

K4000 HIGH FREQUENCY INVERTER

ACCOMEL

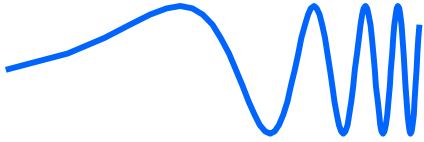


The K4000

• Full digital - SHS modulation

- Design to drive high frequency spindles
- Input voltage 3 x 200 ... 480 V / auto ranging
- Output voltage = 0 ... Input voltage (max. 460 V)
- Output frequency up to 4000 Hz
- The KT4000 are UL certified up to KT4030

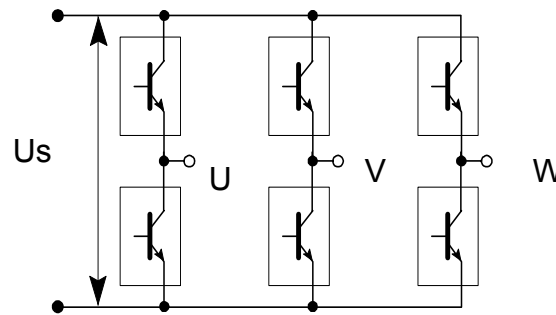
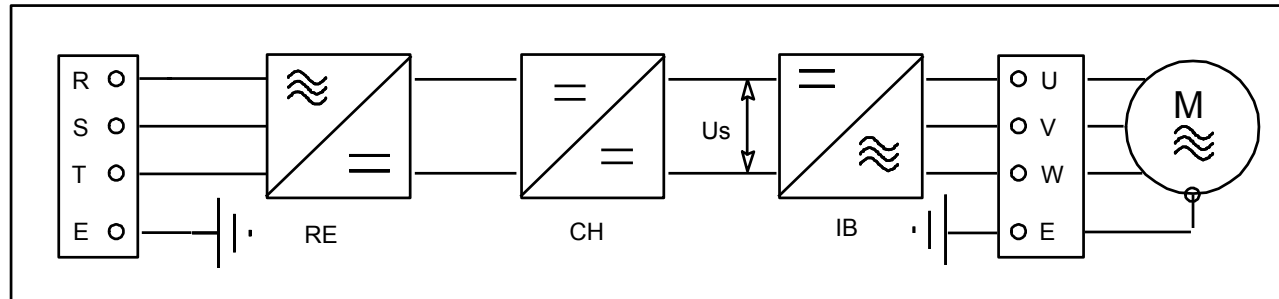
• K4005	6 A continuous	10 A peak
• K4010	12 A	15 A
• K4015	18 A	23 A
• K4020	24 A	30 A
• K4030	36 A	45 A
• K4040	50 A	60 A
• K4060	75 A	90 A
• K4090	110 A	135 A
• K4120	145 A	180 A



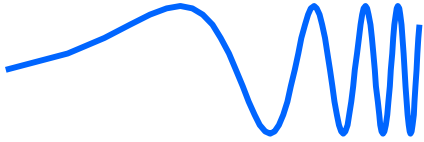
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◆ The Amplitude Modulated Inverters



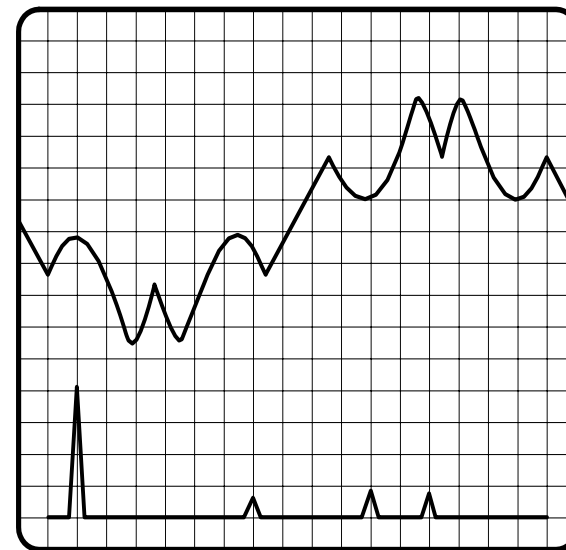
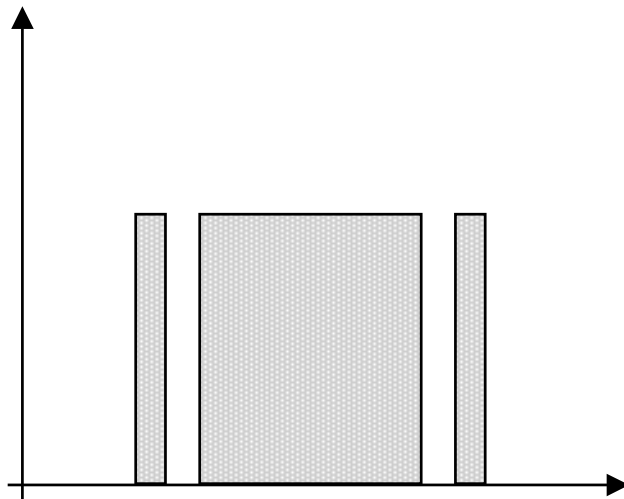
Inverter Bridge



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◆ The ACOMEL SHS

- Selective Harmonics Suppression, an active filter

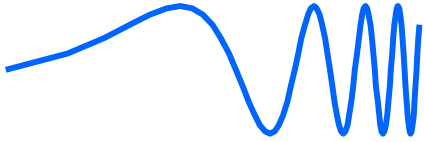


Motor current

Harmonics

F 7F 11F 13F

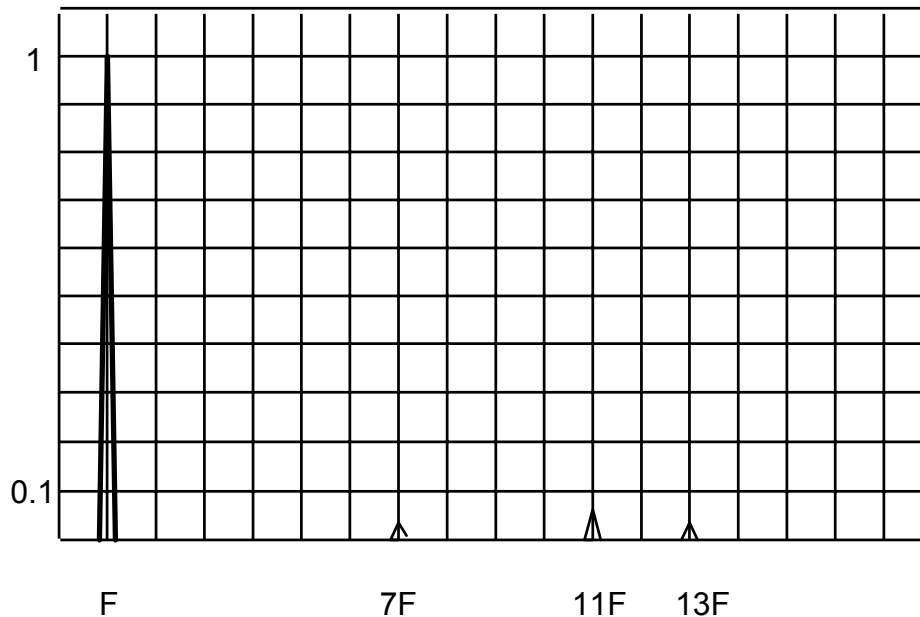
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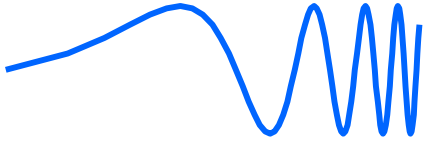
◆ The ACOMEL SHS

- Spectrum of the Power Density



F = 1
7F < 0.02
11F < 0.07
13F < 0.01

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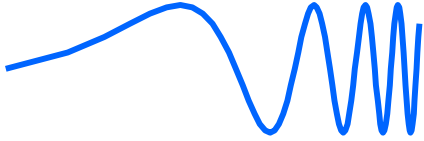


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◆ The **ACOMEL SHS - Modulation**

- The most appropriate modulation for high speed
- Suppression of the 5th, strong reduction of the 7th harmonics
- The motor “sees” only the regulated U_s voltage which equals output voltage time 1.28
- Better monitoring of the output voltage
- The motor “sees” only the output frequency
- Easy monitoring of the output active power using current and voltage information from the DC regulated side
- Due to a lower dynamic than the PWM, could show some stability problems at low speed with standard 50 Hz motors
- A more expensive design due to the chopper used for the intermediate DC voltage regulation

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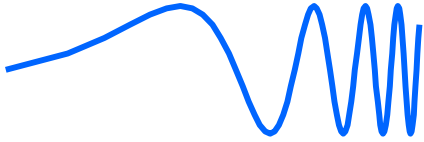


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◆ The Benefits of the K4000

- **Full digital**
 - » No change of the performances due to temperature and / or aging of the components
 - » Higher reliability
 - » Easy to program
 - » Same control boards for all power ratings
- **The SHS modulation**
 - » A motor friendly approach
- **All specific features for high speed machining applications are integrated in the basic unit**
- **Options**
- **Comply to the EEC regulations**

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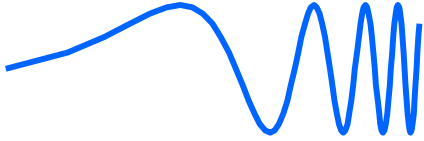


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◆ The Benefits of the SHS

- Less **stress** of the motor windings
 - » The output voltage is always adapted to the motor voltage, regardless to the line voltage
 - » No high frequency switching pulses, motor runs cooler
 - » Limitation of the voltage peaks $dV/dt < 1 \text{ kV}/\mu\text{s}$
- **No output filter** needed even for 4000 Hz
 - » The voltage / power losses due to the filter range between 10 and 15%
 - » Higher efficiency of the complete system
- Regardless of the motor rated voltage, **no input transformer** is required, even for the US 3 x 480 V mains
- **Higher efficiency** of the drive i.e.. $> 96\%$

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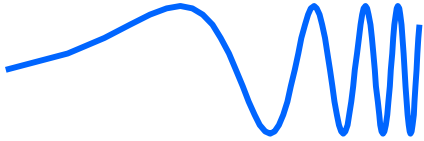


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◆ How do we increase protection of the spindle motor?

- Integrated processing of the spindle **temperature sensor** “PTC” and “KTY”. The drive will turn off or trigger an alarm if the spindle temperature reach a critical level
- **Independent current monitoring** for the drive and the motor. The motor current “Iref” can be set for each motor and belong to the motor parameters group
- The use of the SHS and the **limitation of the voltage peak** dV/dt
- The use of the speed measurement option. A setting of a **slip limit value** can be programmed and will turn off the drive or trigger an alarm if the programmed slip is exceeded

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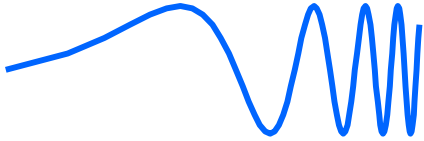


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◆ Input Voltage and Protections

- Voltage 200 V -15% to 480 V +10% (170 V to 530 V)
- Input circuit breaker
- Short-circuit between phases
- Earth short-circuit
- Converter Temperature
- Motor Temperature Protection - PTC, NTC or KTY
- Short circuit on auxiliary power supply

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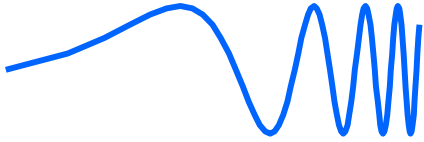


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◆ Inputs / Outputs (1)

- Analog Inputs, 12 bits resolution
 - » +/- 10 V - 0 ... 10V, 0 ... 20 mA for speed reference
 - » One free programmable with trigger level and delay
 - » 0 to 10 V, resolution 0.01 V, trigger delay 0 - 5 s
- START, STOP, External interlocks, MCM-S.H., RESET
- Current monitoring RTRIP
- 9 Dedicated Digital Inputs
 - » Motor partition selection - 64 max.
 - » Pre-set speeds - up to 3 for each partition
 - » MCM sensitivity level - up to 4 for each partition
- 2 Programmable Analog Outputs 0 .. 10 V / 10 bits

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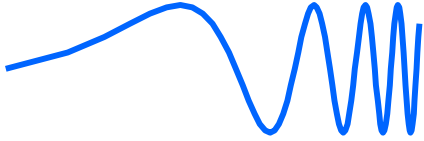


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◆ Inputs / Outputs (2)

- Possibility from terminal block to “force” the control of the speed back to the keypad even if this control is allocated to the terminal block in the menu B. Make test of the drive and the spindle easier once they are integrated into a machine and its CNC control
- 1 Dedicated digital output for speed
- 5 Programmable digital outputs - Switching relay contact
- A specific switchable D-Sub connector, RS232 / RS422 for programming and control of the drive using a PC in terminal mode or Windows software

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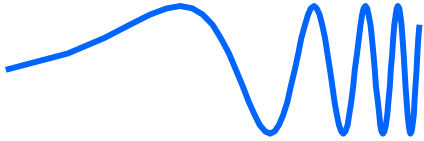


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Programming Features

- Plain text instructions
- Plain text messages
- English, German, French, Italian, Spanish
- 64 Groups of complete Motor Parameters, including acceleration, deceleration, V/Hz characteristic, etc...
- Each V/Hz characteristic with up to 32 points
- Programming of current monitoring
- Programmable GAP eliminator
- Windows software with upload, download, save, and print functions, as well on-line control window

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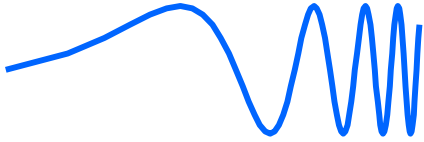


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◆ Software - Menu A

- Converter data - serial number - software version
- delivery date and 2 time counters:
- Time counter 1
 - » Cumulated running time of the converter -
START mode
- Time counter 2
 - » Cumulated time - converter ON

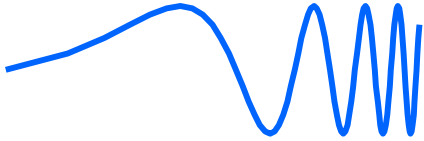


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◆ Software - Menu B - Operating Parameters (1)

- The motor reversing function can be locked in order to avoid any reversing possibility either from Keypad or from Terminal block
- Input of a digital filter value for the analogue speed reference signal
- In case of non destructive failure you can choose:
 - » To Coast to rest, or
 - » To stop the motor using the deceleration ramp
 - » To delay the tripping of the inverter - max 5 s - to give the CNC the possibility to stop the machining operation before to trip the drive

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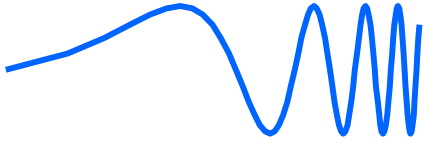


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◆ Software - Menu B - Operating Parameters (2)

- The possibility to catch a spinning motor is now integrated in the software. This function helps to save time switching from one spindle to the other on a turret machine as it is no more necessary to brake down the spindle to zero speed
- A PASSWORD is necessary to access to the “Motor Related Parameter” section of the menu B. We have now 3 access level security:
 - » The PASSWORD for the motor parameters
 - » The access key - which lock access either to:
 - The menu B and C - protecting the machine operating set-up, or
 - To all menus except A, F, G and H

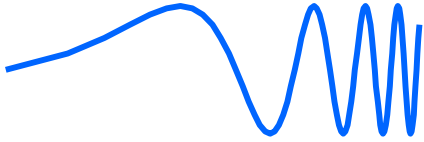


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◆ Menu B - Motor related parameters (1)

- With the input of the max. Motor power we can calibrate the analogue output in order that 10 V correspond to the motor max. power respectively to the max. motor active current instead of to the max. value of the inverter
- We can input a specific limitation current I_{ACCEL} for the acceleration. During the acceleration phase, the function $I_m > I_{REF}$ is inhibited
- The input of the nominal current of the motor is used to monitor the various current input and to refuse the input if:
 - » $I_{ACCEL} < 200 \% I_{nom}$
 - » $I_{REF} < 150 \% I_{nom}$
 - » $I_{FCP} < 100 \% I_{nom}$

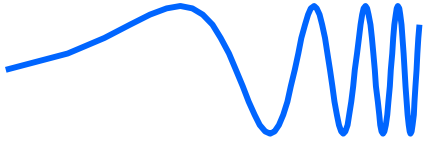


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◆ Menu B - Motor related parameters (2)

- Acceleration and deceleration times are minimum values.
 - » The input in menu D can only be equal or higher
- Pre-set frequencies
 - » You can input up to 3 pre-set frequencies
 - » Selection is made using a BCD coding on terminal bloc X2
 - » No selection applied = analogue reference speed active
- Prohibited frequencies
 - » You can input up to 3 bands of frequency to be skipped
 - » You input the middle frequency of the band
 - » You input the width of the band

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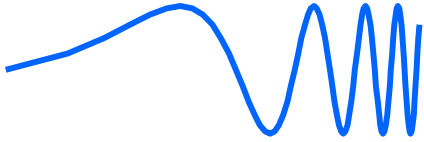


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◆ Menu B - Motor related parameters (3)

- Speed measurement and display
 - » With the option SpeedSense you can display the true speed of the motor
 - » The number of pulses / revolution is now programmable, maximum 256 pulses / revolution
 - » The SpeedSense option can be used to supervise the slip
- MCM - Motor current monitoring
 - » As in the past you can choice between: Absolut, Sample-Hold and DTO
 - » New is that for the selected mode, up to 4 sensitivity levels can be entered
 - » The selection is made using a BCD coding on the terminal block X2

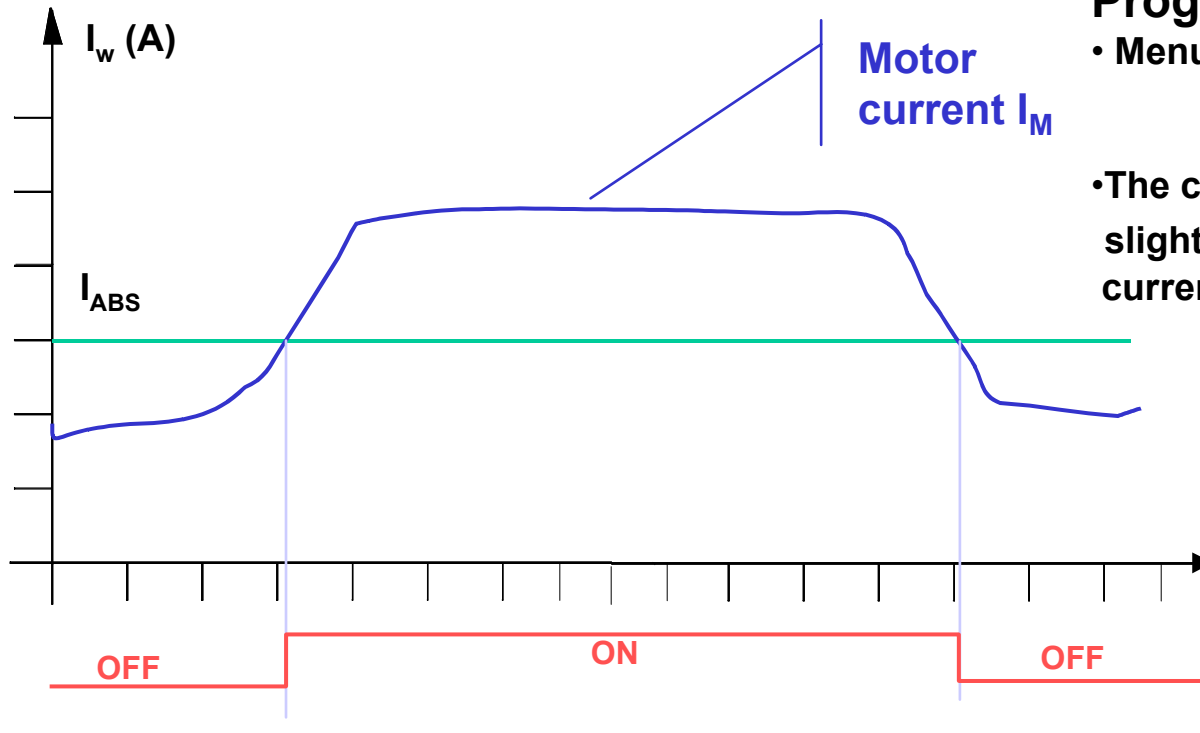
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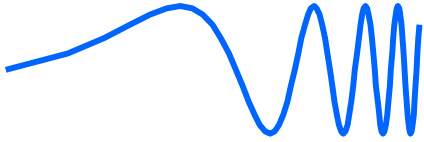
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◆ MCM based on an absolute reference



Programming:

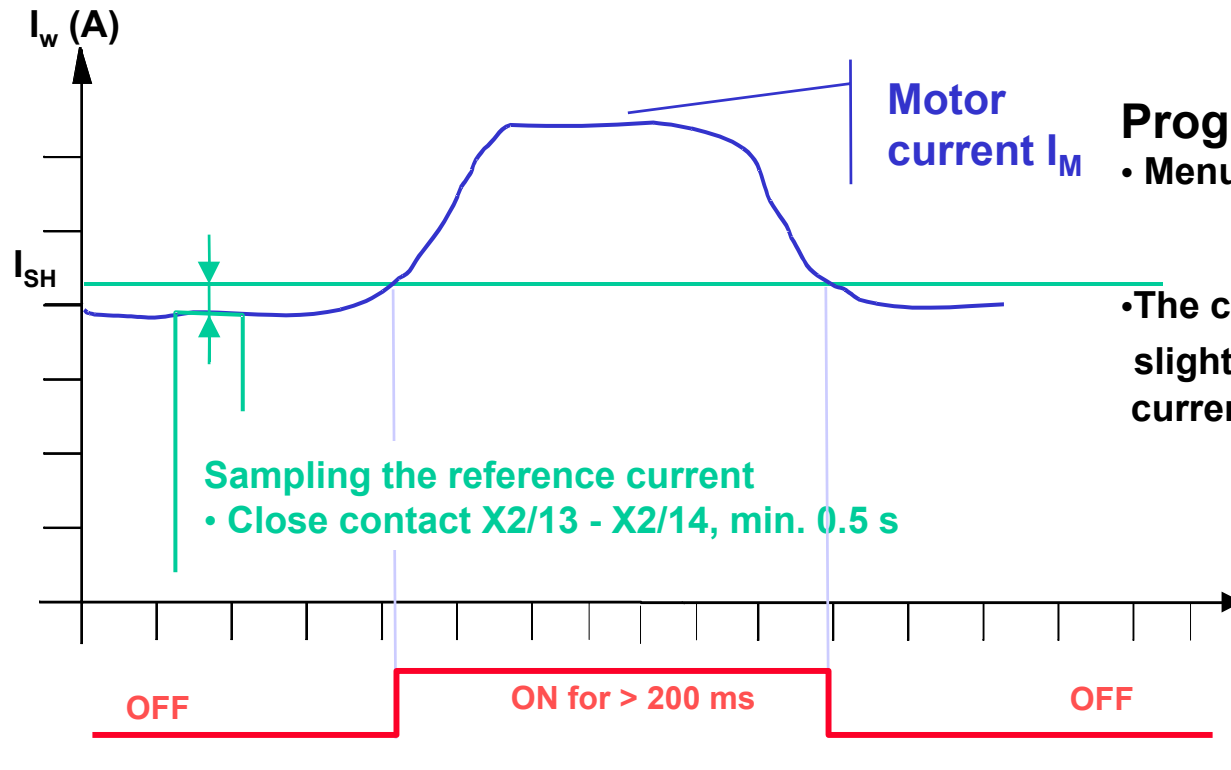
- Menu B
 - MCM = 0
 - $I_{ABS} = xxx$ A
- The current should be set slightly over the spindle current at NO load



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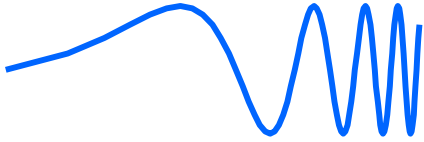
◆ MCM - the Sample Hold Function



Programming:

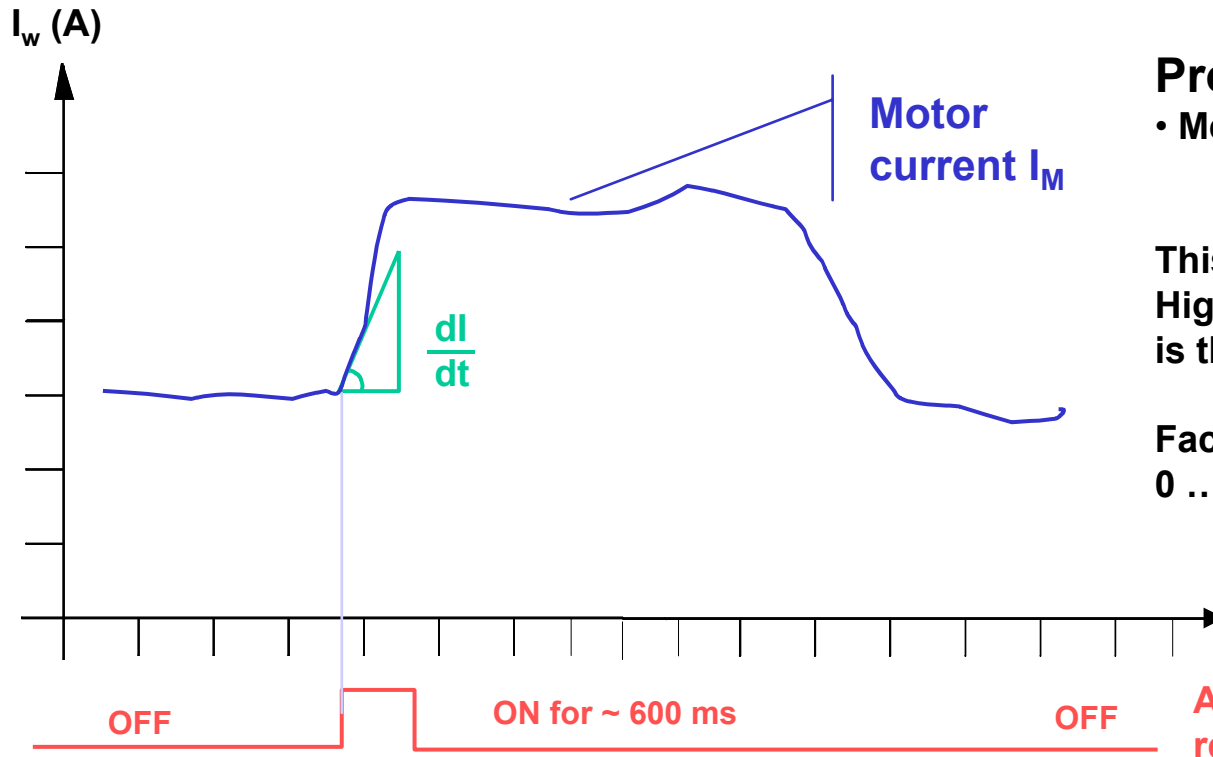
- Menu B
 - MCM = 1
 - $I_{SH} = 0.x$ A
- The current should be set slightly over the sampled current

Assigned output relay Menu C



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◆ MCM - the I_{DTO} dynamic current sensing



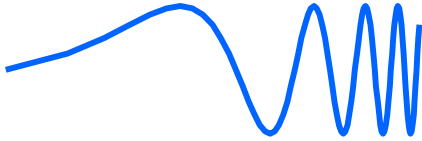
Programming:

- Menu B
 - MCM = 2
 - $I_{DTO} = xxx$
- This is a sensitivity factor
Higher is the factor, lower is the sensitivity

Factor to be set between
0 300

Assigned output
relay Menu C

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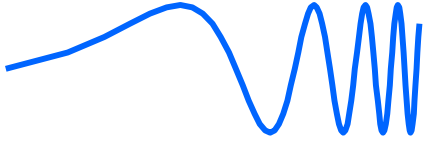


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◆ Menu C - Outputs allocation

- The heatsink temperature will trigger an alarm before to trip the drive
- The slip supervision can be allocated to an output relay
- The 2 analogue outputs can deliver a 10 V signal for:
 - » the output frequency $10 \text{ V} = F_{\text{MAX}}$
 - » the motor current $10 \text{ V} = I_{\text{NOM}}$
 - » the speed of the motor $10 \text{ V} = N_{\text{MAX}}$ (SpeedSense)
 - » the active power $10 \text{ V} = P_{\text{MAX}}$ of the motor
 - » the active current $10 \text{ V} = I_{\text{W}} = P_{\text{MAX}} / 1.28 U_{\text{S}}$
 - » the output voltage $10 \text{ V} = \text{last } U_{\text{S}} / F_{\text{S}} \text{ Point}$

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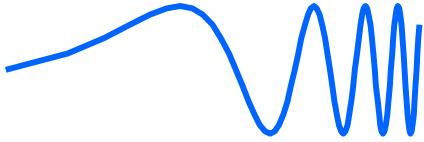


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◆ Setting parameters using “Arrow-up” and “Arrow-down” of the keypad

- 2ndF F - new frequency or speed
 - » value can be either entered as a number or increased or decreased just using the “arrow-up” or “arrow-down”
- 2ndF D - Setting of the I_{DTC}
 - » value can be either entered as a number or increased or decreased just using the “arrow-up” or “arrow-down”
 - » a \$ character will be displayed at position 17 of the second line of the display when the output signal is triggered

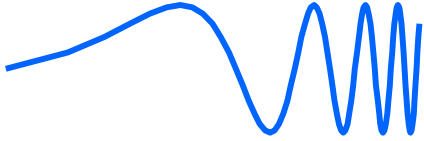


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◆ Display of the status of the digital I/O

- Using 2ndF G you can select a display block showing the status of all digital inputs and outputs
 - » Characters of the 2 lines of the display are allocated to specific inputs and outputs
 - » The status of the allocated function is shown using a 0 (low) or a 1 (high)
 - » A very valuable tool for starting up or commissioning a machine

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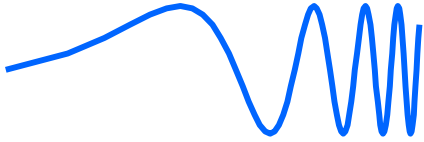


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◆ Programming and control of the drive using a RS232 or RS422 serial link and a PC in terminal mode

- The new control board is fit with a D-Sub connector with a switch selectable RS232 / RS422
- The drive can be programmed and / or controlled using a PC in terminal mode
- All functions are available, including reading of the values of current, power, speed etc...
- Communication protocol is integrated into the drive operating software at NO charge

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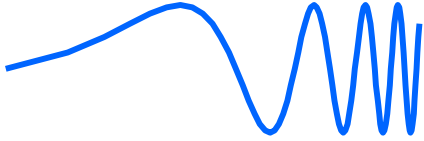


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◆ Windows 98/2000 - NT software

- Full operating software
- On-line operation
- Off-line programming
- Download and upload functions
- Print of programmed parameters
- Connect to serial link D-sub connector

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◆ Options

- Dynamic Braking Resistor
- Speed measurement
- Remote control unit PC560DX1
- IP54 / NEMA 12 cabinet
 - » Fan cooling
 - » Heat exchanger air-air or air-water
 - » Air conditioning
 - » Customized accessories
- EMC line filters

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