NOVELIC

POWER ELECTRONICS
SOLUTIONS

Control Units for **Power Converters**

Three types of assemblies in a set:

- Converter Control Assembly – Primary **(nP-CCp)**
- Converter Control Assembly – Extended **(nP-CCx)**
- Measurement & Acquisition Assembly **(nP-CMa)**

Two types of configurations:

- **Standalone (Single power block) grid-connected converter control** (CCp+CMa or CCx+CMa) for up to 6 IGBT or Thyristor gate-drivers (B6 bridges).

- **Stacked grid-connected converter control** (CCx+CCp+CMa). Supports stacking of power blocks to increase output power. Each power block is individually controlled. Easy maintenance and repair, without converter shutdown.

- Ideal **both for retrofitting & new designs.**
- Supports **full redundancy** using multi-channel configuration, for high-performance critical applications.
- Powerful high-performance platform supports grid frequencies up to 500 Hz.

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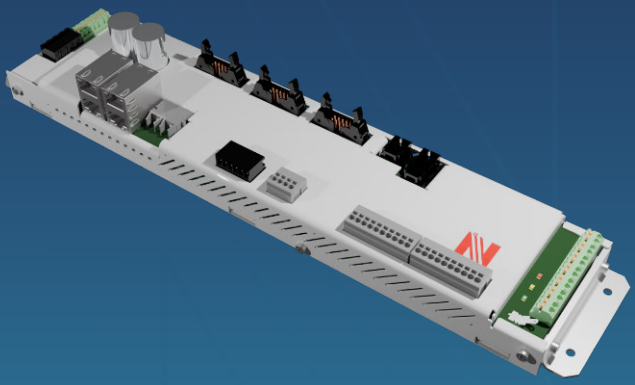
CONVERTER CONTROL ASSEMBLY – PRIMARY

nP-CCp

For controlling of one B6 thyristor rectifier or IGBT 2-Level inverter stack.

- **Acquires local measurements, necessary for proper operation and protection of the power block.**
- **One or two optical links to nP-CMa for primary or redundant functionality**
- **Analog input, several binary inputs and outputs for basic local control and status signals.**
- **Emergency stop interface (SIL2).**
- **Generates 6 driving signals for thyristor or IGBT firing board.**
- **Redundant communication with up to 3 superior level controllers. Multiple industrial protocols are available.**

  - **AC current inputs:** 3 phase current transformers (CT) or Rogowski coils
  - **Temperature sensor inputs:** up to 5 NTC / PTC / PT100
  - **GPIO:** 8 x DI / 4 x DO / 1 x AI (±10V / ±20mA)
  - 6 x PWM (Firing pulses)
  - 2 x PoF (for redundant connection with two nP-CMa assemblies)
  - Up to 3 x (2 x EtherCAT/Profinet RJ45) for redundant connection to nP-CCx



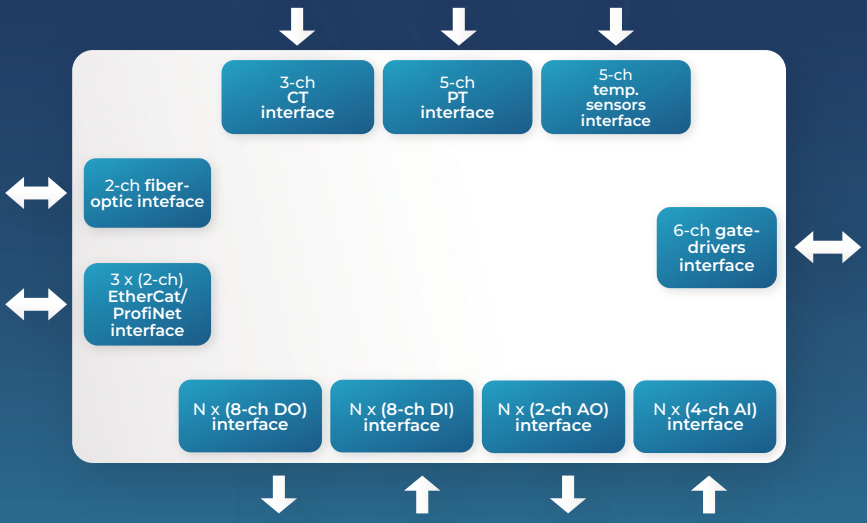
CONVERTER CONTROL ASSEMBLY – EXTENDED

nP-CCx

For control of the standalone or multi power block converter.

- Generates 6 driving signals for thyristor or IGBT firing board in standalone application.
- Operates as a main controller for driving of *N* x nP-CCp controllers.
- Extended for receiving up to 5 potential transformers (PT) inputs.
- Extended set of temperature measurement sensors.
- Extended with isolated groups of GPIOs for seamless integration.
- Emergency stop interface (SIL 2).

  - **Voltage measurements:** up to 5 independent PT inputs
  - **Current measurements:** up to 3 independent CT inputs
  - **Binary IOs:** n x 8DI | n x 8DO
  - **Analog IOs:** n x 4AI, n x 2AO (V/mA selectable)
  - **Temp. inputs:** n x 5NTC | PTC | PT100
  - **Comm:** 2 x PoF for two redundant nP-CMa assemblies
  - **Comm:** 3 x 2 x Ether CAT/Profinet RJ45



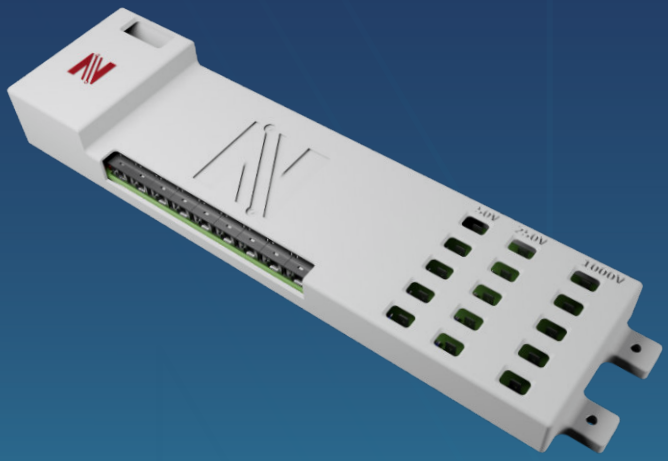
MEASUREMENT & ACQUISITION ASSEMBLY

nP-CMa

Measurement & acquisition of analog values for the power block: input voltages, output voltage, output current.

- **Transfers values by multiple high-speed optical communication links to nP-CCp and/or nP-CCx assemblies.**
- **Generates separate wide-bandwidth hardware-based analog output.**
- **One board sufficient for primary application. Two boards in parallel for redundancy.**
- **Additional test-points with fast-on terminals for easy commissioning and testing.**
- **Chassis or DIN-rail mountable.**

  - **AC voltage inputs:** 3 phase, selectable multirange up to 1000V, 500Hz
  - **DC voltage input:** selectable multirange up to 1500V
  - **DC current sensor input:** selectable multirange up to ±500mV
  - **AO:** direct conversion of the DC current input
  - 15kV measurement insulation
  - Multiple fiber-optic fast serial communication



CONTROL UNITS FOR POWER CONVERTERS

Application cases

CASE #1
Basic B6 thyristor rectifier

CASE #2
Stacked B6 thyristor rectifier

CASE #3
Fully redundant stacked rectifier

CASE #4
Twelve-pulse thyristor rectifier

CASE #5
Grid-connected IGBT inverter

CASE #1
Basic B6 thyristor rectifier

APPLICATION FIELDS

- Three-phase battery chargers for industry (power plants, steel and petrochemical industry), marine, hospitals
- Three-phase variable DC sources for the processing industry (electroplating, induction heating, anodic and cathodic corrosion protection, DC drives...)
- Rectifiers for effluent and sewage water treatment plants
- Excitation of synchronous machines with VAr and cosφ control in power plants, compressor lines, mills, synchronous compensators/condensers...

Three available types of assemblies:

- **nP-CMA** for acquisition of common measurements
- **nP-CCp** for single-block converter control
- **nP-CCx** for system control

Combinations of these boards make up the control assembly of different grid-connected converters. Boards can be used as-is, or easily modified for a tailored solution, both in HW and SW.

Basic B6 thyristor rectifier

For simple thyristor rectifier applications like battery chargers, controlled DC sources and stand-alone static excitation systems.

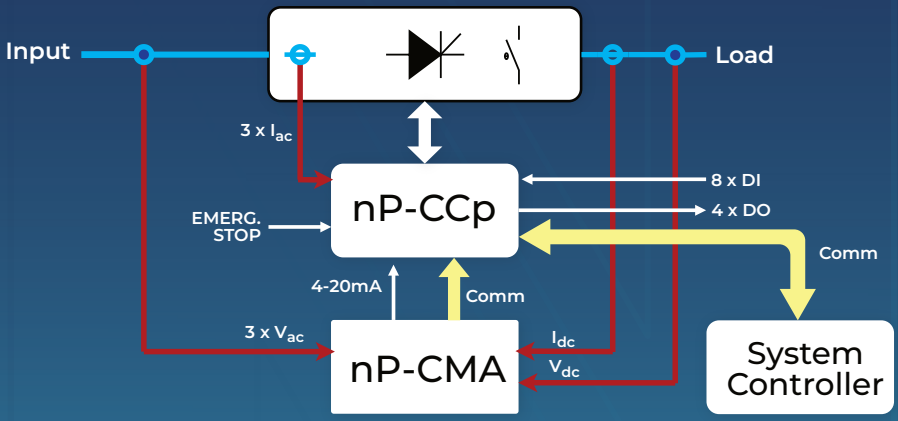
Two boards for full-scale basic rectifier control:

- **nP-CMA** acquires system input and output measurements
- **nP-CCp** performs primary tasks: it acquires power block measurements, handles local binary I/O, generates driving pulses and performs power block protection
- **nP-CCp** communicates with the system controller which performs system-level control functions

Optionally:

Basic system control implemented in nP-CCp - no need for a separate system controller.

Communication port used for connection with an outdoor touch-panel or some other means of HMI.



CASE #2
Stacked B6 thyristor rectifier

APPLICATION FIELDS

- High-power three-phase battery chargers for industry (power plants, steel and petrochemical industry), marine, hospitals...
- High-power variable DC sources for process industry (electroplating, induction heating, anodic and cathodic corrosion protection, DC drives...) and traction applications.
- Rectifiers for effluent and sewage water treatment plants
- Excitation of medium and large synchronous machines with VAr and cosφ control in power plants, compressor lines, mills, synchronous compensators/ condensers...

Three available types of assemblies:

- nP-CMA for acquisition of common measurements
- nP-CCp for single-block converter control
- nP-CCx for system control

Combinations of these boards make up the control assembly of different grid-connected converters. Boards can be used as-is, or easily modified for a tailored solution, both in HW and SW.

Stacked B6 thyristor rectifier

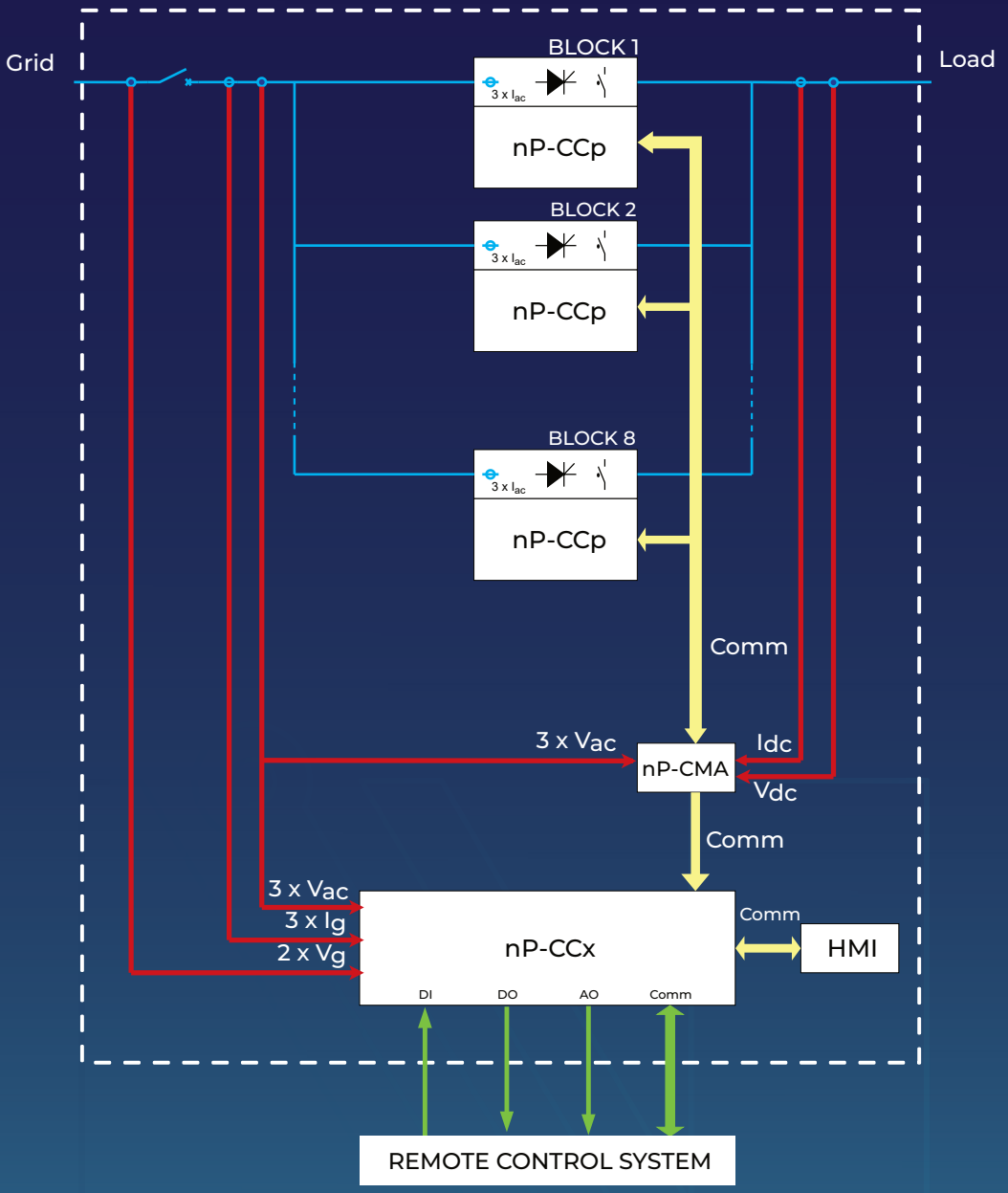
For high-current DC sources in process industry, high-capacity stationary battery chargers and excitation systems.

All three types of boards for full-scale stacked rectifier control:

- One nP-CMA acquires common input and output measurements, providing data for all control boards
- Each power block is equipped a with dedicated nP-CCp board; it acquires local power measurements and recieves common measurements from nP-CMA assembly
- Each nP-CCp handles basic binary I/O for its own power block, generates driving pulses and performs own power block protection
- One nP-CCx assembly performs system-level control functions; all nP-CCp boards are supplied with local references through communication

In case of a stack loss, the system will continue its operation as long as it has enough power to supply the load.

In case of communication failure, the stack stops its operation.



Application in Stacked B6 thyristor

CASE #3
Fully redundant stacked rectifier

APPLICATION FIELDS

- High-power, high-reliability three-phase battery chargers for industry (power plants, steel and petrochemical industry), marine, hospitals...
- Three-phase variable high-power high-reliability DC sources for process industry and traction (electroplating, induction heating, anodic and cathodic corrosion protection, DC drives...)
- Rectifiers for effluent and sewage water treatment plants
- Excitation of large synchronous machines with VAr and cosφ control in power plants, compressor lines, mills...

Three available types of assemblies:

- **nP-CMA** for acquisition of common measurements
- **nP-CCp** for single-block converter control
- **nP-CCx** for system control

Combinations of these boards make up the control assembly of different grid-connected converters. Boards can be used as-is, or easily modified for a tailored solution, both in HW and SW.

Fully redundant stacked rectifier

For critical applications, high-current DC sources in the process industry, excitation systems, milling, traction and marine applications.

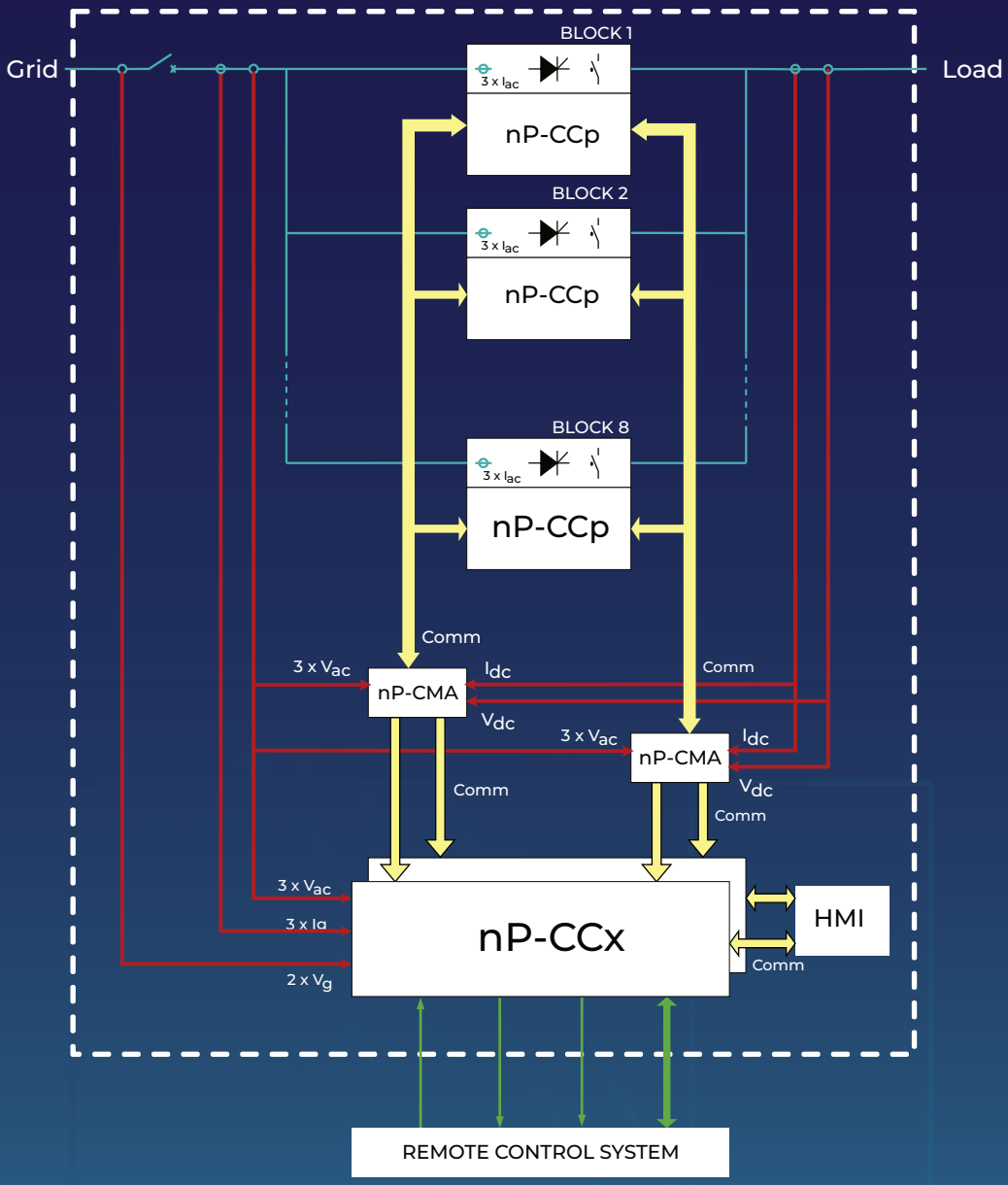
All three types of boards for full-scale stacked rectifier control:

- Two nP-CMA boards acquire common input and output measurements, providing data for all control boards redundantly
- Each power block is equipped with a dedicated nP-CCp board; it acquires local power measurements and receives common measurements from nP-CMA assemblies
- Each nP-CCp handles basic binary I/O for its own power block, generates driving pulses and performs own power block protection
- Two nP-CCx controllers perform redundant system-level control functions; all nP-CCp boards receive the same reference value through redundant communication.

The system is resilient to any single-point failure.

In case of any board or communication failure, the system will continue its operation.

The worst case failure is a loss of one stack; the system will continue its operation as long as it has enough power to supply the load.



Fully redundant stacked rectifier

CASE #4
Twelve-pulse thyristor rectifier

APPLICATION FIELDS

- High-power low-harmonic variable DC sources for process industry (electroplating, induction heating, anodic and cathodic corrosion protection, DC drives...) and traction applications
- Rectifiers for hydrogen electrolyzers
- Three-phase high-capacity battery chargers with low current harmonic requirements (steel and petrochemical industries) marine, hospitals....
- Excitation of large synchronous machines with VAr and cosφ control in power plants, compressor lines, mills, synchronous compensators/condensers...

Three available types of assemblies:

- **nP-CMA** for acquisition of common measurements
- **nP-CCp** for single-block converter control
- **nP-CCx** for system control

Combinations of these boards make up the control assembly of different grid-connected converters. Boards can be used as-is, or easily modified for a tailored solution, both in HW and SW.

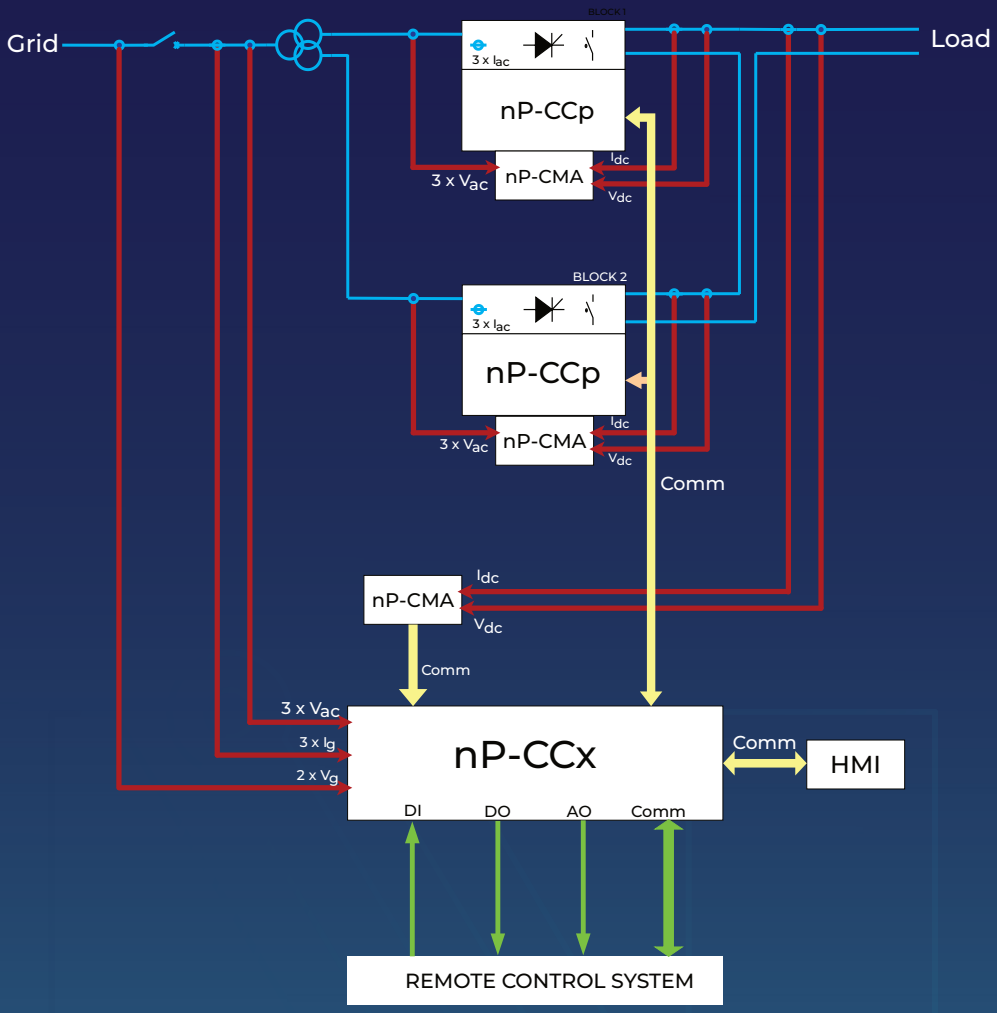
Twelve-pulse thyristor rectifier

For high-power applications with low THD requirement, like high-current DC sources in the process industry, hydrogen electrolyzers, and marine applications.

All three types of boards included:

- One power block for each transformer secondary; each powerblock with dedicated nP-CCp and nP-CMA for local measurements and control
- Each nP-CCp generates driving pulses and performs its own power block protection
- One nP-CCx with dedicated nP-CMA for system converter control, it generates reference values for nP-CCp controllers
- nP-CCx handles global binary interface, thermal control, integration into high-level system control

The control system can be easily extended to become fully redundant.



Application in Twelve-pulse thyristor rectifier

CASE #5
Grid-connected IGBT inverter

APPLICATION FIELDS

- Renewable power generation
- Hydrogen electrolyzers
- Unidirectional / Bidirectional three-phase DC sources with very low grid-current harmonic content
- Rectifiers for effluent and sewage water treatment plants
- Excitation of low-power synchronous machines with VAr and cosφ control in power plants, compressor lines, mills, synchronous compensators/condensers...
- Active power filters

Three available types of assemblies:

- **nP-CMA** for acquisition of common measurements
- **nP-CCp** for single-block converter control
- **nP-CCx** for system control

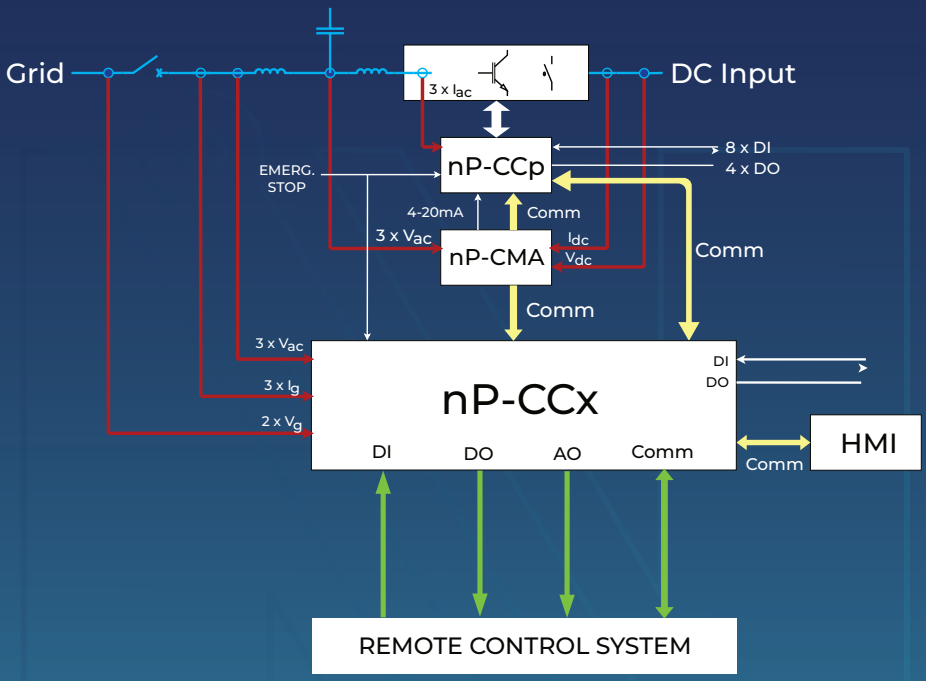
Combinations of these boards make up the control assembly of different grid-connected converters. Boards can be used as-is, or easily modified for a tailored solution, both in HW and SW.

Grid-connected IGBT inverter

For high-power applications with low grid current THD requirements.

All three types of boards included:

- One nP-CMA for acquisition of converter input voltage, converter output voltage and current; values transferred to nP-CCp and nP-CCx
- nP-CCx acquires grid-voltages on both sides of the main switch nP-CCx acquire grid-current and generate reference values for nP-CCp
- nP-CCp generates 6 PWM driving signals for 2-level six-switch IGBT bridge converter
- nP-CCx handles binary interface, thermal control, integration into high-level system control



NOVELIC **POWER ELECTRONICS**

Version 2 | 2025/05/15

Founded in 2012, NOVELIC gathers the finest talent in embedded hardware and software engineering, forming a strong foundation for creating end-to-end turnkey solutions in power electronics and embedded systems.

6 ENGINEERING CENTERS
300+ SUCCESSFUL PROJECTS
160+ SATISFIED CUSTOMERS
180+ EMPLOYEES