User’s Manual

Contents

1. Introduction

1.1 Matrix Scan brief introduction

Matrix Scan is software design for special application. It utilized hardware communication with 4 different external equipment:

- USB CCD camera,
- PLC controller (using RS232 protocol),
- Scan head with USB controller (Sino-galvo JD2207 and Eastern Logic UMC4),
- UV DPSS laser (Coherent Matrix 3555-50)

The Matrix Scan software run on PC with 900 MHz CPU and 256 MB RAM at least. In general, it is recommended to use the fastest PC available. Matrix Scan was developed in Microsoft Windows 10 Professional.

1.2 Software instalation

Please be sure to install CCD camera driver, scan head driver and laser software before Matrix Scan installation. Use matrix_scan_v1_0_64x.exe installer and choose destination folder for the software. After installation, a shortcut links are made at the Desktop and Start Menu. Use uninstall link in Settings/Applications to remove software from the system.

1.3 Software functions

Main functions of the software are:

1. Hardware control of the laser,
2. Hardware control of the scan head,
3. CCD camera preview of the working area,
4. Manual selection of the scan area (polygons and lines),
5. Precise correction of point or polygon position,
6. Selection of the hatch angle,
7. Saving program files (JOB) with marking elements (Polygons),
8. Creating and editing marking lists of JOB programs (Layouts),
9. Sending and receiving digital signals with PLC controller,
10. Selecting working area or marking element with red laser pointer,
11. Choosing multiple PEN settings for fast laser and scanner parameters switch,
12. Saving error logs and application events.

1.4 Interface introduction

The software should be running with administrative priviledge and it is set to accept it after first run. The splash screen appears while running the program and the initial operations takes place in the background. User interface is shown on fig 1.

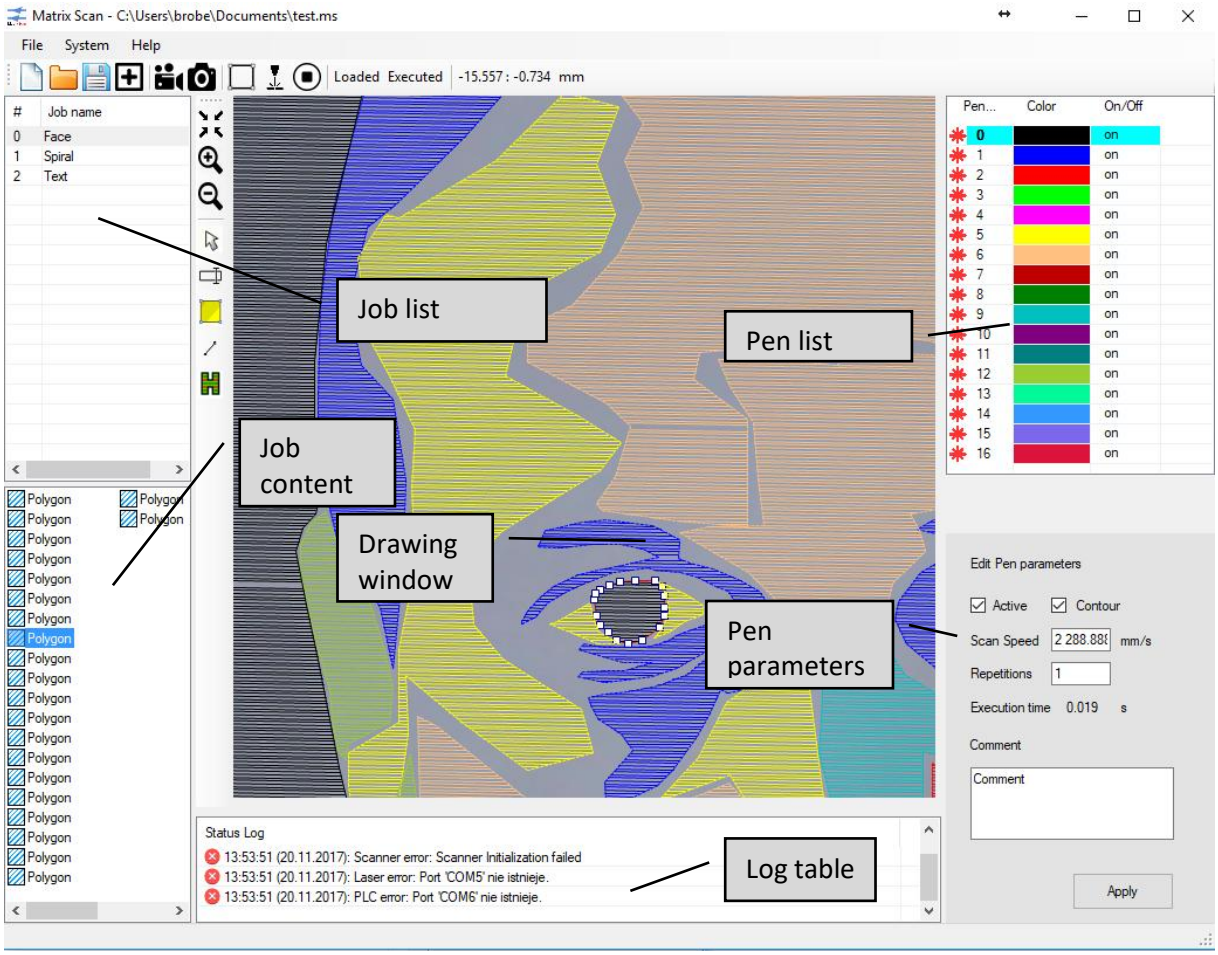

Fig 1. User interface of Matrix Scan

Matrix Scan consist of six main windows:

- Job list – list of marking Jobs; every job represents one laser marking program,
- Job content – there is a list of marking elements indicated in Drawing window; it can be draw polygons and lines,
- Log table – shows errors of hardware device and status of operations,
- Pen list – shows 16 customizable pens,
- Pen parameters – shows selected pen paramters like: marking speed, repetions.

2. Software operation

2.1 Adding new job

To start operation use „Add job" button or „New" button on main toolbar (see Fig. 2). It consist of 8 buttons.

Fig. 2 Main toolbar

Their functions are as follow (starging from left):

- New Job – also add empty job into program list,
- Open Program – open selected file (with *.ms extension),
- Save All – save all programs, polygons and pens in defined file,
- Add Job – add another job in Job List,
- Live Preview – execute video camera preview in Drawing Window,
- Capture frame – capture one frame of the camera,
- Pointer - Mark contour with red laser pointer,
- Start Marking – execute marking process based on Program List,
- Stop Marking – abort marking process.

This functions as well as open recent files are also available from „File" at Menu Bar (see fig. 3)

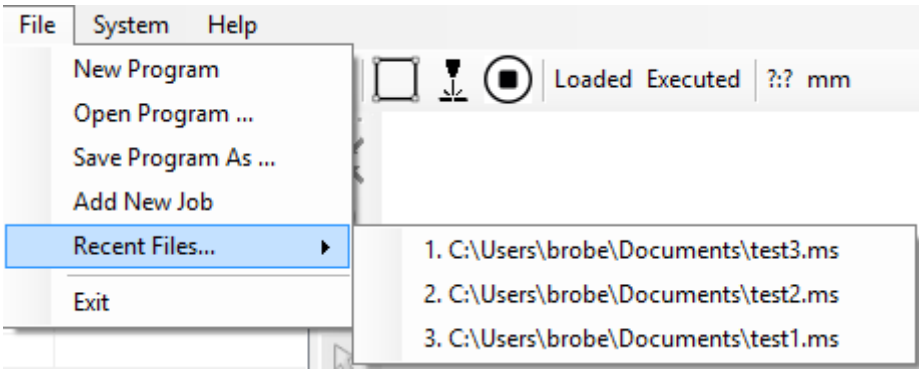

Fig. 3 "File" at Menu Bar

A new item will show up at Program list with acutal time extension. At this momment, Drawing window toolbar became active. Use can select polygon or line icon to start drawing a shape. Mouse left- click add point to the shape, right-click ends drawing. Below are description of toolbar icons.

- this icon unzoom current preview in Drawing Window,
- This icon zoom-in in mouse possition,
- This icon zoom-out in mouse possition,
- This icon retreive basic icon,
- This icon show additonal form to move selected point or polygon,
- This icon is for drawing polygons,
- This icon is for drawing lines,
- This icon show additional form with polygon fill properties.

On Fig 4. Polygon fill window is presented.

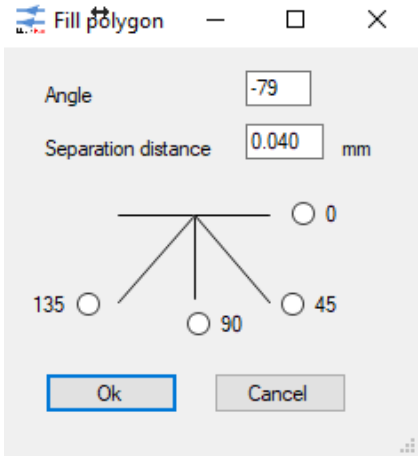

Fig. 4 Polygon fill properties window

By default, polygon fill is made with parallel lines. The user can specify a direction of polygon fill as well as distance between lines or choose 4 angles with 45 degree distance. The polygon icon is chagned after fill action is performed.

After pressing move icon a relative displacement of an element is presented (Fig. 5).

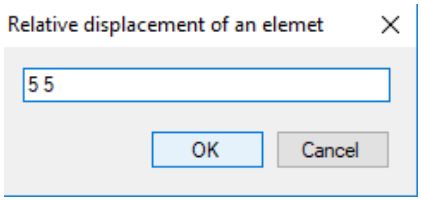

Fig. 5 Input window to move selected corner or polygon (X=5 Y=5, space between).

In displacement window user should input x any y value of displacement with space between. Values can be positive or negative.

2.2 Drawing polygons and lines

To draw polygons in drawing window, add new job and start camera preview to see an object under the scan head. Then use yellow square icon (Fig. 6) to mark any kind of polygon shape, except intersecting lines. To close polygon, just use right mouse click. The same way, use line icon to draw complex lines. Each polygon can be selected by mouse and precisely corrected dragging corners to its new position. It can be done using also manual input of a displacement value (see fig. 5). For precise drawing user can use mouse roller to zoom in and out image preview.

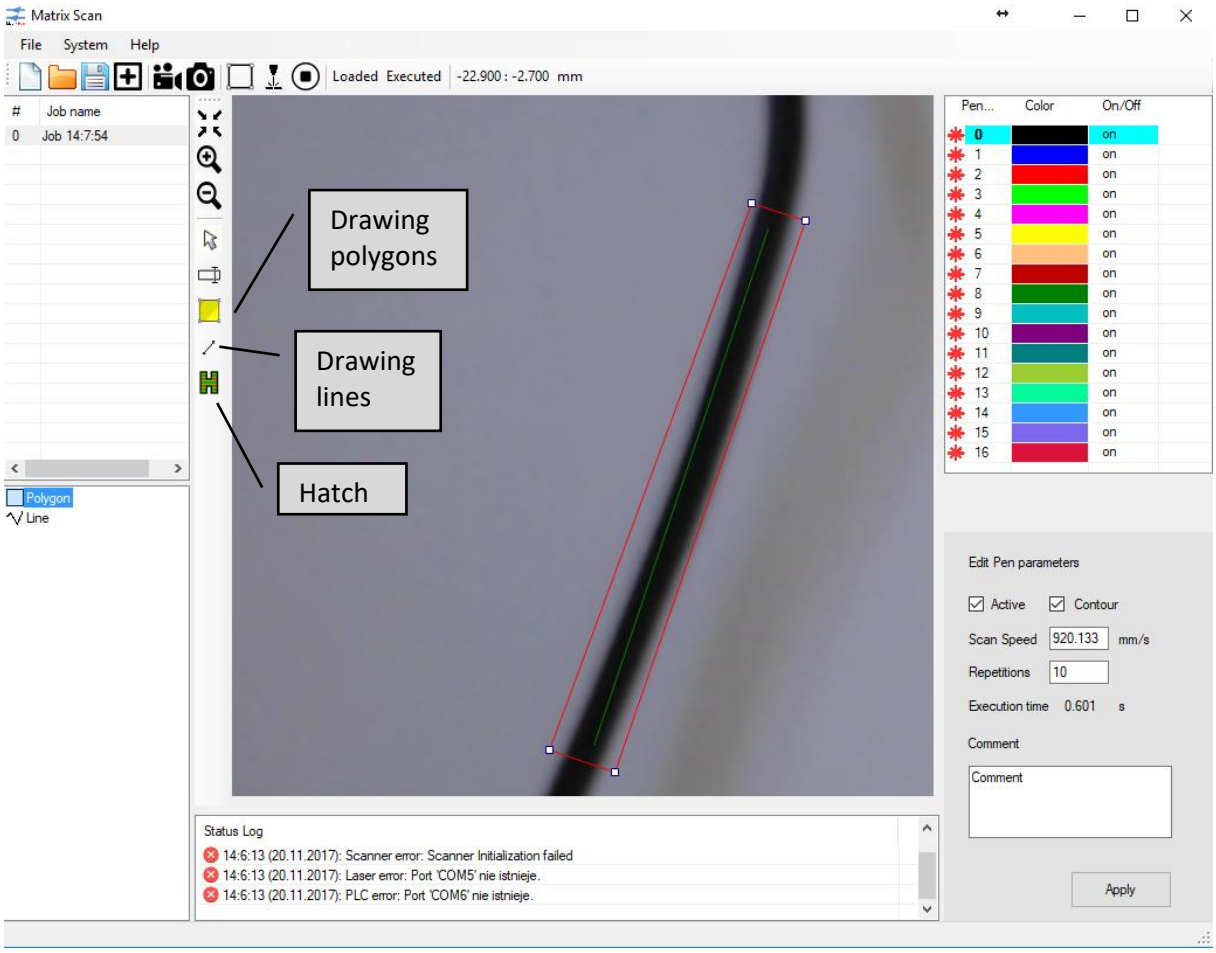

Fig 6. Polygon, lines and hatch icons.

2.3 Saving pen parameters

There are 16 available pens to use within the software. Each of them have different color to distiguish different settings. Before drawing any polygon or line, please select a pen color first from

pen list on the right side of the program. This gives different polygon color in drawing window. Each pen properties can be edited in section below polygon list (Fig. 7).

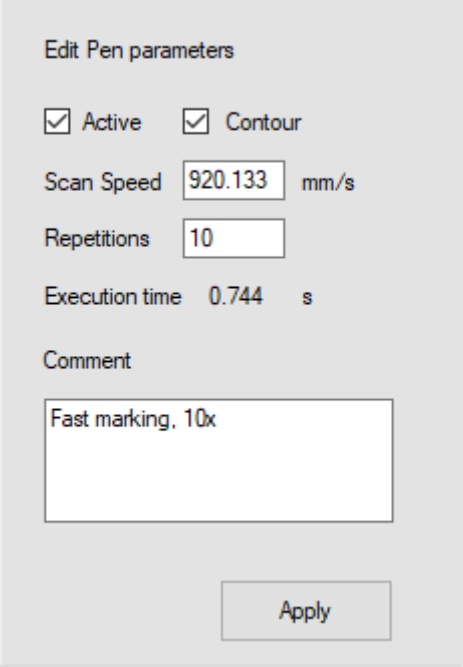

Fig. 7 Edit pen parameters.

Every pen information contain 6 data:

- Active – any pen can be temporaily enabled or disabled from the use,
- Contour – marking information can contain contour of polygon or just hatch data,
- Scan speed – allow to set appropriate marking speed of every polygon,
- Repetitions – allow to set appropriate number of scans for every polygon,
- Execution time – shows execution time for selected polygon,
- Commens – allow to add short comment for each pen properties.

Each pen is saved in INI file for future usage with Apply button.

2.4 Lists control

There are two lists in Matrix Scan program:

- Job list - list of jobs inside a single program file,
- Job content – list of elements inside every job.

Each list have additional control feature after right-button mouse click on selected list element. When user select upper job list element the popup window will show with additional functionality

(see Fig. 8). It is possible to duplicate job, rename it, remove it or just locate position of selected item with move commands.

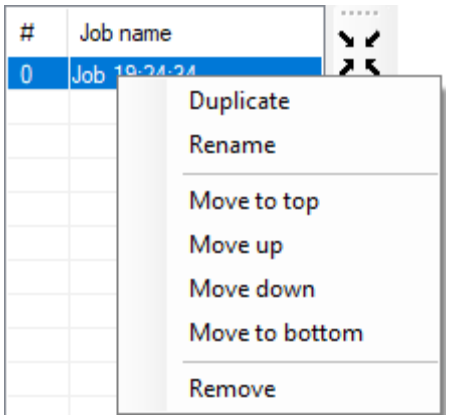

Fig. 8. Popup window on Job list after right-button mouse click.

When use select job element list another popup window will show with additional functionality (see fig. 9). It allows to set element properties like (Active, Deactive, Remove Hatch, Rename, Remove). It also allows to set each element position inside the list with move commands.

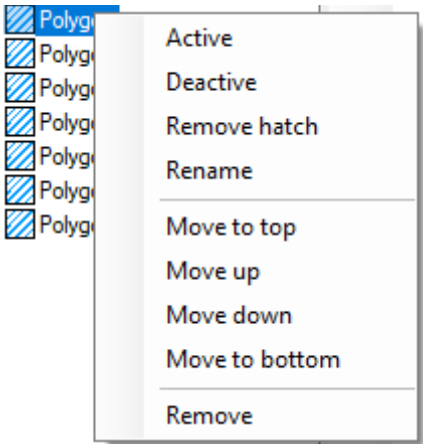

Fig. 9 Popup window on Job element list after right-button mouse click.

2.5 Saving program parameters

Using Menu Bar File→Save Program As.. command, user can save all work parameters, like Jobs, polygons, lines, and pen properties in a single file (extension *.ms). So, there are two ways to restore pen settings:

- By opening previous program file,
- By modification of INI file, where all pen settings are recorded.

3. File menu - System

3.1 Load calibration file

Using Menu Bar System→Load Calibration file, user can open location of calibration file for scanner, camera, and software preview common calibration (Fig. 8). This file is provided within the software (C:\Program Files (x86)\Matrix Scan\calib.ms_cal). This file gives a scan head correction of an working area, distortion and rotation based on camera preview. The correction file must be prepared every time camera position is changed.

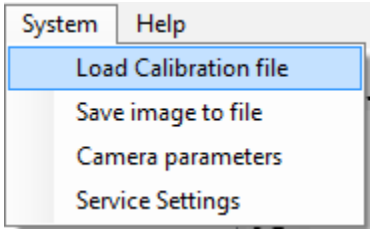

Fig. 8 Load calibration file in Menu Bar – System.

Calibration process is made by software developer and can be easily repeated using few simple steps:

- Run a red pointer and start marking a calibration pattern (C:\Program Files (x86)\Matrix Scan\calib_ptrn.ms),
- Record image captured by camera using menu bar action (System→Save image to file),
- Send it by email to the system developer (you can find image file using System→Help→Open Application Location),
- Receive calibration file and use Load calibration file command to apply correction.

4. PLC communication

This software is equipped with PLC communication protocol based on RS-232. The logic for communication is presented in tab. 1. Each PLC command must end with semicolon (no LF nor CR characters) eg. " ST1;". The PC response always end with LF and CR character.

Tab 1. Communication protocol between PC and PLC.

PLC and PC commands			
PLC Command	**Description**	**PC response**	**Description**
ST1;	Run last program loaded	WP1	Program started properly
		WP0	Program could not be started
		PK1	Program finished properly
		PK0	Program finished with error
SP1;	Stop running program	PK0	Program interrupted
ZP???;	Change into ??? number program	PZ???	??? - 3 digit program number loaded properly

		PN???	??? - 3 digit program number could not be loaded
		LE	Laser ready
		RD	Laser error
STS;	Status request	SSBaPbcdReEf	a = {1,0} busy bcd = 3 digit loaded program number bcd = NNN - no program loaded e = {1,0} laser ready f = {1,0} laser error eg. SSB1P001R1E0
		ECC	Command corrupted (uncompleted)
		EUC	Unknown command

5. Troubleshooting

Program Matrix Scan has been tested for normal operation. Please try some advice if problems with communication occur. Below in tab. 2, some known issues are listed.

Tab. 2 Problems with communication and solutions

Slow communication	Please set in Windows Device Manager at respective COM port minimal value for Delay .
RS-232 does not work	Please set a proper COM port in setup.ini file of Scan Matrix program.
Every received command is ECC	Please check, that terminal character of sent command is semicolon (;) without additional characters like CR or LF.
	Please check a proper RS232 settings (Baud rate = 115200, Data Bits = 8, Parity = Even, Stop Bits = 1)
	Command sending timeout is 100 ms.