EDITION CONTROL

SW VERSION	SW VERSION DDU	ISSUE	DATE
30_xx_b00/ 02_xx_b00	0x1Exx_b0x00/ 0x02xx_b0x00	Energy Saving Mode conditions change/ VCB Holding Bypass management in SIMULATION MODE	2024-04-09
30_xx_b01/ 02_xx_b01	0x1Exx_b0x01/ 0x02xx_b0x01	Energy Saving Mode conditions change	2024-04-19
30_xx_b02/ 02_xx_b02	0x1Exx_b0x02/ 0x02xx_b0x02	Energy Saving Mode conditions change/ Rectifier stop as VCB On Fast signal is received	2024-05-23
30_xx_b03/ 02_xx_b03	0x1Exx_b0x03/ 0x02xx_b0x03	Energy Saving Mode conditions change	2024-06-26
30_xx_b04/ 02_xx_b04	0x1Exx_b0x04/ 0x02xx_b0x04	Energy Saving Mode conditions change	2024-06-27
30_xx_b05/ 02_xx_b05	0x1Exx_b0x05/ 0x02xx_b0x05	Rectifier Message Timeout error / Neutral Zone management change	2024-08-26
30_xx_b06/ 02_xx_b06	0x1Exx_b0x06/ 0x02xx_b0x06	Non – official SW internal SW changes for testing purpose on Itarsi Shed	2024-08-26
30_xx_b07/ 02_xx_b07[1]	0x1Exx_b0x07/ 0x02xx_b0x07	SW Changes after IR/CLW visit on September 2024	2024-10-04
30_xx_b08/ 02_xx_b08	0x1Exx_b0x08/ 0x02xx_b0x08	Rectifier Message Timeout error solution	2024-10-31

Prepared by:	**Reviewed by:**	**Approved by:**
Name: Iñigo Beristain	**Name:** Ion Sagarzazu	**Name:** Xabier Zaldua
Date: 2024-10-31	**Date:** 2024-10-31	**Date:** 2024-10-31

[1] xx = 09 for WAG9 Locomotives, xx = 07 for WAP7 Locomotives and xx = 05 for WAP5 Locomotives.

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1. GLOSSARY

CAF	Construcciones y Auxiliar de Ferrocarriles
CGL	Crompton Greaves Limited
TCU	Traction Control Unit
VEGA	Vehicle Electronics for Generic Applications
ESM	Energy Saving Mode
HW	Hardware
SW	Software
VCU	Vehicle Control Unit
VCB	Vacuum Circuit Breaker
FLG	Master Controller CPU
SLG/SR	Traction Converter
HP	Horsepower
BUR	Auxiliary Converter
IGBT	Insulated Gate Bipolar Transistor
IR	Indian Railways
DO	Digital Output
DC	Direct Current
SCC	Short Circuit
SNS	Snapshoot

2. OBJECT

This document summarizes the purpose and the new features of the Software Version 30_xx_b08[2] for the project 6000HP 9 Module Power Converter Locomotive and SW version 02_xx_b08 for the project 6000HP 5 Module Power Converter Locomotive. This is released as per the feedback from previous SW v29 of 9 Module Power Converter and SW v01 for 5 Module Power Converter.

[2] xx = 09 for WAG9 Locomotives, xx = 07 for WAP7 Locomotives and xx = 05 for WAP5 Locomotives.

3. RELEASE NOTIFICATION

3.1. SW v30_xx_b00 / v02_xx_b00

Description
Energy Saving Mode modification
Problem: During the validation process of the ESM logic implemented in SW v29_xx_b15, it is detected that the transformer low pressure alarm management is not considering the ESM activation status. Once the ESM is activated, as the ERROR_TRAFO_UNDER_PRESS is not managed properly during this mode, the alarm is pop-up causing the ESM deactivation.
Solution: It is required to not consider the ERROR_TRAFO_UNDER_PRESS alarm activation conditions if the ESM is activated.

Description
VCB Holding Bypass error in SIMULATION MODE
Problem: During the validation process of SW v29, it is detected that in Simulation Mode, if any of two TCUs is isolated (or switched off), the VCB management was not properly done. Even if the VCB closing command is active, the VCB opens after 2 seconds. This problem was detected previously and solved for normal operating mode.

Solution:
The VCB management in Simulation mode shall consider the status of both TCUs (if there are any TCU isolated or switched off) to manage the different open/closing order coming from the different DOs:
`//! BYPASS VCB HOLD DO:`
`  //! 2020-03-27 CAFPA realized that SW was not properly managing VCB holding bypass DOs`
`  //! and SW has been corrected. From now the SLG will bypass the other TCU VCB contact only`
`  //! when the other TCU is isolated or switched OFF.`
`  if (m_pMVBDataBus->GetOtherSLGIsolatedOrSwitchedOff()){`
`  // the other SLG is isolated or switched off and it may not be controlling its own DO to`
`  // close the VCB so the working TCU bypasses it.`
`  bBypassVCBHoldDO = true;`
`  }else{`
`  // the other SLG is NOT isolated so, it is controlling its own VCB DO and there is no`
`  // need to bypass it`
`  bBypassVCBHoldDO = false;`
`  }`

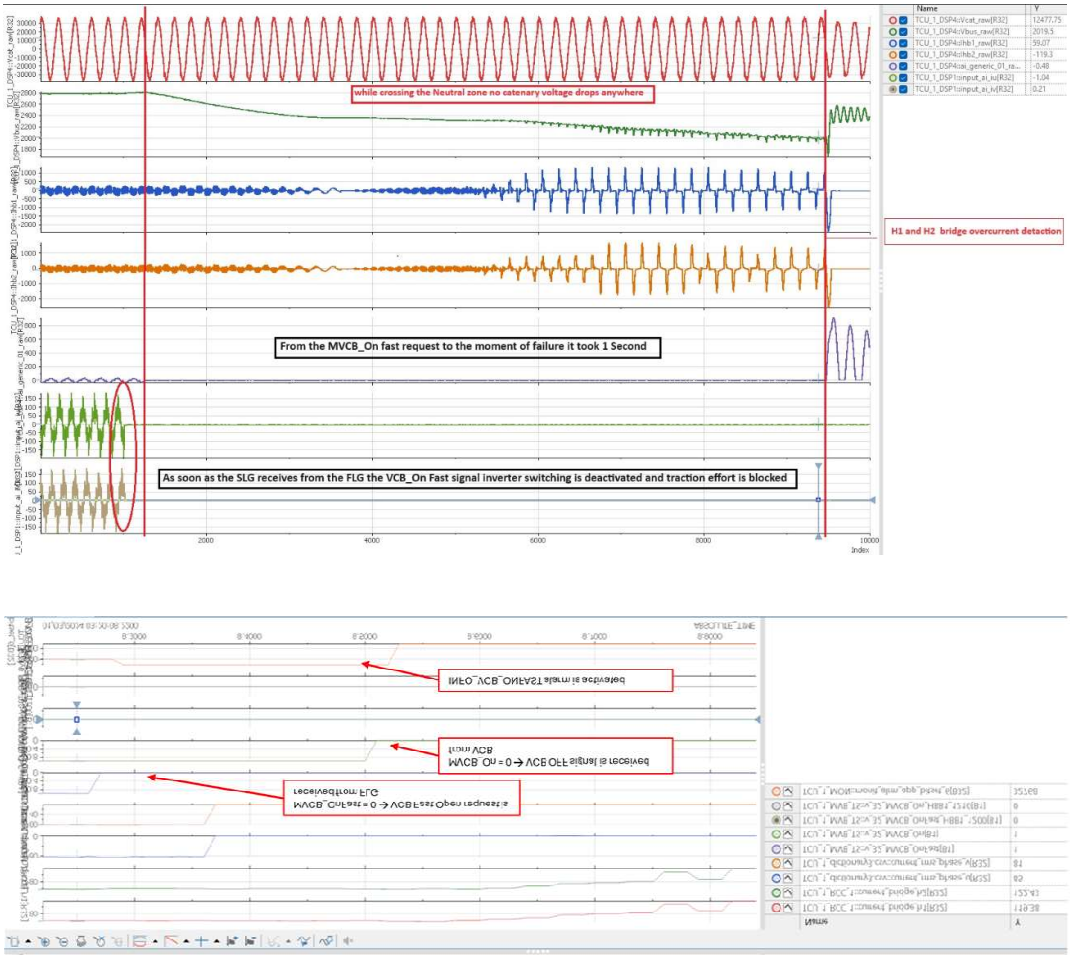
3.2. SW v30_xx_b01 / v02_xx_b01

Description
Energy Saving Mode modification
Problem: During the validation of SW v30_xx_b00 it is detected that even the variable v_07_XNodeMSC changed above Node 570 when the reverser position change from Neutral to Traction, the applied effort is not published into the variable v_53_WTE _BE_Loco until The FLG Node reached Node 596. In the conditions set on SW v29_xx_b15, and OR logic is implemented for those two variables v_07_XNodeMS ≤ 570 OR v_53_WTE _BE_Loco ≠ 0. As the v_53_WTE _BE_Loco does not change the value until Node 596 the FLG could close the contactors before the SLG considers that the ESM shall be deactivated isolating the system.
Solution: The condition of v_53_WTE _BE_Loco ≠ 0 shall be removed from the logic of ESM.

3.3. SW v30_xx_b02 / v02_xx_b02

Description
Energy Saving Mode modification
Problem: After several iterations with CGL it is agreed that the FLG will check also the conditions to enter/exit the ESM and will inform the SLG using the variable m_v_MEner_Sav_Mode_Act that the SLG can activate the ESM. The 5 minutes timer is erased from the SLG logic as it will be managed by FLG instead. The conditions to enter/exit the ESM will check in SLG to maintain the redundancy.

Description
Rectifier stop as VCB On Fast signal is received
Problem: During the validation of SW v29, there was an issue while crossing a Neutral Section. All the info related this issue is reported in Jira ID CLW-874 and that is the sequence of the failure: - The driver advises the SLG that the unit will cross a Neutral Section by pressing the VCB Open button and commanding the MVCB_OnFast signal to the SLG - In that moment, the TCU published a severity 4 alarm and blocks traction command stopping the switching of the inverter side IGBTs.The SLG maintains the line contactors closed. - As the Line voltage is still 25kV during the Neutral section (strange behavior to be clarified), the rectifier IGBTs remain switching. - The DC link voltage starts discharging quickly due to the switching of the rectifier IGBTs. - In less than 1 second after the Neutral section ENTER command is received the Neutral section EXIT command is received form the FLG. - As the rectifier remained switching during the “Neutral section”, the dv/dt generated when the VCB closed again generated an H bridge overcurrent. This overcurrent is detected by the rectifier opening the line contactors.



Solution:

To avoid this kind of situation will happen again, the rectifier IGBTs switching shall stop as soon as the MVCB_OnFast signal is received without waiting line voltage drops to zero in a Neutral section.

3.4. SW v30_xx_b03 / v02_xx_b03

Description
Energy Saving Mode modification
Problem: During the validation of SW v30_xx_b02, it is detected that there is a delay between the detection of the conditions to enter/exit the ESM between the SLG and the FLG that leads to the malfunctioning of this mode.
Solution: It is agreed along with CGL that the SLG will not check any condition to enter/exit ESM set on previous SW versions. The FLG will check all the required conditions to enter/exit this mode and will inform the SLG using the activation bit m_v_MEner_Sav_Mode_Act. If m_v_MEner_Sav_Mode_Act = 1 the SLG will enter the ESM and will pop-up the corresponding DDS to inform the driver that the ESM is activated. However, if m_v_MEner_Sav_Mode_Act = 0 the SLG will exit from the ESM and will pop-up the corresponding DDS.

3.5. SW v30_xx_b04 / v02_xx_b04

Description
Energy Saving Mode modification
Problem: During the validation of SW v30_xx_b03 it is detected that even if the ESM is active, the SLG sends ventilation request for inverter/rectifier modules when the temperature exceeds 45ºC. As during the ESM all BURs are deactivated, no ventilation command is sent. If the SLG request for ventilation and there is no feedback from the FLG/BURs, then the system is isolated.
Solution: It is agreed along with CGL that all the ventilation requests from the SLG will not be considered while the ESM remains active.

3.6. SW v30_xx_b05 / v02_xx_b05

Description

Rectifier Message Timeout

Problem:

In 5 Modules Locomotives, it is detected several ERROR_MESSAGE_TIMOUT activations right after the starting of VEGA rack (during the booting process of VEGA right after switching ON it):

17/08/2024 21:05:11.327	TCU_2_fr_log_ALARM_166	Info: TCU start WAG9 type	INFO_TCU_START_WAG9	1
17/08/2024 21:05:12.325	TCU_1_fr_log_ALARM_166	Info: TCU start WAG9 type	INFO_TCU_START_WAG9	1
17/08/2024 21:05:13.027	TCU_2_rc_log_ALARM_1	Message timeout	ERROR_MESSAGE_TIMEOUT	1
17/08/2024 21:05:13.035	TCU_2_rc_log_ALARM_30	Rectifier is in OUT OF SERVICE state	INFO_RCC_ENTER_OUT_OF_SERVICE	1
17/08/2024 21:05:13.045	TCU_2_fr_log_ALARM_271	Info: VCB open order sent due to disturbance	INFO_VCB_OPEN_DUE_TO_DISTURBANCE	1
17/08/2024 21:05:39.315	TCU_2_rc_log_ALARM_1	Message timeout	ERROR_MESSAGE_TIMEOUT	0
17/08/2024 21:05:39.327	TCU_2_fr_log_ALARM_166	Info: TCU start WAG9 type	INFO_TCU_START_WAG9	1
17/08/2024 21:05:40.116	TCU_2_fr_log_ALARM_271	Info: VCB open order sent due to disturbance	INFO_VCB_OPEN_DUE_TO_DISTURBANCE	0
17/08/2024 21:05:40.146	TCU_2_fr_log_ALARM_164	Info: SLG has been isolated	INFO_SLG_ISOLATED	1
17/08/2024 21:05:41.027	TCU_2_rc_log_ALARM_1	Message timeout	ERROR_MESSAGE_TIMEOUT	1
17/08/2024 21:05:41.036	TCU_2_rc_log_ALARM_30	Rectifier is in OUT OF SERVICE state	INFO_RCC_ENTER_OUT_OF_SERVICE	1
17/08/2024 21:05:41.046	TCU_2_fr_log_ALARM_271	Info: VCB open order sent due to disturbance	INFO_VCB_OPEN_DUE_TO_DISTURBANCE	1
17/08/2024 21:07:06.315	TCU_2_rc_log_ALARM_1	Message timeout	ERROR_MESSAGE_TIMEOUT	0
17/08/2024 21:07:06.327	TCU_2_fr_log_ALARM_166	Info: TCU start WAG9 type	INFO_TCU_START_WAG9	1
17/08/2024 21:07:06.327	TCU_1_fr_log_ALARM_166	Info: TCU start WAG9 type	INFO_TCU_START_WAG9	1
17/08/2024 21:07:07.116	TCU_2_fr_log_ALARM_271	Info: VCB open order sent due to disturbance	INFO_VCB_OPEN_DUE_TO_DISTURBANCE	0
17/08/2024 21:07:07.117	TCU_2_fr_log_ALARM_164	Info: SLG has been isolated	INFO_SLG_ISOLATED	0
17/08/2024 21:07:08.027	TCU_2_rc_log_ALARM_1	Message timeout	ERROR_MESSAGE_TIMEOUT	1
17/08/2024 21:07:08.036	TCU_2_rc_log_ALARM_30	Rectifier is in OUT OF SERVICE state	INFO_RCC_ENTER_OUT_OF_SERVICE	1
17/08/2024 21:07:08.046	TCU_2_fr_log_ALARM_271	Info: VCB open order sent due to disturbance	INFO_VCB_OPEN_DUE_TO_DISTURBANCE	1
17/08/2024 21:07:34.314	TCU_2_rc_log_ALARM_1	Message timeout	ERROR_MESSAGE_TIMEOUT	0
17/08/2024 21:07:34.327	TCU_2_fr_log_ALARM_166	Info: TCU start WAG9 type	INFO_TCU_START_WAG9	1

Solution:

The booting process tasks of VEGA rack have been sequenced. In previous SW versions, as VEGA is restarted, all cards started their corresponding booting task at the same time, so if the one of the booting tasks of DSP/MON started earlier than the CPU is started completely, then the communication between the DSP/MON/CPU shall suffer some problems. In SW v30_xx_b05, the DSP/MON cars will wait until the CPU starts before completing their corresponding booting tasks.

Description

Neutral Zone management change

Problem:

As a result of the validation of previous SW versions (29 and 30_b04), customer and CG requested to implement the same logic that is implementing for Neutral Sections also when driver opens the VCB in static condition:

दक्षिण रेलवे
Southern Railway
चेन्नै मंडल
Chennai Division

वरिष्ठ मंडल बिजली इंजीनियर कार्यालय
Office of Sr. Divisional Electrical Engineer
बिजली लोको शेड, रायपुरम
Electric Loco Shed, Royapuram
चेन्नै - 600 013
Chennai - 600 013
इ-मेल:/ Email : srdeersrpm@mas.railnet.gov.in

IMS (ISO 9001:2015, ISO 14001:2015 & ISO 45001 : 2018)

सं/No.M/RS/RPM/221/III/08/24/E8 दिनांक/Date 13.08.2024

CELE/SR

Sub: Performance of CGL IGBT software Version 30 Beta 04 **-reg**

CGL has come up with a new software version 30 Beta 04 to address the issue Line contactors opening and DC link voltage discharging immediately after opening the VCB in neutral section. This software version 30 Beta 04 has been started loading in locos from date 24-07-24 onwards for trial basis and completed in 10 locos. After running for 15 days in mainline the VCU and SR data of loco no. 30422 has been analyzed and no abnormalities were noticed in the data. The performance of new software is satisfactory. However, the following Minor issues are yet to be addressed/checked in this software are,

1. Currently DC link voltage is maintained on VCB opening/closing only after loco speed reaches above 5 Kmph. Below 5 Kmph and at stand still condition if VCB opened Line contactors are opening and DC link voltage is discharging and after closing VCB DC link capacitor has to go to charging cycle which causes IGBT power modules to undergo heavy inrush current. So, during routine test at shed/trip sheds, the new software is not helping to safe guard modules. So, software has to be corrected such that DC link voltage should not discharge immediately irrespective of the running speed.
2. Locking of traction converters to be checked and verified when severe fault like IGBT error is being detected.

It is requested to advise CLW to validate the release notes and give approval for loading the software in remaining fleet of locos.

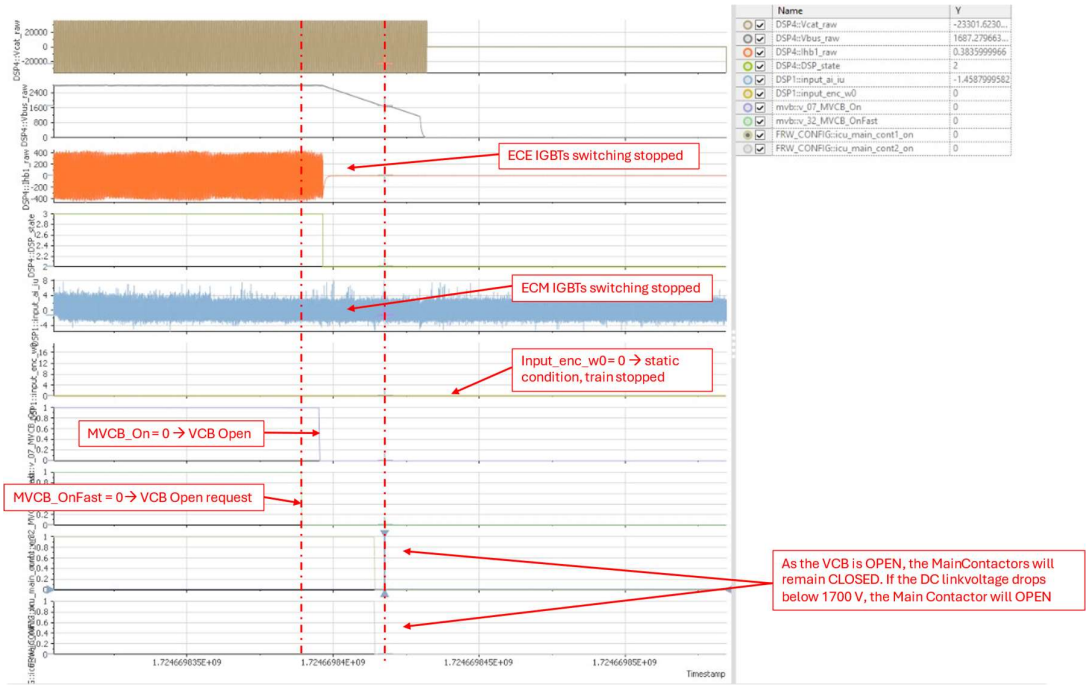
13.08.24
Naga Sreenivasu Rongala,
Sr.DEE/RS/RPM

Copy To:
Dy.CEE/D-II/CLW/CRJ - for kind information and necessary action

Solution:

The speed limitation of 1 m/s (3.6 km/h) is erased from the Neutral Section management logic so in both static and running conditions, as soon as the driver requested to open the VCB, the ECE and ECM IGBTs switching will stop, the contactors will REMAIN CLOSED, and the DC link will start discharging through the Permanent Discharge Resistor (RDP). If the DC link voltage drops below 1700 Vdc, the contactors will open to prevent high inrush current peak when the VCB is reconnected.

The behavior is evaluated in the HIL environment successfully:



3.7. SW v30_xx_b06 / v02_xx_b06

Description
Nonofficial SW version released for testing purpose on Itarsi shed

3.8. SW v30_xx_b07 / v02_xx_b07[3]

SW Identification changed

As per request of IR, the SW version identification has been changed to show clearly into the HMI the SW version uploaded as long as the Loco Type identification:

For 9 Modules:

- WAG9: 30_09_bxx → HMI format: 1E09 (**1E** = v30/ **09**=WAG9)
- WAP7: 30_07_bxx → HMI format: 1E07 (**1E** = v30/ **07**=WAP7)
- WAP5: 30_05_bxx → HMI format: 1E05 (**1E** = v30/ **05**=WAP5)

For 5 Modules:

- WAG9: 02_09_bxx → HMI format: 0209 (**02** = v02/ **09**=WAG9)
- WAP7: 02_07_bxx → HMI format: 0207 (**02** = v02/ **07**=WAP7)
- WAP5: 02_05_bxx → HMI format: 0205 (**02** = v02/ **05**=WAP5)

As per the new identification format, the major of the SW version (first two digits) will be used for SW version identification itself (v29, v30, v31, etc.), while the minor (last two digits) will be used for Locomotive Type identification (WAG9 = 09, WAP7=07 and WAP5=05).

The same is tested in a WAG9 locomotive in Rourkela shed:

[3] xx = 09 for WAG9 Locomotives, xx = 07 for WAP7 Locomotives and xx = 05 for WAP5 Locomotives.

Description
Converter Liquid Pump DO management
Problem: It is detected that with SW v29 the Converter Cooling System pump DO is commanded to switch ON and OFF every time the VCB is open/close. The multiple number of switches is generating stress to the cooling pump contactor that is leading to failures.
Solution: The pump DO command logic is change as per Royapuram shed's request: - If SLG in IDLE state → Pump ON (FLG Node <504) - If VCB Off → Pump ON - If SLG Isolated → Pump OFF The same was evaluated in the HIL environment:

Description
NSC/ASC/Converter Contactor Timeout issues
Problem: Old problem. It is detected that the SLG is getting stuck in a different node than the FLG while recovering from a severity 3 alarm activation (Severity 3 alarm = open contactor request).

When a Severity 3 alarm is activated, the affected SLG would open its contactors and would try to recover by itself without informing the FLG about the error to not open the VCB. In that process, the SLG state machine goes back to the initial Node 1999 and moves forward to the Node 3216 (FLG Node 596). It is detected that during the recovering process the SLG is getting stuck in some of the nodes in between generating the miss synchronization between the FLG and SLG Nodes.

This lack of synchronization leads to the FLG generating the Timeout alarms and isolating the corresponding SLG.

Solution:

The error recovering process of the SLG is reinforced to ensure that while recovering from the Node 1999, the SLG can move up to the Node 3216 without any error.

This behavior shall be evaluated on field service.

Description

MOTOR ISOLATION due to Cooling Evaluator problems

Problem:

In some sheds, it is detected that if the Cooling System is not ready and the driver moves the throttle to forward position (usually 9 seconds after the VCB is closed) to apply traction effort, the SLG is getting isolated due to ALL MOTORS ISOLATION alarm.
Once the VCB is closed, if the Cooling System (Cooling level or Cooling pressure) is not ready, the alarm WARNING_COOLING_SYSTEM_NOT_READY is active in Traction Logs. Being the alarm active, if the FLG commands to apply traction effort, the alarm ALL MOTORS ISOLATED is pop-up to the driver isolating the corresponding SLG.

2. Motor/ Bogie isolation due to VBUS maximum/without proper logs.

- In 29 Version software Motors used to get isolate with Vbus max. in 30 version software Motors are getting isolated without proper SR Logs. In 30B05 version also motors getting isolated without proper reasons. Additionally warning message cooling not ready logged in SR data.

24 . 08 . 2024 15:18:27	FLG1:0040-S/R interlock - main res. low
24 . 08 . 2024 15:18:15	FLG1:0094-SS02 traction bogie1 off
24 . 08 . 2024 15:17:52	SLG1:0087-Motor 1 Isolation
24 . 08 . 2024 15:17:16	SLG1:0087-Motor 1 Isolation
24 . 08 . 2024 15:17:52	SLG1:0088-Motor 2 Isolation
24 . 08 . 2024 15:17:16	SLG1:0088-Motor 2 Isolation
24 . 08 . 2024 15:17:52	SLG1:0089-Motor 3 Isolation
24 . 08 . 2024 15:17:16	SLG1:0089-Motor 3 Isolation
24 . 08 . 2024 13:50:13	SLG1:0020-Primary voltage < minimum

VCU data 39345

24-08-2024 15:17:04	Info: HSCB Closed	INFO_HSCB_CLOSE	TCU_1_fr_log_ALARM_175	1
24-08-2024 15:17:04	Warning: Pump ACK signal not working properly	WARNING_PUMP_ACK_NOT_RECEIVED	TCU_1_fr_log_ALARM_244	0
24-08-2024 15:17:10	Info: Traction lock command received from FLG	INFO_FLG_TRACTION_LOCK_ACTIVE	TCU_1_fr_log_ALARM_274	0
24-08-2024 15:17:13	Info: ASC not pulsing so traction is locked	INFO_ASC_NOT_PULSING_TRACTION_LOCK_ACTIVE	TCU_1_fr_log_ALARM_275	0
24-08-2024 15:17:18	Error: Motor has been isolated until electronics are reset	ERROR_MOTOR_ISOLATED	TCU_1_tc1_log_ALARM_48	1
24-08-2024 15:17:18	Error: Motor has been isolated until electronics are reset	ERROR_MOTOR_ISOLATED	TCU_1_tc2_log_ALARM_48	1
24-08-2024 15:17:18	Error: Motor has been isolated until electronics are reset	ERROR_MOTOR_ISOLATED	TCU_1_tc3_log_ALARM_48	1
24-08-2024 15:17:18	Error: All motors in bogie are isolated	ERROR_ALL_MOTORS_ISOLATED	TCU_1_fr_log_ALARM_302	1
24-08-2024 15:17:18	Info: VCB open order sent due to disturbance	INFO_VCB_OPEN_DUE_TO_DISTURBANCE	TCU_1_fr_log_ALARM_271	1
24-08-2024 15:17:18	Warning: Cooling system not ready	WARNING_COOLING_SYSTEM_NOT_READY	TCU_1_fr_log_ALARM_317	0
24-08-2024 15:17:21	Info: Fast VCB open order received	INFO_HSCB_FAST_OPEN	TCU_1_fr_log_ALARM_173	1
24-08-2024 15:17:21	Info: Traction lock command received from FLG	INFO_FLG_TRACTION_LOCK_ACTIVE	TCU_1_fr_log_ALARM_274	1
24-08-2024 15:17:21	Info: ASC not pulsing so traction is locked	INFO_ASC_NOT_PULSING_TRACTION_LOCK_ACTIVE	TCU_1_fr_log_ALARM_275	1
24-08-2024 15:17:21	Info: HSCB Closed	INFO_HSCB_CLOSE	TCU_1_fr_log_ALARM_175	0

SR data 30b05

Solution:

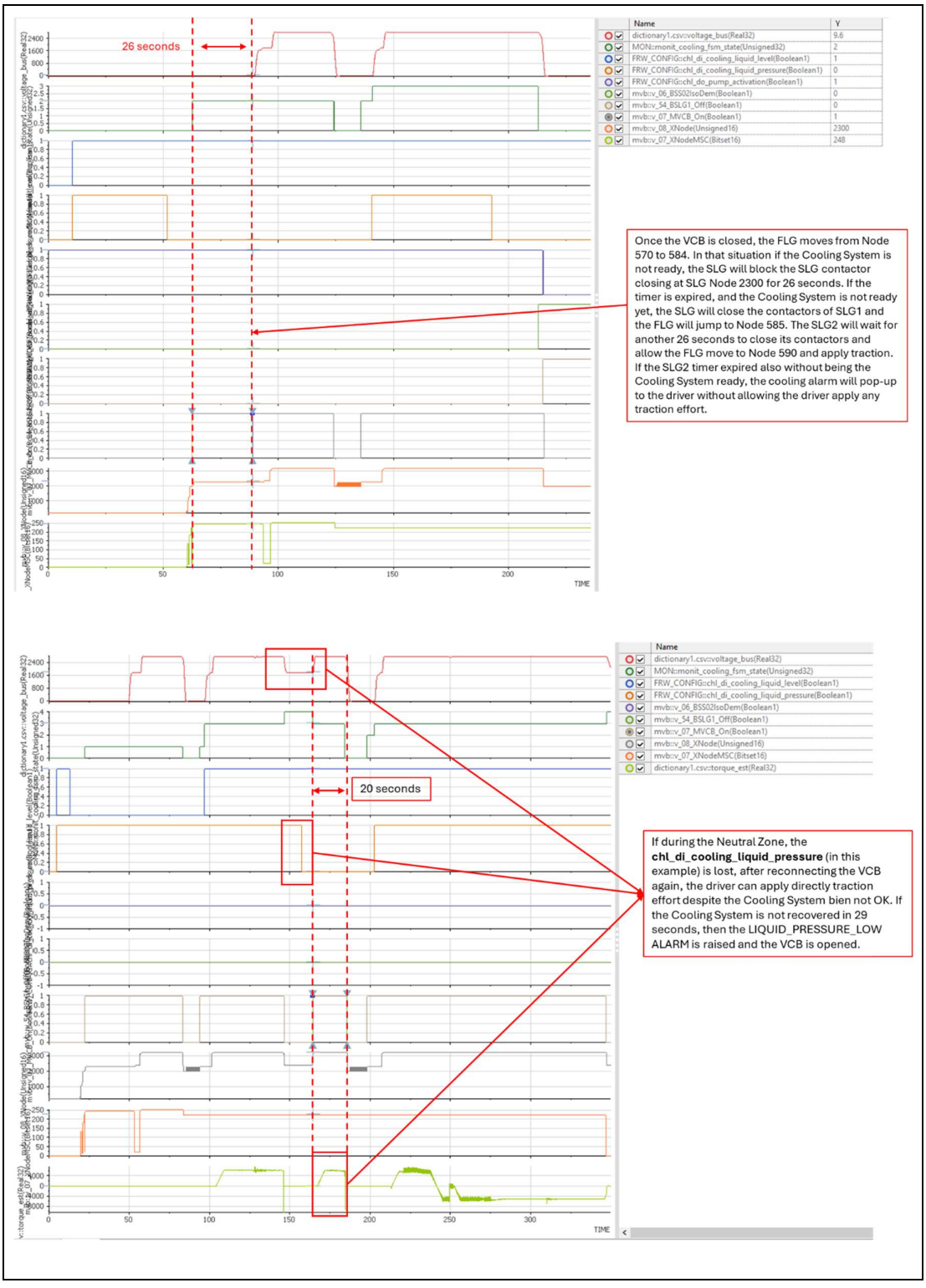
The SLG contactor closed at FLG Node 584 (SLG1) and 585 (SLG2) has been conditioned to the Cooling System ready status. This means that if the Cooling System is not ready when the driver goes from Node 570 to 590, the SLG will block the contactor closing at Node 584/585 to prevent apply any traction effort in that situation.

To avoid the FLG alarm of Converter Contactor Timeout if the Cooling System is not becoming ready after the FLG commands the contactor closing in these nodes, a timer of 26 seconds is added also to the conditions as if the timer is expired but the Cooling System is not ready yet, the FLG could move to Node 585 without giving any error.

The same logic is implemented in node 584 (For SLG1) and Node 585 (for SLG2). With this, if the Cooling System is not ready in 52 seconds, the alarm of LIQUID_PRESSURE_LOW or LIQUID_LEVEL_LOW will rise before the driver can reach Node 590.

Note that after crossing a Neutral section, once the VCB is closed and if the DC link is not dropped below 1700 Vdc (and the contactors are not opened) the driver could apply directly Traction effort regardless of the status of Cooling System. Then, if after crossing a Neutral Section the Cooling System remains not OK for 20 seconds, the alarm will raise to the driver. **If any of the Cooling System alarm is raised twice (LIQUID_PRESSURE_LOW OR LIQUID_LEVEL_LOW), the SLG would be isolated until the electronics are restarted. For more information, refer to SW v00_29 Release Note.**

The same was evaluated in the HIL environment:


26 seconds
Name
Y
dictionary1.csv::voltage_bus(Real32) 9.6
MON::monit_cooling_fsm_state(Unsigned32) 2
FRW_CONFIG::chl_di_cooling_liquid_level(Boolean1) 1
FRW_CONFIG::chl_di_cooling_liquid_pressure(Boolean1) 0
FRW_CONFIG::chl_do_pump_activation(Boolean1) 1
mvb::v_06_BSS02IsoDem(Boolean1) 0
mvb::v_54_BSLG1_Off(Boolean1) 0
mvb::v_07_MVCB_On(Boolean1) 1
mvb::v_08_XNode(Unsigned16) 2300
mvb::v_07_XNodeMSC(Bitset16) 248
Once the VCB is closed, the FLG moves from Node 570 to 584. In that situation if the Cooling System is not ready, the SLG will block the SLG contactor closing at SLG Node 2300 for 26 seconds. If the timer is expired, and the Cooling System is not ready yet, the SLG will close the contactors of SLG1 and the FLG will jump to Node 585. The SLG2 will wait for another 26 seconds to close its contactors and allow the FLG move to Node 590 and apply traction. If the SLG2 timer expired also without being the Cooling System ready, the cooling alarm will pop-up to the driver without allowing the driver apply any traction effort.
TIME
20 seconds
Name
dictionary1.csv::voltage_bus(Real32)
MON::monit_cooling_fsm_state(Unsigned32)
FRW_CONFIG::chl_di_cooling_liquid_level(Boolean1)
FRW_CONFIG::chl_di_cooling_liquid_pressure(Boolean1)
mvb::v_06_BSS02IsoDem(Boolean1)
mvb::v_54_BSLG1_Off(Boolean1)
mvb::v_07_MVCB_On(Boolean1)
mvb::v_08_XNode(Unsigned16)
mvb::v_07_XNodeMSC(Bitset16)
dictionary1.csv::torque_est(Real32)
If during the Neutral Zone, the chl_di_cooling_liquid_pressure (in this example) is lost, after reconnecting the VCB again, the driver can apply directly traction effort despite the Cooling System bien not OK. If the Cooling System is not recovered in 29 seconds, then the LIQUID_PRESSURE_LOW ALARM is raised and the VCB is opened.
TIME

Description

SLG Background Data (SNS) Configuration Change

Problem:

SLG background data is neither clear nor sufficient for system fault investigation.

Solution:

In SW version 30b07, 10 new triggers have been defined for snapshot generation to improve the analysis from the SLG background data during fault investigation.

The background data stored as a snapshot or trigger file in the SLG can be of two types, DSP fast frequency variables (100us) or CPU and MVB slow frequency variables (10ms). The high frequency DSP background data variables will be taken from the SLG subsystem, and the normal frequency background data variables will be taken from VCU and SLG subsystems.

The first 3 triggers (0-1-2), defined as the most critical failures, will store high and low frequency variables, and the next 3 to 9 trigger only low frequency variables.

The IGBT error trigger1 background data will be the only one non-recordable type of snapshot, which is considered critical in case of an IGBT error in the system. The other triggers are overwritable in time.

The IGBT, Overvoltage and Overcurrent triggers, set with high frequency variables, will have a maximum capacity of 10 snapshots. The other less critical triggers, each will have 5 numbers.

Below is the detail of the new snapshot configuration:

Trigger	ERROR description	Sample Period	SNS Type	Max Number
0	IGBT	High + Low	Non-recordable	10
1	Over Current	High + Low	Recordable	10
2	Over Voltage	High + Low	Recordable	10
3	SLG1 Isolation	Low	Recordable	5
4	SLG2 Isolation	Low	Recordable	5
5	Cooling System	Low	Recordable	5
6	Harmonic Filter	Low	Recordable	5
7	Contactors	Low	Recordable	5
8	Temperature 1	Low	Recordable	5
9	Temperature 2	Low	Recordable	5

*Snapshots variable description document will be updated according to changes done in SW v30.

Description

SLG Isolation due to Harmonic Filter Overcurrent alarms

Problem:

On Royapuram shed, it is detected that if the Harmonic Filter Overcurrent alarm is detected twice in less than 1800 seconds, then the corresponding SLG harmonic filter is isolated, and the speed is limited to 40 kmph. The activation of this alarm could be normal after raising the pantograph and/or closing the VCB due to magnetization current through the transformer winding or due to a high harmonic frequency component in the AC catenary.

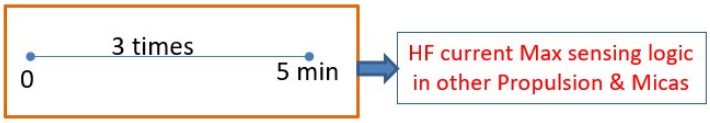
The proposal is to change the alarm management so that if the alarm is detected three times in less than 5 minutes, then the harmonic filter would be isolated. This management could help to better differentiate a critical over current situation (real problem on the harmonic filter) to the non-critical sporadic events and increase the field availability.

3. Harmonic filter isolation with filter current > Max

- Harmonic filter isolation with Filter current greater than maximum is frequent in CGL. Firm is advised to solve this problem by adding a delay of 1 sec in detection of fault and by permitting the fault for 3 occurrences in 5 minutes(as implemented in BHEL/MEDHA locos). Additionally This harmonic filter counter to be reset every 5 minutes as per MICAS logic. CGL is yet to solve this issue.

04 . 07 . 2024 22:15:11	FLG1:0117-Power off of MCE
04 . 07 . 2024 22:10:19	FLG1:0018-Emergency stop - shutdown
04 . 07 . 2024 22:08:29	SLG1:0023-Filter current > maximum
04 . 07 . 2024 22:08:26	FLG1:0096-SS04 harmonic filter
04 . 07 . 2024 22:08:21	SLG1:0023-Filter current > maximum
04 . 07 . 2024 21:56:48	SLG2:0023-Filter current > maximum
04 . 07 . 2024 21:56:31	SLG1:0023-Filter current > maximum
04 . 07 . 2024 21:56:31	SLG2:0023-Filter current > maximum
04 . 07 . 2024 07:45:22	FLG1:0035-S/R interlock - loco brake

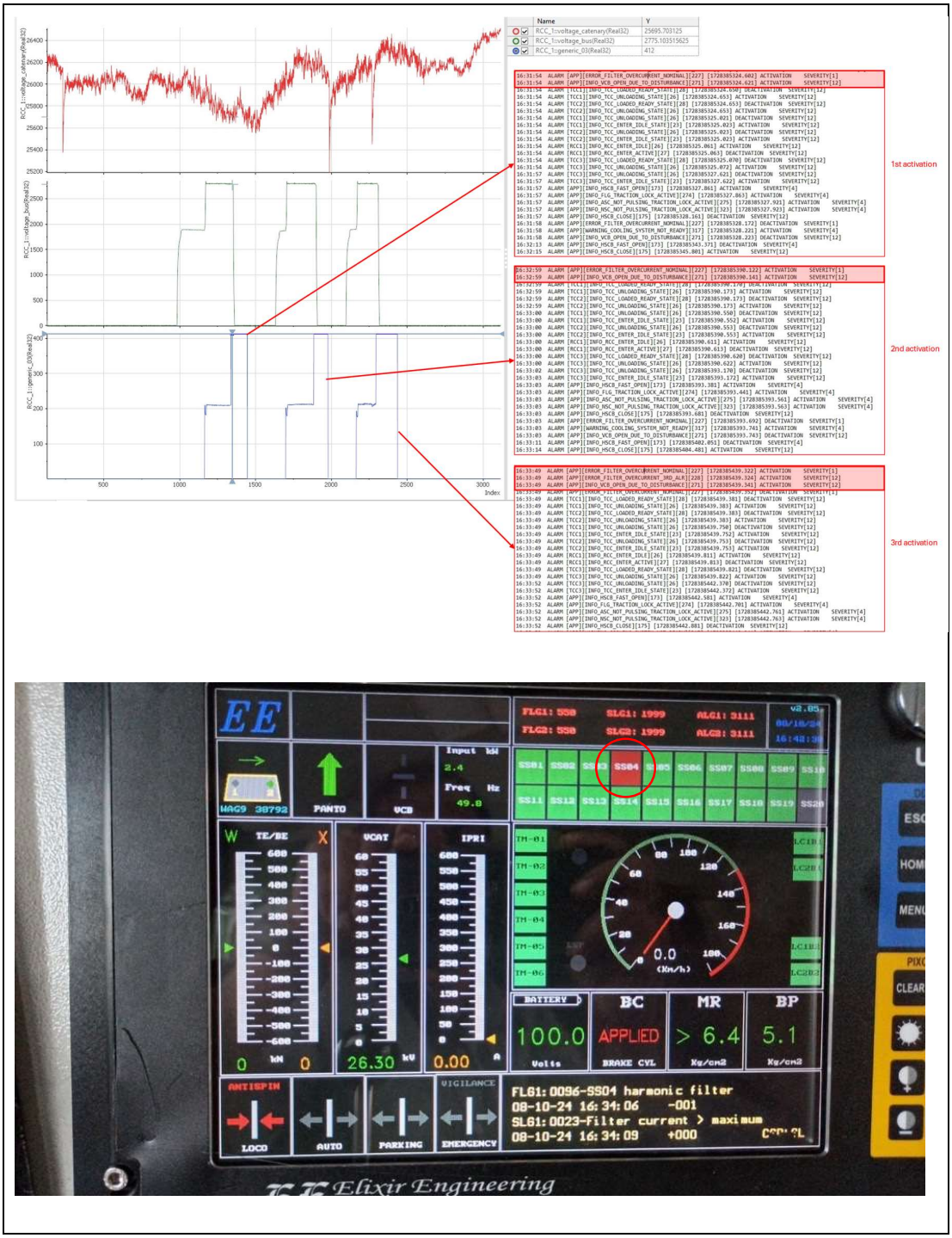
VCU data



Solution:

The Harmonic Filter Overcurrent alarm management is changed.

This behavior has been evaluated on field service at Rourkela shed:


1st activation
2nd activation
3rd activation
Elixir Engineering

Description

IGBT error management change

Problem:

After the implementation of SW v29 (v01 of 5 Module) it is detected that the number of SR Block events has increased due to the new management of the IGBT errors set on the v29 SW version, reducing the Loco availability on field service.

Solution:

The IGBT errors and the corresponding alarm management has been segregated to Critical IGBT errors and NON-Critical IGBT errors as follows:

- **Non – Critical Inverter (ECM):**
  - Error in IGBT X; igbt_err_X
  - Error in IGBT Ack X; igbt_no_ack_X
  - Error in IGBT chopper X; igbt_err_chop_
  - Error in IGBT chopper ack X; igbt_no_ack_chop_X
  - Error. VGE error in IGBTX; IGBT_ERROR_VGE_X
  - Error. Long term error in IGBTX; IGBT_ERROR_LONG_X
  - Error. Short term error in IGBTX; IGBT_ERROR_SHORT_X
- **Critical - Inverter (ECM):**
  - SCC error in IGBTX; IGBT_ERROR_SCC_X [TCUX] [4]

- **Non – Critical Rectifier (ECE):**
  - General error in IGBT X; ERROR_GENERAL_IGBT_X
  - No ACK error in IGBT X; ERROR_NO_ACK_IGBT_X
  - VGE error in IGBT X; ERROR_VGE_IGBT_X
  - Short term error in IGBT X; ERROR_SHORT_TERM_IGBT_X
  - Long term error in IGBT X; ERROR_LONG_TERM_IGBT_X
- **Critical – Rectifier (ECE):**
  - Short circuit in IGBT X; ERROR_SCC_IGBT_X [RCUX][5]

To increase the field availability, the IGBT error management has been changed as per a Non – Critical IGBT error only would isolate the part of the SR that is generating the error leaving the rest of the converters on the same SR available to apply traction.

It is detected also, from different module blast recordings analysis, that many times the Short Circuit (SCC) error is not recorded along with the module blast case. However, any Non – Critical IGBT errors are detected instead along with a DC link sudden drop (DC link short circuit).

To detect and segregate the critical IGBT error blast situation from the non-critical situation, a new DC link Voltage drop detection is added also to detect a DC link short circuit.

The behavior of the system has been evaluated in the HIL environment for all the possible situations:

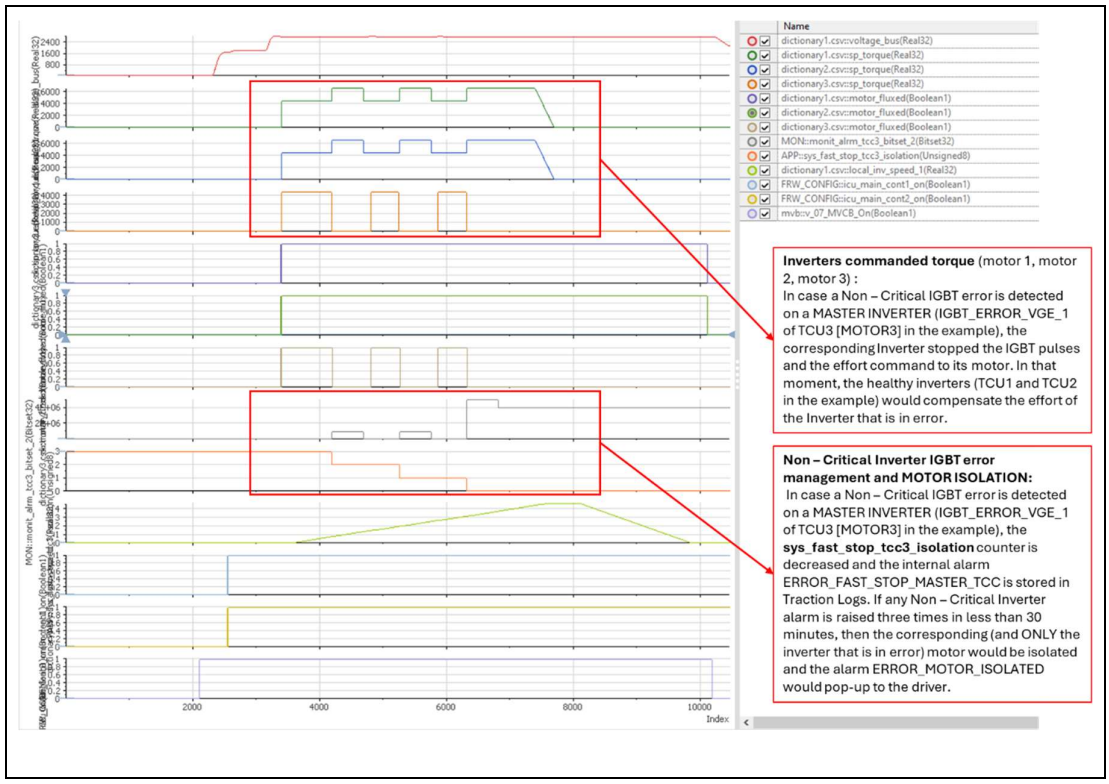
[4] X being the IGBT number 1 to 8

[5] X being the IGBT number 1 to 8

- **Non – Critical IGBT error - Slave Inverter (TCC1, TCC2) → UP to ISOLATION**

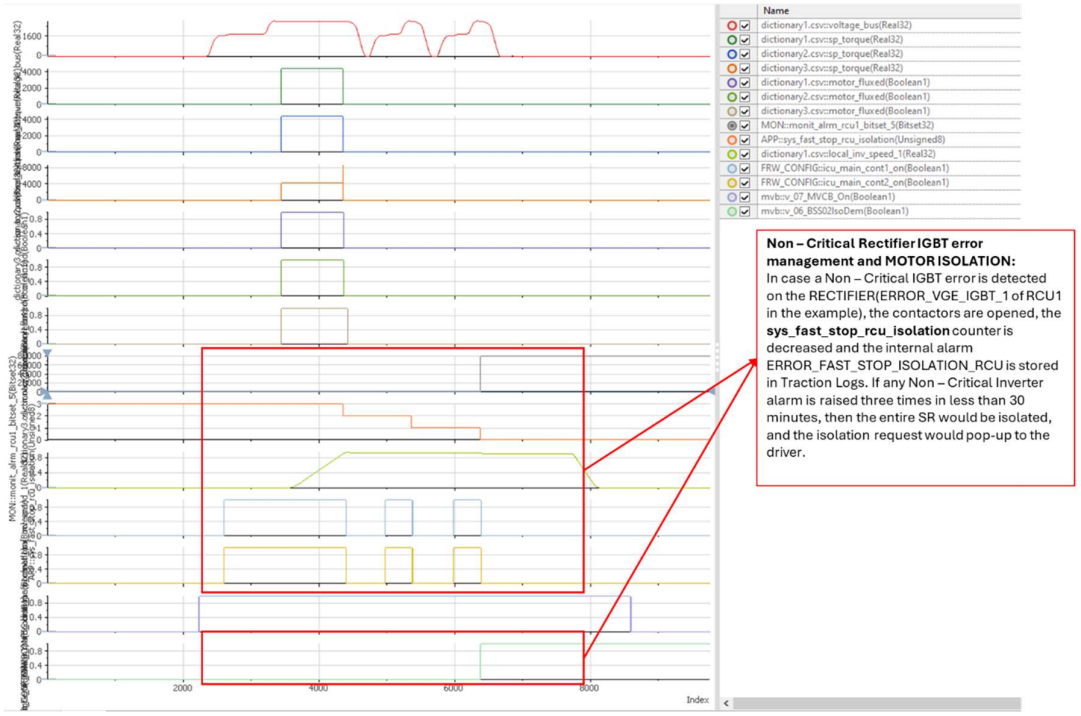
```
10:39:37  ALARM [ICU1][IGBT_ERROR_VGE_1][183] [1727778980.068] ACTIVATION    SEVERITY[4]
10:39:37  ALARM [TCC1][INFO_TCC_LOADED_READY_STATE][28] [1727778980.069] DEACTIVATION  SEVERITY[12]
10:39:37  ALARM [TCC1][INFO_TCC_LOADED_DISABLED_STATE][25] [1727778980.071] ACTIVATION    SEVERITY[12]
10:39:37  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727778980.078] ACTIVATION    SEVERITY[11]
10:39:37  ALARM [TCC1][ERROR_FAST_STOP_SLAVE_TCC][55] [1727778980.090] ACTIVATION    SEVERITY[11]
10:39:38  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727778981.189] DEACTIVATION  SEVERITY[11]
10:39:42  ALARM [ICU1][IGBT_ERROR_VGE_1][183] [1727778985.098] DEACTIVATION  SEVERITY[4]
10:39:42  ALARM [TCC1][INFO_TCC_LOADED_DISABLED_STATE][25] [1727778985.099] DEACTIVATION  SEVERITY[12]
10:39:42  ALARM [TCC1][INFO_TCC_LOADED_READY_STATE][28] [1727778985.101] ACTIVATION    SEVERITY[12]
10:39:42  ALARM [TCC1][ERROR_FAST_STOP_SLAVE_TCC][55] [1727778985.130] DEACTIVATION  SEVERITY[11]
10:39:43  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727778986.199] ACTIVATION    SEVERITY[11]
10:39:45  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727778987.458] DEACTIVATION  SEVERITY[11]
10:39:48  ALARM [ICU1][IGBT_ERROR_VGE_1][183] [1727778991.048] ACTIVATION    SEVERITY[4]
10:39:48  ALARM [TCC1][INFO_TCC_LOADED_READY_STATE][28] [1727778991.049] DEACTIVATION  SEVERITY[12]
10:39:48  ALARM [TCC1][INFO_TCC_LOADED_DISABLED_STATE][25] [1727778991.051] ACTIVATION    SEVERITY[12]
10:39:48  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727778991.058] ACTIVATION    SEVERITY[11]
10:39:48  ALARM [TCC1][ERROR_FAST_STOP_SLAVE_TCC][55] [1727778991.070] ACTIVATION    SEVERITY[11]
10:39:49  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727778992.169] DEACTIVATION  SEVERITY[11]
10:39:53  ALARM [ICU1][IGBT_ERROR_VGE_1][183] [1727778996.078] DEACTIVATION  SEVERITY[4]
10:39:53  ALARM [TCC1][INFO_TCC_LOADED_DISABLED_STATE][25] [1727778996.079] DEACTIVATION  SEVERITY[12]
10:39:53  ALARM [TCC1][INFO_TCC_LOADED_READY_STATE][28] [1727778996.081] ACTIVATION    SEVERITY[12]
10:39:53  ALARM [TCC1][ERROR_FAST_STOP_SLAVE_TCC][55] [1727778996.110] DEACTIVATION  SEVERITY[11]
10:39:54  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727778997.178] ACTIVATION    SEVERITY[11]
10:39:56  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727778998.438] DEACTIVATION  SEVERITY[11]
10:39:59  ALARM [ICU1][IGBT_ERROR_VGE_1][183] [1727779002.088] ACTIVATION    SEVERITY[4]
10:39:59  ALARM [TCC1][INFO_TCC_LOADED_READY_STATE][28] [1727779002.089] DEACTIVATION  SEVERITY[12]
10:39:59  ALARM [TCC1][INFO_TCC_LOADED_DISABLED_STATE][25] [1727779002.091] ACTIVATION    SEVERITY[12]
10:39:59  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727779002.099] ACTIVATION    SEVERITY[11]
10:39:59  ALARM [TCC1][ERROR_FAST_STOP_SLAVE_TCC][55] [1727779002.110] ACTIVATION    SEVERITY[11]
10:39:59  ALARM [TCC1][ERROR_FAST_STOP_ISOLATION_SLAVE_TCC][57] [1727779002.129] ACTIVATION    SEVERITY[4]
10:40:00  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727779003.209] DEACTIVATION  SEVERITY[11]
10:40:02  ALARM [TCC1][ERROR_MOTOR_ISOLATED][48] [1727779005.148] ACTIVATION    SEVERITY[4]
10:40:04  ALARM [ICU1][IGBT_ERROR_VGE_1][183] [1727779007.118] DEACTIVATION  SEVERITY[4]
10:40:04  ALARM [TCC1][INFO_TCC_LOADED_DISABLED_STATE][25] [1727779007.119] DEACTIVATION  SEVERITY[12]
10:40:04  ALARM [TCC1][INFO_TCC_LOADED_READY_STATE][28] [1727779007.121] ACTIVATION    SEVERITY[12]
10:40:04  ALARM [TCC1][ERROR_FAST_STOP_SLAVE_TCC][55] [1727779007.150] DEACTIVATION  SEVERITY[11]
```

- **Non – Critical IGBT error - Master Inverter (TCC3) → Up to ISOLATION**


Name
dictionary1.csv::voltage_bus(Real32)
dictionary1.csv::sp_torque(Real32)
dictionary2.csv::sp_torque(Real32)
dictionary3.csv::sp_torque(Real32)
dictionary1.csv::motor_fluxed(Boolean1)
dictionary2.csv::motor_fluxed(Boolean1)
dictionary3.csv::motor_fluxed(Boolean1)
MON::monit_alrm_tcc3_bitset_2(Bitset32)
APP::sys_fast_stop_tcc3_isolation(Unsigned8)
dictionary1.csv::local_inv_speed_1(Real32)
FRW_CONFIG::icu_main_cont1_on(Boolean1)
FRW_CONFIG::icu_main_cont2_on(Boolean1)
mvb::v_07_MVCB_On(Boolean1)
2000
4000
6000
8000
10000
Index
Inverters commanded torque (motor 1, motor 2, motor 3) :
In case a Non – Critical IGBT error is detected on a MASTER INVERTER (IGBT_ERROR_VGE_1 of TCU3 [MOTOR3] in the example), the corresponding Inverter stopped the IGBT pulses and the effort command to its motor. In that moment, the healthy inverters (TCU1 and TCU2 in the example) would compensate the effort of the Inverter that is in error.
Non – Critical Inverter IGBT error management and MOTOR ISOLATION:
In case a Non – Critical IGBT error is detected on a MASTER INVERTER (IGBT_ERROR_VGE_1 of TCU3 [MOTOR3] in the example), the sys_fast_stop_tcc3_isolation counter is decreased and the internal alarm ERROR_FAST_STOP_MASTER_TCC is stored in Traction Logs. If any Non – Critical Inverter alarm is raised three times in less than 30 minutes, then the corresponding (and ONLY the inverter that is in error) motor would be isolated and the alarm ERROR_MOTOR_ISOLATED would pop-up to the driver.

```
10:53:51  ALARM [ICU3][IGBT_ERROR_VGE_1][183] [1727779834.109] ACTIVATION    SEVERITY[4]
10:53:51  ALARM [TCC3][INFO_TCC_LOADED_READY_STATE][28] [1727779834.111] DEACTIVATION  SEVERITY[12]
10:53:51  ALARM [TCC3][INFO_TCC_LOADED_DISABLED_STATE][25] [1727779834.112] ACTIVATION    SEVERITY[12]
10:53:51  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727779834.119] ACTIVATION    SEVERITY[11]
10:53:51  ALARM [TCC3][ERROR_FAST_STOP_MASTER_TCC][56] [1727779834.131] ACTIVATION    SEVERITY[11]
10:53:52  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727779835.230] DEACTIVATION  SEVERITY[11]
10:53:56  ALARM [ICU3][IGBT_ERROR_VGE_1][183] [1727779839.139] DEACTIVATION  SEVERITY[4]
10:53:56  ALARM [TCC3][INFO_TCC_LOADED_DISABLED_STATE][25] [1727779839.142] DEACTIVATION  SEVERITY[12]
10:53:56  ALARM [TCC3][INFO_TCC_LOADED_READY_STATE][28] [1727779839.142] ACTIVATION    SEVERITY[12]
10:53:56  ALARM [TCC3][ERROR_FAST_STOP_MASTER_TCC][56] [1727779839.171] DEACTIVATION  SEVERITY[11]
10:53:57  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727779840.270] ACTIVATION    SEVERITY[11]
10:53:58  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727779841.529] DEACTIVATION  SEVERITY[11]
10:54:02  ALARM [ICU3][IGBT_ERROR_VGE_1][183] [1727779844.729] ACTIVATION    SEVERITY[4]
10:54:02  ALARM [TCC3][INFO_TCC_LOADED_READY_STATE][28] [1727779844.731] DEACTIVATION  SEVERITY[12]
10:54:02  ALARM [TCC3][INFO_TCC_LOADED_DISABLED_STATE][25] [1727779844.732] ACTIVATION    SEVERITY[12]
10:54:02  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727779844.739] ACTIVATION    SEVERITY[11]
10:54:02  ALARM [TCC3][ERROR_FAST_STOP_MASTER_TCC][56] [1727779844.751] ACTIVATION    SEVERITY[11]
10:54:03  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727779845.849] DEACTIVATION  SEVERITY[11]
10:54:07  ALARM [ICU3][IGBT_ERROR_VGE_1][183] [1727779849.759] DEACTIVATION  SEVERITY[4]
10:54:07  ALARM [TCC3][INFO_TCC_LOADED_DISABLED_STATE][25] [1727779849.762] DEACTIVATION  SEVERITY[12]
10:54:07  ALARM [TCC3][INFO_TCC_LOADED_READY_STATE][28] [1727779849.762] ACTIVATION    SEVERITY[12]
10:54:07  ALARM [TCC3][ERROR_FAST_STOP_MASTER_TCC][56] [1727779849.791] DEACTIVATION  SEVERITY[11]
10:54:08  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727779850.859] ACTIVATION    SEVERITY[11]
10:54:09  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727779852.119] DEACTIVATION  SEVERITY[11]
10:54:12  ALARM [ICU3][IGBT_ERROR_VGE_1][183] [1727779855.349] ACTIVATION    SEVERITY[4]
10:54:12  ALARM [TCC3][INFO_TCC_LOADED_READY_STATE][28] [1727779855.351] DEACTIVATION  SEVERITY[12]
10:54:12  ALARM [TCC3][INFO_TCC_LOADED_DISABLED_STATE][25] [1727779855.352] ACTIVATION    SEVERITY[12]
10:54:12  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727779855.359] ACTIVATION    SEVERITY[11]
10:54:12  ALARM [TCC3][ERROR_FAST_STOP_MASTER_TCC][56] [1727779855.371] ACTIVATION    SEVERITY[11]
10:54:12  ALARM [TCC3][ERROR_FAST_STOP_ISOLATION_MASTER_TCC][58] [1727779855.390] ACTIVATION    SEVERITY[4]
10:54:13  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727779856.470] DEACTIVATION  SEVERITY[11]
10:54:15  ALARM [TCC3][ERROR_MOTOR_ISOLATED][48] [1727779858.439] ACTIVATION    SEVERITY[4]
10:54:17  ALARM [ICU3][IGBT_ERROR_VGE_1][183] [1727779860.379] DEACTIVATION  SEVERITY[4]
10:54:17  ALARM [TCC3][INFO_TCC_LOADED_DISABLED_STATE][25] [1727779860.382] DEACTIVATION  SEVERITY[12]
10:54:17  ALARM [TCC3][INFO_TCC_LOADED_READY_STATE][28] [1727779860.382] ACTIVATION    SEVERITY[12]
10:54:17  ALARM [TCC3][ERROR_FAST_STOP_MASTER_TCC][56] [1727779860.411] DEACTIVATION  SEVERITY[11]
```

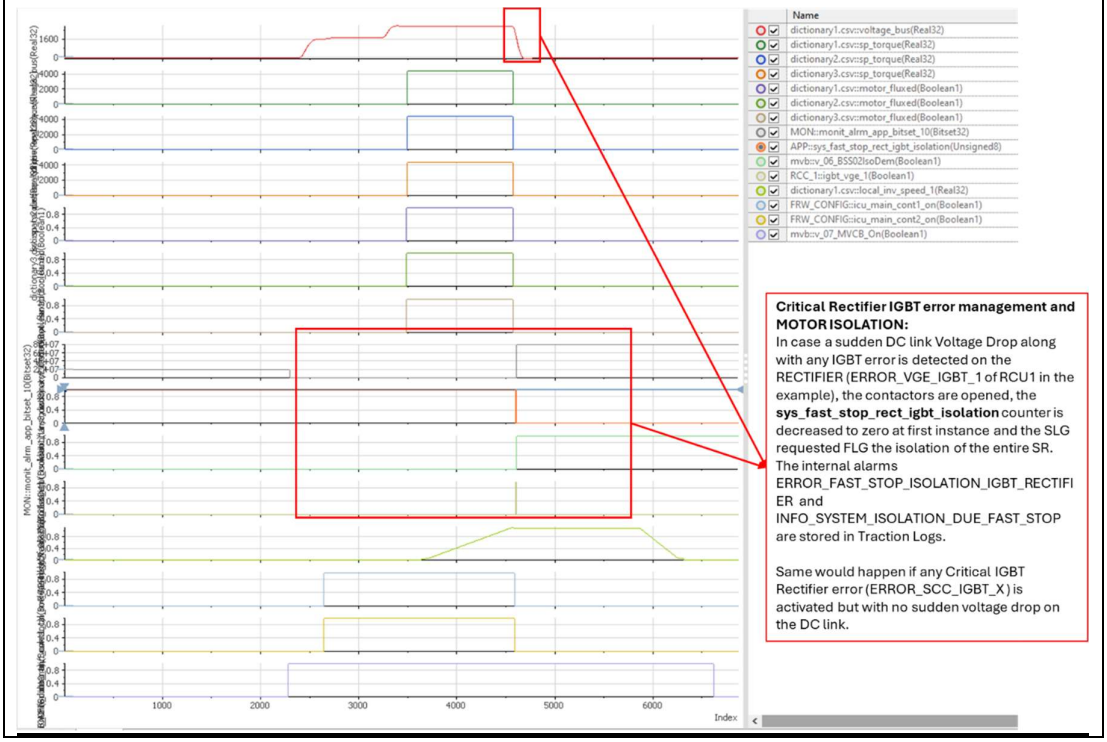
- **Non – Critical IGBT error - Rectifier → Up to ISOLATION**




```
10:59:11  ALARM [RCU1][ERROR_VGE_IGBT_1][117] [1727780154.877] ACTIVATION    SEVERITY[3]
10:59:11  ALARM [TCC1][INFO_TCC_LOADED_READY_STATE][28] [1727780154.925] DEACTIVATION  SEVERITY[12]
10:59:11  ALARM [TCC1][INFO_TCC_UNLOADING_STATE][26] [1727780154.927] ACTIVATION    SEVERITY[12]
10:59:11  ALARM [TCC2][INFO_TCC_LOADED_READY_STATE][28] [1727780154.927] DEACTIVATION  SEVERITY[12]
10:59:11  ALARM [TCC2][INFO_TCC_UNLOADING_STATE][26] [1727780154.927] ACTIVATION    SEVERITY[12]
10:59:11  ALARM [RCU1][ERROR_VGE_IGBT_1][117] [1727780154.937] DEACTIVATION  SEVERITY[3]
10:59:11  ALARM [TCC1][INFO_TCC_UNLOADING_STATE][26] [1727780154.995] DEACTIVATION  SEVERITY[12]
10:59:11  ALARM [TCC1][INFO_TCC_ENTER_IDLE_STATE][23] [1727780154.997] ACTIVATION    SEVERITY[12]
10:59:11  ALARM [TCC2][INFO_TCC_UNLOADING_STATE][26] [1727780154.997] DEACTIVATION  SEVERITY[12]
10:59:11  ALARM [TCC2][INFO_TCC_ENTER_IDLE_STATE][23] [1727780154.997] ACTIVATION    SEVERITY[12]
10:59:11  ALARM [RCC1][INFO_RCC_ENTER_IDLE][26] [1727780155.035] ACTIVATION    SEVERITY[12]
10:59:11  ALARM [RCC1][INFO_RCC_ENTER_ACTIVE][27] [1727780155.037] DEACTIVATION  SEVERITY[12]
10:59:11  ALARM [TCC3][INFO_TCC_LOADED_READY_STATE][28] [1727780155.045] DEACTIVATION  SEVERITY[12]
10:59:11  ALARM [TCC3][INFO_TCC_UNLOADING_STATE][26] [1727780155.047] ACTIVATION    SEVERITY[12]
10:59:14  ALARM [TCC3][INFO_TCC_UNLOADING_STATE][26] [1727780157.854] DEACTIVATION  SEVERITY[12]
10:59:14  ALARM [TCC3][INFO_TCC_ENTER_IDLE_STATE][23] [1727780157.856] ACTIVATION    SEVERITY[12]
10:59:15  ALARM [TCC3][INFO_TCC_ENTER_IDLE_STATE][23] [1727780158.405] DEACTIVATION  SEVERITY[12]
10:59:15  ALARM [TCC3][INFO_TCC_LOADING_STATE][24] [1727780158.407] ACTIVATION    SEVERITY[12]
10:59:19  ALARM [TCC3][INFO_TCC_LOADING_STATE][24] [1727780162.664] DEACTIVATION  SEVERITY[12]
10:59:19  ALARM [TCC3][INFO_TCC_LOADED_READY_STATE][28] [1727780162.666] ACTIVATION    SEVERITY[12]
10:59:19  ALARM [TCC1][INFO_TCC_ENTER_IDLE_STATE][23] [1727780162.695] DEACTIVATION  SEVERITY[12]
10:59:19  ALARM [TCC1][INFO_TCC_LOADING_STATE][24] [1727780162.697] ACTIVATION    SEVERITY[12]
10:59:19  ALARM [TCC2][INFO_TCC_ENTER_IDLE_STATE][23] [1727780162.697] DEACTIVATION  SEVERITY[12]
10:59:19  ALARM [TCC2][INFO_TCC_LOADING_STATE][24] [1727780162.697] ACTIVATION    SEVERITY[12]
10:59:19  ALARM [TCC1][INFO_TCC_LOADING_STATE][24] [1727780162.705] DEACTIVATION  SEVERITY[12]
10:59:19  ALARM [TCC1][INFO_TCC_LOADED_READY_STATE][28] [1727780162.707] ACTIVATION    SEVERITY[12]
10:59:19  ALARM [TCC2][INFO_TCC_LOADING_STATE][24] [1727780162.707] DEACTIVATION  SEVERITY[12]
10:59:19  ALARM [TCC2][INFO_TCC_LOADED_READY_STATE][28] [1727780162.707] ACTIVATION    SEVERITY[12]
10:59:19  ALARM [RCC1][INFO_RCC_ENTER_IDLE][26] [1727780162.865] DEACTIVATION  SEVERITY[12]
10:59:19  ALARM [RCC1][INFO_RCC_ENTER_ACTIVE][27] [1727780162.867] ACTIVATION    SEVERITY[12]
10:59:21  ALARM [RCU1][ERROR_VGE_IGBT_1][117] [1727780164.957] ACTIVATION    SEVERITY[3]
10:59:21  ALARM [TCC1][INFO_TCC_LOADED_READY_STATE][28] [1727780165.005] DEACTIVATION  SEVERITY[12]
10:59:21  ALARM [TCC1][INFO_TCC_UNLOADING_STATE][26] [1727780165.007] ACTIVATION    SEVERITY[12]
10:59:21  ALARM [TCC2][INFO_TCC_LOADED_READY_STATE][28] [1727780165.007] DEACTIVATION  SEVERITY[12]
10:59:21  ALARM [TCC2][INFO_TCC_UNLOADING_STATE][26] [1727780165.007] ACTIVATION    SEVERITY[12]
10:59:21  ALARM [RCU1][ERROR_FAST_STOP_ISOLATION_RCU][147] [1727780165.008] ACTIVATION    SEVERITY[3]
10:59:21  ALARM [APP][INFO_SYSTEM_ISOLATION_DUE_FAST_STOP][314] [1727780165.008] ACTIVATION    SEVERITY[12]
10:59:21  ALARM [RCU1][ERROR_VGE_IGBT_1][117] [1727780165.077] DEACTIVATION  SEVERITY[3]
```

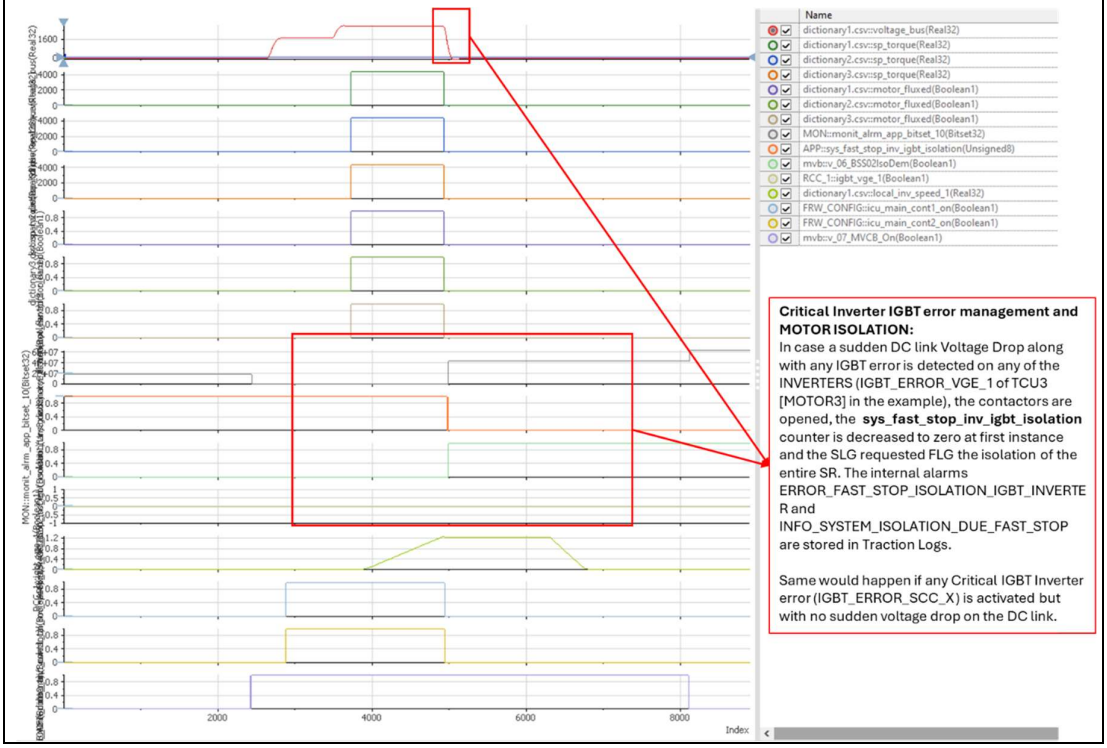
In the case explained above, as the rectifier got isolated due to the multiple activation of Non – Critical IGBT alarms, the entire SR should be isolated as the rectifier control is needed to supply the traction motors.

- **<u>Critical IGBT error – Rectifier → Up to ISOLATION</u>**



```
11:17:35  ALARM [ICU1][phase_w_current_operation_failure][90] [1727781258.517] ACTIVATION    SEVERITY[4]
11:17:35  ALARM [ICU2][phase_u_current_operation_failure][88] [1727781258.518] ACTIVATION    SEVERITY[4]
11:17:35  ALARM [ICU3][phase_w_current_operation_failure][90] [1727781258.519] ACTIVATION    SEVERITY[4]
11:17:35  ALARM [TCC1][INFO_TCC_LOADED_READY_STATE][28] [1727781258.520] DEACTIVATION  SEVERITY[12]
11:17:35  ALARM [TCC1][INFO_TCC_LOADED_DISABLED_STATE][25] [1727781258.520] ACTIVATION    SEVERITY[12]
11:17:35  ALARM [TCC2][INFO_TCC_LOADED_READY_STATE][28] [1727781258.520] DEACTIVATION  SEVERITY[12]
11:17:35  ALARM [TCC2][INFO_TCC_LOADED_DISABLED_STATE][25] [1727781258.520] ACTIVATION    SEVERITY[12]
11:17:35  ALARM [TCC3][INFO_TCC_LOADED_READY_STATE][28] [1727781258.521] DEACTIVATION  SEVERITY[12]
11:17:35  ALARM [TCC3][INFO_TCC_LOADED_DISABLED_STATE][25] [1727781258.521] ACTIVATION    SEVERITY[12]
11:17:35  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727781258.537] DEACTIVATION  SEVERITY[11]
11:17:35  ALARM [RCU1][ERROR_VOLTAGE_BUS_MIN][65] [1727781258.549] ACTIVATION    SEVERITY[3]
11:17:35  ALARM [RCC1][INFO_RCC_ENTER_ACTIVE][27] [1727781258.557] DEACTIVATION  SEVERITY[12]
11:17:35  ALARM [RCC1][INFO_RCC_ENTER_FAULT][29] [1727781258.559] ACTIVATION    SEVERITY[12]
11:17:35  ALARM [ICU2][phase_w_current_operation_failure][90] [1727781258.567] ACTIVATION    SEVERITY[4]
11:17:35  ALARM [TCC1][INFO_TCC_LOADED_DISABLED_STATE][25] [1727781258.597] DEACTIVATION  SEVERITY[12]
11:17:35  ALARM [TCC1][INFO_TCC_UNLOADING_STATE][26] [1727781258.599] ACTIVATION    SEVERITY[12]
11:17:35  ALARM [TCC2][INFO_TCC_LOADED_DISABLED_STATE][25] [1727781258.599] DEACTIVATION  SEVERITY[12]
11:17:35  ALARM [TCC2][INFO_TCC_UNLOADING_STATE][26] [1727781258.599] ACTIVATION    SEVERITY[12]
11:17:35  ALARM [TCC1][INFO_TCC_UNLOADING_STATE][26] [1727781258.607] DEACTIVATION  SEVERITY[12]
11:17:35  ALARM [TCC1][INFO_TCC_ENTER_IDLE_STATE][23] [1727781258.609] ACTIVATION    SEVERITY[12]
11:17:35  ALARM [TCC2][INFO_TCC_UNLOADING_STATE][26] [1727781258.609] DEACTIVATION  SEVERITY[12]
11:17:35  ALARM [TCC2][INFO_TCC_ENTER_IDLE_STATE][23] [1727781258.609] ACTIVATION    SEVERITY[12]
11:17:35  ALARM [TCC3][INFO_TCC_LOADED_DISABLED_STATE][25] [1727781258.637] DEACTIVATION  SEVERITY[12]
11:17:35  ALARM [TCC3][INFO_TCC_UNLOADING_STATE][26] [1727781258.639] ACTIVATION    SEVERITY[12]
11:17:35  ALARM [RCU1][ERROR_VGE_IGBT_1][117] [1727781258.759] ACTIVATION    SEVERITY[3]
11:17:35  ALARM [APP][ERROR_FAST_STOP_ISOLATION_IGBT_RECTIFIER][319] [1727781258.807] ACTIVATION    SEVERITY[3]
11:17:35  ALARM [APP][INFO_SYSTEM_ISOLATION_DUE_FAST_STOP][314] [1727781258.809] ACTIVATION    SEVERITY[12]
11:17:35  ALARM [RCU1][ERROR_VGE_IGBT_1][117] [1727781258.879] DEACTIVATION  SEVERITY[3]
11:17:36  ALARM [TCC3][INFO_TCC_UNLOADING_STATE][26] [1727781259.687] DEACTIVATION  SEVERITY[12]
11:17:36  ALARM [TCC3][INFO_TCC_ENTER_IDLE_STATE][23] [1727781259.689] ACTIVATION    SEVERITY[12]
```

- **<u>Critical IGBT error – Inverter (TCC1, TCC2, TCC3) → Up to ISOLATION</u>**

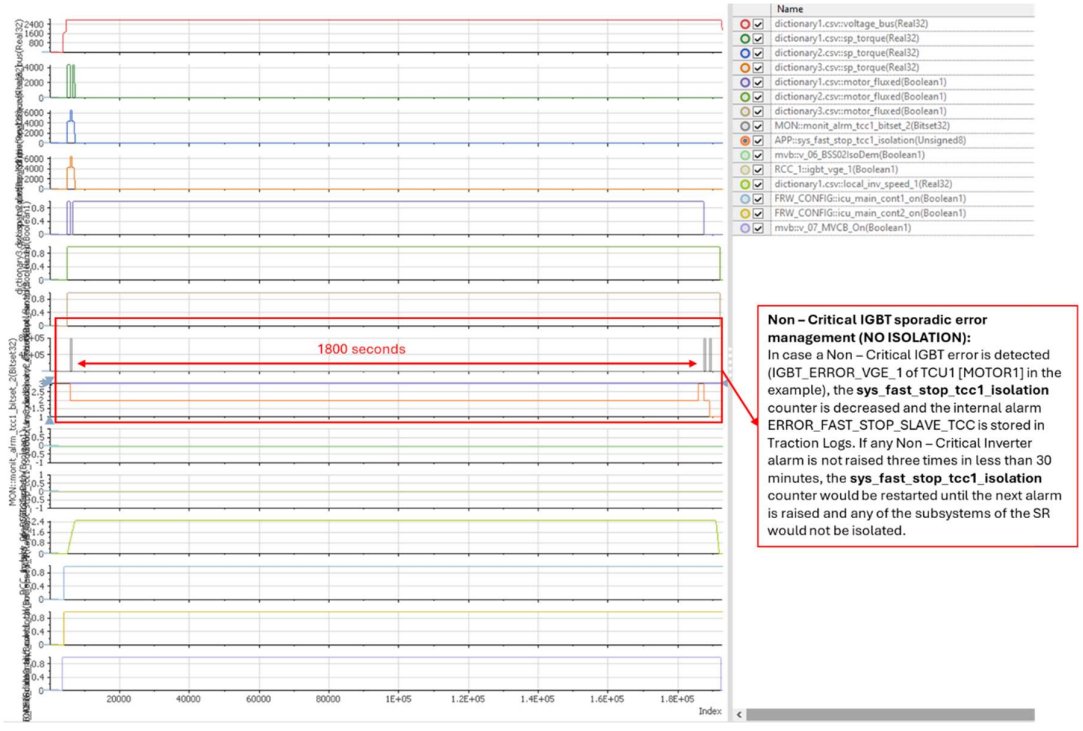


Critical Inverter IGBT error management and MOTOR ISOLATION:
In case a sudden DC link Voltage Drop along with any IGBT error is detected on any of the INVERTERS (IGBT_ERROR_VGE_1 of TCU3 [MOTOR3] in the example), the contactors are opened, the **sys_fast_stop_inv_igbt_isolation** counter is decreased to zero at first instance and the SLG requested FLG the isolation of the entire SR. The internal alarms ERROR_FAST_STOP_ISOLATION_IGBT_INVERTER and INFO_SYSTEM_ISOLATION_DUE_FAST_STOP are stored in Traction Logs.

Same would happen if any Critical IGBT Inverter error (IGBT_ERROR_SCC_X) is activated but with no sudden voltage drop on the DC link.

```
11:55:13  ALARM [ICU2][phase_w_current_operation_failure][90] [1727783516.753] ACTIVATION    SEVERITY[4]
11:55:13  ALARM [ICU3][phase_w_current_operation_failure][90] [1727783516.754] ACTIVATION    SEVERITY[4]
11:55:13  ALARM [TCC2][INFO_TCC_LOADED_READY_STATE][28] [1727783516.755] DEACTIVATION  SEVERITY[12]
11:55:13  ALARM [TCC2][INFO_TCC_LOADED_DISABLED_STATE][25] [1727783516.756] ACTIVATION    SEVERITY[12]
11:55:13  ALARM [TCC3][INFO_TCC_LOADED_READY_STATE][28] [1727783516.756] DEACTIVATION  SEVERITY[12]
11:55:13  ALARM [TCC3][INFO_TCC_LOADED_DISABLED_STATE][25] [1727783516.756] ACTIVATION    SEVERITY[12]
11:55:13  ALARM [ICU1][phase_v_current_operation_failure][89] [1727783516.762] ACTIVATION    SEVERITY[4]
11:55:13  ALARM [ICU3][phase_v_current_operation_failure][89] [1727783516.764] ACTIVATION    SEVERITY[4]
11:55:13  ALARM [TCC1][INFO_TCC_LOADED_READY_STATE][28] [1727783516.765] DEACTIVATION  SEVERITY[12]
11:55:13  ALARM [TCC1][INFO_TCC_LOADED_DISABLED_STATE][25] [1727783516.765] ACTIVATION    SEVERITY[12]
11:55:13  ALARM [APP][WARNING_ASSC_ACTIVE][250] [1727783516.773] DEACTIVATION  SEVERITY[11]
11:55:13  ALARM [RCU1][ERROR_VOLTAGE_BUS_MIN][65] [1727783516.785] ACTIVATION    SEVERITY[3]
11:55:13  ALARM [ICU2][phase_v_current_operation_failure][89] [1727783516.793] ACTIVATION    SEVERITY[4]
11:55:13  ALARM [RCC1][INFO_RCC_ENTER_ACTIVE][27] [1727783516.795] DEACTIVATION  SEVERITY[12]
11:55:13  ALARM [RCC1][INFO_RCC_ENTER_FAULT][29] [1727783516.796] ACTIVATION    SEVERITY[12]
11:55:13  ALARM [TCC1][INFO_TCC_LOADED_DISABLED_STATE][25] [1727783516.833] DEACTIVATION  SEVERITY[12]
11:55:13  ALARM [TCC1][INFO_TCC_UNLOADING_STATE][26] [1727783516.835] ACTIVATION    SEVERITY[12]
11:55:13  ALARM [TCC2][INFO_TCC_LOADED_DISABLED_STATE][25] [1727783516.835] DEACTIVATION  SEVERITY[12]
11:55:13  ALARM [TCC2][INFO_TCC_UNLOADING_STATE][26] [1727783516.835] ACTIVATION    SEVERITY[12]
11:55:13  ALARM [TCC1][INFO_TCC_UNLOADING_STATE][26] [1727783516.843] DEACTIVATION  SEVERITY[12]
11:55:13  ALARM [TCC1][INFO_TCC_ENTER_IDLE_STATE][23] [1727783516.845] ACTIVATION    SEVERITY[12]
11:55:13  ALARM [TCC2][INFO_TCC_UNLOADING_STATE][26] [1727783516.845] DEACTIVATION  SEVERITY[12]
11:55:13  ALARM [TCC2][INFO_TCC_ENTER_IDLE_STATE][23] [1727783516.845] ACTIVATION    SEVERITY[12]
11:55:13  ALARM [TCC3][INFO_TCC_LOADED_DISABLED_STATE][25] [1727783516.873] DEACTIVATION  SEVERITY[12]
11:55:13  ALARM [TCC3][INFO_TCC_UNLOADING_STATE][26] [1727783516.875] ACTIVATION    SEVERITY[12]
11:55:14  ALARM [ICU3][IGBT_ERROR_VGE_1][183] [1727783517.213] ACTIVATION    SEVERITY[4]
11:55:14  ALARM [TCC3][ERROR_FAST_STOP_MASTER_TCC][56] [1727783517.234] ACTIVATION    SEVERITY[11]
11:55:14  ALARM [APP][ERROR_FAST_STOP_ISOLATION_IGBT_INVERTER][318] [1727783517.253] ACTIVATION    SEVERITY[3]
11:55:14  ALARM [APP][INFO_SYSTEM_ISOLATION_DUE_FAST_STOP][314] [1727783517.255] ACTIVATION    SEVERITY[12]
11:55:14  ALARM [TCC3][INFO_TCC_UNLOADING_STATE][26] [1727783517.923] DEACTIVATION  SEVERITY[12]
11:55:14  ALARM [TCC3][INFO_TCC_ENTER_IDLE_STATE][23] [1727783517.925] ACTIVATION    SEVERITY[12]
```

- **Non – Critical IGBT error - Inverter/Rectifier (TCC1, TCC2, TCC3, RCU) → NO ISOLATION**



Note that if any subsystem of the SR or the entire SR is isolated due to IGBT errors, the corresponding subsystem/SR would remain isolated until the NVRAM is erased.

3.9. SW v30_xx_b08 / v02_xx_b08

Description
Rectifier Message Timeout
Problem: During the validation of SW v30_xx_b07 (9 Module) and v02_xx_07 (5 Module) it is detected that the rectifier Message Timeout issues have been increased. SW v30_xx_b07 has implemented new functionalities in the rectifier DSP application that increased the use of the memory on the DSP card. This lack of memory is affecting the configuration message queues during the booting process between the rectifier DSP and the CPU causing the error and the final isolation of the affected SLG.
Solution: To optimize the use of the available memory, the configuration messages that the DSP sends to the CPU have been optimized by selecting only the configuration parameters that the CPU needs during the booting process. In the same way, the timeout value for the DSP giving the error has been increased, increasing also the time the DSP and the CPU have to properly configure themselves during the VEGA booting process. The new rectifier DSP application has been tested in some locomotives and no errors have been detected.

4. Release Approval

All modifications to the new software version are verified by thoroughly testing the new functionalities in a HIL environment.

5. Field Action

The SW must be loaded on a locomotive and perform the corresponding validation tests.