NETZSCH
TAURUS INSTRUMENTS

Flooring Radiant Panel Tester – TBB 913

Reaction to Fire Tests for Floorings in Accordance with EN ISO 9239-1 (Propane Burner) and EN 13501-1 Based on ASTM E648 (Methane Burner)

Analyzing & Testing

Flooring Radiant Panel Tester – TBB 913

FIRE CLASSIFICATION OF FLOORING PRODUCTS – DETERMINATION OF THE BURNING BEHAVIOR USING A RADIANT HEAT SOURCE

In Accordance with EN ISO 9239-1 and EN 13501-1 and Based on ASTM E648

Measurement Results

- Flame propagation distance over time
- Smoke gas density as a function of time
- Critical heat radiation

The flooring radiant panel testing method is used in the United States of America (ASTM E648, ASTM E970, NFPA 253) and in Europe (ISO/EN 9239). The European Union has made this type of fire test one of the requirements for the approval of floor coverings.

The surface radiation test method in accordance with EN ISO 9239-1 rates the burning behavior (flame propagation and smoke development) of horizontally installed floor coverings that are first exposed to a source of thermal radiation and then ignited with a pilot flame.

Commercial and contract application flooring products are tested according to these methods; certain criteria need to be met in order to obtain class B_{fl}, C_{fl} or D_{fl} classification. For residential products, Class E_{fl} is generally sufficient.

Floor coverings are considered flame retardant if they meet the requirements associated with the radiation test for fire classes B_{fl} and C_{fl}.

TBB 913

The TBB test device simulates the probable degree of stress that is exerted on a floor in a corridor using the thermal radiation imposed on the sample by the radiator. Flames and/or hot gases are assumed to be present in the early phase of fire development in an adjacent room or section.

TBB 913 Measurement Method

The floor covering to be tested is placed in a horizontal position under a gas-heated radiator that is inclined at 30° to the horizontal. In this position, the sample is exposed to a defined heat flow. The inclined radiant panel generates a defined heat radiation profile on the specimen ranging from a nominal maximum of 10.9 kW/m² to a minimum of 1.1 kW/m². The thermal load of the flooring in a corridor in the event of a fire is simulated.

Test Chamber

The specimens are mounted in a test chamber made of stainless steel. The lining is built of calcium silicate panels. Specimen feeding takes place from the front. The mounting plate for the specimen holder can be pulled out for this purpose. The flue gas density is determined by the light measuring section, which is integrated in the hood. At the front there is a generous flap, which is equipped with refractory glass to observe the test process.

Temperature of the Test Chamber and Flame Area

In accordance with EN 60584-1, temperature measurement occurs at the upper end plate by using a type K mantle thermocouple which is identical to that of the fume cupboard. The ambient temperature is determined with a thermocouple in the measuring and control cabinet.

Directly in the flame area, the mantle thermocouples also detect the flame temperature of the pilot burner and emitter. When a flame goes out, a signal is sent to stop the gas supply.

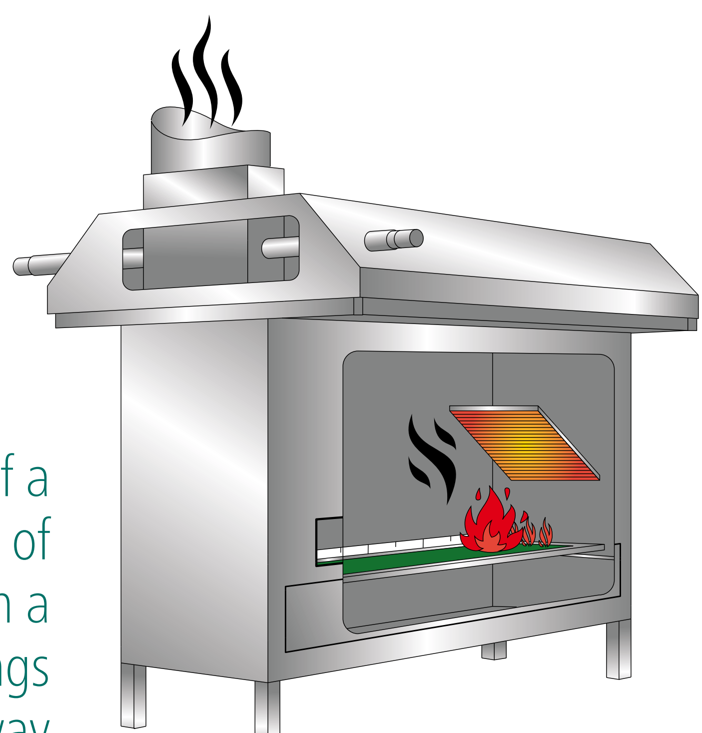
Radiant Panel

The heat radiation source (surface area 0.135 m²) is a radiator made of porous refractory material which is fixed in a steel frame. The heater is temperature-resistant up to 900°C and is supplied by the measuring cabinet with an adjustable propane/air mixture. The mass flow controllers ensure smooth and repeatable operation.

Ignition

The ignition of the line gas burner takes place by means of a high-voltage ignition spark controlled by buttons on the touch panel on the measuring and control cabinet. A separate thermocouple monitors the burning status. As soon as the temperature drops below the specified set point, the gas supply is interrupted.

Thermal exposure is that of a fire spreading in the room of origin and radiating through a doorway to the floor coverings in an adjacent room or hallway



Schematic diagram of the TBB 913

Trendsetting Technology
Conform to Standard

Pilot Burner

The small stainless steel burner inflames the specimen. The flames emerge from a total of 35 holes and ignite the specimen zero line in the ignition position during the test. After ignition of the specimen's hot end (3 mm above the edge of the sample holder), each flame front that forms is identified and documented as a function of time and length. The critical heat flux density in [kW/m^2] is the heat flux acting on the part of the sample surface, from which the flames do not spread further and may subsequently extinguish and can be determined at the flame front position by using the calibration function.

In accordance with the EN ISO 9239-1 standard, the TBB 913 burner operates with propane gas. Optionally, following the ASTM E648 standard, a methane burner is available.

Base Unit

The test chamber includes the gas-fueled radiant panel made of steel/silicate as well as the specimen holder and is connected to an exhaust pipe made of stainless steel. The sample holder consists of a stainless steel welded L-profile design with four fixing clips for easy sample installation. These clips also ensure quick specimen changeout for successive tests.

Burning Section

During the test, the combustion distances are measured as a function of time, as the distance between the flame front and the sample zero line by a potentiometric position measuring system (uncertainty <1%). It is positioned via a hand wheel on the operating front of the TBB 913. The set lengths are transferred to the software and displayed.

Temperature Measurement and Smoke Density

The temperatures in the test chamber and exhaust channel are measured by two NiCrNi thermocouples. The white light measuring section consists of the measuring light source, measuring light receiver (NETZSCH TAURUS EtherCat module), adapter and connection for compressed air flushing.

Gas Controllers

Precise and safe operation is ensured by a mass flow controller (MFC) for propane and air.
The MFC is controlled by the Beckhoff EtherCat module.

Pressure and Air Speed Sensor

A bidirectional probe measures the differential pressure. A portable anemometer (TA430) measures, checks and adjusts the air speed in the smoke chamber. The sensor is inserted through a side opening in the hood and the measuring tip is pulled out to the middle of the hood.

The bidirectional pressure probe is attached to the upper edge of the exhaust channel. This probe detects the differential pressure which is transferred to the differential pressure converter in the measuring and control cabinet via the connected hose lines. It is converted into an electrical signal and displayed as the speed of the gas.

Heat Flux Meter and Heat Flux Density

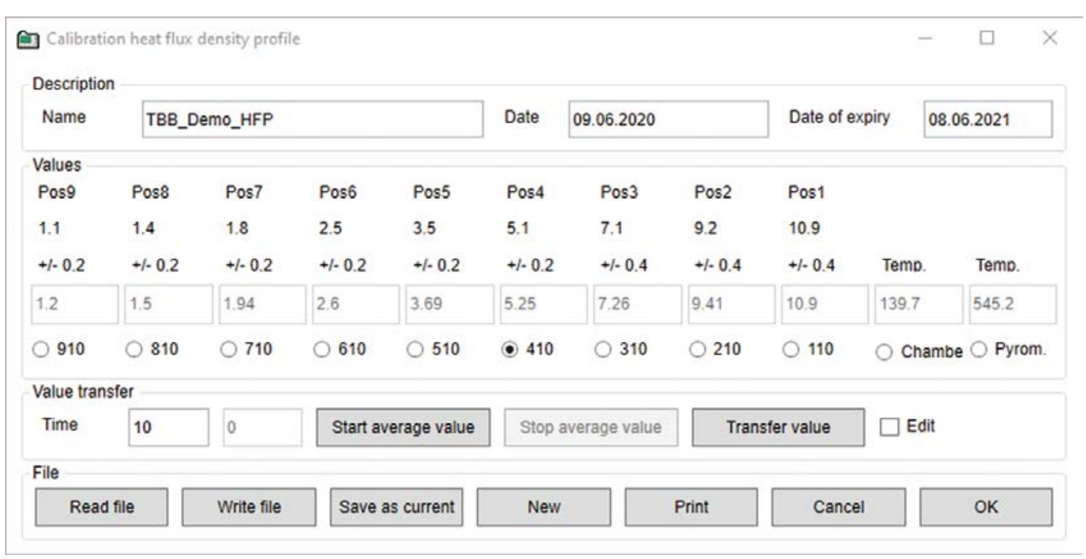
Calibration by Heat Flux Meter

In order to adhere to the corresponding norm, a heat flux profile must be recorded along the centerline of a calibration sample, more precisely a calcium silicate plate. To this end, a heat flux density detector of the Schmidt-Boelter type is used to detect the heat flux density at nine defined positions (holes in the calibration specimen made of calcium silicate) at intervals of 100 mm.

After a minimal heating of the chamber of one hour by means of the radiator until the temperature is stabilized, the Schmidt-Boelter sensor is inserted into these holes one after the other and fixed with a locking screw.

The heat flow is then measured and transferred to the TBB software. The software dialog displays all relevant data and controls the data transfer for each hole position. Calibration data can be saved, printed and exported.

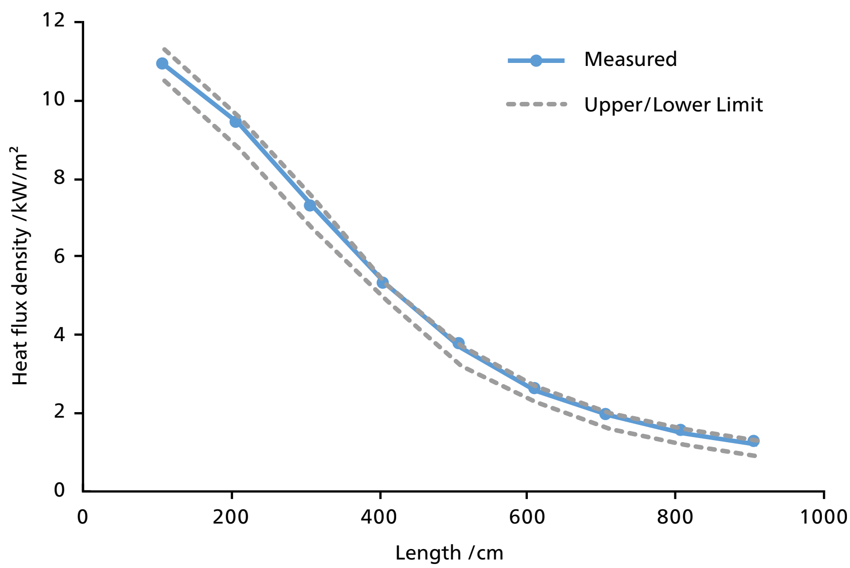
The TBB can be reliably calibrated by the user and is therefore always ready for use, even under high-volume testing.



Screenshot of the TBB software: Determination of the heat flux density profile with automatically transferred and displayed measurement values

Determination of the Heat Flux Density

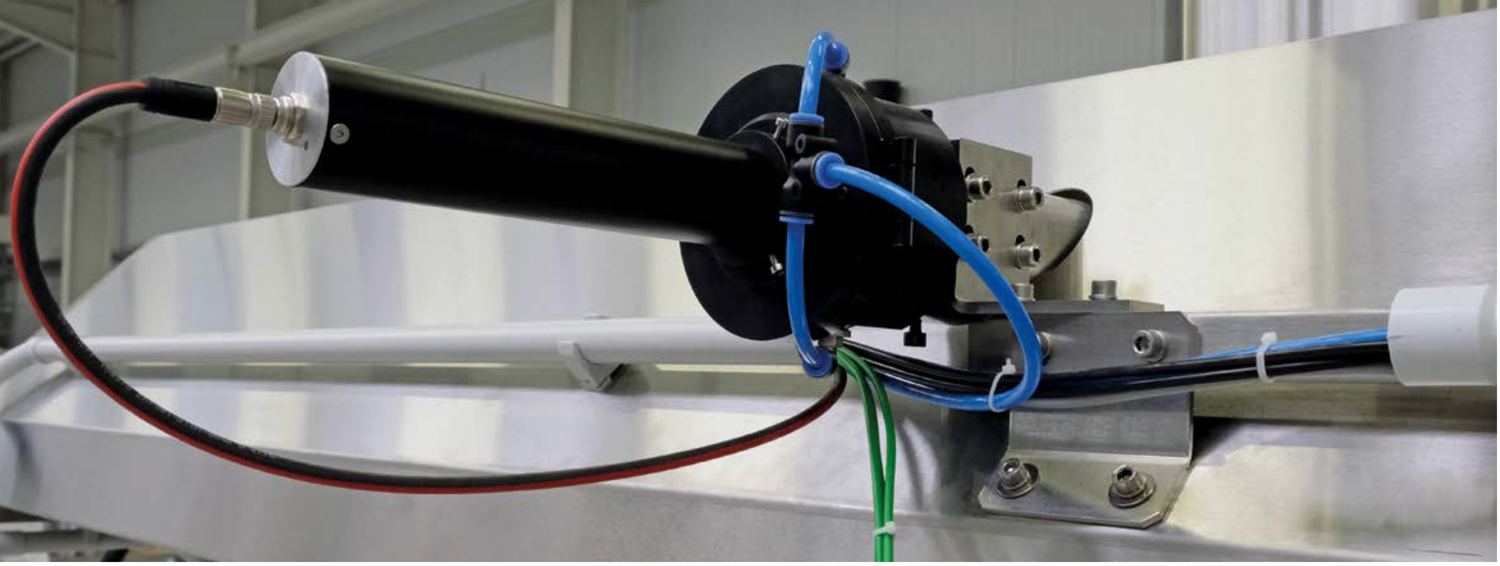
The TBB 913 includes a water-cooled heat flux density sensor of the Schmidt-Boelter type, which ISO standards officially call a heat flux meter. The well-proven heat flux measurement concept is generally referred to as the axial temperature gradient method. Its main purpose is the study of reaction to fire and fire resistance as applied, for example, in flammability tests and smoke chamber tests. For determination of the heat flux density within the sample area, the integrated heat flux meter measures the heat flux in the range between 0 and 20 kW/m².



Measured profile of heat flux density within the sample area (Schmidt-Boelter)

TBB 913 – Your Benefits at a Glance

- Innovative control and data acquisition
- Easy operation and user guidance via intuitive icons
- Emission-resistant, robust furnace for long lifespan
- Measurement of the smoke production in accordance with DIN 50055
- Integrated single board computer with high-resolution color touch screen
- TBB software in Windows 10
- Display of the instrument condition
- Prevention of critical operating errors
- Control unit for storing, recording and analyzing of all test data
- Reduced cleaning and maintenance efforts
- Various options and accessories for calibration and extension of exhaust system
- Potentiometric position measuring system for flame front and automatic data acquisition

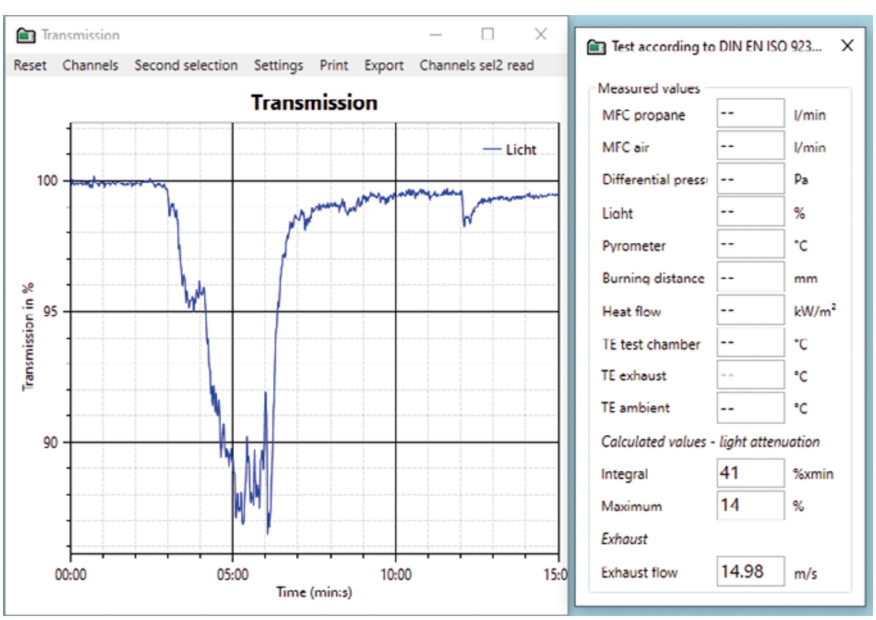


Testing the Smoke Density

Light Measuring for the Determination of the Smoke Density

The light measuring system consists of a light emitter and receiver which records the light signal attenuation as a measure of smoke density over time.

At the start of a test, the initial value of the receiver is set at 100% via the touch panel. If flue gas is generated during the test, the intensity of the detected light signal decreases as a function of the optical density. The TBB software displays the measurement curve. Light transmitter and receiver are covered by additional windows, which are protected by a defined air flow on both sides to prevent condensation effects. This ensures high accuracy and serves to prevent measurement errors.



Transmission measurement by the light measuring system

Light Measuring Features

- Robust light transmitter and receiver; integrated electronics for trouble-free transmission of the measuring signal
- Intuitive icons for menu functions
- DG light emitter with 10-W halogen point light source; heat protection for optics
- LRDE light receiver with silicon photo receiver and heat-protected optics; spectral filter and integrated measuring light amplifier
- Protection windows with air flow to minimize the risk of condensation
- Mounting flange with connection for air purge and measurement bracket for flexible pipe installation (optional)
- Filter set with 6 optical filters and positioning cross for system check

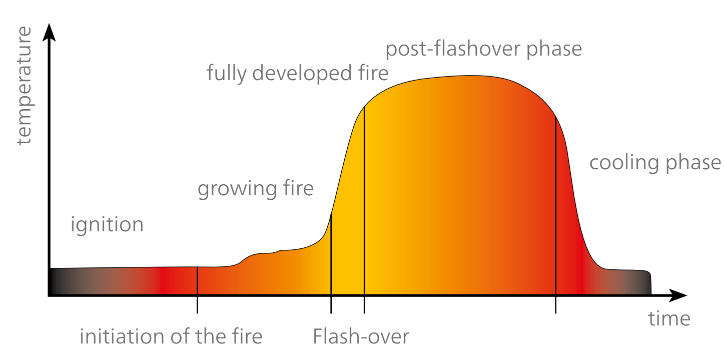
Euro Fire Classification For Floorings

FIRE CLASSIFICATION OF CONSTRUCTION PRODUCTS AND BUILDING ELEMENTS

This European standard for the fire classification of construction products according to their reaction to fire tests defines the classes for the flammability of floor coverings which are now applicable throughout Europe. Further, the CE Mark for floor coverings specifies the testing or classification of flammability in accordance with EN 13501-1.

Class	Remarks
$A1_{fl}$	Only achieved by non-flammable floor coverings which do not present any risk in terms of smoke formation
$A2_{fl}$	Only achieved by non-flammable floor coverings with low levels of organic binding agents
B_{fl}	Radiation intensity of 8 kW/m^2 = flame-retardant construction products
C_{fl}	Comparable with German B1 classification Radiation intensity of 4.5 kW/m^2 = flame-retardant construction products
D_{fl}	Radiation intensity here only 3 kW/m^2 = normally flammable construction products
E_{fl}	Small burner test = normally flammable construction products
F_{fl}	No requirements made No test = easily flammable construction products

fl - flooring; source: wc_eu-firetesting_en



Fire model according to Troitzsch, J, Intern. Plastics Flammability Handbook, Carl Hanser Verlag, München, Wien, New York 1990.

TBB 913 Software and Displays

The TBB software (Windows® 10) allows for the recording of all relevant measurement values. Measurement processes can be tracked and results can be displayed, saved, exported and logged in various formats.

Graphical and Numerical Display of all Test Results

- Freely configurable display of results as chart, diagram, text or bar
- 16 freely configurable windows depending on display format
- Test results can be displayed on separate screens

User Guidance for Test Procedure

- Graphic flow chart
- User instructions via dialogs
- Dialog for input of all parameters required by standard
- Burner activation with defined mass flows
- Automatic activation of valves and burner
- Recording of burning distance and time in a special dialog box
- Calculation and display of test results (according to standard)
- Save test data in EXCEL-compatible format
- Print test results and PDF export

Individual Configuration of Measurement Points

- Allocation of name, measurement range, and correction value for each channel
- Allocation and analysis of thresholds for each channel
- Display of all calculated values according to standard

Calibration of Heat Flow Profile

- Display of all relevant data and control of the data transfer
- Setting the heat flux meter for each position; starting the data transfer
- Saving, printing and exporting calibration data

Test Report

- Input mask for all test-relevant data according to standard
- Test report printout according to DIN EN 9239-1 with graphical and numerical display options
- Display of current calibration data as part of the test report
- Copying of report data (texts/ graphics) to clipboard for further use in user-specific documents
- Export of test report to text file

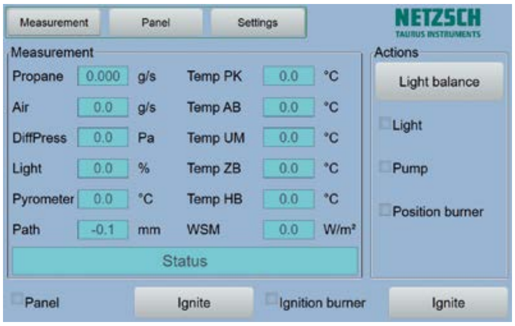
Additional Features

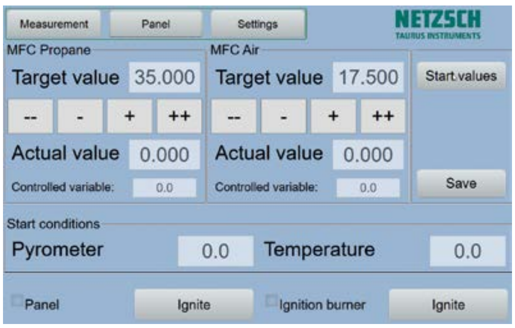
- Monitoring of measuring device with display of relevant messages, and shutdown when individual values exceed critical thresholds
- Storage of all test data in raw for-mat (binary) with interface to EXCEL and CSV format

Control TBB HMI

- Control of hardware via embedded PC and Beckhoff I/O control
- 10.1″ high-resolution touch screen for display and operation
- Control of all hardware components such as valves, light measurement system and mass flow controller
- Data logging for all relevant sensors
- Monitoring of the test with visual and acoustic signals

Integrated Touch Panel for Convenient Operation





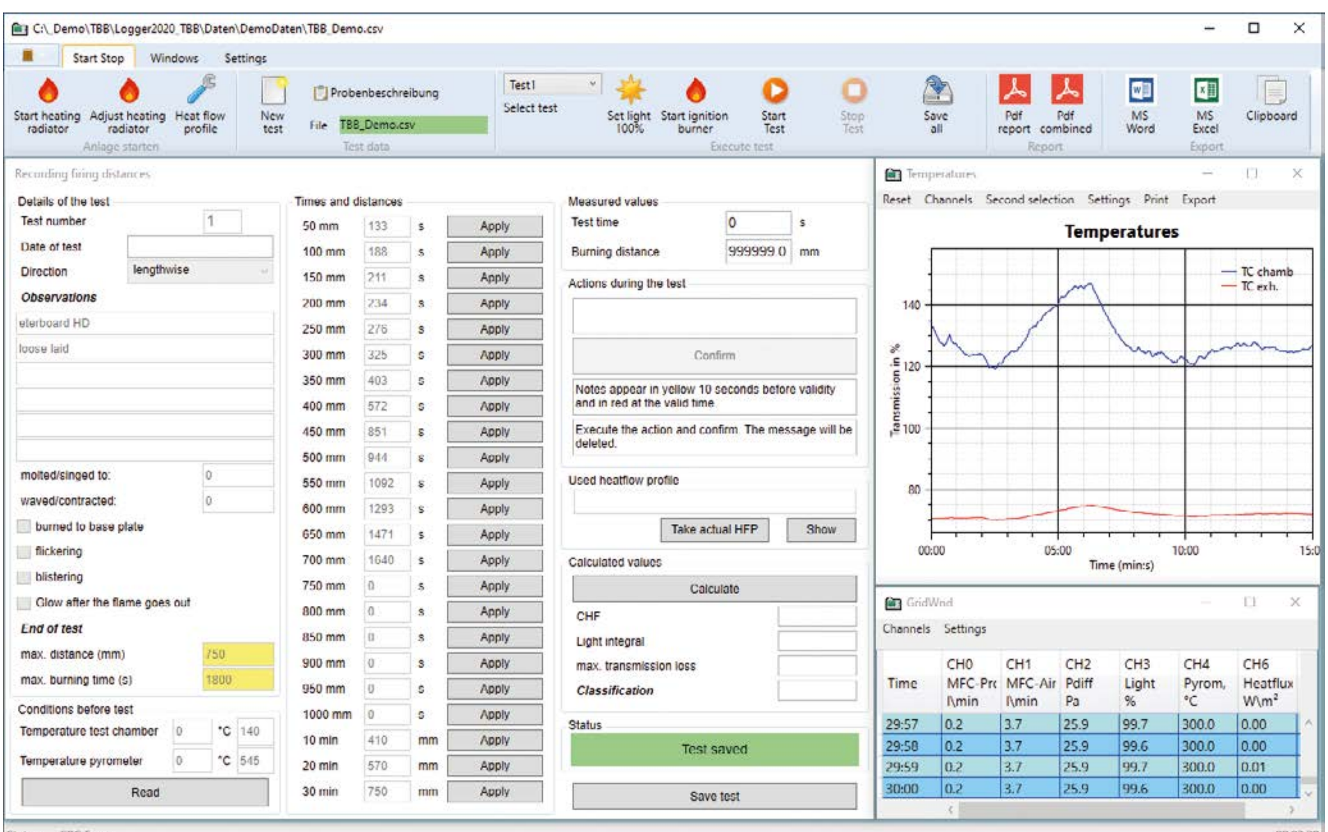
Display for measured and current test values

Propane:	Flow rate of propane gas for radiators
Air:	Flow rate of compressed air for radiators
Diff press:	Differential pressure of the bidirectional probe
Light:	Transmission of the light measuring section
Pyrometer:	Temperature radiation pyrometer
Path:	Position of the path focal distance sensor
Temperatures:	PK – test chamber, AB – deduction, UM – environment, ZB – pilot burner, HB – heater WSM (Schmidt-Boelter type)

Display heating panel: Setting the mass flow controllers for the propane and air mixture

Set points can be increased and decreased using the "+" and "-" buttons and saved as default. The current value of the permanently installed radiation pyrometer is displayed under Pyrometer start conditions; it measures the black body temperature. The current temperature of the test chamber is also displayed.

UNCOMPLICATED USER GUIDANCE THROUGHOUT THE MEASUREMENT BY SMART SOFTWARE



The NETZSCH Group is an owner-managed, international technology company with headquarters in Germany. The Business Units Analyzing & Testing, Grinding & Dispersing and Pumps & Systems represent customized solutions at the highest level. More than 3,800 employees in 36 countries and a worldwide sales and service network ensure customer proximity and competent service.

Our performance standards are high. We promise our customers Proven Excellence – exceptional performance in everything we do, proven time and again since 1873.

When it comes to Thermal Analysis, Calorimetry (adiabatic & reaction), the determination of Thermophysical Properties, Rheology and Fire Testing, NETZSCH has it covered. Our 50 years of applications experience, broad state-of-the-art product line and comprehensive service offerings ensure that our solutions will not only meet your every requirement but also exceed your every expectation.

Proven Excellence.

NETZSCH® TAURUS® Instruments GmbH
Döbereinerstraße 21
99427 Weimar
Germany
Tel.: +49 3643 4174 0
Fax: +49 3643 4174 99
at@netzsch.com

NETZSCH®

www.netzsch.com

NGB · TBB 913 · EN · 0321 · NWS · Technical specifications are subject to change.