1 Introduction

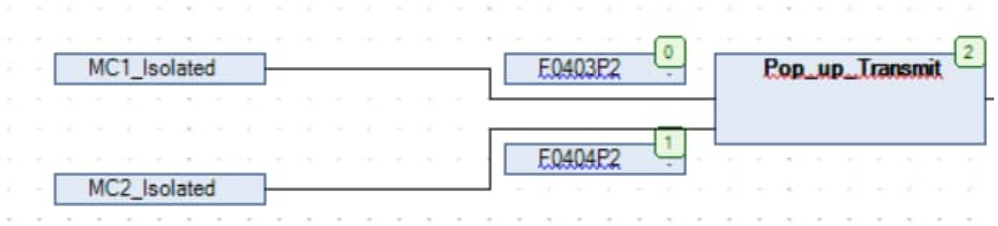
This document summarizes purpose, new features of the Software Version: 53 for the Projects Bordline CC1500 AC 25kV M 2300 fitted in 1500 Amp IGBT Based Traction Converter equipped with PEC Trac Controller. This is the released version as per the feedback from previous Test Version 52.

2 Release Notification

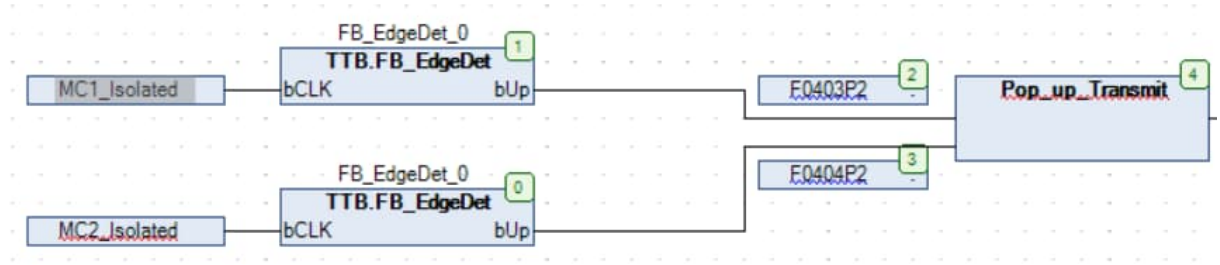
2.1 Improvement in SW V53

Non-Generation of motor pop-up in case one motor is already blocked by Speed Sensor Failure.

Problem: Secondary pop-up message supressed during tranmission as 1st pop-up bit remains high all the time.



Solution: Added Transmission with positive edge detection so that the tranmission time for one pop-up is fixed and the subsequent next pop-up is not supressed.

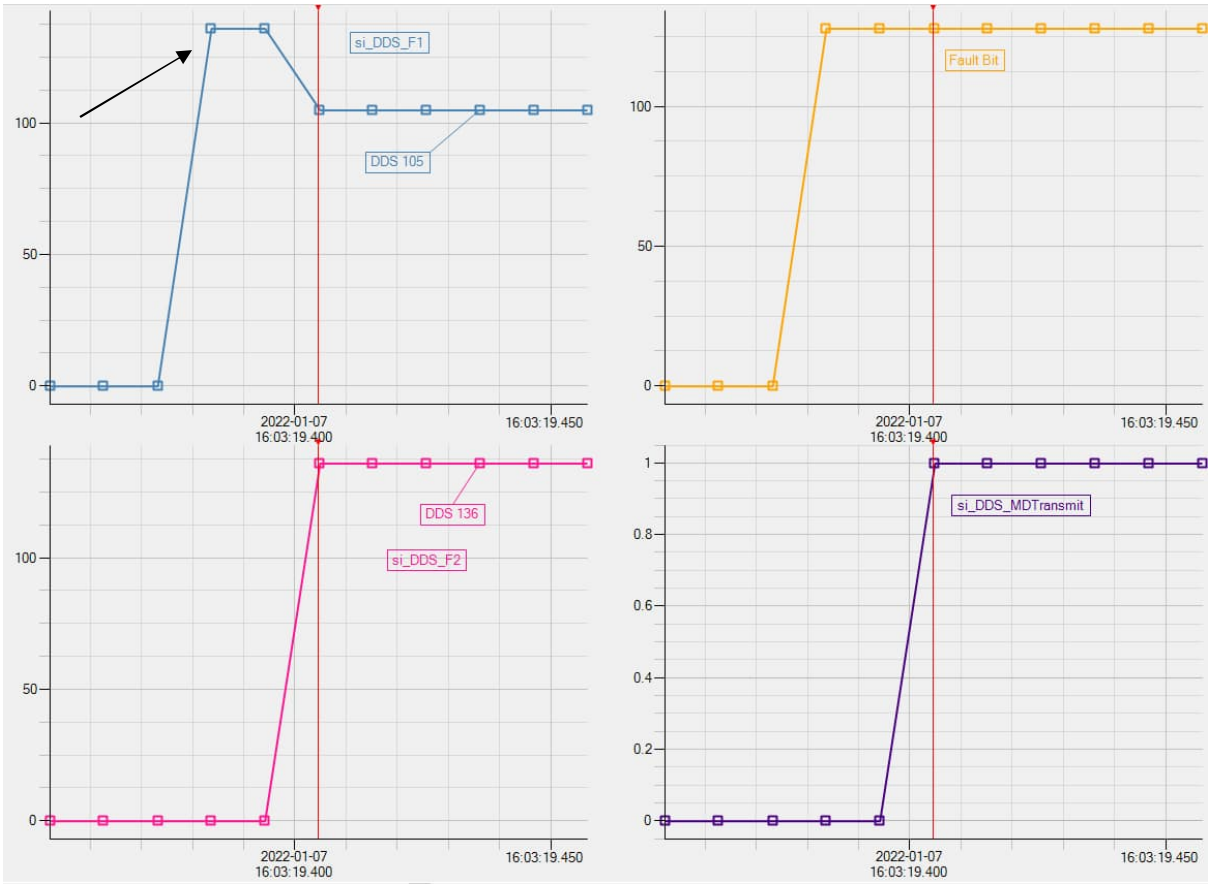


2.2 Major bug resolved in former SW V52

1. Interruption of secondary DDS Message during Fault Condition, wrong DDS Generation in some faults.

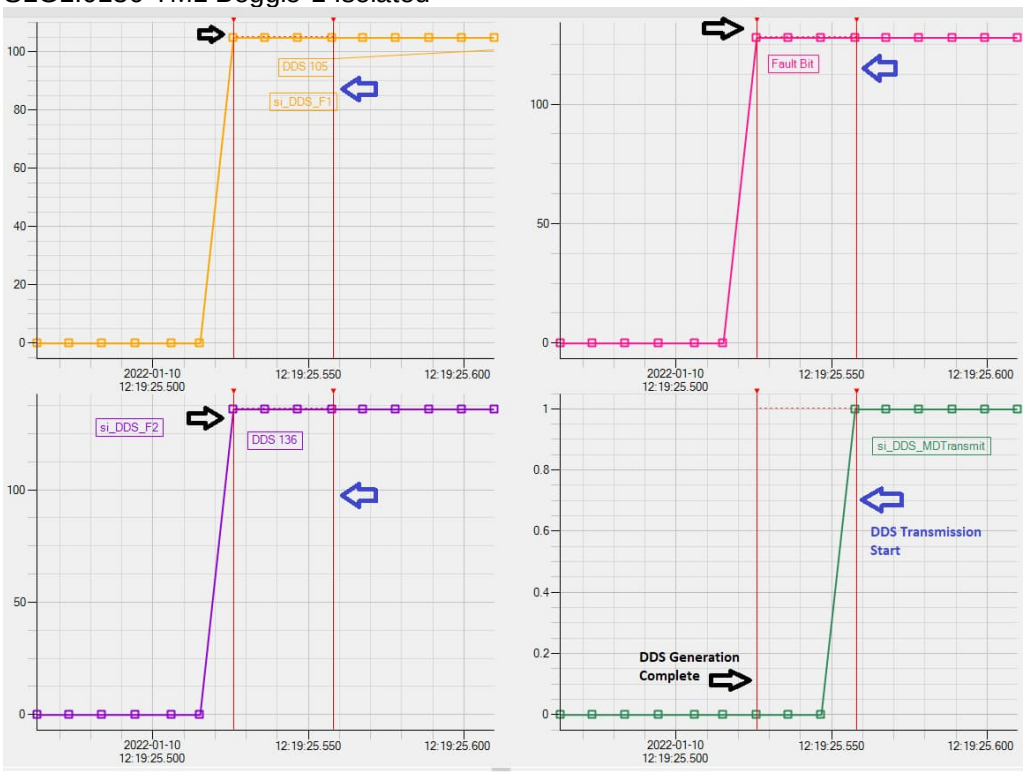
Problem:

The DDS generation and Transmission was occuring at the same time, therefore some DDS Tasks were not transmitted. The Red line is placed in all the graph for better visual understanding. DDS considered below are SLG1:0105-Dist.temp sensor motor-1, SLG1:0136-TM1 Boggie-1 Isolated Also the F1 Fault was trying to generate 2 DDS at the same time which is not ideal and provides junk data.



Solution:
The Transmission task is delayed by 2 Tasks so that the Transmission can start after the DDS generation is complete. Also the DDS generation Fault Word is corrected to generate one fault message per word. Now we observe the correct generation and transmission. Similar issues were reported with DDS for UD_Failure, LC_isolation and speed_sensor_failure which will also be addressed by this update.

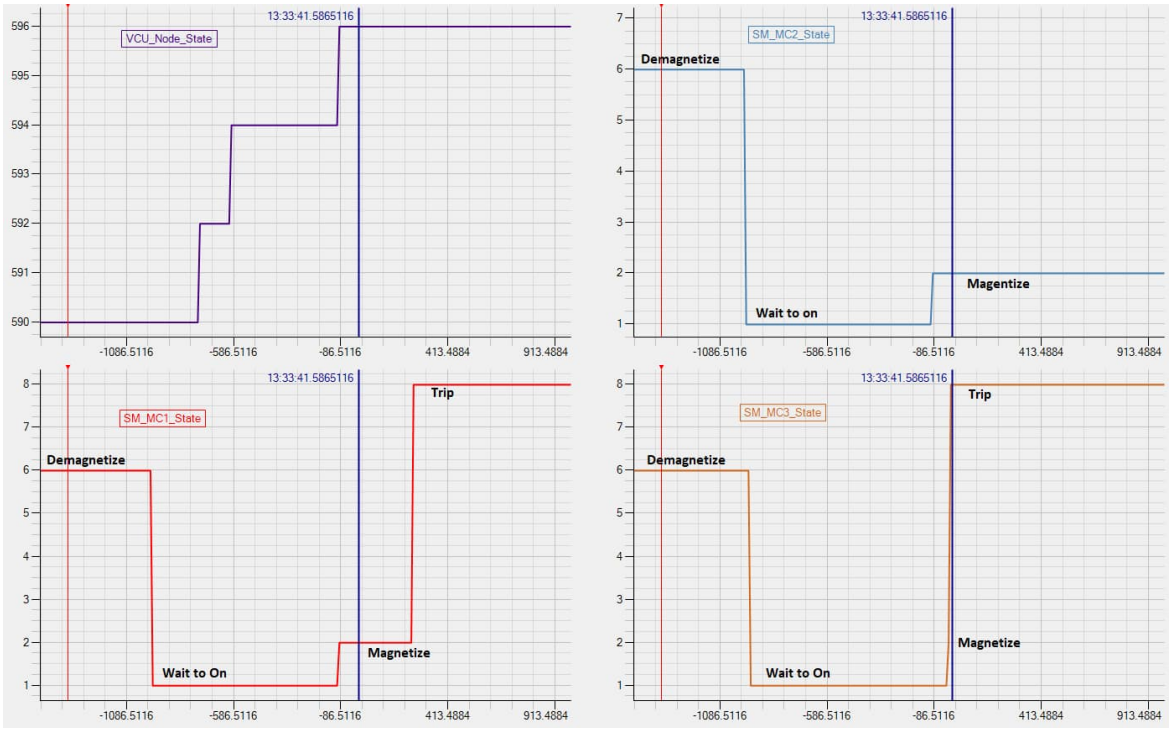
SLG1:0105-Dist.temp sensor motor-1
SLG1:0136-TM1 Boggie-1 Isolated

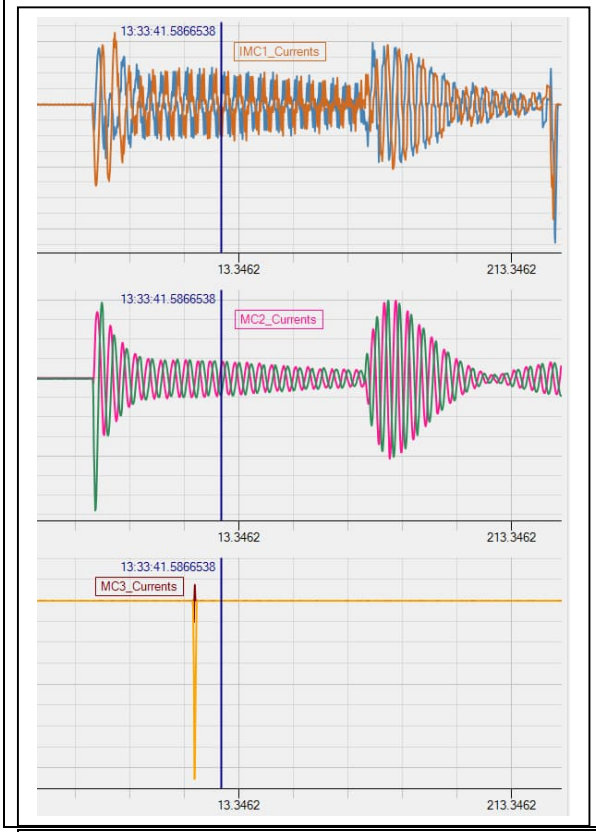


2. MC Overcurrrent in Dynamic Conditions.

Problem:

4 Cases of Mc Overcurrent reported which is anlyzed. All Cases are reported at dynamic operation speeds. All cases show the trend of high magnetization current in the motors during pulsing when the motor completed a prior demagnetization cycle.





The MC1 goes into magnetization and remains in magentization for approx 350msec and then trips with an over current.

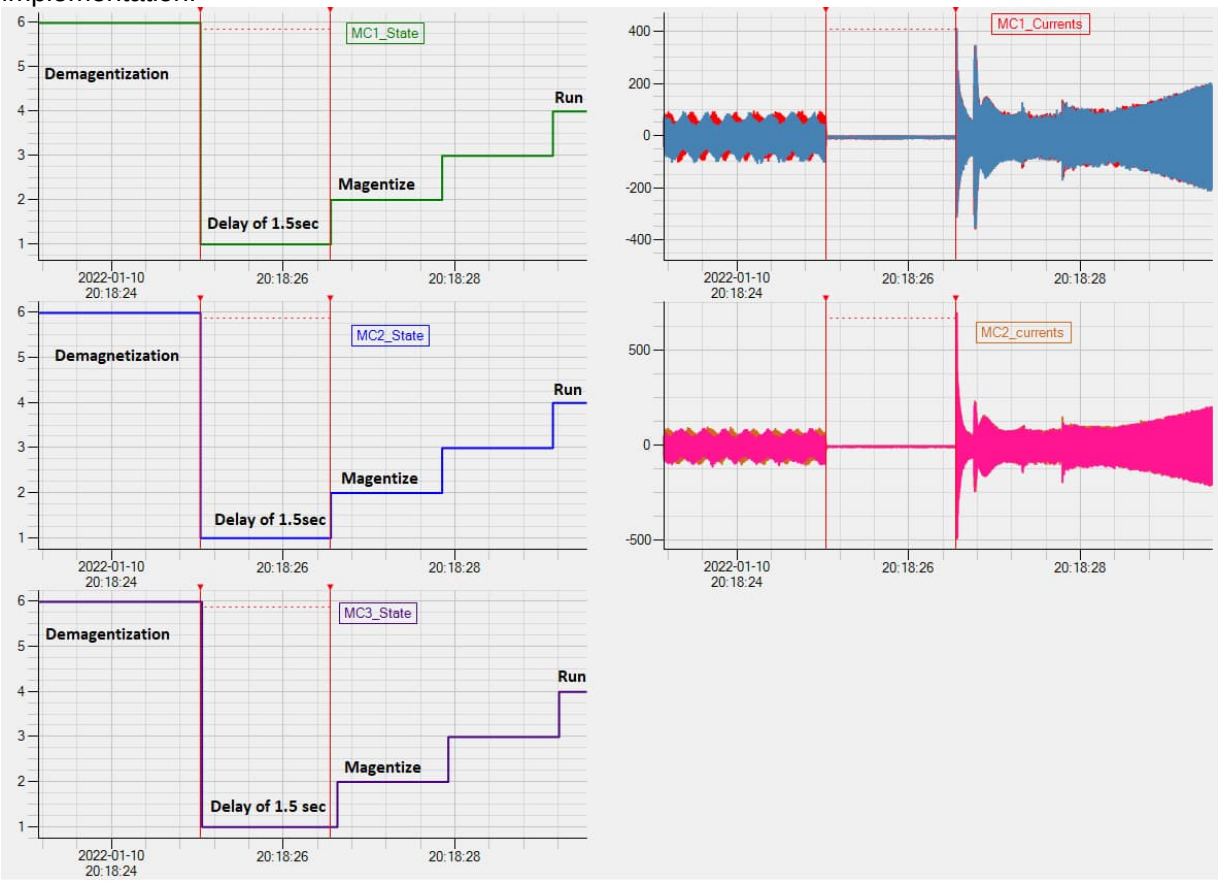
MC2 shows a successful magentization and it continues to pulse

MC3 trips instantaneously when it starts magentization.

Solution:

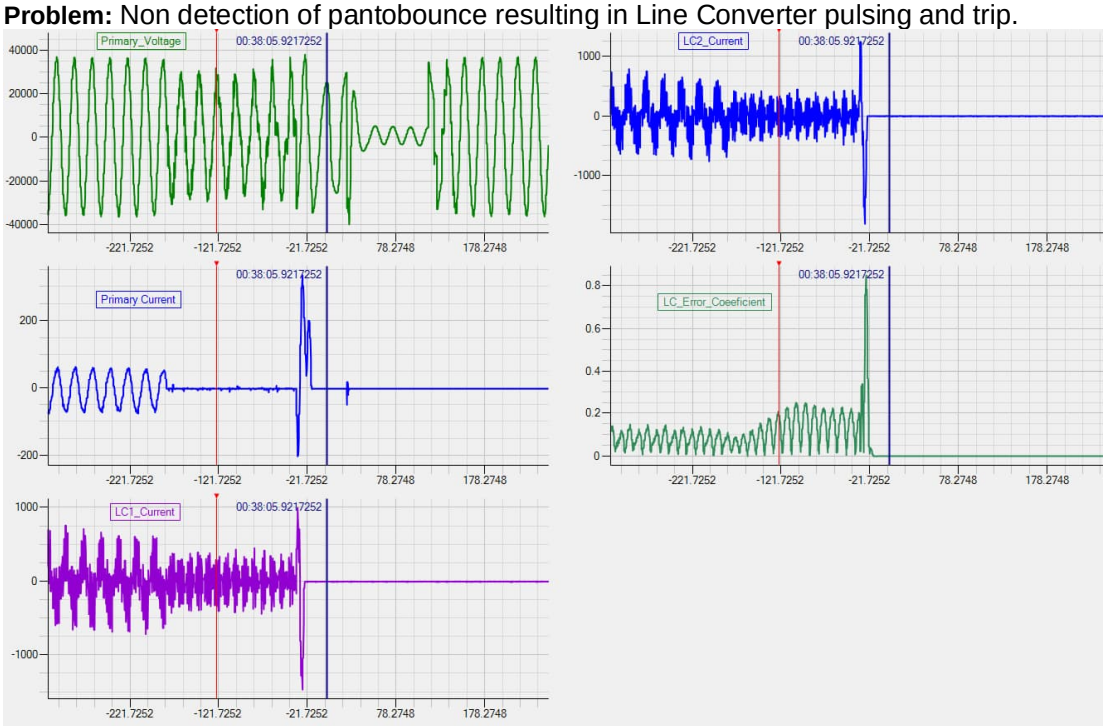
On Delay of 1.5 seconds introduced between successive demagnetization and magentization cycle. This should improve the demagentization of the motor and help to prevent the dynamic pulsing transients.

Below shows the testing result in Real Time Simulator with the new software and the implementation.



3. LC Overcurrent in Dynamic Condition.

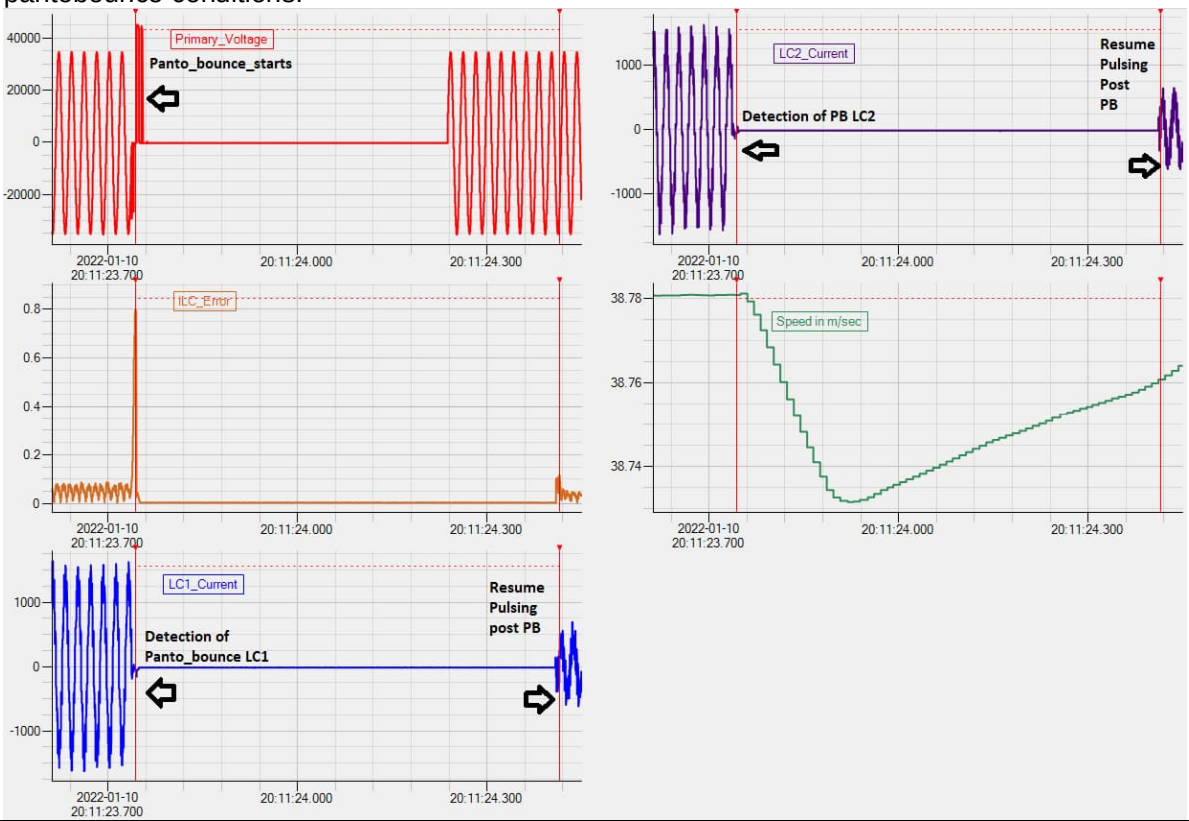
Problem: Non detection of pantobounce resulting in Line Converter pulsing and trip.



Solution:

Introduction of additional monitoring of pantobounce considering Difference in P.U current for each Line Converter which if exceed 0.2.

Below shows the testing result in the Real Time Simulator with the new software and different pantobounce conditions.



4. Earth Fault Mode.

Problem: Converter isolation in case of Earth Fault in Motor.

Solution:

Introduction of Earth Fault Mode to detect the fault in motor by pulsing Motors consecutively. Introduced Additional delay of 1.5 seconds between pulsing of consecutive motors in Earth Fault Mode. Added Extra events for Detection and Block the Faulty motors.

Event Name	Trip Reaction	DDS
M1_EarthFault_inEFmode	Block Motor1	SLG1:0136-TM1 Boggie-1 Isolated
M2_EarthFault_inEFmode	Block Motor2	SLG1:0136-TM2 Boggie-1 Isolated
M2_EarthFault_inEFmode	Block Motor3	SLG1:0136-TM3 Boggie-1 Isolated

5. Trip Reaction Modification as per bug report.

Modifications:

Event Name	Trip (Prev)	Trip (New)	Comment
M1_Temp_Probe_Failed	Block Motor1	Trip Motor1	Non-Blocking of Motor in case of Temperature Probe Broken/ Failed and limited to isolation of motor.
M2_Temp_Probe_Failed	Block Motor2	Trip Motor2	
M3_Temp_Probe_Failed	Block Motor3	Trip Motor3	
M1_Encoder_PlausabilityErr	None	Trip Motor1	DDS and pop-up registration for Encoder_Plausability error and Motor Trip.
M2_Encoder_PlausabilityErr	None	Trip Motor2	
M3_Encoder_PlausabilityErr	None	Trip Motor3	
LC_OC_due_to_OHE	Alarm	None	Removed the Internal Alarm

Added 100miliseconds OFF_Delay for Reconfiguration of Holding Circuit in case of Traction Converter isolation.

Added 100miliseconds of OFF_Delay for Reconfiguration of Harmonic Filter in case of Traction Converter isolation.

2.3 New features and extensions

1. Protection improvement for Earth Fault.

Change: Increased the delay time for Earth Fault detection to 200miliseconds from 100 miliseconds and adapted the parameters for Low Pass Filter to avoid spurious tripping.

Event Name	Trip (Prev)	Trip (New)	Comment
Earth_Fault	100miliseconds On Delay	200 miliseconds On Delay	Start Earth_Fault Mode and in case of un-successful Block converter 3 Attempts

2. Speed sensor non-physical fault mapping in DDS and popup

Change: Internal Alarm Message was introduced in last software named as «Speed_sensor_non_physical» fault. This helped to debug cases of intermittan speed encoder signal loss due to Grease or external conditions. The trips are further updated with DDS and popup.

Event Name	Trip (Prev)	Trip (New)
SpeedSens1_nonPhysical	Alarm	2 Times Event in 2 Minutes isolate Motor1 SLG1:0107-Dist.In speed sensor Motor-1
SpeedSens2_nonPhysical	Alarm	2 Times Event in 2 Minutes isolate Motor2 SLG1:0118-Dist.In speed sensor Motor-2
SpeedSens3_nonPhysical	Alarm	2 Times Event in 2 Minutes isolate Motor3 SLG1:0129-Dist.In speed sensor Motor-3

In the current software this fault is mapped to DDS and pop-up of «Speed_Encoder_Failure». Speed Valid Bit will not be modified in the event.

3 Release Approval

All the modifications of the new SW release are verified by testing the new functionalities comprehensively on the real time setup.

4 Field Action

With the RTS test results, it is recommended to upload the software into Locomotive and test the application in a run trial for improved converter reliability and to address the different issues reported by zonal railways.