

e-Diagnostic Working Group Meeting

June 29, 2000

e-Diagnostics Data Elements - Working Group Draft

07/13/2000 2:00 PM

Data Elements Table

Category	Data elements	Relevant Data (Y/N)	Equipment capability supported	Generic (G) Equipment-specific (S)	Comments (e.g., how data is used, why data is important, explanation of data element, ...)
Equipment					
Equipment Performance Tracking and Management	Time-stamped event notifications on transitioning from one operation state to another	YES	For availability we need E10/E58 all data only.		Track tool state, availability, utilization Critical: Must establish master clock and sync for all time stamping data generators at the fab level.
	ID of current and previous operational state for equipment and each major module	YES, same as above			
	Time-stamped event notification showing updated count for units processed (count of what?)	For some tools			Tool specific?
	Component level information including component identification and parts life information and any internal threshold for maintenance	YES			Almost all tool data will be useful at some point.
	Available information about internal loadlocks.	YES	Too much detail for Equipment Performance Management		Almost all tool data will be useful at some point
	Chamber and/or sub-system specific data	YES			Sub-system performance
E10 Data	Current E10 state/substate id	YES	NEED ARAMS E58		
	Previous E10 state/substate id	YES			
	Equipment notations concerning last state transition (e.g., Operator ID, errors, ...)	YES			
	Timestamp of last state transition	YES			

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	Cycle count (# runs)	YES			
	Alarms	YES			
	Last alarm triggering downtime state (id and text)	YES			
	Component associated with last alarm (serial number and type)	YES			
	Counter for time-in-state for 6 basic states	YES			
	Reset timestamp when counters last reset	YES			
	# interrupts during Productive	YES			
	# interrupts total	YES			
	Estimated timestamp of last power-down	YES			
	User-supplied symptom for last user-selected downtime state	YES			
Summary statistics tool must track and report	RF hours since Wafers since last clean Hours since last component installed Hours on current target Time of last time-sync Pumps Endpoint is complex... PM history Requirement will soon be that Tool will have on-board ARAMS.				All are tool specific

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Equipment & Component					
	Operator / maintenance technician ID	Nice To Have	<ul style="list-style-type: none"> • Access control • Auditing/Notification 	G	Data will be used to ensure access control and audit. Maintenance or operator tech correlation to events is possible. Do not use name, legal / training concerns.
	Equipment model, serial number, and local Tool ID (equipment locator)	Y	<ul style="list-style-type: none"> • Access control • Auditing/Notification 	G	Data can be used for access control and audit.
	Equipment installation date	N	<ul style="list-style-type: none"> • Access control • Auditing/Notification 	G	Data will allow predictive maintenance timing and gross level failure data based on age of equipment.
	Installer name or ID	N	<ul style="list-style-type: none"> • Access control • Auditing/Notification 	G	Maintenance tech correlation to events is possible.
	Software revision number / level	Y	<ul style="list-style-type: none"> • Preventive Maintenance 	S	Will keep equipment configuration current.
	Software installation date	N	<ul style="list-style-type: none"> • Auditing/Notification • Preventive Maintenance 	G	Will allow correlation of software upgrade with performance and keep equipment configuration current.
	Software event logs (provides history of activity, should include history of Relevant process / sensor data)	Y	<ul style="list-style-type: none"> • Auditing/Notification • Preventive Maintenance 	S	Will allow the recreation of events to determine failure mode
	Software error logs (provides history of errors)	Y	<ul style="list-style-type: none"> • Auditing/Notification • Preventive Maintenance 	S	Will allow tracking of software faults and enable the correlation of software errors with performance
	Current tool state - production/engineering/idle/down	Y	<ul style="list-style-type: none"> • Auditing/Notification • Preventive Maintenance 	G	Allows real time assessment of tool state enabling potentially enabling remote equipment monitoring.
	Remote commands allowed in current state	N	<ul style="list-style-type: none"> • Connectivity • Equipment Control 	G	Allows remote equipment commends enabling remote diagnostic assessment.
	Security level required for remote operation / access.	N	<ul style="list-style-type: none"> • Access Control • Safety 	G	Prevents accidental remote control or security breach.
	Current equipment location or run status (i.e., position or location product)	Y	<ul style="list-style-type: none"> • Auditing/Notification 	S	Allows assessment of product status to potentially reduce misprocessing and aid in the assessment of failure modes.

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	Reset / Reboot history	Y			
	Component = Field Replaceable Unit				Need more detail by component type. Differentiate between function (software) and component identification. The equipment supplier needs to access data for subcomponents integrated into tool (not the component supplier).

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Component					
	Replacement spare part ID (serial number or part number)	Y	<ul style="list-style-type: none"> Auditing/Notification Preventive Maintenance 	G	Useful to suppliers. Enables the equipment to maintain configuration data and may allow the correlation of certain configuration or parts sources with performance. Leverage e-business, e-commerce.
	Tool configuration including hardware and software	Y	<ul style="list-style-type: none"> Auditing/Notification 	S	Enables the equipment to maintain configuration data and may allow the correlation of certain configuration with performance. As much as can be read by software.
	Replacement spare part installation date	N	<ul style="list-style-type: none"> Auditing/Notification Preventive Maintenance 	G	Data will allow predictive maintenance timing and gross level failure data based on age of part. May also allow correlation of parts installations with equipment performance.
	Component ID (i.e., sensor, motor, robot, power supply)	N	<ul style="list-style-type: none"> Auditing/Notification Preventive Maintenance 	S	Data will allow the connection of performance signals to specific components.
	Component performance/diagnostics data (drive current, temperature, moisture)	Y	<ul style="list-style-type: none"> Preventive Maintenance 	S	Data will allow predictive maintenance based on declining performance.
	Component run time (hours, wafers, cycles, etc)	N	<ul style="list-style-type: none"> Preventive Maintenance 	G	Data will allow predictive maintenance based on age or use of component. May also allow correlation of use with performance. Requires human intervention.
	Upgrade ID for configuration changes	N	<ul style="list-style-type: none"> Auditing/Notification Preventive Maintenance 	S	Enables the equipment to maintain configuration data and may allow the correlation of certain configuration with performance.
	Upgrade installation date	N	<ul style="list-style-type: none"> Auditing/Notification 	G	Will allow correlation of upgrade with performance and keep equipment

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			<ul style="list-style-type: none"> Preventive Maintenance 		configuration current. Requires human intervention.
	PM counters (provides preventative maintenance look-ahead - could be time or cycles)	N	<ul style="list-style-type: none"> Auditing/Notification Preventive Maintenance 	G	Allows enhanced planning of PM procedures. Human dependent.
	Relevant / selected process / sensor data on demand (real-time reading of Critical parameters)	Nice to Have	<ul style="list-style-type: none"> Auditing/Notification Preventive Maintenance 	S	Data will allow diagnosis based on data, research of failure modes, and predictive maintenance based on trending performance data.

Component group answered NO for relevant data if manual input required.
 Some of the data labeled No would be useful to receive to enable preventive maintenance.

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Process / Sensor					
	Temperature				Example IO points for key process parameters. Collection and analysis of data from complementary & redundant subsystems / sensors.
	Flows				
	Pressure				
	Speed (pull/push)				
	Dispense/flowtime				
	Ambient temperature				
	Coolant temperature				
	Dispense/flow pressure				
	Beam current				
	Source life				
	Time/wafers since clean				
	Command control timestamp				
	Various calibration timestamps & data				
	Position data				
	Relevant driving inputs for an output				
	Compare input against output				
	Process x sensitivity				
	Timestamp				
	Wafer transfer time				
	Flow time				
	RF power phase shift, vector impedance, forward and reflected powers				
s	What components are involved				
	Alarms association				
	Correlation with all other data				
	Date/time of process excursion				

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Wafer					
	Recipe				Note: This data is examples and must be modified by tool type.
	Lot				
	Carrier/Slot				
	Wafer ID				
	Layer / Level				
	Chamber(s)				
	Load Position				
	Wafer temperature				
	Incoming wafer properties				
	Incoming plasma optical signals				
	Incoming particles				
	Film tension				
	Sheet resistance				
	CD				
	Film thickness				
	Film uniformity				
	Yield data				
	e-test parameters				
	Overlay measurements				
	Polish time				
Issues					
	Sampling rate / # data points				
	Bandwidth				
	35 datapoints per chamber @ 1 Hz				
	Retention time				
	Summarization methodology				
	Storage format				
	Use of std. compression algorithms				
	# G per quarter? 10				

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Factory					
	EMI	Y	Diagnostics Safety	Both	
	Power Transience	Y	Diagnostics	G	Trace equipment issues due to power marginality
	DI Water temperature	Y	Diagnostics	Both	Trace equipment issues due to temp.
	DI Water purity	Y	Diagnostics	Both	Trace equipment issues to purity.
	Clean room class/particle counts	Y	Diagnostics		
	Factory Material Handling	Y	Diagnostics		Tool correlation
	Gas/chemical purity	Y	Diagnostics	Both	
	Environmental Humidity/temp	Y	Diagnostics	G	
	Air flow	Y	Diagnostics	G	
	Barometric pressure	Y	Diagnostics	G	
	Process cooling water temp/pressure	Y	Diagnostics	Both	
	Vacuum	Y	Diagnostics	S	
	Vibration	Y	Diagnostics	Both	
	Noise pollution	Y	Diagnostics Safety	Both	
	Radiation Monitor data	Y	Diagnostics Safety	Both	
	Network status	?	Diagnostics	G	
	Fab Population	?	Diagnostics	G	
	Exhaust pressure/chemistry/temp/flow rate	Y	Safety Diagnostics	Both	

Component Data?

- Equipment state. Does the tool need to know how it is installed (pedestal vs. slab)?
- Incoming wafer variability
- Previous tool status (blame deflector)
- Bottleneck

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- Product ID or product mix or recipe