

SYSTEM 10, MODEL 1107

PROCESS MODULE

SECTION I

OVERVIEW

Features

General Description

The Model 1107 Process Module is an ion enhanced, implanted photoresist removal system that reduces polymer resists in a non-damaging environment. Its design incorporates closed loop control of vital process parameters which, in turn, eliminate device damage that can be both thermal and electrical.

This manual is designed to be used in conjunction with the "Overall System 10" manual.

Process Module Assemblies

386/486 Microprocessor
Reactor Chamber
RF Generator
Pressure Controller
Temperature Controller
Vacuum Valve
Capacitive Manometer
RF Matching Network
Gas Distribution Module
Electronic Control Module
Liquid Source Delivery System (LSDS)

ISOLATED REACTOR DESIGN
REACTIVE ION ETCH REACTOR
6" OR 8" WAFER CAPABILITY
CLOSED LOOP TEMPERATURE
CONTROL SYSTEM
BUTTERFLY TYPE PRESSURE
CONTROLLER
DISPERSIVE GAS PLENUM
PINS UP OR DOWN PROCESSING
PHASE MAGNITUDE RF
MATCHING TUNER
TIMED ENDPOINT
REDUCED OVERHEAD TIME
DIAGNOSTICS

EQUIPMENT SPECIFICATIONS

WATER

Liquid Vapor Delivery System

(There will be no connection for automatic refill of the reservoir.)
The reservoir is manually filled and holds approximately 1.5 liters of deionized water which provides approximately 100+ hours of vapor flow.

RF Generator/Reactor Body

Cooling for RF Generator and Reactor Chamber	Distilled water from a closed loop recirculator or house water.
Connections	$\frac{3}{8}$ " Brass compression fittings
Inlet Pressure	< 60 psig
Inlet Temperature	25 °C - 30 °C
Equipment pipe material	$\frac{3}{8}$ " polypropylene tubing
Consumption	1.5 GPM

Wafer Chuck

Cooling or heating for	De-ionized water from the closed loop temperature controller.
Connections	$\frac{3}{8}$ " Brass compression fittings
Inlet Pressure	Less than 60 psig
Inlet Temperature	0 to 90 °C
Equipment Pipe Material	Teflon, copper, brass, and stainless steel at the chuck
Flow	1.5 GPM

NITROGEN

Reactor Backfill

Inlet Pressure	15 - 40 psig
Connection Dimensions	$\frac{3}{8}$ " Compression or #8 VCR fittings
Equipment pipe material	Stainless steel
Max Flow/Consumption	200 SLPM/20 SLPM
Gas Purity	99.999%

Pneumatic Supply

Inlet Pressure	80 psig
Connection Dimensions	$\frac{1}{4}$ " compression
Equipment pipe material	$\frac{1}{4}$ " polyurethane
Consumption	18 SLPM
Gas Purity	Instrument air quality nitrogen

OXYGEN

Inlet Pressure	8 - 10 psig
Connection Dimensions	$\frac{1}{4}$ " VCR
Equipment pipe material	Stainless Steel
Consumption	1 SLPM
Gas Purity	99.999%

SUBASSEMBLY SPECIFICATIONS

RF Generator (Comdel® CPS-1250)

Frequency:
13.56 MHz

Frequency Stability:
±.005% Max.

RF Output Impedance:
50 Ohms

Power Line:
Power input is 208 VAC ±5%, three phase, 50/60 Hz, at 7 amps per phase or less at full power output.

RF Power Control:
Automatically forward power leveled.

Maximum Power Output:
More than 1200 Watts.

Harmonic Distortion:
All harmonics are more than 55dB below the fundamental. Noise, hum and ripple; more than 30dB down at maximum power output.

AC Line to Power Regulation:
0.25% maximum change in output power for 7.5% change in the AC line voltage.

Power Output Meter:
0 to 1250 Watts with accuracy of 4% of full scale. Forward and reverse power by switch selection.

Auto. Forward Power Leveling:
1 to 1200 Watts internally or externally controlled.

Power Foldback Protection:
Automatic. Occurs when reverse power reaches 150 watts, or power amplifier current exceeds preset limit.

Auto. Forward Power Regulation:
±3% typical, ±5% maximum of set power for load variation from 1.1 VSWR to :1 VSWR (within foldback Limits).

Cooling:
Water flow at 1.5 gal./min. minimum. Connections provided to accept 3/8" compression.

Maximum Water Inlet Temperature:
+27 °C

Mass Flow Controllers (Tylan General)

Gas Type:
Nitrogen

Gas Flow Rate:
Gas Position 1 is 0 to 10 SLPM
Gas Position 2 is 0 to 2 SLPM

NOTE:

When the third and fourth MFC's are used, Gas Position 3 and 4 are selectable by the customer.

NOTE:

See Conversion table on next page for flow rates of gases other than nitrogen.

NOTE:

The mass flow controllers used in the System 10 are calibrated for 2 SLPM and 10 SLPM of nitrogen. Other process gases may be used, however, it is necessary to determine the proper flow rate for the substituted gas using a formula with the appropriate conversion factor. Conversion factors for other gases typically used in the System 10 are:

Oxygen (O ₂)	.99
Helium (He)	1.42
Nitrogen (N ₂)	1.00
Nitrous Oxide (N ₂ O)	.71
Nitrogen Trifluoride (NF ₃)	.48

CAUTION
Conversion of a controller to or from helium may seriously alter dynamic response or stability.

The following formula should be used to determine the proper flow rate:

$$\frac{\text{Desired rate of flow}}{\text{Gas conversion factor} \times \text{MFC Size}} = \text{adjusted flow rate}$$

For example: Required calibration for 0.5 SLPM of nitrogen trifluoride is:

$$\frac{0.50}{0.48} = 1.042 \text{ SLPM of Nitrogen calibrated MFC}$$

For a 2 SLPM nitrogen flow controller, the percentage flow would be:

$$\frac{1.042}{2.00} \times 100\% = 52\% \text{ of full scale of N}_2 \text{ rated 2 SLPM MFC.}$$

Accuracy:

± 1.0% of Full Scale

Temperature Coefficient:

± 0.1% Full Scale/°C

Linearity:

± 0.5% of Full Scale

Pressure Coefficient:

± 0.01% of Full Scale/psi (typical.)

Repeatability:

± 0.2% of Full Scale

Temperature (ambient and gas):

5 to 45 °C

Regulation:

± 0.25% of Full Scale

Pressure:

Proof 1500 psig
 Maximum Operating 150 psig
 Pressure Drop 10 to 40 psig

Output Indication:

0 to 5.0 VDC into 2000 ohm min. load impedance, short-circuit protected.

Command Signal:

0 to 5.0 VDC (from voltage source with maximum impedance 2500)

Input power:

+15 VDC (+4%), 25 mAmps
-15 VDC (+4%), 125 mAmps

Leak Integrity:

1 x 10⁻⁷ sccs He

Fittings:

1/4" VCR

Filtration:

20 µm inlet

**Butterfly Pressure Controller
(AC-2®)**

Input Power:

30 Watts at 90, 115, 230 VAC as required

Input Frequency:

50/60 Hz

Fuse Size:

.5 Amp Slow Blow

Ambient Temperature Range:

0 to 50 °C

Input Pressure Signal:

0 to 10 VDC proportional to pressure

Input Impedance:

10K Ohms

Control Accuracy:

.25% of setpoint

Repeatability:

.1% of full scale

Input Command:

RS232C -- Format fixed and available.
All setpoints continuously adjustable plus report command.

Output Command:

RS232C -- Reporting format fixed and available. Reports pressure, stored setpoints, valve position and lock status.

**Butterfly Valve
(Tylan General)**

Maximum Pressure Differential:

1 Atmosphere

Full Closed Leak Rate:

< 1/10,000 of full scale conductance

Motor Type:

4-Pole stepping motor

Drive Assembly Output Torque:

Start/Stop -- 240 ounce/inches
Running -- 430 ounce/inches

Opening and Closing Rate:

300 steps/second maximum;
1 step = 1/2 degree (approx.)

Materials Exposed to Process:

Stainless Steel and Teflon®

**Capacitance Manometer
(Tylan General)**

Pressure Ranges:
0 to 10 Torr

Accuracy (at 25°C when zeroed):
1.5% of reading; $\pm 0.001\%$ of full scale

NOTE:
Accuracy includes linearity, hysteresis,
long term stability and reference

Resolution:
Dependent on readout; $\pm 0.01\%$ of full
scale with Tylan General 80-6
Module.

Overpressure Without Damage:
1140 Torr (1.5 atmospheres)

Response Time:
5 milliseconds

Volume of Sensing Cavity:
20 cubic centimeters

Materials Exposed to Process:
Inconel, 304 Stainless Steel

**Operating Voltage and Current
Requirements:**
+15 Volts DC at 10 milliamps

Output Voltage:
0 to +10 Volts DC

Minimum Load Impedance:
5 kilohms

Temperature Range
+5 °C to +45 °C

Temperature Effect on Zero:
.01% of full scale/°C

Temperature Effect on Span:
.04% of reading/°C

Mounting Position:
Tubulation facing sideways or down,
but NOT up.

Weight:
1.125 lbs. (510 grams)

**Temperature Controller
(Omega® CN6070A)**

Electrical
120/240 VAC, +10% -15%,
50 - 60 Hz

Power Consumption
Less than 6 VA (Instrument)

Thermocouple Type: J or K, R or S,
or T. Maximum lead resistance 100 Ω
for rated accuracy. Cold Junction
compensation standard.

Linearization: continuously calculated
and updated using ROM based
algorithm.

RTD Type: Platinum 3 wire, 100 Ω at
0° C, DIN curve standard (.00385)

Accuracy
 $\pm 0.2\%$ of Full scale, \pm one digit
Temperature Stability
5 $\mu\text{V}/^\circ\text{C}$ maximum, 3 $\mu\text{V}/^\circ\text{C}$ typical

T/C Cold end tracking
0.05 °C/°C ambient temperature

Operating Ambient Temperature

For rated accuracy = 32 to 131 °F
(0 to 55 °C)

Series mode noise rejection

80 dB

Common mode noise rejection

120 dB

Dual Display

Process temperature or parameter code is shown on upper display; setpoint or parameter value can be selected on lower display.

Update rate

Process display updated 2.5 times per second; digitally filtered to eliminate noise fluctuation.

°F/°C

Front panel selectable, setpoint and alarms affected.

Alarms

1 and 2 auxiliary on/off, adjustable for high or low temperature triggering; LED on front panel displays alarm status; process/deviation mode selectable; optically isolated solid-state relays, rated 1A at 120/240 VAC (on/off)

Outputs, Primary set point

Mech. Relay (time proportional):
SPST relay, 7 amps resistive at 120 VAC, 5 amp resistive at 240 VAC, 50 VA inductive.

"F" Current Proportional: 4-20 mA dc into 500 Ω maximum

"DC" Pulsed Voltage: 20 VDC pulsed time proportional signal for driving solid state relays

"T" Triac (time proportional):

Solid-state plug in relay output zero voltage switched; rated 1 amp holding and 10 amps in-rush for inductive or resistive loads

Communications

Digital Format: 7 bit ASCII, asynchronous with 1 start and 1 stop bit, odd parity, selectable baud.

Electrical: Isolated RS232C, 20 ma loop on plug in cards

Mechanical: 9 pin "D" connector, DB-9 Type on rear of unit

**RF Matching Network
(Trazar Model AMU1-20)**

Maximum RF power to network:

5 kW subject to load impedance (see OEM Manual)

Network input impedance:

50 ohms nominal

Reflected power:

1% maximum of forward power for forward power between 20 watts and 5 kW (13.560 MHz generator only)

Load impedance:

(See OEM Manual)

Network efficiency:

Load impedance dependent (see OEM Manual)

Maximum output voltage:

Nominally 1000 volts peak at 13.560 MHz

Maximum allowable DC:

1000 volts potential (bias) on driven electrode

Primary AC power:

120 + 10%, - 15% RMS volts, 50/60 Hz; 1 ampere RMS maximum connector: IEC 320

Fuse:

1 ampere slow blow, .25 diameter x 1.25 inches

User interface:

DA-15, 15 pin female sub-miniature D (see Paragraph 3.6 for signal descriptions)

Outline dimensions:

147.3 x 223.5 x 304.8 mm (5.8 x 8.8 x 12 inches nominal)

Weight:

5.4 kg (12 pounds) maximum

Cooling:

Conduction cooling through network mounting

Mounting surface:

80 °C maximum temperature

Maximum elevation:

2150 meters (7000 feet)

Liquid Source Delivery System

DSE® Type: LSDS - H₂O - 500 sccm

Flow Controller:

MKS 1150C-356V
Flow Rate: 500 sccm FS
Operating Temp. 80°C

Electrical:

Power: 440 watts, 220 VAC

Remote Control Connection: 15 Pin Sub D Male

Remote EMO Connector: 3 pin C91A Amphenol male

Remote DI Connector: 5 pin C91A Amphenol female

Remote external Heater Connector: 7 pin C16-1 Amphenol female

Water Specifications:

Control Range: 5% - 100%

Accuracy: ± 5%

Repeatability: ± 0.2% FS

Response Time: 1 sec. to within 2% of Setpoint

Advised Temperature of H₂O: 35°C

Mechanical Specifications:

Leak Rate: < 1 x 10⁻⁹ mbar/sec Vapor

Line fitting: #8 VCR

Fill Fitting: ¼" Swagelok®

Vessel Capacity: 1.5 Liter