



Thermo Scientific

HAAKE MARS iQ (Air) Rheometer

Reference Manual

(Original Instructions)

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Release history:

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Preface

This manual gives additional information on setting up a network connection between the Thermo Scientific™ HAAKE™ MARS™ iQ (Air) Rheometer and the PC on which Thermo Scientific HAAKE RheoWin™ Software is running, on working with the touchscreen user interface, on working with specific parts of the HAAKE RheoWin software and on updating the rheometer firmware.

For a detailed description of how to install and operate the HAAKE MARS iQ (Air) and how to mount and dismount the various temperature modules and other accessories, see the HAAKE MARS iQ (Air) instruction manual.

Note In this manual the name HAAKE MARS iQ (or MARS iQ) is used to describe both the HAAKE MARS iQ (with ball-bearing drive motor) and the HAAKE MARS iQ Air (with air-bearing drive motor) unless stated differently.

Related documentation

In addition to this guide, Thermo Fisher Scientific provides the following documents for use with the HAAKE MARS rheometer:

- HAAKE MARS iQ (Air) Rheometer, Instruction Manual.
- HAAKE MARS™ Temperature Modules, Instruction Manual.
- HAAKE RheoWin, Installation and 21 CFR Part 11 Configuration, Instruction Manual.
- HAAKE RheoWin, Instruction Manual.

Safety and special notices

Make sure that you follow the cautions and special notices presented in this guide. Cautions and special notices appear in boxes; those concerning safety or possible damage also have corresponding caution symbols.

This manual uses the following types of cautions and special notices.



CAUTION Highlights hazards to humans, property, or the environment. Each CAUTION notice is accompanied by an appropriate CAUTION symbol.

IMPORTANT Highlights information necessary to prevent damage to software, loss of data, or invalid test results; or may contain information that is critical for optimal performance of the system.

Note Highlights information of general interest and information that can make a task easier.

This manual contains the following caution-specific symbols (see [Table 1](#)).

Table 1. Caution-specific symbols and their meanings

Symbol	Meaning
	Pinch point: The bracket holding the HAAKE MARS iQ drive motor may move up and down as part of a measurement or during manual controlled lift movement. There is a risk that body parts may be pinched between the bracket and the instrument frame or between the upper and lower part of a measuring geometry. Keep away any body parts (specifically hands) from these parts when they are moving.

Contacting us

Please always first address any question to the local Thermo Fisher Scientific office, see the following web-page for a list of addresses,

<https://www.rheowin.com/contact>

or the general agent or partner company who delivered your instrument.

International Helpdesk

You can also contact our international helpdesk directly. In that case we kindly ask you to use the following telephone number or e-mail address.

❖ To contact the international helpdesk

Telephone +49 721 409 4444
E-Mail ts.mc@thermofisher.com

Application Support

For questions regarding your rheological application please use the following e-mail address to contact our application specialists. Do not use this e-mail address for any other questions.

❖ To contact Application Support, Germany and International

E-mail support.rheology@thermofisher.com

Software and Firmware downloads

The latest HAAKE RheoWin software version and firmware versions for all HAAKE rheometers and viscometers are available as downloads from our dedicated web-site.

❖ To download software and firmware

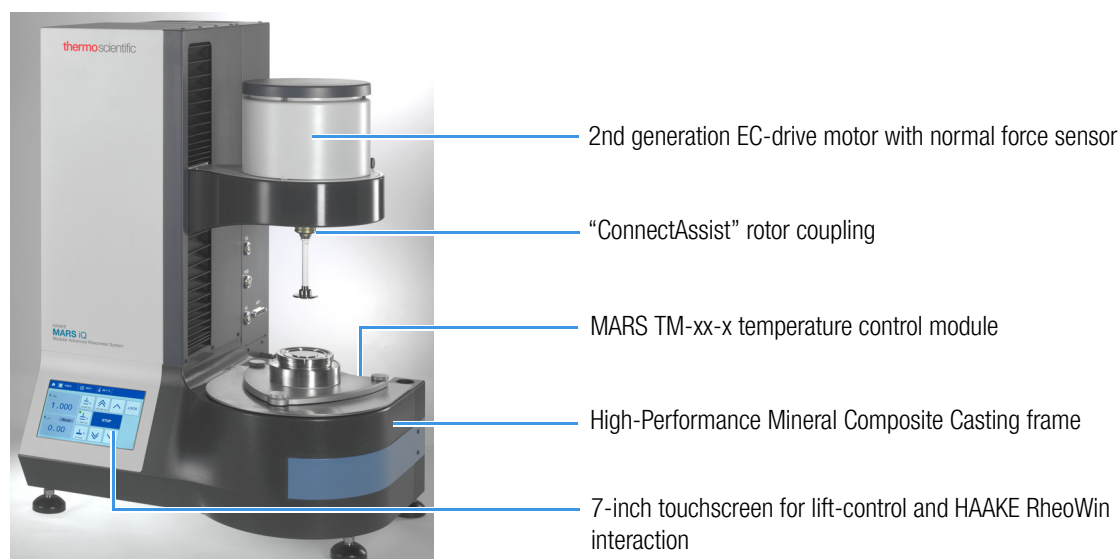
Internet www.rheowin.com

Instrument Description

The development of the HAAKE MARS iQ¹ rheometer was driven by customer demands from the quality control (QC) and product development area. In the HAAKE MARS iQ we have combined our decades of experience in rheology and rheometry with new technical solutions, which are especially designed for highly dynamic working environments.

Our goal was to enable fast, reliable and precise rheological measurements with a maximum ease of operation. As an operator, please feel encouraged to challenge the HAAKE MARS iQ performance.

Figure 1. The HAAKE MARS iQ



The following list sums up the main features of the HAAKE MARS iQ.

- A choice between two models:
 - The HAAKE MARS iQ with a ball-bearing drive motor.
 - The HAAKE MARS iQ Air with an air-bearing drive motor for a (much) wider torque range.
- Second generation, highly dynamic, powerful, synchronous, EC-motor² with CR-mode³, CD-mode⁴ and CS-mode⁵ for both rotational and oscillatory rheometry.

¹ Unless stated differently in this manual the name HAAKE MARS iQ is used to describe both the HAAKE MARS iQ and the HAAKE MARS iQ Air. **MARS** stands for “**M**odular **A**dvanced **R**heometer **S**ystem”.

² EC-motor: Electronically Commutated motor

³ CR-mode: Controlled shear Rate mode

⁴ CD-mode: Controlled Deformation mode

⁵ CS-mode: Controlled shear Stress mode

- A new high resolution normal force transducer with very good temperature stability for axial rheometry (standard with HAAKE MARS iQ Air, optional with HAAKE MARS iQ).
- A completely new, very spacious, folded H-frame instrument design with a very high stiffness and high precision lift with a large travel range. The instrument electronics is completely integrated.
- Instrument frame and bracket for drive motor made from a High-Performance Mineral Composite Casting (HPMC-Casting) material which offers an unmatched strength and stiffness as well as unmatched vibrational damping and temperature stability.
- A completely new direct drive lift with a highly accurate linear optical encoder.
- New designed, very rigid mounting system for upper temperature modules.
- A large, 7 inch capacitive colour, touchscreen with an intuitive, easy to use, clearly structured user interface for manual lift control and interaction with the HAAKE RheoWin rheometer software.
HAAKE RheoWin measuring routines (Jobs) can be launched and controlled from the touchscreen.
The touchscreen user interface language can be selected from a list of 18 languages: English, German, Dutch, French, Polish, Czech, Slovakian, Spanish, Portuguese, Italian, Hungarian, Finnish, Russian, Turkish, Thai, Chinese, Korean and Japanese.
- High precision “ConnectAssist” quick coupling for measuring geometries and temperature modules with automatic recognition including automatic transfer of the relevant geometry parameters.
- Compatibility with existing HAAKE MARS TM-xx-x temperature control modules and other accessories.
Existing upper TM-xx-x that are mounted to the guide bar holder are **not** directly compatible.
- Compatibility with existing HAAKE Viscotester iQ and HAAKE MARS 40/60 “ConnectAssist” measuring geometries.
- Easy and quick exchange of temperature modules with “ColorAssist” and comfortable access to cable and hose connector sockets.
- Optional “ProtectAssist” door with safety lock to protect the operator.
- Ethernet TCP/IP interface for point-to-point communication with a PC on which HAAKE RheoWin is running or for integration in a company network.
- Multiple input/output and trigger signals for auxiliary devices.
- Integrated power supply connector socket for the external HX R Peltier heat exchanger.
- Relative small footprint due to one-box design for optimal use of lab space (width 515 mm, depth 500 mm, height 700 mm).
- HAAKE RheoWin PC software for,
 - complex measuring and data evaluation routines (Jobs) and interactive data analysis,
 - automatic report export (PDF) and report printout,
 - 21 CFR part 11 compatibility.

For a more detailed description of the functionality, installation, operation and specifications, etc. of the HAAKE MARS iQ and its accessories, see the following chapters of this manual.

Touchscreen user interface

This chapter describes how to operate the instruments touchscreen user interface.

IMPORTANT Read the relevant parts of this chapter before operating the instrument for the first time.

Touchscreen user interface

The touchscreen used in the HAAKE MARS iQ is a 7 inch capacitive touchscreen panel. A light touch of a finger tip is enough for executing a command. The touchscreen can be operated while wearing standard nitrile (laboratory) gloves without limitations.

Note The touchscreen is equipped with a screensaver, see “Screensaver” on [page 25](#).

Figure 2. Working with the touchscreen



Using the graphical user interface on the touchscreen, the operator can manually control the lift, set and start the temperature control, launch HAAKE RheoWin Jobs and interact with them, view instrument status information and put the instrument in standby mode.



CAUTION Do not operate the touchscreen when the glass of the touchscreen is broken.

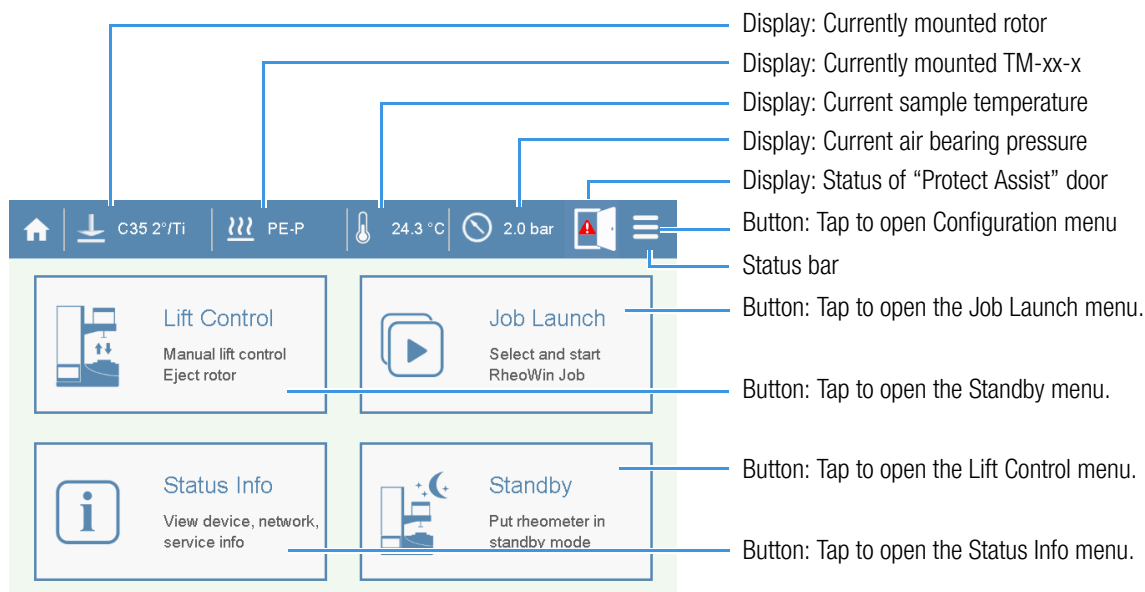
Main menu

The touchscreen user interface main menu, see [Figure 3](#), consist of the following functional elements:

- A status bar with several integrated buttons at the top of the screen.

- Four large buttons for accessing the main touchscreen functionality.

Figure 3. The Main menu



The four sub-menus, that is the “Lift control menu,” the “Job Launch menu,” the “Status Info menu,” and the “Standby menu,” can be accessed by tapping on the corresponding large button.

Status bar functionality

The status bar displays basic instrument setup and includes some buttons.

Information in status bar

The following is displayed in the status bar from left to right:

- The name of the measuring geometry rotor (C35 2°/Ti in [Figure 3](#)) which rotor is mounted to the drive motor shaft coupling
- The name of the temperature control module(s) (TM-PE-P in [Figure 3](#)) which is (are) connected to the corresponding socket(s) at the right hand side of the MARS iQ frame.

Both the measuring geometry and the temperature control unit are automatically detected when they are mounted/connected to the rheometer.

- The current temperature (24.3 °C in [Figure 3](#)) of the temperature control module.
- The current air pressure (2.0 bar in [Figure 3](#)) of the air-bearing (MARS iQ Air only).
- The status (open in [Figure 3](#)) of the optional TM-CR-O oven half shells or the optional “ProtectAssist” door. The three possible status icons indicate the following:

-  the TM-CR-O oven or “ProtectAssist” door is completely **open**.
-  the TM-CR-O oven or “ProtectAssist” door is completely **closed**.
-  the TM-CR-O oven or “ProtectAssist” door is in an **undefined** position.

Buttons in status bar

The following text/symbols have the following button functionality:

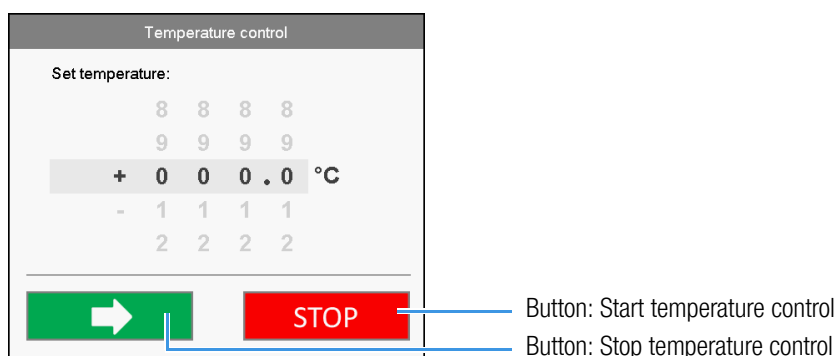
- Tapping the  button will open the geometry status information screen (see [Figure 22](#)) of the “Status Info menu,”.
- Tapping the  button will open the temperature control status information screen (see [Figure 23](#)) of the “Status Info menu,”.
- Tapping the  button will open the temperature control popup-window (see “Manual temperature control” on [page 5](#)).
- Tapping the  button will open the configuration menu (see “Configuration menu” on [page 19](#)).

Manual temperature control

❖ To start the temperature control

1. Tap on the current **sample temperature value** in the status bar.
2. In the Temperature control pop-up window (see [Figure 4](#)) edit the temperature value by sliding the numbers up/down.

Figure 4. Set temperature popup-window



3. Tap the  button to start the temperature control.

❖ To stop the temperature control

1. Tap on the current **sample temperature value** in the status bar.
2. Tap the  button in the Temperature control pop-up window (see [Figure 4](#)).

Lift control menu

The basic functionality of the Lift control menu is described in [Figure 5](#), for a more detailed description of the functionality see the following procedures.

Moving the lift up/down

❖ To move the lift downward

1. Tap the **Lift down** button  to move the lift downward with the maximum speed.
The lift will automatically stop at the lower-stop-position gap value which is displayed on the button. This lower-stop-position gap value can be modified, see “[To edit a gap value.](#)”
When the lower-stop-position gap value is set to 0.0 mm, no gap value is displayed on the button.

or

2. Tap and hold the **Lift down** button  to move the lift downward slowly.

The slow lift speed value can be changed in the **Configuration > Lift** menu, see “[Configuration menu](#)” on [page 19](#).

Note

- As long as the lift is moving a yellow dot ● is displayed on the button.
- The gap value on the button is automatically hidden, when the actual gap is smaller than the set lower stop-position-gap value.

❖ **To move the lift upward**

1. Tap the **Lift up** button  to move the lift upward with the maximum speed.

The lift will automatically stop at the intermediate-stop-position gap value displayed on the button. This intermediate-stop-position gap value can be modified, see “[To edit a gap value](#),”

When the intermediate-stop-position gap value is set to 0 mm or > 175 mm, no gap value is displayed on the button.

or

2. Tap and hold the **Lift slow up** button  to move the lift upward slowly.

The slow lift speed value can be modified in the **Configuration > Lift** menu, see “[Configuration menu](#)” on [page 19](#).

As long as the lift is moving a yellow dot is displayed on the button.

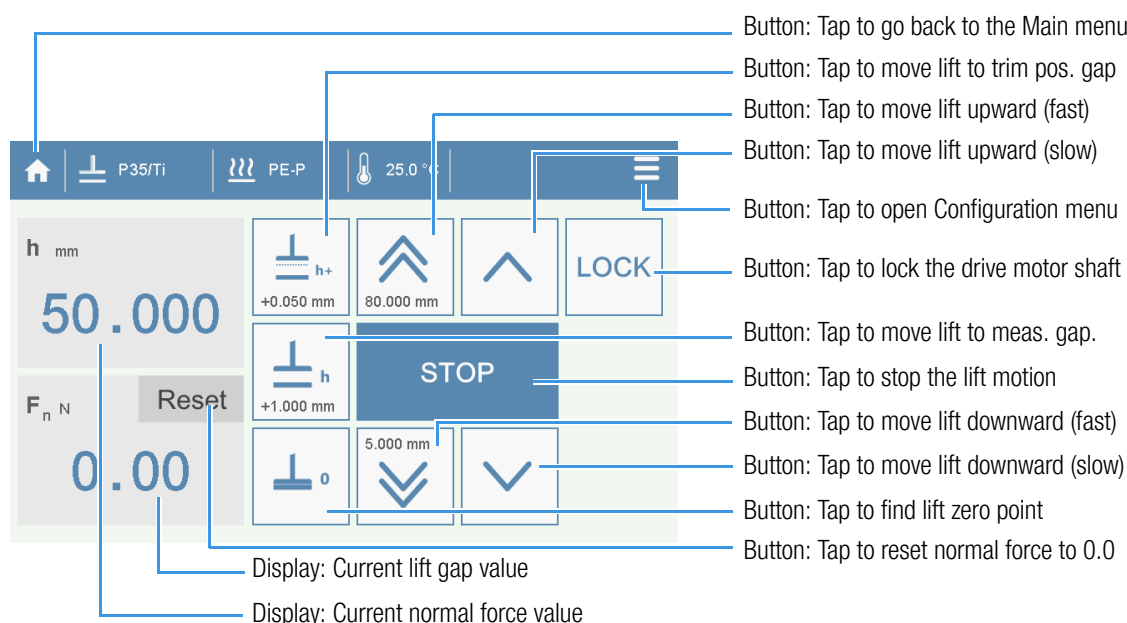
Note

- As long as the lift is moving a yellow dot ● is displayed on the button.
- The gap value on the button is automatically hidden, when the actual gap is larger than the set intermediate-stop-position gap value.

❖ **To stop the Lift movement**

1. Tap the STOP button  to stop the lift movement immediately anytime.

Figure 5. Lift control menu



Setting the lift zero point

Because the effective length of the various measuring geometry rotors is not the same for all rotors it is crucial to determine the lift zero point before setting the measurement gap, that is before running a measurement.

The preferred method is to have the instrument find and set the lift position automatically.

❖ To automatically find and set the lift zero point

1. Tap the **Zero point** button .

The lift will then automatically move downward and determine the zero point.

Note

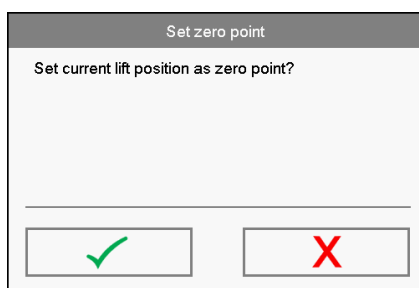
- During the procedure a yellow dot ● is displayed on the button.
- When the zero point was found and set, the colour of the dot ● changes to green.
- When the procedure is finished the normal force signal will show a small positive value indicating that the rotor touches the lower plate or cup.

For non-typical measurements it may be useful to be able to define/set the lift zero point manually.

❖ To manually set the zero point

1. Tap and hold the **Zero point** button  for at least 3 seconds to open the **Set zero point** dialog, see Figure 6.

Figure 6. Set zero point dialog



2. Tap the Ok  button to set the current lift position as the zero point.

Moving the lift into measurement position

Moving the lift into the trim position and/or measurement position is normally done automatically as part of a RheoWin job, but it can also be done from the touchscreen.

❖ To move the lift to the trim position

1. Tap the **Trim position gap** button .

The trim position gap value can be modified, see [“To edit a gap value.”](#) The trim position gap value is a value relative to the measurement position.

Note

- As long as the lift is moving a yellow dot ● is displayed on the button.
- When the trim position has been reached, the colour of the dot ● changes to green.

❖ To move the lift to the measurement position

1. Tap the **Measurement gap** button .

For measuring geometries that do not require a specific gap value (like parallel-plate geometries and vanes), the measurement position gap value can be modified, see [“To edit a gap value.”](#)

Note

- As long as the lift is moving a yellow dot ● is displayed on the button.
- When the measurement position has been reached, the colour of the dot ● changes to green.

Modifying lift position values

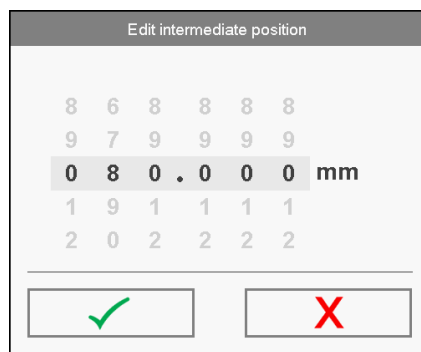
The gap values on the following buttons can be edited on the touchscreen:

- The gap value on the **Measurement gap** button .
- The relative trim position on the **Trim position gap** button .
- Intermediate lift position value on the **Lift up** button .
- Intermediate lift position value on the **Lift down** button .

❖ **To edit a gap value**

1. Tap and hold the corresponding button for at least 3 seconds to open the **Edit gap** dialog, see Figure 7.

Figure 7. Edit gap value dialog



2. Use the scroll wheels in the Edit gap dialog to modify the gap value digit by digit.
3. Tap the Ok  button to accept the new value.

Normal force signal

Under non-typical circumstances it may be useful to be able to “tare” or reset (to 0.0 N) the normal force signal. On a MARS iQ **without** installed normal force option, the resolution of the normal signal is limited to 0.5 N and the normal force signal can not be used in measurements.

❖ **To reset the normal force signal**

1. Tap the **Reset** button above the normal force value to set the normal force signal to 0.0 N.

Locking the drive motor shaft

The drive motor shaft can be “locked” in a certain angular position to prevent it from rotating. This is useful for sample loading and sample trimming. The drive motor shaft is automatically unlocked by the first measurement element in a RheoWin Job.

❖ **To lock the drive motor shaft**

1. Tap the **Lock** button .

Note

- A red dot ● is displayed on the button to indicate that the drive motor shaft is locked.

❖ **To unlock/release the drive motor shaft**

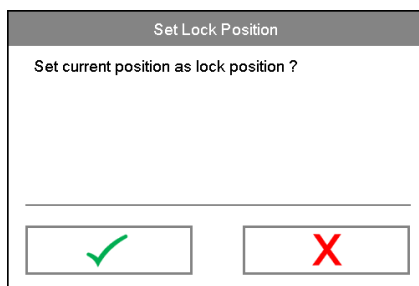
1. Tap the **Lock** button .

Under certain circumstances, for example when applying a sample to the SER-tool, it is very handy to apply a specific angular lock position to the drive motor shaft.

❖ **To set the drive motor shaft angular lock position**

1. Tap and hold the **Lock** button  for at least 3 seconds to open the **Set Lock Position** dialog, see [Figure 8](#).

Figure 8. Set lock position dialog



2. Tap the Ok  button to set the current drive motor shaft angular position as the lock position.

Pull/push lift control

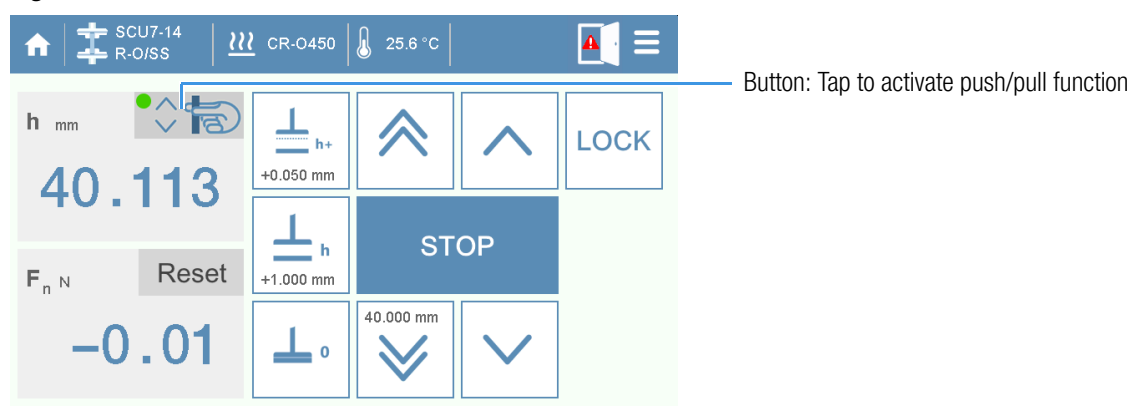
To make loading a sample in a solid clamp measuring geometry more comfortable, the operator can control the lift directly by pushing or pulling on the drive motor shaft. This functionality is **only** available when a solid clamp measuring geometry is attached to the drive motor shaft.

❖ **To use the pull/push functionality**

1. Tap the pull/push  button, see [Figure 9](#), to activate the pull/push functionality.
A green dot will appear on the button to indicate that the functionality is activated.
2. Pull (exert a downward force) on the drive motor shaft to move the measuring head bracket, and thus the upper part of the measuring geometry, downward.
or
3. Push (exert an upward force) on the drive motor shaft to move the measuring head bracket, and thus the upper part of the measuring geometry, upward.
when finished
4. Tap the pull/push  button again to deactivate the pull/push functionality.

The (slow) lift speed used for this can be selected from the configuration menu on the touchscreen, see [“To change the slow lift speed”](#) on [page 23](#) for more information.

Figure 9. Lift control menu



Lift safety mechanisms

The following safety mechanism are implemented in the lift control logic.

1. When the lift is moving downward and an upward force is detected (by the normal force sensor in the measuring head) the lift will stop immediately. This is valid for all downward lift movement apart from when moving to measurement position.

Note This safety mechanism is also active when the normal force option is not installed.



CAUTION The hand or a finger of a person or any other object in the lift travel area may be pinched between the upper and lower part of the measuring geometry.

2. When moving downward, the lift will automatically stop when the position of the last zero point is reached. At this point the lift can be moved to a lower position with the down buttons on the touchscreen (or in RheoWin) or by using the find and set zero point button on the touchscreen (or in RheoWin).
3. When no rotor is mounted to the motor drive shaft or the mounted rotor is not recognized or no TM-xx-x module is connected to the instrument or the connected TM-xx-x module is not recognized the lift speed for the downward movement is automatically limited to 2 mm/s.

In this case a message explaining the (unexpected) slow lift speed is displayed on the touchscreen, see [Figure 10](#) and [Figure 11](#).



CAUTION When the lift is moving downward **without** a rotor being mounted to the motor drive shaft, the hand or a finger of a person, or any other object in the lift travel area, may be pinched between a sample hood mounted to the measuring head bracket and the lower part of the measuring geometry.

Figure 10. Safety message: No rotor detected

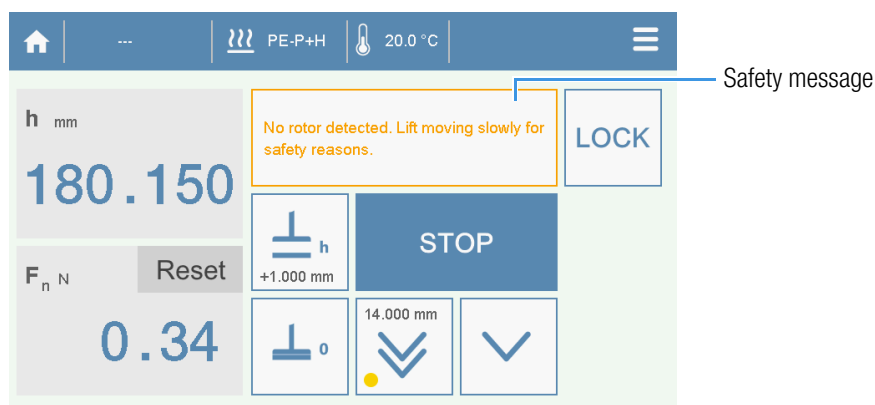
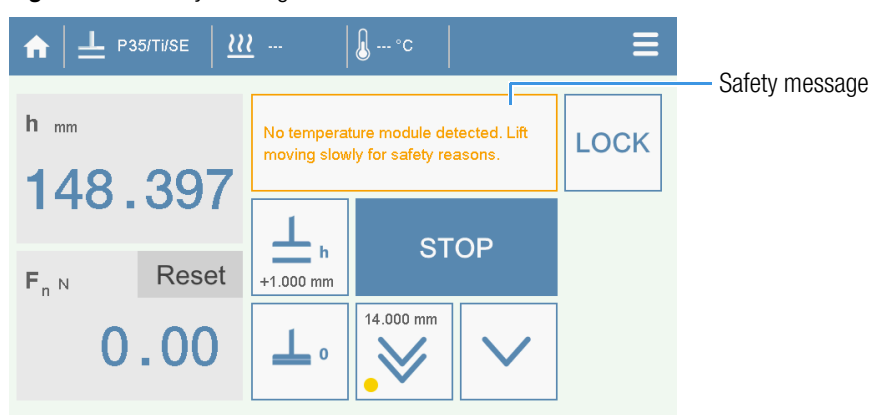


Figure 11. Safety message: No TM-xx-x detected



Additional lift safety mechanisms for TM-CR-O oven

In addition to the standard safety mechanisms, the following safety mechanisms are active in the lift control logic when the TM-CR-O oven is mounted on and connected to the HAAKE MARS iQ (Air) rheometer:

1. When the HAAKE MARS iQ half shells are both in the completely opened position the lift control is not limited.
2. When the HAAKE MARS iQ half shells are in an undefined position, that is not completely open nor completely closed, lift control is not possible.
3. When the HAAKE MARS iQ is completely closed the lift travel is limited.



CAUTION The hand or a finger of a person or any other object in the lift travel area may be pinched between the upper and lower part of the measuring geometry or between the upper part of the measuring geometry and the oven shell or between the measuring head bracket and the oven shell.

Job Launch menu

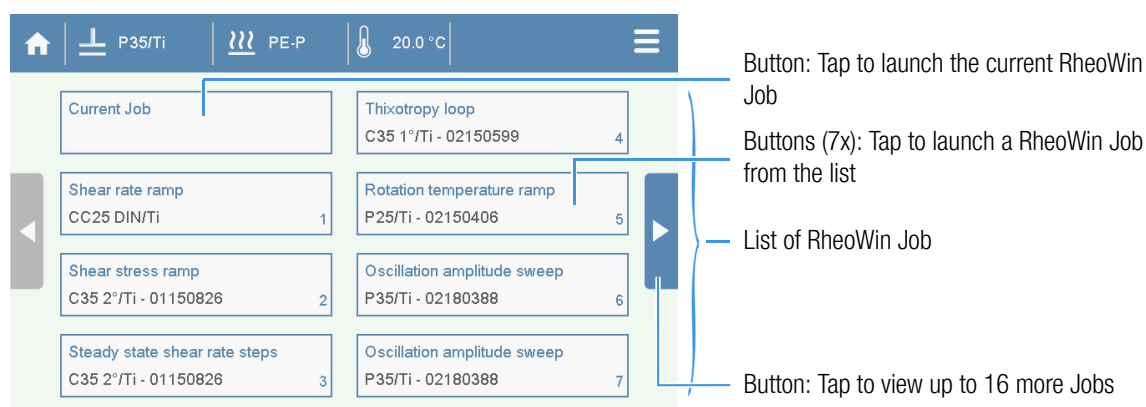
The MARS iQ touchscreen can be used as a “remote control” unit for a RheoWin Job running on a PC. This “remote control” feature includes launching (starting) a Job, but it is not limited to that: All messages that are displayed in RheoWin as part of a running Job are also displayed on the touchscreen and can be controlled from the touchscreen.

Launching a RheoWin Job

From the Job Launch menu (see [Figure 12](#)), either the RheoWin Job in the currently active Job Editor window in RheoWin JobManager or any Job from the list of RheoWin Jobs (on the touchscreen) can be launched.

IMPORTANT Launching (starting) from the touchscreen is the same as starting a Job in RheoWin (on a PC). In both cases the Job is running in RheoWin and controlled by RheoWin. Regarding RheoWin Jobs, the touchscreen should be seen as a remote control unit for RheoWin. This implies that RheoWin must be running and communicating with the MARS iQ before a Job can be started.

Figure 12. Job Launch menu with list of RheoWin Jobs



For a detailed description on how to edit the list of RheoWin Jobs in the Job Launch menu see [“Uploading a Job list to the rheometer touchscreen”](#) on [page 37](#).

❖ To launch a RheoWin Job

1. In the Job Launch menu tap the button for the desired RheoWin Job.

❖ To stop a RheoWin job

1. Tap the **Stop STOP** button in the upper right corner of the screen to stop the RheoWin Job immediately at any time.

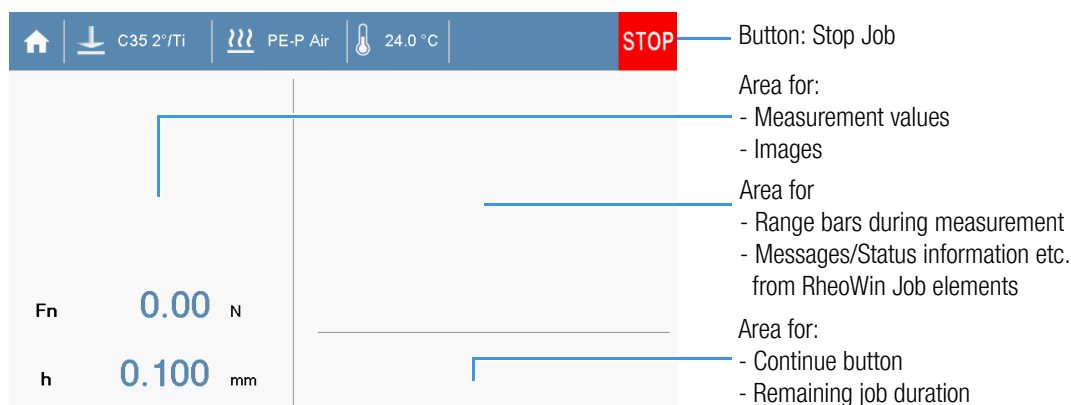
The Job run menu

When a RheoWin Job is started, either from RheoWin or from the Job Launch menu on the MARS iQ touchscreen, the Job run menu is automatically displayed. Depending on which RheoWin Job element is being executed, different information, messages and controls are displayed in the three screen areas as described in [Figure 13](#).

The current temperature, normal force and gap values are always displayed.

The RheoWin Job can be stopped anytime by tapping the **Stop STOP** button.

Figure 13. Job run menu



Note The area for messages has space for 11 lines of text with a length of 40 characters each. Longer text lines will be wrapped.

In the following two paragraphs a few examples of the Job run menu are shown.

RheoWin Job element messages and user interaction

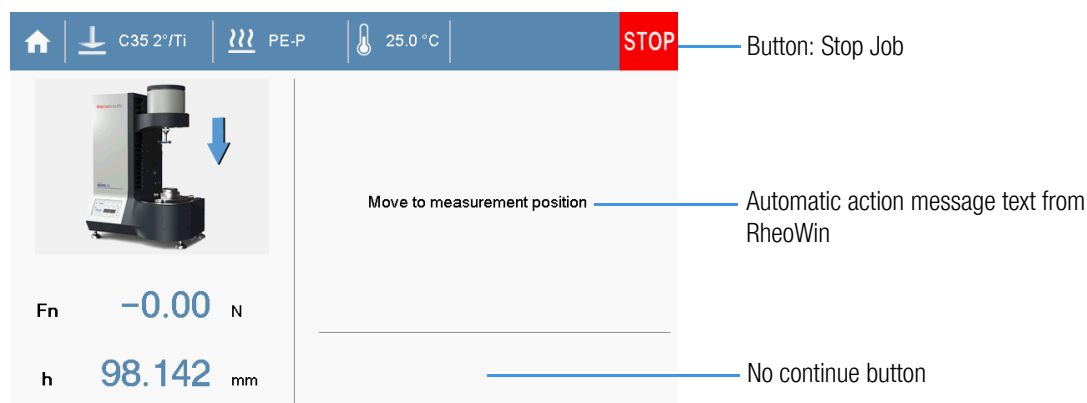
All messages which are displayed in RheoWin, either in the JobController or in separate message windows, as part of a running Job are also displayed on the touchscreen. Messages may be accompanied by a matching image on the right hand side of the touchscreen.

There are two main type of messages:

- **Automatic messages** from various RheoWin Job elements.
 - Automatic action messages, **without** Continue button, which disappear automatically when the action is finished. Messages of this type are generated by the **Lift** element, see [Figure 14](#), for an example.
 - Automatic user action messages, **with Continue** button, which can be confirmed on the touchscreen **or** in RheoWin.
 - Automatic user action messages that can **only** be confirmed in RheoWin, see [Figure 15](#). Such a message is generated by the **Save** element when the **Ask for file name** option is selected, entering a *.rwd file is not possible on the touchscreen.
- **User defined messages** from the Lift element and the Message element, **with Continue** Button. The user defined text on the touchscreen is the same as the text in the RheoWin message window, see [Figure 16](#) and [Figure 17](#).

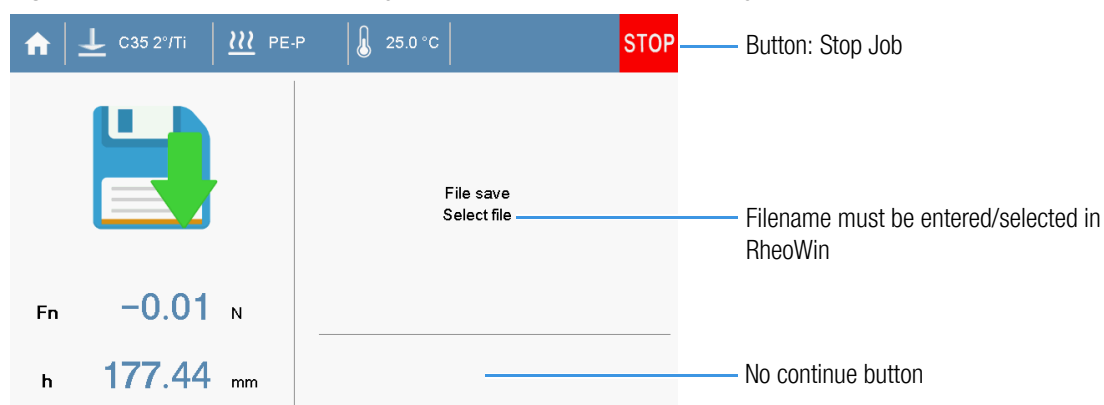
Any RheoWin Job controlled lift movement, moving upward/downward, finding the zero-position, moving to trim/measurement/standby position, etc., is automatically displayed in the Job run menu, see [Figure 14](#), for an example.

Figure 14. Automatic action message from the lift element



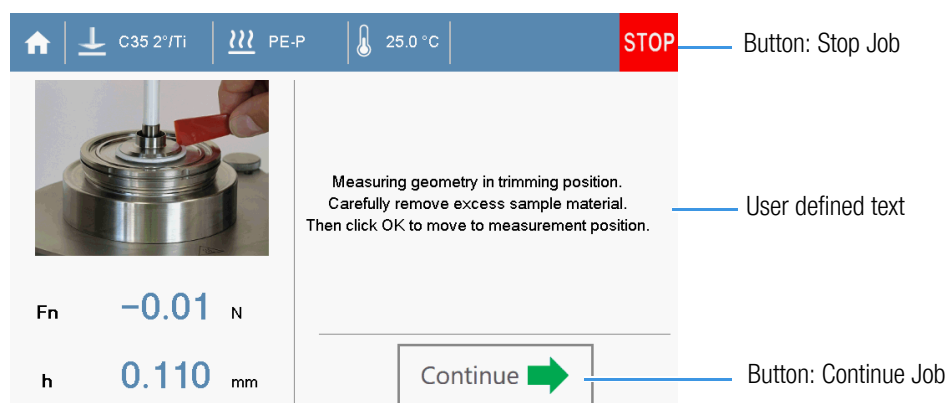
When the RheoWin Job is setup to ask for a filename for the measured data a corresponding message plus image is displayed in the Job run menu, see [Figure 15](#).

Figure 15. Automatic action message from the file save element message



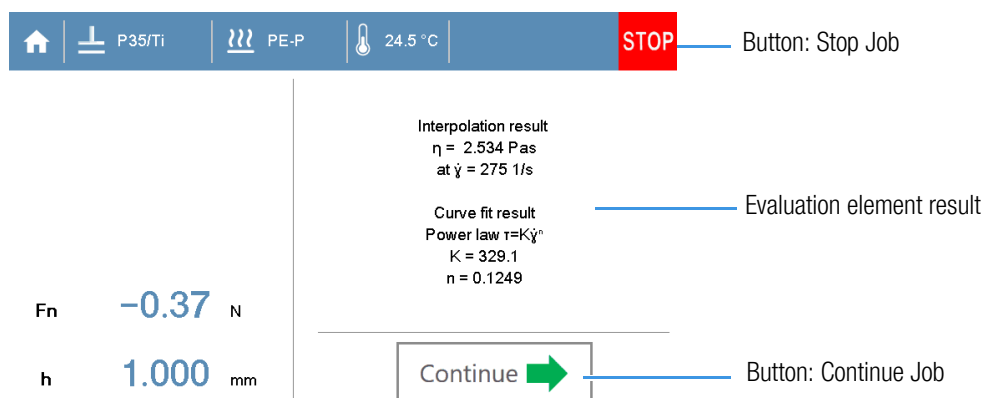
The optional messages, with user defined text, from the **Lift** element are displayed in the Job run menu as shown in [Figure 16](#), to continue the Job tap the **Continue** button on the touchscreen or click the **Continue** button in the RheoWin message window which is displayed simultaneously.

Figure 16. User defined message from the lift element



Messages from the RheoWin **Message** element are also displayed in the Job run menu, see [Figure 17](#) for an example. Here the result of an evaluation element is displayed using the RheoWin R_IDx_Py_z parameters.

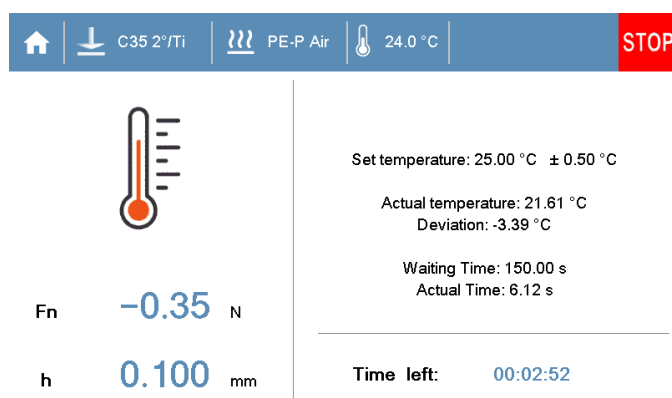
Figure 17. User defined message from the message element



Basic measurement data

When the RheoWin Set temperature element is being executed the Job run menu will display the information as displayed in [Figure 18](#).

Figure 18. Waiting for set temperature status information

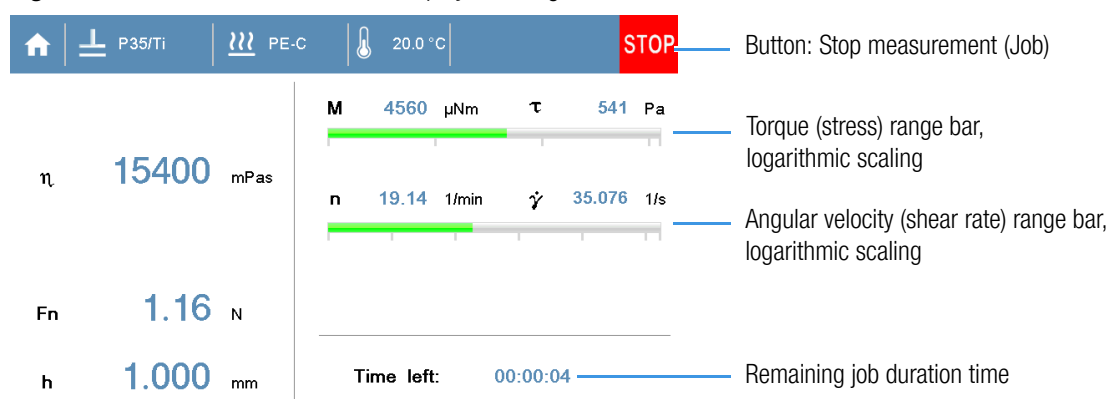


When a RheoWin measurement element is being executed the Job run menu will display some basic measurement data. During any rotation or axial Element the data in [Figure 19](#) is displayed, during any oscillation element the data in [Figure 20](#) is displayed.

The Job run menu in [Figure 19](#) is also displayed when the RheoWin Monitor (manual control) windows is opened and used.

The displayed rheological quantities on the left hand side of the screen can not be modified. The units used for all displayed quantities are those that are currently selected in RheoWin.

Figure 19. Basic measurement data displayed during rotational and axial measurements



On the right hand side of the measurement screen two logarithmically scaled range bars are displayed. The upper bar shows the current torque and stress measured or set values. The lower bar shows the current angular velocity and shear-rate (during rotation) or angle and strain (during oscillation) measured or set values.

Range bar colours:

- A range bar is red when the value is below the minimum allowed value.
- A range bar is yellow when the value is below 10x the minimum allowed value.
- A range bar is green when the value is above 10x the minimum allowed value.

During an oscillation measurement the set frequency and measured phase angle are displayed also.

Figure 20. Basic measurement data displayed during oscillation measurements



The remaining duration of the measurement part of the Job is displayed at the bottom right hand side of the screen.

Status Info menu

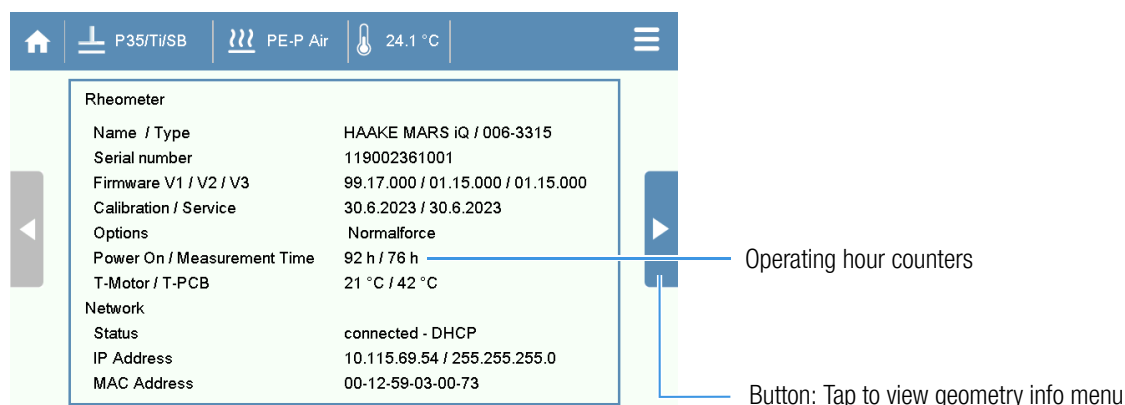
The Status Info menu gives basic information on the instrument itself (see [Figure 21](#)) as well the currently mounted measuring geometry (rotor) and the temperature control module.

❖ To switch between the rheometer, geometry and the temperature control status menus

1. Tap the arrow buttons on the left and right hand side of the menu to select another screen, see [Figure 21](#), [Figure 22](#), [Figure 23](#) and [Figure 24](#).

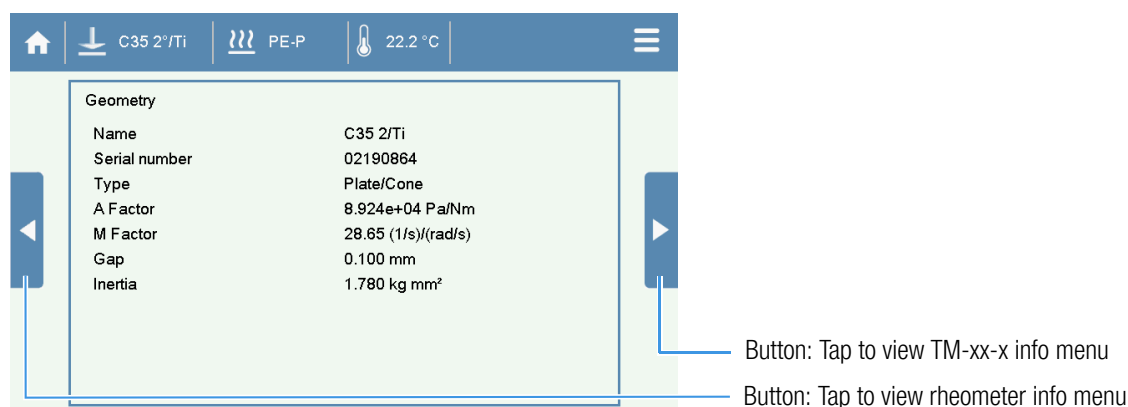
The Rheometer status information menu, see [Figure 21](#), lists basic instrument and network connection information.

Figure 21. Rheometer status information menu



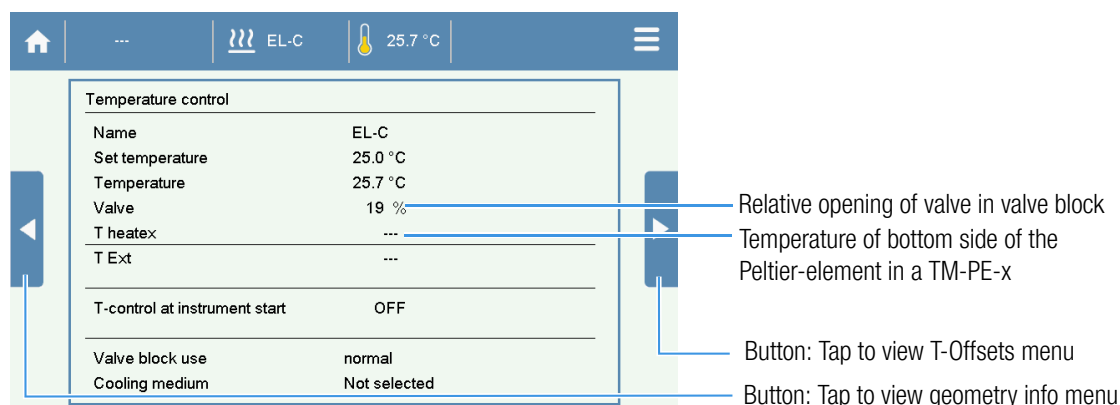
The Geometry status information menu, see [Figure 22](#), lists the basic geometry parameters.

Figure 22. Geometry status information menu



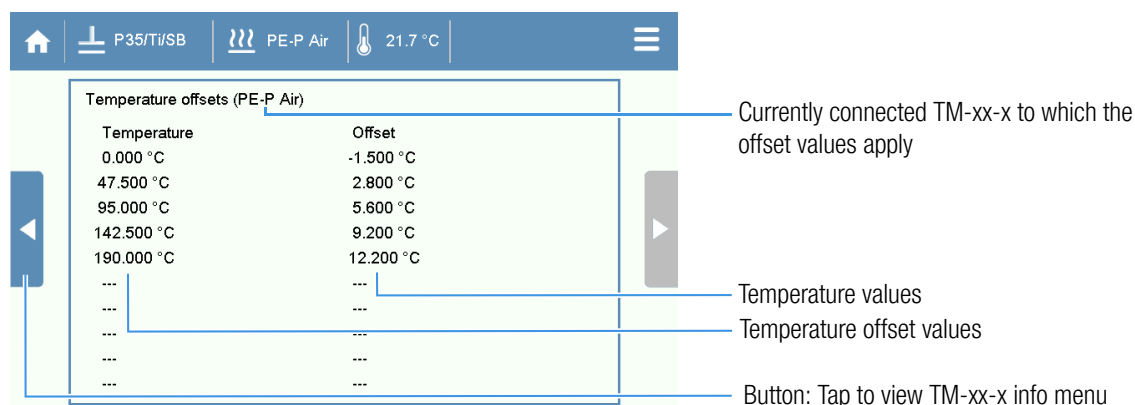
The Temperature control status information menu, see [Figure 23](#), lists basics information on the TM-xx-x modules connected to the rheometer.

Figure 23. Temperature control (TM-xx-x) status information menu



The Temperature offsets menu, see [Figure 24](#), lists the temperature offset values for the TM-xx-x module which is currently connected to the MARS iQ (Air). The same values can be viewed in the RheoWin DeviceManager.

Figure 24. Temperature offsets menu



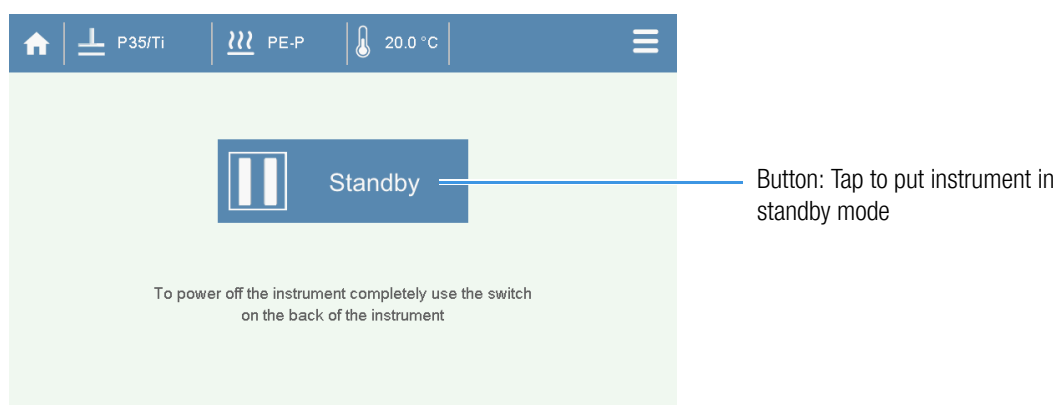
Standby menu

❖ To put the MARS iQ in power-saving standby mode

1. In the Standby menu tap the **Standby** button, see Figure 25.

Standby mode is signaled by LED L1 on the left side of the E-box rucksack (Figure 7 on page 8).

Figure 25. Standby menu



❖ To “wake up” the MARS iQ

1. Tap the (then black) touchscreen.

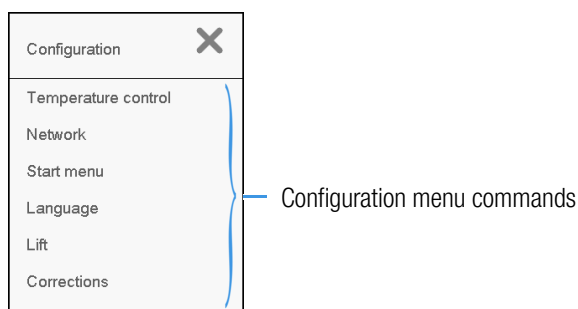
Configuration menu

Using the commands from the Configuration menu (Figure 26) the operator can select a language for the user interface, modify the network settings (IP address, etc.), change the manual slow lift speed value, etc.

❖ To open the Configuration menu

1. Tap the **Menu** button in the upper right corner of the main menu to open the configuration menu, see Figure 26.

Figure 26. Configuration menu



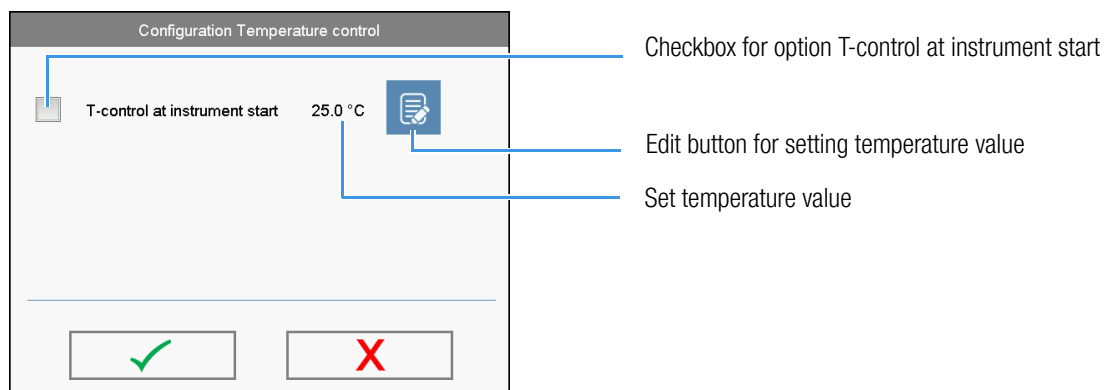
Temperature control configuration menu

In the Temperature control configuration menu, see [Figure 27](#), the operator can select whether temperature control should start automatically with a certain set temperature value when the instrument is switched on.

❖ To (de)activate the temperature control at instrument start-up

1. Open the **Configuration** menu, see “[To open the Configuration menu](#)” on [page 19](#).
2. Tap the checkbox to (de)activate the option.
3. Tap the **Edit**  button behind the temperature value (see [Figure 29](#)) to set the desired temperature.
4. Tap the **Ok**  button to accept the new setting and to close the menu.

Figure 27. Temperature control configuration menu

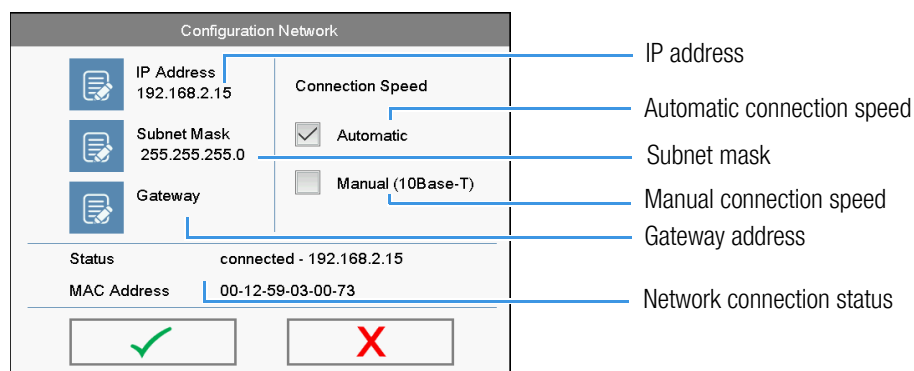


The current status of the option in this menu is displayed in the Temperature control (TM-xx-x) status information menu, see [Figure 23](#).

Network configuration menu

In the Configuration network menu, see [Figure 28](#), the instrument IP address and the Ethernet connection speed can be modified.

Figure 28. Network configuration menu



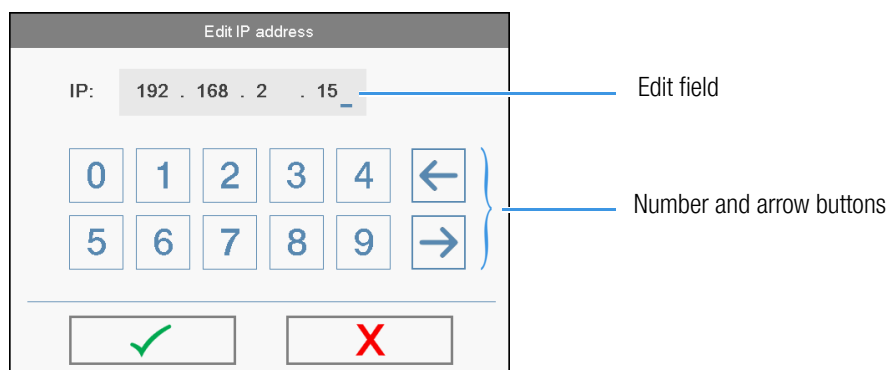
In most cases the default **Automatic** connection speed setting will work just fine. When there are problems connected the MARS iQ to a network, select the **Manual (10Base-T)** option.

❖ **To edit the IP address, the subnet mask value or the Gateway address**

1. Open the **Configuration** menu, see “[To open the Configuration menu](#)” on [page 19](#).
2. Select the **Network** command from the Configuration menu to open the **Configuration Network** menu, see [figure Figure 28](#).
3. Tap the **Edit**  button in front of the IP address or subnet mask to open the **Edit IP address**, the **Edit Subnet mask** or the **Edit Gateway** menu, see [Figure 29](#).
4. Edit the IP address, Subnet mask or Gateway address by tapping the number buttons below the edit field.

Use the arrow buttons to move to the next or previous three digit group.

Figure 29. Edit IP address



5. Tap the **Ok**  button to accept the new value and to close **Edit** menu.
6. Tap the **Ok**  button to accept all values in the **Configuration Network** menu and to close that menu.

IMPORTANT

- The IP address is changed immediately, this means that the IP address setting of the MARS iQ must also be modified in RheoWin DeviceManager for the communication between the MARS iQ and RheoWin to (continue to) work,

IMPORTANT

- See “[Gateways and VLANs](#)” on [page 29](#), before using the Gate address functionality.

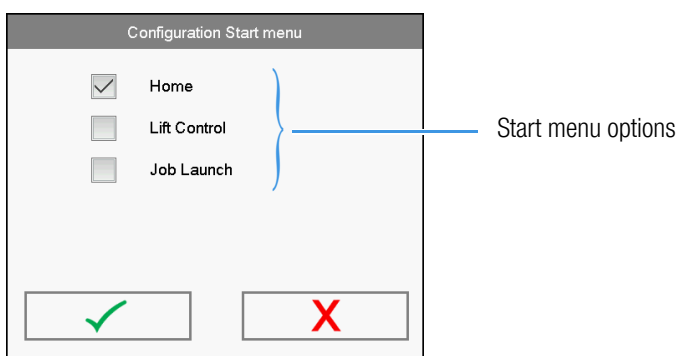
Start menu configuration menu

The operator can select which menu, the **Home** (Main) menu, the **Lift Control** menu or the **Job Launch** menu, is displayed after the instrument is initialized.

❖ To select a start menu

1. Open the **Configuration** menu, see [“To open the Configuration menu”](#) on [page 19](#).
2. Select the **Start menu** command from the Configuration menu to open the **Configuration Start menu**, see figure [Figure 30](#).
3. Tap the checkbox in front of the desired start menu.

Figure 30. Start menu configuration



4. Tap the **Ok**  button to accept the selection and to close the menu.

Language configuration menu

The touchscreen user interface language can be selected from a list of 18 languages: English, German, Dutch, French, Polish, Czech, Slovakian, Spanish, Portuguese, Italian, Hungarian, Finnish, Russian, Turkish, Thai, Chinese, Korean and Japanese.

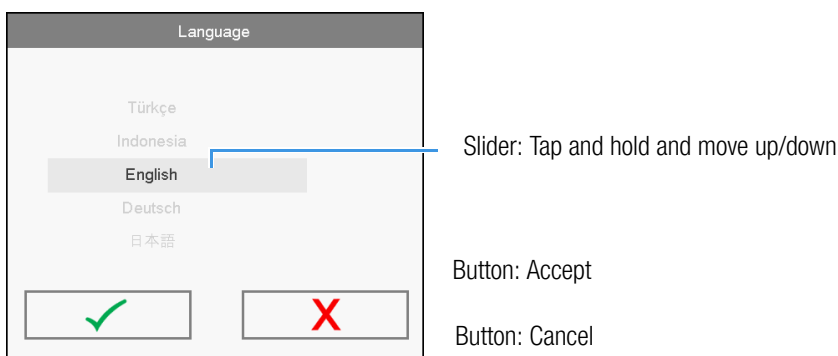
❖ To select a language

1. Open the **Configuration** menu, see [“To open the Configuration menu”](#) on [page 19](#).
2. Select the **Language** command from the Configuration menu to open the **Configuration Language** menu, see figure [Figure 31](#).

1. Tap and hold the slider and then scroll through the list to select the new language.

The selected language is displayed in the darker grey box.

Figure 31. Language configuration menu

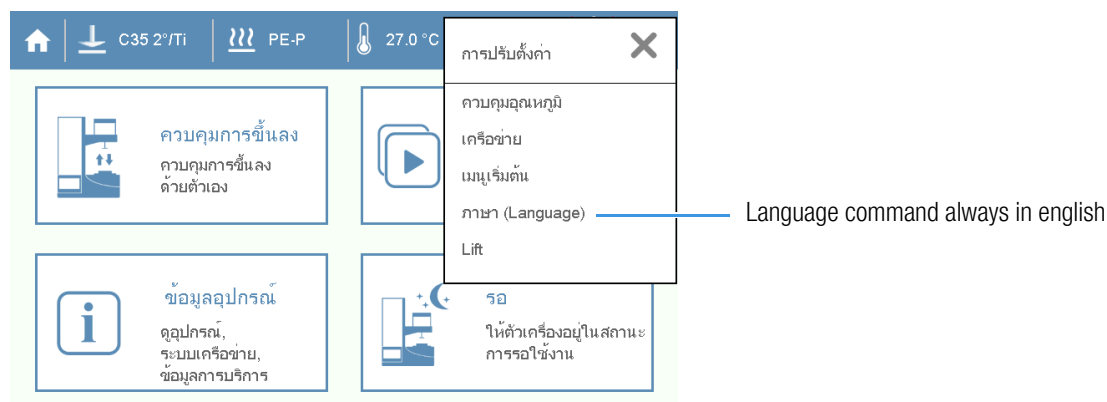


2. Tap the **Ok**  button to accept the new language and to close the menu.

The new language setting takes immediate effect.

As an example [Figure 32](#) shows the main menu in the Thai language.

Figure 32. Main menu in Thai language

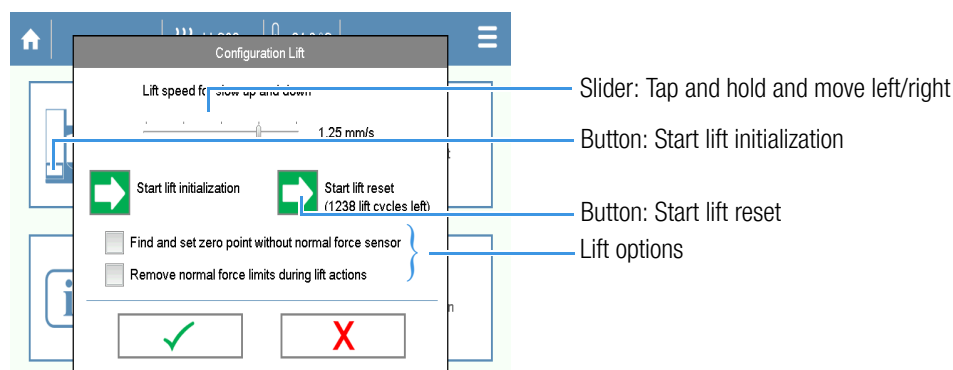


Lift configuration menu

In the **Configuration lift** menu the slow speed can be selected. This menu also offers two initialization/reset maintenance routines for the lift (linear slide), see [“Lift maintenance routines”](#) on [page 24](#), and two lift options for special situations.

The slow lift speed can be selected from the following values: **0.15 mm/s**, **0.30 mms/s**, **0.60 mm/s**, **1.25 mm/s** and **2.50 mm/s**.

Figure 33. Lift configuration menu



❖ To change the slow lift speed

1. Open the **Configuration** menu, see [“To open the Configuration menu”](#) on [page 19](#).
2. Select the **Lift** command from the Configuration menu to open the **Configuration Lift** menu, see figure [Figure 33](#).
3. Tap an hold the slider and move it left/right to select another lift speed.
The selected lift speed is displayed at the right hand side of the slider.
4. Tap the **Ok**  button to accept the selection and to close the menu.

Lift maintenance routines

Lift initialization

Tapping the **Lift initialization** button will move the drive motor bracket to the highest possible position to reset the lift position measuring routine. Depending on the lift starting position this routine takes up to 15 s to complete.

Lift reset

Tapping the **Lift reset** button will move the drive motor bracket to the lowest possible position for “resetting” the roller bearings of the lift linear slide. For this routine to work there must **not** be a rotor connected to the drive motor. Depending on the lift starting position this routine takes up to 27 s to complete.



CAUTION

- Make sure that there are no objects between the drive motor bracket and the TM-xx-x.
- A hand or a finger of a person or any other object in the lift travel area may be pinched between the drive motor bracket and the TM-xx-x or instruments frame.

Lift options

Note Under normal circumstances the following two options must be deactivated.

Zero position detection

Under certain circumstances it may be necessary to activate the **Find and set zero point without normal force sensor** option. When this option is activated the measurement gap zero point is detected by letting the rotor rotate and measure the torque, instead of measuring the normal force.

Note This option is only available for the MARS iQ Air.

Normal force limits

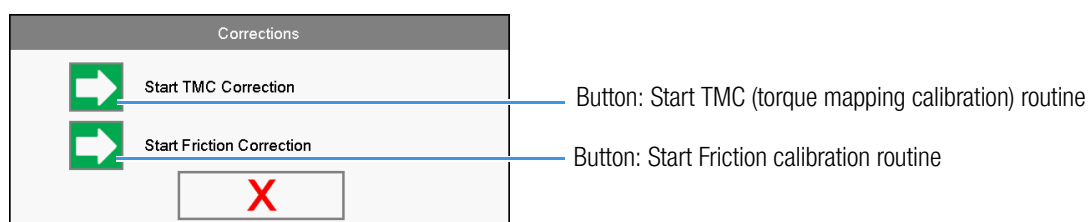
When measuring (very) high viscous samples it can be useful to activate the **Remove normal force limits during lift actions** option to reach the measurement position quicker.

Corrections menu

Tapping the **Corrections** command item in the Configuration menu will open

The Torque Mapping calibration routine takes 65 s to complete. The Friction calibration routine takes 127 s to complete.

Figure 34. Corrections menu



Screensaver

To prevent the touchscreen from “burning in”, the user interface is equipped with a screensaver which is automatically activated when the touchscreen was not touched for more than 30 minutes.

Note The screensaver will not be activated as long as a RheoWin Job is running.

When the screensaver is active the screen is black with the text ‘**thermo** scientific’ moving around on the screen, see [Figure 35](#).

Figure 35. Screensaver



❖ **To stop the screensaver**

1. Tap the touchscreen.

Note The screensaver is automatically stopped when a Job is started in RheoWin.

Network Setup

The communication between the HAAKE MARS and the HAAKE RheoWin rheometer control software uses the TCP and UDP protocols on an IP network connection. This chapter describes how to setup this network connection.

Note It is assumed that any hardware network interface used for the communication between the MARS and the PC (with RheoWin) has been properly setup as part of the PC and operating system installation. This manual does not deal with PC hardware installations and/or network problems. In case of problems with the PC hardware or with the network a local IT specialist should be consulted.

Note The serial interface on the rear panel of the electronic box is only intended for service purposes, that is not for controlling the instrument.

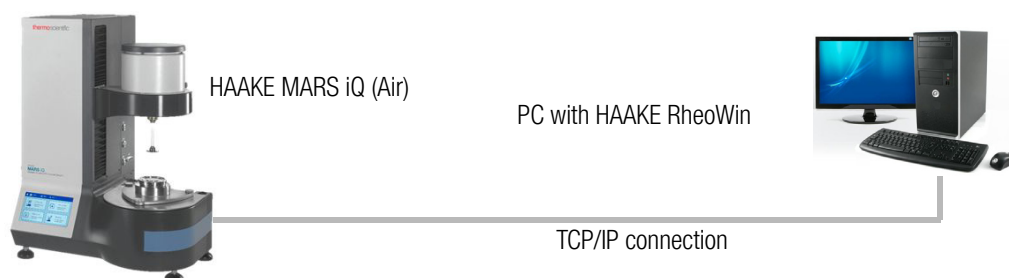
IMPORTANT Read this chapter completely before starting the network setup.

Network considerations

There are two different ways to make the connection between a HAAKE MARS and a PC (with HAAKE RheoWin):

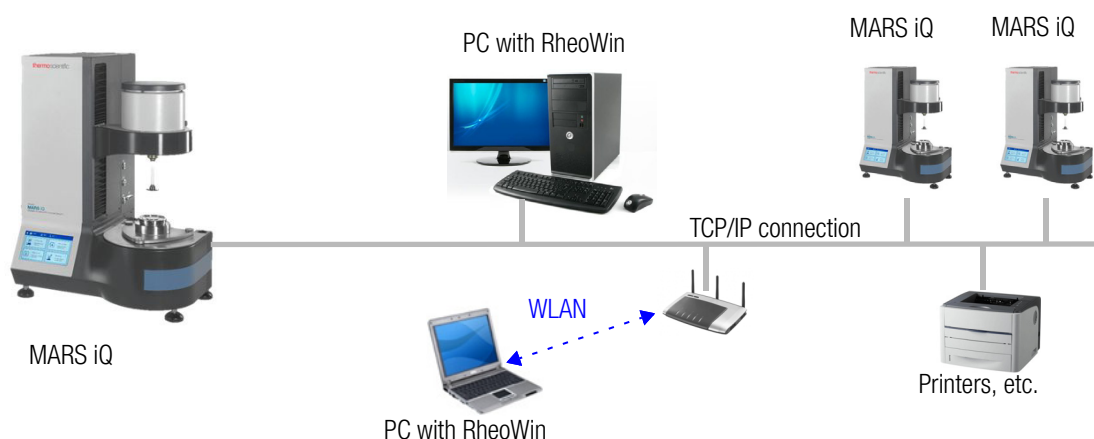
- **Point-to-point network**
The HAAKE MARS can be directly connected to a PC (with RheoWin) using a so-called point-to-point network. In such a network there are only two clients and the network connection is only used for the communication between the HAAKE MARS and HAAKE RheoWin (and a browser).

Figure 36. HAAKE MARS and PC (with RheoWin) in point-to-point network



- Company or local network (LAN, WAN, Internet)
The HAAKE MARS can be connect to a network of any size, for example a small dedicated network, a company network (LAN) or a local network with a few or many clients of which the HAAKE MARS and the PC (with HAAKE RheoWin) are just two clients. The connection between the HAAKE MARS and HAAKE RheoWin is just one of many connections in the network.

Figure 37. HAAKE MARS and PC (with RheoWin) in LAN



Point-to-point network

Using a point-to-point network has the following advantages and disadvantages:

- A point-to-point network is easy to setup. An IT network specialist is normally not needed.
- In a point-to-point network the network connection is only used by the communication between the HAAKE MARS and HAAKE RheoWin. Because of this and also due to the intelligent data buffering in the HAAKE MARS firmware the communication can not be interrupted and the highest data acquisition rate of 500 Hz (one data point every 2 ms) can always be achieved when needed.
- The HAAKE MARS can only be accessed from the PC (with HAAKE RheoWin) to which it is connected to by the point-to-point network.
- When the PC (with HAAKE RheoWin) needs to be connected to a company network (and/or the internet) in order to be able to access network directories for exchanging data files etc., the PC needs two hardware network interfaces. One for the HAAKE MARS point-to-point network and the other for the company network (and/ or internet). Many PCs only come with one hardware network interface, however it almost always possible to add a second internal or external hardware network interface. Under order number 222-1760 Thermo offers such an USB to Ethernet adapter. For detailed installation instructions and more information on this adapter see the documentation on the CD that comes with the adapter.

Company or local network

Using a company or local network has the following advantages and disadvantages:

- Integrating the HAAKE MARS and the PC (with HAAKE RheoWin) into a company network normally needs an IT network specialist.

- In a company or local network the network is used by many different services at the same time (accessing network drives, printing, internet connections etc.). Because of that, and even with intelligent data buffering in the HAAKE MARS firmware, it is not possible to guarantee a certain continuous data acquisition-rate for the communication between the HAAKE MARS and HAAKE RheoWin. As a result measurement data may (but certainly must not) show missing data points.
- The HAAKE MARS can be accessed from any PC in the network on which HAAKE RheoWin or a browser is installed. While the HAAKE MARS can of course only be controlled from one instance of HAAKE RheoWin at a time, it is possible to access the HAAKE MARS internal web-server from one or more other PCs at the same time even when HAAKE RheoWin is controlling the HAAKE MARS.
- Only one hardware network interface in the PC (with HAAKE RheoWin) is needed.

Gateways and VLANs

The network connection between the MARS iQ (Air) and the PC is designed for use in a basic one segment LAN. It is possible to define a Gateway address for the rheometer, see “[Network configuration menu](#)” on [page 20](#), but it is *not* recommended to do so. The reason for this is that for certain functionality, see [Table 2](#), the communication relies on broadcast messages send using the UDP protocol which are normally limited to one network segment. This functionality will not work when sending UDP broadcast messages between the rheometer and the PC is not possible.

Multiple HAAKE rheometers connected to one PC

One instance of RheoWin running on one PC can *control multiple* HAAKE rheometer (that is multiple MARS iQ (Air) and/or MARS 40/60 and/or Viscotester iQ (Air)) *at the same the time*. In this case separate RheoWin Jobs are running at the same time, each Job controlling a different rheometer.

For this each rheometer can be connected to the PC using an individual point-to-point network, or all rheometers can be connected to a company or local network.

TCP/IP connection

The TCP/IP connection requirements for the HAAKE MARS are listed in the following sections.

Note The TCP/IP connection requirements are all standard specifications and should be fulfilled by any PC network interface.

Firewall, TCP and UDP protocol, ports

IMPORTANT Any Firewall (Windows Defender, Symantec, Norton, etc.) software installed on the PC on which HAAKE RheoWin is running must be configured in such a way that the TCP and UDP protocol and ports listed in [Table 2](#) are *not* blocked for RheoWin and the iQ Updater.

3 Network Setup

Setting up a HAAKE MARS using a point-to-point network

The UDP protocol is used for sending “ConnectAssist” messages (automatic rotor recognition), “ProtectAssist” messages (door position) as well as Job Launch and Job Control commands from the MARS iQ to RheoWin. The UDP protocol is also used as part of the firmware update process.

These functions will *not* work when the UDP protocol is blocked.

Table 2. TCP and UDP ports used by the HAAKE MARS and HAAKE RheoWin

Protocoll	Port(s)	Used for
TCP	2010	THMP, protocol for instrument control (measurements, lift)
UDP	2000	Network scan function and instrument detection in RheoWin DeviceManager
UDP	2001	“ConnectAssist” (automatic rotor recognition) “ProtectAssist” (automatic detection of door position) Job launch and job control commands from touchscreen
UDP	67, 68	iQ Updater (firmware update software)

IP and MAC address

The default IP address of a HAAKE MARS iQ is 192.168.2.15.

The current IP address can be viewed in the **Status info** screen of the touchscreen (see [Figure 35](#) on [page 38](#)). The instruments IP address can be modified on the **Configuration > Network** menu of the instruments touchscreen user interface (see [Figure 37](#) on [page 39](#)).

The unique MAC address of the HAAKE MARS iQ (Air) Rheometer, Reference Manual electronics can be viewed in the **Status info** screen of the touchscreen.

Setting up a HAAKE MARS using a point-to-point network

As described above a free hardware network interface on the PC is needed for setting up a point-to-point network between the HAAKE MARS and the PC (with HAAKE RheoWin), see [Figure 36](#).

Making a hardware connection

❖ To make a hardware connection

1. Connect the RJ45 socket of the PC hardware network interface with the MARS RJ45 socket ((see [Figure 7](#) on [page 8](#) of the HAAKE MARS iQ (Air) Instruction Manual) using the patch cable (082-2526) which is part of the HAAKE MARS standard delivery.

PC network interface configuration

❖ To configure the PC network interface in Windows

In Windows 7:

1. On the Windows (7) taskbar, click the Windows **Start**  button to open the Windows start menu. Continue with [step 3](#).

In Windows 8 and 8.1:

- On the Windows (8, 8.1) taskbar, *right* click the Windows **Start**  button to open the Windows start menu. Continue with [step 3](#).

In Windows 7, 8 and 8.1:

- From the Windows (7, 8, 8.1) start menu select **Control panel**. Continue with [step 4](#).
- In the Windows (7, 8, 8.1) Control Panel select **Network and sharing center**. Continue with [step 8](#).

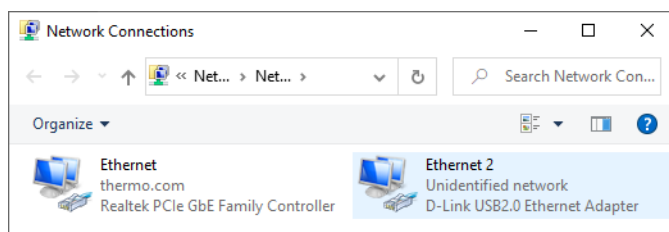
In Windows 10 and 11:

- On the Windows (10, 11) taskbar, click the Windows **Start**  button to open the Windows start menu.
- In the Windows (10, 11) start menu select the **Settings**  button to open the (Windows) Settings dialog.
- In the Windows (10, 11) Settings dialog select **Network & Internet**.

In Windows 7, 8, 8.1, 10 and 11:

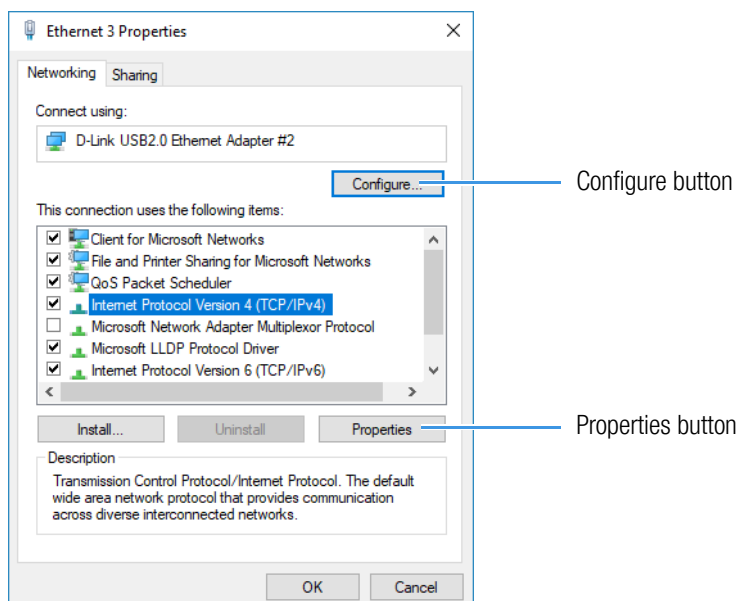
- Select **Change adapter options** to open the Network connections dialog, see [Figure 38](#).
- In the **Network Connections** dialog *right* click the network connection that will be used for the HAAKE MARS iQ (Air) Rheometer, Reference Manual (here Ethernet 2) and then select **Properties** from the context popup-menu to open the networks properties dialog (see [Figure 39](#)).

Figure 38. Network Connection dialog with context popup-menu



- In the Network Connection Properties dialog (see [Figure 39](#)) select **Internet Protocol Version (TCP/IPv4)** from the list and then click the **Properties** button.

Figure 39. Network Connection Properties dialog

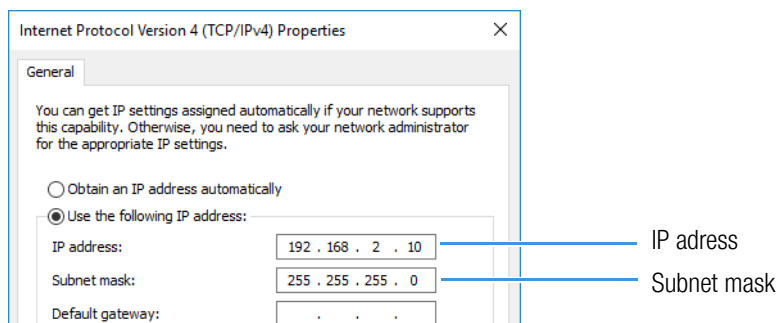


3 Network Setup

Setting up a HAAKE MARS using a point-to-point network

11. In the Internet Protocol Version 4 (TCP/IPv4) Properties dialog (see [Figure 40](#)) select **Use the following IP address** and enter the values 192.168.2.10 for the **IP address** and 255.255.255.0 for the **Subnet mask**.

Figure 40. Internet protocol Version 4 (TCP/IPv4) properties



Note The last number of the **IP address** (here 10) does not have to be 10, it can be in the range of 0 to 255, but it *must be different* from the last number (15) of the IP address of the HAAKE MARS iQ (the default IP address 192.168.2.15).

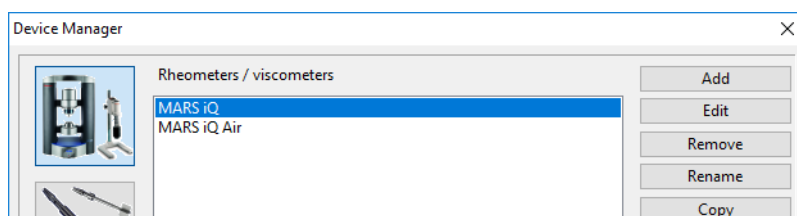
IMPORTANT The IP address of the network card in the PC and the IP address of the HAAKE MARS iQ (Air) Rheometer, Reference Manual *must be different* from each other but they must be in the same subnet range. This means that the first three numbers of the IP addresses (in dotted-decimal notation) must be the same but the last number must be different. For local area network connections it is customary to use IP addresses in the range of 192.168.xx.xx.

MARS iQ configuration in RheoWin

❖ To configure the MARS in RheoWin

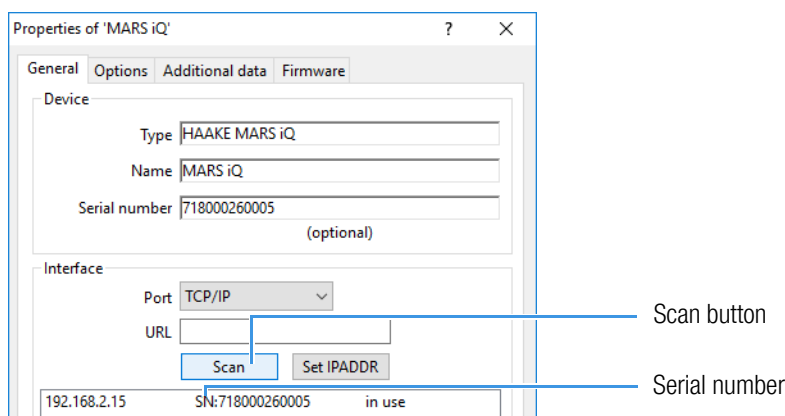
1. Start **RheoWin JobManager**.
2. Select the **DeviceManager** command from the **Configuration** menu.
3. In the **DeviceManager** dialog select the **MARS iQ** or **MARS iQ Air** from the list of **Rheometers / viscometers**.
4. Click the **Edit** button on the right hand side of the list.

Figure 41. RheoWin Device Manager dialog

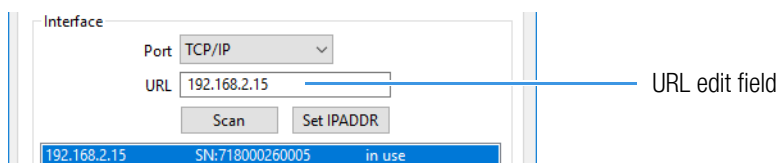


5. Select the **General** page in the **Properties of 'MARS'** dialog.
6. In the **Interface** box in the **Properties of 'MARS'** dialog click the **Scan** button.

After a short time the serial number of the MARS will appear in the list box below the **Scan** button.

Figure 42. IP address of the HAAKE MARS

7. Double click the line containing the serial number of the MARS to transfer the IP address of the MARS to the **URL** edit field. (The IP address can also be entered manually in that field).

Figure 43. Transfer the IP address of the HAAKE MARS

8. Click the **Ok** button to close the **Properties of 'MARS'** dialog.
9. In the **DeviceManager** dialog click the **Test** or **Diagnosis** button on the right hand side of the list in order to test the communication between RheoWin and the MARS.

The RheoWin software and the MARS are now ready to be used.

Setting up a MARS iQ in a company network

In this case the PC (with RheoWin) must already be connected to an existing company network, see [Figure 37](#).

Making a hardware connection

❖ To make a hardware connection

1. Connect the RJ45 socket of the MARS iQ (see [Figure 7](#) on [page 8](#) of the HAAKE MARS iQ (Air) Instruction Manual) with a RJ45 (wall) socket of the company network using the patch cable (082-2526) which is part of the HAAKE MARS standard delivery.

Network without DHCP server

When the network uses the default range of 192.168.xx.xx IP addresses, make sure that the default MARS iQ IP address 192.168.2.15 is not already used in the network. Otherwise change the MARS IP address.

When the network uses IP addresses in a range different from 192.168.xx.xx the IP address of the MARS iQ must be changed.

When multiple MARS instruments are connected to one network the IP address of at least one MARS must be changed, since all network clients must have different IP addresses.

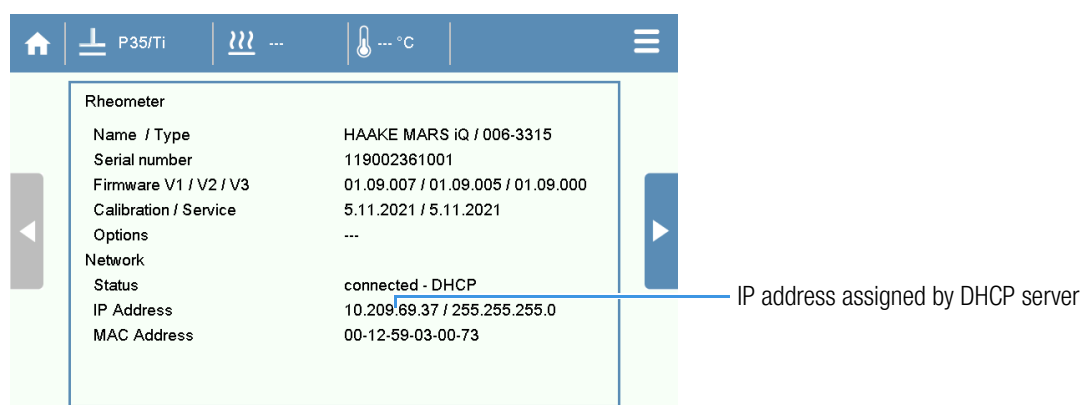
Instructions on how to change the MARS iQ IP address from the instruments touchscreen can be found in [Chapter 2, “Touchscreen user interface,”](#) in “Network configuration menu” on [page 20](#).

Network with DHCP server

When the network is equipped with a DHCP server the IP addresses of any client in the network is not set by the client itself but assigned to the client by the DHCP server.

The MARS iQ network interface is equipped with an automatic DHCP client functionality (conforming to RFC-2131). When the MARS iQ is (physically) connected to a network with a DHCP server, the DHCP client in the instrument will automatically be assigned an IP address. There is no need to switch the instrument off/on for the new IP address to take effect. The new address is displayed in the Rheometer status information menu, see [Figure 44](#).

Figure 44. Rheometer status information menu with DHCP assigned IP address



MARS configuration in RheoWin

In RheoWin JobManager open the Properties of 'MARS' dialog as described in [“To configure the MARS in RheoWin”](#) on [page 32](#).

Note The Scan function can not search beyond the boundaries of the network which are set by the *nearest router* in the network.

Note The *nearest router* restriction only applies to the Scan function, that is not to the ability of RheoWin to communicate with a MARS which is located behind the nearest router. In this case the IP address of the MARS can be manually entered in the URL edit field.

Trouble shooting a network connection

In case the communication does not work check the computer network adapter speed setting.

❖ **To check/set the computer network adapter speed setting**

1. In the Local Area Connection Properties dialog (see [Figure 39](#)) click the **Configure** button to open a Properties dialog
2. In the Properties dialog select the **Advanced** page.
3. On the Advanced page set the Value of **Speed & Duplex** or **Connect type** to **10 Mbs Full Duplex** instead of the default AutoSense or AutoNegotiation.

HAAKE RheoWin Software

This chapter describes how to operate those parts of the HAAKE RheoWin software which are specific for the HAAKE MARS iQ (Air). The basic operation of HAAKE RheoWin, which is identical for all HAAKE rheometers and viscometers is described in the HAAKE RheoWin manual.

Software Version

HAAKE RheoWin version 4.85.0000 or higher is needed for operating the HAAKE MARS iQ (Air).

Uploading a Job list to the rheometer touchscreen

The HAAKE MARS iQ and HAAKE MARS iQ Air rheometers offer the unique possibility to launch a RheoWin Job directly from the rheometer touchscreen user interface.

IMPORTANT It is important to understand that in this scenario the MARS iQ touchscreen “only” acts as remote-control unit for RheoWin.

A RheoWin Job launched (started) from the instrument touchscreen is running in RheoWin just as if it was started from within RheoWin itself.

IMPORTANT After adding a Job to the JobList from a certain directory on the PC or network the Job file must be stay available in that directory. The Job name in the JobList on the touchscreen is a only a **link** to a job file.

In the rest of this document it is assumed that the MARS iQ (Air) and RheoWin are installed properly and that the communication between the MARS iQ and RheoWin is working.

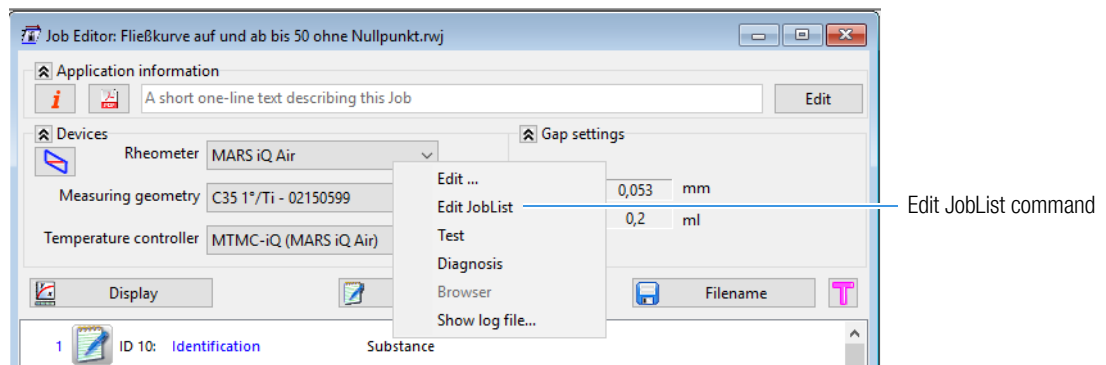
Editing the JobList

There are three different methods to access the JobList edit dialog in RheoWin.

❖ To open the JobList edit dialog

1. In a RheoWin JobEditor dialog right click the MARS iQ or MARS iQ in the Rheometer edit field and select the command **Edit JobList** from the context menu, see [Figure 45](#).

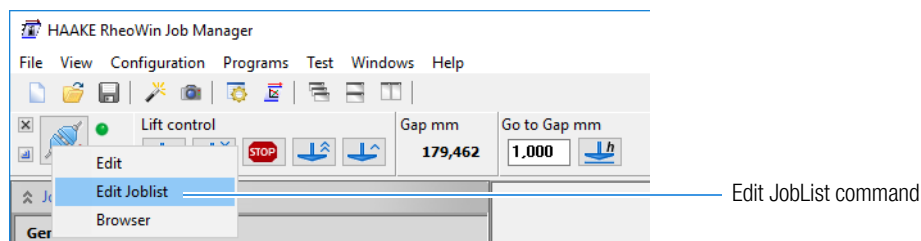
Figure 45. Access the JobList editor from a JobEditor dialog



or

2. In the RheoWin DeviceToolbar right click on the Connect/Disconnect button and select the command **Edit JobList** from the context menu, see [Figure 46](#).

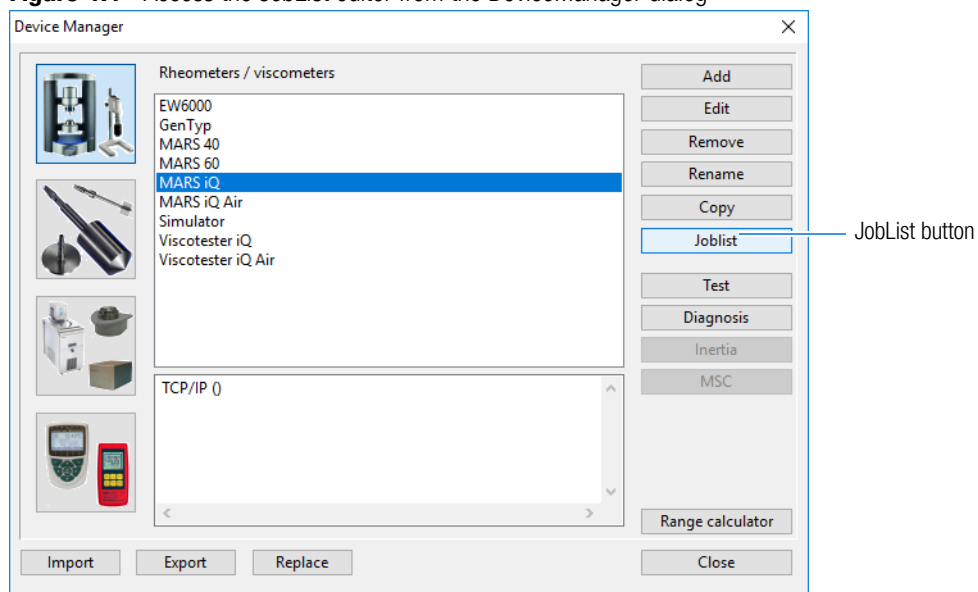
Figure 46. Access the JobList editor from the Device Toolbar



or

3. In the RheoWin DeviceManager select a MARS iQ or MARS iQ Air from the list of devices and click the **JobList** Button at the right hand side of the device list, see [Figure 47](#).

Figure 47. Access the JobList editor from the DeviceManager dialog



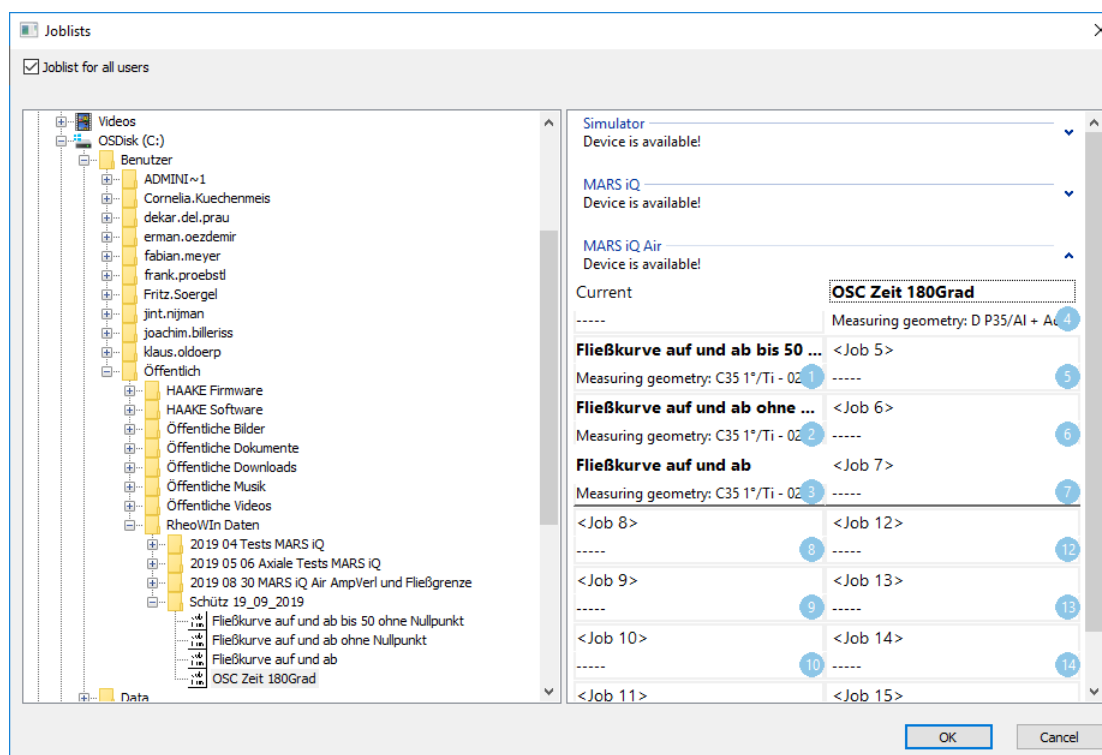
The JobList Editor will now be opened, see [Figure 48](#).

❖ To add a Job to the JobList

1. Open the JobList edit dialog, see [“To open the JobList edit dialog.”](#)

2. In the directory/file tree on the left hand side of the JobList editor dialog, see [Figure 48](#), select the directory with the Jobs (*.rwj Job files) that are to be added to the JobList.

Figure 48. The JobList editor dialog



3. **Drag & drop** any Job file from any directory on the PC or a network into the JobList on the right hand side of the JobList editor dialog.

Note The Job files in the JobList do **not** have to be located in just one directory on the PC or in a network, they can come from different directories.

Note A Job must be configured for the correct rheometer before adding it to the JobList. Jobs that are not correctly configured can **not** be added to the JobList.

4. Click **Ok** to transfer the modified list with Job names to the MARS iQ (Air).

The JobList will now be visible on the JobLaunch screen on the MAR iQ (Air) touchscreen user interface.

IMPORTANT After adding a Job to the JobList from a certain directory on the PC or network the Job file must stay available in that directory. The Job name in the JobList on the touchscreen is only a **link** to a job file.

❖ To remove a Job from the JobList

1. Open the JobList edit dialog, see [“To open the JobList edit dialog.”](#)
2. Right click on the Job entry in the list which is to be deleted to open the context popup-menu.
3. Click the **Remove Job from list** command.
4. Click the **Ok** button to transfer the modify list with Job names to the MARS iQ (Air).

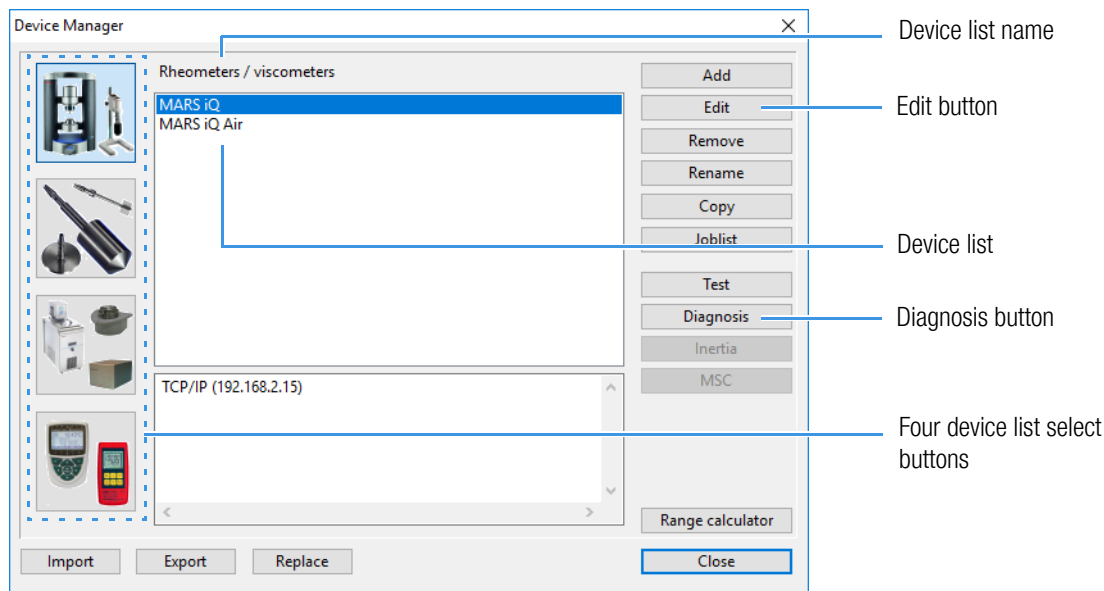
Note Each RheoWin user has its own JobList, unless the **JobList for all users** option is selected in the JobList editor dialog, see [Figure 48](#).

RheoWin DeviceManager and Device Drivers

In order to be able to communicate with any rheometer, viscometer, temperature control unit, circulator or auxillary instrument (i.e. any device) RheoWin needs a so-called driver for that device. Such a driver consists of a *.dll file which is stored in the \RheoWin\Drivers directory. The necessary device drivers are installed automatically during the RheoWin installation process.

In the DeviceManager the devices are sorted into four separate lists, one for the rheometers and viscometers, one for the measuring geometries, one for the temperature control units and circulators and one for the auxillary devices (e.g. pressure sensor, humidity sensor). Each device driver has a user-interface (editor) in which its settings can be modified.

Figure 49. RheoWin Device Manager with list of Rheometer devices



❖ To open a device editor

1. Click on one of the four buttons on the left hand side of the device list to select the appropriate device list, in this case the list of **Rheometers / viscometers**, see [Figure 49](#).
2. Select the device from the list of devices, in this case the **MARS iQ** or **MARS iQ Air**, see [Figure 49](#).
3. Click the **Edit** button on the right hand side of the device list to open the device editor.

The properties of all devices are (automatically) stored in one file, the drivers.flp file, which is stored in the c:\ProgramData\Thermo\RheoWin\drivers directory, for more information on this see the RheoWin manual.

MARS iQ (Air) and MTMC device drivers

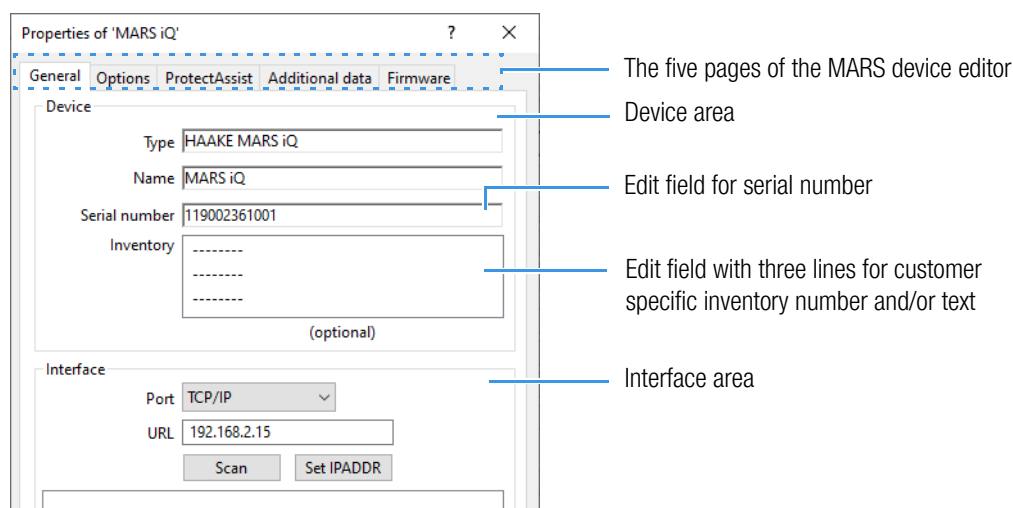
For the MARS iQ (Air) two device drivers are installed; the MARSiQ.dll or MARSiQAir.dll driver for the MARS iQ rheometer itself and the MARSiQT.dll driver for the MARS temperature module controller which is integrated in the MARS instrument.

Note The MTMC driver and device editor are described in the HAAKE MARS Temperature Modules Instruction Manual.

MARS iQ (Air) Device Editor

The editor for the properties of the MARS iQ (Air) device consists of 5 pages which are described below.

Figure 50. MARSiQ (Air) device editor with General page



The General page

On the **General** page, see [Figure 50](#), the device Type, Name, Serial number and Inventory information are shown in the **Device** area. The device **Type** can not be modified. The device **Name** can be modified using the **Rename** button in the DeviceManager dialog (see [Figure 49](#)). The **Serial number** can be edited directly in the edit field. The three lines of the customer specific **Inventory** number and/or text can be edited directly in the edit field. The Inventory information is stored in the instrument firmware.

In the **Interface** area the properties of the communication interface between RheoWin and the MARS are shown.

The value for the **Port** is TCP/IP, and can not be modified, the MARS can only be controlled by RheoWin using a TCP/IP ethernet connection (The RS232 port on the back of the MARS electronics box is for service issues only).

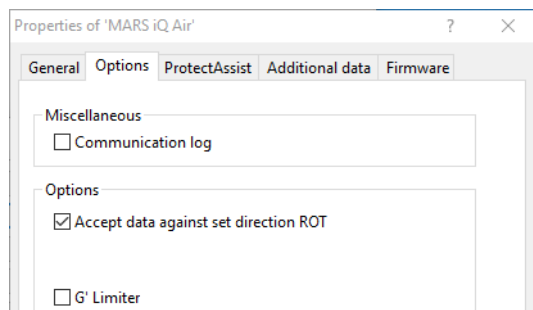
The value for the **URL** can be entered manually but it is recommended to use the Scan button instead, see [“MARS iQ configuration in RheoWin”](#) on [page 32](#) in [Chapter 3, “Network Setup.”](#)

Normally setting up the interface for the MARS is only done once during the initial installation of the instrument.

The Options page

On the **Options** page, [Figure 51](#), several options which influence the data-acquisition and communication between RheoWin and the instruments can be set.

Figure 51. MARS iQ device editor with Options page



Accept data against set direction ROT

Under certain circumstances the measured shear rate can be negative when the set shear stress is positive or vice versa. This can be caused by residual stresses in the sample caused by sampling loading or by a less than perfect MSC correction when measuring at very low torques, etc. When the option **Accept data against set direction** is set such measured values are accepted and saved, when this option is deactivated these values are set to zero. By default this option is activated.

G' Limiter

When the option G' limiter is active, the value of G' will be limited to values $G' \geq 10^{-3} G''$. This limit reflects the accuracy of the measurement of the phase angle δ .

Communication log

When the option **Communication log** is activated the RheoWin MARS device driver will create a log file (in ASCII format) which contains all the commands sent to the device and all the answers from the device. This log file has the file name `marsiq.log` or `marsiqair.log` and is stored in the folder `c:\ProgramData\Thermo\Rheowin\Drivers`. The log file can be viewed comfortably by using the **Show log file...** command from the JobManager **Help** menu.

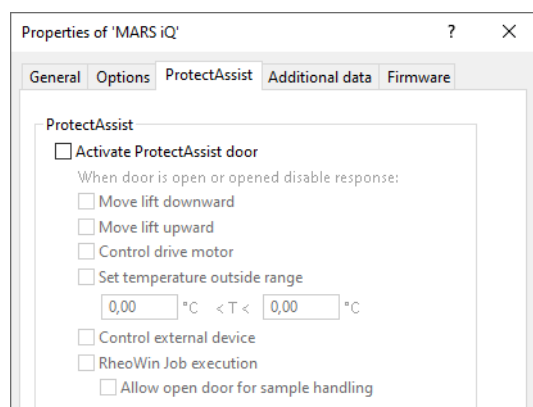
When this option is activated RheoWin will show a warning message every time the communication with the device is started, this because the logging may influence the timing of the communication in a negative way.

Note The Communication log option should **not** be activated unless it is explicitly needed for service issues, trouble shooting, debugging, etc.

The ProtectAssist page

The optional ProtectAssist door is mounted to the MARS iQ instrument frame and, when closed, physically prohibits the operator to access the (sample) area below the instrument head and above the TM-xx-x module. This can be used to protect the operator from touching the rotating and/or vertically moving rotor during a measurement, from touching very hot/cold parts of the instrument, from unwanted contact with sample material, from controlling an external device, etc.

Figure 52. MARS iQ device editor with ProtectAssist page



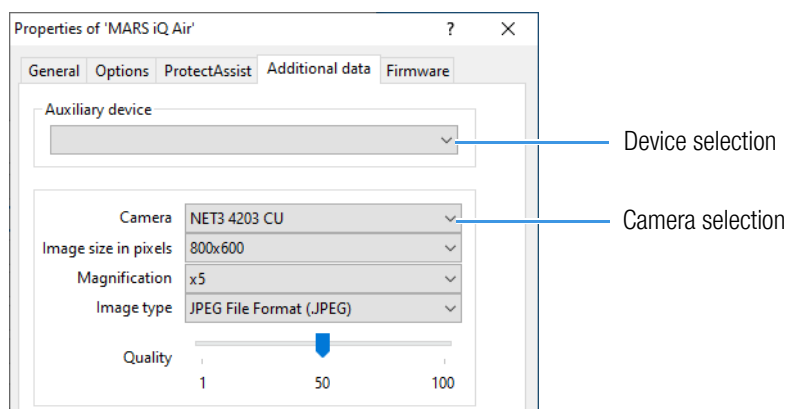
On the **ProtectAssist** page, see [Figure 52](#), the following settings for the use of the optional ProtectAssist door can be made:

- **Activate ProtectAssist door**
When this option is active a ProtectAssist door status icon will be displayed on the instruments touchscreen status bar as well as in the RheoWin JobManager device toolbar.
Activating this option also enables access to the following options.
- **Move lift downward**
When this option is active, the lift can not be moved downward when the door is open and will stop moving downward as soon as the door is opened.
- **Move lift upward**
When this option is active, the lift can not be moved upward when the door is open and will stop moving upward as soon as the door is opened.
- **Control drive motor**
When this option is active, the drive motor can not be controlled (in ROT or OSC mode) and any drive motor control will stop as soon as the door is opened.
- **Set temperature range**
When this option is active, temperature control outside of the defined temperature range is not possible when the door is open and such temperature control will be stopped as soon as the door is opened.
- **Control external device**
When this option is active controlling an external device (through RheoWin) is not possible when the door is open and any such control will be stopped as soon as the door is opened.
- **RheoWin Job execution**
When this option is active it is not possible to start a RheoWin Job when the door is open and a running RheoWin Job will be stopped as soon as the door is opened.
When the **Allow open door for sample handling** is active the door can be opened (without stopping the Job) during the time the RheoWin lift element is displaying a message.

The Additional data page

On the **Additional data** page, see [Figure 53](#), settings for the acquisition of data from external instruments or sensors, auxiliary devices and cameras can be made.

Figure 53. MARS iQ device editor with Additional data page



Auxiliary device

RheoWin can acquire data from the following auxiliary devices:

- A hygrometer, that is the Ahlborn ALMEMO 2590 (and compatible models) universal measuring device equipped with a special sensor to measure humidity.
- A thermometer, that is the Ahlborn ALMEMO 2590 (and compatible models) universal measuring device equipped with a temperature sensor.
- A manometer, the Greisinger GMH 3110 and GMH 3111 pressure measuring devices. This device can be used with the pressure cells that are available for the MARS.

These devices can be connected to an USB or RS232 port on the PC on which RheoWin is running. The properties of these auxiliary devices must be set in the RheoWin DeviceManager. By selecting one of these auxiliary devices in the list box, the measuring signal delivered by this device will be acquired and stored by RheoWin.

Camera

RheoWin can acquire images from certain specific USB 3.0 and Firewire (IEEE 1394) cameras or a generic USB cameras for which a WDM (Windows Driver Model) compatible driver is installed on the PC on which RheoWin is running. The camera must be selected from the list-box in which any camera for which a WDM driver was installed will appear (at the end of the list).

- By selecting **(---)** no camera is selected and no images will be acquired.
- By selecting **(Any)** the first camera found when starting a RheoWin Job or the Manual Control Window will be used for acquiring images (searching for a camera name is done in an alphabetical order).
- By selecting **(Smart selection)** the user will be asked (when starting a RheoWin Job or the Manual Control Window) which camera should be used when more then one camera is found, when only one camera is found that camera will be used automatically.
- By selecting **(Select at start)** the user will always be asked which camera should be used when starting a RheoWin Job or the Manual Control Window.

The selected **Image size in pixels** influences the maximum possible image acquisition rate, the smaller the image the higher the acquisition rate. For the HAAKE RheoScope only, the magnification of the lens used in the RheoScope must be selected from the **Magnification** list-box.

Note The ruler which is displayed on all images is only correct for RheoScope images.

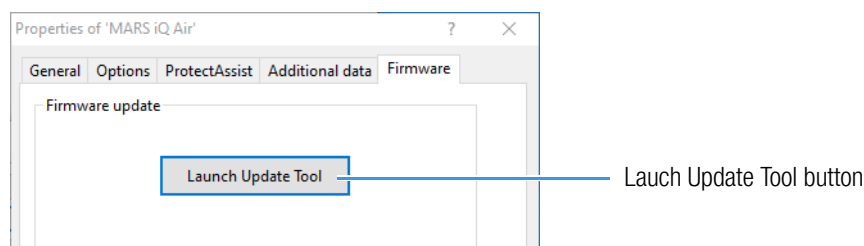
The image type of the acquired images can be selected from the **Image type** list-box:

- The use of the **.BMP** format is recommended when achieving the highest possible image acquisition rate is important. Since .BMP images are not compressed this image type does not require PC computing time.
- The use of the **.PNG** or **.TIF** format results in a slightly lower acquisition rate and smaller file sizes.
- The use of the **.JPG** format is recommended when stronger compression of the images is not an issue but a small file size is important. A lower value for the **Quality** will result in a higher compression of the image.

The Firmware page

The functionality on the Firmware page, see [Figure 54](#), is used for updating the MARS and MTMC firmware. The MTMC firmware is an integral part of the MARS Stand (M-Box) firmware.

Figure 54. MARS iQ device editor with Firmware page



Firmware update

Although it is generally recommended to have a firmware update performed by a qualified service engineer, updating the firmware can be done by any user after carefully reading the instructions in [Appendix A, "Firmware update"](#) on [page 47](#).

Firmware update

This appendix contains information on how to update the firmware of the HAAKE MARS iQ.

IMPORTANT Read this appendix completely and thoroughly before updating the firmware.

The HAAKE MARS iQ (Air) firmware consist of three parts, one for each of the two microprocessors which are part of the instruments electronics and a third for the touchscreen microprocessor.

Note For each microprocessor a separate file (which contains the firmware) must be uploaded to the instrument. The version numbers of the three firmware parts are not necessary identical.

Note It is not always necessary to update the firmware of all three microprocessors at the same time.

Note When the firmware is to be updated for all three microprocessors at the same time, the order in which they are updated is not important.

Table 3. Microprocessors and firmware files

Microprocessor	Tasks	Firmware filename ^a
μC1	User interface control, Job control, TM-xx-x control, communication with PC, USB control	MARSIQ-V1-xx.xx.xxx.bin or MARSIQAIR-V1-xx.xx.xxx.bin
μC2	EC drive motor control	MARSIQ-V2-xx.xx.xxx.i00 or MARSIQAIR-V2-xx.xx.xxx.i00
μC3	Touchscreen control	MARSIQ-V3-xx.xx.xxx.bin ^b

^a Here xx.xx.xxx stands for the actual version number.

^b The firmware for μC3 is identical for the MARS iQ and the MARS iQ Air.

New firmware functionality may come with changes in the HAAKE MARS iQ (Air) touchscreen user interface or HMI (HMI = Human Machine Interface). When this is the case, a HMI Zip-file is part of the new firmware and must be updated, using the HAAKE iQ Update tool, as well.

Note Information on the current firmware versions as well as download links for the firmware and HMI files are available in the HAAKE MARS iQ (Air) section of the www.rheowin.com/firmware.htm web page.

Launching the HAAKE iQ Update Tool from HAAKE RheoWin

The HAAKE iQ Update Tool is part of the HAAKE RheoWin installation and can be comfortably accessed from the HAAKE RheoWin JobManager.

❖ To launch the HAAKE iQ Update Tool from HAAKE RheoWin

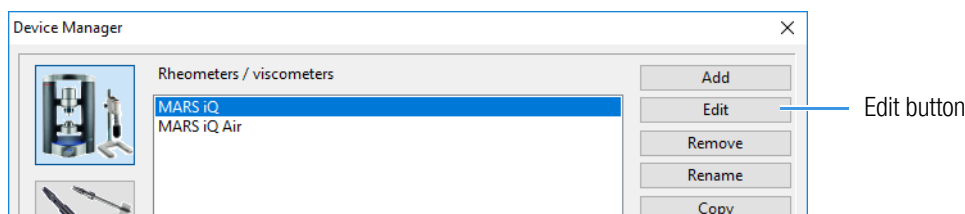
1. Establish a hardware (cable) connection between the PC (on which HAAKE RheoWin is running) and the HAAKE MARS iQ and make sure the PC network interface is configured correctly.

When the PC with HAAKE RheoWin was already used for controlling the HAAKE MARS iQ (Air) the network connection is already setup. If not see [“Setting up a HAAKE MARS using a point-to-point network”](#) on [page 30](#) for detailed information.

WARNING Only use a point-to-point network connection for updating the firmware. Do **not** update the firmware using a company (LAN) network connection.

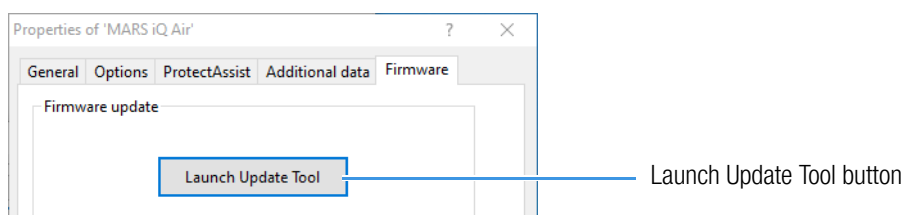
1. Start **RheoWin JobManager**.
2. Select the **DeviceManager** command from the **Configuration** menu.
3. In the **DeviceManager** dialog select the **MARS iQ** or **MARS iQ (Air)** from the list of **Rheometers / viscometers**.
4. Click the **Edit** button on the right hand side of the list, [Figure 55](#).

Figure 55. RheoWin Device Manager dialog



5. Select the **Firmware** page in the **Properties of MARS iQ (Air)** dialog, see [Figure 56](#).

Figure 56. RheoWin Device Manager dialog



6. Click the **Launch Update Tool** button, this will launch the HAAKE iQ Update Tool V2.6.0.0 program (the version number must be 2.6.0.0 or higher), see [Figure 58](#).

The HAAKE iQ Update Tool program window appears.

Note In case the HAAKE iQ Update Tool program window does not appear the program can be launched by navigating to the `c:\Program Files (x86)\Thermo\Rheowin\Drivers` directory and running the `iquupdate.exe` program.

7. See [“Updating the firmware using the HAAKE iQ Update Tool,”](#) on how to use the HAAKE iQ Update Tool program.

Updating the firmware using the HAAKE iQ Update Tool

When the HAAKE iQ Update Tool was launched for the first time on a PC, a Windows Security Alert dialog (issued by the Windows Firewall), see [Figure 57](#), may pop up. When a different Firewall software is used, another but similar dialog may pop up.

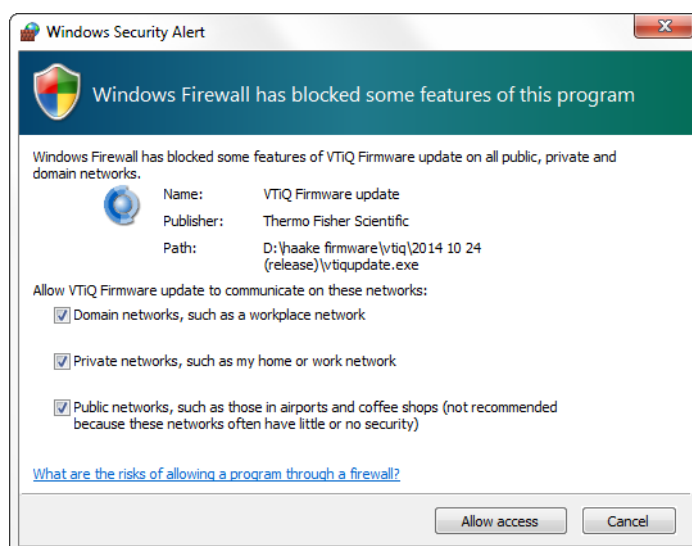
Note Sometimes the security alert dialog does pop up but stays in the background (behind other windows) and is not (easily) visible.

IMPORTANT In the Windows Security Alert dialog (or in a similar dialog from another Firewall software) the HAAKE iQ Update Tool **must** be allowed to communicate over all the listed networks, otherwise updating the firmware or HMI will **not** work. Depending on the computer, up to three networks can be listed.

❖ To allow communication on the listed networks

1. In the Windows Security Alert dialog select the **Domain networks...**, **Private networks...** and **Public networks...** checkbox(es) when available.

Figure 57. Windows Security Alert dialog



2. Click **Allow access** to close the dialog.

After the HAAKE MARS iQ (Air) Update Tool has been launched (and the communication on the network(s) allowed), proceed as described in the following procedure to update the firmware.

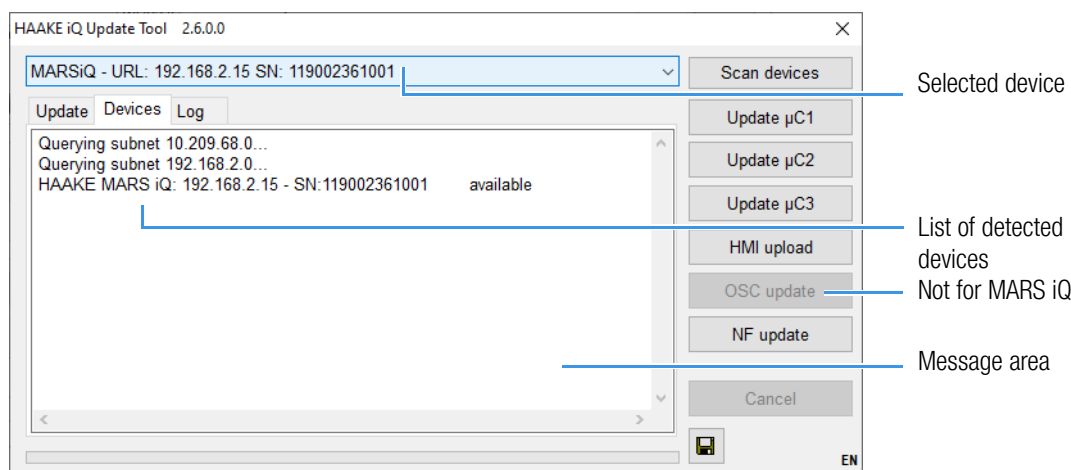
❖ To update the HAAKE MARS iQ firmware

After the update tool is launched it will automatically search for HAAKE MARS iQ (Air) instruments connected to the PC the update tool is running on, and display the detected device(s) in a list, showing the URL and the serial number (SN) of the instrument(s), see [Figure 58](#).

A Firmware update

Updating the firmware using the HAAKE iQ Update Tool

Figure 58. The HAAKE iQ Update Tool program window



1. Select the instrument for which the firmware is to be updated from the list by referring to its serial number.

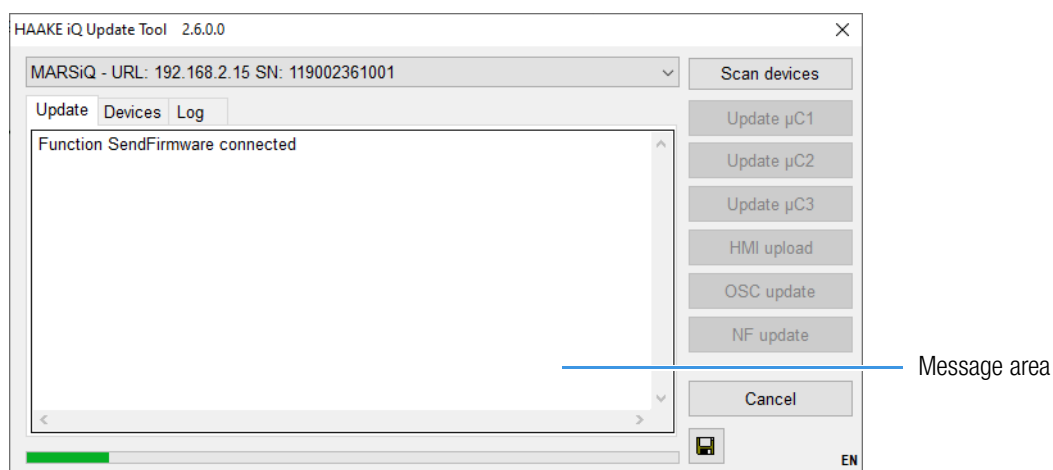
Note Since in most cases only one HAAKE MARS iQ (Air) will be connected to the PC the correct instrument will automatically be selected.

2. Click the **Update μC3** button to update the firmware for microprocessor μC3,
or
Click the **Update μC2** button to update the firmware for microprocessor μC2,
or
Click the **Update μC1** button to update the firmware for microprocessor μC1.

Note Since the HAAKE MARS iQ (Air) will (only) automatically restart after the firmware for microprocessor μC1 was successfully uploaded, it is recommended to upload the files in reverse numerical order.

A message will appear in the message area of the HAAKE iQ Update Tool, see [Figure 59](#).

Figure 59. Network status information



Directly after that the Windows file open dialog will appear, see [Figure 60](#), [Figure 61](#) or [Figure 62](#).

3. Navigate to the directory where the firmware files are stored and select the file for the microprocessor μC3 (with the extension .bin), for the microprocessor μC2 (with the

extension .i00) or the microprocessor μ C1 (with the extension .bin) that is to be used for the update.

Figure 60. Window file open dialog for the microprocessor μ C3 firmware file

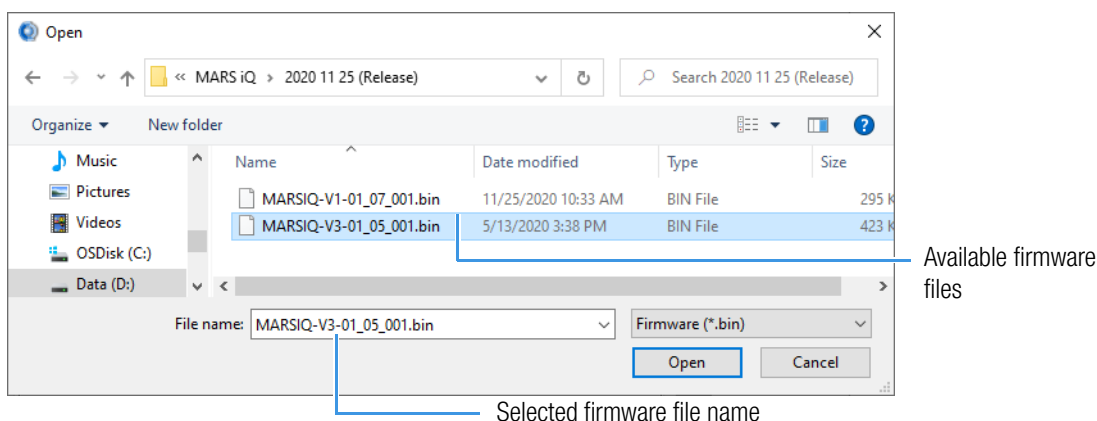


Figure 61. Window file open dialog for the microprocessor μ C2 firmware file

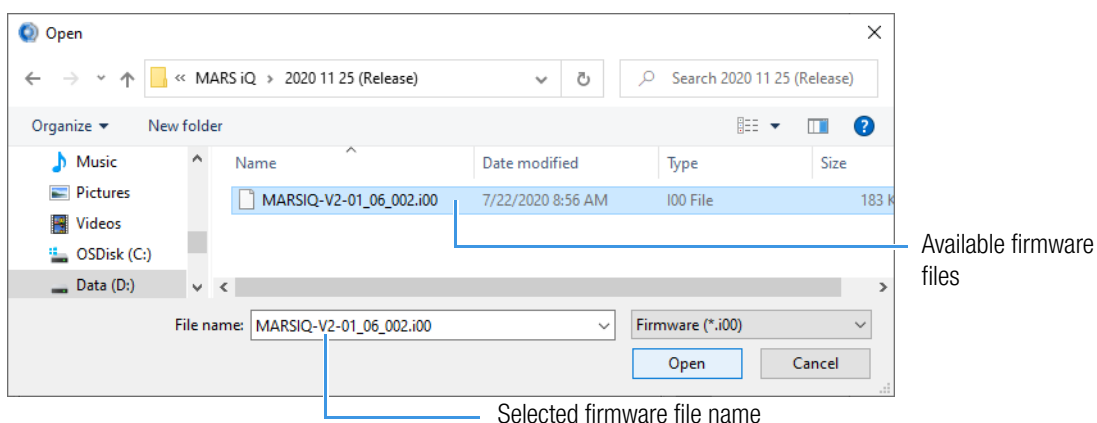
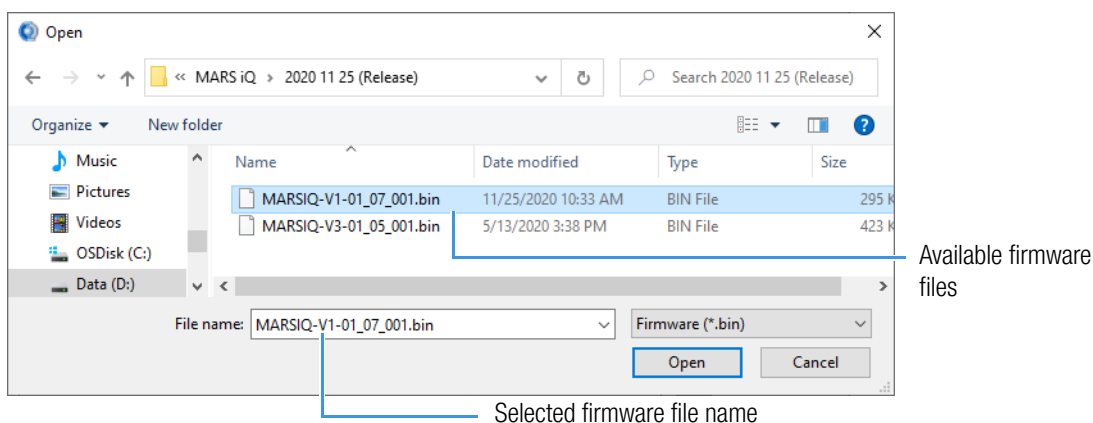


Figure 62. Window file open dialog for the microprocessor μ C1 firmware file

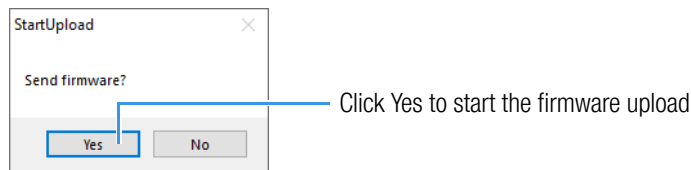


4. Click the **Open** button to initialize the firmware update process.
Directly after that the StartUpload confirmation dialog will appear, see [Figure 63](#).
5. Click **Yes** to start the firmware upload.

A Firmware update

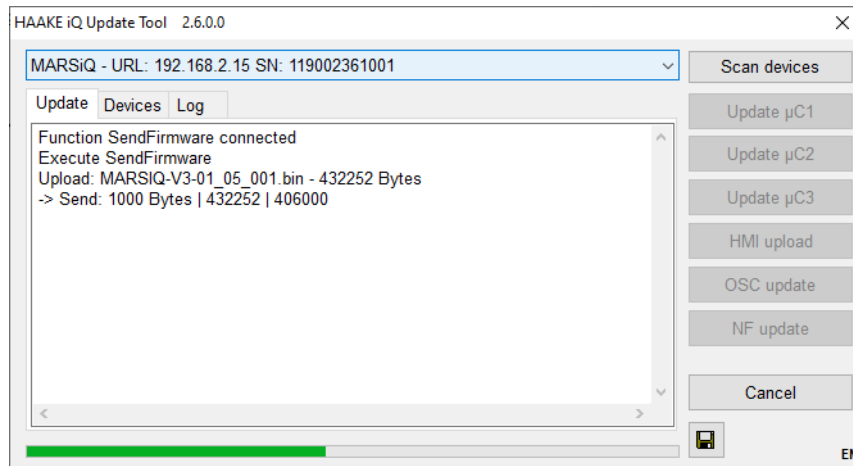
Updating the firmware using the HAAKE iQ Update Tool

Figure 63. Confirmation dialog



6. Progress status information will now be displayed in the message area, see [Figure 64](#) for an example.

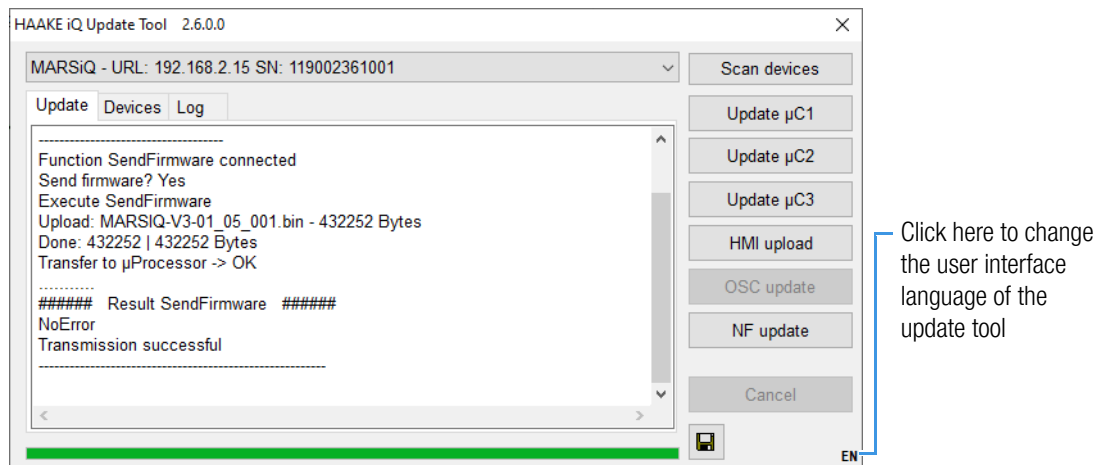
Figure 64. Update progress status information for the microprocessor μ C3 file



The text `Transmission successful` will appear when the firmware update process was successfully finished, see [Figure 65](#) for an example.

Note The duration for uploading the three firmware files is approximately:
63 s for the microprocessor μ C3 firmware
23 s for the microprocessor μ C2 firmware
13 s for the microprocessor μ C1 firmware

Figure 65. Update progress status information for the microprocessor μ C3 file



IMPORTANT When the text `Transmission successful` does not after appear the above mentioned duration, restart the update process by starting at [step 1](#) again.

7. Return to [step 2](#) of this procedure to update the firmware of the other microprocessors if required.

Note After the successful upload of the microprocessor μ C1 firmware the HAAKE MARS iQ (Air) will restart automatically. In case only the firmware for microprocessor μ C2 and/or μ C3 was updated the MARS must be manually switched off and on again using the operating switch on the rear of the instrument E-box rucksack (see [Figure 5](#) on [page 6](#) in [Chapter 2, “Functional Elements,”](#) of the HAAKE MARS iQ (Air) Instruction Manual).

8. Click the **Close** button , to close the HAAKE iQ Update Tool program window.

Updating the HMI using the HAAKE iQ Update Tool

After the HAAKE iQ Update Tool has been launched, proceed as described in the following procedure to update the HMI.

❖ To update the HAAKE MARS iQ HMI

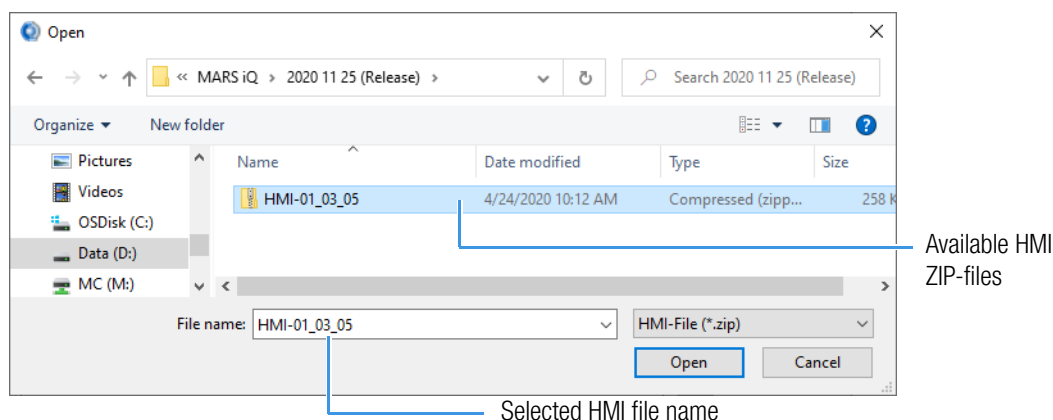
After the update tool is launched it will automatically search for HAAKE MARS iQ (Air) instruments connected to the PC the update tool is running on, and display the instrument(s) found in a list, showing the URL and the serial number (SN) of the instrument(s), see [Figure 58](#).

1. Select the instrument for which the HMI is to be updated from the list by referring to its serial number (see [Figure 58](#)).

Note Since in most cases only one HAAKE MARS iQ (Air) will be connected to the PC the correct instrument will automatically be selected.

2. Click the **HMI Upload** button to open Windows file open dialog, see [Figure 66](#).
3. Navigate to the directory where the HMI update files are stored and select the file HMI-Update-xx-xx-xx.zip (where xx-xx-xx stands for the actual date) that is to be used for the update, see [Figure 66](#).

Figure 66. Window file open dialog for HMI update file



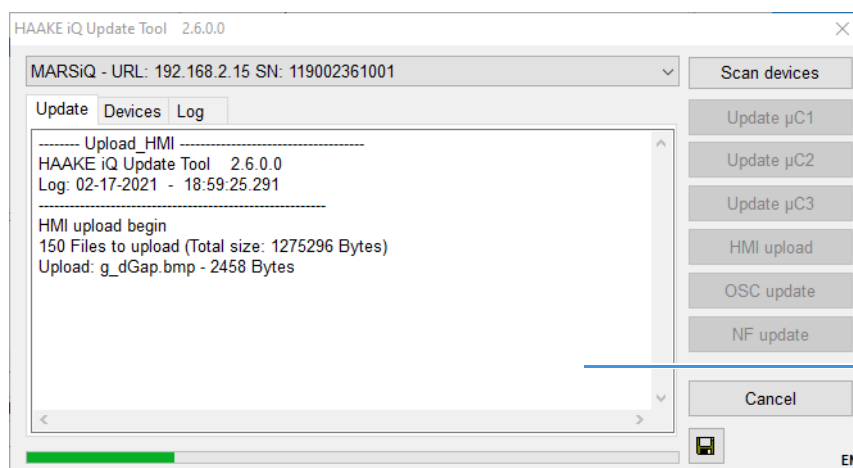
4. Click the **Open** button to start the HMI update process.

Progress status information on the HMI update will now appear in the message area, see [Figure 67](#).

A Firmware update

Applying the Fn Update using the HAAKE iQ Update Tool

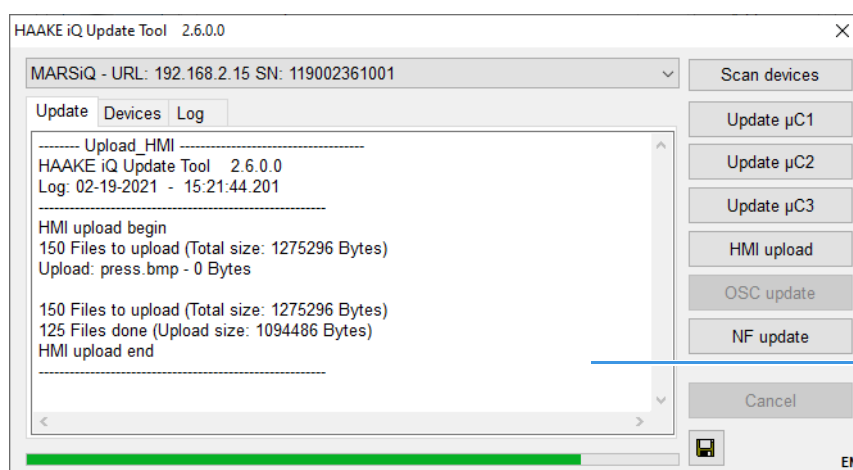
Figure 67. HMI update status information



Uploading the HMI files take approximately 5 minutes and 30 seconds.

When the HMI update process is successfully finished the text HMI upload end will appear in the Message area, see [Figure 68](#).

Figure 68. HMI update status information



5. Click the **Close** button , to close the HAAKE iQ Update Tool program window.
6. Switch the HAAKE MARS iQ (Air) off and on again using the operating switch on the right side of the instrument head (see [Figure 5](#) on [page 6](#) in [Chapter 2, "Functional Elements,"](#) of the HAAKE MARS iQ (Air) Instruction Manual).

Applying the Fn Update using the HAAKE iQ Update Tool

The HAAKE MARS iQ rheometer is equipped with an optional normal force sensor which can be activated any time by applying the Normal Force (NF) Update (order number 222-2391).

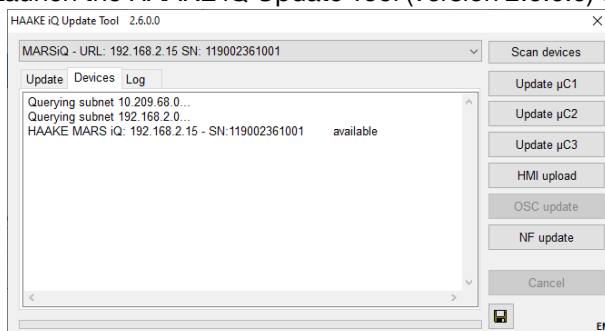
IMPORTANT The HAAKE MARS iQ must be equipped with firmware versions V1:01.03.008 and V3:1.03.003 or newer.

The Update consists of an installation key which must be entered in a dialog using the HAAKE iQ Update Tool.

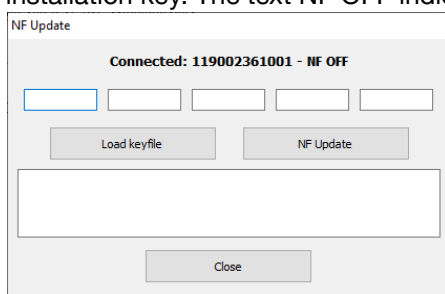
See ["Launching the HAAKE iQ Update Tool from HAAKE RheoWin"](#) on [page 48](#) for instructions on how to use the HAAKE iQ Update Tool.

❖ **To enter the installation key**

1. Launch the HAAKE iQ Update Tool (version 2.6.0.0) or newer.)



2. Click the **NF update** button to open the NF Update dialog. The number behind Connected is the serial number of the HAAKE MARS iQ (Air) which must match the serial number in the installation key. The text NF OFF indicates that the normal force option is not yet activated.

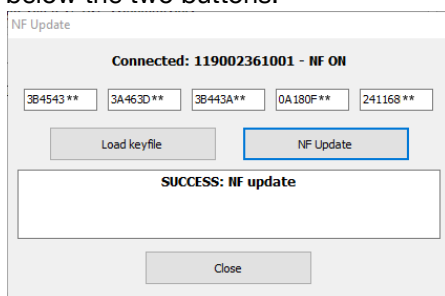


3. Enter the key information in the five edit fields above the two buttons.

or

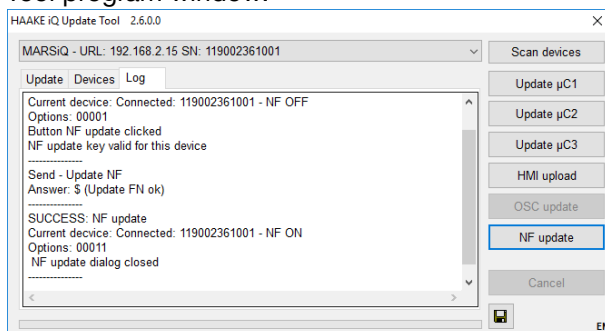
Click the **Load keyfile** button to read the key information from a key file if available.

4. When the update was successful the text SUCCESS NF update will be displayed in the area below the two buttons.



5. Click the **Close** button to close the NF Update dialog.

A confirmation text for the update is now displayed in the **Log** page of the HAAKE iQ Update Tool program window.

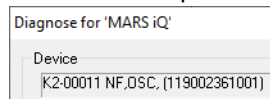


6. Click the **Close** button , to close the HAAKE iQ Update Tool program window.

7. In RheoWin JobManager open the **DeviceManager**.

8. In the DeviceManager select the MARS iQ and then click **Diagnosis** button.

In the first line of the Diagnosis dialog the text NF should now be displayed to show that the normal force option is activated.



Troubleshooting Firewall and other network settings

In case the HAAKE iQ Update Tool does not transfer the firmware and/or HMI files to the instrument as intended, check the firewall and network settings as described below.

Basic Firewall settings

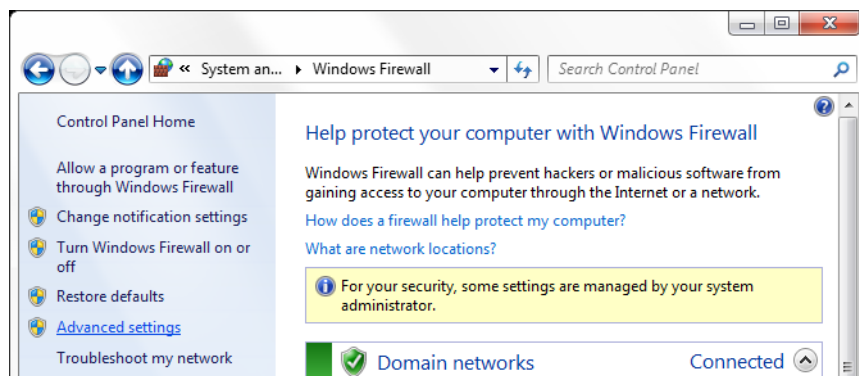
In case the HAAKE iQ Update Tool does not work, first check whether the settings in the Firewall program used on the computer are correct.

Note The following procedure describes how to check the settings in the Windows Firewall program. In other IT environments other Firewall programs may be used.

❖ To check the Windows Firewall settings for the HAAKE iQ Update Tool

1. In the Windows Control Panel select **System and Security > Windows Firewall**, then select **Advanced settings** (on the right hand side of the dialog) see [Figure 69](#), to open the Windows Firewall with Advanced Security dialog.

Figure 69. Firewall dialog in Windows Control Panel



or

On the Windows (10, 11) taskbar, **right** click the Windows **Start** button  to open the Windows start button context menu.

Select **Run** from the context menu.

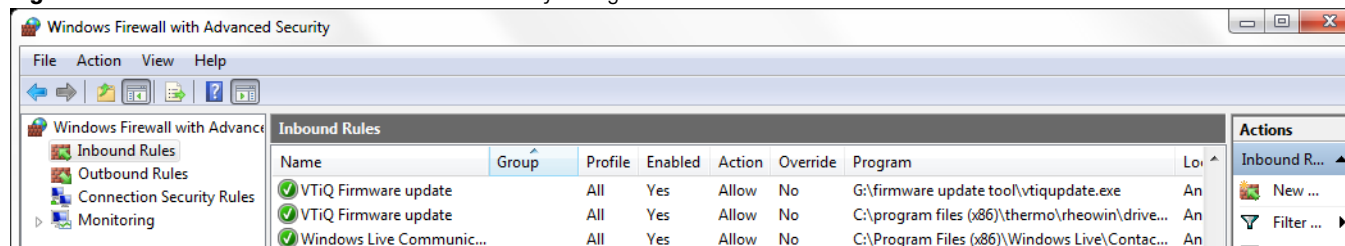
In the **Open** edit field enter the text `wf.msc` and click the **Ok** button.

2. In the Windows Firewall with Advanced Security dialog select **Inbound Rules** then scroll down to **HAAKE iQ Firmware update**, in the Inbound Rules list, see [Figure 70](#).

Note There may be multiple entries for HAAKE iQ Firmware update in the list because there is an entry for every path the program was launched from.

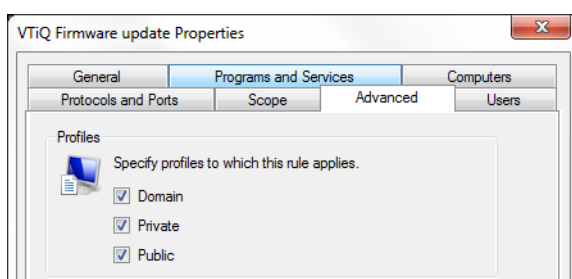
Note Entries for HAAKE iQ Firmware update in the list that are not needed anymore can be deleted. When all entries are deleted the Windows security alert dialog, see [“To allow communication on the listed networks,”](#) will pop-up again on the next launch of the HAAKE iQ Update Tool.

Figure 70. Windows Firewall with Advanced Security dialog



3. Double click on the **HAAKE iQ Firmware update** entry that needs to be checked, to open the HAAKE iQ Firmware update Properties dialog, see [Figure 71](#).

Figure 71. HAAKE iQ Firmware update Properties dialog



4. In the HAAKE iQ Firmware update Properties dialog make sure that the check boxes for **Domain**, **Private** and **Public** are all selected (when available).
5. Close all Firewall and Control Panel dialogs.

The Bootp protocol

In case the (basic) Firewall settings are ok and updating the firmware still does not work, check whether the Firewall allows the so called Bootp protocol to run on the PC. Although the Bootp protocol, as defined in RFC 951 is a standard RFC 951 network protocol, it is often blocked (by IT policies in the Firewall) in company networks.

IMPORTANT The Bootp protocol *must* be allowed (not blocked) on the PC otherwise the HAAKE iQ Firmware Updater will *not* work.

At Thermo Fisher Scientific the Bootp protocol is (was) blocked by default on all company notebooks by the McAfee Host Intrusion Prevention program.

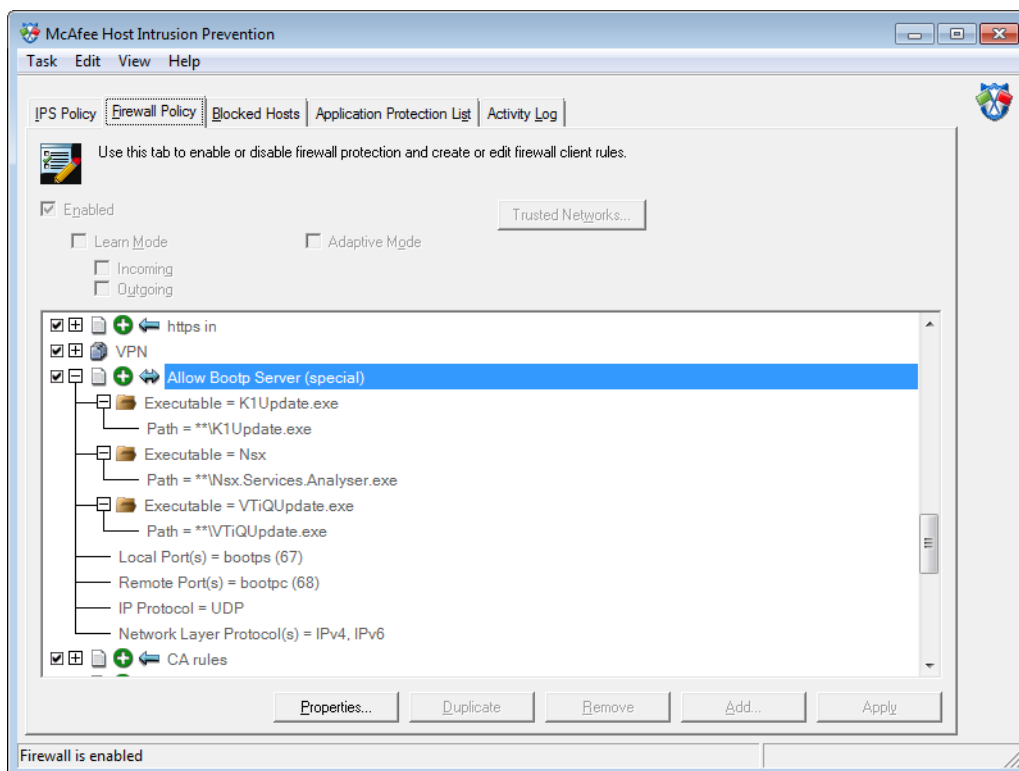
Note The following procedure describes how to check the settings in the McAfee Host Intrusion Prevention (McAfee Firewall) program. In other IT environments other Firewall programs may be used.

❖ To check the Bootp settings in McAfee Host Intrusion Prevention (McAfee Firewall)

1. Navigate to the directory `c:\Program Files\McAfee\Host Intrusion Prevention` and run the program **McAfeeFire.exe**.

2. In the McAfee Host Intrusion Prevention program window select the **Firewall policies** page, see [Figure 72](#).

Figure 72. McAfee Firewall dialog



3. In the list scroll down to the **Allow Bootp Server (special)** entry (just below the VPN entry).
4. Check whether **iQupdate.exe** is listed as an executable file.

If this is not the case consult the IT department of your company to unblock the Bootp protocol.

Symbols, Quantities and Units

This appendix contains tables of all the quantities and their symbols and units as used in the HAAKE MARS iQ touchscreen panel user interface, in the HAAKE RheoWin software as well as in this manual.

Table 4. Instrument and general quantities

Symbol	Quantity	Unit	mult. Factor	Unit name
ϕ	Angle	rad mrad μ rad °	0.001 rad 10^{-6} rad $\pi/180$ rad	radiant milli radiant micro radiant degree
n	Rotational speed	rpm 1/min	1.0 rpm	revolutions per minute revolutions per minute
Ω	Angular velocity	rad/s		radiants per second
M	Torque	N·m N·cm mN·m μ N·m dyn·m kgf·m	0.01 N·m 0.001 N·m 10^{-6} N·m 10^{-5} N·m 9.80665 N·m	Newton meter Newton centimeter milli Newton meter micro Newton meter dyne meter kilogram-force meter
F _n	Normal force	N		Newton
t	Time	s ms min h	0.001 s 60 s 3600 s	second milli second minute hour
t-seg	Segment time	see t		
f	Frequency	Hz		Hertz
ω	Angular frequency	rad/s		radiants per second
T	Temperature	K °C °F		Kelvin degree Celsius degree Fahrenheit

Table 5. Rheological quantities

Symbol	Quantity	Unit		
γ	Strain or deformation	-	%	
$\dot{\gamma}$	Shear rate or strain rate	1/s	one per second	
τ	Shear stress	Pa mPa kPa MPa dyn/cm ² kgf/cm ²	 10 ⁻³ Pa 10 ³ Pa 10 ⁶ Pa 0.1 Pa 98066.5 Pa	Pascal milli Pascal kilo Pascal mega Pascal dyne per square centimeter kilogram-force per square centimeter
η	Viscosity	Pa·s mPa·s P cP	 0.001 Pa·s 0.1 Pa·s 0.001 Pa·s	Pascal second milli Pascal second Poise centi Poise
J	Compliance	1/Pa 1/kPa 1/MPa	 10 ⁻³ 1/Pa 10 ⁻⁶ 1/Pa	Pascal inverse kilo Pascal inverse mega Pascal inverse
N_1	First normal stress difference	see τ		
Ψ_1	First normal stress coefficient	Pa·s ²		
δ	Phase angle	see ϕ		
$\tan \delta$	tangens of phase angle	-		
G'	Loss modulus	Pa kPa MPa	 1000 Pa 10 ⁶ Pa	Pascal kilo Pascal mega Pascal
G''	Storage modulus	see G'		
$ G^* $	Complex modulus	see G'		
η'	Dynamic viscosity (in phase with strain) ^a	see η		
η''	Out-of-phase (with strain) component of η^* ^a	see η		
$ \eta^* $	Complex viscosity	see η		

^a Nomenclature according to the Society of Rheology.