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KIGEM
Automation Software

User's Manual

KIGEM-900-01 Rev. C / September 2019

KIGEM-900-01C

KEITHLEY
A Tektronix Company

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Automation Software

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Cleveland, Ohio, U.S.A.

These are the original instructions in English.

Document number: KIGEM-900-01 Rev. C / September 2019

Software safety precautions

KEITHLEY
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Before using this product, see the safety precautions associated with your instrument. The instrument associated with this software is intended for use by personnel who recognize shock hazards and are familiar with the instrument safety precautions to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using any instrument.

Refer to your instruments user documentation for complete product specifications. If the product is used in a manner not specified, the protection provided by the product warranty may be impaired.

Safety precaution revision as of January 2018.

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Section 1

General information

In this section:

Introduction

Keithley Instruments 300mm SECS/GEM Automation Interface (KIGEM) on the S530 Parametric Test system provides an interface that complies with both the traditional SECS/GEM standards and the newer set of 300mm SEMI standards. It allows S530 systems to be integrated into fully-automated semiconductor fabrication facilities.

The KIGEM specifications described in this manual are based on version 5.7.2A of the KIGEM software. This document may not accurately describe other versions of the software. Additional information about KIGEM 300mm specifications can be found in the KIGEM Automation Reference Manual (KIGEM-901-01), KIGEM Release Notes (KIGEM-910-01), and the associated customer-specific implementation documents.

SEMI standard versions

The following table shows the SEMI standard versions.

Standard	KIGEM version	Description
	5.7.2a **5.7.2b**	
SEMI E4	0699(0612)	SEMI Equipment Communications Standard 1 Message Transfer (SECS I)
SEMI E5	0813	SEMI Equipment Communications Standard 2 Message Content (SECS II)
SEMI E30	0416	Generic Model for Communications and Control of Manufacturing Equipment (GEM)
SEMI E37	0413	High-Speed SECS Message Services (HSMS) Generic Services
SEMI E37.1	0702(0413)	High-Speed SECS Message Service Single Selected-Session Mode (HSMS-SS or HSMS-SSS)
SEMI E39	0703(0614)	Object Services Standard: Concepts, Behavior and Services
SEMI E40	0813	Standard for Processing Management
SEMI E40.1	0813	SECS-II Support for Processing Management Standard
SEMI E87	0312	Carrier Management (CMS)
SEMI E87.1	0707	Provisional Specification for SECS-II Protocol for Carrier Management (CMS)
SEMI E90	0312	Substrate Tracking
SEMI E90.1	0312	Provisional Specification for SECS-II Protocol Substrate Tracking
SEMI E94	0314	Control Job Management
SEMI E109	1110	Reticle and Pod Management (RPMS) KIGEM does not support E109 capabilities for internal buffer tools. It also does not support the optional capability of Reticle Transfer Jobs.
SEMI E109.1	1110	SECS-II Protocol for Reticle and Pod Management (RPMS)
SEMI E116	0707E	Equipment Performance Tracking
SEMI E116.1	0707	SECS-II Protocol for Equipment Performance Tracking (EPT)
SEMI E148	1109	Time Synchronization and Definition of the TS-Clock Object
SEMI E157	0611	Module Process Tracking

Note about source materials and other reference documents

Some of the content in this manual is borrowed from the I300I/J300 CIM Global Joint Guidance for 300mm Semiconductor Factories standards and ConX300 documentation, which is a trademark of PEER Intellectual Property, Inc.

In addition to this manual, you will also need the following Keithley manuals:

- KIGEM Automation Software Users Manual (document number KIGEM-900-01)
- KIGEM Automation Software Release Notes (document number KIGEM-910-01)

For more information on other KTE components and building user libraries, refer to:

- S530 Parametric Test System Reference Manual (document number S530-901-01)
- Keithley Test Environment (KTE) Programmer's Manual (document number S500-904-01)

Information in this manual has also been derived from the following SEMI standards documents.

You should also be familiar with:

- SEMI E4 SEMI Equipment Communications Standard 1 Message Transfer (SECS-I)
- SEMI E5 SEMI Equipment Communications Standard 2 Message Content (SECS-II)
- SEMI E30 Generic Model for Communications and Control of SEMI Equipment (GEM)
- SEMI E37 High-Speed SECS Message Services (HSMS) Generic Services
- SEMI E37.1 High-Speed SECS Message Services Single-Session Mode (HSMS-SS)
- SEMI E39 and E39.1 Object Services
- SEMI E40 and E40.1 Processing Management
- SEMI E84 Enhanced Carrier Handoff Parallel I/O Interface
- SEMI E87 and E87.1 Carrier Management
- SEMI E90 and E90.1 Substrate Tracking
- SEMI E94 and E94.1 Control Job Management
- SEMI E95 Human Interface for Semiconductor Manufacturing Equipment

Section 2

System architecture

In this section:

Single-wire solution

The goal for KIGEM automation is to deliver and support fully-integrated equipment with a single communication link to the Host.

NOTE

The following descriptions for I300I/J300 CIM Global Joint Guidance for 300mm Semiconductor Factories Release Five (April 2000) standards are quoted in this manual. This is copyright-protected material.

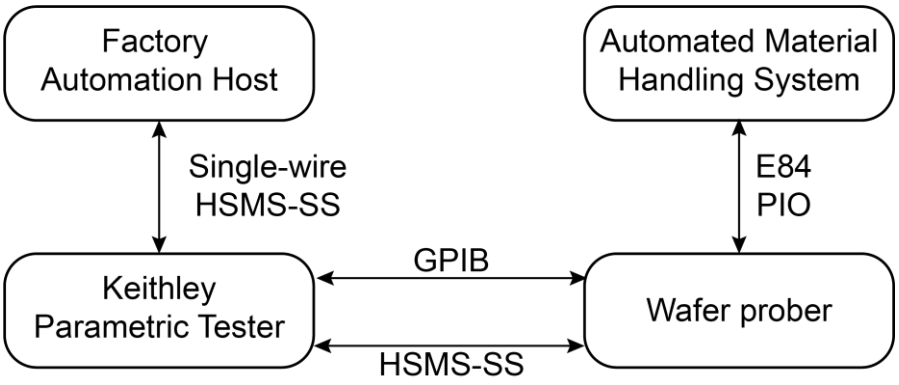
The first guideline of I300I/J300 CIM Global Joint Guidance for 300mm Semiconductor Factories Release Five (April 2000) specifies:

"A single physical communication connection must link the production equipment to the Host. A single physical communication connection means that the Equipment Front End Module (EFEM) is integrated through the production equipment rather than connected directly to the Host."

Because a parametric test system consists of a tester and a wafer prober that come from two equipment vendors, only one of them can be connected directly to the Host.

Keithley S530 Series testers meet this requirement. This is achieved by providing a single, fully-integrated 300mm SECS/GEM equipment interface to the factory automation host for both the tester and the prober. The interface acts as a host to the wafer prober and provides transparent integration of 300mm SEMI standards implemented on the wafer prober.

Figure 1: Single-wire solution

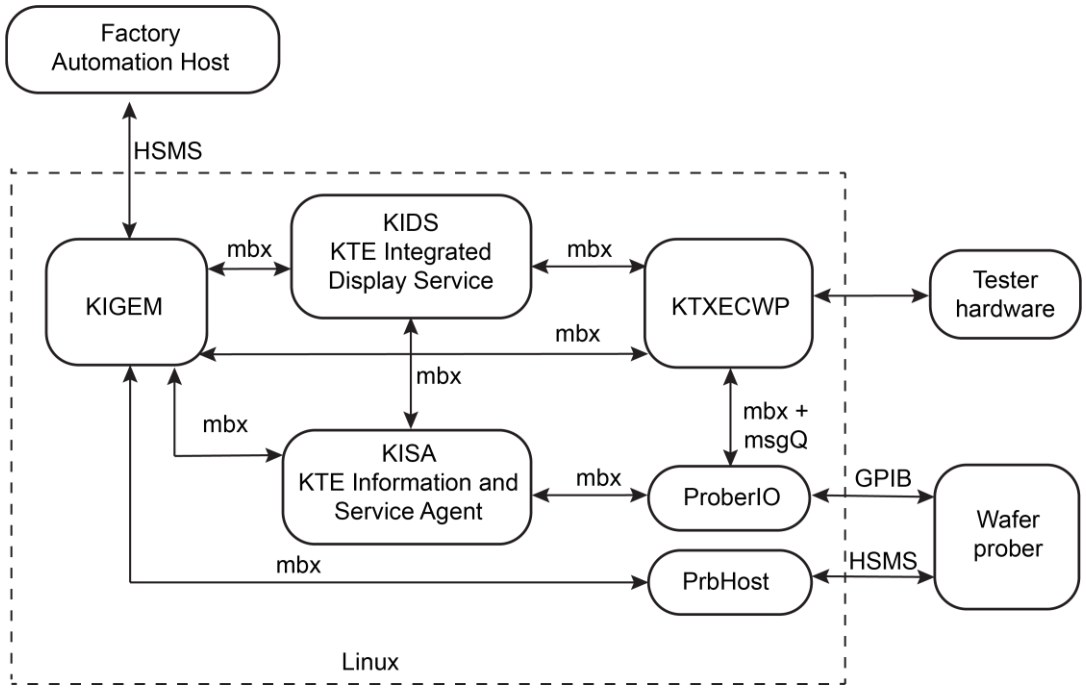


KTE overall architecture

Keithley Test Environment (KTE) consists of many software components that work together and communicate with each other. All of the KTE components run on the Linux® computer.

The following figure shows the overall architecture of KTE.

Figure 2: Keithley Test Environment (KTE) overall architecture



In this architecture, KIGEM is the main application that provides a single-wire 300mm SECS/GEM equipment interface to the Factory Automation Host. Since it runs in the background, all user-interactions are handled by KIDS (Keithley Integrated Display Service).

ProberIO is responsible for communication with the wafer prober through GPIB, and PrbHost is responsible for communication with the wafer prober through HSMS (High-speed SECS Message Services). KISA (KTE Information and Service Agent) is an assistance application that can be customized through user-access points (UAPs).

KIGEM overview

KIGEM is the KTE software component that communicates with the Factory Automation Host. It provides a single-wire, 300mm SECS/GEM equipment interface that complies with all applicable SEMI standards.

KIGEM runs in the background on a Linux® computer and uses the ConX300® software driver from PEER Group, Inc. The 300mm SECS/GEM driver is widely used and guarantees that low-level communications and key state models of KIGEM comply with SEMI standards.

KIGEM uses DataHub to communicate with other KTE components on a Linux® computer. All KIGEM user interactions are executed on the Linux® computer using KIDS.

KIDS overview

KIDS (Keithley Integrated Display Service) is the primary graphical user interface (GUI) of KTE. It is designed to comply with the SEMI E95 (Specification for Human Interface for Semiconductor Manufacturing Equipment) standard.

KIDS provides an integrated display for several KTE components including KTXECWP and KIGEM. Test status and test results are displayed on KIDS. It also allows an operator to select and start a recipe.

KIDS also serves as the GUI for KIGEM. SECS/GEM communication statuses and KIGEM control buttons are accessible on the KIDS GUI. This design provides access to KIGEM from a Linux® computer.

KTXECWP overview

KTXECWP is based on KTXE (Keithley Test Execution Engine). It is a test program that performs measurements. KTXECWP is started when the operator or Host starts a test. It terminates when the test is completed, stopped, or aborted. When KIDS is running, KTXECWP runs in the background and uses KIDS to display test status and results.

Refer to the S530 Reference Manual (document Number S530-901-01) for more information on KTXE.

KISA overview

KISA (Keithley Information and Service Agent) is an event-driven application that runs on the Linux® computer. It is automatically started when the Linux® computer is booted. KISA runs in the background and waits for DataHub messages from other KTE components.

When KISA receives a message, it executes a user library function specified in its `.ini` file. KTE comes with several built-in KISA user libraries. Additional user libraries can be created using KULT (Keithley User Library Tool).

Both KIDS and KIGEM use KISA to retrieve a list of available recipes and start a test.

ProberIO overview

ProberIO is the KTE component that is responsible for managing all GPIB communications with the wafer prober. It is automatically started when the Linux® computer is booted. ProberIO runs in the background and waits for prober commands from other KTE components.

There are two input channels for sending prober commands to ProberIO. The msgQ channel is used primarily by KTXECWP during test program execution. It is a fast channel (microseconds), but it is not cross-platform. The other input channel uses DataHub mailbox messages (mbx). It is a cross-platform channel but functions at a lower speed than msgQ (milliseconds). This allows you to issue material-handling GPIB commands for a second load port while running test programs on the first load port on dual-port probers.

Since the ProberIO is always running in the background, it can be customized to trap GPIB unsolicited events (SRQs) from the prober. For instance, you might customize the ProberIO to trap GPIB unsolicited events when a Carrier is placed or removed. This can be done through user-access points.The custom code can update the `port_status` table in the DataHub to notify all applicable KTE components.

PrbHost overview

PrbHost is a KTE component that acts as a SECS/GEM automation Host to the wafer prober. It is automatically started by ProberIO when the Linux® computer is booted. PrbHost runs in the background.

PrbHost establishes, configures, and maintains HSMS communications links with the prober. It uses a SEMI E30 (GEM) protocol to establish communications, set applicable Equipment Constants, create event reports, and enable collection events. It notifies KIGEM of all collection events and alarms that it receives from the prober.

PrbHost is also an event-driven application. Other KTE components can perform HSMS transactions with the prober by sending DataHub messages to PrbHost. For example, KIGEM uses this mechanism to query Status Variables and send E87 commands to the wafer prober.

DataHub overview

DataHub is a message and in-memory database server from Hume Integration Software. It is automatically started when the Linux® computer is booted. DataHub runs in the background.

DataHub is used in KTE for communications among KTE components, storing global status information, and other purposes. Each KTE component can open a mailbox in the DataHub and be notified whenever a message is sent to the mailbox. Each component can also create, modify, delete, or subscribe to a database table in the DataHub. A table subscription causes the component to be notified whenever there is a change in the table. It allows an efficient mechanism to notify all applicable KTE components whenever an event occurs such as carrier arrival and removal events and starting or ending tests.

Section 3

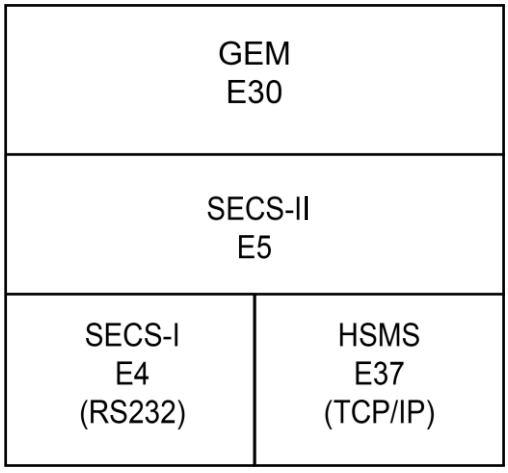
SECS/GEM user applications

In this section:

Basic SECS/GEM concepts

SECS/GEM, also referred as Keithley GEM (KIGEM), stands for SEMI Equipment Communication Standard/Generic Equipment Model and includes SECS-I, HSMS, SECS-II and GEM. The following figure shows the basic SECS/GEM structure.

Figure 3: Basic SECS/GEM structure



SECS: SEMI Equipment Communications Standard

The following sections explain the SECS communication standards for SEMI E4, SEMI E37, and SEMI E5.

SEMI E4: SEMI Equipment Communications Standard 1 Message Transfer (SECS-I)

The SECS-I Standard defines point-to-point communication of data utilizing a subset of the international standard known in the U.S.A. as EIA RS-232-C and in Japan as JIS C 6361 for the connector and voltage levels.

SEMI E37: High-speed SECS message services (HSMS) generic services

HSMS defines a communication interface suitable exchanging messages between computers in a semiconductor factory. HSMS is intended as an alternative to SEMI E4 (SECS-I) for applications where higher-speed communication is needed or when a simple point-to-point topology is insufficient. In Keithley KIGEM software, we are using SEMI E37 instead of E4.

SEMI E5: SEMI Equipment Communications Standard 2 Message Content (SECS-II)

SECS-II defines the details of the interpretation of messages exchanged between intelligent equipment and a host. It gives form and meaning to messages exchanged between the equipment and the host using a message transfer protocol such as SECS-I.

GEM: Generic Model for Communications and Control of Manufacturing Equipment

The SEMI E30 communications and control standard is explained in the following section.

SEMI E30: Specification for Generic Model for Communications and Control of Manufacturing Equipment (GEM)

GEM defines a standard implementation of SECS-II for all semiconductor manufacturing equipment. The GEM Standard defines a common set of equipment behavior and communications capabilities that provide the functionality and flexibility to support the manufacturing automation programs of semiconductor device manufacturers. Equipment suppliers may provide additional SECS-II functionality not included in GEM as long as the additional functionality does not conflict with any of the behavior or capabilities defined in GEM. Such additions may include SECS-II messages, collection events, alarms, remote command codes, processing states, variable data items (data values, status values or equipment constants), or other functionality that is unique to a class (like etchers and steppers) or specific instance of equipment. Please read the SEMI standard for more details.

SxFx

The SxFx is Streams and Functions, for example S1F1. It is from the message transfer protocol of SEMI E5. The message transfer protocol is used to send messages between equipment and host. The message transfer protocol must be capable of sending a primary message, indicating whether a reply is requested; and, if a reply is requested, it must be capable of associating the corresponding secondary message or reply message with the original primary message. The term originator will refer to the creator of the original primary message. The term interpreter will refer to the entity that interprets the primary message at its destination and generates a reply when requested.

Primary message: an odd numbered message.

Second message: an even-numbered message.

Streams: a stream is a category of messages intended to support similar or related activities.

Functions: a function is a specific message for a specific activity within a stream.

All the functions used in SECS-II will follow a numbering convention corresponding to primary and secondary message pars. All primary messages will be given an odd-numbered function code. The reply message function code is determined by adding one to the primary message function code. The even-numbered function following a primary message which requests no reply is reserved and is not to be used.

ON-LINE / OFF-LINE mode

The Control model provides the host with three basic levels of control. In the highest level (Remote), the host may control the equipment to the full extent possible. The middle level (Local) allows the host full access to information, but places some limits on how the host can affect equipment operation. In the lowest level (OFF-LINE), the equipment allows no host control and only very limited information.

The Remote and Local both belongs to the ON-LINE mode.

OFF-LINE has three substates: EQUIPMENT OFF-LINE, ATTEMPT ON-LINE, AND HOST OFF-LINE.

OFF-LINE

When the OFF-LINE state is active, operation of the equipment is performed by the operator at the operator console. While the equipment is OFF-LINE, message transfer is possible. However the use of messaging for any automation purpose is severely restricted. While the OFF-LINE state is active, the equipment will only respond to those messages used for the establishment of communications or a host request to activate the ON-LINE state.

OFF-LINE / EQUIPMENT OFF-LINE

While this state is active, the system maintains the OFF-LINE state. It awaits operator instructions to attempt to go ON-LINE.

OFF-LINE / ATTEMPT ON-LINE

While the ATTEMPT ON-LINE state is active, the equipment has responded to an operator instruction to attempt to go to the ON-LINE state. Upon activating this state, the equipment attempts to send an S1,F1 to the host.

Note that when this state is active, the system does not respond to operator actuation of either the ON-LINE or the OFF-LINE switch.

OFF-LINE / HOST OFF-LINE

While the HOST OFF-LINE state is active, the operator’s intent is that the equipment be ON-LINE. However, the host has not agreed. Entry to this state may be due to a failed attempt to go ON-LINE or to the host’s request that the equipment go OFF-LINE from ON-LINE. While this state is active, the equipment shall positively respond to any host’s request to go ON-LINE (S1,F17). Such a request shall be denied when the HOST OFF-LINE state is not active.

ON-LINE

While the ON-LINE state is active, SECS-II messages may be exchanged and acted upon. Capabilities that may be available to the host should be similar to those available from the operator console wherever practical.

The use of Sx,F0 messages is not required while the ON-LINE state is active. Their use is discouraged in this case. The only allowed use is to close open transactions in conjunction with message faults.

ON-LINE / LOCAL

Operation of the equipment is implemented by direct action of an operator. All operation commands shall be available for input at the local operator console of the equipment.

The host shall have the following capabilities and restrictions when the LOCAL state is active:

- The host shall be prohibited from the use of remote commands that cause physical movement or which initiate processing. During processing, the host shall be prohibited from the use of any remote command that affects that process.
- During processing, the host shall be prohibited from modifying any equipment constants that affect that process. Other equipment constants shall be changeable during processing. The host will be able to modify all available equipment constants when processing is stopped.
- The host shall be capable of initiating the upload and download of recipes to/from the recipe storage area on the equipment. The host shall be capable of selecting recipes for execution so long as this action does not affect any currently executing recipe.
- The host shall be able to configure automatic data reporting capabilities including alarms, event reporting, and trace data reporting. The host shall receive all such reports at the appropriate times.
- The host shall be able to inquire for data from the equipment, including status data, equipment constants, event reports, Process Recipe directories, and alarms.
- The equipment shall be able to perform Terminal Services as defined in GEM.

The host shall be allowed any other capabilities that were not specifically restricted in the above items as long as the LOCAL state is active.

ON-LINE / REMOTE

For equipment which supports the GEM capability of remote control, while the REMOTE state is active, the host shall have access, through the communications interface, to the necessary commands to operate the equipment through the full process cycle in an automated manner. The equipment does not restrict any host capabilities when REMOTE is active. The degree of control executed by the host may vary from factory to factory. In some cases, the operator maybe required to interact during remotely controlled processes. This interaction may involve set-up operations, operator assist situations, and others. This state is intended to be flexible enough to accommodate these different situations.

To support the different factory automation policies and procedures, it shall be possible to configure the equipment to restrict the operator in specific non-emergency procedures. These restrictions shall be configurable so that the equipment may be set up to allow the operator to perform necessary functions without contention with the host.

The categories for configuration shall include (but are not limited to):

- Change equipment constants (process-related)
- Change equipment constants (non-process-related)
- Initiate process recipe download
- Select process recipe
- Start process recipe
- Pause/resume process recipe
- Operator assist
- Material movement to/from equipment
- Equipment-specific commands (on a command-by-command basis if needed)

No Capabilities that are available to the operator when the LOCAL state is active should be unconditionally restricted when the REMOTE state is active. The supplier may provide for configurable restriction of operator capabilities not included in the list above if desired. No configurability is necessary for any operator functions not available to the host.

The control functions must be shared to some degree between the host and the local operator. At the very least, the operator must have the capability to change the CONTROL state, actuate an Emergency Stop, and interrupt processing (such as STOP, ABORT, or PAUSE). All of these capabilities except Emergency Stop may be access-limited.

The host software should be designed to be compatible with the capabilities allotted to the operator.

Access Mode

The Access Mode State Model define the host view of equipment access mode, as well as the host interactions with the equipment necessary to switch the Access Mode. Each load port has its own Access Mode State Model. There are two access modes states: MANUAL and AUTO.

MANUAL: A substate of Access Mode. When the production equipment or specified load ports are in this mode, only manual (non-AMHS) carrier transfers are allowed. The production equipment may generate an alarm if an automated (AMHS) transfer is attempted, but this capability is not required. If a `ChangeAccess` service with the value of MANUAL is received in this state, the equipment shall accept the service and no event is sent for this action.

AUTO: A substate of Access Mode. When the production equipment or specified load ports are in this mode, only automated (AMHS) carrier transfers are allowed in normal operation. The production equipment shall have the capability of generating an `AccessModeViolation` alarm if a manual transfer is attempted. If a `ChangeAccess` service with the value of AUTO is received in this state, the equipment shall accept the service and no event is sent for this action.

Critical terms and concepts

SECS/GEM data types can be classified as SV, ECV, or DVVAL. Status values (SVs) always contain valid information, while data values (DVVALs) may only be valid upon the occurrence of a particular event. All equipment constants (ECVs) are stable by the Host.

The following terms and concepts are important for you to know when working with KIGEM:

VID: Variable Data ID. A unique identifier of a variable data item. The set of VIDs is a combination of all SVIDs, ECIDs, and IDs for DVVALs.

SVID: Status variable ID. Status variables may include any parameter that can be sampled in time such as temperature or quantity of a consumable.

SV: Status variable value.

DVNAME: Data value name.

DVVAL: Data Value.

DVVALNAME: A descriptive name for the data variable.

ECID: Equipment constant ID.

ECV: Equipment constant value.

RPTID: Report ID. A unique identifier of a specific report.

CEID: Collected event ID.

ALID: Alarm identification.

Substrate: Material held within a carrier. This can be a product such as a wafer.

FOUP: Front opening unified pod.

Carrier: A container, such as a FOUP or open cassette, with one or more positions for holding substrates.

Carrier Location: A carrier location, signified by `LocationID`, is used for tracking carriers as they move through the equipment.

Load Port: A load port is used by the factory to load and unload carriers to and from production equipment.

AMHS: Automated material handling system

PJ: Process Job. A Process Job is a single unit of work that ensures that appropriate processing is applied to a material by a processing resource. The Process Job provides an applicable supervisory control capability for automated processing of material in equipment no matter which process is being used. The Process Job creates a transient link between the three elements of the manufacturing process:

- The material to be processed.
- The equipment where the process will occur.
- The process specification, a Process Recipe.

When a Process Job has completed, it is deleted. The Process Job ID is no longer valid.

CJ: Control Job. The Control Job is used to group a set of related Process Jobs. The group is logically related from the Host's viewpoint. For instance, if a carrier contains multiple lots, then the Process Jobs for each lot (in the carrier) could be included in the Control Job specification. Control Jobs also provide mechanisms for specifying the destination for processed material.

Standard workflow

The following tables describe the processes that are completed between the Host and the Tester in a standard workflow.

NOTE

Tester refers to your Keithley test system in the following tables.

Communication establishment

The following table shows the standard workflow for Communications establishment.

Tester	Message	Host
	<-- S1F13 S1F14 -->	Establish communication
Request online	S1F17 --> <-- S1F18	
AccessSMGoManual/Auto (CEID: 5102/5103)	S6F11 --> <-- S6F12	

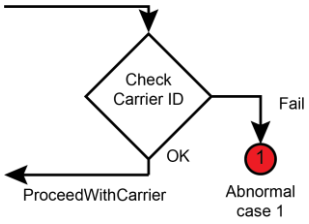
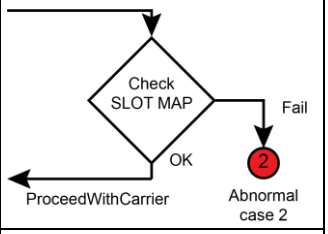
Events and Alarms configuration

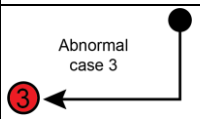
The following table shows the standard workflow for Events and Alarms configuration.

Tester	Message	Host
	<-- S2F37 S2F38 -->	Disable all CEIDs
	<-- S2F33 S2F34 -->	Delete all RPTIDs
	<-- S2F33 S2F34 -->	Define all RPTIDs
	<-- S2F35 S2F36 -->	Attach RPTIDs to CEIDs
	<-- S2F37 S2F38 -->	Enable CEIDs
	<-- S5F3 S5F4 -->	Enable Alarms

Starting a test

The following table shows the standard workflow for starting a test.

Tester	Message	Host
PortTransferSMTrans06 READY TO LOAD ->TRANSFER BLOCKED (CEID: 5146)	S6F11 -->` <-- S6F12	
CarrierClamped (CEID: 5107)	S6F11 -->` <-- S6F12	
AssocSMGoAssoc NOT ASSOCIATED->ASSOCIATED (CEID: 5134)	S6F11 -->` <-- S6F12	
CarrierSMTrans03 no state->WAITING FOR HOST (CEID: 5113)	S6F11 -->` <-- S6F12	
	<-- S3F17 S3F18 -->	
CarrierSMTrans08 WAITING FOR HOST->ID VERIFICATION OK (CEID: 5118)	S6F11 -->` <-- S6F12	
CarrierLocationChange (CEID: 5106)	S6F11 -->` <-- S6F12	
CarrierSMTrans14 SLOT MAP NOT READ->WAITING FOR HOST (CEID: 5124)	S6F11 -->` <-- S6F12	
	<-- S3F17 S3F18 -->	
CarrierSMTrans15 WAITING FOR HOST->SLOT MAP VERIFICATION OK (CEID: 5125)	S6F11 -->` <-- S6F12	
	<-- S16F11 S16F12 -->	Create PJ

Tester	Message	Host
PrJobSMTrans01 no state-> QUEUED/POOLED (CEID: 5301)	S6F11 --> <-- S6F12	
	<-- S14F9 S14F10 -->	Create CJ
CtrlJobSMTrans01 no state-> QUEUED (CEID: 5401)	S6F11 --> <-- S6F12	
CtrlJobSMTrans03 QUEUED->SELECTED (CEID: 5403)	S6F11 --> <-- S6F12	
CtrlJobSMTrans05 SELECTED-> EXECUTING (CEID: 5405)	S6F11 --> <-- S6F12	
PrJobSMTrans02 QUEUED/POOLED-> SETTING UP (CEID: 5302)	S6F11 --> <-- S6F12	
CarrierSMTrans18 NOT ACCESS-> IN ACCESS (CEID: 5128)	S6F11 --> <-- S6F12	
PrJobSMTrans04 SETTINGUP-> PROCESSING (CEID: 5304)	S6F11 --> <-- S6F12	
EndOfSite (CEID: 103)	S6F11 --> <-- S6F12	
	..... (Series of EndOfSite(s))	

Tester	Message	Host
EndOfWafer (CEID: 104)	S6F11 --> <-- S6F12	
PrJobSMTrans06 PROCESSING-> PROCESS COMPLETE (CEID: 5306)	S6F11 --> <-- S6F12	
CtrlJobSMTrans10 EXECUTING-> COMPLETED (CEID: 5410	S6F11 --> <-- S6F12	
EndOfCarrier (CEID: 200)	S6F11 --> <-- S6F12	
CarrierSMTrans19 IN ACCESS->CARRIER COMPLETE (CEID: 5129)	S6F11 --> <-- S6F12	
CarrierLocationChange (CEID: 5106)	S6F11 --> <-- S6F12	
CarrierUnclamped (CEID: 5108)	S6F11 --> <-- S6F12	
PortTransferSMTrans09 TRANSFER BLOCKED-> READY TO UNLOAD (CEID: 5149)	S6F11 --> <-- S6F12	
PortTransferSMTrans07 READY TO UNLOAD-> TRANSFER BLOCKED (CEID: 5147)	S6F11 --> <-- S6F12	
AssocSMGoNotAssoc ASSOCIATED-> NOT ASSOCIATED (CEID: 5136)	S6F11 --> <-- S6F12	
PortTransferSMTrans08 TRANSFER BLOCKED-> READY TO LOAD (CEID: 5148)	S6F11 --> <-- S6F12	
PrJobSMTrans07 PROCESS COMPLETE-> termination (CEID: 5307)	S6F11 --> <-- S6F12	
CtrlJobSMTrans13 COMPLETED-> termination (CEID: 5413)	S6F11 --> <-- S6F12	

Abnormal workflow

The following tables describe the processes that are completed between the Host and the Tester in a standard workflow.

NOTE

Tester refers to your Keithley test system in the following tables.

Abnormal case 1: CarrierID Verification Fail

The following table shows an abnormal workflow for a failed CarrierID Verification.

Tester	Message	Host
	<-- S3F17 S3F18 -->	`CancelCarrier`
`CarrierSMTrans09` WAITING FOR HOST->ID VERIFICATION FAILED (CEID: 5119)	S6F11 -->` <-- S6F12	
`CarrierUnclamped` (CEID: 5108)	S6F11 -->` <-- S6F12	
`PortTransferSMTrans09` TRANSFER BLOCKED ->READY TO UNLOAD (CEID: 5149)	S6F11 -->` <-- S6F12	
`PortTransferSMTrans07` READY TO UNLOAD ->TRANSFER BLOCKED (CEID: 5147)	S6F11 -->` <-- S6F12	
`AssocSMGoNotAssoc` ASSOCIATED->NOT ASSOCIATED (CEID: 5136)	S6F11 -->` <-- S6F12	
`PortTransferSMTrans08` TRANSFER BLOCKED-> READY TO LOAD (CEID: 5148)	S6F11 -->` <-- S6F12	

Abnormal case 2: Slotmap Verification Fail

The following table shows an abnormal workflow for failed Slotmap Verification.

Tester	Message	Host
	<-- S3F17 S3F18 -->	CancelCarrier
CarrierSMTrans26 WAITING FOR HOST -> SLOT MAP VERIFICATION FAIL (CEID: 5126)	S6F11 --> <-- S6F12	
CarrierLocationChange (CEID: 5106)	S6F11 --> <-- S6F12	
CarrierUnclamped (CEID: 5108)	S6F11 --> <-- S6F12	
PortTransferSMTrans09 TRANSFER BLOCKED -> READY TO UNLOAD (CEID: 5149)	S6F11 --> <-- S6F12	
PortTransferSMTrans07 READY TO UNLOAD-> TRANSFER BLOCKED (CEID: 5147)	S6F11 --> <-- S6F12	
AssocSMGoNotAssoc ASSOCIATED->NOT ASSOCIATED (CEID: 5136)	S6F11 --> <-- S6F12	
PortTransferSMTrans08 TRANSFER BLOCKED-> READY TO LOAD (CEID: 5148)	S6F11 --> <-- S6F12	

Abnormal case 3: Control Job Stop

The following table shows an abnormal workflow for a Control Job Stop.

Tester	Message	Host
	<-- S16F27 S16F28 -->	CJStop
PrJobSMTrans11 EXECUTING-> STOPPING (CEID: 5311)	S6F11 --> <-- S6F12	
EndOfSite (CEID: 103)	S6F11 --> <-- S6F12	
	..... (Series of EndofSite of current wafer)	

Tester	Message	Host
EndOfWafer (CEID: 104)	S6F11 --> <-- S6F12	
PrJobSMTrans17 STOPPING->termination (CEID: 5317)	S6F11 --> <-- S6F12	
CtrlJobSMTrans11 ACTIVE->COMPLETED (CEID: 5411)	S6F11 --> <-- S6F12	
EndOfCarrier (CEID: 200)	S6F11 --> <-- S6F12	
CarrierSMTrans19 IN ACCESS-> CARRIER COMPLETE (CEID: 5129)	S6F11 --> <-- S6F12	
CarrierLocationChange (CEID: 5106)	S6F11 --> <-- S6F12	
CarrierUnclamped (CEID: 5108)	S6F11 --> <-- S6F12	
PortTransferSMTrans09 TRANSFER BLOCKED-> READY TO UNLOAD (CEID: 5149)	S6F11 --> <-- S6F12	
PortTransferSMTrans07 READY TO UNLOAD -> TRANSFER BLOCKED (CEID: 5147)	S6F11 --> <-- S6F12	
AssocSMGoNotAssoc ASSOCIATED -> NOT ASSOCIATED (CEID: 5136)	S6F11 --> <-- S6F12	
PortTransferSMTrans08 TRANSFER BLOCKED-> READY TO LOAD (CEID: 5148)	S6F11 --> <-- S6F12	
CtrlJobSMTrans13 COMPLETED-> termination (CEID: 5413)	S6F11 --> <-- S6F12	

User variables

The following sections show tables containing the user variables for various standards.

E30 GEM

The following table shows user variables for the E30 GEM standard.

VID	Class	Format	Name	Description
5	EC	A [0..80]	DeviceName	Provides name of current device. Default: Keithley Parametric Test System
6	EC	U2	EstabCommDelay	Delay between attempts to establish communications with Host. Default: 20
8	EC	U1	InitCommState	Determine initial Communications State. 0 = Disabled 1 = Enabled Default: 1
9	EC	U1	InitControlState	Determine initial Control State. 1 = OFFLINE 2 = ONLINE Default: 2
10	EC	U2	HeartBeat	Specifies how often to send S1F1 heartbeat: 0 to 1800 seconds. (0 = no heartbeat) Default: 0
27	SV	A	Clock	Contains the host's view of the time and date on the equipment. Its default format is: YYYYMMDDhhmmsscc.
28	SV	U1	ControlState	Current control state value. 1 = OFF-LINE/EQUIPMENT OFF-LINE 2 = OFF-LINE/ATTEMPT ON-LINE 3 = OFF-LINE/HOST OFF-LINE 4 = ON-LINE/LOCAL 5 = ON-LINE/REMOTE
30	SV	L	EventsEnabled	Determine which events have been enabled for reporting.
31	SV	A	MDLN	Brief equipment identifier. Initial value is KI_APT.
32	SV	A	PPExecName	Provide name of current process program.
33	SV	U4	PreviousCEID	History of last event
34	SV	A	PreviousCommand	Record history of last issued command.

VID	Class	Format	Name	Description
35	SV	U1	PreviousControlState	History of previous control state. 1 = OFF-LINE/EQUIPMENT OFF-LINE 2 = OFF-LINE/ATTEMPT ON-LINE 3 = OFF-LINE/HOST OFF-LINE 4 = ON-LINE/LOCAL 5 = ON-LINE/REMOTE
36	SV	U1	PreviousProcessState	History of previous process state. See ProcessState below for values.
37	SV	U1	ProcessState	Show current process state. 0 = Initializing 1 = Idle 2 = Moving to site 3 = Moving to subsite 4 = Loading wafer 5 = Testing 6 = Waiting for user input 7 = Unloading wafer 8 = Terminating test program 9 = Operator abort
38	SV	A	SOFTREV	Equipment software revision number.
39	SV	A	Time	The host's view of the current date and time. The format is either YYYYMMDDhhmmsscc (TimeFormat = 1) or YYMMDDhhmmss (TimeFormat = 0).
40	DV	A	PPChangeName	Notify Host of the name of the process program that was changed or deleted. Valid on GemPPChangeEvent (CEID=5) event.
41	DV	U1	PPChangeStatus	Notify Host of modification of process program by operator. Valid on GemPPChangeEvent (CEID=5) event.
42	EC	U1	OfflineSubstate	Determine default Offline Equipment state. 1 = OFF-LINE/EQUIPMENT OFFLINE 2 = OFFLINE/ATTEMPT ONLINE 3 = OFFLINE/HOST OFFLINE Default: 3
43	EC	U1	OnlineFailed	Determine which Offline substate the Equipment transitions to. 1 = OFFLINE/EQUIPMENT OFFLINE 3 = OFFLINE/HOST OFFLINE Default: 3
44	EC	U1	OnlineSubstate	Determine which Online substate the in which the Equipment transitions. 4 = ONLINE/LOCAL 5 = ONLINE/REMOTE Default: 5

VID	Class	Format	Name	Description
53	SV	U1	SpoolState	Current spool state of Equipment in POWER ON super-state. 1 = Spool Inactive 2 = Spool Active
63	EC	U1	ConfigSpool	Enable or Disable spooling. 0 = DISABLED 1 = ENABLED Default: 0
67	EC	U1	TimeFormat	Specifies whether to use 12-byte or 16-byte format in reporting date and time: 0 = 12-byte format 1 = 16-byte format Default: 1
69	EC	I4	TermReqSendMax	Maximum length of Stream 10 sending text. Default: 256
72	DV	U4	ECIDChange	VID of Equipment Constant that is changed by operator. Valid on OperatorECChange (CEID=153) event.
83	SV	U1	LinkState	Current Communication State. 0 = Disabled 1 = Enabled/Not Communicating 2 = Communicating
84	SV	L	VIDList	A variable containing a list of all defined VIDs.
85	SV	L	ALIDList	A variable containing a list of all defined alarms.
86	SV	L	CEIDList	A list of all defined collection events.
100	DV	A [0..51]	LotID	Lot ID being tested. Valid on LotInfoAvailable (CEID=162) event.
101	DV	A [0..256]	TestProgName	Test program name currently being used. Valid on PPSelected (CEID=151) and StartOfLot (CEID=146) events.
102	DV	A [0..51]	ProductType	Product(Device)Type. Valid on LotInfoAvailable (CEID=162) and StartOfCarrier (CEID=199) events
103	DV	A [0..21]	TesterID	System/Tester ID. Valid on LotInfoAvailable (CEID=162) and StartOfCarrier (CEID=199) events.
104	DV	A [0..21]	LotStartTime	Time lot was started. Valid on StartOfLot (CEID=146) and StartOfCarrier (CEID=199) events.
105	DV	A [0..21]	LotEndTime	Time lot was completed. Valid on EndOfLot (CEID=105) and EndOfCarrier (CEID=200) events.

VID	Class	Format	Name	Description
106	DV	A [0..51]	ProcessType	Process type (example: CMOS/MOS). Valid on LotInfoAvailable (CEID=162) and StartOfCarrier (CEID=199) events.
107	DV	A [0..33]	WaferID	Wafer ID being tested. Valid on StartWafer (CEID=102) event.
108	DV	A [0..33]	SiteID	Site ID being tested. Valid on StartOfSite (CEID=183) event.
109	DV	U2	SlotID	Slot ID for a given wafer. Valid on StartWafer (CEID=102) event.
110	DV	A [0..33]	SplitID	Split ID for a given wafer. Valid on StartWafer (CEID=102) event.
111	DV	I4	ProberErrorCode	Prober alarm error number. Valid on LotAborted (CEID=147), Prober1ErrorContinued (CEID=176) and Prober1ErrorSkipped (CEID=178) events.
112	DV	I4	KeithleyErrorCode	Keithley equipment alarm error number. Valid on LotAborted (CEID=147), LotStopped (CEID=148), Prober1ErrorContinued (CEID=176), Prober1ErrorSkipped (CEID=178) and ProbeCardError (CEID=187) events.
113	DV	A [0..256]	KeithleyErrorText	Keithley equipment alarm error text. Valid on LotAborted (CEID=147), LotStopped (CEID=148), Prober1ErrorContinued (CEID=176), Prober1ErrorSkipped (CEID=178) and ProbeCardError (CEID=187) events.
114	DV	U2	CustomDataType	Custom data type. Values are user-defined. 1 = integer 2 = unsigned integer 3 = floating point 4 = ascii 5 = binary 6 = boolean Valid on CustomDataAvailable (CEID=106) event.
115	DV	B [1..64000]	CustomData	Custom data block of binary data. Maximum length is 64,000 bytes. Valid on CustomDataAvailable (CEID=106) event.
126	DV	F4	SiteRow	Site row (Y). Valid on StartOfSite (CEID=183) event.
127	DV	F4	SiteCol	Site column (X). Valid on StartOfSite (CEID=183) event.

VID	Class	Format	Name	Description
132	DV	A [0..256]	WaferPlanID	Wafer plan ID. Valid on StartWafer (CEID=102) event.
133	DV	A [0..51]	Cassette1ID	Cassette #1 ID. Valid on Cassette1IdRead (CEID=136) event.
134	DV	A [0..51]	Cassette2ID	Cassette #2 ID. Valid on Cassette2IdRead (CEID=137) event.
135	DV	A [0..31]	OperatorID	Operator ID. Valid on LotInfoAvailable (CEID=162) and StartOfCarrier (CEID=199) events.
136	DV	U2	TestResultCount	Number of available test results. Valid on TestDataAvailable (CEID=158) event.
137	DV	U2	ArrayResultCount	Number of available array results. Valid on TestDataAvailable (CEID=158) event.
138	SV	U1	ToolState	SEMI E10 Tool state as set by operator. Possible values are: 0 = Productive 1 = Standby 2 = Engineering 3 = Scheduled downtime 4 = Unscheduled downtime 5 = Nonscheduled time
144	SV	U1	Port1State	Port #1 State. Possible values are: 0 = Empty 1 = Loading 2 = Loaded 3 = Error 4 = Clamped 5 = Unclamped 6 = Unloaded 7 = Occupied 8 = Docked 9 = Undocked
145	SV	U1	Port2State	Port #2 State. Uses the same Port State codes as Port1State above.
146	SV	U1	Lot1State	Port #1 Lot State. Possible values are: 0 = Idle 1 = Processing 2 = Paused 3 = Complete 4 = Error
147	SV	U1	Lot2State	Port #2 Lot State. Uses the same Lot State codes as Lot1State above.

VID	Class	Format	Name	Description
149	DV	A [0..33]	SubsiteID	Subsite ID being tested. Valid on EndOfSubsite (CEID=161) and StartOfSubsite (CEID=184) events.
150	DV	F4	SubsiteX	Subsite X coordinate. Valid on EndOfSubsite (CEID=161) and StartOfSubsite (CEID=184) events.
151	DV	F4	SubsiteY	Subsite Y coordinate. Valid on EndOfSubsite (CEID=161) and StartOfSubsite (CEID=184) events.
152	DV	A [0..256]	TestMacroID	Test macro (KTM) ID. Valid on StartOfTest (CEID=182) event.
153	DV	A [0..81]	WaferDescriptionID	Wafer Description (WDF) ID. Valid on StartWafer (CEID=102) event.
154	DV	A [0..81]	LimitFileID	Limit File (KLF) ID. Valid on StartWafer (CEID=102) event.
155	DV	A [0..256]	ProductFileID	Uploaded prober product file ID. Valid on StartWafer (CEID=102) and LotInfoAvailable (CEID=162) events.
165	EC	U1	StopUnit	When to stop a test. Possible values are: 0 = End of site 1 = End of wafer Default: 1
168	EC	A [0..32]	EquipmentID	User-configurable Equipment ID. Default: KEITHLEY APT
170	EC	A [0..32]	ProberID	User-configurable Prober ID. Default: Prober ID
5500	SV	U1	PrbHsmsCommStatus	Status of PRBHOST to prober HSMS communications. Possible values are: 0 = Disabled 1 = Enabled
5504	SV	U1	PrbControlState	Prober Control State. Possible values are: 1 = OFFLINE 4 = ONLINE/LOCAL 5 = ONLINE/REMOTE
5505	DV	I4	PrbAlarmID	Prober Alarm ID. Valid on PrbAlarmEventOff (CEID=5550) and PrbAlarmEventOn (CEID=5551) events.
5506	DV	A [0..256]	PrbAlarmText	Prober Alarm Text. Valid on PrbAlarmEventOff (CEID=5550) and PrbAlarmEventOn (CEID=5551) events.

VID	Class	Format	Name	Description
5507	SV	A [0..256]	ProjectName	Currently selected project name. The ProjectNameChanged (CEID=5507) event is sent out whenever the value of this variable changes.
8013	EC	U1	CfgSubstDelimiter	Controls how the default substrate IDs are created 0 = Uses "." (e.g. CarrierID.01) 1 = Uses "_" (e.g. CarrierID_01) Default: 0

E87 Carrier Management

The following table shows user variables for the E87 Carrier Management standard.

VID	Class	Format	Name	Description
5101	EC	BOOLEAN	BypassReadID	This Equipment Constant can be used to modify the operation of E87 Carrier ID Verification logic for all Load Ports with an unavailable Carrier ID Reader. See the E87 standard for details. Values are: TRUE = BYPASSREADID IS ACTIVATED FALSE = BYPASSREADID IS DEACTIVATED Default: FALSE
5110	DV	L	Carrier	When a Carrier-related event occurs, this Variable contains the entire related (current) Carrier Object. The actual format of the variable is: <L [NumberOfAttributes] <L [2] <A "ObjType"> <A "Carrier"> > <L [2] <A "ObjID"> <A CarrierID> > <L [2] <A AttributeName> <AttributeValue> >… >

VID	Class	Format	Name	Description
5111	DV	U1	CarrierAccessingStatus	The current status of accessing the material. Values are: 0 = NOT ACCESSED 1 = IN ACCESS 2 = CARRIER COMPLETE (Process finished normally) 3 = CARRIER STOPPED (Process finished abnormally)
5112	DV	U1	CarrierCapacity	The Capacity of the current Carrier.
5113	DV	L	CarrierContentMap	Identifies the Substrate contained in each Slot of the Carrier. An ordered series of 2-element lists, corresponding to Carrier Slots 1, 2, ... n. Format is: <L [NumberOfSlots] <L [2] <A[0..80] LotID> <A[0..80] SubstrateID > > ... >
5114	DV	A [1..80]	CarrierID	The identity of the current Carrier.
5115	DV	U1	CarrierIDStatus	The CarrierID Status of the current Carrier. Values are: 0 = ID NOT READ 1 = WAITING FOR HOST 2 = ID VERIFICATION OK 3 = ID VERIFICATION FAILED
5116	DV	A [1..80]	CarrierLocationID	The LocationID of the current Carrier.
5117	DV	L	CarrierSlotMap	Shows the status of each slot in the carrier. An ordered list, corresponding to Carrier Slots 1, 2, ..., n. Format is: <L [NumberOfSlots] <U1 SlotStatus> ... > Values for SlotStatus are: 1 = EMPTY 2 = NOT EMPTY 3 = CORRECTLY OCCUPIED 4 = DOUBLE SLOTTED 5 = CROSS SLOTTED
5118	DV	U1	CarrierSlotMapStatus	The SlotMap status of the current Carrier. 0 = SLOT MAP NOT READ 1 = WAITING FOR HOST 2 = SLOT MAP VERIFICATION OK 3 = SLOT MAP VERIFICATION FAILED

VID	Class	Format	Name	Description
5119	DV	U1	CarrierSubstrateCount	The count of the Substrates in a Carrier.
5120	DV	A	CarrierUsage	The usage of the substrates contained in the carrier. If unknown, value is zero-length. Typical values are PRODUCT, TEST, FILLER, CLEANING, and so on.
5122	DV	U1	PortID	The Port ID of the current Load Port.
5123	DV	U1	PortAccessMode	The Access Mode of the current Load Port. 0 = MANUAL (Operator) 1 = AUTOMATIC (AMHS)
5124	DV	U1	PortAssociationState	The Load Port / Carrier Association State of the current Load Port. Values are: 0 = NOT ASSOCIATED 1 = ASSOCIATED
5126	DV	L	PortStateInfo	Port State Information for the current Load Port. The actual format is: <L[2] <U1 PortAssociationState> <U1 PortTransferState> >
5127	DV	U1	PortTransferState	The transfer state of the current Load Port. Values are: 0 = OUT OF SERVICE 1 = TRANSFER BLOCKED 2 = READY TO LOAD 3 = READY TO UNLOAD
5128	DV	U1	PortClampState	Shows whether the Carrier is present and clamped. Values are: 0 = UNCLAMPED - A Carrier might or might not be present. 1 = CLAMPED - A Carrier is present and clamped.
5131	DV	A [1..80]	LocationCarrierID	The identification of the Carrier at the current Carrier Location.
5132	DV	A [1..80]	LocationID	The Carrier Location ID for the Carrier Location Event.
5140	SV	L	PortList	The numerical list of all load ports on the equipment. <L[2] <U1 1> <U1 2> >

VID	Class	Format	Name	Description
5141	SV	L	PortAssociationStateList	The PortAssociationStateList shows the loadport carrier association state for all registered loadports on the equipment. For GCD purposes, the format specified is unimportant. Actual format of the Variable is: <L[NumberOfPorts] <U1 PortAssociationState> ... > For details of codes, see PortAssociationState.
5142	SV	L	PortStateInfoList	Shows information about all registered loadports on the equipment. For GCD purposes, the format specified is unimportant. Actual format of the Variable is: <L[NumberOfPorts] <L[2] <U1 PortAssociationstate> <U1 PortTransferState> > ... >
5143	SV	L	PortTransferStateList	Shows the Load Port Transfer State for all registered loadports on the equipment. For GCD purposes, the format specified is unimportant. Actual format of the Variable is: <L[NumberOfPorts] <U1 PortTransferState> ... >

VID	Class	Format	Name	Description
5149	DV	U1	Reason	When Carrier State Transition #7 occurs, this variable shows the reason for the transition. Values are: 2 = CARRIER ID READ FAIL 4 = WRONG PORT When Carrier State Transition #9 or Carrier State Transition #16 occurs, it shows the reason for the transition. Values are: 5 = CANCEL CARRIER COMMAND RECEIVED FROM HOST 6 = EQUIPMENT-INITIATED CANCEL CARRIER DUE TO DUPLICATE CARRIER ID When Carrier State Transition #14 occurs, it shows the reason for the transition. Values are: 0 = SLOT MAP VERIFICATION NEEDED 1 = SLOT MAP VERIFICATION BY EQUIPMENT UNSUCCESSFUL 2 = SLOT MAP READ FAILURE 3 = SLOT MAP IMPROPER SUBSTRATE POSITION
8202	DV	L	Port	The current port object.

E40 Process Job Management

The following table shows the user variables for the E40 Process Job Management standard.

VID	Class	Format	Name	Description
5301	EC	U2	PRMaxJobSpace	Specifies maximum space for Process Jobs. Default: 50s
5311	DV	L	PRJob	The current Process Job Object. The actual format of the Variable is: <L [NumberOfAttributes] <L [2] <A "ObjType"> <A "PRJob"> > <L [2] <A "ObjID"> <A PRJobID> > <L [2] <A AttributeName> <AttributeValue> > … >

VID	Class	Format	Name	Description
5312	DV	L	PauseEvent	The list of events detailing why the Process Job has paused.
5313	DV	A [0..80]	PRJobId	The Process Job ID of the current Process Job.
5314	DV	U1	PRJobState	The Process Job State of the current Process Job. 0 = QUEUED/POOLED 1 = SETTING UP 2 = WAITING FOR START 3 = PROCESSING 4 = PROCESS COMPLETE 5 = RESERVED 6 = PAUSING 7 = PAUSED 8 = STOPPING 9 = ABORTING 10 = STOPPED 11 = ABORTED
5315	DV	L	PRMtlNameList	The list of types of material being processed. Actual format of the Variable is: <L [NumberOfCarriers] <L [2] <A CarrierID> <L [NumberOfSlots] <U1 SlotID> ... /* More SlotIDs */ > > ... /* More Carriers */ >
5316	DV	U1	PRMtlType	The type of Material the PR Job is currently processing. <B 0x0D> = Carrier <B 0x0E> = Substrate It must be 0x0D (Carrier).
5317	DV	BOOLEAN	PRProcessStart	An indication that the Equipment can start a Process Job. values are: TRUE = AUTOMATIC START FALSE = MANUAL START
5318	DV	U1	PRRecipeMethod	An indication of which Recipe Method the Process Job is currently processing. 1 = RECIPE ONLY 2 = RECIPE WITH VARIABLE TUNING Only value 1 (RECIPE ONLY) is supported. So RecVariableList is not used within the equipment.
5319	DV	A [0..80]	RecID	The current recipe of the Process Job.

VID	Class	Format	Name	Description
5320	DV	L	RecVariableList	List of variables pertaining to the recipe method. Actual format of the variable is: <L[ListofVariables] <L[2] <U1 RecipeVarName> <U1 RecipeVarValue> > ... >
5509	SV	A	ProcessingPRJobId	Name (ID) of Process Job (PJ) that is currently in the Processing State. This variable is updated whenever a new PJ enters the Processing State and cleared whenever KTXECWP exits.

E94 Control Job Management

The following table shows user variables for the E94 Control Job Management standard.

VID	Class	Format	Name	Description
5401	EC	U2	CtrlMaxJobSpace	Maximum number of queued Control Jobs. Default: 2
5402	SV	L	QueuedCJobs	Lists all queued Control Jobs. Actual format is: <L[NumberOfQueuedControlJobs] <A CtrlJobID > /* HOQ*/ <A CtrlJobID > ... >
5403	SV	U2	QueueAvailableSpace	Indicates how many more Control Jobs may be added to the queue.
5404	EC	A[1..80]	SetUpName	Describes current equipment setup. Default: unknown

VID	Class	Format	Name	Description
5411	DV	L	CtrlJob	The current Control Job Object. The actual format of the Variable is: <L [NumberOfAttributes] <L [2] <A "ObjType"> <A "CtrlJob"> > <L [2] <A "ObjID"> <A CtrlJobID> > <L [2] <A AttributeName> <AttributeValue> > … >
5413	DV	L	CtrlJobCurrentPRJob	The list of all running Process Jobs. This variable is valid only when the CtrlJobPause and CtrlJobResume events are raised.
5415	DV	L	CtrlJobMtrlOutByStatus	Customization is required.
5417	DV	L	CtrlJobPauseEvent	The list of Events detailing why the Control Job has paused.
5418	DV	L	CtrlJobProcessingCtrlSpec	The list of specifications that defines Process Jobs and how they will behave within a Control Job.
5419	DV	U1	CtrlJobProcessOrderMgmt	The order in which Process Jobs are initiated. 0 = UNDEFINED 1 = ARRIVAL 2 = OPTIMIZE 3 = LIST This equipment only supports 3 (LIST).
5420	DV	BOOLEAN	CtrlJobStartMethod	An indication of the method in which the Control Job started. TRUE = AUTOMATIC START FALSE = USER START
5421	DV	U1	CtrlJobState	The current state of the Control Job. 0 = QUEUED 1 = SELECTED 2 = WAITING FOR START 3 = EXECUTING 4 = PAUSED 5 = COMPLETED
5422	DV	A	CtrlJobID	The Control Job ID of the current Control Job.

VID	Class	Format	Name	Description
5423	DV	L	CtrlJobPRJobStatusList	List of managed Process Jobs and their associated status. Format is: <L [NumberOfPjobs] <L <A PRJobID> <I4 PRJobState> > ... >
5510	SV	A	ExecutingCtrlJobID	Name (ID) of Control Job (CJ) that is currently in the Executing State. This variable is updated whenever a new CJ enters the Executing State and cleared whenever KTXECWP exits.

E90 Substrate Management

The following table shows user variables the E90 Substrate Management standard.

VID	Class	Format	Name	Description
5201	DV	L	Substrate	The current Substrate Object. The actual format of the Variable is: <L [NumberOfAttributes] <L [2] <A "ObjType"> <A "Substrate"> > <L [2] <A "ObjID"> <A SubstrateID> > <L [2] <A AttributeName> AttributeValue> >… >
5202	DV	A [0..80]	SubstLotID	The Lot ID for the current Substrate.
5203	DV	U1	SubstMtrlStatus	It is related with CtrlJobMtrlOutByStatus. Customization is required.
5204	DV	A [1..80]	SubstId	The identification of the current Substrate.
5205	DV	A [0..80]	SubstDestination	The Substrate Location ID on which the Substrate shall be finally restored. If zero-length, then SubstDestination is implicitly the same as SubstSource.

VID	Class	Format	Name	Description
5206	DV	L	SubstHistory	The history of the current Substrate. <L [NumberOfHistoryRecords] <L [3] <A [1..80] SubstLocID or BatchLocID. SubstPosInBatch> <A [16] TimeIn> <A [16] TimeOut> > ... >
5207	DV	A [1..80]	SubstLocID	The Location of the current Substrate.
5208	DV	U1	SubstProcState	The processing state of the Substrate. 0 = NEEDS PROCESSING 1 = IN PROCESS 2 = PROCESSED 3 = ABORTED 4 = STOPPED 5 = REJECTED 6 = LOST
5209	DV	U1	SubstState	The transport state of the current Substrate. The values are: 0 = AT SOURCE 1 = AT WORK 2 = AT DESTINATION
5210	DV	A [1..80]	SubstSource	The source Location of the current Substrate.
5211	DV	U1	SubstType	The type of the current Substrate. The values are: 0 = WAFER 1 = FLAT PANEL 2 = CD 3 = MASK
5212	DV	U1	SubstUsage	The usage of the current Substrate. 0 = PRODUCT 1 = TEST 2 = FILLER 3 = CLEANING According to CarrierUsage.

VID	Class	Format	Name	Description
5220	DV	L	SubstLoc	The current Substrate Location Object. The actual format of the Variable is: <L [NumberOfAttributes] <L [2] <A "ObjType"> <A SubstLoc"> < <L [2] <A "ObjID"> <A SubstLocID> > <L [2] <A AttributeName> <AttributeValue> > … >
5221	DV	A [0..80]	SubstLocSubstID	The Substrate ID at the current Substrate Location.
5222	DV	A [1..80]	SubstLocSubstLocID	The ID of the current Substrate Location.
5223	DV	U1	SubstLocSubstLocState	The state of the current Substrate Location. Values are: 0 = UNOCCUPIED 1 = OCCUPIED

E39 Object Service

The following table shows user variables for the E39 Object Service standard.

VID	Class	Format	Name	Description
8200	SV	L	Global	Define the Global Object. The actual format of the Variable is: <L [2] <A "ObjType"> <A "Global"> > <L [2] <A "ObjID"> <A "ConX"> > <L [2] <A AttributeName[1]> <AttributeValue[1]> > <L [2] <A AttributeName[2]> <AttributeValue[2]> > ... <L [2] <A AttributeName[n]> <AttributeValue[n]> >
8201	SV	A [1..80]	GlobalID	The Global ID of the single Global Object.

E116 Equipment Performance Tracking

The following table shows user variables for the E116 Equipment Performance Tracking standard.

VID	Class	Format	Name	Description
6900	DV	L	EPTTracker	The current EPT Tracker Object.
6901	DV	A [1..80]	EPTID	The identity of the current EPT Tracker.
6902	DV	U1	BlockedReason	Identifies the reason the EPT Object is blocked. 0 = Not Blocked 1 = Unknown 2 = Safety Threshold 3 = Error Condition 4 = Parametric Exception 5 = Aborting, Aborted 6 = Pausing, Paused 7 = Reserved 8 = Reserved 9 = Reserved

VID	Class	Format	Name	Description
6903	DV	A [0..80]	BlockedReasonText	BlockedReasonText identifies the reason an EPT Module is blocked and may provide further details to the BlockedReason. When BlockedReason is 0 (Not Blocked), the value is <A[0]> (zerolength).
6904	DV	U1	EPTElementType	Indicates the type of the EPT Module. 0 = Equipment 1 = Production EPT Module 2 = EFEM/LoadPort EPT Module
6905	DV	U1	EPTState	The current state of the EPT object. 0 = Idle 1 = Busy 2 = Blocked 3 = No State
6906	DV	U4	EPTStateTime	EPTStateTime is the time in seconds an EPT object spent in the previous EPT State, prior to entering the current EPT state.
6907	DV	A [0..80]	EPTElementName	The name for an EPT Object.
6908	DV	U1	PreviousEPTState	The previous EPT state for an EPT object. 0 = Idle 1 = Busy 2 = Blocked 3 = No State (Power Up)
6909	DV	A [0..80]	PreviousTaskName	The previously running EPT Task. When PreviousTaskType is 0, this value is <A[0]> (zero-length).
6910	DV	U1	PreviousTaskType	The type of the EPT Task previously running on an EPT object. 0 = No Task 1 = Unspecified 2 = Process -- adding value (e.g. exposing) 3 = Support -- incapable of adding value (e.g. Handling or Transport) 4 = Equipment Maintenance (e.g. Equipment-initiated clean cycle) 5 = Equipment Diagnostics (e.g. Equipment-initiated health check) 6 = Waiting
6911	DV	A [0..80]	TaskName	The name of the EPT task currently running on an EPT object.

VID	Class	Format	Name	Description
6912	DV	U1	TaskType	The type of EPT task currently running on an EPT object. 0 = No Task 1 = Unspecified 2 = Process -- adding value (e.g. exposing) 3 = Support -- incapable of adding value (e.g. Handling or Transport) 4 = Equipment Maintenance (e.g. Equipment-initiated clean cycle) 5 = Equipment Diagnostics (e.g. Equipment-initiated health check) 6 = Waiting
6913	DV	A[0..32]	TransitionTimestamp	The time of the most recent EPT object transition. The format of TransitionTimestamp is controlled by the GemTimeFormat EC. If GemTimeFormatEC is set to: • 0, the time will be in the 12-byte format YYMMDDhhmmss • 1, the time will be in the 16-byte format YYYYMMDDhhmmsscc • 2, AND the GemE50308 EC is set to 1, the time will be in the max 32-byte format YYYY-MMDDThh:mm:ss.sTZD Format Note: If you want to use the new 32-byte formula, you must define GemE50308Time in your GCD file and set its value to 1.
6914	DV	U1	Transition	The most recent EPT object transition. TRANSITION_1 = 1 TRANSITION_2 = 2 TRANSITION_3 = 3 TRANSITION_4 = 4 TRANSITION_5 = 5 TRANSITION_6 = 6 TRANSITION_7 = 7 TRANSITION_8 = 8 TRANSITION_9 = 9
6915	DV	U4	TrackerEventID	Numeric Identifier for the event (CEID) that is triggered for a change in the state model for this EPT object.

VID	Class	Format	Name	Description
6920	DV	A [0..32]	EPTClock	Gives the transition time for last EPT state model transition. The format of EPTClock is controlled by the GemTimeFormat EC. If GemTimeFormatEC is set to: • 0, the time will be in the 12-byte format YYMMDDhhmmss • 1, the time will be in the 16-byte format YYYYMMDDhhmmsscc • 2, AND the GemE50308 EC is set to 1, the time will be in the max 32-byte format YYYY-MMDDThh:mm:ss.sTZD Format Note: If you want to use the new 32-byte formula, you must define GemE50308Time in your GCD file and set its value to 1.
6950	DV	U1	NumBusy	NumBusy is the number of BUSY Production EPT objects on the equipment, excluding EFEM/LoadPort EPT Modules.
6951	DV	U1	NumIdle	NumIdle is the number of IDLE production EPT objects on the equipment, excluding EFEM/LoadPort EPT Modules.
6952	DV	U1	NumBlocked	NumBlocked is the number of BLOCKED production EPT modules on the equipment, excluding EFEM/LoadPort EPT Modules.
8205	DV	L	DisableEventOnTransition	List of Transitions which will not be reported as a Host Event for current EPTTracker. Format is: <L <U1 TRANSITION> ... >

Frequently used CEIDs

In KIGEM, CEID format is U4. The following tables summarize the CEID data into groups. Once certain events occur, all variables in the same data group are available.

Variable data groups

The following table shows variables for commonly used data groups.

Data group	Variables	VID
Load Port	PortID	5122
	PortAccessMode	5123
	PortAssociationState	5124
	PortReservationState	5125
	PortTransferState	5127
	PortClampState	5128
Carrier	CarrierAccessingStatus	5111
	CarrierCapcity	5112
	CarrierContentMap	5113
	CarrierID	5114
	CarrierIDStatus	5115
	CarrierLocationID	5116
	CarrierSlotMap	5117
	CarrierSlotMapStatus	5118
	CarrierSubstrateCount	5119
	CarrierUsage	5120
Carrier Location	LocationCarrierID	5131
	LocationID	5132
Substrate	SubstLotID	5202
	SubstMtrlStatus	5203
	SubstID	5204
	SubstDestination	5205
	SubstHistory	5206
	SubstLocID	5207
	SubstProcState	5208
	SubstState	5209
	SubstSource	5210
	SubstType	5211
	SubstUsage	5212
Substrate Location	SubstLocSubstID	5221
	SubstLocSubstLocID	5222
	SubstLocSubstLocState	5223

Data group	Variables	VID
Control Job	CtrlJobCarrierInputSpec	5412
	CtrlJobCurrentPRJob	5413
	CtrlJobDataCollectionPlan	5414
	CtrlJobMtrlOutByStatus	5415
	CtrlJobMtrlOutSpec	5416
	CtrlJobPauseEvent	5417
	CtrlJobProcessingCtrlSpec	5418
	CtrlJobProcessOrderMgmt	5419
	CtrlJobStartMethod	5420
	CtrlJobState	5421
	CtrlJobID	5422
	CtrlJobPRJobStatusList	5423
Process Job	PauseEvent	5312
	PRJobId	5313
	PRJobState	5314
	PRMtlNameList	5315
	PRMtlType	5316
	PRProcessStart	5317
	PRRecipeMethod	5318
	RecID	5319
	RecVariableList	5320

E87 Carrier Management

The following table shows E87 Carrier Management standard CEIDs, Events, and VIDs.

CEID	Event Name	Available Data Group / Data (VID)	Comment
Material Movement Events			
9	GemMaterialReceivedEvent	Load Port	
10	GemMaterialRemovedEvent	Load Port, Carrier	
Access Mode State Model			
5101	AccessSMInit	Load Port	Initialization (power up).
5102	AccessSMGoAuto	Load Port	Manual -> Auto
5103	AccessSMGoManual	Load Port	Auto -> Manual
Carrier			
5104	CarrierClosed	Carrier, Load Port, Carrier Location	
5105	CarrierIDReadFail	Load Port	
5106	CarrierLocationChange	Carrier, Carrier Location	
5107	CarrierClamped	Carrier, Load Port, Carrier Location	
5108	CarrierUnclamped	Carrier, Load Port, Carrier Location	
5109	CarrierTagReleased	Carrier, Load Port, Carrier Location	
5110	CarrierOpened	Carrier, Load Port, Carrier Location	
5132	DuplicateCarrierIDInProcess	Carrier	
5140	CarrierApproachingComplete	Carrier	
5153	UnknownCarrierID	Load Port	
Carrier State Model			
5111	CarrierSMTrans01	Carrier	The Carrier Object is created.
5112	CarrierSMTrans02	Carrier	no state -> ID NOT READ
5113	CarrierSMTrans03	Carrier, Load Port	no state -> WAITING FOR HOST

CEID	Event Name	Available Data Group / Data (VID)	Comment
5114	CarrierSMTrans04	Carrier	no state -> ID VERIFICATION OK
5115	CarrierSMTrans05	Carrier	no state -> ID VERIFICATION FAILED
5116	CarrierSMTrans06	Carrier, Load Port	ID NOT READ -> ID VERIFICATION OK
5117	CarrierSMTrans07	Carrier, Load Port, Reason (5149)	ID NOT READ -> WAITING FOR HOST
5118	CarrierSMTrans08	Carrier, Load Port	WAITING FOR HOST -> ID VERIFICATION OK
5119	CarrierSMTrans09	Carrier, Load Port, Reason (5149)	WAITING FOR HOST -> ID VERIFICATION FAILED
5120	CarrierSMTrans10	Carrier, Load Port	ID NOT READ -> WAITING FOR HOST (Bind, Carrier ID Reader unavailable, BypassReadID = FALSE)
5121	CarrierSMTrans11	Carrier, Load Port	ID NOT READ -> ID VERIFICATION OK (Bind, Carrier ID Reader unavailable, BypassReadID = TRUE)
5122	CarrierSMTrans12	Carrier	no state -> SLOT MAP NOT READ
5123	CarrierSMTrans13	Carrier, Load Port, Carrier Location	SLOT MAP NOT READ -> SLOT MAP VERIFICATION OK
5124	CarrierSMTrans14	Carrier, Load Port, Carrier Location, Reason (5149)	SLOT MAP NOT READ -> WAITING FOR HOST
5125	CarrierSMTrans15	Carrier, Load Port, Carrier Location	WAITING FOR HOST -> SLOT MAP VERIFICATION OK
5126	CarrierSMTrans16	Carrier, Load Port, Carrier Location, Reason (5149)	WAITING FOR HOST -> SLOT MAP VERIFICATION FAIL

CEID	Event Name	Available Data Group / Data (VID)	Comment
5127	CarrierSMTrans17	Carrier	The Carrier Object is instantiated.
5128	CarrierSMTrans18	Carrier	NOT ACCESS -> IN ACCESS
5129	CarrierSMTrans19	Carrier	IN ACCESS -> CARRIER COMPLETE
5130	CarrierSMTrans20	Carrier	IN ACCESS -> CARRIER STOPPED
5131	CarrierSMTrans21	Carrier	CARRIER -> no state
Load Port/Carrier Association State Model			
5133	AssocSMInit	Load Port	Initialized to NOT ASSOCIATED.
5134	AssocSMGoAssoc	Carrier, Load Port	NOT ASSOCIATED -> ASSOCIATED
5135	AssocSMReAssoc	Carrier, Load Port	ASSOCIATED -> ASSOCIATED
5136	AssocSMGoNotAssoc	Load Port	ASSOCIATED -> NOT ASSOCIATED
Load Port Transfer State Model			
5141	PortTransferSMTrans01	Load Port	no state -> OUT OF SERVICE or IN SERVICE
5142	PortTransferSMTrans02	Load Port	OUT OF SERVICE -> IN SERVICE
5143	PortTransferSMTrans03	Load Port	IN SERVICE -> OUT OF SERVICE
5144	PortTransferSMTrans04	Load Port	IN SERVICE -> TRANSFER READY or TRANSFER BLOCKED
5145	PortTransferSMTrans05	Load Port, Carrier	TRANSFER READY -> READY TO LOAD or READY TO UNLOAD
5146	PortTransferSMTrans06	Load Port	READY TO LOAD -> TRANSFER BLOCKED
5147	PortTransferSMTrans07	Load Port	READY TO UNLOAD -> TRANSFER BLOCKED
5148	PortTransferSMTrans08	Load Port	TRANSFER BLOCKED -> READY TO LOAD
5149	PortTransferSMTrans09	Load Port, Carrier	TRANSFER BLOCKED -> READY TO UNLOAD
5150	PortTransferSMTrans10	Load Port	TRANSFER BLOCKED -> TRANSFER READY

E90 Substrate Management

The following table shows E90 Substrate Management standard CEIDs, Events, and VIDs.

CEID	Event Name	Available Data Group / Data (VID)	Comment
Substrate Transfer State Model			
5201	SubstSMTrans01	Substrate	no state -> AT SOURCE
5202	SubstSMTrans02	Substrate	AT SOURCE -> AT WORK
5203	SubstSMTrans03	Substrate	AT WORK -> AT SOURCE
5204	SubstSMTrans04	Substrate	AT WORK -> AT WORK
5205	SubstSMTrans05	Substrate	AT WORK -> AT DESTINATION
5206	SubstSMTrans06	Substrate	AT DESTINATION -> AT WORK
5207	SubstSMTrans07	Substrate	AT DESTINATION -> extinction
5208	SubstSMTrans08	Substrate	AT DESTINATION -> AT SOURCE
5209	SubstSMTrans09	Substrate	any sub-state -> extinction
5210	SubstSMTrans10	Substrate	no state -> NEEDS PROCESSING
5211	SubstSMTrans11	Substrate	NEEDS PROCESSING -> IN PROCESS
5212	SubstSMTrans12	Substrate	IN PROCESS -> PROCESSING COMPLETE
5213	SubstSMTrans13	Substrate	IN PROCESS -> NEEDS PROCESSING
5214	SubstSMTrans14	Substrate	NEEDS PROCESSING -> PROCESSING COMPLETE
Substrate Location Transfer State Model			
5221	SubstLocSMTrans01	Substrate Location	UNOCCUPIED -> OCCUPIED
5222	SubstLocSMTrans02	Substrate Location	OCCUPIED -> UNOCCUPIED

E94 Control Job Management

The following table shows E94 Control Job Management standard CEIDs, Events, and VIDs.

CEID	Event Name	Available Data Group / Data (VID)	Comment
Control Job State Transitions			
5401	CtrlJobSMTrans01	Control Job	Instantiated and Queued.
5402	CtrlJobSMTrans02	Control Job	Queued -> termination
5403	CtrlJobSMTrans03	Control Job	Queued -> Selected
5404	CtrlJobSMTrans04	Control Job	Selected -> Queued
5405	CtrlJobSMTrans05	Control Job	Selected -> Executing
5406	CtrlJobSMTrans06	Control Job	Selected -> Waiting For Start
5407	CtrlJobSMTrans07	Control Job	Waiting For Start -> Executing
5408	CtrlJobSMTrans08	Control Job	Executing -> Paused
5409	CtrlJobSMTrans09	Control Job	Paused -> Executing
5410	CtrlJobSMTrans10	Control Job	Executing -> Completed
5411	CtrlJobSMTrans11	Control Job	Active -> Completed (S16F27 CjStop)
5412	CtrlJobSMTrans12	Control Job	Active -> Completed (S16F27 CjAbort)
5413	CtrlJobSMTrans13	Control Job	Completed -> termination
5420	SelectedCjSetEmptied	Control Job	
5421	CjHOQCompleted	Control Job	

E40 Process Job Management

The following table shows E40 Process Job Management standard CEIDs, Events, and VIDs.

CEID	Event Name	Available Data Group / Data (VID)	Comment
Process Job State Transition			
5301	PrJobSMTrans01	Process Job, Control Job	Instantiated and Queued/Pooled.
5302	PrJobSMTrans02	Process Job, Control Job	Queued/Pooled -> Setting Up
5303	PrJobSMTrans03	Process Job, Control Job	Setting Up -> Waiting For Start
5304	PrJobSMTrans04	Process Job, Control Job	Setting Up -> Processing
5305	PrJobSMTrans05	Process Job, Control Job	Waiting For Start -> Processing
5306	PrJobSMTrans06	Process Job, Control Job	Processing -> Process Complete
5307	PrJobSMTrans07	Process Job, Control Job	Process Complete -> termination
5308	PrJobSMTrans08	Process Job, Control Job	Executing -> Pausing
5309	PrJobSMTrans09	Process Job, Control Job	Pausing -> Paused
5310	PrJobSMTrans10	Process Job, Control Job	Paused -> Executing
5311	PrJobSMTrans11	Process Job, Control Job	Executing -> Stopping
5312	PrJobSMTrans12	Process Job, Control Job	Pause -> Stopping.
5313	PrJobSMTrans13	Process Job, Control Job	Executing -> Aborting
5314	PrJobSMTrans14	Process Job, Control Job	Stopping -> Aborting
5315	PrJobSMTrans15	Process Job, Control Job	Pause -> Aborting
5316	PrJobSMTrans16	Process Job, Control Job	Aborting -> termination
5317	PrJobSMTrans17	Process Job, Control Job	Stopping -> termination
5318	PrJobSMTrans18	Process Job, Control Job	Queued/Pooled -> termination
E30 Style Events			
5321	PRJobSetup	Process Job, Control Job	PRJobSMTrans02
5322	PRJobProcessing	Process Job, Control Job	PRJobSMTrans04 or PRJobSMTrans05
5323	PRJobProcessingComplete	Process Job, Control Job	PRJobSMTrans06

CEID	Event Name	Available Data Group / Data (VID)	Comment
5324	PRJobComplete	Process Job, Control Job	PRJobSMTrans07 or PRJobSMTrans16 or PRJobSMTrans17 or PRJobSMTrans18
5325	PRJobWaitingForStart	Process Job, Control Job	PRJobSMTrans03
5327	PRJobStateChange	Process Job, Control Job	

E30 Generic Model for Communications and Control of Manufacturing Equipment

The following table shows E30 standard CEIDs, Events, and VIDs.

NOTE

The standard KIGEMUAP user library provides an example for the use of many (but not all) of these collection events. The CEIDs marked with (*) require custom user code implementation, and the available data are advisable. Contact Keithley for assistance and further details.

CEID	Event Name	Available Data(VID)	Comment
Process Recipe Management			
1	GemBadDownloadEvent		
5	GemPPChangeEvent	PPChangeName(40) PPChangeStatus(41)	
Control State Model			
2	GemControlStateLOCAL		
3	GemControlStateREMOTE		
4	GemEquipmentOFFLINE		
Process related Events (compatible with 200mm)			
101	RunStateChanged		
102*	StartWafer	WaferID(107), SplitID(110), SlotID(109), WaferPlanID(132), WaferDescriptionID (153), LimitFileID(154)	

CEID	Event Name	Available Data(VID)	Comment
103*	EndOfSite	SiteID(108)	
104*	EndOfWafer	WaferID(107)	
105*	EndOfLot	LotID(100)	
106*	CustomDataAvailable	CustomDataType(114), BlockOfBinaryData (115)	
119 - 130*	KeiGPEvent1 – KeiGPEvent12		General-purpose (user defined) events.
146*	StartOfLot	LotID(100), TestStartTime(104), TestProgramName(101), TestProgramArgs(148)	
147*	LotAborted	LotID(100) ProberErrorCode(111) KeithleyErrorCode (112) KeithleyErrorText (113)	
148*	LotStopped	LotID(100) KeithleyErrorCode (112) KeithleyErrorText (113)	
149*	EndOfTest	TestMacroID(152), TestEndTime(105)	
153	ECChange	OperatorECChange	Operator changes an Equipment Constant value
158*	TestDataAvailable	TestResultCount(136), ArrayResultCount (137), TestResult1-TestResult450 (1001-1450), TestResult1Tag-TestResult450Tag (2001-2450), TestResultArray1-TestResultArray5 (116-120), TestResultArray1Tag-TestResultArray5Tag (121-125)	
159*	LotPaused	LotID(100)	
160*	LotResumed	LotID(100)	
161*	EndOfSubsite	SubsiteID(149), SubsiteX(150), SubsiteY(151)	

CEID	Event Name	Available Data(VID)	Comment
162*	LotInfoAvailable	TesterID(103), LotID(100), Product(Device)Type (102), ProcessType(106), OperatorID(135), ProductFileID(155)	
182*	StartOfTest	TestMacroID(152)	
183*	StartOfSite	SiteID(108), SiteRow(126), SiteCol(127)	
184*	StartOfSubsite	SubsiteID(149), SubsiteX(150), SubsiteY(151)	
199*	StartOfCarrier	TestStartTime(104)	
200*	EndOfCarrier	TestEndTime(105)	
3018*	WaferTestResultsOK	WaferID(107)	
3019*	WaferTestResultsError	WaferID(107)	
Events for Relaying Prober Alarms			
5550	PrbAlarmEventOff	PrbAlarmID(5505), PrbAlarmText(5506)	When prober sends an alarm OFF notification (S5F1).
5551	PrbAlarmEventOn	PrbAlarmID(5505), PrbAlarmText(5506)	When prober sends an alarm ON notification (S5F1).

Frequently used ALIDs

The following tables summarize the ALID data into groups. Once certain events occur, all variables in the same data group are available.

GEM Alarms

The following table used frequently used Alard IDs for GEM.

ALID	ALCD	On CEID	Off CEID	ALTX	Description
121	7	107: KeiEvent1	108: KeiEvent2	Configuration Error	Test Program could not start due to configuration problem.
122	7	109: KeiEvent3	110: KeiEvent4	Hardware Error	Test Program could not start due to hardware problem.
123	7	111: KeiEvent5	112: KeiEvent6	Software Error	Test Program could not start due to software problem.

ALID	ALCD	On CEID	Off CEID	ALTX	Description
124	7	113: KeiEvent7	114: KeiEvent8	Data Overflow	More than 450 test results or more than 5 arrays of data.
170	7	115: KeiEvent9	116: KeiEvent10	Prober Alarm	Alarmed during KTE GPIB control when a prober error occurs.

Carrier Management Alarms

The following table shows Alarm IDs for Carrier Management.

ALID	ALCD	On CEID	Off CEID	ALTX	Description
5007	7	5007: AlarmCarrierID-VerificationEventOn	5023: AlarmCarrierID-VerificationEventOff	CarrierID Verification Failed	An error has occurred during Carrier ID Verification.
5009	7	5009: AlarmSlotMap-ReadEventOn	5010: AlarmSlotMap-ReadEventOff	Slot Map Read Failed	An equipment attempt to read the Slot Map has failed.
5011	7	5011: AlarmSlotMap-VerificationEventOn	5012: AlarmSlotMap-VerificationEventOff	Slot Map Verification Failed	An error occurred during Slot Map Verification.
5023	7	5023: AlarmDuplicate-CarrierIDEventOn	5024: AlarmDuplicate-CarrierIDEventOff	Duplicate CarrierID	The equipment has detected loading of a carrier with the same Carrier ID as another carrier already in the equipment.

Handling prober alarms

During E87/E90/E84 state machine working, when the real prober sends a prober alarm, the equipment will send a S6F11 event to the HOST. Since KIGEM supports several 300mm prober types and each 300mm prober can have more than one thousand alarms, a special mechanism is used to handle prober alarms.

During E87/E90/E84 state machine working, when the prober sends any prober alarm, and when KIGEM receives a S5F1 alarm from the prober:

• KIGEM stores the reported Alarm ID and text to `PrbAlarmID` (VID=5505) and `PrbAlarmText` (VID=5506).

• KIGEM sends out S6F11 to the Host with either CEID=5551 (`PrbAlarmEventOn`) or CEID=5550 (`PrbAlarmEventOff`) depending on the value of bit 8 in ALCD, as reported by the prober.

• KIGEM displays the prober alarm on the KIDS Alarms Panel Prober tab.

• To obtain the prober alarms, the HOST software has to define a report ID and attach the `PrbAlarmID` (VID=5505) and `PrbAlarmText` (VID=5506) to this report. Then the HOST software links the CEID=5551 (`PrbAlarmEventOn`) and CEID=5550 (`PrbAlarmEventOff`) to the report ID. Now, HOST can collect all the alarms events.

During facility processing (the test is executing, KTE prober driver control prober through GPIB), any prober GPIB errors will trigger this equipment to send a S5F1 (ALID=170) to the HOST.

As long as KTE detects that the GPIB prober driver operation return status is not OK, and the prober error handler UAP is called, alarm 170 is sent. This includes `PrChuck` Error (include `BAD_CHUCK-1017`)and `PrMove` Error (include `MOVE_FAIL-1014`) for example. The equipment will ask you whether to continue or abort when this type of error occurs.

Support UF3000(Ex) prober

The following sections explain how KIGEM can support the UF3000(Ex) prober.

KIGEM configuration for UF3000

To configure KIGEM for use with a UF3000 prober:

1. Set the IP to the prober equipment address in the `$KIHOME/dat/proberio_xxxx.ini` file.
2. Set PORT to 5000 in the `$KIHOME/dat/proberio_xxxx.ini` file.

Switch the prober from Remote to Local

To switch the UF3000 prober mode from remote to local mode:

1. Make sure that the FOUP is removed.
2. On the KIDS GUI, SECS/GEM tab, Host Comm page, make sure that the Control State is `OFFLINE-LOCAL`. Select **Go offline** to enable this state.
3. Go to prober side, set the mode from Remote to Local.
   a. From OPTION Mode Settings, go to CHANGE GRP MNG.
   b. From COMM MODE, go to Current Control substatus and select **LOCAL**.
   c. Select **ENT** on the bottom right.
   d. Select **EXIT** to exit the mode settings.
   e. Select **ENT** at the previous screen.
4. Close the KIDS window.
5. From the prober screen display `ENBL/ON/LCL`, now you can run `kte` to run a project without SECS/GEM directly. Before selecting OK button, place the FOUP by selecting `Clear screen` and selecting CONFIRM.
6. The prober will start a wafer scan. Select `Clear screen` again.
7. Select `CONFIRM`.
8. Select **OK** the `kte` GUI.

You can also create a prober recipe file on the prober software.

Switching the prober mode from Local to Remote

The SECS/GEM program may lose the status of the prober which may cause all statuses to improperly function. To resolve this, you must restart the programs.

To restart the programs:

1. On the prober side, switch from Local to Remote mode. The prober displays as `ENBL/ON/RMT`.
2. Enter `su.`
3. Enter the password `keithley`.
4. Enter `kte_system restart`.
5. Enter `exit` to exit the root account.
6. Enter `run_ic.pl` to check and start the instruments.
7. Enter `kids&` to start the Display GUI.
8. Wait for for the host communication to send OK.
9. Prober communication is then enabled. This can display on the KIDS GUI, SECS/GEM tab, and HOST COMM tabs. Then you can use SECS/GEM to control the tester again.

10. On the KIDS GUI, SECS/GEM tab, Host Comm page, make sure that the Control State is `ONLINE-REMOTE` if you want to do automation control from Host.
11. Select the `Go Remote` button to enter this state.

Note for using UF-3000(Ex) probers

KIGEM uses the prober's `Ready To Load` event for resetting its internal variables. Therefore, it is recommended that you place a Front Opening Universal Pod (FOUP) and subsequently remove the FOUP to resynchronize the prober and tester.

The FOUP must be completely removed for the Accretech UF-3000 prober to generate the `Ready To Load` event. Both Placed and Present lights must be off. Any object near the prober's load port will keep the Present light on and prevent the prober from generating the `Ready To Load` event.

The prober may take several seconds to generate the `Ready To Load` event. For example, using an older Accretech software version 15-0N with STS (Substrate Tracking Standard) support, the prober takes from 6 seconds to 17 seconds to generate the `Ready To Load` event after both Placed and Present lights are off.

Before placing or removing a FOUP, always make sure that the KIDS load port status on the top-right corner is highlighted in green (Access Mode as MANUAL).

Press **New CST** after you place a FOUP. You can also configure the prober to automatically clamp the FOUP when it is placed.

On some older Accretech UF-3000 probers with a Carrier ID reader, wait at least ten seconds after placing a FOUP manually before pressing the New CST button on the prober. The prober may fail in reading the Carrier ID if the New CST button is pressed too early.

Support Tel Precio prober (P12 XL)

The following sections explain how KIGEM can support a Tel Precio prober (P12 XL).

KIGEM configuration for a Tel Precio prober

To make the equipment function in ONLINE mode, complete the following procedure first.

NOTE

For OFFLINE mode, follow this procedure first, and then see Switching between ONLINE and OFFLINE Mode (on page 3-53).

To configure KIGEM for use with a Tel Precio prober:

1. Open the `$KIDAT` directory.
2. Open `prbcnfg_QMO.dat`.
3. Set `PROBER_1_CASSETTEMAP=Y`.
4. Access root user.
5. Run the `kte_system restart` command
6. Exit root.
7. Run the `run_ic.pl` command.

Prober configuration

The following procedure configures the equipment to work in ONLINE mode.

NOTE

For OFFLINE mode, follow this procedure first, and then see Switching between ONLINE and OFFLINE Mode (on page 3-53).

To configure the prober:

1. In KIGEM **Diagnostics**, select **Hardware Options**.
2. Select **GPIB Parameters**.
3. Set the Initial wafer SRQ to 46(H).
4. On the **Setup** screen, select **GPIB**.
5. Select **Option parameters**.
6. Set Receive parameters to `YES`.
7. Set Random wafer to `YES`.
8. In KIGEM **Diagnostics**, select `Adjustments`.
9. Select **Testing Limitations**.
10. Set DISPLAY END OF LOT MESSAGE to `NO`.
11. In KIGEM diagnostics, select **GEM**.
12. Select **Setup EC**, and set CarrierReleaseControl to EQUIPMENT.
13. On the **Setup** screen, select **Operation Parameters**.
14. Select **Loader Transfer Conditions**, and set Warning display to `NO`.

Switching between ONLINE and OFFLINE mode

The following procedure switches your equipment between ONLINE to OFFLINE mode.

To switch your equipment between ONLINE to OFFLINE mode:

1. To switch between ONLINE and OFFLINE mode, please follow the table below.

	Items to be configured	**Switch cases**	
		ONLINE to OFFLINE	**OFFLINE to ONLINE**
KIGEM configuration	In `$KIDAT/prbconf_6373.dat`, set `Prober_1_CASSETEMAP` =	N	Y
Prober configuration	In [Diagnositics] -> [GEM], set Control State	Equipment OFFLINE	Equipment ONLINE - REMOTE
	In [Setup] -> [GPIB] -> [Option parameters], set Receive parameters to	NO	YES

2. Access root user, and run `kte_system restart` command.
3. Exit root, and run `run_ic.pl` command.
4. Run the command `kids&`.
5. In the KIDS window, switch to either ONLINE or OFFLINE mode.

KIGEM verification before delivery

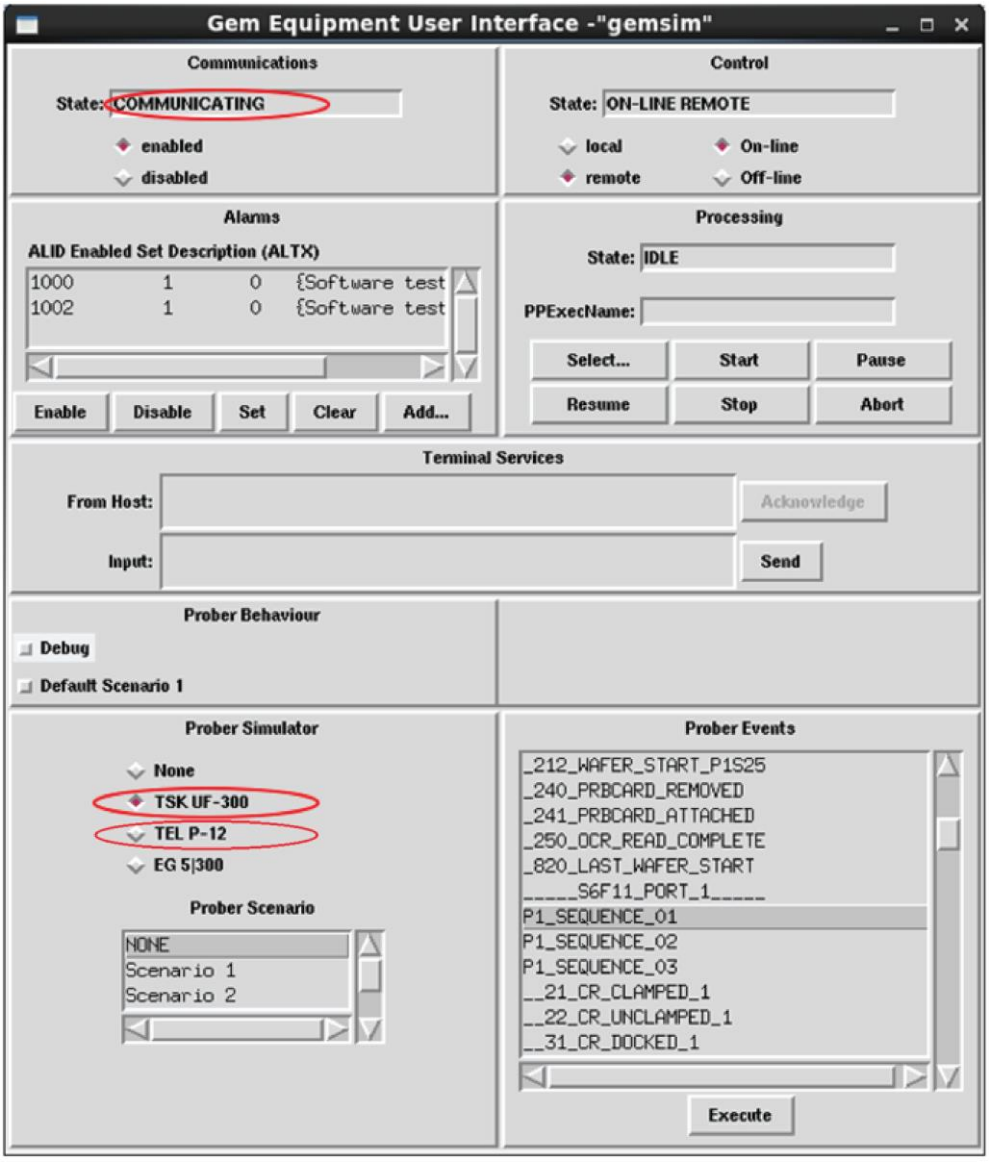
The testing and verification process for KIGEM is a complicated process. The difficulties are that, during this process, there are no real hosts or AMHS and, possibly, there are no real probers either. To guarantee success in this process, Keithley uses licensed HUME equipment and a licensed PEER GROUP Host Simulator to verify KIGEM before delivery. Both ONLINE Local and ONLINE Remote testing and verification are completed before delivering to customers.

Using a Prober simulator to verify ONLINE Local mode

The Keithley Software Prober Simulator GUI, shown in the following figure, supports both the Tel P12/XL prober and the UF3000 (Ex) prober. With this software prober simulator, critical prober HSMS events (defined in E87, Such as ReadyToLoad, TransferBlocked, Clamped, WaitingForHost, IDVerifyOK, Docked, SlotmapWaitingForHost…ReadyToUnload) can be triggered to run the standard workflow within KIGEM.

Sometimes, a prober vendor may provide a hardware prober simulator that can be used to verify both the Keithley software prober simulator and the hardware prober simulator. This allows KIGEM to behave exactly the same as the one to be installed in production.

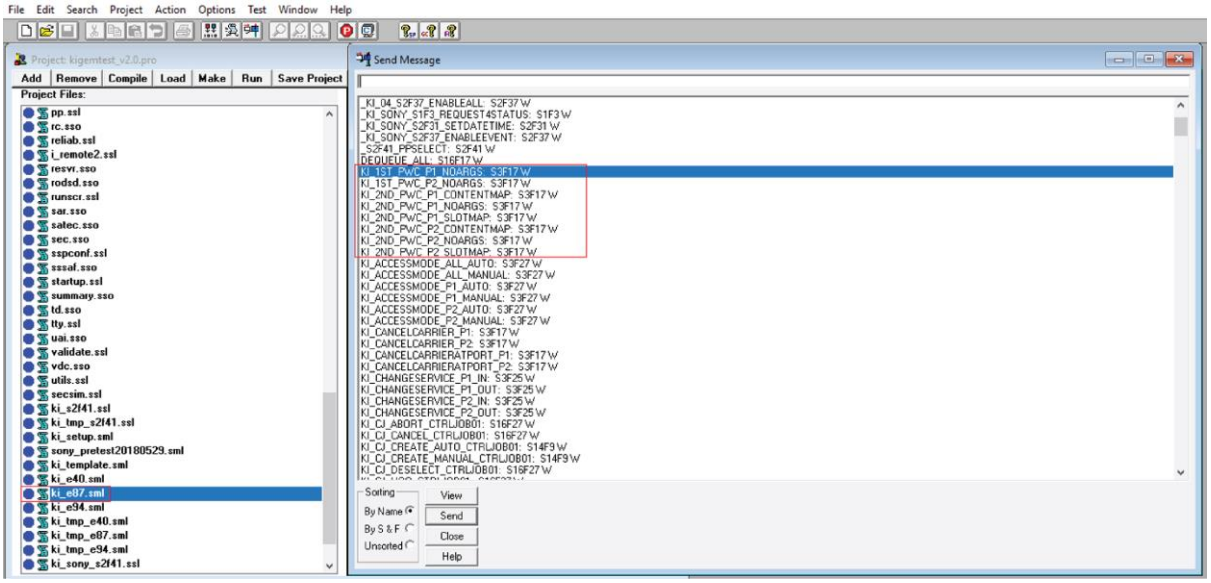
Figure 4: Keithley Software Prober Simulator GUI



PEER GROUP Host Simulator to verify ONLINE Remote mode

With SECSIM Pro+ working as a Fab Host, Keithley writes SML scripts to comply with SEMI standards, such as E87/E40/E94, and verifies all of the standard SxFy functions. The SECSIM Pro+ GUI is shown below.

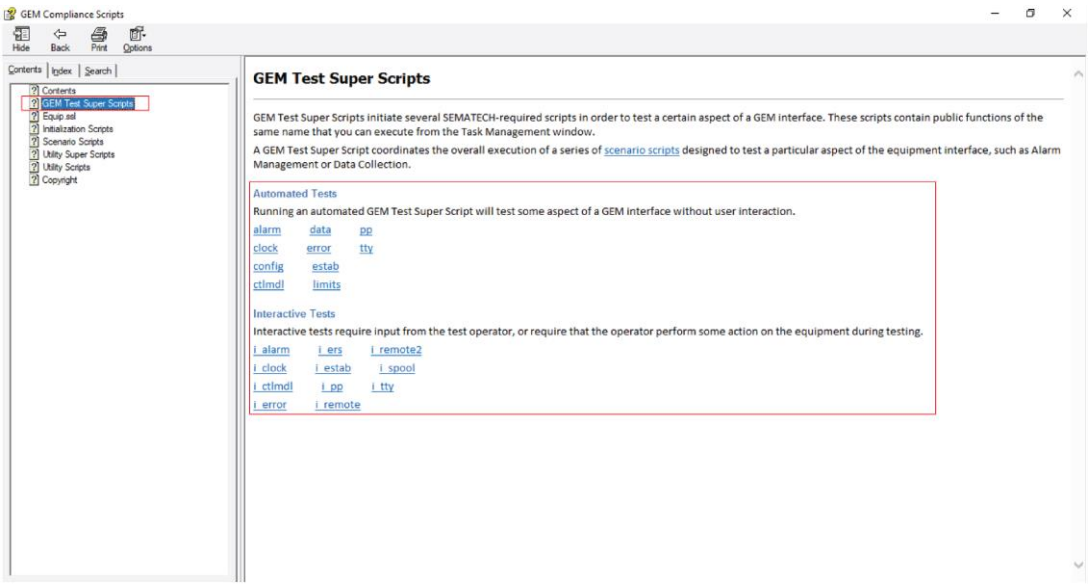
Figure 5: SECSIM Pro+ GUI



Keithley test scripts are differentiated into normal cases and abnormal cases. The abnormal cases contain many common cases on that occur on the customer side. For example, changing Access Mode during Slot Map reading; Cancel Carrier at various moments; Proceed Carrier with a different Carrier ID, PJ stop/abort, and CJ stop/abort.

Except for Keithley-owned test scripts, SECSIM Pro+ provides its own build-in test plans. The following figure shows the SECSIM Pro+ Test Script GUI.

Figure 6: SECSIM Pro+ test super scripts



Keithley guarantees that all of the SECSIM Pro+ built-in super test scripts pass before running a Keithley test plan.

Customer provides Host log and Acceptance test before installation

Before completing installation at the customer site, Keithley will request the Host log (text file) and Acceptance test (Excel file or other format).

Keithley will:

- Define reports according to the host log;
- Enable all events recorded in customer Host log;
- Run the same workflow recorded in the Host log with a prober simulator and a host simulator;
- Verify details according to customer special Acceptance test after the main flow verify;
- Pay attention to customer special features (customizations).

Verify steps during customer installation

Keithley will verify, step-by-step, the installation at the customer site.

Keithley will:

- Use Keithley Host simulator (PEER Group SECSIM Pro+), onsite tester(S530), and prober simulator;
- Use Keithley Host simulator (PEER Group SECSIM Pro+), onsite tester (S530), and on-site prober to primarily test ONLINE Remote, Access mode, and MANUAL mode;
- Use a customer Host simulator instead of the Keithley Host simulator if there is one;
- Connect to a Fab Host, run a final test with AMHS (E84), ONLINE Remote, and Access mode as AUTO mode.

This equipment can do a customer request (special) verify if there is one according to customer details and fab request.

Section 4

System configuration

In this section:

Configuring KIGEM

After KIGEM has been installed, you may need to configure or reconfigure it. For example, you may need to set or change the HSMS communication parameters to match the settings on the host side. You may also need to set or change the HSMS IP address of the prober.

This section will show you how to configure KIGEM. To do so, you should make sure that:

- KTE has been properly installed and configured.
- The Linux® computer network parameters, including IP address, have been properly configured.
- KIGEM has been previously installed and configured correctly.

Site configuration checklist

Configuring KIGEM requires you to enter the value of important parameters. It is recommended that you gather all of this information before attempting to configure KIGEM. The following table will help you gather the necessary information for configuring KIGEM. Complete the following table for each tester that you want to configure.

KIGEM site configuration checklist

#	Status	Name and description	Value
1	[__]	**Is the equipment an HSMS Active or Passive Entity?** Determine what HSMS communications role is assigned for KIGEM. Enter either Active or Passive. Note: Skip item #2 and #3 below if the answer is Passive.	
2	[__]	**HSMS Passive Entity IP Address** Only applicable if item #1 above is Active. Specify the IP Address of the HSMS Passive entity. Format: *nnn.nnn.nnn.nnn*. Where: nnn is 0 to 255 Example: 123.88.222.1	
3	[__]	**HSMS Passive Entity TCP Port** Only applicable if item #1 above is Active. Specify the TCP port number used by the HSMS Passive entity. Format: nnnn. Where: nnnn is 5000 to 9999 Typical values: 5000 or 5555	
4	[__]	**T3 Timeout** T3 Reply timeout in seconds. Valid range is 1 to 120. Default value: 30	
5	[__]	**T5 Timeout** T5 Connect Separation timeout in seconds. Default value: 5	
6	[__]	**T6 Timeout** T6 Control timeout in seconds. Default value: 30	
7	[__]	**T7 Timeout** T7 Connection Idle timeout in seconds. Default value: 5	
8	[__]	**T8 Timeout** T8 Network Intercharacter timeout in seconds. Default value: 6	
9	[__]	**Connection Establishment** Only applicable if item #1 above is Active. Specifies the maximum time (in seconds) to wait after issuing TCP/IP connect command. Default value: 5	

KIGEM site configuration checklist

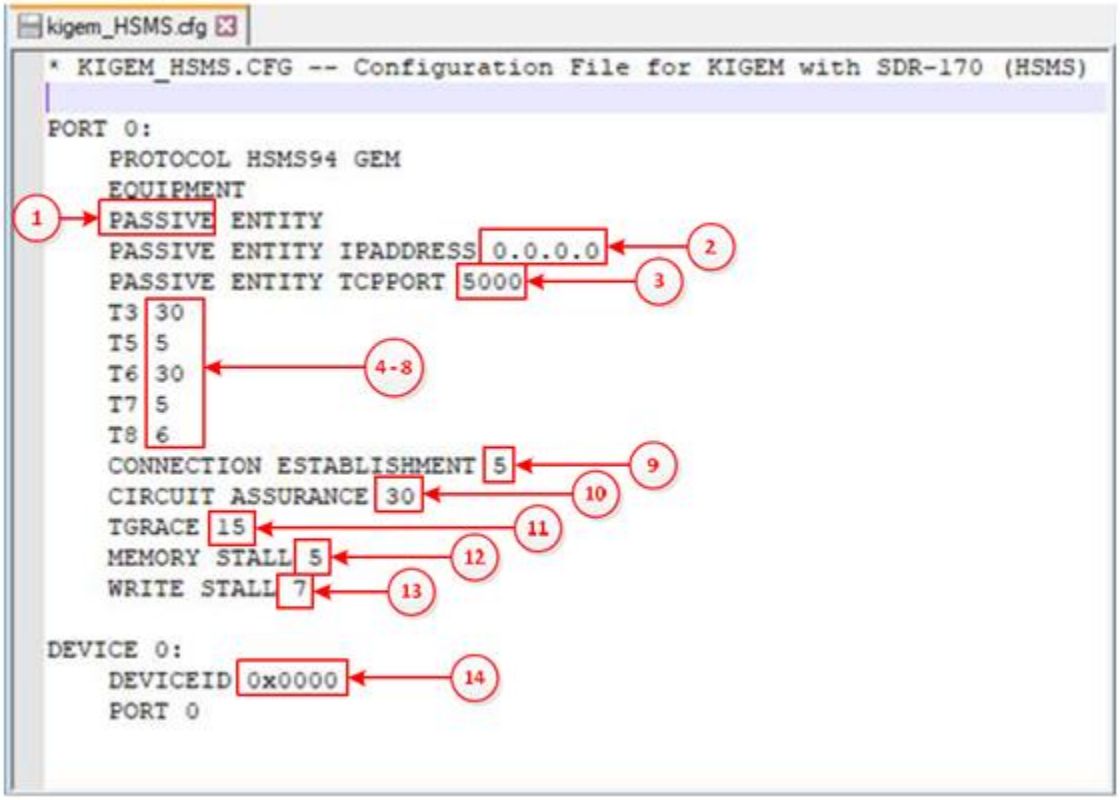
#	Status	Name and description	Value
10	[__]	**Circuit Assurance** Time interval in seconds between Linktest transactions. A value of `0` will disable Linktest. Default value: `30`	
11	[__]	**TGRACE** Specifies the grace period in seconds to buffer messages sent during connection establishment. Default value: **15**	
12	[__]	**Memory Stall** Specifies timeout in seconds when all SDR buffers are full and the other end of the link attempts to send more data. Default value: `5`	
13	[__]	**Write Stall** Specifies timeout in seconds when waiting for TCP/IP to accept data SDR is passing to TCP/IP. Default value: `7`	
14	[__]	**Equipment Device ID** SECS Device ID assigned for KIGEM in decimal value. Format: `n`. Where: `n` is `0` to `32767` Default value: `0`	
15	[__]	`Prober HSMS IP Address` IP Address of the prober's HSMS interface. Format: `nnn.nnn.nnn.nnn`. Where: `nnn` is `0` to `255` Example: `123.88.222.102`	
16	[__]	**Prober HSMS TCP Port Number** TCP port number used by prober's HSMS interface. Format: `nnnn`. Where: `nnnn` is `5000` to `9999` Typical values: `5000` or `5555`	
17	[__]	**Prober HSMS Device ID** SECS Device ID of the prober in decimal value. Format: `n`. Where: `n` is `0` to `32767` Typical value: 0	
18	[__]	**Prober Type** Valid values are: `UF3000 and P12`	
19	[__]	**AUTO_START** Whether or not ProberIO will start PrbHost automatically. Must be set to `ENABLED` when using KIGEM. Default value: `DISABLED`.	`Enabled`

HSMS Communications parameters

To configure KIGEM HSMS communications parameters:

1. Log in as `kthmgr`.
2. Using a text editor, open and edit the KIGEM HSMS configuration file: `$KIDAT\kigem_HSMS.cfg`
3. Enter the values from KIGEM Site Configuration Checklist as indicated in the following figure. The number inside the circle corresponds to the item number in the checklist.
4. Save the changes and exit your text editor.
5. Restart KIGEM.

Figure 7: KIGEM HSMS configuration file

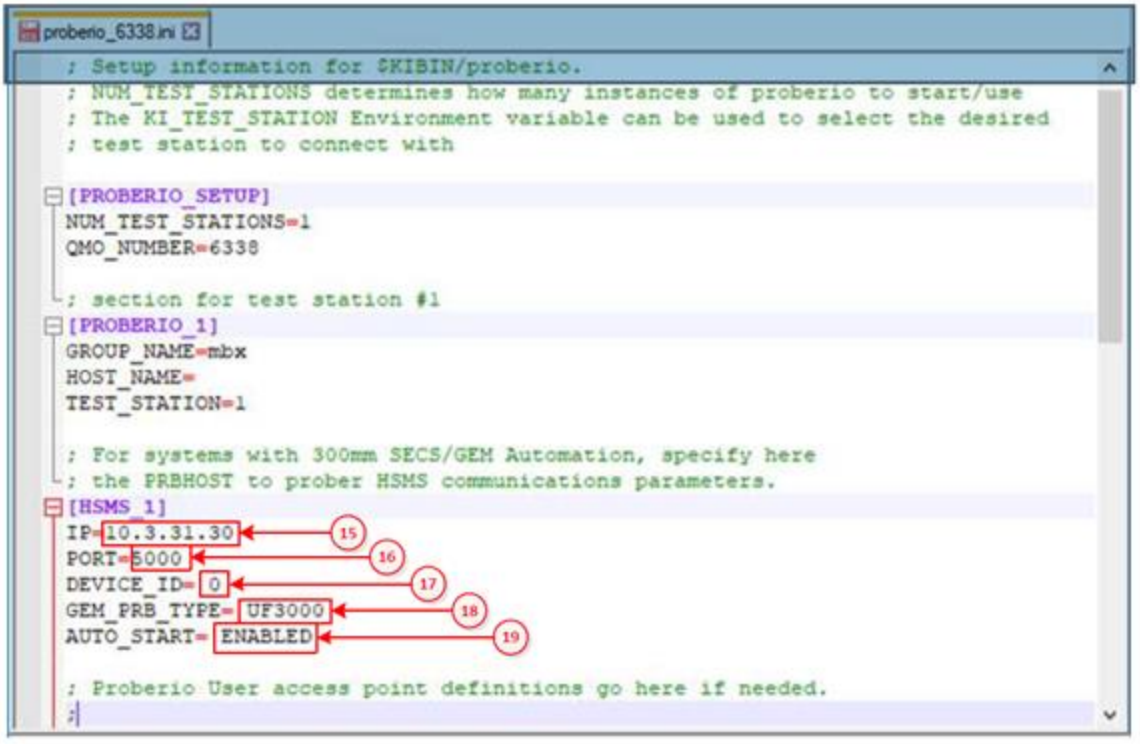


Prober HSMS parameters

To configure PrbHost to prober HSMS communications parameters:

1. Login as `kthmgr`.
2. Using a text editor, open and edit the ProberIO configuration file: `$KIDAT\proberio_NNNN.cfg` where `NNNN` is the QMO number.
3. Enter the values from KIGEM Site Configuration Checklist as indicated below. The number inside the circle corresponds to the item number in the checklist.
4. Make sure `AUTO_START` is set to `ENABLED`.
5. Save the changes and exit your text editor.
6. Restart all KTE components.

Figure 8: ProberIO configuration file



Controlling KIGEM manually

KIGEM is automatically started when the Linux® computer is booted, even when there is nobody logged in to the Linux® computer. It is designed to run in the background and does not need any user interaction. For maintenance and troubleshooting purposes, you may need to start or stop KIGEM manually.

Starting KIGEM manually

To start KIGEM manually:

1. Log in as `kthmgr`.
2. Open a terminal window.
3. At the command prompt, type `su`, and press **Enter** to log in as `root` user.
4. Enter the password when you are prompted.
5. From the terminal window, enter `/etc/rc2.d/S85kigem start`, and press **Enter**.
6. Log out as `root`.

Stopping KIGEM manually

To stop KIGEM manually:

1. Log in as `kthmgr`.
2. Open a terminal window.
3. At the command prompt, type `su`, and press **Enter** to log in as `root` user.
4. Enter the password when you are prompted.
5. From the terminal window, enter `/etc/rc2.d/S85kigem stop`, and press **Enter**.
6. Log out as `root`.

Restarting all KTE components

When you restart all KTE components, you are also restarting DataHub, KISA, ProberIO, PrbHost, and KIGEM.

To restart all KTE components:

1. Make sure that there is not a FOUP on the prober. All load ports must be empty.
2. Log in as `kthmgr`.
3. Open a terminal window.
4. At the command prompt, type `su`, and press **Enter** to log in as `root` user.
5. Enter the password when you are prompted.
6. From the terminal window, enter `$KIBIN/kte_system restart`, and press **Enter**.
7. Logout as `root` user.

Environment Variables

KIGEM Environmental Variables	
KIHOME	Base KTE installation directory
KIBIN	KTE executable files directory
KIDAT	KTE configuration files directory
KILOG	KTE log files directory
KILOGSIZE	An optional Environment Variable to specify the maximum size of log files in kilobytes (default value is 1440).
KI_KIGEM_DEBUG	KIGEM debug flag. A value of zero turns off debug messages (default value is 1).
KI_KIGEM_SHOW_LOG	A non-zero value will repeat all debug messages to the Console Window for real-time monitoring (default value is 0).

Important files

Other important KIGEM files	
/etc/rc2.d/S85kigem	This file is executed at boot time to launch KIGEM.
$KI_KTXE_UAP/kigem.uap	This .uap file is automatically included in any test run from KIDS or the Factory Automation Host whenever KIGEM is running. You may add or delete entries in this file to meet your needs, but do not move, rename, or delete this file.
$KIDAT\kigem.ini	This is the KIGEM configuration file.
$KIDAT\kigem_HSMS.cfg	This is the configuration file for the HSMS driver.
$KIDAT\kisa_NNNN.ini	This is the KISA configuration file.
$KIDAT\kids_1_NNNN.ini	This is the KIDS configuration file.

Section 5

Using KIGEM

In this section:

KIDS SECS/GEM window

Since KIGEM runs in the background, a graphical user interface application (GUI) is needed for accessing KIGEM from the Linux® computer. You will use KIDS (Keithley Integrated Display Service) to do this.

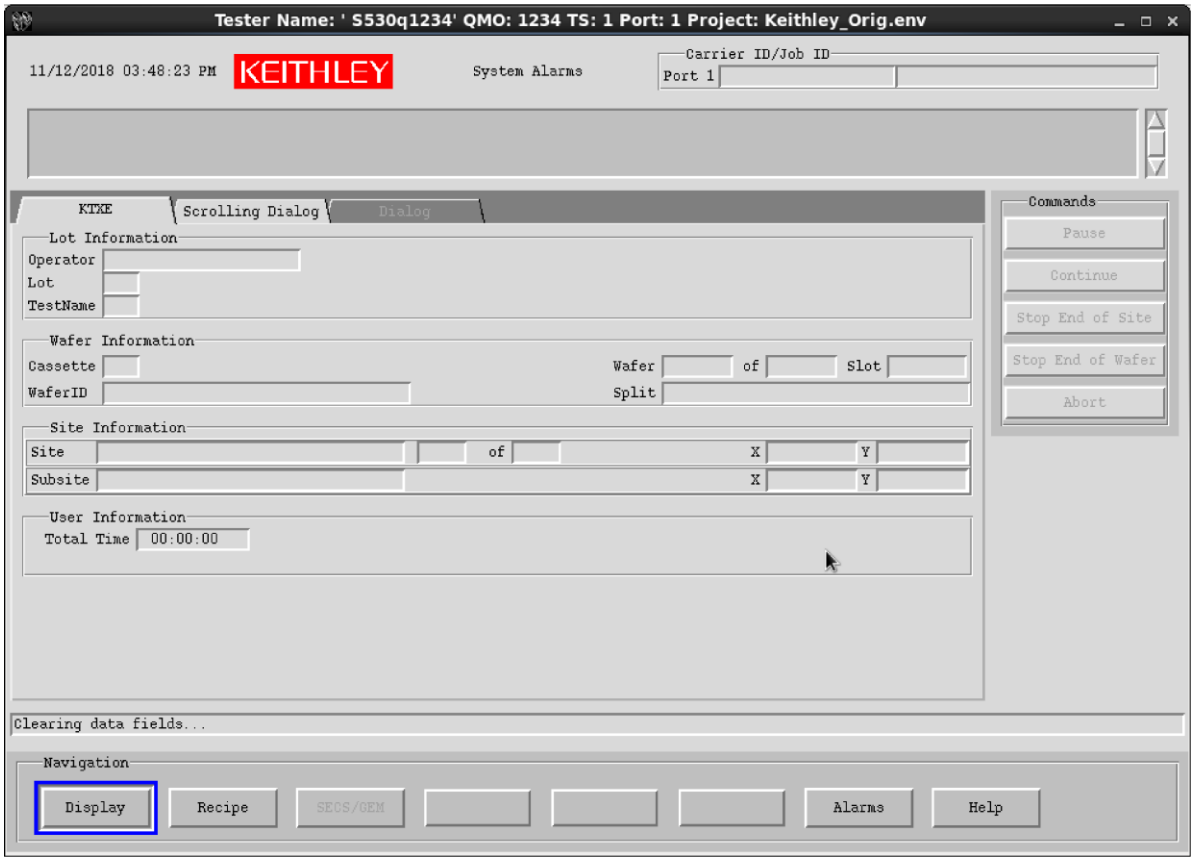
KIDS serves as an integrated display for KIGEM and other KTE components such as KTXECWP. Only KIGEM-related areas of KIDS are described in this manual.

To run KIDS:

1. Log in to one of the KTE accounts.
2. Open a terminal window.
3. Enter `kids&`

The main interface of KIDS is shown in the following figure.

Figure 9: KIDS main interface



NOTE

In this screenshot, the SECS/GEM button on the Navigation window is disabled, and there is not a status for Host Communication. This is the default configuration. Configuring KIDS for 300mm SECS/GEM Automation will enable the SECS/GEM features.

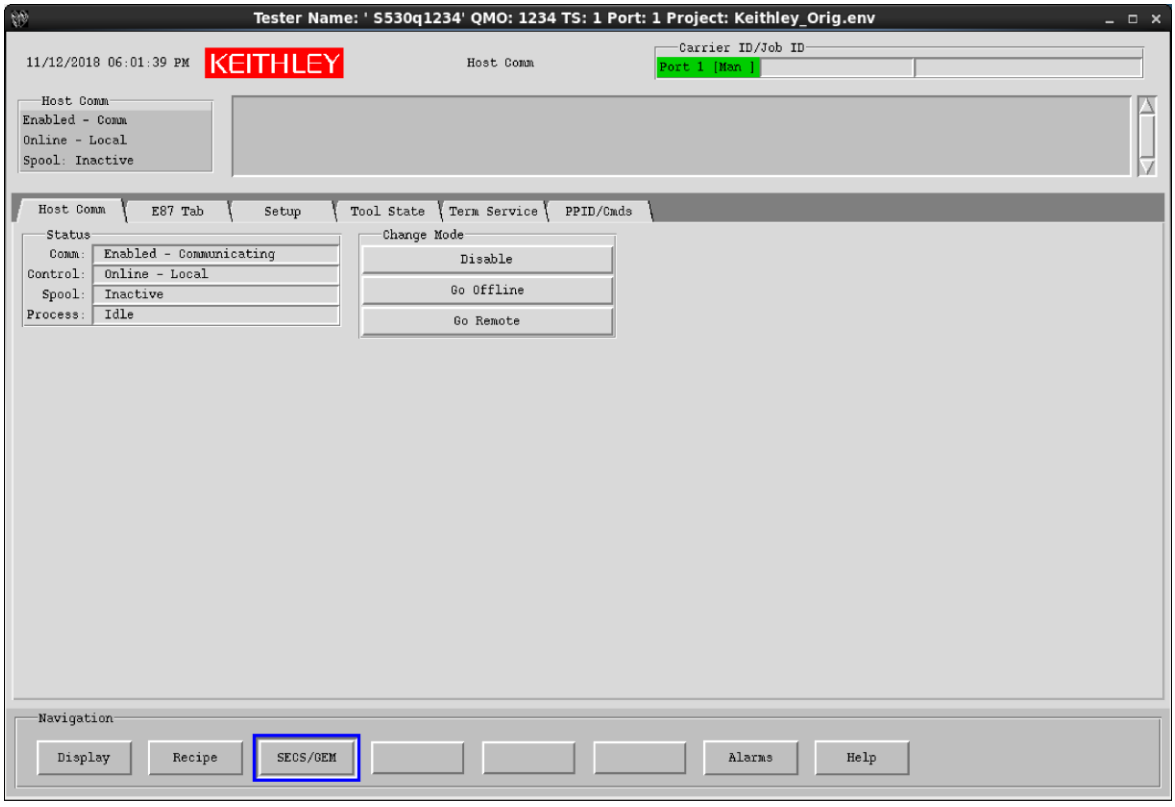
The following sections use screen captures of KIDS when it is properly configured for 300mm SECS/GEM Automation using a single-port prober.

Selecting the SECS/GEM button on the navigation window opens the SECS/GEM window. The SECS/GEM window contains the following six tabs:

- Host Comm
- E87 Tab
- Setup
- Tool State
- Term Service
- PPID/Cmds

Host Comm tab

Figure 10: KIDS Host Comm tab



The Host Comm tab shows the SECS/GEM Communication Status of the link between KIGEM and the Factory Automation Host. It also shows the Control State, Spooling State, and Process State of the instrument as specified in the SEMI E30 (GEM) standard.

To comply with the SEMI E95 requirement, the Communication State, Control State, and Spooling State are shown on the top-left corner of KIDS and are always visible.

There are three buttons on the Host Comm tab.

Host Comm tab buttons	
Enable / Disable	This button controls the GEM communications state. Pressing this button in the `Enabled Communicating` or `Enabled Not Communicating` state changes the state to `Disabled`. Pressing this button in the `Disabled` state changes the state to `Enabled Not Communicating`.
Go Offline / Go Online	This button controls the GEM control state. Pressing this button in the `Offline-Equipment Offline` state changes the state to `Offline-Attempt Online`. Pressing this button in the `Offline-Attempt Online`, `Online-Local`, or `Online-Remote` state changes the state to `Offline-Equipment Offline`.
Go Remote / Go Local	This button causes the control state to toggle between `Online-Local` and `Online-Remote`. This button has no effect when the control state is in any of the offline states.

Comm Status

The Comm Status field will display one of the following messages.

Comm status messages	
`Disabled`	In this state, the equipment will not send messages to the Host and will not respond to a Host ENQ.
`Enabled - Not Communicating`	In this state the equipment is ready to communicate. When the equipment receives an S1F13 message from the Host, the state changes to `Enabled Communicating`.
`Enabled - Communicating`	This message indicates the communications link is operating and functional.

Control Status

The Control Status field will display one of the following messages.

Control status messages	
OFF-LINE - EQUIPMENT OFF-LINE	This state indicates that the equipment is OFF-LINE. From this state, only the equipment can switch itself ON-LINE. The equipment will not send other primary messages to the Host except S1F13 (Connect Request).
OFF-LINE - ATTEMPT ON-LINE	In this state, the equipment is attempting to transit from OFF-LINE to ON-LINE. The equipment sends S1F1 (Are You There) to the Host, requesting permission to go ON-LINE. The equipment will not send other primary messages to the Host except S1F13.
OFF-LINE - HOST OFF-LINE	In this state, the equipment is ready to go ON-LINE but is waiting for the Host to request it. If the Host sends an S1F17 (Online Request), the equipment will reply and go ON-LINE.
ON-LINE - LOCAL	The SECS link operates normally. The Host can receive result data but cannot start a test. The operator may perform all functions.
ON-LINE - REMOTE	This state is similar to the Online-Local Mode with the exception that the Host controls the testing. Remote commands sent from the Host can only be executed in a safe processing state and cannot interfere with processing.

Spool Status

The equipment uses spooling when it is unable to communicate with the Host to save messages for transmission. The Spool Status field displays one of the following messages.

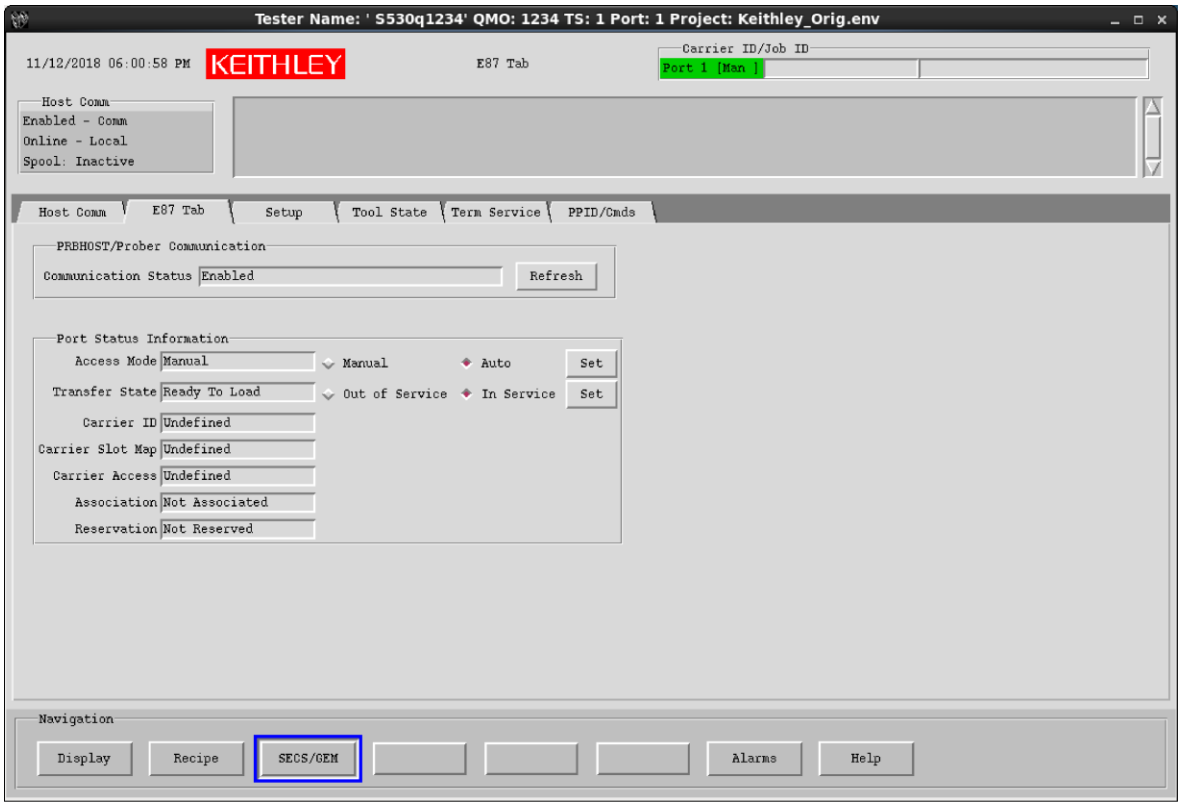
Spool status messages	
Inactive	Communication with the Host is occurring, and messages are not being spooled.
Active	Messages are being spooled to a disk file. The equipment will stay in this state regardless of the communications and state until an S6F43 message is received from the Host.

The Process Status field indicates the status of the tester. You can set the Process Status from one of the user-access point (UAP) routines to display one of the following tester states:

- Initializing
- Idle
- Moving to Site
- Moving to Subsite
- Loading Wafer
- Testing
- Waiting for User Input
- Unloading Wafer
- Terminating Test Program
- Operator Abort

E87 tab

Figure 11: KIDS E87 tab



The E87 tab displays status information and control buttons associated with the SEMI E87 standard. You must enable the `E87_SUPPORT` parameter in the `[SECS_OPTIONS]` section of the KIDS configuration file to make the E87 tab active.

PRBHOST/Prober Communication is used to display the HSMS communications link status between PRBHOST and the prober.

Communication status field messages	
`Disabled`	HSMS communications link between PRBHOST and the prober is down.
`Enabled`	HSMS communications link between PRBHOST and the prober is working normally.

The Communication Status field updates as soon as KIGEM detects any changes in HSMS communications link between PRBHOST and the prober. If the status is taking too long to update, select the **Refresh** button to force KIGEM to check the communications link and update the Communication Status field.

The Refresh button triggers the following actions:

- KIGEM sends S1F1 to the prober.
- If KIGEM receives S1F2 from the prober, the HSMS communications link is verified. The prober must be in the Online state. Therefore, KIGEM sets the Communication Status field to `Enabled`.
- If the S1F1 fails, KIGEM automatically sends S1F13 (Establish Communication Request), followed by S1F17 (Online Request) and another S1F1. If the S1F1 still fails, KIGEM will conclude that the HSMS link is not functioning and set the Communication Status field to `Disabled`.

The Status Information field for the Port 1/Port 2 area is used to display the current state of the instruments for various SEMI E87 state models:

- Access Mode
- Load Port Transfer State
- Carrier ID Status
- Carrier Slot Map Status
- Carrier Accessing Status
- Load Port/Carrier Association State
- Load Port Reservation State

Refer to the SEMI E87 Standard for the definition and possible values for these state models.

NOTE

`Transfer Blocked` is one of the normal states for the SEMI E87 Load Port Transfer State. `Transfer Blocked` is not an error.

When KIGEM is not in Online-Remote mode, you can set the Access Mode of the prober from this window:

1. Select either **Manual** or **Auto** next to the Access Mode field.
2. Select either **Port 1** or **Port 2** (applicable on dual-port probers only).
3. Select Set.

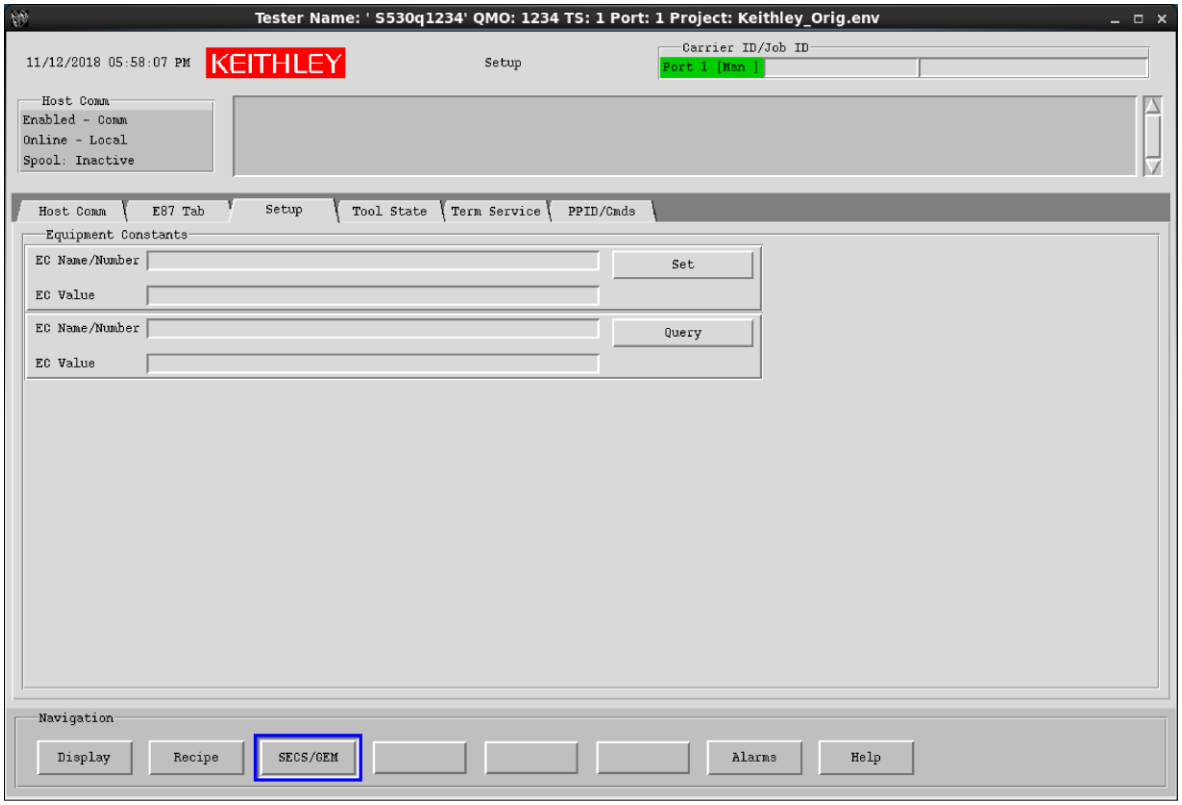
You can also set the Load Port Transfer state of the prober to either In Service or Out of Service when KIGEM is not in Online-Remote mode:

1. Select either **In Service** or **Out of Service** next to the Transfer State field.
2. Select either **Port 1** or **Port 2**. This step is only applicable on dual-port probers.
3. Select Set.

When KIGEM is in Online-Remote mode, both of the Set buttons are disabled. Only the Factory Automation Host can change these two state models when KIGEM is in Online-Remote mode.

Setup tab

Figure 12: KIDS Setup tab



Use the Setup tab to set or query KIGEM Equipment Constants. You can use either the Equipment Constant name or ID to query or set its value. The top portion of the Setup tab is used for setting the value of an Equipment Constant.

Refer to the KIGEM Automation Reference Manual (document number KIGEM-901-01) for supported Equipment Constants.

To set the value of an Equipment Constant:

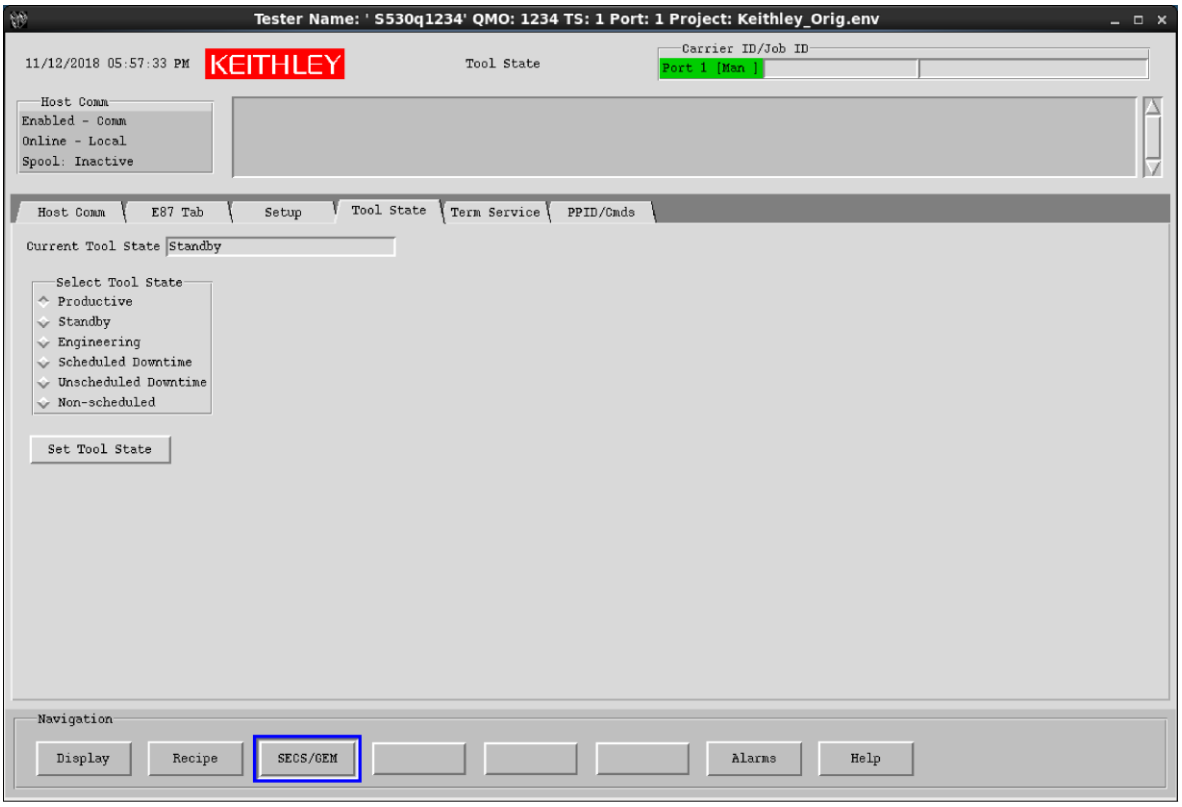
1. Enter the Equipment Constant name or ID in the first EC Name/Number field.
2. Enter the new value in the top EC Value field.
3. Select **Set**.

The bottom portion of the Setup tab is used for querying the value of an Equipment Constant.

To query the value of an Equipment Constant:

1. Enter the Equipment Constant name or ID in the bottom EC Name/Number field.
2. Select **Query**.
3. The value is displayed on the bottom EC Value field.

Tool State tab



The Tool State tab shows the Current State of the equipment as defined in the SEMI E10 standard. It also allows you to change the Tool State.

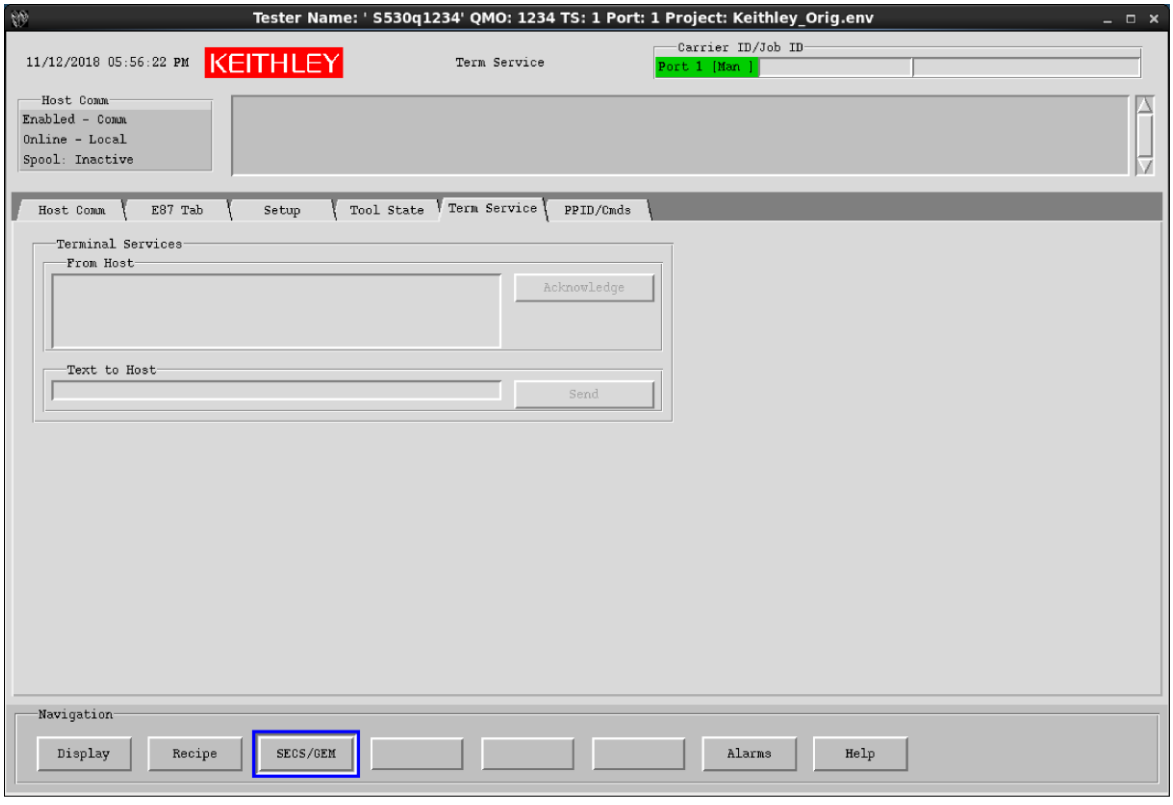
To change the Tool State:

1. Select the new state.
2. Select **Set Tool State**.

When the Tool State is changed, KIGEM updates the `Tool State` Status Variable (`VID=138`) and notifies the Factory Automation Host by sending out a S6F11 message with `CEID=163 (ToolStateChanged)`.

Term Service tab

Figure 13: KIDS Term Service tab



Use the Term Service tab for sending and displaying terminal service messages (S10Fy) as defined in the SEMI E30 standard.

When KIGEM receives a terminal message from the Host, the message is displayed in the From Host field. The Acknowledge button is enabled when there is an unacknowledged message from the Host. Selecting the Acknowledge button sends out S6F11 message with `CEID=150 (S10Ack)` to the Host.

To send a terminal message to the Host:

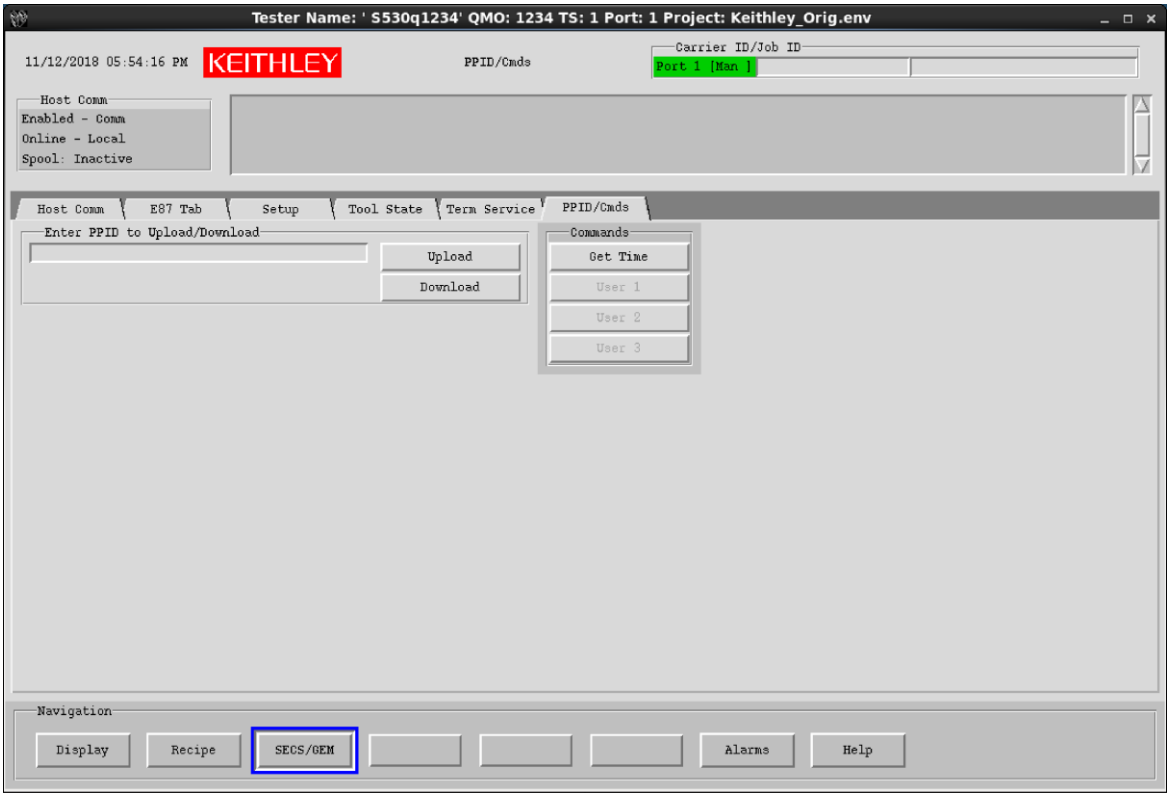
1. Enter the text in the Text to Host field.
2. Select **Send**.

NOTE

The equipment only supports terminal `ID = 0`.

PPID/Cmds tab

Figure 14: KIDS PPID/Cmds tab



Use the PPID/Cmds tab for uploading and downloading a process program from the equipment, retrieving the time from the Host, and other custom commands.

Selecting Get Time causes KIGEM to send an S2F17 message to Host.

To upload a process program from the equipment to the Host:

1. Enter the Process Program ID in the text field.

NOTE

The PPID does not include the path, but it must include the file extension (`.cpf` or `.krf`).

2. Select **Upload**.

To download a process program from the Host to the equipment:

1. Enter the Process Program ID in the text field.

NOTE

The PPID does not include the path, but it must include the file extension (`.cpf` or `.krf`).

2. Select **Download**.

See Recipe management (on page 5-27) for more information on Process Program Management.

There are up to three user-defined buttons that can be enabled for custom implementations.

To enable the user-defined buttons:

1. Edit the `[SECSTAB]` section of the KIDS configuration file.

   For each button to be enabled:

   - Set the corresponding `USER_n` parameter to `Enabled`.
   - Set the corresponding `USER_n_label` to the desired button label.

2. Edit the KISA configuration file: `$KIDAT/kisa_qmo.ini`, where `qmo` is the QMO number. For each button to be enabled, enable and set the corresponding `KUAP_KISA_USERn` parameter to specify the user library and module names to be executed when the button is pressed.
3. Use KULT to create, compile and build the user library and modules to be executed.
4. Restart KISA using `$KIBIN/S82kisa`.

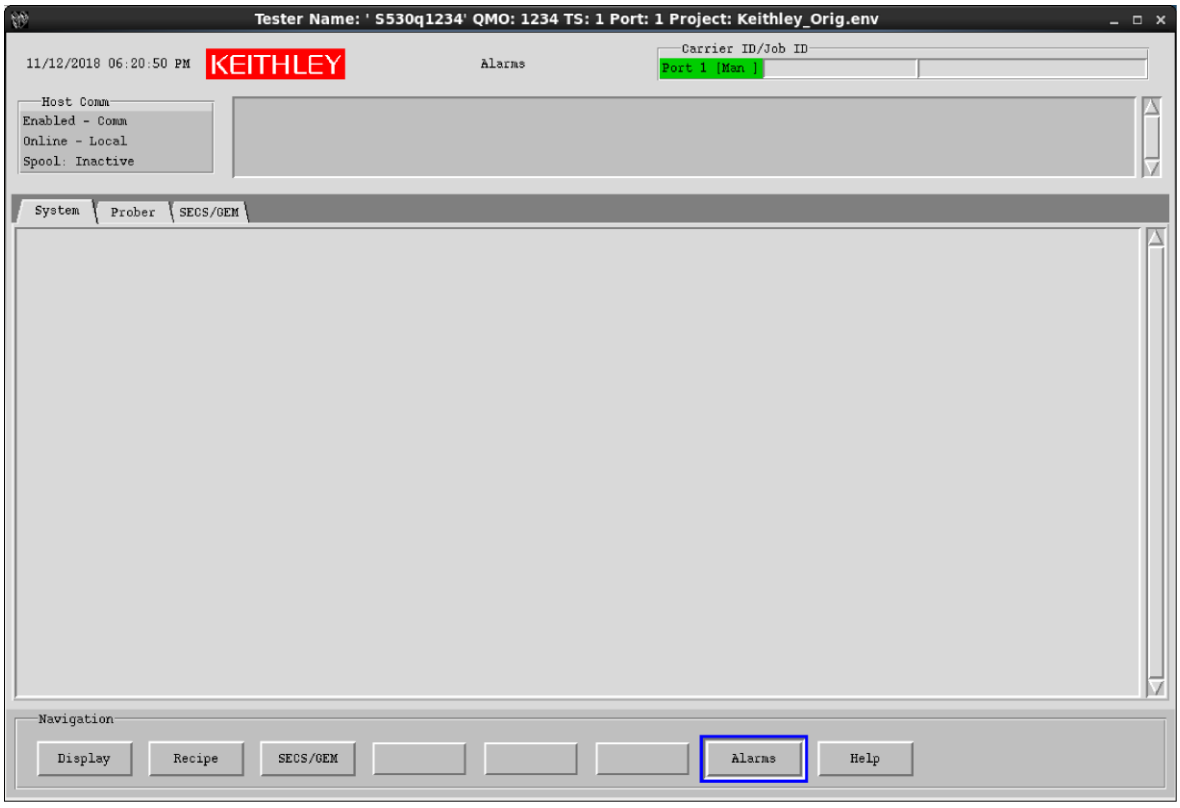
NOTE

You must be logged in as `root` user to execute this script.

5. Restart KIDS.

Alarms window

Figure 15: KIDS Alarms Panel



Use the Alarms window to display three types of alarms:

- System Alarms
- Prober Alarms
- SECS/GEM Alarms

Each alarm is color-coded as follows:

- Errors are displayed in red.
- Warnings are displayed in yellow.
- Information messages are not highlighted.

Remote commands

KIGEM supports the following S2F41 remote commands:

S2F41 RCMD	Description
ABORT	Immediately terminates a test execution.
CHANGE_PROJECT	Selects a different project (test environment).
CHECK_PRB_HSMS	Checks the HSMS communications link between PRBHOST and the prober.
CLAMP	Executes a user-defined clamp function (KUAP_CLAMP).
PAUSE	Causes test execution to suspend until receipt of the RESUME remote command.
PP-SELECT	This command is supported by KIGEM but not required for test execution. PP-SELECT copies the CPVAL to TestProgramName (VID=101).
RELEASE_CARRIER	Release Carrier using GPIB command.
RESUME	Causes the test execution to resume after is was paused.
SET_RFI	Selects a different .rfi file for RF testing.
START	Builds and executes a cassette plan file from the remote command parameters and a template cassette plan file.
START_PLAN	Executes an existing cassette plan file. Applicable when KRF_Mode=0 only.
START_KRF	Executes an existing recipe (.krf) file. Applicable when KRF_Mode=1 only.
STOP	Safely terminates a test execution.
UNCLAMP	Executes a user-defined unclamp function (KUAP_UNCLAMP).
GUAP_usrCmd	KIGEM executes a user-defined function.
KUAP_usrCmd	KISA executes a user-defined function.

NOTE

Some remote commands require changing KIGEM configuration and creating custom user-access point (UAP) code. Contact Keithley Instruments for assistance.

ABORT

The format of the S2F41 ABORT message is described below:

```
<L [2]
   <A "ABORT">
   <L
          <L [2]
                 <A "PORTNO" >
                 <A "1">
          >
   >
>.
```

The ABORT remote command immediately terminates a running test execution. Supported Port Numbers are 1 and 2.

CHANGE_PROJECT

The format of the S2F41 CHANGE_PROJECT message is described below:

```
<L [2]
   <A "CHANGE_PROJECT">
   <L
         <L [2]
                 <A "PROJECTNAME" >
                 <A "Keithley_Orig.env">
          >
   >
>.
```

The CHANGE_PROJECT remote command selects a different project (test environment). The CPVAL for PROJECTNAME must include the .env extension.

This remote command is only supported when KIGEM is not in Recipe Mode. For instance, KRF_Mode must be 0. When KIGEM is used in Recipe Mode with the Keithley Recipe Manager and Version Control, KIGEM will always use the Production Environment Project and cannot be changed.

Whenever the equipment project is successfully changed, either by the operator or the Host, KIGEM updates the ProjectName (VID=5507) Status Variable and sends out S6F11 collection events (CEID=5507) to the Factory Automation Host.

CHECK_PRB_HSMS

The format of the S2F41 CHECK_PRB_HSMS message is described below:

```
<L [2]
    <A "CHECK_PRB_HSMS">
    <L
    >
>.
```

The CHECK_PRB_HSMS remote command checks the HSMS communications link between PRBHOST and the prober. Sending this remote command is identical to selecting Refresh on the KIDS E87 tab user-interface window. See E87 tab (on page 5-6) for more information.

CLAMP

The format of the S2F41 CLAMP message is described below:

```
<L [2]
   <A "CLAMP">
   <L
        <L [2]
             <A "PORTNO" >
             <A "1">
        >
   >
>.
```

The CLAMP remote command executes a user-defined clamp function (KUAP_CLAMP). Supported Port Numbers are 1 and 2 and are passed to the KISA user-access point function as an argument.

PAUSE

The format of the S2F41 PAUSE message is described below:

```
<L [2]
         <A "PAUSE">
         <L
               <L [2]
                     <A "PORTNO" >
                     <A "1">
               >
         >
>.
```

The PAUSE remote command causes a test to suspend until you send the RESUME remote command. Supported Port Numbers are 1 and 2.

PP-SELECT

The format of the S2F41 PP-SELECT message is described below:

```
<L [2]
         <A "PP-SELECT">
         <L
                <L [2]
                       <A "TESTPROGRAM" >
                       <A "Gem_Test.cpf">
                >
         >
   >.
```

The PP-SELECT remote command is supported by KIGEM, but it is not required for running a test. PP-SELECT only copies the CPVAL to TestProgramName (VID=101).

RELEASE_CARRIER

The format of the S2F41 RELEASE_CARRIER message is described below:

```
<L [2]
         <A "RELEASE_CARRIER">
         <L
                <L [2]
                       <A "PORTNO" >
                       <A "1">
                >
        >
>.
```

The RELEASE_CARRIER remote command sends a GPIB command that is equivalent to the SEMI E87 CancelCarrier/CancelCarrierAtPort command to the prober.

This remote command must only be used when the E87 CarrierAccessingStatus is IN_ACCESS, CARRIER_COMPLETE or CARRIER_STOPPED.

According to E87, CancelCarrier/CancelCarrierAtPort service cannot be used after substrates have been removed for processing (when CarrierAccessingStatus is IN_ACCESS, CARRIER_COMPLETE, or CARRIER_STOPPED). In these cases, the RELEASE_CARRIER remote command provides an alternative for releasing the Carrier using the GPIB command when supported by the prober.

RESUME

The format of the S2F41 RESUME message is described below:

```
<L [2]
          <A "RESUME">
          <L
                 <L [2]
                        <A "PORTNO" >
                        <A "1">
                 >
          >
>.
```

The RESUME remote command causes test execution to continue from a paused state. Supported Port Numbers are 1 and 2.

SET_RFI

The format of the S2F41 SET_RFI message is described below:

```
<L [2]
          <A "SET_RFI">
          <L
                 <L [2]
                        <A "RFIFILE" >
                        <A "example.rfi">
                 >
          >
>.
```

The SET_RFI remote command selects a different .rfi file for RF testing. The CPVAL for RFIFILE must include the .rfi extension.

This remote command is only supported when the RF option is enabled.

Whenever the equipment .rfi file is successfully changed, either by the operator or the Host, KIGEM updates the RfiFile (VID=5508) Status Variable and sends S6F11 collection event (CEID=5508) to the Factory Automation Host.

START

The format of the S2F41 START message is described below:

```
<L [2]
     <A "START" >
     <L
          <L [2]
               <A "PORTNO" >
               <A "1">
          >
          <L [2]
               <A "PROG_ARGS" >
               <A "-l klf_fname –w wdf_fname">
          >
          <L [2]
               <A "LOTID" >
               <A "lot1">
          >
          <L [2]
               <A "DEVICE" >
               <A "device1">
          >
          <L [2]
               <A "PROCESS" >
               <A "process1">
          >
          <L [2]
               <A "WAFERCNT" >
               <U4  n>
          >
          /* The next 4 lists repeat n times */
          <L [2]
               <A "SLOTID" >
               <U2 2>
          >
          <L [2]
               <A "WAFERID" >
               <A "wafer_1">
          >
          <L [2]
               <A "WAFER_PLAN_ID"
               <A "test_1k.wpf"
           >
           <L [2]
                <A "SPLITID" >
                <A "Split1">
           >
          .
          .
          .
          <L [2]
               <A "SLOTID" >
               <U2 4>
          >
```

```
          <L [2]
               <A "WAFERID" >
               <A "wafer_3">
          >
          <L [2]
               <A "WAFER_PLAN_ID"
               <A "test_5k.wpf"
          >
          <L [2]
               <A "SPLITID" >
               <A "Split1">
          >
     >
>.
```

NOTE

For backwards compatibility, the `PORTNO` and `PROG_ARGS` parameters and their values are optional

The remote command `START` builds and executes a cassette plan based on the skeleton cassette plan `<DEVICE>.cpf`. The following table shows an example cassette plan skeleton file and the resulting cassette plan built when the above S2F41 message for three wafers is received.

Skeleton cassette plan file device1.cpf	**`START` command produced cassette plan file lot1.cpf**
`#Keithley Cassette Plan Definition File`	`#Keithley Cassette Plan Definition File`
`Version,1.0`	`Version,1.0`
`File,device1.cpf`	`File,lot1.cpf`
`Date,10/14/2018`	`Date,10/14/2018`
`Comment,GEM test case`	`Comment,GEM test case`
`Data,device1`	`Data,lot1`
`Engine,ktxe`	`Engine,ktxe`
`Probe,test_1k.pcf`	`Probe,test_1k.pcf`
`Global,test_1k.gdf`	`Global,test_1k.gdf`
`UAPdefaults,gemdef.uap`	`UAPdefaults,gemdef.uap`
`<EOH>`	`<EOH>`
`<EOSLOTS>`	`2,wafer_1,test_1k.wpf`
`<EOUAP>`	`3,wafer_2,test_1k.wpf`
`-`	`4,wafer_3,test_5k.wpf`
`-`	`<EOSLOTS>`
`-`	`<EOUAP>`

The START remote command is only supported when KRF_Mode=0. LOTID must contain alphanumerical, underscore (_), or dash (-) characters only.

The optional PROG_ARGS parameter can be used to specify applicable KTXE command-line arguments.

Slot, wafer id, wafer plan, and split id arrays, one entry for each wafer, are accessible within KTXE User-Access Points using the KIGEMUAP function gem_get_vid(). The following GEM Variables are also updated.

Variable name	VID	Size	Updated on
LotID	100	50 characters	START message
TestProgramName	101	255 characters	START message
TestProgramArgs	148	255 characters	START message
Product(Device)Type	102	50 characters	START message
ProcessType	106	50 characters	START message
WaferID	107	32 characters	UAP_WAFER_BEGIN
SlotID	109	2-byte integer	UAP_WAFER_BEGIN
SplitID	110	32 characters	UAP_WAFER_BEGIN
WaferPlanID	132	255 characters	UAP_WAFER_BEGIN
SiteID	108	32 characters	UAP_SITE_CHANGE

START_PLAN

The remote command START_PLAN executes the designated cassette plan. The .cpf extension is appended to the CASSETTE_PLAN_ID.

```
S2F41 W
<L [2]
   <A "START_PLAN" >
   <L
         <L [2]
               <A "PORTNO" >
               <A "1">
         >
         <L [2]
               <A "LOTID" >
               <A "lot_123">
         >
         <L [2]
               <A "PROG_ARGS" >
               <A "-l klf_fname –w wdf_fname">
         >
         <L [2]
               <A "CASSETTE_PLAN_ID" >
               <A "cassette_plan1">
         >
         <L [2]
               <A "DEVICE" >
               <A "device1">
         >

         <L [2]

               <A "PROCESS" >

               <A "process1">
```

```
          >
          <L [2]
                <A "WAFERCNT" >
                <U4  n>
          >
          /* The next list repeats n times */
          <L [2]
                <A "SPLITID" >
                <A "Split1">
          >
   >
>.
```

NOTE

For purposes of backwards compatibility, `PORTNO`, `LOTID`, `PROG_ARGS` and their associated values are optional parameter list items.

The `START_PLAN` remote command is only supported when `KRF_Mode=0`. Updated variables are the same for `START_PLAN` as for `START`.

`LOTID` must contain alphanumerical, '_' (underscore), or '–' (dash) characters only.

The optional `PROG_ARGS` parameter can be used to specify applicable KTXE command-line arguments.

START_KRF

The remote command START_KRF executes the specified recipe file. If necessary, the .krf extension will be automatically appended to the RECIPE_ID. This remote command replaces the START and START_PLAN commands when KIGEM is operating in the Recipe Mode (KRF_Mode = 1).

```
S2F41 W
<L [2]
  <A "START_KRF" >
  <L
        <L [2]
              <A "PORTNO" >
              <A "1">
        >
        <L [2]
              <A "LOTID" >
              <A "lot-123">
        >
        <L [2]
              <A "PROG_ARGS" >
              <A "-l klf_fname -w wdf_fname">
        >
        <L [2]
              <A "RECIPE_ID" >
              <A "krf_fname">
        >
        <L [2]
              <A "DEVICE" >
              <A "device1">
        >
        <L [2]
              <A "PROCESS" >
              <A "process1">
        >
        <L [2]
              <A "WAFERCNT" >
              <U4  n>
        >
        /* The next list repeats n times */
        <L [2]
              <A "SPLITID" >
              <A "splitid1">
        >
  >
>.
```

The START_KRF remote command is only supported when KRF_Mode=1. LOTID must contain alphanumerical, '_' (underscore), or '–' (dash) characters only. The optional PROG_ARGS parameter can be used to specify applicable KTXE command-line arguments.

STOP

The format of the S2F41 STOP remote command is as follows:

```
<L [2]
   <A "STOP">
   <L
          <L [2]
                 <A "PORTNO" >
                 <A "1">
          >
          <L [2]
                 <A "LOTID">
                 <A "lot1">
          >
   >
>.
```

The STOP remote command terminates a running test.

UNCLAMP

The format of the S2F41 UNCLAMP message is described below:

```
<L [2]
   <A "UNCLAMP">
   <L
          <L [2]
                 <A "PORTNO" >
                 <A "1">
          >
   >
>.
```

The UNCLAMP remote command executes a user-defined unclamp function (KUAP_UNCLAMP). Supported Port Numbers are 1 or 2 and are passed to the KISA User-Access Point function as an argument.

GUAP_usrCmd

The format of the S2F41 GUAP_usrCmd message is described below:

```
<L [2]
  <A "GUAP_usrCmd">
  <L
        <L [2]
              <A "UsrCPNAME_1" >
              <A "UsrCPVAL_1">
        >
        …
        <L [2]
              <A "UsrCPNAME_n" >
              <A "UsrCPVAL_n">
        >
  >
>.
```

The GUAP_usrCmd remote command makes KIGEM execute a user-defined GUAP function. The UsrCPNAME_n and UsrCPVAL_n pairs must be of the ASCII type. The command arguments will be passed to the GUAP function as a single-string argument of "UsrCPNAME_1= UsrCPVAL_n,…, UsrCPNAME_n= UsrCPVAL_n".

KUAP_usrCmd

The format of the S2F41 KUAP_usrCmd message is described below:

```
<L [2]
  <A "KUAP_usrCmd">
  <L
        <L [2]
              <A "UsrCPNAME_1" >
              <A "UsrCPVAL_1">
        >
        …
        <L [2]
              <A "UsrCPNAME_n" >
              <A "UsrCPVAL_n">
        >
  >
 >.
```

The KUAP_usrCmd remote command makes KISA execute a user-defined KUAP function. The UsrCPNAME_n and UsrCPVAL_n pairs must be ASCII type. The command arguments will be passed to the KUAP function as a single string argument of "UsrCPNAME_1= UsrCPVAL_n,…, UsrCPNAME_n= UsrCPVAL_n".

Recipe management

KTE recipes consist of several hierarchical files and compiled user libraries that are shared among different recipes. Changing any of the files or user libraries could affect multiple recipes. Therefore, many aspects of the SEMI E30 PP Management requirements are not suitable for the KTE environment. Keithley recommends using Keithley Recipe Manager and Version Control for managing the recipes in a production environment, instead of the SEMI E30 PP Management method.

Refer to the Keithley S530 Reference Manual (S530-901-01) for more information on the Keithley Recipe Manager.

The following are notes on KIGEM implementation with regard to SEMI E30 PP Management:

- Only unformatted process programs are supported.
- Only top-level recipes (either `.cpf` or `.krf` files) are supported for recipe upload/download.
- KIGEM supports the following PP Management functionalities:
  - PP list
  - Host-initiated PP download
  - Host-initiated PP upload
  - Host-initiated PP delete
  - Equipment-initiated PP upload
  - Equipment-initiated PP download
- PP change, add, and delete event notifications are not supported.

NOTE

PPIDs should not include a path, but they must include proper file extensions such as `.cpf` or `.krf`.

- When KIGEM is configured to work with Keithley Recipe Manager and Version Control (`KRF_Mode=1`):
  - The PP list always returns a long recipe name. It could include process and product family names.
  - The PP upload supports both long and short recipe names.
  - The PP download and delete are not supported. These are managed by Keithley Recipe Manager and Version Control.

Alarms handling

Tester alarms

Tester alarms are reported using the standard S5F1 messages.

Prober alarms

Since KIGEM supports several 300mm prober types and each 300mm prober can have more than one thousand alarms, a special mechanism is used to handle prober alarms.

Whenever KIGEM receives an S5F1 alarm from the prober:

- KIGEM stores the reported Alarm ID and text to `PrbAlarmID (VID=5505)` and `PrbAlarmText (VID=5506)`.
- KIGEM sends out S6F11 to the Host with either `CEID=5551 (PrbAlarmEventOn)` or `CEID=5550 (PrbAlarmEventOff)`, depending on the value of bit 8 in ALCD, as reported by the prober.
- KIGEM displays the prober alarm on the KIDS Alarms Panel Prober tab.

User-Access Points (UAPs)

Many types of User-Access Points (UAPs) are available in KTE to extend KIGEM capabilities to meet specific customer needs. An excellent understanding of KTE architecture and internal codes is usually needed to develop UAP codes. Please contact your Keithley representative if you need assistance in developing UAP codes. The following is a brief overview of different UAP types that you can use to extend the capabilities of KIGEM.

KIGEMUAP

KIGEMUAP is a user library with functions that allow communication with KIGEM from KTXE user-access points. The library includes functions to establish a communication link with KIGEM, set and query GEM Variables, send collection events to the Host, and set and clear GEM Alarms. It allows KTXE to notify KIGEM of test progress and send measurement results. This library is installed as part of the KIGEM installation.

The functions within the KIGEMUAP library are automatically executed at certain KTXE user-access points whenever a test is run from KIDS or Host and KIGEM is running. This is automatically achieved through the inclusion of `$KI_KTXE_UAP/kigem.uap` whenever a test is run from KIDS or Host and KIGEM is running. The default entries of `$KI_KTXE_UAP/kigem.uap` are as follows:

```
#Keithley UAP File
Version,1.0
File,kigem.uap
Date,06/15/2002
Id,
Comment,Sample UAP file for SECS/GEM
RevID,$Revision: 1.4 $
<EOH>
#UAP_PROG_ARGS,KIGEMUAP,gem_set_slot_list()
UAP_CASSETTE_LOAD,KIGEMUAP,gem_cassette_load()
UAP_CARRIER_BEGIN,KIGEMUAP,gem_cassette_load()
UAP_LOT_INFO,KIGEMUAP,gem_lot_info()
UAP_WAFER_MISMATCH,KIGEMUAP,gem_wafer_mismatch()
UAP_WRITE_LOT_INFO,KIGEMUAP,gem_write_lot_info(product_file)
UAP_WAFER_PREPARE,KIGEMUAP,gem_wafer_prepare(current_slot_list,wafers_tested)
UAP_VALIDATE_OCR,KIGEMUAP,gem_validate_ocr(wafers_tested,prober_has_id_reader)
UAP_WAFER_BEGIN,KIGEMUAP,gem_wafer_begin(wafer,current_slot_list)
#UAP_SITE_CHANGE,KIGEMUAP,gem_site_change(site)
#UAP_SUBSITE_CHANGE,KIGEMUAP,gem_subsite_change(subsite)
#UAP_TEST_BEGIN,KIGEMUAP,gem_test_begin(current_wwp_list)
#UAP_TEST_END,KIGEMUAP,gem_test_end()
#UAP_SUBSITE_END,KIGEMUAP,gem_subsite_end()
#UAP_SITE_END,KIGEMUAP,gem_site_end()
UAP_WAFER_END,KIGEMUAP,gem_wafer_end()
UAP_ENGINE_EXIT,KIGEMUAP,gem_engine_exit()
UAP_PRB_ERR_HDLR,KIGEMUAP,gem_prb_err_hdlr()
UAP_STATUS_CHANGE,KIGEMUAP,gem_status_change()
<EOUAP>
```

You may add or delete entries in the `$KI_KTXE_UAP/kigem.uap` file, but do not move, rename, or delete the file.

KGAP

KGAP (KISA GEM Access Point) is an access point in KISA that is dedicated to KIGEM support. KGAP functionalities are implemented in the KGAPLIB library. This library is installed as part of KIGEM installation.

KGAP functions are registered to KISA through its `.ini` file `$KIDAT/kisa_qmo.ini`, where `qmo` is the system's QMO number. During KIGEM installation, the following KGAP entries are added in the `[KISA_GEM_AP_n]` section of the `.ini` file:

```
;---------------------------------------------------------------------
; KISA SECS/GEM support function definitions
; Do NOT modify this section! It is reserved for Keithley use ONLY.
; Use the [KISA_UAP_ts] section for adding user/custom access points.
; Note: All entries must start with "KGAP_"
;---------------------------------------------------------------------
[KISA_GEM_AP_1]
    KGAP_RCMD_ABORT = KGAPLIB,kgap_rcmd_abort
    KGAP_RCMD_PAUSE = KGAPLIB,kgap_rcmd_pause
    KGAP_RCMD_PPSELECT = KGAPLIB,kgap_rcmd_ppselect
    KGAP_RCMD_RESUME = KGAPLIB,kgap_rcmd_resume
    KGAP_RCMD_START = KGAPLIB,kgap_rcmd_start
    KGAP_RCMD_START_PLAN = KGAPLIB,kgap_rcmd_start_plan
    KGAP_RCMD_START_KRF = KGAPLIB,kgap_rcmd_start_krf
    KGAP_RCMD_STOP = KGAPLIB,kgap_rcmd_stop
    KGAP_RCMD_PROJECT = KGAPLIB,kgap_rcmd_project
    KGAP_PP_INSTALL = KGAPLIB,kgap_pp_install
    KGAP_PP_UPLOAD = KGAPLIB,kgap_pp_upload
    KGAP_PP_DELETE = KGAPLIB,kgap_pp_delete
    KGAP_PP_FIND = KGAPLIB,kgap_pp_find
    KGAP_DO_THIS = KGAPLIB,kgap_do_this
[END_OF_KISA_GEM_AP_1]
```

KUAP

KUAP (KISA User-Access Point) is a user-access point in KISA that can be used for user-defined functions to be executed on a Linux® computer. KUAP enables custom modifications to KIGEM to extend its capabilities in meeting customer needs. For example, a custom S2F41 remote command (`KUAP_usrCmd`) can be created by registering `KUAP_usrCmd` to KISA and implementing the desired functionality using KULT.

A template for creating a KUAP user library is provided in the `$KIHOME/src/KUAPLIB` directory. You can use `kult_copy_lib` to install this template library.

KUAP functions must be registered to KISA through its `.ini` file `$KIDAT/kisa_qmo.ini`, where `qmo` is the system's QMO number. The KUAP entries must be added in the `[KISA_UAP_n]` section of the `.ini` file. You will need to restart KISA after you make changes to the `.ini` file.

GUAP

GUAP (KIGEM User-Access Point) is a user-access point in KIGEM that can be used for user-defined functions to be executed on Linux® computer. GUAP enables custom modifications to KIGEM to extend its capabilities in meeting customer needs.

For example, a custom S2F41 remote command (`GUAP_usrCmd`) can be created by registering `GUAP_usrCmd` to KIGEM's `.ini` file and implementing the desired functionality.

PAP

PAP (ProberIO Access Point) is a user-access point in ProberIO that can be used for user-defined functions to handle unsolicited GPIB events (SRQs) from the prober. PAP enables custom modifications to KIGEM to extend its capabilities.

For example, on probers that are capable of asserting SRQs, such as material arrival and removal, custom PAP functions can be implemented using KULT to notify the Factory Automation Host.

A template for creating PAP user library is provided in `$KIHOME/src/prb/paplib` directory. You can use `kult_copy_lib` to install this template library.

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