# **Smart System<sup>®</sup> PC Plus**

Visual Acuity and Fixation Systems



TECHNOLOGIES The First Choice in Vision Testing Systems

**User & Operation Guide** 

Volume 23 | March 2025 Publication: IMP-S2020 ©2025 M&S° Technologies

151-0006 Effective: 03/11/25

# **Table of Contents**

Introduction	1
Label Graphics Explanations	2
Physical Description	
Specific tions, Precautions, Limitations	4
Hardware Specific tions	6
Spécific tions matérielles	7
Assembly Instructions	
Initialize and Calibrate Equipment	
Re-Calibration of Focal Distance Only	11
Keypad & Designations	
Primary Keypad Assignments & Functions	
Shift-Level Keypad Assignments & Functions	
Keypad Use & Operation	
Keypad Display	
Optional Remote Control & Designations	
Primary Remote Assignments & Functions	
Function-Level Remote Control Assignments and Functions	19
Remote Control Use & Operation	
Fixation and Patient Education Movies	
Dynamic Voice Recognition	23
System Shut Down	
Appendix	27
Snellen Distance Equivalents	
Customizing the Keypad, Remote Control & Footpedal	
Adjusting the Letters & Symbols	
Worth 4 Dot Adjustment	
Distance Stereo	
Customized Protocols	
Customizing the Video & Image Lists	
Assigning Buttons to Display Movies, Images, and Presentations	
Function Groups and Associated Functions	
Astigmatic Dial	44
Showing Sizing for each Line	45
M&S Smart System <sup>®</sup> 20/20 – Contrast Functions	
Suggested Contrast Test Procedure (Example 1)	47
Suggested Contrast Sensitivity Form (Example 1)	
Suggested Contrast Test Procedure (Example 2)	49
Suggested Contrast Sensitivity Form (Example 2)	50
Sine Wave Grating Contrast	
Integrating with Marco, Topcon & Reichert Automated Refraction Systems	52
ATS-HOTV and eETDRS™ Protocols	53
Assigning a Screen Saver	55
Low Vision	
Advanced Configu ation	
Sine Grating Protocol Use	
Enhanced Fixation Disparity Test	68
Fixation Disparity measurements using the Central Dot	69
How to Plot a Ogle Forced Vergence Curve	71
Harris Visual Acuity Test	74
Harris Contrast Test	
Harris Sine Contrast Test	
ColorCheck for Smart System <sup>®</sup>	
Running a Manual Color Test	
License Agreements	

#### M&S<sup>®</sup> Technologies

Sales: 877-225-6101 / 847-763-0500 Fax: 847-763-9170 Technical Support: 847-763-0500 www.mstech-eyes.com

# Smart System<sup>®</sup> PC-Plus Visual Acuity and Fixation Systems User & Operation Guide



T +1.877.225.6101 F +1.847.763.9170 Technical Support: +1.847.763.0500

www.mstech-eyes.com

Smart System<sup>®</sup> PC-Plus is assembled in the USA by M&S Technologies, a division of The Hilsinger Company Parent, LLC.

The Hilsinger Company Parent, LLC holds US Patent Numbers 7,354,155; 7,926,948; 8,167,429; 8,419,184; 8,425,040; 8,550,631; 8,992,022; 9,433,347; 9,820,644; 10,244,938; and 10,182,713. Other patents pending.

©2025 M&S Technologies Made and Printed in the US Smart System® PC-Plus User and Operation Guide

# Introduction

# **Purpose of Manual**

This manual provides the essential information necessary for installation, operation, and routine care of Smart System<sup>®</sup> PC-Plus. The instructions within this manual should be carefully followed for safe and effective equipment use. It contains important operation and maintenance information for personnel trained to use this device.

It is important that all personnel who will operate Smart System<sup>®</sup> PC-Plus:

- Read and understand this manual before device operation.
- Follow all warnings and precautions outlined in the sections **Operational Precautions and Limitations** and **Hazards** for their own safety and the safety of those around them.

In this manual, the following definitions apply for all WARNING and CAUTION statements:



WARNING: A warning statement covers any operation, procedure, practice, etc., which if not strictly observed, might result in serious injury or long-term health hazards to personnel or patients.

CAUTION: A caution statement covers any operation, procedure, practice, etc., which if not strictly observed, might result in mild or moderate injury or damage or destruction of equipment or loss of performance.

# Abbreviations

The abbreviations used in this manual are listed and defined in the following table.

cm	Centimeter (1 cm = .01 m)	
CPU	Central processing unit	
EHR workstation	Electronic Health Record workstation	
IFU	Instructions For Use	
IR	Infrared	
USB	Universal Serial Bus	
VGA	Video Graphics Array	

Our devices are stand-alone systems and do not require Internet access or network connections for their operation. All functionalities are self-contained within the device, ensuring that they perform optimally without external connectivity.

# Label Graphics Explanations

The following table provides an explanation of the label graphics found on the Smart System<sup>®</sup> PC-Plus.

	Warning / Caution
REF	Reference Number
***	Manufacturer
MD	Medical Device
	Temperature Limits
li	Consult Instructions for Use
Ť	Keep Dry
<u> </u>	Electric Shock Hazard

# **System Description**

# Intended Use

Smart System<sup>®</sup> PC-Plus is intended for use in displaying computerized images on a screen for vision testing.

# Indications for Use

Smart System<sup>®</sup> PC-Plus is indicated for use as part of a pediatric eye exam.

### Safety

Smart System<sup>®</sup> PC-Plus is safe when used as described in this manual. Be sure to review all Warnings and Cautions prior to use.

# Contraindications

There are no known contraindications when used as directed.

# Medical Device Classification

Class I	FDA listed device
Class I	EU MDD 93/42/EEC
Class I	Health Canada

# **Physical Description**

Smart System<sup>®</sup> PC-Plus is comprised of an All-in-One Unit (CPU and display screen); an IBMcompatible 101-key keyboard; computer mouse; USB 2.0 IR Detector; remote control; power strip; brackets and mounting software (optional).

\*For end users who prefer to supply their own computer equipment (CPU and LCD computer monitor required), Smart System<sup>®</sup> PC-Plus may be supplied as software only. See Device Specifications and Assembly Instructions for configuration details.

### All-in-One Unit

The All-In-One Unit consists of a CPU with a widescreen flat display panel. The Unit is intended to be installed in a permanent location within the exam room. See Assembly Instructions for directions on positioning the All-in-One Unit.

### **Keyboard and Mouse**

A standard IBM-Compatible 101-key keyboard, computer mouse, and USB keyboard / mouse adaptor are supplied for use with the All-In-One Unit.

### **USB Infrared Detector**

The USB Infrared (IR) Detector, when connected to the All-in-One Unit via USB 2.0 port, receives data input from the Remote Control.

### **Remote Control**

The Remote Control is used to control the operation of the Smart System® PC-Plus.

### Foot Pedal (optional)

The Foot Pedal is an optional input controller of Smart System<sup>®</sup> PC-Plus.

### Smart System Android Tablet Controller (optional)

The Smart System Tablet is an optional input controller of Smart System<sup>®</sup> PC-Plus and may also be used for limited Near Vision testing applications. See the Smart System<sup>®</sup> Tablet Instructions For Use for more information.

### Power Strip (optional)

An optional power strip is provided for ease of set-up for the User.

### Brackets and Mounting Hardware (optional)

Brackets and mounting hardware are provided for ease of set-up by the User.

# Specifications, Precautions, Limitations

# **Device Specifications**

Intended Use	Smart System <sup>®</sup> 20/20 is intended for use in
	displaying computerized images on a screen
	for vision testing.
Indications for Use	Smart System <sup>®</sup> 20/20 is indicated for use in
	vision testing as part of a standard ophthalmic
	exam.
Operating System	Windows <sup>®</sup> 11 IoT (64-bit)
Processor	Intel® Celeron™ N6210 1.2GHz
Dimensions	23.8" W x 18.2" H x 3.5" D (60.5 cm x 46.2 cm x
	8.9 cm)
Weight	15.6 lbs. (7.1 Kg)
Memory	4GB DDR4 SODIMM
Video	Intel <sup>®</sup> HD Graphics
Display	22" Widescreen Flat Panel Display (16:10),
	1680 x 1050
Storage	128 GB M.2
Network Interface	Intel <sup>®</sup> I225 V/I226V 2.S GbE Controller
Audio	Realtek ALC888S, integrated 2 x speakers
I/O Ports	2 USB 3.2 ports
	2 USB 2.0
	2 Serial ports
	2 RJ45
	1 HDMI
	1 Display Port
	3 Audio Ports (In, Out, Mic)
Input Voltage Range	12V DC 5A
System Included AC Adapter	100 ~ 240V AC 50/60Hz North America UL Listed
Storage Conditions	10°C - 35°C (50°F - 95°F); 35% - 80% humidity
Operating Conditions	10°C - 35°C (50°F - 95°F); 35% - 80% humidity

# **Operational Precautions and Limitations**

The following information will affect the operator's success in using Smart System® PC-Plus.

**Should Be Used Only by Trained Professionals** – Federal law restricts the sale of this device to physicians and medical professionals only. Use of the device in procedures other than those described in this manual may result in injury.

**Connect the System to an External Power Supply According to Labeling** – Smart System<sup>®</sup> PC-Plus uses externally supplied electricity to operate. Check the voltage and amperage ratings of the external supplies and make sure they match the labeled ratings for electricity inputs shown on the rear of Smart System<sup>®</sup> PC-Plus.

**Shut System Down on a Daily Basis** – Smart System<sup>®</sup> PC-Plus should be shut down on a daily basis. See "System Shut Down" section for the shut-down procedure.

**Conduct of Examinations and Interpretation of Results** – M&S Technologies does not suggest or endorse any specific method of conducting any examination, 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.

### Hazards

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 patient or anyone in the patient's family has an epileptic condition, consult a physician prior to using the hardware. Immediately discontinue use of the hardware and consult a physician if patient experiences 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.

WARNING: To prevent or reduce the risk of electrical shock or fire, do not expose the unit to rain or moisture.



**CAUTION**: There are no user serviceable parts inside this unit. Attempting repairs will void the manufacturer's warranty. If unit requires service, please contact M&S Technologies Technical Support helpline.

# **Hardware Specifications**

Operating System Windows® 11 Home IoT (64-bit)

Processor Intel® Celeron™ N6210 1.2GHz

Dimensions/Weight 23.8"W x 18.2"H x 3.5"D, 15.6 lbs

Memory 4GB DDR3L SODIMM

Video Intel® HD Graphics

**Display** 22" Widescreen Flat Panel Display (16:10), 1680 x 1050

Storage 128GB M.2

Network Interface Intel® I225 V/I226 V 2.S GbE Controller

Audio Realtek ALC888S, integrated 2 x speakers

#### I/O Ports

2 USB 3.2 ports 2 USB 2.0 ports 2 Serial Ports 2 RJ45 1 HDMI 1 Display Port 3 Audio Ports (In, Out, Mic)

Input Voltage Range 12V DC 5A

#### System Included AC adapter

100 ~ 240V AC, 50/60Hz America UL Listed

.

# **Spécifications matérielles**

#### Système d'exploitation Windows<sup>®</sup> 11 Édition IoT (64-bit)

Processeur Intel<sup>®</sup> Celeron ™ N6210 1.2GHz

Dimensions et poids 60.452cm W x 45.228cm H x 8.89cm D, 9.979 kg (23.8"W x 18.2" H x 3.5" D, 15.6 lbs)

### Mémoire

4GB DDR4 SODIMM

### Vidéo

Intel<sup>®</sup> HD Graphique

#### Affichage de l'ordinateur

22" Écran Large et Plat (16:10), 1680 x 1050

### Stockage

128GB M.2

#### Interface réseau

Intel® 1225 V/1226 V 2.S GbE contrôleur

#### Audio

Realtek ALC888S, intégré 2 x haut-parleurs

#### I/O Ports

2 USB 3.2 ports 2 USB 2.0 ports 2 Serial Ports 2 RJ45 1 HDMI 1 Display Port 3 Audio Ports (in, Out, Mic)

#### Gamme de tension

12V DC 5A

#### Systéme Inclus AC adaptateur

100 ~ 240V AC, 50/60Hz Amérique du Nord UL Listé

# **Assembly Instructions**

The following are step-by-step instructions for the Smart System<sup>®</sup> PC Plus 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 & LCD Computer Monitor OR All-in-One Unit
    - 2) IBM Compatible 101 Key Keyboard
    - 3) Mouse
    - 4) USB IR Detector (Built into USA 2.0)
    - 5) Remote Control
    - 6) Power Strip
    - 7) Brackets and Mounting Hardware (optional)
  - b) Locate the Monitor and Computer at a permanent location within the exam room.
    - In a direct-view situation, the center of the monitor should be approximately 60" 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 center of the mounting bracket or monitor should be roughly 78" 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<sup>®</sup>
      - (B) Windows<sup>®</sup> 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
      - (D) Smart System<sup>®</sup> and drivers should be installed using Software Installation Instructions and CD
  - c) Plug Keyboard & Mouse into any open USB port.
  - d) Plug USB Infrared Detector into Computer. (Built into USA 2.0)
  - e) Plug Computer Power Cord into the back of Computer at location.
  - f) Plug Monitor Cable into the back of Computer at Monitor Input location Color Coded Blue (if not using All-in-One unit).
  - g) Plug in Monitor Power Cable into the back of the Monitor (if not using All-in-One unit).
  - h) Plug Power Cables into Outlet or optional Power Strip.

# **Initialize and Calibrate Equipment**

#### **Complete Calibration**

- 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<sup>®</sup> will launch if calibration does not automatically appear on first use, press "**z**" or "**Home**" key to make the set-up screen appear.

M&S Main Configuration Screen		
	Display Settings	VERSION: 2014.1
Distance From the Sc Bridge of the Patient         ● Feet       Dist 1         ● Meters       Dist 2         ✓ Show Opto Size in Bottom Left       Dist 2         ✓ Show Opto Sizes for each Chart Line       Timer Settings         Blank Screen Timer (minutes)       20 •         20 •       •         Letter Cycle Timer (Seconds)       4         4       •         Silent Fixation Timer (Milli Seconds)       400 •	reservent to the   It's Nose   FT   IN    IN	System FunctionalityEdit Letter Charts and Lines, Defaults, Random,LetterEdit Movie Ordering and add Image/Movies to Lists.MediaEdit Movie Ordering and add Image/Movies to Lists.MediaCreate/Edit Protocols you can Execute During RuntimeProtocolProgram your Wireless Remote, Wired Keypad, and Footpedal.DeviceFor more settings press the Advanced Settings Button.Advanced
	DONE	Import Config Files Files

- 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.

### Initialize and Calibrate Equipment (Cont'd)



- 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<sup>®</sup> 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 to make the set-up screen appear.

M&S Main Configuration Screen			
Distance From the Sc	Display Settings	VERSION: 2014.1	
<ul> <li>Feet Dist 1</li> <li>Meters Dist 2</li> <li>Show Opto Size in</li> </ul>	It's Nose     Screen Position - Direct       FT     IN     or Using a Mirror       19     8     Direct       9     10     Direct       List of Monitors     1920x1200\\.\DISPLAY1	System Functionality Edit Letter Charts and Lines, Defaults, Random,	
Bottom Left     Show Opto Sizes for     each Chart Line	Available to Display Smart System. Note: For Partial Screen, go to Advanced/Other	Edit Movie Ordering and add Image/Movies to Lists.	
Timer Settings Blank Screen Timer (minutes) 20 -	Click Here to Adjust your Screen Pixel Size for Proper Display Worth 4 Dot Controls Section	Create/Edit Protocols you can Execute During Runtime Program your Wireless	
Letter Cycle Timer (Seconds) 4 Silent Fixation Timer (Milli Seconds) 400	Worth4Dot ColorAdjuster       Choose Green or Blue         Image: Choose Green Worth 4 Dot         Image:	Remote, Wired Keypad, and Footpedal. For more settings press the Advanced Settings Button.	
	DONE	Import Config Files Files	

- 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.

# **Keypad & Designations**

The keypad is the primary control for Smart System® PC Plus. The keypad is grouped into logical sections. Most of the first three lines provide direct access to particular sizes and also are home to the Plus and Minus keys that move up or down one row of the chart at a time. The final three keys of line three provide the ability to isolate a single optotype, **SGL**, a single line of optotypes, **LINE**, or Blank the screen, **B**.

The final two rows of the keypad provide access to various tests and other commonly used features. The most frequently used key is the SN key which displays the Snellen letters in a multi-line chart. Other tests include Allen Pictures, LEA Pictures, LEA Numbers, HOTV, and Tumbling E's. After pressing the appropriate test key, any subsequent press will randomize the optotypes.

The remaining keys provide functionality such as Crowding Bars, Red-Green testing, the Worth 4 Dot, and cycling optotypes.

10	15	20	25	30	+
40	50	60	80	100	-
125	200	400	Sgl	Line	В
Sn	Aln	Lea	#'s	Arrw	HOTV
Cbr	E	Cycl	R/G	4D	Shift

### Shift Level

These functions are accessed by pressing and holding Shift while pressing the appropriate key.

MOV 1	MOV 2	MOV 3	ANIM	Image	+
Dir MPG	Dir JPG	PLAY	Gross Fix	REV	-
STR	ATS	Astig		V Line	Exit
MOV Selec t	Assn Mov1	Assn Mov2	Assn Mov3	DVD	
Cbr 100	C's	ETDR S	Sn- Log	1 Dot	Shift

The shift-level functions provide access to the video capabilities as well as less frequently used functions. The first, second and fourth rows provide access to the videos for use in fixation as well as patient education. Their use is covered in the section on **Fixation and Patient Education movies** found below.

The complete table of Shift-Level functions is found below in the **Shift-Level Keypad Assignments & Functions** table.

10, 15, 	Directly select a given acuity level (e.g. $30 = 20/30$ ; pressing a $2^{nd}$ time will randomize)
SGL	Displays a single optotype (i.e. letters, numbers, LEA SYMBOLSI Á Allen Pictures)
LINE	Displays a single line of any optotype
В	Blank Screen
SN	Sloan & Snellen Letters
ALN	Allen Pictures
LEA	LEA SYMBOLS <sup>®</sup>
#'s	Displays Numbers
Arrw	Displays an arrow beneath the first optotype in a single line – vertical or
	horizontal
HOTV	HOTV
CBR	Interaction bars at 50%
E	Tumbling E's
CYCL	Adolescent/Older Child Fixation, single optotype (letters, LEA, Allen,
	Numbers) or single line on screen will randomize at regular timing intervals.
	User can program the timing of the intervals.
R/G	Red/Green
W4D	Worth 4 Dot
SHIFT	Shift Key
+	Scroll up in size on any optotype
-	Scroll down in size on any optotype

### **Primary Keypad Assignments & Functions**

.

# Shift-Level Keypad Assignments & Functions

Key-press	Function	Description
Shift + 10	Play Movie 1	Movie 1
Shift + 15	Play Movie 2	Movie 2
Shift + 20	Play Movie 3	Movie 3
Shift + 25	Silent Animation	A silent fixation for children distracted by sound
Shift + 30	ColorCheck	ColorCheck Color Testing
Shift + 40	Directory Movies	Directory of Movies on System – Use +/- to navigate
Shift + 50	Directory Images	Directory of Images on System (Patient Education)
Shift + 60	Play Selected Movies or Image	Plays (Displays) selected movie or image
Shift + 80	Gross Fixation	Gross Non-accommodative Distance Fixation Target
Shift + 100	White on Black/Black on	White optotypes on Black Screen or Black optotypes on White Screen Toggle
	White Toggle	
Shift + 125	LEA Contour Stereo	Distance Stereo using LEA SYMBOLS®
Shift + 200	ATS	ATS Protocol
Shift + 400	Astigmatic Dial	Astigmatic Dial – use +/- to move pointer
Shift + Line	V-Line	Vertical Line
Shift + B	Exit	Exits the software to Windows
Shift + Arrow	Play DVD	Plays a DVD if DVD present If applicable
Shift + Sn	Directory Movies	Directory of movies on System
Shift + Aln	Assign Movie 1	Assign Selected Movie to Shift 10 and Left Footswitch
Shift + Lea	Assign Movie 2	Assign Selected Movie to Shift 15 and Center Footswitch
Shift + #'s	Assign Movie 3	Assign Selected Movie to Shift 20 or Right Footswitch
Shift + Cbr	Cbr 100	100% Crowding Bar
Shift + E	C's	Landoldt Rings
Shift + Cycl	ETDRS	The ETDRS Chart – Pressing SN after toggling will switch between the 3 ETDRS Charts
Shift + R/G	Snellen/LogMar	Toggle between Snellen and LogMAR
Shift + W4D	1 Dot	Single Fixation Dot

.

.

### Keypad Use & Operation

Here are the most common tasks and how to accomplish them with the keypad.

- Switching between tests To switch between tests, for instance moving from Snellen letters to Allen Pictures, press the appropriate test mode button. In this example, pressing Aln will switch to Allen Pictures.
- 2. **Isolating a line** To isolate a single line of optotypes, press the **Line** key. To isolate a vertical line of descending optotypes, press **SHIFT + Line**.
- 3. Isolating a letter To isolate a single optotype, press the SGL button.
- 4. **Randomizing** There are several ways to randomize the display:
  - 1. Press the test mode button again. For example, if you desire to randomize the Snellen letters, simply press **Sn** a second time
  - 2. 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**
  - 3. If working with a single optotype or single line, press the **SGL** or **Line** button a second time
- 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.
- The Optotype Pointer When working in a Line or Vertical Line of optotypes, press the Arrw key to bring up the optotype pointer. Subsequently pressing + and - will move the pointer in either direction. Press any key to remove the pointer.
- Cycling a line or single optotype To randomize a single optotype or line of optotypes at a predetermined rate, press the Cycl key. The row will refresh every several seconds. This works well for adult fixation.

### Keypad Display

The keypad has a four-line LCD display that shows what is currently being displayed on the screen so that focus can be kept on the patient. It shows the current test mode, e.g. Snellen, the measurement, e.g. Feet, and the top-line size, e.g. 20/100. The remaining lines show the size of the line and the optotypes present, e.g 20: TZVECL

SNELLEN	
25: APEOTF	10: ORZSKD
20: TZVECL	
15: OHPNTZ	

Example of Keypad Display

### **Optional Remote Control & Designations**

The wireless remote is used to control the operation of the Smart System PC Plus<sup>®</sup>. The remote control is laid out in logical sections: Tests, Patient Education, Isolation, Additional Tests, and Sizing.



Primary

# Primary Remote Assignments & Functions

10, 15,	Directly select a given acuity level (e.g. 30 = 20/30 Pressing a 2 <sup>nd</sup> time will randomize)
SCI	Displays a single entetype (i.e. letters, numbers, I.EA. Symbols, Allen
JOL	Displays a single oplotype (i.e. letters, numbers, LEA Symbols, Allen Disturce)
	Dienleye a single line of any entetyne
	Displays a single line of any optotype
LINES	3 lines of the same size
VLine	A vertical line of optotypes
В	Blank Screen
LTR	Sloan & Snellen Letters
ALN	Allen Pictures
LEA	LEA Symbols
#'s	Displays Numbers
Arrow	Displays an arrow beneath the first optotype in a single line – vertical or
	horizontal
HOTV	HOTV
CBR	Interaction bars at 50%
E	Tumbling E's
CYC	Adolescent/Older Child Fixation, single optotype (letters, LEA, Allen, and
	Numbers) or single line on screen will randomize at regular timing
	intervals. User can program the timing of the intervals.
R/G	Red/Green
WFD	Worth 4 Dot
FNC	"Shift" Key provides access to less commonly used features
+	Scroll up in size on any optotype
-	Scroll down in size on any optotype
Round 1	Plays Movie #1
Round 2	Plays Movie #2
Round 3	Plays Movie #3

.

.

.

### **Function-Level Remote Control**

Assignments and Functions

Press **FNC**, release, and then press the desired key.

Key-press	Function	Description
FNC + #	On Screen Size	Toggles the Large On-Screen Size Display that
		shows the top-line.
FNC + LTR	ETDRS	Toggles between Snellen and the ETDRS Chart
FNC + CBR	100% Crowding	Switches to 100% Crowding Bars
	Bars	
FNC +	Gross Non-	Dr. Gross Non-accommodative distance fixation
HOTV	Accommodative	target
	Fixation	
FNC + Rnd	Assign Movie 1	Assign Selected Movie to Shift 10 and Left
1		Footswitch
FNC + Rnd	Assign Movie 2	Assign Selected Movie to Shift 15 and Center
2		Footswitch
FNC + Rnd	Assign Movie 3	Assign Selected Movie to Shift 20 or Right
3		Footswitch
FNC + Rnd	Directory	Brings up a list of Movies on the CD – use +/- to
4	Movies	navigate
FNC +	Play DVD	Plays DVD if DVD present If applicable
Random		Displaya Landaldt Dinga
FNC + E	Landoldt Rings	Displays Landoldt Rings
FNC + R/G	Single Fixation	Displays a single fixation dot
	DOL Disal/M/bita	Toggles block ontotypes on white series and white
FNC + Line	black/white	roggies black optotypes on white screen and white
		Exite the software to Windows
	EXIL Dlay Salastad	Exits the solution video from the list. If you wish to
	Flay Selected	show a particular video from the beginning, this is
Allow		the correct function
$ENC \pm 10$	Additional Tests	Eivation disparity and Maddox rod use + and to
	Additional 16313	sten through tests
ENC + 15	ColorCheck	ColorCheck Color Vision Test
FNC + 20	Astigmatic Dial	Displays the Astigmatic dial – use + and – to step
1110 - 20		the pointer-ball around the dial
ENC + 50	Random Dot	Random Dot Stereo – See Appendix
	Stereo	
<b>FNC + 80</b>	Contour Stereo	Contour Stereo - Landolt Rings – See Appendix
FNC + 200	LEA Contour	Distance Stereo
FNC + 400	Retinoscopy F	A red-green screen with a 20/400 F used by some
		doctors for fixation during retinoscopy

# **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<sup>®</sup>, press the appropriate test mode button. In this example, pressing **PIX** will switch to LEA Symbols<sup>®</sup>.
- 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.
- 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.
- Cycling a Line or Single Optotype To randomize a single optotype or line of optotypes at a predetermined rate, press the Cyc key. The row will refresh every several seconds. 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<sup>®</sup> unit.
- 3. Press "z" or "Home" key to enter the configuration.
- 4. Press the "**Media**" button.

MediaSettings							
Ad	d and Assign Mo	vies and Imag	jes.			The Or	der of the Movies can be stomized in this box.
Select Me Mon Ima Pre Loop Me	edia Type vies uges sentation ovies Continuous	Add	Movies t with this Add Mov	to your Lis Button. vies	st	Ta	Movie Groups All  Individual Movie List rget_4
Press Butto Device for FootPedal	on on Desired Assignment. Press here if yo	Device Keyboard	Value 27 sign a Fo	Current None ot Pedal br	Value	Add Selected to Lis	t Waiting Room ca_LASIK ca_Refractive Surgery - Wavefront er_Macular Degeneration
Assign Movie to Device. Assign Clear Assignment	Movie Name Target_4 0 ASCRS 2 0 ASCRS Basic Introdu ca_CS- Catara ca_CS- Inform ca_CS- Microi ca_CS- Microi ca_CS- Microi	uction acts med Consent incision Ph incision Ph	Device Keybo	e Value	P	Remove Selected from List Remove Move Selected Movie in the Box Up or Down	
Clear	ca_CS- Phaco ca_Informed ( ca_LASIK	& Yag Consent			-	Move Up Move	
Screen S	aver Settings	Select		Jpg Time	er (sec)		
					DONE		

- 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).

Here Adding Movie									<b>X</b>
Look in:	퉬 Smart System	1		•	G	ø	Þ	•	
9	Name	Date modif	Туре	Size					
Recent Places	Config								
Desktop	Media OptoImage Quick	в							
0 Kevin									
() Computer									
2									
Network	File <u>n</u> ame:						•		Open
	Files of type:	Video Files (r	n3u avi qt mov mj	pg mp	eg m'	1v wr	n 🕶		Cancel

#### Fixation and Patient Education Movies (Cont'd)

- 8. Click Open.
- 9. The file(s) will copy to the proper Smart System<sup>®</sup> 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.

#### ENABLING VOICE ACTIVATION

- 1. Press the Z or HOME button on the keyboard to access the Main Configu ation screen.
- 2. Click the **Advanced** button in the lower right corner.
- 3. Select Glare and Speech click to place a check mark in the box "Use Speech Commands" the system will default to "Smart System" as the audible command key word. The command word can be changed, but must remain two words.

🖶 AdvancedDynamicConfig		-	×
Acuity Chart Defaults			
Acuity Sizing/Spacing	Glare Control Levels		
Arrow Settings	Low Medium High		
Device Settings			
Glare And Speech	Speech Command Settings		
Image Settings	Audio Confirmation		
MS Study	Smart System Channe Seech Command		
Other			
Tablet Settings			
Video Settings			
User Settings			
AddOns			
	DONE		

- 4. Click **Done** to exit the Advanced Dynamic Config sc een.
- 5. Click **Done** to exit the M&S Main Configu ation screen.
- 6. Restart the software Press the X or END button on the keyboard to exit and relaunch the software.

\* Note – the software must be restarted after enabling voice activation

#### **VOICE COMMANDS**

Speech Commands – Start with "Smart System" then say the word(s) below. Make sure there is at least a 1 second pause after you say Smart System before you do one of the power commands below.

#### Sizing

#### - Size Up

- Size Down
- Size 1 (10)
- Size 2 (20)
- Size 3 (30)
- Size 4 (40)
- Size 5 (50)
- Size 6 (60)
- Size 7 (70)
- Size 8 (80)

- Chart/Letter Functions
- Letters (Snellen)
- Numbers

• Letter Types

- Lea Symbols
- Allen Pictures
- E (Tumbling E)
- HOTV
- Contrast
  - Letter Contrast
  - Contrast Up
- Size 10 (100)

- One Line
- Three Lines

- Contrast Down

#### Other Functions

- Astig Dial, Astigmatic Dial
- Color Check
- Blank

#### Media

- Play Video (Video)
- DVD If applicable

- Chart (back to full chart)

- Single (single character on screen)

- Arrow
- Move Right

- Vertical Line

- Move Left
- Cycle

### - Random

- Red Green

### - Worth Four Dot

- White Dot

- \* Please note: It may be necessary to "train the computer" to better understand you if the speech recognition is not responding as expected. To do so:
- 1. Press the X or END button on the keyboard to exit SmartSystem
- 2. Click the start button and immediately begin typing *Control Panel* as you type windows will begin searching. Click to select the Control Panel.

Destauratel		
Best match	_	
Control Panel App		<u>•</u> :
Apps		Control Panol
🔅 Settings	>	Арр
Search the web		
	>	다 Open
Settings (3)		$\sim$
		Recent
		Speech Recognition
		Devices and Printers
		Sound
		Device Manager
		Uninstall a program
		Credential Manager
		Power Options
		File History
ho  control panel		

3. Inside the control panel click Ease of Access



4. Click Speech Recognition

🚱 Ease of Access		-	×
← → ▾  🚱 > Control Panel > Ea	e of Access v ඊ		
Control Panel Home System and Security Network and Internet Hardware and Sound Programs User Accounts Appearance and Personalization Clock and Region - Ease of Access	Ease of Access Center Let Windows suggest setting:   Optimiter visual display   Replace sounds with visual cues   Change how your mouse works   Optimiter visual display   Replace sounds with visual cues   Speech Recognition   Set Uptiment Provider Provide		

5. Click Train your computer to better understand you

Speech Recognition	-	
← → ▾ ↑ 🖡 « Ease of Access	> Speech Recognition v Ö Search Control Panel	
Control Panel Home	Configure your Speech Recognition experience	0
Advanced speech options Text to Speech	Surface for the second for the second secon	
See also Ease of Access Audio Devices		

#### 6. This will begin the Speech Recognition Voice Training

Follow the prompts through the speech training. Windows will guide you through several sentences that you will speak aloud. As you speak the sentences, Windows will listen and learn your speech patterns. Voice recognition within SmartSystem should be improved upon completion of the voice training. Please restart the SmartSystem software after completing the voice training.

\* Please note the voice training process will take approximately 10-15 minutes to complete.

# System Shut Down

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

- 1. Press **FNC + B** key. The system will exit out of Smart System<sup>®</sup> software and return to the Windows<sup>®</sup> 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.

Size	20 foot	Metric	Decimal
10	20/10	6/3	2.00
12.5	20/12.5	6/3.8	1.60
16	20/16	6/4.8	1.25
20	20/20	6/6	1.00
25	20/25	6/7.5	.80
32	20/32	6/9.5	.63
40	20/40	6/12	.50
50	20/50	6/15	.40
63	20/63	6/19	.32
80	20/80	6/24	.25
100	20/100	6/30	.20
125	20/125	6/38	.16
160	20/160	6/48	.12
200	20/200	6/60	.10
250	20/250	6/75	.080
320	20/320	6/95	.063
400	20/400	6/120	.050

# Customizing the Keypad, Remote Control and Footpedal

Note: Some peripheral controls such as the keypad and footpedal may be dependent on the hardware configuration purchased. The information that follows covers all possible control options for the Smart System software.

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.

	Dev	vice Configuration - Customize Device Fun	ctionality
1.	Currently Selected: Press here if you want	Device Value	Current Function
Availa	ble Functionality: Select Group in that Function Group	, then pick from Available Commands Group. Available Commands	Devices Active in System: Device Reset moved to Advanced Screen.
3.	Assign Contrast General Glare LowVision Media Misc Optotype OptoFunctional Peds Polarized Screen Size Stereo Study Xoma	Astigmatic_Dial_3Para Astigmatic_Dots Astigmatic_Fan Astigmatic_Parallel	Remote/Keypad Layout Types         Wireless Remote       General         Wired Keypad       Pediatric         Clear Custom <ul> <li>Clear Custom</li> <li>Assignments</li> <li>Clear</li> <li>Other Device Settings</li> <li>Stereo Glasses Type</li> <li>Blue</li> <li>FootPedal - Select</li> <li>Type or COM Port</li> <li>Standard PS2</li> <li> </li></ul>
		DONE	

Note: DO NOT change the <u>Layout Type</u> for any of the controllers without instruction from M&S Technical Support (877-225-6101).

- 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).
- 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<sup>®</sup> 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.

Set Letter Chart S	Settings Here	e Chart Will	Automaticall	y Update w	rith Changes on Left	Oefault 1
		Opto Size	Lines Below	Num Chars	Default Chars for Def. 1	
Select Opto Sn	ellen	. 8	0	6	HZOSTV	
Letter Type		10	0	6	ORZSKD	
		15	1	6	OHPNTZ	
Select Opto	20	- 20	2	6	TZVECL	
Size for Editing		25	3	6	APEOTF	
Number Additional		30	4	5	OFLCT	
ince Below Defaul	+ 2	A0	4	5	FZBDE	
Lilles Delow Delau		50	4	5	EGNDH	
Number of		60	3	4	DAOF	
Characters	6	70	3	4	VLNE	
characters		80	2	3	PHT	
		100	2	2	HB	
Random/Default B	ох	125	1	2	DO	
		150	1	1	Α	
Always Rando	om	200	0	1	E	
Never Randor	n	250	0	1	С	
_		300	0	1	F	
Default 1	ZVECLNI	400	0	1	В	
Note: Leave	Def. 2 Blank if	500	0	1	Α	
not to	be used.	600	0	1	E	
Default 2		800	0	1	Н	
Donaute		1000	0	1	Α	
		1250	0	1	К	
Images Listed in this Box will be Used During Runtime A,B,C,D,E,F,G,H,K,L,N,O,P,R,S,T,U,V,Z (Shown in						
Available to be Used						
RESET! Warn	ing: This Rese ages back to t	RESET! Warning: This Reset button will reset DONE				

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

<u>To change the **"Size Display Indicator"**</u> 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

Images Listed in this Box will be Used During Runtime	Bear Bird Cake Jeep Hand Horse House Phone Tree
These are the Images	Bear Bird Cake Jeep Hand Horse House Phone Tree
Available to be Used	

- 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 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, select the Opto Letter Type set by clicking the down-arrow and selecting the set to be modified.
- 2. Each size row can now be individually edited.
- 3. Select Opto Size for Editing by clicking the down-arrow and choosing the size.
- 4. To alter the number of lines shown, in the "Number Additional Lines below Default in Chart" section, 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 for the number of lines shown below the current line. (To have a total of 3 lines shown, set the number to 2).
- 5. To alter the number of letters/symbols displayed on the line, in the "Number of Characters Displayed on Line" section, increase or decrease the number shown. Letters will be added or removed automatically to match the number shown up to 8 across.
- 6. 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 second set of defaults so that a semi-random chart can be presented to patients.
- 7. Repeat steps 4-7 for each Line of the Chart.
- 8. Click Done.
- 9. Click Done.

# Worth 4 Dot Adjustment

To adjust the brightness of the Red, Green or Blue Worth 4 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 **Worth 4 Dot Color Adjuster.**
- 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 should 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<sup>®</sup> provides three methods for measuring distance stereo: Random Dot, Contour Stereo using Rings, and Contour Lea Symbols<sup>®</sup> 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.
- In the Stereo Glasses Type select "Blue" or "Shutter" Note that the dots will not have to be adjusted for shutter glasses – shutter glasses are not available for the All-in-one system.
- 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<sup>®</sup> Symbol Stereo

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

Middle Circle should appear to come out of screen.		
If circle appears fuzzy, press plus. If circle appears inside screen, press minus.		
Press Arrow to start testing		
	0	0

- If the circle appears fuzzy, press Up or +
- If the middle circle is not in front of the two circles and appears behind them instead, 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 the position in the lower right corner (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<sup>®</sup> allows the creation of customized testing protocols, allowing various charts and isolations to be combined into a repeatable protocol. This is 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 <u>M&S Main Configuration Screen.</u>
- 3. Press the **Protocol** button.

Protocol		
Protocol Creation, Selection, and Control Assignment.	Build your Protocol commands in this box. Select your Im Opto Size and Function then Click the Add Button	age Type,
Protocol Name Delete	OptoType/Test Opto Size LinesPerHand	Add Selected to
Protocol 1 ADD Rename	Test_AstigmaticDial	ADD
Protocol 1 Selected Protocol in this List Can be Assigned in the Box Below.	Snellen: Standard_Chart, Size = 40 Snellen: Standard_Chart, Size = 30 Test_AstigmaticDial: Lines Per Clock Hand: 1	Remove Selected from List Remove Move Selected Command in the Box Up Move Up
Press Button on Desired Device Device for Assigning Protocol. Keyboard 4	Value Current Value Pressing this Button Will Reassign Command to	Assign
	DONE	

- 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<sup>®</sup>, 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 steps 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

- 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.

Ad Select Me Mo Ima Pres Mo Loop Me Press Butt Device for Footpedal Assign Movie to Device. Assign Clear Screen S Blank Sci	td and Assign Movies and Images.         edia Type       Add Movies to your Liwith this Button.         ages       Add Movies         ages       Add Movies         esentation       Add Movies         ovies Continuously       Add Movies         on on Desired       Device       Value         Press here if you want to assign a Foot Pedal E       Movie Name       Device         Movie Name       Device       Value       Current         Assignment.       Carset 4       Keyboard 77       0 ASCRS 2         0 ASCRS       Basic       Introduction       ca CS - Cataracts         ca CS - Microincision Pha       ca CS - Microincision Pha       ca CS - Microincision Pha         ca CS - Microincision Pha       ca CS - Microincision Pha       ca CS + Microincision Pha         ca CS - Microincision Pha       ca CS + Microincision Pha       ca CS + Microincision Pha         ca CS - Microincision Pha       ca LASIK       Select	st The Orr cus st Tar Add Selected to List atton. P Remove Selected from List Remove Move Selected Movie in the Box Up or Down Move Move	ler of the Movies can be stomized in this box. <u>Movie Groups</u> All Individual Movie List get_4 Waiting Room ca_LASIK ca_Refractive Surgery - Wavefront er_Macular Degeneration					
	DONE							

## 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 steps 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)

To Add additional Movies, Images, and Presentations

Select Media Type					
Movies					
Images					
Presentation					

- 1. Click the "Radio Button".
- 2. Click the Add button (Add Movie, Add Image, Add Presentation).



- 3. From the Windows<sup>®</sup> Dialog, select the image you wish to copy. You may use a USB "thumb drive" or "portable hard drive".
- 4. Use the Windows<sup>®</sup> 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.

## Assigning Buttons to Display Movies, Images, and Presentations

Any of the Smart System<sup>®</sup> controllers can be programmed to directly play a particular movie, including Images, 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: Movies, Images, or Presentation

Press Button on Desired     Device     Value     Current Value     Add Selected to List       Device for Assignment,     Respond     32     Play_Ilovie       Assign     Press Button,     Add Selected to List       Movie Name     Device Value     P       Assign     0 AscRs     Device Value       Device,     0 AscRs     Device       Device,     0 AscRs     Remove       Device,     0 AscRs     Move from List       Clear     ca, CS- Matronicsion Pha     Nove view       ca, CS- Matronicsion Pha     Move Up       ca, SS- Matronicsion Pha     Move Up       a_ IASTK     Move	Add and Assign Movies and Images. Select Media Type Movies Movies Mages Presentation Loop Movies Continuously	The Order of the Movies can be customized in this box.
Screen Saver 🗸	Press Button on Desired Device Value Current Device for Assignment. Keyboard 32 Play_Mov FoolPada Press here if you want to assign a Foot Pedd Ib Movie Name Assign Movie to ASCRS 2 0 ASCRS 2 Device. Basic Introved Consent ca_CS- Cataracts ca_CS- Microincision Pha ca_CS- Microincision Pha ca_CS- Phace of Yag ca_Informed Consent ca_SSIG Clear Clear CS- Phace of Yag ca_Informed Consent ca_LS- Phace of Yag Screen Saver Settings Screen Saver settings	Adus Add Selected to List Add Selected to List ADD P Remove Selected Move Selected Move Up Move Up Move Up

- 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 steps 3-6 to program additional or Click **Done.**
- 8. Click Done.

In some settings, primarily Pediatric Smart System<sup>®</sup> PC-Plus Systems, 3 assigned movies have been the norm and work via SHIFT + 10, SHIFT + 15, and SHIFT + 20, the three footpedal 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:

Movie Name	Device	Value	Р
Target 4	Keyboar	d 7'	Vone 🔻
0 ASCRS 2			
Basic Introduction	Keyboar	a 31	2
ca_CS- Cataracts		ì	Vone
ca_CS- Informed Consent			

- 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 steps 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.

Function Group	Function			
Astigmatic	Dial			
	Dots			
	Fan			
	Parallel			
	3 Parallel			
Contrast	Contrast_Contrast_Sensitivity			
	Landolt_Contrast			
	SineGrating			
	SineGrating_Protocol			
	ETDRS Contrast			
	Richer Glare Disability Test			
	Harris Contrast			
	Harris Sine Contrast			
	Richer Glare Disability			
Glare	Low			
	Medium			
	High			
General	MINUS			
	MINUS_Control_2			
	PLUS			
	PLUS_Control_2			
Low Vision	Amsler Grid			
	Circle Quadrant Test			
	Dynamic Visual Acuity			
	ELVT			
	Masked_LowVision			
	OneMeter_Testing			

	Low Size Progression
	SineGrating_Contrast
	Masked Low Vision
	One Meter Testing
Media	Assign_Image
	Assign_Video
	Directory_Movies
	Directory_Images
	Directory_Presentations
	Presentation_Play
	Image_General_Group
	Image_Patient_Ed
	Image_Show Specific
	Play_Selected
	WinTV_Play
	WinTV_Reset
	Play_DVD If applicable
	Pause_Movie
	Start_Over
	Language_Select
	Skip_Forward_30_Seconds
Misc	Blank
	Exit_to_Windows <sup>®</sup>
	Change User
	No_Function
	Quick_Custom_Letter
	Toggle_Full_Screen
	Print
	Open_Config_Screen
	RedGreen_E_20_400
	Version_Info
OptoFunctional	Arrow_Display
	Crowding_50_Percent
	Crowding_100_Percent
	Crowding_Line_25_Percent
	Crowding_Line_50_Percent

	Chart_MultiLine					
	Cycle_Interval					
	One_Dot					
	One_Line					
	Randomize					
	Red-Green					
	Single_Char					
	Snellen_Logmar					
	Three_Lines					
	Vertical_Line					
	Vertical_Line_SameSize					
	White_Black_Reverse					
	Worth_4_Dot					
	Verhoeff_Circles					
	Harris Acuity					
Optotype	Allen_Pictures					
	LEA_Numbers <sup>®</sup>					
	ETDRS_Chart					
	Hebrew					
	HOTV					
	Landoldt_Rings					
	LEA_Symbols <sup>®</sup>					
	Sloan_Letters					
	Snellen_Letters					
	Tumbling_E					
	Extra_Numbers					
	Japanese Letters					
Peds	External_Fixation					
Some Features Not	Assign_Movie1					
Available on General	Assign_Movie2					
Systems	Assign_Movie3					
	Play_Movie1					
	Play_Movie2					
	Play_Movie3					
	Phidgets_Port_1					
	Phidgets_Port_2					

	Phidgets_Port_3
	Phidgets_Port_4
	Phidgets_Port_1_and_2
	Phidgets_Port_3_and_4
	Fix_DancingBear
	Fix_NonAccommodative_Target – Dr. Robert Gross' non-accommodative distance fixation target
Polarized	Cross
Some features may	Cross Dot
Require a separate	VLines
Polarized monitor	1Line
	3Line
	Binocular Balance
	Horizontal Coincidence
	Vertical Coincidence
	RG Fixation Disp
	RG Fixation Disp Dot
	RG Fixation Disp Enhanced
	RG Fixation Disp Enhanced Dot
	Phoria
	Worth 4 Dot
Screen	Screen_Monitor_2nd_Distance
	Screen_On_Screen_Size
Size	8
	10
	15
	20
	25
	30
	40
	50
	60
	70
	80
	100
	125

	150
	200
	250
	300
	400
	500
	600
	800
	1000
	1250
	1600
Stereo	Contour
	LEA_Symbols <sup>®</sup>
	Random_Dot
Study	ATS_Hotv_Protocol
	eEDTRS_Protocol
	Dynamic_eETDRS_Protocol
	ColorCheck

.

# **Astigmatic Dial**

Smart System<sup>®</sup> 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** again.

The table below shows the result for each:



# Showing Sizing for each Line

EGNDH 50 FZBDE 40 oFLCT 30 APEOTF 25 TZVECL 20

Smart System<sup>®</sup> PC Plus 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.

			Di	oplay	Cotti						
			U	spiay	setti	iiys			VE	RSION: 2	012.2.6
Distance Fr Bridge of	om the Sci the Patien	reen t's N F1	to th lose r	e IN		Screen Po or Usi	osition - D ng a Mirro	irect r	S	ystem Functi	onality
Feet	Dist 1	16	*	10	+	Direct	~		Edit Letter (	harts and	
O Meters	Dist 2	9	+	10	•	Direct	~		Lines, D Rando	efaults, om,	Letter
Show Opto Bottom Lef Show Opto each Chart	Size in t Sizes for Line		L Ava	ist of ailable Smart	Moni to D Syst	itors 1 lisplay tem.	440x900 Note: For Ac	N.\DISPLAY1 Partial Screen, go to ivanced/Other	Edit Movie O add Image Lis	rdering and Movies to ts.	Media
Timer Setting Blank Scree (minute	gs n Timer es)		c	lick H Pixel	ere t Size	o Adjust y for Prope	our Scree r Display	<sup>n</sup> Display	Create/Edit you can Exe Runt	Protocols cute During ime	Protocol
20	-		W	orth 4	Dot	Controls S	ection		Drogram you	ur Mirologo	
Letter Cycle (Second	e Timer is)	Worth4Dot ColorAdjuster Blue Worth 4 Dot					Choos Choose	Remote, Wir and Foo	Device		
Silent Fixatio (Milli Seco 400	on Timer onds)			Th Re	is Cl vert	neckbox W to Old Sta	/ill ndard		For more set the Advance Butt	ttings press ed Settings on.	Advanced
								DONE	Imp	oort Config Files	Export Config Files

- 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® PC Plus – Contrast Functions**

## **Operation of the Smart System<sup>®</sup> PC Plus Contrast Testing**

### Contrast Control

When the Smart System<sup>®</sup> is in contrast test mode, the left "+/-"keys control the contrast level and the right "+/-" keys control the optotype size.

### Contrast Display

When the Smart System<sup>®</sup> 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.

<u>Contrast Testing with the M&S Smart System<sup>®</sup> PC Plus Letter Contrast Test</u> The M&S Smart System<sup>®</sup> PC Plus Letter Contrast Test uses Sloan Letters. Optotype contrast uses 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 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 of almost yellower appearance than standard monitors that can have values in excess of 165 cd/m2 and 7800K, which result in a brighter bluer image.

**M&S Technologies** 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.

NEC AccuSync 72V LCD Monitor Brightness: 86% Contrast: 40% User Color Settings: R=93, G=67, B=0

NEC Multisync 1770NXM & 1990NXM Brightness: 67.9% Contrast: 50% User Color Settings: R=92.9 G=73.7 17" B=43.5 / 19" B = 34.5

### NEC Mutisync 205WXM 20"

Brightness: 54.0% Contrast: 50% User Color Settings: R=92.9 G=73.7 B=25.5

#### NEC Mutisync 225WXM 22" Brightness: 54.0% Contrast: 50%

Contrast: 50% User Color Settings: R=92.9 G=73.7 B=25.5

### NEC Accusync 224 22"

Brightness: 54.0% Contrast: 50% User Color Settings: R=92.9 G=73.7 B=25.5

### NEC Accusync 221

Brightness: 54.0% Contrast: 50% User Color Settings: R=92.9 G=73.7 B=25.5

# 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).
- 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. Compare and record the higher percentage using the two results. 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)

Patient Name:	Chart:				
Date: / /	Time: : AM PM				
VA OD:	VA OS:				
Pupil Size OD:	Pupil Size OS:				

### Exam should be conducted in dark exam room

	OD		OS	
Beginning Contrast %	Acuity	Contrast %	Acuity	Contrast %
100		100		100
25	20/25		20/25	
8	20/50		20/50	
4	20/100		20/100	
3	20/200		20/200	

Record Contrast % as the last correct value. Compare and record the higher percentage using the two results as directed.

# 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. **The 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 3 out of 5 letters incorrectly. Record the previous value (last line with 3 out of 5 correct).
- 4. Press "-" to reach 0.8%.
- 5. Use "+" to increase the contrast percentage until the patient answers 3 out of 5 letters correctly.
- 6. Record the last line where the patient recorded 3/5 correct.
- 7. Compare and record the higher percentage using the two results. 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)

Patient Name:	Chart:
Date: / /	Time: : AM PM
VA OD:	VA OS:
Pupil Size OD:	Pupil Size OS:

### Exam should be conducted in dark exam room

Size	OD	OS	Norm
Acuity			20/20
20/70			4%
20/50			5%
20/30			10%

.

# Sine Wave Grating Contrast

Contrast testing using Sine Wave Gratings is available in Smart System<sup>®</sup> PC Plus. 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**.



# Integrating with Marco, Topcon and Reichert Automated Refraction Systems

Smart System<sup>®</sup> can be integrated with the Marco 6100, 5100 and 3100 and Topcon KB50/CV5000 and Reichert APRS using CustomLink<sup>®</sup> technology.

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. The chart "projector" selected on the CV5000 can be set in the M&S Advanced Configuration's *Other* tab:



### Example

Marco can be wireless or wired for the 6100, 5100 and 3100. The integration kit can be ordered by contacting M&S Technologies. 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. The current *Chart Type* for the 5100 and 3100 is SC2000 Type M, and for the 6100 SC1600 Type M.

The Reichert APRS can either use Bluetooth or a cable. The integration requires a software update and hardware available from M&S Technologies and Reichert. Please contact Technical Support for additional assistance.

# **ATS-HOTV and eETDRS<sup>™</sup> Protocols**

Smart System<sup>®</sup> can run both the ATS-HOTV and eETDRS 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 randomly presents 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 the patient 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 optotypes, the visual acuity will be the last line where the patient responded with three out of four correct answers.

## ATS-HOTV and eETDRS Protocols (Cont'd)

### eETDRS Algorithm

The eETDRS 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 begin 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 responses by logMAR level is also presented for review.

Note that the crowding is "100% crowding" where the bars are one full optotype width from the next optotype.

# Assigning a Screen Saver

Smart System<sup>®</sup> 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<sup>®</sup> screen-savers should be utilized, which includes system screen savers. The screen saver can be:

- Blank Screen The traditional blank screen
- Windows<sup>®</sup> Screen Saver Choose any of the Windows<sup>®</sup> Screen Savers
- JPG Directory Play Pick a presentation folder to cycle through allowing customized marketing and education for your practice

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<sup>®</sup> 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<sup>®</sup> 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 **LowVision | Masked\_LowVision** 

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



### **One Meter Testing**

Smart System<sup>®</sup> now allows one meter testing for Low-Vision patients, greatly increasing the range of sizes available to 20/1600. 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 LowVision | One\_Meter\_Testing

## eLVT<sup>™</sup> - Electronic Low Vision Testing

Smart System<sup>®</sup> has the eLVT protocol developed to allow vision testing to 20/16000 using a protocol based on eETDRS. 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 **LowVision | ELVT** 

The test begins at 4 meters or configured calibration distance with standard eETDRS. If the patient cannot see the optotypes, the patient is moved to 1 meter and eETDRS is tried again. If the patient cannot see letters, Tumbling E's are attempted. If the patient cannot see Tumbling E's at 1 meter, the patient is moved to a distance of about 25 cm (the system will provide the exact distance based on monitor resolution) and E's are attempted again. If E's are not able to be seen at 25 cm, grating acuity is attempted. If any of the above are able to be resolved, the protocol continues and attempts smaller sizes or high spatial frequencies and will provide a equivalent Snellen Visual Acuity up to about 20/16000.

If the patient is unable to perform the grating acuity test, a White Field Projection (quadrant test) and Black White Discrimination (hemisphere) Test is performed to see if the patient can resolve black and white. The tests will then provide results showing where the patient has some ability to resolve black and white.

Test Complete	WFP Test Complete
Visual Acuity Grating Acuity at 21 cm 2.80 20/12500 5 of 5 2.70 20/10000 0 of 5	Basic Vision Function Tests at 21 cm         White Field Projection (WFP) Quad Field RESPONSES         Target Orientation Correct Partial Correct Incorrect         DL       X       X         UR       X       X         DR       X       X         UL       X       X         Totals       6       0       2
	White Field Projection (WFP)           Hemi Field         RESPONSES           Target Orientation         Correct         Partial Correct Incorrect           D         X         X
	U X X
Score by letter (0.02 per letter)	R X X
Grating Acuity LogMAR = 2.8 20/12500	L X X
Score by row (Criterion = 3 of 5) Grating Acuity LogMAR = 2.80 20/12500	Totais 5 0 3
	Press Plus '+' for Black White Discrimination test
Press 'SN' for main screen	Press 'SN' for main screen
Grating Acuity	White Field Projection

# **Advanced Configuration**

There are many aspects of the Smart System<sup>®</sup> that can be set using the Advanced Configuration.

- 1. Using the Keyboard & Mouse, press the "**Home**" key (near page up and page down) to open the Main configuration.
- 2. Click the **Advanced** button.

,,					
Acuity Sizing/Spacing	Acuity Chart On Startup Select Default ACUITY Type on Startup	Snellen	~	Opto Functional - Single On Single Character, show first default	
Arrow Settings	Cycle Functional Behavio	ur		on line before Random. Sgl button on Allen is Alphabetical	
Device Settings	Select Cycle Chart Default	All	~	Opto Functional - Crowding	
Glare Levels	Contrast and Stereo Select Custom Contrast			Crowding Bars	
Image Settings	Opto Type Select Custom Stereo	Sloan Lea	~	Percent     Opto Functional - Other	
MS Study	Select Contrast Startup Mode	Single	~	Maintain Chart Format on Optotype Change	
Other				Remain Same Size	
Tablet Settings	Select Specific Letter	0	¥	Use Red-Green Button As On/Off Toggle	
Video Settings	Select Specific Size	50	*	for Size Change	
User Settings					

- 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. Contrast & Stereo
    - 1. Select Custom Contrast Optotype: allows the contrast test to use Sloan or other available optotypes.
    - 2. Select Customer Stereo Optotype: allows the stereo test to use LEA Symbols<sup>®</sup> or other optotypes for stereo measurements.
    - 3. Single Letter Test
      - a) It is possible to have a particular letter at a particular size be available via the remote control (e.g. a 20/40 "O") – set this to pick the letter and size.
  - 4. 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.

- 5. To "Maintain Chart Format on Optotype Change" or to stay in a line when moving between Snellen and Allen, check this box.
- 6. "Allow Adjustable Crowding Bars" is a research tool.
- 7. Show Crowding Percent will show whether the bars are 50% or 100%.
- 8. 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.
- 9. Binocular Testing Line is for use with autophoroptors.
- 10. Use Red-Green Button as On/Off Toggle. It allows the Red/Green mask to be enabled/disabled with the R/G button default behavior is randomization of the chart.
- 4. The Acuity Sizing/Spacing allows several chart changes

•	AdvancedDynam	nicConfig – 🗆 🗙
Acuity Chart Defaults		
Acuity Sizing/Spacing	Opto Sizes to be Excluded	Acuity Size On Software Startup
Arrow Settings	Selection Exclude	Select Default Size on Startup
Device Settings	Add	Auto-Accommodate
Glare Levels	Remove	Auto-Adjust for Accommodation by Distance
Image Settings		Break-Spacing-Rules
MS Study	Chart Spacing	✓ Allow Letters Closer to Edge Of Screen
Other	⊖ Log	Astigmatic Dots - Acuity Size Equivalent
Tablet Settings		Select Size for DEFAULT v
Video Settings		
User Settings		
	DONE	

- 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.
- 4. Auto-accommodate should only be used with the direction of M&S Technical Support.
- 5. Allow Letters Closer to edge of screen permits letters to approach the edge of the screen by default, an optotype width of separation is kept.
- 6. The Jackson Cylinder/Dots default sizing can be adjusted.

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

•	AdvancedDynamicConfig	- 🗆 🗙
Acuity Chart Defaults		
Acuity Sizing/Spacing	Arrow Button Behavior Arrow Sizing (% letter)	
Arrow Settings	On/Off Switch     Always Moves Right	
Device Settings	Arrow Remains In Position	
Glare Levels	Arrow Remains on Acuity Size Change	
Image Settings		
MS Study		
Other		
Tablet Settings		
Video Settings		
User Settings		
	DONE	.н

- 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 3<sup>rd</sup> character. If the size of the chart is changed, the arrow will still point to the 3<sup>rd</sup> character.
- 3. The Size and Spacing of the arrow can be adjusted.
- 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 EHR, 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. All other use should be with M&S Technologies Technical Support.

7. The Glare Levels screen should only be used with M&S Technical Support.

	AdvancedDynamicConlig	
Acuity Chart Defaults		
Acuity Sizing/Spacing	Glare Control Levels	
Arrow Settings	205 ÷ 180 ÷ 0 ÷	
Device Settings		
Glare Levels		
Image Settings		
MS Study		
Other		
Tablet Settings		
Video Settings		
User Settings		
	DONE	

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. The color for Fixation Disparity can be selected Green or Blue, Shutter or Polarized. The Linear Sine Grating Protocol settings can be adjusted for the time the presentation is on-screen and as well for all spatial frequencies or Critical (1.5, 3 and 6 cpd). The Contrast settings can be adjusted for the monitor or All-in-one unit.

•	AdvancedDynamicConfig – 🗆	×
Acuity Chart Defaults		
Acuity Sizing/Spacing	Astigmatic Dial - Num Non Accommodative Circle	
Arrow Settings	Arms per Clock     Stay in Middle       2     Image: Clock of the second secon	
Device Settings	Fixation Disparity Color	
Glare Levels	Green Color     Shutter Glasses     Blue Color     Polar Glasses	
Image Settings	Linear Cantrast Satiana	
MS Study	5.0     Interval in Seconds (Image shown on screen)     LenovoM72Z	
Other	Critical (3)  All (5)	
Tablet Settings	Critical skips 18 and 12 CPD     Linear Contrast Glare Level       Save Results (arrow)     O Low <ul> <li>Medium</li> <li>High</li> </ul>	
Video Settings	IDocuments Save Directory	
User Settings		
	DONE	

9. The MS Study screen determines if the separate program for Jaeb Center studies should be used. The choice is grayed-out if software is not present. The test distance can be selected to be either Distance 1 or Distance 2 from the Main configuration. Dynamic Visual Acuity speed can be adjusted. The Richer Glare Disability test settings can be adjusted for timing and contrast. The Harris Protocol for Contrast and Acuity timing can be adjusted.

<b>.</b>	AdvancedDy	namicConfig			- □	×
Acuity Chart Defaults						
Acuity Sizing/Spacing	MS Study Program	Richer Glare Dis	ability Test			
Arrow Settings	✓ Use External MS Study: E-Etdrs and ATS Protocols	Starting Contrast	Glare Light On (ms)	Target On Screen (ms)		
Device Settings	Select Distance Associated with E-Etdrs and ATS	Settings				
Glare Levels	O Distance 2 (9.8 ft)	Image Time	e (ms) Blan ÷ 5	k Between (ms) 00 📮		
Image Settings	Dynamic Visual Acuity					
MS Study	The speed of DVA is based on and other Applications running	your processor on your system				
Other	Slow Processor     Mu     Fast Processor	lti-Directional				
Tablet Settings						
Video Settings	Dynamic Visual Acuity CM Per Second	3.0 🛓				
User Settings						
	DONE					

10. The **Other** screen controls the behavior of the Windows<sup>®</sup> Task bar and should only be used with assistance from Technical Support. The Delay of the software to allow Windows<sup>®</sup> to load can be adjusted from 0 to 60 seconds. The other items are for M&S Technical Support.

	AdvancedDyna	micConfig		>
Acuity Chart Defaults				
Acuity Sizing/Spacing	Hide Task Bar	Partial Screen	Settings	
Arrow Settings	on Startup	0	1440 <del>•</del>	
Device Settings	Delay Start - Seconds Delay USB Detector Drivers	Left	900 ÷	
Glare Levels	on Startup to Allow Time for Windows to Load First			
Image Settings	0 ~			
MS Study	Phoropter Settings Random on KB Chart Double-Click			
Other	Play Balloons Video instead of Phoropter Parallel Lines			
Tablet Settings	Select KB v			
Video Settings				
User Settings				
	DONE			

- 11. The **Tablet Settings** Screen allows the tablet layout to be customized to the doctor's preferences. Buttons can be added, deleted and renamed and additional tabs can be created. For additional information, consult the separate instructions for the tablet.
- 12. 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. If applicable
- 13. The **User Settings** allows multiple doctors to maintain different configurations such as assigned buttons on the remote, tablet or keypad, or separate Patient Education lists. Each user name can be added and buttons assigned will switch between users. Once added, any configuration changes will only affect the user currently in usage.

	AdvancedDynamicConfig – 🗖
Acuity Chart Defaults	
Acuity Sizing/Spacing	Users On Smart System
Arrow Settings	Create, Remove Users for this System. User in Top Position is Default on Startup Users
Device Settings	New User
Glare Levels	Add
Image Settings	
MS Study	User on Startup
Other	Assign
Tablet Settings	
Video Settings	
User Settings	
	DONE

# **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 answer is recorded. The protocol then goes up 0.2 log units and will 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 answer. 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. Select the age as prompted.
- 4. If the Glare testing is in use, select to use Glare.



5. The Instructions will be shown on screen:



- 6. 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
  - e. OR Up A is correct | Down is Incorrect
- 7. Press any direction on the remote to continue and begin the protocol.

### Sine Grating Protocol Use (Cont'd)

8. 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.



- 9. Once complete, the test will commence and test the user at 18 cpd, 12 cpd, 6 cpd, 3 cpd and 1.5 cpd.
- 10. 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
- 11. The results will be displayed for recording. The results will also be saved to a comma delimited file for later review.
- 12. Press any key to leave the protocol.



## M&S Contrast Sensitivity Function Test Results

## **Enhanced Fixation Disparity Test**

Developed with Dr. David Kirschen, OD, PhD the Enhanced Fixation Disparity Tests provide an accurate assessment of fixation disparity either with or without the central dot.

### How to perform a Fixation Disparity measurement

- 1. Have the patient wear his/her best distance glasses
- 2. Put the R/B glasses (supplied with the M&S FD test) over their glasses (if the patient doesn't wear glasses for distance vision then just wear the R/B glasses)
- 3. Push the assigned button on the remote control to activate FixationDisp Enhanced (For assistance in programming the remote buttons, see the Appendix below).



- 4. Choose from the menu **Horizontal-Move Bottom (OS)** for horizontal FD measurements.
- 5. Instruct the patient to continuously look at the bottom of the top line and tell you which way the bottom line has to be moved to be aligned with the top line (left or right).
- Push the + or button on the remote to move the bottom line either right or left until the patient reports that the lower line is aligned with the top line. (The rightside + and – button (up/down) is used for large movements and the left-side +

and - button is used for small or finer movements of the line.)



- 7. When the patient says that the upper and lower lines are aligned push the **Arrow** button.
- 8. The answer in arc-minutes is displayed on the screen. Record the result.



- 9. Push the Arrow button again to return to the main menu.
- 10. Repeat the procedure for **Vertical** FD by selecting the appropriate choice from the menu.
- 11. If you prefer to have the patient fixate with the left eye, choose **Horizontal-Top Line moves (OD)** and repeat steps 5-8 above. When selecting this option, instruct the patient to continuously look at the top of the bottom line.
## Fixation Disparity measurements using the central dot

1. Push the assigned button on the remote control to activate FixationDisp Enhanced\_Dot (For assistance in programming the remote buttons, see the Appendix below).

Select the type of Fixation Disparity test to be performed
Push ± to change selection
Push ARROW key to start
Horizontal Vertical

- 2. Select Horizontal or Vertical from the menu.
- 3. Instruct the patient to always look at the central white dot and tell you to move the upper line to the left or the right so that the upper line is aligned with the white dot.
- 4. Push the + or button (up/down) on the hand controller to move the line the desired amount.
- 5. When aligned, push the **Arrow** button.
- 6. Then ask the patient which way the lower line has to be moved to line up in the center (left or right).
- 7. Push the + or button (up/down) until the lower line is lined up with the center dot.
- 8. Push the **Arrow** button to display the answer in arc-minutes on the screen. Record the answer.



- 9. Push the **Arrow** button again to return to the main menu.
- 10. If you wish to measure the monocular components of vertical FD, repeat steps 3-8 above after selecting **Vertical** FD from the menu.

#### How to plot a Ogle Forced Vergence Curve

- 1. Have the patient wear his/her best distance glasses.
- 2. Put the R/B glasses (supplied with the M&S FD test) over his/her glasses (if the patient doesn't wear glasses for distance vision then just wear the R/B glasses).
- 3. Push the assigned button on the remote control for FixationDisp Enhanced (For assistance in programming the remote buttons, see the Appendix below).
- 4. Choose from the menu Horizontal-Bottom line moves (OS) for horizontal FD measurements.
- 5. Instruct the patient to continuously look at the bottom of the top line and tell you which way the bottom line has to be moved to be aligned with the top line (left or right).
- Push the + or button on the remote to move the bottom line either right or left until the patient reports that the lower line is aligned with the top line. (The right +and – button is used for large movements and the left + and – button is used for small or finer movements of the line.)
- 7. When the patient says that the upper and lower lines are aligned, push the arrow button and the answer is displayed on the screen. Record the result on the graph.
- Put a 2pD Base In prism in front of the patient's left eye and repeat steps 5-7 above. Continue to add Base In prism and make measurements until there is either:
  - a. A significant increase in Eso FD or
  - b. A break down in binocular vision (suppression or diplopia)
- Now add Base Out prism in front of the patient's left eye and repeat steps 5 thru 7 above. Continue to add Base Out prism and make measurements until there is either:
  - a. A significant increase in Exo FD or
  - b. A break down in binocular vision (suppression or diplopia)

# Programming the Enhanced Fixation Disparity features to the remote control or keypad

If the remote control isn't pre-set with the new Enhanced Fixation Disparity functions, perform the following steps.

- 1. With Smart System running, press the HOME key on the computer keyboard
- 2. Click **Device** button
- 3. On Device Configuration
  - a. Choose the button on the remote you wish to use and press it for example #2 on the remote (Left on Round Button) or a SHIFT+Button on the keypad
  - b. In Section 2, in the left column *Function Group* choose *Polarized Type Tests*
  - c. In the right column, Available Commands, choose
    - For tests without the Dot: **RG\_FixationDisp\_Enhanced**
    - For tests with the Fixation Dot: RG\_FixationDisp\_Enhanced\_Dot



- d. In Section 3, click Assign Command
- e. Repeat steps a-e for the other test if desired
- f. Click Done
- 4. Click Done

#### Setting Red-Green or Red-Blue Glasses

Fixation Disparity can use either Red-Green or Red-Blue glasses or lenses in the refractor head. To choose, follow these steps:

- 1. With Smart System running, press the **HOME** key on the computer keyboard
- 2. Click Advanced button
- 3. Choose *Image Settings* tab
- 4. In the box *Fixation Disparity Color*, choose either Green or Blue Shutter and Polar are reserved for future use.

Acuity Chart Defaults	
Acuity Sizing/Spacing	
Arrow Settings	Astigmatic bial - Num Arms per Clock Stay in Middle D D Clock Stay in Middle
Device Settings	
Glare Levels	Disparity Fixation Color
Image Settings	
MS Study	Linear Contrast Settings Contrast Levels by Monitor
Other	5.0 + Interval in Seconds NEC221 v
Tablet Settings	Critical (3)   All (5) Critical skips 18 and 12 CPD
Video Settings	Linear Contrast Glare Level
User Settings	○ Low
AddOns	

- 5. Click **Done**
- 6. Click Done

## Harris Visual Acuity Test

The Harris Visual Acuity Test was developed by Paul Harris, OD, FCOVD, FACBO, FAAO Associate Professor of Optometry at Southern College of Optometry, to quickly measure very specific visual acuities in between the normal increments (e.g. 20/170). The test will need to be assigned to a button on the remote control following the steps in the Appendix Section *Customizing the Keypad, Remote Control and Footpedal.* The *Function Group* is **OptoFunctional** and the *Function* is **Harris Acuity**.

- 1. Press the assigned button on the remote control
- 2. The test begins

	HARRIS VISUAL ACUITY	
	Starting Acuity Size: 8	
	Push left ± to change Acuity Size	
	Push ARROW key to start	
2	Chasses a starting souity size using the L	
3.	point	p/Down +/- buttons – 20/8 is the default starting
4	Dread the ADDOM butter to be give	

- 4. Press the ARROW button to begin
- 5. The test presents a single letter
- 6. Press Up (+) until the patient gets the answer correct the test goes up in standard size increments (10, 15, 20, etc)
- 7. When the patient gets the correct answer, press Down (-)
- 8. The letter is reduced to the next smaller line size
- Press Up (+) until the patient gets the answer correct the test goes up in single increments (10, 11, 12, 13, etc). At larger sizes the test will move in 5's, 2's and then 1's as the patient gets closer to the true visual acuity
- 10. Press Arrow when complete to view the final size

HARF	RIS VA: 22
Corre	ct Answer:
Press (+) if Correct	to return to Main Menu

## Harris Contrast Test

The Harris Contrast Test was developed by Paul Harris, OD, FCOVD, FACBO, FAAO Associate Professor of Optometry at Southern College of Optometry, to quickly measure very specific contrast sensitivity function. The test will need to be assigned to a button on the remote control following the steps in the Appendix Section *Customizing the Keypad, Remote Control and Footpedal.* The *Function Group* is **Contrast** and the *Function* is **Harris Contrast**.

- 1. Press the assigned button on the remote control
- 2. The test begins



- 4. Choose the starting contrast percentage using the Right Up/Down +/- buttons
- 5. Press the ARROW button to begin
- 6. The test presents a single letter
- 7. Press Up (+) until the patient gets the answer correct the contrast increases in 0.3 log unit steps
- 8. When the patient gets the correct answer, press Down (-)
- 9. The letter contrast is reduced by 0.3 log steps
- 10. Press Up (+) until the patient gets the answer correct the test goes up in 0.1 log steps
- 11. Use Up/Down to verify the results
- 12. When ready for result, press Arrow when complete to view the final contrast percentage

## Harris Sine Contrast Test

The Harris Sine Contrast Test was developed by Paul Harris, OD, FCOVD, FACBO, FAAO Associate Professor of Optometry at Southern College of Optometry, to quickly measure very specific contrast sensitivity function using sine wave gratings with a Gabor patch. The test will need to be assigned to a button on the remote control following the steps in the Appendix Section *Customizing the Keypad, Remote Control and Footpedal.* The *Function Group* is **Contrast** and the *Function* is **Harris Sine Contrast**.

- 1. Press the assigned button on the remote control
- 2. The test begins



- 3. Choose a starting Cycles/Degree size using the Left Up/Down +/- buttons
- 4. Choose the starting contrast percentage using the Right Up/Down +/- buttons
- 5. Press the ARROW button to begin
- 6. The test presents a sine grating



- Press Up (+) until the patient gets the answer correct the contrast increases in 0.3 log unit steps
- 8. When the patient gets the correct answer, press Down (-)
- 9. The letter contrast is reduced by 0.3 log steps
- 10. Press Up (+) until the patient gets the answer correct the test goes up in 0.1 log steps
- 11. Use Up/Down to verify the results
- 12. When ready for result, press Arrow when complete to view the final contrast percentage



Color vision deficiency (CVD) is the inability or decreased ability to see color or perceive color differences under normal lighting conditions. In the US, about 7% of the male population and 0.4% of the female population either cannot distinguish red from green, or see red and green differently from how others do. More than 95% of all variations in human color vision involve the red and green receptors. Only a very small percentage of the population is "blind" to the blue end of the color spectrum.

Inherited CVD can be congenital, or it can develop later on in childhood or adulthood. Depending on the mutation, it can remain the same throughout a person's lifetime or progress.

Other causes of color deficiencies include accidents and other trauma which produce swelling of the brain in the occipital lobe, damage to the retina caused by exposure to ultraviolet light, and substance toxicity (antibiotics, chemical solvents, etc.).

CVD may also present itself in the spectrum of degenerative diseases of the eye, such as age-related macular degeneration, and as part of the retinal damage caused by diabetes.

**ColorCheck** for Smart System<sup>®</sup> is the Color Vision Testing System from M&S Technologies.

It screens for Red, Green and Blue (Protan, Deutan and Tritan) color deficiencies in an easy-to-use, patient-driven protocol. Much like the traditional books, ColorCheck presents a series of pseudo-isochromatic plates for the patient to identify the number or symbol shown.

- Launch ColorCheck by pressing the assigned button on the remote control or keypad. In version 2013.4 and higher, this is FNC + 15. If the older plates are shown, please follow the instructions at the end of this document to assign a button for ColorCheck.
- 2. ColorCheck will build test plates dynamically so that patient memorization is impossible.



 Select Adult (Numbers) or Pediatric (Lea Symbols) – the top two choices are automated protocols; the bottom two choices are manual and can be changed like flipping pages in a book:

ADULT
PEDIATRIC
Adult -manual
Pediatric -manual
Press Arrow to Begin

- 4. Use the Up/Down buttons to select
- 5. Press the Arrow button to commence testing

6. An example plate will appear – this will also screen for malingerers:



7. The patient will be presented with choices and selects an answer:

Select your answer.	
Blank	
5 4	
8 9	
6 9	
3 7	
3 1	
Press Arrow to Enter	

- 8. Use the Up/Down buttons to select an answer
- 9. Press the Arrow button to select and enter the choice
- 10. The user is prompted to "Get Ready" in anticipation of the next plate.
- 11. The plate is displayed and will stay on the screen for 3 seconds.



- 12. Again, the user will be presented with answer choices and should select the number or symbol that matches what he/she saw, or *Blank* if he/she saw nothing on the plate.
- 13. Several of the plates have color combinations that will be seen more clearly by those with deficiencies than those with normal color vision.
- 14. An example of a Pediatric plate:



15. The final phase of the test screens for Blue (Tritan) deficiencies (Adult Only).



16. The conclusion of the test will show the patient results:



17. Press the Arrow button to return to ColorCheck main screen or **LTR** to return to eye chart.

## **Running a Manual Color Test**

ColorCheck may be run manually in a similar manner to the traditional books. This may be useful for a quick screening where the entire automated protocol may not be needed.

- Launch ColorCheck by pressing the assigned button on the remote control or keypad. In version 2013.4 and higher, this is FNC + 15. If the older plates are shown, please follow the instructions at the end of this document to assign a button for ColorCheck.
- 2. ColorCheck will build test plates dynamically so that patient memorization is impossible.



 Select Adult (Numbers) or Pediatric (Lea Symbols) – the top two choices are automated protocols; the bottom two choices are manual and can be changed like flipping pages in a book. Select Adult or Pediatric Manual.

ADULT	l
PEDIATRIC	I
Adult -manual	I
Pediatric -manual	I
Press Arrow to Begin	J

4. Use the Up/Down buttons to select - to run a manual test choose "manual"

- 5. Press the Arrow button to commence testing
- 6. An example plate will appear this will also screen for malingerers:



7. Press the Arrow button to move through the plates



8. At completion, press the Arrow button.

## LICENSE AGREEMENTS

#### M&S<sup>®</sup> Technologies ("MST")

#### End User Non Web-Based Software License Agreement

Please read this License Agreement and the other license agreements and warranty agreements, if any, accompanying your MST computer system before using any of the non web-based software provided with and as part of the MST computer system. By using the software, you are agreeing to be bound by the terms of the applicable license agreements and warranty agreements. There may be software products included as part of this MST computer system which are governed by separate agreements contained within this MST computer system. Any non web-based software contained as part of the MST computer system that is not governed by a separate applicable agreement is governed by this License Agreement ("MST Software"). If you do not agree to these terms, or the terms of any other agreements contained in the MST computer system, promptly return the MST computer system and all enclosed material (including software) to the place where you purchased it for a full refund.

**Limited License.** The MST Software is licensed to you, the Licensee ("Licensee"), by MST ("Licensor"). The copyrighted MST Software and copyright to the printed information contained in this package is and shall remain the intellectual property of MST and/or its suppliers. This License granted to Licensee is a non-exclusive right to use the MST Software on a single computer system. Licensee may make one copy of the MST Software for backup or archival purposes.

**Restrictions on Use.** The MST Software contains copyrighted material, and in its human readable form it contains trade secrets and proprietary information owned by or licensed to MST. Licensee may not de-compile, disassemble or otherwise reduce it to human readable form. Licensee may not modify, rent, lease, loan or distribute copies of the MST Software. Licensee may not modify or create derivative software based upon any trade secret or proprietary information of MST or its suppliers. Licensee further acknowledges that this Limited License is not a sale of MST intellectual property (including the MST Software) contained on the MST computer system and that MST and/or its suppliers continue to own title to the MST Software and copyright to the printed information even upon termination of this Limited License Agreement. Licensee may not remove any proprietary notices or labels on or in the MST Software.

**Notice.** The MST Software may be licensed or transferred by MST to an Authorized Distributor ("AD"). An AD is granted a Distribution License to distribute the MST Software according to the terms and conditions of a separate AD Agreement. If no AD Agreement/Distribution License is in place with MST, a user/possessor of the MST Software has no right to distribute, sell, sublicense or use the MST Software as defined in the paragraph above entitled Restrictions on Use.

**Termination.** This License shall remain in full force and effect unless and until terminated. This License will terminate immediately, automatically and without notice if Licensee fails to comply with any provision of this agreement. Upon termination, Licensee must stop using the MST Software, erase or destroy all copies of the MST Software, and destroy all printed information provided with the MST Software.

Hardware Limited Warranty. Hardware Limited Warranty is included in Licensee's MST computer system package.

**MST Software Limited Warranty**. If Licensee purchased the MST Software from M&S Technologies, or one of its AD's, M&S warrants that the MST Software is substantially free from defects in materials or workmanship. ANY AND ALL OTHER WARRANTIES, STATUTORY OR OTHERWISE, WITH RESPECT TO THE SOFTWARE AND THE ACCOMPANYING WRITTEN MATERIALS, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY EXPRESSLY DISCLAIMED. This software limited warranty is void if failure of the MST Software has resulted from accident, abuse, neglect or misapplication by the Licensee or their agents.

**End User Exclusive Remedy.** If a defect in the MST Software appears while in use on a single hardware device, Licensee may return the software to M&S Technologies for replacement with the same version of software, or, if so elected by M&S Technologies refund of amounts paid by Licensee under this License Agreement. Licensee agrees that the foregoing constitutes Licensee's sole and exclusive remedy for breach by M&S Technologies, of any warranties made under this Agreement. EXCEPT FOR THE WARRANTIES SET FORTH ABOVE, THE MST SOFTWARE ARE LICENSED "AS IS", AND M&S TECHNOLOGIES DISCLAIMS ANY AND ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTIBILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Limitation of Liability. IN NO EVENT WILL MST OR ITS AD'S BE LIABLE FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL, ECONOMIC, COVER, EXEMPLARY, PUNITIVE OR INDIRECT DAMAGES (INCLUDING WITHOUT LIMITATION LOSS OF PROFITS, BUSINESS, GOODWILL, DATA, TIME OR COMPUTER PROGRAMS) ARISING OUT OF LICENSEE'S USE OR INABILITY TO USE THE SOFTWARE OR PRINTED INFORMATION CONTAINED THEREIN, WHETHER OR NOT MST HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH LOSS, HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY. THIS EXCLUSION INCLUDES ANY LIABILITY THAT MAY ARISE OUT OF THIRD-PARTY CLAIMS AGAINST LICENSEE. THESE LIMITATIONS SHALL APPLY NOTWITHSTANDING ANY FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY. IN NO EVENT WILL M&S TECHNOLOGIES LIABILITY EXCEED THE AMOUNT PAID BY LICENSEE FOR THE MST SOFTWARE REGARDLESS OF THE FORM OF CLAIM (INCLUDING, WITHOUT LIMITATION, ANY CONTRACT, PRODUCT LIABILITY, OR TORT CLAIM).

**Export Law Assurances**. Licensee agrees that the MST Software and other technical information, both printed and verbal, received from MST will not be exported outside of the United States except as permitted by the laws and regulations of the United States. If Licensee rightfully obtains the MST Software and MST technical information outside of the United States, Licensee agrees not to re-export the MST Software and information except as permitted by the laws and regulations of the United States. Licensee agrees not to re-export the MST Software and information except as permitted by the laws and regulations of the United States and the jurisdiction in which Licensee obtained the MST Software.

**US Government Use.** Use, duplication or disclosure of the MST Software by the U.S. Government is subject to "Restricted Rights", as that term is defined in the Department of Defense ("DOD") Supplement to the Federal Acquisition Regulations ("DFARS") in paragraph 252.227-7013(c)(1)(ii) if to the DOD, or, if the MST Software is supplied to any unit or agency of the U.S. Government other than DOD, the Government's rights in MST Software shall be as defined in subparagraphs (c)(1) or (c)(2) of FAR 52.227-19, Commercial Computer software -Restricted Rights; or FAR 52.227-14, Rights in General Data Alternative III, as applicable. Contractor: M&S Technologies, 5715 W. Howard Street, Niles, IL 60714.

**Entire Agreement.** This agreement constitutes the entire agreement between Licensee and MST and supersedes any other prior agreements or communications regarding the MST Software. If any provision of this agreement is held invalid, the remainder of this agreement shall continue in effect.

#### M&S<sup>®</sup> Technologies ("MST")

#### End User Web-based Software ("WBS") License Agreement

Please read this WBS License Agreement and the other license agreements and warranty agreements, if any, accompanying your MST computer system before using any of the software provided with and as part of the MST computer system. By using the WBS, you are agreeing to be bound by the terms of the applicable license agreements and warranty agreements. There may be software products included as part of this MST computer system which are governed by separate agreements contained within this MST computer system. Any software contained as part of the MST computer system that is not governed by a separate applicable agreement is governed by this WBS License Agreement. If you do not agree to these terms, or the terms of any other agreements contained in the MST computer system, promptly return the MST computer system and all enclosed material (including software) to the place where you purchased it for a full refund.

**Limited License.** The WBS is licensed to you, the Licensee ("Licensee"), by MST ("Licensor"). The copyrighted WBS and copyright to the printed information contained in this package is and shall remain the intellectual property of MST and/or its suppliers. This License grants to Licensee a non-exclusive right to use the WBS on a single computer system. Licensee may make one copy of the WBS for backup or archival purposes.

**Restrictions on Use**. The WBS contains copyrighted material, and in its human readable form it contains trade secrets and proprietary information owned by or licensed to MST. Licensee may not de-compile, disassemble or otherwise reduce it to human readable form. Licensee may not modify, rent, lease, loan or distribute copies of the WBS. Licensee may not modify or create derivative software based upon any trade secret or proprietary information of MST or its suppliers. Licensee further acknowledge that this Limited License is not a sale of MST intellectual property (including the WBS Software) contained on the MST computer system and that MST and/or its suppliers continue to own title to the WBS and copyright to the printed information. Licensee may not remove any proprietary notices or labels on or in the WBS.

Notice: The WBS may be licensed or transferred by MST to an Authorized Distributor ("AD"). An AD is granted a Distribution License to distribute WBS according to the terms and conditions of a separate AD Agreement. If no AD Agreement Distribution License is in place with MST, a user/possessor of the WBS has no right to distribute, sell, sublicense or use the WBS as defined in the paragraph above entitled Restrictions on Use.

**Termination**. This License shall remain in full force and effect unless and until terminated. This License will terminate immediately, automatically and without notice if Licensee fails to comply with any provision of this agreement. Upon termination, Licensee must stop using the WBS, erase or destroy all copies of the WBS, and destroy all printed information provided with the WBS.

**Hardware Limited Warranty**. Hardware Limited Warranty information provided in the Licensee's MST computer system package.

**WBS Limited Warranty**. If Licensee purchased the WBS from M&S Technologies or one of its authorized AD's, M&S warrants that the WBS is substantially free from defects in materials or workmanship. ANY AND ALL OTHER WARRANTIES, STATUTORY OR OTHERWISE, WITH RESPECT TO THE SOFTWARE AND THE ACCOMPANYING WRITTEN MATERIALS, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT, AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY EXPRESSLY DISCLAIMED. LICENSEE EXPRESSLY UNDERSTAND AND AGREE THAT LICENSEE'S USE OF THE WBS AND ANY HYPERLINKS TO 3<sup>RD</sup> PARTY SITES IS AT LICENSEE'S SOLE RISK AND THAT THESE PRODUCTS AND SERVICES ARE PROVIDED "AS IS" AND "AS AVAILABLE".

**Confidentiality of Account**. Licensees agree and understand that Licensees are responsible for maintaining the confidentiality of passwords associated with any accounts Licensee use to access the WBS. Accordingly, Licensee agree that Licensee will be solely responsible for all entries, uploads, emails, transmissions, downloads and other activities performed on or with the WBS and its related 3<sup>rd</sup> party hyperlinks.

Responsibility for Content. Licensee understand that all information, data, text, software, photographs, graphics, messages or other materials ("Content"), are the sole responsibility of the person from whom such content originated. This means that Licensee, and not M&S Technologies are entirely responsible for all Content that Licensee upload, post, email, transmit or otherwise make available via the WBS. M&S Technologies does not control the Content posted, and as such, does not guarantee the accuracy, integrity or quality of such Content. Under no circumstances will M&S Technologies be liable in any way for the Content, including, but not limited to, any errors or omissions in any Content, or any loss or damage of any kind incurred as a result of the use of any Content posted, emailed, transmitted or otherwise made available via the WBS. Licensee agree to not use the WBS and its 3<sup>rd</sup> Party Hyperlinked sites to: a) upload, post, transmit or otherwise make available any Content that is unlawful, harmful, threatening, abusive, harassing, tortuous, defamatory, vulgar, obscene, libelous, invasive of another's privacy, hateful, or racially, ethnically or otherwise objectionable; b) harm minors in any way; c) impersonate any person or entity, or falsely state or otherwise misrepresent Licensee affiliation with a person or entity; d) forge headers or otherwise manipulate identifiers in order to disguise the origin of any Content transmitted through the WBS; e) upload, post, email, transmit or otherwise make available any Content that Licensee do not have a right to make available under any law or under any contractual or fiduciary relationships (such as inside information, proprietary and confidential information learned or disclosed as part of employment relationships, or under nondisclosure agreements); f) upload, post, email, transmit or otherwise make available any Content that infringes any patent, trademark, trade secret, copyright or other proprietary rights of any party; g) upload, post, email, transmit or otherwise make available any unsolicited or unauthorized advertising, promotional materials, junk mail, spam, chain letters, pyramid schemes or any other form of solicitation; h) upload, post, email, transmit or otherwise make available any material that contains software viruses or any other computer code, files, or programs designed to interrupt, destroy, or limit the functionality of any computer software or hardware or telecommunications equipment; i) disrupt the normal flow of dialogue, cause a screen to scroll faster than other users of the WBS are able to type, or otherwise act in a manner that negatively affects other users' ability to engage in real time exchanges; j) interfere with or disrupt the WBS or servers or networks connected to the WBS, or disobey any requirements, procedures, policies or regulations of networks connected to the WBS, including using any device, software or routine to bypass our robot exclusion headers; k) intentionally or unintentionally violate any applicable local, state, national or international law, including, but not limited to, regulations promulgated by the U.S. Securities and Exchange Commission, any rules of any national or other securities exchange, and any regulations having the force of law, including HIPAA and any and all laws and regulations regarding the protection of privacy; I) provide material support or resources (or to conceal or disguise the nature, location, source or ownership of material support or resources) to any organization(s) designated by the United States government as a foreign terrorist organization pursuant to section 219 of the Immigration and Nationality Act; m) stalk, harass or otherwise another and/or n) collect or store personal data about other users in connection with the prohibited conduct and activities set forth in paragraphs a through m above. This software limited warranty is void if failure of the WBS has resulted from accident, abuse, neglect or misapplication by the Licensee or their agents.

#### M&S<sup>®</sup> Technologies End User Web-based Software ("WBS") License Agreement (3 of 4)

**End User Exclusive Remedy**. If a defect in the WBS appears while in use on a single hardware device, Licensee may return the software to M&S Technologies for replacement with the same version of software, or, if so elected by M&S Technologies refund of amounts paid by Licensee under this License Agreement. Licensee agrees that the foregoing constitutes Licensee sole and exclusive remedy for breach by M&S Technologies of any warranties made under this Agreement. EXCEPT FOR THE WARRANTIES SET FORTH ABOVE, THE WBS ARE LICENSED "AS IS", AND M&S TECHNOLOGIES, DISCLAIMS ANY AND ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTIBILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Limitation of Liability. IN NO EVENT WILL MST OR ITS AD'S BE LIABLE FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL, ECONOMIC, COVER, EXEMPLARY, PUNITIVE OR INDIRECT DAMAGES (INCLUDING WITHOUT LIMITATION LOSS OF PROFITS, BUSINESS, GOODWILL, DATA, TIME OR COMPUTER PROGRAMS) ARISING OUT OF LICENSEE USE OR INABILITY TO USE THE SOFTWARE OR PRINTED INFORMATION CONTAINED HEREIN, WHETHER OR NOT MST HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH LOSS, HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY. THIS EXCLUSION INCLUDES ANY LIABILITY THAT MAY ARISE OUT OF THIRD-PARTY CLAIMS AGAINST LICENSEE. THESE LIMITATIONS SHALL APPLY NOTWITHSTANDING ANY FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY. IN NO EVENT WILL M&S TECHNOLOGIES LIABILITY EXCEED THE AMOUNT PAID BY LICENSEE FOR THE WBS REGARDLESS OF THE FORM OF CLAIM (INCLUDING, WITHOUT LIMITATION, ANY CONTRACT, PRODUCT LIABILITY, OR TORT CLAIM).

Internet Limitation of Liability. MST has no control over any websites, content or resources which are provided by the 3<sup>rd</sup> Party Hosting and any 3<sup>rd</sup> Party Hyperlinked sites. IN PARTICULAR, M&S TECHNOLOGIES AND ITS AD'S DO NOT REPRESENT OR WARRANT TO LICENSEE THAT: A) LICENSEE USE OF THE WBS OR THE 3<sup>RD</sup> PARTY HYPERLINKS WILL BE UNINTERUPTED, TIMELY, OR FREE FROM ERRORS B) ANY INFORMATION OBTAINED BY LICENSEE AS A RESULT OF THE WBS OR 3<sup>RD</sup> PARTY HYPERLINK WILL BE ACCURATE AND RELIABLE C) THAT DEFECTS IN THE OPERATION OR FUNCTIONALITY OF THE 3<sup>RD</sup> PARTY HYPERLINK WILL BE CORRECTED. ANY MATERIAL DOWNLOADED FROM 3<sup>RD</sup> PARTY HYPERLINKS PROVIDED WITH THE WBS ARE UTILIZED AT LICENSEE OWN DISCRETION AND RISK AND LICENSEE WILL BE SOLELY RESPONSIBLE FOR ANY DAMAGE TO LICENSEE COMPUTER SYSTEM OR OTHER DEVICE FOR LOSS OF DATA THAT RESULTS FROM THE DOWNLOAD OF ANY SUCH MATERIAL. NO ADVICE OR INFORMATION, WHETHER ORAL OR WRITTEN, OBTAINED BY LICENSEE FROM M&S TECHNOLOGIES OR ITS AUTHORIZED DISTRIBUTORS SHALL CREATE ANY WARRANTY NOT EXPRESSLY STATED IN THE WBS LICENSE AGREEMENT. Licensee acknowledge and agree that M&S Technologies is not responsible for the availability of such 3<sup>rd</sup> party hyperlinked sites and M&S Technologies is not liable for any loss, damage which may be incurred by Licensee as a result of the availability of those 3<sup>rd</sup> party hyperlinked sites, or as a result of any reliance placed by Licensee on the completeness, accuracy or existence of information contained within those 3<sup>rd</sup> party hyperlinked sites.

**Export Law Assurances**. Licensee agree that the WBS and other technical information, both printed and verbal, received from MST will not be exported outside of the United States except as permitted by the laws and regulations of the United States. If Licensee rightfully obtain the WBS and MST technical information outside of the United States, Licensee agree not to re-export the WBS and information except as permitted by the laws and regulations of the United States and the jurisdiction in which Licensee obtained the WBS.

#### M&S<sup>®</sup> Technologies End User Web-based Software ("WBS") License Agreement (4 of 4)

**US Government Use**. Use, duplication or disclosure of the WBS by the U.S. Government is subject to "Restricted Rights", as that term is defined in the Department of Defense ("DOD") Supplement to the Federal Acquisition Regulations ("DFARS") in paragraph 252.227-7013(c)(1)(ii) if to the DOD, or, if the WBS is supplied to any unit or agency of the U.S. Government other than DOD, the Government's rights in WBS shall be as defined in subparagraphs (c)(1) or (c)(2) of FAR 52.227-19, Commercial Computer software -Restricted Rights; or FAR 52.227-14, Rights in General Data Alternative III, as applicable. Contractor: M&S Technologies, 5715 W. Howard Street, Niles, IL 60714.

**Entire Agreement.** This agreement constitutes the entire agreement between Licensee and MST and supersedes any other prior agreements or communications regarding the WBS. If any provision of this agreement is held invalid, the remainder of this agreement shall continue in effect.

### M&S<sup>®</sup> Technologies ("MST")

#### End User Limited Hardware Warranty

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

This limited hardware warranty covers defects in M&S Technologies, 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, or its Authorized Distributors
- Problems that result from:
  - External causes such as accident, abuse, misuse, or problems with electrical power
  - Servicing not authorized by M&S Technologies
  - 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 serial numbers
- Products for which M&S has not received payment
- Expendable and/or consumable parts
- Normal wear and tear

This warranty gives M&S Purchaser of Record (POR) specific legal rights, and POR 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 POR for damages, for products not being available for use, or for lost data or lost software. M&S liability will be no more than the amount POR paid for the product that is the subject of a claim. This is the maximum amount for which M&S is 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 POR, or anyone in POR's family, have an epileptic condition, consult a physician prior to using the hardware. Immediately discontinue use of the hardware and consult a physician if POR experiences 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 M&S repairs or replaces 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 POR purchased from M&S, or on behalf of M&S through our Authorized Distributors, are free from defects in materials or workmanship under normal use during the Limited Warranty Period. POR's are entitled to warranty service according to the terms and conditions of this document if a repair to POR's 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 Distributors. Please also have your hardware serial number 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 Distributor 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 Distributor is not able to troubleshoot the problem with the end user or repair the product, M&S 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 Distributor 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 POR's exclusive remedy for defective products. M&S reserves the right to elect, at its sole discretion, to give POR a refund of POR's purchase price instead of a replacement.

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

#### M&S<sup>®</sup> Technologies End User Limited Hardware Warranty (3 of 5)

When POR's warranty service requires POR to return hardware to the M&S Technologies, Illinois warehouse, M&S will provide a loaner and a return label to ship POR M&S-purchased product for repair. POR must return the defective products to M&S 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 POR. M&S will pay to ship the repaired or replaced products to POR 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 POR freight collect. If the failed M&S-purchased hardware is not received by M&S 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, POR must ship any loaned hardware to the M&S Technologies, Illinois warehouse using the prepaid freight provided.

If M&S determines that the problem is not covered under this warranty, M&S will notify POR and inform POR of service alternatives that are available to POR 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 Distributor, depending on circumstances, POR may be required to return M&S-purchased hardware to the Authorized Distributor via prepaid freight.

<u>NOTE</u>: Before POR ships 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. M&S is not responsible for any of POR's 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 Distributor when the product was provided to the end user by M&S or on behalf of M&S by its Authorized Distributor.

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

M&S uses 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.

	M&S <sup>®</sup> Technologies End Us	ser Limited Hardware Warrant	y (	(4 of 5)	
--	--------------------------------------	------------------------------	-----	----------	--

Replacement parts and systems are covered for the remaining period of the limited hardware warranty for the product POR bought. M&S owns all parts removed from repaired products.

This limited hardware warranty coverage terminates if POR 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, its subsidiaries and affiliates, with offices at 5715 W. Howard Street, Niles, Illinois 60714 ("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 Distributors.

"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.

"Third Party Products" means any hardware or software licensed or distributed by M&S to Customer that is not owned by M&S.

|--|

Except as expressly set forth in this limited warranty, M&S makes no other warranties or conditions, expressed or implied, including any implied warranties of merchantability and fitness for a particular purpose, title and non-infringement. M&S expressly disclaims all warranties and conditions not stated in this limited warranty. Any implied warranties that may be imposed by law are limited in duration to the limited warranty period. Some states or countries do not allow a limitation on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages for consumer products. In such states or countries, some exclusions or limitations of this limited warranty may not apply to POR.

This Limited Warranty applies only to Products sold by M&S or on behalf of M&S by their Authorized Distributors.

These terms and conditions constitute the complete and exclusive warranty agreement between POR and M&S regarding the purchased hardware and accessories from M&S Technologies, POR have purchased. These terms and conditions supersede any prior agreements or representations, including representations made in M&S sales literature or advice given to POR by M&S or an agent or employee of the M&S that may have been made in conjunction with your purchase of the Product. No change to the conditions of this Limited Warranty is valid unless it is made in writing and signed by an Authorized Distributor of the M&S.

#### M&S° Technologies

5715 W. Howard Street Niles, IL 60714

Sales: 1/877-225-6101 1/847-763-0500 Fax: 1/847-763-9170 Technical Support: 1/847-763-0500

mstech-eyes.com



A Hilco Vision Brand

TECHNOLOGIES The First Choice in Vision Testing Systems

©2025 M&S and Smart System are registered trademarks of the Hilsinger Company Parent LLC. All rights reserved. The Hilsinger Company Parent LLC holds US Patents 7,354,155; 7,926,948; 8,425,040; 8,167,429; 8,419,184; 8,550,631; 8,992,022; 9,433,347; 9,820,644; 10,244,938 and 10,182,713. Other Patents Pending.