SIEMENS

Mobility

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Your letter of	
Our reference	SMO/RS/Propulsion/Software Trial
Date	14.04.2025

Dy. CEE-D&D-I
Chittaranjan Locomotive Works
Chittaranajan, West Bengal

Kind Attn.: Mr. Pankaj Kumar

Sub: Request for trial of software before regular approval

Ref:

1. CLW PO no. 70231134100669 dated 05-APR-24.
2. CLW PO no. 70241134100070 dated 11.01.2025.
3. CLW Letter no. C-D&D/T/24 (Part)/ Siemens dated 27.02.2025.
4. CLW Letter no. C-D&D/T/24(Part)/SIEMENS dated 11.03.2025.
5. LGD letter no. C/E.221/ELS/LGD/Tech/55 dated 15.03.2025.
6. Siemens Letter no. SMO/RS/ACU/Failures dated 03.04.2025.

Dear Sir,

We would like to thank you for according the necessary permission for the software version 2.08 vide your letter under Ref. 3) and 4). All locomotives commissioned from CLW are uploaded with the software and rendering trouble free commercial services. As confirmed in our previous letter, we are ready with a combined software for fleet and incorporated changes required against failure and operational requests from various Zonal Railways as mentioned under Ref. 5) and 6). We have implemented 2.08 in newly commissioned locomotives and have not proliferated the same in field fleet to avoid duplication of activity and to maintain common traceability as 2.09 release will be ready commonly for the fleet in line with this letter.

In view of the above, we would like to test CCU software version – 2.09 with TCU software version 2.29 & DDU software version 2.1.4 tabulated in detail below to incorporate the changes as mentioned under:

1. Combined redundancy software for 800A & 1500A IGBT modules.
2. VCU redundancy for LEROY type VCU
3. Angle transmitter Failure mode improvement
4. TCU power supply monitoring
5. Compressor not working if requested during off sequence
6. BP Pressure signal implausible
7. Identification of 1500A Type IGBT
8. Protection scheme for different type of TCCs

9. Change in 4QC pulse control for standalone Aux variants
10. Panto to be lowered in slave loco if Master is dead
11. TM isolation clarity in AMiT DDU
12. DPWCS Integration with MEDHA

Additionally, we would like to test ACU Test Software Version: Z431W0MA.999 for modification of the PLL error loop to expand the input voltage frequency band.

Device	Application	NSDB	OS	Para
CCU1	2.09	2.82	2.5	0.236
CCU2	2.09	2.82	2.5	0.236
TCU1	2.29	2.32	2.5	
TCU2	2.29	2.32	2.5	
WTB	3.13	2.85		
Siemens	1.2.2 (WAG-9)	2.81		
Display 1	1.1.6 (WAP 7)			
Siemens	1.2.2 (WAG-9)	2.81		
Display 2	1.1.6 (WAP 7)			
AMiT Display 1	2.1.4	2.66		
AMiT Display 2	2.1.4	2.66		
AUX 1	2.07	1.67		
AUX 2	2.07	1.67		
AUX 3	2.07	1.67		
IO Station 11	1.05/1.22/2.00/0.21/0.23	1.00/0.002/0.01/2.00/1.02		
IO Station 12	1.05/1.22/2.00/0.52	1.00/0.002/0.01/2.00/1.02		
IO Station 21	1.05/1.22/2.00/0.21/0.23	1.00/0.002/0.01/2.00/1.02		
IO Station 22	1.05/1.22/2.00/0.52	1.00/0.002/0.01/2.00/1.02		

During testing of the redundancy function we have found that to fully utilise the redundancy feature without any driver intervention, we are providing one additional contactor relay rated for 110 VDC control voltage) in each VCU cubicle. This is implemented in locos commissioned from CLW in Mar'25 and will be implemented across the fleet.

The detail of the implementation is as follows:

1. Background and Objective

To enhance system reliability and safety, particularly in scenarios involving TCU failures, it is proposed to remotely control the TCU power supply via a contactor relay. This relay will allow for remote disconnection in fault scenarios, ensuring converter isolation and safe shutdown of IGBT modules.

Currently, four such contactors are already available inside VCU-1 and VCU-2. The same mechanical provision can be utilized to mount the proposed contactor without significant modification. The control voltage for the new contactor is proposed to be drawn from the SB panel, while the contactor itself will be installed inside VCU-1 and VCU-2.

No change in Railway-side wiring index is envisaged & this scope will be executed by Siemens.

Please find attached Annexure-A: Datasheet of Siemens-make contactor (3RH2131-2XF40-0LA2) for your reference.

2. Observations from System Behavior

With the implemented redundancy logic, a failed TCU cannot guarantee closing of the contact in the VCB loop.

Consequently, to ensure complete converter isolation, it becomes necessary to bypass this VCB loop contact by disconnecting TCU power supply.

This can be achieved in two ways:

- Manual operation using a Circuit Breaker.
- Remote operation using a Contactor Relay controlled by the CCU.

3. Why to switch off TCU power supply by additional contactor?

Redundancy requirements and demonstrated solution also considered ICU electronic failures (part of TCU) i.e. drive side controller & line side controller, such as:

- Processor faults
- Binary I/O failure
- Interface issues with gate-drive units
- Analog input malfunction

To isolate a failed ICU electronic, the ICU software is commanded into off-mode (sleep mode), so software will stop all operations.

In consequence all outputs will not be operated &

- The gate-drive unit will autonomously keep the relevant IGBTs in off-mode.
- The contact in the VCB-loop will be kept open.

Thus, the ability to command ICU into off-mode is critical to achieving a fail-safe condition, and this necessitates switching off the TCU power supply – which is best achieved using a remotely controlled contactor relay.

4. What happens in case of complete converter isolation?

With respect to redundancy, complete converter isolation means that a failure occurs, which cannot be managed by isolation of individual ICU electronic.

For complete converter isolation, all ICU electronics will be set to off-mode, to ensure, that all IGBTs are safe off, and in consequence the all contacts in the VCB-loop are kept open.
What must be done to finalize converter isolation:

- TCU-MCU in off-mode (as TCU-MCU could also failed)
- Bypass VCB-loop
- Q1 line disconnector to stay in open position

Hence, the proposed solution is to switch off 110V power supply for TCC (TCU off, bypass set, Q1 safe in open position)

5. Implemented solution

We propose to add **one Contactor Relay** (rated for 110 VDC control supply) inside each VCU cubicle, as follows:

1) **Control Voltage Source**: Drawn from SB panel to maintain independence from VCU systems.
2) **Control Method**: Remotely operated via CCU.
3) **Location**: Mounted inside existing provision in VCU-1 and VCU-2.
4) **Relay Type**: Siemens 3RH2131-2XF40-0LA2 (Datasheet in Annexure A).

6. Feasibility & Impact

1) **Impact on Existing Circuitry**: No Impact. The contactor only regulates TCU power supply (ON/OFF) and does not carry operational load continuously.
2) **Mechanical Integration**: Existing contactor provisions in VCU make installation straightforward.

The addition of this contactor relay provides a safer, remote, and more reliable means of achieving converter isolation under fault conditions. It improves system resilience improving reliability and aligns with redundancy requirements without overloading existing systems or requiring major retrofit effort.

In view of the above, request you to kindly accord the necessary permission to implement the same in 5 Freight and 5 Passenger locomotives in the field for monitoring for 15 days against the cases highlighted under Ref. 5). Our engineer will be present in CLW to test the same and request you to kindly accord the permission to load the software in under commissioning locomotives in CLW.

Thanking you and assuring you of our most careful attention, we remain.

For Siemens Ltd.

Arka Dey

Dey Arka
Digitally signed by Dey Arka
Date: 2025.04.14 12:37:13 +05'30'

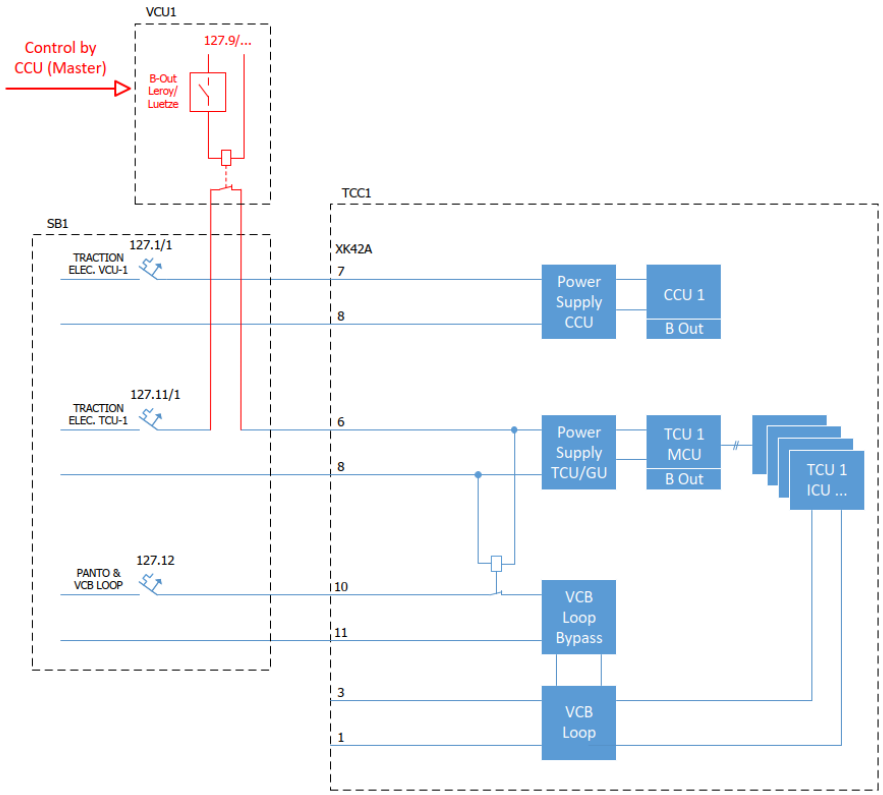
Project Manager

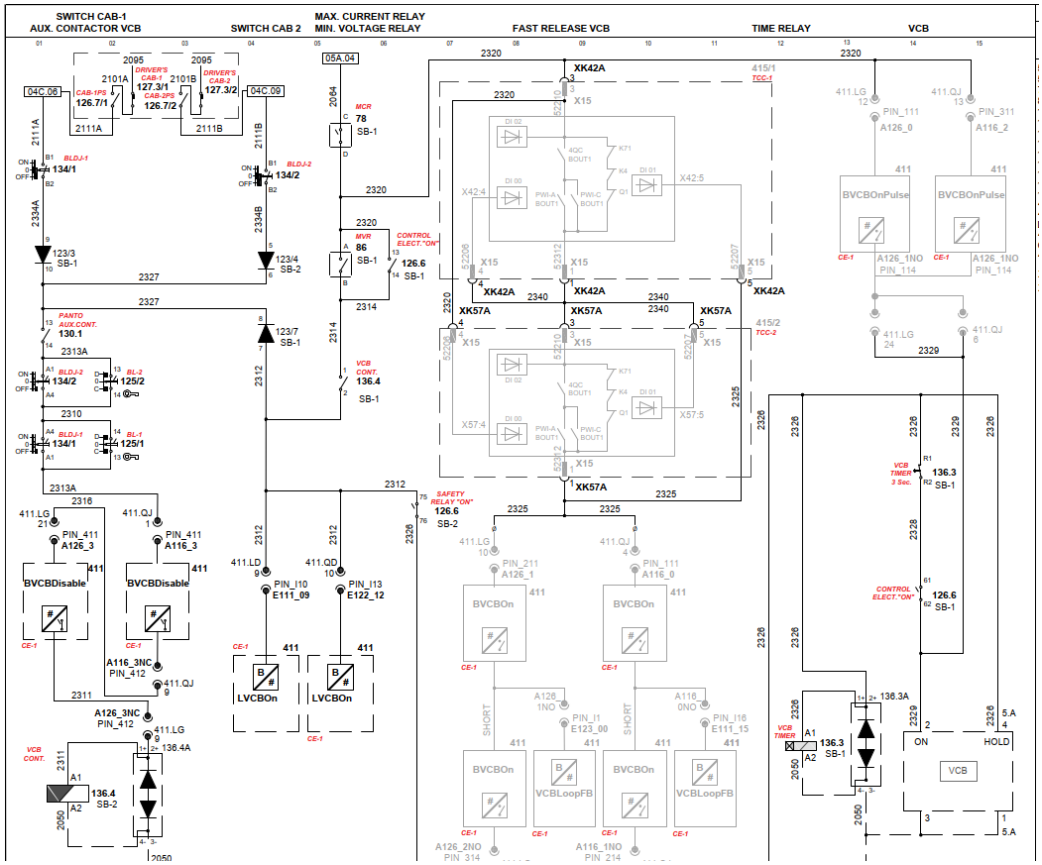
Copy To:

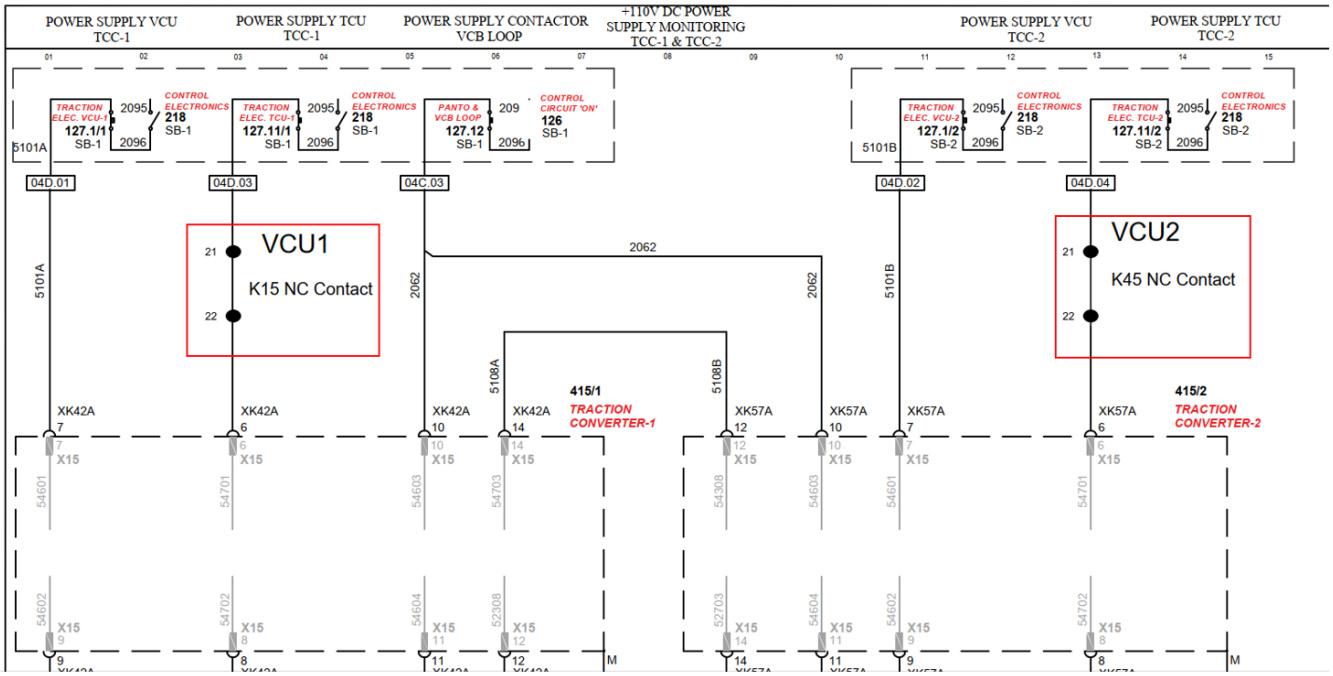
Dy. CEE/Loco-CLW/CRJ & CLW/DKAE – For your kind information
Sr. DEE/TRS/TKD - For your kind information
Sr. DEE/TRS/BRC - For your kind information
Sr. DEE/TRS/NKJ - For your kind information
Sr. DEE/TRS/LGD - For your kind information
Sr. DEE/TRS/BNDM - For your kind information
Sr. DEE/DLS/MLY - For your kind information

Annexure A – datasheet of contactor proposed
Siemens-make 3RH2131-2XF40-0LA2

Annexure B – proposed integration in electrical schematic

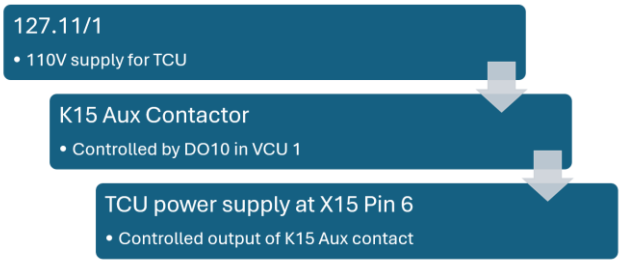



SWITCH CAB-1
AUX. CONTACTOR VCB
SWITCH CAB 2
MAX. CURRENT RELAY
MIN. VOLTAGE RELAY
FAST RELEASE VCB
TIME RELAY
VCB
XK42A
XK57A
BVCBDisable
BVCBOn
LVCBOn
VCBLoopFB
VCB TIMER
3 Sec.
ON
HOLD
VCB

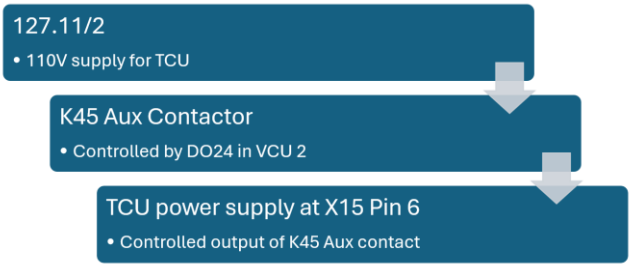

POWER SUPPLY VCU
TCC-1
POWER SUPPLY TCU
TCC-1
POWER SUPPLY CONTACTOR
VCB LOOP
+110V DC POWER
SUPPLY MONITORING
TCC-1 & TCC-2
POWER SUPPLY VCU
TCC-2
POWER SUPPLY TCU
TCC-2
VCU1
K15 NC Contact
VCU2
K45 NC Contact
2062
5101A
5101B
5108A
5108B
415/1
TRACTION
CONVERTER-1
415/2
TRACTION
CONVERTER-2
XK42A
XK57A

Annexure C

Cabling scheme of K71 for TC-1



Cabling scheme of K71 for TC-2



VCU 1	VCU 2
DO 10 (NO)	DO 24 (NO)
Aux Contact K15 A1+ (NO) Aux Contact K15 A2- (TBN)	Aux Contact K45 A1+ (NO) Aux Contact K45 A2- (TBN)
Cable 0.5sqmm	

VCU 1 K15	VCU 2 K45
Aux Contact 21NC (CB Power supply gate unit) (2601A)	Aux Contact 21NC (CB Power supply gate unit) (2601B)
Aux Contact 22NC (XK22R 6 SB1)	Aux Contact 22NC (XK77R 6 SB2)

SIEMENS

Data sheet 3RH2131-2XF40-0LA2

Contactor relay for railway 3 NO + 1 NC DC 72-125V, 0,7...1,25*US, with integrated varistor Size S00, Spring-type terminal suitable for PLC outputs

product brand name	SIRIUS
product designation	Contactor relay for railway applications
product type designation	3RH2
General technical data	
size of contactor	S00
product extension auxiliary switch	Yes
power loss [W] for rated value of the current without load current share typical	0.75 W
insulation voltage with degree of pollution 3 at AC rated value	690 V
surge voltage resistance rated value	6 kV
shock resistance at rectangular impulse	
● at DC	10g / 5 ms, 5g / 10 ms
shock resistance with sine pulse	
● at DC	15g / 5 ms, 8g / 10 ms
mechanical service life (operating cycles)	
● of contactor typical	30 000 000
● of the contactor with added electronically optimized auxiliary switch block typical	5 000 000
● of the contactor with added auxiliary switch block typical	10 000 000
reference code according to IEC 81346-2	K
Substance Prohibitance (Date)	10/01/2009
Ambient conditions	
installation altitude at height above sea level maximum	2 000 m
ambient temperature	
● during operation	-40 ... +70 °C
● during storage	-55 ... +80 °C
relative humidity minimum	10 %
relative humidity at 55 °C according to IEC 60068-2-30 maximum	95 %
Main circuit	
no-load switching frequency	
● at DC	1 500 1/h
Control circuit/ Control	
type of voltage of the control supply voltage	DC
control supply voltage at DC	
● rated value	72 ... 125 V
operating range factor control supply voltage rated value of magnet coil at DC	
● initial value	0.7
● full-scale value	1.25
design of the surge suppressor	Varistor

inrush current peak	1.1 A
duration of inrush current peak	50 µs
locked-rotor current mean value	0.04 A
locked-rotor current peak	0.04 A
duration of locked-rotor current	250 ms
holding current mean value	7 mA
closing power of magnet coil at DC	4.5 W
holding power of magnet coil at DC	0.75 W
closing delay	
● at DC	30 ... 70 ms
opening delay	
● at DC	25 ... 45 ms
arcing time	10 ... 15 ms
residual current of the electronics for control with signal <0> at DC at 24 V maximum permissible	10 mA
Auxiliary circuit	
number of NC contacts for auxiliary contacts	1
● instantaneous contact	1
number of NO contacts for auxiliary contacts	3
● instantaneous contact	3
identification number and letter for switching elements	31 E
operational current at AC-12 maximum	10 A
operational current at AC-15	
● at 230 V rated value	10 A
● at 400 V rated value	3 A
● at 500 V rated value	2 A
● at 690 V rated value	1 A
operational current at 1 current path at DC-12	
● at 24 V rated value	10 A
● at 110 V rated value	3 A
● at 220 V rated value	1 A
● at 440 V rated value	0.3 A
● at 600 V rated value	0.15 A
operational current with 2 current paths in series at DC-12	
● at 24 V rated value	10 A
● at 60 V rated value	10 A
● at 110 V rated value	4 A
● at 220 V rated value	2 A
● at 440 V rated value	1.3 A
● at 600 V rated value	0.65 A
operational current with 3 current paths in series at DC-12	
● at 24 V rated value	10 A
● at 60 V rated value	10 A
● at 110 V rated value	10 A
● at 220 V rated value	3.6 A
● at 440 V rated value	2.5 A
● at 600 V rated value	1.8 A
operating frequency at DC-12 maximum	1 000 1/h
operational current at 1 current path at DC-13	
● at 24 V rated value	10 A
● at 110 V rated value	1 A
● at 220 V rated value	0.3 A
● at 440 V rated value	0.14 A
● at 600 V rated value	0.1 A
operational current with 2 current paths in series at DC-13	
● at 24 V rated value	10 A
● at 60 V rated value	3.5 A
● at 110 V rated value	1.3 A
● at 220 V rated value	0.9 A
● at 440 V rated value	0.2 A
● at 600 V rated value	0.1 A

operational current with 3 current paths in series at DC-13	
● at 24 V rated value	10 A
● at 60 V rated value	4.7 A
● at 110 V rated value	3 A
● at 220 V rated value	1.2 A
● at 440 V rated value	0.5 A
● at 600 V rated value	0.26 A
operating frequency at DC-13 maximum	1 000 1/h
design of the miniature circuit breaker for short-circuit protection of the auxiliary circuit up to 230 V	C characteristic: 6 A; 0.4 kA
contact reliability of auxiliary contacts	1 faulty switching per 100 million (17 V, 1 mA)
UL/CSA ratings	
contact rating of auxiliary contacts according to UL	A600 / Q600
Short-circuit protection	
design of the fuse link for short-circuit protection of the auxiliary switch required	fuse gL/gG: 10 A
Installation/ mounting/ dimensions	
mounting position	+/-180° rotation possible on vertical mounting surface, can be tilted forward and backward by +/- 22.5° on vertical mounting surface, standing, on horizontal mounting surface
fastening method	screw and snap-on mounting onto 35 mm DIN rail
● side-by-side mounting	Yes
height	70 mm
width	45 mm
depth	73 mm
required spacing	
● with side-by-side mounting	
— forwards	10 mm
— upwards	10 mm
— downwards	10 mm
— at the side	0 mm
● for grounded parts	
— forwards	10 mm
— upwards	10 mm
— at the side	6 mm
— downwards	10 mm
● for live parts	
— forwards	10 mm
— upwards	10 mm
— downwards	10 mm
— at the side	6 mm
Connections/ Terminals	
type of electrical connection for auxiliary and control circuit	spring-loaded terminals
connectable conductor cross-section for auxiliary contacts	
● solid or stranded	0.5 ... 4 mm²
● finely stranded with core end processing	0.5 ... 2.5 mm²
● finely stranded without core end processing	0.5 ... 2.5 mm²
type of connectable conductor cross-sections	
● for auxiliary contacts	
— solid or stranded	2x (0,5 ... 4 mm²)
— finely stranded with core end processing	2x (0.5 ... 2.5 mm²)
— finely stranded without core end processing	2x (0.5 ... 2.5 mm²)
● for AWG cables for auxiliary contacts	2x (20 ... 12)
AWG number as coded connectable conductor cross section for auxiliary contacts	20 ... 12
Safety related data	
product function positively driven operation according to IEC 60947-5-1	Yes
B10 value with high demand rate according to SN 31920	1 000 000
proportion of dangerous failures	
● with low demand rate according to SN 31920	40 %
● with high demand rate according to SN 31920	73 %

T1 value for proof test interval or service life according to IEC 61508	20 a
protection class IP on the front according to IEC 60529	IP20
touch protection on the front according to IEC 60529	finger-safe, for vertical contact from the front

Certificates/ approvals

General Product Approval					EMC
CSA	Confirmation	CCC	KC	EAC	RCM

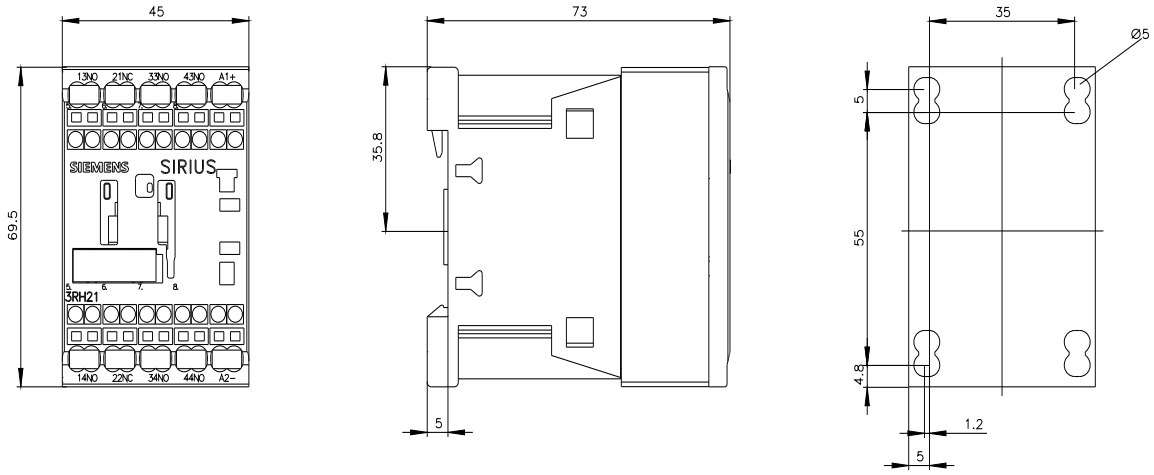
Functional Safety/Safety of Machinery	Declaration of Conformity		Test Certificates	Marine / Shipping	
Type Examination Certificate	UKCA	EG-Konf.	Type Test Certificates/Test Report	ABS	BUREAU VERITAS

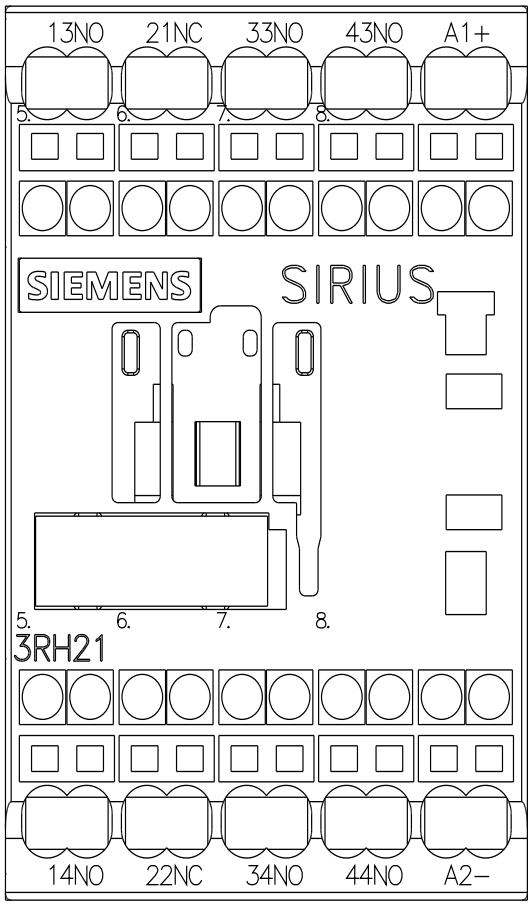
Marine / Shipping					other
DNV	LRS	PRS	RINA	RMRS	Confirmation

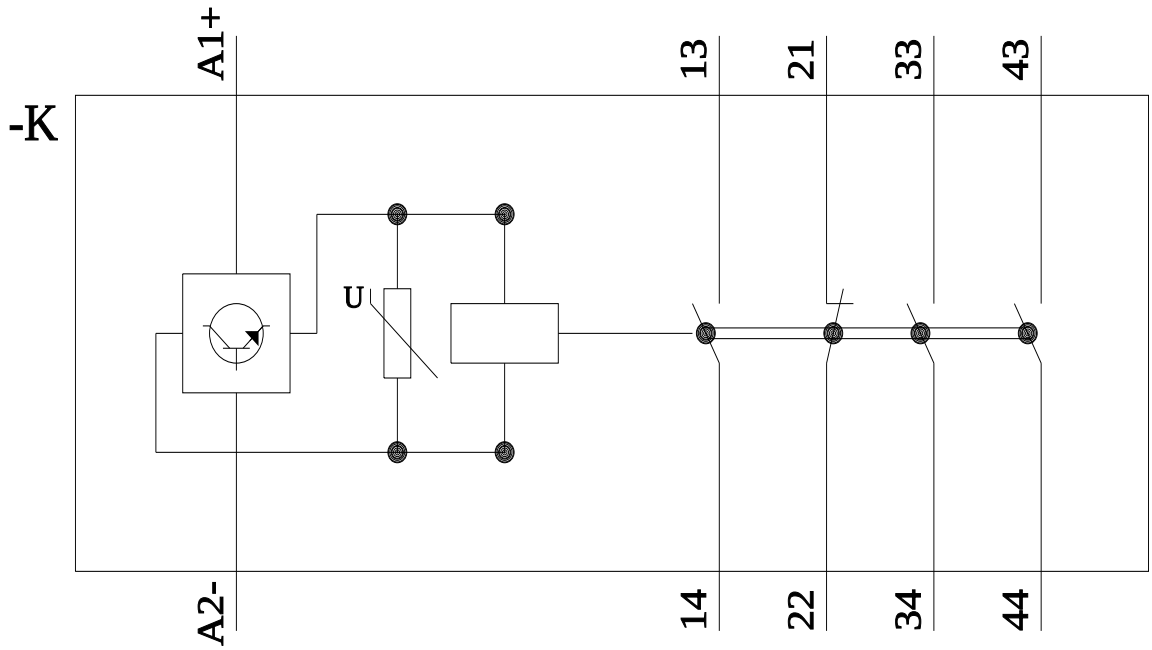
other	Railway		Dangerous Good
VDE	Special Test Certificate	Vibration and Shock	Transport Information

Further information

Siemens has decided to exit the Russian market (see here).
https://press.siemens.com/global/en/pressrelease/siemens-wind-down-russian-business
Siemens is working on the renewal of the current EAC certificates.
Please contact your local Siemens office on the status of validity of the EAC certification if you intend to import or offer to supply these products to an EAC relevant market (other than the sanctioned EAEU member states Russia or Belarus).
Information on the packaging
https://support.industry.siemens.com/cs/ww/en/view/109813875
Information- and Downloadcenter (Catalogs, Brochures,…)
https://www.siemens.com/ic10
Industry Mall (Online ordering system)
https://mall.industry.siemens.com/mall/en/en/Catalog/product?mlfb=3RH2131-2XF40-0LA2
Cax online generator
http://support.automation.siemens.com/WW/CAXorder/default.aspx?lang=en&mlfb=3RH2131-2XF40-0LA2
Service&Support (Manuals, Certificates, Characteristics, FAQs,...)
https://support.industry.siemens.com/cs/ww/en/ps/3RH2131-2XF40-0LA2
Image database (product images, 2D dimension drawings, 3D models, device circuit diagrams, EPLAN macros, ...)
http://www.automation.siemens.com/bilddb/cax_de.aspx?mlfb=3RH2131-2XF40-0LA2&lang=en
Characteristic: Tripping characteristics, I²t, Let-through current
https://support.industry.siemens.com/cs/ww/en/ps/3RH2131-2XF40-0LA2/char
Further characteristics (e.g. electrical endurance, switching frequency)
http://www.automation.siemens.com/bilddb/index.aspx?view=Search&mlfb=3RH2131-2XF40-0LA2&objecttype=14&gridview=view1







last modified: 7/14/2023

Mouser Electronics

Authorized Distributor

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Siemens:

3RH21312XF400LA2

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Mobility

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Our reference	SMO/RS/ACU Failures
Date	03.04.2025

Sr. Divisional Electrical Engineer
Electric Loco Shed
Lallaguda

Kind Attn.: Mr. Santosh Kumar Rajula

Sub: Isolation of Auxiliary Conveters in Siemens Propulsion systems

Ref:

1. LGD letter no. C/E.221/ELS/LGD/Tech/55 dated 15.03.2025.

Dear Sir,

We are in receipt of your letter mentioned under reference 1 above vide which you have informed us about the isolation of auxiliary converters in Siemens make propulsion systems. We have undertaken a detailed investigation of the occurrence and the finding along with action plan is as follows.

1. Incident Summary

- **Issue**: PLL error detected in locomotives with Siemens propulsion.
- **Duration**: Approximately 15 minutes (1300 Hrs to 1315 Hrs).
- **Observation**:
  - Not all Locos with Siemens propulsion were affected.
  - Not all Locos in the same region/zone were impacted.
  - Issue persisted for 15 minutes, after which normal operations resumed.
  - Most affected converters were locked three times, possibly due to battery resets.

2. Root Cause Analysis

The PLL error might have triggered when multiple conditions were met simultaneously, including:

- Sudden variations in load.
- Input voltage fluctuations.
- Input frequency variations.
- Entry or exit from the neutral section.
- Command from CCU.

3. Reason for Limited Scope of Impact

- Not all Locos with Siemens propulsion experienced the issue because only certain locomotives simultaneously met the conditions for triggering the PLL error.
- Variations in operational conditions such as load, voltage, and frequency fluctuations contributed to the selective occurrence.

4. Corrective and Preventive Actions

- Siemens is optimizing the ACU software logic to prevent similar occurrences.
- Internal trials have already been conducted to fine-tune the correct combination of logic.

5. Target Timeline for Solution Implementation

- The optimized ACU software will be released within April 2025

6. Conclusion

- The issue was identified and contained within a short period.
- A targeted solution is under development & validation to prevent recurrence.

Thanking you and assuring you of our most careful attention, we remain.

For Siemens Ltd.

Srivastava Namit
Digitally signed by Srivastava Namit
Date: 2025.04.03 16:41:46 +05'30'

Hemant Ratnakumar
Digitally signed by Hemant Ratnakumar
DN: cn=Hemant Ratnakumar, c=IN, ou=Siemens Mobility, email=hemant.ratnakumar@siemens.com
Reason: approved
Date: 2025.04.03 16:38:40 +05'30'

Namit Srivastava
Sr. Manager – Project Execution

Hemant Ratnakumar
Technical Project Manager

Copy To:

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ED/RDSO

Dy. CEE/D&D-I

Sr. DEE/ELS/BRC