

SECOM

Power Electronic Equipment & Components

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SECOMDrive

Multilevel Drives



SECOMDrive MV Multilevel



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Our products have with following key features:

- State of art & latest technology
- Special power module design to allow easy maintenance
- Simple, flexible & powerful control architecture with embedded remote access and PLC functionalities
- Inbuilt drives process control functions for Metals applications
- Cabinets design focused on safety

**MV MULTILEVEL DRIVES
BIG POWER, BIG FLEXIBILITY!**

SECOMDrive MV Multilevel

SDML – Multilevel MV Cascade H-Bridge IGBT type : for smaller sizes and less demanding 2 quadrants applications including DOL MV motors revamping, air cooled converters, for output voltages up to 11 KV (3.3 - 6.6 - 10 KV standardised types, 4.16 KV & 11 KV version upon request) with power ranging from 320 KVA up to 13 MVA.



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SECOMDrive MV Multilevel

Typical applications

MultiLevel MV CHB – 3L-NPC cells IGBT type

“Energy saving in process control”

Typical Applications

- Fans
- Pumps
- Compressors
- Conveyors
- Extruders and separators
- Kilns
- Grinders
- Shredders



SECOMDrive MV Multilevel Applications

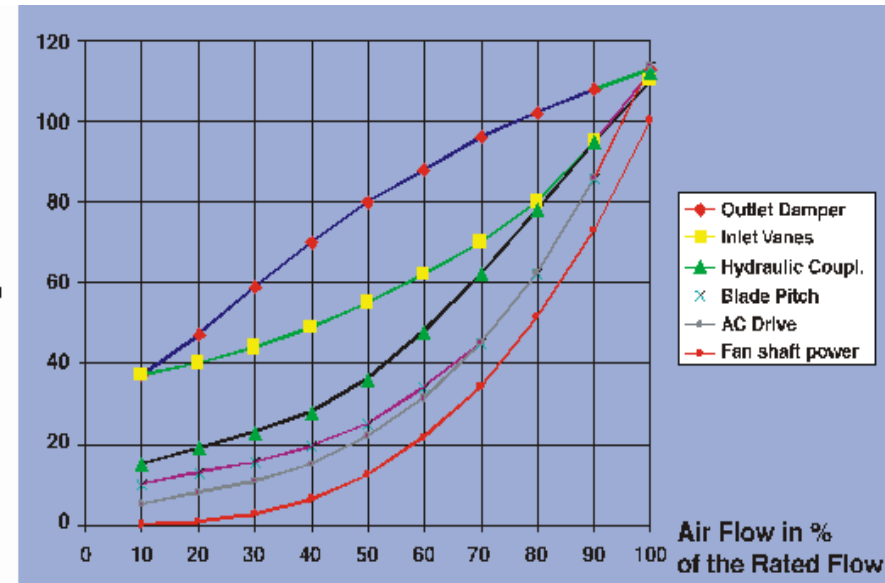
FANS AND PUMPS APPLICATIONS

SAVE ENERGY WITH FAST RETURN OF INVESTMENT

REPLACING MECHANICAL FLOW CONTROL & FIXED SPEED MOTORS WITH VARIABLE SPEED SYSTEM KEEPING EXISTING MOTORS

- Existing systems with inefficient damper controls
- At 70% of rated flow – savings are 30...40% of power compared to damper control

Power consumption in % of the rated fan shaft power



SECOMDrive MV Multilevel

Main features

- Ready-to-connect cabinet unit
- Input line voltage up to 35 kV
- Design focused on easy maintenance and quick power module replacement (a lifting trolley allows converter power cells very fast substitution)
- Modular design with up to 5 CHB power cells for each phase for 11kV converter series
- Cabinet design focused on safety
- Extremely low line harmonics spectrum: the multi-winding integrated transformer reduces input side current harmonics and conforms to standards without installation of additional harmonic filters
- Possibility to convert fixed speed DOL to VSD without requiring cumbersome sinusoidal filters to preserve motor insulation integrity



SECOMDrive MV Multilevel

Main features

- Fully-digital vector closed-loop control for synchronous and induction motors
- High degree of efficiency
- High control accuracy and dynamic response
- Simple and fast commissioning
- Extremely reliable in operation and almost maintenance-free

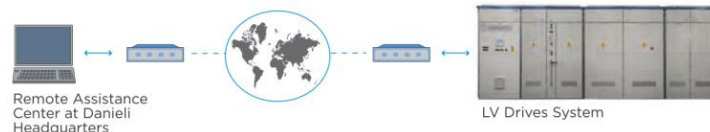


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SECOMDrive MV Multilevel

Main features

- Simple operator control and monitoring: advanced maintenance, parameterization, monitoring, troubleshooting and signal tracing functionalities with operator panel and PC
- Maximum flexibility and optimum interaction with automation overriding control system: different Fieldbus Interfaces as option (Profibus, CANopen, DeviceNet, Ethernet, exc.)
- Possibility of I/O terminals expansion according to the application requirements
- PLC functionalities embedded into drive control unit with possibility for Users to add their programming in CodeSys for any additional functionality
- Inbuilt remote access for Teleservice option



SECOM
Power Electronic Equipment & Components



SECOMDrive MV Multilevel

General electrical data

| | |
|------------------------------------|--|
| Power switches elements | IGBTs |
| Drive arrangement | Single unit in cascaded 3L-NPC H-cell topology No-regenerative type with 6 or 12 pulses type diode bridges |
| Rated output voltage types | 3.3 kV – 4.16 kV – 6.6 kV – 11 kV |
| Efficiency | Typ. $\geq 97\%$ (including multi-winding transformer) |
| Motor type | Induction or Synchronous with separate dc excitation |
| Main supply voltage (50/60Hz) | = typically output voltage +/- 10%, or any other input voltages upon request, up to 35 kV |
| Inverter output frequency | Typ. 0... 50 / 60 Hz – up to 75 Hz |
| Braking method | Natural deceleration by load torque and motor losses |
| Input power factor | Typ. better than 0.95 depending on output load |
| Output current overload capability | 110% for 60 sec every 300 sec with base current of I_n 125% for 60 sec every 600 sec with base current of I_n |

SECOMDrive MV Multilevel

General electrical data

| | |
|---|--|
| Transformer configuration | Multi-windings multi-pulse (see relevant table) |
| Type of control | Scalar control, FOC sensorless / sensed |
| Speed accuracy | 0.5% @ 100% speed (FOC sensorless) |
| Torque accuracy | Better than $\pm 5\%$ of rated motor torque (FOC sensed and motor rated current $\geq 80\%$ of converter rated current) |
| Auxiliary voltages range | 380...480 Vac 50/60 Hz |
| UPS for control unit | Integrated into converter cabinet auxiliary section as standard |
| Installation place | Indoor (clean electrical room typically), with site altitude up to 1000 m a.s.l. Atmosphere: general clean environment, free from corrosive gas, dust and explosive / flammable gas |
| Electrical room operating temperature range | 10 - 35 °C without derating - from 36°C to 45°C with derating (standard version) |
| Humidity | 90% relative humidity max (no condensation) |

SECOMDrive MV Multilevel

General electrical data

| | |
|---|--|
| External cooling water operating temperature range | 10 - 32 °C (water cooled type only) |
| Protection degree | IP32 (higher protection degree available upon request) |
| Power losses to air | For sizing of cooling equipment, max heat losses into air to be considered is about 3.5 kW/100 kVA of output power (i.e. for 1000 kVA output type consider approx 35 kW of heat losses, including transformer) |
| Sound pressure | Less than 75 dB (A) at 1 m from enclosure |
| Control unit interface to overriding control system | Profibus as standard or other fieldbuses upon request |
| Applicable standards | IEC 60146 – IEC 61800-3/4/5 – IEC 60071-1 – IEC60204-11 – EN62271 UL 347 A & CSA C22.2 (Certification in progress) |

SECOMDrive MV Multilevel

General electrical data

MV-ML SECOMDrive OPTIONS

| | |
|--|---|
| EXC - Field exciter converter cabinet for synchronous motor excitation | Unidirectional thyristor LV AC/DC converter with crowbar, incoming line circuit breaker (DA standard cabinet type) |
| AUX_MCS - Auxiliary system Motors control starters cabinet + UPS for control unit | Cabinet with starters, feeders for aux. loads & UPS for control unit with drive system supervision panel (OP2) – typically needed for large motors in IC37AW86 cooling method |
| HPV - Higher Pulses Version Different converter transformer and diode front-end configuration to achieve higher number of supply line input current pulses | With this optional different configuration is possible to double the number of MV supply line input current pulses adopting a different transformer and input diode bridge configuration (double series connected input diode bridge configuration) |
| HIVT - High Input Voltage Transformer Version | Special multi-winding transformer version with input voltage higher than 11kV (possible classes up to 36kV) without any additional external MV/MV transformer |
| IBC - Input bypass cubicle | Input bypass circuitry to bypass inverter unit and providing DOL supply for the driven motor with synch. bypass |
| SIBC – Synchronised Input Bypass | HW & Control function to implement synchronised bypass and flying restart |
| INRL – Converter Transformer Inrush current limiter | Converter transformer Inrush current limiter circuitry on primary side |
| OIC – Output Isolator Cubicle | Output motor isolator & grounding switch |
| RCF – Redundant Cooling Fans | Available only for air-cooled versions |
| INT_UPS – UPS for control unit | Integrated into converter cabinet auxiliary section |
| WCV – Water Cooling Version | Solution with Converter water cooled Water Cooling Unit (WCU) installed in a dedicated section |
| HPDV5 or HPDV4 – Version for high protection | For enclosures in IP54 & IP42, it has an appropriate number of cooling units installed on the roof |

SECOMDrive MV Multilevel

Typical cabinet layout



FRONT VIEW



SIDE VIEW

SECOMDrive MV-ML
6.6kV 73A
AIR COOLED VERSION
for 35 kV MV supply line

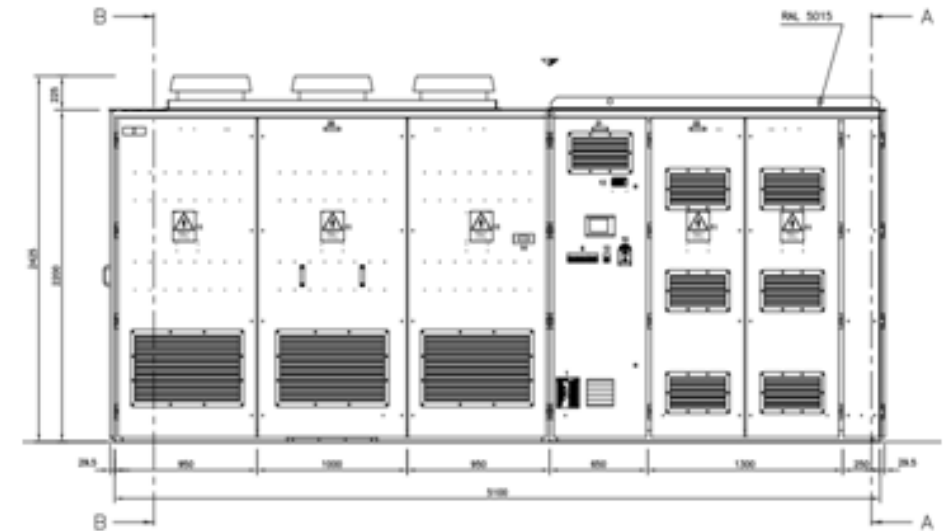


INCOMING LINE
AND MAIN TRANSFORMER SECTION

CONTROL
SECTION

INVERTER
AND TERMINAL UNIT

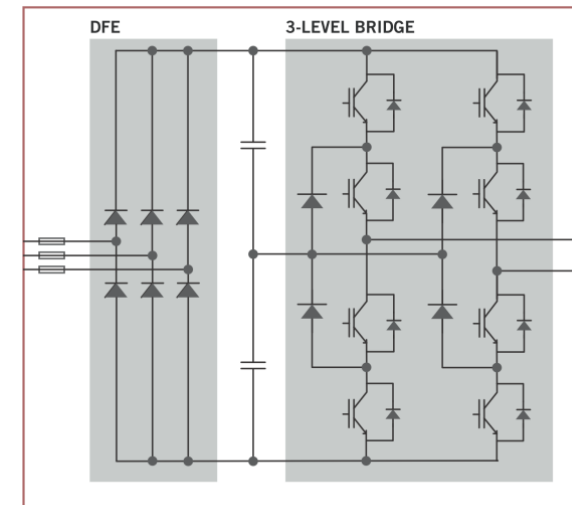
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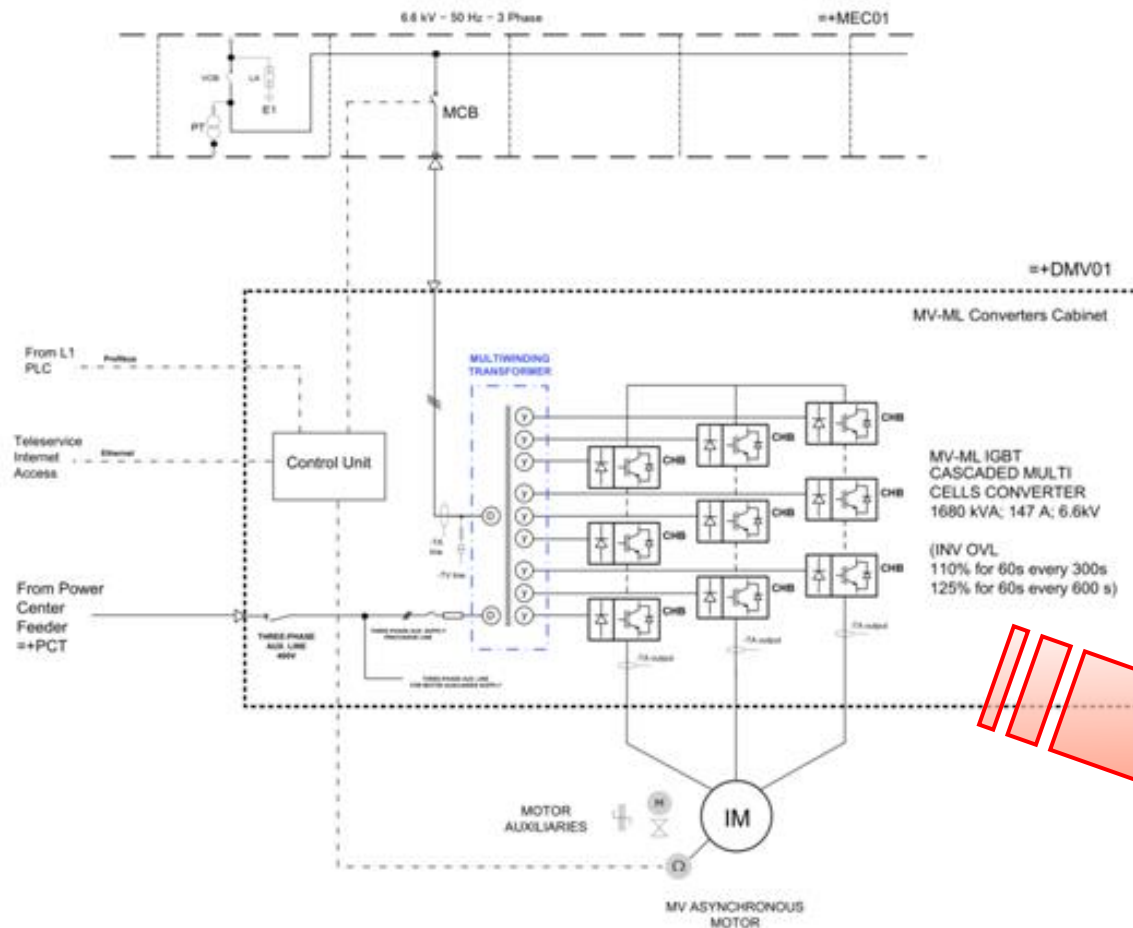
SECOMDrive MV Multilevel Power part configurations

CONCEPT SINGLE LINE DIAGRAM
CHB CELL with input diode bridge 6 pulses
version

| Output Voltage | Number of CHB cells for each phase | Number of secondaries windings |
|----------------|------------------------------------|--------------------------------|
| 3.3kV | 2 | 6 |
| 4.16kV | 2 | 6 |
| 6.6kV | 3 | 9 |
| 11kV | 5 | 15 |

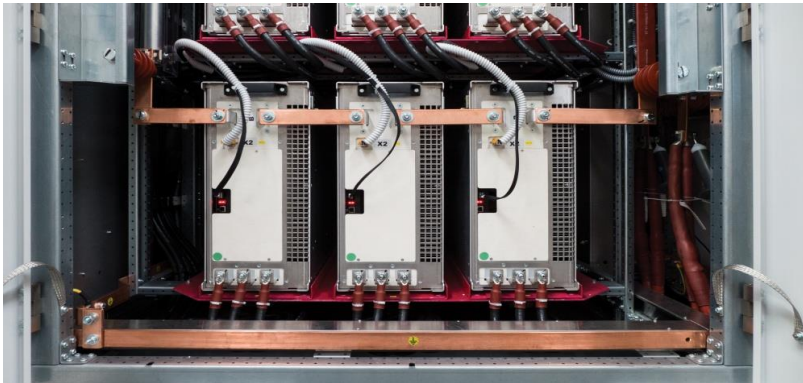


CHB-cell converter detail - 6 pulses input diode bridge



SECOMDrive MV Multilevel

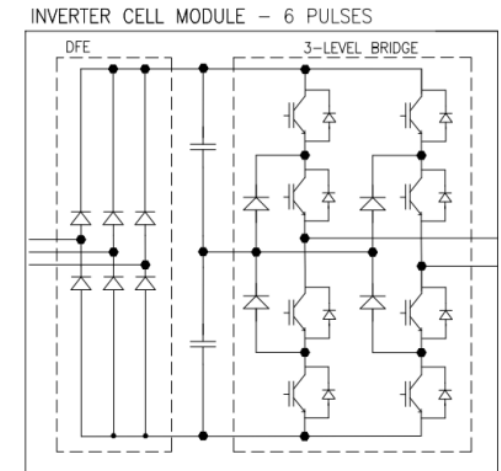
Power part configurations



Multi-winding Transformer Configurations

according to converter output voltage levels

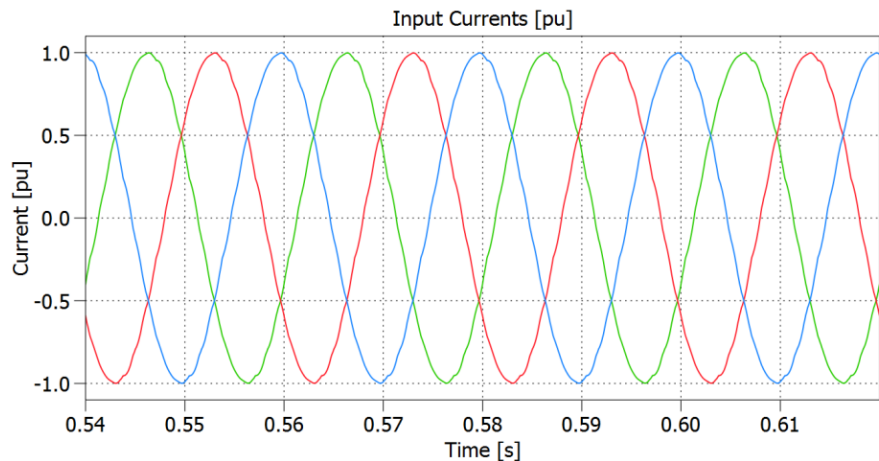
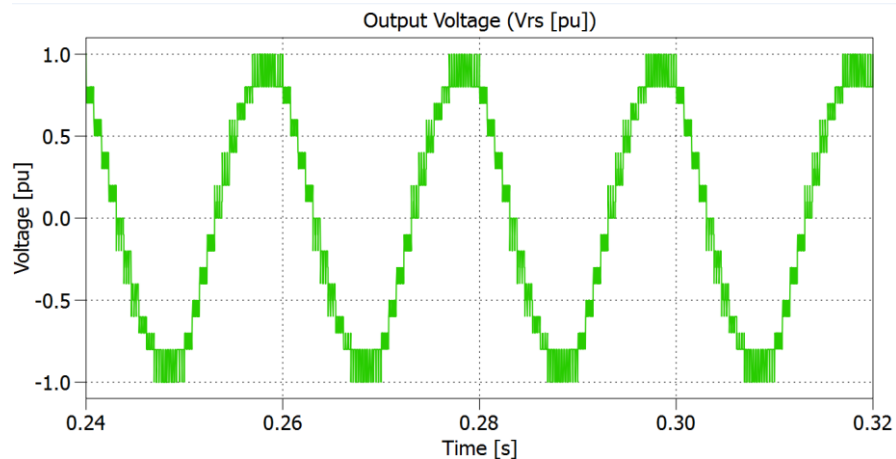
CHB CELL with input diode bridge 6 pulses version



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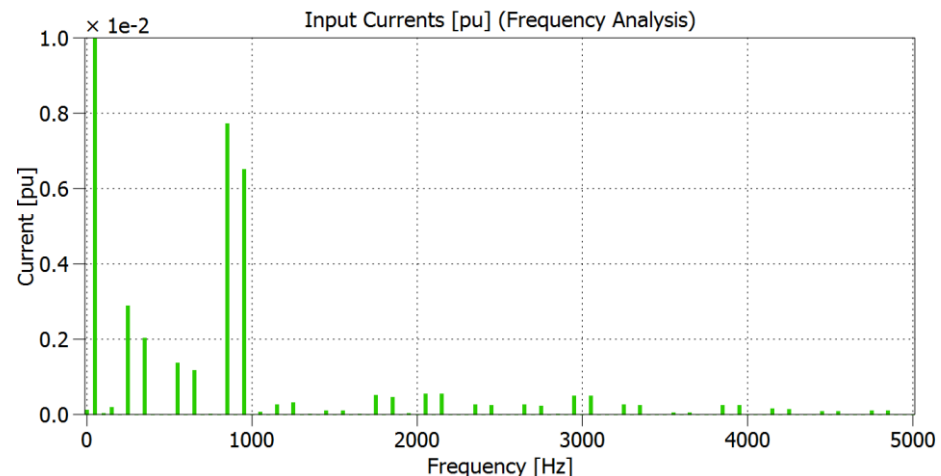
| Output voltage (kV) | 3.3 | 4.16 | 6.6 | 11 |
|--|-----|------|-----|----|
| Number of CHB cells for each phase | 2 | 2 | 3 | 5 |
| Phase shift between secondaries windings of each | 30 | 30 | 20 | 12 |
| Output waveforms voltage levels | 17 | 17 | 25 | 41 |
| Three groups of "n" windings | 2 | 2 | 3 | 5 |
| Number of secondaries windings | 6 | 6 | 9 | 15 |
| MV supply line side "pulses" in input current | 12 | 12 | 18 | 30 |

SECOMDrive MV Multilevel Power part configurations



TYPICAL WAVEFORMS & LINE CURRENT HARMONICS SPECTRUM (3 CHB FOR PHASE)

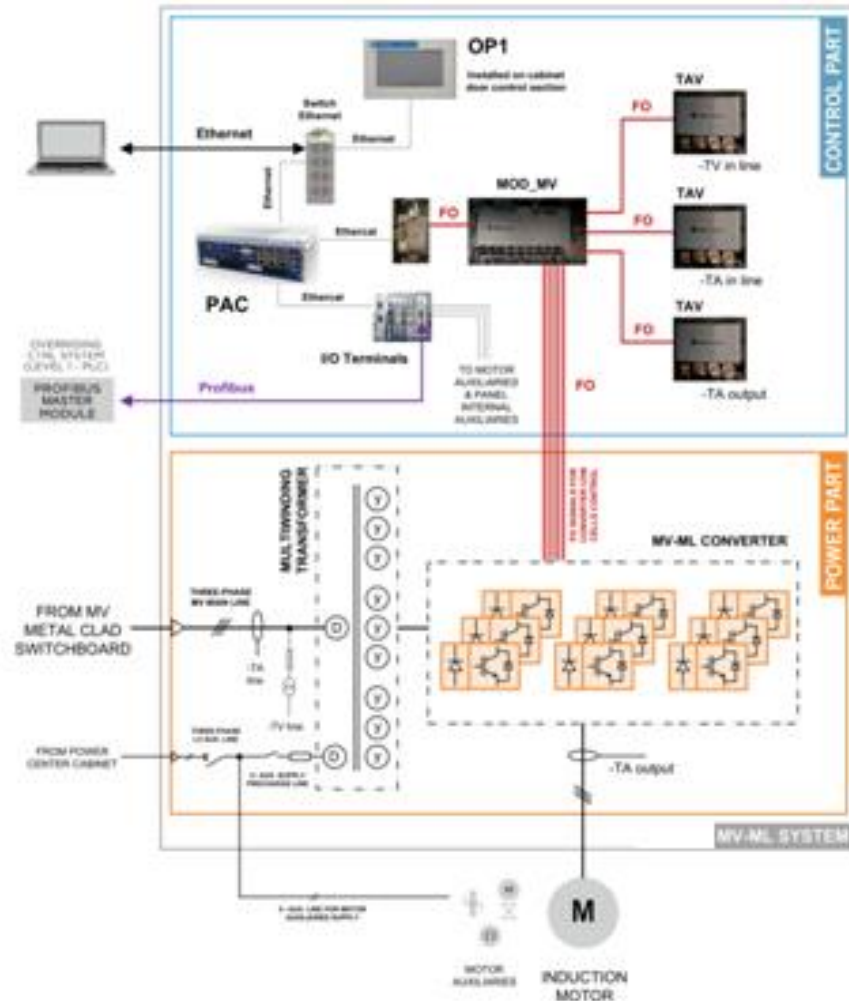
The use of the multi-cell multiwindings transformer – converter topology and of a particular modulation technique allows to achieve an excellent behaviour on the MV supply network, in terms of power factor and line current harmonics, in full compliance with IEEE and IEC relevant.



SECOMDrive MV Multilevel Converter ratings

| <i>SECOMDrive MV-ML Output Voltage</i> | <i>Number of CHB cells for each phase</i> | <i>Converters Output rated power range [KVA]</i> | <i>Converters Output rated current [A]</i> | <i>Transformer Rated Power [KVA]</i> |
|--|---|--|--|--------------------------------------|
| 3.3 kV | 2 | 200 ... 4000 | 35 A 52 A 73 A 107 A 147 A 192 A 227 A 262 A 306 A 350 A 402 A 472 A 525 A 612 A 700 A | 225 ... 4500 |
| 4.16 kV | 2 | 250 ... 5040 | | 285 ... 5680 |
| 6.6 kV | 3 | 400 ... 8000 | | 450 ... 9000 |
| 11 kV | 5 | 660 ... 13340 | | 750 ... 15000 |

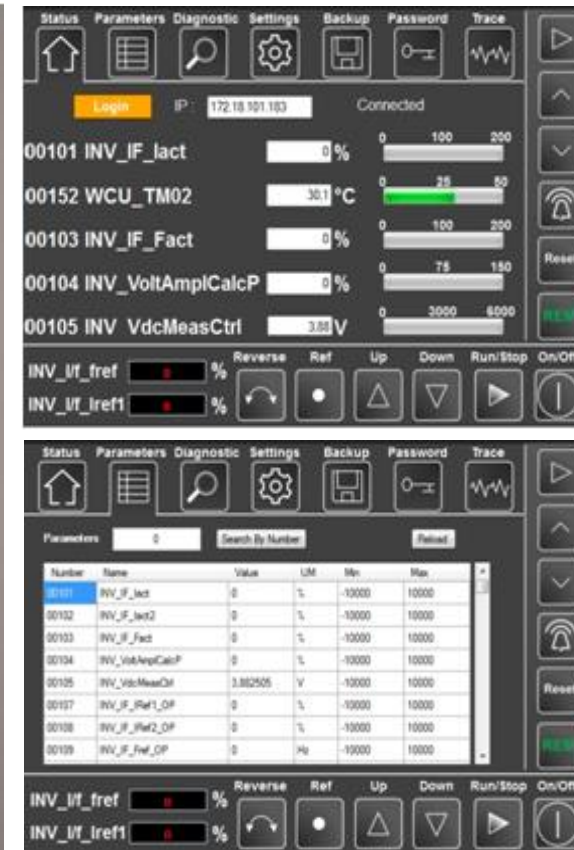
SECOMDrive MV Multilevel Converter ratings



SECOMDrive MV Multilevel Converter cabinet operator panel



LARGE
TOUCH
SCREEN
OPERATOR
PANEL

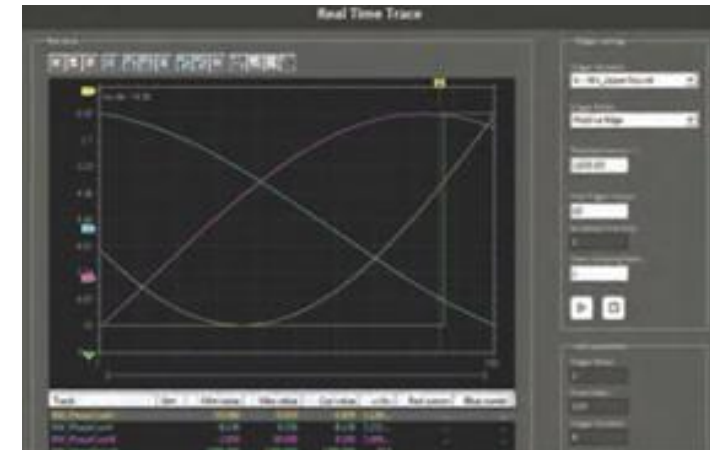


SECOMDrive MV Multilevel Configuration tool

Each drive control unit could be easily interfaced to a PC using Ethernet.

The **SECOMDrive Configurator Tool** is a software application that allows:

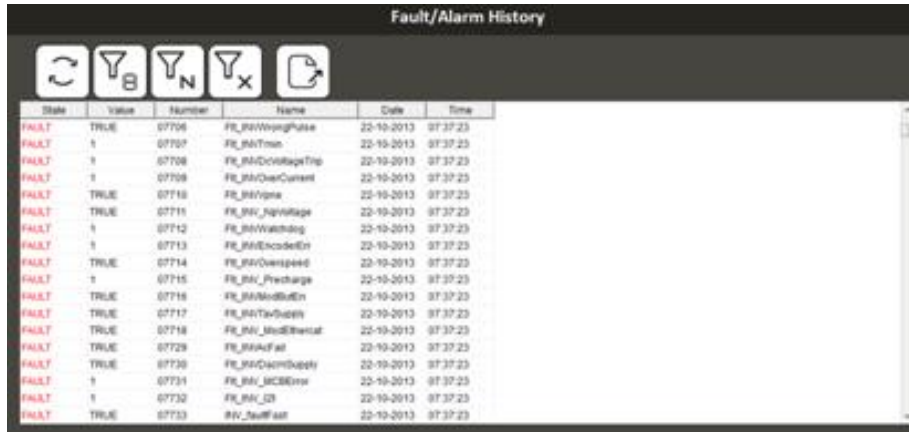
- Drive parameterization
- Tuning
- Accurate and fast signals tracing (triggering and visualization of up to 8 variables)
- Saving / retrieving of drive parameters
- Advanced troubleshooting



| Name | Type | Value | Unit | Group | Status |
|--------|------|-------|------|-------|--------|
| INVT01 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT02 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT03 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT04 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT05 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT06 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT07 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT08 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT09 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT10 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT11 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT12 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT13 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT14 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT15 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT16 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT17 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT18 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT19 | IGBT | 1.00 | % | 1.00 | 1.00 |
| INVT20 | IGBT | 1.00 | % | 1.00 | 1.00 |

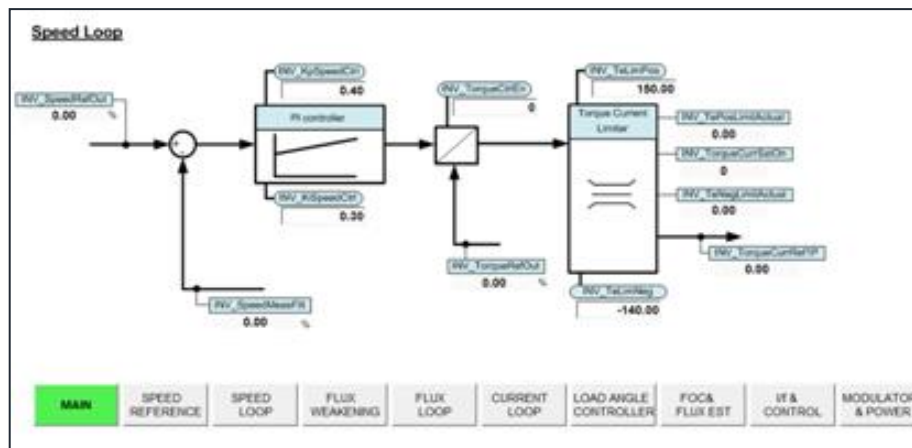
SECOMDrive MV Multilevel Configuration tool

Fault/Alarm History



| State | Value | Number | Name | Date | Time |
|-------|-------|--------|----------------------|------------|----------|
| FAULT | TRUE | 07706 | FR_RNWrongPhase | 22-10-2013 | 07:37:23 |
| FAULT | 1 | 07707 | FR_RNTrim | 22-10-2013 | 07:37:23 |
| FAULT | 1 | 07708 | FR_RNOverVoltageTrip | 22-10-2013 | 07:37:23 |
| FAULT | 1 | 07709 | FR_RNOverCurrent | 22-10-2013 | 07:37:23 |
| FAULT | TRUE | 07710 | FR_RNOpen | 22-10-2013 | 07:37:23 |
| FAULT | TRUE | 07711 | FR_RNqVoltage | 22-10-2013 | 07:37:23 |
| FAULT | 1 | 07712 | FR_RNWatchdog | 22-10-2013 | 07:37:23 |
| FAULT | 1 | 07713 | FR_RNEncoderEn | 22-10-2013 | 07:37:23 |
| FAULT | TRUE | 07714 | FR_RNOverSpeed | 22-10-2013 | 07:37:23 |
| FAULT | 1 | 07715 | FR_RNPrecharge | 22-10-2013 | 07:37:23 |
| FAULT | TRUE | 07716 | FR_RNModBusEn | 22-10-2013 | 07:37:23 |
| FAULT | TRUE | 07717 | FR_RNTxStatus | 22-10-2013 | 07:37:23 |
| FAULT | TRUE | 07718 | FR_RNModBusStat | 22-10-2013 | 07:37:23 |
| FAULT | TRUE | 07729 | FR_RNAdf all | 22-10-2013 | 07:37:23 |
| FAULT | TRUE | 07730 | FR_RNDiscomSupply | 22-10-2013 | 07:37:23 |
| FAULT | 1 | 07731 | FR_RNMCBErr | 22-10-2013 | 07:37:23 |
| FAULT | 1 | 07732 | FR_RN_ID | 22-10-2013 | 07:37:23 |
| FAULT | TRUE | 07733 | FR_RNRef all | 22-10-2013 | 07:37:23 |

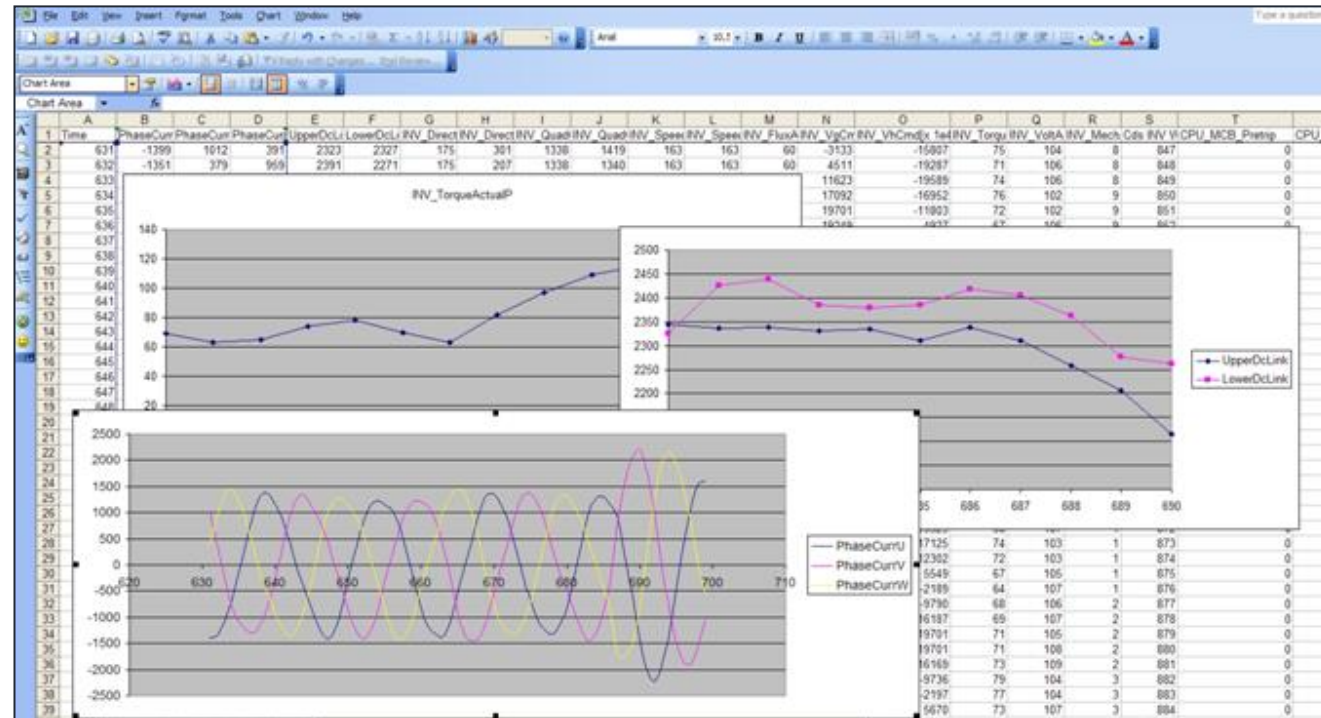
Faults / Alarms
On-Line Monitoring



Tuning Interfaces

SECOMDrive MV Multilevel Configuration tool

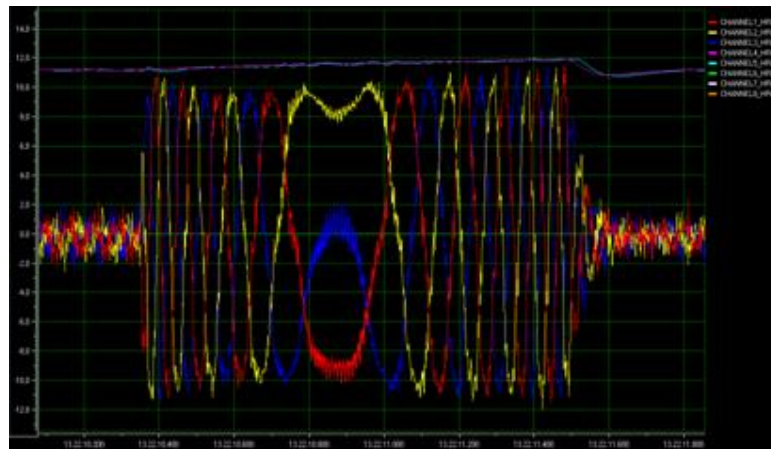
Possibility of Faults/Alarms History Saving, Analysis and Reconstruction of signals and main variables.



SECOMDrive MV Multilevel Configuration tool



Up to 8 selectable variables



Selection possibility also on-line

SECOMDrive MV Multilevel Maintenance



FAST & TROUBLE-FREE REPLACEMENT
IN ABOUT
30 MIN



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