Converteam LV7000 product family

Product overview

03.07.2007

CONVERTEAM
THE POWER CONVERSION COMPANY

Co-operation between Converteam and Vacon

- By signing a global co-operation agreement in Nov. 2006, Converteam group and Vacon stepped into a close partnership
- Subject of the co-operation agreement are low voltage, air-cooled AC drive products

PRESS RELEASE

Converteam and Vacon sign a global cooperation agreement for AC drives

Massy, France - - November 29, 06 - Converteam, an international company developing systems and customized solutions for the conversion of electrical energy, and the AC drives manufacturer Vacon have entered into a global cooperation agreement. Under the terms of the agreement, Vacon will supply low voltage air-cooled AC drives to Converteam worldwide.

This arrangement is in line with Vacon's strategy of building strong cooperation with system integrators, for which the company's independent position as a low-voltage AC drives supplier provides excellent possibilities. For Converteam, Vacon is a focused and non-competing supplier with a complete low voltage AC drives product range, which is easy and efficient to apply.

In the field of power conversion, Converteam has an extensive offering from design-only to turnkey systems including installation, commissioning and a full range of services. Their solutions are based on variable-speed systems and advanced automation. "Converteam is a major supplier in marine and offshore, oil and gas, process and renewables industries, as well as in many specialized areas, and we are very pleased that Converteam has chosen us as their AC drives supplier," said Mr Heikki Hiltunen, Executive Vice President, Products and Markets, Vacon.

"We chose Vacon because of the synergies between our two ranges of drives. In addition, we highly appreciate their willingness to meet our specific requirements as well as their worldwide presence," said Mr Florent Battistella, Executive Vice President, Chief Operating Officer, Converteam.

Product range

- The product range is based on modularity
  - Different controller units (LV7000-1, LV7000-2, LV7000-3-controller)
  - Air cooled
  - A broad range of option boards
  - Different local panels
  - AC-fed converters and …

LV7000-1

LV7000-2

LV7000-3

LV7000-3
IP00 modules

LV7000-3
Stand-alone

LV7000-4

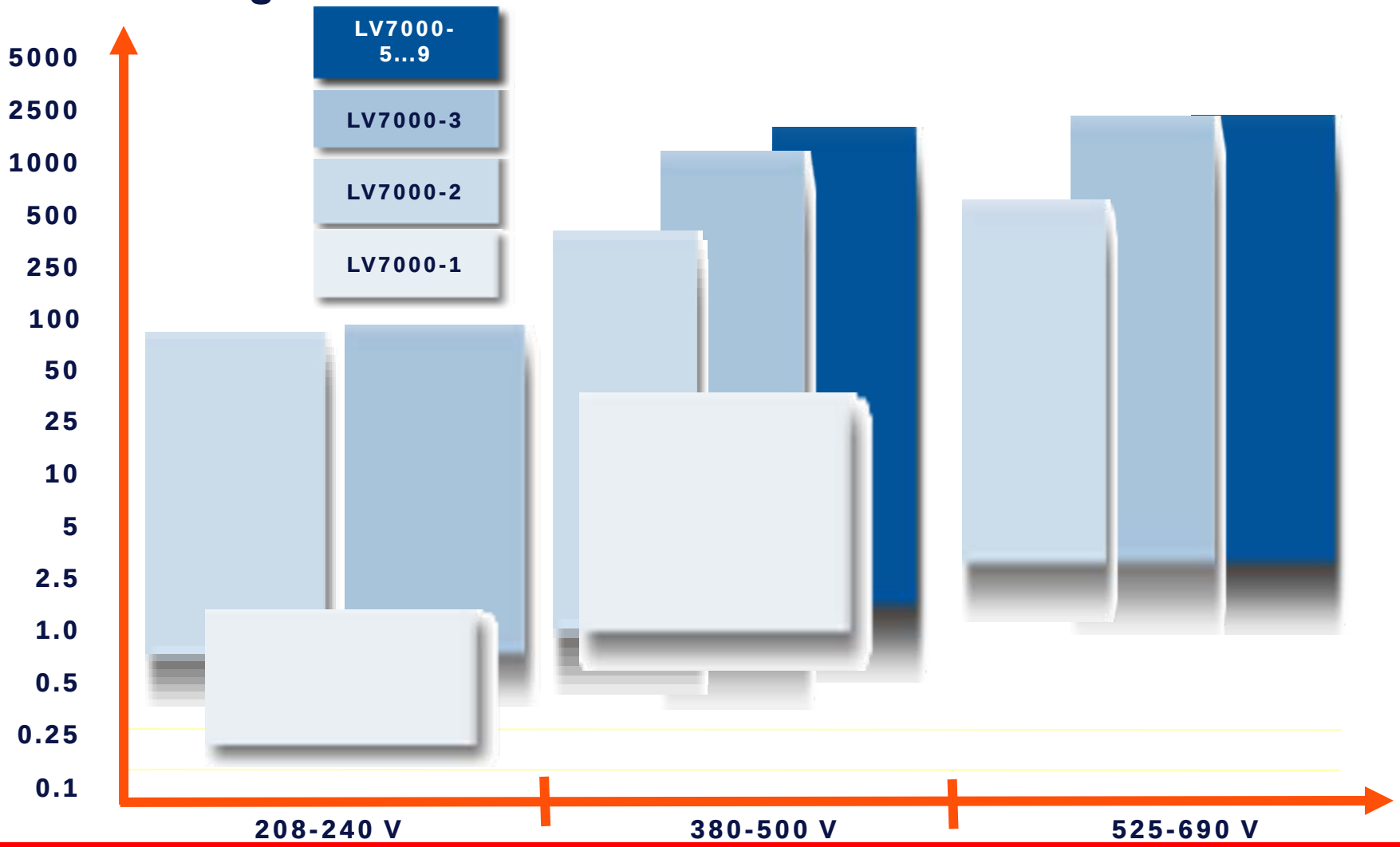
Product range

- The product range is based on modularity
  - … products for a common DC-bus system
    - Inverter units
    - Front end units
    - Brake chopper units

LV7000 products for common DC-bus systems LV7000-5 … LV7000-9

Low voltage AC drives of type LV7000

Product range



To choose the right LV7000 AC-drive

- Dimensioning
  - Feeding voltage , AC or DC
  - Torque (starting, variable, constant)
  - Overloadability
  - Ambient temperature (40° C, 45 ° C and 50 ° C)
  - Physical size

- Performance
  - U/f frequency control
  - Sensorless vector control
  - Closed-loop vector control
  - Static and dynamic accuracy of speed and torque
  - Response time

LV7000 AC-fed converters

CONVERTEAM
THE POWER CONVERSION COMPANY

Converter of type LV7000-1

- Compact AC drive for industrial and residential purpose
  - Compact drive (MF2 and MF3 frames)
    - Power range 0,37 – 2,2 kW
    - 208 – 240 V and 380 – 500 V; +/- 10 %
    - IP20, EMV class N
    - Slot for one option board (I/Os programmable)
  - General purpose drive (MF4 – MF6 frames)
    - Power range 1,1 – 30 kW
    - 380 – 500 V; +/- 10 %
    - IP21 or IP54
    - RFI-filter and AC-mains-choke integrated (MF4 – MF6)
    - Internal brake chopper (MF4 – MF6)
    - Slots for two option boards (I/Os programmable)
  - Standard control terminals with digital and analogue I/Os (programmable) and integrated RS485 (Modbus) connector

LV7000-1
MF2 and MF3

LV7000-1
MF4 … MF6

Converter of type LV7000-1 – Options

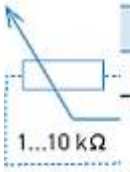
- DIN-rail mounting kit
- External RFI-filter and AC-choke
- Internal brake chopper
- RS-232 PC-adapter kit
- Door installation kit
- 7-segment LCD keypad without memory
- Filters (du/dt, sine)
- Varnished circuit boards
- Flange mounting kit
- Kit for IP54 enclosure
- External 24 V supply for control

Converter of type LV7000-1 – Features

- Steady state speed error < 1 %
- Low torque ripple
- High immunity to resonance vibrations
- Starting torque > 200 %, depending on the motor and drive sizing
- Suitable for multi-motor applications
- Dynamic open loop vector control
- Fitted with „Multi-Control“ application software
- Other application software available

Converter of type LV7000-1 – Standard and option I/Os

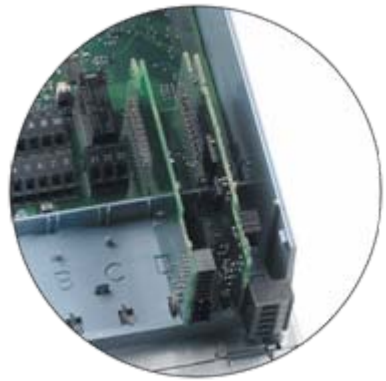
Standard I/O



Terminal		Signal, default settings
1	+10V	Reference voltage
2	AI1+	Analog input, 0–10 V (0/4–20 mA)
3	AI1-	AI common
4	AI2+	Analog input, 0/4–20 mA (0–10 V)
5	AI2-	AI common
6	+24V	24V auxiliary voltage
7	GND	I/O ground
8	DIN1	Start forward
9	DIN2	Start reverse
10	DIN3	Preset speed 1
11	GND	I/O ground
18	AO1+	Analog output, output frequency
19	AO1-	AO common
A	RS485	Serial bus (Modbus RTU)
B	RS485	Serial bus
30	+24V	External control voltage supply
21	RO1	Relay output 1, FAULT
22	RO1	
23	RO1	

OPT-AI (typical option)

Terminal		Signal, default settings
12	+24V	24 V auxiliary voltage
13	GND	I/O ground
14	DIN1	Preset speed 2
15	DIN2	Fault reset
16	DIN3	Disable PID
25	RO1	Relay output 1, RUN
26	RO1	
28	TI1+	Thermistor input
29	TI1-	(galvanically isolated)



OPT-AA (typical option)

Terminal		Signal, default settings
1	+24V	24 V auxiliary voltage
2	GND	I/O ground
3	DIN1	Preset speed 2
4	DIN2	Fault reset
5	DIN3	Disable PID
6	DO1	Digital output, Ready
24	RO1	Relay output 1, RUN
25	RO1	
26	RO1	

Converter of type LV7000-1 – Option boards

Card typecode	Slot		I/O signal								
	D	E	DI	DO	AI mA isol.	AO mA isol.	RO NO NC	RO NO	Therm	+24 EXT +24V	NOTE
Basic I/O cards (OPT-A)											
OPT-AA			3	1			1				
OPT-AI			3					1	1		
I/O expander cards (OPT-B), typical											
OPT-B2							1	1	1		
OPT-B4					1	2				1	analog signals galvanically isolated separately
OPT-B5								3			
Fieldbus cards (OPT-C)											
OPT-C2			RS-485 (Multiprotocol)								Johnson N2 (Modbus as standard)
OPT-C3			Profibus DP								
OPT-C4			LonWorks								
OPT-C5			Profibus DP (D9 type connector)								
OPT-C6			CANopen (slave)								
OPT-C7			DeviceNet								
OPT-C8			RS-485 (Multiprotocol, D9 type connector)								Johnson N2 (Modbus as standard)
OPT-CI			Modbus/TCP (Ethernet)								
OPT-CJ			BACnet								

Converter of type LV7000-2

- Drive for standard industrial applications, that **do not** require a very high precision for speed and torque (i. e. without speed feedback device)
  - FR4 – FR9 for wall / enclosure mounting
    - 208 – 240 V, 380 – 500 V, 525 – 690 V; +/- 10 %
    - Power range 0,55 – 200 kW
    - IP21 or IP54, EMC class C, H, L, T
  - RFI-filter and AC-mains-choke integrated
  - Up to 5 I/O-cards, programmable
  - Control unit can be detached from the power unit

LV7000-2

Converter of type LV7000-2 IP21 Stand-alone

- High-power drive modules installed in a light housing
  - FR10 – FR11 stand-alone
    - 380 – 500 V, 525 – 690 V; +/- 10 %
    - Power range 200 – 560 kW
    - With integrated fuses or load switch
    - IP21 (stand alone unit)

LV7000-2
Stand-alone

Converter of type LV7000-2

3AC	FR4	FR5	FR6	FR7	FR8	FR9	FR10	FR11
230V	3 kW	7.5 kW	15 kW	30 kW	55 kW	90 kW	-	-
400V	5.5 kW	15 kW	30 kW	55 kW	110 kW	160 kW	250 kW	400 kW
500V	7.5 kW	18.5 kW	37 kW	75 kW	132 kW	200 kW	355 kW	500 kW
690V	-	-	30 kW	45 kW	90 kW	200 kW	400 kW	560 kW

Maximum nominal power in mechanical size at different voltages

Converter of type LV7000-2 – Options

- Internal brake chopper
- Internal brake resistor
- Door installation kit
- Display with memory (standard or graphical), dummy or no display
- Filters (RFI, du/dt, sine)
- Varnished circuit boards
- Flange mounting kit
- Kits for IP54 enclosure
- Additional DC-connection
- External 24 V supply for control

Converter of type LV7000-2 – Features

- Steady state speed error < 1 %
- Low torque ripple
- High immunity to resonance vibrations
- Starting torque > 200 %, depending on the motor and drive sizing
- Suitable for multi-motor applications
- High-speed applications (up to 7.200 Hz) possible
- Fitted with „All-In-One“ application software
- Other application software available

Converter of type LV7000-3

- High performance drive for industrial applications, that **do** require a very high precision for speed and torque (i. e. with speed feedback device)
  - FR4 – FR9 for wall / enclosure mounting
    - 208 – 240 V, 380 – 500 V, 525 – 690 V; +/- 10 %
    - Power range 0,55 – 200 kW
    - IP21 or IP54
  - RFI-filter and AC-mains-choke integrated
  - Up to 5 I/O-cards, programmable
  - Control unit can be detached from the power unit

LV7000-3

Converter of type LV7000-3 IP21 Stand-alone

- High-power drive modules installed in a light housing
  - FR10 – FR11
    - 380 – 500 V, 525 – 690 V; +/- 10 %
    - Power range 200 – 560 kW
    - With integrated fuses or load switch
    - IP21 (stand alone unit)

LV7000-3
Stand-alone

Converter of type LV7000-3

3AC	FR4	FR5	FR6	FR7	FR8	FR9	FR10	FR11
230V	3 kW	7.5 kW	15 kW	30 kW	55 kW	90 kW	-	-
400V	5.5 kW	15 kW	30 kW	55 kW	110 kW	160 kW	250 kW	400 kW
500V	7.5 kW	18.5 kW	37 kW	75 kW	132 kW	200 kW	355 kW	500 kW
690V	-	-	30 kW	45 kW	90 kW	200 kW	400 kW	560 kW

Maximum nominal power in mechanical size at different voltages

Converter of type LV7000-3 IP00 modules

- High-power drive modules for easy installation into a cabinet
  - Control, power electronics and cooling integrated in one unit, FR10 – FR14
    - Power range 160 – 2.000 kW
    - 380 – 500 V, 525 – 690 V; +/- 10 %
    - IP 00, EMC class N, T
  - Integrated control unit (external as option)
  - Integrated brake chopper (as option)
  - 6-pulse supply (12-pulse as option)
  - External AC-mains-choke

Separate AC-choke

LV7000-3 IP00 modules

	FR10	FR11	FR12	FR13	FR14
400 V	**250 kW**	**400 kW**	**560 kW**	**800 kW**	**1200 kW**
500 V	**355 kW**	**500 kW**	**710 kW**	**1000 kW**	**1500 kW**
690 V	**400 kW**	**560 kW**	**800 kW**	**1150 kW**	**2000 kW**

Converter of type LV7000-3 – Options

- Internal brake chopper
- Internal brake resistor
- Door installation kit
- Display with memory (standard or graphical), dummy or no display
- Filters (RFI, du/dt, sine)
- Varnished circuit boards
- Flange mounting kit
- Kits for IP54 enclosure
- Additional DC-connection
- External 24 V supply for control

Converter of type LV7000-3 – Features

- Steady state speed error < 0,01 %, depending on the encoder
- Incremental or absolute encoder support
- Full torque control at all speeds, incl. zero speed
- Torque accuracy < 2 %; < 5 % down to zero speed
- Starting torque > 200 %, depending on the motor and drive sizing
- Full capability for master / slave configurations
- Integrated data logger for system analysis
- Fast multiple drive monitoring with PC
- High-speed bus (12 Mbit/s) for fast inter-drive communication
- High-speed applications (up to 7.200 Hz) possible
- Induction motor and permanent magnet motor operation
- Fitted with „All-In-One“ application software
- Other application software available

Converter of type LV7000-4 (Cabinet drive)

- Pre-engineered drives in a robust cabinet
  - Based on basic LV7000-3 power modules, FR10 – FR14
    - Power range 200 – 2.000 kW
    - 380 – 500 V, 525 – 690 V; +/- 10 %
    - IP 21 or IP54,
    - Control unit physically separated from power module

	FR10	FR11	FR12	FR13	FR14
400 V	**250 kW**	**400 kW**	**560 kW**	**800 kW**	**1200 kW**
500 V	**355 kW**	**500 kW**	**710 kW**	**1000 kW**	**1500 kW**
690 V	**400 kW**	**560 kW**	**800 kW**	**1150 kW**	**2000 kW**

LV7000-4

Converter of type LV7000-4 (Cabinet drive)

- A wide range of options available, e.g.
  - 6-pulse or 12-pulse
  - Input devices (fuses, switches, breakers)
  - Cabling input top / down
  - Output filters (dv/dt, common mode, sine wave)
  - Measuring and protection devices
  - Keypad in door
  - Power modules on rails
  - Etc.

LV7000-4

Converter of type LV7000-4 (Cabinet drive)

- FR13, 14
  - Based on feeder and inverter combinations
  - 6- and 12-pulse solution possible
  - FR13: 1 x FI13 inverter + 2 – 4 x feeder modules
  - FR14: 2 x FI13 inverter + 3 – 4 x feeder modules

LV7000-4

LV7000 products for DC-bus systems

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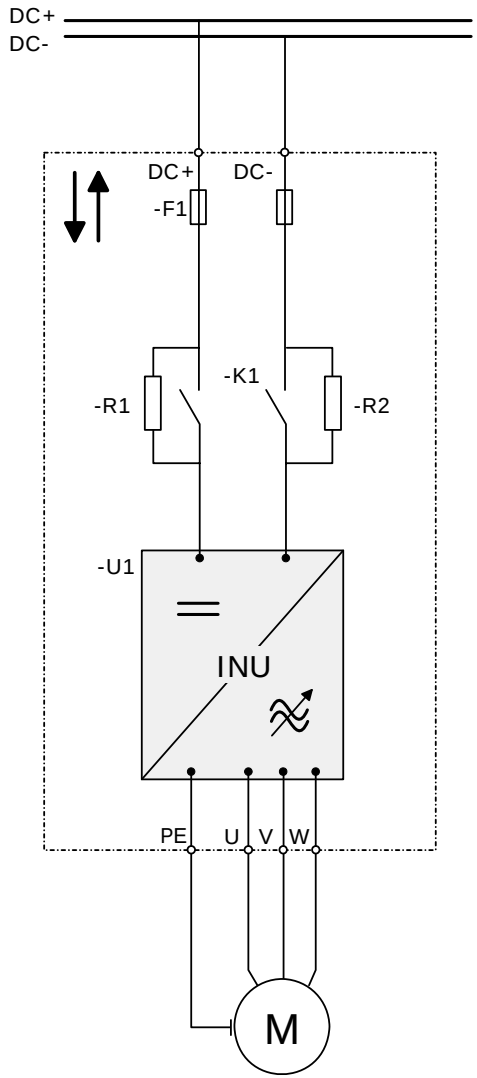
THE POWER CONVERSION COMPANY

Products for common DC bus systems LV7000-5 … LV7000-9

- The product family, based on LV7000-3 controller, covers a number of front-end units, inverter units and brake chopper units in the entire power range from 1 -2000 kW at 380 V – 690 V.
  - Inverter units
    - LV7000-5: INU
  - Front-end units
    - LV7000-6: AFE (Active front-end)
    - LV7000-7: FFE (Fundamental front-end)
    - LV7000-8: NFE (Non-regenerative front-end)
  - Brake chopper units
    - LV7000-9: BCU

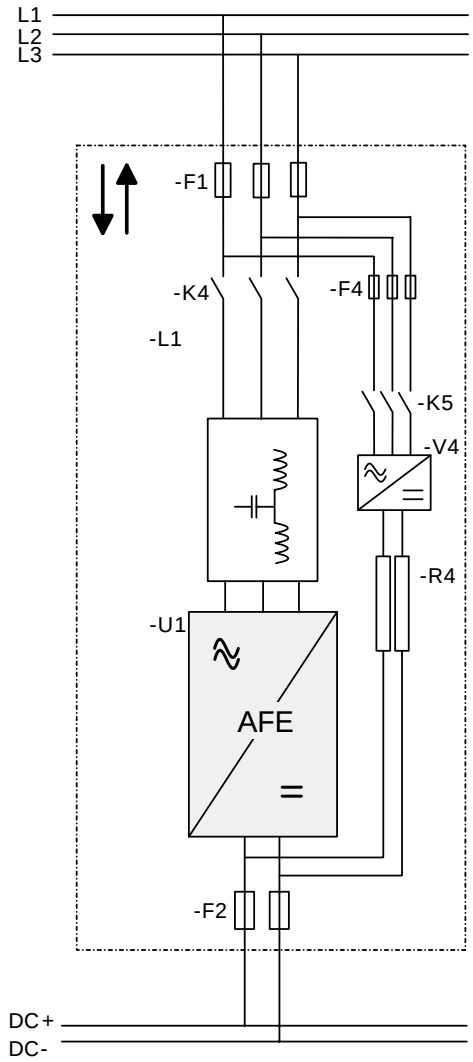
Inverter units LV7000-5

- The inverter unit (INU) is a bi-directional DC-fed power inverter for the supply and control of AC-motors
  - Charging circuit is needed in case the connection possibility to a live DC bus is requested.
    - Charging circuit is integrated in FR4 – FR8 (up to 75kW)
    - For higher power ratings an external charging circuit can be foreseen
  - 380 – 500 V: 4 A … 2.700 A
  - 525 – 690 V: 4 A … 2.250 A



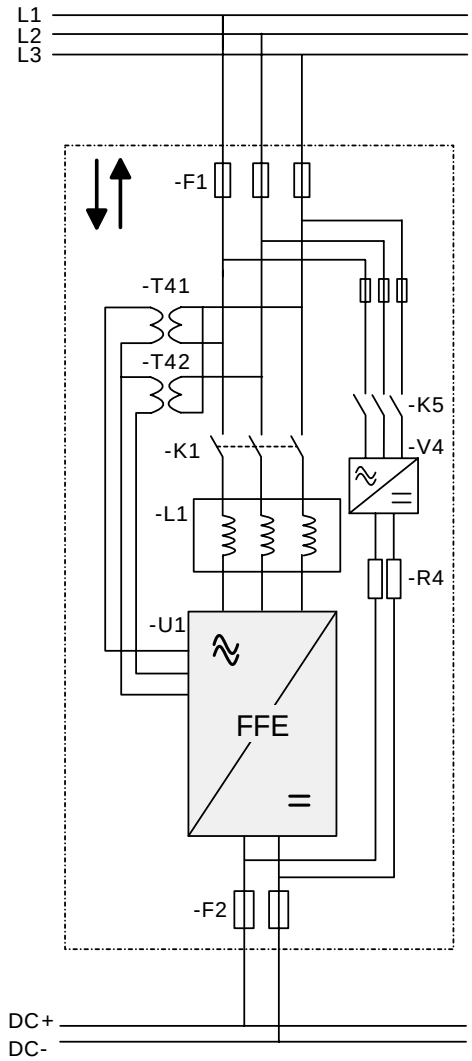
Front-end units LV7000-6 (AFE)

- The active front-end unit is suitable for applications where low harmonics are required and kinetic energy needs to be fed back from the DC-bus to the mains
  (in case of braking)
  - Bi-directional (regenerative) IGBT-power converter
  - Based on standard hardware, AFE function is realized by a specific AFE-application software
  - High frequency modulation
  - External LCL filter at the input for low harmonics
  - 380 – 500 V: AC 261 A … 1.300 A
  - 525 – 690 V: AC 170 A … 1.030 A
  - Higher ratings by paralleling



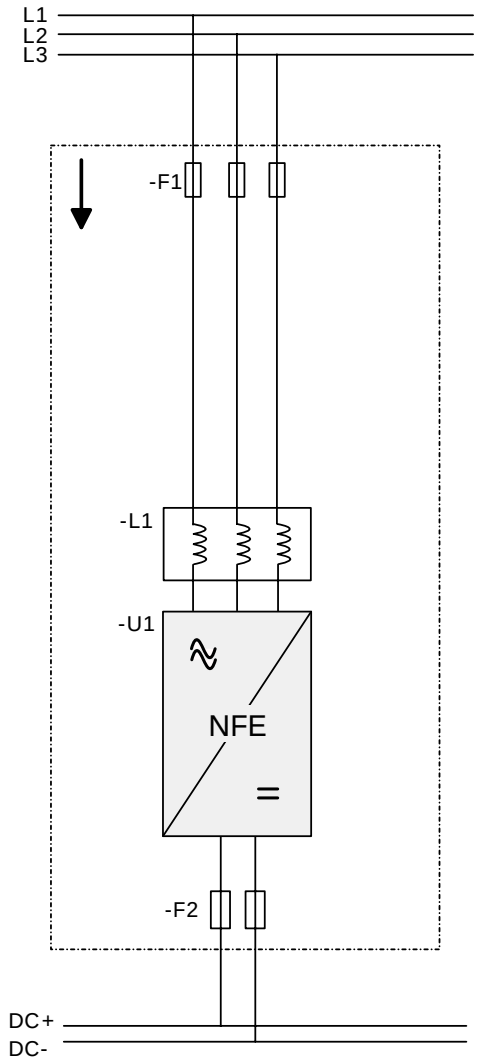
Front-end units LV7000-7 (FFE)

- The fundamental front-end unit is suitable for applications where a „normal“ level of harmonics is accepted and kinetic energy needs to be fed back from the DC-bus to the mains in case of braking
  - Bi-directional (regenerative) IGBT-bridge (operates as a diode bridge for motoring power and like an anti-parallel thyristor bridge for regenerating power)
  - Avg. switching frequency app. equivalent to line frequency
  - External choke is used in the input
  - 380 – 500 V: AC 300 A … 2.700 A
  - 525 – 690 V: AC 208 A … 2.250 A



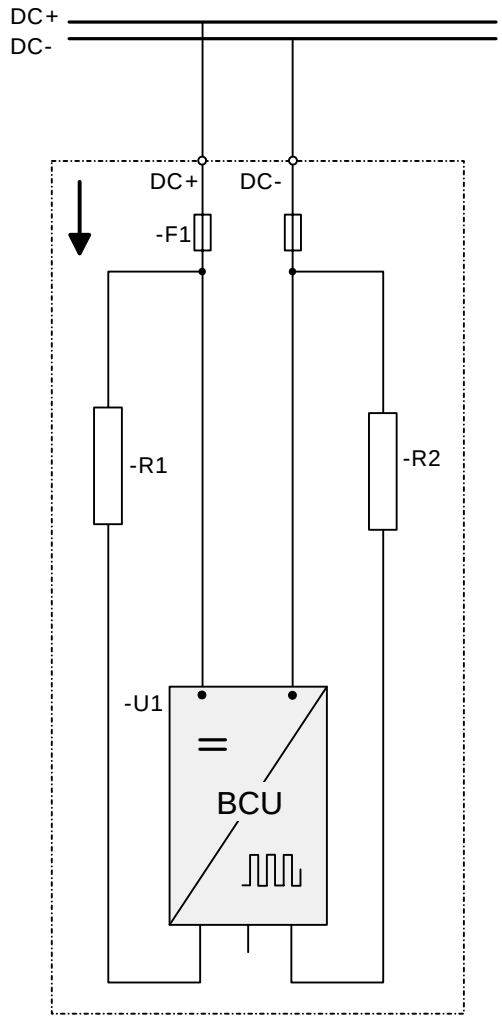
Front-end units LV7000-8 (NFE)

- The non-regenerative front-end unit is a uni-directional converter suitable for applications where a „normal“ level of harmonics is accepted and no regeneration of energy is required from the DC-bus to the mains in case of braking
  - Operates as a diode bridge using diode/thyristor components
  - Controlled half-bridge
  - External choke is used in the input
  - 380 – 500 V: AC 650 A … 3900 A
  - 525 – 690 V: AC 650 A … 3900 A



Brake chopper units LV7000-9 (BCU)

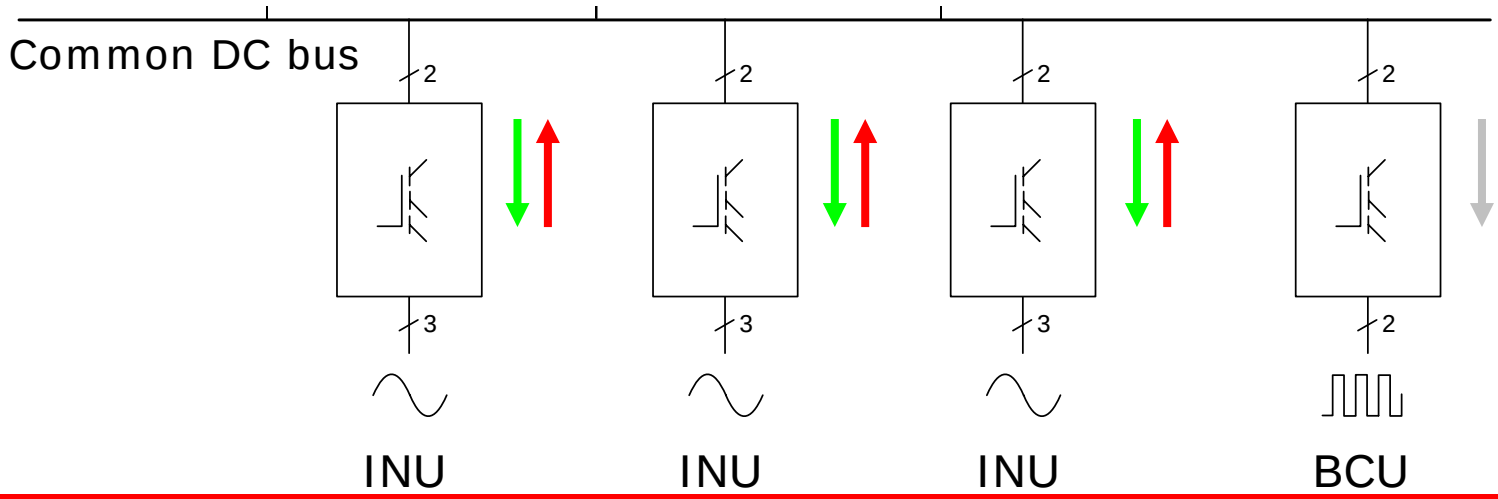
- The brake-chopper unit (BCU) is a uni-directional power converter for the supply of excessive energy from a common DC-bus to resistors, where the electrical energy is getting converted in heat.
  - External resistor(s) are needed
  - 380 – 500 V: 2 x 4 – 2 x 1.450 A
  - 525 – 690 V: 2 x 4 – 2 x 1.180 A



Flexible DC-bus configurations

NFEs + INUs + BCU

- high total mains power
- $P_{mains} \leq \Sigma P_{INU}$
- short time high power braking



LV7000 options, tools & documentation

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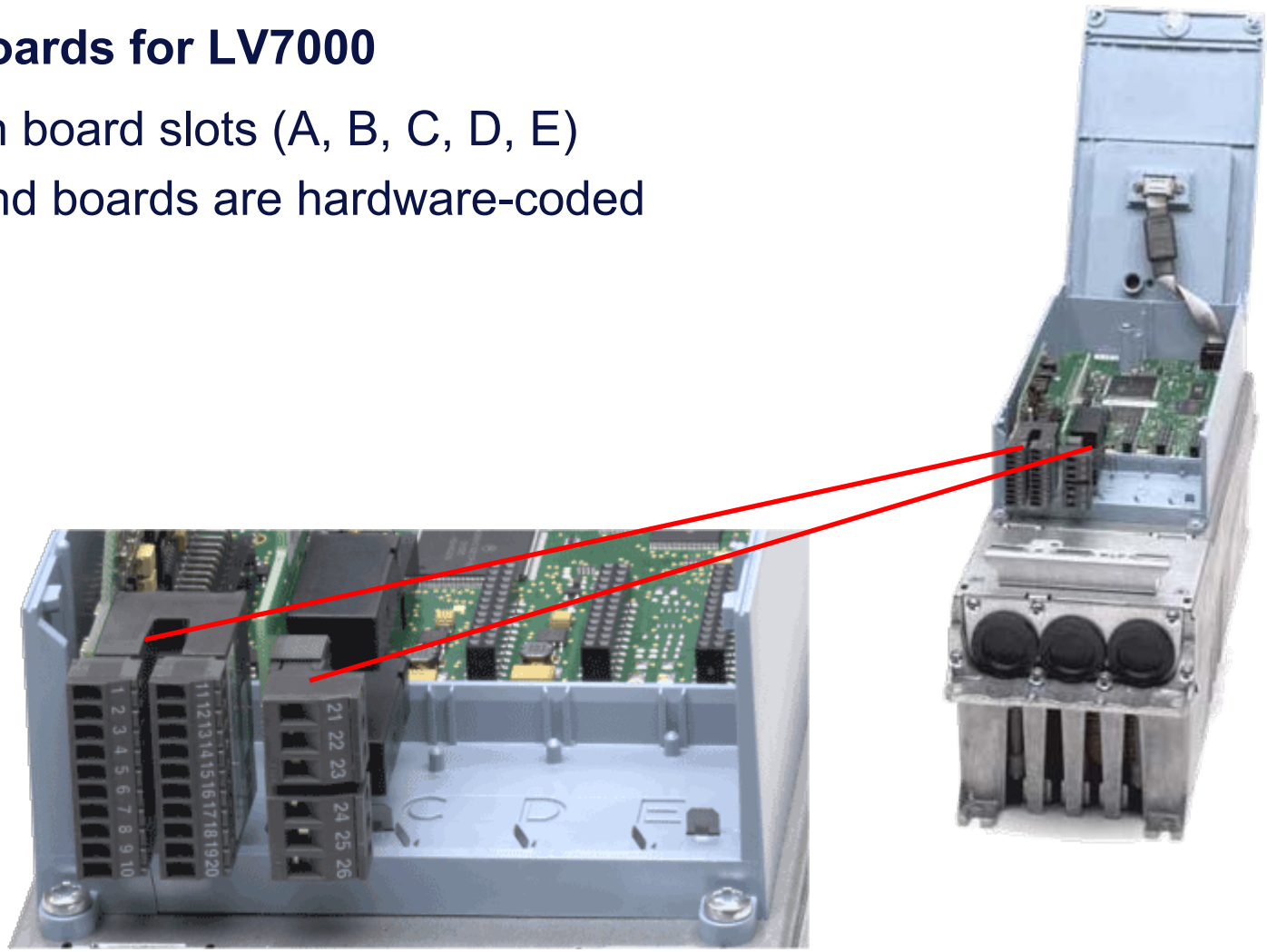
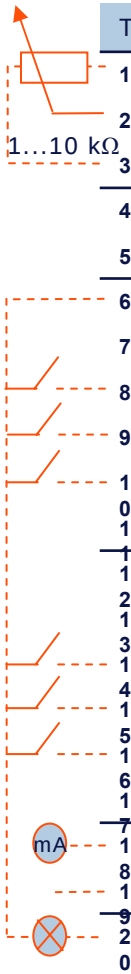
Option boards for LV7000

- 5 option board slots (A, B, C, D, E)
- Slots and boards are hardware-coded



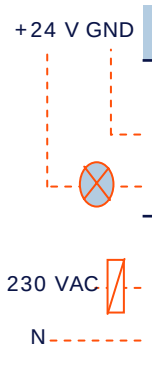
Option boards for LV7000 – I/O-boards

OPT-A1



Terminal		Default settings	Programmable
1	+10V	Reference voltage	
2	AI1+	Frequency reference 0-10 V	-10 - +10 V, 0/4 -20 mA
3	AI1-	AI common (GND)	Differential
4	AI2+	Frequency reference 4-20 mA	0-20 mA, 0/-10 V – 10 V
5	AI2-	AI common (differential)	GND
6	+24V	Control supply (bidirectional)	
7	GND	I/O Ground	
8	DIN1	Start forward	Many possibilities
9	DIN2	Start reverse	Many possibilities
10	DIN3	External fault input	Many possibilities
11	CMA	Common for DIN1 – DIN3 (GND)	Floating
12	+24V	Control supply (bidirectional)	
13	GND	I/O Ground	
14	DIN4	Multi-step speed select 1	Many possibilities
15	DIN5	Multi-step speed select 2	Many possibilities
16	DIN6	Fault reset	Many possibilities
17	CMB	Common fot DIN4 – DIN6 (GND)	Floating
18	AO1+	Output frequency (0-24 mA)	Many possibilities
19	AO1-	AO common (GND)	4-20 mA, 0-10 V
20	DO1	READY, I ≤ 50 mA, U ≤ 48 VDC	Many possibilities

OPT-A2



Terminal	Default settings		Programmable
21 RO1			
22 RO1		RUN	Many possibilities
23 RO1			
24 RO2			
25 RO2		FAULT	Many possibilities
26 RO2			

OPT-A3

Terminal	Default settings		Programmable
21 RO1			
22 RO1		RUN	Many possibilities
23 RO1			
25 RO2		FAULT	Many possibilities
26 RO2			
28 TI1+	Thermistor		Warning,
29 TI1-	input fault		no response

Option boards for LV7000

- A wide range of option boards is available in the LV7000 family

Type	Card slot					I / O signal																		
	A	B	C	D	E	DI	DO	DI DO	AI (mA/ V/±V)	AI (mA) isolated	AO (mA/V)	AO (mA) isolated	RO (NO/ NC)	RO (NO)	RO (NC)	+10V$_{ref}$	Therm	+24V/ EXT +24V	pt100	42-240 VAC input	DI/DO Encoder (10...24V)	DI/DO/ Encoder (RS422)	Resolver	Out +5V/ +15V/ +24V	Out +15V/ +24V	Out +5V/ +12V/ +15V	Note
Basic I/O cards (OPT-A)																										
OPT-A1						6	1		2		1					1		2									
OPT-A2													2				1										
OPT-A3													1	1													
OPT-A4						2																3/0		1			
OPT-A5						2															3/0				1		
OPT-A7																					6/2				1		2 enc. input + 1 enc. output
OPT-A8						6	1		2		1					1		2									1)
OPT-A9						6	1		2		1					1		2									2.5 mm^2 terminals
OPT-AE							2														3/0				1		D0 = Divider+Direction
OPT-AF						2							2				1										3) Safe disable EN954-1, cat 3
I/O expander cards (OPT-B)																											
OPT-B1								6										1									Selectable DI/DO
OPT-B2													1	1			1										
OPT-B4										1		2						1									
OPT-B5														3													2)
OPT-B8																		1	3								
OPT-B9						2								1						5							
OPT-BB						2																0/2				1	+EnDat+Sin/Cos 1 Vp-p
OPT-BC																					3/3		1				Encoder out= Resolver simulation
Fieldbus cards (OPT-C)																											
OPT-C2						RS-485 (Multiprotocol)																					Modbus, N2
OPT-C3						Profibus DP																					
OPT-C4						LonWorks																					
OPT-C5						Profibus DP (D9-type connector)																					
OPT-C6						CANopen (slave)																					
OPT-C7						DeviceNet																					
OPT-C8						RS-485 (Multiprotocol, D9-type connector)																					Modbus, N2
OPT-CF						CAN / Euromap																					
OPT-CG						SELMA 2 protocol (SAMI)																					
OPT-CI						Modbus/TCP (Ethernet)																					
Communication cards (OPT-D)																											
OPT-D1						System Bus adapter (2 x fiber optic pairs)																					
OPT-D2						System Bus adapter (1 x fiber optic pair) & CAN-bus adapter (galvanically decoupled)																					
OPT-D3						RS232 adapter card (galvanically decoupled), used mainly for application engineering to connect another keypad																					
OPT-D6						CAN-bus adapter (galvanically decoupled)																					

LV7000 Panels

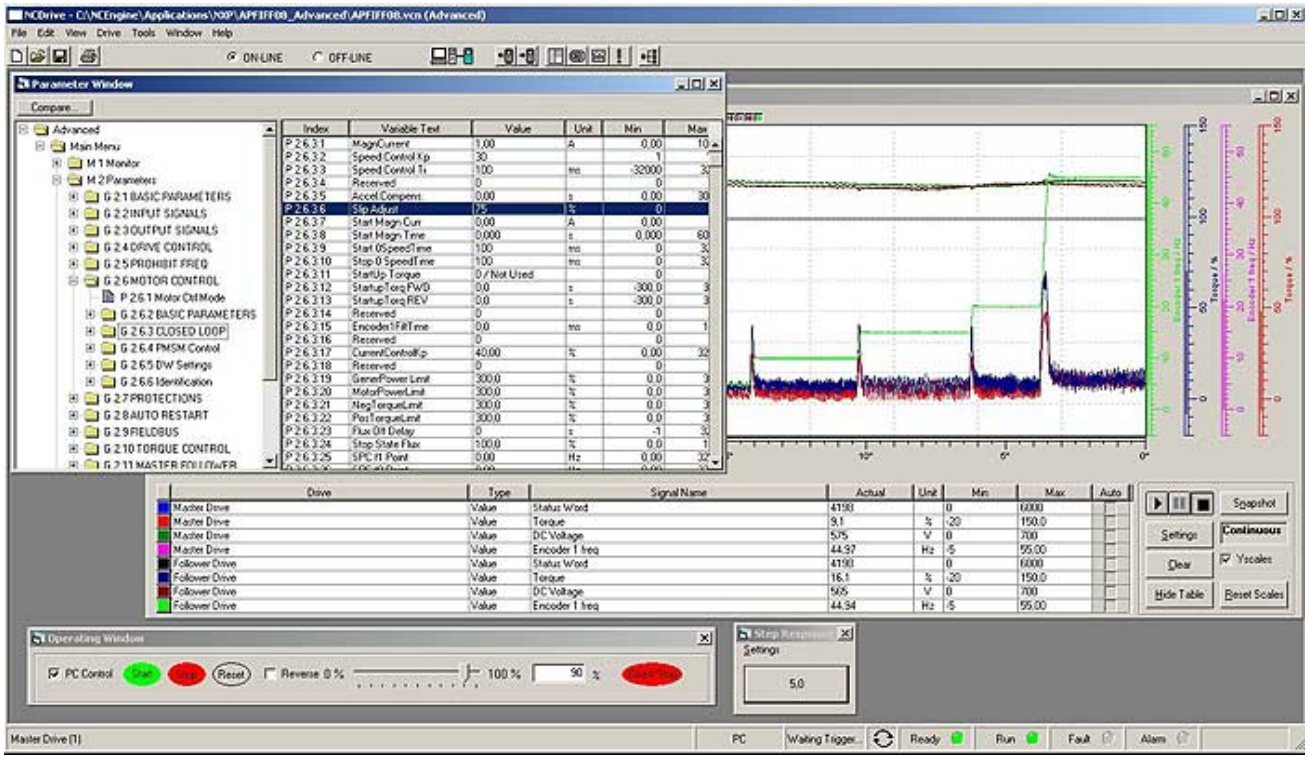
- Alphanumeric LCD panel with a clear text display as standard
- Fully graphical LCD with support for Cyrillic and Chinese character sets as option
- Features: Start-up wizard, Multi-Monitoring, Default page, Copy function, Back-up function, RS-232 communication

Graphical display

Standard display

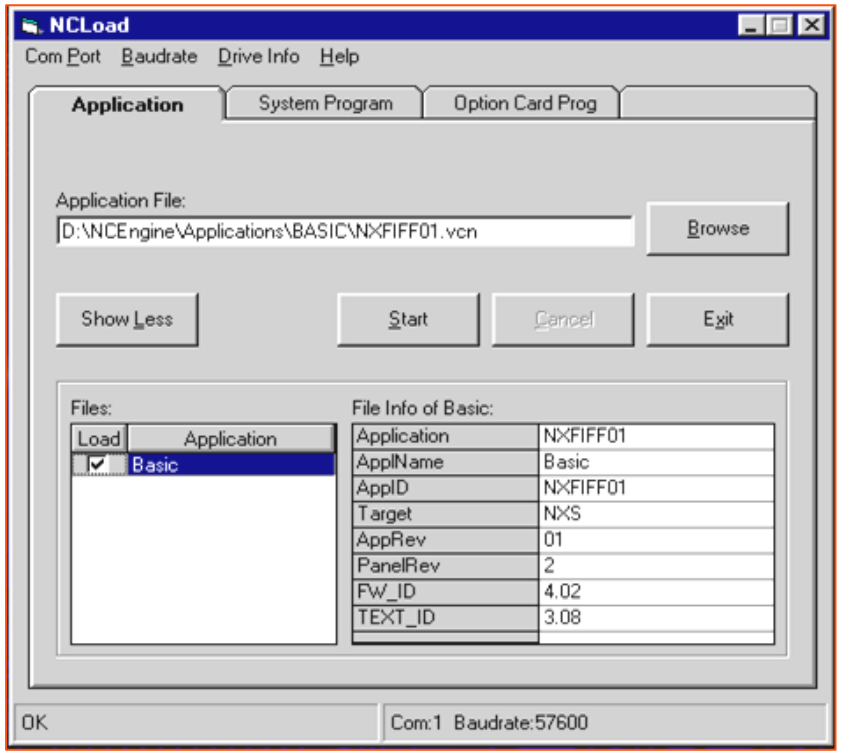
Software: Tools

- NCDrive
  - Tool for commissioning and control of the drive. Parameter loading, setting, saving and change of application can be performed. Furthermore parameter settings and maintenance reports can be stored and printed

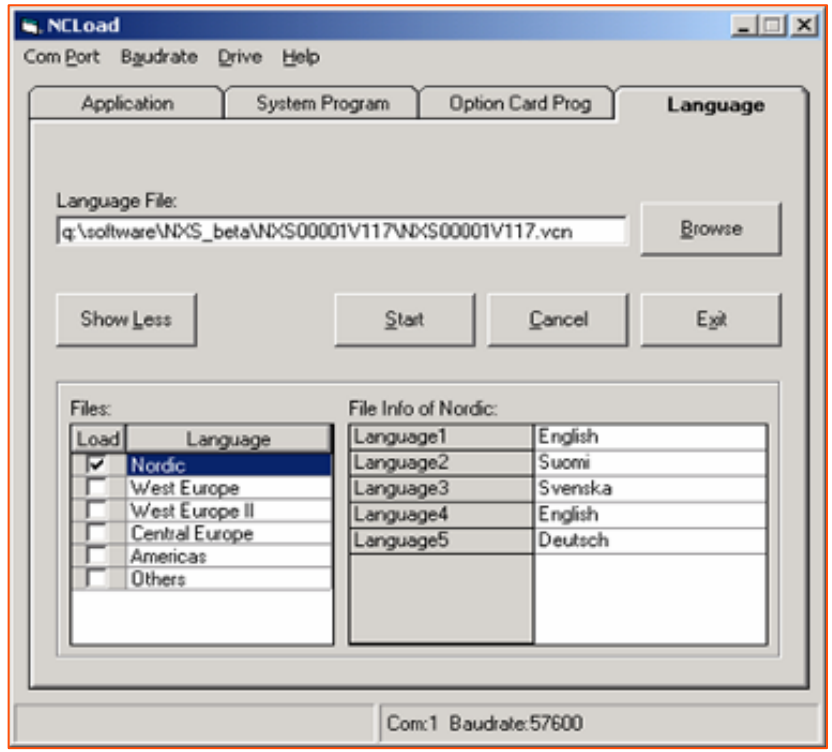


Software: Tools

- NCLoad
  - To load application software, system software, language packs and additional board software



Application loading view



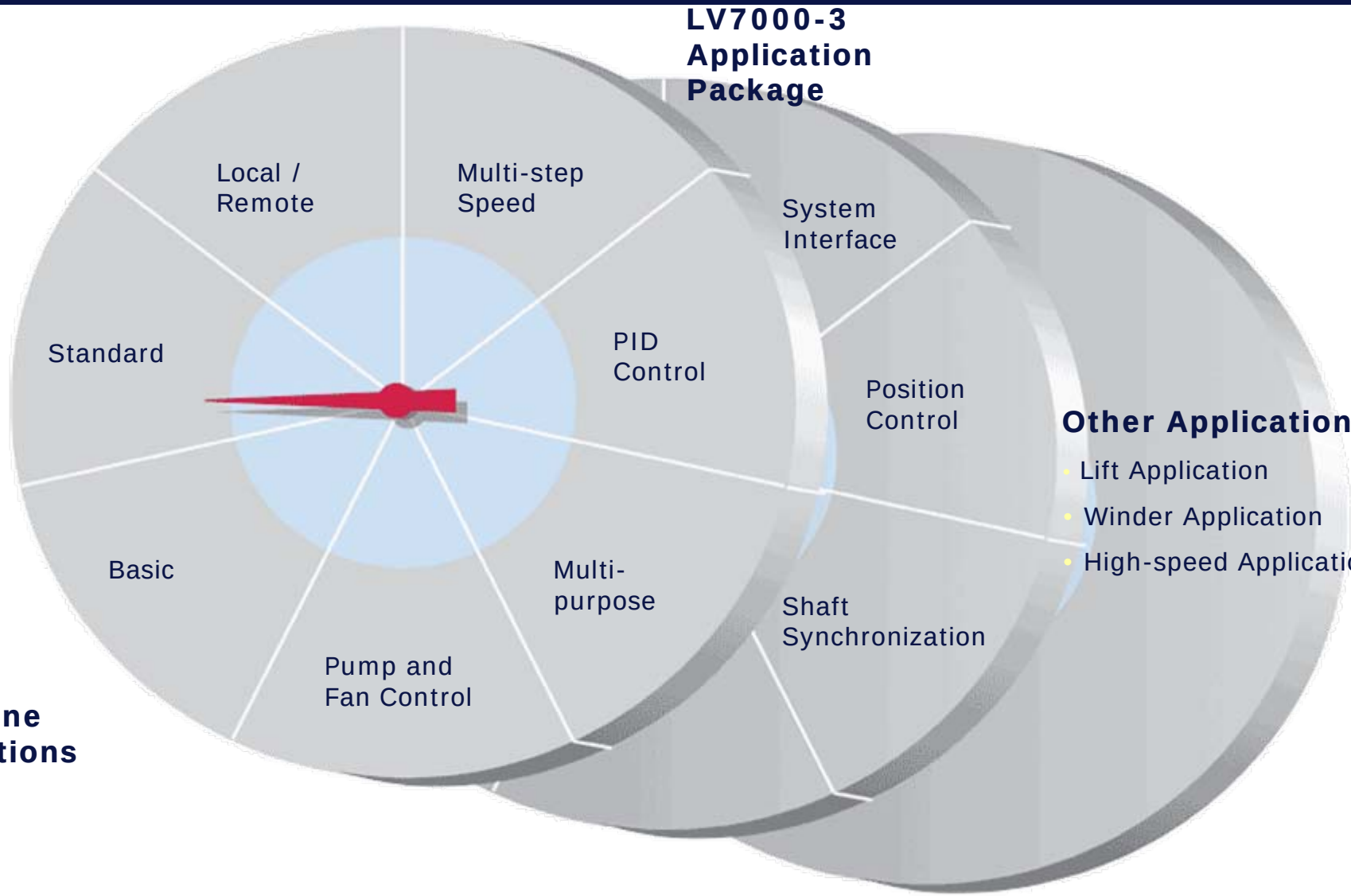
Language pack view

Software: Applications

- For standard industrial applications (speed or torque controlled fans, pumps, …) Converteam is using existing standard application software.

- For more demanding or special applications, Converteam will develop own application software for the LV7000 drives.

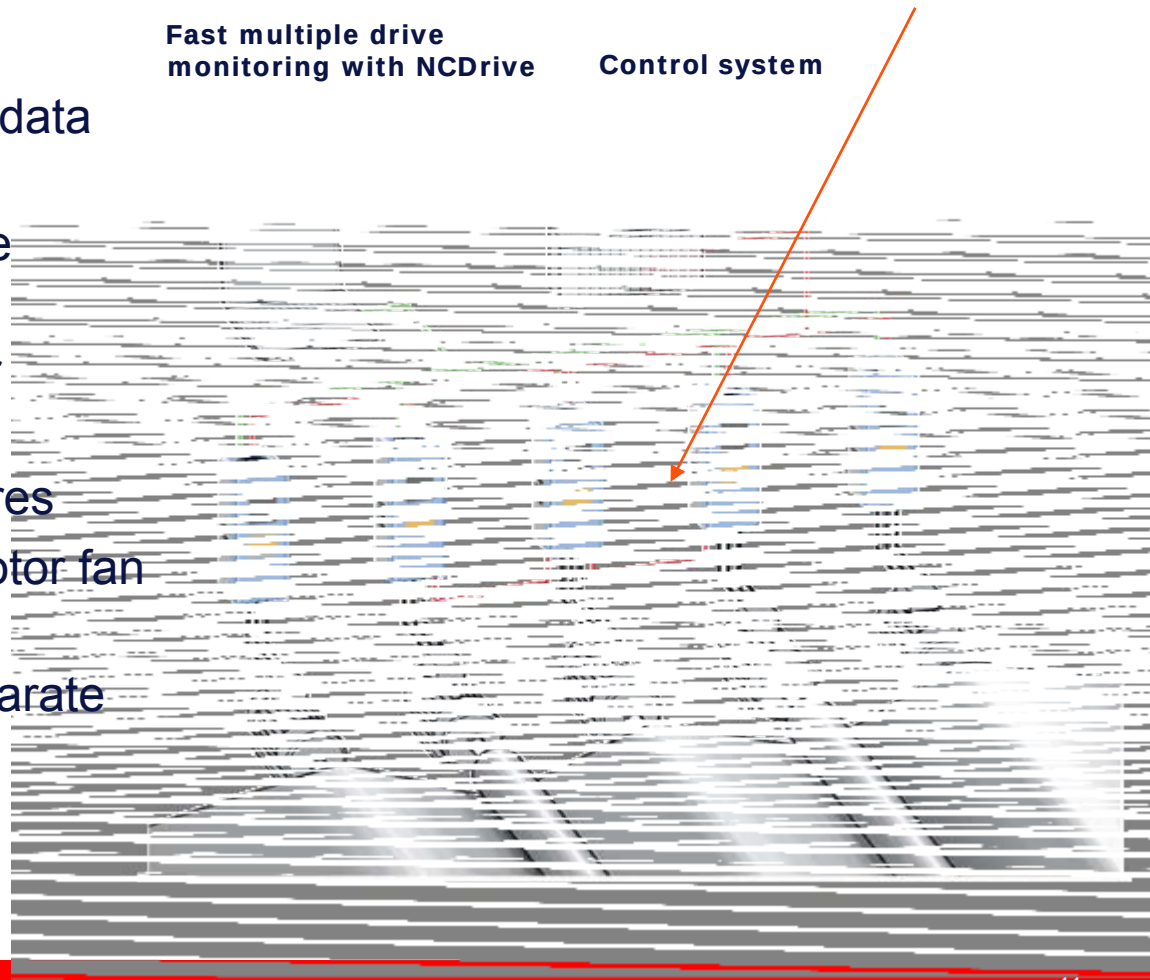
LV7000-3 applications



System Interface Application

Features

- Flexible fieldbus process data connections
- Flexible speed and torque reference chains
- Adaptive speed controller
- Inertia compensation and oscillation damping features
- Mechanical brake and motor fan control
- Emergency stop with separate ramp time



Documentation

- Full range of documentation in English language available from Q3 / 2007
- Further languages can be prepared on request

THANK YOU FOR YOUR ATTENTION