HOMER Analyzer ISM 900 MHz, R-9 Waveguide

Basic Description

The HOMER-Series STH 900-MHz Analyzer is an auto-matic impedance and power measurement system based on R-9 (WR-975) waveguide. The system works under the full-power operating conditions of magne-tron-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. STH can be:

- Controlled from or monitored by a personal com-puter or another controller via RS232 or CAN Bus interface;

- Integrated into a LabVIEW environment.

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

Optionally, the HOMER can include a stepper motor driver card for a 3-stub tuner control. In this case, the model is designated STHT.

Principle of Operation

The HOMER Analyzer is based on the six-port reflec-tometer (SPR) principle. SPR is capable of measuring complex reflection coefficient of the load as well as the incident, reflected and absorbed powers. A frequency counter is also integrated with the system. This concep-tual simplicity of SPR facilitates its stable and tempera-ture-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 perfor-mance 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

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

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

Rectified mode is designed for slowly pulsing micro-wave 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 μs.

Rectified and Pulsed modes can provide both instanta-neous 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
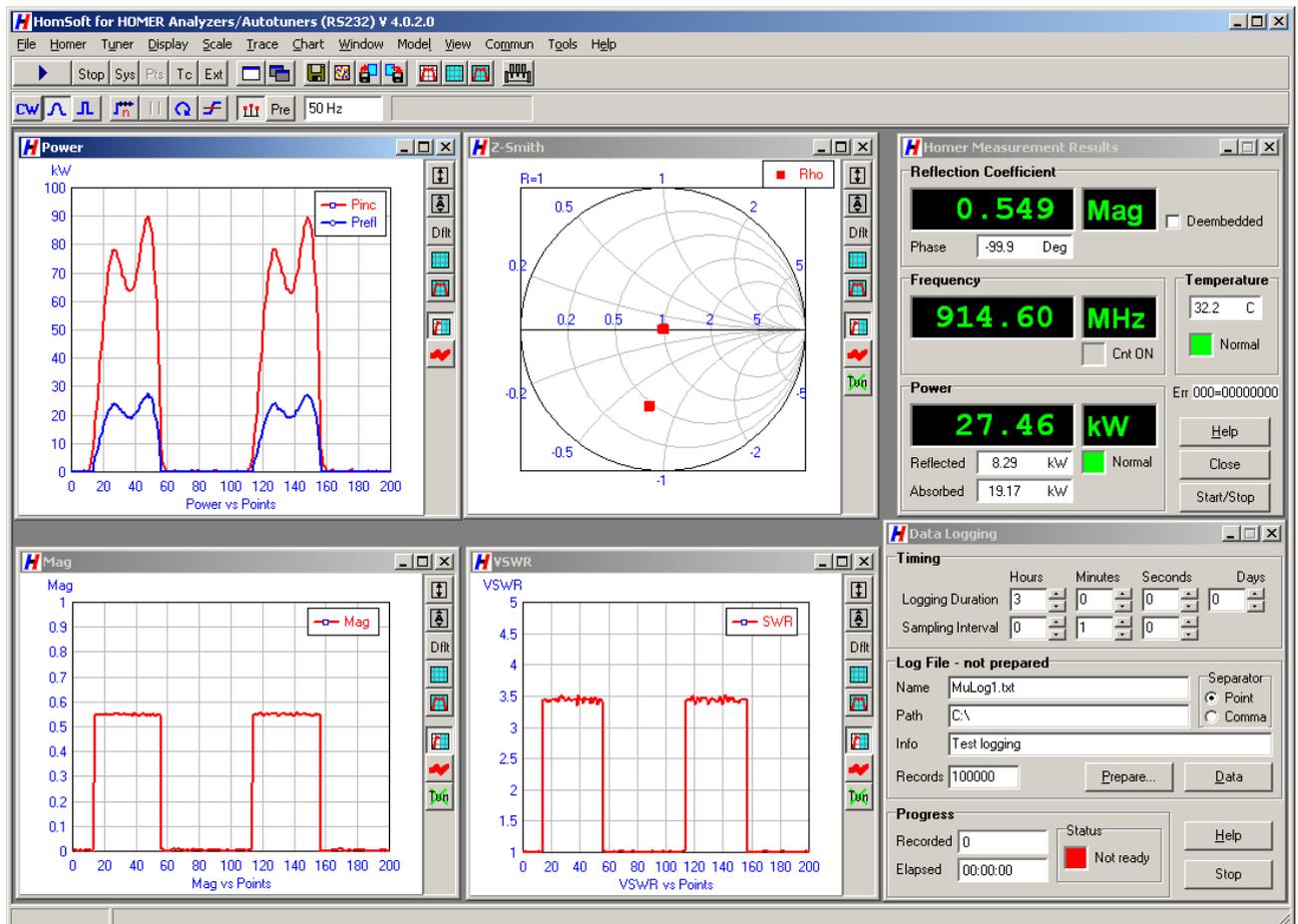
Example of *HomSoft* graphical user interface.

Specifications

Electrical	
Waveguide type	R-9 (WR-975)
Flange type	IEC
Frequency range	880 to 930 MHz
Maximum working power[1][2]	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)	$\pm$5 %
Power supply voltage	24 V $\pm$10% DC
Current consumption	2 A
Interface	RS232 or RS422, CAN Bus
Modes of sampling	CW, Rectified, Pulsed
Max ripple in CW mode	15 % of peak value
Max repetition rate of signal envelope in Rectified mode[3]	10 kHz
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 ^{0}C
Storage temperature range	-10 to +125 ^{0}C
Other	
Cooling water flow rate (minimum)	5 liters/minute
Cooling water temperature	+15 to +25 ^{0}C
Water inlet/outlet connector[4]	SMC KPH12-03
Water hose	SMC TU 1208 Polyurethane

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[1] 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 working 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.

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

[3] Signal envelope repetition rate (ripple frequency) f_e is determined by power line frequency f_p and rectification method. Examples: One-phase half-wave rectification $f_e=f_p$; one-phase full-wave rectification $f_e=2f_p$; three-phase half-wave rectification $f_e=3f_p$; three-phase full-wave rectification $f_e=6f_p$; three-phase Y+Δ half-wave rectification $f_e=6f_p$; three-phase Y+Δ full-wave rectification $f_e=12f_p$.

[4] See e.g. www.smc.eu

Configurations

Basic Configuration

- STH or STHD[5] Basic Unit
- Internal firmware (Server)
- Calibration in 890 to 930 MHz band
- RS232 or RS422 serial interface
- CW and Rectified modes of operation
- Operating handbook (pdf)
- Communication protocol manual (pdf)
- Set of standard cables[6]

Options

1. *HomSoft* Windows visualization and control software
2. Pulsed mode of sampling
3. CAN Bus communication interface (includes CAN Bus cable)
4. CAN-USB Adapter (to connect PC to CAN Bus network)
5. LabVIEW Homer Virtual Instruments Library
6. Dynamic Data Exchange (DDE) server in HomSoft Windows SW[7]
7. Technical support in hours (four hours are complimentary)
8. Upgrade of STH HW and SW to STHD
9. Water cooling

Optional Power Supplies

- Traco Power TBL 150-124, 24V/6.25A, DIN rail mountable
- Electro-Automatik EA-PS-524-11T, 24V/10.5A, input 90-264 V, benchtop

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[5] STHD includes stepper motor driver card for 3-stub tuner control.
[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.

Miscellaneous

CAN-USB Adapter. To connect your PC with a CAN Bus network (or with the STHT 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).

LabVIEW HOMER Virtual Instruments Library enables HOMER control and monitoring (measurement results retrieval) from within the National Instruments' LabVIEW environment. The library consists of a number of virtual subinstruments and is accompanied by a few useful examples. The library enables users to integrate HOMER into their own applications with much less effort than trying to start from scratch by studying HOMER communication protocol and programming the communication themselves.
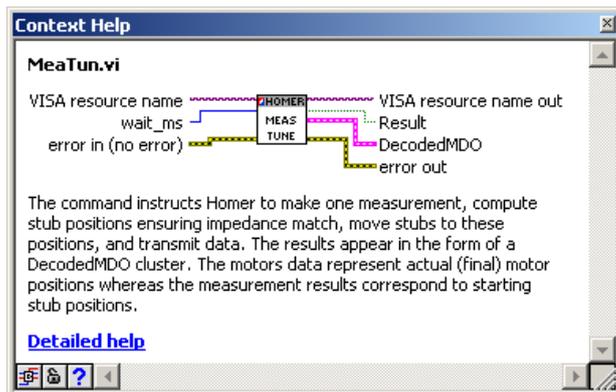
DDE Server. DDE Server is a functionality within the *HomSoft* Windows SW hence it needs the *HomSoft Windows visualization and control software* option, too. The DDE Server enables another (customer's) Windows program to extract measurement results from *HomSoft* program, e.g. to a LabVIEW environment.

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.

STH to STHD upgrade. The STH Homer Analyzer functionality can be enhanced to become STHD, and thus to enable control of the STT Mototuner. The STHD + STT combination is a full-fledged automatic impedance matching unit (Autotuner). For the upgrade, you will need not only the STT Mototuner but also an additional stepper motor driver card inside the STH Basic Unit. The STT tuner details must be known and programmed to the Basic Unit by S-TEAM, too. Both Basic Unit firmware (Server) and *HomSoft* must be upgraded.

Water Cooling. The purpose of water cooling is not enhancing cooling efficiency but isolating HOMER interior from the ambient air, enabling thus its operation in a dusty or too hot environment. The air is forcibly circulated inside the HOMER electronics compartment, passing through the water-cooler, and cooling the interior.