

HOMER Analyzer ISM 900 MHz, R-9 Waveguide

Basic Description

The HOMER-Series STHD 900-MHz Analyzer is an automatic impedance and power measurement system based on R-9 (WR-975) waveguide. The system works under the full-power operating conditions of magnetron-based microwave generators and measures both magnitude and phase of reflection coefficient as well as incident, reflected and absorbed powers and frequency. The system is designed for CW, high-ripple (Rectified) and Pulsed sampling modes. STHD can be:

- controlled or monitored from a personal computer or another controller via RS232 or CAN Bus interface;
- integrated into a LabVIEW environment;
- integrated in a DeviceNet network.

The system comes with its own software (Server) and documentation.

Optionally HOMER can include a stepper motor driver card for 3-stub tuner control.



Principle of Operation

The HOMER Analyzer is based on the six-port reflectometer (SPR) principle. The microwave hardware of a SPR creates four different combinations of the waves incident on and reflected from the load. Powers of these combined waves are sensed by four amplitude detectors. Using the detector outputs and signal frequency, SPR can compute the complex reflection coefficient of the load as well as the incident, reflected and absorbed powers. This conceptual simplicity of SPR facilitates its stable and temperature-independent operation over

long periods of time. The system parameters required for the computations are obtained in the process of factory-made calibration where a collection of impedance standards is used in place of load. It is recommended for the best performance that the recalibration be performed once a year. Reflectometers of this type are especially suitable for industrial applications where on-line monitoring and control under full working power is required.

Modes of Sampling

STHD supports three modes of signal sampling, named *CW*, *Rectified*, and *Pulsed*.

CW mode is applicable to unmodulated microwave signals with output power ripple not exceeding 15% of the peak value.

Rectified mode is designed for slowly pulsing microwave signals (up to 400 Hz repetition rate). Such signals are typical for magnetrons powered by low-cost power

supplies which incorporate simple half-wave or full-wave rectifiers.

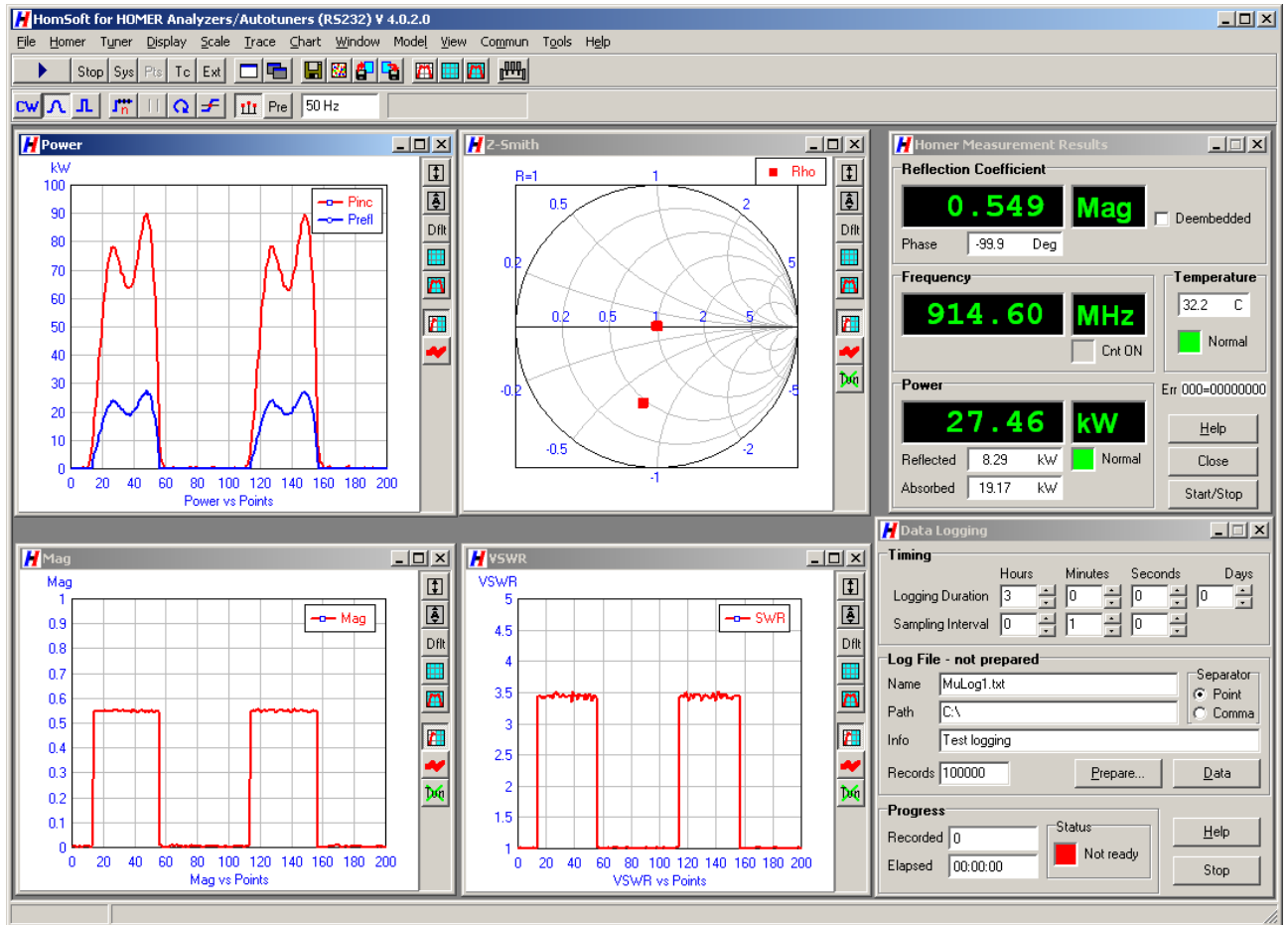
Pulsed mode option is intended primarily for sampling fast pulse-modulated microwave signals with pulse widths down to 100 μ s.

Rectified and Pulsed modes can provide both instantaneous and average values of reflection coefficient and power.

HomSoft Windows Control, Visualization and Data Logging Software

The *HomSoft* control, visualization and data logging software significantly expands the system capabilities. The basic features include:

- Microsoft Windows® environment
- Accurate measurement of complex reflection coefficient and its displaying in various formats, including
 - Magnitude
 - Phase
 - Return Loss
 - VSWR
 - Polar Display
 - Smith Charts (Z and Y)
 - Rieke-Type Chart
- Measurement of incident, reflected, and absorbed power and its displaying in various formats, including watts, decibels, percentage of incident power
- Numerical readout of signal frequency, load reflection coefficient and power in various formats
- Arbitrary shifting of the measurement plane
- Saving measured data as tables (text files) or pictures (BMP, GIF, JPG)
- Periodic data logging of all or some of the measured quantities
- Multiple windows enabling simultaneous observation of various quantities in different formats
- Wide selection of appearances of displayed curves
- Storing and retrieving of complete system settings tailored to particular tasks
- DDE server option enables another Windows application to share measurement results
- Extensive on-line help



Specifications

Electrical	
Waveguide type	R-9 (WR-975)
Flange type	IEC
Frequency range ¹	880 ÷ 930 MHz
Maximum working power ^{2 3}	100 kW
Minimum working power	10 W
Dynamic range of working power	20 dB
Reflection coefficient measurement error (uncertainty circle radius)	0.05
Incident power measurement error (matched load)	±5 %
Power supply voltage	24 V ±10% DC
Current consumption	2 A
Interface	RS232 or RS422, CAN, DeviceNet
Modes of sampling	CW, Rectified, Pulsed
Max ripple in CW mode	15 % of peak value
Max repetition rate of signal envelope in Rectified mode ⁴	400 Hz
Min pulse width in Pulsed mode	100 µs
Mechanical	
Mass	8.1 kg
Length	300 mm (11.81 in)
Width	336.6 mm (13.25 in)
Height	295 mm (11.61 in)
Surface finish	E-CLPS 4600
Environmental	
Operating temperature range	+5 to +55 °C
Storage temperature range	-10 to +125 °C
Other	
Cooling water flow rate (minimum)	5 liters/minute
Cooling water temperature	+15 to +25 °C
Water inlet/outlet connector ⁵	SMC KPH12-03
Water hose	SMC TU 1208 Polyurethane

¹ The system can be calibrated in the three ISM sub-bands, centered at 896 MHz, 915 MHz, and 922 MHz.

² Actual maximum working power is fixed according to customer's demand (must not exceed 100 kW). The actual minimum working power is 20 dB (=dynamic range) below the actual maximum operating power or 10 W, whichever is greater. Maximum working power is specified for **matched load** conditions. For loads with high reflection coefficient magnitude (>0.9), the maximum power is derated to avoid arcing with deeply inserted tuning stubs. Please contact the manufacturer for details.

³ In Rectified and Pulsed modes, maximum power means **peak** power (not its mean value).

⁴ Signal envelope repetition rate (ripple period) f_e is determined by power line frequency f_p and the rectification method. Examples: Half-wave-rectified signal $f_e=f_p$; full-wave-rectified signal $f_e=2f_p$; 3-phase ripple period $f_e=3f_p$ (half-wave rectification), $f_e=6f_p$ (full-wave rectification).

⁵ See e.g. www.smc.eu

Configurations

Basic Configuration

- STHD + Internal firmware (Server)
- Calibration in 896, 915 or 922 MHz band
- RS232 or RS422 serial interface
- CW and Rectified modes of operation
- Operating handbook (pdf)
- Communication protocol manual (pdf)
- Set of standard cables⁶

Options

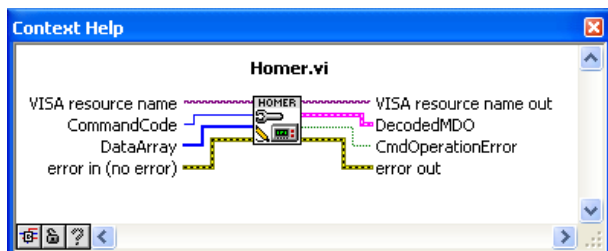
1. **HomSoft** Windows visualization and control software
2. Pulsed mode of operation
3. Additional Server – CAN Bus
4. Additional Server – DeviceNet
5. Dynamic Data Exchange (DDE) server in HomSoft Windows SW⁷
6. LabVIEW Homer.vi virtual instrument
7. CAN-USB Adapter (to connect PC to CAN Bus or DeviceNet network)
8. Additional frequency band calibration
9. Steper motor driver card for 3-stub tuner control
10. Technical support in hours (four hours are complimentary)

Miscellaneous

DeviceNet. Elements of complex industrial applications (sensors, actuators, controllers) are often interconnected via CAN Bus network where special protocols for smooth collaboration are used. One of the common communication protocols is DeviceNet. HOMER can be equipped with internal program (Server) which enables connection to DeviceNet.

DDE Server. DDE Server is a functionality within the *HomSoft* Windows SW hence it needs the *HomSoft Windows visualization and control software* option, too. The DDE Server enables another (customer's) Windows program to extract measurement results from *HomSoft* program, e.g. to a LabVIEW environment.

LabVIEW Homer.vi Virtual Instrument. *Homer.vi* is a LabVIEW virtual subinstrument (plug-and-play instrument driver) enabling full HOMER control and monitoring (measurement results retrieval) from within the National Instruments' LabVIEW environment. *Homer.vi* can be incorporated into users' LabVIEW projects. *Homer.vi* is accompanied with usage examples.



CAN-USB Adapter. To connect your PC with a CAN Bus network (or with the STHD alone), the *Sontheim CAN USB Light Dongle* adapter is needed. You can order it as an option. Another possibility is to buy the dongle yourself from the manufacturer (see <http://www.s-i-e.de>).

Steper motor driver card. The card serves for 3-stub motorized tuner control connected between STHD and load. Tuner details must be known and programmed to STHD by S-TEAM.

⁶ Set of standard cables includes DC power supply cable, RS232/RS422 cable, and, in case of CAN Bus, CAN Bus cable.

⁷ *HomSoft* Windows visualization and control SW option required.

Technical support. Very often users, especially in the initial phase, need counsel about issues that are not the matter of HOMER itself but of their particular application, or about topics that are in detail described in the accompanying documentation. Four hours of such support are provided free of charge; additional support should be ordered.