

## Test Equipment List



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## Electrical test equipment

### • PCM Measurements

#### HP3456A 6½ digit Digital Voltmeter [TU]

DC Voltage range .....	: 0.1 Volt to 1000.0 Volt
DC Voltage accuracy .....	: 0.0008 % +2 counts at 1.0 Volt
AC True RMS range .....	: 1.0 Volt to 1000.0 Volt
AC True RMS accuracy .....	: 0.07 % + 730 counts at 1.0 Volt, 50 Hz
Resistance range .....	: 100 Ohm to 1 Giga-Ohm
Resistance accuracy .....	: 0.002 % + 4 counts at 1 kOhm
Up to 330 readings per second in 3½ digit mode	
Up to 48 readings per second in 6½ digit mode	

#### HP4141B Modular DC Source/Monitor [TU]

4 floating Source/Monitor Units (SMU) .....	: ±1mV to ±100 V voltage range
.....	: ±50 fA to ±20 mA current range

#### HP4280A 1MHz C Meter / CV Plotter [TU]

C measurement range .....	: 1 fF to 1.9 nF
G measurement range .....	: 10 nS to 12 mS
DC Biase Source.....	: 0 Volt to ±100 V
Step generator.....	: up/down, up, pulse, DC and OFF

#### HP4145B Semiconductor Parameter Analyser [TU]

4 Source/Monitor Units (SMU).....	: ± 1 mV to ± 100 V voltage range
.....	: ± 50 fA to ± 20 mA current range
2 Voltage Sources (VS) range .....	: ± 20 V / 10 mA max.
2 Voltage Monitors (Vm) range .....	: ± 20 V

#### HP4084B Switching Matrix Controller [TU]

Number of DUT pins .....	: 24
1 Low leakage SMU port	
3 SMU ports	
2 Vs ports	
2 Vm ports	

#### Electroglass X2001 Semi-automatic wafer prober [TU]

Maximum wafer size .....	: 6 inch
Hot Chuck range .....	: amb. to +175°C

#### HP4083B Switching Controller [TU]

#### STEAM / HP IC-MS software [TU]

### • CV and CP Measurements

#### HP4140B pA Meter / DC Voltage Source [TU]

Current measurements range .....	: 1 pA to 10 mA
2 Voltage sources.....	: ±100 Volt DC and ±100 Volt source/generator
Synchronized I-V measurements	
Quasi-static C-V measurements	

#### HP4275A Multifrequency LCR meter [TU]

Testfrequency range .....	: 10 kHz to 10 MHz
Test signal level .....	: 1 mVolt rms to 1 Volt rms
L measurement range.....	: 100.00 nH to 10.00 H
C measurement range .....	: 1.0000 pF to 100.00 µH
R,  Z , ESR, X range.....	: 1.0000 Ohm to 10.000 MOhm
D measurement range .....	: 0.00001 to 9.9999
Q, 1/D measurement range .....	: 0.01 to 9900
G, B measurement range .....	: 1.0000 µS to 10.00 S
ø measurement range.....	: 0° to 180°

**Wentworth manual wafer prober [TU]**

Maximum wafer size ..... : 4 inch  
 Hot Chuck range ..... : +10°C to +250°C  
 5 manual micro probe manipulators  
 MDC Mercury probe for doping concentration and profiling  
 Materials Development Corp. CV/CT/IV software [TU]

• **DC Measurements, incl. Manual Probe Station**

**Agilent B1500A Semiconductor Device Analyser [ME]**

2 High Power Source/Monitor Units (SMU) ..... : ±100 µV to ±200 V voltage range  
 ..... : ±50 fA to ±1000 mA current range  
 2 Medium Power Source/Monitor Units (SMU) ..... : ±25 µV to ±100 V voltage range  
 ..... : ±50 fA to ±100 mA current range

**HP4156A Precision Semiconductor Parameter Analyser [TU]**

4 High Res. Source/Monitor Units (SMU) ..... : ±100 µV to ±100 V voltage range  
 ..... : ±10 fA to ±100 mA current range  
 2 Voltage Sources (VS) range ..... : ±20 V / 100 mA max.  
 2 Voltage Monitors (Vm) range ..... : ±20 V  
 1 High Power SMU ..... : ±100 µV to ±200 V voltage range  
 ..... : ±100 fA to ±1 A current range  
 2 Pulse Generator Units ..... : ±40 V / 100 mA / 2µs to 10s pulse width

**HP4156B Precision Semiconductor Parameter Analyser [TU]**

4 High Res. Source/Monitor Units (SMU) ..... : ±100 µV to ±100 V voltage range  
 ..... : ±10 fA to ±100 mA current range  
 2 Voltage Sources (VS) range ..... : ±20 V / 100 mA max.  
 2 Voltage Monitors (Vm) range ..... : ±20 V

**HP4156C Precision Semiconductor Parameter Analyser [TU]**

4 High Res. Source/Monitor Units (SMU) ..... : ±2 µV to ±100 V voltage range  
 ..... : ±1 fA to ±100 mA current range  
 2 Voltage Sources (VS) range ..... : ±20 V / 100 mA max.  
 2 Voltage Monitors (Vm) range ..... : ±20 V  
 Quasi-static CV ..... : 5 fF

**Cascade Microstation low noise manual probe station [TU]**

Maximum wafer size ..... : 6 inch  
 Hot Chuck range ..... : -65°C to +175°C  
 4 DCM200 precision probe manipulators

**Karl Suss PM8 + PS200 probe shield manual probe station [TU]**

Maximum wafer size ..... : 8 inch  
 Hot Chuck range ..... : none  
 4 PH150 precision probe manipulators

**HP VEE software (Visual Engineering Environment) [TU]**

**Keithley 2400 SourceMeter [ME]**

Voltage measurement range ..... : ±200 mV to ±200 V  
 Voltage source range ..... : ±200 mV to ±200 V  
 Current measurement range ..... : ±1µA to ±1000mA  
 Current source range ..... : ±1µA to ±1000mA  
 Resistance measurement range ..... : 2 Ohm to 200 Mohm

**Keithley 7001 High Density Switch System [ME]**

7011 Quad 1x10 Multiplexer Card ..... : quad 1x10 2-pole switches  
 7158 Low Current Scanner Card ..... : 10 channel scanner  
 7158 Current offset ..... : <30fA typical

**Agilent E5272A Source/Monitor unit [ME]**

Voltage source/measurement range ..... : ±2 V to ±100 V  
 Voltage source/measurement resolution ..... : ±2 µV to ±100 µV  
 Current source/measurement range ..... : ±1 nA to ±200mA  
 Current source/measurement resolution ..... : ±10 fA to ±200nA

## Keithley 6485 PICOAMMETER [ME]

Display resolution.....	: 5 ½ digit
Current Range .....	: ±2nA to ±20mA
Current resolution .....	: 10fA
Burden Voltage .....	: <200µV
Readings/sec .....	: Up to 1000

## Kikusui Electronic load PL153W

Rated Power .....	: 150W
Operating Voltage .....	: 1.5 to 120V
Rated Current.....	: 30A

## ESD and LatchUp Characterisation and Device Modelling

### Thermo KEYTEK ZAPmaster Mk.2 SE [ME]

ESD test voltages.....	: 50 Volt to 8.000 Volt
ESD puls test models.....	: Human Body Model / Machine Model
LatchUp models .....	: EIA/JESD-78
Vector memory per pin .....	: 64k
Number of pins .....	: 384
Number of V/I.....	: 6
Current verification.....	: Spot and Curve test

### ORYX 11000EX [EX]

ESD test voltages.....	: 50 Volt to 5.000 Volt
ESD puls test models.....	: Human Body Model / Machine Model
Number of pins .....	: 528
Current verification.....	: Spot and Curve test

### LeCroy 6051 Oscilloscope [ME]

Number of channels.....	: 2
Bandwidth (-3dB).....	: dc to 500 MHz
Maximum sampling rate.....	: 5 GSa/s
Time base scale .....	: 100ps/div to 1s/div
Channel scale .....	: 20mV/div to 1V/div

### Thermo KEYTEK RCDM3 [ME]

ESD test voltages.....	: 50 Volt to 8.000 Volt
ESD puls test models.....	: Field induced Charge Device Model (ESDA, JEDEC, Q100)
Positioning accuracy .....	: 0.01mm
Number of pins .....	: 1
Current verification.....	: Spot and Curve test

### LeCroy 6000SDA Oscilloscope [ME]

Number of channels.....	: 4
Bandwidth (-3dB).....	: dc to 6 GHz
Bandwidth Limiters.....	: 20MHz, 200MHz, 1GHz, 3 GHz, 4GHz
Maximum sampling rate.....	: 20 GSa/s
Time base scale .....	: 20ps/div to 10s/div
Channel scale .....	: 2mV/div to 1V/div
Option .....	: 2 AP-1M High impedance adapters

### Transmission line pulse generator [TU]

FUG High Voltage Supply.....	: HCN 200 - 12500
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### AEC-Q100-006 gate leakage test

FUG High Voltage Supply.....	: HCN 200 - 12500
ESD test voltages.....	: 400 Volt
ESD puls test models.....	: Field induced gate leakage Model
Number of testlocations .....	: 3

- **LF Device Characterisation**

**HP3314A Function Generator [TU]**

Lin/Log sweeps, gated, counted burst, AM/FM/VCO  
 Arbitrary waveform generator  
 Phase lock xN and /N modes, 1/2-cycle mode

Frequency range .....: 0.001 Hz to 19.99 MHz  
 Amplitude range.....: 0.01 mV p-p to 10 Volt p-p into 50 Ohm  
 Output impedance.....: 50 Ohm  
 Waveforms.....: sine, square, triangle, variable ramps and pulses  
 Sweep types.....: linear, logarithmic and manual

**HP3326A Synthesized Function Generators [TU]**

2 channels, two-tone and two phase signals

Frequency range .....: DC to 13 MHz  
 Frequency resolution .....: 1 µHz (<100 kHz) or 1 mHz (>100 kHz)  
 Amplitude range.....: 1 mV p-p to 10 Volt p-p into 50 Ohm  
 DC Offset in 50 Ohm.....: ± 20 Volt maximum amplitude  
 Output impedance.....: 50 Ohm  
 Waveforms.....: sine, square, pulse and DC  
 Sweep types.....: linear and discrete (2 - 63 elements)  
 Sweep time .....: 5 ms to 1000 s

**HP3455A Digital Voltmeter [TU]**

DC Voltage range .....: 1 Volt to 1000.0 Volt  
 DC Voltage accuracy.....: 0.002 % +3 counts at 10.0 Volt  
 AC True RMS range .....: 1.0 Volt to 1000.0 Volt  
 AC True RMS accuracy.....: 0.05 % + 50 counts at 1.0 Volt, 50 Hz  
 Resistance range.....: 1 kOhm to 10 MOhm  
 Resistance accuracy .....: 0.0025 % + 4 counts at 1 kOhm  
 Up to 22 dcV readings per second in 5½ digit mode

**HP4145B Semiconductor Parameter Analyser [TU]**

4 Source/Monitor Units (SMU).....: ± 1 mV to ± 100 V voltage range  
 .....: ± 50 fA to ± 20 mA current range  
 2 Voltage Sources (VS) range.....: ± 20 V / 10 mA max.  
 2 Voltage Monitors (Vm) range.....: ± 20 V

**HP4194A Impedance / Gain Phase Analyser [TU]**

Frequency range .....: 100 Hz to 100 MHz  
 Impedance test accuracy.....: ±1.5% to ±3.0% (>100 kHz)  
 .....: ±3% to ±6% (<100 kHz)  
 |Z|, R, X measurement range.....: 10 mOhm to 100 MOhm (100 µOhm resolution)  
 |Y|, G, B measurement range.....: 10 nS to 100S (1 nS resolution)  
 ∅ measurement range.....: ± 180° (0.01° resolution)  
 L measurement range.....: 1 nH to 100 kH (10 pH resolution)  
 C measurement range .....: 10 fF to 0.1 F (0.1 fF resolution)  
 D measurement range .....: 0.001 to 10 (0.0001 resolution)  
 Q measurement range .....: 0.1 to 1000 (0.1 resolution)  
 Tch/Rch (dB, Linear Ratio) .....: 0 to ± 120 dB (0.001 dB resolution)  
 Tch, Rch (V, dBm, dBV) .....: -107 dBm to -5 dBm with 0 dB attenuator  
 ∅ (degree, rad) .....: ± 180° (0.01° resolution)  
 Group delay.....: 0.1 ns to 1 s (1 ns resolution)  
 Gain-Phase accuracy.....: 0.1 dB, 0.5°, 0.35 dBm

**HP8112A Pulse Generator (50 MHz) [TU]**

Period range .....: 20.0 ns to 950 ms  
 Pulse delay .....: 75.0 ns to 950 ms  
 Pulse width.....: 10.0 ns to 950 ms  
 Transition timing, fixed .....: 5 ns typical  
 Transition timing, linear/cosine .....: 6.5 ns to 95.0 ms  
 Output impedance .....: 50 Ohm

## HP8904A Multifunction Synthesizer [TU]

Frequency range .....	: DC to 600 kHz (sine)
.....	: DC to 50 kHz (square, triangle, ramp)
Amplitude range.....	: 0 to 10 Volt p-p into 50 Ohm
DC amplitude range.....	: 0 to $\pm 10$ Volt p-p
Spectral purity (sine only) .....	: THD and noise -63 dBc rms (0.07%)
12 bit digital synthesis	

## HP4284A LCR meter [TU]

Test frequencies .....	: 20Hz to 1MHz
Measurement accuracy .....	: $\pm 0.05\%$ basic
Z , R, X measurement range .....	: 0.01 mOhm to 100 MOhm
Y , G, B measurement range .....	: 0.01 nS to 100 S
$\phi$ measurement range.....	: $\pm 180^\circ$
L measurement range.....	: 0.01 nH to 100 kH
C measurement range .....	: 0.01 fF to 10 F
D measurement range .....	: 0.000001 to 9.99999
Q measurement range .....	: 0.01 to 99999.9

## HP4263B LCR meter [ME]

Test frequencies .....	: 100Hz, 12Hz, 1kHz, 10kHz and 100kHz
Measurement accuracy .....	: $\pm 0.1\%$ basic
Z , R, X measurement range .....	: 1 mOhm to 100 MOhm
Y , G, B measurement range .....	: 10 nS to 1000 S
$\phi$ measurement range.....	: $\pm 180^\circ$
L measurement range.....	: 10 nH to 100 kH
C measurement range .....	: 1 pF to 1 F
D measurement range .....	: 0.0001 to 9.9999
Q measurement range .....	: 0.1 to 9999.9
Rdc measurement range .....	: 1 mOhm to 100 MOhm

## HP3582A Spectrum Analyser [TU]

## Tektronix TM 5006 Distortion Analyser [TU]

## HP VEE software (Visual Engineering Environment) [TU]

## HP IC- CAP Integrated Circuit Characterisation and Analysis Program [TU]

- **Relay Testing**

### Markenrich RT160 relay tester [ME]

Coil resistance .....	: max. 4095 Ohm
Contact resistance.....	: max. 2000 Ohm
Pull-in / Drop-out voltage.....	: max. 40.95 Volt
Pull-in / Drop-out current .....	: max. 409.5 mA
Pull-in / Drop-out operate time .....	: max. 40.95 ms
Pull-in / Drop-out bounce time.....	: max. 10.24 ms
Parallel diode forward voltage.....	: max. 40.95 Volt
Series diode, reverse leakage .....	: max. 409.5 mA
Transistor pull-in current / drop-out voltage .....	: max. 4.095 mA / 4.095 Volt
HIPOT.....	: max. 4.095 mA @ 250-1000 VAC

- **IC Verification Test**

**Teradyne FLEX-24 [EX]**

Per pin architecture.....	: Timing and Voltage
.....	: Programmable Loads
Digital channels .....	: 244
Vector memory depth .....	: 16M in 200 MHz mode
Power supply voltage range.....	: -30 Volt / +30 Volt / 200mA
LF synthesizer / digitizer .....	: 15 MHz / 15 MHz
HF synthesizer / digitizer.....	: 400 MHz / 125 MHz
DC parametric unit, 192 channel .....	: -2V/6.5V ± 32mA source and sink

- **HF Device Characterisation**

**HP4195A Network / Spectrum Analyser [TU]**

Network source frequency .....	: 10 Hz to 500 MHz, 1 mHz resolution
Network source power .....	: -50 dBm to +15 dBm, 0.1 dB resolution
Network sweep parameters .....	: frequency, power and DC bias
Network sweep types.....	: linear, log, cw, program and partial
Network receiver frequency .....	: 10 Hz to 500 MHz
Resolution Bandwidth .....	: 3 Hz to 300 kHz
Dynamic range.....	: >100 dB, 0.001 dB resolution
Spectrum measurement range.....	: 10 Hz to 500 MHz
Resolution Bandwidth .....	: 3 Hz to 300 kHz
Selectivity (60/3dB) .....	: 4.5@3Hz, 9@100Hz-10kHz, 8.5@30kHz-300 kHz
Noise Sideband .....	: < -100 dBc/Hz @ 1 kHz offset
.....	: < -90 dBc/Hz @ 100 Hz offset
Spectrum amplitude range .....	: -135 dBm to +20 dBm
Spectrum amplitude accuracy .....	: ± 1.0 dB @ 50 MHz
2nd Harm. distortion range .....	: <70 dBc @ > 2 MHz
T.O.I distortion range .....	: <80 dBc @ > 100 kHz
Average noise level .....	: typically -140 dBm @ 10Hz RBW
Spectrum sweep types.....	: linear, log, cw, program and partial
Spectrum sweep parameters .....	: continue, single and manual

**HP5371A Frequency and Time Interval Analyser [TU]**

Frequency A,B range .....	: 125 mHz to 500 MHz
Frequency modes .....	: A&B, A+B, B-A, A/B, B/A
Period A, B, range .....	: 2 ns to 8 seconds
Period modes.....	: A&B, A+B, B-A, A/B, B/A
Totalize A, B, A&B, A+B, A-B .....	: 0 to (2 <sup>32</sup> - 1) events, each channel
Time interval A, B, A>B, B>A .....	: 10 ns to 8.0 seconds
Continues time interval A, B .....	: 100 ns to 8.0 seconds
Time interval A, B, A>B, B>A .....	: -4.0 s to +4.0 s including 0 seconds
Rise and fall time A .....	: 1 ns to 100 µs (auto trigger)
Positive and negative pulsewidth .....	: 1 ns to 1ms (auto trigger)
Duty cycle A .....	: 0% to 100% for pulsewidths >1ns
Phase A rel B, B rel A.....	: 0° to ±360°
Peak amplitudes A, B.....	: 200 mV p-p to 2 Volt p-p

**HP4396A Network/Spectrum/Impedance Analyser including HP85046A S-parameter test set [TU]**

Network source frequency .....	100 kHz to 1800 MHz, 1 mHz resolution
Network source power .....	-60 dBm to +20 dBm, 0.1 dB resolution
Network receiver frequency .....	10 Hz to 500 MHz
Resolution Bandwidth .....	3 Hz to 300 kHz
Dynamic range.....	>100 dB, 0.001 dB resolution
Spectrum measurement range.....	100 kHz to 1800 MHz
Resolution Bandwidth .....	1 Hz to 3 MHz
Selectivity (60/3dB) .....	RBW $\geq$ 10 kHz < 10, RBW $\leq$ 3 kHz < 3
Noise Sideband .....	< -105 dBc/Hz @ 10 kHz offset
.....	< -95 dBc/Hz @ 100 Hz offset
Impedance measurement range.....	100 kHz to 1800 MHz
Basic accuracy .....	3%
Measurement parameters.....	Z , $\theta_z$ ,  Y , $\theta_y$ , R, X, G, B, Cp, Cs,
.....	Lp, Ls, Rp, Rs, D, Q, $ \Gamma $ , $\theta_y$ , $\Gamma_x$ , $\Gamma_y$
Source level at DUT.....	-66 dBm to +14 dBm
DC bias.....	$\pm$ 40 Volt through an external DC source

**HP8660B Synthesized Signal Generator [TU]**

• **RF Device Characterisation**

**HP4396A Network Analyser / Spectrum Analyser including HP85046A S-parameter test set [TU]**

Network source frequency .....	30 kHz to 3 GHz, 1 Hz resolution
Network source power .....	-85 dBm to +10 dBm, 0.05 dB resolution
Level accuracy .....	$\pm$ 1.0 dB relative to 0 dBm output level
Level linearity .....	$\pm$ 0.2 dB (-15 dBm to +5 dBm)
.....	$\pm$ 0.5 dB (+5 dBm to +15 dBm)
Average noise level .....	-82 dBm @ 3 kHz BW
.....	-102 dBm @ 10 Hz BW
Harmonic Measurement Accuracy.....	$\pm$ 1 dB @ 16 MHz to 3 GHz

**HP8510C Network Analyser including HP8517B S-parameter test set [TU]**

Network source frequency .....	45 MHz to 50 GHz, 1 Hz resolution
Test Port max. power.....	+13 dBm
Dynamic range .....	up to 100 dB
Measurement resolution.....	0.001 dB / 0.01 degree / 0.01 ns

**Agilent ESG4438C Digital RF Signal Generator [TU]**

Frequency range .....	250 kHz to 6 GHz, 0.01 Hz resolution
I Q modulation	
WCDMA multichannel-multicarrier	

**Agilent 8665B RF Signal Generator [TU]**

Frequency range .....	100 kHz to 6 GHz, 0.01 Hz resolution
RF Output .....	+13 to -140 dBm, 0.1 dB resolution
Harmonics and subharmonics .....	< -75 dBc @ < 1.5 GHz
.....	< -40 dBc @ < 3 GHz
.....	< -50 dBc @ < 6 GHz

**Agilent E5501B Phase Noise Test Set [TU]**

Frequency range .....	50 kHz to 1.6 GHz, 0.01 Hz resolution
Offset frequency range .....	0.01 Hz to 100 MHz
System noise response .....	-140 dBc
Phase detector R input.....	Rinput 0 to +23 dBm
Phase detector L input .....	Rinput +15 dBm to +23 dBm

**Agilent E4404B Spectrum Analyser [TU]**

Frequency range .....	9 kHz to 3 GHz, 1 kHz resolution
Resolution .....	1Hz to 1MHz
Input sensitivity, 1kHz RBW.....	-112 dBm @ 3 GHz
Max. input level .....	+30 dBm

## Agilent N8973A Noise Figure Analyser [TU]

Frequency range ..... : 10 MHz to 3000 MHz, 1 MHz resolution  
 Noise figure measurement range ..... : 0 to 30 dB± 0.1 dB

## HP346C Noise Source [TU]

Frequency range ..... : 10 MHz to 26.5 GHz  
 ENR ..... : 12dB – 17dB @ 10 MHz to 26.5 GHz  
 SWR ..... : 1.25 @ 18 GHz and 1.35 @ 26.5 GHz

## Tektronix TDS7404 Digitizing Oscilloscopes [TU]

Number of channels ..... : 4  
 Bandwidth (-3dB) ..... : DC to 4000 MHz  
 Sampling rate ..... : 20 GSa/s  
 Time interval accuracy ..... : 100 ps  
 Time base scale ..... : 50 ps/div to 10s/div  
 Input sensitivity ..... : 2 mV/div to 1 V/div @ 50 Ohm

## HP4142B Modular DC Source/Monitor [TU]

1 Source/Monitor Units (SMU 41420B) ..... : ± 100 µV to ± 200 V voltage range  
 ..... : ± 50 fA to ± 1 A current range  
 1 Source/Monitor Units (SMU 41421B) ..... : ± 100 µV to ± 100 V voltage range  
 ..... : ± 50 fA to ± 100 mA current range

## Cascade SUMMIT wafer prober including 4 microwave probes [TU]

## HP VEE software [TU]

## HP IC-CAP software [TU]

## • Silicon Debugging

### DCG systems OptiFIB IV Focused Ion Beam system [ME]

Ion source ..... : Field emission gallium liquid metal  
 Coaxial optical microscope ..... : Visible / NIR  
 Front and Backside editing ..... : Yes  
 Beam voltage ..... : 5 kV to 30 kV in 5 kV steps  
 Beam current ..... : 0.5pA-20nA  
 Piezo stage movement ..... : 50mm x 50 mm  
 Piezo stage resolution ..... : <300nm  
 CAD based computer navigation ..... : NEXS layout and FIBassist  
 Depositions ..... : Pt – Mo – SiO<sub>2</sub>  
 Enhanced etching ..... : CU<sub>2</sub> Copper Etch – XeF<sub>2</sub> – Alu etch

### Inovys Ocelot ZFP [ME]

Structural tester architecture ..... : Scan path testing  
 Digital channels ..... : 256  
 Vector memory depth ..... : 32M in 50 MHz mode  
 Data memory depth ..... : 32M in 50 MHz mode  
 Power supplies ..... : 4, up to 6V / 2,5A  
 PMU per 16 channels ..... : -2 Volt / +5 Volt / 40mA

### Teradyne µFLEX [EX]

Per pin architecture ..... : Timing and Voltage  
 Programmable Loads ..... : yes  
 Digital channels ..... : 244  
 Vector memory depth ..... : 16M in 200 MHz mode  
 Power supply voltage range ..... : -30 Volt / +30 Volt / 200mA  
 DC parametric unit, 192 channel ..... : -2V/6.5V ± 32mA source and sink

## Environmental test equipment

- **Temperature Cycling (air-to-air)**

**Greco GTST.3.64.80.200 [ME]**

Number of zones.....	3
Temperature range.....	-80 °C / +200 °C
Temperature accuracy.....	± 2 °C
Testarea volume.....	approx. 64 liter
Max. load weight.....	10 kg
Temperature stabilisation.....	< 5 min. on any extreme temperature

**Greco GTST.2.64.80.200 [ME]**

Number of zones.....	2
Temperature range.....	-80 °C / +200 °C
Temperature accuracy.....	± 2 °C
Testarea volume.....	approx. 64 liter
Max. load weight.....	10 kg
Temperature stabilisation.....	< 5 min. on any extreme temperature

**ESPEC TSE-11-A [ME]**

Number of zones.....	2
Temperature range.....	-80 °C / +200 °C
Temperature accuracy.....	± 1 °C
Testarea volume.....	approx. 10 liter
Max. load weight.....	5 kg
Temperature stabilisation.....	< 5 min. on any extreme temperature
Cable feedthrough for signal cables.....	50mm Ø

**ESPEC HC-120 [ME]**

Number of zones.....	1
Temperature range.....	-60 °C / +150°C
Temperature transition.....	10K/min. @ 1kg FR4 material
Temperature accuracy.....	± 0,5 °C
Testarea volume.....	approx. 12 liter
Cable feedthrough for signal cables.....	yes

**ESPEC TCC-150 [ME]**

Number of zones.....	1
Temperature range.....	-70 °C / +180°C
Temperature transition.....	15K/min. @ 4kg FR4 material
Temperature accuracy.....	± 1 °C
Testarea volume.....	approx. 150 liter
Cable feedthrough for signal cables.....	yes

**Heraeus HTS 7057 [ME]**

Temperature range, single chamber.....	-70 °C to +180°C
Temperature accuracy.....	± 1 °C
Test chamber dimensions.....	82 cm x 80 cm x 87 cm
Testarea volume.....	570 liter
Temperature transition after DIN50011, part 12.....	5,0 °C/min both heating and cooling
2 times 80 mm Ø feedthrough for signal and temperature monitoring of device/material under test	

- **Temperature Shock (liquid-to-liquid)**

**Heraeus VFS 2/07/15/2 [ME]**

Cold zone temperature range.....	-65 °C
Hot bath temperature range.....	+150 °C
Temperature accuracy.....	± 1 °C
Test area volume.....	2 x 1.5 liter
Max. load weight.....	0.5 kg
Temperature stabilisation.....	< 10 sec. on any extreme temperature

- **Dynamic Burn-in**

**Despach PNC 2-16, MASER Engineering system [ME]**

Temperature range.....	ambient to 175°C
Power dissipation.....	7.5 kW
Board positions.....	80

Dynamic driver .....	: 28 channel
Maximum signal speed.....	: 16 MHz into 100 Ohm lines
Vector memory .....	: 28 x 64k bit
<b>Despach PNC 2-16, MASER Engineering system [ME]</b>	
Temperature range.....	: ambient to 175°C
Power dissipation .....	: 7.5 kW
Board positions .....	: 80
Dynamic driver .....	: 28 channel
Maximum signal speed.....	: 10 MHz into 100 Ohm lines
Vector memory .....	: 28 x 1M bit

- **Salt Mist Testing**

**Weiss Technik [ME]**

Temperature range.....	: Ambient to +55 °C
Temperature humidifier.....	: Ambient to +80 °C
Humidity range .....	: 95% to 98%
Test area content .....	: 400 liter

- **High Accelerated Stress Testing**

**ESPEC TPC421 [ME]**

Test chamber dimensions.....	: 39.5 cm diameter x 45 cm
Temperature control range .....	: +105°C to +162°C
Temperature accuracy .....	: ± 0.5 °C
Humidity control range .....	: 75% to 100%
Humidity accuracy .....	: ± 3%
Pressure control range .....	: 0.2 to 4 kg/cm <sup>2</sup> G
Number of cable feed through connectors.....	: 72

**ESPEC EHS-221MD [ME]**

Dual test chamber dimensions .....	: dual 35,5 cm diameter x 42,6 cm
Temperature control range .....	: +105°C to +142°C
Temperature accuracy .....	: ± 0.5 °C
Humidity control range .....	: 75% to 100%
Humidity accuracy .....	: ± 3%
Pressure control range .....	: 0.02 to 0.2MPa
Number of cable feed through connectors.....	: 72

- **Climat Simulation**

**ESPEC PL2KP [ME]**

Test chamber volume .....	: 225 liter
Test chamber dimensions.....	: 50 cm x 75 cm x 60 cm
Temperature range.....	: -40 °C to +150°C
Temperature accuracy .....	: ± 0,5°C
Humidity range .....	: 40% to 95%
Humidity accuracy.....	: ± 3%

**ESPEC PL3KP [ME]**

Test chamber volume .....	: 408 liter
Test chamber dimensions.....	: 60 cm x 85 cm x 80 cm
Temperature range.....	: -40 °C to +150°C
Temperature accuracy .....	: ± 0,5°C
Humidity range .....	: 40% to 95%
Humidity accuracy.....	: ± 3%

**Weiss Technik SB1/300/40 [ME]**

Test chamber volume .....	: 300 liter
Test chamber dimensions.....	: 68 cm x 54 cm x 82 cm
Temperature range.....	: -40 °C to +180 °C
Temperature accuracy .....	: ± 1 °C
Humidity range .....	: 10% to 95% RH
Humidity accuracy.....	: ± 3%

## ESPEC LHU 212 M-E [ME]

Test chamber volume .....	: 120 liter
Test chamber dimensions .....	: 50 cm x 60 cm x 39 cm
Temperature range.....	: -20 °C to +85 °C
Temperature accuracy .....	: ± 1 °C
Humidity range .....	: 40% to 95%
Humidity accuracy .....	: ± 3%

## ESPEC LHL 113 M-E [ME]

Test chamber volume .....	: 120 liter
Test chamber dimensions .....	: 50 cm x 60 cm x 39 cm
Temperature range.....	: +5°C to +85 °C
Temperature accuracy .....	: ± 1 °C
Humidity range .....	: 40% to 95%
Humidity accuracy .....	: ± 3%

## • Dust and Sand Test System

### A/S swirling dust chamber [EX]

Temperature range.....	: ambient to +40 °C
Temperature accuracy .....	: ± 3 °C
Test conditions.....	: IEC529, DIN40 050 Teil 9
Test conditions.....	: DEF-STAN 07-55 Part 2 Section 4/1, Test D1
Dust/Sand Mixture .....	: B-mix and others on request

## • Water Intrusion Test System

### MASER Engineering IP test water spray system [ME]

Spray radius range .....	: 200 mm to 800 mm
Spray opening .....	: 0.4 mm / 0.8 mm
Water pressure .....	: up to 4 bar
Test conditions.....	: IEC529, DIN40 050 Teil 9

## • High Temperature Storage

### Memmert UFE400 [ME]

Temperature range.....	: +50°C to +250°C
Temperature accuracy .....	: ± 1°C
Test area volume .....	: 53 liter

### Memmert UFE500 [ME]

Temperature range.....	: +50°C to +250°C
Temperature accuracy .....	: ± 3°C
Test area volume .....	: 108 liter

### ESPEC PHH-101 [ME]

Temperature range.....	: +50°C to +300°C
Temperature accuracy .....	: ± 1 °C
Test chamber volume .....	: 90 liter
Test chamber dimensions.....	: 45 cm x 45 cm x 45 cm
Nitrogen purge.....	: yes

## • Low Temperature Storage

### Frigor GLE-20 [ME]

Temperature range.....	: -10°C to -40°C
Temperature accuracy .....	: ± 1 °C
Test area volume .....	: 200 liter

- **Aggressive Gas Environment Test System**

- **Modified Heraeus HC 0033 climat system [EX]**

Temperature range.....	: +10°C to +90°C
Temperature accuracy .....	: ± 1 °C
Humidity range .....	: 30% to 95%
Humidity accuracy.....	: ± 3%
Internal test area content.....	: 30 liter
Applicable gases.....	: SO <sub>2</sub> , NO <sub>2</sub> , H <sub>2</sub> S, Cl <sub>2</sub>
Mass-flow control .....	: ppm / ppb range

- **Modified Heraeus HC 0057 climat system [EX]**

Temperature range.....	: +10°C to +90°C
Temperature accuracy .....	: ± 1 °C
Humidity range .....	: 30% to 95%
Humidity accuracy.....	: ± 3%
Internal test area content.....	: 120 liter
Applicable gases.....	: SO <sub>2</sub> , NO <sub>2</sub> , H <sub>2</sub> S, Cl <sub>2</sub>
Mass-flow control .....	: ppm / ppb range

- **Solar Simulation Test System**

- **ATLAS SolarClimatic SC1600 [EX]**

Temperature range.....	: ambient to +40°C
Temperature accuracy .....	: ± 3 °C
Light source.....	: MHG bulbs
Rain simulation .....	: optional
Test chamber dimensions.....	: 160 cm x 60 cm x 60 cm

- **XENOTEST Suntest [EX]**

Light source.....	: Xenon bulbs
Irradiation power .....	: 3kW
Rain simulation .....	: pulsed mode
Test chamber capacity.....	: 10 holders of 45 cm x 130 cm

- **ATLAS Ci3000 Xenon Weather-O-meter [EX]**

Light source.....	: Xenon bulbs
Irradiation power .....	: 4500W
Rain simulation .....	: pulsed mode
Test chamber capacity.....	: 10 holders of 45 cm x 130 cm

## Optical test equipment

- **Optical LED test**

- **Instrument Systems MAS40 LED test station [ME]**

Spectral range .....	: 380 nm to 950 nm
Spectral resolution .....	: 2,5 nm
Luminous intensity sensitivity range .....	: 0,4 mcd to 4 cd
Luminous flux sensitivity range .....	: 20 mlm to 200 lm
Goniophotometer angular range.....	: ± 90°
Angular resolution .....	: 0,056°

## HALT / HASS test equipment

- **HALT / HASS test system**

**QualMark OVS 1.5HP [ME]**

Temperature range.....	-100 °C / +200°C
Temperature accuracy .....	± 1 °C
Temperature transition .....	-100 °C to +200 °C at 60 K/min
Random vibration spectrum.....	0 – 10 kHz
Max. acceleration level.....	45 Grms (2Hz-10kHz)
Testarea dimensions (wxdxh) .....	450 x 450 x 400 mm
Max. load weight.....	20 kg
Two 75*100 mm feedthrough windows for signal and temperature monitoring of device/material under test	

**QualMark OVS 4.0 [EX]**

Testarea dimensions (wxdxh) .....	1200 x 1200 x 900/1390 mm
Max. load weight.....	180 kg

- **Vibration analysis system**

**Data Physics Signal Calc 430 [ME]**

FFT analyser channels.....	8 inputs
Frequency range .....	0 - 20 kHz with 4x oversampling
Frequency resolution .....	max. 4000 lines
Dynamic range.....	80 dB

**Endevco Model 133 [ME]**

Signal conditioning inputs.....	3 PE/ISOTRON
-3dB bandwidth .....	200 kHz
High pass filter.....	4-pole BW @ 10 Hz
Low pass filter .....	4-pole BW @ @ 10 kHz

**Bruël & Kjaer 4294 Exciter [ME]**

Calibrated vibration level.....	10 ms <sup>-2</sup>
Fixed frequency .....	159.15 Hz

**PCB Piezotronics 357C10 Accelerometer [ME]**

Frequency range ±10% .....	13 kHz
Weight.....	0.45 gram
Charge sensitivity.....	1.25 pC/g
Temperature range.....	-73°C to +176°C

**Bruël & Kjaer 4326 Triaxial Accelerometer [ME]**

Frequency range ±10% .....	13 kHz (X-axis)
.....	10 kHz (Y-axis)
.....	16 kHz (Z-axis)
Charge sensitivity.....	3pC/g
Temperature range.....	-55°C to +175°C

- **Data acquisition system**

**Hewlett Packard 34970A [ME]**

Multimeter accuracy .....	6½ digit
Scan rates.....	250 chan./sec.
Multiplexer HP 34901A.....	20 channel
Thermocouple.....	T-type
Temperature range.....	-200°C to +400°C

- **Electrical test**

**Tektronix THS720A [ME]**

Bandwidth.....	100 MHz
Sampling rate.....	500 MS/s
Independent Floating and Isolated Channels.....	2

## Mechanical test equipment

- **Particle Impact Noise Detection**

**Dunegan 4501A PIND tester [ME]**

Programmable shock range .....	200g to 2000g
Vibration frequency range .....	40 Hz to 250 Hz
Acceleration range .....	max. 20 g

- **Mechanical shock**

**Lansmont M23 Shock testing machine [ME]**

Pulse shape .....	Half sinusoidal; Trapezium shaped
Pulse duration.....	0.1 ms to 40 ms
Maximum g-level.....	10000g
Max. payload .....	35 kg

**Salon Teknopaja PWB level drop tester [ME]**

Pulse shape .....	Half sinusoidal
Pulse duration.....	0.1 ms to 5 ms
Maximum g-level.....	5000g
Max. payload .....	1 kg

**Barry impuls Shock testing machine [EX]**

Pulse shape .....	Half sinusoidal
Pulse duration.....	0.2 ms to 40 ms
Maximum g-level.....	2000g
Max. payload .....	40 kg

**Event detector [ME]**

Number of channels.....	32
Event duration .....	1µs

- **Mechanical vibration**

**Ling V826LS Combo 9000 [EX]**

Rated force sine vector .....	26.6 kN (continues duty)
Frequency range .....	5 Hz to 3000 Hz
Maximum displacement.....	50.8 mm
Maximum velocity .....	2 m/s
Maximum acceleration .....	981 m/s <sup>2</sup> (100 g)

- **Bump test**

**Ling Combo 900/V826LS [EX]**

Rated force sine vector .....	26.6 kN (continues duty)
Frequency range .....	5 Hz to 3000 Hz
Maximum displacement.....	50.8 mm
Maximum velocity .....	2 m/s
Maximum acceleration .....	981 m/s <sup>2</sup> (100 g)

- **Seal test**

- **Trio Tech Bubble leak / gross leak test system [ME]**

- Temperature range selectable.....: +85 °C or +125 °C

- Test liquids.....: FC40 / FC43

- **Balzers HLT 160 Helium fine leak tester [TU]**

- Minimum detectable leakage rate.....:  $8 \times 10^{-11}$  mbar l/s

- Twin flow principle and turbopump

- Measurement cycle time.....: 30 seconds

- **MASER Vacuum / Pressure preparation station [ME]**

- Vacuum pump.....: less than 1 mbar

- Automatic liquid inlet

- Pressure programs.....: 2 bar, 4 bar

- **Bond pull / shear and Die shear**

- **Shimpo large product multipurpose force tester (<50 kgf) [ME]**

- Force range.....: <50 kgf

- Shear tool range.....: 250 µm to 10 mm in 7 steps

- **Shimpo small product multipurpose force tester (<200 gf) [ME]**

- Force range.....: <200 gf

- Shear tool.....: 25 µm

- **XYZtec Condor 150 multifunctional bond tester [ME]**

- Pull Force range 1.....: 50 gf – 800 gf

- Pull Force range 2.....: 500 gf – 8000 gf

- Pull Force range 3.....: 2500 gf – 40000 gf

- Shear Force range 1.....: 50 gf – 800 gf

- Shear Force range 2.....: 2500 gf – 40000 gf

- Shear Force range 3.....: 12500 gf – 200000 gf

- Measuring sensors accuracy.....: 0.1%

- Wafer level bump shear.....: up to 8" wafers

## Physical Analysis equipment

- **Optical Microscopy**

**Leica S6 stereo zoom 10x – 60x stereo zoom** [ME]

**Leica S8 APO StereoZoom 10x - 160x stereo zoom** [ME]

Darkfield / Nikon DS Fi1/L2 5M pixel digital camera

**Leica Z16 APO Macroscope** [ME]

Brighthfield / Darkfield / Polarised / Nikon DS Fi1/L2 5M pixel digital camera

**Leica DM/RM high power microscope 50x - 1000x** [ME]

Brighthfield / Darkfield / Polarised / Normarski illumination / Nikon DS Fi1/L2 5M pixel digital camera

**Leica DM4000 high power microscope 50x - 1000x** [ME]

Brighthfield / Darkfield / Polarised / Normarski illumination / Nikon DS Fi1/L2 5M pixel digital camera

**Leica IRM HC high power inverted microscope 50x - 1000x** [ME]

Brighthfield / Darkfield / Polarised / Normarski illumination / Nikon DS Fi1/L2 5M pixel digital camera

- **Saw / Grinding / Polishing**

**Struers Secutom-10** [ME]

**Struers DAP-7 grinder/polisher** [ME]

**Struers Pedemin-3** [ME]

**Struers TegraPol-25 grinder/polisher** [ME]

**Struers TegraForce-5** [ME]

- **Electron and Ion Microscopy**

**FEI Inspect S Low Vacuum SEM** [ME]

Tungsten hairpin filament gun beam voltage ..... : 200 V to 30 kV

Beam current ..... : > 2  $\mu$ A

Resolution in high vacuum mode, optimal WD ..... : 3,0 nm @ 30 kV; 10 nm @ 3 kV

Resolution in low vacuum mode, optimal WD ..... : < 12 nm @ 3 kV

Magnification range..... : 6x to 500.000x

4-axis eucentric goniometer stage movement ..... : 50 mm x 50 mm x 25 mm x 360°

Manual tilt movement ..... : -15° to +75°

EDX analyser ..... : EDAX Genesis XM2/4

**LEICA 440 SEM** [ME]

Tungsten hairpin filament gun beam voltage ..... : 200 V to 40 kV

Beam current ..... : > 1  $\mu$ A

Resolution ..... : 6,0 nm @ 40kV

Magnification range..... : 6x to 250.000x

3-axis eucentric goniometer stage movement ..... : 50 mm x 50 mm x 25 mm

Manual rotation ..... : 0-360°

Manual tilt movement ..... : -15° to +75°

Oxford Instruments INCA EDX analyser

**FEI NanoSEM 230 Low Vacuum / Low Voltage FE-SEM** [ME]

Schottky field emission gun beam voltage ..... : 200 V to 30 kV

Probe current ..... : 0,6 pA – 100 nA

Detectors..... : In-lens SE/BSE; ET-SED; HELIX; LVD-SED

Resolution in high vacuum mode, optimal WD ..... : 1,0 nm @ 15 kV; 1,6 nm @ 1 kV

Resolution in low vacuum mode with HELIX detector ..... : 1,5 nm @ 10 kV; 1,8 nm @ 3 kV

Magnification range..... : 35x to 1.000.000x

4-axis eucentric goniometer stage movement ..... : 50 mm x 50 mm x 25 mm x 360°

Manual tilt movement ..... : -15° to +75°

EDX analyser ..... : EDAX Genesis XM2/4

## FEI Quanta 3D FEG Dual Beam FIB/FE-SEM [ME]

Schottky field emission gun beam voltage .....	200 V to 30 kV
Probe current .....	0,6 pA – 100 nA
Detectors.....	In-lens SE/BSE; ET-SED; GAD LV-BSED; LVD-SED
SEM resolution in high vacuum mode, optimal WD.....	1,2 nm @ 30 kV; 2,9 nm @ 1 kV
SEM resolution in low vacuum mode .....	1,5 nm @ 30 kV; 2,9 nm @ 3 kV
High current Ga ion source beam voltage .....	2 kV to 30 kV
Probe current .....	1 pA – 65 nA
5-axis eucentric goniometer stage movement .....	50 mm x 50 mm x 25 mm x 360°
Motorised tilt movement.....	-15° to +75°
Magnification range.....	30x to 1.280.000x
Charge neutraliser .....	automatic mode
EDX analyser .....	EDAX Genesis XM2/4

## FEI Tecnai G<sup>2</sup> F20 XTWIN S/TEM [ME]

FEG-gun beam voltage .....	80 kV to 200 kV
Schottky field emitter beam current .....	> 100nA
TEM point resolution .....	0,25 nm
TEM information limit .....	0,14 nm
STEM HAADF resolution.....	0,18 nm
STEM magnification range.....	150x – 230Mx
EDX analyser .....	EDAX DPP II

## LEO 1550 Gemini FEG-SEM [ME/TU]

Schottky field emission gun beam voltage .....	200 V to 30 kV
Probe current .....	4pA – 10 nA
Detectors.....	In-lens SE; LV-SE; BSE
Resolution in high vacuum mode, optimal WD.....	1,5 nm @ 20 kV; 3,0 nm @ 1 kV
Magnification range.....	40x to 1.500.000x
5-axis eucentric goniometer stage movement .....	130 mm x 130 mm x 50 mm x 360°
Motorised tilt movement.....	-15° to +75°
Sample load lock .....	yes
EDX analyser .....	Noran Vantage
WDX analyser .....	Noran MAXRAY

## Philips CM300 EFTEM [TU]

FEG-gun beam voltage.....	120 kV to 300 kV
TEM point resolution .....	0,20 nm
TEM information limit .....	0,12 nm
EDX analyser .....	Noran Vantage
EELS analyser .....	GATAN Tridium

## • SEM/TEM Sample preparation

### TEM lift-out tool Omniprobe 100.7 [ME]

Basic system.....	Quanta 3D FEG
Piezo motor movement control.....	100nm

### Sample sputter coaters [ME]

Gold / Paladium coater .....	Cressington 108 auto
Carbon coater .....	Cressington 108 carbon

### Fischione model 1020 plasma cleaner [ME]

Cleaning gas .....	25% Oxygen / 75% Argon
Vacuum storage ports .....	5

- **Surface Analysis equipment**

**PHI Quantum 2000 Scanning X-ray Photoelectron Spectroscope [TU]**

Focused X-ray beam diameter ..... : < 10 micron

**ION-TOF TOF SIMS IV [EX]**

**Digital Instruments Nanoscope III, Atomic Force Microscope [TU]**

**Digital Instruments Nanoscope III, Scanning Tunneling Microscope [TU]**

- **IC circuit edit equipment**

**DCG systems OptiFIB IV Focused Ion Beam system [ME]**

Ion source ..... : Field emission gallium liquid metal

Coaxial optical microscope ..... : Visible / NIR

Front and Backside editing ..... : Yes

Beam voltage ..... : 5 kV to 30 kV in 5 kV steps

Beam current ..... : 0.5pA-20nA

Piezo stage movement ..... : 50mm x 50 mm

Piezo stage resolution ..... : <300nm

CAD based computer navigation ..... : NEXS layout and FIBassist

Depositions ..... : Pt – Mo – SiO<sub>2</sub>

Enhanced etching ..... : CU<sub>2</sub> Copper Etch – XeF<sub>2</sub> – Alu etch

**FEI 200 Focused Ion Beam system [ME]**

Ion source ..... : Field emission gallium liquid metal

Beam voltage ..... : 5 kV to 30 kV in 5 kV steps

Beam current density ..... : > 10 A/cm<sup>2</sup>

Front and Backside editing ..... : Front side only

Stage resolution ..... : 1,5 µm

Magnification range ..... : 100x to 100,000x

Specimen size ..... : up to 50 mm diameter

FIB gas chemistry ..... : Pt deposition, Iodine, XeF<sub>2</sub>, Sel. Carbon

- **Non Destructive Microscopy**

**Phoenix Nanome|x [ME]**

Maximum Deflection Voltage ..... : 180 kV

Resolution ..... : <0,5 micron

Inspection area ..... : 600 mm x 550 mm

3D reconstruction volume ..... : yes

**Phoenix BenchMate X-ray microscope [ME]**

Maximum Deflection Voltage ..... : 100 kV

Resolution ..... : 3 micron

Scanning area ..... : 150 mm x 150 mm

**Phoenix NanoTOM [EX]**

Maximum Deflection Voltage ..... : 180 kV

Resolution ..... : <0,5 micron

3D reconstruction volume resolution ..... : <1 µvoxel

**SAMTEC Evolution II UltraSonic Microscope [ME]**

Ultrasonic frequency ..... : 10-15-20-30-50-110-230 MHz

Through Scan mode ..... : yes

- **IR-Confocal Emission Microscope**

**Phemos-1000 [ME]**

Photon Emission Detectors ..... : Peltier cooled CCD and InGaAs

Obirch Analysis ..... : yes

Backside Analysis ..... : Suss PA200 DSP system with Confocal NIR laser microscopy

Objective lenses ..... : 0,8x, 5x, 20x, 100x and High NA 50x

Multiple wavelengths lasers ..... : yes

Lock-in amplifier ..... : static and P/F driven

- **Precision Grinding and Polishing**

**Ultratec ASAP-1 [ME]**

Precision grinding polishing for frontside and backside ..... : yes

Ultracollimator ..... : yes

- **Plasma Etching**

- **Bal-Tec RES 101 [ME]**

- Dual saddle field ion sources with voltage range..... : 1 kV to 10 kV
    - Beam current density..... : > 200mA
    - Etching gas ..... : Argon
    - Stage movement..... : motorised and oscillating
    - Specimen size..... : up to 25 mm diameter

- **Nextral NE 90 [ME]**

- RF power @ 13.56 MHz..... : 300 W
    - Full anisotropic etching for multilayer metals ..... : yes
    - Maximum selectable gases ..... : 4
    - Laser End Point detector ..... : yes
    - Plasma focalization ..... : yes

- **Package decapsulation**

- **B&G D-Cap Delta Dual system [ME]**

- Nitric Acid, fuming..... : yes
    - Sulfuric Acid, fuming..... : yes
    - Mixed Etchant ratio..... : selectable
    - Wide range of package adapters ..... : yes

- **Controlled Semiconductor FatCAT system [ME]**

- LASER cutter ..... : IR
    - Stage movement..... : 6" travel
    - Pattern overlay module ..... : yes

- **Device probing and Laser cutting**

- **Suss Microtec PM8 [ME]**

- Manual probes PH110 ..... : 4

- **New Wave Research [EX]**

- Laser model EzLAZE-3 wavelengths ..... : 355 nm - 532 nm

- **Wire bonding**

- **F&K Delvotec 5630 [ME]**

- Wedge – Wedge Aluminium or Gold ..... : 17,5 µm to 75 µm
    - Bonding pitch..... : 60 µm
    - Pattern recognition control ..... : yes

## Miscellaneous equipment

- **Thermo Streaming**

**Thermonix T2420 [ME]**

Temperature range.....: -70 °C to +225 °C  
 Air flow.....: up to 500 liter/min.

- **Solderability Testing**

**Metronelec ST60 [ME]**

Wetting balance test standards.....: IEC60668-2-69  
 .....: NF89400  
 Dip and Look test standards.....: MIL-STD-883 / ANSI-STD  
 Solderbath, SnPb and Pb free alloys, temperature range...: +50°C to +400°C  
 Solder globule test modules, globule sizes.....: 2mm and 4mm

**Metronelec Met-Steam 5 [ME]**

Steam and water temperature controller.....: +80°C to +100°C  
 Test chambers.....: 5

- **SMD Rework Station / Reballing Station**

**FineTech FinePlacer system [ME]**

Flow control.....: Nitrogen  
 Placing accuracy.....: 2,5 micron in x/y axis, 10 micron in z-axis  
 PC controlled hot-gas soldering.....: yes  
 Component insertion area.....: 280 x 155 mm

- **Weighing**

**Sartorius 2004 MP6 [ME]**

Weighing range.....: 166 g  
 Readability.....: 0.01 mg  
 Standard deviation.....: < ± 0.02 mg

**Sartorius LE 26 [ME]**

Weighing range.....: 5 / 21 g  
 Readability.....: 2 µg / 10 µg  
 Repeatability.....: < ± 4 µg

- **Internal Water Vapour Content**

**Pernicka Gas Analyser [EX]**

Chamber size.....: up to 6 devices simultaneously  
 Detection limit.....: 100 ppm Water  
 Other measured masses.....: He, O, N, CO, CO2, Ar,

- **Wafer Probing**

**Electroglass X2001 [TU]**

Maximum wafer size.....: 6 inch  
 Hot Chuck range.....: amb. to +175 °C

- **2D Mechanical dimension measurement**

**Mitutoyo PJ3000 [ME]**

**Mitutoyo Linear height [EX]**

**Mitutoyo surface profiler [EX]**

Working area.....: 100mm x 100mm

[ME] Facilities at MASER Engineering, operated by MASER Engineering employees.

[TU] Facilities at Twente University, operated by MASER Engineering employees.

[EX] External facilities, operated by MASER Engineering employees.