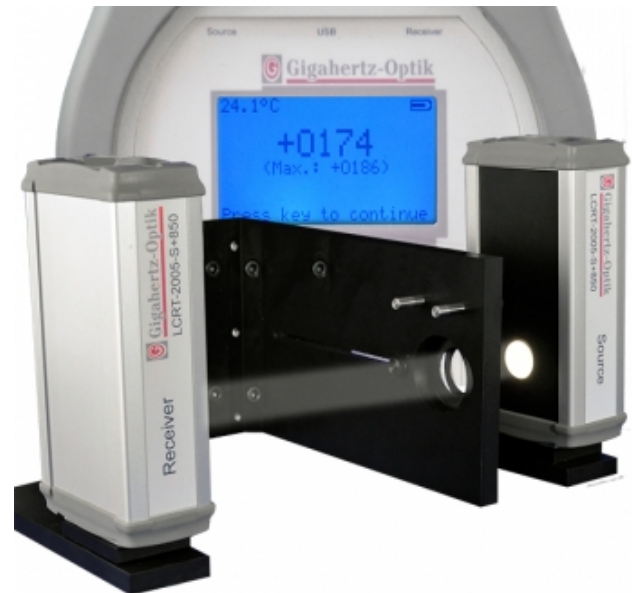


**LCTR-2005-S**  
**LCRT-2005-S+850**  
**LCRT-2005-SIS**

### Light and Spectral Transmission Meter

The LCRT-2005 is a portable spectrophotometer designed to measure light transmission and spectral transmission in the visible wavelength range. Its hand-held design and compact size allow measurement at the test sample. Profiling a test sample by multiple measurements across the sample is easily performed. For stable stationary measurements the LCRT-2005-SIS is available.



### Alignment Camera Supports Hand-held Use

The LCRT-2005-S internal camera aiming system enables simple and precise alignment of light source to receiver. This makes on site *in situ* single spot measurements or profiling a test sample by multiple measurements across the sample easy to perform.

### Spectral Reference and Measurement Detector

For high accuracy spectral transmission measurements two BTS256 diode array spectrometers are implemented in the LCRT-2005-S. One in the LCRT-2005-Source works as reference detector and one in the LCRT-2005-Receiver as radiance measurement detector. The transmission measurement is made by simultaneously comparing the spectral reference and measured signal making the result unaffected by any light source changes during the measurement. Back reflected light from the test sample into the LCRT-2005-Source is recognized and compensated for by the reference detector as well.

### Measurement in Ambient Light Conditions

The LCRT-2005-Source is pulse modulated during the measurement. By synchronizing the LCRT-2005-Receiver to the flash frequency ambient light is eliminated from the measurement.

### Measurement of Spectral Transmission

Spectral transmission measurements can be performed covering the whole integrated spectral range from 425 to 705nm or monochromatically with selectable wavelengths between 425 to 705nm and selectable bandwidths down to 1nm.

### Measurement of Light Transmission

Light transmission data is calculated using the spectral measurement data. Simulation of the CIE standard illuminant A or D65 illumination and photometric CIE  $V(\lambda)$  detection improves the measurement uncertainty.

### 70% and 80% Light Transmission Calibration Standards

For light transmission measurements applications where traceability of the measurements to national measurement and standards institutes is required calibration standard filters with 70% and 80% light transmission are available.

### Measurement of Total Transmission of Non-scattering and Thin Scattering Test Samples

The LCRT-2005-S measures the total transmission of non-scattering and thin test samples with some light scattering. Common applications are in process control, incoming inspection and R&D where the measurement of the efficiency of antireflection coatings, plastic film transmission, influence of interference effects on transparency, legal conformity of architectural, automotive, railroad or aircraft window transmission is required.

### Evaluation of the Diffuse Component of Total Transmission

The optionally available B2S-75-TRTH optical bench fixtures the LCRT-2005-S ensuring a stable platform required for the measurement of just the diffuse component of the total transmission. This is accomplished by measuring the total transmission and regular transmission by varying the distance between source and test sample. The diffuse transmission is calculated by the difference in total and regular transmission. A common application of this is the haze measurement of thin films in the display industry.

### Measurement of Regular Transmission

The optionally available PMS-RIT stand for the LCRT-2005-S is used for fixed regular transmission measurements. Common applications are transmission measurements of scattering and non-scattering test samples such as armored glass or ceramic glass.

## LCRT-2005-S and LCRT-2005-S+850 Portable Light Transmission and Spectral Transmission Meter

The **LCRT-2005-S** is a portable transmission measurement instrument. It is designed to duplicate the luminance measurement set-up in CIE 130 and DIN 5036. The instrument consists of three main units: light transmitter, light receiver and controller.

The **LCRT-2005-Source** is built around a compact integrating sphere and white LEDs providing a 20mm diameter uniform light output port for test sample illumination. The integrating sphere synthetic ODM98 coating, protective window over the output port and the semiconductor light sources ensure stable long-time operation even in rugged applications. The LEDs are operated in pulse mode enabling measurement under ambient light conditions. The BTS256 spectral reference detector makes the transmission measurement independent of any spectral drift in the LED sources as well as from substitution effects by back reflected light from the test samples.

The **LCRT-2005-Receiver** is designed as a spectral radiance detector with narrow viewing angle of  $0.4^\circ$  and a 6.6mm diameter measurement beam. Incoming light is depolarized to avoid polarization errors in the measurement. A compact digital camera mounted looking into the receiver measurement beam supports alignment of the receiver to the light source.

The **LCRT-2005-Controller** controls the measurement set-up, the measurement itself and display with simple four button operation. Initialization and operation is menu supported. The monochrome backlit graphic display features large digit size for easy reading, displays spectral graphical information and supports receiver to light source alignment. The device is powered by standard AA type batteries, rechargeable AA type batteries or USB interface. Measured data can be saved to a PC with the software supplied. Controller, light source, receiver, cables and software CD are supplied in a stable hard case for transportation and storage.

The **LCRT-2005-S+850** includes all the features of the LCRT-2005-S but has an added 850nm LED in the LCRT-2005-Source and 850nm sensitive detector in the LCRT-2005-Receiver for single wavelength NIR measurement. A main application for this device is the measurement of solar cell panel top glass to check the NIR wave transmission which can degrade by ion oxidation reducing solar cell efficiency.



*LCRT-2005-S Supplied in Hardcase*



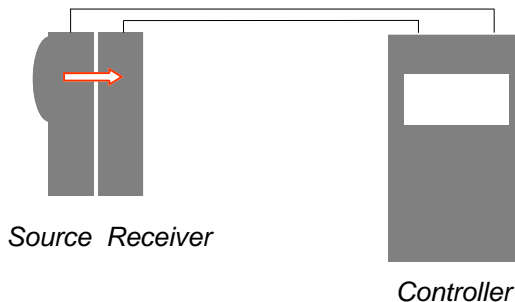
*Mobile Measurement of Windshield Transmittance*



*AR Coated Headlight Transmittance*

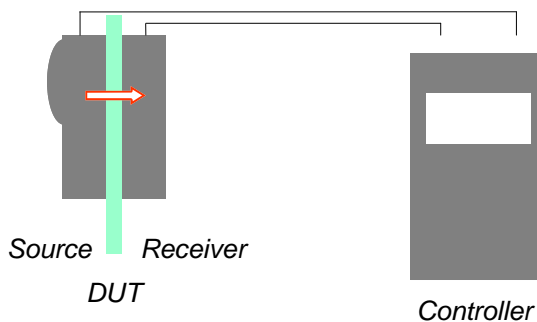
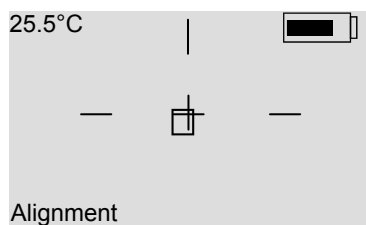
### Three Step Measurement Procedure

#### I. 100% Adjustment



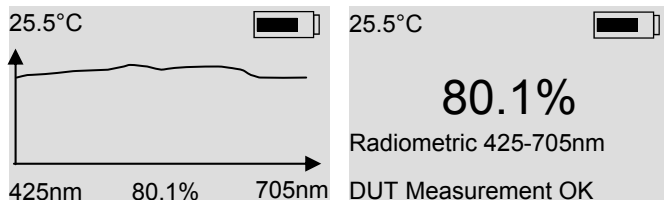
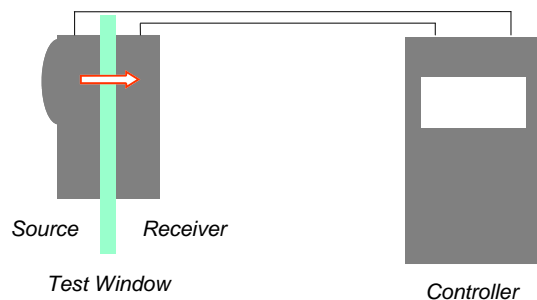
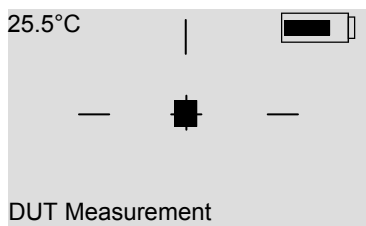
- A set 100% adjustment of the instrument is required before measurement
- For the 100% adjustment the alignment plate is placed between source and receiver and aligned
- 100% adjustment is initialized at the controller by pressing the 100% button

#### II. DUT Alignment



The DUT (device under test) is placed between the light source and receiver, aligned then measured

#### III. DUT Measurement



- After alignment measurement is started automatically or manually. Alignment position is monitored by the instrument.
- The spectral transmittance measured can be displayed numerically or graphically
- Several successive measurements can be performed using the set 100% as reference value

## Specifications

<b>LCRT-2005-S</b>	
Measurement Set-up	CIE 130 & DIN 5036 luminance ratio method with diffuse light source (Inverse ECE R43 set-up); BTS256 Diode array detectors for reference and measurement signal
Measurement Conditions	0.38° field of view; Incident angle on test sample 0°; 6.6 mm beam diameter at zero measurement distance. 12.6mm beam diameter at 1000mm measurement distance
Light Source	Integrating sphere with white LED light source; Diode array reference detector
Detector	Radiance sensor with diode array spectrometer and achromatic corrected optic; Simulation of Illuminant A, D65 sample illumination by spectral measurement data
Measurement Range	5 to 100 % transmission at color neutral attenuation
Transmittance Uncertainty	± 1 % absolute
Transmittance Resolution	0.1 %
Calibration	Transmission measurement without sample for 100% adjustment Transmission measurement with calibrated transmittance standard filter
Operation Temperature, Humidity	+ 10 to + 40 deg C (above dew-point); <85% at the instrument

<b>LCRT-2005-S Source</b>	
Light Source	LEDs in pulse mode; Useful emission spectrum from 425nm to 705nm; Pulse synchronization to receiver via controller Lambert source with ODM98 integrating sphere; 20 mm diameter light output port; Protective front window BTS256 reference detector; Shutter for On-line offset
Controller Connection	1.5m length flexible cable with connectors; RS232 protocol with 115.2 kbaud
Dimensions	160 x 45 (60) x 85 mm
Weight	450 g

<b>LCRT-2005-S Receiver</b>	
Detector	BTS256 detector with achromatic corrected front lens; Pulse synchronized to light source via controller
Measurement Aperture	0.38° field of view; Incident angle on test sample 0°; 6.6mm beam diameter at zero measurement distance. 12.60mm beam diameter at 1000mm distance
Controller Connection	1.5m length flexible cable with connectors; RS232 protocol with 115.2 kbaud
Dimensions	160 x 45 x 85 mm
Weight	400 g

<b>LCRT-2005-S Controller</b>	
Source and Receiver Input	Two sockets
Display	Back lit monochromatic display with on/off function
Parameter Settings	Menu controlled parameter set-up. Retention of last settings in continuous memory. Four function buttons.
Remote Interface	USB
Printer Interface	IR LED
Operating Temperature	10 to 40° C
Dimension	230 x 72 (115) x 35 (50) mm
Weight	400 g
Battery	4 x AA Type; Alternative 4 x re-chargeable AA Type Batteries; USB Power

## LCRT-2005-SIS Stationary Light Transmission and Spectral Transmission Meter

The **LCRT-2005-SIS** is a bench-top light transmittance meter designed for stationary measurement of light and spectral transmittance in the visible wavelength range.

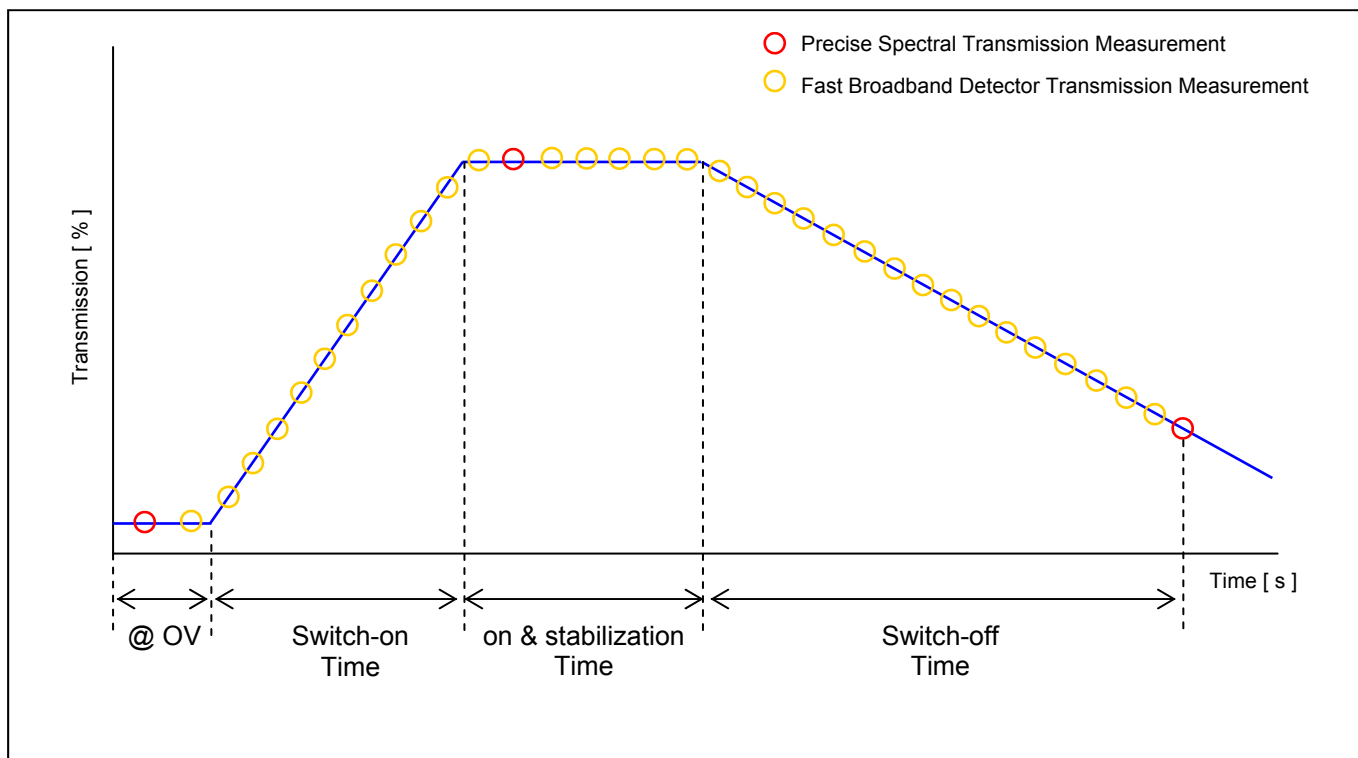
The differences between the **LCRT-2005-SIS** and the standard LCRT-2005-S are:

**LCRT-2005-SIS system controller** with powerful microprocessor and touch screen display operation in 19" rack-mount housing with USB, RS232 and LAN interface for system integration.

**LCRT-2005 Source and Receiver** are built with Bi-tech reference and monitor detector. The diode array spectrometers are used for precise spectral transmission measurements. The broadband photometric detector is used for fast sampling transmission measurements. The spectral measurement data is also used to



LCRT-2005-SIS



Data sampling measurement of the switch-on and off characteristic of light transmission controllable windows with precise spectral transmission measurement at reference points

improve the  $V(\lambda)$  responsivity of the photometric detector for on-line simulated best photometric spectral match and standard illuminant A and D65 illumination simulation.

## B2S-75-TRTH Rail-Bench for LCRT-2005-S for Diffuse Transmission Evaluation

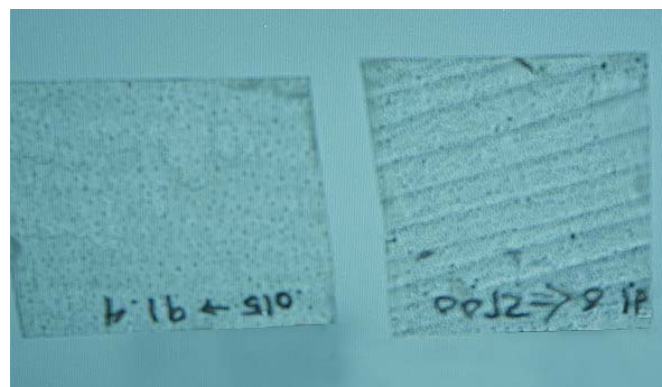
The **B2S-75-TRTH** rail bench is an optional accessory for the LCRT-2005-S and LCRT-2005-SIS used to extend the unit's range of transmission measurement applications. Adding the B2S-75-TRTH rail-bench to the LCRT-2005-S allows light transmittance of thin test samples such as thin films of displays under different test sample illumination conditions to be measured.

The **total transmission** is measured when the test sample is in contact position (short distance) to the light source. In this measurement position the test sample is diffusely illuminated.

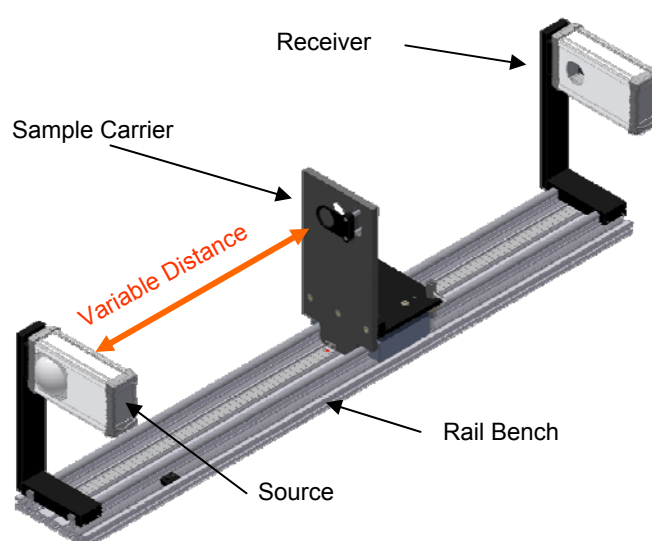
The **regular transmission** is measured when the test sample is at a longer distance to the light source. The longer the distance the more collimated the incident light on the test sample.

**Diffuse transmission** is calculated by the difference between the total transmission and regular transmission. In some cases the diffuse transmission is also specified as haze. Using the B2S-75-TRTH with the LCRT-2005-S can help evaluate the haze characteristics of thin film material under different illumination conditions.

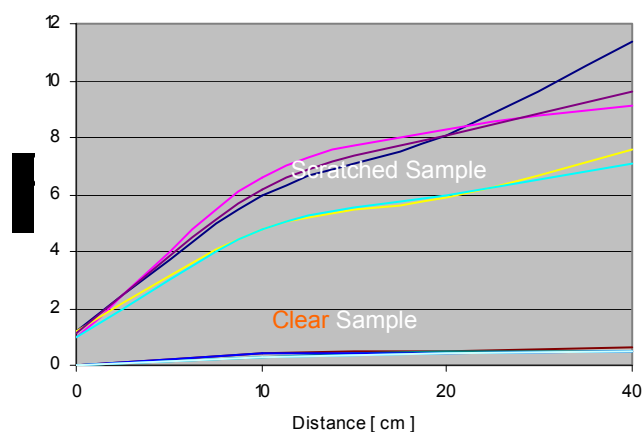
The B2S-75-TRTH is built by components from Gigahertz-Optik GmbH B2S-75 rail bench system. Please refer to *Light - Measurement - Components* on our website for more B2S-75 rail bench system information.



*Transparent Foil Test Samples*



*B2S-75-TRTH Measurement Set-up*



*Diffuse Transmittance (Haze) of Clear and Scratched Thin-film samples as a function of diffuse or collimated incident light (effected by distance)*

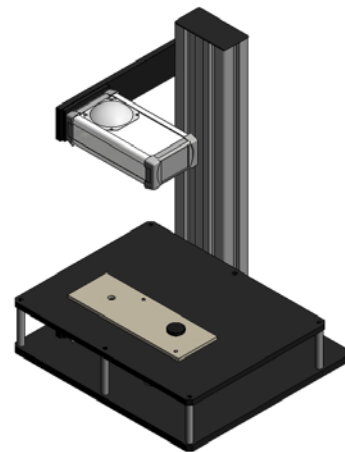
## LCRT-2005-S PMS-RIT Stand for Regular Transmission Measurements

The **PMS-RIT** stand is an optional accessory for the LCRT-2005-S and LCRT-2005-SIS. Mounting the LCRT-2005-S to the PMS-RIT stand enables reproducible and repeatable lab based transmission measurement of regular light transmittance of thin or thick, scattering or non-scattering test samples.

The **LCRT-2005-S** light transmittance meter with the PMS-RIT stand is designed to measure the regular or in-line light transmittance of transparent and scattering test samples at various thicknesses. For regular light transmittance measurement the test sample is illuminated with an almost parallel light beam. The quasi parallel light incident on the test sample is effected by the distance between the test sample and the LCRT-2005-S source. The PMS-RIT bench supports the perpendicular positioning of the test sample between the LCRT-2005-S source and receiver.



*PMS-RIT Stand*



*PMS-RIT Measurement Set-up*

Dimensions:





## LCRT-2005-S-BN-T Calibration Standards

The **LCRT-2005-S-BN-T** calibration standards enable the traceable calibration of the LCRT-2005-S and LCRT-2005-SIS at the transmission levels of 70% and 80%. Those transmissions are recommended by international standards for minimum windscreen transmission.

The LCRT-2005-S-BN-T70 and LCRT-2005-S-BN-T80 are calibrated at Gigahertz-Optik GmbH calibration laboratory in reference to transfer standards calibrated by the PTB Germany.



LCRT-2005-S-BN-T Calibration Standard

Purchasing Information

<b>Model</b>	<b>Item No.:</b>	<b>Description</b>
LCRT-2005-S	101426	Light Transmission Meter, Light Source, Receiver, Controller, Read-out Software, Hard Case, Manual
LCRT-2005-S+850	101426-2	Light Transmission Meter, Light Source, Receiver, Controller, Read-out Software, Hard Case, Manual
LCRT-2005-SIS	101426-3	Light Transmission Meter, Light Source, Receiver, Controller, Read-out Software, Hard Case, Manual
<b>Measurement Accessory:</b>		
B2S-75-TRTH	102635	1m long Bench with translation stage and sample holder for short and long distance measurements with LCRT-2005-S and LCRT-2005-SIS; Requires dark-room conditions
PMS-RIT	102590	Stand for regular and real in-line transmission measurements with LCRT-2005-S and LCRT-2005-SIS
<b>Calibration Accessory:</b>		
LCRT-2005-S-BN-T70	102549	70% calibration standard for Spectral and Light Transmission with calibration certificate
LCRT-2005-S-BN-T80	102550	80% calibration standard for Spectral and Light Transmission with calibration certificate
<b>Re-Calibration:</b>		
K-LCRT2005S-COC	301357	Certificate of Compliance of LCRT-2005-S with 70% and 6% transmission filters. Inspection and cleaning of source and receiver windows. Wavelength check of source and receiver with re-adjustment. Final operation check with 70% and 6% transmittance filters.
K-LCRT2005S-BNT70-SD		Re-calibration of the 70% calibration standard with calibration certificate
K-LCRT2005S-BNT80-SD		Re-calibration of the 80% calibration standard with calibration certificate

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