Plasma & Reactive Gas Solutions

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SmartMatch® Intelligent Microwave Matching Unit for high speed, reliable, repeatable matching.

SmartMatch®

MODELS AX3060 AND AX3070
INTELLIGENT MICROWAVE MATCHING UNIT

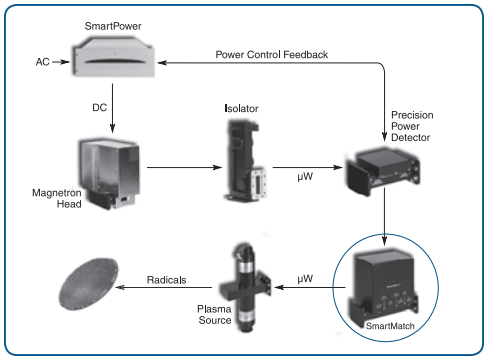
The SmartMatch module is an advanced microwave matching unit which utilizes phase-magnitude detection hardware and an advanced predictive tuning algorithm to provide fast, reliable and repeatable matching. Available for power levels up to 6 kW, with user selectable operating modes and reflected power threshold, the SmartMatch module has been qualified to provide fast, reliable tuning with multiple plasma loads including O_2, N_2, CF_4, NF_3, H_2O, NH_3, N_2H_2 (and many others). Typical matching speed is below 1 second.

The SmartMatch module is compact and self-contained, with the micro-controller located in the tuning head. This eliminates the need for a separate CPU and allows for completely automatic, hands-off operation—ideal for multi-step processes while greatly reducing development time.

The SmartMatch matching unit is available in standard or custom waveguide configurations to best meet the specific size requirements. For flexibility, and upon customer request, a separate local interface module may be used for program presets and manual tuning operation.

Features & Benefits

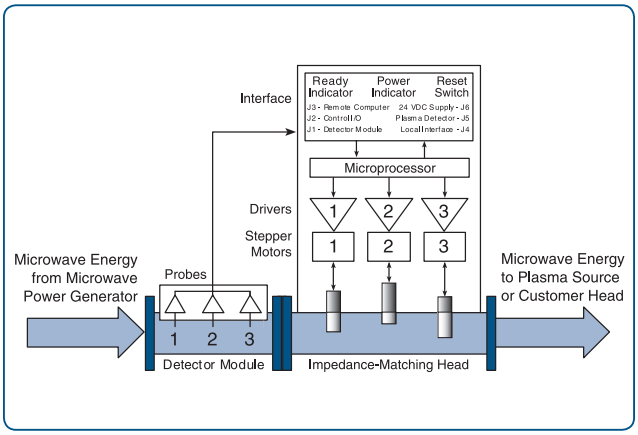
- Fast, reliable matching, even for difficult plasma loads
- Hands-off operation with no separate controller needed for increased accuracy and lower CoO
- Advanced predictive algorithm complete with powerful micro-controller and fast stub moving mechanism ensures immediate plasma ignition, rapid matching and higher throughput



Microwave Plasma Subsystem —
The SmartMatch is designed to be used as a part of MKS Microwave Plasma System, including microwave power generator, waveguide components, and plasma sources.

Performance

The SmartMatch microwave matching unit utilizes the Precision Power Detector Module which employs a three-probe measurement of the standing wave in the waveguide to determine the phase and magnitude of the reflections. The SmartMatch module's micro-controller, through an advanced predictive algorithm, drives three tuning stubs to the optimum location matching the load impedance and optimizing microwave power coupling into the plasma. Each Precision Power Detector Module undergoes precise calibration at MKS to ensure accurate microwave power measurement and to compensate for any measurement drifts related to change in operating temperature. The combination of the fast, repeatable SmartMatch module performance with Precision Power Detector accuracy ensures high process repeatability for more consistent yield.



Block Diagram —

SmartMatch microwave match unit

The SmartMatch intelligent microwave matching unit provides immediate plasma ignition and precision tuning, typically in less than 1 second, and immediately compensates for any dynamic changes in the plasma impedance, providing reliable and repeatable performance (see Figure 1).

With precise mechanical design and construction materials selection, the SmartMatch unit is designed to work at high power levels (up to 6 kW) and with practically any plasma load (reducing reflected power below 1% for loads with VSWR up to 10 - See figure 2).

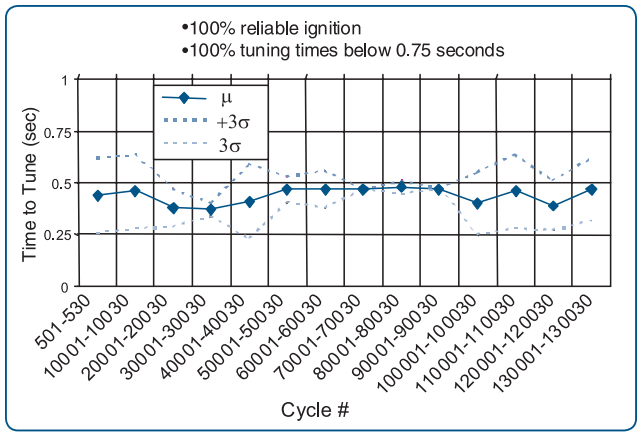


Figure 1 —

SmartMatch microwave match unit tuning speed repeatability with typical plasma load.

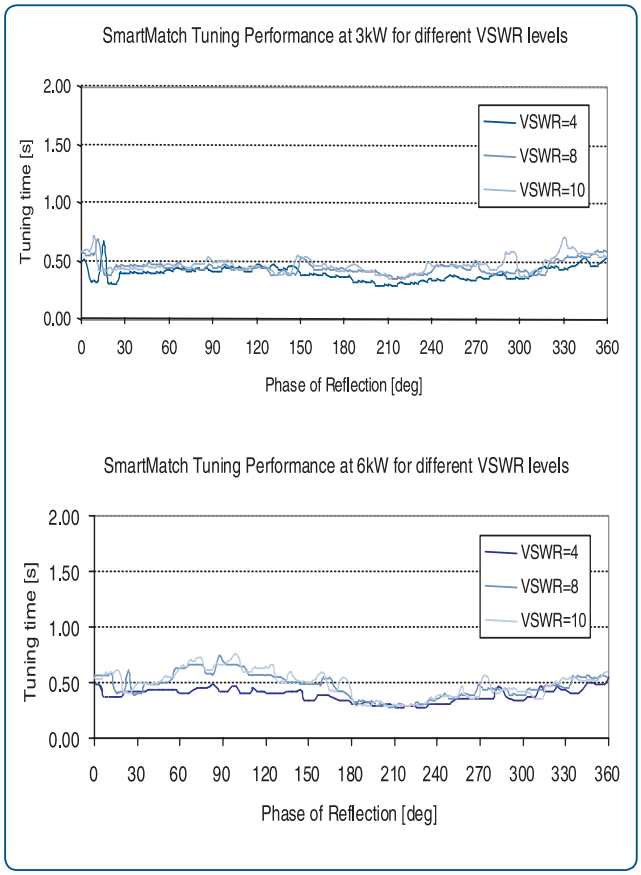


Figure 2 —

SmartMatch microwave tuning performance under varying VSWR levels

During the MKS manufacturing process, each SmartMatch unit is tested with dynamically changing load (at VSWR=10) to verify tuning performance before shipment to the customer.

The SmartMatch unit can be offered in standard or custom waveguide configurations (AX3060 series with separate Precision Power Detector Module, AX3070 series with integrated Precision Power Detector Module) to accommodate available process chamber real estate and to allow for easy integration on customer tools. The MKS engineering and applications group will work with the customer to determine the optimum system configuration. In its plasma applications laboratory, MKS can also verify the plasma ignition and tuning performance of the system in customer specific applications.

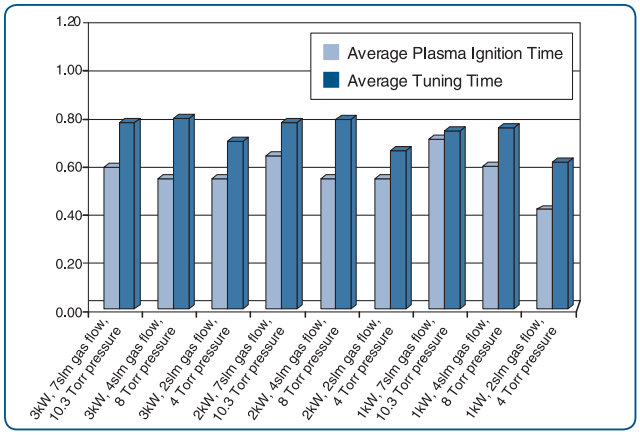


Figure 3 —
SmartMatch tuning performance under various conditions

Specifications

Matching Head

Time to Match	< 2 seconds
Matching System	Three stubs on ¼ length waveguide intervals
Possible Matching Range	Match to maximum VSWR of 10
Operating Frequency	2.45 GHz ± 15 MHz
Power Requirement	24 VDC ±10%
User Interface	RS485, Analog
Cooling Requirement	Water at 0.25 gpm, 30° C maximum @ 30 psid
Size (H x W x L)	10.25 x 6.18 x 11 in. (260 x 156 x 279 mm)
Weight	14 lb. (6.4 kg)
Mounting Position	Any
Waveguide Size	WR284
Ambient Temperature	Up to 50° C maximum

Phase and Magnitude Measurement Module

Size (H x W x L)	3.43 x 4.87 x 8.0 in. (87 x 124 x 203 mm)
Weight	2 lb. (0.9 kg)
Mounting Position	Any
Waveguide Size	WR284

Optional Local Interface Module*

Model numbers	
AX3060 Series	AX3060-12 (1.8 kW), AX3060-10 (3 kW), AX3060-16 (6 kW)
Integrated units**	
AX3070 Series	AX3072 (1.8 kW), AX3073 (3 kW)

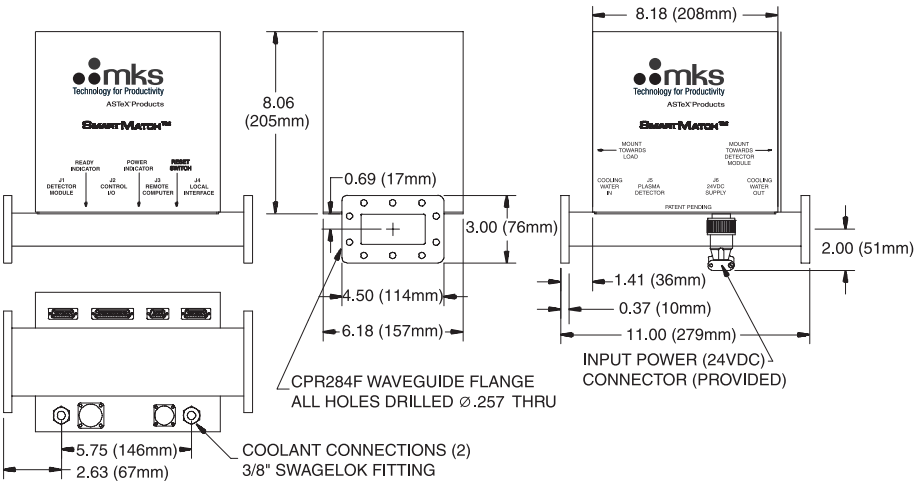
* *Allows user configuration of matching parameters and manual operation of the tuning head. The interface may be removed once the matching unit has been configured.*

** *Includes integrated Precision Power Detector*

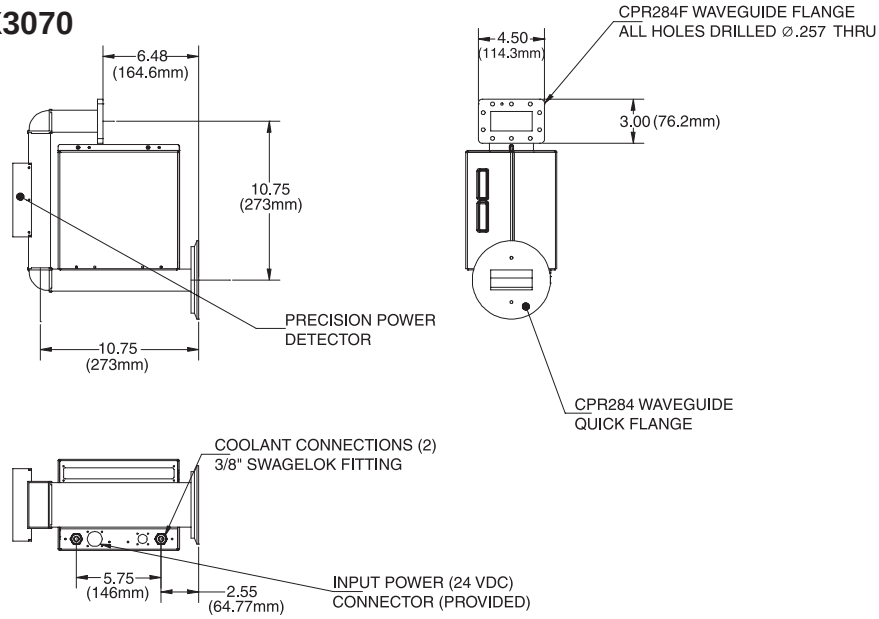
Ordering Information

Please contact your local MKS office for price and availability information.

AX3060



AX3070



Dimensional Drawing —

Note: Unless otherwise specified, dimensions are nominal values in inches (mm referenced).

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SmartMatch - 11/15