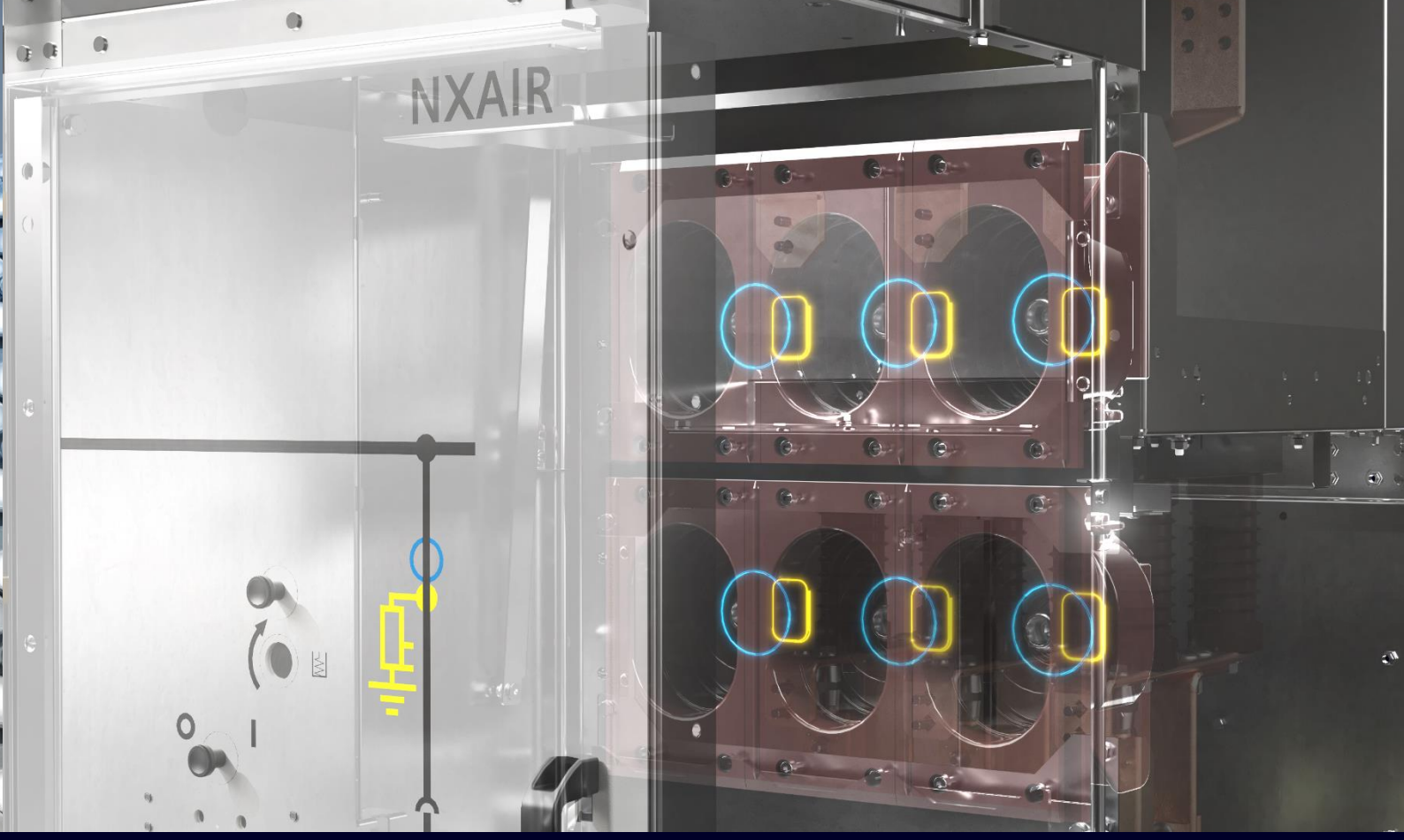

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SMART INFRASTRUCTURE ELECTRIFICATION & AUTOMATION

LPITs - **Low Power Instrument Transformers for NXAIR** medium-voltage switchgear

For even more sustainability and reliability in power systems

SIEMENS

Contents

Technology of the future – our solution

The goal of fully decarbonizing Europe's energy supply by 2050 is a major challenge, driven by the need to mitigate the impacts of climate change. Achieving this ambitious goal requires a collaborative effort from all parties involved, addressing a wide range of issues across the entire life cycle of products and services.

One key aspect of this endeavor involves the massive installation of renewable energy sources. However, the drive toward electrification and decarbonization, fueled by the increased use of renewables, introduces volatility and bidirectional power flows on the grid. This emphasizes the need for monitoring high-voltage power grids and low-voltage networks, both from the power generation and consumer sides. To master this challenge, it is essential to apply advanced technologies that are resistant to such volatility.

With our strong dedication to shaping a sustainable future, Siemens is actively advancing solutions that contribute to the well-being of our planet. As part of our commitment, we proudly offer the Low Power Instrument Transformers (LPITs aka. NCITs), a successor component of our NXAIR air-insulated medium voltage switchgear family. LPITs are set to replace conventional instrument transformers in a wide range of applications.

LPITs play a key role in enabling sustainable power systems and exemplify our ongoing efforts to deliver environmentally conscious solutions.

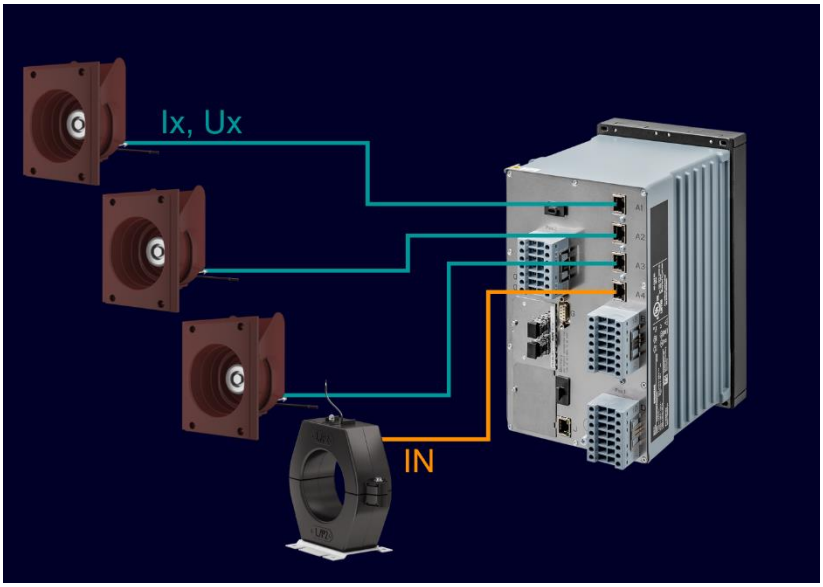
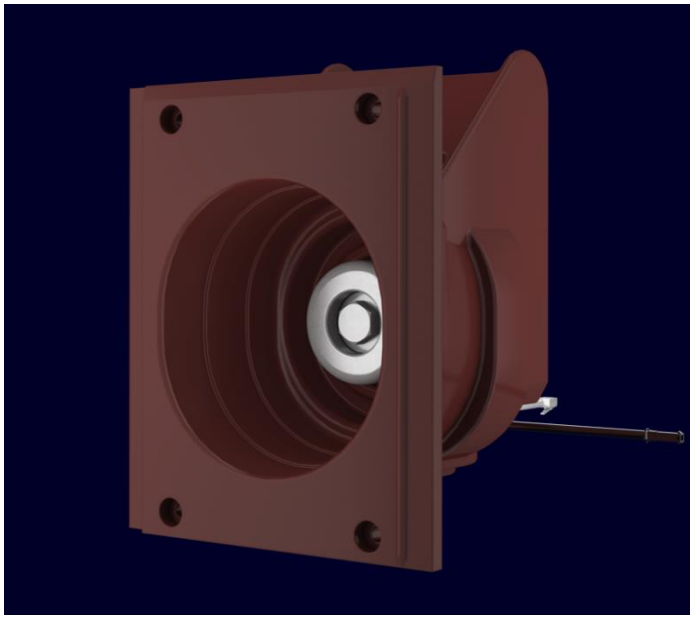


Figure 1
IEC 61869-compliant current and voltage sensors inside NXAIR, connected with the latest design of SIPROTEC 5 protection relay 7SY82

Sustainability

One remarkable aspect of LPITs is their impact on resource utilization. Siemens' approach involves locating the LPITs into the existing bushing geometry, eliminating the need for additional standalone transformers, and maximizing resource savings, reducing the overall environmental footprint.



LPITs in AIS

Saves up to 15.000 kgs CO_2eq per feeder, throughout the expected lifetime of 40 years *

*...4000A CB feeder, operating 7/24/365 @100% load rate, EU-27 greenhouse gas emission intensity of electricity generation average *(Data source as of 23.10.2023): European Environment Agency website – An official website of the European Union)*

Figure 2
LPIT embedded bushing in NXAIR

The sustainability benefits of LPITs extend beyond the manufacturing phase and into the operational phase. By eliminating block-type transformers, LPITs effectively eliminate ohmic resistance losses on the main current path, power dissipation due to windings, power losses on wiring harnesses, and losses due to higher relay burden requirements. This comprehensive approach to sustainability helps reduce energy consumption, CO_2 emissions, and operating costs, thereby supporting our customers' operational expenditure (OPEX) objectives.

With the flexibility to effortlessly adapt to diverse load currents through a straightforward adjustment of the protection relay parameters, LPITs prevent the hassle of replacing the entire set of instrument transformers when load conditions change. Embracing the concept of dematerialization, LPITs promote sustainability and resource conservation.

Beyond their sustainable characteristics, LPITs offer a multitude of advantages. Reliability, flexibility, and safety are three notable benefits that enhance their value proposition.

Reliability

From a reliability standpoint, LPITs are immune to grid disturbances, such as ferro-resonance phenomena. They demonstrate linearity throughout the whole measuring range, even up to rated short-circuit fault currents.

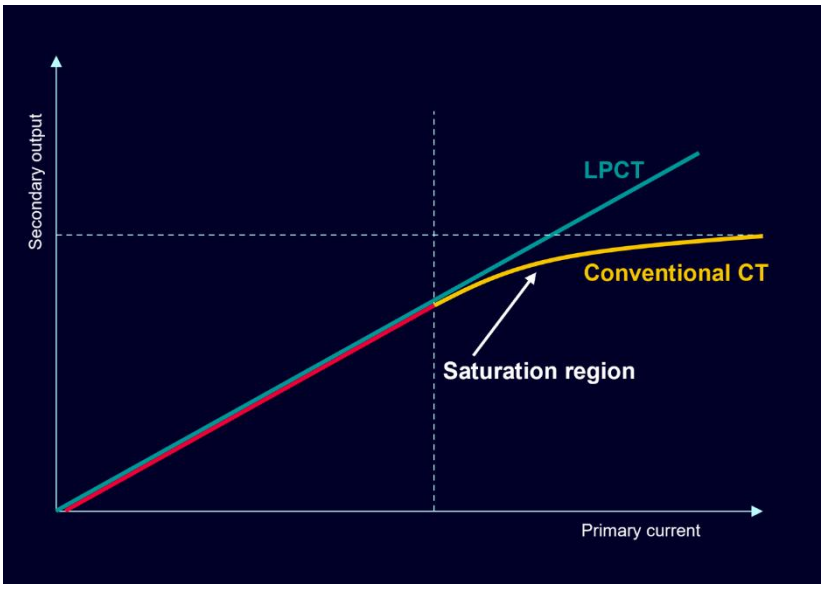


Figure 3
Saturation curve of a conventional CT vs. LPCT

In contrast to the conventional method, which involves numerous cables and terminals susceptible to human error, LPITs simplify the system by employing a single cable directly plugged into the relay from the LPITs. This reduced human interaction significantly decreases the risk of malfunction, akin to the error-free nature of an ethernet cable connecting to our routers at our homes.

Flexibility

From a flexibility perspective, LPITs offer easy adaptation to changes in the network. Thanks to a single design with its linear characteristics, wide primary current range coverage, and effective catering to the requirements of the entire SWG portfolio, LPITs can accommodate diverse load currents by simply adjusting the parameters on the protection relay.

	Current sensing
Technology	Rogowski-coil
Rated primary current I_{pr}	80 A
Rated secondary output U_{sr}	22.5 mV @50 Hz / 27 mV @60 Hz
Rated continuous thermal current I_{cth}	up to 4000 A
Rated short-time thermal current I_{th}	up to 50 kA
Rated dynamic current I_{dyn}	up to 137 kA
Rated extended primary current factor K_{pcr}	up to 50
Accuracy limit factor K_{alf}	up to 630
Accuracy class	0.5/5P

Figure 4
Current sensing characteristics

	Voltage sensing
Technology	Resistive divider
Rated primary voltage U_{pr}	17.5/√3 kV for NXAIR & NXAIR 50 kA 22/√3 kV for NXAIR M
Rated secondary voltage U_{sr}	3.25/√3V
Accuracy class	0.5/3P

Figure 5
Voltage sensing characteristics

This versatility enables seamless adjustments to changes in feeder current within the functional unit's allowed range. This approach minimizes costs associated with engineering, installation, and scheduling downtime for current transformers and empowers our customers to respond to evolving network demands efficiently, ensuring optimal performance and grid stability.

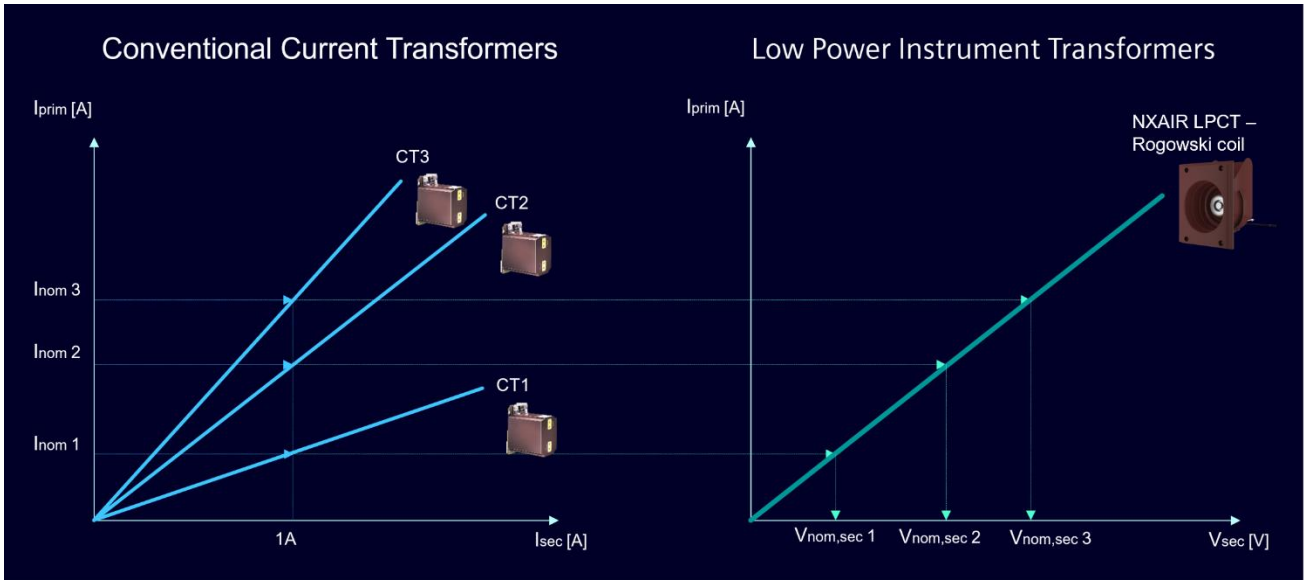


Figure 6
Wide range coverage with the LPCT in NXAIR

LPITs also impact the engineering and order execution processes of medium voltage switchgear. Unlike conventional instrument transformers which the configuration and order process often necessitate project-specific units to meet varying customer requirements, LPITs, on the other hand, adopt a standardized design with a wide dynamic range of protection and measuring purposes. This streamlines the initial engineering and later ordering processes.

While LPITs offer high accuracy (class 0.5) for current and voltage measurements, revenue metering may require even higher accuracy classes. For this purpose, conventional block-type transformers can be optionally added to sensor-equipped panels without a change in their footprint.

Figure 7
Possible sensor locations in the switchgear

Safety

Addressing the safety of LPITs, they present a lower risk for operational staff. Due to their low output power and small secondary voltages ranging from millivolts to a few volts only, LPITs significantly reduce the danger to personnel compared to conventional instrument transformers.

By employing a single RJ45 connector for sensor-to-protection device connections, wiring errors are minimized with a simplified installation and commissioning process.

Figure 8
Minimized wiring effort

Universal protection device using LPITs

Siemens' latest product from the SIPROTEC 5 line, the 7SY82 Universal Protection Device, offers unparalleled flexibility throughout the entire product life cycle. In cases where the system protection requirements change, users can easily adapt the universal device to the new demands without the need to procure new protective devices. Users can select protection functions from the extensive SIPROTEC 5 library, customizing the device to their specific needs.

The ability to modify functionality during project execution or at a later stage of the life cycle of the switchgear reduces electrical waste, conserves resources, and streamlines the entire process. With our universal approach, sustainability and flexibility go hand in hand, providing a superior solution for our customers.

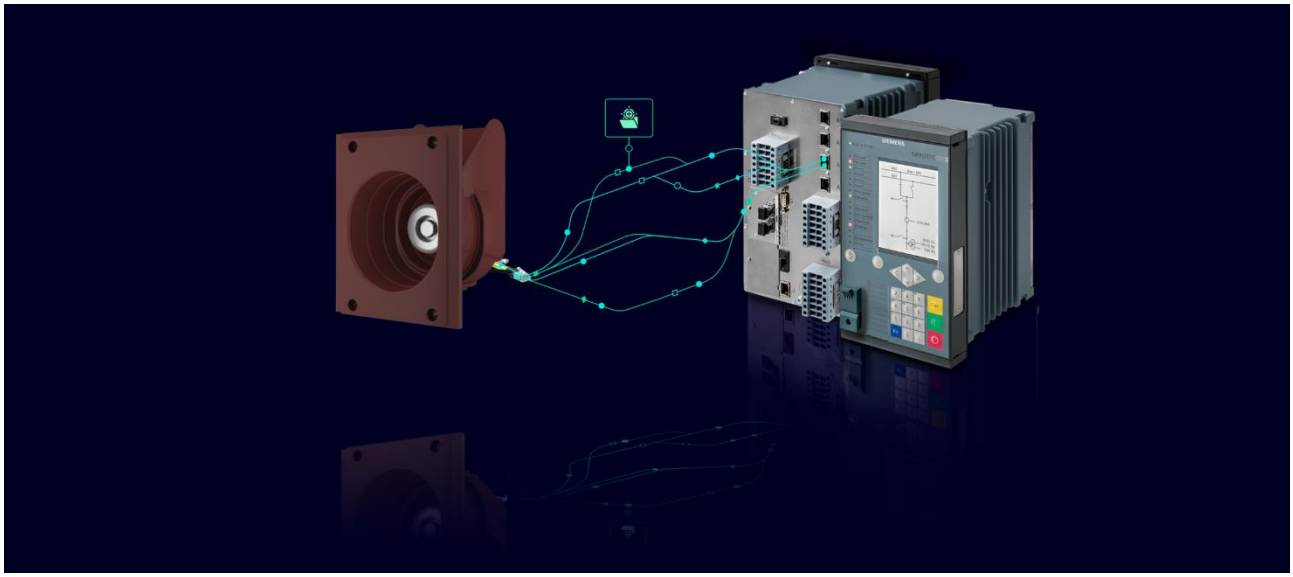


Figure 9
Our solution entails an optimized integration of IEC 61869-compliant current and voltage sensors into existing bushings of NXAIR, combined with the latest design of SIPROTEC 5 protection relays

Your benefits using LPITs

In summary, Low Power Instrument Transformers (LPITs) in NXAIR family products are paving the way for a more sustainable and efficient power system. By replacing conventional instrument transformers, LPITs promote resource savings, reduce energy consumption, and lower CO_2 emissions. Their benefits extend beyond sustainability, offering improved reliability, flexibility, and safety.

LPITs optimize engineering and commissioning processes, simplify system configuration, and enable seamless adaptation to changing load flows and protection requirements.

With Siemens' commitment to sustainability and cutting-edge solutions, LPITs are transforming the future of power grids, setting a new standard for efficiency and environmental stewardship.

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