# Functional Design Specification for Advanced Process Controller APC-J141_LIC_002_004C

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## Executive Summary

This document is the Functional Design Specification (FDS) for the Advanced Process Controller (APC) that is being implemented. The document is structured into the following six sections:

Section 1 is a process background and description the process whereby the APC controller will be implemented. Based on the S88 standard, the process descriptions are covered.Also included are the stability and efficiency measures on the each unit which drive APC systems to align with Anglo American strategy.

Section 2 is an explanation of the basic control philosophy of the process unit.

Section 3 is a detailed explanation of the APC controller, including descriptions of the control, manipulated and disturbance variables as well as the controller objectives and key performance indicators (KPI's). This section also describes the logic for the detection of the four types of plant process state alarms which are; critical, high, low and default.

Section 4 (optional) is a description of the control technologies that will be used in the implementation of the APC controller. The control technologies are Fuzzy Control and Model Predictive Control (MPC).

Section 5 (optional) is a list of the heartbeats.

Section 6 (optional) is a list of all the tags that will be used in the implementation of the DMS Feed process unit APC controller.

Addendums (optional) is the final section of the document which is an explanation of the basic principles of operations for Process States, Fuzzy Control, Model Based Control and finally Model Predictive Control.

## 1) Process Background And Description

### 1.1) SIS-JIG (Site)

#### 1.1.1) Background

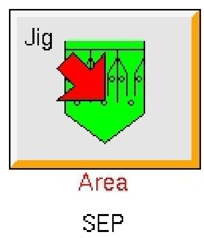



*Fig 1: The members of the SIS-JIG Site - Highlighting the Jig-Area - SEP*

### 1.2) SEP (Jig-Area)

### 1.2.1) Background

The jig plant at Sishen Iron Ore Mne consists of a primary, secondary and tertiary crushing circuit crushing the feed material to a -25 mm top size and longitudinally stacking it on two ROM (run of mine) feed beds. The ROM feed bed material is reclaimed by a bucket reclaimer and conveyed to eight feed bunkers.

After beneficiation the lumpy ore (-25 mm +8 mm) is conveyed and stacked on the blending beds while the fine material (-8 mm +1 mm) is conveyed to the dewatering bunkers and then stacked on the fine blending beds. The jig plant consist of eight modules with three jigs each, the coarse jig (-25 mm +8 mm), medium jig (-8 mm +3 mm) and fine jig (-3 mm +1 mm).

Jigging is a process of particle stratification in which the particle rearrangement results from an alternate expansion and compaction of a bed of particles by a pulsating fluid flow. The rearrangement results in layers of particles that are arranged by increasing density from top to bottom of the jig bed. The particles, in addition to the vertically expanded and compacted bed motion, move continuously and horizontally across the supporting jig screen helped by the feed material that is introduced at one end. The feed rate influences the retention time of the material in the jig and thus the number of pulses the material will receive. Following the particle stratification, the particle bed is physically cut at a desired horizontal particle density plane to separate the desired product from the less dense gangue material.

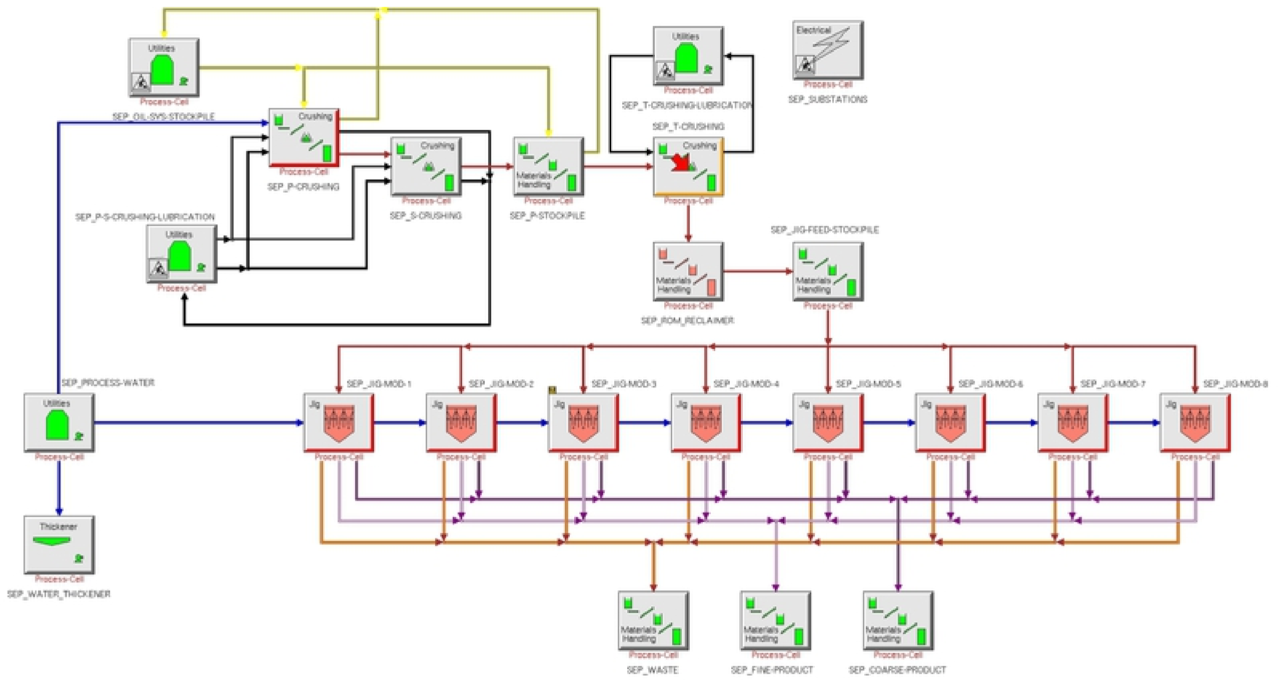



*Fig 2: The members of the SEP Jig-Area - Highlighting the Crushing-Process-Cell - T-CRUSHING*

## 1.3) T-CRUSHING (Crushing-Process-Cell)

### 1.3.1) Background

The tertiary crusher stage is fed from the primary stockpile, which contains the primary and secondary crusher product. The tertiary crushing plant consists of four tertiary cone crushers, each of which are fed at a controlled rate through a feed bin, two feeders per crusher. The tertiary crushing plant is in closed circuit and produces a -25mm which is conveyed to one of two pre-blending beds, these beds are fed to the beneficiation process (jigging).

### 1.3.2) Purpose

### 1.3.3) Theory

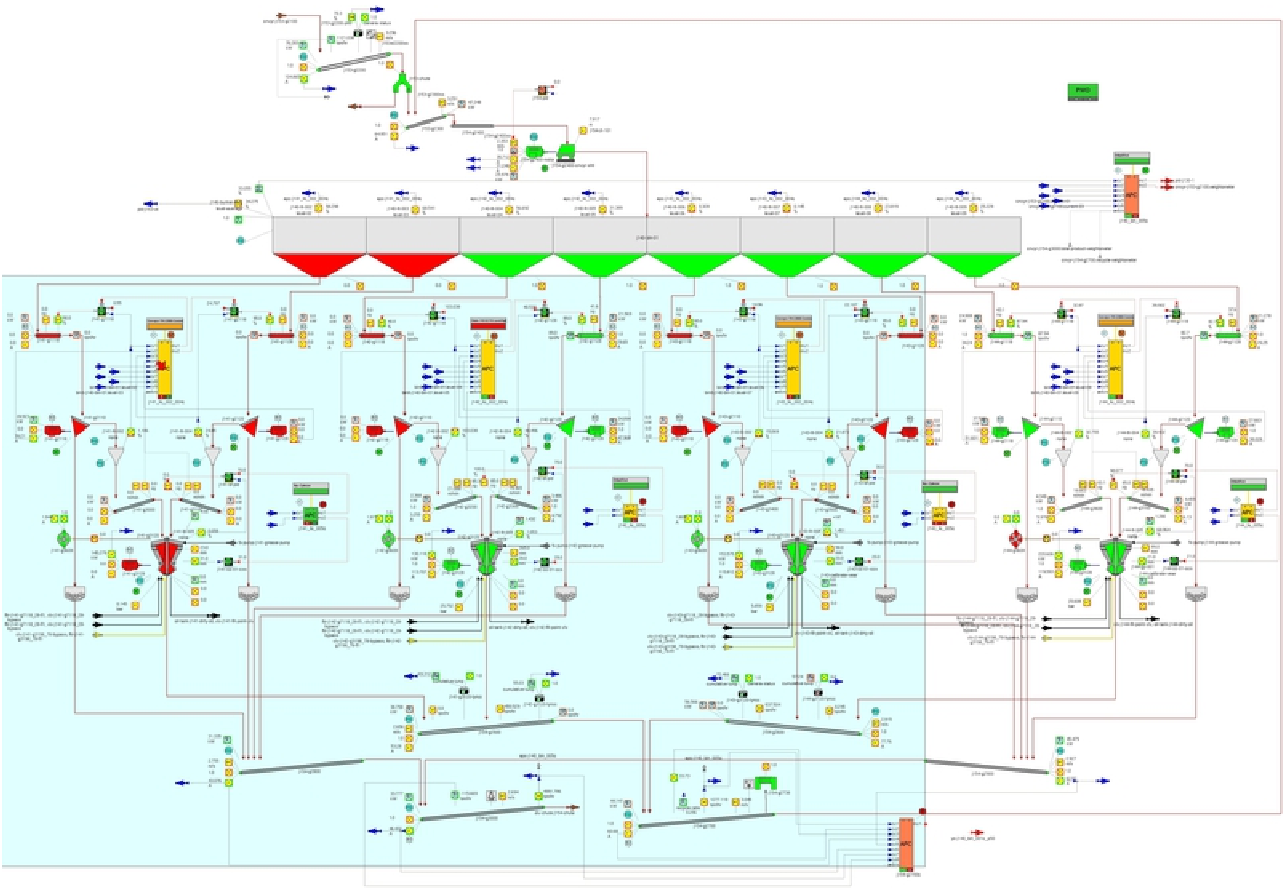


*Fig 3: The members of the CRUSHER-01-FEED unit which is a member of T-CRUSHING Crushing-Process-Cell - Highlighting J141_LIC_002_004C*

## 1.4) CRUSHER-01-FEED (Unit)

### 1.4.1) Background

The secondary crusher (J120-G3100) output reports to the primary stockpile (J130-ST-01) which reports to the tertiary crusher feed bin (J140-BIN-01) via the tertiary crusher feed bin conveyor (J153-G2100). For each crusher unit there are two variable speed vibrating feeders (J141-G1118 and J141-G1128) withdrawing material from the tertiary crusher feed bin (J140-BIN-01). These feeders feed screens (J141-G2110 and J141-G2120) which separates the oversize from the undersize. The -25mm reports to J154-G3000 which will feed the JIG feed stockpile. The +25mm ore reports to chutes (J141-G2110-CHUTE and J141-G2120-CHUTE) which in turns feed the tertiary crusher (J141-G3120) via two variable speed conveyors (J141-G3000 and J141-G3100).

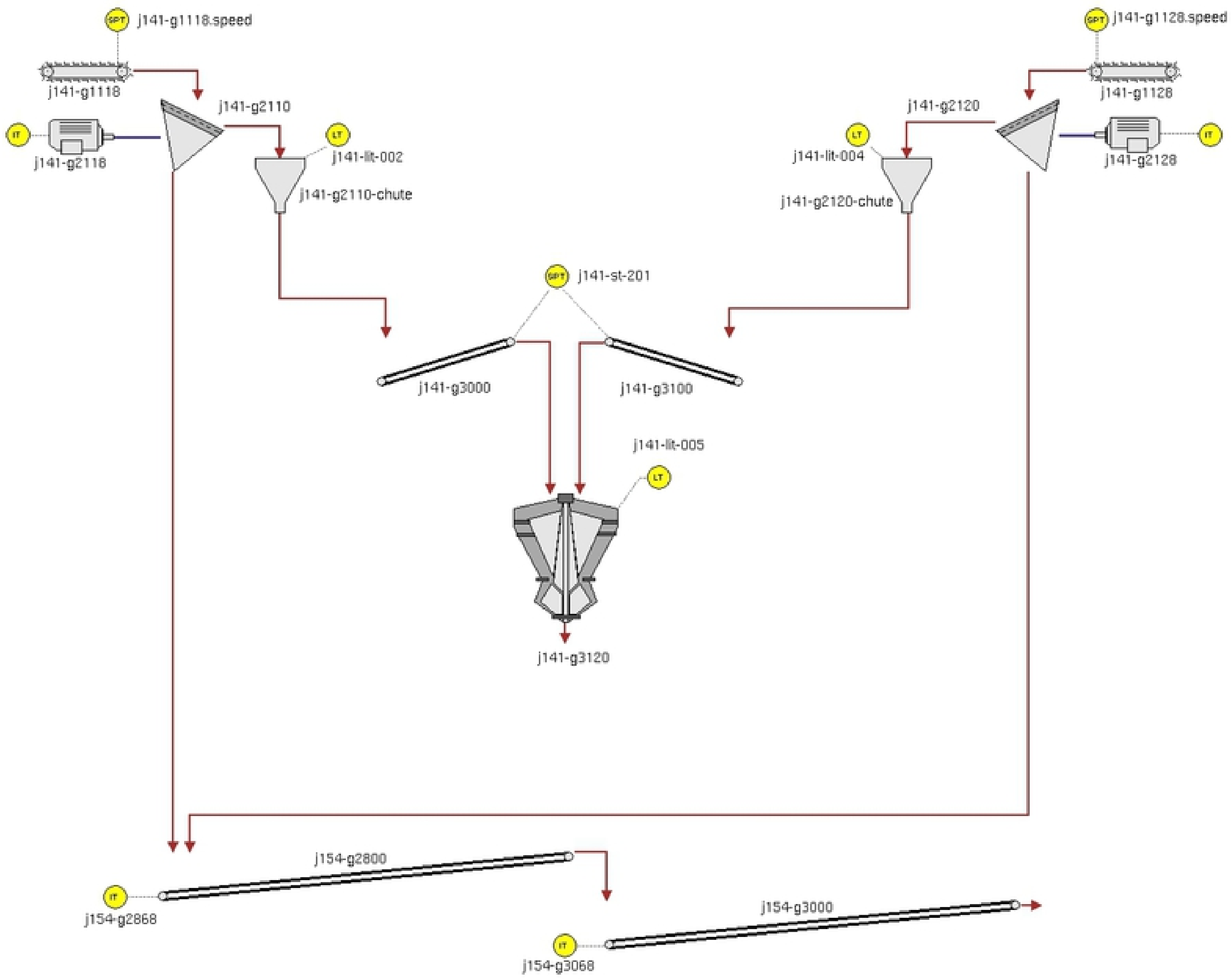



*Fig 4: Relevant Circuit Schematic*

## 1.4.2) Measures

### 1.4.2.1) Scrn-J141-G2110: Measure: Nr-Starts

| Nr-Starts Measure | | | | | | | |
|---|---|---|---|---|---|---|---|
| Measure | Goal | EU | Owner | Key Performance Indicator (KPI)? | Lower Control Limit (LCL) | Target Value | Upper Control Limit (UCL) |
| NR-STARTS | MINIMIZE | | APC-CUSTODIAN | false | 0 | 0 | 10 |

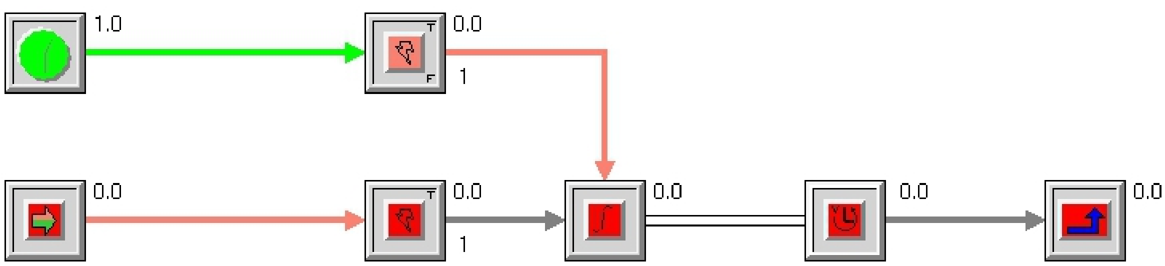



*Fig 5: Determining Nr-Starts*

### 1.4.2.2) Scrn-J141-G2120: Measure: Nr-Starts

| Nr-Starts Measure | | | | | | | |
|---|---|---|---|---|---|---|---|
| Measure | Goal | EU | Owner | Key Performance Indicator (KPI)? | Lower Control Limit (LCL) | Target Value | Upper Control Limit (UCL) |
| NR-STARTS | MINIMIZE | | APC-CUSTODIAN | false | 0 | 0 | 10 |

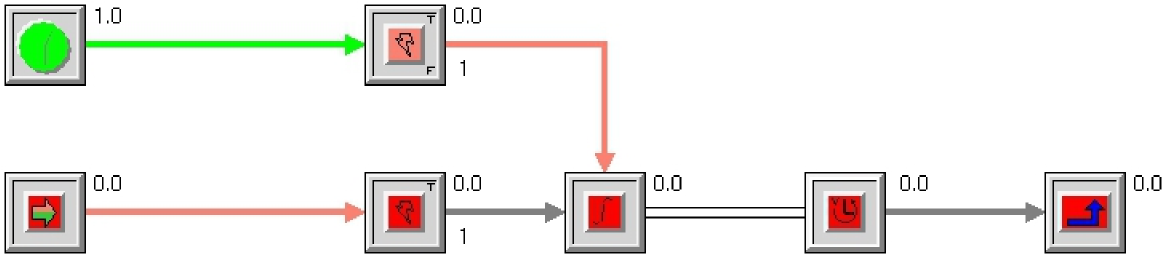



*Fig 6: Determining Nr-Starts*

## 2) BASIC CONTROL

### 2.1) Description

When in regulatory control mode (PLC based control), the feed rate to the screen (J141-G2110) will be manipulated by the level PID controller (J141-G1118). This PID controller will manipulate the tertiary crusher (J141-G3120) feeder (J141-G1118) speed (J141-G1118.SPEED). The level setpoint for this controller is determined by the control room operator. The process value for this PID controller is measured as the tertiary crusher chute (J141-G2110-CHUTE) level (J141-LIT-002).
When in regulatory control mode (PLC based control), the feedrate to the screen (J141-G2120) will be manipulated by the level PID controller (J141-G2118). This PID controller will manipulate the tertiary crusher (J141-G3120) feeder (J141-G1128) speed (J141-G1128.SPEED). The level setpoint for this controller is determined by the control room operator. The process value for this PID controller is measured as the tertiary crusher chute (J141-G2120-CHUTE) level (J141-LIT-004).
When in regulatory control mode (PLC based control), the feedrate to the tertiary crusher (J141-G3120) will be manipulated by the speed PID controller (). This PID controller will manipulate the tertiary crusher (J141-G3120) conveyors (J141-G3000 and J141-G3100) speed (). The speed setpoint for this controller is determined by the control room operator. The process value for this PID controller is measured as the tertiary crusher cavity level (154-G3000).

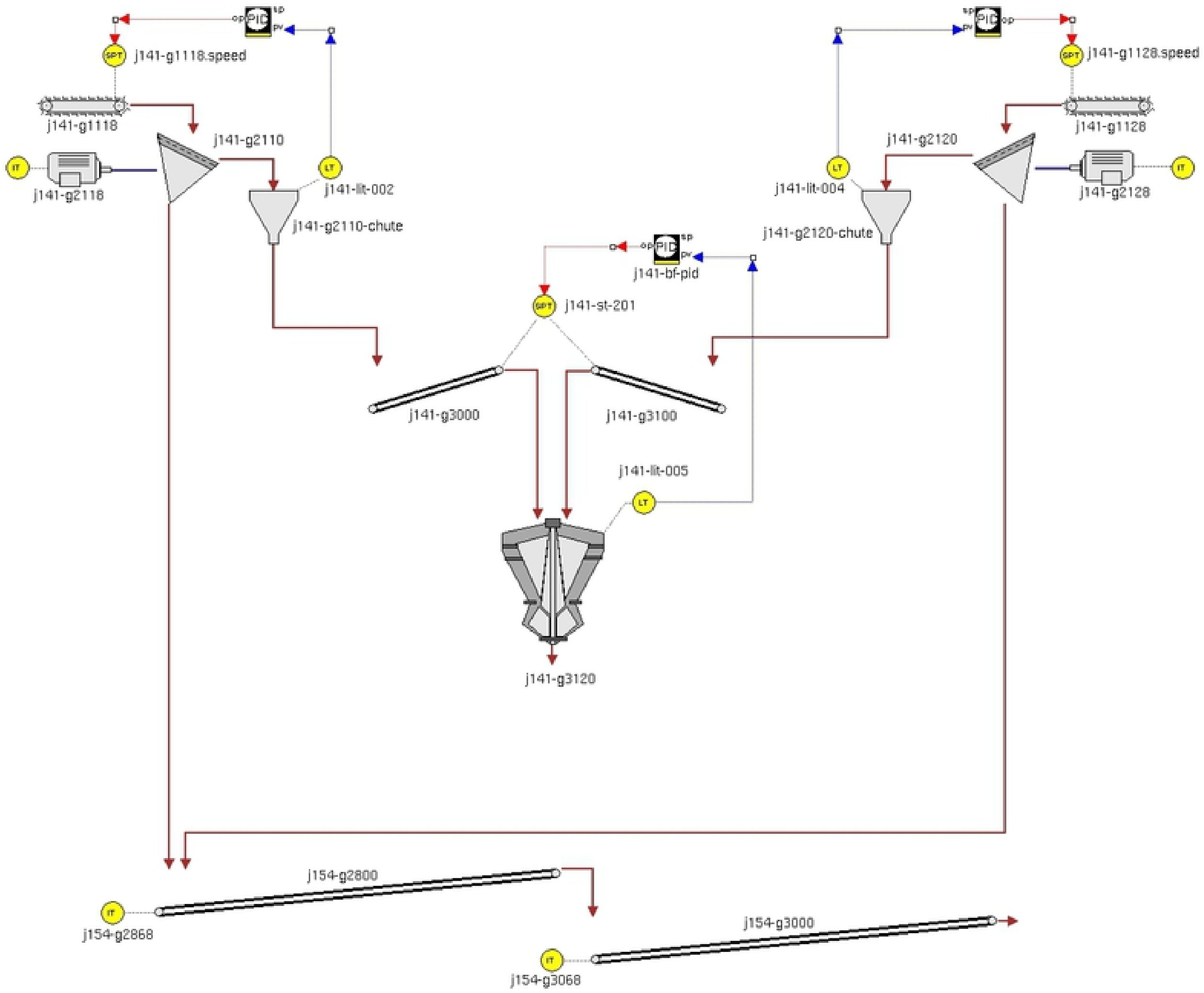



*Fig 7: Circuit with Basic Control*

### 2.2) PID Tuning Parameters

| PID Tuning | | | |
|---|---|---|---|
| Controller ID | P | I | D |
| J141-G1118 | 0.30 | 20000.00 | 0.00 |
| | | | |

| | | | |
|---|---|---|---|
| J141-G2118 | 0.26 | 88000.00 | 0.00 |
| J141-BF-PID | 0.26 | 88000.00 | 0.00 |

# 3) ADVANCED CONTROL

## 3.1) Description

The advanced control layer makes use of a fuzzy logic rule-based algorithm and model predictive control that utilizes the tertiary crusher's vibrating feeder 1 (J141-G1118.SPEED) AND the tertiary crusher's vibrating feeder 2 (J141-G1128.SPEED) feeding from the tertiary crusher feed bin (J140-BIN-01) to control the chute 1 level (J141-LIT-002), screen 1 current (J141-G2118), chute 2 level (J141-LIT-004), screen 2 current (J141-G2128), undersize conveyor current (J154-G2868) and the JIG stockpile feed conveyor current (J154-G3068).
**The objective of the advanced process controller (J141_LIC_002_004C) is to optimize the feed rate to the screens (J141-G2110 and J141-G2120), transfer chutes (J141-G2110-CHUTE and J141-G2120-CHUTE) and the tertiary crusher (). This will be accomplished by manipulating the tertiary crusher feed bin feeders (J141-G1118 and J141-G1128) speeds (J141-G1118.SPEED and J141-G1128.SPEED) and the tertiary crusher feeder conveyors (J154-G2800 and J154-G3000) speed () without overloading the -25mm conveyors (J154-G2800 and J154-G3000) and exceeding the high limit of the chute levels (J141-LIT-002 and J141-LIT-004).**
**Additional Controller Logic**
Additional control logic is added to set the vibrating feeder speed (J141-G1118.SPEED) to max when the level in chute (J141-G2110-CHUTE) is below its low limit. The same logic was also added to set the vibrating feeder speed (J141-G1128.SPEED) to max when the level in chute (J141-G2120-CHUTE) is below its low limit. As soon as the level in the chutes (J141-G2110-CHUTE) and (J141-G2120-CHUTE) are above the low limit, the MPC is allowed to take over and control the level between its limits.
Logic have also been added to start reducing the feeder speed, if the chute level is above 35 % and the chute level rate of change is posetive, by 2 %, however if the MPC wants to reduce the speed by more than 2 %, the MPC change will be accepted.

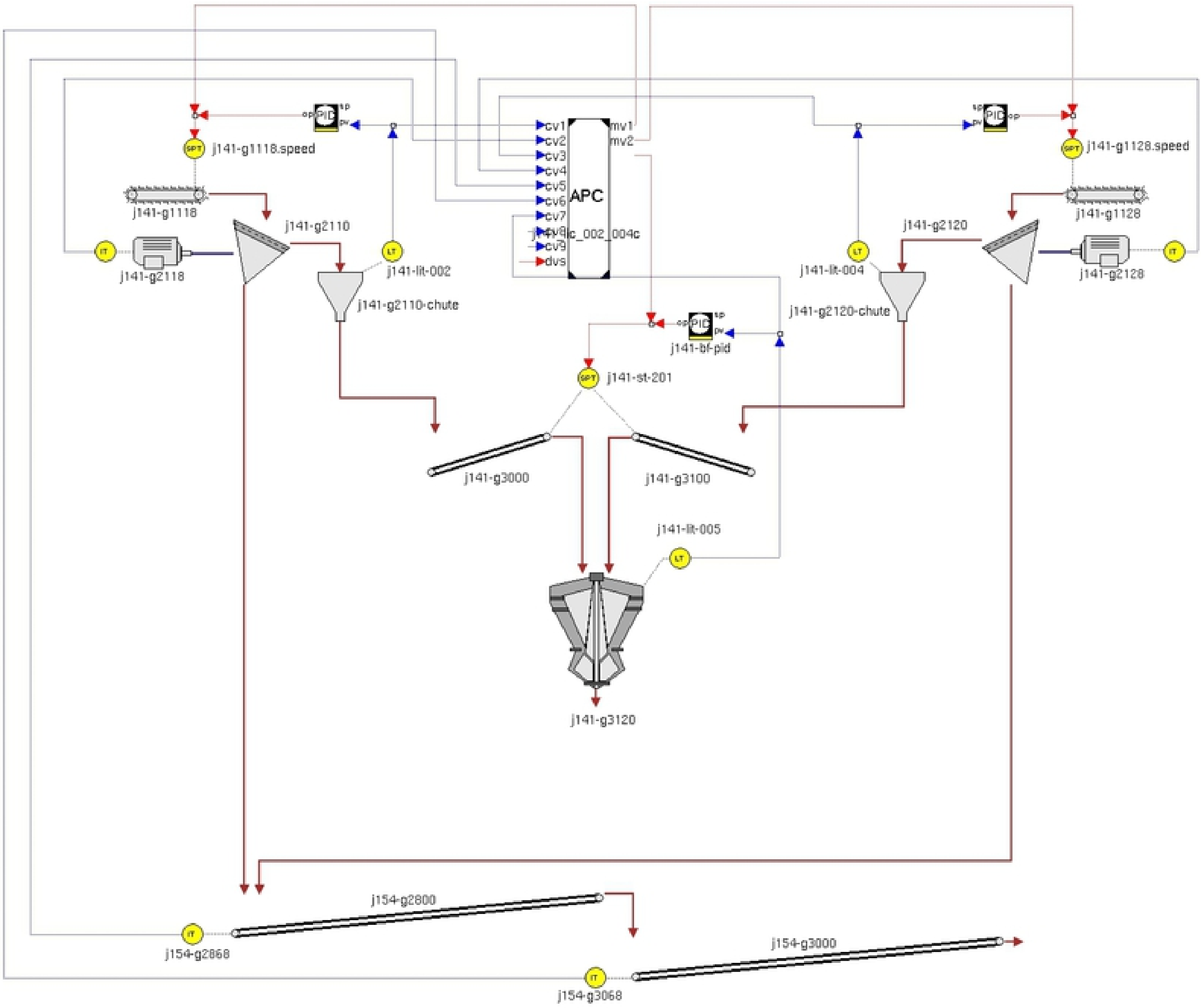



*Fig 8: Circuit with Advanced Control*

## 3.2) Controlled Variables

**The first process variable** is the transfer chute (J141-G2110-CHUTE) level reading (J141-LIT-002). This level reading represents the level of the tertiary crusher () feed chute (J141-G2110-CHUTE).
In the event that the chute level reaches a high limit as entered on the SCADA faceplate.
The following actions will be taken:
1. The feedrate from the bin (J140-BIN-01) to the chute (J141-G2110-CHUTE) will be reduced by:
a. Decreasing the feeder (J141-G1118) speed (J141-G1118.SPEED) which will reduce the feedrate to the chute (J141-G2110-CHUTE).
**The second process controlled variable** is the screen (J141-G2110) current (J141-G2118). This current is provided as an override control, it is important to prevent the screen (J141-G2110) motor current (J141-G2118) from reaching the high limit as entered on the SCADA faceplate.
The following actions will be taken:
1. The feedrate from the bin (J140-BIN-01) to the screen (J141-G2110) will be reduced by:
a. Decreasing the feeder (J141-G1118) speed (J141-G1118.SPEED) which will reduce the feedrate to the screen (J141-G2110) and reduce the screen motor current (J141-G2118).
**The third process variable** is the transfer chute (J141-G2120-CHUTE) level reading (J141-LIT-004). This level reading represents the current level of the tertiary crusher () feed chute (J141-G2120-CHUTE).
In the event that the chute level reaches a high limit as entered on the SCADA faceplate:
The following actions will be taken:
1. The feedrate from the bin (J140-BIN-01) to the chute (J141-G2120-CHUTE) will be reduced by:
a. Decreasing the feeder (J141-G1128) speed (J141-G1128.SPEED) which will reduce the feedrate to the chute (J141-G2120-CHUTE).
**The fourth process variable** is the second screen (J141-G2120) current (J141-G2128). This current is provided as an override control, it is important to prevent the screen (J141-G2120) motor current (J141-G2128) from reaching the high limit as entered on the SCADA faceplate.
The following actions will be taken:
1. The feedrate from the bin (J140-BIN-01) to the screen (J141-G2120) will be reduced by:
a. Decreasing the feeder (J141-G1128) speed (J141-G1128.SPEED) which will reduce the feedrate to the screen (J141-G2120) and reduce the screen motor current (J141-G2128)
**The fifth process variable** is the screens (J141-G2110 and J141-G2120) undersize ( -25mm ) conveyor (J154-G2800) motor current (J154-G2868). The current is provided as an override control, as it is important to prevent the tertiary crusher screens undersize conveyor (J154-G2800) motor current (J154-G2868) from reaching the high limit as entered on the SCADA faceplate.
The following actions will be taken:
1. The feedrate from the bin (J140-BIN-01) to the screen (J141-G2110) will be reduced by:
a. Decreasing the feeder (J141-G1118) speed (J141-G1118.SPEED) will reduce the feedrate to the screen (J141-G2110) which will reduce the amount of under size product feeding conveyor (J154-G2800).
2. The feedrate from the bin (J140-BIN-01) to the screen (J141-G2120) will be reduced by:
a. Decreasing the feeder (J141-G1128) speed (J141-G1128.SPEED) will reduce the feedrate to the screen (J141-G2120) which will reduce the amount of under size product feeding conveyor (J154-G2800).
**The sixth process variable** is the JIG stockpile feed conveyor current (J154-G3068). The current is provided as an override control, as it is important to prevent the JIG stockpile feed conveyor (J154-G3000) motor current (J154-G3068) from reaching the high limit as entered on the SCADA faceplate.
The following actions will be taken:
1. The feedrate from the bin (J140-BIN-01) to the screen (J141-G2110) will be reduced by:
a. Decreasing the feeder (J141-G1118) speed (J141-G1118.SPEED) which will reduce the feedrate to the screen (J141-G2110) which will reduce the amount of under size product feeding the JIG stockpile feed conveyor (J154-G3000).
2. The feedrate from the bin (J140-BIN-01) to the screen (J141-G2120) will be reduced by:
Decreasing the feeder (J141-G1128) speed (J141-G1128.SPEED) will reduce the feedrate to the screen (J141-G2120) which will reduce the amount of under size product feeding the JIG stockpile feed conveyor (J154-G3000).

The following table lists the relevant controlled variables for this controller along with their engineering units and control limits. Note that these control limits can be adjusted from the SCADA faceplate

| APC CVs for APC-J141_LIC_002_004C | | | | |
|---|---|---|---|---|
| Description | ID | EU | Low | High |
| CV1: T-Crusher-1 J141-Rockbox-1 Level | J141-LIT-002 | % | 25.00 | 62.00 |
| CV2: Screen Motor J141-G2118 Current | J141-G2118 | A | 25.00 | 67.00 |
| CV3: T-Crusher-1 J141-Rockbox-2 Level | J141-LIT-004 | % | 25.00 | 62.00 |
| CV4: Screen Motor J141-G2128 Current | J141-G2128 | A | 25.00 | 67.00 |
| CV5: Tertiary Crusher Conveyor J154-G2800 Current | J154-G2868 | A | 0.00 | 88.40 |
| | | | | |

| | | | | |
|---|---|---|---|---|
| CV6: Tertiary Crusher Conveyor J154-G3000 Current | J154-G3068 | A | 0.00 | 78.70 |
| CV7: Tertiary Crusher Conveyor J154-G3000 Total-Product-Weightometer | 154-G3000 | ton/hr | 0.00 | 5000.00 |
| CV8: T-Crushing Feed Bin J154-BIN-01 Level-02 | J140-LIT-002 | % | 20.00 | 70.00 |
| CV9: T-Crushing Feed Bin J154-BIN-01 Level-03 | J140-LIT-003 | % | 20.00 | 70.00 |

## 3.3) Manipulated Variables

**The first manipulated variable** is the feeder speed (J141-G1118) which will write directly to the feeder (J141-G1118) speed (J141-G1118).
Increasing the feeder speed will:
1. Increase the feed to the screen (J141-G2110) and
2. Increase the chute () level (J141-LIT-002) and
3. Increase the feed to screen undersize conveyors (J141-G3000 and ).
**The second manipulated variable** is the feeder speed (J141-G2118) which will write directly to the feeder (J141-G1128) speed (J141-G2118).
Increasing the feeder speed will:
1. Increase the feed to the screen () and
2. Increase the chute (J141-G2120-CHUTE) level (J141-LIT-004) and
3. Increase the feed to screen undersize conveyors (J141-G3000 and ).

The following table lists the relevant manipulated variables for this controller along with their engineering units and control limits. Note that these control limits can be adjusted from the SCADA faceplate

| APC MVs for APC-J141_LIC_002_004C | | | | |
|---|---|---|---|---|
| Description | ID | EU | Low | High |
| MV1: Feeder J141-G1118 | J141-G1118 | % | 40.00 | 90.00 |
| MV2: Feeder J141-G1128 | J141-G1128 | % | 40.00 | 95.00 |

## 3.4) Disturbance Variables

The following table lists the relevant disturbance variables for this controller along with their engineering units.

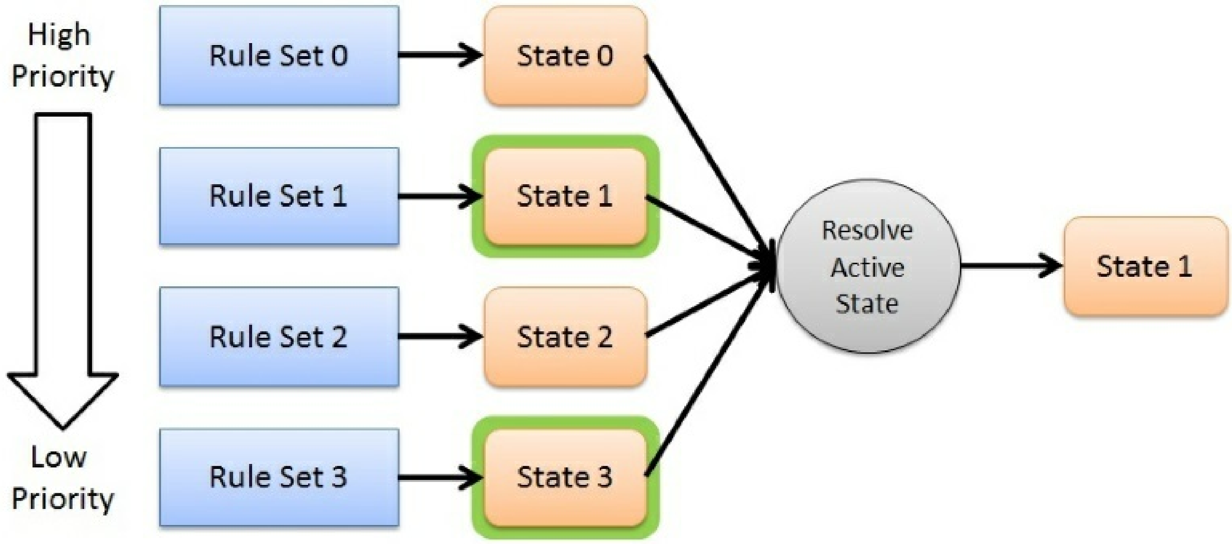
| APC DVs for APC-J141_LIC_002_004C | | |
|---|---|---|
| Description | ID | EU |
| DV1: Conveyor J141-G3000 Hz-Speed | J141-ST-101 | Hz |
| DV2: Conveyor J141-G3100 Hz-Speed | J141-ST-201 | Hz |

## 3.5) Objectives and KPI's

| Objectives For Apc-J141_Lic_002_004c | | | | |
|---|---|---|---|---|
| Measure | Goal | Owner | KPI | Weight |

## 3.6) Process States

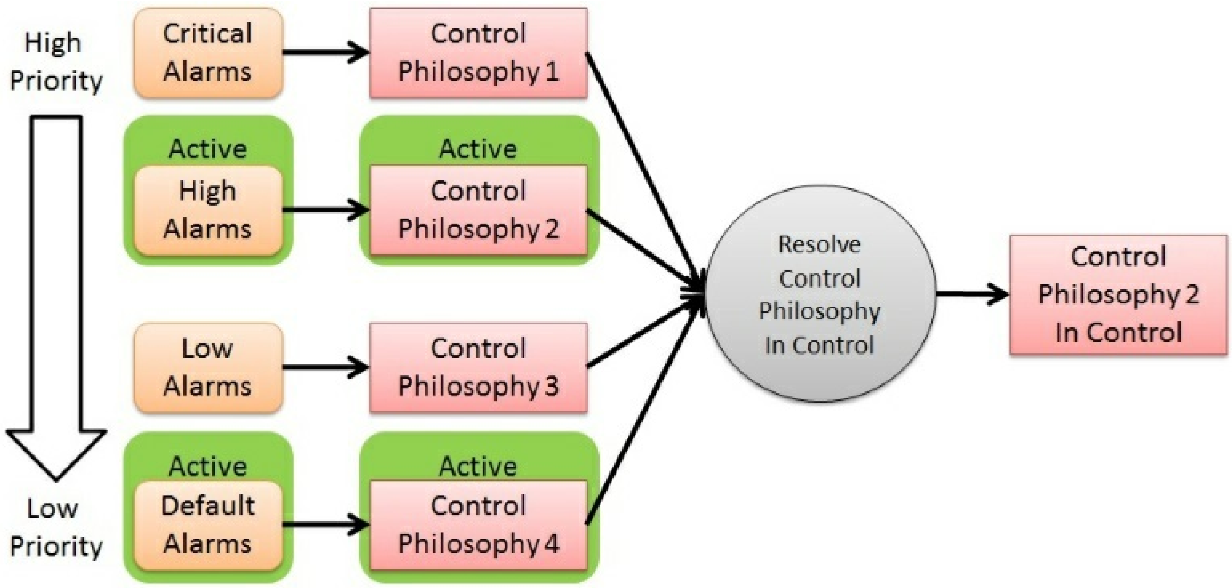
In APET, control philosophies are built around the state of the process. Different process conditions (broadly speaking) require different actions to be taken to achieve performance targets. In APET, process states are resolved through graphical rules and used in a hierarchical bidding system to determine the current process state. The governing state is then used in deciding which control scheme to implement.
These two steps are briefly described below.
1) Active State Resolution
Each state is determined by a set of rules. These are usually built up using graphical rules and may monitor any information available within the APET application. A state is considered active if all specified conditions are met. This means that it is possible the more than one state can be active at a time. To deal with this, states are ranked based on a priority, so that the active state with the highest priority becomes the in-control state.




Because it is also possible that no states are active, it is important to select a state that acts as the default state. The default state usually corresponds to the state with the lowest priority (default alarms).

2) Control Philosophy Resolution

Each state corresponds to a specific control philosophy that will be implemented. Once the active state has been determined, the corresponding control philosophy is activated.




There are always 4 controller states for every APC controller in APET. These controller states are grouped together as follows:

1. Critical Alarms
2. High Alarms
3. Low Alarms
4. Default Alarms

Each of these 4 controller states may containing at least one referencing state. For example, the Default Alarms container will contain the MPC optimizer and default states amongst others.

Based on the referenced states of each controller state, the State Index of the controller state may be:

0 if it is not active

1 active but not in-control

2 active AND in-control

All of the attributes of the controller states are display on the SCADA faceplate.

### 3.6.1) CRITICAL-ALARMS

The following CRITICAL-ALARMS are defined:

### 3.6.1.1) Chute-J141-G2110-Level-High

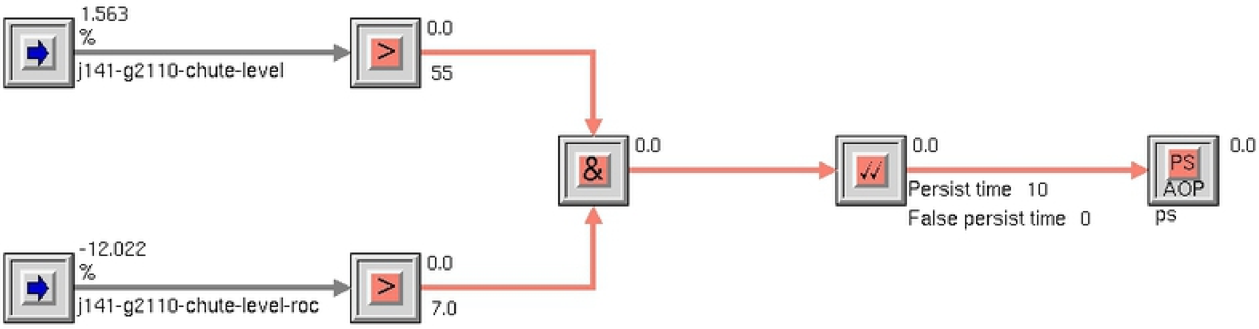



*Fig 9: Determining Chute-J141-G2110-Level-High*

### 3.6.1.2) Chute-J141-G2120-Level-High

This process state determines if the chute level (J141-LIT-004) is above 55.0% for longer than 10 seconds.
While this state is true the chute extraction conveyor speed (J141-ST-201) should be increased. This will decrease the level of the chute (J141-G2120-CHUTE).

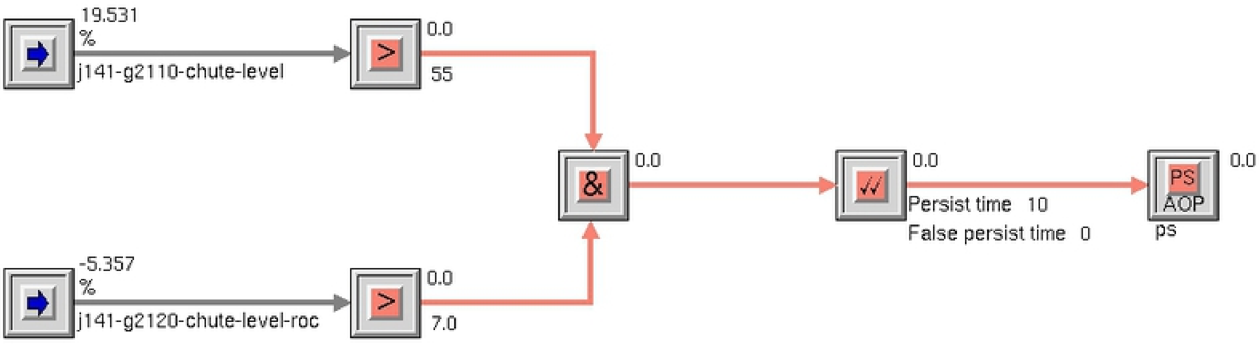



*Fig 10: Determining Chute-J141-G2120-Level-High*

## 3.6.2) HIGH-ALARMS

The following HIGH-ALARMS are defined:

### 3.6.2.1) Chute-J141-G2120-Level-Extr-Low

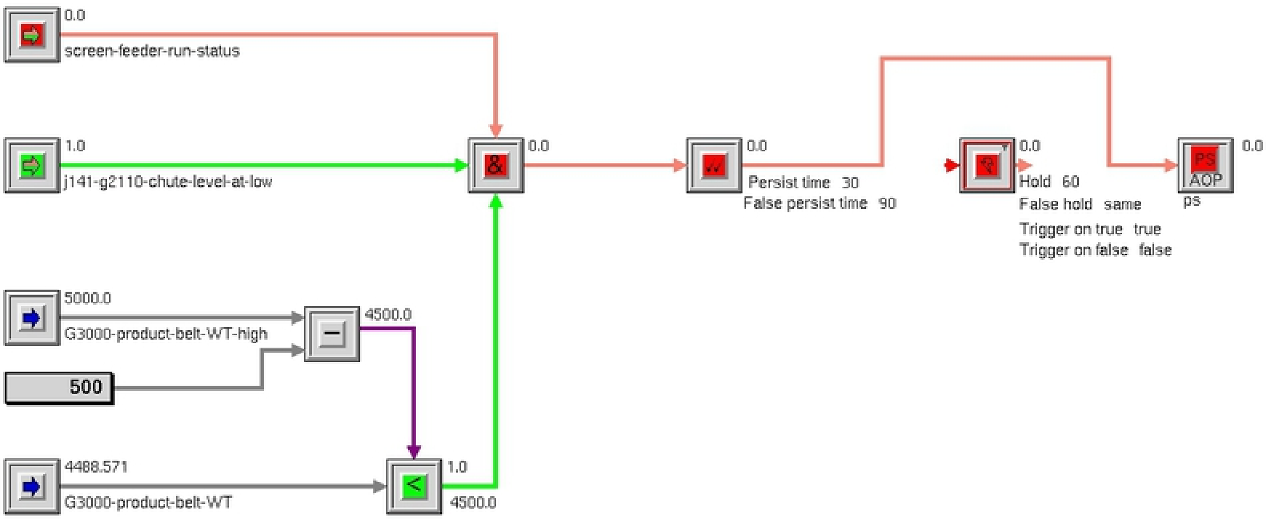



*Fig 11: Determining Chute-J141-G2120-Level-Extr-Low*

### 3.6.2.2) Chute-J141-G2110-Level-Extr-Low

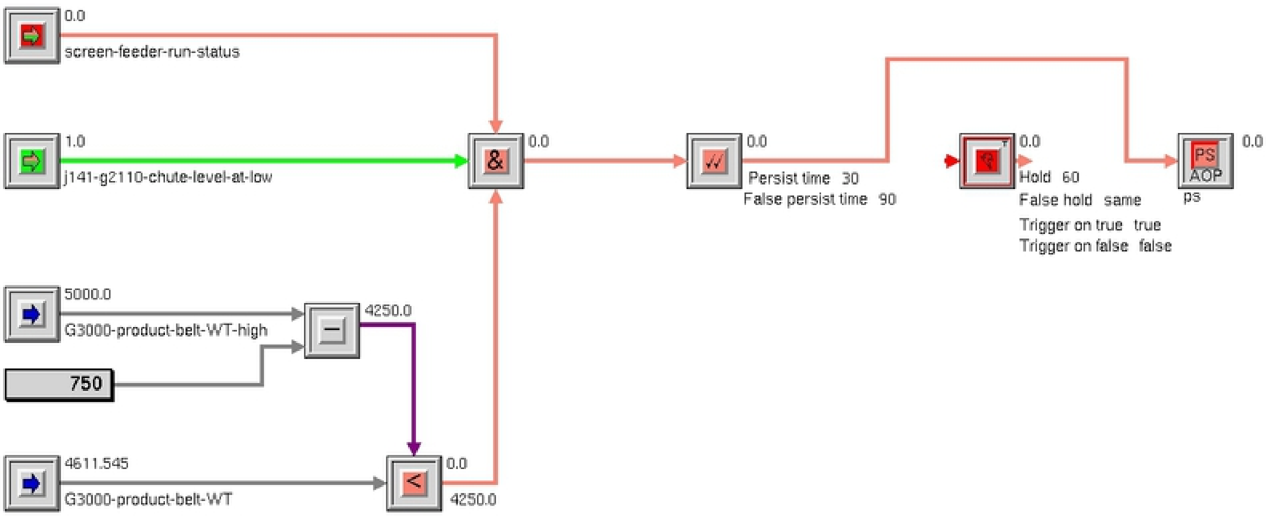



*Fig 12: Determining Chute-J141-G2110-Level-Extr-Low*

### 3.6.2.3) Conveyor-154-G3000-Constrained

This process state determines if the JIG feed stockpile conveyor (J154-G3000) current (J154-G3068) is constrained. This process state becomes true when the JIG feed stockpile conveyor current (J154-G3068) reaches a high limit as set on the SCADA face plate.
While this state is true the tertiary crusher feeders speed (J141-G1118.SPEED and J141-G1128.SPEED) must be decreased. This will decrease the feed to the two screens (J141-G2110 and J141-G2120) and reduce the feed to the conveyor (J154-G3000).

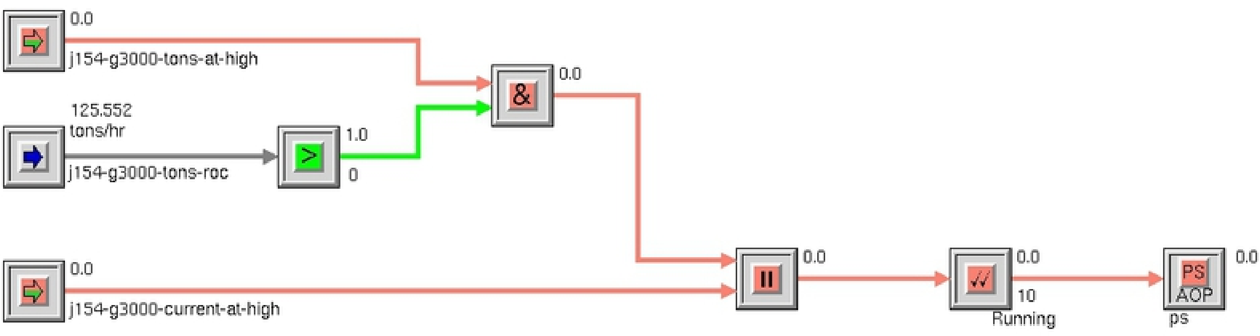



*Fig 13: Determining Conveyor-154-G3000-Constrained*

#### 3.6.2.4) Conveyor-154-G2800-Constrained

This process state determines if the screens under size conveyor (J154-G2800) current (J154-G2868) is constrained. This process state becomes true when the screens under size conveyor current (J154-G2868) reaches a high limit as set on the SCADA face plate.
While this state is true the tertiary crusher feeders speed (J141-G1118.SPEED and J141-G1128.SPEED) must be decreased. This will decrease the feed to the two screens (J141-G2110 and J141-G2120) and reduce the feed to the conveyor (J154-G2800).

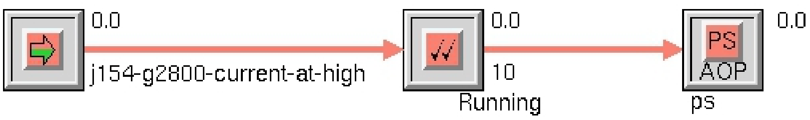



*Fig 14: Determining Conveyor-154-G2800-Constrained*

### 3.6.3) LOW-ALARMS

The following LOW-ALARMS are defined:

#### 3.6.3.1) Screen-J141-G2120-Constrained

This process state determines if the screen motor current (J141-G2128) is constrained. This process states becomes true when the screen motor current (J141-G2128) reaches the high limit as set on the SCADA faceplate.
While this state is true the tertiary crusher feeder speed (J141-G1128.SPEED) must be decreased. This will decrease the feed to the screen (J141-G2120).

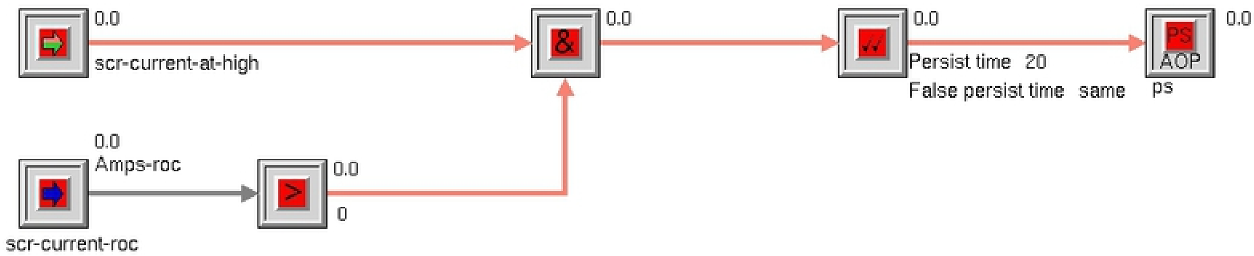



*Fig 15: Determining Screen-J141-G2120-Constrained*

#### 3.6.3.2) Screen-J141-G2110-Constrained

This process state determines if the screen motor current (J141-G2118) is constrained. This process states becomes true when the screen motor current (J141-G2118) reaches the high limit as set on the SCADA faceplate.

While this state is true the tertiary crusher feeder speed (J141-G1118.SPEED) must be decreased. This will decrease the feed to the screen (J141-G2110).

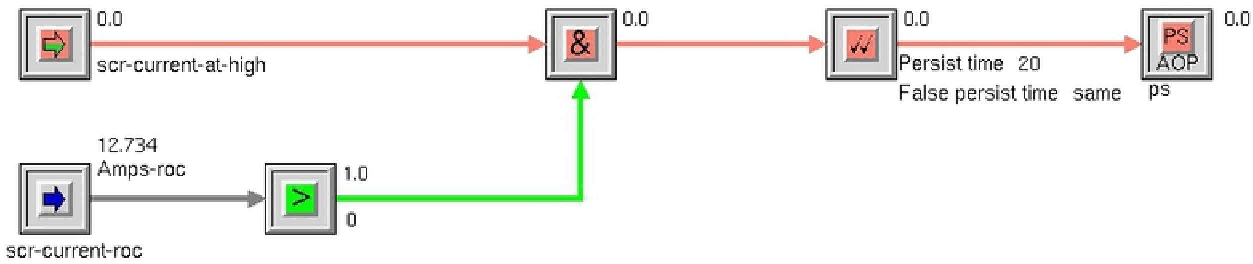



*Fig 16: Determining Screen-J141-G2110-Constrained*

## 3.6.4) DEFAULT-ALARMS

The following DEFAULT-ALARMS are defined:

### 3.6.4.1) Mpc-Optimizer

Discrete logic ensuring that:
the operator request is ON;
the MPC controller is switched ON; and
the communications between the MPC and APET are OK (HB healty).
Note that the MPC optimizer state will be true (Active) if the logic above is true. The MPC optimizer will be In Control if none of the higher priority states are true.

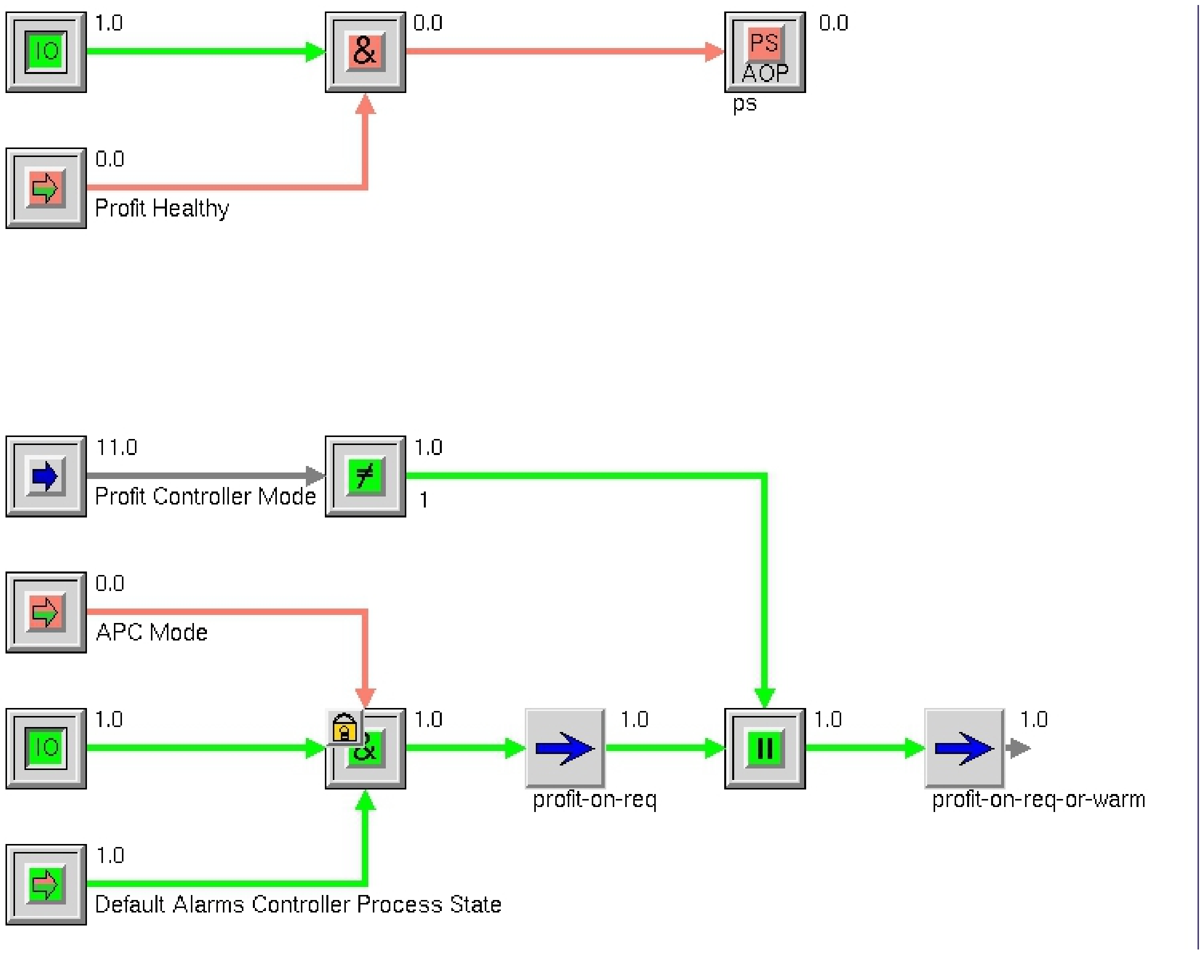



*Fig 17: Determining Mpc-Optimizer*

#### 3.6.4.2) Default-Root

This process state determines if the crusher bin level is above 40.0%. When the Secondary Crusher feed bin lelel is high, the APC controller should not attempt to make CSS changes to Crusher 1 (Belief = 0.5) . The reason being that once a new CSS SP is written to the PLC, the Crusher Feeder will be I/Locked, which will cause the bin level High High Limit to be reached. This will I/Lock all the conveyors upstream in a cascade mode, which will result in a ZERO production scenario. Zero production is worse than production at a less than optimal Lump:Fine Ratio.

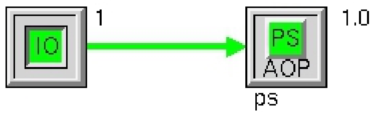



*Fig 18: Determining Default-Root*

## 3.7) Interlocks

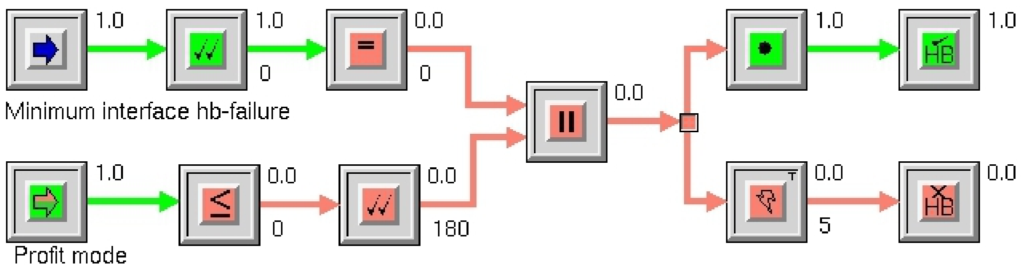
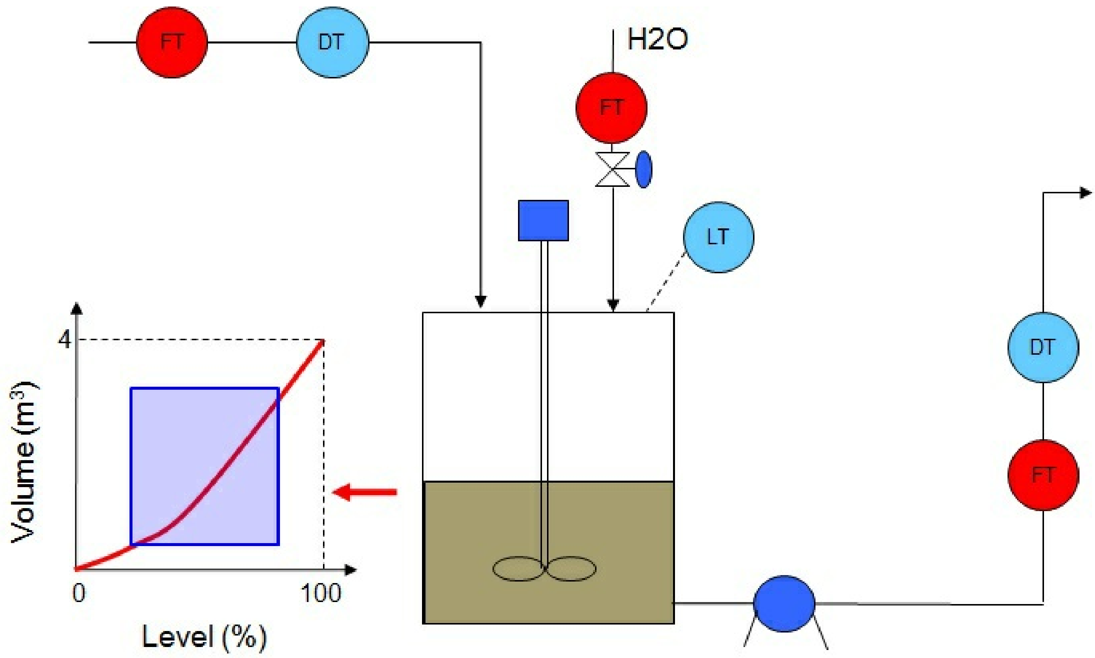




*Fig 19: Interlocks: Apc-J141_Lic_002_004c.interlocks*

## 4) Control Technologies

Model predictive control (MPC) is an advanced method of process control that has been in use in the process industries in chemical plants and oil refineries since the 1980s. Model predictive controllers rely on dynamic models of the process, most often linear empirical models obtained by system identification. Dynamic process models describe how the process parameters will respond in the future for changes made to the process in the present time. These models can therefore predict process responses into the future. The main advantage of MPC is the fact that it allows for the current process conditions (current timeslot) to be optimized, while accounting for future process conditions (future timeslots) still to happen as a result of changes to the current process conditions. This is achieved by optimizing over a finite time-horizon (the future predictions), implementing the current timeslot actions and then relying on feedback to account for unmeasured disturbances and model/plant mismatches. This implies that the model prediction error that may exist (or develop over time) is also taken into account by the MPC algorithm. MPC models therefore do not have to be 100% accurate. As a result of this the MPC technology is very robust, and typically outperforms most other advanced process control techniques. The MPC further has the ability to anticipate/predict future events and can take control actions accordingly. An example of this is that the MPC can predict that the bin level will drop below the low level limit, which will result in the feeder being interlocked and stopped. The feeder stop will again cause the bin level to increase sharply. The MPC can take all of these future predictions into account and prevent this scenario from happening. PID controllers normally implemented as part of the base layer (PLC) control do not have this predictive ability. Therefore the PID controller in the base layer (PLC) control will not be able to prevent the above feeder interlock and stop.
The models used in MPC are generally intended to represent the behaviour of complex dynamic systems, which cannot be effectively controlled by base layer (PLC) controllers such as PID controllers. Dynamic characteristics that are difficult for PID controllers include large time delays, variable interaction and high-order dynamics.
MPC uses current and historical plant responses/measurements, the current dynamic state of the process, the MPC models, and the process variable targets and limits to calculate future changes in the dependent variables (the variables to be controlled, such as bin levels and product mass flowrates). These changes are calculated to hold the dependent variables close to target while honoring constraints on both independent (the levers that can be pulled by the MPC system, such as feeder speeds or PID setpoints) and dependent variables. The MPC typically sends out only the first setpoint change (of the sequence of calculated changes required going into the future) in each independent variable to be implemented, and repeats the calculation when the next change is required (by updating the sequence of calculated changes required going into the future).
Below is an image to illustrate the concepts:




In summary, Model Predictive Control (MPC) is a multivariable control algorithm that uses:
1. an internal dynamic model of the process
2. a history of past control moves and
3. an optimization cost function J over the receding prediction horizon,
to calculate the optimum control moves.
An example of a quadratic cost function for optimization is given by:

$$J = \sum_{i=1}^{N} w_{x_i}(r_i - x_i)^2 + \sum_{i=1}^{N} w_{u_i}\,\Delta {u_i}^2$$

With:

$X_i$ = *i*-th controlled variable (e.g. measured bin level)

$r_i$ = *i*-th reference variable (e.g. required bin level)

$u_i$ = *i*-th manipulated variable (e.g. feeder speed)

$w_{Xi}$ = weighting coefficient reflecting the relative importance of $X_i$

$w_{ui}$ = weighting coefficient penalizing relative big changes in $u_i$

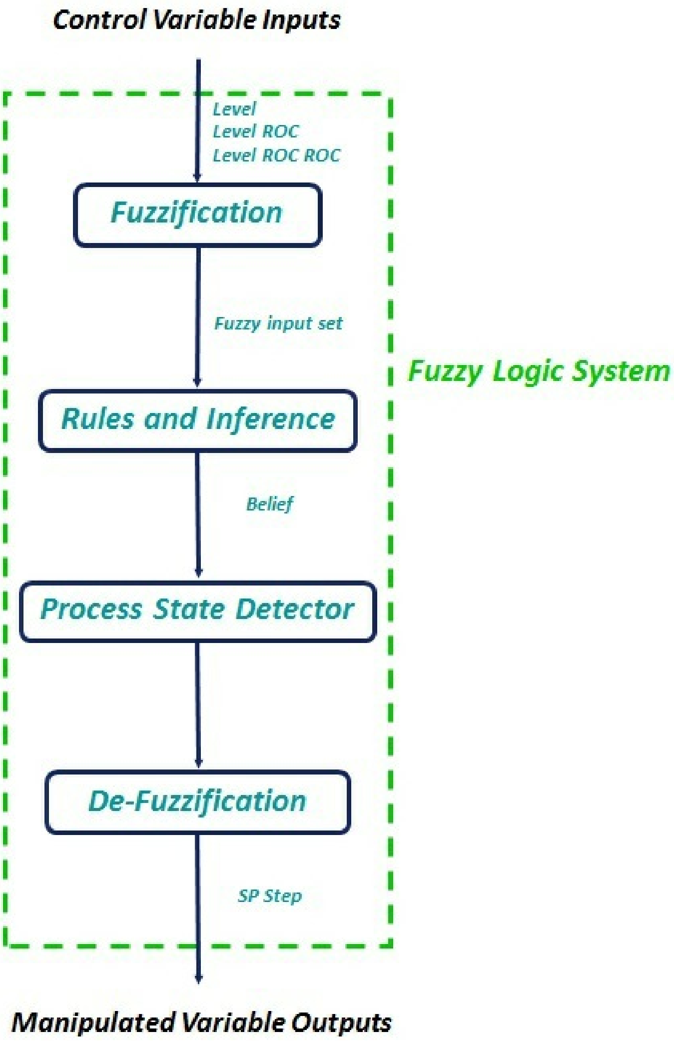
The figure below represents the model matrix for the secondary crusher model predictive controller, showing the dynamic step response between each controller input-output pair.

## 4.1) Expert Rule Based Control

## 4.2) Fuzzy Control

### 4.2.1) Fuzzy Sets

A fuzzy logic system (FLS) can be defined as the nonlinear mapping of an input data set to a scalar output data. A FLS consists of four main parts: fuzzifier, rules, inference engine, and defuzzifier. These components and the general architecture of a FLS is shown in the figure below.




The process of fuzzy logic is defined as follows: Firstly, a crisp set of input data are gathered and converted to a fuzzy set using fuzzy linguistic variables, fuzzy linguistic terms and membership functions. This step is known as fuzzification. Afterwards, an inference is made based on a set of rules. Lastly, the resulting fuzzy output is mapped to a crisp output using the membership functions, in the defuzzification step.
The fuzzy logic algorithm can be summarized as follows:
1. Define the linguistic variables and terms (initialization)
2. Construct the membership functions (initialization)
3. Construct the rule base (initialization)
4. Convert crisp input data to fuzzy values using the membership functions (fuzzification)
5. Evaluate the rules in the rule base (inference)
6. Combine the results of each rule (inference)
7. Convert the output data to non-fuzzy values (defuzzification)
Linguistic variables are the input or output variables of the system whose values are words or sentences from a natural language, instead of numerical values. A linguistic variable is generally decomposed into a set of linguistic terms. Example: Leven in a bin. Let level (LVL) be the linguistic variable which represents the amount of metarial in the bin. To qualify the level, terms such as high and low are used in real life. These are the linguistic values of the level. Then, LVL(t) = extremely low, low, ok, high, extremely high can be the set of decompositions for the linguistic variable level. Each member of this decomposition is called a linguistic term and can cover a portion of the overall values of the bin level.
Membership functions are used in the fuzzification and defuzzification steps of a FLS, to map the non-fuzzy input values to fuzzy linguistic terms and vice versa. A membership function is used to quantify a linguistic term. Note that, an important characteristic of fuzzy logic is that a numerical value does not have to be fuzzified using only one membership function. In other words, a value typically belongs to multiple sets at the same time. For example the bin level value can be considered as extremely low and low at the same time, with different degrees of memberships.
APET includes a powerful fuzzy controller toolset which includes a very flexible editing environment as well as a variety of membership functions to be used.
Each CV feeding into the controller is fuzzified (classified within a fuzzy membership function) by one or more FIS-INPUTS. For control variables (CV) there are typically three types of classification: proximity (this relates to the

normalised value), slope (rate of change) and slope rate of change (this implies acceleration).
For each of the fuzzy families, a specific input must be provided based on the value of the CV (and its recent history).
1. Proximity: this is a comparison of the normalised value of the CV
2. Slope: this represents the slope or rate of change of the CV over a defined period and is calculated within the APC system
3. Slope Rate of Change: this represents the rate of change of the slope of the CV and is calculated within the APC system

#### 4.2.1.1) Fuzzy Sets For CHUTE-J141-G2110-CHUTE.LEVEL

There are no fuzzy sets for first transfer chute(J141-G2110-CHUTE) level (J141-LIT-002). This reading is used by the model predictive controller as a control variable (CV).

#### 4.2.1.2) Fuzzy Sets For MOTOR-J141-G2118.CURRENT

There are no fuzzy sets for the first screen (J141-G2110) motor current (Screen Motor J141-G2118 Current). This reading is used by the model predictive controller as a control variable (CV).

#### 4.2.1.3) Fuzzy Sets For CHUTE-J141-G2120-CHUTE.LEVEL

There are no fuzzy sets for the second transfer chute(J141-G2120-CHUTE) level (J141-LIT-004). This reading is used by the model predictive controller as a control variable (CV).

#### 4.2.1.4) Fuzzy Sets For MOTOR-J141-G2128.CURRENT

There are no fuzzy sets for the second screen (J141-G2120) motor current (Screen Motor J141-G2128 Current). This reading is used by the model predictive controller as a control variable (CV).

#### 4.2.1.5) Fuzzy Sets For CNVYR-J154-G2800.CURRENT

There are no fuzzy sets for the screens (J141-G2110 and J141-G2120) under size conveyor (J154-G2800) motor current (J154-G2868). This reading is used by the model predictive controller as a control variable (CV).

#### 4.2.1.6) Fuzzy Sets For CNVYR-J154-G3000.CURRENT

There are no fuzzy sets for the JIG stockpile feed conveyor (J154-G3000) motor current (Tertiary Crusher Conveyor J154-G3000 Current). This reading is used by the model predictive controller as a control variable (CV).

#### 4.2.1.7) Fuzzy Sets For CNVYR-J154-G3000.TOTAL-PRODUCT-WEIGHTOMETER

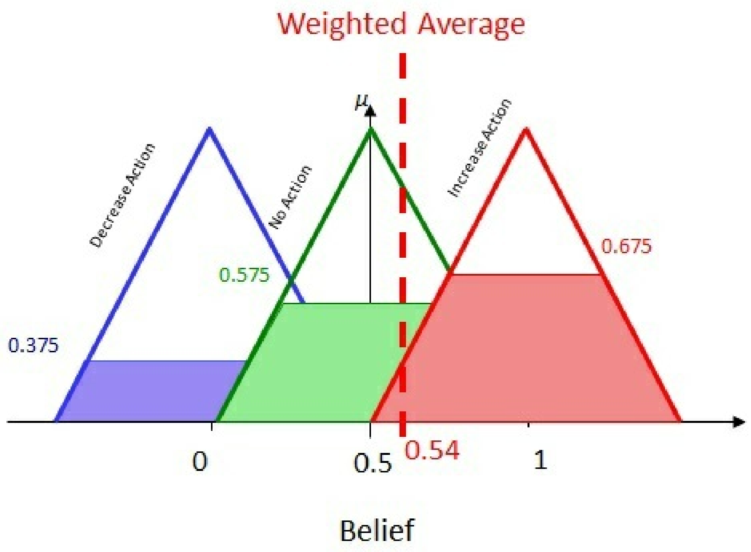
#### 4.2.1.8) Fuzzy Sets For BIN8-J140-BIN-01.LEVEL-02

#### 4.2.1.9) Fuzzy Sets For BIN8-J140-BIN-01.LEVEL-03

There are no fuzzy memberships for the T-Crushing Feed Bin Compartment 2 level (J140-LIT-003). This reading is used to calculate the available bin inventory.

### 4.2.2) Defuzzy Function

After the inference step, the overall result is a fuzzy value. This result should be defuzzified based on the process state which is In Control to obtain a final crisp output. This is the purpose of the defuzzifier component of a FLS. Defuzzification is performed according to the membership function of the output variable. For instance, assume that we have the result in the figure below at the end of the inference. In this figure, the shaded areas all belong to the fuzzy result. The purpose is to obtain a crisp value, represented by the dotted line in the figure below, from this fuzzy result.




The crisp value (or belief) is then converted back to a setpoint change using the defuzzy function.

#### 4.2.2.1) Defuzzy functions for PID-J141-G1118

The defuzzification of the belief for feeder (J141-G1118) speed PID controller (T-Crusher-1 J141-Rockbox-1 Level PID-Controller J141-G1118) contains functions for
1. Optimizer (for old prime controller, not in use),
2. MPC-Optimizer (Psibyl controller) and
3. Default control (when the APC is not in control).

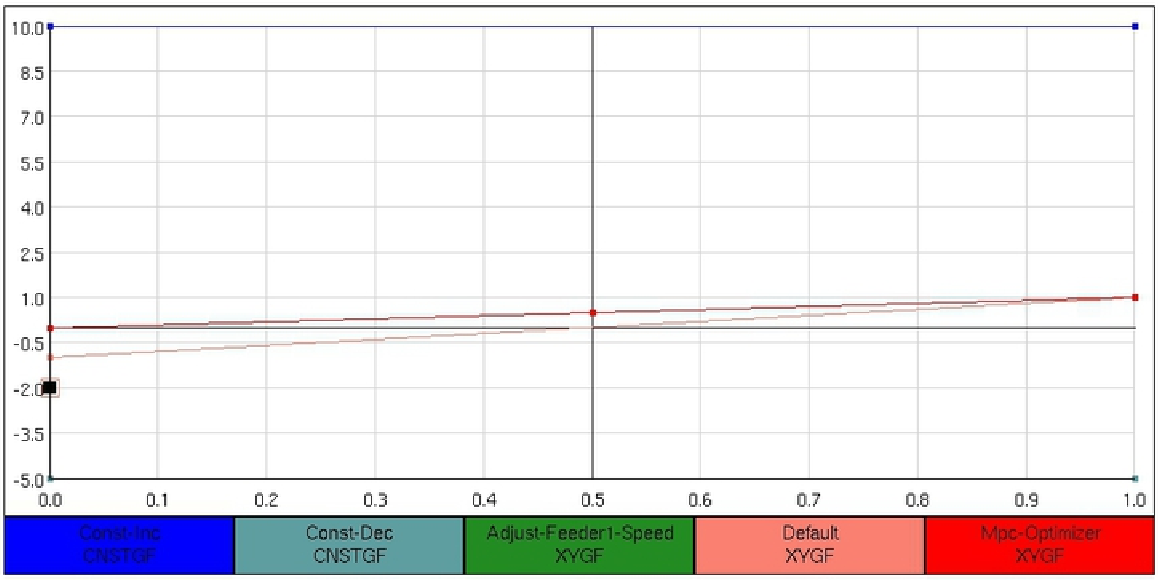



*Fig 20: The defuzzy function for PID-J141-G1118.OP-STEP.FIS*

#### 4.2.2.2) Defuzzy functions for PID-J141-G2118

The defuzzification of the belief for feeder (J141-G1128) speed PID controller (T-Crusher-1 J141-Rockbox-2 Level PID-Controller J141-G2118) contains functions for:
1. Optimizer (for old prime controller, not in use),
2. MPC-Optimizer (Psibyl controller) and
3. Default (When the APC is not in control).

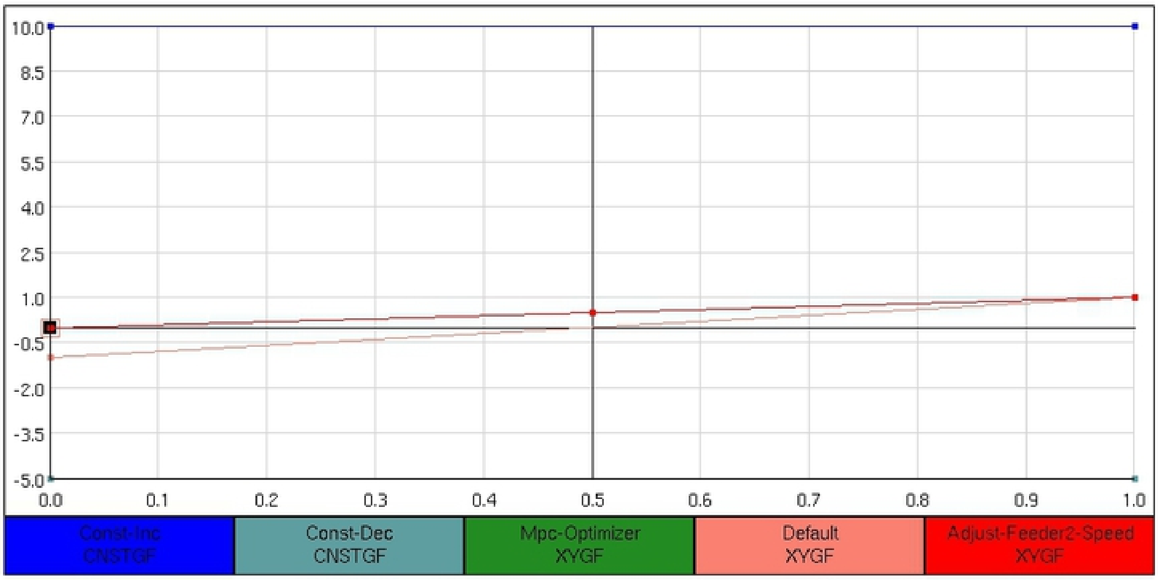



*Fig 21: The defuzzy function for PID-J141-G2118.OP-STEP.FIS*

## 4.3) Model Based Control

## 4.4) Model Predictive Control (MPC)

### 4.4.1) Model Matrix: PROFIT-CONTROLLER - J141_LIC_002

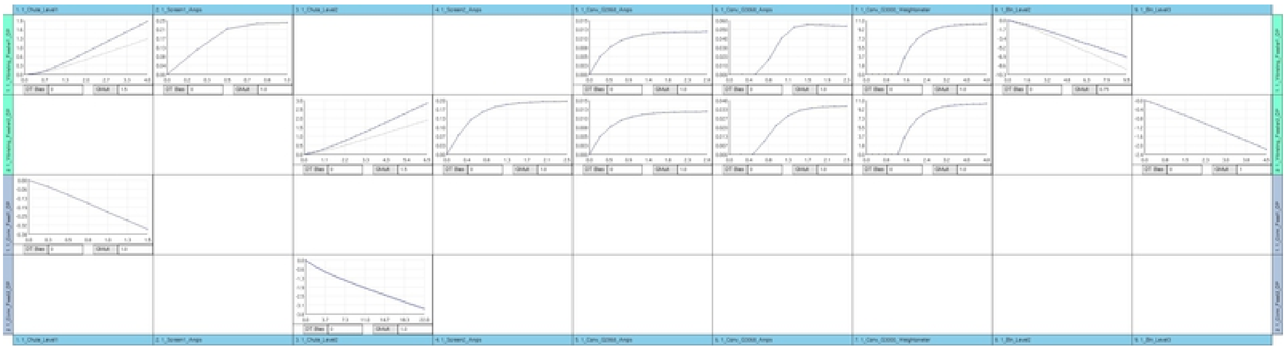
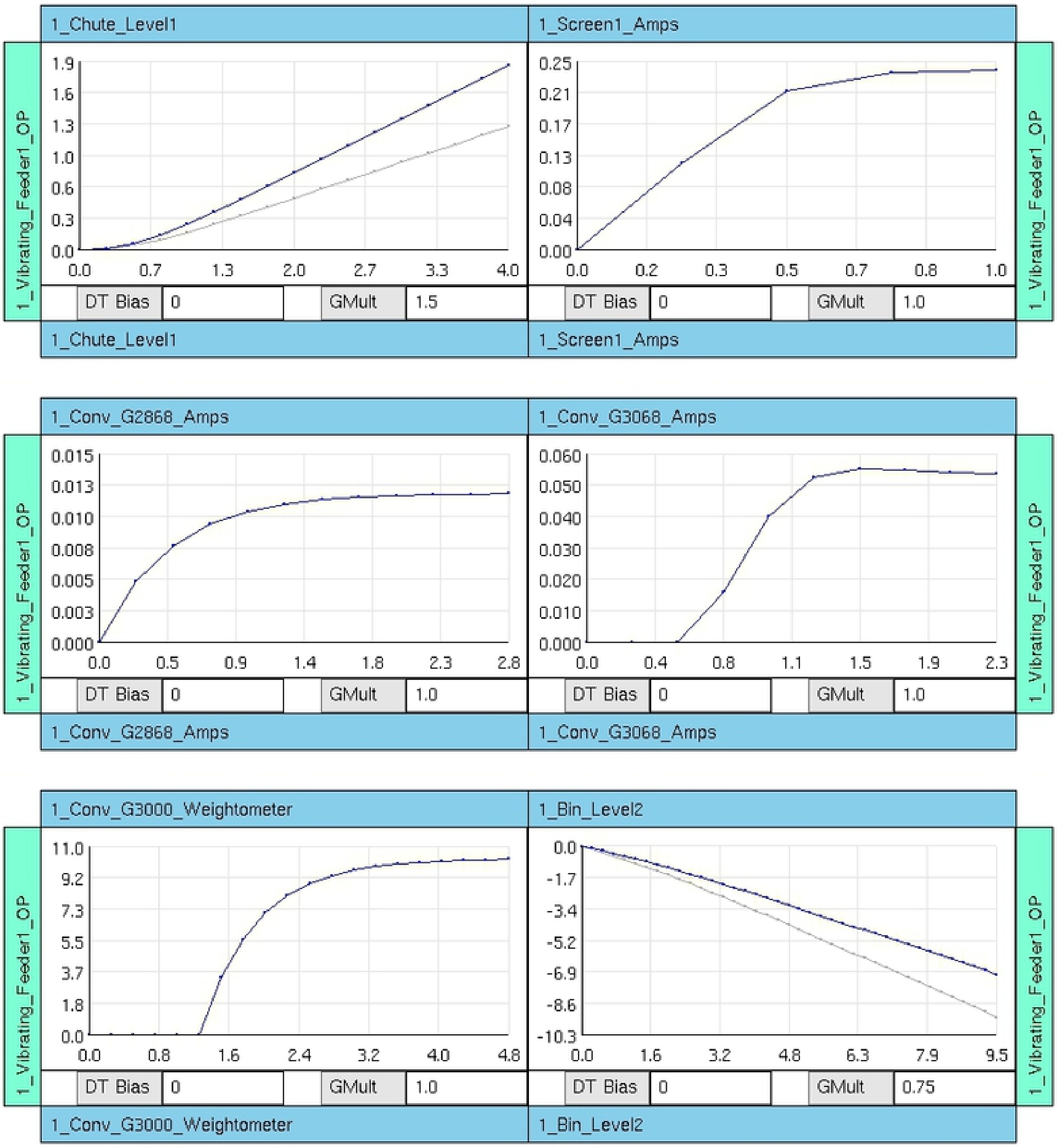
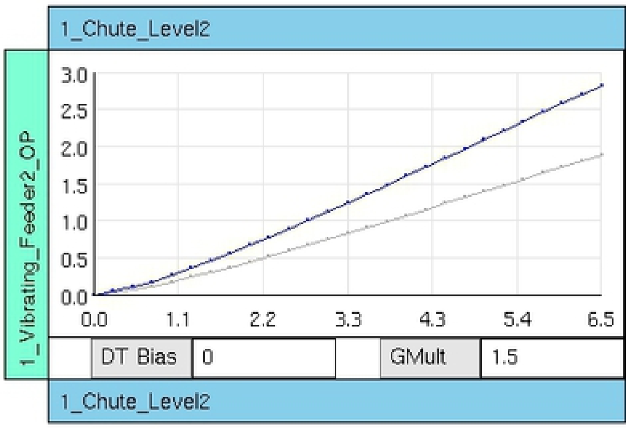
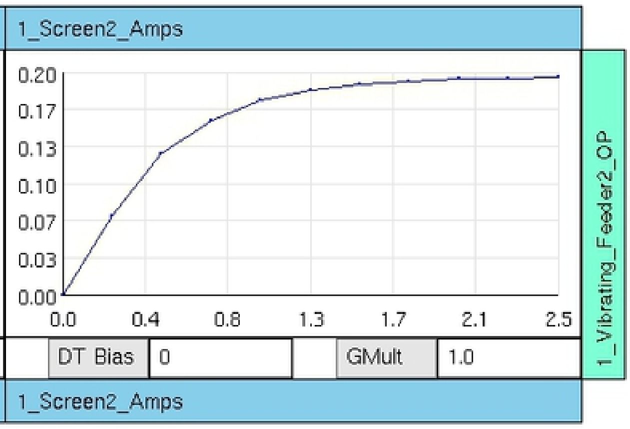
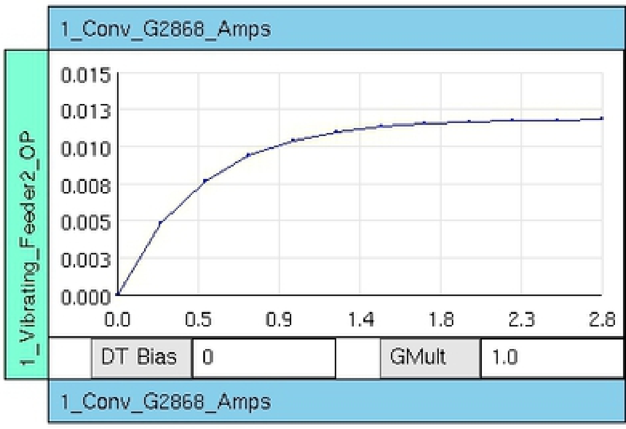


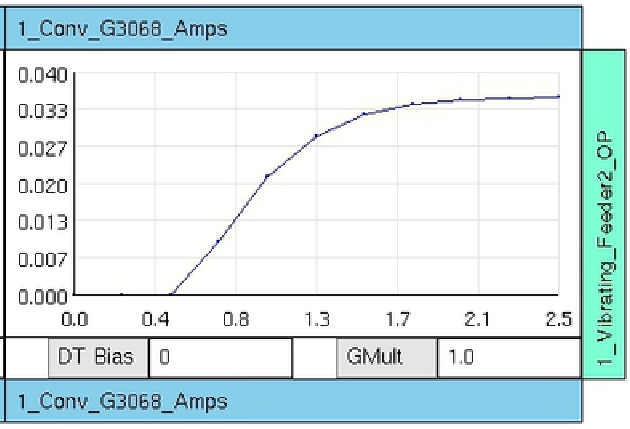
*Fig 22: Model Matrix: PROFIT-CONTROLLER - J141_LIC_002*

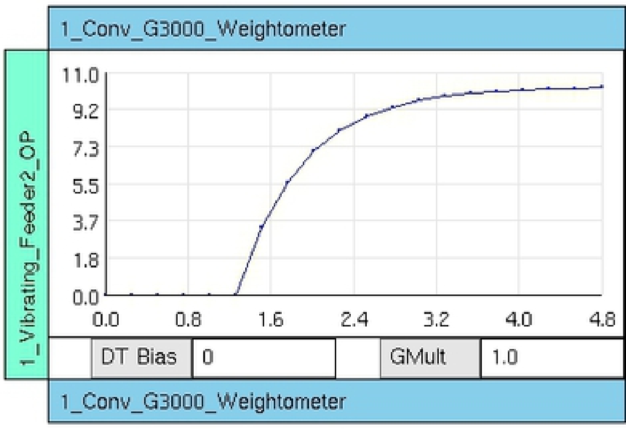


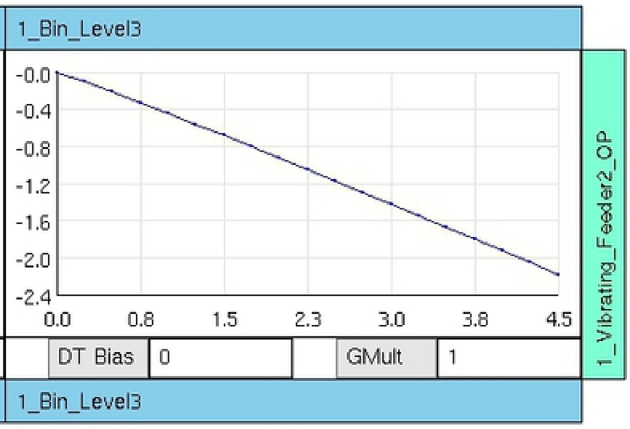

1_Chute_Level2
1_Vibrating_Feeder2_OP
3.0 2.5 2.0 1.5 1.0 0.5 0.0
0.0 1.1 2.2 3.3 4.3 5.4 6.5
DT Bias 0 GMult 1.5
1_Chute_Level2

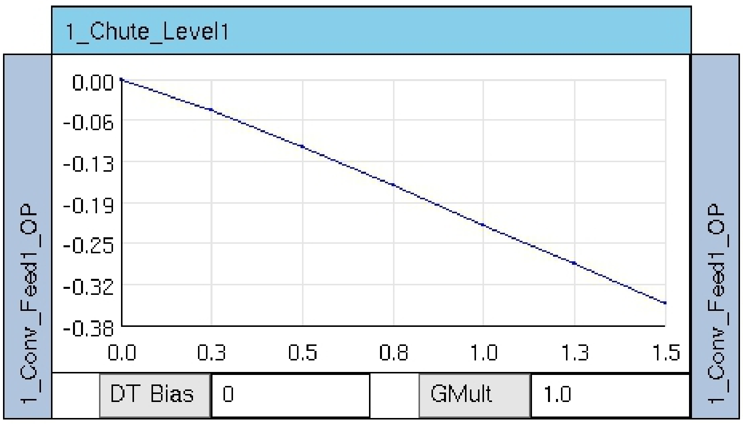

1_Screen2_Amps
1_Vibrating_Feeder2_OP
0.20 0.17 0.13 0.10 0.07 0.03 0.00
0.0 0.4 0.8 1.3 1.7 2.1 2.5
DT Bias 0 GMult 1.0
1_Screen2_Amps

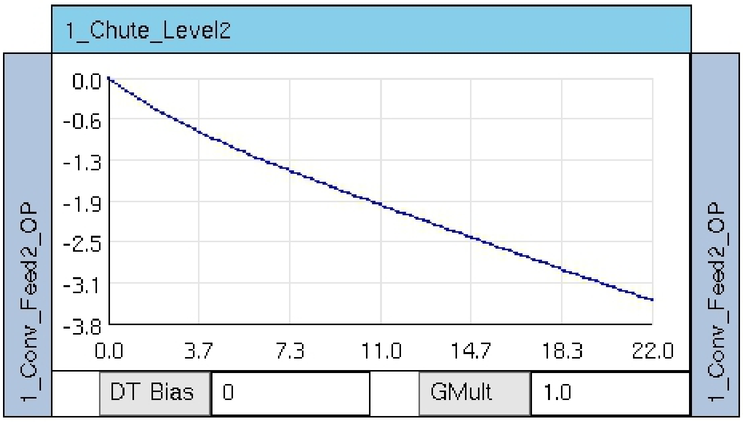

1_Conv_G2868_Amps
1_Vibrating_Feeder2_OP
0.015 0.013 0.010 0.008 0.005 0.003 0.000
0.0 0.5 0.9 1.4 1.8 2.3 2.8
DT Bias 0 GMult 1.0
1_Conv_G2868_Amps


1_Conv_G3068_Amps
1_Vibrating_Feeder2_OP
0.040 0.033 0.027 0.020 0.013 0.007 0.000
0.0 0.4 0.8 1.3 1.7 2.1 2.5
DT Bias 0 GMult 1.0
1_Conv_G3068_Amps


1_Conv_G3000_Weightometer
1_Vibrating_Feeder2_OP
11.0 9.2 7.3 5.5 3.7 1.8 0.0
0.0 0.8 1.6 2.4 3.2 4.0 4.8
DT Bias 0 GMult 1.0
1_Conv_G3000_Weightometer


1_Bin_Level3
1_Vibrating_Feeder2_OP
-0.0 -0.4 -0.8 -1.2 -1.6 -2.0 -2.4
0.0 0.8 1.5 2.3 3.0 3.8 4.5
DT Bias 0 GMult 1
1_Bin_Level3


1_Chute_Level1
1_Conv_Feed1_OP
0.00 -0.06 -0.13 -0.19 -0.25 -0.32 -0.38
0.0 0.3 0.5 0.8 1.0 1.3 1.5
DT Bias 0 GMult 1.0




## 5) Heartbeats

| Heartbeats | | | |
|---|---|---|---|
| Name | Type | Parameter | Update Interval |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.HB-IN | TIMED-TOGGLE | TIMEOUT:120 | 40 |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.HB-OUT | TOGGLE | MIN:0; MAX:1 | 30 |

# 6) Tag Listing

## 6.1) APC Tags

### 6.1.1) GSI Interface: IDX_COMMON

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.OBJECTIVE | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.OBJECTIVE-BEST-PERF | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROCESS-RUN-SIGNAL | |

### 6.1.2) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.AUTO-MANUAL-MODE | JIG_Galaxy.J141LIC002_004C_MVC.QON |

## 6.2) CV1 Tags

### 6.2.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.CHUTE-J141-G2110-CHUTE.LEVEL.HH | G02M100.G02M100.DB902;REAL678 |
| SIS-JIG.SEP.CHUTE-J141-G2110-CHUTE.LEVEL.INT-HI | JIG_Galaxy.J141LIC002_004C_MVC.PV1_H |
| SIS-JIG.SEP.CHUTE-J141-G2110-CHUTE.LEVEL.INT-LO | JIG_Galaxy.J141LIC002_004C_MVC.PV1_L |
| SIS-JIG.SEP.CHUTE-J141-G2110-CHUTE.LEVEL.LL | G02M100.G02M100.DB902;REAL686 |
| SIS-JIG.SEP.CHUTE-J141-G2110-CHUTE.LEVEL.PV | G02M100.G02M100.DB902;REAL18 |

## 6.3) CV2 Tags

### 6.3.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.MOTOR-J141-G2118.CURRENT.HH | G02M100.G02M100.DB902;REAL690 |
| SIS-JIG.SEP.MOTOR-J141-G2118.CURRENT.INT-HI | JIG_Galaxy.J141LIC002_004C_MVC.PV2_H |
| SIS-JIG.SEP.MOTOR-J141-G2118.CURRENT.INT-LO | JIG_Galaxy.J141LIC002_004C_MVC.PV2_L |
| SIS-JIG.SEP.MOTOR-J141-G2118.CURRENT.LL | G02M100.G02M100.DB902;REAL698 |
| SIS-JIG.SEP.MOTOR-J141-G2118.CURRENT.PV | G02M100.G02M100.DB902;REAL44 |

## 6.4) CV3 Tags

### 6.4.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.CHUTE-J141-G2120-CHUTE.LEVEL.HH | G02M100.G02M100.DB902;REAL702 |
| SIS-JIG.SEP.CHUTE-J141-G2120-CHUTE.LEVEL.INT-HI | JIG_Galaxy.J141LIC002_004C_MVC.PV3_H |
| SIS-JIG.SEP.CHUTE-J141-G2120-CHUTE.LEVEL.INT-LO | JIG_Galaxy.J141LIC002_004C_MVC.PV3_L |
| SIS-JIG.SEP.CHUTE-J141-G2120-CHUTE.LEVEL.LL | G02M100.G02M100.DB902;REAL710 |
| SIS-JIG.SEP.CHUTE-J141-G2120-CHUTE.LEVEL.PV | G02M100.G02M100.DB902;REAL70 |

## 6.5) CV4 Tags

### 6.5.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.MOTOR-J141-G2128.CURRENT.HH | G02M100.G02M100.DB902;REAL714 |
| SIS-JIG.SEP.MOTOR-J141-G2128.CURRENT.INT-HI | JIG_Galaxy.J141LIC002_004C_MVC.PV4_H |
| SIS-JIG.SEP.MOTOR-J141-G2128.CURRENT.INT-LO | JIG_Galaxy.J141LIC002_004C_MVC.PV4_L |

| | |
|---|---|
| SIS-JIG.SEP.MOTOR-J141-G2128.CURRENT.LL | G02M100.G02M100.DB902;REAL722 |
| SIS-JIG.SEP.MOTOR-J141-G2128.CURRENT.PV | JIG_Galaxy.J141G2128_T1.S_Current |

## 6.6) CV5 Tags

### 6.6.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.CNVYR-J154-G2800.CURRENT.HH | G02M100.G02M100.DB932;REAL678 |
| SIS-JIG.SEP.CNVYR-J154-G2800.CURRENT.INT-HI | JIG_Galaxy.J141LIC002_004C_MVC2.PV1_H |
| SIS-JIG.SEP.CNVYR-J154-G2800.CURRENT.INT-LO | JIG_Galaxy.J141LIC002_004C_MVC2.PV1_L |
| SIS-JIG.SEP.CNVYR-J154-G2800.CURRENT.LL | G02M100.G02M100.DB932;REAL686 |
| SIS-JIG.SEP.CNVYR-J154-G2800.CURRENT.PV | G02M100.G02M100.DB932;REAL18 |

## 6.7) CV6 Tags

### 6.7.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.CNVYR-J154-G3000.CURRENT.HH | G02M100.G02M100.DB903;REAL690 |
| SIS-JIG.SEP.CNVYR-J154-G3000.CURRENT.INT-HI | JIG_Galaxy.J141LIC002_004C_MVC2.PV2_H |
| SIS-JIG.SEP.CNVYR-J154-G3000.CURRENT.INT-LO | JIG_Galaxy.J141LIC002_004C_MVC2.PV2_L |
| SIS-JIG.SEP.CNVYR-J154-G3000.CURRENT.LL | G02M100.G02M100.DB903;REAL698 |
| SIS-JIG.SEP.CNVYR-J154-G3000.CURRENT.PV | G02M100.G02M100.DB932;REAL44 |

## 6.8) CV7 Tags

### 6.8.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.CNVYR-J154-G3000.TOTAL-PRODUCT-WEIGHTOMETER.HH | G02M100.G02M100.DB903;REAL702 |
| SIS-JIG.SEP.CNVYR-J154-G3000.TOTAL-PRODUCT-WEIGHTOMETER.LL | G02M100.G02M100.DB903;REAL610 |
| SIS-JIG.SEP.CNVYR-J154-G3000.TOTAL-PRODUCT-WEIGHTOMETER.PV | G02M100.G02M100.DB932;REAL70 |

## 6.9) CV8 Tags

### 6.9.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.BIN8-J140-BIN-01.LEVEL-02.INT-HI | |
| SIS-JIG.SEP.BIN8-J140-BIN-01.LEVEL-02.INT-LO | |
| SIS-JIG.SEP.BIN8-J140-BIN-01.LEVEL-02.PV | JIG_Galaxy.J140LIT002_T4.S_ProcessValue |

## 6.10) CV9 Tags

### 6.10.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.BIN8-J140-BIN-01.LEVEL-03.INT-HI | |
| SIS-JIG.SEP.BIN8-J140-BIN-01.LEVEL-03.INT-LO | |
| SIS-JIG.SEP.BIN8-J140-BIN-01.LEVEL-03.PV | JIG_Galaxy.J140LIT003_T4.S_ProcessValue |

## 6.11) MV1 Tags

### 6.11.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|

| | |
|---|---|
| SIS-JIG.SEP.FDR-J141-G1118.SPEED.HH | G02M100.G02M100.DB902;REAL726 |
| SIS-JIG.SEP.FDR-J141-G1118.SPEED.INT-HI | JIG_Galaxy.J141LIC002_004C_MVC.C1_SP_H |
| SIS-JIG.SEP.FDR-J141-G1118.SPEED.INT-LO | JIG_Galaxy.J141LIC002_004C_MVC.C1_SP_L |
| SIS-JIG.SEP.FDR-J141-G1118.SPEED.LL | G02M100.G02M100.DB902;REAL734 |
| SIS-JIG.SEP.FDR-J141-G1118.SPEED.PV | G02M100.G02M100.DB902;REAL128 |
| SIS-JIG.SEP.PID-J141-G1118.AUTO-MANUAL-MODE | JIG_Galaxy.J141G1118_T22.C_ManualOn_Off |

## 6.12) MV2 Tags

### 6.12.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.FDR-J141-G1128.SPEED.HH | G02M100.G02M100.DB902;REAL746 |
| SIS-JIG.SEP.FDR-J141-G1128.SPEED.INT-HI | JIG_Galaxy.J141LIC002_004C_MVC.C2_SP_H |
| SIS-JIG.SEP.FDR-J141-G1128.SPEED.INT-LO | JIG_Galaxy.J141LIC002_004C_MVC.C2_SP_L |
| SIS-JIG.SEP.FDR-J141-G1128.SPEED.LL | G02M100.G02M100.DB902;REAL754 |
| SIS-JIG.SEP.FDR-J141-G1128.SPEED.PV | G02M100.G02M100.DB902;REAL178 |
| SIS-JIG.SEP.PID-J141-G2118.AUTO-MANUAL-MODE | JIG_Galaxy.J141G2118_T22.C_ManualOn_Off |

## 6.13) DV1 Tags

### 6.13.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.CNVYR-J141-G3000.HZ-SPEED.PV | JIG_Galaxy.J141G3068_T12.S_Speed |

## 6.14) DV2 Tags

### 6.14.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.CNVYR-J141-G3100.HZ-SPEED.PV | JIG_Galaxy.J141G3168_T12.S_Speed |

## 6.15) PROCESS-STATES Tags

### 6.15.1) GSI Interface: IDX_COMMON

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CHUTE-J141-G2110-LEVEL-EXTR-LOW.STATE-BELIEF | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CHUTE-J141-G2110-LEVEL-EXTR-LOW.STATE-INDEX | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CHUTE-J141-G2110-LEVEL-HIGH.STATE-BELIEF | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CHUTE-J141-G2110-LEVEL-HIGH.STATE-INDEX | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CHUTE-J141-G2120-LEVEL-EXTR-LOW.STATE-BELIEF | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CHUTE-J141-G2120-LEVEL-EXTR-LOW.STATE-INDEX | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CHUTE-J141-G2120-LEVEL-HIGH.STATE-BELIEF | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CHUTE-J141-G2120-LEVEL-HIGH.STATE-INDEX | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CONVEYOR-154-G2800-CONSTRAINED.STATE-BELIEF | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CONVEYOR-154-G2800-CONSTRAINED.STATE-INDEX | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CONVEYOR-154-G3000-CONSTRAINED.STATE-BELIEF | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CONVEYOR-154-G3000-CONSTRAINED.STATE-INDEX | |

| | |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.DEF-ROOT.STATE-BELIEF | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.DEF-ROOT.STATE-INDEX | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.MPC-OPTIMIZER.STATE-BELIEF | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.MPC-OPTIMIZER.STATE-INDEX | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SCREEN-J141-G2110-CONSTRAINED.STATE-BELIEF | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SCREEN-J141-G2110-CONSTRAINED.STATE-INDEX | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SCREEN-J141-G2120-CONSTRAINED.STATE-BELIEF | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SCREEN-J141-G2120-CONSTRAINED.STATE-INDEX | |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.STATE-INDEX | |

### 6.15.2) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CRIT-ALARMS.CMNTS | JIG_Galaxy.J141LIC002_004C_MVC.S1_CMNT |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CRIT-ALARMS.DESC | JIG_Galaxy.J141LIC002_004C_MVC.S1_DESCR |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CRIT-ALARMS.STATE-BELIEF | JIG_Galaxy.J141LIC002_004C_MVC.S1_WEIGHT |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.CRIT-ALARMS.STATE-INDEX | JIG_Galaxy.J141LIC002_004C_MVC.S1_STATE |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.DEF-ALARMS.CMNTS | JIG_Galaxy.J141LIC002_004C_MVC.S4_CMNT |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.DEF-ALARMS.DESC | JIG_Galaxy.J141LIC002_004C_MVC.S4_DESCR |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.DEF-ALARMS.STATE-BELIEF | JIG_Galaxy.J141LIC002_004C_MVC.S4_WEIGHT |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.DEF-ALARMS.STATE-INDEX | JIG_Galaxy.J141LIC002_004C_MVC.S4_STATE |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.HIGH-ALARMS.CMNTS | JIG_Galaxy.J141LIC002_004C_MVC.S2_CMNT |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.HIGH-ALARMS.DESC | JIG_Galaxy.J141LIC002_004C_MVC.S2_DESCR |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.HIGH-ALARMS.STATE-BELIEF | JIG_Galaxy.J141LIC002_004C_MVC.S2_WEIGHT |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.HIGH-ALARMS.STATE-INDEX | JIG_Galaxy.J141LIC002_004C_MVC.S2_STATE |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.LOW-ALARMS.CMNTS | JIG_Galaxy.J141LIC002_004C_MVC.S3_CMNT |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.LOW-ALARMS.DESC | JIG_Galaxy.J141LIC002_004C_MVC.S3_DESCR |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.LOW-ALARMS.STATE-BELIEF | JIG_Galaxy.J141LIC002_004C_MVC.S3_WEIGHT |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.LOW-ALARMS.STATE-INDEX | JIG_Galaxy.J141LIC002_004C_MVC.S3_STATE |

## 6.16) MESSAGES Tags

### 6.16.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.BODY1 | JIG_Galaxy.J141LIC002_004C_MVC.M1_DESCR |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.BODY2 | JIG_Galaxy.J141LIC002_004C_MVC.M2_DESCR |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.BODY3 | JIG_Galaxy.J141LIC002_004C_MVC.M3_DESCR |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.BODY4 | JIG_Galaxy.J141LIC002_004C_MVC.M4_DESCR |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.BODY5 | JIG_Galaxy.J141LIC002_004C_MVC.M5_DESCR |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.ID1 | JIG_Galaxy.J141LIC002_004C_MVC.M1_LOGIC |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.ID2 | JIG_Galaxy.J141LIC002_004C_MVC.M2_LOGIC |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.ID3 | JIG_Galaxy.J141LIC002_004C_MVC.M3_LOGIC |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.ID4 | JIG_Galaxy.J141LIC002_004C_MVC.M4_LOGIC |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.ID5 | JIG_Galaxy.J141LIC002_004C_MVC.M5_LOGIC |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SP-ACTION1 | JIG_Galaxy.J141LIC002_004C_MVC.M1_ACTION |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SP-ACTION2 | JIG_Galaxy.J141LIC002_004C_MVC.M2_ACTION |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SP-ACTION3 | JIG_Galaxy.J141LIC002_004C_MVC.M3_ACTION |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SP-ACTION4 | JIG_Galaxy.J141LIC002_004C_MVC.M4_ACTION |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SP-ACTION5 | JIG_Galaxy.J141LIC002_004C_MVC.M5_ACTION |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SP-CHANGE1 | JIG_Galaxy.J141LIC002_004C_MVC.M1_CHANGE |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SP-CHANGE2 | JIG_Galaxy.J141LIC002_004C_MVC.M2_CHANGE |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SP-CHANGE3 | JIG_Galaxy.J141LIC002_004C_MVC.M3_CHANGE |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SP-CHANGE4 | JIG_Galaxy.J141LIC002_004C_MVC.M4_CHANGE |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.SP-CHANGE5 | JIG_Galaxy.J141LIC002_004C_MVC.M5_CHANGE |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.TIME1 | JIG_Galaxy.J141LIC002_004C_MVC.M1_TIMESTAMP |

| | |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.TIME2 | JIG_Galaxy.J141LIC002_004C_MVC.M2_TIMESTAMP |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.TIME3 | JIG_Galaxy.J141LIC002_004C_MVC.M3_TIMESTAMP |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.TIME4 | JIG_Galaxy.J141LIC002_004C_MVC.M4_TIMESTAMP |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.TIME5 | JIG_Galaxy.J141LIC002_004C_MVC.M5_TIMESTAMP |

## 6.17) INTERLOCKS Tags

### 6.17.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.INTERLOCKS.ILCK_1 | JIG_Galaxy.J141LIC002_004C_MVC_FU.STA_IL_WordA.08 |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.INTERLOCKS.ILCK_1-DESC | JIG_Galaxy.J141LIC002_004C_MVC_FU.STA_FaultTable[1] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.INTERLOCKS.ILCK_2 | JIG_Galaxy.J141LIC002_004C_MVC_FU.STA_IL_WordA.09 |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.INTERLOCKS.ILCK_2-DESC | JIG_Galaxy.J141LIC002_004C_MVC_FU.STA_FaultTable[2] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.INTERLOCKS.ILCK_3 | JIG_Galaxy.J141LIC002_004C_MVC_FU.STA_IL_WordA.10 |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.INTERLOCKS.ILCK_3-DESC | JIG_Galaxy.J141LIC002_004C_MVC_FU.STA_FaultTable[3] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.INTERLOCKS.ILCK_4 | JIG_Galaxy.J141LIC002_004C_MVC_FU.STA_IL_WordA.11 |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.INTERLOCKS.ILCK_4-DESC | JIG_Galaxy.J141LIC002_004C_MVC_FU.STA_FaultTable[4] |

## 6.18) PROFIT-CONTROLLER Tags

### 6.18.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT.CONTROL-RESTART | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Control Restart.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT.DEMAND | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/urtDemand.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT.HB | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/urtIntervalCount.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT.URT-COUNTDOWN | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/urtCountdown.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT.URT-EXEC-STATE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/urtExecState.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_CTRL-MODE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Controller Mode.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_DISPLAY-STATUS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Displayed Status.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_MPC-STATE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MPC_State.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_ON-OFF-TOGGLE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Turn ON OFF.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_OPT-ACC-TOL | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Opt Acceleration Tol.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_OPT-SPEED-FACTOR | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Optimizer Speed Factor.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_READ-MODEL-FLAG | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Read Model Flag.InternalValue |

## 6.19) PROFIT-CONTROLLER-CV1 Tags

### 6.19.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.BALANCE-FACTOR | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Balar Factor Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.CLOSED-LOOP-RESP-TIME | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Close Loop Resp Time.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.DV1.DTBIAS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Dead Time Bias.Value[1] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.DV1.GMULT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Gain Multiplier.Value[1] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.ENABLED | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Contr This CV.InternalValue |

| | |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.FF-TO-FB-PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/FF to Perf Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.FUTURE-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Futur Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.HIGH-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Delta Soft High Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.HIGH-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/High Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.HIGH-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/High Limit Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.INTEGRATING | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Mode type.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.LIMIT-VIOLATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Read Value.Color |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.LINEAR-COEFF | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Linea Coeff.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.LOW-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Delta Soft Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.LOW-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.LOW-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Low l Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.MV1.DTBIAS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Dead Time Bias.Value[0] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.MV1.GMULT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Gain Multiplier.Value[0] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.NUMBER-OF-BLOCKS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Numb of Blocks.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Perf Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.PV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Read Value DCS.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.SS-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/SS Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.STATE-ESTIMATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/State Estimation.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.TARGET | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Desir Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL1.TARGET-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level1/Quac Coeff.Value |

## 6.20) PROFIT-CONTROLLER-CV2 Tags

### 6.20.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.BALANCE-FACTOR | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Bal Factor Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.CLOSED-LOOP-RESP-TIME | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Clo Loop Resp Time.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.ENABLED | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Coi This CV.InternalValue |
| SIS-JIG.SEP.APC- | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/FF |

| | |
|---|---|
| J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.FF-TO-FB-PERF-RATIO | Perf Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.FUTURE-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Fut Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.HIGH-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Del Soft High Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.HIGH-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Hig Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.HIGH-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Hig Limit Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.INTEGRATING | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Mo type.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.LIMIT-VIOLATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Rea Value.Color |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.LINEAR-COEFF | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Lin Coeff.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.LOW-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Del Soft Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.LOW-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Lov Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.LOW-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Lov Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.MV1.DTBIAS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Dead Time Bias.Value[2] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.MV1.GMULT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Gain Multiplier.Value[2] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.NUMBER-OF-BLOCKS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Nur of Blocks.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Per Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.PV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Rea Value DCS.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.SS-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/SS Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.STATE-ESTIMATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Sta Estimation.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.TARGET | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Des Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN1_AMPS.TARGET-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen1_Amps/Qua Coeff.Value |

## 6.21) PROFIT-CONTROLLER-CV3 Tags

### 6.21.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.BALANCE-FACTOR | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Balar Factor Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.CLOSED-LOOP-RESP-TIME | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Close Loop Resp Time.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.DV2.DTBIAS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Dead Time Bias.Value[4] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.DV2.GMULT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Gain Multiplier.Value[4] |

| | |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.ENABLED | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Contr This CV.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.FF-TO-FB-PERF-RATIO | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/FF to Perf Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.FUTURE-VALUE | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Futur Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.HIGH-LIMIT-DELTA | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Delta Soft High Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.HIGH-LIMIT-SLOT | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/High Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.HIGH-LIMIT-WEIGHT | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/High Limit Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.INTEGRATING | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Mode type.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.LIMIT-VIOLATION | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Read Value.Color |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.LINEAR-COEFF | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Linea Coeff.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.LOW-LIMIT-DELTA | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Delta Soft Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.LOW-LIMIT-SLOT | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.LOW-LIMIT-WEIGHT | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Low l Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.MV2.DTBIAS | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/Dead Time Bias.Value[3] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.MV2.GMULT | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/Gain Multiplier.Value[3] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.NUMBER-OF-BLOCKS | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Numb of Blocks.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.PERF-RATIO | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Perf Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.PV | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Read Value DCS.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.SS-VALUE | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/SS Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.STATE-ESTIMATION | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/State Estimation.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.TARGET | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Desir Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CHUTE_LEVEL2.TARGET-WEIGHT | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Chute_Level2/Quac Coeff.Value |

## 6.22) PROFIT-CONTROLLER-CV4 Tags

### 6.22.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.BALANCE-FACTOR | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Bal Factor Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.CLOSED-LOOP-RESP-TIME | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Clo Loop Resp Time.Value |
| SIS-JIG.SEP.APC- | (J141_LIC_002)\$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Cor |

| | |
|---|---|
| J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.ENABLED | This CV.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.FF-TO-FB-PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/FF Perf Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.FUTURE-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Fut Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.HIGH-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Del Soft High Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.HIGH-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Hig Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.HIGH-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Hig Limit Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.INTEGRATING | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Mo type.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.LIMIT-VIOLATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Rea Value.Color |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.LINEAR-COEFF | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Lin Coeff.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.LOW-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Del Soft Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.LOW-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.LOW-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Low Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.MV2.DTBIAS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Dead Time Bias.Value[5] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.MV2.GMULT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Gain Multiplier.Value[5] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.NUMBER-OF-BLOCKS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Nur of Blocks.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Per Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.PV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Rea Value DCS.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.SS-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/SS Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.STATE-ESTIMATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Sta Estimation.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.TARGET | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Des Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_SCREEN2_AMPS.TARGET-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Screen2_Amps/Qua Coeff.Value |

## 6.23) PROFIT-CONTROLLER-CV5 Tags

### 6.23.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.BALANCE-FACTOR | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Factor Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.CLOSED-LOOP-RESP-TIME | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Loop Resp Time.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.ENABLED | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ This CV.InternalValue |

| | |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.FF-TO-FB-PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Perf Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.FUTURE-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.HIGH-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Soft High Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.HIGH-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.HIGH-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Limit Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.INTEGRATING | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ type.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.LIMIT-VIOLATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Value.Color |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.LINEAR-COEFF | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Coeff.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.LOW-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Soft Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.LOW-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.LOW-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.MV1.DTBIAS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Dead Time Bias.Valu |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.MV1.GMULT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Gain Multiplier.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.MV2.DTBIAS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Dead Time Bias.Valu |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.MV2.GMULT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Gain Multiplier.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.NUMBER-OF-BLOCKS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ of Blocks.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.PV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Value DCS.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.SS-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.STATE-ESTIMATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Estimation.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.TARGET | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G2868_AMPS.TARGET-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G2868_/ Coeff.Value |

## 6.24) PROFIT-CONTROLLER-CV6 Tags

### 6.24.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.BALANCE-FACTOR | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Factor Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.CLOSED- | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ |

| | |
|---|---|
| LOOP-RESP-TIME | Loop Resp Time.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.ENABLED | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ This CV.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.FF-TO-FB-PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Perf Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.FUTURE-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.HIGH-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Soft High Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.HIGH-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.HIGH-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Limit Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.INTEGRATING | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ type.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.LIMIT-VIOLATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Value.Color |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.LINEAR-COEFF | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Coeff.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.LOW-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Soft Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.LOW-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.LOW-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.MV1.DTBIAS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Dead Time Bias.Valu |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.MV1.GMULT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Gain Multiplier.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.MV2.DTBIAS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Dead Time Bias.Valu |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.MV2.GMULT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Gain Multiplier.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.NUMBER-OF-BLOCKS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ of Blocks.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.PV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Value DCS.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.SS-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.STATE-ESTIMATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Estimation.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.TARGET | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3068_AMPS.TARGET-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Conv_G3068_/ Coeff.Value |

## 6.25) PROFIT-CONTROLLER-CV7 Tags

### 6.25.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC- | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co |

| | |
|---|---|
| J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.BALANCE-FACTOR | Factor Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.CLOSED-LOOP-RESP-TIME | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Loop Resp Time.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.ENABLED | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co This CV.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.FF-TO-FB-PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Perf Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.FUTURE-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.HIGH-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Soft High Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.HIGH-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.HIGH-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Limit Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.INTEGRATING | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co type.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.LIMIT-VIOLATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Value.Color |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.LINEAR-COEFF | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Coeff.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.LOW-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Soft Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.LOW-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.LOW-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.MV1.DTBIAS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Dead Tin |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.MV1.GMULT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Gain Mul |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.MV2.DTBIAS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Dead Tin |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.MV2.GMULT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Gain Mul |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.NUMBER-OF-BLOCKS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co of Blocks.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.PV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Value DCS.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.SS-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.STATE-ESTIMATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Estimation.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.TARGET | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_G3000_WEIGHTOMETER.TARGET-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Co Coeff.Value |

## 6.26) PROFIT-CONTROLLER-CV8 Tags

### 6.26.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.BALANCE-FACTOR | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Balance Factor Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.CLOSED-LOOP-RESP-TIME | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Closed Loop Resp Time.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.ENABLED | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Control This CV.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.FF-TO-FB-PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/FF to FB Perf Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.FUTURE-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Future Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.HIGH-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Delta Soft High Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.HIGH-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/High Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.HIGH-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/High Limit Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.INTEGRATING | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Model type.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.LIMIT-VIOLATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Read Value.Color |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.LINEAR-COEFF | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Linear Coeff.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.LOW-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Delta Soft Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.LOW-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.LOW-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Low Limit Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.MV1.DTBIAS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Dead Time Bias.Value[12] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.MV1.GMULT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Gain Multiplier.Value[12] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.NUMBER-OF-BLOCKS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Number of Blocks.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Perf Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.PV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Read Value DCS.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.SS-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/SS Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.STATE-ESTIMATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/State Estimation.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.TARGET | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Desired Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL2.TARGET-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level2/Quadratic Coeff.Value |

## 6.27) PROFIT-CONTROLLER-CV9 Tags

### 6.27.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
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| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.BALANCE-FACTOR | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Balance Factor Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.CLOSED-LOOP-RESP-TIME | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Closed Loop Resp Time.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.ENABLED | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Control This CV.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.FF-TO-FB-PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/FF to FB Perf Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.FUTURE-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Future Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.HIGH-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Delta Soft High Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.HIGH-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/High Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.HIGH-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/High Limit Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.INTEGRATING | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Model type.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.LIMIT-VIOLATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Read Value.Color |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.LINEAR-COEFF | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Linear Coeff.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.LOW-LIMIT-DELTA | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Delta Soft Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.LOW-LIMIT-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Low Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.LOW-LIMIT-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Low Limit Error Weight.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.MV2.DTBIAS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Dead Time Bias.Value[13] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.MV2.GMULT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/Gain Multiplier.Value[13] |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.NUMBER-OF-BLOCKS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Number of Blocks.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.PERF-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Perf Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.PV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Read Value DCS.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.SS-VALUE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/SS Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.STATE-ESTIMATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/State Estimation.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.TARGET | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Desired Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_BIN_LEVEL3.TARGET-WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/CV/1_Bin_Level3/Quadratic Coeff.Value |

## 6.28) PROFIT-CONTROLLER-MV1 Tags

### 6.28.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
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| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.APC-SP | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.CONSTRAINT-TYPE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Type.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.DELTA-SOFT-HIGH-LIMIT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.DELTA-SOFT-LOW-LIMIT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.ENABLED | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating MV.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.HIGH-LIMIT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.LIMIT-VIOLATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.LINEAR-COEFF | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.LOW-LIMIT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.MAIN-CV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating CV.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.MAX-MOVE-DOWN | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Down.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.MAX-MOVE-UP | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.MV-MAN-ACTION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Action.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.NUMBER-OF-BLOCKS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Blocks.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.OP | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.OP-HIGH | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Windup.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.OP-HIGH-TRANSITION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Transition.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.OP-LOW | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Windup.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.OP-LOW-TRANSITION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Transition.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.OP-TO-PV-GAIN | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Gain.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.PB-ANTIWINDUP-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Ratio.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.PV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.QUADRATIC-COEFF | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Coeff.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.RESOLUTION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.SP | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.STATUS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.TARGET | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Value.Value |
| SIS-JIG.SEP.APC- | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |

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| J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.USE-ARCH-LIMIT | Limit.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER1_OP.WINDUP-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Status.InternalValue |

## 6.29) PROFIT-CONTROLLER-MV2 Tags

### 6.29.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.APC-SP | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.CONSTRAINT-TYPE | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Type.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.DELTA-SOFT-HIGH-LIMIT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.DELTA-SOFT-LOW-LIMIT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Limit.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.ENABLED | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating MV.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.HIGH-LIMIT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.LIMIT-VIOLATION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.LINEAR-COEFF | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.LOW-LIMIT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.MAIN-CV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating CV.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.MAX-MOVE-DOWN | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Down.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.MAX-MOVE-UP | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.MV-MAN-ACTION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Action.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.NUMBER-OF-BLOCKS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Blocks.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.OP | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.OP-HIGH | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Windup.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.OP-HIGH-TRANSITION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Transition.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.OP-LOW | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Windup.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.OP-LOW-TRANSITION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Transition.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.OP-TO-PV-GAIN | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Gain.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.PB-ANTIWINDUP-RATIO | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Ratio.Value |

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| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.PV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.QUADRATIC-COEFF | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Coeff.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.RESOLUTION | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.SP | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.STATUS | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.TARGET | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Value.Value |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.USE-ARCH-LIMIT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Limit.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.WEIGHT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_VIBRATING_FEEDER2_OP.WINDUP-SLOT | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/MV/1_Vibrating Status.InternalValue |

## 6.30) PROFIT-CONTROLLER-DV1 Tags

### 6.30.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_FEED1_OP.ENABLED | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/DV/1_Conv_Feed1_OP/Use This DV.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_FEED1_OP.PV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/DV/1_Conv_Feed1_OP/Reac Value.Value |

## 6.31) PROFIT-CONTROLLER-DV2 Tags

### 6.31.1) GSI Interface: IDX_SIS_MPC_26583_JIG_T_CRUSHING_HONEYWELL

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_FEED2_OP.ENABLED | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/DV/1_Conv_Feed2_OP/Use This DV.InternalValue |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.PROFIT_1_CONV_FEED2_OP.PV | (J141_LIC_002)/$J141_LIC_002/J141_LIC_002/ProfCon/DV/1_Conv_Feed2_OP/Reac Value.Value |

## 6.32) OTHER Tags

### 6.32.1) GSI Interface: IDX_SIS_EXPERT_22583_JIG_T_CRUSHING

| Tag | OPC Tag |
|---|---|
| SIS-JIG.SEP.APC-J141_LIC_002_004C.HB-IN | G02M100.G02M100.DB902;INT664 |
| SIS-JIG.SEP.APC-J141_LIC_002_004C.HB-OUT | G02M100.G02M100.DB902;INT14 |
| SIS-JIG.SEP.BIN8-J140-BIN-01.LEVEL-01.HH | G02M100.G02M100.DB940;REAL436 |
| SIS-JIG.SEP.BIN8-J140-BIN-01.LEVEL-01.LL | G02M100.G02M100.DB940;REAL444 |
| SIS-JIG.SEP.CNVYR-J141-G3000.STATUS.PV | JIG_Galaxy.J141G3068_T12.S_Running |
| SIS-JIG.SEP.CNVYR-J141-G3100.STATUS.PV | JIG_Galaxy.J141G3168_T12.S_Running |
| SIS-JIG.SEP.CNVYR-J154-G2800.STATUS.PV | JIG_Galaxy.J154G2868_T1.S_Running |
| SIS-JIG.SEP.CNVYR-J154-G3000.STATUS.PV | JIG_Galaxy.J154G3068_T25.S_Running |
| SIS-JIG.SEP.FDR-J141-G1118.STATUS.PV | JIG_Galaxy.J141G1118_T12.S_Running |
| SIS-JIG.SEP.FDR-J141-G1128.STATUS.PV | JIG_Galaxy.J141G1128_T12.S_Running |
| SIS-JIG.SEP.MOTOR-J141-G2118.STATUS.PV | JIG_Galaxy.J141G2118_T1.S_Running |
| SIS-JIG.SEP.MOTOR-J141-G2128.STATUS.PV | JIG_Galaxy.J141G2128_T1.S_Running |

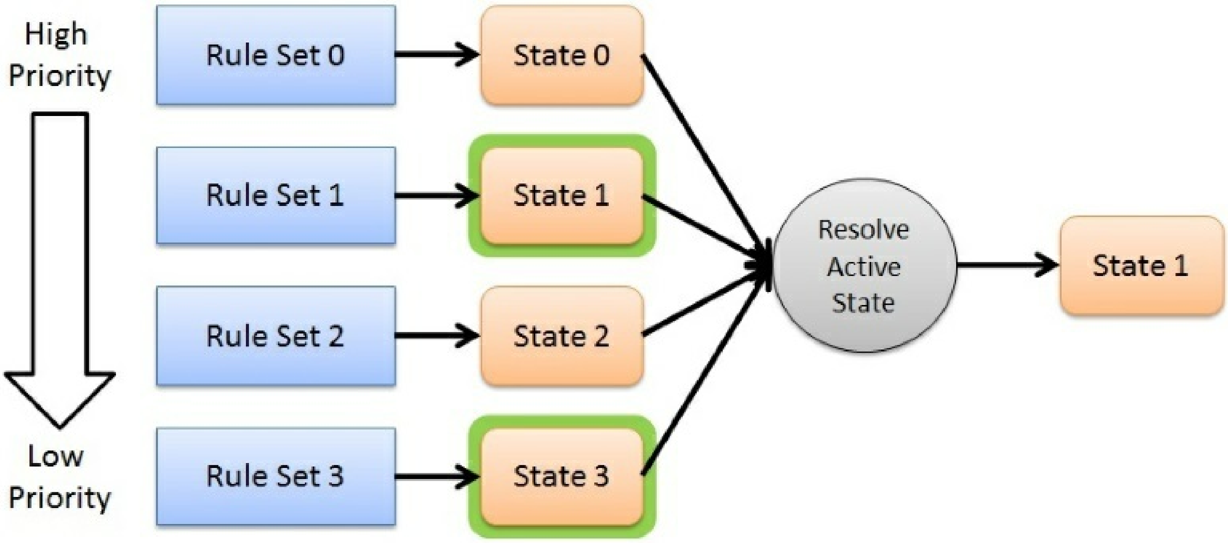
# ADDENDUMS

## A1 - Basic principles of Process States

In APET, control philosophies are built around the state of the process. Different process conditions (broadly speaking) require different actions to be taken to achieve performance targets. In APET, process states are resolved through graphical rules and used in a hierarchical bidding system to determine the current process state. The governing state is then used in deciding which control scheme to implement.

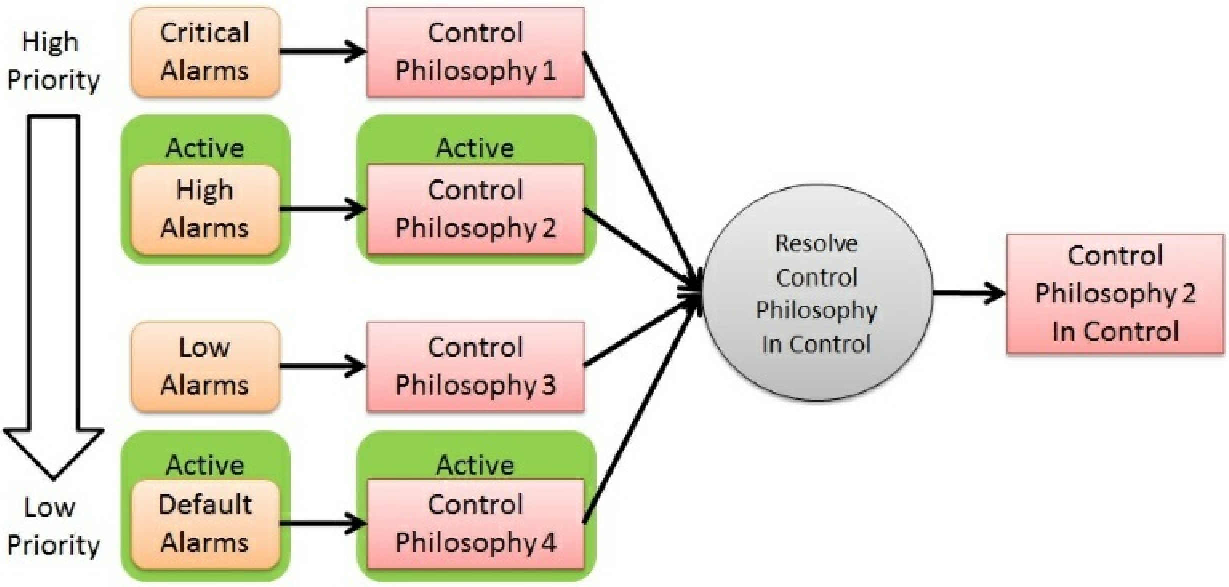
These two steps are briefly described below.

1) Active State Resolution
Each state is determined by a set of rules. These are usually built up using graphical rules and may monitor any information available within the APET application. A state is considered active if all specified conditions are met. This means that it is possible the more than one state can be active at a time. To deal with this, states are ranked based on a priority, so that the active state with the highest priority becomes the in-control state.




Because it is also possible that no states are active, it is important to select a state that acts as the default state. The default state usually corresponds to the state with the lowest priority (default alarms).

2) Control Philosophy Resolution
Each state corresponds to a specific control philosophy that will be implemented. Once the active state has been determined, the corresponding control philosophy is activated.



There are always 4 controller states for every APC controller in APET. These controller states are grouped together as follows:
1. Critical Alarms
2. High Alarms
3. Low Alarms
4. Default Alarms

Each of these 4 controller states may containing at least one referencing state. For example, the Default Alarms container will contain the MPC optimizer and default states amongst others.

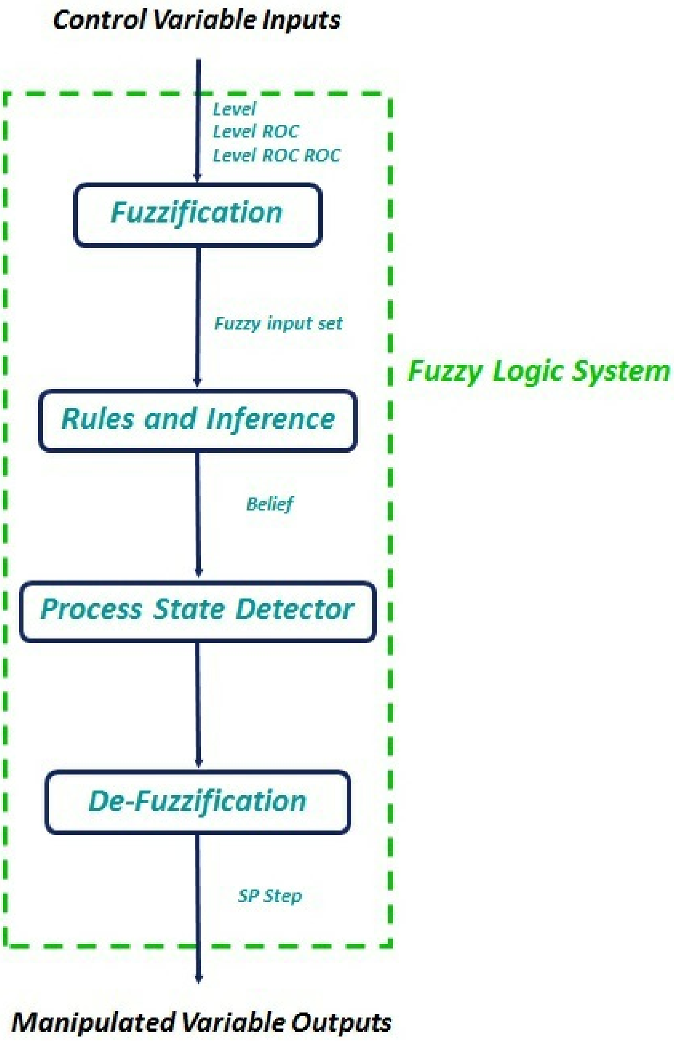
Based on the referenced states of each controller state, the State Index of the controller state may be:
0 if it is not active
1 active but not in-control
2 active AND in-control

All of the attributes of the controller states are display on the SCADA faceplate.

If the controller has detected a certain process state scenario, it will take corrective actions in an attempt to resolve this scenario. The corresponding BELIEF value displayed next to a PROCESS STATE is an indication of how true this state is. The belief value of each state will determine the size of the control actions implemented. If the PROCESS STATE belief state is 65.0% true, than less aggressive control actions will be implemented to resolve this condition compared to a scenario where the belief value is 90.0% true. This approach implies that the controller will never wait for any process state (excluding the DEFAULT state, which represents the stable state) to reach a value of 100.0% before implementing any control actions to resolve the state. All of the PROCESS STATES other than the DEFAULT state are less desirable state conditions and the controller will attempt to keep their belief values as low as possible.

## A2 - Basic principles of Fuzzy Control

A fuzzy logic system (FLS) can be defined as the nonlinear mapping of an input data set to a scalar output data. A FLS consists of four main parts: fuzzifier, rules, inference engine, and defuzzifier. These components and the general architecture of a FLS is shown in the figure below.




The process of fuzzy logic is defined as follows: Firstly, a crisp set of input data are gathered and converted to a fuzzy set using fuzzy linguistic variables, fuzzy linguistic terms and membership functions. This step is known as fuzzification. Afterwards, an inference is made based on a set of rules. Lastly, the resulting fuzzy output is mapped to a crisp output using the membership functions, in the defuzzification step.

The fuzzy logic algorithm can be summarized as follows:

1. Define the linguistic variables and terms (initialization)
2. Construct the membership functions (initialization)
3. Construct the rule base (initialization)
4. Convert crisp input data to fuzzy values using the membership functions (fuzzification)
5. Evaluate the rules in the rule base (inference)
6. Combine the results of each rule (inference)
7. Convert the output data to non-fuzzy values (defuzzification)

Linguistic variables are the input or output variables of the system whose values are words or sentences from a natural language, instead of numerical values. A linguistic variable is generally decomposed into a set of linguistic terms. Example: Leven in a bin. Let level (LVL) be the linguistic variable which represents the amount of material in the bin. To qualify the level, terms such as high and low are used in real life. These are the linguistic values of the level. Then, LVL(t) = extremely low, low, ok, high, extremely high can be the set of decompositions for the linguistic variable level. Each member of this decomposition is called a linguistic term and can cover a portion of the overall values of the bin level.

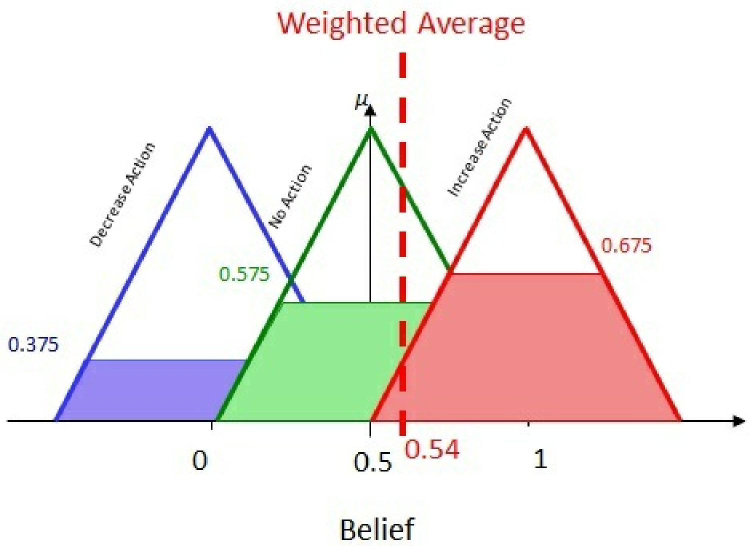
Membership functions are used in the fuzzification and defuzzification steps of a FLS, to map the non-fuzzy input values to fuzzy linguistic terms and vice versa. A membership function is used to quantify a linguistic term. Note that, an important characteristic of fuzzy logic is that a numerical value does not have to be fuzzified using only one membership function. In other words, a value typically belongs to multiple sets at the same time. For example the bin level value can be considered as extremely low and low at the same time, with different degrees of memberships.

APET includes a powerful fuzzy controller toolset which includes a very flexible editing environment as well as a variety of membership functions to be used.

Each CV feeding into the controller is fuzzified (classified within a fuzzy membership function) by one or more FIS-INPUTS. For control variables (CV) there are typically three types of classification: proximity (this relates to the normalized value), slope (rate of change) and slope rate of change (this implies acceleration).

For each of the fuzzy families, a specific input must be provided based on the value of the CV (and its recent history).
1. Proximity: this is a comparison of the normalized value of the CV
2. Slope: this represents the slope or rate of change of the CV over a defined period and is calculated within the APC system
3. Slope Rate of Change: this represents the rate of change of the slope of the CV and is calculated within the APC system

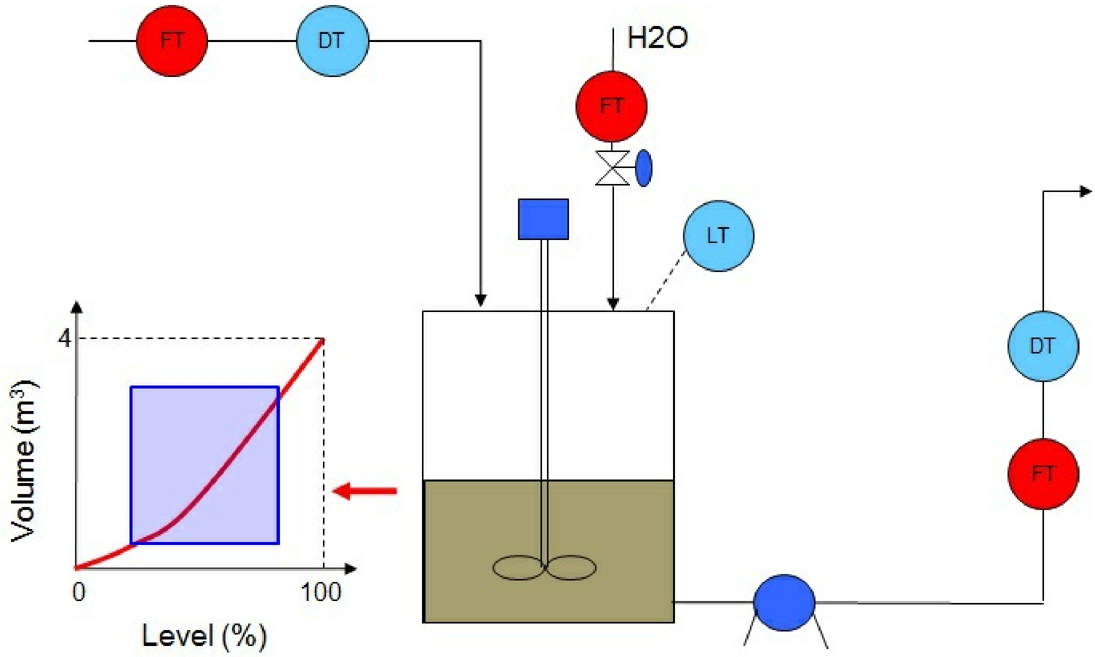
After the inference step, the overall result is a fuzzy value. This result should be defuzzified based on the process state which is In Control to obtain a final crisp output. This is the purpose of the defuzzifier component of a FLS. Defuzzification is performed according to the membership function of the output variable. For instance, assume that we have the result in the figure below at the end of the inference. In this figure, the shaded areas all belong to the fuzzy result. The purpose is to obtain a crisp value, represented by the dotted line in the figure below, from this fuzzy result.




The crisp value (or belief) is then converted back to a setpoint change using the defuzzy function.

## A3 - Basic principles of Model Based Control (MBC)

Sumps and surge tanks form a buffer between processes, and can be used to reject large disturbances and thereby improve stability in downstream operations. They typically resemble the diagram below, with multiple input lines (some possibly unmeasured) and a single discharge.




Fundamentally, the change in sump volume (dV/dt) is equal to the net flow into the sump, or:

$$\frac{dV(t)}{dt} = F_{in}(t) - F_{out}(t)$$

Where: $F_{in}$ and $F_{out}$ = respective flow measured in $m^3/s$

Integrating to get the current sump volume:

$$V(t) = \int_0^t F_{in}(\tau) - F_{out}(\tau)d\tau = \int_0^t \Delta F(\tau)d\tau$$

This is the principle on which all derivations are done The sump tank is a pure integrating process, where the model based control aims to minimize flow out deviation by modifying the sump level via its derivative DeltaF(t).

To minimize the discharge flowrate variation, there are two basic approaches the model based controller can take:
1. Delay control action until it is really necessary, or
2. Perform minimal control action now in the event that it will stave off drastic changes later.

Principle: There exists a time Tc such that if we ramp Fout(t) at a rate of Mout then we will be at capacity at Tc, with a net flowrate of zero, given that Fin(t) remains constant.

This implies that we begin the ramp now, and depending on the volume between the capacity and our current level, we will reach the capacity limit at Tc. Therefore if there is a large DeltaV (effectively - capacity available), the ramp will have an extremely slow rate and the flow out will hardly be affected, whereas if we are at capacity (DeltaV), the flow out will track the flow in. It is possible to even allow for discharge flow overshoot if we are over capacity.

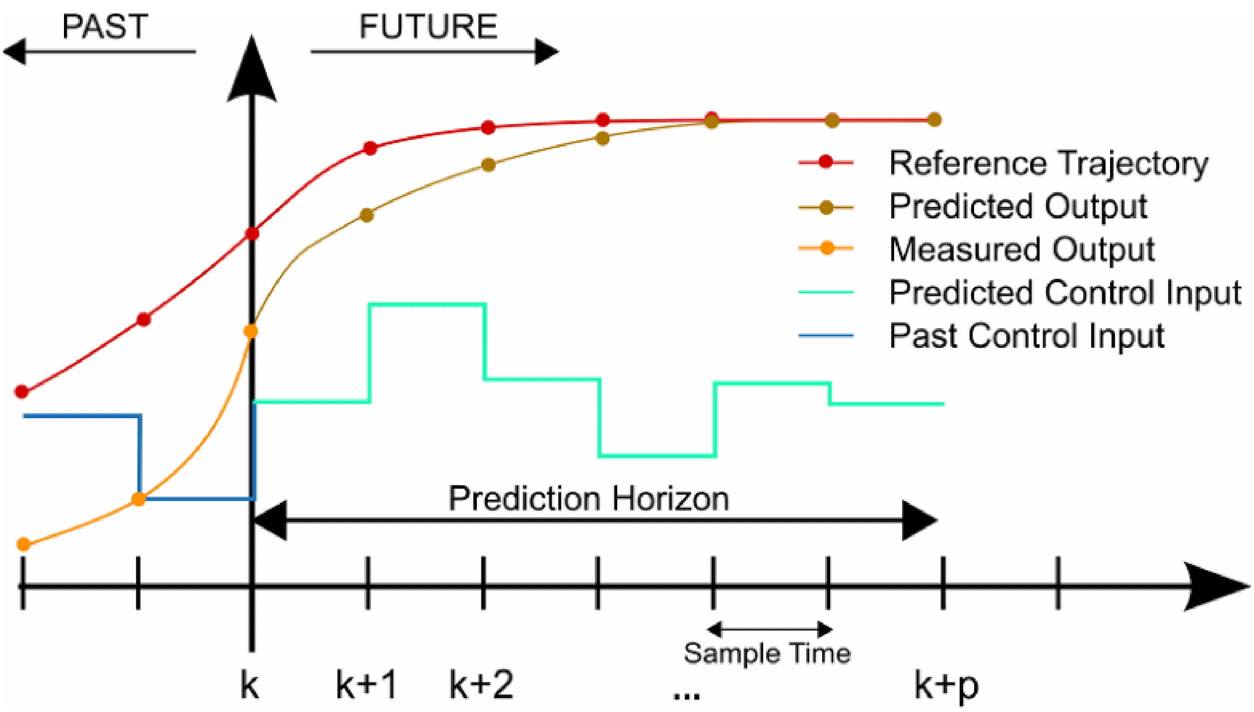
## A4 - Basic Principles of Model Predictive Control (MPC)

Model predictive control (MPC) is an advanced method of process control that has been in use in the process industries in chemical plants and oil refineries since the 1980s. Model predictive controllers rely on dynamic models of the process, most often linear empirical models obtained by system identification. Dynamic process models describe how the process parameters will respond in the future for changes made to the process in the present time. These models can therefore predict process responses into the future. The main advantage of MPC is the fact that it allows for the current process conditions (current timeslot) to be optimized, while accounting for future process conditions (future timeslots) still to happen as a result of changes to the current process conditions. This is achieved by optimizing over a finite time-horizon (the future predictions), implementing the current timeslot actions and then relying on feedback to account for unmeasured disturbances and model/plant mismatches. This implies that the model prediction error that may exist (or develop over time) is also taken into account by the MPC algorithm. MPC models therefore do not have to be 100% accurate. As a result of this the MPC technology is very robust, and typically outperforms most other advanced process control techniques. The MPC further has the ability to anticipate/predict future events and can take control actions accordingly. An example of this is that the MPC can predict that the bin level will drop below the low level limit, which will result in the feeder being interlocked and stopped. The feeder stop will again cause the bin level to increase sharply. The MPC can take all of these future predictions into account and prevent this scenario from happening. PID controllers normally implemented as part of the base layer (PLC) control do not have this predictive ability. Therefore the PID controller in the base layer (PLC) control will not be able to prevent the above feeder interlock and stop.

The models used in MPC are generally intended to represent the behaviour of complex dynamic systems, which cannot be effectively controlled by base layer (PLC) controllers such as PID controllers. Dynamic characteristics that are difficult for PID controllers include large time delays, variable interaction and high-order dynamics.

MPC uses current and historical plant responses/measurements, the current dynamic state of the process, the MPC models, and the process variable targets and limits to calculate future changes in the dependent variables (the variables to be controlled, such as bin levels and product mass flowrates). These changes are calculated to hold the dependent variables close to target while honoring constraints on both independent (the levers that can be pulled by the MPC system, such as feeder speeds or PID setpoints) and dependent variables. The MPC typically sends out only the first setpoint change (of the sequence of calculated changes required going into the future) in each independent variable to be implemented, and repeats the calculation when the next change is required (by updating the sequence of calculated changes required going into the future).

Below is an image to illustrate the concepts:




In summary, Model Predictive Control (MPC) is a multivariable control algorithm that uses:
1. an internal dynamic model of the process
2. a history of past control moves and
3. an optimization cost function J over the receding prediction horizon,
to calculate the optimum control moves.

An example of a quadratic cost function for optimization is given by:

$$J = \sum_{i=1}^{N} w_{x_i}(r_i - x_i)^2 + \sum_{i=1}^{N} w_{u_i}\, \Delta u_i{}^2$$

With:

$X_i$ = *i*-th controlled variable (e.g. measured bin level)

$r_i$ = *i*-th reference variable (e.g. required bin level)

$u_i$ = *i*-th manipulated variable (e.g. feeder speed)

$w_{Xi}$ = weighting coefficient reflecting the relative importance of $X_i$

$w_{ui}$ = weighting coefficient penalizing relative big changes in $u_i$