

## NXS, P Series Variable Frequency Drive

### SUBMITTAL SPECIFICATION DATA



### DESCRIPTION

The NX Series, comprised of the NXL, NXS and NXP drive families, is a dual-microprocessor base Pulse Width Modulated (PWM) adjustable frequency AC drive. The NX Series drives offer a suite of simple to highly sophisticated and complex application packages for general HVAC and advanced water solutions. Built-in input and output EMI/RFI filters and input AC chokes provide compact, reliable drive protection and reduced interference to the surrounding environment. Advanced IGBT PWM modulating control delivers leading edge precision and system response.

NXL, NXS and NXP drives, ranging from 1 to 800 HP, offer a simple, low cost but sophisticated interface (NXL) or a multi-featured, alpha-numeric based keypad display (NXS, NXP). The both options are based on a common parameter set platform which offers maximum operator flexibility, maneuverability and control with the minimum possible complexity. Either through a straight-forward code structure (NXL) or in plain English (NXS, NXP), the operator is able to start-up or reset parameters in minutes.

Both interface (keypad) systems offer "start-up wizards" for simpler applications requiring the minimum of parameter settings. Up to three monitoring values can be viewed simultaneously in all applications. The menu structure allows rapid movement throughout the parameter sets which include: basic; input; output; drive; prohibit frequency; motor control; protections; and auto-restart. Unique in the industry, the NX Series drive can easily be operated via a local PC for up/downloaded applications, standard and custom parameter sets (NCLoad) and monitored/controlled via a "no cost" advanced NCDrive interface application. Groups of parameter sets can be viewed simultaneously and changed as needed, active and fault history can be evaluated, a Service Info file can easily be produced for a time-stamped record of the current drive parameters, faults as well as hardware and software profile information. In addition, up to eight drive or motor parameters can be viewed "real time" and trending information saved via a snap-shot function.

All NX Series drives include a suite of ready to use "out of the box" applications including: basic; standard; local/remote; multi-step; PID; multi-purpose; multiple fan or pump. Additional specialized industrial as well as advanced HVAC pump water solution applications can be downloaded to drives via NCLoad.



# FEATURES

## Standard Features

- UL, cUL labeled and CE marked
- EMI/RFI Filter - Input & Output
- Start-Up Wizard
- Fault & Diagnostics Assistance
- Fault History NXS, P - max 30 stored faults
- Real Time Clock function - PC or manual input mode
  - Day, Month, Year; Hour, Minute, Second
- 7 prepackaged applications: Basic; Standard; Local/Remote; Multi-Step; PID Control; Multi-Purpose; Multiple Fan and Pump
- NCLoad & NCDrive PC no charge software for: drive access for operation, monitoring up to 8 variables, diagnostics/faults, service record
- VFD & Keypad Parameter Backup (upload/download)
- Full Graphic and Multilingual Display
  - Operator Control, Parameter Set-Up, Control location designation
  - Data Display:
    - Output Frequency (Hz)
    - Frequency reference (Hz)
    - Motor Speed (RPM calculated)
    - Motor Current (Measured)
    - Motor Torque (Calculated)
    - Motor Power (Calculated)
    - Motor Voltage (Calculated)
    - DC Link Voltage (Measured)
    - Heatsink Temperature (Measured)
    - Motor Temperature (Calculated)
    - Analogue Inputs 1, 2, 3, 4
    - Digital Inputs 1, 2, 3
    - Digital Inputs 4, 5, 6
    - PID Reference, Actual Value, Error Value, Output
    - Multiple Monitoring (3) values
    - Fault Text
    - User Selectable Engineering Units
- Two (2) Programmable Analog Inputs
- Six (6) Programmable Digital Inputs
- One (1) Programmable Analog Output
- Two (2) standard Programmable Relay Outputs
- Five (5) Additional AI/AO, DI/DO, RO Boards
- Adjustable Filters on Analog Inputs and Outputs
- Mathematical Functions on Analog Reference Signals
- All Control Inputs Isolated from Ground and Power
- Optional Communication Protocols
  - RS-485 Modbus & Johnson Controls N2
  - Lonbus
  - BACnet
  - Profibus & Device Net
- Input Speed Signals
  - Current 0 (4) to 20 mA
  - Voltage 0 (2) to 10 VDC
  - Increase/Decrease Reference Contacts(Floating Point)
  - Serial Communications
- Start/Stop
  - 2 Wire (Dry Contact Closure)
  - Output Frequency Supervision
  - Application of Reference Signal (Sleep/Wake-Up)
  - Serial Communications
- Start Functions
  - Ramp, Flying Start,
  - Automatic Torque Boost (U/f optimization)
  - Auto Restart Selectable by Ramp or Flying Start (Reset) - Customer Selectable and
  - Adjustable (Over/Under V, Over/Under C, AI, Motor Temp, Underload)

- Stop Functions
  - Ramp or Coast to Stop
  - Emergency Stop
  - DC Braking / Hold at Stop
  - Flux Braking
- Acceleration/Deceleration
  - Two (2) sets of Independently Ramps
  - Linear, Squared or Adjustable 'S' Curve
- Seven HVAC and Open Use Prepackaged Applications
- Separate Safeties (2) and Run Permissive Inputs
- Override Input (Fire Mode)
- Timer Functions
- Up to fifteen (15) Preset Speeds (Multi-Step Application)
- Supervision Functions
- Adjustable Current Limit
- Electronic Reverse
- Automatic Extended Power Loss Ride Through (Selectable)
- Programmable Maximum Frequency to 320 Hz, 7200 Hz Utilizing Pre-packaged High Speed Application
- PID Control
  - Two (2) Integral Independent Programmable PID
  - Setpoint Controllers (Process and External)
  - External Selection between Two (2) Sets of Process
  - PID Controller Parameters
  - PID Sleep/Wake-Up
- Motor Control Features
  - Scalar (V/Hz) and Vector Modes of Motor Control
  - V/Hz Shapes
    - Linear
    - Squared
    - Energy Optimization
    - IR Compensation
    - Slip Compensation
  - Three (3) Critical Frequency Lockout Bands
- Preprogrammed Protection Circuits
  - Overcurrent
  - Short Circuit
  - Ground Fault
  - Overvoltage
  - Undervoltage
  - Input Phase Loss
  - Output Device (IGBT) Overtemperature
  - Adjustable Current Limit Regulator
  - UL508C approved Electronic Motor Overload (I2T)
- Programmable Fault Functions for Protection Include
  - Loss of Analog Input
  - Panel Loss
  - External Fault
  - Motor Thermal Protection
  - Stall
  - Underload
  - Motor Phase Loss
  - Ground Fault
- 3% AC Choke built-into all models

## OPTIONAL FEATURES

- Five additional I/O boards (various AI, AO, DI, DO, RO combinations)
- Available Fieldbus Protocol Option Boards: LonWorks, BACnet, RS485-MODbus & N2, Profibus and Device Net
- Advanced water solutions no charge application software
- Fan Replacement Kit

# SPECIFICATIONS

<b>Mains Connections</b>	Input voltage $U_{in}$	208...240V; 380...500V; 525...690V; -10%...+10%
	Input frequency	45...66 Hz
	Connection to mains	Once per minute or less (normal case)
<b>Motor Connection</b>	Output voltage	$0-U_{in}$
	Continuous output current	$I_h$ : Ambient temperature max. +122°F (50°C), overload $1.5 \times I_h$ (1 min./10 min.) $I_l$ : Ambient temperature max. +104°F (40°C), overload $1.1 \times I_l$ (1 min./10 min.)
	Starting torque	$I_s$ for two seconds, torque motor dependent
	Peak current	$I_s$ for 2 s every 20 s
	Output frequency	0...320 Hz (NXS); 7200 Hz (Special)
	Frequency resolution	0.01 Hz (NXS); Application dependent (NXP)
	<b>Control Characteristics</b>	Control method
Switching frequency (see parameter 2.6.9)		<b>NX B:</b> Up to and including NX_0061: <b>NX A:</b> 1...16 kHz; Factory default 10 kHz From NX_0072: 1...10 kHz; Factory default 3.6 kHz <b>NX C:</b> 1...6 kHz; Factory default 1.5 kHz
Frequency reference Analogue input Panel reference		Resolution 0.1% (10-bit), accuracy $\pm 1\%$ Resolution 0.01 Hz
Field weakening point		8...320 Hz
Acceleration time		0.1...3000 sec
Deceleration time		0.1...3000 sec
Braking torque		DC brake: 30% * $T_n$ (without brake option)
<b>Ambient Conditions</b>		Ambient operating temperature
	Storage temperature	-104°F...+158°F
	Relative humidity	0 to 95% RH, non-condensing, non-corrosive, no dripping water
	Air quality: -chemical vapors -mechanical particles	IEC 721-3-3, unit in operation, class 3C2 IEC 721-3-3, unit in operation, class 3S2
	Altitude	100% load capacity (no derating) up to 3147 feet; -1% derating for each 327 ft above 3147 ft.; max. 9843 ft
	Vibration EN50178/EN60068-2-6	5...150 Hz Displacement amplitude 0,04 in (peak) at 3...15.8 Hz Max acceleration amplitude 1 G at 15.8...150 Hz
	Shock IEC50178, IEC60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 G, 11 ms (in package)
	Enclosure class	IP21/NEMA1 standard in entire kW/HP range IP54/NEMA12 option in entire kW/HP range Note: Keypad installation required for IP54
	<b>EMC (at default settings)</b>	Immunity
Emissions		EMC level H: IEC 61800-3 (1996)+A11 (2000)(1st environment, restricted use); IEC 61000-6-4 EMC level L: IEC 61800-3 (1996)+A11 (2000)(2nd environment)
<b>Safety</b>		EN 50178 (1997), IEC 60204-1 (1996), IEC 60950 (2000, 3rd edition) (as relevant), CE, UL, CUL, FI, GOST R, IEC 61800-5; (see unit nameplate for more detailed approvals)

<b>Control Connections</b>	Analogue input voltage	0...+10V, Ri = 200k $\Omega$ , (-10V...+10V joystick control) Resolution 0.1%, accuracy $\pm$ 1%
	Analogue input current	0(4)...20 mA, Ri = 250 $\Omega$ differential
	Digital inputs (6)	Positive or negative logic; 18...30VDC
	Auxiliary voltage	+24V, $\pm$ 15%, max. 250mA
	Output reference voltage	+10V, +3%, max. load 10mA
	Analogue output	0(4)...20mA; RL max. 500 $\Omega$ ; Resolution 10 bit; Accuracy $\pm$ 2%
	Digital outputs	Open collector output, 50mA/48V
	Relay outputs	2 programmable change-over relay outputs (1 NO/NC; 1 NO) Switching capacity: 24VDC/8A, 250VAC/8A, 125VDC/0.4A Min. switching load: 5V/10mA 1 thermister input for motor overtemperature warning
	<b>Protections</b>	Overcurrent protection
Overvoltage protection Undervoltage protection		NX_2: 437VDC; NX_5: 911VDC; NX_6: 1200VDC NX_2: 183VDC; NX_5: 333VDC; NX_6: 460 VDC
Ground fault protection		In case of ground fault in motor or motor cable, only the frequency drive is protected
Mains supervision		Trips if any of the input phases is missing
Motor phase supervision		Trips if any of the output phases is missing
Unit overtemperature protection		Yes
Motor overload protection		Yes
Motor stall protection		Yes
Motor underload protection		Yes
Short-circuit protection of +24V and +10V reference voltages		Yes

## Fault codes

The fault codes, their causes and correcting actions are presented in the table below. The faults 37, 38, 39 are A faults only. The following faults for which you can be program different responses in the application are: 3, 9, 10, 11, 15, 16, 17, 42, 50 indicated by \*. See parameter group Protections.

NOTE: When contacting distributor because of a fault condition, always write down all text and codes on the keypad display.

Fault code	Fault	Possible Cause	Correcting Measures
1	Overcurrent	Frequency drive has detected too high a current (>4*I <sub>n</sub> ) in the motor cable: - sudden heavy load increase - short circuit in motor cables - unsuitable motor	Check loading. Check motor. Check cables.
2	Overvoltage	The DC-link voltage has exceeded the limits defined in Table 4-2. - too short a deceleration time - high overvoltage spikes in supply	Make the deceleration time longer. Use brake chopper or brake resistor (available as options)
3	Ground Fault*	Current measurement has detected that the sum of motor phase current is not zero. - insulation failure in cables or motor	Check motor cables and motor.
5	Charging switch	The charging switch is open, when the START command has been given. - faulty operation - component failure	Reset the fault and restart. Should the fault re-occur, contact your nearest distributor.
6	Emergency stop	Stop signal has been given from the option board.	
7	Saturation trip	Various causes, e.g. defective component	Cannot be reset from the keypad. Switch off power. DO NOT RE-CONNECT POWER! Contact factory. If this fault appears simultaneously with Fault 1, check motor cables and motor
8	System fault	-component failure -faulty operation Note exceptional fault data record, see 7.3.4.3.	Reset the fault and restart. Should the fault re-occur, contact your nearest distributor.
9	Under voltage*	DC-link voltage is under the voltage limits defined in. - most probable cause: too low a supply voltage - frequency drive internal fault	In case of temporary supply voltage break reset the fault and restart the frequency drive. Check the supply voltage. If it is adequate, an internal failure has occurred. Contact your nearest distributor.
10	Input line supervision*	Input line phase is missing.	Check supply voltage and cable.
11	Output phase supervision*	Current measurement has detected that there is no current in one motor phase.	Check motor cable and motor.
12	Brake chopper supervision*	no brake resistor installed brake resistor is broken brake chopper failure	Check brake resistor. If the resistor is ok, the chopper is faulty. Contact your nearest distributor.
13	Frequency drive under-temperature	Heatsink temperature is under 14°F (– 10°C)	
14	Frequency drive overtemperature	Heatsink temperature is over 194°F (90°C). Overtemperature warning is issued when the heatsink temperature exceeds 185°F (85°C).	Check the correct amount and flow of cooling air. Check the heatsink for dust. Check the ambient temperature. Make sure that the switching frequency is not too high in relation to ambient temperature and motor load.
15	Motor stalled*	Motor stall protection has tripped.	Check motor.
16	Motor overtemperature*	Motor overheating has been detected by frequency drive motor temperature model. Motor is overloaded.	Decrease the motor load. If no motor overload exists, check the temperature model parameters.
17	Motor underload*	Motor underload protection has tripped.	
22	EEPROM	Parameter save fault	
23	checksum fault	Faulty operation component failure	

<b>Fault code</b>	<b>Fault</b>	<b>Possible Cause</b>	<b>Correcting Measures</b>
25	Microprocessor watchdog fault	Faulty operation component failure	Reset the fault and restart. Should the fault re-occur, contact your nearest distributor.
26	Start-up prevented	Start-up of the drive has been prevented.	Cancel prevention of start-up.
29	Thermistor fault	The thermistor input of option board has detected increase of the motor temperature	Check motor cooling and loading Check thermistor connection (If thermistor input of the option board is not in use it has to be short circuited)
32	Fan cooling	Cooling fan of the frequency drive does not start, when ON command is given	Contact your nearest distributor.
34	CAN bus communication	Sent message not acknowledged.	Ensure that there is another device on the bus with the same configuration.
36	Control unit	NXS Control Unit can not control NXP Power Unit and vice versa	Change control units
37	Device changed (same type)	Option board or control unit changed. Same type of board or same power rating of drive.	Reset Note: No fault time data record!
38	Device added (same type)	Option board or drive added. Drive of same power rating or same type of board added.	Reset Note: No fault time data record!
39	Device removed	Option board removed. Drive removed.	Reset Note: No fault time data record!
40	Device unknown	Unknown option board or drive.	Contact your nearest distributor.
41	IGBT temperature	IGBT Inverter Bridge overtemperature protection has detected too high a short term overload current	Check loading. Check motor size.
42	Brake resistor overtemperature*	Brake resistor overtemperature protection has detected too heavy braking	Set the deceleration time longer. Use external brake resistor.
43	Encoder fault	Note the exceptional Fault data record. 1 = Encoder 1 channel A is missing 2 = Encoder 1 channel B is missing 3 = Both encoder 1 channels are missing 4 = Encoder reversed	Check encoder channel connections. Check the encoder board.
50	Analog input $I_{in}$ <4mA (selected signal range 4 to 20 mA)*	Current at the analogue input is <4mA. - control cable is broken or loose - signal source has failed	Check the current loop circuitry.
51	External fault	Digital input fault.	
52	Keypad communication fault	The connection between the control key-pad and the freq. drive is broken.	Check keypad connection and possible keypad cable.
53	Fieldbus fault	The data connection between the fieldbus Master and the fieldbus board is broken.	Check installation. If installation is correct contact your nearest distributor.
54	Slot fault	Defective option board or slot	Check board and slot. Contact your nearest distributor.
56	PT100 board temp. fault	Temperature limit values set for the PT100 board parameters have been exceeded	Find the cause of temperature rise

### Fault time data record

When a fault occurs the information described above is displayed. By pushing the right arrow menu button it is possible to view the Fault time data record menu indicated by T.1...T.13.

In this menu, some selected important data valid at the time of the fault are recorded. This feature is intended to help the user or the service person to determine the cause of fault.

The data available are:

T.1	Counted operation days (Fault 43: Additional code)	d
T.2	Counted operation hours (Fault 43: Counted operation days)	hh:mm:ss (d)
T.3	Output frequency (Fault 43: Counted operation hours)	Hz (hh:mm:ss)
T.4	Motor current	A
T.5	Motor voltage	V
T.6	Motor power	%
T.7	Motor torque	%
T.8	DC voltage	V
T.9	Unit temperature	°F
T.10	Run status	
T.11	Direction	
T.12	Warnings	
T.13	0-speed	

### REAL TIME RECORD


If real time is set to run on the frequency drive the data items T1 and T2 will appear as follows:

T.1	Counted operation days	yyyy-mm-dd
T.2	Counted operation hours	hh:mm:ss,sss

## VFD CONTROL KEYPAD



Fig. 1. Control Keypad

The control keypad is the link between the frequency drive and the user. The NX control keypad features an alphanumeric display with seven indicators for the Run status (RUN, , READY, STOP, ALARM, FAULT) and three indicators for the control place (I/O term/ Keypad/BusComm). There are also three Status Indicator LEDs (green - green - red).

The control information, i.e. the number of menu, description of menu or the displayed value and the numeric information are presented on three text lines.

The frequency drive is operable through the nine push-buttons of the control keypad. Furthermore, the buttons serve the purposes of parameter setting and value monitoring.

The keypad is detachable and isolated from the input line potential.

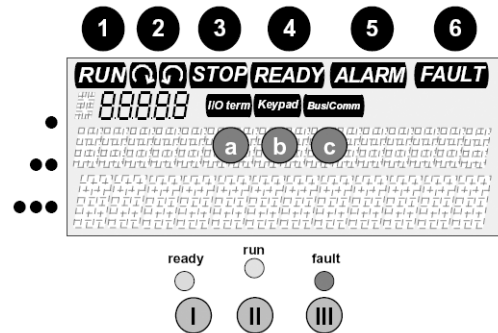



Fig. 2. Keypad indications

### Drive status indications

The drive status indications tell the user what the status of the motor and the drive is, and whether the motor control software has detected irregularities in motor or frequency drive functions.

- 1 RUN = Motor is running; Blinks when the stop command has been given but the frequency is still ramping down.
- 2  = Indicates the direction of motor rotation.
- 3 STOP = Indicates that the drive is not running.
- 4 READY = Lights when AC power is on. In case of a trip, the symbol will not light up.
- 5 ALARM = Indicates that the drive is running outside a certain limit and a warning is given.
- 6 FAULT = Indicates that unsafe operating conditions were encountered due to which the drive was stopped.


### Control place indications


The symbols I/O term, Keypad and Bus/Comm (see Fig. 2) indicate the choice of control place made in the Keypad control menu (M3).


- a I/O term = I/O terminals are the selected control place; i.e. START/STOP commands or reference values etc. are given through the I/O terminals.
- b Keypad = Control keypad is the selected control place; i.e. the motor can be started or stopped, or its reference values etc. altered from the keypad.
- c Bus/Comm = The frequency drive is controlled through a fieldbus.

### Status LEDs

The status LEDs light up in connection with the READY, RUN and FAULT drive status indicators.

- I  = Illuminates with the AC power connected to the drive. Simultaneously, the drive status indicator READY is lit up.

- II  = Illuminates when the drive is running. Blinks when the STOP button has been pushed and the drive is ramping down.

- III  = Illuminates when unsafe operating conditions were encountered due to which the drive was stopped (Fault Trip). Simultaneously, the drive status indicator FAULT blinks on the display and the fault description can be seen, see Active Faults.

## KEYPAD MAIN MENU AND SUBMENU NAVIGATION

For more information on the menus, see the User Manual.

### Navigation on the control keypad

The data on the control keypad are arranged in menus and submenus. The menus are used for example for the display and editing of measurement and control signals, parameter settings, reference values and fault displays. Through the menus, the contrast of the display can be adjusted.

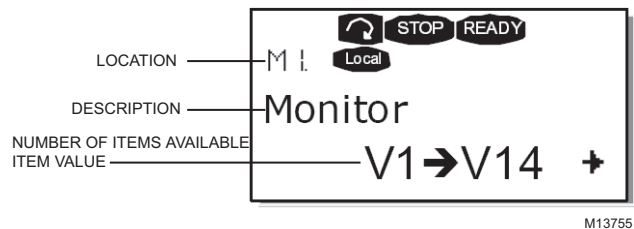


Fig. 3. Menus

The first menu level consists of menus M1 to M7 and is called the Main menu. The user can navigate in the main menu using the Browser buttons up and down. The desired submenu can be entered from the main menu using the Menu buttons. When there still are pages to enter under the currently displayed menu or page, an arrow ( → ) can be seen in the lower right corner of the display and by pressing the right arrow menu button, the next menu level can be reached.

The control keypad navigation chart is shown on the next page. Please note that the menu M1 is located in the lower left corner. From there it is possible to navigate your way up to the desired menu using the menu and browser buttons.



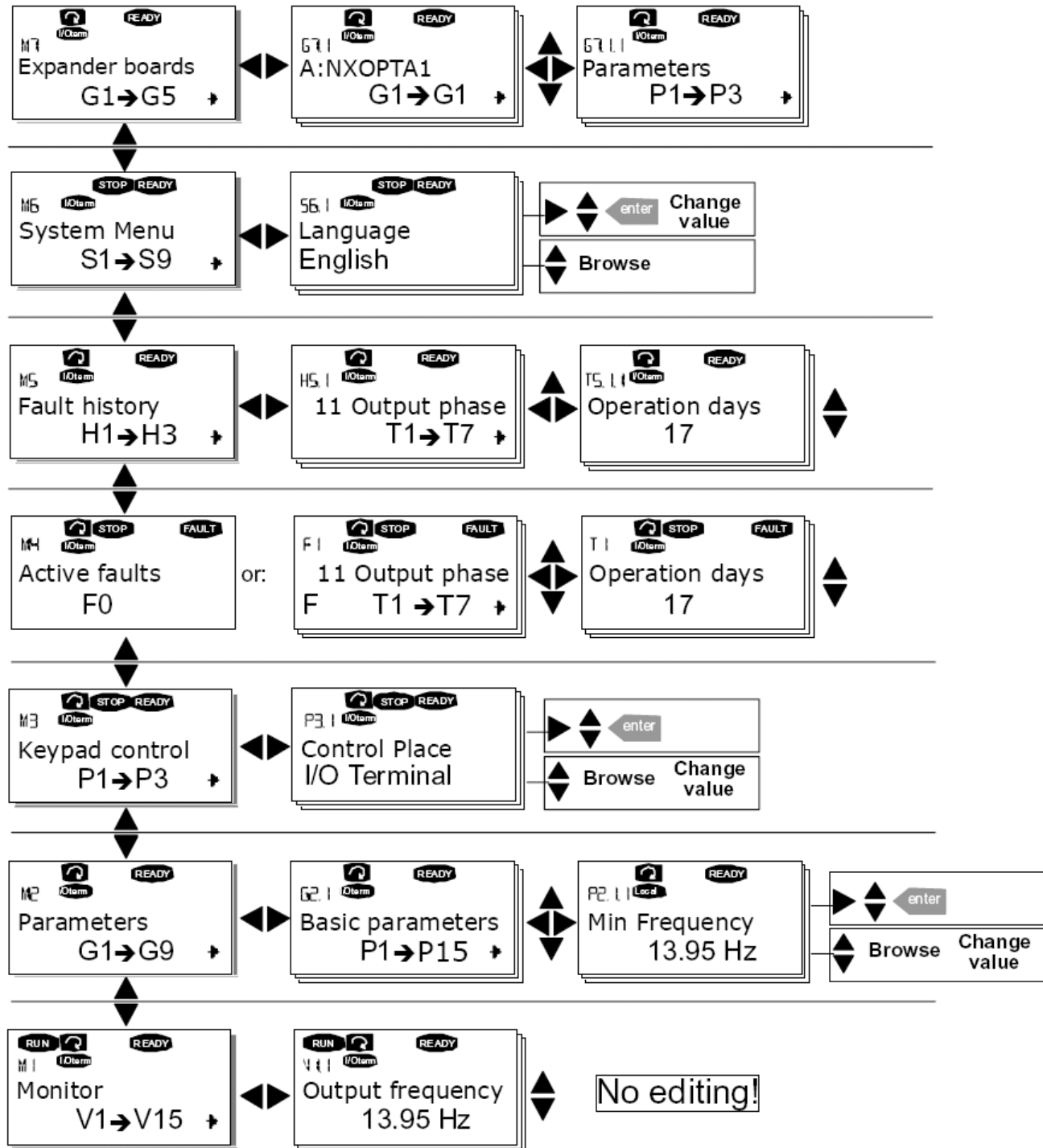


Fig. 4. Keypad Navigation Chart

### Monitoring menu (M1)

The monitoring menu can be entered from the main menu by pushing the Right arrow menu button when the location indication M1 is visible on the first line of the display. How to browse through the monitored values is presented in Fig. 5.

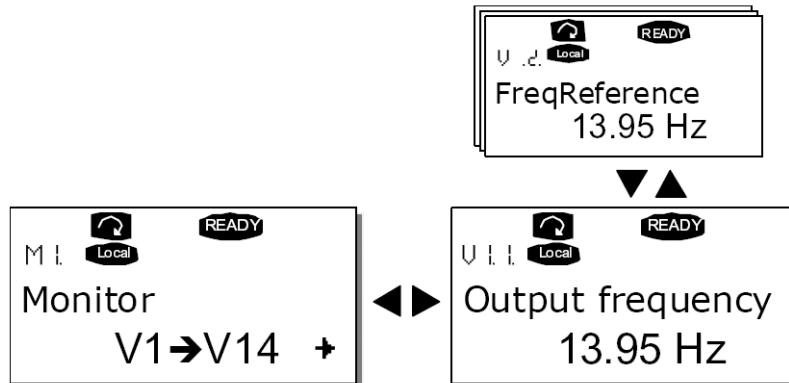


Fig. 5. Monitoring menu

The monitored signals carry the indication V#.# and they are listed in the Table below. The values are updated once every

0.3 seconds. This menu is only for signal checking. The values cannot be altered here.

Table 1. Monitored signals

Code	Signal name	Unit	Description
V1.1	Output frequency	Hz	Frequency to the motor
V1.2	Frequency reference	Hz	
V1.3	Motor speed	rpm	Calculated motor speed
V1.4	Motor current	A	Measured motor current
V1.5	Motor torque	%	Calculated actual torque/nominal torque of the unit
V1.6	Motor power	%	Calculated actual power/nominal power of the unit
V1.7	Motor voltage	V	Calculated motor voltage
V1.8	DC-link voltage	V	Measured DC-link voltage
V1.9	Unit temperature	°F	Heat sink temperature
V1.10	Motor temperature	%	Calculated motor temperature
V1.11	Voltage input	V	AI1
V1.12	Current input	mA	AI2
V1.13	DIN1, DIN2, DIN3		Digital input statuses
V1.14	DIN4, DIN5, DIN6		Digital input statuses
V1.15	DO1, RO1, RO2		Digital and relay output statuses
V1.16	Analogue output current	mA	AO1
V1.17	Multi monitoring items		Displays three selectable monitoring values.

In the Keypad Controls Menu, it is possible to choose the control place, edit the frequency reference and change the direction of the motor. Enter the submenu level with the right arrow menu button.

Change the control place by entering the edit mode with the right arrow menu button. The options can then be browsed through with the Browser buttons. Select the desired control place with the Enter button.

#### SELECTION OF CONTROL PLACE

There are three different places (sources) which the frequency drive can be controlled from. For each control place, a different symbol will appear on the alphanumeric display:

**KEYPAD REFERENCE**

The keypad reference submenu displays and allows the operator to edit the frequency reference. The changes will take place immediately. This reference value will not, however, influence the rotation speed of the motor unless the keypad has been selected as the active control place.

NOTE: The maximum difference between the output frequency and the keypad reference is 6 Hz.

The application software monitors the keypad frequency automatically.

**KEYPAD DIRECTION**

The keypad direction submenu displays and allows the operator to change the rotating direction of the motor. This setting will not, however, influence the rotation direction of the motor unless the keypad has been selected as the active control place.

See Fig. 6 for how to change the rotation direction.

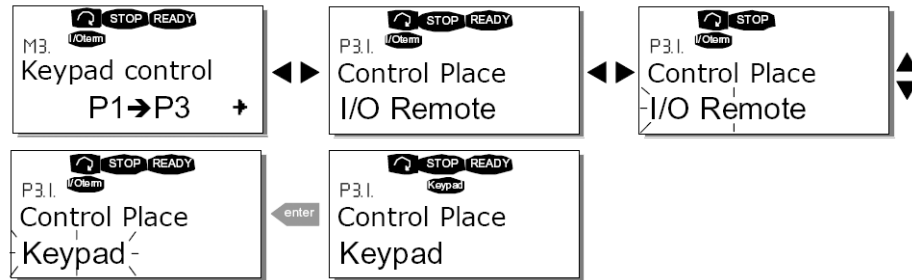


Fig. 6. Selection of control place

**STOP BUTTON ACTIVATED**

By default, pushing the STOP button will always stop the motor regardless of the selected control place. You can disable this function by giving parameter 3.4 the value 0. If the value of this parameter is 0, the STOP button will stop the motor only when the keypad has been selected as the active control place.

NOTE: Information on controlling the motor with the keypad is in the User Manual.

NOTE: There are some special functions that can be performed when in the M3 menu:

Select the keypad as the active control place by keeping the start button pushed down for 3 seconds when the motor is running. The keypad will become the active control place and the current frequency reference and direction will be copied to the keypad.

Select the keypad as the active control place by keeping the stop button pushed down for 3 seconds when the motor is stopped. The keypad will become the active control place and the current frequency reference and direction will be copied to

the keypad. Copy the frequency reference set elsewhere (I/O, fieldbus) to the panel by keeping the enter button pushed down for 3 seconds.

NOTE: That While in any other than M3 menu these functions will not work.

If in a different menu other than M3 menu and try to start the motor by pressing the START button when the keypad is not selected as the active control place an error message Keypad Control NOT ACTIVE will be displayed.

**System Menu (M6)**

The System menu can be entered from the main menu by pushing the right arrow menu button when the location indication M6 is visible on the display.

The controls associated with the general use of the frequency drive, such as application selection, customized parameter sets or information about the hardware and software are located under the System menu. The number of submenus and sub pages is shown with the symbol S (or P) on the value line.

Table 2. Functions in the System menu

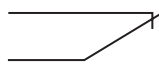
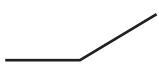
Code	Function	Min	Max	Unit	Default	Cust	Selections
S6.1	Language selection				English		English Deutsch Suomi Svenska Italiano
S6.2	Application selection				Basic Application		Basic Application Standard Application Local/ Remote control Appl. Multi-Step Application PID Control Application Multi- Purpose Control Appl. Pump and Fan Control Appl.
S6.3	Copy parameters						
S6.3.1	Parameter sets						Store set 1 Load set 1 Store set 2 Load set 2 Load factory defaults
S6.3.2	Load up to keypad						All parameters
S6.3.3	Load down from keypad						All parameters All but motor parameters Application parameters
P6.3.4	Parameter backup				No		Yes No
S6.4	Compare parameters						
S6.5	Security						
S6.5.1	Password				Not used		0=Not used
P6.5.2	Parameter lock				Change Enabled		Change Enabled Change Disabled
S6.5.3	Start-up wizard						No Yes
S6.5.4	Multi monitoring items						Change Enabled Change Disabled
S6.6	Keypad settings						
P6.6.1	Default page						
P6.6.2	Default page/ Operating menu						
P6.6.3	Time-out time	0	65535	s	30		
P6.6.4	Contrast	0	31		18		
P6.6.5	Backlight time	Always	65535	min	10		
S6.7	Hardware settings						
P6.7.1	Internal brake resistor				Connected		Not connected Connected
P6.7.2	Fan control				Continuous		Continuous Temperature
P6.7.3	HMI acknowledge. time-out	200	5000	ms	200		
P6.7.4	HMI number of retries	1	10		5		
S6.8	System information						
S6.8.1	Total counters						
C6.8.1.1	MWh counter			kWh			
C6.8.1.2	Power On day counter						
C6.8.1.3	Power On hours counter			hh:mm:ss			

Code	Function	Min	Max	Unit	Default	Cust	Selections
<b>S6.8.2</b>	Trip counters						
<b>T6.8.2.1</b>	MWh counter			kWh			
<b>T6.8.2.2</b>	Clear MWh trip counter						
<b>T6.8.2.3</b>	Operating days trip counter						
<b>T6.8.2.4</b>	Operating hours trip counter			hh:mm:ss			
<b>T6.8.2.5</b>	Clear operating time counter						
<b>S6.8.3</b>	Software info						
<b>S6.8.3.1</b>	Software package						
<b>S6.8.3.2</b>	System software version						
<b>S6.8.3.3</b>	Firmware interface						
<b>S6.8.3.4</b>	System load						
<b>S6.8.4</b>	Applications						
<b>S6.8.4.#</b>	Name of application						
<b>D6.8.4.#.1</b>	Application ID						
<b>D6.8.4.#.2</b>	Applications: Version						
<b>D6.8.4.#.3</b>	Applications: Firmware interface						
<b>S6.8.5</b>	Hardware						
<b>I6.8.5.1</b>	Info: Unit power			kW			
<b>I6.8.5.2</b>	Info: Unit voltage			V			
<b>I6.8.5.3</b>	Info: Brake chopper						
<b>I6.8.5.4</b>	Info: Brake resistor						
<b>S6.8.6</b>	Expander boards						

## CONTROL TERMINAL SIGNALS

Terminal	Signal	Technical Information
1	+10 Vref	Reference voltage Maximum current 10 mA
2	AI1+	Analogue input, voltage or current Selection V or mA with jumper block X1 (see page 68): Default: 0– +10V (Ri = 200 kΩ) (-10V.....+10V Joy-stick control, selected with a jumper) 0– 20mA (Ri = 250 Ω) Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
3	GND/AI1–	
4	AI2+	Analogue input, voltage or current Selection V or mA with jumper block X2 (see page 68): Default: 0– 20mA (Ri = 250 Ω) 0– +10V (Ri = 200 kΩ) (-10V.....+10V Joy-stick control, selected with a jumper) Differential input if not connected to ground; Allows ±20V differential mode voltage to GND
5	GND/AI2–	
6	24 V <sub>out</sub> (bidirectional)	24V auxiliary voltage ±15%, maximum current 250mA (all boards total);150mA (from single board); Can also be used as external power backup for the control unit (and fieldbus)
7	GND	I/O ground Ground for reference and controls
8	DIN1	Digital input 1 Ri = min. 5k.
9	DIN2	
10	DIN3	
11	CMA	Digital input common A for DIN1, DIN2 and DIN3. Must be connected to GND or 24V of I/O terminal or to external 24V or GND Selection with jumper block X3 (see page 68):
12	24 V <sub>out</sub> (bidirectional)	24V auxiliary voltage Same as terminal #6
13	GND	I/O ground Same as terminal #7
14	DIN4	Digital input 4 Ri = min. 5k.
15	DIN5	
16	DIN6	
17	CMB	Digital input common B for DIB4, DIB5 and DIB6 Must be connected to GND or 24V of I/O terminal or to external 24V or GND Selection with jumper block X3 (see page 68):
18	AO1+	Analogue signal (+output) Analogue output common Output signal range: Current 0(4)–20mA, RL max 500Ω or Voltage 0–10V, RL >1k. Selection with jumper block X6 (see page 68):
19	AO1–	
20	DO1	Open collector output Maximum U <sub>in</sub> = 48VDC Maximum current = 50 mA

### Control I/O Terminal Signals On Basic Relay Board OPT-A3

Terminal	Signal	Technical Information
21	RO1/1	 Relay output 1 Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A Min. switching load 5V/10mA
22	RO1/2	
23	RO1/3	
25	RO2/1	 Relay output 2 Switching capacity 24VDC/8A 250VAC/8A 125VDC/0.4A Min. switching load 5V/10mA
26	RO2/2	
28	TI1+	Thermistor input
29	TI1-	

## APPLICATIONS

Below is an introduction to each of the applications. For more information see the product user's Manual.

### Basic Application

The Basic Application is easy and flexible to use due to its versatile fieldbus features. It is the default setting on delivery from the factory. Otherwise select the Basic Application in menu M6.

Digital input DIN3 is programmable.

Motor protection functions in the Basic Application

The Basic Application provides almost all the same protection functions as the other applications:

- External fault protection
- Input phase supervision
- Undervoltage protection
- Output phase supervision
- Ground fault protection
- Motor thermal protection
- Thermistor fault protection
- Fieldbus fault protection
- Slot fault protection

Unlike the other applications, the Basic Application does not provide any parameters for choosing the response function or limit values for the faults.

### Standard Application

Select the Standard Application in menu M6. The Standard Application is typically used in pump and fan applications and conveyors for which the Basic Application is too limited but where no special features are needed.

- The Standard Application has the same I/O signals and the same control logic as the Basic Application.
- Digital input DIN3 and all the outputs are freely programmable.
- Additional functions:
  - Programmable Start/Stop and Reverse signal logic
  - Reference scaling
  - One frequency limit supervision
  - Second ramps and S-shape ramp programming
  - Programmable start and stop functions
  - DC-brake at stop
  - One prohibit frequency area
  - Programmable U/f curve and switching frequency
  - Auto-restart
  - Motor thermal and stall protection: Programmable action; off, warning, fault

### Local/remote Control Application

Select the Local/Remote Control Application in menu M6.

Utilizing the Local/Remote Control Application it is possible to have two different control places. For each control place the frequency reference can be selected from either the control keypad, I/O terminal or fieldbus. The active control place is selected with the digital input DIN6.

- All outputs are freely programmable.

Additional functions:

- Programmable Start/Stop and Reverse signal logic
- Reference scaling
- One frequency limit supervision
- Second ramps and S-shape ramp programming
- Programmable start and stop functions
- DC-brake at stop
- One prohibit frequency area
- Programmable U/f curve and switching frequency
- Auto-restart
- Motor thermal and stall protection: Programmable action; off, warning, fault

### Multi-step Speed Control Application (Software ASFIF04)

Select the Multi-step Speed Control Application in menu M6.

The Multi-step Speed Control Application can be used in applications where fixed speeds are needed. Totally 15 + 2 different speeds can be programmed: one basic speed, 15 multi-step speeds and one jogging speed. The speed steps are selected with digital signals DIN3, DIN4, DIN5 and DIN6. If jogging speed is used, DIN3 can be programmed from fault reset to jogging speed select.

The basic speed reference can be either voltage or current signal via analogue input terminals (2/3 or 4/5). The other one of the analogue inputs can be programmed for other purposes.

- All outputs are freely programmable.

Additional functions:

- Programmable Start/Stop and Reverse signal logic
- Reference scaling
- One frequency limit supervision
- Second ramps and S-shape ramp programming
- Programmable start and stop functions
- DC-brake at stop
- One prohibit frequency area
- Programmable U/f curve and switching frequency
- Auto-restart
- Motor thermal and stall protection: Programmable action; off, warning, fault

### PID Control Application (Software ASFIF05)

Select the PID Control Application in menu M6.

In the PID Control Application, there are two I/O terminal control places; place A is the PID controller and source B is the direct frequency reference. The control place A or B is selected with digital input DIN6.

The PID controller reference can be selected from the analogue inputs, fieldbus, motorized potentiometer, enabling the PID Reference 2 or applying the control keypad reference. The PID controller actual value can be selected from the analogue inputs, fieldbus, the actual values of the motor or through the mathematical functions of these. The direct frequency reference can be used for the control without the PID controller and selected from the analogue inputs, fieldbus, motor potentiometer or keypad.

The PID Application is typically used to control level measuring or pumps and fans. In these applications, the PID Application provides a smooth control and an integrated measuring and controlling package where no additional components are needed.

- Digital inputs DIN2, DIN3, DIN5 and all the outputs are freely programmable.

Additional functions:

- Analogue input signal range selection
- Two frequency limit supervisions
- Torque limit supervision
- Reference limit supervision
- Second ramps and S-shape ramp programming
- Programmable start and stop functions
- DC-brake at start and stop
- Three prohibit frequency areas
- Programmable U/f curve and switching frequency
- Auto-restart
- Motor thermal and stall protection: fully programmable; off, warning, fault
- Motor underload protection
- Input and output phase supervision
- Sum point frequency addition to PID output
- The PID controller can additionally be used from control places I/O B, keypad and fieldbus
- Easy ChangeOver function
- Sleep function

### Multi-purpose Control Application (Software ASFIFF06)

Select the Multi-purpose Control Application in menu M6.

Multi-purpose control application provides a wide range of parameters for controlling motors. It can be used for various kinds of different processes, where wide flexibility of I/O signals is needed and PID control is not necessary (if you need PID control functions, use the PID Control Application or Pump and Fan Control Application).

The frequency reference can be selected e.g. from the analogue inputs, joystick control, motor potentiometer and from a mathematical function of the analogue inputs. There are parameters also for Fieldbus communication. Multi-step speeds and jogging speed can also be selected if digital inputs are programmed for these functions.

- The digital inputs and all the outputs are freely programmable and the application supports all I/O-boards

Additional functions:

- Analogue input signal range selection
- Two frequency limit supervisions
- Torque limit supervision
- Reference limit supervision
- Second ramps and S-shape ramp programming
- Programmable Start/Stop and Reverse logic
- DC-brake at start and stop
- Three prohibit frequency areas
- Programmable U/f curve and switching frequency
- Auto-restart
- Motor thermal and stall protection: fully programmable; off, warning, fault
- Motor underload protection

- Input and output phase supervision
- Joystick hysteresis
- Sleep function

NXP functions:

- Power limit functions
- Different power limits for motoring and generating side
- Master Follower function
- Different torque limits for motoring and generating side
- Cooling monitor input from heat exchange unit
- Brake monitoring input and actual current monitor for immediate brake close.
- Separate speed control tuning for different speeds and loads
- Inching function two different references
- Possibility to connect the FB Process data to any parameter and some monitoring values
- Identification parameter can be adjusted manually

### Pump And Fan Control Application (Software ASFIFF07)

Select the Pump and Fan Control Application in menu M6.

The Pump and Fan Control Application can be used to control one variable speed drive and up to four auxiliary drives. The PID controller of the frequency drive controls the speed of the variable speed drive and gives control signals to start and stop the auxiliary drives to control the total flow. In addition to the eight parameter groups provided as standard, a parameter group for multi-pump and fan control functions is available.

The application has two control places on the I/O terminal. Place A is the pump and fan control and place B is the direct frequency reference. The control place is selected with input DIN6. As already its name tells, the Pump and Fan Control Application is used to control the operation of pumps and fans. It can be used, for example, to decrease the delivery pressure in booster stations if the measured input pressure falls below a limit specified by the user.

The application utilizes external contactors for switching between the motors connected to the frequency drive. The autochange feature provides the capability of changing the starting order of the auxiliary drives. Autochange between 2 drives (main drive + 1 auxiliary drive) is set as default.

- All inputs and outputs are freely programmable.

Additional functions:

- Analogue input signal range selection
- Two frequency limit supervisions
- Torque limit supervision
- Reference limit supervision
- Second ramps and S-shape ramp programming
- Programmable Start/Stop and Reverse logic
- DC-brake at start and stop
- Three prohibit frequency areas
- Programmable U/f curve and switching frequency
- Auto-restart
- Motor thermal and stall protection: fully programmable; off, warning, fault
- Motor underload protection
- Input and output phase supervision
- Sleep function









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