EEHA AUTOMATION
ELECTRICAL ENGINEERING SERVICES

2016 April

# Newsletter

First Edition

## Welcome

Welcome to the first edition of the EEHA Automation's Newsletter. For most, 2016 looks to be another tough year. Financial pressure stemming from low commodity prices, oversupply and a continuing weak Chinese housing market have placed a lot of pressure on businesses to output more with less.

It is more critical than ever to seek efficiencies, have appropriate disaster recovery plans, and ensure that staff are adequately trained.

This newsletter will focus on providing:

- Product recommendations and reviews;
- Project updates;
- Tutorials and guides;
- Blatant solicitation of our services;

Hopefully we can provide some useful information to assist and improve your business.

Enjoy

-Tyson Warat

## Did you know?


"The word engineer comes from a Latin word meaning 'cleverness'"

## Managing Alarm Floods


### In established systems.

When creating a new site, it is easy to come up with an alarm strategy / philosophy. One might decide to have four alarm types for Critical, Fault, Warning and Event alarms.

If the PCS Engineer is being proactive they would include alarm masking at the PLC level to only display the most important alarms.

In short for a new, small operation managing an alarm system is easy. For larger established operations where multiple vendors have created different components of the overall system, very typically the

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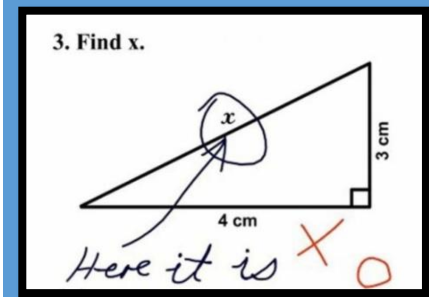
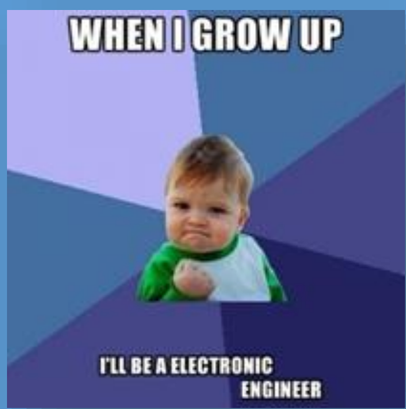
EEHA Automation Now Offer

Electrical Drafting Services!!!



alarming system becomes a nightmare.  All too often the Control Room Operators (CRO) are trying to respond to more than one alarm a minute; they become overwhelmed leading to confusion, frustration and delays.

The some of the challenges include:

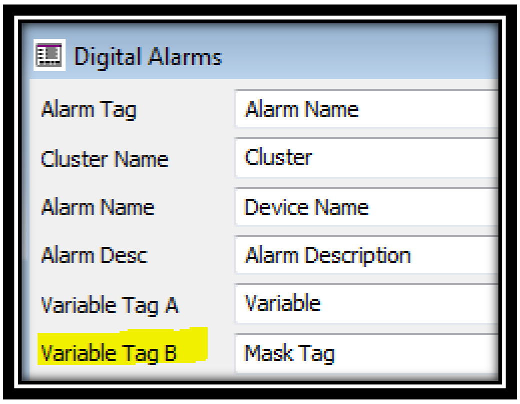
- No alarm masking. - One device will trip a number of downstream devices, generating a multitude of alarms at once.  The CRO will then have to evaluate the root cause amongst the group of alarms displayed, all with the same timestamp;
- No real world testing - Sometimes alarms are based on process setpoint levels, the process would use the alarm levels to start and stop equipment thus generating unnecessary alarms for each start/stop transition.
- Poor alarm page and banner organisation - Alarm pages commonly show all alarm categories simultaneously (Warnings, Trips, Events) with no easy facility to say all I want is the trips.
- Confused alarm categories - Mixture of Trips and Warnings and Events in the wrong places.
- Very large systems - The sheer size of an operation can mean there is a high likelihood for lots of alarms being generated.  I find it particularly useful to create a small group of very high level Critical alarms and have a dedicated screen showing only these alarms. E.g. Mains Power Lost, or Stacker Conveyor Stopped.
- No out-of-service facility -  No means by which to disable alarms for equipment that in not presently being utilised.  Some alarms would remain on indefinitely.
- Poor naming conventions.  (Is an "Alarm" a Trip or a Warning.  Is a "Fault" a Trip or Warning.)
- Poor or inconsistent device/ alarm descriptions.

Solving some of these issues might be easier than you think.  What's more it can be done on an existing system with minimal impact.

We would typically:

1) Audit the existing system as a whole.
2) Establish core alarm system requirements. categories, navigation, area or device groupings, enabling/disabling of alarms, alarm click navigation, what the alarm banner displays.  (E.g. I personally would make the alarm banner at the bottom of the page only display the Critical Alarms for the area the current page is on.  I.e. If I am on the stacker page, I would only be interested in the Critical Alarms as related to the stacker.

3) Monitor your existing system for the most frequent and longest duration alarms.
4) Form an action plan.
    a. One of the most effective ways to fix alarm floods is actually quite simple. Apply alarm masking.
       Citect SCADA makes this easy with the addition of a second tag variable tag 'B'. (Both tags must be on before an alarm is raised). Normally this second tag would go unutilised; however, if we link it to the masked tag we can easily reduce the quantity of alarms dramatically.
       We would create a new PLC Mask tag for each device. This tag would represent that the upstream device is both healthy and powered. Only if the upstream device is healthy, power and the trip is active is a new alarm generated.




    b. Mass renaming of alarms to make the descriptions clean and consistent. A set of rules can be used to make abbreviations consistent throughout.
    c. Apply appropriate groupings to tags. To allow for easy searching. Custom fields can be utilised for alternative filtering options.
    d. Investigate the most frequently occurring and longest occurring alarms. This should be part of a monthly proactive approach to managing alarms.
    e. Ensure that the page layout and sizing is appropriate; operators should not have to resize the columns each time they view the alarms.
    f. Provide easy one click filtering options. Easy quick navigation is key.
5) Document and outline the rules and expectations for future vendors.
6) Ensure that alarms are captured and logged in an appropriate format for historical searching.

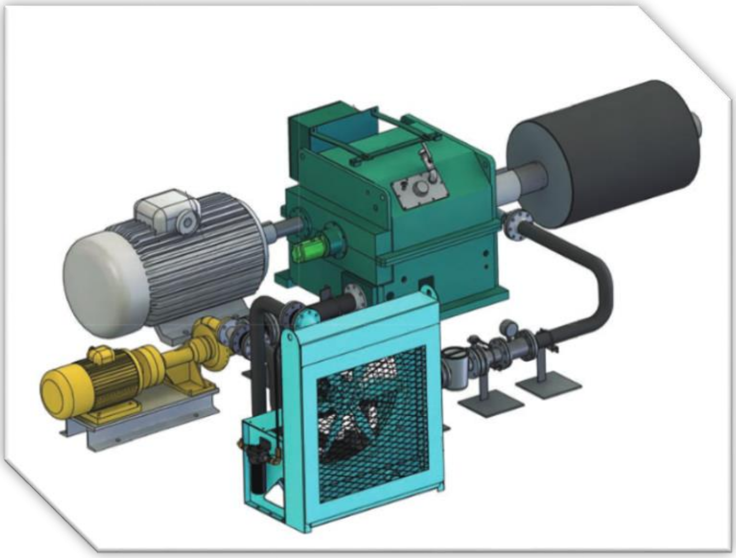
Alarms can be an extremely powerful tool. Enhancing the consistency, quality and filtering capabilities of your Alarms System will improve Operator Response Time.

## Did you know?

"The Atari Portfolio was released in 1989 and was the world's first palmtop computer. Two years later it appeared in the film Terminator 2, where it was used by John Connor to hack an ATM and retrieve the key to the vault in the Cyberdyne lab"

# CST Speed Control

## Cascading PID Loop Case Study



Modern conveyor systems are typically started by one of two methods. Variable Speed Drives (VSDs) or Controlled Start Transmission (CST) Gearbox / Hydoclutches. VSDs provide a relatively easy means of speed control and load sharing as the VSD takes care of most of the control in an accurate and consistent way. CST utilise Direct On-Line (DOL) drives and apply a Hydro-Viscous clutch to transfer the load onto the conveyor pulleys during startup.

CSTs have a number of challenges:

- The 'engage zone' of the clutch is unknown and load dependant;
- In a two drive arrangement the pulley sizes are different and the engage zone may be different between the two CSTs. (i.e. 30% CST clutch output on both drives results in different torque on each motor)
- A loaded belt performs significantly differently to a non-loaded belt.

Our task; product a control system which was capable of starting a conveyor loaded and non-Loaded, for short and long conveyor lengths in a consistent and reliable manner following an Ideal 'S' curve. Thus placing the least amount of mechanical load on the belt. Load sharing was of significant importance. In addition to this the conveyor would be capable of running at a reduced 'Inspection Speed' continuously.

The below graph demonstrates the resulting conveyor startup. Our real-world solution.

Green is the Clutch Valve Output 0-100%

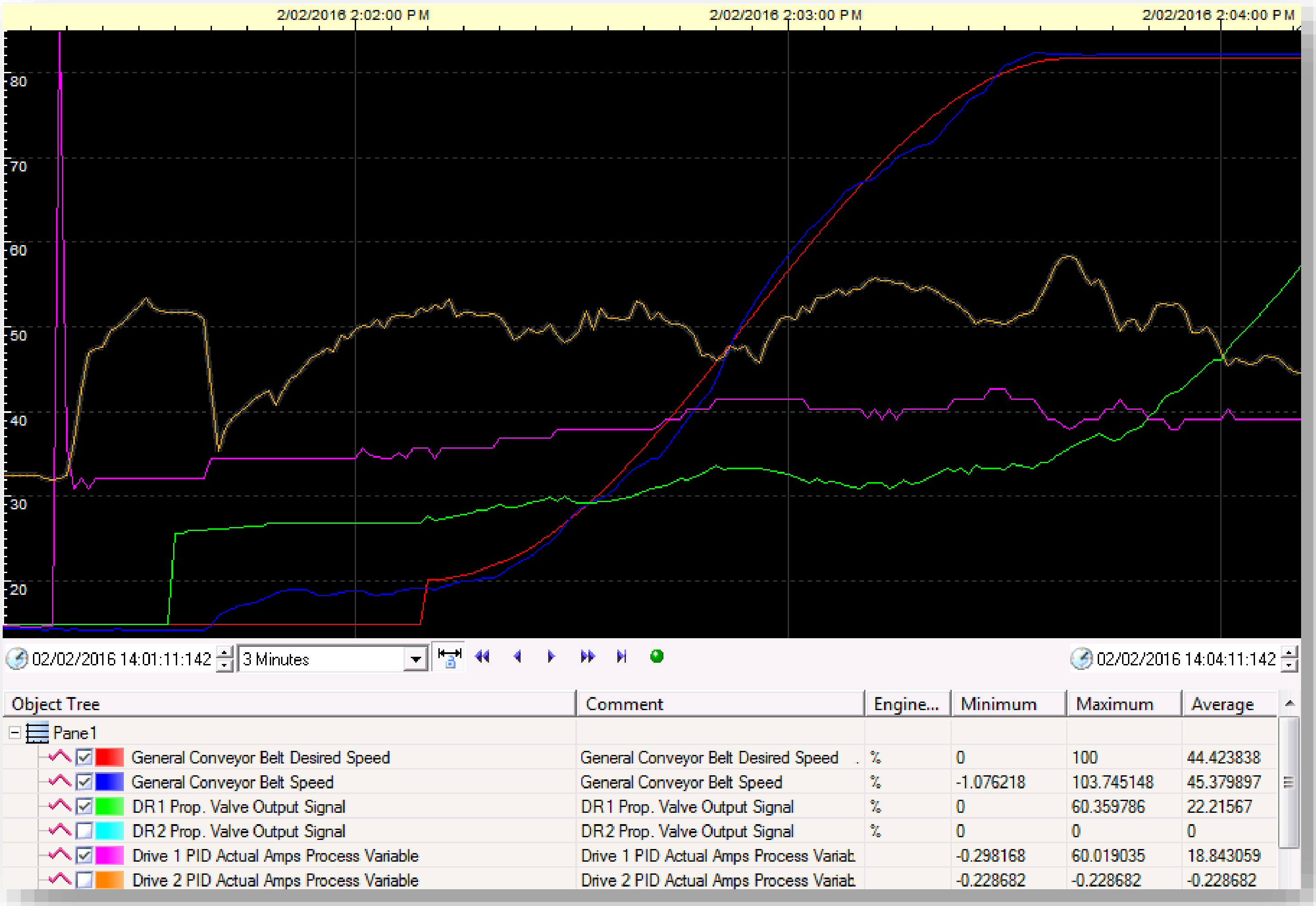
Red is the Desired 'S' Curve Speed

Blue is the Actual Conveyor Speed

Purple is the Actual Motor Current

Gold is the Belt Tension @ the Loop Take Up

Notice the small variance in Clutch Output over the entire start up ~6%. This is a very small window to control effectively within.




Our Solutions was comprised of a number of components.

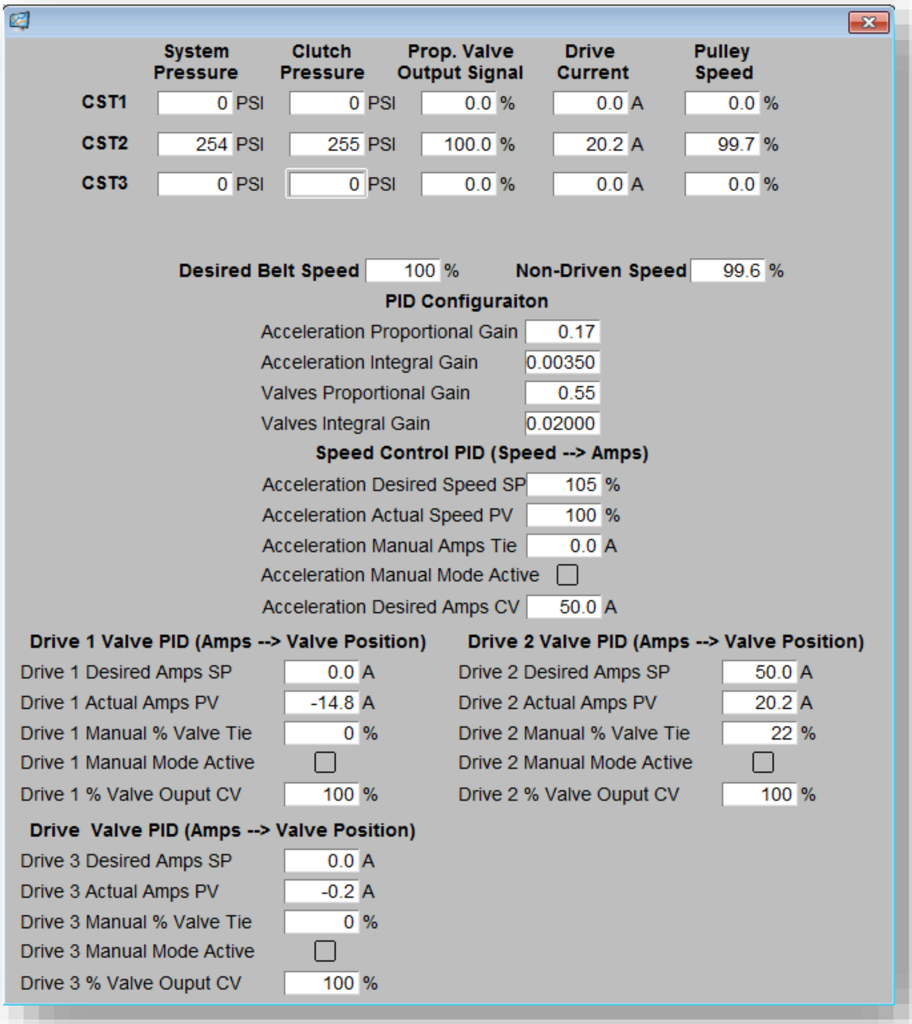
1) Precharge both CST clutches to a position just before the belt begins to move the ‘breakaway’ point. (14% in our Case)
2) Slowly apply a linear ramp, increasing both CST clutches until conveyor speed has been detected. (5% speed)
3) Once the conveyor has started to move we lock the clutches in their current position for a ‘Dwell Period’. This is to take up tension on the top of the belt. (~15 seconds). Note that an empty belt will continue to increase in speed even with a fixed clutch position.
4) After the ‘Dwell Period’ is complete we take the current belt speed and use this speed as the starting point for an ‘S’ curve formula.
    a. At this point both drives are transferred to a Cascading Proportional, Integral, Derivative (PID) Loop. The first PID utilises the ‘S’ curve as the desired speed setpoint. The conveyors actual speed as the feedback and outputs a desired motor current to be utilised by the secondary PID Loops.

b. Each drive then has its own PID loop where the desired motor current is the setpoint (fed from the first PID loop) and the feedback is from each drives actual current. The output adjusts the clutch position required in order to achieve the desired motor current.

c. So… The first PID loop increases or decrease the required current inorder to achieve the ideal 'S' curve. The second PID loop individually adjusts the CST clutch to achieve the desired motor current. As both drives are trying to achieve the same motor current they are sharing the startup load.

5) Once the conveyor is up-to-speed the small pulleys CST is ramped to 100% clutch. The larger pulleys PID is now set to match the motor current of the smaller pulley motor.

This control philosophy eliminates any discrepancy between CSTs and caters for both loaded and unloaded belts. Providing maximum shared torque on start-up and minimal belt tension spikes.

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