DHR

MagnetoRheology Accessory

Getting Started Guide

Revision A Issued April 2015

Notice

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TA Instruments — Waters LLC
159 Lukens Drive
New Castle, DE 19720

Introduction

Important: TA Instruments Manual Supplement

Please click the TA Manual Supplement link to access the following important information supplemental to this Getting Started Guide:

- TA Instruments Trademarks
- TA Instruments Patents
- Other Trademarks
- TA Instruments End-User License Agreement
- TA Instruments Offices

Notes, Cautions, and Warnings

This manual uses NOTES, CAUTIONS, and WARNINGS to emphasize important and critical instructions. In the body of the manual these may be found in the shaded box on the outside of the page.

NOTE: A NOTE highlights important information about equipment or procedures.

CAUTION: A CAUTION emphasizes a procedure that may damage equipment or cause loss of data if not followed correctly.

MISE EN GARDE: UNE MISE EN GARDE met l'accent sur une procédure susceptible d'endommager l'équipement ou de causer la perte des données si elle n'est pas correctement suivie.

A WARNING indicates a procedure that may be hazardous to the operator or to the environment if not followed correctly.

Un AVERTISSEMENT indique une procédure qui peut être dangereuse pour l'opérateur ou l'environnement si elle n'est pas correctement suivie.

Regulatory Compliance

Safety Standards

For Canada

CAN/CSA-C22.2 No. 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1: General Requirements.

CAN/CSA-C22.2 No. 61010-2-010 Particular requirements for laboratory equipment for the heating of materials.

For European Economic Area

(In accordance with Council Directive 2006/95/EC of 12 December 2006 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.)

EN 61010-1:2001 Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1: General Requirements + Amendments.

EN 61010-2-010:2003 Particular requirements for laboratory equipment for the heating of materials + Amendments.

For United States

UL61010-1:2004 Electrical Equipment for Laboratory Use; Part 1: General Requirements.

Electromagnetic Compatibility Standards

For Australia and New Zealand

AS/NZS CISPR11:2004 Limits and methods of measurement of electronic disturbance characteristics of industrial, scientific and medical (ISM) radio frequency equipment.

For Canada

ICES-001 Issue 4 June 2006 Interference-Causing Equipment Standard: Industrial, Scientific, and Medical Radio Frequency Generators.

For the European Economic Area

(In accordance with Council Directive 2004/108/EC of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility.)

EN61326-1:2006 Electrical equipment for measurement, control, and laboratory use-EMC requirements-Part 1: General Requirements. Emissions: Meets Class A requirements per CISPR 11. Immunity: Per Table 1 - Basic immunity test requirements.

For the United States

CFR Title 47 Telecommunication Chapter I Federal Communications Commission, Part 15 Radio frequency devices (FCC regulation pertaining to radio frequency emissions).

Safety

WARNING: The operator of this accessory is advised that if the equipment is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.

AVERTISSEMENT: L'utilisateur de cet accessoire est prévenu qu'en cas d'utilisation contraire aux indications du manuel, la protection offerte par l'équipement peut être altérée.

Required Equipment

While operating this accessory, you must wear eye protection that either meets or exceeds ANSI Z87.1 standards. Additionally, wear protective clothing that has been approved for protection against the materials under test and the test temperatures.

Thermal Safety

WARNING: Parts of the MR Accessory and hoses that will get hot or cool during operation should not be touched when testing at high and low temperatures. Time must be allowed for these to reach ambient temperature.

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Chapter 1:

Introducing the MagnetoRheology Accessory

Overview

Magneto-rheological (MR) fluids are suspensions of small magnetizable particles dispersed in a liquid carrier which show dramatic and reversible rheological changes when an external magnetic field is applied. These changes in viscosity can be up to seven decades in magnitude. A typical MR fluid can go from the consistency of a liquid to that of a solid, and back, with response times on the order of milliseconds.

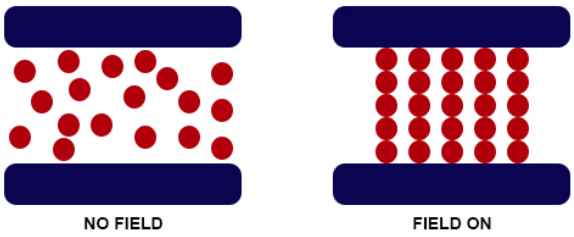


Figure 1 Effect of applying external magnetic to magneto-rheology fluids.

The application of an external magnetic field, H, induces a magnetic moment in the magnetizable particles present in the MR fluid. The polarized particles then associate with each other to form structures aligned along the magnetic field. The formation of these field-induced structures results in a dramatic increase in the sample viscosity. The extent of the change in rheological properties depends on the strength of the magnetic field applied and the particle concentration in the MR fluid. A great deal of interest in characterizing MR fluids results from potential applications in active vibro-protection and lubrication systems (damping devices, clutches, braking devices, actuators, optical devices) and precise polishing devices.

The DHR MR-Accessory is able to control the magnetic flux density, B, in a range from 0 to 1 Tesla while a steady, transient, or oscillatory rheological experiment in parallel plate or cone plate geometry is performed. Temperature control for the MR Accessory is provided by a recirculating fluid bath. The accessible temperature range is dependent on the circulator and circulating fluid. In the standard configuration, the sample temperature may be controlled from 5°C to 75°C. With the appropriate fluid and circulator, the temperature range of the MR Accessory can be extended from -10°C to 170°C.

The MR Accessory is available as:

- MR module base unit with operating temperature range of 5°C to 75°C depending on circulator used. Sample temperature is always recorded and reported in the software, but controlling the sample temperature requires an appropriate computer-controlled fluid circulator from Julabo.
- Upgrade for closed loop magnetic field control with the Closed Loop Field Kit. Maximum temperature for use is 75°C.
- Upgrade for wider temperature range with Extended Temperature Kit.

MR Components

The following section describes the components included with the DHR MR Accessory.

MR Module

The MR module consists of the upper and lower cover assembly and a cylindrical core of magnetizable steel that is connected to a steel cup enclosure at the bottom and surrounded by a solenoid. A recirculating fluid between the solenoid and the center cylinder provides temperature control of the MR module and cooling of the solenoid. A temperature sensor located below the sample plate records the sample temperature. The lower plate has a rectangular channel that can be used to position an optional external Hall probe for monitoring, calibrating, or controlling the magnetic flux density.

The upper cover assembly consists of two semicircular pieces. The upper plate of the test geometry is attached to the motor shaft of the DHR. Both lower plate and upper plate are made of Stainless Steel to eliminate interference with the magnetic field.

With the upper cover assembly in place, the magnetic flux lines are perpendicular to the plate surface and are oriented in the direction of the velocity gradient during the rheological experiment.

The MR accessory is calibrated in the factory without any sample loaded in the parallel plate geometry. Calibrations derived from user measurements can also be generated and saved.

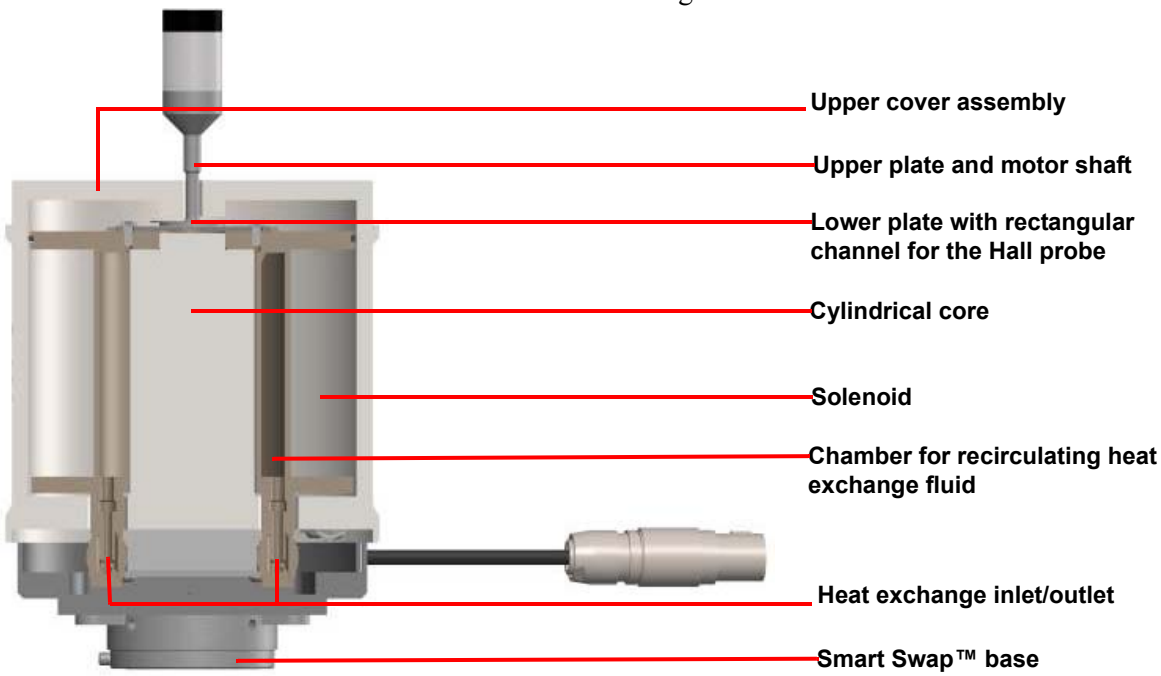


Figure 2 Schematic of MR Accessory.

Circulator

The temperature of the MR Accessory is controlled with a recirculating fluid bath. The primary temperature sensor of the MR module located below the lower plate geometry monitors the sample temperature. The recirculating fluid sets the temperature of the test sample and removes excessive heat from the windings of the solenoid.

NOTE: A manual circulator (for example, Thermocube) can be used instead of the computer-controlled circulator described below. In this case, the test temperature has to be set at the circulator and cannot be controlled through TRIOS.

For closed loop temperature control, an appropriate Julabo circulator is required.

Figure 3 Computer-controlled circulator used in conjunction with the MR module.

NOTE: Refer to the operation manual of the circulator for detailed information.

WARNING: In the extended temperature module, temperatures of 150°C and above are used in the operation of the equipment described herein. Operating personnel must at all times observe all safety regulations governing the installation, operation, and calibration.

MR Accessory Specifications

Table 1: MR Accessory Specifications

Item/Area	**Specification**
Geometry	20 mm parallel plate 20 mm 2° cone
Temperature range: MR Accessory Extended temperature module	 5°C to 75°C (plate temperature) -10°C to 170°C (plate temperature)
Magnetic flux density	0 T to 1 T (0 G – 10^5 G)

Chapter 2:

Installing the MR Accessory

This chapter briefly describes the installation of the MR Accessory on the DHR.

The MR module is a single unit that attaches to the Smart Swap™ mount at the rheometer base. Once the MR module is connected to the rheometer and the module is registered by the instrument, the TRIOS software identifies the MR Accessory and allows the accessory-specific test forms to be accessed.

WARNING: Magnetic fields up to 1 T (tesla) are used in the operation of the equipment described herein. Operating personnel must at all times observe all safety regulations governing the installation, operation, and calibration of equipment utilizing high magnetic fields. Do not remove or fit the upper cover assembly while a magnetic field is applied.

NOTE: Refer to TRIOS Software Online Help for detailed operation of the MR Accessory.

Preparing the DHR

Before installing the MR Accessory, proceed as follows:

NOTE: Refer to your instrument documentation for detailed procedures on removing and reassembling components.

1 Raise the stage to maximum height.

2 Remove all upper test geometries as well as any lower Smart Swap™ base attachments.

3 Thoroughly inspect the geometry mounting surfaces and clean off any material that may interfere with mounting the upper geometry and the lower Smart Swap accessory.

Unpacking the MR Accessory

The MR Accessory needs to be removed carefully from its packaging to avoid damage due to its weight.

Follow the steps shown below once the main case has been opened.

1 Remove the white inner foam packaging and place on bench.

Figure 4 Remove the MR accessory from the box.

2 Place the white foams as shown below, with the Smart Swap™ base cover visible, and remove the Velcro strap.

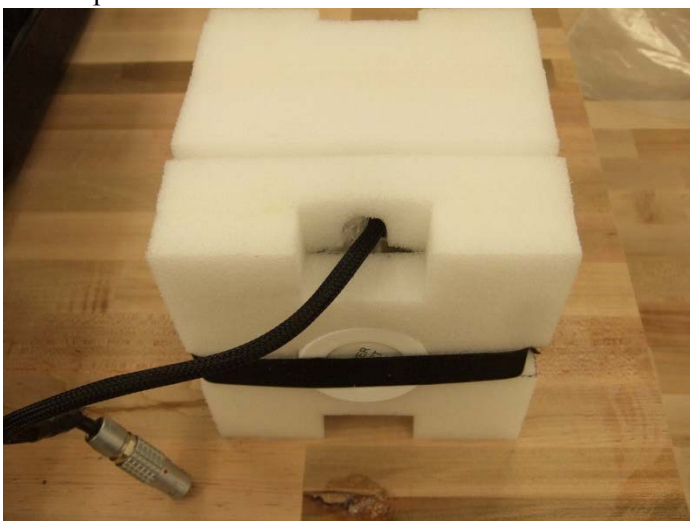


Figure 5 MR accessory before unpacking.

3 Remove the lower section around the pipes, feeding through the Smart Swap connector.

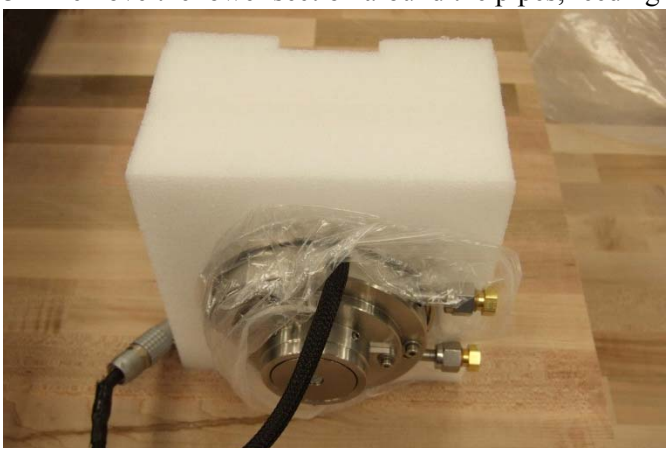


Figure 6 Remove the lower packaging.

4 Place the unit upright with the Smart Swap base on the bench.

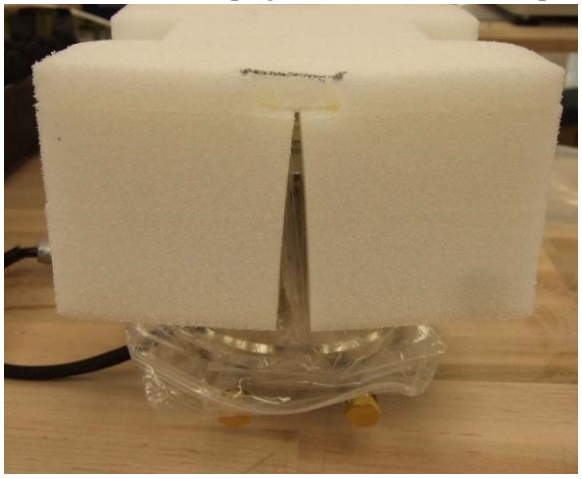


Figure 7 Remove the upper packaging.

5 Slide off the top white foam and bag.

Figure 8 MR unpackaged.

6 The MR accessory can now be put on the instrument and should be carried as shown.

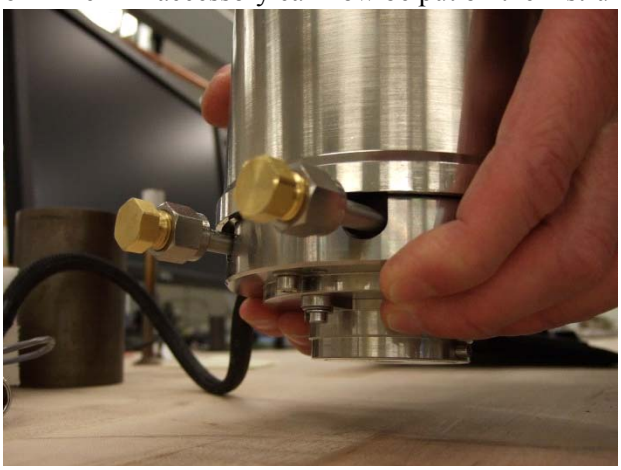


Figure 9 Hold the MR accessory at the base to lift.

NOTE: THE PIPES ON THE MR ACCESSORY SHOULD NOT BE USED TO CARRY THE ACCESSORY.

Installing the MR Accessory on the DHR

This section details the installation of the MR accessory for operation from 5°C to 75°C (plate temperature) using a circulator such as the Thermocube or a comparable circulator such as the Julabo FP35-HE

To install the base MR Module, follow the instructions below:

1 Raise the rheometer head to the top most position

2 Press the **Release** button on the instrument keypad. A continuous green light indicates that the rheometer is ready for the MR module to be fitted.

NOTE: The release state will only stay active for 10 seconds.

3 Fit the MR module, the pipes exit to the left-hand side of the instrument. Ensure it is aligned correctly. See the figure below.

Figure 10 Fitting the MR module onto the Smart Swap™ base.

4 Connect the Smart Swap™ connector to the instrument base in order to register the accessory in the firmware.

Figure 11 Connect the MR module with the Smart Swap connector to the rheometer.

5 Remove the blanking plugs from the pipe on the side of the MR module. Use one wrench to hold the nut nearest the body of the MR module stationary, and rotate the outer nut.

Figure 12 Remove the plugs from the pipe.

6 Use the wrenches provided to remove the end caps on the pre-assembled hoses. Screw the pipe assembly onto the module by hand. Turn the nuts so that they are finger tight, and then tighten using the wrenches, keeping the nut closest to the MR module stationary.

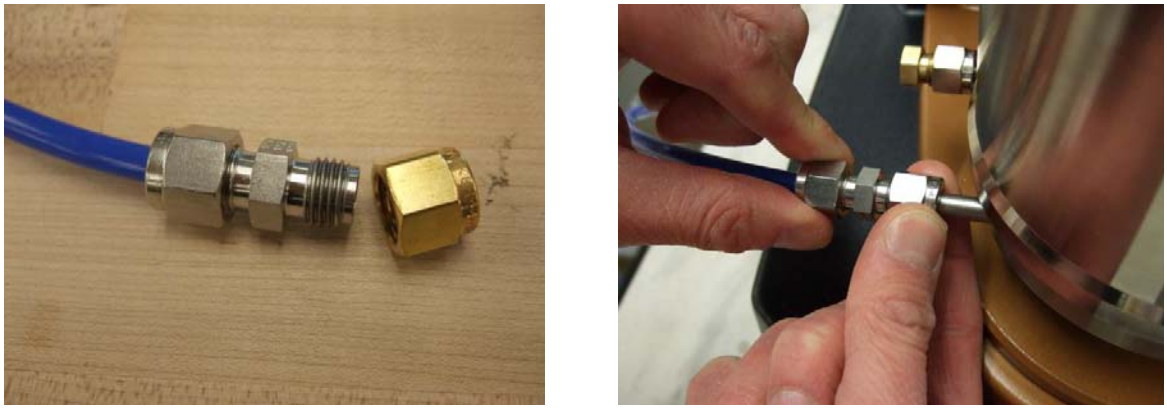


Figure 13 Connecting tube assembly to the MR Accessory.

7 Raise the rheometer head to attach the MR 20 mm upper geometry (either plate or cone) to the motor shaft.

NOTE: Only use MR plate or cone geometries that are designed to be used with the upper cover assembly.

8 Install and calibrate the geometry. Refer to TRIOS Online Help for instructions.

9 Install the lower plate. See "Installing the Lower Plate"

Installing the Lower Plate

1 Remove the lower plate from the plastic case that it arrives in.

2 Loosen the button head screws and place the lower plate on top of the magneto casing as shown.

Figure 14 Place the plate onto the casing.

3 Rotate the lower plate so that the screws sit in the smaller end of the hole; tighten the 2 screws to secure the plate.

Figure 15 Secure the plate.

MR Accessory Fluid Circulator Options

The MR Accessory is designed to be used with a fluid circulator.

For manual temperature control, a circulator such as the Thermocube or Julabo FP35HE can be used.

In this configuration, the test temperature is set manually on the circulator control panel; the sample temperature at the lower plate is then displayed and reported in TRIOS. The standard tubing and fittings provided with the MR Accessory allow a sample temperature of 5°C to 75°C.

NOTE: Always check circulator manual for fluid compatibility and circulator operating guidelines.

For closed loop temperature control a Julabo Computer Controlled Fluid Circulator (CCFC) with TA firmware is used (normally a Julabo model FP35-HE or F32-HE). The operation of the cell and CCFC can be directly controlled through TRIOS software. For full details of the operation of the Julabo and Safety information, see the manufacturers operating manual.

For test temperatures outside the range of 5°C to 75°C, the Extended Temperature Kit must be used. The fluid circulator manual should be checked for fluid compatibility and circulator operating guidelines and limits.

The Extended Temperature Kit extends the accessible temperature range to -10°C to 170°C with appropriate circulator.

Operating range of possible circulators:

- Thermocube: -5°C to 65°C
- Julabo FP35HE: -35°C to 150°C
- Julabo F32HE: -35°C to 200°C (low temp using C5 fluid, high temp using C20S)

NOTE: The extended temperature range can be covered only when using the high temperature fittings provided in the kit and an appropriate circulator and fluid. Refer to "Installing the Extended Temperature Kit" for more information.

Important Information

The following items are important to the installation and use of circulators with the MR Accessory:

- For general instructions on the use of a Julabo circulator, see the manufacturer's operating manual.
- Position the fluid circulator close to the rheometer to keep the tubing runs as short as possible. Locate the circulator at a height slightly lower than the rheometer.
- Ensure that the connecting hoses do not pose a tripping hazard.
- For the standard testing temperatures, use deionized water as the circulating fluid. Below 5°C, it may be necessary to use a glycol/water mixture.

It is recommended that the following procedures be carried out on a regular basis:

- **Circulation fluid**: This should be changed once per week, or if the water becomes contaminated.
- **Hose inspection**: The hoses need to be inspected periodically for cracks or signs of wear and should be replaced if necessary

In the case of the push-to-connect fittings used on the 5 to 75°C MR Accessory, if you find leaks occurring, first locate the pipe that is leaking. Turn off the fluid circulator's main power switch before disconnecting any lines. Disconnect and reconnect the problem pipe. If problem persists, use a pipe cutter tool to trim approximately 3 mm from the end of the pipe (do not use scissors, as this will pinch a hose flat). Then reconnect the pipe.

WARNING: Before turning on any circulator or operating the MR, the fluid circuit must be checked to ensure the circuit from and to the circulator is complete with no possibility of trapped fluid.

Fluid Circulator Tubing/Hose Connections for Standard Temperature Operation (5°C–75°C range)

Thermocube

The Thermocube comes with 8 mm female push-to-connect fittings in the inlet/outlet ports. The reducer provided with the MR Accessory will fit into these and allow the ¼" OD tubing to be easily connected.

Figure 16 Thermocube connections.

1 Insert the tube-end of the reducers into the female 8 mm ports on the circulator ports.

2 Insert the ends of the 1/4" OD tubing provided into the female end of the reducers.

3 Remove the push-in blanking plugs and connect to the tubing from the circulator.

4 Connect the other ends of the 1/4" straight connector already attached to the MR Module.

NOTE: If the Thermocube circulator is used, the test temperature can only be set at the circulator and not through TRIOS. Closed loop temperature requires the use of an appropriate Julabo computer-controlled fluid circulator.

Julabo

The FP35-HE comes with fittings that thread directly onto the back of the Julabo M16x1 ports. The ¼ inch tubing can be pushed into the female push-to-connect end of these adaptors.

1 Insert the tube-end of the reducers into the female 8 mm x 6mm expander on the circulator ports.

2 Insert the ends of the 1/4" OD tubing provided into the female end of the reducers.

3 Remove the push in blanking plugs and connect to the tubing from the circulator.

4 Connect the other ends of the 1/4" straight connector already attached to the MR Module.

Cable Connections for TRIOS Control (Julabo Only)

The RS232 auxiliary port on the DHR electronics box should be connected to the **SERIAL** port on the CCFC using the 9 to 9-pin RS232 cable provided.

Figure 17 Connections for Julabo CCFC with HE-style head.

Installing the Extended Temperature Kit

CAUTION: If the MR is being used over an extended temperature range ensure the hoses are securely fastened at both ends and the tubing is not under excessive stress or likely to cause trip hazard.

1. The MR accessory should be on the instrument when the hoses are installed.
2. Ensure the circulator and tubing are safely positioned.
3. Ensure the circulator and fluid being used is correctly rated for temperature and has been correctly installed.

Fluid Circulator Tubing/Hose Connections for Extended Temperature Operation (-10°C-170°C range)

WARNING: Fluid hoses will get hot or cool depending on the test; ensure that any contact with other surfaces will not pose a hazard.

For sample temperatures from -10°C to 170°C, a Julabo F32-HE is recommended and the configuration of the circulator for each fluid is listed below.

For operation over a wider range, the high-temperature hoses must be installed:

1 Remove the end caps from the hoses and connect until they are finger-tight on the outlet pipes on the MR Module. Then tighten with the wrenches provided.

Figure 18 High-temperature hoses connected to the MR Module.

2 Connect the other end of the hoses to the Julabo outlets.

Figure 19 High temperature hoses connected to the Julabo circulator.

3 Follow the instructions given in "Cable Connections for TRIOS Control (Julabo Only)" on page 21 for temperature control.

MR Interface Module

The MR Interface module is available as an optional upgrade for closed loop control of the magnetic flux density during testing. The module interfaces the Hall probe with the rheometer.

NOTE: Do not exceed 70°C.

Figure 20 MR Interface module: With the MR Closed Loop Field Kit, the connector on the right side is used (marked as “MR PROBE INPUT”).

NOTE: The MR Interface module is also used in the ElectroRheology Accessory.

The Hall Probe

The signals from the Hall probe are processed in the MR interface module, transferred to the rheometer, converted to Tesla units (probe specific) and the magnetic flux density is reported on the instrument display.

The Hall probe has been calibrated and certified by the manufacturer.

Figure 21 Closed Loop Field Kit Probe.

When using this kit the MR interface module provides the continuous monitoring and adjusting of the magnetic flux density during testing.

1 Place the MR Interface module on the bench, preferably to the right of the DHR test station and connect the power cable at the rear.

2 Plug one end of the CAN bus cable into the CAN bus connector on the rear panel of the DHR electronic box.

Figure 22 CAN bus connection and RS232 port connections at the rear of the DHR electronic box.

3 Interface Module rear connections: Plug the other end of the CAN bus cable into the CAN bus connector labeled CAN IN. Insert the ID plug into the H.V. ENABLE. Plug the CAN termination plug into the connector marked CAN OUT. Finally, plug the Power connector from the rear of the MR Interface box into a wall outlet.

Figure 23 Connections on the rear or the MR Interface module.

4 Connect the Hall probe with the connector MR PROBE INPUT on the right side of the MR/ER interface module. None of the other connectors on the front panel of the interface module are used for the MR accessory.

Figure 24 Hall probe connection with the MR/ER interface module on the right hand side.

5 Place the probe support holder over the MR cell and secure with the thumb screw against the body of the MR Accessory. The support clip should be aligned with the rectangular probe channel at the bottom plate of the test geometry on the right side of the MR module.

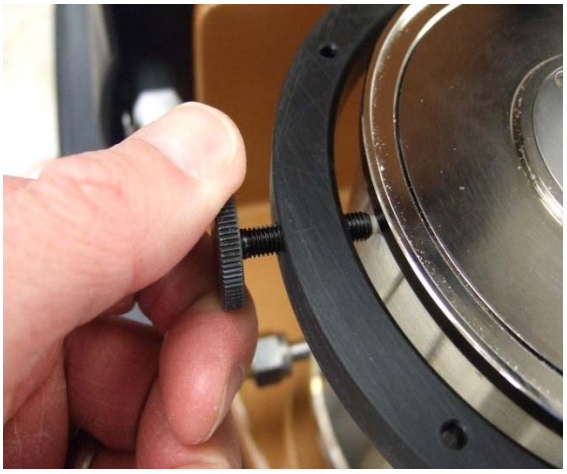


Figure 25 Install the holder supporting the Hall probe.

6 Insert the Hall probe into the rectangular probe channel at the bottom plate of the test geometry until the mark on the probe and the MR module are aligned as shown (also see Installing the Hall probe for calibration).

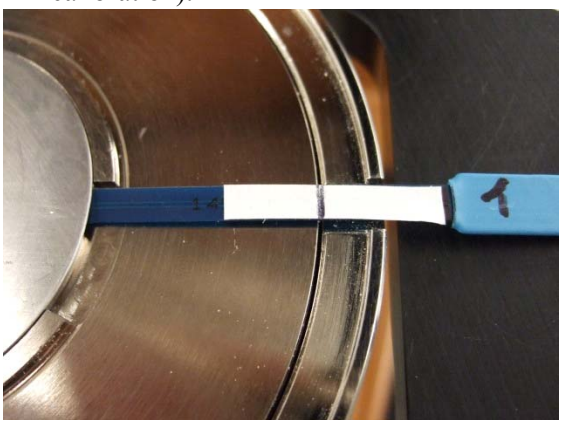


Figure 26 Insert Hall probe and align the black mark with the gap in the cover plate.

NOTE: The tip of the probe with the Hall probe element should be positioned so it is at 0.76 R with R being the radius of the plate/cone geometry. The probe will be in this position if it is aligned with the MR module as shown in Figure 26. The support clamp has a clip provided to lightly secure the probe in the correct position and prevent accidental repositioning.

7 Secure the probe in place by lightly clamping with the clip.

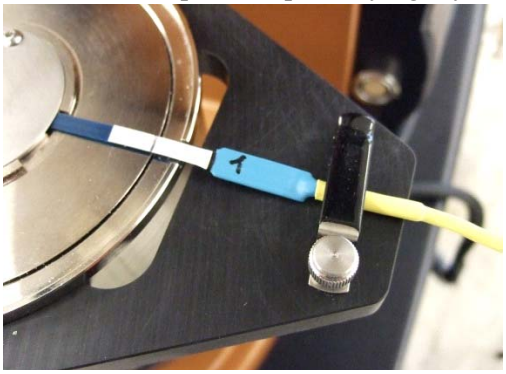


Figure 27 Secure the probe with the clip.

8 The magnetic flux is displayed on the LCD on the test station as follows: Idle - MR probe 0.001T.

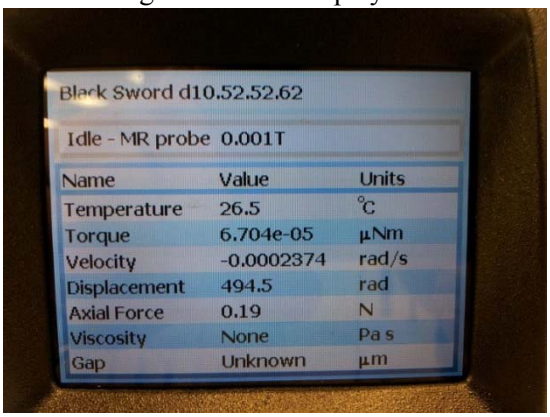


Figure 28 Magnetic flux displayed on the LCD at the test station with the Hall probe installed.

NOTE: If the built-in Hall probe and the ER/MR Interface are not installed and powered up, the LCD at the test station displays “Idle - MR cell 0.001 T” and reports the command magnetic flux density based on the current calibration curve.

Chapter 3:

Operating and Maintaining the MR Accessory

This chapter briefly describes the operation and maintenance of the DHR MR Accessory.

Establishing Connection with TRIOS

In order to operate the MR Accessory, connection through the instrument control software (TRIOS Software) must first be established. TRIOS V3.3 and firmware V9.35 or later must be installed.

1 Make sure that the MR module is installed and the Smart Swap connector is plugged into the rheometer base.

2 TRIOS automatically connects to the MR Accessory and a “MagnetoRheology: Open Loop - Ready” or “MagnetoRheology: Closed Loop - Ready” message displays on the Status bar (depending on whether the closed loop attachment is installed or not).

Installing a Hall Probe for Calibration of the MR module

The MR Accessory is factory-calibrated for the magnetic flux density with no sample. You can also calibrate the MR Accessory using an external Hall probe and Gauss meter (see online Help: Calibrating the MR Accessory).

NOTE: The MR accessory needs to be calibrated when operated in open loop control. If the closed loop control option for the magnetic flux density is used, calibration is not required.

NOTE: The magnetic flux density for the MR module has to be calibrated at a temperature within the operating range of the Hall probe used. Tests at higher temperature have to be run without closed loop control and with the Hall probe removed to avoid damaging parts.

NOTE: The Gauss (Tesla) meter and the reference Hall probe shown in the following steps are not part of the base MR option.

1 Insert any commercial Hall probe into the rectangular channel at the bottom of the geometry plate (maximum dimensions are 5x1mm). The sensitive element of the Hall probe should be located under the sample at 7.6 mm from the center of the sample.

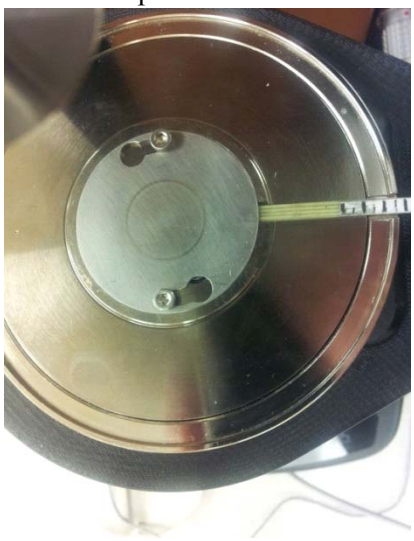


Figure 29 Hall probe installed.

2 Secure the probe to avoid accidental displacement.

Figure 30 Securing a Hall probe.

3 Connect the Hall probe to an external Gauss (Tesla) meter.

Calibrating the MR Accessory

With a Hall probe installed and the sample loaded (see TRIOS online Help: Calibrating the MR accessory), the MR module can be calibrated to display the correct magnetic flux density.

Perform the following steps:

1 Make sure that the sample is loaded, Hall probe installed and the upper cover assembly in place.

2 In TRIOS select **Instrument** > **Calibrate** > **Accessory Calibration**.

3 Click **Calibrate** and follow the on-screen instructions.

4 **Accept** and **Save** to update the calibration factor or cancel to discard the calibration.

NOTE: If one or more calibration curves are listed under stored calibration, any of these calibrations can be sent to the instrument. The last calibration sent to the instrument is the current calibration and is displayed in the header line. If no calibration has been saved or sent it will default to the factory calibration.

Operating the MR Accessory

Operating the MR Accessory on the DHR requires the following steps (see TRIOS Online Help: Operating the MR Accessory for details)

1 Selecting and preparing the sample.

2 Selecting and installing the geometry.

3 Setting up your experiment through TRIOS Software.

4 Zeroing the gap at the subsequent, initial experimental temperature.

5 Loading the sample, as required.

6 Installing the upper cover assembly and starting the test.

NOTE: It is crucial to control the amount of sample loaded prior to each experiment very accurately in order to maximize reproducibility. It is recommended to use a volume adjustable repetitive pipette (Repetitive syringe dispenser from Nichiryo P/N S-07936-03 recommended) to load the sample. With the geometry diameter of 20 mm, a gap of 300 -500 microns and a volume of 100 to 150 µl is needed to fill the space between the upper and lower plate completely.

NOTE: In order to operate at low magnetization levels, it is necessary to demagnetize the MR module and the sample before starting a new experiment. Refer to TRIOS online help for instructions.

Maintaining the MR Accessory

The maintenance required for the DHR MR Accessory consists of the following tasks:

- Thoroughly clean the geometries and the top of the accessory if they become visibly soiled.

Clean the geometries

Cover the magnet provided in the MR Accessory Kit with a thin tissue or wipe and use this to remove the bulk of the magnetic sample from the geometry and plate prior to cleaning.

Figure 31 Cleaning the geometry.

Replacement Parts

The table below lists the replacement parts available for the MR Accessory.

Table 2: Replacement Parts for MR Accessory

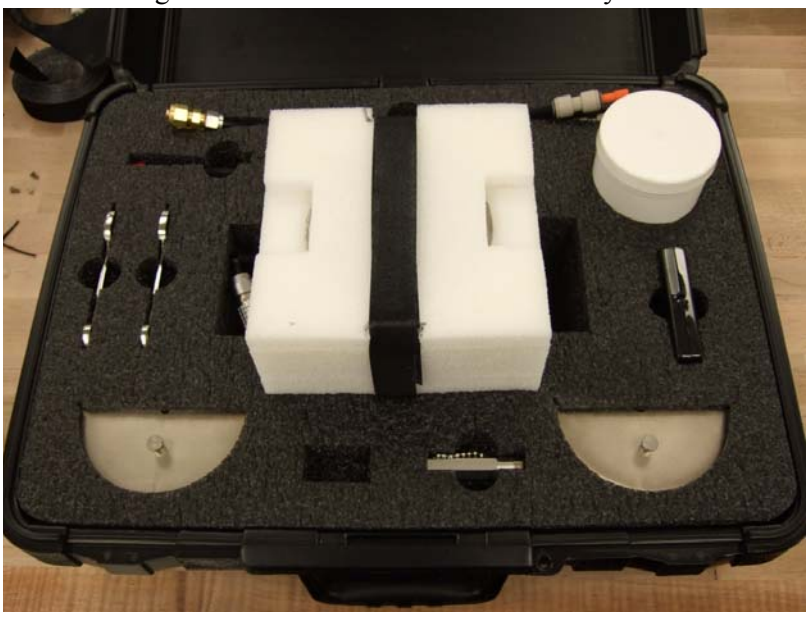
Part Number	Description
547110.901	DHR MR PARALLEL PLATE 20 MM SST
54711.901	DHR MR CONE 20 MM 2 DEG SST
547112.901	DHR MR LOWER PLATE SST
547114.901	DHR MR CLOSED LOOP FIELD PROBE

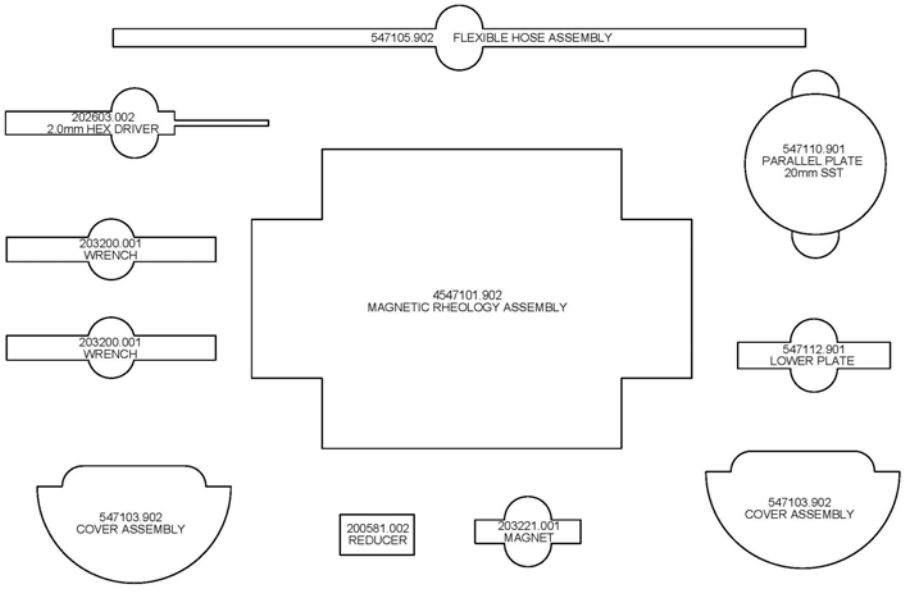
Appendix A:

MR Accessory Case Contents

Accessory Case Contents

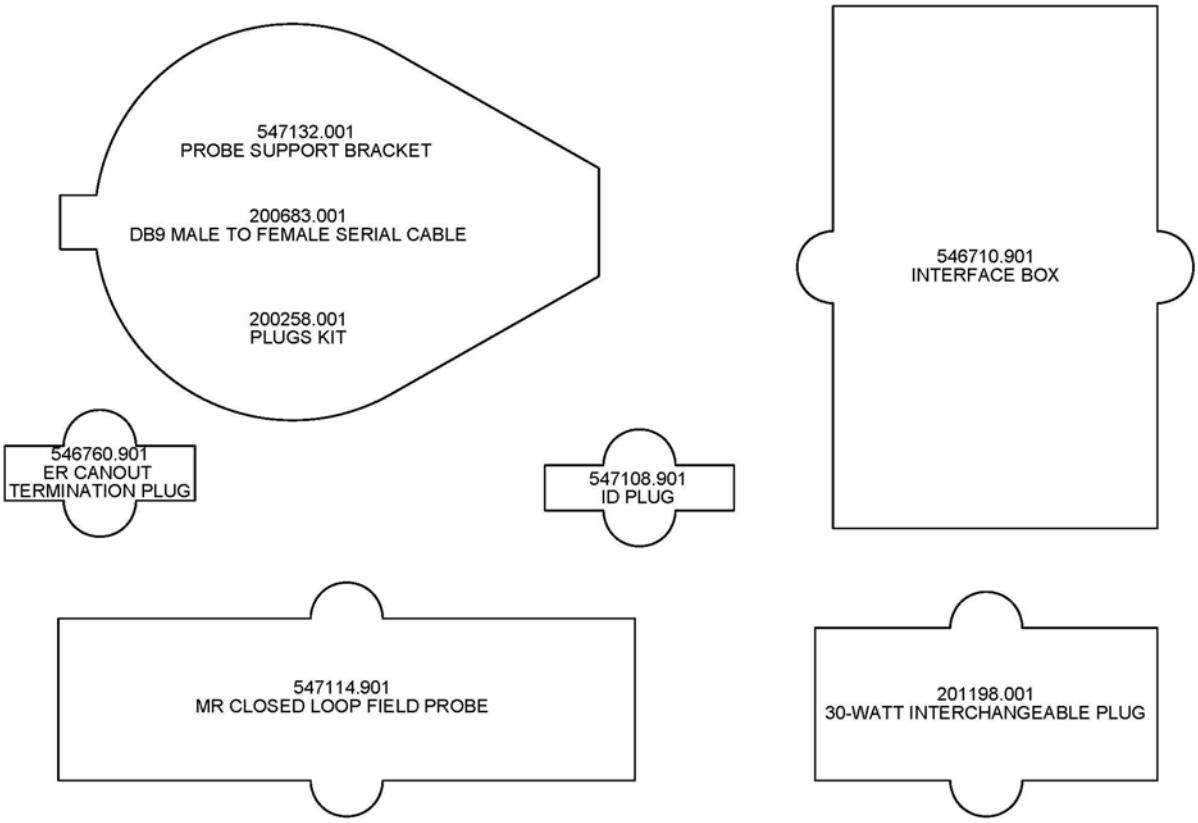
The following items are stored in the MR Accessory Case:





Closed Loop Field Kit

The following items are stored in the Closed Loop Field Kit:



Extended Temperature Kit

The following items are stored in the Extended Temperature Kit:

- 2x High Temperature Hose Assemblies
  - Viton tubing
  - Julabo Adapter fittings

Appendix B:

Setting the Circulator Configuration for Closed Loop Temperature Control (HE Style)

Startup Procedure

Follow the procedure below to configure the Julabo Circulator and refer to the Manual provided with the circulator:

1 Power on the Julabo CCFC. “TA SPECIAL” displays upon power up, then the firmware versions appear.

2 Open the Julabo menu by pressing the **Menu** key 

on the front panel.

3 Use the up and down  keys to scroll through the menus and to change parameter values.

4 Press **OK** to save changes to the configuration.

5 Press **OK** to return to the previous menu selection and to exit the menu.

Circulator Settings for TRIOS Control

NOTE: the SAFETEMP, OVERTEMP and SUBTEMP VALUES are set to the same as the limits:

For Julabo C5 fluid they are -20°C and 110°C

For Julabo C20S fluid they are 0°C to 190°C

- P.Start: Not used in closed loop temperature control mode, leave as defaults
- Program: Not used in closed loop temperature control mode, leave as defaults
- Pump: Set to Level 2 (this is the factory default)
- Config:
  - Remote: Remote on
  - Auto St: Set to Off
  - Off Mode: Pump off
  - Actvar: Control
  - Time/Dt: Setting time and date
  - Reset: see Circulator Manual

- Control:
  - C-Type: Int
  - Self Tun: Off
  - Dynamic: Aper
  - XP INT: 0.8
  - TN INT: 100
  - TV INT: 8
- Serial:
  - Baudrate: 4800
  - Parity: Even
  - Hshake: Hard
- ATC
  - Sensor: Ext
  - ATC(E):Status
  - ATC(E):Type: 1 Point
  - ATC (E): TMP VAL 1: 25
  - ATC(E): CAL VAL 1: 25
- Limits: Temperature and Capacity Limits. The values shown below are for C5 fluid, which is for taking the MR down to -10°C plate temperature.
  - Set Max: 110°C
  - Set Min: -20°C
  - Heat Max: 100%
  - Cool Max: 100%
- Safety installations and warning values SECVAL:
  - SAFETEMP: 110.00
  - ALTYPE: WARNING
  - OVERTEMP:110.00
  - SUBTEMP: -20.00