MITRAS Transmissometer

VAISALA

Reliable RVR with MITRAS Transmissometer

Accurate RVR measurement reduces airport down-time and improves safety and reliability of operations.
The MITRAS Transmissometer system provides You with correct visibility data without breaks.

Vaisala's MITRAS is a well-proven solution to Runway Visual Range assessment. The system has been in operational use since 1986 and has demonstrated excellent performance in international intercomparisons. MITRAS provides many operational and reliability benefits:

- Conformance to all ICAO and WMO requirements for RVR and Meteorological Optical Range (MOR)
- Fully automatic operation with excellent accuracy and stability
- Unique contamination detection and compensation
- Double baseline for CAT IIIB by means of two different beams from one transmitter
- Extensive built-in monitoring to verify performance and to generate warnings before failures actually occur
- Verified operation in all weather conditions

SYSTEM STRUCTURE

The standard MITRAS Transmissometer consists of a light transmitter and a light receiver installed at a suitable distance from each other. MITRAS measures transmission of white light over the baseline path and converts the measurement value to the corresponding MOR value. The transmittance measurement resolution of MITRAS is better than 0.1 % and the measurement accuracy is better than 1 %.

A single baseline MITRAS can be easily and economically upgraded to a double baseline system when extended measurement range is needed for CAT IIIB applications. The two baselines are realized by adding an individual lens system in the transmitter unit and a second receiver unit. Excellent accuracy is guaranteed because the two separate light beams from the single transmitter unit do not interfere with each other.

Vaisala's LM11 Background Luminance Meter can be connected to a MITRAS transmitter unit. The luminance sensor is interfaced to the MITRAS processor unit and it shares the same communication line with the transmissometer.

MITRAS communicates the measurement results to a host system via a modem line. RVR calculations are carried out by a dedicated RVR computer or an integrated airport weather observation system and the results are sent to various displays.

COST SAVINGS THROUGH EASY MAINTENANCE

Contamination of the optical windows with time is inevitable and it can have a significant impact on RVR accuracy. MITRAS measures the window contamination and automatically compensates for the loss in measured transmittance. When

The visibility measurement ranges achieved by single and double baseline MITRAS systems are shown below. The baseline of MITRAS can be freely selected between 10 ... 200 m.

Single baseline

Baseline	MOR range	RVR range*)
35 m	25 ... 1500 m	100 ... 1500 m
50 m	40 ... 2000 m	150 ... 2000 m
75 m	50 ... 3000 m	200 ... 3000 m
100 m	70 ... 5000 m	300 ... 5000 m
200 m	150 ... 10 000 m	500 ... 10 000 m

*) The actual RVR range is dependent on runway lighting. The values shown are based on usual lighting arrangements.

Double baseline

Baseline	MOR range	RVR range*)
10 and 75 m	7 ... 3000 m	40 ... 3000 m
10 and 200 m	7 ... 10 000 m	40 ... 10 000 m

(Double baseline is required in CAT IIIB operating category.)

One background luminance meter, mounted on top of the light transmitter, is sufficient per runway to measure the background luminance value needed in visibility calculation.

window contamination exceeds an acceptable level, a warning is sent out and the window can be cleaned. This unique function extends the cleaning intervals significantly, while the user is assured of consistently high data quality.

Each MITRAS unit continuously monitors several technical parameters and generates warning and alarm messages in cases of fault. The MITRAS status can be monitored remotely over the modem line. Automatic monitoring in the transmitter and receiver covers supply voltages, internal temperatures, optical performance including correct calibration/alignment and detected failures. This information can be interrogated by the service technician before leaving for the site. Warnings of lamp ageing and window contamination are generated as needed.

The xenon flash lamp's nominal lifetime is 8 years at one flash per second. MITRAS extends the lifetime by adjusting the flash rate depending on visibility. An interval of one second between flashes is used in low visibility. The flash interval increases stepwise to 10 seconds when visibility improves to a measured value above 10 km.

SUPERIOR ACCURACY

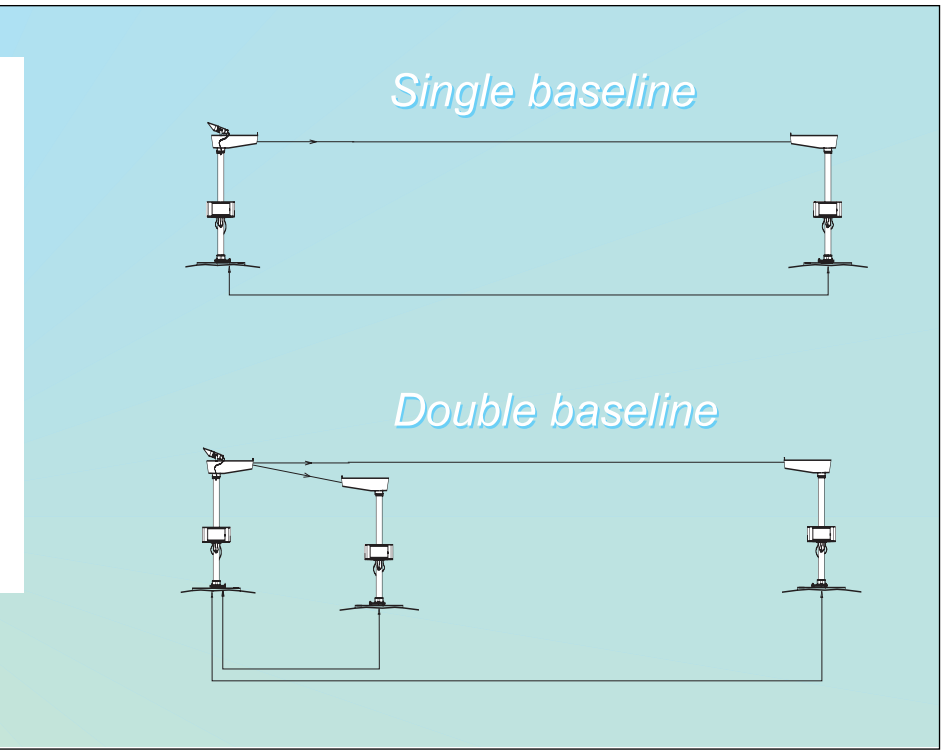
In the WMO intercomparison of visibility measurements, MITRAS achieved the best results concerning measurement accuracy.

MITRAS measures both the transmitted and the received light pulse amplitudes. Instead of relying on estimates of projected light power, every transmitted pulse is measured. Atmospheric transmittance is then calculated as the ratio of received and transmitted light power on a single pulse basis. Receiver electronics are gated to receive only light pulses from the transmitter, and will not accept any interference light during the interval.

The wide-bandwidth white light of the transmitter's xenon flash lamp and the photopically corrected receiver sensitivity provide an ideal match of the human eye's spectral range.

MITRAS beams are optimized. Interference from other light sources, such as the sun or the aircraft lights is minimized by accurate beam forming. Light distribution across the beam is even. Multiple forward scattering and dispersion in fog is minimized. Simplicity of optical design and good temperature stability are key factors of the system's exceptional stability.

Temperature of the optics is maintained constant and above the ambient to prevent condensed moisture on the optical surfaces. Control is proportional to avoid temperature cycling.



Technical Information

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GENERAL

Measuring range	0 ... 100 % transmittance
Resolution	0.02 % of transmittance
Accuracy (verified by calibrated optical filters)	1 % of FSR
Meets ICAO (Annex 3) recommendations in specific ranges.	
Time constant	60 s
Sample interval	1 s
Baseline allocations	10 ... 200 m altered by neutral density filters
Height with standard pedestal (others on request)	2500 mm
Calibration and checks	With optical filters & maintenance terminal command checks
Operating temperature	–40 ... +55 °C
Operating humidity	0 ... 10 % RH
Wind speed	Construction withstands up to 60 m/s
Power supply	115/130/230/240 VAC +10 % -15 % of nominal value 45.65 Hz, single phase
Weight	35 kg
Dimensions	
Optical head with hood	390(h) × 225(w) × 980(l) mm
Electron. box without rad. shield	310(h) × 400(w) × 190(l) mm
Colour	White
Housing	Aluminum, weatherproof
Mounting	On concrete foundation

LP11 LIGHT TRANSMITTER

Light source	Xenon flash bulb
Peak radiated power (adjustable by commands)	40 ... 160 kW
Lamp life	55 000 hours
Spectral output range	300 .... 1100 nm
Microprocessor	8031 with application program to control all functions, calculations, communications and built-in test facilities
Power consumption	250 W/300 W with LM11
MTBF (MIL-STD-217E)	> 13 700 hours
RVR computer interface	Modem CCITT V.21 Dedicated line to RVR computer Without modem: RS-232C interface
Maintenance terminal interface	RS-232C, 300 baud
Output message	Visibility, transmittance values, luminance data (if connected), status data in ASCII
Options	Double baseline optics (LPO11) LM11 Background Luminance Meter

LR11 LIGHT RECEIVER

Reception angle	9 mrad
Immunity to external light	75 000 W halogen lamp 30 m far (cont. light) has no influence
Spectral response range	300 ... 700 nm
Peak wavelength	550 nm
Microprocessor	8031 with application program to control all functions, calculations, communications and built-in test facilities
Power consumption	250 W
Maintenance terminal interface	RS-232C, 300 baud
MTBF (MIL-STD-217E)	22 100 hours

LM11 BACKGROUND LUMINANCE METER

Measuring range	4 ... 30 000 cd/m²
Accuracy	10 %
Spectral response range	300 ... 700 nm
Peak wavelength	550 nm
Field of view	5 degrees
MTBF (MIL-STD-217E)	183 000 hours
Connection	To any LP11 Light Transmitter
Mounting	On top of LP11 by a screw

VAISALA

Head Office:
VAISALA Oy
PL 26, FIN-00421 Helsinki
FINLAND
Phone (int.): (+358 0) 894 91
Telefax: (+358 0) 894 9227
Telex: 122832 vsala fi

VAISALA GmbH
Postfach 540267
D-22502 Hamburg
DEUTSCHLAND
Phone (nat.): (040) 858 027
Telefax: (040) 850 8444

VAISALA (UK) Ltd
Cambridge Science Park
Milton Road
Cambridge CB4 4GH
UNITED KINGDOM
Phone (nat.): (01223) 420 112
Telefax: (01223) 420 988

VAISALA TMI Ltd
Vaisala House
349 Bristol Road
Birmingham B5 7SW
UNITED KINGDOM
Phone (nat.): (0121) 683 1200
Telefax: (0121) 683 1299

VAISALA SA
3, Parc Ariane
Saint-Quentin-En-Yvelines
F-78284 Guyancourt Cedex
FRANCE
Phone (nat.): (1) 3057 2728
Telefax: (1) 3096 0858

VAISALA Inc.
100 Commerce Way
Woburn, MA 01801 - 1068
USA
Phone (nat.): (617) 933 4500
Telefax: (617) 933 8029

VAISALA KK
42 Kagurazaka 6-Chome
Shinjuku-Ku,
Tokyo 162
JAPAN
Phone (nat.): (03) 3266 9611
Telefax: (03) 3266 9610

VAISALA Pty. Ltd.
A.C.N. 006 500 616
80 Dodds Street
South Melbourne, VIC 3205
AUSTRALIA
Phone (nat.): (3) 9696 5699
Telefax: (3) 9696 5776

VAISALA Beijing Representative Office
Room 518, 520
Wangfujing Grand Hotel
No. 57 Wangfujing Street
Beijing 100006
PEOPLE'S REPUBLIC OF CHINA
Phone (nat.): (10) 522 4050
Telefax: (10) 522 4051

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