20 wireless system. Carefully follow each step to ensure proper operation.

1) General Installation
   
a) Unpacking: Carefully unpack each of the components, the following is a list of components:
   
   1) Computer
   2) LCD Computer Monitor
   3) IBM Compatible 101 Key Keyboard
   4) Mouse
   5) USB IR Detector
   6) Remote Control
   7) Power Strip
   8) Brackets and Mounting Hardware (optional)

b) Locate the Monitor and Computer at a permanent location within the exam room.
   
   1) In a direct-view situation, the center of the monitor should be approximately 54" off the ground and represent a direct line of sight from the average adult patient in the exam chair to the center of the monitor.
   2) In a mirrored environment, the bottom of the mounting bracket or monitor should be roughly 72" off the ground.
   3) With a mirror the monitor should be moved over 18" from the center of the chair to the opposite side of the stand so as not to interfere with the phoroptor or near-rod.
   4) Note that the computer and monitor can be mounted in different locations if long audio and video cables are run between the two units.
   5) If using customer-provided computer (e.g. EHR workstation):
      
      (A) A second graphics card must be provided and installed with VGA output for Smart System®
      (B) Windows must be configured in advance for dual-video
      (C) M&S recommends working with an IT professional to specify and install card and set up video output

   c) Plug Keyboard into any open USB port (including the front-side).
   d) Plug Mouse into any open USB port (including the front-side).
   e) Plug USB Infrared Detector into Computer.
   f) Plug Computer Power Cord into the back of Computer at location.
   g) Plug Monitor Cable into the back of Computer at Monitor Input location Color Coded Blue.
   h) Plug in Monitor Power Cable into the back of the Monitor.
   i) Plug Monitor and Computer Power Cables into Outlet or Power Strip.
Initialize and Calibrate Equipment

Complete Calibration

1. Upon completing all of the connections, turn on the computer and monitor. System will initialize and the startup process begins. If using a user-supplied computer, the software will need to be installed and registered at this point using the separate installation instructions provided. Upon completion of the start-up process on first-use, the monitor will display System Calibration set-up.

2. Smart System® will launch – if calibration does not automatically appear on first use, press “z” or “Home” key, set up screen appears.

3. Move the cursor to the FT field for DIST1
4. Enter the new Focal Distance in FT and IN (e.g. 10 feet and 2 inches)
5. Select Direct or Mirrored
6. If a Second Distance is desired, for instance with Wheelchairs or Clinical Trials, move the cursor to the FT field for DIST2
7. Enter the new Focal Distance in FT and IN (e.g. 10 feet and 2 inches)
8. Select Direct or Mirrored
9. Press Display button
10. Measure the 10cm x 10cm square and use the adjusting arrows to size the black box correctly. **Note this is crucial for correct optotype sizing!** This is a change from previous software that was based on 4” x 4”.

11. Click **Done**

12. Click **Done**

13. Smart System® is now calibrated and ready for use
Re-Calibration of Focal Distance Only

Note that the focal distance is measured from the bridge of the nose of the average patient to the monitor (direct) or from the bridge of the nose to the mirror and then from the mirror to the monitor (mirrored).

1. Press “z” or “Home” key, set up screen appears.

2. Move the cursor to the FT field for DIST1
3. Enter the new Focal Distance in FT and IN (e.g. 10 feet and 2 inches)
4. Select Direct or Mirrored
5. If a second distance, for instance with wheelchairs or clinical trials, is desired, move the cursor to the FT field for DIST2.
6. Enter the new Focal Distance in FT and IN (e.g. 10 feet and 2 inches)
7. Select Direct or Mirrored
   • Note: toggling between Feet and Meters allows the distance to be entered in the appropriate format
8. Click Done
Remote Control & Designations

The Wireless Remote is used to control the operation of the Smart System® 20/20

The remote control is laid out in logical sections: Tests, Patient Education, Isolation, Additional Tests, and Sizing.
# Primary Remote Assignments & Functions

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10, 15, ...</td>
<td>Directly select a given acuity level (eg 30 = 20/30 Pressing a 2nd time will randomize)</td>
</tr>
<tr>
<td>SGL</td>
<td>Displays a single optotype, (ie Letters, Numbers, Lea Symbols®, Allen Pictures)</td>
</tr>
<tr>
<td>LINE</td>
<td>Displays a single line of any optotype</td>
</tr>
<tr>
<td>LINES</td>
<td>3 lines of the same size</td>
</tr>
<tr>
<td>VLine</td>
<td>A vertical line of optotypes</td>
</tr>
<tr>
<td>B</td>
<td>Blank Screen</td>
</tr>
<tr>
<td>LTR</td>
<td>Sloan &amp; Snellen Letters</td>
</tr>
<tr>
<td>PIX</td>
<td>Lea Symbols®</td>
</tr>
<tr>
<td>CONT</td>
<td>Contrast Sensitivity</td>
</tr>
<tr>
<td>#’s</td>
<td>Displays Numbers</td>
</tr>
<tr>
<td>Arrow</td>
<td>Displays an arrow beneath the first Optotype in a single line – vertical or horizontal</td>
</tr>
<tr>
<td>HOTV</td>
<td>HOTV</td>
</tr>
<tr>
<td>E</td>
<td>Tumbling E’s</td>
</tr>
<tr>
<td>CYC</td>
<td>Adolescent/Older Child Fixation, single optotype (Letters, Lea Symbols®, Allen, and Numbers) or single line on screen will randomize at regular timing intervals. User can program the timing of the intervals.</td>
</tr>
<tr>
<td>R/G</td>
<td>Red/Green</td>
</tr>
<tr>
<td>W4D</td>
<td>Worth 4 Dot</td>
</tr>
<tr>
<td>FNC</td>
<td>“Shift” Key provides access to less commonly used features</td>
</tr>
<tr>
<td>+</td>
<td>Scroll up in size on any optotype or scroll up through movies/images</td>
</tr>
<tr>
<td>-</td>
<td>Scroll down in size on any optotype or scroll down through movies/images</td>
</tr>
</tbody>
</table>

**Round 1** Plays the selected image or movie

**Round 2** Glare Medium (Optional)

**Round 3** Directory of Images (Patient Education) JPG Format

**Round 4** Directory of Videos MPG or WMV Format
# Function-Level Remote Control

## Assignments and Functions

Press **FNC** and then the desired key

<table>
<thead>
<tr>
<th>Key-press</th>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNC + WFD</td>
<td>On Screen Size</td>
<td>Toggles the Large On-Screen Size Display that shows the sizing of the optotypes</td>
</tr>
<tr>
<td>FNC + LTR</td>
<td>ETDRS</td>
<td>Toggles between Snellen and the ETDRS Chart</td>
</tr>
<tr>
<td>FNC + PIX</td>
<td>Allen Pictures</td>
<td>Allen Pictures for children</td>
</tr>
<tr>
<td>FNC + LINE</td>
<td>Black/White Toggle</td>
<td>Toggles black optotypes on white screen and white optotypes on black screen. Useful for low vision.</td>
</tr>
<tr>
<td>FNC + SGL</td>
<td>Sine Wave Contrast</td>
<td>Linear Sine Wave Grating Contrast test – See appendix for additional information</td>
</tr>
<tr>
<td>FNC + B</td>
<td>Exit</td>
<td>Exits the software to Windows</td>
</tr>
<tr>
<td>FNC + 10</td>
<td>Additional Tests</td>
<td>Fixation disparity and Maddox rod – use + and – to step through tests</td>
</tr>
<tr>
<td>FNC + 15</td>
<td>Ishihara Plates</td>
<td>Cycle through Ishihara plates – use + and – to step through plates</td>
</tr>
<tr>
<td>FNC + 20</td>
<td>Astigmatic Dial</td>
<td>Displays the Astigmatic dial – use + and – to step the pointer-ball around the dial</td>
</tr>
<tr>
<td>FNC + 50</td>
<td>Random Dot Stereo</td>
<td>Random Dot Stereo – See Appendix</td>
</tr>
<tr>
<td>FNC + 80</td>
<td>Contour Stereo</td>
<td>Contour Stereo - Landolt Rings – See Appendix</td>
</tr>
<tr>
<td>FNC + 200</td>
<td>Lea Symbols® Contour</td>
<td>Distance Stereo</td>
</tr>
<tr>
<td>FNC + 400</td>
<td>Retinoscopy E</td>
<td>A red-green screen with a 20/400 E used by some doctors for fixation during retinoscopy</td>
</tr>
</tbody>
</table>
Remote Control Use & Operation

Most Common Tasks Accomplished with the Remote Control

1. **Switching between Tests** – To switch between tests, for instance moving from Snellen letters to Lea Symbols®, press the appropriate test mode button. In this example, pressing **PIX** will switch to Lea Symbols®.

2. **Isolating a Line** – To isolate a single line of optotypes, press the **Line** key. To isolate a vertical line of descending optotypes, press **VLine**.

3. **Isolating a Letter** – To isolate a single optotype, press the **SGL** button.

4. **Randomizing** – There are several ways to randomize the display:
   a. Press the test mode button again. For example, if you desire to randomize the Snellen letters, simply press **LTR** a second time.
   b. Press the optotype size button again. For example if the top line of the chart is 20/40 and you wish to randomize the chart, simply press **40**.
   c. If working with a single optotype or single line, press the **SGL** or **Line** button a second time.

5. **Access to a Particular Size** – To access a particular size of optotype or a particular line of the chart, press the numbered button corresponding to it. For example to bring up 20/100, press **100**.

6. **Increasing and Decreasing Size** – To increase or decrease the optotype size, simply press + (Plus) or – (Minus) on the keypad.

7. **Blanking the Screen** – To blank the screen, press the **B** key.

8. **The Optotype Pointer** – When working in a Line or Vertical Line of optotypes, press the **Arrow** key to bring up the optotype pointer. Next use the left side Up/Down (+/-) buttons to move the arrow left or right. Using the right side Up/Down (+/-) buttons will change the optotype size. Subsequently pressing **Arrow** will toggle off the arrow.

9. **Cycling a Line or Single Optotype** – To randomize a single optotype or line of optotypes at a predetermined rate, press the **Cyc** key. Every several seconds the row will refresh. This works well for adult fixation.
Fixation and Patient Education Movies

Copying a Movie, Image or Presentation from CD-ROM or USB Drive/Stick

If you purchase or own additional Patient Education or Fixation Movies (MPGs), Images or Presentations, to copy the file, please follow the instructions below:

1. Plug in the Keyboard and Mouse
2. Insert the CD into the CD-ROM drive in the Smart System® unit
3. Press “z” or Home key to enter the configuration
4. Press the “Media” button

5. In the Select Media Type click the appropriate choice: Movies, Images or Presentation
6. Click Add [Movie/Image/Presentation] button just to the right
7. Using the dialog box, navigate to the location of the movie, image or presentation (Note that presentations will be the folder name, rather than a file)
Fixation and Patient Education Movies (Cont’d)

8. Click Open
9. The file/s will copy to the proper Smart System® folder automatically and be ready for use

To “Play” the movies
1. Press “4” on the Round Button to display list
2. Scroll through the movies using the + and – keys
3. “Play” the selected movie by pressing “1” on the Round Button

To “Display” an image
1. Press “3” on the Round Button to display list
2. Scroll through the movies using the + and – keys
3. “Display” the selected image by pressing “1” on the Round Button
System Shut Down

The System should be Shut Down on a Daily Basis. The procedure is as follows:

1. Press **FNC + B** key, system will exit out of Smart System® software and return to the Windows operating system.
2. Press ON\Off button on the Computer and the CPU will shut down.
3. If using the optional keypad, turn it off using the switch on the top of the keypad.
4. **The monitor should remain on**, but will automatically go to power-saver mode. This is indicated when the monitor’s power light turns from green to amber.
Appendix

Snellen Distance Equivalents

This Chart shows the Conversion between Common Optotype Size Measuring Units. If you work in 6-meter based metric or decimal units, use this table to convert from the displayed size based on 20-feet to the metric or decimal equivalent. To switch to a different format shown on-screen, please see Adjusting the Letters & Symbols.

<table>
<thead>
<tr>
<th>Size</th>
<th>20 foot</th>
<th>Metric</th>
<th>Decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>20/10</td>
<td>6/3</td>
<td>2.00</td>
</tr>
<tr>
<td>12.5</td>
<td>20/12.5</td>
<td>6/3.8</td>
<td>1.6</td>
</tr>
<tr>
<td>16</td>
<td>20/16</td>
<td>6/4.8</td>
<td>1.25</td>
</tr>
<tr>
<td>20</td>
<td>20/20</td>
<td>6/6</td>
<td>1.00</td>
</tr>
<tr>
<td>25</td>
<td>20/25</td>
<td>6/7.5</td>
<td>.80</td>
</tr>
<tr>
<td>32</td>
<td>20/32</td>
<td>6/9.5</td>
<td>.63</td>
</tr>
<tr>
<td>40</td>
<td>20/40</td>
<td>6/12</td>
<td>.50</td>
</tr>
<tr>
<td>50</td>
<td>20/50</td>
<td>6/15</td>
<td>.40</td>
</tr>
<tr>
<td>63</td>
<td>20/63</td>
<td>6/19</td>
<td>.32</td>
</tr>
<tr>
<td>80</td>
<td>20/80</td>
<td>6/24</td>
<td>.25</td>
</tr>
<tr>
<td>100</td>
<td>20/100</td>
<td>6/30</td>
<td>.20</td>
</tr>
<tr>
<td>125</td>
<td>20/125</td>
<td>6/38</td>
<td>.16</td>
</tr>
<tr>
<td>200</td>
<td>20/200</td>
<td>6/60</td>
<td>.10</td>
</tr>
<tr>
<td>250</td>
<td>20/250</td>
<td>6/75</td>
<td>.080</td>
</tr>
<tr>
<td>320</td>
<td>20/320</td>
<td>6/95</td>
<td>.063</td>
</tr>
<tr>
<td>400</td>
<td>20/400</td>
<td>6/120</td>
<td>.050</td>
</tr>
</tbody>
</table>
Customizing the Keypad, Remote Control and Footpedal

To customize the layout of the Keypad, Remote Control, or Footpedal, please follow these instructions:

- Plug in a keyboard and mouse
- Press z or Home on the keyboard to enter the configuration
- At the main configuration screen click the Device button to reach the Device Customization screen

**Note:** Do not change the Layout Type for any of the controllers without instruction from M&S Technical Support.

1. Press the button on the device you wish to customize (Keypad, Remote, Footpedal, Marco or Topcon) – this can include FNC or SHIFT with a button (e.g. FNC + 50 or SHIFT + 200)
2. Note – For the Footpedal, press the Footpedal button and the button will switch to Waiting ... Press the footpedal switch desired and the value shown above it will reflect 1, 2 or 3. Continue as shown below.
3. Choose the Function Group of the feature you’d like to set and then from the Available Commands. For a complete list of functions see the “Appendix Entry for Function Groups and Associated Functions”
4. Click Assign Command
5. Click Done to exit Device Customization
6. Click Done to exit Main Configuration
Adjusting the Letters and Symbols

It is possible to Remove Letters or Symbols from Smart System® as well as Adjusting the Number of Lines shown and Letters/Symbols across:

1. Plug in the Keyboard and Mouse
2. Press “z” or “Home” to enter the M&S Main Configuration Screen
3. Press the “Letter” button and the M&S Letter Configuration Screen displays

Note: “The Reset Button” will reset all letters to the default lines and should be used with caution.

To change the “Size Display Indicator” to local notation 20 feet, Logmar Int, Logmar Decimal, 6 meter or Decimal follow the procedure below:

1. In the “Size Display Type” (shown in bottom left corner) Click the down-arrow
2. Select 20 feet, 6 meter, Logmar Int, Logmar Decimal or Decimal
3. Click Done
4. Click Done
Adjusting the Letters and Symbols (Cont’d)

To change to “Always Random” or “Never Random” Charts:

1. In the “Random/Default” box check the box Always Random or Never Random
2. Click Done
3. Click Done

Removing Letters/Symbols

1. In the Images Listed in this Box will be Used During Runtime box remove any unwanted letters or symbols, maintaining a space between each choice
2. The list of valid letters/symbols is shown below for reference below
3. Press Enter key on keyboard when done editing the list
4. If the Reset Button is pressed, the symbol will be removed and replaced on all lines
5. Click Done
6. Click Done

Adjusting Chart Defaults: Number of Characters, Lines Displayed, and Default Characters

1. In the Set Letter Chart Settings Here section
2. Select the Opto Letter Type set by clicking the down-arrow and selecting the set to be modified
3. Each size row can now be individually edited
4. Select Opto Size for Editing by clicking the down-arrow and choosing the size
5. To alter the number of lines shown, in the Number Additional Lines below Default in Chart increase or decrease the default number shown. Note that the total number of lines shown is 1 greater than the number selected as the choice made is the for the number of lines shown below the current line. (To have a total of 3 lines shown, set the number to 2)
6. To alter the number of letters/symbols displayed on the line, in the Number of Characters Displayed on Line increase or decrease the number shown. Letters will be added or removed automatically to match the number shown up to 8 across.
7. To alter the Default 1 and Default 2 characters shown, in the Random/Default Box adjust the letters in the Default 1 and Default 2. Note that Default 2 allows a 2nd set of defaults so that a semi-random chart can be presented to patients.
8. Repeat Steps 4-7 for each Line of the Chart
9. Click Done
10. Click Done
Worth Four Dot Adjustment

To the brightness of the Red, Green or Blue Worth Four Dots and Distance Stereo follow these instructions:

1. Plug in a Keyboard and Mouse
2. Press “z” or “Home” on the keyboard to enter the configuration
3. In the Worth 4 dot section of the Main Configuration select Blue or Green for the Worth 4 dot type

4. To adjust the color of the dot to perfectly occlude with the glasses found in the exam room, press Worth4Dot ColorAdjuster
5. The following screen will display
6. In the Upper Left, select the color of dot you wish to adjust – the choices are Red, Blue, or Green

7. Using your red-blue or red-green glasses, slide the slider left or right to decrease or increase the brightness until the filtering is correct for your glasses.
   • Note that you view the dot through the opposite colored lens (e.g. view the red dot with the blue or green lens)
8. Once correct, select the next color for your glasses and repeat Step 16
9. When finished, click Done
10. At the Main Configuration screen, click Done
Distance Stereo

Smart System® provides three methods for measuring distance stereo: Random Dot, Contour Stereo using Rings, and Contour Lea Symbols® Stereo.

To select Red-Blue or Shutter Glasses for Distance Stereo
1. Plug in a Keyboard and Mouse
2. Press “z” or “Home” on the keyboard to enter the configuration
3. Click Device
4. In the Stereo Glasses Type select “Blue” or “Shutter” Note that the dots will not have to be adjusted for shutter glasses.
5. Click Done
6. Click Done
7. It is critical that the Worth 4 Dot settings be adjusted to completely occlude the colors as detailed in the Worth 4 Dot appendix section if using Red/Blue stereo. The color levels are used to accurately present the stereo separation.
Distance Stereo (Cont’d)

Press the Assigned Key to Enable Stereo Testing

- **FNC** + 50 Random Dot Stereo
- **FNC** + 80 Contour Stereo Rings
- **FNC** + 200 Contour Lea Symbols® Symbol Stereo

If using Shutter Glasses, at the commencement of testing will display a screen to verify that Stereo is working properly through the glasses.

- If the circle appears fuzzy press Up or +
- If the middle circle is not in front of the two circles and appears behind them, press down or -
- Press Arrow to start testing

**Note:**

- If using the wired keypad, the indicator for position and arc-seconds will be shown on the keypad rather than on the screen.
- If using the remote control, the screen will show in the lower right the position (if Red-Blue the quadrant 1 indicating upper left, 2 upper right, 3 lower left and 4 lower right or if LC Shutter glasses, the position 1-4 left to right) followed by the arc-seconds of separation.
- The “Minus” key reduces the separation and the “Plus” key increases the separation.
Customized Protocols

Smart System® allows the creation of customized testing protocols, allowing various charts and isolations to be combined into a repeatable protocol, useful when it is required to test the same way every time.

1. Plug in the Keyboard and Mouse
2. Press “z” or “Home” to enter the **M&S Main Configuration Screen**
3. Press the **Protocol** button

![Protocol creation interface](image)

4. In the **Protocol Name** box enter a descriptive name
5. Click **Add**
6. The Name will now show in the list
7. Click on the Name
8. To add tests select an Image Type or Optotype, Snellen, Lea Symbols®, etc.
9. Select the Opto Size that should be displayed
10. Click on the appropriate function: Chart, Single Line, Single Char, Vertical Line or 3 Lines of the same size
11. Click **Add**
12. Repeat 8-11 to add additional steps
13. If a mistake is made, click the line and click **Remove**
14. The list can be ordered with the **Move Up** and **Move Down** buttons
15. Steps 4-14 can be repeated for multiple protocols. This can be useful to create adult and pediatric protocols or to create custom protocols for consistent testing.
Customized Protocols (Cont’d)

Assigning the Protocol to the Keypad or Remote Control

Remote Control
1. Click the “Button” or “FNC” + button on the Remote that will activate the protocol. (e.g. FNC + 50)
   (Note: the keypad can also be used by just pressing the “Key” or “SHIFT” + key)
2. The Current Command will display if the key is already assigned
3. Click Assign to set the protocol to the button

Keypad
1. Click the key or SHIFT + key on the keypad that will activate the protocol. e.g. FNC + 200
2. The Currently Set To... will display if the key is already assigned
3. Click Assign to set the protocol to the key

Using the Protocol
1. Press the assigned key to activate the protocol
2. Use + and – to move forward or backward through the protocol
3. Press any other key to escape the protocol
Customizing the Video and Image Lists

The Video and Image display is now completely customizable. To enter the Media Settings Configuration follow these steps:

1. Plug in a keyboard and mouse
2. Press “z” or “Home” on the keyboard to enter the configuration
3. Click the Media button and the Media Settings screen will appear

**Note:** The Loop Videos Continuously is used for fixation primarily so that the videos continue from the top after reaching the end. With patient education, this will cause the video to loop.

If you do not have Eyemaginations and wish to order from our list of videos, click the “Individual Movie List,” drop-down arrow

1. Select a video from the list
2. Click Add button
3. Continue 1-3 until the videos are selected
4. You can order the list with the Move Up and Move Down buttons
5. When complete, click Done
6. The videos will now be sorted when the list is displayed as selected
Customizing the Video and Image Lists (Cont’d)

If you have Eyemaginations and wish to order the list of videos:

1. To add a subset of the Eyemaginations videos and have them appear in order in a specific spot in the list of available videos, click the Movie Groups drop-down arrow and select from choices such as Exam Room, Consultation Area, etc.
2. To add the subset to the list, click Add
3. To add individual selections, including the Eyemaginations videos, Click the “Individual Movie List” drop-down arrow
4. Select a video from the list
5. Click Add button
6. Continue 1-3 until the videos are selected
7. You can order the list with the Move Up and Move Down buttons
8. When complete, click Done
9. The videos will now be sorted when the list is displayed as selected

To Add additional Movies, Images, and Presentations

1. Click the “Radio Button”
2. Click the Add button (Add Movie, Add Image, Add Presentation)
3. From the Windows Dialog, select the image you wish to copy. You may use a USB “thumb drive” or “portable hard drive”.
4. Use the Windows file navigation to find and select your movie or image file – presentations are selected by selecting the Folder
5. Click OK
6. Click Done
7. Click Done
8. The images will now be available using the key assigned to display a list of Movies or Images.
Eyemaginations Integration

3-D Eye Office from Eyemaginations can be easily integrated with Smart System®

If you purchased the System from M&S Technologies, Inc. with Eyemaginations, the System may already be configured for use.

If you purchased 3-D Eye Office from Eyemaginations at an earlier or later time for your clinic, follow the steps below to integrate the software.

1. Install 3-D Eye Office from the CDs provided by Eyemaginations
2. Register or unlock the software with Eyemaginations
3. Restart the System
4. To use Eyemaginations, Press “4” or “Down” on the remote’s round button to show a list of available content.
5. Next, use + and – to scroll through the available videos
6. Press “1” or “Up” on the remote’s round button to “play” the video
7. To organize the files, please consult the Customizing the Video and Image Lists section of this Manual.
Assigning Buttons to Display Movies, Images, and Presentations

Any of the Smart System® controllers can be programmed to directly play a particular movie, including Eyemaginations, mage, or Presentation. To program the controller, with a Keyboard and Mouse:

1. Press “z” or Home on the keyboard to enter the configuration
2. Press the Media button
3. Select the Media Type: Movie, Image, or Presentation
4. Press the desired button or FNC/Shift Combination (e.g. FNC 100)
   Note: For the Footpedal, press the Footpedal button you wish to program and continue
5. Select the Movie, Image or Presentation from the Movie Name list
6. Click Assign
7. Continue 3-6 to program additional or Click Done
8. Click Done

In some settings, primarily Pediatric Smart System® PC-Plus Systems, 3 assigned movies have been the norm and work via SHIFT + 10, SHIFT + 15, and SHIFT + 20, the three foot-pedal switches, and the Up, Left and Right buttons on the remote. To change this, either use the traditional methods described earlier in this manual or perform the following steps:

1. Click on a Movie in the Movie Name list
2. To the right in the column under the red-letter P right click the mouse
3. A drop-down will appear
4. Choose 1, 2, or 3 which is Remote: Up, Left or Right / Keypad: Shift + 10 Shift + 15 and Shift + 20 or Footpedal: Left Center Right
5. The number will appear in the column
6. Repeat for 2 and 3 or Click Done
7. Click Done
### Function Groups and Associated Functions

The table below is used for assigning functionality to any of the controls as described in the section above **Customizing the Keypad, Remote Control and Footpedal**. First, choose the appropriate Function Group and then the Function you wish to assign.

<table>
<thead>
<tr>
<th>Function Group</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Astigmatic</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dial</td>
</tr>
<tr>
<td></td>
<td>Dots</td>
</tr>
<tr>
<td></td>
<td>Fan</td>
</tr>
<tr>
<td></td>
<td>Parallel</td>
</tr>
<tr>
<td><strong>Contrast</strong></td>
<td>Contrast_Contrast_Sensitivity</td>
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<tr>
<td></td>
<td>Landolt_Contrast</td>
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<tr>
<td></td>
<td>SineGrating</td>
</tr>
<tr>
<td></td>
<td>SineGrating_Protocol</td>
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<tr>
<td><strong>Glare</strong></td>
<td>Low</td>
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<tr>
<td></td>
<td>Medium</td>
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<tr>
<td></td>
<td>High</td>
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<td></td>
<td>EMR_Counter</td>
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<tr>
<td><strong>General</strong></td>
<td>MINUS</td>
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<tr>
<td></td>
<td>MINUS_Control_2</td>
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<tr>
<td></td>
<td>PLUS</td>
</tr>
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<td>PLUS_Control_2</td>
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<tr>
<td><strong>Low Vision</strong></td>
<td>Amsler Grid</td>
</tr>
<tr>
<td></td>
<td>Circle Quadrant Test</td>
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<tr>
<td></td>
<td>Dynamic Visual Acuity</td>
</tr>
<tr>
<td></td>
<td>EETDRS_Bailey_Test</td>
</tr>
<tr>
<td></td>
<td>Ishihaara Plates</td>
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<tr>
<td></td>
<td>Masked_LowVision</td>
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<tr>
<td></td>
<td>OneMeter_Testing</td>
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<td>Rothbloom_Test</td>
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<td>SineGrating_Contrast</td>
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<td><strong>Media</strong></td>
<td>Assign_Image</td>
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<td>Assign_Video</td>
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<td></td>
<td>Directory_Movies</td>
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<td></td>
<td>Directory_Images</td>
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<td>Function Group</td>
<td>Function</td>
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<td>---------------------------------</td>
</tr>
<tr>
<td><strong>Media (cont’d)</strong></td>
<td>Directory_Presentations</td>
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<td></td>
<td>Presentation_Play</td>
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<td>Image_Astig_Test</td>
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<td>Image_SineGrating</td>
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<td>Play_Selected</td>
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<td>WinTV_Play</td>
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<td>WinTV_Reset</td>
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<td>Play_DVD</td>
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<td><strong>Misc</strong></td>
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<td>Print</td>
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<td>Open_Config_Screen</td>
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<td>Cycle_Interval</td>
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<td>One_Line</td>
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<td>Randomize</td>
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<td>Single_Char</td>
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<td>Three_Lines</td>
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<tr>
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<td>Play_Movie1</td>
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<td>Play_Movie2</td>
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<td>Phidgets_Port_3_and_4</td>
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<td>Fix_NonAccomodative_Target – Dr. Robert Gross' Non-accomodative distance fixation target</td>
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<td><strong>Polarized</strong></td>
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<td>VLines</td>
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<td>Function Group</td>
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<td>E-EDTRS_Protocol</td>
</tr>
<tr>
<td></td>
<td>Dynamic_E-ETDRS_Protocol</td>
</tr>
</tbody>
</table>
Astigmatic Dial

Smart System® 2011 has an astigmatic dial that can be utilized with the blue-ball pointer. To get the Astigmatic Dial, press FNC + 20 on the remote control. Then, use Up/Down on the remote to move the pointer. The number of lines can be configured by Pressing “z” to enter the configuration and clicking Advanced. Click the drop-down next to Astigmatic Dial – Num Arms per Clock Section and choose 1 (Hourly), 2 (Every 30 Minutes), or 3 (Every 20 Minutes). Click Done and click Done.

The table below shows the result for each

<table>
<thead>
<tr>
<th></th>
<th>Every 20 minutes</th>
<th>Every 30 minutes</th>
<th>Every hour</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Astigmatic Dial - Num Arms per Clock Section.</strong></td>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
<td><img src="image3.png" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
Showing Sizing for each Line

Smart System® 20/20 has the ability to show the size for each line of a chart on the right side.

To enable this feature:

1. Press “z” or Home to enter the configuration

2. On the Main Configuration Screen check the box marked “Show Opto Sizes for Each Chart Line”

3. Click Done

4. The line sizing will now appear on the right edge of the chart for easy reference
M&S Smart System® 20/20 – Contrast Functions

Operation of the Smart System® 20/20 Contrast Testing

Contrast Control
When the Smart System® is in contrast test mode, the left “+/-” keys control the contrast level, the right “+/-” keys control the optotype size.

Contrast Display
When the Smart System® is in contrast mode, the on-screen display shows the contrast level in the lower right corner and the optotype size, as usual, in the lower left corner. The contrast levels are 63, 50, 32, 25, 20, 16, 12, 10, 9, 8, 7, 6, 5, 4, 3, 2, and 1 percent.

Contrast Testing with the M&S Smart System® 20/20 Letter Contrast Test
The M&S Smart System® 20/20 Letter Contrast Test uses Sloan Letters. Optotype contrast use a "pixel density" approach that sets the gray value to the percent of contrast between the Black and White values of the monitor.

Monitor Calibration
If using a monitor from M&S Technologies, Inc. it has been calibrated as closely as possible to a luminance of approximately 85 cd/m² and a color temperature of 3300K as the standards specify. This will be a warmer or almost yellower appearance that standard monitors that can have values in excess of 165 cd/m² and 7800K, which results in a brighter bluer image.

M&S Technologies, Inc. does not suggest or endorse any specific method of conducting any examination, including contrast testing, nor do we suggest any interpretation of results obtained by conducting such an examination. As a medical professional, it is your responsibility to determine the appropriate method for conducting an examination as well as the interpretation of the results.

Monitor Benchmark Settings
The monitors provided by M&S are pre-set to the values found below for optimal use in testing contrast. If you feel that your monitor has been modified, please consult the table below or contact Technical Support for assistance.

<table>
<thead>
<tr>
<th>NEC AccuSync 72V LCD Monitor</th>
<th>NEC Mutisync 225WXM 22”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brightness: 86%</td>
<td>Brightness: 54.0%</td>
</tr>
<tr>
<td>Contrast: 40%</td>
<td>Contrast: 50%</td>
</tr>
<tr>
<td>User Color Settings: R=93, G=67, B=0</td>
<td>User Color Settings: R=92.9 G=73.7 B=25.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NEC Multisync 1770NXM &amp; 1990NXM</th>
<th>NEC Mutisync 224 22”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brightness: 67.9%</td>
<td>Brightness: 54.0%</td>
</tr>
<tr>
<td>Contrast: 50%</td>
<td>Contrast: 50%</td>
</tr>
<tr>
<td>User Color Settings: R=92.9 G=73.7 B=34.5</td>
<td>User Color Settings: R=92.9 G=73.7 B=25.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NEC Mutisync 205WXM 20”</th>
<th>NEC Accusync 221</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brightness: 54.0%</td>
<td>Brightness: 54.0%</td>
</tr>
<tr>
<td>Contrast: 50%</td>
<td>Contrast: 50%</td>
</tr>
<tr>
<td>User Color Settings: R=92.9 G=73.7 B=25.5</td>
<td>User Color Settings: R=92.9 G=73.7 B=25.5</td>
</tr>
</tbody>
</table>
Suggested Contrast Test Procedure (Example 1)

Determine visual acuity threshold at 100% contrast, black letters. This test assumes Corrected or Uncorrected VA of 20/20. The room lights should be off for contrast testing

1. Press CONT and then SGL to get a single Sloan Letter.
2. Use “-” to reduce the contrast until the patient no longer correctly answers.
3. Record the previous value (last correct).
4. Press “+” three times, check to see if the patient is correct. If not, press “+” until a correct answer.
5. Use “-” to once again reduce the contrast percentage until the patient answers incorrectly again.
6. Record the last correct value.
7. With the two results, compare and record the higher percentage. Perform for each of the following:

Begin testing at the following lines and percentages

- 20/25 / 25%
- 20/50 / 8%
- 20/100 / 4%
- 20/200 / 3%
Suggested Contrast Sensitivity Form (Example 1)

<table>
<thead>
<tr>
<th>Patient Name:</th>
<th>Chart:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date: / /</td>
<td>Time: : AM PM</td>
</tr>
<tr>
<td>VA OD:</td>
<td>VA OS:</td>
</tr>
<tr>
<td>Pupil Size OD:</td>
<td>Pupil Size OS:</td>
</tr>
</tbody>
</table>

Exam should be conducted in dark exam room

<table>
<thead>
<tr>
<th>Beginning Contrast %</th>
<th>OD</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acuity</td>
<td>Contrast %</td>
<td>Acuity</td>
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<tr>
<td>100</td>
<td>100</td>
<td>100</td>
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<tr>
<td>25</td>
<td>20/25</td>
<td>20/25</td>
</tr>
<tr>
<td>8</td>
<td>20/50</td>
<td>20/50</td>
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<tr>
<td>4</td>
<td>20/100</td>
<td>20/100</td>
</tr>
<tr>
<td>3</td>
<td>20/200</td>
<td>20/200</td>
</tr>
</tbody>
</table>

Record Contrast % as the last correct value. With the two results as directed, compare and record the higher percentage.
Suggested Contrast Test Procedure (Example 2)

Determine visual acuity threshold at 100% contrast, black letters. This test assumes Corrected or Uncorrected VA of 20/20.  
*Note: Room lights should be off for contrast testing*

1. Press CONT to enter contrast – it will automatically switch to a single line at 63% contrast
2. Press Size button to switch to 20/30, 20/50 or 20/70 as directed below
3. Use “-” to reduce the contrast until the patient answers incorrectly on 3 out of the 5 letters
4. Record the previous value (last line with 3 out of 5 correct).
5. Press “-” to reach 0.8%
6. Use “+” to increase the contrast percentage until the patient answers correctly on 3 out of the 5 letters
7. Record the last line where the patient recorded 3/5 correct
8. With the two results, compare and record the higher percentage. Perform for each of the following

Begin testing at the following lines and percentages

- 20/30 @ 25%
- 20/50 @ 25%
- 20/70 @ 25%
Suggested Contrast Sensitivity Form (Example 2)

<table>
<thead>
<tr>
<th>Patient Name:</th>
<th>Chart:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>/      /</td>
</tr>
<tr>
<td>VA OD:</td>
<td>VA OS:</td>
</tr>
<tr>
<td>Pupil Size OD:</td>
<td>Pupil Size OS:</td>
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</tbody>
</table>

Exam should be conducted in dark exam room

<table>
<thead>
<tr>
<th>Size</th>
<th>OD</th>
<th>OS</th>
<th>Norm</th>
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<tbody>
<tr>
<td>Acuity</td>
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<td>20/20</td>
<td></td>
</tr>
<tr>
<td>20/70</td>
<td></td>
<td></td>
<td>4%</td>
</tr>
<tr>
<td>20/50</td>
<td></td>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>20/30</td>
<td></td>
<td></td>
<td>10%</td>
</tr>
</tbody>
</table>
Sine Wave Grating Contrast

Contrast testing using Sine Wave Gratings is available in Smart System® 20/20. This uses gratings at Horizontal, Vertical, 45 degrees and 135 degrees in the following spatial frequencies: 1.5, 3, 6, 12, and 18 cycles/degree and allows contrast percentages from 0.4% to 100%. To activate Sine Wave Grating Contrast Testing:

1. Press the FNC + SGL Button
2. The Left Up/Down button changes the contrast percentage up and down
3. The Right Up/Down button changes the Spatial Frequency in Cycles/Degree
4. The Contrast Percentage is shown in the Upper Left
5. The Spatial Frequency is shown in the Upper Right

Adjust the Contrast Percentage
On the wired keypad, + and – adjusts the Contrast Percentage and Shift & +/- adjusts the spatial frequency.

Spatial Frequency
To toggle the Spatial Frequency and Contrast Percentage, simply press the Arrow Button ARW

<table>
<thead>
<tr>
<th>32% - 1.5 Cycles/Degree</th>
<th>25% - 6 Cycles/Degree</th>
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</thead>
<tbody>
<tr>
<td>32</td>
<td>1.5</td>
</tr>
<tr>
<td>25</td>
<td>6</td>
</tr>
</tbody>
</table>
Integrating with Marco and Topcon Autophoroptors

Smart System® can be integrated with the Marco RT5100 and RT2100 and Topcon KB50/CV5000 Autophoroptors.

Topcon is wireless and requires the Topcon wireless transmitter be plugged into the KB50 unit. The system will automatically detect the presence of the Topcon device and pressing the touchpad will result in the chart being changed.

Marco can be wireless or wired for the RT2100, 3100 and 5100. The integration kit can be ordered by contacting M&S Technologies, Inc. The M&S IR detector will automatically detect the presence of the Marco device and pressing the touchpad will result in the chart being changed.
ATS-HOTV and E-ETDRS Protocols

Smart System® can run both the ATS-HOTV and E-ETDRS Protocols, providing a consistent and repeatable testing methodology. These tests can be assigned to a FNC button combination on the remote control. After pressing this combination, up/down +/- record correct (up/) and incorrect (down/-) responses and test commences following the algorithms described below. At the completion of the test, the resulting VA is displayed on the screen.

**ATS HOTV Algorithm**

The ATS HOTV Algorithm is a 4 part test that uses the HOTV optotypes crowded at 100% with crowding or interaction bars

**Screening:** The screening phase begins at either 20/400 or 20/100 depending on the choice the doctor or technician makes during the selection of the test. It begins at the selected size and reduces the size with each correct answer until a wrong answer is made. The size is then set two lines higher and it enters Phase 1.

**Phase 1:** The first phase begins two lines above the previous wrong answer and presents randomly each of the four optotypes H O T and V. If the patient gets three or more correct out of four, the line is reduced in size by one and again, the four optotypes are presented. This continues until the patient misses two of the four or worse. The size is increased by three and the Reinforcement phase begins.

**Reinforcement:** The reinforcement phase helps to regain interest in the test by presenting three optotypes beginning 3 lines higher in size than the line they did not get correct in Phase 1. For example if the patient misses on 20/100, the reinforcement would show a 200, 150 and 125 optotype to help the patient regain interest and focus on the test.

**Phase 2:** The second phase begins at the line they missed in Phase 1 and provides another opportunity to get this line correct and work lower still. At the next miss of two or more, the visual acuity will be the last line where they responded with three out of four correct answers.
ATS-HOTV and E-ETDRS Protocols (Cont’d)

E-ETDRS Algorithm

The E-ETDRS Visual Acuity Testing Protocol is conducted in two distinct phases, culminating in the determination of the visual acuity and the Letter Score. Each phase is described below.

1. **Screening Phase** – Single crowded optotypes are presented to determine the smallest logMAR level that is correctly identified by the patient. The testing commences with 20/400 and moves 3 log units smaller with each correct answer until an optotype is missed. For instance, 20/400, 20/200, 20/100, 20/50, etc. When an optotype is missed, the screening then moves up two log units and presents an optotype. If this is correctly answered, the screening moves down in one log unit steps until the next miss whereupon the last correct answer is the acuity used to begin the Testing Phase. If the optotype shown after moving back up two log units is incorrectly answered, the screening moves up in one log unit steps until a correct answer and this answer is used to being the Testing Phase.

2. **Testing Phase** – The Testing Phase commences with the last correctly identified size from the Screening Phase and one level smaller. For example if the Screening Phase found the smallest level to be 20/50, the Testing Phase would begin with 20/50 and intermix 20/40 level optotypes. If an optotype is missed, one level larger is added to the testing pool. If a letter is correct at a given level, one additional level smaller is added to the testing pool. So continuing the example, if the patient identifies the 20/40 optotype, 20/32 would be added to the testing pool, and if the user misidentifies the 20/50 optotype, 20/63 would be added to the testing pool. For each level that becomes part of the testing pool, five presentations are made. The test continues until the smallest level with 5 out of 5 correct is determined as well as the smallest level with 0 out of 5 correct. This determines the upper and lower logMAR levels.

3. **Visual Acuity** – The Approximate Snellen Visual Acuity is determined based on the letter score to provide the traditional measure of acuity.

4. **Letter Score** – The Letter Score is determined to be the total number of optotypes correctly identified during the Testing Phase plus 5 times the number lines above (larger) than the upper logMAR level (5/5 correct) through 20/800. For example if 20/63 is the upper logMAR level, there are 11 lines above (larger) than 20/63. So, the formula would be the number of correctly identified optotypes plus 5 * 11 (55). If there were 8 correctly identified optotypes during the testing phase, the score would be 63.

At the completion of the testing, both the Visual Acuity and Letter Score are presented for recording. The complete list of correct/incorrect response by logMAR level is also presented for review.

Note that the crowding is “100% crowding” where the bars are one full optotype width from optotype.
Assigning a Screen Saver

Smart System® can do one of four things as a screen saver. Note that the regular system screen saver should not be used, but rather one of the built-in Smart System® screen-savers should be utilized, which includes system screen savers. The screen saver can be:

- Blank Screen – The traditional blank screen
- Windows® Screen Saver – Choose any of the Windows® Screen Savers
- JPG Directory Play – Pick a presentation folder to cycle through allowing customized marketing and education for your practice
- Eyemaginations Screen Saver – Pick an Eyemaginations Playlist to use educating your patients during idle time.

To set a Screen Saver, using a Keyboard and Mouse:
1. Press “z” or Home to enter the configuration
2. Press Media button
3. In the Screen Saver Settings click the drop-down and choose between the four types
4. For Windows Screen Saver, JPG Directory and Eyemaginations, press Select to navigate to the file or folder desired
5. For JPG Directory, use the JPG Timer to choose how fast to cycle the images
6. Click Done
7. Click Done
Low Vision Masking

Smart System® now allows an optotype to be “masked” for use with Low-Vision patients. This function can be assigned to any key, [FNC] + Key or SHIFT + Key. Assigning a key is described in the section entitled “Customizing the Keypad, Remote Control and Footpedal”. The function is found in OptoFunctional | Masked_LowVision

When the resulting key is pressed a single optotype will be masked and will appear on the screen as shown below.
Advanced Configuration

There are many aspects of the M&S Technologies Smart System® PC-Plus 2011 that can be set using the Advanced Configuration. These settings should no

1. Using the Keyboard & Mouse, press the Home key (near page up and page down) to open the configuration

2. Click the Advanced button

3. The Acuity Chart Defaults screen allows changing several parameters
   1. The default optotype at system startup can be changed from Snellen to any other set
   2. The Cycling function can be set to cycle all (full chart) or only lines or letters
   3. To have the single optotype when first pressed be the first letter of the corresponding line (e.g. if the line is FZBDE, the single will first be F) check off the “On Single Character” box
   4. To “Maintain Chart Format on Optotype Change” or to stay in a line when moving between Snellen and Allen, check this box
   5. “Allow Adjustable Crowding Bars” is a research tool
   6. The “Sgl button on Allen is Alphabetical” allows the doctor to step through the Allen pictures in Alphabetical Order to familiarize the children with the pictures if desired.

4. The Acuity Sizing/Spacing allows several chart changes
Advanced Configuration (cont’d)

1. Particular line sizes can be excluded
2. Chart Spacing can be Ansi (space between lines equal to height of larger) or Log (space between lines equal to height of smaller)
3. The Default Startup size can be selected

5. The **Arrow Settings** screen can allow the arrow to be adjusted

1. The Arrow button can be set to toggle where +/- move the arrow or for the Arrow to always move right when the ARW button is pressed
2. The Arrow can be set to stay in its current position when size is changed so that if the arrow is pointing to the 3rd character, if the size of the chart is changed, the arrow will still point to the 3rd character
3. The Size and Spacing of the arrow can be adjusted
Advanced Configuration (cont’d)

6. The **Device Settings** screen allows advanced configuration for the devices. It is mostly for use with M&S Technical Support. For systems running dual-monitor with EMR, the **Ignore Keyboard Commands** box should be checked. This limits the keyboard to just the **Home** (for configuration) & **End** (exit) Keys. The Info Window/Virtual Keypad is used to drop in a virtual window if using multiple monitors.

7. The **Glare Levels** screen allows the glare intensity to be adjusted. These are set at M&S to best reflect the BAT test, but may be increased or decreased.
Advanced Configuration (cont’d)

8. The **Image Settings** screen controls the number of increments in the astigmatic dial (20 minutes, 30 minutes or hourly) and the non-accommodative fixation Target behavior – float or stay in middle of screen.

![Image Settings Screen]

9. The **MS Study** screen determines if the separate program for Jaeb Center studies should be used. The choice is grayed-out if software not present.

![MS Study Screen]
Advanced Configuration (cont’d)

10. The Other screen controls the behavior of the Windows Task bar and should only be used with assistance from Technical Support

![Other Screen Control](image1.png)

11. The Video Settings Screen allows the user to select in Pediatric fixation whether to return to a blank screen, chart, single line or single letter. It also has advanced options for DVD playback that should be used with M&S Technical Support

![Video Settings Screen](image2.png)
Sine Grating Protocol Use

Assign a Button to Sine Grating Protocol
Follow the instructions in the Appendix for Customizing the Keypad, Remote Control and Footpedal to assign a button on the remote control to the Sine Grating Protocol.

Protocol
The protocol for Sine Gratings uses a 3 Round algorithm. Round 1 has 0.3 log unit steps, Round 2 has 0.2 steps and Round 3 has 0.1 log step. The test begins at 25% contrast. If the patient answers correctly, the test reduces the contrast in 0.3 log unit steps until an incorrect is recorded. The protocol then goes up 0.2 log units and will then reduce in 0.2 log unit steps until the next incorrect answer. Finally, the test moves up 0.1 log units and reduces contrast until the final incorrect. Then the best (lowest) two contrast levels are averaged for a final result. At completion of the 5 spatial frequencies a graph is presented detailing patient performance against the normative data.

To run the Linear Sine Grating Protocol:

1. Press towards the assigned button on the remote control
2. The Sine Contrast Main Screen will appear

3. 1 2 3 and 4 are the cardinal directions on the Round button of the remote control
   a. 1 is Up
   b. 2 is to the Left
   c. 3 is to the Right
   d. 4 is Down

4. Press any direction on the remote to continue and begin the protocol
5. A Demo is shown, displaying a target of 6 cycles per degree at 50%, 25%, 12.5% and 6% contrast. This will familiarize the patient with the test.

6. Once complete, the test will commence and test the user at 18 cpd, 12 cpd, 6 cpd, 3 cpd and 1.5 cpd

7. The Round button is used to record the direction the gratings run as indicated on the initial screen. If neither the patient nor the doctor can ascertain the direction, indicate NO by pressing down on one of the Up/Down size buttons. Alternately, correct responses can be indicated by pressing Up to indicate YES.
   a. Yes – Up on size buttons
   b. No – Down on size buttons
   c. Up/"1" – Vertical grating
   d. Down/"4" – Horizontal grating
   e. Left/"2" – Gratings slope to upper left
   f. Right/"3" – Gratings slope to upper right

8. The results will be displayed for recording. The results will also be saved to a comma delimited file for later review.

9. Press “any key” to leave the protocol
M&S Contrast Sensitivity Function Test Results

M&S® Contrast Sensitivity Function Test Results.

18 CPD = -1.4 log / 4%  
12 CPD = -1.5 log / 3.2%  
6 CPD = -1.7 log / 2%  
3 CPD = -1.6 log / 2.5%  
1.5 CPD = -1.5 log / 3.2%
Glare testing is an optional component to Smart System®. It consists of a controller with 4 high intensity LEDs that can be used at Low, Medium and High. All tests can be conducted with glare. The complete procedures for installation and use are provided with the Glare components; consult it for additional information.

If you are interested in additional information on adding Glare, please contact: M&S Technologies, Inc. at 1-847-763-0500.
License Agreements

M&S Technologies, Inc. ("MST")
End User Limited Hardware Warranty

Computer hardware products and related accessories purchased new from M&S Technologies, Inc., or on behalf of M&S through its Authorized Representatives, come with a 1-year limited hardware warranty. Refurbished computer hardware products and related accessories purchased from M&S Technologies, Inc., or on behalf of M&S through its Authorized Representatives, come with a 30-day limited hardware warranty.

This limited hardware warranty covers defects in M&S Technologies, Inc. materials and workmanship relating to purchased hardware and accessory product purchases by M&S end-users customers.

This limited hardware warranty does not cover:

- Software, including the operating system and software added to the M&S-purchased hardware products. (See the M&S Software License Agreement and related Limited Lifetime Warranty for any M&S-developed software.)
- Hardware products and accessories not purchased through M&S Technologies, Inc. or its Authorized Representatives
- Problems that result from:
  - External causes such as accident, abuse, misuse, or problems with electrical power
  - Servicing not authorized by M&S Technologies, Inc.
  - Usage that is not in accordance with product instructions
  - Failure to follow the product instructions or failure to perform preventive maintenance
  - Problems caused by using accessories, parts, or components not supplied by M&S
- Products with missing or altered Service Tags or serial numbers
- Products for which M&S has not received payment
- Expendable and/or consumable parts
- Normal wear and tear

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state (or jurisdiction to jurisdiction). M&S' responsibility for malfunctions and defects in hardware is limited to troubleshooting with the end user, repair and/or replacement as set forth in this warranty statement. All express and implied warranties for the product, including but not limited to any implied warranties and conditions of merchantability and fitness for a particular purpose, are limited in time to the term of the 1-year limited warranty period or the 30-day limited warranty period. No warranties, whether express or implied, will apply after the limited warranty period has expired.

M&S does not accept liability beyond the remedies provided for in this limited hardware warranty or for consequential or incidental damages, including, without limitation, any liability for third-party claims against you for damages, for products not being available for use, or for lost data or lost software. Our liability will be no more than the amount you paid for the product that is the subject of a claim. This is the maximum amount for which we are responsible.
A small percentage of users may experience epileptic seizures when exposed to certain light patterns or backgrounds on a computer screen or while using the hardware. Certain conditions may induce previously undetected epileptic symptoms even in users who have no history of prior seizures or epilepsy. If you, or anyone in your family, have an epileptic condition, consult your physician prior to using the hardware. Immediately discontinue use of the hardware and consult your physician if you experience any of the following symptoms while using the hardware: dizziness, altered vision or muscle twitches, loss of awareness, disorientation, any involuntary movement, convulsions, or any unusual behavior or condition.

The limited hardware warranty on all M&S-purchased hardware products begins on the earliest date of the packing slip, invoice, or receipt. The warranty period is not extended if we repair or replace a warranted product or any parts. M&S may change the availability of limited hardware warranties, at its discretion, but any changes will not be retroactive.

M&S warrants that the Products that you purchased from us, or on behalf of M&S through our Authorized Representatives, are free from defects in materials or workmanship under normal use during the Limited Warranty Period. You are entitled to warranty service according to the terms and conditions of this document if a repair to your Product is required within the Limited Warranty period. This Limited Warranty extends to the original end user purchaser and is not transferable. Warranty service availability and response times may vary.

Before the warranty expires, please contact M&S Technical Support at 847-763-0500 or our Authorized Representatives. Please also have your hardware Service Tag or invoice number available.

During the 30 days of the 30-day limited refurbished hardware warranty and the first year of all other limited hardware warranties, M&S or its authorized representative will provide telephone support, repair or replace any M&S-purchased hardware products that prove to be defective in materials or workmanship. If M&S or its authorized representative is not able to troubleshoot the problem with the end user or repair the product, we will replace it with a comparable product that is new or refurbished. M&S may also provide loaner hardware in circumstances whereby a repair or replacement is required. It is at the full discretion of M&S, as to the best approach for providing warranty service.

As part of warranty repairs or replacement, M&S or its Authorized Representatives may require the system software/firmware be brought up-to-date.

During the Limited Warranty Period, M&S will troubleshoot and correct the issue with the end user, repair or replace any defective component. This is your exclusive remedy for defective products. M&S reserves the right to elect, at its sole discretion, to give you a refund of your purchase price instead of a

All warranty service calls handled directly by M&S will be assigned a Technical Support tracking number.

When your warranty service requires you to return hardware to the M&S Technologies, Inc. Illinois warehouse, M&S will provide a loaner and a return label to ship your M&S-purchased product for repair. You must return the defective products to us in their original or equivalent packaging, or accept the risk if the product is lost or damaged in shipment. M&S will return the repaired or replacement products to you. M&S will pay to ship the repaired or replaced products to you if you use an address in the United States (excluding Puerto Rico and U.S. possessions and territories). Otherwise, M&S will ship the product to you freight collect. If the failed M&S-purchased hardware is not received by us within twenty-one (21) business days from the date that the loaner was dispatched to customer, or the unit is not returned in the specific packaging, the Customer will be invoiced at list price for the replacement unit. Upon receipt of the repaired or replaced hardware, you must ship any loaned hardware to the M&S Technologies, Inc. Illinois warehouse using the prepaid freight provided.
If M&S determines that the problem is not covered under this warranty, we will notify you and inform you of service alternatives that are available to you on a fee basis. Products returned will not be accepted if there is damage due to external causes, including accident, abuse, misuse, natural and unnatural disasters, acts of God, problems with electrical power, servicing not authorized by the M&S, usage not in accordance with product instructions, failure to perform required preventative maintenance, problems caused by use of parts and components not supplied by M&S, and damage incurred during shipment of defective parts to M&S for repair. If damage is evident from these causes, the CUSTOMER will be invoiced at list price for the replacement parts. Servicing fees may also be applied at the sole discretion of M&S. Although M&S is not under any obligation to provide warranty service for Product damaged in any of the ways mentioned herein, M&S may, at its sole discretion, agree to provide additional service for such Products if, after inspection by M&S, we determine that the Product is still in acceptable operating condition.

If warranty service is provided by an M&S authorized representative, depending on circumstances, you may be required to return M&S-purchased hardware to the authorized representative via prepaid freight.

**NOTE:** Before you ship the product(s) to us, make sure to back up the data on the hard drive(s) and any other storage device(s) in the product(s). Remove any confidential, proprietary, or personal information and removable media such as floppy disks, CDs, or PC Cards. We are not responsible for any of your confidential, proprietary, or personal information; lost or corrupted data; or damaged or lost removable media.

M&S is not responsible for the preservation of any data or the protection of any confidential, proprietary or personal data contained in any product, nor is M&S responsible for the restoration or reinstallation of any programs or data other than software written and installed by M&S or its authorized representatives when the product was provided to the end user by M&S or on behalf of M&S by its authorized representative.

Upon the expiration of the limited hardware warranty, you will be offered an option to purchase an extended service contract. Hardware service will be provided to you under the terms of the service agreement. Please refer to that contract for details on how to obtain service.

We use new and refurbished parts made by various manufacturers in performing warranty repairs and in building replacement parts and systems. Refurbished parts and systems are parts or systems that have been returned to M&S, some of which were never used by a customer. All systems are inspected and tested for quality. Replacement parts and systems are covered for the remaining period of the limited hardware warranty for the product you bought. M&S owns all parts removed from repaired products.

This limited hardware warranty coverage terminates if you sell or otherwise transfer this product to another party.
This Limited Warranty is made as of the date of shipment of the Products to the Customer (the "Effective Date") by and between M&S Technologies, Inc., its subsidiaries and affiliates, with offices at 5557 W. Howard Street, Skokie, Illinois 60077 ("collectively "the Company"), and the Customer (as defined below).

1. Definitions.

In addition to the terms defined elsewhere in this Agreement, the following terms whenever used in this Agreement shall have the following meanings:

"Customer" means the end user of the Products.

"Hardware" means the hardware purchased from M&S, along with any end user manuals supplied by M&S. This includes M&S Products purchased through M&S authorized representatives.

"Maintenance Releases" means any update, upgrade, revision, patch, bug fix or an improved, upgraded or enhanced version of the Products released by M&S to which Customer is rightfully entitled by way of a valid maintenance agreement, warranty, or other M&S offering. Third Party Products are excluded and subject to their own terms and conditions.

"Object Code" means computer programs assembled, compiled, or converted to magnetic or electronic binary form on software or hardware media, which are readable and usable by computer equipment, but not generally readable by humans without reverse assembly, reverse compiling, reverse conversion, reverse engineering and/or any other disassembly or decompilation.

"Product(s)" means, collectively, the Hardware and Software which may be supplied to Customer.

"Software" means all components of M&S vision testing industry software and related documentation made generally available by M&S from time to time, which is accompanied by its own license agreement. The term "Software" shall include any and all software, scripts, firmware, and microcode running on Hardware or any computer system, including all Maintenance Releases supplied in accordance with this Agreement. The Software shall be provided in Object Code form only. No source code will be provided.

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