



## LMF SDK v1.9.0.2507 beta What's new?

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## Differences between provided LMF 1.9 beta versions

### LMF 1.9.0.2507 to 1.9.0.2135

In contrast to LMF 1.9.0.2135, LMF 1.9.0.2507 contains the following major changes

- The latest version contains a fix regarding the disconnection behaviour for the AT960 tracker in combination with the AS1 (see chapter Improvements for the AT9x0 interface).
- The following LMF classes, which were part of previous LMF 1.9 beta versions, are removed:
  - WrtlRemoteBox
  - Internals Namespaces
  - Adapters Namespaces
  - Test.MeasurementResults
- Integration of the RemoteControlTrigger for AT500 (Same as AT40x)
- Bug Fixes

### LMF 1.9.0.2135 to 1.9.0.1891

In contrast to LMF 1.9.0.1891, LMF 1.9.0.2135 contains the following major implementations

- The B-Probe<sup>plus</sup> will not generate measurements when the user releases the button on the device. Instead, the user receives a button event if the measurement button on the B-Probe plus is pressed manually. By means of the button down event the 3<sup>rd</sup> party software can react correspondingly, e.g. by invoking a measurement with *startMeasurement* (see chapter Support for the new B-Probe<sup>plus</sup> ).
- The B-Probe<sup>plus</sup> does not allow and support continuous time or continuous distance measurements. The same restrictions as for the B-Probe regarding the measurement modes also apply for the B-Probe plus (see chapter Support for the new B-Probe<sup>plus</sup> ).



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## Prerequisites and Compatibility

LMF 1.9 supports the following AT systems and respective system software versions

- Leica Absolute Tracker AT500 v1.0
- Leica Absolute Tracker ATS600 v1.1
- Leica Absolute Tracker AT9x0 v2.2
- Leica Absolute Tracker AT40x v2.4
- Leica Absolute Tracker AT901 v3.8
  - Please note that LMF 1.9 will be the last version to be compatible with the AT901

Most of the new features are due to the introduction of the new Absolute Tracker AT500 and the new B-Probe plus.

LMF 1.9 has the following system requirements:

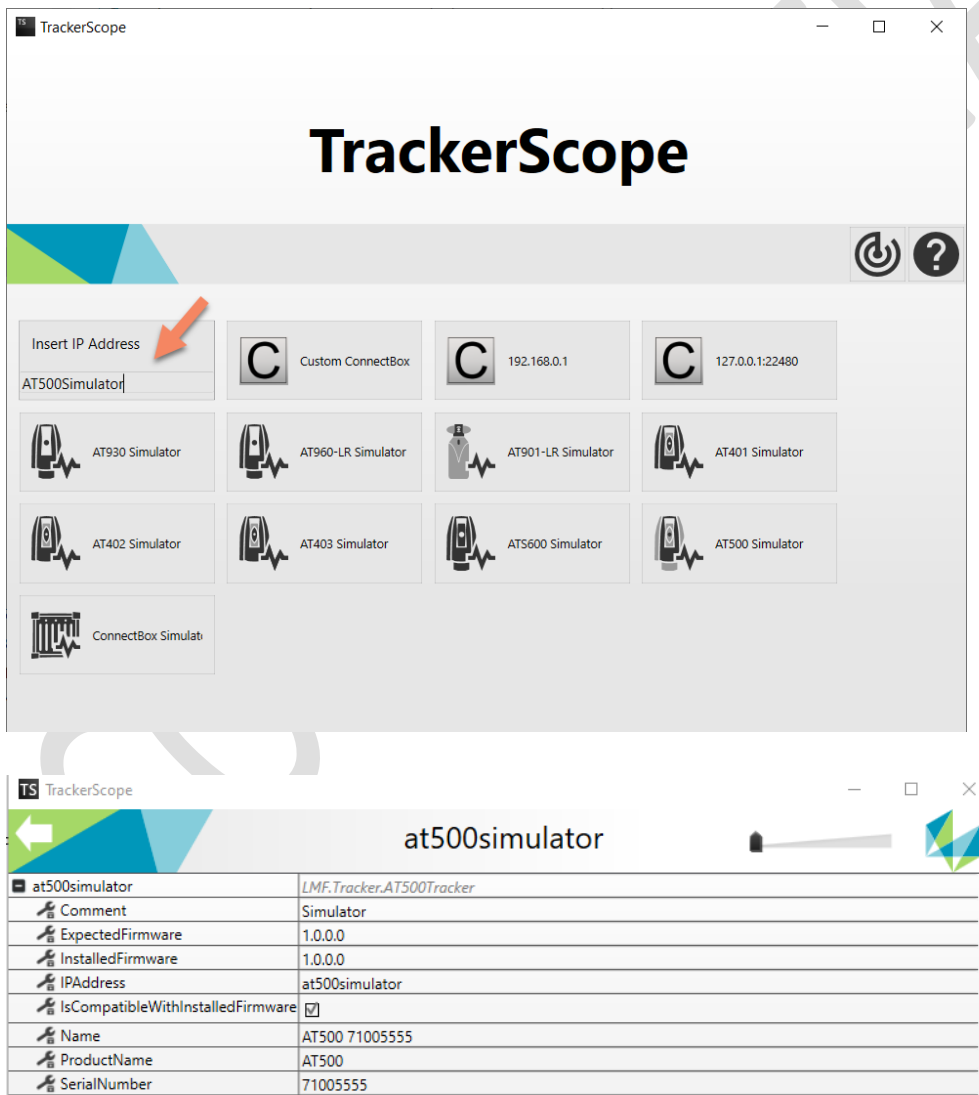
- Windows 10 or higher
- .Net Framework 4.5
- Visual Studio Redist 2019

## Support for the new Absolute Tracker AT500

The AT500 is a new tracker model comparable to an AT40x. It supports 3d measurements to a reflector, as well as measurements to a simple 6dof device. The differences between an AT500 and an AT40x are explained in more details in the following sections.

### AT500 available in Simulator

The AT500 Simulator can be accessed by using TrackerScope.





## Sample Code for connections to the AT500

Additionally, LMF Tracker SDK Setup will install a sample project written in C# showing how to connect to and use the AT500.

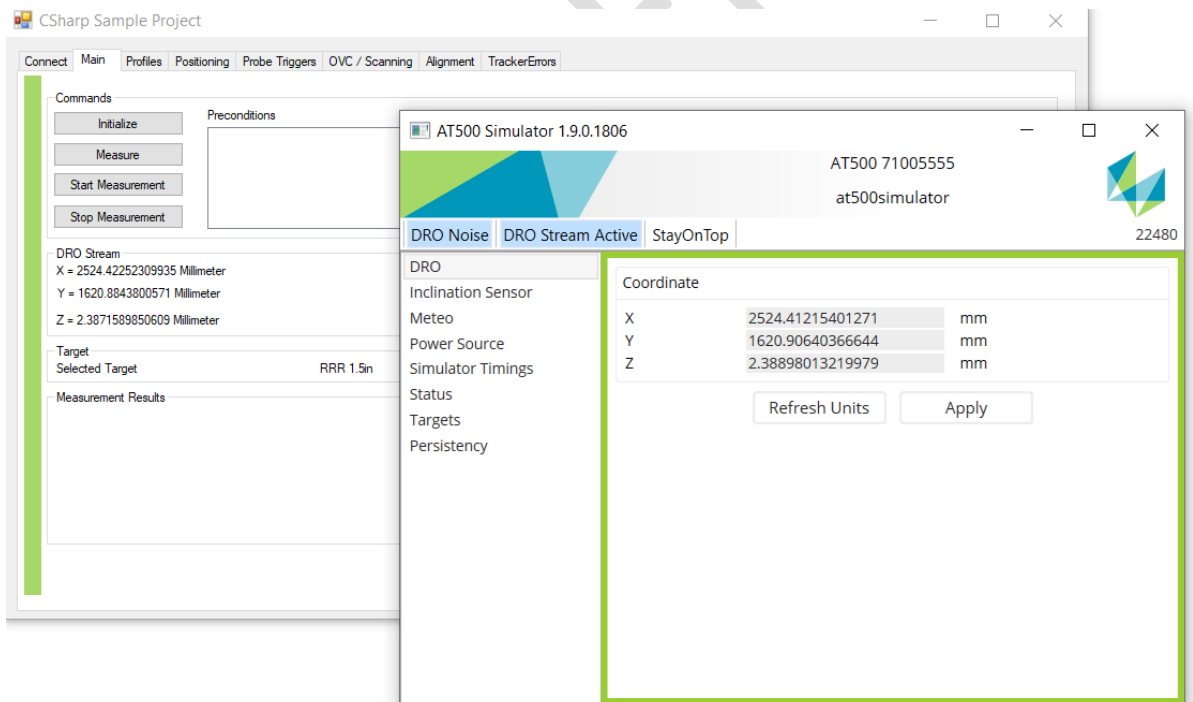
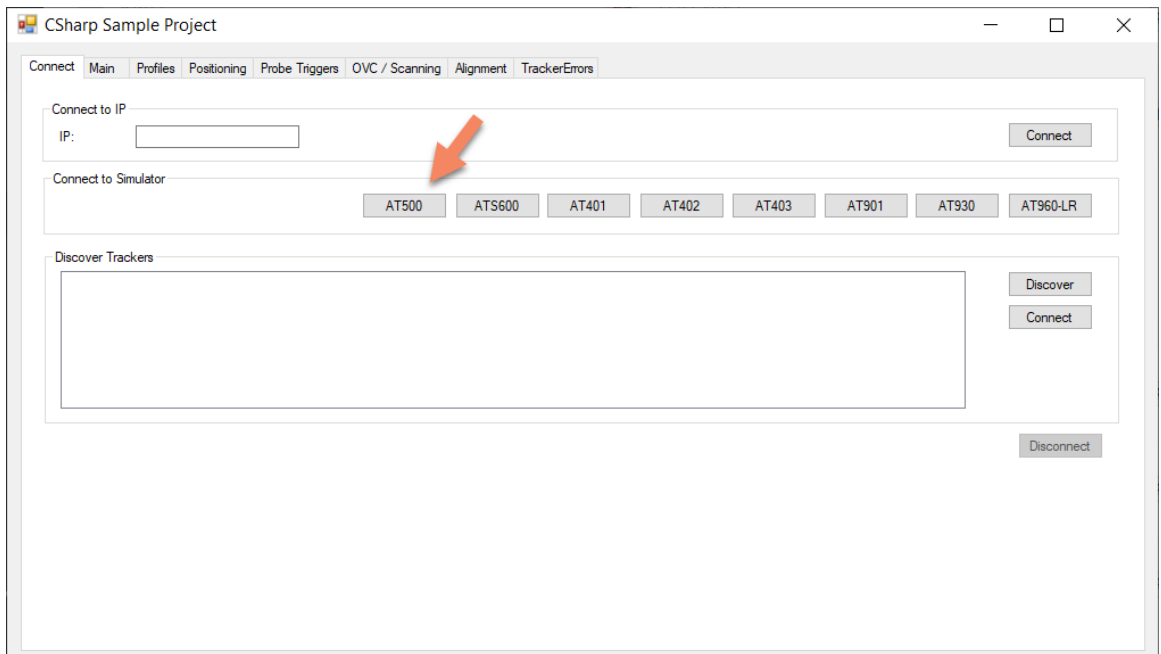
> Program Files (x86) > Leica Metrology Foundation - Tracker SDK

Name	Date modified	Type	Size
COMSampleProject	26/11/2021 17:02	File folder	
CSharpConnectBoxSampleProject	26/11/2021 17:02	File folder	
CSharpSampleProject	26/11/2021 17:02	File folder	
LabViewSampleProject	26/11/2021 17:02	File folder	
ManagedWrapperSampleProject	26/11/2021 17:02	File folder	
MFCSampleProject	26/11/2021 17:02	File folder	
PythonSampleProject	26/11/2021 17:02	File folder	
VBASampleProject	26/11/2021 17:02	File folder	
VC++ Redistributables	26/11/2021 17:02	File folder	
Appendix ExternalTriggerInterface.pdf	26/11/2021 00:08	Foxit PDF Reader ...	839 KB
deploy32Bit.bat	26/11/2021 00:08	Windows Batch File	1 KB
deploy64Bit.bat	26/11/2021 00:08	Windows Batch File	1 KB
LMF Tracker User Guide.pdf	26/11/2021 15:09	Foxit PDF Reader ...	2,241 KB
LMF.Tracker.Connection.dll	26/11/2021 15:07	Application extens...	16,390 KB
LMF.Tracker.Connection.tlb	26/11/2021 17:02	TLB File	382 KB
LMF.Tracker.Connection.xml	26/11/2021 15:06	XML Document	439 KB
LMFDocumentation.chm	26/11/2021 15:13	Compiled HTML H...	5,278 KB
Logalyzer.exe	26/11/2021 14:52	Application	5,110 KB
TrackerScope.exe	26/11/2021 15:10	Application	9,257 KB
undeploy32Bit.bat	26/11/2021 00:08	Windows Batch File	1 KB
undeploy64Bit.bat	26/11/2021 00:08	Windows Batch File	1 KB
unins000.dat	26/11/2021 17:02	DAT File	588 KB
unins000.exe	26/11/2021 17:02	Application	1,175 KB

The simulator is started by pressing on the corresponding tracker type.



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Besides the C# SampleProject the COMSampleProject as well as PythonSampleProject can be used.





## Extended LMF Tracker User guide

The LMF Tracker User guide is updated with the latest changes.

## Relocation of the battery state to Sensor Power Status

AT500 contains two sensor batteries. Unlike the ATS600 and AT9x0, the battery status and level are represented under SensorPowerStatus, as the batteries are attached to the ATS500 Sensor and not to a controller like in ATS600/AT9x0.

The structure remains the same, the enums have not been extended.

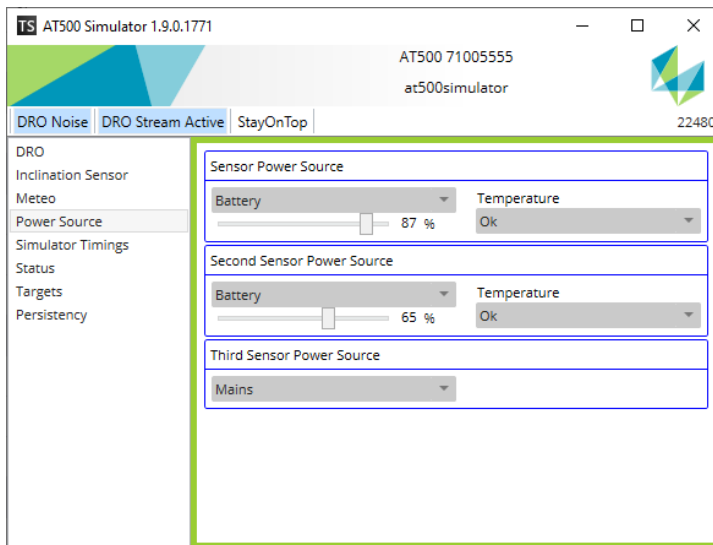
Property	Type
Face	LMF.Tracker.Face
InclinationSensor	LMF.Tracker.Inclination.InclinationSensor
Laser	LMF.Tracker.Laser
Measurement	LMF.Tracker.Measurements.MeasurementSettings
MeteoStation	LMF.Tracker.Meteo.MeteoStation
OverviewCamera	LMF.Tracker.OVC.OverviewCamera
PowerLock	LMF.Tracker.PowerLock
PowerSource	LMF.Tracker.PowerSource
ControllerPowerStatus	NULL
SensorPowerStatus	LMF.Tracker.PowerStatus
Level	LMF.Tracker.BasicTypes.DoubleValue.ReadOnlyDoubleValue
Label	Level
UnitString	%
UnitType	Percent
Value	78
ValueInBaseUnits	0.78
Changed	Changed
RunsOn	LMF.Tracker.BasicTypes.EnumTypes.ReadOnlyPowerSourceValue
Label	Runs on
Value	Battery
Changed	Changed
QuickRelease	NULL
Settings	LMF.Tracker.Settings
Targets	LMF.Tracker.Targets.TargetCollection
TargetSearch	LMF.Tracker.Targets.TargetSearch

Due to mechanical constraints, it is not possible to measure with one inserted battery only. If this occurs, the user will be informed with the following warning:

⚡ InformationArrived	InformationArrived												
⚡ WarningArrived	WarningArrived												
	<table border="1"> <thead> <tr> <th>Parameters</th> <th></th> </tr> </thead> <tbody> <tr> <td>⚡ warning</td> <td>LMF.Tracker.ErrorHandling.LmfWarning</td> </tr> <tr> <td>Description</td> <td>There is only one battery in the sensor.</td> </tr> <tr> <td>Number</td> <td>200127</td> </tr> <tr> <td>Solution</td> <td>To be able to measure, please put both batteries into the sensor battery compartments. Both batteries need to have a minimal battery level of at least one percent each.</td> </tr> <tr> <td>Title</td> <td>Sensor Battery missing</td> </tr> </tbody> </table>	Parameters		⚡ warning	LMF.Tracker.ErrorHandling.LmfWarning	Description	There is only one battery in the sensor.	Number	200127	Solution	To be able to measure, please put both batteries into the sensor battery compartments. Both batteries need to have a minimal battery level of at least one percent each.	Title	Sensor Battery missing
Parameters													
⚡ warning	LMF.Tracker.ErrorHandling.LmfWarning												
Description	There is only one battery in the sensor.												
Number	200127												
Solution	To be able to measure, please put both batteries into the sensor battery compartments. Both batteries need to have a minimal battery level of at least one percent each.												
Title	Sensor Battery missing												



Besides the two internal batteries it is also possible to connect the AT500 to either the external battery pack (MPB100 / MPB25) or to mains. Therefore LMF 1.9 for AT500 is extended by a third power source item in the AT500 simulator.



The overall battery level is calculated as follows

$$\text{Battery level} = \text{Max} (\text{min} (\text{int1}, \text{int2}), \text{Ext3})$$

Where

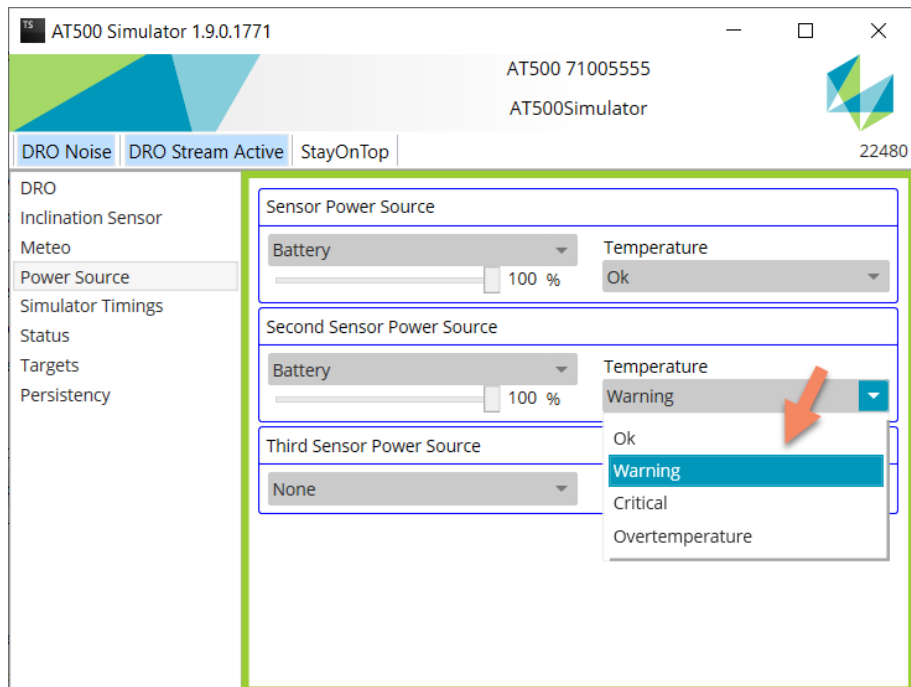
- Int1 = Internal battery 1
- Int2 = Internal battery 2
- Ext3 = External battery 3

Hence, only one battery level will be provided through the interface, as for AT40x, AT9x0 and ATS600.

## Battery temperature warnings and errors

The AT500 sensor batteries itself might throw warnings or errors on a real device. They appear as usual in the warnings or error handler.

Those warnings/errors can be simulated as follows:



The “Warning” status will return the following warning:

⚡ InformationArrived	InformationArrived	
⚡ WarningArrived	WarningArrived	
	Parameters	
	warning	LMF.Tracker.ErrorHandling.LmfWarning
	Description	Battery temperature is high.
	Number	200125
	Solution	Consider connecting AC power.
	Title	Battery temperature high

As soon as the battery reaches a “Critical” temperature, the user is informed to change the battery immediately or connect the tracker to mains.

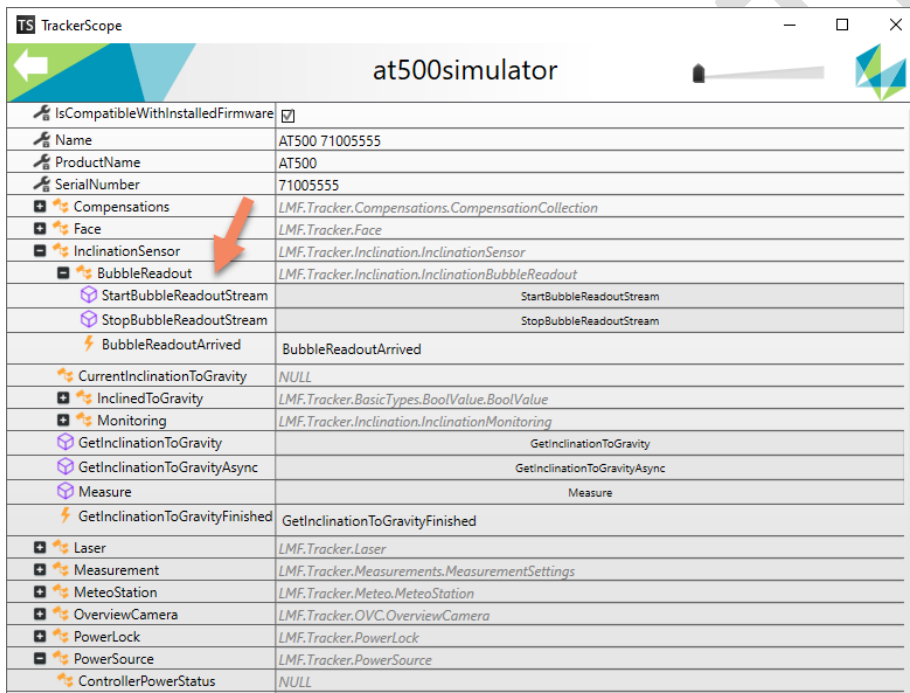
⚡ InformationArrived	InformationArrived	
⚡ WarningArrived	WarningArrived	
	Parameters	
	warning	LMF.Tracker.ErrorHandling.LmfWarning
	Description	System temperature is too high for battery operation.
	Number	200126
	Solution	Stop battery operation immediately by connecting AC power.
	Title	Battery temperature critical

In this case the sensor drives are turned off; the user is not able to measure anymore.

If the battery reaches an overtemperature a tracker shut down will be triggered.

## Bubble read out stream for accurate levelling

AT500 is the first Leica Absolute Tracker which is integrating the controller in the sensor head itself. As a result, the user is not able to see information related to accurate levelling on the controller display anymore; a major difference compared to AT9x0 and ATS600. To provide the minimal information needed regarding the accurate levelling of an AT500, LMF 1.9 is extended by a subtree called “BubbleReadout” within InclinationSensor.



TrackerScope	
at500simulator	
IsCompatibleWithInstalledFirmware	<input checked="" type="checkbox"/>
Name	AT500 71005555
ProductName	AT500
SerialNumber	71005555
Compensations	LMF.Tracker.Compensations.CompensationCollection
Face	LMF.Tracker.Face
InclinationSensor	LMF.Tracker.Inclination.InclinationSensor
BubbleReadout	LMF.Tracker.Inclination.InclinationBubbleReadout
StartBubbleReadoutStream	StartBubbleReadoutStream
StopBubbleReadoutStream	StopBubbleReadoutStream
BubbleReadoutArrived	BubbleReadoutArrived
CurrentInclinationToGravity	NULL
InclinedToGravity	LMF.Tracker.BasicTypes.BoolValue.BoolValue
Monitoring	LMF.Tracker.Inclination.InclinationMonitoring
GetInclinationToGravity	GetInclinationToGravity
GetInclinationToGravityAsync	GetInclinationToGravityAsync
Measure	Measure
GetInclinationToGravityFinished	GetInclinationToGravityFinished
Laser	LMF.Tracker.Laser
Measurement	LMF.Tracker.Measurements.MeasurementSettings
MeteoStation	LMF.Tracker.Meteo.MeteoStation
OverviewCamera	LMF.Tracker.OVC.OverviewCamera
PowerLock	LMF.Tracker.PowerLock
PowerSource	LMF.Tracker.PowerSource
ControllerPowerStatus	NULL

Below this new subtree all related calls and events receivers are grouped.

- InclinationSensor->BubbleReadout->StartBubbleReadoutStream
- InclinationSensor->BubbleReadout->StopBubbleReadoutStream
- InclinationSensor->BubbleReadout->BubbleReadoutArrived

The COMSampleProject contains the InclinationStreamData.

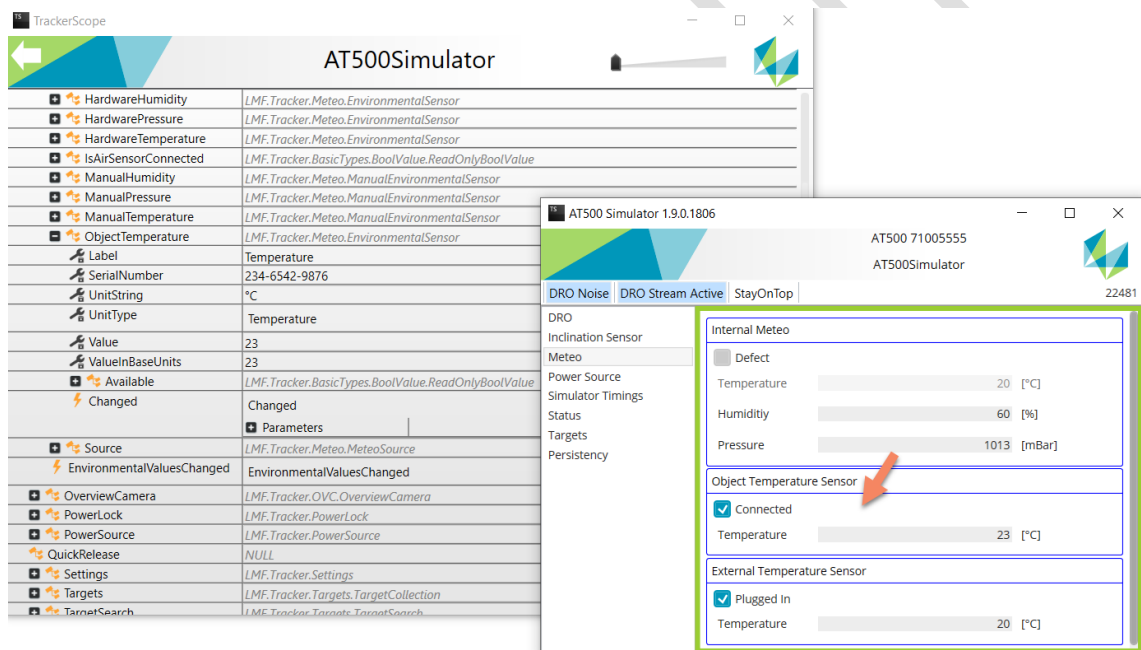
Additionally, AT500 will be released with a mobile application which provides the leveling and changing the network settings as known from the AT9x0 and ATS600 controller.

## Optional (Bluetooth) object temperature sensor

AT500 will be released with a Bluetooth module which enables the possibility to connect the AT500 sensor with a Bluetooth temperature sensor.

The LMF structure has however not changed, the structure and behavior are the same as with an Object Temperature Sensor on any other Leica Tracker.

The received temperature value is shown as the ObjectTemperature.



The screenshot displays the TrackerScope interface for the AT500 simulator. The main window shows a list of LMF objects and their properties. The 'ObjectTemperature' property is highlighted, showing a value of 23 and a unit of °C. A secondary window, 'AT500 Simulator 1.9.0.1806', is open, showing the 'Object Temperature Sensor' settings. The 'Connected' checkbox is checked, and the temperature is displayed as 23 [°C]. A red arrow points to the 'Connected' checkbox.

Property	Value
HardwareHumidity	LMF.Tracker.Meteo.EnvironmentalSensor
HardwarePressure	LMF.Tracker.Meteo.EnvironmentalSensor
HardwareTemperature	LMF.Tracker.Meteo.EnvironmentalSensor
IsAirSensorConnected	LMF.Tracker.BasicTypes.BoolValue.ReadOnlyBoolValue
ManualHumidity	LMF.Tracker.Meteo.ManualEnvironmentalSensor
ManualPressure	LMF.Tracker.Meteo.ManualEnvironmentalSensor
ManualTemperature	LMF.Tracker.Meteo.ManualEnvironmentalSensor
ObjectTemperature	LMF.Tracker.Meteo.EnvironmentalSensor
Label	Temperature
SerialNumber	234-6542-9876
UnitString	°C
UnitType	Temperature
Value	23
ValueInBaseUnits	23
Available	LMF.Tracker.BasicTypes.BoolValue.ReadOnlyBoolValue
Changed	Changed
Parameters	
Source	LMF.Tracker.Meteo.MeteoSource
EnvironmentalValuesChanged	EnvironmentalValuesChanged
OverviewCamera	LMF.Tracker.OVC.OverviewCamera
PowerLock	LMF.Tracker.PowerLock
PowerSource	LMF.Tracker.PowerSource
QuickRelease	NULL
Settings	LMF.Tracker.Settings
Targets	LMF.Tracker.Targets.TargetCollection
TargetSearch	LMF.Tracker.Targets.TargetSearch



## No quick release detection

In contrast to AT9x0 and ATS600, the quick release detection is not supported for AT500.

Property	Value
AT500Simulator	LMF.Tracker.AT500Tracker
Comment	Simulator
ExpectedFirmware	1.0.0.0
InstalledFirmware	1.0.0.0
IPAddress	AT500Simulator
IsCompatibleWithInstalledFirmware	<input checked="" type="checkbox"/>
Name	AT500 71005555
ProductName	AT500
SerialNumber	71005555
Compensations	LMF.Tracker.Compensations.CompensationCollection
Face	LMF.Tracker.Face
InclinationSensor	LMF.Tracker.Inclination.InclinationSensor
Laser	LMF.Tracker.Laser
Measurement	LMF.Tracker.Measurements.MeasurementSettings
MeteoStation	LMF.Tracker.Meteo.MeteoStation
OverviewCamera	LMF.Tracker.OVC.OverviewCamera
PowerLock	LMF.Tracker.PowerLock
PowerSource	LMF.Tracker.PowerSource
QuickRelease	NULL
Settings	LMF.Tracker.Settings
Targets	LMF.Tracker.Targets.TargetCollection
TargetSearch	LMF.Tracker.Targets.TargetSearch
TrackerAlignment	LMF.Tracker.TrackerAlignments.TrackerAlignment
Triggers	LMF.Tracker.Triggers.TriggerCollection
Disconnect	Disconnect
Dispose	Dispose
ConnectFile	ConnectFile

## Support for the new B-Probe<sup>plus</sup>

LMF 1.9 introduces a new B-Probe class called “BProbePlus” which is provided with an AT500 only.

The known B-Probe class remains for AT40x.

The reason to introduce a new class for the B-Probe<sup>plus</sup> on an AT500 is the fact that this device behaves significantly different to a B-Probe on an AT40x. The main differences are detailed below.

- 6Dof DRO with
  - Shank directions/6dof rotation
  - Positions related to ball center

This feature e.g., allows inspecting a part by moving the probe over the part and comparing DRO to CAD, same as a T-Probe on an AT9x0. This is not possible with a B-Probe for AT40x as here the DRO only refers to the probe reflector and cannot be used for such workflows.



- Secondly, the B-Probe <sup>plus</sup> will not generate measurements when the user releases the button on the device, as it is currently done for the B-Probe on an AT40x. Instead, the user receives a button event if the measurement button on the B-Probe plus is pressed manually. For the B-Probe plus the button-up is changed to a button-down event. By means of the button down event the 3<sup>rd</sup> party software can react correspondingly, e.g. by invoking a measurement with *startMeasurement*.

The screenshot displays the AT500 Simulator interface. On the left, the 'TrackerScope' window shows a configuration table for the 'B-Probe Button' trigger. On the right, the 'AT500 Simulator' window shows a control panel for the 'B-Probe plus' target.

Property	Value
Targets	LMF.Tracker.Targets.TargetCollection
TargetSearch	LMF.Tracker.Targets.TargetSearch
TrackerAlignment	LMF.Tracker.TrackerAlignments.TrackerAlignment
Triggers	LMF.Tracker.Triggers.TriggerCollection
[0] StableProbingTrigger	LMF.Tracker.Triggers.StableProbingTrigger
[1] BProbeButtonTrigger	LMF.Tracker.Triggers.BProbeButtonTrigger
GUID	cca4a593-13f7-4f28-af1a-c10a874cede7
Name	B-Probe Button
IsEnabled	LMF.Tracker.BasicTypes.BoolValue.BoolValue
RaiseButtonPressed	RaiseButtonPressed
Count	2
TriggerHappened	TriggerHappened
paramTrigger	LMF.Tracker.Triggers.BProbeButtonTrigger
GUID	cca4a593-13f7-4f28-af1a-c10a874cede7
Name	B-Probe Button
IsEnabled	LMF.Tracker.BasicTypes.BoolValue.BoolValue
Label	Is enabled
Value	<input checked="" type="checkbox"/>
Changed	Changed
RaiseButtonPres	RaiseButtonPressed
Disconnect	Disconnect
Dispose	Dispose
GenerateLFile	GenerateLFile
GetDirection	GetDirection
GetDirectionAsync	GetDirectionAsync

The control panel on the right shows the 'Sensor pointing to' dropdown set to 'BProbe plus'. Below it, the 'Target Action' section includes a 'Probe Recognized' toggle (checked), a 'Stable Probing' button, and a 'B-Probe plus Button' button.

## Similarities from B-Probe <sup>plus</sup> to B-Probe

- B-Probe <sup>plus</sup> needs to be selected manually, there is no automatic recognition by the sensor. Consequently, there will be no unsolicited selected target changed event triggered by the sensor (as it can be the case on a T-Probe), the selected target only changes when the user selects it.
- Measurement structures delivered by a B-Probe <sup>plus</sup> are the same as the ones delivered by a B-Probe on an AT40x.



- The B-Probe <sup>plus</sup> does not allow continuous time or continuous distance measurements. Therefore, the same restrictions as for the B-Probe regarding the measurement modes also apply for the B-Probe plus.

The screenshot shows the AT500 Simulator interface. On the left is a configuration table for a 'Continuous Distance' profile. An arrow points to the 'DistanceSeparatic' field. An error dialog box is overlaid on the table, displaying the following text:

```
#200058 Exception
Error# 200058
Continuous Measurement not possible
Continuous Measurements are not
supported with a B-Probe
Select a Reflector to do Continuous
Measurements or change the
MeasurementProfile to Stationary to
measure with a B-Probe
```

On the right, the control panel shows the 'Sensor pointing to' dropdown set to 'BProbe plus'. Below it, the 'Target Action' section includes a 'B' button, which is highlighted by a red box. The 'B-Probe plus Button' is also visible in the control panel.

- There is no shank compensation available for a B-Probe <sup>plus</sup>. Shank measurements are still not supported by the B-Probe <sup>plus</sup>; same as for the B-Probe.

The newly introduced B-Probe plus can be found under





TrackerScope

### AT500Simulator

Targets	LMF.Tracker.Targets.TargetCollection
[0] ToolingBallReflector05	LMF.Tracker.Targets.Reflectors.ToolingBallReflector05
[1] FixedInstallationReflector05	LMF.Tracker.Targets.Reflectors.FixedInstallationReflector05
[2] RedRingReflector05	LMF.Tracker.Targets.Reflectors.RedRingReflector05
[3] BreakResistantReflector15	LMF.Tracker.Targets.Reflectors.BreakResistantReflector15
[4] RedRingReflector15	LMF.Tracker.Targets.Reflectors.RedRingReflector15
[5] MirrorReflector	LMF.Tracker.Targets.Reflectors.MirrorReflector
[6] RedRingReflector78	LMF.Tracker.Targets.Reflectors.RedRingReflector78
[7] CustomReflector	LMF.Tracker.Targets.Reflectors.CustomReflector
[8] CustomReflector	LMF.Tracker.Targets.Reflectors.CustomReflector
[9] BProbePlus	LMF.Tracker.Targets.Probes.PassiveProbes.BProbes.BProbePlus
Comment	
GUID	3439954f-bd9e-420d-8d2a-16f47e4c2637
IsSelectable	<input checked="" type="checkbox"/>
Name	#0112 (12.7 mm)
ProductName	B-Probe plus
SerialNumber	0112
TimeStamp	Wednesday, 23. October 2013 12:00:00.000
FaceCompensation	LMF.Tracker.Targets.Probes.PassiveProbes.BProbes.BProbeFaceCompensation
TipCompensation	LMF.Tracker.Targets.Probes.PassiveProbes.BProbes.BProbeTipCompensation
Deselect	Deselect
GetLockOnToken	GetLockOnToken
Select	Select
Count	10
PreSelected	LMF.Tracker.Targets.Reflectors.RedRingReflector15
Selected	LMF.Tracker.Targets.Reflectors.RedRingReflector15

AT500 Simulator 1.9.0.1848

AT500 71005555  
AT500Simulator

DRO Noise | DRO Stream Active | StayOnTop | 22480

DRO  
Inclination Sensor  
Meteo  
Power Source  
Simulator Timings  
Status  
Targets  
Persistency

Sensor pointing to

Target: BProbe plus

Target Action: Reflector, No Target, BProbe plus

Probe Recognized Stable Probing B-Probe Button



## General improvements

### Allocation of the bubble read out stream

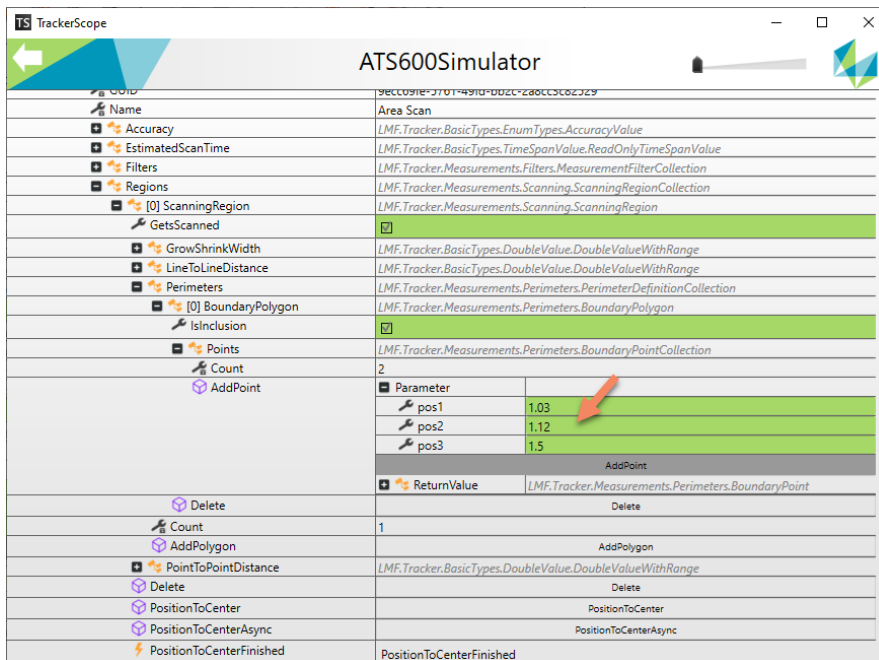
This feature introduced in LMF 1.9 for the AT500 is also available for the ATS600 and the AT9x0. For ATS600 and AT9x0 the user has now the option to perform an accurate levelling, either by using the screen on the controller or by using the bubble read-out stream provided by LMF.

### Improvements for the AT9x0 interface

LMF 1.9 contains a specific fix for the AT9x0 interface which solves a connection/disconnection issue caused by an internal race condition. In rare cases the initial connection to an AS1 does not start the RDS interface after a beam break since LMF has not been properly disconnect before. Hence, a re-connection could not be established. Latter issue is fixed in LMF 1.9.

### Improvements for the ATS600 interface

LMF 1.9 includes an improvement for the ATS600 interface: as part of the area scan the minimum distance for programmatically added boundary points is shortened from 1.5m to 1m. The option to enter corresponding perimeter directly in the OVC was possible prior to LMF 1.9, latter minimum distance is now also available for programmatically added points.



## Improvements for the AT40x interface

LMF 1.9 contains a bug fix for the AT40x interface, which allows the user to invoke StartMeasurement multiple times when the OutdoorProfile is selected. The fix sets the MeasurementInProgress flag to false after the measurement is finished.

Last updated  
2022-21-04 – Leica Geosystems AG