SECS/GEM DOCUMENTATION

For Equipment:

GPD Global MAX/DS Dispensers

Manufactured By:

GPD Global, Inc.

Revision

1.2.0

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TABLE OF CONTENTS

1 INTRODUCTION

1.1 Purpose

This document describes the GEM compliant SECS-II interface for the mentioned equipment. It includes the information required by the SECS-II and GEM standards including the GEM Compliance Statement, GEM State Models, SECS-II Message Documentation, and other interface details.

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1.3 Equipment

GPD MAX Dispensers

GPD DS Dispensers

1.4 Changes From Previous Version

1.4.1 Changes From 1.1.0

- Updated screenshots and verbiage §8.8.2.5 SECS/GEM Connection Status
  - Reflecting changes to OnlineLocal/OnlineRemote controls
- Clarified operation of PP-SELECT remote command §8.7
- Updated screenshots and verbiage §8.8.1 FLOware GUI
  - Reflecting changes to OnlineLocal/OnlineRemote and Spool Controls
- Added Equipment Constants 10004,10005 – see §8.4
- Changed Sections §8.2 - §8.7 to landscape orientation for improved readability
- Added Section §9 documenting additions/changes related to Option 22271055

1.5 References

Standard	Name	Acronym
SEMI E30	Generic Model for Communication and Control of SEMI Equipment	GEM

SEMI E5	SEMI Equipment Communications Standard 2 Message Content	SECS-II
SEMI E4	SEMI Equipment Communications Standard 1 Message Transfer	SECS-I
SEMI E37	High Speed Message Service-Single Session	HSMS-SS

For more information about SEMI or the standards produced by SEMI, contact SEMI by one of the

following references.

http://www.semi.org/

1.6 Definitions, acronyms, abbreviations, and symbols

1.6.1 Data Item Formats

Abbreviation	SM L	Description
A	A[length] or A[min, max]	ASCII
Bi	B	Binary
Bo	BOOLEAN	Boolean
F4	F4	4-byte floating point
F8	F8	8-byte floating point
J	J[length] or J[min, max]	JIS-8, Japanese international standard
L	L[length]	List
I1	I1	1-byte signed integer
I2	I2	2-byte signed integer
I4	I4	4-byte signed integer
I8	I8	8-byte signed integer
U1	U1	1-byte unsigned integer
U2	U2	2-byte unsigned integer
U4	U4	4-byte unsigned integer
U8	U8	8-byte unsigned integer

1.6.2 Definitions

Alarm	An alarm is related to any abnormal situation on the equipment that may endanger people, equipment, or material being processed. Alarm notification may be disabled or enabled. Each alarm is always either set or clear.
Capability	Capabilities are operations performed by semiconductor manufacturing equipment. These operations are initiated through the communications interface using sequences of SECS-II messages.
Collection Event	A collection event is an event (or grouping of related events) on the equipment that is considered significant to the host. Event notification may be disabled or enabled as desired. Data reports may be linked to events.
Communication Failure	A communication failure is said to occur when an established communications link is broken. In a SECS-I environment, this occurs when the protocol retry-limit (RTY) is exceeded.
Communication Fault	A communication fault occurs when the equipment does not receive an expected

	message, or when either a transaction timer or a conversation timer expires.
Data Variable	Information directly related to a collection event. The value is only guaranteed to be valid when included in a report linked to a valid collection event. A list of valid collection events is included in the data variable's description in this manual.
Equipment Constant	A machine setting. The host or local operator may set the value.
Event Report	One or more reports linked to a collection event. The data in the report is sent in the same SECS-II message as the collection event notification.
Generic Equipment Model	This is used as a reference model for any type of equipment. It contains functionality that can apply to most equipment, but does not address unique requirements of specific equipment.
GEM	Generic Model for Communications and Control of SEMI Equipment. SEMI E30. A standard implementation of the SECS-II standard defining a common set of equipment behavior and communications capabilities.
Harel Notation	The use of state charts that show traditional state-transition diagrams with several additional concepts such as hierarchy and concurrent. See the Harel Notation heading in section 1.7.3 for more information.
HSMS	High Speed Message Service. SEMI E37. This standard defines TCP/IP based communication as an alternative to SECS-I (serial) communication. There are two modes of this standard, HSMS-SS (single session) and HSMS-GS (general session).
Host	The SEMI E4 and E5 standards define Host as "the intelligent system that communicates with the equipment."
Message Fault	A message fault occurs when the equipment receives a message that it cannot process because of a defect in the message.
Operator	A human who operates the equipment in order to perform its intended function (e.g. processing). The operator typically interacts with the equipment via the equipment supplied operator console.
Processing Cycle	A processing cycle is a sequence wherein all of the material contained in a typical process unit is processed. This is often used as a measure of action or time.
Recipe	A file of equipment processing instructions. The instructions tell the equipment what to do and how to do it. Recipes are also called process programs.
Report	List of status variables, data variables, and equipment constants. An ID number identifies it uniquely.
Scenario	A scenario is a group of SECS-II messages arranged in a sequence to perform a capability. Other information may also be included in a scenario for clarity.
SECS-I	SEMI Equipment Communications Standard 1; SEMI E4. This standard specifies a method for a message transfer protocol with electrical signal levels based upon EIA RS232-C.
SECS-II	SEMI Equipment Communications Standard 2; SEMI E5. This standard specifies a group of messages and the respective syntax and semantics

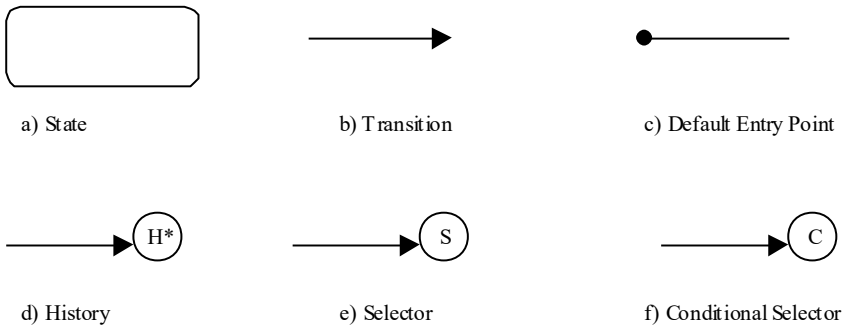
	for those messages relating to semiconductor manufacturing equipment control.
SECS-II message	The host and equipment communicate by sending each other SECS-II messages. A stream number, function number, and message body describe a SECS-II message.
SEMI	Semiconductor Equipment and Materials International. See www.semi.org for more information.
State Model	A State Model is a collection of states and state transitions that combine to describe the behavior of a system. This model includes a definition of the conditions that delineate a state, the actions/reactions possible within a state, the events that trigger transitions to other states, and the process of transitioning between states.
Status Variable	Information about the status of the machine. The value is always valid.
System Default	Refers to state(s) in the equipment behavioral model that are expected to be active at the end of system initialization. It also refers to the value(s) that specified equipment variables are expected to contain at the end of system initialization.
System Initialization	The process that equipment performs at power-up, system activation, and/or system reset. This process is expected to prepare the equipment to operate properly and according to the equipment behavioral models.
Trace	List of status variables polled and sent to the host at a defined frequency. An ID number identifies it uniquely.
Unit	Unit identifier defined in the SECS-II standard.
Variable Type	One of the types defined by the SECS-II standard.

1.6.3 Harel Notation

In GEM, proper state machine Harel Notation requires a state diagram, state definitions, and a transition table.

1.6.3.1 State-Transition Diagrams

Harel's statecharts extend traditional state-transition diagrams with several additional concepts, most important of which are hierarchy and concurrence. Statecharts depict the behavior of a system by showing possible states, events that prompt a change of state, and the composition of states. The symbols are then listed and explained. See the figure below for the basic notational symbols.



Rounded boxes represent states. A state transition is shown graphically with a line from the old state terminating with the arrow symbol at the new state. Transitions are unidirectional -- while the reverse

transition may be possible, it is considered a different transition with different conditions for initiation and different resultant actions.

States may be subdivided into substates to define more concise behavior. Thus, a hierarchy is defined whereby any state may be a substate of some parent state and in turn be the parent of its own substates. Substates must be one of two types, termed AND substates and OR substates.

A parent may be divided into two or more OR substates of which one and only one is the active substate at any time. The accepted term for this exclusivity is XOR. For example, some system (perhaps a motor) has a state named FUNCTIONAL. When the motor is FUNCTIONAL, it may be either ON or OFF, but never both.

Another way of dividing a parent state corresponds roughly to subsystems. These AND substates represent parallelism, such that every AND substate of an active parent state is considered active. Harel also uses the term "Orthogonal Component" to refer to AND substates. However, these parallel substates tend to be highly interactive and interdependent. For this reason, the word orthogonal is considered confusing and has been excluded from use in this document. Figure A.5.3, in the SEMI E30 manual, shows an example of AND substates representing (in part) an automobile. Note the convention of attaching the name of the parent's state AUTOMOBILE to the outside of the state in a small box. The substates shown are independent components and may have their own substates (of either the "AND" or "OR" type):

- LIGHTS may be ON or OFF;
- DOOR may be OPEN or CLOSED;
- ENGINE is constructed of components such as pumps, pistons, carburetor, etc.

Exiting one of a set of AND substates requires the exit of all others. In some cases, a transition arrow will be shown from only one of the substates with the others implied.

A simplification that also helps to prevent in determinacy is implemented with the symbol for default entry point. This symbol will indicate which OR substate is initially active when there is not an explicit choice. A transition arrow from one state to another that does not cross the boundary of the parent to point specifically to a substate indicates this lack of specification.

An entrance to a state terminating in a history symbol indicates that the "OR" substate to be entered should be that which was active the last time the parent state was active. For example, the last time the car was running the radio was on. The history symbol H refers to the choice of substates of the parent. The symbol H* extends further to the lowest level substates defined. In the absence of memory of a "last time", the default entry is used.

The selector and conditional selector symbols serve to abbreviate complex entrances to states. The meaning is similar and indicates that the choice of OR substate upon entry of a parent state depends on some condition that is not shown. The selector is usually used to combine several similar transition events, while the conditional selector will typically require some computation or test of condition external to the stimulus for state transition. Please examine the referenced article for more detail.

NOTE: Within the body of this document, the term statechart is not used in favor of the more traditional term state diagram.

1.6.3.2 State Definitions

The state diagram provides a concise description of the function of a system. However, a full definition requires detail that cannot be included on the diagram. A description of each state is required that covers the boundaries of the state and any responses that occur within that state to the environment. The convention in this document is to provide state names in ALL CAPS to help the reader identify where these are used. A sample state description of the "ON" state might be:

ON

The switch is in the on position. Power is available to the motor. Speed of the motor will change in proportion to the speed knob adjustment.

1.6.3.3 Transition Table

The last piece of the state model is the transition table. It consists of several columns that list the transition number from the diagram, the starting and ending state for the transition, and three columns titled trigger, action, and comment. The trigger column describes the combination of events and conditions that initiates the transition (e.g. Sx, Fy message received). The trigger should be related to a single clearly defined event at the equipment. The action column identifies the activities associated directly with the transition. These activities may be of three types: a) actions taken upon exit of the old state, b) actions taken upon entry to the new state, and c) actions not associated with either state. These are not differentiated in this document. The final column allows for additional comments that help to clarify the transition. Table A.5, an example of a transition table, illustrates the motor example in Figure A.5.2 (shown in the SEMI E30 manual).

Table A.5. Transition Table for Motor Example

#	Current State	Trigger	New State	Action	Comment
1	OFF	Switch turned to on position	ON	Power supplied to motor.	Power supply assumed available. Motor begins to turn.
2	ON	Switch turned to off position.	OFF	Power supply to motor disconnected.	Motor begins deceleration.

2 GEM COMPLIANCE STATEMENT

Fundamental GEM Requirements	Implemented	GEM Compliant
State Models	Yes	Yes
Equipment Processing States	Yes	
Host-Initiated S1, F13/14 Scenario	Yes	
Event Notification	Yes	
On-line Identification	Yes	
Error Messages	Yes	
Documentation	Yes	
Control (Operator) Initiated	Yes	

Additional Capabilities	Implemented	GEM Compliant
Establish Communications	Yes	Yes
Dynamic Event Report Configuration	Yes	Yes
Data Variable and Collection Event Namelist Requests	Yes	Yes
Variable Data Collection	Yes	Yes
Trace Data Collection	Yes	Yes
Status Data Collection	Yes	Yes
Alarm Management	Yes	Yes
Remote Control	Yes	Yes
Equipment Constants	Yes	Yes
Process Program Management	Yes	Yes
Material Movement	No	No
Equipment Terminal Services	Yes	Yes
Clock	Yes	Yes
Limits Monitoring	No	No
Spooling	Yes	Yes

Control (Host-Initiated)	Yes	Yes

3 STATE MODELS

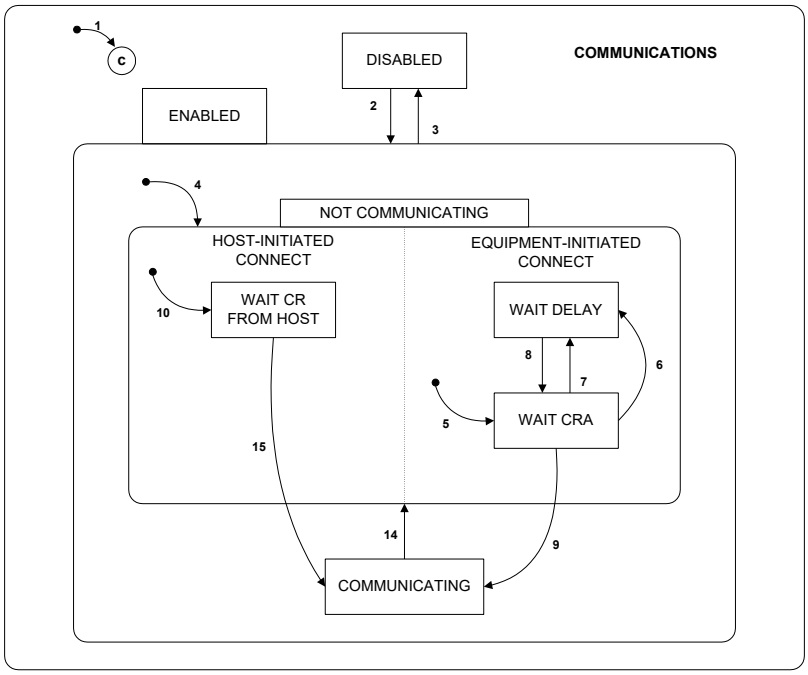
The following sections contain state models for semiconductor manufacturing equipment. These state models describe the behavior of the equipment from a host. GEM requires each state model to be documented with a state diagram, a transition table and a definition of each system behavior when that state is active. Multiple host equipment must have the same documented models for each host.

3.1 Communications

3.1.1 General Description

The Communications State Model defines the behavior of the equipment in relation to the existence or absence of a communications link with the host. Two major states of SECS communication protocols are DISABLED and ENABLED. The ENABLED state has two sub-states, NOT COMMUNICATING and COMMUNICATING.

3.1.2 Communications State Diagram



3.1.3 State Definitions

3.1.3.1 DISABLED

The equipment does not desire SECS-II communication with a host computer. If the operator switches from ENABLED to DISABLED, all SECS-II communications will cease immediately. Any unsent messages are discarded. All further actions on any open transactions and conversations are terminated. Refer to SEMI E5 for definitions of SECS-II transaction and conversation protocols. The DISABLED State may be the system default.

3.1.3.2 ENABLED

The equipment desires SECS-II communication with a host computer. ENABLED has two sub-states, COMMUNICATING and NOT COMMUNICATING. Whenever communications are enabled, either during system initialization or through operator selection, the sub-state of NOT COMMUNICATING is active until communications are formally established. Lower-level protocols (such as SECS-I or HSMS-SS)

are assumed to be functioning normally in that they are capable of supporting the communication of SECS-II syntax. The ENABLED State may be the system default.

3.1.3.3 NOT COMMUNICATING

Only messages S1, F13, S1, F14, and Stream 9 are sent while this sub-state is active. The equipment discards any messages received from the host other than S1, F13 or S1, F14. The equipment will periodically attempt to establish communication with the host computer by issuing an S1, F13 until communications are successfully established. Only one equipment-initiated S1, F13 transaction is open at any time.

The NOT COMMUNICATING state has two sub-states, HOST-INITIATED CONNECT and EQUIPMENT-INITIATED CONNECT. Both are active whenever the equipment is NOT COMMUNICATING. These sub-states clarify the behavior of the equipment in the event that both the equipment and the host attempt to establish communications during the same period of time. Note that in the Harel notation, an exit from any sub-state is an exit from the parent state and thus from all other sub-states of that parent sub-state.

3.1.3.4 EQUIPMENT-INITIATED CONNECT

This state has two sub-states, WAIT CRA and WAIT DELAY. Upon any entry to the NOT COMMUNICATING State, whenever EQUIPMENT-INITIATED CONNECT first becomes active, a transition to WAIT CRA occurs. The CommDelay timer is then set to "expired," and an immediate attempt to send S1, F13 is made.

3.1.3.5 WAIT CRA

An establish-communications request has been sent. The equipment waits for the host to acknowledge the request.

3.1.3.6 WAIT DELAY

A connection-transaction failure has occurred. The CommDelay timer has been initialized. The equipment waits for the timer to expire.

3.1.3.7 HOST-INITIATED CONNECT

This state describes the behavior of the equipment in response to a host-initiated S1, F13 while NOT COMMUNICATING is active.

3.1.3.8 WAIT CR FROM HOST

This is a sub state of HOST-INITIATED CONNECT. The equipment waits for an S1, F13 from the host. If an S1, F13 is received, the equipment attempts to send an S1, F14 with COMMACK = 0.

3.1.3.9 COMMUNICATING

Communications have been established between the equipment and host. The equipment may receive any message from the host, including S1, F13. When the equipment is COMMUNICATING, SECS communications with a host computer must be maintained. This state remains active until communications are disabled or a communication failure occurs. If the equipment receives S1, F13 from the host while in the COMMUNICATING sub-state, it should respond with S1, F14 with COMMACK set to zero. If the equipment receives S1, F14 from a previously sent S1, F13, no action is required.

In case of communication failure, the equipment returns to the NOT COMMUNICATING sub-state and attempts to re-establish communications with the host.

It is possible that the equipment will be waiting for an S1, F14 from the host in EQUIPMENT-INITIATED CONNECT/WAIT CRA when an S1, F13 is received from the host in HOST-INITIATED CONNECT/WAIT CR FROM HOST. When this situation occurs, both equipment and host have an open S1, F13/S1, F14 transaction. Since communications are successfully established on the favorable completion of any S1, F13/S1, F14 transaction, either of these two transactions may be the first to complete successfully and to cause the transition from NOT COMMUNICATING to COMMUNICATING. In this

event, the other transaction remains open regardless of the transition to COMMUNICATING until it is closed in a normal manner.

If the equipment has not yet sent an S1, F14 to a previously received S1, F13 at the time when COMMUNICATING becomes active, the S1, F14 response is sent in a normal manner. This includes transmissions that may have started but not yet successfully completed at the time that the transition to COMMUNICATING occurs. A failure to send the S1, F14 is then treated as any other communication failure.

If the equipment-initiated S1, F13/S1, F14 transaction is still open when the transition to COMMUNICATING occurs, then a subsequent failure to receive a reply from the host is considered a communication fault by equipment. An S9, F9 is sent when a transaction timer timeout occurs.

3.1.4 State Transition Table

#	Current State	Trigger	New State	Action	Comment
1	(Entry to COMMUNICATIONS)	System initialization	System Default	None	The system default may be set to DISABLED OR ENABLED.
2	DISABLED	Operator switches from DISABLED to ENABLED	ENABLED	None	SECS-II communications are enabled.
3	ENABLED	Operator switches from ENABLED to DISABLED	DISABLED	None	SECS-II communications are prohibited.
4	(Entry to ENABLED)	Any entry to ENABLED state.	NOT COMMUNICATING	None	May enter from system initialization to ENABLED or through operator switch to ENABLED.
5	(Entry to EQUIPMENT-INITITATED CONNECT)	(Any entry to NOT COMMUNICATING)	WIAT CRA	Initialize communications. Set CommDelay timer “expired." Send S1, F13	Begin the attempt to establish communications.
6	WAIT CRA	Connection transaction failure.	WAIT DELAY	Initialize CommDelay timer.	Wait for timer to expire.
7	WAIT DELAY	CommDelay timer expired	WAIT CRA	Send S1, F13	Wait for S1, F14. May receive S1, F13 from Host.
8	WAIT DELAY	Received a message other than S1, F13	WAIT CRA	Discard message. No reply. Set CommDelay timer “expired”. Send S1, F13.	Indicates opportunity to establish communications.
9	WAIT CRA	Received expected S1, F14 with COMMACK=0	COMMUNICATING	None.	Communications established.
10	(Entry to HOST-	(Any entry to	WAIT CR FROM	None.	Wait for S1, F13 from Host.

	INITIATED CONNECT)	NOT COMMUNICATING)	HOST		
14	COMMUNCATING	Communication failure	NOT COMMUNICATING	Dequeue all messages queued to send.	Dequeued messages may be placed in spool buffer as appropriate.
15	WAIT CR FROM HOST	Received S1,F13	COMMUNICATING	Send S1,F14 with COMMACK = 0	Communications are established.

3.1.5 Related Variables, Constants and Events

For complete descriptions, refer to the Appendix.

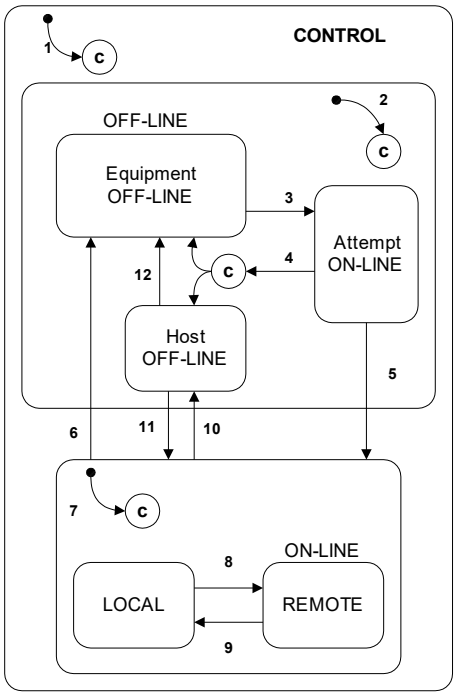
Name	**Type**
EstablishCommunicationsTimeout	Equipment Constant
DefaultCommState	Equipment Constant
CommState	Status Variable
CommEnableSwitch	Status Variable

3.2 Control

3.2.1 General Description

The Control State Model defines the level of cooperation between the host and equipment. This model also specifies how the operator may interact at the different levels of host control and defines the equipment's responsibility to act upon messages that it receives. Three levels of control exist. The highest level, REMOTE, allows the host to control the equipment to the full extent possible. The middle level, LOCAL, allows the host to access all information, but places some limitations on how the host may control equipment operation. The lowest level, OFF-LINE, allows no host control and no access.

3.2.2 Control State Diagram



3.2.3 Control State Definitions

3.2.3.1 OFF-LINE

When the OFF-LINE State is active, the operator at the operator console only performs operation of the equipment. Message transfer is severely restricted. The equipment will respond with an Sx, F0 to any primary message from the host other than S1, F13 or S1, F17. It will process and respond to S1, F13 (establishment of communications) and S1, F17 (host request to activate the ON-LINE State). The equipment will accept the S1, F17 and send a positive response only when the HOST OFF-LINE state is active (see transition 11 in the Control State Transition Table).

While the OFF-LINE State is active, the equipment will not send any primary messages other than S1, F13, S9, Fx, and S1, F1 (see ATTEMPT ON-LINE sub-state). Sending of S1, F13 is based upon the COMMUNICATIONS State Model. S9, Fx messages is issued only in response to the messages to which the equipment will normally respond while OFF-LINE (i.e., S1, F13 and S1, F17). If the equipment receives a reply message from the host other than S1, F14 or S1, F2, this message is discarded.

No messages enter the spool when the system is OFF-LINE. Spooling may be active when the Communications State of NOT COMMUNICATING is active. This might occur during OFF-LINE, but since the equipment will not attempt to send messages except as mentioned in the previous paragraph, no messages will enter the spool. The equipment may send S1, F1 or S1, F13, but since Stream 1 messages are not eligible for spooling, they will not enter the spool.

OFF-LINE has three sub-states: EQUIPMENT OFF-LINE, ATTEMPT ON-LINE, and HOST OFF-LINE.

3.2.3.2 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.

3.2.3.3 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.

3.2.3.4 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 (see the Control State Transition Table for more detail). While this state is active, the equipment positively responds to any host's request to go ON-LINE (S1, F17). Such a request is denied when the HOST OFF-LINE State is not active.

3.2.3.5 ON-LINE

While the ON-LINE State is active, SECS-II messages may be exchanged and active. Capabilities available to the host are similar to those available from the operator console wherever practical. The equipment may go ON-LINE only when the Communication State is COMMUNICATING.

3.2.3.6 LOCAL

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

The host has the following capabilities and restrictions when the LOCAL State is active:

- During processing, the host is be prohibited from modifying equipment constants that affect that process. Other equipment constants are changeable during processing. The host may modify all available equipment constants when no processing is in progress.
- The host may initiate the upload and download of recipes to or from the recipe storage area on the equipment unless it affects the current recipe during processing.
- The host may configure automatic data reporting capabilities including alarms, event reporting, and trace data reporting. The host receives all such reports at the appropriate times.
- The host may inquire for data from the equipment, including status data, equipment constants, event reports, process program directories, and alarms.
- The equipment may perform Terminal Services.

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

3.2.3.7 REMOTE

Control is shared between the host and the local operator.

Remote commands are listed and described in the Appendix.

3.2.4 Control State Transition Table

#	Current State	Trigger	New State	Action	Comments
1	(Undefined)	Entry into CONTROL state (system initialization)	CONTROL (Substate conditional on configuration).	None	Equipment may be configured to default to ON-LINE or OFF-LINE.
2	(Undefined)	Entry into OFF_LINE state	OFF_LINE (Substate conditional on configuration).	None	Equipment may be configured to default to any substate of OFF-LINE.
3	EQUIPMEN OFF-LINE	Operator actuates ON-LINE switch.	ATTEMPT ON-LINE	None	Note that an S1, F1 is sent whenever ATTEMPT ON-LINE is activated.
4	ATTEMPT ON-LINE	S1, F0	New state conditional	None	This may be due to a communication failure, reply

			on configuration.		timeout, or receipt of S1, F0. Configuration may be set to EQUIPMENT OFF-LINE or HOST OFF-LINE.
5	ATTEMPT ON-LINE	Equipment receives expected S1, F2 message from the host.	ON-LINE	None	Host is notified of transition to ON-LINE at transition 7.
6	ON-LINE	Operator actuates OFF-LINE switch.	EQUIPMENT OFF-LINE	None	“Equipment OFF-LINE” event occurs. Event reply will be discarded while OFF-LINE is active.
7	(Undefined)	Entry on ON_LINE state	ON-LINE (Substate conditional on REMOTE/LOCAL switch setting.)	None	“Control State LOCAL” or “Control State REMOTE” event occurs. Event reported based on actual ON-LINE substate activated.
8	LOCAL	Operator sets front panel switch to REMOTE.	REMOTE	None	“Control State REMOTE” event occurs.
9	REMOTE	Operator sets front panel switch to LOCAL.	LOCAL	None	“Control State LOCAL” event occurs.
10	ON-LINE	Equipment accepts “Set OFF-LINE” message from host (S1, F15).	HOST OFF-LINE	None	“Equipment OFF-LINE” event occurs.
11	HOST OFF-LINE	Equipment accepts host request to go ON-LINE (S1, F17).	ON-LINE	None	Host is notified to transition to ON-LINE at transition 7.
12	HOST OFF-LINE	Operator actuates OFF-LINE switch.	EQUIPMENT OFF-LINE	None	“Equipment OFF-LINE” event occurs.

3.2.5 Related Variables, Constants and Events

For complete descriptions, refer to the Appendix.

Name	**Type**
ControlState	Status Variable
CtrlRemoteSwitch	Status Variable
CtrlOnlineSwitch	Status Variable
DefCtrlOfflineState	Equipment Constant
DefaultCtrlState	Equipment Constant
PreviousControlState	Status Variable
ControlStateLocal	Collection Event

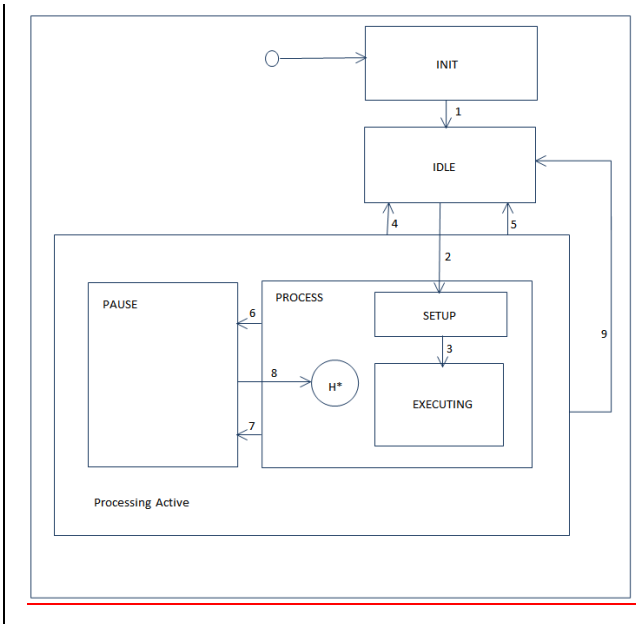
ControlStateRemote	Collection Event
EquipmentOffline	Collection Event

3.3 Equipment Processing

3.3.1 General Description

The Equipment Processing State Model defines the operation of the machine. Because operation varies between machines, the GEM standard does not define a specific model.

3.3.2 Equipment Processing State Diagram



3.3.3 Equipment Processing State Definitions

3.3.3.1 IDLE

The equipment is awaiting instructions.

3.3.3.2 PROCESSING ACTIVE

This state is the parent of all substates where the context of process program execution exists.

3.3.3.3 PROCESS

This state is the parent of those substates that refer to the active preparation and execution of a process program.

3.3.3.4 SETUP

In this state all external conditions necessary for process execution are satisfied, such as ensuring material is present at the equipment, input/output ports are in the proper state, parameters such as temperature and pressure values are within limits, etc. If all setup operations are already complete, then this becomes a fall-through state and a transition to the next state takes place.

3.3.3.5 EXECUTING

Executing is the state in which the equipment is executing a process program automatically and can continue to do so without external intervention.

3.3.3.6 PAUSE

In this state processing is suspended and the equipment is awaiting a command.

3.3.4 Equipment Processing State Transition Table

#	Current State	Trigger	New State	Action	Comments
1	INIT	Equipment initialization complete	IDLE	None	None
2	IDLE	Commit has been made to set up.	SETUP	RUN	None
3	SETUP	All setup activity has completed and the equipment is ready to receive a START command.	EXECUTING	Completed Setup	None
4	PROCESSING ACTIVE	Operator aborted process	IDLE	ABORT	None
5	PROCESSING ACTIVE	The processing task has been completed.	IDLE	None	None
6	PROCESS	The equipment decides to PAUSE due to a condition such as alarm	PAUSE	None	None
7	PROCESSING ACTIVE	Equipment has received a PAUSE command from operator console.	PAUSE	This activity is process specific.	None
8	PAUSE	Equipment receives RESUME from operator	*previous PROCESSING ACTIVE substate*	This activity is equipment specific.	For this type of problem, an operator assist is usually required.

3.3.5 Processing State IDs

State #	State
0	INIT
1	IDLE
2	SETUP
3	EXECUTING
4	PAUSE

3.3.6 Related Variables, Constants and Events

For complete descriptions, refer to the Appendix.

Name	Type
ProcessStateString	Status Variable
PreviousProcessState	Status Variable
ProcessState	Status Variable
ProcessingCompleted	Collection Event
ProcessingStarted	Collection Event
ProcessingStateChange	Collection Event
ProcessingStopped	Collection Event

3.4 Alarms

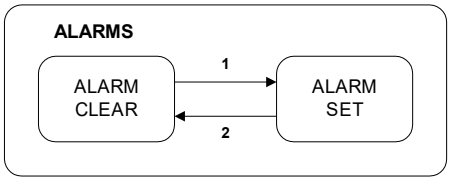
3.4.1 General Description

The alarm management capability provides for host notification and management of alarm conditions occurring on the equipment. This alarm management provides several useful tools.

- Reporting the time of an alarm state change.
- Uploading a list of alarm texts.
- Enabling and disabling the notification of specific alarms.
- Host query of alarms set and enabled status on the equipment.

An alarm is related to any abnormal situation on the equipment that may endanger people, equipment, or material being processed. Such abnormal situations are defined by the equipment manufacturer based on physical safety limitations. Equipment activities potentially impacted by the presence of an alarm are inhibited. Note that exceeding control limits associated with process tolerance do not constitute an alarm nor do normal equipment events such as the start or completion of processing.

3.4.2 Alarms State Diagram



3.4.3 Alarms State Definitions

3.4.3.1 ALARM CLEAR

The alarm is inactive. The situation is normal or safe.

3.4.3.2 ALARM SET

The alarm is active. The situation is abnormal, unsafe or requires operator attention.

3.4.4 Alarms State Transition Table

#	Current	Trigger	New State	Action	Comment
1	$ALARM_n$ CLEAR	$ALARM_n$ is detected on the equipment.	$ALARM_n$ SET	Initiate local actions (if any) to ensure safety. Update "AlarmsSet and $ALCD_n$ values." Generate and issue alarm message if enabled.	Inhibited activities require operator or host intervention prior to resuming.
2	$ALARM_n$ SET	$ALARM_n$ is no longer detected on the equipment.	$ALARM_n$ CLEAR	Update AlarmsSet and $ALCD_n$ values. Generate and issue alarm message if enabled.	Inhibited activities require operator or host intervention prior to resuming.

3.4.5 Related Variables, Constants and Events

For complete descriptions, refer to the Appendix.

Name	Type
ASer	Status Variable
AlarmState	Status Variable
AlarmsEnabled	Status Variable
AlarmsSet	Status Variable
AlarmID	Data Variable
AlarmCode	Data Variable
AlarmText	Data Variable
WBitS5	Equipment Constant

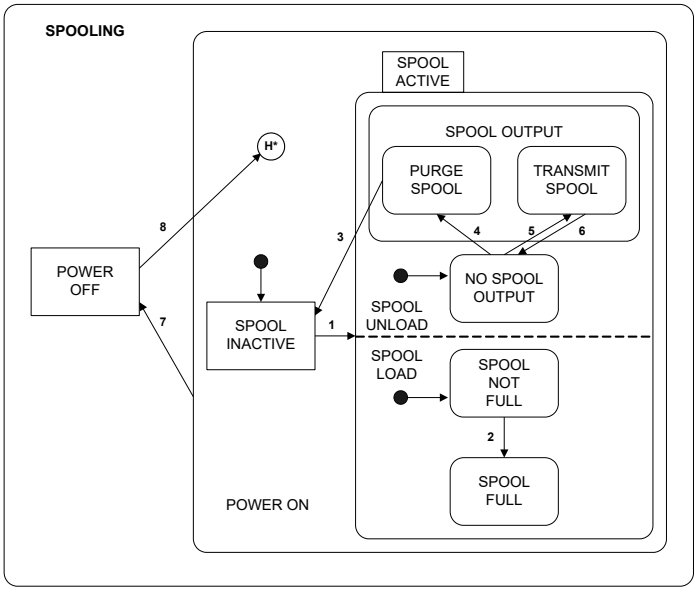
3.5 Spooling

3.5.1 General Description

Spooling allows the equipment to queue messages intended for the host during times of unexpected communication failure and subsequently deliver these messages when communication is restored. Spooling is limited to primary messages of host-selected streams and functions.

The purpose of spooling is to provide a method for retaining equipment message data that might otherwise be lost due to communication failure. The motive for producing this functionality is to retain valuable data used to track material and to improve product quality. The spooling capability fills a gap in the SEMI E5 standard. In the past, without a spooling capability, equipment has typically discarded messages that could not be delivered, or turned messaging off altogether. It is intended that the host initiate the spool unload process immediately following the reestablishment of communications.

3.5.2 Spooling State Diagram



3.5.3 Spooling State Definitions

3.5.3.1 POWER OFF

The equipment has lost power for any reason (e.g. power failure, power switch set to off, etc.).

3.5.3.2 POWER ON

The equipment is powered up.

3.5.3.3 SPOOL INACTIVE

This is the normal operating mode. No spooling occurs. The spool area is empty. Primary SECS-II messages are transmitted normally.

3.5.3.4 SPOOL ACTIVE

All primary SECS-II messages ready for sending and for which spooling is enabled (see S2, F43) are directed to the spool area. All other primary messages, except Stream 1, are discarded. The equipment attempts to send any generated secondary messages, yet discards them if the attempt to send fails.

Once communications are established, the host must initiate the spool unload sequence to restore full functionality (see below). Since the equipment will deliver secondary messages, the host may inquire for information or send commands as needed.

The SPOOL ACTIVE State has two substates, SPOOL LOAD and SPOOL UNLOAD. This means that they operate independently, though sharing data and some state change stimuli.

3.5.3.5 SPOOL LOAD

The SPOOL LOAD component enters messages into the spool area. It is divided into two substates: SPOOL NOT FULL and SPOOL FULL. SPOOL NOT FULL is the default entry substate of the parent state SPOOL LOAD.

3.5.3.6 SPOOL NOT FULL

As primary SECS-II messages are directed to the spool area, the equipment "writes" the SECS-II message to the end of the spool. Spooling status variables are incremented each time a message is placed in the spool area.

3.5.3.7 SPOOL FULL

In this state, all of the allocated spooling area is filled. The following options are equipment constant controlled. The first message to be dealt with is that which could not be fit into the spool prior to transition from SPOOL NOT FULL (see transition table below).

If the "OverWriteSpool" equipment constant is true and the spool is full, then the equipment will delete the “oldest” record (e.g. SECS-II message) contained in the spool area to make space before adding the new message. The "SpoolCountTotal" status variable is incremented whenever a message is submitted to the spool area. The "SpoolCountActual" status variable is manipulated to keep an accurate count of the number of messages contained in the spool area.

If the "OverWriteSpool" equipment constant is false, then the subsequent primary messages are discarded. When such a message is discarded, the "SpoolCountTotal" SV is still incremented, and the “SpoolCountActual” remains unchanged.

3.5.3.8 SPOOL UNLOAD

The SPOOL UNLOAD component of SPOOLACTIVE deals with movement of messages out of the spool. It has an active substate (SPOOL OUTPUT) and a passive substate (NO SPOOL OUTPUT). NO SPOOL OUTPUT is the default entry substate since the equipment is NOT COMMUNICATING at the time spooling is initiated. When communications between equipment and host are restored, there is an opportunity for the host to recover spooled messages. No action is taken until the host initiates the spool output process via the S6, F23 (Request Spooled Data). The host has the option to either receive the spooled messages (see substate TRANSMIT SPOOL) or discard all messages in the spool (see substate PURGE SPOOL).

3.5.3.9 NO SPOOL OUTPUT

In this state, no messages are removed from the spool.

3.5.3.10 SPOOL OUTPUT

The SPOOL OUTPUT State encompasses the removal of messages from the spool. Its substates are TRANSMIT SPOOL and PURGE SPOOL.

3.5.3.11 TRANSMIT SPOOL

The host elects to receive all messages contained in the spool area. The equipment is expected to keep track of the oldest record (i.e. message) within the spool area. When communications are re-established with the host and transmission of the spool area is started, the oldest record is the first record transmitted then the next oldest record, etc. There is no prioritization of messages to be sent from the spool.

As each spooled message is successfully transmitted to the host, it is removed from the spool area upon successful completion of the transaction. The "SpoolCountActual" SV is decremented as each message is removed from the spool. The equipment transmits messages only from the spool area until all spooled messages have been completely transmitted to the host.

Flow control of the spool transmit process is achieved in two ways. First, only one open transaction on the equipment is allowed during spool unload. Thus, if a message requires a reply, the equipment waits for that reply before transmitting the next spooled message. Messages that require no reply are transmitted sequentially as rapidly as the message transfer mechanism will allow.

The second flow control method is to allow the host to limit the maximum number of messages sent from the spool in response to the S6, F23 request. The "MaxSpoolTransmit" equipment constant may be set by the host to achieve this behavior. If set to five, for example, the equipment will send the first five messages from the spool and then transition to the NO SPOOL OUTPUT State, awaiting the nextS6, F23 request. There is no event report generated when the "maximum spool transmit" value is reached. The host is responsible for determining this situation by one of the following:

- counting the messages received
- timing out waiting for the next message
- inquiring to the equipment for the current value of the "SpoolCountActual" SV

- some combination of the above

If the "MaxSpoolTransmit" equipment constant is set to zero, the spool is transmitted completely in response to S6, F23.

Normal spooling continues during the spool transmit process. If the SPOOL LOAD component transitions to SPOOL FULL, it does not have any effect on the SPOOL UNLOAD component. Once full, the spool cannot make the transition back to SPOOL NOT FULL except via the SPOOL INACTIVE State. Space made available due to the spool unload process is not used in this case.

When a multi-block message is to be transmitted from the spool, any required inquire/grant transaction is initiated. If the host's response denies permission to send the multi-block message, the equipment discards that message and continues with the transmit process. This sequence counts as one message in the "maximum spool transmit" EC count.

SPOOL LOAD and SPOOL UNLOAD may interact when the spool is full and "OverwriteSpool" EC is True. During the spool transmission process, spooled messages are removed while new primary messages are written to the spool. These new messages are overwriting the oldest messages available, unless the process of unloading has made sufficient spool space available. There is a possibility that unloading and overwriting processes may compete for control of the same message area. The loss of continuity may be "disorienting" to the host program receiving the messages. It is expected that the unloading process will be fast relative to the generation of new messages, so this occurrence will be rare.

Should a communication failure occur during the spool transmit process, spooling continues as before the transmit process began. However, the spool unload sequence terminates (i.e. transition to NO SPOOL OUTPUT will occur--see transition table below).

3.5.3.12 PURGE SPOOL

The equipment discards all messages in the spool and, when the spool is empty, "SpoolCountActual" SV becomes zero.

3.5.4 Spooling State Transition Table

#	Current State	Trigger	New State	Action	Comment
1	SPOOL INACTIVE	Communication failure detected	SPOOL ACTIVE	Status variables "SpoolCountActual" and "SpoolCountTotal" are initialized to zero. Any open transactions with the host are aborted. Status variable "SpoolStartTime" is set to current time. Alert the operator that spooling is active.	The default state in each OR substate is entered. Unsent messages remain in the queue until handled within the SPOOL ACTIVE state. The "SpoolingActivated" collection event has occurred.
2	SPOOL NOT FULL	Message generated which will not fit into spool area.	SPOOL FULL	Status variable "SpoolFullTime" is set to current time. Alert the operator that the spool is full.	The message that would not fit into the spooling area is dealt with after the transition. No collection event is generated.
3	SPOOL OUTPUT	Spool area emptied.	SPOOL INACTIVE	Spooling process disabled. Alert the operator that spooling has been terminated.	The "SpoolingDeactivated" collection event has occurred. Transition from the AND substate SPOOL LOAD component occurs.

4	NO SPOOLOUTPUT	S6, F23 received w/RSDC=1	PURGE SPOOL	No action	Initiates purging process. No collection event is generated since this is based on host request.
5	NO SPOOLOUTPUT	S6, F23 received w/RSCD=0	TRANSMIT SPOOL	No action	Initiates message transmission from spool. No collection event is generated since this is based on host request.
6	TRANSMIT SPOOL	Communication failure or "MaxSpoolTransmit" EC value reached.	NO SPOOL OUTPUT	Spool transmission process suspended	If communications failure, the "SpoolTransmitFailure" collection event has occurred. No collection event is generated for "MaxSpoolTransmit" EC value reached.
7	POWER ON	Equipment power source discontinued.	POWER OFF	No action	Spooling context has been maintained in non-volatile storage prior to this transition.
8	POWER OFF	Equipment power source restored.	POWER ON	Spooling context restored from non-volatile memory.	If spooling were active prior to power down, it continues. If the TRANSMIT SPOOL was active at power down, then transition #6 is expected to follow since communications state is initially NOT COMMUNICATING.

3.5.5 Related Variables, Constants and Events

For complete descriptions, refer to the Appendix.

Name	Type
SpoolCountActual	Status Variable
SpoolCountTotal	Status Variable
SpoolFullTime	Status Variable
SpoolStartTime	Status Variable
SpoolState	Status Variable
MaxSpoolTransmit	Equipment Constant
OverwriteSpool	Equipment Constant
SpoolEnabled	Equipment Constant
SpoolTransmitFailure	Collection Event

SpoolingActivated	Collection Event
SpoolingDeactivated	Collection Event

4 MACHINE CAPABILITIES

4.1 Establish Communications

4.1.1 Purpose

Communications between host and equipment are formally established through use of the Establish Communications Request/Establish Communications Acknowledge transaction, S1, F13/F14.

4.1.2 Description

There are potential problems when one side of the communications link fails and the other side does not detect it. From the point of view of the host, a loss of communications has many possible causes. In some cases, host-controlled settings on the equipment may need to be reset. In other cases, the equipment may have continued an automatic processing sequence during the period of no communication and may have changed states.

The equipment considers communications as formally established whenever either of the following conditions has been satisfied. Satisfaction of either of these conditions will result in a transition to the COMMUNICATING sub-state. See the Communications State Model for further detail.

- Communications Request has been sent to the host and an Establish Communications Acknowledge has been received within the transaction timeout period and with an acknowledge code of "Accept", or
- Communications Request has been received from the host, and an Establish Communications Acknowledge response has been successfully sent with an acknowledge code of "Accept."

When the equipment is attempting to establish communications, an Establish Communications Request is sent periodically until communications have been formally established as described above. The interval between attempts is user-configurable and begins as soon as a connection transaction failure is detected (see Communications State Model).

Attempting to establish communications is not a low-level connectivity issue, but rather a logical application issue used by either party to notify its partner that the host may need to perform synchronization activities with the equipment.

4.1.3 Scenarios

4.1.3.1 Host Attempts to Establish Communications

COMMENT	HOST	EQUIPMENT	COMMENT
Establish Communications	S1, F13 ➔		
			Communications state is enabled (any substate)
		← S1, F14	Reply COMMACK = Accept and Communications state = COMMUNICATING

4.1.3.2 Equipment Attempts To Establish Communications and Host Acknowledges

COMMENT	HOST	EQUIPMENT	COMMENT
			Communications State = NOT COMMUNICATING

		← S1, F13	[LOOP] [LOOP] -- SEND Establish Communications Request
Establish Communications Acknowledge	S1, F14 →		[IF] S1, F14 received without timeouts [THEN] exit loop -- SEND [ELSE] Delay for interval in EstablishCommunicationsTimeout [ENDIF] [END_LOOP]--SEND [IF] COMMACK = Accept [THEN] Communications state = Communicating exit loop -- [ELSE] Reset timer for delay, and delay for interval specified in EstablishCommunicationsTimeout [ENDIF] [END_LOOP]

4.1.3.3 Simultaneous Attempts to Establish Communications

For equipment that supports interleaving, it is possible that either the host or equipment could send an Establish Communications Request before receiving the request from its partner. As communications are established by the successful acceptance of any one Establish Communications Request, it is immaterial who sends the request first. The roles of host and equipment may be reversed.

4.1.3.3.1 Equipment Receives S1, F14 From Host Before Sending S1, F14

COMMENT	HOST	EQUIPMENT	COMMENT
			Communications State = NOT COMMUNICATING
		← S1, F13	Establish Communications Request
Establish Communications Request	S1, F13 →		
Reply COMMACK = Accept	S1, F14 →		S1, F14 received from Host and Communications established* and Communications state = COMMUNICATING
		← S1, F14	Reply COMMACK = Accept**

4.1.3.3.2 Equipment Sends S1, F14 To Host Before Receiving S1, F14

COMMENT	HOST	EQUIPMENT	COMMENT
			Communications State = NOT COMMUNICATING
		← S1, F13	Establish Communications Request
Establish Communications Request	S1, F13 →		
		← S1, F14	Reply COMMACK = Accept* Communications established** and Communications state = COMMUNICATING
Reply COMMACK = Accept	S1, F14 →		S1, F14 received from Host

Communications are established at the successful completion of the S1, F13/F14 transaction where COMMACK is set to zero.

** Communications are established on the successful transmission of S1, F14, even if there is an open S1, F13.

4.2 Dynamic Event Report Configuration

4.2.1 Purpose

This capability provides the data reporting flexibility required in some manufacturing environments. It allows the host to increase or decrease the data flow according to need. For example, if the performance of the equipment degrades, the data flow from that equipment may be increased to help diagnose the problem.

4.2.2 Detailed Description

The equipment supports the following event report configuration functionality through the SECS-II interface:

- Host definition/deletion of custom reports,
- Host linking/unlinking of defined reports to specified collection events, and
- Host enabling/disabling the reporting of specified collection events.

Note: The equipment may also supply alternative means for defining reports and linking reports to events (e.g. via the operator console). Implementation of alternate means is not required.

The equipment can be instructed by the host to enable or disable reporting of collection events on an individual or collective basis. A status variable (SV) is available that consists of a list of enabled collection events.

Reports may be attached to an event report message (S6, F11). These reports are linked to the desired collection event. They typically contain variables relating to that event. The reported data in the event report messages might include status variables (SV), equipment constants (EC), or data variables (DV). Note that data variable values are only valid upon certain events and should be included only in reports linked to those events.

4.2.3 Scenarios

4.2.3.1 Collection Event Reporting Set-up

COMMENT	HOST	EQUIPMENT	COMMENT
[IF] Define Report is Multi-block [THEN] send Multi-block inquire	S2, F39 ➔		
[ENDIF]		← S2, F40	Multi-block grant
Send report definitions	S2, F33 ➔		DATAIDs, RPTIDs and VIDs received
		← S2, F34	DRACK* = 0 the reports are OK
[IF] Link Events/Report is Multi-block [THEN] send Multi-block inquire	S2, F39 ➔		
		← S2, F40	Multi-block grant
[ENDIF]			
Link reports to events	S2, F35 ➔		CEIDs and the corresponding RPTIDs are received
		← S2, F36	LRACK = 0 the event linkages are acceptable.
Enable specific collection events	S2, F37 ➔		Enable/disable codes (CEEDs) and the respective event reporting CEIDs received.
		← S2, F38	ERACK = 0 OK, will generate the specified reports when the appropriate collection events happen.

4.3 Data Variable and Collection Event Namelist Requests

4.3.1 Purpose

This capability allows the host to query for the data variables and collection events that are available from the equipment.

4.3.2 Detailed Description

The host may request a list of data variables from the equipment including their VID, name and units. In addition, the host may request a list of collection events from the equipment including their CEID, name, and list of associated DVs.

4.3.3 Scenarios

4.3.3.1 Host Requests Data Variables

COMMENT	HOST	EQUIPMENT	COMMENT
Host requests data variables	S1, F21 ➔		
		← S1, F22	Equipment responds with list of data variable information

4.3.3.2 Host Requests Collection Events

COMMENT	HOST	EQUIPMENT	COMMENT
Host requests collection events	S1, F23➔		
		← S1, F24	Equipment responds with list of collection event information

4.4 Variable Data Collection

4.4.1 Purpose

This capability allows the host to query for the equipment variables and is useful during initialization and synchronization.

4.4.2 Detailed Description

The host may request a report containing data variables from the equipment by specifying the RPTID. It is assumed that the report has been previously defined (e.g. using the Define Report S2, F33 transaction; refer to Event Data Collection). The values of any status variables (SV) and equipment constants (EC) contained within the report must be current. Discrete data values (DV) are only guaranteed to be valid upon the occurrence of a specific collection event.

4.4.3 Scenarios

4.4.3.1 Host Requests Report

COMMENT	HOST	EQUIPMENT	COMMENT
Host requests data variables contained in report RPTID	S6, F19 ➔		
		← S6, F20	Equipment responds with list of variable data for the given RPTID.

4.5 Trace Data Collection

4.5.1 Purpose

Trace data collection provides a method of sampling data on a periodic basis. The time-based approach to data collection is useful in tracking trends or repeated applications within a time window, or monitoring of continuous data.

4.5.2 Detailed Description

The equipment establishes a trace report as instructed by the host (S2, F23). For a trace report (S6, F1) the host designates the following:

- Trace report identifier (TRID)
- Time interval for data sampling (DSPER)
- Total number of samples to be taken (TOTSMP)
- Number of samples per trace report (REPGSZ)
- Listing of which data will be sent with the report

The number of trace reports sent to the host is determined by total samples, divided by reporting group size (TOTSMP/REPGSZ).

The equipment samples the specified data at the interval designated by the host (DSPER) and sends a predefined trace report to the host for the specified reporting group size (REPGSZ). The trace report definition is automatically deleted from the equipment after the last trace report has been sent.

The host may modify or re-initiate a trace function currently in progress by specifying the same TRID in a trace request definition. At this point, the old trace is terminated and the new trace is initiated. The host may also instruct the equipment to terminate a trace report prior to its completion by specifying TOTSMP = 0 for that TRID, at which point the trace definition is deleted.

4.5.3 Scenarios

4.5.3.1 Host Initiates Trace Report

COMMENT	HOST	EQUIPMENT	COMMENT
Trace Data initialization requested	S2, F23 ➔		
		← S2, F24	Acknowledge, trace initiated [DO] TOTSMP REPGSZ times [DO] REPGSZ many times: collect $SVID_1 \ldots SVID_n$ data, delay time by DSPER. [END DO]
		← S6, F1	Send $SV_1, \ldots SV_n$
Acknowledge receipt	S6, F2 ➔		[END DO]
Optional: Request trace termination prior to completion (TOTSMP = 0)	S2, F23 ➔		
		← S2, F24	Acknowledge premature termination

4.6 Status Data Collection

4.6.1 Purpose

This capability allows the host to query the equipment for selected status information and is useful in synchronizing with equipment status.

4.6.2 Detailed Description

The host may query equipment status by specifying the desired SVID. Upon such a request, the equipment sends the host the value of the selected status variables. The host also may request the description (name and units) of any or all status variables.

4.6.3 Scenarios

4.6.3.1 Request Equipment Status Report

COMMENT	HOST	EQUIPMENT	COMMENT
Host requests report of selected status variable values.	S1, F3 ➔		
		← S1, F4	Equipment responds with the requested status variable data.

4.6.3.2 Request Equipment Status Variable Namelist

COMMENT	HOST	EQUIPMENT	COMMENT
Host requests equipment to identify selected status variables.	S1, F11 ➔		
		← S1, F12	Equipment responds with the requested status variable descriptions.

4.7 Alarm Management

4.7.1 Purpose

Historically, a precise definition of an equipment alarm has been absent. Consequently, differing interpretations have resulted in inconsistent implementations. This is addressed by providing a more rigorous alarm definition.

In addition, it is often important for equipment to report more extensive information to the host than has been available in the S5, F1/F2 (Alarm Report Send/Acknowledge) transaction. The data required in such cases is very dependent on equipment type, host information requirements, and alarm situation. This issue is addressed by providing event-reporting methods that are tied to alarm state changes.

Lastly, the alarm management capability provides mechanisms for the following.

- Reporting the time of an alarm state change
- Uploading a list of alarm texts
- Enabling and disabling the notification of specific alarms
- Host query of alarms set and enabled status on the equipment

4.7.2 Detailed Description

Two alarm notification mechanisms are defined to achieve the flexibility necessary for the reporting required by host systems. First, stream 5 alarm reporting enables a brief, yet fixed, method for notification

of alarm occurrences using the S5, F1/F2 transaction. Second, two collection events (a "Set" and "Clear" event) are defined for each alarm defined on the equipment to allow the use of event data collection mechanisms. This addresses the hosts' potential need for more extensive and flexible data reporting. In the latter case, reports are sent by the equipment using the Event Report/Acknowledge transaction (refer to Event Data Collection).

In the Alarm State model, the transition from the ALARM CLEAR to the ALARM SET state (transition 1) will trigger the set event for the alarm. Conversely, the transition from ALARM SET to ALARM CLEAR state (transition 2) will trigger the clear event.

NOTE: The alarm capability is intended as an addition to standard safety alarms (e.g. lights, horns, etc.). There is no intent to replace direct operator notification of such problems, nor is there the expectation that the host can prevent or directly address such alarms.

4.7.2.1 Differences Between Events and Alarms

EVENT	ALARM
An event is any occurrence detectable by the equipment.	An alarm is related to only those occurrences that are abnormal, undesirable, AND endanger people, equipment, or physical material being processed.
Certain events may trigger a state transition(s).	Each alarm has an associated two-state state model: ALARM SET (or unsafe) and ALARM CLEAR (or safe).
Equipment activities are not necessarily inhibited by the occurrence of an event (unless it is associated with an alarm or intentional inhibit).	The presence of an alarm inhibits equipment activities to ensure safe operation until the alarm condition is cleared.
Certain events may occur in an expected sequence.	Alarms may occur at any time.

4.7.3 Scenarios

Note: Consult event-reporting sections of this document for descriptions of enabling, disabling, and sending collection event reports.

4.7.3.1 Enable/Disable Alarms

COMMENT	HOST	EQUIPMENT	COMMENT
Enable/Disable Alarm	S5, F3 ➔		
		← S5, F4	Acknowledge

4.7.3.2 Upload Alarm Information

COMMENT	HOST	EQUIPMENT	COMMENT
Request alarm data/text	S5, F5 ➔		
		← S5, F6	Send alarm data/text

4.7.3.3 List Enabled Alarms Request

COMMENT	HOST	EQUIPMENT	COMMENT

Request enabled alarms	S5, F7 ➔		
		← S5, F8	Send alarm data/text

4.7.3.4 Send Alarm Report

Alarm occurrence detected by the equipment

COMMENT	HOST	EQUIPMENT	COMMENT
		← S5, F1	Send alarm report (if enabled)
Acknowledge	S5, F2 ➔		
		← S6, F11	Send event report (if enabled)
Acknowledge	S6, F12 ➔		

4.8 Remote Control

4.8.1 Purpose

This capability provides the host with a level of control over equipment operations.

4.8.2 Description

The equipment responds to host commands that provide the following functions relative to individual equipment implementations:

- Start processing
- Select a process program
- Stop processing
- Temporarily suspend processing
- Resume processing
- Abort processing

Remote commands are interpreted as "request action be initiated" rather than "do action." The equipment may then respond via S2, F42 with HCACK = 4 if the command "is going to be performed." This alleviates any transaction timeouts for commands that may take a long time to perform. The completion of the action initiated by the remote command (i.e., HCACK = 0 or 4) must result in either a state transition or other action that generates a collection event upon normal/abnormal completion.

The format for all remote commands is ASCII, with a maximum length of 20 characters. The character set is restricted to the printable characters (hexadecimal 21 through 7E). Note that spaces are not allowed.

A detailed list of supported remote commands is provided in the “Remote Commands” section.

4.8.3 Scenarios

4.8.3.1 Host sends a remote command message

COMMENT	HOST	EQUIPMENT	COMMENT
Host Command Send	S2, F41 ➔		Remote Command Message

		← S2, F42	Host Command Acknowledge
		← S6, F11	[IF] Command Accepted (HCACK = 0 or 4) [THEN] State change or other collection event occurrence
Event Report Acknowledge	S6, F12 →		

4.8.3.2 Host sends an enhanced remote command message

COMMENT	HOST	EQUIPMENT	COMMENT
Host Command Send	S2, F49 →		Enhanced Remote Command Message
		← S2, F50	Host Command Acknowledge
		← S6, F11	[IF] Command Accepted (HCACK = 0 or 4) [THEN] State change or other collection event occurrence
Event Report Acknowledge	S6, F12 →		

4.9 Equipment Constants

4.9.1 Purpose

This capability provides a method for the host to read and to change the value of selected equipment constants on the equipment.

4.9.2 Description

This capability allows the host to reconfigure equipment constants to support a variety of situations. Note that when the host changes an equipment constants value, the new value is not required to take effect immediately, although the equipment accepts the new value.

4.9.3 Scenarios

4.9.3.1 Host Sends Equipment Constants

Allow the host to change the value of one or more equipment constants.

COMMENT	HOST	EQUIPMENT	COMMENT
Host sends equipment constants	S2, F15 →		
		← S2, F16	EAC = 0 equipment sets constants

4.9.3.2 Host Equipment Constants Request

Allow the host to determine the current value of equipment constants.

COMMENT	HOST	EQUIPMENT	COMMENT
Host constant request	S2, F13 →		

		← S2, F14	Equipment constant data (NOTE: This capability also can be accomplished using S2, F19 and S6, F20.

4.9.3.3 Host Equipment Constant Namelist Request

Allow the host to retrieve basic information about the equipment constants available at the equipment.

COMMENT	HOST	EQUIPMENT	COMMENT
Host constant namelist Request	S2, F29 →		
		← S2, F30	Equipment constant namelist

4.9.3.4 Operator Changes Equipment Constant

COMMENT	HOST	EQUIPMENT	COMMENT
			Operator changes equipment constant at equipment operator console.
		← S6, F11	Equipment reports equipment constant change.
Host acknowledges event	S6, F12 →		

4.10 Process Program Management

4.10.1 Purpose

Process program management provides a means to transfer process programs and to share the management of those process programs between the host and equipment.

4.10.2 Description

A process program is the pre-planned and reusable set of instructions, settings, and parameters that determine the processing environment seen by the manufactured object. Process programs are also called recipes. It might be changed between runs and processing cycles.

Process programs allow the equipment's process, and/or the parameters used by that process, to be set and modified by the engineer to achieve different results. Different process programs may be required for different products, while often the same process program will be used for all lots of a given product. The engineer must be able to create such programs, to modify current programs, and to delete programs from equipment storage.

For the host to ensure that the proper process programs are on the equipment, there must be a means of transferring them from equipment to host and from host to equipment. The host also may need to delete process programs from the equipment's storage to make room for a process program to be downloaded.

Unformatted process programs may be uploaded and downloaded. This capability provides for host-initiated transfers. This machine only supports unformatted process programs.

If a process program exists with the same PPID as the one given in the SECS-II message, the old process program will be replaced. The PPID in the SECS-II message is used to identify the process program in non-volatile storage.

The equipment may deny overwriting or deleting a recipe if it is in use or affects the recipe in use.

4.10.3 Process Program Format

FLOware Process Programs are transferred as unformatted, binary data (blobs). These blobs are actually ZIP archives containing several files.

Each ZIP archive contains the following three files:

File Name	File Type	Description
gem-pp-export.csv	A comma separated ASCII text file containing the exported data. This file is generated by the FLOware export program and may be consumed by the FLOware import program.	See FLOware Import/Export Guide for details. This file is suitable for direct import into the FLOware database using the importx program.
gem-pp-export.fmt	A comma separated ASCII 'format' file generated at data export time. This file is required when importing the data file.	This file is generated during the export operation and is required during the import operation. Do not modify this file. See FLOware Import/Export Guide for details.
gem-pp-export.dat	Captured output from export program.	May be useful in diagnosing problems.

4.10.4 Scenarios

4.10.4.1 Process Program Deletion by Host

COMMENT	HOST	EQUIPMENT	COMMENT
Delete Process Program Send	S7, F17 ➔		
		← S7, F18	The process program is removed from non-volatile storage. Delete Process Program Acknowledge.

4.10.4.2 Process Program Directory Request

COMMENT	HOST	EQUIPMENT	COMMENT
Current EPPD Request	S7, F19 ➔		
		← S7, F20	Current EPPD Data

4.10.4.3 Host-Initiated Process Program Upload -- Unformatted

COMMENT	HOST	EQUIPMENT	COMMENT

Process Program Request	S7, F5 ➔		
		← S7, F6*	Process Program Data *If the process program does not exist, a zero-length list will be sent.

4.10.4.4 Host-Initiated Process Program Download -- Unformatted

COMMENT	HOST	EQUIPMENT	COMMENT
[IF] Process program is multi-block [THEN]			
Process Program Load Inquire	S7, F1* ➔		
		← S7, F2	Process Program Load Grant * S7, F1 should be used only to request permission to transfer a multi-block formatted or unformatted process program. It should not be used to select a process program for execution; the remote command PP-SELECT should be used.
[END_IF]			
Process Program Send	S7, F3 ➔		
		← S7, F4	Process Program Acknowledge

4.10.5 Process Program Libraries

FLOware's Process Program data model relies extensively on the concept of libraries. For example, the Materials library maintains default process parameters for a number of material types. Assigning a specific material to a process program applies that material's parameters to that process program.

Because all process programs have external references to library elements, it is necessary that these libraries be maintained on the host for distribution to the FLOware equipment. To this end, each library has a 'special name' but is otherwise treated identically to a process program.

To acquire a library from FLOware equipment, issue a RequestProcessProgram command (S7F5) with one of the PPIDs from the table below.

To restore a library to FLOware equipment, issue a ProcessProgramSend command (S7F3) with one of the PPIDs from the table below.

All libraries follow the FLOware Import/Export specification as detailed in the FLOware Import/Export Guide.

Library Name (PPID)	DB Table	Description
__Library_FixedLocations__	FIXEDLOCS	Equipment's Fixed Locations – See FLOware Manual
__Library_Materials__	MATERIALS	Equipment's Material Definitions – See FLOware Manual
__Library_Needles__	NEEDLES	Equipment's Needle Definitions – See FLOware Manual
__Library_Shapes__	SHAPES	Equipment's Shapes Library– See FLOware Manual
__Library_SpecialLocations__	SPECIALLOCS	Equipment's Special Locations – See FLOware Manual
__Library_SubTypes__	SUBTYPES	Equipment's Sub Type Definitions – See FLOware Manual
__Library_Tools__	TOOLS	Equipment's Tool (Pump/Valve) Definitions – See FLOware Manual
__Library_VisionPatterns__ [L1]	PATTERNS	Equipment's Fiducial Patterns – See FLOware Manual

Notes:

1) The Vision Patterns (fiducial) library can grow to extremely large sizes when even a moderate number of patterns are defined. The FLOware equipment is capable of transferring Process Programs in excess of 250MB in size but it is recommended that the Vision Patterns library be kept under this size if possible.
   Vision Pattern sizes are dependent upon the number of visual 'features' described by the pattern, therefore it's difficult to predict the size of an individual pattern.

4.11 Equipment Terminal Services

4.11.1 Purpose

Equipment Terminal Services allows the factory operators to exchange information with the host from their equipment workstations.

4.11.2 Detailed Description

The equipment is capable of displaying information passed to it by the host for the operator's attention. The information, or an indication of a message, remains on the equipment's display until the operator indicates message recognition. Message recognition results in a collection event that informs the host that the operator has actually viewed the information.

The equipment has no responsibility for interpreting any of the data passed to or from the host using this method.

4.11.3 Scenarios

4.11.3.1 Host sends information to an equipment's display device

COMMENT	HOST	EQUIPMENT	COMMENT
Host sends textual information to equipment for display to the operator on terminal x.	S10, F3 ➔		
		← S10, F4	Equipment acknowledges request to display text (equipment sets unrecognized message indicator).
			Operator indicates message recognition (equipment clears unrecognized message indicator).
		← S6, F11	Message recognition event. (see Event Data Collection for details).
Host acknowledges Optional:	S6, F12 ➔		
		← S10, F1	Operator responds with text via terminal x.
Host acknowledges receipt of operator text.	S10, F2 ➔		

4.11.3.2 Host sends information to an equipment's display device and then overwrites the information before operator recognizes message

COMMENT	HOST	EQUIPMENT	COMMENT
Host sends textual information to equipment for display to the operator on terminal x.	S10, F3 ➔		
		← S10, F4	Equipment acknowledges request to display text (equipment sets unrecognized message indicator).
Host sends textual information to equipment for display to the operator on terminal x. This message overwrites the first one sent by the host since it is still unrecognized.	S10, F3 ➔		
		← S10, F4	Equipment acknowledges request to display text (equipment sets unrecognized message indicator).
			Operator indicates message recognition. (Equipment clears unrecognized message indicator).
		← S6, F11	Message recognition event

Host acknowledges	S6, F12 ➔		

4.11.3.3 Host sends a multi-block display message

COMMENT	HOST	EQUIPMENT	COMMENT
Send information	S10, F5 ➔		
		← S10, F6	Accepted or denied Note that since multi-block display is supported, the equipment will not send the S10, F7 message.

4.12 Clock

4.12.1 Purpose

The clock capability enables time stamping of collection event and alarm reports. Time stamping is useful for resolving relative order of event/alarm occurrences and scheduling of equipment activities by the host.

The ability for the host to instruct the equipment to set an internal clock to a specified time value, and for the equipment to request the current date and time, is needed for effective time management and synchronization.

4.12.2 Detailed Description

The clock capability assumes the existence of a relative time reference on the equipment. This time reference is used as a basis for updating the time value of an equipment status variable called "Clock." The time reference must reflect the current time to within a resolution range of seconds to centiseconds (refer to the format for Clock in the SEMI E5 Standard). The purpose of time stamping with centiseconds is to resolve the order in which nearly simultaneous events occur rather than to provide a more precise record of the time of day at which they occurred. Where more than one event occurs within a given period of clock resolution, the centiseconds reported in the event time stamps must reflect the actual order that the events were detected. Equipment with a clock resolution of less than a second should report centiseconds. Otherwise, centiseconds should be assigned to reflect the relative order in which events were detected. Equipment unable to resolve time to less than a second and unable to reflect the relative order in which events were detected may report centiseconds as "00."

The host employs the "Date and Time Set Request" message (S2, F31) to initialize the value of Clock to the value contained in the TIME data item. Similarly, the equipment may employ the "Date and Time Request" message (S2, F17) to obtain a new initialization time for Clock. As before, the value of TIME returned by the host is used to set Clock. Note that since the precision of TIME is seconds and that for Clock is centiseconds, in both cases the initial value of Clock contains "00" for its centisecond digits upon initialization.

4.12.3 Scenarios

4.12.3.1 Equipment Requests TIME (Optional Scenario)

COMMENT	HOST	EQUIPMENT	COMMENT
		← S2, F17	Equipment requests a time value from the host.
Host responds with a TIME value	S2, F18 ➔		Equipment sets its internal time reference to the value of TIME received from the host.

4.12.3.2 Host Instructs Equipment to Set Time

COMMENT	HOST	EQUIPMENT	COMMENT
Host instructs equipment to set its time.	S2, F31 ➔		
		← S2, F32	The equipment sets its internal time reference to the value of TIME received from the host and acknowledges completion.

4.12.3.3 Host Requests Equipment's Current Time Value

COMMENT	HOST	EQUIPMENT	COMMENT
Host requests equipment time.	S2, F17 ➔		
		← S2, F18	Equipment returns its internal time reference value to the host.

4.13 Spooling

4.13.1 Purpose

Spooling provides a method for retaining equipment message data that might otherwise be lost due to communication failure. The motive for producing this functionality is to retain valuable data used to track material and to improve product quality. The spooling capability fills a gap in the SEMI E5 standard. In the past, without a spooling capability, the equipment has typically discarded messages that could not be delivered, or turned messaging off altogether. It is intended that the host initiate the spool unload process immediately following the reestablishment of communications.

4.13.2 Description - Enabling Spooling

The equipment provides the host with the ability to enable and disable Spooling for any message (except Stream 1 messages, i.e. S1, F1 and S1, F13) via the S2, F43/F44 transaction. Spooling may be enabled for an entire Stream, for individual messages within a stream, or for any combination of the two. Streams and Functions not referenced in this message are not spooled. Spooling can be totally disabled by sending an S2, F43 with a zero length list for the first item (see S2, F43 definition).

The Spooling State Machine is described in section 3.6.

4.13.3 Scenarios

4.13.3.1 Define the Set of Messages to be Spooled

This Scenario is used to set up the list of messages that the equipment should spool (or by defining none, to disable spooling).

COMMENT	HOST	EQUIPMENT	COMMENT
Host defines messages to be spooled in case of communications failure.	S2, F43 ➔		
		← S2, F44	Equipment acknowledges setup

4.13.3.2 Define the Maximum Number of Messages to Send in Response to S6, F23

This Scenario sets the value of the "MaxSpoolTransmit" equipment constant.

COMMENT	HOST	EQUIPMENT	COMMENT
Host sends value for the "MaxSpoolTransmit" equipment constant.	S2, F15 ➔		
		← S2, F16	Equipment acknowledges equipment constant change.

4.13.3.3 Request or Delete Spooled Data ("MaxSpoolTransmit" EC = 0)

This Scenario is used to initiate the transfer of the spooled data from the equipment to the host or to purge the spools.

COMMENT	HOST	EQUIPMENT	COMMENT
			Communications were lost and then re-established.
Host requests data that includes spool related status variables. NOTE: S1, F3 is one of various methods that could be used.	S1, F3 ➔		
		← S1, F4	Send status data
Request or delete spooled data	S6, F23 ➔		
		← S6, F24	Request spooled data acknowledgement.
			[IF] RSDC = 0 (Spool data requested). [THEN] The appropriate Streams and Functions are used to transmit the spooled data to the host. [ELSE_IF] RSDC = 1 [THEN] Spool data discarded. [END_IF]
		← S6, F11	SpoolingDeactivated event report sent
Acknowledge	S6, F12 ➔		

4.13.3.4 Request or Delete Spooled Data ("MaxSpoolTransmit" EC > 0)

This Scenario shows the effect of "MaxSpoolTransmit" EC < "SpoolCountActual" SV on the Spool Transmit process. For the purpose of illustration, the value of "MaxSpoolTransmit" EC is 5 and the "SpoolCountActual" SV is 8 (at the time communications are re-established). No messages are added to the Spool during the transmit process.

COMMENT	HOST	EQUIPMENT	COMMENT

			Communications were lost and then re-established.
Host requests data that includes spool related status variables.	S1, F3 ➔		
		← S1, F4	Send status data (e.g. "SpoolCountActual" SV = 8, "MaxSpoolTransmit" EC = 5).
Host requests spooled data (RSDC =0).	S6, F23 ➔		Request spooled data acknowledgement. The five oldest messages in the Spool are transmitted to the host. Spooling remains active.
		← S6, F24	Request spooled data acknowledgement.
Host recognizes that "MaxSpoolTransmit" EC is reached.			
Host requests additional spooled data (RSDC =0).	S6, F23 ➔		
		← S6, F24	The remaining messages are transmitted from the spool.
		← S6, F11	"SpoolingDeactivated" collection event report sent.
Acknowledge	S6, F12 ➔		

4.14 Control (Host-Initiated)

4.14.1 Purpose

This section complements the Control State Model description found in section 3.2. It defines the requirements for implementation of this model.

4.14.2 Description Control Configuration

The control state model has two areas of configuration. The first area is related to the default entry states of the state model. Upon system initialization, the system must activate either the ON-LINE or the OFF-LINE state. Upon entry to OFF-LINE, the system must in turn activate one of the substates of OFF-LINE (EQUIPMENT OFF-LINE, ATTEMPT ON-LINE, or HOST OFF-LINE). In both these cases, the user configures the equipment to make the choices appropriate to that factory. Entry to the ON-LINE state also involves a choice of substates. In this case, the equipment reads the front panel REMOTE/LOCAL switch to determine the appropriate state.

The second area of configuration involves the transition to be made if the ON-LINE attempt should fail. The model may be set to transition to either HOST OFF-LINE or to EQUIPMENT OFF-LINE should the S1, F1 transaction be terminated unsuccessfully. Choosing HOST OFF-LINE allows the host to cause the equipment to transition to ON-LINE when the host becomes ready. This is accomplished via the message S1, F17 (see below).

4.14.2.1 Changing Control State

In the control state model, both the operator and the host can affect the control state. The operator retains ultimate authority to set the equipment OFF-LINE by means of an OFF-LINE switch mechanism. The operator also can cause the equipment to attempt to go ON-LINE. Under some circumstances, the host can initiate the transition to ON-LINE.

If the operator requests to go ON-LINE, the equipment will send an S1, F1 to the host. The host may confirm ON-LINE with an S1, F2 or deny ON-LINE by sending an S1, F0. If there is no host response (i.e., reply timeout), the equipment treats it as a denial.

When the equipment is ON-LINE, the host may request that it transition to OFF-LINE. It transitions to the HOST OFF-LINE substate. When the equipment HOST OFF-LINE state is active, the host may request that it transition to ON-LINE. The combination of these two allows the host to cycle the equipment between ON-LINE and OFF-LINE.

Only the operator may change the ON-LINE substate (REMOTE or LOCAL).

4.14.3 Scenarios

4.14.3.1 Host Accepts ON-LINE

COMMENT	HOST	EQUIPMENT	COMMENT
			Operator actuates ON-LINE switch when equipment OFF_LINE state is active.
		← S1, F1	Equipment request ON-LINE.
Host grants ON-LINE	S1, F2 →		
		← S6, F11	“Control State LOCAL (or REMOTE)” collection event.
Acknowledge	S6, F12 →		

4.14.3.2 Host Denies ON-LINE

COMMENT	HOST	EQUIPMENT	COMMENT
			Operator actuates ON-LINE switch when equipment OFF_LINE state is active.
		← S1, F1	Equipment requests ON-LINE.
Host denies ON-LINE	S1, F0 →		

4.14.3.3 Operator Sets OFF-LINE

COMMENT	HOST	EQUIPMENT	COMMENT
			Operator actuates OFF-LINE switch when equipment ON_LINE state is active.
		← S6, F11	“Equipment request OFF-LINE” event.

Acknowledge	S6, F12 ➔		

4.14.3.4 Operator Sets REMOTE

COMMENT	HOST	EQUIPMENT	COMMENT
			Operator sets switch from LOCAL to REMOTE.
		← S6, F11	“Control State REMOTE” event.
Acknowledge	S6, F12 ➔		

4.14.3.5 Operator Sets LOCAL

COMMENT	HOST	EQUIPMENT	COMMENT
			Operator sets switch from REMOTE to LOCAL.
		← S6, F11	“Control State LOCAL” event.
Acknowledge	S6, F12 ➔		

4.14.3.6 Host Sets OFF-LINE

COMMENT	HOST	EQUIPMENT	COMMENT
Host request OFF-LINE.	S1, F15 ➔		
			[IF] Equipment is OFF-LINE
		← S1, F0	[THEN] Equipment does not process requests.
			[ELSE] Equipment ON-LINE
		← S1, F16	Equipment acknowledges request and transitions to OFF-LINE.
		← S6, F11	“Equipment OFF_LINE” event.
Acknowledge	S6, F12 ➔		
			[END_IF]

4.14.3.7 Host Sets ON-LINE

COMMENT	HOST	EQUIPMENT	COMMENT
Host requests ON-LINE	S1, F17 ➔		
			[IF] Equipment is HOST OFF-LINE state not active.
		← S1, F18	[THEN] Equipment denies request

			(ONLACK = 0).
			[ELSE] Equipment HOST OFF-LINE state is active.
		← S1, F18	Equipment acknowledges request (ONLACK = 0).
		← S6, F11	“Control state LOCAL (or REMOTE)” event.
Acknowledge	S6, F12 →		
			[END_IF]

5 SECS-II MESSAGE SUMMARY

5.1 Control State Dependency

The equipment's Control State Model, as described in section 3.2, determines the availability of most SECS-II message communication. If the host sends an unavailable SECS-II message while the equipment is off-line, then the equipment will respond with a respective Sx, F0 message.

Control State	Description
On-line L, R	On-line local or remote
Any	Any control state
Off-line	Off-line equipment, host or on-line Attempt. It may be accepted while on-line, but has no meaning.
On-line R	On-line remote

5.2 Host Initiated

This section lists primary, host initiated SECS-II messages supported by the equipment.

Primary	Reply	Notes	Control State	Primary Description
Sx, Fy	Sx, F0		Off-line	Any host primary message that is rejected by equipment because equipment control state is off-line
S1, F1	S1, F2		On-line L	Are you there request
S1, F3	S1, F4		On-line L	Selected equipment status request
S1, F11	S1, F12		On-line L	Status variable name-list request
S1, F13	S1, F14		Any	Establish communication request
S1, F15	S1, F16		On-line L	Request off-line
S1, F17	S1, F18		Off-line	Request on-line
S1, F21	S1, F22		On-line L	Data Variable Namelist Request
S1, F23	S1, F24		On-line L	Collection Event Namelist Request
S2, F13	S2, F14		On-line L	Equipment constant request
S2, F15	S2, F16		On-line L	New equipment constant send
S2, F17	S2, F18		On-line L	Date and time request
S2, F21	S2, F22	A	On-line L	Remote command send
S2, F23	S2, F24		On-line L	Trace initialize send

S2, F25	S2, F26	A	On-line L	Loop-back diagnostic request
S2, F29	S2, F30		On-line L	Equipment constant name-list request
S2, F31	S2, F32		On-line L	Date and time send
S2, F33	S2, F34		On-line L	Define report
S2, F35	S2, F36		On-line L	Link event report
S2, F37	S2, F38		On-line L	Enable/disable event report
S2, F39	S2, F40		On-line L	Multi-block inquire
S2, F41	S2, F42		On-line L	Host command send
S2, F43	S2, F44		On-line L	Reset spooling request
S2, F45	S2, F46		On-line L	Define variable limit attributes
S2, F47	S2, F48		On-line L	Variable limit attribute request
S2, F49	S2, F50		On-line L	Enhanced remote command send
S5, F3	S5, F4		On-line L	Enable/disable alarm send
S5, F5	S5, F6		On-line L	List alarms request
S5, F7	S5, F8	A	On-line L	List enabled alarm request
S6, F15	S6, F16		On-line L	Event report request
S6, F19	S6, F20		On-line L	Individual report request
S6, F23	S6, F24		On-line L	Request spooled data
S7, F1	S7, F2		On-line L	Process program load inquire
S7, F3	S7, F4		On-line L	Process program send
S7, F5	S7, F6		On-line L	Process program request
S7, F17	S7, F18		On-line L	Delete process program send
S7, F19	S7, F20		On-line L	Current EPPD request
S10, F3	S10, F4		On-line L	Terminal display, single
S10, F5	S10, F6		On-line L	Terminal display, multi-block
S127,F1	S127,F2	A	Any L	Get SEDD Document
S127,F3	S127,F4	A	Any L	Get SEDD XSD Document

5.3 Equipment Initiated

This section lists primary, equipment initiated SECS-II messages supported by the equipment.

Primary	Reply	Notes	Primary Description
S1, F1	S2, F2		Are you there request
S1, F13	S1, F14		Establish communication request
S2, F17	S2, F18		Date and time request
S5, F1	S5, F2	W5	Alarm report send
S6, F1	S6, F2	W6	Trace data send
S6, F3	S6, F4	A, W6	Discrete variable data send
S6, F5	S6, F6		Multi-block data send inquire
S6, F11	S6, F12	W6	Event report send
S6, F13	S6, F14	A, W6	Annotated event report send
S7, F1	S7, F2		Process program load inquire
S7, F3	S7, F4		Process program send
S9, F1	None		Unrecognized device ID
S9, F3	None		Unrecognized stream type
S9, F5	None		Unrecognized function type
S9, F7	None		Illegal data
S9, F9	None		Transaction timer timeout
S9, F11	None		Data too long
S9, F13	None		Conversation timeout
S10, F7	None		Multi-block not allowed

5.4 Notes

These notes describe special conditions about the message.

Key	Description
N	A supported SECS-II message that conflicts with the GEM standard. The "N" abbreviates Non-GEM.
A	A supported SECS-II message that does not conflict with the GEM standard. The "A" abbreviates Addition to GEM.

W5	Equipment constant WBitS5 determines whether or not the equipment expects the host to reply.
W6	Equipment constant WBitS6 determines whether or not the equipment expects the host to reply.
W10	Equipment constant WBitS10 determines whether or not the equipment expects the host to reply.

6 DATA ITEM DEFINITION TABLE

Variable	Description	Values
ABS	Any binary string	
ACKA	Indicates success of a request:	TRUE is successful else FALSE
ACKC5	Acknowledge code	0 = Accepted > 0 = Error, not accepted 1-63 Reserved
ACKC6	Acknowledge code	0 = Accepted > 0 = Error, not accepted 1-63 Reserved
ACKC7	Acknowledge code	0 = Accepted 1 = Permission not granted 2 = Length error 3 = Matrix overflow 4 = PPID not found 5 = Mode unsupported 6-63 Reserved
ACKC10	Acknowledge code	0 = Accepted for display 1 = Message will not be displayed 2 = Terminal not available 3-63 Reserved
ALCD	Alarm code byte	bit 8 = 1 Alarm set bit 8 = 0 Alarm clear bit 7-1 Alarm category, not used
ALED	Alarm enable/disable code	bit 8 = 1 Enable alarm bit 8 = 0 Disable alarm
ALID	Alarm identification. U1-U8, I1-I8, F4, F8 formats will be accepted as long as the value is between 0 and 4294967294	
ALTX	Alarm text limited to 40 characters	
ATTRDATA	Contains a specific attribute value for a specific object	

ATTRID	Identifier for an attribute for a specific type of object	
ATTRRELN	The relationship that a specified qualifying value has to the value of an attribute of an object instance (the value of interest):	0= The qualifying value is equal tothe value of interest, 1 = The qualifying value is not equal to the value of interest, 2= The qualifying value is less than the value of interest, 3= The qualifying value is less than or equal to the value of interest, 4= The qualifying value is greater than the value of interest, 5 = The qualifying value is greater than or equal to the value of interest, 6= The qualifying value is present (contained in the set of) the value of interest, 7= The qualifying value is absent (not contained in the set of) the value of interest, >7 = Reserved.
CAACK	Carrier Action Acknowledge Code, 1 byte	0 = Acknowledge, command has been performed. 1 = Invalid command 2 = Can not perform now 3 = Invalid data or argument 4 = Acknowledge, request will be performed with completion signaled later by an event. 5 = Rejected. Invalid state. 6 = Command performed with errors. 7-63 Reserved.
CARRIERACTION	Specifies the action requested for a carrier	
CARRIERID	The identifier of a carrier	
CARRIERSPEC	The object specifier for a carrier. Conforms to OBJSPEC.	
CATTRDATA	The value of a carrier attribute	
CATTRID	The name of a carrier attribute	
CEED	Collection event enable/disable code	FALSE = Disable

		TRUE = Enable
CEID	Collected event ID. U1-U8, I1-I8, F4, F8 formats will be accepted as long as the value is between 0 and 4294967294.	
COMMACK	Establish communications acknowledge code	0 = Accepted 1 = Denied 2-63 Reserved
CPACK	Command parameter acknowledge code	1 = Parameter Name (CPNAME does not exist 2 = Illegal value specified for CPVAL 3 = Illegal format specified by CPVAL >3 Other equipment-specific error 4-63 Reserved
CPNAME	Command parameter name	
CPVAL	Command parameter value	
CTLJOBCMD	Control Job command codes are assigned as follows:	1 = CJStart 2 = CJPause 3 = CJResume 4 = CJCancel 5 = CJDeselect 6 = CJStop 7 = CJAbort 8 = CJHOQ
CTLJOBID	Identifier for Control Job. Conforms to OBJID.	
DATA	A vector or string of unformatted data.	
DATAID	Data ID. U1-U8, I1-I8, F4, F8 formats will be accepted as long as the value is between 0 and 4294967294.	
DATALENGTH	Total bytes to be sent	
DATASEG	Used to identify the data requested.	
DRACK	Define report acknowledge code	0 = Accept 1 = Denied, insufficient space

		2 = Denied, invalid format 3 = Denied, at least one RPTID already defined 4 = Denied, at least VID does not exist. >4 Other errors 5-63 Reserved
DSPER	Data sample period	hhmmss, 6 bytes or hhmmsscc, 8 bytes
EAC	Equipment acknowledge code	0 = Acknowledge 1 = Denied, At least one constant does not exist. 2 = Denied, busy 3 = Denied, at least one constant out of range. >3 Other equipment-specific error 4-63 Reserved
ECDEF	Equipment constant default value	
ECID	Equipment constant ID. U1-U8, I1-I8, F4, F8 formats will be accepted as long as the value is between 0 and 4294967294.	
ECMAX	Equipment constant maximum value	
ECMIN	Equipment constant minimum value	
ECNAME	Equipment constant name	
ECV	Equipment constant value	
EDID	Expected data identification	Possible responses: MEXP EDID EDID S07F03 <PPID> A[16]
EPPD	Equipment Process Program Directory	List of Process Programs available on Equipment.
ERACK	Enable/disable event report	0 = Accepted 1 = Denied >1 Other errors 2-63 Reserved
ERRCODE	Code identifying an error	0 = No error

		1 = Unknown object in Object Specifier 2= Unknown target object type 3 = Unknown object instance 4 = Unknown attribute name 5 = Read-only attribute - access denied 6 = Unknown object type 7 = Invalid attribute value 8 = Syntax error 9 = Verification error 10 = Validation error 11 = Object identifier in use 12 = Parameters improperly specified 13 = Insufficient parameters specified 14 = Unsupported option requested 15 = Busy 16 = Not available for processing 17 = Command not valid for current state 18 = No material altered 19 = Material partially processed 20 = All material processed 21 = Recipe specification related error 22 = Failed during processing 23 = Failed while not processing 24 = Failed due to lack of material 25 = Job aborted 26 = Job stopped 27 = Job cancelled 28 = Cannot change selected recipe 29 = Unknown event 30 = Duplicate report ID 31 = Unknown data report 32 = Data report not linked 33 = Unknown trace report 34 = Duplicate trace ID 35 = Too many data reports 36 = Sample period out of range 37 = Group size to large 38 = Recovery action currently invalid 39 = Busy with another recovery

		currently unable to perform the recovery 40 = No active recovery action 41 = Exception recovery failed 42 = Exception recovery aborted 43 = Invalid table element 44 = Unknown table element 45 = Cannot delete predefined 46 = Invalid token 47 = Invalid parameter 48 = Load port does not exist 49 = Load port already in use 50 = Missing Carrier 51-63 = Reserved (data formats 51, 52, 54, or 50 must be used) 64-32767 = User defined (data formats 52, 54, or 50 must be used) formats 52, 54, or 50 must be used) 32768 = Action will be performed at earliest opportunity 32769 = Action can not be performed now 32770 = Action failed due to errors 32771 = Invalid command 32772 = Client Already Connected 32773 = Duplicate ClientID 32774 = Invalid ClientType 32775 = IncompatibleVersions 32776 = Unrecognized ClientID (Client not currently connected) 32777 = Failed (Completed Unsuccess-fully) 32778 = Failed (Unsafe) — External intervention required 32779 = Sensor-Detected Obstacle 32780 = Material Not Sent 32781 = Material Not Received 32782 = Material Lost 32783 = Hardware Failure 32784 = Transfer Cancelled 32785–32792 reserved for future use by SEMI E127 service requests. 32793-65335 Reserved (data formats 52,

		54, or 50 must be used) 65536 or above = User defined data formats 54 or 50 must be used)
ERRTEXT	Text string describing the error noted in the corresponding ERRCODE. Limited to 120 characters maximum.	
FCNID	Function identification	
GRANT	Grant code	0 = Permission granted 1 = Busy, try again 2 = No space available 3 = Duplicate DATAID >3 Equipment specific error code 4-63 Reserved
GRANT6	Permission to send	0 = Permission granted 1 = Busy, try again 2 = Not interested >2 Other errors 3-63 Reserved
HCACK	Host command parameter acknowledge code	0 = Acknowledge 1 = Command does not exist 2 = Cannot perform now 3 = At least one parameter is invalid 4 = Acknowledge, command will be performed with completion signaled later 5 = Rejected, already in the desired condition 6 = No such object exists 7-63 Reserved
LENGTH	Length of the service program or process program in bytes. U1-U8, I1-I8, F4, F8 formats will be accepted as long as the value is between 0 and 4294967294.	
LIMITACK	Acknowledgment code for variable limit attribute set	1 = LIMITID does not exist 2 = UPPERDB > LIMITMAX

		3 = LOWERDB < LIMITMIN 4 = UPPERDB < LOWERDB 5 = Illegal format specified for UPPERDB or LOWERDB 6 = ASCII value cannot be translated to numeric 7 = Duplicate limit definition for this variable >7 Other equipment-specific error 8-63 Reserved
LIMITID	The identifier of a specific limit in the set of limits (as defined by UPPERDB and LOWERDB) for a variable to which the corresponding limit attributes refer	
LIMITMAX	The maximum allowed value for the limit values of a specific variable. The equipment manufacturer should specify this value, which would typically coincide with the maximum value of the variable being monitored. The format must match that of the referenced variable.	
LIMITMIN	The minimum allowed value for the limit values of a specific variable. The equipment manufacturer should specify this value, which would typically coincide with the minimum value of the variable being monitored. The format must match that of the referenced variable.	
LINKID	Used to link a completion message with a request that an operation be performed. LINKID is set to the value of RMOPID in the initial request except for the last completion message to be sent, where it is set to zero.	
LOCID	The logical identifier of a material location.	
LOWERDB	A variable limit attribute, which defines the lower boundary of the dead-band of a limit. The value applies to a single limit (*LIMITID) for a specified VID. Thus, UPPERDB and LOWERDB	

	as a pair define a limit.	
LRACK	Link report acknowledge code	0 = Accepted 1 = Denied, Insufficient space 2 = Denied, Invalid format 3 = Denied, At least one CEID link already defined 4 = Denied, At least one CEID does not exist 5 = Denied, At least one RPTID does not exist >5 Other errors 6-63 Reserved
LVACK	Variable limit definition, acknowledge code. Defines the error with limit attributes for the reference VID.	1 = Variable does not exist 2 = Variable has no limits capability 3 = Variable repeated in message 4 = Limit value error as described in LIMITACK 5-63 Reserved
MDLN	Equipment Model Type, 6 bytes max	
MEXP	Message expected	SXX, FYY X = stream Y = function
MF	Material format code 1 byte by Format 10	Items with format 10 will be encoded as follows: 1 = Quantities in wafers 2 = Quantities in cassette 3 = Quantities in die or chips 4 = Quantities in boats 5 = Quantities in ingots 6 = Quantities in leadframes 7 = Quantities in lots 8 = Quantities in magazines 9 = Quantities in packages 10 = Quantities in plates 11 = Quantities in tubes 12 = Quantities in waterframes 13 = Quantities in carriers

		14 = Quantities in substrates 15-63 Reserved Items with format 20 will be a unit identifier for one of the special SECS generic units, as specified in § 12.
MHEAD	SECS message block header associated with message block in error	
MID	Material ID	80 Characters maximum
OBJACK	Acknowledge code:	0 = Successful completion of requested data 1 = Error >1 Reserved
OBJCMD	Specifies an action to be performed by an object:	0 = Reserved 1 = Attach to requestor 2 = Detach from requestor (requires authorization token) 3 = Reattach to requestor 4 = Set attributes (requires authorization token) >4 Reserved
OBJID	Identifier for an object	
OBJSPEC	A text string that has an internal format and that is used to point to a specific object instance. The string is formed out of a sequence of formatted substrings, each specifying an object's type and identifier. The substring format has the following four fields: object type, colon character ":", object identifier, greater-than symbol ">" where the colon character ":" is used to terminate an object type and the "greater than" symbol ">" is used to terminate an identifier field. The object type field may be omitted where it may be otherwise determined. The final ">" is optional.	

OBJTYPE	Identifier for a group or class of objects. All objects of the same type must have the same set of attributes available.	
OBJTOKEN	Token used for authorization	
OFLACK	Acknowledge code for OFF-LINE request	0 = OFF-LINE Acknowledge 1-63 Reserved
ONLACK	Acknowledge code for ON-LINE	0 = ON-LINE Accepted 1 = ON-LINE Not Allowed 2 = Equipment Already ON-LINE 3-63 Reserved
OPID	Operation ID. A unique integer generated by the requestor of an operation, used where multiple completion confirmations may occur.	
PARAMNAME	The name of a parameter in a request	
PARAMVAL	The value of the parameter named in PARAMNAME. Values that are lists are restricted to lists of single items of the same format type.	
PGRPACTION	The action to be performed on a port group	
PORTACTION	The action to be performed on a port	
PORTGRPNAME	The identifier of a group of ports	
PPBODY	Process program body	
PPGNT	Process program grant status	0 = OK 1 = Already have 2 = No space 3 = Invalid PPID 4 = Busy, try later 5 = Will not accept >5 Other error 6-63 Reserved
PPID	Process program ID	

PREVENTID	Processing related event identification:	1 = Waiting for material 2 = Job state change
PRJOBID	Text string which uniquely identifies a process job	
PRJOBMILESTONE	Notification of Processing status shall have one of the following values:	1 = Job Setup 2 = Job Processing 3 = Job Processing Complete 4 = Job Complete 5 = Job Waiting for Start
PRMTRLORDER	Defines the order by which material in the process jobs material list will be processed. Possible values are assigned as follows:	1 = ARRIVAL – process whichever material first arrives 2 = OPTIMIZE – process in an order that maximizes throughput 3 = LIST – follow the order in the list
PRPAUSEEVENT	The list of event identifiers, which may be sent as an attribute value to a process job. When a process job encounters one of these events it will pause, until it receives the PRJobCommand RESUME.	
PRPROCESSSTART	Indicates that the process resource start processing immediately when ready:	TRUE = Automatic Start FALSE = Manual Start
PRRECIPEMETHOD	Indicates the recipe specification type, whether tuning is applied and which method is used:	1 – Recipe only 2 – Recipe with variable tuning
PRSTATE	Enumerated value, 1 byte	
PTN	Material Port number, 1 byte	
RCPPARNM	The name of a recipe variable parameter. Maximum length of 256 characters.	
RCPPARVAL	The initial setting assigned to a recipe variable parameter. Text form restricted to maximum of 80 characters.	
RCPSPEC	Recipe specifier. The object specifier of a recipe.	

REPGSZ	Reporting group size. U1-U8, I1-I8, F4, F8 formats will be accepted as long as the value is between 0 and 4294967294.	
RPTID	Report ID. U1-U8, I1-I8, F4, F8 formats will be accepted as long as the value is between 0 and 4294967294.	
RSDA	Request spool data acknowledge	0 = OK 1 = Denied, busy, try later 2 = Denied, spooled data does not exist 3-63 Reserved
RSDC	Request spool data code	0 = Transmit spooled messages 1 = Purge spooled messages 2-63 Reserved
RSPACK	Reset spooling acknowledge	0 = Acknowledge, spooling setup accepted 1 = Spooling setup rejected 2-63 Reserved
SEDD	SECS Equipment Data Dictionary (XML data dictionary)	
SEDDXSD	SEDD Schema Definition	
SHEAD	Stored header related to the transaction timer	
SLOTID	Used to reference material by slot (a position that holds material/substrates) in a carrier. This item may be implemented as an array in some messages.	
SMPLN	Sample number	
SOFTREV	Software revision code 6 bytes maximum	
SPNAME	Service parameter name defined in specific standard. If service parameter is defined as an object attribute, this is completely the same as ATTRID except format restrictions above.	

SPVAL	Service parameter value, corresponding to SPNAME. If service parameter is defined as an object attribute, this is completely the same as ATTRDATA except format restrictions for the attribute.	
STIME	Sample time	same as TME
STRID	Stream identification	
SV	Status variable value	
SVCACK	Service acceptance acknowledge code, 1 byte	0 = Acknowledge, service has been performed 1 = Service does not exist 2 = Cannot perform now 3= At least parameter is invalid 4 = Acknowledge, service will be performed with completion notified later with parameters for response 5 = Service is not completed or prohibited 6 = No such object exists 7-63 Reserved
SVID	Status variable ID. U1-U8, I1-I8, F4, F8 formats will be accepted as long as the value is between 0 and 4294967294.	
SVNAME	Status variable name	
TARGETSPEC	Object specifier of target object	
TEXT	A single line of characters.	
TIAACK	Equipment acknowledgment code	0 = Everything correct 1 = Too many SVID 2 = No more traces allowed 3 = Invalid period 4 = Unknown SVID specified 5 = Invalid REPGSZ or when it is outside of 1..262144 range 6-63 Reserved 64 = Unknown error creating trace.

		Possible errors include; No variables listed, Invalid TRID, or TOTSMP = 0. 66 = At least one variable is of List type or estimated message size > 244 bytes(only occurs when TraceReportMultiBlock=0)
TIACK	Time acknowledge code	0 = OK 1 = Error, not done 2-63 Reserved
TID	Terminal number	
TIME	Time of day	If 12 bytes the format is YYMMDDhhmmss YY = year 00 to 99 MM = month 01 to 12 DD = day 01 to 31 hh = hour 00 to 23 mm = minute 00 to 59 ss = second 00 to 59 If 16 bytes the format is YYYYMMDDhhmmsscc YYYY = year 0000 to 9999 MM = month 01 to 12 DD = day 01 to 31 hh = hour 00 to 23 mm = minute 00 to 59 ss = second 00 to 59 cc = centisecond 00 to 99 If Extended the format is YYYY-MM-DDThh:mm:ss.sTZD YYYY = year 0000 to 9999 MM = month 01 to 12 DD = day 01 to 31 T = Special separator character (“T”) used between date and time hh = hour 00 to 23 mm = minute 00 to 59 ss = second 00 to 59 s = One or more digits representing

		a fraction of a second TZD = time zone designator “Z” (for UTC) or +/-hh:mm (for offset from UTC to local time)
TIMESTAMP	Timestamp in 12, 16 bytes, or Extended format indicating the time of an event, which encodes time as specified by the TimeFormat equipment constant value setting.	Where: 12-byte format YYMMDDhhmmss 16-byte format YYYYMMDDhhmmsscc Extended (max 32 byte) format YYYY-MM-DDThh:mm:ss.sTZD (see SEMI E148) See TimeFormat equipment constant variable item in Table 4 for additional detail on the formats.
TOTSMP	Total samples to be made. U1-U8, I1-I8, F4, F8 formats will be accepted as long as the value is between 0 and 4294967294.	
TRID	Trace request ID. U1-U8, I1-I8, F4, F8 formats will be accepted as long as the value is between 0 and 4294967294.	
UNITS	Units Identifier	
UPPERDB	A variable limit attribute that defines the upper boundary of the dead-band of a limit. The value applies to a single limit (LIMITID) for a specified VID. Thus, UPPERDB and LOWERDB as a pair define a limit.	
V	Variable data	
VID	Variable ID. U1-U8, I1-I8, F4, F8 formats will be accepted as long as the value is between 0 and 4294967294.	
VLAACK	Variable Limit Attribute Acknowledge Code	0 = Acknowledge, command will be performed. 1 = Limit attribute definition error 2 = Cannot perform now >2 Equipment-specific error 3-63 Reserved

XML	Valid XML content	UTF8
XMLNS	XML namespace	UTF8 Typically applies to associated XML content
XMLSYSID	XML System ID	UTF8

`A, Bi, Bo, F4, F8, I1, I2, I4, U1, U2, U4`

7 STREAMS AND FUNCTIONS

The sections below describe the subset of SECS-II message streams and their included functions that are supported by the interface. It can be seen that the odd numbered functions within each stream are requests and the subsequent, even numbered functions are the corresponding response.

Symbol	Description
H⇔E	Host to equipment or equipment to host
H←E	Equipment to host only
H→E	Host to equipment only

7.1 Stream 1: Equipment Status

7.1.1 S1, F1 Are You There Request (H⇔E)

Establishes that the SECS-II link is operational and that the host and machine are on-line. The machine responds with its model number and software revision. The host responds with a null list. The equipment may use this message when using SECS-I as a "heartbeat" to detect communication failures. The equipment also uses this message in the Control State model when attempting to go online.

```
Header only
```

7.1.2 S1, F2 On-line Data (H←E)

```
L, 2
       1. <A MDLN>
       2. <A SOFTREV>
```

7.1.3 S1, F2 On-line Data (H→E)

```
L, 0
```

7.1.4 S1, F3 Selected Equipment Status Request (H→E)

This message is a request from the host to report the values of certain status variables in a predefined order.

```
L, n
       1. <U4 SVID>
       …
       n. <U4 SVID>
```

- A zero-length list means report all SVID.

7.1.5 S1, F4 Selected Equipment Status Data (H←E)

```
L, n
       1. <* SV>
       n. <* SV>
* A, Bi, Bo, F4, F8, L, I1, I2, I4, I8, U1, U2, U4, U8
```

- A zero-length U1 for SV means that the SVID does not exist.

7.1.6 S1, F11 Status Variable Namelist Request (H→E)

A request from the host to the machine to report the name and units of certain status variables, in the order requested.

```
L, n
```

```
1. <U4 SVID>
…
n. <U4 SVID>
```

- A zero-length list means report all SVID.

7.1.7 S1, F12 Status Variable Namelist Reply (H←E)

```
L, n
       1. L, 3
              1. <U4 SVID>
              2. <A SVNAME>
              3. <A UNITS>
       …
       n. L, 3
              1. <U4 SVID>
              2. <A SVNAME>
              3. <A UNITS>
```

7.1.8 S1, F13 Establish Communications Request (H→E)

Initiate an attempt to establish a SECS-II communications link at a logical level on power-up or after a break in the link. It is the first message sent after either of the above conditions.

```
L, 0
```

7.1.9 S1, F14 Establish Communications Request Acknowledge (H→E)

```
L, 2
       1. <Bi COMMACK>
       2. L, 0
```

7.1.10 S1, F13 Establish Communications Request (H←E)

Initiate an attempt to establish a SECS-II communications link at a logical level on power-up or after a break in the link. It is the first message sent after either of the above conditions. If no response is received from the host, the machine will periodically send a S1F13 message until a S1F14 with the correct COMMACK is received.

```
L, 2
       1. <A MDLN>
       2. <A SOFTREV>
```

7.1.11 S1, F14 Establish Communications Request Acknowledge (H←E)

```
L, 2
       1. <Bi COMMACK>
       2. L, 2
              1. <A MDLN>
              2. <A SOFTREV>
```

7.1.12 S1, F15 Off-line Control State Request (H→E)

The host requests that the equipment transition to the OFF-LINE state.

```
Header only
```

7.1.13 S1, F16 Off-line Control State Acknowledge (H←E)

```
<Bi OFLACK>
```

7.1.14 S1, F17 On-line Control State Request (H→E)

The host requests that the equipment transition to the ON-LINE state.

```
Header only
```

7.1.15 S1, F18 On-line Control State Acknowledge (H←E)

```
<Bi ONLACK>
```

7.1.16 S1, F21 Data Variable Namelist Request (H→E)

A request from the host to the machine to report the name and units of certain data variables, in the order requested.

```
L, n
       1. <U4 VID>
       …
       n. <U4 VID>
```

- A zero-length list means report all DVID.

7.1.17 S1, F22 Data Variable Namelist Reply (H←E)

```
L, n
       1. L, 3
              1. <U4 VID>
              2. <A DVVALNAME>
              3. <A UNITS>
       …
       n. L, 3
              1. <U4 VID>
              2. <A DVVALNAME>
              3. <A UNITS>
```

Zero-length ASCII items for both DVVALNAME and UNITS indicates that VID doesn't exist or is not the identifier of a DVVAL class variable.

7.1.18 S1, F23 Collection Event Namelist Request (H→E)

A request from the host to the machine to report the name and the list of associated data variables for certain collection events, in the order requested.

```
L, n
       1. <U4 CEID>
       …
       n. <U4 CEID>
```

- A zero-length list means report all CEIDs.

7.1.19 S1, F24 Collection Event Namelist Reply (H←E)

```
L, n
       1. L, 3
              1. <U4 CEID>
              2. <A CENAME>
              3. L, a
                     1. <U4 VID>
                     …
                     a. <U4 VID>
       …
       n. L, 3
              1. <U4 CEID>
              2. <A CENAME>
              3. L, b
                     1. <U4 VID>
                     …
                     b. <U4 VID>
```

When both CENAME and the list of associated VIDs are zero-length items, this indicates the CEID does not exist.

7.2 Stream 2: Equipment Control and Diagnostics

7.2.1 S2, F13 Equipment Constant Request (H→E)

A request from the host to report the value of certain equipment constants in a predefined order.

```
L, n
       1. <U4 ECID>
       …
       n. <U4 ECID>
```

- A zero-length list or item means report all ECID.

7.2.2 S2, F14 Equipment Constant Data (H←E)

```
L, n
       1. <* ECV>
       …
       n. <* ECV>
* A, Bi, Bo, F4, F8, I1, I2, I4, I8, U1, U2, U4, U8
```

- A zero-length list item for ECV means that ECID does not exist.

7.2.3 S2, F15 New Equipment Constant Send (H→E)

Host updates the values of specified EC. If the host returns a non-zero EAC the equipment will not change the value of any ECID specified in the S2F15 body.

```
L, n
       1. L, 2
              <U4 ECID>
              <* ECV>
       …
       n. L, 2
              <U4 ECID>
              <* ECV>
* A, Bi, Bo, F4, F8, I1, I2, I4, I8, U1, U2, U4, U8
```

7.2.4 S2, F16 New Equipment Constant Acknowledge (H←E)

```
<Bi EAC>
```

7.2.5 S2, F17 Date and Time Request (H⇔E)

The host and machine synchronize time-stamps.

```
Header Only
```

7.2.6 S2, F18 Date and Time Data (H⇔E)

<A *TIME*>

- A zero-length item means no time exists.

7.2.7 S2, F21 Remote Command Send (H→E)

The host requests equipment to perform an action.

```
<A RCMD>
```

7.2.8 S2, F22 Remote Command Acknowledge (H←E)

```
<U1 CMDA>
```

7.2.9 S2, F23 Trace Initialize Send (H→E)

The host requests a time driven trace of specified status variables. If TOTSMP is zero, the machine will cancel an existing trace with the given TRID.

```
L, 5
       1. <U4 TRID>
       2. <A DSPER>
       3. <U4 TOTSMP>
       4. <U4 REPGSZ>
       5. L, n
              1. <U4 SVID>
              …
              n. <U4 SVID>
```

7.2.10 S2, F24 Trace Initialize Acknowledge (H←E)

```
<Bi TIAACK>
```

7.2.11 S2, F25 Loop-back Diagnostic Request (H⇔E)

A diagnostic message for checkout of protocol and communication circuits. The message sent is echoed back.

```
<* ABS>

* Any structure is valid except a "HEADER ONLY" message.
```

7.2.12 S2, F26 Loop-back Diagnostic Data (H⇔E)

```
<* ABS>
* The same structure is returned.
```

7.2.13 S2, F29 Equipment Constant Namelist Request (H→E)

A request from the host to the equipment to retrieve information regarding the specified equipment constants. A zero length list (n = 0) means to send information for all ECID.

```
L, n
       1. <U4 ECID>
       …
       n. <U4 ECID>
```

- A zero-length list means to send information for all ECID.

7.2.14 S2, F30 Equipment Constant Namelist (H←E)

```
L, n
       1. L, 6
              1. <U4 ECID>
              2. <A ECNAME>
              3. <* ECMIN>
              3. <* ECMAX>
              3. <* ECDEF>
              3. <A UNITS>
       …
       n. L, 6
              1. <U4 ECID>
              2. <A ECNAME>
              3. <* ECMIN>
              3. <* ECMAX>
              3. <* ECDEF>
              3. <A UNITS>
```

Zero length ASCII items for ECNAME, ECMIN, ECMAX, ECDEF and UNITS indicates that the ECID does not exist.

```
* A, Bi, Bo, F4, F8, I1, I2, I4, I8, U1, U2, U4, U8
```

7.2.15 S2, F31 Date and Time Set Request (H→E)

The host instructs the equipment to set its time base to the specified value.

```
<A TIME>
```

Note that setting the time on a machine configured to follow Daylight Savings Time may have unexpected results in the following two cases.

- target time between 2 AM and 3AM on the day the clock is to be adjusted to daylight time. 2AM to 2:59:59 AM does not exist on this day, yet you can set the clock to this time.
- target time between 1AM and 2AM on the day the clock is to be adjusted to standard time. 1AM to 2AM repeats twice on this day and there is no way to specify which occurrence the target is when setting the clock.

7.2.16 S2, F32 Date and Time Set Acknowledge (H←E)

```
<Bi TIACK>
```

7.2.17 S2, F33 Define Report (H→E)

A request from the host for the machine to define a group of event reports. One or more Report IDs is specified, each containing a list of variable IDs to be included in the report.

```
L, 2
       1. <U4 DATAID>
       2. L, a
              1. L, 2
                     1. <U4 RPTID>
                     2. L, b
                            1. <U4 VID>
                            …
                            b. <U4 VID>
              …
              a. L, 2
                     1. <U4 RPTID>
                     2. L, c
                            1. <U4 VID>
                            …
                            c. <U4 VID>
```

- A zero-length list following DATAID deletes all report definitions and associated links. See S2, F35.
- A zero-length list following RPTID deletes report type RPTID. All CEID links to this RPTID are also deleted.

7.2.18 S2, F34 Define Report Acknowledge (H←E)

```
<Bi DRACK>
```

7.2.19 S2, F35 Link Event Report (H→E)

The host links Report IDs (RPTID) to Collection event IDs (CEID). These linked event reports default to "disabled" upon linking. That is, the occurrence of an event would not cause the report to be sent until enabled. See S2, F37 for enabling events.

```
L, 2
       1. <U4 DATAID>
       2. L, a
```

```
1. L, 2
       1. <U4 CEID>
       2. L, b
              1. <U4 RPTID>
              …
              b. <U4 RPTID>
…
a. L, 2
       1. <U4 CEID>
       2. L, c
              1. <U4 RPTID>
              …
              c. <U4 RPTID>
```

- A zero-length list following CEID deletes all report links to that event.
- The SEMI E5 standard is ambiguous as to the behavior of a zero-length list following DATAID. It has been interpreted to be an invalid condition. The S2F36 reply message will have an LRACK value of 2.

7.2.20 S2, F36 Link Event Report Acknowledge (H←E)

```
<Bi LRACK>
```

7.2.21 S2, F37 Enable/Disable Event Report (H→E)

Host requests to enable or disable reporting for a list of Collection events (CEID).

```
L, 2
       1. <Bo CEED>
       2. L, n
              1. <U4 CEID>
              …
              n. <U4 CEID>
```

- A zero-length list (n = 0) means all CEID.

7.2.22 S2, F38 Enable/Disable Event Report Acknowledge (H←E)

```
<Bi ERACK>
```

7.2.23 S2, F39 Multi-Block Inquire (H→E)

The host initiates this transaction preceding a multi-block S2, F33 or S2, F35.

```
L, 2
       1. <U4 DATAID>
       2. <U4 DATALENGTH>
```

7.2.24 S2, F40 Multi-Block Grant (H←E)

```
<Bi GRANT>
```

7.2.25 S2, F41 Host Command Send (H→E)

Note: a detailed list of remote commands is provided in the "Remote Commands" section.

```
L, 2
       1. <A RCMD>
       2. L, n
              1. L, 2
                     1. <A CPNAME>
                     2. <* CPVAL>
              …
```

```
              n. L, 2
                     1. <A CPNAME>
                     2. <* CPVAL>

* A, Bi, Bo, L, F4, F8, I1, I2, I4, I8, U1, U2, U4, U8
```

7.2.26 S2, F42 Host Command Acknowledge (H←E)

```
L, 2
       1. <Bi HCACK>
       2. L, n
              1. L, 2
                     1. <A CPNAME>
                     2. <Bi CPACK>
              …
              n. L, 2
                     1. <A CPNAME>
                     2. <Bi CPACK>
```

- If there are no invalid parameters, then a list of zero length will be sent for item 2 (n = 0).

7.2.27 S2, F43 Reset Spooling Streams and Functions (H→E)

The host can use this message to select specific streams and functions to be spooled whenever spooling is active.

```
L, m
       1. L, 2
              1. <U1 STRID>
              2. L, n
                     1. <U1 FCNID>
                     …
                     n. <U1 FCNID>
       …
       m. L, 2
              1. <U1 STRID>
              2. L, n
                     1. <U1 FCNID>
                     …
                     n. <U1 FCNID>
```

- A zero-length list, m = 0, turns off spooling for all streams and functions.
- A zero-length list, n = 0, turns on spooling for all functions for the associated stream
- Turning off spooling for all functions for a specific stream is achieved by omitting reference to the stream from this message.
- Spooling for Stream 1 is not allowed.
- All other primary messages for a stream are allowed.
- A defined list of functions for a stream in this message will replace any previously selected functions.

7.2.28 S2, F44 Reset Spooling Acknowledge (H←E)

```
L, 2
       1. <Bi RSPACK>
       2. L, m             (m = number of streams with errors)
              1. L, 3
                     1. <U1 STRID>
                     2. <Bi STRACK>
                     3. L, n             (n = number of functions in error)
                            1. <U1 FCNID>
                            …
```

```
                        n. <U1 FCNID>
                …
                m. L, 3
                        1. <U1 STRID>
                        2. <Bi STRACK>
                        3. L, n
                                1. <U1 FCNID>
                                …
                                n. <U1 FCNID>
```

- If RSPACK = 0, then a zero-length list, m = 0, is given. This indicates no streams or functions are in error.
- A zero-length list, n = 0, indicates no functions in error for specified streams.

7.2.29 S2, F45 Define Variable Limit Attributes (H→E)

```
L, 2
        1. <U4 DATAID>
        2. L, m
                1. L, 2
                        1. <U4 VID>
                        2. L, n
                                1. L, 2
                                        1. <Bi LIMITID>
                                        2. L, p = {0,2}
                                                1. <* UPPERDB>
                                                2. <* LOWERDB>
                                …
                                n. L, 2
                                        1. <Bi LIMITID>
                                        2. L, p = {0,2}
                                                1. <* UPPERDB>
                                                2. <* LOWERDB>
                …
                m. L, 2
                        1. <U4 VID>
                        2. L, n
                                1. L, 2
                                        1. <Bi LIMITID>
                                        2. L, p = {0,2}
                                                1. <* UPPERDB>
                                                2. <* LOWERDB>
                                …
                                n. L, 2
                                        1. <Bi LIMITID>
                                        2. L, p = {0,2}
                                                1. <* UPPERDB>
                                                2. <* LOWERDB>
* A, Bo, F4, F8, I1, I2, I4, I8, U1, U2, U4, U8
```

- A zero length list, m=0, sets all limit values for all monitored VID to "undefined".
- A zero length list, n=0, sets all limit values for that VID to "undefined".
- A zero length list, p=0, sets that limit to "undefined".

7.2.30 S2, F46 Variable Limit Attribute Acknowledge (H←E)

Acknowledge definition of variable limit attributes or report error. If DVLA is not accepted due to one or more invalid parameters (e.g., LIMITACK=3), then a list of invalid parameters is returned containing the variable limit attribute and reason for rejection. If an error condition is detected, the entire message is rejected, i.e., partial changes are not allowed.

```
L, 2
```

```
1. <Bi VLACK>
2. L, m       (m = number of invalid parameters)
       1. L, 3
              1. <U4 VID>          (VID with error)
              2. <Bi LVACK>        (reason)
              3. L, n = {0,2}
                     1. <Bi LIMITID>     (1st limit in error for VID)
                     2. <Bi LIMITACK>    (reason)
       …
       m. L, 3
              1. <U4 VID>
              2. <Bi LVACK>
              3. L, n = {0,2}
                     1. <Bi LIMITID>
                     2. <Bi LIMITACK>
```

- A zero-length list, m = 0, indicates no invalid variable limit attributes.
- A zero-length list, n = 0, indicates no invalid limit values for that VID.

7.2.31 S2, F47 Variable Limit Attribute Request (H→E)

This message allows the host to query the equipment for current variable limit-attribute definitions.

```
L, m
       1. <U4 VID>
       …
       m. <U4 VID>
```

- A zero-length list, m = 0, requests a list of all VID values that can have variable limit attributes.

7.2.32 S2, F48 Variable Limit Attribute Send (H←E)

```
L, m
       1. L, 2
              1. <U4 VID>
              2. L, p = {0,4}
                     1. <A UNITS>
                     2. <* LIMITMIN>
                     3. <* LIMITMAX>
                     4. L, n
                            1. L, 3
                                   1. <Bi LIMITID>
                                   2. <* UPPERDB>
                                   3. <* LOWERDB>
                            …
                            n. L, 3
                                   1. <Bi LIMITID>
                                   2. <* UPPERDB>
                                   3. <* LOWERDB>
       …
       m. L, 2
              1. <U4 VID>
              2. L, p = {0,4}
                     1. <A UNITS>
                     2. <* LIMITMIN>
                     3. <* LIMITMAX>
                     4. L, n
                            1. L, 3
                                   1. <Bi LIMITID>
                                   2. <* UPPERDB>
                                   3. <* LOWERDB>
                            …
```

```
                        n. L, 3
                                1. <Bi LIMITID>
                                2. <* UPPERDB>
                                3. <* LOWERDB>
```

```
* A, Bo, F4, F8, I1, I2, I4, I8, U1, U2, U4, U8
```

- A zero-length list, p = 0, indicates that limits are not supported for the VID.
- A zero-length list, n = 0, means no limits are currently defined for the specified variable.

7.2.33 S2, F49 Enhanced Remote Command (H→E)

Note: a detailed list of remote commands is provided in the "Remote Commands" section.

```
L, 4
       1. <U4 DATAID>
       2. <A OBJSPEC>
       3. <A RCMD>
       4. L, m
              1. L, 2
                     1. <A CPNAME>
                     2. <* CEPVALUE>
              …
              m. L, 2
                     1. <A CPNAME>
                     2. <* CEPVALUE>
```

```
* A, Bi, Bo, F4, F8, I1, I2, I4, I8, U1, U2, U4, U8
```

7.2.34 S2, F50 Enhanced Remote Command Acknowledge (H←E)

```
L, 2
       1. <Bi HCACK>
       2. L, n
              1. L, 2
                     1. <A CPNAME>
                     2. <* CEPACK>
              …
              n. L, 2
                     1. <A CPNAME>
                     2. <* CEPACK>
```

```
* L, U1
```

7.3 Stream 5: Exception Reporting

7.3.1 S5, F1 Alarm Report Send (H←E)

This message is sent whenever an alarm changes states to "Set" or "Clear"

```
L, 3
       1. <Bi ALCD>
       2. <U4 ALID>
       3. <A ALTX>
```

7.3.2 S5, F2 Alarm Report Acknowledge (H→E)

```
<Bi ACKC5>
```

7.3.3 S5, F3 Enable/Disable Alarm Send (H→E)

This message enables or disables an alarm from being reported to the host. Some alarms (safety related) are not controllable in this way.

```
L, 2
       1. <Bi ALED>
       2. <U4 ALID>
```

- A zero-length item for ALID means all alarms.

7.3.4 S5, F4 Enable/Disable Alarm Acknowledge (H←E)

```
<Bi ACKC5>
```

7.3.5 S5, F5 List Alarms Request (H→E)

The host requests the equipment to send information on currently defined alarms.

Three formats are supported: list, array and single value.

```
L, n
       1. <U4 ALID>
       …
       n. <U4 ALID>
```

- A zero-length item (n = 0) means send all possible alarms regardless of the state of ALED.

```
<U4 ALID1, …, ALIDn>
```

- A zero-length item (n = 0) means send all possible alarms regardless of the state of ALED.
-
- <U4 ALID>
- A zero-length item means send all possible alarms regardless of the state of ALED.

7.3.6 S5, F6 List Alarms Data (H←E)

```
L, m
       1. L, 3
              1. <Bi ALCD>
              2. <U4 ALID>
              3. <A ALTX>
       …
       m. L, 3
              1. <Bi ALCD>
              2. <U4 ALID>
              3. <A ALTX>
```

- If m = 0, no response can be made. A zero-length item returned for ALCD or ALTX means that value does not exist.

7.3.7 S5, F7 List Alarms Request (H→E)

The host requests the equipment to send information on currently defined alarms.

```
Header only.
```

7.3.8 S5, F8 List Alarms Data (H←E)

```
L, m
       1. L, 3
              1. <Bi ALCD>
              2. <U4 ALID>
              3. <A ALTX>
```

```
…
m. L, 3
       1. <Bi ALCD>
       2. <U4 ALID>
       3. <A ALTX>
```

- If m = 0, no response can be made. A zero-length item returned for ALCD or ALTX means that value does not exist.

7.4 Stream 6: Data Collection

7.4.1 S6, F1 Trace Data Send (H←E)

Trace Samples configured with S2, F23 messages are sent to the host in these messages.

```
L, 4
       1. <U4 TRID>
       2. <U4 SMPLN>
       3. <A STIME>
       4. L, n
              1. <* SV>
              …
              n. <* SV>
* A, Bi, Bo, F4, F8, L, I1, I2, I4, I8, U1, U2, U4, U8
```

- A zero-length STIME means no value is given and that the time is to be derived from SMPLN along with knowledge of the request.

7.4.2 S6, F2 Trace Data Acknowledge (H→E)

```
<Bi ACKC6>
```

7.4.3 S6, F3 Discrete Variable Data Send (H←E)

The machine sends a defined, event linked and enabled group of reports to the host on a linked event. This is a message that possibly requires a preceding S6, F5/F6 multi-block enquire/grant transaction.

```
L, 3
       1. <U4 DATAID>
       2. <U4 CEID>
       3. L, a
              1. L, 2
                     1. <U4 DSID>
                     2. L, b
                            1. L, 2
                                   1. <A DVNAME>
                                   2. <* DVVAL>
                            …
                            1. L, 2
                                   1. <A DVNAME>
                                   2. <* DVVAL>
              …
              a. L, 2
                     1. <U4 DSID>
                            1. L, 2
                                   1. <A DVNAME>
                                   2. <* DVVAL>
                            …
                            1. L, 2
                                   1. <A DVNAME>
```

```
        2. <* DVVAL>
```

```
* A, Bi, Bo, F4, F8, L, I1, I2, I4, I8, U1, U2, U4, I8
```

- If there are no reports linked to the event a "null" report is assumed. A zero-length list for # of reports means there are no reports linked to the given CEID.

7.4.4 S6, F4 Discrete Variable Data Acknowledge (H→E)

```
<Bi ACKC6>
```

7.4.5 S6, F5 Multi-Block Data Send Inquire (H←E)

The machine initiates this transaction preceding a multi-block S6 report.

```
L, 2
       1. <U4 DATAID>
       2. <U4 DATALENGTH>
```

7.4.6 S6, F6 Multi-Block Grant (H→E)

<Bi *GRANT6*>

7.4.7 S6, F11 Event Report Send (H←E)

The machine sends a defined, event linked and enabled group of reports to the host on a linked event. This is a message that possibly requires a preceding S6, F5/F6 multi-block enquire/grant transaction.

```
L, 3
       1. <U4 DATAID>
       2. <U4 CEID>
       3. L, a
              1. L, 2
                     1. <U4 RPTID>
                     2. L, b
                            1. <*V>
                            …
                            b. <*V>
              …
              a. L, 2
                     1. <U4 RPTID>
                     2. L, c
                            1. <*V>
                            …
                            c. <*V>
```

```
* A, Bi, Bo, F4, F8, L, I1, I2, I4, I8, U1, U2, U4, U8
```

- If there are no reports linked to the event a "null" report is assumed. A zero-length list for # of reports (a = 0) means there are no reports linked to the given CEID.

7.4.8 S6, F12 Event Report Acknowledge (H→E)

```
<Bi ACKC6>
```

7.4.9 S6, F13 Annotated Event Report Send (H←E)

The machine sends a defined, event linked and enabled group of reports to the host on a linked event. This is a message that possibly requires a preceding S6, F5/F6 multi-block enquire/grant transaction.

```
L, 3
       1. <U4 DATAID>
```

```
       2. <U4 CEID>
       3. L, a
              1. L, 2
                     1. <U4 RPTID>
                     2. L, b
                            1. L, 2
                                   1. <A VID>
                                   2. <* V>
                            …
                            1. L, 2
                                   1. <A VID >
                                   2. <* V>
              …
              a. L, 2
                     1. <U4 RPTID >
                            1. L, 2
                                   1. <A VID >
                                   2. <* V>
                            …
                            1. L, 2
                                   1. <A VID >
                                   2. <* V>
```

```
* A, Bi, Bo, F4, F8, L, I1, I2, I4, I8, U1, U2, U4, U8
```

- If there are no reports linked to the event a "null" report is assumed. A zero-length list for # of reports (a = 0) means there are no reports linked to the given CEID.

7.4.10 S6, F14 Annotated Event Report Acknowledge (H→E)

```
<Bi ACKC6>
```

7.4.11 S6, F15 Event Report Request (H→E)

The host requests event report data for a specified CEID.

```
<U4 CEID>
```

7.4.12 S6, F16 Event Report Data (H←E)

Equipment sends reports linked to given CEID to host.

```
L, 3
       1. <U4 DATAID>
       2. <U4 CEID>
       3. L, a
              1. L, 2
                     1. <U4 RPTID>
                     2. L, b
                            1. <* V>
                            …
                            b. <* V>
              …
              a. L, 2
                     1. <U4 RPTID>
                     2. L, c
                            1. <* V>
                            …
                            c. <* V>
```

```
* A, Bi, Bo, F4, F8, L, I1, I2, I4, I8, U1, U2, U4, U8
```

- A zero-length item (a = 0) means there are no reports linked to the given CEID.

7.4.13 S6, F19 Individual Report Request (H→E)

The host requests a defined report from the equipment.

```
<U4 RTPID>
```

7.4.14 S6, F20 Individual Report Data (H←E)

Equipment sends variable data defined for the given RPTID to the host.

```
L, n
       1. <* V>
       …
       n. <* V>

* A, Bi, Bo, F4, F8, L, I1, I2, I4, I8, U1, U2, U4, U8
```

- A zero-length list (n = 0) means RPTID is not defined.

7.4.15 S6, F23 Request Spooled Data (H→E)

Host requests transmission or deletion of messages currently spooled by the equipment.

```
<U1 RSDC>
```

7.4.16 S6, F24 Request Spooled Data Acknowledgement Send (H←E)

```
<Bi RSDA>
```

7.5 Stream 7: Process Program Management

7.5.1 S7, F1 Process Program Load Inquire (H⇔E)

This message is used to initiate the transfer of a process program.

```
L, 2
       1. <A PPID>
       2. <U4 LENGTH>
```

7.5.2 S7, F2 Process Program Load Grant (H⇔E)

```
<Bi PPGNT>
```

7.5.3 S7, F3 Process Program Send (H⇔E)

The purpose of this message is to send the process program.

```
L, 2
       1. <A PPID>
       2. <Bi PPBODY>
```

7.5.4 S7, F4 Process Program Acknowledge (H⇔E)

```
<Bi ACKC7>
```

7.5.5 S7, F5 Process Program Request (H⇔E)

This message is used to request the transfer of a process program.

```
<A PPID>
```

7.5.6 S7, F6 Process Program Data (H⇔E)

This message is used to transfer a process program.

```
L, 2
       1. <A PPID>
       2. <Bi PPBODY>
```

- A zero-length list means request denied.

7.5.7 S7, F17 Delete Process Program Send (H→E)

This message is used by the host to request the deletion of a process program.

```
L, n
       1. <A PPID>
       …
       n. <A PPID>
```

7.5.8 S7, F18 Delete Process Program Acknowledge (H←E)

```
<Bi ACKC7>
```

7.5.9 S7, F19 Current EPPD Request (H→E)

This message is used by the host to request the name of the process program directory (EPPD) in use.

```
Header only
```

7.5.10 S7, F20 Current EPPD Data (H←E)

```
L, n
       1. <A PPID>
       …
       n. <A PPID>
```

7.6 Stream 9: System Errors

7.6.1 S9, F1 Unrecognized Device ID (H←E)

Device ID specified in block header is not defined in the machine.

```
<Bi MHEAD>
```

7.6.2 S9, F3 Unrecognized Stream Type (H←E)

Machine does not recognize the stream type in the message block header.

```
<Bi MHEAD>
```

7.6.3 S9, F5 Unrecognized Function Type (H←E)

Machine does not recognize the function type in the message block header.

```
<Bi MHEAD>
```

7.6.4 S9, F7 Illegal Data (H←E)

This error signifies that the stream and function were correctly interpreted but the associated data was not.

```
<Bi MHEAD>
```

7.6.5 S9, F9 Transaction Timer Timeout (H←E)

This error specifies that a transaction / receive timer has timed out and the transaction aborted. The host system should respond to this message in a suitable manner to keep the system operational.

```
<Bi SHEAD>
```

7.6.6 S9, F11 Data Too Long (H←E)

The machine has been sent more data than it can handle.

```
<Bi MHEAD>
```

7.6.7 S9, F13 Conversation Timeout (H←E)

Machine informs host that data was expected, but none was received within time period given.

```
L, 2
       1. <A MEXP>
       2. <A EDID>
```

7.7 Stream 10: Terminal Services

7.7.1 S10, F1 Terminal Request (H←E)

A terminal text message to the host.

```
L, 2
       1. <Bi TID>
       2. <A TEXT>
```

7.7.2 S10, F2 Terminal Request Acknowledge (H→E)

```
<Bi ACKC10>
```

7.7.3 S10, F3 Terminal Display (Single) (H→E)

The host requests a text message be displayed on the machine.

```
L, 2
       1. <Bi TID>
       2. <A TEXT>
```

7.7.4 S10, F4 Terminal Display (Single) Acknowledge (H←E)

```
<Bi ACKC10>
```

7.7.5 S10, F5 Terminal Display, Multi-Block (H→E)

The host requests a multi-block text message be displayed on the machine.

```
L, 2
       1. <Bi TID>
       2. L, n
              1. <A TEXT>
              …
              n. <A TEXT>
```

7.7.6 S10, F6 Terminal Display, Multi-Block Acknowledge (H←E)

```
<Bi ACKC10>
```

7.7.7 S10, F7 Multi-Block Not Allowed (H←E)

Equipment sends an error message from a terminal that cannot handle a multi-block message from S10, F5

```
<Bi TID >
```

7.8 Stream 127: GPD Custom Functions

7.8.1 S127,F1 Get Equipment SEDD XSD Schema (H→E)

The host requests the current SEDD XSD Schema from the equipment.

```
L, 0
```

7.8.2 S127,F2 Get Equipment SEDD XSD Schema Acknowledge (H←E)

The equipment replies with the SEDD XSD

```
L, 2
   1. <Bi ERRCODE>
   2. L, 4
         a. <A XMLNS>     xmlns=urn:semi-org:xsd.SEDD
         b. <A XMLNS>     xmlns:smn=urn:semi-org:xsd.SMN
         c. <A XMLSYSID>
         d. <A XML>
```

7.8.3 S127,F3 Get Equipment SEDD (H→E)

The host requests the current SEDD from the equipment.

```
L, 0
```

7.8.4 S127,F4 Get Equipment SEDD Acknowledge (H←E)

The equipment generates SEDD from current data set then sends to the host.

```
L, 2
   1. <Bi ERRCODE>
   2. L, 2
         a. <A XMLNS>     xmlns:smn=urn:semi-org:xsd.SMN
         b. <A XML>
```

8 APPENDIX

8.1 Communication Setup

8.1.1 HSMS-SS Configuration

Parameter	Description	Range	Resolution	Typical value
Network hardware				
Device ID	The device-id identifies the equipment and will be assigned by the factory.	0 to 32767	1	0
IP Address	Local network interface			0.0.0.0
TCP Port	The TCP port number.	5000 – 5002		5000
Role	The equipment must be configured to be a PASSIVE or ACTIVE connection. Usually, a PASSIVE connection is preferred for the equipment side.	EQUIPMENT (Passive) OR HOST (Active)		EQUIPMENT
T3	The T3 timeout is the transaction timer. This is the maximum amount of time between a primary message and the expected response before declaring the transaction closed. If the timer expires, an S9F9 error message is sent if AUTOS9F9 is specified.	1 – 120 seconds	1 msec	45 seconds
T5	The T5 timeout is the connect separation timeout. This is the amount of time which must elapse between successive attempts to actively establish a connection.	1 – 240 seconds	1 msec	5 seconds
T6	The T6 timeout is the control transaction timeout. This is the maximum amount of time allowed between an HSMS-level control message and its response. If the timer expires, communications failure is declared.	1 – 240 seconds	1 msec	5 seconds
T7	The T7 timeout is the NOT SELECTED timeout. This is the maximum amount of time a TCP/IP connection can remain in the NOT SELECTED state (no HSMS activity) before a communications failure is declared.	1 – 240 seconds	1 msec	10 seconds
T8	The T8 timeout is the network intercharacter timeout. This is the	1 – 120 seconds	1 msec	5 seconds

	maximum amount of time allowed between successive bytes of a single HSMS message before a communications failure is declared.			
linktest	The linktest timeout is the amount of time between successive transmissions HSMS LINKTEST.REQ messages. This is an HSMS level heartbeat that can be used to detect communications hardware failure such as a disconnected network cable.	1-240 seconds	1 msec	60 seconds
AUTOS9F1	This is an optional setting. Including AUTOS9F1 will cause an S9F1 Invalid Device-ID message to be transmitted whenever a message is received with a device ID that does not match the Device ID of the equipment.			AUTOS9F1

8.1.2 Configuring HSMS Connections

Connection configuration is maintained in the FLOgems Application Settings file (`C:\ProgramData\GPDGlobal\FLOgems\Configuration\AppSettings.ini`).

This file is a 'standard' Win32 style INI file and as such may be edited with any text editor. FLOgems will open the system default text editor on this file when the File>Edit Options menu item is selected.

The AppSettings.ini file is comprised of several sections. The sections related to configuring a specific connection are named GEMS-CONNECTION with the connection number appended.

Connection	**Section Name**	**Notes**
1	GEMS-CONNECTION1	
2	GEMS-CONNECTION2	
3	GEMS-CONNECTION3	

Each section may contain the following keys:

Key	**Default Value**	**Notes**
DeviceID	0	See 8.1.1
TCPPort	5000	
Protocol	HSMS	DO NOT CHANGE
IPAddress	0.0.0.0	Must be a valid network interface. 0.0.0.0 indicates any interface It is recommended that this not be changed.
T3Timeout	45000	

T5Timeout	5000	
T6Timeout	5000	
T7Timeout	10000	
T8Timeout	5000	
Role	EQUIPMENT	DO NOT CHANGE
Linktest	30000	
AUTOS9F1	True	

To change the configuration of one or more connections, edit the AppSettings.ini file and restart the application. Connection configuration is applied only at application launch.

8.1.3 Multiple Host Configuration

This product can support multiple hosts (5) and attention should be taken when configuring the communication setup. Each connection must have a unique TCP/IP port number and has a unique identification number.

8.1.4 Connections

ID	Name	Default TCP/IP Port	Default Device ID
1	GPD FLOware 5000	5000	0
2	GPD FLOware 5001	5001	0
3	GPD FLOware 5002	5002	0
4	GPD FLOware 5003	5003	0
5	GPD FLOware 5004	5004	0

8.1.5 Example AppSettings.ini File

Location: `C:\ProgramData\GPDGlobal\FLOgems\Configuration\AppSettings.ini`

```
==== BEGIN EXAMPLE
      ;;
      ;; GEMS/HSMS Connection Parameters
      ;;

      ;; Connection 1
      [GEMS-CONNECTION1]
      ;; connection device id
      DeviceID=0
      ;; connection TCP/IP port
      TCPPort=5000
      Protocol=HSMS
      IPAddress=0.0.0.0
      T3Timeout=45000
      T5Timeout=5000
      T6Timeout=5000
      T7Timeout=10000
      T8Timeout=5000
      Role=EQUIPMENT
      Linktest=30000
      AUTOS9F1=True

      ;; Connection 2
      [GEMS-CONNECTION2]
      DeviceID=0
      TCPPort=5001
      Protocol=HSMS
      IPAddress=0.0.0.0
      T3Timeout=45000
      T5Timeout=5000
      T6Timeout=5000
      T7Timeout=10000
      T8Timeout=5000
```

```
Role=EQUIPMENT
Linktest=30000
AUTOS9F1=True

;; Connection 3
[GEMS-CONNECTION3]
DeviceID=0
TCPPort=5002
Protocol=HSMS
IPAddress=0.0.0.0
T3Timeout=45000
T5Timeout=5000
T6Timeout=5000
T7Timeout=10000
T8Timeout=5000
Role=EQUIPMENT
Linktest=30000
AUTOS9F1=True

;; Connection 4
[GEMS-CONNECTION4]
DeviceID=0
TCPPort=5003
Protocol=HSMS
IPAddress=0.0.0.0
T3Timeout=45000
T5Timeout=5000
T6Timeout=5000
T7Timeout=10000
T8Timeout=5000
Role=EQUIPMENT
Linktest=30000
AUTOS9F1=True

; Connection 5
[GEMS-CONNECTION5]
DeviceID=0
```

```
      TCPPort=5004
      Protocol=HSMS
      IPAddress=0.0.0.0
      T3Timeout=45000
      T5Timeout=5000
      T6Timeout=5000
      T7Timeout=10000
      T8Timeout=5000
      Role=EQUIPMENT
      Linktest=30000
      AUTOS9F1=True

==== END EXAMPLE
```

8.2 Data Variables

ID	Name	Type	Unit	Min	Max	Description
0	AlarmID	U4		U4 0	U4 4294967295	Alarm ID (ALID) of the most recent alarm to change state. This may be linked to any alarm's SET or CLEAR collection event.
1	EventLimit	L		L	L	List of one or more Limit IDs of limits that have been crossed. This may be linked to any variable's Limit Monitoring collection event.
2	LimitVariable	U4		U4 0	U4 4294967295	VID of variable associated with the last limit. This may be linked to any variable's Limit Monitoring collection event.
3	PPChangeName	A		A	A	Name of the process program (recipe) created edited or deleted by the machine operator.
4	PPChangeStatus	U1		U1 0	U1 255	Type of change made to a process program (recipe) by the machine operator. Possible values include 1 (created) 2 (edited) and 3 (deleted).
5	TransitionType	Bi		Bi 0	Bi 255	Direction of a Limit Monitoring zone transition. This may be linked to any variable's Limit Monitoring collection event. Possible values include 0 (lower to upper) and 1 (upper to lower zone).
6	OperatorCommand	A		A	A	The name of a command issued by the machine operator.
7	ECID	U4		U4 0	U4 4294967295	The ID of the equipment constant changed by the machine operator.
8	HostECHostID	U4		U4 0	U4 4294967295	ID of the host that changed the EC value. This may be linked to CE HostECChange. See also DV HostECID.
9	HostECID	U4		U4 0	U4 4294967295	ECID changed by another host. This may be linked to CE HostECChange. See also DV HostECHostID.
10	HostCmdName	A		A	A	Name of the remote command sent by another host.
11	HostCmdHostID	U4		U4 0	U4 4294967295	ID of the host that sent a remote command.

12	HostPPChangeName	A		A	A	Name of the process program (recipe) changed by another host. This may be linked to collection event HostPPChange. See also DV HostPPChangeStatus and HostPPChangeHostID.
13	HostPPChangeStatus	U1		U1 0	U1 255	Type of change made to a process program (recipe) by another host. Possible values include 1 (created) 2 (edited) and 3 (deleted). This may be linked to collection event HostPPChange. See also DV HostPPChangeName and HostPPChangeHostID.
14	HostPPChangeHostID	U4		U4 0	U4 4294967295	ID of the host that changed a process program (recipe).
1200	CurrentOperatorId	A		A	A	Current Operator Id
1201	CurrentRecipeName	A		A	A	Currently selected process program (recipe).
1202	CurrentProcessState	A		A	A	Current Process State Name
1250	PNCurrent	A		A	A	Current Part Number
1251	PNPrevious	A		A	A	Previous Part Number
1252	PNProgId	A		A	A	Program Id mapped from Part Number
1270	BCRawScan	A		A	A	Raw Barcode scan data
1271	BCValidateStatus	I4		I4 -2147483648	I4 2147483647	Barcode validation status 0=good 1=partnumber not mapped to program 2=malformed data
1272	BCValidateErr	A		A	A	Reason for bar code validation failure
1273	BCCommandLine	A		A	A	Last command issued from barcode scan
2010	PPError	A		A	A	A text data value with information about verification errors of a process program (recipe) that failed verification.
2052	ECChangeName	A		A	A	The name of the equipment constant changed by the machine operator.
2053	ECChangeValue	Any				The value of the equipment constant changed by the machine operator.

2055	CEDescription	A		A	A	Description of the last collection event triggered.
2058	AlarmCode	Bi		Bi 0	Bi 255	Alarm Code (ALCD) of the most recent alarm to change state. This may be linked to any alarm's SET or CLEAR collection event.
2059	AlarmText	A		A	A	Alarm Text (ALTX) of the most recent alarm to change state. This may be linked to any alarm's SET or CLEAR collection event.
2060	ECPreviousValue	Any				The value of the equipment constant before it was changed by the machine operator.
3000	JobId	I4		I4 -2147483648	I4 2147483647	Job ID
3001	JobElapsedTime	F8	s	F8 -1.797e+308	F8 1.797e+308	Job Elapsed Time
3002	JobIdleTime	F8	s	F8 -1.797e+308	F8 1.797e+308	Job Idle Time
3010	JobBoardCount	I4		I4 -2147483648	I4 2147483647	Board Count for Job
3011	JobBadBdsIn	I4		I4 -2147483648	I4 2147483647	Bad Boards In for Job
3012	JobBadBdsOut	I4		I4 -2147483648	I4 2147483647	Bad Boards Out for Job
3013	JobSBoardCount	I4		I4 -2147483648	I4 2147483647	Subboard Count for Job
3014	JobSBadBdsIn	I4		I4 -2147483648	I4 2147483647	Bad Subboard In Count for Job
3015	JobSBadBdsOut	I4		I4 -2147483648	I4 2147483647	Bad Subboard Out Count for Job
3020	JobDotCount1	F8		F8 -1.797e+308	F8 1.797e+308	Head1 Dot Count for Job
3021	JobDotCount2	F8		F8 -1.797e+308	F8 1.797e+308	Head2 Dot Count for Job
3022	JobDotCount3	F8		F8 -1.797e+308	F8 1.797e+308	Head3 Dot Count for Job
3023	JobDotCount4	F8		F8 -1.797e+308	F8 1.797e+308	Head4 Dot Count for Job
3024	JobDotCount5	F8		F8 -1.797e+308	F8 1.797e+308	Head5 Dot Count for Job

3030	JobValveTime1	F8	s	F8 -1.797e+308	F8 1.797e+308	Head1 Valve OnTime for Job
3031	JobValveTime2	F8	s	F8 -1.797e+308	F8 1.797e+308	Head2 Valve OnTime for Job
3032	JobValveTime3	F8	s	F8 -1.797e+308	F8 1.797e+308	Head3 Valve OnTime for Job
3033	JobValveTime4	F8	s	F8 -1.797e+308	F8 1.797e+308	Head4 Valve OnTime for Job
3034	JobValveTime5	F8	s	F8 -1.797e+308	F8 1.797e+308	Head5 Valve OnTime for Job
3040	JobAirPressure1	F8	kpa	F8 -1.797e+308	F8 1.797e+308	Head1 Air Pressure Set Point
3041	JobAirPressure2	F8	kpa	F8 -1.797e+308	F8 1.797e+308	Head2 Air Pressure Set Point
3042	JobAirPressure3	F8	kpa	F8 -1.797e+308	F8 1.797e+308	Head3 Air Pressure Set Point
3043	JobAirPressure4	F8	kpa	F8 -1.797e+308	F8 1.797e+308	Head4 Air Pressure Set Point
3044	JobAirPressure5	F8	kpa	F8 -1.797e+308	F8 1.797e+308	Head5 Air Pressure Set Point
3050	JobLotNo	A		A	A	Job Material Lot Number
3051	JobLotType	A		A	A	Job Material Lot Type
3052	JobLotInfo	A		A	A	Job Material Info
3053	JobMatlID1	A		A	A	Job Material Head1
3054	JobMatlID2	A		A	A	Job Material Head2
3055	JobMatlID3	A		A	A	Job Material Head3
3056	JobMatlID4	A		A	A	Job Material Head4
3057	JobMatlID5	A		A	A	Job Material Head5
3058	JobHead1	A		A	A	Job Pump Head1
3059	JobHead2	A		A	A	Job Pump Head2

3060	JobHead3	A		A	A	Job Pump Head3
3061	JobHead4	A		A	A	Job Pump Head4
3062	JobHead5	A		A	A	Job Pump Head5
4027	LastCEID	U4		U4 0	U4 4294967295	The last triggered CEID.
4029	DataID	U4		U4 0	U4 4294967295	The last value of DATAID used in a SECS-II message.
5000	SurfaceZ	F8	mm	F8 -1.797e+308	F8 1.797e+308	Last Touch Probe Elevation - most recent surface probe (any)
5001	TouchPadZ	F8	mm	F8 -1.797e+308	F8 1.797e+308	Last Touch Pad Elevation - most recent probe of touch pad surface
5002	DotCalZ	F8	mm	F8 -1.797e+308	F8 1.797e+308	Last Dot Calib Area Elevation - most recent probe of dot calibration surface
5003	BoardSurfaceZ	F8	mm	F8 -1.797e+308	F8 1.797e+308	Last Board Surface Elevation - most recent probe of board surface
5004	ActiveHead	U4		U4 0	U4 3	Active Head Index - head to which an operation applies
5005	MaterialId	A		A	A	Material Identifier - material serial number
5006	FiducialAdjustX	F8	mm	F8 -10	F8 10	Last fiducial adjustment in X (vision adjust)
5007	FiducialAdjustY	F8	mm	F8 -10	F8 10	Last fiducial adjustment in Y (vision adjust)
5008	FidPatternExec	A		A	A	Fiducial Pattern executing
5009	DotAdjustX	F8	mm	F8 -1.797e+308	F8 1.797e+308	Last dot adjustment in X (vision adjust)
5010	DotAdjustY	F8	mm	F8 -1.797e+308	F8 1.797e+308	Last dot adjustment in Y (vision adjust)
5011	NeedleAdjustZ	F8	mm	F8 -1.797e+308	F8 1.797e+308	Last Needle Z Measurement
5020	Weight	F8	mg	F8 -1.797e+308	F8 1.797e+308	Last weight value
5021	WeightTarget	F8	mg	F8 -1.797e+308	F8 1.797e+308	Last weight target value
5022	WeightDiff	F8	mg	F8 -1.797e+308	F8 1.797e+308	Last weigh operation different (target-actual)

5023	WeightAdjust	F8	mg	F8 -1.797e+308	F8 1.797e+308	Last weight adjustment
5100	Head1Z	F8	mm	F8 -1.797e+308	F8 1.797e+308	Head1 Needle Elevation
5101	Head1AirPressure	F8	kPa	F8 -1.797e+308	F8 1.797e+308	Head1 Air Pressure
5102	Head1Weight	F8	mg	F8 -1.797e+308	F8 1.797e+308	Head1 Weight Calibration Value
5103	Head1X	F8	mm	F8 -1.797e+308	F8 1.797e+308	Head1 X Adjustment
5104	Head1Y	F8	mm	F8 -1.797e+308	F8 1.797e+308	Head1 Y Adjustment
5200	Head2Z	F8	mm	F8 -1.797e+308	F8 1.797e+308	Head2 Needle Elevation
5201	Head2AirPressure	F8	kPa	F8 -1.797e+308	F8 1.797e+308	Head2 Air Pressure
5202	Head2Weight	F8	mg	F8 -1.797e+308	F8 1.797e+308	Head1 Weight Calibration Value
5203	Head2X	F8	mm	F8 -1.797e+308	F8 1.797e+308	Head2 X Adjustment
5204	Head2Y	F8	mm	F8 -1.797e+308	F8 1.797e+308	Head2 Y Adjustment
5300	Head3Z	F8	mm	F8 -1.797e+308	F8 1.797e+308	Head3 Needle Elevation
5301	Head3AirPressure	F8	kPa	F8 -1.797e+308	F8 1.797e+308	Head3 Air Pressure
5302	Head3Weight	F8	mg	F8 -1.797e+308	F8 1.797e+308	Head1 Weight Calibration Value
5303	Head3X	F8	mm	F8 -1.797e+308	F8 1.797e+308	Head3 X Adjustment
5304	Head3Y	F8	mm	F8 -1.797e+308	F8 1.797e+308	Head3 Y Adjustment
5400	Head4Z	F8	mm	F8 -1.797e+308	F8 1.797e+308	Head4 Needle Elevation
5401	Head4AirPressure	F8	kPa	F8 -1.797e+308	F8 1.797e+308	Head4 Air Pressure
5402	Head4Weight	F8	mg	F8 -1.797e+308	F8 1.797e+308	Head1 Weight Calibration Value
5403	Head4X	F8	mm	F8 -1.797e+308	F8 1.797e+308	Head4 X Adjustment

5404	Head4Y	F8	mm	F8 -1.797e+308	F8 1.797e+308	Head4 Y Adjustment
6000	TweakVarChanged	A		A	A	Most recent Tweak variable changed
6100	TweakHd1OnTime	F8	mm	F8 0	F8 100	OnTime Adjustment Factor - Head1
6101	TweakHd1DispenseHeight	F8	mm	F8 0	F8 100	Dispense Height Adjustment Factor - Head1
6102	TweakHd1ValveOnTime	F8	mm	F8 0	F8 100	Valve On Time Adjustment Factor - Head1
6103	TweakHd1ApproachVelocity	F8	mm	F8 0	F8 100	Approach Velocity Adjustment Factor - Head1
6104	TweakHd1SnapOffZ	F8	mm	F8 0	F8 100	SnapOff Z Adjustment Factor - Head1
6105	TweakHd1SettleZ	F8	mm	F8 -1.797e+308	F8 1.797e+308	Settle Z Adjustment Factor - Head1
6106	TweakHd1StartDelay	F8	mm	F8 0	F8 100	Start Delay Adjustment Factor - Head1
6107	TweakHd1FillSpace	F8	mm	F8 0	F8 100	Fill Space Adjustment Factor - Head1
6108	TweakHd1DispenseVelocity	F8	mm	F8 0	F8 100	Dispense Velocity Adjustment Factor - Head1
6109	TweakHd1ValveOff	F8	mm	F8 0	F8 100	Valve Off Adjustment Factor - Head1
6110	TweakHd1EndZ	F8	mm	F8 0	F8 100	EndZ Adjustment Factor - Head1
6111	TweakHd1MoveVelocity	F8	mm	F8 0	F8 100	Move Velocity Adjustment Factor - Head1
6112	TweakHd1Weight	F8	mm	F8 0	F8 100	Weight Adjustment Factor - Head1
6113	TweakHd1ValveSteps	F8	mm	F8 0	F8 100	Valve Step Adjustment Factor - Head1
6114	TweakHd1ValveReverse	F8	mm	F8 0	F8 100	Valvce Reverse (suckback) Adjustment Factor - Head1
6200	TweakHd2OnTime	F8	mm	F8 0	F8 100	OnTime Adjustment Factor - Head2
6201	TweakHd2DispenseHeight	F8	mm	F8 0	F8 100	Dispense Height Adjustment Factor - Head2
6202	TweakHd2ValveOnTime	F8	mm	F8 0	F8 100	Valve On Time Adjustment Factor - Head2

6203	TweakHd2ApproachVelocity	F8	mm	F8 0	F8 100	Approach Velocity Adjustment Factor - Head2
6204	TweakHd2SnapOffZ	F8	mm	F8 0	F8 100	SnapOff Z Adjustment Factor - Head2
6205	TweakHd2SettleZ	F8	mm	F8 0	F8 100	Settle Z Adjustment Factor - Head2
6206	TweakHd2StartDelay	F8	mm	F8 0	F8 100	Start Delay Adjustment Factor - Head2
6207	TweakHd2FillSpace	F8	mm	F8 0	F8 100	Fill Space Adjustment Factor - Head2
6208	TweakHd2DispenseVelocity	F8	mm	F8 0	F8 100	Dispense Velocity Adjustment Factor - Head2
6209	TweakHd2ValveOff	F8	mm	F8 0	F8 100	Valve Off Adjustment Factor - Head2
6210	TweakHd2EndZ	F8	mm	F8 0	F8 100	EndZ Adjustment Factor - Head2
6211	TweakHd2MoveVelocity	F8	mm	F8 0	F8 100	Move Velocity Adjustment Factor - Head2
6212	TweakHd2Weight	F8	mm	F8 0	F8 100	Weight Adjustment Factor - Head2
6213	TweakHd2ValveSteps	F8	mm	F8 0	F8 100	Valve Step Adjustment Factor - Head2
6214	TweakHd2ValveReverse	F8	mm	F8 0	F8 100	Valvce Reverse (suckback) Adjustment Factor - Head2
6300	TweakHd3OnTime	F8	mm	F8 0	F8 100	OnTime Adjustment Factor - Head3
6301	TweakHd3DispenseHeight	F8	mm	F8 0	F8 100	Dispense Height Adjustment Factor - Head3
6302	TweakHd3ValveOnTime	F8	mm	F8 0	F8 100	Valve On Time Adjustment Factor - Head3
6303	TweakHd3ApproachVelocity	F8	mm	F8 0	F8 100	Approach Velocity Adjustment Factor - Head3
6304	TweakHd3SnapOffZ	F8	mm	F8 0	F8 100	SnapOff Z Adjustment Factor - Head3
6305	TweakHd3SettleZ	F8	mm	F8 0	F8 100	Settle Z Adjustment Factor - Head3
6306	TweakHd3StartDelay	F8	mm	F8 0	F8 100	Start Delay Adjustment Factor - Head3
6307	TweakHd3FillSpace	F8	mm	F8 0	F8 100	Fill Space Adjustment Factor - Head3

6308	TweakHd3DispenseVelocity	F8	mm	F8 0	F8 100	Dispense Velocity Adjustment Factor - Head3
6309	TweakHd3ValveOff	F8	mm	F8 0	F8 100	Valve Off Adjustment Factor - Head3
6310	TweakHd3EndZ	F8	mm	F8 0	F8 100	EndZ Adjustment Factor - Head3
6311	TweakHd3MoveVelocity	F8	mm	F8 0	F8 100	Move Velocity Adjustment Factor - Head3
6312	TweakHd3Weight	F8	mm	F8 0	F8 100	Weight Adjustment Factor - Head3
6313	TweakHd3ValveSteps	F8	mm	F8 0	F8 100	Valve Step Adjustment Factor - Head3
6314	TweakHd3ValveReverse	F8	mm	F8 0	F8 100	Valvce Reverse (suckback) Adjustment Factor - Head3
6400	TweakHd4OnTime	F8	mm	F8 0	F8 100	OnTime Adjustment Factor - Head4
6401	TweakHd4DispenseHeight	F8	mm	F8 0	F8 100	Dispense Height Adjustment Factor - Head4
6402	TweakHd4ValveOnTime	F8	mm	F8 0	F8 100	Valve On Time Adjustment Factor - Head4
6403	TweakHd4ApproachVelocity	F8	mm	F8 0	F8 100	Approach Velocity Adjustment Factor - Head4
6404	TweakHd4SnapOffZ	F8	mm	F8 0	F8 100	SnapOff Z Adjustment Factor - Head4
6405	TweakHd4SettleZ	F8	mm	F8 0	F8 100	Settle Z Adjustment Factor - Head4
6406	TweakHd4StartDelay	F8	mm	F8 0	F8 100	Start Delay Adjustment Factor - Head4
6407	TweakHd4FillSpace	F8	mm	F8 0	F8 100	Fill Space Adjustment Factor - Head4
6408	TweakHd4DispenseVelocity	F8	mm	F8 0	F8 100	Dispense Velocity Adjustment Factor - Head4
6409	TweakHd4ValveOff	F8	mm	F8 0	F8 100	Valve Off Adjustment Factor - Head4
6410	TweakHd4EndZ	F8	mm	F8 0	F8 100	EndZ Adjustment Factor - Head4
6411	TweakHd4MoveVelocity	F8	mm	F8 0	F8 100	Move Velocity Adjustment Factor - Head4
6412	TweakHd4Weight	F8	mm	F8 0	F8 100	Weight Adjustment Factor - Head4

6413	TweakHd4ValveSteps	F8	mm	F8 0	F8 100	Valve Step Adjustment Factor - Head4
6414	TweakHd4ValveReverse	F8	mm	F8 0	F8 100	Valve Reverse (suckback) Adjustment Factor - Head4

8.3 Status Variables

ID	Name	Type	Unit	Min	Max	Description
15	LastPPRequested	A		A	A	Name of the process program (recipe) requested by the equipment.
1100	EquipmentMode	U4		U4 0	U4 4294967295	Current Equipment Mode 0=operator 1=engineer 2=service
1101	EquipmentStatus	U4		U4 0	U4 4294967295	Current Equipment Status 0=disconnected 1=idle 2=processing 3=paused 4=down
1102	EquipmentConnected	U4		U4 0	U4 4294967295	Current Equipment Connection Status 0=disconnected 1=connected
1110	LastPowerOn	A		A	A	Last Power On Date/Time
1111	LastBackup	A		A	A	Last Backup Date/Time
1115	SysPowerOnTime	F8	s	F8 -1.79e+308	F8 1.79e+308	Total System Power On Time
1116	SysPrevMaintTotalTime	F8	s	F8 -1.79e+308	F8 1.79e+308	Preventative Maintenance Total Time
1117	SysTotalProcessTime	F8	s	F8 -1.79e+308	F8 1.79e+308	System Total Process Time
1118	SysTotalIdleTime	F8	s	F8 -1.79e+308	F8 1.79e+308	System Total Process Time
1120	SysTotalJobs	U4		U4 0	U4 4294967295	System Jobs Processed
1121	SysTotalBoards	U4		U4 0	U4 4294967295	System Total Boards Processed
1122	SysTotalBadBoardsIn	U4		U4 0	U4 4294967295	System Total Boards Processed
1123	SysTotalBadBoardsOut	U4		U4 0	U4 4294967295	System Total Boards Processed
1210	AirPressureHead1	F8	PSI	F8 -1.79e+308	F8 1.79e+308	Current Air Pressure - Head 1
1211	AirPressureHead2	F8	PSI	F8 -1.79e+308	F8 1.79e+308	Current Air Pressure - Head 2

1212	AirPressureHead3	F8	PSI	F8 -1.79e+308	F8 1.79e+308	Current Air Pressure - Head 3
1213	AirPressureHead4	F8	PSI	F8 -1.79e+308	F8 1.79e+308	Current Air Pressure - Head 4
2004	Clock	A				The value of the equipment's internal clock plus the offset from the ClockOffset variable. The format is determined by the equipment constant TimeFormat.
2008	MDLN	A		A	A	Equipment model type up to 20 characters. The value is constant.
2009	PPExecName	A		A	A	Currently selected process program (recipe). This process program (recipe) can not be deleted or overwritten by the host since it is considered to be in use.
2015	SOFTREV	A		A	A	Equipment software revision ID up to 20 characters. The value is constant.
2016	SpoolCountActual	U4		U4 0	U4 4294967295	Number of messages actually stored in the spool area. Multi-block inquire/grant messages are not included in this count.
2017	SpoolCountTotal	U4		U4 0	U4 4294967295	Total number of messages put into spool area from the time spooling was activated. Multi-block inquire/grant messages are not included in this count.
2018	SpoolFullTime	A		A	A	Time when the spooling state machine area becomes full. The format is determined by the equipment constant TimeFormat.
2019	SpoolStartTime	A		A	A	Time when the spooling state machine was last activated. The format is determined by the equipment constant TimeFormat.
2026	ALARMSENABLED	L		L	L	List of all enabled ALID.
2027	ALARMSSET	L		L	L	List of all currently SET ALIDs.
2028	CONTROLSTATE	U1		U1 0	U1 5	State of the Control State Machine. Possible values include 1=EquipOffline 2=AttemptOnline 3=HostOffline 4=OnlineLocal and 5=OnlineRemote.
2029	EVENTSENABLED	L		L	L	List of all enabled CEID.
2030	PREVIOUSPROCESSSTATE	U1		U1 0	U1 255	Previous Processing State Machine state.
2031	PROCESSSTATE	U1		U1 0	U1 255	Current Processing State Machine state.

2032	ProcessState	A		A	A	Name of the current Processing State Machine state.
2033	ControlStateSwitch	U4		U4 0	U4 0	The GEM local/remote control switch where 0 = local and 1 = remote.
2034	CtrlOnlineSwitch	U4		U4 0	U4 1	The GEM online/offline control switch where 0 = offline and 1 = online.
2035	CommEnableSwitch	U4		U4 0	U4 4294967295	The GEM communications enable/disable operator switch where 0 = disabled and 256 = enabled.
2036	CommState	U4		U4 0	U4 4294967295	The current state of the GEM communications state machine where 0 = disabled 260 = communicating 273 = WaitCRA | WaitCRFromHost and 274 = WaitDelay | WaitCRFromHost.
2037	SpoolState	U4		U4 0	U4 4294967295	The current state of the GEM spooling state machine where 0 = inactive 273 = NoSpoolOutput | SpoolNotFull 274 = TransmitSpool | SpoolNotFull 276 = PurgeSpool | SpoolNotFull 289 = NoSpoolOutput | SpoolFull 290 = TransmitSpool | SpoolFull 292 = PurgeSpool | SpoolFull.
2050	ASer	U4		U4 0	U4 4294967295	The alarm state change count since startup.
2051	Time	A				Equipment computer date and time. The format is determined by the equipment constant TimeFormat.
2054	AlarmState	U1		U1 0	U1 255	State of the alarm that last changed state since startup(128=SET 0=CLEAR null=no alarm state change).
2056	PPFormat	U1		U1 1	U1 16	Indicates the type or types of process programs and recipes that are supported
4030	PreviousControlState	U1		U1 0	U1 255	The previous state of the Control State Machine. Values include 1=EquipOffline 2=AttemptOnline 3=HostOffline 4=OnlineLocal and 5=OnlineRemote.

8.4 Equipment Constants

ID	Name	Type	Unit	Min	Max	Default	Description
4000	EstablishCommunications Timeout	U2		U2 0	U2 65535	U2 10	Communication attempt timeout. When the Communication State Machine is enabled but not communicating the machine will attempt to establish communication with a host every timeout period.
4005	MaxSpoolTransmit	U4		U4 0	U4 4294967295	U4 250	Maximum number of messages that the machine will transmit from the spool area in response to an S6F23 (transmit spooled messages) request as part of the Spooling State Machine. If 0 there is no limit. Multi-block inquire/grant messages are not included in this count.
4009	OverwriteSpool	Bo		Bo 0	Bo 1	Bo 0	Determines whether to overwrite data in the spool area or to discard further messages when the spool area is full as part of the Spooling State Machine. Possible values include 1 (overwrite) and 0 (discard).
4010	SpoolEnabled	Bo		Bo 0	Bo 1	Bo 1	Enable or disable the Spooling State Machine. Disabling the Spooling State Machine will not make it INACTIVE if already ACTIVE. Possible values include 1 (enabled) and 0 (disabled).
4011	WBitS10	Bo		Bo 0	Bo 1	Bo 1	Request host reply for stream 10 messages (Terminal Services). Possible values include 1 (reply) 0 (no reply).
4012	WBitS5	Bo		Bo 0	Bo 1	Bo 1	Request host reply for stream 5 messages (Alarms). Possible values include 1 (reply) 0 (no reply).
4013	WBitS6	Bo		Bo 0	Bo 1	Bo 1	Request host reply for stream 6 messages (Events). If the machine is producing frequent collection events it may be a good idea to disable request reply. Possible values include 1 (reply) 0 (no reply).
4020	TimeFormat	U4		U4 0	U4 2	U4 1	Time format selection. Possible values include 1 (compliant 16 byte); 0 (not compliant 12 byte) and 2 (Extended YYYY-MM-DDThh:mm:ss.sTZD). Depends on ExtendedTimeFormat when set to 2.

4021	DefCtrlOfflineState	U1		U1 1	U1 3	U1 3	State of the Control State Machine when going offline. Possible values include 1 = Equipment Offline 3 = Host Offline.
4022	EventReportMsg	U4		U4 0	U4 4294967295	U4 67083	Specifies the event report message. Possible values include 67083 (S6F11) 67075 (S6F3) 67085 (S6F13).
4023	DefaultCommState	U4		U4 0	U4 256	U4 256	The default state of the GEM communications state machine where 0 = disabled and 256 = enabled.
4024	DefaultCtrlState	U1		U1 0	U1 3	U1 0	The default state of the GEM control state machine: 0=Online where ControlStateSwitch determines the sub-state; 1=EquipOffline; 2=AttemptOnline; 3=HostOffline; 4=OnlineLocal; 5=OnlineRemote.
4025	HeartBeat	U2	s	U2 0	U2 65535	U2 0	The frequency (in seconds) at which S1F1 messages are sent to the host (0 turns it off).
4031	S6MultiBlockInquire	Bo		Bo 0	Bo 1	Bo 0	Enable or disable the usage of S6F5 multi-block inquire (MBI) messages. 1=send MBI 0=don't send MBI.
4032	SpoolingWaitDelayActivation	U1		U1 0	U1 2	U1 0	0=Spooling is not activated when the WAIT CRA to WAIT DELAY communication state machine transition occurs; 1=Spooling is activated anytime the WAIT CRA to WAIT DELAY communication state machine transition occurs and spooling is enabled (this establishes strict compliance with E30); 2=Spooling is activated after the second WAIT CRA to WAIT DELAY communication state machine trasition (this allows the host time to establish communication without aggressively activating spooling).
4036	ExtendedTimeFormat	U1		U1 0	U1 1	U1 0	The format applied to report time values when TimeFormat EC is 2. 0=UTC (default setting; PV2 compliant); 1=local time with time zone offset.
10000	EquipmentSerialNumber	A		A	A	A UNKNOWN	Equipment Manufacturer’s Serial Number
10001	EquipmentSoftwareId	A		A	A	A 2227093-0001	Equipment Software Id

10002	EquipmentSoftwareVersion	A		A	A	A UNKNOWN	Equipment Software Version
10003	EquipmentManufacturer	A		A	A	A UNKNOWN	Equipment Manufacturer
10004	EquipmentRemoteEndPt	A		A	A	A UNKNOWN	Equipment Communications Remote Network End Point IPAddress:Port *see SV EquipmentConnected*
10005	EquipmentLocalEndPt	A		A	A	A UNKNOWN	Equipment Communications Local Network End Point IPAddress:Port *see SV EquipmentConnected*
301005	VariableReportingStyle	U4		U4 0	U4 4294967295	U4 0	S1F3 and S2F23 VID tolerance where 0 = Strict compliance with SEMI standards where only SVID are allowed; 1 = Allow any variable type (SV; DV; or EC) to be reported.
301008	TraceReportMultiBlock	U4		U4 0	U4 4294967295	U4 1	Allow Trace Reports with total data size that is larger than 244 bytes (0 = do not allow large reports. 1[default] = allow large trace reports). It is recommended to leave this at U4 1. Set to 0 to help avoid unintentional performance degradation from trace reports larger than 244 bytes.
301010	SpoolingActivatedEventOption1	U1		U1 0	U1 255	U1 1	Options for sending SpoolingActivated GEM Collection Event (0=trigger event when the Spooling state changes to ACTIVE; 1=trigger event before any queued messages have been spooled).
301013	SupportPV2	U1		U1 0	U1 255	U1 0	0 = default behavior - GEM functionality; 1 = enable PV2 behavior. Causes CIMConnect not to send Event reports for Set/Clear Alarm events if the Alarm is not enabled.
301017	S2F35DisablesEvents	U1		U1 0	U1 255	U1 1	When this variable exists and is set to non-zero value the equipment will automatically disable the collection event whenever a link to a report is created by S2F35 message from GEM Host or deleted by S2F35 or S2F33 message. A zero value is not GEM compliant.

8.5 Alarms

ID	Name	Set CE	Clear CE	Text
0	U00	110	111	U00:Default User Message 0
1	U01	110	111	U01:Default User Message 1
2	U02	110	111	U02:Default User Message 2
3	U03	110	111	U03:Default User Message 3
4	U04	110	111	U04:Default User Message 4
5	U05	110	111	U05:Default User Message 5
6	U06	110	111	U06:Default User Message 6
7	U07	110	111	U07:Default User Message 7
8	U08	110	111	U08:Default User Message 8
9	U09	110	111	U09:Default User Message 9
10	T00	110	111	T00:Debug Message
11	S19	110	111	S19:Message Conflict -- Notify GPD Global
12	S20	110	111	S20:Illegal Resource ID
13	C01	110	111	C01:Mount Board Click CONTINUE When Done
14	C02	110	111	C02:Purging... Click DONE to Stop
15	C03	110	111	C03:Attach Ground Clip to Needle Click CONTINUE When Done

16	C04	110	111	C04:Remove Ground Clip from Needle Click CONTINUE When Done
17	C05	110	111	C05:Clean the Needle Click CONTINUE to Proceed
18	C06	110	111	C06:Lock Drill Probe Up Attach Ground Clip to Drill Click CONTINUE When Done
19	C07	110	111	C07:Release Probe Lock Remove Ground Clip from Drill Click CONTINUE When Done
20	C08	110	111	C08:Place a Clean Chip in the Drill Pad
21	C09	110	111	C09:No Head Mounts for This Program
22	C10	110	111	C10:Cannot Find Selected Program
23	C11	110	111	C11:Cannot Calibrate Vision System
24	C12	110	111	C12:Cannot Read Fiducial Pattern
25	C13	110	111	C13:Excessive Adjustment Accept Current Position or Adjust Manually
26	C14	110	111	C14:Adjusting Lens
27	C15	110	111	C15:Cannot Load Required Shape
28	C16	110	111	C16:* Remove Board From Exit
29	C17	110	111	C17:Bad Mark Test
30	C18	110	111	C18:Head is Unknown
31	C19	110	111	C19:Cannot Reference Scale
32	C20	110	111	C20:Scale Underflow
33	C21	110	111	C21:Scale Overflow
34	C22	110	111	C22:Weight Out of Range

35	C23	110	111	C23:C23 TEST MESSAGE
36	C24	110	111	C24:Probe Limit Failure
37	C25	110	111	C25:Adjust Micrometer and Needle Height
38	C26	110	111	C26:Cannot Communicate with Two Part Valve
39	C27	110	111	C27:Prepare to Fill Syringe
42	C30	110	111	C30:Remove Filled Syringe
43	C31	110	111	C31:Filling Syringe... Click CONTINUE to Stop
44	C32	110	111	C32:Valve On Times are too large to dispense properly
48	R01	110	111	R01:Fluid Level is Low, Head
49	R02	110	111	R02:TEST TIMEOUT Ignore Test, Retry, or Abort
50	R03	110	111	R03:Shapes are nested too deeply
51	R04	110	111	R04:Run Paused Before Board
52	R05	110	111	R05:Run Paused After
53	R06	110	111	R06:Error reading Board Items
54	R07	110	111	R07:Board is Missing
55	R08	110	111	R08:Remove ALL Boards from Conveyor Clear Standoffs from Lifter Plate
56	R09	110	111	R09:Adjust Conveyor Width Manually
57	R10	110	111	R10:Conveyor Adjustment is Hung
58	R11	110	111	R11:Adjust Lifter Pins

59	R12	110	111	R12:Lifter is Hung
60	R13	110	111	R13:Transfer Timeout
61	R14	110	111	R14:Center Stand-Off in Camera
62	R15	110	111	R15:Missing Fixed Location
63	R16	110	111	R16:Mount Required Pallets
64	R17	110	111	R17:Pallet Feeder Is Hung
65	R18	110	111	R18:Mount New Pallet on
66	R19	110	111	R19:Dot Count Exceeded Head
67	R20	110	111	R20:Total On Time Exceeded Head
68	R21	110	111	R21:Operation Time Exceeded Head
69	R22	110	111	R22:Lens Timeout
70	R23	110	111	R23:Clear Standoffs from Lifter Plate
71	R24	110	111	R24:Bad Head Location
72	R25	110	111	R25:Refresh Head
73	R26	110	111	R26:Failure to Pickup Head
74	C43	110	111	C43:Needle Cleaners are set up incorrectly
75	R28	110	111	R28:Program Pause
76	R29	110	111	R29:Vision Error
77	R30	110	111	R30:Lifter Down Error

78	J00	110	111	J00:Use the pointer to jog around...
79	J01	110	111	J01:Move to Fiducial Click Close when there...
80	J02	110	111	J02:Move to Calibration Dot Click Close when there...
81	J03	110	111	J03:Move to this Board's REFERENCE POINT then Click Close...
82	J04	110	111	J04:Move to This Shape's REFERENCE POINT then Click Close...
83	J05	110	111	J05:Move to the Fiducial Then Click Close...
84	J06	110	111	J06:Move to the Operation Point Then click Close...
85	H00	110	111	H00:Axis Not Homed
86	H01	110	111	H01:Locating Home Sensor
87	H02	110	111	H02:Searching for Encoder Index
88	H03	110	111	H03:Axis Homed
89	H04	110	111	H04:Moving to World Origin
90	H05	110	111	H05:Homing Sequence Failed
91	H06	110	111	H06:Homing Completed
92	S00	110	111	S00:Do you Really Want to Reboot?
93	S01	110	111	S01:Do you Really Want to Shut Down?
94	S02	110	111	S02:Illegal Password Entered
95	S03	110	111	S03:Enter a Password
96	S04	110	111	S04:Illegal Access Attempted All Access Changes are Logged

97	R31	110	111	R31:Wait for Valve Loading
98	S05	110	111	S05:A problem was detected while homing the gantry
99	S06	110	111	S06:Message Tables are Corrupt
100	S07	110	111	S07:Ready to home servos Click OK to proceed.
101	S08	110	111	S08:System Stopped. Turn it off now.
102	S09	110	111	S09:A problem is detected within the servo system.
103	S10	110	111	S10:Unable to locate/open the database
104	S11	110	111	S11:Unable to open COMMON
105	S12	110	111	S12:Unable to attach name
106	S13	110	111	S13:Air Pressure Lost. Click OK to Clear.
107	S14	110	111	S14:Safety Violation. Click OK to Clear.
108	S15	110	111	S15:Live Camera
109	S16	110	111	S16:Unable to start the Flasher
110	R32	110	111	R32:Tilt Unit has Malfunctioned.
111	S17	110	111	S17:Cannot open Display.
112	R33	110	111	R33:Wait for Heaters to Reach Proper Temperature.
113	S18	110	111	S18:Wait . . .
114	T06	110	111	T06:Timed Message test
115	R35	110	111	R35:Prepare and Mount Items Specified.

116	S30	110	111	S30:Cannot Read Universal Options
117	S31	110	111	S31:Cannot Read General Defaults
118	S21	110	111	S21:Cannot Read Special Locations
119	S22	110	111	S22:The vision processor is unavailable
120	S23	110	111	S23:Cannot Open Conveyor Control
123	S26	110	111	S26:Log Open Failure
124	S27	110	111	S27:Pipe Open Failure
125	C35	110	111	C35:Purging... Click DONE to Stop
126	C36	110	111	C36:Replace or Clean the Needle Cleaner Pad or Brushes
127	C37	110	111	C37:Vacuum Hold-down has failed
128	S28	110	111	S28:I/O System Open Failure
129	S29	110	111	S29:Create Server Failure
130	C38	110	111	C38:Touch Probe Failure
131	C39	110	111	C39:Adjust Micrometer to Avoid Needle Damage
132	C40	110	111	C40:Scale Adjustment Out of Spec Weight Retries Exhausted
133	C41	110	111	C41:Wait for the scale to settle
134	E01	110	111	E01:New Name for the Program
135	E02	110	111	E02:Name for the new Board
136	E03	110	111	E03:Name for the new Program

137	E04	110	111	E04:Name for the new Shape
138	E05	110	111	E05:Name for the new Copy
139	E06	110	111	E06:New Name for the Shape
140	E07	110	111	E07:Unable to use this name The name may exist already
141	E08	110	111	E08:Unable to create this item
142	T04	110	111	T04:Table Test
143	M03	110	111	M03:Select a Program from this List
144	M01	110	111	M01:Automatic Mode Calibration is Incomplete. Turn Auto Mode ON to reCalibrate.
145	M02	110	111	M02:No Processing Information is Available
146	E09	110	111	E09:List Select Error
147	T05	110	111	T05:Table TEST
148	S33	110	111	S33:Select any number of Classes
149	R36	110	111	R36:Cannot Open AUTOrun File
150	R37	110	111	R37:AUTOrun File is Corrupt
151	R38	110	111	R38:Illegal AUTOrun Program
152	R39	110	111	R39:Illegal AUTOrun Calibration
153	R40	110	111	R40:Cannot find specified program
154	C42	110	111	C42:Calibration is not valid
155	E10	110	111	E10:Improper Selection Re-select or turn AutoMode off

156	M05	110	111	M05:Illegal AUTOrun Calibration
157	M06	110	111	M06:Cannot Open AUTOrun File
158	M07	110	111	M07:Specified program does not exist
159	M08	110	111	M08:Waiting for Board
160	M09	110	111	M09:Waiting for Instructions
161	E11	110	111	E11:Conveyor MUST be active for Auto Mode
162	R41	110	111	R41:Prepare Valves/Materials
163	E12	110	111	E12:Illegal Password Entered (Passwords must be unique)
164	E13	110	111	E13:Program data has changed Save changes?
165	S34	110	111	S34:A Data Base error has occurred
166	E14	110	111	E14:Confirm deletion of Password
167	E15	110	111	E15:Confirm deletion of Tool/Valve
168	E16	110	111	E16:Confirm deletion of Material
169	E17	110	111	E17:Confirm deletion of Pattern
170	C01_170	110	111	C01_170:Mount Board Click CONTINUE When Done
171	E19	110	111	E19:Enter the name of the new pattern
172	E20	110	111	E20:Patterns in use by a program cannot be deleted
173	E21	110	111	E21:Pattern already exists
174	E22	110	111	E22:Select a Valve or Tool

175	E22_175	110	111	E22_175:Select a Valve or Tool
176	E23	110	111	E23:Optimizing in Progress . . .
177	E24	110	111	E24:Confirm deletion of Detail Line
178	E25	110	111	E25:Confirm deletion of Program
179	E26	110	111	E26:Select a Material
180	E26_180	110	111	E26_180:Select a Material
181	E27	110	111	E27:Confirm deletion of Material
182	E28	110	111	E28:Select a Needle
183	T03	110	111	T03:Test Animated Display
184	E29	110	111	E29:Item already exists Confirm UPDATE of
185	E30	110	111	E30:Select a Pattern
186	E30_186	110	111	E30_186:Select a Pattern
187	E31	110	111	E31:Wait for Pattern Loading
188	M10	110	111	M10:Select a Material
189	M11	110	111	M11:Select a Valve or Tool
190	T01	110	111	T01:Test for FILE selection
191	M12	110	111	M12:Warning
192	S35	110	111	S35:Shutdown in process
193	S36	110	111	S36:Line Power is Lost -- Starting Shutdown

194	E32	110	111	E32:Blank Name is not allowed
195	E33	110	111	E33:Is this a New item?
196	E34	110	111	E34:Pattern is illegal
197	M13	110	111	M13:Select a backup to be deleted
198	M14	110	111	M14:Select a file to edit
199	J07	110	111	J07:Adjust Vision Parameters Then Click Close...
200	E35	110	111	E35:Tools/Valves in use by a program cannot be deleted
201	E36	110	111	E36:Unused
202	S37	110	111	S37:Jog Conflict -- Only one jog screen allowed
203	S15_203	110	111	S15_203:Live Camera
204	M15	110	111	M15:Wait for Valve to Home.
205	S38	110	111	S38:Vision System Busy -- Unable to perform operation
206	E37	110	111	E37:Unable to Convert
207	E38	110	111	E38:Wait for Pattern Training
208	E28_208	110	111	E28_208:Select a Needle
209	E18	110	111	E18:Confirm deletion of Needle
210	E39	110	111	E39:Needle in use by a program cannot be deleted
211	C44	110	111	C44:Unable to reset scale
212	E40	110	111	E40:Select a Part Number

213	E40_213	110	111	E40_213:Select a Part Number
214	E41	110	111	E41:Confirm deletion of Part Number
215	E42	110	111	E42:Part Number in use by a program cannot be deleted
216	C45	110	111	C45:Scale has not stabilized
217	E43	110	111	E43:Select a Shape
218	E44	110	111	E44:Select an Operation
219	E45	110	111	E45:Cannot add this Item
220	J08	110	111	J08:Move to the Point desired Then Click Close
221	E46	110	111	E46:Select a new Operation
222	E47	110	111	E47:Select a new Operation SubType
223	E48	110	111	E48:Select a new Head
224	E49	110	111	E49:The vision processor is unavailable
225	E50	110	111	E50:Clipboard cannot be used
226	M16	110	111	M16:BACKUP FAILED Reboot Required
227	M17	110	111	M17:Select a PID
228	R42	110	111	R42:Wait for Pattern Searching
229	E52	110	111	E52:Enter a Feature ID
230	E53	110	111	E53:No Match Found
231	R43	110	111	R43:Program tweaks data has changed Save changes?

232	R27	110	111	R27:Pause for badmark
233	E54	110	111	E54:Values have changed Do you want to save?
234	E55	110	111	E55:Confirm deletion of this item
235	E56	110	111	E56:Items in use cannot be deleted
236	S39	110	111	S39:Live Camera
237	E57	110	111	E57:Delete Patterns
238	E58	110	111	E58:Delete Materials
239	E59	110	111	E59:Materials in use by a program cannot be deleted
240	E60	110	111	E60:Delete Tools/Valves
241	E61	110	111	E61:Delete Needles
242	E62	110	111	E62:Delete Part Numbers
243	J09	110	111	J09:Move to the Coordinate Point Then click a button
244	E63	110	111	E63:Move to Coords
245	P03	110	111	P03:Waiting for Post Press Heater to Reach Temperature.
246	P00	110	111	P00:Press Results
247	P01	110	111	P01:Post Press Vacuum Hold-down has failed
248	P02	110	111	P02:Post Press Lifter is Hung
249	J10	110	111	J10:View Dot Calibration Position or Adjust Manually
250	E65	110	111	E65:Select an Operation for the subtype

251	E64	110	111	E64:Select a SubType
252	E66	110	111	E66:Confirm deletion of SubType
253	E67	110	111	E67:Select a Fixed Location
254	E67_254	110	111	E67_254:Select a Fixed Location
255	E68	110	111	E68:Confirm deletion of Fixed Location
256	E69	110	111	E69:Delete Fixed Locations
257	J11	110	111	J11:Jog the camera to the initial point
258	J12	110	111	J12:Jog the camera to the farthest X point
259	J13	110	111	J13:Jog the camera to the X point next to the initial point
260	J14	110	111	J14:Jog the camera to the Y point next to the initial point
261	J15	110	111	J15:Jog the Z axis to the desired location
262	C46	110	111	C46:Clean Probe and Touchpad Click CONTINUE to Proceed
263	R45	110	111	R45:Wait for MV Valve to Reach Idle Pressure
264	R46	110	111	R46:Parts Pallet is not Ready
265	R44	110	111	R44:Loading Program
266	M18	110	111	M18:Select an export file name
267	M19	110	111	M19:Select a format file name
268	M20	110	111	M20:Select any number of Program Names
269	M21	110	111	M21:Select any number of Vision Pattern Names

270	M22	110	111	M22:Select any number of Valve or Tool Names
271	M23	110	111	M23:Select any number of Needle Names
272	M24	110	111	M24:Select any number of Material Names
273	M25	110	111	M25:Select any number of Part Numbers
274	M26	110	111	M26:Select any number of Shape Names
275	M27	110	111	M27:Select any number of Names to delete
276	M28	110	111	M28:Wait for Export
277	M29	110	111	M29:Output from EXPORT
278	R47	110	111	R47:Program Paused by Operator
279	M30	110	111	M30:Select an import file name
280	M31	110	111	M31:Wait for Import
281	T08	110	111	T08:Edit test
282	R34	110	111	R34:Select Features to be Processed.
283	S40	110	111	S40:Run is Inhibited . . .
284	R48	110	111	R48:Probe Elevations
285	M33	110	111	M33:Wait for Import
286	M34	110	111	M34:Output from IMPORT
287	C47	110	111	C47:Weight Retries Exhausted
288	R48_288	110	111	R48_288:Probe Elevations

289	C48	110	111	C48:Prepare Tilt Fixture for Calibration
290	C49	110	111	C49:You MUST calibrate to continue
291	C50	110	111	C50:The Tilt Fixture is NOT operating
292	R49	110	111	R49:The Tilt Fixture is NOT operating
293	R50	110	111	R50:Scale Cup Needs Cleaning
294	C51	110	111	C51:Move to desired Y coordinate
295	C52	110	111	C52:Move to desired Z location
296	R51	110	111	R51:Dot size is out of range
297	R52	110	111	R52:ERROR -- Cannot Find Calibration Dot
298	R53	110	111	R53:ERROR -- Cannot Find Dot
299	M36	110	111	M36:Select a Data Type to convert
300	M37	110	111	M37:Select a source file name
301	M38	110	111	M38:Select a feeder file name
302	M39	110	111	M39:Wait for Convert
303	M40	110	111	M40:Conversion Failed
304	C53	110	111	C53:Wait for Scale Calibration
305	J16	110	111	J16:Move to the Bad Mark Then Click Close...
306	R54	110	111	R54:Fixed Location Pattern Not Found
307	E70	110	111	E70:Error in Fiducial or Bad Mark

308	R55	110	111	R55:Part Not Present
309	T07	110	111	T07:DEBUG Live Camera
310	R56	110	111	R56:Too Many Pallet Retries
311	S41	110	111	S41:You must reboot to apply changes to video parameters
312	R57	110	111	R57:Wait for board flip
313	R58	110	111	R58:Turn the board over
314	C54	110	111	C54:Remove board
315	C55	110	111	C55:Click OK to continue
316	R59	110	111	R59:Warning!! Material is about to expire
317	R60	110	111	R60:Material has expired. Replace and reset the timer.
318	M41	110	111	M41:NOTIFICATION!! Time to back up the dispenser!
319	R62	110	111	R62:Defined Material Timers are not started.
320	M42	110	111	M42:Are you sure you want to restart this timer?
321	M43	110	111	M43:Material has expired.
322	E71	110	111	E71:Warning time is greater than expiration time.
323	M44	110	111	M44:Material has been saved. Do you want to use the saved material?
324	R62_324	110	111	R62_324:Power Supply is NOT responding
325	R63	110	111	R63:Waiting for Ink Ready
326	R64	110	111	R64:Remove platen from the dispenser

327	R65	110	111	R65:Cleaning Valves
328	R66	110	111	R66:Air Drying
329	R67	110	111	R67:Waiting for Valve Fill
330	R68	110	111	R68:Enter Run Count
331	R69	110	111	R69:Ink Failure
332	R70	110	111	R70:Operation is Ended.
333	M45	110	111	M45:USB features are not available.
334	M46	110	111	M46:Mount USB Device
335	M47	110	111	M47:DO NOT REMOVE USB DEVICE UNTIL REQUESTED!
336	M48	110	111	M48:Remove the USB device now
337	R71	110	111	R71:Calculated dot diameter
338	C22_338	110	111	C22_338:Shape Weight Out of Tolerance
339	C22_339	110	111	C22_339:Shape Weight Out of Tolerance
340	C60	110	111	C60:Z Elevation Out of Tolerance
341	C61	110	111	C61:Dot Sizing Retries Exhausted
342	C62	110	111	C62:Probed Z Out of Tolerance
343	C63	110	111	C63:Z Sensor Is Stuck
344	C64	110	111	C64:Probed Z Out of Tolerance
345	C65	110	111	C65:Z Sensor Is Stuck

1000	SafetyViolation	110	111	Shield is Open
1001	AirPressureInsufficient	110	111	System Air Pressure Low

8.6 Collection Events

ID	Name	Description	Associated DVs
0	ControlStateLocal	Control State Machine switched to local (operator) control.	
1	ControlStateRemote	Control State Machine switched to remote (host) control.	
2	EquipmentOffline	Control State Machine switched to the offline state.	
5	MessageRecognition	Machine operator recognized a terminal service message from the host. Triggered when the client application calls RecognizeTerminalMsg().	
6	OperatorCommandIssued	Machine operator issued a control command.	OperatorCommand(6)
7	PPChange	A process program (recipe) has been created changed or deleted.	PPChangeName(3), PPChangeStatus(4)
8	PPSelected	A new process program (recipe) has been accepted. Either the host or machine operator has	

		selected the recipe.	
9	ProcessingCompleted	Normal exit of the EXECUTING state as part of the Processing State Machine.	
10	ProcessingStarted	Normal entry of the EXECUTING state as part of the Processing State Machine.	
11	ProcessingStateChange	The state of the Processing State Machine has changed.	
12	ProcessingStopped	A previously requested STOP command has been performed.	
13	SpoolTransmitFailure	A communication failure has occurred while in the TRANSMIT SPOOL state.	
14	SpoolingActivated	Spooling State Machine has entered the SPOOL ACTIVE state.	
15	SpoolingDeactivated	Spooling State Machine has entered the SPOOL INACTIVE state.	
16	ECChange	An equipment constant value was changed locally by the operator.	ECID(7), ECChangeName(2052), ECChangeValue(2053), ECPreviousValue(2060)

17	TraceTimestampOutOfTolerance	Trace time tolerance set by TraceTimestampTolerance is exceeded	
18	HostCommandAccepted	Another host remote command was performed.	HostCmdName(10), HostCmdHostID(11)
19	HostECChange	Another host changed an equipment constant(EC) value.	HostECID(9), HostECHostID(8)
20	HostPPChange	Another host created deleted or overwrote a Process Program.	HostPPChangeName(12), HostPPChangeStatus(13), HostPPChangeHostID(14)
21	PPVerificationFailed	Process program (recipe) verification failed.	
100	InitializationStarted	Processor Initialization Started	
101	InitializationCompleted	Processor Initialization Completed	
102	SetupStarted	Load Pumps/Material has started	
103	SetupCompleted	Load Pumps/Material completed	
104	ProcessStarted	Processing Has Started	
105	ProcessCompleted	Processing Has Completed	

107	Paused	System Held	
108	Resumed	System un-held	
109	Aborted	Reset	
110	AlarmPaused	Equipment is down	
111	AlarmCleared	Equipement is up	
200	ProcessStateInit	Process State Init	
201	ProcessStateIdle	Process State Idle	
202	ProcessStateSetup	Process State Setup	
203	ProcessStateExecuting	Process State Executing	
204	ProcessStatePause	Process State Pause	
1000	SurfaceDetectStarted	A surface detect operation has begun	
1001	SurfaceDetectCompleted	A surface detect operation has completed	SurfaceZ(5000)
1002	TouchPadZDetectStarted	A needle Z detection has begun	
1003	TouchPadZDetectCompleted	A needle Z detection has completed	TouchPadZ(5001)
1004	NeedleZDetectStarted	A needle Z detection has begun	

1005	NeedleZDetectCompleted	A needle Z detection has completed	ActiveHead(5004), NeedleAdjustZ(5011)
1006	DotZCalibDetectStarted	A needle Z detection has begun	
1007	DotZCalibDetectCompleted	A needle Z detection has completed	DotCalZ(5002)
1008	WeightCalibrationStarted	A material calibration by weight has begun	
1009	WeightCalibrationCompleted	A material calibration by weight has completed	ActiveHead(5004), Weight(5020), WeightTarget(5021), WeightDiff(5022), WeightAdjust(5023)
1010	XYCalibrationStarted	An X/Y position calibration has started	
1011	XYCalibrationCompleted	An X/Y position calibration has completed	ActiveHead(5004), DotAdjustX(5009), DotAdjustY(5010)
1012	FiducialLocateStarted	An X/Y position calibration has started	
1013	FiducialLocateCompleted	An X/Y position calibration has completed	FidPatternExec(5008), FiducialAdjustX(5006), FiducialAdjustY(5007)
1014	DotLocateStarted	Dot X/Y position calibration has started	
1015	DotLocateCompleted	Dot X/Y position calibration has completed	
1016	BoardZDetectStarted	Board Z Surface Detect has started	

1017	BoardZDetectCompleted	Board Z Surface Detect has completed	BoardSurfaceZ(5003)
1018	HeadCalibrationStarted	Head Calibration has started	
1019	HeadCalibrationCompleted	Head Calibration has completed	ActiveHead(5004), DotAdjustX(5009), DotAdjustY(5010), NeedleAdjustZ(5011), Weight(5020)
1020	CameraCalibStarted	Camera Calibration has started	
1021	CameraCalibCompleted	Camera Calibration has completed	
1030	MaterialReceived	Material arrived to a port on the equipment.	
1031	MaterialRemoved	Material departed from a port on the equipment.	
1032	MaterialRequested	Material requested.	
1033	MaterialReadyToRemove	Material is ready for removal.	
1034	MaterialReleased	Material released. Transfer underway.	
1050	OperatorChanged	Current operator ID changed	
1060	PNCurrentChanged	Current Part Number changed	PNCurrent(1250), PNPrevious(1251)

1070	BCScanned	Barcode scanned	
1071	BCValidateSucceeded	Barcode validation succeeded	BCValidateErr(1272)
1072	BCValidateFailed	Barcode validation failed	BCValidateErr(1272)
1073	BCCommandExecuted	BC	BCCommandLine(1273)
1080	TweakValueChanged	Tweak Values Are Changed	TweakVarChanged(6000)
1090	JobAccountingStarted	Job Accounting Started	
1091	JobAccountingUpdated	Job Accounting Values Are Updated	JobId(3000), JobElapsedTime(3001), JobIdleTime(3002), JobBoardCount(3010), JobBadBdsIn(3011), JobBadBdsOut(3012), JobSBoardCount(3013), JobSBadBdsIn(3014), JobSBadBdsOut(3015), JobDotCount1(3020), JobDotCount2(3021), JobDotCount3(3022), JobDotCount4(3023), JobDotCount5(3024), JobValveTime1(3030), JobValveTime2(3031), JobValveTime3(3032), JobValveTime4(3033), JobValveTime5(3034), JobAirPressure1(3040), JobAirPressure2(3041), JobAirPressure3(3042), JobAirPressure4(3043), JobAirPressure5(3044), JobLotNo(3050), JobLotType(3051), JobLotInfo(3052), JobMatlID1(3053), JobMatlID2(3054), JobMatlID3(3055), JobMatlID4(3056), JobMatlID5(3057), JobHead1(3058), JobHead2(3059), JobHead3(3060), JobHead4(3061), JobHead5(3062)
1100	EquipmentConnected	Equipment Communications Connected	
1101	EquipmentDisconnected	Equipment Communications Disconnected	

8.7 Remote Commands

Name	Arguments		Processing States	Description
	Name (ASCII)	Value (ASCII)		
ABORT	AbortLevel	1	READY PROCESSING	Command to terminate the current cycle prior to its completion. Abort intents to quickly stopping during abnormal conditions. Abort makes no guarantee about the subsequent condition of material. In the above example, the wafers being processed at the time of the abort may not be completely processed. The termination occurs at the next "safe break point," retrieves all material, stops in a safe condition and returns to the idle state in the processing state machine. The "AbortLevel" argument is optional. If present the equipment ignores the value.
PAUSE			PROCESSING	Command to suspend processing temporarily at the next safe break point. Pause has the intent of resuming the process at the same point where it was paused. The process maybe RESUMED, STOPPED or ABORTED while in a PAUSED condition.
PP-SELECT	PPID	<ppid>	IDLE	This command instructs the equipment to make the requested process program(s) available in the execution area. The process program (PPID) is specified via the command parameter list. The specified PPID is made pending until the next START operation is executed (either remotely or by the Operator). When the START operation begins execution, it makes the pending PPID 'selected' and updates all related status variable.. A status variable contains the PPID of the process program currently selected.
RESUME			PAUSED	Command to resume processing from the point where the process was paused.
START			READY	This command is available to the host when a process program has been selected and the equipment is in the "ready" processing state. The START command instructs the equipment to initiate processing.
STOP			READY PROCESSING	Command to complete the current cycle, stop in a safe condition and return to the "idle" processing state. Stop has the intent of stopping the process. The equipment does not support the continuation of processing. The STOP command may leave material partially processed.

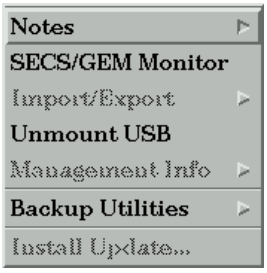
ALARM-ACK			READY PAUSED	Command to acknowledge in the **affirmative** any Alarm message which may be displayed on the equipment UI. Typically this results in a normal continuation of the process.
ALARM-NAK			READY PAUSED	Command to acknowledge in the **negative** any Alarm message which may be displayed on the equipment UI. Typically this results in an immediate termination of the process.

8.8 GEM Graphical User Interface

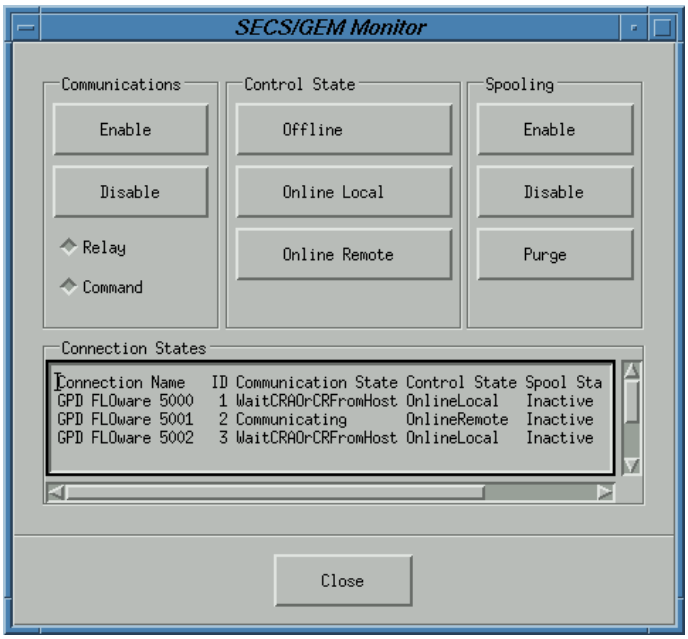
There are two separate GUIs which control the GEM interface. The first is available to the equipment operator through the FLOware interface. The second is the FLOgems GUI which is typically available only to engineer level operators.

8.8.1 FLOware GUI

The Utilities menu provides a button which will open the SECS/GEM Monitor:



Selecting SECS/GEM Monitor opens the monitor window:



The SECS/GEM Monitor window allows the equipment operator to:

- enable/disable SECS/GEM communication
- place the equipment online or offline
- control connection spooling
- view the status of host connections

8.8.1.1 Communications

Enable	Enables HSMS communications on all connections. Host will be allowed to connect to the equipment.
Disable	Disables HSMS communications on all connections. Hosts will not be allowed to connect to the equipment.
Relay	This indicates when the 'Data Relay' sub process is active. When checked (indented) the Data Relay is active. When unchecked (not indented) the Data Relay is nonfunctioning and the equipment will not provide any data to the host(s). *Note: this is not a user selectable control (i.e. clicking the indicator has no effect)*
Command	This indicates when the 'Command Relay' sub process is active. When checked (indented) the Command Relay is active. When unchecked (not indented) the Command Relay is not functioning for some reason and the equipment will not execute any remote commands. *Note: this is not a user selectable control (i.e. clicking the indicator has no effect)*

8.8.1.2 Control State

Offline	Places all connections in **Equipment Offline** state
Online Local	Places all connections is **Equipment Online Local** state
Online Remote	Places all connections is **Equipment Online Remote** state

8.8.1.3 Spooling

Enable	Enables spooling on all connections
Disable	Disables spooling on all connections
Purge	Purges spools on all connections

8.8.2 FLOgems GUI

The FLOgems GUI is accessed on the secondary display of the equipment. To access the display, change the KVM to #2:

- Tap the ScrollLock key twice
- Tap the 2 key
- Press ENTER

To return the display to the FLOware screen:

- Tap the ScrollLock key twice
- Tap the 1 key
- Press ENTER

8.8.2.1 Overview

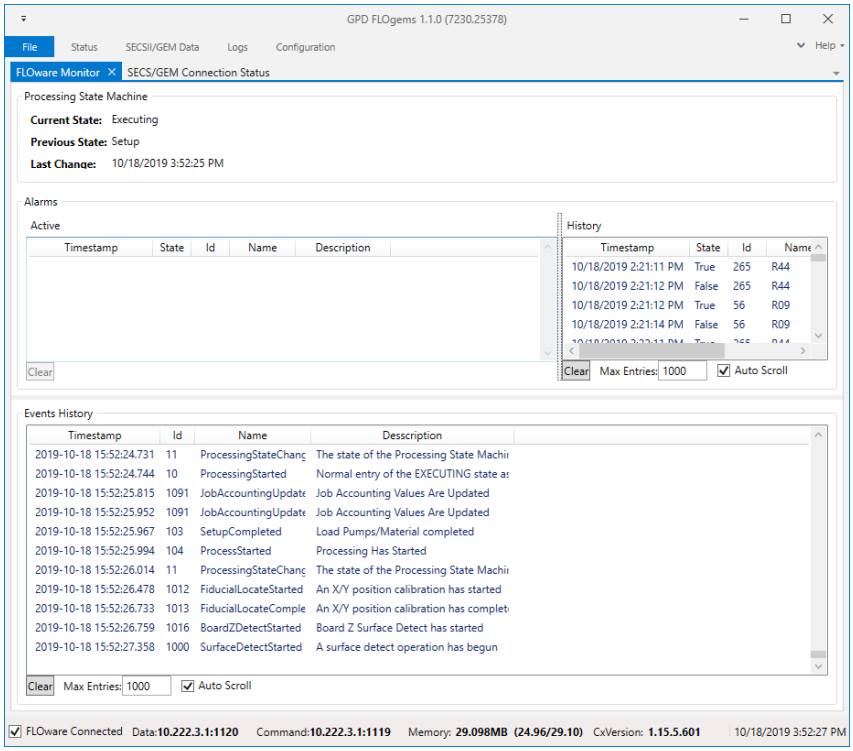
This is not intended as a comprehensive manual for the FLOgems application. This is provided as a brief introduction and enumeration of the application's capabilities.

When first opened, FLOgems will display the FLOware Status window. This provides a method to determine of the SECS/GEM system is functioning properly

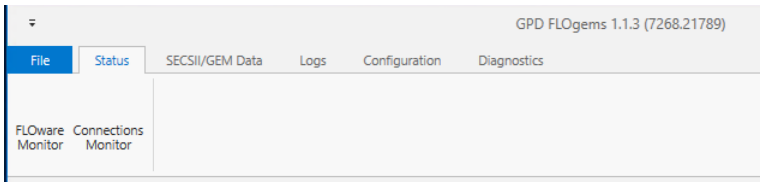
Additional windows may be opened from the Ribbon Menu. These additional windows are not necessary to access but do provide information that GEM host implementers may find useful.

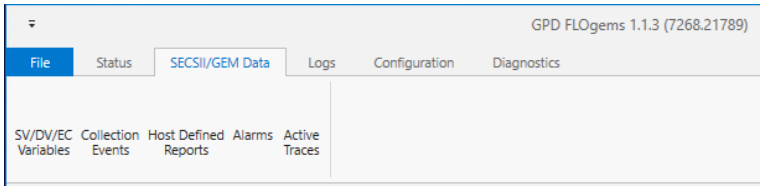
- Host connections/controls
- Variables and current values
- Alarms, Events, reports, etc.

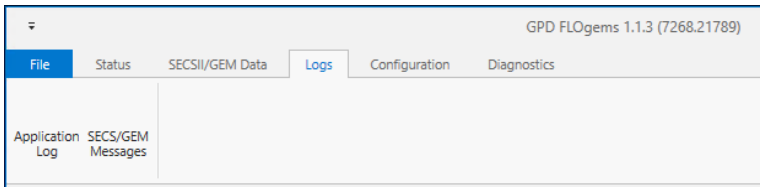
8.8.2.2 Default View

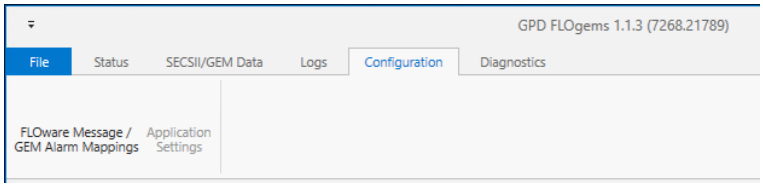


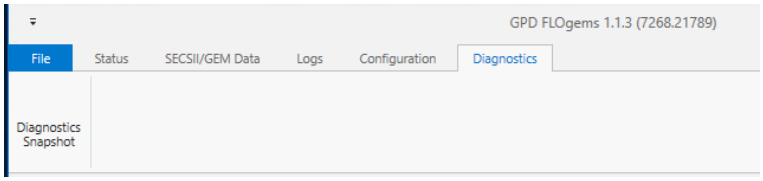
8.8.2.3 Ribbon Menu





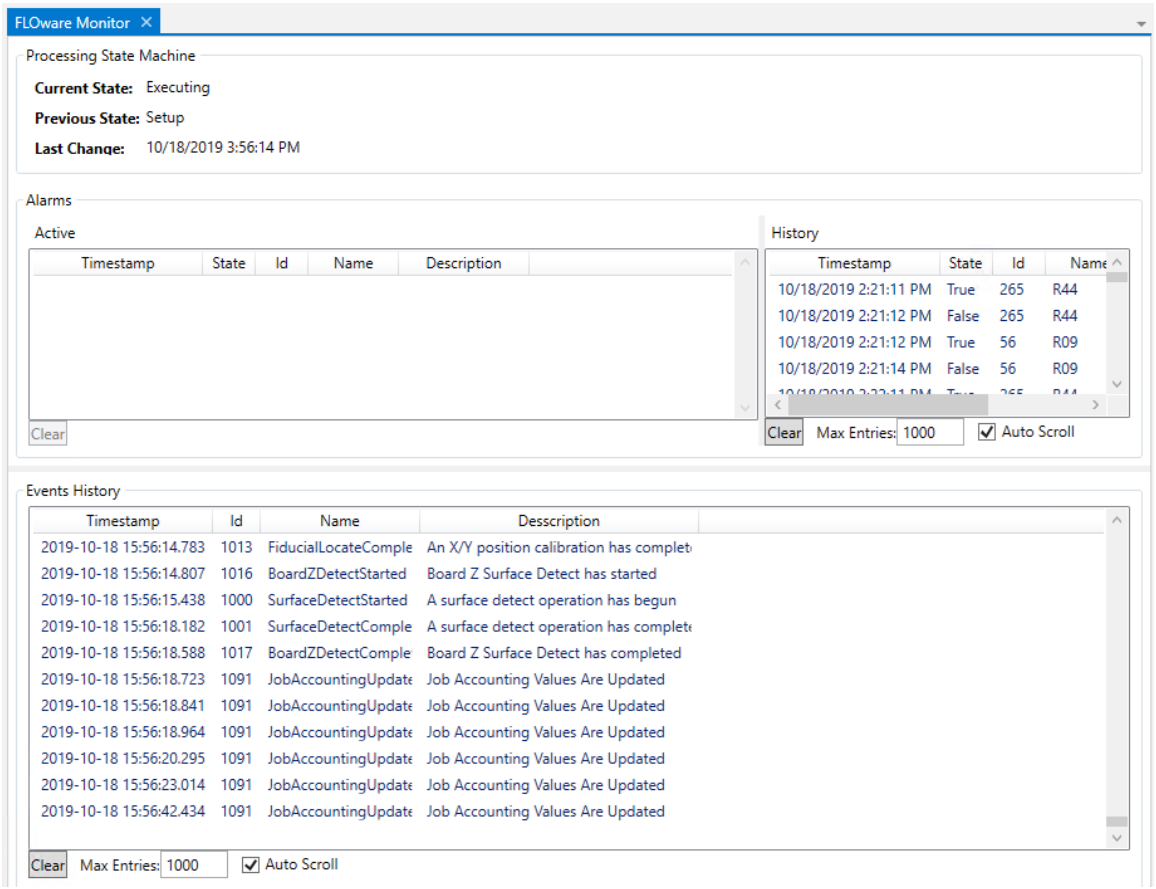






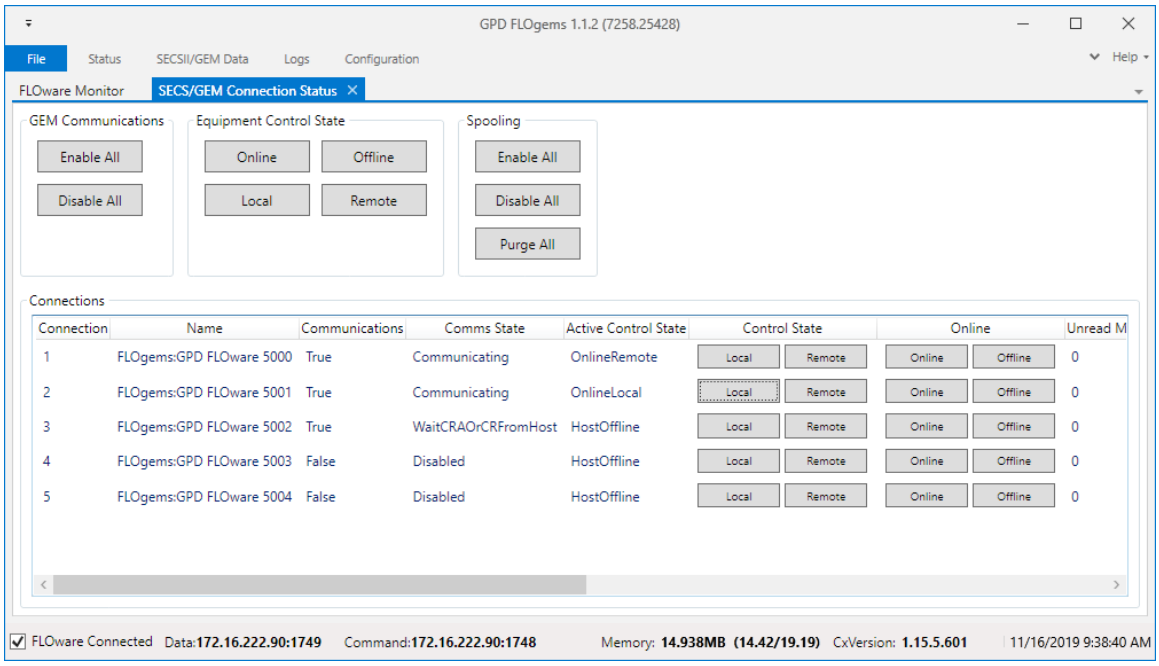
8.8.2.4 FLOware Monitor

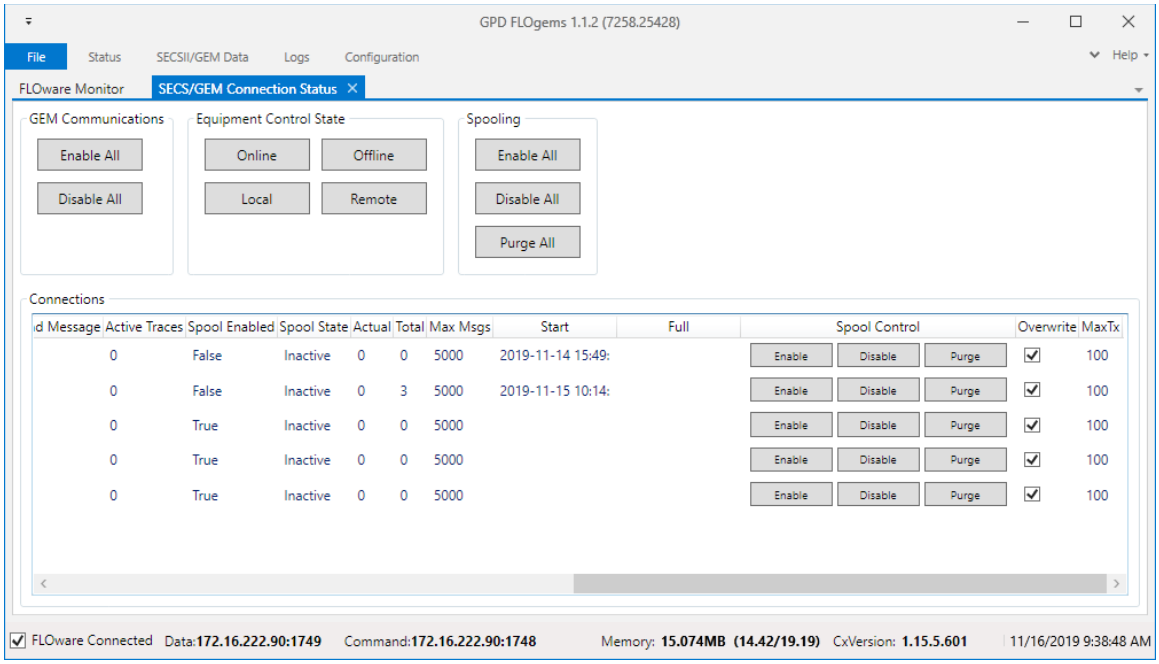
The FLOware Monitor view displays the status of the FLOware processing state machine and current activity (Alarms and Events).



8.8.2.5 SECS/GEM Connection Status

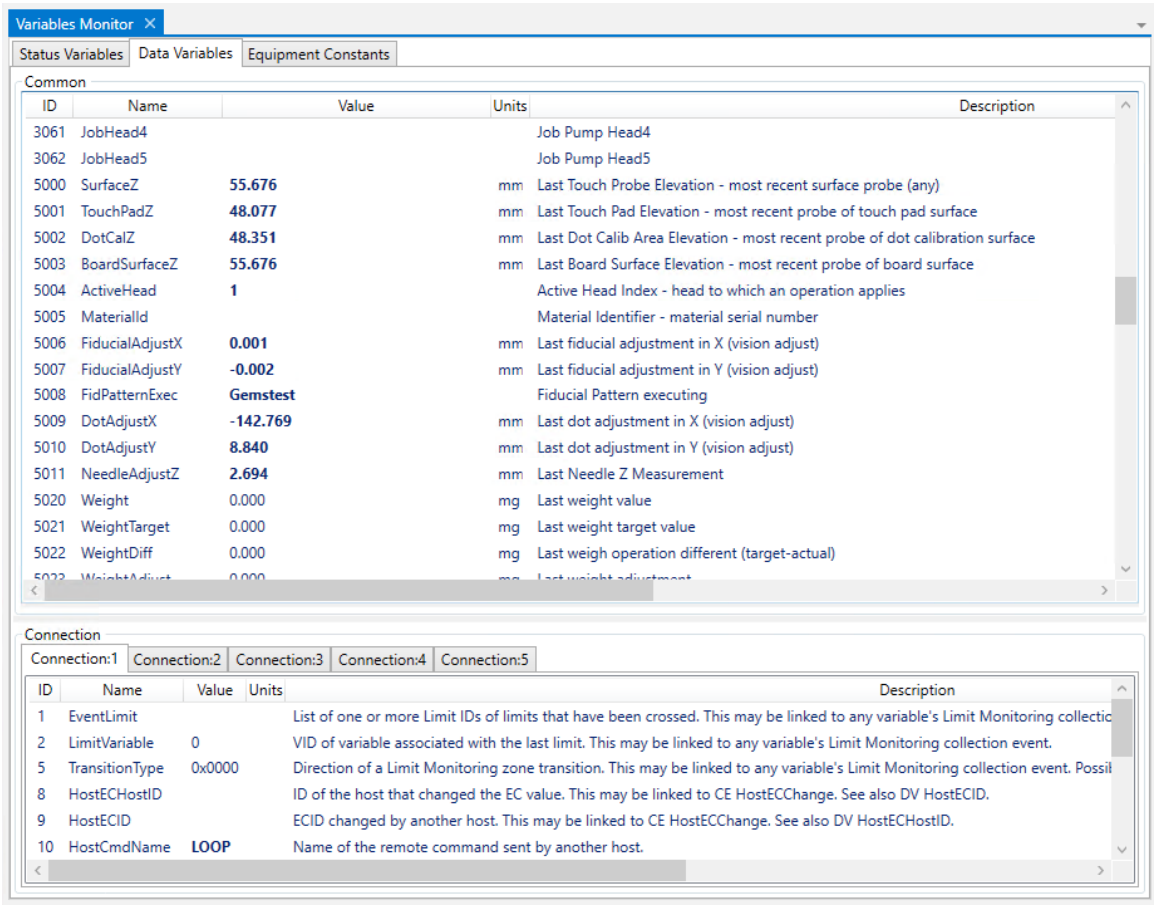
The SECS/GEM Connection Status displays the current status of all SECS/GEM host connections. Additionally allows enabling/disabling communications, placing the equipment online/offline, local/remote (globally or by connection) and spool manipulation.





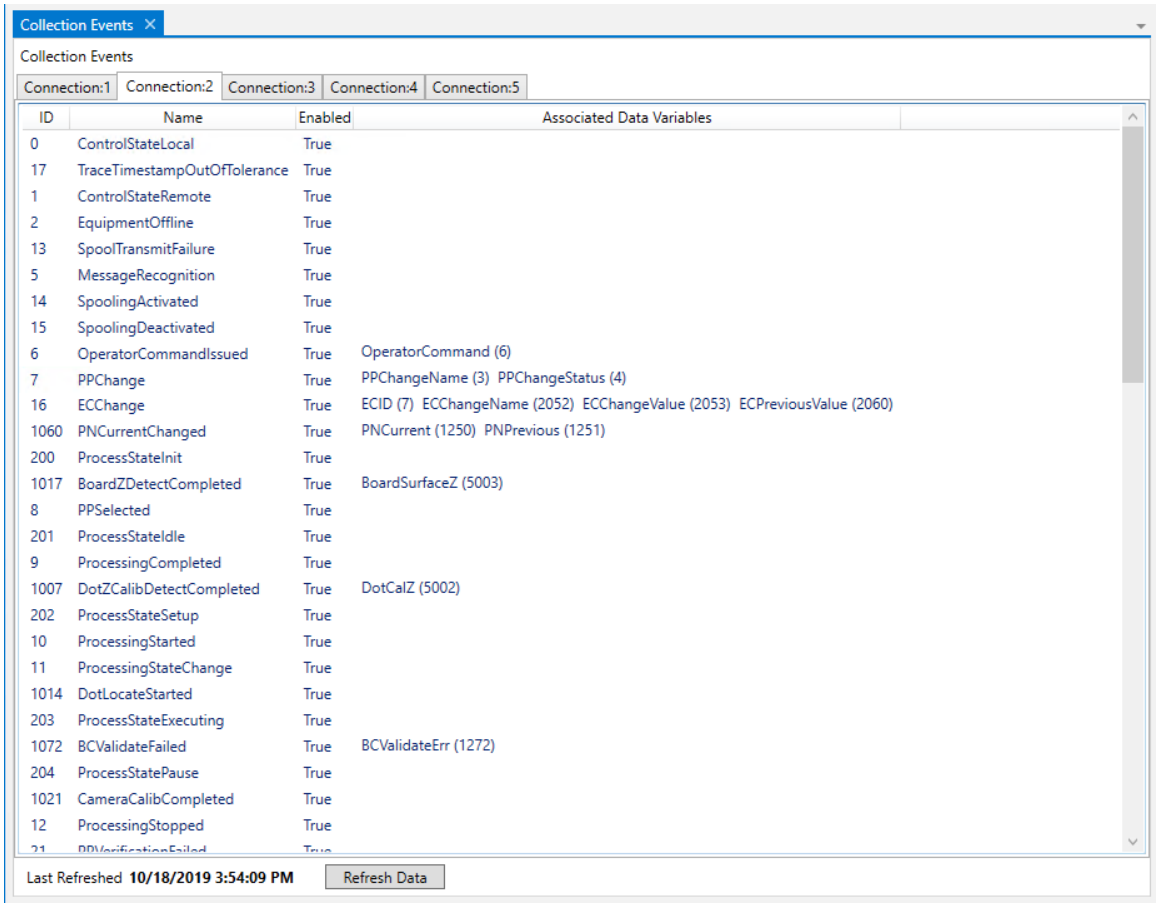
8.8.2.6 Variables Monitor

The Variables Monitor displays all variables and their current values. Displayed are Status Variables, Data Variables and Equipment Constants. Across the bottom of the window are displayed variables which are unique to each host connection.



8.8.2.7 Collection Events

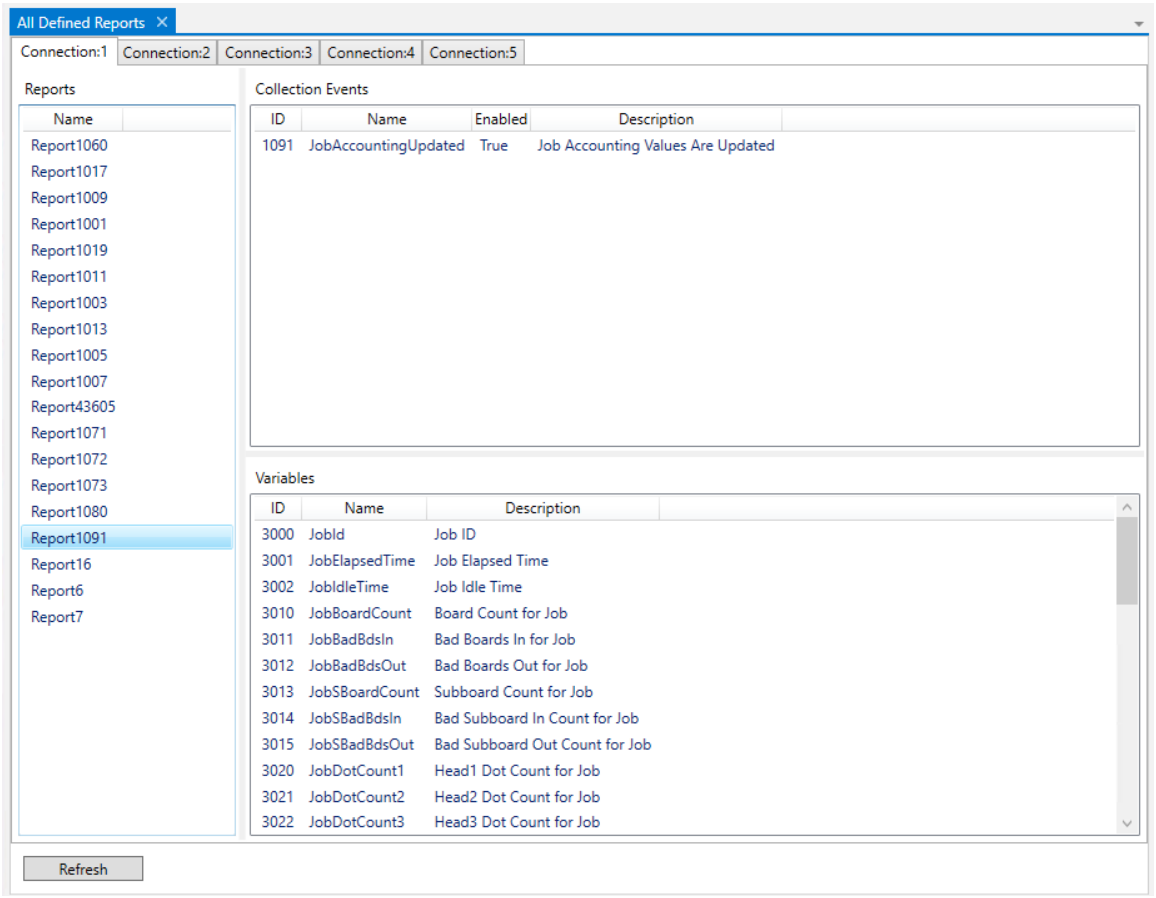
The Collection Events View displays all Connection Events and each event's *Enabled Status* for each host connection.



ID	Name	Enabled	Associated Data Variables
0	ControlStateLocal	True	
17	TraceTimestampOutOfTolerance	True	
1	ControlStateRemote	True	
2	EquipmentOffline	True	
13	SpoolTransmitFailure	True	
5	MessageRecognition	True	
14	SpoolingActivated	True	
15	SpoolingDeactivated	True	
6	OperatorCommandIssued	True	OperatorCommand (6)
7	PPChange	True	PPChangeName (3) PPChangeStatus (4)
16	ECChange	True	ECID (7) ECChangeName (2052) ECChangeValue (2053) ECPreviousValue (2060)
1060	PNCurrentChanged	True	PNCurrent (1250) PNPrevious (1251)
200	ProcessStateInit	True	
1017	BoardZDetectCompleted	True	BoardSurfaceZ (5003)
8	PPSelected	True	
201	ProcessStateIdle	True	
9	ProcessingCompleted	True	
1007	DotZCalibDetectCompleted	True	DotCalZ (5002)
202	ProcessStateSetup	True	
10	ProcessingStarted	True	
11	ProcessingStateChange	True	
1014	DotLocateStarted	True	
203	ProcessStateExecuting	True	
1072	BCValidateFailed	True	BCValidateErr (1272)
204	ProcessStatePause	True	
1021	CameraCalibCompleted	True	
12	ProcessingStopped	True	

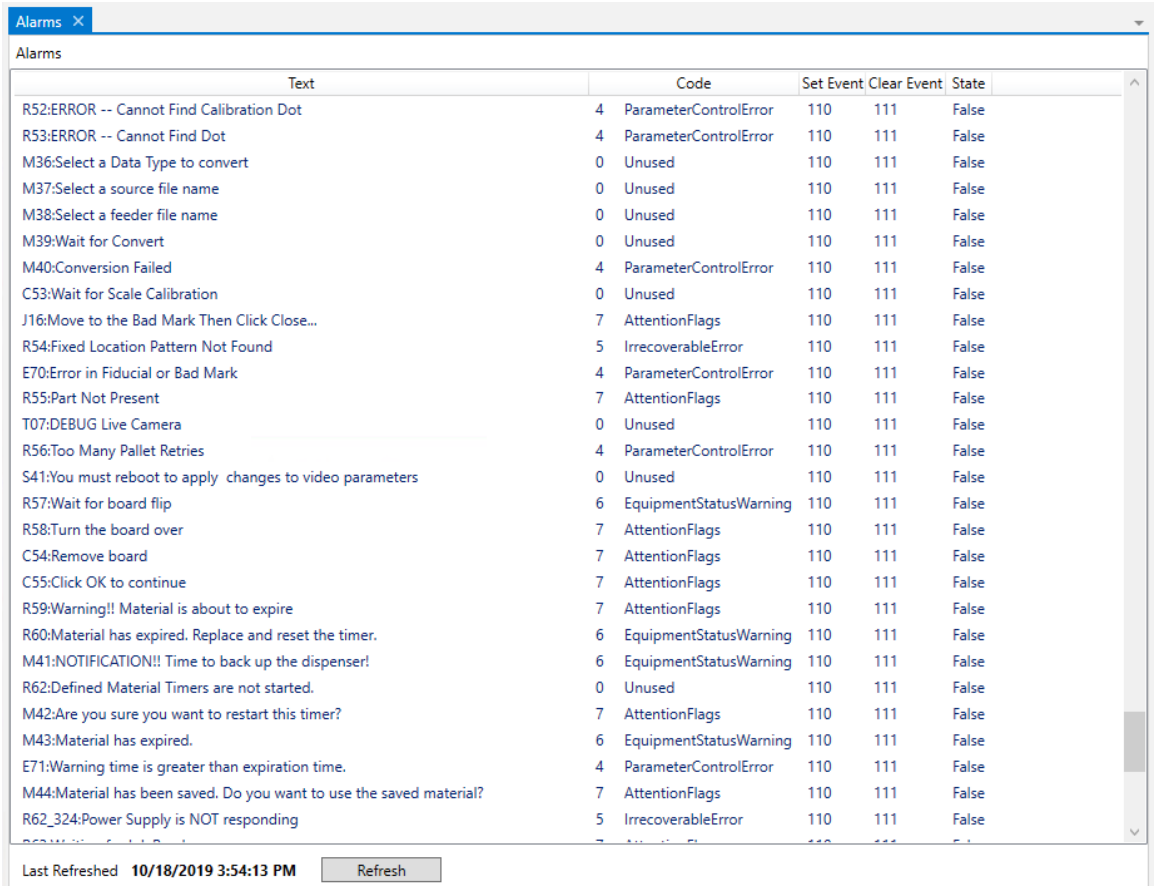
8.8.2.8 Host Defined Reports

The Host Defined Reports view displays (by connection) all reports which have been defined by a host.



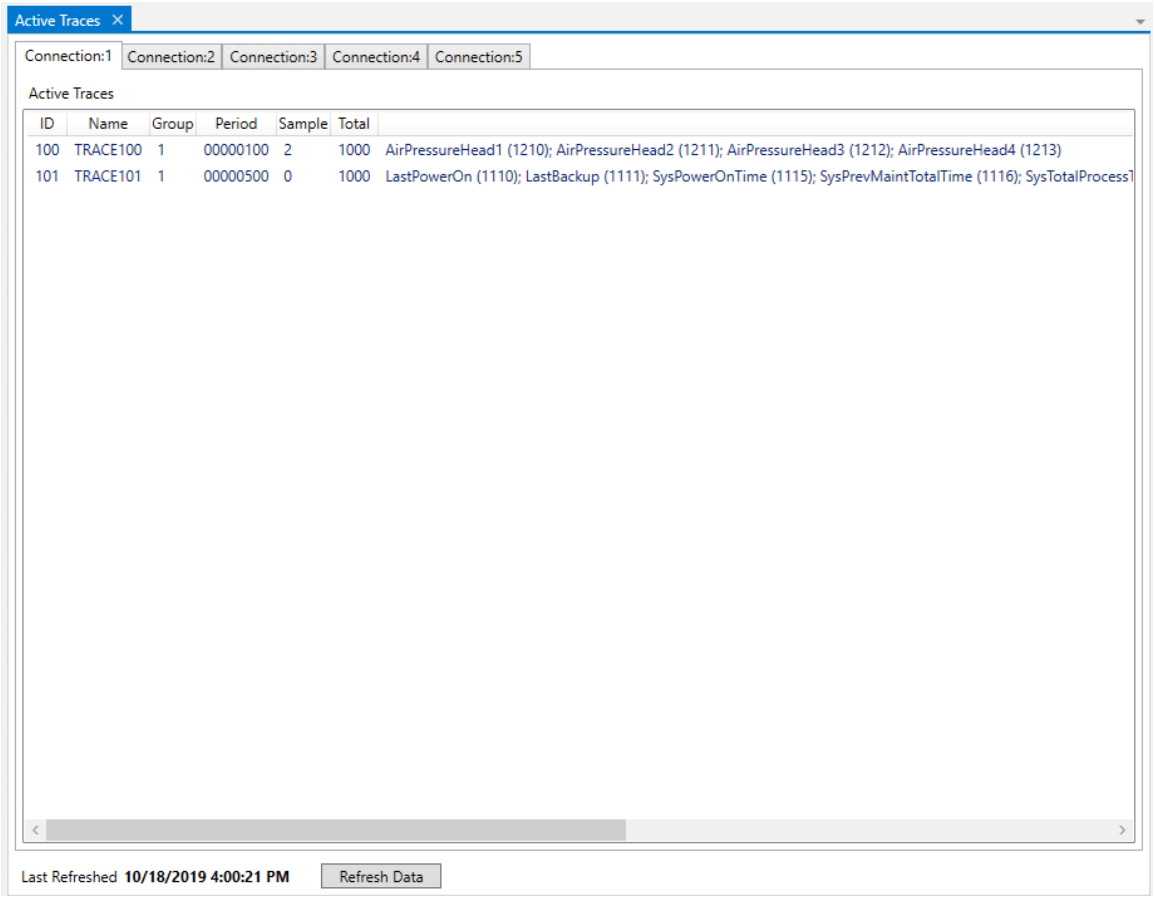
8.8.2.9 Alarms

The Alarms view displays all alarms, Set and Clear Event IDs and *Enabled Status*.



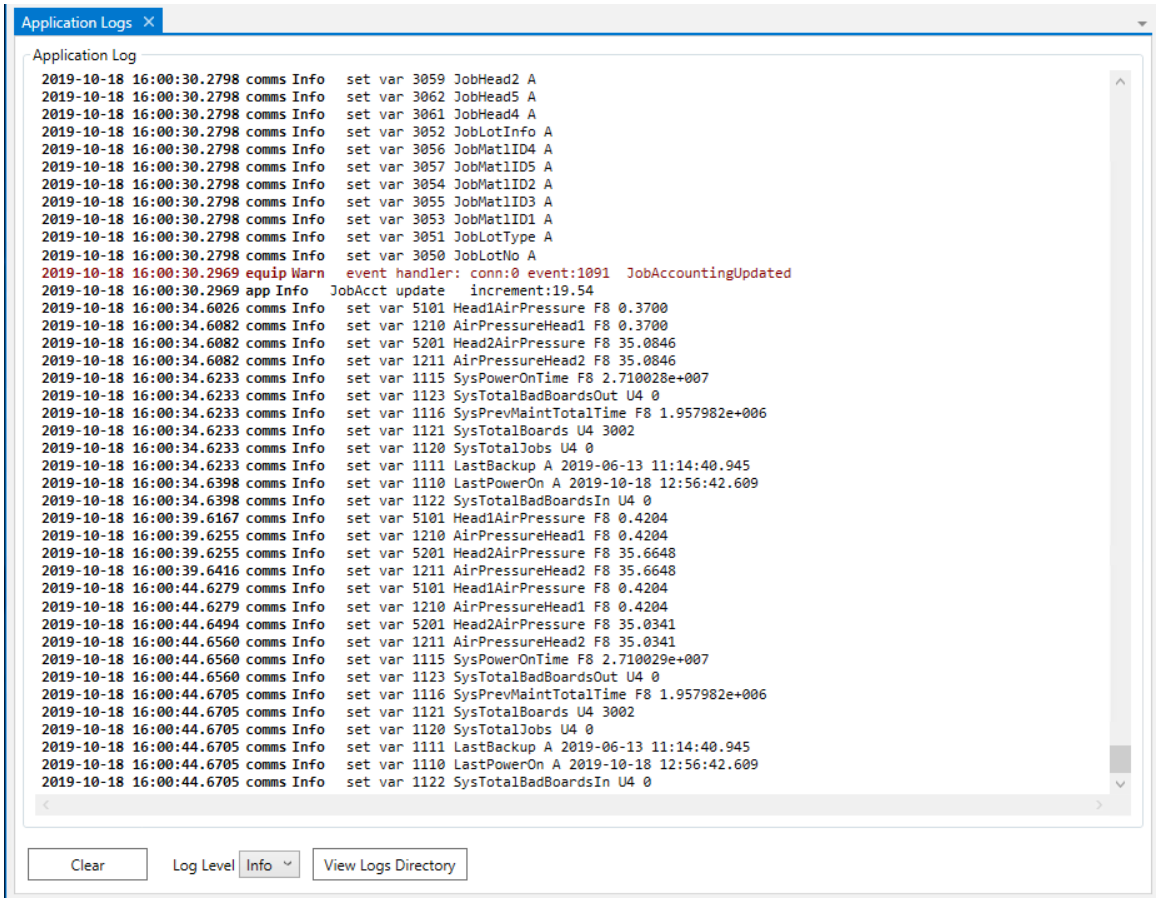
8.8.2.10 Active Traces

The Active Traces view displays, by connection, active Traces for each host.



8.8.2.11 Application Logs

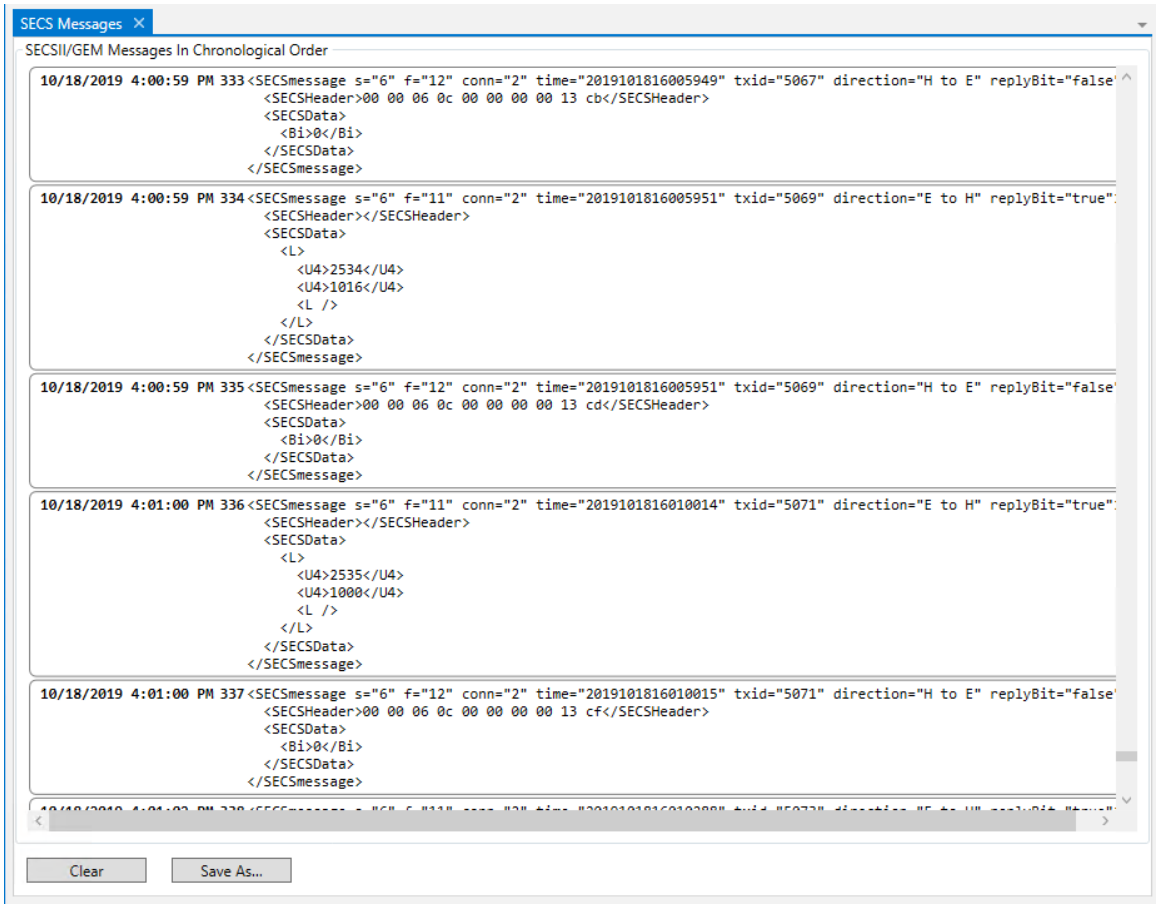
The Application Log view displays the application log in real time. Additionally there are controls which allow easy collection of the application's log files for post-mortem analysis when needed.



8.8.2.12 SECS Messages

The SECS Messages view displays, in real time, all SECS/GEMS messages received or transmitted by the FLOgems application. Messages are displayed in XML notation.

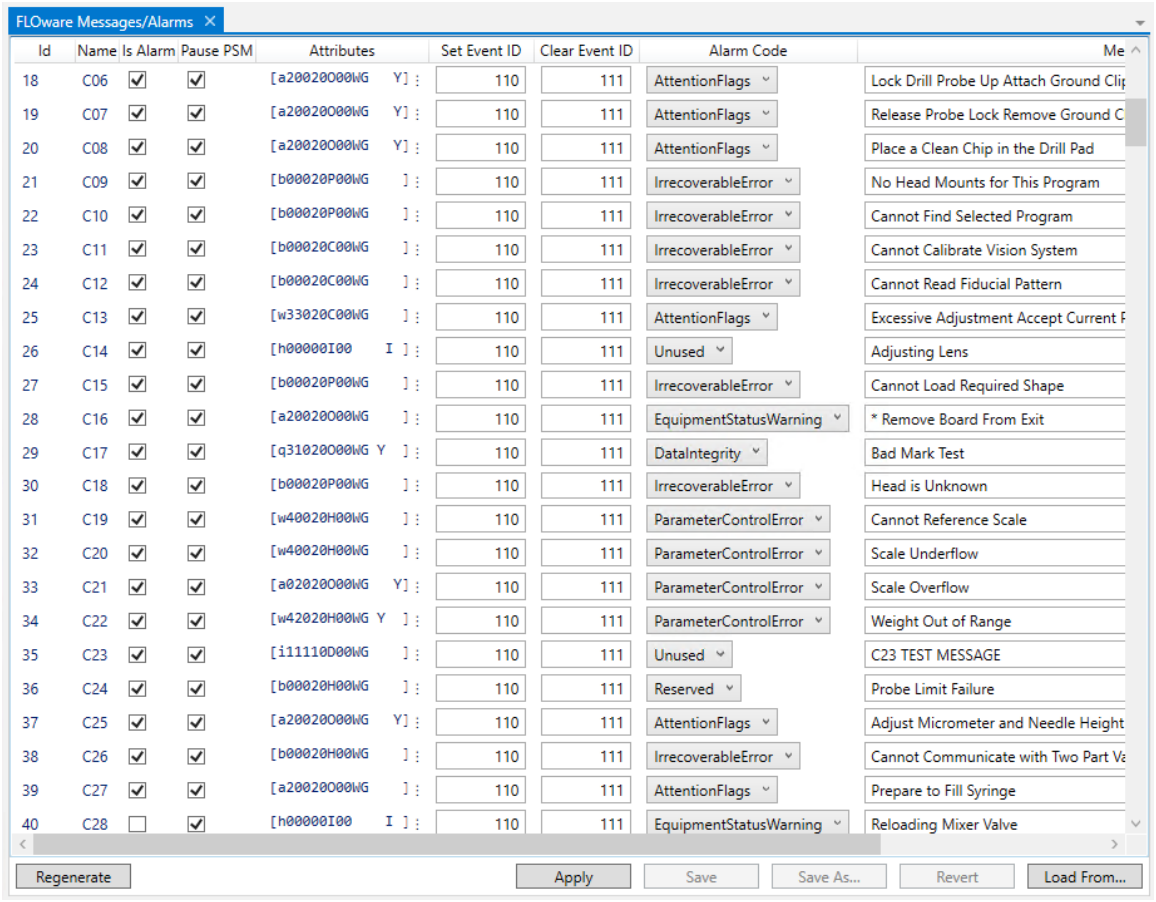
Note: the content of the view may be saved to a disk file for offline analysis.



8.8.2.13 FLOware Messages / Alarm Mappings

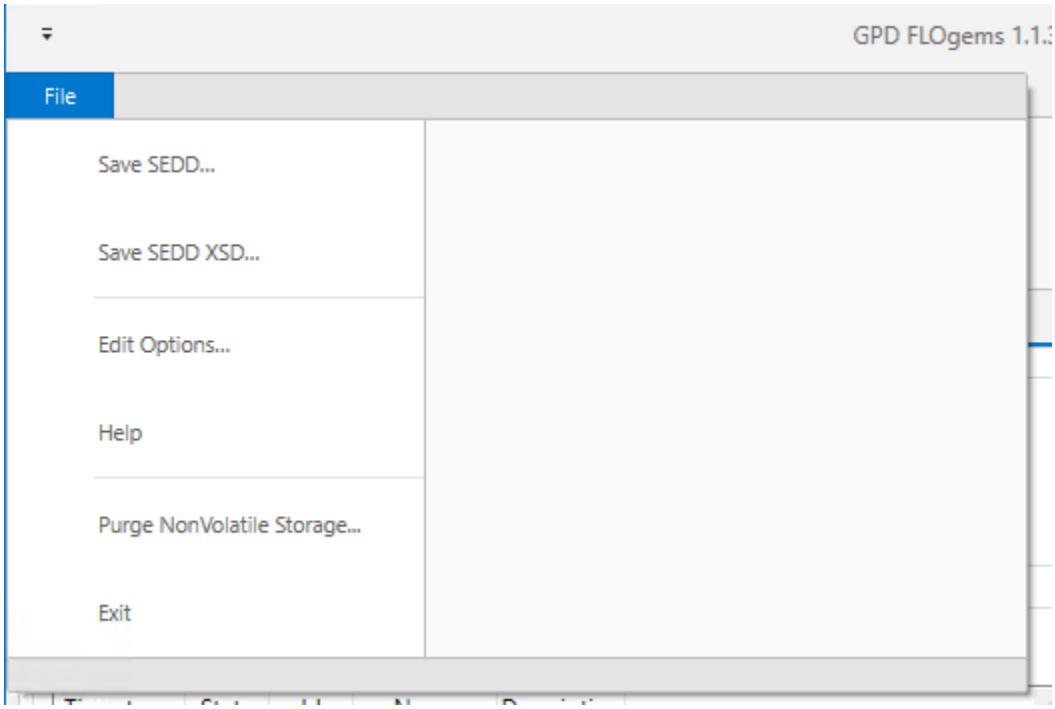
The FLOware Messages/Alarm Mappings view displays/controls the mapping between FLOware messages and GEM alarms.

Note that any changed alarm mapping will not be reflected in the alarms tables above.



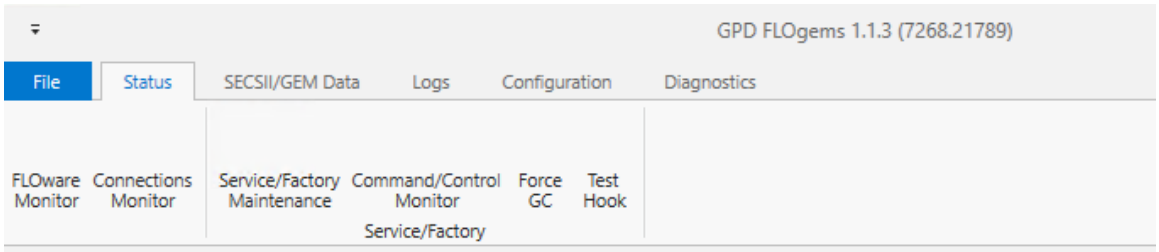
8.8.2.14 Administrator Role

Specifying the command line argument `-role-admin` at application startup will enable some additional features.



- Purge NonVolatile Storage

  This function will purge all GEM connection persistent data and restart the application. Do not perform this operation unless you understand the effects of purging persistent data.



- Service/Factory Maintenance
  Provides access to additional SECS/GEM information
- Command/Control Monitor
  Gives access to a diagnostic window for analysis of Command related problems.
- Force GC

  Forces a memory compaction
- Test Hook

  This is a developer debug hook. Not to be used in unstructured testing environments.

9 OPTION 22271055

9.1 Overview

The GPD P/N 22271055 option to FLOgems adds a number of variables and events to the system's capabilities. These values have to do with

- Work Order data (work order number, part number, serial number, etc.)
- fluid pot life and expiration
- pump maintenance schedules

This option is not enabled by default; a license key must be added to the application's settings file to enable the option and its associated variables/events/alarms.

9.2 Enabling This Option

To enable this option:

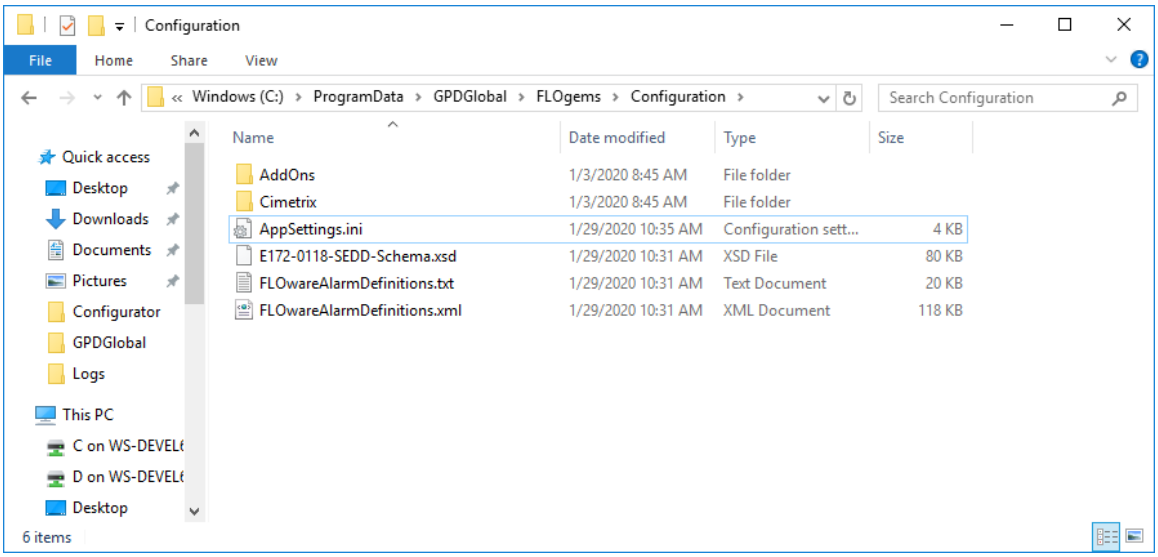
1) Obtain a license key from GPD Global Sales Department. You will receive an electronic copy of the license key which will look similar to:

```
6D04C079-7E74-48BC-A477-8D537CFC0C5C
```

2) Add the license key to the application settings file.
Edit the Options file

Options File

Folder	**File Name**
`C:\ProgramData\GPDGlobal\FLOgems\Configuration`	`AppSettings.ini`



3) Using Notepad.exe or similar text editor program, add the supplied key value to the [AddOns] section of the AppSettings.ini file (adding the section name, [AddOns], as necessary.. It should look similar to this (note that the key shown below is not the actual license key – it is however representative):

```
[AddOns]

22271055=6D04C079-7E74-48BC-A477-8D537CFC0C5C
```

DO NOT CHANGE OTHER VALUES IN THIS FILE.

4) Restart the application
5) All Variables, Events and Alarms will now be active and visible in the various Monitor windows.

9.3 Work Order Data

9.3.1 Data Variables

ID	Name	Type	Unit	Min	Max	Description
1050001	WOPartNumber	A		A	A	WO Part Number
1050002	WOSerialNumber	A		A	A	WO Serial Number
1050003	WOProductOrigin	A		A	A	WO Product Origin (13==Malaysia)
1050004	WOMfgDate	A		A	A	WO Manufacturing Date (YY/WW)
1051000	Mnt1MtrlBeginTime	A	date	A	A	Mounted Material Begin Time (Head 1)
1051001	Mnt1MtrlPotLife	U4	s	U4 0	U4 4294967295	Mounted Material Pot Life (Head 1)
1051002	Mnt1MtrlWarnTime	U4	s	U4 0	U4 4294967295	Mounted Material Expiration Warn Time (Head 1)
1051003	Mnt1MtrlType	A		A	A	Mounted Material Type (Head 1)
1051004	Mnt1MtrlBatch	A		A	A	Mounted Material Batch (Head 1)
1051005	Mnt1MtrlExpiration	A	date	A	A	Mounted Material Expiration Date (Head 1)
1051006	Mnt1MtrlWarning	Bo		Bo 0	Bo 1	Head 1 Material Expiration Warning
1051007	Mnt1MtrlExpired	Bo		Bo 0	Bo 1	Head 1 Material Expired
1051010	Mnt2MtrlBeginTime	A	date	A	A	Mounted Material Begin Time (Head 2)
1051011	Mnt2MtrlPotLife	U4	s	U4 0	U4 4294967295	Mounted Material Pot Life (Head 2)
1051012	Mnt2MtrlWarnTime	U4	s	U4 0	U4 4294967295	Mounted Material Expiration Warn Time (Head 2)
1051013	Mnt2MtrlType	A		A	A	Mounted Material Type (Head 2)
1051014	Mnt2MtrlBatch	A		A	A	Mounted Material Batch (Head 2)
1051015	Mnt2MtrlExpiration	A	date	A	A	Mounted Material Expiration Date (Head 2)
1051016	Mnt2MtrlWarning	Bo		Bo 0	Bo 1	Head 2 Material Expiration Warning
1051017	Mnt2MtrlExpired	Bo		Bo 0	Bo 1	Head 2 Material Expired
1051020	Mnt3MtrlBeginTime	A	date	A	A	Mounted Material Begin Time (Head 3)

1051021	Mnt3MtrlPotLife	U4	s	U4 0	U4 4294967295	Mounted Material Pot Life (Head 3)
1051022	Mnt3MtrlWarnTime	U4	s	U4 0	U4 4294967295	Mounted Material Expiration Warn Time (Head 3)
1051023	Mnt3MtrlType	A		A	A	Mounted Material Type (Head 3)
1051024	Mnt3MtrlBatch	A		A	A	Mounted Material Batch (Head 3)
1051025	Mnt3MtrlExpiration	A	date	A	A	Mounted Material Expiration Date (Head 3)
1051026	Mnt3MtrlWarning	Bo		Bo 0	Bo 1	Head 3 Material Expiration Warning
1051027	Mnt3MtrlExpired	Bo		Bo 0	Bo 1	Head 3 Material Expired
1052000	Mnt1PumpMaintPeriodStart	A	date	A	A	Cartridge Cleaned Time (Head 1)
1052001	Mnt1PumpMaintPeriodDuration	U4	s	U4 0	U4 4294967295	Next Cartridge Clean Time (Head 1)
1052002	Mnt1PumpMaintPeriodWarning	Bo		Bo 0	Bo 1	Head 1 Pump Clean Time Warning
1052003	Mnt1PumpMaintPeriodExpired	Bo		Bo 0	Bo 1	Head 1 Pump Clean Time Expired
1052010	Mnt2PumpMaintPeriodStart	A	date	A	A	Cartridge Cleaned Time (Head 2)
1052011	Mnt2PumpMaintPeriodDuration	U4	s	U4 0	U4 4294967295	Next Cartridge Clean Time (Head 2)
1052012	Mnt2PumpMaintPeriodWarning	Bo		Bo 0	Bo 1	Head 2 Pump Maintenance Time Warning
1052013	Mnt2PumpMaintPeriodExpired	Bo		Bo 0	Bo 1	Head 2 Pump Maintenance Time Expired
1052020	Mnt3PumpMaintPeriodStart	A	date	A	A	Cartridge Cleaned Time (Head 3)
1052021	Mnt3PumpMaintPeriodDuration	U4	s	U4 0	U4 4294967295	Next Cartridge Clean Time (Head 3)
1052022	Mnt3PumpMaintPeriodWarning	Bo		Bo 0	Bo 1	Head 3 Pump Maintenance Time Warning
1052023	Mnt3PumpMaintPeriodExpired	Bo		Bo 0	Bo 1	Head 3 Pump Maintenance Time Expired
1058000	WOErrorCode	U4		U4 0	U4 4294967295	WO Data Entry Error Code
1058001	WOError	A		A	A	WO Data Entry Error Message

1058010	MntMtrlErrorCode	U4		U4 0	U4 4294967295	Mounted Material Data Entry Error Code
1058011	MntMtrlError	A		A	A	Mounted Material Entry Error Message
1059000	CurrentOperatorAliasId	A		A	A	Aliased Operator ID

9.3.2 Status Variables

None

9.3.3 Equipment Constants

None

9.3.4 Alarms

ID	Name	Set CE	Clear CE	Text
105001	WODataEntry	107	108	WO Data Entry Active
105002	MatlDataEntry	107	108	Materials Data Entry

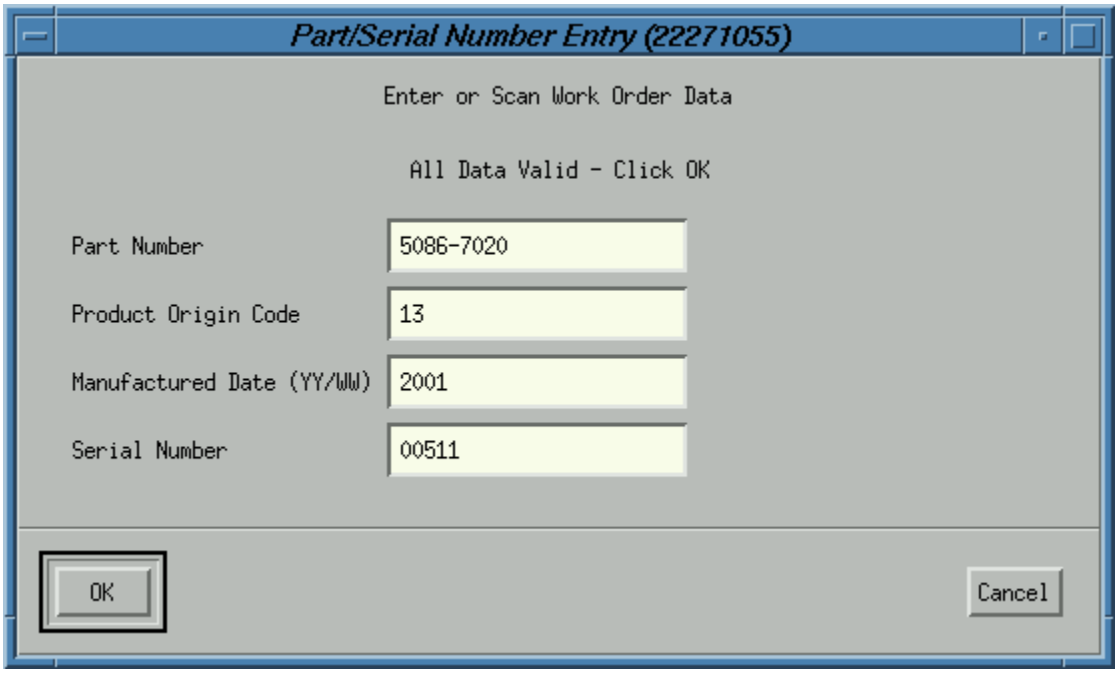
9.3.5 Collection Events

ID	Name	Description	Associated DVs
105501	WODataChanged	Work Order Data Changed	WOPartNumber(1050001), WOSerialNumber(1050002), WOProductOrigin(1050003), WOMfgDate(1050004)
105502	WODataError	Work Order Data Entry error	WOErrorCode(1058000), WOError(1058001)
105510	MntMtrlDataChanged	Mounted Material Data Changed	Mnt1MtrlBeginTime(1051000), Mnt1MtrlPotLife(1051001), Mnt1MtrlWarnTime(1051002), Mnt1MtrlType(1051003), Mnt1MtrlBatch(1051004), Mnt1MtrlExpiration(1051005), Mnt2MtrlBeginTime(1051010), Mnt2MtrlPotLife(1051011), Mnt2MtrlWarnTime(1051012), Mnt2MtrlType(1051013), Mnt2MtrlBatch(1051014),

			Mnt2MtrlExpiration(1051015), Mnt3MtrlBeginTime(1051020), Mnt3MtrlPotLife(1051021), Mnt3MtrlWarnTime(1051022), Mnt3MtrlType(1051023), Mnt3MtrlBatch(1051024), Mnt3MtrlExpiration(1051025)
105511	MntMaintDataChanged	Pump Maintenance Data Changed	Mnt1PumpMaintPeriodStart(1052000), Mnt1PumpMaintPeriodDuration(1052001), Mnt2PumpMaintPeriodStart(1052010), Mnt2PumpMaintPeriodDuration(1052011), Mnt3PumpMaintPeriodStart(1052020), Mnt3PumpMaintPeriodDuration(1052021)
105530	MaterialExpiredWarning	Material Expiration Warning	Mnt1MtrlWarning(1051006), Mnt2MtrlWarning(1051016), Mnt3MtrlWarning(1051026)
105531	MaterialExpired	Material Is Expired	Mnt1MtrlExpired(1051007), Mnt2MtrlExpired(1051017), Mnt3MtrlExpired(1051027)
105540	PumpMaintPeriodWarning	Pump Maintenance Time Is About To Expire	Mnt1PumpMaintPeriodWarning(1052002), Mnt2PumpMaintPeriodWarning(1052012), Mnt3PumpMaintPeriodWarning(1052022)
105541	PumpMaintPeriodExpired	Pump Maintenance Time Expired	Mnt1PumpMaintPeriodExpired(1052003), Mnt2PumpMaintPeriodExpired(1052013), Mnt3PumpMaintPeriodExpired(1052023)

9.4 User Interface

9.4.1 Work Order Data Entry



Work Order data entry window. All fields must be entered with properly formatted data. All data fields are validated against a set of regular expressions (detailed below).

If the entered data does not match the corresponding regular expression, the entire data field is highlighted in red (see below) and the OK button is dimmed and made inactive.

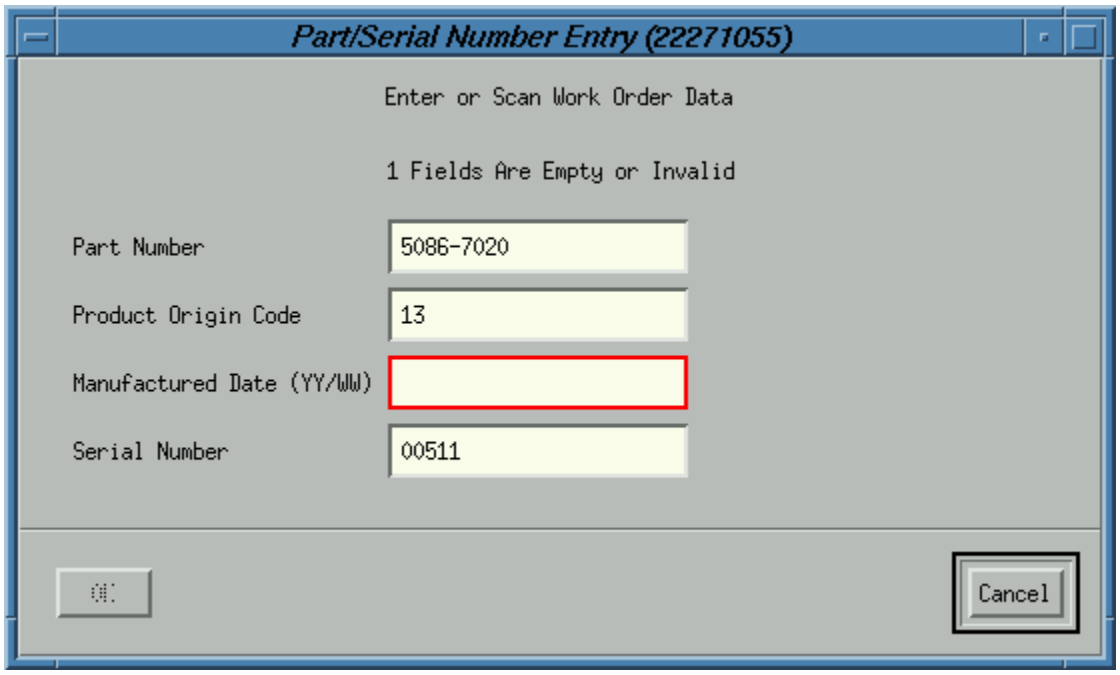
If all the entered data matches the corresponding regular expressions, no fields will be displayed with a red border and the OK button will be enabled.

Field	Description	Example(s)	Validating Regular Expression

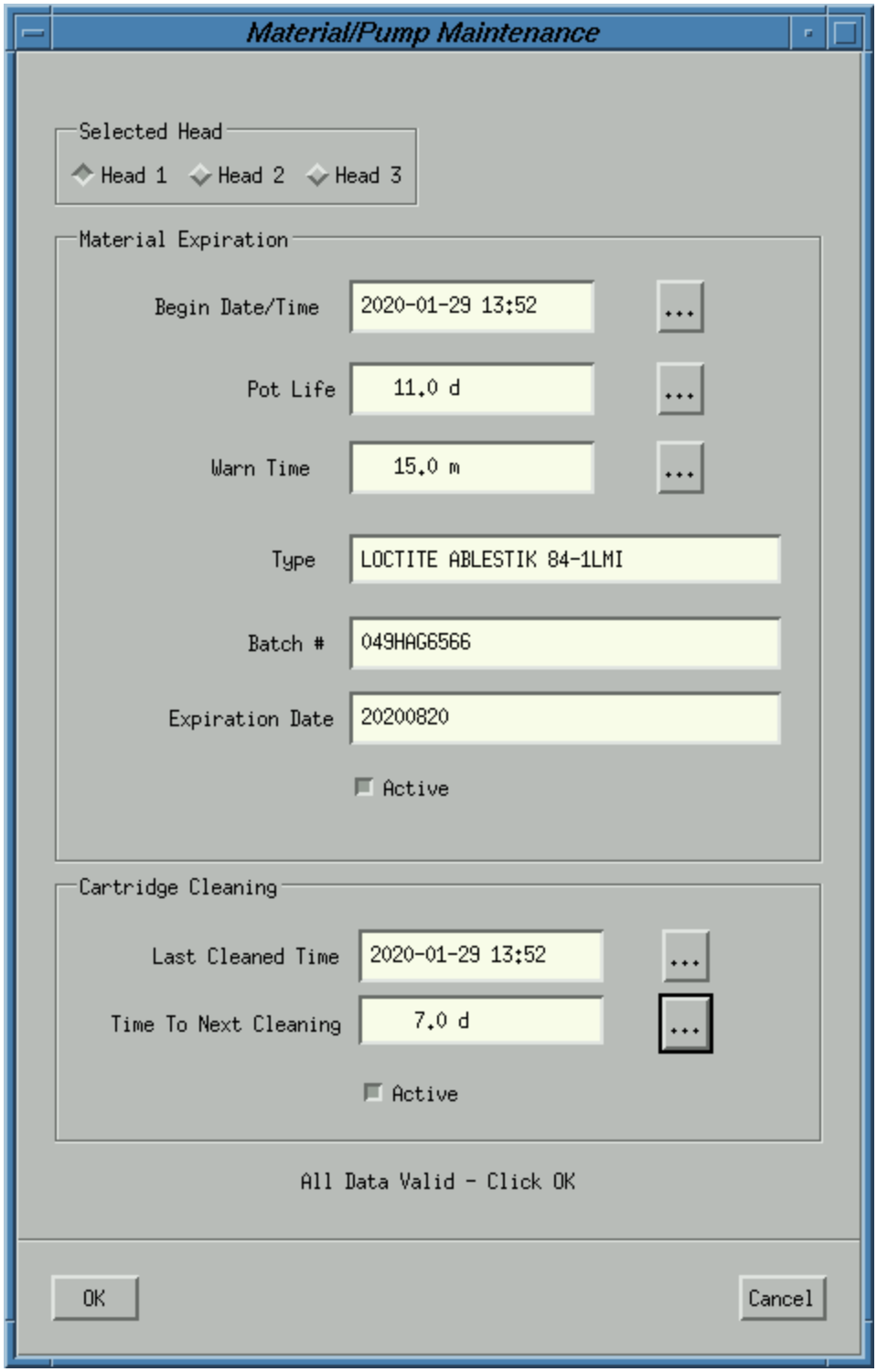
Part Number	Product Part Number from Work Order	5086-7020
		U2054-66502
			`^[[:digit:]]\{4\}-[[:digit:]]\{4\}$`
			`^[[:digit:]]\{5\}-[[:digit:]]\{5\}$`
			`^U[[:digit:]]\{4\}-`

			`[[:digit:]]\{5\}$`
Product Origin Code	Product Origin Code (country code)	13	`^[[:digit:]]\{2\}$`
Manufactured Date	Year and Week number of manufacture	2001 2043	`^(19|2[0-9])([0-4][1-9]|5[0-2])$`
Serial Number	Product Serial Number from Work Order	03472,	`^[[:digit:]]\{5\}$` `^[[:upper:]][[:digit:]]\{5\}$`

Work Order data entry window showing an invalid field. The Manufacture Date is empty (invalid) – note that the OK button is dimmed (inactive).



9.4.2 Material Pot Life / Pump Maintenance Data Entry



Field	Description	Example(s)	Validating Regular Expression
Begin Date/Time	Begin date/time of the material pot life timer	2020-01-30 13:14	`^20[0-9]\{2\}-(0[0-9]|1[0-2])-[0-3][0-9] ([0-1][0-9]|2[0-3]):[0-5][0-9]$`
Pot Life	Duration of the material's pot life (in days)	11d	`n/a`
Warn Time	Time before pot life expiration at which a warning is raised (in minutes)	15m	`n/a`
Type	Material Type (from material label)	LOCTITE ABELSTIK 84-1LMI	`^[A-Z0-9[:space:]-]\{21,24\}$`
Batch #	Material Batch# (from material label)	049HA66566	`^[A-Z0-9]\{10\}$`
Expiration Date [1]	Material Expiration Date (from material label)	20200820	`^[0-9]\{8\}$`
Active	When depressed, this material pot life timer is active, otherwise the timer is inactive.		`n/a`
Last Clean Time	Date/Time of the last pump cleaning	2020-01-29 21:14	`^20[0-9]\{2\}-(0[0-9]|1[0-2])-[0-3][0-9] ([0-1][0-9]|2[0-3]):[0-5][0-9]$`
Time To Next Cleaning	Number of days from the Last Clean Time, to the next cleaning time.	7d	`n/a`
Active	When depressed, this pump cleaning timer is active, otherwise the timer is inactive.		`n/a`

[1] Material Expiration Date is the date as presented on the material label. As such it is likely formatted differently than other date/time fields.