



MANUAL
CONFIGURATION PROGRAM
FOR "CUA-USB" AND "CUA-ETH" CONTROL UNITS

NEWSON ENGINEERING NV

Table of Contents

1	SOFTWARE INSTALLATION INSTRUCTIONS	3
1.1	DRIVER INSTALLATION FOR CONTROL UNIT "CUA-USB"	3
1.2	ETHERNET INSTALLATION FOR CONTROL UNIT "CUA-ETH"	3
1.3	SOFTWARE INSTALLATION	4
2	STARTING "RHOTHOR.EXE"	5
3	PAGE: CONFIG.....	6
3.1	FIELD SIZE	6
3.2	MAX SPEED	7
3.3	AVG SPEED	7
3.4	DELAY	7
3.5	FUNCTION BLOCKS	9
3.6	IO's	10
3.7	SAVE CONFIGURATION.....	12
4	PAGE: CHANNEL1, CHANNEL2, CHANNEL3.....	13
5	PAGE: CONTROL	14
5.1	STATUS FLAGS.....	14
5.2	EXECUTOR	15
5.3	CALIBRATION	16
5.4	FLASH EXPLORER.....	18

1 SOFTWARE INSTALLATION INSTRUCTIONS

1.1 DRIVER INSTALLATION FOR CONTROL UNIT “CUA-USB”

To install rhothor™ driver software in **Windows 2000**, follow these steps:

1. Power up the computer and the rhothor™ deflection system.
2. Log in with administrative rights when prompted by Windows 2000
3. Connect the deflection system to the computer with an USB cable.
4. Wait for Windows 2000 to detect the newly installed hardware and display the **Found New Hardware Wizard**. Click **Next**.
5. Insert the rhothor™ CD-ROM into the CD-ROM drive.
6. On the **Install Hardware Device Drivers** screen verify that **Search for a suitable driver for my device (recommended)** is selected, click **Next**.
7. On the **Locate Driver Files** screen verify that **Specify a location** is selected, click **Next**.
8. When the **Found New Hardware Wizard** dialog appears, click **Browse** and choose the rhothor.inf file from the D:\Driver\Win2000 directory [CD-ROM drive], then click **OK**.
9. On the **Driver Files Search Results** screen, verify that Windows 2000 is found the NwsnBulk64.sys for rhothor, click **Next** to install the driver.
10. On the **Completing the Found New Hardware Wizard** screen, click **Finish**.
11. The hardware is now installed. Proceed to Software Installation.

To install driver software in **Windows XP**, follow these steps:

1. Power up the computer and rhothor™ deflection system.
2. Log in with administrative rights when prompted by Windows XP
3. Connect the deflection system to the computer with an USB cable.
4. Wait for Windows XP to detect the newly installed hardware and display the **Found New Hardware Wizard**.
5. Insert the rhothor™ CD-ROM into the CD-ROM drive.
6. On the **Welcome to the Found New Hardware Wizard** screen verify that **Install from a list or specific location (Advanced)** is selected, and then click **Next**.
7. When the **Please choose your search and installation options** appears, select **Search for the best driver** in these locations. Verify that the item **Include this location in the search** is checked, click **Browse** and choose the D:\Driver\WinXP directory [CD-ROM drive], and then click **Next**.
8. When the **Windows Logo testing** dialog appears, click **Continue Anyway**.
9. On the **Completing the Found New Hardware Wizard** screen, click **Finish**.
10. The hardware is now installed. Proceed to Software Installation.

1.2 ETHERNET INSTALLATION FOR CONTROL UNIT “CUA-ETH”

Control units for ethernet deflection heads are default configured with the IP address 172.16.224.20 and netmask 255.255.0.0. In order to address the control unit, the IP addresses of the device and the PC must be on the same Local Area Network and subnet.

To do so, configure your PC with a static IP address on the same subnet as the address of the control unit. When you try to access the control unit for the first time, the IP address has to be in the 172.16.x.x domain. A valid configuration on the PC would be a static IP 172.16.224.100 and netmask 255.255.0.0.

Note: The subnet mask indicates that the first 2 octets in each IP address on the network must be the same number. This

allows network devices to communicate on the Local Area Network (LAN)

For information on configuring a static IP address in Windows, see the Windows help files. You can access Windows help files by clicking the Windows Start button and selecting Help. Search in Windows help for static IP address.

Note: It is possible to change the IP address of the control unit using CuaEthSetup.exe. This software is part of the rhothor™ installation package.

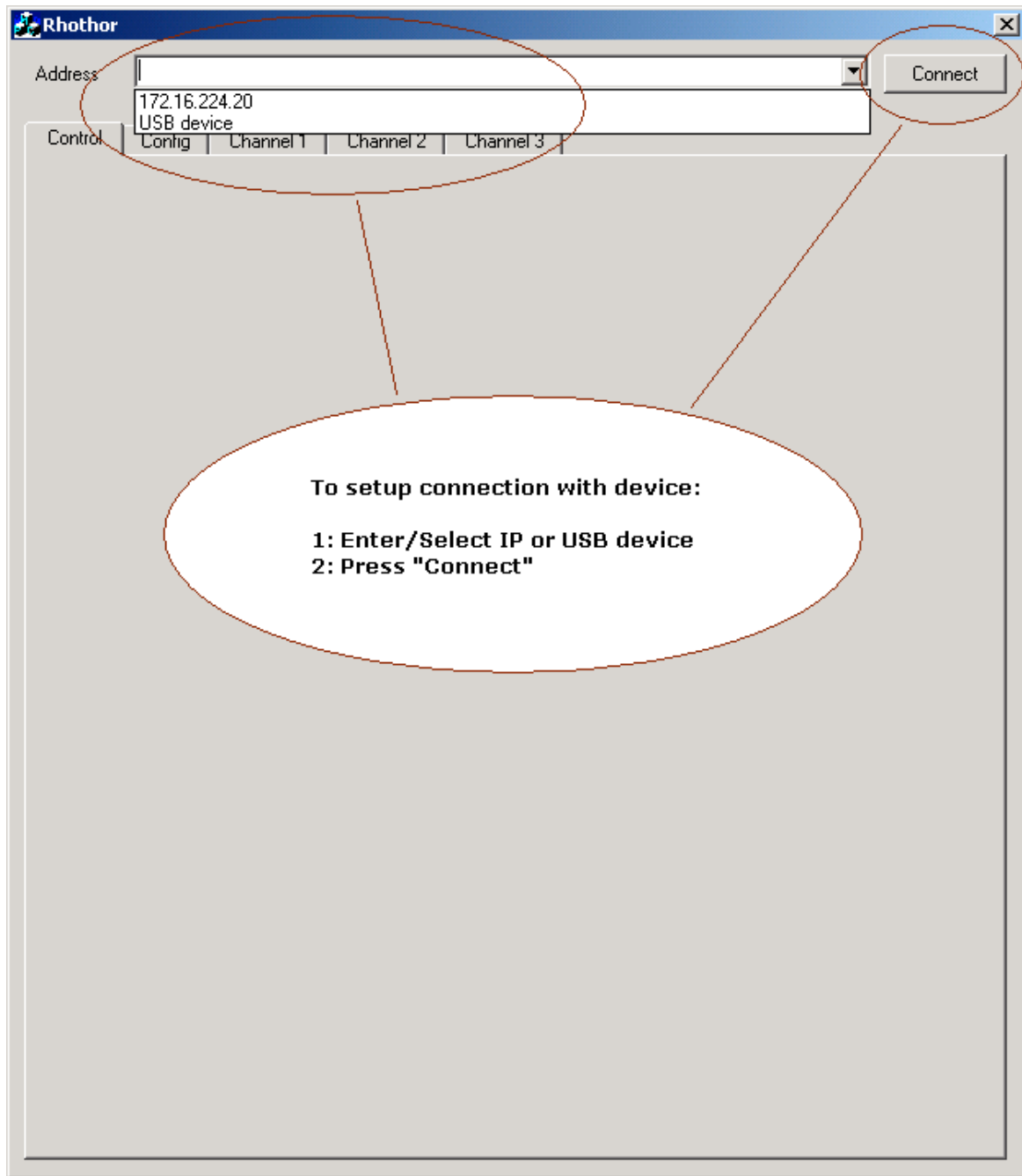
1.3 SOFTWARE INSTALLATION

To install the rhothor™ configuration and diagnostic software, follow the steps:

1. Insert the rhothor™ CD-ROM into the CD-ROM drive.
2. Run **setup.exe** from the CD-ROM.
3. On the intro screen click **Next**.
4. On the **Welcome to the rhothor Setup Wizard** screen click **Next**.
5. After reading the **Licence Agreement**, select "I Agree", then click **Next**.
6. On the **Select Installation Folder** choose the folder where the software will be installed, then click **Next**.
7. When the Confirm Installation dialog appears, click **Next** to start installation.
8. When the **Installation Complete** dialog appears, indicating that the software was installed successfully, click **Close** to exit the set-up wizard.

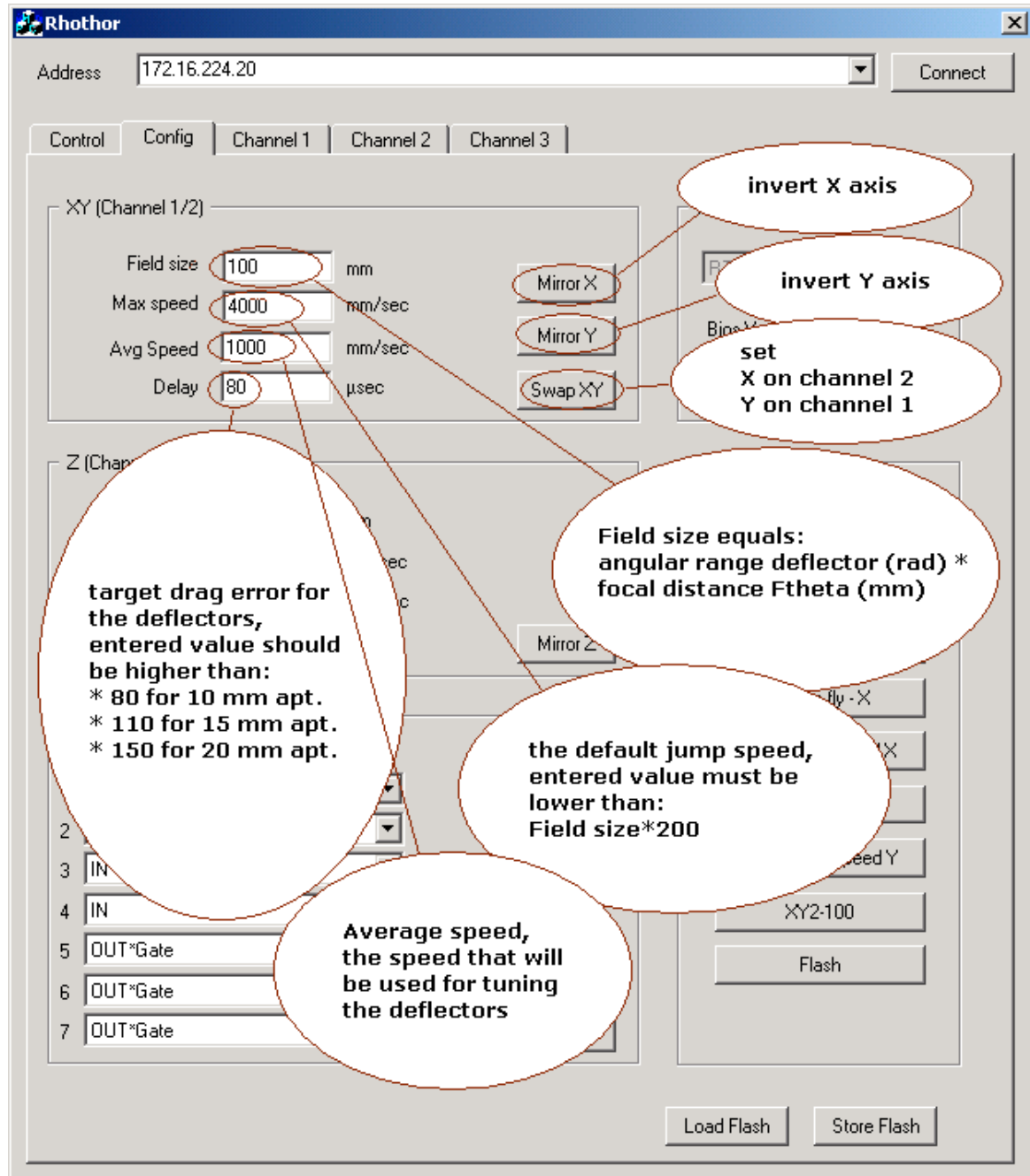
The software is now ready for use !

2 STARTING "RHOTHOR.EXE"



3 PAGE: CONFIG

Before using the system, its properties should be set. Press the "Config" tab on the rhothor™ software to start the configuration.



3.1 FIELD SIZE

Fieldsize is the size of the marking area. This is the area that the system can cover. This range is a function of angular range of the installed rhothor™ motors and focal length of the mounted optics.

The value to be entered can be calculated:

$$\text{FIELDSIZE} = \text{FOCAL_LENGTH} * \text{ANGULAR_RANGE}/1000$$

"focal_length" is the focal length of the used lens.

"angular_range" is the optical scanning range of the installed motors in milli radians.

Example:

If an f-theta 163 mm flat field lens is used on a system fitted with RTA-AR800 motors the fieldsize that has to entered equals:

$$\begin{aligned} \text{fieldsize} &= \text{focal_length} * \text{angular_range}/1000 \\ &= 163*800/1000 = 130 \text{ mm} \end{aligned}$$

Trial and error is another way to determine the value that has to be entered. Mark a square and measure its size. The relation between measured size and required size of the square can be used to change the fieldsize setting. The square needs to be positioned at centre of the marking area and must be smaller than the fieldsize.

Example:

- step 1. set fieldsize to 100 mm (*)
 - step 2. mark a square size 50 mm (**)
 - step 3. measure the SIZE of this square
 - step 4. multiply fieldsize setting with SIZE/50
- (*) first guess fieldsize
(**) size can be any value substantially smaller than fieldsize

3.2 MAX SPEED

This is the maximum speed that the system will allow.

In general fast servo systems do not response nicely on setpoint jumps. It is a known phenomenon that jumps often leads to damage on analogue-based deflection systems. The speed limitation gives the rhothor™ deflection system a protection against faulty steering commands.

There is a relation ship between drag error and max speed. If a high max speed is selected the drag error of the motor probably needs to be increased. Following graphs show the relation between max speed and drag error.

3.3 AVG SPEED

The smart deflectors connected to the control unit can autotuned. During this tuning a setpoint ramp is applied to the deflector. The response of the deflector is optimised based on the property "Delay" while the speed of the applied ramp is set by the property "Avg Speed". Every deflector should be retuned when either "Avg Speed" or "Delay" is changed.

3.4 DELAY

A rhothor™ deflection system uses digital regulator technology to control the motors in a closed loop fashion. Drag error is the time delay between setpoint and actual value of a closed loop system. In an ideal system this drag error is zero, all steering commands are executed immediately. However zero drag error is not possible. The motors need time to accelerate. Drag error buys those motors time. With the entry drag error in the properties page the dynamics of the

connected deflectors can be set. Choosing a low value will reduce rounding errors at corners. There are limits to take into consideration, **see Table 1**.

TABLE 1 : APERTURE - DRAG ERROR

aperture (mm)	drag error (μ sec)
10	≥ 80
15	≥ 110
20	≥ 150

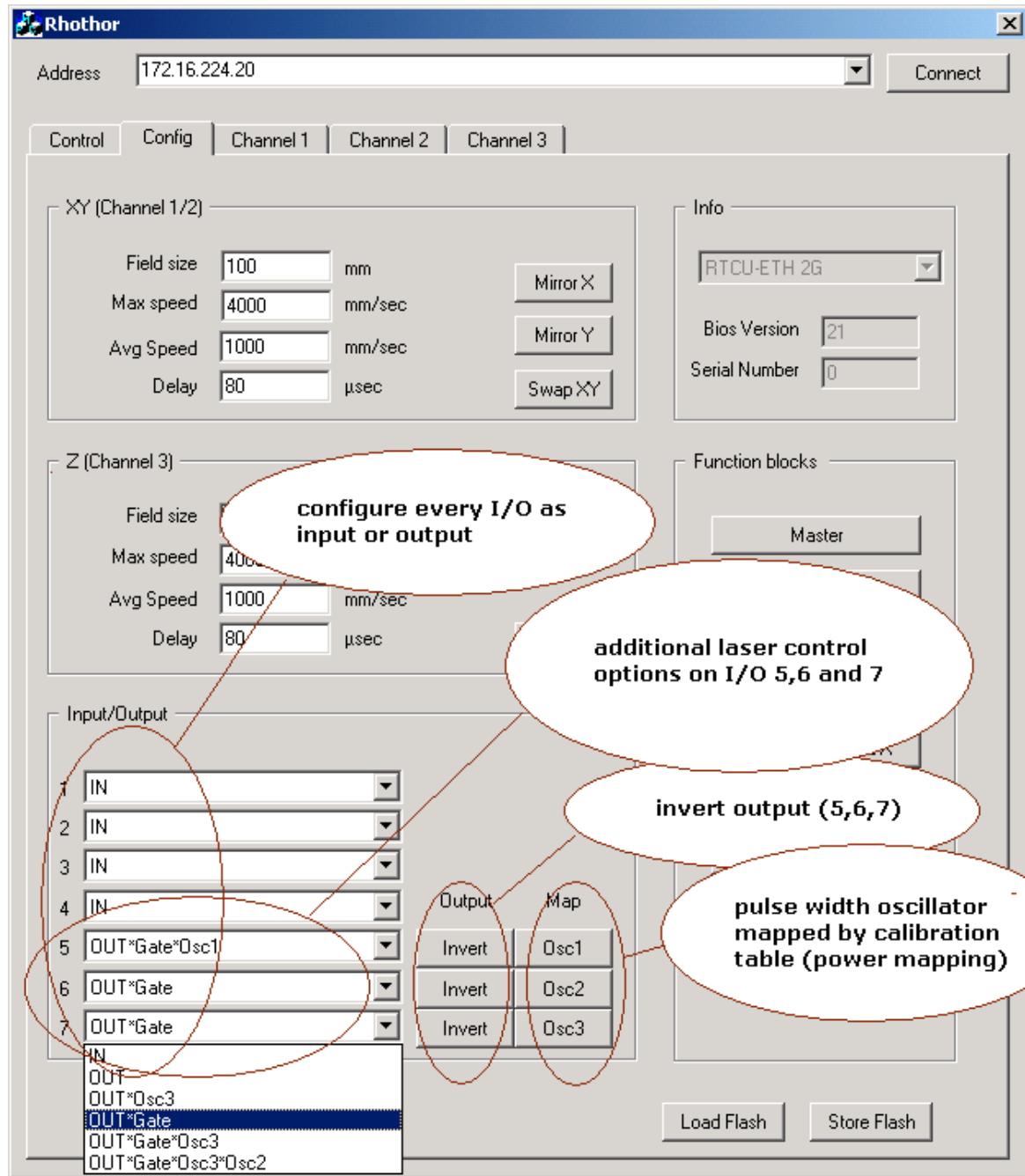
Settings values lower than those limits will not damage the system, but give it a tendency to go into oscillation. Furthermore there is a relation between drag error and maximum speed. If a high maximum speed value is set, the drag error should be increased giving more time to the motors to accelerate.

3.5 FUNCTION BLOCKS

The screenshot shows the Rhothor software interface with the following components and callouts:

- Address:** 172.16.224.20
- Control Tab:**
 - XY (Channel 1/2):**
 - Field size: 100 mm
 - Max speed: 4000 mm/sec
 - Avg Speed: 1000 mm/sec
 - Delay: 80 µsec
 - Mirror X
 - Mirror Y
 - Mirror Z
 - Info:**
 - RTCU-ETH 2G
 - Bios Version: 21
 - Number: 0
 - Function blocks:**
 - Master
 - Slave type 1
 - Slave type 2
 - On the fly - X
 - On the fly - Speed X
 - On the fly - Y
 - On the fly - Speed Y
 - XY2-100
 - Flash
- Callouts:**
 - broadcast X and Y to Slave systems, allocates I/O 1 and 2** (points to Master)
 - recieve X and Y from Master system, allocates I/O 5 and 6** (points to Slave type 1)
 - recieve X and Y from Master system, allocates I/O 1 and 2** (points to Slave type 2)
 - enables resolver input for marking on the fly on X (Y) axis, allocates I/O 1 and 2 (3 and 4)** (points to On the fly - X)
 - enables speed controled marking on the fly on X (Y) axis** (points to On the fly - Speed X)
 - enables XY2-100 input for X and Y, allocates I/O 1,2,3,4 and 6** (points to XY2-100)
 - enables file operations on flash memory** (points to Flash)

3.6 IO's



When an activated function block uses IO's, then those IO's become allocated. All other ones are free to be set as an input or an output. All IO pins are using RS485 compatible drivers. Connection to different signal types should be done through interface electronics. When the system is tracking or running a test, the live status of all IO pins can be seen. This status is updated every 50 msec and is a nice tool to verify connections and system behaviour.

IO channels 5, 6 and 7 are intended to serve as an interface to the laser. When the system is processing vectors not only the motors but also the laser has to be controlled in a synchronised fashion. A deflection system with integrated control can be connected to almost any laser type. Three programmable oscillators, each linked with one of these IO's, can be

interconnected to generate laser signals. The oscillators can be set to generate the lasers trigger frequency or provide a pulse width modulated output for generating analog values.

Selections IO5

1. IN: use as an input
2. OUT: use as an output
3. OUT*OSC1: binary AND-function of out and oscillator 1. (*)
4. OUT*Gate: binary AND-function of out and GATE.
5. OUT*OSC1*GATE: binary AND-function of out and oscillator 1 and GATE. (**)
6. OUT*(GATE*OSC1+!GATE*OSC2): when out is set, gate controlled switch between oscillator 1 and 2. (***)

(*) On a laser with analog power control this mode can be used to generate an analog voltage using an external lowpass filter.

(**) On a CO₂ laser this pin can be used to pulse width modulate the laser. Set the duty cycle of oscillator 1 to desired value. Whenever GATE is active the CO₂ laser sees oscillator 1 signal.

(***) On a CO₂ laser this setting can be used to switch between two pulse width modulation levels of the laser.

Selections IO6

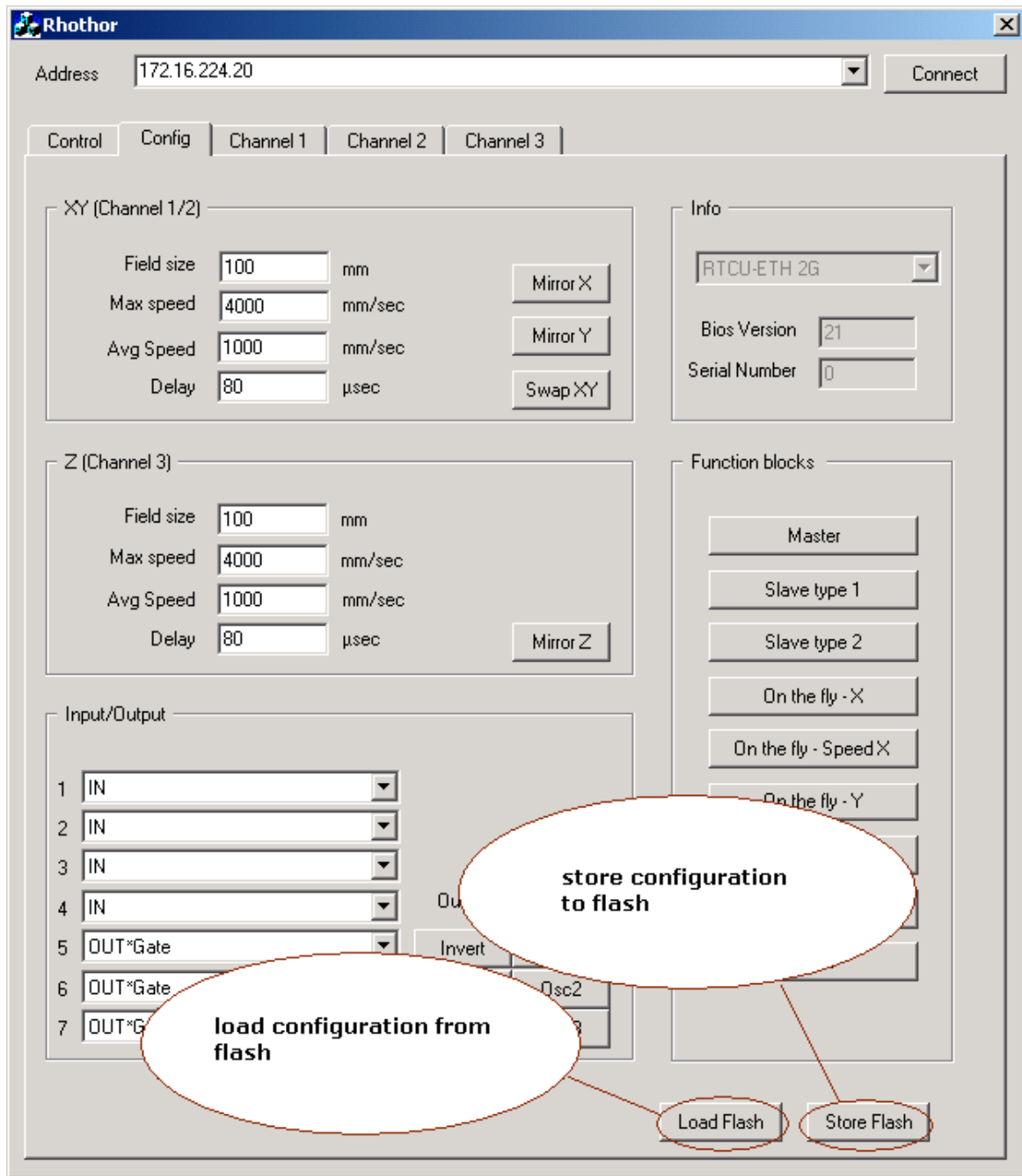
1. IN: use as an input
2. OUT: use as an output
3. OUT*OSC2: binary AND-function of out and free running oscillator 2.
4. OUT*Gate: binary AND-function of out and GATE.

Selections IO7

1. IN : use as an input
2. OUT : use as an output
3. OUT*Osc3 : binary AND-function of out and free running oscillator 3
4. OUT*Gate: binary AND-function of out and gate
5. OUT*Gate*Osc3: binary AND-function of out and GATE and oscillator 3 (*)
6. OUT*Gate*Osc3*Osc2: binary AND-function of out and Gate and Osc3 and Osc2

(*) Oscillator 3 is synchronised with rising edges of gate. This configuration can be used to control lasers with external triggering.

3.7 SAVE CONFIGURATION



Entered values in the “Config” window are immediately accepted by the rhothor application. During it’s session there is no need to store the entered values in flash. Storing to “Flash” makes the configuration non-volatile.

When the control system is configured, it is likely that the connected deflectors will have to be tuned. Press tabs “Channel1”, “Channel2” and or “Channel3” to verify or tune the connected deflectors.

4 PAGE: CHANNEL1, CHANNEL2, CHANNEL3

The screenshot shows the Rhothor control software interface. The window title is "Rhothor". At the top, there is an "Address" field containing "172.16.224.20" and a "Connect" button. Below this, the interface is divided into several sections:

- Control:** Contains buttons for "Off", "Track", "Tune", "Noise", "Round", "Square", and "Jump".
- Test Parameters:** Contains sliders and digital displays for "Setpoint (mm)" (14.674), "Amplitude (mm)" (0.476), and "Period (msec)" (0.580). A "Goto Zero" button is also present.
- Status:** Contains a section for "Actual (mm)" with a digital display showing 14.674 and a small diagram of a deflector. Below this are two green indicator lights.

Callouts provide the following information:

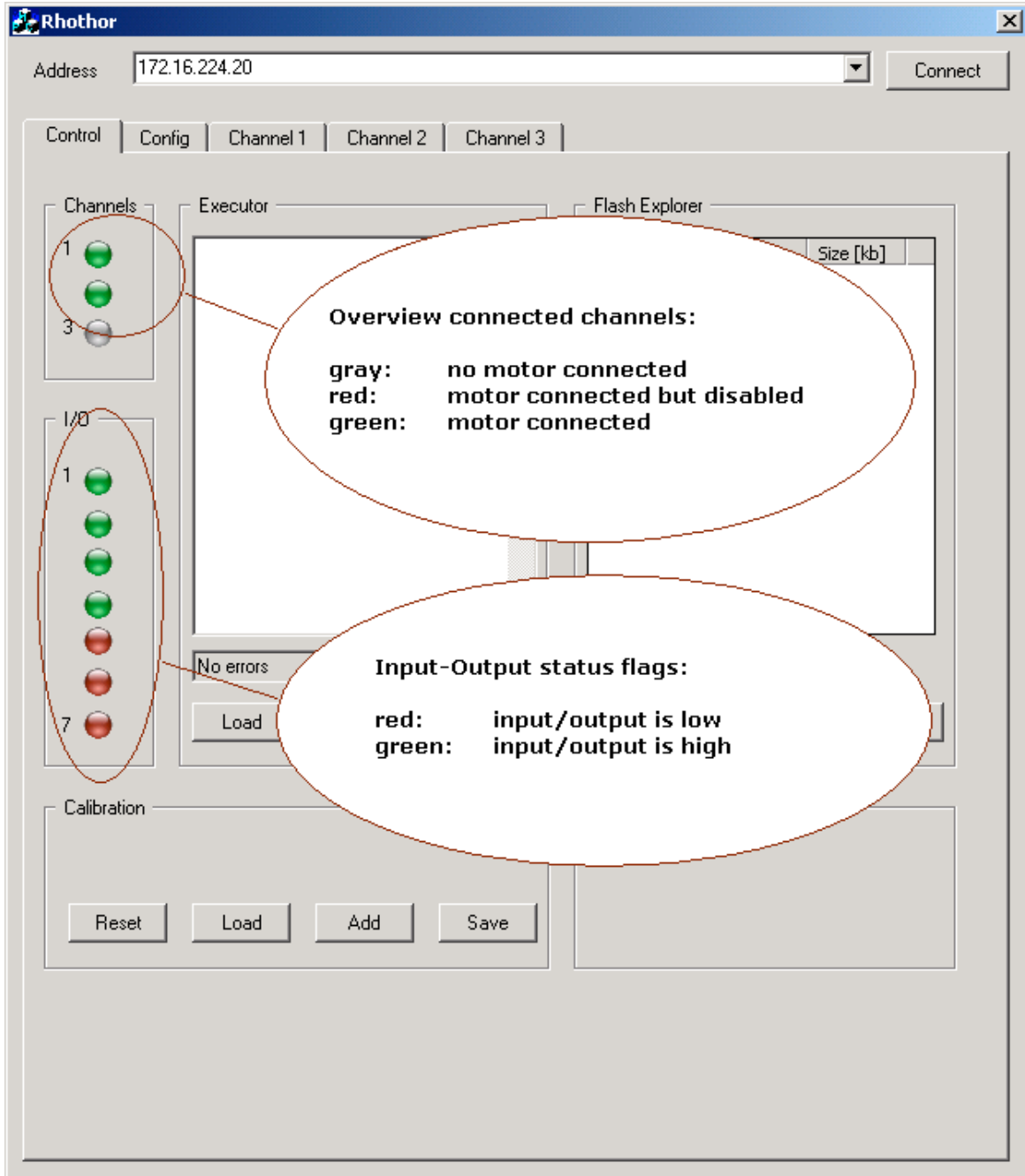
- switch off amplifier deflector:** Points to the "Off" button in the Control section.
- set deflector in normal mode:** Points to the "Track" button in the Control section.
- setpoint center position, slider can be operated when deflector is in test mode,** Points to the Setpoint (mm) slider.
- sliders to set setpoint function period and amplitude during test mode** Points to the Amplitude (mm) and Period (msec) sliders.
- set deflector in test mode: setpoint function can be 1: constant at "Noise" test 2: cosine at "Round" test 3: ramp at "Square" test 4: step at "Jump" test** Points to the "Tune" button.
- auto tune deflector using "Avg Speed" and "Delay" settings from "Config" page** Points to the "Tune" button.

After setting the properties on the "Config" page and tuning the deflector, its behaviour can be tested. The deflector can be set-up to execute periodically jumps, rounds and squares. An oscilloscope provides live graphical presentation of setpoint (green line) and actual (red line) positions.

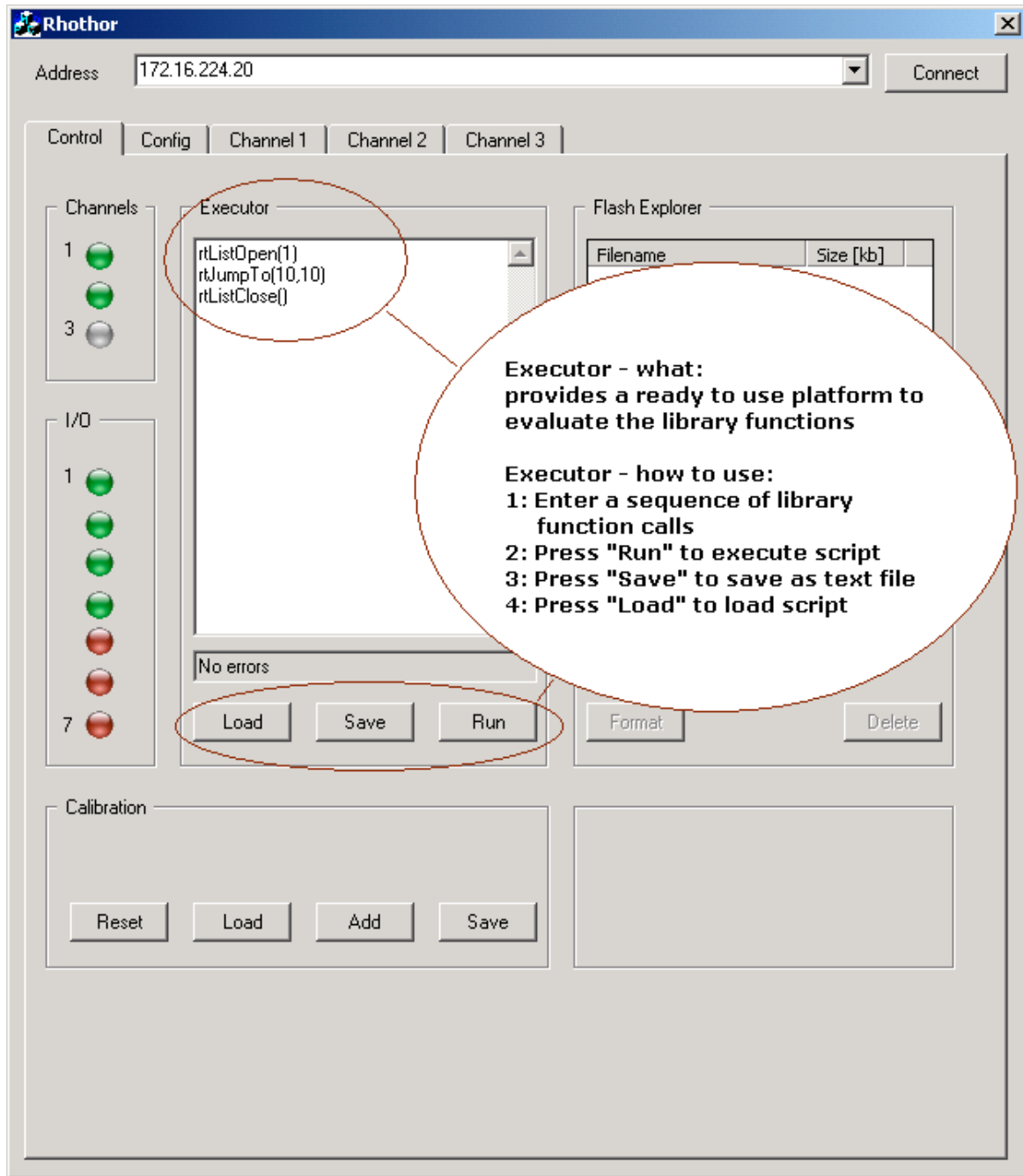
The rhothor™ deflection technology supports settable dynamics. The drag error can be set and regulators can be auto tuned. However there is a relation between system noise, drag error and setpoint value. Use the noise analyse test if the required drag error is low. This noise test should be done at all boundary points of the fieldsize.

5 PAGE: CONTROL

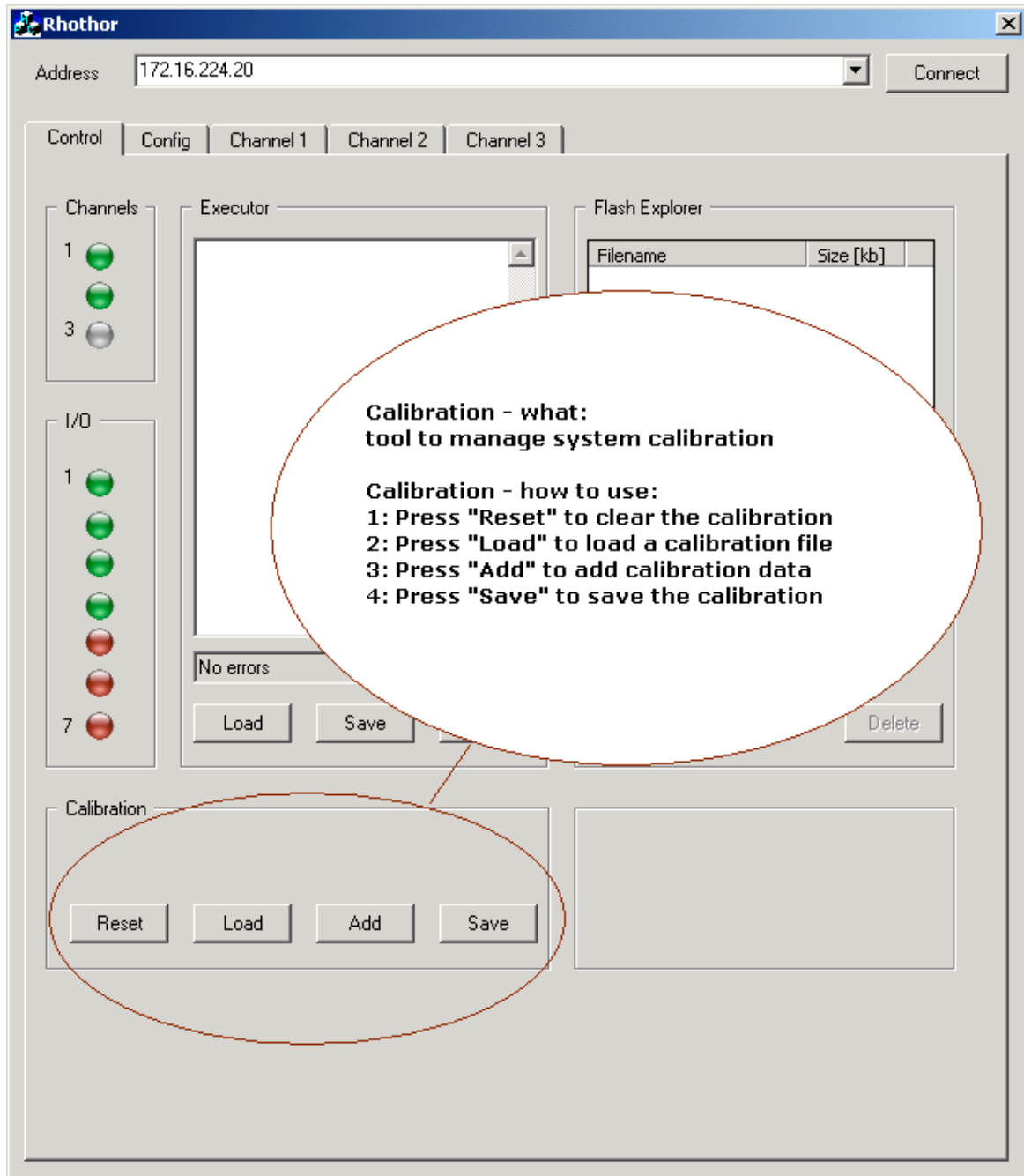
5.1 STATUS FLAGS



5.2 EXECUTOR



5.3 CALIBRATION



rhothor™ deflection systems use lookup tables to handle projection distortions. Calibration files are used to store those lookup tables. After power-up the calibration needs to be loaded into the system. The rhothor DII library has functions that allow to load, generate and store calibration files. Using the rhothor™ software those functions can be called by pressing a button.

5.3.1 Reset

Pressing button "Reset" will reset the calibration currently loaded in the system.

5.3.2 Load

Pressing button "Load" will pre-set the calibration with file data. In general the calibration file is a file generated by the system itself (Store command). However third party software can also generate Calibration files. See manual "A2G_App" for a complete description of calibration file format.

5.3.3 Add

By nature calibration differs from system to system. Therefore errors need to be measured and compensation needs to be adjusted. This can be done by lasering a raster of crosses and measure their positions. The number and position of those crosses is a function of the desired accuracy. The result of those measurements has to be stored in a data file. This data file can be added to the current calibration by pressing Add in the calibration interface. Data files need to be generated by application software. For more information on the file format of the data see manual "A2G_App".

5.3.4 Store

The currently loaded calibration can be stored to a file by pressing Store. This file can then be used to reload the current calibration after a restart of the system (Load command).

5.4 FLASH EXPLORER

